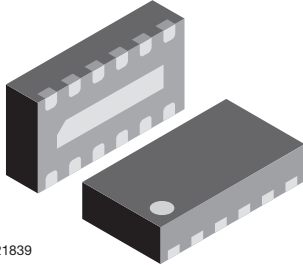
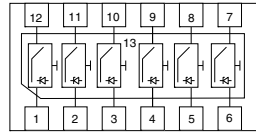


## 6-Channel EMI-Filter with ESD-Protection



21839



20378

### 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  
 $\pm 30 \text{ kV}$  contact discharge  
 $\pm 30 \text{ kV}$  air discharge
- e4 - precious metal (e.g. Ag, Au, NiPd, NiPdAu) (no Sn)
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC



### MARKING (example only)



20720

Dot = pin 1 marking

YY = type code (see table below)

XX = date code

### ORDERING INFORMATION

| DEVICE NAME  | ORDERING CODE     | TAPED UNITS PER REEL<br>(8 mm TAPE ON 7" REEL) | MINIMUM ORDER QUANTITY |
|--------------|-------------------|--|------------------------|
| VEMI65AA-HCI | VEMI65AA-HCI-GS08 | 3000   | 15 000                 |

### PACKAGE DATA

| DEVICE NAME  | PACKAGE NAME | TYPE CODE | WEIGHT | MOLDING COMPOUND<br>FLAMMABILITY RATING | MOISTURE SENSITIVITY LEVEL           | SOLDERING CONDITIONS     |
|--------------|--------------|-----------|--------|---|--------------------------------------|--------------------------|
| VEMI65AA-HCI | LLP2513-13L  | 9P        | 5.5 mg | UL 94 V-0                               | MSL level 1<br>(according J-STD-020) | 260 °C/10 s at terminals |

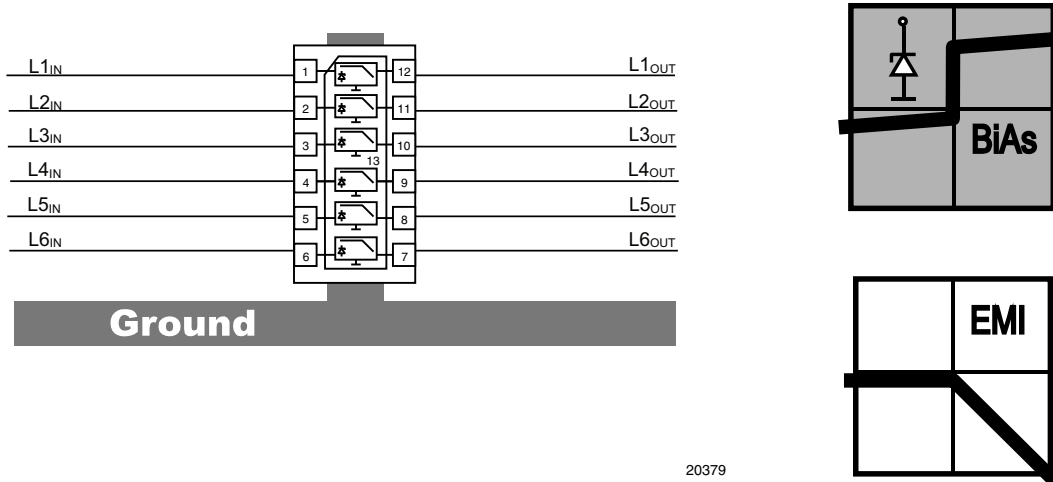
### ABSOLUTE MAXIMUM RATINGS

| PARAMETER             | TEST CONDITIONS  | SYMBOL    | VALUE         | UNIT |
|-----------------------|--|-----------|---------------|------|
| Peak pulse current    | All I/O pin to pin 13; acc. IEC 61000-4-5;<br>$t_p = 8/20 \mu\text{s}$ ; single shot | $I_{PPM}$ | 4             | A    |
| ESD immunity          | Contact discharge acc. IEC61000-4-2; 10 pulses                                       | $V_{ESD}$ | $\pm 30$      | kV   |
|                       | Air discharge acc. IEC61000-4-2; 10 pulses   |           | $\pm 30$      |      |
| Operating temperature | Junction temperature   | $T_J$     | - 40 to + 125 | °C   |
| Storage temperature   |  | $T_{STG}$ | - 55 to + 150 | °C   |

 \*\* Please see document "Vishay Material Category Policy": [www.vishay.com/doc?99902](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 Bidirectional and Asymmetric (BiAs).



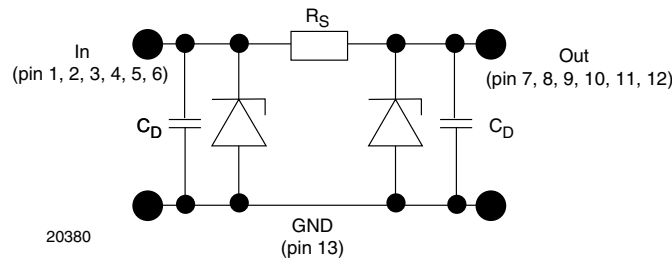
20379

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  $C_D$ .



