# 2SP0115T2Ax-2MBI450VN-170-50
# Preliminary Data Sheet

Compact, high-performance, plug-and-play dual-channel IGBT driver based on SCALE-2 technology for individual and parallel-connected modules


## Abstract

The SCALE-2 plug-and-play driver 2SP0115T2Ax-2MBI450VN-170-50 is a compact dual-channel intelligent gate driver designed for Fuji's 17mm dual IGBTs 2MBI450VN-170-50. The driver features an electrical interface with a built-in DC/DC power supply.

For drivers adapted to other types of high-power and high-voltage IGBT modules, refer to

www.IGBT-Driver.com/go/plug-and-play


## Features

- ✓ Plug-and-play solution
- ✓ Allows parallel connection of IGBT modules
- ✓ 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 2MBI450VN-170-50

## 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 2SP0115T SCALE-2 IGBT Drivers" on www.IGBT-Driver.com/go/2SP0115T.

When applying SCALE-2 plug-and-play drivers, please note that these drivers are specifically adapted to a particular type of IGBT module. Therefore, the type designation of SCALE-2 plug-and-play drivers also includes the type designation of the corresponding IGBT module. These drivers are not valid for IGBT modules other than those specified. Incorrect use may result in failure.

## Mechanical Dimensions

Dimensions: See "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers"

Mounting principle: Soldered onto 17mm dual IGBT module 2MBI450VN-170-50

## Absolute Maximum Ratings

| Parameter | Remarks | Min | Max | Unit |
|---|---|---|---|---|
| Supply voltage $V_{CC}$ | VCC to GND | 0 | 16 | V |
| Logic input and output voltages | To GND | -0.5 | VCC+0.5 | V |
| $SO_x$ current | Fault condition, total current | | 20 | mA |
| Gate peak current $I_{out}$ | Note 1 | -8 | +15 | A |
| Average supply current $I_{CC}$ | Note 2 | | 290 | mA |
| Output power per gate | Ambient temperature <70°C (Note 3) | | 1.2 | W |
| | Ambient temperature 85°C (Note 3) | | 1 | W |
| Switching frequency F | | | 9.5 | kHz |
| Test voltage (50Hz/1min.) | Primary to secondary (Note 17) | | 5000 | $V_{AC(eff)}$ |
| | Secondary to secondary (Note 17) | | 4000 | $V_{AC(eff)}$ |
| DC-link voltage | Note 4 | | 1200 | V |
| \|dV/dt\| | Rate of change of input to output voltage (Note 5) | | 50 | kV/µs |
| Operating voltage | Primary/secondary, secondary/secondary | | 1700 | $V_{peak}$ |
| Operating temperature | Note 20 | -20 | +85 | °C |
| Storage temperature | | -40 | +90 | °C |

## Recommended Operating Conditions

| Parameter | Remarks | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply voltage $V_{CC}$ | To GND | 14.5 | 15 | 15.5 | V |
| Resistance from TB to GND | Blocking time≠0, ext. value | 128 | | ∞ | kΩ |
| $SO_x$ current | Fault condition, 3.3V logic | | | 4 | mA |

## Electrical Characteristics

| Power Supply | Remarks | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply current $I_{CC}$ | Without load | | 33 | | mA |
| Efficiency η | Internal DC/DC converter | | 85 | | % |
| Coupling capacitance $C_{io}$ | Primary side to secondary side, total, 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 6) | 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 7) | 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 7) | 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) > 3V (Note 8) | 3.5 | 4.1 | 4.6 | kΩ |
| Turn-on threshold | V(INx) (Note 9) | | 2.6 | | V |
| Turn-off threshold | V(INx) (Note 9) | | 1.3 | | V |
| SOx output voltage | Fault condition, I(SOx)<8mA | | | 0.7 | V |
| **Short-circuit Protection** | **Remarks** | **Min** | **Typ** | **Max** | **Unit** |
| Vce-monitoring threshold | Between auxiliary terminals | | 10.2 | | V |
| Response time | DC-link voltage > 550V (Note 10) | | 5.4 | | µs |
| Delay to IGBT turn-off | After the response time (Note 11) | | 1.4 | | µs |
| Blocking time | After fault (Note 12) | | 90 | | ms |

