



## 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 :  $I_R = 2\mu A$  max
- Holding current:  $I_H = 150$  mA min
- Repetitive peak pulse current :  
 $I_{PP} = 100$  A (10/1000 $\mu s$ )

### 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 stressful 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

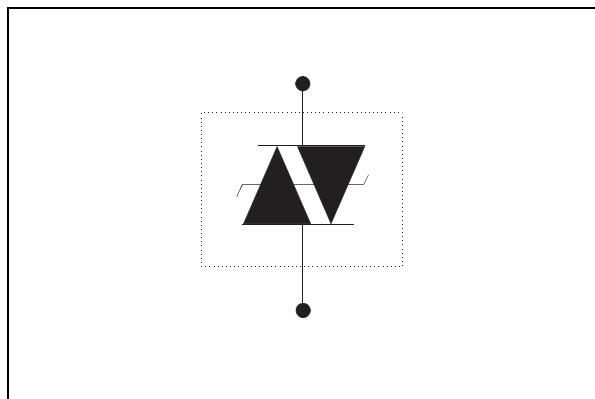
Trisils are not subject to ageing and provide a fail safe mode in short circuit for a better protection. They are used to help equipment to meet main standards such as UL60950, IEC950 / CSA C22.2 and UL1459. They have UL94 V0 approved resin. SMB package is JEDEC registered (DO-214AA). Trisils comply 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**



## SMP100MC

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 ( $\Omega$ )
GR-1089 Core First level	2500	2/10 $\mu$ s	500	2/10 $\mu$ s	0
	1000	10/1000 $\mu$ s	100	10/1000 $\mu$ s	0
GR-1089 Core Second level	5000	2/10 $\mu$ s	500	2/10 $\mu$ s	0
GR-1089 Core Intra-building	1500	2/10 $\mu$ s	100	2/10 $\mu$ s	0
ITU-T-K20/K21	6000	10/700 $\mu$ s	150	5/310 $\mu$ s	0
	1500		37.5		0
ITU-T-K20 (IEC61000-4-2)	8000	1/60 ns	ESD contact discharge		0
	15000		ESD air discharge		0
VDE0433	4000	10/700 $\mu$ s	100	5/310 $\mu$ s	0
	2000		50		0
VDE0878	4000	1.2/50 $\mu$ s	100	1/20 $\mu$ s	0
	2000		50		0
IEC61000-4-5	4000	10/700 $\mu$ s	100	5/310 $\mu$ s	0
	4000	1.2/50 $\mu$ s	100	8/20 $\mu$ s	0
FCC Part 68, lightning surge type A	1500	10/160 $\mu$ s	200	10/160 $\mu$ s	0
	800	10/560 $\mu$ s	100	10/560 $\mu$ s	0
FCC Part 68, lightning surge type B	1000	9/720 $\mu$ s	25	5/320 $\mu$ s	0

Table 3: Absolute Ratings ( $T_{amb} = 25^{\circ}\text{C}$ )

Symbol	Parameter	Value	Unit	
$I_{PP}$	Repetitive peak pulse current	10/1000 $\mu$ s	100	A
		8/20 $\mu$ s	400	
		10/560 $\mu$ s	140	
		5/310 $\mu$ s	150	
		10/160 $\mu$ s	200	
		1/20 $\mu$ s	400	
		2/10 $\mu$ s	500	
$I_{FS}$	Fail-safe mode : maximum current (note 1)	8/20 $\mu$ s	5	kA
$I_{TSM}$	Non repetitive surge peak on-state current (sinusoidal)	t = 0.2 s	18	A
		t = 1 s	9	
		t = 2 s	7	
		t = 15 mn	4	
$I^2t$	$I^2t$ value for fusing	t = 16.6 ms	20	$\text{A}^2\text{s}$
		t = 20 ms	21	
$T_{stg}$	Storage temperature range	-55 to 150	$^{\circ}\text{C}$	
$T_j$	Maximum junction temperature	150	$^{\circ}\text{C}$	
$T_L$	Maximum lead temperature for soldering during 10 s.	260	$^{\circ}\text{C}$	

