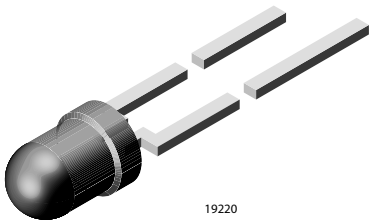
# High Efficiency LED in Ø 3 mm Tinted Total Diffused Package




## FEATURES

- Choice of three bright colors
- Standard Ø 3 (T-1) package
- Small mechanical tolerances
- Suitable for DC and high peak current
- Very wide viewing angle
- Luminous intensity categorized
- Yellow and green color categorized
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

## DESCRIPTION

The TLH.46.. series was developed for applications which need a very wide radiation angle like backlighting, general indicating and lighting purposes.

It is housed in a 3 mm tinted total diffused plastic package. The wide viewing angle of these devices provides a high on-off contrast.

Several selection types with different luminous intensities are offered. All LEDs are categorized in luminous intensity groups. The green and yellow LEDs are categorized additionally in wavelength groups.

That allows users to assemble LEDs with uniform appearance.

## APPLICATIONS

- Status lights
- Off / on indicator
- Background illumination
- Readout lights
- Maintenance lights
- Legend light

## PRODUCT GROUP AND PACKAGE DATA

- Product group: LED
- Package: 3 mm
- Product series: standard
- Angle of half intensity: ± 60°

## 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. | | |
| TLHR4600 | Red | 1 | 4 | - | 10 | 612 | - | 625 | 10 | - | 2 | 3 | 20 | GaAsP on GaP |
| TLHR4605 | Red | 2.5 | 6 | - | 10 | 612 | - | 625 | 10 | - | 2 | 3 | 20 | GaAsP on GaP |
| TLHR4605-MS12Z | Red | 2.5 | 6 | - | 10 | 612 | - | 625 | 10 | - | 2 | 3 | 20 | GaAsP on GaP |
| TLHY4600 | Yellow | 0.63 | 3.5 | - | 10 | 581 | - | 594 | 10 | - | 2.4 | 3 | 20 | GaAsP on GaP |
| TLHY4601 | Yellow | 1 | 4 | - | 10 | 581 | - | 594 | 10 | - | 2.4 | 3 | 20 | GaAsP on GaP |
| TLHY4605 | Yellow | 2.5 | 5 | - | 10 | 581 | - | 594 | 10 | - | 2.4 | 3 | 20 | GaAsP on GaP |
| TLHY4605-MS12Z | Yellow | 2.5 | 5 | - | 10 | 581 | - | 594 | 10 | - | 2.4 | 3 | 20 | GaAsP on GaP |
| TLHG4600 | Green | 1 | 4 | - | 10 | 562 | - | 575 | 10 | - | 2.4 | 3 | 20 | GaP on GaP |
| TLHG4605 | Green | 4 | 6 | - | 10 | 562 | - | 575 | 10 | - | 2.4 | 3 | 20 | GaP on GaP |
| TLHG4605-AS12Z | Green | 4 | 6 | - | 10 | 562 | - | 575 | 10 | - | 2.4 | 3 | 20 | GaP on GaP |
| TLHG4605-MS21Z | Green | 4 | 6 | - | 10 | 562 | - | 575 | 10 | - | 2.4 | 3 | 20 | GaP on GaP |

| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified)<br>**TLHR460., TLHY460., TLHG460.** | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| Reverse voltage | | $V_R$ | 6 | V |
| DC forward current | $T_{amb} \leq 60$ °C | $I_F$ | 30 | mA |
| Surge forward current | $t_p \leq 10$ µs | $I_{FSM}$ | 1 | A |
| Power dissipation | $T_{amb} \leq 60$ °C | $P_V$ | 100 | mW |
| Junction temperature | | $T_j$ | 100 | °C |
| Operating temperature range | | $T_{amb}$ | -20 to +100 | °C |
| Storage temperature range | | $T_{stg}$ | -55 to +100 | °C |
| Soldering temperature | t ≤ 5 s, 2 mm from body | $T_{sd}$ | 260 | °C |
| Thermal resistance junction/ambient | | $R_{thJA}$ | 400 | K/W |

