

## APPLICATIONS

- ✓ Ethernet - 10 Base T
- ✓ Cellular Phones
- ✓ Handheld Electronics
- ✓ FireWire & USB Interfaces

## IEC COMPATIBILITY (EN61000-4)

- ✓ 61000-4-2 (ESD): Air - 15kV, Contact - 8kV
- ✓ 61000-4-4 (EFT): 40A - 5/50ns
- ✓ 61000-4-5 (Surge): 12A, 8/20 $\mu$ s - Level 1(Line-Gnd) & Level 2(Line-Line)

## FEATURES

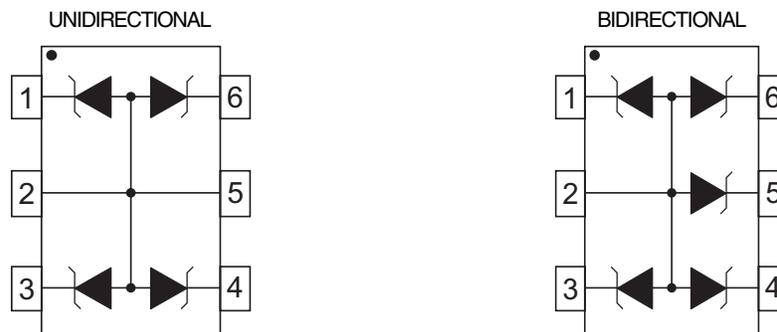
- ✓ 350 Watts Peak Pulse Power per Line (tp=8/20 $\mu$ s)
- ✓ Monolithic Design
- ✓ Available in Multiple Voltage Types Ranging From 5V to 24V
- ✓ Protect 4 Lines
- ✓ ESD Protection > 25 kilovolts
- ✓ Low Clamping Voltage
- ✓ Unidirectional & Bidirectional Configurations
- ✓ Low Leakage Current
- ✓ RoHS Compliant

## MECHANICAL CHARACTERISTICS

- ✓ Molded JEDEC SOT-23-6 Package
- ✓ Weight 16 milligrams (Approximate)
- ✓ Available in Lead-Free Pure-Tin Plating(Annealed)
- ✓ Solder Reflow Temperature:  
Pure-Tin - Sn, 100: 260-270°C
- ✓ Consult Factory for Leaded Device Availability
- ✓ Flammability Rating UL 94V-0
- ✓ 8mm Tape and Reel Per EIA Standard 481
- ✓ Marking: Marking Code & Pin One Defined By DOT on Package


**SOT-23-6**

## PIN CONFIGURATIONS



# SMS05 thru SMS24C

## DEVICE CHARACTERISTICS

### MAXIMUM RATINGS @ 25°C Unless Otherwise Specified

PARAMETER	SYMBOL	VALUE	UNITS
Peak Pulse Power ( $t_p = 8/20\mu\text{s}$ ) - See Figure 1	$P_{PP}$	350	Watts
Operating Temperature	$T_L$	-55 to 150	°C
Storage Temperature	$T_{STG}$	-55 to 150	°C

### ELECTRICAL CHARACTERISTICS PER LINE @ 25°C Unless Otherwise Specified

PART NUMBER (See Notes 1-3)	DEVICE MARKING	RATED STAND-OFF VOLTAGE  $V_{WM}$ VOLTS	MINIMUM BREAKDOWN VOLTAGE  @ 1mA $V_{(BR)}$ VOLTS	MAXIMUM CLAMPING VOLTAGE (See Fig. 2)  @ $I_p = 1A$ $V_C$ VOLTS	MAXIMUM CLAMPING VOLTAGE (See Fig. 2)  @ 8/20 $\mu\text{s}$ $V_C @ I_{PP}$	MAXIMUM LEAKAGE CURRENT  @ $V_{WM}$ $I_b$ $\mu\text{A}$	TYPICAL CAPACITANCE (See Note 4)  0V @ 1 MHz $C_j$ pF
SMS05	PRH	5.0	6.0	9.8	21.0V @ 17.0A	20	150
SMS05C	PRL	5.0	6.0	9.8	21.0V @ 17.0A	20	150
SMS12	PRI	12.0	13.3	19	29.2V @ 12.0A	1	80
SMS12C	PRM	12.0	13.3	19	29.2V @ 12.0A	1	80
SMS15	PRJ	15.0	16.7	24	34.6V @ 10.0A	1	50
SMS15C	PRN	15.0	16.7	24	34.6V @ 10.0A	1	50
SMS24	PRK	24.0	26.7	40	58.3V @ 6.0A	1	40
SMS24C	PRO	24.0	26.7	40	58.3V @ 6.0A	1	40

