TN5050H-12WL

Datasheet

50 A - 1200 V - 150 °C SCR in TO-247LL HC package

Product status
TN5050H-12WL

Product summary	
$I_{T(RMS)}$	50 A
V_{DRM}/V_{RRM}	1200 V
V_{DSM}/V_{RSM}	1400 V
I_{GT} max.	50 mA
T_j max.	150 °C

Features

- Max. blocking voltage = V_{DRM}, V_{RRM} = 1200 V
- Max. surge voltage = V_{DSM}, V_{RSM} = 1400 V
- Max. I_{GT} = 50 mA
- Max. junction temperature = 150 °C at V_D/V_R = 800 V
- High static and dynamic commutation:
  - dV/dt = 1500 V/µs
  - dI/dt = 200 A/µs
- ECOPACK2 compliant component (RoHS and HF compliance)
- High creepage TO247 long lead package
- UL94 , level V0 resin compliance

Application

- Solar
- Wind renewable energy inverters
- Solid state relay (SSR)
- Uninterruptible power supply (UPS)
- Industrial SMPS
- Bypass switch
- AC DC inrush current limiting circuit (ICL)
- AC DC voltage-controlled rectifier
- Battery charger
- Industrial welding systems
- Soft starter for motor drive
- Heating systems

Description

The SCR TN5050H-12WL is a high-temperature device suitable for industrial applications requiring high immunity and low gate current, such as motor starters and power supplies.

With a surge capability of 1400 V, this SCR offers additional robustness for network applications such as renewable energy inverters and UPS.

This device is available in a high-power TO-247LL package with a backside anode and resin corners to provide additional creepage distance up to 6.8 mm to comply with safety standards.

The TN5050H-12WL SCR is also suitable for industrial applications up to 50 A RMS.

1 Characteristics

Table 1. Absolute maximum ratings (limiting values)

Symbol	Parameter		Value	Unit
V_{DRM}, V_{RRM}	Repetitive peak off-state voltage (50-60 Hz)	T_j = 125 °C	1200	V
		T_j = 150 °C	800	
V_{DSM}, V_{RSM}	Non-repetitive surge voltage, t_P = 10 ms	T_j = 25 °C	1400	V
$I_{T(RMS)}$	On-state RMS current (180 ° conduction angle)	T_c = 121 °C	50	A
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)		32	
I_{TSM}	Non repetitive surge peak on-state current (T_j initial = 25 °C), V_R = 0 V	t_p = 8.3 ms	493	A
		t_p = 10 ms	450	
I^2t	I^2t value for fusing	t_p = 10 ms	1013	A^2s
dI/dt	Critical rate of rise of on-state current I_G = 100 mA, dI_g/dt = 1 A/µs	T_j = 25 °C	200	A/µs
I_{GM}	Maximum peak positive gate current	t_p = 20 µs, T_j = 150 °C	8	A
V_{GM}	Maximum peak positive gate voltage		5	V
$P_{G(AV)}$	Average gate power dissipation	T_j = 150 °C	1	W
V_{RGM}	Maximum peak reverse gate voltage		3.5	V
T_{stg}	Storage junction temperature range		-40 to +150	°C
T_j	Operating junction temperature range		-40 to +150	

Table 2. Electrical characteristics (T_j = 25 °C unless otherwise specified)

Symbol	Test conditions		Value		Unit
I_{GT} (1)	V_D = 12 V, R_L = 33 Ω	Max.	50		mA
	V_D = 12 V, R_L = 33 Ω	T_j = -40 °C	Max.	80	mA
V_{GT}	V_D = 12 V, R_L = 33 Ω		Max.	1.0	V
V_{GD}	V_D = 800 V, R_L = 3.3 kΩ	T_j = 150 °C	Min.	0.15	V
I_H (1)	I_T = 500 mA, gate open		Max.	100	mA
I_L	I_G = 1.2 x I_{GT}		Max.	125	mA
dV/dt(1)	V_D = 800 V, gate open	T_j = 125 °C	Min.	2.0	kV/µs
		T_j = 150 °C	Min.	1.5	kV/µs
t_{gt}	I_T = 50 A, V_D = V_{DRM}, I_G = 100 mA, (dI_G/dt) max = 0.2 A/µs		Typ.	2.5	µs
t_q	I_T = 50 A, (dI/dt) max = 10 A/µs, V_R = 25 V, dV/dt = 100 V/µs, V_D = 800 V	T_j = 150 °C	Typ.	150	µs

