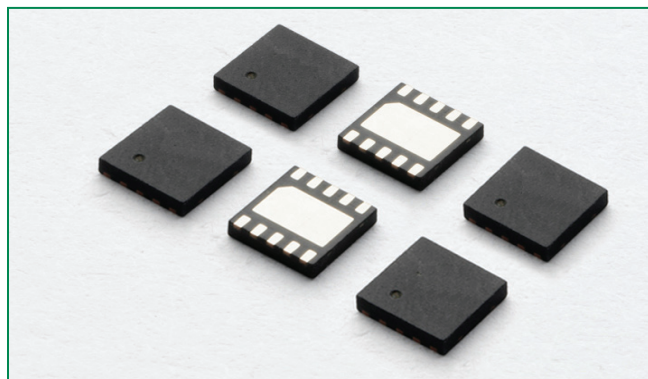
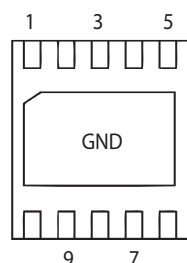


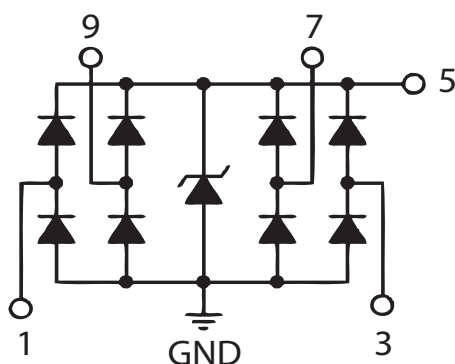
## SP2504N Series 2.5V 20A Diode Array



## Pinout



## 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.

## Description

The SP2504N integrates 4 channels of low capacitance diodes with an additional zener diode to protect sensitive I/O pins against lightning induced surge events and ESD. This robust device can safely absorb up to 20A per IEC61000-4-5 ( $t_p=8/20\mu s$ ) without performance degradation and a minimum  $\pm 30kV$  ESD per IEC61000-4-2 international standard. The low loading capacitance makes the SP2504N ideal for protecting high-speed signal pins.

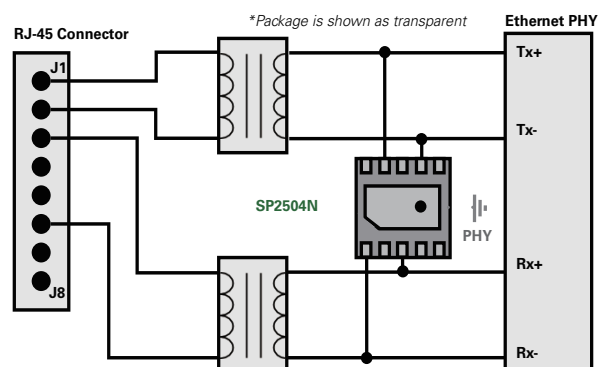
## Features

- ESD, IEC61000-4-2,  $\pm 30kV$  contact,  $\pm 30kV$  air
- EFT, IEC61000-4-4, 40A ( $t_p=5/50ns$ )
- Lightning, IEC61000-4-5, 20A ( $t_p=8/20\mu s$ )
- Low capacitance of 3.5pF (TYP) per I/O
- Low leakage current of  $1\mu A$  (MAX) at 2.5V

## Applications

- 10/100/1000 Ethernet Interfaces
- Customer Premise Equipment (CPE)
- VoIP Phones
- Set Top Boxes
- PBX Systems

## Application Example



### Absolute Maximum Ratings

| Symbol     | Parameter                            | Value      | Units |
|------------|--------------------------------------|------------|-------|
| $I_{PP}$   | Peak Current ( $t_p=8/20\mu s$ )     | 20.0       | A     |
| $P_{PK}$   | Peak Pulse Power ( $t_p=8/20\mu s$ ) | 300        | W     |
| $T_{OP}$   | Operating Temperature                | -40 to 85  | °C    |
| $T_{STOR}$ | Storage Temperature                  | -50 to 150 | °C    |

