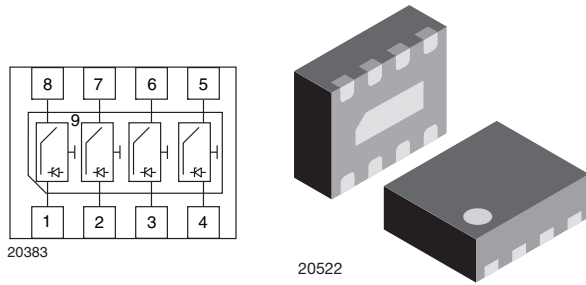


## 4-Channel EMI-Filter with ESD-Protection



### FEATURES

- Ultra compact LLP1713-9L package
- Low package profile of 0.6 mm
- 4-channel EMI-filter
- Low leakage current
- Line resistance  $R_S = 100 \Omega$
- Typical cut off frequency  $f_{3dB} = 100 \text{ MHz}$
- ESD-protection acc. IEC 61000-4-2  
 $\pm 30 \text{ kV}$  contact discharge  
 $\pm 30 \text{ kV}$  air discharge
- e4 - precious metal (e.g. Ag, Au, NiPd, NiPdAu) (no Sn)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**  
**GREEN**  
 (5-2008)

### MARKING (example only)



Dot = pin 1 marking  
 Y = type code (see table below)  
 XX = date code

### DESIGN SUPPORT TOOLS

[click logo to get started](#)

**3D**  
 Models  
 Available

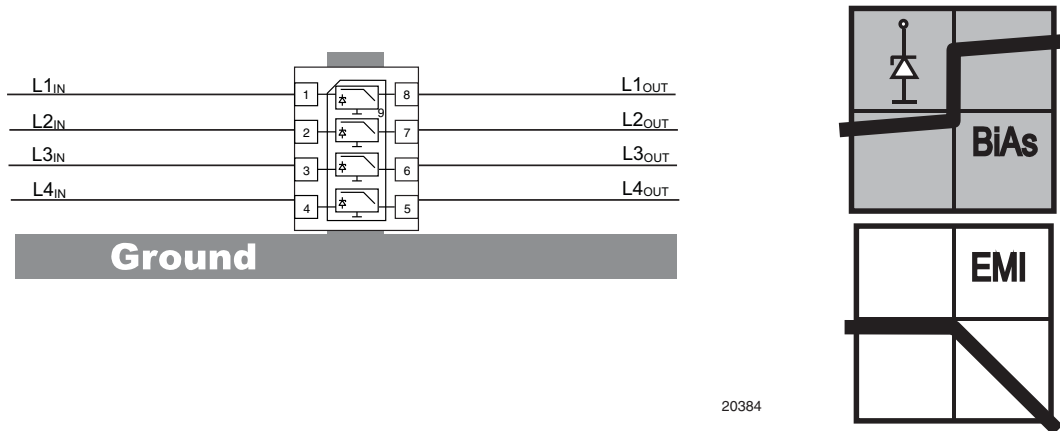
ORDERING INFORMATION			
DEVICE NAME	ORDERING CODE	TAPED UNITS PER REEL (8 mm TAPE ON 7" REEL)	MINIMUM ORDER QUANTITY
VEMI45AA-HNH	VEMI45AA-HNH-GS08	3000	15 000

PACKAGE DATA						
DEVICE NAME	PACKAGE NAME	TYPE CODE	WEIGHT	MOLDING COMPOUND FLAMMABILITY RATING	MOISTURE SENSITIVITY LEVEL	SOLDERING CONDITIONS
VEMI45AA-HNH	LLP1713-9L	A	3.7 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	TEST CONDITIONS	SYMBOL	VALUE	UNIT
Peak pulse current	All I/O pin to pin 9; acc. IEC 61000-4-5; $t_p = 8/20 \mu\text{s}$ ; single shot	$I_{PPM}$	4	A
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	$V_{ESD}$	$\pm 30$	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		$\pm 30$	
Operating temperature	Junction temperature	$T_J$	-40 to +125	°C
Storage temperature		$T_{STG}$	-55 to +150	°C

**APPLICATION NOTE**

With the VEMI45AA-HNH 4 different signal or data lines can be filtered and clamped to ground. Due to the different clamping levels in forward and reverse direction the clamping behaviour is Bidirectional and Asymmetric (BiAs).