1. *Measurements referenced to K.*

Table 3. Static characteristics

Symbol	Test conditions			Value	Unit
V_{TM}	I_{TM} = 64 A, t_p = 380 µs	T_j = 25 °C	Max.	1.55	V
V_{TO}	Threshold voltage	T_j = 150 °C	Max.	0.85	
R_D	Dynamic resistance	T_j = 150 °C	Max.	11	mΩ
I_{DRM}, I_{RRM}	V_{DRM} = V_{RRM} = 1200 V	T_j = 25 °C	Max.	5	µA
		T_j = 125 °C		3.5	mA
	V_{DRM} = V_{RRM} = 800 V	T_j = 150 °C		10	mA

Table 4. Thermal parameters

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Max.	0.53	°C/W
$R_{th(j-a)}$	Junction to ambient (DC)	Typ.	50	

1.1 Characteristics curves

Figure 1. Maximum average power dissipation versus average on-state current

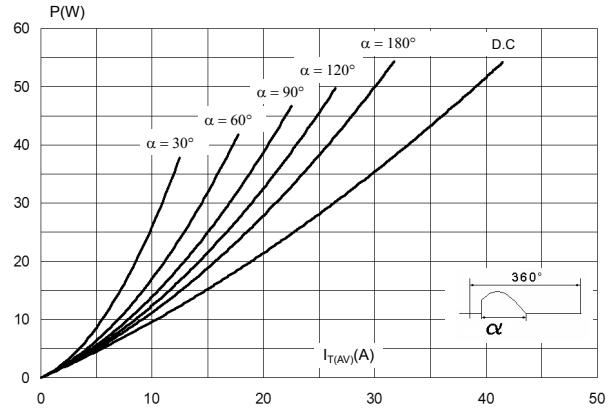


Figure 2. Average and DC on-state current versus case temperature

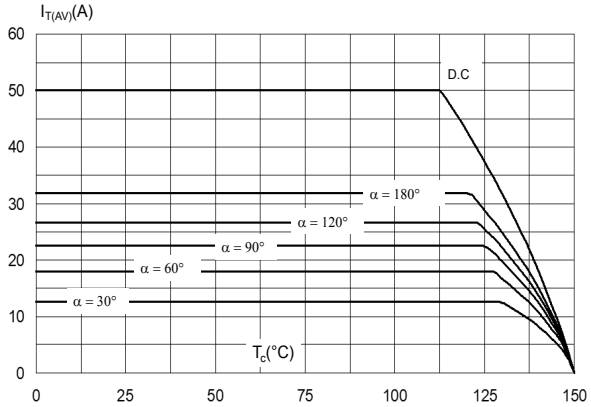


Figure 3. On-state characteristics (maximum values)

