2SC0106T2A1-12 and 2SC0106T2A1C-12 Preliminary Data Sheet

Dual-channel ultra-compact SCALE™-2+ driver core

Short Description

The SCALE™-2+ dual-driver core 2SC0106T2A1-12 / 2SC0106T2A1C-12 (Coated version using ELPEGUARD SL 1307 FLZ/2 from Lackwerke Peters) combines unrivalled compactness with broad applicability. The driver is designed for universal applications requiring high reliability. The 2SC0106T2A1(C)-12 drives all usual IGBT modules up to 450A/1200V or 600A/650V. The 2SC0106T2A1(C)-12 is the most compact driver core available for industrial applications, with a footprint of only 45.5 x 31mm and an insertion height of 13mm. 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.

The 2SC0106T2A1(C)-12 combines a complete two-channel driver core with all components required for driving, such as an isolated DC/DC converter, short-circuit protection 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 6A and 1W drive power is available per channel, making the 2SC0106T2A1(C)-12 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 even in harsh industrial applications.

Product Highlights

- ✓ Ultra-compact dual-channel driver
- ✓ Highly integrated SCALE-2+ chipset
- ✓ Gate current ±6A, 1W output power per channel
- ✓ +15V/-8V gate driving
- ✓ Blocking voltages up to 1200V
- ✓ Safe isolation to IEC 60664-1
- ✓ Short delay and low jitter
- ✓ Interface for 3.3V…15V logic level
- ✓ Lead-free
- ✓ UL recognition E321757 for UL508C (NMMS2/8) up to 85°C
- ✓ UL recognition E346491 for UL60950-1 (NWGQ2/8) up to 85°C

Applications

- ✓ Industrial motor drives
- ✓ Premium drives
- ✓ Uninterruptible power supplies (UPS)
- ✓ Solar converters
- ✓ Electric/hybrid drive vehicles
- ✓ Switched mode power supplies (SMPS)
- ✓ Medical equipment (MRT, CT, X-ray)
- ✓ Welding and plasma cutters

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 "2SC0106T Description & Application Manual" on www.power.com/igbt-driver/go/2SC0106T.

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
SO current	Failure condition, total current		20	mA
Gate peak current I_{out}	Note 1	-6	+6	A
External gate resistance	Turn-on and turn-off, switching frequency ≤ 25 kHz	2.5		Ω
	Turn-on and turn-off, switching frequency > 25 kHz	5		Ω
IGBT gate charge	Notes 12		8	µC
Average supply current I_{CC}	Notes 2, 3		300	mA
Output power	Ambient temperature <70°C (Note 4)		1.2	W
	Ambient temperature <85°C (Notes 4, 5)		1.0	W
	Ambient temperature <105°C (Notes 4, 5)		0.35	W
Test voltage (50Hz/1min.)	Primary to secondary (Note 16)		4000	$V_{AC(eff)}$
	Secondary to secondary (Note 16)		4000	$V_{AC(eff)}$
Switching frequency f			50	kHz
|dV/dt|	Rate of change of input to output voltage		50	kV/µs
Operating voltage	Primary/secondary, secondary/secondary		1200	V_{peak}
Operating temperature	Note 5	-40	105	°C
Storage temperature	Note 20	-40	50	°C
Surface temperature	Only for 2SC0106T2A1C-12 (Note 21)		125	°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		40		mA
Coupling capacitance C_{io}	Primary side to secondary side, per channel		24		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 13)	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 14)	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 14)	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
SO output voltage	Failure condition, I(SO) < 20mA			0.7	V
Short-Circuit Protection	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Vce-monitoring threshold	Note 9		9.3		V
Minimum response time	Note 10		4.5		µs
Minimum blocking time	Note 11		9		µs