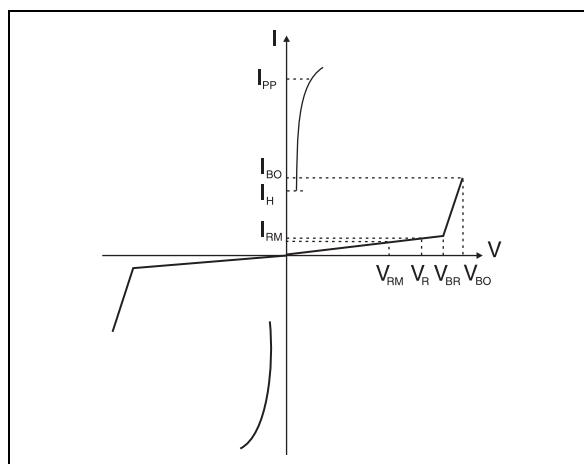
Note 1: in fail safe mode, the device acts as a short circuit

**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** ( $T_{amb} = 25^{\circ}C$ )

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



Types	$I_{RM} @ V_{RM}$ max.		$I_R @ V_R$ max. note 1		Dynamic $V_{BO}$ max. note 2	Static $V_{BO} @ I_{BO}$ max. max. note 3		$I_H$ min. note 4	C typ. note 5	C typ. note 6
	$\mu A$	V	$\mu A$	V	V	V	mA	mA	pF	pF
SMP100MC-120*	2	108	5	120	155	150	800	150	30	60
SMP100MC-140*		126		140	180	175			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

**Note 1:**  $I_R$  measured at  $V_R$  guarantee  $V_{BR} min \geq V_R$

**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

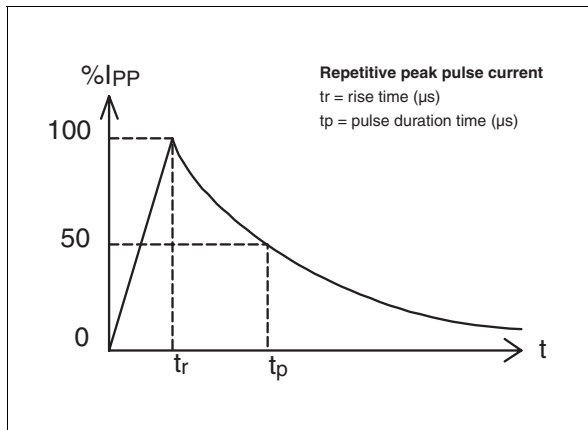


Figure 3: Non repetitive surge peak on-state current versus overload duration

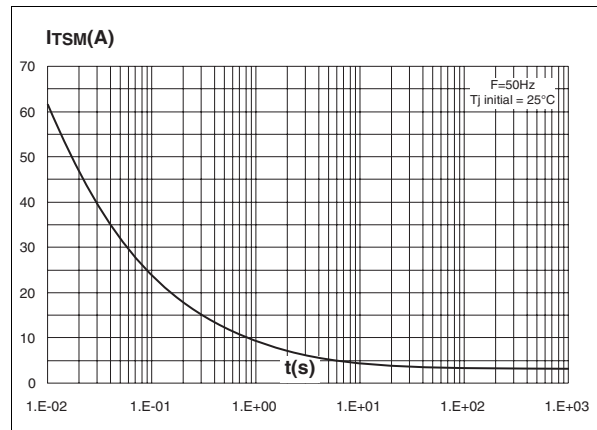


Figure 4: On-state voltage versus on-state current (typical values)

