

## Sensitive standard SCRs up to 0.8 A

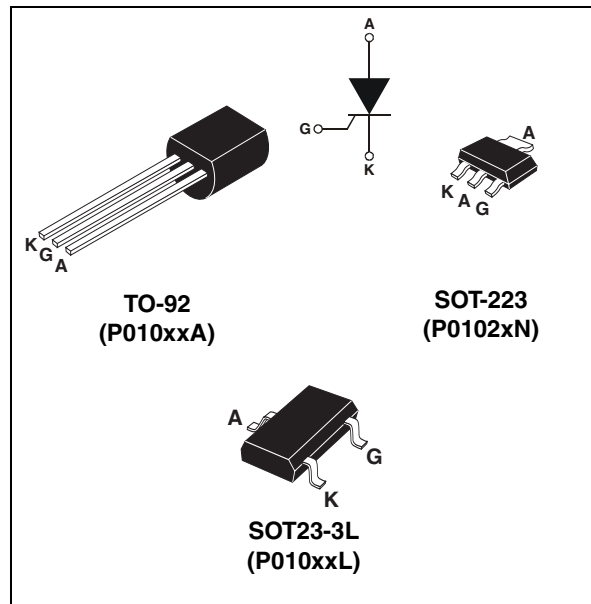
### Features

- $I_{T(RMS)}$  up to 0.8 A
- $V_{DRM}/V_{RRM}$  100, 200, 400 and 600 V
- $I_{GT}$  from 5 to 200  $\mu$ A

### Description

Thanks to highly sensitive triggering levels, the P010xx SCR series is suitable for all applications where available gate current is limited, such as ground fault circuit interruptors, pilot circuits in solid state relays, stand-by mode power supplies, smoke and alarm detectors.

Available in through-hole or surface mount packages, the voltage capability of this series has been upgraded since its introduction and is now available up to 600 V.



**Table 1. Device summary**

Order code	Voltage				Sensitivity	Package	Packing Mode
	100 V	200 V	400 V	600 V			
P0102AA 1AA3	X				200 $\mu$ A	TO-92	Bulk
P0102AA 5AL3	X				200 $\mu$ A	TO-92	Tape and reel 13 inch
P0102AL 5AA4	X				200 $\mu$ A	SOT23-3L	Tape and reel 7 inch
P0102BA 1AA3		X			200 $\mu$ A	TO-92	Bulk
P0102BL 5AA4		X			200 $\mu$ A	SOT23-3L	Tape and reel 7 inch
P0102DA 1AA3			X		200 $\mu$ A	TO-92	Bulk
P0102DA 2AL3			X		200 $\mu$ A	TO-92	Ammopack
P0102DA 5AL3			X		200 $\mu$ A	TO-92	Tape and reel 13 inch
P0102DN 5AA4	X		X		200 $\mu$ A	SOT-223	Tape and reel 7 inch
P0102MA 1AA3				X	200 $\mu$ A	TO-92	Bulk
P0102MN 5AA4				X	200 $\mu$ A	SOT-223	Tape and reel 7 inch
P0109AL 5AA4	X				1 $\mu$ A	SOT23-3L	Tape and reel 7 inch
P0109DA 1AA3			X		1 $\mu$ A	TO-92	Bulk
P0109DA 5AL3			X		1 $\mu$ A	TO-92	Tape and reel 13 inch

