TN13050H-12WL

Datasheet

130 A 1200 V high temperature SCR in high creepage TO247-LL HC

Backside: Anode
TO-247 LL HC

Product status link
TN13050H-12WL

Product summary	
Package	TO-247LL
$I_{T(RMS)}$	130 A
V_{DRM}/V_{RRM}	1200 V
V_{DSM}/V_{RSM}	1400 V
T_j	150 °C

Features

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

Applications

- Solar and wind renewable energy inverter
- Solid state relay (SSR)
- Uninterruptible power supply (UPS)
- Battery charger
- Soft starter for motor control
- AC/DC Inrush current limiting circuit (ICL)
- AC/DC voltage-controlled rectifier
- Heating resistor control for heaters and welding systems

Description

Thanks to its operating junction temperature up to 150 °C, the TN13050H-12WL offers high thermal performance operation up to 130 A RMS.

Available in through-hole high power package TO-247 long lead with anode in backside. The resin wedges - on top of each package pin - offer an additional creepage distance of up to 6.8 mm to ensure compliance with the safety standard.

The TN13050H-12WL SCR is suitable in industrial applications where high immunity is required with a lower gate current, such as motor soft starter and power supply. In addition, its 1400 V surge capability brings robustness to grid application such as UPS or renewable energy inverters.

1 Characteristics

Table 1. Absolute maximum ratings (limiting values)

Symbol	Parameters			Value	Unit
$I_{T(RMS)}$	On-state RMS current (180° conduction angle)		T_C = 110 °C	130	A
$I_{T(AV)}$	Average on-state current (180° conduction angle)			83	A
I_{TSM}	Non repetitive surge peak on-state current, V_R = 0 V	t_p = 8.3 ms	T_j initial = 25 °C	1205	A
		t_p = 10 ms		1100	
I^2t	I^2t value for fusing		t_p = 10 ms	6050	A^2s
dI/dt	Critical rate of rise of on-state current I_G = 2 x I_{GT} , $t_r \leq$ 100 ns	f = 50 Hz	T_j = 25 °C	200	A/µs
V_{DRM} / V_{RRM}	Repetitive peak off-state voltage		T_j = 125 °C	1200	V
			T_j = 150 °C	800	
V_{DSM} / V_{RSM}	Non repetitive surge peak off-state voltage	t_p = 10 ms	T_j = 25 °C	1400	V
V_{GM}	Maximum positive peak gate voltage	t_p = 20 µs	T_j = 150 °C	5	V
I_{GM}	Maximum positive peak gate current			8	A
$P_{G(AV)}$	Average gate power dissipation			1	W
V_{RGM}	Maximum peak reverse voltage			3.5	V
T_{stg}	Storage junction temperature range			-40 to +150	°C
T_j	Operating junction temperature range			-40 to +150	°C

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

Symbol	Parameters		Value		Unit
I_{GT}	V_D = 12 V, R_L = 33 Ω	T_j = 25 °C	Max.	50	mA
		T_j = -40 °C	Max.	80	mA
V_{GT}	V_D = 12 V, R_L = 33 Ω		Max.	1	V
V_{GD}	V_D = 800 V, R_L = 3300 Ω	T_j = 150 °C	Min.	0.15	V
I_H	I_T = 500 mA, gate open		Max.	100	mA
I_L	I_G = 1.2 I_{GT}		Max.	125	mA
dV/dt	V_D = 800 V, gate open	T_j = 125 °C	Min.	2000	V/µs
		T_j = 150 °C	Min.	1500	
t_{gt}	I_T = 130 A, V_D = 800 V, I_G = 100 mA, (dI_G/dt)max = 0.2 A/µs		Typ.	2	µs
t_q	I_T = 130 A, V_D = 800 V, V_R = 25 V, dV_D/dt = 100 V/µs, (dI/dt) = 10 A/µs	T_j = 150 °C	Typ.	150	µs

