1 Characteristics

Table 1. In compliance with the following standards

Standard	Peak surge voltage (V)	Waveform voltage	Required peak current (A)	Current waveform	Minimum serial resistor to meet standard (Ω)
GR-1089 Core First level	2500 1000	2/10 µs 10/1000 µs	500 100	2/10 µs 10/1000 µs	0 0
GR-1089 Core Second level	5000	2/10 µs	500	2/10 µs	0
GR-1089 Core Intra-building	1500	2/10 µs	100	2/10 µs	0
ITU-T-K20/K21	6000 1500	10/700 µs	150 37.5	5/310 µs	0 0
ITU-T-K20 (IEC61000-4-2)	8000 15000	1/60 ns	ESD contact discharge ESD air discharge		0 0
IEC61000-4-5	4000 4000	10/700 µs 1.2/50 µs	100 100	5/310 µs 8/20 µs	0 0
TIA/EIA IS-968, lightning surge type A	1500 800	10/160 µs 10/560 µs	200 100	10/160 µs 10/560 µs	0 0
TIA/EIA IS-968, lightning surge type B	1000	9/720 µs	25	5/320 µs	0

Table 2. Absolute ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Units
I_{PP}	Repetitive peak pulse current	10/1000 µs 8/20 µs 10/560 µs 5/310 µs 10/160 µs 1/20 µs 2/10 µs	100 300 140 150 200 300 500	A
I_{FS}	Fail-safe mode: maximum current(1)	8/20 µs	5	kA
I_{TSM}	Non repetitive surge peak on-state current (sinusoidal)	t = 0.2 s t = 1 s t = 2 s t = 15 mn	18 9 7 4	A
I^2t	I^2t value for fusing	t = 16.6 ms t = 20 ms	20 21	A^2s
T_{stg}	Storage temperature range		-55 to 150	°C
T_j	Operating junction temperature range		-40 to 150	°C
T_L	Maximum lead temperature for soldering during 10 s.		260	°C

1. In fail safe mode the device acts as a short circuit.

Table 3. Thermal resistances

Symbol	Parameter	Value	Unit
$R_{th(j-a)}$	Junction to ambient (with recommended footprint)	100	°C/W
$R_{th(j-l)}$	Junction to leads	20	°C/W

Figure 1. Electrical characteristics - definitions (T_{amb} = 25 °C)

Symbol	Parameter
V_{RM}	Stand-off voltage
V_{BO}	Breakover voltage
I_{RM}	Leakage current
I_{PP}	Peak pulse current
I_{BO}	Breakover current
I_H	Holding current
V_R	Continuous reverse voltage
I_R	Leakage current at V_R
C	Capacitance

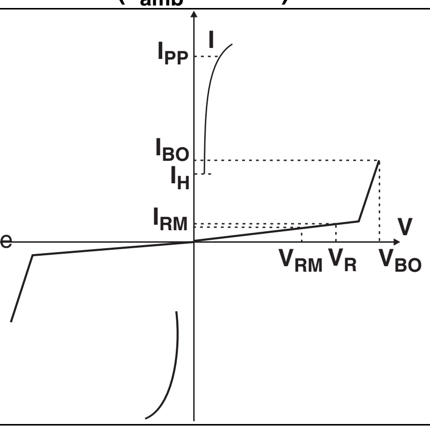


Table 4. Electrical characteristics - values (T_{amb} = 25 °C)

Types	I_{RM} @ V_{RM}		I_R @ V_R		Dynamic V_{BO} (1)	Static V_{BO} @ I_{BO} (2)		I_H (3)	C (4)	C (5)
	max.		max.		max.	max.	max.	min.	typ.	typ.
	µA	V	µA	V	V	V	mA	mA	pF	pF
SMP100MC-140	2	126	5	140	180	175	800	150	30	60
SMP100MC-160		144		160	205	200			25	50
SMP100MC-200		180		200	255	250			20	45
SMP100MC-230		207		230	295	285			20	40
SMP100MC-270		243		270	345	335			20	40
SMP100MC-320		290		320	400	390			15	35
SMP100MC-360		325		360	460	450			15	35
SMP100MC-400		360		400	540	530			15	30