# 1 Characteristics

**Table 2. Absolute ratings (limiting values) P010xxA and P010xxN**

Symbol	Parameter		Value	Unit	
$I_{T(RMS)}$	RMS on-state current (180° conduction angle)	TO-92	$T_j = 55\text{ °C}$	0.8	A
		SOT-223	$T_{amb} = 70\text{ °C}$		
$I_{T(AV)}$	Average on-state current (180° conduction angle)	TO-92	$T_j = 55\text{ °C}$	0.5	A
		SOT-223	$T_{amb} = 70\text{ °C}$		
$I_{TSM}$	Non repetitive surge peak on-state current	$t_p = 8.3\text{ ms}$	$T_j = 25\text{ °C}$	8	A
		$t_p = 10\text{ ms}$		7	
$I^2t$	$I^2t$ Value for fusing	$t_p = 10\text{ ms}$	$T_j = 25\text{ °C}$	0.24	$A^2s$
dl/dt	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$	F = 60 Hz	$T_j = 125\text{ °C}$	50	A/ $\mu s$
$I_{GM}$	Peak gate current	$t_p = 20\text{ }\mu s$	$T_j = 125\text{ °C}$	1	A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 125\text{ °C}$	0.1	W
$T_{stg}$ $T_j$	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	$^{\circ}C$

**Table 3. Absolute ratings (limiting values) P010xxL**

Symbol	Parameter		Value	Unit	
$I_{T(RMS)}$	RMS on-state current (180° conduction angle)		$T_{amb} = 36\text{ °C}$	0.25	A
$I_{T(AV)}$	Average on-state current (180° conduction angle)		$T_{amb} = 36\text{ °C}$	0.16	A
$I_{TSM}$	Non repetitive surge peak on-state current	$t_p = 8.3\text{ ms}$	$T_j = 25\text{ °C}$	7	A
		$t_p = 10\text{ ms}$		6	
$I^2t$	$I^2t$ Value for fusing	$t_p = 10\text{ ms}$	$T_j = 25\text{ °C}$	0.18	$A^2s$
dl/dt	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$	F = 60 Hz	$T_j = 125\text{ °C}$	50	A/ $\mu s$
$I_{GM}$	Peak gate current	$t_p = 20\text{ }\mu s$	$T_j = 125\text{ °C}$	0.5	A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 125\text{ °C}$	0.02	W
$T_{stg}$ $T_j$	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	$^{\circ}C$

**Table 4. Electrical characteristics<sup>(1)</sup> P010xxA and P010xxN**

Symbol	Test conditions		Value	Unit	
$I_{GT}$	$V_D = 12\text{ V}$ $R_L = 140\ \Omega$	Min.	-	$\mu\text{A}$	
		Max.	200		
$V_{GT}$		Max.	0.8	V	
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $R_{GK} = 1\text{ k}\Omega$	$T_j = 125\text{ }^\circ\text{C}$	Min.	0.1	V
$V_{RG}$	$I_{RG} = 10\ \mu\text{A}$		Min.	8	V
$I_H$	$I_T = 50\text{ mA}$ $R_{GK} = 1\text{ k}\Omega$		Max.	5	mA
$I_L$	$I_G = 1\text{ mA}$ $R_{GK} = 1\text{ k}\Omega$		Max.	6	mA
dV/dt	$V_D = 67\% V_{DRM}$ $R_{GK} = 1\text{ k}\Omega$	$T_j = 125\text{ }^\circ\text{C}$	Min.	75	V/ $\mu\text{s}$
$V_{TM}$	$I_{TM} = 1.6\text{ A}$ $t_p = 380\ \mu\text{s}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	1.95	V
$V_{t0}$	Threshold voltage	$T_j = 125\text{ }^\circ\text{C}$	Max.	0.95	V
$R_d$	Dynamic resistance	$T_j = 125\text{ }^\circ\text{C}$	Max.	600	m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM} = 400\text{ V}$ $R_{GK} = 1\text{ k}\Omega$	$T_j = 25\text{ }^\circ\text{C}$	Max.	1	$\mu\text{A}$
	$V_{DRM} = V_{RRM} = 600\text{ V}$ $R_{GK} = 1\text{ k}\Omega$			10	
	$V_{DRM} = V_{RRM}$ $R_{GK} = 1\text{ k}\Omega$	$T_j = 125\text{ }^\circ\text{C}$		100	

