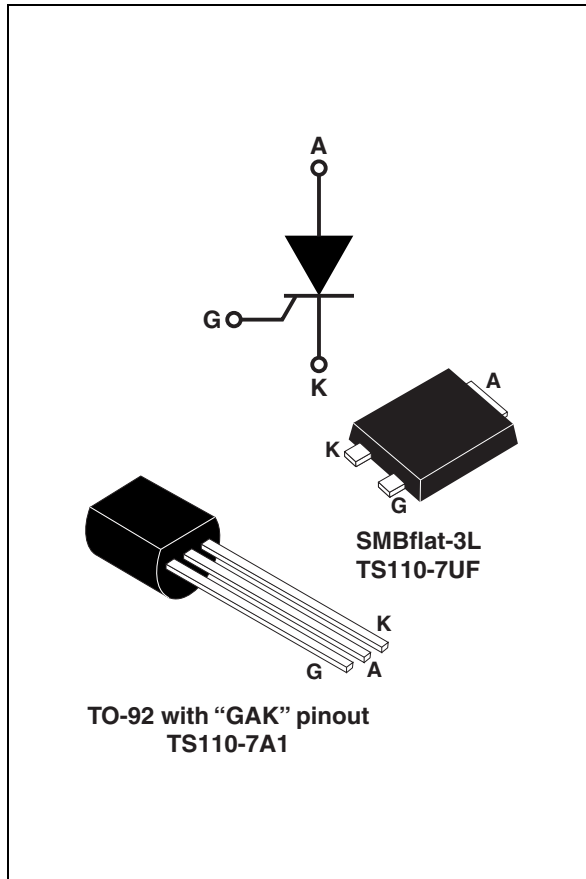


High surge voltage 1.25 A SCR for circuit breaker

Datasheet - production data



Features

- On-state rms current, 1.25 A
- Repetitive peak off-state voltage, 700 V
- Non-repetitive direct surge peak off-state voltage, 1250 V
- Non-repetitive reverse surge peak off-state voltage, 850 V
- Triggering gate current, 100 μ A

Description

Thanks to highly sensitive triggering levels, the TS110-7 series is suitable for circuit breaker applications where the available gate current is limited. Such applications include GFCI (ground fault circuit interrupter), AFCI (arc fault circuit interrupter), RCD (residual current device), and RCBO (residual current circuit breaker with overload protection).

The 1250 V surge voltage capability of the TS110-7 enables high robustness of the whole circuit breaker. The low leakage current of the TS110-7 reduces power consumption over the entire lifetime of the circuit breaker.

The TS110-7 is available in through-hole TO-92 package with GAK pinout and in SMBflat-3L.

1 Characteristics

Table 1. Absolute ratings (limiting values)

Symbol	Parameter		Value	Unit	
I _{T(RMS)}	On-state rms current (180° conduction angle)	TO-92	T _j = 58 °C	1.25	A
		SMBflat-3L	T _{tab} = 110 °C		
I _{T(AV)}	Average on-state current (180° conduction angle)	TO-92	T _j = 58 °C	0.8	A
		SMBflat-3L	T _{tab} = 110 °C		
I _{TSM}	Non repetitive surge peak on-state current	t _p = 8.3 ms		27	A
		t _p = 10 ms		25	
	1st step: one surge every 5 seconds, 25 surges 2nd step: one surge every 5 seconds, 25 surges	t _p = 10 ms	T _{j initial} = 25 °C	25 times 12 A, 25 times 16 A	
I ² t	I ² t Value for fusing	t _p = 10 ms		3.1	A ² s
di/dt	Critical rate of rise of on-state current I _G = 2 x I _{GT} , t _r ≤ 100 ns	F = 60 Hz	T _j = 125 °C	100	A/μs
	Critical rate of rise of on-state current Gate open, V _D = V _{BO} , t _r ≤ 100 ns			T _j = 25 °C	
V _{DRM} , V _{RRM}	Repetitive peak off-state voltage, gate open		T _j = 125 °C	700	V
V _{DSM}	Non-repetitive direct surge peak off-state voltage, R _{GK} = 220 Ω	t _p = 50 μs	T _j = 25 °C	1250	V
V _{RSM}	Non-repetitive reverse surge peak off-state voltage, R _{GK} = 220 Ω	t _p = 50 μs	T _j = 25 °C	850	V
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}	Storage junction temperature range			- 40 to + 150	°C
T _j	Operating junction temperature range			- 40 to + 125	

