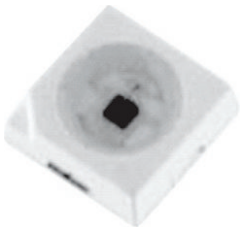
# Power SMD LED PLCC-2 Plus



22068

## DESCRIPTION

The VLMR51.., VLMK51.., and VLMY51.. LED series in PLCC2 plus package are an advanced product in terms of high luminous flux and low thermal resistance.

In combination with the small package outline (3.5 mm x 3.5 mm x 1.2 mm) the PLCC2 plus is an ideal choice for backlighting, signage, exterior and interior automotive lighting as well as decorative lighting.

## PRODUCT GROUP AND PACKAGE DATA

- Product group: LED
- Package: SMD PLCC-2 plus
- Product series: power
- Angle of half intensity: ± 60°

## FEATURES

- High efficient AlInGaP technology
- Compact package outline 3.5 mm x 3.5 mm x 1.2 mm
- Angle of half intensity $\varphi$ = ± 60°
- Luminous intensity and color categorized per packing unit
- Luminous intensity ratio per packing unit $\phi_{min.}/\phi_{max.}$ < 1.6
- ESD-withstand voltage: up to 2 kV (HBM) according to JESD22-A114-B
- Preconditioning according to JEDEC® level 2a
- Compatible with IR-reflow soldering profiles according to J-STD-020
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

## APPLICATIONS

- Interior and exterior automotive lighting: dashboard, brake lights, turn lights, backlighting
- Signal and symbol luminaire
- Decorative lighting
- Architectural lighting
- Backlighting: LCDs, switches, keys, illuminated advertising
- Marker lights
- Traffic lights

## 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. | | |
| VLMR51Z1AA-GS08 | Red | 4500 | 7100 | 9000 | 140 | 620 | - | 630 | 140 | 1.9 | 2.2 | 2.65 | 140 | AlInGaP on Si |
| VLMK51Z1AA-GS08 | Amber | 4500 | 7100 | 9000 | 140 | 610 | - | 621 | 140 | 1.9 | 2.2 | 2.65 | 140 | AlInGaP on Si |
| VLMY51Z1AA-GS08 | Yellow | 4500 | 7100 | 9000 | 140 | 585 | - | 594 | 140 | 1.9 | 2.2 | 2.65 | 140 | AlInGaP on Si |

## ABSOLUTE MAXIMUM RATINGS ($T_{amb}$ = 25 °C, unless otherwise specified)

**VLMR51.., VLMK51.., VLMY51..**

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|---|---|---|---|---|
| Reverse voltage | $I_R$ = 10 µA | $V_R$ | 12 | V |
| DC forward current | | $I_F$ | 200 | mA |
| Surge forward current | $t_p \leq 10$ µs | $I_{FSM}$ | 1000 | mA |
| Power dissipation | | $P_V$ | 530 | mW |
| Junction temperature | | $T_j$ | 125 | °C |
| Operating temperature range | | $T_{amb}$ | -40 to +110 | °C |
| Storage temperature range | | $T_{stg}$ | -40 to +110 | °C |
| Thermal resistance junction-to-solder point | | $R_{thJS}$ | 50 | K/W |
| Thermal resistance junction-to-ambient | Mounted on PCB, total Cu area > 900 mm² | $R_{thJA}$ | 100 | K/W |

| **OPTICAL AND ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) **VLMR51.., RED** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Luminous intensity | $I_F$ = 140 mA | VLMR51Z1AA | $I_V$ | 4500 | 7100 | 9000 | mcd |
| Luminous flux | $I_F$ = 140 mA | VLMR51Z1AA | $\phi_V$ | - | 20 | - | lm |
| Dominant wavelength | $I_F$ = 140 mA | | $\lambda_d$ | 620 | - | 630 | nm |
| Angle of half intensity | $I_F$ = 140 mA | | $\varphi$ | - | ± 60 | - | ° |
| Forward voltage | $I_F$ = 140 mA | | $V_F$ | 1.9 | 2.2 | 2.65 | V |
| Temperature coefficient $I_V$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_{IV}$ | - | - 26.8 | - | mcd/K |
| Temperature coefficient $V_F$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_V$ | - | - 3.5 | - | mV/K |
| Temperature coefficient $\lambda_d$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_{\lambda d}$ | - | 0.06 | - | nm/K |

