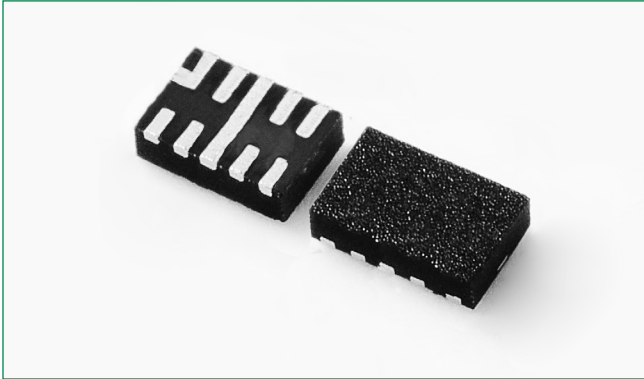


SP5003 Series 4 Channel Common Mode Filter



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

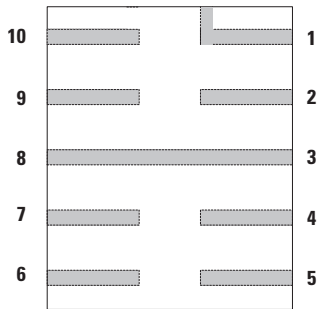


**Description**

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**

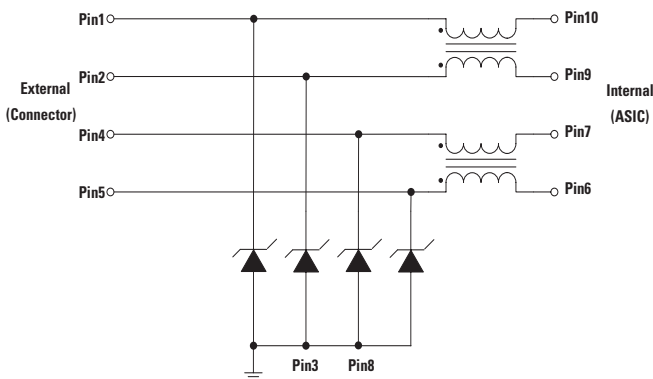


Note: Bottom-view

**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.

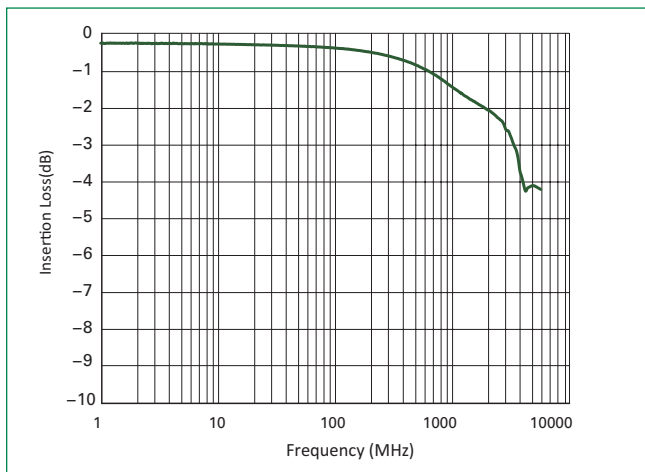
### Electrical Characteristics ( $T_{OP}=25^{\circ}C$ )

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	$\Omega$
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	$\mu A$
Dynamic Resistance <sup>2,3</sup>	$R_{DYN}$	Positive (tp=8/20 $\mu s$ )		1.36		$\Omega$
		Negative (tp=8/20 $\mu s$ )		0.6		
		TLP, tp=100ns, I/O to GND		0.42		
ESD Withstand Voltage <sup>1,2</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 15$			kV
		IEC 61000-4-2 (Air Discharge)	$\pm 30$			kV
Differential Mode Cutoff Frequency <sup>2</sup>	$F_{3dB}$	$Z_{SOURCE} = 50 \Omega, Z_{LOAD} = 50 \Omega$		4.0		GHz
Common Mode Impedance	$Z_C$	@100MHz		32		$\Omega$
Common Mode Stop Band Attenuation <sup>2</sup>	$F_{atten}$	f=900MHz		16		dB

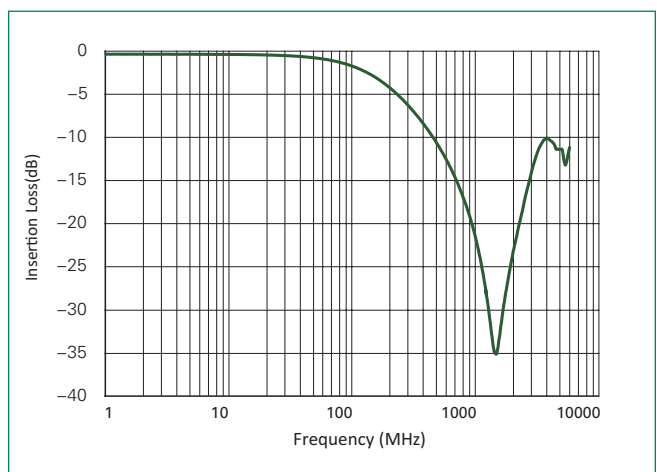
**Notes:**

- 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.

