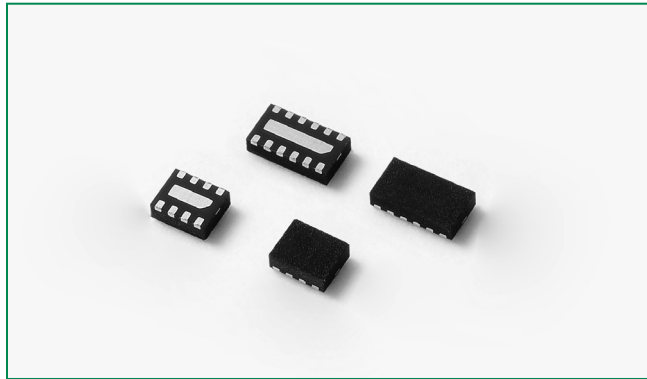
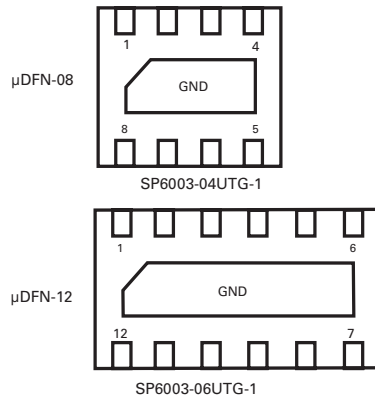


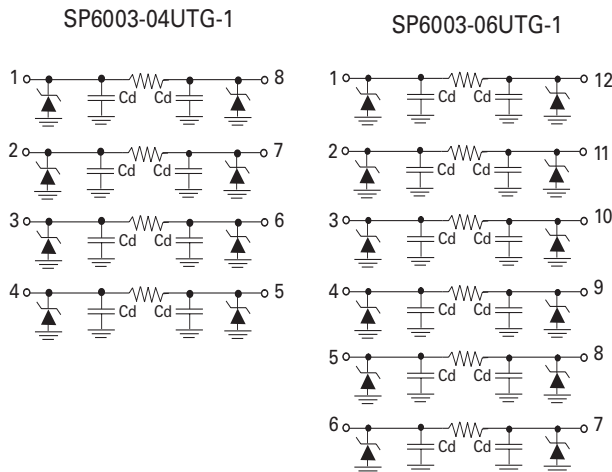
# SP6003 Series 7pF EMI Filter Array with ESD Protection



## Pinout



## Functional Block Diagram



## Description

Littelfuse's SP6003 integrates 4 and 6 EMI filters (C-R-C) into a small, low-profile  $\mu$ DFN package with each filter providing greater than -20dB attenuation at 1GHz. Additionally, each I/O is capable of shunting  $\pm 12$ kV ESD strikes (IEC61000-4-2, contact discharge) away from sensitive electronic components. The performance of this small, slim design makes it extremely suitable for mobile handsets, PDA's, and notebook computers.

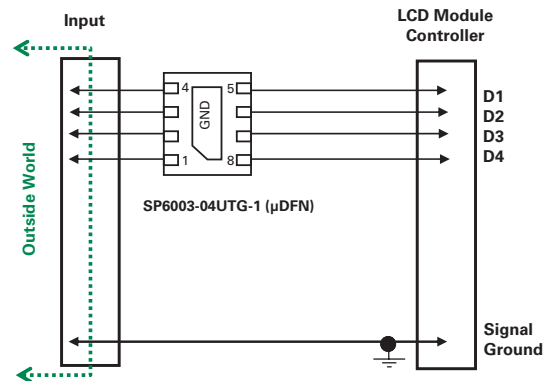
## Features

- EMI filtering of frequencies from 800MHz to 3GHz
- Greater than -20dB attenuation (TYP) at 1GHz
- ESD, IEC61000-4-2,  $\pm 12$ kV contact,  $\pm 15$ kV air
- Small, low-profile  $\mu$ DFN (JEDEC MO-229) package (TYP 0.5mm height)

## Applications

- Keypad Interface for Portable Electronics
- LCD and Camera Display Interfaces for Handsets
- Connector Interfaces for Handsets
- PDA's
- Digital Cameras
- Notebook Computers

## Application Example



### Absolute Maximum Ratings

| Symbol     | Parameter             | Value      | Units |
|------------|-----------------------|------------|-------|
| $T_{OP}$   | 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 10s) | 260        | °C    |

