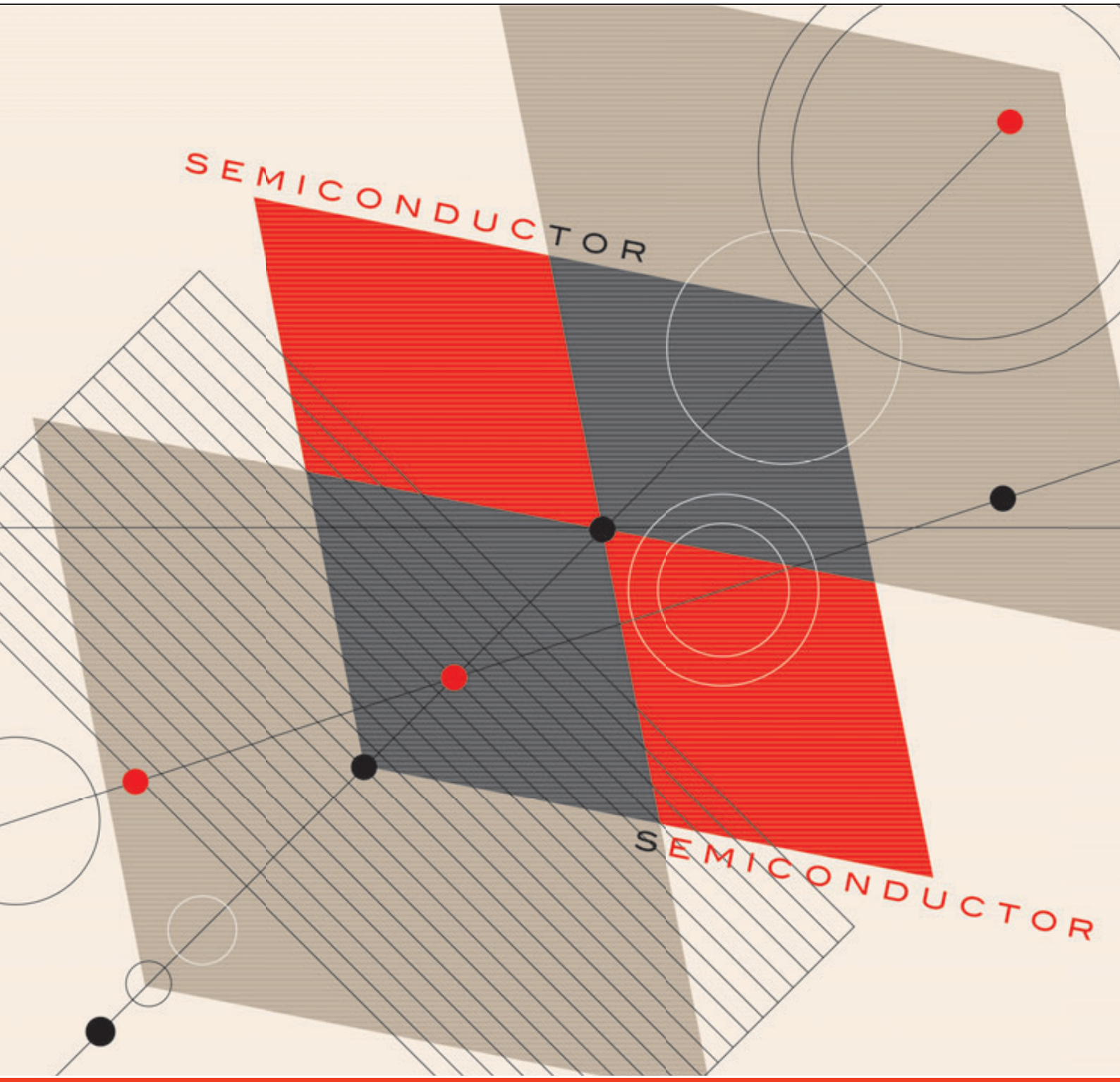
TOSHIBA
Leading Innovation

2011-3

PRODUCT GUIDE

LED Lamps



SEMICONDUCTOR

http://www.semicon.toshiba.co.jp/eng

High-Brightness LED Lamps

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For other LED product guides such as the *LED Lamps Application Guide*, please visit the Toshiba Web site at **http://www.semicon.toshiba.co.jp/eng**

Overview of Toshiba's Visible LED Lamp Family

Visible LED Lamp Family

High-Brightness Through-Hole Type

■ InGaAℓP
- TL✻K Series
- TL✻H Series
- TL✻E Series
- TL✻U Series

- Four-element (InGaAℓP) LED lamps ranging from the TL✻K Series, which offers the brightest luminous intensity level in Toshiba LED lamps, to the TL✻U Series, which is for general-purpose applications.
- Package: ϕ5-mm, ϕ3-mm, oval and arched lenses
- For ϕ5-mm packages, LED lamps with and without standoffs are available. (Suffix P in the part number indicates an LED lamp without standoffs.)

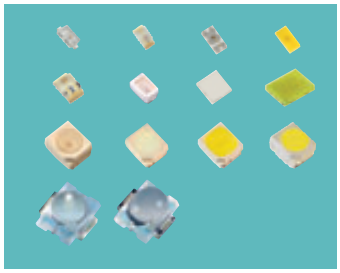
SMD Type

■ InGaAℓP
- TL✻M Series
- TL✻K Series
- TL✻H Series
- TL✻E Series
- TL✻F Series
- TL✻V Series
- TL✻U Series

■ InGaN
- TL✻F Series
- TL✻D Series
- TL19W Series
- TL0✻C3 Series

■ GaN
- TL✻A1100 Series

- Package size : 1.6 x 0.8 mm
  2.0 x 1.25 mm
  2.2 x 1.4 mm
  3.5 x 2.8 mm (Flat-top type)
  3.5 x 2.9 mm (Flat-top type)
  3.1 x 2.9 mm
  3.1 x 3.8 mm
  5.2 x 5.2 mm (ϕ 3.6-mm lens-top type)
  5.2 x 5.2 mm (3.6 x 4.4-mm oval lens-top type)



Part Number Format

▶Through-Hole Type

The part number of the through-hole type consists of the following groups of alphanumeric codes.

Part number: TL □ ○○ □ □ (F)
(* : □, ** : □, (F) : Note, ○○ : Two-digit package number, □ : Color symbol, TL : Toshiba LED)

✻ Lens type T: Transparent C: Colored, transparent D: Colored, diffusing M: Milky white, diffusing
✻✻ P indicates LEDs without standoffs (for ϕ5-mm packages only).
G indicates LEDs that can be mounted flush on a PCB.

Example: TLRME68TG(F)
- High-brightness TLRME Series
- Transparent lens
- Part number: 68
- Can be mounted flush on a PCB.

▶SMD Type

The part number of the SMD type consists of the following fifth groups of alphanumeric codes.

