

2SP0115T2B0-12

Data Sheet

Compact, high-performance, plug-and-play dual-channel IGBT driver based on SCALE™-2 technology for individual and parallel-connected modules

Abstract

The SCALE™-2 plug-and-play driver 2SP0115T2B0-12 is a compact dual-channel intelligent gate driver designed for 1200V 17mm dual IGBT modules. The driver features an electrical interface with a built-in DC/DC power supply.

The turn-on and turn-off gate resistors of both channels are not assembled in order to provide maximum flexibility. They must be assembled by the user before start of operation. Please refer to the paragraph on "Gate Resistor Assembly" for the recommended gate resistors.

For drivers adapted to other types of high-power and high-voltage IGBT modules, refer to

www.power.com/gate-driver/go/plug-and-play

Features

- ✓ Plug-and-play solution
- ✓ Allows parallel connection of IGBT modules
- ✓ Shortens application development time
- ✓ Extremely reliable; long service life
- ✓ Built-in DC/DC power supply
- ✓ 20-pin flat cable interface
- ✓ Duty cycle 0... 100%
- ✓ Active clamping of V_{ce} at turn-off
- ✓ IGBT short-circuit protection
- ✓ Monitoring of supply voltage
- ✓ Safe isolation to EN 50178
- ✓ UL compliant
- ✓ Suitable for 1200V 17mm dual IGBT modules
- ✓ Gate resistors not assembled

Applications

- ✓ Wind-power converters
- ✓ Industrial drives
- ✓ UPS
- ✓ Power-factor correctors
- ✓ Traction
- ✓ Railroad power supplies
- ✓ Welding
- ✓ SMPS
- ✓ Radiology and laser technology
- ✓ Research
- ✓ and many others

Data Sheet

Safety Notice!

The data contained in this 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 60747-1, Chapter IX or European standard EN 100015 (i.e. the workplace, tools, etc. must comply with these standards). Otherwise, this product may be damaged.

Important Product Documentation

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 "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers" on www.power.com/gate-driver/go/2SP0115T.

The gate resistors on this gate driver are not assembled in order to provide maximum flexibility. For the gate resistors required for specific IGBT modules, refer to the paragraph on "Gate Resistor Assembly". Use of gate resistors other than those specified may result in failure.

Mechanical Dimensions

Dimensions: Refer to "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers"

Mounting principle: Soldered onto 17mm dual IGBT module

Absolute Maximum Ratings

Parameter	Remarks	Min	Max	Unit
Supply voltage V_{CC}	VCC to GND	0	16	V
Logic input and output voltages	To GND	-0.5	$V_{CC}+0.5$	V
SO_x current	Fault condition, total current		20	mA
Gate peak current I_{out}	Note 1	-8	+15	A
Average supply current I_{CC}	Note 2		290	mA
Output power per gate	Ambient temperature $\leq 70^\circ\text{C}$ (Note 3)		1.2	W
	Ambient temperature $\leq 85^\circ\text{C}$ (Note 3)		1	W
Turn-on gate resistance	Note 15	1.3		Ω
Turn-off gate resistance	Note 15	1.8		Ω
Switching frequency f	Note 19		n.d.	kHz
Test voltage (50Hz/1min.)	Primary to secondary (Note 16)		3800	$V_{AC(eff)}$
	Secondary to secondary (Note 16)		3800	$V_{AC(eff)}$
DC-link voltage	Note 4		800	V
$ dV/dt $	Rate of change of input to output voltage		50	kV/ μs

Data Sheet

Parameter	Remarks	Min	Max	Unit
Operating voltage	Primary/secondary, secondary/secondary		1200	V _{peak}
Operating temperature		-40	+85	°C
Storage temperature		-40	+90	°C

Recommended Operating Conditions

Parameter	Remarks	Min	Typ	Max	Unit
Supply voltage V _{CC}	To GND	14.5	15	15.5	V
Resistance from TB to GND	Blocking time≠0, ext. value	128		∞	kΩ
SO _x current	Fault condition, 3.3V logic			4	mA

Electrical Characteristics

Power Supply	Remarks	Min	Typ	Max	Unit
Supply current I _{CC}	Without load		33		mA
Efficiency η	Internal DC/DC converter		85		%
Coupling capacitance C _{io}	Primary side to secondary side, total, per channel		23		pF

