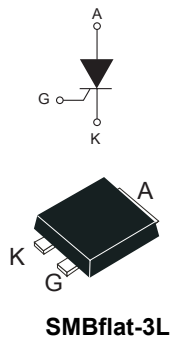


## 1 A sensitive gate SCR thyristor



### Features

- On-state rms current, 1 A
- Narrow sensitive gate current from 30  $\mu$ A to 150  $\mu$ A
- Repetitive peak off-state voltage, 600 V
- Non-repetitive surge peak off-state voltage, 750 V
- Compact and ultraflat SMBflat-3L package with creepage distance of 3.4 mm

### Applications

- Ground-fault circuit interrupter (GFCI, RCB, RCD)
- Arc-fault circuit interrupter (AFCI)
- Overvoltage crowbar protection in power supplies
- Capacitive ignition circuits
- Low consumption triggering switches

### Description

Thanks to highly sensitive triggering levels, the 1 A X0115MUF SCR thyristor is suitable for all applications where available gate current is limited. The X0115MUF offers a high blocking voltage of 600 V, and a surge peak voltage of 750 V, ideal for applications like ground fault circuit interrupter (GFCI) and arc fault circuit interrupters (AFCI).

The surface mount SMBflat-3L package allows modern, compact, SMD based designs for automated manufacturing. Its 3.4 mm creepage distance guarantees a 250 V functional isolation (UL 840) at a level 2 pollution degree.

#### Product status link

[X0115MUF](#)

#### Product summary

$I_{T(RMS)}$	1 A
$V_{DRM}/V_{RRM}$	600 V
$T_{j(max.)}$	125 °C

# 1 Characteristics

**Table 1. Absolute maximum ratings (limiting values)**

Symbol	Parameters		Value	Unit	
$I_{T(RMS)}$	On-state RMS current (180° conduction angle)		1	A	
$I_{T(AV)}$	Average on-state current (180° conduction angle)				
$I_{TSM}$	Non repetitive surge peak on-state current ( $T_j$ initial = 25 °C)	$t_p = 8.3$ ms	12	A	
		$t_p = 10$ ms			
$I^2t$	$I^2t$ value for fusing	$t_p = 10$ ms	$T_j = 25$ °C	0.60	A <sup>2</sup> s
$di/dt$	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , $t_r \leq 100$ ns	F = 60 Hz	$T_j = 25$ °C	75	A/ $\mu$ s
$V_{DRM} / V_{RRM}$	Repetitive peak off-state voltage		$T_j = 125$ °C	600	V
$V_{DSM} / V_{RSM}$	Non repetitive surge peak off-state voltage	$t_p = 10$ ms	$T_j = 25$ °C	750	V
$I_{GM}$	Peak forward gate current	$t_p = 20$ $\mu$ s	$T_j = 125$ °C	1.2	A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 125$ °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 ( $T_j = 25$  °C, unless otherwise specified)**

Symbol	Parameters	Value		Unit
$I_{GT}$	$V_D = 12$ V, $R_L = 140$ $\Omega$	Min.	30	$\mu$ A
		Max.	150	
$V_{GT}$		Max.	0.8	V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 3.3$ k $\Omega$ , $R_{GK} = 1$ k $\Omega$ , $T_j = 125$ °C	Min.	0.2	V
$V_{RG}$	$I_{RG} = 10$ $\mu$ A	Min.	5	V
$I_H$	$I_T = 50$ mA, $R_{GK} = 1$ k $\Omega$	Max.	5	mA
$I_L$	$I_G = 1.2 I_{GT}$ , $R_{GK} = 1$ k $\Omega$	Max.	6	mA
$dV/dt$	$V_D = 67\%$ $V_{DRM}$ , $R_{GK} = 1$ k $\Omega$ , $T_j = 125$ °C	Min.	80	V/ $\mu$ s