Table 3. Static characteristics

Symbol	Test conditions		Value		Unit
V_{TM}	I_{TM} = 166 A, t_p = 380 µs	T_j = 25 °C	Max.	1.65	V
			Typ.	1.45	
V_{TO}	Threshold on-state voltage	T_j = 150 °C	Max.	0.85	V
R_D	Dynamic resistance	T_j = 150 °C	Max.	5.2	mΩ
I_{DRM} / I_{RRM}	V_D = V_R = 1200 V	T_j = 25 °C	Max.	5	µA
		T_j = 125 °C		4.5	mA
	V_D = V_R = 800 V	T_j = 125 °C		4	
		T_j = 150 °C		20	

Table 4. Thermal resistance

Symbol	Parameters		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Max.	0.25	°C/W
$R_{th(j-a)}$	Junction to ambient	Typ.	50	

1.1 Characteristics (curves)

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

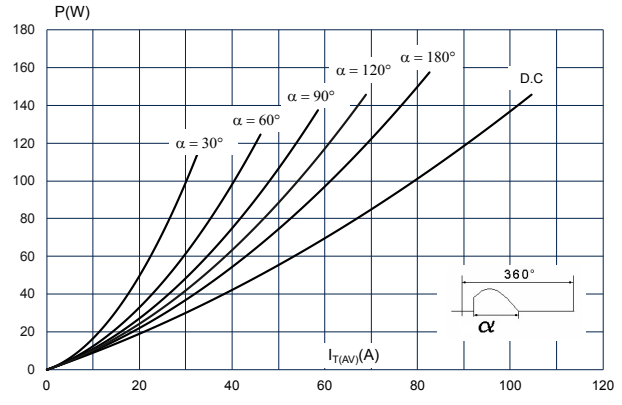


Figure 2. Average and DC on-state current versus case temperature

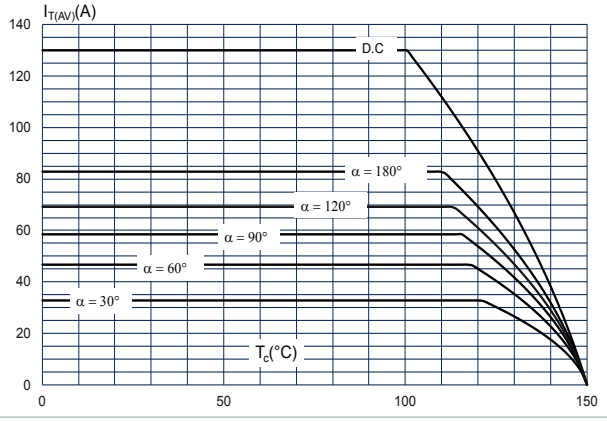


Figure 3. On-state characteristics (maximum values)

