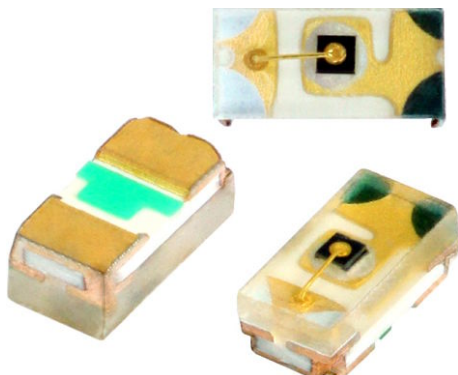




## Ultrabright 0402 ChipLED



### FEATURES

- Super thin ChipLED with exceptional brightness  
1.0 mm x 0.5 mm x 0.35 mm (L x W x H)
- High reliability PCB based
- Wavelength (470 to 475) nm (blue), typ. 571 nm (yellow green), (587 to 597) nm (yellow), typ. 605 nm (soft orange), typ. 631 nm (super red)
- AllnGaP and InGaP technology
- Viewing angle: extremely wide 130°
- Grouping parameter: luminous intensity, wavelength,  $V_F$
- Available in 8 mm tape on 7" diameter reel
- Compatible to IR reflow soldering
- Preconditioning according to JEDEC® level 2a
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTION

The new ChipLED series have been designed in the smallest SMD package. This innovative ChipLED technology opens the way to

- smaller products of higher performance
- more design in flexibility
- enhanced applications

The 0402 LED is an obvious solution for small-scale, high brightness products that are expected to work reliable in an arduous environment.

### PRODUCT GROUP AND PACKAGE DATA

- Product group: LED
- Package: SMD 0402 ChipLED
- Product series: standard
- Angle of half intensity:  $\pm 65^\circ$

### APPLICATIONS

- Backlight keypads
- Navigation systems
- Cellular phone displays
- Displays for industrial control systems
- Miniaturized color effects
- Traffic displays

### PARTS TABLE

| PART          | COLOR        | LUMINOUS INTENSITY (mcd) |      |      | at $I_F$ (mA) | WAVELENGTH (nm) |      |      | at $I_F$ (mA) | FORWARD VOLTAGE (V) |      |      | at $I_F$ (mA) | TECHNOLOGY |
|---------------|--------------|--------------------------|------|------|---------------|-----------------|------|------|---------------|---------------------|------|------|---------------|------------|
|               |              | MIN.                     | TYP. | MAX. |               | MIN.            | TYP. | MAX. |               | MIN.                | TYP. | MAX. |               |            |
| VLMS1500-GS08 | Super red    | 18                       | 54   | -    | 20            | -               | 631  | -    | 20            | -                   | 2.0  | 2.4  | 20            | AllnGaP    |
| VLMO1500-GS08 | Soft orange  | 45                       | 90   | -    | 20            | -               | 605  | -    | 20            | -                   | 2.0  | 2.4  | 20            | AllnGaP    |
| VLMY1500-GS08 | Yellow       | 28                       | -    | 180  | 20            | 587             | -    | 597  | 20            | -                   | 2.0  | 2.4  | 20            | AllnGaP    |
| VLMG1500-GS08 | Yellow green | 18                       | 35   | -    | 20            | -               | 571  | -    | 20            | -                   | 2.0  | 2.4  | 20            | AllnGaP    |
| VLMB1500-GS08 | Blue         | 11.2                     | -    | 45   | 5             | 470             | -    | 475  | 5             | 2.65                | -    | 3.15 | 5             | InGaP      |

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

#### VLMS1500, VLMO1500, VLMY1500, VLMG1500 (AllnGaP technology)

| PARAMETER                      | TEST CONDITION                      | SYMBOL    | VALUE      | UNIT             |
|--------------------------------|-------------------------------------|-----------|------------|------------------|
| Reverse voltage <sup>(1)</sup> |                                     | $V_R$     | 5          | V                |
| DC forward current             |                                     | $I_F$     | 30         | mA               |
| Surge forward current          | 1/10 duty cycle, 0.1 ms pulse width | $I_{FSM}$ | 80         | mA               |
| Power dissipation              | $T_{amb} \leq 25^\circ\text{C}$     | $P_V$     | 75         | mW               |
| Operating temperature range    |                                     | $T_{amb}$ | -30 to +85 | $^\circ\text{C}$ |
| Storage temperature range      |                                     | $T_{stg}$ | -40 to +85 | $^\circ\text{C}$ |
| IRE solder conditions          | according Vishay specifications     | $T_{st}$  | 260        | $^\circ\text{C}$ |

#### Note

- <sup>(1)</sup> Driving the LED in reverse direction is suitable for short term application


