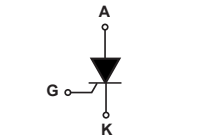
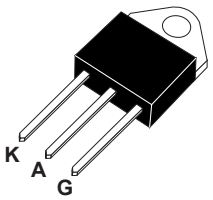
TN8050H-12PI

Datasheet

80 A 1200 V 150 °C junction temperature SCR in TOP3 package





TOP3 Isolated

Product status
TN8050H-12PI

Product summary	
$I_{T(RMS)}$	80 A
V_{DRM}/V_{RRM}	1200 V
V_{DSM}/V_{RSM}	1400 V
I_{GT} max.	50 mA
T_j max.	150 °C
Package	TOP3 ins.

Features

- Max. blocking voltage = V_{DRM}, V_{RRM} = 1200 V
- Max. surge voltage = V_{DSM}, V_{RSM} = 1400 V
- I_{GT} maximum = 50 mA
- Max. junction temperature = 150 °C at V_D/V_R = 800 V
- High static and dynamic commutation:
  - dI/dt = 200 A/µs
  - dV/dt = 1500 V/µs
- ECOPACK2 compliant component (RoHS and HF compliance)
- Complies with UL1557 standard (file ref: E81734) rated at 2.5 kV RMS thanks to it's ceramic insulator
- UL94, level V0 molding resin compliance

Application

- Solar / Wind renewable energy inverters and rectifiers
- Solid state relay (SSR)
- Uninterruptible power supply (UPS)
- Industrial SMPS
- Battery charger
- Soft starter for motor control
- AC/DC inrush current limiter (ICL)
- AC/DC voltage controlled rectifier
- Heating resistor control for heaters and welding systems

Description

The TN8050H-12PI high temperature 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.

The insulated TOP3 package allows simplified design assembly thanks to its 2.5 kV certified rated insulation.

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_j = 25 °C	1400	V
$I_{T(RMS)}$	On-state RMS current (180 ° conduction angle)		T_c = 55 °C	80	A
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)			51	
I_{TSM}	Non repetitive surge peak on-state current (T_j initial = 25 °C), V_R = 0 V		t_p = 8.3 ms	745	A
			t_p = 10 ms	680	
I^2t	I^2t value for fusing		t_p = 10 ms	2312	A^2s
dI/dt	Critical rate of rise of on-state current I_G = 2 x I_{GT}, t_r < 100 ns, T_j = 150 °C		f = 50 Hz	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	
V_{ins}	Insulation RMS voltage; 1 min			2.5	kV

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

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

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.	9.5	mΩ
I_{DRM}, I_{RRM}	V_{DRM} = V_{RRM} = 1200 V	T_j = 25 °C	Max.	5	µA
		T_j = 125 °C		5.5	mA
	V_{DRM} = V_{RRM} = 800 V	T_j = 150 °C		15	mA

Table 4. Thermal parameters

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Typ.	0.8	°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

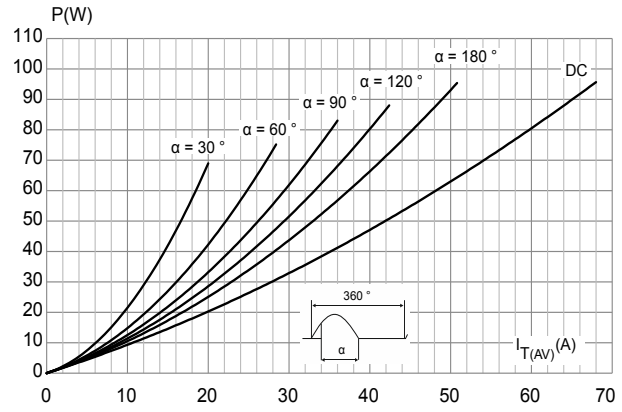


Figure 2. Average and DC on-state current versus case temperature

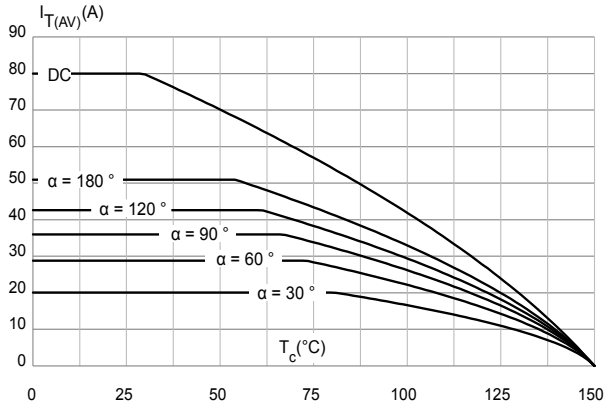


Figure 3. On-state characteristics (maximum values)

