

## SM712 Series 600W Asymmetrical TVS Diode Array

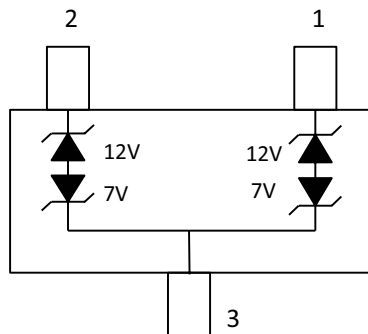


### Description

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 IEC 61000-4-2 international standard without performance degradation and safely dissipate up to 19A of 8/20us induced surge current (IEC-61000-4-5 2nd edition) 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

- RoHS compliant and lead-free
- ESD, IEC 61000-4-2,  $\pm 30\text{kV}$  contact,  $\pm 30\text{kV}$  air
- EFT, IEC 61000-4-4, 50A (5/50ns)
- Lightning, IEC 61000-4-5 2nd edition, 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)
- Lighting Control - DALI
- Communication Equipments

### Additional Information



Datasheet

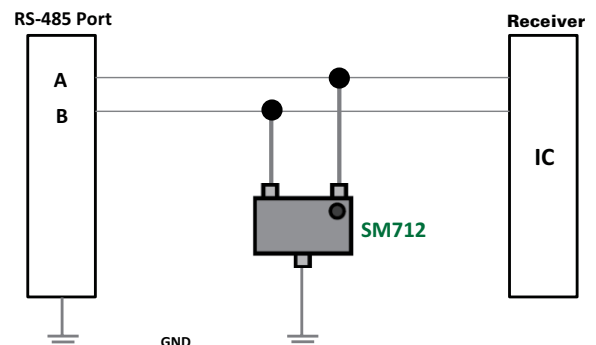


Resources



Samples

### 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

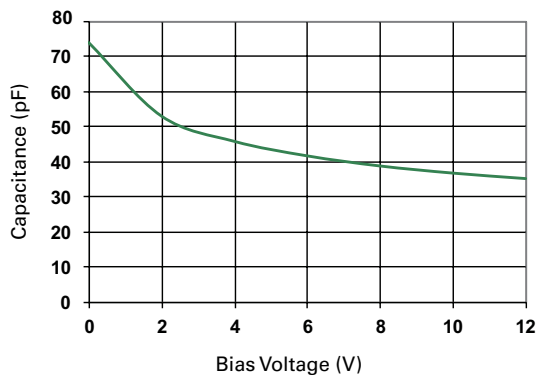
| Parameter                                   | Rating     | Units |
|---------------------------------------------|------------|-------|
| Storage Temperature Range                   | -55 to 150 | °C    |
| Maximum Junction Temperature                | 150        | °C    |
| Maximum Lead Temperature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

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

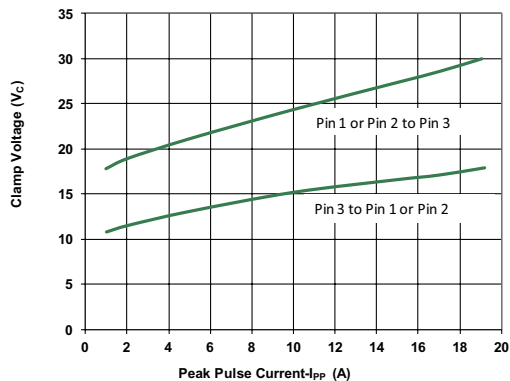
| Parameter                          | Symbol        | Test Conditions                                          | Min      | Typ | Max  | Units    |
|------------------------------------|---------------|----------------------------------------------------------|----------|-----|------|----------|
| Reverse 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   | $\mu A$  |
|                                    |               | $V_R=12V$                                                |          |     | 1    | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP}=1A$ , $t_p=8/20\mu s$ , 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 <sup>1</sup>    | $R_{DYN}$     | $(V_{C2} - V_{C1}) / (I_{PP2} - I_{PP1})$                |          | 0.5 |      | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$     | IEC 61000-4-2 (Contact Discharge)                        | $\pm 30$ |     |      | kV       |
|                                    |               | IEC 61000-4-2 (Air Discharge)                            | $\pm 30$ |     |      | kV       |
| Diode Capacitance <sup>1</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz;<br>Pin 1 or Pin2 to Pin 3       |          |     | 75   | pF       |

