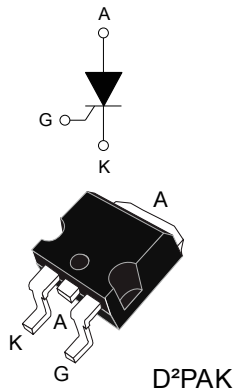



40 A 1200 V automotive grade thyristor (SCR) in D<sup>2</sup>PAK


## Features

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

## Application

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

## Description

The **TN4050HP-12GY-TR** 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-12GY-TR** is available in D<sup>2</sup>PAK surface mount package, ideal for automatic assembly lines.

## Product status

TN4050HP-12GY-TR

## Product summary

<b>I<sub>T(RMS)</sub></b>	40 A
<b>V<sub>DRM</sub>/V<sub>RRM</sub></b>	1200 V
<b>V<sub>DSM</sub>/V<sub>RSM</sub></b>	1400 V
<b>I<sub>GT</sub></b>	50 mA
<b>T<sub>j</sub></b>	-40 to 150 °C

# 1 Characteristics

**Table 1. Absolute ratings (limiting values)**

Symbol	Parameter		Value	Unit
$I_{T(RMS)}$	RMS on-state current (180 ° conduction angle)		40	A
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)			
$I_{TSM}$	Non repetitive surge peak on-state current, $V_R = 0$ V	$t_p = 8.3$ ms	440	A
		$t_p = 10$ ms		
$I^2t$	$I^2t$ value for fusing	$t_p = 10$ ms	800	$A^2s$
$di/dt$	$I_G = 2 \times I_{GT}$ , $tr \leq 100$ ns Critical rate of rise of on-state current	$f = 50$ Hz	200	$A/\mu s$
$V_{DRM} / V_{RRM}$	Repetitive off-state voltage		1200	V
$V_{DSM} / V_{RSM}$	Non repetitive surge peak off-state voltage	$t_p = 10$ ms	1400	V
$V_{GM}$	Peak forward gate voltage	$t_p = 20$ $\mu s$	10	V
$I_{GM}$	Peak forward gate current	$t_p = 20$ $\mu s$	8	A
$V_{RGM}$	Maximum peak reverse gate voltage		5	V
$P_{G(AV)}$	Average gate power dissipation		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, $R_L = 33$ $\Omega$	Min.	10	mA
		Max.	50	
$V_{GT}$		Max.	1.3	V
$I_{GD}$	$V_D = 800$ V, $R_L = 3.3$ $\Omega$	$T_j = 150$ °C	Min. 3	mA
$V_{GD}$	$V_D = 800$ V, $R_L = 3.3$ $\Omega$	$T_j = 150$ °C	Min. 0.2	V
$I_H$	$I_T = 500$ mA, gate open		Max. 100	mA
$I_L$	$I_G = 1.2 \times I_{GT}$		Max. 125	mA
$dV/dt$	$V_D = 800$ V, gate open	$T_j = 150$ °C	Min. 1000	$V/\mu s$

**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/ $\mu s$		Typ. 1	$\mu s$
$t_q$	$I_{TM} = 25$ A, $V_D = 800$ V, $dI_T/dt = 10$ A/ $\mu s$ , $V_R = 75$ V, $dV_D/dt = 20$ V/ $\mu s$ , $t_p = 100$ $\mu s$	$T_j = 150$ °C	Typ. 150	$\mu s$

