P010xx

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 µA

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.

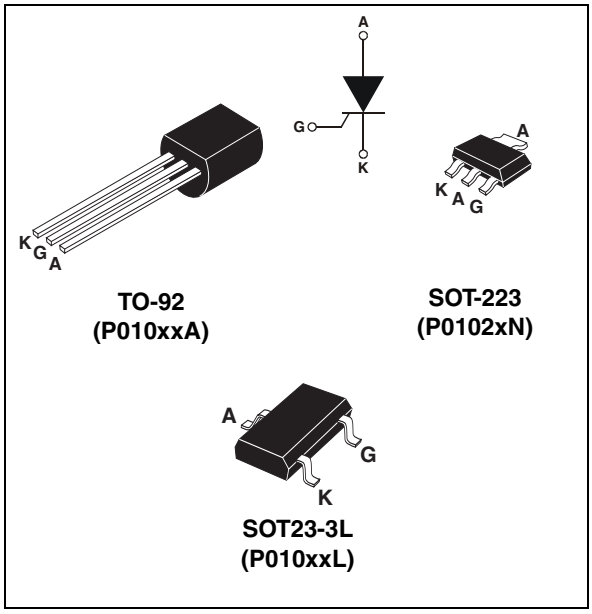


Table 1. Device summary

Order code	Voltage				Sensitivity	Package	Packing Mode
	100 V	200 V	400 V	600 V			
P0102AA 1AA3	X				200 µA	TO-92	Bulk
P0102AA 5AL3	X				200 µA	TO-92	Tape and reel 13 inch
P0102AL 5AA4	X				200 µA	SOT23-3L	Tape and reel 7 inch
P0102BA 1AA3		X			200 µA	TO-92	Bulk
P0102BL 5AA4		X			200 µA	SOT23-3L	Tape and reel 7 inch
P0102DA 1AA3			X		200 µA	TO-92	Bulk
P0102DA 2AL3			X		200 µA	TO-92	Ammopack
P0102DA 5AL3			X		200 µA	TO-92	Tape and reel 13 inch
P0102DN 5AA4	X		X		200 µA	SOT-223	Tape and reel 7 inch
P0102MA 1AA3				X	200 µA	TO-92	Bulk
P0102MN 5AA4				X	200 µA	SOT-223	Tape and reel 7 inch
P0109AL 5AA4	X				1 µA	SOT23-3L	Tape and reel 7 inch
P0109DA 1AA3			X		1 µA	TO-92	Bulk
P0109DA 5AL3			X		1 µA	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_l = 55 °C	0.8	A
		SOT-223	T_{amb} = 70 °C		
$IT_{(AV)}$	Average on-state current (180° conduction angle)	TO-92	T_l = 55 °C	0.5	A
		SOT-223	T_{amb} = 70 °C		
I_{TSM}	Non repetitive surge peak on-state current	t_p = 8.3 ms	T_j = 25 °C	8	A
		t_p = 10 ms		7	
I^2t	I^2t Value for fusing	t_p = 10 ms	T_j = 25 °C	0.24	A^2s
dI/dt	Critical rate of rise of on-state current I_G = 2 x I_{GT} , $t_r \leq$ 100 ns	F = 60 Hz	T_j = 125 °C	50	A/µs
I_{GM}	Peak gate current	t_p = 20 µs	T_j = 125 °C	1	A
$P_{G(AV)}$	Average gate power dissipation		T_j = 125 °C	0.1	W
T_{stg} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	°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 °C	0.25	A
$IT_{(AV)}$	Average on-state current (180° conduction angle)		T_{amb} = 36 °C	0.16	A
I_{TSM}	Non repetitive surge peak on-state current	t_p = 8.3 ms	T_j = 25 °C	7	A
		t_p = 10 ms		6	
I^2t	I^2t Value for fusing	t_p = 10 ms	T_j = 25 °C	0.18	A^2s
dI/dt	Critical rate of rise of on-state current I_G = 2 x I_{GT} , $t_r \leq$ 100 ns	F = 60 Hz	T_j = 125 °C	50	A/µs
I_{GM}	Peak gate current	t_p = 20 µs	T_j = 125 °C	0.5	A
$P_{G(AV)}$	Average gate power dissipation		T_j = 125 °C	0.02	W
T_{stg} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	°C

