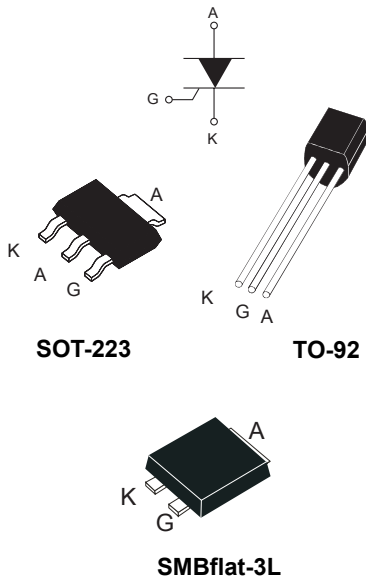


## 1.25 A sensitive gate SCR



### Features

- On-state rms current,  $I_{T(RMS)}$  1.25 A
- Repetitive peak off-state voltage,  $V_{DRM}/V_{RRM}$  600 or 800 V
- Triggering gate current,  $I_{GT(Q1)}$  50 to 200  $\mu$ A

### 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.

#### Product status link

[X02](#)

#### Product summary

$I_{T(RMS)}$	1.25 A
$V_{DRM}/V_{RRM}$	600, 800 V
$I_{GTstandard}$	50 to 200 $\mu$ A

# 1 Characteristics

**Table 1. Absolute ratings (limiting values,  $T_J = 25\text{ °C}$  unless otherwise specified)**

Symbol	Parameters	Value		Unit	
$I_{T(RMS)}$	RMS on-state current (180 ° conduction angle)	SOT-223	$T_{tab} = 99\text{ °C}$	1.25	A
		TO-92	$T_L = 63\text{ °C}$		
		SMBflat-3L	$T_{tab} = 111\text{ °C}$		
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)	SOT-223	$T_{tab} = 99\text{ °C}$	0.8	A
		TO-92	$T_L = 63\text{ °C}$		
		SMBflat-3L	$T_{tab} = 111\text{ °C}$		
$I_{TSM}$	Non repetitive surge peak on-state current	F = 50 Hz	$t_p = 8.3\text{ ms}$	25	A
		F = 60 Hz	$t_p = 10\text{ ms}$	22.5	
$I^2t$	$I^2t$ value for fusing	$t_p = 10\text{ ms}$	$T_J = 25\text{ °C}$	2.5	A <sup>2</sup> s
dI/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	$T_J = 125\text{ °C}$	1.2	A
$P_{G(AV)}$	Average gate power dissipation	$T_J = 125\text{ °C}$		0.2	W
$T_{stg}$	Storage junction temperature range			-40 to +150	°C
$T_J$	Operating junction temperature range			-40 to +125	°C

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

Symbol	Parameters	Value		Unit	
		X0202	X0205		
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ , $R_L = 140\text{ }\Omega$	Min.		20	$\mu$ A
		Max.	200	50	
$V_{GT}$		Max.	0.8		V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$ , $R_{GK} = 1\text{ k}\Omega$ , $T_J = 125\text{ °C}$	Min.	0.1		V
$V_{RG}$	$I_{RG} = 10\text{ }\mu$ A	Min.	8		
$I_H^{(2)}$	$I_T = 50\text{ mA}$ , $R_{GK} = 1\text{ k}\Omega$	Max.	5		mA
$I_L$	$I_G = 1\text{ mA}$ , $R_{GK} = 1\text{ k}\Omega$	Max.	6		mA
dV/dt <sup>(2)</sup>	$V_D = 67\% V_{DRM}$ , $R_{GK} = 1\text{ k}\Omega$ , $T_J = 110\text{ °C}$	Min.	10	15	V/ $\mu$ s

1. Minimum  $I_{GT}$  is guaranteed at 5 % of  $I_{GT}$  max.
2. For both polarities of A2 referenced to A1

**Table 3. Static electrical characteristics**

Symbol	Test conditions		Value	Unit
$V_T^{(1)}$	$I_{TM} = 2.5 \text{ A}$ , $t_p = 380 \text{ } \mu\text{s}$	$T_j = 25 \text{ } ^\circ\text{C}$	Max. 1.45	V
$V_{TO}^{(1)}$	Threshold on-state voltage	$T_j = 125 \text{ } ^\circ\text{C}$	Max. 0.9	V
$R_d$	Dynamic resistance	$T_j = 125 \text{ } ^\circ\text{C}$	Max. 200	m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_j = 25 \text{ } ^\circ\text{C}$	Max.	5 $\mu\text{A}$
		$T_j = 125 \text{ } ^\circ\text{C}$		500 $\mu\text{A}$

