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Questions about this communication ?
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Viering, Jentschura & Partner mbB
Patent- und Rechtsanwälte
Am Brauhaus 8
01099 Dresden
ALLEMAGNE

Date
16.03.20

Reference	Application No./Patent No.
P56843	12762781.8 - 1209 / 2692118
Applicant/Proprietor	
Lattice Semiconductor Corporation	

Communication regarding the expiry of the time limit within which notice of opposition may be filed

You are hereby informed that on expiry of the nine-month time limit from the publication of the mention of the grant of European patent No. 2692118 no notice of opposition had reached the files.

The entry in the Register of European Patents will be automatically generated by the electronic data processing system.

For the Examining Division

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EPPU 02: 08.05.19 1209

DELL/HP/LENOVO EXHIBIT 1012, Page 1

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Viering, Jentschura & Partner mbB
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01099 Dresden
ALLEMAGNE

Date
20.05.19

Reference	Application No./Patent No.
P56843	12762781.8 - 1209 / 2692118
Applicant/Proprietor	
Lattice Semiconductor Corporation	

Transmission of the certificate for a European patent pursuant to Rule 74 EPC

The certificate for a European patent is herewith transmitted.

The European patent specification can be downloaded from the EPO publication server **https://data.epo.org/publication-server/** (see OJ EPO 2005, 126).

Note:
A corrected title page of the European patent specification will be published, if the bibliographic data have been changed after completion of the technical preparations.

For the Examining Division

DELL/HP/LENOVO EXHIBIT 1012, Page 2

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Viering, Jentschura & Partner mbB
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01099 Dresden
ALLEMAGNE

Date
11.04.19

Reference	Application No./Patent No.
P56843	12762781.8 - 1209 / 2692118
Applicant/Proprietor	
Lattice Semiconductor Corporation	

Decision to grant a European patent pursuant to Article 97(1) EPC

Following examination of European patent application No. 12762781.8 a European patent with the title and the supporting documents indicated in the communication pursuant to Rule 71(3) EPC (EPO Form 2004C) or in the information (EPO Form 2004W, cf. Notice from the EPO dated 8 June 2015, OJ EPO 2015, A52) dated 06.11.18 is hereby granted in respect of the designated Contracting States.

Patent No. : 2692118
Date of filing : 30.03.12
Priority claimed : 31.03.11/USP201161470431
29.03.12/USA201213434273

Designated Contracting States and Proprietor(s) : AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Lattice Semiconductor Corporation
111 SW 5th Avenue, Suite 700
Portland, OR 97204/US

This decision will take effect on the date on which the European Patent Bulletin mentions the grant (Art. 97(3) EPC).

The mention of the grant will be published in European Patent Bulletin 19/19 of 08.05.19.

Examining Division

Maciu, Emanoil Gonzalez Ordonez, Os Vázquez del Real, Sa

Europäisches Patentamt • European Patent Office • Office européen des brevets

Registered letter
EPO Form 2006A 07.15 (04/04/19)

to EPO postal service: 05.04.19

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ANMERKUNG ZUR ENTSCHEIDUNG ÜBER DIE ERTEILUNG
EINES EUROPÄISCHEN PATENTS (EPA Form 2006)

1. **EPA Informationsbroschüre "Nationales Recht zum EPÜ"**
Diese Broschüre enthält nützliche Informationen zu den formalen Erfordernissen und den Handlungen, die vor den Patentbehörden der Vertragsstaaten vorzunehmen sind, um Rechte in diesen Staaten zu erlangen. Da diese Handlungen einem ständigen Wandel unterworfen sind, sollte immer nur die neueste Ausgabe der Broschüre benutzt werden. Nachträgliche Informationen werden im Amtsblatt veröffentlicht.

2. **Übersetzung der europäischen Patentschrift nach Artikel 65 (1) des Europäischen Patentübereinkommens**
Sie werden erneut darauf hingewiesen, dass bestimmte Vertragsstaaten nach Artikel 65 (1) EPÜ eine Übersetzung der europäischen Patentschrift verlangen; hierauf wird in der Mitteilung gemäß Regel 71 (5) EPÜ verwiesen. Die Nichteinreichung dieser Übersetzung kann zur Folge haben, dass das Patent in dem betreffenden Staat/in den betreffenden Staaten als von Anfang an nicht eingetreten gilt. Weitere Einzelheiten entnehmen Sie bitte der oben genannten Broschüre.

3. **Zahlung von Jahresgebühren für europäische Patente**
Nach Artikel 141 EPÜ können "nationale" Jahresgebühren für das europäische Patent für die Jahre erhoben werden, die an das Jahr anschließen, in dem der Hinweis auf die Erteilung des europäischen Patents im "Europäischen Patentblatt" bekanntgemacht wird. Weitere Einzelheiten entnehmen Sie bitte der oben genannten Broschüre.

NOTE RELATING TO THE DECISION TO GRANT A
EUROPEAN PATENT (EPO Form 2006)

1. **EPO Information Brochure "National law relating to the EPC"**
This brochure provides useful information regarding formal requirements and the steps to be taken before the patent authorities of the Contracting States in order to acquire rights in those states. Since the necessary steps are subject to change the latest edition of the brochure should always be used. Subsequent information is published in the Official Journal.

2. **Translation of the European patent application under Article 65(1) of the European Patent Convention**
Your attention is again drawn to the requirements regarding translation of the European patent specification laid down by a number of Contracting States under Article 65(1) EPC, to which reference is made in the communication under Rule 71(5) EPC. Failure to supply such translation(s) may result in the patent being deemed to be void "ab initio" in the State(s) in question. For further details you are recommended to consult the above-mentioned brochure.

3. **Payment of renewal fees for European patents**
Under Article 141 EPC "national" renewal fees in respect of a European patent may be imposed for the years which follow that in which the mention of the grant of the European patent is published in the "European Patent Bulletin". For further details you are recommended to consult the above-mentioned brochure.

REMARQUE RELATIVE A LA DECISION DE DELIVRANCE
D'UN BREVET EUROPEEN (OEB Form 2006)

1. **Brochure d'information de l'OEB "Droit national relatif à la CBE"**
Cette brochure fournit d'utiles renseignements sur les conditions de forme requises et sur les actes à accomplir auprès des offices de brevet des Etats contractants aux fins d'obtenir des droits dans les Etats contractants. Etant donné que les actes indispensables sont susceptibles de modifications, il serait bon de toujours consulter la dernière édition de la brochure. Toute information ultérieure est publiée au Journal Officiel.

2. **Traduction du fascicule du brevet européen en vertu de l'article 65(1) de la Convention sur le brevet européen**
Votre attention est de nouveau attirée sur l'obligation faite par certains États contractants, en vertu de l'article 65(1) CBE, de fournir une traduction du fascicule du brevet européen, à laquelle il est fait référence dans la notification établie conformément à la règle 71(5) CBE. Si la(les) traduction(s) n'est(ne sont) pas fournie(s), le brevet européen peut, dès l'origine, être réputé sans effet dans cet(ces) Etat(s). Pour plus de détails, nous vous renvoyons à la brochure susmentionnée.

3. **Paiement des taxes annuelles pour le brevet européen**
Conformément à l'article 141 CBE des taxes annuelles "nationales" dues au titre du brevet européen peuvent être perçues pour les années suivant celle au cours de laquelle la mention de la délivrance du brevet européen est publiée au "Bulletin européen des brevets. Pour plus de détails, nous vous renvoyons à la brochure susmentionnée.

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GERMANY

Questions about this communication ?
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Viering, Jentschura & Partner mbB
Patent- und Rechtsanwälte
Am Brauhaus 8
01099 Dresden
ALLEMAGNE

Date
13.03.19

Reference	Application No./Patent No.
P56843	12762781.8 - 1209 / 2692118

Applicant/Proprietor
Lattice Semiconductor Corporation

Communication

concerning the registration of amendments relating to

☑ a transfer (R. 22 and 85 EPC)

☐ entries pertaining to the applicant / the proprietor (R. 143(1)(f) EPC)

As requested, the entries pertaining to the applicant of the above-mentioned European patent application / to the proprietor of the above-mentioned European patent have been amended to the following:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU
LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Lattice Semiconductor Corporation
111 SW 5th Avenue, Suite 700
Portland, OR 97204/US

The registration of the changes has taken effect on 05.03.19.

In the case of a published application / a patent, the change will be recorded in the European Patent Register and published in the European Patent Bulletin (Section I.12 / II.12).

Your attention is drawn to the fact that, in the case of the registration of a transfer, any automatic debit order only ceases to be effective from the date of its express revocation (cf. point 14(c) of the Arrangements for the automatic debiting procedure, Supplementary publication 5 - OJ EPO 2017).

Receiving Section / For the Examining Division / For the Opposition Division / For the Legal Division *)

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*) See note.

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Note
This communication is issued by/for the department with whom responsibility lies. The Legal Division is responsible for the registration of transfers, changes of name (Articles 71, 72 and 74 EPC and Rules 22 and 85 EPC) as well as for the rectification of the designation of the inventor (Rule 21 EPC) (see Decision of the President of the EPO, OJ EPO 2013, 600). In all other cases, the Receiving Section, the Examining Division or the Opposition Division is responsible, depending on the stage in proceedings.

DELL/HP/LENOVO EXHIBIT 1012, Page 6

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European Patent Office
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Acknowledgement of receipt

We hereby acknowledge receipt of the following subsequently filed document(s):

Submission number	7251367
Application number	EP12762781.8
Date of receipt	05 March 2019
Receiving Office	European Patent Office, The Hague
Your reference	P56843
Applicant	All applicants as on file
Documents submitted	package-data.xml epf1038.pdf (2 p.) CLMSTRAN-FR-1.pdf\P56843_translation of the claims_FR.pdf (5 p.) ep-sfd-request.xml CLMSTRAN-DE-1.pdf\P56843_translation of the claims_DE.pdf (5 p.) IGRA-1.pdf\P56843_submission.pdf (1 p.)
Submitted by	CN=Kornelia Ihle 12543
Method of submission	Online
Date and time receipt generated	05 March 2019, 11:20 (CET)
Message Digest	70:0C:1D:F6:2E:88:EC:F9:79:F4:31:33:4D:F6:2C:FD:76:65:C0:F3

Correction by the EPO of errors in debit instructions filed by eOLF
Errors in debit instructions filed by eOLF that are caused by the editing of Form 1038E entries or the continued use of outdated software (all forms) may be corrected automatically by the EPO, leaving the payment date unchanged (see decision T 152/82, OJ EPO 1984, 301 and point 6.3 ff ADA, Supplement to OJ EPO 10/2007).

/European Patent Office/

Europäisches Patentamt
European Patent Office
Office européen des brevets

Acknowledgement of receipt

We hereby acknowledge receipt of the following subsequently filed document(s):

Submission number	7251344
Application number	EP12762781.8
Date of receipt	05 March 2019
Receiving Office	European Patent Office, The Hague
Your reference	P56843
Applicant	All applicants as on file
Documents submitted	package-data.xml epf1038.pdf (2 p.) CDAPPR-TOR-2.pdf\P56843_submission.pdf (2 p.) ep-sfd-request.xml CDAPPR-TOR-1.pdf\P56843_Certifcate_of_Merger.pdf (4 p.)
Submitted by	CN=Kornelia Ihle 12543
Method of submission	Online
Date and time receipt generated	05 March 2019, 11:16 (CET)
Message Digest	EC:E7:90:25:E0:7A:9C:6B:0F:B2:92:C4:FD:26:66:73:B6:29:E6:6E

Correction by the EPO of errors in debit instructions filed by eOLF
Errors in debit instructions filed by eOLF that are caused by the editing of Form 1038E entries or the continued use of outdated software (all forms) may be corrected automatically by the EPO, leaving the payment date unchanged (see decision T 152/82, OJ EPO 1984, 301 and point 6.3 ff ADA, Supplement to OJ EPO 10/2007).

/European Patent Office/

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF MERGER, WHICH MERGES:

"SILICON IMAGE, INC.", A DELAWARE CORPORATION,

WITH AND INTO "LATTICE SEMICONDUCTOR CORPORATION" UNDER THE NAME OF "LATTICE SEMICONDUCTOR CORPORATION", A CORPORATION ORGANIZED AND EXISTING UNDER THE LAWS OF THE STATE OF DELAWARE, AS RECEIVED AND FILED IN THIS OFFICE THE TWENTY-EIGHTH DAY OF MAY, A.D. 2015, AT 2:15 O'CLOCK P.M.

AND I DO HEREBY FURTHER CERTIFY THAT THE EFFECTIVE DATE OF THE AFORESAID CERTIFICATE OF MERGER IS THE FIRST DAY OF JUNE, A.D. 2015.

A FILED COPY OF THIS CERTIFICATE HAS BEEN FORWARDED TO THE NEW CASTLE COUNTY RECORDER OF DEEDS.



Jeffrey W. Bullock, Secretary of State

2056084 8100M

150805988

AUTHENTICATION: 2426123

DATE: 06-02-15

You may verify this certificate online at corp.delaware.gov/authver.shtml

State of Delaware
Secretary of State
Division of Corporations
Delivered 02:52 PM 05/28/2015
FILED 02:15 PM 05/28/2015
SRV 150805988 - 2056084 FILE

CERTIFICATE OF OWNERSHIP AND MERGER
MERGING
SILICON IMAGE, INC., A DELAWARE CORPORATION
WITH AND INTO
LATTICE SEMICONDUCTOR CORPORATION, A DELAWARE CORPORATION

Pursuant to Section 253
of the General Corporation Law of the State of Delaware

Lattice Semiconductor Corporation, a Delaware corporation (the "Parent Corporation"),

DOES HEREBY CERTIFY:

FIRST: That the Parent Corporation was incorporated pursuant to the General Corporation Law of the State of Delaware (the "Code").

SECOND: That the Parent Corporation owns all of the outstanding shares of each class of the capital stock of Silicon Image, Inc., a Delaware corporation (the "Subsidiary Corporation").

THIRD: That the Parent Corporation, by the following resolutions of its board of directors, duly adopted on May 7, 2015, determined to merge the Subsidiary Corporation into itself (the "Merger"), with the Parent Corporation being the surviving corporation:

> RESOLVED, that pursuant to Section 253 of the Code, in the Merger, the Subsidiary Corporation shall be merged with and into the Parent Corporation, whereupon the separate existence of the Subsidiary Corporation shall cease, and the Parent Corporation shall be the surviving corporation (the "Surviving Corporation") of the Merger;
>
> RESOLVED FURTHER, that the Merger is hereby approved pursuant to the provisions of Section 253 of the Code;
>
> RESOLVED FURTHER, that the Merger shall become effective upon filing of the Certificate of Ownership and Merger with the Delaware Secretary of State or at such time as is otherwise specified therein (the "Effective Time");
>
> RESOLVED FURTHER, that from and after the Effective Time, until successors are duly elected or appointed in accordance with applicable law, the directors of the Parent Corporation at the Effective Time shall be the directors of the Surviving Corporation, and the officers of the Parent Corporation at the Effective Time shall be the officers of the Surviving Corporation;
>
> RESOLVED FURTHER, that from and after the Effective Time, the bylaws of the Parent Corporation shall be the bylaws of the Surviving Corporation;

DELL/HP/LENOVO EXHIBIT 1012, Page 10

RESOLVED FURTHER, that from and after the Effective Time, the certificate of incorporation of the Parent Corporation shall be the certificate of incorporation of the Surviving Corporation; and

RESOLVED FURTHER, that from and after the Effective Time, the name of the Surviving Corporation shall be Lattice Semiconductor Corporation

FOURTH: The Parent Corporation shall be the surviving corporation of the Merger.

FIFTH: The certificate of incorporation of the Parent Corporation as in effect immediately prior to the effective time of the Merger shall be the certificate of incorporation of the Surviving Corporation.

SIXTH: The Merger shall become effective as of June 1, 2015.

(Signature page follows)

IN WITNESS WHEREOF, the Parent Corporation has caused this Certificate of Ownership and Merger to be signed as of the date written below by a duly authorized officer, declaring that the facts stated herein are true.

LATTICE SEMICONDUCTOR CORPORATION, a Delaware corporation

By: _____
Name: Byron W. Milstead
Title: Corporate Vice President & General Counsel
Date: May 13, 2015

Viering, Jentschura & Partner mbB
Am Brauhaus 8
01099 Dresden [3]
Germany
Tel.: +49-351-6568 30
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E-mail: vjp-dd@vjp.de

VAT ID No.: DE 130 750 861
Partnership Register Munich PR97

Patentanwälte [I] • European Patent Attorneys [II]
European Trademark & Design Attorneys [III]
Not admitted in Germany [VI]
US Patent Attorneys [VIII] / Agents [IX] • US Attorneys at Law [X]
Hungarian Patent Attorney [XI]
Australian & New Zealand Patent Attorney [XII]

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Natalie Lee, B.A.Chem., M.Sc.Biotech. [2 • VI, VIII-X]
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Colin Jamieson, B.Sc. Mech. Eng. [3 • VI, VIII-X]
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Uriel Santiesteban, B.Sc. Chem. Eng. [3 • VI, VIII-X]
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Dr. Katja Antovic, M.S. Biochem. [2 • II]
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Benjeman Nichols, B.Mus.Ed. [3 • VI, VIII-X]
Brett Rustemeyer, B.Sc. Elec. Eng. [3 • VI, VIII-X]
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Dr. Nadine Götz, M.Sc. Chem. [2 • I-III]
Dr. Tim Pust, Dipl.-Chem. [1 • I-III]
Amanda Lai, CN Representative [6 • VI]
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Audrey Goh, B.Eng. EE. [4, 6 • VI, VII]
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Jaslyn Lim, B.Eng. Chem. M. ISE [4 • VI, VII]
Angela Leong, LLB [4 • VI, VII]
Gerald Koh, LLB [4 • VI, VII]
Aaron Koh, B.Eng.EE, B.Sc.CS, MIP [4 • VI, VII, XII]
Kwang Chin Teo, B.Eng.-ME, [4 • VI, VII]
Kian Chiew Seow, B.Eng. EE, M.SE [4 • VI, VII]

MUNICH Office [1] • DÜSSELDORF Office [2]
SINGAPORE Office [4]
CHINA [6] and TAIWAN [5] Representative Offices

Europäisches Patentamt
80298 München

Your file:	Our file:	Writers initials:	Date:
	P56843	**ma/Ih**	**25.02.2019**

European Patent Application 12 762 781.8 based on PCT/US2012/31463
Silicon Image, Inc.

In response to the communication of November 6, 2018 (Rule 71(3) EPC)

Accompanying this letter are the French and German translations of claims 1 to 7.

Moreover, herewith it is kindly requested to amend the English title of the invention into:

"Method, apparatus and system for transitioning an audio/video device between a source and a sink mode"

The grant fee is paid via EPOline.

Kornelia Ihle
European Patent Attorney

Enclosures
French claim transl. (5 pages);
German claim transl. (5 pages)

REVENDICATIONS :

1. Procédé, comprenant les étapes suivantes :

initialiser un premier dispositif (110) audio / vidéo (AV) dans un mode de fonctionnement récepteur AV, où le mode de fonctionnement récepteur AV inclut le fait que le premier dispositif AV ne fournit pas d'alimentation à une broche alimentation (Canal 18 pour un connecteur HDMI), une tension sur une broche détection de connexion à chaud n'est pas fournie (Canal 19 pour un connecteur HDMI), une résistance de rappel au niveau haut est désactivée pour une broche canal de données d'affichage (DDC) (Canal 15 pour un connecteur HDMI) et une fonctionnalité de données d'identification d'affichage étendu (EDID) est initialisée ;

après l'initialisation, placer au niveau bas, par le premier dispositif AV (110), la broche sortie d'alimentation par l'intermédiaire d'une résistance de rappel au niveau bas ;

détecter avec un circuit de commande (505) du premier dispositif (110) audio / vidéo (AV), un couplage par l'intermédiaire d'un connecteur câblé (114, 510) entre le premier dispositif AV (110), et un second dispositif AV (120) en détectant grâce au premier dispositif AV qu'une tension est fournie à la broche alimentation (Canal 18) du connecteur câblé (114, 510) ;

en réponse à la détermination qu'une tension d'alimentation est fournie à la broche alimentation du connecteur câblé (114, 510), continuer de faire fonctionner le premier dispositif AV (110) en mode de fonctionnement récepteur AV, et fournir une

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tension sur la broche détection de connexion à chaud (Canal 19 du connecteur 510) du connecteur câblé (114, 510), examiner périodiquement la présence de la tension d'alimentation au niveau de la broche d'alimentation, et enlever la tension sur la broche détection de connexion à chaud en réponse à l'absence de tension d'alimentation au niveau de la broche d'alimentation, où le premier dispositif AV (110) reçoit des données AV fournies au premier dispositif AV (110) par l'intermédiaire du connecteur câblé (114, 510), et reçoit l'alimentation à partir de la tension d'alimentation fournie au premier dispositif AV (110) au niveau de la broche d'alimentation du connecteur câblé (114, 510) dans le mode de fonctionnement récepteur AV ; et

en réponse à la détermination que la tension d'alimentation n'est pas fournie à la broche alimentation du connecteur câblé (114, 510), et en réponse à la détection qu'un dispositif fonctionnant dans le mode de fonctionnement de récepteur est couplé au connecteur câblé (114, 510) en testant les impédances sur le canal DDC (Canal 15 et Canal 16 pour un connecteur HDMI),

faire passer le premier dispositif AV (110) du mode de fonctionnement récepteur AV à un mode de fonctionnement source AV, où le premier dispositif AV (110) fournit une tension d'alimentation à la broche alimentation du connecteur câblé (114, 510), établir une limite prédéterminée d'une minuterie, et

attendre la détection d'une tension à la broche détection de connexion à chaud, et si la tension est détectée avant l'expiration de la minuterie, le premier dispositif AV (110) fonctionne dans le mode de fonctionnement source AV où le premier dispositif AV (110) envoie des données AV par l'intermédiaire du connecteur câblé (114, 510), et active la résistance de rappel au niveau haut pour la broche DDC (Canal 15), sinon, si la tension n'est pas détectée à la broche détection de connexion à chaud avant l'expiration de la minuterie, faire passer le premier dispositif AV (110) du mode de fonctionnement source AV au mode de fonctionnement récepteur AV.

2. Procédé selon la revendication 1, où le mode de fonctionnement par défaut est celui d'une communication selon une norme d'interface multimédia haute définition.

DELL/HP/LENOVO EXHIBIT 1012, Page 15

3. Procédé selon la revendication 1, où une première impédance est fournie au canal de données du connecteur câblé (114, 510) dans le mode de fonctionnement source AV, et la première impédance n'est pas fournie au canal de données dans le mode de fonctionnement récepteur AV.

4. Procédé selon la revendication 1, comprenant en outre l'étape suivante :

exécuter un échange de données AV entre le premier dispositif AV (110) et le second dispositif AV (120).

5. Dispositif (110) audio / vidéo (AV) comprenant :

une logique de communication (580) destinée à être couplée à un connecteur câblé (114, 510), la logique de communication (580) comprenant des circuits destinés à mettre en application :

un mode de fonctionnement récepteur AV pour que la logique de communication (580) reçoive des données AV fournies au dispositif AV (110) au niveau du connecteur câblé (114, 510) et reçoive une alimentation à partir d'une tension d'alimentation fournie au dispositif AV (110) par l'intermédiaire d'une broche d'alimentation du connecteur câblé (114, 510), et

un mode de fonctionnement source AV pour que la logique de communication (580) envoie des données AV à partir du dispositif AV (110) par l'intermédiaire du connecteur câblé (114, 510), et fournisse une tension d'alimentation à la broche alimentation du connecteur câblé (114, 510) ; et

une logique de commande (505) comprenant des circuits configurés pour initialiser la logique de communication (580) pour faire fonctionner le dispositif AV (110) dans le mode de fonctionnement récepteur AV, où le mode de fonctionnement récepteur AV inclut le fait que le premier dispositif AV ne fournit pas d'alimentation à une broche alimentation (Canal 18 pour un connecteur HDMI), une tension sur une broche détection de connexion à chaud (Canal 19 pour un connecteur HDMI) n'est pas fournie,

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une résistance de rappel au niveau haut est désactivée pour une broche canal de données d'affichage (DDC) (Canal 15 pour un connecteur HDMI) et une fonctionnalité de données d'identification d'affichage étendu (EDID) est initialisée ;

après l'initialisation, placer au niveau bas, par le dispositif AV (110), la broche sortie d'alimentation par l'intermédiaire d'une résistance de rappel au niveau bas ; en réponse à la détermination que la tension d'alimentation est fournie à la broche alimentation du connecteur câblé (114, 510), continuer de faire fonctionner le dispositif AV (110) dans le mode de fonctionnement récepteur AV, fournir une tension sur la broche détection de connexion à chaud (Canal 19 du connecteur 510) du connecteur câblé (114, 510), examiner périodiquement la présence de la tension d'alimentation au niveau de la broche d'alimentation, et enlever la tension sur la broche détection de connexion à chaud en réponse à l'absence de la tension d'alimentation au niveau de la broche d'alimentation ; et

en réponse à la détermination que la tension d'alimentation n'est pas fournie à la broche alimentation du connecteur câblé (114, 510), et en réponse à la détection qu'un dispositif fonctionnant dans le mode de fonctionnement récepteur est couplé au connecteur câblé (114, 510) en testant les impédances sur le canal DDC (Canal 15 et Canal 16 pour un connecteur HDMI), initialiser la logique de communication (580) pour faire passer le dispositif AV (110) du mode de fonctionnement récepteur AV au mode de fonctionnement source AV, où le premier dispositif AV (110) fournit une tension d'alimentation à la broche alimentation du connecteur câblé (114, 510),

établir une limite prédéterminée d'une minuterie, et

attendre la détection d'une tension au niveau de la broche détection de connexion à chaud, et si la tension est détectée avant l'expiration de la minuterie, le premier dispositif AV (110) est configuré pour fonctionner dans le mode de fonctionnement source AV où le premier dispositif AV (110) envoie des données AV par l'intermédiaire du connecteur câblé (114, 510), et active la résistance de rappel au niveau haut pour la broche DDC (Canal 15), sinon, si la tension n'est pas détectée au niveau de la broche détection de connexion à chaud avant l'expiration de la minuterie, le dispositif AV (110) est configuré pour passer du mode de fonctionnement source AV au mode de fonctionnement récepteur AV.

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6. Dispositif selon la revendication 5, où le mode de fonctionnement par défaut est celui d'une communication selon une norme d'interface multimédia haute définition.

7. Dispositif selon la revendication 5, où la logique de communication (580) est initialisée en outre pour fournir une première impédance pour un canal de données du connecteur câblé (114, 510) dans le mode de fonctionnement source AV, et est initialisée pour ne pas fournir la première impédance pour le canal de données dans le mode de fonctionnement récepteur AV.

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Ansprüche

1. Ein Verfahren, aufweisend:

Initialisieren einer ersten Audio/Video (AV)-Vorrichtung (110) in einem AV-Senke-Betriebsmodus, wobei der AV-Senke-Betriebsmodus aufweist, dass die erste AV-Vorrichtung keinen Strom an einen Strom-Kontakt (Kanal 18 für einen HDMI Steckverbinder) bereitstellt, eine Spannung an einem Hot-Plug-Detektion-Kontakt nicht bereitgestellt wird (Kanal 19 für einen HDMI Steckverbinder), ein Pull-Up-Widerstand für einen Display-Data-Channel (DDC)-Kontakt (Kanal 15 für einen HDMI Steckverbinder) deaktiviert ist und eine Extended-Display-Identification-Data (EDID)-Funktionalität initialisiert wird;

nach dem Initialisieren, Hinunterziehen, durch die erste AV-Vorrichtung (110), des Stromausgabe-Kontakts durch einen Pull-Down-Widerstand;

Detektieren, mittels eines Steuerschaltsystems (505) der ersten Audio/Video (AV)-Vorrichtung (110), einer Verbindung über einen kabelgebundenen Steckverbinder (114, 510) zwischen der ersten AV-Vorrichtung (110) und einer zweiten AV-Vorrichtung (120) durch Detektieren, durch die erste AV-Vorrichtung, dass eine Spannung an dem Strom-Kontakt (Kanal 18) des kabelgebundenen Steckverbinders (114, 510) anliegt;

als Antwort auf ein Ermitteln, dass eine Versorgungsspannung an dem Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510) anliegt, Fortsetzen des Betriebs der ersten AV-Vorrichtung (110) in dem AV-Senke-Betriebsmodus, und Aktivieren einer Spannung an dem Hot-Plug-Detektion-Kontakt (Kanal 19 des Steckverbinders 510) des kabelgebundenen Steckverbinders (114, 510), periodisches Überprüfen des Strom-Kontaktes auf das Vorhandensein der Versorgungsspannung an dem Strom-Kontakt, und Deaktivieren der Spannung an dem Hot-Plug-Detektion-Kontakt als Antwort auf ein Nicht-Vorhandensein der Versorgungsspannung an dem Strom-Kontakt, wobei die erste AV-Vorrichtung (110) AV-Daten empfängt, welche über den kabelgebundenen Steckverbinder (114, 510) an die erste AV-

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Vorrichtung (110) bereitgestellt werden, und Strom von der Versorgungsspannung empfängt, die an dem Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510) an die erste AV-Vorrichtung (110) bereitgestellt wird, in dem AV-Senke-Betriebsmodus; und

als Antwort auf ein Ermitteln, dass die Versorgungsspannung nicht an dem Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510) anliegt und als Antwort auf ein Detektieren, dass eine in dem Senke-Betriebsmodus betriebene Vorrichtung mit dem kabelgebundenen Steckverbinder (114, 510) verbunden ist, durch Testen der Impedanzen auf dem DDC-Kanal (Kanal 15 und Kanal 16 für einen HDMI Steckverbinder), Überführen der ersten AV-Vorrichtung (110) von dem AV-Senke-Betriebsmodus in einen AV-Quelle-Betriebsmodus, wobei die erste AV-Vorrichtung (110) eine Versorgungsspannung an den Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510) bereitstellt,

Einstellen eines Timers auf eine vorbestimmte Begrenzung, und

Warten auf das Detektieren einer Spannung an dem Hot-Plug-Detektion-Kontakt, und, wenn die Spannung vor Ablauf des Timers detektiert wird, arbeitet die erste AV-Vorrichtung (110) in dem AV-Quelle-Betriebsmodus, wobei die erste AV-Vorrichtung (110) AV-Daten über den kabelgebundenen Steckverbinder (114, 510) sendet und den Pull-Up-Widerstand für den DDC-Kontakt (Kanal 15) aktiviert,

andernfalls, wenn die Spannung an dem Hot-Plug-Detektion-Kontakt nicht vor Ablauf des Timers detektiert wird, Überführen der ersten AV-Vorrichtung (110) von dem AV-Quelle-Betriebsmodus in den AV-Senke-Betriebsmodus.

2. Das Verfahren gemäß Anspruch 1, wobei der Standard-Betriebsmodus zur Kommunikation gemäß einem Hochauflösende-Multimedia-Schnittstelle-Standard dient.

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3. Das Verfahren gemäß Anspruch 1, wobei eine erste Impedanz für einen Datenkanal des kabelgebundenen Steckverbinders (114, 510) in dem AV-Quelle-Betriebsmodus bereitgestellt wird, und die erste Impedanz für den Datenkanal in dem AV-Senke-Betriebsmodus nicht bereitgestellt wird.

4. Das Verfahren gemäß Anspruch 1, ferner aufweisend:

Durchführen eines AV-Daten-Austauschs zwischen der ersten AV-Vorrichtung (110) und der zweiten AV-Vorrichtung (120).

5. Eine Audio/Video (AV)-Vorrichtung (110), aufweisend:

eine Kommunikationslogik (580) zum Verbinden mit einem kabelgebundenen Steckverbinder (114, 510), wobei die Kommunikationslogik (580) ein Schaltungssystem aufweist zum Implementieren von:

einem AV-Senke-Betriebsmodus für die Kommunikationslogik (580) zum Empfangen von AV-Daten, die an die AV-Vorrichtung (110) bereitgestellt werden, an dem kabelgebundenen Steckverbinder (114, 510) und zum Empfangen von Strom von einer Versorgungsspannung, die an die AV-Vorrichtung (110) bereitgestellt wird, über einen Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510), und

einem AV-Quelle-Betriebsmodus für die Kommunikationslogik (580) zum Senden von AV-Daten von der AV-Vorrichtung (110) über den kabelgebundenen Steckverbinder (114, 510) und zum Bereitstellen einer Versorgungsspannung an den Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510); und

eine Steuerlogik (505), welche ein Schaltungssystem aufweist, das konfiguriert ist, um

die Kommunikationslogik (580) zu initialisieren, sodass sie die AV-Vorrichtung (110) in dem AV-Senke-Betriebsmodus betreibt, wobei der AV-Senke-Betriebsmodus aufweist,

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dass die AV-Vorrichtung keinen Strom an einen Strom-Kontakt (Kanal 18 für einen HDMI Steckverbinder) bereitstellt, eine Spannung an einem Hot-Plug-Detektion-Kontakt nicht bereitgestellt wird (Kanal 19 für einen HDMI Steckverbinder), ein Pull-Up-Widerstand für einen Display-Data-Channel (DDC)-Kontakt (Kanal 15 für einen HDMI Steckverbinder) deaktiviert ist und eine Extended-Display-Identification-Data (EDID)-Funktionalität initialisiert wird;

nach dem Initialisieren, durch die AV-Vorrichtung (110), den Stromausgabe-Kontakts durch einen Pull-Down-Widerstand herunterzuziehen;

als Antwort auf ein Ermitteln, dass die Versorgungsspannung an dem Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510) anliegt, den Betrieb der AV-Vorrichtung (110) in dem AV-Senke-Betriebsmodus fortzusetzen, eine Spannung an dem Hot-Plug-Detektion-Kontakt (Kanal 19 des Steckverbinders 510) des kabelgebundenen Steckverbinders (114, 510) zu aktivieren, den Strom-Kontakt auf das Vorhandensein der Versorgungsspannung periodisch zu überprüfen, und die Spannung an dem Hot-Plug-Detektion-Kontakt als Antwort auf ein Nicht-Vorhandensein der Versorgungsspannung an dem Strom-Kontakt zu deaktivieren; und

als Antwort auf ein Ermitteln, dass die Versorgungsspannung nicht an dem Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510) anliegt und als Antwort auf ein Detektieren, dass eine in dem Senke-Betriebsmodus betriebene Vorrichtung mit dem kabelgebundenen Steckverbinder (114, 510) verbunden ist, durch Testen der Impedanzen auf dem DDC-Kanal (Kanal 15 und Kanal 16 für einen HDMI Steckverbinder), die Kommunikationslogik (580) zum Überführen der AV-Vorrichtung (110) von dem AV-Senke-Betriebsmodus in den AV-Quelle-Betriebsmodus zu initialisieren, wobei die erste AV-Vorrichtung (110) eine Versorgungsspannung an dem Strom-Kontakt des kabelgebundenen Steckverbinders (114, 510) bereitstellt, einen Timer auf eine vorbestimmte Begrenzung einzustellen, und

auf ein Detektieren einer Spannung an dem Hot-Plug-Detektion-Kontakt zu

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warten, und, wenn die Spannung vor Ablauf des Timers detektiert wird, die erste AV-Vorrichtung (110) konfiguriert ist, um in dem AV-Quelle-Betriebsmodus zu arbeiten, wobei die erste AV-Vorrichtung (110) AV-Daten über den kabelgebundenen Steckverbinder (114, 510) sendet und den Pull-Up-Widerstand für den DDC-Kontakt (Kanal 15) aktiviert,

andernfalls, wenn die Spannung an dem Hot-Plug-Detektion-Kontakt nicht vor Ablauf des Timers detektiert wird, die AV-Vorrichtung (110) konfiguriert ist zum Übergehen von dem AV-Quelle-Betriebsmodus in den AV-Senke-Betriebsmodus.

6. Die Vorrichtung gemäß Anspruch 5, wobei der Standard-Betriebsmodus zur Kommunikation gemäß einem Hochauflösende-Multimedia-Schnittstelle-Standard dient.

7. Die Vorrichtung gemäß Anspruch 5, wobei die Kommunikationslogik (580) ferner initialisiert ist zum Bereitstellen einer ersten Impedanz für einen Datenkanal des kabelgebundenen Steckverbinders (114, 510) in dem AV-Quelle-Betriebsmodus, und initialisiert ist zum Nicht-Bereitstellen der ersten Impedanz für den Datenkanal in dem AV-Senke-Betriebsmodus.

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The document(s) listed below is (are) subsequently filed documents pertaining to the following application:

Application number	12762781.8
Applicant's or representative's reference	P56843

	Description of document	Original file name	Assigned file name
1	German translations of the claims	P56843_translation of the claims_DE.pdf	CLMSTRAN-DE-1.pdf
2	French translations of the claims	P56843_translation of the claims_FR.pdf	CLMSTRAN-FR-1.pdf
3	Reply to the communication under rule 71(3) EPC	P56843_submission.pdf	IGRA-1.pdf

	Fees	Factor applied	Fee schedule	Amount to be paid
15-1	007 Fee for grant, including fee for publication of the European patent specification (R71(3))	1	925.00	925.00
	Total:		**EUR**	**925.00**

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The document(s) listed below is (are) subsequently filed documents pertaining to the following application:

Application number	12762781.8
Applicant's or representative's reference	P56843

	Description of document	Original file name	Assigned file name
1	Request for transfer of rights	P56843_Certifcate_of_Merger.pdf	CDAPPR-TOR-1.pdf
2	Request for transfer of rights	P56843_submission.pdf	CDAPPR-TOR-2.pdf

	Fees	Factor applied	Fee schedule	Amount to be paid
15-1	022 Fee for registering a transfer	1	100.00	100.00
	Total:		**EUR**	**100.00**

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	P56843	**ma/Ih**	**25.02.2019**

European Patent Application 12 762 781.8 based on PCT/US2012/31463
Silicon Image, Inc.

Herewith, it is indicated that the applicant of the above mentioned European patent application, Silicon Image, Inc., has merged with and into

Lattice Semiconductor Corporation
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Enclosed is a copy of the Certificate of Merger. The official fee is being paid.

It is kindly requested to record Lattice Semiconductor Corporation as new applicant of the above European patent application and to provide us with a corresponding notification.

Further it is indicated that our firm takes over the representation of the new applicant.

Kornelia Ihle
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Enclosure:
Copy of Certificate of Merger

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Annex to EPO Form 2004, Communication pursuant to Rule 71(3) EPC

Bibliographical data of European patent application No. 12 762 781.8

For the intended grant of the European patent, the bibliographical data are set out below, for information:

Title of invention:

- VERFAHREN, VORRICHTUNG UND SYSTEM FÜR DEN ÜBERGANG EINER AUDIO/VIDEO-VORRICHTUNG ZWISCHEN EINEM QUELL- UND EINEM SENKMODUS
- METHOD. APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE AND A SINK MODE
- PROCÉDÉ, APPAREIL ET SYSTÈME POUR FAIRE TRANSITER UN DISPOSITIF AUDIO/VIDÉO ENTRE UN MODE DE SOURCE ET UN MODE DE COLLECTE

Classification: INV. H04L29/10 H04L29/12 H04L12/10 G06F3/14 G09G5/00 ADD. H04L12/12 H04L12/28 H04N5/775 H04N21/4363 H04N21/442

Date of filing: 30.03.2012

Priority claimed: US / 31.03.2011 / USP201161470431
US / 29.03.2012 / USA201213434273

Contracting States* for which fees have been paid: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Extension States* for which fees have been paid:

Validation States* for which fees have been paid:

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DE

*)	If the time limit for the payment of designation fees according to Rule 39(1) EPC has not yet expired and the applicant has not withdrawn any designation, **all Contracting States/Extension States/Validation States** are currently still deemed to be designated. See also Rule 71a(3) EPC and, if applicable, the above Note to users of the automatic debiting procedure.
**)	If two or more applicants have designated different Contracting States, this is indicated here.

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Application No.	Ref.	Date
12 762 781.8 - 1209	P56843	06.11.2018
Applicant: Silicon Image, Inc.		

Communication under Rule 71(3) EPC

1. Intention to grant

You are informed that the examining division intends to grant a European patent on the basis of the above application, with the text and drawings and the related bibliographic data as indicated below.

A copy of the relevant documents is enclosed.

1.1 In the text for the Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Description, Pages

1, 3-20	as published	
2	filed in electronic form on	19-05-2017

Claims, Numbers

1-7	filed in electronic form on	19-05-2017

Drawings, Sheets

1/7-7/7	as published

With the following amendments to the above-mentioned documents proposed by the division

Description, Pages	1
Claims, Numbers	1, 5, 7

Registered letter
EPO Form 2004C 12.17CXP

Comments

DESCRIPTION
Page 1: Removed "the teaching of which is incorporated herein by reference" (Guidelines F-III, 8)
CLAIMS
Pages 1, 2, CLAIMS 1, 5: Scope of claim unclear - clarified (Art. 84 EPC) based on Fig. 4A and 4B
Page 3, Claim 7: Inconsistency between claim and description removed (Art. 84 EPC)

1.2 Bibliographic data

The title of the invention in the three official languages of the European Patent Office, the international patent classification, the designated contracting states, the registered name(s) of the applicant(s) and the other bibliographic data are shown on **EPO Form 2056** (enclosed).

2. Invitation

You are invited, **within a non-extendable period of four months** of notification of this communication,

2.1 to EITHER approve the text communicated above and verify the bibliographic data (Rule 71(5) EPC)

(1) by filing a translation of the claim(s) in the other two official languages of the EPO

	Fee code	EUR
(2a) by paying the fee for grant including the fee for publication:	**007**	925.00
minus any amount already paid (Rule 71a(5) EPC):		0.00
	Total amount:	925.00
(3) by paying additional claims fees under Rule 71(4) EPC; number of claims fees payable: 0	**016**	0.00
minus any amount already paid (Rule 71a(5) EPC):		0.00
	Total amount:	0.00

Important: If the translations of the claims and fees have already been filed and paid respectively in reply to a previous communication under Rule 71(3) EPC, e.g. in the case of resumption of examination after approval (see Guidelines C-V, 6), **agreement as to the text to be granted** (Rule 71a(1) EPC) must be expressed within the same time limit (e.g. by approving the text and verifying the bibliographic data, by confirming that grant proceedings can go ahead with the documents on file and/or by stating which translations of the claims already on file are to be used).

Note 1: See "Notes concerning fee payments" below.
Note 2: Any overpaid "minus" amounts will be refunded when the decision to grant (EPO Form 2006A) has been issued.
Note 3: For the calculation of the grant fee under Article 2(2), No. 7, RFees (old fee structure), the number of pages is determined on the basis of a clean copy of the application documents, in which text deleted as a result of any amendments by the examining division is not shown. Such clean copy is made available via on-line file inspection only.

2.2 OR, in the case of disapproval, to request reasoned amendments or corrections to the text communicated above or keep to the latest text submitted by you (Rule 71(6) EPC).

In this case the translations of the claims and fee payments mentioned under point 2.1 above are NOT due.

The terms "amendment(s)" and "correction(s)" refer only to amendments or corrections of the application documents and not of other documents (e.g. bibliographic data, the designation of the inventor, etc.).

If filing amendments, you must identify them and indicate the basis for them in the application as filed. Failure to meet either requirement may lead to a communication from the examining division requesting that you correct this deficiency (Rule 137(4) EPC).

2.3 Bibliographic data

Where you request a change or correction of bibliographic data in response to the Rule 71(3) communication, this will **not** cause the sending of a further communication under Rule 71(3) EPC. You will still have to pay the fees and file translations in reply to the Rule 71(3) communication in the case of 2.1 above, unless you also file a reasoned request for amendments or corrections in response to the Rule 71(3) communication (see case 2.2 above).

3. Loss of rights

If neither of the two possible actions above (see points 2.1 or 2.2) is performed in due time, the European patent application will be deemed to be withdrawn (Rule 71(7) EPC).

4. Further procedure

4.1 In the case of point 2.1 above

4.1.1 The decision to grant the European patent will be issued, and the **mention of the grant** of the patent will be published in the European Patent Bulletin, if the requirements concerning the translation of the claims and the payment of all fees are fulfilled and there is agreement as to the text to be granted (Rule 71a(1) EPC).

Note on payment of the renewal fee:
If a renewal fee becomes due before the next possible date for publication of the mention of the grant of the European patent, publication will be effected only after the renewal fee and any additional fee have been paid (Rule 71a(4) EPC).

Under Article 86(2) EPC, the obligation to pay renewal fees to the European Patent Office terminates with the payment of the renewal fee due in respect of the year in which the mention of the grant of the European patent is published.

Note on payment of the designation fee(s):
If the designation fee(s) become(s) due after the communication under Rule 71(3) EPC, the mention of the grant of the European patent will not be published until these fees have been paid (Rule 71a(3) EPC).

4.1.2 After publication, the **European patent specification** can be downloaded free of charge from the EPO publication server https://data.epo.org/publication-server.

4.1.3 Filing of translations in the contracting states

As regards translation requirements prescribed by the contracting states under Article 65(1) EPC, please consult the website of the European Patent Office
www.epo.org ➞Law & practice ➞Legal texts, National law relating to the EPC
www.epo.org ➞Law & practice ➞All Legal texts ➞London Agreement

In the case of a valid extension or validation

As regards translation requirements prescribed by the extension or validation states, please consult the website of the European Patent Office
www.epo.org ➞Law & practice ➞Legal texts, National law relating to the EPC

Failure to supply a prescribed translation in a contracting state, or in an extension or validation state may result in the patent being deemed to be void *ab initio* in the state concerned (Art. 65(3) EPC).

4.2 In the case of 2.2 above

If the present communication under Rule 71(3) EPC is based on an auxiliary request and, within the time limit, you maintain the main request or a higher ranking request which is not allowable, the application will be refused (Art. 97(2) EPC).

If the examining division gives its consent to the requested amendments or corrections, it will issue a new communication under Rule 71(3) EPC; otherwise, it shall resume the examination proceedings (Rule 71(6) EPC).

5. Filing of a divisional application

Any divisional application relating to this European patent application must be filed directly with the European Patent Office in Munich, The Hague or Berlin and will be in the language of the proceedings for the present application, or if the latter was not in an official language of the EPO, the divisional application may be filed in the language of the present application as filed (see Article 76(1) and Rule 36(2) EPC). Any such divisional application must be filed while the present application is still pending (Rule 36(1) EPC; Guidelines A-IV, 1.1.1).

6. Notes concerning fee payments

6.1 Making payments

For payments made via deposit account, please note that as from 1 December 2017 debit orders will only be carried out if filed in an electronically processable format (xml), using an accepted means of filing as laid down in the Arrangements for deposit accounts (ADA), published in the Supplementary publication in the Official Journal.

All relevant information related to the modes of payment of fees to the EPO can be retrieved from the EPO website at "**Making Payments**".

6.2 Information concerning fee amounts

Procedural fees are usually adjusted every two years, on even years, with effect from 1 April. Therefore, before making a payment, parties should verify the amounts actually due on the date of payment using the applicable version of the Schedule of fees and expenses, published as a Supplement to the Official Journal of the EPO, available on the EPO website (**www.epo.org**) at **www.epo.org/schedule-of-fees**. The "Schedule of fees" table allows the viewing, downloading and searching of individual fee amounts, both current and previous.

6.3 Note to users of the automatic debiting procedure

The fee for grant, including the fee for publication, and any additional claims fees due under Rule 71(4) EPC will be debited automatically on the date of filing of the translations of the claims, or on the last day of the period of this communication. However, if the designation fee(s) become(s) due as set out in Rule 71a(3) EPC and/or a renewal fee becomes due as set out in Rule 71a(4) EPC, these should be paid separately by another permitted way of payment in order not to delay the publication of the mention of the grant. The same applies in these circumstances to the payment of extension and validation fees. The same applies in these circumstances to the payment of extension and validation fees.

Note: If a waiver is expressed in response to a Rule 71(3) communication (see OJ EPO 2015, A52), the fee for grant, including the fee for publication/printing, and any additional claims fees will not be debited automatically. These fees must be paid separately by another means of payment allowed under the Rules relating to Fees.

Examining Division:

Chairman: Vázquez del Real, S
2nd Examiner: Gonzalez Ordonez, O
1st Examiner: Maciu, Emanoil



van Ekelenburg, J
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Enclosures: Text intended for grant

EPO Form 2056

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Application No.: 12 762 781.8

IV.2. Patent classification

The classification has been changed. It now is as follows:

INV. H04L29/10 H04L29/12 H04L12/10 G06F3/14 G09G5/00 ADD. H04L12/12 H04L12/28 H04N5/775 H04N21/4363 H04N21/442

IV.3. Title of the invention

The title indicated on the published patent application remains unchanged. It reads as follows:

VERFAHREN, VORRICHTUNG UND SYSTEM FÜR DEN ÜBERGANG EINER AUDIO/VIDEO-VORRICHTUNG ZWISCHEN EINEM QUELL- UND EINEM SENKMODUS

METHOD. APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE AND A SINK MODE

PROCÉDÉ, APPAREIL ET SYSTÈME POUR FAIRE TRANSITER UN DISPOSITIF AUDIO/VIDÉO ENTRE UN MODE DE SOURCE ET UN MODE DE COLLECTE

IV.4. Documentation

CDOC The following documents not mentioned in the Search Report were cited during the Examination Procedure:

JP 2009 060204 A (PANASONIC CORP) 19 March 2009 (2009-03-19)

24-10-2018
Date

Vázquez del Real, S
Chairman

Maciu, Emanoil
1st examiner

González Ordonez, O
2nd examiner

Enclosure(s):

METHOD, APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE MODE AND A SINK MODE

RELATED APPLICATIONS

[0001] This application claims priority from Provisional Application Serial Number 61/470,431, filed March 31, 2011, entitled "METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO CONTENT".

BACKGROUND

1. Technical Field

[0002] Embodiments relate generally to techniques for exchanging audio/video information. More particularly, certain embodiments provide techniques for controlling an audio/video device to selectively receive or send audio/video information.

2. Background Art

[0003] The size of computers and other audio/video (AV) capable electronic devices continue to scale with successive improvements in integrated circuit (IC) fabrication techniques. Consequently, there is a general trend toward a wider variety of AV devices, notably smaller AV devices, implementing functionality to support higher throughput and/or higher quality of AV information.

[0004] Certain conventional AV devices include a High-Definition Multimedia Interface (HDMI) connector or other such hardware for coupling to some other device, where the AV device operates as a source to provide AV information to the other device via the connector. Typical examples of conventional AV sources include a camcorder, digital camera, personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), smart phone, video game console, DVD player,

digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source. US 2009/0 046 690 A1 discloses a bidirectional high-speed digital interface transceiver which, by selectively coupling a multiplexer to a transmitter or to a receiver, can act as a source device or a sink device. JP 2009 060 204 A discloses an audio/video device which can be used as source or sink.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

[0012] FIG. 4A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0013] FIG. 4B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0014] FIG. 5 is a block diagram showing elements of an audio/video device according to an embodiment.

DETAILED DESCRIPTION

[0015] Embodiments discussed herein variously make, use or otherwise provide circuit logic to selectively control an audio/video (or "AV") device for operation at different times in various ones of a plurality of operation modes. The plurality of operation modes may include what is referred to herein as an "AV Sink" operation mode, for the AV device (also referred to herein as simply "device") to be a sink for receiving AV information from another AV device via a connector, and what is referred to herein as an "AV Source" operation mode, for the AV device to be a source for providing AV information to another AV device via the same connector. In an embodiment, the AV device includes the connector. In an alternate embodiment, the AV device may operate in a system which includes the connector – e.g. where the connector is to couple the system with some external device for an exchange of AV information.

[0016] As used herein, "audio/video" or "AV" refers to the characteristic of relating to either audio content or video content, or relating to both audio content and video content. For example, AV information may include some or all of audio data and/or control information and video data and/or control information. In an embodiment, an AV device may, in addition to exchanging AV information with another device, be operable to render audio content and/or video content for a user, although certain embodiments are not limited in this regard.

[0017] An AV device according to an embodiment includes communication logic to exchange AV data according to some interface standard. By way of illustration and not limitation, such communication logic may exchange AV data via

a connector which is compatible with one or more of an HDMI standard such as the HDMI 1.4 standard released May 28, 2009 by HDMI Licensing, LLC of Sunnyvale, CA, a Mobile High-Definition Link (MHL) standard such as the MHL 1.0 specification released June 30, 2010 by the MHL Consortium of Sunnyvale, CA, a Digital Visual Interface (DVI) standard such as the DVI 1.0 standard released April 02, 1999 by the Digital Display Working Group of Vancouver, WA, a DisplayPort standard such as the DisplayPort 1.2 standard released December 22, 2009 by the Video Electronics Standards Association of Newark, CA and/or the like.

[0018] In an embodiment, such communication logic may implement communications which, at different times, are compatible with different interface standards, where all such communications are via the same connector. For example, communication logic may include first logic to detect the presence of, and communicate with, an HDMI device and second logic to detect the presence of, and communicate with, an HDMI device, where the respective detection and communication functionalities of the first logic and second logic do not conflict with or otherwise impede the other. Such communication logic may, for example, be referred to as "MHL-ready HDMI," "HDMI/MHL" and/or the like. Features of various embodiments are discussed herein in the context of exchanging AV information according to an HDMI interface standard. However, such discussion may be extended to apply to any of a variety of additional or alternative interface standards for exchanging AV data, according to different embodiments.

[0019] Certain embodiments variously provide that, from either or both of a device power up and a device reset, an AV device will, by default, return to or otherwise be in a Sink mode. While in this mode such an AV device may then determine by stimulus and response or measurement means described herein that it is connected to an AV Sink device, in which case it may safely transition to an AV Source operation mode. In an embodiment, the AV device may translate back to AV Sink operation mode in response to an indication of a change in connectivity to the AV Sink device.

[0020] FIG. 1 illustrates elements of a system 100 for exchanging AV information according to an embodiment. System 100 may include a first device

110 comprising AV logic 112 to variously implement AV communications between first device 110 and one or more other devices. One embodiment may, for example, be implemented entirely within AV logic 112. Another embodiment may be implemented by first device 110 as a whole. Still another embodiment may be implemented by system 100 as a whole. Any of a variety of other embodiments may be alternatively implemented according to techniques discussed herein.

[0021] In an embodiment, first device 110 includes functionality of one or more of conventional AV source devices and/or functionality of one or more conventional AV sink devices. By way of illustration and not limitation, first device 110 may include functionality of one or more devices including, but not limited to, a personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), camcorder, smart phone, video game console, television, monitor, display, set-top box, home theater receiver and/or the like.

[0022] First device 110 may include a connector 114, coupled via one or more signal lines to AV logic 112, to variously connect first device 110 to some other device of system 100 for an exchange of AV information. Connector 114 may include a plurality of channels, such as pins and/or other interconnect hardware, which are compatible with a particular AV interface standard – e.g. an HDMI standard.