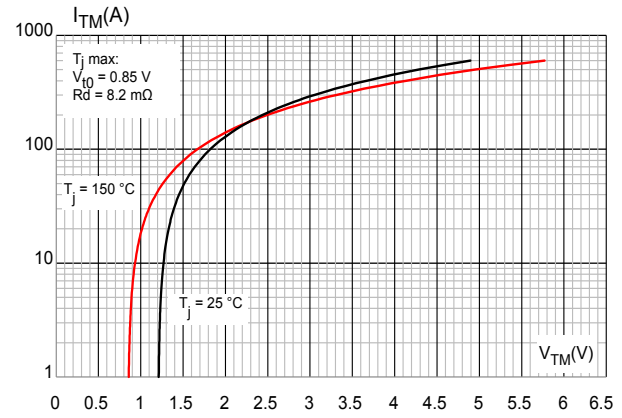


Figure 4. Average and D.C. on-state current versus ambient temperature

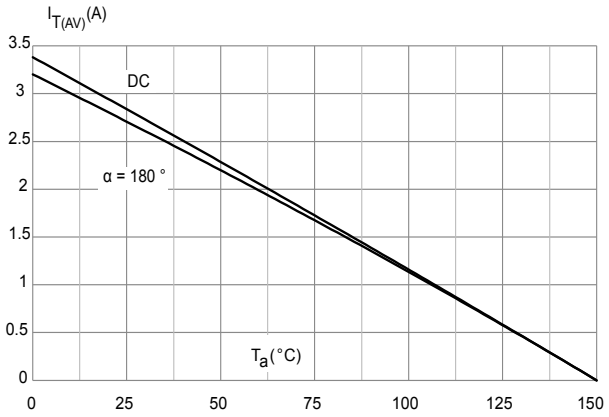


Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration

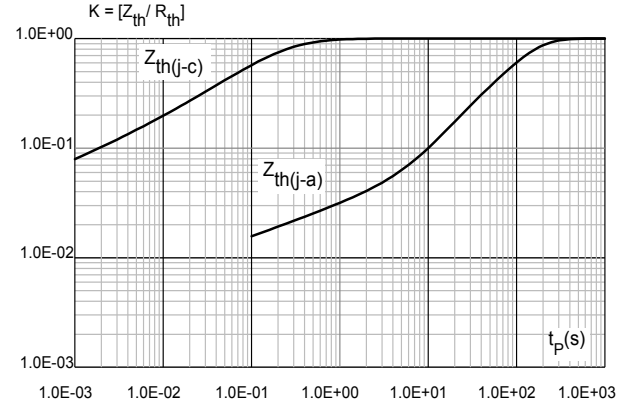


Figure 6. Surge peak on-state current versus number of cycles

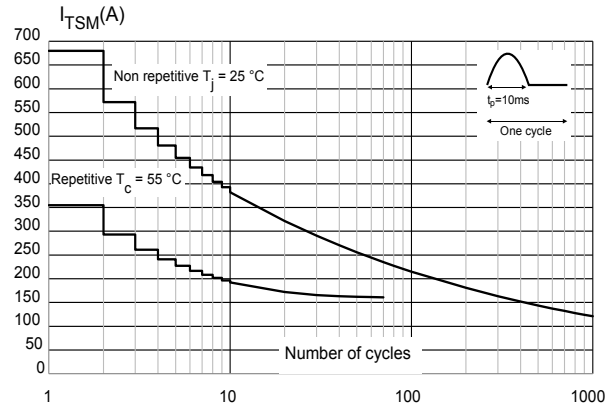


Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms

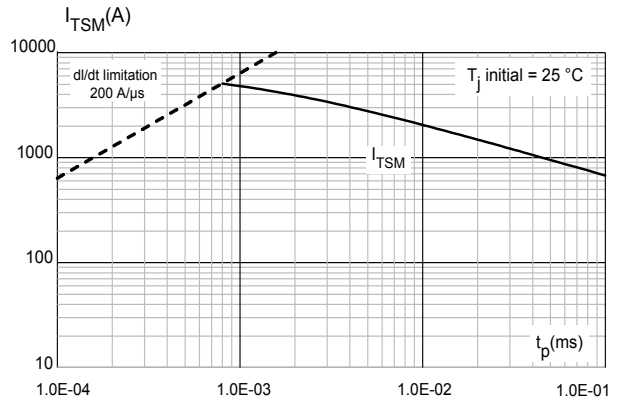


Figure 8. Relative variation of holding current and latching current versus junction temperature (typical values)