| **OPTICAL AND ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified)<br>**TLHR4600, TLHR4605, RED** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Luminous intensity (1) | $I_F$ = 10 mA | TLHR4600 | $I_V$ | 1 | 4 | - | mcd |
| | | TLHR4605 | $I_V$ | 2.5 | 6 | - | mcd |
| Dominant wavelength | $I_F$ = 10 mA | | $\lambda_d$ | 612 | - | 625 | nm |
| Peak wavelength | $I_F$ = 10 mA | | $\lambda_p$ | - | 635 | - | nm |
| Angle of half intensity | $I_F$ = 10 mA | | φ | - | ± 60 | - | deg |
| Forward voltage | $I_F$ = 20 mA | | $V_F$ | - | 2 | 3 | V |
| Reverse voltage | $I_R$ = 10 µA | | $V_R$ | 6 | 15 | - | V |
| Junction capacitance | $V_R$ = 0 V, f = 1 MHz | | $C_j$ | - | 50 | - | pF |

**Note**
(1) In one packing unit $I_{Vmin.}/I_{Vmax.} \leq 0.5$.

| **OPTICAL AND ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified)<br>**TLHY4600, TLHY4601, THLY4605, YELLOW** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Luminous intensity (1) | $I_F$ = 10 mA | TLHY4600 | $I_V$ | 0.63 | 3.5 | - | mcd |
| | | TLHY4601 | $I_V$ | 1 | 4 | - | mcd |
| | | TLHY4605 | $I_V$ | 2.5 | 5 | - | mcd |
| Dominant wavelength | $I_F$ = 10 mA | | $\lambda_d$ | 581 | - | 594 | nm |
| Peak wavelength | $I_F$ = 10 mA | | $\lambda_p$ | - | 585 | - | nm |
| Angle of half intensity | $I_F$ = 10 mA | | φ | - | ± 60 | - | deg |
| Forward voltage | $I_F$ = 20 mA | | $V_F$ | - | 2.4 | 3 | V |
| Reverse voltage | $I_R$ = 10 µA | | $V_R$ | 6 | 15 | - | V |
| Junction capacitance | $V_R$ = 0 V, f = 1 MHz | | $C_j$ | - | 50 | - | pF |

**Note**
(1) In one packing unit $I_{Vmin.}/I_{Vmax.} \leq 0.5$.

| **OPTICAL AND ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified)<br>**TLHG4600, TLHG4605, GREEN** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Luminous intensity (1) | $I_F$ = 10 mA | TLHG4600 | $I_V$ | 1 | 4 | - | mcd |
| | | TLHG4605 | $I_V$ | 4 | 6 | - | mcd |
| Dominant wavelength | $I_F$ = 10 mA | | $\lambda_d$ | 562 | - | 575 | nm |
| Peak wavelength | $I_F$ = 10 mA | | $\lambda_p$ | - | 565 | - | nm |
| Angle of half intensity | $I_F$ = 10 mA | | φ | - | ± 60 | - | deg |
| Forward voltage | $I_F$ = 20 mA | | $V_F$ | - | 2.4 | 3 | V |
| Reverse voltage | $I_R$ = 10 µA | | $V_R$ | 6 | 15 | - | V |
| Junction capacitance | $V_R$ = 0 V, f = 1 MHz | | $C_j$ | - | 50 | - | pF |

**Note**
(1) In one packing unit $I_{Vmin.}/I_{Vmax.} \leq 0.5$.

| LUMINOUS INTENSITY CLASSIFICATION | | |
|---|---|---|
| GROUP | LIGHT INTENSITY (mcd) | |
| STANDARD | MIN. | MAX. |
| K | 0.63 | 1.25 |
| L | 1 | 2 |
| M | 1.6 | 3.2 |
| N | 2.5 | 5 |
| P | 4 | 8 |
| Q | 6.3 | 12.5 |
| R | 10 | 20 |
| S | 16 | 32 |
| T | 25 | 50 |
| U | 40 | 80 |