[0023] In an illustrative embodiment, connector 114 may, at some point in time, couple first device 110 via an interconnect 122 to a second device 120 of system 100 – e.g. for an exchange 124 of AV information from second device 120 to first device 110. The particular direction of exchange 124 is not limiting on certain embodiments, and may alternatively be in the opposite direction, where first device 110 operates as the AV Source and second device 120 operates as the AV Sink. Accordingly, second device 120 may, for example, include both logic (not shown) to implement conventional AV Source functionality or conventional AV Sink functionality. In another embodiment, second device 120 may include logic to variously provide both AV Source functionality and AV Sink functionality according to techniques described herein.

[0024] Certain embodiments variously mitigate at least one problem which might otherwise arises if two conventional AV devices are coupled to one another when those two devices are concurrently configured each for respective operation as an AV Source. Such connecting of AV Source devices to one another can risk damage to transmission hardware in either or both devices. For example, the two devices may attempt to drive power in opposite directions in the same power supply voltage channel of a connector. Alternatively, or in addition, two such devices may attempt to drive data signals in opposite directions via the same data channel of the connector. Such AV Source devices may risk driving any of a variety of other signals – e.g. hot plug detect signals, clock signals and/or the like – against one another each on some common respective channel of a connector.

[0025] AV logic 112 may limit the risk of the resulting damage in system 100 by providing a control mechanism to selectively prevent one or more aspects of AV Source functionality from being provided during operation of first device 110. By way of illustration and not limitation, AV logic 112 may selectively transition itself between a plurality of operation modes which includes an AV Source operation mode and an AV Sink operation mode. The AV Source operation mode may be for AV logic 112 to provide a particular signal to connection 114 – e.g. a supply voltage, a digital data signal and/or the like. Additionally or alternatively, the AV Source operation mode may be for AV logic 112 to provide a particular amount of impedance – e.g. pull-up impedance, pull-down impedance and/or the like – for a signal line coupled to a channel of connection 114.

[0026] In an embodiment, control logic (not shown) of AV logic 112 selects one of the plurality of operation modes in response to an indication of a particular type of event at first device 110. Whether and/or how AV logic 112 might transition between operation modes may be based, for example, on whether the indicated event is a power-up event, a power-down event a reset event, and/or the like.

[0027] Whether and/or how AV logic 112 might transition between operation modes may be additionally or alternatively based on an event which detects a particular characteristic (or absence of said characteristic) regarding connectivity between connector 114 and second device 120. By way of illustration and not

limitation, such a characteristic may include whether (or not) some second device 120 is providing a supply voltage at a particular channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a supply voltage to its corresponding AV Sink – e.g. the +5V output to be provided from Source to Sink according to HDMI, as on pin 18 of a 19-pin HDMI connector.

[0028] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing to connector 114 a hot plug detect (HPD) signal. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Sink is to indicate its presence with a HPD signal to its corresponding AV Source – e.g. the HPD signal to be provided from Sink to Source according to HDMI, as on pin 19 of a 19-pin HDMI connector.

[0029] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing a clock signal to connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a clock signal to an AV Sink – e.g. the DDC_SCL signal to be provided from Source to Sink according to HDMI, as on pin 15 of a 19-pin HDMI connector.

[0030] Additionally or alternatively, such a characteristic may include whether (or not) a particular amount of impedance is being provided by second device 120 for a channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that a particular pull-up impedance is to be implemented at an AV Sink – e.g. a 47kΩ pull-up resistance which HDMI requires be provided at an AV Sink for a SDA line (e.g. pin 16 of a 19-pin HDMI connector).

[0031] In an embodiment, the functionality of AV logic 112 allows connector 114 to be variously coupled, decoupled and/or recoupled at different times to one or more devices, while limiting a risk of damage to hardware in system 100. By way of illustration and not limitation, connector 114 may at some point in time be decoupled from second device 120 and subsequently coupled via an interconnect 132 to some third device 130 – e.g. for an exchange 134 of AV information to third

device 130 from first device 110. The particular direction of exchange 134 is not limiting on certain embodiments, any may alternatively be in the opposite direction, where first device 110 operates as the AV Sink and third device 130 operates as the AV Source. In an embodiment, third device 130 is simply second device 120 – e.g. where second device 120 is decoupled from and subsequently recoupled to first device 110 and/or where first device 110 and second device 120 switch AV Sink and AV Source roles for different AV information exchanges.

[0032] As shown in the discussion herein, AV logic 112 may protect various circuitry of system 100 for different successive couplings of first device 110 each to a respective device and/or for successive different AV information exchanges each between first device 110 and a respective device.

[0033] FIG. 2A illustrates elements of a method 200 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 200 may, for example, be a device including some or all of the features of first device 110. In one embodiment, an AV device controlled by performing method 200 may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Features of various embodiments are discussed herein in terms of performing method 200 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0034] In an embodiment, the AV device includes communication logic comprising circuitry to operate at different times in different ones of a plurality of operation modes which include an AV Source operation mode and an AV Sink operation mode. The AV Sink operation mode may, for example, be for the communication logic to receive AV data provided to the AV device via a connector – e.g. via connector 114. The AV Sink operation mode may further be for the communication logic to receive power from a first supply voltage provided via a channel of the connector. By contrast, the AV Source operation mode may be for the communication logic to send AV data from the AV device, where the AV data is sent through the connector. The AV Source operation mode may further be for the

communication logic to provide a second supply voltage at the channel of the connector. In an embodiment, a level of the first supply voltage is equal to a level of the second supply voltage.

[0035] In an embodiment, method 200 includes, at 210, detecting an indication of one of a power up event at the AV device, a power down event at the device or a reset event at the AV device. The detecting at 210 may, for example, include control circuitry of AV logic 112 directly or indirectly detecting an indication sent from some agent included in or otherwise accessible to AV logic 112. By way of illustration and not limitation, first device 110 may include a power management unit, a host processor or other agent which sends to AV logic 112 a signal specifying, for example, that first device 110 is going through, has gone through, or is expected to go through a boot up or boot down operation, or otherwise to transition to or from an operative power state. In an embodiment, transitioning to or from such an operative power state may include transitioning between a first power state in which AV logic 112 is incapable of exchanging AV information via connector 114 and a second power state in which AV logic 112 is capable of exchanging AV information via connector 114. Alternatively or in addition, AV logic 112 may include detector logic to evaluate power state of AV logic 112 and/or of other components of first device 110.

[0036] The detecting at 210 may additionally or alternatively include control circuitry of AV logic 112 directly or indirectly detecting a signal from some agent, included in or otherwise accessible to AV logic 112, the signal specifying or otherwise indicating that AV logic 112 or some other component of first device 110 have been, are being, or are expected to be reset. Such a reset may flush some current state of circuit logic in favor of some predetermined baseline configuration. A reset may, for example, return some or all of first device 110 to a predetermined configuration without powering down first device 110.

[0037] In response to the indication detected at 210, method 200 may, at 220, automatically initialize communication logic of the AV device. By way of illustration and not limitation, control logic of AV logic 112 may automatically place the communication logic of AV logic 112 into a default operation mode which

prevents the second supply voltage from being provided by the communication logic at the channel of the connector. In an embodiment, the default operation mode is the AV Sink operation mode. In an embodiment, the AV Source operation mode is further for the communication logic of the AV device to provide a first total amount of impedance for a data channel of the connector. In such an embodiment, the default operation mode may prevent the first total amount of impedance for the data channel from being provided by the communication logic.

[0038] FIG. 2B illustrates elements of a method 250 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 250 may, for example, be a device having some or all of the features of a device controlled by method 200. Method 250 may, for example, be performed after method 200 – although certain embodiments are not limited in this regard. Features of various embodiments are discussed herein in terms of performing method 250 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0039] Method 250 may include, at 260, detecting a characteristic regarding a connectivity of the AV device to another device via a connector – e.g. connector 114. For example, detector logic of AV logic 112 may detect connectivity to the other device via the connector – e.g. the detecting while the communication logic of the AV device is in the default operation mode of method 200. Additionally or alternatively, such detector logic of AV logic 112 may detect a change in a state of connectivity to the other device via the connector. The detecting the characteristic at 260 may, for example, include detecting an indication that the other device is providing the first supply voltage discussed with regard to method 200. Alternatively or in addition, the detecting at 260 may include detecting that the other device is providing to the connector a hot plug detect (HPD) signal, a clock signal and/or any of a variety combinations of one or more other signals. Alternatively or in addition, the detecting at 260 may include evaluating an impedance of a signal line which couples the other device to the connector.

[0040] In response to detecting the characteristic at 260, method 200 may, at 270, automatically place the communication logic of the AV device into some first operation mode which prevents a providing of the second supply voltage referred to in the discussion of method 200. The first operation mode may, for example, be the default operation mode of method 200, although certain embodiments are not limited in this regard. In placing the AV device into the first operation mode, method 250 may limit the possibility of circuit damage due to conflicting output signals from two coupled AV devices, each device attempting to operate as an AV Source.

[0041] FIG. 3 illustrates select elements of a connector 300 for exchanging AV information according to an embodiment. Connector 300 may include some or all of the features of connector 114, for example. The illustrative connector 300 is a 19-channel (e.g. 19-pin) connector which is compatible with an HDMI interface standard, although certain embodiments are not limited in this regard. Connector 300 may support AV information exchanges by any of a variety of other types of interconnect hardware – e.g. a connector including more, fewer, or alternative channels to those shown in FIG. 3 – where communication via such a connector is consistent with techniques discussed herein.

[0042] The illustrative connector 300 includes interconnect hardware to support transition-minimized differential signaling (TMDS) in HDMI communication. More particularly, the respective functions of the channels in connector 300 may be assigned according to HDMI 1.4 or some other HDMI interface standard – e.g. as follows:

Channel 1	TMDS Data2+
Channel 2	TMDS Data2 Shield
Channel 3	TMDS Data2–
Channel 4	TMDS Data1+
Channel 5	TMDS Data1 Shield
Channel 6	TMDS Data1–
Channel 7	TMDS Data0+
Channel 8	TMDS Data0 Shield
Channel 9	TMDS Data0–

Channel 10	TMDS Clock+
Channel 11	TMDS Clock Shield
Channel 12	TMDS Clock–
Channel 13	Consumer Electronics Control (CEC)
Channel 14	HDMI Ethernet Channel (HEC) Data
Channel 15	System Clock Line (SCL) – I²C Serial Clock for Display Data Channel (DDC)
Channel 16	System Data (SDA) – I²C Serial Data Line for DDC
Channel 17	DDC/CEC/HEC Ground
Channel 18	+5 V Power
Channel 19	Hot Plug Detect (HPD) and/or HEC Data+

Potential conflict may result when two connected AV devices concurrently attempt to drive respective supply voltages and/or other signals according to the same function assignments for connector 300.

[0043] In an embodiment, an AV device including or coupled to connector 300 may implement techniques to reduce the likelihood of such conflict – e.g. techniques including some or all of the features discussed with respect to method 200 and/or method 250. By way of illustration and not limitation, control logic of such an AV device may provide that after some event – e.g. from one or more of a power up event, a power down event and a reset event – communication logic of the AV device will operate in an AV Source operation mode only after certain connectivity conditions are subsequently identified. For example, the control logic may configure the AV device after/during power up – or before/during a power down – for a default operation mode in which a functionality required for operation as an AV Source is disabled. For instance, the disabled functionality may be required for operation as an AV Source device according to the conditions of HDMI or some other interface standard.

[0044] Alternatively or in addition, the control logic may configure the AV device for an AV Sink operation mode in response to detecting a change of a characteristic regarding connectivity between the AV devices. For example, the AV device may be set to, or return to, some default AV Sink operation mode in response

to an indication of a loss or absence at connector 300 of a supply voltage, an indication of a loss or absence of a HPD signal, an indication of a signal line pull-up impedance implemented by any other connected AV device, and/or an indication of a clock signal provided by any other connected AV device. Any of a variety of additional or alternative detected conditions may determine whether and/or how the AV device may be configured – or reconfigured – for operation in such a default mode. In one embodiment, the default operating mode is a SINK mode of HDMI in which the AV device is capable of operation as an AV Sink.

[0045] In an embodiment, control logic of an AV device may implement a state machine or other mechanism for transitioning the communication logic between operation modes including SINK mode and SOURCE mode. By way of illustration and not limitation, the AV device may default its communication logic to SINK mode in response to (or during) a power up of the AV device (or in response to, or during, a power down of the AV device), and/or in response to detecting that a connectivity characteristic with another AV device is absent or has changed. The AV device may variously transition between SINK mode and SOURCE mode, depending on one or more connectivity characteristics detected for connector 300. Such connectivity characteristics may include, but are not limited to, whether a +5V voltage is provided by another AV device through connector 300, and/or whether one or more signals or other connectivity characteristics (e.g. HPD, DDC pull ups, TDMS termination, etc.) indicate presence or absence of functionality of some other connected AV device as an operable Sink or operable Source.

[0046] FIG. 4A and 4B illustrate select elements of methods 400a, 400b, respectively, for controlling operation of an AV device according to an embodiment. An AV device controlled by performing either or both of methods 400a, 400b may, for example, be a device including some or all of the features of first device 110. In one embodiment, the AV device controlled by performing either or both of methods 400a, 400b may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Methods 400a, 400b may include some or all of the features discussed herein with respect to methods 200, 250, although certain embodiments are not limited in this regard.

[0047] FIG. 4A and 4B are discussed herein with respect to features which are specific to HDMI interface requirements. However, such discussion may be extended to apply to requirements of any of a variety of additional or alternative interface standards for communicating AV information. For example, various additional or alternative test conditions (e.g. different delays, resistance values, signal outputs, test conditions, etc.) may be used, according to different embodiments, for determining whether and/or how one or more operation mode transitions of an AV device are to take place.

[0048] Method 400a may, at 405, initialize the AV device to SINK mode by default in response to an indication of a reset event, a power-on event or a power-off event. The initializing at 405 may, for example, include disabling one or more of a +5V HDMI output (channel 18), HPD output (pin 19), some or all DDC outputs (pins 15 and/or 16), and respective 1.8K pull-up resistors for such DDC outputs. The initializing at 405 may further include initializing extended display identification data (EDID) functionality of the AV device in preparation for identifying capabilities to any other device coupled via the connector – e.g. connector 114. After the initializing at 405, method 400 may, at 410, provide some delay – e.g. 100ms – for a high-value pull-down resistor to discharge the +5V HDMI output. However, such delay may not be required, in certain embodiments.

[0049] After delay at 410, method 400 may test for some indication that another device is coupled to the AV device being controlled by method 400a. By way of illustration and not limitation, method 400a may test, at 415, test whether a +5V HDMI supply voltage is being provided at connector 114 – indicating that a device coupled via the connector is operating in some AV Source mode. If the +5V supply voltage is detected at 415, then method 400a may, at 420, assert a HPD signal at the connector (pin 19) and, at 425, commence operation of the communication logic of the AV device in a SINK mode. The AV device may test for a change in connectivity with the other device – e.g. by occasionally testing at 430 +5V supply voltage continues to be provided at the connector by the other device. In an embodiment, detecting that the +5V supply voltage is not being so provided may result in method 400a disabling its HPD signal, its DDC output functionality and/or any other AV Sink functionality that is not currently being used. Method 400a may

then return to providing the delay at 410 in preparation for again testing for presence of any connected device.

[0050] If the +5V supply voltage is not detected at 415, then method 400a may detect for the presence of any device which might be coupled via the connector and which is operating in some AV Sink mode. By way of illustration and not limitation, method 400a may test, at 440, to confirm that there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification, that an impedance on the data (SDA channel 16) is not in the HDMI specified Source range of 1.5kΩ to 2.0kΩ, and that a receiver sense input (RSEN) signal indicates that one or more differential pairs of the connector are provided with terminators at some coupled device. If no AV Sink device is detected at 415, method 400a may then return to providing the delay at 410, in preparation for again testing for presence of any connected device.

[0051] If an AV Sink device is detected at 415, then in one embodiment, operations of method 400b may follow. For example, method 400b may, at 450, initiate a transition to SOURCE mode – e.g. including enabling the communication logic of the AV device to provide the +5V supply voltage to the connector. In an embodiment, method 400b may, at 455, start a HPD timer – e.g. set for 0.5 seconds – for timing out if a HPD signal is not detected from some AV Sink device. Method 400b may test, at 460, whether an HPD signal is detected – e.g. where the test at 460 may be successively performed according to a test at 480 of whether the HPD timer has expired. If an HPD signal is detected at 460, method 400b may begin operation of the AV device in a SOURCE mode, at 465.

[0052] If the HPD timer is determined to have expired at 480, method 400b may perform evaluations of whether one or more indications of a coupled AV Sink device are still present at the connector. By way of illustration and not limitation, method 400b may test, at 485, to confirm whether there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification. If such a 47kΩ pull-up resistor is detected at 485, method 400b may return to setting another HPD timer at 455.

[0053] If no such 47kΩ pull-up resistor is detected at 485, method 400b may begin preparations, at 445, to transition the AV device back to a SINK mode – e.g. including disabling one or more of a +5V HDMI output (channel 18), some or all DDC outputs (pins 15 and/or 16), respective 1.8K pull-up resistors for such DDC outputs, and/or the like. After the preparation for SINK mode operation at 445, method 400b may be followed by an operation of method 400a – e.g. the providing of a delay at 410.

[0054] In an embodiment, operation of the AV device in SOURCE mode, at 465, includes enabling 1.8K pull-up resistors for DDC channels of the connector which are to serve as output channels. Additionally or alternatively, SOURCE mode operation at 465 may include performing an EDID read of the capabilities of the detected AV Sink device. Operation of the AV device in SOURCE mode may continue until a test at 470 indicates that the detected AV Sink device is no longer providing a HPD signal. If such an HPD signal is no longer detected, method 400b may begin to protect the AV device from possible harm – e.g. caused by the detected AV Sink device somehow transitioning to AV Source operation. By way of illustration and not limitation, method 400b may, at 475, disable respective 1.8 kΩ pull-up resistors for one or more DDC channels of the connector. After the disabling at 475, method 400b may perform the presence test at 485.

[0055] FIG. 5 illustrates select elements of a system 500 for exchanging AV information according to an embodiment. System 500 may include some or all of the features of first device 110, for example. For example, system 500 may include AV logic 570 having some or all of the features of AV logic 112.

[0056] System 500 may include an AV connector – represented by an illustrative HDMI connector 510 at the edge of system 500 – to couple system 500 to some external device (not shown) for an AV information exchange. AV logic 570 may include mechanisms to variously implement different operation modes in system 500 to accommodate different types of AV communications via HDMI connector 510. By way of illustration and not limitation, AV 570 may include control logic 505 to receive information indicating a presence or absence of one or

more characteristics regarding connectivity of system 500 with some AV device via HDMI connector 510.

[0057] For example, control logic 505 may include or otherwise have access to detection logic 520 of system 500 which relays and/or analyzes signals exchanged via HDMI connector 510. In an embodiment, detection logic 520 may include one or more of logic to detect for a supply voltage output, logic to detect for a signal line termination, logic to detect for an EDID or other such identifier, logic to detect for a digital data functionality, logic to detect for a clock signal and/or the like. The particular mechanism for detection logic 520 to perform such detecting may be adapted from conventional techniques for detecting clock signals, data voltage inputs, impedances, etc., and are not limiting on certain embodiment. Although shown as being coupled along the data exchange path to intercept one or more signals exchanged via HDMI connector 510, detection logic 520 may, in an alternate embodiment, be configured to passively sense signals exchanged via HDMI connector 510.

[0058] Messages from detection logic 520 may indicate to control logic 505 whether and/or how system 500 is to transition logic of system 500 between operating modes. In an embodiment, control logic 505 may provide control functionality to variously place communication logic 580 of system 500 at different times in different ones of a plurality of operation modes – e.g. where the plurality of operation modes includes a SINK mode and a SOURCE mode. For example, control logic 505 may transition communication logic 580 between operation modes according to some or all of the techniques of method 500 and/or method 550.

[0059] By way of illustration and not limitation, control logic 505 may configure a switch of communication logic 580 – represented by an illustrative analog switch 530 – to switch between HDMI (or other AV interface standard) transmit logic 540 for SOURCE mode operation and HDMI (or other AV interface standard) receive logic 550 for SINK mode operation.

[0060] Control logic 505 may also provide functionality to further configure either or both of HDMI transmitter logic 540 and HDMI receive logic 550, although certain embodiments are not limited in this regard. For example, HDMI receive

logic 550 may include HDMI/MHL functionality to switch between a sub-mode to receive HDMI information from another AV device and a sub-mode to receive MHL information. Control logic 505 may provide signaling (not shown) to selectively configure HDMI receive logic 550 to variously operate in such sub-modes at different times.

[0061] Techniques and architectures for configuring an AV device are described herein. In the above description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of certain embodiments. It will be apparent, however, to one skilled in the art that certain embodiments can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the description.

[0062] Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[0063] Some portions of the detailed description herein are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the computing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0064] It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely

convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the discussion herein, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0065] Certain embodiments also relate to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs) such as dynamic RAM (DRAM), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and coupled to a computer system bus.

[0066] The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description herein. In addition, certain embodiments are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of such embodiments as described herein.

[0067] Besides what is described herein, various modifications may be made to the disclosed embodiments and implementations thereof without departing from their scope. Therefore, the illustrations and examples herein should be construed in

an illustrative, and not a restrictive sense. The scope of the invention should be measured solely by reference to the claims that follow.

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Claims

1. A method, comprising:

initializing a first audio/video (AV) device (110) in an AV sink mode of operation, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), a voltage on a hot plug detect pin is not supplied (Channel 19 for an HDMI connector), a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized;

after the initializing, pulling down, by the first AV device (110) the power output pin through a pull down resistor;

detecting with control circuitry (505) of the first audio/video (AV) device (110), a coupling via a wired connector (114, 510) between the first AV device (110) and a second AV device (120) by detecting by the first AV device that a voltage is being supplied at the power pin (Channel 18) of the wired connector (114, 510);

in response to determining that a supply voltage is provided at the power pin of the wired connector (114, 510), continuing to operate the first AV device (110) in the AV sink operation mode, and asserting a voltage on the hot plug detect pin (Channel 19 of connector 510) of the wired connector (114, 510), periodically checking the power pin for presence of the supply voltage at the power pin, and de-asserting the voltage on the hot plug detect pin in response to absence of the supply voltage at the power pin, wherein the first AV device (110) receives AV data provided to the first AV device (110) via the wired connector (114, 510) and receives power from the supply voltage provided to the first AV device (110) at the power pin of the wired connector (114, 510) in the AV sink operation mode; and

in response to determining that the supply voltage is not provided at the power pin of the wired connector (114, 510), and in response to detecting that a device operating in the sink operating mode is coupled at the wired connector (114, 510) by testing the impedances on the DDC channel (Channel 15 and Channel 16 for an HDMI connector),

transitioning the first AV device (110) from the AV sink operation mode to an AV source operation mode, wherein the first AV device (110) provides a supply voltage at the power pin of the wired connector (114, 510),

setting a timer for a pre-determined limit, and

waiting for detection of a voltage at the hot plug detect pin, and if the voltage is detected before expiration of the timer, the first AV device (110) operates in the AV source operation mode wherein the first AV device (110) sends AV data via the wired connector (114, 510) and enables the pull-up resistor for the DDC pin (Channel 15), else, if the voltage is not detected at the hot plug detect pin before expiration of the timer,

1

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transitioning the first AV device (110) from the AV source operation mode to the AV sink operation mode.

2. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

3. The method of claim 1, wherein a first impedance is provided for a data channel of the wired connector (114, 510) in the AV source operation mode, and the first impedance is not provided for the data channel in the AV sink operation mode.

4. The method of claim 1, further comprising:

performing an AV data exchange between the first AV device (110) and the second AV device (120).

5. An audio/video (AV) device (110) comprising:

communication logic (580) to couple to a wired connector (114, 510), the communication logic (580) including circuitry to implement:

an AV sink operation mode for the communication logic (580) to receive AV data provided to the AV device (110) at the wired connector (114, 510) and to receive power from a supply voltage provided to the AV device (110) via a power pin of the wired connector (114, 510), and

an AV source operation mode for the communication logic (580) to send AV data from the AV device (110) via the wired connector (114, 510) and to provide a supply voltage at the power pin of the wired connector (114, 510); and

control logic (505) including circuitry configured

to initialize the communication logic (580) to operate the AV device (110) in the AV sink operation mode, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), a voltage on a hot plug detect pin (Channel 19 for an HDMI connector) is not supplied,

a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized; after the initializing, to pull down, by the AV device (110) the power output pin through a pull down resistor; in response to determining that the supply voltage is provided at the power pin of the wired connector (114, 510) to continue to operate the AV device (110) in the AV sink operation mode, to assert a voltage on the hot plug detect pin (Channel 19

of connector 510) of the wired connector (114, 510), to periodically check the power

pin for presence of the supply voltage at the power pin, and to de-assert the voltage

on the hot plug detect pin in response to absence of the supply voltage at the power pin; and

in response to determining that the supply voltage is not provided at the power pin of the wired connector (114, 510) and in response to detecting that a device operating in the sink operating mode is coupled at the wired connector (114, 510) by testing the impedances on the DDC channel (Channel 15 and Channel 16 for an HDMI connector),

to initialize the communication logic (580) to transition the AV device (110) from the AV sink operation mode to the AV source operation mode, wherein the first AV device (110) provides a supply voltage at the power pin of the wired connector (114, 510),

to set a timer for a pre-determined limit, and

to wait for detection of a voltage at hot plug detect pin, and if the voltage is detected before expiration of the timer, the first AV device (110) is configured to operate in the AV source operation mode wherein the first AV device (110) sends AV data via the wired connector (114, 510) and enables the pull-up resistor for the DDC pin (Channel 15),

else, if the voltage is not detected at the hot plug detect pin before expiration of the timer, the AV device (110) is configured to transit from the AV source operation mode to the AV sink operation mode.

6. The device of claim 5, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

7. The device of claim 5, wherein the communication logic (580) is further initialized to provide a first impedance for a data channel of the wired connector (114, 510) in the AV source operation mode and is initialized to not provide the first impedance for the data channel in the AV sink operation mode.

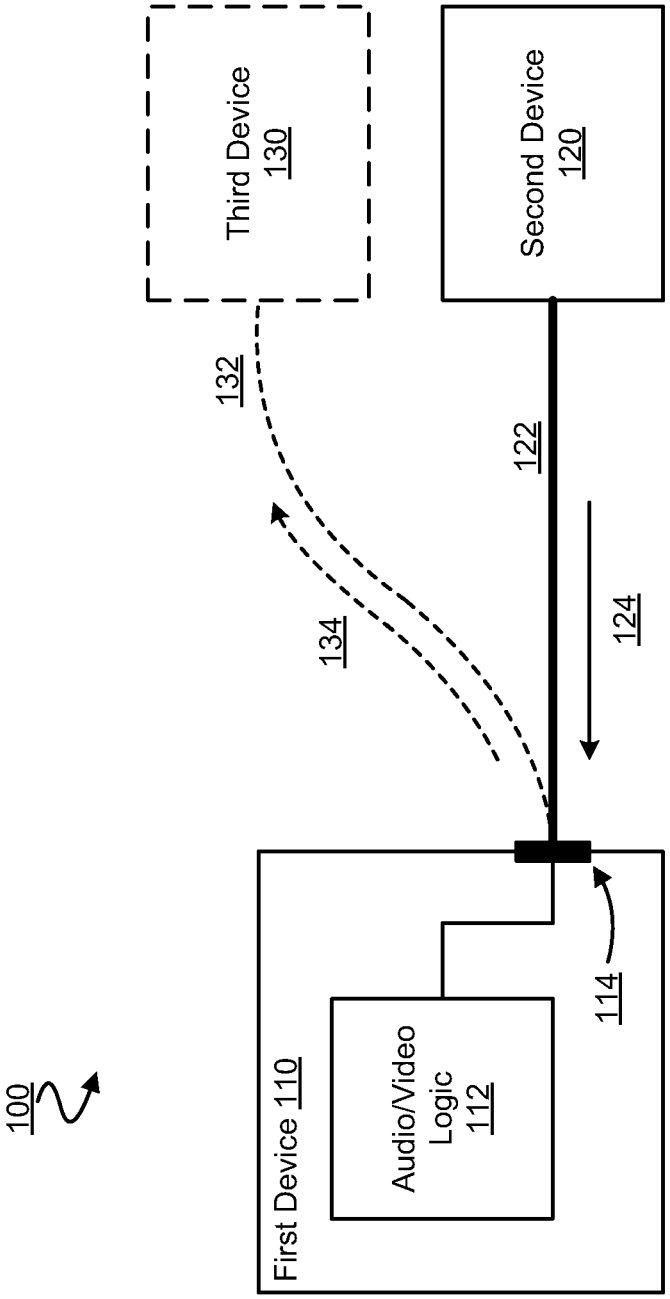

Third Device
130
Second Device
120
132
122
134
124
100
First Device 110
Audio/Video
Logic
112
114

FIG. 1

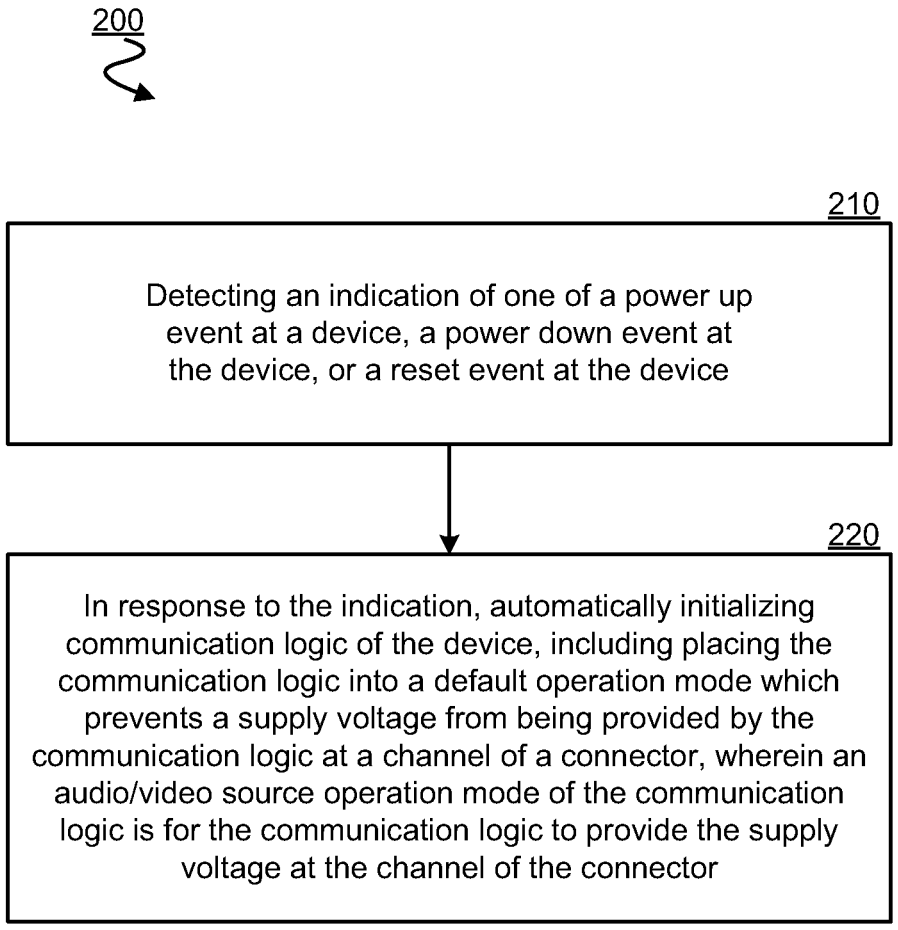

200
210
Detecting an indication of one of a power up event at a device, a power down event at the device, or a reset event at the device
220
In response to the indication, automatically initializing communication logic of the device, including placing the communication logic into a default operation mode which prevents a supply voltage from being provided by the communication logic at a channel of a connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2A

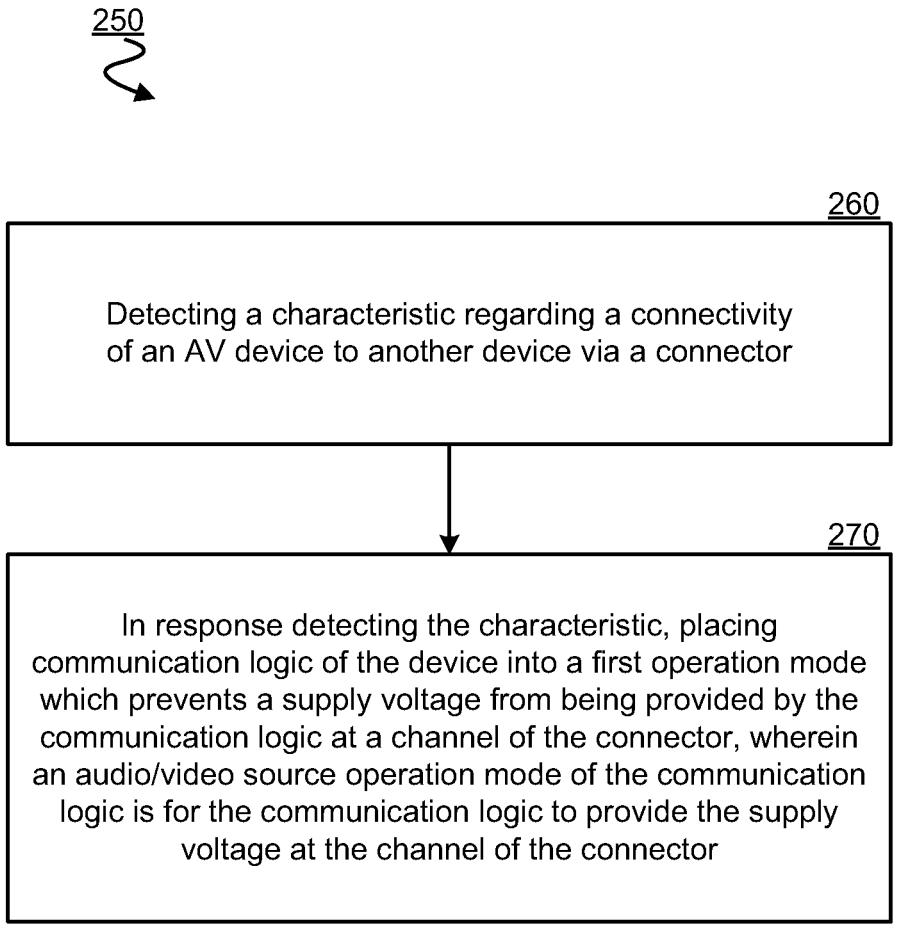

250
260
Detecting a characteristic regarding a connectivity of an AV device to another device via a connector
270
In response detecting the characteristic, placing communication logic of the device into a first operation mode which prevents a supply voltage from being provided by the communication logic at a channel of the connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2B

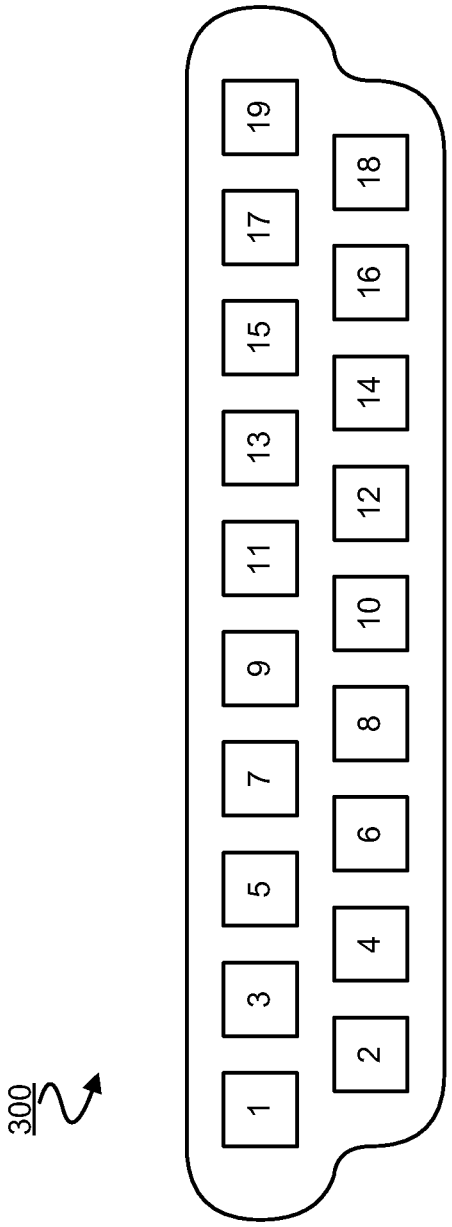


FIG. 3

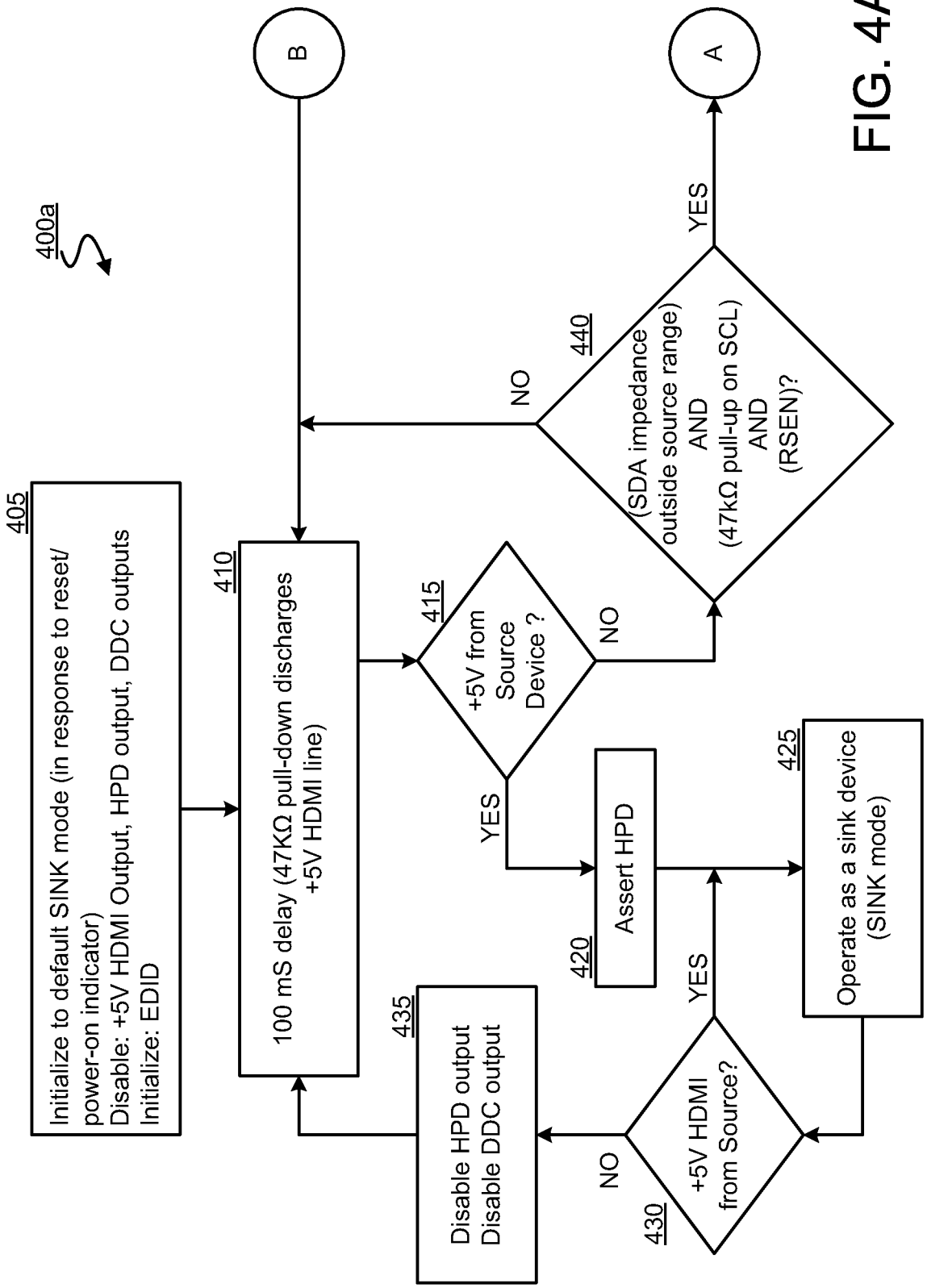

400a
405
Initialize to default SINK mode (in response to reset/ power-on indicator)
Disable: +5V HDMI Output, HPD output, DDC outputs
Initialize: EDID
410
100 mS delay (47KΩ pull-down discharges +5V HDMI line)
415
+5V from Source Device ?
YES
NO
420
Assert HPD
425
Operate as a sink device (SINK mode)
430
+5V HDMI from Source?
YES
NO
435
Disable HPD output
Disable DDC output
440
(SDA impedance outside source range) AND (47kΩ pull-up on SCL) AND (RSEN)?
YES
NO
A
B

FIG. 4A

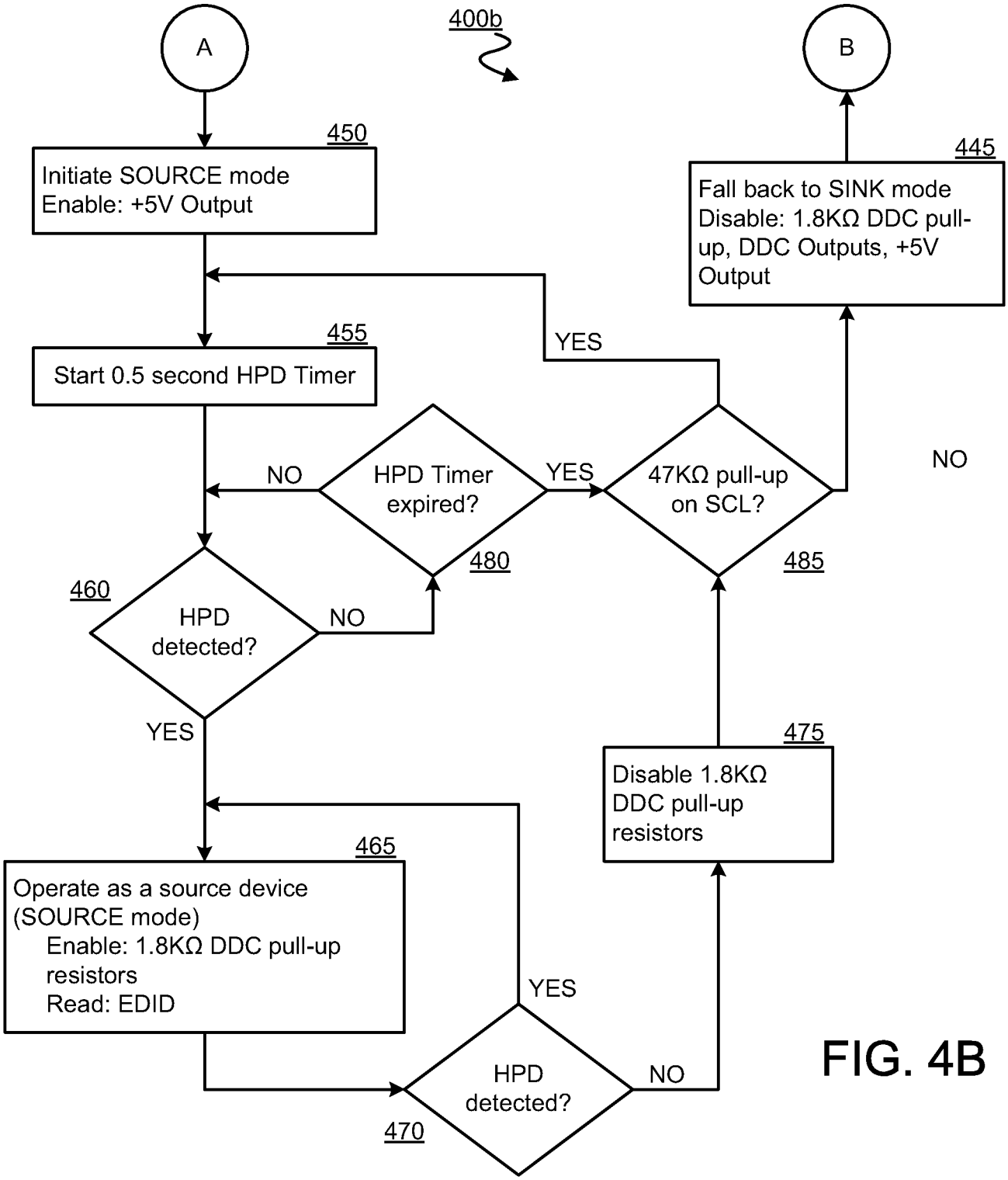

400b
A
B
450
Initiate SOURCE mode
Enable: +5V Output
445
Fall back to SINK mode
Disable: 1.8KΩ DDC pull-up, DDC Outputs, +5V Output
455
Start 0.5 second HPD Timer
YES
NO
HPD Timer expired?
YES
47KΩ pull-up on SCL?
NO
480
485
460
HPD detected?
NO
YES
475
Disable 1.8KΩ DDC pull-up resistors
465
Operate as a source device (SOURCE mode)
Enable: 1.8KΩ DDC pull-up resistors
Read: EDID
YES
HPD detected?
NO
470

FIG. 4B

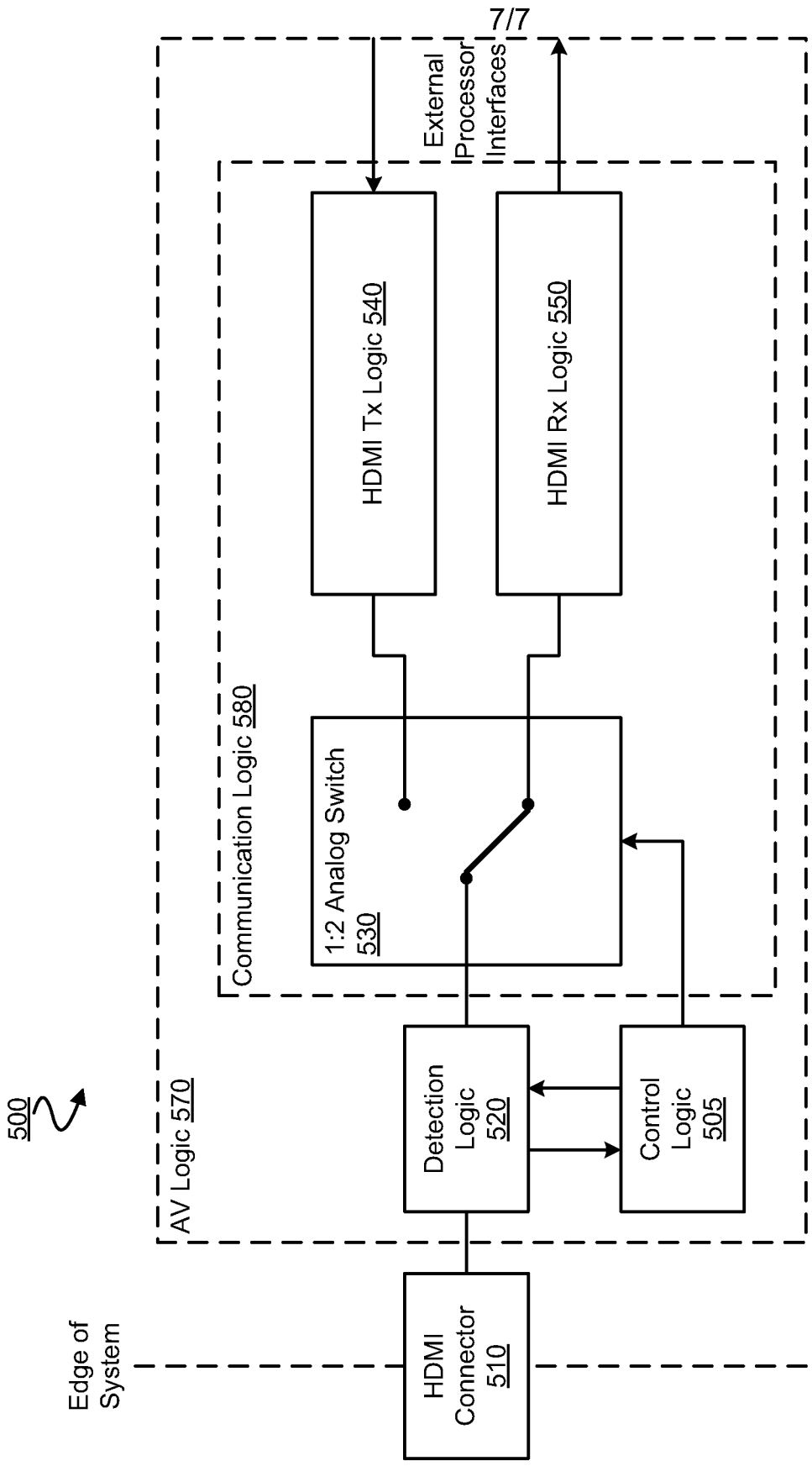

500
AV Logic 570
External Processor Interfaces
Communication Logic 580
HDMI Tx Logic 540
HDMI Rx Logic 550
1:2 Analog Switch 530
Detection Logic 520
Control Logic 505
HDMI Connector 510
Edge of System

FIG. 5

METHOD, APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE MODE AND A SINK MODE

RELATED APPLICATIONS

[0001] This application claims priority from Provisional Application Serial Number 61/470,431, filed March 31, 2011, entitled "METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO 2 CONTENT". 2 ~~CONTENT", the teaching of which is incorporated herein by reference~~.

BACKGROUND

1. Technical Field

[0002] Embodiments relate generally to techniques for exchanging audio/video information. More particularly, certain embodiments provide techniques for controlling an audio/video device to selectively receive or send audio/video information.

2. Background Art

[0003] The size of computers and other audio/video (AV) capable electronic devices continue to scale with successive improvements in integrated circuit (IC) fabrication techniques. Consequently, there is a general trend toward a wider variety of AV devices, notably smaller AV devices, implementing functionality to support higher throughput and/or higher quality of AV information.

[0004] Certain conventional AV devices include a High-Definition Multimedia Interface (HDMI) connector or other such hardware for coupling to some other device, where the AV device operates as a source to provide AV information to the other device via the connector. Typical examples of conventional AV sources include a camcorder, digital camera, personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), smart phone, video game console, DVD player,

digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source. US 2009/0 046 690 A1 discloses a bidirectional high-speed digital interface transceiver which, by selectively coupling a multiplexer to a transmitter or to a receiver, can act as a source device or a sink device. JP 2009 060 204 A discloses an audio/video device which can be used as source or sink.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

[0012] FIG. 4A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0013] FIG. 4B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0014] FIG. 5 is a block diagram showing elements of an audio/video device according to an embodiment.

DETAILED DESCRIPTION

[0015] Embodiments discussed herein variously make, use or otherwise provide circuit logic to selectively control an audio/video (or "AV") device for operation at different times in various ones of a plurality of operation modes. The plurality of operation modes may include what is referred to herein as an "AV Sink" operation mode, for the AV device (also referred to herein as simply "device") to be a sink for receiving AV information from another AV device via a connector, and what is referred to herein as an "AV Source" operation mode, for the AV device to be a source for providing AV information to another AV device via the same connector. In an embodiment, the AV device includes the connector. In an alternate embodiment, the AV device may operate in a system which includes the connector – e.g. where the connector is to couple the system with some external device for an exchange of AV information.

[0016] As used herein, "audio/video" or "AV" refers to the characteristic of relating to either audio content or video content, or relating to both audio content and video content. For example, AV information may include some or all of audio data and/or control information and video data and/or control information. In an embodiment, an AV device may, in addition to exchanging AV information with another device, be operable to render audio content and/or video content for a user, although certain embodiments are not limited in this regard.

[0017] An AV device according to an embodiment includes communication logic to exchange AV data according to some interface standard. By way of illustration and not limitation, such communication logic may exchange AV data via

a connector which is compatible with one or more of an HDMI standard such as the HDMI 1.4 standard released May 28, 2009 by HDMI Licensing, LLC of Sunnyvale, CA, a Mobile High-Definition Link (MHL) standard such as the MHL 1.0 specification released June 30, 2010 by the MHL Consortium of Sunnyvale, CA, a Digital Visual Interface (DVI) standard such as the DVI 1.0 standard released April 02, 1999 by the Digital Display Working Group of Vancouver, WA, a DisplayPort standard such as the DisplayPort 1.2 standard released December 22, 2009 by the Video Electronics Standards Association of Newark, CA and/or the like.

[0018] In an embodiment, such communication logic may implement communications which, at different times, are compatible with different interface standards, where all such communications are via the same connector. For example, communication logic may include first logic to detect the presence of, and communicate with, an HDMI device and second logic to detect the presence of, and communicate with, an HDMI device, where the respective detection and communication functionalities of the first logic and second logic do not conflict with or otherwise impede the other. Such communication logic may, for example, be referred to as "MHL-ready HDMI," "HDMI/MHL" and/or the like. Features of various embodiments are discussed herein in the context of exchanging AV information according to an HDMI interface standard. However, such discussion may be extended to apply to any of a variety of additional or alternative interface standards for exchanging AV data, according to different embodiments.

[0019] Certain embodiments variously provide that, from either or both of a device power up and a device reset, an AV device will, by default, return to or otherwise be in a Sink mode. While in this mode such an AV device may then determine by stimulus and response or measurement means described herein that it is connected to an AV Sink device, in which case it may safely transition to an AV Source operation mode. In an embodiment, the AV device may translate back to AV Sink operation mode in response to an indication of a change in connectivity to the AV Sink device.

[0020] FIG. 1 illustrates elements of a system 100 for exchanging AV information according to an embodiment. System 100 may include a first device

110 comprising AV logic 112 to variously implement AV communications between first device 110 and one or more other devices. One embodiment may, for example, be implemented entirely within AV logic 112. Another embodiment may be implemented by first device 110 as a whole. Still another embodiment may be implemented by system 100 as a whole. Any of a variety of other embodiments may be alternatively implemented according to techniques discussed herein.

[0021] In an embodiment, first device 110 includes functionality of one or more of conventional AV source devices and/or functionality of one or more conventional AV sink devices. By way of illustration and not limitation, first device 110 may include functionality of one or more devices including, but not limited to, a personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), camcorder, smart phone, video game console, television, monitor, display, set-top box, home theater receiver and/or the like.

[0022] First device 110 may include a connector 114, coupled via one or more signal lines to AV logic 112, to variously connect first device 110 to some other device of system 100 for an exchange of AV information. Connector 114 may include a plurality of channels, such as pins and/or other interconnect hardware, which are compatible with a particular AV interface standard – e.g. an HDMI standard.

[0023] In an illustrative embodiment, connector 114 may, at some point in time, couple first device 110 via an interconnect 122 to a second device 120 of system 100 – e.g. for an exchange 124 of AV information from second device 120 to first device 110. The particular direction of exchange 124 is not limiting on certain embodiments, and may alternatively be in the opposite direction, where first device 110 operates as the AV Source and second device 120 operates as the AV Sink. Accordingly, second device 120 may, for example, include both logic (not shown) to implement conventional AV Source functionality or conventional AV Sink functionality. In another embodiment, second device 120 may include logic to variously provide both AV Source functionality and AV Sink functionality according to techniques described herein.

