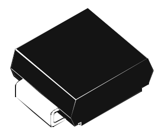
SMP100MC

TRISIL™ FOR TELECOM EQUIPMENT PROTECTION

FEATURES

- Bidirectional crowbar protection
- Voltage: range from 120V to 270V
- Low V_{BO} / V_R ratio
- Micro capacitance from 20pF to 30pF @ 50V
- Low leakage current : I_R = 2µA max
- Holding current: I_H = 150 mA min
- Repetitive peak pulse current : I_{PP} = 100 A (10/1000µs)



SMB
(JEDEC DO-214AA)

MAIN APPLICATIONS

Any sensitive equipment requiring protection against lightning strikes and power crossing.

These devices are dedicated to central office protection as they comply with the most stressfull standards.

Their Micro Capacitance make them suitable for ADSL2+ and low end VDSL.

DESCRIPTION

The SMP100MC is a series of micro capacitance transient surge arrestors designed for the protection of high debit rate communication equipment. Its micro capacitance avoids any distortion of the signal and is compatible with digital transmission line cards (ADSL, VDSL, ISDN...).

Compatible with Cooper Bussmann fuse:
TCP 1.25A.

BENEFITS

Trisils are not subject to ageing and provide a fail safe mode in short circuit for a better protection. They are used to help equipment to meet main standards such as UL60950, IEC950 / CSA C22.2 and UL1459. They have UL94 V0 approved resin. SMB package is JEDEC registered (DO-214AA). Trisils comply with the following standards GR-1089 Core, ITU-T-K20/K21, VDE0433, VDE0878, IEC61000-4-5 and FCC part 68.

Table 1: Order Codes

Part Number	Marking
SMP100MC-120	ML12
SMP100MC-140	ML14
SMP100MC-160	ML16
SMP100MC-200	ML20
SMP100MC-230	ML23
SMP100MC-270	ML27

Figure 1: Schematic Diagram

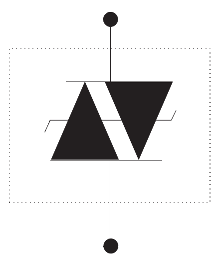


Table 2: In compliance with the following standards

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
VDE0433	4000 2000	10/700 µs	100 50	5/310 µs	0 0
VDE0878	4000 2000	1.2/50 µs	100 50	1/20 µs	0 0
IEC61000-4-5	4000 4000	10/700 µs 1.2/50 µs	100 100	5/310 µs 8/20 µs	0 0
FCC Part 68, lightning surge type A	1500 800	10/160 µs 10/560 µs	200 100	10/160 µs 10/560 µs	0 0
FCC Part 68, lightning surge type B	1000	9/720 µs	25	5/320 µs	0

Table 3: Absolute Ratings (T_{amb} = 25°C)

Symbol	Parameter		Value	Unit
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	100 400 140 150 200 400 500	A
I_{FS}	Fail-safe mode : maximum current (note 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} T_j	Storage temperature range Maximum junction temperature		-55 to 150 150	°C
T_L	Maximum lead temperature for soldering during 10 s.		260	°C

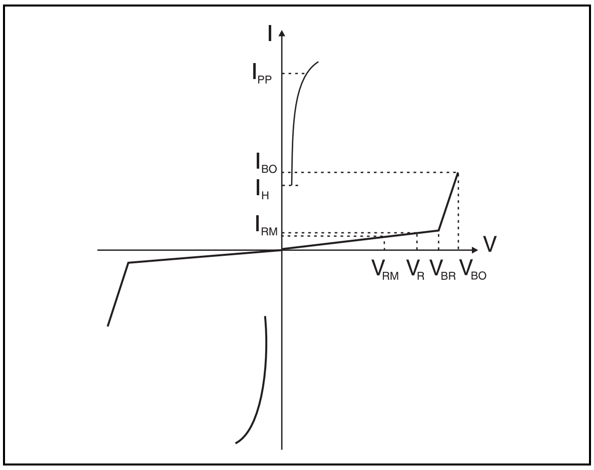
Note 1: in fail safe mode, the device acts as a short circuit

