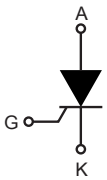
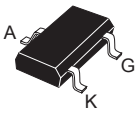
0.8 A sensitive gate SCR thyristor in SOT23-3L





SOT23-3L

Features

- On-state rms current, 0.8 A sensitive
- Repetitive peak off-state voltage, 600 V
- Non-repetitive surge peak off-state voltage, 750 V
- Narrow sensitive gate current range [30 to 150] µA
- Compact SOT23-3L package:
  - Creepage distance of 1.1 mm
  - 9 mm² footprint

Applications

- Ground-fault circuit interrupter (GFI)
- 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, X0115ML SCR thyristor is suitable for all applications where available gate current is limited. The X0115ML 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 SOT23-3L package provides the smallest SCR footprint while keeping 1.1 mm creepage distance, guaranteeing 120 V functional insulation (UL-840) at level 2 pollution degree without extra certification.

Product status link
X0115ML

Product summary	
$I_{T(RMS)}$	0.8 A
V_{DRM}/V_{RRM}	600 V
V_{DSM}/V_{RSM}	750 V
I_{GT}	[30-150] µA

1 Characteristics

Table 1. Absolute maximum ratings (limiting values)

Symbol	Parameters			Value	Unit
$I_{T(RMS)}$	On-state RMS current (180° conduction angle)		T_C = 41 °C	0.8	A
$I_{T(AV)}$	Average on-state current (180° conduction angle)			0.5	A
I_{TSM}	Non repetitive surge peak on-state current (T_j initial = 25 °C)	t_p = 8.3 ms	T_j = 25 °C	7.6	A
		t_p = 10 ms		7	
	One surge every 500 ms, 50 surges	t_p = 8.3 ms	T_{AMB} = 105 °C	5	
I^2t	I^2t value for fusing	t_p = 10 ms	T_j = 25 °C	0.25	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 = 25 °C	75	A/µs
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 µs	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 = 33 Ω	Min.	30	µA
		Max.	150	
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.	0.2	V
V_{RG}	I_{RG} = 10 µA	Min.	5	V
I_H	I_T = 50 mA, gate open, R_{GK} = 1 kΩ	Max.	5	mA
I_L	I_G = 1.2 I_{GT}, R_{GK} = 1 kΩ	Max.	6	mA
dV/dt	V_D = 67 % V_{DRM}, gate open, R_{GK} = 1 kΩ, T_j = 125 °C	Min.	80	V/µs

Table 3. Static characteristics

Symbol	Test conditions		Value		Unit
V_{TM}	I_{TM} = 1.6 A, t_p = 380 µs	T_j = 25 °C	Max.	1.7	V
V_{TO}	Threshold on-state voltage	T_j = 125 °C	Max.	1.06	V
R_d	Dynamic resistance	T_j = 125 °C	Max.	540	mΩ
I_{DRM} / I_{RRM}	V_T = V_{DRM}, V_T = V_{RRM}, R_{GK} = 1 kΩ	T_j = 25 °C	Max.	1	µA
		T_j = 125 °C		150	µA

Table 4. Thermal resistance

Symbol	Parameters		Value	Unit
$R_{th(j-l)}$	Junction to lead (DC)	Typ.	60	°C/W
$R_{th(j-a)}$	Junction to ambient (DC) for 5 cm^2 copper surface	Typ.	400	

1.1 Characteristics (curves)

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

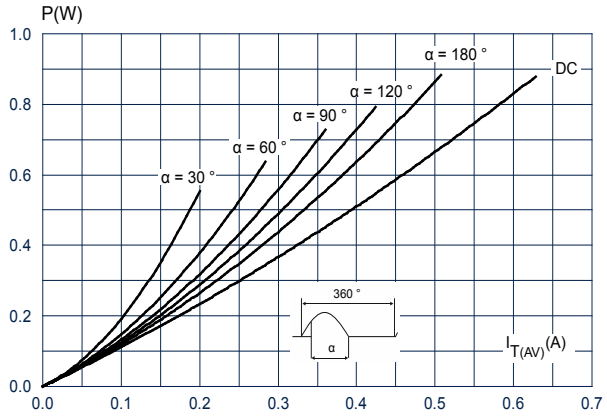


Figure 2. Average and DC on-state current versus lead temperature

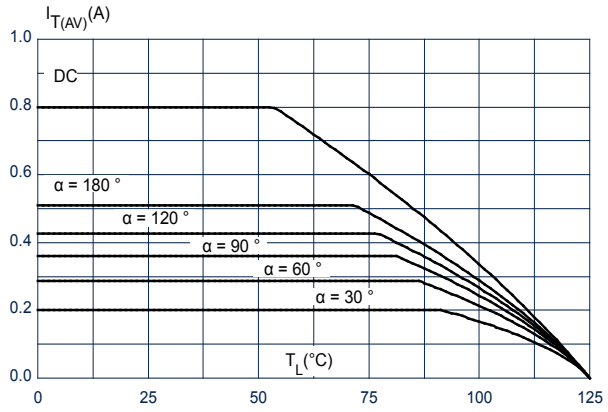


Figure 3. On-state characteristics (maximum values)

