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TVS Diode Arrays (SPA® Diodes)

General Purpose ESD Protection - SM712

SM712 Series 600W Asymmetrical TVS Diode Array

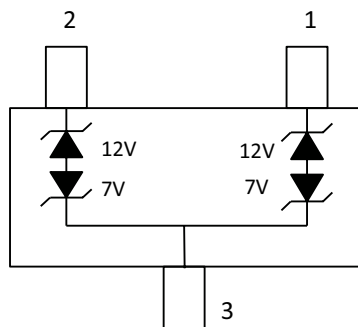


Description

The SM712 TVS Diode Array is designed to protect RS-485 applications with asymmetrical working voltages (-7V to 12V) from damage due to electrostatic discharge (ESD), electrical fast transients (EFT), and lightning induced surges.

The SM712 can absorb repetitive ESD strikes above the maximum level specified in the IEC61000-4-2 international standard without performance degradation and safely dissipate up to 19A of 8/20us induced surge current (IEC-61000-4-5) with very low clamping voltages.

Pinout and Functional Block Diagram



Life Support Note:

Not Intended for Use in Life Support or Life Saving Applications

The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

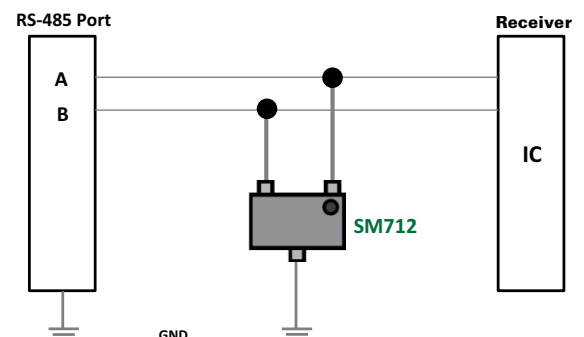
Features

- ESD, IEC61000-4-2, $\pm 30\text{kV}$ contact, $\pm 30\text{kV}$ air
- EFT, IEC61000-4-4, 50A (5/50ns)
- Lightning, IEC61000-4-5, 19A ($t_p=8/20\mu\text{s}$)
- Working Voltages: -7V to 12V
- Low clamping voltage
- Low leakage current
- AEC-Q101 Qualified

Applications

- RS-485
- Fieldbus
- Modbus
- Profibus
- DMX512
- Security Systems
- Automated Teller Machines (ATMs)
- Automation Equipments
- Communication Equipments

RS-485 Application Example



Absolute Maximum Ratings

Symbol	Parameter	Value	Units
P_{PK}	Peak Pulse Power ($t_p=8/20\mu s$)	600	W
I_{PP}	Peak Pulse Current ($t_p=8/20\mu s$)	19	A
T_{OP}	Operating Temperature	-40 to 125	°C
T_{STOR}	Storage Temperature	-55 to 150	°C

Notes:
CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Thermal Information

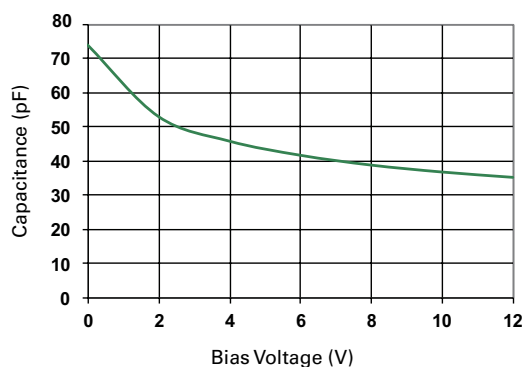
Parameter	Rating	Units
Storage Temperature Range	-55 to 150	°C
Maximum Junction Temperature	150	°C
Maximum Lead Temperature (Soldering 20-40s)	260	°C

SM712 Electrical Characteristics ($T_{OP}=25^\circ C$)

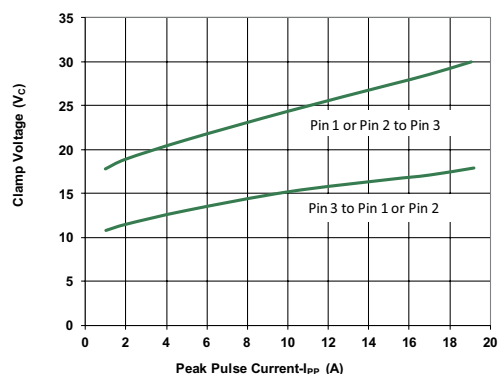
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	$I_R \leq 1\mu A$, Pin3 to Pin1 or Pin2			7.0	V
		$I_R \leq 1\mu A$, Pin1 or Pin2 to Pin3			12.0	V
Reverse Breakdown Voltage	V_R	$I_R = 1mA$, Pin3 to Pin1 or Pin2	7.5			V
		$I_R = 1mA$, Pin1 or Pin2 to Pin3	13.3			V
Leakage Current	I_{LEAK}	$V_R = 7V$			20	μA
		$V_R = 12V$			1	μA
Clamp Voltage ¹	V_C	$I_{PP}=1A$, $t_p=8/20\mu s$, Pin 1 or Pin 2 to Pin 3			19	V
		$I_{PP}=1A$, $t_p=8/20\mu s$, Pin 3 to Pin 1 or Pin 2			11	V
		$I_{PP}=19A$, $t_p=8/20\mu s$, Pin 1 or Pin 2 to Pin 3			31	V
		$I_{PP}=19A$, $t_p=8/20\mu s$, Pin 3 to Pin 1 or Pin 2			19	V
Dynamic Resistance ¹	R_{DYN}	$(V_{C2} - V_{C1}) / (I_{PP2} - I_{PP1})$		0.5		Ω
ESD Withstand Voltage ¹	V_{ESD}	IEC61000-4-2 (Contact Discharge)	± 30			kV
		IEC61000-4-2 (Air Discharge)	± 30			kV
Diode Capacitance ¹	$C_{I/O-GND}$	Reverse Bias=0V, $f=1MHz$; Pin 1 or Pin2 to Pin 3			75	pF