Table 2. Electrical characteristics

Symbol	Test conditions		Value	Unit	
I _{GT}	V _D = 12 V, R _L = 140Ω	T _j = 25 °C	Min.	1	μA
			Max.	100	
V _{GT}			Max.	0.8	V
V _{GD}	V _D = V _{DRM} , R _L = 33 kΩ, R _{GK} = 220 Ω	T _j = 125 °C	Min.	0.1	V
V _{RG}	I _{RG} = 2 mA	T _j = 25 °C	Min.	7.5	V
I _H	I _T = 50 mA, R _{GK} = 220 Ω	T _j = 25 °C	Max.	2	mA
I _L	I _G = 5 mA, R _{GK} = 220 Ω	T _j = 25 °C	Max.	2	mA
dV/dt	V _D = 67% V _{DRM} , R _{GK} = 220 Ω	T _j = 125 °C	Min.	15	V/μs

Table 3. Static electrical characteristics

Symbol	Test conditions		Value	Unit
V_{TM}	$I_{TM} = 2.5 \text{ A}$, $t_p = 380 \mu\text{s}$	$T_j = 25 \text{ }^\circ\text{C}$	Max. 1.4	V
V_{T0}	Threshold 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 Ω
I_{DRM} I_{RRM}	$V_D = V_{DRM} / V_{RRM}$, $R_{GK} = 220 \Omega$	$T_j = 25 \text{ }^\circ\text{C}$	Max. 1	μA
		$T_j = 125 \text{ }^\circ\text{C}$	Max. 100	μA

Table 4. Thermal resistance

Symbol	Parameter		Value	Unit
$R_{th(j-l)}$	Junction to leads (DC)	TO-92	65	$^\circ\text{C/W}$
$R_{th(j-a)}$	Junction to ambient (DC)	TO-92	160	
		SMBflat-3L	75	
$R_{th(j-c)}$	Junction to case (DC)	$S = 5 \text{ cm}^2$ SMBflat-3L	14	

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

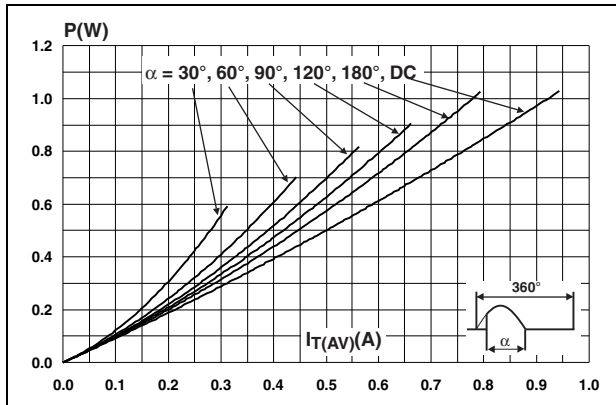


Figure 2. Average and DC on-state current versus lead temperature (TO-92)

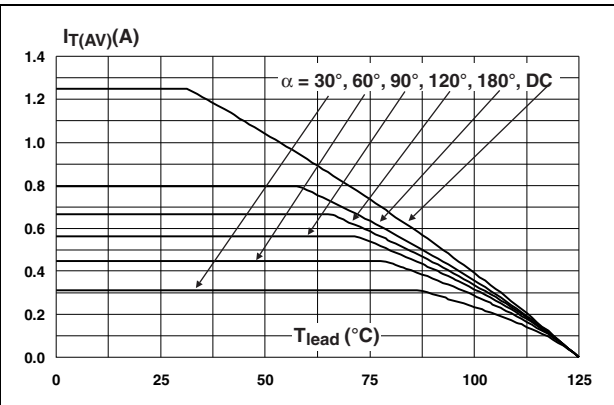


Figure 3. Average and DC on-state current versus lead temperature (SMBflat-3L)

