

# TVS Diode Arrays

## Surface Mount TVS Avalanche Diode Array

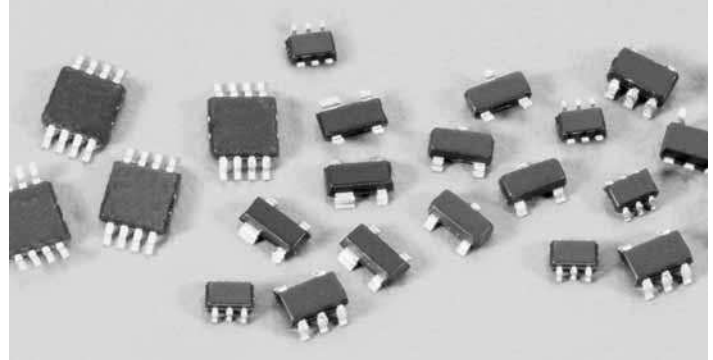
### SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

The surface mount family of arrays are designed to suppress ESD and other transient overvoltage events. These arrays are used to meet the International Electrotechnical Compatibility (IEC transient immunity standards IEC 61000-4-2 for Electrostatic Discharge Requirements). The series are used to help protect sensitive digital or analog input circuits on data, signal, or control lines with voltage levels up to 5VDC.

The monolithic silicon arrays are comprised of specially designed 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 |
|-------------|----|--------------|-------------------|
| SP0502BAHT  | 2  | SOT23        | 3000              |
| SP0503BAHT  | 3  | SOT143       | 3000              |
| SP0504BAHT  | 4  | SOT23-5      | 3000              |
| SP0505BAHT  | 5  | SOT23-6      | 3000              |
| SP0504BAAT  | 4  | TSSOP-8      | 3000              |
| SP0506BAAT  | 6  | MSOP-8       | 4000              |
| SP0502BAJT  | 2  | SC70-3       | 3000              |
| SP0504BAJT  | 4  | SC70-5       | 3000              |
| SP0505BAJT  | 5  | SC70-6       | 3000              |

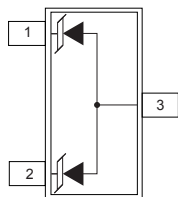


#### Features

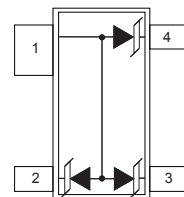
- An Array of 2, 3, 4, 5 or 6 TVS Avalanche Diodes in a ultra small SC70, SOT-23, SOT-143, MSOP or TSSOP packages
- ESD Capability Standards
  - IEC 61000-4-2, Direct Discharge . . . . . 20kV (Level 4)
  - IEC 61000-4-2, Air Discharge . . . . . 30kV (Level 4)
  - MIL STD 883 3015.7 . . . . . 30kV
- Input Protection for Applications Up to 5VDC
- Fast Response Time . . . . . < 1ns
- Low Input Capacitance . . . . . 30pF Typical
- Operating Temperature Range . . . . . -40°C to 85°C

#### Pinout

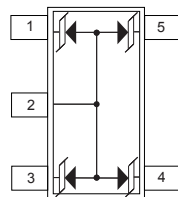
SP0502BAHT  
SP0502BAJT



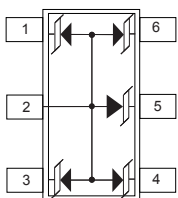
SP0503BAHT



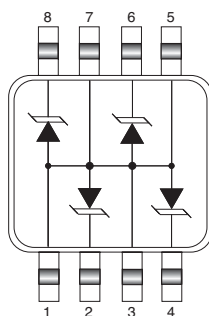
SP0504BAHT  
SP0504BAJT



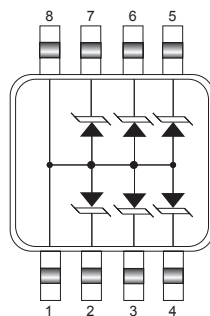
SP0505BAHT  
SP0505BAJT



SP0504BAAT



SP0506BAAT



#### Applications

- Mobile phone handsets
- Personal Digital Assistants (PDA)
- Portable handheld equipment (Laptop, Palmtop computers)
- Computer port, keyboard (USB1.1)
- Digital still cameras
- Digital video cameras
- MP3 players