**Note**

- Luminous intensity is tested at a current pulse duration of 25 ms and an accuracy of ± 11 %.
  These type numbers represent the order groups which include only a few brightness groups. Only one group will be shipped on each bag (there will be no mixing of two groups on each bag).
  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 bag.
  In order to ensure availability, single wavelength groups will not be orderable.

| COLOR CLASSIFICATION | | | | |
|---|---|---|---|---|
| GROUP | DOM. WAVELENGTH (nm) | | | |
| | YELLOW | | GREEN | |
| | MIN. | MAX. | MIN. | MAX. |
| 1 | 581 | 584 | - | - |
| 2 | 583 | 586 | - | - |
| 3 | 585 | 588 | 562 | 565 |
| 4 | 587 | 590 | 564 | 567 |
| 5 | 589 | 592 | 566 | 569 |
| 6 | 591 | 594 | 568 | 571 |
| 7 | - | - | 570 | 573 |
| 8 | - | - | 572 | 575 |

**Note**

- Wavelengths are tested at a current pulse duration of 25 ms.

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

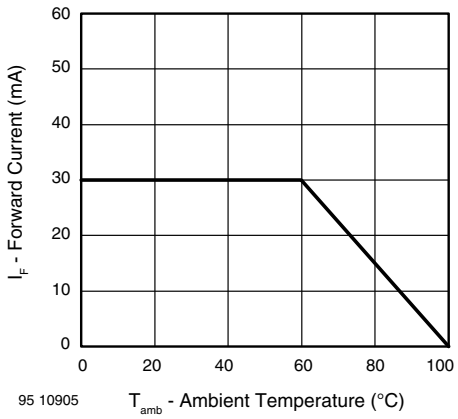



Fig. 1 - Forward Current vs. Ambient Temperature

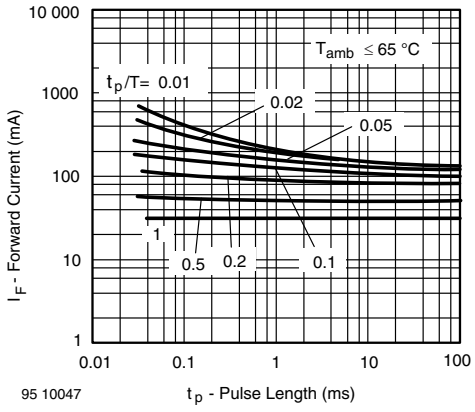



Fig. 2 - Forward Current vs. Pulse Length

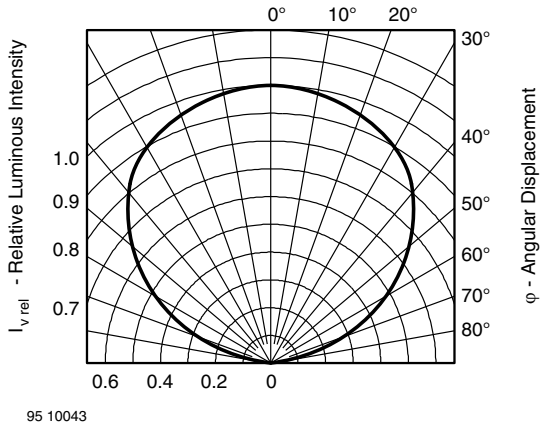



Fig. 3 - Relative Luminous Intensity vs. Angular Displacement

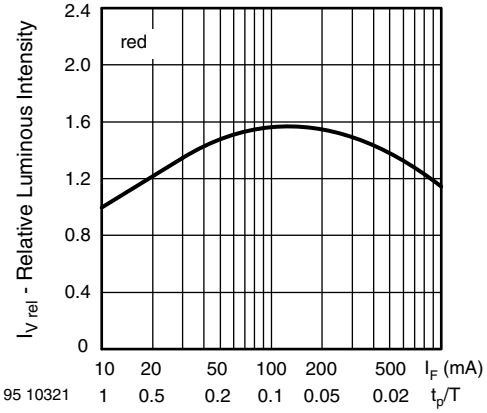



Fig. 6 - Relative Luminous Intensity vs. Forward Current/Duty Cycle

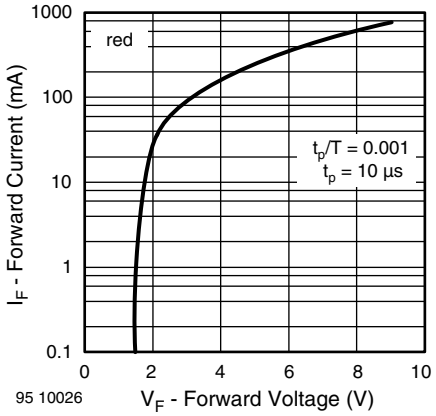