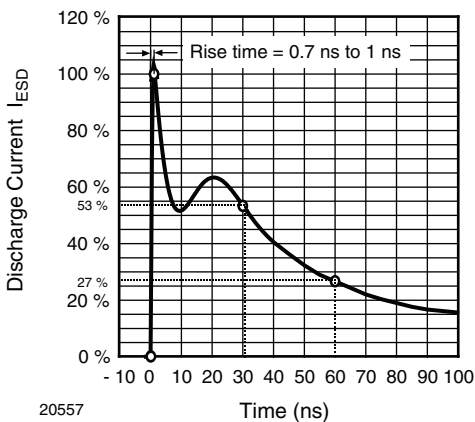
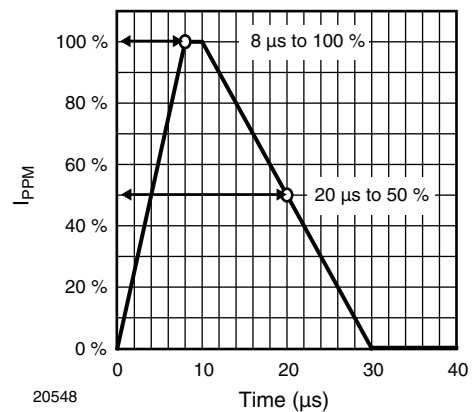
20380

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

| ELECTRICAL CHARACTERISTICS VEMI65AA-HCI |   |                      |       |      |      |               |
|---|---|----------------------|-------|------|------|---------------|
| 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 $I_R = 1 \mu\text{A}$  | $V_{RWM}$            | 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   | -    | pF            |
|   | at $V_R = 2.5 \text{ V}$ ; $f = 1 \text{ MHz}$  | $C_{IN}$             | -     | 36   | -    | pF            |
| 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;<br>$I_S = 10 \text{ mA}$   | $R_S$                | 90    | 100  | 110  | $\Omega$      |
| Cut-off frequency                       | $V_{IN} = 0 \text{ V}$ ; measured in a $50 \Omega$ system   | $f_{3dB}$            | -     | 100  | -    | MHz           |

**Note**

- Ratings at 25 °C, ambient temperature unless otherwise specified. All inputs (pin 1, 2, 3 and 4) to ground (pin 9)