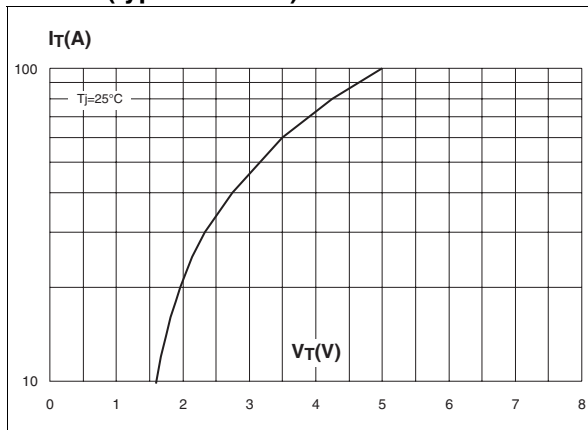


Figure 5: Relative variation of holding current versus junction temperature

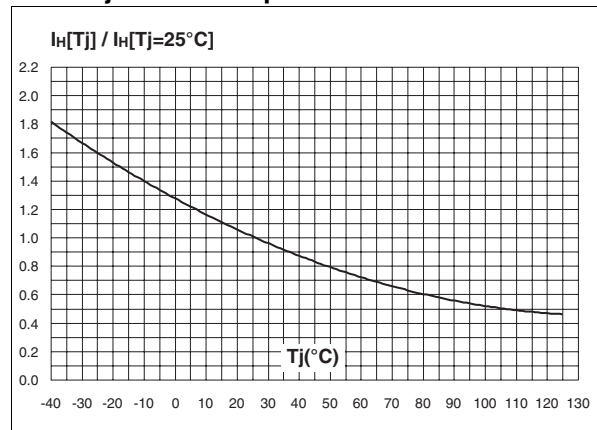


Figure 6: Relative variation of breakover voltage versus junction temperature

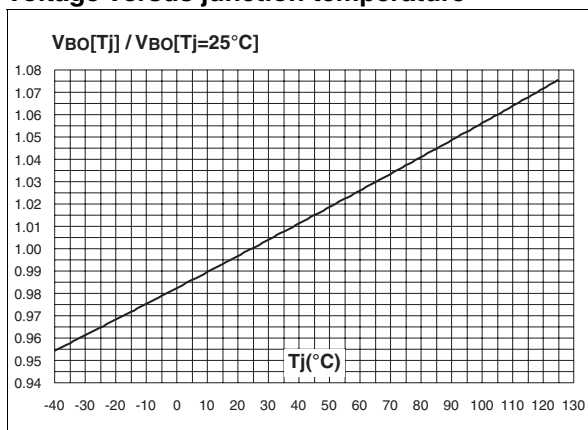
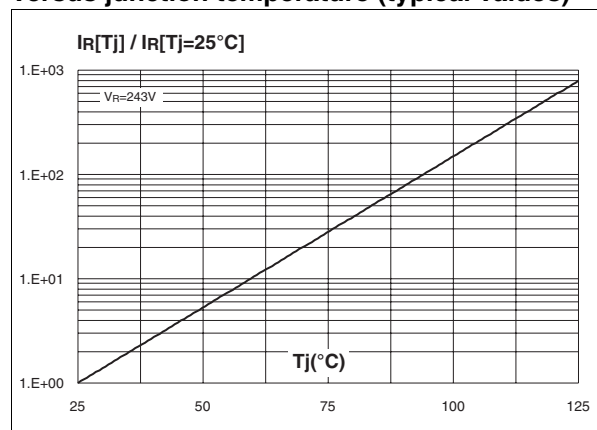
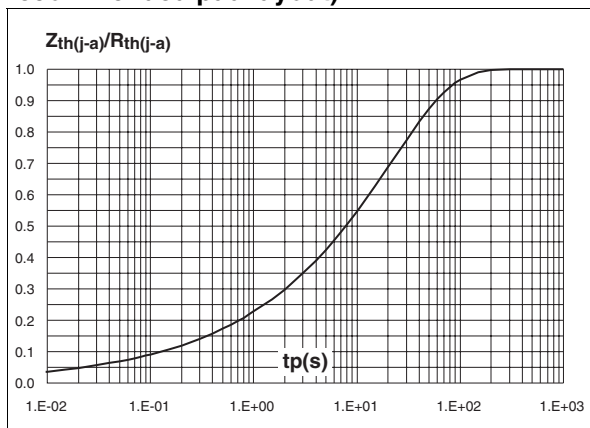


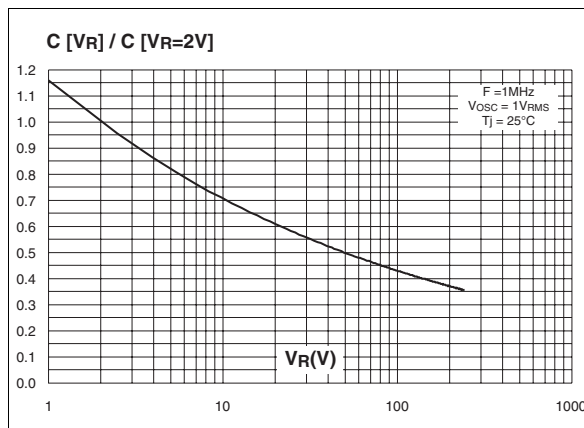
Figure 7: Relative variation of leakage current versus junction temperature (typical values)



