



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY DOCKET NO	TOT CLAIMS	IND CLAIMS
61/780,985	03/14/2013		250	68354.225441		

CONFIRMATION NO. 5303

86528
King & Spalding LLP
401 Congress Avenue
Suite 3200
Austin, TX 78701

FILING RECEIPT



OC000000060876847

Date Mailed: 05/03/2013

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Huamin Zhou, Chandler, AZ;
Woowai Martin, Phoenix, AZ;
Cristian Albina, Chandler, AZ;
Fritz Schlunder, Gilbert, AZ;
Minh Le, Gilbert, AZ;

Applicant(s)

Huamin Zhou, Chandler, AZ;
Woowai Martin, Phoenix, AZ;
Cristian Albina, Chandler, AZ;
Fritz Schlunder, Gilbert, AZ;
Minh Le, Gilbert, AZ;

Power of Attorney:

Richard McNeely--59149

If Required, Foreign Filing License Granted: 05/01/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 61/780,985**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

page 1 of 3

Title

USB REGULATOR WITH CURRENT BUFFER TO REDUCE COMPENSATION CAPACITOR SIZE
AND PROVIDE FOR WIDE RANGE OF ESR VALUES OF EXTERNAL CAPACITOR

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. _____

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Huamin	Zhou	Chandler, AZ
Woowai	Martin	Phoenix, AZ
Cristian	Albina	Chandler, AZ
Fritz	Schlunder	Gilbert, AZ
Minh	Le	Gilbert, AZ
<i>Additional inventors are being named on the _____ separately numbered sheets attached hereto.</i>		
TITLE OF THE INVENTION (500 characters max):		
USB REGULATOR WITH CURRENT BUFFER TO REDUCE COMPENSATION CAPACITOR SIZE AND PROVIDE FOR WIDE RANGE OF ESR VALUES OF EXTERNAL CAPACITOR		
<i>Direct all correspondence to:</i> CORRESPONDENCE ADDRESS		
☒ The address corresponding to Customer Number: 86528		
OR		
☐ Firm or Individual Name		
Address		
City	State	Zip
Country	Telephone	Email
ENCLOSED APPLICATION PARTS (check all that apply)		
☐ Application Data Sheet. See 37 CFR 1.76		
☐ CD(s), Number of CDs _____		
☒ Drawing(s) Number of Sheets <u>7</u>		
☐ Other (specify) _____		
☒ Specification (e.g. description of the invention) Number of Pages <u>5</u>		
Fees Due: Filing Fee of \$220 (\$110 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).		
METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT		
☐ Applicant claims small entity status. See 37 CFR 1.27.		
☐ A check or money order made payable to the <i>Director of the United States Patent and Trademark Office</i> is enclosed to cover the filing fee and application size fee (if applicable).		
☐ Payment by credit card. Form PTO-2038 is attached.		
☒ The Director is hereby authorized to charge the filing fee and application size fee (if applicable) or credit any overpayment to Deposit Account Number: <u>50-4871</u>		
250.00 TOTAL FEE AMOUNT (\$)		

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PROVISIONAL APPLICATION COVER SHEET
Page 2 of 2

PTO/SB/16 (12-08)

Approved for use through 06/30/2010. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.



No.



Yes, the name of the U.S. Government agency and the Government contract number are: _____

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

SIGNATURE _____

Date March 13, 2013

TYPED or PRINTED NAME

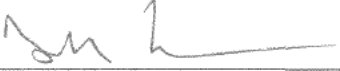
Andreas H. Grubert

REGISTRATION NO. 59,149
(if appropriate)

TELEPHONE

(512) 457-2025

Docket Number: 68354.225441

CERTIFICATE OF FILING ELECTRONICALLY VIA EFS MPEP 503 I HEREBY CERTIFY THAT I HAVE A REASONABLE BASIS FOR BELIEF THAT THIS CORRESPONDENCE IS BEING SUBMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA EFS (ELECTRONICALLY) ON THE DATE INDICATED BELOW, AND IS ADDRESSED TO: HONORABLE COMMISSIONER FOR PATENTS P.O. BOX 1450 ALEXANDRIA, VA 22313-1450  _____ TODD ROSSON DATE OF SUBMISSION: MARCH 13, 2013 ELECTRONIC FILING (EFS)
--

**PROVISIONAL PATENT APPLICATION COVER SHEET
FOR
USB REGULATOR WITH CURRENT BUFFER TO REDUCE
COMPENSATION CAPACITOR SIZE AND PROVIDE FOR
WIDE RANGE OF ESR VALUES OF EXTERNAL CAPACITOR**

Inventors:	Huamin Zhou	Fritz Schlunder
	1553 West Homestead Drive	1129 Nancy Lane
	Chandler, Arizona 85286	Gilbert, Arizona 85296
	Citizenship: China	Citizenship: U.S.A.
	Woowai Martin	Minh Le
	14217 South 5th Street	711 West Desert Ave.
	Phoenix, Arizona 85048	Gilbert, Arizona 85233
	Citizenship: U.S.A.	Citizenship: U.S.A.
	Cristian Albina	
	400 North Coronada St., Apt. 1099	
	Chandler, Arizona 85224	
	Citizenship: Germany	