Table 4: 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

Table 5: Electrical Characteristics (T_{amb} = 25°C)

Symbol	Parameter
V_{RM}	Stand-off voltage
V_{BR}	Breakdown 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>
<tr><th rowspan="3">Types</th><th colspan="2">I_{RM} @ V_{RM}
max.</th><th colspan="2">I_R @ V_R
max.
note1</th><th>Dynamic V_{BO}
max.
note 2</th><th colspan="2">Static V_{BO} @ I_{BO}
max. max.
note 3</th><th>I_H
min.
note 4</th><th>C
typ.
note 5</th><th>C
typ.
note 6</th></tr>
<tr><th>µA</th><th>V</th><th>µA</th><th>V</th><th>V</th><th>V</th><th>mA</th><th>mA</th><th>pF</th><th>pF</th></tr>
<tr></tr>
<tr><td>SMP100MC-120*</td><td rowspan="6">2</td><td>108</td><td rowspan="6">5</td><td>120</td><td>155</td><td>150</td><td rowspan="6">800</td><td rowspan="6">150</td><td>30</td><td>60</td></tr>
<tr><td>SMP100MC-140*</td><td>126</td><td>140</td><td>180</td><td>175</td><td>30</td><td>60</td></tr>
<tr><td>SMP100MC-160</td><td>144</td><td>160</td><td>205</td><td>200</td><td>25</td><td>50</td></tr>
<tr><td>SMP100MC-200</td><td>180</td><td>200</td><td>255</td><td>250</td><td>20</td><td>45</td></tr>
<tr><td>SMP100MC-230</td><td>207</td><td>230</td><td>295</td><td>285</td><td>20</td><td>40</td></tr>
<tr><td>SMP100MC-270</td><td>243</td><td>270</td><td>345</td><td>335</td><td>20</td><td>40</td></tr>
</table>

Note 1: I_R measured at V_R guarantee V_{BR} min $\geq$ VR
Note 2: see functional test circuit 1
Note 3: see test circuit 2
Note 4: see functional holding current test circuit 3
Note 5: V_R = 50V bias, V_{RMS}=1V, F=1MHz
Note 6: V_R = 2V bias, V_{RMS}=1V, F=1MHz

* in development

Figure 2: Pulse waveform

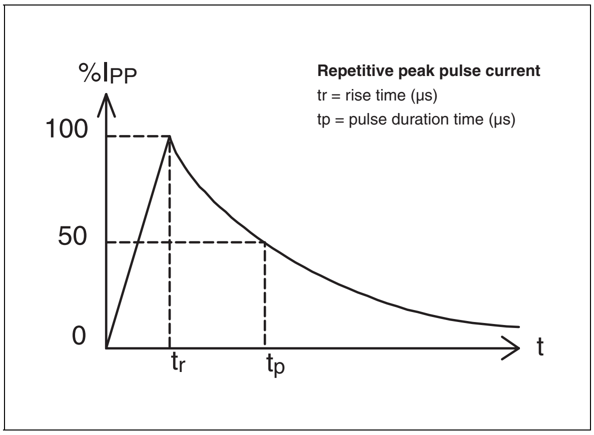


Figure 3: Non repetitive surge peak on-state current versus overload duration

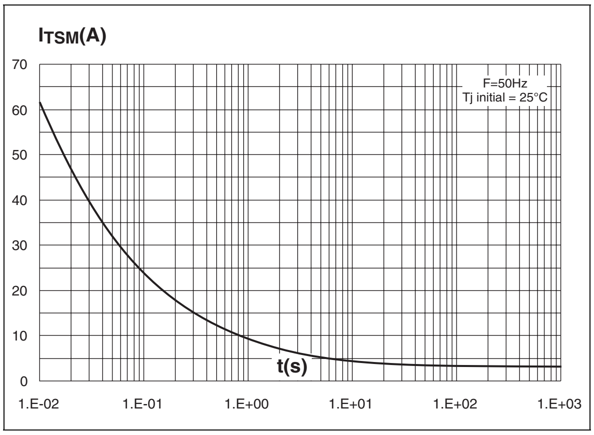


Figure 4: On-state voltage versus on-state current (typical values)