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

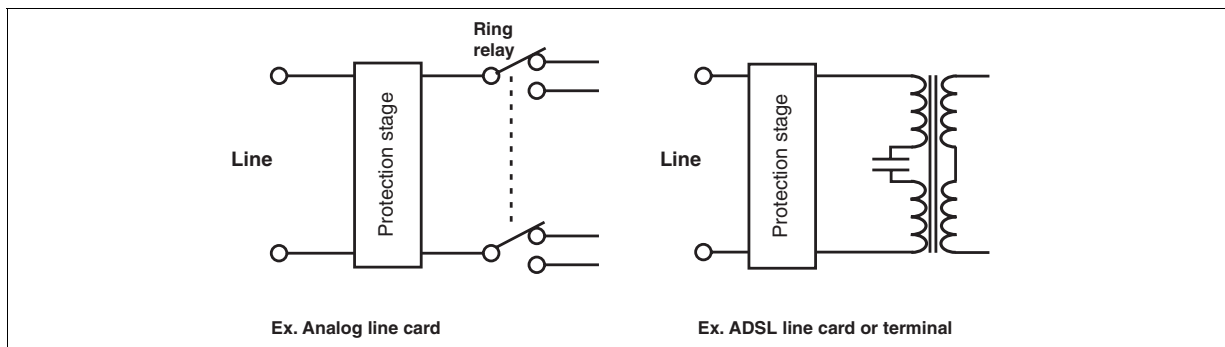


**Figure 9: Relative variation of junction capacitance versus reverse voltage applied (typical values)**

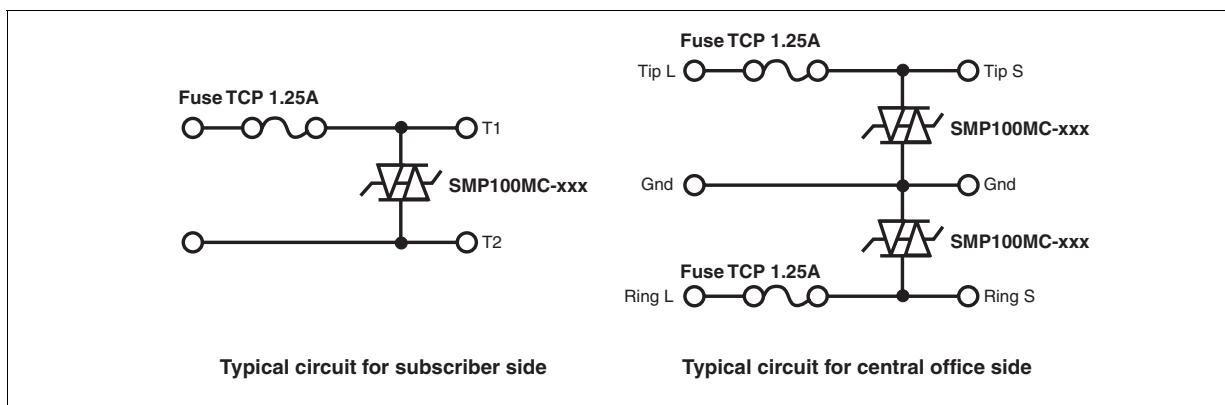


**APPLICATION NOTE**

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.

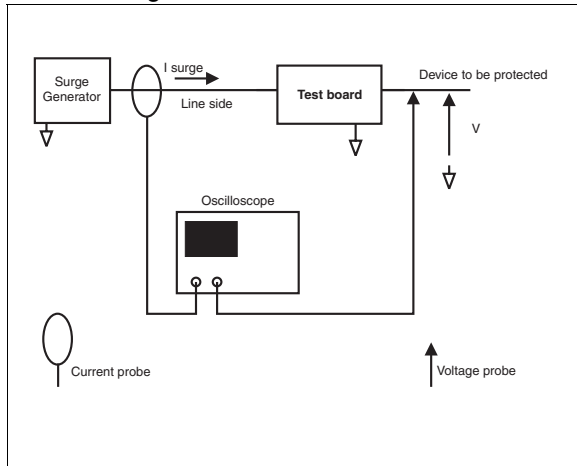


In such a stage, parallel function is assumed by one or several Trisil, and is used to protect against short duration surge (lightning). During this kind of surges the Trisil limits the voltage across the device to be protected at its break over value and then fires. The fuse assumes the series function,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

