EMI Filter with ESD Protection

EMI7112

Product Description

The EMI7112 is an L−C EMI filter array with ESD protection that integrates two Pi−filters (C−L−C) to suppress EMI/RFI Noise. EMI7112 includes ESD protection diodes on all input/output pins, and provides a very high level of protection for sensitive electronic components against possible electrostatic discharge (ESD). The ESD diodes connected to the filter ports safely dissipate ESD strikes of ±30 kV, which is beyond the maximum requirement of the IEC61000−4−2 international standard.

Features

- Two Channels of EMI Filtering
- ±30 kV ESD Protection (IEC 61000−4−2, Contact Discharge)
- ±30 kV ESD Protection (IEC 61000−4−2, Air Discharge)
- Greater than 45 dB of Attenuation at 900 MHz
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Mobile Phones

MAXIMUM RATINGS (T_A = 25°C)

Rating	Symbol	Value	Unit
ESD Discharge IEC61000−4−2 Contact Discharge Air Discharge	V_{pp}	 30 30	kV
RMS Current per Line	I_{Line}	350	mA
Operating Temperature Range	T_J	−40 to +125	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
Lead Solder Temperature (10 second duration)	T_L	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

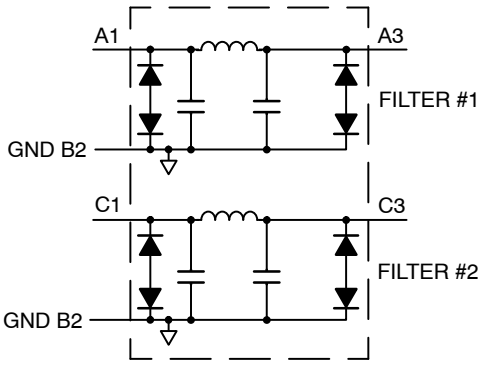
ON Semiconductor®

www.onsemi.com



WLCSP5
FC SUFFIX
CASE 567KK

BLOCK DIAGRAM



MARKING DIAGRAM



7A = Specific Device Code
M = Date Code

ORDERING INFORMATION

Device	Package	Shipping†
EMI7112FCTAG	WLCSP5 (Pb−Free)	5000/Tape & Reel

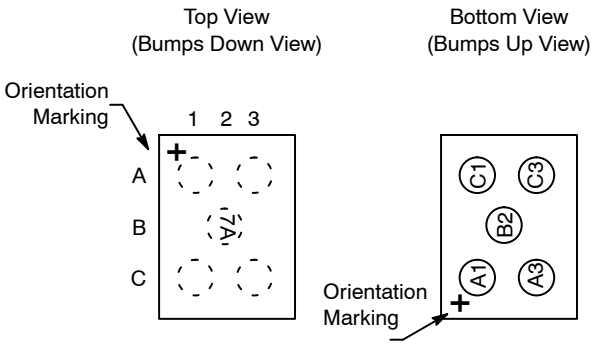
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

© Semiconductor Components Industries, LLC, 2015

Table 1. PIN DESCRIPTIONS

Pin	Name	Description
A1	Filter #1	Filter #1 Input/Output
A3	Filter #1	Filter #1 Input/Output
C1	Filter #2	Filter #2 Input/Output
C3	Filter #2	Filter #2 Input/Output
B2	GND	Device Ground

PACKAGE/PINOUT DIAGRAMS



WLCSP5 Package

Table 2. ELECTRICAL OPERATING CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{RWM}	Working Voltage			3.0		V
V_{BR}	Breakdown Voltage	I_T = 1 mA; (Note 4)	6.0			V
I_{LEAK}	Channel Leakage Current	V_{IN} = 3.0 V, GND = 0 V			400	nA
R_{CH}	Channel Resistance (Pins A1 – A3, C1 – C3)			0.35	0.8	Ω
C_t	Line Capacitance	V_R = 0 V, f = 1 MHz	185	250	315	pF
f_{3dB}	Cut-off Frequency	50 Ω Source and Load Termination		20		MHz
F_{atten}	Stop Band Attenuation	@ 700 MHz @ 900 MHz		40 47		dB
V_{ESD}	In-system ESD Withstand Voltage a) Contact discharge per IEC 61000-4-2 standard, Level 4 **(External Pins)** b) Contact discharge per IEC 61000-4-2 standard, Level 1 **(Internal Pins)**	(Notes 1 and 2)	 ±30 ±30			kV
V_{CL}	TLP Clamping Voltage	Forward I_{PP} = 8 A Forward I_{PP} = 16 A Forward I_{PP} = ±8 A Forward I_{PP} = ±16 A		9.77 11.51 –9.66 –11.67		V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Standard IEC61000–4–2 with $C_{Discharge}$ = 150 pF, $R_{Discharge}$ = 330, GND grounded.
2. These measurements performed with no external capacitor.
3. TVS devices are normally selected according to the working peak reverse voltage (V_{RWM}), which should be equal to or greater than the DC or continuous peak operating voltage level.
4. V_{BR} is measured at pulse test current I_T.