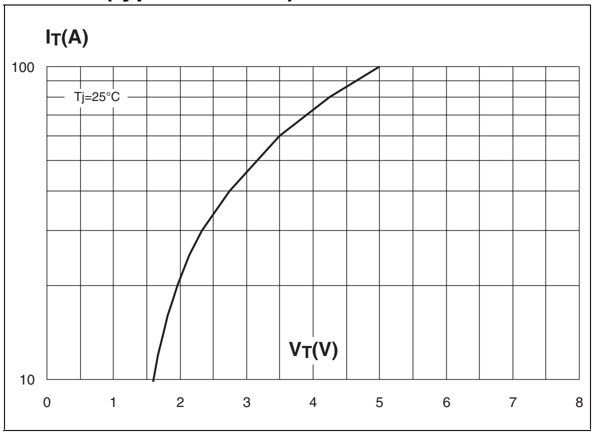


Figure 5: Relative variation of holding current versus junction temperature

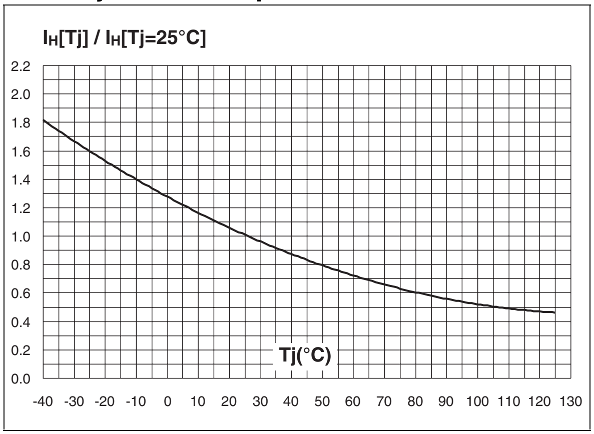


Figure 6: Relative variation of breakover voltage versus junction temperature

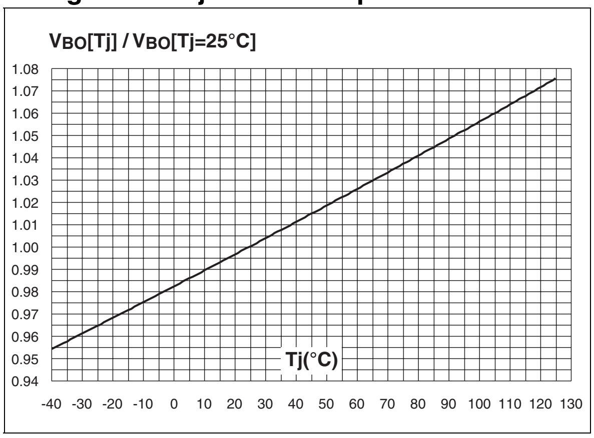


Figure 7: Relative variation of leakage current versus junction temperature (typical values)

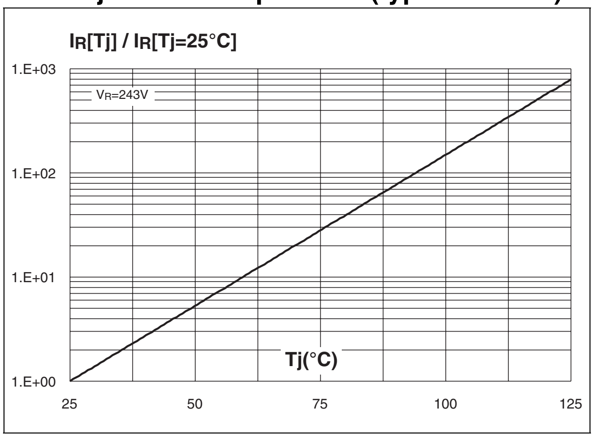


Figure 8: Variation of thermal impedance junction to ambient versus pulse duration (Printed circuit board FR4, SCu=35µm, recommended pad layout)

