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Littelfuse
SP5003-04TTG

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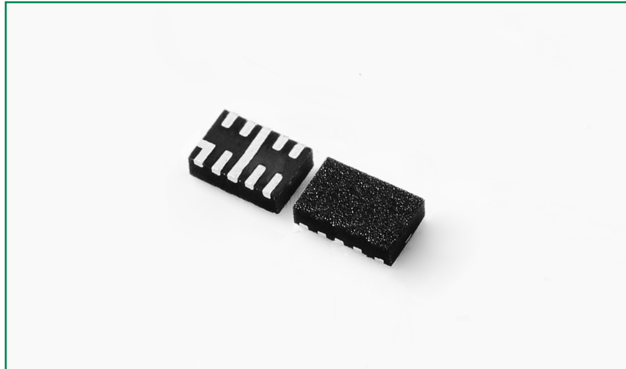
SP5003 Series 4 Channel Common Mode Filter with ESD Protection

AUTOMOTIVE GRADE RoHS Pb GREEN

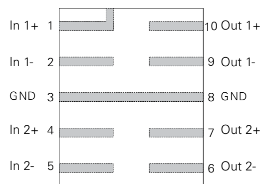


Description

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

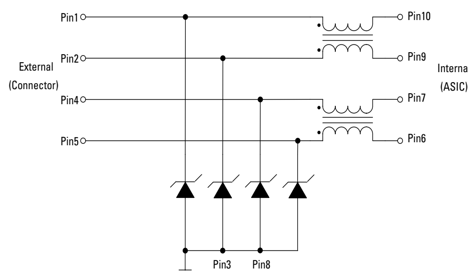


Note :This drawing is not to scale.

Features

- Large differential bandwidth > 4.0 GHz
- High Common Mode Stop Band Attenuation: > 16 dB at 900 MHz
- Common Mode Impedance: Zc: 32Ω 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
- AEC-Q101 qualified

Functional Block Diagram



Applications

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

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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 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

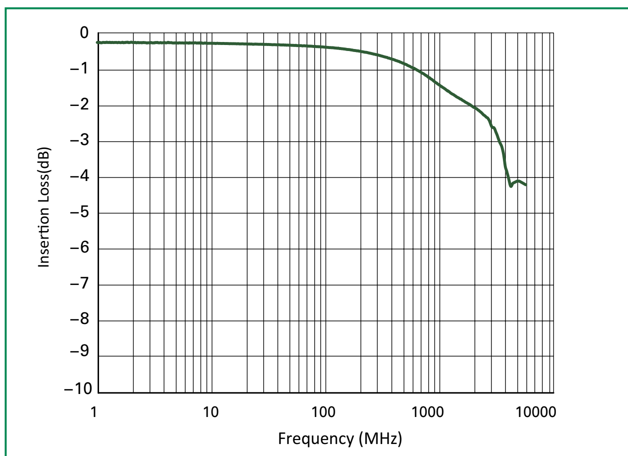
Parameter	Rating	Units
Storage Temperature Range	-55 to 150	°C
Maximum Junction Temperature	150	°C
Maximum Lead Temperature (Soldering 20-40s)	260	°C

Electrical Characteristics (T_{OP}=25°C)

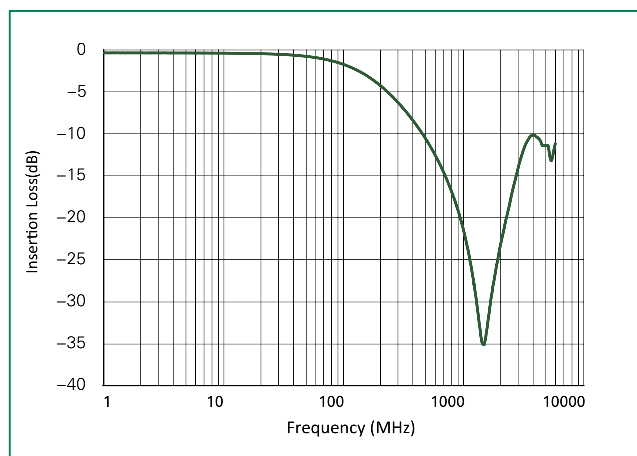
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Channel Resistance	R_{CH}	Pins 1–10, 2–9, 4–7 and 5–6		3.5	5.0	Ω
Total Channel Capacitance	C_{TOTAL}	$V_{I/O}$ = 1.65VDC Reverse Bias; f=1MHz, 30mV_{AC}		0.8	1.3	pF
Reverse Standoff Voltage	V_{RWM}				5.0	V
Breakdown Voltage	V_{BR}	I_T=1mA	6.0	8.0	10.0	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=8/20µs)		1.36		Ω
		Negative (tp=8/20µs)		0.6		
		TLP, tp=100ns, I/O to GND		0.42		
ESD Withstand Voltage[1 2]	V_{ESD}	IEC61000-4-2 (Contact Discharge)	±15			kV
		IEC61000-4-2 (Air Discharge)	±30			kV
Differential Mode Cutoff Frequency[2]	F_{3dB}	Z_{SOURCE}=50 Ω, Z_{LOAD}50 Ω		4.0		GHz
Common Mode Impedance	Z_C	@100MHz		32		Ω
Common Mode Stop Band Attenuation[2]	F_{atten}	f=900MHz		16		dB

