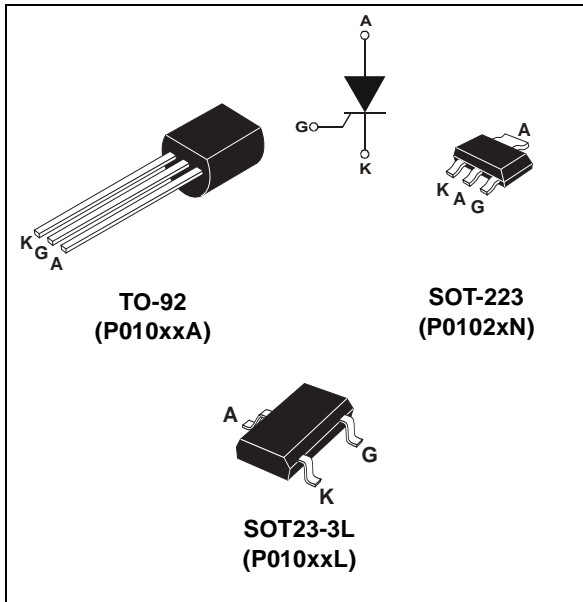


## Sensitive standard SCRs up to 0.8 A

Datasheet – production data


**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 interrupters, 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**

Symbol	Value	Unit
$I_{T(RMS)}$	up to 0.8	A
$V_{DRM}/V_{RRM}$	up to 600	V
$I_{GT}$	From 5 to 200	$\mu A$

**Features**

- On-state rms current, 0.8 A
- Repetitive peak off-state voltage up to 600 V
- Triggering gate current from 5 to 200  $\mu A$
- ECOPACK<sup>®</sup>2 compliant component

# 1 Characteristics

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

Symbol	Parameter		Value	Unit	
$I_{T(RMS)}$	On-state rms 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	$A^2s$
$di/dt$	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}, t_r \leq 100\text{ ns}$	$F = 60\text{ Hz}$	$T_j = 125\text{ °C}$	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	
$I_{T(RMS)}$	On-state rms 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	$A^2s$
$di/dt$	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}, t_r \leq 100\text{ ns}$	$F = 60\text{ Hz}$	$T_j = 125\text{ °C}$	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	
$I_{GT}$	$V_D = 12\text{ V}, R_L = 140\ \Omega$		Max.	200	$\mu\text{A}$
$V_{GT}$			Max.	0.8	V
$V_{GD}$	$V_D = V_{DRM}, R_L = 3.3\ \text{k}\Omega, R_{GK} = 1\ \text{k}\Omega$	$T_j = 125\ ^\circ\text{C}$	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	$V_D = 67\% V_{DRM}, R_{GK} = 1\ \text{k}\Omega$	$T_j = 125\ ^\circ\text{C}$	Min.	75	V/ $\mu\text{s}$
$V_{TM}$	$I_{TM} = 1.6\ \text{A}, t_p = 380\ \mu\text{s}$		Max.	1.95	V
$V_{t0}$	Threshold voltage		Max.	0.95	V
$R_d$	Dynamic resistance		Max.	600	m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM} = 400\ \text{V}$	$R_{GK} = 1\ \text{k}\Omega$	Max.	1	$\mu\text{A}$
	$V_{DRM} = V_{RRM} = 600\ \text{V}$	$R_{GK} = 1\ \text{k}\Omega$		10	
	$V_{DRM} = V_{RRM}$	$R_{GK} = 1\ \text{k}\Omega$		$T_j = 125\ ^\circ\text{C}$	

1.  $T_j = 25\ ^\circ\text{C}$ , 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	$\mu\text{A}$
$V_{GT}$			Max.	0.8		V
$V_{GD}$	$V_D = V_{DRM}, R_L = 3.3\ \text{k}\Omega, R_{GK} = 1\ \text{k}\Omega$	$T_j = 125\ ^\circ\text{C}$	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	$V_D = 67\% V_{DRM}, R_{GK} = 1\ \text{k}\Omega$	$T_j = 125\ ^\circ\text{C}$	Min.	200	100	V/ $\mu\text{s}$
$V_{TM}$	$I_{TM} = 0.4\ \text{A}, t_p = 380\ \mu\text{s}$		Max.	1.7		V
$V_{t0}$	Threshold voltage		Max.	1.0		V
$R_d$	Dynamic resistance		Max.	1000		m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_j = 25\ ^\circ\text{C}$	Max.	1		$\mu\text{A}$
		$T_j = 125\ ^\circ\text{C}$		100		

