

## PROTECTION PRODUCTS

### Description

The SMS series of TVS arrays are designed to protect sensitive electronics from damage or latch-up due to ESD and other voltage-induced transient events. Each device will protect up to four lines. They are available with operating voltages of 5V, 12V, 15V and 24V. They are unidirectional devices and may be used on lines where the signal polarities are above ground.

TVS diodes are solid-state devices designed specifically for transient suppression. They feature large cross-sectional area junctions for conducting high transient currents. They offer desirable characteristics for board level protection including fast response time, low operating and clamping voltage and no device degradation.

The SMS series devices may be used to meet the immunity requirements of IEC 61000-4-2, level 4. The low cost SOT23-6L package makes them ideal for use in portable electronics such as cell phones, PDA's, and notebook computers.

### Features

- ◆ Transient protection for data lines to **IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact)**  
**IEC 61000-4-4 (EFT) 40A (5/50ns)**  
**IEC 61000-4-5 (Lightning) 24A (8/20µs)**
- ◆ Small package for use in portable electronics
- ◆ Protects four I/O lines
- ◆ Working voltages: 5V, 12V, 15V and 24V
- ◆ Low leakage current
- ◆ Low operating and clamping voltages
- ◆ Solid-state silicon avalanche technology

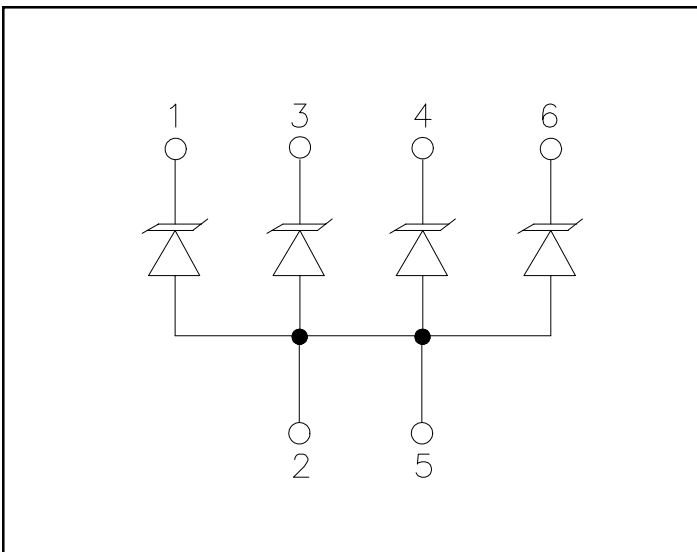
### Mechanical Characteristics

- ◆ EIAJ SOT23-6L package
- ◆ Molding compound flammability rating: UL 94V-0
- ◆ Marking : Marking Code
- ◆ Packaging : Tape and Reel per EIA 481

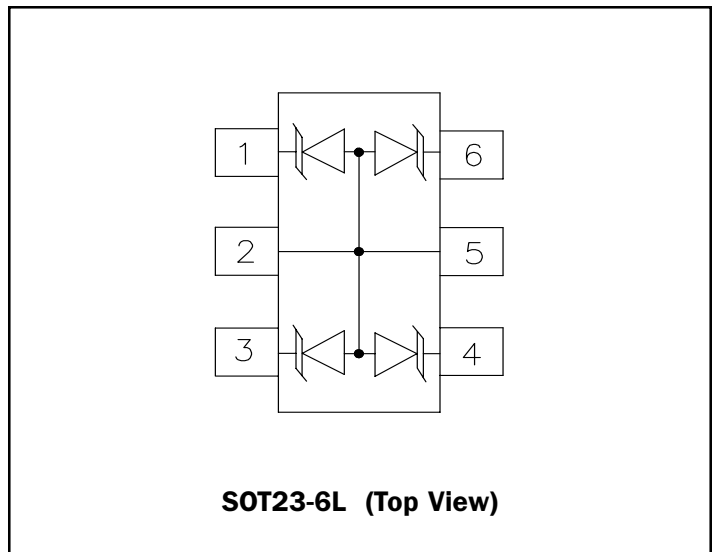
### Applications

- ◆ Cell phone Handsets and Accessories
- ◆ Microprocessor Based Equipment
- ◆ Personal Digital Assistants (PDA's) and Pagers
- ◆ Desktops PC and Servers
- ◆ Notebook, Laptop, and Palmtop Computers
- ◆ Portable Instrumentation
- ◆ Peripherals
- ◆ MP3 Players
- ◆ Cordless Phones