Assignee: Microchip Technology Incorporated

Attorney: Andreas H. Grubert
King & Spalding LLP
401 Congress Ave.
Suite 3200
Austin, TX 78701
(Customer Number 86528)

Attorney Docket No.: 68354.225441

Client Reference: MTI-3670.US.P

**USB REGULATOR WITH CURRENT BUFFER TO REDUCE
COMPENSATION CAPACITOR SIZE AND PROVIDE FOR
WIDE RANGE OF ESR VALUES OF EXTERNAL CAPACITOR**

TECHNICAL FIELD

[0001] The present disclosure relates to USB voltage regulators, and, more particularly, to a USB voltage regulator having a current buffer to reduce compensation capacitor size and provide for a wide range of external compensation capacitor ESR values.

BACKGROUND

[0002] USB voltage regulators operate with extremely low equivalent series resistance (ESR) values, for example around 10 milliohms. This ESR value is not very accurate because the ceramic capacitor manufacturers rarely specify the value of ESR in their data sheets. Additionally, the exact value depends on the size/voltage rating design of the external capacitor, and can vary based on user connection topology (circuit board layout and components used thereon), *e.g.*, putting multiple small capacitors in parallel, thereby reducing ESR; or using small/long printed circuit board traces to connect to the capacitor, thereby adding copper trace resistance ESR. Typically the external compensated low-drop out (LDO) voltage regulator uses fairly large internal compensation capacitors to separate the non-dominant poles and uses large value external capacitors for stability with a limited range of ESR ratings. The ESR values will heavily impact the design of LDO voltage regulators due to its variable zero pole locations depending upon the load conditions. The existing products having a USB interface use standard voltage regulator architectures that use fairly large internal compensation capacitors to accommodate the change of external capacitor sizes with variations of ESR values in order to keep the LDO voltage regulator stable.

[0003] Referring to Figures 1 and 1A, depicted are various frequency response graphs showing different ESR situations. Figure 1(a) shows a desired normal frequency response. Figure 1(b) shows a situation where the ESR is too high. Figure 1(c) shows a situation where the ESR is too low. And Figure 1(d) shows ESRs resulting in the dreaded "tunnel of death."

SUMMARY

[0004] Therefore a need exists to significantly reduce the capacitance values of the internal compensation capacitor and external capacitor for stabilizing the associated LDO voltage regulator.

[0005] According to various embodiments, a large gm current driver (buffer amplifier) is added between the first stage operation amplifier (OpAmp) and the last stage power transistor, *e.g.*, p-channel metal oxide semiconductor (PMOS) transistor. This buffer amplifier allows significant reduces of the maximum internal capacitance to about 3.7 picofarads, and the maximum external capacitance to about 0.4 microfarads. In addition, the buffer amplifier, according to the teachings of this disclosure, offers the circuit designer a wider range of external capacitor sizes to choose from. The buffer amplifier compensation circuit described and claimed herein by reducing the external capacitor size increases the overall circuit board layout efficiency. In addition according to various embodiments, the USB voltage regulator may consume less power.

[0006] According to various embodiments, various values of ESR may be handled by separating the poles inside of the voltage regulator circuit sufficiently to create an approximate one pole system. Referring to Figure 2, depicted is a schematic block diagram of the USB voltage regulator, according to a specific example embodiment of this disclosure. The USB regulator may comprise a low-gain amplifier stage 202, a low-impedance current buffer driver stage 204, and a power PMOS output stage 206. The key to being able to use smaller value internal and external capacitances is to have a large gm current driver buffer amplifier 204 between the first stage OpAmp 202 and the last stage power PMOS driver 206.

[0007] The input stage OpAmp 202 may be a low-gain, high-bandwidth amplifier comprising diode connected PMOS transistors that lower the output impedance of the folded-cascode amplifier. Referring to Figure 3, a folded-cascode amplifier design was selected for the input stage OpAmp 202 for two reasons: (1) This design has a fairly large working bandwidth, and (2) the output stage thereof acts like a source follower which is an advantage for overall compensation of the regulator system. The output stage from the amplifier then connects to the gate of the PMOS second stage. The low impedance looking into the amplifier creates a fairly high frequency pole that would be irrelevant to interact with the system dominant pole, thereby

allowing easier frequency compensation. The current driver stage of the regulator creates a low impedance environment using the current buffer to separate the poles seen on the big PMOS output stage 206 and the internal stages of the regulator. By literally pushing this pole to a high frequency domain, effectively leaves the only dominant pole at the output. To achieve such operation, a Gm-boost stage may be used and is shown more fully in Figure 4.

[0008] Referring to Figure 4, depicted is a schematic diagram of the Gm-boost, current driver and current feedback circuits, according to specific embodiments of this disclosure. The gm of the PMOS current buffer driver 204 may be coupled to two sources of currents, one from the bias network and the other as current feedback 210 from the output stage 206. The bias network is fixed by transistor N1. Then these currents are ratio'ed in transistor P1 to provide a sufficient amount of current for the driver transistor Pd but not enough to increase more current based upon a limited current mirror by transistor N1. The feedback network 212 coupled to the output transistor Pw actively provides current to the current driver transistor Pd when the regulation circuit experiences different output load conditions. The only compensation capacitor required between the output stage of the amplifier and the output stage of the regulator need only be sized to make sure that the poles are even further well separated. This value is limited to a small number which helps in stabilizing the regulator system. With the simple current buffer 204, the voltage regulator acts like a pseudo "one-pole" system that is independent from the output pole changing so long as it falls within the bandwidth of the system. Thus, the range of ESR is extended along with the output capacitance. Therefore a wider range of external capacitors may be effectively used, according to the teachings of this disclosure.