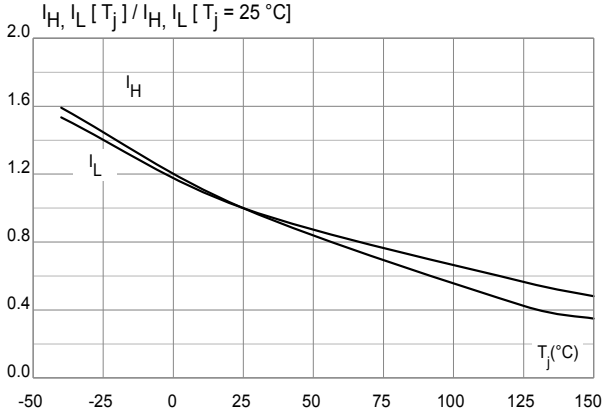


Figure 9. Relative variation of gate triggering current and voltage versus junction temperature

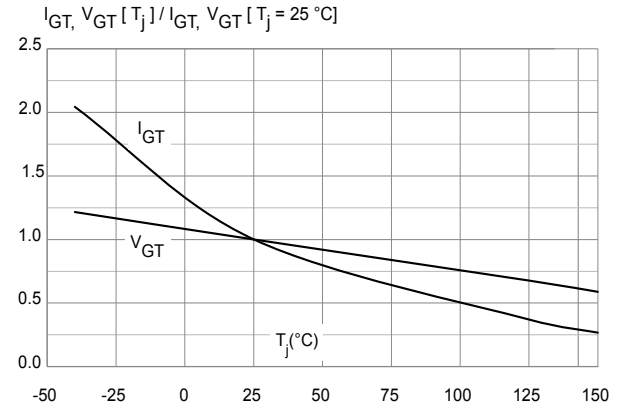


Figure 10. Relative variation of static dV/dt immunity versus junction temperature

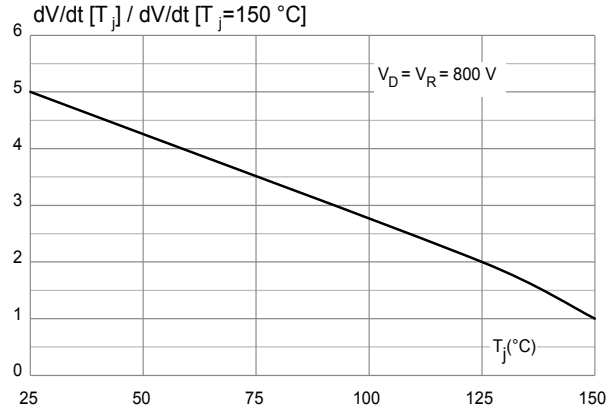
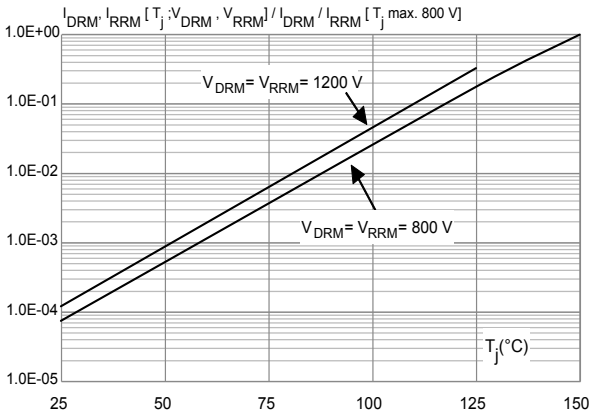


Figure 11. Relative variation of leakage current versus junction temperature for different values of blocking voltage (0.8 kV, 1.2 kV)



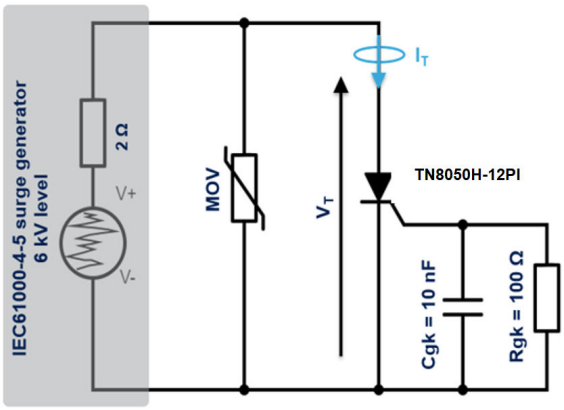
2 Application

2.1 Overvoltage surge management

The TN8050H-12PI specification in Table 1 gives a non-repetitive surge voltage forward V_{DSM} and reverse V_{RSM} 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.