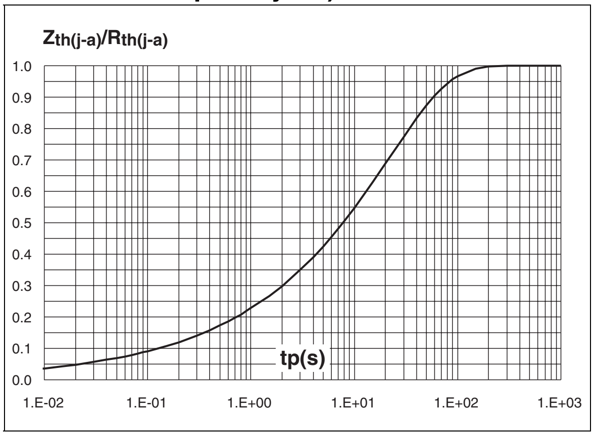
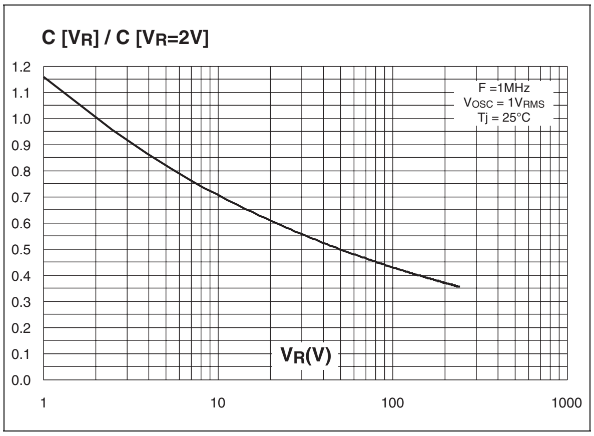
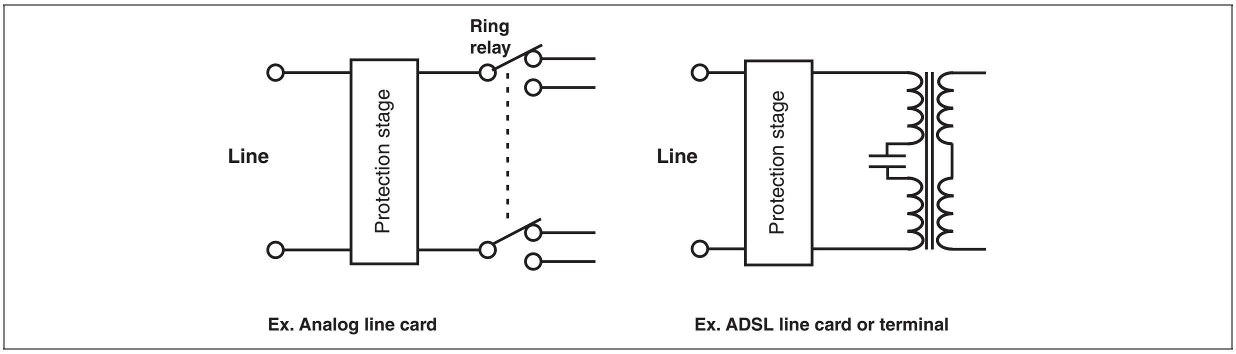


Figure 9: Relative variation of junction capacitance versus reverse voltage applied (typical values)