Part number: TL □ ○○○○ □ (T□)
(TL : Toshiba LED, □ : Color symbol, ○○○○ : Part number, □ : Revision code, (T□) : Tape specification)

Example: TLYK1100C(T11)
- High-brightness TLYK Series
- Tape and reel: T11
- Part number: 1100C

TL✻H1032 Series

Part number: TL □ ○○○○ (T□, F)
(TL : Toshiba LED, □ : Color symbol, ○○○○ : Part number, (T□) : Tape specification, (F) : Note)

Example: TLRMH1032(T14,F)
- High-brightness TLRMH Series
- Tape and reel: T14
- Part number: 1032

▶High-Luminous-Flux LEDs

Part number: TL ○○ □ ○ —□ (T□)
(TL : Toshiba LED, ○○ : Two-digit package number, □ : Color symbol, ○ : Part number suffix, □ : Color temperature*, (T□) : Tape specification)

Example: TL19W01-D(T32
- See-through high-flux white LED Series
- Subfamily: 19
- Type: 01
- Tape and reel: T32

* D: White (Color temp. = 6500 K)
N: White (Color temp. = 5000 K)
W: White (Color temp. = 4000 K)
WW: White (Color temp. = 3500 K)
L: White (Color temp. = 3000 K)

▶Multi-Color Type

Part number: TL ○○ C □ —□ (T□)
(TL : Toshiba LED, ○○ : Two-digit package number, C : Multi-color LED, □ : Number of colors, ○ : Part number suffix, (T□) : Tape specification)

Example: TL03C3-M(T28
- Multi-color LED Series
- Part number: 03
- 3-color LED
- Tape and reel: T28

Note: [[G]]/RoHS COMPATIBLE
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

1. New Product Digest

1 High-Luminous-Flux White LED Lamps for General Lighting (See-Through Type): TL19W01 Series

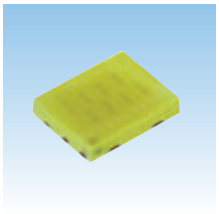
High-efficiency and physically small high-flux white LEDs housed in a newly developed package

▶Features

- 1-W type LEDs with up to 120-lm/W efficiencies (as of October 2010)
- Industry's thinnest package for 1-W type white LEDs (as of October 2010)
  Package dimensions: 3.1 (L) x 3.8 (W) x 0.65 (H) mm
- Wide viewing angle: 130 to 140° (typ.)
- Color variations: 6500 to 3000 K (as per the ANSI C78.377 standard)
- LEDs with high color-rendering performance close to natural light are also offered.

▶Applications

Light sources for general lighting



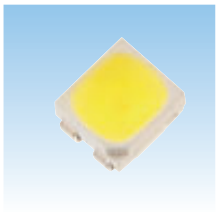
▶Electrical and Optical Characteristics (Ta = 25˚C)

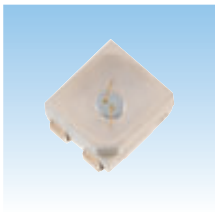
* All values are typical.

Type	Part Number	Color temperature (K)	Luminous Flux (lm)	Cx/Cy	Efficiency (lm/W)	Ra	Forward Voltage(V)	Forward current(mA)
High efficiency	**TL19W01-D(T32**	6500	110	0.313/0.329	110	65	3.3	300
	TL19W01-N(T32	5000	120	0.345/0.355	120	65	3.3	300
	TL19W01-W(T32	4000	110	0.382/0.380	110	65	3.3	300
	TL19W01-WW(T32	3500	100	0.407/0.392	100	65	3.3	300
	TL19W01-L(T32	3000	100	0.434/0.403	100	70	3.3	300
Medium color rendering (Ra85)	**TL19W01-NH1(T32**	5000	95	0.345/0.355	95	85	3.3	300
	TL19W01-WH1(T32	4000	90	0.382/0.380	90	85	3.3	300
	TL19W01-WWH1(32	3500	85	0.407/0.392	85	85	3.3	300
	TL19W01-LH1(T32	3000	85	0.434/0.403	85	85	3.3	300
High color rendering (Ra92)	**TL19W01-NH2(T32**	5000	90	0.345/0.355	90	92	3.3	300
	TL19W01-LH2(T32	3000	80	0.434/0.403	80	92	3.3	300

2 High-Brightness InGaN LED Lamps in PLCC-4: TL*F1108, TL*F1109 Series

LED lamps in the Toshiba PLCC-4 package are now available in new colors.





▶Features

- PLCC-4 package: 3.5 (L) x 2.9 (W) x 1.9 (H) mm
- Color variations: Five colors — White (6500 K, 5000 K, 3000 K), blue, green
- The heat-resistant casing provides support for an extended operating temperature range.
  Operating temperature: T_{opr} = –40 to 100˚C, Storage temperature: T_{stg} = –40 to 100˚C

▶Optical and Electrical Characteristics (I_F = 40 mA, Ta = 25˚C)

Part Number	Color	Typical Luminous Intensity Iv (mcd)	Typical Chromaticity Coordinates		Typical Dominant Wavelength, λd (nm)	Typ. Voltage V_F (V)
			Cx	Cy		
TLWF1108(T11	White (6500 K)	3200	0.31	0.3	–	3.5
TLWNF1108(T11	White (5000 K)	3200	0.345	0.35	–	3.5
TLWLF1108(T11	White (3000 K)	2500	0.44	0.4	–	3.5
TLWF1109(T11*	White (6500 K)	3200	0.31	0.3	–	3.5
TLWNF1109(T11*	White (5000 K)	3200	0.345	0.35	–	3.5
TLWLF1109(T11*	White (3000 K)	2500	0.44	0.4	–	3.5
TLBF1108(T11	Blue	560	–	–	470	3.5
TLEGF1108(T11	Green	2000	–	–	528	3.5

* With Zener diode

▶Applications

Automotive interiors, general lighting, home appliances, various backlighting sources

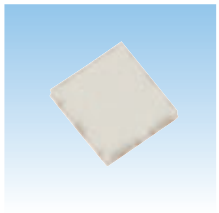
3 3-Color LED Lamps (See-Through Type): TL0*C3 Series

Under development

Full-color LED lamps that incorporate red, blue and green LED chips in a new package

▶Features

- Small and thin Package dimensions: 3.1 (L) x 2.9 (W) x 0.6 (H) mm
- Operating temperature: T_{opr} = –40 to 85˚C,
  Storage temperature: T_{stg} = –40 to 100˚C



▶Applications

Amusement equipment, small and thin products, etc.

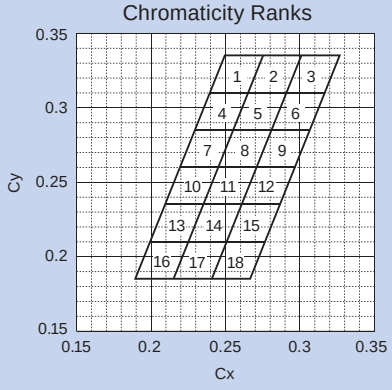
▶Product Lineup

Part Number	Zener Diode	Part Number	Zener Diode
TL03C3-M(T28	Yes	**TL04C4-M(T28**	No

▶Electrical and Optical Characteristics (Ta = 25˚C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Luminous Intensity (3 LED chips on)	Iv	Red: I_F = 20 mA, Green: I_F = 20 mA Blue: I_F = 20 mA	(1000)	1700	(2500)	mcd
Dominant Wavelength	λd	Red: I_F = 20 mA	–	624	–	nm
		Green: I_F = 20 mA	–	525	–	
		Blue: I_F = 20 mA	–	470	–	

Chromaticity Ranks



The specs shown above are based on the latest information available as of March 2011 and subject to change. Ask your local Toshiba sales representative for up-to-date information.

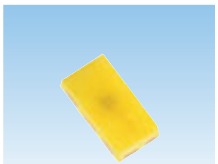
4 Small High-Brightness LED Lamps for Indicator Applications (See-Through Type): TL∗∗1034 Series

The TLxx1034 is a small high-brightness LED series housed in Toshiba's newly developed see-through package. It helps to improve the brightness and reduce the power consumption of various indicators and backlight sources.

▶Features

- Package
  - Suitable for space-saving.
    Package dimensions: 1.6 (L) x 0.8 (W) x 0.4 (H) mm
- Color variations
  12 LED colors: Three red, one orange, two yellow, four green, one blue and one white LEDs
  Green LEDs are also available in the high-brightness H Series.
- Wide view angle ideal for indicator and backlight applications

Except TLWD1034



TLWD1034

▶Applications

Indicator light sources for home appliances, information equipment, car audio systems, etc.