[0024] Certain embodiments variously mitigate at least one problem which might otherwise arises if two conventional AV devices are coupled to one another when those two devices are concurrently configured each for respective operation as an AV Source. Such connecting of AV Source devices to one another can risk damage to transmission hardware in either or both devices. For example, the two devices may attempt to drive power in opposite directions in the same power supply voltage channel of a connector. Alternatively, or in addition, two such devices may attempt to drive data signals in opposite directions via the same data channel of the connector. Such AV Source devices may risk driving any of a variety of other signals – e.g. hot plug detect signals, clock signals and/or the like – against one another each on some common respective channel of a connector.

[0025] AV logic 112 may limit the risk of the resulting damage in system 100 by providing a control mechanism to selectively prevent one or more aspects of AV Source functionality from being provided during operation of first device 110. By way of illustration and not limitation, AV logic 112 may selectively transition itself between a plurality of operation modes which includes an AV Source operation mode and an AV Sink operation mode. The AV Source operation mode may be for AV logic 112 to provide a particular signal to connection 114 – e.g. a supply voltage, a digital data signal and/or the like. Additionally or alternatively, the AV Source operation mode may be for AV logic 112 to provide a particular amount of impedance – e.g. pull-up impedance, pull-down impedance and/or the like – for a signal line coupled to a channel of connection 114.

[0026] In an embodiment, control logic (not shown) of AV logic 112 selects one of the plurality of operation modes in response to an indication of a particular type of event at first device 110. Whether and/or how AV logic 112 might transition between operation modes may be based, for example, on whether the indicated event is a power-up event, a power-down event a reset event, and/or the like.

[0027] Whether and/or how AV logic 112 might transition between operation modes may be additionally or alternatively based on an event which detects a particular characteristic (or absence of said characteristic) regarding connectivity between connector 114 and second device 120. By way of illustration and not

limitation, such a characteristic may include whether (or not) some second device 120 is providing a supply voltage at a particular channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a supply voltage to its corresponding AV Sink – e.g. the +5V output to be provided from Source to Sink according to HDMI, as on pin 18 of a 19-pin HDMI connector.

[0028] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing to connector 114 a hot plug detect (HPD) signal. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Sink is to indicate its presence with a HPD signal to its corresponding AV Source – e.g. the HPD signal to be provided from Sink to Source according to HDMI, as on pin 19 of a 19-pin HDMI connector.

[0029] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing a clock signal to connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a clock signal to an AV Sink – e.g. the DDC_SCL signal to be provided from Source to Sink according to HDMI, as on pin 15 of a 19-pin HDMI connector.

[0030] Additionally or alternatively, such a characteristic may include whether (or not) a particular amount of impedance is being provided by second device 120 for a channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that a particular pull-up impedance is to be implemented at an AV Sink – e.g. a 47kΩ pull-up resistance which HDMI requires be provided at an AV Sink for a SDA line (e.g. pin 16 of a 19-pin HDMI connector).

[0031] In an embodiment, the functionality of AV logic 112 allows connector 114 to be variously coupled, decoupled and/or recoupled at different times to one or more devices, while limiting a risk of damage to hardware in system 100. By way of illustration and not limitation, connector 114 may at some point in time be decoupled from second device 120 and subsequently coupled via an interconnect 132 to some third device 130 – e.g. for an exchange 134 of AV information to third

device 130 from first device 110. The particular direction of exchange 134 is not limiting on certain embodiments, any may alternatively be in the opposite direction, where first device 110 operates as the AV Sink and third device 130 operates as the AV Source. In an embodiment, third device 130 is simply second device 120 – e.g. where second device 120 is decoupled from and subsequently recoupled to first device 110 and/or where first device 110 and second device 120 switch AV Sink and AV Source roles for different AV information exchanges.

[0032] As shown in the discussion herein, AV logic 112 may protect various circuitry of system 100 for different successive couplings of first device 110 each to a respective device and/or for successive different AV information exchanges each between first device 110 and a respective device.

[0033] FIG. 2A illustrates elements of a method 200 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 200 may, for example, be a device including some or all of the features of first device 110. In one embodiment, an AV device controlled by performing method 200 may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Features of various embodiments are discussed herein in terms of performing method 200 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0034] In an embodiment, the AV device includes communication logic comprising circuitry to operate at different times in different ones of a plurality of operation modes which include an AV Source operation mode and an AV Sink operation mode. The AV Sink operation mode may, for example, be for the communication logic to receive AV data provided to the AV device via a connector – e.g. via connector 114. The AV Sink operation mode may further be for the communication logic to receive power from a first supply voltage provided via a channel of the connector. By contrast, the AV Source operation mode may be for the communication logic to send AV data from the AV device, where the AV data is sent through the connector. The AV Source operation mode may further be for the

communication logic to provide a second supply voltage at the channel of the connector. In an embodiment, a level of the first supply voltage is equal to a level of the second supply voltage.

[0035] In an embodiment, method 200 includes, at 210, detecting an indication of one of a power up event at the AV device, a power down event at the device or a reset event at the AV device. The detecting at 210 may, for example, include control circuitry of AV logic 112 directly or indirectly detecting an indication sent from some agent included in or otherwise accessible to AV logic 112. By way of illustration and not limitation, first device 110 may include a power management unit, a host processor or other agent which sends to AV logic 112 a signal specifying, for example, that first device 110 is going through, has gone through, or is expected to go through a boot up or boot down operation, or otherwise to transition to or from an operative power state. In an embodiment, transitioning to or from such an operative power state may include transitioning between a first power state in which AV logic 112 is incapable of exchanging AV information via connector 114 and a second power state in which AV logic 112 is capable of exchanging AV information via connector 114. Alternatively or in addition, AV logic 112 may include detector logic to evaluate power state of AV logic 112 and/or of other components of first device 110.

[0036] The detecting at 210 may additionally or alternatively include control circuitry of AV logic 112 directly or indirectly detecting a signal from some agent, included in or otherwise accessible to AV logic 112, the signal specifying or otherwise indicating that AV logic 112 or some other component of first device 110 have been, are being, or are expected to be reset. Such a reset may flush some current state of circuit logic in favor of some predetermined baseline configuration. A reset may, for example, return some or all of first device 110 to a predetermined configuration without powering down first device 110.

[0037] In response to the indication detected at 210, method 200 may, at 220, automatically initialize communication logic of the AV device. By way of illustration and not limitation, control logic of AV logic 112 may automatically place the communication logic of AV logic 112 into a default operation mode which

prevents the second supply voltage from being provided by the communication logic at the channel of the connector. In an embodiment, the default operation mode is the AV Sink operation mode. In an embodiment, the AV Source operation mode is further for the communication logic of the AV device to provide a first total amount of impedance for a data channel of the connector. In such an embodiment, the default operation mode may prevent the first total amount of impedance for the data channel from being provided by the communication logic.

[0038] FIG. 2B illustrates elements of a method 250 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 250 may, for example, be a device having some or all of the features of a device controlled by method 200. Method 250 may, for example, be performed after method 200 – although certain embodiments are not limited in this regard. Features of various embodiments are discussed herein in terms of performing method 250 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0039] Method 250 may include, at 260, detecting a characteristic regarding a connectivity of the AV device to another device via a connector – e.g. connector 114. For example, detector logic of AV logic 112 may detect connectivity to the other device via the connector – e.g. the detecting while the communication logic of the AV device is in the default operation mode of method 200. Additionally or alternatively, such detector logic of AV logic 112 may detect a change in a state of connectivity to the other device via the connector. The detecting the characteristic at 260 may, for example, include detecting an indication that the other device is providing the first supply voltage discussed with regard to method 200. Alternatively or in addition, the detecting at 260 may include detecting that the other device is providing to the connector a hot plug detect (HPD) signal, a clock signal and/or any of a variety combinations of one or more other signals. Alternatively or in addition, the detecting at 260 may include evaluating an impedance of a signal line which couples the other device to the connector.

[0040] In response to detecting the characteristic at 260, method 200 may, at 270, automatically place the communication logic of the AV device into some first operation mode which prevents a providing of the second supply voltage referred to in the discussion of method 200. The first operation mode may, for example, be the default operation mode of method 200, although certain embodiments are not limited in this regard. In placing the AV device into the first operation mode, method 250 may limit the possibility of circuit damage due to conflicting output signals from two coupled AV devices, each device attempting to operate as an AV Source.

[0041] FIG. 3 illustrates select elements of a connector 300 for exchanging AV information according to an embodiment. Connector 300 may include some or all of the features of connector 114, for example. The illustrative connector 300 is a 19-channel (e.g. 19-pin) connector which is compatible with an HDMI interface standard, although certain embodiments are not limited in this regard. Connector 300 may support AV information exchanges by any of a variety of other types of interconnect hardware – e.g. a connector including more, fewer, or alternative channels to those shown in FIG. 3 – where communication via such a connector is consistent with techniques discussed herein.

[0042] The illustrative connector 300 includes interconnect hardware to support transition-minimized differential signaling (TMDS) in HDMI communication. More particularly, the respective functions of the channels in connector 300 may be assigned according to HDMI 1.4 or some other HDMI interface standard – e.g. as follows:

Channel 1	TMDS Data2+
Channel 2	TMDS Data2 Shield
Channel 3	TMDS Data2–
Channel 4	TMDS Data1+
Channel 5	TMDS Data1 Shield
Channel 6	TMDS Data1–
Channel 7	TMDS Data0+
Channel 8	TMDS Data0 Shield
Channel 9	TMDS Data0–

Channel 10	TMDS Clock+
Channel 11	TMDS Clock Shield
Channel 12	TMDS Clock–
Channel 13	Consumer Electronics Control (CEC)
Channel 14	HDMI Ethernet Channel (HEC) Data
Channel 15	System Clock Line (SCL) – I²C Serial Clock for Display Data Channel (DDC)
Channel 16	System Data (SDA) – I²C Serial Data Line for DDC
Channel 17	DDC/CEC/HEC Ground
Channel 18	+5 V Power
Channel 19	Hot Plug Detect (HPD) and/or HEC Data+

Potential conflict may result when two connected AV devices concurrently attempt to drive respective supply voltages and/or other signals according to the same function assignments for connector 300.

[0043] In an embodiment, an AV device including or coupled to connector 300 may implement techniques to reduce the likelihood of such conflict – e.g. techniques including some or all of the features discussed with respect to method 200 and/or method 250. By way of illustration and not limitation, control logic of such an AV device may provide that after some event – e.g. from one or more of a power up event, a power down event and a reset event – communication logic of the AV device will operate in an AV Source operation mode only after certain connectivity conditions are subsequently identified. For example, the control logic may configure the AV device after/during power up – or before/during a power down – for a default operation mode in which a functionality required for operation as an AV Source is disabled. For instance, the disabled functionality may be required for operation as an AV Source device according to the conditions of HDMI or some other interface standard.

[0044] Alternatively or in addition, the control logic may configure the AV device for an AV Sink operation mode in response to detecting a change of a characteristic regarding connectivity between the AV devices. For example, the AV device may be set to, or return to, some default AV Sink operation mode in response

to an indication of a loss or absence at connector 300 of a supply voltage, an indication of a loss or absence of a HPD signal, an indication of a signal line pull-up impedance implemented by any other connected AV device, and/or an indication of a clock signal provided by any other connected AV device. Any of a variety of additional or alternative detected conditions may determine whether and/or how the AV device may be configured – or reconfigured – for operation in such a default mode. In one embodiment, the default operating mode is a SINK mode of HDMI in which the AV device is capable of operation as an AV Sink.

[0045] In an embodiment, control logic of an AV device may implement a state machine or other mechanism for transitioning the communication logic between operation modes including SINK mode and SOURCE mode. By way of illustration and not limitation, the AV device may default its communication logic to SINK mode in response to (or during) a power up of the AV device (or in response to, or during, a power down of the AV device), and/or in response to detecting that a connectivity characteristic with another AV device is absent or has changed. The AV device may variously transition between SINK mode and SOURCE mode, depending on one or more connectivity characteristics detected for connector 300. Such connectivity characteristics may include, but are not limited to, whether a +5V voltage is provided by another AV device through connector 300, and/or whether one or more signals or other connectivity characteristics (e.g. HPD, DDC pull ups, TDMS termination, etc.) indicate presence or absence of functionality of some other connected AV device as an operable Sink or operable Source.

[0046] FIG. 4A and 4B illustrate select elements of methods 400a, 400b, respectively, for controlling operation of an AV device according to an embodiment. An AV device controlled by performing either or both of methods 400a, 400b may, for example, be a device including some or all of the features of first device 110. In one embodiment, the AV device controlled by performing either or both of methods 400a, 400b may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Methods 400a, 400b may include some or all of the features discussed herein with respect to methods 200, 250, although certain embodiments are not limited in this regard.

[0047] FIG. 4A and 4B are discussed herein with respect to features which are specific to HDMI interface requirements. However, such discussion may be extended to apply to requirements of any of a variety of additional or alternative interface standards for communicating AV information. For example, various additional or alternative test conditions (e.g. different delays, resistance values, signal outputs, test conditions, etc.) may be used, according to different embodiments, for determining whether and/or how one or more operation mode transitions of an AV device are to take place.

[0048] Method 400a may, at 405, initialize the AV device to SINK mode by default in response to an indication of a reset event, a power-on event or a power-off event. The initializing at 405 may, for example, include disabling one or more of a +5V HDMI output (channel 18), HPD output (pin 19), some or all DDC outputs (pins 15 and/or 16), and respective 1.8K pull-up resistors for such DDC outputs. The initializing at 405 may further include initializing extended display identification data (EDID) functionality of the AV device in preparation for identifying capabilities to any other device coupled via the connector – e.g. connector 114. After the initializing at 405, method 400 may, at 410, provide some delay – e.g. 100ms – for a high-value pull-down resistor to discharge the +5V HDMI output. However, such delay may not be required, in certain embodiments.

[0049] After delay at 410, method 400 may test for some indication that another device is coupled to the AV device being controlled by method 400a. By way of illustration and not limitation, method 400a may test, at 415, test whether a +5V HDMI supply voltage is being provided at connector 114 – indicating that a device coupled via the connector is operating in some AV Source mode. If the +5V supply voltage is detected at 415, then method 400a may, at 420, assert a HPD signal at the connector (pin 19) and, at 425, commence operation of the communication logic of the AV device in a SINK mode. The AV device may test for a change in connectivity with the other device – e.g. by occasionally testing at 430 +5V supply voltage continues to be provided at the connector by the other device. In an embodiment, detecting that the +5V supply voltage is not being so provided may result in method 400a disabling its HPD signal, its DDC output functionality and/or any other AV Sink functionality that is not currently being used. Method 400a may

then return to providing the delay at 410 in preparation for again testing for presence of any connected device.

[0050] If the +5V supply voltage is not detected at 415, then method 400a may detect for the presence of any device which might be coupled via the connector and which is operating in some AV Sink mode. By way of illustration and not limitation, method 400a may test, at 440, to confirm that there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification, that an impedance on the data (SDA channel 16) is not in the HDMI specified Source range of 1.5kΩ to 2.0kΩ, and that a receiver sense input (RSEN) signal indicates that one or more differential pairs of the connector are provided with terminators at some coupled device. If no AV Sink device is detected at 415, method 400a may then return to providing the delay at 410, in preparation for again testing for presence of any connected device.

[0051] If an AV Sink device is detected at 415, then in one embodiment, operations of method 400b may follow. For example, method 400b may, at 450, initiate a transition to SOURCE mode – e.g. including enabling the communication logic of the AV device to provide the +5V supply voltage to the connector. In an embodiment, method 400b may, at 455, start a HPD timer – e.g. set for 0.5 seconds – for timing out if a HPD signal is not detected from some AV Sink device. Method 400b may test, at 460, whether an HPD signal is detected – e.g. where the test at 460 may be successively performed according to a test at 480 of whether the HPD timer has expired. If an HPD signal is detected at 460, method 400b may begin operation of the AV device in a SOURCE mode, at 465.

[0052] If the HPD timer is determined to have expired at 480, method 400b may perform evaluations of whether one or more indications of a coupled AV Sink device are still present at the connector. By way of illustration and not limitation, method 400b may test, at 485, to confirm whether there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification. If such a 47kΩ pull-up resistor is detected at 485, method 400b may return to setting another HPD timer at 455.

[0053] If no such 47kΩ pull-up resistor is detected at 485, method 400b may begin preparations, at 445, to transition the AV device back to a SINK mode – e.g. including disabling one or more of a +5V HDMI output (channel 18), some or all DDC outputs (pins 15 and/or 16), respective 1.8K pull-up resistors for such DDC outputs, and/or the like. After the preparation for SINK mode operation at 445, method 400b may be followed by an operation of method 400a – e.g. the providing of a delay at 410.

[0054] In an embodiment, operation of the AV device in SOURCE mode, at 465, includes enabling 1.8K pull-up resistors for DDC channels of the connector which are to serve as output channels. Additionally or alternatively, SOURCE mode operation at 465 may include performing an EDID read of the capabilities of the detected AV Sink device. Operation of the AV device in SOURCE mode may continue until a test at 470 indicates that the detected AV Sink device is no longer providing a HPD signal. If such an HPD signal is no longer detected, method 400b may begin to protect the AV device from possible harm – e.g. caused by the detected AV Sink device somehow transitioning to AV Source operation. By way of illustration and not limitation, method 400b may, at 475, disable respective 1.8 kΩ pull-up resistors for one or more DDC channels of the connector. After the disabling at 475, method 400b may perform the presence test at 485.

[0055] FIG. 5 illustrates select elements of a system 500 for exchanging AV information according to an embodiment. System 500 may include some or all of the features of first device 110, for example. For example, system 500 may include AV logic 570 having some or all of the features of AV logic 112.

[0056] System 500 may include an AV connector – represented by an illustrative HDMI connector 510 at the edge of system 500 – to couple system 500 to some external device (not shown) for an AV information exchange. AV logic 570 may include mechanisms to variously implement different operation modes in system 500 to accommodate different types of AV communications via HDMI connector 510. By way of illustration and not limitation, AV 570 may include control logic 505 to receive information indicating a presence or absence of one or

more characteristics regarding connectivity of system 500 with some AV device via HDMI connector 510.

[0057] For example, control logic 505 may include or otherwise have access to detection logic 520 of system 500 which relays and/or analyzes signals exchanged via HDMI connector 510. In an embodiment, detection logic 520 may include one or more of logic to detect for a supply voltage output, logic to detect for a signal line termination, logic to detect for an EDID or other such identifier, logic to detect for a digital data functionality, logic to detect for a clock signal and/or the like. The particular mechanism for detection logic 520 to perform such detecting may be adapted from conventional techniques for detecting clock signals, data voltage inputs, impedances, etc., and are not limiting on certain embodiment. Although shown as being coupled along the data exchange path to intercept one or more signals exchanged via HDMI connector 510, detection logic 520 may, in an alternate embodiment, be configured to passively sense signals exchanged via HDMI connector 510.

[0058] Messages from detection logic 520 may indicate to control logic 505 whether and/or how system 500 is to transition logic of system 500 between operating modes. In an embodiment, control logic 505 may provide control functionality to variously place communication logic 580 of system 500 at different times in different ones of a plurality of operation modes – e.g. where the plurality of operation modes includes a SINK mode and a SOURCE mode. For example, control logic 505 may transition communication logic 580 between operation modes according to some or all of the techniques of method 500 and/or method 550.

[0059] By way of illustration and not limitation, control logic 505 may configure a switch of communication logic 580 – represented by an illustrative analog switch 530 – to switch between HDMI (or other AV interface standard) transmit logic 540 for SOURCE mode operation and HDMI (or other AV interface standard) receive logic 550 for SINK mode operation.

[0060] Control logic 505 may also provide functionality to further configure either or both of HDMI transmitter logic 540 and HDMI receive logic 550, although certain embodiments are not limited in this regard. For example, HDMI receive

logic 550 may include HDMI/MHL functionality to switch between a sub-mode to receive HDMI information from another AV device and a sub-mode to receive MHL information. Control logic 505 may provide signaling (not shown) to selectively configure HDMI receive logic 550 to variously operate in such sub-modes at different times.

[0061] Techniques and architectures for configuring an AV device are described herein. In the above description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of certain embodiments. It will be apparent, however, to one skilled in the art that certain embodiments can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the description.

[0062] Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[0063] Some portions of the detailed description herein are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the computing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0064] It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely

convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the discussion herein, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0065] Certain embodiments also relate to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs) such as dynamic RAM (DRAM), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and coupled to a computer system bus.

[0066] The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description herein. In addition, certain embodiments are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of such embodiments as described herein.

[0067] Besides what is described herein, various modifications may be made to the disclosed embodiments and implementations thereof without departing from their scope. Therefore, the illustrations and examples herein should be construed in

an illustrative, and not a restrictive sense. The scope of the invention should be measured solely by reference to the claims that follow.

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Claims

1. A method, comprising:

initializing a first audio/video (AV) device (110) in an AV sink mode of operation, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), ƨ a voltage on a hot plug detect pin is not supplied (Channel 19 for an HDMI connector), ƨ a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized;

after the initializing, pulling down, by the first AV device (110) the power output pin through a pull down resistor;

detecting with control circuitry (505) of the first audio/video (AV) device (110), a coupling via a wired connector (114, 510) between the first AV device (110) and a second AV device (120) by detecting by the first AV device that a voltage is being supplied at the power pin (Channel 18) of the wired connector (114, 510);

in response to determining that a supply voltage is provided at the power pin of the wired connector (114, 510), continuing to operate the first AV device (110) in the AV sink operation mode, and asserting a voltage on ƨ the ƨ ~~a~~ hot plug detect pin (Channel 19 of connector 510) of the wired connector (114, 510), periodically checking the power pin for presence of the supply voltage at the power pin, and de-asserting the voltage on the hot plug detect pin in response to absence of the supply voltage at the power pin, wherein the first AV device (110) receives AV data provided to the first AV device (110) via the wired connector (114, 510) and receives power from the supply voltage provided to the first AV device (110) at the power pin of the wired connector (114, 510) in the AV sink operation mode; and

in response to determining that the supply voltage is not provided at the power pin of the wired connector (114, 510), ƨ and in response to detecting that a device operating in the sink operating mode is coupled at the wired connector (114, 510) by testing the impedances on the DDC channel (Channel 15 and Channel 16 for an HDMI connector), ƨ

transitioning the first AV device (110) from the AV sink operation mode to an AV source operation mode, wherein the first AV device (110) ~~sends AV data via the wired connector (114, 510), enables the pull-up resistor for the DDC pin (Channel 15) and~~ provides a supply voltage at the power pin of the wired connector (114, ƨ 510), ƨ ~~510) in the AV source operation mode;~~

setting a timer for a pre-determined limit, and

waiting for detection of a voltage at ƨ the ƨ hot plug detect pin, and ƨ if the voltage is detected before expiration of the timer, the

first AV device (110) operates in the AV source operation mode wherein the first AV device (110) sends AV data via the wired connector (114, 510) and enables the pull-up resistor for the DDC pin (Channel 15), ¶

else, ▟ 2 if the voltage

is not detected at the hot plug detect pin before expiration of the timer,

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transitioning the first AV device (110) from the AV source operation mode to the AV sink operation mode.

2. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

3. The method of claim 1, wherein a first impedance is provided for a data channel of the wired connector (114, 510) in the AV source operation mode, and the first impedance is not provided for the data channel in the AV sink operation mode.

4. The method of claim 1, further comprising:

performing an AV data exchange between the first AV device (110) and the second AV device (120).

5. An audio/video (AV) device (110) comprising:

communication logic (580) to couple to a wired connector (114, 510), the communication logic (580) including circuitry to implement:

an AV sink operation mode for the communication logic (580) to receive AV data provided to the AV device (110) at the wired connector (114, 510) and to receive power from a supply voltage provided to the AV device (110) via a power pin of the wired connector (114, 510), and

an AV source operation mode for the communication logic (580) to send AV data from the AV device (110) via the wired connector (114, 510) and to provide a supply voltage at the power pin of the wired connector (114, 510); and

control logic (505) including circuitry ƨ configured ƨ

to initialize the communication logic (580) to operate the AV device (110) in the AV sink operation mode, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), ƨ a voltage on a hot plug detect pin (Channel 19 for an HDMI connector) is not supplied, ƨ

a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized; after the initializing, to pull down, by the AV device (110) the power output pin through a pull down resistor; in response to determining that the supply voltage is provided at the power pin of the wired connector (114, 510) ƨ to continue ƨ ~~and continuing~~ to operate the AV device (110) in the AV sink operation mode, ƨ to assert ƨ ~~and asserting~~ a voltage on ƨ the ƨ ~~a~~ hot plug detect pin (Channel 19

of connector 510) of the wired connector (114, 510), to periodically check ~~periodically checking~~ the power pin for presence of the supply voltage at the power pin, and to de-assert ~~de-asserting~~ the voltage on the hot plug detect pin in response to absence of the supply voltage at the power pin; and

in response to determining that the supply voltage is not provided at the power pin of the wired connector (114, 510) and in response to detecting that a device operating in the sink operating mode is coupled at the wired connector (114, 510) by testing the impedances on the DDC channel (Channel 15 and Channel 16 for an HDMI connector),

to initialize the communication logic (580) to transition the AV device (110) from the AV sink operation mode to the AV source operation mode, wherein the first AV device (110) provides a supply voltage at the power pin of the wired connector (114, 510), ~~mode in response to determining that the supply voltage is not provided at the power pin of the wired connector (114, 510), to enable the pull-up resistor for the DDC pin (Channel 15).~~

to set a timer for a pre-determined limit, and

to wait for detection of a voltage at hot plug detect pin, and ¶
if the voltage is detected before expiration of the timer, the first AV device (110) is configured to operate in the AV source operation mode wherein the first AV device (110) sends AV data via the wired connector (114, 510) and enables the pull-up resistor for the DDC pin (Channel 15), ¶
else, if the voltage is not detected at the hot plug detect pin before expiration of the timer, the AV device (110) is configured to transit ~~the AV device (110)~~ from the AV source operation mode to the AV sink operation mode.

6. The device of claim 5, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

7. The device of claim 5, wherein the communication logic (580) is further initialized to provide a first impedance for a data channel ~~power pin~~ of the wired connector (114, 510) in the AV source operation mode and is initialized to not provide the first impedance for the data channel in the AV sink operation mode.

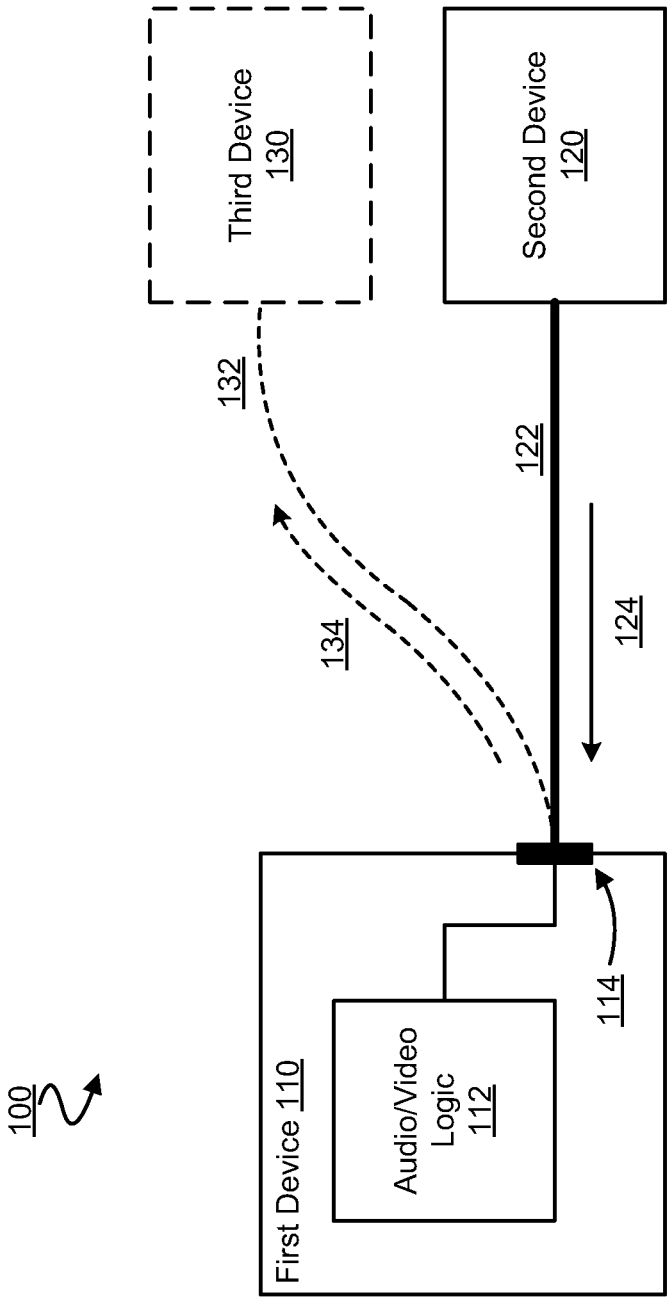

Third Device
130
Second Device
120
132
122
134
124
100
First Device 110
Audio/Video
Logic
112
114

FIG. 1

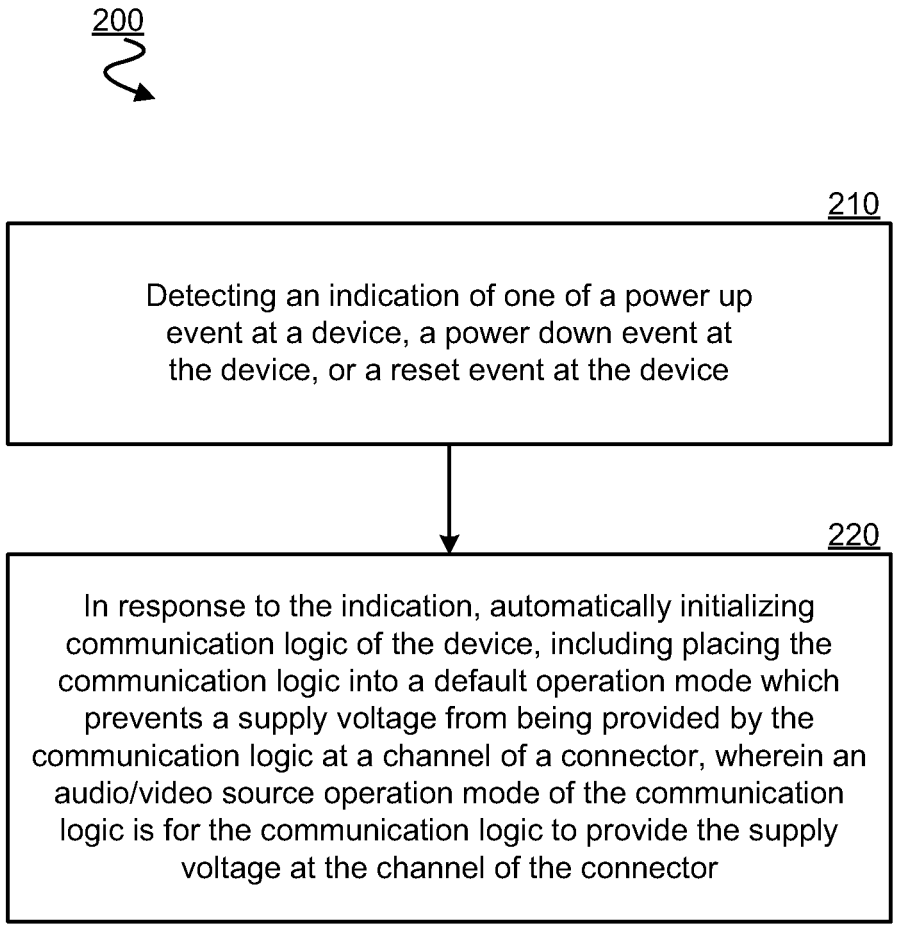

200
210
Detecting an indication of one of a power up event at a device, a power down event at the device, or a reset event at the device
220
In response to the indication, automatically initializing communication logic of the device, including placing the communication logic into a default operation mode which prevents a supply voltage from being provided by the communication logic at a channel of a connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2A

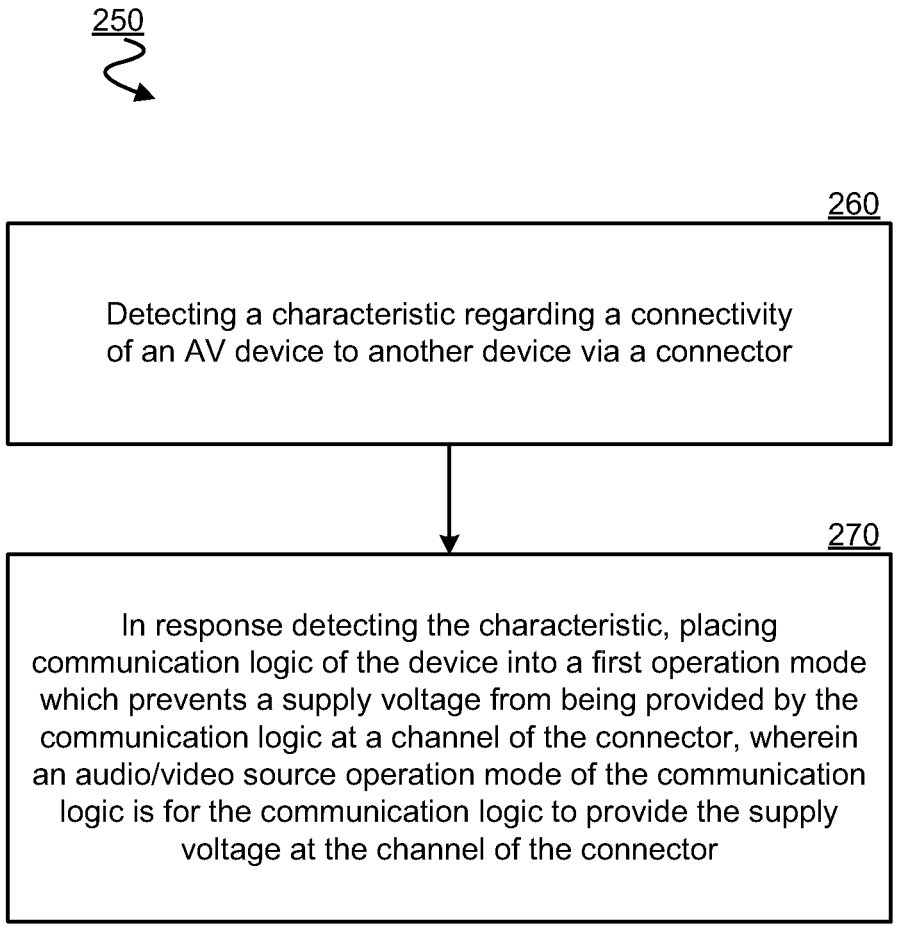

250
260
Detecting a characteristic regarding a connectivity of an AV device to another device via a connector
270
In response detecting the characteristic, placing communication logic of the device into a first operation mode which prevents a supply voltage from being provided by the communication logic at a channel of the connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2B

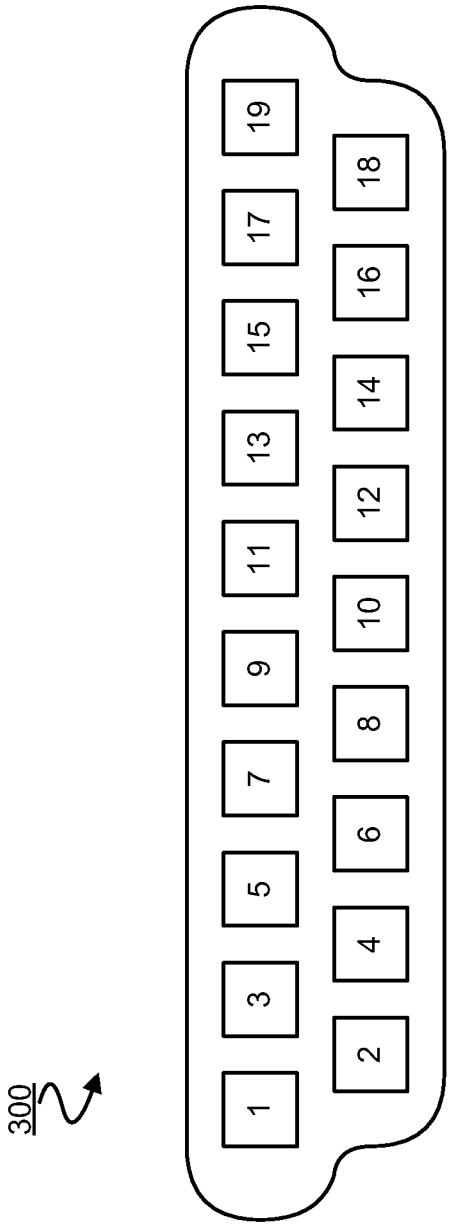


FIG. 3

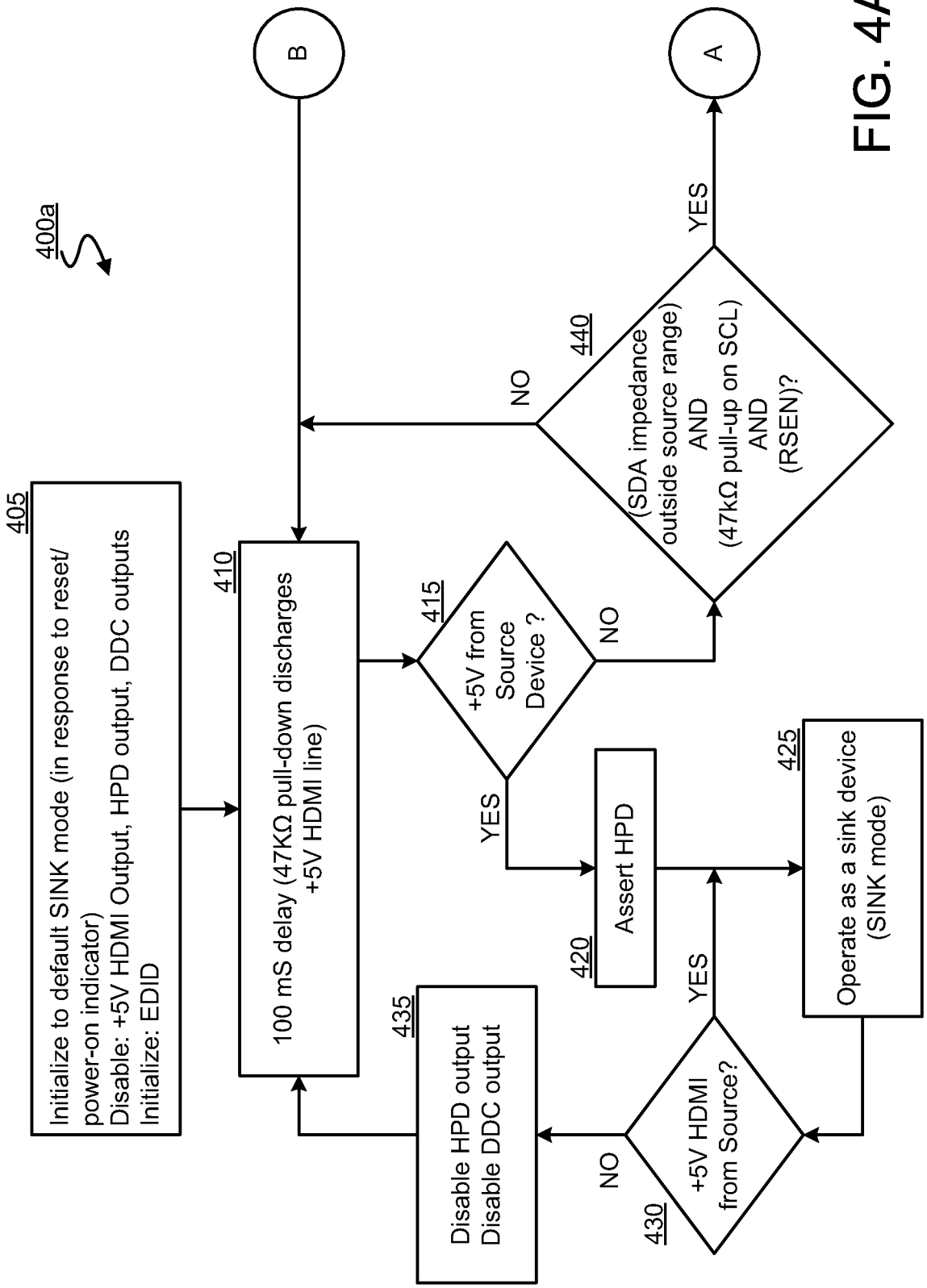

400a
405
Initialize to default SINK mode (in response to reset/ power-on indicator)
Disable: +5V HDMI Output, HPD output, DDC outputs
Initialize: EDID
410
100 mS delay (47KΩ pull-down discharges +5V HDMI line)
415
+5V from Source Device ?
YES
NO
420
Assert HPD
425
Operate as a sink device (SINK mode)
430
+5V HDMI from Source?
YES
NO
435
Disable HPD output
Disable DDC output
440
(SDA impedance outside source range) AND (47kΩ pull-up on SCL) AND (RSEN)?
YES
NO
A
B

FIG. 4A

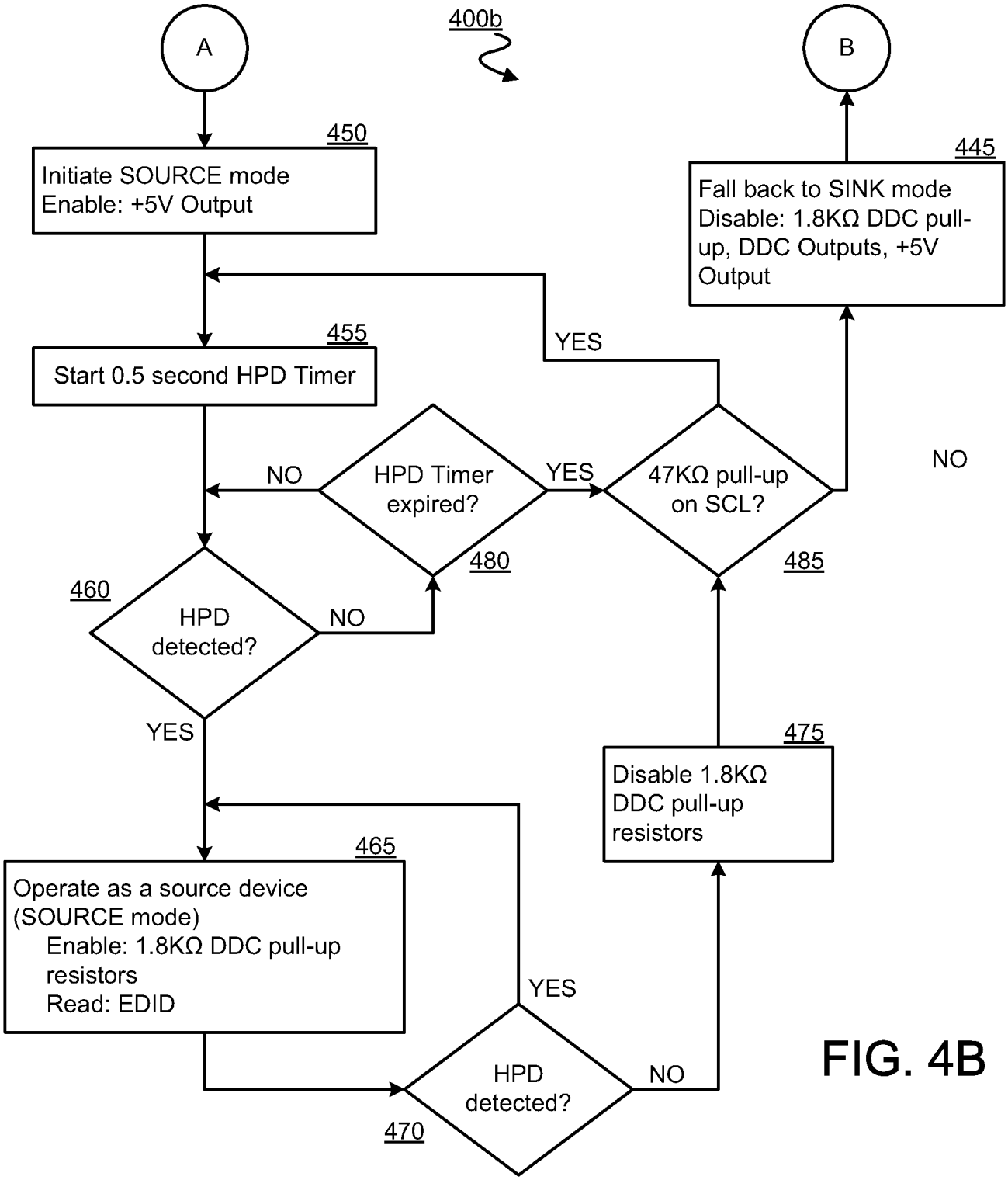

400b
A
B
450
Initiate SOURCE mode
Enable: +5V Output
445
Fall back to SINK mode
Disable: 1.8KΩ DDC pull-up, DDC Outputs, +5V Output
455
Start 0.5 second HPD Timer
YES
NO
HPD Timer expired?
YES
47KΩ pull-up on SCL?
NO
480
485
460
HPD detected?
NO
YES
475
Disable 1.8KΩ DDC pull-up resistors
465
Operate as a source device (SOURCE mode)
Enable: 1.8KΩ DDC pull-up resistors
Read: EDID
YES
HPD detected?
NO
470

FIG. 4B

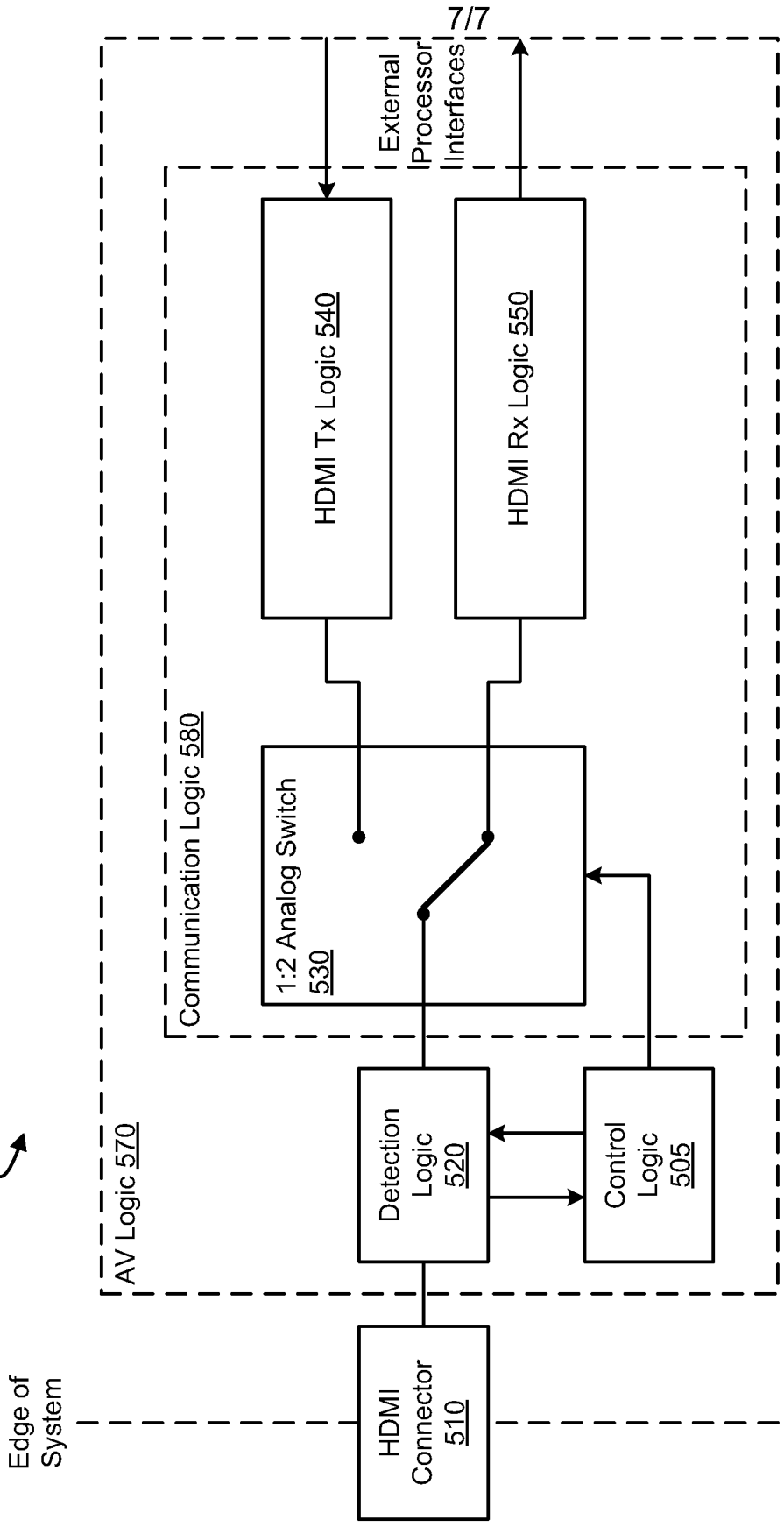

500
AV Logic 570
Communication Logic 580
External Processor Interfaces
HDMI Tx Logic 540
HDMI Rx Logic 550
1:2 Analog Switch 530
Detection Logic 520
Control Logic 505
HDMI Connector 510
Edge of System

FIG. 5

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Acknowledgement of receipt

We hereby acknowledge receipt of the following subsequently filed document(s):

Submission number	5292737
Application number	EP12762781.8
Date of receipt	19 May 2017
Receiving Office	European Patent Office, The Hague
Your reference	P56843
Applicant	All applicants as on file
Documents submitted	package-data.xml epf1038.pdf (1 p.) CLMS-HWA-1.pdf\P56843 amended claims info copy.pdf (4 p.) DESC-HWA-1.pdf\P56843 amended description pages info copy.pdf (1 p.) ep-sfd-request.xml CLMS-1.pdf\P56843 amended claims clean copy.pdf (3 p.) DESC-1.pdf\P56843 amended description pages clean copy.pdf (1 p.) EXRE3-1.pdf\P56843 submission.pdf (4 p.)
Submitted by	CN=Philipp Mehler 25146
Method of submission	Online
Date and time receipt generated	19 May 2017, 09:04 (CEST)
Message Digest	75:62:37:A1:3C:DD:FE:07:CF:43:E0:13:E3:D0:58:03:EC:28:69:C0

Correction by the EPO of errors in debit instructions filed by eOLF

Errors in debit instructions filed by eOLF that are caused by the editing of Form 1038E entries or the continued use of outdated software (all forms) may be corrected automatically by the EPO, leaving the payment date unchanged (see decision T 152/82, OJ EPO 1984, 301 and point 6.3 ff ADA, Supplement to OJ EPO 10/2007).

/European Patent Office/

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Claims

1. A method, comprising:

initializing a first audio/video (AV) device (110) in an AV sink mode of operation, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized;

after the initializing, pulling down, by the first AV device (110) the power output pin through a pull down resistor;

detecting with control circuitry (505) of ~~a~~ the first audio/video (AV) device (110), a coupling via a wired connector (114, 510) between the first AV device (110) and a second AV device (120) by detecting by the first AV device that a voltage is being supplied at the power pin (Channel 18) of the wired connector (114, 510);

~~determining whether a first supply voltage is provided at a channel of a connector (114, 510), the connector coupling the first AV device (110) and the second AV device (120);~~

in response to determining that ~~the first~~ a supply voltage is provided at the ~~channel~~ power pin of the wired connector (114, 510), ~~operating~~ continuing to operate the first AV device (110) in ~~an~~ the AV sink operation mode, and asserting a voltage on a hot plug detect pin (Channel 19 of connector 510) of the wired connector (114, 510), periodically checking the power pin for presence of the supply voltage at the power pin, and de-asserting the voltage on the hot plug detect pin in response to absence of the supply voltage at the power pin, wherein the first AV device (110) receives AV data provided to the first AV device (110) via the wired connector (114, 510) and receives power from the ~~first~~ supply voltage provided to the first AV device (110) at the ~~channel~~ power pin of the wired connector (114, 510) in the AV sink operation mode~~, the AV sink operation mode being a default mode of operation~~; and

in response to determining that the ~~first~~ supply voltage is not provided at the ~~channel~~ power pin of the wired connector (114, 510),

transitioning the first AV device (110) from the AV sink operation mode to an AV source operation mode, wherein the first AV device (110) sends AV data via the wired connector (114, 510), enables the pull-up resistor for the DDC pin (Channel 15) and provides a ~~second~~ supply voltage at the ~~channel~~ power pin of the wired connector (114, 510) in the AV source operation mode.

setting a timer for a pre-determined limit, and

waiting for detection of a voltage at hot plug detect pin, and if the voltage is not detected at the hot plug detect pin before expiration of the timer, transitioning the first AV device (110) from the AV source operation mode to the AV sink operation mode.

2. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

3. The method of claim 1, wherein a first impedance is provided for a data channel of the wired connector (114, 510) in the AV source operation mode, and the first impedance is not provided for the data channel in the AV sink operation mode.

4. The method of claim 1, further comprising:

performing an AV data exchange between the first AV device (110) and the second AV device (120).

~~5. The method of claim 4, further comprising:~~

~~detecting a change to the coupling of the first AV device (110) after the AV data exchange; and~~

~~in response to the detected change to the coupling of the first AV device (110), placing the communication logic into the AV sink operation mode.~~

~~6~~5. An audio/video (AV) device (110) comprising:

communication logic (580) to couple to a wired connector (114, 510), the communication logic (580) including circuitry to implement:

an AV sink operation mode for the communication logic (580) to receive AV data provided to the AV device (110) at the wired connector (114, 510) and to receive power from a ~~first~~ supply voltage provided to the AV device (110) via a ~~channel~~ power pin of the wired connector (114, 510), ~~the AV sink operation mode being a default mode of operation for the AV device (110),~~ and

an AV source operation mode for the communication logic (580) to send AV data from the AV device (110) via the wired connector (114, 510) and to provide a ~~second~~ supply voltage at the ~~channel~~power pin of the wired connector (114, 510); and

control logic (505) including circuitry

to initialize the communication logic (580) to operate the AV device (110) in the AV sink operation mode, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized; after the initializing, to pull down, by the AV device (110) the power output pin through a pull down resistor; in response to determining that the ~~first~~ supply voltage is provided at the ~~channel~~power pin of the wired connector (114, 510) and continuing to operate the AV device (110) in the AV sink operation mode, and asserting a voltage on a hot plug detect pin (Channel 19 of connector 510) of the wired connector (114, 510), periodically checking the power pin for presence of the supply voltage at the power pin, and de-asserting the voltage on the hot plug detect pin in response to absence of the supply voltage at the power pin; and

to initialize the communication logic (580) to transition the AV device (110) from the AV sink operation mode to the AV source operation mode in response to determining that the ~~first~~ supply voltage is not provided at the ~~channel~~power pin of the wired connector (114, 510), to enable the pull-up resistor for the DDC pin (Channel 15), to set a timer for a pre-determined limit, and

to wait for detection of a voltage at hot plug detect pin, and if the voltage is not detected at the hot plug detect pin before expiration of the timer, to transit the AV device (110) from the AV source operation mode to the AV sink operation mode.

