Silicon PIN Photodiode

DESCRIPTION
VEMD5010X01 is a high speed and high sensitive PIN photodiode. It is a low profile surface mount device (SMD) including the chip with a 7.5 mm² sensitive area detecting visible and near infrared radiation.

FEATURES
- Package type: surface mount
- Package form: top view
- Dimensions (L x W x H in mm): 5 x 4 x 0.9
- Radiant sensitive area (in mm²): 7.5
- AEC-Q101 qualified
- High photo sensitivity
- High radiant sensitivity
- Suitable for visible and near infrared radiation
- Fast response times
- Angle of half sensitivity: \( \varphi = \pm 65^\circ \)
- Floor life: 72 h, MSL 4, according to J-STD-020
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS
- High speed photo detector

PRODUCT SUMMARY

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>( I_{ra} ) (( \mu A ))</th>
<th>( \varphi ) (deg)</th>
<th>( \lambda_{0.1} ) (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEMD5010X01</td>
<td>48</td>
<td>( \pm 65 )</td>
<td>430 to 1100</td>
</tr>
</tbody>
</table>

Note
- Test conditions see table “Basic Characteristics”

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>ORDERING CODE</th>
<th>PACKAGING</th>
<th>REMARKS</th>
<th>PACKAGE FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEMD5010X01</td>
<td>Tape and reel</td>
<td>MOQ: 1000 pcs, 1000 pcs/reel</td>
<td>Top view</td>
</tr>
<tr>
<td>VEMD5010X01-GS15</td>
<td>Tape and reel</td>
<td>MOQ: 5000 pcs, 5000 pcs/reel</td>
<td>Top view</td>
</tr>
</tbody>
</table>

Note
- MOQ: minimum order quantity

ABSOLUTE MAXIMUM RATINGS (\( T_{amb} = 25^\circ C \), unless otherwise specified)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td></td>
<td>( V_R )</td>
<td>20</td>
<td>V</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>( T_{amb} \leq 25^\circ C )</td>
<td>( P_V )</td>
<td>215</td>
<td>mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td>( T_j )</td>
<td>110</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td></td>
<td>( T_{amb} )</td>
<td>-40 to +110</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td></td>
<td>( T_{stg} )</td>
<td>-40 to +110</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>Acc. reflow solder profile fig. 8</td>
<td>( T_{sd} )</td>
<td>260</td>
<td>°C</td>
</tr>
<tr>
<td>Thermal resistance junction/ambient</td>
<td></td>
<td>( R_{thJA} )</td>
<td>350</td>
<td>K/W</td>
</tr>
<tr>
<td>ESD safety HBM</td>
<td>( \pm 2000 V, 1.5 , k\Omega, 100 , pF, 3 ) pulses</td>
<td>( ESD_{HBM} )</td>
<td>( \geq 2 )</td>
<td>kV</td>
</tr>
</tbody>
</table>
BASIC CHARACTERISTICS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage</td>
<td>I&lt;sub&gt;F&lt;/sub&gt; = 50 mA</td>
<td>V&lt;sub&gt;F&lt;/sub&gt;</td>
<td>1</td>
<td>1.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Breakdown voltage</td>
<td>I&lt;sub&gt;R&lt;/sub&gt; = 100 μA, E = 0</td>
<td>V&lt;sub&gt;(BR)&lt;/sub&gt;</td>
<td>20</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse dark current</td>
<td>V&lt;sub&gt;R&lt;/sub&gt; = 10 V, E = 0</td>
<td>I&lt;sub&gt;r0&lt;/sub&gt;</td>
<td>2</td>
<td>30</td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td>Diode capacitance</td>
<td>V&lt;sub&gt;R&lt;/sub&gt; = 0 V, f = 1 MHz, E = 0</td>
<td>C&lt;sub&gt;D&lt;/sub&gt;</td>
<td>70</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V&lt;sub&gt;R&lt;/sub&gt; = 3 V, f = 1 MHz, E = 0</td>
<td>C&lt;sub&gt;D&lt;/sub&gt;</td>
<td>25</td>
<td>40</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Open circuit voltage</td>
<td>E&lt;sub&gt;o&lt;/sub&gt; = 1 mW/cm&lt;sup&gt;2&lt;/sup&gt;, λ = 950 nm</td>
<td>V&lt;sub&gt;v&lt;/sub&gt;</td>
<td>350</td>
<td>mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient of V&lt;sub&gt;o&lt;/sub&gt;</td>
<td>E&lt;sub&gt;o&lt;/sub&gt; = 1 mW/cm&lt;sup&gt;2&lt;/sup&gt;, λ = 950 nm</td>
<td>TK&lt;sub&gt;Vo&lt;/sub&gt;</td>
<td>-2.6</td>
<td>mV/K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short circuit current</td>
<td>E&lt;sub&gt;e&lt;/sub&gt; = 1 mW/cm&lt;sup&gt;2&lt;/sup&gt;, λ = 950 nm</td>
<td>I&lt;sub&gt;k&lt;/sub&gt;</td>
<td>45</td>
<td>μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient of I&lt;sub&gt;k&lt;/sub&gt;</td>
<td>E&lt;sub&gt;e&lt;/sub&gt; = 1 mW/cm&lt;sup&gt;2&lt;/sup&gt;, λ = 950 nm</td>
<td>TK&lt;sub&gt;Ik&lt;/sub&gt;</td>
<td>0.1</td>
<td>%/K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse light current</td>
<td>E&lt;sub&gt;e&lt;/sub&gt; = 1 mW/cm&lt;sup&gt;2&lt;/sup&gt;, λ = 950 nm, V&lt;sub&gt;R&lt;/sub&gt; = 5 V</td>
<td>I&lt;sub&gt;ra&lt;/sub&gt;</td>
<td>40</td>
<td>48</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>Angle of half sensitivity</td>
<td></td>
<td>φ</td>
<td>± 65</td>
<td>deg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength of peak sensitivity</td>
<td></td>
<td>λ&lt;sub&gt;φ&lt;/sub&gt;</td>
<td>940</td>
<td>nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of spectral bandwidth</td>
<td>V&lt;sub&gt;R&lt;/sub&gt; = 10 V, λ = 950 nm</td>
<td>NEP</td>
<td>4 x 10&lt;sup&gt;-14&lt;/sup&gt;</td>
<td>W/√Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise equivalent power</td>
<td>V&lt;sub&gt;R&lt;/sub&gt; = 10 V, R&lt;sub&gt;L&lt;/sub&gt; = 1 kΩ, λ = 820 nm</td>
<td>t&lt;sub&gt;r&lt;/sub&gt;</td>
<td>100</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>V&lt;sub&gt;R&lt;/sub&gt; = 10 V, R&lt;sub&gt;L&lt;/sub&gt; = 1 kΩ, λ = 820 nm</td>
<td>t&lt;sub&gt;f&lt;/sub&gt;</td>
<td>100</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BASIC CHARACTERISTICS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