Notes : 1. Parameter is guaranteed by design and/or device characterization.

Capacitance vs. Reverse Bias



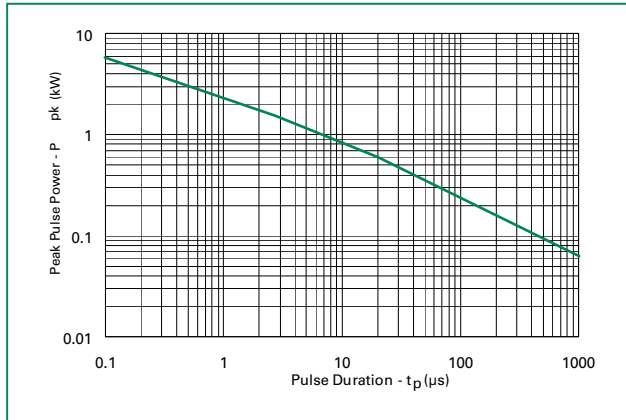
Clamping Voltage vs. I_{PP}



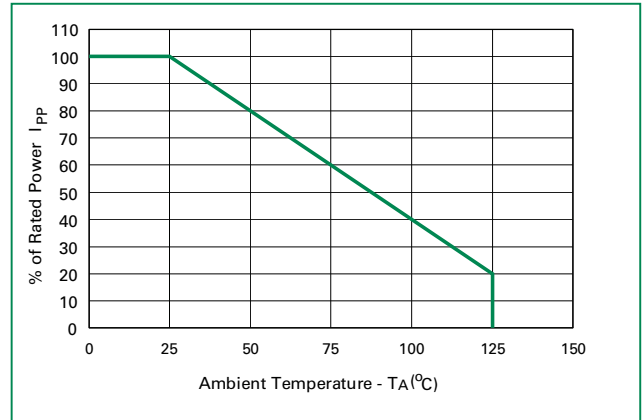
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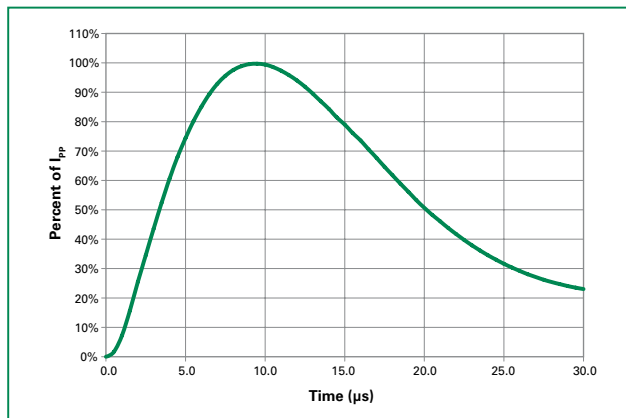
Non-Repetitive Peak Pulse Power vs. Pulse Time



Power Derating Curve



Pulse Waveform



Product Characteristics

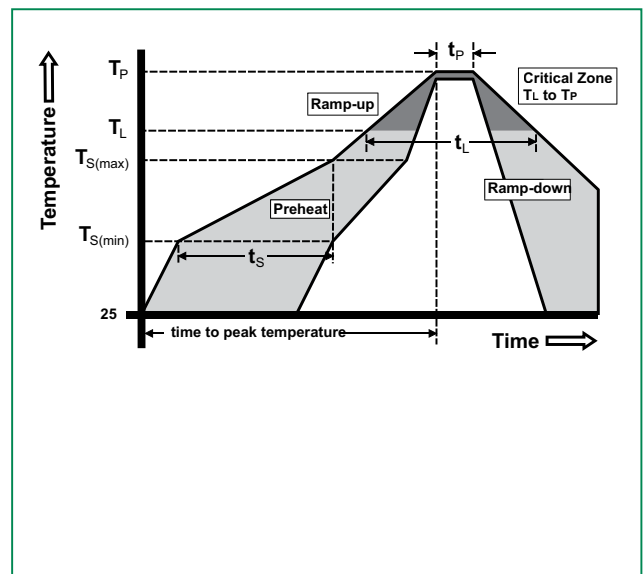
Lead Plating	Matte Tin
Lead Material	Copper Alloy
Lead Coplanarity	0.0004 inches (0.102mm)
Substrate material	Silicon
Body Material	Molded Epoxy
Flammability	UL 94 V-0

Notes :

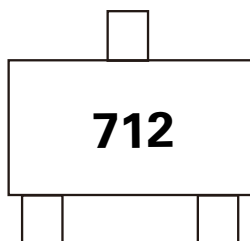
1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
5. Package surface matte finish VDI 11-13.