**Note**

- Forward voltages are tested using a current pulse of 1 ms and has an accuracy of ± 0.1 V

| **OPTICAL AND ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) **VLMK51.., AMBER** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Luminous intensity | $I_F$ = 140 mA | VLMK51Z1AA | $I_V$ | 4500 | 7100 | 9000 | mcd |
| Luminous flux | $I_F$ = 140 mA | VLMK51Z1AA | $\phi_V$ | - | 20 | - | lm |
| Dominant wavelength | $I_F$ = 140 mA | | $\lambda_d$ | 610 | - | 621 | nm |
| Angle of half intensity | $I_F$ = 140 mA | | $\varphi$ | - | ± 60 | - | ° |
| Forward voltage | $I_F$ = 140 mA | | $V_F$ | 1.9 | 2.2 | 2.65 | V |
| Temperature coefficient $I_V$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_{IV}$ | - | - 35.3 | - | mcd/K |
| Temperature coefficient $V_F$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_V$ | - | - 2.9 | - | mV/K |
| Temperature coefficient $\lambda_d$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_{\lambda d}$ | - | 0.07 | - | nm/K |

**Note**

- Forward voltages are tested using a current pulse of 1 ms and has an accuracy of ± 0.1 V

| **OPTICAL AND ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) **VLMY51.., YELLOW** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Luminous intensity | $I_F$ = 140 mA | VLMY51Z1AA | $I_V$ | 4500 | 7100 | 9000 | mcd |
| Luminous flux | $I_F$ = 140 mA | VLMY51Z1AA | $\phi_V$ | - | 20 | - | lm |
| Dominant wavelength | $I_F$ = 140 mA | | $\lambda_d$ | 585 | - | 594 | nm |
| Angle of half intensity | $I_F$ = 140 mA | | $\varphi$ | - | ± 60 | - | ° |
| Forward voltage | $I_F$ = 140 mA | | $V_F$ | 1.9 | 2.2 | 2.65 | V |
| Temperature coefficient $I_V$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_{IV}$ | - | - 55.5 | - | mcd/K |
| Temperature coefficient $V_F$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_V$ | - | - 2.9 | - | mV/K |
| Temperature coefficient $\lambda_d$ | $I_F$ = 140 mA, 0 °C ≤ T ≤ 100 °C | | $TC_{\lambda d}$ | - | 0.09 | - | nm/K |

**Note**

- Forward voltages are tested using a current pulse of 1 ms and has an accuracy of ± 0.1 V

| LUMINOUS INTENSITY CLASSIFICATION | | |
|---|---|---|
| GROUP | LIGHT INTENSITY (mcd) | |
| STANDARD | MIN. | MAX. |
| Z1 | 4500 | 5600 |
| Z2 | 5600 | 7150 |
| AA | 7150 | 9000 |

**Note**

- Luminous flux is tested at a current pulse duration of 25 ms and an accuracy of ± 11 %.
  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 on any one reel.
  In order to ensure availability, single wavelength groups will not be orderable

| COLOR CLASSIFICATION | | | | |
|---|---|---|---|---|
| GROUP | DOM. WAVELENGTH (nm) | | | |
| | AMBER | | YELLOW | |
| | MIN. | MAX. | MIN. | MAX. |
| W | 610 | 615 | - | - |
| X | 615 | 621 | 585 | 588 |
| Y | - | - | 588 | 591 |
| Z | - | - | 591 | 594 |

**Note**

- Wavelengths are tested at a current pulse duration of 25 ms and an accuracy of ± 1 nm

## TYPICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified)

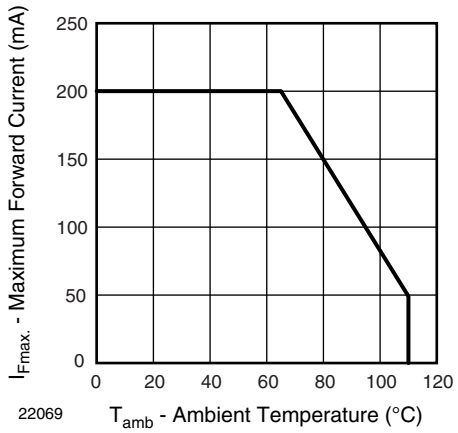



Fig. 1 - Forward Current vs. Ambient Temperature

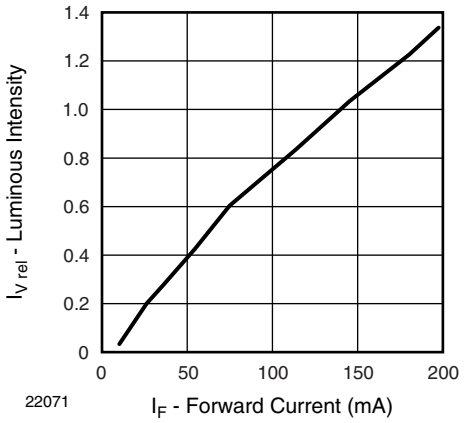



Fig. 3 - Relative Luminous Intensity vs. Forward Current

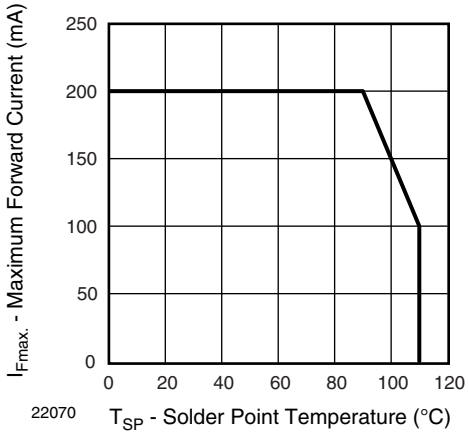



Fig. 2 - Maximum Forward Current vs. Solder Point Temperature