Table 4. Electrical characteristics(1) P010xxA and P010xxN

Symbol	Test conditions			Value	Unit
I_{GT}	V_D = 12 V R_L = 140 Ω		Min.	-	µA
			Max.	200	
V_{GT}			Max.	0.8	V
V_{GD}	$V_D = V_{DRM}$ R_L = 3.3 kΩ R_{GK} = 1 kΩ	T_j = 125 °C	Min.	0.1	V
V_{RG}	I_{RG} = 10 µA		Min.	8	V
I_H	I_T = 50 mA R_{GK} = 1 kΩ		Max.	5	mA
I_L	I_G = 1 mA R_{GK} = 1 kΩ		Max.	6	mA
dV/dt	V_D = 67 % V_{DRM} R_{GK} = 1 kΩ	T_j = 125 °C	Min.	75	V/µs
V_{TM}	I_{TM} = 1.6 A tp = 380 µs	T_j = 25 °C	Max.	1.95	V
V_{t0}	Threshold voltage	T_j = 125 °C	Max.	0.95	V
R_d	Dynamic resistance	T_j = 125 °C	Max.	600	mΩ
I_{DRM} I_{RRM}	$V_{DRM} = V_{RRM}$ = 400 V R_{GK} = 1 kΩ	T_j = 25 °C	Max.	1	µA
	$V_{DRM} = V_{RRM}$ = 600 V R_{GK} = 1 kΩ			10	
	$V_{DRM} = V_{RRM}$ R_{GK} = 1 kΩ	T_j = 125 °C		100	

1. T_j = 25 °C, unless otherwise specified

Table 5. Electrical characteristics(1) P010xxL

Symbol	Test conditions			P0102xL	P0109AL	Unit
I_{GT}	V_D = 12 V R_L = 140 Ω		Max.	200	1	µA
V_{GT}			Max.	0.8		V
V_{GD}	$V_D = V_{DRM}$ R_L = 3.3 kΩ R_{GK} = 1 kΩ	T_j = 125 °C	Min.	0.1		V
V_{RG}	I_{RG} = 10 µA		Min.	8		V
I_H	I_T = 50 mA R_{GK} = 1 kΩ		Max.	6		mA
I_L	I_G = 1 mA R_{GK} = 1 kΩ		Max.	7		mA
dV/dt	V_D = 67 % V_{DRM} R_{GK} = 1 kΩ	T_j = 125 °C	Min.	200	100	V/µs
V_{TM}	I_{TM} = 0.4 A tp = 380 µs	T_j = 25 °C	Max.	1.7		V
V_{t0}	Threshold voltage	T_j = 125 °C	Max.	1.0		V
R_d	Dynamic resistance	T_j = 125 °C	Max.	1000		mΩ
I_{DRM} I_{RRM}	$V_{DRM} = V_{RRM}$	T_j = 25 °C	Max.	1		µA
		T_j = 125 °C		100		

1. T_j = 25 °C, unless otherwise specified

Table 6. Thermal resistance

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

1. S = Copper surface under tab.

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

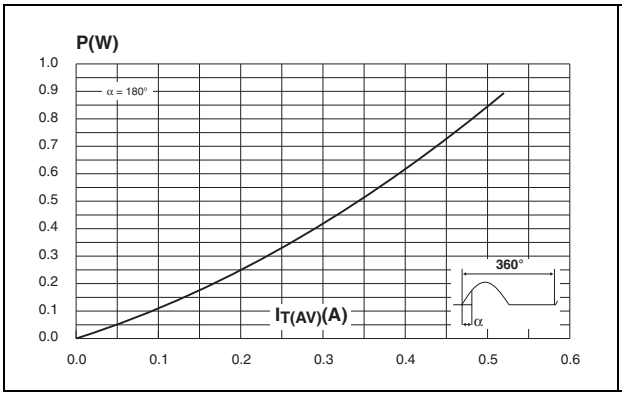


Figure 2. Maximum average power dissipation vs. average on-state current P010xxL

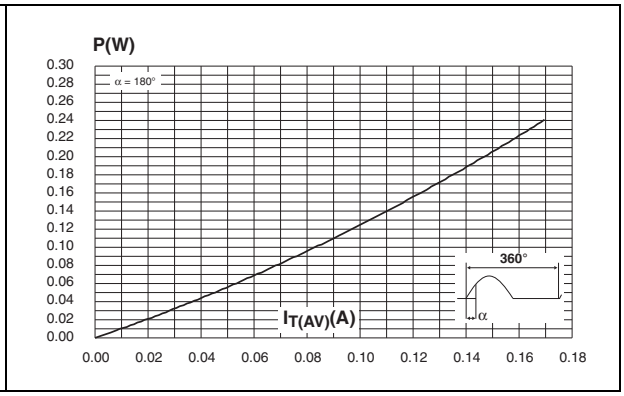


Figure 3. Average and DC on-state current vs. lead temperature P010xxA and P010xxN

