

# 2SC0108T2F1-17 and 2SC0108T2F1C-17

## Preliminary Data Sheet

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

#### Short Description

The low-cost SCALE™-2+ dual-driver core 2SC0108T2F1-17 (Connector pin length of 5.84mm; increased EMI capability; SSD implemented; lead free) / 2SC0108T2F1C-17 (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 2SC0108T2F1(C)-17 drives all usual IGBT modules up to 600A/1200V or 450A/1700V. The embedded paralleling capability allows easy inverter design covering higher power ratings. Multi-level topologies are also supported.

The 2SC0108T2F1(C)-17 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 2SC0108T2F1(C)-17 combines a complete two-channel driver core with all components required for driving, such as an isolated DC/DC converter, short-circuit protection, Soft Shut Down (SSD) 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 2SC0108T2F1(C)-17 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 harsh 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 1700V
- ✓ Safe isolation to EN 50178
- ✓ Short delay and low jitter
- ✓ Soft Shut Down function
- ✓ UL recognition E321757 for UL508C (NMMS2/8)
- ✓ UL recognition E346491 for UL60950-1 (NWGQ2/8)
- ✓ Lead-free

#### Applications

- ✓ General purpose drives
- ✓ Uninterruptible power supplies (UPS)
- ✓ Solar and wind power converters
- ✓ Auxiliary converters for traction
- ✓ Electro/hybrid drive vehicles
- ✓ Driving parallel-connected IGBTs
- ✓ Switched mode power supplies (SMPS)
- ✓ Medical (MRT, CT, X-Ray)
- ✓ Laser technology

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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 "2SC0108T Description & Application Manual" on [www.power.com/igbt-driver/go/2SC0108T](http://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		$\Omega$
IGBT gate charge			6.3	$\mu$ C
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 13)		5000	$V_{AC(eff)}$
	Secondary to secondary (Note 13)		4000	$V_{AC(eff)}$
Switching frequency f			50	kHz
dV/dt	Rate of change of input to output voltage		50	kV/ $\mu$ s
Operating voltage	Primary/secondary, secondary/secondary		1700	$V_{peak}$
Operating temperature	Note 5	-40	85	°C
Storage temperature	Note 18	-40	50	°C
Surface temperature	Only for 2SC0108T2F1C-17 (Note 19)		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

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<b>Electrical Characteristics</b>
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All data refer to +25°C and  $V_{CC} = 15V$  unless otherwise specified.

<b>Power supply</b>	<b>Remarks</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Supply current $I_{CC}$	Without load		31		mA
Coupling capacitance $C_{io}$	Primary side to secondary side, per channel		23		pF
<b>Power Supply Monitoring</b>	<b>Remarks</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Supply threshold $V_{CC}$	Primary side, clear fault	11.9	12.6	13.3	V
	Primary side, set fault (Note 10)	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 11)	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 11)	4.7	4.85	5	V
Monitoring hysteresis	Secondary side, set/clear fault	0.15			V
<b>Logic Inputs and Outputs</b>	<b>Remarks</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Input bias current	$V(INx) > 3V$		190		$\mu A$
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
<b>Short-Circuit Protection</b>	<b>Remarks</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Current through pin REFx	$R(REFx, VEx) < 70k\Omega$		150		$\mu A$
Minimum response time	Note 8		1.2		$\mu s$
Minimum blocking time	Note 9		9		$\mu s$
<b>Timing Characteristics</b>	<b>Remarks</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Turn-on delay $t_{d(on)}$	Note 6		75		ns
Turn-off delay $t_{d(off)}$	Note 6		65		ns
Jitter of turn-on delay	Note 16		$\pm 2$		ns
Jitter of turn-off delay	Note 16		$\pm 2$		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 12		360		ns
<b>Soft Shut Down (SSD)</b>	<b>Remarks</b>	<b>Implementation</b>			
SSD function	Note 17		Yes		

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Electrical Isolation	Remarks	Min	Typ	Max	Unit
Test voltage (50Hz/1s)	Primary to secondary side (Note 13)	5000	5050	5100	$V_{\text{eff}}$
	Secondary to secondary side (Note 13)	4000	4050	4100	$V_{\text{eff}}$
Partial discharge extinction volt.	Primary to secondary side (Note 15)	1768			$V_{\text{peak}}$
	Secondary to secondary side (Note 15)	1700			$V_{\text{peak}}$
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	6.5			mm

Outputs	Remarks	Min	Typ	Max	Unit
Blocking capacitance	VISOx to VEx		9.4		$\mu\text{F}$
	VEx to COMx		9.4		$\mu\text{F}$
Typical internal gate resistance	Turn-on and turn-off (Note 14)		0.5		$\Omega$

### Output voltage swing

The output voltage swing consists of two distinct segments. First, there is the turn-on voltage  $V_{\text{GHx}}$  between pins GHx and VEx.  $V_{\text{GHx}}$  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  $V_{\text{GLx}}$ .  $V_{\text{GLx}}$  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, $V_{\text{GHx}}$	Any load condition		15.0		V
Turn-off voltage, $V_{\text{GLx}}$	No load		-9.4		V
Turn-off voltage, $V_{\text{GLx}}$	1W output power		-7.6		V
Turn-off voltage, $V_{\text{GLx}}$	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

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- 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 ( $C_{ax} = 0\text{pF}$ ,  $R_{thx} = 43\text{k}\Omega$ ).
  - 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) 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.
  - 11) 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.
  - 12) Transmission delay of fault state from the secondary side to the corresponding primary status output.
  - 13) 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  $1200\text{V}_{AC(eff)}$  may lead to insulation degradation. No degradation has been observed over 1min. testing at  $5000\text{V}_{AC(eff)}$ . Every production sample shipped to customers has undergone 100% testing at the given value for 1s.
  - 14) The resulting gate resistance is the sum of the external and the internal gate resistance.
  - 15) 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.
  - 16) 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.
  - 17) The SSD function reduces the turn-off di/dt at turn-off to limit the Vce overvoltage as soon as a short-circuit condition is detected. It cannot be deactivated. Refer to "2SC0108T Description & Application Manual" for more information.
  - 18) 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 90°C.
  - 19) 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.

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### **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.

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## Preliminary Data Sheet

### Ordering Information

Our international terms and conditions of sale apply.

Type Designation	Description
2SC0108T2F1-17	Dual-channel SCALE-2+ driver core (Connector pin length of 5.84mm, increased EMI capability, SSD implemented, lead free)
2SC0108T2F1C-17	Dual-channel SCALE-2+ driver core (Connector pin length of 5.84mm, increased EMI capability, SSD implemented, lead free, conformal coating)

Product home page: [www.power.com/igbt-driver/go/2SC0108T](http://www.power.com/igbt-driver/go/2SC0108T)

Refer to [www.power.com/igbt-driver/go/nomenclature](http://www.power.com/igbt-driver/go/nomenclature) for information on driver nomenclature.

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### Information about Other Products

**For other drivers, product documentation, and application support**

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Please click: [www.power.com](http://www.power.com)

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## Preliminary Data Sheet

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