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

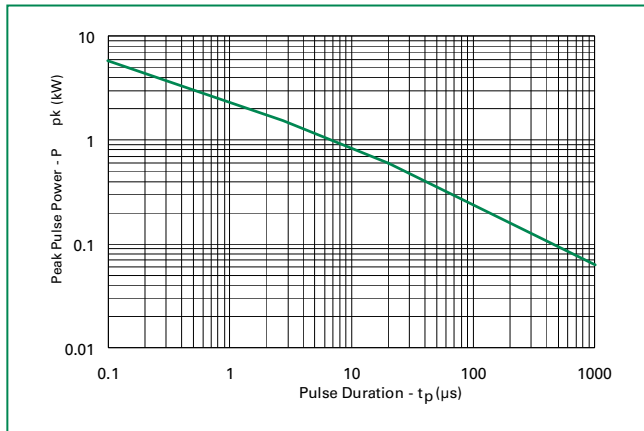
### Capacitance vs. Reverse Bias



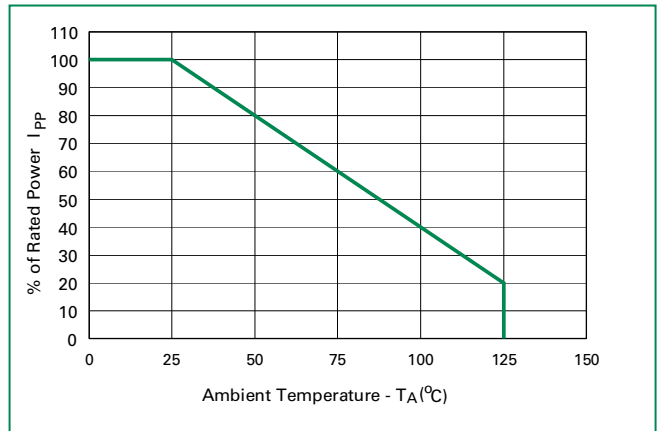
### Clamping Voltage vs. $I_{PP}$



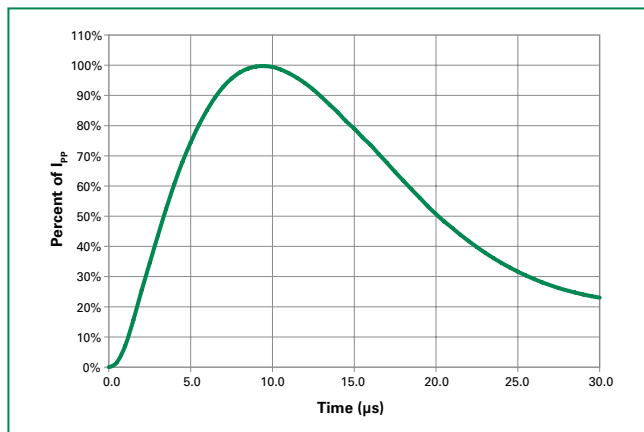
### Non-Repetitive Peak Pulse Power vs. Pulse Time



### Power Derating Curve



### Pulse Waveform



### Product Characteristics

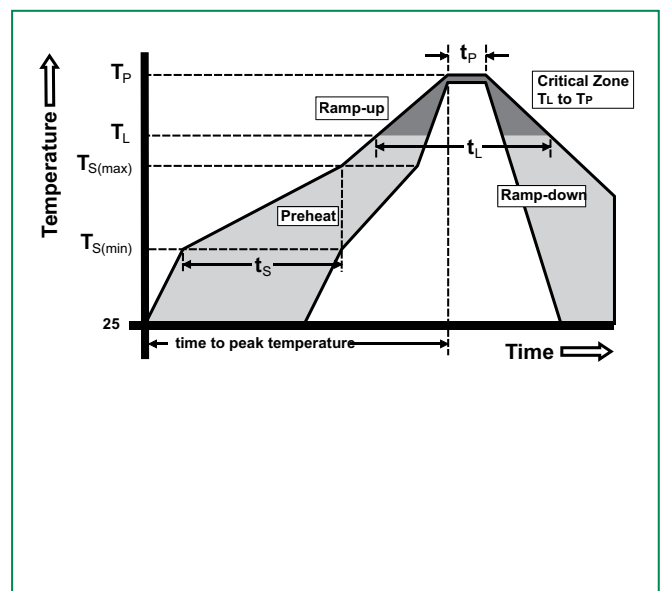
|                           |                         |
|---------------------------|-------------------------|
| <b>Lead Plating</b>       | PPF                     |
| <b>Lead Material</b>      | Copper Alloy            |
| <b>Lead Coplanarity</b>   | 0.0004 inches (0.102mm) |
| <b>Substrate material</b> | Silicon                 |
| <b>Body Material</b>      | Molded Epoxy            |
| <b>Flammability</b>       | UL 94 V-0               |

Notes :

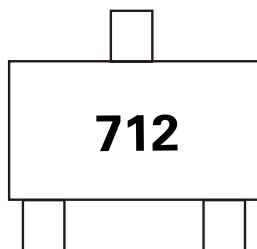
1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
5. Package surface matte finish VDI 11-13.

### 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            |



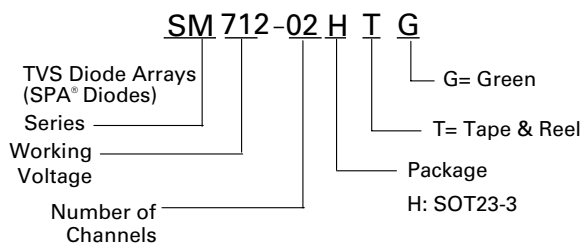
### Part Marking System



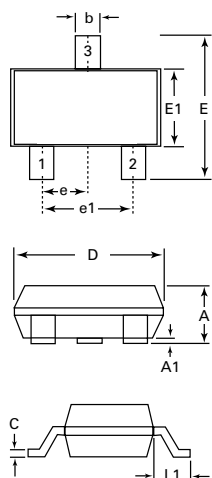
### Ordering Information

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

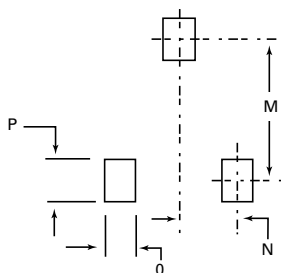
### Part Numbering System



### Package Dimensions — SOT23-3



Recommended Pad Layout



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