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

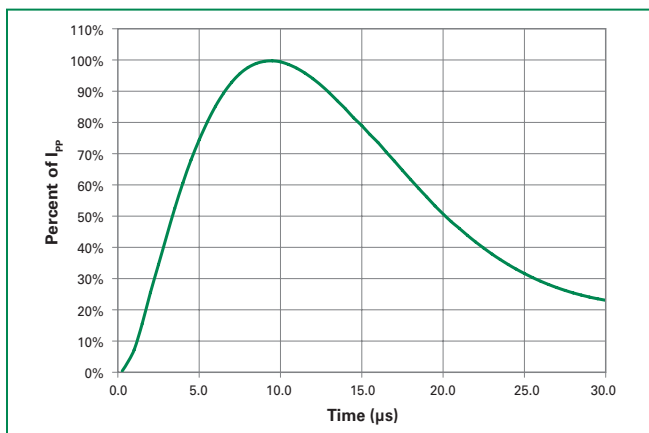
| Parameter                                   | Rating     | Units |
|---------------------------------------------|------------|-------|
| Storage Temperature Range                   | -65 to 150 | °C    |
| Maximum Junction Temperature                | 150        | °C    |
| Maximum Lead Temperature (Soldering 20-40s) | 260        | °C    |

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

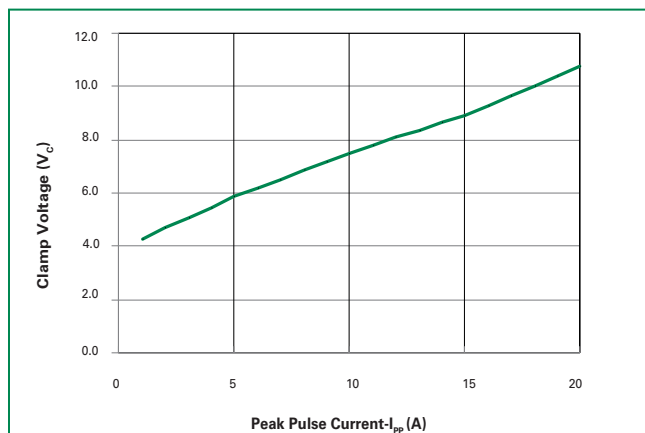
| Parameter                          | Symbol        | Test Conditions                      | Min      | Typ  | Max  | Units    |
|------------------------------------|---------------|--------------------------------------|----------|------|------|----------|
| Reverse Standoff Voltage           | $V_{RWM}$     |                                      |          |      | 2.5  | V        |
| Snap Back Voltage                  | $V_{SB}$      | $I_{SB}=50mA$                        | 2.0      |      |      | V        |
| Reverse Leakage Current            | $I_{LEAK}$    | $V_R=2.5V$ , I/O to GND              |          | 0.5  | 1.0  | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP}=1A$ , $t_p=8/20\mu s$ , Fwd  |          |      | 5.0  | V        |
|                                    |               | $I_{PP}=5A$ , $t_p=8/20\mu s$ , Fwd  |          |      | 6.3  | V        |
|                                    |               | $I_{PP}=10A$ , $t_p=8/20\mu s$ , Fwd |          |      | 8.0  | V        |
|                                    |               | $I_{PP}=20A$ , $t_p=8/20\mu s$ , Fwd |          |      | 11.5 | V        |
| Dynamic Resistance                 | $R_{DYN}$     | $(V_{C2}-V_{C1})/(I_{PP2}-I_{PP1})$  |          | 0.35 |      | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$     | IEC61000-4-2 (Contact)               | $\pm 30$ |      |      | kV       |
|                                    |               | IEC61000-4-2 (Air)                   | $\pm 30$ |      |      | kV       |
| Diode Capacitance <sup>1</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V                      |          | 3.5  | 5.0  | pF       |
| Diode Capacitance <sup>1</sup>     | $C_{I/O-I/O}$ | Reverse Bias=0V                      |          | 2.0  |      | pF       |

Note: <sup>1</sup> Parameter is guaranteed by design and/or device characterization.