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

**VLMB1500** (InGaN technology)

| PARAMETER                   | TEST CONDITION                            | SYMBOL    | VALUE       | UNIT               |
|-----------------------------|-------------------------------------------|-----------|-------------|--------------------|
| DC forward current          |                                           | $I_F$     | 20          | mA                 |
| Surge forward current       | 1/10 duty cycle, 0.1 ms pulse width       | $I_{FSM}$ | 100         | mA                 |
| Power dissipation           | $T_{amb} \leq 25\text{ }^{\circ}\text{C}$ | $P_V$     | 76          | mW                 |
| Operating temperature range |                                           | $T_{amb}$ | -20 to +80  | $^{\circ}\text{C}$ |
| Storage temperature range   |                                           | $T_{stg}$ | -30 to +100 | $^{\circ}\text{C}$ |
| IRED solder conditions      | according Vishay specifications           | $T_{st}$  | 260         | $^{\circ}\text{C}$ |

**OPTICAL AND ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

**VLMS1500, SUPER RED**

| PARAMETER                | TEST CONDITION       | SYMBOL          | MIN. | TYP.     | MAX. | UNIT          |
|--------------------------|----------------------|-----------------|------|----------|------|---------------|
| Luminous intensity       | $I_F = 20\text{ mA}$ | $I_V$           | 18   | 54       | -    | mcd           |
| Dominant wavelength      | $I_F = 20\text{ mA}$ | $\lambda_d$     | -    | 631      | -    | nm            |
| Peak wavelength          | $I_F = 20\text{ mA}$ | $\lambda_p$     | -    | 639      | -    | nm            |
| Angle of half intensity  | $I_F = 20\text{ mA}$ | $\varphi$       | -    | $\pm 65$ | -    | deg           |
| Spectral line half width | $I_F = 20\text{ mA}$ | $\Delta\lambda$ | -    | 20       | -    | nm            |
| Forward voltage          | $I_F = 20\text{ mA}$ | $V_F$           | -    | 2.0      | 2.4  | V             |
| Reverse current          | $V_R = 5\text{ V}$   | $I_R$           | -    | -        | 10   | $\mu\text{A}$ |

**OPTICAL AND ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

**VLMO1500, SOFT ORANGE**

| PARAMETER                | TEST CONDITION       | SYMBOL          | MIN. | TYP.     | MAX. | UNIT          |
|--------------------------|----------------------|-----------------|------|----------|------|---------------|
| Luminous intensity       | $I_F = 20\text{ mA}$ | $I_V$           | 45   | 90       | -    | mcd           |
| Dominant wavelength      | $I_F = 20\text{ mA}$ | $\lambda_d$     | -    | 605      | -    | nm            |
| Peak wavelength          | $I_F = 20\text{ mA}$ | $\lambda_p$     | -    | 611      | -    | nm            |
| Angle of half intensity  | $I_F = 20\text{ mA}$ | $\varphi$       | -    | $\pm 65$ | -    | deg           |
| Spectral line half width | $I_F = 20\text{ mA}$ | $\Delta\lambda$ | -    | 17       | -    | nm            |
| Forward voltage          | $I_F = 20\text{ mA}$ | $V_F$           | -    | 2.0      | 2.4  | V             |
| Reverse current          | $V_R = 5\text{ V}$   | $I_R$           | -    | -        | 10   | $\mu\text{A}$ |

**OPTICAL AND ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

**VLMY1500, YELLOW**

| PARAMETER                | TEST CONDITION       | SYMBOL          | MIN. | TYP.     | MAX. | UNIT          |
|--------------------------|----------------------|-----------------|------|----------|------|---------------|
| Luminous intensity       | $I_F = 20\text{ mA}$ | $I_V$           | 28   | -        | 180  | mcd           |
| Dominant wavelength      | $I_F = 20\text{ mA}$ | $\lambda_d$     | 587  | -        | 597  | nm            |
| Peak wavelength          | $I_F = 20\text{ mA}$ | $\lambda_p$     | -    | 588      | -    | nm            |
| Angle of half intensity  | $I_F = 20\text{ mA}$ | $\varphi$       | -    | $\pm 65$ | -    | deg           |
| Spectral line half width | $I_F = 20\text{ mA}$ | $\Delta\lambda$ | -    | 15       | -    | nm            |
| Forward voltage          | $I_F = 20\text{ mA}$ | $V_F$           | -    | 2.0      | 2.4  | V             |
| Reverse current          | $V_R = 5\text{ V}$   | $I_R$           | -    | -        | 10   | $\mu\text{A}$ |


**OPTICAL AND ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified)  
**VLMG1500, YELLOW GREEN**

| PARAMETER                | TEST CONDITION                          | SYMBOL          | MIN. | TYP.     | MAX. | UNIT          |
|--------------------------|-----------------------------------------|-----------------|------|----------|------|---------------|
| Luminous intensity       | $I_F = 20\text{ mA}$                    | $I_V$           | 18   | 35       | -    | mcd           |
| Dominant wavelength      | $I_F = 20\text{ mA}$                    | $\lambda_d$     | -    | 571      | -    | nm            |
| Peak wavelength          | $I_F = 20\text{ mA}$                    | $\lambda_p$     | -    | 574      | -    | nm            |
| Angle of half intensity  | $I_F = 20\text{ mA}$                    | $\varphi$       | -    | $\pm 65$ | -    | deg           |
| Spectral line half width | $I_F = 20\text{ mA}$                    | $\Delta\lambda$ | -    | 15       | -    | nm            |
| Forward voltage          | $I_F = 20\text{ mA}$                    | $V_F$           | -    | 2.0      | 2.4  | V             |
| Junction capacitance     | $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ | $C_j$           | -    | 40       | -    | pF            |
| Reverse current          | $V_R = 5\text{ V}$                      | $I_R$           | -    | -        | 10   | $\mu\text{A}$ |

