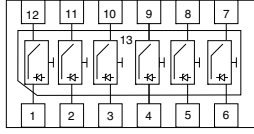
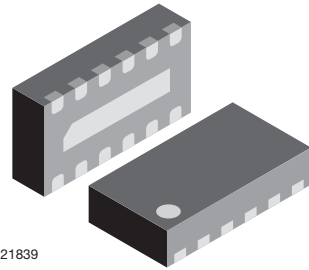


## 6-Channel EMI-Filter with ESD-Protection



20378



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### 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  $f_{3dB} = 240 \text{ MHz}$
- ESD-protection acc. IEC 61000-4-2  
 $\pm 10 \text{ kV}$  contact discharge  
 $\pm 12 \text{ kV}$  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)



### MARKING (example only)



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

### DESIGN SUPPORT TOOLS

[click logo to get started](#)



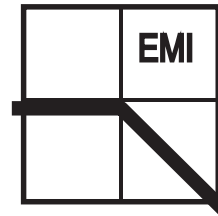
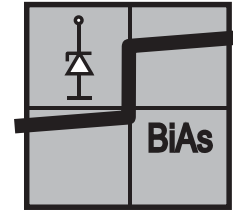
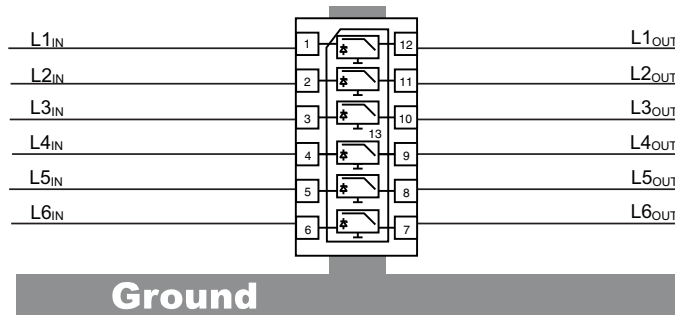
| ORDERING INFORMATION |                   |  |                        |
|----------------------|-------------------|--|------------------------|
| DEVICE NAME          | ORDERING CODE     | TAPED UNITS PER REEL<br>(8 mm TAPE ON 7" REEL) | MINIMUM ORDER QUANTITY |
| VEMI65AC-HCI         | VEMI65AC-HCI-GS08 | 3000   | 15 000                 |

| PACKAGE DATA |              |           |        |   |                                      |                              |
|--------------|--------------|-----------|--------|---|--------------------------------------|------------------------------|
| DEVICE NAME  | PACKAGE NAME | TYPE CODE | WEIGHT | MOLDING COMPOUND<br>FLAMMABILITY RATING | MOISTURE SENSITIVITY LEVEL           | SOLDERING CONDITIONS         |
| VEMI65AC-HCI | LLP2513-13L  | 9T        | 5.5 mg | UL 94 V-0                               | MSL level 1<br>(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 13; acc. IEC 61000-4-5;<br>$t_p = 8/20 \mu\text{s}$ ; single shot | $I_{PPM}$ | 2           | A    |
| ESD immunity             | Contact discharge acc. IEC 61000-4-2; 10 pulses                                      | $V_{ESD}$ | $\pm 10$    | kV   |
|                          | Air discharge acc. IEC 61000-4-2; 10 pulses  |           | $\pm 12$    |      |
| Operating temperature    | Junction temperature   | $T_J$     | -40 to +125 | °C   |
| Storage temperature      |  | $T_{STG}$ | -55 to +150 | °C   |

**APPLICATION NOTE**

With the VEMI65AC-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).



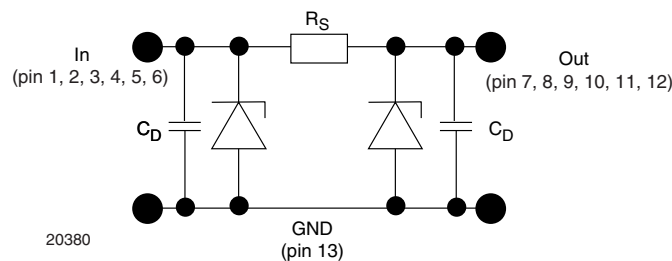
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The 6 independent EMI-filter are placed between

- 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.