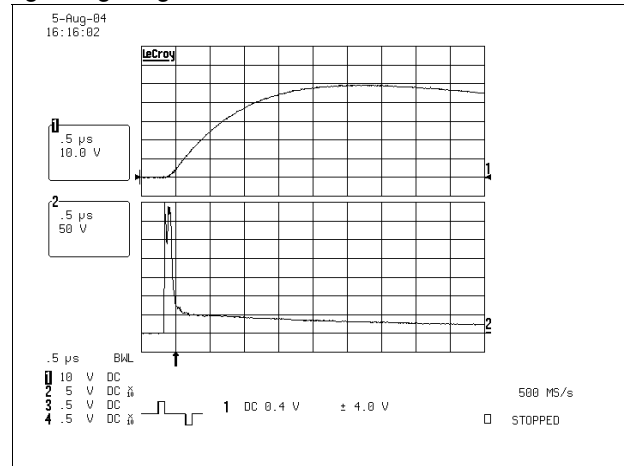


## SMP100MC

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:

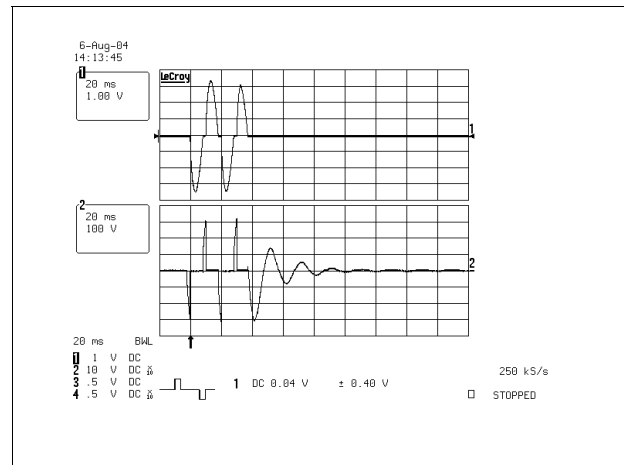
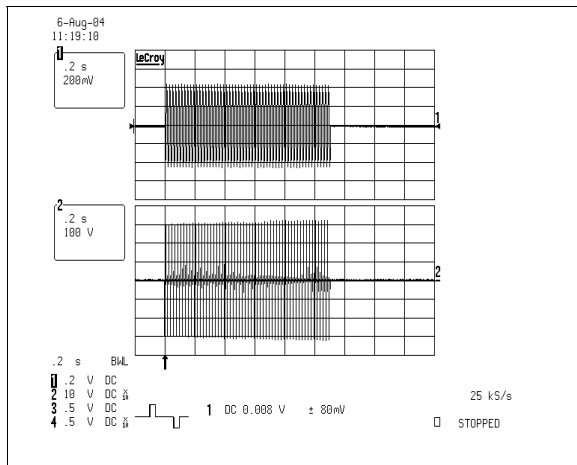
2/10µs + and -2.5 and 5kV 500A (10 pulses of each polarity),  $T_{amb} = 25^{\circ}\text{C}$

### Test result:

Fuse and Trisil OK after test in accordance with GR1089 requirements

Following curve shows Trisil action while the fuse remains operational.