**OPTICAL AND ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified)  
**VLMB1500, BLUE**

| PARAMETER                | TEST CONDITION      | SYMBOL          | MIN. | TYP.     | MAX. | UNIT          |
|--------------------------|---------------------|-----------------|------|----------|------|---------------|
| Luminous intensity       | $I_F = 5\text{ mA}$ | $I_V$           | 11.2 | -        | 45   | mcd           |
| Dominant wavelength      | $I_F = 5\text{ mA}$ | $\lambda_d$     | 470  | -        | 475  | nm            |
| Peak wavelength          | $I_F = 5\text{ mA}$ | $\lambda_p$     | -    | 468      | -    | nm            |
| Angle of half intensity  | $I_F = 5\text{ mA}$ | $\varphi$       | -    | $\pm 65$ | -    | deg           |
| Spectral line half width | $I_F = 5\text{ mA}$ | $\Delta\lambda$ | -    | 25       | -    | nm            |
| Forward voltage          | $I_F = 5\text{ mA}$ | $V_F$           | 2.65 | -        | 3.15 | V             |
| Reverse current          | $V_R = 5\text{ V}$  | $I_R$           | -    | -        | 10   | $\mu\text{A}$ |

**LUMINOUS INTENSITY CLASSIFICATION**

| GROUP | LUMINOUS INTENSITY (mcd) |      |
|-------|--------------------------|------|
|       | MIN.                     | MAX. |
| L     | 11.2                     | 18   |
| M     | 18                       | 28   |
| N     | 28                       | 45   |
| P     | 45                       | 71   |
| Q     | 71                       | 112  |
| R     | 112                      | 180  |
| S     | 180                      | 280  |
| T     | 280                      | 450  |

**Note**

- Luminous intensity is tested at a current pulse duration of 25 ms and an accuracy of  $\pm 15\%$ .  
The above type numbers represent the order groups which include only a few brightness groups. Only one group will be shipped on each reel (there will be no mixing of two groups on each reel). In order to ensure availability, single brightness groups will not be orderable.  
In a similar manner for colors where wavelength groups are measured and binned, single wavelength groups will be shipped in any one reel.  
In order to ensure availability, single wavelength groups will not be orderable.

**COLOR CLASSIFICATION**

| COLOR        | GROUP | DOMINANT WAVELENGTH (nm) |       |
|--------------|-------|--------------------------|-------|
|              |       | MIN.                     | MAX.  |
| Yellow       | J     | 587                      | 589.5 |
|              | K     | 589.5                    | 592   |
|              | L     | 592                      | 594.5 |
|              | M     | 594.5                    | 597   |
| Yellow green | C     | 567.5                    | 570.5 |
|              | D     | 570.5                    | 573.5 |
|              | E     | 573.5                    | 576.5 |
| Blue         | AD    | 470                      | 475   |

**Note**

- Wavelengths are tested at a current pulse duration of 25 ms and an accuracy of  $\pm 1\text{ nm}$ .



| FORWARD VOLTAGE CLASSIFICATION |       |                     |      |
|--------------------------------|-------|---------------------|------|
| COLOR                          | GROUP | FORWARD VOLTAGE (V) |      |
|                                |       | MIN.                | MAX. |
| Yellow                         | D2    | 1.8                 | 2.0  |
|                                | D3    | 2.0                 | 2.2  |
|                                | D4    | 2.2                 | 2.4  |
| Yellow green                   | 4     | 1.9                 | 2    |
|                                | 5     | 2                   | 2.1  |
|                                | 6     | 2.1                 | 2.2  |
|                                | 7     | 2.2                 | 2.3  |
|                                | 8     | 2.3                 | 2.4  |
| Blue                           | 1     | 2.65                | 2.75 |
|                                | 2     | 2.75                | 2.85 |
|                                | 3     | 2.85                | 2.95 |
|                                | 4     | 2.95                | 3.05 |
|                                | 5     | 3.05                | 3.15 |

#### Note

- Forward voltage is measured with a tolerance of  $\pm 0.1$  V.