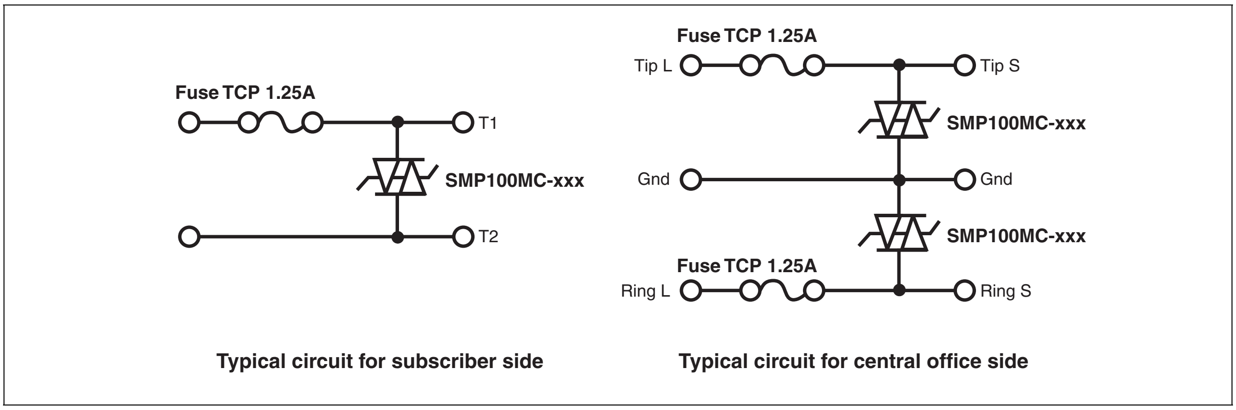


APPLICATION NOTE

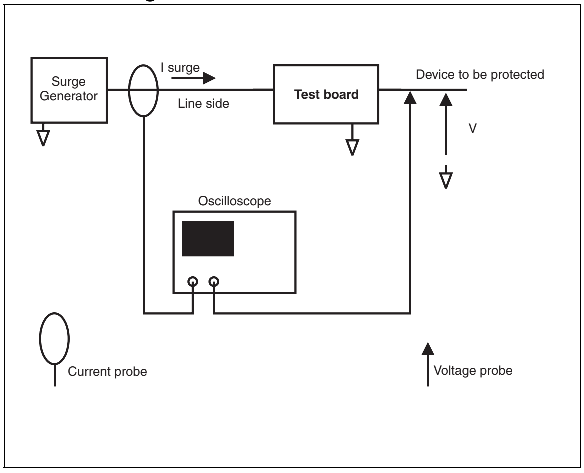
In wireline applications, analog or digital, both central office and subscriber sides have to be protected. This function is assumed by a combined series / parallel protection stage.



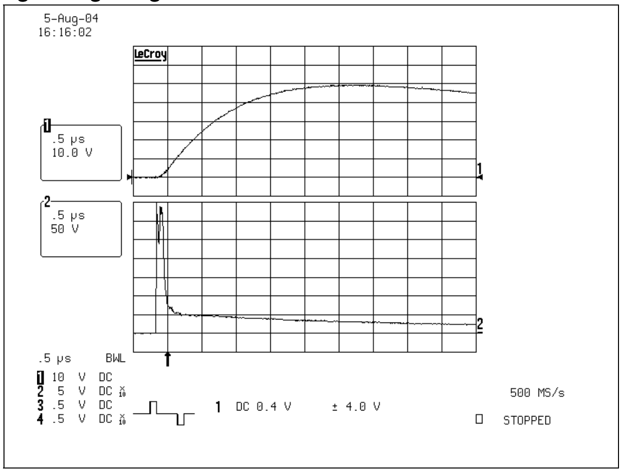
In such a stage, parallel function is assumed by one or several Trisil, and is used to protect against short duration surge (lightning). During this kind of surges the Trisil limits the voltage across the device to be protected at its break over value and then fires. The fuse assumes the series function, 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, FCC part 68, ITU-T K20.



Following figure shows the test method of the board having Fuse and Trisil.



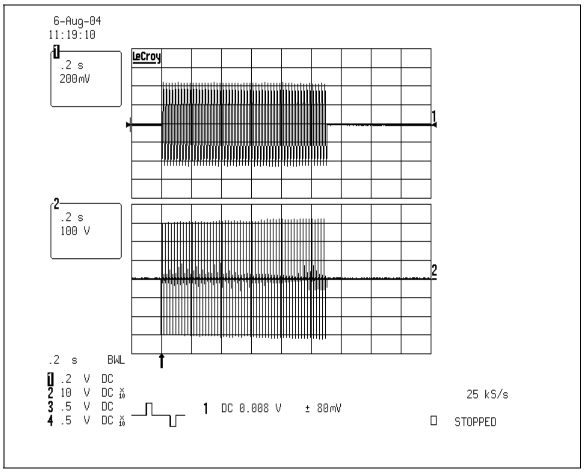
Following curve shows the turn on of the Trisil during lightning surge.