Timing Characteristics	Remarks	Min	Typ	Max	Unit
Turn-on delay $t_{d(on)}$	Note 6		75		ns
Turn-off delay $t_{d(off)}$	Note 6		75		ns
Jitter of turn-on delay	Note 19		±2		ns
Jitter of turn-off delay	Note 19		±3		ns
Output rise time $t_{r(out)}$	Note 7		20		ns
Output fall time $t_{f(out)}$	Note 7		13		ns
Transmission delay of fault state	Note 15		450		ns

Electrical Isolation	Remarks	Min	Typ	Max	Unit
Test voltage (50Hz/1s)	Primary to secondary side (Note 16)		4000		V_{eff}
	Secondary to secondary side (Note 16)		4000		V_{eff}
Partial discharge extinction volt.	Primary to secondary side (Note 18)	1800			V_{peak}
	Secondary to secondary side (Note 18)	1440			V_{peak}
Creepage distance	Primary to secondary side	9			mm
	Secondary to secondary side	5.5			mm
Clearance distance	Primary to secondary side	9			mm
	Secondary to secondary side	5.5			mm

Outputs	Remarks	Min	Typ	Max	Unit
Blocking capacitance	VISOx to VEx (Note 8, 12)		9.4		µF
	VEx to COMx (Note 8, 12)		10		µF
Typical internal gate resistance	Turn-on and turn-off (Note 17)		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		-10.2		V
	1W output power		-8.4		V
	1.2W output power		-8.2		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 to short pulses.
2) The average supply input current is limited for thermal reasons. Higher values than those 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 a 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) Between 70°C and 85°C and between 85°C and 105°C the output power can be linearly interpolated with the given values.
6) The delay time is measured between 50% of the input signal and a 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 with turn-on and turn-off gate resistor values of 2.5Ω and 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) Refers to the values assembled on the driver core.
9) The Vce-monitoring threshold cannot be modified by the user.
10) The minimum response time is valid for the circuit given in the description and application manual with the values of the corresponding table (C_{ax} = 15pF).
11) 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 SO). The value of the blocking time can be adjusted at pin TB. The specified blocking time is valid if TB is connected to GND.
12) Additional external blocking capacitors are to be placed between the VISOx and VEx terminals. Refer to "2SC0106T Description & Application Manual", paragraph "DC/DC output (VISOx) and emitter (VEx) terminals" for recommendations.
13) Undervoltage monitoring of the primary-side supply voltage (VCC to GND). If the voltage drops below this limit, a fault is transmitted to the SO output and the IGBTs are switched off.
14) Undervoltage monitoring of the secondary-side supply voltage (VISOx to VEx and VEx to COMx, which correspond to 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 SO output.
15) Transmission delay of the fault state from the secondary side to the corresponding primary status output.
16) HiPot testing (= dielectric testing) must generally be restricted to suitable components. This gate driver is suited to HiPot testing. Nevertheless, it is strongly recommended to limit the testing time to 1s slots. 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 $4000V_{AC(eff)}$. The transformer of every production sample shipped to customers has undergone 100% testing at the given value for 1s.
17) The resulting gate resistance is the sum of the external and the internal gate resistances.
18) Partial discharge measurement is performed in accordance with IEC 60270 and isolation coordination specified in IEC 60664-1. The partial discharge extinction voltage between the primary and either secondary side is coordinated for safe isolation to IEC 60664-1.
19) 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.
20) The storage temperature inside the original package (1) or in case the coating material of coated products may touch external parts (2) must be limited to the given value. Otherwise, it is limited to 105°C.

21) The component surface temperature, which may strongly vary depending on the operating condition, must be limited to the given value for coated driver versions to ensure long-term reliability of the coating material.

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.

Preliminary Data Sheet

Ordering Information

Our international terms and conditions of sale apply.

Type Designation	Description
2SC0106T2A1-12	Dual-channel SCALE-2+ driver core
2SC0106T2A1C-12	Dual-channel SCALE-2+ driver core with conformal coating

Product home page: www.power.com/igbt-driver/go/2SC0106T

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

 Version 2.0 from 2018-02-06

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