X02

1.25 A sensitive gate SCR

Features

- on-state rms current: 1.25 A
- repetitive peak off-state voltage: 600 V and 800 V
- gate triggering current: 50 and 200 µA

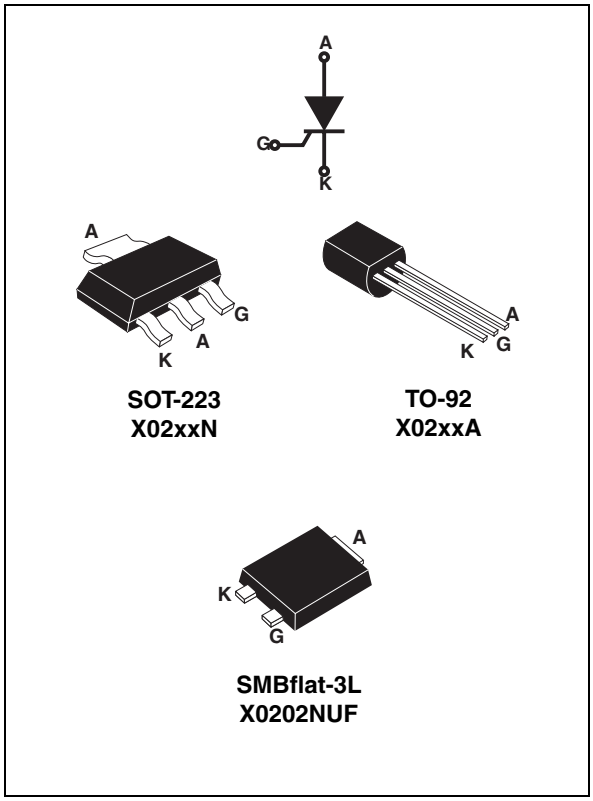
Applications

- ground fault circuit interrupters
- overvoltage crowbar protection in power supplies
- capacitive ignition circuits

Description

The X02 SCR can be used as the on/off function in applications where topology does not offer high current for gate triggering.

This device is optimized in forward voltage drop and inrush current capabilities for reduced power losses and high reliability in harsh environments.



SOT-223
X02xxN

TO-92
X02xxA

SMBflat-3L
X0202NUF

Table 1. Device summary

Order code	Voltage		Sensitivity µA	Package
	600 V	800 V		
X0202MA	Y		200	TO-92
X0202MN	Y		200	SOT-223
X0202NA		Y	200	TO-92
X0202NN		Y	200	SOT-223
X0205MA	Y		50	TO-92
X0205NA		Y	50	TO-92
X0202NUF		Y	200	SMBflat-3L

1 Characteristics

Table 2. Absolute ratings (limiting values, T_J = 25 °C unless otherwise specified)

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	On-state rms current (180 °Conduction angle)	TO-92	T_L = 63 °C	1.25	A
		SOT-223	T_{tab} = 99 °C		
		SMBflat-3L	T_{tab} = 111 °C		
$IT_{(AV)}$	Average on-state current (180 °Conduction angle)	TO-92	T_L = 63 °C	0.8	A
		SOT-223	T_{tab} = 99 °C		
		SMBflat-3L	T_{tab} = 111 °C		
I_{TSM}	Non repetitive surge peak on-state current	t_p = 8.3 ms	T_j = 25 °C	25	A
		t_p = 10 ms		22.5	
I^2t	I^2t Value for fusing	t_p = 10 ms	T_j = 25 °C	2.5	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	1.2	A
$P_{G(AV)}$	Average gate power dissipation		T_j = 125 °C	0.2	W
T_{stg} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	°C

Table 3. Electrical characteristics (T_J = 25 °C unless otherwise specified)

Symbol	Test conditions			X0202	X0205	Unit
I_{GT}	V_D = 12 V, R_L = 140 Ω		Min.		20	µA
			Max.	200	50	
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 = 110 °C	Min.	10	15	V/µs