1.  $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified

**Table 5. Electrical characteristics<sup>(1)</sup> P010xxL**

Symbol	Test conditions		P0102xL	P0109AL	Unit	
$I_{GT}$	$V_D = 12\text{ V}$ $R_L = 140\ \Omega$	Max.	200	1	$\mu\text{A}$	
		Max.	0.8			
$V_{GT}$		Max.	0.8		V	
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $R_{GK} = 1\text{ k}\Omega$	$T_j = 125\text{ }^\circ\text{C}$	Min.	0.1	V	
$V_{RG}$	$I_{RG} = 10\ \mu\text{A}$		Min.	8	V	
$I_H$	$I_T = 50\text{ mA}$ $R_{GK} = 1\text{ k}\Omega$		Max.	6	mA	
$I_L$	$I_G = 1\text{ mA}$ $R_{GK} = 1\text{ k}\Omega$		Max.	7	mA	
dV/dt	$V_D = 67\% V_{DRM}$ $R_{GK} = 1\text{ k}\Omega$	$T_j = 125\text{ }^\circ\text{C}$	Min.	200	100	V/ $\mu\text{s}$
$V_{TM}$	$I_{TM} = 0.4\text{ A}$ $t_p = 380\ \mu\text{s}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	1.7		V
$V_{t0}$	Threshold voltage	$T_j = 125\text{ }^\circ\text{C}$	Max.	1.0		V
$R_d$	Dynamic resistance	$T_j = 125\text{ }^\circ\text{C}$	Max.	1000		m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	1		$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$		100		

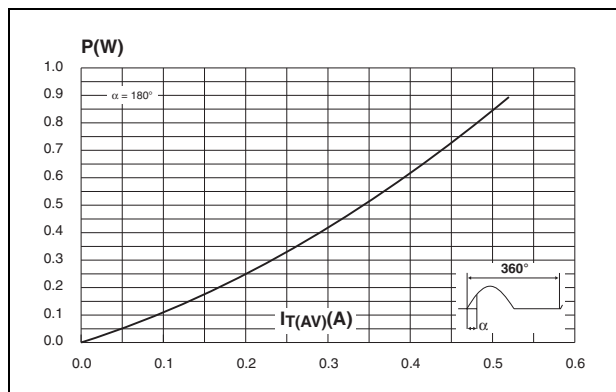
1.  $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified

**Table 6. Thermal resistance**

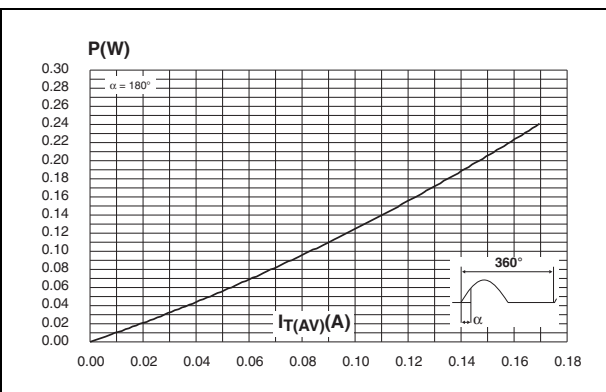
Symbol	Parameter		Maximum	Unit
$R_{th(j-a)}$	Junction to case (DC)	TO-92	80	$^{\circ}C/W$
$R_{th(j-t)}$	Junction to tab (DC)	SOT-223	30	$^{\circ}C/W$
$R_{th(j-a)}$	Junction to ambient (DC)	TO-92	150	$^{\circ}C/W$
		$S^{(1)} = 5\text{ cm}^2$ SOT-223	60	
$R_{th(j-a)}$	Junction to ambient (mounted on FR4 with recommended pad layout)	SOT23-3L	400	$^{\circ}C/W$

1. S = Copper surface under tab.

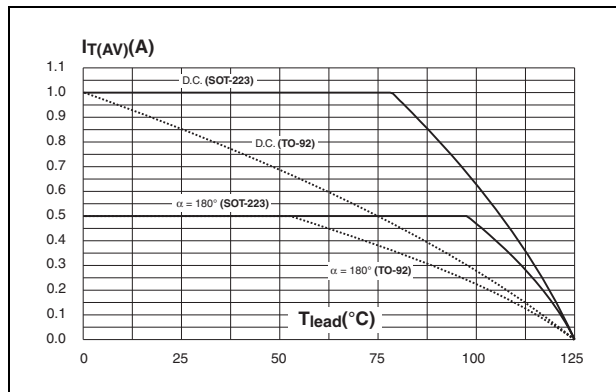
**Figure 1. Maximum average power dissipation vs. average on-state current P010xxA and P010xxN**



