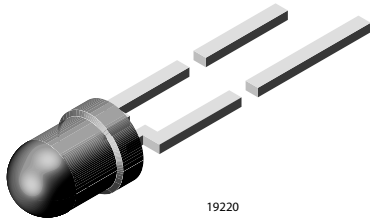




## High Efficiency LED in Ø 3 mm Tinted Diffused Package



### DESCRIPTION

The TLH.44.. series was developed for standard applications like general indicating and lighting purposes.

It is housed in a 3 mm tinted 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.

### PRODUCT GROUP AND PACKAGE DATA

- Product group: LED
- Package: 3 mm
- Product series: standard
- Angle of half intensity:  $\pm 30^\circ$

### FEATURES

- Standard Ø 3 mm (T-1) package
- Small mechanical tolerances
- Suitable for DC and high peak current
- Wide viewing angle
- Luminous intensity categorized
- Yellow and green color categorized
- Material categorization:

For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### APPLICATIONS

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

PARTS TABLE													
PART	COLOR	LUMINOUS INTENSITY (mcd)			at I <sub>F</sub> (mA)	WAVELENGTH (nm)			FORWARD VOLTAGE (V)			at I <sub>F</sub> (mA)	TECHNOLOGY
		MIN.	TYP.	MAX.		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
TLHP4401	Pure green	1	4	-	10	555	-	565	-	2.4	3	20	GaP on GaP
TLHP4401-AS12Z	Pure green	1	4	-	10	555	-	565	-	2.4	3	20	GaP on GaP
TLHG4400	Green	2.5	13	-	10	562	-	575	-	2.4	3	20	GaP on GaP
TLHG4400-MS12	Green	2.5	13	-	10	562	-	575	-	2.4	3	20	GaP on GaP
TLHG4401	Green	4	14	-	10	562	-	575	-	2.4	3	20	GaP on GaP
TLHG4405	Green	6.3	15	-	10	562	-	575	-	2.4	3	20	GaP on GaP
TLHY4400	Yellow	1.6	10	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4400-AS12Z	Yellow	1.6	10	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4400-AS21	Yellow	1.6	10	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4400-AS21Z	Yellow	1.6	10	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4400-BT12	Yellow	1.6	10	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4400-CS12	Yellow	1.6	10	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4400-MS12	Yellow	1.6	10	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4401	Yellow	2.5	10.5	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4401-AS12	Yellow	2.5	10.5	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4401-AS12Z	Yellow	2.5	10.5	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4401-AS21	Yellow	2.5	10.5	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4405	Yellow	6.3	11	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4405-AS12	Yellow	6.3	11	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4405-AS12Z	Yellow	6.3	11	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP



PARTS TABLE													
PART	COLOR	LUMINOUS INTENSITY (mcd)			at I <sub>F</sub> (mA)	WAVELENGTH (nm)			FORWARD VOLTAGE (V)			at I <sub>F</sub> (mA)	TECHNOLOGY
		MIN.	TYP.	MAX.		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
TLHY4405-BT12Z	Yellow	6.3	11	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4405-MS12	Yellow	6.3	11	-	10	581	-	594	-	2.4	3	20	GaAsP on GaP
TLHY4438	Yellow	6.3	11	20	10	583	-	586	-	2.4	3	20	GaAsP on GaP
TLHY4442-MS12	Yellow	6.3	11	20	10	585	-	590	-	2.4	3	20	GaAsP on GaP
TLHO4400	Soft orange	1.6	13	-	10	598	-	611	-	2.4	3	20	GaAsP on GaP
TLHO4400-AS12Z	Soft orange	1.6	13	-	10	598	-	611	-	2.4	3	20	GaAsP on GaP
TLHO4400-MS12Z	Soft orange	1.6	13	-	10	598	-	611	-	2.4	3	20	GaAsP on GaP
TLHR4400	Red	1.6	13	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4400-AS12	Red	1.6	13	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4400-AS21	Red	1.6	13	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4400-AS12Z	Red	1.6	13	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4400-AS21Z	Red	1.6	13	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4400-MS12Z	Red	1.6	13	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4401	Red	2.5	14	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4401-AS12Z	Red	2.5	14	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4401-LS12Z	Red	2.5	14	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4405	Red	6.3	15	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4405-AS12	Red	6.3	15	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4405-AS21	Red	6.3	15	-	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4407	Red	4	-	12.5	10	612	-	625	-	2	3	20	GaAsP on GaP
TLHR4407-MS12Z	Red	4	-	12.5	10	612	-	625	-	2	3	20	GaAsP on GaP

ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified) TLHG440., TLHO440., TLHP440., TLHR440., TLHY440.				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Reverse voltage		V <sub>R</sub>	6	V
DC forward current		I <sub>F</sub>	30	mA
Surge forward current	t <sub>p</sub> ≤ 10 μs	I <sub>FSM</sub>	1	A
Power dissipation	T <sub>amb</sub> ≤ 60 °C	P <sub>V</sub>	100	mW
Junction temperature		T <sub>j</sub>	100	°C
Operating temperature range		T <sub>amb</sub>	- 40 to + 100	°C
Storage temperature range		T <sub>stg</sub>	- 55 to + 100	°C
Soldering temperature	t ≤ 5 s, 2 mm from body	T <sub>sd</sub>	260	°C
Thermal resistance junction/ambient		R <sub>thJA</sub>	400	K/W

OPTICAL AND ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified) TLHR440., RED							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity <sup>(1)</sup>	I <sub>F</sub> = 10 mA	TLHR4400	I <sub>V</sub>	1.6	13	-	mcd
		TLHR4401	I <sub>V</sub>	2.5	14	-	mcd
		TLHR4405	I <sub>V</sub>	6.3	15	-	mcd
		TLHR4407	I <sub>V</sub>	4	-	12.5	mcd
Dominant wavelength	I <sub>F</sub> = 10 mA		λ <sub>d</sub>	612	-	625	nm
Peak wavelength	I <sub>F</sub> = 10 mA		λ <sub>p</sub>	-	635	-	nm
Angle of half intensity	I <sub>F</sub> = 10 mA		φ	-	± 30	-	deg
Forward voltage	I <sub>F</sub> = 20 mA		V <sub>F</sub>	-	2	3	V
Reverse voltage	I <sub>R</sub> = 10 μA		V <sub>R</sub>	6	15	-	V
Junction capacitance	V <sub>R</sub> = 0 V, f = 1 MHz		C <sub>j</sub>	-	50	-	pF

**Note**

<sup>(1)</sup> In one packing unit I<sub>Vmin</sub>/I<sub>Vmax</sub> ≤ 0.5



<b>OPTICAL AND ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
<b>TLHO440., SOFT ORANGE</b>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity <sup>(1)</sup>	$I_F = 10\text{ mA}$	TLHO4400	$I_V$	1.6	13	-	mcd
Dominant wavelength	$I_F = 10\text{ mA}$		$\lambda_d$	598	-	611	nm
Peak wavelength	$I_F = 10\text{ mA}$		$\lambda_p$	-	605	-	nm
Angle of half intensity	$I_F = 10\text{ mA}$		$\phi$	-	$\pm 30$	-	deg
Forward voltage	$I_F = 20\text{ mA}$		$V_F$	-	2.4	3	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		$V_R$	6	15	-	V
Junction capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$		$C_j$	-	15	-	pF

