

# Transient Voltage Suppressors Array for ESD Protection

## SM712

### Features

- ◆ 400 watts peak pulse power ( $t_p=8/20\mu s$ )
- ◆ Protects two -7V to +12V lines
- ◆ Low capacitance
- ◆ Low clamping voltage
- ◆ Solid-state silicon avalanche technology

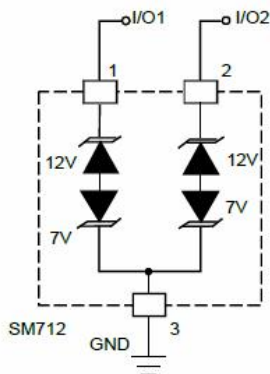
### IEC Compatibility (EN61000-4)

- ◆ IEC 61000-4-2 (ESD)  $\pm 15kV$  (air),  $\pm 8kV$  (contact)
- ◆ IEC 61000-4-4 (EFT) 40A (5/50ns)

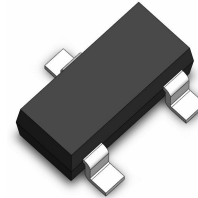
### Applications

- ◆ Protection of RS-485 transceivers with extended common-mode range
- ◆ Security systems
- ◆ Automatic Teller Machines
- ◆ HFC systems
- ◆ Networks

### Circuit Diagram



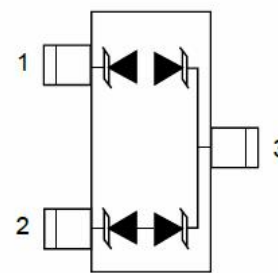
### SOT-23



### Mechanical Characteristics

- ◆ JEDEC SOT-23 package
- ◆ Molding compound flammability rating : UL 94V-0
- ◆ Packaging : Tape and Reel per EIA 481
- ◆ Quantity Per Reel : 3,000pcs
- ◆ Marking Code: 712

### Schematic & PIN Configuration



SOT-23 (Top View)

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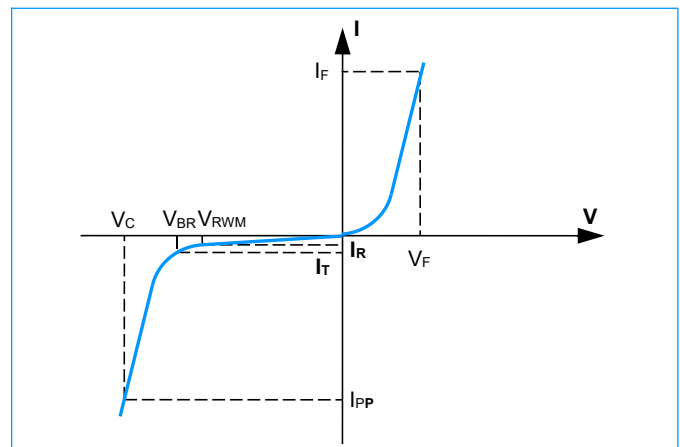
## SM712

### Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power ( $t_p=8/20\mu s$ )	$P_{PP}$	400	W
Lead Soldering Temperature	$T_L$	260 (10 sec.)	$^{\circ}C$
Peak Pulse Current ( $t_p=8/20\mu s$ )	$I_{PP}$	17/12	A
Operating Temperature	$T_J$	-55 to +125	$^{\circ}C$
Storage Temperature	$T_{STG}$	-55 to +150	$^{\circ}C$

### Electrical Parameters (T=25 $^{\circ}C$ )

Symbol	Parameter
$I_{PP}$	Maximum Reverse Peak Pulse Current
$V_C$	Clamping Voltage @ $I_{PP}$
$V_{RWM}$	Working Peak Reverse Voltage
$I_R$	Maximum Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Breakdown Voltage @ $I_T$
$I_T$	Test Current
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$