**Figure 2. Maximum average power dissipation vs. average on-state current P010xxL**



**Figure 3. Average and DC on-state current vs. lead temperature P010xxA and P010xxN**



**Figure 4. Average and DC on-state current vs. ambient temperature P010xxA and P010xxN**

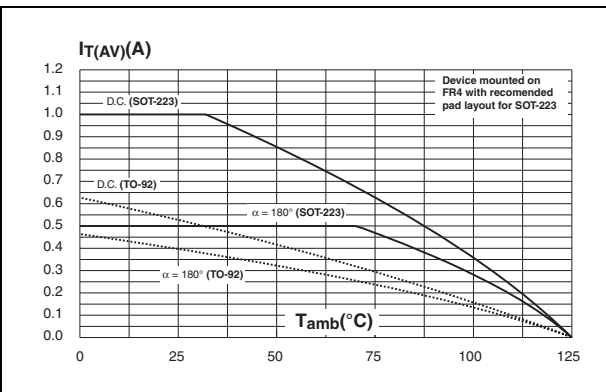


Figure 5. Average and DC on-state current vs. case temperature P010xxL

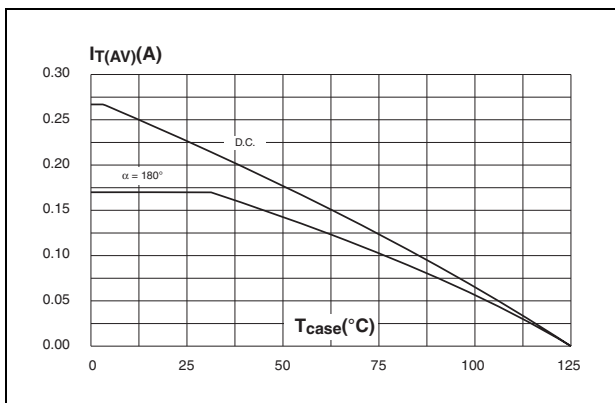


Figure 6. Relative variation of thermal impedance junction to ambient vs. pulse duration

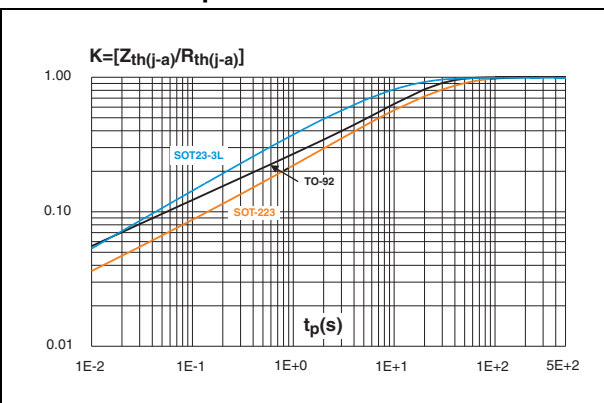


Figure 7. Relative variation of gate trigger, holding, and latching currents vs. junction temperature