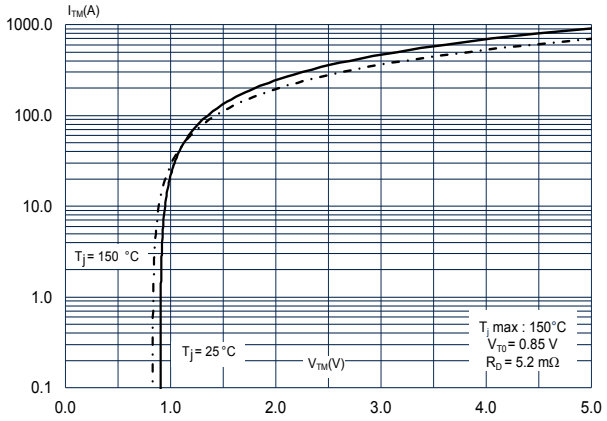


Figure 4. Average and D.C. on-state current versus ambient temperature

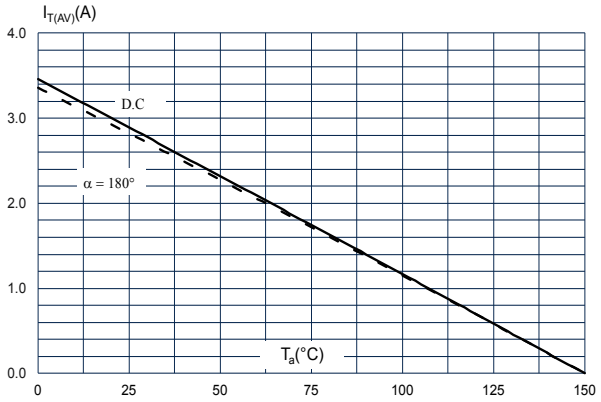


Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration

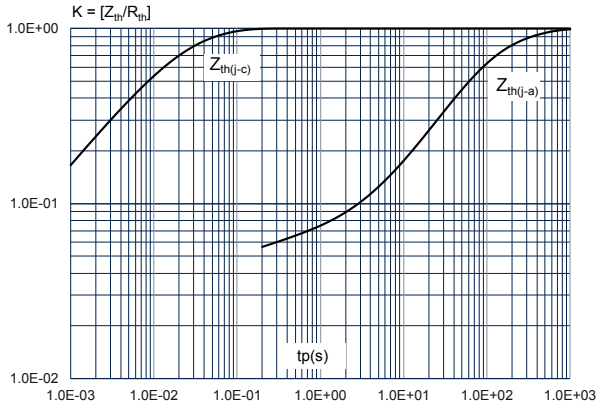


Figure 6. Surge peak on-state current versus number of cycles

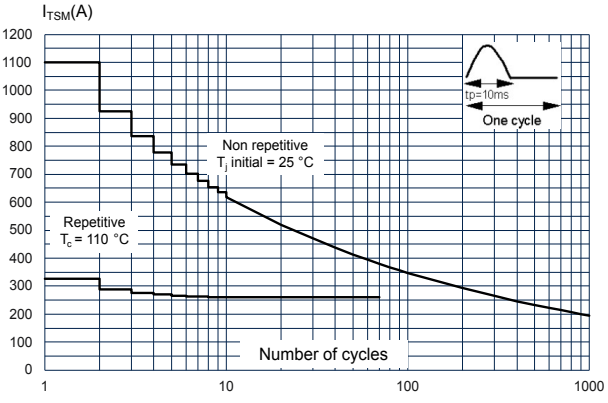


Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms

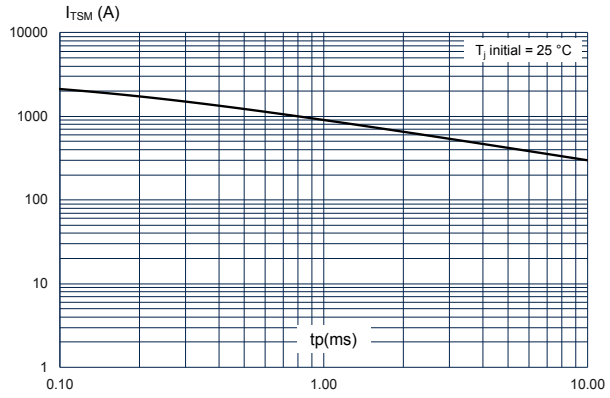


Figure 8. Relative variation of holding and latching current versus junction temperature (typical value)

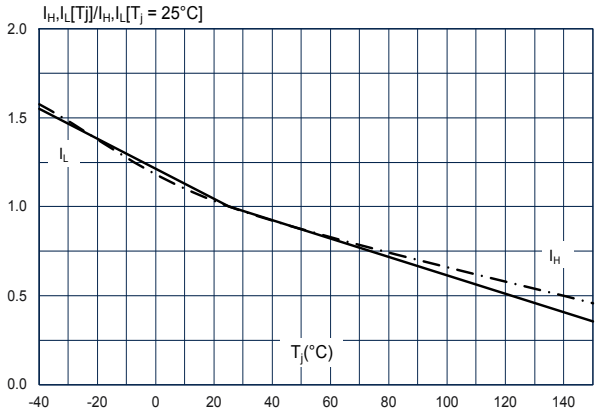


Figure 9. Relative variation of Turn-off time versus junction temperature (typical values)

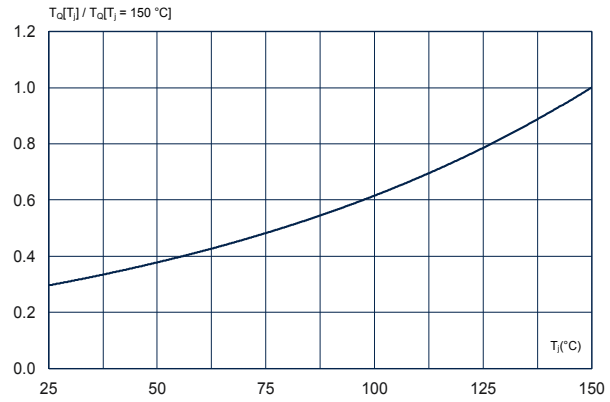


Figure 10. Relative variation of static dV/dt immunity versus junction temperature