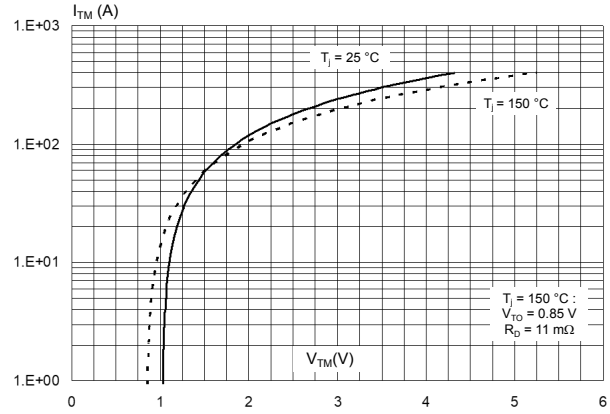


Figure 4. Average and D.C. on-state current versus ambient temperature

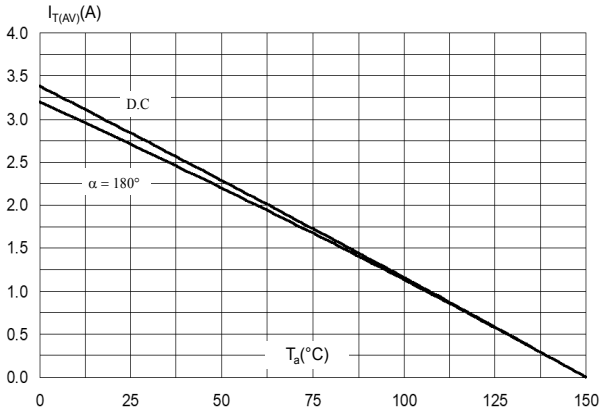


Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration

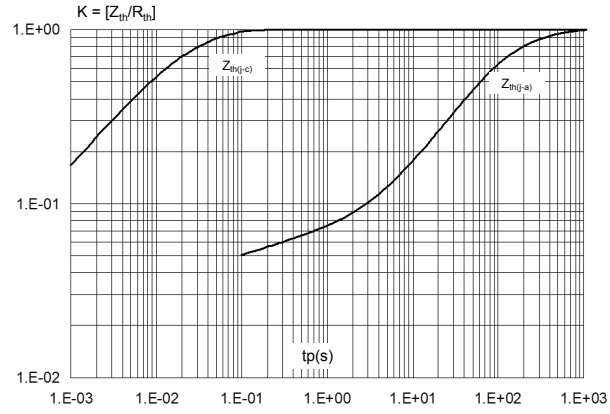


Figure 6. Relative variation of holding and latching current versus junction temperature (typical value)

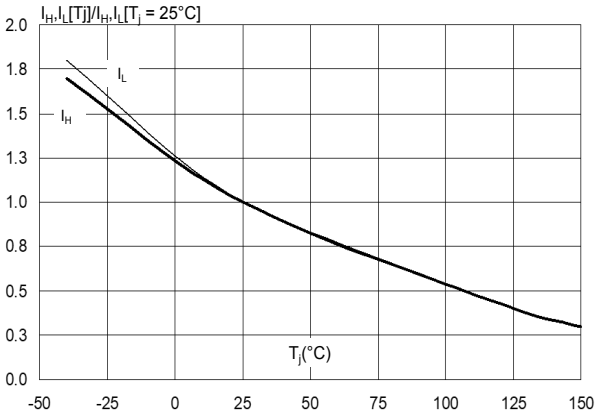


Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms

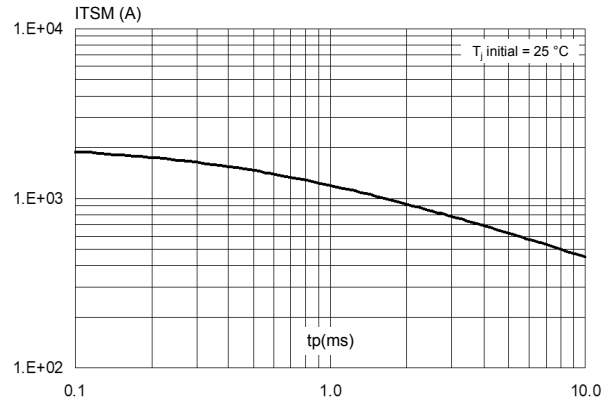


Figure 8. Relative variation of gate trigger current and gate trigger voltage versus junction temperature (typical value)