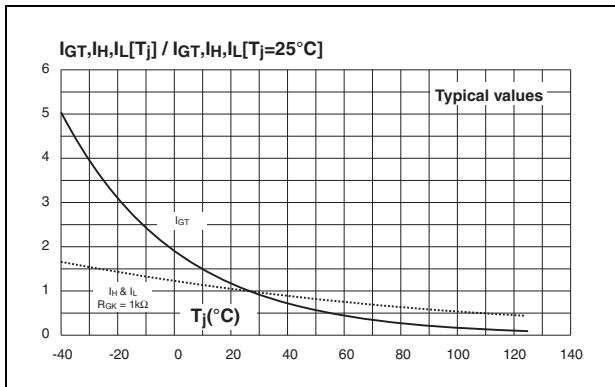


Figure 8. Relative variation of holding current vs. gate-cathode resistance

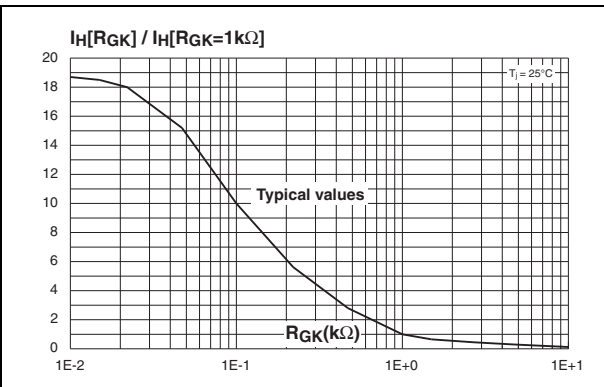


Figure 9. Relative variation of dV/dt immunity vs. gate-cathode resistance

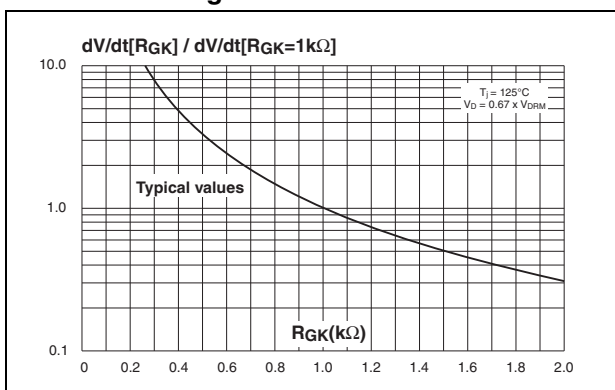


Figure 10. Relative variation of dV/dt immunity vs. gate-cathode capacitance

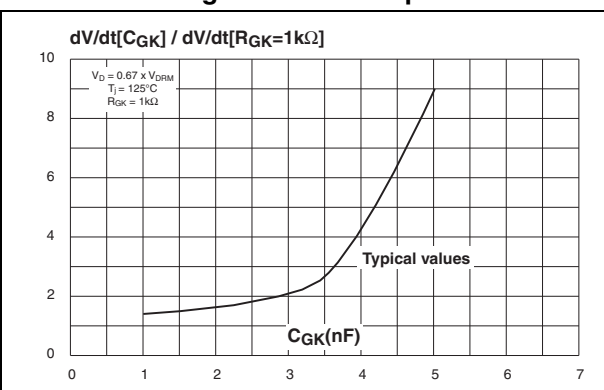


Figure 11. Surge peak on-state current versus number of cycles

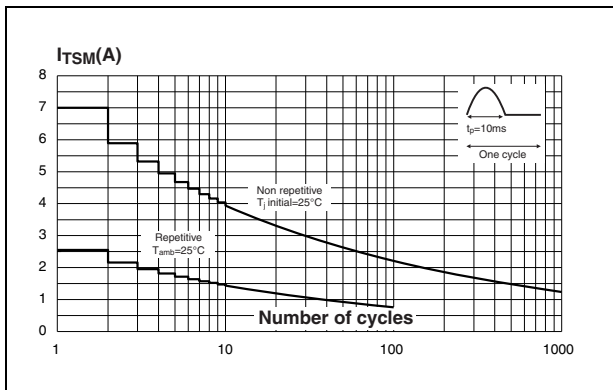


Figure 12. Non-repetitive surge peak on-state current and corresponding value of I<sup>2</sup>t