PERFORMANCE INFORMATION

Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ω Environment)

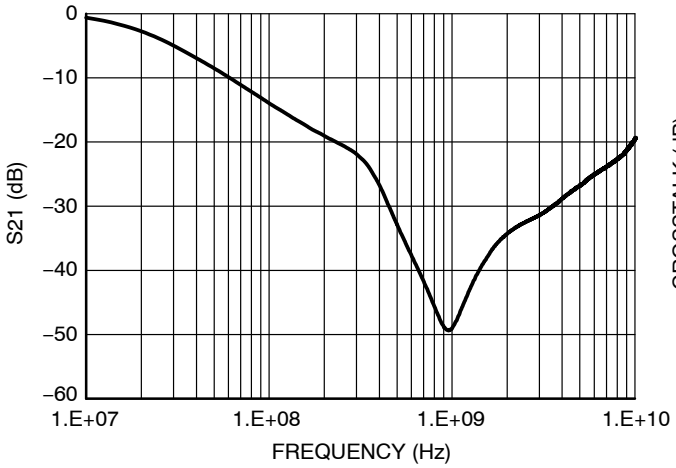


Figure 1. Typical Insertion Loss

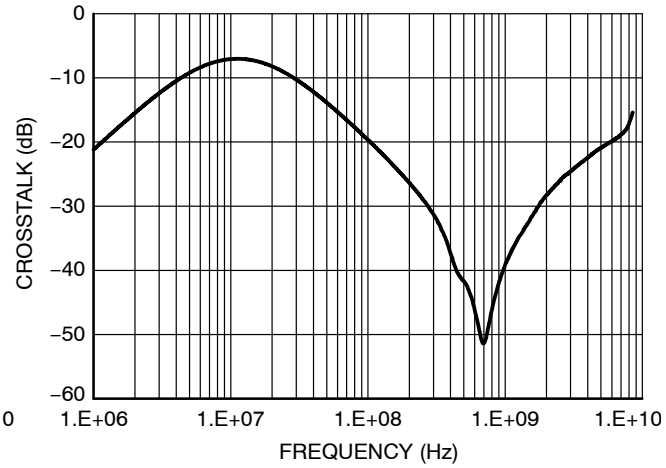


Figure 2. Typical Channel to Channel Crosstalk

IEC 61000−4−2 Spec.

Level	Test Voltage (kV)	First Peak Current (A)	Current at 30 ns (A)	Current at 60 ns (A)
1	2	7.5	4	2
2	4	15	8	4
3	6	22.5	12	6
4	8	30	16	8