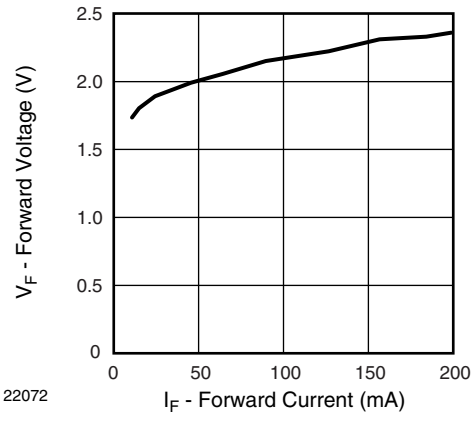



Fig. 4 - Relative Forward Voltage vs. Forward Current

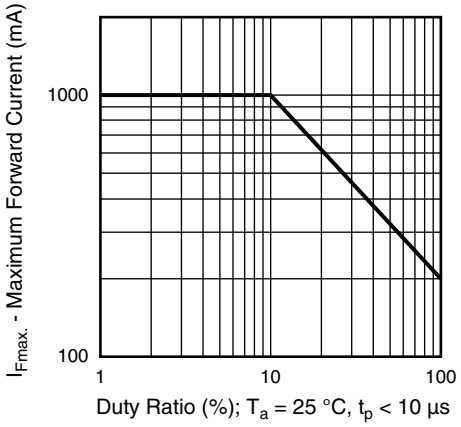



Fig. 5 - Forward Current vs. Duty Ratio

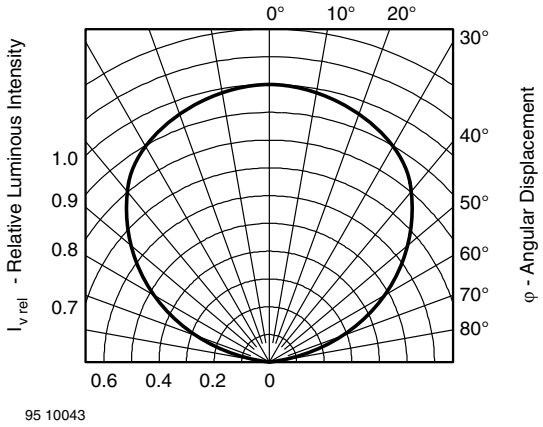



Fig. 7 - Relative Luminous Intensity vs. Angular Displacement

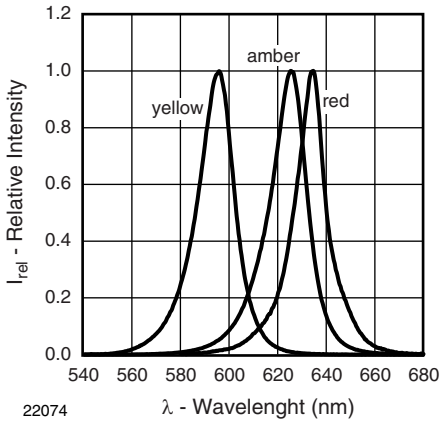
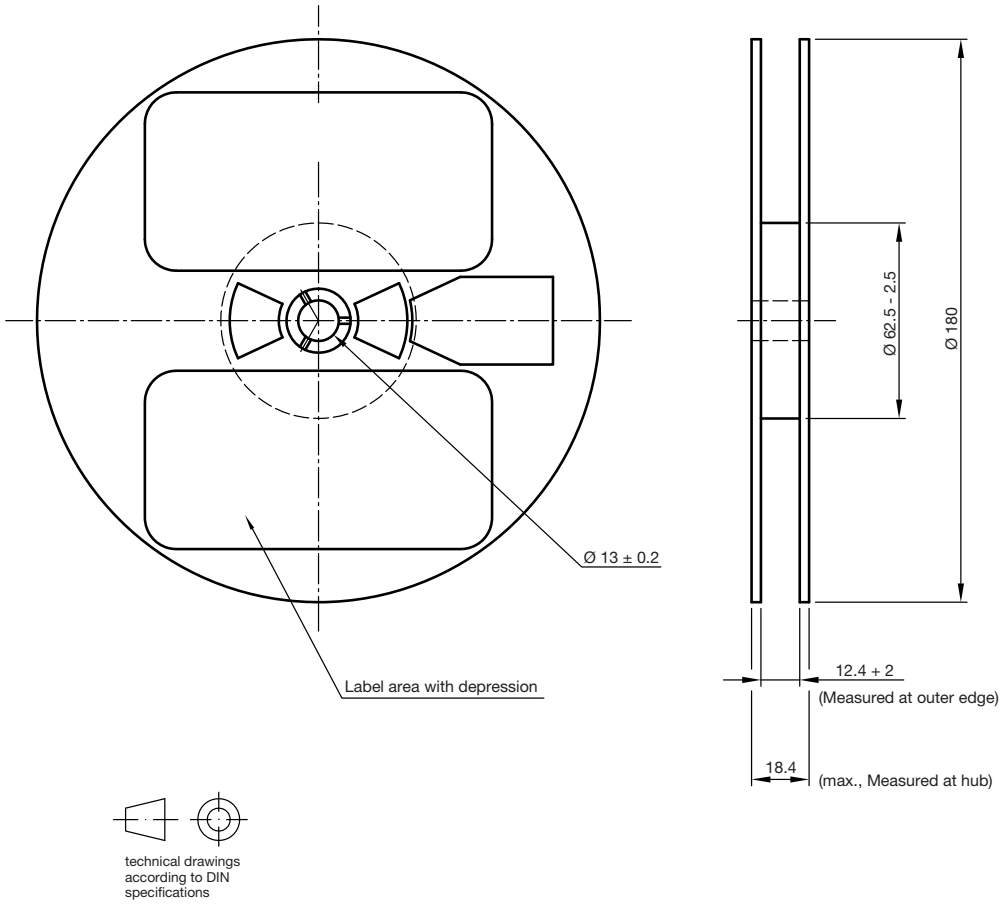



