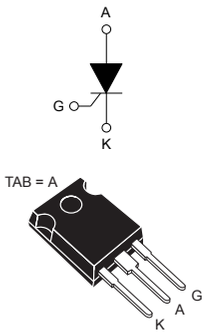
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TN4050HP-12WY

Datasheet

40 A 1200 V automotive grade thyristor (SCR)



TO-247 uninsulated

Features

- AEC-Q101 qualified
- High junction temperature: 150 °C
- AC off state voltage: +/- 1200 V
- Nominal on-state RMS current: 40 A_{RMS}
- High noise immunity: 1000 V/µs
- Max. gate triggering current: 50 mA
- ECOPACK2 compliant component

Applications

- On board charger
- Capacitor discharge
- Overvoltage crowbar protection
- Power supplies
- AC switches
- Solid state relays

Description

The TN4050HP-12WY is an automotive grade SCR thyristor designed for applications such as automotive on board and stationary battery chargers.

This SCR Thyristor, rated for a 40 A RMS power switching, offers superior performances in peak voltage robustness up to 400 V sine wave pulse. Its key features allow the design of functions such as a 56 A RMS AC switch and a 50 A AC-DC controlled rectifier-bridge.

The TN4050HP-12WY is available in TO-247 package, ideal for a maximum thermal performance.

Product status
TN4050HP-12WY

Product summary	
$I_{T(RMS)}$	40 A
V_{DRM}/V_{RRM}	1200 V
V_{DSM}/V_{RSM}	1400 V
I_{GT}	50 mA
T_j	-40 to 150 °C

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1 Characteristics

Table 1. Absolute ratings (limiting values)

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (180 ° conduction angle)		T_C = 139 °C	40	A
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)			25	
I_{TSM}	Non repetitive surge peak on-state current, V_R = 0 V	t_p = 8.3 ms	T_j initial = 25 °C	440	A
		t_p = 10 ms		400	
I^2t	I^2t value for fusing	t_p = 10 ms	T_j = 25 °C	800	A^2s
dI/dt	Critical rate of rise of on-state current, I_G = 2 x I_{GT} , tr ≤ 100 ns	f = 50 Hz	T_j = 150 °C	200	A/µs
V_{DRM} / V_{RRM}	Repetitive off-state voltage		T_j = 150 °C	1200	V
V_{DSM} / V_{RSM}	Non repetitive surge peak off-state voltage	t_p = 10 ms	T_j = 25 °C	1400	V
V_{GM}	Peak forward gate voltage	t_p = 20 µs	T_j = 150 °C	10	V
I_{GM}	Peak forward gate current	t_p = 20 µs	T_j = 150 °C	8	A
V_{RGM}	Maximum peak reverse gate voltage		T_j = 25 °C	5	V
$P_{G(AV)}$	Average gate power dissipation		T_j = 150 °C	1	W
T_{stg}	Storage junction temperature range			-40 to +150	°C
T_j	Operating junction temperature			-40 to +150	°C

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		Min.	10	mA
			Max.	50	
V_{GT}			Max.	1.3	V
I_{GD}	V_D = 800 V, R_L = 3.3 Ω	T_j = 150 °C	Min.	3	mA
V_{GD}	V_D = 800 V, R_L = 3.3 kΩ	T_j = 150 °C	Min.	0.2	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 = 150 °C	Min.	1000	V/µs

Table 3. Timing Parameters

Symbol	Test Conditions			Value	Unit
t_{gt}	I_T = 80 A , V_D = 800 V, I_G = 100 mA, dI_G/dt = 0.2 A/µs		Typ.	1	µs
t_q	I_{TM} = 25 A, V_D = 800 V, dI_T/dt = 10 A/µs, V_R = 75 V, dV_D/dt = 20 V/µs, t_p = 100 µs	T_j = 150 °C	Typ.	150	µs

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Table 4. Static Characteristics

Symbol	Test Conditions			Value	Unit
V_{TM}	I_{TM} = 80 A, t_P = 380 µs	T_j = 25 °C	Max.	1.55	V
V_{TO}	On-state threshold voltage	T_j = 150 °C	Max.	0.83	V
R_D	On-state dynamic resistance	T_j = 150 °C	Max.	10	mΩ
I_{DRM}/I_{RRM}	$V_D = V_{DRM}$, $V_R = V_{RRM}$	T_j = 25 °C	Max.	5	µA
		T_j = 125 °C		0.9	mA
		T_j = 150 °C		6	mA
I_{DSM}/I_{RSM}	$V_D = V_{DSM}$, $V_R = V_{RSM}$	T_j = 25 °C	Max.	10	µA