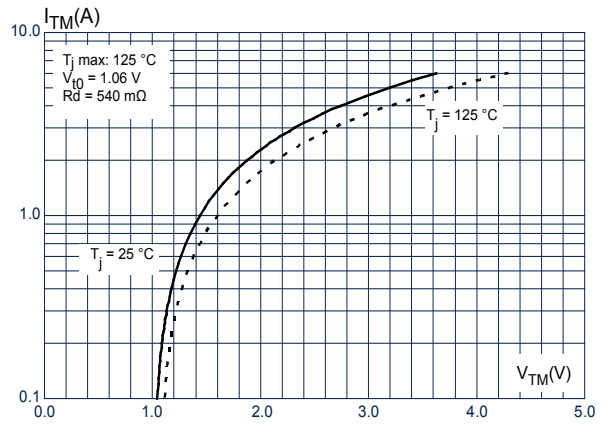


Figure 4. Average and D.C. on-state current versus ambient temperature

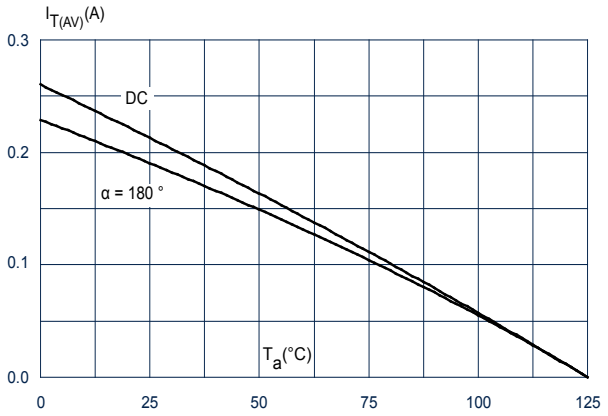


Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration

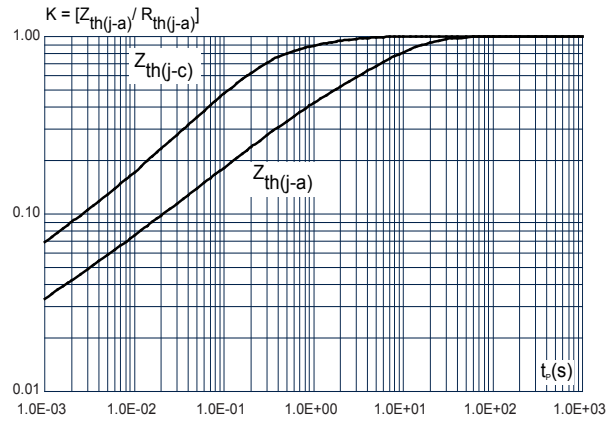


Figure 6. Surge peak on-state current versus number of cycles

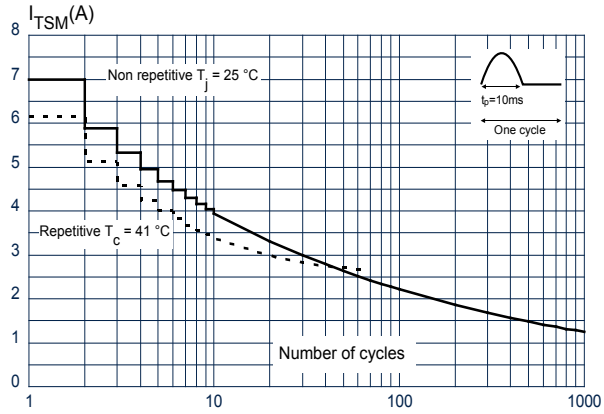


Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms

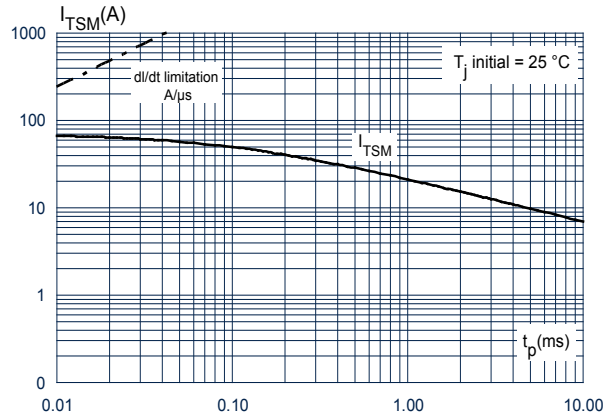


Figure 8. Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)

