

# 2SP0115T2A0-CM600DX-24T

## 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 2SP0115T2A0-CM600DX-24T is a compact dual-channel intelligent gate driver designed for Mitsubishi's 17mm dual IGBTs CM600DX-24T. 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.power.com/igbt-driver/go/plug-and-play](http://www.power.com/igbt-driver/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 CM600DX-24T

### 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.power.com/igbt-driver/go/2SP0115T](http://www.power.com/igbt-driver/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: Refer to "Description & Application Manual for 2SP0115T SCALE-2 IGBT Drivers"

Mounting principle: Soldered onto 17mm dual IGBT module CM600DX-24T

### 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	$V_{CC}+0.5$	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 $\leq 70^\circ\text{C}$ (Note 3)		1.2	W
	Ambient temperature $\leq 85^\circ\text{C}$ (Note 3)		1	W
Switching frequency $f$			7.5	kHz
Test voltage (50Hz/1min.)	Primary to secondary (Note 16)		3800	$V_{AC(eff)}$
	Secondary to secondary (Note 16)		3800	$V_{AC(eff)}$
DC-link voltage	Note 4		800	V
$ dV/dt $	Rate of change of input to output voltage		50	kV/ $\mu\text{s}$
Operating voltage	Primary/secondary, secondary/secondary		1200	$V_{peak}$

## Preliminary Data Sheet

Parameter	Remarks	Min	Max	Unit
Operating temperature	Note 19	-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 $\neq$ 0, ext. value	128		$\infty$	k $\Omega$
SO <sub>x</sub> 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 $\eta$	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 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 6)	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 6)	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 7)	3.5	4.1	4.6	k $\Omega$
Turn-on threshold	$V(INx)$ (Note 8)		2.6		V
Turn-off threshold	$V(INx)$ (Note 8)		1.3		V
SO <sub>x</sub> output voltage	Fault condition, $I(SOx) < 8mA$			0.7	V

## Preliminary Data Sheet

Short-circuit Protection	Remarks	Min	Typ	Max	Unit
Vce-monitoring threshold	Between auxiliary terminals		10.2		V
Response time	DC-link voltage >550V (Note 9)		5.4		μs
Delay to IGBT turn-off	After the response time (Note 10)		1.4		μs
Blocking time	After fault (Note 11)		90		ms
Timing Characteristics	Remarks	Min	Typ	Max	Unit
Turn-on delay $t_{d(on)}$	Note 12		75		ns
Turn-off delay $t_{d(off)}$	Note 12		65		ns
Jitter of turn-on delay	Note 18		±2		ns
Jitter of turn-off delay	Note 18		±4		ns
Output rise time $t_{r(out)}$	$G_x$ to $E_x$ (Note 13)		5		ns
Output fall time $t_{f(out)}$	$G_x$ to $E_x$ (Note 13)		10		ns
Dead time between outputs	Half-bridge mode (Note 20)		3		μs
Jitter of dead time	Half-bridge mode		±50		ns
Transmission delay of fault state	Note 14		400		ns
Outputs	Remarks	Min	Typ	Max	Unit
Turn-on gate resistor $R_{g(on)}$	Note 15		1.3		Ω
Turn-off gate resistor $R_{g(off)}$	Note 15		1.6		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 16)	3800	3850	3900	$V_{eff}$
	Secondary to secondary side (Note 16)	3800	3850	3900	$V_{eff}$
Partial discharge extinction volt.	Primary to secondary side (Note 17)	1220			$V_{peak}$
	Secondary to secondary side (Note 17)	1200			$V_{peak}$
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

---

## Preliminary Data Sheet

### 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) 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.
- 6) 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.
- 7) The input impedance can be modified to values <18 kΩ (customer-specific solution).
- 8) Turn-on and turn-off threshold values can be increased (customer-specific solution).
- 9) 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.
- 10) The turn-off event of the IGBT is delayed by the specified time after the response time.
- 11) 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".
- 12) 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).
- 13) 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.
- 14) Transmission delay of the fault state from the secondary side to the primary status outputs.
- 15) The gate resistors can be leaded or surface mounted. Power Integrations 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.
- 16) 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<sub>AC(eff)</sub> may lead to insulation degradation. No degradation has been observed over 1min. testing at 3800V<sub>AC(eff)</sub>. The transformer of every production sample shipped to customers has undergone 100% testing at the given value or higher (<5100V<sub>eff</sub>) for 1s.
- 17) 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.
- 18) 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.
- 19) A version with extended operating temperature range of -40°C...85°C (2SP0115T2B0) can also be supplied.
- 20) Note that the dead time may vary from sample to sample. A tolerance of approximately ±20% may be expected. If higher timing precisions are required, Power Integrations recommends using direct mode and generating the dead time externally.

