Data Sheet
1SD536F2-CM2400HC-34N

Single-Channel SCALE Plug-and-Play IGBT Driver

Ultra-compact, high-performance driver for 2-level, 3-level and multilevel converters

Abstract

The SCALE plug-and-play driver 1SD536F2-CM2400HC-34N is an ultra-compact single-channel intelligent gate driver designed for Mitsubishi's high-power IGBTs of type CM2400HC-34N. The driver features a fiber-optic interface, a built-in DC/DC power supply and a selectable operating mode via a jumper.

For drivers adapted to other types of high-power and high-voltage IGBT modules, refer to www.IGBT-Driver.com/go/plug-and-play

Product Highlights

- Plug-and-play solution
- Protects the IGBT from short-circuit failure
- Active clamping of V_{ce} at turn-off
- Extremely reliable; long service life
- No electrolytic capacitors
- Gate current up to ±36A
- Electrical insulation 4000 V_{AC}
- Fiber-optic links
- Monitoring of supply voltage and fiber optics
- Switching frequency DC to max. 8kHz
- Duty cycle 0... 100%
- Built-in DC/DC power supply
- Shortens application development time

Applications

- Three/multi-level converters
- Two-level converters
- Medium-voltage converters
- Industrial drives
- Traction
- Railroad power supplies
- Wind-power converters
- Radiology and laser technology
- Research
- Almost all other conceivable applications

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Important Notes

This data sheet contains only product-specific data. For a detailed description, must-read application notes and common data that apply to the whole series, please refer to the “Description & Application Manual for 1SD536F2 SCALE High-Power IGBT Drivers”.

When applying SCALE plug-and-play drivers, please note that these drivers are specifically adapted to a particular type of IGBT module. Therefore, the type designation of SCALE plug-and-play drivers also includes the type designation of the corresponding IGBT module. **These drivers are not valid for IGBT modules other than those specified. Incorrect use may result in failure.**

Mechanical and Electrical Interfaces

Dimensions: 193 x 50mm. Mounting Principle: Direct screw mount on IGBT.

Interface	Remarks	Part type #
Drive signal input (Standard)	Fiber-optic receiver (Notes 16,18)	HFBR-2522
Drive signal input (Opt. 01)	Fiber-optic receiver (Notes 16,20)	HFBR-2412T
Status output (Standard)	Fiber-optic transmitter (Notes 16,19)	HFBR-1522
Status output (Opt. 01)	Fiber-optic transmitter (Notes 16,21)	HFBR-1412T
Power supply connector	On-board connector (Note 17)	77315-101-05

Power supply connector	Designator	Pin numbers
Ground	GND	1, 2, 4, 5
Supply voltage	V_{DC}	3

Absolute Maximum Ratings

Parameter	Remarks	Min	Max	Units
Supply voltage V_{DC}	VDC to GND (Note 1)	0	16	V
Gate peak current I_{out}	Note 8	-36	+36	A
Average supply current I_{DC}	Note 3		500	mA
Output power DC/DC converter	Notes 3,12		5	W
Switching frequency	Note 12		8	kHz
Test voltage (50Hz/1min)	Primary to output (Note 15)		4000	$V_{AC(eff)}$
DC-link voltage	Note 5		1200	V
Operating temperature	Note 12	-40	+85	°C
Storage temperature		-40	+90	°C

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Electrical Characteristics

All data refer to +25°C and V_{DC} = 15V unless otherwise specified

Power supply	**Remarks**	**Min**	**Typ.**	**Max**	**Units**
Nominal supply voltage V_{DC}	VDC to GND (Note 1)	14.5	15	15.5	V
Supply current I_{DC}	Without load (Note 2)				
	Standard		120		mA
	Opt. 01		125		mA
Efficiency η	Internal DC/DC converter		85		%
Turn-on threshold V_{th}	Note 4		13		V
Hysteresis on/off	Note 4		0.6		V
Coupling capacitance C_{io}	Primary to output		15		pF

Short-circuit protection	**Remarks**	**Min**	**Typ.**	**Max**	**Units**
V_{ce} monitoring threshold	Between aux. terminals	50		60	V
Response time	3-level mode (Note 11)		8.5	9	µs
Response time	2-level mode (Note 6)		9.5	10	µs
Blocking time	2-level mode (Note 7)		1		s

Timing characteristics	**Remarks**	**Min**	**Typ.**	**Max**	**Units**
Turn-on delay $t_{pd(on)}$	Note 13		350		ns
Turn-off delay $t_{pd(off)}$	Note 13		450		ns
Output rise time $t_{r(out)}$	Note 9		15		ns
Output fall time $t_{f(out)}$	Note 9		20		ns
Acknowledge delay time	At status output (Note 14)		380		ns
Acknowledge pulse width	At status output	0.6		1.8	µs

Gate output	**Remarks**	**Min**	**Typ.**	**Max**	**Units**
Turn-on gate resistor $R_{g(on)}$	Note 8		0.7		Ω
Turn-off gate resistor $R_{g(off)}$	Note 8		1.7		Ω

Electrical insulation	**Remarks**	**Min**	**Typ.**	**Max**	**Units**
Operating voltage (Note 10)	Continuous or repeated			1700	V
Test voltage (50Hz/1min)	Primary to output (Note 15)			4000	$V_{AC(eff)}$
Partial discharge extinction volt.	IEC1287 / <10pC	1400			$V_{AC(eff)}$
Creepage distance	Primary to output	21			mm

