

# 2SP0320T2Cx-12

## Preliminary Data Sheet

Compact, high-performance, plug-and-play dual-channel IGBT driver based on SCALE™-2 technology for individual and parallel-connected modules in 2-level, 3-level and multilevel converter topologies

### Abstract

The SCALE™-2 plug-and-play driver 2SP0320T2Cx-12 is a compact dual-channel intelligent gate driver designed for 1200V IGBT modules from Danfoss, Fuji or Infineon. 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.IGBT-Driver.com/go/plug-and-play](http://www.IGBT-Driver.com/go/plug-and-play)

### Features

- ✓ Plug-and-play solution
- ✓ Allows parallel connection of IGBT modules
- ✓ For 2-level, 3-level and multilevel topologies
- ✓ 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 IGBT modules
- ✓ 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

## Preliminary Data Sheet

### 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 2SP0320T SCALE-2 IGBT Drivers" on [www.IGBT-Driver.com/go/2SP0320](http://www.IGBT-Driver.com/go/2SP0320).

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: See the relevant "Description and Application Manual"

Mounting principle: Connected to IGBT module with screws

### Absolute Maximum Ratings

| Parameter                       | Remarks   | Min  | Max     | Unit          |
|---------------------------------|---|------|---------|---------------|
| Supply voltage $V_{DC}$         | VDC to GND  | 0    | 16      | V             |
| Supply voltage $V_{CC}$         | VCC to GND (Note 1)                                 | 0    | 16      | V             |
| Logic input and output voltages | To GND  | -0.5 | VCC+0.5 | V             |
| SO <sub>x</sub> current         | Fault condition, total current                      |      | 20      | mA            |
| Gate peak current $I_{out}$     | Note 2  | -20  | +20     | A             |
| Average supply current $I_{DC}$ | Note 16   |      | 600     | mA            |
| Output power per gate           | Ambient temperature <70°C (Note 3)                  |      | 3       | W             |
|                                 | Ambient temperature 85°C (Note 3)                   |      | 2       | W             |
| Turn-on gate resistance         | Note 17   | 0.3  |         | Ω             |
| Turn-off gate resistance        | Note 17   | 1    |         | Ω             |
| Switching frequency F           | Note 23   |      | n.d.    | kHz           |
| Test voltage (50Hz/1min.)       | Primary to secondary (Note 19)                      |      | 3800    | $V_{AC(eff)}$ |
|                                 | Secondary to secondary (Note 19)                    |      | 3800    | $V_{AC(eff)}$ |
| DC-link voltage                 | Note 4  |      | 800     | V             |
| dV/dt                           | Rate of change of input to output voltage (Note 20) |      | 50      | kV/μs         |
| Operating voltage               | Primary/secondary, secondary/secondary              |      | 1200    | $V_{peak}$    |

## Preliminary Data Sheet

| Parameter             | Remarks | Min | Max | Unit |
|-----------------------|---------|-----|-----|------|
| Operating temperature |         | -40 | +85 | °C   |
| Storage temperature   |         | -40 | +90 | °C   |

### Recommended Operating Conditions

| Power Supply              | Remarks                            | Min  | Typ | Max      | Unit       |
|---------------------------|------------------------------------|------|-----|----------|------------|
| Supply voltage $V_{DC}$   | To GND (Note 1)                    | 14.5 | 15  | 15.5     | V          |
| Supply voltage $V_{CC}$   | To GND (Note 1)                    | 14.5 | 15  | 15.5     | V          |
| Resistance from TB to GND | Blocking time $\neq$ 0, ext. value | 128  |     | $\infty$ | k $\Omega$ |

### Electrical Characteristics

| Power Supply                  | Remarks  | Min | Typ | Max | Unit |
|-------------------------------|--|-----|-----|-----|------|
| Supply current $I_{DC}$       | Without load                                       |     | 37  |     | mA   |
| Efficiency $\eta$             | Internal DC/DC converter                           |     | 85  |     | %    |
| Supply current $I_{CC}$       | Without load                                       |     | 19  |     | mA   |
| Coupling capacitance $C_{io}$ | Primary side to secondary side, total, per channel |     | 20  |     | 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 21) | 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 21) | 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 6)           | 4.3 | 4.5  | 4.6 | k $\Omega$ |
| Turn-on threshold           | $V(INx)$ (Note 7)                 |     | 10.5 |     | V          |
| Turn-off threshold          | $V(INx)$ (Note 7)                 |     | 5    |     | V          |
| SOx pull-up resistor to VCC | On board                          |     | 10   |     | k $\Omega$ |
| SOx output voltage          | Fault condition, $I(SOx) < 6.5mA$ |     |      | 0.7 | V          |