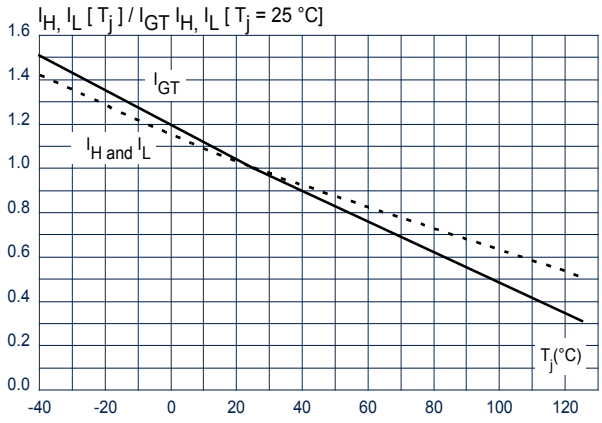


Figure 9. Relative variation of holding current versus gate-cathode resistance (typical values)

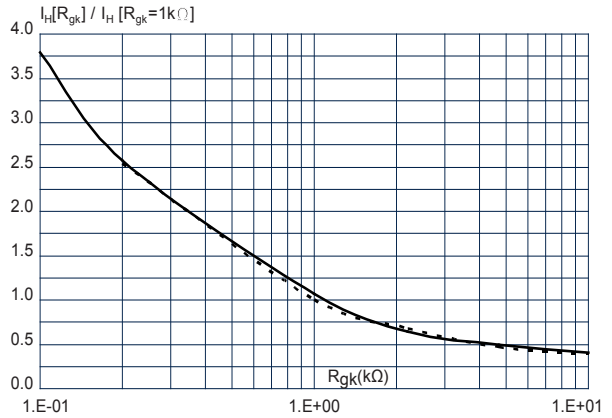


Figure 10. Relative variation of static dV/dt immunity versus junction temperature

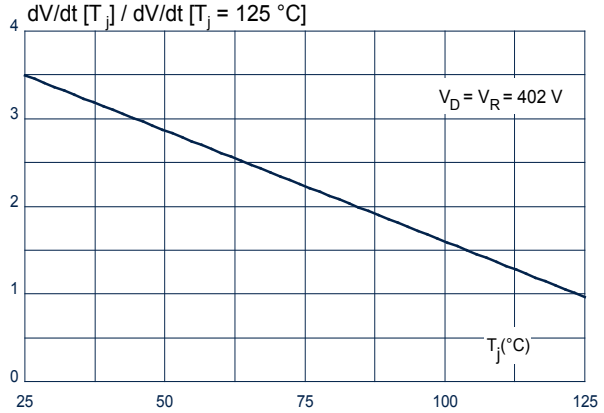


Figure 11. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)

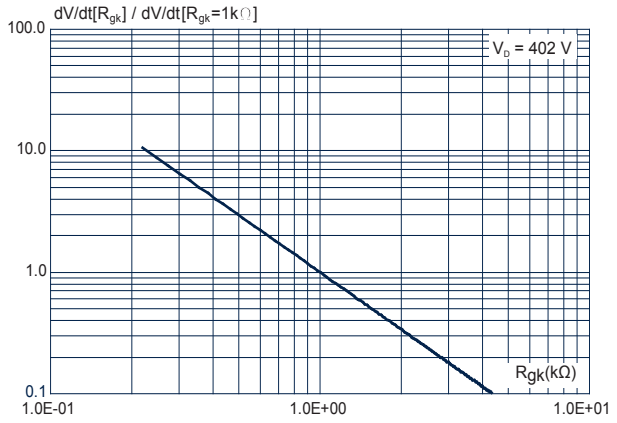


Figure 12. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)