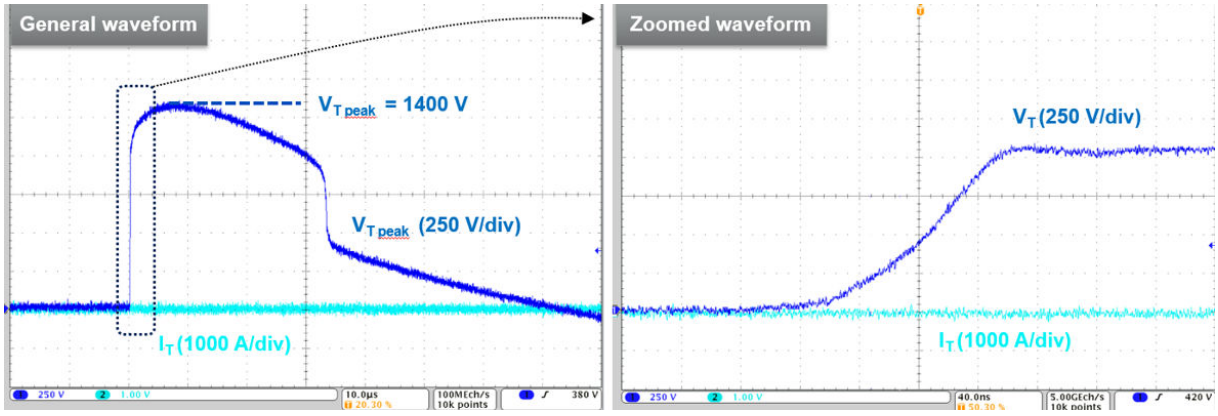
Here below is an example of an overvoltage surge, as defined in IEC61000-4-5 electromagnetic compatibility standard, applied to the TN8050H-12PI. The Figure 12. Simplified front-end circuit using TN8050H-12PI details a simplified application front-end circuit, including the surge protection, made of metal oxyde varistor, in parallel of the TN8050H-12PI.

Figure 12. Simplified front-end circuit using TN8050H-12PI



When an 1.2/50 µs overvoltage surge occurs on the AC line, the application input protection clamps the voltage across the TN8050H-12PI SCR. Thanks to the extra V_{DSM} / V_{RSM} specification, the maximum allowed voltage across the SCR is 1400 V. The waveform Figure 13. Waveform of line and SCR voltages illustrates the voltage across the AC Line and the SCR during a 6 kV surge event, performed within the Figure 12. Simplified front-end circuit using TN8050H-12PI left test schematic, when the junction temperature equals the maximum junction temperature of the TN8050H-12PI: 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 13. Waveform of line and SCR voltages



3 Package information

In order 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 TOP3 insulated package information

- ECOPACK (lead-free plating and halogen free package compliance)
- Lead-free package leads finishing
- Halogen-free molding compound resin meets UL94 standard level V0
- Recommended torque: 1.05 N·m (max. torque: 1.2 N·m)

