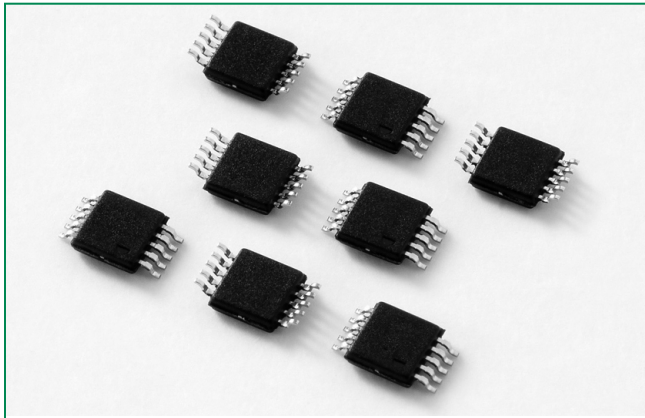
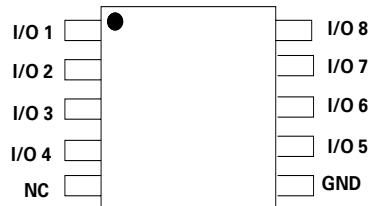


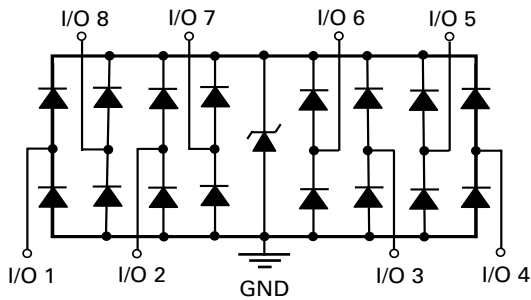
**SP4060 Series 2.5V 20A Diode Array**



**Pinout**



**Functional Block Diagram**



**Additional Information**



Datasheet



Resources



Samples

**Description**

The SP4060 integrates low capacitance diodes with an additional zener diode to protect each I/O pin against ESD and high surge events. This robust device can safely absorb up to 20A per IEC 61000-4-5 ( $t_p=8/20\mu s$ ) without performance degradation and a minimum  $\pm 30kV$  ESD per IEC 61000-4-2 International Standard. Their low loading capacitance also makes them ideal for protecting high speed signal pins.

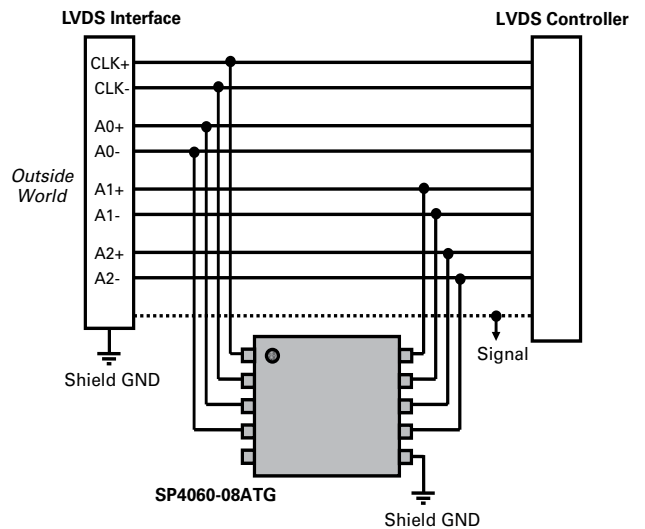
**Features**

- ESD, IEC 61000-4-2,  $\pm 30kV$  contact,  $\pm 30kV$  air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5, 20A (8/20 $\mu s$ )
- Low capacitance of 4.4pF (TYP) per I/O
- Low leakage current of 1 $\mu A$  (MAX) at 2.5V
- Moisture Sensitivity Level (MSL-1)

**Applications**

- LCD/PD TVs
- Desktops
- Game Consoles
- Set Top Boxes
- Notebooks

**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.

### 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 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 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