---

## Preliminary Data Sheet

### **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.

**Power Integrations Driver Type #****Related IGBT**

2SP0115T2A0-CM600DX-24T (Temperature range –20°C...85°C)

CM600DX-24T

2SP0115T2B0-CM600DX-24T (Temperature range –40°C...85°C)

CM600DX-24T

Product home page: [www.power.com/igbt-driver/go/2SP0115T](http://www.power.com/igbt-driver/go/2SP0115T)

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

### Information about Other Products

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

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

## Preliminary Data Sheet

**Power Integrations Sales Offices****WORLD HEADQUARTERS**

5245 Hellyer Avenue  
San Jose, CA 95138 USA  
Tel: +1-408-414-9200  
Fax: +1-408-414-9765  
Email: [usasales@power.com](mailto:usasales@power.com)

**AMERICAS WEST**

5245 Hellyer Avenue  
San Jose, CA 95138 USA  
Tel: +1-408-414-8778  
Fax: +1-408-414-3760  
Email: [usasales@power.com](mailto:usasales@power.com)

**GERMANY** (AC-DC/LED Sales)

Lindwurmstrasse 114  
80337 München, Germany  
Tel: +49-89-5527-39100  
Fax: +49-89-1228-5374  
Email: [eurosales@power.com](mailto:eurosales@power.com)

**INDIA** (Mumbai)

Unit: 106-107, Sagar Tech Plaza-B  
Sakinaka, Andheri Kurla Road  
Mumbai, Maharashtra 400072 India  
Tel 1: +91-22-4003-3700  
Tel 2: +91-22-4003-3600  
Email: [indiasales@power.com](mailto:indiasales@power.com)

**JAPAN**

Kosei Dai-3 Bldg.  
2-12-11, Shin-Yokohama, Kohoku-ku  
Yokohama-shi, Kanagawa  
Japan 222-0033  
Tel: +81-45-471-1021  
Fax: +81-45-471-3717  
Email: [japansales@power.com](mailto:japansales@power.com)

**TAIWAN**

5F, No. 318, Nei Hu Rd., Sec. 1  
Nei Hu Dist.  
Taipei, 114 Taiwan  
Tel: +886-2-2659-4570  
Fax: +886-2-2659-4550  
Email: [taiwansales@power.com](mailto:taiwansales@power.com)

**AMERICAS EAST**

7360 McGinnis Ferry Road  
Suite 225  
Suwanee, GA 30024 USA  
Tel: +1-678-957-0724  
Fax: +1-678-957-0784  
Email: [usasales@power.com](mailto:usasales@power.com)

**CHINA** (Shanghai)

Room 2410, Charity Plaza  
No. 88 North Caoxi Road  
Shanghai, 200030 China  
Tel: +86-21-6354-6323  
Fax: +86-21-6354-6325  
Email: [chinasales@power.com](mailto:chinasales@power.com)

**GERMANY** (IGBT Driver Sales)

HellwegForum 1  
59469 Ense, Germany  
Tel: +49-2938-64-39990  
Email: [igbt-driver.sales@power.com](mailto:igbt-driver.sales@power.com)

**INDIA** (New Dehli)

#45, Top Floor  
Okhla Industrial Area, Phase - III  
New Dehli, 110020 India  
Tel 1: +91-11-4055-2351  
Tel 2: +91-11-4055-2353  
Email: [indiasales@power.com](mailto:indiasales@power.com)

**KOREA**

RM602, 6FL, 22  
Teheran-ro 87-gil, Gangnam-gu  
Seoul, 06164 Korea  
Tel: +82-2-2016-6610  
Fax: +82-2-2016-6630  
Email: [koreasales@power.com](mailto:koreasales@power.com)

**UNITED KINGDOM**

Bulding 5, Suite 21  
The Westbrook Centre  
Milton Road  
Cambridge, CB4 1YG United Kingdom  
Tel: +44-7823-557-484  
Email: [eurosales@power.com](mailto:eurosales@power.com)

**AMERICAS CENTRAL**

333 Sheridan Road  
Winnetka, IL 60093 USA  
Tel: +1-847-721-6293  
Email: [usasales@power.com](mailto:usasales@power.com)

**CHINA** (Shenzhen)

17/F, Hivac Building, No 2  
Keji South 8th Road, Nanshan District  
Shenzhen, 518057 China  
Tel: +86-755-8672-8689  
Fax: +86-755-8672-8690  
Email: [chinasales@power.com](mailto:chinasales@power.com)

**INDIA** (Bangalore)

#1, 14th Main Road  
Vasanthangar  
Bangalore, 560052 India  
Tel 1: +91-80-4113-8020  
Tel 2: +91-80-4113-8028  
Fax: +91-80-4113-8023  
Email: [indiasales@power.com](mailto:indiasales@power.com)

**ITALY**

Via Milanese 20  
20099 Sesto San Giovanni (MI), Italy  
Tel: +39-02-4550-8708  
Email: [eurosales@power.com](mailto:eurosales@power.com)

**SINGAPORE**

51 Newton Road  
#19-01/05 Goldhill Plaza  
Singapore, 308900  
Tel 1: +65-6358-2160  
Tel 2: +65-6358-4480  
Fax: +65-6358-2015  
Email: [singaporesales@power.com](mailto:singaporesales@power.com)