## Preliminary Data Sheet

| <b>Short-circuit Protection</b>     | <b>Remarks</b>                        | <b>Min</b>            | <b>Typ</b>    | <b>Max</b> | <b>Unit</b> |
|-------------------------------------|---------------------------------------|-----------------------|---------------|------------|-------------|
| Vce-monitoring threshold            | Between auxiliary terminals           |                       | 10.2          |            | V           |
| Response time                       | DC-link voltage > 550V (Note 8)       |                       | 6.9           |            | μs          |
| Delay to IGBT turn-off              | After the response time (Note 9)      |                       | 1.4           |            | μs          |
| Blocking time                       | After fault (Note 10)                 |                       | 90            |            | ms          |
| <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 11                               |                       | 95            |            | ns          |
| Turn-off delay $t_{d(off)}$         | Note 11                               |                       | 75            |            | ns          |
| Jitter of turn-on delay             | Note 12                               |                       | ±2            |            | ns          |
| Jitter of turn-off delay            | Note 12                               |                       | ±2            |            | ns          |
| Output rise time $t_{r(out)}$       | $G_x$ to $E_x$ (Note 13)              |                       | 7             |            | ns          |
| Output fall time $t_{f(out)}$       | $G_x$ to $E_x$ (Note 13)              |                       | 25            |            | ns          |
| Dead time between outputs           | Half-bridge mode (Note 14)            |                       | 3             |            | μs          |
| Jitter of dead time                 | Half-bridge mode                      |                       | ±100          |            | ns          |
| Transmission delay of fault state   | Note 15                               |                       | 450           |            | ns          |
| <b>Outputs</b>                      | <b>Remarks</b>                        | <b>Min</b>            | <b>Typ</b>    | <b>Max</b> | <b>Unit</b> |
| Turn-on gate resistor $R_{g(on)}$   | Note 17                               |                       | not assembled |            | Ω           |
| Turn-off gate resistor $R_{g(off)}$ | Note 17                               |                       | not assembled |            | Ω           |
| Gate voltage at turn-on             |                                       |                       | 15            |            | V           |
| Gate-voltage at turn-off            | P = 0W                                |                       | -10.4         |            | V           |
|                                     | P = 0.3W                              |                       | -10.2         |            | V           |
|                                     | P = 2.1W                              |                       | -9.7          |            | V           |
|                                     | P = 3W                                |                       | -9.6          |            | V           |
| Gate resistance to COMx             |                                       |                       | 4.7           |            | kΩ          |
| <b>dV/dt Feedback</b>               | <b>Remarks</b>                        | <b>Implementation</b> |               |            |             |
| dV/dt feedback                      | Note 18                               |                       | No            |            |             |
| <b>Electrical Isolation</b>         | <b>Remarks</b>                        | <b>Min</b>            | <b>Typ</b>    | <b>Max</b> | <b>Unit</b> |
| Test voltage (50Hz/1s)              | Primary to secondary side (Note 19)   | 3800                  | 3850          | 3900       | $V_{eff}$   |
|                                     | Secondary to secondary side (Note 19) | 3800                  | 3850          | 3900       | $V_{eff}$   |
| Partial discharge extinction volt.  | Primary to secondary side (Note 22)   | 1220                  |               |            | $V_{peak}$  |
|                                     | Secondary to secondary side (Note 22) | 1200                  |               |            | $V_{peak}$  |
| Creepage distance                   | Primary to secondary side             | 20                    |               |            | mm          |
|                                     | Secondary to secondary side           | 17                    |               |            | mm          |

