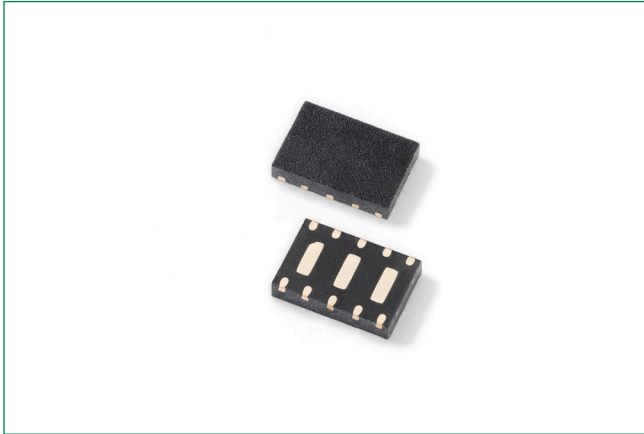
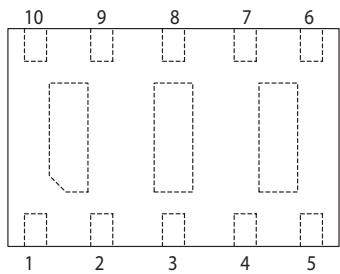
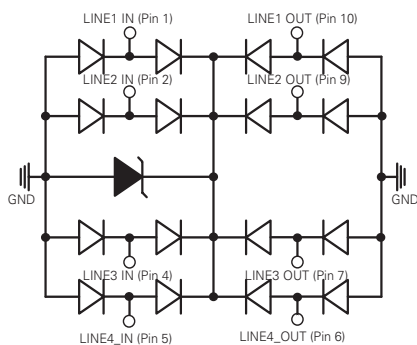


# SP2555NUTG Series

## Lightning Surge Protection

**HF** **RoHS** **Pb**

**Pinout**

**Functional Block Diagram**


## Description

The SP2555NUTG is a low-capacitance, TVS Diode Array designed to provide protection against ESD (electrostatic discharge), CDE (cable discharge events), EFT (electrical fast transients), and lightning induced surges for high-speed, differential data lines. It's packaged in a  $\mu$ DFN package (3.0 x 2.0mm) and each component can protect up to 4 channels or 2 differential pairs, up to 45A (IEC 61000-4-5 2nd edition,) and up to 30kV ESD (IEC 61000-4-2). The "flow-through" design minimizes signal distortion, reduces voltage overshoot, and provides a simplified PCB design.

The SP2555NUTG with its low capacitance and low clamping voltage makes it ideal for high-speed data interfaces such as 1GbE applications found in notebooks, switches, etc.

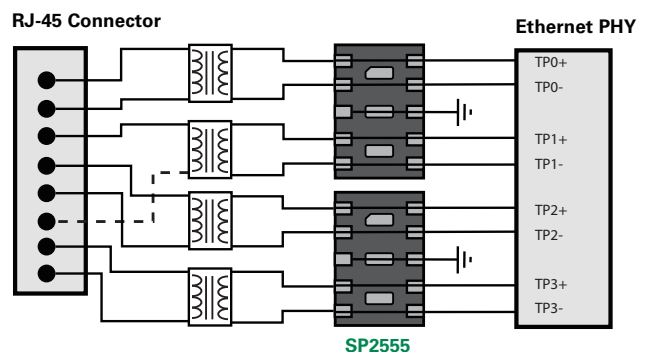
## Features & Benefits

- ESD, IEC 61000-4-2,  $\pm$ 30kV contact,  $\pm$ 30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5 2nd Edition, 45A (8/20 $\mu$ s)
- Low capacitance of 2.5pF@0V (TYP) per I/O
- Low leakage current of 0.1 $\mu$ A (TYP) at 2.5V
- $\mu$ DFN-10 package is optimized for high-speed data line routing
- Provides protection for two differential data pairs (4 channels) up to 45A
- Low operating and clamping voltage
- AEC-Q101 qualified
- Halogen free, Lead free and RoHS compliant

## Applications

- 10/100/1000 Ethernet
- WAN/LAN Equipment
- Desktops, Servers and Notebooks
- LVDS Interfaces
- Integrated Magnetics
- Smart TV

## Application Example



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.