These topologies, using SMP100MC from ST and TCP1.25A 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.

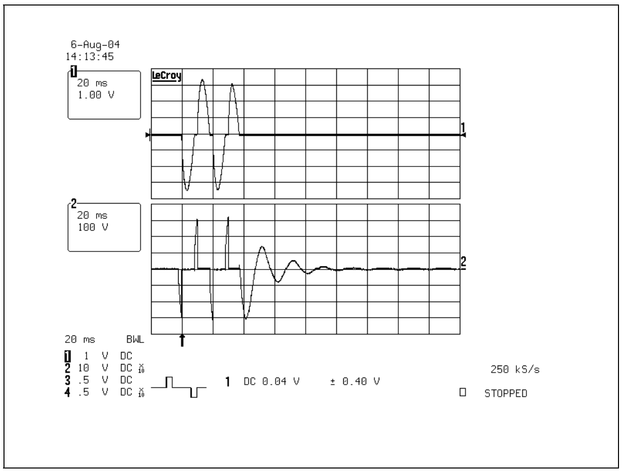
Test conditions:
2/10µs + and -2.5 and 5kV 500A (10 pulses of each polarity), T_{amb} = 25°C
Test result:
Fuse and Trisil OK after test in accordance with GR1089 requirements

Following curve shows Trisil action while the fuse remains operational.



Test conditions:
600V 3A 1.1s (first level), T_{amb} = 25°C
Test result:
Fuse and Trisil OK after test in accordance with GR1089 requirements

In case of high current power cross test, the fuse acts like a switch by opening the circuit.



Test conditions:
277V 25A (second level), T_{amb} = 25°C
Test result:
Fuse safety opened and Trisil OK after test in accordance with GR1089 requirements

Figure 10: Test circuit 1 for Dynamic I_{BO} and V_{BO} parameters

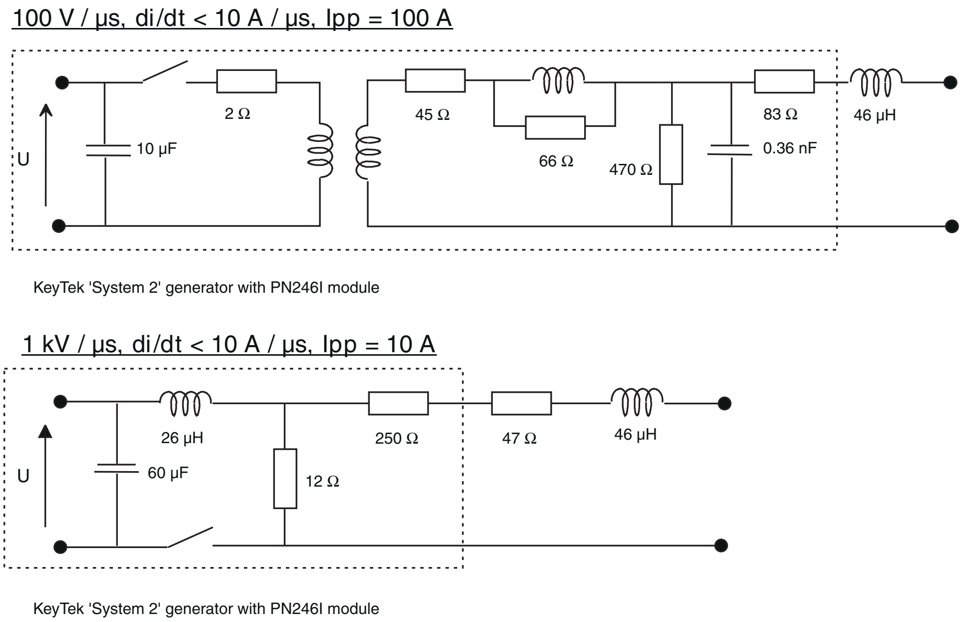
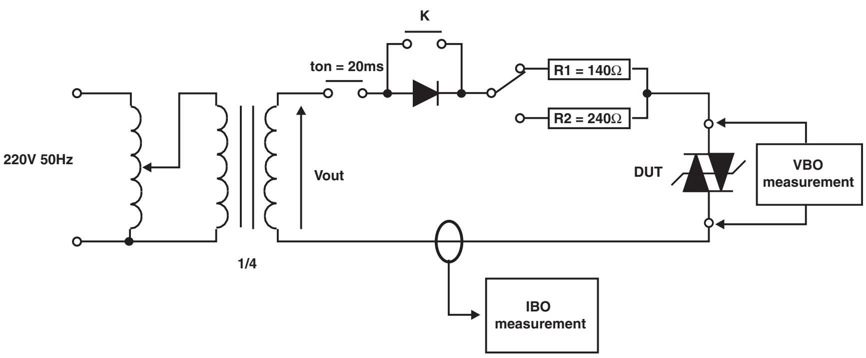