### Circuit Diagram



### Schematic & PIN Configuration



**PROTECTION PRODUCTS**
**Absolute Maximum Rating**

Rating	Symbol	Value	Units
Peak Pulse Power (tp = 8/20μs)	P <sub>pk</sub>	350	Watts
Peak Pulse Current (tp = 8/20μs)	I <sub>pp</sub>	24	A
ESD Voltage (HBM per IEC 61000-4-2)	V <sub>pp</sub>	>25	kV
Lead Soldering Temperature	T <sub>L</sub>	260 (10 sec.)	°C
Operating Temperature	T <sub>J</sub>	-55 to +125	°C
Storage Temperature	T <sub>STG</sub>	-55 to +150	°C

**Electrical Characteristics**
**SMS05**

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V <sub>RWM</sub>				5	V
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>t</sub> = 1mA	6			V
Reverse Leakage Current	I <sub>R</sub>	V <sub>RWM</sub> = 5V, T=25°C			20	μA
Clamping Voltage	V <sub>C</sub>	I <sub>pp</sub> = 5A, tp = 8/20μs			9.8	V
Clamping Voltage	V <sub>C</sub>	I <sub>pp</sub> = 24A, tp = 8/20μs			14.5	V
Junction Capacitance	C <sub>J</sub>	Between I/O Pins and Gnd V <sub>R</sub> = 0V, f = 1MHz		325	400	pF

**SMS12**

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V <sub>RWM</sub>				12	V
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>t</sub> = 1mA	13.3			V
Reverse Leakage Current	I <sub>R</sub>	V <sub>RWM</sub> = 12V, T=25°C			1	μA
Clamping Voltage	V <sub>C</sub>	I <sub>pp</sub> = 5A, tp = 8/20μs			19	V
Clamping Voltage	V <sub>C</sub>	I <sub>pp</sub> = 15A, tp = 8/20μs			23	V
Junction Capacitance	C <sub>J</sub>	Between I/O Pins and Gnd V <sub>R</sub> = 0V, f = 1MHz		135	150	pF

**PROTECTION PRODUCTS**
**Electrical Characteristics (Continued)**

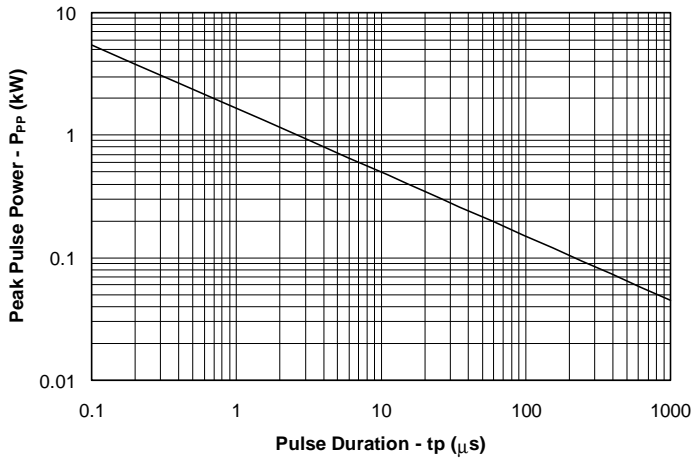
<b>SMS15</b>						
<b>Parameter</b>	<b>Symbol</b>	<b>Conditions</b>	<b>Minimum</b>	<b>Typical</b>	<b>Maximum</b>	<b>Units</b>
Reverse Stand-Off Voltage	$V_{RWM}$				15	V
Reverse Breakdown Voltage	$V_{BR}$	$I_t = 1mA$	16.7			V
Reverse Leakage Current	$I_R$	$V_{RWM} = 15V, T=25^{\circ}C$			1	$\mu A$
Clamping Voltage	$V_C$	$I_{PP} = 5A, tp = 8/20\mu s$			24	V
Clamping Voltage	$V_C$	$I_{PP} = 12A, tp = 8/20\mu s$			29	V
Junction Capacitance	$C_j$	Between I/O Pins and Gnd $V_R = 0V, f = 1MHz$		100	125	pF