Fig. 4 - Forward Current vs. Forward Voltage

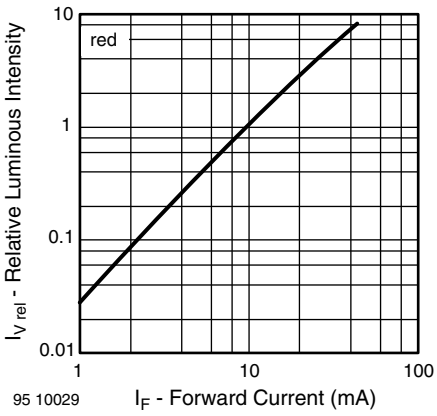



Fig. 7 - Relative Luminous Intensity vs. Forward Current

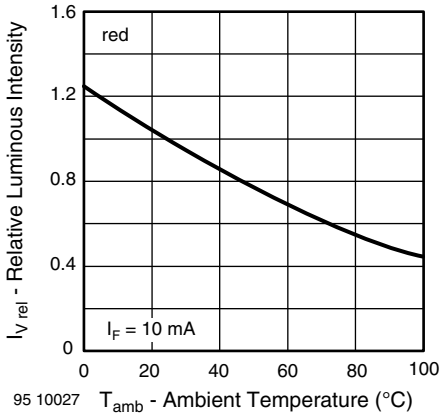



Fig. 5 - Relative Luminous Intensity vs. Ambient Temperature

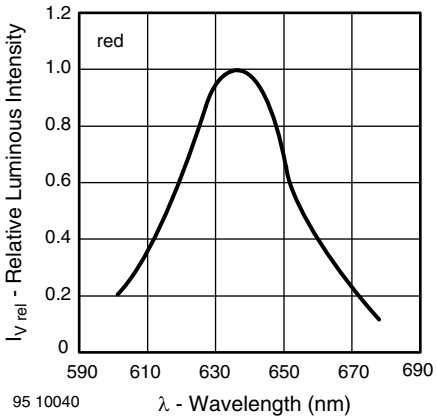



Fig. 8 - Relative Intensity vs. Wavelength

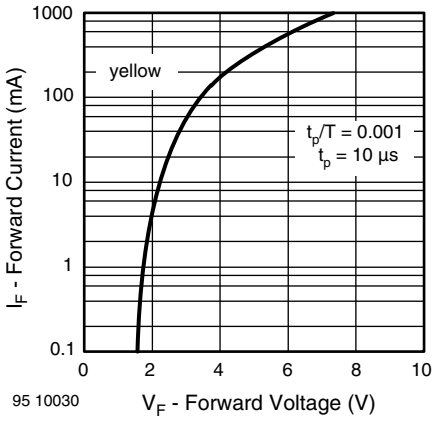



Fig. 9 - Forward Current vs. Forward Voltage

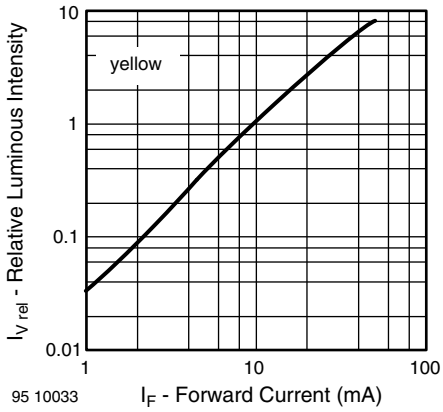



Fig. 12 - Relative Luminous Intensity vs. Forward Current

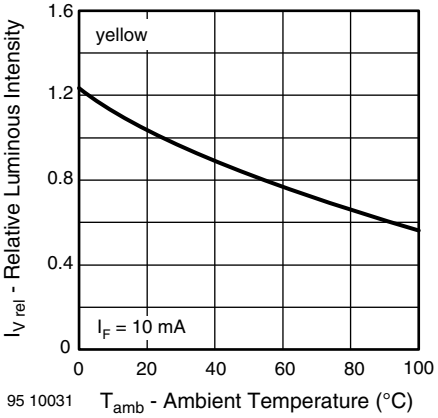



Fig. 10 - Relative Luminous Intensity vs. Ambient Temperature