# TVS Diode Arrays

## Surface Mount TVS Avalanche Diode Array

### SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

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

| PARAMETER                          | TEST CONDITIONS             | MIN  | TYPICAL | MAX  | UNITS            |
|------------------------------------|-----------------------------|------|---------|------|------------------|
| Reverse Standoff Voltage           | $I = 10\mu\text{A}$         | 5.5  | -       | -    | V                |
| Reverse Standoff Leakage Current   | $V = 5.0\text{V}$           |      | 1       | 100  | nA               |
| Signal Clamp Voltage               |                             |      |         |      |                  |
| Positive                           | $I = 10\text{mA}$           | 5.6  | 6.8     | 8    | V                |
| Negative                           | $I = 10\text{mA}$           | -1.2 | -0.8    | -0.4 | V                |
| Clamp Voltage during ESD           |                             |      |         |      |                  |
| MIL-STD-883 Method 3015 (HBM) test |                             |      |         |      |                  |
| 8kV                                |                             |      | 12      |      | V                |
| 8kV                                |                             |      | -8      |      | V                |
| ESD Test Level (1)                 |                             |      |         |      |                  |
| IEC-61000-2, Contact discharge     |                             | 20   |         |      | kV               |
| MIL-STD-883 Method 3015 (HBM)      |                             | 30   |         |      | kV               |
| Capacitance                        | $2.5\text{V} @ 1\text{Mhz}$ |      | 30      |      | pF               |
| Turn on/off Time                   |                             |      | <1      |      | ns               |
| Temperature Range                  |                             |      |         |      |                  |
| Operating                          |                             | -40  |         | 85   | $^\circ\text{C}$ |
| Storage                            |                             | -65  |         | 150  | $^\circ\text{C}$ |
| Diode Dynamic Resistance           |                             |      |         |      |                  |
| Forward Conduction                 |                             |      | 1.0     |      | $\Omega$         |
| Reverse Conduction                 |                             |      | 1.4     |      | $\Omega$         |

Note:

(1) ESD voltage applied between channel pins and ground, one pin at a time; all other channel pins are open; all ground pins are grounded.

| Absolute Maximum Ratings          |              |      |
|-----------------------------------|--------------|------|
| Parameter                         | Rating       | Unit |
| Storage Temperature Range         | -65 to + 150 | C    |
| Package Power Dissipation         |              |      |
| SC70                              | 0.2          | W    |
| SOT23-3, SOT23-5, SOT23-6, SOT143 | 0.225        | W    |
| TSSOP, MSOP                       | 0.5          | W    |