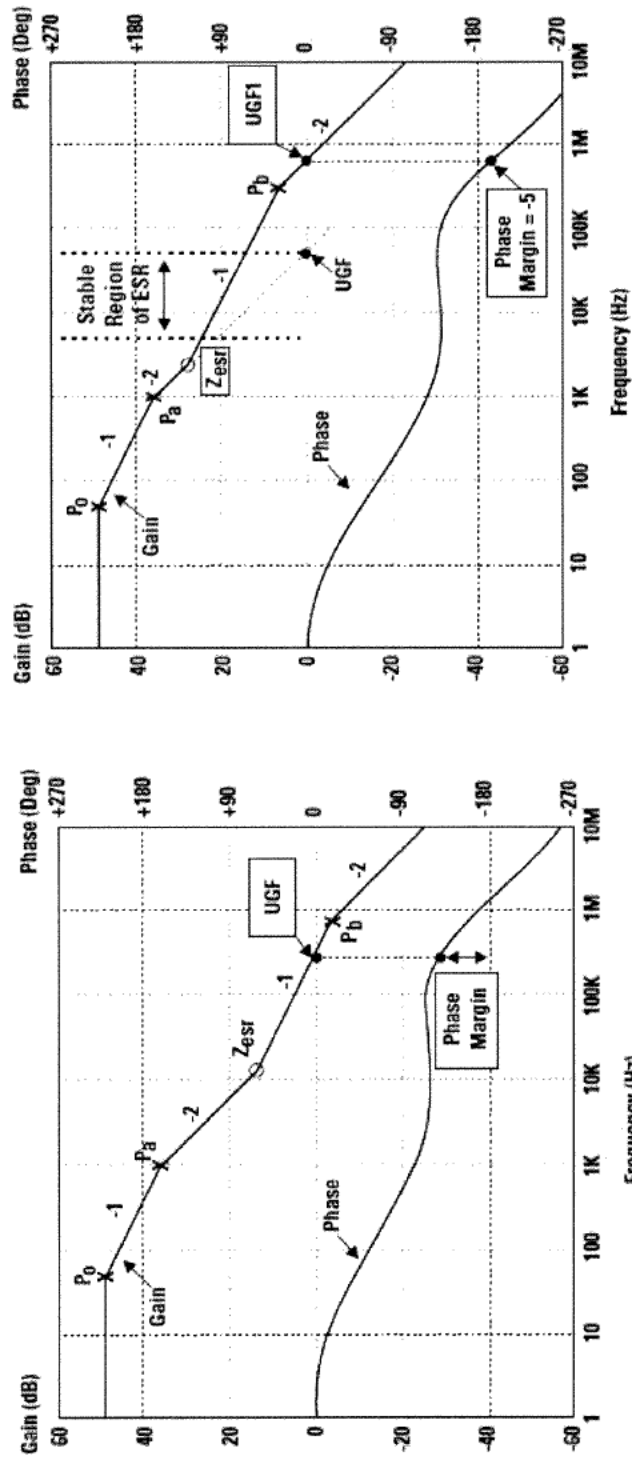
[0009] Referring to Figures 5 and 6, depicted are transient and regulation response curves, according to the teachings of this disclosure.

[0010] While embodiments of this disclosure have been depicted, described, and are defined by reference to example embodiments of the disclosure, such references do not imply a limitation on the disclosure, and no such limitation is to be inferred. The subject matter disclosed is capable of considerable modification, alteration, and equivalents in form and function, as will occur to those ordinarily skilled in the pertinent art and having the benefit of this disclosure. The depicted and described embodiments of this disclosure are examples only, and are not exhaustive of the scope of the disclosure.

CLAIMS

What is claimed is:

1. A low drop out voltage regulator, comprising:
an input operational amplifier, wherein the input operational amplifier is low gain and high bandwidth;
a current buffer driver, wherein the current buffer driver is low impedance;
an output power driver, wherein the current buffer driver is coupled between the input operational amplifier and the output power driver;
a current feedback circuit coupled between the output power driver and the current buffer driver; and
a feedback loop coupled between the output power driver and the input operational amplifier.
2. The low drop out voltage regulator according to claim 1, further comprising a gm-boost circuit coupled to the current buffer driver.
3. The low drop out voltage regulator according to claim 1, further comprising a bias circuit coupled to the current buffer driver.
4. The low drop out voltage regulator according to claim 1, further comprising an external compensation capacitor coupled between the output power driver and the input operational amplifier.