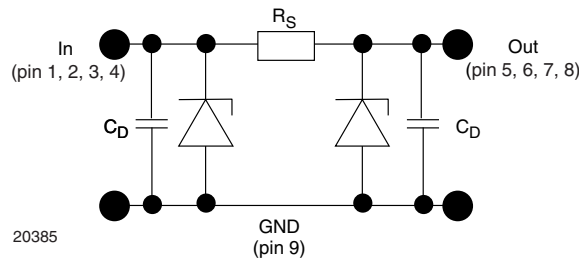


The 4 independent EMI-filter are placed between

- pin 1 and pin 8,
- pin 2 and pin 7,
- pin 3 and pin 6 and
- pin 4 and pin 5.

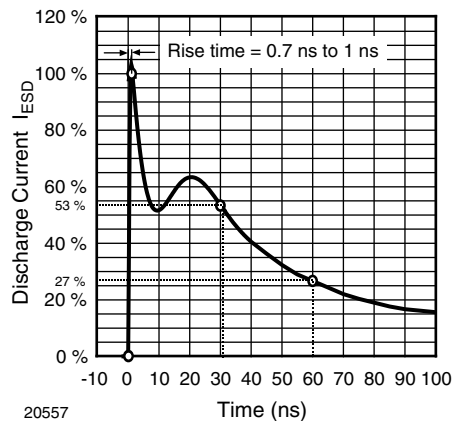
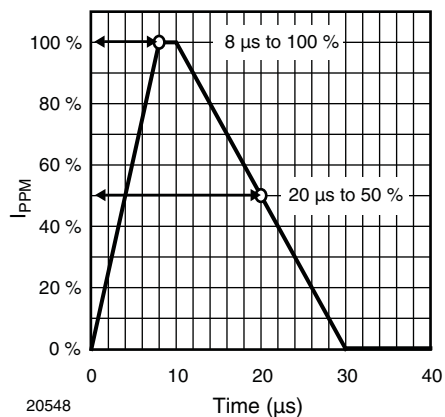
They all are connected to a common ground pin 9 on the backside of the package.

The circuit diagram of one EMI-filter-channel shows two identical Z-diodes at the input to ground and the output to ground. These Z-diodes are characterized by the breakthrough voltage level ( $V_{BR}$ ) and the diode capacitance ( $C_D$ ). Below the breakthrough voltage level the Z-diodes can be considered as capacitors. Together with these capacitors and the line resistance  $R_S$  between input and output the device works as a low pass filter. Low frequency signals ( $f < f_{3dB}$ ) pass the filter while high frequency signals ( $f > f_{3dB}$ ) will be shorted to ground through the diode capacitances  $C_D$ .



Each filter is symmetrical so that both ports can be used as input or output.

<b>ELECTRICAL CHARACTERISTICS</b> All inputs (pin 1, 2, 3, and 4) to ground (pin 9) ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of channels which can be protected	$N_{channel}$	-	-	4	channel
Reverse stand off voltage	Max. reverse working voltage	$V_{RWM}$	-	-	5	V
Reverse voltage	at $I_R = 1\text{ }\mu\text{A}$	$V_R$	5	-	-	V
Reverse current	at $V_R = V_{RWM}$	$I_R$	-	-	1	$\mu\text{A}$
Reverse break down voltage	at $I_R = 1\text{ mA}$	$V_{BR}$	6	-	-	V
Pos. clamping voltage	at $I_{PP} = 1\text{ A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{C-out}$	-	-	7	V
	at $I_{PP} = I_{PPM} = 4\text{ A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{C-out}$	-	-	8	V
Neg. clamping voltage	at $I_{PP} = -1\text{ A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{C-out}$	- 1	-	-	V
	at $I_{PP} = I_{PPM} = -4\text{ A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{C-out}$	- 1.2	-	-	V
Input capacitance	at $V_R = 0\text{ V}$ ; $f = 1\text{ MHz}$	$C_{IN}$	-	60	-	$\mu\text{F}$
	at $V_R = 2.5\text{ V}$ ; $f = 1\text{ MHz}$	$C_{IN}$	-	36	-	$\mu\text{F}$
ESD-clamping voltage	at $\pm 30\text{ kV}$ ESD-pulse acc. IEC 61000-4-2	$V_{CESD}$	-	7.5	-	V
Line resistance	Measured between input and output; $I_S = 10\text{ mA}$	$R_S$	90	100	110	$\Omega$
Cut-off frequency	$V_{IN} = 0\text{ V}$ ; measured in a $50\text{ }\Omega$ system	$f_{3dB}$	-	100	-	MHz