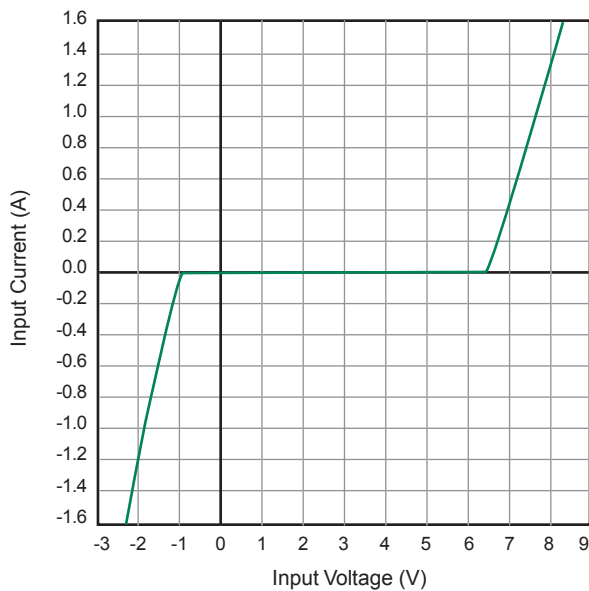
# TVS Diode Arrays

## Surface Mount TVS Avalanche Diode Array

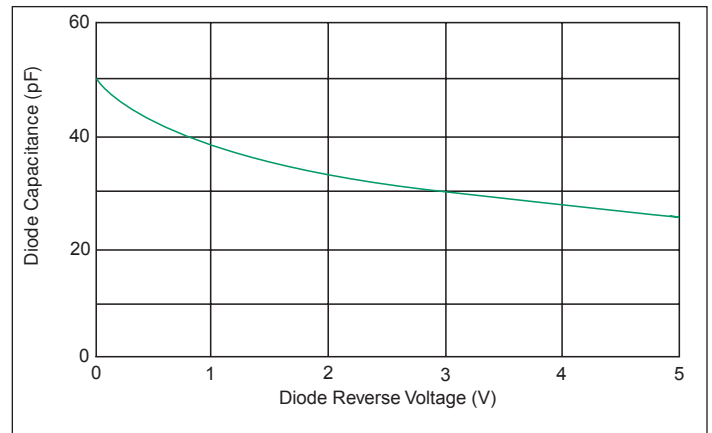
### SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

#### Typical Input VI Characteristics

(Pulse-mode measurements, pulse width = 0.7 mS nominal)



#### Typical Diode Capacitance vs. Reverse Voltage



#### Package Information

| Mechanical Specifications |                        |
|---------------------------|------------------------|
| Lead Plating              | Tin-Lead               |
| Lead Material             | Copper Alloy           |
| Lead Coplanarity          | 0.004 inches (0.102mm) |
| Substitute Material       | Silicon                |
| Body Material             | Molded Epoxy           |
| Flammability              | UL94-V-0               |

#### Notes:

1. All dimensions are in millimeters.
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. All specifications comply to JEDEC SPEC MO-203 ISSUE A.
5. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
6. Package surface matte finish VDI 11-13.

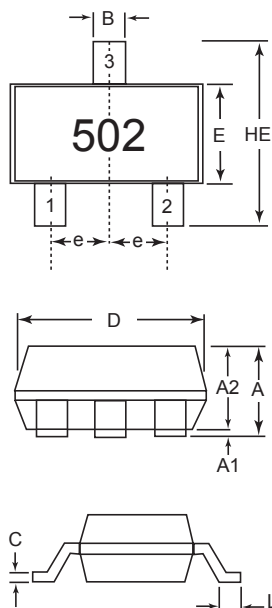
## TVS Diode Arrays

### Surface Mount TVS Avalanche Diode Array

## SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

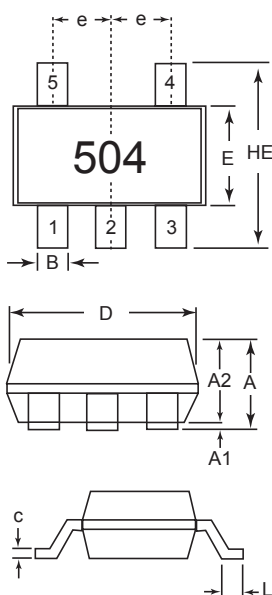
### Outline Drawings

SP0502BAJT - SC70-3



| Package | SC70-3         |      |           |       |
|---------|----------------|------|-----------|-------|
| Pins    | 3              |      |           |       |
| JEDEC   | MO-203 Issue A |      |           |       |
|         | mm             |      | inches    |       |
|         | min            | max  | min       | max   |
| A       | 0.80           | 1.10 | 0.031     | 0.043 |
| A1      | 0.00           | 0.10 | 0.00      | 0.004 |
| A2      | 0.70           | 1.00 | 0.028     | 0.039 |
| B       | 0.15           | 0.30 | 0.006     | 0.012 |
| c       | 0.08           | 0.25 | 0.003     | 0.010 |
| D       | 1.85           | 2.25 | 0.073     | 0.089 |
| E       | 1.15           | 1.35 | 0.045     | 0.053 |
| e       | 0.66 BSC       |      | 0.026 BSC |       |
| HE      | 2.00           | 2.40 | 0.079     | 0.094 |
| L       | 0.26           | 0.46 | 0.010     | 0.018 |