▶Absolute Maximum Ratings (Ta = 25˚C)

Characteristic	Symbol	Rating		Unit
		TL∗V,TL∗D Series	TLGH Series	
Forward Current	I_F	15	25	mA
Reverse Voltage	V_R	5		V
Operating Temperature	T_{opr}	–40 to 100		˚C
Storage Temperature	T_{stg}	–40 to 100		˚C

▶Electrical and Optical Characteristics (Typical, Ta = 25°C)

TL∗V, ∗D Series (I_F = 5 mA)

Part Number	Color	Luminous Intensity I_V (mcd)	Dominant Wavelength, λd (nm)	Forward Voltage V_F (V)
TLRV1034	Red	15	630	1.8
TLRMV1034	Red	20	626	1.8
TLSV1034	Red	30	613	2.0
TLOV1034	Orange	38	605	2.0
TLYV1034	Yellow	25	587	2.0
TLPYV1034	Pure Yellow	23	580	2.0
TLGV1034	Green	14	571	2.0
TLFGV1034	Green	8	565	2.0
TLPGV1034	Pure green	3.5	561	2.0
TLEGD1034	Green	70	528	2.9
TLBD1034	Blue	20	470	2.9
TLWD1034	White	100	Chromaticity Coordinates Cx=0.31 Cy=0.30	2.9

TLGH Series (I_F = 20 mA)

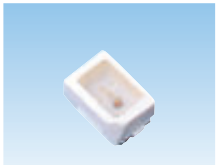
Part Number	Color	Luminous Intensity I_V (mcd)	Dominant Wavelength, λd (nm)	Forward Voltage V_F (V)
TLGH1034	Green	70	571	2.1
TLFGH1034	Green	40	565	2.1
TLPGH1034	Pure green	20	561	2.1

5 High-Brightness LED Lamps in Mini PLCC and PLCC-4: TL∗M1060, TL∗M1108 Series

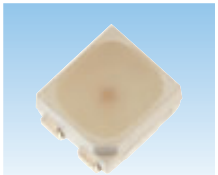
The TLxxM1060 and TLxM1108 Series incorporate a newly developed InGaAlP high-brightness LED chip. They are suitable for a wide range of consumer and automotive applications and help to reduce the size and power consumption of end products.

▶Features

- Package dimensions
  Mini PLCC: 2.2 (L) x 1.4 (W) x 1.3 (H) mm
  PLCC-4: 3.5 (L) x 2.9 (W) x 1.9 (H) mm
- Color variations: red, orange, yellow
- The heat-resistant casing provides support for an extended operating temperature range.
  Operating temperature: T_{opr} = –40 to 100˚C, Storage temperature: T_{stg} = –40 to 100˚C



TL∗M1060 Series



TL∗M1108 Series

▶Applications

Automotive interiors, home appliances, various backlighting sources

▶Absolute Maximum Ratings (Ta = 25˚C)

Characteristic	Symbol	Rating		Unit
		TL∗M1060 Series	TL∗M1108 Series	
Forward Current	I_F	50	70	mA
Allowable Power Dissipation	P_D	125	203	mW
Reverse Voltage	V_R	4		V
Operating Temperature	T_{opr}	–40 to 100		˚C
Storage Temperature	T_{stg}	–40 to 100		˚C

▶Electrical and Optical Characteristics(Typical, Ta = 25°C)

TL∗M1060 Series (I_F = 20 mA)

Part Number	Color	Luminous Intensity I_V (mcd)	Dominant Wavelength, λd (nm)	Forward Voltage V_F (V)
TLRM1060	Red	350	630	2.1
TLRMM1060	Red	450	626	2.1
TLSM1060	Red	650	613	2.1
TLOM1060	Orange	650	605	2.2
TLYM1060	Yellow	600	590	2.2

TL∗M1108 Series (I_F = 50 mA)

Part Number	Color	Luminous Intensity I_V (mcd)	Dominant Wavelength, λd (nm)	Forward Voltage V_F (V)
TLRM1108	Red	1300	630	2.5
TLRMM1108	Red	1600	626	2.5
TLSM1108	Red	2400	613	2.5
TLOM1108	Orange	2500	605	2.55
TLYM1108	Yellow	2200	590	2.55

2. Overview

1 Features

Toshiba's LED lamps are available in a wide range of brightness, colors and package types.
Please select the appropriate products for your applications.

▶Through-Hole Type

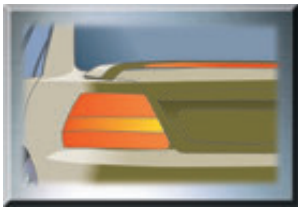
- 9 colors: 3 reds, 1 orange, 2 yellows, 3 greens
- High-brightness LEDs are available for outdoor applications.
- Various packages allow customers to select the LED whose viewing angle best meets the requirements for their applications.

▶SMD Type

- Wide range of packages for mobile and automotive applications
- Variety of colors such as white, blue and green
- Reflow-solderable

2 Applications

▶Through-Hole Type



HMSL
(High Mounted Stop Lamp)

Traffic signal

Amusement equipment

Message board

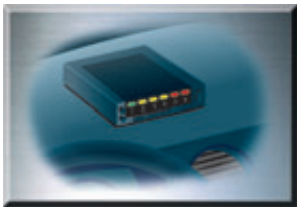
Safety indicator

▶SMD Type

Instrumental cluster

AV equipment
(karaoke machine, etc.)