**Table 3. Static characteristics**

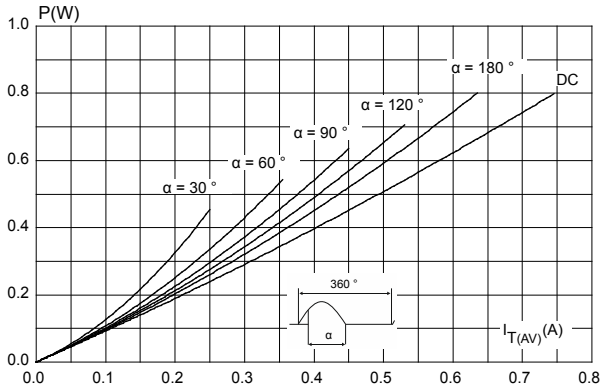
Symbol	Test conditions	Value		Unit
$V_T$	$I_{TM} = 2.0$ A, $t_p = 380$ $\mu$ s	$T_j = 25$ °C	Max. 1.40	V
$V_{TO}$	Threshold on-state voltage	$T_j = 125$ °C	Max. 0.90	V
$R_d$	Dynamic resistance	$T_j = 125$ °C	Max. 230	m $\Omega$
$I_{DRM} / I_{RRM}$	$V_D = V_{DRM}$ , $V_R = V_{RRM}$ , $R_{GK} = 1$ k $\Omega$	$T_j = 25$ °C	Max. 1	$\mu$ A
		$T_j = 125$ °C	150	$\mu$ A

**Table 4. Thermal resistance**

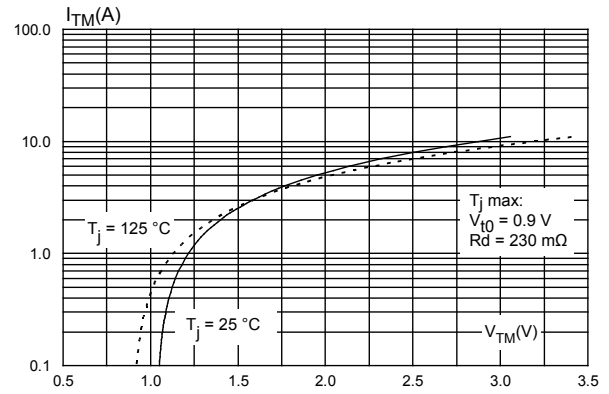
Symbol	Parameters	Value	Unit
$R_{th(j-l)}$	Junction to lead (DC)	15	°C/W
$R_{th(j-a)}$	Junction to ambient (DC) for 5 cm <sup>2</sup> copper surface	75	

## 1.1 Characteristics (curves)

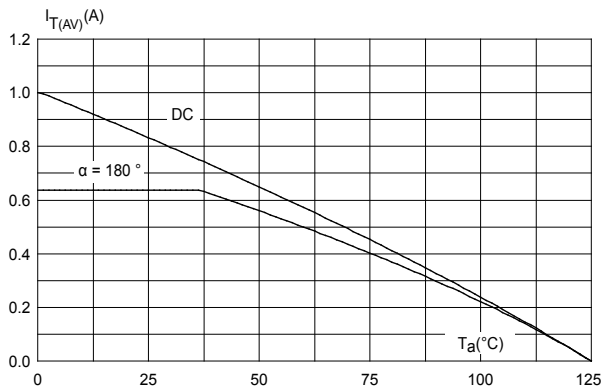
**Figure 1. Maximum average power dissipation versus average on-state current**



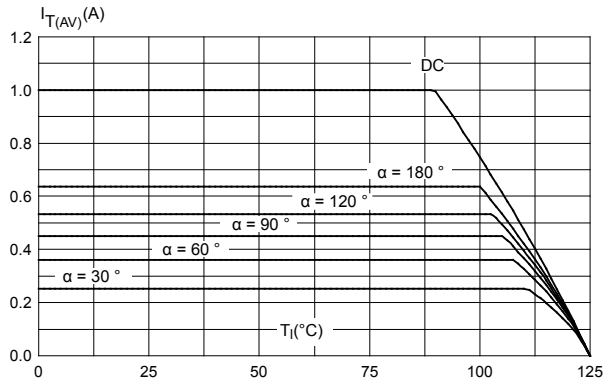
**Figure 2. On-state characteristics (maximum values)**