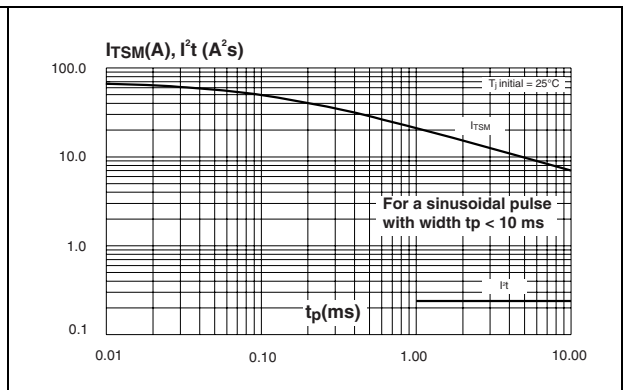


Figure 13. On-state characteristics P010xxA, P010xxN

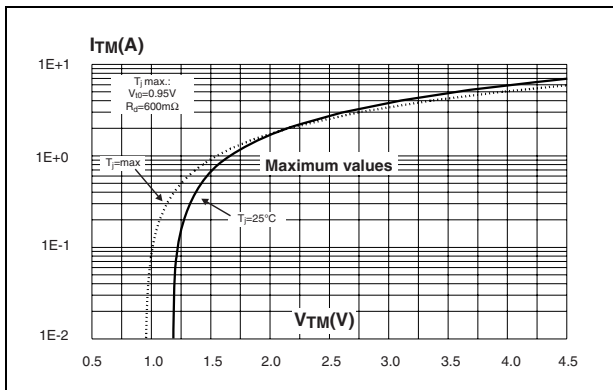


Figure 14. On-state characteristics P010xxL

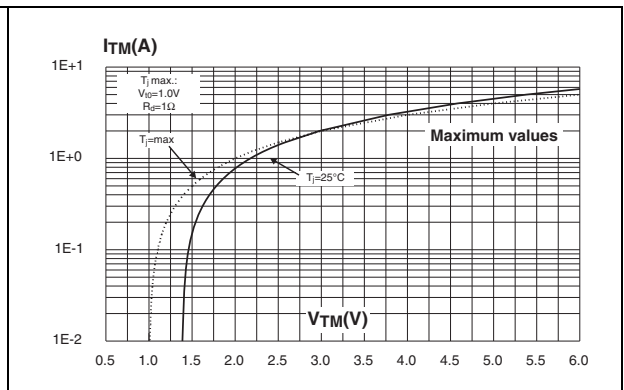


Figure 15. Thermal resistance junction to ambient vs. copper surface under tab P010xxN

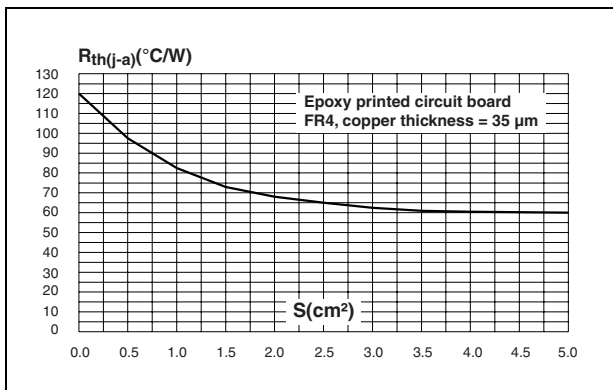
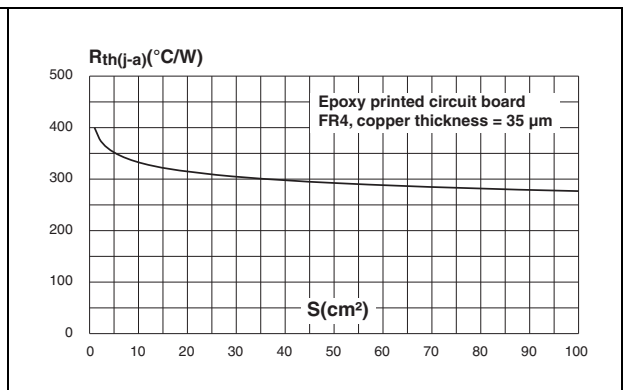
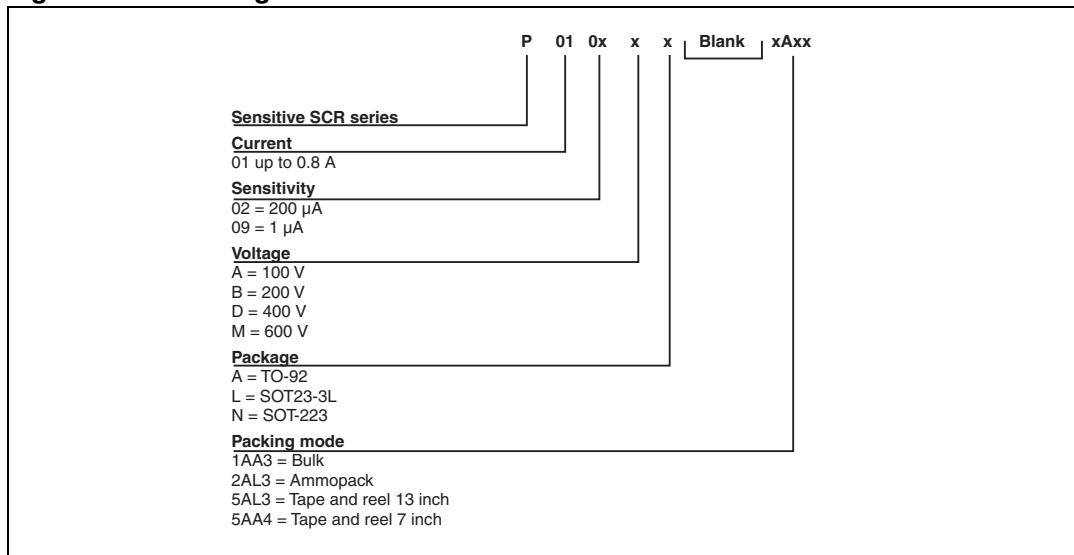