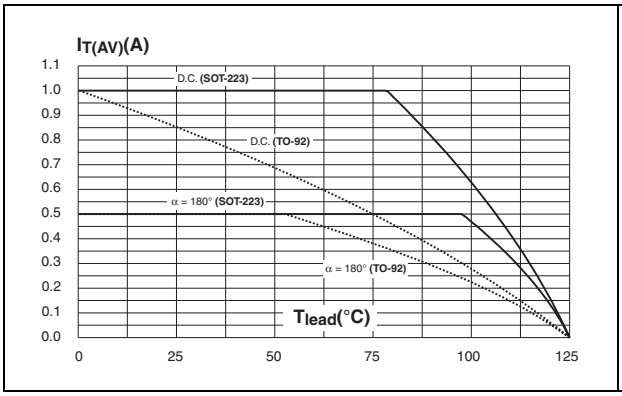


Figure 4. Average and DC on-state current vs. ambient temperature P010xxA and P010xxN

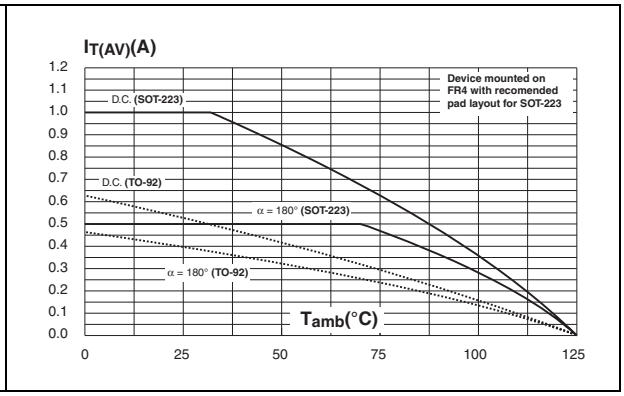


Figure 5. Average and DC on-state current vs. case temperature P010xxL

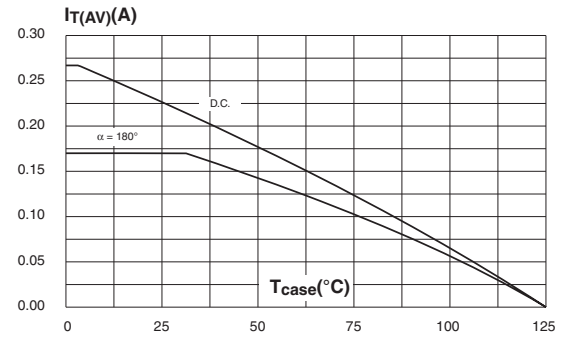


Figure 6. Relative variation of thermal impedance junction to ambient vs. pulse duration

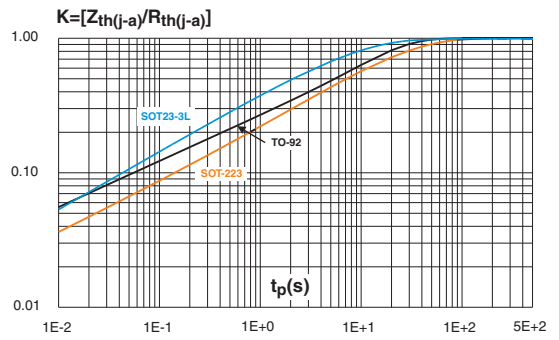


Figure 7. Relative variation of gate trigger, holding, and latching currents vs. junction temperature

