

**SP5002 6 Channel Common Mode Filter**

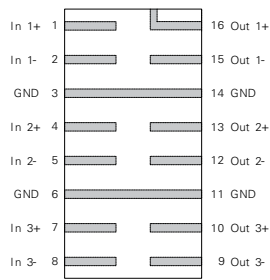


**Description**

The SP5002 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.

The SP5002 Series can protect and filter three differential line pairs in a small RoHS-compliant TDFN-16 package, with cost and space savings over discrete solutions.

**Pinout**

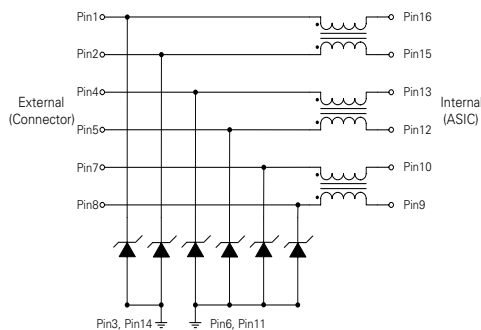


Note :This drawing is not to scale.

**Features**

- Large differential bandwidth > 2GHz
- 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-16 4.00mm × 2.00mm × 0.75mm package with 0.50mm lead pitch
- RoHS-compliant, Lead-free packaging
- AEC-Q101 qualified
- Moisture Sensitivity Level (MSL-1)

**Functional Block Diagram**



**Applications**

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

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$I_{DC}$	DC Current Per Line	100	mA
$P_{DC}$	DC Package Power Rating	0.5	W
$T_{OP}$	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 ( $T_{OP}=25^{\circ}C$ )

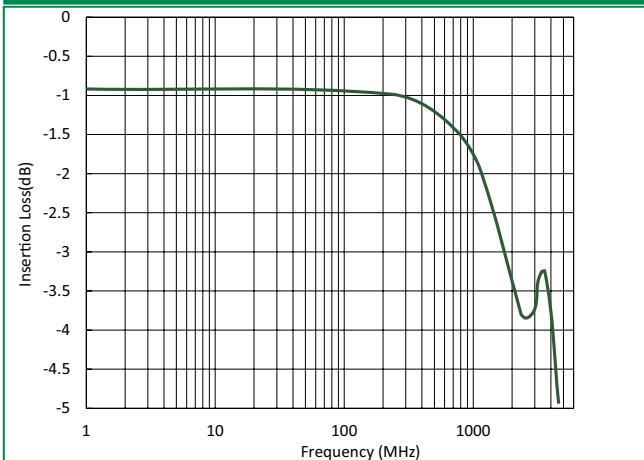
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Channel Resistance	$R_{CH}$	Pins 1-10, 2-9, 4-7 and 5-6		8.0		$\Omega$
Total Channel Capacitance	$C_{TOTAL}$	$V_{I/O} = 1.65V_{DC}$ Reverse Bias; $f=1MHz, 30mV_{AC}$		0.8	1.3	pF
Reverse Standoff Voltage	$V_{RWM}$				5.0	V
Breakdown Voltage	$V_{BR}$	$I_T=1mA$	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	$I_{LEAK}$	$V_{I/O}=3.3V$		0.01	0.10	$\mu A$
Dynamic Resistance <sup>2,3</sup>	$R_{DYN}$	Positive (tp=8/20 $\mu s$ )		1.3		$\Omega$
		Negative (tp=8/20 $\mu s$ )		0.7		
		TLP, tp=100ns, I/O to GND		0.36		
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>	$F_{3dB}$	$Z_{SOURCE}=50\Omega, Z_{LOAD}=50\Omega$		2.0		GHz
Common Mode Stop Band Attenuation <sup>2</sup>	$F_{\alpha}$	$f=800MHz$		30		dB

Notes: <sup>1</sup> ESD zapping at I/O pins (1,2,4,5,7,8) with respect to GND.

