

# SMP100MC

## TRISIL™ FOR TELECOM EQUIPMENT PROTECTION

#### **FEATURES**

Bidirectional crowbar protectionVoltage: range from 140V to 400V

■ Low V<sub>BO</sub> / V<sub>R</sub> ratio

■ Micro capacitance from 15pF to 30pF @ 50V

Low leakage current : I<sub>R</sub> = 2µA max
 Holding current: I<sub>H</sub> = 150 mA min
 Repetitive peak pulse current : I<sub>PP</sub> = 100 A (10/1000µs)

#### **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...).

SMP100MC series tested and confirmed compatible with Cooper Bussmann Telecom Circuit Protector 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.

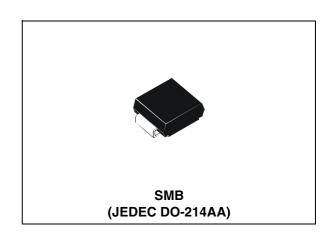
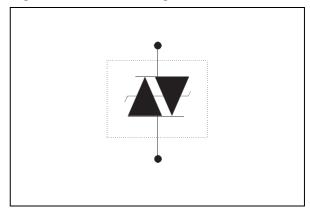


Table 1: Order Codes

Part Number	Marking
SMP100MC-140	ML14
SMP100MC-160	ML16
SMP100MC-200	ML20
SMP100MC-230	ML23
SMP100MC-270	ML27
SMP100MC-320	ML32
SMP100MC-360	ML36
SMP100MC-400	ML40

Figure 1: Schematic Diagram



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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 1000	2/10 μs 10/1000 μs	500 100	2/10 μs 10/1000 μs	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
ITU-T-K20 (IEC61000-4-2)	8000 15000	1/60 ns	ESD contact discharge ESD air discharge		0
VDE0433	4000 2000	10/700 μs	100 50 5/310 μs		0
VDE0878	4000 2000	1.2/50 µs	100 50	1/20 µs	0
IEC61000-4-5	4000 4000	10/700 μs 1.2/50 μs	100 100	5/310 μs 8/20 μs	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
FCC Part 68, lightning surge type B	1000	9/720 μs	25	5/320 µs	0

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

Symbol	Parameter	Value	Unit		
Ірр	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	А	
I <sub>FS</sub>	Fail-safe mode : maximum current (note 1)	5	kA		
I <sub>TSM</sub>	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	А	
l <sup>2</sup> t	I <sup>2</sup> t value for fusing	20 21	A <sup>2</sup> s		
T <sub>stg</sub> T <sub>j</sub>	Storage temperature range Maximum junction temperature	-55 to 150 150	°C		
TL	Maximum lead temperature for soldering during 10 s. 260				

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

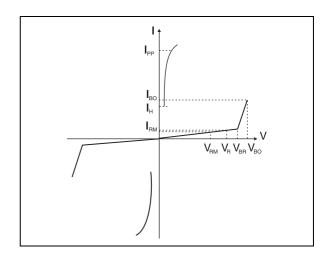
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**Table 4: Thermal Resistances** 

Symbol	Parameter	Value	Unit
R <sub>th(j-a)</sub>	Junction to ambient (with recommended footprint)	100	°C/W
R <sub>th(j-l)</sub>	Junction to leads	20	°C/W

**Table 5: Electrical Characteristics**  $(T_{amb} = 25^{\circ}C)$ 

Symbol	Parameter
V <sub>RM</sub>	Stand-off voltage
V <sub>BR</sub>	Breakdown voltage
V <sub>BO</sub>	Breakover voltage
I <sub>RM</sub>	Leakage current
I <sub>PP</sub>	Peak pulse current
I <sub>BO</sub>	Breakover current
lΗ	Holding current
VR	Continuous reverse voltage
I <sub>R</sub>	Leakage current at V <sub>R</sub>
С	Capacitance



	I <sub>RM</sub> @	V <sub>RM</sub>	I <sub>R</sub> @	V <sub>R</sub>	Dynamic V <sub>BO</sub>		atic @ I <sub>BO</sub>	Ι <sub>Η</sub>	С	С
Types	ma	ax.	max.		max.	max.	max.	min.	typ.	typ.
			no	te1	note 2	not	e 3	note 4	note 5	note 6
	μA	V	μA	V	V	V	mA	mA	pF	pF
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	2	207	5	230	295	285	800	150	20	40
SMP100MC-270		243	3	270	345	335	800	150	20	40
SMP100MC-320		290		320	400	390			15	35
SMP100MC-360		325		360	460	450			15	35
SMP100MC-400		360		400	540	530	1		15	30

Note 1: IR measured at VR guarantee VBR 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<sub>R</sub> = 50V bias, V<sub>RMS</sub>=1V, F=1MHz
Note 6: V<sub>R</sub> = 2V bias, V<sub>RMS</sub>=1V, F=1MHz