Figure 11: Test circuit 2 for I_{BO} and V_{BO} parameters



TEST PROCEDURE

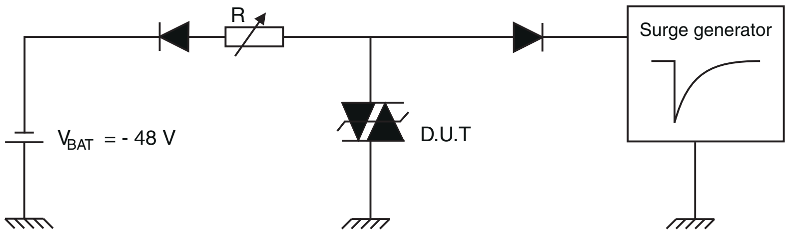
Pulse test duration (tp = 20ms):

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

V_{OUT} selection:

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

Figure 12: 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} = 10A, 10/1000µs.

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

Figure 13: Order Code

SMP 100 MC - xxx

Trisil Surface Mount → SMP

Repetitive Peak Pulse Current → 100

100 = 100A

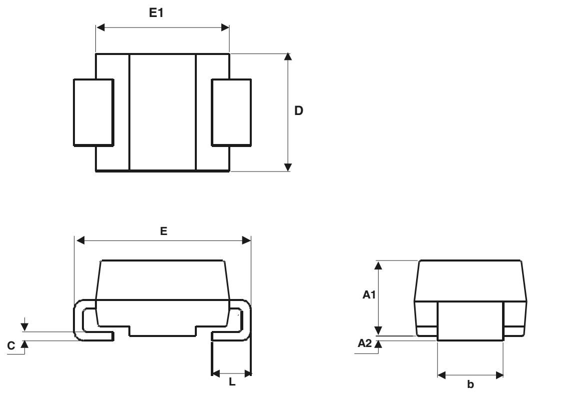
Capacitance → MC

MC = Micro Capacitance

Voltage → xxx

270 = 270V

Figure 14: SMB Package Mechanical data



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	0.41	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	1.60	0.030	0.063

Figure 15: Foot Print Dimensions (in millimeters)

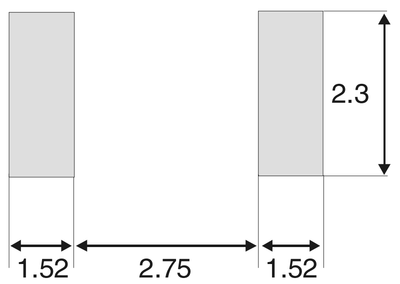


Table 5: Ordering Information

Part Number	Marking	Package	Weight	Base qty	Delivery mode
SMP100MC-120	ML12	SMB	0.11 g	2500	Tape & reel
SMP100MC-140	ML14				
SMP100MC-160	ML16				
SMP100MC-200	ML20				
SMP100MC-230	ML23				
SMP100MC-270	ML27				

Table 6: Revision History

Date	Revision	Description of Changes
September-2003	0B	First issue.
14-Dec-2004	1	Absolute ratings values, table 3 on page 2, updated.