1. See *Figure 16: Test circuit 1 for Dynamic IBO and VBO parameters*
2. See *Figure 17: Test circuit 2 for IBO and VBO parameters*
3. See *Figure 18: Test circuit 3 for dynamic IH parameter*
4. V_R = 50 V bias, V_{RMS}=1V, F=1 MHz
5. V_R = 2 V bias, V_{RMS}=1V, F=1 MHz

Figure 2. Pulse waveform

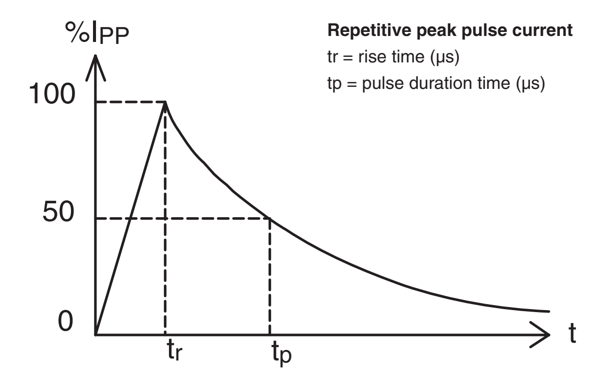


Figure 3. Non repetitive surge peak on-state current versus overload duration

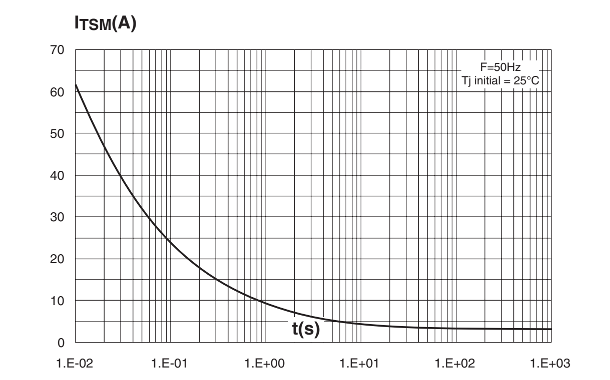


Figure 4. On-state voltage versus on-state current (typical values)

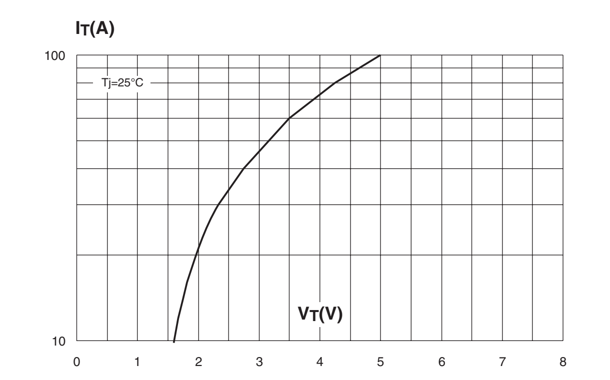


Figure 5. Relative variation of holding current versus junction temperature

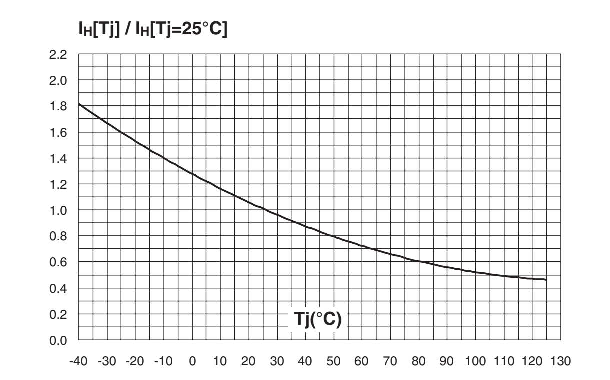


Figure 6. Relative variation of breakover voltage versus junction temperature

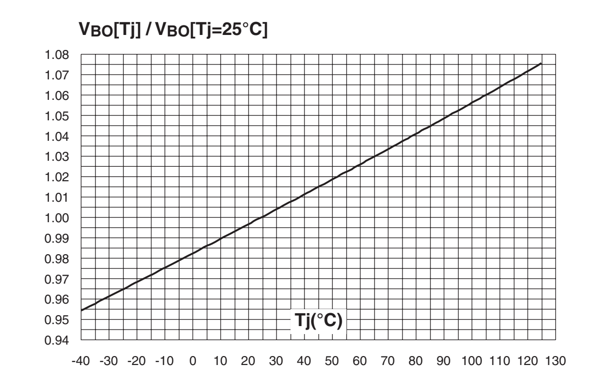


Figure 7. Relative variation of leakage current versus reverse voltage applied (typical values)