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



### Test conditions:

600V 3A 1.1s (first level),  $T_{amb} = 25^{\circ}\text{C}$

### Test result:

Fuse and Trisil OK after test in accordance with GR1089 requirements

### Test conditions:

277V 25A (second level),  $T_{amb} = 25^{\circ}\text{C}$

### Test result:

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

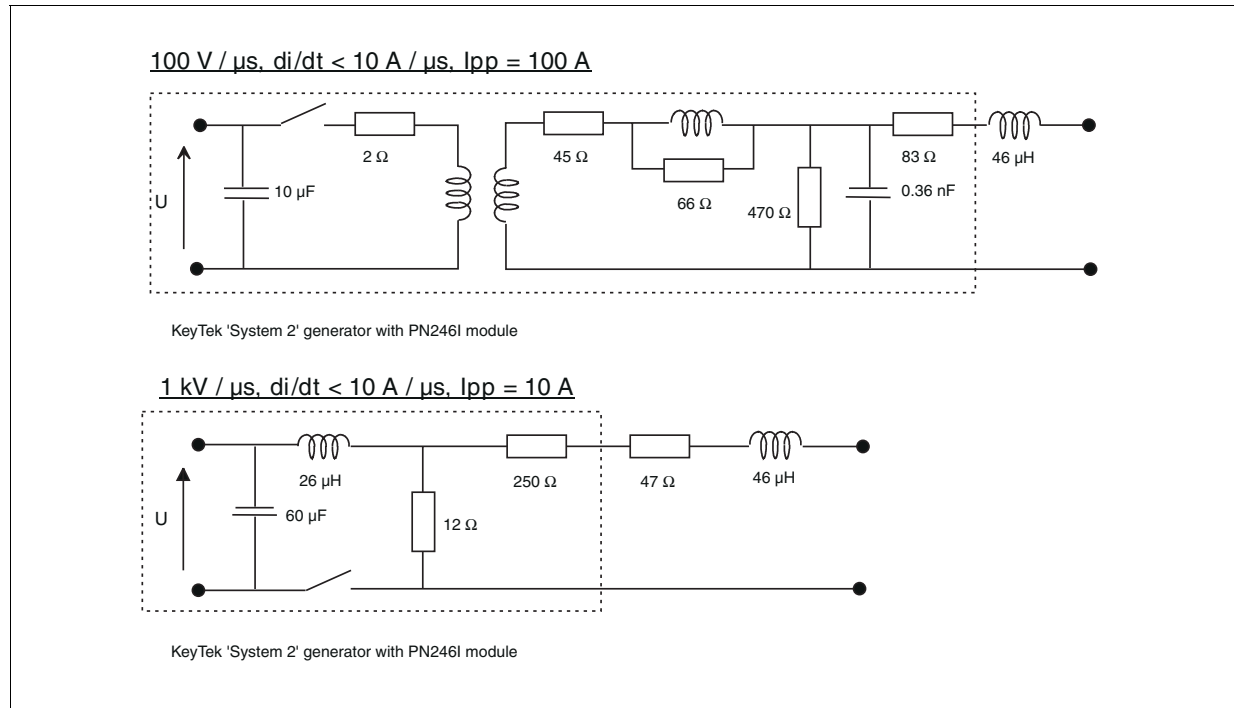
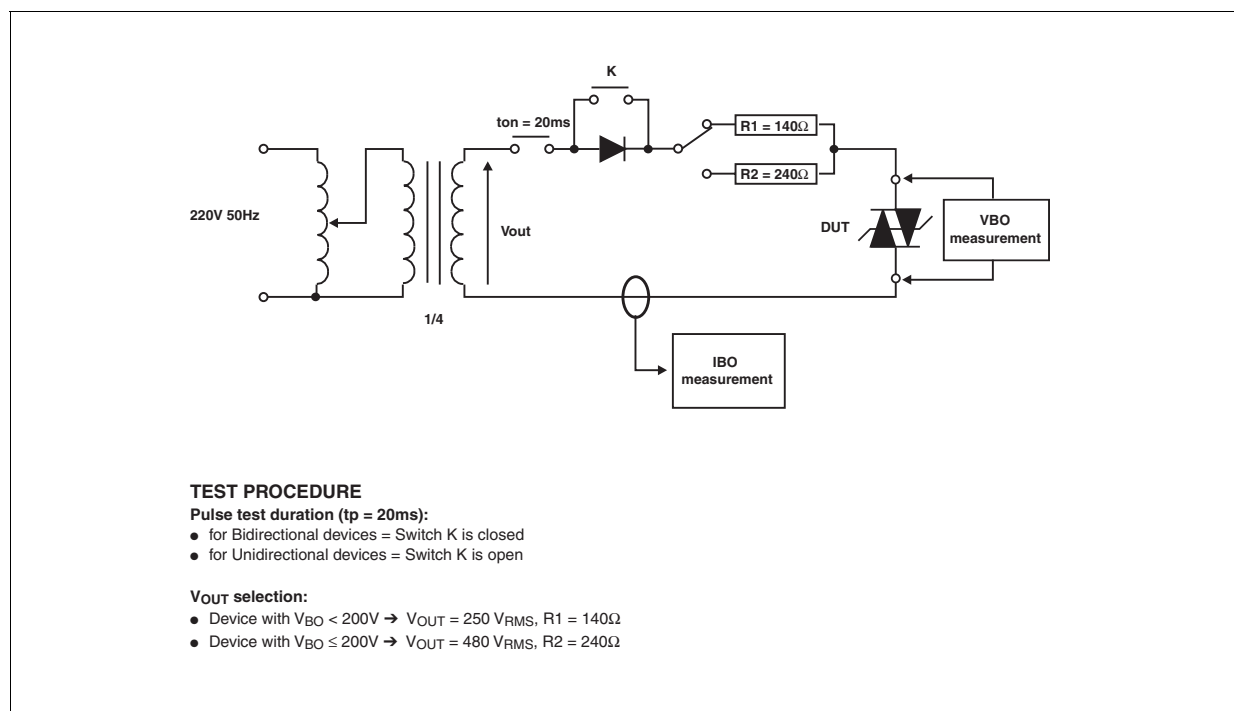
Figure 10: Test circuit 1 for Dynamic  $I_{BO}$  and  $V_{BO}$  parametersFigure 11: Test circuit 2 for  $I_{BO}$  and  $V_{BO}$  parameters