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

Table 6. Electrical device summary

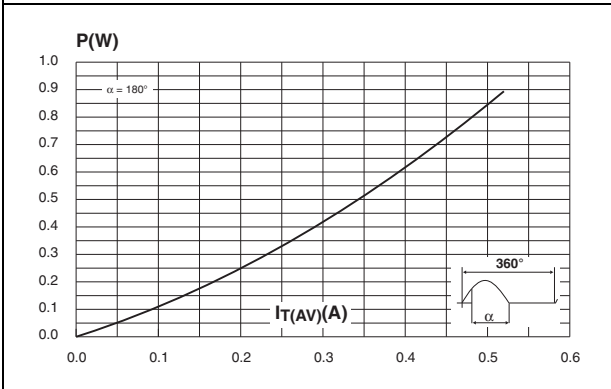
Order code	Voltage				Sensitivity	Package	Packing mode
	100 V	200 V	400 V	600 V			
P0102AA 1AA3	X				200 $\mu$ A	TO-92	Bulk
P0102AA 5AL3	X				200 $\mu$ A	TO-92	Tape and reel 13 inch
P0102AL 5AA4	X				200 $\mu$ A	SOT23-3L	Tape and reel 7 inch
P0102BA 1AA3		X			200 $\mu$ A	TO-92	Bulk
P0102BL 5AA4		X			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

Table 7. Thermal resistance

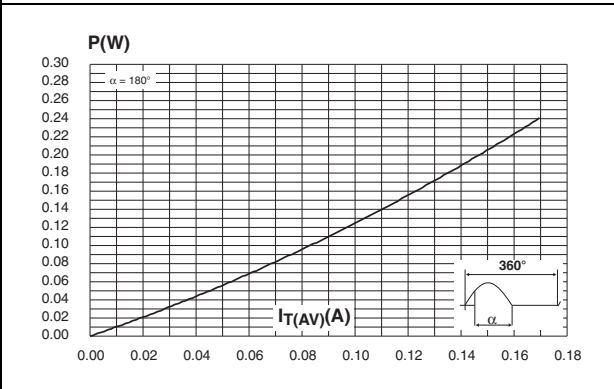
Symbol	Parameter		Maximum	Unit
$R_{th(j-a)}$	Junction to case (DC)	TO-92	80	$^{\circ}$ C/W
$R_{th(j-t)}$	Junction to tab (DC)	SOT-223	30	$^{\circ}$ C/W
$R_{th(j-a)}$	Junction to ambient (DC)	TO-92	150	$^{\circ}$ C/W
		$S^{(1)} = 5 \text{ cm}^2$ SOT-223	60	
$R_{th(j-a)}$	Junction to ambient (mounted on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

1. S = Copper surface under tab.

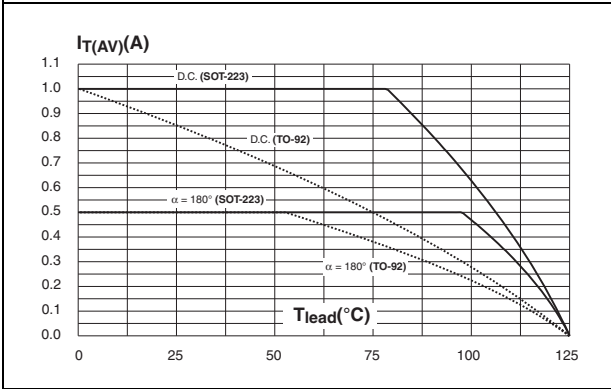
**Figure 1. Maximum average power dissipation versus average on-state current P010xxA and P010xxN**