Table 5. Thermal parameters

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Max.	0.3	°C/W
$R_{th(j-a)}$	Junction to ambient	Typ.	50	

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1.1 Characteristics curves

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

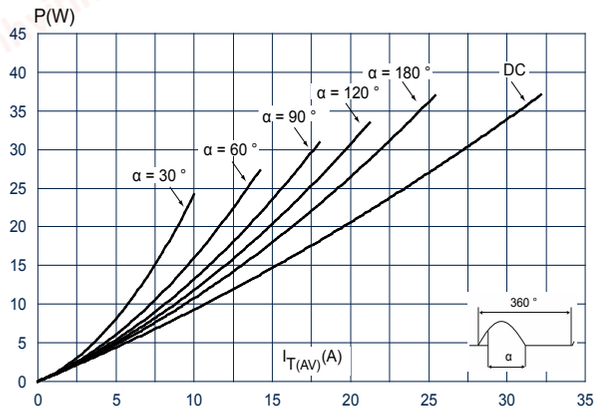


Figure 2. Average and D.C. on-state current versus case temperature

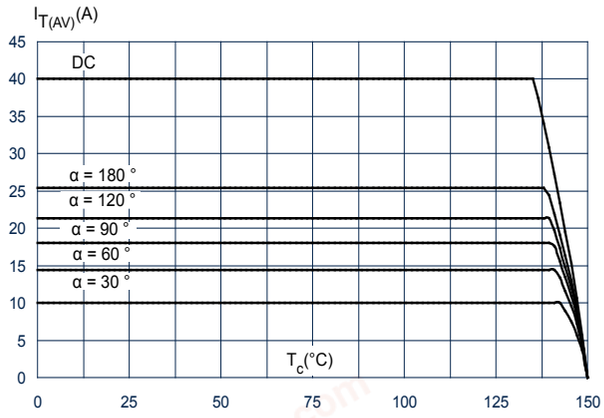


Figure 3. Average and D.C. on-state current versus ambient temperature

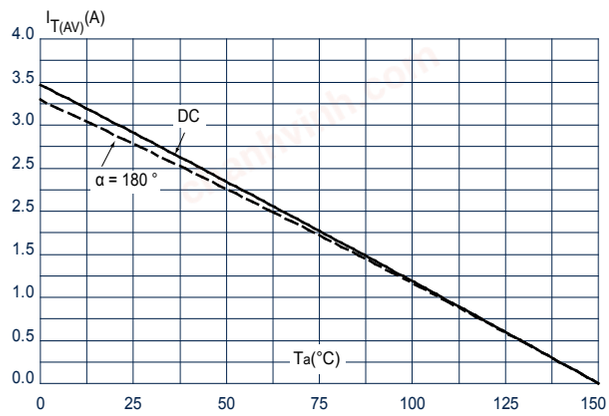


Figure 4. On-state characteristics (maximum values)