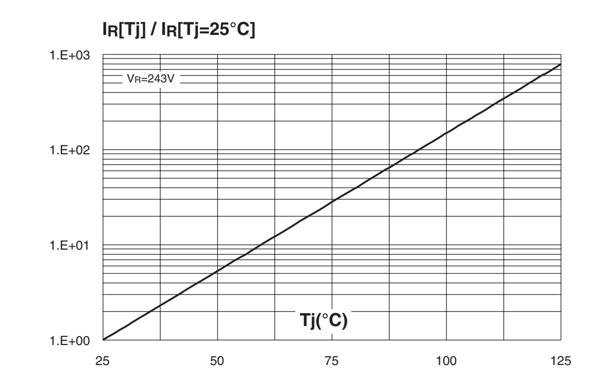


Figure 8. Variation of thermal impedance junction to ambient versus pulse duration

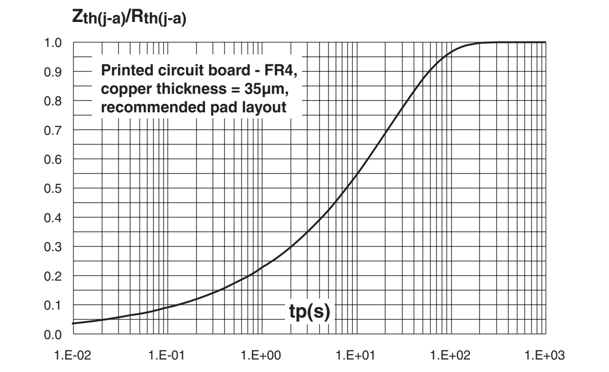
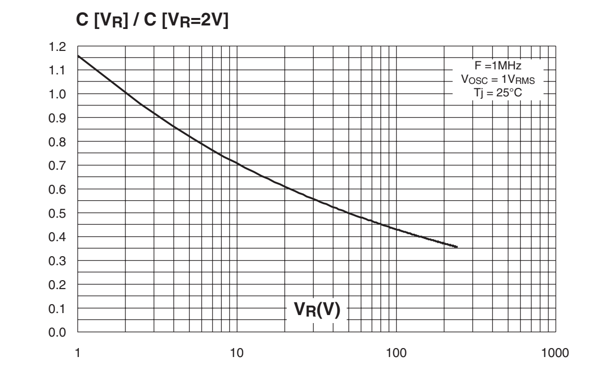


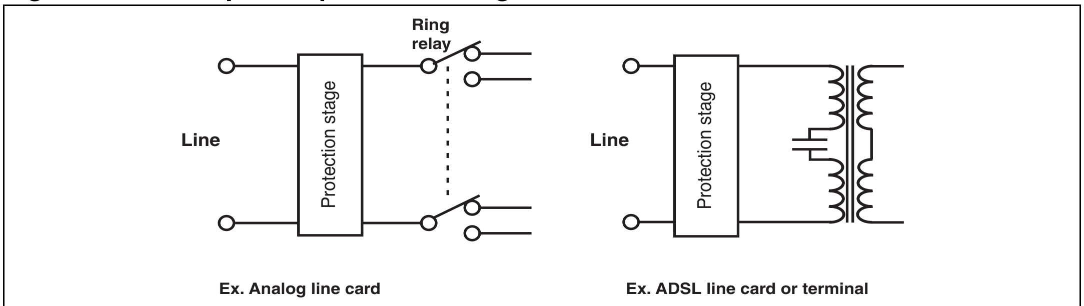
Figure 9. Relative variation of junction capacitance versus reverse voltage applied (typical values)