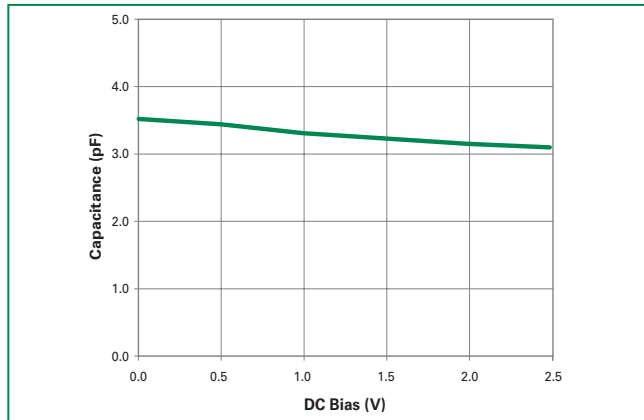
### Pulse Waveform



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



### Capacitance vs. Bias

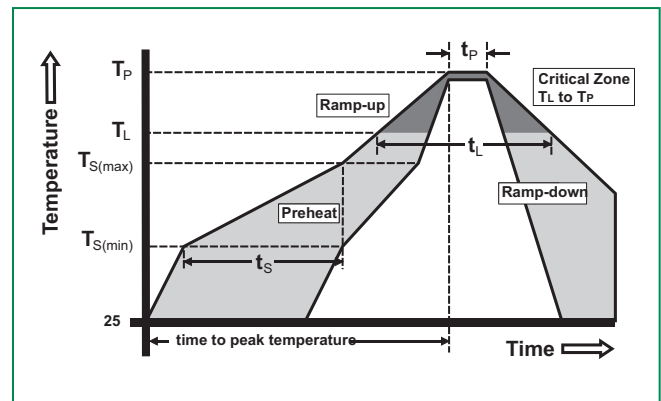


### Ordering Information

| Part Number | Package | Marking | Min. Order Qty. |
|-------------|---------|---------|-----------------|
| SP2504NUTG  | μDFN-10 | TH4     | 3000            |

### Soldering Parameters

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



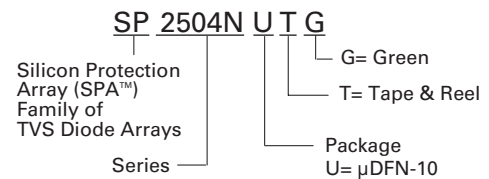
### Product Characteristics

|                     |                         |
|---------------------|-------------------------|
| Lead Plating        | Pre-Plated Frame        |
| Lead Material       | Copper Alloy            |
| Lead Coplanarity    | 0.0004 inches (0.102mm) |
| Substitute Material | Silicon                 |
| Body Material       | Molded Epoxy            |
| Flammability        | UL 94 V-0               |

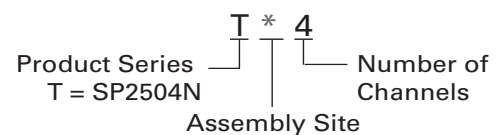
Notes :

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.