1. For both polarities of A2 referenced to A1

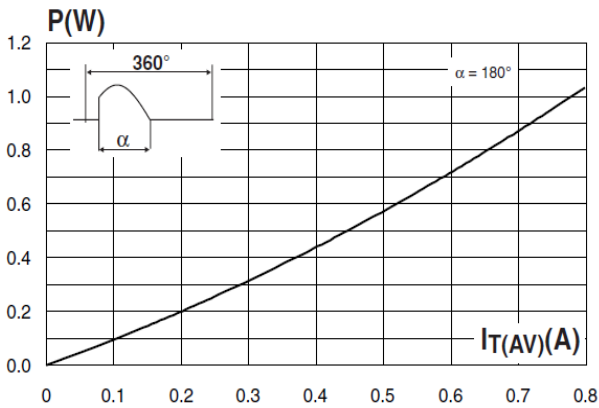
**Table 4. Thermal resistance**

Symbol	Parameters		Max. value	Unit
$R_{th(j-t)}$	Junction to tab (AC)	SOT-223	25	$^\circ\text{C/W}$
		SMBflat-3L	14	
$R_{th(j-l)}$	Junction to lead (AC)	TO-92	60	
$R_{th(j-a)}$	Junction to ambient ( $S^{(1)} = 5 \text{ cm}^2$ )	SOT-223	60	
		SMBflat-3L	75	
	Junction to ambient	TO-92	150	

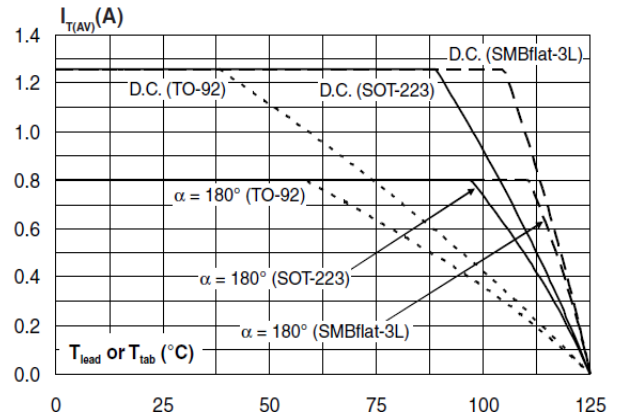
1. Copper surface under tab.

## 1.1 Characteristics (curves)

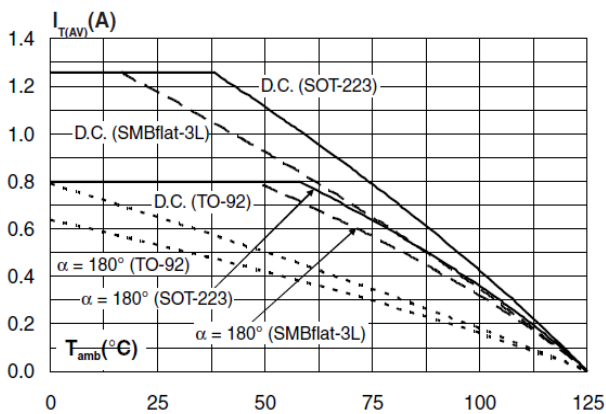
**Figure 1. Maximum power dissipation versus on-state RMS current (full cycle)**



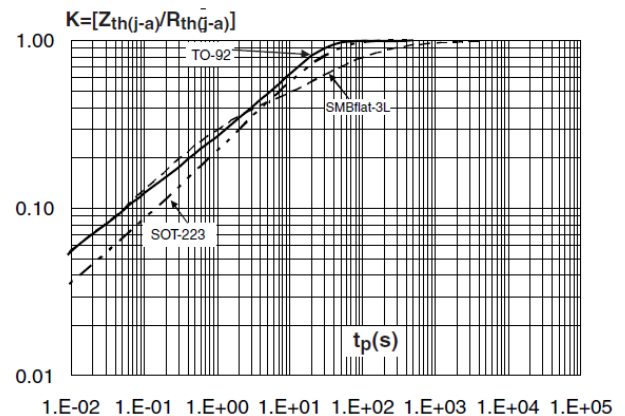
**Figure 2. Average and DC on-state current versus tab (SOT-223, SMBflat-3L) or lead (TO-92) temperature**