**Note**

<sup>(1)</sup> In one packing unit  $I_{Vmin.}/I_{Vmax.} \leq 0.5$

<b>OPTICAL AND ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
<b>TLHY440., YELLOW</b>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity <sup>(1)</sup>	$I_F = 10\text{ mA}$	TLHY4400	$I_V$	1.6	10	-	mcd
		TLHY4401	$I_V$	2.5	10.5	-	mcd
		TLHY4405	$I_V$	6.3	11	-	mcd
		TLHY4438	$I_V$	6.3	-	20	mcd
		TLHY4442	$I_V$	6.3	-	20	mcd
Dominant wavelength	$I_F = 10\text{ mA}$	TLHY4400	$\lambda_d$	581	-	594	nm
		TLHY4401	$\lambda_d$	581	-	594	nm
		TLHY4405	$\lambda_d$	581	-	594	nm
		TLHY4438	$\lambda_d$	583	-	590	nm
		TLHY4442	$\lambda_d$	585	-	592	nm
Peak wavelength	$I_F = 10\text{ mA}$		$\lambda_p$	-	585	-	nm
Angle of half intensity	$I_F = 10\text{ mA}$		$\phi$	-	$\pm 30$	-	deg
Forward voltage	$I_F = 20\text{ mA}$		$V_F$	-	2.4	3	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		$V_R$	6	15	-	V
Junction capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$		$C_j$	-	50	-	pF

**Note**

<sup>(1)</sup> In one packing unit  $I_{Vmin.}/I_{Vmax.} \leq 0.5$

<b>OPTICAL AND ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
<b>TLHG440., GREEN</b>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity <sup>(1)</sup>	$I_F = 10\text{ mA}$	TLHG4400	$I_V$	2.5	13	-	mcd
		TLHG4401	$I_V$	4	14	-	mcd
		TLHG4405	$I_V$	6.3	15	-	mcd
Dominant wavelength	$I_F = 10\text{ mA}$		$\lambda_d$	562	-	575	nm
Peak wavelength	$I_F = 10\text{ mA}$		$\lambda_p$	-	565	-	nm
Angle of half intensity	$I_F = 10\text{ mA}$		$\phi$	-	$\pm 30$	-	deg
Forward voltage	$I_F = 20\text{ mA}$		$V_F$	-	2.4	3	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		$V_R$	6	15	-	V
Junction capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$		$C_j$	-	50	-	pF

**Note**

<sup>(1)</sup> In one packing unit  $I_{Vmin.}/I_{Vmax.} \leq 0.5$



OPTICAL AND ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified) TLHP440., PURE GREEN							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity <sup>(1)</sup>	I <sub>F</sub> = 10 mA	TLHP4401	I <sub>V</sub>	1	4	-	mcd
Dominant wavelength	I <sub>F</sub> = 10 mA		λ <sub>d</sub>	555	-	565	nm
Peak wavelength	I <sub>F</sub> = 10 mA		λ <sub>p</sub>	-	555	-	nm
Angle of half intensity	I <sub>F</sub> = 10 mA		φ	-	± 30	-	deg
Forward voltage	I <sub>F</sub> = 20 mA		V <sub>F</sub>	-	2.4	3	V
Reverse voltage	I <sub>R</sub> = 10 μA		V <sub>R</sub>	6	15	-	V
Junction capacitance	V <sub>R</sub> = 0 V, f = 1 MHz		C <sub>j</sub>	-	50	-	pF

**Note**

<sup>(1)</sup> In one packing unit I<sub>Vmin</sub>/I<sub>Vmax</sub> ≤ 0.5

LUMINOUS INTENSITY CLASSIFICATION		
GROUP	LIGHT INTENSITY (mcd)	
	MIN.	MAX.
STANDARD		
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. The above 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		PURE GREEN	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
0	-	-	-	-	555	559
1	581	584	-	-	558	561
2	583	586	-	-	560	563
3	585	588	562	565	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** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)