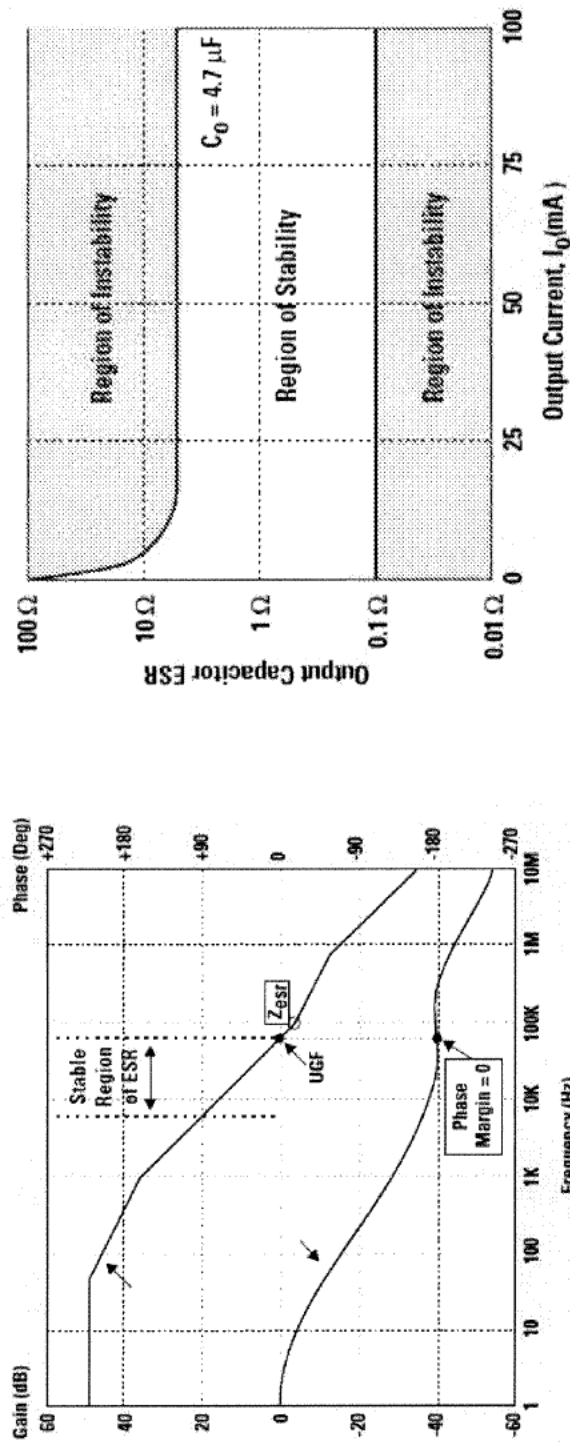


(a) Normal frequency response

(b) ESR value too high

FIGURE 1

Title: USB Regulator with Current Buffer To Reduce Compensation Capacitor Size and
 Provide for Wide Range of ESR Values Of External Capacitor³
 Inventors: Huamin Zhou, Woowai Martin, Cristian Albina, Fritz Schlunder and Minh Le
 Att'y Docket No.: 68354.225441



(c) ESR value too low

(d) "Tunnel of death"