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

---

## Preliminary Data Sheet

### Footnotes to the Key Data

- 1) Both supply voltages  $V_{DC}$  and  $V_{CC}$  should be applied in parallel.
- 2) The gate current is limited by the gate resistors located on the driver.
- 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 "Description & Application Manual for 2SP0320T SCALE-2 IGBT Drivers".
- 5) Undervoltage monitoring of the primary-side supply voltage ( $V_{CC}$  to GND). If the voltage drops below this limit, a fault is transmitted to the corresponding output(s) and the IGBTs are switched off.
- 6) The input impedance can be modified (customer-specific solution).
- 7) Turn-on and turn-off threshold values can be modified (customer-specific solution).
- 8) 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.
- 9) The turn-off event of the IGBT is delayed by the specified time after the response time.
- 10) Factory set value. The blocking time can be reduced with an external resistor. Refer to "Description & Application Manual for 2SP0320T SCALE-2 IGBT Drivers".
- 11) 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).
- 12) Jitter measurements are performed with input signals  $IN_x$  switching between 0V and 15V referred to GND, with a corresponding rise time and fall time of 8ns.
- 13) Refers to the direct output of the gate drive unit (excluding the delay of the gate resistors).
- 14) Note that the dead time may vary from sample to sample. A tolerance of approximately  $\pm 20\%$  may be expected. If higher timing precisions are required, CONCEPT recommends using direct mode and generating the dead time externally.
- 15) Transmission delay of the fault state from the secondary side to the primary status outputs.
- 16) If the specified value is exceeded, this indicates a driver overload. It should be noted that the driver is not protected against overload.
- 17) 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".
- 18) A  $dV/dt$  feedback can optionally be implemented in order to reduce the rate of rise of the collector emitter voltage of the IGBTs at turn-off (customer-specific solution).
- 19) 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  $3800V_{AC(eff)}$ . Every production sample shipped to customers has undergone 100% testing at the given value or higher ( $< 5100V_{eff}$ ) for 1s.
- 20) This specification guarantees that the drive information will be transferred reliably even at a high DC-link voltage and with ultra-fast switching operations.
- 21) Undervoltage monitoring of the secondary-side supply voltage ( $V_{isox}$  to  $V_{eex}$  and  $V_{eex}$  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.
- 22) 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.
- 23) 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.

## Preliminary Data Sheet

### Gate Resistor Assembly

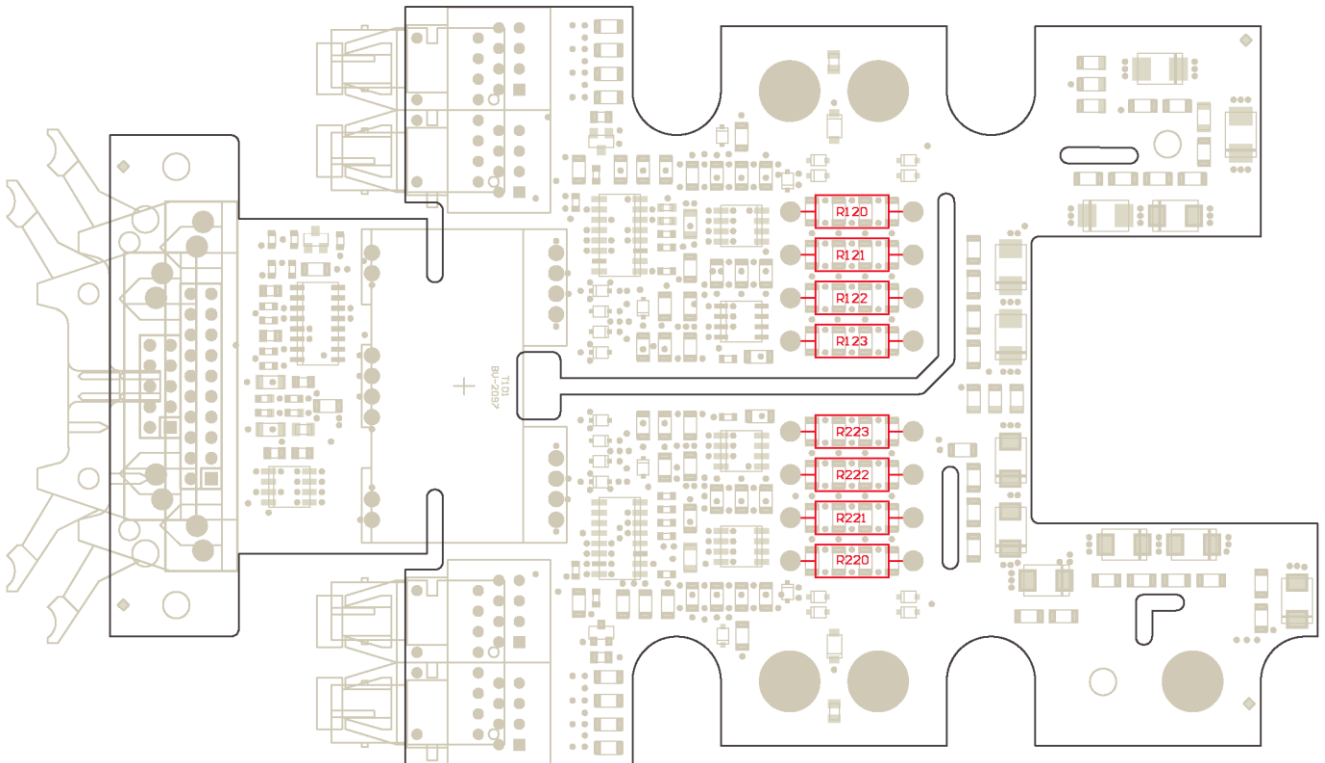
The turn-on and turn-off gate resistors of 2SP0320T2Cx drivers are adapted to their respective IGBT modules. Recommended gate resistors are: PR02 / 2W / 5% from Vishay.