Preliminary Data Sheet

| **Timing Characteristics** | **Remarks** | **Min** | **Typ** | **Max** | **Unit** |
|---|---|---|---|---|---|
| Turn-on delay $t_{d(on)}$ | Note 13 | | 75 | | ns |
| Turn-off delay $t_{d(off)}$ | Note 13 | | 65 | | ns |
| Jitter of turn-on delay | Note 19 | | ±2 | | ns |
| Jitter of turn-off delay | Note 19 | | ±4 | | ns |
| Output rise time $t_{r(out)}$ | $G_x$ to $E_x$ (Note 14) | | 5 | | ns |
| Output fall time $t_{f(out)}$ | $G_x$ to $E_x$ (Note 14) | | 10 | | ns |
| Dead time between outputs | Half-bridge mode | | 3 | | µs |
| Jitter of dead time | Half-bridge mode | | ±50 | | ns |
| Transmission delay of fault state | Note 15 | | 400 | | ns |
| **Outputs** | **Remarks** | **Min** | **Typ** | **Max** | **Unit** |
| Turn-on gate resistor $R_{g(on)}$ | Note 16 | | 3.3 | | Ω |
| Turn-off gate resistor $R_{g(off)}$ | Note 16 | | 2.2 | | Ω |
| Gate voltage at turn-on | | | 15 | | V |
| Gate-voltage at turn-off | P = 0W | | -9.2 | | V |
| | P = 1.2W | | -7.1 | | V |
| Gate resistance to COMx | | | 4.7 | | kΩ |
| **Electrical Isolation** | **Remarks** | **Min** | **Typ** | **Max** | **Unit** |
| Test voltage (50Hz/1s) | Primary to secondary side (Note 17) | 5000 | 5050 | 5100 | $V_{eff}$ |
| | Secondary to secondary side (Note 17) | 4000 | 4050 | 4100 | $V_{eff}$ |
| Partial discharge extinction volt. | Primary to secondary side (Note 18) | 1768 | | | $V_{peak}$ |
| | Secondary to secondary side (Note 18) | 1700 | | | $V_{peak}$ |
| Creepage distance | Primary to secondary side | 12.6 | | | mm |
| | Secondary to secondary side | 6.6 | | | mm |
| | Primary to NTC | 6.5 | | | mm |
| Clearance distance | Primary to secondary side | 12.3 | | | mm |
| | Secondary to secondary side | 6.6 | | | mm |
| | Primary to NTC | 6.5 | | | mm |

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

**Footnotes to the Key Data**

1) The gate current is limited by the gate resistors located on the driver.
2) If the specified value is exceeded, this indicates a driver overload. It should be noted that the driver is not protected against overload.
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 the "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers".
5) This specification guarantees that the drive information will be transferred reliably even at a high DC-link voltage and with ultra-fast switching operations.

6) Undervoltage monitoring of the primary-side supply voltage (VCC to GND). If the voltage drops below this limit, a fault is transmitted to the corresponding outputs and the IGBTs are switched off.
7) Undervoltage monitoring of the secondary-side supply voltage (Visox to Veex and Veex 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.
8) The input impedance can be modified to values < 18 kΩ (customer-specific solution).
9) Turn-on and turn-off threshold values can be increased (customer-specific solution).
10) 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.
11) The turn-off event of the IGBT is delayed by the specified time after the response time.
12) Factory set value. The blocking time can be reduced with an external resistor. Refer to the "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers".
13) 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).
14) Output rise and fall times are measured between 10% and 90% of the nominal output swing with an output load of 10Ω and 40nF. The values are given for the driver side of the gate resistors. 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.
15) Transmission delay of the fault state from the secondary side to the primary status outputs.
16) The gate resistors can be leaded or surface mounted. CONCEPT reserves the right to determine which type will be used. Typically, higher quantities will be produced with SMD resistors and small quantities with leaded resistors.
17) 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 $1200V_{AC(eff)}$ may lead to insulation degradation. No degradation has been observed over 1min. testing at $5000V_{AC(eff)}$. Every production sample shipped to customers has undergone 100% testing at the given value for 1s.
18) 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.
19) Jitter measurements are performed with input signals INx switching between 0V and 15V referred to GND, with a corresponding rise time and fall time of 8ns.
20) A version with extended operating temperature range of –40°C…85°C (2SP0115T2B0) can also be supplied.

## 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 AG 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 AG apply.

Preliminary Data Sheet

## Ordering Information

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

| CONCEPT Driver Type # | Related IGBT |
|---|---|
| 2SP0115T2A0-2MBI450VN-170-50 (Temperature range –20°C…85°C) | 2MBI450VN-170-50 |
| 2SP0115T2B0-2MBI450VN-170-50 (Temperature range –40°C…85°C) | 2MBI450VN-170-50 |

Product home page: www.IGBT-Driver.com/go/2SP0115T

Refer to 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

## Manufacturer

CT-Concept Technologie AG
Intelligent Power Electronics
Renferstrasse 15
CH-2504 Biel-Bienne
Switzerland

Tel. +41 - 32 - 344 47 47
Fax +41 - 32 - 344 47 40

E-mail Info@IGBT-Driver.com
Internet www.IGBT-Driver.com

© 2009…2012 CT-Concept Technologie AG - Switzerland. All rights reserved.
We reserve the right to make any technical modifications without prior notice. Version from 2012-06-26