Digital cameras



Accessories on dashboard

Message board

Home and cellular phones

Flat-panel TVs

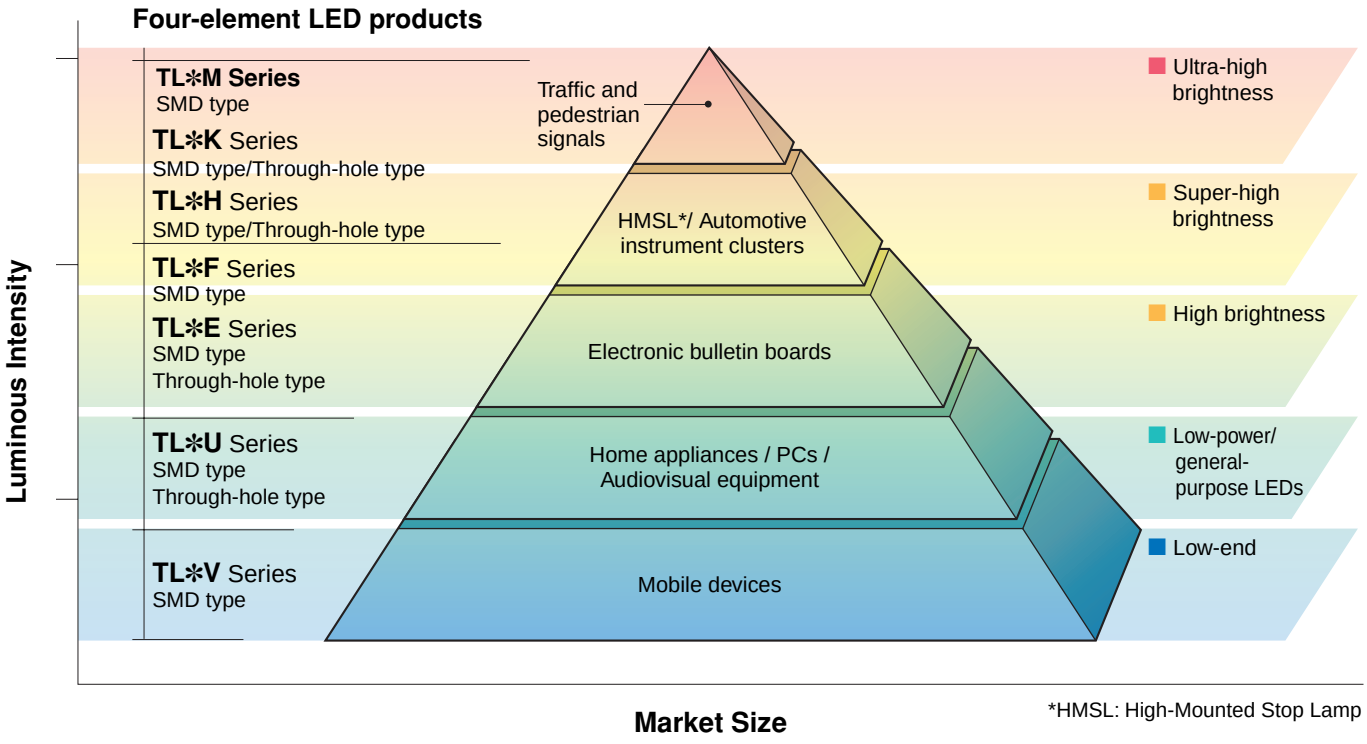
LED billboards

❸ Advantages of Four-Element High-Brightness LED Lamps

▶What is a Four-Element LED?

A four-element LED is a compound semiconductor device made from four elements: In, Ga, Aℓ, and P. The same material and crystal growth method can be used in manufacture of high-brightness LEDs from green to red.

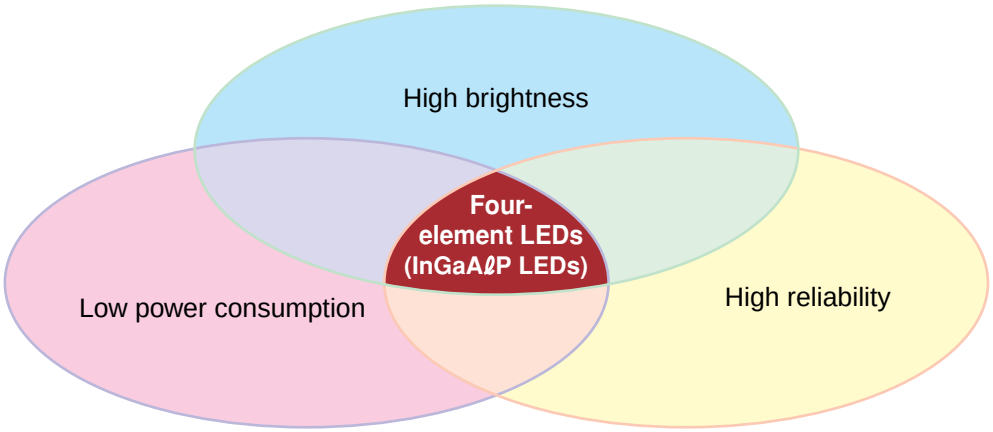
▶Large Market Size of Four-Element LEDs



*HMSL: High-Mounted Stop Lamp

▶Advantages of High-Brightness LEDs

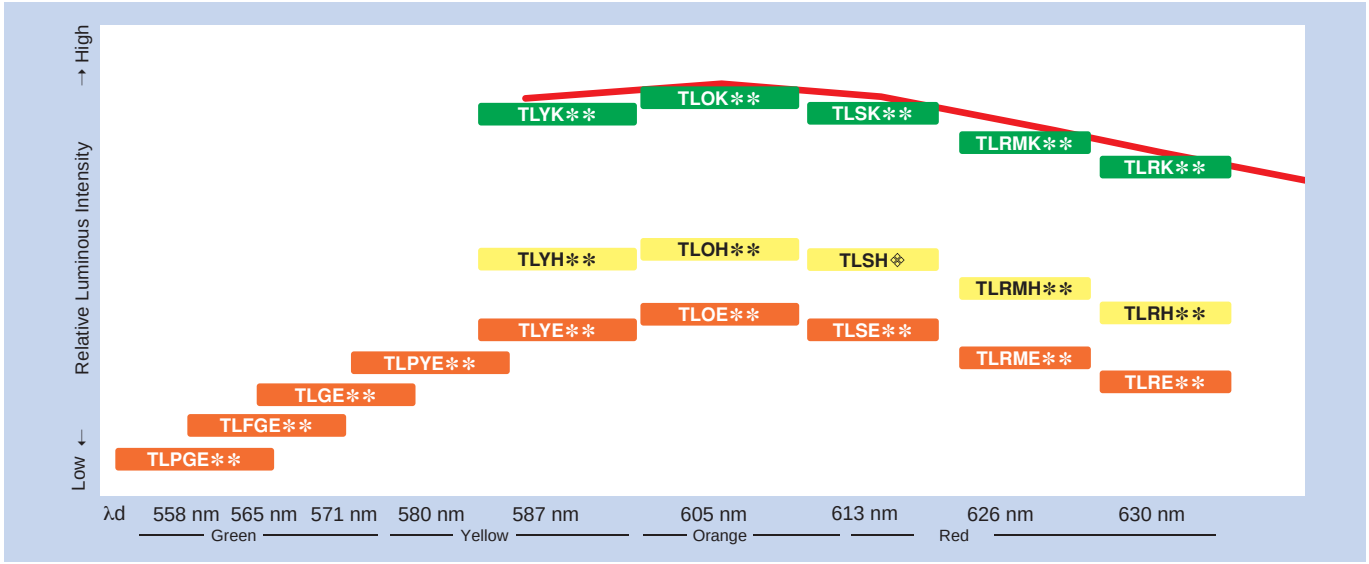
- Excellent visibility: Usable in daylight applications. Operating status can be read even from a distance.
- Low power consumption: Power consumption can be reduced since high brightness is achieved at low current.
- Low component count: The number of LEDs used for LCD backlighting can be reduced. Thus, component assembly cost can be also saved.
- High reliability: The service life can be prolonged due to reduced forward current.



2. Overview

4 Colors of Four-Element High-Brightness LED Lamps

Toshiba offers a wide variety of LEDs to meet your diverse needs.The following shows Toshiba's offerings of high-brightness LEDs: K, H and E Series.