Fig. 1 - Forward Current vs. Ambient Temperature for InGaN



Fig. 4 - Forward Current vs. Forward Voltage

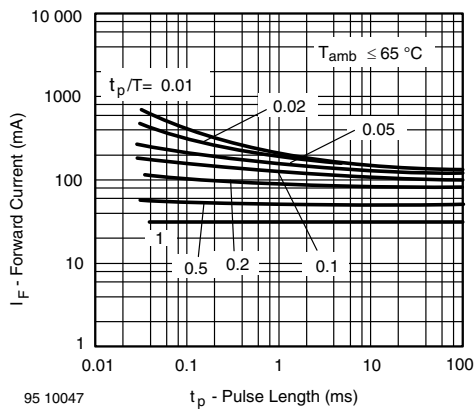


Fig. 2 - Forward Current vs. Pulse Length



Fig. 5 - Relative Luminous Intensity vs. Ambient Temperature

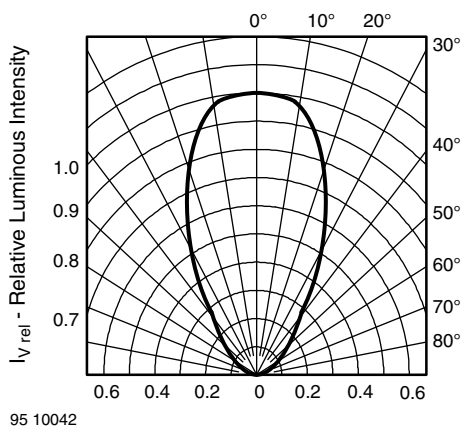


Fig. 3 - Relative Luminous Intensity vs. Angular Displacement

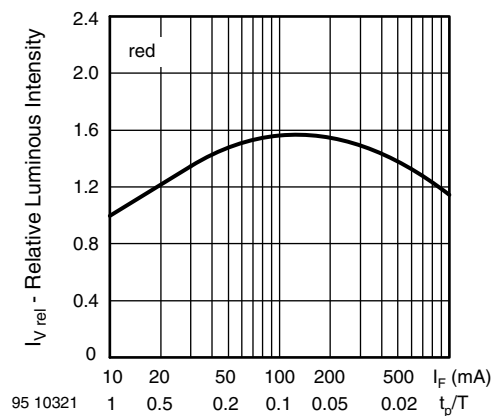


Fig. 6 - Relative Luminous Intensity vs. Forward Current/Duty Cycle

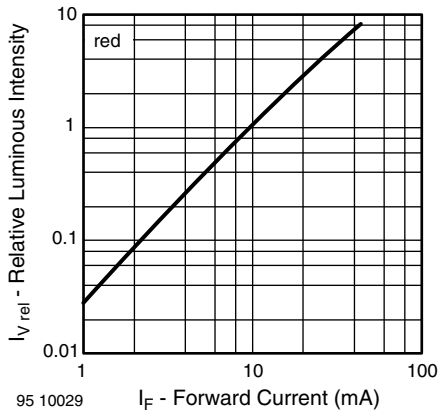


Fig. 7 - Relative Luminous Intensity vs. Forward Current



