

## TVS Diode Arrays

### TVS Rail Clamp Array in a Surface Mount Package

## SP0502AAH, SP0506AAA, SP0506AAB

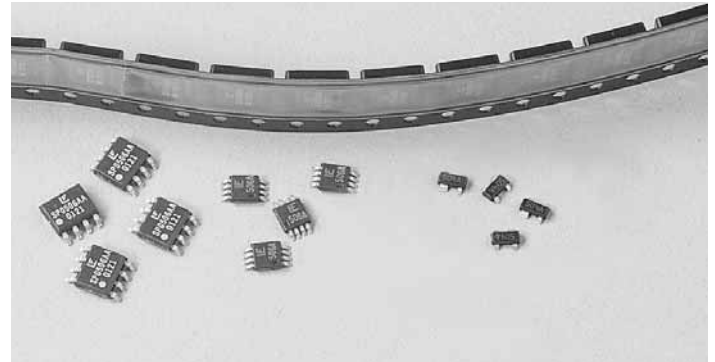
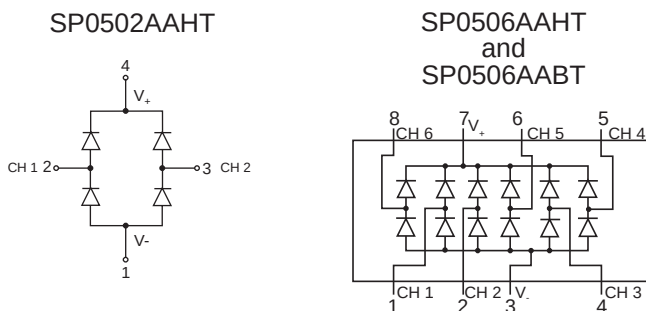
This family of rail clamp or “diode steering” arrays is designed for very low capacitance ESD protection and is offered in small surface mount packages. The multi-channel devices are used to help protect high speed sensitive digital or analog input circuits on data, signal, or control lines with unipolar voltage levels up to 5 VDC. The state-of-the-art structure is designed to suppress ESD and other transient over-voltage events to meet the International Electrotechnical Compatibility (IEC) transient immunity standards IEC 61000-4-2 for Electrostatic Discharge Requirements.

The monolithic silicon devices are comprised of specially designed low capacitance structures for transient voltage suppression (TVS). The size and shape of these structures have been tailored for transient protection. The low capacitance and clamp voltage are ideal for high speed signal line protection.

### Ordering Information

| Part Number | CH | Package Type | Quantity Per Reel |
|-------------|----|--------------|-------------------|
| SP0502AAHT  | 2  | SOT143       | 3000              |
| SP0506AAAT  | 6  | MSOP8        | 4000              |
| SP0506AABT  | 6  | SOIC8        | 2500              |

### Schematic



### Features

- A low capacitance 2, 6 and 18 channel array of rail clamp current steering diodes in small surface mount packages
- ESD Protection Capability (SP0502 and SP0506)
  - IEC 61000-4-2, Direct Discharge . . . . . 8kV (Level 4)
  - MIL STD 3015.7 . . . . . 15kV
- ESD Protection Capability (SP0518)
  - IEC 61000-4-2, Direct Discharge . . . . . 15kV (Level 4)
  - MIL STD 3015.7 . . . . . 15kV
- Input Protection for Applications Up to 5VDC
- Fast Response Time . . . . . < 1ns
- Low Input Capacitance. . . . . .3-7pF Typical
- Low Clamp Voltage . . . . . Vrail + 13V Max
- Operating Temperature Range. . . . . - 40°C to +85°C

### Applications

- Cell phone hand sets
- Personal Digital Assistants (PDA)
- Portable handheld equipment (Laptop, Palmtop computers)
- Computer port, keyboard (USB1.1)
- Digital cameras
- V6A port protection
- Digital still camera
- Digital video camera