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



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



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

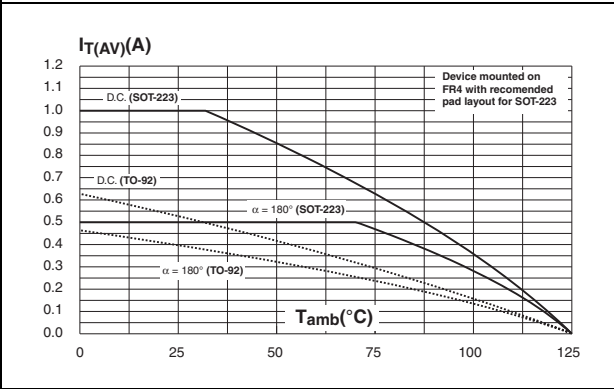


Figure 5. Average and DC on-state current versus case temperature P010xxL

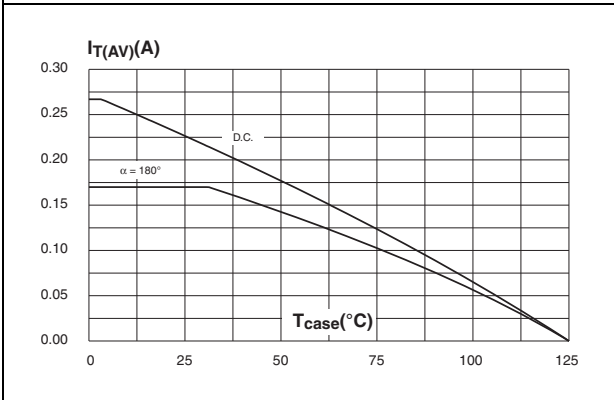


Figure 6. Relative variation of thermal impedance junction to ambient versus pulse duration

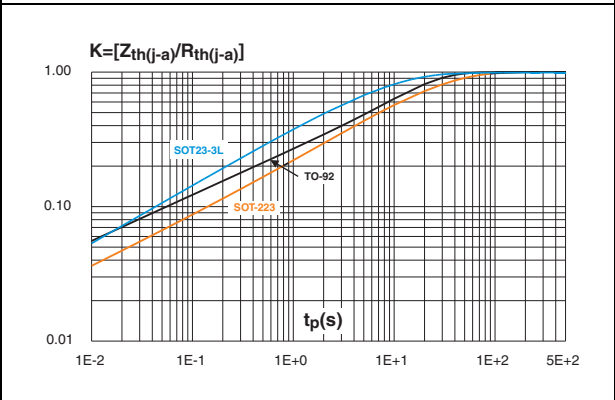


Figure 7. Gate trigger, holding, and latching currents with gate trigger voltage versus junction temperature