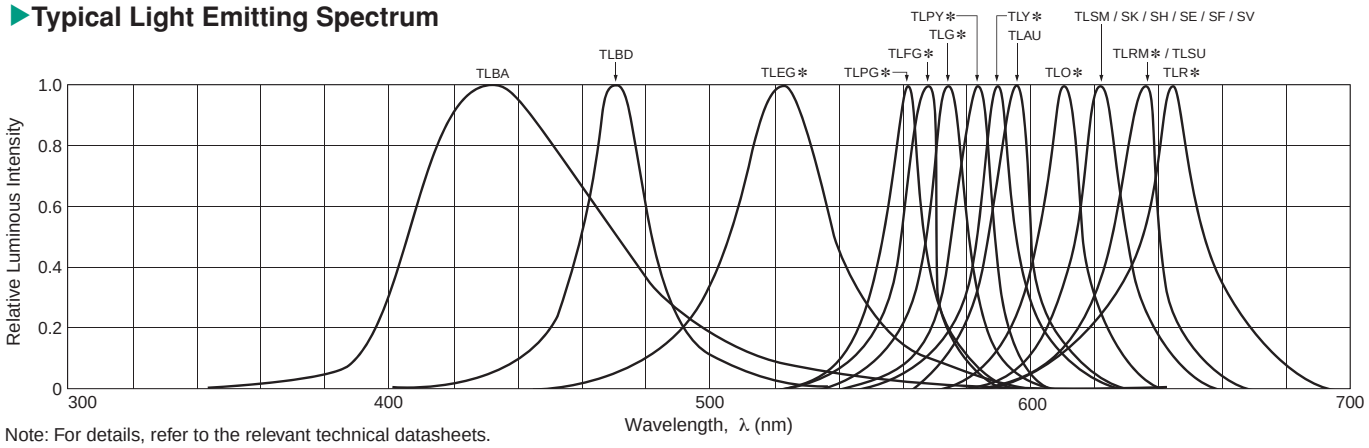


5 Colors and Materials

Color	Material	Wavelength (typ.)@I_F = 20 mA		Color Symbol
		Peak Emission λp (nm)	Dominant λd (nm)	
Red	InGaAℓP	644	630	RM/RK/RH/RE/RF/RU
	InGaAℓP	636	626	RMM/RMK/RMH/RME/RMF/RMV
	InGaAℓP	636	623	SU
	InGaAℓP	623	613	SM/SK/SH/SE/SF/SV
Orange	InGaAℓP	612	605	OM/OK/OH/OE/OF/OV/OU
Amber	InGaAℓP	596	592	AU
Yellow	InGaAℓP	592	590	YM/YK
	InGaAℓP	590	587	YH/YE/YF/YV/YU
	InGaAℓP	583	580	PYE/PYF
Green	InGaAℓP	574	571	GH/GE/GF/GV/GU
	InGaAℓP	568	565	FGH/FGE/FGF
	InGaAℓP	562	558	PGH/PGE/PGF/PGV/PGU
	InGaN	523	528	EGD
Blue	InGaN	468	470	BD
	GaN	428	465	BA

Note: For details, refer to the relevant technical datasheets.

▶Typical Light Emitting Spectrum



Note: For details, refer to the relevant technical datasheets.

6 Luminous Intensity and Flux Classifications

Through-Hole Type / SMD Type

Bin	Luminous Intensity (mcd)	Bin	Luminous Intensity (mcd)
A	0.09 to 0.23	N	85 to 230
B	0.15 to 0.41	P	153 to 414
C	0.27 to 0.74	Q	272 to 736
D	0.48 to 1.29	R	476 to 1,290
E	0.85 to 2.3	S	850 to 2,300
F	1.53 to 4.14	T	1,530 to 4,140
G	2.72 to 7.36	U	2,720 to 7,360
H	4.76 to 12.9	V	4,760 to 12,900
J	8.5 to 23	W	8,500 to 23,000
K	15.3 to 41.4	X	15,300 to 41,400
L	27.2 to 73.6	Y	27,200 to 73,600
M	47.6 to 129		

TL19W Series

Tolerance: ±10%

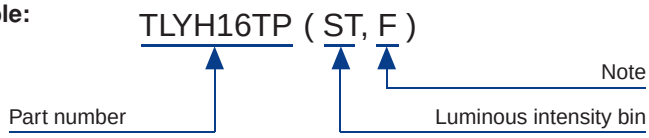
Bin	Luminous Flux (lm)	Bin	Luminous Flux (lm)
B06	60 to 70	B10	100 to 110
B07	70 to 80	B11	110 to 120
B08	80 to 90	B12	120 to 130
B09	90 to 100	B13	130 to 140

TL**1032 / 1034 / 1060 / 1106 / 1108 / 1109 / 1100 Series
Some of the TL**1050/1052 series

Bin		Luminous Intensity (mcd)	Bin		Luminous Intensity (mcd)
JA	JA1	4.0 to 6.3	RA	RA1	100 to 160
	JA2	5.0 to 8.0		RA2	125 to 200
KA	KA1	6.3 to 10	SA	SA1	160 to 250
	KA2	8.0 to 12.5		SA2	200 to 320
LA	LA1	10 to 16	TA	TA1	250 to 400
	LA2	12.5 to 20		TA2	320 to 500
MA	MA1	16 to 25	UA	UA1	400 to 630
	MA2	20 to 32		UA2	500 to 800
NA	NA1	25 to 40	VA	VA1	630 to 1000
	NA2	32 to 50		VA2	800 to 1250
PA	PA1	40 to 63	WA	WA1	1000 to 1600
	PA2	50 to 80		WA2	1250 to 2000
QA	QA1	63 to 100			
	QA2	80 to 125			

▶Part Number Format for the Through-Hole Type

Example:



This example indicates the TLYH16TP binned at S and T. Generally, binned LEDs can be ordered at two adjacent bins.

· For the available luminous intensity bins, contact your nearest Toshiba representative.

Note: [[G]]/RoHS COMPATIBLE

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

7 Lens Colors

Lens Color	Transparent	Colorless diffused	Colored transparent	Colored diffused
Appearance				

Colored transparent and colored diffused lenses are of the same color as the emitted light.

8 General Characteristics

▶Absolute Maximum Ratings

The absolute maximum ratings of a semiconductor device are a set of specified parameter values that must not be exceeded during operation, even for an instant. Circuit designers need to be fully aware of the importance of absolute maximum ratings.

▶Viewing Angle

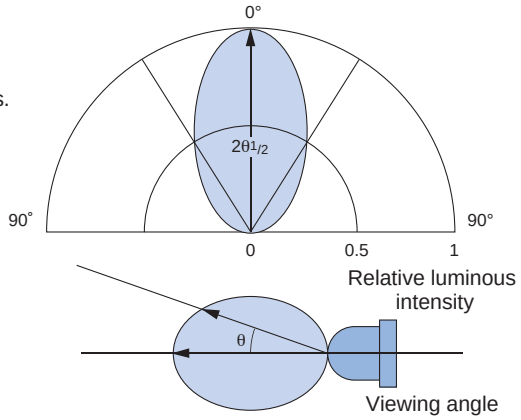
This parameter indicates the ratio of the LED's luminous intensity to its axial luminous intensity (= 100%) as viewed from an angle of θ with respect to the axis of the light source. The angle at which luminous intensity is exactly 50% of the axial luminous intensity is called the half-value angle, θ 1/2. The total half-value angle on both sides of the axis is expressed as 2 θ 1/2.

▶Luminous Intensity

Luminous intensity is equal to the amount of luminous flux emitted into a solid angle at a defined angular orientation from the light source. The measurement unit for luminous intensity is mcd. A narrow-viewing-angle LED provides a high luminous intensity.

▶Temperature Dependence

The light output changes according to the ambient temperature.



3. SMD LEDs

1 1608 Package (See-Through Type): TL∗∗1034(T22

Features

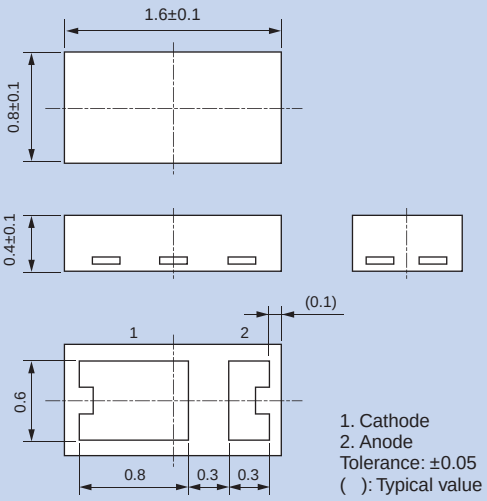
- Suitable for space-saving
  - Package dimensions: 1.6 (L) x 0.8 (W) x 0.4 (H) mm
- Color variations
  - 12 LED colors: Three red, one orange, two yellow, four green, one blue and one white LEDs
  - Green LEDs are also available in the high-brightness H Series.
- Wide view angle ideal for indicator and backlight applications