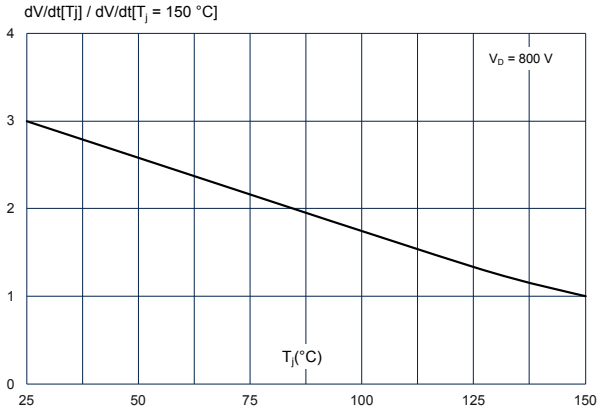


Figure 11. Relative variation of leakage current versus junction temperature for different values of blocking voltage (typical values)

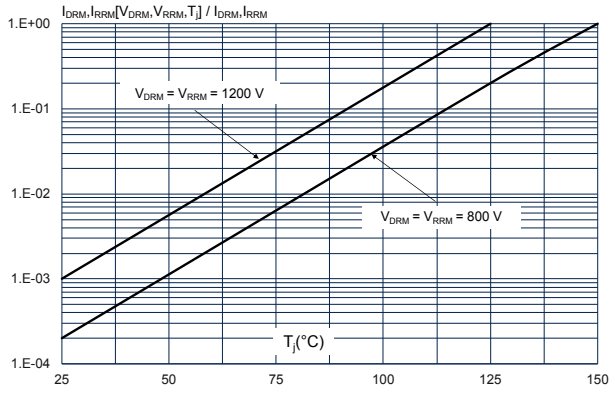


Figure 12. Relative variation of gate trigger current and gate trigger voltage versus junction temperature (typical value)

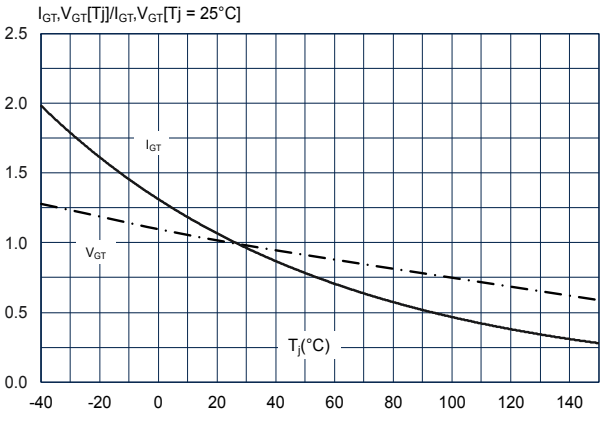


Figure 13. Gate characteristic

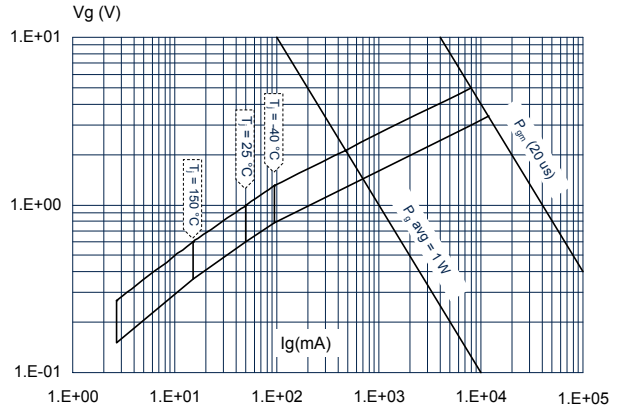
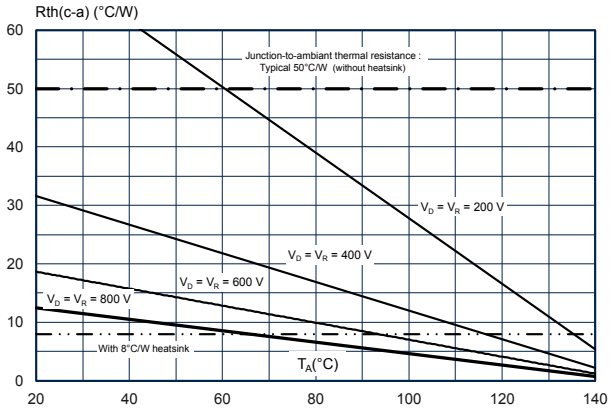