#### TYPICAL CHARACTERISTICS ( $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified)

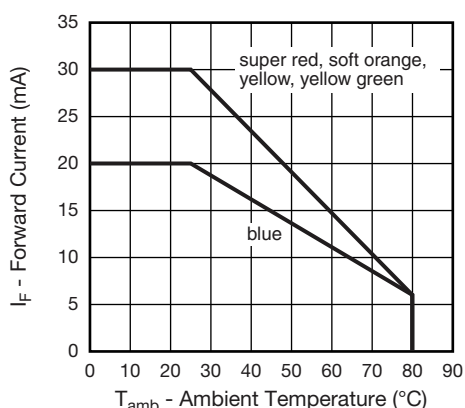


Fig. 1 - Forward Current vs. Ambient Temperature

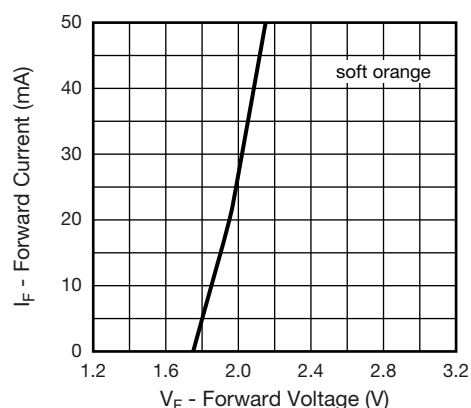


Fig. 3 - Forward Current vs. Forward Voltage (soft orange)

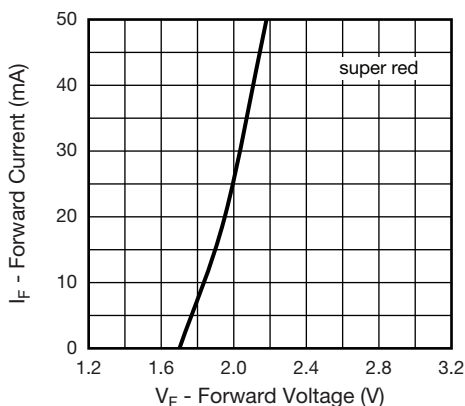


Fig. 2 - Forward Current vs. Forward Voltage (super red)

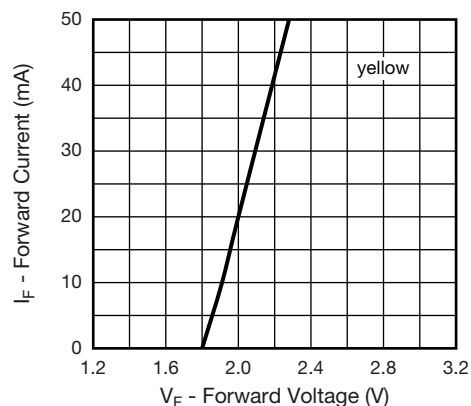


Fig. 4 - Forward Current vs. Forward Voltage (yellow)

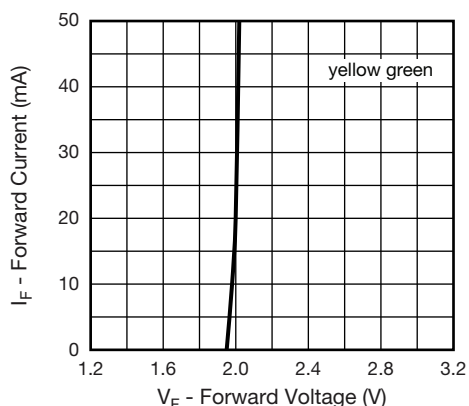


Fig. 5 - Forward Current vs. Forward Voltage (yellow green)

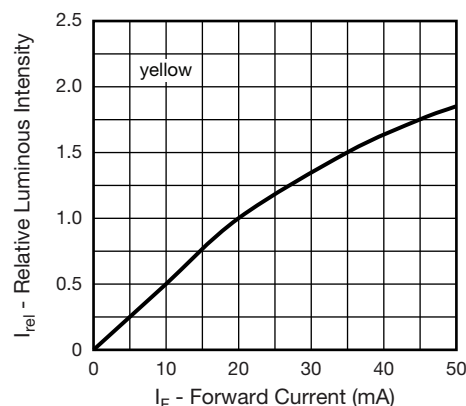


Fig. 8 - Relative Luminous Intensity vs. Forward Current (yellow)

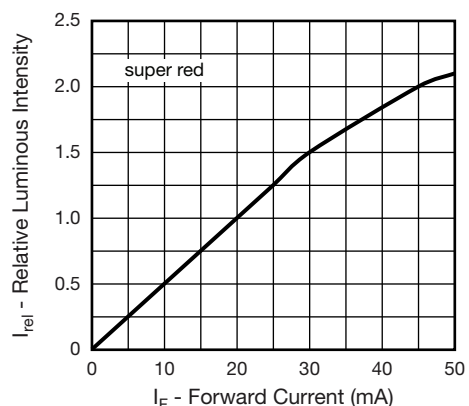


Fig. 6 - Relative Luminous Intensity vs. Forward Current (super red)