Power Supply Monitoring	Remarks	Min	Typ	Max	Unit
Supply threshold V _{CC}	Primary side, clear fault	11.9	12.6	13.3	V
	Primary side, set fault (Note 5)	11.3	12.0	12.7	V
Monitoring hysteresis	Primary side, set/clear fault	0.35			V
Supply threshold V _{ISOx} -V _{EEEx}	Secondary side, clear fault	12.1	12.6	13.1	V
	Secondary side, set fault (Note 6)	11.5	12.0	12.5	V
Monitoring hysteresis	Secondary side, set/clear fault	0.35			V
Supply threshold V _{EEEx} -V _{COMx}	Secondary side, clear fault	5	5.15	5.3	V
	Secondary side, set fault (Note 6)	4.7	4.85	5	V
Monitoring hysteresis	Secondary side, set/clear fault	0.15			V

Logic Inputs and Outputs	Remarks	Min	Typ	Max	Unit
Input impedance	V(INx)>3V (Note 7)	3.5	4.1	4.6	kΩ
Turn-on threshold	V(INx) (Note 8)		2.6		V
Turn-off threshold	V(INx) (Note 8)		1.3		V
SO _x output voltage	Fault condition, I(SO _x)<8mA			0.7	V

Data Sheet

Short-circuit Protection	Remarks	Min	Typ	Max	Unit
Vce-monitoring threshold	Between auxiliary terminals		10.2		V
Response time	DC-link voltage >550V (Note 9)		5.4		µs
Delay to IGBT turn-off	After the response time (Note 10)		1.4		µs
Blocking time	After fault (Note 11)		90		ms
Timing Characteristics	Remarks	Min	Typ	Max	Unit
Turn-on delay $t_{d(on)}$	Note 12		75		ns
Turn-off delay $t_{d(off)}$	Note 12		65		ns
Jitter of turn-on delay	Note 18		±2		ns
Jitter of turn-off delay	Note 18		±4		ns
Output rise time $t_{r(out)}$	G _x to E _x (Note 13)		5		ns
Output fall time $t_{f(out)}$	G _x to E _x (Note 13)		10		ns
Dead time between outputs	Half-bridge mode (Note 20)		3		µs
Jitter of dead time	Half-bridge mode		±50		ns
Transmission delay of fault state	Note 14		400		ns
Outputs	Remarks	Min	Typ	Max	Unit
Turn-on gate resistor R _{g(on)}	Note 15		not assembled		Ω
Turn-off gate resistor R _{g(off)}	Note 15		not assembled		Ω
Gate voltage at turn-on			15		V
Gate-voltage at turn-off	P=0W		-9.2		V
	P=1.2W		-7.1		V
Gate resistance to COMx			4.7		kΩ
Electrical Isolation	Remarks	Min	Typ	Max	Unit
Test voltage (50Hz/1s)	Primary to secondary side (Note 16)	3800	3850	3900	V _{eff}
	Secondary to secondary side (Note 16)	3800	3850	3900	V _{eff}
Partial discharge extinction volt.	Primary to secondary side (Note 17)	1220			V _{peak}
	Secondary to secondary side (Note 17)	1200			V _{peak}
Creepage distance	Primary to secondary side	12.6			mm
	Secondary to secondary side	6.6			mm
	Primary to NTC	6.5			mm
Clearance distance	Primary to secondary side	12.3			mm
	Secondary to secondary side	6.6			mm
	Primary to NTC	6.5			mm