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di/dt feedback		Remarks
di/dt feedback implemented	Note 22	no

Footnotes to the key data

1) Supply voltages higher than those specified can lead to the destruction of the driver and protection circuits on the output side. The gate-emitter voltage tracks the primary supply voltage. (Not regulated by the supply circuitry or the gate drive unit.)
2) Static power consumption of the gate driver.
3) If the specified power consumption is exceeded on average, this indicates an overload of the DC/DC converter. The DC/DC converter is not protected against overload.
4) Under-voltage monitoring of power supply. For a voltage lower than this limit, the power modules are switched off. The voltage refers to the secondary supply voltage of the gate driver, which is approximately the same as the voltage between VDC and GND.
5) This limit is due to active clamping. Refer to the “Description and Application Manual for 1SD536F2 SCALE High-Power IGBT Drivers”.
6) Pulse width of the direct output of the gate drive unit. (Excluding the delay of the gate resistors.)
7) Duration of blocking the command input (keeping the gate driver and the IGBT in the off-state) after fault detection, i.e. power supply under-voltage lock out, or – only in 2-level mode – short-circuit detection. (For three/multilevel mode, turn-off under the short-circuit condition is managed by the host controller.)
8) The gate current is limited by on-board gate resistors.
9) Refers to the direct output of the gate drive unit. (Excluding the delay of the gate resistors.)
10) Maximum continuous or repeatedly applied DC voltage or peak value of the repeatedly applied AC voltage between the power supply inputs and all other terminals.
11) Including the delay of external fiber-optic links. Measured from turn-on transition at direct output of the gate drive unit (excluding the delay of the gate resistors) to the transition of the status signal at the optical receiver on the host controller side.
12) Application-specific self-heating of gate drivers and IGBT modules, especially at high switching frequency, must be taken into account. The switching frequency is commonly limited due to switching losses of the IGBT modules. Because CONCEPT cannot predict how the drivers will be incorporated in the user’s application, no binding recommended value for self-heating and thus for the maximum useable output power can be made. It is therefore recommended to check the gate driver’s ambient temperature within the system.
13) Including the delay of external fiber-optic links. Measured from the transition of turn-on or turn-off command at the optical transmitter on the host controller side to direct output of the gate drive unit. (Excluding the delay of the gate resistors.)
14) Including the delay of external fiber-optic links. Measured from the transition of turn-on or turn-off command at the optical transmitter on the host controller side to the transition of the acknowledge signal at the optical receiver on the host controller side.

15) The test voltage may be applied only once during one minute. It should be noted that with this (strictly speaking obsolete) test method, some (minor) damage occurs to the insulation layers due to the partial discharge. Consequently, this test is not performed at CONCEPT as a series test. In the case of repeated insulation tests (e.g. module test, equipment test, system test) the subsequent tests should be performed with a lower test voltage: the test voltage is reduced by 10% for each additional test. The more modern if more elaborate partial-discharge measurement is better suited than such test methods as it is almost entirely non-destructive.
16) The transceivers required at the host controller side are not delivered with the gate driver. It is recommended to use the same types as used in the gate driver. For product information refer to www.IGBT-Driver.com/go/fiberoptics
17) The customer-side connector is not supplied with the gate driver, but via FCI Inc. Recommended crimp contact housing: order code 65039-032; recommended crimp contacts: 5 pcs, order code 48236-002. Refer to www.IGBT-Driver.com/go/fci
18) The recommended transmitter current at the host controller is 30-35mA, suitable for plastic optic fibers with a length of less than 2.5 meters. Higher current may increase jitter or delay at turn-off.
19) The transmitter current at the gate driver is 30-35mA.
20) The recommended transmitter current at the host controller is 60mA.
21) The transmitter current at the gate driver is about 49mA.
22) With “yes”, a di/dt feedback reduces the di/dt of the IGBT at turn-off. For more information refer to the “Description and Application Manual for 1SD536F2 SCALE High-Power IGBT Drivers”. With “no”, no di/dt feedback is implemented.

Important Notice

The data contained in this product data sheet is intended exclusively for technically trained staff. Handling all high-voltage equipment involves risk to life. Strict compliance with the respective safety regulations is mandatory!

Any handling of electronic devices is subject to the general specifications for protecting electrostatic-sensitive devices according to international standard IEC 747-1, Chapter IX or European standard EN 100015 (i.e. the workplace, tools, etc. must comply with these standards). Otherwise, this product may be damaged.

Disclaimer

This data sheet specifies devices but cannot promise to deliver any specific characteristics. No warranty or guarantee is given – either expressly or implicitly – regarding delivery, performance or suitability.

CT-Concept Technology AG reserves the right to make modifications to its technical data and product specifications at any time without prior notice. The general terms and conditions of delivery of CT-Concept Technology AG apply.

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Ordering Information

The general terms and conditions of delivery of CT-Concept Technologie AG apply.

Related IGBT	CONCEPT Driver Type #
Mitsubishi CM2400HC-34N	1SD536F2-CM2400HC-34N
Mitsubishi CM2400HC-34N	1SD536F2-CM2400HC-34N Opt. 01

Opt. 01: Fiber-optic interface with threaded port (HFBR-2412T and HFBR-1412T), see "Description and Application Manual for 1SD536F2 SCALE High-Power IGBT Drivers".

Information about Other Products

For drivers adapted to other high-voltage or high-power IGBT modules

Direct link: www.IGBT-Driver.com/go/plug-and-play

For other drivers and evaluation systems

Please click: www.IGBT-Driver.com

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