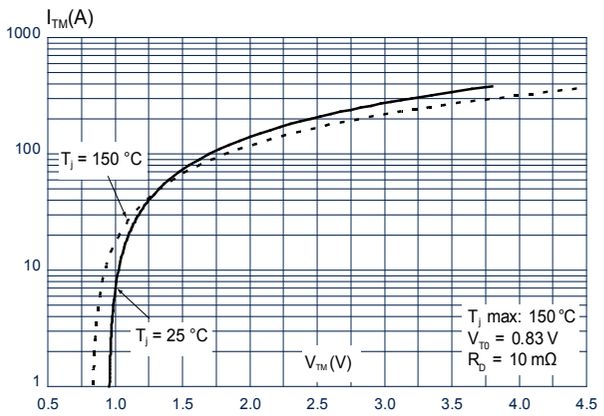


Figure 5. Surge peak on-state current versus number of cycles

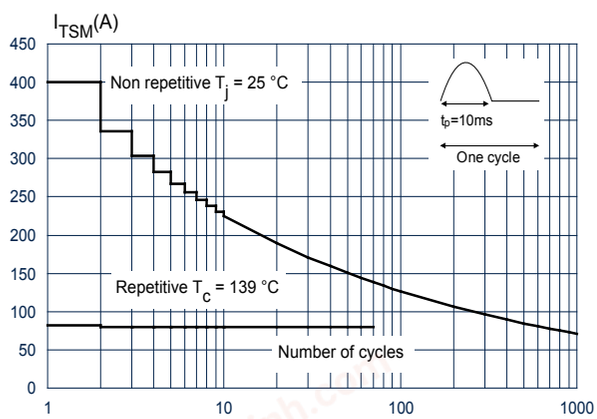
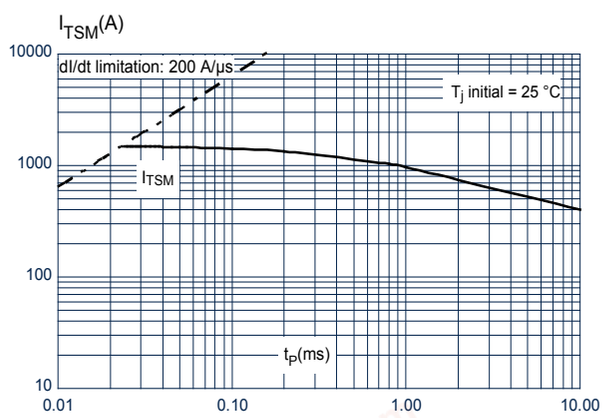


Figure 6. Non repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms



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Figure 7. Relative variation of leakage current versus junction temperature for different values of blocking voltage (typical values)

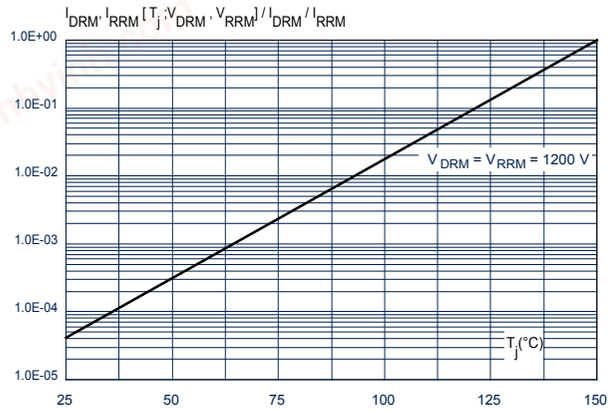


Figure 8. Relative variation of holding and latching current versus junction temperature (typical values)

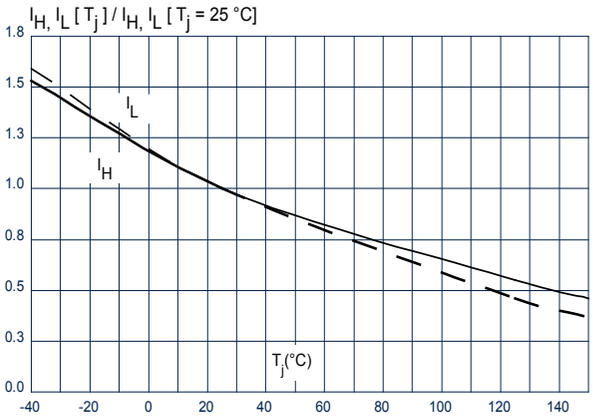


Figure 9. Relative variation of gate trigger current and gate trigger voltage versus junction temperature (typical values)

