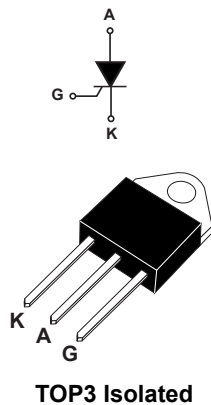


## 40 A, 1200 V standard SCR



### Features

- Max. Repetitive Blocking Voltage =  $V_{DRM}$ ,  $V_{RRM}$  = 1200 V
- $I_{GT}$  maximum = 50 mA
- High static and dynamic commutation:
  - $di/dt$  = 100 A/ $\mu$ s
  - $dV/dt$  = 2000 V/ $\mu$ s
- ECOPACK<sup>®2</sup> component (RoHS and HF compliance)
- Complies with UL 1557 standard (File ref : E81734)

### Applications

- Solar / Wind renewable energy inverters and rectifiers
- Solid state relay (SSR)
- Uninterruptible power supply (UPS)
- Industrial SMPS
- Bypass
- AC DC inrush current limiter (ICL)
- Battery charger
- AC DC voltage controlled rectifier
- Industrial welding systems
- Off board automotive battery charger
- Soft starter
- Heating systems

### Description

The TN4050-12PI SCR is suitable in industrial applications where high immunity is required with a lower gate current and ceramic isolated tab, UL1557 certified rated at 2.5 kV RMS and UL94-V0 resin compliance.

Available in through-hole high power package TOP3 isolated tab.

Product status	
TN4050-12PI	
Product summary	
Order code	TN4050-12PI
Package	TOP3 isolated
$I_{T(RMS)}$	40 A
$V_{DRM}/V_{RRM}$	1200 V
$I_{GT}$	50 mA

# 1 Characteristics

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

Symbol	Parameter		Value	Unit	
$I_{T(RMS)}$	On-state RMS current (180 ° conduction angle)	$T_c = 82.5\text{ °C}$	40	A	
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)		25		
$I_{TSM}$	Non repetitive surge peak on-state current ( $T_j$ initial = 25 °C)		$t_p = 8.3\text{ ms}$	420	A
			$t_p = 10\text{ ms}$	400	
$I^2t$	$I^2t$ value for fusing		$t_p = 10\text{ ms}$	800	$A^2s$
$di/dt$	Critical rate of rise of on-state current $I_G = 100\text{ mA}$ , $di_G/dt = 1\text{ A}/\mu s$	$f = 60\text{ Hz}$	$T_j = 125\text{ °C}$	100	$A/\mu s$
$I_{GM}$	Maximum peak positive gate current	$t_p = 20\text{ }\mu s$	$T_j = 125\text{ °C}$	8	A
$V_{GM}$	Maximum peak positive gate voltage			5	V
$P_{G(AV)}$	Average gate power dissipation		$T_j = 125\text{ °C}$	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 +125	

**Table 2. Electrical characteristics ( $T_j = 25\text{ °C}$  unless otherwise specified)**

Symbol	Test conditions		Value	Unit	
$I_{GT}$	$V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$		Min.	10	mA
			Max.	50	
$V_{GT}$			Max.	1.5	V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$	$T_j = 125\text{ °C}$	Min.	0.2	V
$I_H$	$I_T = 500\text{ mA}$ , gate open		Max.	100	mA
$I_L$	$I_G = 1.2 \times I_{GT}$		Max.	130	mA
$dV/dt$	$V_D = 67\% V_{DRM}$ , gate open	$T_j = 125\text{ °C}$	Min.	2	$kV/\mu s$
$t_{gt}$	$I_T = 40\text{ A}$ , $V_D = V_{DRM}$ , $I_G = 200\text{ mA}$ , $(di_G/dt)_{max} = 0.2\text{ A}/\mu s$		Typ.	2	$\mu s$
$t_q$	$I_{TM} = 40\text{ A}$ , $V_D = 800\text{ V}$ , $dI_{TM}/dt = 30\text{ A}/\mu s$ , $V_R = 75\text{ V}$ , $dV_D/dt = 20\text{ V}/\mu s$	$T_j = 125\text{ °C}$	Typ.	100	$\mu s$