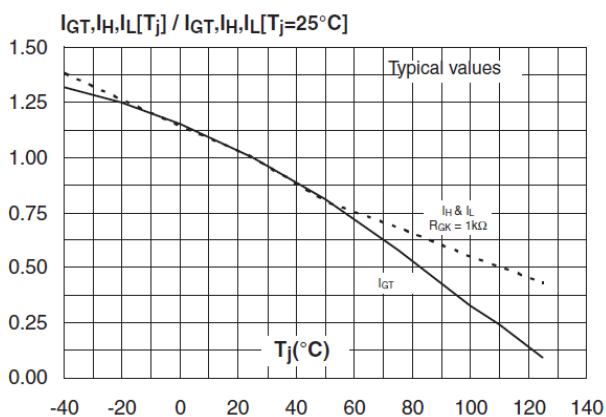
**Figure 3. Average and DC on-state current versus ambient temperature**



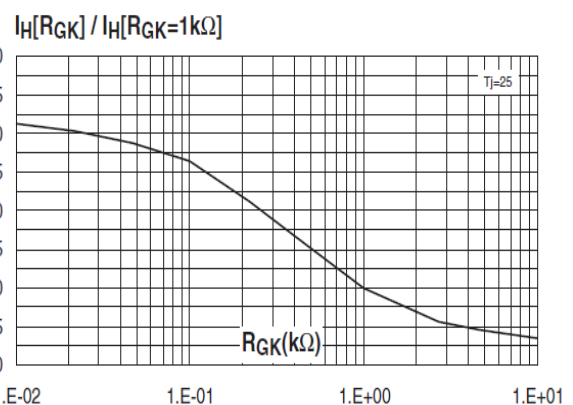
**Figure 4. Relative variation of thermal impedance versus pulse duration**



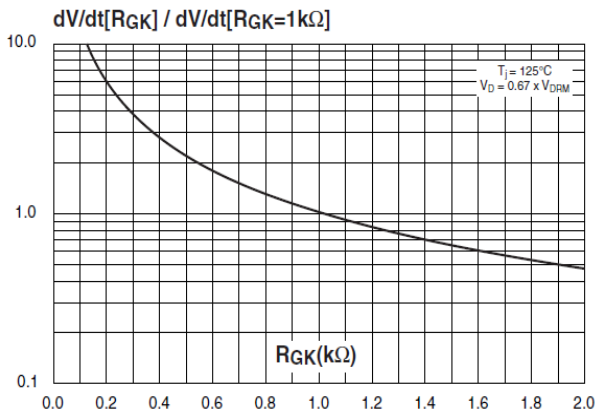
**Figure 5. Relative variation of triggering, holding and latching current versus junction temperature**



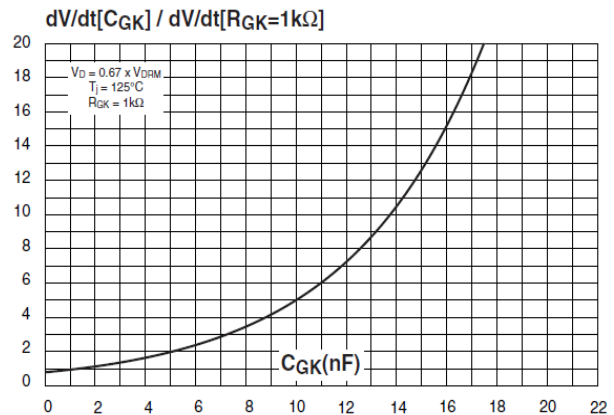
**Figure 6. Relative variation of holding current versus gate-cathode resistance (typical values)**



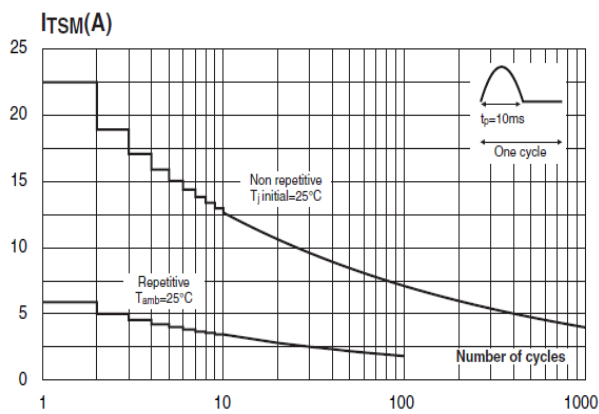
**Figure 7. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)**