2 Application information

In wire line applications, analog or digital, both central office and subscriber sides have to be protected. This function is assumed by a combined series / parallel protection stage

Figure 10. Examples of protection stages for line cards



In such a stage, parallel function is assumed by one or several Trisil, and is used to protect against short duration surge (lightning). During this kind of surges the Trisil limits the voltage across the device to be protected at its break over value and then fires. The fuse assumes the series function, and is used to protect the module against long duration or very high current mains disturbances (50/60Hz). It acts by safe circuits opening. Lightning surge and mains disturbance surges are defined by standards like GR1089, TIA/EIA IS-968, ITU-T K20.

Figure 11. Typical circuits

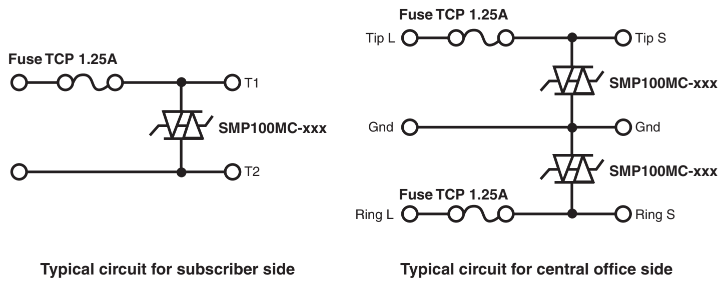
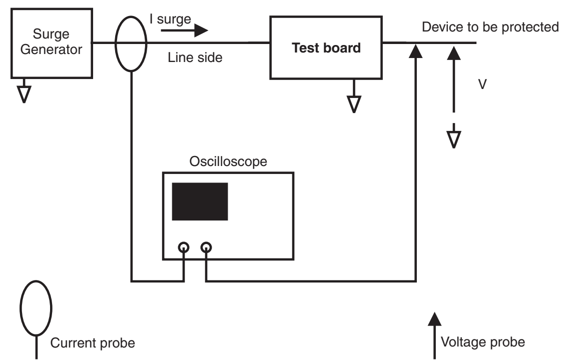
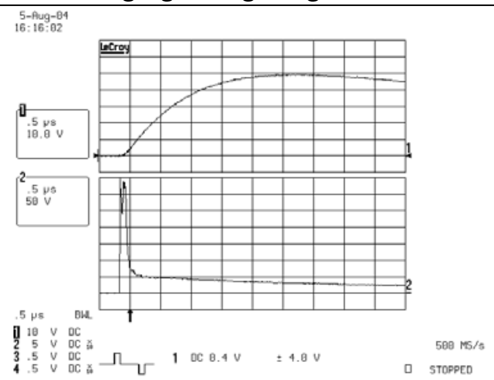


Figure 12. Test method of the board having fuse and Trisil



These topologies, using SMP100MC from ST and TCP1.25 A from Cooper Bussmann, have been functionally validated with a Trisil glued on the PCB. Following example was performed with SMP100MC-270 Trisil. For more information, see Application Note AN2064.

Figure 13. Trisil turns on during lightning surge



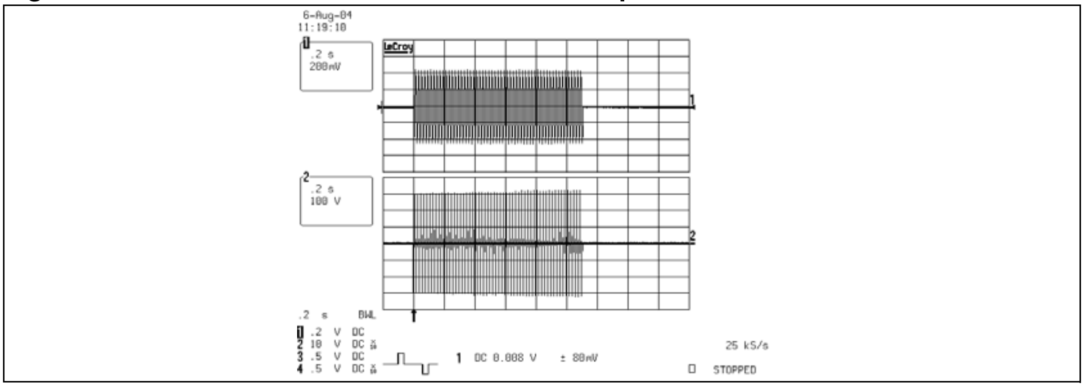
Test conditions:

2/10 µs + and -2.5 and 5 kV 500 A (10 pulses of each polarity), T_{amb} = 25 °C

Test result:

Fuse and Trisil OK after test in accordance with GR1089 requirements.