**Table 3. Static characteristics**

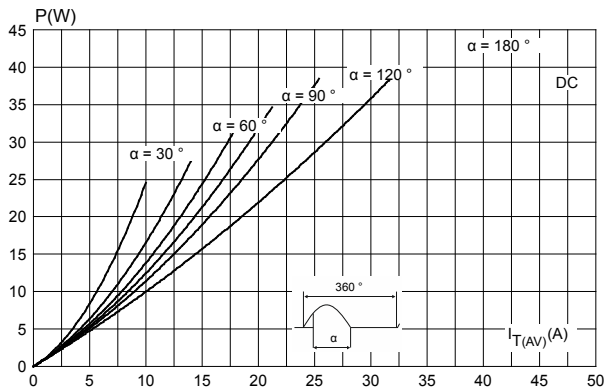
Symbol	Test conditions		Value	Unit	
$V_{TM}$	$I_{TM} = 80\text{ A}$ , $t_p = 380\text{ }\mu s$	$T_j = 25\text{ °C}$	Max.	1.75	V
$V_{TO}$	Threshold voltage	$T_j = 125\text{ °C}$	Max.	0.9	
$R_D$	Dynamic resistance	$T_j = 125\text{ °C}$	Max.	9.8	$m\Omega$
$I_{DRM}$ , $I_{RRM}$	$V_{DRM} = V_{RRM} = 1200\text{ V}$	$T_j = 25\text{ °C}$	Max.	10	$\mu A$
		$T_j = 125\text{ °C}$		5	mA

**Table 4. Thermal parameters**

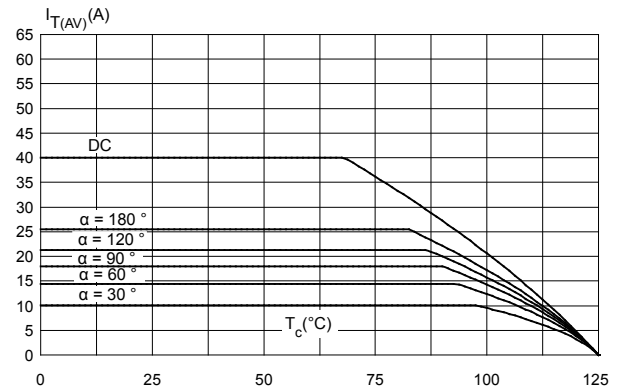
Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Typ.	1.1	°C/W
$R_{th(j-a)}$	Junction to ambient (DC)		50	

## 1.1 Characteristics curves

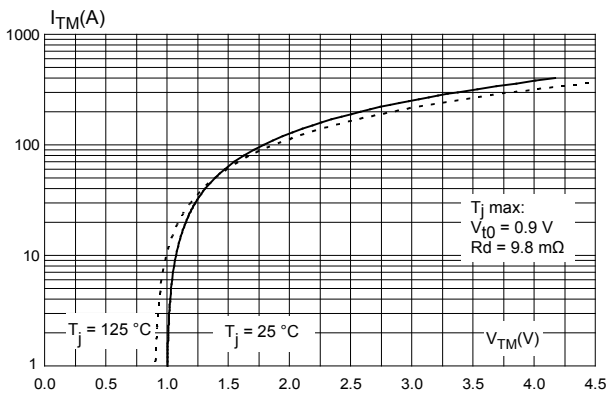
**Figure 1. Maximum average power dissipation versus average on-state current**



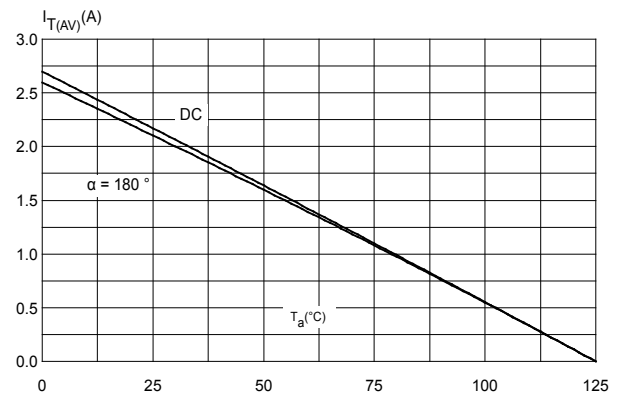
**Figure 2. Average and DC on-state current versus case temperature**