Fig. 10 - Relative Luminous Intensity vs. Ambient Temperature

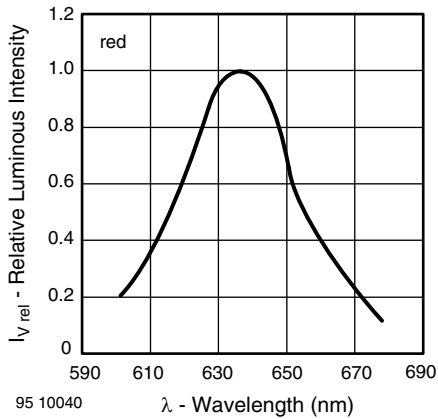


Fig. 8 - Relative Intensity vs. Wavelength

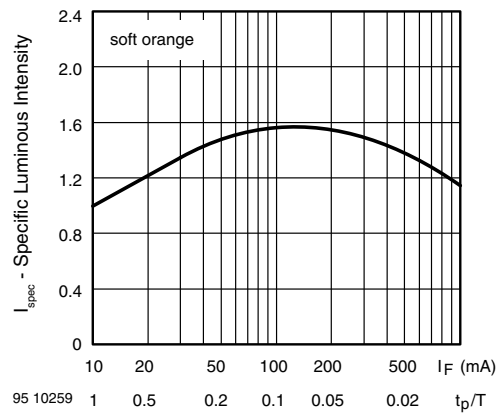


Fig. 11 - Relative Luminous Intensity vs. Forward Current/Duty Cycle



Fig. 9 - Forward Current vs. Forward Voltage



Fig. 12 - Relative Luminous Intensity vs. Forward Current

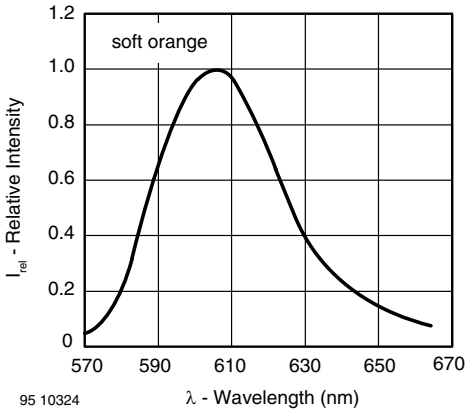


Fig. 13 - Relative Intensity vs. Wavelength

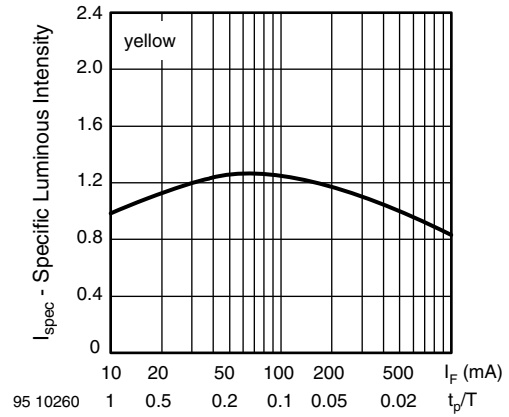


Fig. 16 - Relative Luminous Intensity vs. Forward Current/Duty Cycle