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

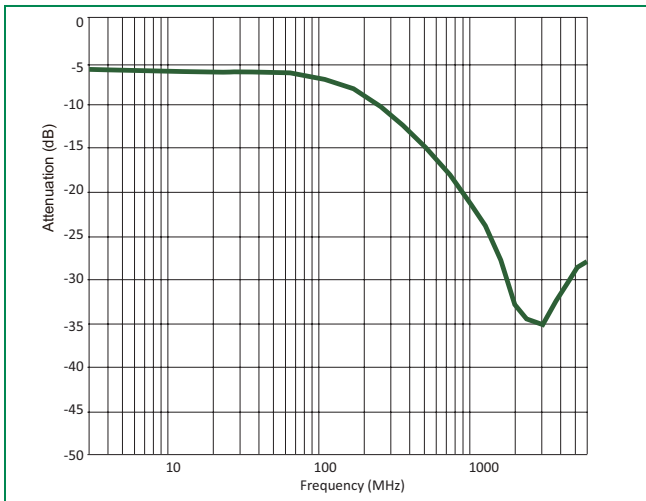
| Parameter                          | Symbol     | Test Conditions                                      | Min      | Typ | Max | Units         |
|------------------------------------|------------|--|----------|-----|-----|---------------|
| Reverse Standoff Voltage           | $V_{RWM}$  |  |          |     | 5.0 | V             |
| Breakdown Voltage                  | $V_{BR}$   | $I_R=1\text{mA}$                                     |          | 7.0 |     | V             |
| Reverse Leakage Current            | $I_{LEAK}$ | $V_{RWM}=5\text{V}$                                  |          | 0.1 | 1.0 | $\mu\text{A}$ |
| Resistance                         | $R_A$      | $I_R=10\text{mA}$                                    | 80       | 100 | 120 | $\Omega$      |
| Diode Capacitance <sup>1,2</sup>   | $C_D$      | $V_R=2.5\text{V}, f=1\text{MHz}$                     |          | 7   |     | pF            |
| Line Capacitance <sup>1,2</sup>    | $C_L$      | $V_R=2.5\text{V}, f=1\text{MHz}$                     | 11       | 14  | 17  | pF            |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$  | IEC61000-4-2 (Contact Discharge)                     | $\pm 12$ |     |     | kV            |
|                                    |            | IEC61000-4-2 (Air Discharge)                         | $\pm 15$ |     |     | kV            |
| Cutoff Frequency <sup>3</sup>      | $F_{-3dB}$ | Above this frequency, appreciable attenuation occurs |          | 250 |     | MHz           |

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

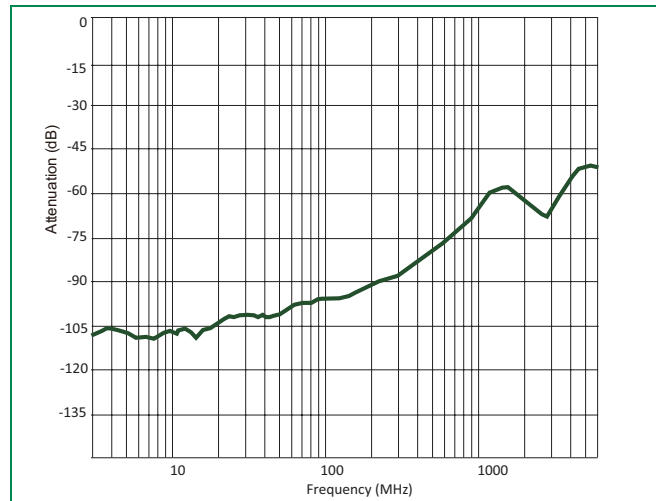
<sup>2</sup> Total line capacitance is two times the diode capacitance ( $C_D$ ).

<sup>3</sup> 50 $\Omega$  source and 50 $\Omega$  load termination

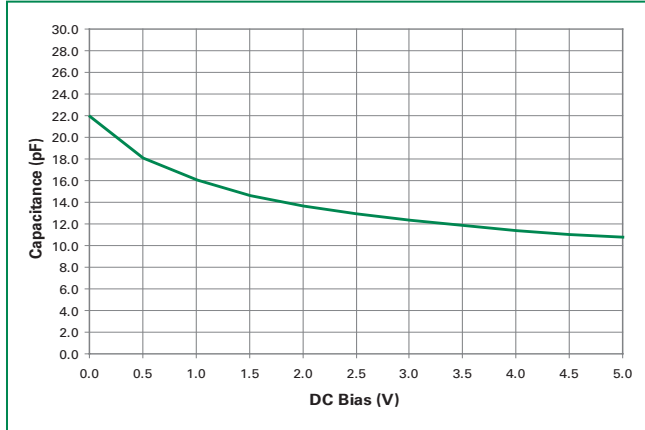
### Insertion Loss (S21)