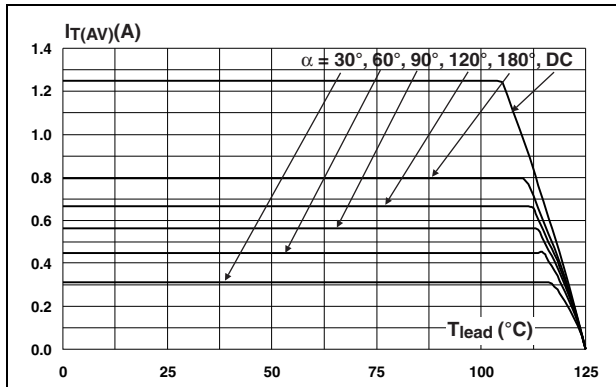


Figure 4. Average and DC on-state current versus ambient temperature

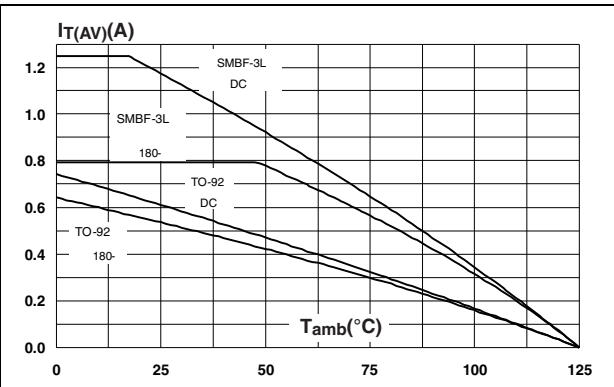


Figure 5. Relative variation of thermal impedance junction to ambient versus pulse duration

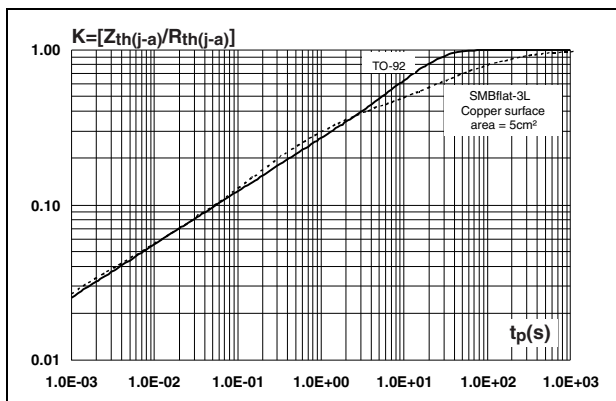


Figure 6. Relative variation of gate triggering current and voltage, holding and latching current versus T_j

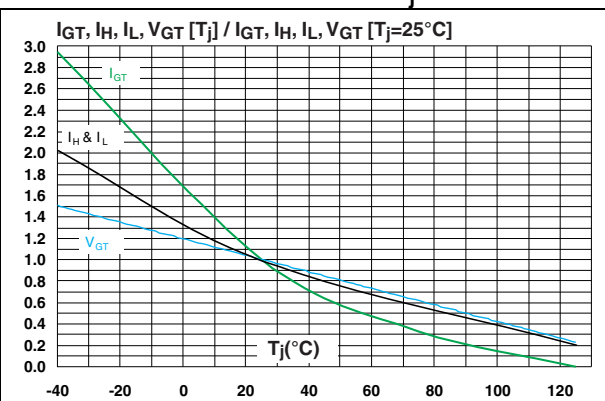


Figure 7. Relative variation of holding current versus gate-cathode resistance (typical values)

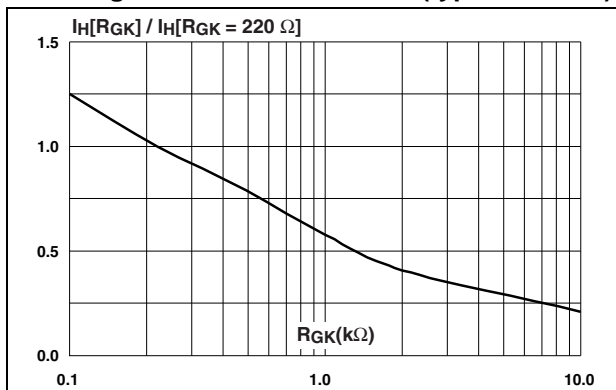


Figure 8. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)

