

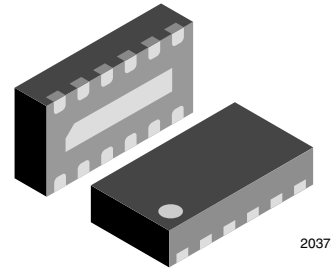
## 6-Channel EMI-Filter with ESD-Protection

### Features

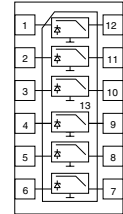
- Ultra compact LLP2513-13L package
- Low package profile of 0.6 mm
- 6-channel EMI-filter
- Low leakage current
- Line resistance  $R_S = 100 \Omega$
- Typical cut off frequency  $f_{3dB} = 100 \text{ MHz}$
- ESD-protection acc. IEC 61000-4-2
  - ± 30 kV contact discharge
  - ± 30 kV air discharge
- Lead (Pb)-free component
- Lead finish = "e3" = matte tin (Sn)
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



**RoHS**  
COMPLIANT  
**GREEN**  
(5-2008)\*\*



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### Marking (example only)



Dot = Pin 1 marking  
YY = Type code (see table below)  
XX = Date code

### Ordering Information

Device name	Ordering code	Taped units per reel (8 mm tape on 7" reel)	Minimum order quantity
VEMI65AA-HCI	VEMI65AA-HCI-GS08	3000	15 000

### Package Data

Device name	Package name	Marking code	Weight	Molding compound flammability rating	Moisture sensitivity level	Soldering conditions
VEMI65AA-HCI	LLP2513-13L	9P	5.5 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	260 °C/10 s at terminals

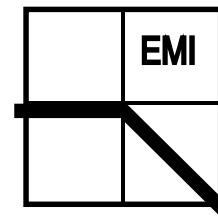
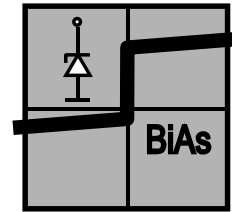
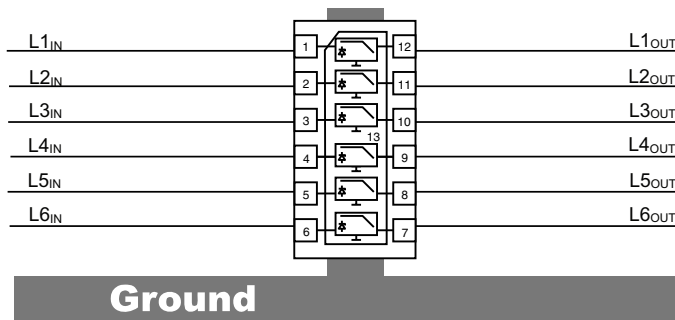
### Absolute Maximum Ratings

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. IEC61000-4-2; 10 pulses	$V_{ESD}$	± 30	kV
	Air discharge acc. IEC61000-4-2; 10 pulses		± 30	
Operating temperature	Junction temperature	$T_J$	- 40 to + 125	°C
Storage temperature		$T_{STG}$	- 55 to + 150	°C

\*\* Please see document "Vishay Green and Halogen-Free Definitions (5-2008)" <http://www.vishay.com/doc?99902>

## Application Note:

With the **VEMI65AA-HCI** 6 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 **B**idirectional and **A**symmetric (**BiAs**).



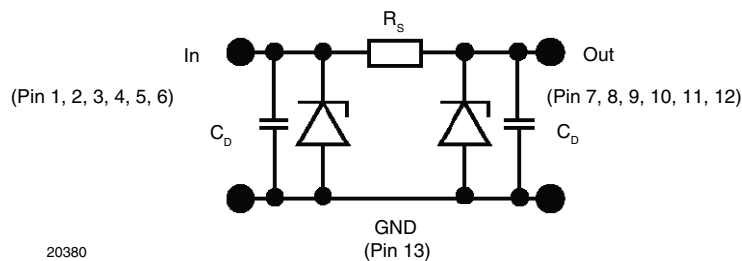
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The 6 independent EMI-Filter are placed between

- pin 1 and pin 12,
- pin 2 and pin 11,
- pin 3 and pin 10,
- pin 4 and pin 9,
- pin 5 and pin 8 and
- pin 6 and pin 7.