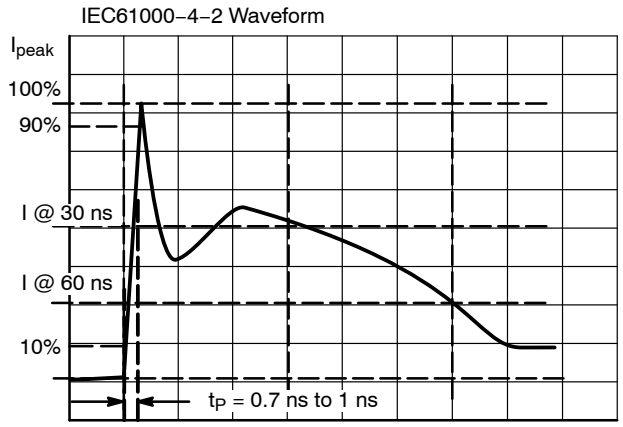


Figure 3. IEC61000−4−2 Spec

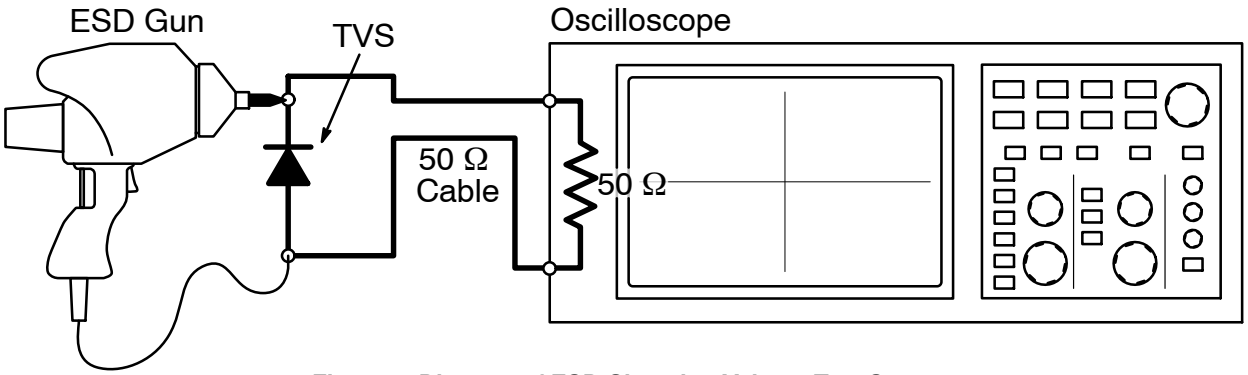


Figure 4. Diagram of ESD Clamping Voltage Test Setup

The following is taken from Application Note AND8308/D − Interpretation of Datasheet Parameters for ESD Devices.

ESD Voltage Clamping

For sensitive circuit elements it is important to limit the voltage that an IC will be exposed to during an ESD event to as low a voltage as possible. The ESD clamping voltage is the voltage drop across the ESD protection diode during an ESD event per the IEC61000−4−2 waveform. Since the IEC61000−4−2 was written as a pass/fail spec for larger systems such as cell phones or laptop computers it is not clearly defined in the spec how to specify a clamping voltage at the device level. ON Semiconductor has developed a way to examine the entire voltage waveform across the ESD protection diode over the time domain of an ESD pulse in the form of an oscilloscope screenshot, which can be found on the datasheets for all ESD protection diodes. For more information on how ON Semiconductor creates these screenshots and how to interpret them please refer to AND8307/D.

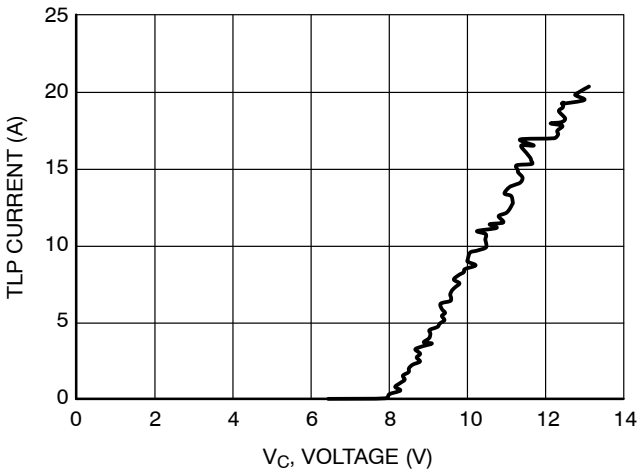


Figure 5. Positive TLP I–V Curve

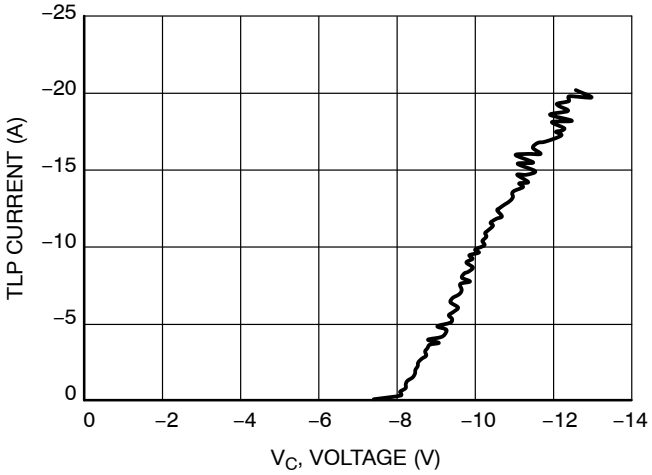


Figure 6. Negative TLP I–V Curve

NOTE: TLP parameter: Z_0 = 50 Ω, t_p = 100 ns, t_r = 300 ps, averaging window: t_1 = 30 ns to t_2 = 60 ns. V_{IEC} is the equivalent voltage stress level calculated at the secondary peak of the IEC 61000−4−2 waveform at t = 30 ns with 2 A/kV. See TLP description below for more information.

Transmission Line Pulse (TLP) Measurement

Transmission Line Pulse (TLP) provides current versus voltage (I−V) curves in which each data point is obtained from a 100 ns long rectangular pulse from a charged transmission line. A simplified schematic of a typical TLP system is shown in Figure 7. TLP I−V curves of ESD protection devices accurately demonstrate the product's ESD capability because the 10s of amps current levels and under 100 ns time scale match those of an ESD event. This is illustrated in Figure 8 where an 8 kV IEC 61000−4−2 current waveform is compared with TLP current pulses at 8 A and 16 A. A TLP I−V curve shows the voltage at which the device turns on as well as how well the device clamps voltage over a range of current levels.