FIGURE 1A

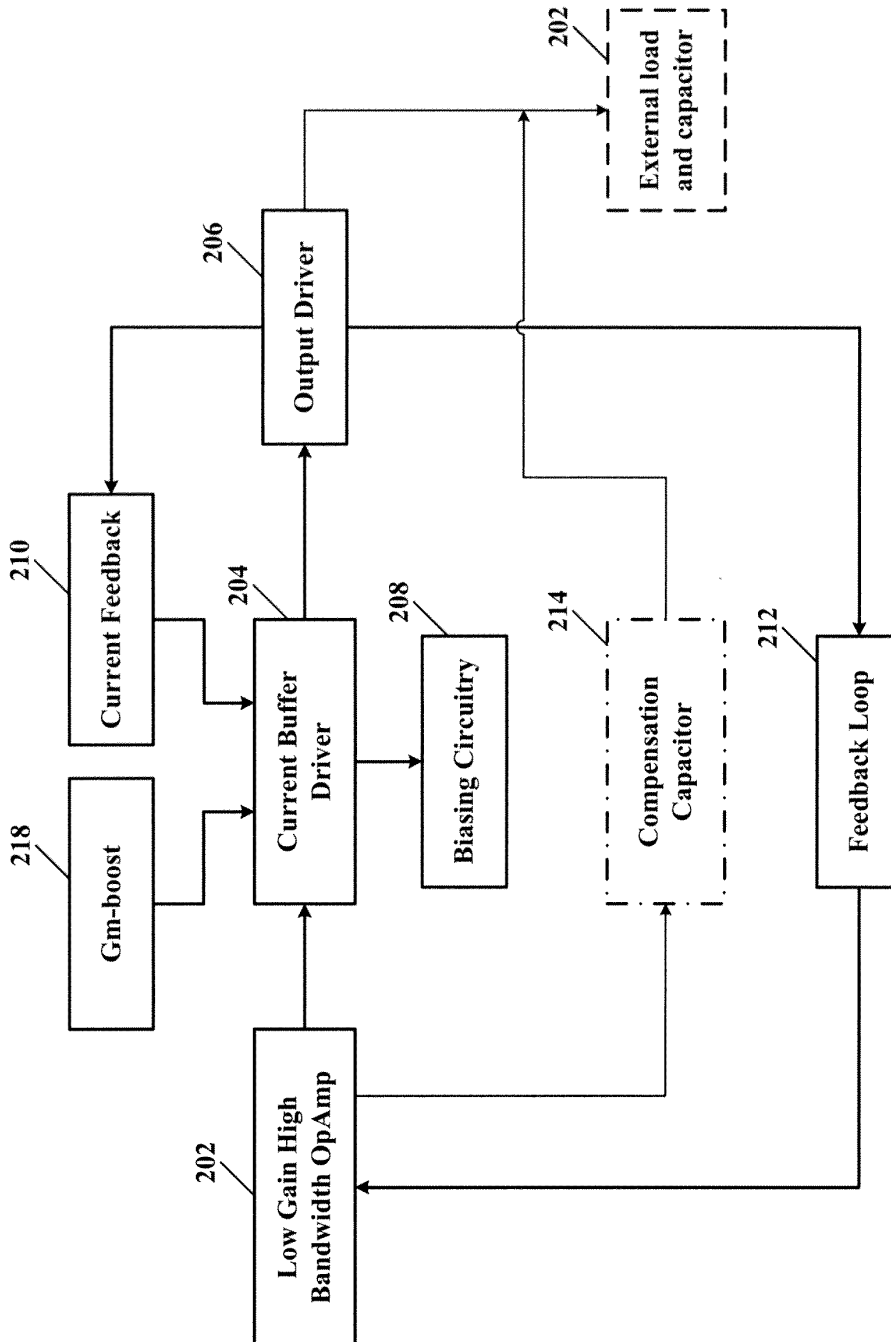


FIGURE 2

Title: USB Regulator with Current Buffer To Reduce Compensation Capacitor Size and Provide for Wide Range of ESR Values Of External Capacitor”
 Inventors: Huamin Zhou, Woowai Martin, Cristian Albina, Fritz Schlunder and Minh Le
 Att’y Docket No.: 68354.225441