Figure 14. Recommended maximum case-to-ambient thermal resistance versus ambient temperature for different peak off-state voltages (for heatsink sizing to avoid thermal runaway)



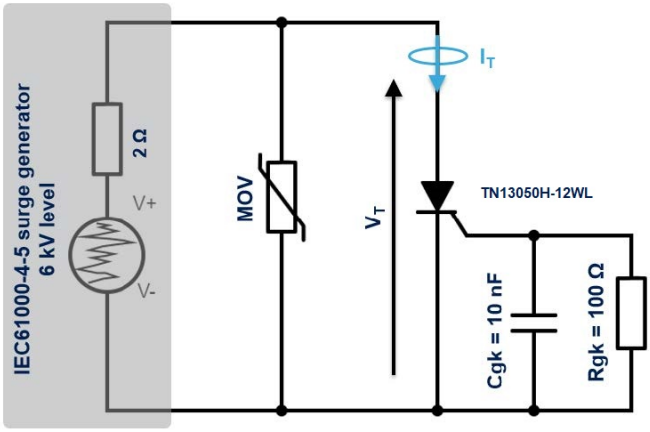
2 Application

2.1 Overvoltage surge management

The TN13050H-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.

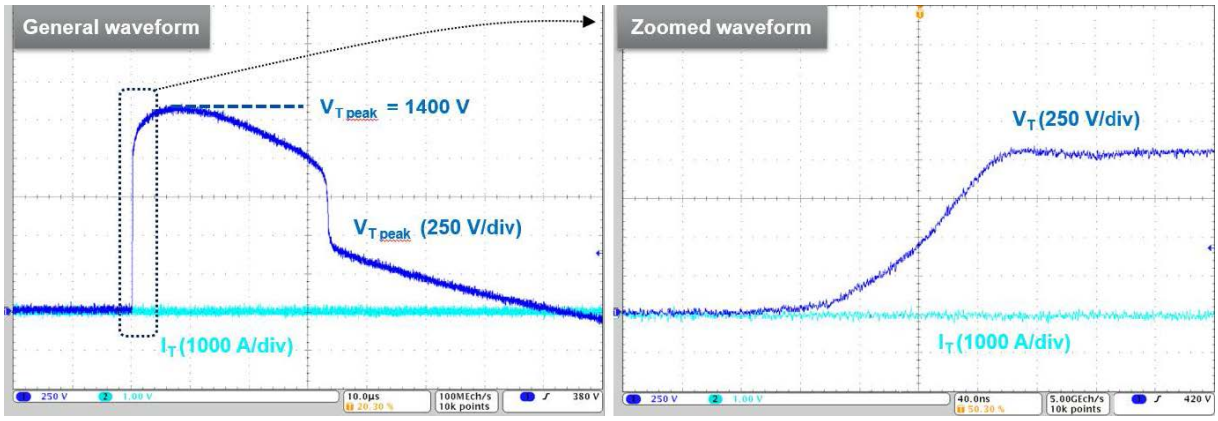
Here below is an example of an overvoltage surge, as defined in IEC61000-4-5 Electromagnetic compatibility standard, applied to the TN13050H-12WL. The Figure 15 details a simplified application front-end circuit, including the surge protection, made of Metal Oxyde Varistor, in parallel of the TN13050H-12WL.