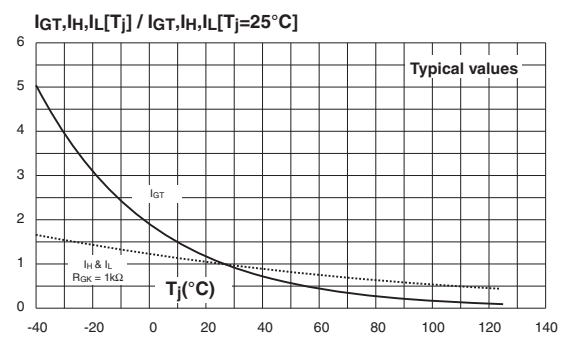


Figure 8. Relative variation of holding current vs. gate-cathode resistance

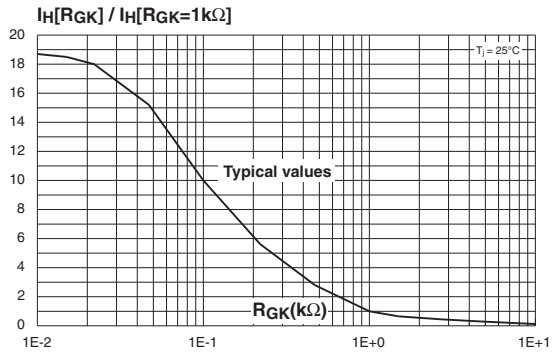


Figure 9. Relative variation of dV/dt immunity vs. gate-cathode resistance

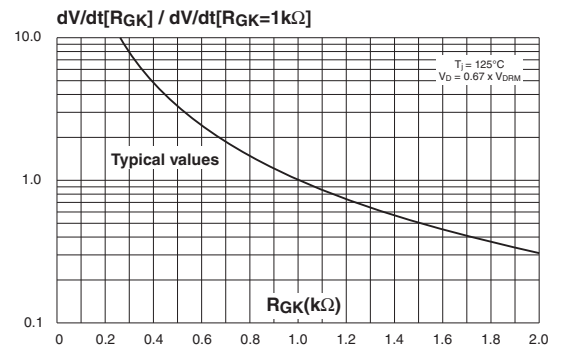


Figure 10. Relative variation of dV/dt immunity vs. gate-cathode capacitance

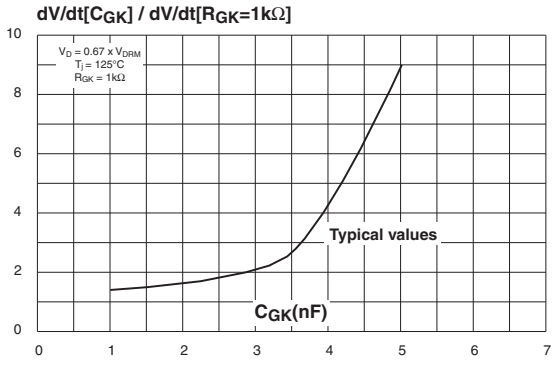


Figure 11. Surge peak on-state current versus number of cycles

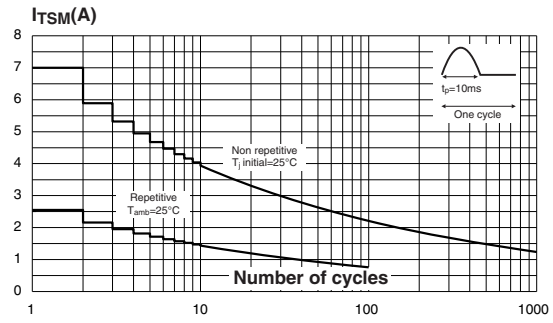


Figure 12. Non-repetitive surge peak on-state current and corresponding value of I²t