The following versions exist:

| <b>1200V IGBT Type</b> | <b>R120/R121/<br/>R220/R221</b> | <b>R122/R123 /<br/>R222/R223</b> | <b>Resulting<br/>Rg,on</b> | <b>Resulting<br/>Rg,off</b> |
|------------------------|---------------------------------|----------------------------------|----------------------------|-----------------------------|
| FF450R12IE4            | 5.1Ω                            | 6.8Ω                             | 2.55Ω                      | 3.4Ω                        |
| FF600R12IE4            | 3.6Ω                            | 6.8Ω                             | 1.8Ω                       | 3.4Ω                        |
| 2MBI900VXA-120E-50     | 3.3Ω                            | 5.1Ω                             | 1.65Ω                      | 2.55Ω                       |
| 2MBI900VXA-120P-50     | 4.3Ω                            | 3.3Ω                             | 2.15Ω                      | 1.65Ω                       |
| FF900R12IE4            | 2.7Ω                            | 6.8Ω                             | 1.35Ω                      | 3.4Ω                        |
| FF900R12IP4            | 3.3Ω                            | 6.8Ω                             | 1.65Ω                      | 3.4Ω                        |
| 2MBI1400VXB-120E-50    | 2Ω                              | 3Ω                               | 1Ω                         | 1.5Ω                        |
| 2MBI1400VXB-120P-50    | 3.3Ω                            | 3.3Ω                             | 1.65Ω                      | 1.65Ω                       |
| DP1400B1200T103714     | 2Ω                              | 4.7Ω                             | 1Ω                         | 2.35Ω                       |
| FF1400R12IP4           | 2Ω                              | 6.8Ω                             | 1Ω                         | 3.4Ω                        |

For the component position, refer to Fig. 1.

## Preliminary Data Sheet

**Assembly Drawing**

*Fig. 1: Assembly drawing of 2SP0320 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.

**Legal Disclaimer**

This data sheet specifies devices but cannot promise to deliver any specific characteristics. No warranty or guarantee is given – either expressly or implicitly – regarding delivery, performance or suitability.

CT-Concept Technologie GmbH reserves the right to make modifications to its technical data and product specifications at any time without prior notice. The general terms and conditions of delivery of CT-Concept Technologie GmbH apply.

---

## Preliminary Data Sheet

### Ordering Information

The general terms and conditions of delivery of CT-Concept Technologie GmbH apply.

| <b>CONCEPT Driver Type #</b>              | <b>Related IGBT</b> |
|---|---------------------|
| 2SP0320T2C0-12 (Only 15V logic supported) | 1200V IGBT modules  |

Product home page: [www.IGBT-Driver.com/go/2SP0320](http://www.IGBT-Driver.com/go/2SP0320)

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

---

### Information about Other Products

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

---

Please click: [www.IGBT-Driver.com](http://www.IGBT-Driver.com)

---

### Manufacturer

CT-Concept Technologie GmbH  
A Power Integrations Company  
Johann-Renfer-Strasse 15  
2504 Biel-Bienne  
Switzerland

Phone +41 - 32 - 344 47 47  
Fax +41 - 32 - 344 47 40

E-mail [Info@IGBT-Driver.com](mailto:Info@IGBT-Driver.com)  
Internet [www.IGBT-Driver.com](http://www.IGBT-Driver.com)

© 2008...2014 CT-Concept Technologie GmbH - Switzerland.  
We reserve the right to make any technical modifications without prior notice.

All rights reserved.  
Version 2.0 from 2014-03-24



# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Power Integrations:](#)

[2SP0320T2C0-12](#)



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.