**Description**

The SP5001 Series is a highly integrated Common Mode Filter (CMF) providing both ESD protection and EMI common mode noise filtering for systems using high speed differential serial interfaces, such as MIPI D-PHY or HDMI.

The SP5001 Series can protect and filter two differential line pairs in a small RoHS-compliant TDFN-10 package, with cost and space savings over discrete solutions.

**Features**

- Large differential bandwidth > 2.5 GHz
- High Common Mode Stop Band Attenuation:
  - > 25 dB at 700 MHz
  - > 30 dB at 800 MHz
- ±15kV ESD protection per channel (IEC 61000-4-2 Level 4, contact discharge and ±30kV air discharge)
- TDFN-10 2.50mm × 2.00mm × 0.75mm package with 0.50mm lead pitch
- RoHS-compliant, Lead-free packaging
- Moisture Sensitivity Level (MSL=1)

**Applications**

- HDMI/DVI Display in Mobile Phones
- MIPI D-PHY (CSI-2, DSI, etc) in Mobile Phones and Digital Still Cameras
## Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDC</td>
<td>DC Current Per Line</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>PDC</td>
<td>DC Package Power Rating</td>
<td>0.5</td>
<td>W</td>
</tr>
<tr>
<td>TOP</td>
<td>Operating Temperature</td>
<td>-40 to 125</td>
<td>°C</td>
</tr>
<tr>
<td>TSTOR</td>
<td>Storage Temperature</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

**CAUTION:** Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

## Electrical Characteristics (TOP=25°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Resistance</td>
<td>RCH</td>
<td>Pins 1−10, 2−9, 4−7 and 5−6</td>
<td>8.0</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Total Channel Capacitance</td>
<td>CTOTAL</td>
<td>VRC=1.65V, Reverse Bias; f=1MHz, 30mVRc</td>
<td>0.8</td>
<td>1.3</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Reverse Standoff Voltage</td>
<td>VRWM</td>
<td></td>
<td>5.0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td>VBR</td>
<td>I=1mA</td>
<td>6.0</td>
<td>8.0</td>
<td>10.0</td>
<td>V</td>
</tr>
<tr>
<td>Forward Voltage at If</td>
<td>Vf</td>
<td>I=1mA</td>
<td>0.4</td>
<td>0.7</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>Reverse Leakage Current</td>
<td>ILEAK</td>
<td>V=3.3V</td>
<td>0.01</td>
<td>0.10</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Dynamic Resistance</td>
<td>RDPN</td>
<td>Positive (tp=8/20µs)</td>
<td>1.3</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative (tp=8/20µs)</td>
<td>0.7</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TLP, tp=100ns, I/O to GND</td>
<td>0.36</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>ESD Withstand Voltage</td>
<td>VESD</td>
<td>IEC 61000-4-2 (Contact Discharge)</td>
<td>±15</td>
<td></td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-2 (Air Discharge)</td>
<td>±30</td>
<td></td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td>Differential Mode Cutoff Frequency</td>
<td>Fc</td>
<td>ZSOURCE=50 Ω, ZLOAD=50 Ω</td>
<td>2.5</td>
<td></td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>Common Mode Stop Band Attenuation</td>
<td>Fc</td>
<td>f=800MHz</td>
<td>30</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
</tbody>
</table>

**Notes:**
1. ESD zapping at I/O pins (1,2,4,5) with respect to GND.
2. Guaranteed by design.
3. Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

### Differential Mode Attenuation SDD21 vs. Frequency (Zdiff = 100Ω)

![](image1.png)

### Common Mode Attenuation SCC21 vs. Frequency (Zcomm = 50Ω)

![](image2.png)
**TVS Diode Array (SPA® Diodes)**
Low Capacitance ESD Protection - SP5001 Series

### Differential Return Loss SDD11 vs. Frequency (Z_{diff} = 100Ω)

![Differential Return Loss SDD11 vs. Frequency Graph]

### Differential Return Loss SDD22 vs. Frequency (Z_{diff} = 100Ω)

![Differential Return Loss SDD22 vs. Frequency Graph]

### Transmission Line Pulsing (TLP) Plot

![Transmission Line Pulsing (TLP) Plot]

### Part Numbering System

SP 5001 - 04 T T G
- **Series:** TVS Diode Arrays (SPA® Diodes)
- **Number of Channels:** 04 = 4 Channel TDFN-10
- **Package:** TDFN-10 (2.5x2.0mm)

### Part Marking System

Product Series
32 = SP5001
- **Date Code:** 32 = SP5001

### Soldering Parameters

**Reflow Condition**
- **Pb – Free assembly**

**Pre Heat**
- **Temperature Min (T_{min})** 150°C
- **Temperature Max (T_{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_{min}** to **T_{L}** - **Ramp-up Rate**
3°C/second max

**Reflow**
- **Temperature (T_L) (Liquidus)** 217°C
- **Temperature (t_P)** 60 – 150 seconds

**Peak Temperature (T_P)**
260°C ± 5°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

### Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Size</th>
<th>Min. Order Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP5001-04TTG</td>
<td>TDFN-10</td>
<td>2.5x2.0mm</td>
<td>3000</td>
</tr>
</tbody>
</table>

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Revised: 09/19/19
Package Dimensions — TDFN-10

Tape & Reel Specification — TDFN-10

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Revised: 06/18/19