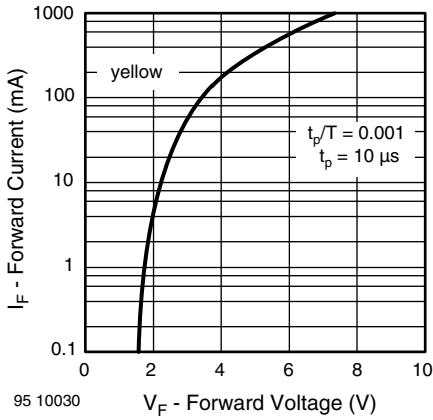


Fig. 14 - Forward Current vs. Forward Voltage



Fig. 17 - Relative Luminous Intensity vs. Forward Current

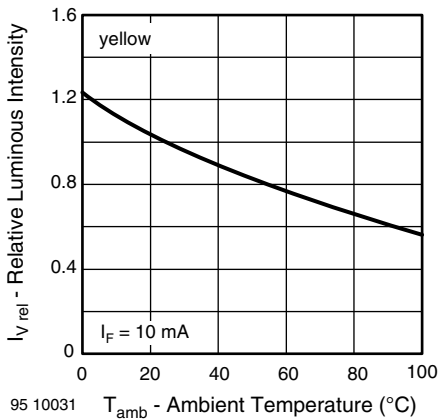


Fig. 15 - Relative Luminous Intensity vs. Ambient Temperature

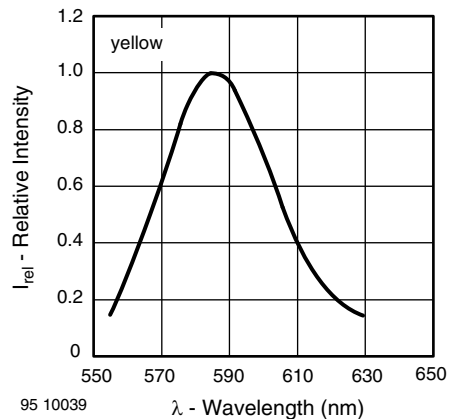


Fig. 18 - Relative Intensity vs. Wavelength



Fig. 19 - Forward Current vs. Forward Voltage



Fig. 22 - Relative Luminous Intensity vs. Forward Current



Fig. 20 - Relative Luminous Intensity vs. Ambient Temperature