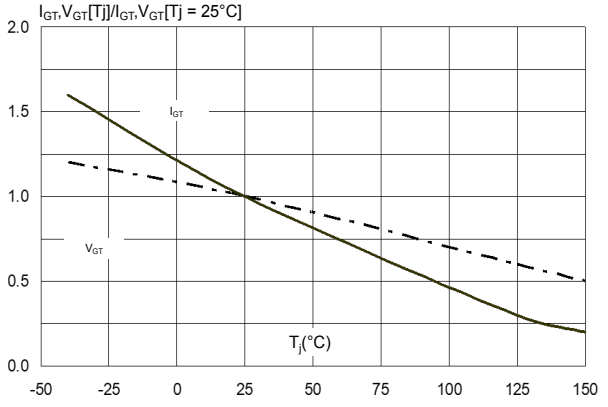


Figure 9. Surge peak on-state current versus number of cycles

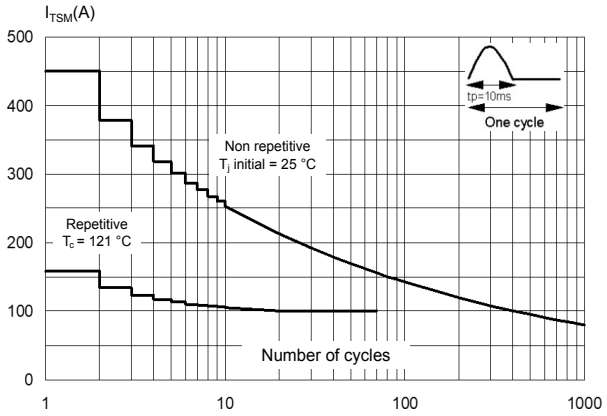


Figure 10. Relative variation of static dV/dt immunity versus junction temperature

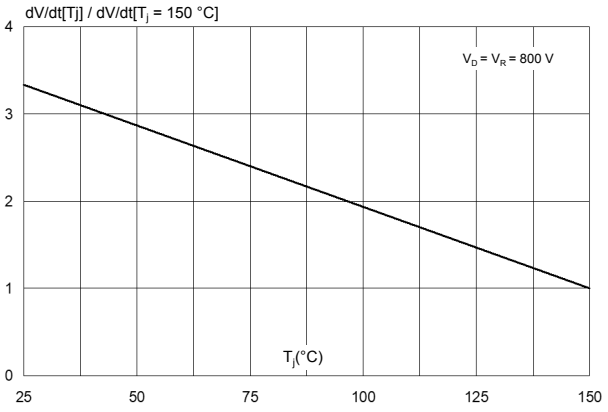


Figure 11. Relative variation of leakage current versus junction temperature for different values of blocking voltage (typical values)

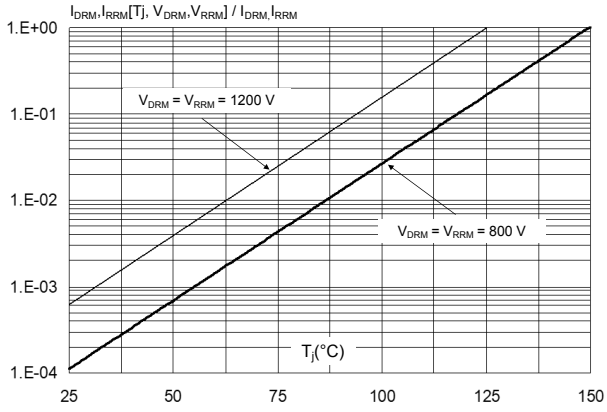


Figure 12. Recommended maximum case-to-ambient thermal resistance versus ambient temperature for different peak off-state voltages (for heatsink sizing to avoid thermal runaway)

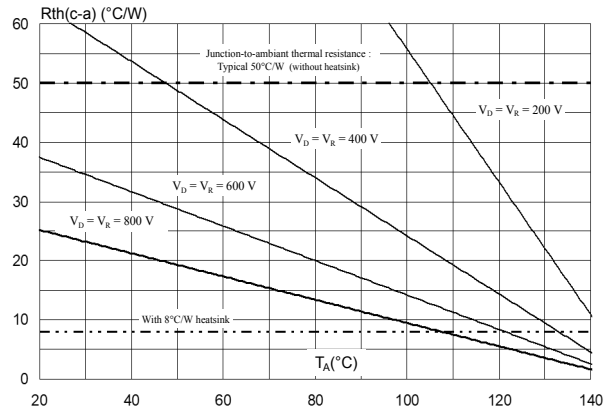
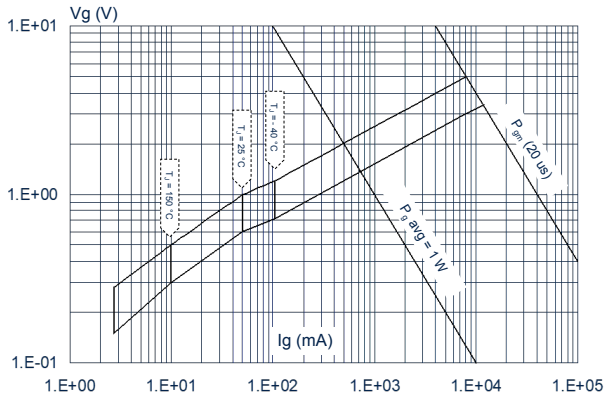