~~7~~6. The device of claim ~~6~~5, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

~~8~~7. The device of claim ~~6~~5, wherein the communication logic (580) is further initialized to provide a first impedance for a data ~~channel~~power pin of the wired connector (114, 510) in the AV source operation mode and is initialized to not provide the first impedance for the data channel in the AV sink operation mode.

~~9. The device of claim 6, further comprising:~~

~~detector logic (520) to detect, while the communication logic (580) is in the default operation mode, a coupling of the AV device (110) to another AV device (120) via the connector (114);~~

~~and~~

~~wherein the communication logic (580) is further initialized to perform an AV data exchange with the another AV device (120) in response to the detection.~~

~~10. The device of claim 9, the detector logic (520) further initialized to detect a change to the coupling after the AV data exchange, wherein, in response to the detected change to the coupling, the control logic (5050) further initialized to place the communication logic (580) into the AV sink operation mode.~~

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Amendment Information Copy

digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source. US 2009/0 046 690 A1 discloses a bidirectional high-speed digital interface transceiver which, by selectively coupling a multiplexer to a transmitter or to a receiver, can act as a source device or a sink device. JP 2009 060 204 A discloses an audio/video device which can be used as source or sink.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

Claims

1. A method, comprising:

initializing a first audio/video (AV) device (110) in an AV sink mode of operation, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized;

after the initializing, pulling down, by the first AV device (110) the power output pin through a pull down resistor;

detecting with control circuitry (505) of the first audio/video (AV) device (110), a coupling via a wired connector (114, 510) between the first AV device (110) and a second AV device (120) by detecting by the first AV device that a voltage is being supplied at the power pin (Channel 18) of the wired connector (114, 510);

in response to determining that a supply voltage is provided at the power pin of the wired connector (114, 510), continuing to operate the first AV device (110) in the AV sink operation mode, and asserting a voltage on a hot plug detect pin (Channel 19 of connector 510) of the wired connector (114, 510), periodically checking the power pin for presence of the supply voltage at the power pin, and de-asserting the voltage on the hot plug detect pin in response to absence of the supply voltage at the power pin, wherein the first AV device (110) receives AV data provided to the first AV device (110) via the wired connector (114, 510) and receives power from the supply voltage provided to the first AV device (110) at the power pin of the wired connector (114, 510) in the AV sink operation mode; and

in response to determining that the supply voltage is not provided at the power pin of the wired connector (114, 510),

transitioning the first AV device (110) from the AV sink operation mode to an AV source operation mode, wherein the first AV device (110) sends AV data via the wired connector (114, 510), enables the pull-up resistor for the DDC pin (Channel 15) and provides a supply voltage at the power pin of the wired connector (114, 510) in the AV source operation mode,

setting a timer for a pre-determined limit, and

waiting for detection of a voltage at hot plug detect pin, and if the voltage is not detected at the hot plug detect pin before expiration of the timer,

transitioning the first AV device (110) from the AV source operation mode to the AV sink operation mode.

2. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

3. The method of claim 1, wherein a first impedance is provided for a data channel of the wired connector (114, 510) in the AV source operation mode, and the first impedance is not provided for the data channel in the AV sink operation mode.

4. The method of claim 1, further comprising:
performing an AV data exchange between the first AV device (110) and the second AV device (120).

5. An audio/video (AV) device (110) comprising:
communication logic (580) to couple to a wired connector (114, 510), the communication logic (580) including circuitry to implement:
an AV sink operation mode for the communication logic (580) to receive AV data provided to the AV device (110) at the wired connector (114, 510) and to receive power from a supply voltage provided to the AV device (110) via a power pin of the wired connector (114, 510), and
an AV source operation mode for the communication logic (580) to send AV data from the AV device (110) via the wired connector (114, 510) and to provide a supply voltage at the power pin of the wired connector (114, 510); and
control logic (505) including circuitry
to initialize the communication logic (580) to operate the AV device (110) in the AV sink operation mode, wherein the AV sink mode of operation includes that the first AV device does not supply power to a power pin (Channel 18 for an HDMI connector), a pull up resistor is disabled for a Display Data Channel (DDC) pin (Channel 15 for an HDMI connector) and an extended display identification data (EDID) functionality is initialized; after the initializing, to pull down, by the AV device (110) the power output pin through a pull down resistor; in response to determining that the supply voltage is provided at the power pin of the wired connector (114, 510) and continuing to operate the AV device (110) in the AV sink operation mode, and asserting a voltage on a hot plug detect pin (Channel 19

of connector 510) of the wired connector (114, 510), periodically checking the power pin for presence of the supply voltage at the power pin, and de-asserting the voltage on the hot plug detect pin in response to absence of the supply voltage at the power pin; and

to initialize the communication logic (580) to transition the AV device (110) from the AV sink operation mode to the AV source operation mode in response to determining that the supply voltage is not provided at the power pin of the wired connector (114, 510), to enable the pull-up resistor for the DDC pin (Channel 15), to set a timer for a pre-determined limit, and

to wait for detection of a voltage at hot plug detect pin, and if the voltage is not detected at the hot plug detect pin before expiration of the timer, to transit the AV device (110) from the AV source operation mode to the AV sink operation mode.

6. The device of claim 5, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

7. The device of claim 5, wherein the communication logic (580) is further initialized to provide a first impedance for a data power pin of the wired connector (114, 510) in the AV source operation mode and is initialized to not provide the first impedance for the data channel in the AV sink operation mode.

digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source. US 2009/0 046 690 A1 discloses a bidirectional high-speed digital interface transceiver which, by selectively coupling a multiplexer to a transmitter or to a receiver, can act as a source device or a sink device. JP 2009 060 204 A discloses an audio/video device which can be used as source or sink.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

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The document(s) listed below is (are) subsequently filed documents pertaining to the following application:

Application number	12762781.8
Applicant's or representative's reference	P56843

	Description of document	Original file name	Assigned file name
1	Amended claims (clean copy)	P56843 amended claims clean copy.pdf	CLMS-1.pdf
2	Amended claims with annotations	P56843 amended claims info copy.pdf	CLMS-HWA-1.pdf
3	Amended description (clean copy)	P56843 amended description pages clean copy.pdf	DESC-1.pdf
4	Amended description with annotations	P56843 amended description pages info copy.pdf	DESC-HWA-1.pdf
5	Reply to examination report	P56843 submission.pdf	EXRE3-1.pdf

	Payment	
1	Mode of payment	Not specified

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Your file:	Our file:	Writers initials:	Date:
	P56843	**lm/Fs/Ih**	**12.05.2017**

European Patent Application 12 762 781.8 based on PCT/US2012/31463
Silicon Image, Inc.

Reply to the Communication pursuant to Article 94(3) EPC dated November 23, 2016

1. Newly submitted documents

1.1 New claims 1 to 7 are submitted which replace the previous claims.

- *Previous claims* 5, 9 and 10 have been cancelled.

- *Previous claims 1 and 6* have been amended. The basis for the amendments is found in paragraphs [0048]-[0054] and FIGs. 4A and 4B of the PCT-application.

- Where necessary, the dependent claims have been amended to match the wording of their respective independent claim.

- Where necessary, the claims have been *renumbered* and their *references updated*.

- The claims contain reference signs.

- The independent claims are kept in one-part form as the two-part from would reduce the intelligibility.

1.2 A new description page 2 is submitted which replaces the previous description page 2.

- The prior art documents D1 and D6 have been acknowledged in the new description page and the relevant background art disclosed therein has been briefly discussed.

2. Requests

2.1 It is requested to proceed with the examination on the basis of the newly submitted documents and to grant a patent.

2.2 As an auxiliary request, in case the examining division intends to reject the application, Oral Proceedings pursuant to Article 116 EPC are requested.

3. Reasons

ARTICLE 84

Claim 1

It seems that there is some confusion in the communication about initializing to the sink mode and detecting whether the

external device is connected. In particular - the objection says:

> "device switches to an AV source mode when it is not connected, since no first supply voltage can be provided from an external unconnected device. Practically the default state would be the AV source operation mode when the device is not connected."

The applicant points out, that this is not true, because the disclosure states that the first AV device initializes in a sink mode, where it is not driving the power pin, and instead pulls down on the power pin, and if that power pin returns to a high voltage, that is an indication of presence of an AV source, which is driving that power pin.

In any case, the amendments address the clarity objection, because Claim 1 now is clear concerning how the first AV device initializes, and how it transitions between sink and source mode.

Claim 5

Claim 5 should be clear for the same reasons as stated for claim 1.

ARTICLE 54 and 56

Claims 1 and 5

D6 (JP 2009 060 204 A) appears to disclose a similar problem of allowing a device to determine whether it should act as an AV sink or an AV source.

However, D6 does not disclose or suggest the solution claimed in Claims 1 or 5.

Similarly, **D1** (US 2009/0 046 690 A1) does not disclose or suggest the solution claimed in Claims 1 or 5.

Thus, claims 1 and 5 are patentable over the cited prior art.

Claims 2-4

Claims 2-4 depend from claim 1, and therefore, these dependent claims should also be novel and be based on an inventive step for the same reasons as independent claim 1.

Claims 6-7

Claims 6-7 depend from claim 5, and therefore, these dependent claims should also be novel and be based on an inventive step for the same reasons as independent claim 5.

Kornelia Ihle
European Patent Attorney

Enclosures
New claims 1 to 7;
new description page 2;
in clean and marked-up versions

Europäisches Patentamt
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Office européen des brevets

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Questions about this communication ?
Contact Customer Services at www.epo.org/contact

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Reference	Application No./Patent No.
P56843	12762781.8 - 1903 / 2692118
Applicant/Proprietor	
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Extension of time limit pursuant to Rule 132(2) EPC

Examination procedure

With reference to your request, the time limit for replying to the communication pursuant to Article 94(3) EPC dated 23.11.16 has been extended

by 2 months

to a total of 6 months

from the date of notification of the above-mentioned communication.

Please note: To the extent that your request exceeded the above extension, your request has been refused.

Note
The granting of extensions to time limits is governed by the Implementing Regulations to the EPC and the Guidelines for Examination in the EPO, E-VII, 1.6. A request for extension, which would result in the total period set exceeding six months, must be reasoned and supported by evidence.

If no reply to the communication is received in due time, the European patent application will be deemed to be withdrawn (Art. 94(4) EPC).

DELL/HP/LENOVO EXHIBIT 1012, Page 116

Important information in case of a PACE request
If a PACE request has been validly filed for the application, the applicant is herewith informed that with the grant of the request for extension of time limit the application is removed from the PACE programme. A second PACE request for that application during the same stage of the procedure will not be processed (see OJ EPO 2015, A93, point 4).

For the Examining Division



DELL/HP/LENOVO EXHIBIT 1012, Page 117

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Acknowledgement of receipt

We hereby acknowledge receipt of the following subsequently filed document(s):

Submission number	5117378	
Application number	EP12762781.8	
Date of receipt	15 March 2017	
Receiving Office	European Patent Office, The Hague	
Your reference	P56843	
Applicant	All applicants as on file	
Documents submitted	package-data.xml epf1038.pdf (1 p.)	ep-sfd-request.xml EXRE92-1.pdf\P56843_Submission.pdf (1 p.)
Submitted by	CN=Eric-Michael Dokter 6940	
Method of submission	Online	
Date and time receipt generated	15 March 2017, 12:58 (CET)	
Message Digest	4D:A5:18:48:7A:E7:F2:40:22:1E:25:3C:A5:2D:07:71:14:2D:41:CB	

Correction by the EPO of errors in debit instructions filed by eOLF
Errors in debit instructions filed by eOLF that are caused by the editing of Form 1038E entries or the continued use of outdated software (all forms) may be corrected automatically by the EPO, leaving the payment date unchanged (see decision T 152/82, OJ EPO 1984, 301 and point 6.3 ff ADA, Supplement to OJ EPO 10/2007).

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The document(s) listed below is (are) subsequently filed documents pertaining to the following application:

Application number	12762781.8
Applicant's or representative's reference	P56843

	Description of document	Original file name	Assigned file name
1	Request for extension of time limit during examination procedure	P56843_Submission.pdf	EXRE92-1.pdf

	Payment	
1	Mode of payment	Not specified

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Your file:	Our file:	Writers initials:	Date:
	P56843	**hj/lh**	**14.03.2017**

European Patent Application 12 762 781.8
based on PCT/US2012/31463
Silicon Image, Inc.

In reply to the official Communication pursuant to Article 94(3) EPC dated November 23, 2016

Herewith, a time extension of two months for filing a reply to the outstanding official Communication is respectfully requested.

Kornelia Ihle
Patentanwältin

JP2009060204

CLAIM + DETAILED DESCRIPTION

[Claim(s)]
[Claim 1]
They are the source / sink combination apparatus provided with a second function means which realizes a first function as a function means and sink apparatus that realizes a function as source equipment based on a HDMI standard,
A connector which connects either one of said first function means or said second function means, and an external instrument based on a HDMI standard,
A first voltage level monitor means to detect a voltage level of a power source line of the aforementioned connector,
A second voltage level monitor means to detect a voltage level of a TMDS_CLK line of the aforementioned connector,
The source / sink combination apparatus provided with a functional judging means which judges a function of the aforementioned external instrument based on two voltage levels detected [aforementioned].
[Claim 2]
The source / the sink combination apparatus according to claim 1 further provided with an operational mode determination means to determine first operation of said function means and said second function means, based on a function judged [aforementioned].
[Claim 3]
The source / the sink combination apparatus according to claim 2 further provided with a motion-control means to control said first function means and said second function means, based on operation determined [aforementioned].
[Claim 4]
Said first voltage level monitor means generates the 1st binary level signal based on a power supply level of a power source line detected [aforementioned],
Claim 1, Claim 2, and the source / sink combination apparatus described in any of Claim 3, wherein said 2nd suppression level monitor means generates the 2nd binary level signal based on a voltage level of a TMDS_CLK line detected [aforementioned].
[Claim 5]
The source / the sink combination apparatus according to claim 4 when said 1st level signal is Low and said 2nd level signal is Low, wherein the aforementioned functional judging means judges with the aforementioned external instrument not being connected.
[Claim 6]
The source / the sink combination apparatus according to claim 5 determining that the aforementioned operational mode determination means makes a standby mode said first function means and said second function means.
[Claim 7]
The source / the sink combination apparatus according to claim 6, wherein the aforementioned motion-control means makes high impedance said first function means and said second function means.

[Claim 8]
The source / the sink combination apparatus according to claim 4 characterized by judging with the aforementioned external instrument of the aforementioned functional judging means being unusual when said 1st level signal is High and said 2nd level signal is High.
[Claim 9]
The source / the sink combination apparatus according to claim 8 determining that the aforementioned operational mode determination means makes shunting mode said first function means and said second function means.
[Claim 10]
The source / the sink combination apparatus according to claim 9, wherein the aforementioned motion-control means makes high impedance said first function means and said second function means.
[Claim 11]
The source / the sink combination apparatus according to claim 4 when said 1st level signal is Low and said 2nd level signal is High, wherein the aforementioned functional judging means judges with the aforementioned external instrument being a sink.
[Claim 12]
The source / the sink combination apparatus according to claim 11 determining that the aforementioned operational mode determination means makes a source mode said first function means and said second function means.
[Claim 13]
The source / the sink combination apparatus according to claim 12, wherein the aforementioned motion-control means validates said first function means.
[Claim 14]
The source / the sink combination apparatus according to claim 4 when said 1st level signal is High and said 2nd level signal is Low, wherein the aforementioned functional judging means judges with the aforementioned external instrument being a source.
[Claim 15]
The source / the sink combination apparatus according to claim 14 determining that the aforementioned operational mode determination means makes sink mode said first function means and said second function means.
[Claim 16]
The source / the sink combination apparatus according to claim 15, wherein the aforementioned motion-control means validates said second function means.
[Claim 17]
They are the source / sink combination apparatus provided with a second function means which realizes a first function as a function means and sink apparatus that realizes a function as source equipment based on a HDMI standard,
A connector which connects either one of said first function means or said second function means, and an external instrument based on a HDMI standard,
A first voltage level monitor means to detect a voltage level of a power source line of the aforementioned connector,
A second voltage level monitor means to detect a voltage level of a TMDS_CLK line of

the aforementioned connector,
The source / sink combination apparatus provided with a motion-control means to control said first function means and said second function means, based on two voltage levels detected [aforementioned].

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
The present invention relates to the source / sink combination apparatus which has the attribute of source equipment and sink apparatus based on a HDMI standard.
[Background of the Invention]
[0002]
In recent years, the AV system based on a HDMI (High Definition Multimedia Interface) standard is spreading. HDMI is one of the multimedia interfaces, and since it can transmit to AV output equipment from AV reproduction apparatus without carrying out the data compression of a video signal or the audio signal, it does not need exclusive chips or software, such as a decoder. Since a video signal, an audio signal, and a control signal can be transmitted by one cable, there is an advantage of being able to simplify wiring of apparatus (for example, see Patent Document 1).
[0003]
The AV system based on a HDMI standard connects and comprises a cable (henceforth, "HDMI cable") by which the source equipment which supplies an AV signal, and the sink apparatus which receives an AV signal were usually based on the HDMI standard. As source equipment, the apparatus which supplies video signals and audio signals, such as STB, a DVD player, and a digital camcorder, is used. As sink apparatus, the apparatus which outputs images and sounds, such as a television receiver (henceforth, "television") and a projector, is used. It is possible to constitute the source / sink combination apparatus which combines the function of source equipment, and the function of sink apparatus like the television having a DVD player.
[0004]
An example of the source / sink combination apparatus considered is shown in Fig.4. A source / sink combination apparatus 10 contains the sink apparatus corresponding block 11, the source equipment corresponding block 12, the connector 13a, and the connector 13b. The sink apparatus corresponding block 11 has a function of sink apparatus, and the source equipment corresponding block 12 has a function of source equipment. The sink apparatus corresponding block 11 and the source equipment corresponding block 12 are connected to the connector 13a and the connector 13b based on a HDMI standard, respectively. When a source / sink combination apparatus 10 is constituted as television with a built-in DVD player, television is equivalent to the sink apparatus corresponding block 11, and a DVD player is equivalent to the source equipment corresponding block 12.
[0005]
Thus, in the source / sink combination apparatus 10 constituted as television with a built-in DVD player, graphic display of the video signal reproduced with the DVD player

is usually carried out on the display of television, and voice response of the audio signal is carried out from the loudspeaker of television. However, he may wish viewing and listening by a projector, without viewing and listening to an image on the display of television for some users. He may wish to reproduce the image photoed with the digital camcorder, and a sound by the display and loudspeaker of a source / sink combination apparatus 10.

[0006]

In order to respond to such a hope, it is required that a signal should be received from external source equipment to the sink apparatus corresponding block 11 with which a source / sink combination apparatus 10 is provided, or a signal should be supplied to external sink apparatus from the source equipment corresponding block 12. In order to fill such a demand, the above-mentioned connectors 13a and 13b are provided.

[0007]

Next, with reference to Fig.5, it describes about the AV system which external sink apparatus or external source equipment is connected to a source / sink combination apparatus 10, and is constituted. So that a source / sink combination apparatus 10 may be used as a sink. [Fig.5 (A)] [apparatus] It is connected with source equipment 20src, and AV system 1a constituted is shown, and Fig.5 (B) shows AV system 1b which is connected to sink apparatus 20snk and constituted so that a source / sink combination apparatus 10 may be used as a source. The connectors 21 and 22 based on the HDMI standard, respectively are provided by the input output end of source equipment 20src and sink apparatus 20snk. Source equipment 20src and sink apparatus 20snk are named the external instrument 20 generically.

[0008]

In AV system 1a with which a source / sink combination apparatus 10 is used as a sink of source equipment 20src, such as a digital camcorder and a DVD player, as shown in Fig.5 (A), The sink apparatus corresponding block 11 is connected with source equipment 20src via the connector 13a based on a HDMI standard, the HDMI cable 40, and the connector 21. In this case, the video signal and audio signal which were reproduced with the source equipment (for example, digital camcorder) 20 are transmitted to the sink apparatus corresponding block (television) 11 of a source / sink combination apparatus (for example, television with a built-in DVD player) 10 via the HDMI cable 40, An image is displayed on a built-in display, and a sound is outputted from a loudspeaker.

[0009]

In AV system 1b with which a source / sink combination apparatus 10 is used as a source of sink apparatus, such as a projector, as shown in Fig.5 (B), The source equipment corresponding block 12 is connected with sink apparatus 20snk via the connector 13b based on a HDMI standard, the HDMI cable 40, and the connector 22. In this case, the video signal and audio signal which were reproduced by the source equipment corresponding block (DVD player) 12 are transmitted to the sink apparatus (for example, projector) 30 via the HDMI cable 40, and are projected as an image which has force in the screen of a big screen.

[0010]

In the AV system based on a HDMI standard, since a video signal, an audio signal, and a control signal are transmitted between each apparatus via a HDMI cable, the connector based on a HDMI standard is provided by the input output end of each apparatus. This principle is kept also in a source / sink combination apparatus 10, and the sink apparatus corresponding block 11 and the source equipment corresponding block 12 are connected with the external instrument 20 via the connectors 13a and 13b (further HDMI cable 40), respectively.

[0011]

However, providing a connector for exclusive use to each of the sink apparatus corresponding block 11 and the source equipment corresponding block 12 causes the cost increase of apparatus, and enlargement. It is necessary to judge any of the source equipment which is an output side, and the sink apparatus which is input sides the external instruments 20 connected to the input-and-output combination apparatus 10 are. It is necessary to choose correctly either the two connectors 13a (sink side) or the connector 13b (source side), and to connect the external instrument 20, and is troublesome work for a user.

[0012]

For this reason, to make the connector for each block serve a double purpose by one connector is desired. In fact, in the field of the AV equipment which is not based on a HDMI standard, the input terminal and output terminal of a video voice signal are made to serve a double purpose with one terminal, and the art which switches a connected state automatically has spread according to the state of input and output of a video voice signal (a Patent document 2 - four references).

[Patent document 1] Japanese Published Patent Application No. 2007-79176 (JP2007-79176A)

[Patent document 2] Japanese Published Patent Application No. H07-038817 (JP H07-038817A)

[Patent document 3] Japanese Published Patent Application No. 2001-086416 (JP2001-086416A)

[Patent document 4] Japanese Published Patent Application No. H04-368666 (JP H04-368666A)

[Description of the Invention]

[Problem to be solved by the invention]

[0013]

It is possible that the change art proposed by an above-mentioned Patent document 2 - 4 is applied also to the source / sink combination apparatus of HDMI standard conformity, and the external instrument connected to one connector switches an own function to a sink or a source according to whether it is a sink side and whether it is a source side. However, the target source [present invention] / sink combination apparatus, and the apparatus connected are connected by a HDMI cable.

[0014]

The video signal to which a HDMI cable top is transmitted, an audio signal, and also a control signal are signals according to a HDMI standard. It does not have a function which notifies a connection partner of the function attributes which express with the

apparatus of HDMI standard conformity whether self is a source and whether it is a sink. Therefore, the information about the function attributes as which the near apparatus connected expresses whether it is a source and whether it is a sink in the source / sink combination apparatus of HDMI standard conformity cannot be obtained. That is, according to the function attributes of the apparatus connected to one connector, own source / sink function cannot be switched automatically.

[0015]

If the input (sink) and output (source) of a source / sink combination apparatus will be simply switched even if it is able to know the function attributes of the apparatus connected by a certain means, problems, such as mismatching of impedance, will arise. Thus, in the source / sink combination apparatus of HDMI standard conformity, the change art adopted as common AV equipment is inapplicable.

[0016]

The present invention was made in view of such a conventional problem, and an object of the present invention is to provide the source / sink combination apparatus which can detect the function attributes of the HDMI apparatus connected to a single connector. It sets it as the further purpose to provide the source / sink combination apparatus by which an own function can be switched automatically according to the function attributes of the detected apparatus.

[Means for solving problem]

[0017]

The source / sink combination apparatus applied to the present invention in order to achieve the above-mentioned object,

They are the source / sink combination apparatus provided with the second function means which realizes the first function as a function means and sink apparatus that realizes the function as source equipment based on a HDMI standard,

they are the source / sink combination apparatus provided with the second function means to realize based on a HDMI standard -- the connector which connects either one of the above-mentioned first function means or the above-mentioned second function means, and the external instrument based on a HDMI standard,

A first voltage level monitor means to detect the voltage level of the power source line of the aforementioned connector,

A second voltage level monitor means to detect the voltage level of the TMDS_CLK line of the aforementioned connector,

Based on two voltage levels detected [aforementioned], it has a functional judging means which judges the function of the aforementioned external instrument.

[0018]

As for the source / sink combination apparatus concerning the present invention, it is preferable to further have an operational mode determination means to determine operation of the above-mentioned first function means and the above-mentioned second function means, based on the function judged [aforementioned]. It is preferable to further have a motion-control means to control the above-mentioned first function means and the above-mentioned second function means, based on the operation determined [aforementioned].

[0019]
The above-mentioned first voltage level monitor means generates the 1st binary level signal based on the power supply level of the power source line detected [aforementioned],
As for the above-mentioned 2nd suppression level monitor means, it is preferable to generate the 2nd binary level signal based on the voltage level of the TMDS_CLK line detected [aforementioned].
[0020]
Here, when the 1st above-mentioned level signal is Low and the 2nd above-mentioned level signal is Low, the aforementioned functional judging means judges with the aforementioned external instrument not being connected. In this case, the aforementioned operational mode determination means determines making the above-mentioned first function means and the above-mentioned second function means into a standby mode. That is, the aforementioned motion-control means makes high impedance the above-mentioned first function means and the above-mentioned second function means.
[0021]
When the 1st above-mentioned level signal is High and the 2nd above-mentioned level signal is High, the aforementioned functional judging means judges with the aforementioned external instrument being unusual. In this case, the aforementioned operational mode determination means determines making the above-mentioned first function means and the above-mentioned second function means into shunting mode. That is, the aforementioned motion-control means makes high impedance the above-mentioned first function means and the above-mentioned second function means.
[0022]
When the 1st above-mentioned level signal is Low and the 2nd above-mentioned level signal is High, the aforementioned functional judging means judges with the aforementioned external instrument being a sink. In this case, the aforementioned operational mode determination means determines making the above-mentioned first function means and the above-mentioned second function means into a source mode. That is, the aforementioned motion-control means validates the above-mentioned first function means.
[0023]
When the 1st above-mentioned level signal is High and the 2nd above-mentioned level signal is Low, the aforementioned functional judging means judges with the aforementioned external instrument being a source. In this case, the aforementioned operational mode determination means determines making the above-mentioned first function means and the above-mentioned second function means into sink mode. That is, the aforementioned motion-control means validates the above-mentioned second function means.
[0024]
Second source / sink combination apparatus concerning the present invention,
They are the source / sink combination apparatus provided with the second function means which realizes the first function as a function means and sink apparatus that

realizes the function as source equipment based on a HDMI standard,
The connector which connects either one of the above-mentioned first function means or the above-mentioned second function means, and the external instrument based on a HDMI standard,
A first voltage level monitor means to detect the voltage level of the power source line of the aforementioned connector,
A second voltage level monitor means to detect the voltage level of the TMDS_CLK line of the aforementioned connector,
Based on two voltage levels detected [aforementioned], it has a motion-control means to control the above-mentioned first function means and the above-mentioned second function means.
[Effect of the Invention]
[0025]
In the present invention, an own function can be automatically set up according to the function or state of the HDMI apparatus connected in the source / sink combination apparatus connected to external HDMI apparatus via a single connector.
[Best Mode of Carrying Out the Invention]
[0026]
Before explaining an embodiment of the invention in full detail, it describes about the main characteristics in the present invention first. The source / sink combination apparatus concerning the present invention are constituted based on a HDMI standard, and it is provided with two monitor sections which detect the state of the signal which flows into a HDMI cable further. When an external instrument is connected to the connector of a source / sink common use of a source / sink combination apparatus via a HDMI cable, based on the detection result of two monitor sections, the function attributes whether the external instrument based on the connected HDMI standard is a source or it is a sink are judged.
[0027]
According to the function attributes of the judged external instrument, as for a source / sink combination apparatus, an own function is switched in a source or a sink. In this case, a source / sink combination apparatus 1 performs own impedance adjustment so that impedance mismatching may not arise between external instruments. a result -- a user -- a change -- operation -- nothing -- a common use connector -- connecting -- having had -- apparatus -- an attribute, i.e., sink apparatus, -- it is -- or -- source equipment -- **** -- or -- responding -- a source / sink combination apparatus -- the function as source equipment or sink apparatus -- exerting -- it can make .
[0028]
The calibration of the source / sink combination apparatus concerning an embodiment of the invention is shown in Fig.1. A source / sink combination apparatus 100 contains the connector 110, the power source block 120, the hot plug block 130, the DCC block 140, the TDMS block 150, the voltage line monitor part 160, the TDMS line monitor part 170, and the HDMI attribute change processing part 180.
[0029]
The connector 110 is exclusively connected with any one of other source equipment

20src (Fig.5) which was based on the HDMI standard and based on the HDMI standard via the HDMI cable 200, or the sink apparatus 20snk (Fig.5). That is, the connector 110 is shared by source equipment 20src and sink apparatus 20snk. A plurality of lines which transmit a signal and data are included in the HDMI cable 200. As a typical line, there are a CEC line, a hot plug line, a DDC line, and a HDMC line.

[0030]

A CEC line is used for transmission of the control data between source equipment and sink apparatus. A hot plug line is used for judgment of the existence of connection of a HDMI cable. A DDC line is used for transmission of EDID (Extended Display Identification Data) data including video image format information. A HDMI line is used for transmission of the video signal of a TMDS method, and an audio signal.

[0031]

The power source line 111, the hot plug line 112, the DDC line 113, and the TMDS line 114 are provided in the form corresponding to each line of the HDMI cable 200 by the connector 110. Among these, by Fig.1, although multiple TMDS lines 114 usually carry out an actual existence, since it is easy, only one line is displayed.

[0032]

The power source block 120 includes power source block input-and-output SW sections 121, the power-outlet part 122, and the power source inputting part 123. The hot plug block 130 contains hot plug input / output attribute SW sections 131, the hot plug input part 132, and the hot plug outputting part 133. The DCC block 140 contains DDC block input / output attribute SW sections 141, the DDC outputting part 142, and the DDC input part 143. The TDMS block 150 contains TDMS input / output attribute SW sections 151, the TDMS outputting part 152, the TDMS input part 153, and the TMDS signal processing part 154.

[0033]

A source / sink combination apparatus 100 can function as source equipment based on a HDMI standard by the power-outlet part 122, the hot plug input part 132, the DDC outputting part 142, the TDMS outputting part 152, and the TMDS signal processing part 154. On the other hand, a source / sink combination apparatus 100 can function as sink apparatus based on a HDMI standard by the power source inputting part 123, the hot plug outputting part 133, the DDC input part 143, the TDMS input part 153, and the TMDS signal processing part 154.

[0034]

[the change of the source equipment function and sink apparatus function in the power source block 120, the hot plug 130, the DDC block 140, and the TDMS block 150] It is performed by the change of the switch in power source block input-and-output SW sections 121, hot plug input / output attribute SW sections 131, DDC block input / output attribute SW sections 141, and TDMS input / output attribute SW sections 151. Thus, the source equipment function part and sink apparatus function part in a source / sink combination apparatus 100 share the connector 110 to connection with the external instrument 20.

[0035]

Next, it describes about the function of each block. In the power source block 120, the

power-outlet part 122 supplies the hot plug input part 132 and the DDC outputting part 142, and when a source / sink combination apparatus 100 realizes a source equipment function, it supplies electric power to the TDMS outputting part 152.

[0036]

On the other hand, when a source / sink combination apparatus 100 realizes a sink apparatus function, the power source inputting part 123 supplies electric power to the hot plug outputting part 133, the DDC input part 143, and the TDMS input part 152. By providing independently the power-outlet part 122 and the power source inputting part 123, the back run of the current from the sink side to the source side can be prevented.

[0037]

The hot plug block 130 is used when judging whether a source / sink combination apparatus 100 is connected with the HDMI cable 200. The hot plug input part 132 is used when a source / sink combination apparatus 100 functions as a source, and the hot plug outputting part 133 is used when a source / sink combination apparatus 100 functions as a sink.

[0038]

In the DDC block 140, [the DDC outputting part 142] When a source / sink combination apparatus 100 functions as a source, the EDID data about the video image format which can be displayed from sink apparatus 20snk connected to the HDMI cable 200 are transmitted, and memory (not shown) memorizes. The DDC outputting part 142 sets up a video image format based on a user's instruction from EDID memorized by the memory.

[0039]

When a source / sink combination apparatus 100 functions as a sink, the video image format which can be displayed is memorized as EDID by memory (not shown) of the DDC input part 143. EDID memorized by the memory is read by access from source equipment 20src when a source / sink combination apparatus 100 is connected with source equipment 20src.

[0040]

In the TDMS block 150, [the TDMS outputting part 152] When a source / sink combination apparatus 100 functions as a source, the picture image data and voice data which were converted to the data of the TDMS method by the TDMS signal processing part 154 are outputted to sink apparatus 20snk connected to the HDMI cable 200.

[0041]

The TDMS input part 153 receives the picture image data and voice data of a TDMS method which were transmitted from source equipment 20src connected to the HDMI cable 200, when a source / sink combination apparatus 100 functions as a sink. Picture image data and voice data are transmitted to the TMDS signal processing part 154 from the TDMS input part 153, and are converted to picture image data and voice data before TDMS processing is performed by the TMDS signal processing part 154. By providing independently the TDMS outputting part 152 and the TDMS input part 153, the problem of the impedance mismatching of the TDSM line 114 is solvable.

[0042]

Next, it describes about the two monitor sections 160 and 170 which monitor the

connected state of the HDMI cable 200 and the external instrument 20. The power supply line monitor part 160 repeats and detects voltage-level VL1 of the power source line 111 at an interval for a predetermined period among a plurality of lines connected to the connector 110, and generates the binary level signal (henceforth, "power source line level") C1.

[0043]

When the external instrument 40 to which the connector 110 is connected via the HDMI cable 200 is source equipment 20src, voltage-level VL1 of the power source line 111 shows a High level (5V). On the other hand, when whether it is connected or the external instrument 40 connected is sink apparatus 20snk is not energizing even if connected, and not operating, voltage-level VL1 shows a Low level (0V). The power source line level C1 takes which value of High and Low corresponding to the level of voltage-level VL1.

[0044]

The TDMS line monitor part 170 repeats and detects at an interval voltage-level VL2 of the TDMS line (specifically TDMS_CLK line) 114 included in the connector 110 for a predetermined period, and generates the binary level signal (henceforth, "TDMS line level") C2. When the connector 110 is connected with sink apparatus via the HDMI cable 200, voltage-level VL2 of the TDMS line 114 shows a High level (3.3V).

[0045]

On the other hand, when the connector 110 is connected with source equipment via the HDMI cable 200, voltage-level VL2 when not being connected with other apparatus shows a Low level (0V). The TDMS line level C2 takes which value of High and Low corresponding to the level of voltage-level VL2.

[0046]

Below, with reference to Fig.2, it describes about operation of the HDMI attribute change processing part 180. The HDMI attribute change processing part 180 judges the function J of the external instrument connected to the connector 110 shared by connection with source equipment and sink apparatus based on the power source line level C1 and the TDMS line level C2. It is said any of "connectionless", "abnormalities", a "sink", and four state of a "source" "functions" is about an external instrument.

[0047]

"Connectionless" means the state where it is not energizing even if the external instrument is not connected or it is connected. When both the power source line level C1 and the TDMS line level C2 are Low(s), it is judged with "connectionless."

[0048]

"Abnormalities" means the state which is not normal, although the external instrument is connected. When both the power source line level C1 and the TDMS line level C2 are High(s), it is judged as "abnormalities."

[0049]

The "sink" refers to the state where the sink, i.e., the external instrument of an input side, is connected. It cannot be overemphasized that an external instrument is not an abnormal condition and it is energizing. The power source line level C1 is judged to be a "sink" when Low and the TDMS line level C2 are High(s).

[0050]
The "source" refers to the state where the source, i.e., the external instrument of an output side, is connected. It cannot be overemphasized that an external instrument is not an abnormal condition and it is energizing. The power source line level C1 is judged to be a "source" when High and the TDMS line level C2 are Low(s).
[0051]
The HDMI attribute change processing part 180 determines operational mode M of a source / sink combination apparatus 100 further based on the decision result of above-mentioned external instrument function attributes. "Operational mode" means whether a source / sink combination apparatus 100 operates which function of "standby", "error handling", a "source", and a "sink."
[0052]
A source / sink combination apparatus 100 energizes "standby", and it says the processing which waits for connection of an external instrument. "Standby" mode is determined when the function attributes of an external instrument are judged to be "connectionless."
[0053]
The processing which severs a stop or an electrical link with an external instrument for operation of a source / sink combination apparatus 100 is said so that "shunting" may not be subject to the influence of the external instrument in an abnormal condition. "Evacuation" mode is determined when the function attributes of an external instrument are judged to be "abnormalities."
[0054]
The "source" refers to the processing which performs the source function built in a source / sink combination apparatus 100. "Source" mode is determined when the function attributes of an external instrument are judged to be a "sink."
[0055]
The "sink" refers to the processing which performs the sink function built in a source / sink combination apparatus 100. "Sink" mode is determined when the function attributes of an external instrument are judged to be a "source."
[0056]
The HDMI attribute change processing part 180 receives each of the power source block 120, the DDC block 130, the hot plug block 140, and the TDMS block 150 based on above-mentioned operational mode determination, Control signal Sc1 which instructs realization of the function attributes corresponding to the determined operational mode, Sc2, Sc3, and Sc4 are outputted.
[0057]
When it determines as "standby" mode, specifically, So that, as for the control signals Sc1-Sc4, the power source block 120, the hot plug block 130, the DCC block 140, and the TDMS block 150 may become high impedance. Each of power source block input-and-output SW sections 121, DDC block input / output attribute SW sections 131, hot plug input / output attribute SW sections 131, and TMDS block input / output attribute SW sections 151 is controlled.
[0058]

When it determines as "shunting" mode, it controls like the time of the control signals Sc1-Sc4 being determined as "standby" mode. Thereby, the DDC block 130, the hot plug block 140, and the TDMS block 150 are protected from unusual voltage, and malfunction is prevented. It is also desirable to intercept the power supply of a source / sink combination apparatus 100 the very thing further.

[0059]

When it determines as "source" mode, control signal Sc1 switches the input / output attribute of the power source block 120 to an output. That is, power source block input-and-output SW sections 121 are controlled to connect the power-outlet part 122 to the connector 110.

Control signal Sc2 switches the input / output attribute of the hot plug block 130 to an output. That is, hot plug input / output attribute SW sections 131 are controlled to connect the DDC outputting part 132 to the connector 110.

Control signal Sc3 switches the input / output attribute of the DCC block 140 to an input. That is, DDC block input / output attribute SW sections 141 are controlled to connect the DDC input part 143 to the connector 110.

Control signal Sc4 switches the input / output attribute of the TDMS block 150 to an output. That is, TDMS input / output attribute SW sections 151 are controlled to connect the TDMS outputting part 152 to the connector 110.

[0060]

When it determines as "sink" mode, control signal Sc1 switches the input / output attribute of the power source block 120 to an output. That is, power source block input-and-output SW sections 121 are controlled to connect the power-outlet part 122 to the connector 110.

Control signal Sc2 switches the input / output attribute of the hot plug block 130 to an output. That is, hot plug input / output attribute SW sections 131 are controlled to connect the DDC outputting part 132 to the connector 110.

Control signal Sc3 switches the input / output attribute of the DCC block 140 to an input. That is, DDC block input / output attribute SW sections 141 are controlled to connect the DDC input part 143 to the connector 110.

Control signal Sc4 switches the input / output attribute of the TDMS block 150 to an output. That is, TDMS input / output attribute SW sections 151 are controlled to connect the TDMS outputting part 152 to the connector 110.

[0061]

[information required for the judgment of the external instrument function J and the determination of operational mode M which were described in Fig.2 and also control signal Sc of various blocks] It is stored in ROM (not shown) built in the HDMI attribute change processing part 180, and CPU (not shown) reads required information from ROM, and it performs judgment, determination, and also sending out of a control signal. That is, the HDMI attribute change processing part 180 has realized each function of the functional judging means of the present invention, an operational mode determination means, and a motion-control means.

[0062]

Hereinafter, with reference to the flow chart shown in Fig.3, it describes more

specifically about function switching operation of the source / sink combination apparatus 100 by the HDMI attribute change processing part 180 in a source / sink combination apparatus 100. If a power supply is switched on and operation of a source / sink combination apparatus 100 is started, Operation by the HDMI attribute change processing part 180 described below based on the power source line level C1 and the TDMS line level C2 which are outputted at an interval for a predetermined period from each of the voltage line monitor part 160 and the TDMS line monitor part 170 begins.

[0063]

First, in Step S2, it is judged by the HDMI attribute change processing part 180 whether the power source line level C1 is High. When it is judged that No C1, i.e., a power source line level, is Low, control proceeds to the following step S4. When it is judged that Yes C1, i.e., a power source line level, is High, control proceeds to Step S10.

[0064]

In step S4, it is judged whether the TDMS line level C2 is High. When No C2, i.e., a TDMS line level, is judged to be Low, control proceeds to the following step S6. When it is judged that Yes C2, i.e., a TDMS line level, is High, control proceeds to Step S16.

[0065]

Since the power source line level C1 and the TDMS line level C2 are Low(s), as described with reference to Fig.2, it is judged [in / both / Step S6] with the external instrument 20 "connectionless." And in Step S8, the control signals Sc1-Sc4 are outputted, and a source / sink combination apparatus 100 is set as a standby mode. And control returns to the above-mentioned step S2.

[0066]

In Step S10, it is judged whether the TDMS line level C2 is High. When Yes C2, i.e., a TDMS line level, is judged to be High, control proceeds to Step S12. When judged as No, control proceeds to Step S20.

[0067]

Since the power source line level C1 and the TDMS line level C2 are High(s), as described with reference to Fig.2, the external instrument 20 is judged [in / both / Step S12] to be "abnormalities." And in Step S14, the control signals Sc1-Sc4 are outputted, and a source / sink combination apparatus 100 is set as "evacuation" mode.

[0068]

In Step S16, since the power source line level C1 was [Low and the TDMS line level C2] High(s), as it described with reference to Fig.2, the external instrument 20 is judged to be a "sink." And in Step S18, the control signals Sc1-Sc4 are outputted, and a source / sink combination apparatus 100 is set as "source" mode.

[0069]

And the DDC outputting part 132 reads EDID in sink apparatus 20snk connected, and checks the video image format to support. The TDMS block part 152 performs HDCP encryption processing to the video signal and audio signal which were outputted from the TMDS signal processing part, and outputs a TMDS signal to the HDMI cable 200 from the HDMI connector 110. A source / sink combination apparatus 100 exhibits the function as source equipment based on a HDMI standard by passing through the above step.

[0070]
In Step S20, since the power source line level C1 was [High and the TDMS line level C2] Low(s), as it described with reference to Fig.2, the external instrument 20 is judged to be a "source." And in Step S22, the control signals Sc1-Sc4 are outputted, and a source / sink combination apparatus 100 is set as "sink" mode.
[0071]
And source equipment 20src connected reads in the DDC input part 143 EDID about the video image format which self supports. After the TDMS input part 153 decrypts the enciphered TMDS signal which was transmitted from source equipment 20src, it is transmitted to the TMDS signal processing part 154. The TMDS signal processing part 154 decrypts picture image data and voice data from the transmitted TMDS signal. By passing through the above step, a source / sink combination apparatus 100 exhibits the function as sink apparatus based on a HDMI standard.
[0072]
It describes [case / where the external instrument 20 connected to a source / sink combination apparatus 100 below is in the following five kinds of states] specifically about operation of the HDMI attribute change processing part 180.
State 1: Even if the external instrument 20 is not connected to a source / sink combination apparatus 100 or it is connected, it is not energizing.
State 2: The external instrument 20 connected is unusual.
State 3: Normal sink apparatus 20snk is connected.
State 4: Normal source equipment 20src is connected.
State 5: Connection with the external instrument 20 of the state 2 is severed.
State 6: Connection with the external instrument 20 of the state 3 is severed.
State 7: Connection with the external instrument 20 of the state 4 is severed.
State 8: Connection with the external instrument of the state 5, the state 6, and the state 7 is recovered.
[0073]
In the state 1 (connectionless), a source / sink combination apparatus 100 is set as a standby mode by processing at Step S2 (No), step S4 (No), Step S6, and Step S8. And a source / sink combination apparatus 100 waits to connect the external instrument 20, repeating processing of the flow chart of Fig.3.
[0074]
In the state 2 (unusual), a source / sink combination apparatus 100 is set as error-handling mode by processing at Step S2 (Yes), Step S10 (Yes), Step S12, and Step S14. And a source / sink combination apparatus 100 waits to recover the abnormalities of the external instrument 20, repeating processing of the flow chart of Fig.3.
[0075]
In the state 3 (sink), a source / sink combination apparatus 100 is set as a source mode by processing at Step S2 (No), step S4 (Yes), Step S16, and Step S18. And a source / sink combination apparatus 100 monitors the state of the external instrument 20, repeating processing of the flow chart of Fig.3. And if the state of the external instrument 20 changes, own operational mode will be reset up according to it.
[0076]

In the state 4 (source), a source / sink combination apparatus 100 is set as sink mode by processing at Step S2 (Yes), Step S10 (No), Step S20, and Step S22. And a source / sink combination apparatus 100 monitors the state of the external instrument 20, repeating processing of the flow chart of Fig.3. And if the state of the external instrument 20 changes, own operational mode will be reset up according to it.

[0077]

In the state 5, the state 6, and the state 7, when connection with the external instrument 20 of each state is severed, processing of the above-mentioned state 1 is performed.

[0078]

In the state 8, when connection with the external instrument 20 of each state is recovered, according to the state of the external instrument 20, processing [which / of the state 2, the state 3, and the state 4] is performed.

[0079]

As mentioned above, the attribute of source equipment and sink apparatus can be automatically switched without a user's operation, using a single HDMI connector. The time and effort which changes realization of inexpensive-izing by reduction of a result and necessary parts and a miniaturization of apparatus and the attribute (sink apparatus/source equipment) of HDMI by a user is reducible.

[Industrial applicability]

[0080]

The source / sink combination apparatus concerning the present invention can be widely used for the AV equipment applied correspondingly to the HDMI standard.

[Brief Description of the Drawings]

[0081]

[Drawing 1]The functional block diagram showing the calibration of the source / sink combination apparatus which requires an embodiment of the invention

[Drawing 2]The explanatory view showing the decision contents by the HDMI attribute change processing part of Fig.1

[Drawing 3]The flow chart showing operation of the HDMI attribute change processing part of Fig.1

[Drawing 4]The block diagram showing the calibration of the source / sink combination apparatus considered

[Drawing 5]The explanatory view of the AV system which comes to connect external sink apparatus to the source / sink combination apparatus shown in Fig.4

[Explanations of letters or numerals]

[0082]

10 and 100 A source / sink combination apparatus
110 HDMI connector
111 Power source line
120 Power source block
121 Power source block input-and-output SW sections
122 Power-outlet part
123 Power source inputting part
130 Hot plug

131 Hot plug input / output attribute SW sections
132 Hot plug input part
133 Hot plug outputting part
140 DDC block
141 DDC block input / output attribute SW sections
142 DDC outputting part
143 DDC input part
150 TMDS block
151 TDMS input / output attribute SW sections
152 TDMS outputting part
153 TDMS input part
154 TDMS signal processing part
160 Voltage line monitor part
170 TMDS line monitor part
180 HDMI attribute change processing part
200 HDMI cable

The examination is being carried out on the **following application documents**

Description, Pages

1, 3-20	as published	
2	filed in electronic form on	16-02-2015

Claims, Numbers

1-10	filed in electronic form on	16-02-2015

Drawings, Sheets

1/7-7/7	as published

1 The application has been reconsidered in the light of the applicant's letter of reply dated 10-02-2015 (hereafter referred to as L1). Reference will also be made as may be required to the examining division's communication C1 dated 13-08-2014.

2 Document D1 is known from C1:

D1 US 2009/046690 A1 (HSIEH KUN-LI [TW]) 19 February 2009 (2009-02-19)

The following document is cited by the Examiner. A copy of the document is annexed to the communication and the numbering will be adhered to in the rest of the procedure.

D6 JP 2009 060204 A (PANASONIC CORP) 19 March 2009 (2009-03-19)

3 Clarity

The application does not meet the requirements of Article 84 EPC, because claims 1, 6 are not clear.

3.1 Claim 1 refers to:

"*in response to determining that the first supply voltage is provided at the channel of the connector (114, 510), operating the first AV device (110) in an AV sink operation mode, [...] the AV sink operation mode being a default mode of operation; and*

in response to determining that the first supply voltage is not provided at the channel of the connector (114, 510), transitioning the first AV device (110) from the AV sink operation mode to an AV source operation mode, wherein the first AV device (110) sends AV data via the connector (114, 510) and provides a second supply voltage at the channel of the connector (114, 510) in the AV source operation mode." (emphasis added).

Firstly, a default mode of operation is regarded as an operation mode in which the device goes after power on, reset or when it is not connected. According to the above cited passage, the device switches to an AV source mode when it is not connected, since no first supply voltage can be provided from an external, unconnected device. Practically, the default state would be the AV source operation mode when the device is not connected.

Secondly, this case does not appear to be supported by the described embodiment, particularly from Fig. 4A, 4B, which may also lead to Article 123(2) EPC objections. In Fig. 4A, 4B, although the device is initialized to default sink mode (405), it does not transition to source mode (450) when the device is not provided with the first supply voltage (415), without checking whether the external device is connected (440).

Similar objection for claim 6.

4 Independent claims

The present application does not meet the requirements of Article 52(1) EPC because the subject-matter of claims 1, 6 is not new within the meaning of Article 54(1) and (2) EPC.

4.1 Claim 6

D6 discloses an audio/video 'AV' device (Fig. 1) comprising:

communication logic to couple to a connector (Fig. 1: 100), the communication logic including circuitry to implement:

an AV sink operation mode for the communication logic (Fig. 5: S22) to receive AV data provided to the AV device at the connector (Fig. 1: 153) and to receive power from a first supply voltage provided to the AV device via a channel of the connector (Fig. 1: 123), the AV sink operation mode being a default mode of operation for the AV device, and

an AV source operation mode for the communication logic (Fig. 5: S18) to send AV data from the AV device via the connector (Fig. 1: 152) and to provide a second supply voltage at the channel of the connector (Fig. 1: 122); and

control logic including circuitry to initialize the communication logic to operate the AV device in the AV sink operation mode (Fig. 1: 180) in response to determining that the first supply voltage is provided at the channel of the connector (Fig. 1: 160) and to initialize the communication logic to transition the AV device from the AV sink operation mode to the AV source operation mode in response to determining that the first supply voltage is not provided at the channel of the connector (Fig. 5: S2).

4.2 Claim 1

The objections raised in respect of claim 6 also apply to independent claim 1 as corresponding method claim, which is thus not allowable under Article 54(1) and (2) EPC.

5 Dependent claims

Dependent claims 2-5, 7-10 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the EPC with respect to novelty and/or inventive step, see the cited figures and the corresponding passages from D6.

6 Further remarks

It is not at present apparent which part of the application could serve as a basis for a new, allowable claim. Should the applicant nevertheless regard some particular matter as patentable, an independent claim should be filed taking account of Rule 43(1) EPC. The applicant should also indicate how the subject-matter of the new claim differs from the state of the art and the significance thereof.

In the case the applicant intends to file new set of claims, following remarks should be taken into consideration:

6.1 Any amended claim should be filed in the two-part form conf. Rule 43(1) EPC.

6.2 The features of the claims should be provided with reference signs placed in parentheses to increase the intelligibility of the claims (Rule 43(7) EPC). This applies to both the preamble and characterising portion (see Guidelines F-IV, 4.19).

6.3 To meet the requirements of Rule 42(1)(b) EPC, document D6 should be identified in the description and the relevant background art disclosed therein should be briefly discussed.

6.4 In order to comply with the requirements of Rule 137(4) EPC, the applicant should clearly identify the amendments made, irrespective of whether they concern amendments by addition, replacement or deletion, and indicate the passages of the application as filed on which these amendments are based (see Guidelines H III, 2.1).

If the applicant considers it appropriate, these indications could be submitted in handwritten form on a copy of the relevant parts of the application as filed or in documents with tracked changes.

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Application No.	Ref.	Date
12 762 781.8 - 1903	P56843	23.11.2016
Applicant: Silicon Image, Inc.		

Communication pursuant to Article 94(3) EPC

The examination of the above-identified application has revealed that it does not meet the requirements of the European Patent Convention for the reasons enclosed herewith. If the deficiencies indicated are not rectified the application may be refused pursuant to Article 97(2) EPC.

You are invited to file your observations and insofar as the deficiencies are such as to be rectifiable, to correct the indicated deficiencies within a period

of 4 months

from the notification of this communication, this period being computed in accordance with Rules 126(2) and 131(2) and (4) EPC. One set of amendments to the description, claims and drawings is to be filed within the said period on separate sheets (R. 50(1) EPC).

If filing amendments, you must identify them and indicate the basis for them in the application as filed. Failure to meet either requirement may lead to a communication from the Examining Division requesting that you correct this deficiency (R. 137(4) EPC).

In case you withdraw the application within the above-mentioned period, the examination fee will be refunded at a rate of 50% (Art. 11 (b) RFees).

Failure to comply with this invitation in due time will result in the application being deemed to be withdrawn (Art. 94(4) EPC).

Registered letter

Maciu, Emanoil
Primary Examiner
For the Examining Division

Enclosure(s): 4 page/s reasons (Form 2906)
Translation of document D6 - JP2009060204 (17 pages)
JP-2009060204-A & PAJ abstract

Registered letter
EPO Form 2001 11.16TRI

Application No.: 12762781.8

Substantive examination has started on 10.11.16 (see Notice from the European Patent Office dated 29.01.2013, OJ EPO 2013, 153).

For the Examining Division

Europäisches Patentamt
European Patent Office
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European Patent Office
80298 MUNICH
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Questions about this communication ?
Contact Customer Services at www.epo.org/contact

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Date
31.05.16

Reference	Application No./Patent No.
P56843	12762781.8 - 1903 / 2692118
Applicant/Proprietor	
Silicon Image, Inc.	

Communication in response to your enquiry received on 24.05.16

☑ Having regard to the current workload, the EPO will be able to supply a communication within 07 months.

☐ Having regard to the current workload, the EPO will not be able to supply a communication within the next 12 months.