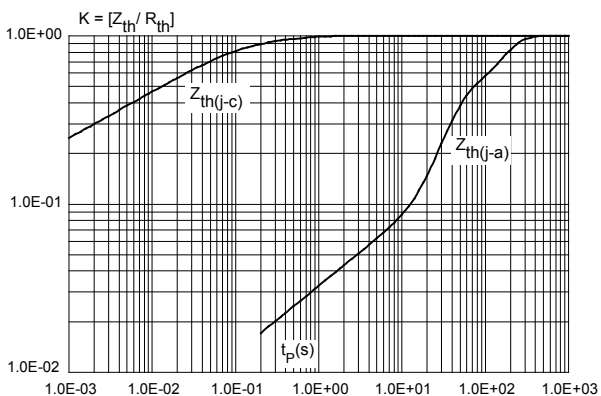
**Figure 3. On-state characteristics (maximum values)**



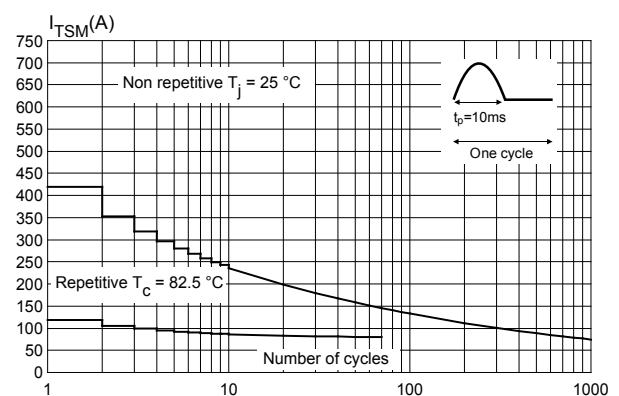
**Figure 4. Average and D.C. on-state current versus ambient temperature**



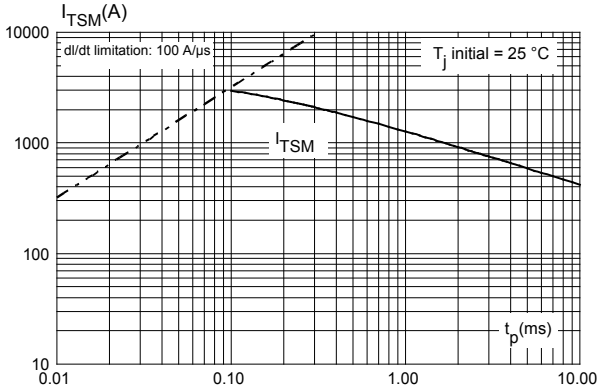
**Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration**



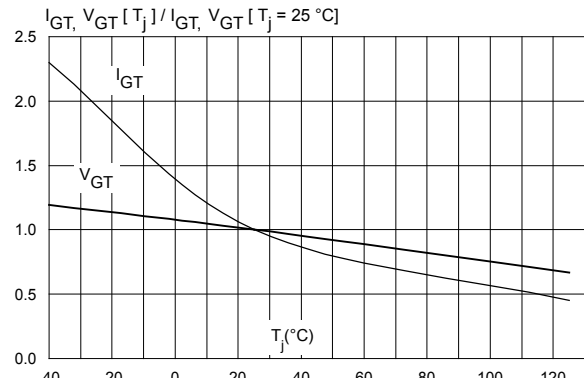
**Figure 6. Surge peak on-state current versus number of cycles**



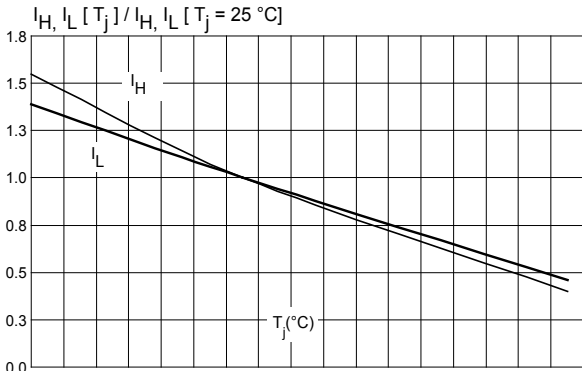
**Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10$  ms**