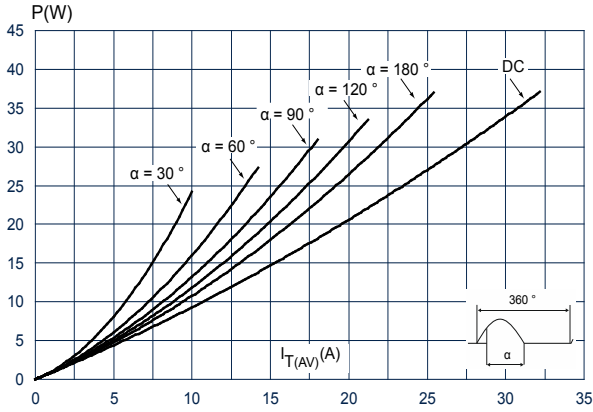
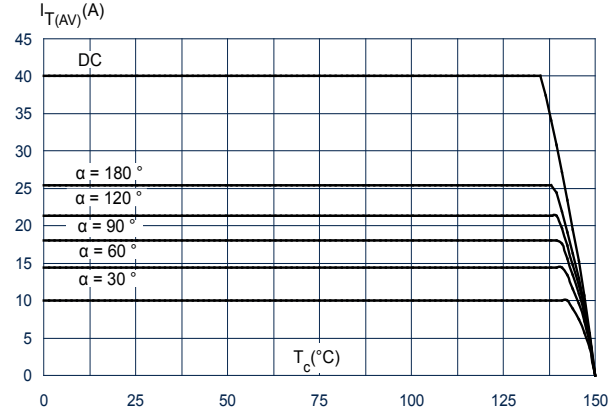
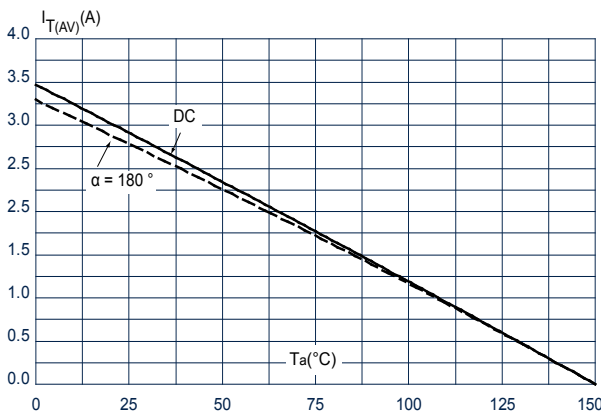
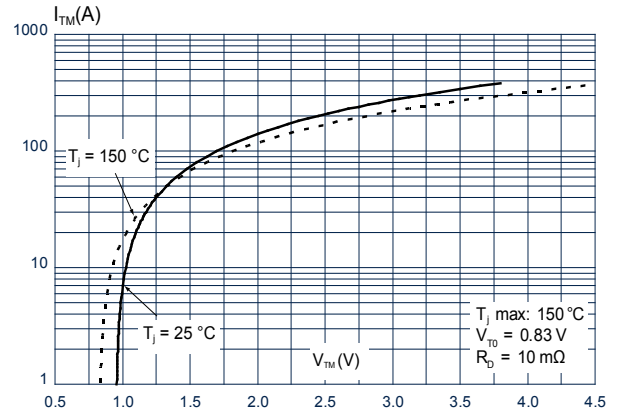
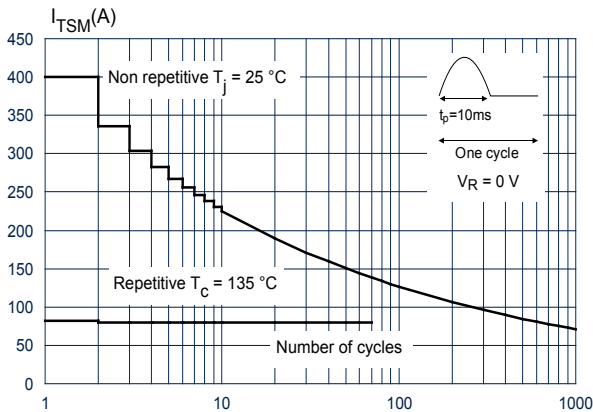
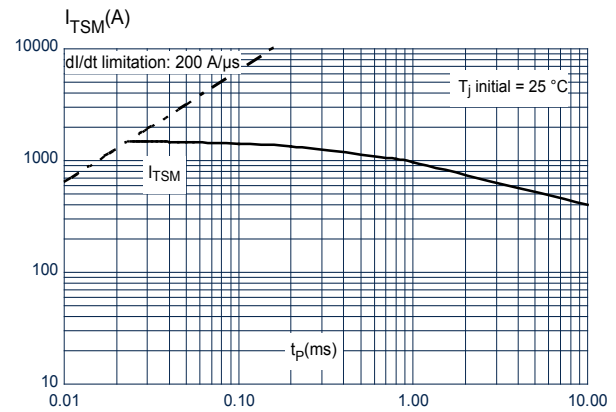
**Table 4. Static Characteristics**