Figure 13. **Gate characteristic**



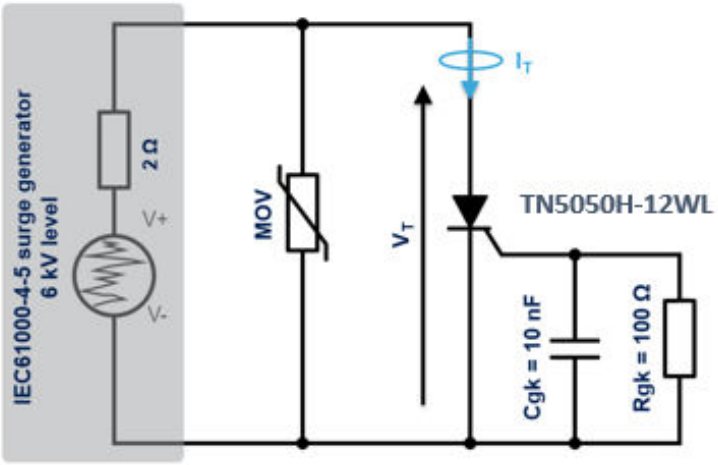
2 Application information

Overvoltage surge management

The TN5050H-12WL specification in Table 1 gives a non-repetitive surge voltage forward VDSM and reverse VRSM at 1400 V, for a surge duration up to 10 ms duration at 25°C of junction temperature. This feature allows designers headroom for overvoltage surge management in final application, reducing ratings of AC Line input protections, but also for an increased reliability of the overall application in the field, such as UPS, AC/DC converters or motor controllers.

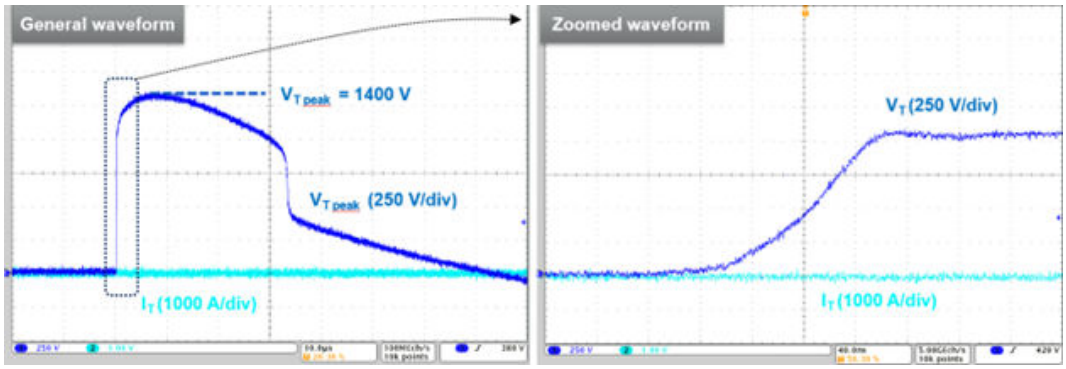
Here below is an example of an overvoltage surge, as defined in IEC61000-4-5 Electromagnetic compatibility standard, applied to the TN5050H-12WL. The Figure 14 details a simplified application front-end circuit, including the surge protection, made of Metal Oxyde Varistor, in parallel of the TN5050H-12WL.