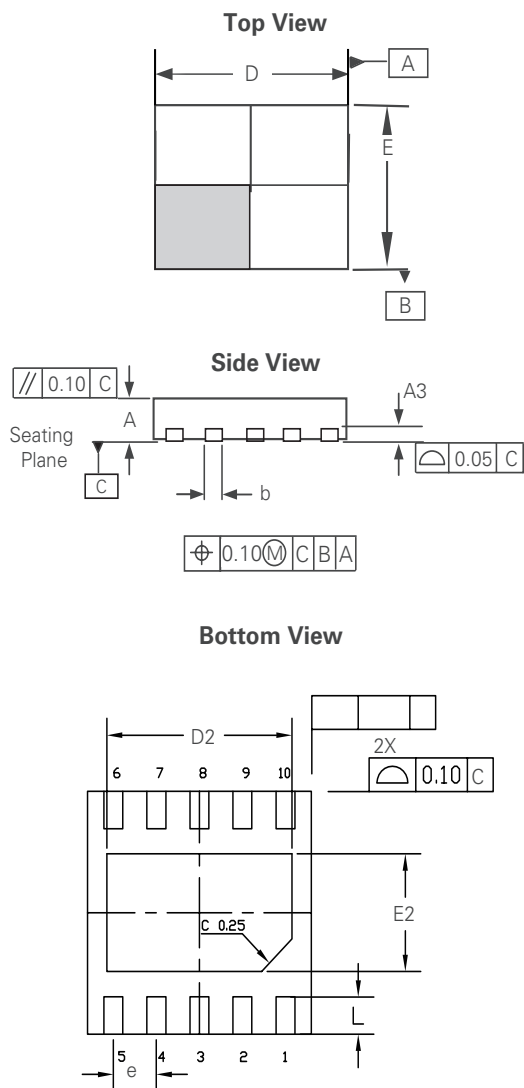
### Part Numbering System



### Part Marking System

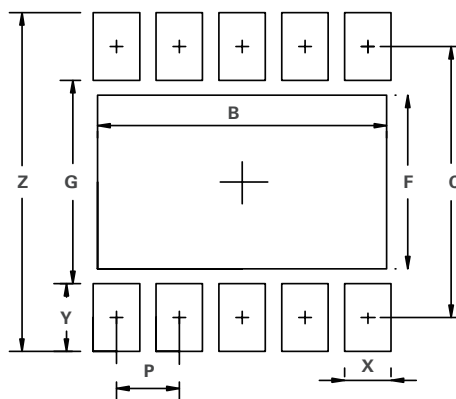


**Package Dimensions —  $\mu$ DFN-10**



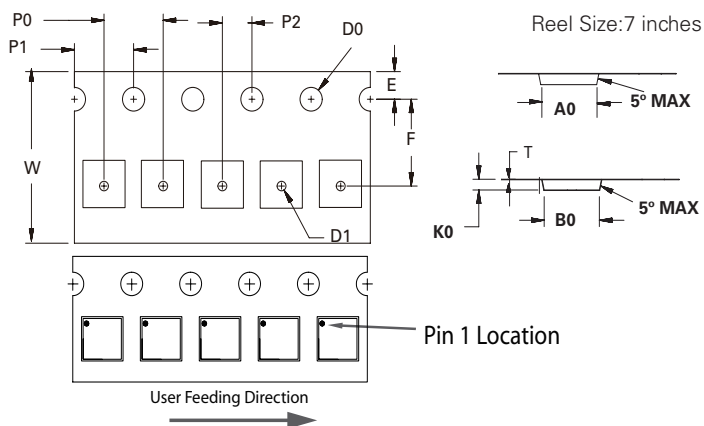
| Package | $\mu$ DFN-10 (2.6x2.6mm) |      |      |           |       |       |
|---------|--------------------------|------|------|-----------|-------|-------|
| JEDEC   | MO-229                   |      |      |           |       |       |
| Symbol  | Millimeters              |      |      | Inches    |       |       |
|         | Min                      | Nom  | Max  | Min       | Nom   | Max   |
| A       | 0.45                     | 0.50 | 0.55 | 0.018     | 0.020 | 0.022 |
| A3      | 0.130 Ref                |      |      | 0.005 Ref |       |       |
| b       | 0.17                     | 0.22 | 0.27 | 0.006     | 0.008 | 0.010 |
| D       | 2.50                     | 2.60 | 2.70 | 0.097     | 0.101 | 0.105 |
| D2      | 2.10                     | 2.15 | 2.20 | 0.081     | 0.083 | 0.085 |
| E       | 2.50                     | 2.60 | 2.70 | 0.097     | 0.101 | 0.105 |
| E2      | 1.21                     | 1.26 | 1.31 | 0.046     | 0.049 | 0.051 |
| e       | 0.50 BSC                 |      |      | 0.020 BSC |       |       |
| L       | 0.35                     | 0.40 | 0.45 | 0.014     | 0.016 | 0.018 |

**Recommended Solder Pads  $\mu$ DFN-10L 2.6x2.6mm**



| Dimension |             |        |
|-----------|-------------|--------|
| Symbol    | Millimeters | Inches |
| B         | 2.30        | 0.091  |
| C         | 2.20        | 0.087  |
| F         | 1.41        | 0.056  |
| G         | 1.65        | 0.065  |
| P         | 0.50        | 0.020  |
| X         | 0.37        | 0.015  |
| Y         | 0.55        | 0.022  |
| Z         | 2.75        | 0.108  |

**Embossed Carrier Tape & Reel Specification —  $\mu$ DFN-10 (2.6x2.6mm)**



| Symbol | Millimeters         |
|--------|---------------------|
| A0     | 2.82 +/- 0.05       |
| B0     | 2.82 +/- 0.05       |
| D0     | Ø1.50 + 0.10        |
| D1     | Ø 0.50 + 0.05       |
| E      | 1.75 +/- 0.10       |
| F      | 3.50 +/- 0.05       |
| K0     | 0.76 +/- 0.05       |
| P0     | 4.00 +/- 0.10       |
| P1     | 4.00 +/- 0.10       |
| P2     | 2.00 +/- 0.05       |
| T      | 0.25 +/- 0.02       |
| W      | 8.00 + 0.30 /- 0.10 |

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