2SC0435T Target Datasheet

Dual-Channel Low-Cost SCALE-2 IGBT and MOSFET Driver Core

Abstract

The low-cost SCALE-2 dual-driver core 2SC0435T combines unrivalled compactness with broad applicability. The driver is designed for universal applications requiring high reliability. The 2SC0435T drives all usual IGBT modules up to 1700V. The embedded paralleling capability allows easy inverter design covering higher power ratings. Multi-level topologies are also supported.

The 2SC0435T is a very compact driver core available for industrial applications, with a footprint of only 57.2 x 51.6mm and an insertion height of max. 20mm. 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 2SC0435T combines a complete two-channel driver core with all components required for driving, such as an isolated DC/DC converter, short-circuit protection, advanced active clamping 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 35A and 4W drive power is available per channel, making the 2SC0435T an ideal driver platform for universal usage in medium and high-power applications. The driver provides a gate voltage swing of +15V/-10V. 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
- ✓ Fast setup and superior adaptability
- ✓ Blocking voltages up to 1700V
- ✓ Short delay and low jitter
- ✓ Gate current ±35A, 4W output power per channel
- ✓ +15V/-10V gate driving
- ✓ Interface for 3.3V ... 15V logic level
- ✓ Dedicated IGBT and MOSFET Mode

Applications

- ✓ General Purpose Drives
- ✓ Uninterruptable power supplies (UPS)
- ✓ Solar and wind power converters
- ✓ Auxiliary converters for traction
- ✓ Electrojhybrid drive vehicles
- ✓ Driving parallel-connected IGBTs
- ✓ Medical (MRT, CT, X-Ray)
- ✓ Laser technology

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 the "2SC0435T Description & Application Manual".

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	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	-35	+35	A
Min. external gate resistance	Turn-on and turn-off	0.5		Ω
Average supply current I_{DC}	Notes 2, 3		750	mA
Output power	Ambient temperature <70°C (Notes 4, 5)		t.b.d.	W
	Ambient temperature 85°C (Note 4)		4	W
Switching frequency F			100	kHz
|dV/dt|	Rate of change of input to output voltage (Note 17)		t.b.d.	kV/µs
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
Nominal supply voltage V_{DC}	VDC to GND	14.5	15	15.5	V
Nominal supply voltage V_{CC}	VCC to GND	14.5	15	15.5	V

Electrical Characteristics (IGBT mode)

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

Power supply	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Supply current I_{DC}	Without load		32		mA
Supply current I_{CC}	F = 0Hz		26		mA
Supply current I_{CC}	F = 100kHz		38		mA
Coupling capacitance C_{io}	Primary to output, total		t.b.d.		pF
Power Supply Monitoring	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Supply threshold V_{thC}	Primary side, clear fault	11.9	12.6	13.3	V
Supply threshold V_{thS}	Primary side, set fault (Note 18)	11.3	12.0	12.7	V
Monitoring hysteresis	Primary side, set/clear fault	0.35			V
Supply threshold V_{thC}	Secondary side, clear fault	17.7	18.5	19.3	V
Supply threshold V_{thS}	Secondary side, set fault (Note 19)	17.2	18.0	18.8	V
Monitoring hysteresis	Secondary side, set/clear fault	0.35	0.5		V
Logic Inputs and Outputs	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Input bias current	V(INx) > 3V		190		µA
Turn-on threshold	V(INx)		2.1		V
Turn-off threshold	V(INx)		1.5		V
SOx output voltage	Failure condition, I(SOx)<20mA			0.7	V
Short-Circuit Protection	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Minimum response time	Note 15		2.5		µs
Minimum blocking time	Note 16		9		µs
Timing Characteristics	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Turn-on delay $t_{d(on)}$	Note 6		80		ns
Turn-off delay $t_{d(off)}$	Note 6		70		ns
Jitter of turn-on delay			t.b.d.		ns
Jitter of turn-off delay			t.b.d.		ns
Output rise time $t_{r(out)}$	Note 7		20		ns
Output fall time $t_{f(out)}$	Note 7		20		ns
Transmission delay of fault state	Note 20		400		ns

Electrical Insulation	Remarks	Min	Typ	Max	Unit
Test voltage	50Hz/1 min (Note 21)			4000	V_{eff}
Partial discharge extinction volt.	IEC60270	1700			V_{peak}
Creepage distance	Primary to secondary side	15.7			mm
Creepage distance	Secondary to secondary side	12			mm

Output	Remarks	Min	Typ	Max	Unit
Blocking capacitance VISOx to VEx	Note 14		9.4		µF
Blocking capacitance VEx to COMx	Note 14		9.4		µF

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		-10.1		V
Turn-off voltage, V_{GLx}	1W output power		-9.8		V
Turn-off voltage, V_{GLx}	4W output power		-9.5		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 changes to (–40°C - 70°C) and the absolute maximum output power rating changes to t.b.d.
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 with an output load of 4.7Ω and 270nF. The values are given for the driver side of the gate resistor. The time

constant of the output load in conjunction with the present gate resistor leads to an additional delay at the load side of the gate resistor.

14) External blocking capacitors are to be placed between VISO and VE as well as VE and COM for gate charges exceeding 5µC. Ceramic capacitors are recommended. A minimum external blocking capacitance of 2µF is recommended for every 1µC of gate charge beyond 5µC.
15) 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}=0pF).
16) 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.
17) This specification guarantees that the drive information will be transferred reliably even at a high DC-link voltage and with ultra-fast switching operations.
18) 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 power semiconductors are switched off.
19) Undervoltage monitoring of the secondary-side supply voltage (VISOx to COMx). If the voltage drops below this limit, the corresponding IGBT is switched off and a fault is transmitted to the corresponding SOx output.
20) Transmission delay of fault state from the secondary side to the corresponding primary status output.
21) The test voltage of 4000VAC(eff)/50Hz may be applied only once during one minute. It should be noted that with this (strictly speaking obsolete) test method, some (minor) damage occurs to the insulation layers due to the partial discharge. Consequently, this test is not performed at CONCEPT as a series test. In the case of repeated insulation tests (e.g. module test, equipment test, system test), the subsequent tests should be performed with a lower test voltage: the test voltage is reduced by 400V for each additional test. The more modern if more elaborate partial-discharge measurement is preferable to such test methods as it is almost entirely non-destructive.

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.

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Ordering Information

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Type Designation	Description
2SC0435T2A0-17	Dual-channel SCALE-2 driver core

Product home page: www.IGBT-Driver.com/go/2SC0435T

Refer to www.IGBT-Driver.com/go/nomenclature for information on driver nomenclature

Information about Other Products

For other drivers, product documentation, and application support

Please click: www.IGBT-Driver.com

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