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 vs. Frequency



Common Mode Attenuation vs. Frequency



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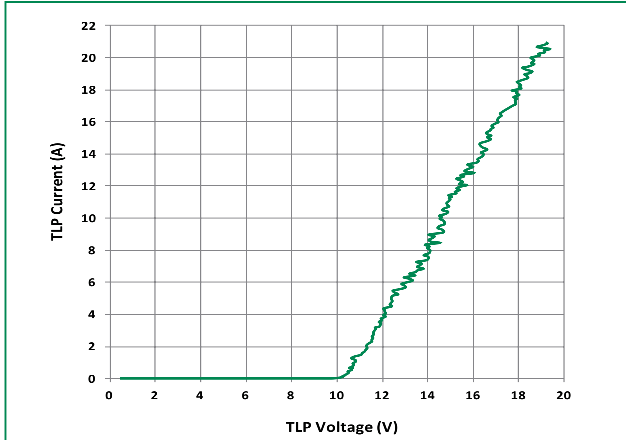
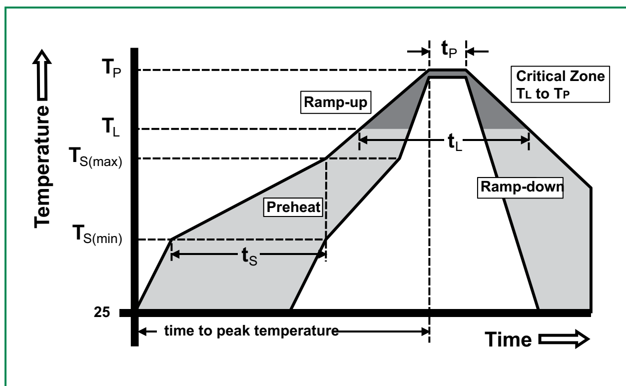
Transmission Line Pulsing (TLP) Plot



Product Characteristics

Lead Plating	Pre-Plated Frame
Lead Material	Copper Alloy
Lead Coplanarity	0.0004 inches (0.102mm)
Substrate material	Silicon
Body Material	Molded Epoxy
Flammability	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.



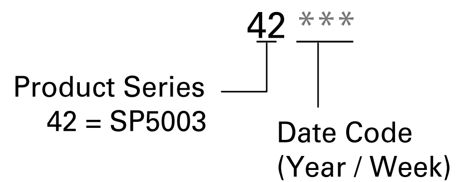
Soldering Parameters

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)		$260^{+0/-5}$ °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

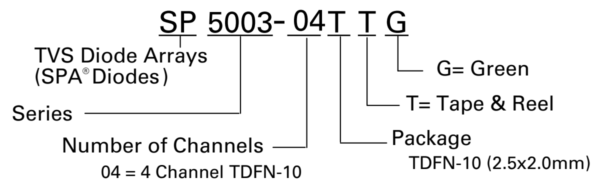
Ordering Information

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

Part Marking System



Part Numbering System



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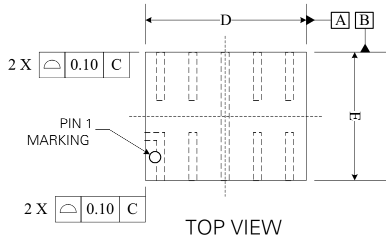
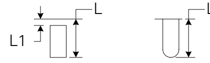
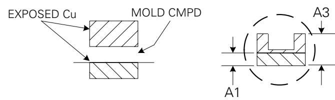
Package Dimensions —TDFN-10



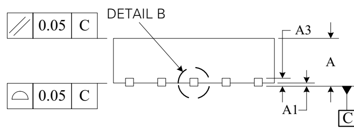
TOP VIEW



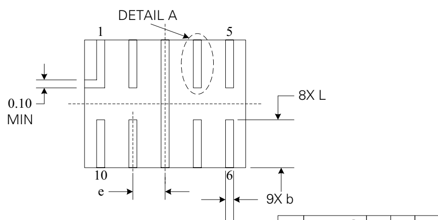
DETAIL A
ALTERNATE TERMINAL CONSTRUCTIONS



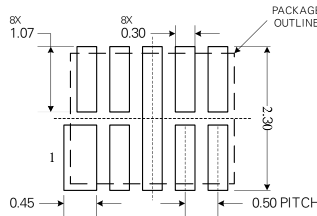
DETAIL B
ALTERNATE CONSTRUCTIONS



SIDE VIEW



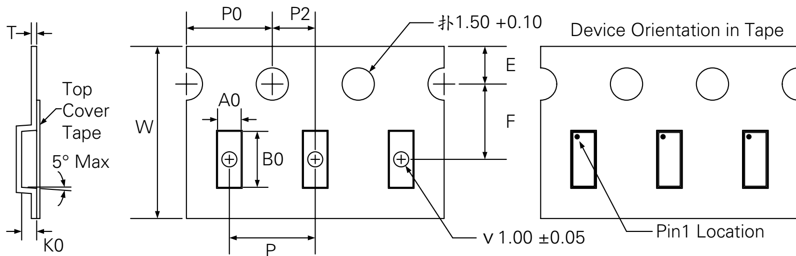
BOTTOM VIEW



Recommended Soldering Footprint

	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

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