# SP2555NUTG Series

## Lightning Surge Protection

### Absolute Maximum Ratings

| Symbol     | Parameter                            | Value      | Units |
|------------|--------------------------------------|------------|-------|
| $I_{PP}$   | Peak Current ( $t_p=8/20\mu s$ )     | 45         | A     |
| $P_{PK}$   | Peak Pulse Power ( $t_p=8/20\mu s$ ) | 1000       | W     |
| $T_{OP}$   | Operating Temperature                | -40 to 125 | °C    |
| $T_{STOR}$ | Storage Temperature                  | -55 to 150 | °C    |

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

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

| Parameter                       | Symbol                   | Test Conditions  | Min      | Typ | Max | Units    |
|---------------------------------|--------------------------|--|----------|-----|-----|----------|
| Reverse Standoff Voltage        | $V_{RWM}$                | $I_R \leq 1\mu A$  |          |     | 2.5 | V        |
| Reverse Leakage Current         | $I_R$                    | $V_{RWM} = 2.5V, T = 25^\circ C$   |          | 0.1 | 0.5 | $\mu A$  |
| Snap Back Voltage               | $V_{SB}$                 | $I_{SB} = 50mA$  | 2.0      |     |     | V        |
| Clamp Voltage                   | $V_C$                    | $I_{PP} = 1A, t_p = 8/20\mu s$ , Any I/O to Ground   |          | 4.5 |     | V        |
|                                 |                          | $I_{PP} = 10A, t_p = 8/20\mu s$ , Any I/O to Ground  |          | 7.5 |     |          |
|                                 |                          | $I_{PP} = 25A, t_p = 8/20\mu s$ , Any I/O to Ground  |          | 12  |     |          |
|                                 |                          | $I_{PP} = 45A, t_p = 8/20\mu s$ ,<br>Line-to-Line <sup>1</sup> , two I/O Pins<br>connected together on each line |          | 19  |     |          |
| Dynamic Resistance <sup>2</sup> | $R_{DYN}$                | TLP, $t_p=100ns$ , Any I/O to Ground   |          | 0.1 |     | $\Omega$ |
| ESD Withstand Voltage           | $V_{ESD}$                | IEC 61000-4-2 (Contact)  | $\pm 30$ |     |     | kV       |
|                                 |                          | IEC 61000-4-2 (Air)  | $\pm 30$ |     |     | kV       |
| Diode Capacitance               | $C_{I/O \text{ to GND}}$ | Between I/O Pins and Ground<br>$V_R = 0V, f = 1MHz$  |          | 2.5 |     | pF       |
|                                 | $C_{I/O \text{ to I/O}}$ | Between I/O Pins<br>$V_R = 0V, f = 1MHz$   |          | 1.2 |     | pF       |

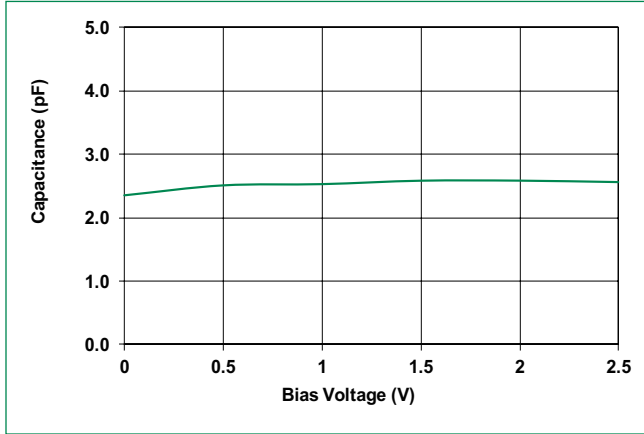
**Notes:**

- Rating with 2 pins connected together per suggested diagram ( For example, pin1 is connected to pin 10, pin 2 is connected to Pin 9, Pin 4 is connected to pin 7 and pin 5 is connected to pin 6)
- Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window  $t_1=70ns$  to  $t_2=90ns$

