UV SMD LED with Silicone Lens

DESCRIPTION
VLMU3500-....-060... series is a ceramic based high power UV LED with silicone lens for long life time. The package size is 3.5 mm x 3.5 mm and the radiant power up to 1250 mW at 700 mA in a wavelength range of 380 nm to 410 nm.

PRODUCT GROUP AND PACKAGE DATA
- Product group: LED
- Package: SMD ceramic high power
- Product series: high power UV LED
- Angle of half intensity: ± 30°
- Lead-finishing: Au

SAFETY ADVICES
Depending on the mode of operation, these devices emit highly concentrated non visible ultraviolet light which can be hazardous to the human eye. Products which incorporate these devices have to follow the safety precautions given in IEC 62471 “Photobiological Safety of Lamps and Lamp Systems”.

FEATURES
- Ceramic SMT package with silicone lens
- Dimension (L x W x H) in mm: 3.5 x 3.5 x 2.9
- Forward current: up to 700 mA
- Radiant power (typ.): 780 mW at 500 mA, 1037 mW at 700 mA
- Materials:
  - Die: InGaN
  - Resin: silicone (water clear)
  - Leads / terminations finish: gold plated (Au)
- Grouping parameters:
  - Radiant power
  - Peak wavelength
  - Forward voltage
- Reflow soldering method
- MSL2 according to J-STD-020
- Packaging: MOQ = 100 pieces; 12 mm tape with 100 pieces per reel, Ø 180 mm (7”)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS
- Industrial curing
- Photocatalytic purification
- Poster printing curing
- Counterfeit money detector
- Blood detector
- Nail curing
- Teeth curing

PARTS TABLE

<table>
<thead>
<tr>
<th>PART</th>
<th>COLOR</th>
<th>RADIANT POWER (mW) at IF (mA)</th>
<th>WAVELENGTH (nm) at IF (mA)</th>
<th>FORWARD VOLTAGE (V) at IF (mA)</th>
<th>TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLMU3500-385-060</td>
<td>Ultraviolet</td>
<td>MIN. 620 TYP. 780 MAX. 940</td>
<td>MIN. 500 TYP. 380 MAX. 390</td>
<td>MIN. 2.8 TYP. 3.4 MAX. 4.0</td>
<td>InGaN</td>
</tr>
<tr>
<td>VLMU3500-385-060-L</td>
<td>Ultraviolet</td>
<td>MIN. 620 TYP. 780 MAX. 940</td>
<td>MIN. 500 TYP. 380 MAX. 390</td>
<td>MIN. 2.8 TYP. 3.4 MAX. 4.0</td>
<td>InGaN</td>
</tr>
<tr>
<td>VLMU3500-395-060</td>
<td>Ultraviolet</td>
<td>MIN. 620 TYP. 780 MAX. 940</td>
<td>MIN. 500 TYP. 390 MAX. 400</td>
<td>MIN. 2.8 TYP. 3.4 MAX. 4.0</td>
<td>InGaN</td>
</tr>
<tr>
<td>VLMU3500-395-060-L</td>
<td>Ultraviolet</td>
<td>MIN. 620 TYP. 780 MAX. 940</td>
<td>MIN. 500 TYP. 390 MAX. 400</td>
<td>MIN. 2.8 TYP. 3.4 MAX. 4.0</td>
<td>InGaN</td>
</tr>
<tr>
<td>VLMU3500-405-060</td>
<td>Ultraviolet</td>
<td>MIN. 620 TYP. 780 MAX. 940</td>
<td>MIN. 500 TYP. 400 MAX. 410</td>
<td>MIN. 2.8 TYP. 3.4 MAX. 4.0</td>
<td>InGaN</td>
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<tr>
<td>VLMU3500-405-060-L</td>
<td>Ultraviolet</td>
<td>MIN. 620 TYP. 780 MAX. 940</td>
<td>MIN. 500 TYP. 400 MAX. 410</td>
<td>MIN. 2.8 TYP. 3.4 MAX. 4.0</td>
<td>InGaN</td>
</tr>
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</table>

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For technical questions, contact: LED@vishay.com
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### ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

**VLMU3500-...-060...**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC forward current</td>
<td>I_F</td>
<td>700</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Power dissipation</td>
<td>P_V</td>
<td>2.8</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Electrostatic discharge</td>
<td>HBM: MIL-STD-883 C 3B</td>
<td>ESD</td>
<td>8000</td>
<td>V</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T_j</td>
<td>+125</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>T_{amb}</td>
<td>-40 to +85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>T_{stg}</td>
<td>-40 to +100</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Solder temperature</td>
<td>T_{sod}</td>
<td>260</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Thermal resistance - junction to solder point</td>
<td>R_{thJS}</td>
<td>8</td>
<td>°C/W</td>
<td></td>
</tr>
</tbody>
</table>