Figure 2: Pulse waveform

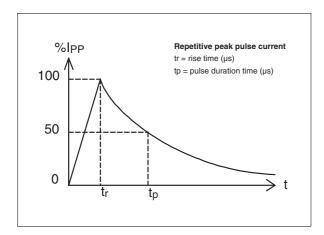


Figure 4: On-state voltage versus on-state current (typical values)

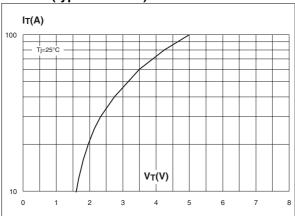


Figure 6: Relative variation of breakover voltage versus junction temperature

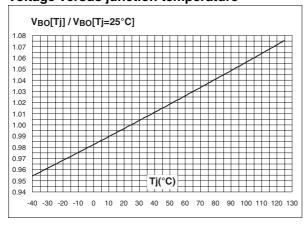


Figure 3: Non repetitive surge peak on-state current versus overload duration

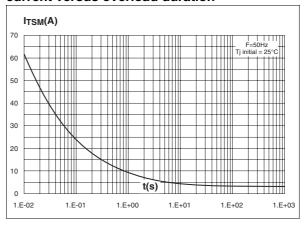


Figure 5: Relative variation of holding current versus junction temperature

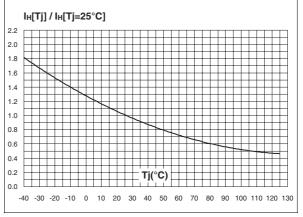
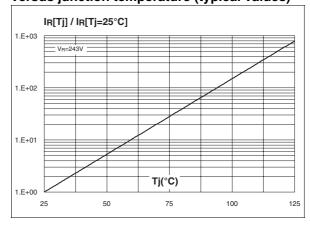


Figure 7: Relative variation of leakage current versus junction temperature (typical values)



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

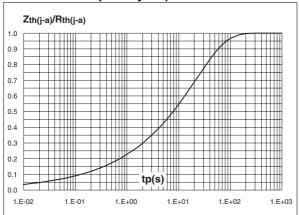
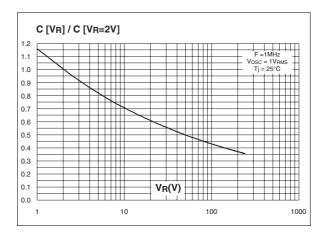
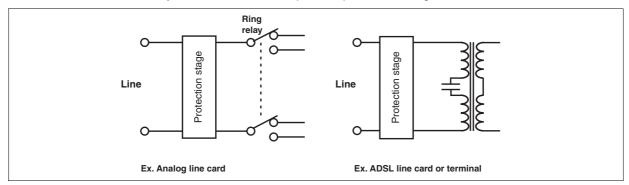


Figure 9: Relative variation of junction capacitance versus reverse voltage applied (typical values)

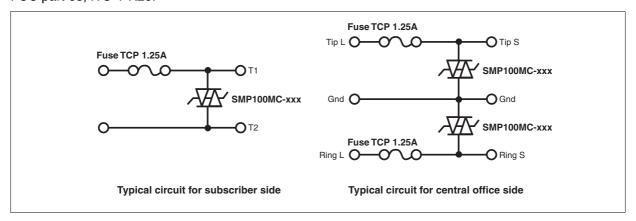


#### APPLICATION NOTE

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.

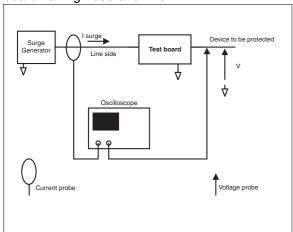


In such a stage, parallel function is assumed by one or several Trisil, and is used to protect against short duration surge (lightning). During this kind of surges the Trisil limits the voltage across the device to be protected at its break over value and then fires. The fuse assumes the series function,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



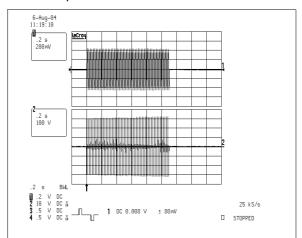
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Following figure shows the test method of the board having Fuse and Trisil.



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.

Following curve shows Trisil action while the fuse remains operational.