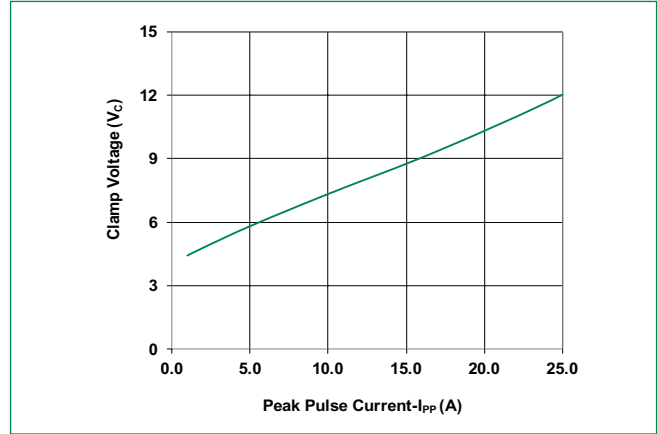
# SP2555NUTG Series

## Lightning Surge Protection

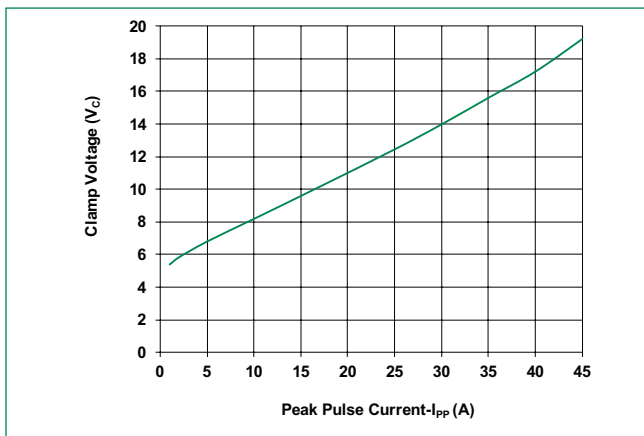
**Capacitance vs. Reverse Bias**



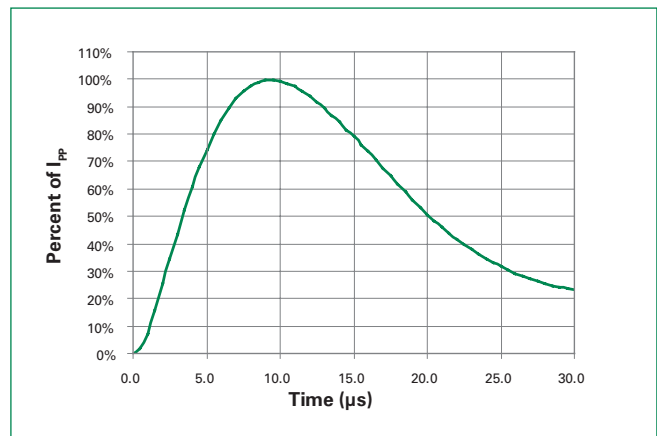
**Clamping Voltage vs.  $I_{pp}$  (I/O to GND)**



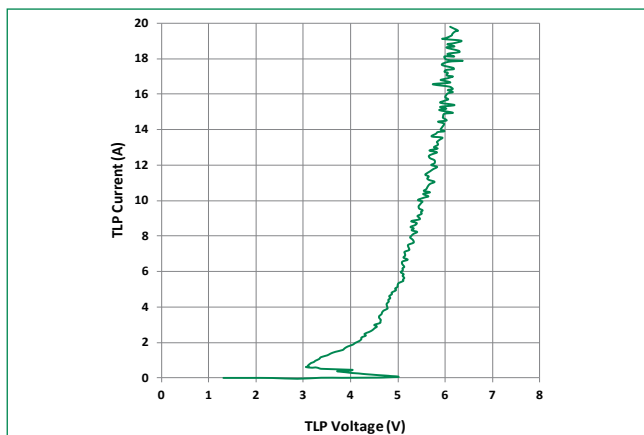
**Clamping Voltage vs.  $I_{pp}$  (Line-to-Line)**