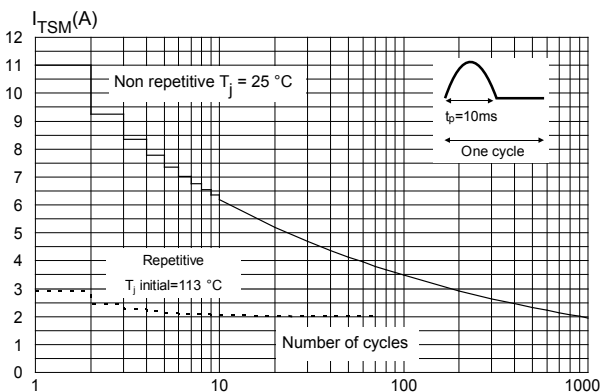
**Figure 3. Average and D.C. on-state current versus ambient temperature for  $1 \text{ cm}^2 \text{ S}_{Cu}$  surface**



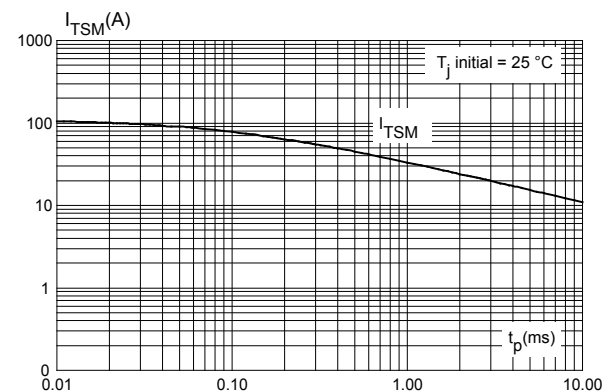
**Figure 4. Average and D.C. on-state current versus lead temperature**



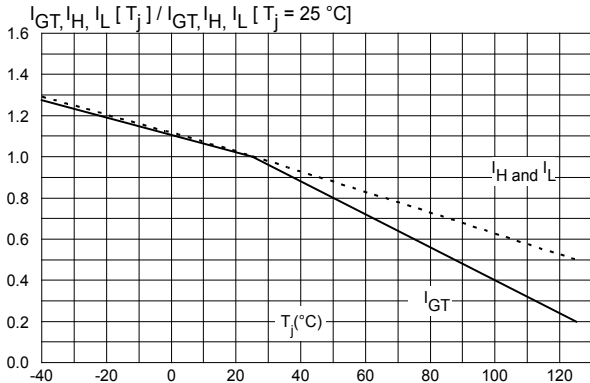
**Figure 5. Surge peak on-state current versus number of cycles**



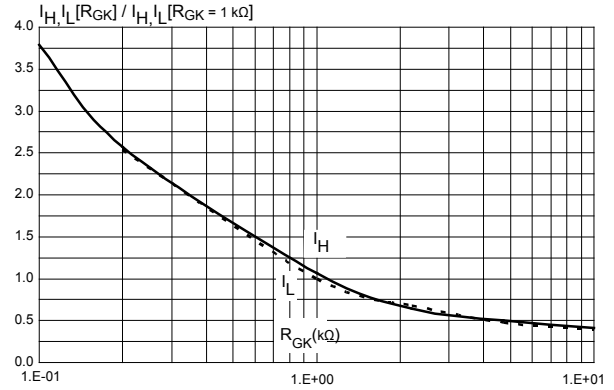
**Figure 6. Non repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10 \text{ ms}$**



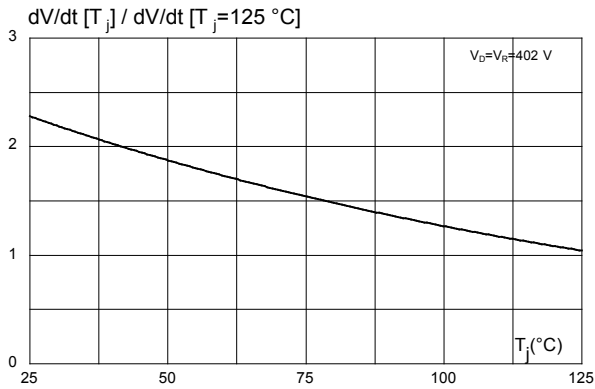
**Figure 7. Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)**