Except TLWD1034

TLWD1034

Package Dimensions

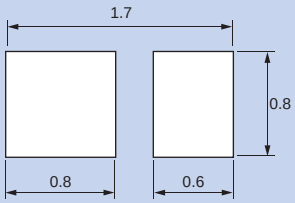
Unit: mm



1. Cathode
2. Anode
Tolerance: ±0.05
( ): Typical value

Land Pattern Dimensions for Reference Only

Unit: mm

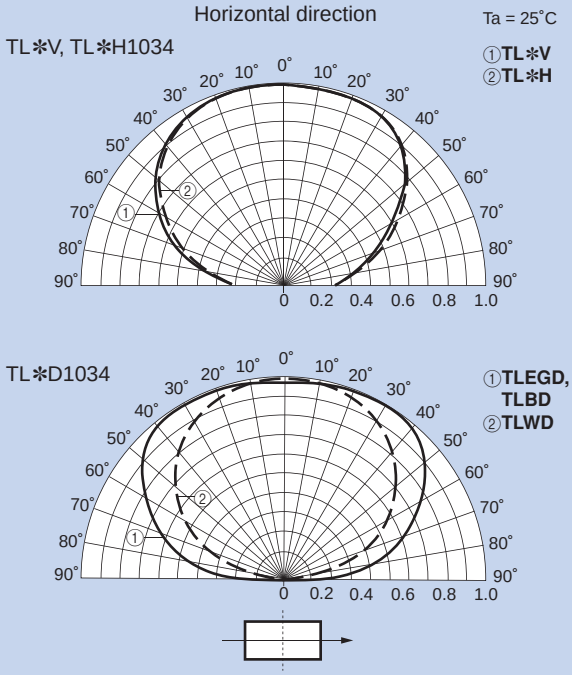


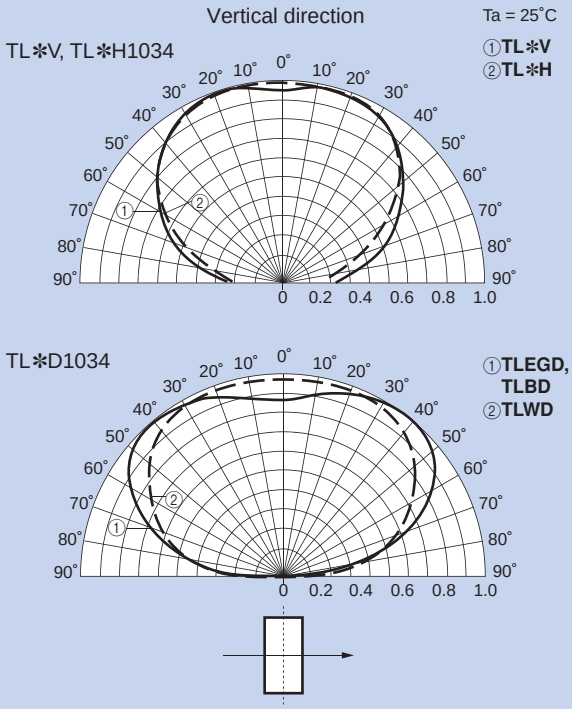
Tape and Reel Specifications

Designation	Units Per Reel
T22	5000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

Radiation Patterns





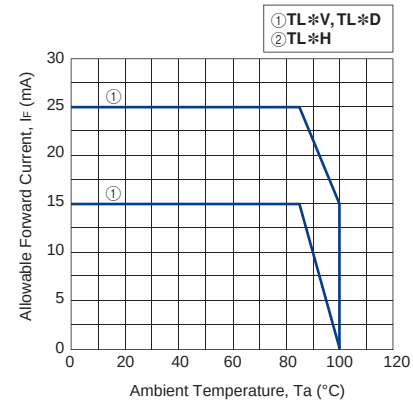
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻V Series (InGaAℓP)	NEW TLRV1034(T22	15	5	31.5	–40 to 100	–40 to 100
	NEW TLRMV1034(T22	15	5	31.5	–40 to 100	–40 to 100
	NEW TLSV1034(T22	15	5	34.5	–40 to 100	–40 to 100
	NEW TLOV1034(T22	15	5	34.5	–40 to 100	–40 to 100
	NEW TLYV1034(T22	15	5	34.5	–40 to 100	–40 to 100
	NEW TLPYV1034(T22	15	5	34.5	–40 to 100	–40 to 100
	NEW TLGV1034(T22	15	5	34.5	–40 to 100	–40 to 100
	NEW TLFGV1034(T22	15	5	34.5	–40 to 100	–40 to 100
	NEW TLPGV1034(T22	15	5	34.5	–40 to 100	–40 to 100
TL✻H Series (InGaAℓP)	NEW TLGH1034(T22	25	5	62.5	–40 to 100	–40 to 100
	NEW TLFGH1034(T22	25	5	62.5	–40 to 100	–40 to 100
	NEW TLPGH1034(T22	25	5	62.5	–40 to 100	–40 to 100
TL✻D Series (InGaN)	NEW TLEGD1034(T22	15	5	51	–40 to 100	–40 to 100
	NEW TLBD1034(T22	15	5	51	–40 to 100	–40 to 100
	NEW TLWD1034(T22	15	5	51	–40 to 100	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Number	Part Number	Color	Dominant Wavelength, λd(nm) @I_F = 5 mA	Luminous Intensity I_V (mcd) @I_F = 5 mA#			Forward Voltage V_F (V) @I_F = 5 mA	Viewing Angle 2θ1/2 (˚)
			Typ.	Min	Typ.	Max	Typ.	Typ.
TL✻V Series (InGaAℓP)	NEW ☆TLRV1034(T22	Red	630	4	15	50	1.8	140
	NEW ☆TLRMV1034(T22	Red	626	4	20	50	1.8	140
	NEW ☆TLSV1034(T22	Red	613	10	30	80	2.0	140
	NEW ☆TLOV1034(T22	Orange	605	10	38	80	2.0	140
	NEW ☆TLYV1034(T22	Yellow	587	10	25	80	2.0	140
	NEW ☆TLPYV1034(T22	Pure Yellow	580	10	23	80	2.0	140
	NEW ☆TLGV1034(T22	Green	571	4	14	50	2.0	140
	NEW ☆TLFGV1034(T22	Green	565	2.5	8	20	2.0	140
	NEW ☆TLPGV1034(T22	Pure green	561	1.6	3.5	12.5	2.0	140

☆: Dry-packed
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

@Ta = 25˚C

Series Number	Part Number	Color	Dominant Wavelength, λd(nm) @I_F = 20 mA	Luminous Intensity I_V (mcd) @I_F = 20 mA#			Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			Typ.	Min	Typ.	Max	Typ.	Typ.
TL✻H Series (InGaAℓP)	NEW ☆TLGH1034(T22	Green	571	40	70	200	2.1	140
	NEW ☆TLFGH1034(T22	Green	565	25	40	125	2.1	140
	NEW ☆TLPGH1034(T22	Pure green	561	10	20	50	2.2	140

☆: Dry-packed
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

@Ta = 25˚C

Series Number	Part Number	Color	Dominant Wavelength, λd(nm) @I_F = 5 mA	Luminous Intensity I_V (mcd) @I_F = 5 mA#			Forward Voltage V_F (V) @I_F = 5 mA	Viewing Angle 2θ1/2 (˚)
			Typ.	Min	Typ.	Max	Typ.	Typ.
TL✻D Series (InGaN)	NEW ☆TLEGD1034(T22	Green	528	32	70	160	2.9	150/150
	NEW ☆TLBD1034(T22	Blue	470	8	20	40	2.9	150/150
	NEW ☆TLWD1034(T22	White	♠0.31/0.3	40	100	200	2.9	130/150

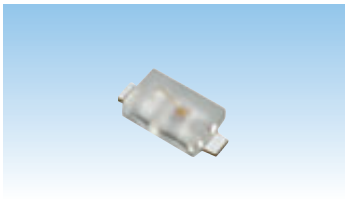
☆: Dry-packed
♠: CIE1931 (typical chromaticity coordinate)
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

For board design considerations, refer to the relevant technical datasheet.