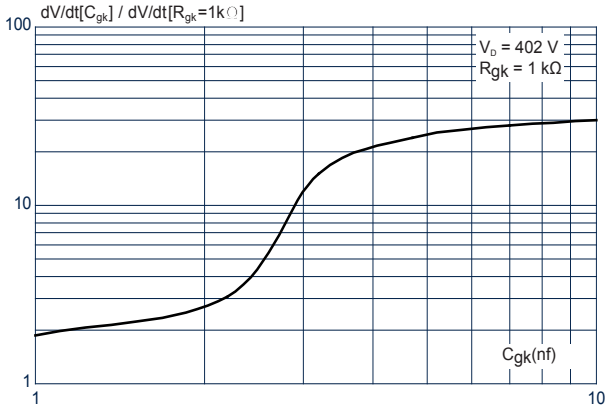
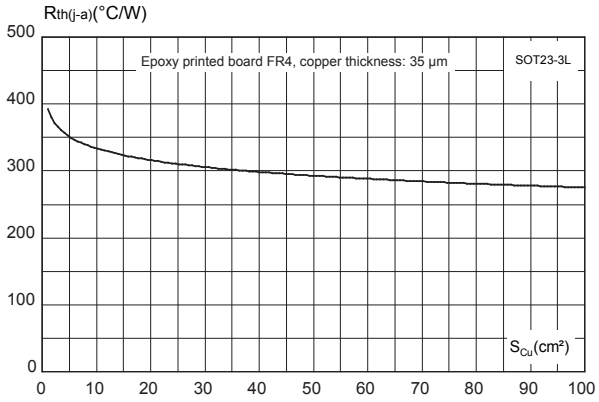


Figure 13. Typical thermal resistance junction to ambient versus copper surface under anode (epoxy FR4, e_{Cu} = 35µm, SOT-23-3L



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. ECOPACK is an ST trademark.

2.1 SOT23-3L package information

- Lead-free package
- Halogen free molding resin
- Epoxy meets UL94, V0

Figure 14. SOT23-3L package outline

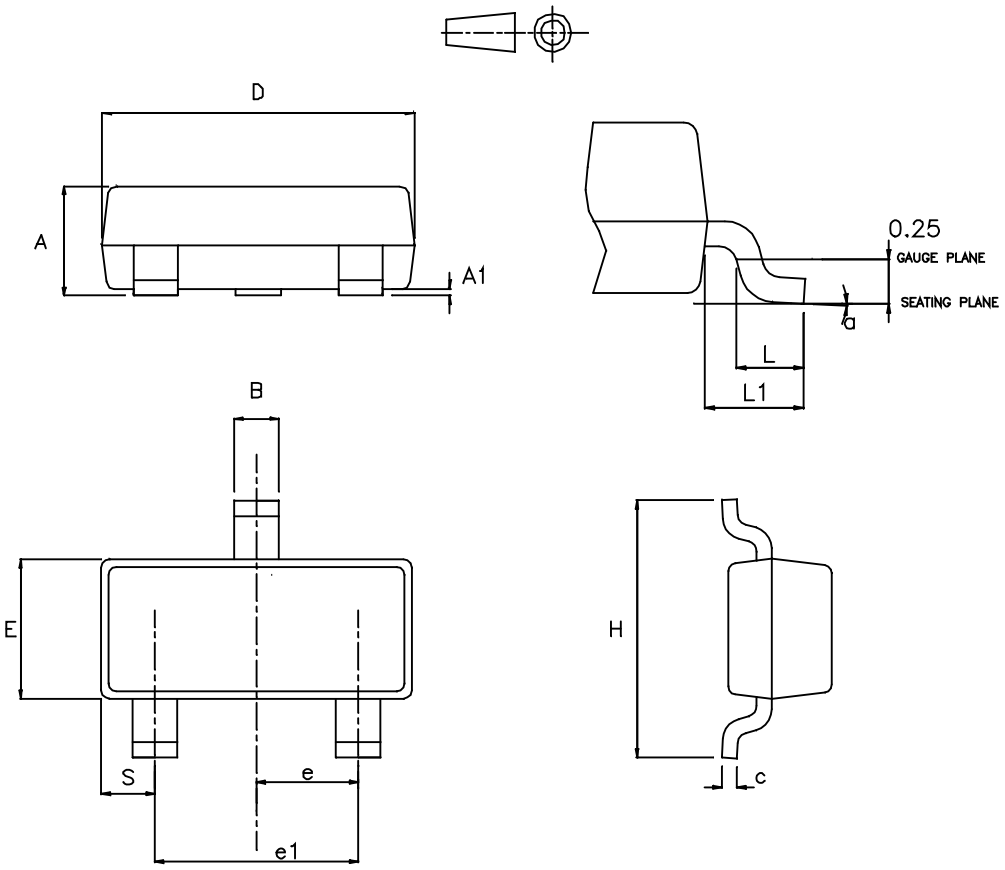
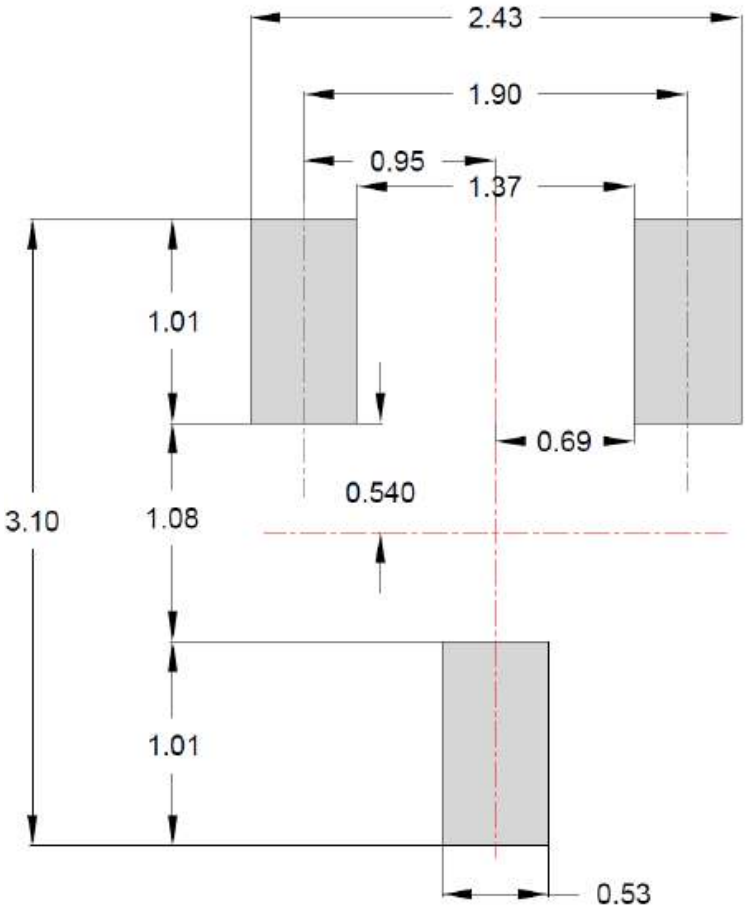