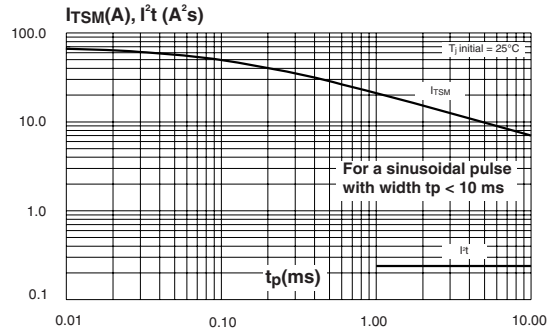


Figure 13. On-state characteristics P010xxA, P010xxN

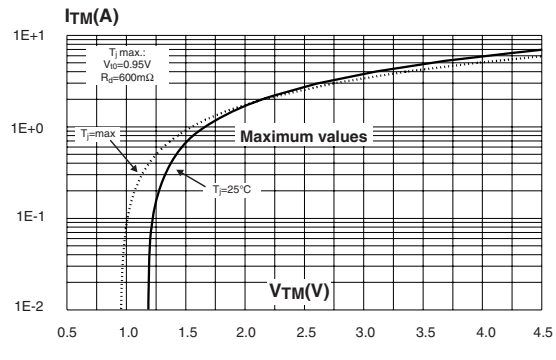


Figure 14. On-state characteristics P010xxL

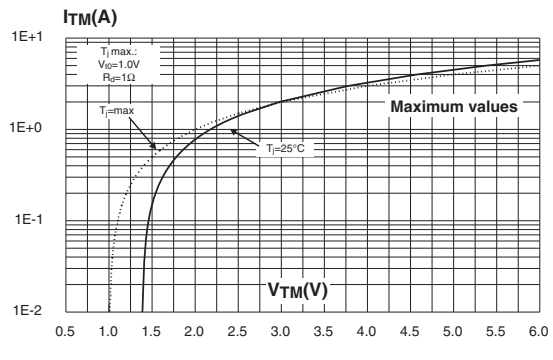


Figure 15. Thermal resistance junction to ambient vs. copper surface under tab P010xxN

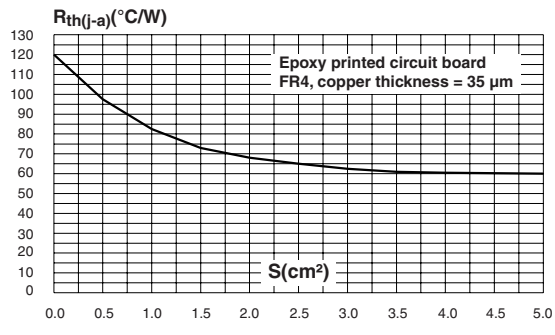
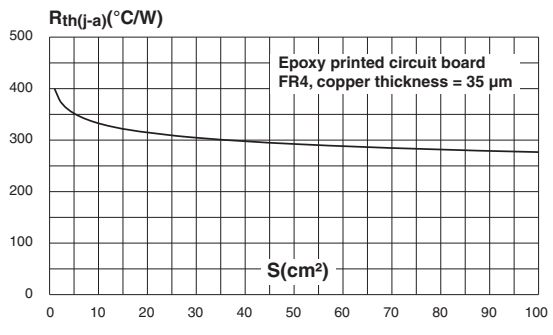
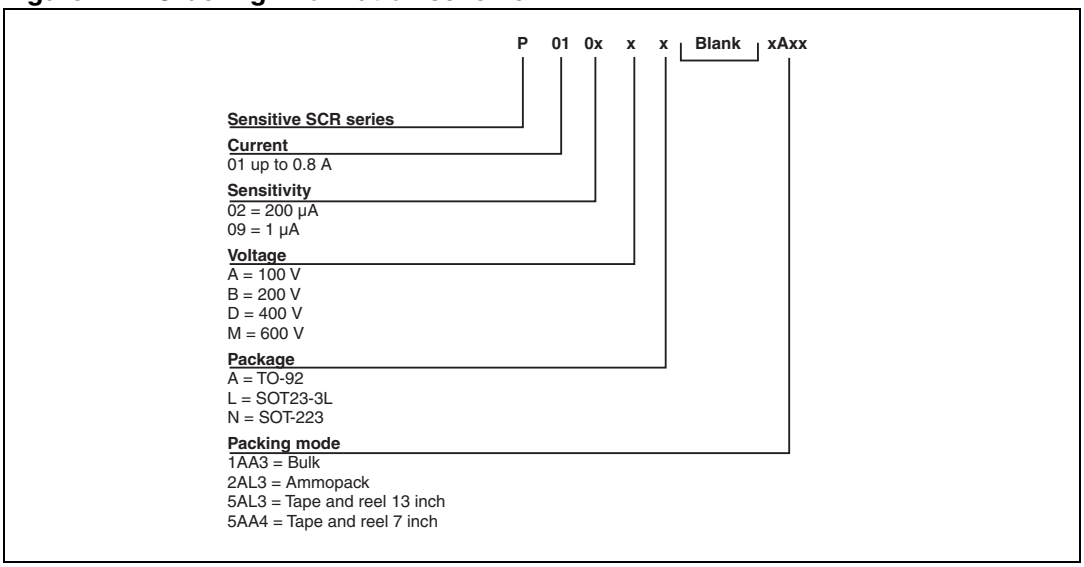