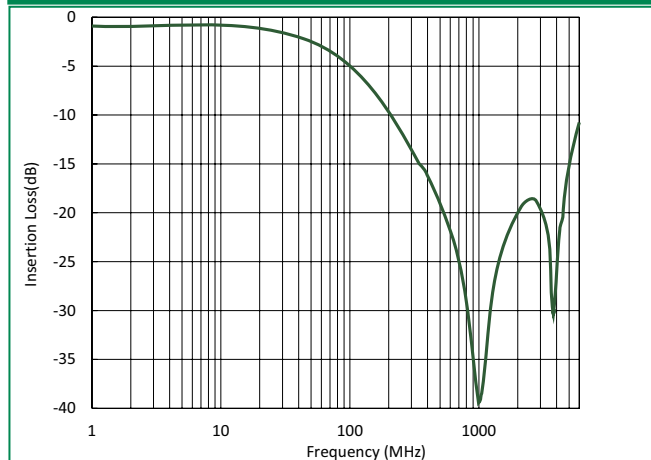
<sup>2</sup> Guaranteed by design.

<sup>3</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

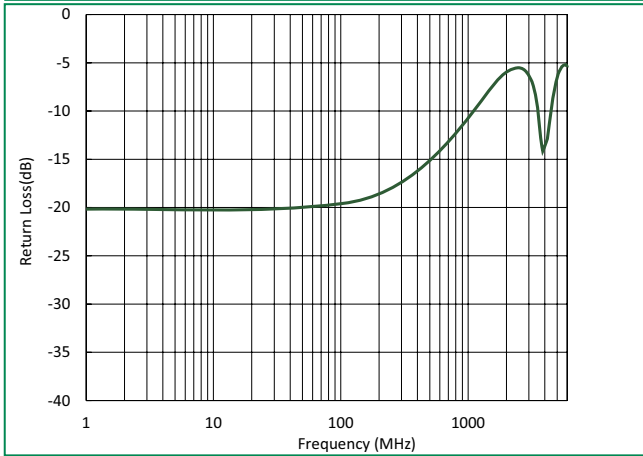
### Differential Mode Attenuation SDD21 vs. Frequency (Zdiff = 100 $\Omega$ )



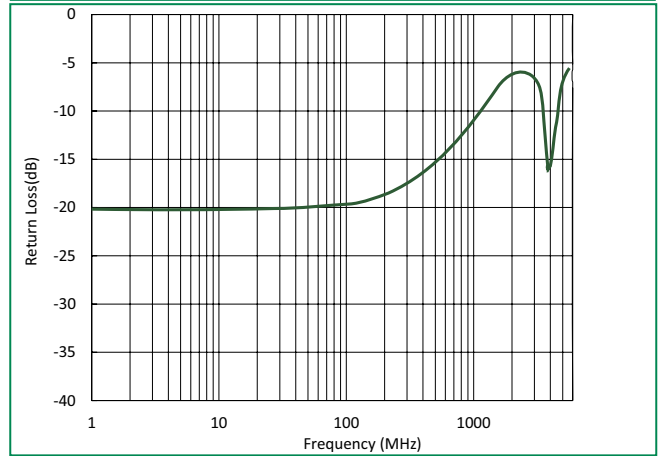
### Common Mode Attenuation SCC21 vs. Frequency (Zcomm= 50 $\Omega$ )



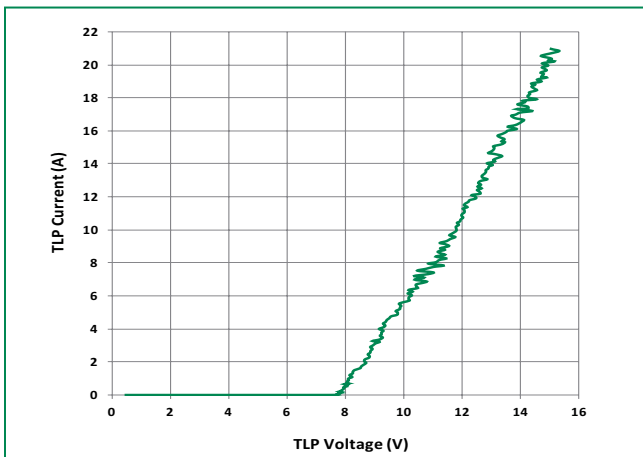
**Differential Return Loss SDD11 vs. Frequency (Zdiff = 100Ω)**



