2SP0115T2D0-12
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 2SP0115T2D0-12 (RoHS version of 2SP0115T2C0-12) 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
- ✓ Lead-free
- ✓ 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

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	VCC+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 ≤70°C (Note 3)		1.2	W
	Ambient temperature ≤85°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 20		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

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

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_{eex}	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_{eex}-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)=15V (Note 7)	4.3	4.5	4.6	kΩ
Turn-on threshold	V(INx) (Note 8)		10.5		V
Turn-off threshold	V(INx) (Note 8)		5		V
SOx pull-up resistor to VCC	On board		10		kΩ
SOx output voltage	Fault condition, I(SOx)<6.5mA			0.7	V

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		80		ns
Turn-off delay $t_{d(off)}$	Note 12		60		ns
Jitter of turn-on delay	Note 18		±2		ns
Jitter of turn-off delay	Note 18		±2		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 19)		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

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 (customer-specific solution).
8) Turn-on and turn-off threshold values can be modified (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 10Ω 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 ($<5100V_{eff}$) 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) Note that the dead time may vary from sample to sample. A tolerance of approximately ±20% may be expected. If higher timing precisions are required, Power Integrations recommends using direct mode and generating the dead time externally.
20) 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.

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.

Assembly Drawing

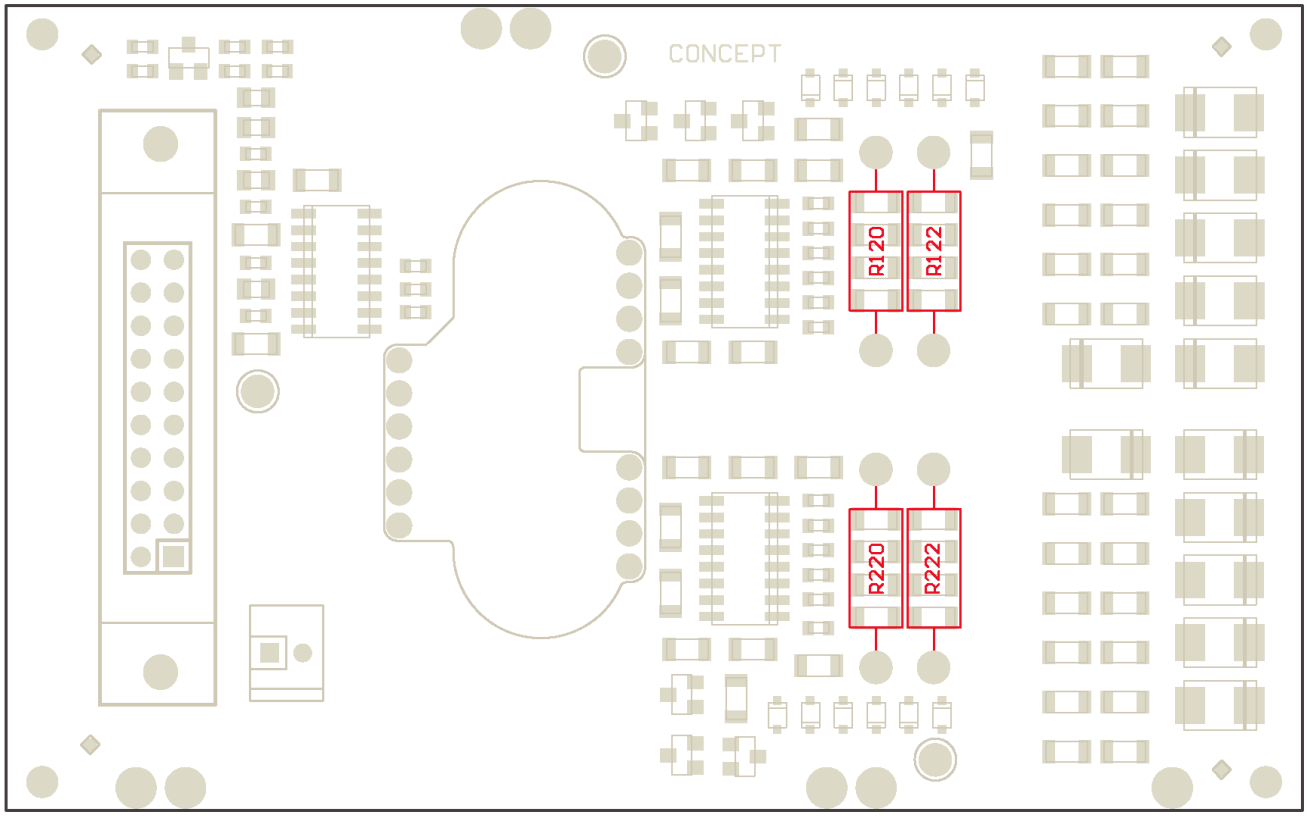

Fig. 1: Assembly drawing of 2SP0115T with highlighted gate resistors

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.

RoHS Statement

On the basis of Annexes II and III of European Directive 2011/65/EC of 08 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS), we hereby state that the products described in this datasheet do not contain lead (Pb), mercury (Hg), hexavalent chromium (Cr VI), cadmium (Cd), polibrometo of biphenyl (PBB) or polibrometo diphenyl ether (PBDE) in concentrations exceeding the restrictions set forth in Annex II of 2011/65/EC with due consideration of the applicable exemptions as listed in Annex III of 2011/65/EC.

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.

Ordering Information

Our international terms and conditions of sale apply.

Power Integrations Driver Type #	Related IGBT
2SP0115T2D0-12 (Only 15V logic supported, lead free)	1200V IGBT modules

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

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