Figure 16. Thermal resistance junction to ambient vs copper surface under tab P010xxL



## 2 Ordering information scheme

Figure 17. Ordering information scheme



## 3 Package information

- Epoxy meets UL94, V0

In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at [www.st.com](http://www.st.com).

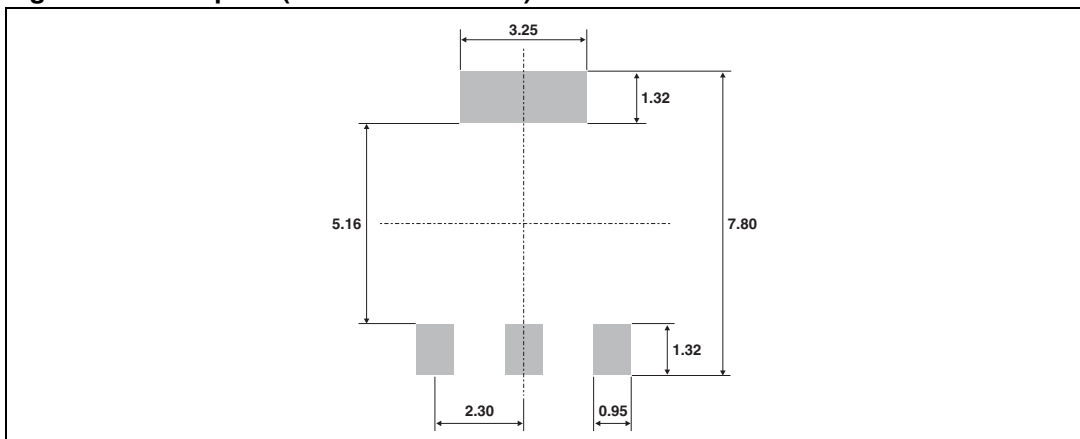
Table 7. TO-92 dimensions

Ref	dimensions					
	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
A		1.35			0.053	
B			4.70			0.185
C		2.54			0.100	
D	4.40			0.173		
E	12.70			0.500		
F			3.70			0.146
a			0.50			0.019