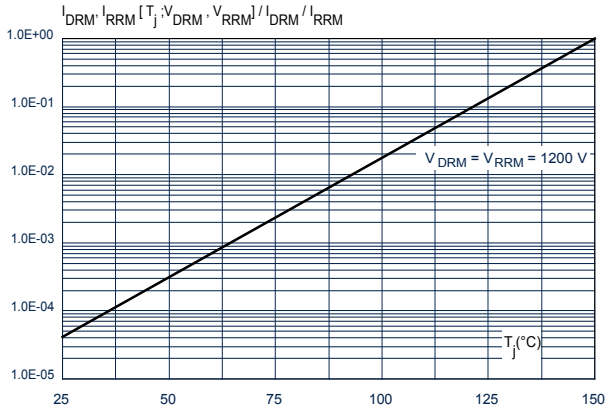
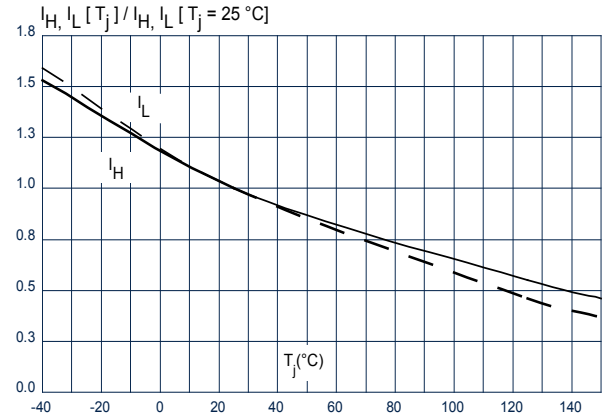
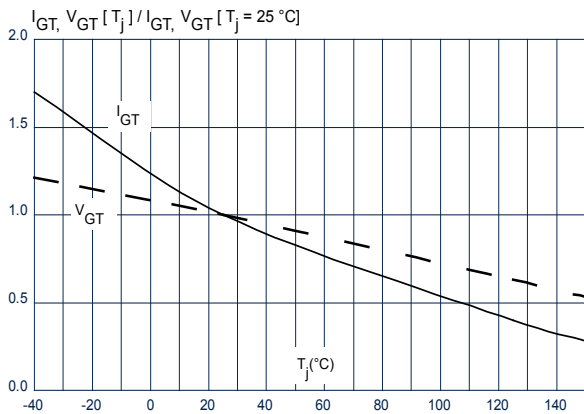
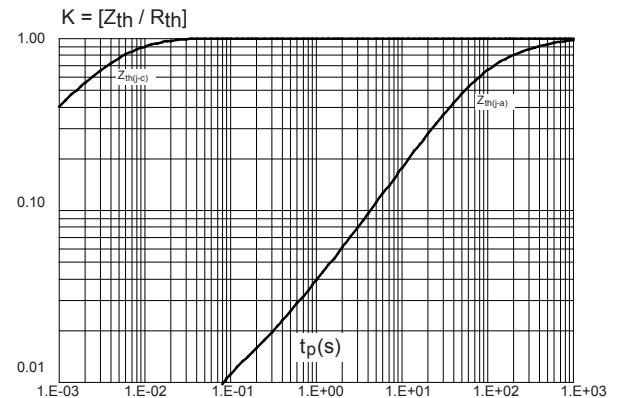
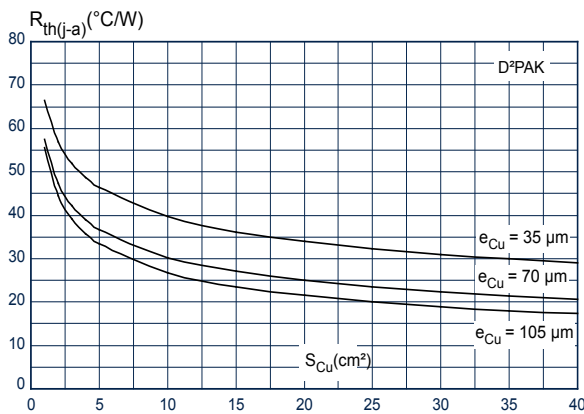
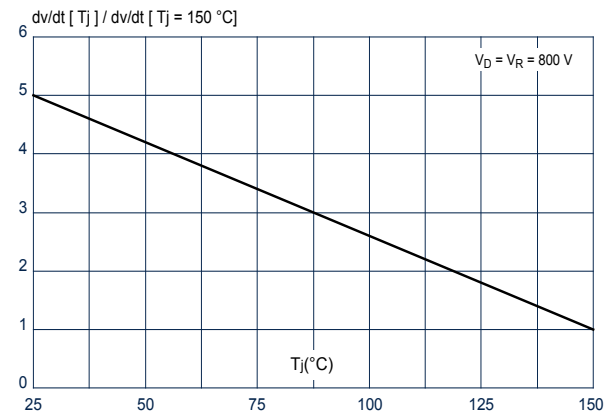
Symbol	Test Conditions		Value	Unit
$V_{TM}$	$I_{TM} = 80$ A, $t_p = 380$ $\mu s$	$T_j = 25$ °C	Max. 1.55	V