If you wish your application to be examined more quickly than the time frame indicated above, your attention is drawn to the possibility of requesting accelerated examination under the "PACE" programme of the EPO (OJ EPO 2015, A93). However, if a request for accelerated examination has already been filed and the application has been removed from the PACE programme, a second request for accelerated examination can no longer be processed (OJ EPO 2015, A93, point 4).

If the proposed time frame does not meet your needs, please contact the responsible examiner or the director:

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24. Mai 2016

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Your file:	Our file:	Writers initials:	Date:
	P56843	**brä/Ih**	**17.05.2016**

European Patent Application 12 762 781.8 based on PCT/US2012/31463
Silicon Image, Inc.

Status enquiry

Herewith, it is respectfully requested when the first Office Action according to Art. 94(3) EPC can be expected.

Kornelia Ihle
European Patent Attorney

VJP– VIERING, JENTSCHURA & PARTNER

EPO - Munich
31
23. Okt. 2015

Europäisches Patentamt
Dir. 524
Rechtsabteilung/Patentverwaltung
80298 München

Ihr Zeichen:	Unser Zeichen:	Bearbeiter:	Datum:
		Si	23.10.2015

Zusammenschluss Nr. 64
Änderung Kanzleiname

Hiermit teilen wir für unseren Zusammenschluss mit, dass sich der Name unserer Kanzlei gemäß Eintrag im Partnerschaftsregister München PR97 ab sofort in nunmehr

Viering, Jentschura & Partner mbB

Patent- und Rechtsanwälte

geändert hat.

Um Beachtung, um eine entsprechende Aktualisierung unseres Zusammenschlusseintrags in allen relevanten Datenbanken und um eine diesbezügliche Bestätigung wird gebeten.

Auf eine separate Bestätigung für jede beim EPA geführte Akte wird ausdrücklich verzichtet.

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Patentanwalt

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Acknowledgement of receipt

We hereby acknowledge receipt of the following subsequently filed document(s):

Submission number	3313963
Application number	EP12762781.8
Date of receipt	16 February 2015
Receiving Office	European Patent Office, The Hague
Your reference	P56843
Applicant	All applicants as on file

Documents submitted	
package-data.xml	ep-sfd-request.xml
epf1038.pdf (1 p.)	WOREPLY-1.pdf\P56843_Submission .pdf (5 p.)
CLMS-1.pdf\P56843_Amended claims.pdf (3 p.)	CLMS-HWA-1.pdf\P56843_Amended claims_marked.pdf (4 p.)
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Submitted by	CN=Eric-Michael Dokter 6940
Method of submission	Online
Date and time receipt generated	16 February 2015, 11:58 (CET)
Message Digest	63:66:F7:71:C5:06:EB:44:7D:E1:F7:A6:78:FA:53:75:AA:9C:89:98

Correction by the EPO of errors in debit instructions filed by eOLF

Errors in debit instructions filed by eOLF that are caused by the editing of Form 1038E entries or the continued use of outdated software (all forms) may be corrected automatically by the EPO, leaving the payment date unchanged (see decision T 152/82, OJ EPO 1984, 301 and point 6.3 ff ADA, Supplement to OJ EPO 10/2007).

/European Patent Office/

DELL/HP/LENOVO EXHIBIT 1012, Page 149

New claims 1 to 10

1. A method, comprising:

detecting with control circuitry (505) of a first audio/video (AV) device (110), a coupling between the first AV device (110) and a second AV device (120);

determining whether a first supply voltage is provided at a channel of a connector (114, 510), the connector coupling the first AV device (110) and the second AV device (120);

in response to determining that the first supply voltage is provided at the channel of the connector (114, 510), operating the first AV device (110) in an AV sink operation mode, wherein the first AV device (110) receives AV data provided to the first AV device (110) via the connector (114, 510) and receives power from the first supply voltage provided to the first AV device (110) at the channel of the connector (114, 510) in the AV sink operation mode, the AV sink operation mode being a default mode of operation; and

in response to determining that the first supply voltage is not provided at the channel of the connector (114, 510), transitioning the first AV device (110) from the AV sink operation mode to an AV source operation mode, wherein the first AV device (110) sends AV data via the connector (114, 510) and provides a second supply voltage at the channel of the connector (114, 510) in the AV source operation mode.

2. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

3. The method of claim 1, wherein a first impedance is provided for a data channel of the connector (114, 510) in the AV source operation mode, and the first impedance is not provided for the data channel in the AV sink operation mode.

4. The method of claim 1, further comprising:

performing an AV data exchange between the first AV device (110) and the second AV device (120).

5. The method of claim 4, further comprising:

detecting a change to the coupling of the first AV device (110) after the AV data exchange; and

in response to the detected change to the coupling of the first AV device (110), placing the communication logic into the AV sink operation mode.

6. An audio/video (AV) device (110) comprising:

communication logic (580) to couple to a connector (114, 510), the communication logic (580) including circuitry to implement:

an AV sink operation mode for the communication logic (580) to receive AV data provided to the AV device (110) at the connector (114, 510) and to receive power from a first supply voltage provided to the AV device (110) via a channel of the connector (114, 510), the AV sink operation mode being a default mode of operation for the AV device (110), and

an AV source operation mode for the communication logic (580) to send AV data from the AV device (110) via the connector (114, 510) and to provide a second supply voltage at the channel of the connector (114, 510); and

control logic (505) including circuitry to initialize the communication logic (580) to operate the AV device (110) in the AV sink operation mode in response to determining that the first supply voltage is provided at the channel of the connector (114, 510) and to initialize the communication logic (580) to transition the AV device (110) from the AV sink operation mode to the AV source operation mode in response to determining that the first supply voltage is not provided at the channel of the connector (114, 510).

7. The device of claim 6, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

8. The device of claim 6, wherein the communication logic (580) is further initialized to provide a first impedance for a data channel of the connector (114, 510) in the AV source operation mode and is initialized to not provide the first impedance for the data channel in the AV sink operation mode.

9. The device of claim 6, further comprising:

detector logic (520) to detect, while the communication logic (580) is in the default operation mode, a coupling of the AV device (110) to another AV device (120) via the connector (114);

and

wherein the communication logic (580) is further initialized to perform an AV data exchange with the another AV device (120) in response to the detection.

10. The device of claim 9, the detector logic (520) further initialized to detect a change to the coupling after the AV data exchange, wherein, in response to the detected change to the coupling, the control logic (5050) further initialized to place the communication logic (580) into the AV sink operation mode.

New claims with amendments shown

Portions of the claims underlined are to be added and portions of the claims stricken through or placed in double brackets are to be deleted

1. (Currently Amended): A method ~~at an audio/video (AV) device, the method~~ comprising:

detecting with control circuitry (505) ~~an indication of one of a power up event at the AV device, a power down event at the AV device, or a reset event at~~ of a first audio/video (AV) device (110), a coupling between the first AV device (110) and a second AV device (120); [[and]]

determining whether a first supply voltage is provided at a channel of a connector (114, 510), the connector coupling the first AV device (110) and the second AV device (120);

in response to determining that the first supply voltage is provided at the channel of the connector (114, 510), operating the first AV device (110) in an AV sink operation mode, wherein the first AV device (110) receives AV data provided to the first AV device (110) via the connector (114, 510) and receives power from the first supply voltage provided to the first AV device (110) at the channel of the connector (114, 510) in the AV sink operation mode, the AV sink operation mode being a default mode of operation; and

in response to determining that the first supply voltage is not provided at the channel of the connector (114, 510), ~~the indication, automatically initializing communication logic of the first AV device (110) with the control circuitry~~ transitioning the first AV device (110) from the AV sink operation mode to an AV source operation mode, ~~wherein an AV sink operation mode of the communication logic is for the communication logic to receive AV data provided to the device via a connector, the AV sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device at a channel of the connector, wherein an AV source operation mode of the communication logic is for the communication logic to send~~ wherein the first AV device (110) sends AV data ~~from the device~~ via the connector (114, 510), ~~the AV source operation mode further for the communication logic to provide~~ and provides a second supply voltage at the channel of the connector (114, 510) in the AV source operation mode, ~~and wherein automatically initializing the communication logic includes placing the communication logic into a default~~

~~operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector~~.

2. (Canceled)

3. (Original) The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

4. (Currently Amended) The method of claim 1, wherein ~~the AV Source operation mode is further for the communication logic to provide~~ a first ~~total amount of~~ impedance is provided for a data channel of the connector (114, 510) in the AV source operation mode, and ~~wherein the default operation mode further prevents~~ the first ~~total amount of~~ impedance is not provided for the data channel ~~from being provided by the communication logic~~ in the AV sink operation mode.

5. (Currently Amended) The method of claim 1, further comprising:

~~detecting a connectivity of the device to another device via the connector, the detecting the connectivity while the communication logic is in the default operation mode;~~

~~in response to the detected connectivity, performing a determination of whether to transition the communication logic from the default operation mode to another operation mode; and~~

performing an AV data exchange ~~with the other~~ between the first AV device (110) and the second AV device (120) ~~based on the determination~~.

6. (Canceled)

7. (Currently Amended) The method of claim 5, further comprising:

detecting a change to the ~~connectivity~~ coupling of the first AV device (110) after the AV data exchange; and

in response to the detected change to the ~~connectivity~~ coupling of the first AV device (110), placing the communication logic into the AV sink operation mode ~~a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector~~.

8. (Canceled)

9. (Currently Amended) [[A]] An audio/video (AV) device (110) comprising:

communication logic (580) to couple to a connector (114, 510), the communication logic (580) including circuitry to implement:

an ~~audio/video (AV) Sink~~ AV sink operation mode for the communication logic (580) to receive AV data provided to the AV device (110) at the connector (114, 510), ~~the AV Sink operation mode further for the communication logic~~ and to receive power from a first supply voltage provided to the AV device (110) via a channel of the connector (114, 510)[[;]], the AV sink operation mode being a default mode of operation for the AV device (110), and

an AV ~~Source~~ source operation mode for the communication logic (580) to send AV data from the AV device (110) via the connector (114, 510), ~~the AV Source operation mode further for the communication logic~~ and to provide a second supply voltage at the channel of the connector (114, 510); and

control logic (505) including circuitry to ~~automatically~~ initialize the communication logic (580)~~in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector~~ to operate the AV device (110) in the AV sink operation mode in response to determining that the first supply voltage is provided at the channel of the connector (114, 510) and to initialize the communication logic (580) to transition the AV device (110) from the AV sink operation mode to the AV source operation mode in response to determining that the first supply voltage is not provided at the channel of the connector (114, 510).

10. (Canceled)

11. (Original) The device of claim 9, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

12. (Currently Amended) The device of claim 9, wherein the ~~AV source operation mode is further for the~~ communication logic (580) is further initialized to provide a first ~~total amount of~~ impedance for a data channel of the connector (114, 510) in the AV source operation mode and ~~wherein the default operation mode further prevents~~ is initialized to not provide the first ~~total amount of~~ impedance for the data channel ~~from being provided by the communication logic~~ in the AV sink operation mode.

13. (Currently Amended) The device of claim 9, further comprising:

detector logic (520) to detect, while the communication logic (580) is in the default operation mode, a ~~connectivity~~ coupling of the AV device (110) to another AV device (120) via the connector (114);

~~wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode;~~ and

wherein the communication logic (580) is further initialized to perform an AV data exchange with the ~~other~~ another AV device (120) ~~based on the determination~~ in response to the detection.

14. (Canceled)

15. (Currently Amended) The device of claim 13, the ~~detect~~ detector logic (520) further initialized to detect a change to the ~~connectivity~~ coupling after the AV data exchange, wherein, in response to the detected change to the ~~connectivity~~ coupling, the control logic (5050) further initialized to place the communication logic (580) into the AV sink operation mode ~~a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector~~.

digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source. US 2009/046690 A1 discloses a bidirectional high-speed digital interface transceiver which, by selectively coupling a multiplexer to a transmitter or to a receiver, can act as a source device or a sink device.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

DELL/HP/LENOVO EXHIBIT 1012, Page 157

digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source. US 2009/046690 A1 discloses a bidirectional high-speed digital interface transceiver which, by selectively coupling a multiplexer to a transmitter or to a receiver, can act as a source device or a sink device.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

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TAIWAN Representative Office [6]
USA Schlee IP International P.C. [5, IX]

Europäisches Patentamt
80298 München

Your file:	Our file:	Writers initials:	Date:
	P56843	**hj/Ih/Fs**	**10.02.2015**

European Patent Application 12 762 781.8
based on PCT/US2012/31463
Silicon Image, Inc.

Reply to the extended European Search Report of August 13, 2014 and the Communication pursuant to Rules 70(2) and 70a(2) EPC of August 29, 2014

0. Proceed further

Herewith, it is indicated that the applicant wishes to proceed further with the above mentioned European patent application.

1. Newly submitted documents

A.) *New claims 1 to 10* are submitted which replace the previous claims 1 to 15.

- *Previous claims* 2, 6, 8, 10, and 14 have been cancelled.

- *Previous claims 1, 4, 5, 7, 9, 12, 13 and 15* have been amended. The basis for the amendments is found, for example, in paragraphs [0046]-[0054] of the PCT-application.
- *Reference signs* have been added to the claims to meet the requirements of Rule 43(7) EPC.
- The *remaining claims* are unchanged.
- Where necessary, the claims have been *renumbered* and their *references updated*.

B.) A new *description page 2* is submitted which replaces the previous description page 2.

- The prior art document D1 has been acknowledged in the new description page and the relevant background art disclosed therein has been briefly discussed.

2. Requests

- It is requested to proceed with the examination on the basis of the newly submitted documents.
- For reasons of prosecution efficiency, it is requested to postpone bringing the description into conformity with the amended claims (Rule 42(1)(c) EPC) and bringing the independent claims into a two-part form (Rule 43(1) EPA) until agreement on the patentability of the claims has be reached.
- As an auxiliary request, in case the examining division intends to reject the application, Oral Proceedings pursuant to Article 116 EPC are requested.

3. Reasons

Claim 6

ARTICLE 54

Claim 6 recites, inter alia,

> "control logic including circuitry to initialize the communication logic to operate the AV device in the AV sink operation mode in response to determining that the first supply voltage is provided at the channel of the connector and to initialize the communication logic to transition the AV device from the AV sink operation mode to the AV source operation mode in response to determining that the first supply voltage is not provided at the channel of the connector."

Per claim 6, the first AV device is transitioned from a default AV sink mode to a AV source mode after determining that a first supply voltage is not provided at the connector that couples the first AV device with a second AV device.

D1 (US 2009/0046690 A1) relates to "a method for supplying a bi-directional communication process on a high-speed digital interface, see [0004]. D1 discloses the bi-directional communication process by a HSDI transceiver that can be configured as a source device or a sink device, see [0016], [0017], and [0034], and Figures 1 and 3.

While D1 discloses a transceiver that supports bi-directional communication by configuring the transceiver in either a source mode or a sink mode, D1 fails to disclose

> "transition[ing] the AV device from the AV sink operation mode to the AV source operation mode in response to determining that the first supply voltage is not provided at the channel of the connector,"

as recited in claim 6.

For at least this reason, the claimed subject matter of claim 6 is novel over D1.

ARTICLE 56 EPC

D1 relates to bi-directional communication process on a high-speed digital interface, see [0004], and may be regarded as *closest prior art* for claim 6 as it has a similar use and requires the minimum of structural and functional modifications to arrive at the claimed invention.

Claim 6 differs, inter alia, by the features outlined above, which may be regarded as *distinguishing features*.

The *technical effect* of the distinguishing features is to protect circuitry when coupling a first AV device with a second AV device, see [0032].
The *objective technical problem* may therefore be formulated as protecting devices that are being coupled to each other.

There does not seem to be any teaching in D1 that *would* (not simply could, but would) have prompted the skilled person, faced with the objective technical problem of protecting devices that are being coupled to each other, to modify or adapt the bi-directional transceiver of D1 to arrive at something falling within the terms of claim 6, and thus achieving what the invention achieves.

Thus, claim 6 is based on an inventive step over D1.

Claims 7-10

depend from claim 6, and therefore, these dependent claims should also be novel and be based on an inventive step over D1 for the same reasons as independent claim 6.

Claim 1

recites features similar to the one discussed above with reference to claim 6 in method form. Therefore, the claimed

subject matter of claim 1 is novel and based on an inventive step over D1 for the same reason as set forth for claim 6.

Claims 2-5

depend from claim 1, and therefore, these dependent claims should also be novel and be based on an inventive step over D1 for the same reasons as independent claim 1.

Kornelia Ihle
Patentanwältin

Enclosures
New Claims 1 to 10;
New description page 2
(clean and marked up versions)

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European Patent Office
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Letter accompanying subsequently filed items

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The document(s) listed below is (are) subsequently filed documents pertaining to the following application:

Application number	12762781.8
Applicant's or representative's reference	P56843

	Description of document	Original file name	Assigned file name
1	Reply to search opinion/written opinion/IPER	P56843_Submission.pdf	WOREPLY-1.pdf
2	Amended claims (clean copy)	P56843_Amended claims.pdf	CLMS-1.pdf
3	Amended claims with annotations	P56843_Amended claims_marked.pdf	CLMS-HWA-1.pdf
4	Amended description (clean copy)	P56843_Amended description page 2.pdf	DESC-1.pdf
5	Amended description with annotations	P56843_Amended description page 2_marked.pdf	DESC-HWA-1.pdf

Signatures

Place:	**Dresden**
Date:	**16 February 2015**
Signed by:	**Eric-Michael Dokter 6940**
Association:	**Viering, Jentschura & Partner**
Capacity:	**(Representative)**

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Date
29.08.14

Reference	Application No./Patent No.
P56843	12762781.8 - 1903 / 2692118 PCT/US2012031463
Applicant/Proprietor	
Silicon Image, Inc.	

Communication pursuant to Rules 70(2) and 70a(2) EPC

A supplementary European search report has been drawn up concerning the above-identified European patent application (publication number: 2692118).

Since the request for examination has been filed (R. 70(1), 159(1)(f), Art. 94(1) EPC) prior to the transmission of the supplementary European search report, you are hereby invited to indicate within

six months

of notification of this communication whether you wish to proceed further with the European patent application.

If you do not indicate in due time that you wish to proceed further with the European patent application, it **will be deemed to be withdrawn** (R. 70(3) EPC).

You are invited, within the above-mentioned six-month period, to comment on the objections raised in the opinion accompanying the European search report and/or to file any amendments to the description, claims and drawings correcting any deficiencies noted in the opinion (R. 70a(2), R. 137(2) EPC; Guidelines for Examination in the EPO, B-XI, 8).

If filing amendments, you must identify them and indicate the basis for them in the application as filed. Failure to meet either requirement may lead to a communication from the Examining Division requesting that you correct this deficiency (R. 137(4) EPC).

Should the reply to the invitation pursuant to Rule 70a(2) EPC be filed in an admissible non-EPO language, a translation is to be submitted within one month of its filing (R. 6(2) EPC).

Should you not comply with this invitation within the time limit, the application **will be deemed to be withdrawn** in accordance with Rule 70a(3) EPC.

Receiving Section

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Date
13.08.14

Reference	Application No./Patent No.
P56843	12762781.8 - 1903 / 2692118 PCT/US2012031463
Applicant/Proprietor	
Silicon Image, Inc.	

Communication

The extended European search report is enclosed.

The extended European search report includes, pursuant to Rule 62 EPC, the supplementary European search report (Art. 153(7) EPC) and the European search opinion.

Copies of documents cited in the European search report are attached.

☑ 0 additional set(s) of copies of such documents is (are) enclosed as well.

Refund of the search fee
If applicable under Article 9 Rules relating to fees, a separate communication from the Receiving Section on the refund of the search fee will be sent later.

Should you wish to further prosecute this application in the examination phase, your attention is drawn to the provisions of Rule 70a EPC. An invitation to respond to the extended European search report will be issued shortly (R. 70(2) EPC).

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The examination is being carried out on the **following application documents**

Description, Pages

1-20 as published

Claims, Numbers

1-15 received on 09-05-2014 with letter of 08-05-2014

Drawings, Sheets

1/7-7/7 as published

1 Reference is made to the following document; the numbering will be adhered to in the rest of the procedure.

D1 US 2009/046690 A1 (HSIEH KUN-LI [TW]) 19 February 2009 (2009-02-19)

2 Independent claims

The present application does not meet the requirements of Article 52(1) EPC because the subject-matter of claims 1, 9 is not new within the meaning of Article 54(1) and (2) EPC.

2.1 Claim 9

D1 discloses a device (Fig. 1, 2) comprising:

communication logic to couple to a connector (Fig. 1: 106, 112, 116, 120), the communication logic including circuitry to implement:

an AV Sink operation mode for the communication logic to receive AV data provided to the device at the connector (Fig. 1: 104), the AV Sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device via a channel of the connector (Fig. 1: 114->116->Input); and

an AV Source operation mode for the communication logic to send AV data from the device via the connector (Fig. 1: 102), the AV Source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector (Fig. 1: V+->116->114);

control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector (paragraphs [0016], [0034]).

2.2 Claim 1

The subject-matter of independent claim 1 corresponds in terms of method features to that of claim 9. The objections raised in respect of this latter claim, therefore, also apply, mutatis mutandis, to independent claim 1, which is thus not allowable under Article 54(1) and (2) EPC.

3 Dependent claims

Dependent claims 2-8, 10-15 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the EPC with respect to novelty and/or inventive step.

3.1 Claims 2, 8, 10

D1 discloses a default operation mode according to user's requirement (paragraph [0016]), then detecting the connected device by alternately switching between source and sink modes (paragraph [0017]). The skilled person would choose to start with a sink mode in order to avoid collision in the output signals, as a normal design measure.

3.2 Claims 3, 11

D1 discloses an HDMI standard mode (paragraph [0016]).

3.3 Claims 4, 12

D1 discloses providing high voltage on the HPD pin when in sink mode (paragraph [0017]). In the normal HDMI design, the HPD pin is connected through an impedance to the incoming +5V pin. The skilled person would use the usual design for sink mode, by providing the required impedance, without being inventive.

3.4 Claims 5, 13

D1 discloses detecting the connectivity with other device (paragraph [0018]), switching operation mode accordingly (paragraphs [0020]-[0022]) and then performing data exchange.

3.5 Claims 6, 14

D1 discloses detecting the connectivity with the other device as well known procedure for HDMI devices (paragraph [0017]). The skilled person would use the presence of +5V signal for detection, as the first choice.

3.6 Claims 7, 15

D1 discloses detecting a change to the connectivity and returning to the default settings when the connection is terminated (paragraph [0034]).

4 Further remarks

The applicant is invited to file new claims which take account of the above comments.

In the case the applicant intends to file new set of claims, following remarks should be taken into consideration:

4.1 When filing amended claims the applicant should at the same time bring the description into conformity with the amended claims. Care should be taken during revision, especially of the introductory portion and of any statements of problem or advantage, not to add subject-matter which extends beyond the content of the application as originally filed (Article 123(2) EPC).

4.2 Any amended claim should be filed in the two-part form conf. Rule 43(1) EPC.

4.3 The features of the claims should be provided with reference signs placed in parentheses to increase the intelligibility of the claims (Rule 43(7) EPC). This applies to both the preamble and characterising portion (see Guidelines F-IV, 4.19).

4.4 To meet the requirements of Rule 42(1)(b) EPC, document D1 should be identified in the description and the relevant background art disclosed therein should be briefly discussed.

4.5 In order to facilitate the examination of the conformity of the amended application with the requirements of Article 123(2) EPC, the applicant should clearly identify the amendments made, irrespective of whether they concern amendments by addition, replacement or deletion, and indicate the passages of the application as filed on which these amendments are based (see Guidelines H-III, 2.2).

If the applicant considers it appropriate, these indications could be submitted in handwritten form on a copy of the relevant parts of the application as filed.

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SUPPLEMENTARY EUROPEAN SEARCH REPORT

Application Number
EP 12 76 2781

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2009/046690 A1 (HSIEH KUN-LI [TW]) 19 February 2009 (2009-02-19) * figures 1-3 * * paragraphs [0001] - [0005], [0015] - [0031], [0034] * -----	1-15	INV. H04L29/10 H04L29/12 H04L12/10 G06F3/14 G09G5/00 ADD. H04L12/12 H04L12/28 H04N5/775 H04N21/4363 H04N21/442

TECHNICAL FIELDS SEARCHED (IPC)

G06F
G09G

The supplementary search report has been based on the last set of claims valid and available at the start of the search.

Place of search	Date of completion of the search	Examiner
The Hague	7 August 2014	Maciu, Emanoil

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C04)

DELL/HP/LENOVO EXHIBIT 1012, Page 171

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 76 2781

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-08-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009046690 A1	19-02-2009	CN 101369997 A	18-02-2009
		TW 200910094 A	01-03-2009
		US 2009046690 A1	19-02-2009

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Application No.: 12762781.8

The search has started on 05.08.14 (see Notice from the European Patent Office dated 03/2013, OJ EPO 2013, 153).

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Date
19.05.14

Reference	Application No./Patent No.
P56843	12762781.8 - 1870 / 2692118
Applicant/Proprietor	
Silicon Image, Inc.	

Communication of amended entries concerning the representative (R. 143(1)(h) EPC)

As requested, for the above-mentioned European patent application / European patent the entries concerning the representative have been amended as follows:

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The amendment will be recorded in the Register of European Patents.

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Acknowledgement of receipt

We hereby acknowledge receipt of the following subsequently filed document(s):

Submission number	2751891
Application number	EP12762781.8
Date of receipt	09 May 2014
Receiving Office	European Patent Office, The Hague
Your reference	P56843
Applicant	All applicants as on file
Documents submitted	package-data.xml epf1038.pdf (1 p.) CLMS-1.pdf\56843 amended claims (clean).pdf (5 p.) ep-sfd-request.xml SRCH-1.pdf\56843_submission to EPO.pdf (2 p.) CLMS-HWA-1.pdf\56843 amended claims (marked copy).pdf (6 p.)
Submitted by	CN=Eric-Michael Dokter 6940
Method of submission	Online
Date and time receipt generated	09 May 2014, 11:32 (CEST)
Message Digest	CB:87:AC:08:D9:92:D8:D6:4E:A1:DF:38:D0:B6:C1:CE:50:2F:23:40

Correction by the EPO of errors in debit instructions filed by eOLF
Errors in debit instructions filed by eOLF that are caused by the editing of Form 1038E entries or the continued use of outdated software (all forms) may be corrected automatically by the EPO, leaving the payment date unchanged (see decision T 152/82, OJ EPO 1984, 301 and point 6.3 ff ADA, Supplement to OJ EPO 10/2007).

/European Patent Office/

Claims

What is claimed is:

1. A method at an audio/video (AV) device, the method comprising:

   - detecting with control circuitry an indication of one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device; and
   - in response to the indication, automatically initializing communication logic of the AV device with the control circuitry, wherein an AV sink operation mode of the communication logic is for the communication logic to receive AV data provided to the device via a connector, the AV sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device at a channel of the connector, wherein an AV source operation mode of the communication logic is for the communication logic to send AV data from the device via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector, and wherein automatically initializing the communication logic includes placing the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

2. The method of claim 1, wherein the default operation mode is the AV sink operation mode.

3. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

4. The method of claim 1, wherein the AV Source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

5. The method of claim 1, further comprising:

- detecting a connectivity of the device to another device via the connector, the detecting the connectivity while the communication logic is in the default operation mode;
- in response to the detected connectivity, performing a determination of whether to transition the communication logic from the default operation mode to another operation mode; and
- performing an AV data exchange with the other device based on the determination.

6. The method of claim 5, wherein detecting the connectivity includes detecting that the other device is providing the first supply voltage to the channel of the connector.

7. The method of claim 5, further comprising:

- detecting a change to the connectivity after the AV data exchange; and

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- in response to the detected change to the connectivity, placing the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

8. The method of claim 7, wherein the first operation mode is the default operation mode.

9. A device comprising:

- communication logic to couple to a connector, the communication logic including circuitry to implement:

  an audio/video (AV) Sink operation mode for the communication logic to receive AV data provided to the device at the connector, the AV Sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device via a channel of the connector; and

  an AV Source operation mode for the communication logic to send AV data from the device via the connector, the AV Source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector;

- control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

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10. The device of claim 9, wherein the default operation mode is the AV Sink operation mode.

11. The device of claim 9, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

12. The device of claim 9, wherein the AV source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

13. The device of claim 9, further comprising:

- detector logic to detect, while the communication logic is in the default operation mode, a connectivity of the device to another device via the connector;
- wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode; and
- wherein the communication logic further to perform an AV data exchange with the other device based on the determination.

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14. The device of claim 13, wherein the detector logic to detect the connectivity includes the detector logic to detect that the other device is providing the first supply voltage to the channel of the connector.

15. The device of claim 13, the detector logic further to detect a change to the connectivity after the AV data exchange, wherein, in response to the detected change to the connectivity, the control logic further to place the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

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Claims

What is claimed is:

1. A method at an audio/video (AV) device, the method comprising:

   - detecting with control circuitry an indication of one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device; and
   - in response to the indication, automatically initializing communication logic of the AV device with the control circuitry, wherein an AV sink operation mode of the communication logic is for the communication logic to receive AV data provided to the device via a connector, the AV sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device at a channel of the connector, wherein an AV source operation mode of the communication logic is for the communication logic to send AV data from the device via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector, and wherein automatically initializing the communication logic includes placing the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

2. The method of claim 1, wherein the default operation mode is the AV sink operation mode.

3. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

4. The method of claim 1, wherein the AV Source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

5. The method of claim 1, further comprising:

- detecting a connectivity of the device to another device via the connector, the detecting the connectivity while the communication logic is in the default operation mode;
- in response to the detected connectivity, performing a determination of whether to transition the communication logic from the default operation mode to another operation mode; and
- performing an AV data exchange with the other device based on the determination.

6. The method of claim 5, wherein detecting the connectivity includes detecting that the other device is providing the first supply voltage to the channel of the connector.

7. The method of claim 5, further comprising:

- detecting a change to the connectivity after the AV data exchange; and

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- in response to the detected change to the connectivity, placing the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

8. The method of claim 7, wherein the first operation mode is the default operation mode.

9. A device comprising:

- communication logic to couple to a connector, the communication logic including circuitry to implement:

  an audio/video (AV) Sink operation mode for the communication logic to receive AV data provided to the device at the connector, the AV Sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device via a channel of the connector; and

  an AV Source operation mode for the communication logic to send AV data from the device via the connector, the AV Source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector;

- control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

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10. The device of claim 9, wherein the default operation mode is the AV Sink operation mode.

11. The device of claim 9, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

12. The device of claim 9, wherein the AV source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

13. The device of claim 9, further comprising:

- detector logic to detect, while the communication logic is in the default operation mode, a connectivity of the device to another device via the connector;
- wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode; and
- wherein the communication logic further to perform an AV data exchange with the other device based on the determination.

14. The device of claim 13, wherein the detector logic to detect the connectivity includes the detector logic to detect that the other device is providing the first supply voltage to the channel of the connector.

~~15. A system comprising:~~

- ~~a connector;~~
- ~~communication logic coupled to the connector, the communication logic including circuitry to implement:~~

~~an audio/video (AV) sink operation mode for the communication logic to receive AV data provided to the system at the connector, the AV sink operation mode further for the communication logic to receive power from a first supply voltage provided to the system at a channel of the connector; and~~

~~an AV source operation mode for the communication logic to send AV data from the system via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector;~~

- ~~control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.~~

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~~16. The system of claim 15, wherein the default operation mode is the AV sink operation mode.~~

~~17. The system of claim 15, further comprising:~~

- ~~detector logic to detect, while the communication logic is in the default operation mode, a connectivity of the system to a device via the connector;~~
- ~~wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode; and~~
- ~~wherein the communication logic further to perform an AV data exchange with the device based on the determination.~~

~~18. The system of claim 17, wherein the detector logic to detect the connectivity includes the detector logic to detect that the device is providing the first supply voltage to the channel of the connector.~~

~~19~~15. The device ~~system~~ of claim ~~17~~13, the detector logic further to detect a change to the connectivity after the AV data exchange, wherein, in response to the detected change to the connectivity, the control logic further to place the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

~~20. The system of claim 19, wherein the first operation mode is the default operation mode.~~

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Your file:	Our file:	Writers initials:	Date:
	P56843	**Ts/Ih**	**08.05.2014**

European Patent Application 12 762 781.8 based on PCT/US2012/31463
Silicon Image, Inc.

Reply to the Communication pursuant to Rules 161(2) and 162 EPC dated November 12, 2013

1. Newly filed Documents

A set of new claims 1 to 15 is filed to replace the set of claims currently on file.

2. Requests

2.1 It is herewith requested to proceed with the examination on basis of the newly filed set of claims 1 to 15, the originally filed description and the originally filed figures.

2.2 In the event that further objections should arise or persist, a telephone interview with the examiner is requested.

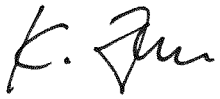
2.3 As an auxiliary request, oral proceedings pursuant to Article 116 EPC are requested.

3. Reasons

3.1 Amendments

Claims 1 to 14 correspond to claims 1 to 14 as initially filed and remain unamended.

Claim 15 corresponds to presently pending claim 19 and has been amended to be now dependent on claim 13.



Kornelia Ihle
Patentanwältin

Enclosures
Set of new claims 1 to 15
(Clean copy and Amendment information copy)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Letter accompanying subsequently filed items

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The document(s) listed below is (are) subsequently filed documents pertaining to the following application:

Application number	12762781.8
Applicant's or representative's reference	P56843

	Description of document	Original file name	Assigned file name
1	Document concerning search matters	56843_submission to EPO.pdf	SRCH-1.pdf
2	Amended claims (clean copy)	56843 amended claims (clean).pdf	CLMS-1.pdf
3	Amended claims with annotations	56843 amended claims (marked copy).pdf	CLMS-HWA-1.pdf

Signatures

Place:	**Dresden**
Date:	**09 May 2014**
Signed by:	**Eric-Michael Dokter 6940**
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Capacity:	**(Representative)**

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Date
08.05.14

Reference	Application No./Patent No.
NJH/FP6930119	12762781.8 - 1853 / 2692118
Applicant/Proprietor	
Silicon Image, Inc.	

Communication of amended entries concerning the representative (R. 143(1)(h) EPC)

As requested, for the above-mentioned European patent application / European patent the entries concerning the representative have been amended as follows:

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The amendment will be recorded in the Register of European Patents.

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23. April 2014

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	P56843	**brä/Ih**	**17.04.2014**

European Patent Application 12 762 781.8 based on PCT/US2012/31463
Silicon Image, Inc.

Taking over representation

Herewith, representation for the above-mentioned European patent application is taken over.

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82
14. April 2014

4 April 2014

CONFIRMATION

BY FACSIMILE
Confirmation by mail

Dear Sirs

Notification of Change of EP Representative
Applicant: Silicon Image, Inc.
Our ref: NJH/MG6941520

We hereby terminate our representation before the EPO for all applications in the name of Silicon Image, Inc., on the attached list.

Please update the official register and address all future correspondence regarding these matters to:

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Yours faithfully

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Att: List of EP applications

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Mewburn Ref	1st Applicant	Application Number
006495519	SILICON IMAGE, INC.	07253698.0
006645758	SILICON IMAGE, INC.	08744220.8
006645766	SILICON IMAGE, INC.	08744214.1
006760409	SILICON IMAGE, INC.	09793204.0
006760417	SILICON IMAGE, INC.	09744823.7
006760425	SILICON IMAGE, INC.	09749258.1
006778450	SILICON IMAGE, INC.	09802089.4
006781785	SILICON IMAGE, INC.	10741672.9
006797955	SILICON IMAGE, INC.	10726748.6
006819544	SILICON IMAGE, INC.	10763264.8
006834956	SILICON IMAGE, INC.	10842506.7
006834964	SILICON IMAGE, INC.	10842507.5
006839526	SILICON IMAGE, INC.	11742641.1
006839534	SILICON IMAGE, INC.	11747884.2
006855233	SILICON IMAGE, INC.	11781011.9
006861157	SILICON IMAGE, INC.	11733339.3
006869978	SILICON IMAGE, INC.	11796182.1
006871859	SILICON IMAGE, INC.	11813036.8
006871909	SILICON IMAGE, INC.	11801416.6
006871925	SILICON IMAGE, INC.	11801419.0
006875009	SILICON IMAGE, INC.	11810271.4
006877583	SILICON IMAGE, INC.	11810273.0
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006887079	SILICON IMAGE, INC.	11842190.8
006890230	SILICON IMAGE, INC.	11831551.4
006435945	SILICON IMAGE, INC.	07250677.7
006418511	SILICON IMAGE, INC.	06256470.3
006891394	SILICON IMAGE, INC.	11841204.8
006899314	SILICON IMAGE, INC.	11853597.0
006899322	SILICON IMAGE, INC.	12739848.5
006902894	SILICON IMAGE, INC.	11853291.0
006902910	SILICON IMAGE, INC.	12734442.2
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006928709	SILICON IMAGE, INC.	12768459.5
006930119	SILICON IMAGE, INC.	12762781.8
006939060	SILICON IMAGE, INC.	12804749.5
006939102	SILICON IMAGE, INC.	12804105.0
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006531289	SILICON IMAGE, INC.	06801919.9
006503742	SILICON IMAGE, INC.	07254316.8
006503734	SILICON IMAGE, INC.	07254314.3
006442032	SILICON IMAGE, INC.	07250987.0
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Date
09.04.14

Reference	Application No./Patent No.
NJH/FP6930119	12762781.8 - 1853 / 2692118 PCT/US2012031463
Applicant/Proprietor	
Silicon Image, Inc.	

Refund of fees

The following fee(s) was/were paid in respect of the application 12762781.8:

Fee	Reference	Voucher No	Date	Currency	Amount
Renewal fee	033	00692502	25.03.14	EUR	445,00
Renewal fee	033	00736956	27.03.14	EUR	445,00

According to the present state of the file the refund will be made by:

CREDITING THE DEPOSIT ACCOUNT 28050013 Mewburn Ellis LLP.

Amount refundable:	Reference	Currency	Amount	Voucher No
	033	EUR	445,00	00774109

Reason for refund: Fee paid twice

The Authorising Officer
Kraanen
(31)(70)3403540

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Germany

4 April 2014

BY FACSIMILE
Confirmation by mail

Dear Sirs

Notification of Change of EP Representative
Applicant: Silicon Image, Inc.
Our ref: NJH/MG6941520

We hereby terminate our representation before the EPO for all applications in the name of Silicon Image, Inc., on the attached list.

Please update the official register and address all future correspondence regarding these matters to:

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Fax: +49 89 2106 9757

Yours faithfully

Nigel Hackney
AUTHORISED REPRESENTATIVE
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Att: List of EP applications

Duration: 04.04.2014 12:48:17 - 04.04.2014 12:49:06. This page 1 of 3 was completed at 04.04.2014 12:48:32
Received at the EPO on Apr 04, 2014 12:49:06. Page 1 of 3
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Mewburn Ref	1st Applicant	Application Number
006495519	SILICON IMAGE, INC.	07253698.0
006645758	SILICON IMAGE, INC.	08744220.8
006645766	SILICON IMAGE, INC.	08744214.1
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006760425	SILICON IMAGE, INC.	09749258.1
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Date
09.01.14

Reference	Application No./Patent No.
NJH/FP6930119	12762781.8 - 1853 / 2692118 PCT/US2012031463
Applicant/Proprietor	
Silicon Image, Inc.	

Communication of European publication number and information on the application of Article 67(3) EPC

The provisional protection under Article 67(1) and (2) EPC in the individual Contracting States becomes effective only when the conditions referred to in Article 67(3) EPC have been fulfilled (for further details, see information brochure of the European Patent Office "National Law relating to the EPC" and additional information in the Official Journal of the European Patent Office).

Pursuant to Article 153(3) EPC the publication under Article 21 PCT of an international application for which the European Patent Office is a designated or elected Office takes the place of the publication of a European patent application.

The bibliographic data of the above-mentioned Euro-PCT application will be published on 05.02.14 in Section I.1 of the European Patent Bulletin. The European publication number is 2692118.

In all future communications to the European Patent Office, please quote the application number plus Directorate number.

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12.11.13

Reference	Application No./Patent No.
NJH/FP6930119	12762781.8 - 1853 PCT/US2012031463
Applicant/Proprietor	
Silicon Image, Inc.	

Communication pursuant to Rules 161(2) and 162 EPC

1. Amendment of the application (R. 161(2) EPC)

The above-mentioned international (Euro-PCT) application has entered the European phase.

Under Articles 28, 41 PCT and Rules 52, 78 PCT the application may be amended before a designated or elected Office.

In accordance with Rule 161(2) EPC, you may amend your application once within a **non-extendable period of six months** after notification of the present communication.

If filing amendments, you must identify them and indicate the basis for them in the application as filed. Failure to meet either requirement may lead to a communication from the Examining Division requesting that you correct this deficiency (R. 137(4) EPC).

The claims applicable on expiry of this period, i.e. those filed on entry into the European phase or in response to the present communication, will form the basis for the calculation of any claims fee to be paid (see page 2).

--2/

2 Claims fees under Rule 162 EPC

If the application documents on which the European grant procedure is to be based comprise more than fifteen claims, a claims fee shall be payable for the sixteenth and each subsequent claim within the period provided for in Rule 159(1) EPC.

☐ Based on the application documents currently on file, all necessary claims fees have already been paid (or the documents do not comprise more than 15 claims).

☐ All necessary fees will be/have been debited automatically according to the automatic debit order.

☑ The claims fees due for the claims 16 to 20 were not paid within the above-mentioned period.

Any outstanding claims fee, either based on the current set of claims or on any amended claims to be filed pursuant to Rule 161 EPC (see page 1), may still be validly paid within a **non-extendable period of six months** after notification of this communication (R. 162(2) EPC).

If a payment is made for only some of the claims, you must indicate for which claims it is intended. If a claims fee is not paid in due time, the claim concerned is deemed to be abandoned (R. 162(4) EPC).

If claims fees have already been paid, but on expiry of the above-mentioned period there is a new set of claims containing fewer fee-incurring claims than before, the claims fees in excess of those due under Rule 162(2), second sentence EPC will be refunded (R. 162(3) EPC).

You are reminded that the supplementary search carried out according to Article 153(7) EPC will relate only to the last set of claims applicable on expiry of the above period AND will be confined to those fee-incurring claims for which fees have been paid in due time.

The claims fee is currently

EUR 225 for the 16th and each subsequent claim up to the limit of 50
EUR 555 for the 51st and each subsequent claim

Note to users of the automatic debiting procedure
Unless the EPO receives prior instructions to the contrary, the fees for all claims incurring fees will be debited on the last day of the period for payment. For further details see the Arrangements for the automatic debiting procedure, Supplement to OJ EPO 3/2009.

Important information concerning fee amounts
Following any amendment to the Rules relating to Fees, the amount(s) mentioned in this communication may be different from the amount(s) **actually due on the date of payment.** The latest version of the Schedule of fees and expenses, published as a Supplement to the Official Journal of the EPO, is also available on the EPO website (**www.epo.org**) and can be found under **www.epo.org/schedule-of-fees**, which allows the viewing, downloading and searching for individual fee amounts, both current and previous.
Please note that procedural fees are usually adjusted every two years, on even years, with effect from 1 April.

Payments by cheque delivered or sent direct to the EPO are no longer accepted as from 1 April 2008 (see OJ EPO 2007, 626).

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Date
08.11.13

Reference	Application No./Patent No.
	12762781.8 - 1853 PCT/US2012031463

Applicant/Proprietor
Silicon Image, Inc.

Notification of the data mentioned in Rule 19(3) EPC

In the above-identified patent application you are designated as inventor/co-inventor.
Pursuant to Rule 19(3) EPC the following data are notified herewith:

DATE OF FILING : 30.03.12

PRIORITY : US/31.03.11/ USP201161470431
: US/29.03.12/ USA201213434273

TITLE : METHOD. APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE AND A SINK MODE

DESIGNATED STATES : AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 October 2012 (04.10.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/135626 A8

(51) International Patent Classification:
H04L 29/10 (2006.01) *H04L 12/10* (2006.01)
H04L 29/12 (2006.01)

(21) International Application Number:
PCT/US2012/031463

(22) International Filing Date:
30 March 2012 (30.03.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/470,431 31 March 2011 (31.03.2011) US
13/434,273 29 March 2012 (29.03.2012) US

(71) Applicant *(for all designated States except US)*: **SILICON IMAGE, INC.** [US/US]; 1140 East Arques Avenue, Sunnyvale, CA 94085 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **MAXWELL, Conrad, Arlo** [US/US]; 6833 Juniper View Circle, Herriman, UT 84096 (US). **DAVIES, Lance** [US/US]; 5081 St. Andrews Drive, Loveland, CO 80537 (US). **JONES, Graeme, P.** [US/US]; 46 Martinique Avenue, Tampa, FL 33606 (US). **MARKS, Glenn, L.** [US/US]; 922 Feather Peak Drive, Corona, CA 92882 (US). **REGALADO-HAWKEY, Jonathan** [GB/GB]; 14 Hazeleigh Avenue, Woolston, Southhampton S019 9DF (GB). **RUDEL, Christian** [DE/DE]; Glueck-auf-strasse 15, 31515 Wunstork (DE).

(74) Agents: **VINCENT, Lester, J.** et al.; Blakely, Sokoloff, Taylor & Zafman LLP, 1279 Oakmead Parkway, Snnyvale, CA 94085-4040 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
14 March 2013

(48) Date of publication of this corrected version:
7 November 2013

(15) Information about Correction:
see Notice of 7 November 2013

(54) Title: METHOD. APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE AND A SINK MODE

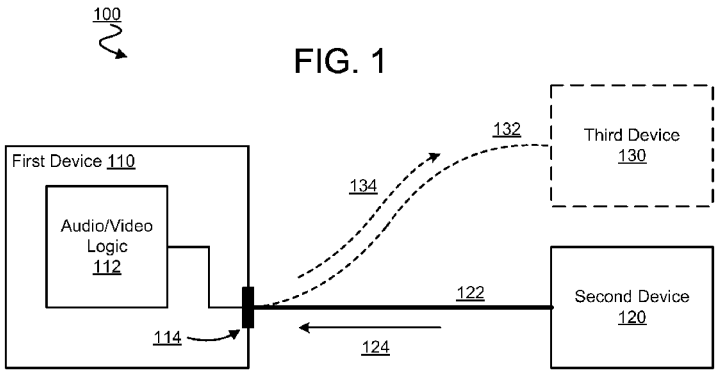


FIG. 1

(57) Abstract: Techniques and mechanisms for determining an operation mode of an audio-video (AV) device. In an embodiment, communication logic of the AV device may be configured at different times for different ones of a plurality of operation modes including an AV source operation mode for providing AV information to another device and an AV sink operation mode for receiving AV information from another device. In response to a detected event, control logic initializes the communication logic of the AV device into a default mode which prevents operation of the communication logic as an AV source.

WO 2012/135626 A8

Europäisches Patentamt
European Patent Office
Office européen des brevets

Acknowledgement of receipt

We hereby acknowledge receipt of the form for entry into the European phase (EPO as designated or elected Office) as follows:

Submission number	2377285
PCT application number	PCT/US2012/031463
EP application number	12762781.8
Date of receipt	29 October 2013
Receiving Office	European Patent Office, The Hague
Your reference	NJH/FP6930119
Applicant	
Country	
Documents submitted	package-data.xml application-body.xml OTHER-1.pdf\Additional Represent-atives.pdf (1 p.) ep-euro-pct.xml epf1200.pdf (5 p.)
Submitted by	CN=Nigel Hackney 20801
Method of submission	Online
Date and time receipt generated	29 October 2013, 12:23 (CET)
Message Digest	7A:DF:F5:C7:1E:BC:1D:F0:86:9C:22:D2:62:B4:9E:60:FC:12:B3:22

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Correction by the EPO of errors in debit instructions filed by eOLF

Errors in debit instructions filed by eOLF that are caused by the editing of Form 1038E entries or the continued use of outdated software (all forms) may be corrected automatically by the EPO, leaving the payment date unchanged (see decision T 152/82, OJ EPO 1984, 301 and point 6.3 ff ADA, Supplement to OJ EPO 10/2007).

/European Patent Office/

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Europäisches Patentamt
European Patent Office
Office européen des brevets

Entry into the European phase (EPO as designated or elected Office)

To the European Patent Office

European application number	EP12762781.8
PCT application number	PCT/US2012/031463
PCT publication number	WO2012135626
Applicant's or representative's reference	NJH/FP6930119
International Filing Date	30.03.2012
International Searching Authority (ISA)	KR
International Preliminary Examining Authority (IPEA)	not applicable

1. Applicant

Indications concerning the applicant(s) are contained in the international publication or were recorded by the International Bureau after the international publication. ☒

Changes which have not yet been recorded by the International Bureau are set out here: ☐

2. Representative

This is the representative who will be listed in the Register of European Patents and to whom notifications will be made

Representative 1

Name: HACKNEY, Mr Nigel

Company: Mewburn Ellis LLP

Address of place of business: 33 Gutter Lane
London, Greater London, EC2V 8AS
United Kingdom

Telephone: +44 20 7776 5300

Fax: +44 20 7776 5399

e-mail: mail@mewburn.com

3. Authorisation

An individual authorisation is attached. ☐

A general authorisation has been registered under No: ☐

A general authorisation has been filed, but not yet registered. ☐

The authorisation filed with the EPO as PCT receiving Office expressly includes the European phase. ☐

4. Request for examination

Examination of the application under Art. 94 EPC is hereby requested. The examination fee is being (has been, will be) paid. ☒

Request for examination in an admissible non-EPO language: ☐

The applicant waives his right to be asked under Rule 70(2) EPC whether he wishes to proceed further with the application. ☐

5. Copies

Additional copies of the documents cited in the supplementary European search report are requested. ☐

Number of additional sets of copies

6. Documents intended for proceedings before the EPO

Number of claims on entry into the European phase: 20

6.1 Proceedings before the EPO as designated Office (PCT I) are to be based on the following documents:

the application documents published by the International Bureau (with all claims, description and drawings), where applicable with amended claims under Art. 19 PCT ☒

unless replaced by the amendments attached. ☐

Where necessary, clarifications should be attached as `Other documents`

6.2 Proceedings before the EPO as elected Office (PCT II) are to be based on the following documents:

the documents on which the international preliminary examination report is based, including any annexes ☐

unless replaced by the amendments attached. ☐

Where necessary, clarifications should be attached as `Other documents`

If the EPO as International Preliminary Examining Authority has been supplied with test reports, these may be used as the basis of proceedings before the EPO. ☐

6.3 A copy of the results of the search carried out by the authority with which the previous application(s) whose priority is claimed was (were) filed is attached (R. 141(1) EPC). ☐

6.4 The applicant waives his right to the communication under Rules 161(1) or (2) and 162 EPC. ☐

7. Translations

Translations in one of the official languages of the EPO (English, French, German) are attached as crossed below: ☐

** In proceedings before the EPO as designated or elected Office (PCT I + II):*

Translation of the international application (description, claims, any text in the drawings) as originally filed, of the abstract as published and of any indication under Rule 13bis.3 and 13bis.4 PCT regarding biological material ☐

Translation of the priority application(s) (to be filed only at the EPO's request, Rule 53(3) EPC) ☐

It is hereby declared that the international application as originally filed is a complete translation of the previous application (Rule 53(3) EPC) ☐

** In addition, in proceedings before the EPO as designated Office (PCT I):*

Translation of amended claims and any statement under Art. 19 PCT, if the claims as amended are to form the basis for the proceedings before the EPO (see Section 6). ☐

** In addition, in proceedings before the EPO as elected Office (PCT II):*

Translation of annexes to the international preliminary examination report ☐

8. Biological material

The invention uses and/or relates to biological material deposited under Rule 31 EPC. ☐

The particulars referred to in Rule 31(1)(c) EPC (if not yet known, the depositary institution and the identification reference(s)) [number, symbols, etc.] of the depositor) are given in the international publication or in the translation submitted in Section 7 on: ☐

page(s) / line(s)

The receipt(s) of deposit issued by the depositary institution

is (are) enclosed. ☐

will be filed later. ☐

Waiver of the right to an undertaking from the requester pursuant to Rule 33(2) EPC attached. ☐

9. Nucleotide and amino acid sequences

The international application discloses nucleotide and/or amino acid sequences. ☐

9.1 The sequence listing was filed under Rule 5.2(a) PCT, or furnished to the EPO as ISA under Rule 13ter.1(a) PCT, or is otherwise available to the EPO, in computer-readable format in accordance with WIPO ST.25. ☐

9.2

The sequence listing is attached in computer-readable format in accordance with WIPO Standard ST.25 ☐

The sequence listing is attached in PDF format. ☐

The sequence listing does not include matter which goes beyond the content of the application as filed. ☐

10. Designation fees

All the contracting states party to the EPC at the time of filing of the international patent application and designated in the international application are deemed to ☒

be designated (see Article 79(1) EPC).

The following states, which were contracting states to the EPC at the time of filing of the international application, are designated:

AL AT BE BG CH&LI CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

11. Extension of the European patent

This application is deemed to be a request to extend the European patent application and the European patent granted in respect of it to all the non-contracting states to the EPC designated in the international application and with which extension agreements are in force on the date on which the international application is filed. However, the extension only takes effect if the prescribed extension fee is paid.

☐

It is currently intended to pay the extension fee for the following states:

Note: Under the automatic debiting procedure, extension fees will only be debited for states indicated here, unless the EPO is instructed otherwise before expiry of the period for payment.

12. List of enclosed documents

	Description of document	Original file name	Assigned file name
1	Additional Representatives	Additional Representatives.pdf	OTHER-1.pdf

13. Mode of payment: Debit from deposit account

☒

Currency: EUR

The European Patent Office is hereby authorised, to debit from the deposit account with the EPO any fees and costs indicated on the fees page.