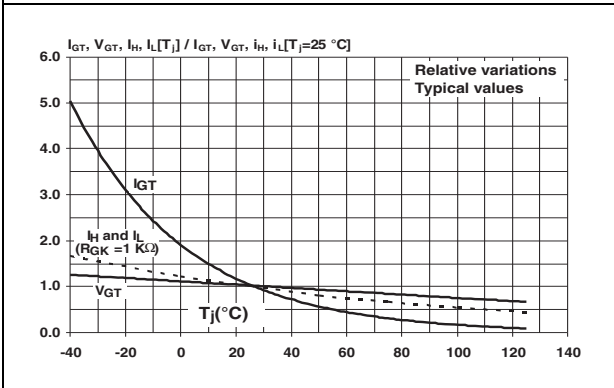


Figure 8. Relative variation of holding current versus gate-cathode resistance

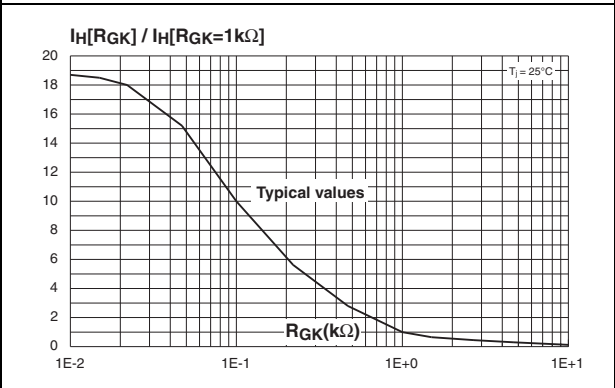


Figure 9. Relative variation of dV/dt immunity versus gate-cathode resistance

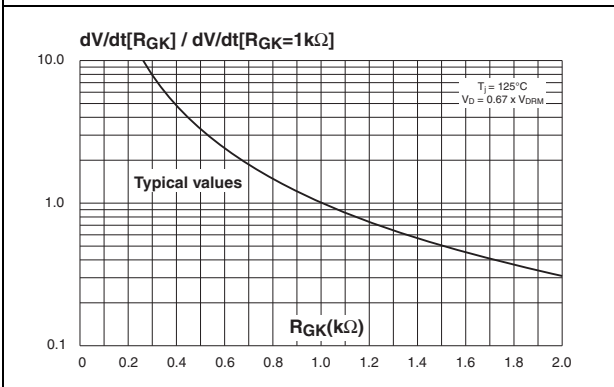
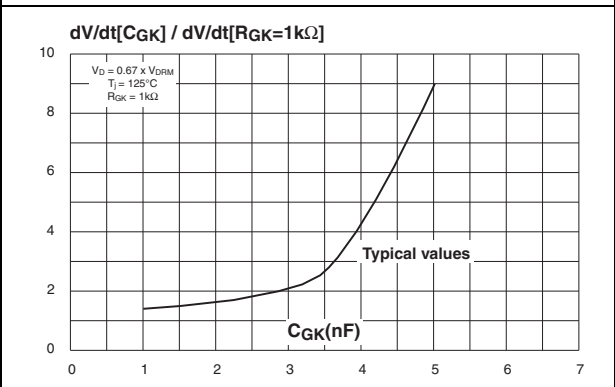
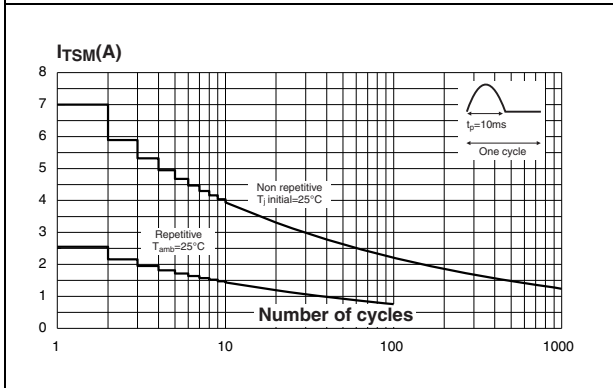


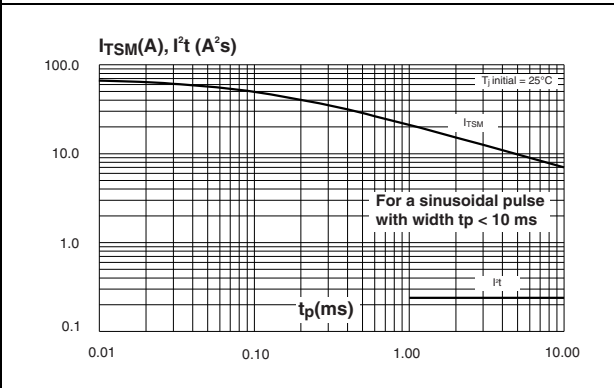
Figure 10. Relative variation of dV/dt immunity versus gate-cathode capacitance



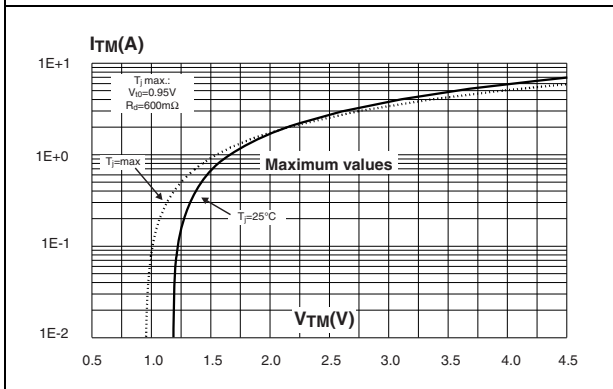
**Figure 11. Surge peak on-state current versus number of cycles**