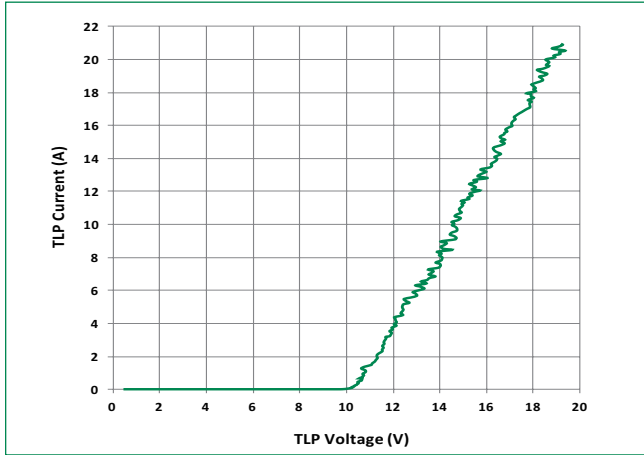
### Differential Mode Attenuation vs. Frequency



### Common Mode Attenuation vs. Frequency

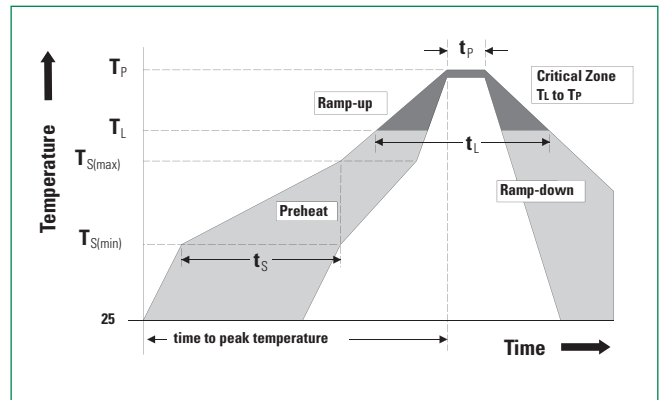


**Transmission Line Pulsing (TLP) Plot**



**Soldering Parameters**

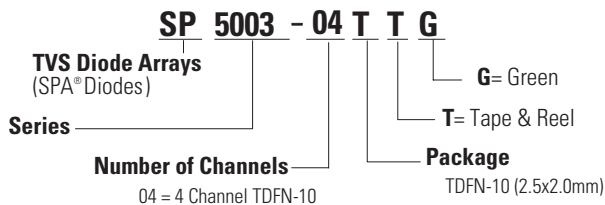
<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 secs
<b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b>		3°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_L$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		20 – 40 seconds
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		260°C



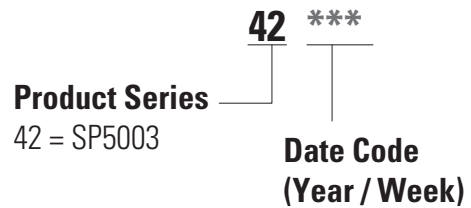
**Ordering Information**

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

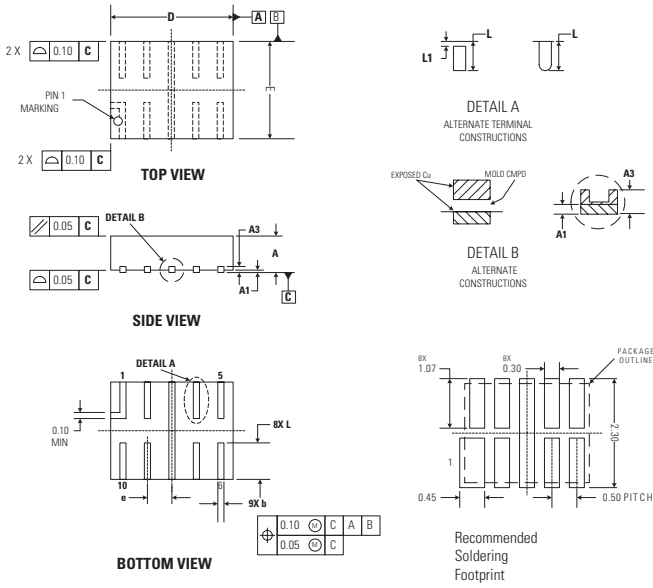
**Part Numbering System**



**Part Marking System**

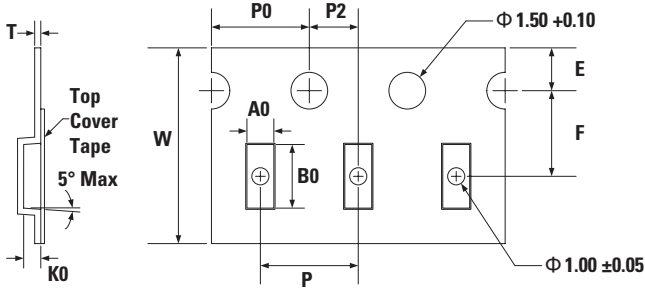


**Package Dimensions –TDFN-10**



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**