<b>SMS24</b>						
<b>Parameter</b>	<b>Symbol</b>	<b>Conditions</b>	<b>Minimum</b>	<b>Typical</b>	<b>Maximum</b>	<b>Units</b>
Reverse Stand-Off Voltage	$V_{RWM}$				24	V
Reverse Breakdown Voltage	$V_{BR}$	$I_t = 1mA$	26.7			V
Reverse Leakage Current	$I_R$	$V_{RWM} = 24V, T=25^{\circ}C$			1	$\mu A$
Clamping Voltage	$V_C$	$I_{PP} = 5A, tp = 8/20\mu s$			40	V
Clamping Voltage	$V_C$	$I_{PP} = 8A, tp = 8/20\mu s$			44	V
Junction Capacitance	$C_j$	Between I/O Pins and Gnd $V_R = 0V, f = 1MHz$		60	75	pF

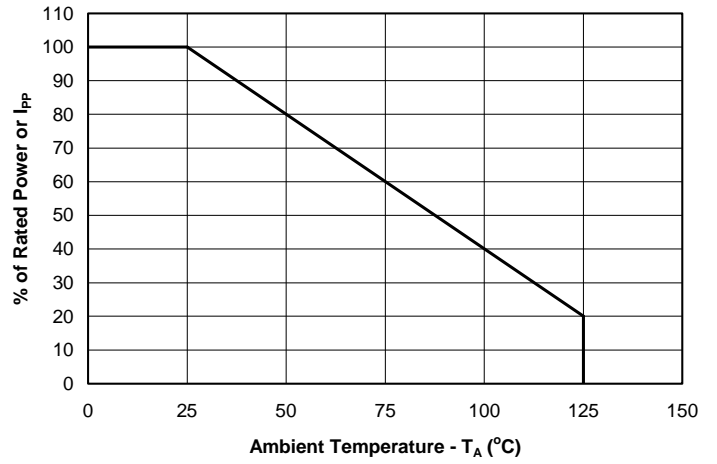
## PROTECTION PRODUCTS

### Typical Characteristics

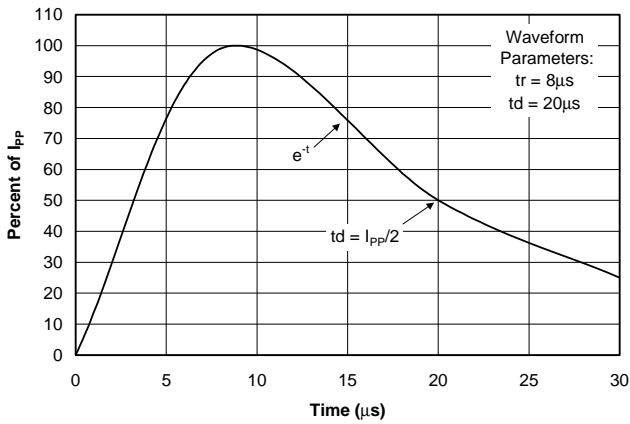
#### Non-Repetitive Peak Pulse Power vs. Pulse Time