Table 4. Static electrical characteristics

Symbol	Test conditions			X0202	X0205	Unit
V_{TM}	I_{TM} = 2.5 A, t_p = 380 µs	T_j = 25 °C	Max.	1.45		V
V_{TO}	Threshold voltage	T_j = 125 °C		0.9		V
R_d	Dynamic resistance			200		mΩ
I_{DRM} I_{RRM}	V_{DRM} = V_{RRM}, R_{GK} = 1 kΩ	T_j = 25 °C		5		µA
		T_j = 125 °C		500		µA

Table 5. Thermal resistances

Symbol	Parameter				Value	Unit
$R_{th(j-l)}$	Junction to leads (DC)		TO-92	Max.	60	°C/W
$R_{th(j-t)}$	Junction to tab (DC)		SOT-223		25	
$R_{th(j-t)}$	Junction to tab (DC)		SMBflat-3L		14	
$R_{th(j-a)}$	Junction to ambient (DC)		TO-92		150	
		S = 5 cm^2	SOT-223		60	
			SMBflat-3L		75	

Figure 1. Maximum average power dissipation versus average on-state current (full cycle)

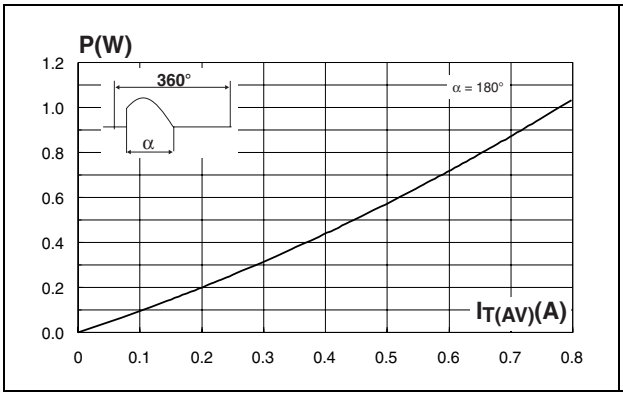


Figure 2. Average and DC on-state current versus tab (SOT-223, SMBflat-3L) or lead (TO-92) temperature

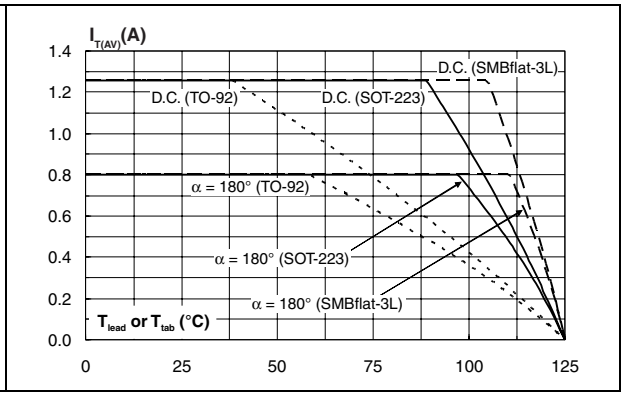


Figure 3. Average and DC on-state current versus ambient temperature

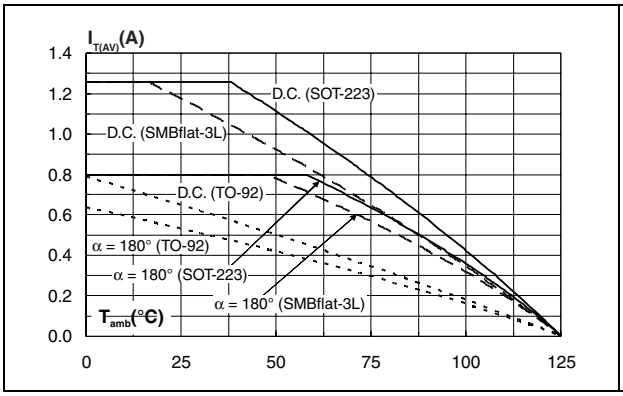


Figure 4. Relative variation of thermal impedance junction to ambient versus pulse duration