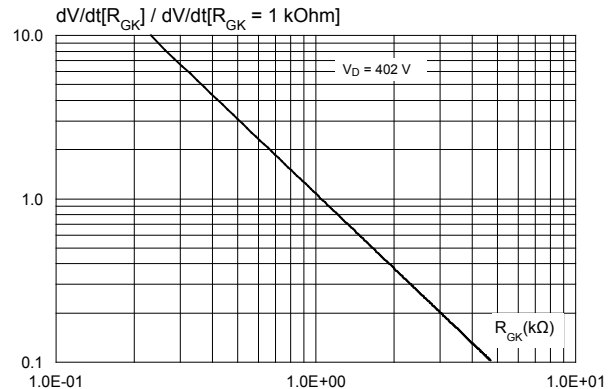
**Figure 8. Relative variation of holding current versus gate-cathode resistance (typical values)**



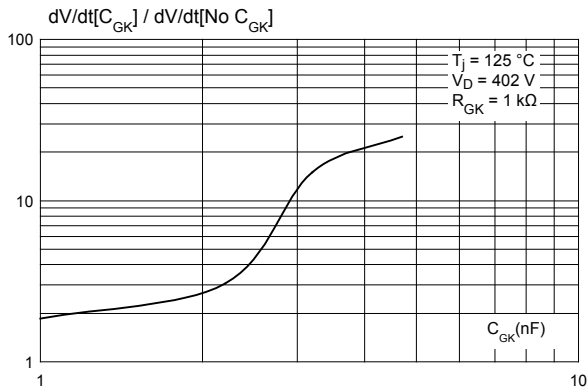
**Figure 9. Relative variation of static dV/dt immunity versus junction temperature**



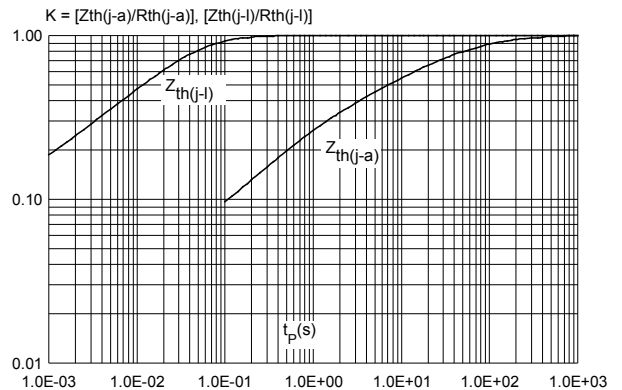
**Figure 10. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)**



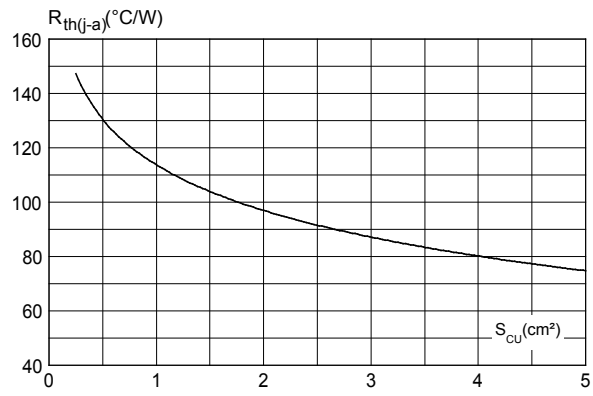
**Figure 11. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical value)**



**Figure 12. Relative variation of thermal impedance junction to lead and junction to ambient versus pulse duration**



**Figure 13. Typical thermal resistance junction to ambient versus copper surface under anode (epoxy FR4,  $e_{CU} = 35 \mu\text{m}$ , SMBflat-3L)**