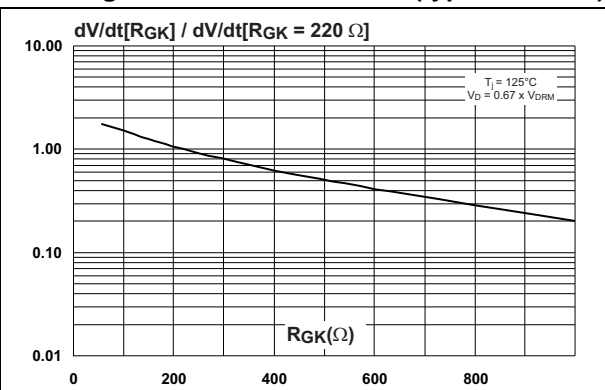


Figure 9. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)

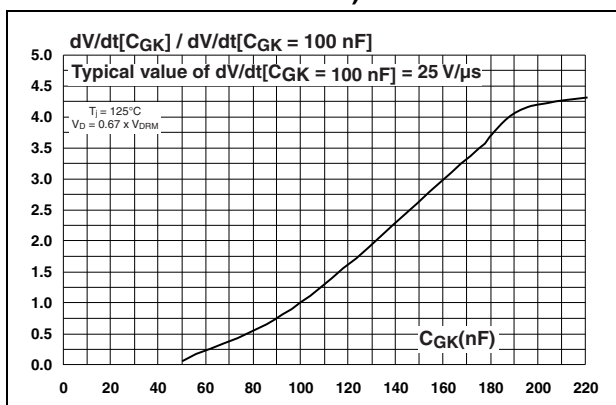


Figure 10. Relative variation of dV/dt immunity versus junction temperature with $R_{GK} = 220 \Omega$ (typical values)

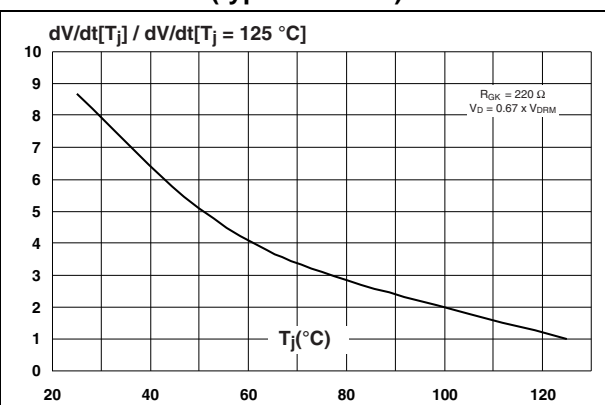


Figure 11. Surge peak on-state current versus number of cycles

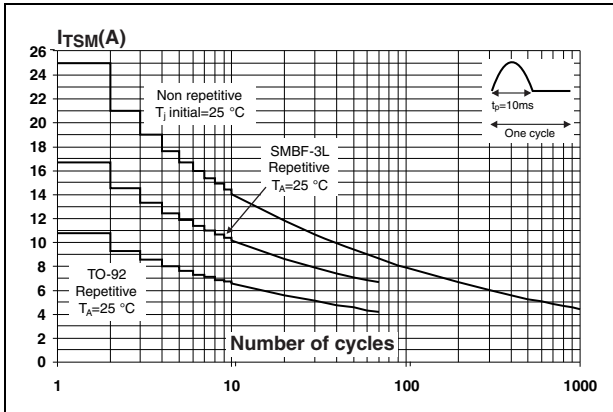


Figure 12. Non-repetitive surge peak on-state current, and corresponding values of I^2t