Fig. 6 - Relative Intensity vs. Wavelength

**REEL DIMENSIONS** in millimeters




technical drawings
according to DIN
specifications

Not indicated tolerances ± 0.5

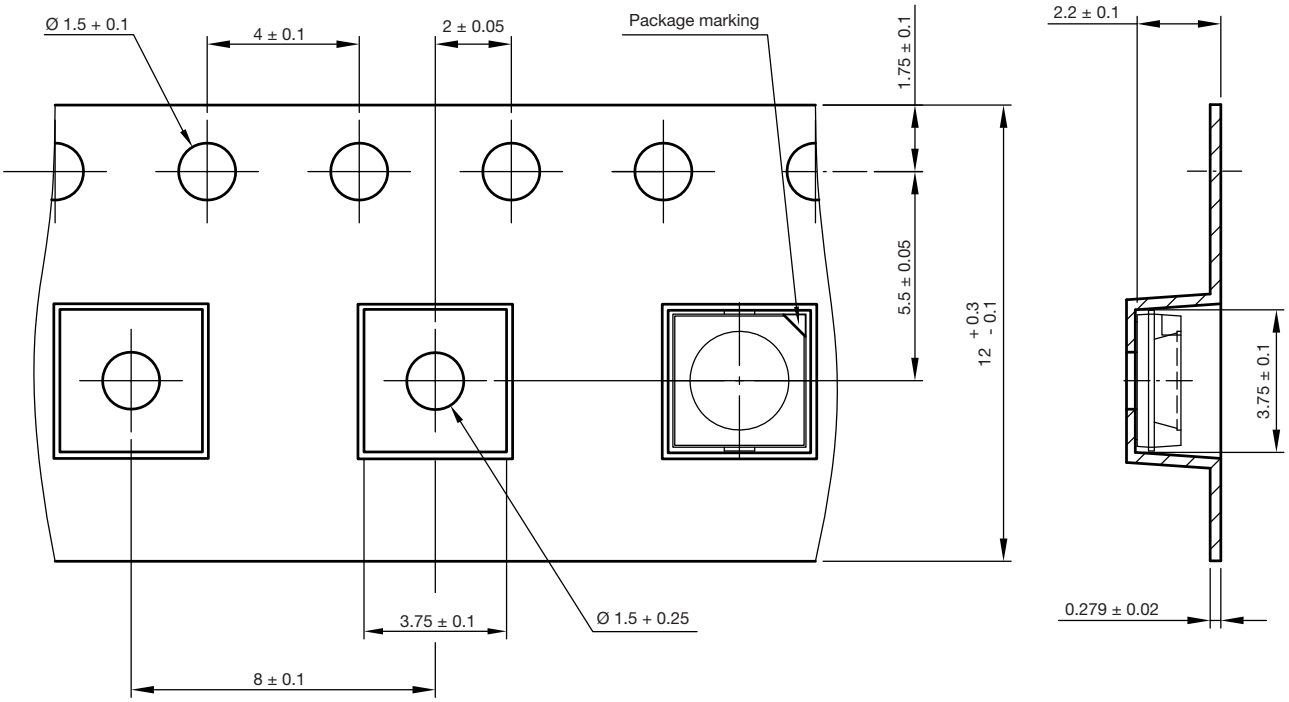
Material: black static dissipative

GS08 = 1000 pcs

Drawing-No.: 9.800-5104.01-4
Issue: 2; 19.03.10
22067

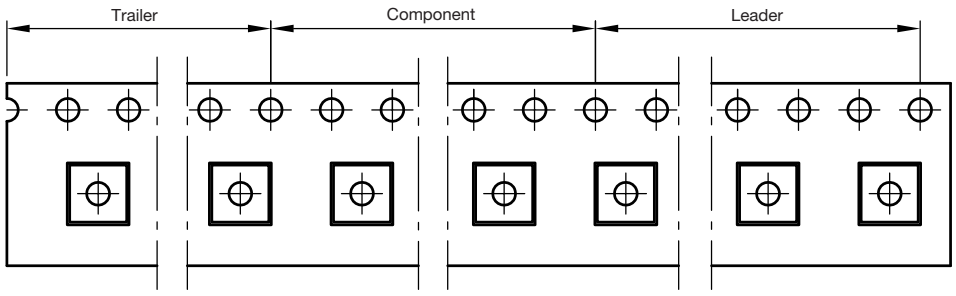
## TAPING AND ORIENTATION DIMENSIONS in millimeters

Reels come in quantity of 1000 units.