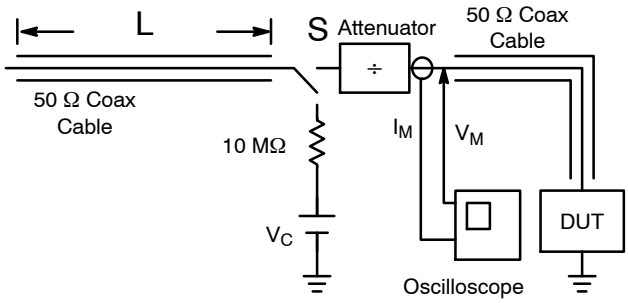


Figure 7. Simplified Schematic of a Typical TLP System

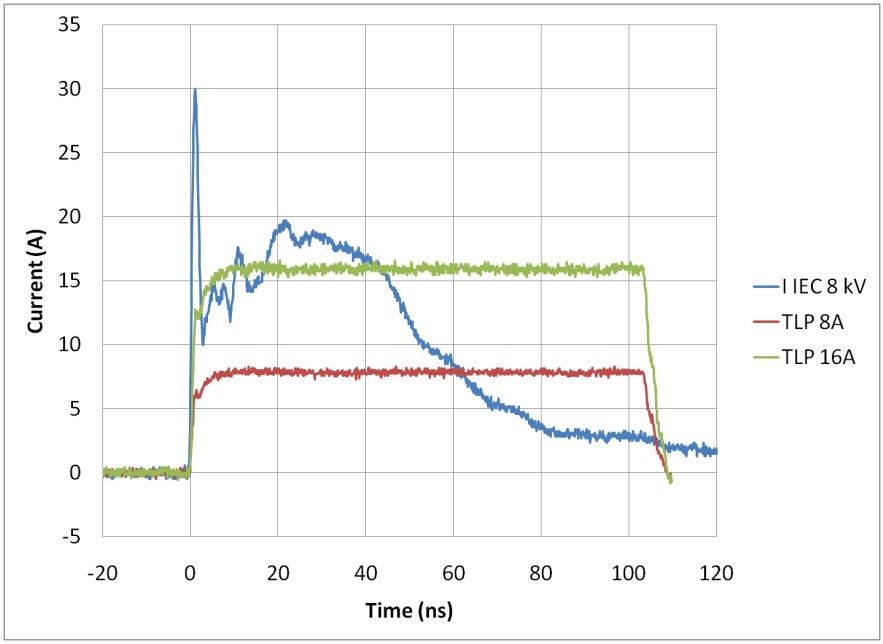
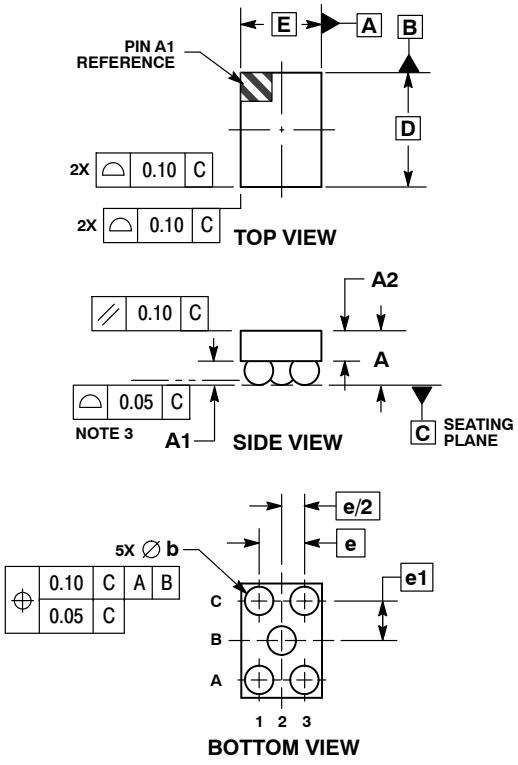


Figure 8. Comparison Between 8 kV IEC 61000−4−2 and 8 A and 16 A TLP Waveforms

PACKAGE DIMENSIONS

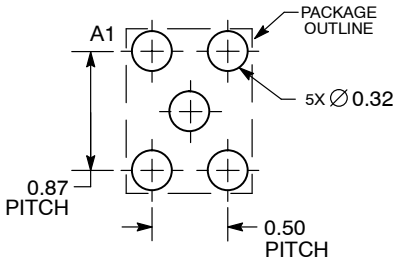
WLCSP5, 1.26x0.89
CASE 567KK
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.
4. DIMENSION b IS MEASURED AT THE MAXIMUM BALL DIAMETER PARALLEL TO DATUM C.

	MILLIMETERS	
DIM	MIN	MAX
A	0.56	0.72
A1	0.21	0.27
A2	0.38 REF	
b	0.29	0.35
D	1.26 BSC	
E	0.89 BSC	
e	0.50 BSC	
e1	0.435 BSC	

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

ON Semiconductor Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative