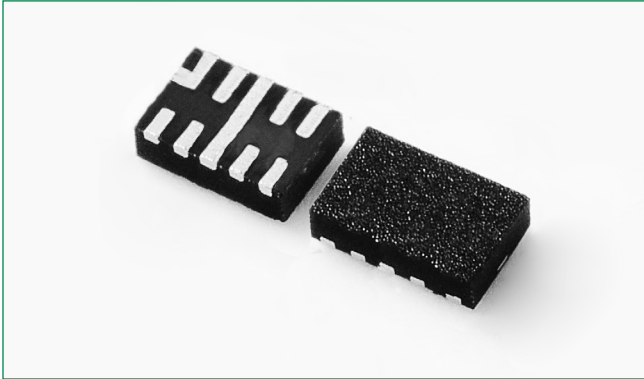


SP5003 Series 4 Channel Common Mode Filter



OBSOLETE DATE: 12/31/2020 PCN/ECN# ESU270-49
REPLACED BY: N/A

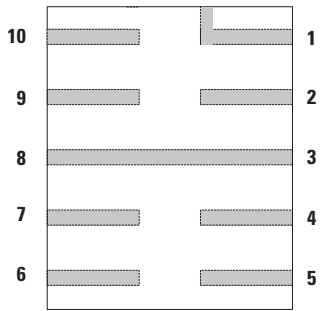


Description

The SP5003 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 SP5003 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.

Pinout

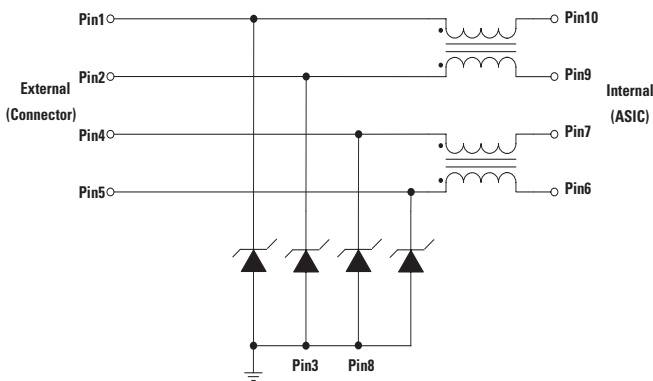


Note: Bottom-view

Features

- Large differential bandwidth > 4.0 GHz
- High Common Mode Stop Band Attenuation: > 16 dB at 900 MHz
- Common Mode Impedance: $Z_c: 32\Omega$ at 100 MHz
- TDFN-10 2.50mm × 2.00mm × 0.75mm package with 0.50mm lead pitch
- ±15kV ESD protection per channel (IEC 61000-4-2 Level 4, contact discharge)
- RoHS-compliant, Lead-free packaging
- Moisture Sensitivity Level (MSL-1)

Functional Block Diagram



Applications

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

Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|------------|-------------------------|------------|-------|
| I_{DC} | DC Current Per Line | 100 | mA |
| P_{DC} | DC Package Power Rating | 0.5 | Watts |
| 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 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.

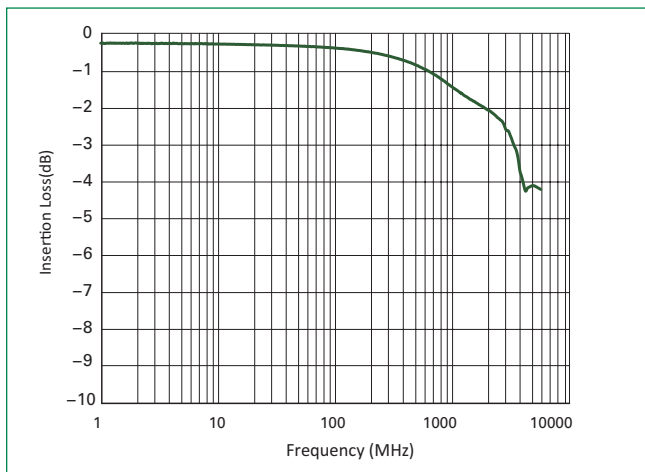
Electrical Characteristics ($T_{OP}=25^{\circ}C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|-------------|--|----------|------|------|----------|
| Channel Resistance | R_{CH} | Pins 1-10, 2-9, 4-7 and 5-6 | | 3.5 | 5.0 | Ω |
| Total Channel Capacitance | C_{TOTAL} | $V_{I/O} = 1.65VDC$ Reverse Bias; $f=1MHz, 30mV_{AC}$ | | 0.8 | 1.3 | pF |
| Reverse Standoff Voltage | V_{RWM} | | | | 5.0 | V |
| Breakdown Voltage | V_{BR} | $I_T=1mA$ | 6.0 | 8.0 | 10.0 | V |
| Forward Voltage at I_F | V_F | $I_F=1mA$ | 0.4 | 0.7 | 1.5 | V |
| Reverse Leakage Current | I_{LEAK} | $V_{Leak} = +3.3V$ | | 0.01 | 0.10 | μA |
| Dynamic Resistance ^{2, 3} | R_{DYN} | Positive (tp=8/20 μs) | | 1.36 | | Ω |
| | | Negative (tp=8/20 μs) | | 0.6 | | |
| | | TLP, tp=100ns, I/O to GND | | 0.42 | | |
| ESD Withstand Voltage ^{1, 2} | V_{ESD} | IEC 61000-4-2 (Contact Discharge) | ± 15 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ± 30 | | | kV |
| Differential Mode Cutoff Frequency ² | F_{3dB} | $Z_{SOURCE} = 50 \Omega, Z_{LOAD} = 50 \Omega$ | | 4.0 | | GHz |
| Common Mode Impedance | Z_C | @100MHz | | 32 | | Ω |
| Common Mode Stop Band Attenuation ² | F_{atten} | f=900MHz | | 16 | | dB |