Table 5. **SOT23-3L package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.89		1.25	0.035		0.0493
A1	0		0.15	0		0.006
B	0.30		0.51	0.0118		0.0201
C	0.085		0.20	0.0033		0.0079
D	2.75		3.04	0.1082		0.1197
E	1.20		1.75	0.0472		0.0689
e	0.85	0.95	1.05	0.0334	0.0374	0.0414
e1	1.70	1.90	2.10	0.0669	0.0748	0.0827
H	2.10		3.00	0.0826		0.1182
L	0.25		0.61	0.0098		0.0241
L1		0.55			0.0217	
S	0.35		0.65	0.0137		0.0256
a	0°		8°	0°		8°

Figure 15. **Footprint recommendations, dimensions in mm**



3 Ordering information

Figure 16. **Ordering information scheme**

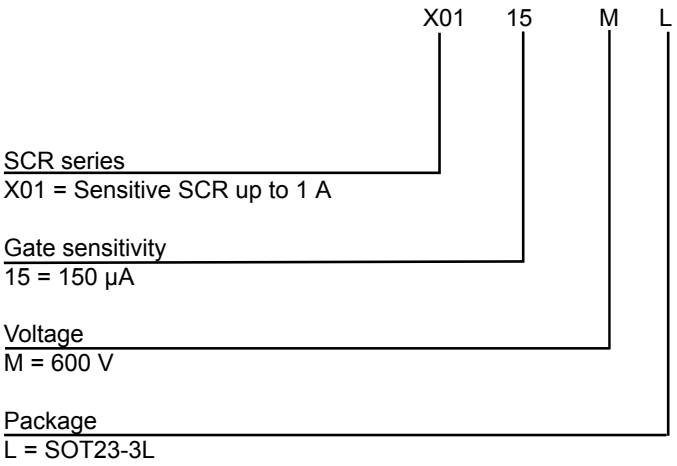


Table 6. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
X0115ML	X1M	SOT23-3L	0.01 mg	3000	Tape and reel

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
16-Jul-2021	1	First issue.
10-Dec-2021	2	Updated Table 1 and Figure 6.
28-Jan-2022	3	Updated Table 2.