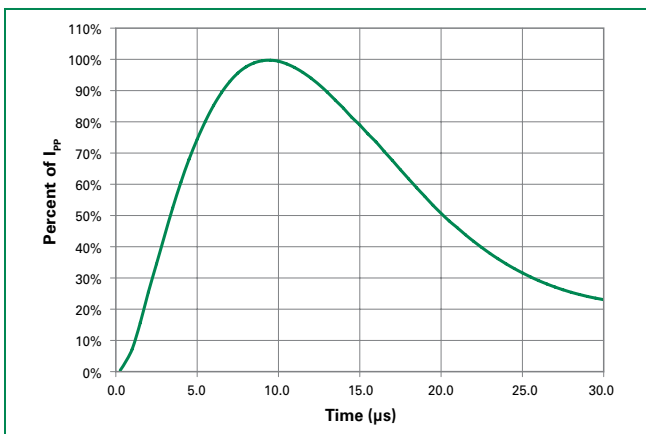
| Parameter                                   | Rating     | Units |
|---|------------|-------|
| Storage Temperature Range                   | -55 to 150 | °C    |
| Maximum Junction Temperature                | 150        | °C    |
| Maximum Lead Temperature (Soldering 20-40s) | 260        | °C   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

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

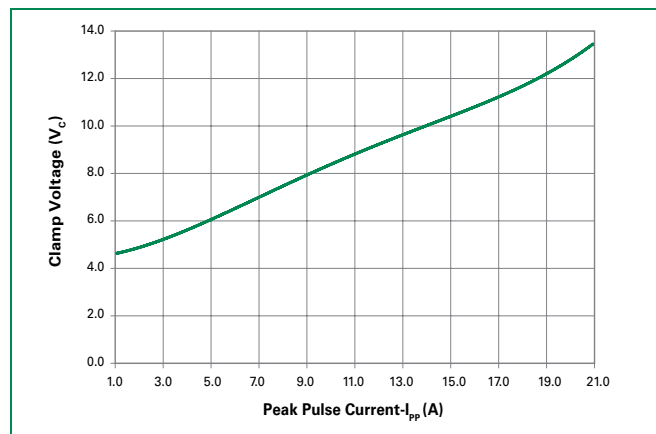
| Parameter                          | Symbol        | Test Conditions                      | Min      | Typ  | Max  | Units   |
|------------------------------------|---------------|--------------------------------------|----------|------|------|---------|
| Reverse Standoff Voltage           | $V_{RWM}$     |                                      |          |      | 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  |          | 4.5  | 5.5  | V       |
|                                    |               | $I_{PP}=5A$ , $t_p=8/20\mu s$ , Fwd  |          | 6.0  | 7.2  | V       |
|                                    |               | $I_{PP}=10A$ , $t_p=8/20\mu s$ , Fwd |          | 8.0  | 9.6  | V       |
|                                    |               | $I_{PP}=20A$ , $t_p=8/20\mu s$ , Fwd |          | 12.5 | 15.0 | V       |
| 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                      |          | 4.4  | 5.0  | pF      |
| Diode Capacitance <sup>1</sup>     | $C_{I/O-I/O}$ | Reverse Bias=0V                      |          | 2.2  |      | pF      |