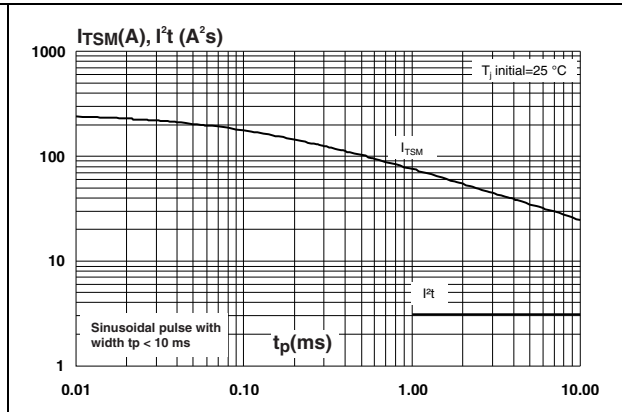


Figure 13. On-state characteristics (maximum values)

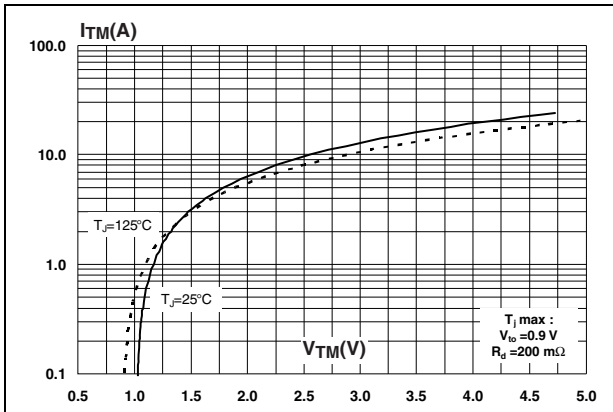
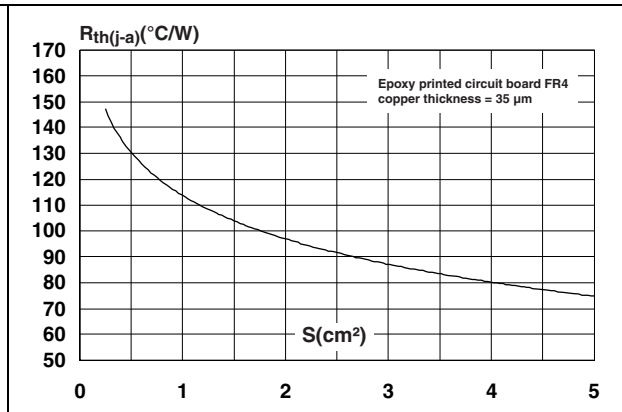


Figure 14. Thermal resistance junction to ambient versus copper surface area under anode (SMBflat-3L)



2 AC line transient voltage ruggedness

In comparison with standard SCRs, the TS110-7 is self-protected against over-voltage. The TS110-7 switch can safely withstand AC line surge voltages by switching to the on state (for less than 10 ms on 50 Hz mains) to dissipate energy shocks through the load. The load limits the current through the TS110-7. The self-protection against over-voltage is based on an overvoltage crowbar technology. This safety feature works even with high turn-on current ramp up.

Figure 15 represents the TS110-7 in a test environment. It is used to stress the TS110-7 switch according to the IEC 61000-4-5 standard conditions. The TS110-7 folds back safely to the on state as shown in Figure 16.

The TS110-7 recovers its blocking voltage capability after the surge and the next zero current crossing. Such a non repetitive test can be done at least 10 times.