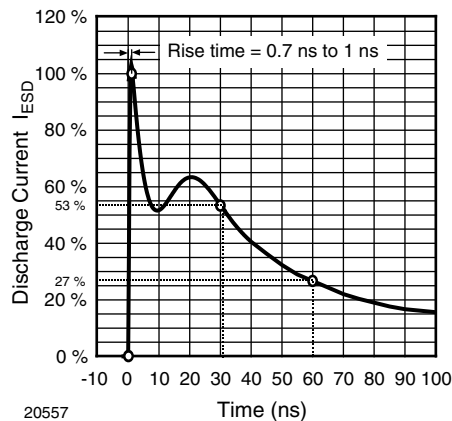
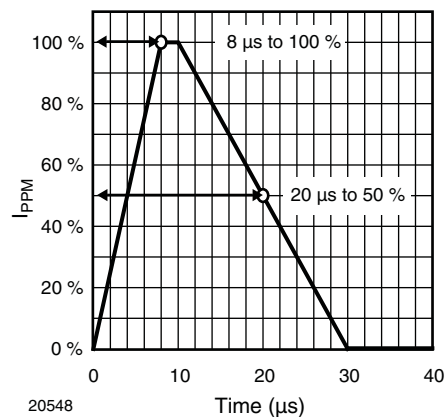
The circuit diagram of one EMI-filter-channel shows two identical Z-diodes at the input to ground and the output to ground. These Z-diodes are characterized by the breakthrough voltage level ( $V_{BR}$ ) and the diode capacitance ( $C_D$ ). Below the breakthrough voltage level the Z-diodes can be considered 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.

| <b>ELECTRICAL CHARACTERISTICS</b> All inputs (pin 1 to pin 6) to ground (pin 13)<br>( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |               |      |       |      |               |
|--|--|---------------|------|-------|------|---------------|
| PARAMETER  | TEST CONDITIONS/REMARKS  | SYMBOL        | MIN. | TYP.  | MAX. | UNIT          |
| Protection paths   | Number of channels which can be protected  | $N_{channel}$ | -    | -     | 6    | 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 $V_R = V_{RWM}$   | $I_R$         | -    | < 0.1 | 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 $I_{PP} = I_{PPM} = 2\text{ A}$ 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 $I_{PP} = I_{PPM} = -2\text{ A}$ applied at the input, measured at the output; acc. IEC 61000-4-5 | $V_{C-out}$   | -1.2 | -     | -    | V             |
| Input capacitance  | at $V_R = 0\text{ V}$ ; $f = 1\text{ MHz}$   | $C_{IN}$      | -    | 20    | -    | pF            |
|  | at $V_R = 2.5\text{ V}$ ; $f = 1\text{ MHz}$   | $C_{IN}$      | -    | 13    | -    | pF            |
| ESD-clamping voltage   | at $\pm 10\text{ kV}$ 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 $50\text{ }\Omega$ system                                      | $f_{3dB}$     | -    | 240   | -    | 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