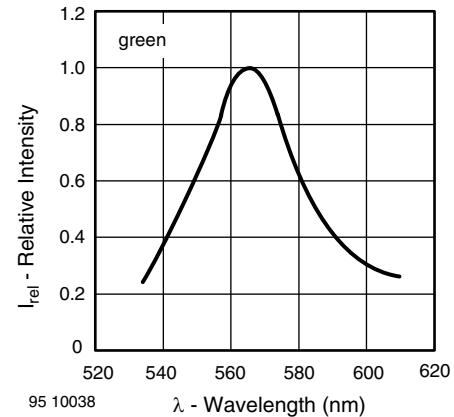


Fig. 23 - Relative Intensity vs. Wavelength

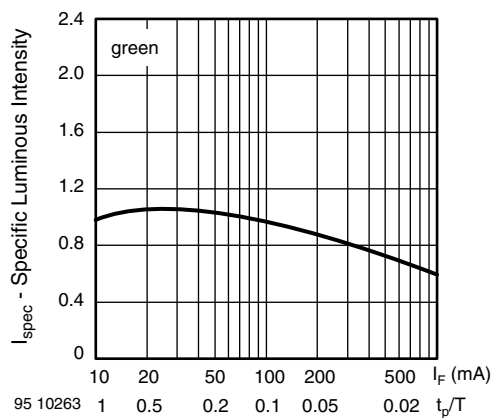


Fig. 21 - Specific Luminous Intensity vs. Forward Current



Fig. 24 - Forward Current vs. Forward Voltage





Fig. 25 - Relative Luminous Intensity vs. Ambient Temperature

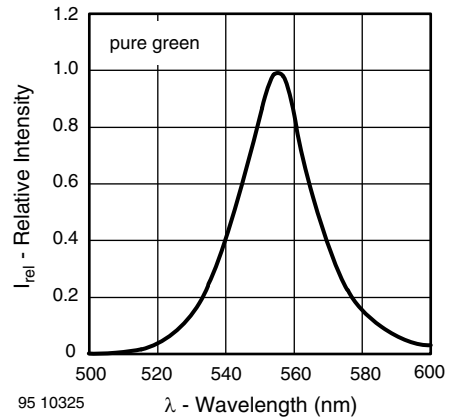


Fig. 28 - Relative Intensity vs. Wavelength

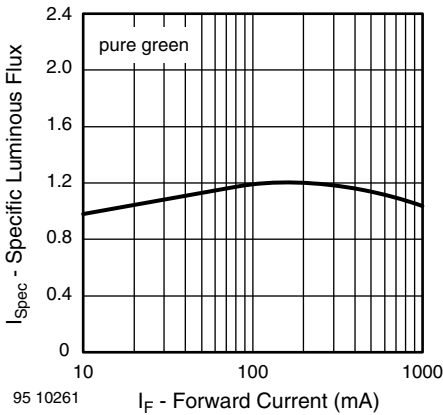


Fig. 26 - Specific Luminous Intensity vs. Forward Current

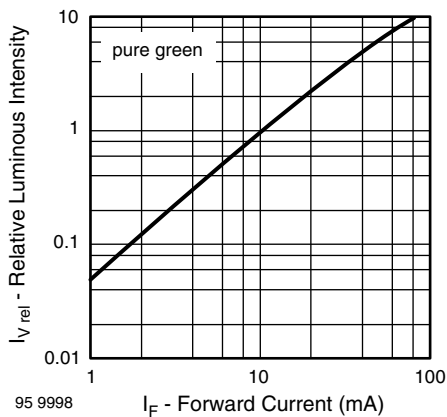
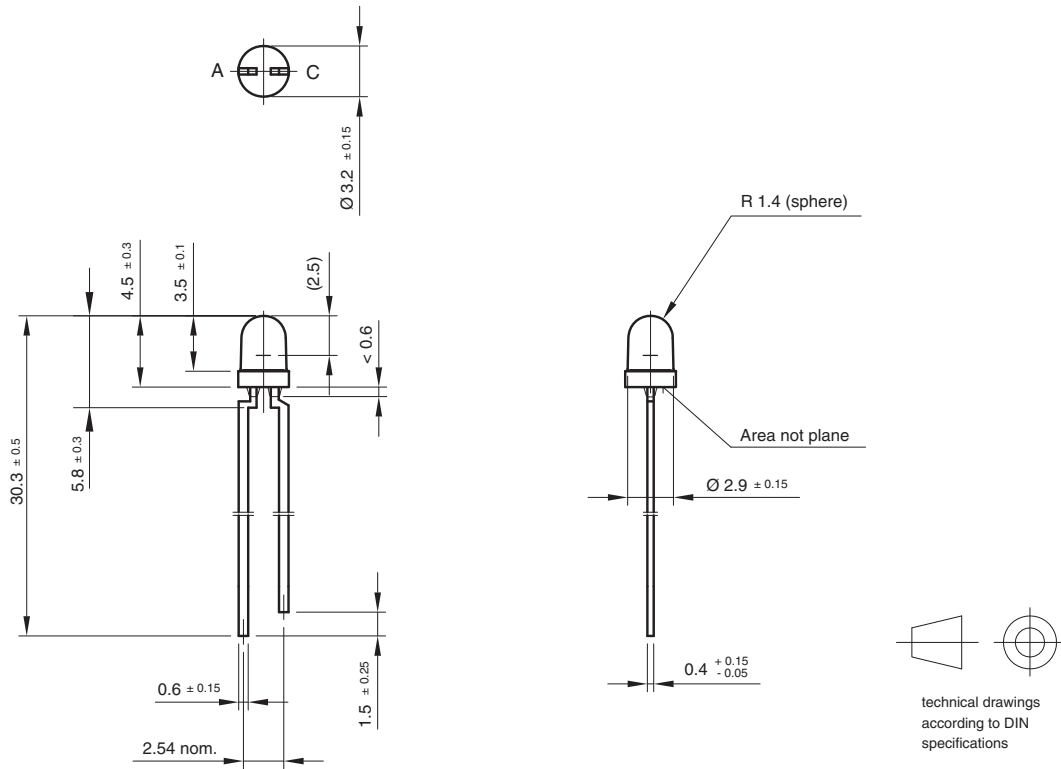