SP0504BAJT - SC70-5



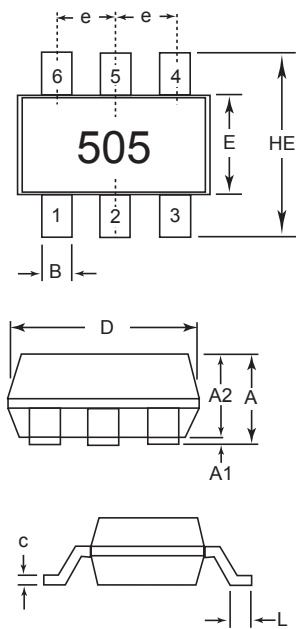
| Package | SC70-5         |      |           |       |
|---------|----------------|------|-----------|-------|
| Pins    | 5              |      |           |       |
| JEDEC   | MO-203 Issue A |      |           |       |
|         | mm             |      | inches    |       |
|         | min            | max  | min       | max   |
| A       | 0.80           | 1.10 | 0.03      | 0.043 |
| A1      | 0.00           | 0.10 | 0.00      | 0.004 |
| A2      | 0.70           | 1.00 | 0.028     | 0.039 |
| B       | 0.15           | 0.30 | 0.006     | 0.012 |
| c       | 0.08           | 0.25 | 0.003     | 0.010 |
| D       | 1.85           | 2.25 | 0.073     | 0.089 |
| E       | 1.15           | 1.35 | 0.045     | 0.053 |
| e       | 0.65 BSC       |      | 0.026 BSC |       |
| HE      | 2.00           | 2.40 | 0.079     | 0.094 |
| L       | 0.26           | 0.46 | 0.010     | 0.018 |

## TVS Diode Arrays

### Surface Mount TVS Avalanche Diode Array

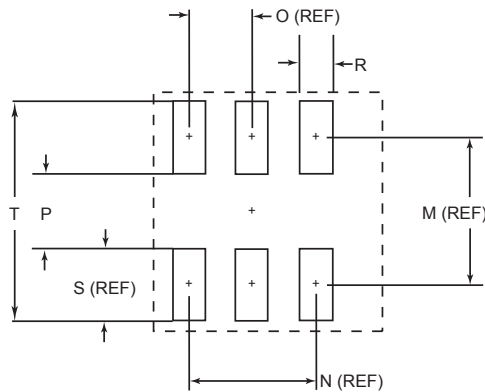
## SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

### Outline Drawings



### SP0505BAJT - SC70-6

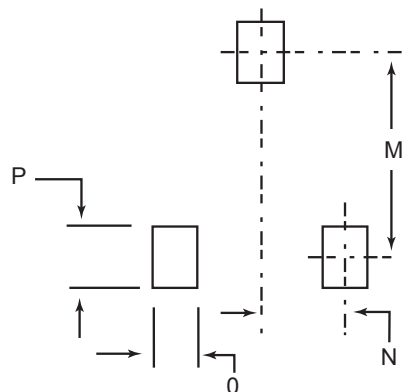
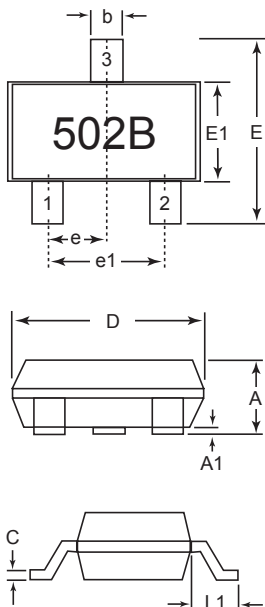
#### Recommended Pad Layout



| Package | SC70-6         |      |           |       |
|---------|----------------|------|-----------|-------|
| Pins    | 5              |      |           |       |
| JEDEC   | MO-203 Issue A |      |           |       |
|         | mm             |      | inches    |       |
|         | min            | max  | min       | max   |
| A       | 0.80           | 1.10 | 0.031     | 0.043 |
| A1      | 0.00           | 0.10 | 0.00      | 0.004 |
| A2      | 0.70           | 1.00 | 0.028     | 0.039 |
| B       | 0.15           | 0.30 | 0.006     | 0.012 |
| c       | 0.08           | 0.25 | 0.003     | 0.010 |
| D       | 1.85           | 2.25 | 0.073     | 0.089 |
| E       | 1.15           | 1.35 | 0.045     | 0.053 |
| e       | 0.65 BSC       |      | 0.026 BSC |       |
| HE      | 2.00           | 2.40 | 0.079     | 0.094 |
| L       | 0.26           | 0.46 | 0.010     | 0.018 |
| M       | -              | 1.60 | -         | 0.063 |
| N       | -              | 1.30 | -         | 0.052 |
| O       | -              | 0.65 | -         | 0.026 |
| P       | -              | 0.70 | -         | 0.058 |
| R       | -              | 0.35 | -         | 0.014 |
| S       | -              | 0.90 | -         | 0.035 |
| T       | -              | 2.50 | -         | 0.098 |

