

2SC0108T2E0-17 Preliminary Data Sheet

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

Short Description

The low-cost SCALE™-2 dual-driver core 2SC0108T2E0-17 (Lead free version of 2SC0108T2B0-17) combines unrivalled compactness with broad applicability. The driver is designed for universal applications requiring high reliability. The 2SC0108T2E0-17 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 2SC0108T2E0-17 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 2SC0108T2E0-17 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 8A and 1W drive power is available per channel, making the 2SC0108T2E0-17 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 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 1700V
- ✓ 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 (NWDGQ2/8)
- ✓ 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

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 | μ 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 14) | | 5000 | $V_{AC(eff)}$ |
| | Secondary to secondary (Note 14) | | 4000 | $V_{AC(eff)}$ |
| Switching frequency f dV/dt | | | 50 | kHz |
| | Rate of change of input to output voltage (Note 10) | | 75 | kV/ μ s |
| Operating voltage | Primary/secondary, secondary/secondary | | 1700 | 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 |

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| 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 | | 19 | | 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 |
| Current through pin REFx | $R(REFx, VEx) < 70k\Omega$ | | 150 | | μA |
| Minimum response time | Note 8 | | 1.2 | | μs |
| Minimum blocking time | Note 9 | | 9 | | μs |
| Timing Characteristics | Remarks | Min | Typ | Max | Unit |
| Turn-on delay $t_{d(on)}$ | Note 6 | | 90 | | ns |
| Turn-off delay $t_{d(off)}$ | Note 6 | | 75 | | 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 |

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| Electrical Isolation | Remarks | Min | Typ | Max | Unit |
|------------------------------------|---------------------------------------|------|------|------|-------------------|
| Test voltage (50Hz/1s) | Primary to secondary side (Note 14) | 5000 | 5050 | 5100 | V_{eff} |
| | Secondary to secondary side (Note 14) | 4000 | 4050 | 4100 | V_{eff} |
| Partial discharge extinction volt. | Primary to secondary side (Note 16) | 1768 | | | V_{peak} |
| | Secondary to secondary side (Note 16) | 1700 | | | 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 | 6.5 | | | mm |

| Outputs | Remarks | Min | Typ | Max | Unit |
|----------------------------------|--------------------------------|-----|-----|-----|---------------|
| Blocking capacitance | VISOx to VEx | | 9.4 | | μF |
| | VEx to COMx | | 9.4 | | μF |
| Typical 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

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- changes to ($-40^{\circ}\text{C} - 70^{\circ}\text{C}$) 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) 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 $1200\text{V}_{AC(eff)}$ 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.
 - 15) The resulting gate resistance is the sum of the external and the internal gate resistance.
 - 16) 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.
 - 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.

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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.

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Ordering Information

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

| Type Designation | Description |
|------------------|-------------|
|------------------|-------------|

| | |
|----------------|--|
| 2SC0108T2E0-17 | Dual-channel SCALE-2 driver core (Lead free version of 2SC0108T2B0-17) |
|----------------|--|

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

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