### Electrical Characteristics

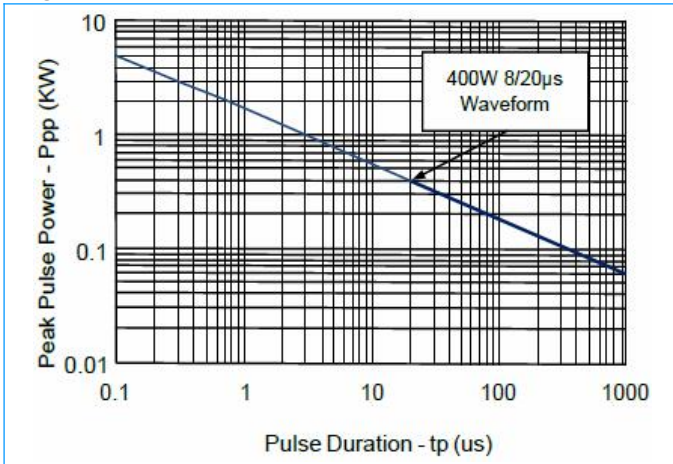
Parameter	Symbol	Conditions	Pins 1 to 3 and 2 to 3 (12V TVS)			Pins 3 to 1 and 3 to 2 (7V TVS)			Units
			Min	Typ	Max	Min	Typ	Max	
Reverse Stand-Off Voltage	$V_{RWM}$	Pin 3 to 1 or Pin 2 to 1	--	--	12	--	--	7	V
Reverse Breakdown Voltage	$V_{BR}$	$I_T = 1mA$	13.3	--	--	7.5	--	--	V
Reverse Leakage Current	$I_R$	$V_R = V_{RWM}$	--	--	1	--	--	1	$\mu A$
Clamping Voltage	$V_C$	$I_{PP} = 12A, t_p = 8/20\mu s$	--	30	35	--	--	--	V
		$I_{PP} = 17A, t_p = 8/20\mu s$	--	--	--	--	18	22	V
Junction Capacitance	$C_j$	$V_R = 0V, f = 1MHz$	--	--	75	--	--	75	pF
		$V_R = V_{RWM}, f = 1MHz$	--	45	--	--	45	--	pF

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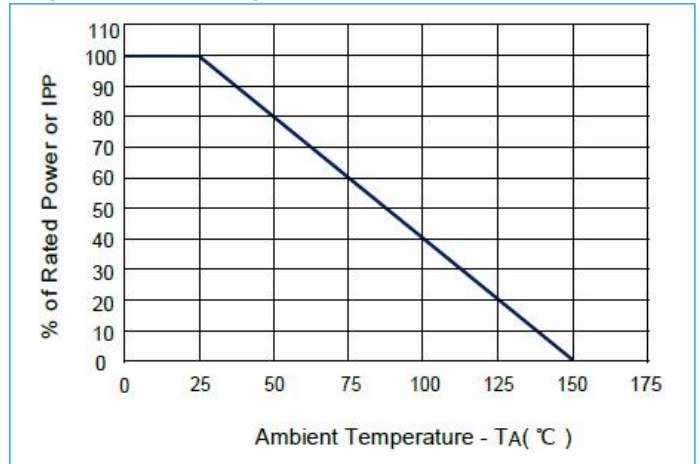
## SM712

### Characteristic Curves

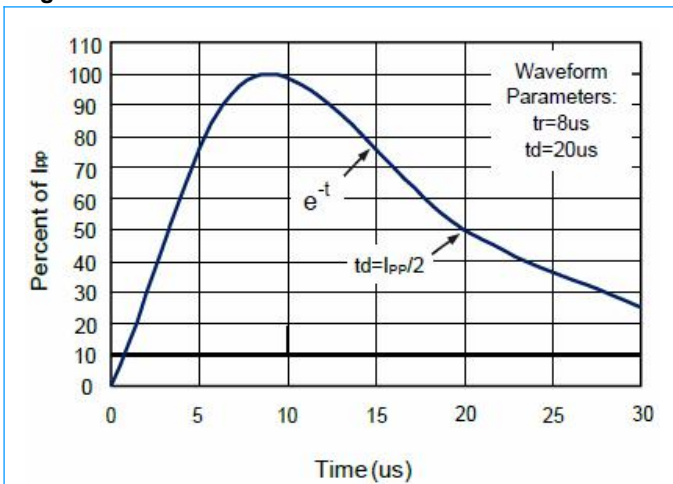
**Fig1. Non-Repetitive Peak Pulse Power vs. Pulse Time**



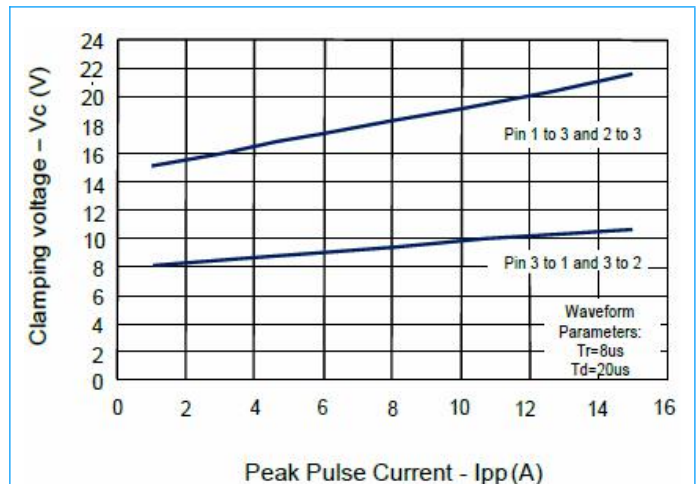
**Fig2. Power Derating curve**



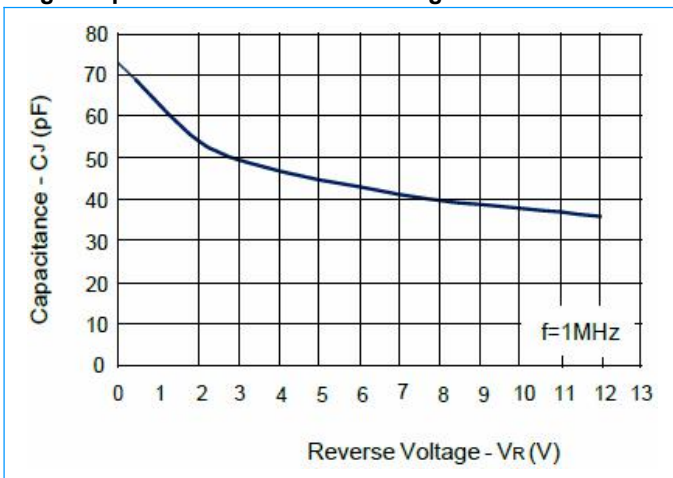
**Fig3. Pulse Waveform**



**Fig4. Clamping Voltage vs. Peak Pulse Current**



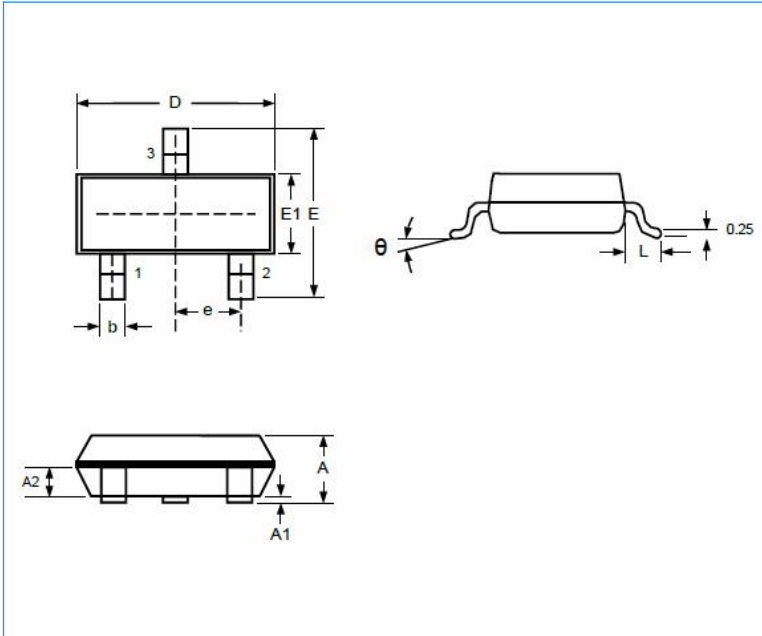
**Fig5. Capacitance vs. Reverse Voltage**



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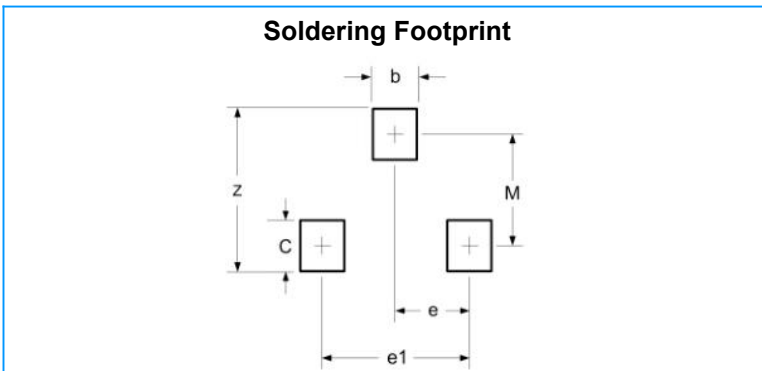
## SM712