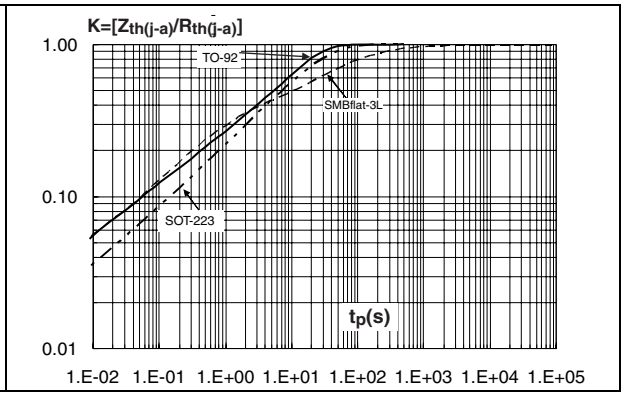


Figure 5. Relative variation of triggering, holding and latching current versus junction temperature

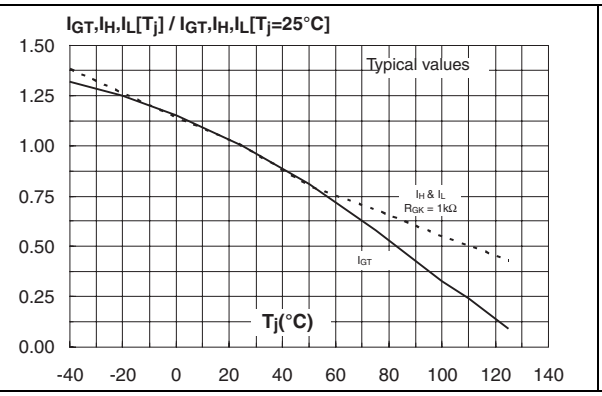


Figure 6. Relative variation of holding current versus gate-cathode resistance (typical values)

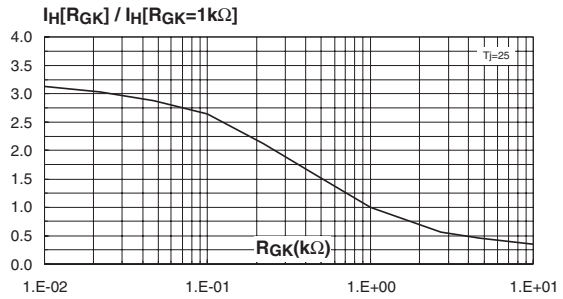


Figure 7. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)

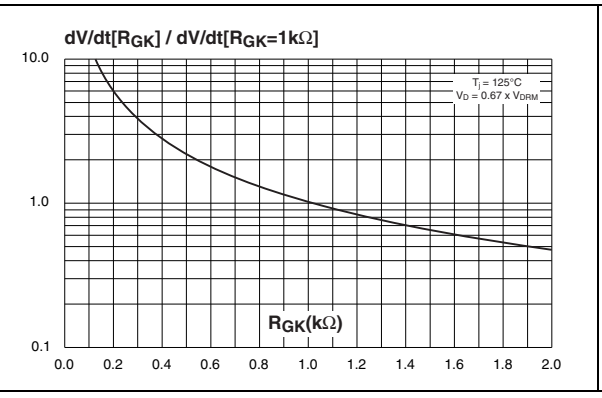


Figure 8. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)