### OPTICAL AND ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

**VLMU3500-...-060..., ULTRAVIOLET**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>DEVICE TYPE</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>Forward voltage</td>
<td>I_F = 500 mA</td>
<td>V_F</td>
<td>2.8</td>
<td>3.4</td>
<td>4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Radiant power</td>
<td>I_F = 350 mA</td>
<td>( \phi_e )</td>
<td>445</td>
<td>560</td>
<td>675</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Radiant power</td>
<td>I_F = 500 mA</td>
<td>( \phi_e )</td>
<td>620</td>
<td>780</td>
<td>940</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Radiant power</td>
<td>I_F = 700 mA</td>
<td>( \phi_e )</td>
<td>824</td>
<td>1037</td>
<td>1250</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Radiant intensity</td>
<td>I_F = 350 mA</td>
<td>I_e</td>
<td>-</td>
<td>395</td>
<td>-</td>
<td>mW/sr</td>
<td></td>
</tr>
<tr>
<td>Radiant intensity</td>
<td>I_F = 500 mA</td>
<td>I_e</td>
<td>-</td>
<td>550</td>
<td>-</td>
<td>mW/sr</td>
<td></td>
</tr>
<tr>
<td>Radiant intensity</td>
<td>I_F = 700 mA</td>
<td>I_e</td>
<td>-</td>
<td>730</td>
<td>-</td>
<td>mW/sr</td>
<td></td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>I_F = 500 mA</td>
<td>( \lambda_p )</td>
<td>380</td>
<td>385</td>
<td>390</td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>VLMU3500-385-060...</td>
<td>( \lambda_p )</td>
<td>390</td>
<td>395</td>
<td>400</td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>VLMU3500-395-060...</td>
<td>( \lambda_p )</td>
<td>400</td>
<td>405</td>
<td>410</td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Angle of half intensity</td>
<td>I_F = 500 mA</td>
<td>( \phi )</td>
<td>-</td>
<td>± 30</td>
<td>-</td>
<td>°</td>
<td></td>
</tr>
<tr>
<td>Reverse current</td>
<td>V_R = 5 V</td>
<td>I_R</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>μA</td>
<td></td>
</tr>
</tbody>
</table>

**Note**
- Tolerances: ± 11 % for \( \phi_e \), ± 0.1 V for V_F, ± 1 nm for \( \lambda_p \)

### RADIANT POWER CLASSIFICATION (I_F = 500 mA)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MIN.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>U062</td>
<td>620</td>
<td>660</td>
<td>mW</td>
</tr>
<tr>
<td>U066</td>
<td>660</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>U070</td>
<td>700</td>
<td>740</td>
<td></td>
</tr>
<tr>
<td>U074</td>
<td>740</td>
<td>780</td>
<td></td>
</tr>
<tr>
<td>U078</td>
<td>780</td>
<td>820</td>
<td></td>
</tr>
<tr>
<td>U082</td>
<td>820</td>
<td>860</td>
<td></td>
</tr>
<tr>
<td>U086</td>
<td>860</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>U090</td>
<td>900</td>
<td>940</td>
<td></td>
</tr>
</tbody>
</table>

### PEAK WAVELENGTH CLASSIFICATION (I_F = 500 mA)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MIN.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q380</td>
<td>380</td>
<td>385</td>
<td>nm</td>
</tr>
<tr>
<td>Q385</td>
<td>385</td>
<td>390</td>
<td></td>
</tr>
<tr>
<td>Q390</td>
<td>390</td>
<td>395</td>
<td></td>
</tr>
<tr>
<td>Q395</td>
<td>395</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Q400</td>
<td>400</td>
<td>405</td>
<td></td>
</tr>
<tr>
<td>Q405</td>
<td>405</td>
<td>410</td>
<td></td>
</tr>
</tbody>
</table>
Note
- In order to ensure availability, single groups for radiant intensity, wavelength, and forward voltage will not be orderable. Only one group for radiant intensity, wavelength, and forward voltage will be shipped in any one reel

MARKING EXAMPLE FOR SELECTION CODE ON LABEL
Selection code: U074Q385V3436
- U074: $\phi_e$, range 740 mW to 780 mW
- Q385: $\lambda_p$, range 385 nm to 390 nm
- V3436: $V_F$, range 3.4 V to 3.6 V

