2SC0108T2D0-07 Preliminary Data Sheet

Dual Channel Ultra-compact Low-cost SCALE™-2 Driver Core

Short Description

The low-cost SCALE™-2 dual-driver core 2SC0108T2D0-07 combines unrivalled compactness with broad applicability. The driver is designed for universal applications requiring high reliability. The 2SC0108T2D0-07 drives all usual IGBT modules up to 650V. The embedded paralleling capability allows easy inverter design covering higher power ratings. Multi-level topologies are also supported.

The 2SC0108T2D0-07 is the most compact driver core available for industrial applications, with a footprint of only 45 x 34.3mm and an insertion height of max. 16mm. It allows even the most restricted insertion spaces to be efficiently used. Compared with conventional drivers, the highly integrated SCALE-2 chipset allows about 85% of components to be dispensed with. This advantage is impressively reflected in increased reliability at simultaneously minimized cost.

The 2SC0108T2D0-07 combines a complete two-channel driver core with all components required for driving, such as an isolated DC/DC converter, short-circuit protection, advanced active clamping as well as supply voltage monitoring. Each of the two output channels is electrically isolated from the primary side and the other secondary channel.

An output current of 8A and 1W drive power is available per channel, making the 2SC0108T2D0-07 an ideal driver platform for universal usage in small and medium power applications. The driver provides a gate voltage swing of +15V/–8V. The turn-on voltage is regulated to maintain a stable 15V regardless of the output power level.

Its outstanding EMC allows safe and reliable operation in even hard industrial applications.

Product Highlights

- ✓ Ultra-compact dual channel driver
- ✓ Highly integrated SCALE-2 chipset
- ✓ Gate current ±8A, 1W output power per channel
- ✓ +15V/-8V gate driving
- ✓ Blocking voltages up to 650V
- ✓ Safe isolation to EN 50178
- ✓ Short delay and low jitter
- ✓ Interface for 3.3V...15V logic level
- ✓ UL recognition E321757 for UL508C (NMMS2/8)
- ✓ UL recognition E346491 for UL60950-1 (NWGQ2/8)

Applications

- ✓ Solar converters
- ✓ Uninterruptible power supplies (UPS)
- ✓ Electro/hybrid drive vehicles

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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 important information that apply to this product, please refer to "2SC0108T2Dx-xx Description & Application Manual" on www.power.com/igbt-driver/go/2SC0108T

Absolute Maximum Ratings

Parameter	Remarks	Min	Max	Unit
Supply voltage V_{CC}	VCC to GND	0	16	V
Logic input and output voltages	Primary side, to GND	-0.5	VCC+0.5	V
SOx current	Failure condition, total current		20	mA
Gate peak current I_{out}	Note 1	-8	+8	A
External gate resistance	Turn-on and turn-off	2		Ω
IGBT gate charge			6.3	µC
Average supply current I_{CC}	Notes 2, 3		260	mA
Output power	Ambient temperature <70°C (Notes 4, 5)		1.2	W
	Ambient temperature <85°C (Note 4)		1	W
Test voltage (50Hz/1min.)	Primary to secondary (Note 14)		3000	$V_{AC(eff)}$
	Secondary to secondary (Note 14)		1500	$V_{AC(eff)}$
Switching frequency f			50	kHz
|dV/dt|	Rate of change of input to output voltage (Note 10)		50	kV/µs
Operating voltage	Primary/secondary, secondary/secondary		650	V_{peak}
Operating temperature	Note 5	-40	+85	°C
Storage temperature		-40	+90	°C

Recommended Operating Conditions

Power Supply	Remarks	Min	Typ	Max	Unit
Supply voltage V_{CC}	VCC to GND	14.5	15	15.5	V

Electrical Characteristics

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

Power supply	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Supply current I_{CC}	Without load		31		mA
Coupling capacitance C_{io}	Primary side to secondary side, 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 11)	11.3	12.0	12.7	V
Monitoring hysteresis	Primary side, set/clear fault	0.35			V
Supply threshold V_{ISOx}-V_{Ex}	Secondary side, clear fault	12.1	12.6	13.1	V
	Secondary side, set fault (Note 12)	11.5	12.0	12.5	V
Monitoring hysteresis	Secondary side, set/clear fault	0.35			V
Supply threshold V_{Ex}-V_{COMx}	Secondary side, clear fault	5	5.15	5.3	V
	Secondary side, set fault (Note 12)	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 bias current	V(INx) > 3V		190		µA
Turn-on threshold	V(INx)		2.6		V
Turn-off threshold	V(INx)		1.3		V
SOx output voltage	Failure condition, I(SOx)<20mA			0.7	V
Short-Circuit Protection	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Vce-monitoring threshold	Note 18		9.3		V
Minimum response time	Note 8		1		µs
Minimum blocking time	Note 9		9		µs
Timing Characteristics	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Turn-on delay $t_{d(on)}$	Note 6		70		ns
Turn-off delay $t_{d(off)}$	Note 6		55		ns
Jitter of turn-on delay	Note 17		±2		ns
Jitter of turn-off delay	Note 17		±2		ns
Output rise time $t_{r(out)}$	Note 7		17		ns
Output fall time $t_{f(out)}$	Note 7		15		ns
Transmission delay of fault state	Note 13		360		ns