**8/20 $\mu$ S Pulse Waveform**



**Transmission Line Pulsing(TLP) Plot**

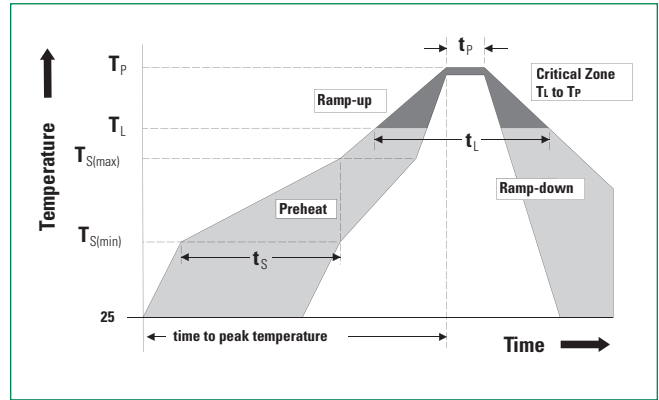


# SP2555NUTG Series

## Lightning Surge Protection

### Soldering Parameters

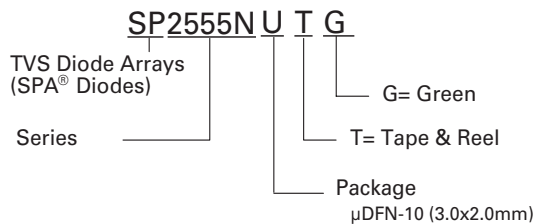
|  |                                    |                         |
|--|------------------------------------|-------------------------|
| <b>Reflow Condition</b>  |                                    | Pb – Free assembly      |
| <b>Pre Heat</b>  | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|  | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|  | - Time (min to max) ( $t_s$ )      | 60 – 120 secs           |
| <b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b> |                                    | 3°C/second max          |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>      |                                    | 3°C/second max          |
| <b>Reflow</b>  | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|  | - Temperature ( $t_L$ )            | 60 – 150 seconds        |
| <b>Peak Temperature (<math>T_p</math>)</b>                             |                                    | 260 <sup>+0/-5</sup> °C |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 30 seconds              |
| <b>Ramp-down Rate</b>  |                                    | 6°C/second max          |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>                |                                    | 8 minutes Max.          |
| <b>Do not exceed</b>   |                                    | 260°C                   |



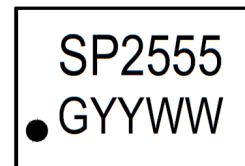
### Ordering Information

| Part Number | Package                | Marking | Min. Order Qty. |
|-------------|------------------------|---------|-----------------|
| SP2555NUTG  | μDFN-10<br>(3.0x2.0mm) | SP2555  | 3000            |