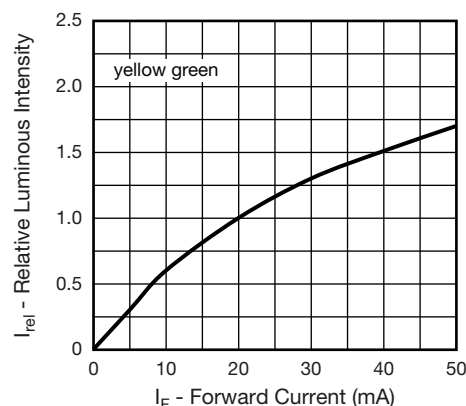


Fig. 9 - Relative Luminous Intensity vs. Forward Current (yellow green)

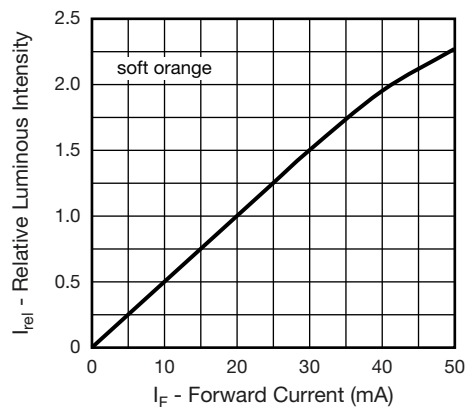


Fig. 7 - Relative Luminous Intensity vs. Forward Current (soft orange)

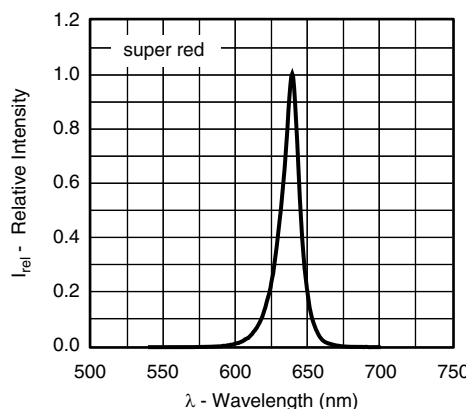


Fig. 10 - Relative Intensity vs. Wavelength (super red)

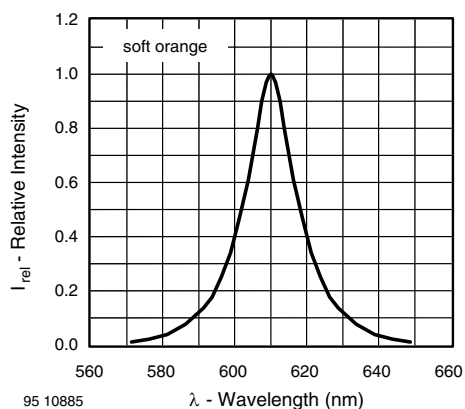


Fig. 11 - Relative Intensity vs. Wavelength (soft orange)

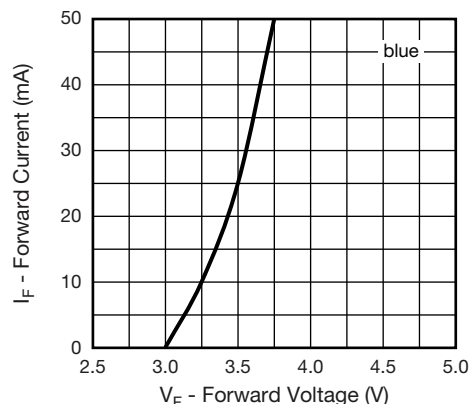


Fig. 14 - Forward Current vs. Forward Voltage (blue)

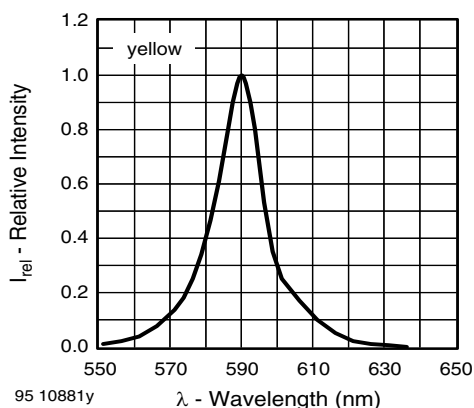


Fig. 12 - Relative Intensity vs. Wavelength (yellow)

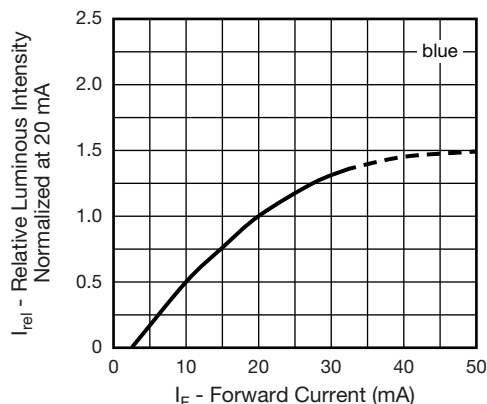


Fig. 15 - Relative Luminous Intensity vs. Forward Current (blue)