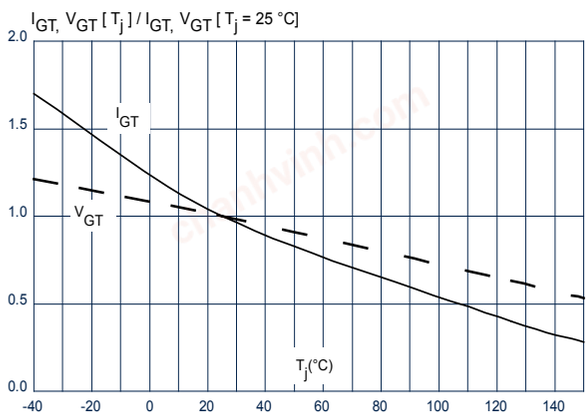


Figure 10. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration

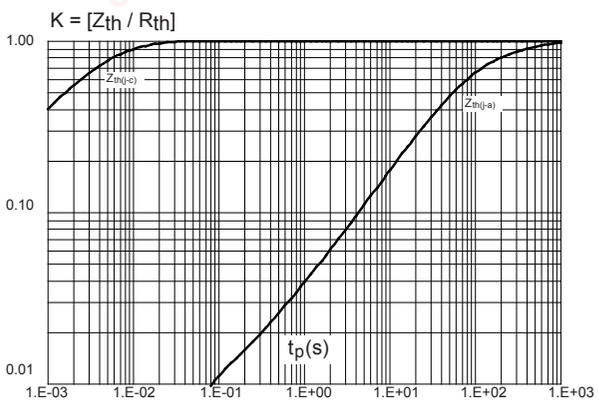
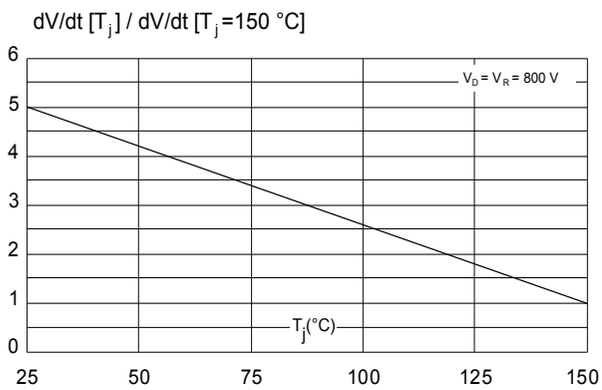


Figure 11. Relative variation of static dV/dt immunity versus junction temperature



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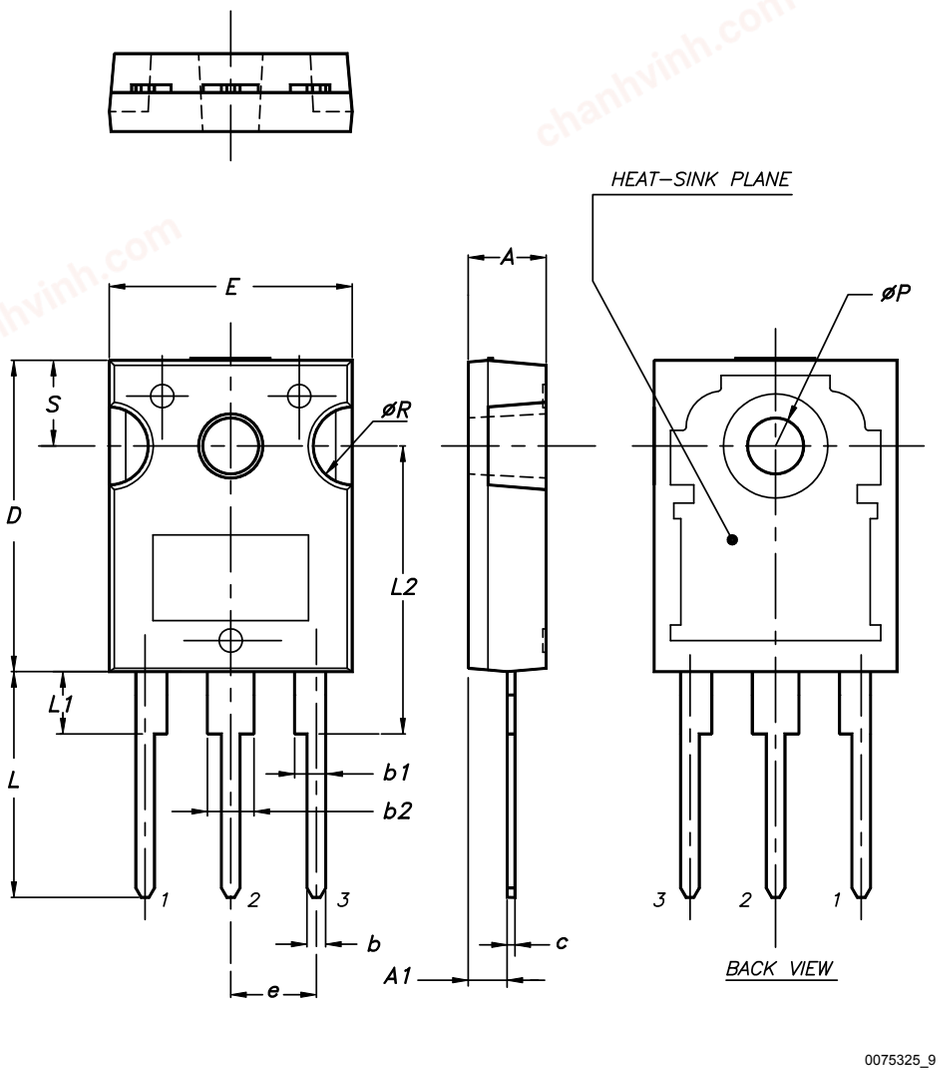
2 Package information

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.

