Semiconductor device and semiconductor device module

Images (15)

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Original Assignee: Fuji Electric Co., Ltd.

Worldwide applications: 2018 JP 2019 CN 2019 DE

Application: JP2018202553A events: 2018-10-29

2020-04-28 - Priority to JP2018202553A

2020-05-28 - Application filed by JP2020135465A

2020-05-28 - Priority to JP2020135465A

2021-10-07 - Publication of JP2021158268A

2021-10-07 - Application granted

2021-10-07 - Publication of JP6931884B2

Status - Active

Prior art keywords - Semiconductor device

Prior art keywords - Semiconductor device module

Latest update: Popular statistics | Citations | Similarity | Legal events | Family | Examiner | Related Cases | Sequence | Global Dossier | Discuss

Classifications

- H01L29/739 - Transistors operated from gate electrode by voltage control, e.g. MOS-gated transistors, e.g. MOSFETs, controlled by current or voltage signals, e.g. "Gate-Turn-Off" devices, "Static Induction Transistors" [SIT], "Static Induction Thyristors" [SITH], "Gate-Turn-Off" [GTO] devices, "Light-Activated Devices" [LAD]
- H01L29/7393 - Insulated gate bipolar transistors [IGBT]

Abstract

The present invention relates to a semiconductor device and a semiconductor device module, and to a semiconductor device and a semiconductor device module having a short circuit protection function for a semiconductor element, and an object thereof is to provide a semiconductor device.

A semiconductor device is provided with a semiconductor element, a first current detection element, a second current detection element, and a control circuit configured to switch an IGBT (Insulated Gate Bipolar Transistor). In addition, a short circuit determination circuit configured to determine a short circuit state of the semiconductor element based on a current detected by the first current detection element and a current detected by the second current detection element, and a short circuit protection circuit configured to perform a short circuit protection operation of the semiconductor element when a short circuit state is determined by the short circuit determination circuit, are provided.

For example, "Patent Document 1" discloses a configuration in which a short circuit protection function is provided in a control circuit configured to switch an IGBT (Insulated Gate Bipolar Transistor) and a current detection element is provided in an IGBT chip.

[omitted]

Further, in order to control a loss generated in the short circuit operation and to control a short circuit current, it is preferable that a short circuit current is detected by using a plurality of current detection elements.

Further, when the wiring length from the power-side main electrode of the current detection element to a control circuit is long, a wiring inductance is generated in a wiring for connecting the current detection element and the control circuit, and a voltage is generated in the wiring due to a change in a current.

The present invention has been made in view of the above problems, and an object thereof is to provide a semiconductor device and a semiconductor device module having a short circuit protection function for a semiconductor element, which can suppress a change in a current detected by a current detection element due to a change in a voltage generated in a wiring for connecting the current detection element and a control circuit, and which can suppressing a short circuit current and a short circuit loss in a short circuit state of a semiconductor element, and which can reduce a short circuit protection operation time, and which can reduce a short circuit protection operation time in a short circuit state of a semiconductor element, and which can suppress a change in a current detected by a current detection element due to a change in a voltage generated in a wiring for connecting a current detection element and a control circuit, and which can suppressing a short circuit current and a short circuit loss in a short circuit state of a semiconductor element

US9322852B2 *	2014-07-15	2016-04-26	Ford Global Technologies, Llc	Gate drive under-voltage detection
JP6086101B2 *	2014-07-16	2017-03-01	トヨタ自動車株式会社	Semiconductor device
CN109302169B *	2018-08-23	2022-04-22	北京长峰天通科技有限公司	SiC MOSFET drive protection circuit and protection method thereof
WO2021072746A1 *	2019-10-18	2021-04-22	Texas Instruments Incorporated	Pin-short detection circuits