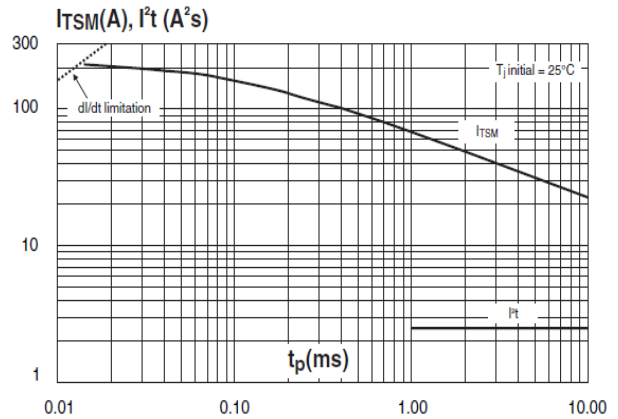
**Figure 8. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)**



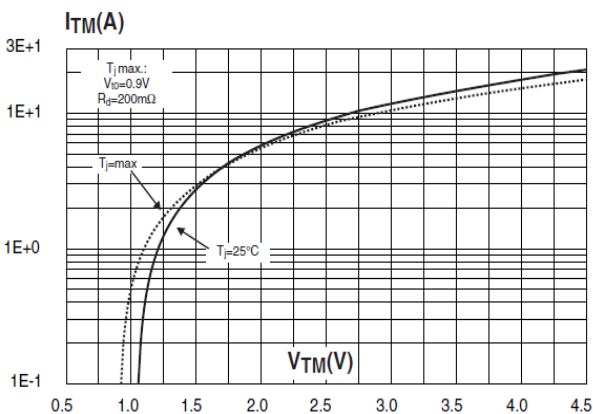
**Figure 9. Surge peak on-state current versus number of cycles**



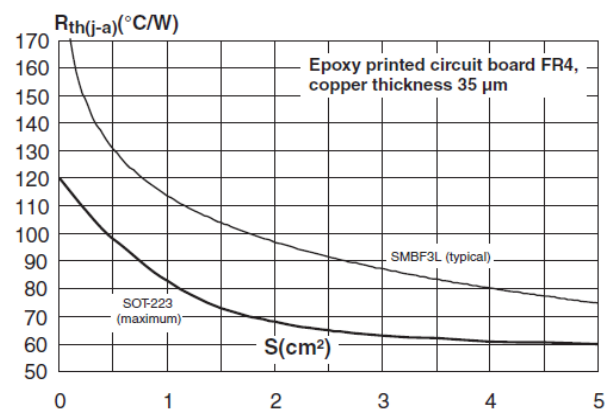
**Figure 10. On-state characteristics (maximum values)**