**TYPICAL CHARACTERISTICS** ( $T_{\text{amb}} = 25 \text{ °C}$ , 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

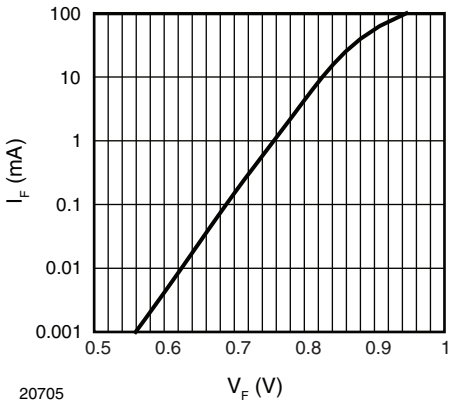


Fig. 3 - Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

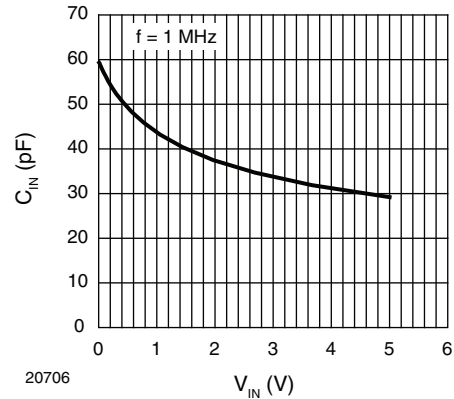


Fig. 6 - Typical Input Capacitance  $C_{IN}$  vs. Input Voltage  $V_{IN}$

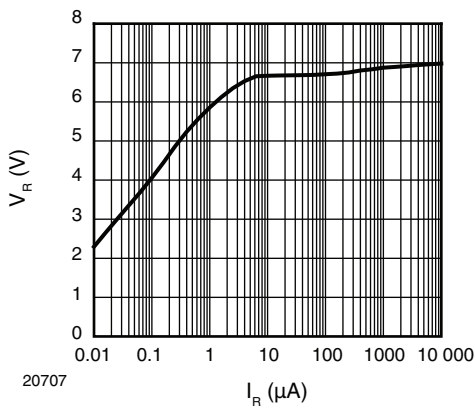


Fig. 4 - Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

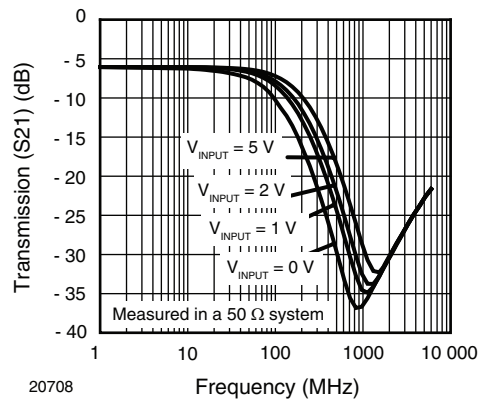


Fig. 7 - Typical Small Signal Transmission ( $S_{21}$ ) at  $Z_O = 50 \Omega$

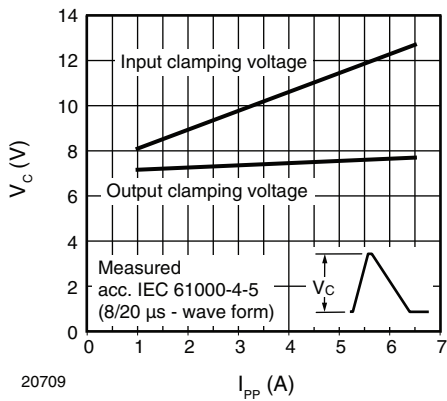
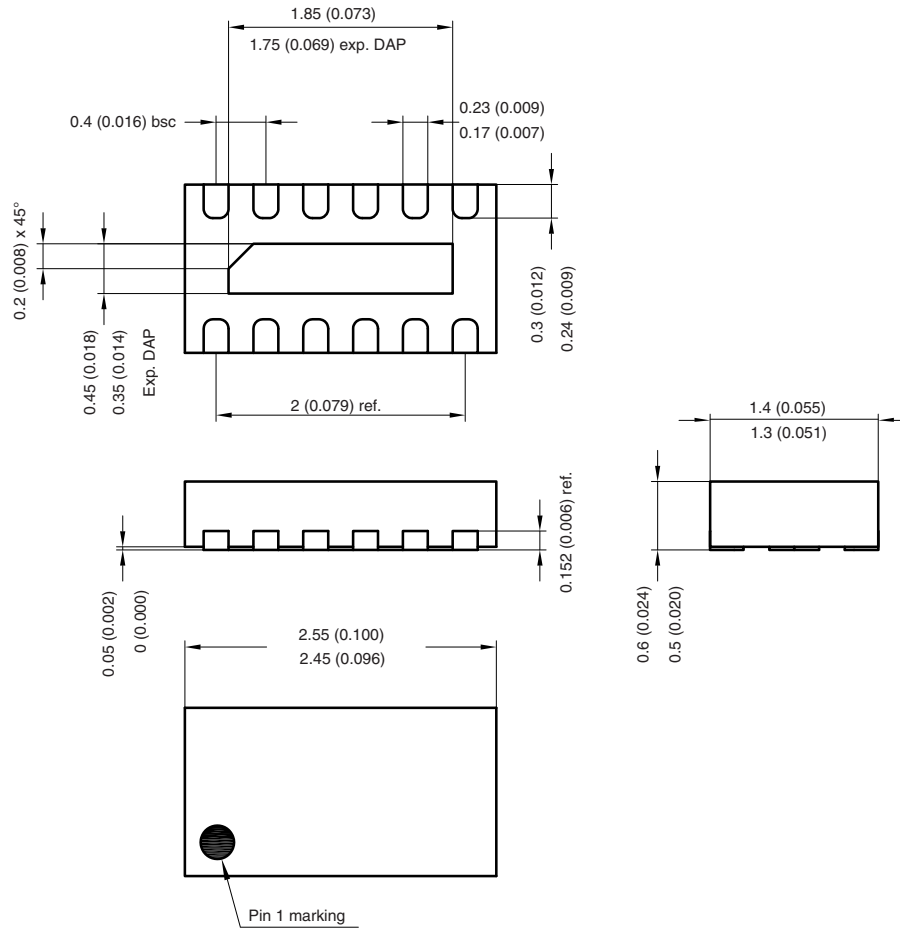
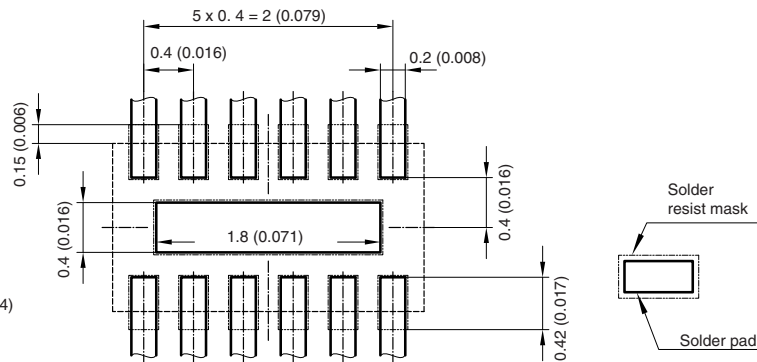


Fig. 5 - Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$

**PACKAGE DIMENSIONS** in millimeters (inches): **LLP2513-13L**



Foot print recommendation:



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



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