

## 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  $\mu$ 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.



**Table 1. Device summary**

Order code	Voltage		Sensitivity $\mu$ A	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,  $T_J = 25\text{ °C}$  unless otherwise specified)**

Symbol	Parameter		Value	Unit	
$I_{T(RMS)}$	On-state rms current (180 °Conduction angle)	TO-92	$T_L = 63\text{ °C}$	1.25	A
		SOT-223	$T_{tab} = 99\text{ °C}$		
		SMBflat-3L	$T_{tab} = 111\text{ °C}$		
$I_{T(AV)}$	Average on-state current (180 °Conduction angle)	TO-92	$T_L = 63\text{ °C}$	0.8	A
		SOT-223	$T_{tab} = 99\text{ °C}$		
		SMBflat-3L	$T_{tab} = 111\text{ °C}$		
$I_{TSM}$	Non repetitive surge peak on-state current	$t_p = 8.3\text{ ms}$	$T_J = 25\text{ °C}$	25	A
		$t_p = 10\text{ ms}$		22.5	
$I^2t$	$I^2t$ Value for fusing	$t_p = 10\text{ ms}$	$T_J = 25\text{ °C}$	2.5	$A^2s$
di/dt	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$	F = 60 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
$T_{stg}$ $T_J$	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	$^{\circ}C$

**Table 3. Electrical characteristics ( $T_J = 25\text{ °C}$  unless otherwise specified)**

Symbol	Test conditions		X0202	X0205	Unit	
$I_{GT}$	$V_D = 12\text{ V}$ , $R_L = 140\text{ }\Omega$	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		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	$V_D = 67\% V_{DRM}$ , $R_{GK} = 1\text{ k}\Omega$	$T_J = 110\text{ °C}$	Min.	10	15	V/ $\mu s$

**Table 4. Static electrical characteristics**

Symbol	Test conditions		X0202	X0205	Unit
$V_{TM}$	$I_{TM} = 2.5\text{ A}$ , $t_p = 380\text{ }\mu s$	$T_J = 25\text{ °C}$	1.45		V
$V_{TO}$	Threshold voltage	$T_J = 125\text{ °C}$	0.9		V
$R_d$	Dynamic resistance		Max.	200	
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$ , $R_{GK} = 1\text{ k}\Omega$	$T_J = 25\text{ °C}$	5		$\mu A$
		$T_J = 125\text{ °C}$	500		$\mu A$

**Table 5. Thermal resistances**

Symbol	Parameter		Value	Unit
$R_{th(j-l)}$	Junction to leads (DC)	TO-92	Max.	°C/W
$R_{th(j-t)}$	Junction to tab (DC)	SOT-223		
$R_{th(j-t)}$	Junction to tab (DC)	SMBflat-3L		
$R_{th(j-a)}$	Junction to ambient (DC)	S = 5 cm <sup>2</sup>	TO-92	150
			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](http://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

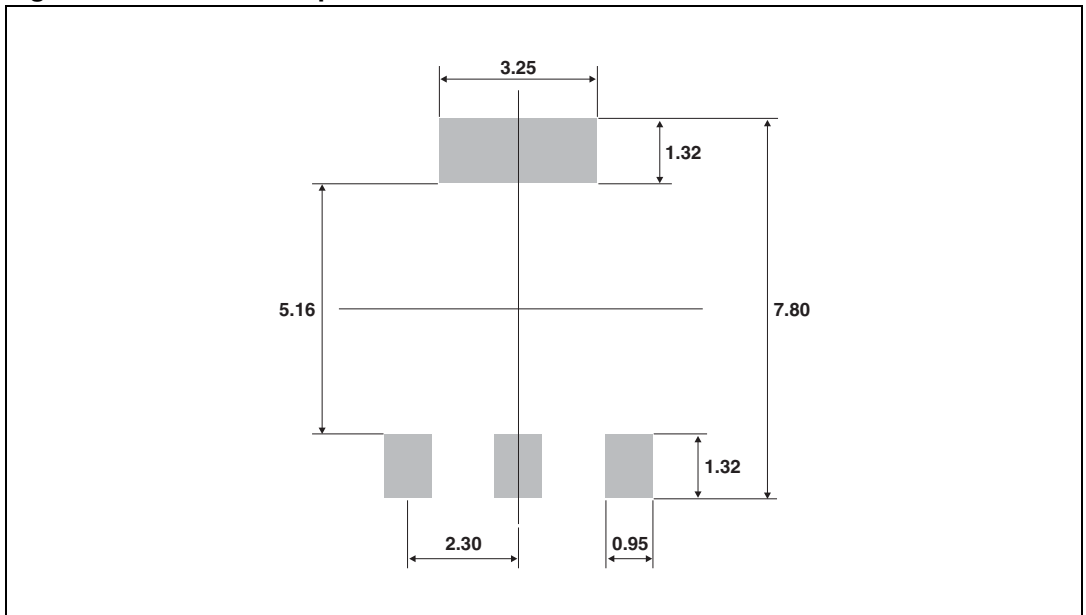


**Table 7. SOT-223 dimensions**

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 <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 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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