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

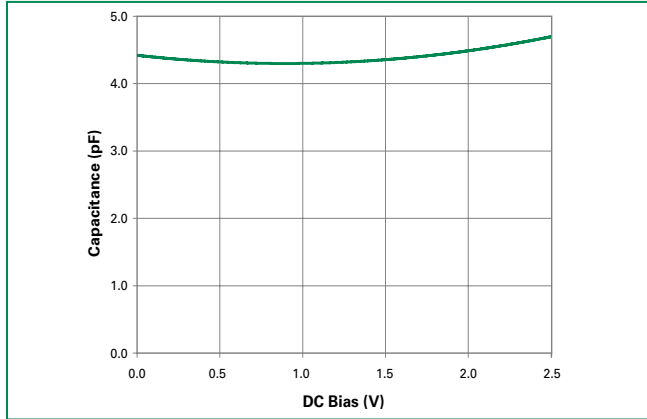
### 8/20 $\mu s$ Pulse Waveform



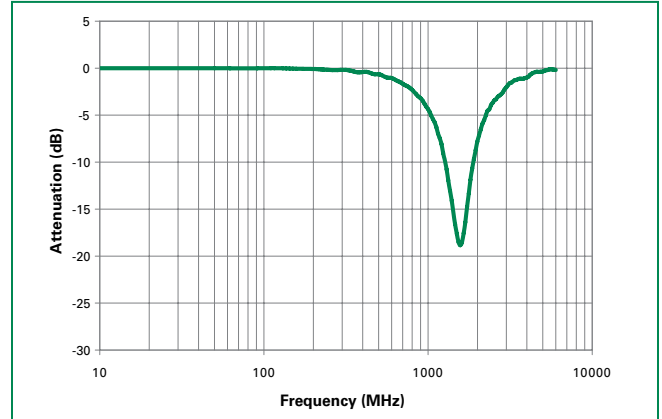
### Clamping Voltage vs. $I_{PP}$



**Capacitance vs. Bias**

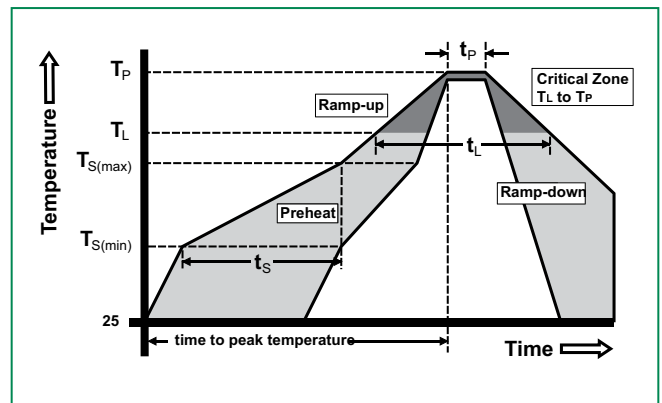


**Insertion Loss (S21) I/O to GND**

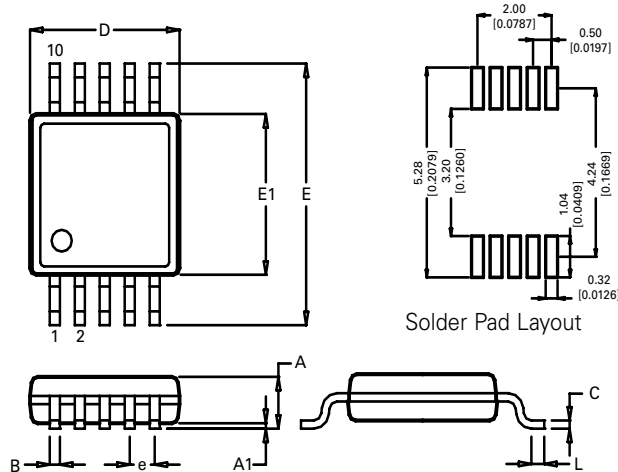


**Soldering Parameters**

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| 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                   |