Figure 14. Simplified front-end circuit using TN5050H-12WL



When an 1.2/50 µs overvoltage surge occurs on the AC Line, the application input protection clamps the voltage across the TN5050H-12WL SCR. Thanks to the extra V_{DSM}/V_{RSM} specification, the maximum allowed voltage across the SCR is 1400 V. The waveform Figure 15 illustrates the voltage across the AC Line and the SCR during a 6 kV surge event, performed within the Figure 14 test schematic, when the junction temperature equals the maximum junction temperature of the TN5050H-12WL: T j max = 150 °C, the device still withstands the stress when the occurrence is up to 10 surges, on each polarity, according to the IEC61000-4-5 standard

Figure 15. Waveform of line and SCR voltages



3 Package information

To meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions, and product status are available at: www.st.com. ECOPACK is an ST trademark.

3.1 TO-247LL HC package information

- Molding epoxy resin is halogen free and meets UL94 level V0
- Lead free plating of the package leads
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1.0 N·m

Figure 16. TO-247LL HC package outline

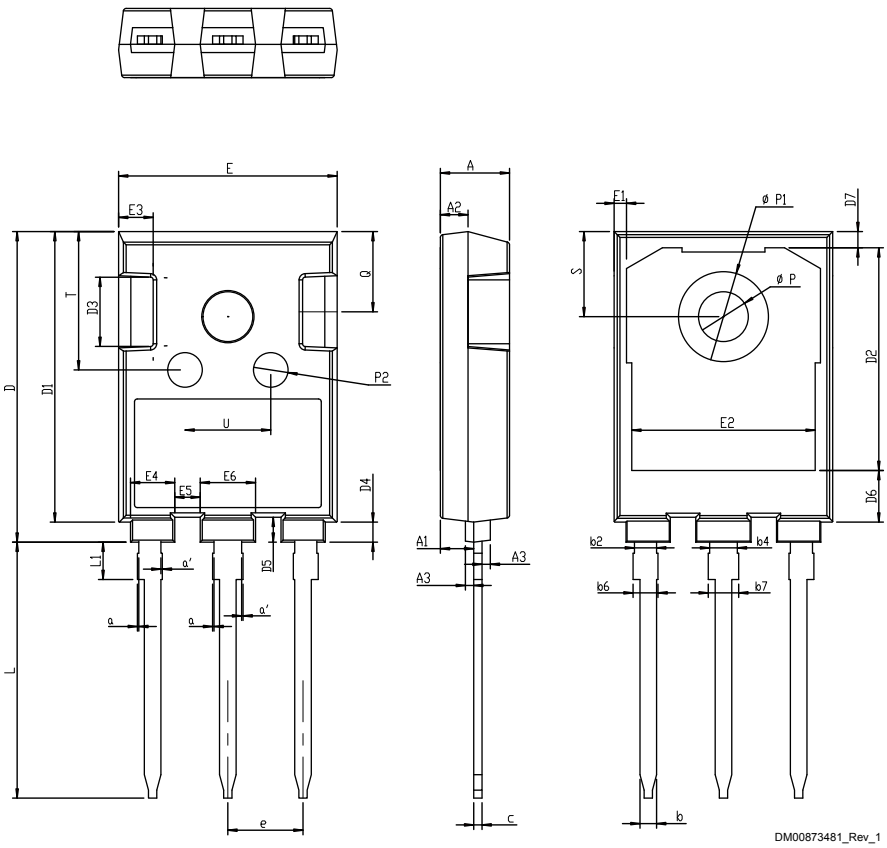


Table 5. **TO-247LL HC package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches (only for reference)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.90	5.00	5.10	0.1929	0.1969	0.2008
A1	2.31	2.41	2.51	0.0909	0.0949	0.0988
A2	1.90	2.00	2.10	0.0748	0.0787	0.0827
A3	0.50	0.60	0.70	0.0197	0.0236	0.0276
a	0.00		0.20	0.0000		0.0079
a'	0.00		0.20	0.0000		0.0079
b	1.16		1.26	0.0457		0.0496
b2	1.56		1.66	0.0614		0.0654
b4	1.96		2.06	0.0772		0.0811
b6			1.90			0.0748
b7			2.30			0.0906
c	0.59		0.66	0.0232		0.0260
D	22.35	22.45	22.55	0.8799	0.8839	0.8878
D1	20.90	21.00	21.10	0.8228	0.8268	0.8307
D2	15.85	16.10	16.35	0.6240	0.6339	0.6437