**Figure 11. On-state characteristics (maximum values)**



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



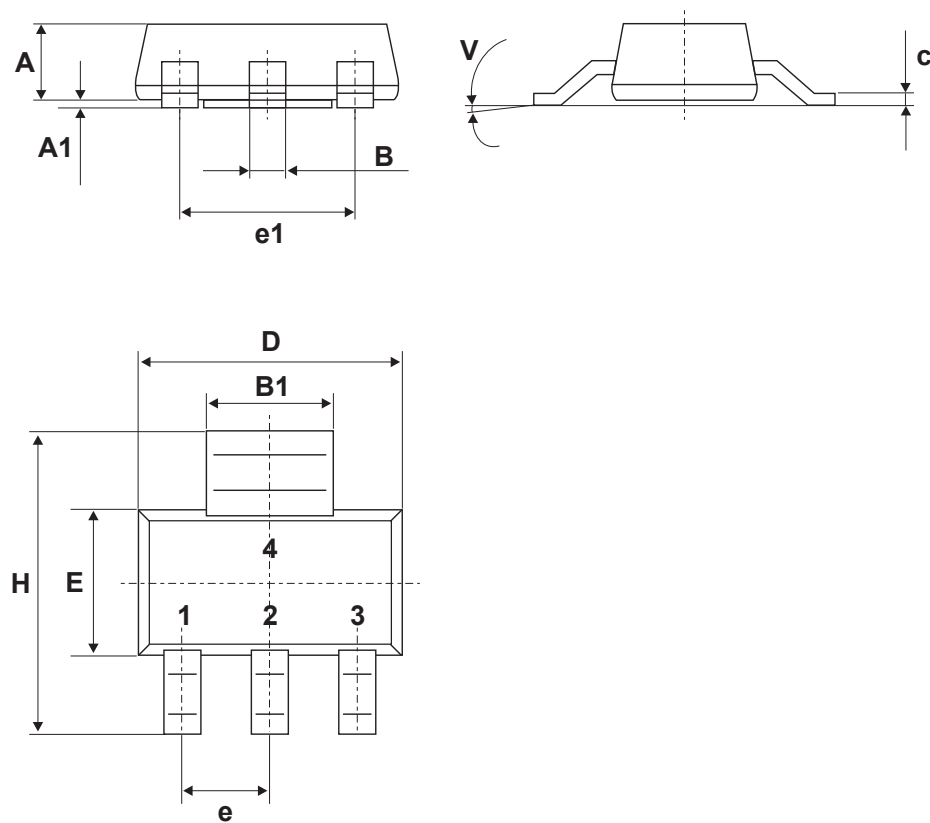
## 2 Package information

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 SOT-223 package information

- Epoxy meets UL94, V0
- Lead free plating + halogen-free molding resin

Figure 13. SOT-223 package outline

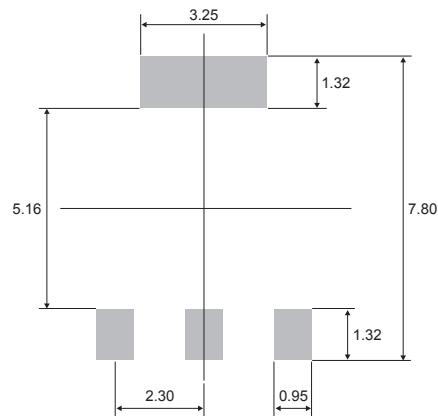


**Table 5. SOT-223 package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.80			0.0709
A1		0.02	0.10		0.0008	0.0039
B	0.60	0.70	0.85	0.024	0.0276	0.0335
B1	2.90	3.00	3.15	0.114	0.1181	0.1240
c	0.24	0.26	0.35	0.009	0.0102	0.0138
D	6.30	6.50	6.70	0.248	0.2559	0.2638
e		2.3			0.0906	
e1		4.6			0.1811	
E	3.30	3.50	3.70	0.130	0.1378	0.1457
H	6.70	7.00	7.30	0.264	0.2756	0.2874
V	10° max.					

1. Inches only for reference

**Figure 14. SOT-223 footprint (dimensions in mm)**



## 2.2 TO-92 package information

- Lead free plating + halogen-free molding resin
- Epoxy meets UL94, V0

Figure 15. TO-92 package outline

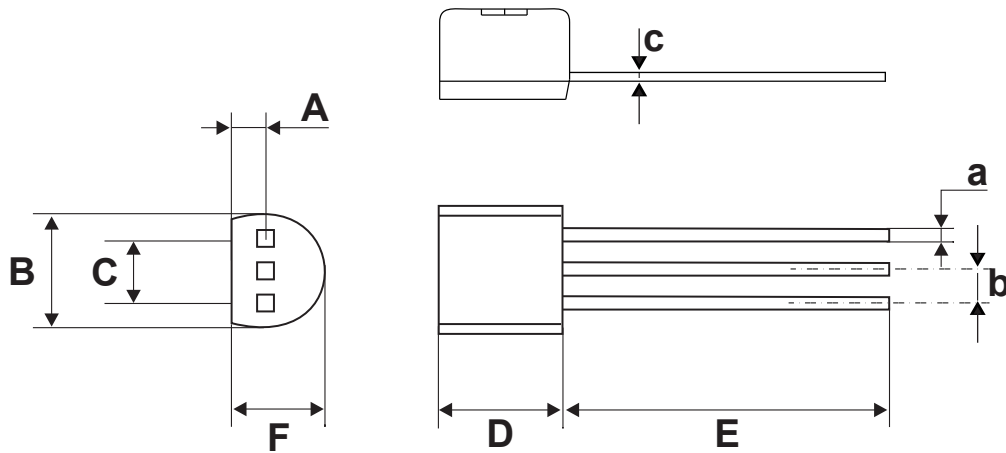


Table 6. TO-92 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		1.35			0.0531	
B			4.70			0.1850
C		2.54			0.1000	
D	4.40			0.1732		
E	12.70			0.5000		
F			3.70			0.1457
a			0.50			0.0197
b		1.27			0.0500	
c			0.48			0.0189