② 1608 Package (ESC Type): TL∗H1032(T14, F),TL∗H1032(T15, F)

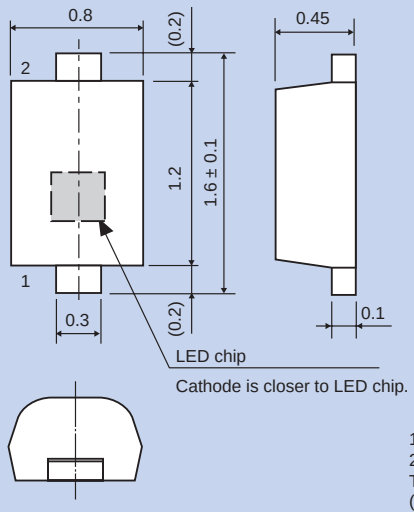
▶Features

- Package dimensions: 1.6 (L) x 0.8 (W) x 0.45 (H) mm (including lead length)
- Suitable as general-brightness LED replacements to increase brightness or reduce power consumption.
- Ideal for backlight applications in slim products and automotive interior applications.



▶Package Dimensions

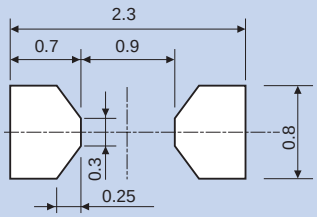
Unit: mm



1. Cathode
2. Anode
Tolerance: ±0.05
( ): Typical value

▶Land Pattern Dimensions for Reference Only

Unit: mm

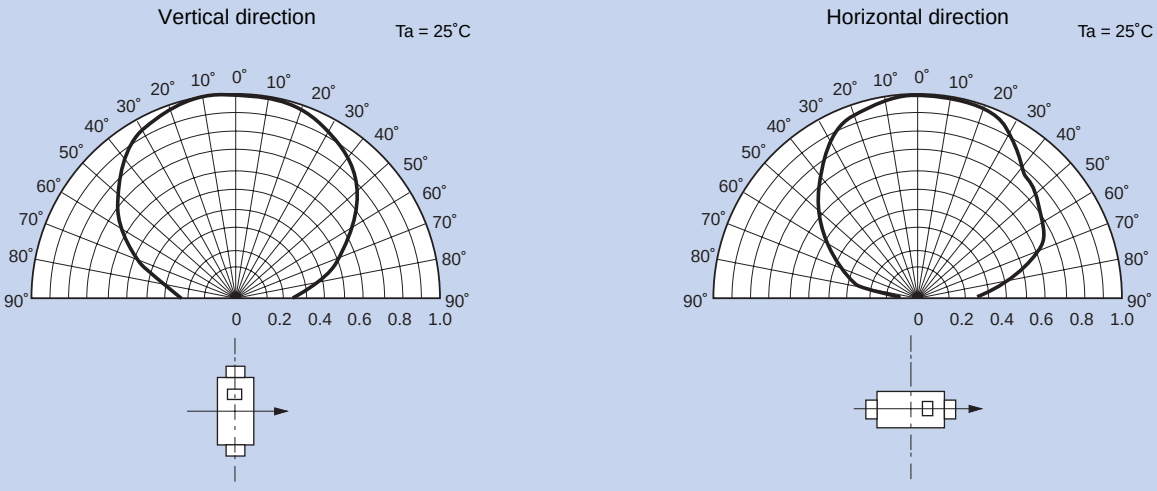


▶Tape and Reel Specifications

Designation	Units Per Reel
T14	4000 pcs/reel
T15	8000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

▶Radiation Patterns



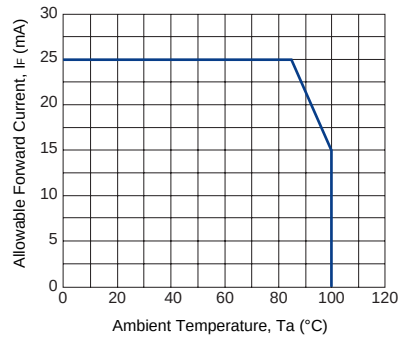
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻H Series (InGaAℓP)	**TLRH1032(T14,F)/(T15,F)**	25	4	60	–40 to 100	–40 to 100
	TLRMH1032(T14,F)/(T15,F)	25	4	60	–40 to 100	–40 to 100
	TLSH1032(T14,F)/(T15,F)	25	4	60	–40 to 100	–40 to 100
	TLOH1032(T14,F)/(T15,F)	25	4	60	–40 to 100	–40 to 100
	TLYH1032(T14,F)/(T15,F)	25	4	60	–40 to 100	–40 to 100
	TLGH1032(T14,F)/(T15,F)	25	4	62.5	–40 to 100	–40 to 100
	TLFGH1032(T14,F)/(T15,F)	25	4	62.5	–40 to 100	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Number	Part Number	Color	Dominant Wavelength, λd(nm) @I_F = 5 mA	Luminous Intensity I_V (mcd) @I_F = 5 mA			Available I_V bins #	Forward Voltage V_F (V) @I_F = 5 mA	Viewing Angle 2θ1/2 (˚)
			Typ.	Min	Typ.	Max		Typ.	Typ.
TL✻H Series (InGaAℓP)	☆**TLRH1032(T14, F)/(T15, F)**	Red	630	25	56	125	NA/PA/QA	2.0	135 to 140
	☆**TLRMH1032(T14, F)/(T15, F)**	Red	626	40	85	200	PA/QA/RA	2.0	135 to 140
	☆**TLSH1032(T14, F)/(T15, F)**	Red	613	63	160	320	QA/RA/SA	2.0	135 to 140
	☆**TLOH1032(T14, F)/(T15, F)**	Orange	605	100	200	500	RA/SA/TA	2.0	135 to 140
	☆**TLYH1032(T14, F)/(T15, F)**	Yellow	587	40	100	200	PA/QA/RA	2.0	135 to 140
	☆**TLGH1032(T14, F)/(T15, F)**	Green	571	25	60	125	NA/PA/QA	2.1	135 to 140
	☆**TLFGH1032(T14, F)/(T15, F)**	Green	565	10	25	50	LA/MA/NA	2.2	135 to 140

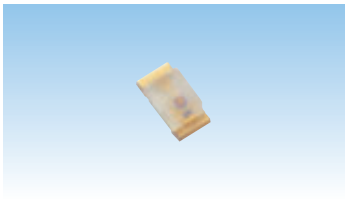
☆: Dry-packed
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

For board design considerations, refer to the relevant technical datasheet.