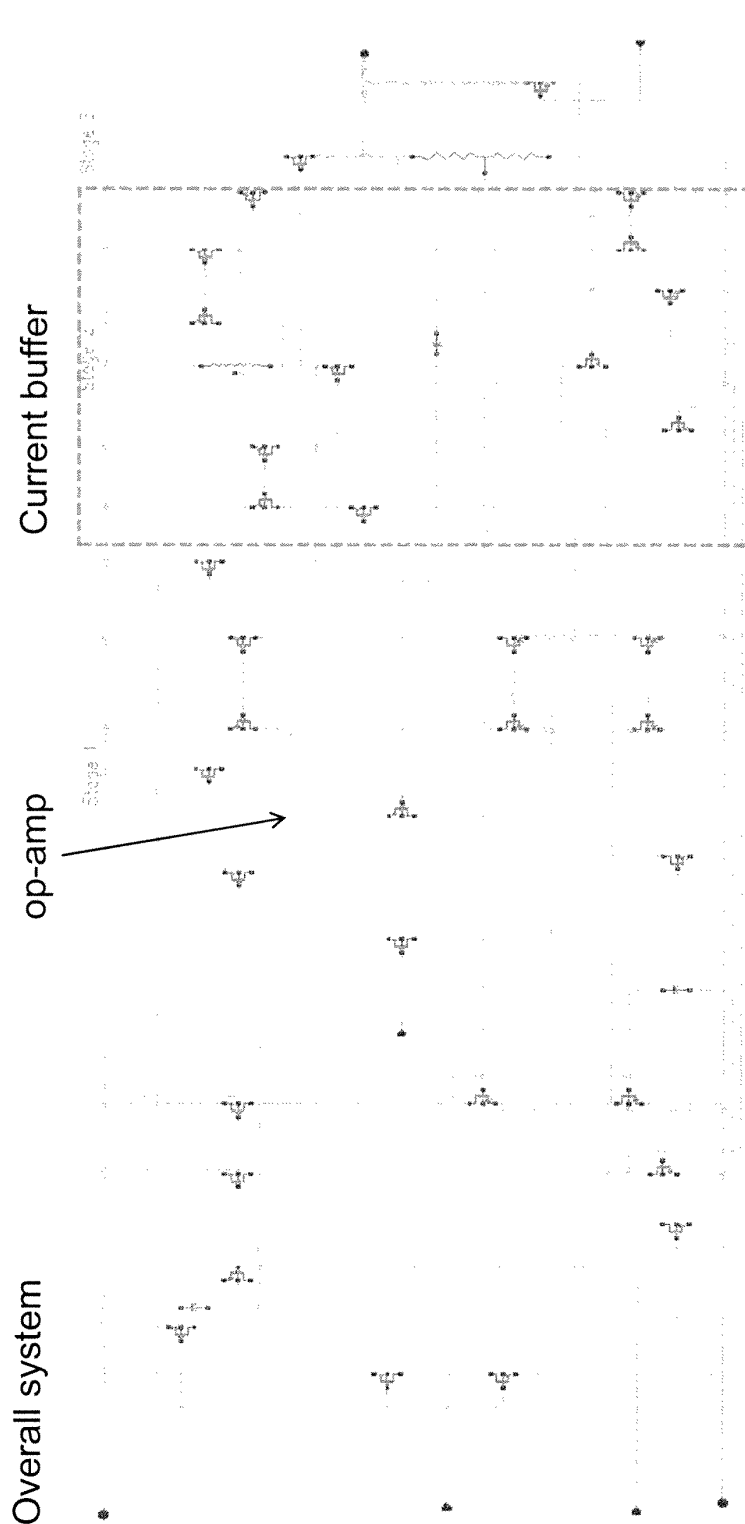


FIGURE 3

Title: USB Regulator with Current Buffer To Reduce Compensation Capacitor Size and Provide for Wide Range of ESR Values Of External Capacitor”
 Inventors: Huamin Zhou, Woowai Martin, Cristian Albina, Fritz Schlunder and Minh Le
 Att’y Docket No.: 68354.225441

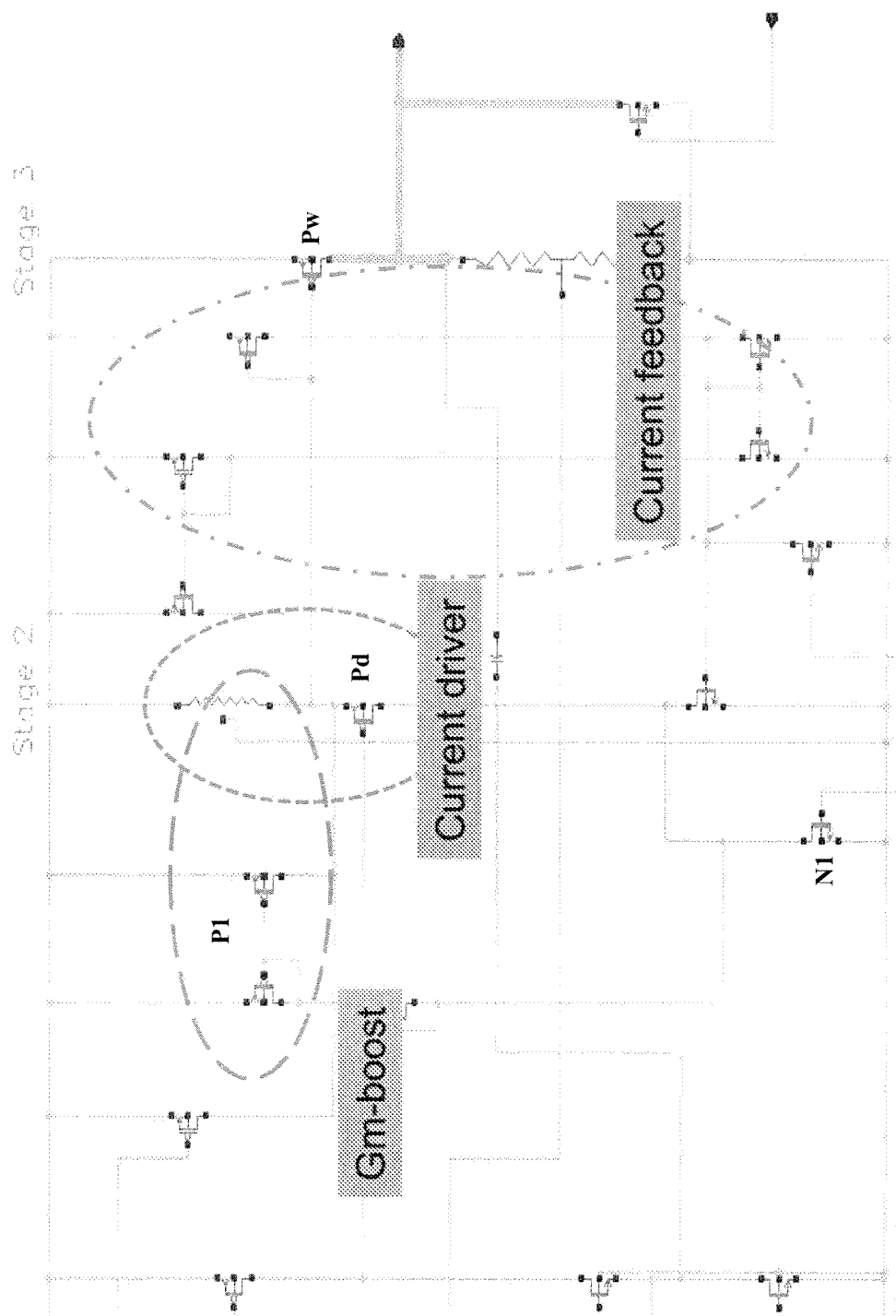


FIGURE 4

Title: USB Regulator with Current Buffer To Reduce Compensation Capacitor Size and
 Provide for Wide Range of ESR Values Of External Capacitor”
 Inventors: Huamin Zhou, Woowai Martin, Cristian Albina, Fritz Schlunder and Minh Le
 Att’y Docket No.: 68354.225441