They all are connected to a common ground pin 13 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  $C_D$ .



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

## Electrical Characteristics

Ratings at 25 °C, ambient temperature unless otherwise specified

### VEMI65AA-HCI

All inputs (pin 1, 2, 3, 4, 5 and 6) to ground (pin 13)

Parameter	Test conditions/remarks	Symbol	Min.	Typ.	Max.	Unit
Protection paths	Number of channels which can be protected	$N_{\text{channel}}$			6	channel
Reverse stand off voltage	at $I_R = 1 \mu\text{A}$	$V_{\text{RWM}}$	5			V
Reverse current	at $V_R = V_{\text{RWM}}$	$I_R$			1	$\mu\text{A}$
Reverse break down voltage	at $I_R = 1 \text{mA}$	$V_{\text{BR}}$	6			V
Pos. clamping voltage	at $I_{\text{PP}} = 1 \text{A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{\text{C-out}}$			7	V
	at $I_{\text{PP}} = I_{\text{PPM}} = 4 \text{A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{\text{C-out}}$			8	V
Neg. clamping voltage	at $I_{\text{PP}} = -1 \text{A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{\text{C-out}}$	- 1			V
	at $I_{\text{PP}} = I_{\text{PPM}} = -4 \text{A}$ applied at the input, measured at the output; acc. IEC 61000-4-5	$V_{\text{C-out}}$	- 1.2			V
Input capacitance	at $V_R = 0 \text{V}$ ; $f = 1 \text{MHz}$	$C_{\text{in}}$		60		pF
	at $V_R = 2.5 \text{V}$ ; $f = 1 \text{MHz}$	$C_{\text{in}}$		36		pF
ESD-clamping voltage	at $\pm 30 \text{kV}$ ESD-pulse acc. IEC 61000-4-2	$V_{\text{CESD}}$		7.5		V
Line resistance	Measured between input and output; $I_S = 10 \text{mA}$	$R_S$	90	100	110	$\Omega$
Cut-off frequency	$V_{\text{IN}} = 0 \text{V}$ ; measured in a $50 \Omega$ system	$f_{3\text{dB}}$		100		MHz

## Typical Characteristics

$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ , unless otherwise specified

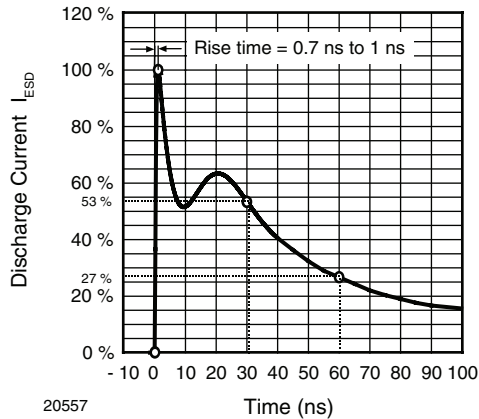


Figure 1. ESD Discharge Current Wave Form  
acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