Figure 14. Trisil action while the fuse remains operational



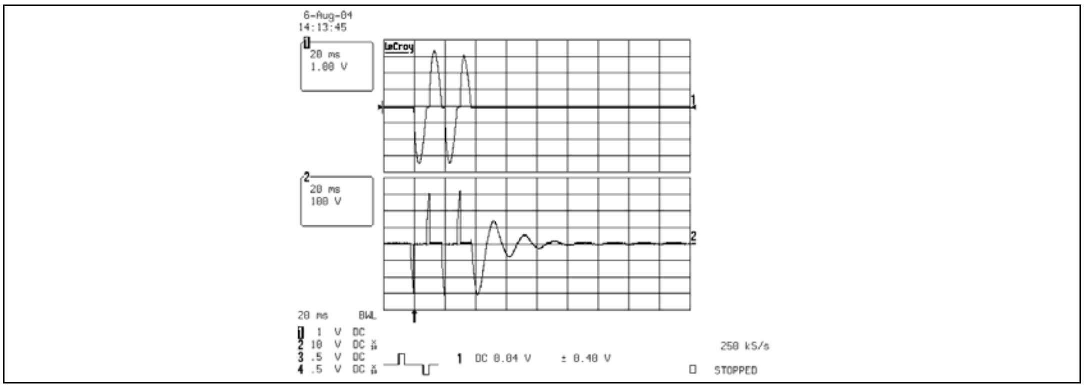
Test conditions:

600 V 3 A 1.1 s (first level), T_{amb} = 25 °C

Test result:

Fuse and Trisil OK after test in accordance with GR1089 requirements

Figure 15. High current power cross test: the fuse acts like a switch by opening the circuit



Test conditions:

277 V 25 A (second level), T_{amb} = 25 °C

Test result:

Fuse safety opened and Trisil OK after test in accordance with GR1089 requirements.