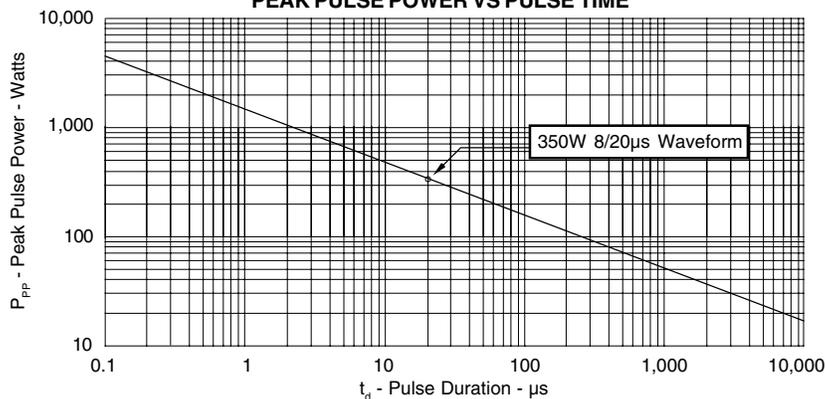
**Note 1:** Part numbers with an additional "C" suffix are bidirectional devices, i.e., SMS05C.

**Note 2:** *Unidirectional Only:* Test between pin 1 to 2 or 5, 4 to 2 or 5, 6 to 2 or 5, 3 to 2 or 5.

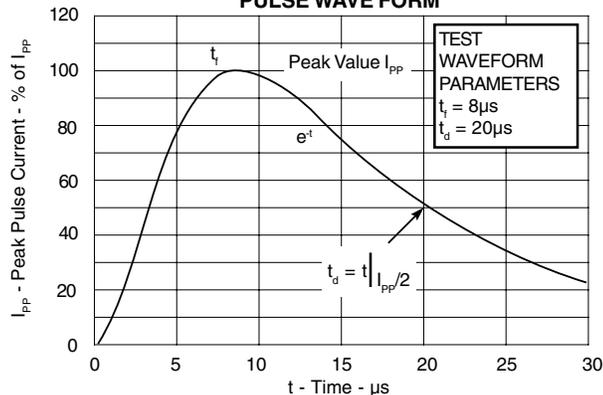
**Note 3:** *Bidirectional Only:* Test between pin 5 to 1 or 3 or 4 or 6. Electrical characteristics apply in both directions.