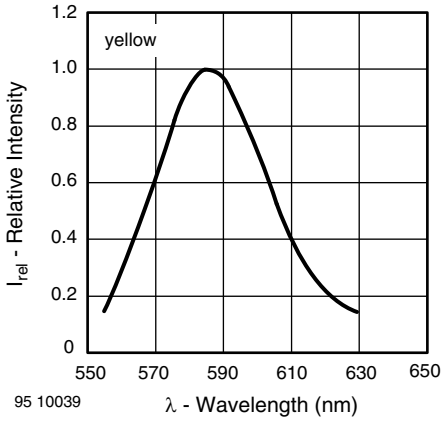



Fig. 13 - Relative Intensity vs. Wavelength

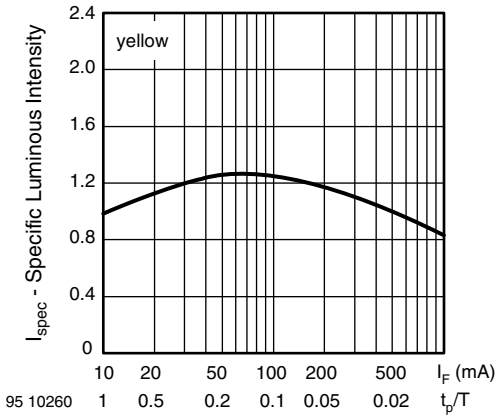



Fig. 11 - Relative Luminous Intensity vs. Forward Current/Duty Cycle

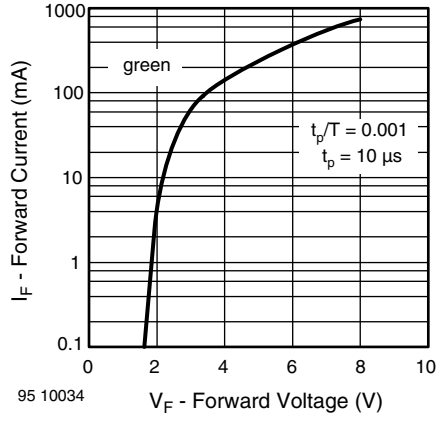



Fig. 14 - Forward Current vs. Forward Voltage

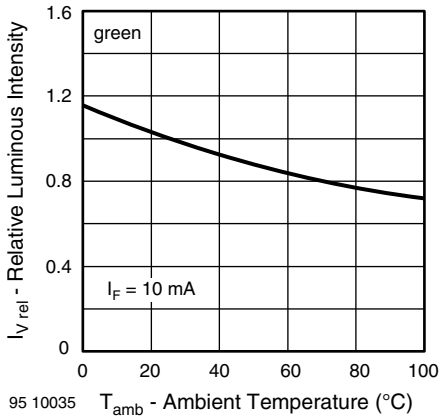



Fig. 15 - Relative Luminous Intensity vs. Ambient Temperature

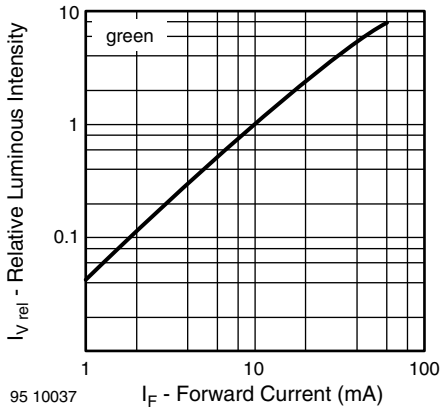



Fig. 17 - Relative Luminous Intensity vs. Forward Current

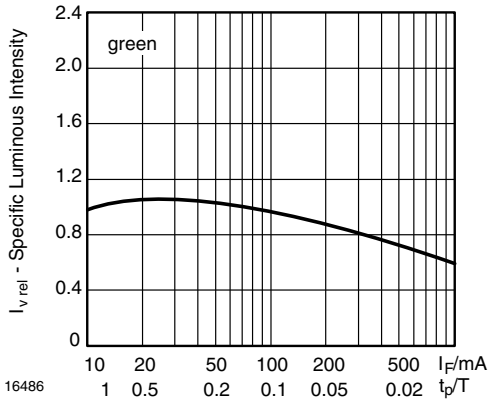



Fig. 16 - Relative Luminous Intensity vs. Forward Current/Duty Cycle

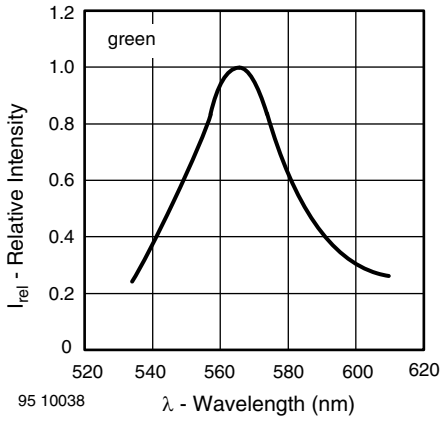
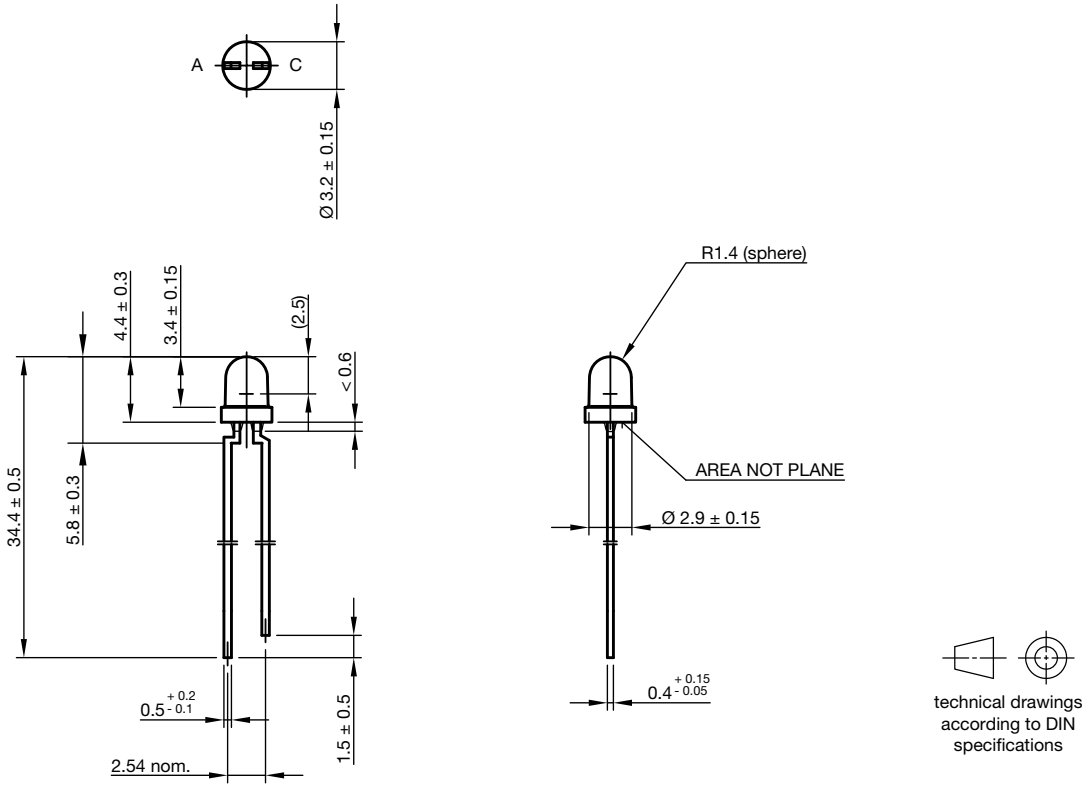