Figure 16. Test circuit 1 for Dynamic I_{BO} and V_{BO} parameters

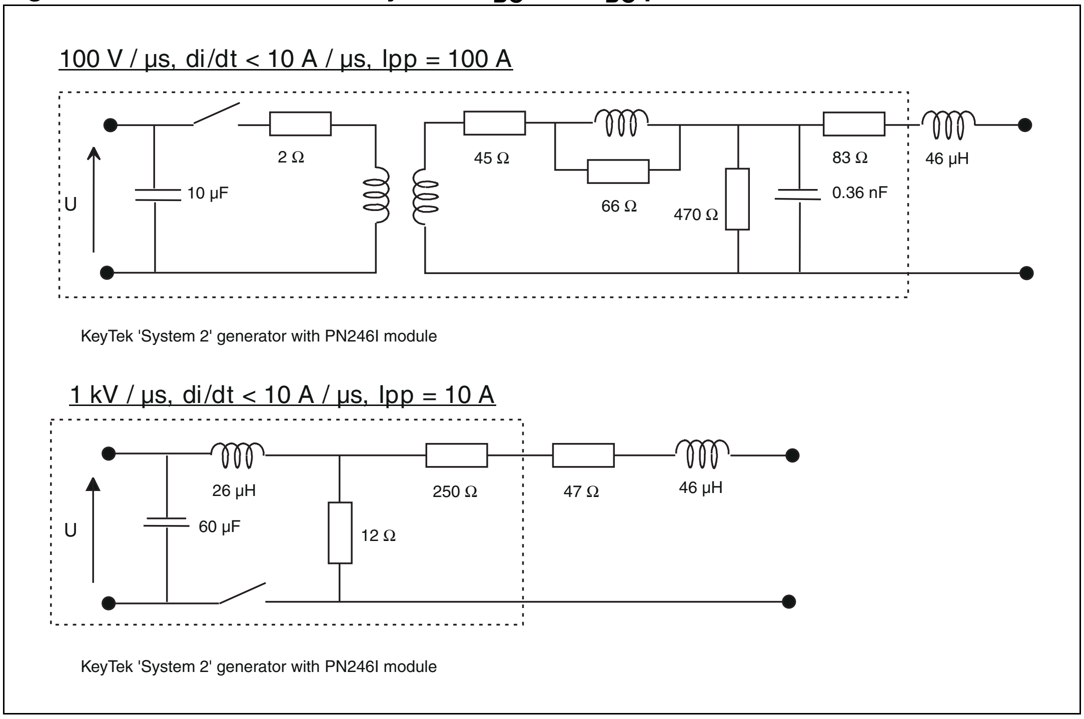
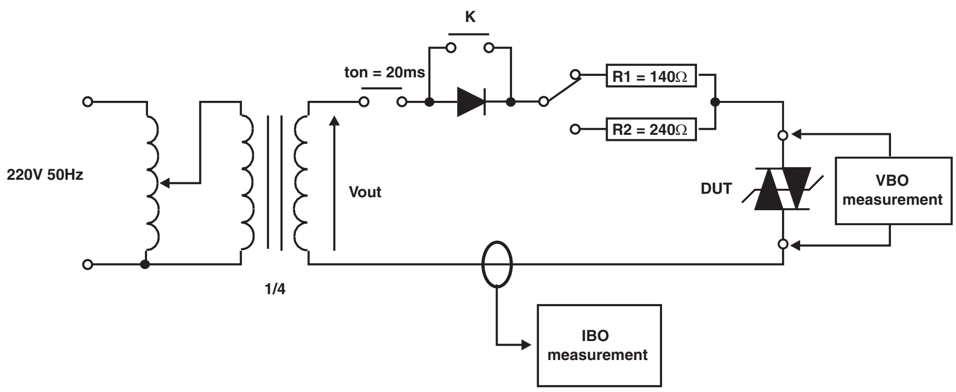


Figure 17. Test circuit 2 for I_{BO} and V_{BO} parameters



TEST PROCEDURE

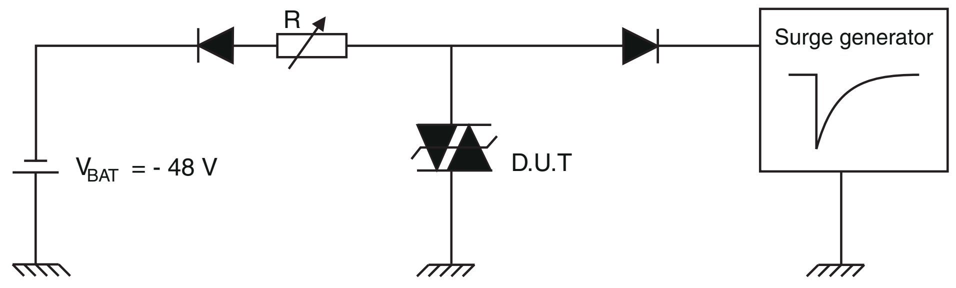
Pulse test duration (tp = 20ms):

- for Bidirectional devices = Switch K is closed
- for Unidirectional devices = Switch K is open

V_{OUT} selection:

- Device with V_{BO} < 200 V → V_{OUT} = 250 V_{RMS}, R1 = 140 Ω
- Device with V_{BO} ≥ 200 V → V_{OUT} = 480 V_{RMS}, R2 = 240 Ω

Figure 18. Test circuit 3 for dynamic I_H parameter



This is a GO-NOGO test which allows to confirm the holding current (I_H) level in a functional test circuit.