Deposit account number: 28050013

Account holder: MEWBURN ELLIS LLP

14. Any refunds should be made to the following EPO deposit account:

☒

Number and account holder: MEWBURN ELLIS LLP, 28050013

15. Fees

		Factor/reduction applied	Fee schedule	Amount to be paid
15-1	002 Fee for a European search - Applications filed on/after 01.07.2005	-190	1 165.00	975.00
15-2	005 Designation fee - For each State designated (max. 7x) for applications filed before 01.04.2009 Designated states: AL, AT, BE, BG, CH&LI, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR	0	95.00	0.00
15-3	005e Designation fee - For all contracting States designated for applications filed on/after 01.04.2009	1	555.00	555.00
15-4	006 Examination fee - For applications filed on/after 01.07.2005	1	1 555.00	1 555.00
15-5	015 Claims fee - For the 16th to the 50th claim	0	225.00	0.00
15-6	15e Claims fee - For the 51st and each subsequent claim	0	555.00	0.00
15-7	020 Filing fee - entry EP phase - online	1	115.00	115.00
	Total:		**EUR**	**3 200.00**

16. Annotations

16-1. Note (for EPO) (EP Phase)

Additional Representatives (MEWBURN ELLIS LLP)

Additional representatives are listed in an additional document

16-2. Note (for EPO) (EP Phase)

Precautionary statements (MEWBURN ELLIS LLP)

1. In this application, unless

NJH/FP6930119

	expressly stated otherwise, the cancellation, abandonment or amendment of any claim or any amendment in the description does not amount to abandonment of any subject matter in the application and upon such cancellation, abandonment or amendment the right to reinstate or file divisional applications in accordance with Rule 36 EPC in respect of any subject matter in the application as filed is maintained. 2. As a matter of precaution, oral proceedings under EPC Art. 116 are requested, to take place in the event that the EPO Receiving Section or the EPO Examining Division forms an intention to refuse the application.
16-3. Note (for EPO) (EP Phase)	Additional fee for applications having more than 35 pages (MEWBURN ELLIS LLP) If, following payment of the filing fee, the EPO believes that there is a shortfall in the amount paid for the additional fee, the EPO is authorised to charge that shortfall from EPO deposit account no. 2805.0013 (Mewburn Ellis LLP) under reference number SHORTFALL.
16-4. Note (for EPO) (EP Phase)	Mewburn Ellis Deposit Account Ref (Nigel Hackney) Please debit the requisite fees from our deposit account no 2805.0013 under Ref: 37425
17. Signature(s) of applicant(s) or representative	

Place:

Date: 28 October 2013

Signed by: Nigel Hackney 20801

Capacity: (Representative)

NJH/FP6930119

Table for section 6 of Form 1200.3

In accordance with the Notice from the European Patent Office dated 26 January 2009 concerning the 2009 fee structure (OJ EPO 2009, 118, and Guidelines for Examination in the EPO, April 2009, A-III, 13.2), the amount of the additional fee (Art. 2, item 1a, Rules relating to Fees) for the pages of this European patent application is calculated as follows:

Documents intended for proceedings before the EPO (R. 159 (1) (b) EPC) and for calculating the additional fee (Art. 2, item 1a, RFees):

		Page(s) from ... to ...	Number of pages
Description:	International application as published	1 to 20	20
Claims:	International application as published	21 to 25	5
Drawings:	International application as published	27 to 33	7
Abstract:	Default count: one page		1
Total number of pages			33
Fee-exempt pages (Art. 2, item 1a, RFees)			-35
Number of pages to be paid for			0
			(x 14 EUR per page)
Total amount payable		EUR	0

NJH/FP6930119

ADDITIONAL SHEET

Additional Representatives

ADDISS, JOHN W.
ANDREWS, ROBERT K.
BAILEY, SAM R.
BRASNETT, ADRIAN H.
CALDERBANK, T. ROGER
CARLISLE, JULIE
CARTER, STEPHEN
CASLEY, CHRISTOPHER
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GREEN, KATHERINE
HACKNEY, NIGEL J.
HARRISON, SUSAN J.
HAYES, EMILY A.L.
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PARRY, SIMON J.
SALISBURY, FRANCES J.
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WOOLLEY, LINDSEY C.
WYTENBURG, WILHELMUS J.

having an address at: Mewburn Ellis LLP
33 Gutter Lane
London EC2V 8AS
Great Britain

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference 8029P107PCT	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/US2012/031463	International filing date *(day/month/year)* 30 March 2012 (30.03.2012)	Priority date *(day/month/year)* 31 March 2011 (31.03.2011)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant SILICON IMAGE, INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 01 October 2013 (01.10.2013)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Simin Baharlou e-mail: pt09.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
VINCENT LESTER J.

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP 1279
OAKMEAD PARKWAY SNNYVALE CA 94085-4040 USA

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)*	**31 OCTOBER 2012 (31.10.2012)**
Applicant's or agent's file reference 8029P107PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2012/031463	**30 MARCH 2012 (30.03.2012)**	31 MARCH 2011 (31.03.2011)

International Patent Classification (IPC) or both national classification and IPC

H04L 29/10(2006.01)i, H04L 29/12(2006.01)i, H04L 12/10(2006.01)i

Applicant

SILICON IMAGE, INC. et al

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. 82-42-472-7140	31 OCTOBER 2012 (31.10.2012)	Kim Sun Jong Telephone No.82-42-481-8260

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2012/031463

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:

   a. a sequence listing filed or furnished
      ☐ on paper
      ☐ in electronic form

   b. time of filing or furnishing
      ☐ contained in the international application as filed.
      ☐ filed together with the international application in electronic form.
      ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additioanl copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2012/031463

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-20	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 2008-0205306 A1 (T. SAITO) 28 August 2008
D2: US 2009-0083825 A1 (R. D. MILLER et al.) 26 March 2009
D3: US 2008-0270635 A1 (M. NAKAHAMA) 30 October 2008
D4: US 2010-0131782 A1 (S. HIGUCHI) 27 May 2010

1. Novelty and Inventive step

1.1 Regarding independent claim 1, document D1 which is considered to represent the most relevant state of the art discloses (the references in parentheses applying to this document):

A method at an audio/video (AV) device, the method comprising:
- detecting with control circuitry an indication of one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device(paragraph [0042]; *receiving a switch request for switching the transmission direction*)
- in response to the indication, automatically initializing communication logic of the AV device with the control circuitry, wherein an AV sink operation mode of the communication logic is for the communication logic to receive AV data provided to the device via a connector, the AV sink operation mode further for the communication logic to receive power of a first supply voltage provided to the device at a channel of the connector, wherein an AV source operation mode of the communication logic is for the communication logic to send AV data from the device via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector(paragraph [0046]; *switches the transmission direction of the data communication unit from the sending side to the receiving side*), and
- wherein automatically initializing the communication logic includes placing the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

The subject matter of claim 1 differs from that of D1 in that D1 does not explicitly disclose a feature of placing the communication logic into a default operation mode which prevents the second supply volage from being provided by the communication logic at the channel of the connector. However, this difference would not have been obvious to a person skilled in the art at the time the application of the invention was filed. Therefore, the subject matter of claim 1 meets the requirements of PCT Article 33(2) and 33(3) with respect to novelty and inventive step.

Continued on Supplemental Box

DELL/HP/LENOVO EXHIBIT 1012, Page 221

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of :

Box V

1.2 The features of device claim 9 and system claim 15 essentially correspond to method claim 1 except for the different claimed categories. Therefore, the subject matter of claims 9 and 15 meets the requirements of PCT Article 33(2) and 33(3) with respect to novelty and inventive step for the same reasoning as given for claim 1.

1.3 Claims 2-8 are dependent on claim 1 and therefore meet the requirements of PCT Article 33(2) and 33(3).

1.4 Claims 10-14 are dependent on claim 9 and therefore meet the requirements of PCT Article 33(2) and 33(3).

1.5 Claims 16-20 are dependent on claim 15 and therefore meet the requirements of PCT Article 33(2) and 33(3).

2. Industrial Applicability

Claims 1-20 have industrial applicability and meet the requirement of PCT Article 33(4).

Copy for (DO-EP) 31
PATENT COOPERATION TREATY

ADVANCE E-MAIL

From the INTERNATIONAL BUREAU

PCT

COMMUNICATION IN CASES FOR WHICH NO OTHER FORM IS APPLICABLE

To:

VINCENT, Lester, J.
Blakely, Sokoloff, Taylor & Zafman LLP
1279 Oakmead Parkway
Snnyvale, CA 94085-4040
ETATS-UNIS D'AMERIQUE

in its capacity as designated Office

Date of mailing *(day/month/year)* 24 September 2013 (24.09.2013)	
Applicant's or agent's file reference 8029P107PCT	**REPLY DUE** **see paragraph 1 below**
International application No. PCT/US2012/031463	International filing date *(day/month/year)* 30 March 2012 (30.03.2012)
Applicant SILICON IMAGE, INC. et al	

1. ☐ REPLY DUE within months/days from the above date of mailing
   ☐ NO REPLY DUE, however, see below
   ☒ IMPORTANT COMMUNICATION
   ☐ INFORMATION ONLY

2. COMMUNICATION:

It has been brought to the attention of the International Bureau that in respect of the above-identified international application, Applicant and inventor name contains an error in the international publication no. WO 2012/135626 A3 published on 04 October 2012 (04.10.2012)

The International Bureau will publish a corrected version of the front page reflecting the correct name on 07 November 2013 (07.11.2013)

Please be also informed that the correct bibliographic data will be available within 24 hours on the WIPO' s Internet site, at

http://www.wipo.int/patentscope/search/en/search.jsf

A copy of this Notification is being sent to the receiving Office (RO/US) and to the designated Offices concerned.

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Date
09.08.13

Reference	Application No./Patent No.
	12762781.8 - 1853 PCT/US2012031463
Applicant/Proprietor	
Silicon Image, Inc.	

Entry into the European phase before the European Patent Office

The following information describes the procedural steps required for entry into the European phase before the European Patent Office (EPO). You are advised to read it carefully because failure to take the necessary action in due time can lead to a loss of rights.

1. The above mentioned international patent application has been given the **European application No. 12762781.8**.

2. Applicants **without a residence or their principal place of business** in an EPC Contracting State may themselves initiate European processing of their international applications, provided they do so before expiry of the 31st month from the priority date.

   During the European phase before the EPO as designated or elected Office, however, such applicants **must** be represented by a professional representative (Art. 133(2) and Art. 134(1) and (8) EPC).

   Where, at the expiry of the time period laid down in Rule 163(5) EPC, the requirements of Article 133(2) EPC have not been complied with, the European patent application will be **refused**, pursuant to Rule 163(6) EPC.

   Please note that a professional representative authorised to act before the EPO and who acted for the applicant during the international phase does not automatically become the representative for the European phase. Applicants are therefore strongly advised to appoint in good time any representative they wish to initiate the European phase for them; otherwise the EPO has to send all communications directly to the applicant.

3. Applicants **with a residence or their principal place of business** in an EPC Contracting State are not obliged to appoint for the European phase a professional representative authorised to act before the EPO. However, in view of the complexity of the procedure it is recommended that they do so.

4. Applicants and professional representatives are also strongly advised to initiate the European phase using **EPO Form 1200**. It is available free of charge from the EPO or via the EPO website at **www.epo.org**. Similarly, it can be or generated with the Online Filing software, obtainable free of charge from the EPO (**www.epoline.org**) The use of the form is not compulsory.

5. Where the EPO acts as designated or elected Office (Art. 22(1) and (3) and 39(1) PCT), to enter the European phase before the EPO, the **following acts** must be performed by the applicant within **31 months** from the date of filing of the international application or (where applicable) the earliest priority date:

   a) Supply a translation of the international application into an EPO official language, if the International Bureau did not publish the application in such language (Art. 22(1) PCT and R. 159(1)(a) EPC);

   b) Specify the application documents, as originally filed or as amended, on which the European grant procedure is to be based (R. 159(1)(b) EPC);

   c) Pay the filing fee and, where applicable, the additional fee for a European patent application comprising more than 35 pages (R. 159(1)(c) EPC, Art. 2, items 1, 1a Rules relating to Fees);

   d) Pay the search fee where a supplementary European search report has to be drawn up (R. 159(1)(e) EPC);

   e) Pay the designation fee if the time limit laid down in Rule 39(1) EPC (i.e. six months after publication of the international search report) has expired before the 31-month period pursuant to Rule 159(1) EPC (R. 159(1)(d) EPC);

   f) File the written request for examination and pay the examination fee if the time limit laid down in Rule 70(1) EPC has expired before the 31-month period pursuant to Rule 159(1) EPC (R. 159(1)(f) EPC);

   g) Pay the renewal fee in respect of the third year, if the fee has fallen due (see Rule 51(1) EPC) before expiry of the 31-month period pursuant to Rule 159(1) EPC (R. 159(1)(g) EPC);

   h) File, where applicable, the certificate of exhibition referred to in Article 55(2) and Rule 25 EPC (R. 159(1)(h) EPC);

   i) Pay the claims fees for the sixteenth and each subsequent claim when the application documents on which the European grant procedure is to be based comprise more than fifteen claims (R. 162(1) EPC). For applications entering the European phase on or after 1 April 2009, a higher amount is payable for the 51st and each subsequent claim (Decision of the Administrative Council of 14 December 2007 amending the Rules relating to Fees, OJ EPO 2008, 10).

   If either the translation of the international application or the request for examination is not filed in time, or if the filing fee, the additional fee, the search fee, the designation fee or the examination fee is not paid in due time, the application shall be deemed to be withdrawn (R. 160(1) EPC).

6. Payment of fees

   An up-to-date guidance for the payment of fees, expenses and prices and a list of the euro accounts of the European Patent Organisation are published in each issue of the Official Journal of the EPO. The guidance includes inter alia a reference to the latest version of the Schedule of fees and expenses where the amounts of fees are set out.

   The Schedule of fees and expenses, published as a Supplement to the Official Journal of the EPO, is also available on the EPO website (**www.epo.org**) and can be found under **www.epo.org/schedule-of-fees**, which allows the viewing, downloading and searching for individual fee amounts, both current and previous.

   Applicants should always check the fee amounts applying at the time of payment.

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Payments can be validly made by any person. Permissible methods of payment are laid down in Article 5 Rules relating to Fees. Please note that payment cannot be made by cheque sent to the EPO.

For information on the calculation of the additional fee for applications comprising more than 35 pages, see Notice from the European Patent Office dated 26 January 2009 concerning the 2009 fee structure (OJ EPO 2009, 118), Notice supplementing the notice from the European Patent Office dated 26 January 2009 concerning the 2009 fee structure (OJ EPO 2009, 338) and Guidelines for Examination in the EPO, April 2010, A-III, 13.2.

For an overview of search and examination fees, see Notice from the European Patent Office dated 6 February 2012 (OJ EPO 2012, 212). Fee information is also published on the EPO website under **www.epo.org/fees.**

7. Restoration of priority right

   Where the international application contains a priority claim to an earlier application and it has been filed within two months from the expiration of the 12-month priority period, a request for restoration before the EPO as designated Office (R. 49*ter*.2 PCT) applies under the following circumstances:

   a) No request for restoration filed before the receiving Office (RO) during the international phase (R. 26*bis*.3 PCT)
   b) Negative decision by the RO irrespective of the criterion applied (due care/ unintentionality)
   c) Positive decision by the RO based on the unintentionality criterion.

   For a request to be admissible, it must be filed and the requisite fee must be paid (R. 49*ter*.2(b)(iii) and R. 49*ter*.2(d) PCT) within one month from the applicable time limit under Article 22 PCT for entering the regional phase (R. 49*ter*.2(b)(i) PCT). The request for restoration also needs to state the reasons for the failure to file the international application within the priority period (Rule 49*ter*.2(b)(ii) PCT).

8. If the applicant had appointed a representative during the application's international phase, the present Form will be sent to the representative, asking him to inform the applicant accordingly.
   All subsequent communications will be sent to the applicant, or - if the EPO is informed of his appointment in time - to the applicant's European representative.

9. For more details about time limits and procedural acts before the EPO as designated or elected Office, see the EPO brochure "How to get an European patent", Guide for applicants - Part 2, PCT procedure before the EPO - "Euro-PCT" (EPO PCT Guide). This brochure, the list of professional representatives before the EPO, Form 1200 and details of the latest fees are available on the Internet under **http://www.epo.org**.

10. **Programme for accelerated prosecution of European patent applications - "PACE"**

    Applicants wishing to accelerate proceedings before the EPO as designated or elected Office may request accelerated search and/or examination under the PACE programme (Notice from the European Patent Office dated 4 May 2010 concerning the programme for accelerated prosecution of European patent applications - "PACE", OJ EPO 2010, 352). To be as effective as possible, this should preferably be requested immediately on entry into the European phase.

Receiving Section



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/031463

A. CLASSIFICATION OF SUBJECT MATTER

H04L 29/10(2006.01)i, H04L 29/12(2006.01)i, H04L 12/10(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L 29/10; G06F 1/28; H04N 7/16; G06F 3/00; H04L 5/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: Audio/video, AV, source, sink, transition, mode, and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008-0205306 A1 (T. SAITO) 28 August 2008 See abstract; figures 1, 3; paragraphs [0032]-[0034], [0042], [0046].	1-20
A	US 2009-0083825 A1 (R. D. MILLER et al.) 26 March 2009 See abstract; figure 1; paragraphs [0023], [0024]; claim 1.	1-20
A	US 2008-0270635 A1 (M. NAKAHAMA) 30 October 2008 See abstract; figure 1; paragraphs [0040], [0042]; claim 1.	1-20
A	US 2010-0131782 A1 (S. HIGUCHI) 27 May 2010 See abstract; figure 1; paragraphs [0053], [0054].	1-20

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 OCTOBER 2012 (31.10.2012)	**31 OCTOBER 2012 (31.10.2012)**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Kim Sun Jong Telephone No. 82-42-481-8260

Form PCT/ISA/210 (second sheet) (July 2009)

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		JP 04-735709 B2	13.05.2011
		JP 2010-130068 A	10.06.2010
		JP 4735709 B2	27.07.2011

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 October 2012 (04.10.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/135626 A3

(51) International Patent Classification:
H04L 29/10 (2006.01) *H04L 12/10* (2006.01)
H04L 29/12 (2006.01)

(21) International Application Number:
PCT/US2012/031463

(22) International Filing Date:
30 March 2012 (30.03.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/470,431 31 March 2011 (31.03.2011) US
13/434,273 29 March 2012 (29.03.2012) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

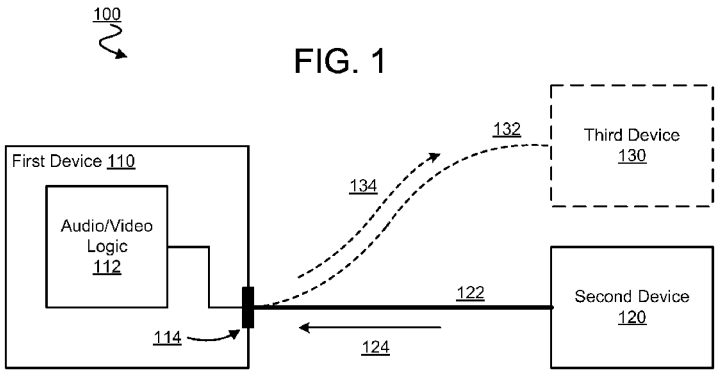
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
14 March 2013

(54) Title: METHOD. APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE AND A SINK MODE



(57) Abstract: Techniques and mechanisms for determining an operation mode of an audio-video (AV) device. In an embodiment, communication logic of the AV device may be configured at different times for different ones of a plurality of operation modes including an AV source operation mode for providing AV information to another device and an AV sink operation mode for receiving AV information from another device. In response to a detected event, control logic initializes the communication logic of the AV device into a default mode which prevents operation of the communication logic as an AV source.

WO 2012/135626 A3

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DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/US2012/031463**
International filing date:		**30 March 2012 (30.03.2012)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**13/434,273**
	Filing date:	**29 March 2012 (29.03.2012)**
Date of receipt at the International Bureau:		**12 April 2012 (12.04.2012)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

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THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

April 11, 2012

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APPLICATION NUMBER: *13/434,273*
FILING DATE: *March 29, 2012*
RELATED PCT APPLICATION NUMBER: *PCT/US12/31463*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US13/434,273*

Certified by

David J. Kappos

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

UNITED STATES PATENT APPLICATION

for

METHOD, APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE MODE AND A SINK MODE

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Attorney Docket No.: 8029.P107

TITLE

METHOD, APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE MODE AND A SINK MODE

RELATED APPLICATIONS

[0001] This application claims priority from Provisional Application Serial Number 61/470,431, filed March 31, 2011, entitled "METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO CONTENT", the teaching of which is incorporated herein by reference.

BACKGROUND

1. Technical Field

[0002] Embodiments relate generally to techniques for exchanging audio/video information. More particularly, certain embodiments provide techniques for controlling an audio/video device to selectively receive or send audio/video information.

2. Background Art

[0003] The size of computers and other audio/video (AV) capable electronic devices continue to scale with successive improvements in integrated circuit (IC) fabrication techniques. Consequently, there is a general trend toward a wider variety of AV devices, notably smaller AV devices, implementing functionality to support higher throughput and/or higher quality of AV information.

DELL/HP/LENOVO EXHIBIT 1012, Page 233

[0004] Certain conventional AV devices include a High-Definition Multimedia Interface (HDMI) connector or other such hardware for coupling to some other device, where the AV device operates as a source to provide AV information to the other device via the connector. Typical examples of conventional AV sources include a camcorder, digital camera, personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), smart phone, video game console, DVD player, digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

[0012] FIG. 4A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0013] FIG. 4B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0014] FIG. 5 is a block diagram showing elements of an audio/video device according to an embodiment.

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DETAILED DESCRIPTION

[0015] Embodiments discussed herein variously make, use or otherwise provide circuit logic to selectively control an audio/video (or "AV") device for operation at different times in various ones of a plurality of operation modes. The plurality of operation modes may include what is referred to herein as an "AV Sink" operation mode, for the AV device (also referred to herein as simply "device") to be a sink for receiving AV information from another AV device via a connector, and what is referred to herein as an "AV Source" operation mode, for the AV device to be a source for providing AV information to another AV device via the same connector. In an embodiment, the AV device includes the connector. In an alternate embodiment, the AV device may operate in a system which includes the connector – e.g. where the connector is to couple the system with some external device for an exchange of AV information.

[0016] As used herein, "audio/video" or "AV" refers to the characteristic of relating to either audio content or video content, or relating to both audio content and video content. For example, AV information may include some or all of audio data and/or control information and video data and/or control information. In an embodiment, an AV device may, in addition to exchanging AV information with another device, be operable to render audio content and/or video content for a user, although certain embodiments are not limited in this regard.

[0017] An AV device according to an embodiment includes communication logic to exchange AV data according to some interface standard. By way of illustration and not limitation, such communication logic may exchange AV data via a connector which is compatible with one or more of an HDMI standard such as the HDMI 1.4 standard released May 28, 2009 by HDMI Licensing, LLC of Sunnyvale, CA, a Mobile High-Definition Link (MHL)

standard such as the MHL 1.0 specification released June 30, 2010 by the MHL Consortium of Sunnyvale, CA, a Digital Visual Interface (DVI) standard such as the DVI 1.0 standard released April 02, 1999 by the Digital Display Working Group of Vancouver, WA, a DisplayPort standard such as the DisplayPort 1.2 standard released December 22, 2009 by the Video Electronics Standards Association of Newark, CA and/or the like.

[0018] In an embodiment, such communication logic may implement communications which, at different times, are compatible with different interface standards, where all such communications are via the same connector. For example, communication logic may include first logic to detect the presence of, and communicate with, an HDMI device and second logic to detect the presence of, and communicate with, an HDMI device, where the respective detection and communication functionalities of the first logic and second logic do not conflict with or otherwise impede the other. Such communication logic may, for example, be referred to as "MHL-ready HDMI," "HDMI/MHL" and/or the like. Features of various embodiments are discussed herein in the context of exchanging AV information according to an HDMI interface standard. However, such discussion may be extended to apply to any of a variety of additional or alternative interface standards for exchanging AV data, according to different embodiments.

[0019] Certain embodiments variously provide that, from either or both of a device power up and a device reset, an AV device will, by default, return to or otherwise be in a Sink mode. While in this mode such an AV device may then determine by stimulus and response or measurement means described herein that it is connected to an AV Sink device, in which case it may safely transition to an AV Source operation mode. In an embodiment, the AV device may translate back to AV Sink operation mode in response to an indication of a change in connectivity to the AV Sink device.

[0020] FIG. 1 illustrates elements of a system 100 for exchanging AV information according to an embodiment. System 100 may include a first device 110 comprising AV logic 112 to variously implement AV communications between first device 110 and one or more other devices. One embodiment may, for example, be implemented entirely within AV logic 112. Another embodiment may be implemented by first device 110 as a whole. Still another embodiment may be implemented by system 100 as a whole. Any of a variety of other embodiments may be alternatively implemented according to techniques discussed herein.

[0021] In an embodiment, first device 110 includes functionality of one or more of conventional AV source devices and/or functionality of one or more conventional AV sink devices. By way of illustration and not limitation, first device 110 may include functionality of one or more devices including, but not limited to, a personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), camcorder, smart phone, video game console, television, monitor, display, set-top box, home theater receiver and/or the like.

[0022] First device 110 may include a connector 114, coupled via one or more signal lines to AV logic 112, to variously connect first device 110 to some other device of system 100 for an exchange of AV information. Connector 114 may include a plurality of channels, such as pins and/or other interconnect hardware, which are compatible with a particular AV interface standard – e.g. an HDMI standard.

[0023] In an illustrative embodiment, connector 114 may, at some point in time, couple first device 110 via an interconnect 122 to a second device 120 of system 100 – e.g. for an exchange 124 of AV information from second device 120 to first device 110. The particular direction of exchange 124 is not limiting on certain embodiments, and may alternatively be in the opposite

direction, where first device 110 operates as the AV Source and second device 120 operates as the AV Sink. Accordingly, second device 120 may, for example, include both logic (not shown) to implement conventional AV Source functionality or conventional AV Sink functionality. In another embodiment, second device 120 may include logic to variously provide both AV Source functionality and AV Sink functionality according to techniques described herein.

[0024] Certain embodiments variously mitigate at least one problem which might otherwise arises if two conventional AV devices are coupled to one another when those two devices are concurrently configured each for respective operation as an AV Source. Such connecting of AV Source devices to one another can risk damage to transmission hardware in either or both devices. For example, the two devices may attempt to drive power in opposite directions in the same power supply voltage channel of a connector. Alternatively, or in addition, two such devices may attempt to drive data signals in opposite directions via the same data channel of the connector. Such AV Source devices may risk driving any of a variety of other signals – e.g. hot plug detect signals, clock signals and/or the like – against one another each on some common respective channel of a connector.

[0025] AV logic 112 may limit the risk of the resulting damage in system 100 by providing a control mechanism to selectively prevent one or more aspects of AV Source functionality from being provided during operation of first device 110. By way of illustration and not limitation, AV logic 112 may selectively transition itself between a plurality of operation modes which includes an AV Source operation mode and an AV Sink operation mode. The AV Source operation mode may be for AV logic 112 to provide a particular signal to connection 114 – e.g. a supply voltage, a digital data signal and/or the like. Additionally or alternatively, the AV Source operation mode may be for AV logic 112 to provide a particular amount of impedance – e.g.

pull-up impedance, pull-down impedance and/or the like – for a signal line coupled to a channel of connection 114.

[0026] In an embodiment, control logic (not shown) of AV logic 112 selects one of the plurality of operation modes in response to an indication of a particular type of event at first device 110. Whether and/or how AV logic 112 might transition between operation modes may be based, for example, on whether the indicated event is a power-up event, a power-down event a reset event, and/or the like.

[0027] Whether and/or how AV logic 112 might transition between operation modes may be additionally or alternatively based on an event which detects a particular characteristic (or absence of said characteristic) regarding connectivity between connector 114 and second device 120. By way of illustration and not limitation, such a characteristic may include whether (or not) some second device 120 is providing a supply voltage at a particular channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a supply voltage to its corresponding AV Sink – e.g. the +5V output to be provided from Source to Sink according to HDMI, as on pin 18 of a 19-pin HDMI connector.

[0028] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing to connector 114 a hot plug detect (HPD) signal. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Sink is to indicate its presence with a HPD signal to its corresponding AV Source – e.g. the HPD signal to be provided from Sink to Source according to HDMI, as on pin 19 of a 19-pin HDMI connector.

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[0029] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing a clock signal to connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a clock signal to an AV Sink – e.g. the DDC_SCL signal to be provided from Source to Sink according to HDMI, as on pin 15 of a 19-pin HDMI connector.

[0030] Additionally or alternatively, such a characteristic may include whether (or not) a particular amount of impedance is being provided by second device 120 for a channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that a particular pull-up impedance is to be implemented at an AV Sink – e.g. a 47kΩ pull-up resistance which HDMI requires be provided at an AV Sink for a SDA line (e.g. pin 16 of a 19-pin HDMI connector).

[0031] In an embodiment, the functionality of AV logic 112 allows connector 114 to be variously coupled, decoupled and/or recoupled at different times to one or more devices, while limiting a risk of damage to hardware in system 100. By way of illustration and not limitation, connector 114 may at some point in time be decoupled from second device 120 and subsequently coupled via an interconnect 132 to some third device 130 – e.g. for an exchange 134 of AV information to third device 130 from first device 110. The particular direction of exchange 134 is not limiting on certain embodiments, any may alternatively be in the opposite direction, where first device 110 operates as the AV Sink and third device 130 operates as the AV Source. In an embodiment, third device 130 is simply second device 120 – e.g. where second device 120 is decoupled from and subsequently recoupled to first device 110 and/or where first device 110 and second device 120 switch AV Sink and AV Source roles for different AV information exchanges.

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[0032] As shown in the discussion herein, AV logic 112 may protect various circuitry of system 100 for different successive couplings of first device 110 each to a respective device and/or for successive different AV information exchanges each between first device 110 and a respective device.

[0033] FIG. 2A illustrates elements of a method 200 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 200 may, for example, be a device including some or all of the features of first device 110. In one embodiment, an AV device controlled by performing method 200 may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Features of various embodiments are discussed herein in terms of performing method 200 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0034] In an embodiment, the AV device includes communication logic comprising circuitry to operate at different times in different ones of a plurality of operation modes which include an AV Source operation mode and an AV Sink operation mode. The AV Sink operation mode may, for example, be for the communication logic to receive AV data provided to the AV device via a connector – e.g. via connector 114. The AV Sink operation mode may further be for the communication logic to receive power from a first supply voltage provided via a channel of the connector. By contrast, the AV Source operation mode may be for the communication logic to send AV data from the AV device, where the AV data is sent through the connector. The AV Source operation mode may further be for the communication logic to provide a second supply

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voltage at the channel of the connector. In an embodiment, a level of the first supply voltage is equal to a level of the second supply voltage.

[0035] In an embodiment, method 200 includes, at 210, detecting an indication of one of a power up event at the AV device, a power down event at the device or a reset event at the AV device. The detecting at 210 may, for example, include control circuitry of AV logic 112 directly or indirectly detecting an indication sent from some agent included in or otherwise accessible to AV logic 112. By way of illustration and not limitation, first device 110 may include a power management unit, a host processor or other agent which sends to AV logic 112 a signal specifying, for example, that first device 110 is going through, has gone through, or is expected to go through a boot up or boot down operation, or otherwise to transition to or from an operative power state. In an embodiment, transitioning to or from such an operative power state may include transitioning between a first power state in which AV logic 112 is incapable of exchanging AV information via connector 114 and a second power state in which AV logic 112 is capable of exchanging AV information via connector 114. Alternatively or in addition, AV logic 112 may include detector logic to evaluate power state of AV logic 112 and/or of other components of first device 110.

[0036] The detecting at 210 may additionally or alternatively include control circuitry of AV logic 112 directly or indirectly detecting a signal from some agent, included in or otherwise accessible to AV logic 112, the signal specifying or otherwise indicating that AV logic 112 or some other component of first device 110 have been, are being, or are expected to be reset. Such a reset may flush some current state of circuit logic in favor of some predetermined baseline configuration. A reset may, for example, return some or all of first device 110 to a predetermined configuration without powering down first device 110.

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[0037] In response to the indication detected at 210, method 200 may, at 220, automatically initialize communication logic of the AV device. By way of illustration and not limitation, control logic of AV logic 112 may automatically place the communication logic of AV logic 112 into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector. In an embodiment, the default operation mode is the AV Sink operation mode. In an embodiment, the AV Source operation mode is further for the communication logic of the AV device to provide a first total amount of impedance for a data channel of the connector. In such an embodiment, the default operation mode may prevent the first total amount of impedance for the data channel from being provided by the communication logic.

[0038] FIG. 2B illustrates elements of a method 250 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 250 may, for example, be a device having some or all of the features of a device controlled by method 200. Method 250 may, for example, be performed after method 200 – although certain embodiments are not limited in this regard. Features of various embodiments are discussed herein in terms of performing method 250 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0039] Method 250 may include, at 260, detecting a characteristic regarding a connectivity of the AV device to another device via a connector – e.g. connector 114. For example, detector logic of AV logic 112 may detect connectivity to the other device via the connector – e.g. the detecting while the communication logic of the AV device is in the default operation mode of method 200. Additionally or alternatively, such detector logic of AV logic 112 may detect a

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change in a state of connectivity to the other device via the connector. The detecting the characteristic at 260 may, for example, include detecting an indication that the other device is providing the first supply voltage discussed with regard to method 200. Alternatively or in addition, the detecting at 260 may include detecting that the other device is providing to the connector a hot plug detect (HPD) signal, a clock signal and/or any of a variety combinations of one or more other signals. Alternatively or in addition, the detecting at 260 may include evaluating an impedance of a signal line which couples the other device to the connector.

[0040] In response to detecting the characteristic at 260, method 200 may, at 270, automatically place the communication logic of the AV device into some first operation mode which prevents a providing of the second supply voltage referred to in the discussion of method 200. The first operation mode may, for example, be the default operation mode of method 200, although certain embodiments are not limited in this regard. In placing the AV device into the first operation mode, method 250 may limit the possibility of circuit damage due to conflicting output signals from two coupled AV devices, each device attempting to operate as an AV Source.

[0041] FIG. 3 illustrates select elements of a connector 300 for exchanging AV information according to an embodiment. Connector 300 may include some or all of the features of connector 114, for example. The illustrative connector 300 is a 19-channel (e.g. 19-pin) connector which is compatible with an HDMI interface standard, although certain embodiments are not limited in this regard. Connector 300 may support AV information exchanges by any of a variety of other types of interconnect hardware – e.g. a connector including more, fewer, or alternative channels to those shown in FIG. 3 – where communication via such a connector is consistent with techniques discussed herein.

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[0042] The illustrative connector 300 includes interconnect hardware to support transition-minimized differential signaling (TMDS) in HDMI communication. More particularly, the respective functions of the channels in connector 300 may be assigned according to HDMI 1.4 or some other HDMI interface standard – e.g. as follows:

Channel 1	TMDS Data2+
Channel 2	TMDS Data2 Shield
Channel 3	TMDS Data2–
Channel 4	TMDS Data1+
Channel 5	TMDS Data1 Shield
Channel 6	TMDS Data1–
Channel 7	TMDS Data0+
Channel 8	TMDS Data0 Shield
Channel 9	TMDS Data0–
Channel 10	TMDS Clock+
Channel 11	TMDS Clock Shield
Channel 12	TMDS Clock–
Channel 13	Consumer Electronics Control (CEC)
Channel 14	HDMI Ethernet Channel (HEC) Data
Channel 15	System Clock Line (SCL) – I^2C Serial Clock for Display Data Channel (DDC)
Channel 16	System Data (SDA) – I^2C Serial Data Line for DDC
Channel 17	DDC/CEC/HEC Ground
Channel 18	+5 V Power
Channel 19	Hot Plug Detect (HPD) and/or HEC Data+

Potential conflict may result when two connected AV devices concurrently attempt to drive respective supply voltages and/or other signals according to the same function assignments for connector 300.

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[0043] In an embodiment, an AV device including or coupled to connector 300 may implement techniques to reduce the likelihood of such conflict – e.g. techniques including some or all of the features discussed with respect to method 200 and/or method 250. By way of illustration and not limitation, control logic of such an AV device may provide that after some event – e.g. from one or more of a power up event, a power down event and a reset event – communication logic of the AV device will operate in an AV Source operation mode only after certain connectivity conditions are subsequently identified. For example, the control logic may configure the AV device after/during power up – or before/during a power down – for a default operation mode in which a functionality required for operation as an AV Source is disabled. For instance, the disabled functionality may be required for operation as an AV Source device according to the conditions of HDMI or some other interface standard.

[0044] Alternatively or in addition, the control logic may configure the AV device for an AV Sink operation mode in response to detecting a change of a characteristic regarding connectivity between the AV devices. For example, the AV device may be set to, or return to, some default AV Sink operation mode in response to an indication of a loss or absence at connector 300 of a supply voltage, an indication of a loss or absence of a HPD signal, an indication of a signal line pull-up impedance implemented by any other connected AV device, and/or an indication of a clock signal provided by any other connected AV device. Any of a variety of additional or alternative detected conditions may determine whether and/or how the AV device may be configured – or reconfigured – for operation in such a default mode. In one embodiment, the default operating mode is a SINK mode of HDMI in which the AV device is capable of operation as an AV Sink.

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[0045] In an embodiment, control logic of an AV device may implement a state machine or other mechanism for transitioning the communication logic between operation modes including SINK mode and SOURCE mode. By way of illustration and not limitation, the AV device may default its communication logic to SINK mode in response to (or during) a power up of the AV device (or in response to, or during, a power down of the AV device), and/or in response to detecting that a connectivity characteristic with another AV device is absent or has changed. The AV device may variously transition between SINK mode and SOURCE mode, depending on one or more connectivity characteristics detected for connector 300. Such connectivity characteristics may include, but are not limited to, whether a +5V voltage is provided by another AV device through connector 300, and/or whether one or more signals or other connectivity characteristics (e.g. HPD, DDC pull ups, TDMS termination, etc.) indicate presence or absence of functionality of some other connected AV device as an operable Sink or operable Source.

[0046] FIG. 4A and 4B illustrate select elements of methods 400a, 400b, respectively, for controlling operation of an AV device according to an embodiment. An AV device controlled by performing either or both of methods 400a, 400b may, for example, be a device including some or all of the features of first device 110. In one embodiment, the AV device controlled by performing either or both of methods 400a, 400b may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Methods 400a, 400b may include some or all of the features discussed herein with respect to methods 200, 250, although certain embodiments are not limited in this regard.

[0047] FIG. 4A and 4B are discussed herein with respect to features which are specific to HDMI interface requirements. However, such discussion may be extended to apply to requirements of any of a variety of additional or alternative interface standards for

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communicating AV information. For example, various additional or alternative test conditions (e.g. different delays, resistance values, signal outputs, test conditions, etc.) may be used, according to different embodiments, for determining whether and/or how one or more operation mode transitions of an AV device are to take place.

[0048] Method 400a may, at 405, initialize the AV device to SINK mode by default in response to an indication of a reset event, a power-on event or a power-off event. The initializing at 405 may, for example, include disabling one or more of a +5V HDMI output (channel 18), HPD output (pin 19), some or all DDC outputs (pins 15 and/or 16), and respective 1.8K pull-up resistors for such DDC outputs. The initializing at 405 may further include initializing extended display identification data (EDID) functionality of the AV device in preparation for identifying capabilities to any other device coupled via the connector – e.g. connector 114. After the initializing at 405, method 400 may, at 410, provide some delay – e.g. 100ms – for a high-value pull-down resistor to discharge the +5V HDMI output. However, such delay may not be required, in certain embodiments.

[0049] After delay at 410, method 400 may test for some indication that another device is coupled to the AV device being controlled by method 400a. By way of illustration and not limitation, method 400a may test, at 415, test whether a +5V HDMI supply voltage is being provided at connector 114 – indicating that a device coupled via the connector is operating in some AV Source mode. If the +5V supply voltage is detected at 415, then method 400a may, at 420, assert a HPD signal at the connector (pin 19) and, at 425, commence operation of the communication logic of the AV device in a SINK mode. The AV device may test for a change in connectivity with the other device – e.g. by occasionally testing at 430 +5V supply voltage continues to be provided at the connector by the other device. In an embodiment, detecting that

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the +5V supply voltage is not being so provided may result in method 400a disabling its HPD signal, its DDC output functionality and/or any other AV Sink functionality that is not currently being used. Method 400a may then return to providing the delay at 410 in preparation for again testing for presence of any connected device.

[0050] If the +5V supply voltage is not detected at 415, then method 400a may detect for the presence of any device which might be coupled via the connector and which is operating in some AV Sink mode. By way of illustration and not limitation, method 400a may test, at 440, to confirm that there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification, that an impedance on the data (SDA channel 16) is not in the HDMI specified Source range of 1.5kΩ to 2.0kΩ, and that a receiver sense input (RSEN) signal indicates that one or more differential pairs of the connector are provided with terminators at some coupled device. If no AV Sink device is detected at 415, method 400a may then return to providing the delay at 410, in preparation for again testing for presence of any connected device.

[0051] If an AV Sink device is detected at 415, then in one embodiment, operations of method 400b may follow. For example, method 400b may, at 450, initiate a transition to SOURCE mode – e.g. including enabling the communication logic of the AV device to provide the +5V supply voltage to the connector. In an embodiment, method 400b may, at 455, start a HPD timer – e.g. set for 0.5 seconds – for timing out if a HPD signal is not detected from some AV Sink device. Method 400b may test, at 460, whether an HPD signal is detected – e.g. where the test at 460 may be successively performed according to a test at 480 of whether the HPD timer has expired. If an HPD signal is detected at 460, method 400b may begin operation of the AV device in a SOURCE mode, at 465.

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[0052] If the HPD timer is determined to have expired at 480, method 400b may perform evaluations of whether one or more indications of a coupled AV Sink device are still present at the connector. By way of illustration and not limitation, method 400b may test, at 485, to confirm whether there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification. If such a 47kΩ pull-up resistor is detected at 485, method 400b may return to setting another HPD timer at 455.

[0053] If no such 47kΩ pull-up resistor is detected at 485, method 400b may begin preparations, at 445, to transition the AV device back to a SINK mode – e.g. including disabling one or more of a +5V HDMI output (channel 18), some or all DDC outputs (pins 15 and/or 16), respective 1.8K pull-up resistors for such DDC outputs, and/or the like. After the preparation for SINK mode operation at 445, method 400b may be followed by an operation of method 400a – e.g. the providing of a delay at 410.

[0054] In an embodiment, operation of the AV device in SOURCE mode, at 465, includes enabling 1.8K pull-up resistors for DDC channels of the connector which are to serve as output channels. Additionally or alternatively, SOURCE mode operation at 465 may include performing an EDID read of the capabilities of the detected AV Sink device. Operation of the AV device in SOURCE mode may continue until a test at 470 indicates that the detected AV Sink device is no longer providing a HPD signal. If such an HPD signal is no longer detected, method 400b may begin to protect the AV device from possible harm – e.g. caused by the detected AV Sink device somehow transitioning to AV Source operation. By way of illustration and not limitation, method 400b may, at 475, disable respective 1.8 kΩ pull-up resistors for one or more DDC channels of the connector. After the disabling at 475, method 400b may perform the presence test at 485.

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[0055] FIG. 5 illustrates select elements of a system 500 for exchanging AV information according to an embodiment. System 500 may include some or all of the features of first device 110, for example. For example, system 500 may include AV logic 570 having some or all of the features of AV logic 112.

[0056] System 500 may include an AV connector – represented by an illustrative HDMI connector 510 at the edge of system 500 – to couple system 500 to some external device (not shown) for an AV information exchange. AV logic 570 may include mechanisms to variously implement different operation modes in system 500 to accommodate different types of AV communications via HDMI connector 510. By way of illustration and not limitation, AV 570 may include control logic 505 to receive information indicating a presence or absence of one or more characteristics regarding connectivity of system 500 with some AV device via HDMI connector 510.

[0057] For example, control logic 505 may include or otherwise have access to detection logic 520 of system 500 which relays and/or analyzes signals exchanged via HDMI connector 510. In an embodiment, detection logic 520 may include one or more of logic to detect for a supply voltage output, logic to detect for a signal line termination, logic to detect for an EDID or other such identifier, logic to detect for a digital data functionality, logic to detect for a clock signal and/or the like. The particular mechanism for detection logic 520 to perform such detecting may be adapted from conventional techniques for detecting clock signals, data voltage inputs, impedances, etc., and are not limiting on certain embodiment. Although shown as being coupled along the data exchange path to intercept one or more signals exchanged via HDMI connector 510, detection logic 520 may, in an alternate embodiment, be configured to passively sense signals exchanged via HDMI connector 510.

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[0058] Messages from detection logic 520 may indicate to control logic 505 whether and/or how system 500 is to transition logic of system 500 between operating modes. In an embodiment, control logic 505 may provide control functionality to variously place communication logic 580 of system 500 at different times in different ones of a plurality of operation modes – e.g. where the plurality of operation modes includes a SINK mode and a SOURCE mode. For example, control logic 505 may transition communication logic 580 between operation modes according to some or all of the techniques of method 500 and/or method 550.

[0059] By way of illustration and not limitation, control logic 505 may configure a switch of communication logic 580 – represented by an illustrative analog switch 530 – to switch between HDMI (or other AV interface standard) transmit logic 540 for SOURCE mode operation and HDMI (or other AV interface standard) receive logic 550 for SINK mode operation.

[0060] Control logic 505 may also provide functionality to further configure either or both of HDMI transmitter logic 540 and HDMI receive logic 550, although certain embodiments are not limited in this regard. For example, HDMI receive logic 550 may include HDMI/MHL functionality to switch between a sub-mode to receive HDMI information from another AV device and a sub-mode to receive MHL information. Control logic 505 may provide signaling (not shown) to selectively configure HDMI receive logic 550 to variously operate in such sub-modes at different times.

[0061] Techniques and architectures for configuring an AV device are described herein. In the above description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of certain embodiments. It will be apparent, however,

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to one skilled in the art that certain embodiments can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the description.

[0062] Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[0063] Some portions of the detailed description herein are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the computing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0064] It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the discussion herein, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or

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"computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0065] Certain embodiments also relate to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs) such as dynamic RAM (DRAM), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and coupled to a computer system bus.

[0066] The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description herein. In addition, certain embodiments are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of such embodiments as described herein.

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[0067] Besides what is described herein, various modifications may be made to the disclosed embodiments and implementations thereof without departing from their scope. Therefore, the illustrations and examples herein should be construed in an illustrative, and not a restrictive sense. The scope of the invention should be measured solely by reference to the claims that follow.

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CLAIMS

What is claimed is:

1. A method at an audio/video (AV) device, the method comprising:

detecting with control circuitry an indication of one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device; and

in response to the indication, automatically initializing communication logic of the AV device with the control circuitry, wherein an AV sink operation mode of the communication logic is for the communication logic to receive AV data provided to the device via a connector, the AV sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device at a channel of the connector, wherein an AV source operation mode of the communication logic is for the communication logic to send AV data from the device via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector, and wherein automatically initializing the communication logic includes placing the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

2. The method of claim 1, wherein the default operation mode is the AV sink operation mode.

3. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

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4. The method of claim 1, wherein the AV Source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

5. The method of claim 1, further comprising:

detecting a connectivity of the device to another device via the connector, the detecting the connectivity while the communication logic is in the default operation mode;

in response to the detected connectivity, performing a determination of whether to transition the communication logic from the default operation mode to another operation mode; and

performing an AV data exchange with the other device based on the determination.

6. The method of claim 5, wherein detecting the connectivity includes detecting that the other device is providing the first supply voltage to the channel of the connector.

7. The method of claim 5, further comprising:

detecting a change to the connectivity after the AV data exchange; and

in response to the detected change to the connectivity, placing the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

8. The method of claim 7, wherein the first operation mode is the default operation mode.

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9. A device comprising:

communication logic to couple to a connector, the communication logic including circuitry to implement:

an audio/video (AV) Sink operation mode for the communication logic to receive AV data provided to the device at the connector, the AV Sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device via a channel of the connector; and

an AV Source operation mode for the communication logic to send AV data from the device via the connector, the AV Source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector;

control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

10. The device of claim 9, wherein the default operation mode is the AV Sink operation mode.

11. The device of claim 9, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

12. The device of claim 9, wherein the AV source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the

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connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

13. The device of claim 9, further comprising:

detector logic to detect, while the communication logic is in the default operation mode, a connectivity of the device to another device via the connector;

wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode; and

wherein the communication logic further to perform an AV data exchange with the other device based on the determination.

14. The device of claim 13, wherein the detector logic to detect the connectivity includes the detector logic to detect that the other device is providing the first supply voltage to the channel of the connector.

15. A system comprising:

a connector;

communication logic coupled to the connector, the communication logic including circuitry to implement:

an audio/video (AV) sink operation mode for the communication logic to receive AV data provided to the system at the connector, the AV sink operation mode further for the

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communication logic to receive power from a first supply voltage provided to the system at a channel of the connector; and

an AV source operation mode for the communication logic to send AV data from the system via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector;

control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

16. The system of claim 15, wherein the default operation mode is the AV sink operation mode.

17. The system of claim 15, further comprising:

detector logic to detect, while the communication logic is in the default operation mode, a connectivity of the system to a device via the connector;

wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode; and

wherein the communication logic further to perform an AV data exchange with the device based on the determination.

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18. The system of claim 17, wherein the detector logic to detect the connectivity includes the detector logic to detect that the device is providing the first supply voltage to the channel of the connector.