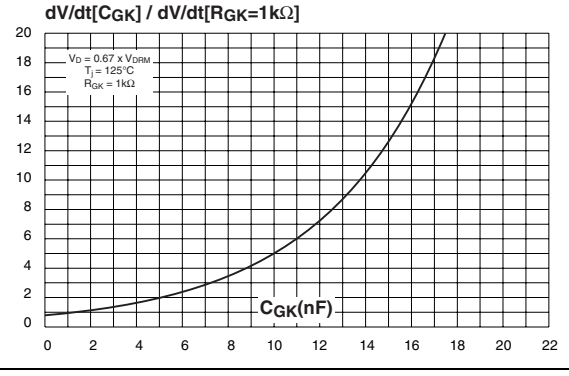


Figure 9. Surge peak on-state current versus number of cycles

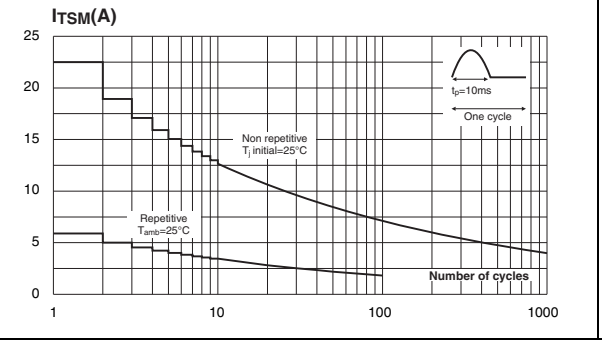


Figure 10. Non repetitive surge peak on state current for a sinusoidal pulse and corresponding value of I^2T

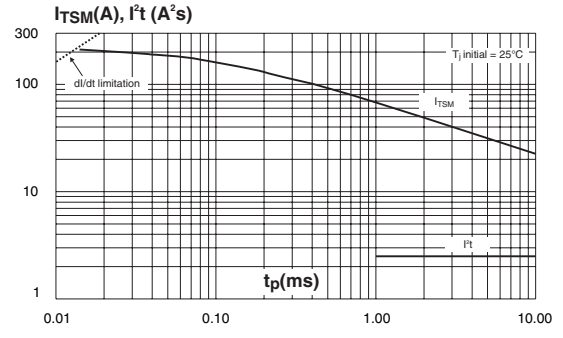


Figure 11. On-state characteristics (maximum values)