TEST PROCEDURE

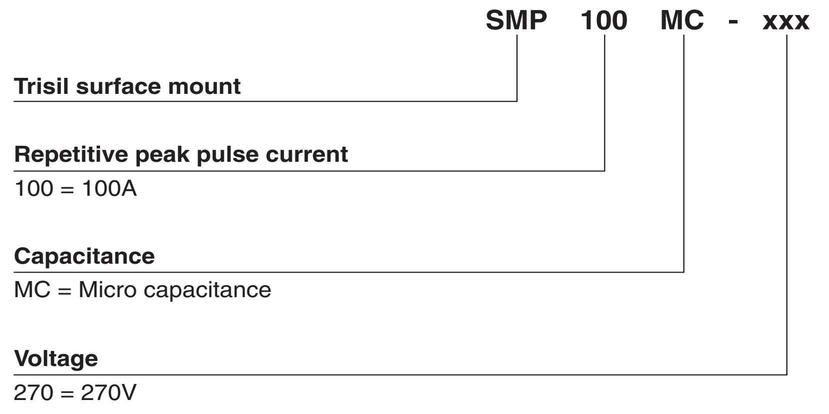
1/ Adjust the current level at the I_H value by short circuiting the AK of the D.U.T.

2/ Fire the D.U.T. with a surge current → I_{PP} = 10 A, 10/1000 µs.

3/ The D.U.T. will come back off-state within 50 ms maximum.

3 Ordering information scheme

Figure 19. Ordering information scheme

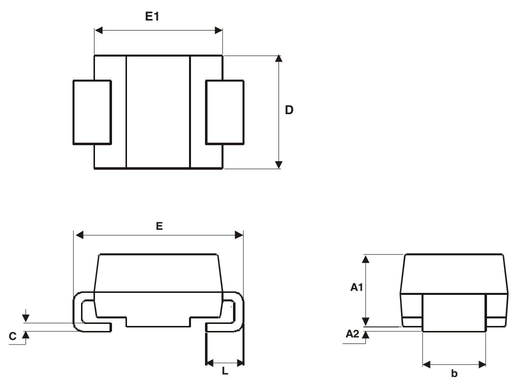


4 Package information

- 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.

Table 5. SMB dimensions



Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	1.95	2.20	0.077	0.087
c	0.15	0.40	0.006	0.016
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
D	3.30	3.95	0.130	0.156
L	0.75	1.50	0.030	0.059

Figure 20. Footprint dimensions in mm (inches)

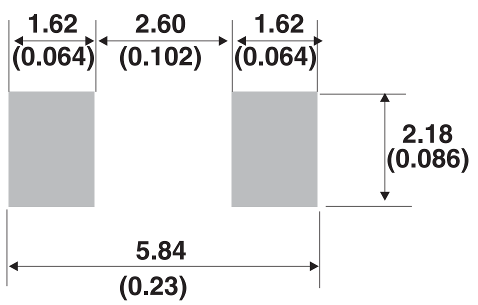
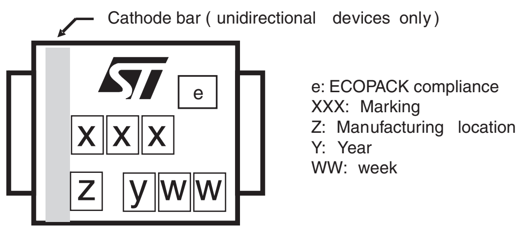


Figure 21. Marking layout(1)



1. Marking layout can vary according to assembly location.

5 Ordering information

Table 6. Ordering information

Part Number	Marking	Package	Weight	Base qty	Delivery mode
SMP100MC-140	ML14	SMB	98 mg	2500	Tape and reel
SMP100MC-160	ML16				
SMP100MC-200	ML20				
SMP100MC-230	ML23				
SMP100MC-270	ML27				
SMP100MC-320	ML32				
SMP100MC-360	ML36				
SMP100MC-400	ML40				

6 Revision history

Table 7. Document revision history

Date	Revision	Changes
September-2003	0B	First issue.
14-Dec-2004	1	Absolute ratings values, table 3 on page 2, updated.
11-May-2005	2	New types introduction.
20-Jun-2005	3	Telecom Circuit Protector added
05-Jan-2006	4	SMP100MC-320 / 360 / 400 in full production (“in development” mention removed)
09-Feb-2012	5	Added UL statement in *Complies with the following standards*.

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