Figure 15. Overvoltage ruggedness test circuit for IEC 61000-4-5 standards

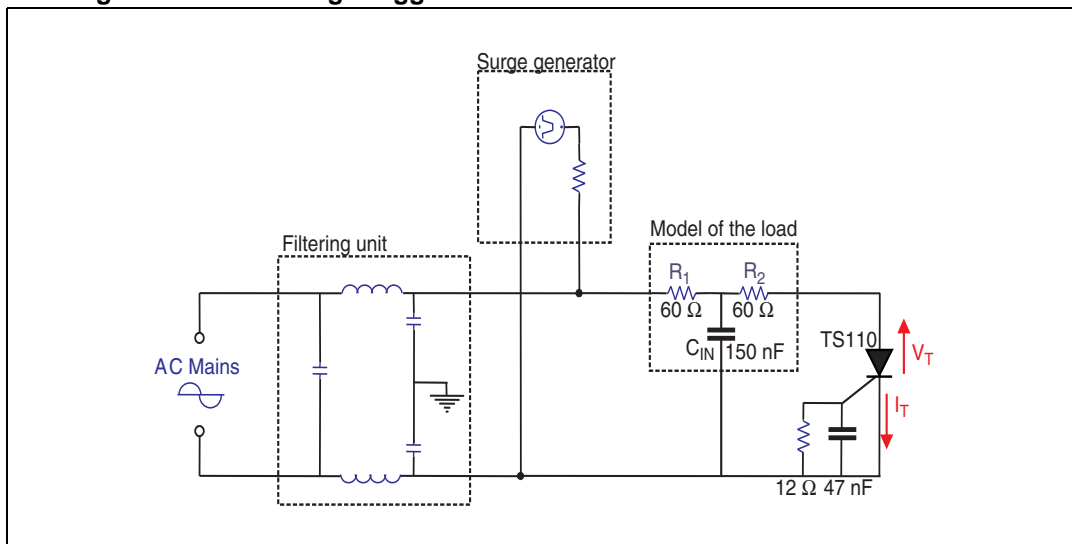
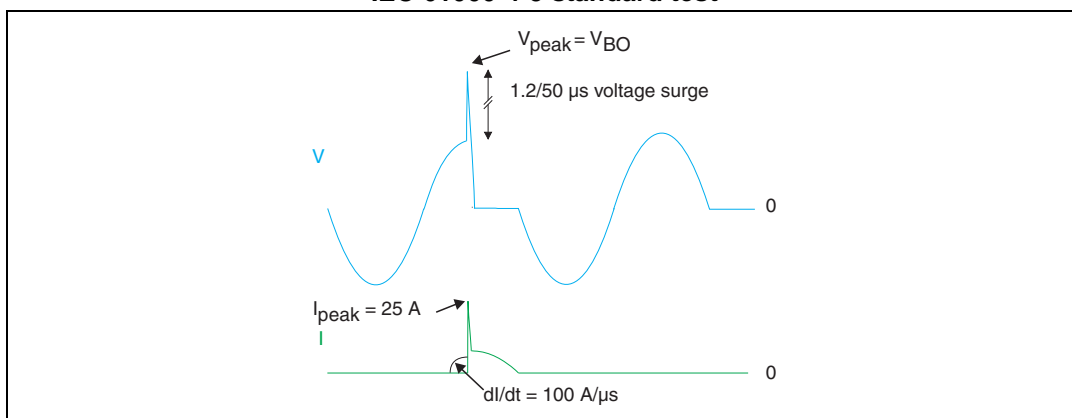


Figure 16. Typical current and voltage waveforms across the TS110-7 during IEC 61000-4-5 standard test



3 Package information

- Epoxy meets UL94, V0
- Lead-free package

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.

Figure 17. TO_92 dimensions (definitions)

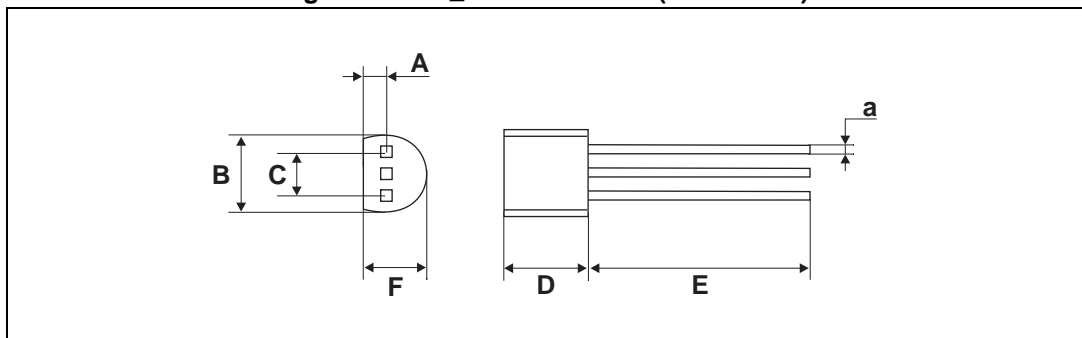


Table 5. TO-92 dimensions (values)

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			0.5			0.019

For packing information see STMicroelectronics document PD0022 Packing information, "Axial, through hole, surface mount and chip scale packages for IPAD[™], protection, rectifiers, thyristors and ACSs[™]".