Figure 15. Simplified front-end circuit using TN13050H-12WL



When an 1.2/50 µs overvoltage surge occurs on the AC Line, the application input protection clamps the voltage across the TN13050H-12WL SCR. Thanks to the extra V_{DSM} / V_{RSM} specification, the maximum allowed voltage across the SCR is 1400 V. The waveform in Figure 16 illustrates the voltage across the AC Line and the SCR during a 6 kV surge event, performed within the Figure 15 test schematic, when the junction temperature equals the maximum junction temperature of the TN13050H-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 16. 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 17. TO-247LL HC package outline

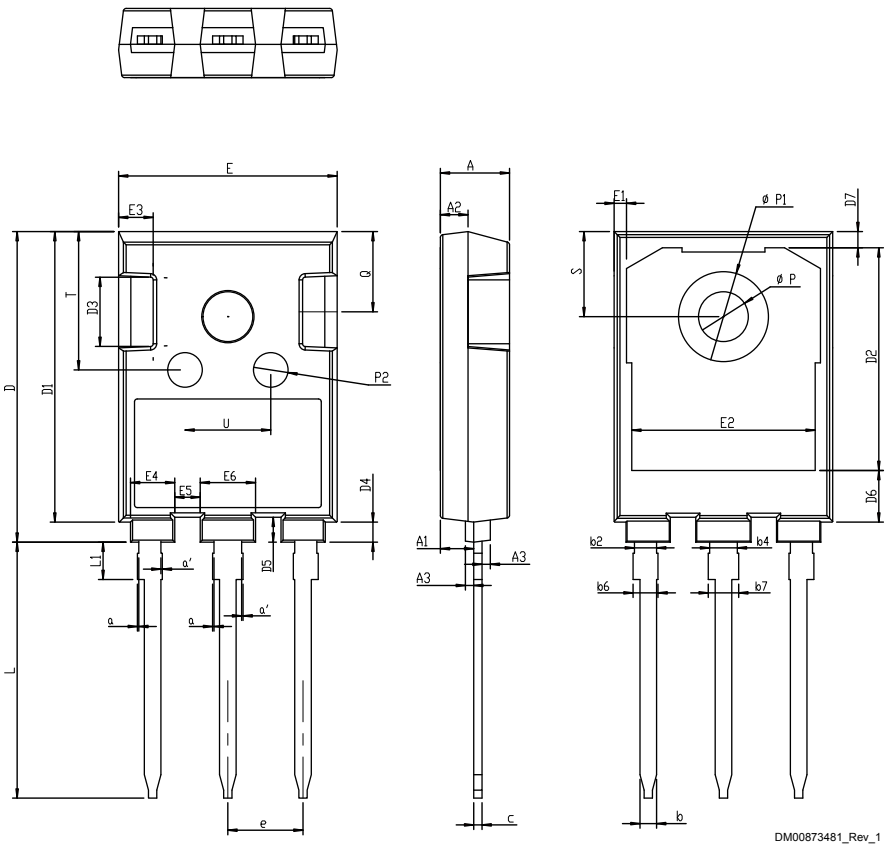


Table 5. **TO-247LL HC package mechanical data**

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 18. **Ordering information scheme**

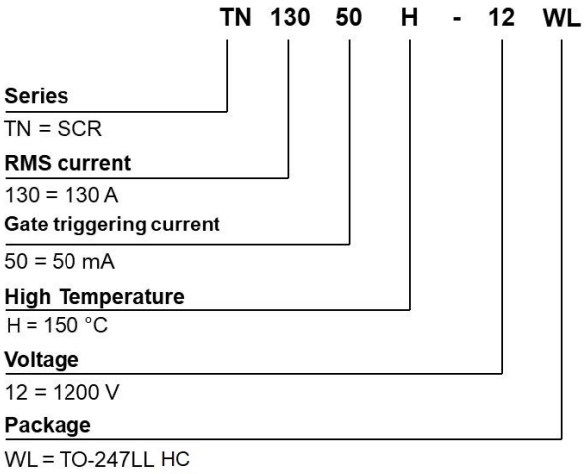


Table 6. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN13050H-12WL	TN13050H-12WL	TO247-LL HC	6.22 g	30	Tube

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
26-Nov-2025	1	Initial release.

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