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

 Fig. 1 - ESD Discharge Current Wave Form  
acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

 Fig. 2 - 8/20  $\mu\text{s}$  Peak Pulse Current Wave Form  
acc. IEC 61000-4-5

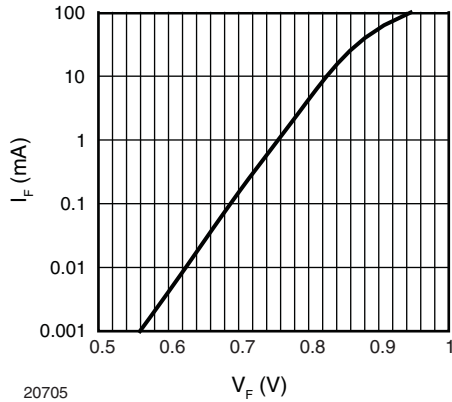


Fig. 3 - Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

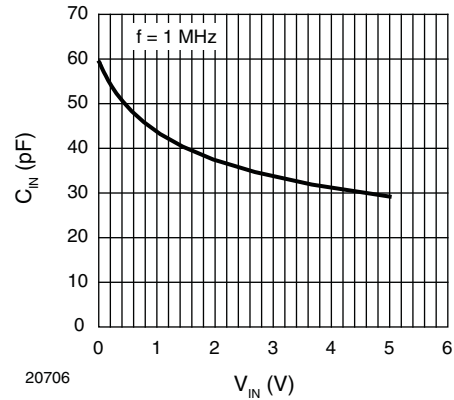


Fig. 6 - Typical Input Capacitance  $C_{IN}$  vs. Input Voltage  $V_{IN}$

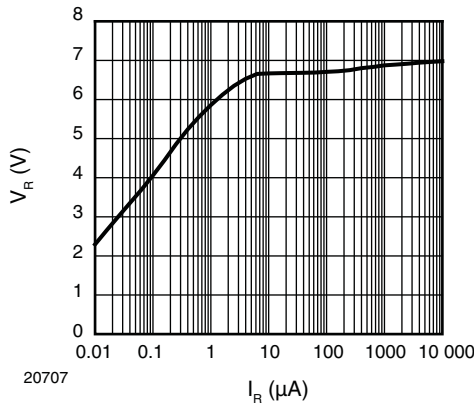


Fig. 4 - Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