2.1 TO-247 package information

- Epoxy meets UL 94,V0
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1 N·m

Figure 12. TO-247 package outline



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Table 6. **TO-247 package mechanical data**

Dim.	Dimensions					
	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.85		5.15	0.1909		0.2028
A1	2.20		2.60	0.0866		0.1024
b	1.0		1.40	0.0394		0.0551
b1	2.0		2.40	0.0787		0.0945
b2	3.0		3.40	0.1181		0.1339
c	0.40		0.80	0.0157		0.0315
D[2]	19.85		20.15	0.7815		0.7933
E	15.45		15.75	0.6083		0.6201
e	5.30	5.45	5.60	0.2087	0.2146	0.2205
L	14.20		14.80	0.5591		0.5827
L1	3.70		4.30	0.1457		0.1693
L2		18.50			0.7283	
ØP[3]	3.55		3.65	0.1398		0.1437
ØR	4.50		5.50	0.1772		0.2165
S	5.30	5.50	5.70	0.2087	0.2165	0.2244

1. *Inch dimensions given only for reference*
2. *Dimension D plus gate protrusion does not exceed 20.5 mm*
3. *Resin thickness around the mounting hole is not less than 0.9 mm*

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3 Ordering information

Figure 13. **Ordering information scheme**

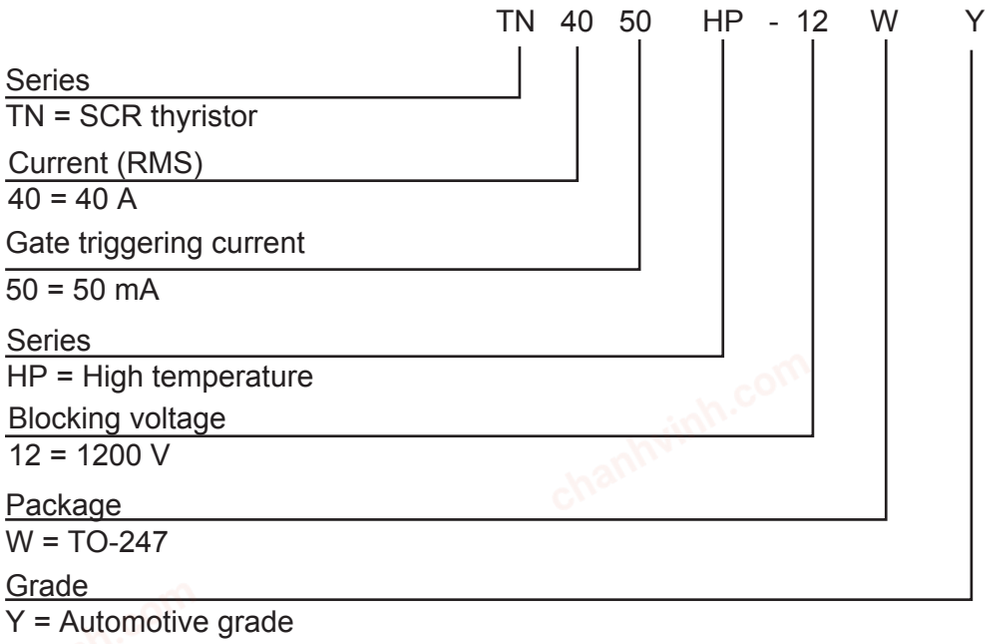


Table 7. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN4050HP-12WY	TN4050HP12Y	TO-247	4.43 g	30	Tube

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Revision history

Table 8. **Document revision history**

Date	Revision	Changes
28-Jul-2021	1	Initial release.
04-Aug-2021	2	Updated description on cover page. Updated Table 1 and Figure 3 title.
16-Dec-2021	3	Updated Section 1.1 Characteristics (curves).

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