### SP0502BAHT - SOT23

#### Recommended Pad Layout



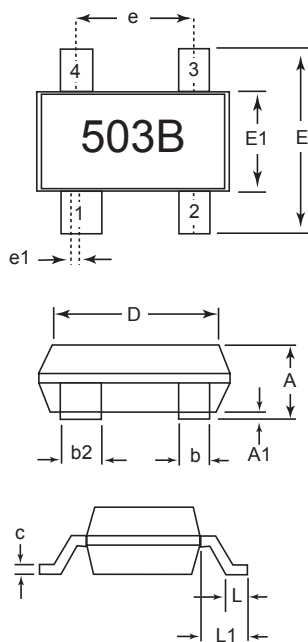
| Package | SOT23    |      |          |         |
|---------|----------|------|----------|---------|
| Pins    | 3        |      |          |         |
| JEDEC   | TO-236   |      |          |         |
|         | mm       |      | inches   |         |
|         | min      | max  | min      | max     |
| A       | 0.89     | 1.12 | 0.035    | 0.044   |
| A1      | 0.01     | 0.1  | 0.0004   | 0.004   |
| b       | 0.3      | 0.5  | 0.012    | 0.020   |
| c       | 0.08     | 0.2  | 0.003    | 0.008   |
| D       | 2.8      | 3.04 | 0.110    | 0.120   |
| E       | 2.1      | 2.64 | 0.083    | 0.104   |
| E1      | 1.2      | 1.4  | 0.047    | 0.055   |
| e       | 0.95 BSC |      | 0.95 BSC |         |
| e1      | 1.90 BSC |      | 1.90 BSC |         |
| L1      | 0.54 REF |      | 0.54 REF |         |
| M       |          | 2.29 |          | .090    |
| N       |          | 0.95 |          | .0375   |
| O       |          | 0.78 |          | .030TYP |
| P       |          | 0.78 |          | .030TYP |

## TVS Diode Arrays

### Surface Mount TVS Avalanche Diode Array

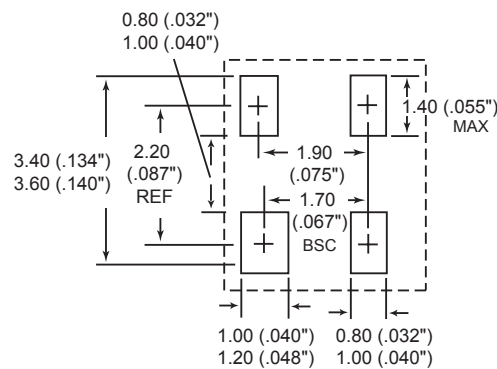
## SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