**Note 4:** *Unidirectional Only:* Capacitance measured between pins 1, 3, 4, 6, to 2.

**FIGURE 1**  
PEAK PULSE POWER VS PULSE TIME

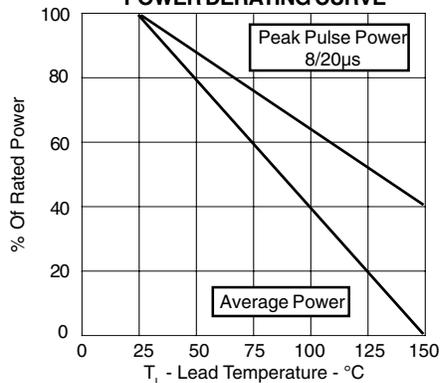


**FIGURE 2**  
PULSE WAVE FORM

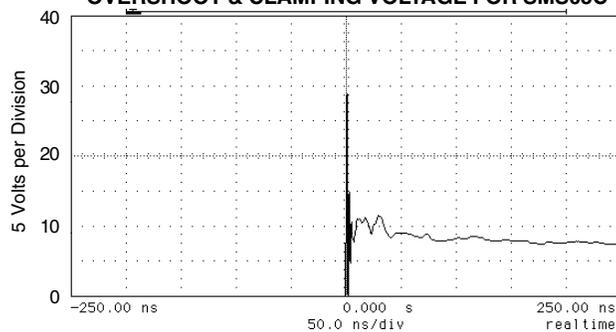


GRAPHS

**FIGURE 3  
POWER DERATING CURVE**

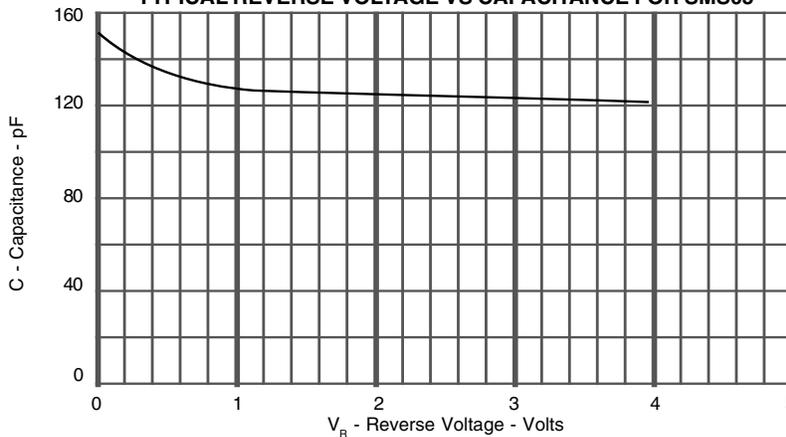


**FIGURE 4  
OVERSHOOT & CLAMPING VOLTAGE FOR SMS05C**



ESD Test Pulse: 25 kilovolt, 1/30ns (waveform)

**FIGURE 5  
TYPICAL REVERSE VOLTAGE VS CAPACITANCE FOR SMS05**



## APPLICATION NOTE

The SMS Series are TVS arrays designed to protect I/O or data lines from the damaging effects of ESD or EFT. This product series provides both unidirectional and bidirectional protection, with a surge capability of 350 Watts  $P_{PP}$  per line for an 8/20 $\mu$ s waveform and ESD protection > 25 kilovolts.

### UNIDIRECTIONAL COMMON-MODE CONFIGURATION (Figure 1)

The SMS Series provides up to four (4) lines of protection in a common-mode configuration as depicted in Figure 1.

Circuit connectivity is as follows:

- ✓ Line 1 is connected to Pin 1.
- ✓ Line 2 is connected to Pin 3.
- ✓ Line 3 is connected to Pin 4.
- ✓ Line 4 is connected to Pin 6.
- ✓ Pin 5 is connected to ground.
- ✓ Pin 2 is not connected.

### BIDIRECTIONAL COMMON-MODE CONFIGURATION (Figure 2)

The SMSxxC Series provides up to four (4) lines of protection in a common-mode configuration as depicted in Figure 2.

Circuit connectivity is as follows:

- ✓ Line 1 is connected to Pin 1.
- ✓ Line 2 is connected to Pin 3.
- ✓ Line 3 is connected to Pin 4.
- ✓ Line 4 is connected to Pin 5.
- ✓ Pin 6 is connected to ground.
- ✓ Pin 2 is not connected.

### CIRCUIT BOARD LAYOUT RECOMMENDATIONS

Circuit board layout is critical for Electromagnetic Compatibility (EMC) protection. The following guidelines are recommended:

- ✓ The protection device should be placed near the input terminals or connectors, the device will divert the transient current immediately before it can be coupled into the nearby traces.
- ✓ The path length between the TVS device and the protected line should be minimized.
- ✓ All conductive loops including power and ground loops should be minimized.
- ✓ The transient current return path to ground should be kept as short as possible to reduce parasitic inductance.
- ✓ Ground planes should be used whenever possible. For multilayer PCBs, use ground vias.