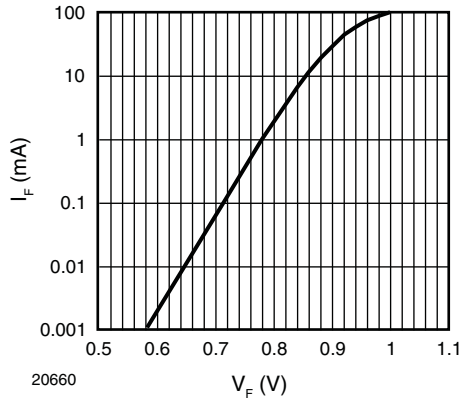


Fig. 3 - Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

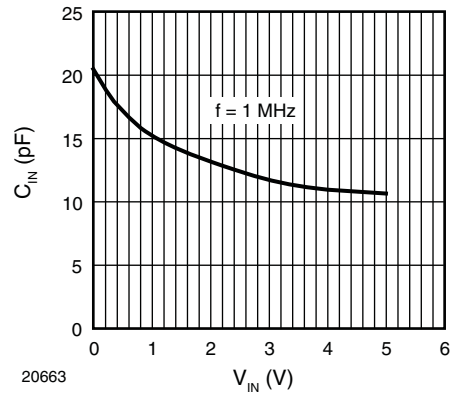


Fig. 6 - Typical Input Capacitance  $C_{IN}$  vs. Input Voltage  $V_{IN}$

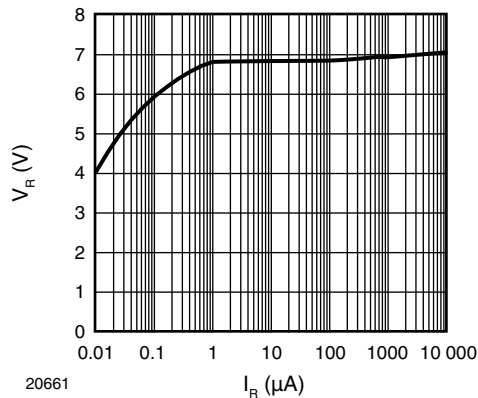


Fig. 4 - Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

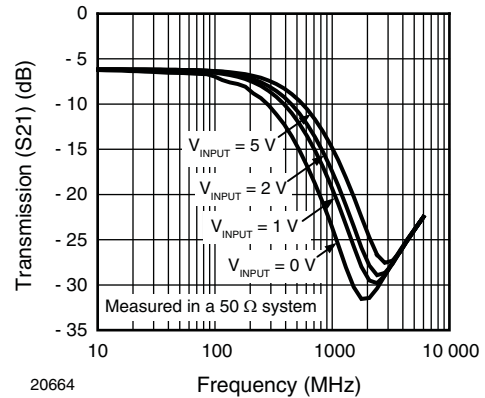


Fig. 7 - Typical Small Signal Transmission ( $S_{21}$ ) at  $Z_O = 50 \Omega$

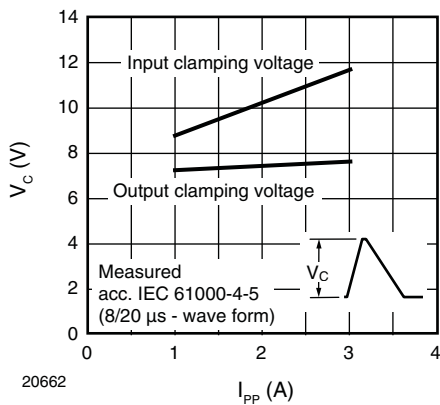
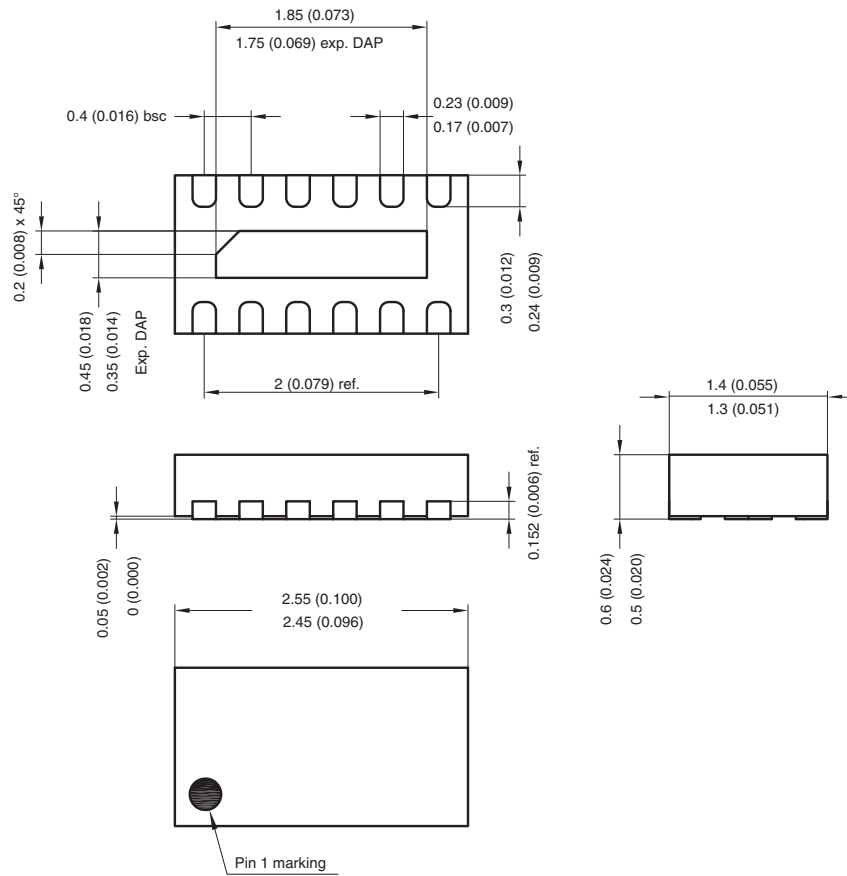


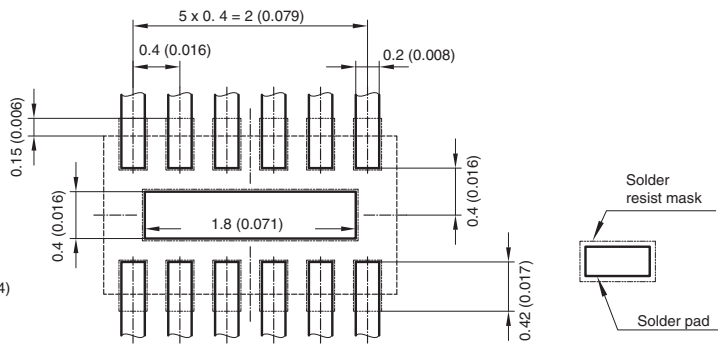
Fig. 5 - Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$



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



Foot print recommendation:



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 Rev. 1 - Date: 27. May 2008  
 20381



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