### Outline Drawings



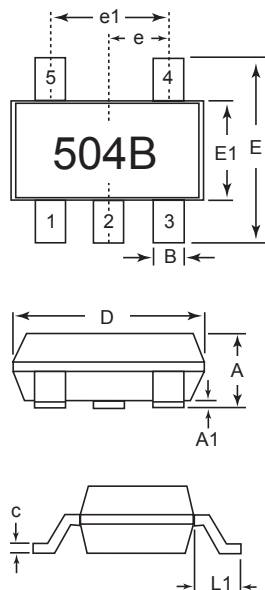
### SP0503BAHT - SOT143

#### Recommended Pad Layout

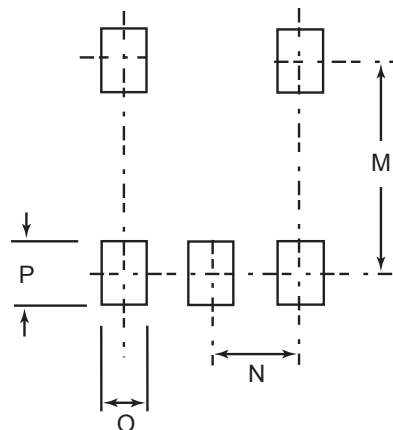


| Package | SOT143    |      |           |       |
|---------|-----------|------|-----------|-------|
| Pins    | 4         |      |           |       |
| JEDEC   | TO-253    |      |           |       |
|         | mm        |      | inches    |       |
|         | min       | max  | min       | max   |
| A       | 0.08      | 1.22 | 0.031     | 0.048 |
| A1      | 0.05      | 0.15 | 0.002     | 0.006 |
| b       | 0.30      | 0.50 | 0.012     | 0.019 |
| b2      | 0.76      | 0.89 | 0.030     | 0.035 |
| c       | 0.08      | 0.20 | 0.003     | 0.008 |
| D       | 2.80      | 3.04 | 0.110     | 0.119 |
| E       | 2.10      | 2.64 | 0.082     | 0.103 |
| E1      | 1.20      | 1.40 | 0.047     | 0.055 |
| e       | 1.92 BSC  |      | 0.076 BSC |       |
| e1      | 0.20 BSC  |      | 0.008 BSC |       |
| L       | 0.4       | 0.6  | 0.016     | 0.024 |
| L1      | 0.550 REF |      | 0.022 REF |       |

### SP0504BAHT - SOT23-5



#### Recommended Pad Layout



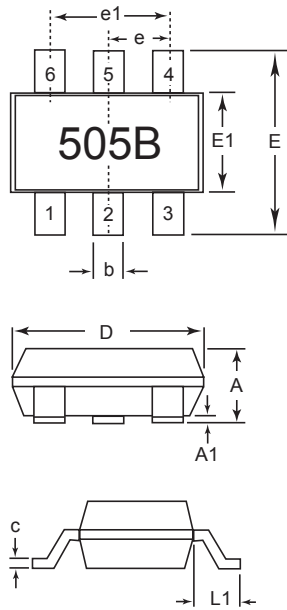
| Package | SOT23-5  |      |          |         |
|---------|----------|------|----------|---------|
| Pins    | 5        |      |          |         |
| JEDEC   | MO-178   |      |          |         |
|         | mm       |      | inches   |         |
|         | min      | max  | min      | max     |
| A       | -        | 1.45 | -        | 0.057   |
| A1      | 0        | 0.15 | 0        | 0.006   |
| b       | 0.3      | 0.5  | 0.012    | 0.020   |
| c       | 0.08     | 0.22 | 0.003    | 0.009   |
| D       | 2.75     | 3.05 | 0.108    | 0.120   |
| E       | 2.6      | 3.0  | 0.102    | 0.118   |
| E1      | 1.45     | 1.75 | 0.057    | 0.069   |
| e       | 0.95 BSC |      | 0.95 BSC |         |
| e1      | 1.90 BSC |      | 1.90 BSC |         |
| L1      | 0.60 REF |      | 0.60 REF |         |
| M       |          | 2.59 |          | .102    |
| N       |          | 0.95 |          | .038    |
| O       |          | 0.69 |          | .027TYP |
| P       |          | 0.99 |          | .039TYP |

## TVS Diode Arrays

### Surface Mount TVS Avalanche Diode Array

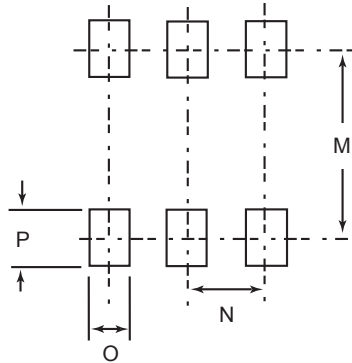
## SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