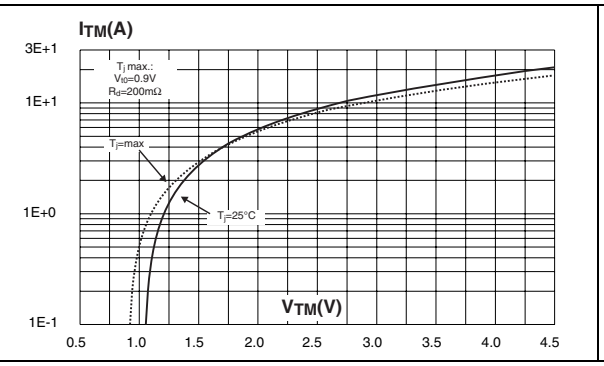
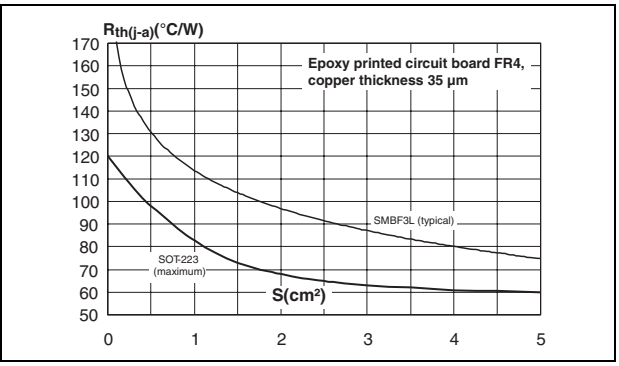
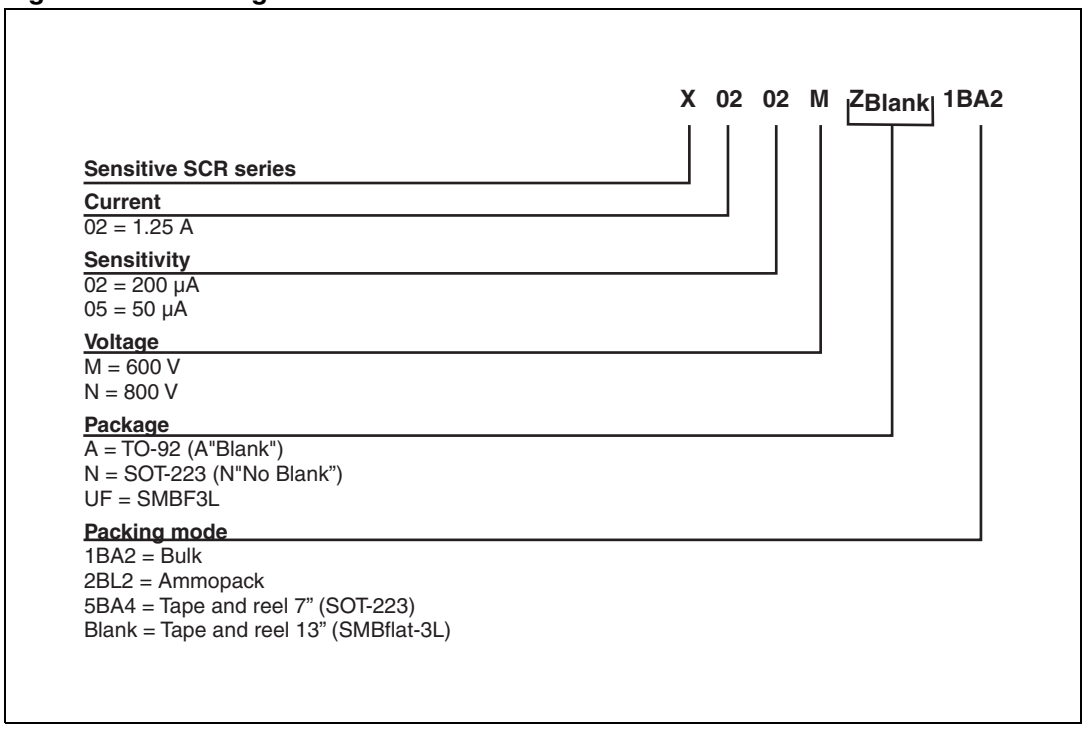


Figure 12. Thermal resistance junction to ambient versus copper surface under tab (SOT-223, SMBflat-3L)



2 Ordering information scheme

Figure 13. Ordering information scheme

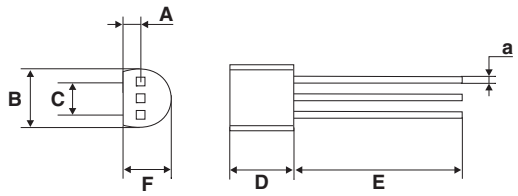


3 Package information

- Epoxy meets UL94, V0
- Lead-free packages

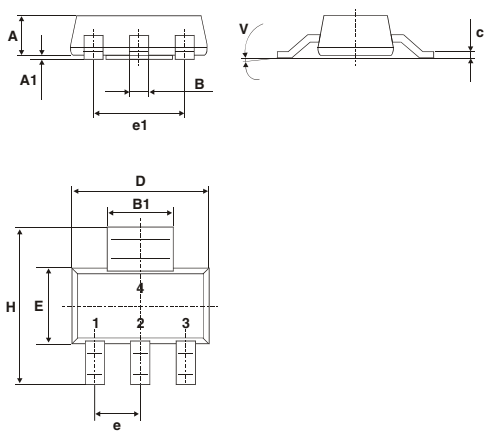
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 6. 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 7. 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(1)	6.30	6.50	6.70	0.248	0.256	0.264
e		2.3			0.090	
e1		4.6			0.181	
E(1)	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 14. SOT-223 footprint