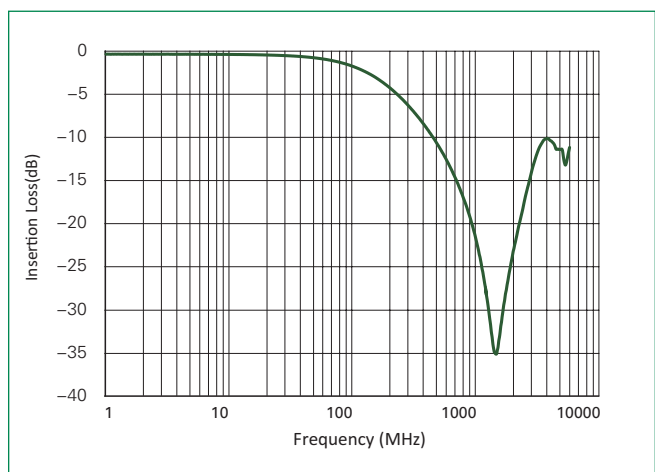
Notes:

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

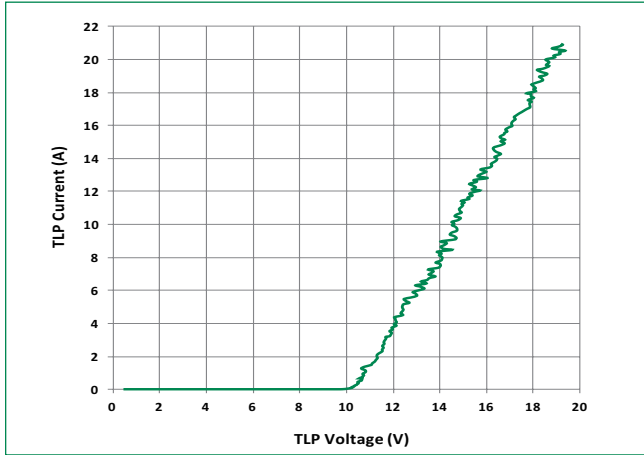
Differential Mode Attenuation vs. Frequency



Common Mode Attenuation vs. Frequency

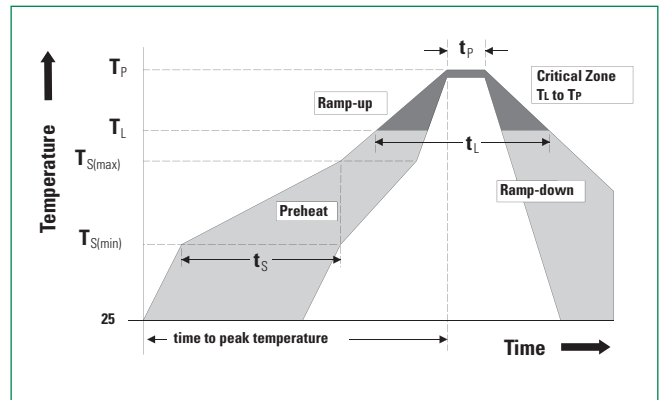


Transmission Line Pulsing (TLP) Plot



Soldering Parameters

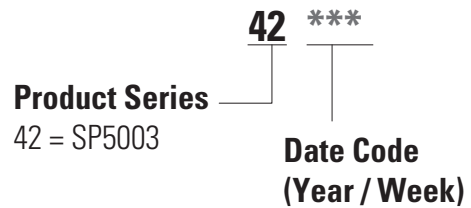
| | | |
|--|------------------------------------|-------------------------|
| Reflow Condition | | Pb – Free assembly |
| Pre Heat | - Temperature Min ($T_{s(min)}$) | 150°C |
| | - Temperature Max ($T_{s(max)}$) | 200°C |
| | - Time (min to max) (t_s) | 60 – 180 secs |
| Average ramp up rate (Liquidus) 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 ^{+0/-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 |