Basic characteristics graphs to be extended to 110 °C ambient temperatures where applicable.

Fig. 1 - Reverse Dark Current vs. Ambient Temperature

Fig. 2 - Relative Reverse Light Current vs. Ambient Temperature
Fig. 3 - Reverse Light Current vs. Irradiance

Fig. 4 - Reverse Light Current vs. Reverse Voltage

Fig. 5 - Diode Capacitance vs. Reverse Voltage

Fig. 6 - Relative Spectral Sensitivity vs. Wavelength

Fig. 7 - Relative Radiant Sensitivity vs. Angular Displacement
PACKAGE DIMENSIONS in millimeters

Bottom view

Top view

Optical window

Recommended footprint

Drawing No.: 6.550-5329.01-4
Issue: 2; 03.03.2016

Not indicated tolerances ± 0.1

Technical drawings according to DIN specification

Tie bar, electrically connected to cathode

Optical center

C (20 : 1)

Cathode

Exposed pad (cathode)

NC

Anode

Center of device

Expo

ded pad
(cathode)

0.4 (4 x)

0.6 (4 x)

0.65

1.8

1.8

3

3

1.2

2.5

0.8

2

0.8

2

0.8

0.8

Cathode

0.9 ± 0.15

Optical center

0.9 ± 0.15

C

0.9 ± 0.15

C (20 : 1)

Recommended footprint

Bottom view

Top view

Optical window

Tie bar, electrically connected to cathode

Optical center

C (20 : 1)

Cathode

Exposed pad (cathode)

NC

Anode

Center of device

Expo

ded pad
(cathode)

0.4 (4 x)

0.6 (4 x)

0.65

1.8

1.8

3

3

1.2

2.5

0.8

2

0.8

2

0.8

0.8

Cathode

0.9 ± 0.15

Optical center

0.9 ± 0.15

C

0.9 ± 0.15

C (20 : 1)
TAPE AND REEL DIMENSIONS in millimeters

Reel-design is representative for different types

Unreel direction

Label posted here

Anode

Drawing-No.: 9,800-5129.01-4;
Issue: 1; 20.07.2015
**SOLDER PROFILE**

![Solder Profile Graph](image)

**DRYPACK**

Devices are packed in moisture barrier bags (MBB) to prevent the products from moisture absorption during transportation and storage. Each bag contains a desiccant.

**FLOOR LIFE**

Time between soldering and removing from MBB must not exceed the time indicated in J-STD-020:

- Moisture sensitivity: Level 4
- Floor life: 72 h
- Conditions: $T_{\text{amb}} < 30 \, ^\circ\text{C}, \, \text{RH} < 60 \, %$

**DRYING**

In case of moisture absorption devices should be baked before soldering. Conditions see J-STD-020 or recommended conditions:

- 192 h at 40 °C (+ 5 °C), RH < 5 %
- or
- 96 h at 60 °C (+ 5 °C), RH < 5 %.

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