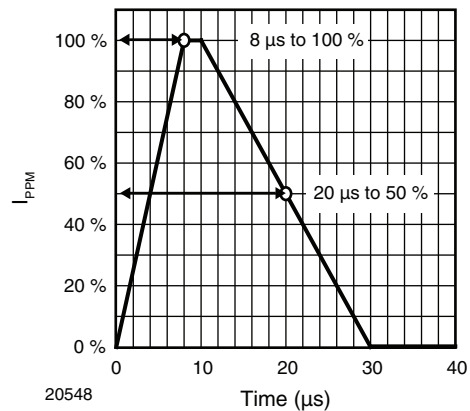


Figure 2. 8/20  $\mu\text{s}$  Peak Pulse Current Wave Form  
acc. IEC 61000-4-5

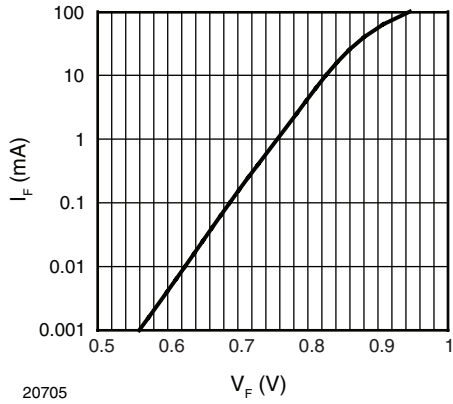


Figure 3. Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

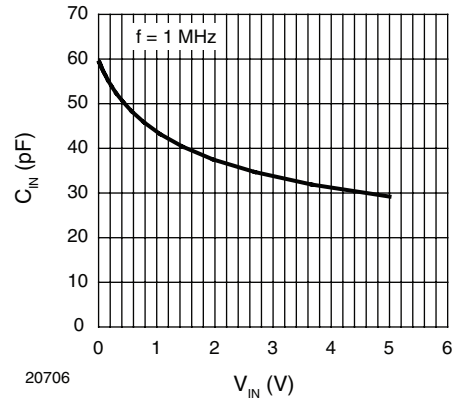


Figure 6. Typical Input Capacitance  $C_{IN}$  vs. Input Voltage  $V_{IN}$

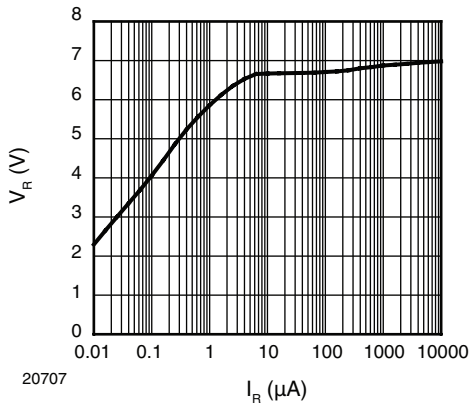


Figure 4. Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

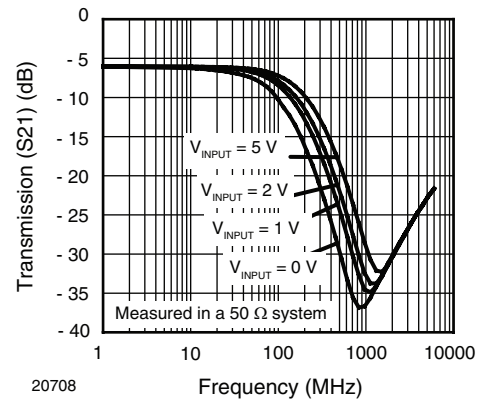


Figure 7. Typical Small Signal Transmission (S21) at  $Z_O = 50 \Omega$