Figure 18. SMBflat-3L dimensions (definitions)

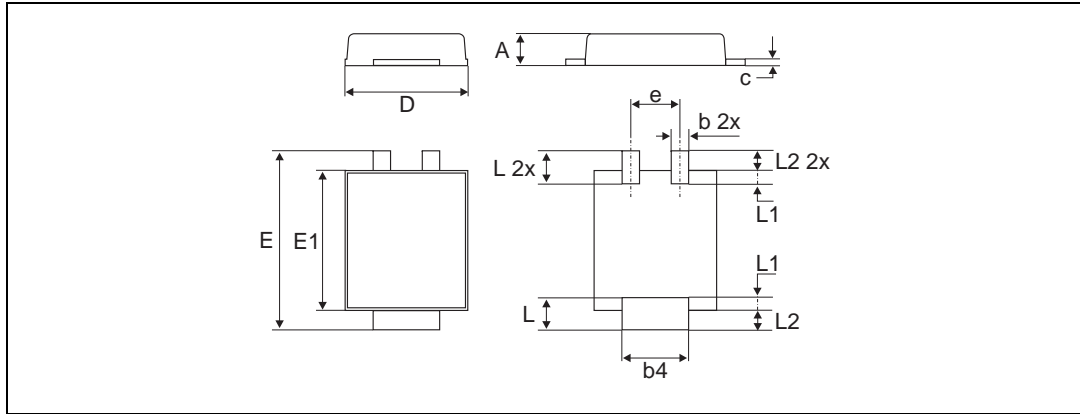
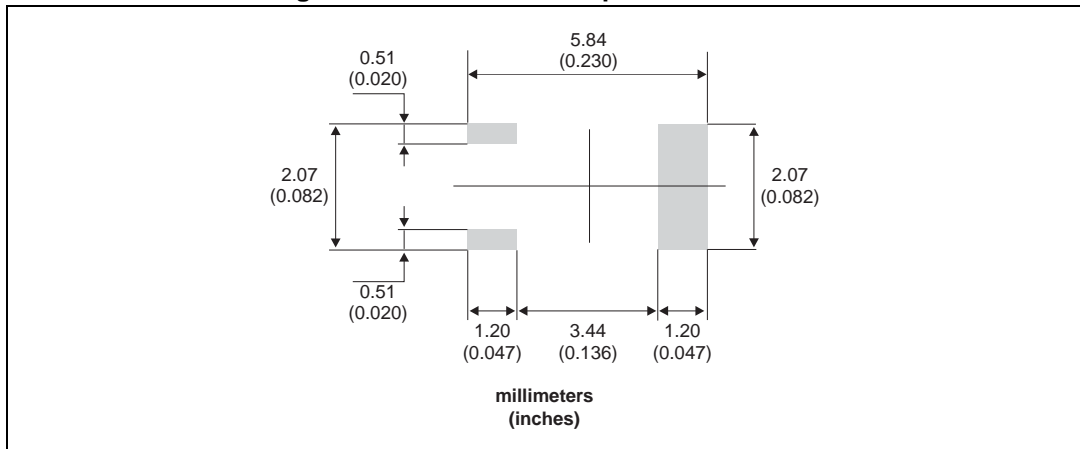


Table 6. SMBflat-3L dimensions (values)

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 19. SMBflat-3L footprint dimensions