200 mm min. for Ø 180 reel

480 mm min. for Ø 180 reel




User feed direction

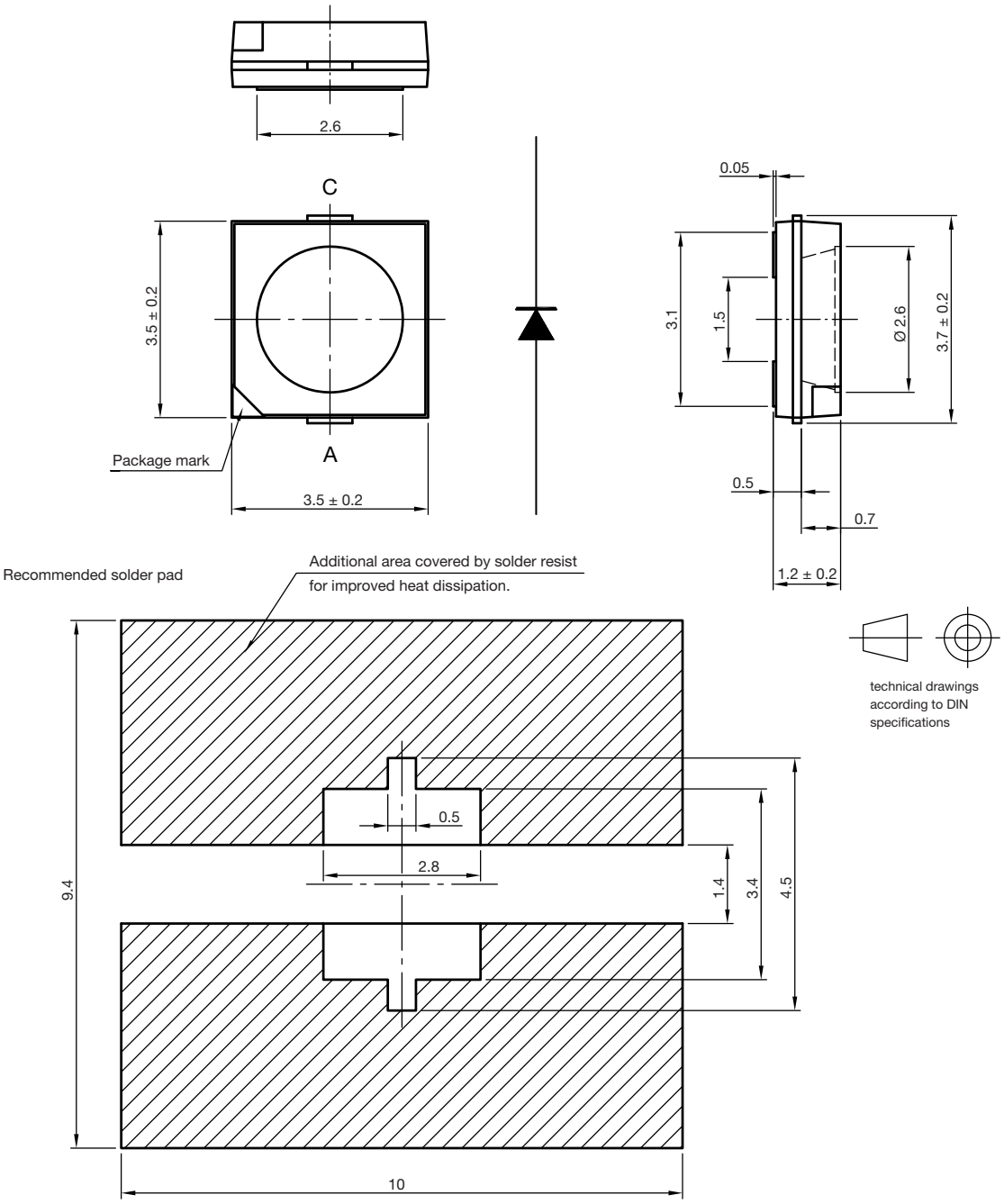
technical drawings according to DIN specifications