D3	4.90	5.00	5.10	0.1929	0.1969	0.2008
D4	1.35	1.45	1.55	0.0531	0.0571	0.0610
D5	1.70	1.80	1.90	0.0669	0.0709	0.0748
D6	3.53	3.73	3.93	0.1390	0.1469	0.1547
D7	0.92	1.17	1.42	0.0362	0.0461	0.0559
E	15.70	15.80	15.90	0.6181	0.6220	0.6260
E1	0.59		1.19	0.0232		0.0469
E2	13.00	13.26	13.50	0.5118	0.5220	0.5315
E3	2.40	2.50	2.60	0.0945	0.0984	0.1024
E4	3.10	3.20	3.30	0.1220	0.1260	0.1299
E5	1.74	1.84	1.94	0.0685	0.0724	0.0764
E6	3.90	4.00	4.10	0.1535	0.1575	0.1614
e	5.34	5.44	5.54	0.2102	0.2142	0.2181
L	18.35	18.50	18.65	0.7224	0.7283	0.7343
L1	2.55	2.70	2.85	0.1004	0.1063	0.1122
P	3.50	3.60	3.70	0.1378	0.1417	0.1457
P1	6.30		6.70	0.2480		0.2638
P2	2.40	2.50	2.60	0.0945	0.0984	0.1024
Q	5.60		6.00	0.2205		0.2362
S	6.05	6.15	6.25	0.2382	0.2421	0.2461
T	9.80		10.20	0.3858		0.4016
U	6.00		6.40	0.2362		0.2520

4 Ordering information

Figure 17. **Ordering information scheme**

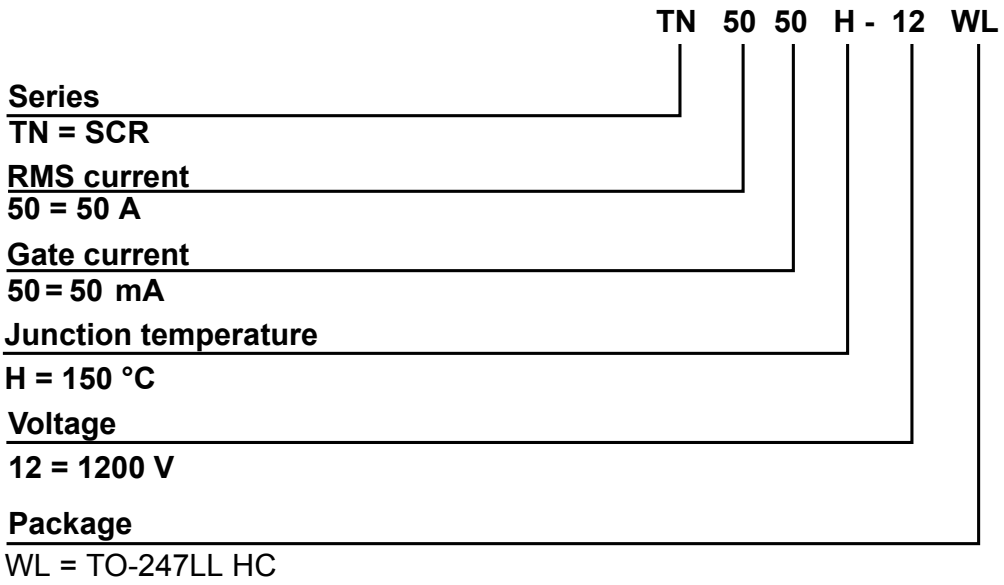


Table 6. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN5050H-12WL	TN5050H-12WL	TO-247LL HC	6.22 g	30	Tube

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
11-Jul-2025	1	Initial release.

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice.

In the event of any conflict between the provisions of this document and the provisions of any contractual arrangement in force between the purchasers and ST, the provisions of such contractual arrangement shall prevail.

The purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

The purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of the purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

If the purchasers identify an ST product that meets their functional and performance requirements but that is not designated for the purchasers' market segment, the purchasers shall contact ST for more information.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.