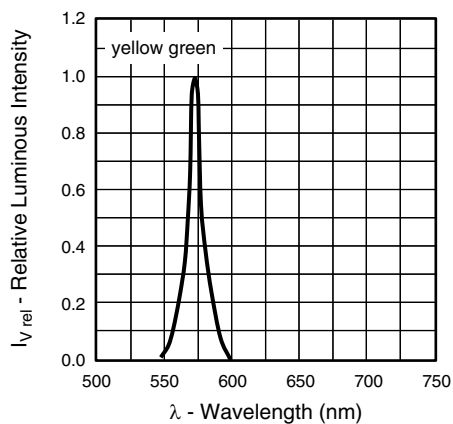


Fig. 13 - Relative Intensity vs. Wavelength (yellow green)

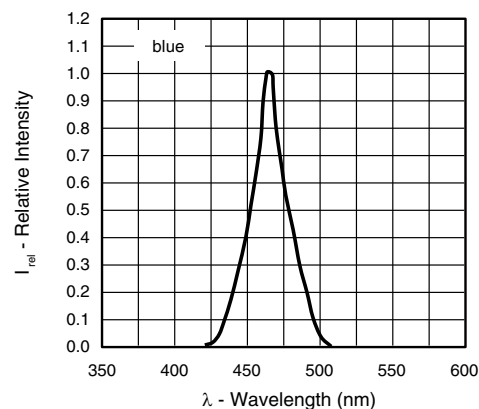


Fig. 16 - Relative Intensity vs. Wavelength (blue)

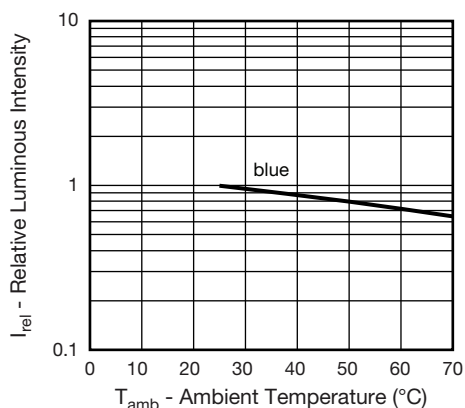


Fig. 17 - Relative Luminous Intensity vs. Ambient Temperature

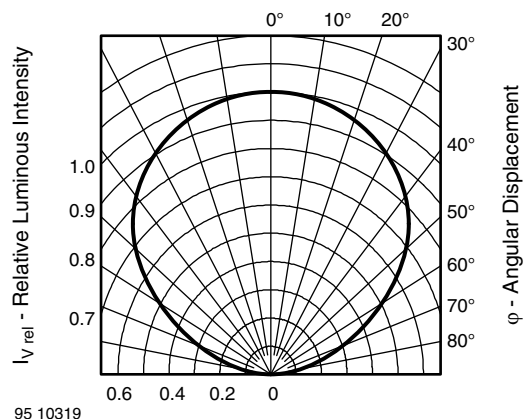
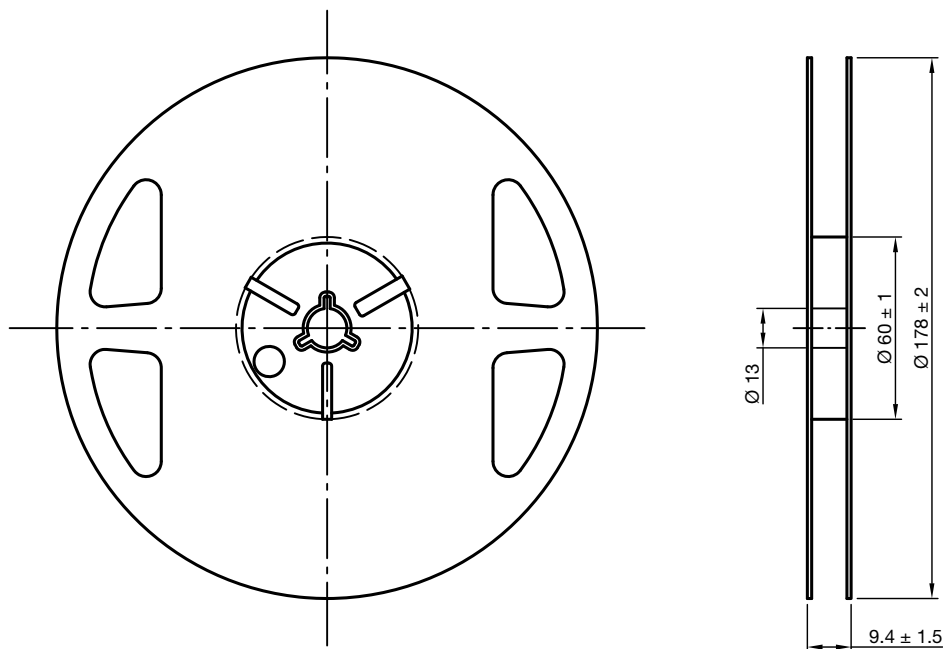
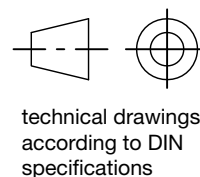