Figure 16. Thermal resistance junction to ambient vs copper surface under tab P010xxL



2 Ordering information scheme

Figure 17. Ordering information scheme

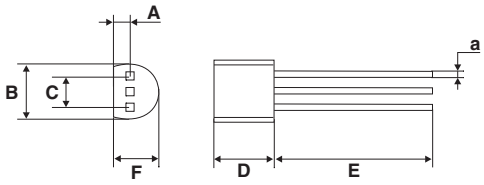


3 Package information

- Epoxy meets UL94, V0

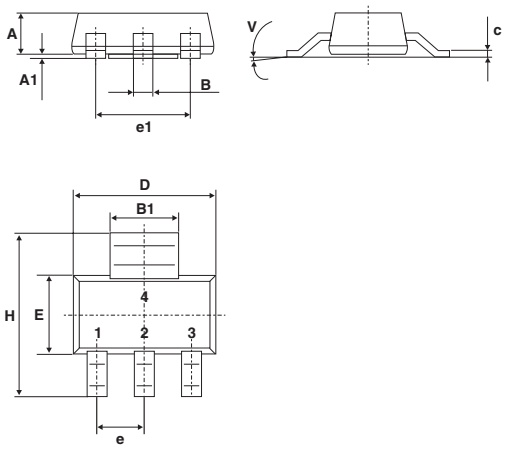
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings 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*.

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)

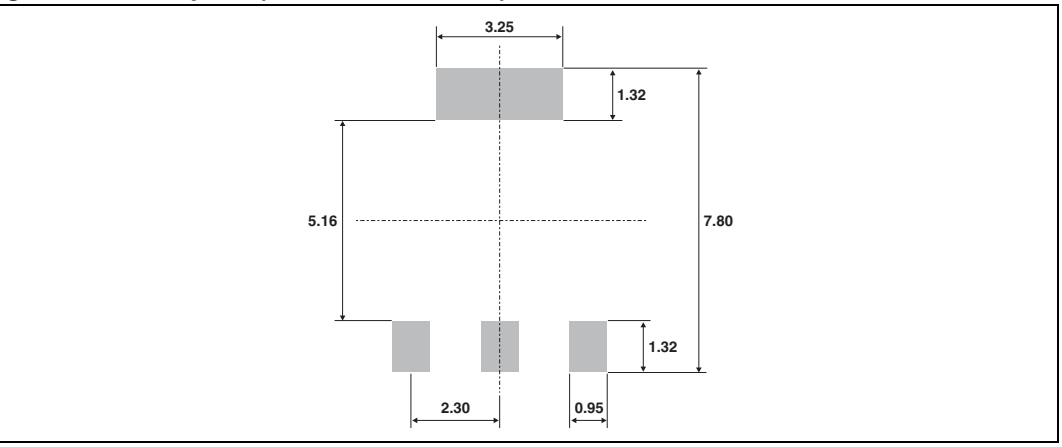
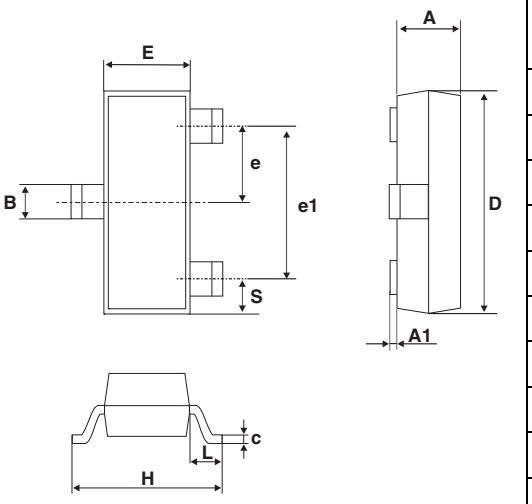
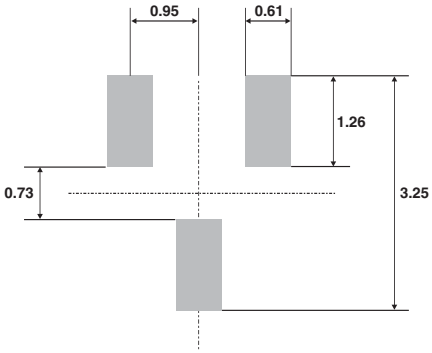


Table 9. SOT23-3L dimensions



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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