### Analog Crosstalk (S41)



**Line Capacitance vs. DC Bias**



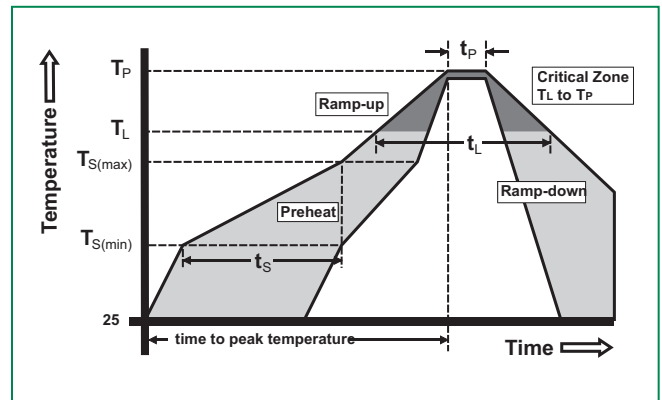
**Product Characteristics**

|                            |                         |
|----------------------------|-------------------------|
| <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               |

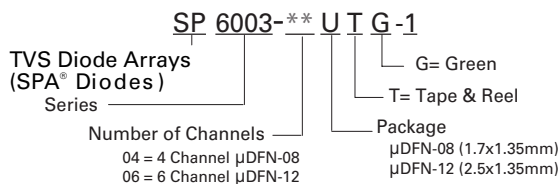
- Notes :
1. All dimensions are in millimeters
  2. Dimensions include solder plating.
  3. Dimensions are exclusive of mold flash & metal burr.
  4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
  5. Package surface matte finish VDI 11-13.

**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                   |



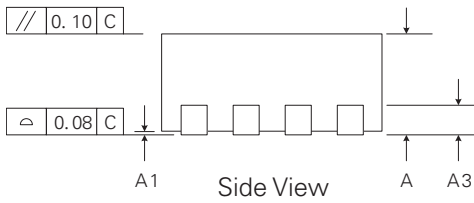
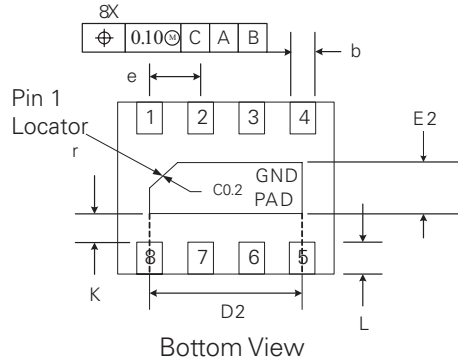
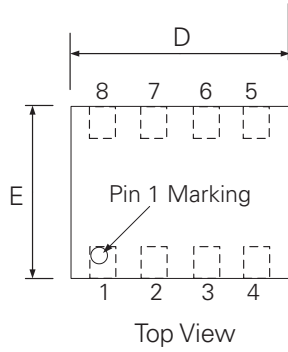
**Part Numbering System**



**Ordering Information**

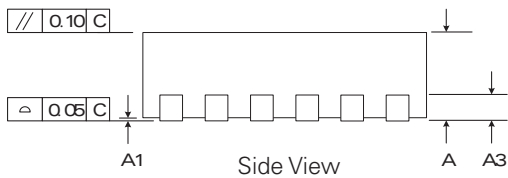
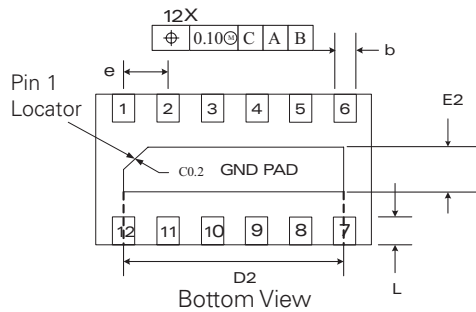
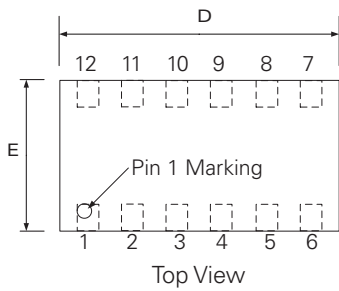
| Part Number    | Package      | Size       | Marking  | Min. Order Qty. |
|----------------|--------------|------------|----------|-----------------|
| SP6003-04UTG-1 | $\mu$ DFN-08 | 1.7x1.35mm | C114     | 3000            |
| SP6003-06UTG-1 | $\mu$ DFN-12 | 2.5x1.35mm | C116YVWW | 3000            |