TYPICAL CHARACTERISTICS ($T_{amb}=25$ °C, unless otherwise specified)
**Fig. 5 - Maximum Forward Current vs. Ambient Temperature**

**Fig. 7 - Change of Peak Wavelength vs. Ambient Temperature**

**Fig. 6 - Relative Radiant Flux vs. Ambient Temperature**

**Fig. 8 - Change of Forward Voltage vs. Ambient Temperature**
**PACKAGE DIMENSIONS** in millimeters

![Package Dimensions Diagram](image)

**WIRING**

![Wiring Diagram](image)

**Drawing-No.: 6.541-5108.01-4**
**Issue: 3VK; 26.11.2019**
TAPE AND REEL DIMENSIONS in millimeters

Reel:
- Ø 178 ± 1
- Ø 13.5
- Label posted here

Unreel direction:
- Tape position coming out from reel
- 100 pcs/reel for VLMU3500...
- 500 pcs/reel for VLMU3500-060-L

Leader and trailer tape:
- Empty (160 mm min.)
- Empty (400 mm min.)
- Part(s) mounted
- Direction of pulling out

Technical drawings according to DIN specification

Drawing-No.: 9.800-5131.01-4
Issue: ZV; 20.02.2020
**HANDLING RECOMMENDATIONS**

In order to achieve excellent lifetime, the package of these UV-LEDs consists of a ceramic substrate in combination with a UV stable silicone as lens material. Compared to standard materials silicone is generally softer and it tends more to attract dust:

- Minimize the level of dirt and dust particles in contact with the LED
- Small amounts of particles on the LEDs, although noticeable from a cosmetic point of view, do not affect the performance in terms of brightness, reliability and quality
- If cleaning is required, a short rinsing with isopropyl alcohol, not longer than 15 seconds, is recommended. Do not use ultrasonic cleaning, it may damage the LED
- Do not apply mechanical stress on the silicone lens
- Avoid any piercing of the silicone lens by sharp objects
- It is recommended to use a suitable pick and place tool for the removal of the LED from blister tape without applying stress to the lens. The recess of the pick-up needle has to be larger than the silicone lens
- For manual handling using tweezers make sure that the LED will be touched carefully at the sidewall of the ceramic substrate, but not at the silicone lens

**SOLDERING PROFILE**

![IR Reflow Soldering Profile for Lead (Pb)-Free Soldering](image)

Preconditioning according to JEDEC level 2

- max. ramp up 3 °C/s
- max. 2 cycles allowed
- max. ramp down 6 °C/s

**BAR CODE PRODUCT LABEL** (example only)

- A. 2D barcode
- B. Part No: Vishay part number
- C. QTY: quantity
- D. SelCode: selection bin code
- E. Country of origin
- F. PTC: production plant code
- G. Termination finish
- H. Region code
- I. Serial#: serial number
- K. Batch Number: year, week, country code, plant code
- L. SL: sales location
- M. Environmental symbols: RoHS, lead (Pb)-free, halogen-free

**DRY PACKING**

The reel is packed in an anti-humidity bag to protect the devices from absorbing moisture during transportation and storage.

**FINAL PACKING**

The sealed reel is packed into a cardboard box. A secondary cardboard box is used for shipping purposes.
RECOMMENDED METHOD OF STORAGE

Dry box storage is recommended as soon as the aluminum bag has been opened to prevent moisture absorption. The following conditions should be observed, if dry boxes are not available:

- Storage temperature 10 °C to 30 °C
- Storage humidity ≤ 60 % RH max.

After more than 1 year under these conditions moisture content will be too high for reflow soldering.

In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:
- 192 h at 40 °C + 5 °C / - 0 °C and < 5 % RH (dry air / nitrogen)
- 24 h at 60 °C + 5 °C and < 5 % RH for all device containers
- 24 h at 100 °C + 5 °C not suitable for reel or tubes.

An EIA JEDEC® standard JESD22-A112 level 2 label is included on all dry bags.

ESD PRECAUTION

Proper storage and handling procedures should be followed to prevent ESD damage to the devices especially when they are removed from the antistatic shielding bag. Electrostatic sensitive devices warning labels are on the packaging.

VISHAY SEMICONDUCTORS STANDARD BAR CODE LABELS

The Vishay Semiconductors standard bar code labels are printed at final packing areas. The labels are on each packing unit and contain Vishay Semiconductors specific data.
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