Fig. 18 - Relative Luminous Intensity vs. Angular Displacement

**REEL DIMENSIONS** in millimeters



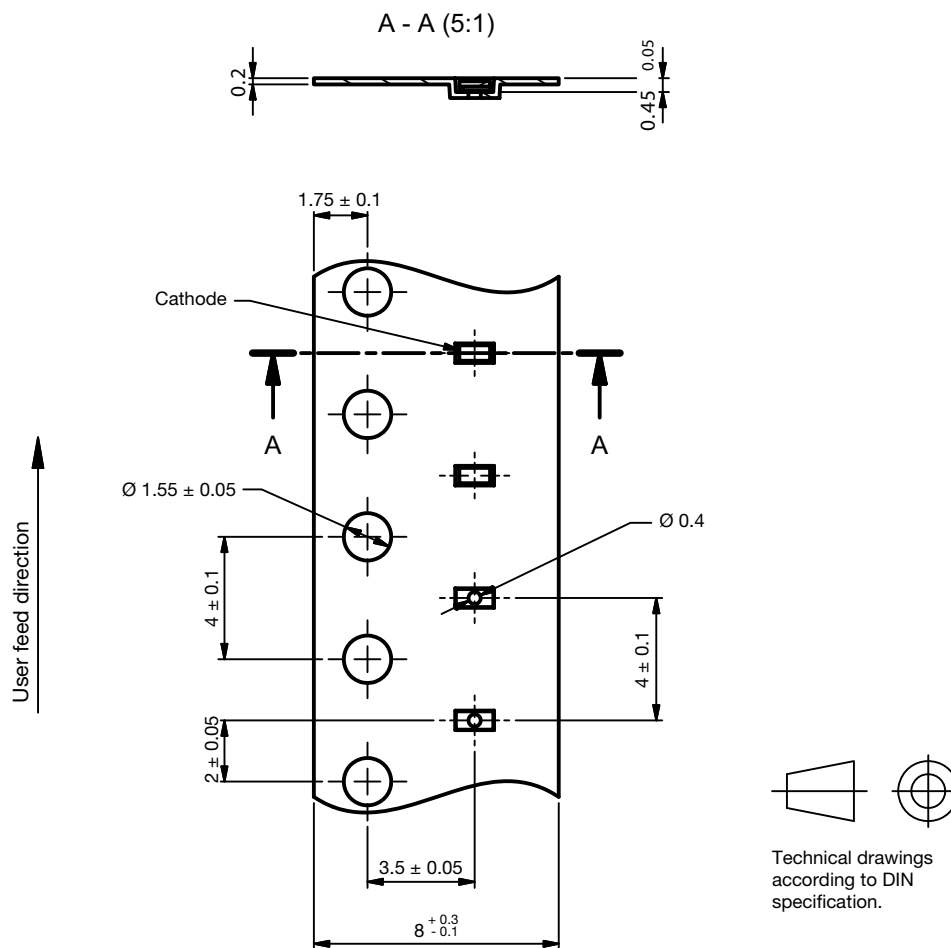
Drawing-No.: 9.800-5122.01-4  
Issue: 2; 03.11.11  
22611





## TAPE DIMENSIONS in millimeters

VLMS1500, VLMO1500, VLMY1500, VLMG1500, VLMB1500

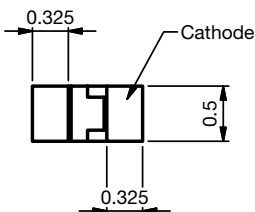


Drawing-No.: 9.700-5388.01-4  
Issue: 1; 20.03.12

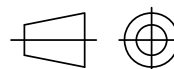
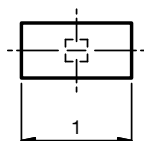
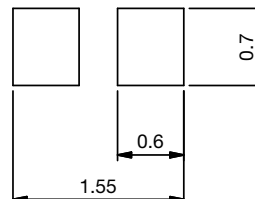
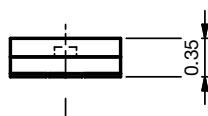


## PACKAGE DIMENSIONS in millimeters

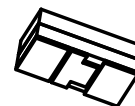
### VLMS1500, VLMO1500, VLMY1500, VLMG1500, VLMB1500