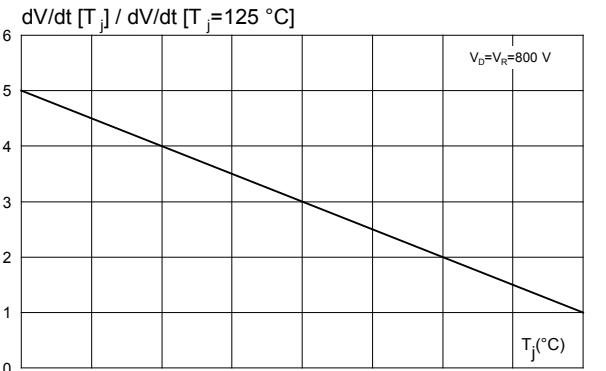
**Figure 8. Relative variation of gate trigger current and gate trigger voltage versus junction temperature (typical value)**



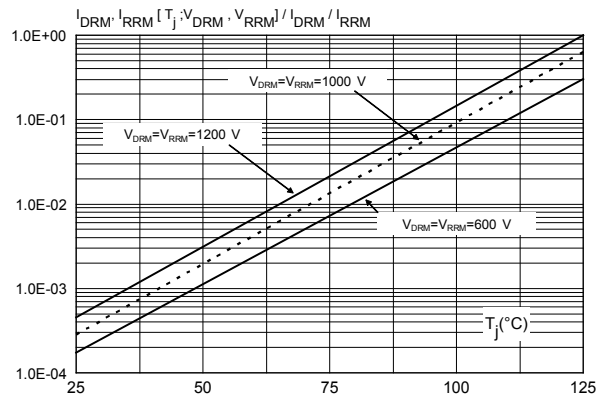
**Figure 9. Relative variation of holding and latching current versus junction temperature (typical value)**



**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)**



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## 2 Package information

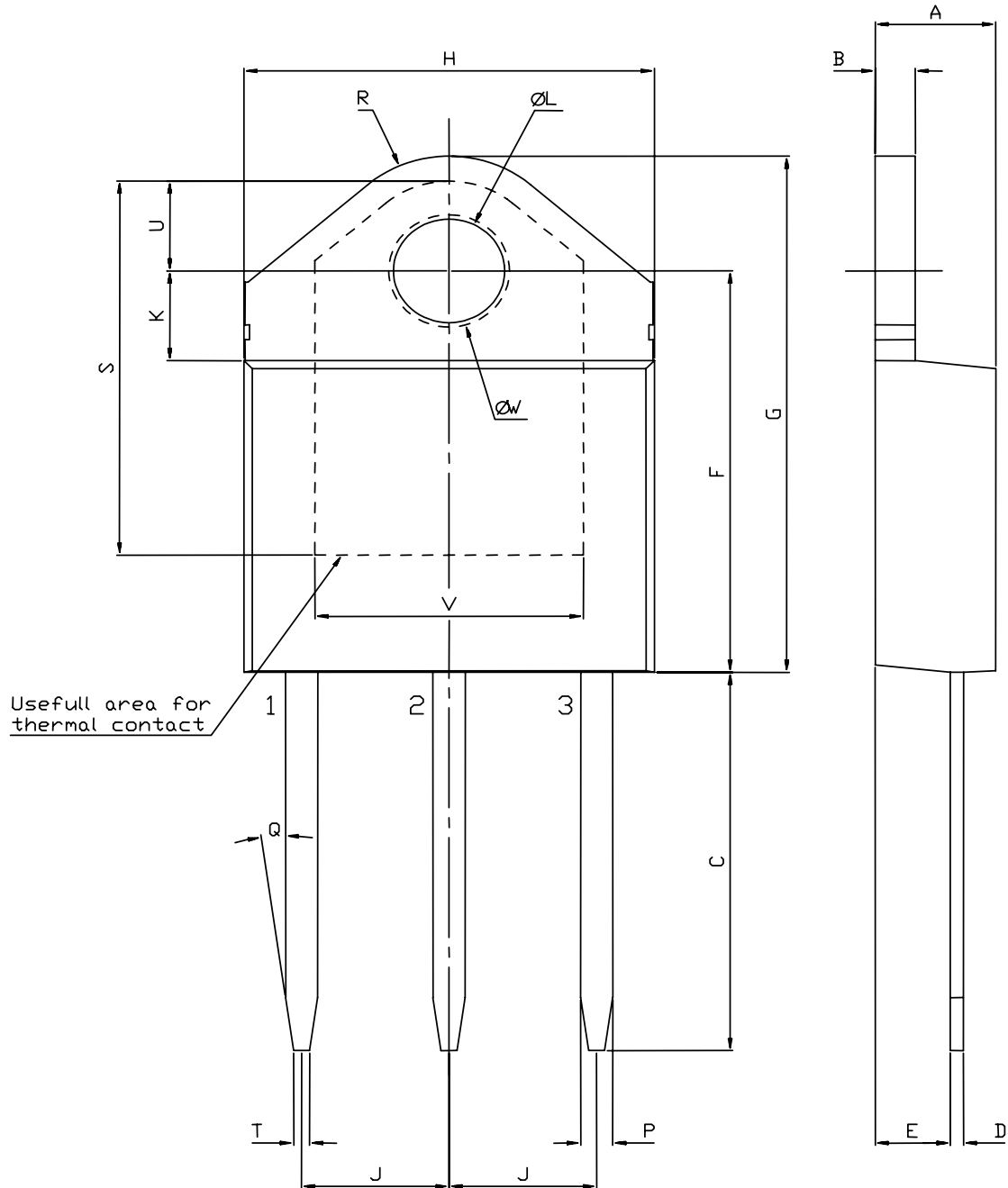
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In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK®** packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