* Cited by examiner, † Cited by third party, ‡ Family to family citation

Similar Documents

Publication	Publication Date	Title
JP4531500B2	2010-08-25	Semiconductor device and semiconductor device module
US9059709B2	2015-06-16	Gate drive circuit for transistor
JP4619812B2	2011-01-26	Gate drive circuit
JP4360310B2	2009-11-11	Drive device
JP4961977B2	2012-06-27	Overcurrent protection circuit
US7595667B2	2009-09-29	Drive circuit
JP6428939B2	2018-11-28	Semiconductor device
JP4420012B2	2010-02-24	Overcurrent protection circuit
JPH09200017A	1997-07-31	Semiconductor device
JP4779549B2	2011-09-28	A gate driving circuit of a voltage driven semiconductor element.
JP2010130822A	2010-06-10	Semiconductor device
US9444249B2	2016-09-13	Semiconductor driving device and semiconductor device
JP3665565B2	2005-06-29	Semiconductor integrated circuit and motor drive control system
JP5287921B2	2013-09-11	Load drive device
JP2006296119A	2006-10-26	Drive circuit of semiconductor switching element
JP2005304113A	2005-10-27	Drive circuit of switching element
US20070001742A1	2007-01-04	Driving circuit for switching elements
JP7095388B2	2022-07-05	Drive device for totem pole circuit
JP2006187101A	2006-07-13	Method of driving voltage driver element
JP2019110431A	2019-07-04	Semiconductor device and power module
US6531894B2	2003-03-11	Pulse generation circuit and a drive circuit
JP2010011131A	2010-01-14	Switching drive circuit
US20210242864A1	2021-08-05	Switch circuit capable of overcurrent protection with small and simple circuit, and with simple operation, without affecting normal operation
JP2010124046A	2010-06-03	Level shift circuit
US11309893B2	2022-04-19	Drive circuit

Priority And Related Applications

Priority Applications (2)

Application	Priority date	Filing date	Title
JP2004001057		2004-01-06	
JP2004262033A	2004-01-06	2004-09-09	Semiconductor device and semiconductor device module

Applications Claiming Priority (5)

Application	Filing date	Title
JP2004262033A	2004-09-09	Semiconductor device and semiconductor device module
DE102004062224A	2004-12-23	Semiconductor device and semiconductor device module
US11/023,590	2004-12-29	Semiconductor device which realizes a short-circuit protection function without shunt resistor, and semiconductor device module
KR1020050000345A	2005-01-04	Semiconductor device and semiconductor device module
CN2005100040300A	2005-01-05	Semiconductor device and semiconductor device module

Legal Events

Date	Code	Title	Description
2007-01-16	A521	Request for written amendment filed	**Free format text**: JAPANESE INTERMEDIATE CODE: A523 **Effective date**: 20070115
2007-01-16	A621	Written request for application examination	**Free format text**: JAPANESE INTERMEDIATE CODE: A621 **Effective date**: 20070115
2009-11-27	RD04	Notification of resignation of power of attorney	**Free format text**: JAPANESE INTERMEDIATE CODE: A7424 **Effective date**: 20091126
2010-04-01	A977	Report on retrieval	**Free format text**: JAPANESE INTERMEDIATE CODE: A971007 **Effective date**: 20100331
2010-04-07	A131	Notification of reasons for refusal	**Free format text**: JAPANESE INTERMEDIATE CODE: A131 **Effective date**: 20100406
2010-05-22	A521	Request for written amendment filed	**Free format text**: JAPANESE INTERMEDIATE CODE: A523 **Effective date**: 20100521
2010-06-03	TRDD	Decision of grant or rejection written	
2010-06-09	A01	Written decision to grant a patent or to grant a registration (utility model)	**Free format text**: JAPANESE INTERMEDIATE CODE: A01 **Effective date**: 20100608
2010-06-10	A01	Written decision to grant a patent or to grant a registration (utility model)	**Free format text**: JAPANESE INTERMEDIATE CODE: A01
2010-06-17	A61	First payment of annual fees (during grant procedure)	**Free format text**: JAPANESE INTERMEDIATE CODE: A61 **Effective date**: 20100609
2010-06-18	R150	Certificate of patent or registration of utility model	**Ref document number**: 4531500 **Country of ref document**: JP **Free format text**: JAPANESE INTERMEDIATE CODE: R150 **Free format text**: JAPANESE INTERMEDIATE CODE: R150
2010-06-21	FPAY	Renewal fee payment (event date is renewal date of database)	**Free format text**: PAYMENT UNTIL: 20130618 **Year of fee payment**: 3
2016-05-17	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2017-05-23	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2018-05-22	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2019-05-21	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2020-05-29	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2020-10-02	S111	Request for change of ownership or part of ownership	**Free format text**: JAPANESE INTERMEDIATE CODE: R313113
2020-10-16	R350	Written notification of registration of transfer	**Free format text**: JAPANESE INTERMEDIATE CODE: R350
2021-05-31	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2022-03-08	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250

Concepts

machine-extracted

Download Filter table

Name	Image	Sections	Count	Query match
semiconductor		title,claims,description	30	0.000
detection method		claims,description	26	0.000
controlling effect		claims,description	9	0.000
complement		claims,description	4	0.000

Show all concepts from the description section

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