Figure 1 - Unidirectional Configuration  
Common-Mode I/O Port Protection

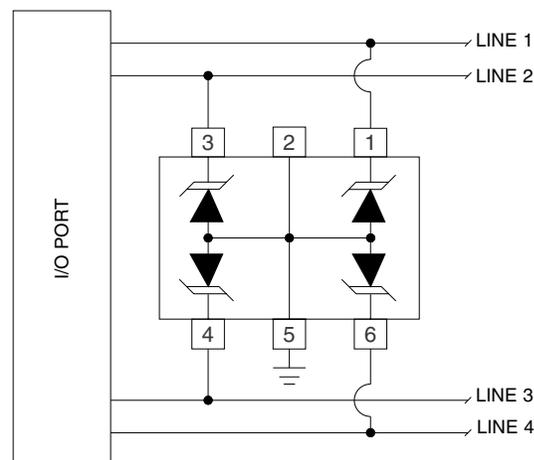
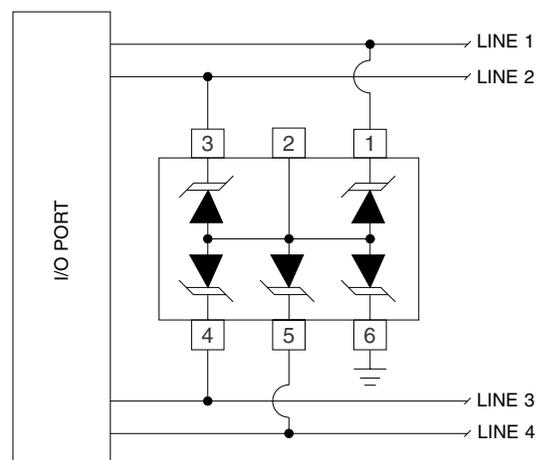


Figure 2 - Bidirectional Configuration  
Common-Mode I/O Port Protection



# SMS05 thru SMS24C

## SOT-23-6 PACKAGE OUTLINE & DIMENSIONS

PACKAGE OUTLINE		SOT-23-6			
PACKAGE DIMENSIONS					
DIM	MILLIMETERS		INCHES		
	MIN	MAX	MIN	MAX	
A	2.80	3.05	0.110	0.120	
B	1.50	1.75	0.059	0.070	
C	0.90	1.30	0.036	0.051	
D	0.35	0.50	0.014	0.020	
E	0.85	1.05	0.033	0.040	
F	1.70	2.10	0.067	0.083	
G	0.90	1.45	0.036	0.057	
J	0.09	0.20	0.003	0.008	
K	2.60	3.00	0.102	0.118	
L	0.20 TYP	0.20 TYP	0.007 TYP	0.007 TYP	
M	0.35	0.55	0.014	0.022	

MOUNTING PAD		
TYPICAL		
DIM	Millimeters	Inches
1	0.70	0.028
2	1.90	0.074
3	0.95	0.037
4	2.40	0.094
5	1.00	0.039

MOUNTING PAD		

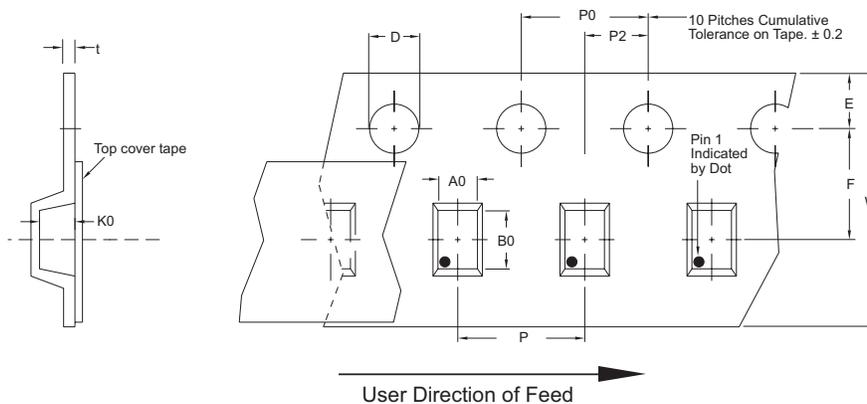
  

NOTES		
1. Dimensioning and tolerances per ANSI Y14.5M, 1985.		
2. Controlling Dimension: Inches		
3. Dimensions are exclusive of mold flash and metal burrs.		
TAPE & REEL/BULK ORDERING NOMENCLATURE		
1. Surface mount product is taped and reeled in accordance with EIA-481.		
2. Suffix -T7 = 7 Inch Reel - 3,000 pieces per 8mm tape, i.e., <i>SMS05-T7</i>		
3. Suffix -LF = Lead-Free, Pure-Tin Plating, i.e., <i>SMS05-LF-T7</i> .		

Outline & Dimensions: Rev 2 - 10/05, 06013

### Tape & Reel Specifications (Dimensions in millimeters)

Reel Dia.	Tape Width	A0	B0	K0	D	E	F	W	P0	P2	P	tmax
178mm (7")	8mm	3.20 ± 0.10	3.20 ± 0.10	1.65 ± 0.10	1.50 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	8.00 ± 0.30	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	0.25



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