Drawing-No.: 9.700-5348.01-4

Issue: 1; 01.03.10

22066

## RECOMMENDED PAD DESIGN DIMENSIONS in millimeters




Drawing-No.: 6.541-5084.01-4
Issue: 1 ; 13.04.10

22103

## SOLDERING PROFILE

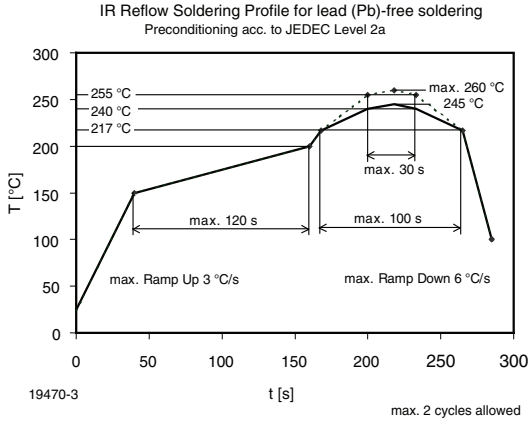
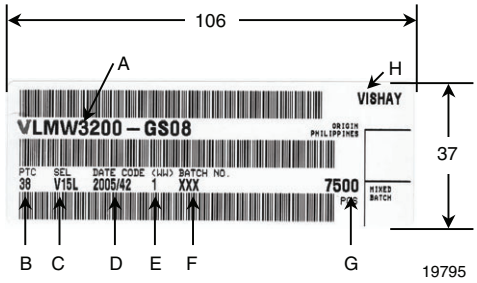



Fig. 8 - Vishay Lead (Pb)-free Reflow Soldering Profile (acc. to J-STD-020)

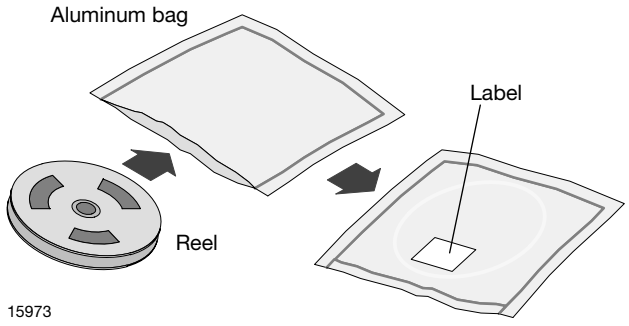
## BAR CODE PRODUCT LABEL (example)




A) Type of component
B) Manufacturing plant
C) SEL - selection code (bin):
e.g.: V1 = code for luminous intensity group
5L = code for chrom. coordinate group
D) Date code year/week
E) Day code (e.g. 1: Monday)
F) Batch no.
G) Total quantity
H) Company code

## 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:

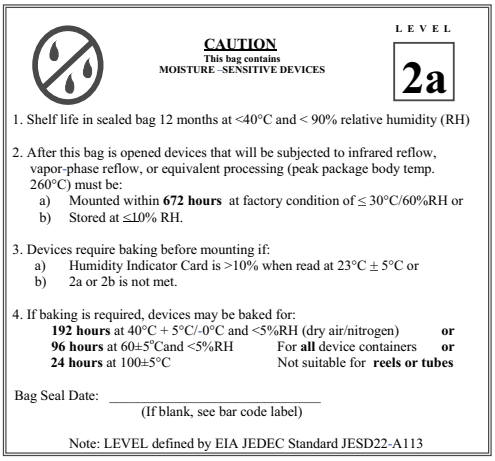
- Storage temperature 10 °C to 30 °C
- Storage humidity ≤ 60 % RH max.

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.




Example of JESD22-A112 Level 2a Label

## 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.

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