Fig. 27 - Relative Luminous Intensity vs. Forward Current

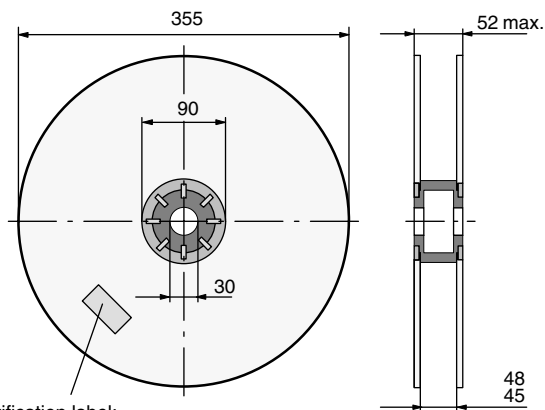


PACKAGE DIMENSIONS in millimeters



Drawing-No.: 6.544-5255.01-4  
Issue: 7; 25.09.08  
95 10913

REEL DIMENSIONS in millimeters

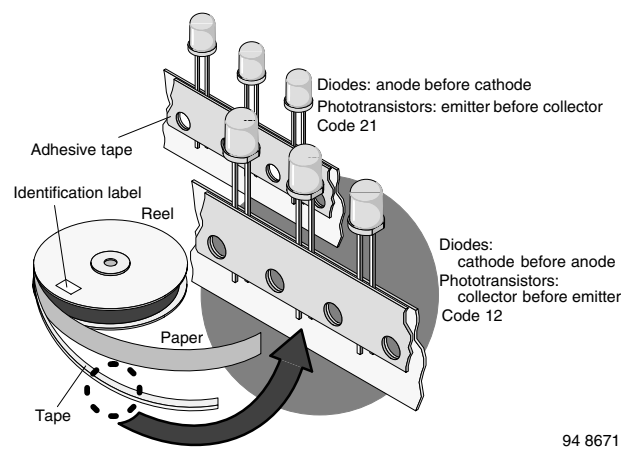


Identification label:  
Vishay/type/group/tape code/production code/quantity

948641

Fig. 29 - Reel

TAPE



94 8671

Fig. 30 - LED in Tape

**AMMOPACK**

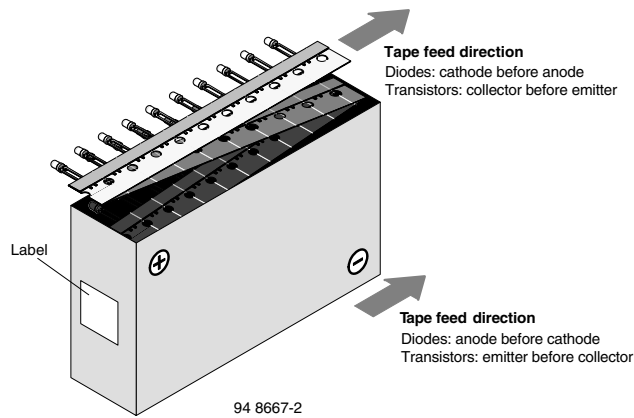
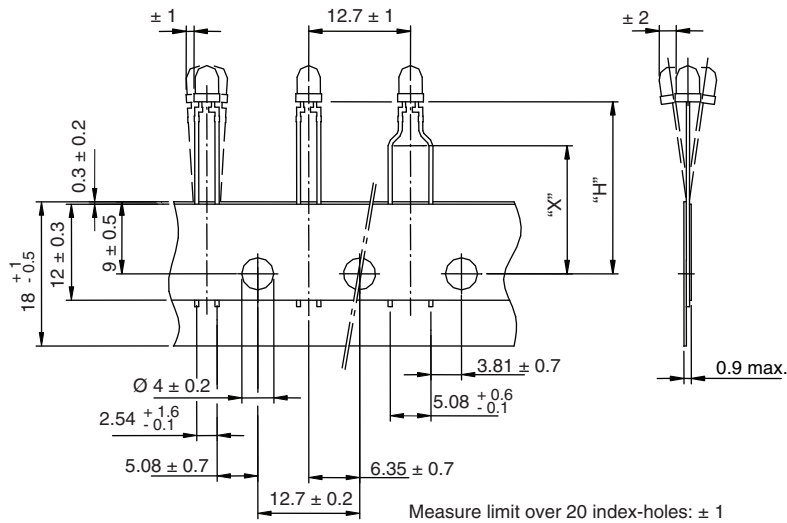


Fig. 31 - Tape Direction

**Note**

- AS12Z and AS21Z still valid for already existing types BUT NOT FOR NEW DESIGN

**TAPE DIMENSIONS** in millimeters



Quantity per:	Reel (Mat.-no. 1764)
	2000

21885

OPTION	DIMENSION "H" $\pm 0.5$ mm	DIMENSION "X" $\pm 0.5$ mm
AS	17.3	-
MS	25.5	-
CS	22.0	-
LS	21.0	-
BT	20.0	16.0



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

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