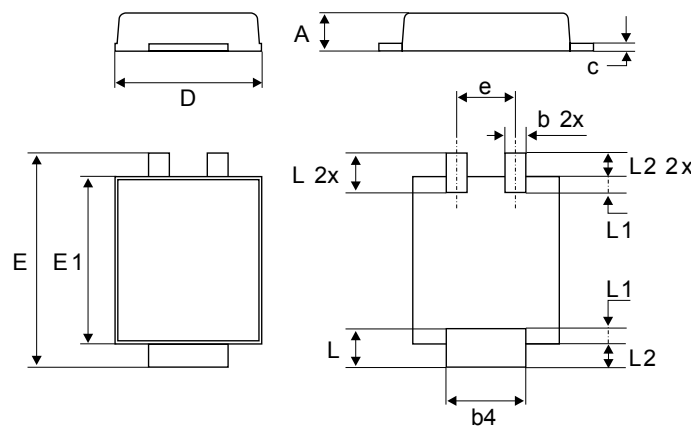
## 2 Package information

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 SMBflat-3L package information

- Epoxy meets UL94, V0
- Lead-free package

**Figure 14. SMBflat-3L package outline**

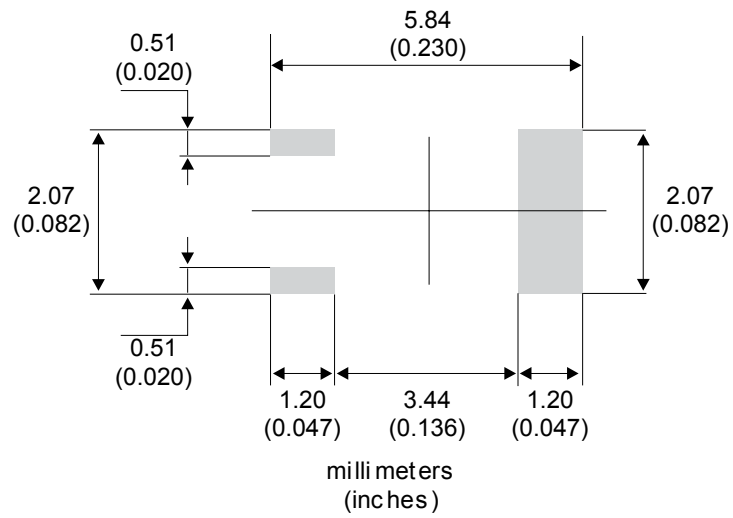


*Note:* This package drawing may slightly differ from the physical package. However, all the specified dimensions in the following table are guaranteed.

**Table 5. 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
b4	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
L1		0.40			0.0157	
L2		0.60			0.0236	
e		1.60			0.0630	

Figure 15. Footprint recommendations, dimensions in mm (inches)

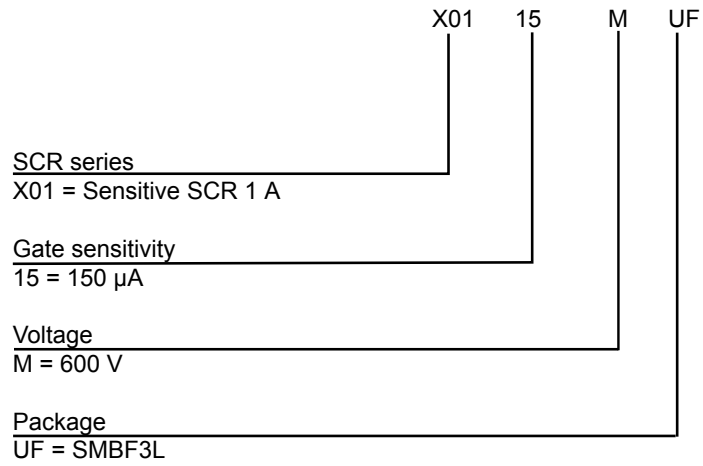


Note: This drawing may not be in scale; however, all the specified dimensions are guaranteed.



### 3 Ordering information

**Figure 16. Ordering information scheme**



**Table 6. Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
X0115MUF	X1M	SMBflat-3L	47 mg	5000	Tape and reel

## Revision history

**Table 7. Document revision history**

Date	Revision	Changes
30-Jul-2019	1	First issue.
10-Oct-2019	2	Updated <a href="#">Table 2. Electrical characteristics</a> ( $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified).

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