### 2.1 TOP3 Isolated 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 12. TOP3 Isolated package outline



**Table 5. TOP3 Isolated mechanical data**

Ref.	Dimensions					
	mm			Inches <sup>(1)</sup>		
	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
M	1.20		1.40	0.0472		0.0551
R		4.60			0.1811	

1. Inches given for reference only



### 3 Ordering information

Figure 13. Ordering information scheme

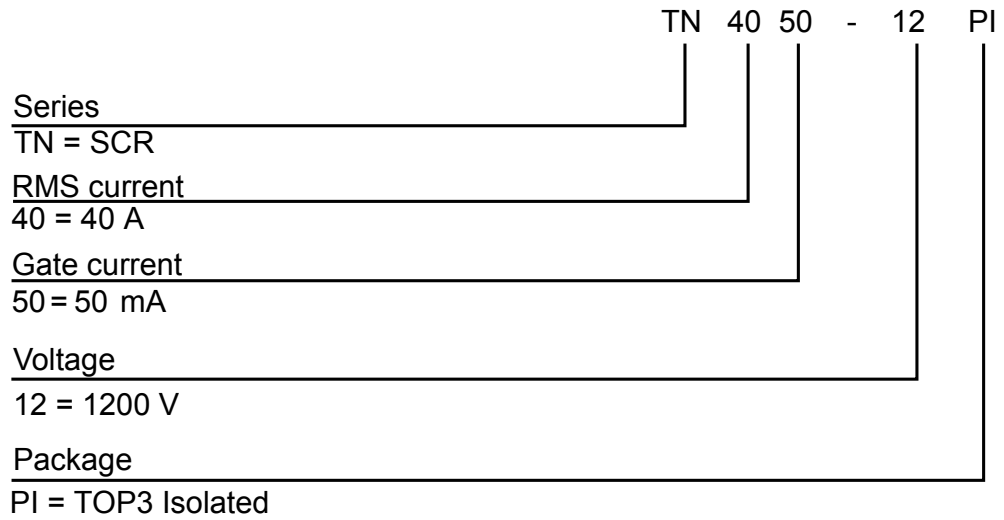


Table 6. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN4050-12PI	TN405012PI	TOP3 Isolated	4.48 g	30	Tube

## Revision history

**Table 7. Document revision history**

Date	Revision	Changes
18-Feb-2019	1	Initial release.

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