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

Data Sheet

Footnotes to the Key Data

- 1) The gate current is limited by the gate resistors located on the driver.
- 2) If the specified value is exceeded, this indicates a driver overload. It should be noted that the driver is not protected against overload.
- 3) If the specified value is exceeded, this indicates a driver overload. It should be noted that the driver is not protected against overload. From 70°C to 85°C, the maximum permissible output power can be linearly interpolated from the given data.
- 4) This limit is due to active clamping. Refer to the "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers".
- 5) Undervoltage monitoring of the primary-side supply voltage (VCC to GND). If the voltage drops below this limit, a fault is transmitted to the corresponding outputs and the IGBTs are switched off.
- 6) Undervoltage monitoring of the secondary-side supply voltage (Visox to Veex and Veex to COMx which correspond with the approximate turn-on and turn-off gate-emitter voltages). If the corresponding voltage drops below this limit, the IGBT is switched off and a fault is transmitted to the corresponding output.
- 7) The input impedance can be modified to values <math>< 18\text{ k}\Omega</math> (customer-specific solution).
- 8) Turn-on and turn-off threshold values can be increased (customer-specific solution).
- 9) The resulting pulse width of the direct output of the gate drive unit for short-circuit type I (excluding the delay of the gate resistors) is the sum of response time plus delay to IGBT turn-off.
- 10) The turn-off event of the IGBT is delayed by the specified time after the response time.
- 11) Factory set value. The blocking time can be reduced with an external resistor. Refer to the "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers".
- 12) Measured from the transition of the turn-on or turn-off command at the driver input to direct output of the gate drive unit (excluding the delay of the gate resistors).
- 13) Output rise and fall times are measured between 10% and 90% of the nominal output swing with an output load of 10 Ω and 40nF. The values are given for the driver side of the gate resistors. The time constant of the output load in conjunction with the present gate resistors leads to an additional delay at the load side of the gate resistors.
- 14) Transmission delay of the fault state from the secondary side to the primary status outputs.
- 15) The gate resistors are not assembled on this IGBT gate driver. They must be assembled by the user according to the paragraph on "Gate Resistor Assembly".
- 16) HiPot testing (= dielectric testing) must generally be restricted to suitable components. This gate driver is suited for HiPot testing. Nevertheless, it is strongly recommended to limit the testing time to 1s slots as stipulated by EN 50178. Excessive HiPot testing at voltages much higher than 850V_{AC(eff)} may lead to insulation degradation. No degradation has been observed over 1min. testing at 3800V_{AC(eff)}. The transformer of every production sample shipped to customers has undergone 100% testing at the given value or higher (<math>< 5100\text{V}_{\text{eff}}</math>) for 1s.
- 17) Partial discharge measurement is performed in accordance with IEC 60270 and isolation coordination specified in EN 50178. The partial discharge extinction voltage between primary and either secondary side is coordinated for safe isolation to EN 50178.
- 18) Jitter measurements are performed with input signals INx switching between 0V and 15V referred to GND, with a corresponding rise time and fall time of 8ns.
- 19) The maximum switching frequency is not defined, as it depends on the IGBT module used. Please consult the corresponding driver data sheet for more information.
- 20) Note that the dead time may vary from sample to sample. A tolerance of approximately $\pm 20\%$ may be expected. If higher timing precisions are required, Power Integrations recommends using direct mode and generating the dead time externally.

Data Sheet

Gate Resistor Assembly

The turn-on and turn-off gate resistors of 2SP0115T drivers are adapted to their respective IGBT modules. Recommended gate resistors are: PR02 / 2W / 5% from Vishay.

The following versions exist:

1200V IGBT Type	Rg,on (R120/R220)	Rg,off (R122/R222)
FF150R12ME3G	8.2Ω	8.2Ω
CM200DX-24S	1.3Ω	1.8Ω
FF225R12ME4	1.6Ω	2.4Ω
2MBI225VN-120-50	1.6Ω	2.4Ω
FF300R12ME3	2.4Ω	3.3Ω
FF300R12ME4	1.3Ω	1.8Ω
2MBI300VN-120-50	1.3Ω	1.8Ω
CM300DX-24S	1.3Ω	1.8Ω
CM300DX-24T	2Ω	2.4Ω
FF450R12ME3	1.6Ω	2.4Ω
FF450R12ME4	1.3Ω	1.8Ω
2MBI450VN-120-50	1.3Ω	1.8Ω
CM450DX-24S	1.3Ω	1.8Ω
CM450DX-24T	1.6Ω	1.6Ω
CM450DX-24T1	1.3Ω	1.8Ω
FF600R12ME4	1.5Ω	2.4Ω
2MBI600VN-120-50	1.5Ω	2.4Ω
CM600DX-24T	1.3Ω	1.6Ω
2MBI800XNE120-50	0.56Ω	3.0Ω
CM800DX-24T1	1.1Ω	1.6Ω
FF900R12ME7_B11	Additional changes required. Please contact the technical support.	

For the component position, refer to Fig. 1.