**Differential Return Loss SDD22 vs. Frequency (Zdiff = 100Ω)**

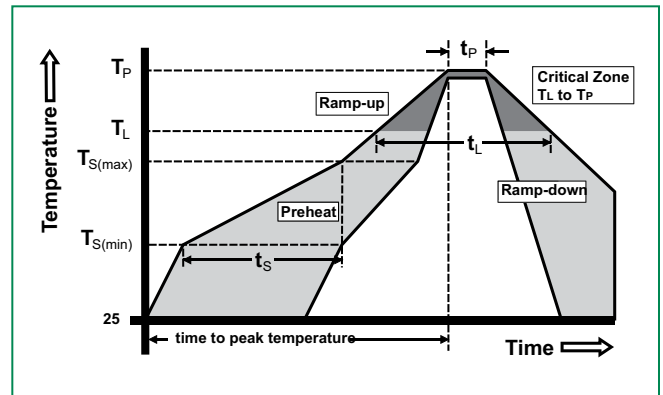


**Transmission Line Pulsing (TLP) Plot**



**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 <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



**Product Characteristics**

<b>Lead Plating</b>	Pre-Plated Frame
<b>Lead Material</b>	Copper Alloy
<b>Substrate material</b>	Silicon
<b>Body Material</b>	V-0 per UL 94 Molded Epoxy

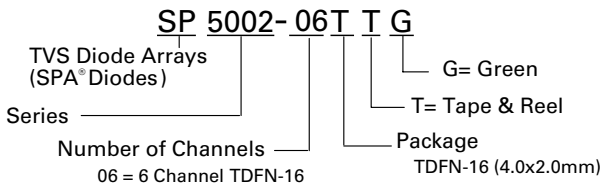
**Ordering Information**

Part Number	Package	Size	Marking	Min. Order Qty.
SP5002-06TTG	TDFN-16	4.0x2.0mm	C33****	3000

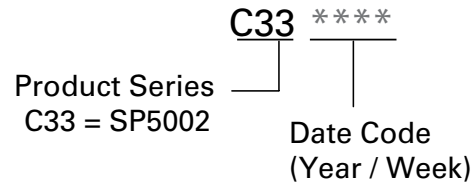
Notes :

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.

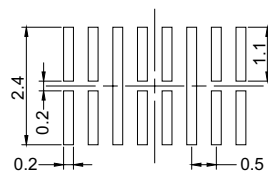
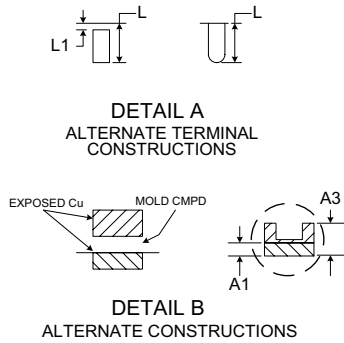
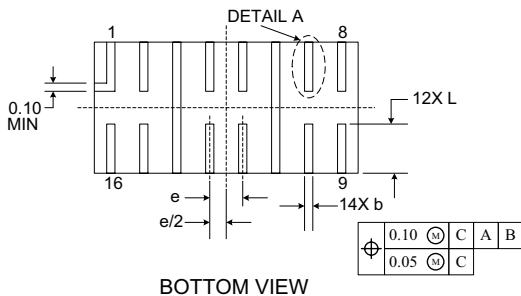
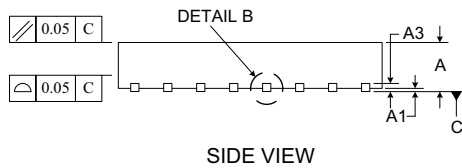
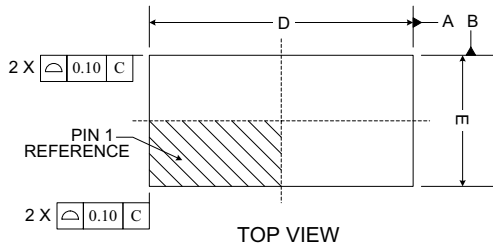
**Part Numbering System**