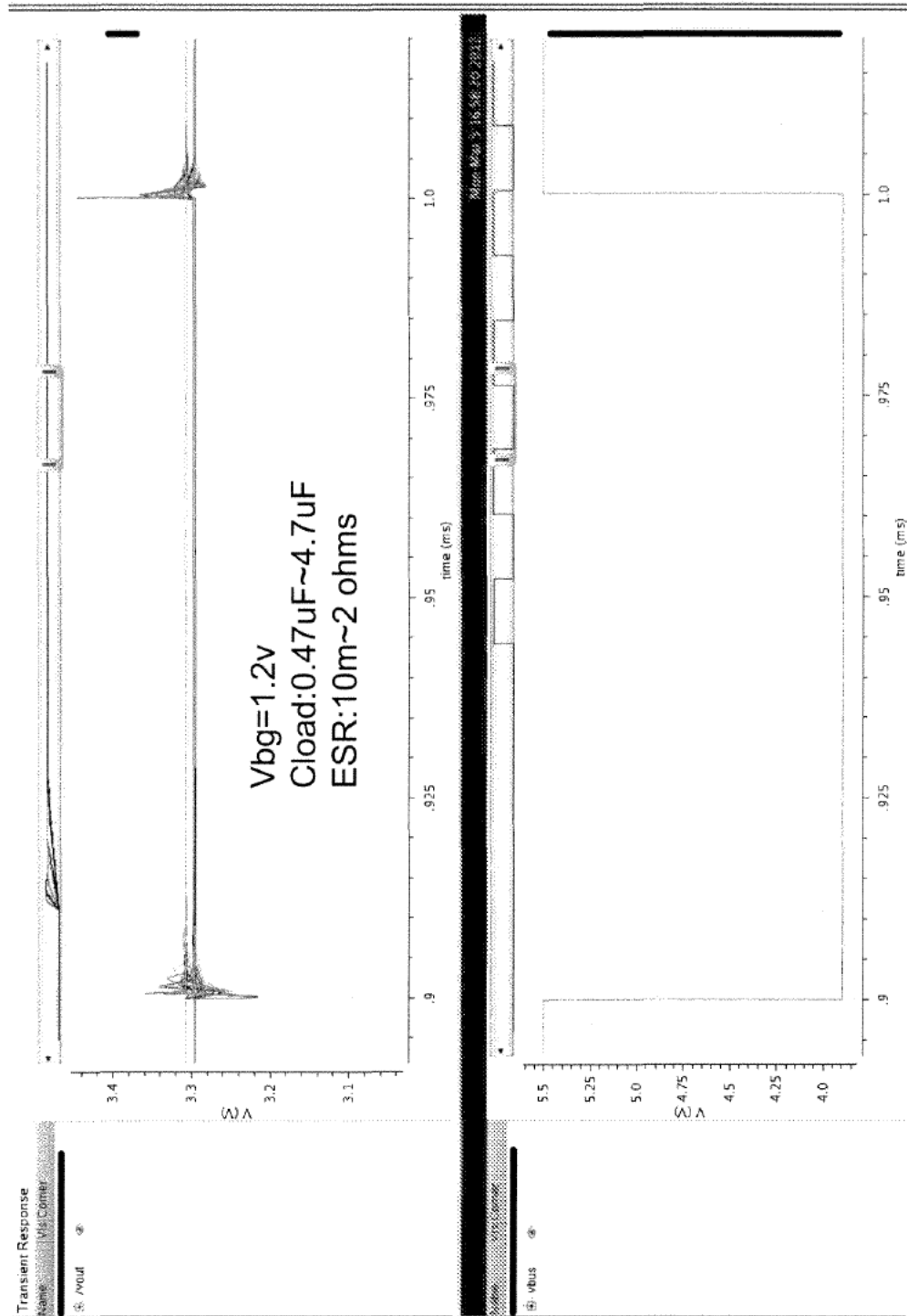
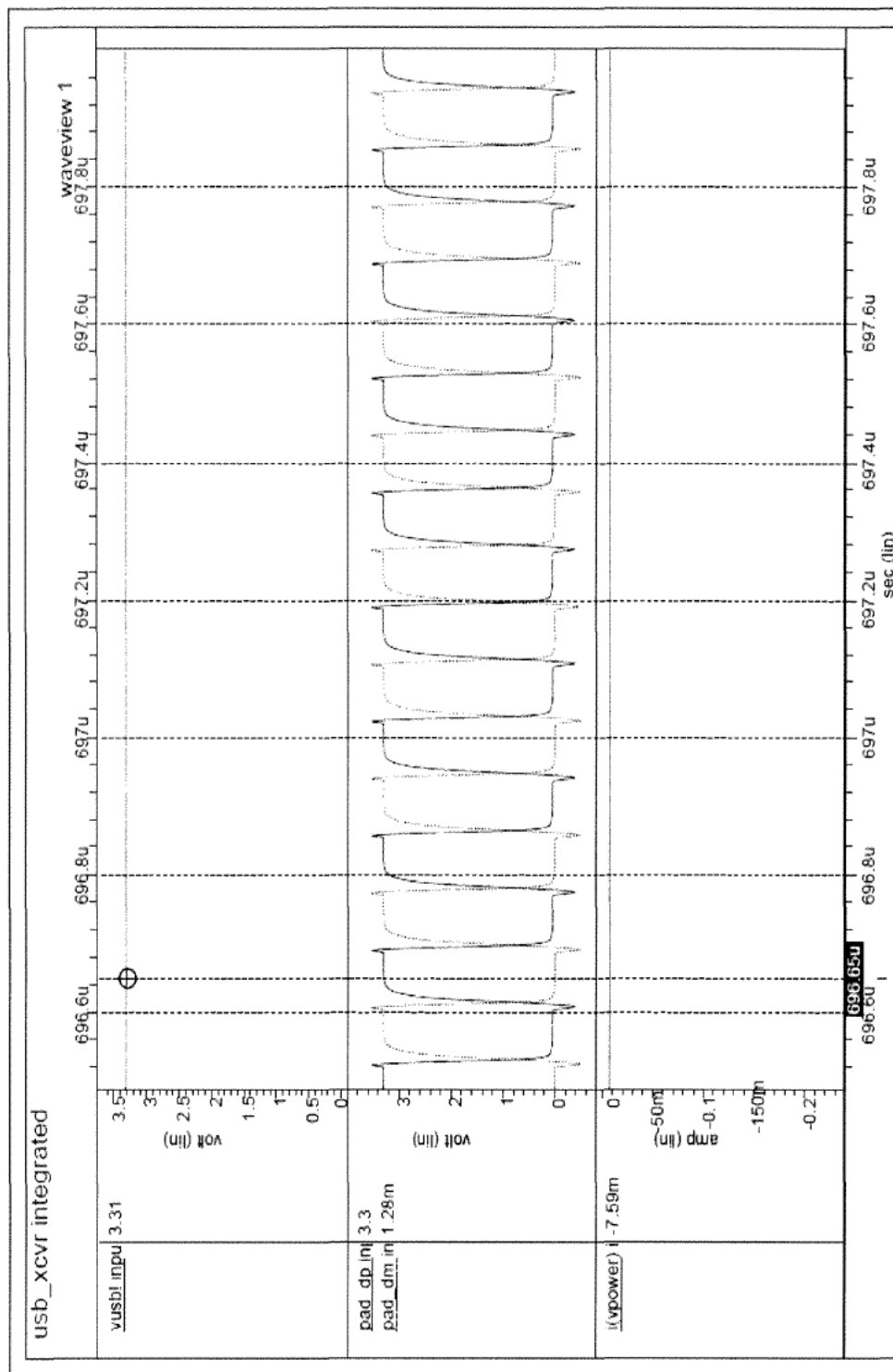