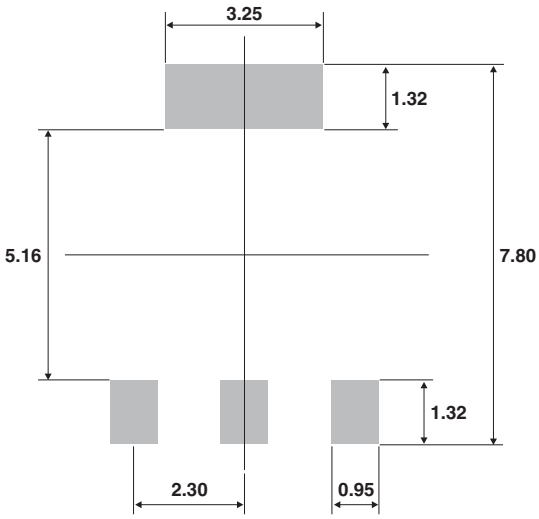
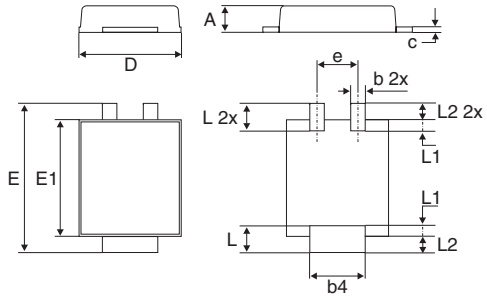


Table 8. SMBflat-3L dimensions



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.10	0.035		0.043
b	0.35		0.65	0.014		0.026
b4	1.95		2.20	0.07		0.087
c	0.15		0.40	0.006		0.016
D	3.30		3.95	0.130		0.156
E	5.10		5.60	0.201		0.220
E1	4.05		4.60	0.156		0.181
L	0.75		1.50	0.030		0.059
L1		0.40			0.016	
L2		0.60			0.024	
e		1.60			0.063	