Data Sheet

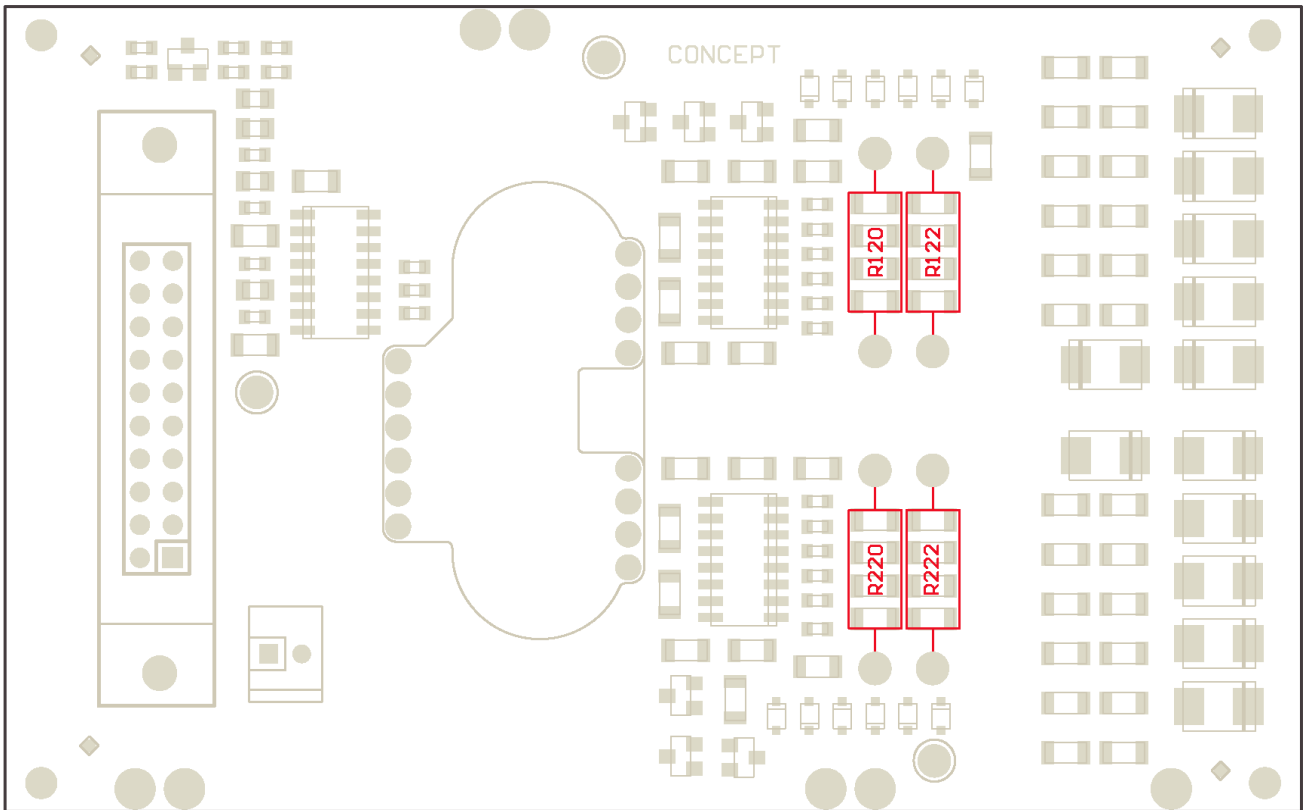
Assembly Drawing

Fig. 1: Assembly drawing of 2SP0115T with highlighted gate resistors

Note that the wires of the gate resistors should not project more than 1.6mm after soldering (excess length at bottom side). Furthermore, a minimum distance of 1mm must be maintained between the gate resistor body and the PCB.

Legal Disclaimer

The statements, technical information and recommendations contained herein are believed to be accurate as of the date hereof. All parameters, numbers, values and other technical data included in the technical information were calculated and determined to our best knowledge in accordance with the relevant technical norms (if any). They may base on assumptions or operational conditions that do not necessarily apply in general. We exclude any representation or warranty, express or implied, in relation to the accuracy or completeness of the statements, technical information and recommendations contained herein. No responsibility is accepted for the accuracy or sufficiency of any of the statements, technical information, recommendations or opinions communicated and any liability for any direct, indirect or consequential loss or damage suffered by any person arising therefrom is expressly disclaimed.