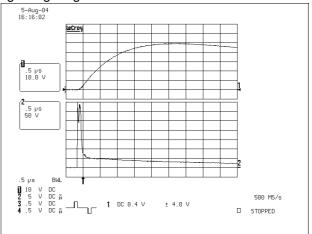
#### **Test conditions:**

600V 3A 1.1s (first level), T<sub>amb</sub> = 25°C

#### **Test result:**

Fuse and Trisil OK after test in accordance with GR1089 requirements

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



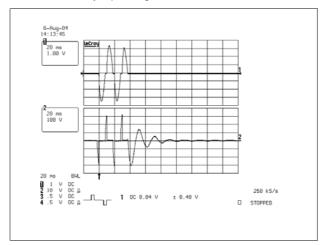
#### **Test conditions:**

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

#### 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<sub>amb</sub> = 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

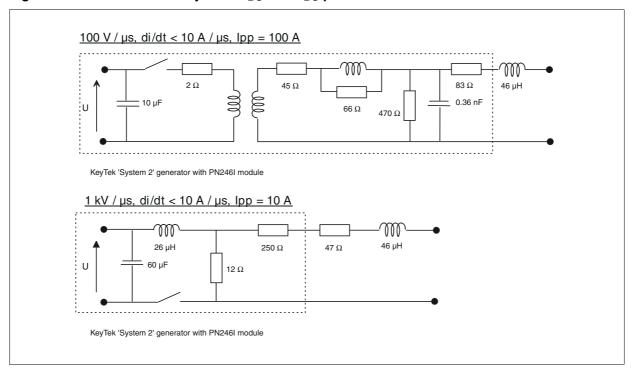


Figure 11: Test circuit 2 for  $I_{BO}$  and  $V_{BO}$  parameters

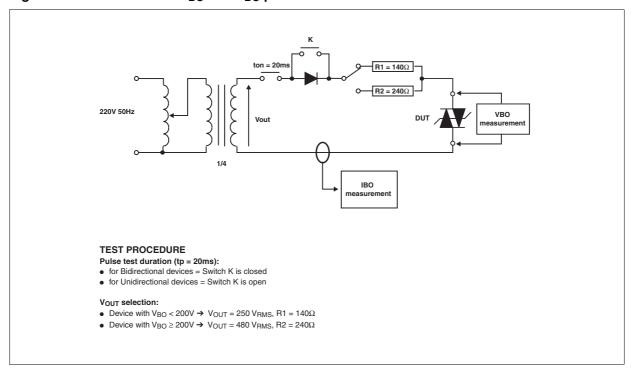


Figure 12: Test circuit 3 for dynamic I<sub>H</sub> parameter

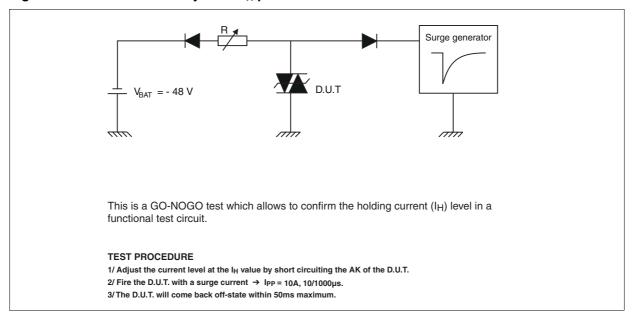


Figure 13: Ordering Information Scheme

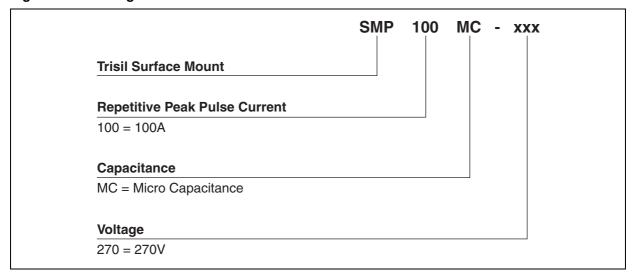
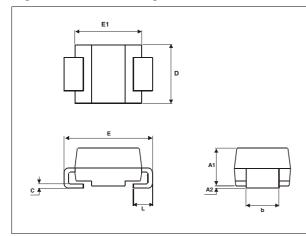
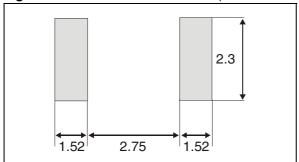


Figure 14: SMB Package Mechanical data



		DIMEN	ISIONS	
REF.	Millin	neters	Inc	hes
	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
С	0.15	0.41	0.006	0.016
Е	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 6: Ordering Information** 

Part Number	Marking	Package	Weight	Base qty	Delivery mode
SMP100MC-140	ML14				
SMP100MC-160	ML16				
SMP100MC-200	ML20				
SMP100MC-230	ML23	SMB	0.11.0	2500	Tape & reel
SMP100MC-270	ML27	SIVID	0.11 g	2500	Tape & Teel
SMP100MC-320	ML32				
SMP100MC-360	ML36		i		
SMP100MC-400	ML40				

**Table 7: 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.
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)

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