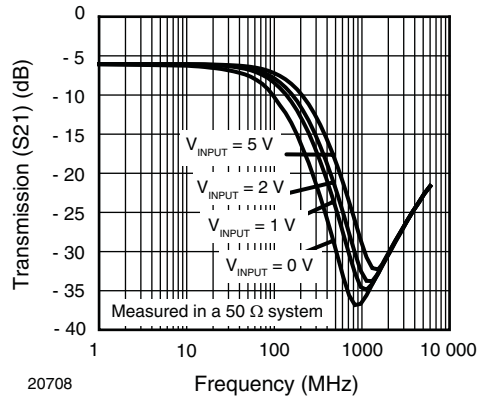


Fig. 7 - Typical Small Signal Transmission ( $S_{21}$ ) at  $Z_O = 50 \Omega$

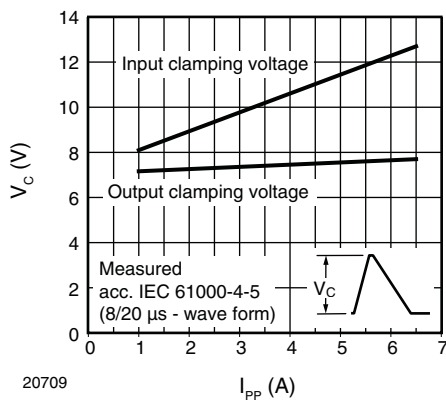
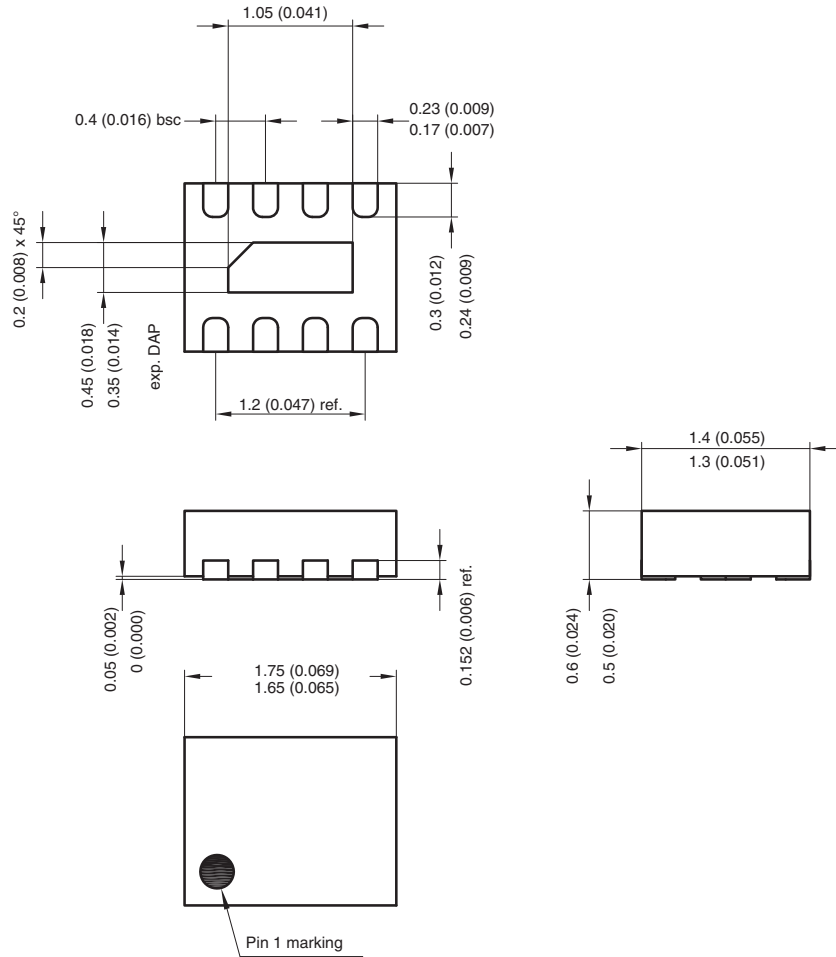


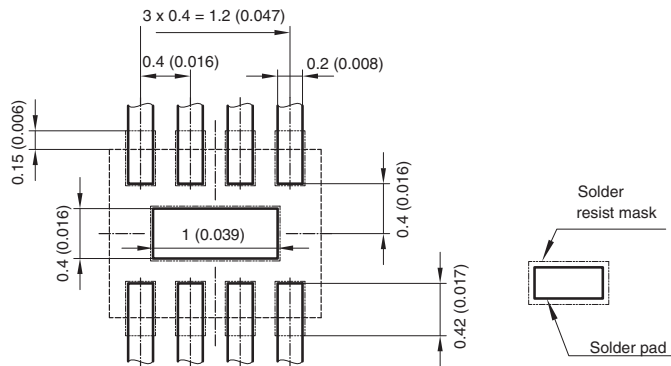
Fig. 5 - Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$



PACKAGE DIMENSIONS in millimeters (inches): **LLP1713-9L**



Foot print recommendation:



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 Rev. 1 - Date: 27. May 2008  
 20386



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