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### Electrical Specifications $T_A = 25^\circ\text{C}$ Unless Otherwise Specified

| PARAMETER                                          | TEST CONDITIONS           | MIN         | TYPICAL | MAX         | UNITS            |
|----------------------------------------------------|---------------------------|-------------|---------|-------------|------------------|
| Operating Supply Voltage                           | $V_P - V_N$               | -           | -       | 6.0         | V                |
| Supply Current                                     | $V_P - V_N = 5.5\text{V}$ |             |         | 10          | $\mu\text{A}$    |
| Channel Leakage Current                            |                           |             | 0.1     | 1.0         | $\mu\text{A}$    |
| Signal Clamp Voltage <sup>(2)</sup>                | 15kV ESD HBM              |             |         |             |                  |
| Positive                                           |                           |             |         | $V_P + 13$  | V                |
| Negative                                           |                           |             |         | $V_N - 13$  | V                |
| Diode Forward Voltage $I_f = 20\text{mA}$          |                           | 0.65        |         | 0.95        | V                |
| Maximum Forward current <sup>(1)</sup>             |                           |             |         |             |                  |
| SP0502 and SP0506x                                 |                           |             |         | 20          | mA               |
| Power Rating (SOT143)                              |                           |             |         | 275         | $\mu\text{W}$    |
| SOIC8                                              |                           |             |         | 350         | $\mu\text{W}$    |
| MSOP8                                              |                           |             |         | 200         | $\mu\text{W}$    |
| Maximum DC Input voltage                           |                           | $V_N - 0.5$ |         | $V_P + 0.5$ | V                |
| ESD Test Level (SP0502 and SP0506x) <sup>(3)</sup> |                           |             |         |             |                  |
| IEC-61000-4-2, Contact discharge                   |                           | 8           |         |             | kV               |
| MIL-STD-883 Method 3015 (HBM)                      |                           | 15          |         |             | kV               |
| Capacitance                                        |                           |             |         |             |                  |
| SP0502 and SP0506x                                 | 2.5VDC @ 1Mhz             |             | 3       | 5           | pF               |
| Turn on/off Time                                   |                           |             | <1      |             | ns               |
| Temperature Range                                  |                           |             |         |             |                  |
| Operating                                          |                           | - 40        |         | +85         | $^\circ\text{C}$ |
| Storage                                            |                           | - 65        |         | +150        | $^\circ\text{C}$ |

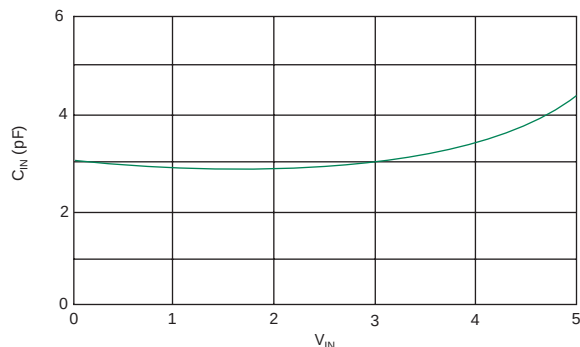
1) One diode conducting at a time.

2) These parameters guaranteed by design and characterization.

3) From I/O pins to  $V_P$  or  $V_N$  only.  $V_P$  bypassed to  $V_N$  with a 0.22  $\mu\text{F}$  ceramic capacitor.

### Typical Capacitance

SP0502 and SP0506x



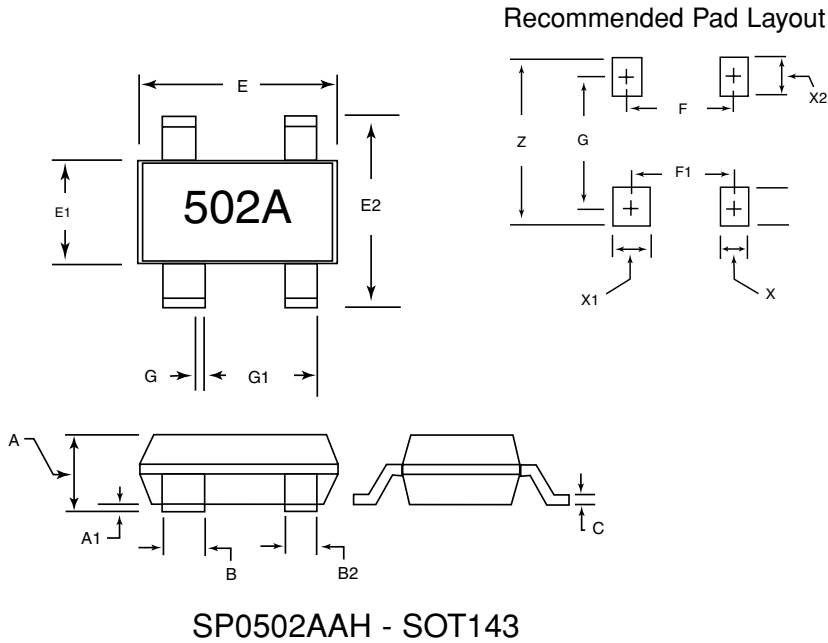
Typical Variation of  $C_{IN}$  with  $V_{IN}$   
 ( $V_P=5\text{V}$ ,  $V_N=0\text{V}$ , 0.1 $\mu\text{F}$  chip capacitor between  $V_P$  &  $V_N$ )

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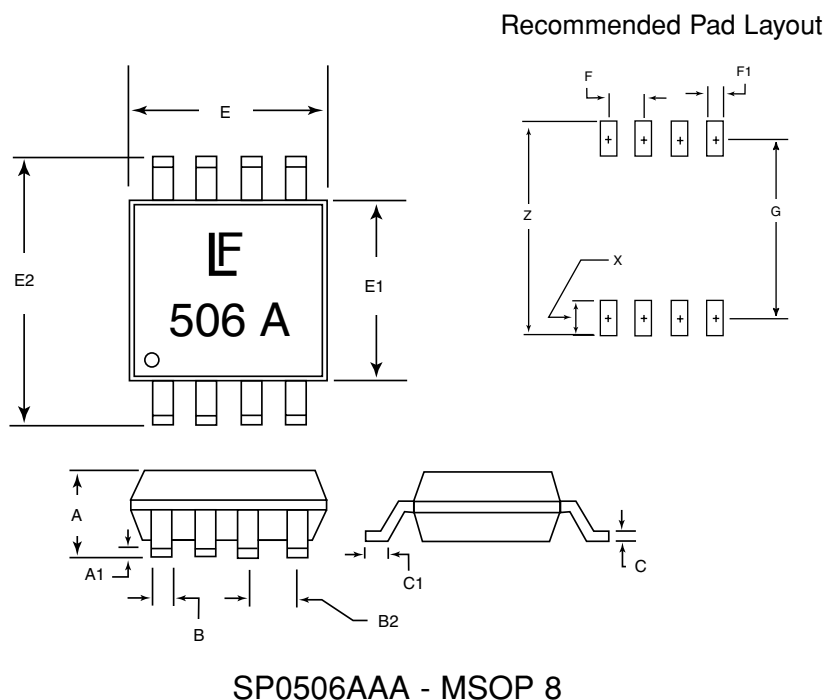
## SP0502AAH, SP0506AAA, SP0506AAB

### Outline Drawings



| Package | SOT143 |          |        |          |
|---------|--------|----------|--------|----------|
|         | mm     |          | inches |          |
|         | min    | max      | min    | max      |
| E       | 2.80   | 3.04     | .110   | .120     |
| E1      | 1.20   | 1.40     | .047   | .055     |
| E2      | 2.10   | 2.64     | .083   | .104     |
| G       | -      | .020REF  | -      | 1.920REF |
| G1      | -      | 1.920REF | -      | .076     |
| A       | 0.890  | 1.120    | .035   | .044     |
| A1      | 0.013  | 0.100    | .0005  | .0040    |
| B       | 0.760  | 0.940    | .030   | .037     |
| B2      | 0.370  | 0.510    | .015   | .020     |
| C       | 0.0850 | 0.180    | .0033  | .0071    |
| Z       | 3.40   | 3.60     | .134   | .140     |
| G       | -      | 2.2REF   | -      | .087REF  |
| F       | -      | 1.90     | -      | .075     |
| F1      | -      | 1.70     | -      | .067     |
| X       | 0.80   | 1.00     | .032   | .040     |
| X1      | 1.00   | 1.20     | .040   | .048     |
| X2      | -      | 1.40     | -      | .055     |

### Outline Drawings



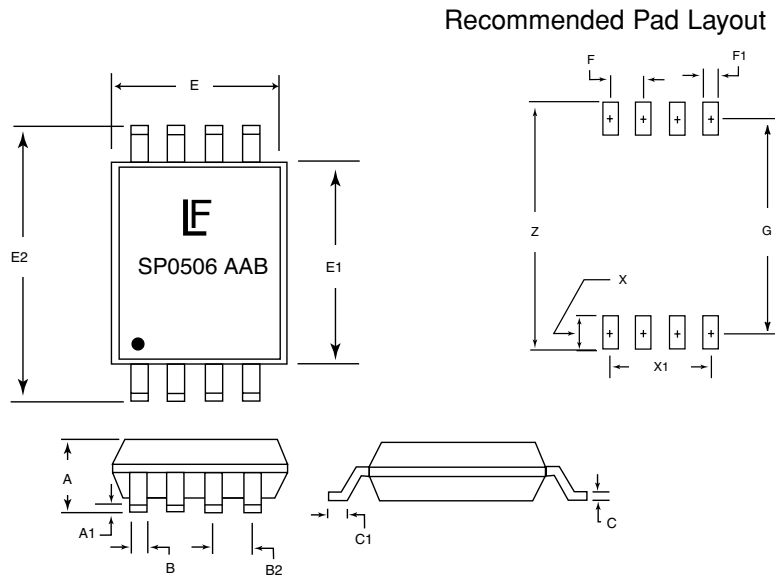
| Package | MSOP 8 |      |        |         |
|---------|--------|------|--------|---------|
|         | mm     |      | inches |         |
|         | min    | max  | min    | max     |
| E       | 2.90   | 3.10 | .114   | .122    |
| E1      | 2.90   | 3.10 | .114   | .122    |
| E2      | 4.78   | 4.98 | .188   | .196    |
| A       | 0.87   | 1.17 | .034   | .046    |
| A1      | 0.05   | 0.25 | .002   | .010    |
| B       | -      | 0.30 | -      | .012TYP |
| B2      | -      | 0.65 | -      | .25TYP  |
| C       | -      | 0.18 | -      | .007TYP |
| C1      | 0.52   | 0.54 | .017   | .025    |
| F       | -      | 0.65 | -      | .0256   |
| F1      | -      | 0.38 | -      | .015    |
| Z       | -      | 5.28 | -      | .208    |
| X       | -      | 1.04 | -      | .041    |
| G       | -      | 4.24 | -      | .167    |

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### Outline Drawings



SP0506AAB - SOIC 8

| Package   | SOIC 8 |         |        |        |
|-----------|--------|---------|--------|--------|
|           | mm     |         | inches |        |
|           | min    | max     | min    | max    |
| <b>E</b>  | 4.80   | 5.00    | .189   | .197   |
| <b>E1</b> | 3.80   | 4.19    | .150   | .165   |
| <b>E2</b> | 5.80   | 6.20    | .228   | .244   |
| <b>A</b>  | 1.35   | 1.75    | .053   | .069   |
| <b>A1</b> | 0.10   | 0.25    | .004   | .010   |
| <b>B</b>  | 0.33   | 0.51    | .013   | .020   |
| <b>B2</b> | -      | 1.27    | -      | .050   |
| <b>C</b>  | 0.19   | 0.25    | .007   | .010   |
| <b>C1</b> | 0.40   | 1.27    | .016   | .050   |
| <b>F</b>  | -      | 1.27    | -      | .05    |
| <b>F1</b> | 0.60   | 0.80    | .02    | .03    |
| <b>Z</b>  | 7.20   | 7.40    | -      | .29    |
| <b>X</b>  | -      | 2.40    | -      | .09    |
| <b>X1</b> | -      | 3.81REF | -      | .15REF |
| <b>G</b>  | -      | 5.00REF | -      | .19REF |