Figure 14. Package outline

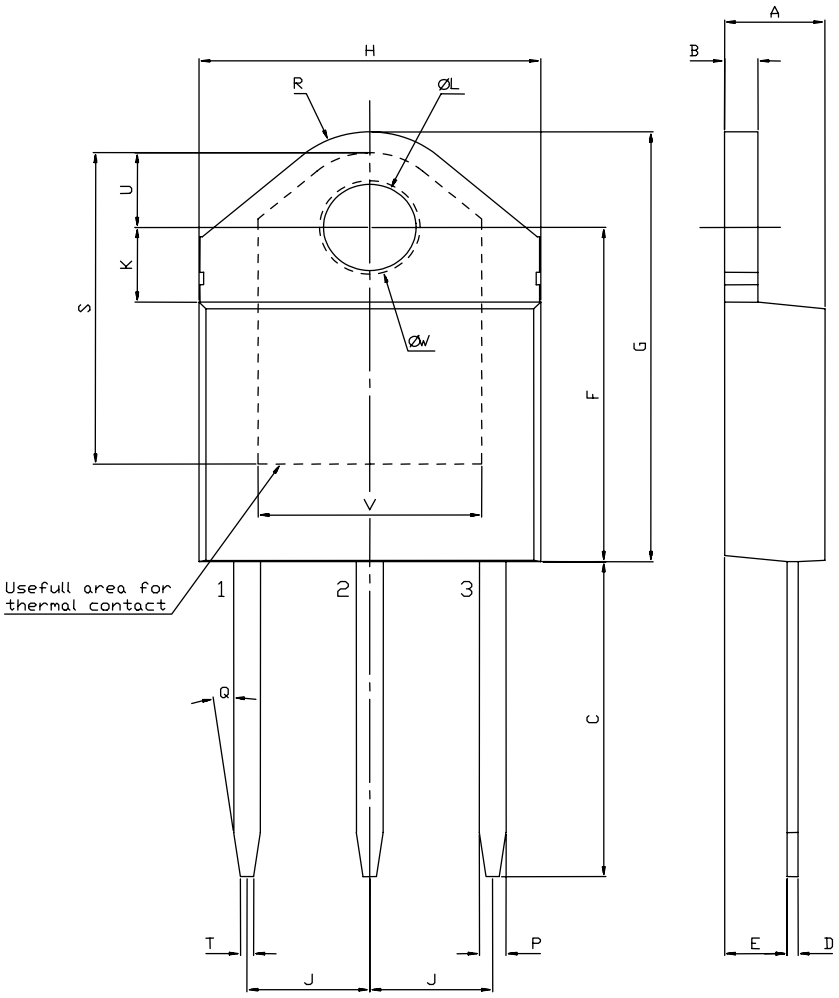


Table 5. Mechanical data

Ref.	Dimensions					
	mm			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.1732		0.1811
B	1.45		1.55	0.0571		0.0610
C	14.35		15.60	0.5650		0.6142
D	0.50		0.70	0.0197		0.0276
E	2.70		2.90	0.1063		0.1142
F	15.80		16.50	0.6220		0.6496
G	20.40		21.10	0.8031		0.8307
H	15.10		15.50	0.5945		0.6102
J	5.40		5.65	0.2126		0.2224
K	3.40		3.65	0.1339		0.1437
L	4.08		4.17	0.1606		0.1642
P	1.20		1.40	0.0472		0.0551
R		4.60			0.1811	

1. *Inches given for reference only*

4 Ordering information

Figure 15. **Ordering information scheme**

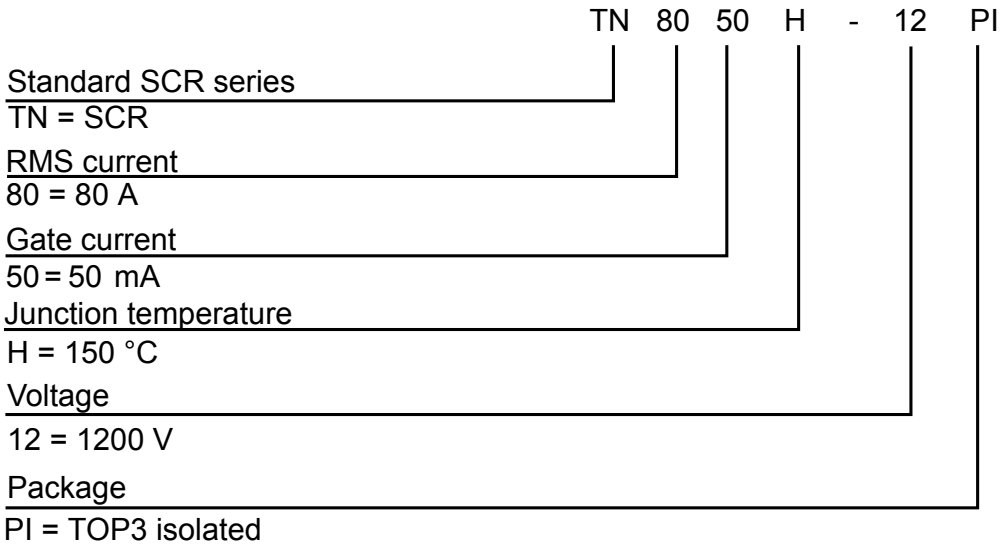


Table 6. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN8050H-12PI	TN8050H12	TOP3 insulated	4.48 g	30	Tube

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
14-Apr-2023	1	Initial release.