**Package Dimensions —  $\mu$ DFN-08**



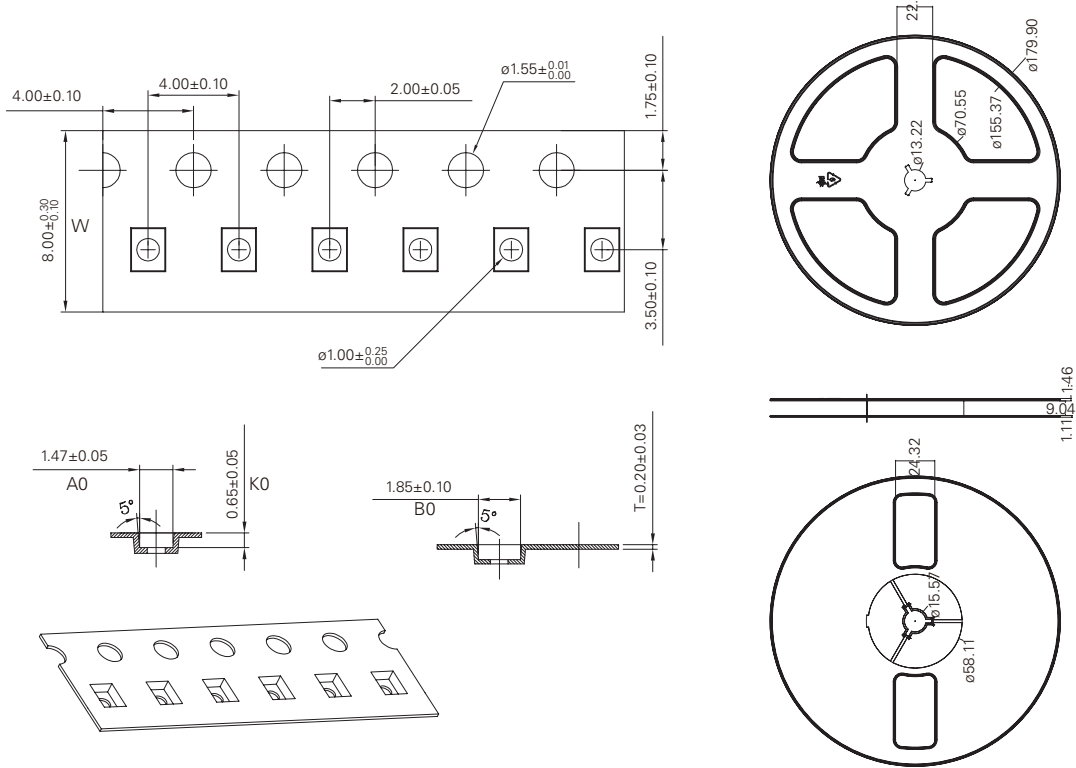
|           | $\mu$ DFN-08 |      |        |       |
|-----------|--------------|------|--------|-------|
|           | JEDEC MO-229 |      |        |       |
|           | Millimeters  |      | Inches |       |
|           | Min          | Max  | Min    | Max   |
| <b>A</b>  | 0.45         | 0.55 | 0.018  | 0.022 |
| <b>A1</b> | 0.00         | 0.05 | 0.000  | 0.002 |
| <b>A3</b> | 0.152        | REF  | 0.006  | REF   |
| <b>b</b>  | 0.15         | 0.25 | 0.006  | 0.010 |
| <b>D</b>  | 1.60         | 1.80 | 0.063  | 0.071 |
| <b>D2</b> | 1.10         | 1.30 | 0.043  | 0.051 |
| <b>E</b>  | 1.25         | 1.45 | 0.049  | 0.057 |
| <b>E2</b> | 0.30         | 0.50 | 0.012  | 0.020 |
| <b>e</b>  | 0.400        | BSC  | 0.016  | BSC   |
| <b>K</b>  | 0.20         |      | 0.008  |       |
| <b>L</b>  | 0.15         | 0.35 | 0.006  | 0.014 |

**Package Dimensions —  $\mu$ DFN-12**



|           | $\mu$ DFN-12 |      |        |       |
|-----------|--------------|------|--------|-------|
|           | JEDEC MO-229 |      |        |       |
|           | Millimeters  |      | Inches |       |
|           | Min          | Max  | Min    | Max   |
| <b>A</b>  | 0.45         | 0.55 | 0.018  | 0.022 |
| <b>A1</b> | 0.00         | 0.05 | 0.000  | 0.002 |
| <b>A3</b> | 0.102        | REF  | 0.004  | REF   |
| <b>b</b>  | 0.15         | 0.25 | 0.006  | 0.010 |
| <b>D</b>  | 2.40         | 2.60 | 0.095  | 0.103 |
| <b>D2</b> | 1.90         | 2.10 | 0.075  | 0.083 |
| <b>E</b>  | 1.25         | 1.45 | 0.050  | 0.058 |
| <b>E2</b> | 0.30         | 0.50 | 0.012  | 0.020 |
| <b>e</b>  | 0.400        | BSC  | 0.016  | BSC   |
| <b>L</b>  | 0.15         | 0.35 | 0.006  | 0.014 |

**Embossed Carrier Tape & Reel Specification —  $\mu$ DFN-08**



**SP6003**

**Embossed Carrier Tape & Reel Specification —  $\mu$ DFN-12**