Figure 12: Test circuit 3 for dynamic I<sub>H</sub> parameter

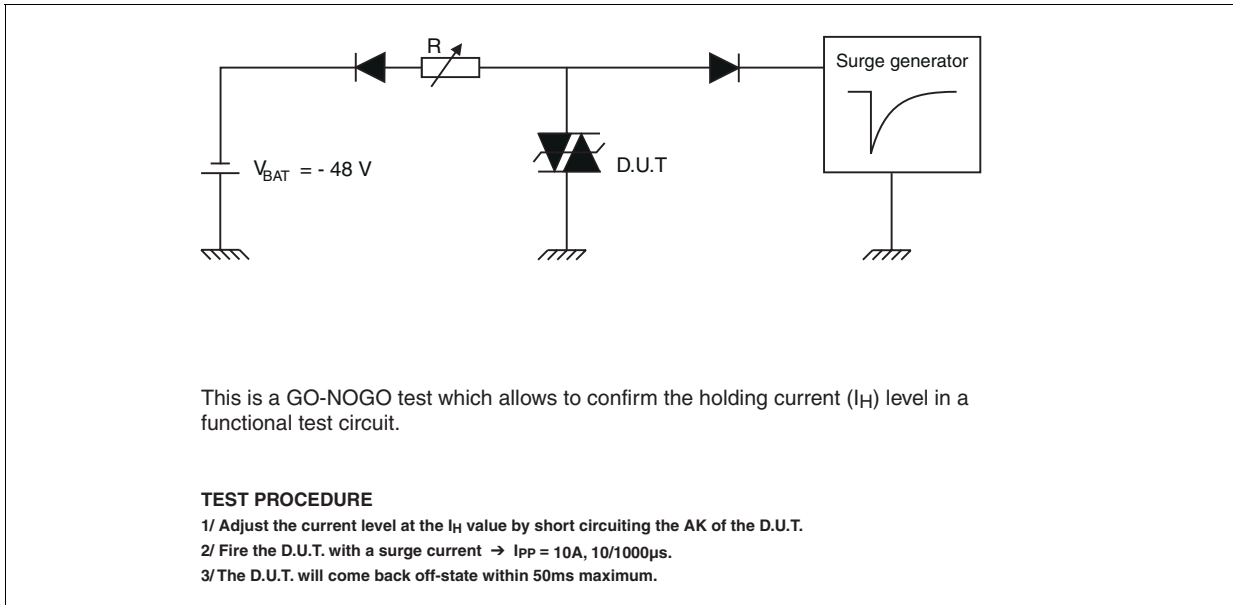


Figure 13: Order Code

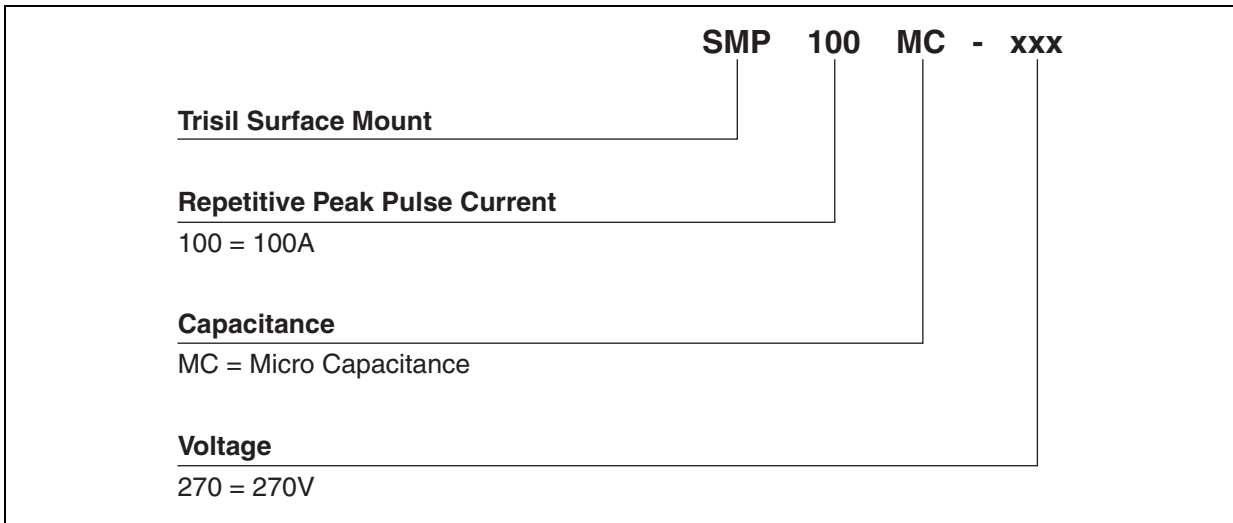




Figure 14: SMB Package Mechanical data

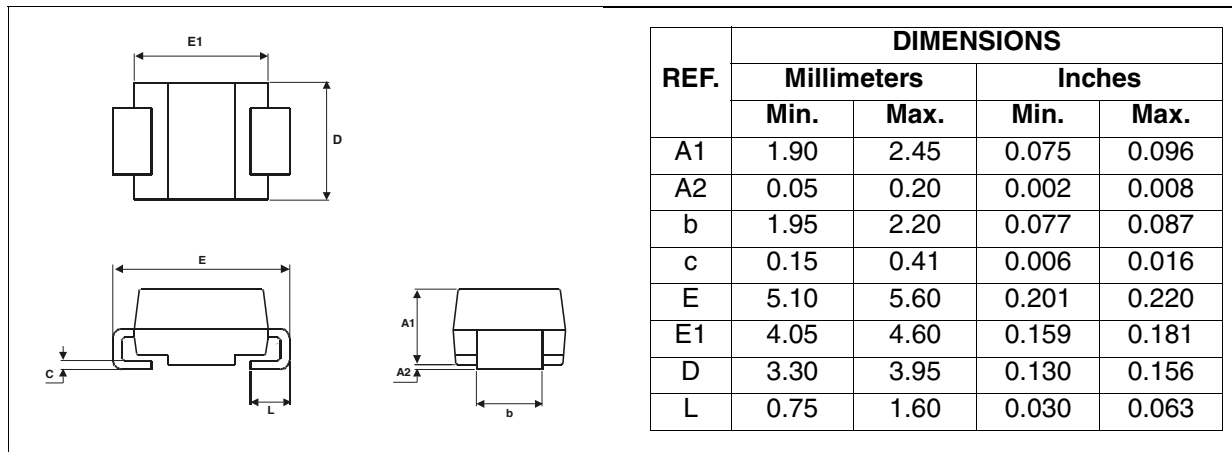


Figure 15: Foot Print Dimensions (in millimeters)

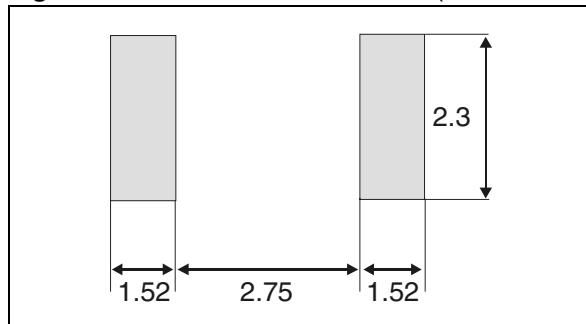


Table 5: Ordering Information

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.

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