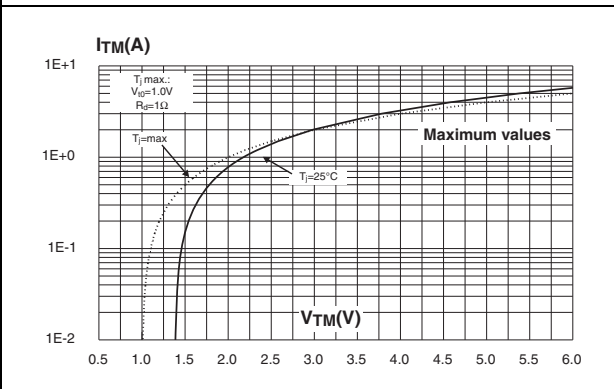
**Figure 12. Non-repetitive surge peak on-state current and corresponding value of I²t**



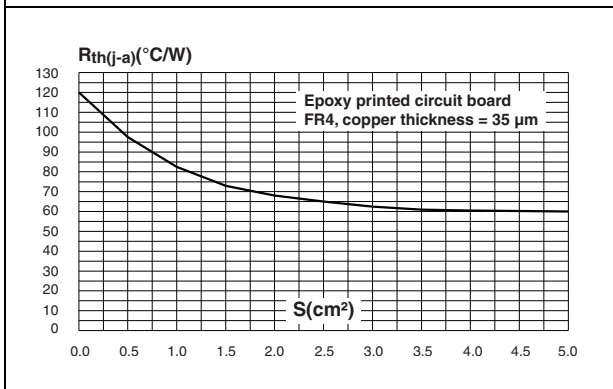
**Figure 13. On-state characteristics P010xxA, P010xxN**



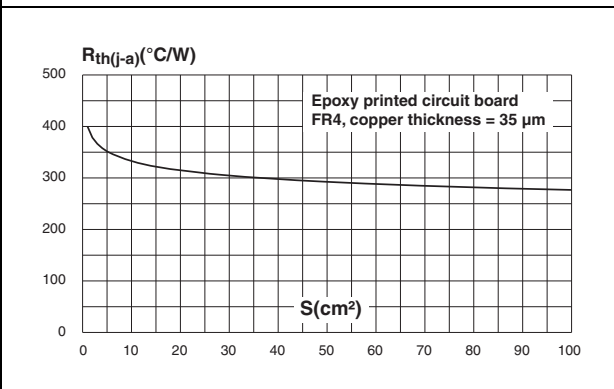
**Figure 14. On-state characteristics P010xxL**



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



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



## 2 Package information

- Epoxy meets UL94, V0
- Lead-free package

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.

Table 8. 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 9. SOT-223 dimensions

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.80			0.071
A1		0.02	0.10		0.001	0.004
B	0.60	0.70	0.85	0.024	0.027	0.033
B1	2.90	3.00	3.15	0.114	0.118	0.124
c	0.24	0.26	0.35	0.009	0.010	0.014
D <sup>(1)</sup>	6.30	6.50	6.70	0.248	0.256	0.264
e		2.3			0.090	
e1		4.6			0.181	
E <sup>(1)</sup>	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					

1. Do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (0.006inches)



Figure 17. Footprint (dimensions in mm)