### Outline Drawings



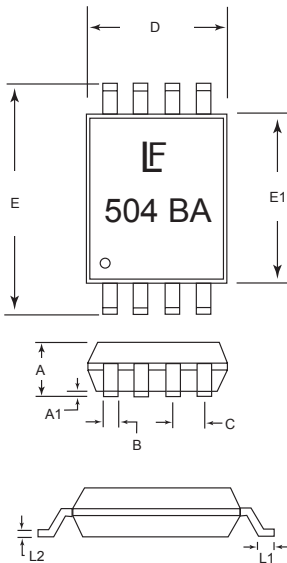
SP0505BAHT - SOT23-6

#### Recommended Pad Layout



| Package | SOT23-6  |      |          |         |
|---------|----------|------|----------|---------|
| Pins    | 6        |      |          |         |
| JEDEC   | MO-178   |      |          |         |
|         | mm       |      | inches   |         |
|         | min      | max  | min      | max     |
| A       | -        | 1.45 | -        | 0.057   |
| A1      | 0        | 0.15 | 0        | 0.006   |
| b       | 0.3      | 0.5  | 0.012    | 0.020   |
| c       | 0.08     | 0.22 | 0.003    | 0.009   |
| D       | 2.75     | 3.05 | 0.108    | 0.120   |
| E       | 2.6      | 3.0  | 0.102    | 0.118   |
| E1      | 1.45     | 1.75 | 0.057    | 0.069   |
| e       | 0.95 BSC |      | 0.95 BSC |         |
| e1      | 1.90 BSC |      | 1.90 BSC |         |
| L1      | 0.60 REF |      | 0.60 REF |         |
| M       |          | 2.59 |          | .102    |
| N       |          | 0.95 |          | 0.038   |
| O       |          | 0.69 |          | .027TYP |
| P       |          | 0.99 |          | .039TYP |
| Pd@70°C | .225W    |      |          |         |

SP0504BAAT - TSSOP-8



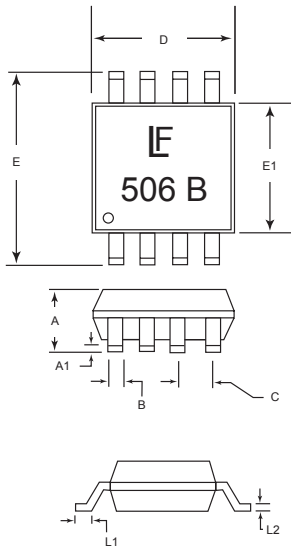
| Package | TSSOP-8   |       |          |        |
|---------|-----------|-------|----------|--------|
|         | mm        |       | inches   |        |
|         | min       | max   | min      | max    |
| D       | 2.90      | 3.10  | .144     | .122   |
| E       | 6.40 REF  |       | .252 REF |        |
| E1      | 4.29      | 4.50  | .17      | .18    |
| A       | 1.194 REF |       | .047 REF |        |
| A1      | 0.051     | 0.152 | .002     | 0.006  |
| B       | -         | 0.30  | -        | .12TYP |
| C       | -         | 0.66  | -        | .26TYP |
| L1      | 0.51      | 0.76  | .020     | .030   |
| L2      | 0.102     | 0.203 | .004     | .008   |

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### Surface Mount TVS Avalanche Diode Array

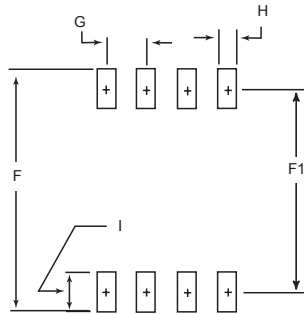
## SP0502BA, SP0503BA, SP0504BA, SP0505BA, SP0506BA

### Outline Drawings



### SP0506BAAT - MSOP-8

#### Recommended Pad Layout



| Package   | MSOP-8 |         |        |         |
|-----------|--------|---------|--------|---------|
|           | mm     |         | inches |         |
|           | min    | max     | min    | max     |
| <b>D</b>  | 2.90   | 3.10    | .144   | .122    |
| <b>E</b>  | 4.78   | 4.98    | .188   | .196    |
| <b>E1</b> | 2.90   | 3.10    | .114   | .122    |
| <b>A</b>  | 0.87   | 1.17    | .034   | .046    |
| <b>A1</b> | 0.05   | 0.25    | .002   | 0.10    |
| <b>B</b>  | -      | 0.30TYP | -      | .12TYP  |
| <b>C</b>  | -      | 0.65TYP | -      | .25TYP  |
| <b>L1</b> | 0.52   | 0.54    | .017   | .025    |
| <b>L2</b> | -      | 0.18TYP | -      | .007TYP |
| <b>F</b>  | -      | 5.28    | -      | .208    |
| <b>F1</b> | -      | 4.24    | -      | .167    |
| <b>G</b>  | -      | 0.65    | -      | .0256   |
| <b>H</b>  | -      | 0.38    | -      | .015    |
| <b>I</b>  | -      | 1.04    | -      | .041    |