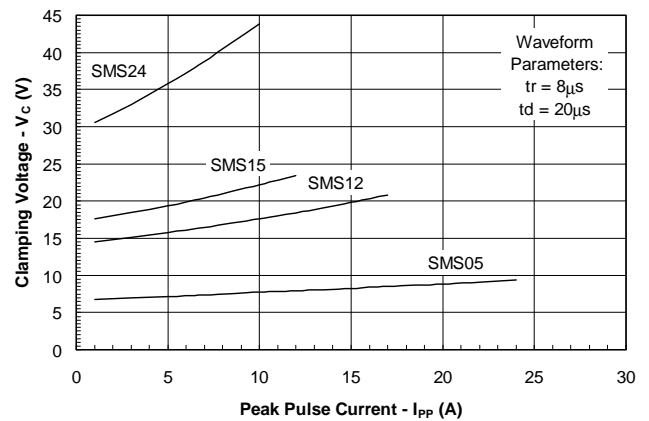
#### Power Derating Curve



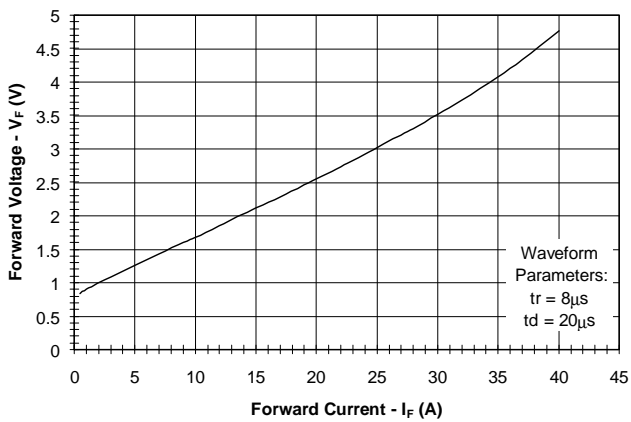
#### Pulse Waveform



#### Clamping Voltage vs. Peak Pulse Current



#### Forward Voltage vs. Forward Current



## PROTECTION PRODUCTS

### Applications Information

#### Device Connection for Protection of Four Data Lines

The SMSxx is designed to protect up to four unidirectional data lines. The device is connected as follows:

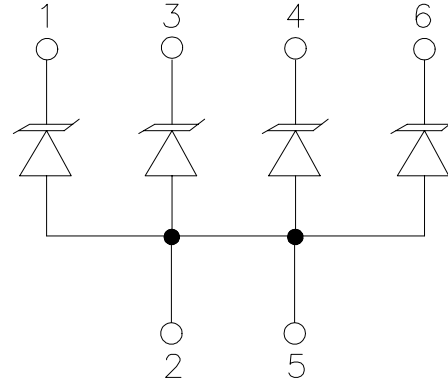
1. Unidirectional protection of four I/O lines is achieved by connecting pins 1, 3, 4 and 6 to the data lines. Pin 2 and 5 are connected to ground. The ground connections should be made directly to the ground plane for best results. The path length is kept as short as possible to reduce the effects of parasitic inductance in the board traces.

#### Circuit Board Layout Recommendations for Suppression of ESD

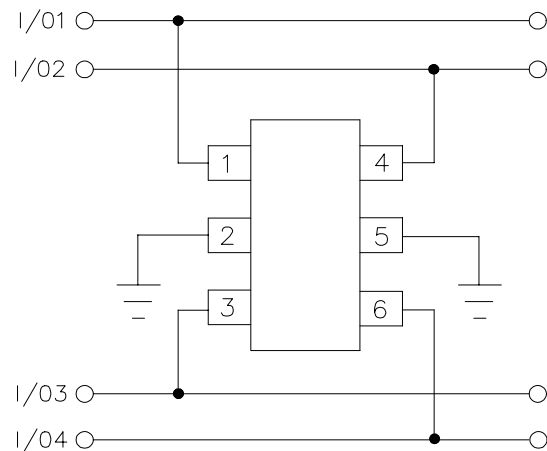
Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

- Place the SMSxx near the input terminals or connectors to restrict transient coupling.
- Minimize the path length between the SMSxx and the protected line.
- Minimize all conductive loops including power and ground loops.
- The ESD transient return path to ground should be kept as short as possible.
- Never run critical signals near board edges.
- Use ground planes whenever possible.