Figure 15. SMBflat-3L footprint dimensions

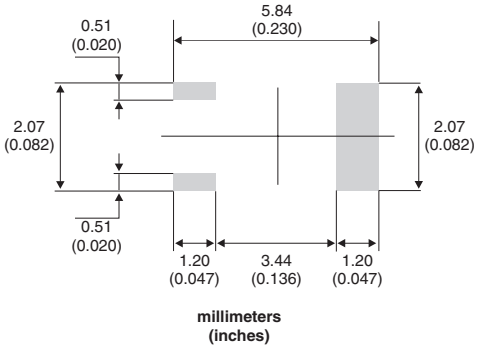
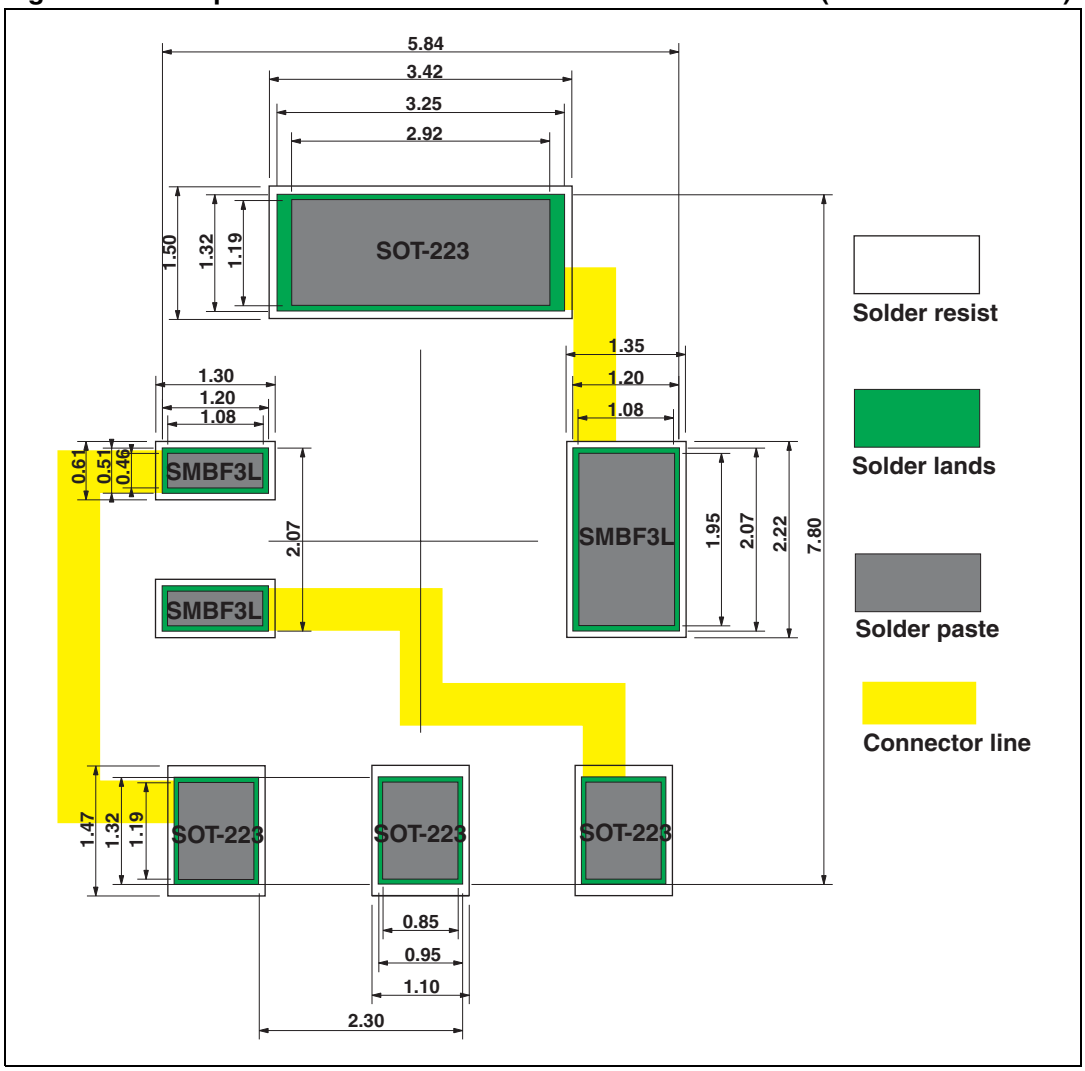


Figure 16. Footprint and connectors for SOT-223 or SMBflat-3L (dimensions in mm)



4 Ordering information

Table 9. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
X0202MA 1BA2	X0202 MA	TO-92	0.2 g	2500	Bulk
X0202MA 2BL2	X0202 MA	TO-92	0.2 g	2000	Ammopack
X0202MN5BA4	X2M	SOT-223	0.12 g	1000	Tape and reel
X0202NA 1BA2	X0202 NA	TO-92	0.2 g	2500	Bulk
X0202NA 2BL2	X0202 NA	TO-92	0.2 g	2000	Ammopack
X0202NN5BA4	X2N	SOT-223	0.12 g	1000	Tape and reel
X0205MA 1BA2	X0205 MA	TO-92	0.2 g	2500	Bulk
X0205MA 2BL2	X0205 MA	TO-92	0.2 g	2000	Ammopack
X0205NA 1BA2	X0205 NA	TO-92	0.2 g	2500	Bulk
X0202NUF	X2N	SMBflat-3L	46.914 mg	5000	Tape and reel

5 Revision history

Table 10. Document revision history

Date	Revision	Changes
Sep-2000	3	Previous issue
14-Jan-2011	4	Added SMBflat-3L package and ECOPACK statement.

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