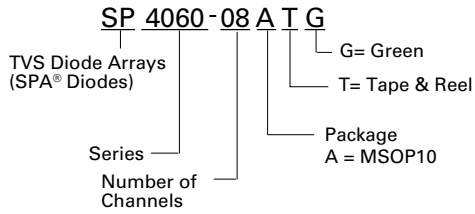


**Package Dimensions – MSOP10**

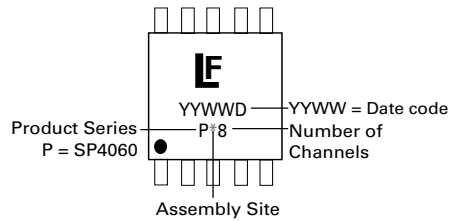


| Package | MSOP        |      |           |       |
|---------|-------------|------|-----------|-------|
| Pins    | 10          |      |           |       |
| JEDEC   | MO-187      |      |           |       |
| DIM     | Millimeters |      | Inches    |       |
|         | Min         | Max  | Min       | Max   |
| A       | -           | 1.10 | -         | 0.043 |
| A1      | 0.00        | 0.15 | 0.000     | 0.006 |
| B       | 0.17        | 0.27 | 0.007     | 0.011 |
| c       | 0.08        | 0.23 | 0.003     | 0.009 |
| D       | 2.90        | 3.10 | 0.114     | 0.122 |
| E       | 4.67        | 5.10 | 0.184     | 0.200 |
| E1      | 2.90        | 3.10 | 0.114     | 0.122 |
| e       | 0.50 BSC    |      | 0.020 BSC |       |
| L       | 0.40        | 0.80 | 0.016     | 0.032 |

**Part Numbering System**



**Part Marking System**



**Product Characteristics**

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

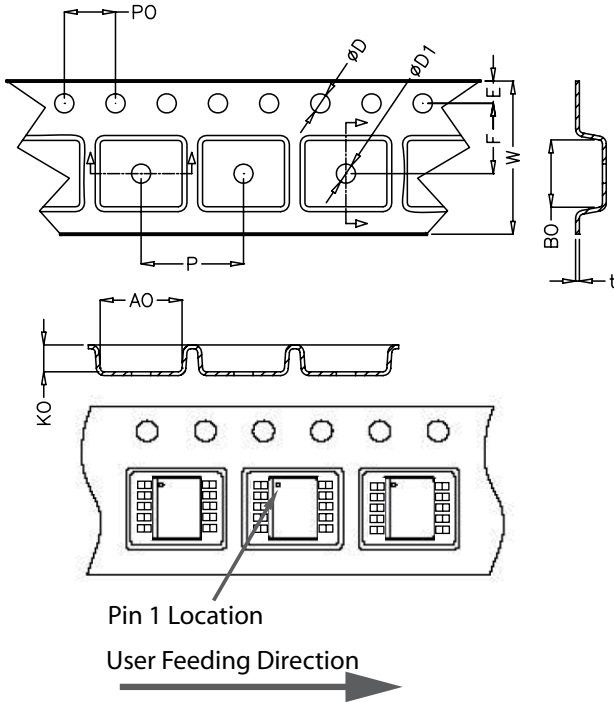
Notes :

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.

**Ordering Information**

| Part Number  | Package | Marking | Min. Order Qty. |
|--------------|---------|---------|-----------------|
| SP4060-08ATG | MSOP10  | P*8     | 4000            |

**Embossed Carrier Tape & Reel Specification – MSOP-10**



|             | Millimetres |       | Inches        |       |
|-------------|-------------|-------|---------------|-------|
|             | Min         | Max   | Min           | Max   |
| <b>E</b>    | 1.65        | 1.85  | 0.065         | 0.073 |
| <b>F</b>    | 5.40        | 5.60  | 0.213         | 0.220 |
| <b>D</b>    | 1.50        | 1.60  | 0.059         | 0.063 |
| <b>D1</b>   | 1.50 Min    |       | 0.059 Min     |       |
| <b>P0</b>   | 3.90        | 4.10  | 0.154         | 0.161 |
| <b>10P0</b> | 40.0 ± 0.20 |       | 1.574 ± 0.008 |       |
| <b>W</b>    | 11.90       | 12.10 | 0.469         | 0.476 |
| <b>P</b>    | 7.90        | 8.10  | 0.311         | 0.319 |
| <b>A0</b>   | 5.20        | 5.40  | 0.205         | 0.213 |
| <b>B0</b>   | 3.20        | 3.40  | 0.126         | 0.134 |
| <b>K0</b>   | 1.20        | 1.40  | 0.047         | 0.055 |
| <b>t</b>    | 0.30 ± 0.05 |       | 0.012 ± 0.002 |       |

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