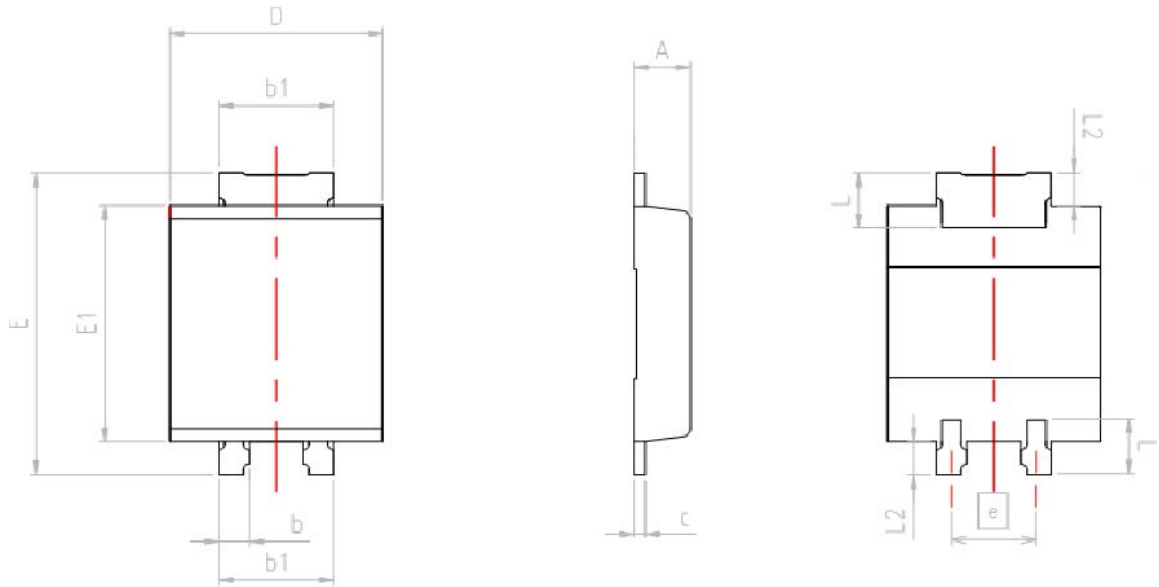
1. Inches dimensions given for information



### 2.3 SMBflat-3L package information

- Epoxy meets UL94, V0
- Lead-free package

**Figure 16. SMBflat-3L package outline**

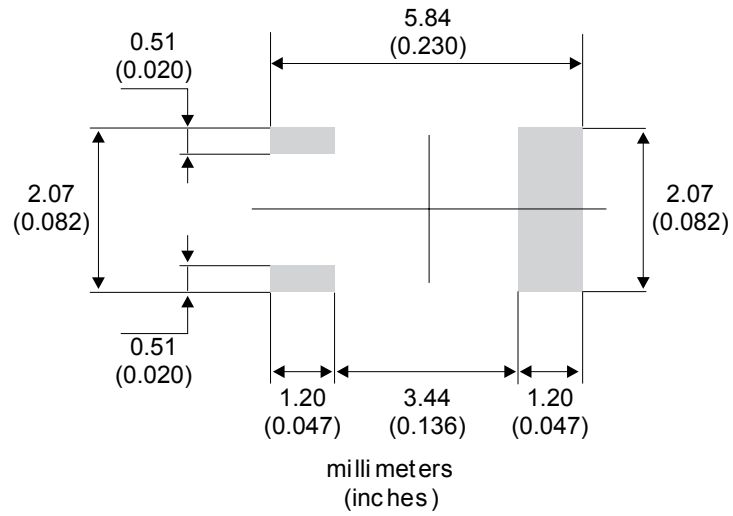


*Note:* This package drawing may slightly differ from the physical package. However, all the specified dimensions in the following table are guaranteed.