19. The system of claim 17, the detect logic further to detect a change to the connectivity after the AV data exchange, wherein, in response to the detected change to the connectivity, the control logic further to place the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

20. The system of claim 19, wherein the first operation mode is the default operation mode.

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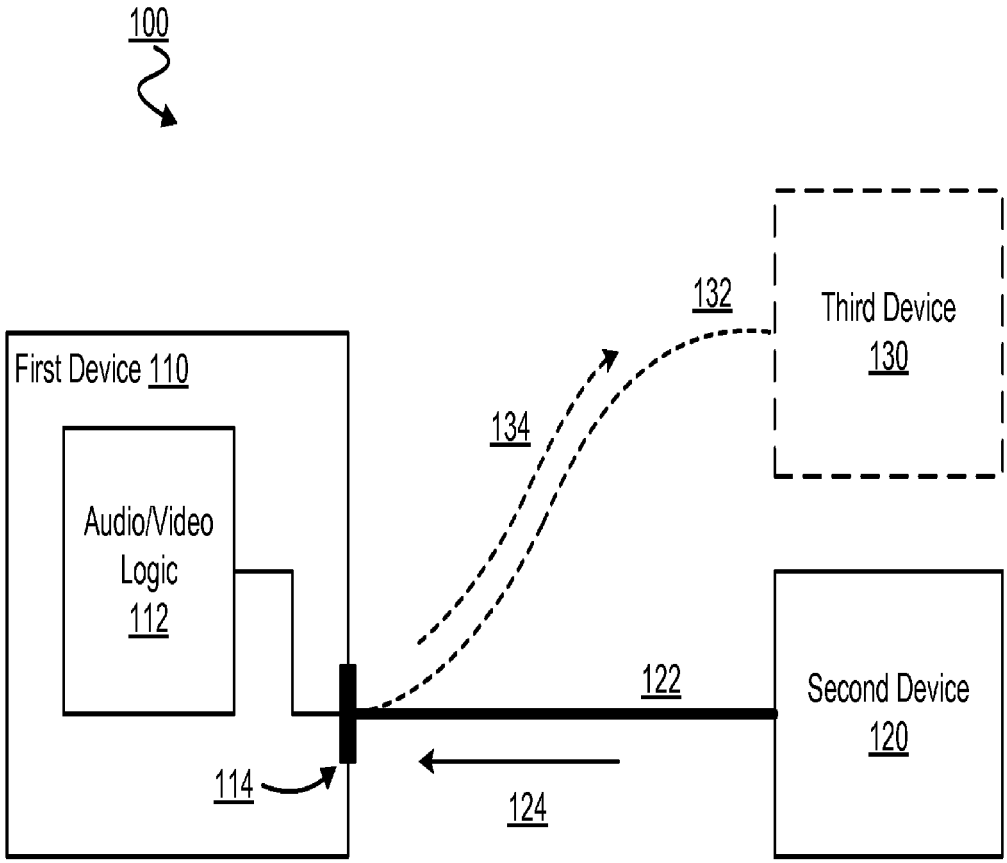

100
First Device 110
Audio/Video Logic 112
114
132
134
Third Device 130
122
Second Device 120
124

FIG. 1

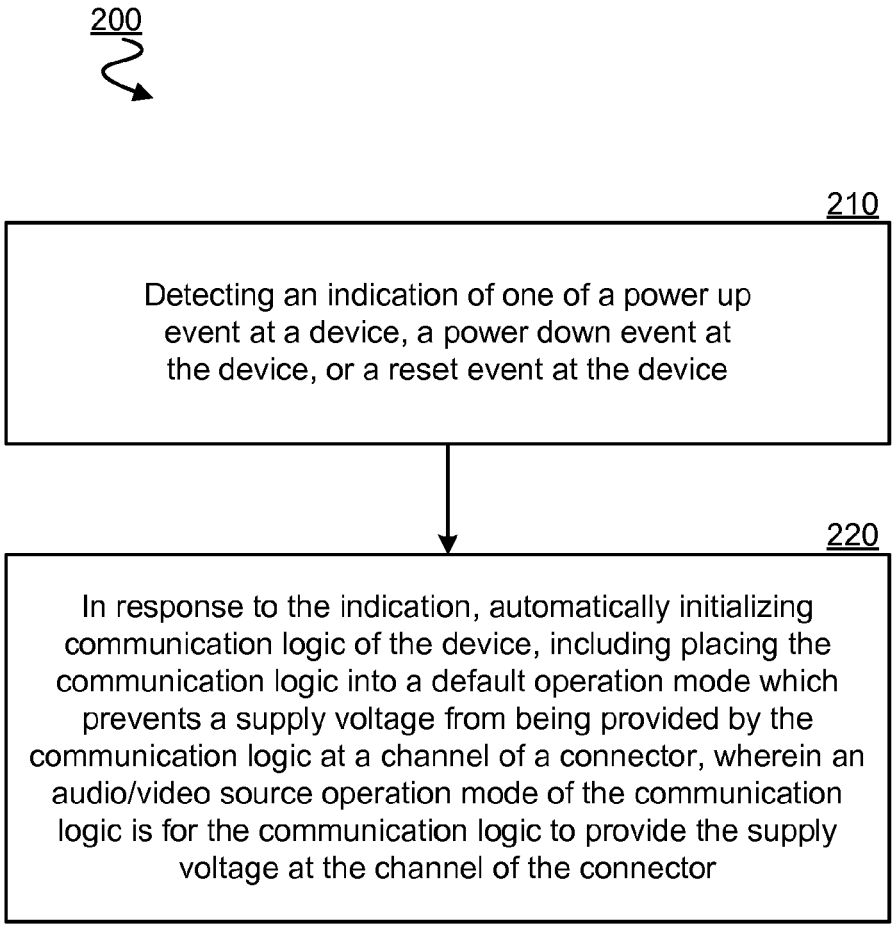

200
210
Detecting an indication of one of a power up event at a device, a power down event at the device, or a reset event at the device
220
In response to the indication, automatically initializing communication logic of the device, including placing the communication logic into a default operation mode which prevents a supply voltage from being provided by the communication logic at a channel of a connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2A

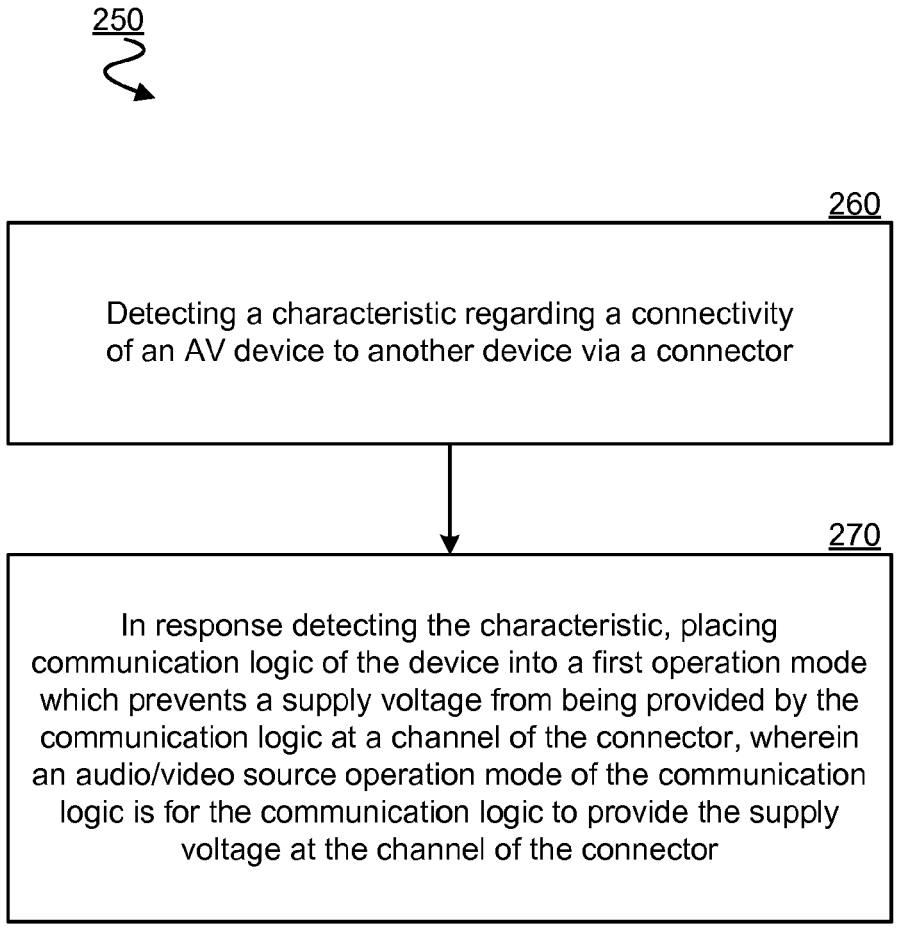

250
260
Detecting a characteristic regarding a connectivity of an AV device to another device via a connector
270
In response detecting the characteristic, placing communication logic of the device into a first operation mode which prevents a supply voltage from being provided by the communication logic at a channel of the connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2B

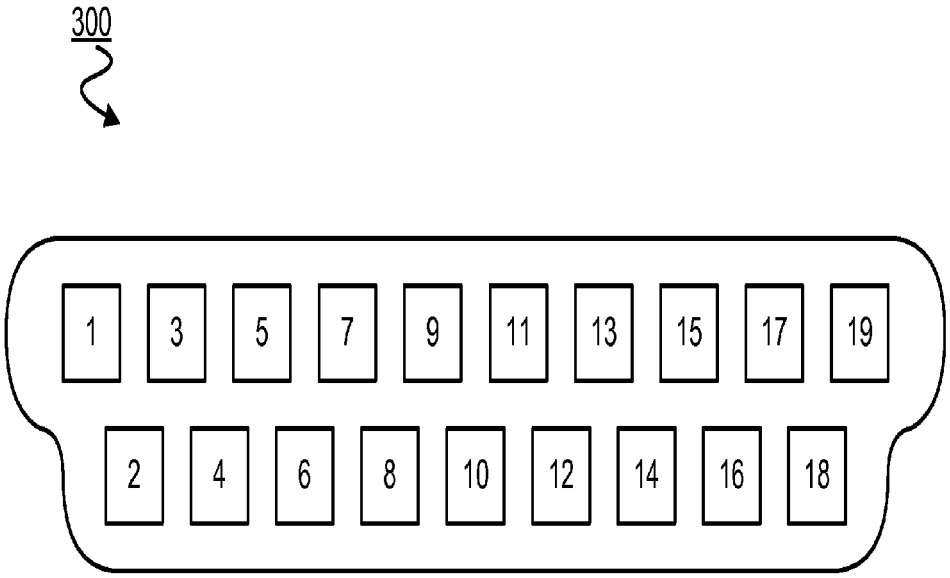


FIG. 3

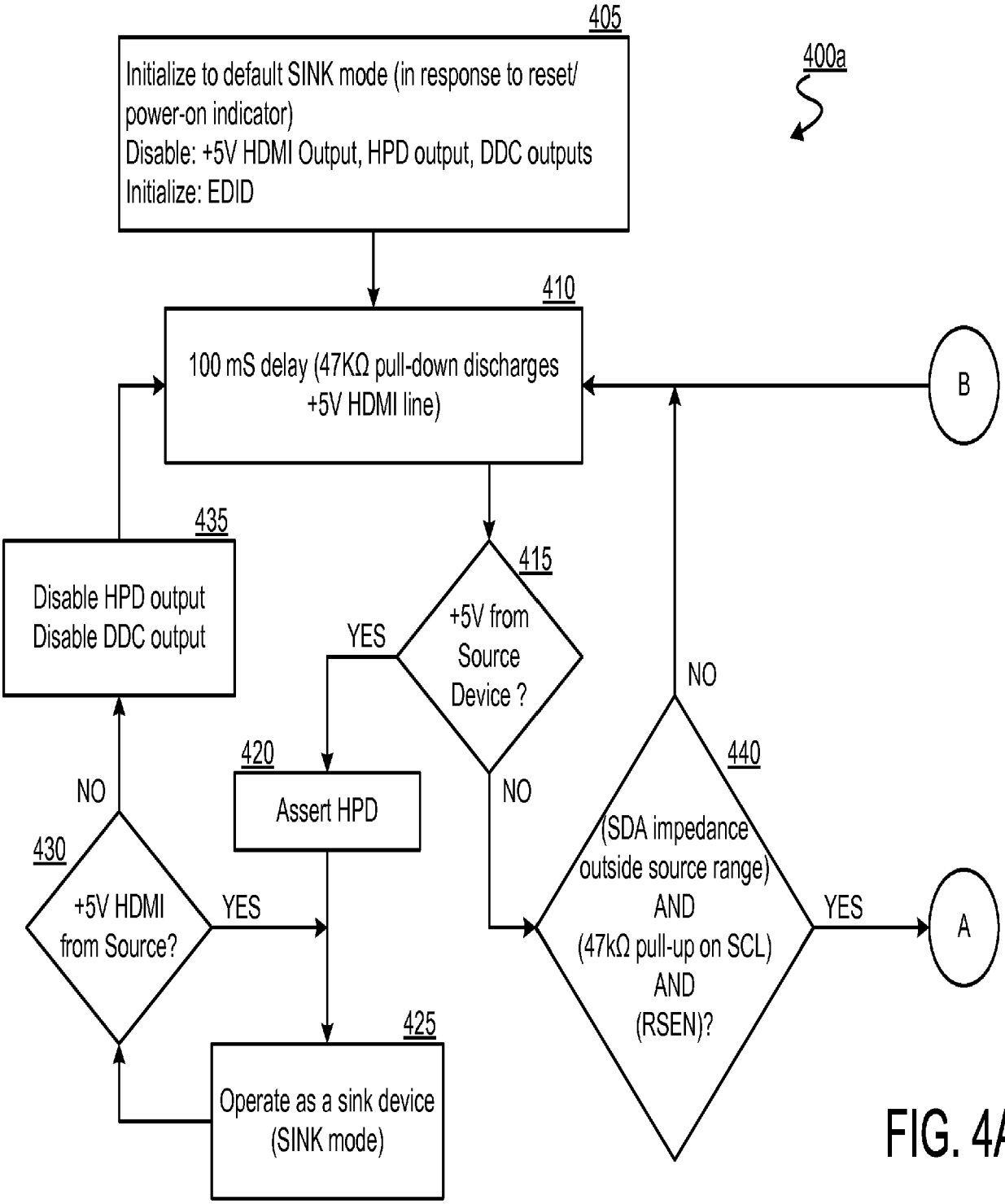

405
Initialize to default SINK mode (in response to reset/ power-on indicator)
Disable: +5V HDMI Output, HPD output, DDC outputs
Initialize: EDID
400a
410
100 mS delay (47KΩ pull-down discharges +5V HDMI line)
B
435
Disable HPD output
Disable DDC output
415
+5V from Source Device ?
YES
NO
420
Assert HPD
NO
430
+5V HDMI from Source?
YES
440
(SDA impedance outside source range) AND (47kΩ pull-up on SCL) AND (RSEN)?
YES
A
425
Operate as a sink device (SINK mode)

FIG. 4A

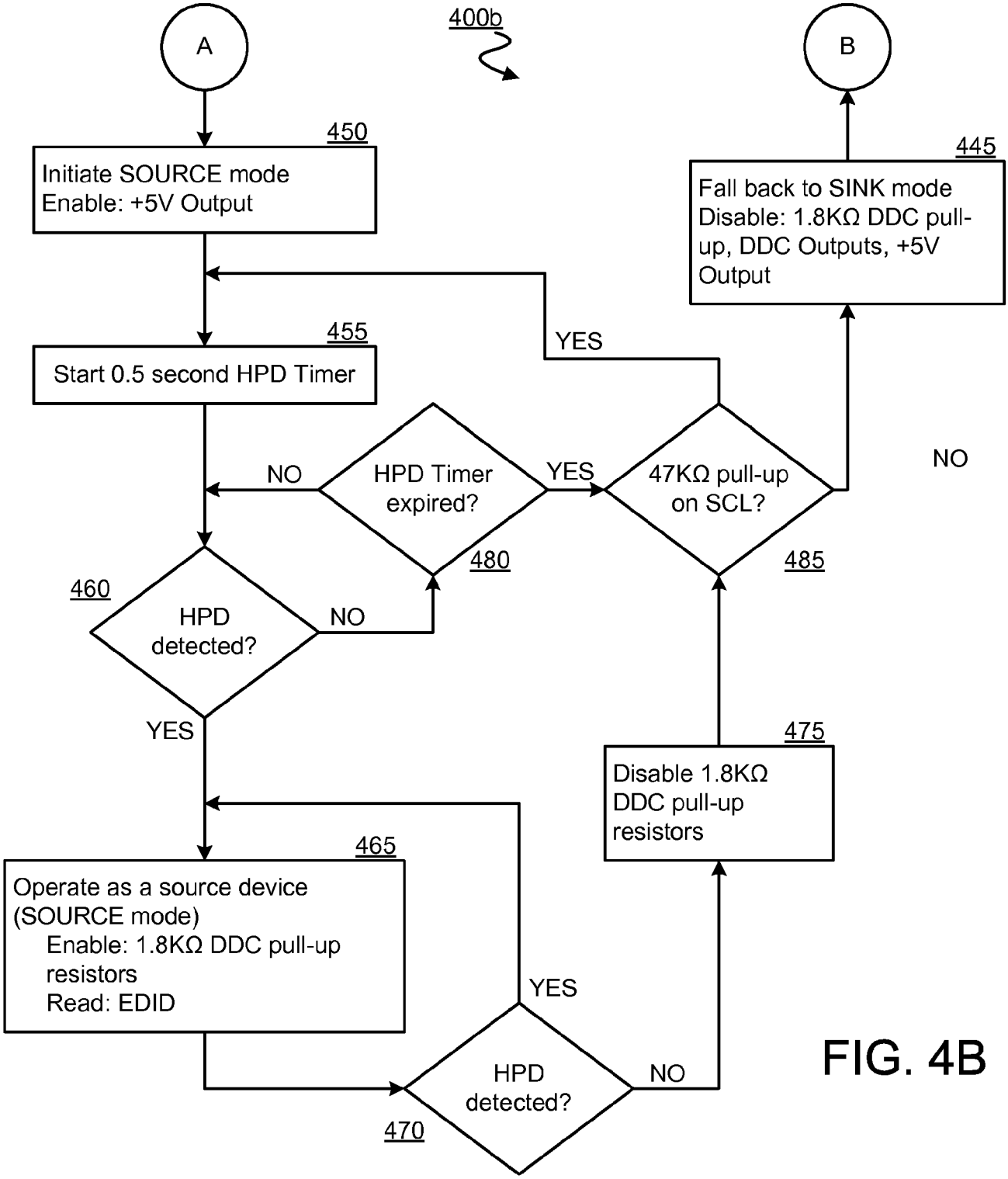

400b
A
B
450
Initiate SOURCE mode
Enable: +5V Output
445
Fall back to SINK mode
Disable: 1.8KΩ DDC pull-up, DDC Outputs, +5V Output
455
Start 0.5 second HPD Timer
YES
NO
HPD Timer expired?
YES
47KΩ pull-up on SCL?
NO
480
485
460
HPD detected?
NO
YES
475
Disable 1.8KΩ DDC pull-up resistors
465
Operate as a source device (SOURCE mode)
Enable: 1.8KΩ DDC pull-up resistors
Read: EDID
YES
HPD detected?
NO
470

FIG. 4B

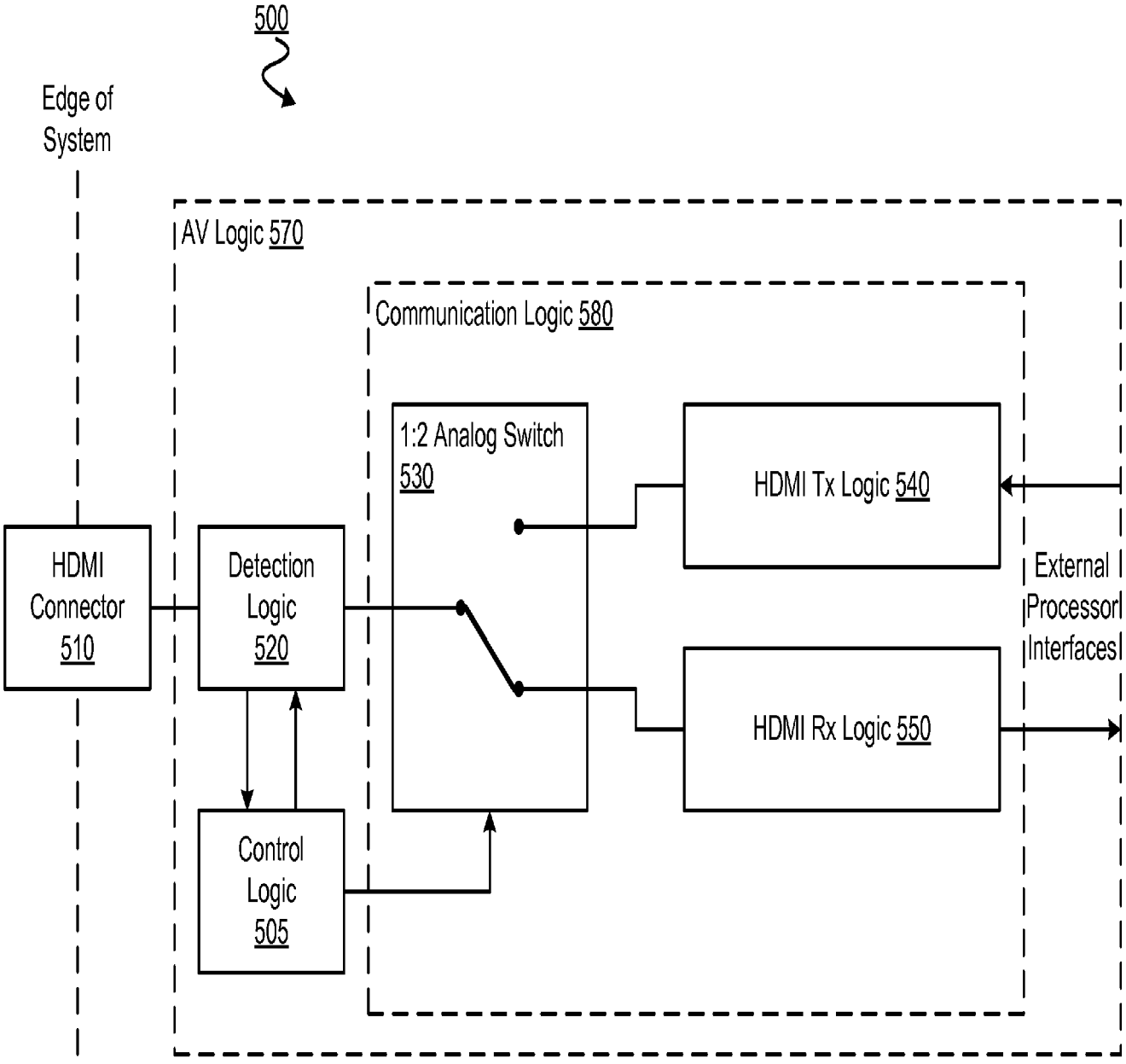

500
Edge of System
AV Logic 570
Communication Logic 580
1:2 Analog Switch 530
HDMI Tx Logic 540
HDMI Connector 510
Detection Logic 520
External Processor Interfaces
HDMI Rx Logic 550
Control Logic 505

FIG. 5

Electronic Acknowledgement Receipt

EFS ID:	12418162
Application Number:	13434273
International Application Number:	
Confirmation Number:	7248
Title of Invention:	METHOD, APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE MODE AND A SINK MODE
First Named Inventor/Applicant Name:	Conrad Arlo Maxwell
Customer Number:	65702
Filer:	Dermot G. Miller/Julie Dussault
Filer Authorized By:	Dermot G. Miller
Attorney Docket Number:	8029P107
Receipt Date:	29-MAR-2012
Filing Date:	
Time Stamp:	16:43:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1250
RAM confirmation Number	3845
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SIMG0383_0395_8029P107_Application.pdf	160492 f18a43e32b09b1ae210ed7ca43c2a0623faa898c	yes	32

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	25
	Claims	26	31
	Abstract	32	32

Warnings:					
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2	Drawings-only black and white line drawings	SIMG0383_0395_8029P107_Figures.pdf	59797 1ed8ece3344d12029b2877fa6a3db41996daafa7	no	7
Warnings:					
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3	Fee Worksheet (SB06)	fee-info.pdf	33523 48cee780550cd11ea2ff2d1a531e1b6428b61752	no	2
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ABSTRACT OF THE DISCLOSURE

Techniques and mechanisms for determining an operation mode of an audio-video (AV) device. In an embodiment, communication logic of the AV device may be configured at different times for different ones of a plurality of operation modes including an AV source operation mode for providing AV information to another device and an AV sink operation mode for receiving AV information from another device. In response to a detected event, control logic initializes the communication logic of the AV device into a default mode which prevents operation of the communication logic as an AV source.

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International application number:		**PCT/US2012/031463**
International filing date:		**30 March 2012 (30.03.2012)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**61/470,431**
	Filing date:	**31 March 2011 (31.03.2011)**
Date of receipt at the International Bureau:		**12 April 2012 (12.04.2012)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

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APPLICATION NUMBER: *61/470,431*
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Certified by

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Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

PROVISIONAL UNITED STATES PATENT APPLICATION

for

METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO CONTENT

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Attorney Docket No.: 8029.P107Z

TITLE

METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO CONTENT

BACKGROUND

1. Technical Field

[0001] Embodiments relate generally to techniques for exchanging audio/video information. More particularly, certain embodiments provide techniques for selectively configuring an audio/video device for receiving or transmitting audio/video information.

DETAILED DESCRIPTION

[0002] Embodiments discussed herein variously make, use or otherwise provide control circuitry to selectively configure an audio/video (or "AV") device for operating either as an AV sink to receive AV information from another AV device or as an AV source to provide AV information to the other AV device.

[0003] As used herein, "audio/video" or "AV" refers to the characteristic of relating to either audio content or video content, or relating to both audio content and video content. For example, AV information may include information for audio content, video content, or both audio content and video content. Similarly, an AV device may be capable of providing – e.g. including playing – audio content, video content, or providing both audio content and video content.

[0004] An AV device according to an embodiment may include any of a variety of logic (hardware, software and/or firmware) suitable for exchanging AV information. By way of illustration and not limitation, the AV device may include one or more of a server, desktop computer, laptop computer, handheld device (e.g. notebook, tablet, smartphone, etc.), computer monitor, radio, television, wired or wireless router, DVD player, CD player, set-top box, game console or other such device suitable for exchanging AV information according to techniques discussed herein.

[0005] The AV device may exchange AV information which is exchanged, for example, over a network including one or more of an LAN, WAN, VLAN, Internet, and the like. In an embodiment, the AV device may exchange AV information according to an interface protocol or other standard – e.g. one which accommodates the exchange of both audio information and video information. By way of illustration and not limitation, AV information may be exchanged according to an HDMI standard, a DVI standard, an MHL standard, and/or the like.

[0006] In an embodiment, the control logic determines a mode of operation of the AV device – e.g. including the control logic selecting from one of a plurality of possible modes of operation. By way of illustration and not limitation, the control logic may select a mode for the AV device to operate as a video sink for receiving AV information from another AV device. Additionally or alternatively, the control logic may select another mode for the AV device to operate as a video source for sending AV information to another AV device.

[0007] The control logic may select a mode of operation of the AV device based on a detected characteristic – understood herein as possibly including a detected absence of a characteristic – regarding connectivity between the AV device and another AV device. For

example, the control logic may include or be in communication with detect logic to variously determine the respective presence (or absence) of one or more connectivity characteristics.

[0008] The selecting of an operating mode for the AV device may be based on a detecting of whether (or not) another AV device is providing to the AV device a supply voltage via a connector of the AV device. For example, an interface standard may stipulate a condition in which an AV source is to provide a power voltage to the AV sink – e.g. the +5V output to be provided from source to sink according to HDMI, as on pin 18 of a 19-pin HDMI connector.

[0009] Additionally or alternatively, the selecting of an operating mode for the AV may be based on a detecting of whether (or not) another AV device is providing to the AV device a hot plug detect (HPD) signal. For example, an interface standard may stipulate a condition in which an AV sink is to indicate its presence with a HPD signal to the AV sink – e.g. the HPD signal to be provided from sink to source according to HDMI, as on pin 19 of a 19-pin HDMI connector.

[0010] Additionally or alternatively, the selecting of an operating mode for the AV may be based on a detecting of whether (or not) another AV device is providing to the AV device a clock signal. For example, an interface standard may stipulate a condition in which an AV sink is to provide a clock signal to an AV source – e.g. the DDC_SCL signal to be provided from sink to source according to HDMI, as on pin 15 of a 19-pin HDMI connector.

[0011] Additionally or alternatively, the selecting of an operating mode for the AV may be based on a detecting of whether (or not) a particular impedance is associated with a signal line coupling another AV device to the AV device. For example, an interface standard may stipulate a condition in which a particular pull-up is to be implemented at an AV sink – e.g. a 47kOhm

pull-up resistance to be provided at an AV sink for a DDC_SDA line (e.g. pin 16 of a 19-pin HDMI connector).

[0012] FIG. 1 illustrates select elements of a 19-pin HDMI connector 100. The functions of the pins in HDMI connector 100 may include the following:

Pin 1 TMDS Data2+
Pin 2 TMDS Data2 Shield
Pin 3 TMDS Data2–
Pin 4 TMDS Data1+
Pin 5 TMDS Data1 Shield
Pin 6 TMDS Data1–
Pin 7 TMDS Data0+
Pin 8 TMDS Data0 Shield
Pin 9 TMDS Data0–
Pin 10 TMDS Clock+
Pin 11 TMDS Clock Shield
Pin 12 TMDS Clock–
Pin 13 CEC
Pin 14 Reserved (HDMI 1.0-1.3c), HEC Data- (Optional, HDMI 1.4+ with Ethernet)
Pin 15 SCL (I^2C Serial Clock for DDC)
Pin 16 SDA (I^2C Serial Data Line for DDC)
Pin 17 DDC/CEC/HEC Ground
Pin 18 +5 V Power (max 50 mA)
Pin 19 Hot Plug Detect (All versions) and HEC Data+ (Optional, HDMI 1.4+ with Ethernet)

[0013] It is understood that an AV device may exchange AV information via any of a variety of other connectors – e.g. a connector including more, fewer, or alternative pins to those shown in FIG. 1 – where communication via such a connector is consistent with techniques discussed herein.

[0014] In an embodiment, control logic provides that an AV device will operate in an AV source mode only after certain connectivity conditions are identified. For example, the control logic may configure the AV device upon power up – or before/during the preceding power down – for a default operation mode in which a functionality required for operation as an AV source is disabled. For instance, the disabled functionality may be required for operation as an AV source device according to the conditions of HDMI or some other interface standard. Alternatively or in addition, the control may configure the AV device for the same or another non-source default operation mode in response to detecting a change of a characteristic regarding connectivity between the AV devices.

[0015] In an embodiment, the AV device may be set to, or return to, a default operation mode in response to an indication of a loss or absence of a supply voltage, an indication of a loss or absence of a HPD signal, an indication of a signal line pull-up impedance implemented by any other connected AV device, and/or an indication of a clock signal provided by any other connected AV device. It is understood that any of a variety of additional or alternative detected conditions may determine whether and/or how the AV device may be (re)configured for operation in a default mode.

[0016] In one embodiment, the default operating mode is a SINK mode in which the AV device is capable of operation as an AV sink. In another embodiment, the default operating mode is an IDLE mode – e.g. in which a necessary AV source functionality is disabled, but in which a necessary AV sink functionality may also be disabled.

[0017] One example of a sequence of transitions between operation modes – which may be implemented by the control logic – is an illustrative case to transition between a SINK mode,

IDLE mode and SOURCE mode. By way of illustration and not limitation, the SINK mode, IDLE mode and SOURCE mode may each be characterized by respective states of enablement of functionalities including but not limited to, for example, one or more of a supply voltage output functionality, a signal line termination functionality, an identification functionality, and a digital data functionality.

[0018] In an embodiment, SINK mode may provide all functionality at the AV device required for another AV device, coupled thereto, to operate as a corresponding AV source. Correspondingly, SOURCE mode may provide all functionality at the AV device required for another AV device, coupled thereto, to operate as a corresponding AV sink. The required functionality may, for example, be determined with reference to some AV interface standard such as HDMI, MHL and/or the like. In an embodiment, IDLE mode may include a disabled functionality at the AV device which is required for the AV device to operate as an AV sink, as an AV source, or both.

[0019] In one embodiment, an AV device may default to IDLE mode in response to (or during) a power up of the AV device (or in response to, or during, the preceding power down of the AV device), and/or in response to detecting that a connectivity characteristic with another AV device is absent or has changed. The AV device may variously transition from IDLE mode to SINK mode, and/or from IDLE mode to SOURCE mode, depending on detected connectivity characteristics. Such connectivity characteristics may include, but are not limited to, whether a +5V voltage is provided by another AV device through the AV connector of the AV device, and/or whether one or more signals or other connectivity characteristics (e.g. HPD, DDC pull ups, TDMS termination, etc.) indicate presence or absence of functionality of some other connected AV device as an operable sink or operable source.

[0020] One alternate embodiment may omit the IDLE mode – e.g. where the AV device instead defaults to the SINK mode on wake ups and/or after a connectivity characteristic of other AV device is absent or lost. In such an alternative scheme, the AV device may transition directly between the SINK mode and the SOURCE mode without entering any IDLE mode.

[0021] FIG. 3A and 3B illustrates select elements of a more detailed algorithm for control logic to transition an AV device between operating modes, according to an embodiment. The particulars of the illustrative algorithm in FIG. 3A and 3B are specific to an HDMI implementation. More particularly, it is understood that various additional or alternative time conditions (e.g. different delays, resistance values, signal outputs, test conditions, etc.) may be used for determining transitions between operating states of an AV device, according to various embodiments.

[0022] The illustrative algorithm of FIGs. 3A and 3B may also be represented by the following:

1. Initialize on power up or RESET
   Disable +5VHDMI Output, HPD output, DDC outputs, and 1.8K DDC pull-up resistors
   Initialize EDID
   Go to State 2
2. Provide time for the high-value pull-down resistor to discharge the +5V HDMI line
   Delay 100ms
   Go to State 3
3. Remain in SINK_MODE, Check if +5V HDMI is present from an attached source
   If +5V HDMI is not present then go to State 5
   Set HPD high and go to State 4
4. Remain in SINK_MODE with HPD output high while +5V HDMI from source is present

If +5V HDMI is present then go to State 4

Disable HPD and DDC outputs and go to State 2

5. Check if a sink is attached by detecting:

47K pull-up resistor on sink's DDC_CLOCK as required by HDMI Spec.

(AND that the DDC_DATA impedance is not in the source range of 1.5K to 2.0K AND that differential pairs have terminators (RSEN). Final detection method or method can be determined at a later time).

If +5V HDMI is present OR the attached devices' DDC_CLOCK does not have 47K pull up resistor

THEN go to State 2

Else go to State 6

6. Initialize SOURCE_MODE

Enable +5V HDMI output

Go to State 7

7. Start 0.5 second HPD timeout

Go to State 8

8. Remain in SOURCE_MODE waiting for HPD to go high up to the timeout period

If HPD is high,

THEN go to State 9

ELSE

IF HPD is LOW AND timeout not reached, go to State 11

ELSE IF timeout not reached, THEN STAY in State 8

9. Remain in SOURCE_MODE until HPD de-asserts

ELSE go to State 10

10. Disable 1.8K DDC pull up resistors

Go to State 11

11. Check if a sink is attached

This check can be done by detecting 47K pull up resistor on sink's DDC_CLOCK as required by HDMI Spec.

If attached devices' DDC_CLOCK has 47K pull up resistor

then go to State 7

ELSE go to State 12

12. Exit SOURCE_MODE

Disable +5V HDMI output, and go to State 2

[0023] FIG. 4 illustrates select elements of an AV device 400 to be configured to an operating mode by control logic 405 according to an embodiment. AV device 400 may include an AV connector – represented by an illustrative HDMI connector 410 – to exchange AV information with another AV device (not shown). Control logic 405 may receive information indicating presence or absence of one or more characteristics regarding connectivity with the other AV device.

[0024] For example, control logic may include or otherwise have access to detection block 420 of AV device 400 which relays and/or analyzes signals exchanged via HDMI connector 410. Messages from detection block 420 may indicate to control logic 405 whether and/or how AV device 400 is to transition between operating modes. Although shown as passively sensing signals exchanged via HDMI connector 410, detection block may, in an alternate embodiment, be coupled along the data exchange path to intercept one or more of such signals.

[0025] By way of illustration and not limitation, control logic 405 may configure a switch – represented by an illustrative analog switch 430 – to switch between an HDMI (or other AV interface standard) transmitter 440 and an HDMI (or other AV interface standard) receiver 450 . Additionally or alternatively, control logic 405 may configure HDMI transmitter logic 440 – e.g. by identifying particular transmission operations to be implemented for operation as an AV source.

[0026] In an embodiment, HDMI receive logic 450 may include functionality to switch between a sub-mode to receive HDMI information from another AV device and a sub-mode to receive MHL information (e.g. according to techniques set forth in US Patent Application 12/606,096, filed October 26, 2009, entitled 'TRANSMISSION OF ALTERNATIVE CONTENT OVER STANDARD DEVICE CONNECTORS').

[0027] In an embodiment, detection block 420 may include one or more of logic to detect for a supply voltage output, logic to detect for a signal line termination, logic to detect for an EDID or other such identifier, logic to detect for a digital data functionality, and logic to detect for a clock signal. Although its application in this particular context is new, such detection techniques may be according to already known techniques to detect for such clock signals, data voltage inputs, impedances, etc.

[0028] Alternatively or in addition, control logic 405 may include logic to variously change states of enablement for respective functionalities of AV device 400. More particularly, functionalities of AV device 400 may be selectively enabled or disabled by control logic 405 to implement operating modes such as those discussed with respect to 3A and 3B.

[0029] FIG. 5 illustrates select elements of a system 500 for determining an operating mode of an AV device, according to an embodiment. System 500 may include, or otherwise provide configuration control functionality, to AV device 400, for example. System 500 may include detect logic 510 to implement detect functionality such as that of detect logic 420. Alternatively or in addition, system 500 may include control logic 520 to implement control functionality such as that of control logic 405.

[0030] Detect logic 510 and control logic 520 may comprise logic (e.g. hardware, firmware and/or software) to implement techniques described herein. For example, detect logic 510 may include one or more components to implement different respective detect functionality. By way of illustration and not limitation, detect logic 510 may include input voltage detector 512 to detect for the presence or absence of an input voltage (e.g. the +5V supply of HDMI) being provided from another AV device. Alternatively or in addition, detect logic 510 may include pull-up impedance detector 514 to determine whether a particular signal line impedance is implemented at another AV device which is coupled to an AV connector of the AV device. Alternatively or in addition, detect logic 510 may include input clock detector 516 to determine whether or not a clock signal is being provided by another AV device which is coupled to an AV connector of the AV device. Alternatively or in addition, detect logic 510 may include hot plug detect logic 518 to detect for a HPD signal from another AV device which is coupled to an AV connector of the AV device. It is understood that any of a variety of additional or alternative components of detect logic 510 may be implemented, according to different embodiments.

[0031] Similarly, control logic 520 may include one or more components to implement different respective control functionality. By way of illustration and not limitation, detect logic 520 may include mode transition logic 522 to determine one or more operation mode transitions which are to take place – e.g. based on a signal from detect logic 510. Alternatively or in addition, detect logic 520 may include hot plug detect control logic 524 to control whether and/or how an HPD communication exchange is to take place between the AV device and another AV device coupled thereto. Alternatively or in addition, detect logic 520 may include output voltage control logic 526 to control whether and/or how an output voltage (e.g. the +5V supply of HDMI) is to be provided from the AV device to another AV device coupled thereto.

Alternatively or in addition, detect logic 520 may include data/clock control logic 528 to control whether and/or how data signals and/or clock signals (e.g. DDC_SDA and/or DDC_SCL) are to be provided from the AV device to another AV device coupled thereto. It is understood that any of a variety of additional or alternative components of control logic 520 may be implemented, according to different embodiments.

[0032] Some techniques for detect logic 510 to detect one or more of signal line impedance, clock signals, EDID, HPD signals, supply voltage signals, etc. are known. However, the application of such detection techniques to the operation mode control techniques discussed herein is novel.

[0033] Techniques and architectures for configuring an AV device are described herein. In the above description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of certain embodiments. It will be apparent, however, to one skilled in the art that certain embodiments can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the description.

[0034] Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[0035] Some portions of the detailed description herein are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These

algorithmic descriptions and representations are the means used by those skilled in the computing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0036] It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the discussion herein, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0037] Certain embodiments also relate to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs,

and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs) such as dynamic RAM (DRAM), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and coupled to a computer system bus.

[0038] The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description herein. In addition, certain embodiments are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of such embodiments as described herein.

[0039] Besides what is described herein, various modifications may be made to the disclosed embodiments and implementations thereof without departing from their scope. Therefore, the illustrations and examples herein should be construed in an illustrative, and not a restrictive sense. The scope of the invention should be measured solely by reference to the claims that follow.

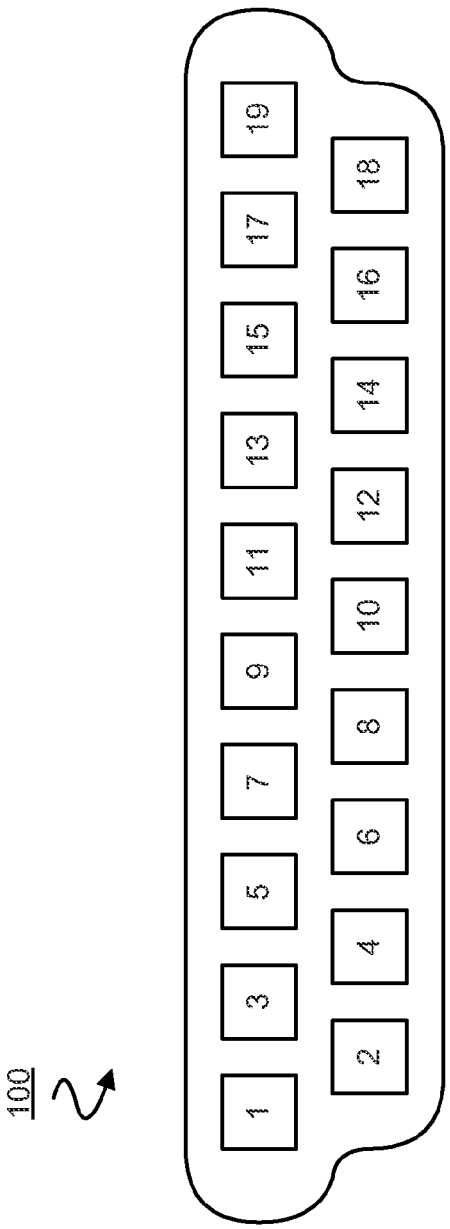


FIG. 1

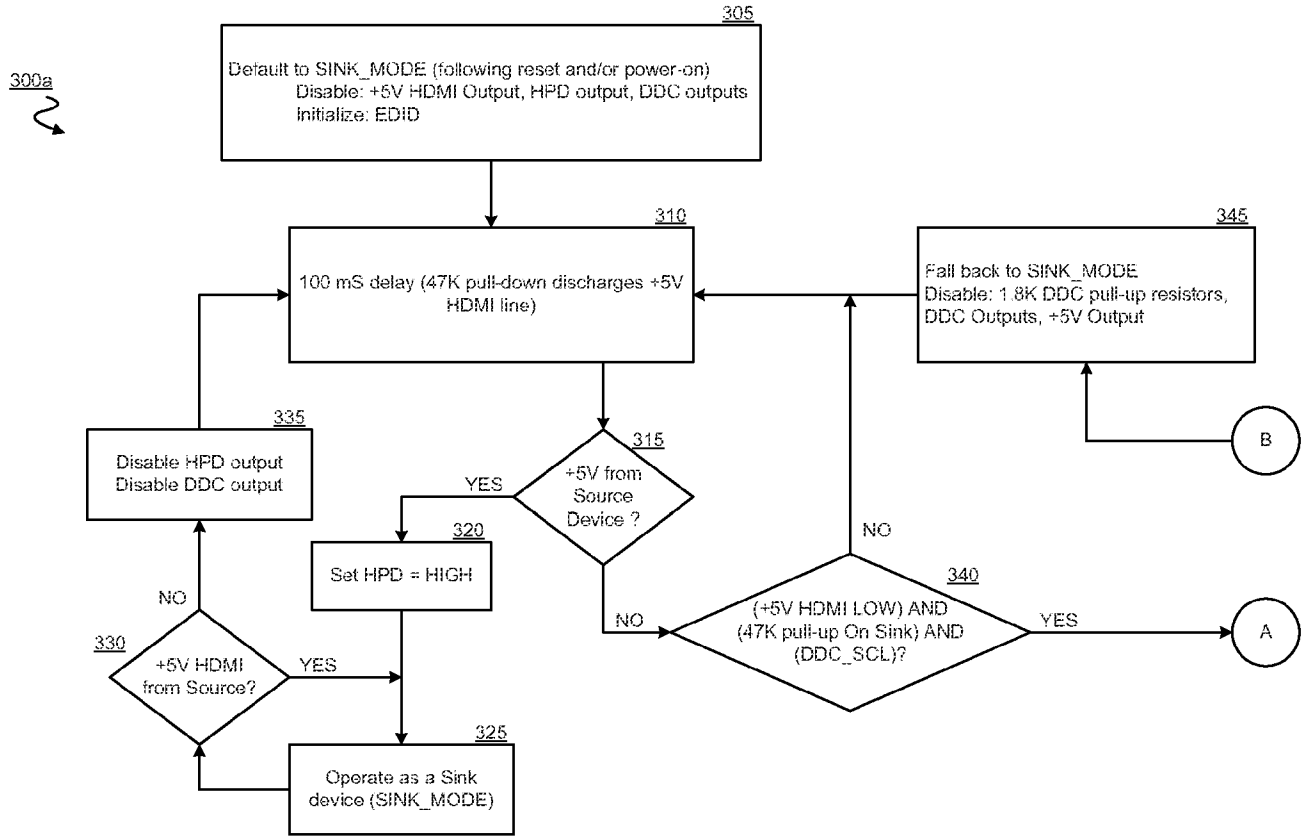


FIG. 3A

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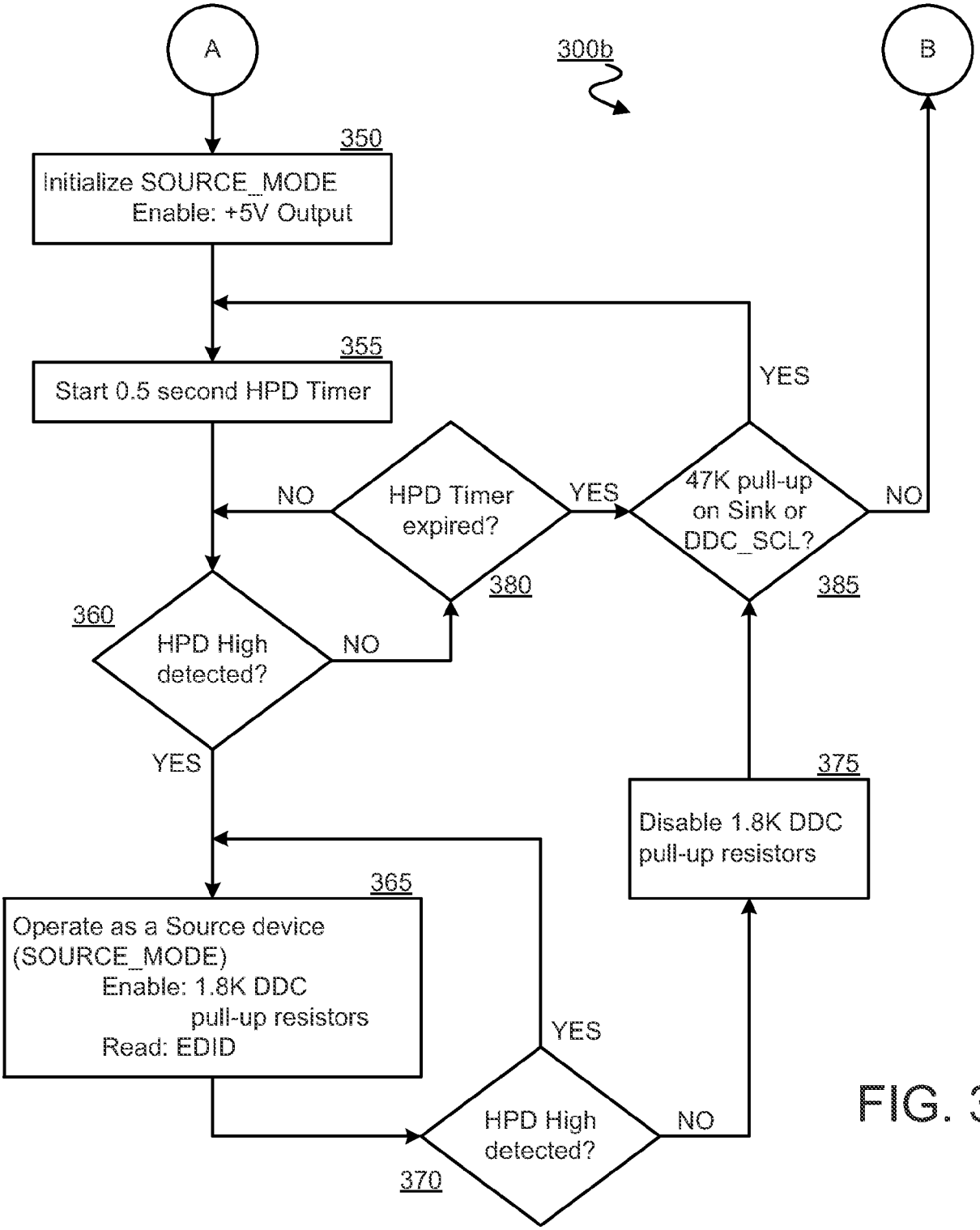

A
300b
B
350
Initialize SOURCE_MODE
Enable: +5V Output
355
Start 0.5 second HPD Timer
YES
NO
HPD Timer expired?
YES
47K pull-up on Sink or DDC_SCL?
NO
380
385
360
HPD High detected?
NO
YES
375
Disable 1.8K DDC pull-up resistors
365
Operate as a Source device (SOURCE_MODE)
Enable: 1.8K DDC pull-up resistors
Read: EDID
YES
HPD High detected?
NO
370

FIG. 3B

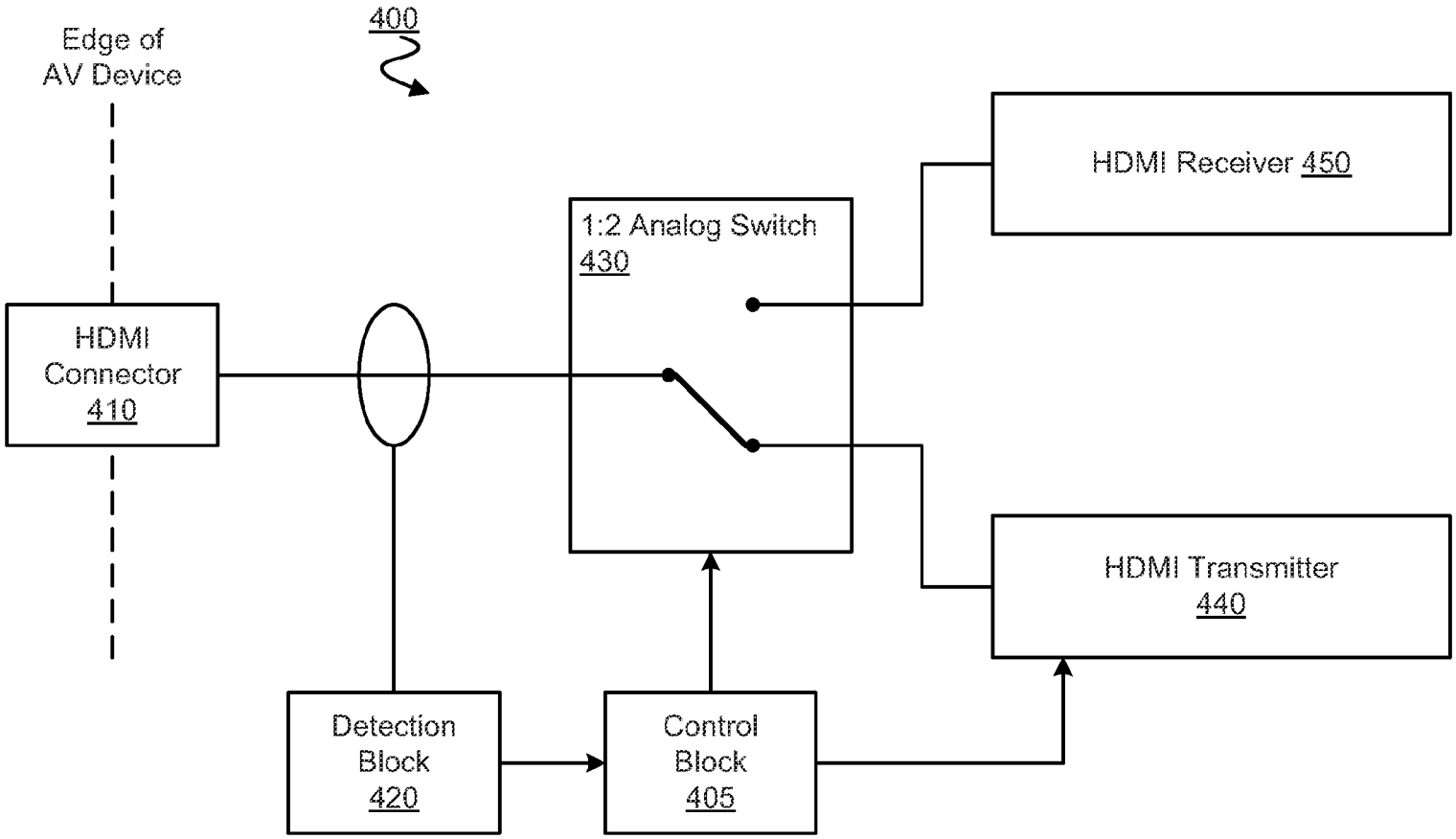


FIG. 4

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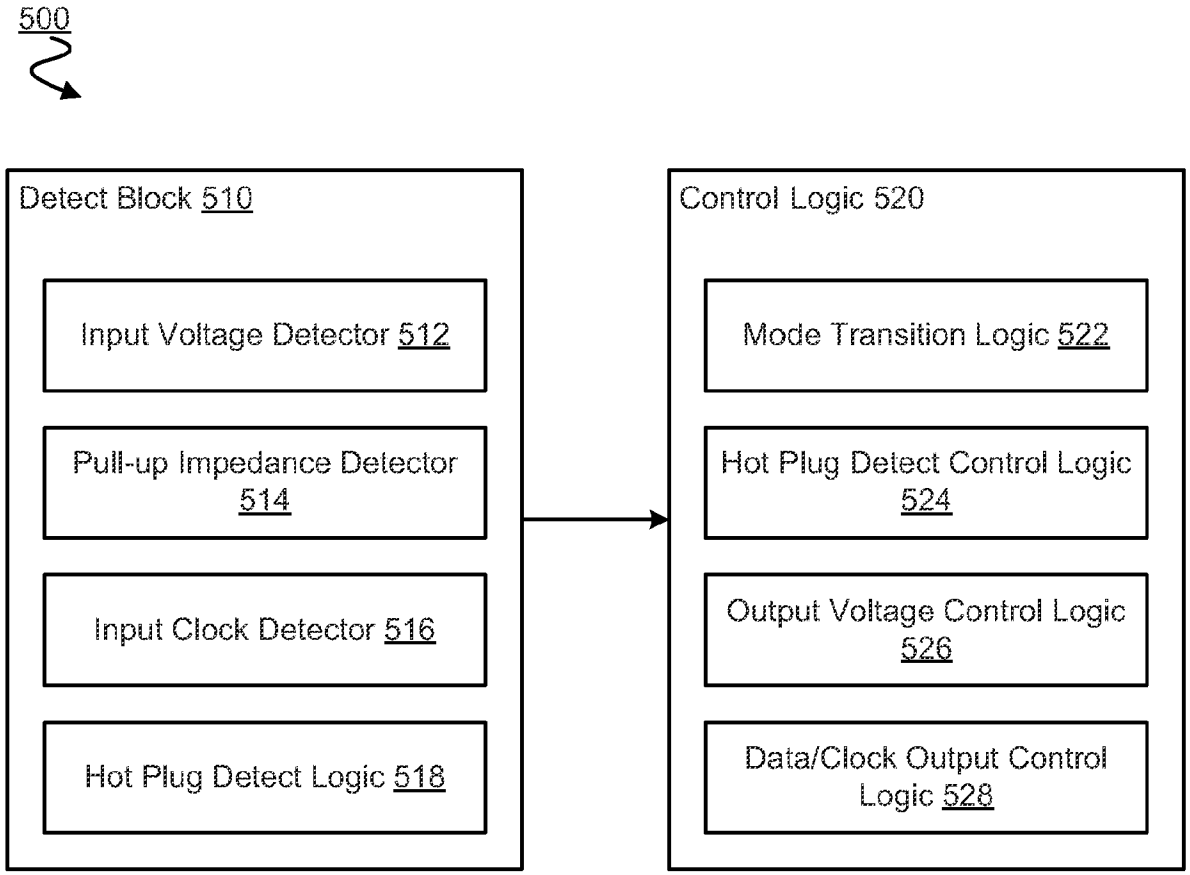


FIG. 5

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Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

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Title of Invention	METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO CONTENT
Attorney Docket Number (if applicable)	SIGM0383_0395_8029P107Z

Correspondence Address

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Document Description: Provisional Cover Sheet (SB16)

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Applicant claims small entity status under 37 CFR 1.27

◯ Yes, applicant qualifies for small entity status under 37 CFR 1.27

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EFS ID:	9787457
Application Number:	61470431
International Application Number:	
Confirmation Number:	6348
Title of Invention:	METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO CONTENT
First Named Inventor/Applicant Name:	Conrad Arlo Maxwell
Customer Number:	65702
Filer:	Dermot G. Miller/Julie Dussault
Filer Authorized By:	Dermot G. Miller
Attorney Docket Number:	SIMG0383_0395_8029P107Z
Receipt Date:	31-MAR-2011
Filing Date:	
Time Stamp:	20:53:02
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
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Warnings:					
Information:					
2	Drawings-only black and white line drawings	SIMG0383_0395_8029P107Z_FIGS_3-31-2011.pdf	27853 575bb9ac12676e12180a58c9896f89ac3c75239c	no	5
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3	Provisional Cover Sheet (SB16)	SIMG0383_0395_8029P107Z_Prov_Cvr_Sheet_3-31-2011.pdf	36879 4a0393e794cb0b546c94a84dca4070766d5eabf5	no	4
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 October 2012 (04.10.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/135626 A2

(51) **International Patent Classification**:
H04L 29/10 (2006.01) ***H04L 12/10*** (2006.01)
H04L 29/12 (2006.01)

(21) **International Application Number**:
PCT/US2012/031463

(22) **International Filing Date**:
30 March 2012 (30.03.2012)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
61/470,431 31 March 2011 (31.03.2011) US
13/434,273 29 March 2012 (29.03.2012) US

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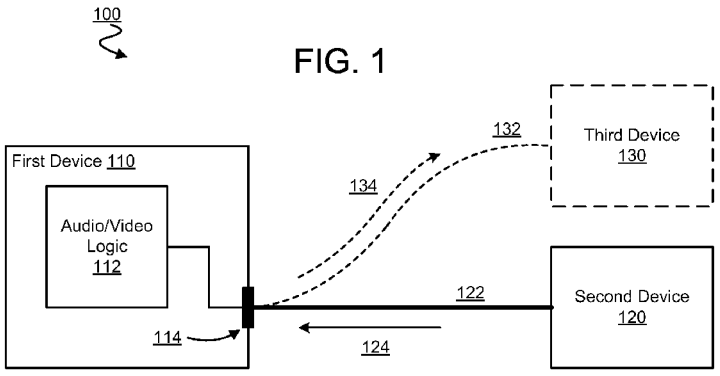
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(54) **Title**: METHOD. APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE AND A SINK MODE



(57) **Abstract**: Techniques and mechanisms for determining an operation mode of an audio-video (AV) device. In an embodiment, communication logic of the AV device may be configured at different times for different ones of a plurality of operation modes including an AV source operation mode for providing AV information to another device and an AV sink operation mode for receiving AV information from another device. In response to a detected event, control logic initializes the communication logic of the AV device into a default mode which prevents operation of the communication logic as an AV source.

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METHOD, APPARATUS AND SYSTEM FOR TRANSITIONING AN AUDIO/VIDEO DEVICE BETWEEN A SOURCE MODE AND A SINK MODE

RELATED APPLICATIONS

[0001] This application claims priority from Provisional Application Serial Number 61/470,431, filed March 31, 2011, entitled "METHOD, APPARATUS AND SYSTEM FOR PROVIDING A BIDIRECTIONAL OPERATING MODE TO EXCHANGE AUDIO/VIDEO CONTENT", the teaching of which is incorporated herein by reference.

BACKGROUND

1. Technical Field

[0002] Embodiments relate generally to techniques for exchanging audio/video information. More particularly, certain embodiments provide techniques for controlling an audio/video device to selectively receive or send audio/video information.