4 Ordering information

Figure 20. Ordering information scheme

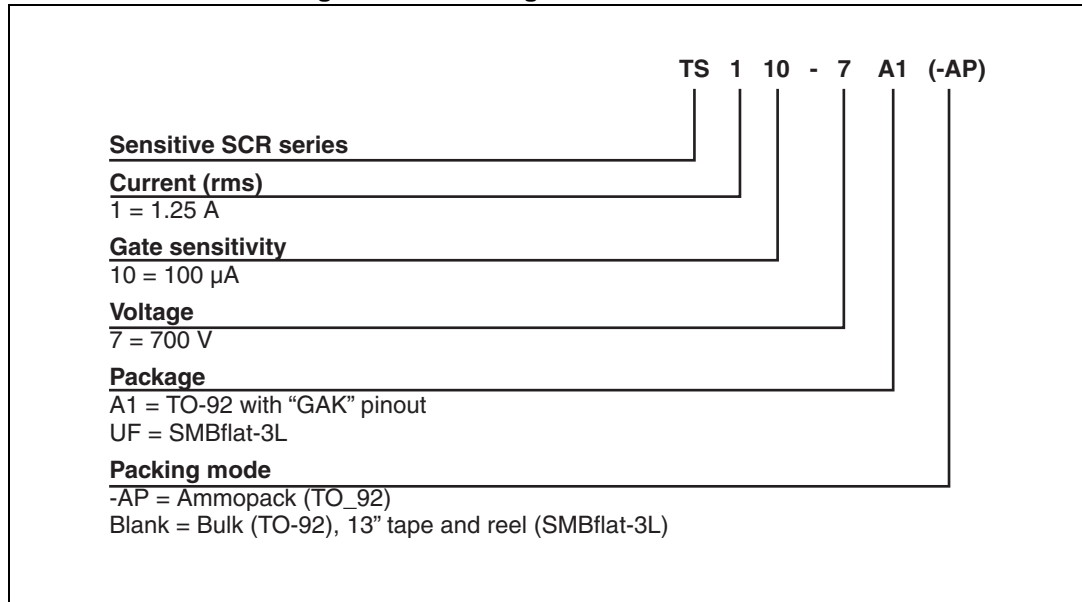


Table 7. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TS110-7A1	TS110-7	T0-92	200 mg	2500	Bulk
TS110-7A1-AP	TS110-7			2000	Ammopack
TS110-7UF	TS110-7	SMBflat-3L	47 mg	5000	Tape and reel 13"

5 Revision history

Table 8. Document revision history

Date	Revision	Changes
01-Sep-2012	1	Initial release.
11-Sep-2012	2	Added SMBflat-3L package.
17-Oct-2013	3	Corrected typographical error in Figure 8 .
18-Jun-2014	4	Updated device name.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2014 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [SCRs](#) category:

Click to view products by [STMicroelectronics](#) manufacturer:

Other Similar products are found below :

[NTE5428](#) [T1500N16TOF VT](#) [T880N16TOF](#) [TT162N16KOF-A](#) [TT162N16KOF-K](#) [TT330N16AOF](#) [VS-22RIA20](#) [VS-2N685](#) [057219R](#)
[T1190N16TOF VT](#) [T1220N22TOF VT](#) [T201N70TOH](#) [T700N22TOF](#) [T830N18TOF](#) [TT250N12KOF-K](#) [VS-110RKI40](#) [NTE5427](#) [NTE5442](#)
[T2160N28TOF VT](#) [TT251N16KOF-K](#) [VS-22RIA100](#) [VS-16RIA40](#) [TD250N16KOF-A](#) [VS-ST110S16P0](#) [T930N36TOF VT](#) [T2160N24TOF](#)
[VT](#) [T1190N18TOF VT](#) [T1590N28TOF VT](#) [2N1776A](#) [T590N14TOF](#) [NTE5375](#) [NTE5460](#) [NTE5481](#) [NTE5512](#) [NTE5514](#) [NTE5518](#)
[NTE5519](#) [NTE5529](#) [NTE5553](#) [NTE5555](#) [NTE5557](#) [NTE5567](#) [NTE5570](#) [NTE5572](#) [NTE5574](#) [NTE5576](#) [NTE5579](#) [NTE5589](#) [NTE5592](#)
[NTE5598](#)