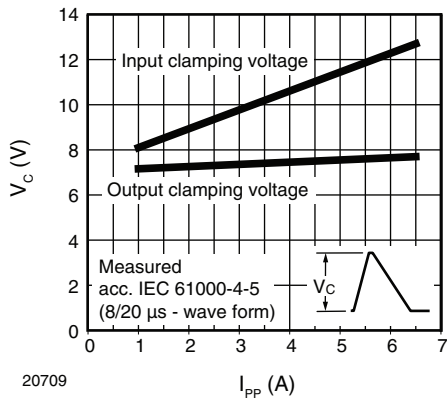
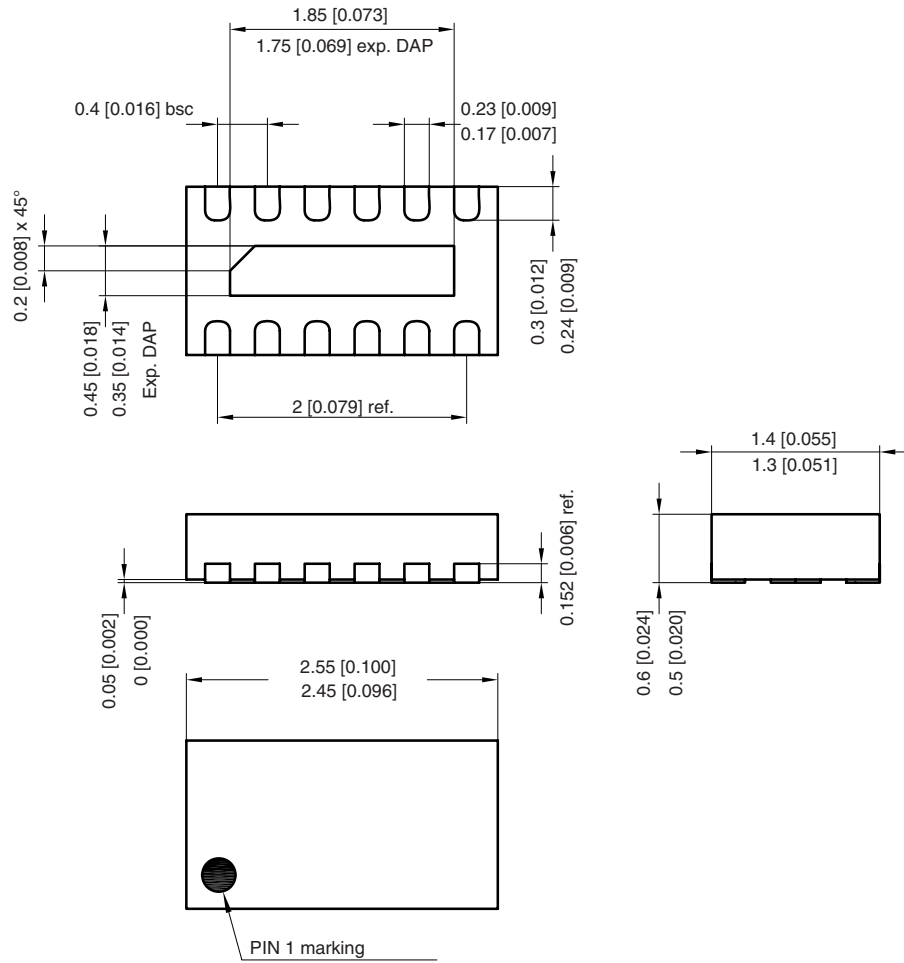
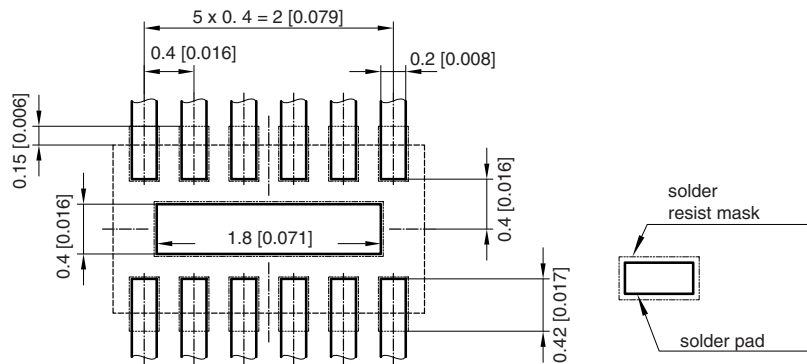


Figure 5. Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$

## Package Dimensions in millimeters (inches): LLP2513-13L



foot print recommendation:



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 Created - Date: 28. August 2006  
 Rev. 1 - Date: 27. May 2008  
 20381

### Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

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