FIGURE 5

Title: USB Regulator with Current Buffer To Reduce Compensation Capacitor Size and
 Provide for Wide Range of ESR Values Of External Capacitor[®]
 Inventors: Huamin Zhou, Woowai Martin, Cristian Albina, Fritz Schlunder and Minh Le
 Att'y Docket No.: 68354.225441



Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		USB REGULATOR WITH CURRENT BUFFER TO REDUCE COMPENSATION CAPACITOR SIZE AND PROVIDE FOR WIDE RANGE OF ESR VALUES OF EXTERNAL CAPACITOR		
First Named Inventor/Applicant Name:		Huamin Zhou		
Filer:		Eric M. Grabski/Todd Rosson		
Attorney Docket Number:		68354.225441		
Filed as Large Entity				
Provisional Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Provisional Application Filing	1005	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				250

Electronic Acknowledgement Receipt	
EFS ID:	15215848
Application Number:	61780985
International Application Number:	
Confirmation Number:	5303
Title of Invention:	USB REGULATOR WITH CURRENT BUFFER TO REDUCE COMPENSATION CAPACITOR SIZE AND PROVIDE FOR WIDE RANGE OF ESR VALUES OF EXTERNAL CAPACITOR
First Named Inventor/Applicant Name:	Huamin Zhou
Customer Number:	86528
Filer:	Eric M. Grabski/Todd Rosson
Filer Authorized By:	Eric M. Grabski
Attorney Docket Number:	68354.225441
Receipt Date:	14-MAR-2013
Filing Date:	
Time Stamp:	00:11:54
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$250
RAM confirmation Number	18403
Deposit Account	504871
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Provisional_Application_225441.pdf	1119513 ba0770e94c78d6758e84e3751ca31d7bdd241cb	yes	14

Multipart Description/PDF files in .zip description

Document Description	Start	End
Provisional Cover Sheet (SB16)	1	2
Specification	3	6
Claims	7	7
Drawings-other than black and white line drawings	8	14

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30260 fac433a5d1a985f88cc874a1ffbe344de962cf4e	no	2
---	----------------------	--------------	---	----	---

Warnings:

Information:

Total Files Size (in bytes): 1149773

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

SCORE Placeholder Sheet for IFW Content

Application Number: 61780985

Document Date: 03/14/2013

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

- Drawing

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

To access the documents in the SCORE database, refer to instructions developed by SIRA.

At the time of document entry (noted above):

- Examiners may access SCORE content via the eDAN interface.
- Other USPTO employees can bookmark the current SCORE URL (<http://es/ScoreAccessWeb/>).
- External customers may access SCORE content via the Public and Private PAIR interfaces.

Form Revision Date: February 8, 2006