**Table 8. SOT-223 Dimensions**

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.80			0.071
A1		0.02			0.001	
B	0.60	0.70	0.80	0.024	0.027	0.031
B1	2.90	3.00	3.10	0.114	0.118	0.122
c	0.24	0.26	0.32	0.009	0.010	0.013
D	6.30	6.50	6.70	0.248	0.256	0.264
e		2.3			0.090	
e1		4.6			0.181	
E	3.30	3.50	3.70	0.130	0.138	0.146
H	6.70	7.00	7.30	0.264	0.276	0.287
V	10° max					

**Figure 18. Footprint (dimensions in mm)**

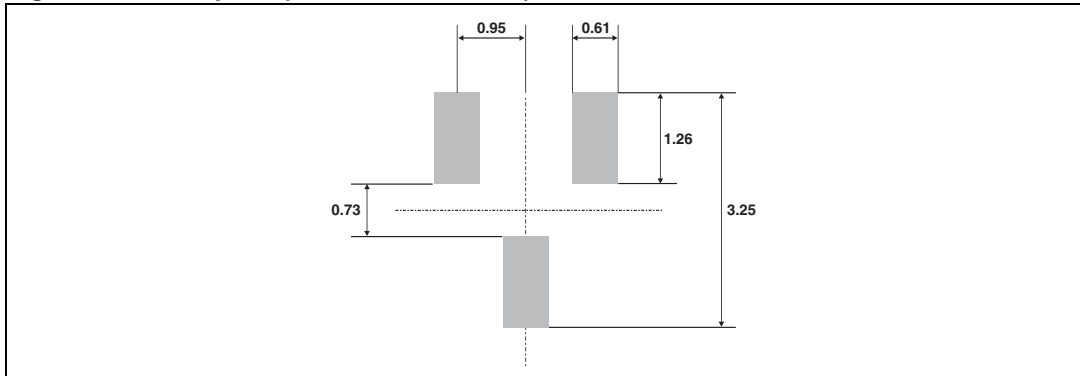




**Table 9. SOT23-3L dimensions**

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.89	1.4	0.035	0.055
A1	0	0.1	0	0.004
B	0.3	0.51	0.012	0.02
c	0.085	0.18	0.003	0.007
D	2.75	3.04	0.108	0.12
e	0.85	1.05	0.033	0.041
e1	1.7	2.1	0.067	0.083
E	1.2	1.6	0.047	0.063
H	2.1	2.75	0.083	0.108
L	0.6 typ.		0.024 typ.	
S	0.35	0.65	0.014	0.026

**Figure 19. Footprint (dimensions in mm)**



## 4 Ordering information

**Table 10. Ordering information**

Order code	Marking	Package	Weight	Base qty	Packing mode
P0102AA 1AA3	P0102 AA	TO-92	0.2 g	2500	Bulk
P0102AA 5AL3	P0102 AA	TO-92	0.2 g	2000	Tape and reel 13 inch
P0102AL 5AA4	P2A	SOT23-3L	0.01 g	3000	Tape and reel 7 inch
P0102BA 1AA3	P0102 BA	TO-92	0.2 g	1000	Bulk
P0102BL 5AA4	P2B	SOT23-3L	0.01 g	3000	Tape and reel 7 inch
P0102DA 1AA3	P0102 DA	TO-92	0.2 g	2500	Bulk
P0102DA 2AL3	P0102 DA	TO-92	0.2 g	2000	Ammopack
P0102DA 5AL3	P0102 DA	TO-92	0.2 g	2000	Tape and reel 13 inch
P0102DN 5AA4	P2D	SOT-223	0.11 g	3000	Tape and reel 7 inch
P0102MA 1AA3	P0102 MA	TO-92	0.2 g	2500	Bulk
P0102MN 5AA4	P2M	SOT-223	0.11 g	2000	Tape and reel 7 inch
P0109AL 5AA4	P9A	SOT23-3L	0.01 g	3000	Tape and reel 7 inch
P0109DA 1AA3	P0109 DA	TO-92	0.2 g	2500	Bulk
P0109DA 5AL3	P0109 DA	TO-92	0.2 g	2000	Tape and reel 13 inch

## 5 Revision history

**Table 11. Document revision history**

Date	Revision	Description of changes
24-Nov-2008	1	First issue.

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