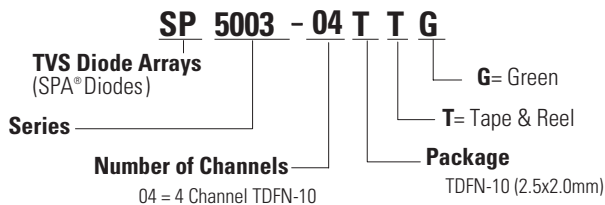
Ordering Information

| Part Number | Package | Size | Marking | Min. Order Qty. |
|--------------|---------|-----------|---------|-----------------|
| SP5003-04TTG | TDFN-10 | 2.5x2.0mm | 42*** | 3000 |

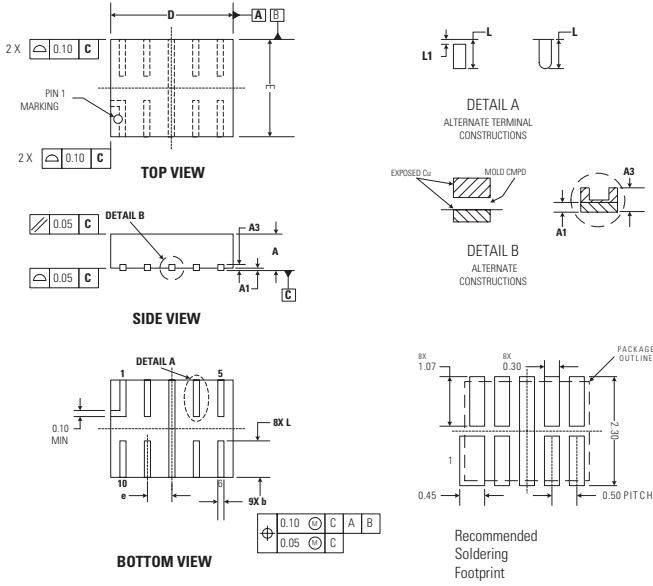
Part Marking System



Part Numbering System

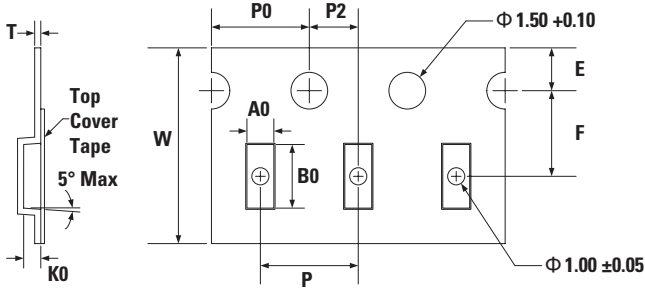


Package Dimensions –TDFN-10



| Symbol | TDFN-10 | | | |
|--------|--------------|------|-----------|-------|
| | JEDEC MO-229 | | | |
| | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| A | 0.70 | 0.80 | 0.028 | 0.031 |
| A1 | 0.00 | 0.05 | 0.000 | 0.002 |
| A3 | 0.2 REF | | 0.008 REF | |
| b | 0.15 | 0.25 | 0.006 | 0.010 |
| D | 2.50 BSC | | 0.098 BSC | |
| E | 2.00 BSC | | 0.079 BSC | |
| e | 0.50 BSC | | 0.020 BSC | |
| L | 0.70 | 0.90 | 0.028 | 0.035 |
| L1 | 0.05 | 0.15 | 0.002 | 0.006 |

Tape & Reel Specification –TDFN-10



| Symbol | Dimensions |
|--------|-------------------|
| | Millimetres |
| E | 1.75 +/- 0.10 |
| F | 3.5 +/- 0.05 |
| P | 4.0 +/- 0.10 |
| P0 | 4.0 +/- 0.10 |
| P2 | 2.0 +/- 0.05 |
| W | 8.00 +0.30/- 0.10 |
| A0 | 2.19 +/- 0.05 |
| B0 | 2.77 +/- 0.05 |
| K0 | 1.05 +/- 0.05 |
| T | 0.25 +/- 0.02 |

Device Orientation in Tape