Soldering Parameters

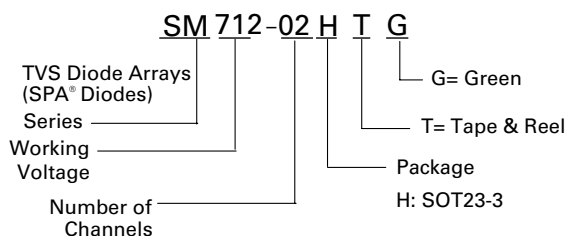
Reflow Condition		Pb – Free assembly
Pre Heat	- Temperature Min ($T_{s(min)}$)	150 $^{\circ}$ C
	- Temperature Max ($T_{s(max)}$)	200 $^{\circ}$ C
	- Time (min to max) (t_s)	60 – 180 secs
Average ramp up rate (Liquidus) Temp (T_L) to peak		3 $^{\circ}$ C/second max
$T_{s(max)}$ to T_L - Ramp-up Rate		3 $^{\circ}$ C/second max
Reflow	- Temperature (T_L) (Liquidus)	217 $^{\circ}$ C
	- Temperature (t_L)	60 – 150 seconds
Peak Temperature (T_p)		260 $^{+0/-5}$ $^{\circ}$ C
Time within 5 $^{\circ}$ C of actual peak Temperature (t_p)		20 – 40 seconds
Ramp-down Rate		6 $^{\circ}$ C/second max
Time 25 $^{\circ}$ C to peak Temperature (T_p)		8 minutes Max.
Do not exceed		260 $^{\circ}$ C



Part Marking System



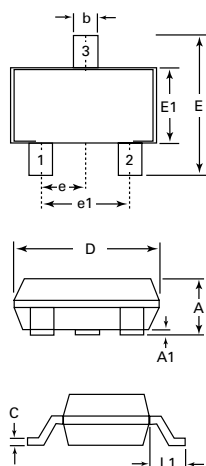
Part Numbering System



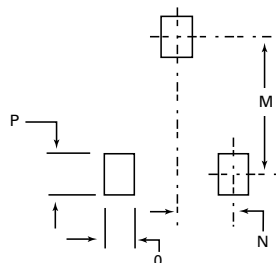
Ordering Information

Part Number	Package	Marking	Min. Order Qty.
SM712-02HTG	SOT23-3	712	3000

Package Dimensions — SOT23-3



Recommended Pad Layout

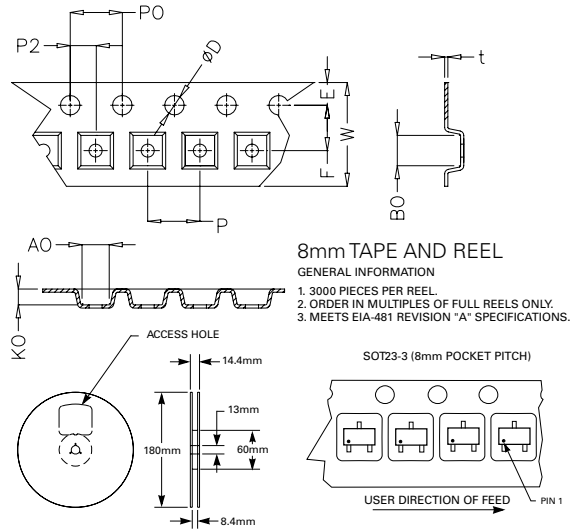


Package	SOT23-3			
Pins	3			
JEDEC	TO-236			
	Millimeters		Inches	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A1	0.01	0.1	0.0004	0.004
b	0.3	0.5	0.012	0.020
c	0.08	0.2	0.003	0.008
D	2.8	3.04	0.110	0.120
E	2.1	2.64	0.083	0.104
E1	1.2	1.4	0.047	0.055
e	0.95 BSC		0.038 BSC	
e1	1.90 BSC		0.075 BSC	
L1	0.54 REF		0.021 REF	
M		2.29		.090
N		0.95		0.038
O		0.78		.030TYP
P		0.78		.030TYP

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Embossed Carrier Tape & Reel Specification — SOT23-3



Symbol	Millimetres		Inches	
	Min	Max	Min	Max
E	1.65	1.85	0.065	0.073
F	3.40	3.60	0.134	0.142
P2	1.90	2.10	0.075	0.083
D	1.40	1.60	0.055	0.063
P0	3.90	4.10	0.154	0.161
W	7.70	8.30	0.303	0.327
P	3.90	4.10	0.154	0.161
A0	3.05	3.25	0.120	0.128
B0	2.67	2.87	0.105	0.113
K0	1.12	1.32	0.044	0.052
t	0.22	0.24	0.009	0.009