### Part Numbering System



### Part Marking System

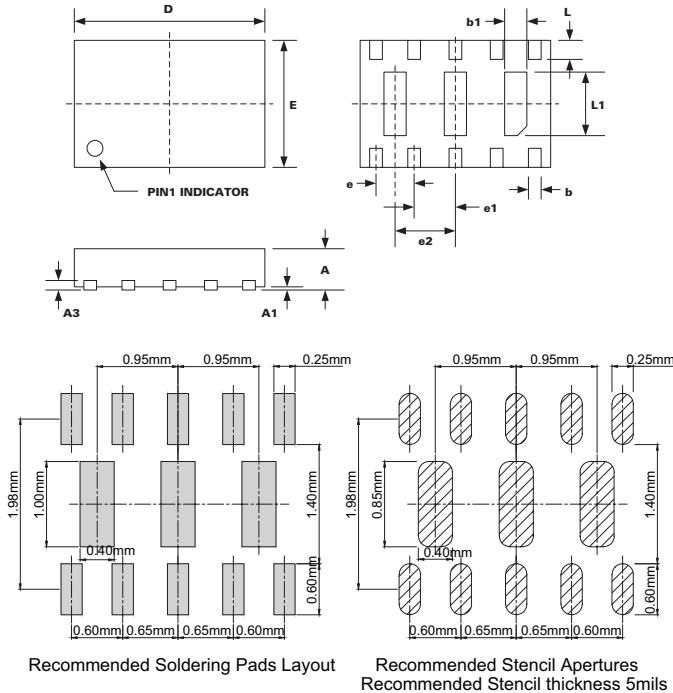


First row= Part Name= SP2555  
Second row= Assembly Code+ Date Code

# SP2555NUTG Series

## Lightning Surge Protection

### Package Dimensions — $\mu$ DFN-10 (3.0x2.0mm)

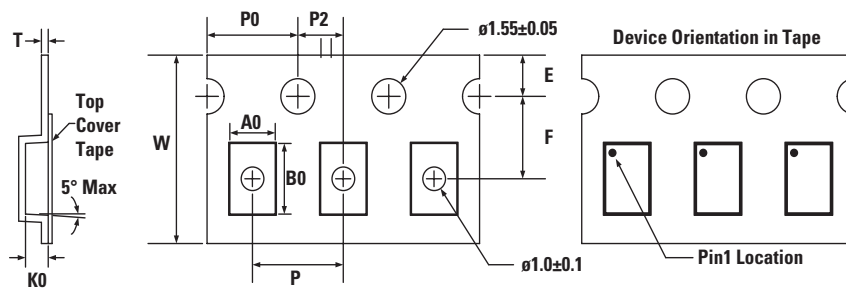


| Package | $\mu$ DFN-10 (3.0x2.0mm) |      |      |           |       |       |
|---------|--------------------------|------|------|-----------|-------|-------|
| JEDEC   | MO-229                   |      |      |           |       |       |
| Symbol  | Millimeters              |      |      | Inches    |       |       |
|         | Min                      | Nom  | Max  | Min       | Nom   | Max   |
| A       | 0.50                     | 0.60 | 0.65 | 0.020     | 0.024 | 0.026 |
| A1      | 0.00                     | 0.03 | 0.05 | 0.000     | 0.001 | 0.002 |
| A3      | 0.15 Ref                 |      |      | 0.006 Ref |       |       |
| b       | 0.15                     | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| b1      | 0.25                     | 0.35 | 0.45 | 0.010     | 0.014 | 0.018 |
| D       | 2.90                     | 3.00 | 3.10 | 0.114     | 0.118 | 0.122 |
| E       | 1.90                     | 2.00 | 2.10 | 0.075     | 0.079 | 0.083 |
| e       | 0.60 BSC                 |      |      | 0.024 BSC |       |       |
| e1      | 0.65 BSC                 |      |      | 0.026 BSC |       |       |
| e2      | 0.95 BSC                 |      |      | 0.037     |       |       |
| L       | 0.25                     | 0.30 | 0.35 | 0.010     | 0.012 | 0.014 |
| L1      | 0.95                     | 1.00 | 1.05 | 0.037     | 0.039 | 0.041 |

#### Notes:

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

### Tape & Reel Specification — $\mu$ DFN-10 (3.0x2.0mm)



| Package | $\mu$ DFN-10 (3.0x2.0mm) |
|---------|--------------------------|
| Symbol  | Millimeters              |
| A0      | 2.30 +/- 0.10            |
| B0      | 3.20 +/- 0.10            |
| E       | 1.75 +/- 0.10            |
| F       | 3.50 +/- 0.05            |
| K0      | 1.0 +/- 0.10             |
| P       | 4.00 +/- 0.10            |
| P0      | 4.00 +/- 0.10            |
| P2      | 2.00 +/- 0.10            |
| T       | 0.3 +/- 0.05             |
| W       | 8.00 +0.30/- 0.10        |

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