Data Sheet

Ordering Information

Our international terms and conditions of sale apply.

Power Integrations Driver Type #	Related IGBT
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2SP0115T2B0-12 (Temperature range –40°C...85°C)	1200V IGBT modules
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Product home page: www.power.com/gate-driver/go/2SP0115T

Refer to www.power.com/gate-driver/go/nomenclature for information on driver nomenclature

Information about Other Products

For other drivers, evaluation systems product documentation and application support

Please click: www.power.com

Data Sheet

Power Integrations Sales Offices
WORLD HEADQUARTERS

5245 Hellyer Avenue
San Jose, CA 95138 USA
Tel: +1-408-414-9200
Fax: +1-408-414-9765
Email: usasales@power.com

AMERICAS WEST

5245 Hellyer Avenue
San Jose, CA 95138 USA
Tel: +1-408-414-8778
Fax: +1-408-414-3760
Email: usasales@power.com

GERMANY (AC-DC/LED Sales)

Einsteinring 24
85609 Aschheim, Germany
Tel: +49-89-5527-39100
Fax: +49-89-1228-5374
Email: eurosales@power.com

INDIA (Mumbai)

Unit: 106-107, Sagar Tech Plaza-B
Sakinaka, Andheri Kurla Road
Mumbai, Maharashtra 400072 India
Tel 1: +91-22-4003-3700
Tel 2: +91-22-4003-3600
Email: indiasales@power.com

JAPAN

Kosei Dai-3 Bldg.
2-12-11, Shin-Yokohama, Kohoku-ku
Yokohama-shi, Kanagawa
Japan 222-0033
Tel: +81-45-471-1021
Fax: +81-45-471-3717
Email: japansales@power.com

TAIWAN

5F, No. 318, Nei Hu Rd., Sec. 1
Nei Hu Dist.
Taipei, 114 Taiwan
Tel: +886-2-2659-4570
Fax: +886-2-2659-4550
Email: taiwansales@power.com

AMERICAS EAST

7360 McGinnis Ferry Road
Suite 225
Suwannee, GA 30024 USA
Tel: +1-678-957-0724
Fax: +1-678-957-0784
Email: usasales@power.com

CHINA (Shanghai)

Room 2410, Charity Plaza
No. 88 North Caoxi Road
Shanghai, 200030 China
Tel: +86-21-6354-6323
Fax: +86-21-6354-6325
Email: chinasales@power.com

GERMANY (Gate Driver Sales)

HellwegForum 1
59469 Ense, Germany
Tel: +49-2938-64-39990
Email: gate-drivers.sales@power.com

INDIA (New Delhi)

#45, Top Floor
Okhla Industrial Area, Phase - III
New Delhi, 110020 India
Tel 1: +91-11-4055-2351
Tel 2: +91-11-4055-2353
Email: indiasales@power.com

KOREA

RM602, 6FL, 22
Teheran-ro 87-gil, Gangnam-gu
Seoul, 06164 Korea
Tel: +82-2-2016-6610
Fax: +82-2-2016-6630
Email: koreasales@power.com

UNITED KINGDOM

Building 5, Suite 21
The Westbrook Centre
Milton Road
Cambridge, CB4 1YG United Kingdom
Tel: +44-7823-557-484
Email: eurosales@power.com

AMERICAS CENTRAL

333 Sheridan Road
Winnetka, IL 60093 USA
Tel: +1-847-721-6293
Email: usasales@power.com

CHINA (Shenzhen)

17/F, Hivac Building, No 2
Keji South 8th Road, Nanshan District
Shenzhen, 518057 China
Tel: +86-755-8672-8689
Fax: +86-755-8672-8690
Email: chinasales@power.com

INDIA (Bangalore)

#1, 14th Main Road
Vasanthangar
Bangalore, 560052 India
Tel 1: +91-80-4113-8020
Tel 2: +91-80-4113-8028
Fax: +91-80-4113-8023
Email: indiasales@power.com

ITALY

Via Milanese 20
20099 Sesto San Giovanni (MI), Italy
Tel: +39-02-4550-8708
Email: eurosales@power.com

SINGAPORE

51 Newton Road
#19-01/05 Goldhill Plaza
Singapore, 308900
Tel 1: +65-6358-2160
Tel 2: +65-6358-4480
Fax: +65-6358-2015
Email: singaporesales@power.com