**Table 7. SMBflat-3L mechanical data**

Ref.	Dimensions					
	Millimeters			Inches (dimensions are for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.10	0.0354		0.0433
b	0.35		0.65	0.0138		0.0256
b1	1.95		2.20	0.0768		0.0866
c	0.15		0.40	0.0059		0.0157
D	3.30		3.95	0.1299		0.1555
E	5.10		5.60	0.2008		0.2205
E1	4.05		4.60	0.1594		0.1811
L	0.75		1.50	0.0295		0.0591
L2		0.60			0.0236	
e		1.60			0.0630	

Figure 17. Footprint recommendations, dimensions in mm (inches)



Note: This drawing may not be in scale; however, all the specified dimensions are guaranteed.

### 3 Ordering information

Figure 18. Ordering information scheme

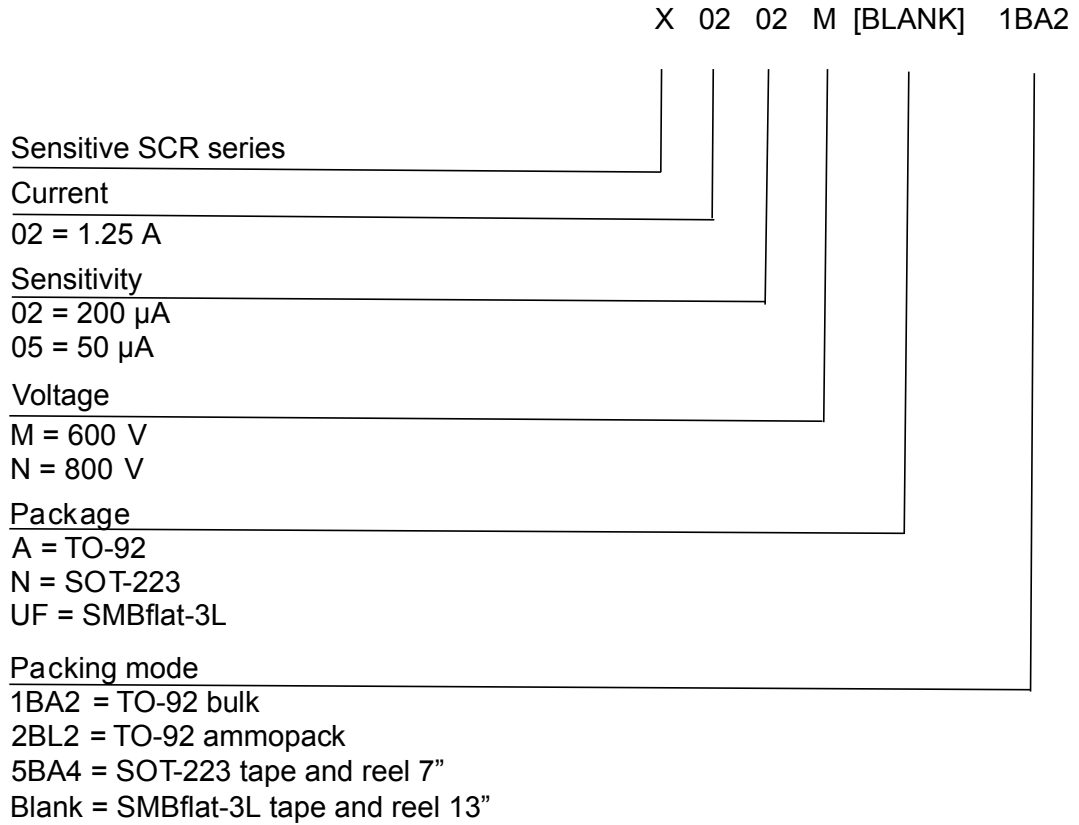


Table 8. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
X0202MA 1BA2	X0202 MA	TO-92	0.2 g	2500	Bulk
X0202MA 2BL2	X0202 MA			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			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			2000	Ammopack
X0205NA 1BA2	X0205 NA			2500	Bulk
X0202NUF	X2N	SMBflat-3L	47 mg	5000	Tape and reel

**Table 9. Product selector**

Part number	Voltage (xxx)		Sensitivity $\mu$ A	Package
	600	800		
X0202MA	X		200	TO-92
X0202MN	X		200	SOT-323
X0202NA		X	200	TO-92
X0202NN		X	200	SOT-323
X0205MA	X		50	TO-92
X0205NA		X	50	TO-92
X0202NUF		X	200	SMBflat-3L

## 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.
17-Apr-2023	5	Updated <a href="#">Figure 16</a> and <a href="#">Table 7</a> . Minor text changes.
19-Jul-2023	6	Updated <a href="#">Table 8</a> .

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