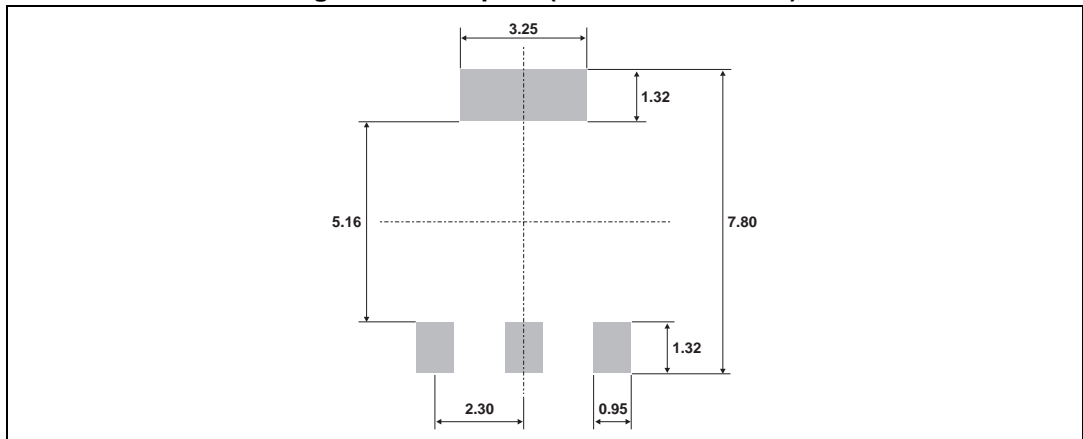
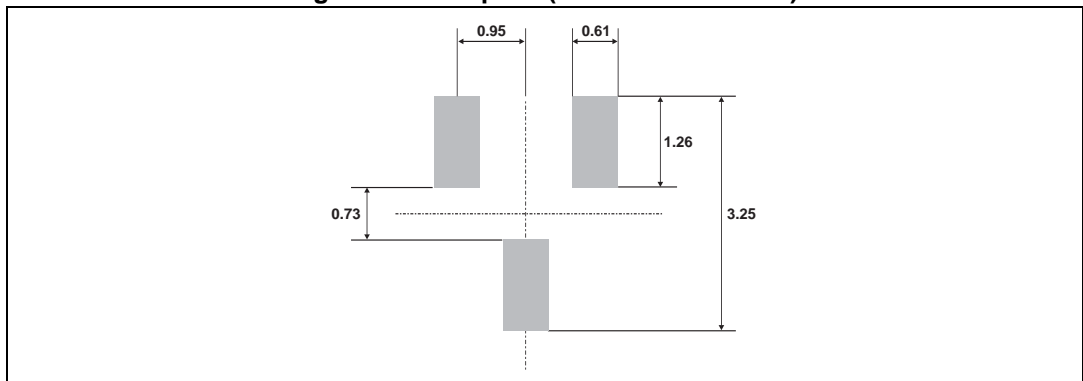


Table 10. SOT23-3L dimensions

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 18. Footprint (dimensions in mm)



### 3 Ordering information

Figure 19. Ordering information scheme

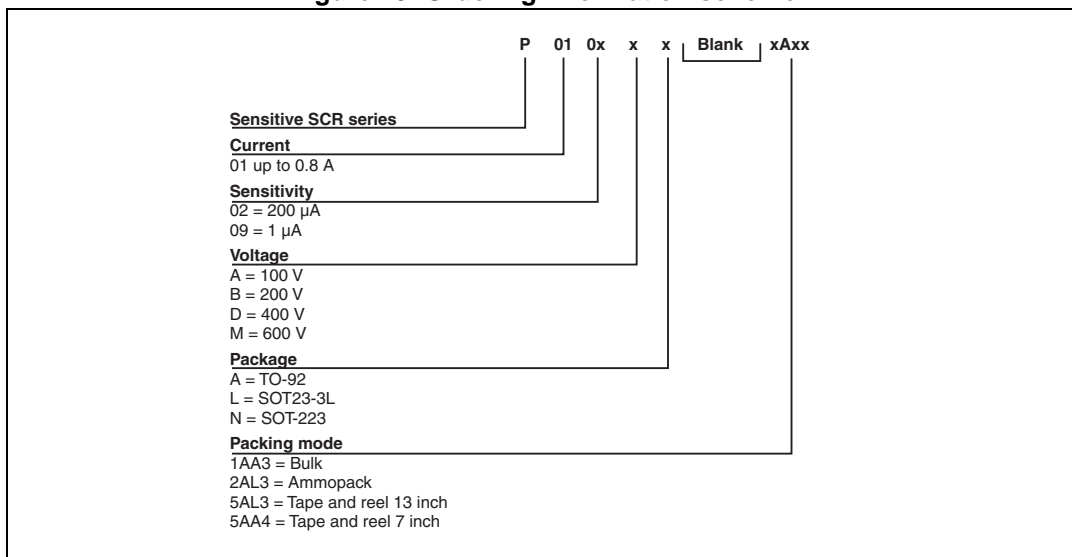


Table 11. Ordering information

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

## 4 Revision history

Table 12. Document revision history

Date	Revision	Changes
24-Nov-2008	1	First issue.
01-Apr-2014	2	Added $V_{GT}$ in <a href="#">Figure 7</a> , updated <a href="#">Figure 11</a> and <a href="#">Table 9</a> and reformatted to current standard.

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[P0102DA 2AL3](#) [P0102MN 5AA4](#) [P0102MA 1AA3](#) [P0102AA 1AA3](#)