**Part Marking System**

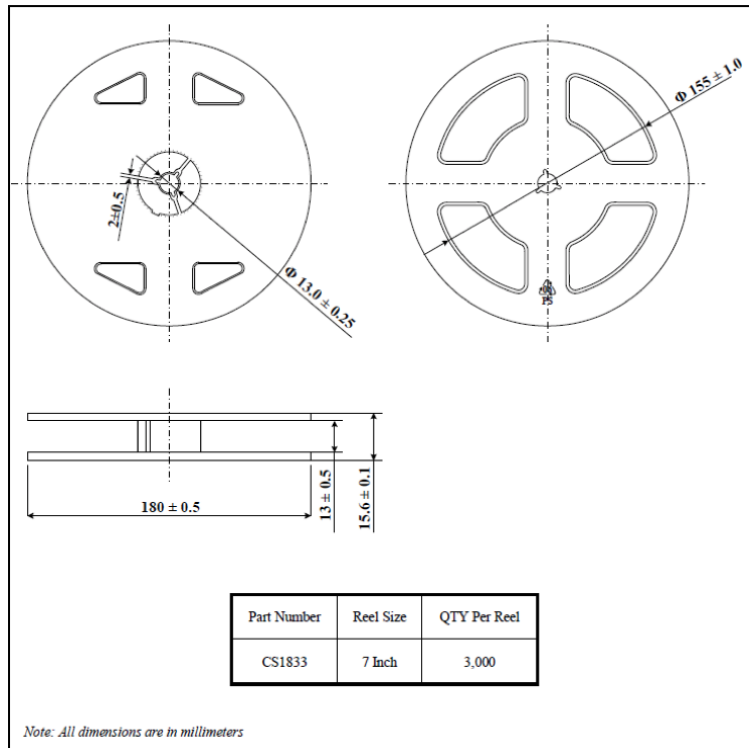
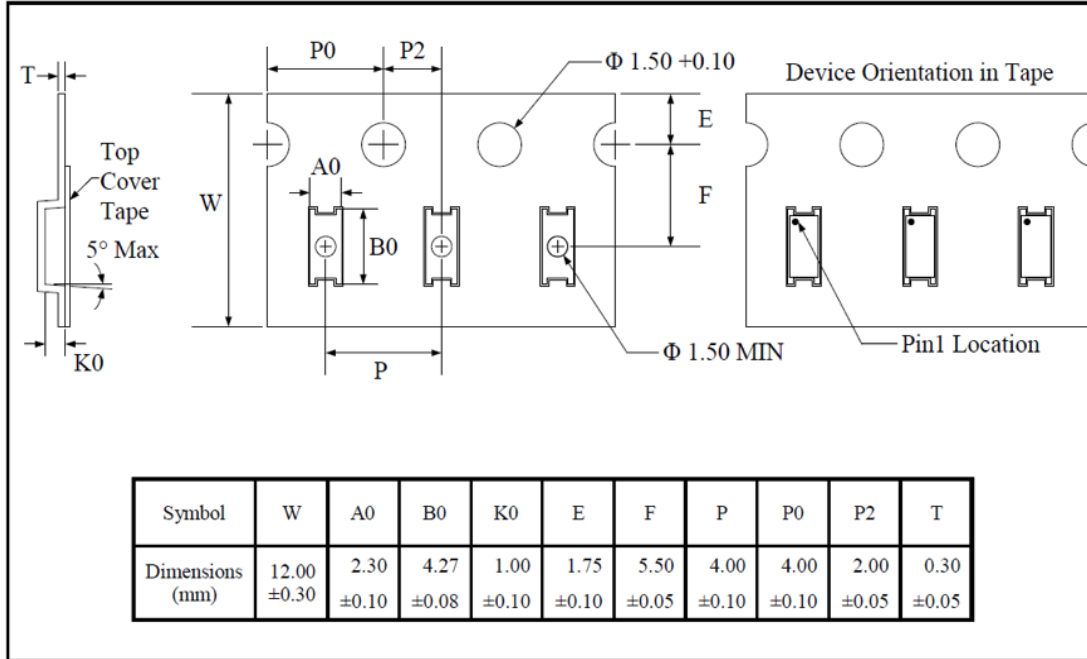


**Package Dimensions – TDFN-16**



	TDFN-16			
	JEDEC MO-229			
	Millimeters		Inches	
	Min	Max	Min	Max
<b>A</b>	0.70	0.80	0.028	0.031
<b>A1</b>	0.00	0.05	0.00	0.002
<b>A3</b>	0.20 REF		0.008 REF	
<b>b</b>	0.15	0.25	0.006	0.010
<b>D</b>	3.95	4.05	0.156	0.159
<b>E</b>	1.95	2.05	0.077	0.081
<b>e</b>	0.50 BSC		0.020 BSC	
<b>L</b>	0.70	0.90	0.028	0.035
<b>L1</b>	0.05	0.15	0.002	0.006

**Tape and Reel Specifications**



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