### SOT-23 Package Outline & Dimensions



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
<b>A</b>	0.900	1.150	0.035	0.045
<b>A1</b>	0.000	0.100	0.000	0.004
<b>A2</b>	0.900	1.050	0.035	0.041
<b>D</b>	2.800	3.000	0.110	0.118
<b>b</b>	0.300	0.500	0.012	0.020
<b>E</b>	2.250	2.550	0.089	0.100
<b>E1</b>	1.200	1.400	0.047	0.055
<b>e</b>	0.950 BSC		0.037 BSC	
<b>L</b>	0.300	0.500	0.012	0.020
<b>θ</b>	0°	8°	0°	8°

### Soldering Footprint



Dim	Millimeters	Inches
<b>M</b>	2.20	0.088
<b>C</b>	0.15	0.0058
<b>Z</b>	2.35	0.093
<b>e</b>	0.95 BSC	0.037 BCS
<b>e1</b>	1.90 BSC	0.074 BSC
<b>b</b>	0.35	0.0389

#### Notes:

1. Dimensioning and tolerances per ANSI Y14.5M,1985.
2. Controlling Dimension: Inches.
3. Pin 3 is the cathode (Unidirectional Only).
4. Dimensions are exclusive of mold flash and metal burrs.

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### Application Information

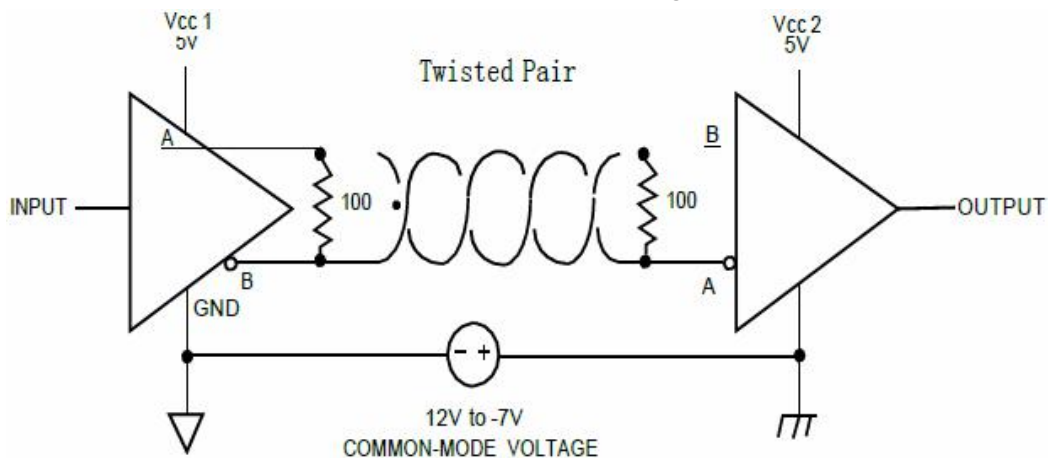
#### Device Connection for Protection of Two RS-485 Data Lines:

EIA RS-485 specifies a  $\pm 7V$  ground difference between devices on the bus. This permits the bus voltage to range from +12V (5V + 7V) to -7V (0 - 7V).

The SM712 is designed to protect two RS-485 data lines in extended common mode applications. The SM712 may be used to protect devices from transient voltages resulting from ESD, EFT, and lightning. The device is designed with asymmetrical operating voltages for optimum protection. The TVS diodes at pins 1 and 2 have a working voltage of 12 volts. These pins are connected to the differential data line pairs. The TVS diodes at pin 3 have a working voltage of 7 volts. Pin 3 is connected to ground. The internal TVS diodes of the SM712 will protect the transceiver input from positive transient voltage spikes greater than 12V and Negative spikes greater than 7V.

A series current limiting resistor may be added in applications requiring enhanced surge immunity.

#### RS-485 Common Mode Voltages



#### RS-485 Protection Circuit