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

**Table 5. Thermal parameters**

Symbol	Parameter	Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Max.	0.4
$R_{th(j-a)}$	Junction to ambient (DC, $S_{CU} = 2.5\text{ cm}^2, e_{CU} = 70\text{ μm}$ )	Typ.	45

**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**


**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 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. Thermal resistance junction to ambient versus copper surface under tab (typical values, epoxy printed board FR4) (D<sup>2</sup>PAK)**

**Figure 12. Relative variation of static dV/dt immunity versus junction temperature**


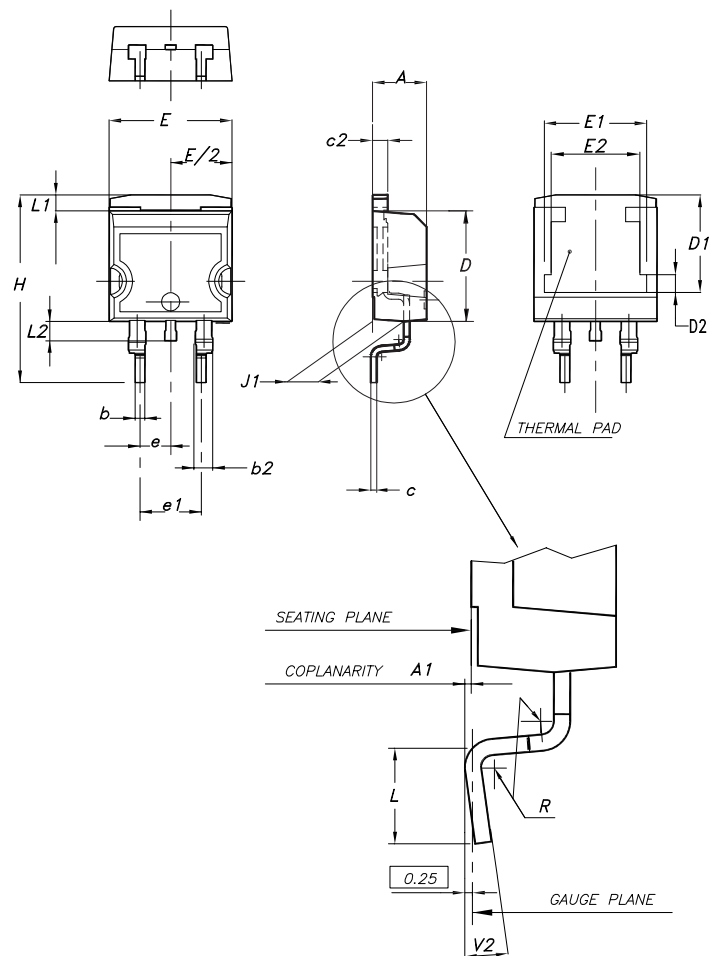
## 2 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 2.1 D<sup>2</sup>PAK package information

- Epoxy meets UL94, V0.
- Cooling method: by conduction (C)

Figure 13. D<sup>2</sup>PAK package outline



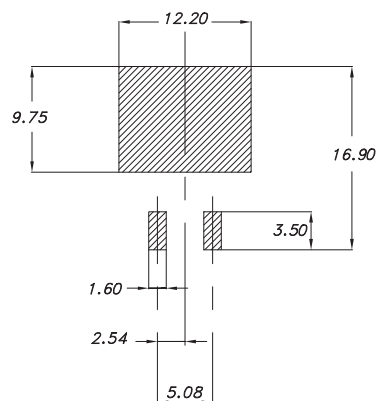
**Note:** This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 6. D<sup>2</sup>PAK package mechanical data

Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.1732		0.1811
A1	0.03		0.23	0.0012		0.0091
b	0.70		0.93	0.0276		0.0366
b2	1.14		1.70	0.0449		0.0669
c	0.45		0.60	0.0177		0.0236
c2	1.23		1.36	0.0484		0.0535
D	8.95		9.35	0.3524		0.3681
D1	7.50	7.75	8.00	0.2953	0.3051	0.3150
D2	1.10	1.30	1.50	0.0433	0.0511	0.0591
E	10		10.40	0.3937		0.4094
E1	8.30	8.50	8.70	0.3267	0.3346	0.3425
E2	6.85	7.05	7.25	0.2697	0.2776	0.2854
e		2.54			0.1000	
e1	4.88		5.28	0.1921		0.2079
H	15		15.85	0.5906		0.6240
J1	2.49		2.69	0.0980		0.1059
L	2.29		2.79	0.0902		0.1098
L1	1.27		1.40	0.0500		0.0551
L2	1.30		1.75	0.0512		0.0689
R		0.4			0.0157	
V2	0°		8°	0°		8°

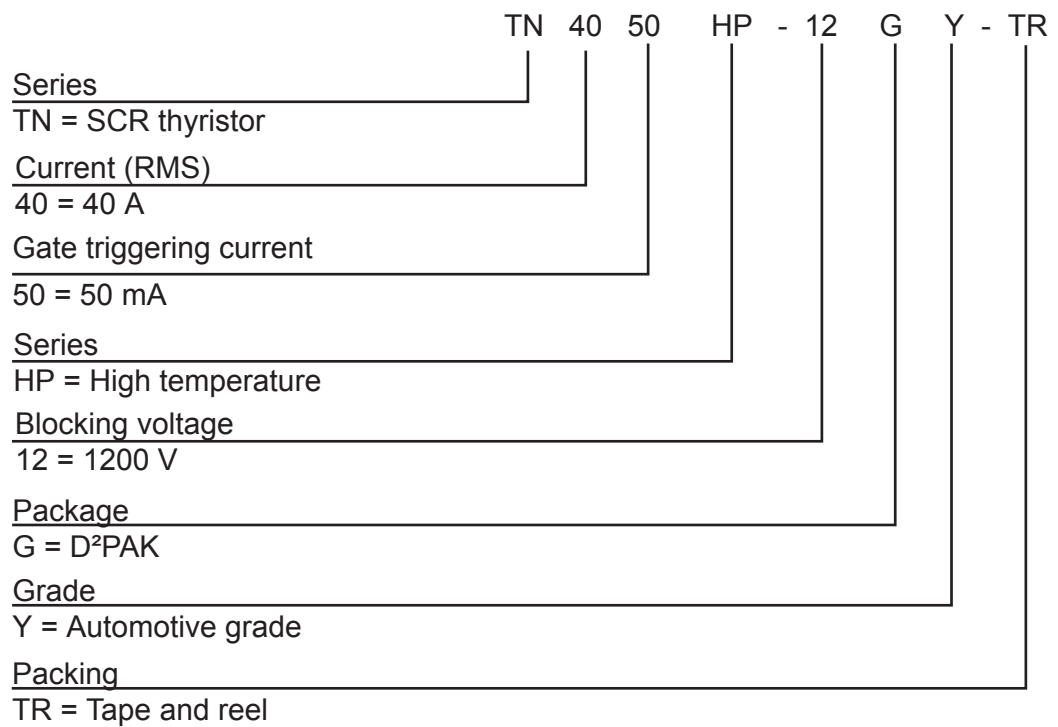
1. Dimensions in inches are given for reference only

Figure 14. D<sup>2</sup>PAK recommended footprint (dimensions are in mm)



0079457\_Rev28\_footprint

### 3 Ordering information

**Figure 15. Ordering information scheme**

**Table 7. Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN4050HP-12GY-TR	TN40P12YB	D <sup>2</sup> PAK	1.38 g	1000	Tape and reel 13"



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## Revision history

**Table 8. Document revision history**

Date	Revision	Changes
16-Dec-2021	1	Initial release.

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