**SMSxx Circuit Diagram**

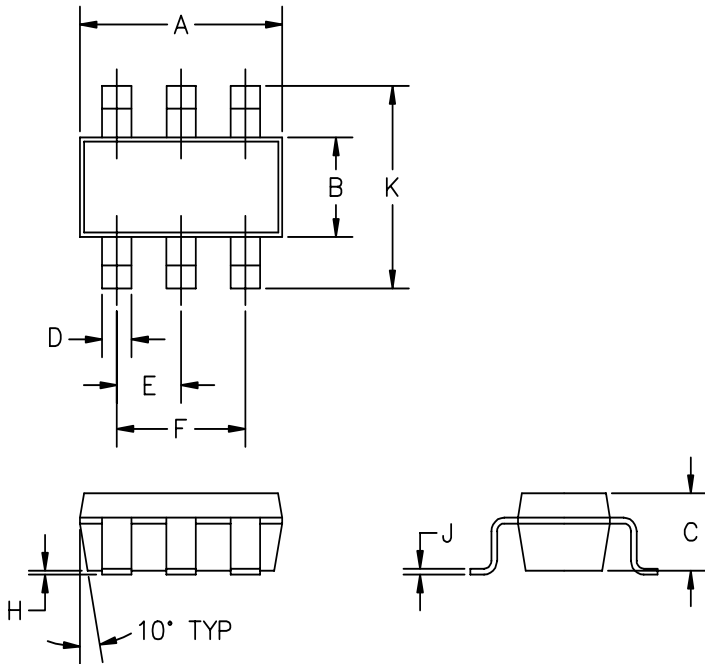


**Protection of Four Unidirectional Lines**



PROTECTION PRODUCTS

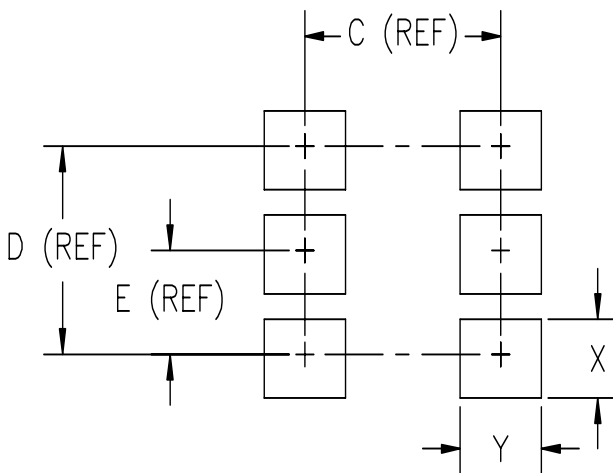
Outline Drawing - SOT23-6L



DIM <sup>N</sup>	DIMENSIONS (1)				NOTE
	INCHES		MM		
	MIN	MAX	MIN	MAX	
A	.110	.120	2.80	3.05	—
B	.059	.070	1.50	1.75	—
C	.036	.051	.90	1.30	—
D	.014	.020	.35	.50	—
E	.033	.040	.85	1.05	—
F	.067	.083	1.7	2.1	—
H	.0004	.006	.010	.150	—
J	.0035	.008	.090	.20	—
K	.102	.118	2.6	3.00	—

- ② PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH AND METAL BURR.
- ① CONTROLLING DIMENSIONS: MILLIMETERS.

Land Pattern - SOT23-6L



DIMENSIONS			
DIM <sup>N</sup>	INCHES	MM	NOTE
C	.094	2.4	—
D	.074	1.9	—
E	.037	.95	—
X	.028	.7	—
Y	.039	1.0	—

**PROTECTION PRODUCTS****Marking Codes**

<b>Part Number</b>	<b>Marking Code</b>
SMS05	05/05
SMS12	12/12
SMS15	15/15
SMS24	24/24

**Ordering Information**

<b>Part Number</b>	<b>Working Voltage</b>	<b>Qty per Reel</b>	<b>Reel Size</b>
SMS05.TC	5V	3,000	7 Inch
SMS05.TG	5V	10,000	13 Inch
SMS12.TC	12V	3,000	7 Inch
SMS12.TG	12V	10,000	13 Inch
SMS15.TC	15V	3,000	7 Inch
SMS15.TG	15V	10,000	13 Inch
SMS24.TC	24V	3,000	7 Inch
SMS24.TG	24V	10,000	13 Inch

**Note:**

(1) No suffix indicates tube pack.

**Contact Information**

Semtech Corporation  
Protection Products Division  
652 Mitchell Rd., Newbury Park, CA 91320  
Phone: (805)498-2111 FAX (805)498-3804