Fig. 18 - Relative Intensity vs. Wavelength

## PACKAGE DIMENSIONS in millimeters




Drawing-No.: 6.544-5255.01-4
Issue: 9; 28.07.14

## AMMOPACK

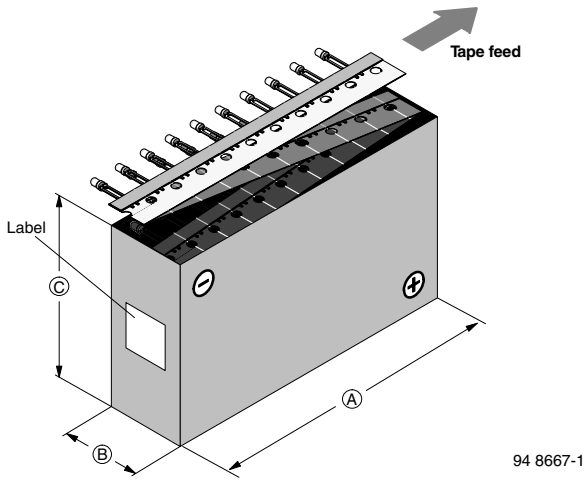
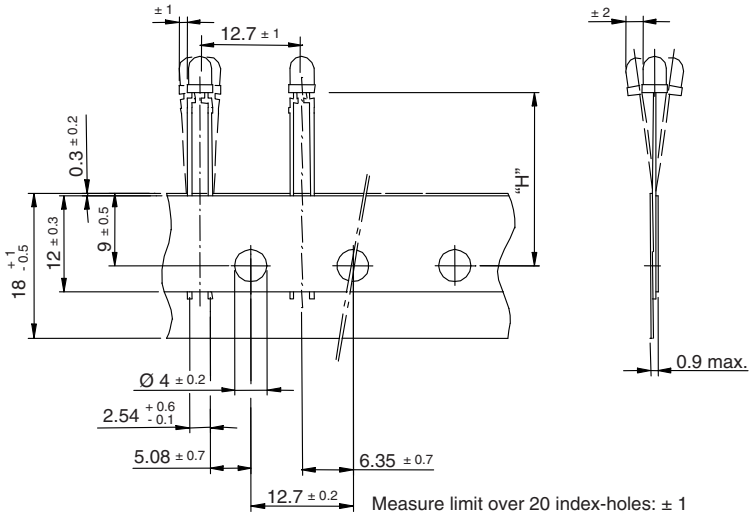



Fig. 19 - Tape Direction

**Note**

- The new nomenclature for ammopack is e.g. ASZ only, without suffix for the LED orientation. The carton box has to be turned to the desired position: “+” for anode first, or “-” for cathode first. AS12Z and AS21Z are still valid for already existing types, BUT NOT FOR NEW DESIGN.

**TAPE DIMENSIONS** in millimeters




| Quantity per: | Reel (Mat. - No. 1764) |
|---|---|
| | 2000 |

94 8171

| Option | Dim. "H" ± 0.5 mm |
|---|---|
| AS | 17.3 |
| MS | 25.5 |

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