Electrical Isolation	Remarks	Min	Typ	Max	Unit
Test voltage (50Hz/1s)	Primary to secondary side (Note 14)	3000	3050	3100	V_{eff}
	Secondary to secondary side (Note 14)	1500	1550	1600	V_{eff}
Partial discharge extinction volt.	Primary to secondary side (Note 16)		950		V_{peak}
	Secondary to secondary side (Note 16)		950		V_{peak}
Creepage distance	Primary to secondary side	12.9			mm
	Secondary to secondary side	8.5			mm
Clearance distance	Primary to secondary side	12.9			mm
	Secondary to secondary side	6.0			mm

Outputs	Remarks	Min	Typ	Max	Unit
Blocking capacitance	VISOx to VEx		9.4		µF
	VEx to COMx		9.4		µF
Internal gate resistance	Turn-on and turn-off (Note 15)		0.5		Ω

Output voltage swing

The output voltage swing consists of two distinct segments. First, there is the turn-on voltage V_{GHx} between pins GHx and VEx. V_{GHx} is regulated and maintained at a constant level for all output power values and frequencies.

The second segment of the output voltage swing is the turn-off voltage V_{GLx}. V_{GLx} is measured between pins GLx and VEx. It is a negative voltage. It changes with the output power to accommodate the inevitable voltage drop across the internal DC/DC converter.

Output Voltage	Remarks	Min	Typ	Max	Unit
Turn-on voltage, V_{GHx}	Any load condition		15.0		V
Turn-off voltage, V_{GLx}	No load		-9.4		V
Turn-off voltage, V_{GLx}	1W output power		-7.6		V
Turn-off voltage, V_{GLx}	1.2W output power		-7.2		V

Footnotes to the Key Data

1) The maximum peak gate current refers to the highest current level occurring during the product lifetime. It is an absolute value and does also apply for short pulses.
2) The average supply input current is limited for thermal reasons. Higher values than specified by the absolute maximum rating are permissible (e.g. during power supply start up) if the average remains below the given value, provided the average is taken over a time period which is shorter than the thermal time constants of the driver in the application.
3) There is no means of actively controlling or limiting the input current in the driver. In the case of start-up with very high blocking capacitor values, or in case of short circuit at the output, the supply input current has to be limited externally.
4) The maximum output power must not be exceeded at any time during operation. The absolute maximum rating must also be observed for time periods shorter than the thermal time constants of the driver in the application.
5) An extended output power range is specified in the output power section for maximum ambient temperatures of 70°C. In that case, the absolute maximum rating for the operating temperature

changes to (–40°C - 70°C) and the absolute maximum output power rating changes to 1.2W.

6) The delay time is measured between 50% of the input signal and 10% voltage swing of the corresponding output. The delay time is independent of the output loading.

7) Output rise and fall times are measured between 10% and 90% of the nominal output swing. The values are given for the driver side of the gate resistors without load. 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.

8) The minimum response time given is valid for the circuit given in the description and application manual (Fig. 6) with the values of table 1 (C_{ax}=0pF).

9) The blocking time sets a minimum time span between the end of any fault state and the start of normal operation (remove fault from pin SOx). The value of the blocking time can be adjusted at pin TB. The specified blocking time is valid if TB is connected to GND.

10) This specification guarantees that the drive information will be transferred reliably even at a high DC-link voltage and with ultra-fast switching operations.

11) Undervoltage monitoring of the primary-side supply voltage (VCC to GND). If the voltage drops below this limit, a fault is transmitted to both SOx outputs and the IGBTs are switched off.

12) Undervoltage monitoring of the secondary-side supply voltage (VISOx to VEx and VEx 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 SOx output.

13) Transmission delay of fault state from the secondary side to the corresponding primary status output.

14) 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 $460V_{AC(eff)}$ may lead to insulation degradation. No degradation has been observed over 1min. testing at $3000V_{AC(eff)}$. Every production sample shipped to customers has undergone 100% testing at the given value for 1s.

15) The resulting gate resistance is the sum of the external and the internal gate resistance.

16) The partial discharge is not measured for this driver type. A sufficient safety margin exists between the maximum operating voltage of $650V_{peak}$ and the partial discharge extinction voltage of typically $950V_{peak}$. Tested types with guaranteed partial-discharge immunity are available (e.g. 2SC0108T2A0-17).

17) Jitter measurements are performed with input signals INx switching between 0V and 5V referred to GND, with a corresponding rise time and fall time of 15ns

18) The Vce-monitoring threshold cannot be modified by the user.

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.

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Ordering Information

The general terms and conditions of delivery of Power Integrations Switzerland GmbH apply.

Type Designation	Description
2SC0108T2D0-07	Dual-channel SCALE-2 driver core

Product home page: www.power.com/igbt-driver/go/2SC0108T

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

Information about Other Products

For other drivers, product documentation, and application support

Please click: www.power.com

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