2. Background Art

[0003] The size of computers and other audio/video (AV) capable electronic devices continue to scale with successive improvements in integrated circuit (IC) fabrication techniques. Consequently, there is a general trend toward a wider variety of AV devices, notably smaller AV devices, implementing functionality to support higher throughput and/or higher quality of AV information.

[0004] Certain conventional AV devices include a High-Definition Multimedia Interface (HDMI) connector or other such hardware for coupling to some other device, where the AV device operates as a source to provide AV information to the other device via the connector. Typical examples of conventional AV sources include a camcorder, digital camera, personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), smart phone, video game console, DVD player,

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digital video recorder (DVR), set-top box, plug-in storage peripheral or other such device which is capable of sending AV information to some other device.

[0005] Other conventional AV devices operate as a sink to receive AV information from another device via such coupling hardware. Typical examples of conventional AV sinks include a television, monitor, display, home theater receiver, personal computer, projector or other such device which is capable of receiving AV information from some AV source.

[0006] One consequence of the current trends in AV technology is smaller and/or higher-capacity AV devices placing an increasing premium on the area which is taken up by multiple AV connectors. Another consequence of current trends is the increasing variety of combinations of AV devices which may be coupled to one another to exchange AV information. Due to such consequences, systems which exchange AV information between electronic devices are increasingly prone to inefficiencies in how such devices are to couple to and communicate with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The various embodiments of the present invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which:

[0008] FIG. 1 is a block diagram showing elements of a system for exchanging audio/video data according to an embodiment.

[0009] FIG. 2A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0010] FIG. 2B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0011] FIG. 3 is a layout diagram showing elements of a connector for exchanging audio/video data according to an embodiment.

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[0012] FIG. 4A is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0013] FIG. 4B is a flow diagram showing elements of a method for controlling an audio/video device according to an embodiment.

[0014] FIG. 5 is a block diagram showing elements of an audio/video device according to an embodiment.

DETAILED DESCRIPTION

[0015] Embodiments discussed herein variously make, use or otherwise provide circuit logic to selectively control an audio/video (or "AV") device for operation at different times in various ones of a plurality of operation modes. The plurality of operation modes may include what is referred to herein as an "AV Sink" operation mode, for the AV device (also referred to herein as simply "device") to be a sink for receiving AV information from another AV device via a connector, and what is referred to herein as an "AV Source" operation mode, for the AV device to be a source for providing AV information to another AV device via the same connector. In an embodiment, the AV device includes the connector. In an alternate embodiment, the AV device may operate in a system which includes the connector – e.g. where the connector is to couple the system with some external device for an exchange of AV information.

[0016] As used herein, "audio/video" or "AV" refers to the characteristic of relating to either audio content or video content, or relating to both audio content and video content. For example, AV information may include some or all of audio data and/or control information and video data and/or control information. In an embodiment, an AV device may, in addition to exchanging AV information with another device, be operable to render audio content and/or video content for a user, although certain embodiments are not limited in this regard.

[0017] An AV device according to an embodiment includes communication logic to exchange AV data according to some interface standard. By way of illustration and not limitation, such communication logic may exchange AV data via

a connector which is compatible with one or more of an HDMI standard such as the HDMI 1.4 standard released May 28, 2009 by HDMI Licensing, LLC of Sunnyvale, CA, a Mobile High-Definition Link (MHL) standard such as the MHL 1.0 specification released June 30, 2010 by the MHL Consortium of Sunnyvale, CA, a Digital Visual Interface (DVI) standard such as the DVI 1.0 standard released April 02, 1999 by the Digital Display Working Group of Vancouver, WA, a DisplayPort standard such as the DisplayPort 1.2 standard released December 22, 2009 by the Video Electronics Standards Association of Newark, CA and/or the like.

[0018] In an embodiment, such communication logic may implement communications which, at different times, are compatible with different interface standards, where all such communications are via the same connector. For example, communication logic may include first logic to detect the presence of, and communicate with, an HDMI device and second logic to detect the presence of, and communicate with, an HDMI device, where the respective detection and communication functionalities of the first logic and second logic do not conflict with or otherwise impede the other. Such communication logic may, for example, be referred to as "MHL-ready HDMI," "HDMI/MHL" and/or the like. Features of various embodiments are discussed herein in the context of exchanging AV information according to an HDMI interface standard. However, such discussion may be extended to apply to any of a variety of additional or alternative interface standards for exchanging AV data, according to different embodiments.

[0019] Certain embodiments variously provide that, from either or both of a device power up and a device reset, an AV device will, by default, return to or otherwise be in a Sink mode. While in this mode such an AV device may then determine by stimulus and response or measurement means described herein that it is connected to an AV Sink device, in which case it may safely transition to an AV Source operation mode. In an embodiment, the AV device may translate back to AV Sink operation mode in response to an indication of a change in connectivity to the AV Sink device.

[0020] FIG. 1 illustrates elements of a system 100 for exchanging AV information according to an embodiment. System 100 may include a first device

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110 comprising AV logic 112 to variously implement AV communications between first device 110 and one or more other devices. One embodiment may, for example, be implemented entirely within AV logic 112. Another embodiment may be implemented by first device 110 as a whole. Still another embodiment may be implemented by system 100 as a whole. Any of a variety of other embodiments may be alternatively implemented according to techniques discussed herein.

[0021] In an embodiment, first device 110 includes functionality of one or more of conventional AV source devices and/or functionality of one or more conventional AV sink devices. By way of illustration and not limitation, first device 110 may include functionality of one or more devices including, but not limited to, a personal computer (e.g. tablet, notebook, laptop, desktop and/or the like), camcorder, smart phone, video game console, television, monitor, display, set-top box, home theater receiver and/or the like.

[0022] First device 110 may include a connector 114, coupled via one or more signal lines to AV logic 112, to variously connect first device 110 to some other device of system 100 for an exchange of AV information. Connector 114 may include a plurality of channels, such as pins and/or other interconnect hardware, which are compatible with a particular AV interface standard – e.g. an HDMI standard.

[0023] In an illustrative embodiment, connector 114 may, at some point in time, couple first device 110 via an interconnect 122 to a second device 120 of system 100 – e.g. for an exchange 124 of AV information from second device 120 to first device 110. The particular direction of exchange 124 is not limiting on certain embodiments, and may alternatively be in the opposite direction, where first device 110 operates as the AV Source and second device 120 operates as the AV Sink. Accordingly, second device 120 may, for example, include both logic (not shown) to implement conventional AV Source functionality or conventional AV Sink functionality. In another embodiment, second device 120 may include logic to variously provide both AV Source functionality and AV Sink functionality according to techniques described herein.

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[0024] Certain embodiments variously mitigate at least one problem which might otherwise arises if two conventional AV devices are coupled to one another when those two devices are concurrently configured each for respective operation as an AV Source. Such connecting of AV Source devices to one another can risk damage to transmission hardware in either or both devices. For example, the two devices may attempt to drive power in opposite directions in the same power supply voltage channel of a connector. Alternatively, or in addition, two such devices may attempt to drive data signals in opposite directions via the same data channel of the connector. Such AV Source devices may risk driving any of a variety of other signals – e.g. hot plug detect signals, clock signals and/or the like – against one another each on some common respective channel of a connector.

[0025] AV logic 112 may limit the risk of the resulting damage in system 100 by providing a control mechanism to selectively prevent one or more aspects of AV Source functionality from being provided during operation of first device 110. By way of illustration and not limitation, AV logic 112 may selectively transition itself between a plurality of operation modes which includes an AV Source operation mode and an AV Sink operation mode. The AV Source operation mode may be for AV logic 112 to provide a particular signal to connection 114 – e.g. a supply voltage, a digital data signal and/or the like. Additionally or alternatively, the AV Source operation mode may be for AV logic 112 to provide a particular amount of impedance – e.g. pull-up impedance, pull-down impedance and/or the like – for a signal line coupled to a channel of connection 114.

[0026] In an embodiment, control logic (not shown) of AV logic 112 selects one of the plurality of operation modes in response to an indication of a particular type of event at first device 110. Whether and/or how AV logic 112 might transition between operation modes may be based, for example, on whether the indicated event is a power-up event, a power-down event a reset event, and/or the like.

[0027] Whether and/or how AV logic 112 might transition between operation modes may be additionally or alternatively based on an event which detects a particular characteristic (or absence of said characteristic) regarding connectivity between connector 114 and second device 120. By way of illustration and not

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limitation, such a characteristic may include whether (or not) some second device 120 is providing a supply voltage at a particular channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a supply voltage to its corresponding AV Sink – e.g. the +5V output to be provided from Source to Sink according to HDMI, as on pin 18 of a 19-pin HDMI connector.

[0028] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing to connector 114 a hot plug detect (HPD) signal. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Sink is to indicate its presence with a HPD signal to its corresponding AV Source – e.g. the HPD signal to be provided from Sink to Source according to HDMI, as on pin 19 of a 19-pin HDMI connector.

[0029] Additionally or alternatively, such a characteristic may include whether (or not) second device 120 is providing a clock signal to connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that an AV Source is to provide a clock signal to an AV Sink – e.g. the DDC_SCL signal to be provided from Source to Sink according to HDMI, as on pin 15 of a 19-pin HDMI connector.

[0030] Additionally or alternatively, such a characteristic may include whether (or not) a particular amount of impedance is being provided by second device 120 for a channel of connector 114. For example, connector 114 may be compatible with an interface standard which stipulates that a particular pull-up impedance is to be implemented at an AV Sink – e.g. a 47kΩ pull-up resistance which HDMI requires be provided at an AV Sink for a SDA line (e.g. pin 16 of a 19-pin HDMI connector).

[0031] In an embodiment, the functionality of AV logic 112 allows connector 114 to be variously coupled, decoupled and/or recoupled at different times to one or more devices, while limiting a risk of damage to hardware in system 100. By way of illustration and not limitation, connector 114 may at some point in time be decoupled from second device 120 and subsequently coupled via an interconnect 132 to some third device 130 – e.g. for an exchange 134 of AV information to third

device 130 from first device 110. The particular direction of exchange 134 is not limiting on certain embodiments, any may alternatively be in the opposite direction, where first device 110 operates as the AV Sink and third device 130 operates as the AV Source. In an embodiment, third device 130 is simply second device 120 – e.g. where second device 120 is decoupled from and subsequently recoupled to first device 110 and/or where first device 110 and second device 120 switch AV Sink and AV Source roles for different AV information exchanges.

[0032] As shown in the discussion herein, AV logic 112 may protect various circuitry of system 100 for different successive couplings of first device 110 each to a respective device and/or for successive different AV information exchanges each between first device 110 and a respective device.

[0033] FIG. 2A illustrates elements of a method 200 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 200 may, for example, be a device including some or all of the features of first device 110. In one embodiment, an AV device controlled by performing method 200 may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Features of various embodiments are discussed herein in terms of performing method 200 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0034] In an embodiment, the AV device includes communication logic comprising circuitry to operate at different times in different ones of a plurality of operation modes which include an AV Source operation mode and an AV Sink operation mode. The AV Sink operation mode may, for example, be for the communication logic to receive AV data provided to the AV device via a connector – e.g. via connector 114. The AV Sink operation mode may further be for the communication logic to receive power from a first supply voltage provided via a channel of the connector. By contrast, the AV Source operation mode may be for the communication logic to send AV data from the AV device, where the AV data is sent through the connector. The AV Source operation mode may further be for the

communication logic to provide a second supply voltage at the channel of the connector. In an embodiment, a level of the first supply voltage is equal to a level of the second supply voltage.

[0035] In an embodiment, method 200 includes, at 210, detecting an indication of one of a power up event at the AV device, a power down event at the device or a reset event at the AV device. The detecting at 210 may, for example, include control circuitry of AV logic 112 directly or indirectly detecting an indication sent from some agent included in or otherwise accessible to AV logic 112. By way of illustration and not limitation, first device 110 may include a power management unit, a host processor or other agent which sends to AV logic 112 a signal specifying, for example, that first device 110 is going through, has gone through, or is expected to go through a boot up or boot down operation, or otherwise to transition to or from an operative power state. In an embodiment, transitioning to or from such an operative power state may include transitioning between a first power state in which AV logic 112 is incapable of exchanging AV information via connector 114 and a second power state in which AV logic 112 is capable of exchanging AV information via connector 114. Alternatively or in addition, AV logic 112 may include detector logic to evaluate power state of AV logic 112 and/or of other components of first device 110.

[0036] The detecting at 210 may additionally or alternatively include control circuitry of AV logic 112 directly or indirectly detecting a signal from some agent, included in or otherwise accessible to AV logic 112, the signal specifying or otherwise indicating that AV logic 112 or some other component of first device 110 have been, are being, or are expected to be reset. Such a reset may flush some current state of circuit logic in favor of some predetermined baseline configuration. A reset may, for example, return some or all of first device 110 to a predetermined configuration without powering down first device 110.

[0037] In response to the indication detected at 210, method 200 may, at 220, automatically initialize communication logic of the AV device. By way of illustration and not limitation, control logic of AV logic 112 may automatically place the communication logic of AV logic 112 into a default operation mode which

prevents the second supply voltage from being provided by the communication logic at the channel of the connector. In an embodiment, the default operation mode is the AV Sink operation mode. In an embodiment, the AV Source operation mode is further for the communication logic of the AV device to provide a first total amount of impedance for a data channel of the connector. In such an embodiment, the default operation mode may prevent the first total amount of impedance for the data channel from being provided by the communication logic.

[0038] FIG. 2B illustrates elements of a method 250 for controlling operation of an AV device according to an embodiment. An AV device controlled by performing method 250 may, for example, be a device having some or all of the features of a device controlled by method 200. Method 250 may, for example, be performed after method 200 – although certain embodiments are not limited in this regard. Features of various embodiments are discussed herein in terms of performing method 250 to control AV logic 112 within first device 110. However, such discussion may be extended to apply to any of a variety of additional or alternative AV hardware, consistent with the techniques disclosed herein.

[0039] Method 250 may include, at 260, detecting a characteristic regarding a connectivity of the AV device to another device via a connector – e.g. connector 114. For example, detector logic of AV logic 112 may detect connectivity to the other device via the connector – e.g. the detecting while the communication logic of the AV device is in the default operation mode of method 200. Additionally or alternatively, such detector logic of AV logic 112 may detect a change in a state of connectivity to the other device via the connector. The detecting the characteristic at 260 may, for example, include detecting an indication that the other device is providing the first supply voltage discussed with regard to method 200. Alternatively or in addition, the detecting at 260 may include detecting that the other device is providing to the connector a hot plug detect (HPD) signal, a clock signal and/or any of a variety combinations of one or more other signals. Alternatively or in addition, the detecting at 260 may include evaluating an impedance of a signal line which couples the other device to the connector.

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[0040] In response to detecting the characteristic at 260, method 200 may, at 270, automatically place the communication logic of the AV device into some first operation mode which prevents a providing of the second supply voltage referred to in the discussion of method 200. The first operation mode may, for example, be the default operation mode of method 200, although certain embodiments are not limited in this regard. In placing the AV device into the first operation mode, method 250 may limit the possibility of circuit damage due to conflicting output signals from two coupled AV devices, each device attempting to operate as an AV Source.

[0041] FIG. 3 illustrates select elements of a connector 300 for exchanging AV information according to an embodiment. Connector 300 may include some or all of the features of connector 114, for example. The illustrative connector 300 is a 19-channel (e.g. 19-pin) connector which is compatible with an HDMI interface standard, although certain embodiments are not limited in this regard. Connector 300 may support AV information exchanges by any of a variety of other types of interconnect hardware – e.g. a connector including more, fewer, or alternative channels to those shown in FIG. 3 – where communication via such a connector is consistent with techniques discussed herein.

[0042] The illustrative connector 300 includes interconnect hardware to support transition-minimized differential signaling (TMDS) in HDMI communication. More particularly, the respective functions of the channels in connector 300 may be assigned according to HDMI 1.4 or some other HDMI interface standard – e.g. as follows:

Channel 1	TMDS Data2+
Channel 2	TMDS Data2 Shield
Channel 3	TMDS Data2–
Channel 4	TMDS Data1+
Channel 5	TMDS Data1 Shield
Channel 6	TMDS Data1–
Channel 7	TMDS Data0+
Channel 8	TMDS Data0 Shield
Channel 9	TMDS Data0–

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Channel 10	TMDS Clock+
Channel 11	TMDS Clock Shield
Channel 12	TMDS Clock–
Channel 13	Consumer Electronics Control (CEC)
Channel 14	HDMI Ethernet Channel (HEC) Data
Channel 15	System Clock Line (SCL) – I²C Serial Clock for Display Data Channel (DDC)
Channel 16	System Data (SDA) – I²C Serial Data Line for DDC
Channel 17	DDC/CEC/HEC Ground
Channel 18	+5 V Power
Channel 19	Hot Plug Detect (HPD) and/or HEC Data+

Potential conflict may result when two connected AV devices concurrently attempt to drive respective supply voltages and/or other signals according to the same function assignments for connector 300.

[0043] In an embodiment, an AV device including or coupled to connector 300 may implement techniques to reduce the likelihood of such conflict – e.g. techniques including some or all of the features discussed with respect to method 200 and/or method 250. By way of illustration and not limitation, control logic of such an AV device may provide that after some event – e.g. from one or more of a power up event, a power down event and a reset event – communication logic of the AV device will operate in an AV Source operation mode only after certain connectivity conditions are subsequently identified. For example, the control logic may configure the AV device after/during power up – or before/during a power down – for a default operation mode in which a functionality required for operation as an AV Source is disabled. For instance, the disabled functionality may be required for operation as an AV Source device according to the conditions of HDMI or some other interface standard.

[0044] Alternatively or in addition, the control logic may configure the AV device for an AV Sink operation mode in response to detecting a change of a characteristic regarding connectivity between the AV devices. For example, the AV device may be set to, or return to, some default AV Sink operation mode in response

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to an indication of a loss or absence at connector 300 of a supply voltage, an indication of a loss or absence of a HPD signal, an indication of a signal line pull-up impedance implemented by any other connected AV device, and/or an indication of a clock signal provided by any other connected AV device. Any of a variety of additional or alternative detected conditions may determine whether and/or how the AV device may be configured – or reconfigured – for operation in such a default mode. In one embodiment, the default operating mode is a SINK mode of HDMI in which the AV device is capable of operation as an AV Sink.

[0045] In an embodiment, control logic of an AV device may implement a state machine or other mechanism for transitioning the communication logic between operation modes including SINK mode and SOURCE mode. By way of illustration and not limitation, the AV device may default its communication logic to SINK mode in response to (or during) a power up of the AV device (or in response to, or during, a power down of the AV device), and/or in response to detecting that a connectivity characteristic with another AV device is absent or has changed. The AV device may variously transition between SINK mode and SOURCE mode, depending on one or more connectivity characteristics detected for connector 300. Such connectivity characteristics may include, but are not limited to, whether a +5V voltage is provided by another AV device through connector 300, and/or whether one or more signals or other connectivity characteristics (e.g. HPD, DDC pull ups, TDMS termination, etc.) indicate presence or absence of functionality of some other connected AV device as an operable Sink or operable Source.

[0046] FIG. 4A and 4B illustrate select elements of methods 400a, 400b, respectively, for controlling operation of an AV device according to an embodiment. An AV device controlled by performing either or both of methods 400a, 400b may, for example, be a device including some or all of the features of first device 110. In one embodiment, the AV device controlled by performing either or both of methods 400a, 400b may merely include some or all of the features of AV logic 112 – e.g. without also including other features of first device 110 such as connector 114. Methods 400a, 400b may include some or all of the features discussed herein with respect to methods 200, 250, although certain embodiments are not limited in this regard.

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[0047] FIG. 4A and 4B are discussed herein with respect to features which are specific to HDMI interface requirements. However, such discussion may be extended to apply to requirements of any of a variety of additional or alternative interface standards for communicating AV information. For example, various additional or alternative test conditions (e.g. different delays, resistance values, signal outputs, test conditions, etc.) may be used, according to different embodiments, for determining whether and/or how one or more operation mode transitions of an AV device are to take place.

[0048] Method 400a may, at 405, initialize the AV device to SINK mode by default in response to an indication of a reset event, a power-on event or a power-off event. The initializing at 405 may, for example, include disabling one or more of a +5V HDMI output (channel 18), HPD output (pin 19), some or all DDC outputs (pins 15 and/or 16), and respective 1.8K pull-up resistors for such DDC outputs. The initializing at 405 may further include initializing extended display identification data (EDID) functionality of the AV device in preparation for identifying capabilities to any other device coupled via the connector – e.g. connector 114. After the initializing at 405, method 400 may, at 410, provide some delay – e.g. 100ms – for a high-value pull-down resistor to discharge the +5V HDMI output. However, such delay may not be required, in certain embodiments.

[0049] After delay at 410, method 400 may test for some indication that another device is coupled to the AV device being controlled by method 400a. By way of illustration and not limitation, method 400a may test, at 415, test whether a +5V HDMI supply voltage is being provided at connector 114 – indicating that a device coupled via the connector is operating in some AV Source mode. If the +5V supply voltage is detected at 415, then method 400a may, at 420, assert a HPD signal at the connector (pin 19) and, at 425, commence operation of the communication logic of the AV device in a SINK mode. The AV device may test for a change in connectivity with the other device – e.g. by occasionally testing at 430 +5V supply voltage continues to be provided at the connector by the other device. In an embodiment, detecting that the +5V supply voltage is not being so provided may result in method 400a disabling its HPD signal, its DDC output functionality and/or any other AV Sink functionality that is not currently being used. Method 400a may

then return to providing the delay at 410 in preparation for again testing for presence of any connected device.

[0050] If the +5V supply voltage is not detected at 415, then method 400a may detect for the presence of any device which might be coupled via the connector and which is operating in some AV Sink mode. By way of illustration and not limitation, method 400a may test, at 440, to confirm that there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification, that an impedance on the data (SDA channel 16) is not in the HDMI specified Source range of 1.5kΩ to 2.0kΩ, and that a receiver sense input (RSEN) signal indicates that one or more differential pairs of the connector are provided with terminators at some coupled device. If no AV Sink device is detected at 415, method 400a may then return to providing the delay at 410, in preparation for again testing for presence of any connected device.

[0051] If an AV Sink device is detected at 415, then in one embodiment, operations of method 400b may follow. For example, method 400b may, at 450, initiate a transition to SOURCE mode – e.g. including enabling the communication logic of the AV device to provide the +5V supply voltage to the connector. In an embodiment, method 400b may, at 455, start a HPD timer – e.g. set for 0.5 seconds – for timing out if a HPD signal is not detected from some AV Sink device. Method 400b may test, at 460, whether an HPD signal is detected – e.g. where the test at 460 may be successively performed according to a test at 480 of whether the HPD timer has expired. If an HPD signal is detected at 460, method 400b may begin operation of the AV device in a SOURCE mode, at 465.

[0052] If the HPD timer is determined to have expired at 480, method 400b may perform evaluations of whether one or more indications of a coupled AV Sink device are still present at the connector. By way of illustration and not limitation, method 400b may test, at 485, to confirm whether there is a 47kΩ pull-up resistor on the clock channel of the connector (SCL channel 15) as required by the HDMI specification. If such a 47kΩ pull-up resistor is detected at 485, method 400b may return to setting another HPD timer at 455.

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[0053] If no such 47kΩ pull-up resistor is detected at 485, method 400b may begin preparations, at 445, to transition the AV device back to a SINK mode – e.g. including disabling one or more of a +5V HDMI output (channel 18), some or all DDC outputs (pins 15 and/or 16), respective 1.8K pull-up resistors for such DDC outputs, and/or the like. After the preparation for SINK mode operation at 445, method 400b may be followed by an operation of method 400a – e.g. the providing of a delay at 410.

[0054] In an embodiment, operation of the AV device in SOURCE mode, at 465, includes enabling 1.8K pull-up resistors for DDC channels of the connector which are to serve as output channels. Additionally or alternatively, SOURCE mode operation at 465 may include performing an EDID read of the capabilities of the detected AV Sink device. Operation of the AV device in SOURCE mode may continue until a test at 470 indicates that the detected AV Sink device is no longer providing a HPD signal. If such an HPD signal is no longer detected, method 400b may begin to protect the AV device from possible harm – e.g. caused by the detected AV Sink device somehow transitioning to AV Source operation. By way of illustration and not limitation, method 400b may, at 475, disable respective 1.8 kΩ pull-up resistors for one or more DDC channels of the connector. After the disabling at 475, method 400b may perform the presence test at 485.

[0055] FIG. 5 illustrates select elements of a system 500 for exchanging AV information according to an embodiment. System 500 may include some or all of the features of first device 110, for example. For example, system 500 may include AV logic 570 having some or all of the features of AV logic 112.

[0056] System 500 may include an AV connector – represented by an illustrative HDMI connector 510 at the edge of system 500 – to couple system 500 to some external device (not shown) for an AV information exchange. AV logic 570 may include mechanisms to variously implement different operation modes in system 500 to accommodate different types of AV communications via HDMI connector 510. By way of illustration and not limitation, AV 570 may include control logic 505 to receive information indicating a presence or absence of one or

more characteristics regarding connectivity of system 500 with some AV device via HDMI connector 510.

[0057] For example, control logic 505 may include or otherwise have access to detection logic 520 of system 500 which relays and/or analyzes signals exchanged via HDMI connector 510. In an embodiment, detection logic 520 may include one or more of logic to detect for a supply voltage output, logic to detect for a signal line termination, logic to detect for an EDID or other such identifier, logic to detect for a digital data functionality, logic to detect for a clock signal and/or the like. The particular mechanism for detection logic 520 to perform such detecting may be adapted from conventional techniques for detecting clock signals, data voltage inputs, impedances, etc., and are not limiting on certain embodiment. Although shown as being coupled along the data exchange path to intercept one or more signals exchanged via HDMI connector 510, detection logic 520 may, in an alternate embodiment, be configured to passively sense signals exchanged via HDMI connector 510.

[0058] Messages from detection logic 520 may indicate to control logic 505 whether and/or how system 500 is to transition logic of system 500 between operating modes. In an embodiment, control logic 505 may provide control functionality to variously place communication logic 580 of system 500 at different times in different ones of a plurality of operation modes – e.g. where the plurality of operation modes includes a SINK mode and a SOURCE mode. For example, control logic 505 may transition communication logic 580 between operation modes according to some or all of the techniques of method 500 and/or method 550.

[0059] By way of illustration and not limitation, control logic 505 may configure a switch of communication logic 580 – represented by an illustrative analog switch 530 – to switch between HDMI (or other AV interface standard) transmit logic 540 for SOURCE mode operation and HDMI (or other AV interface standard) receive logic 550 for SINK mode operation.

[0060] Control logic 505 may also provide functionality to further configure either or both of HDMI transmitter logic 540 and HDMI receive logic 550, although certain embodiments are not limited in this regard. For example, HDMI receive

logic 550 may include HDMI/MHL functionality to switch between a sub-mode to receive HDMI information from another AV device and a sub-mode to receive MHL information. Control logic 505 may provide signaling (not shown) to selectively configure HDMI receive logic 550 to variously operate in such sub-modes at different times.

[0061] Techniques and architectures for configuring an AV device are described herein. In the above description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of certain embodiments. It will be apparent, however, to one skilled in the art that certain embodiments can be practiced without these specific details. In other instances, structures and devices are shown in block diagram form in order to avoid obscuring the description.

[0062] Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[0063] Some portions of the detailed description herein are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the computing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0064] It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely

convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the discussion herein, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0065] Certain embodiments also relate to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs) such as dynamic RAM (DRAM), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and coupled to a computer system bus.

[0066] The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description herein. In addition, certain embodiments are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of such embodiments as described herein.

[0067] Besides what is described herein, various modifications may be made to the disclosed embodiments and implementations thereof without departing from their scope. Therefore, the illustrations and examples herein should be construed in

an illustrative, and not a restrictive sense. The scope of the invention should be measured solely by reference to the claims that follow.

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CLAIMS

What is claimed is:

1. A method at an audio/video (AV) device, the method comprising:

detecting with control circuitry an indication of one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device; and

in response to the indication, automatically initializing communication logic of the AV device with the control circuitry, wherein an AV sink operation mode of the communication logic is for the communication logic to receive AV data provided to the device via a connector, the AV sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device at a channel of the connector, wherein an AV source operation mode of the communication logic is for the communication logic to send AV data from the device via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector, and wherein automatically initializing the communication logic includes placing the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

2. The method of claim 1, wherein the default operation mode is the AV sink operation mode.

3. The method of claim 1, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

4. The method of claim 1, wherein the AV Source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

5. The method of claim 1, further comprising:

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detecting a connectivity of the device to another device via the connector, the detecting the connectivity while the communication logic is in the default operation mode;

in response to the detected connectivity, performing a determination of whether to transition the communication logic from the default operation mode to another operation mode; and

performing an AV data exchange with the other device based on the determination.

6. The method of claim 5, wherein detecting the connectivity includes detecting that the other device is providing the first supply voltage to the channel of the connector.

7. The method of claim 5, further comprising:

detecting a change to the connectivity after the AV data exchange; and

in response to the detected change to the connectivity, placing the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

8. The method of claim 7, wherein the first operation mode is the default operation mode.

9. A device comprising:

communication logic to couple to a connector, the communication logic including circuitry to implement:

an audio/video (AV) Sink operation mode for the communication logic to receive AV data provided to the device at the connector, the AV Sink operation mode further for the communication logic to receive power from a first supply voltage provided to the device via a channel of the connector; and

an AV Source operation mode for the communication logic to send AV data from the device via the connector, the AV Source operation mode further

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for the communication logic to provide a second supply voltage at the channel of the connector;

control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

10. The device of claim 9, wherein the default operation mode is the AV Sink operation mode.

11. The device of claim 9, wherein the default operation mode is for communication according to a high-definition multimedia interface standard.

12. The device of claim 9, wherein the AV source operation mode is further for the communication logic to provide a first total amount of impedance for a data channel of the connector, and wherein the default operation mode further prevents the first total amount of impedance for the data channel from being provided by the communication logic.

13. The device of claim 9, further comprising:

detector logic to detect, while the communication logic is in the default operation mode, a connectivity of the device to another device via the connector;

wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode; and

wherein the communication logic further to perform an AV data exchange with the other device based on the determination.

14. The device of claim 13, wherein the detector logic to detect the connectivity includes the detector logic to detect that the other device is providing the first supply voltage to the channel of the connector.

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15. A system comprising:

a connector;

communication logic coupled to the connector, the communication logic including circuitry to implement:

an audio/video (AV) sink operation mode for the communication logic to receive AV data provided to the system at the connector, the AV sink operation mode further for the communication logic to receive power from a first supply voltage provided to the system at a channel of the connector; and

an AV source operation mode for the communication logic to send AV data from the system via the connector, the AV source operation mode further for the communication logic to provide a second supply voltage at the channel of the connector;

control logic including circuitry to automatically initialize the communication logic in response to one of a power up event at the AV device, a power down event at the AV device, or a reset event at the AV device, wherein the control logic to place the communication logic into a default operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

16. The system of claim 15, wherein the default operation mode is the AV sink operation mode.

17. The system of claim 15, further comprising:

detector logic to detect, while the communication logic is in the default operation mode, a connectivity of the system to a device via the connector;

wherein, in response to the detected connectivity, the control logic further to perform a determination of whether to transition the communication logic from the default operation mode to another operation mode; and

wherein the communication logic further to perform an AV data exchange with the device based on the determination.

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18. The system of claim 17, wherein the detector logic to detect the connectivity includes the detector logic to detect that the device is providing the first supply voltage to the channel of the connector.

19. The system of claim 17, the detect logic further to detect a change to the connectivity after the AV data exchange, wherein, in response to the detected change to the connectivity, the control logic further to place the communication logic into a first operation mode which prevents the second supply voltage from being provided by the communication logic at the channel of the connector.

20. The system of claim 19, wherein the first operation mode is the default operation mode.

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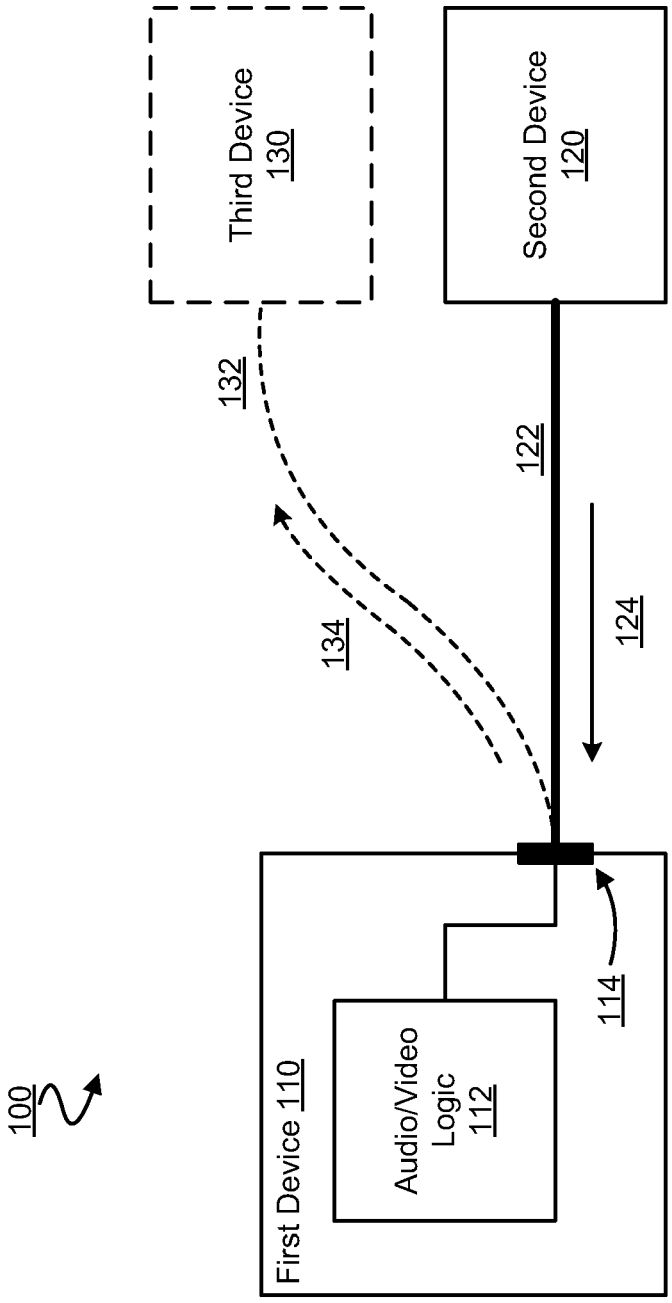

100
First Device 110
Audio/Video Logic 112
114
Third Device 130
Second Device 120
132
134
122
124

FIG. 1

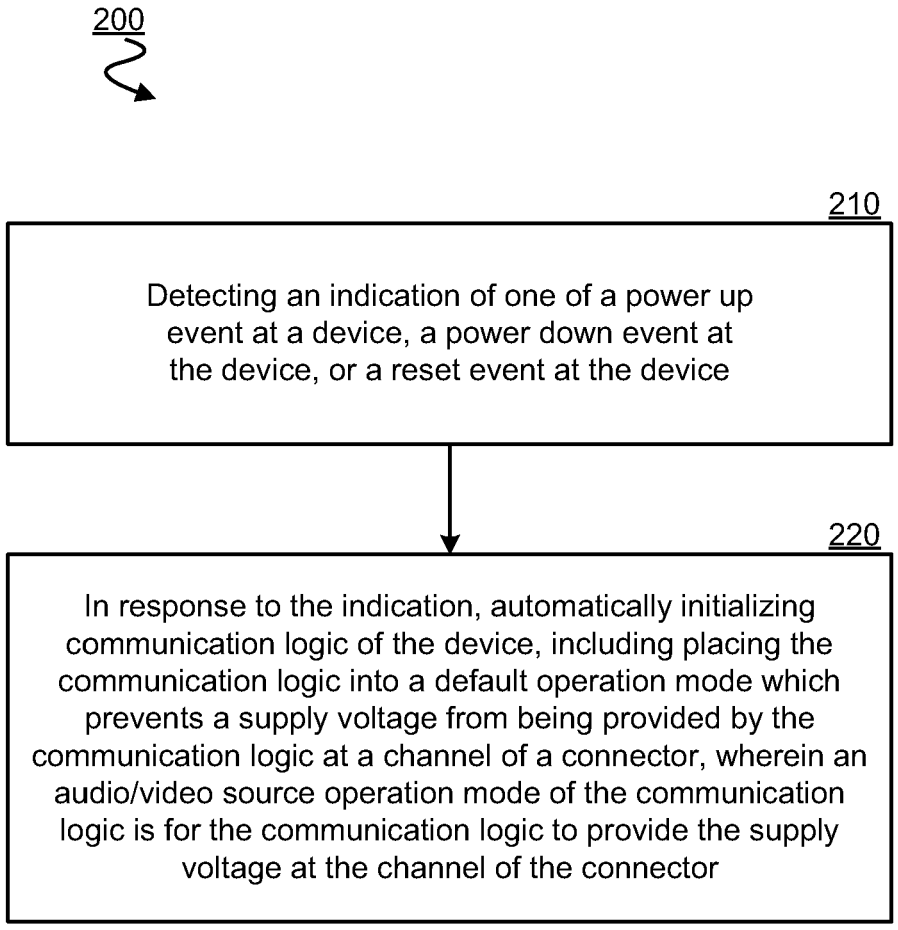

200
210
Detecting an indication of one of a power up event at a device, a power down event at the device, or a reset event at the device
220
In response to the indication, automatically initializing communication logic of the device, including placing the communication logic into a default operation mode which prevents a supply voltage from being provided by the communication logic at a channel of a connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2A

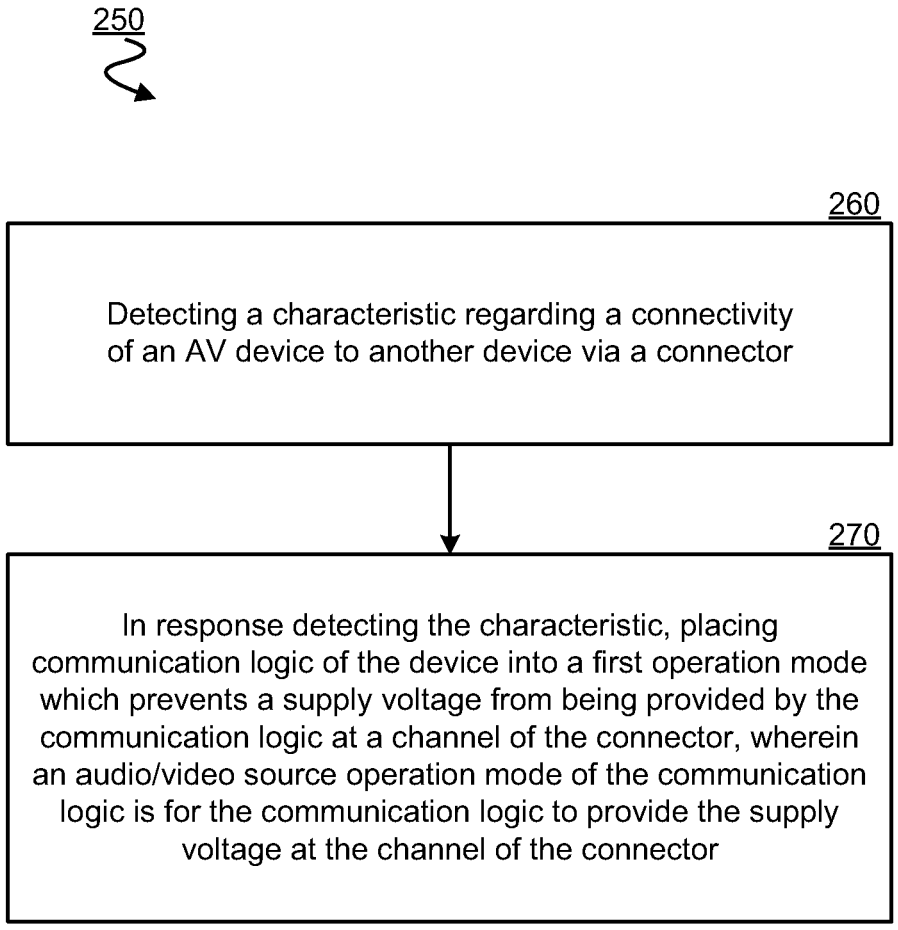

250
260
Detecting a characteristic regarding a connectivity of an AV device to another device via a connector
270
In response detecting the characteristic, placing communication logic of the device into a first operation mode which prevents a supply voltage from being provided by the communication logic at a channel of the connector, wherein an audio/video source operation mode of the communication logic is for the communication logic to provide the supply voltage at the channel of the connector

FIG. 2B

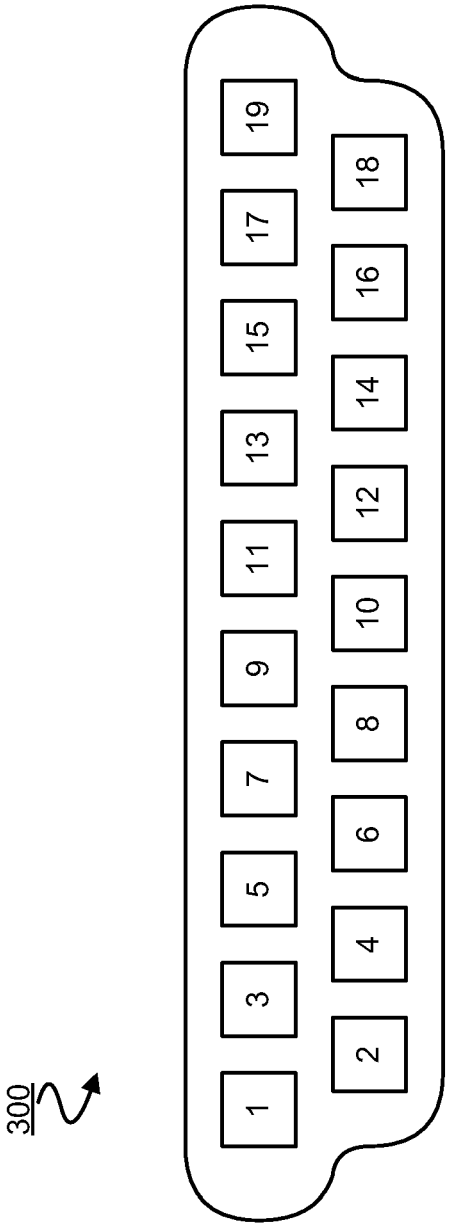


FIG. 3

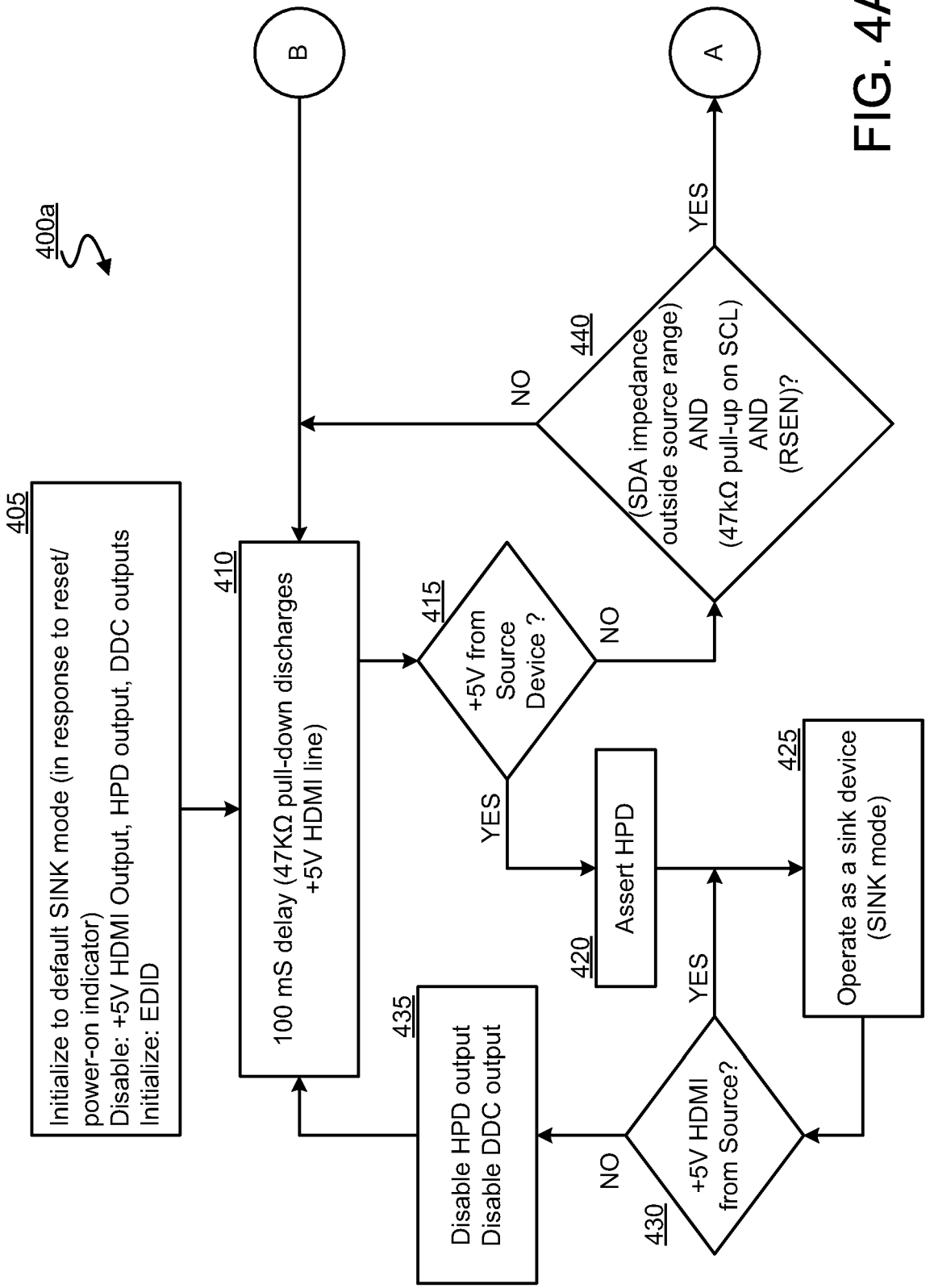

400a
405
Initialize to default SINK mode (in response to reset/ power-on indicator)
Disable: +5V HDMI Output, HPD output, DDC outputs
Initialize: EDID
410
100 mS delay (47KΩ pull-down discharges +5V HDMI line)
415
+5V from Source Device ?
YES
NO
420
Assert HPD
425
Operate as a sink device (SINK mode)
430
+5V HDMI from Source?
YES
NO
435
Disable HPD output
Disable DDC output
440
(SDA impedance outside source range) AND (47kΩ pull-up on SCL) AND (RSEN)?
YES
NO
A
B

FIG. 4A

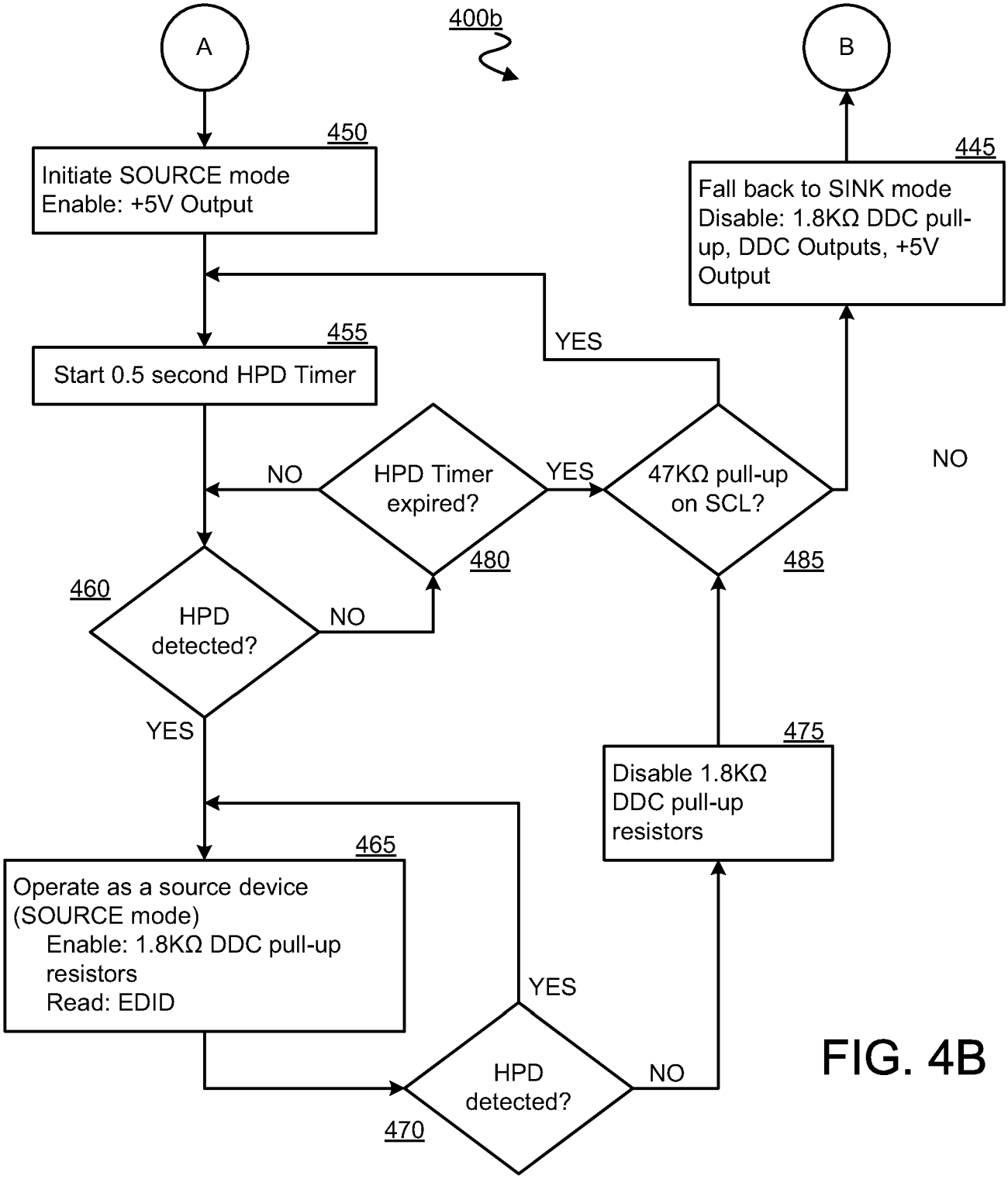

400b
A
B
450
Initiate SOURCE mode
Enable: +5V Output
445
Fall back to SINK mode
Disable: 1.8KΩ DDC pull-up, DDC Outputs, +5V Output
455
Start 0.5 second HPD Timer
YES
NO
HPD Timer expired?
YES
47KΩ pull-up on SCL?
NO
480
485
460
HPD detected?
NO
YES
475
Disable 1.8KΩ DDC pull-up resistors
465
Operate as a source device (SOURCE mode)
Enable: 1.8KΩ DDC pull-up resistors
Read: EDID
YES
HPD detected?
NO
470

FIG. 4B

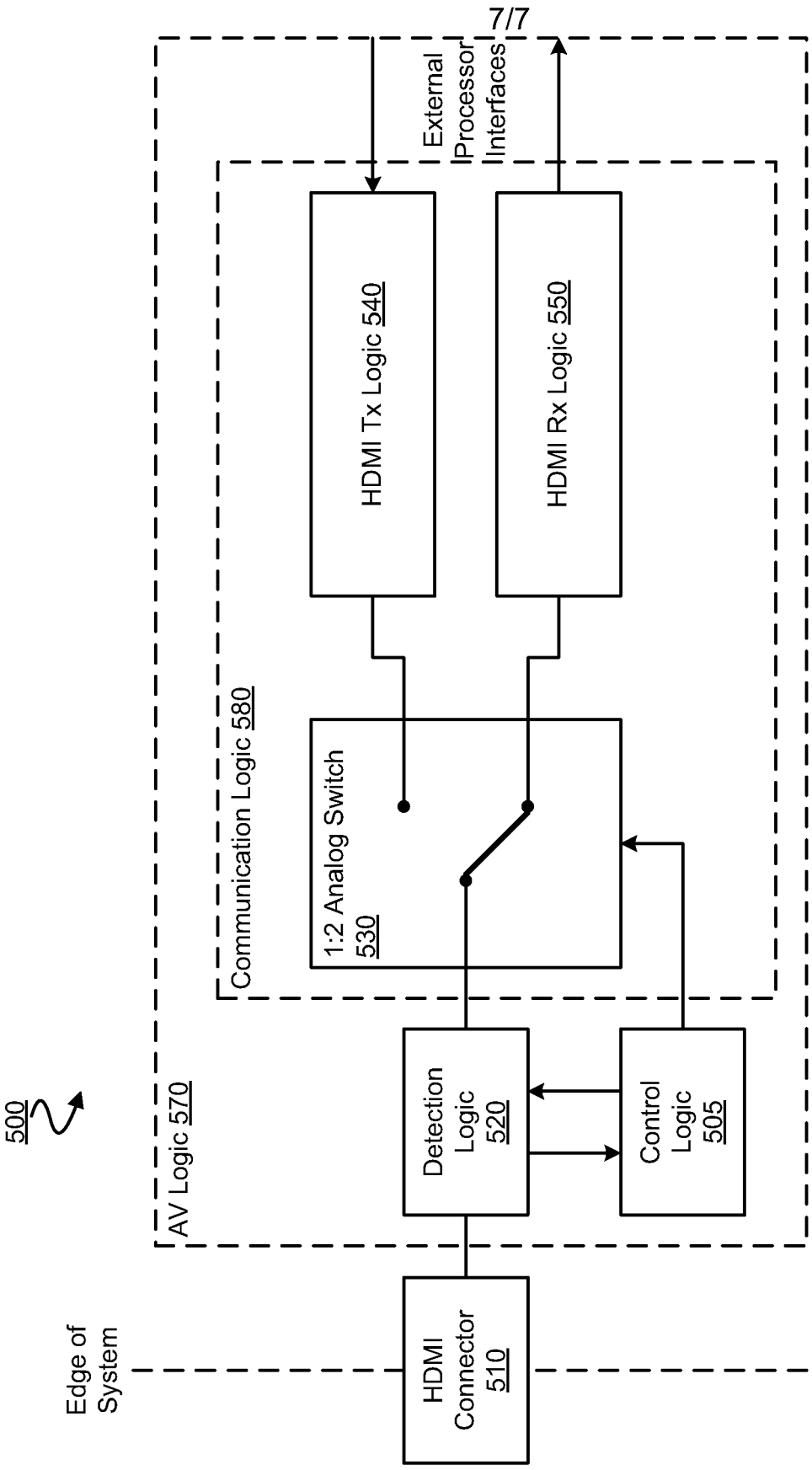

500
AV Logic 570
Edge of System
HDMI Connector 510
Detection Logic 520
Control Logic 505
Communication Logic 580
1:2 Analog Switch 530
HDMI Tx Logic 540
HDMI Rx Logic 550
External Processor Interfaces

FIG. 5