Recommended solder  
pad footprint



Technical drawings  
according to DIN  
specification



Not indicated tolerances  $\pm 0.2$

Drawing-No.: 6.541-5096.01-4  
Issue: 1; 20.03.12

## SOLDERING PROFILE

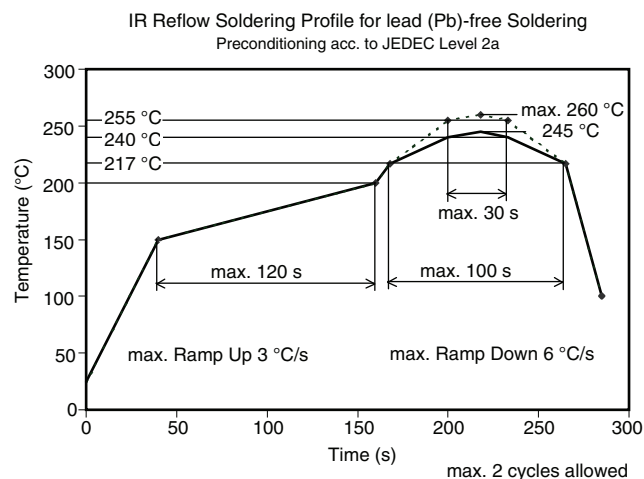
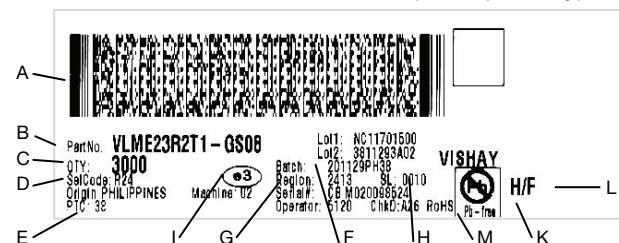


Fig. 19 - Vishay Lead (Pb)-free Reflow Soldering Profile  
(according to J-STD-020C)

## BAR CODE PRODUCT LABEL (Example only)

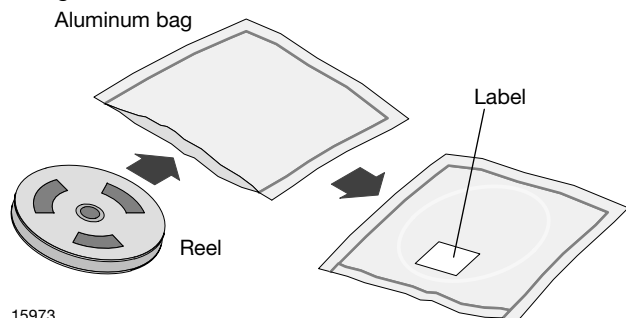


- A) 2D barcode
- B) Vishay part number
- C) Quantity
- D) PTC = selection code (binning)
- E) Code of manufacturing plant
- F) Batch = date code: year / week / plant code
- G) Region code
- H) SL = sales location
- I) Terminations finishing
- K) Lead (Pb)-free symbol
- L) Halogen-free symbol
- M) RoHS symbol



## 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 672 h 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)  
or

96 h at 60 °C + 5 °C and < 5 % RH for all device containers  
or

24 h at 100 °C + 5 °C not suitable for reel or tubes.

An EIA JEDEC standard JESD22-A112 level 2a 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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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>CAUTION</b><br>This bag contains<br>MOISTURE - SENSITIVE DEVICES | LEVEL<br><b>2a</b> |                                                                  |           |                                     |                           |           |                            |                                 |  |
| <p>1. Shelf life in sealed bag 12 months at &lt;40°C and &lt; 90% relative humidity (RH)</p> <p>2. After this bag is opened devices that will be subjected to infrared reflow, vapor-phase reflow, or equivalent processing (peak package body temp. 260°C) must be:</p> <ul style="list-style-type: none"><li>a) Mounted within <b>672 hours</b> at factory condition of ≤ 30°C/60%RH or</li><li>b) Stored at ≤10% RH.</li></ul> <p>3. Devices require baking before mounting if:</p> <ul style="list-style-type: none"><li>a) Humidity Indicator Card is &gt;10% when read at 23°C ± 5°C or</li><li>b) 2a or 2b is not met.</li></ul> <p>4. If baking is required, devices may be baked for:</p> <table border="0"><tr><td><b>192 hours</b> at 40°C + 5°C/-0°C and &lt;5%RH (dry air/nitrogen)</td><td><b>or</b></td></tr><tr><td><b>96 hours</b> at 60±5°C and &lt;5%RH</td><td>For all device containers</td><td><b>or</b></td></tr><tr><td><b>24 hours</b> at 100±5°C</td><td>Not suitable for reels or tubes</td><td></td></tr></table> <p>Bag Seal Date: _____<br/>(If blank, see bar code label)</p> <p>Note: LEVEL defined by EIA JEDEC Standard JESD22-A113</p> |                                                                     |                    | <b>192 hours</b> at 40°C + 5°C/-0°C and <5%RH (dry air/nitrogen) | <b>or</b> | <b>96 hours</b> at 60±5°C and <5%RH | For all device containers | <b>or</b> | <b>24 hours</b> at 100±5°C | Not suitable for reels or tubes |  |
| <b>192 hours</b> at 40°C + 5°C/-0°C and <5%RH (dry air/nitrogen)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>or</b>                                                           |                    |                                                                  |           |                                     |                           |           |                            |                                 |  |
| <b>96 hours</b> at 60±5°C and <5%RH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | For all device containers                                           | <b>or</b>          |                                                                  |           |                                     |                           |           |                            |                                 |  |
| <b>24 hours</b> at 100±5°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Not suitable for reels or tubes                                     |                    |                                                                  |           |                                     |                           |           |                            |                                 |  |

Example of JESD22-A112 Level 2a Label



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