3. SMD LEDs

③ 1608 Package (Surface-Mount Type): TL**1008A(T04),TL**1008A(T05)

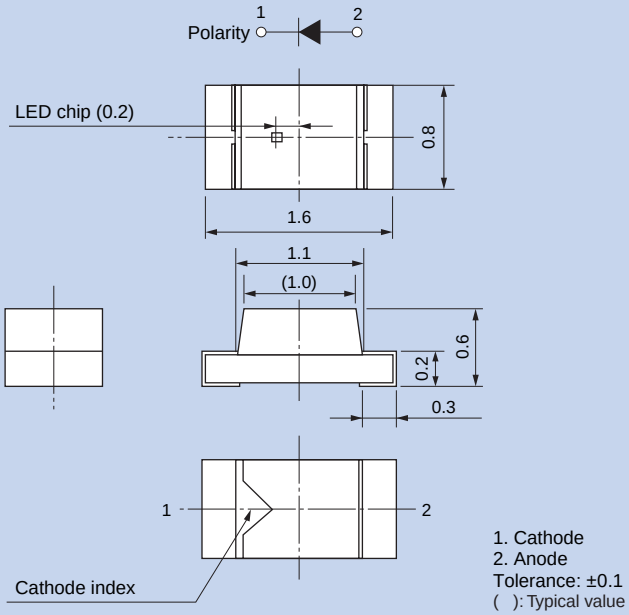
▶Features



- Package dimensions: 1.6 (L) x 0.8 (W) x 0.6 (H) mm
- Suitable as general-brightness LED replacements to increase brightness or reduce power consumption.
- Available in T04 tape (4-mm pitch) and T05 tape (2-mm pitch). Improves the board assembly efficiency.
- Low-profile package (t = 0.6 mm): Suitable for use as backlighting in thin equipment.

▶Package Dimensions

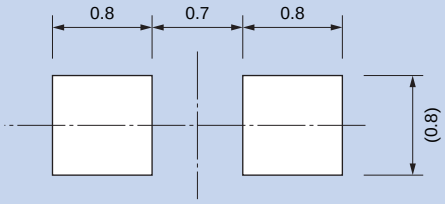
Unit: mm



1. Cathode
2. Anode
Tolerance: ±0.1
( ): Typical value

▶Land Pattern Dimensions for Reference Only

Unit: mm

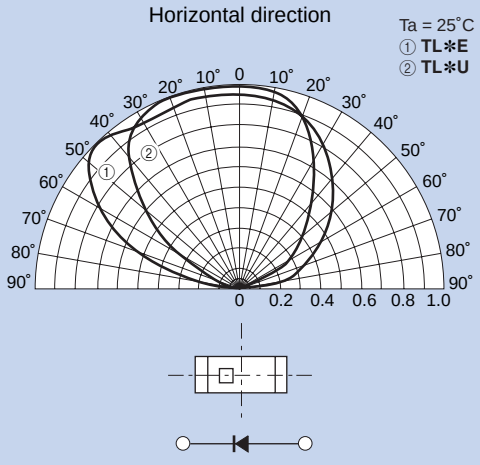


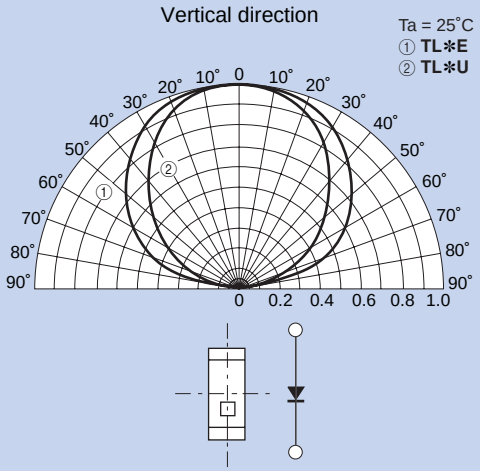
▶Tape and Reel Specifications

Designation	Units Per Reel
T04	4000 pcs/reel
T05	8000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

▶Radiation Patterns





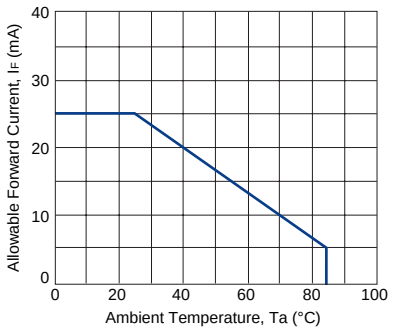
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻E Series (InGaAℓP)	**TLRE1008A(T04)/(T05)**	25	4	60	–40 to 85	–40 to 100
	TLSE1008A(T04)/(T05)	25	4	60	–40 to 85	–40 to 100
	TLOE1008A(T04)/(T05)	25	4	60	–40 to 85	–40 to 100
	TLYE1008A(T04)/(T05)	25	4	60	–40 to 85	–40 to 100
	TLPYE1008A(T04)/(T05)	25	4	60	–40 to 85	–40 to 100
	TLGE1008A(T04)/(T05)	25	4	60	–40 to 85	–40 to 100
	TLFGE1008A(T04)/(T05)	25	4	60	–40 to 85	–40 to 100
	TLPGE1008A(T04)/(T05)	25	4	60	–40 to 85	–40 to 100
TL✻U Series (InGaAℓP)	**TLSU1008A(T04)/(T05)**	25	4	60	–40 to 85	–40 to 100
	TLOU1008A(T04)/(T05)	25	4	62.5	–40 to 85	–40 to 100
	TLAU1008A(T04)/(T05)	25	4	62.5	–40 to 85	–40 to 100
	TLYU1008A(T04)/(T05)	25	4	62.5	–40 to 85	–40 to 100
	TLGU1008A(T04)/(T05)	25	4	62.5	–40 to 85	–40 to 100
	TLPGU1008A(T04)/(T05)	25	4	62.5	–40 to 85	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 20 mA		Luminous Intensity I_V (mcd) @I_F = 20 mA		Available I_V bins #	Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			λp	λd	Min	Typ.		Typ.	Typ.
TL✻E Series (InGaAℓP)	☆**TLRE1008A(T04)/(T05)**	Red	644	630	27.2	70	L/M/N/P	1.9	130 to 135
	☆**TLSE1008A(T04)/(T05)**	Red	623	613	47.6	135	M/N/P/Q	1.9	130 to 135
	☆**TLOE1008A(T04)/(T05)**	Orange	612	605	47.6	150	M/N/P/Q	2.0	130 to 135
	☆**TLYE1008A(T04)/(T05)**	Yellow	590	587	27.2	105	L/M/N/P	2.0	130 to 135
	☆**TLPYE1008A(T04)/(T05)**	Pure Yellow	583	580	27.2	100	L/M/N/P	2.0	130 to 135
	☆**TLGE1008A(T04)/(T05)**	Green	574	571	27.2	70	L/M/N/P	2.0	130 to 135
	☆**TLFGE1008A(T04)/(T05)**	Green	568	565	15.3	40	K/L/M/N	2.0	130 to 135
	☆**TLPGE1008A(T04)/(T05)**	Pure green	562	558	4.76	18	H/J/K/L	2.1	130 to 135
TL✻U Series (InGaAℓP)	☆**TLSU1008A(T04)/(T05)**	Red	636	623	27.2	60	L/M/N/P	2.0	100 to 110
	☆**TLOU1008A(T04)/(T05)**	Orange	612	605	27.2	78	L/M/N/P	2.1	100 to 110
	☆**TLAU1008A(T04)/(T05)**	Amber	596	592	8.5	30	J/K/L/M	2.1	100 to 110
	☆**TLYU1008A(T04)/(T05)**	Yellow	590	587	8.5	30	J/K/L/M	2.1	100 to 110
	☆**TLGU1008A(T04)/(T05)**	Green	574	571	8.5	30	J/K/L/M	2.1	100 to 110
	☆**TLPGU1008A(T04)/(T05)**	Pure green	562	558	1.53	6	F/G/H/J	2.1	100 to 110

☆: Dry-packed
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

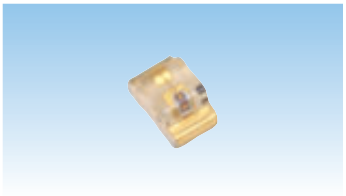
For board design considerations, refer to the relevant technical datasheet.

3. SMD LEDs

4 2125 Package: TL∗∗1002A(T02)

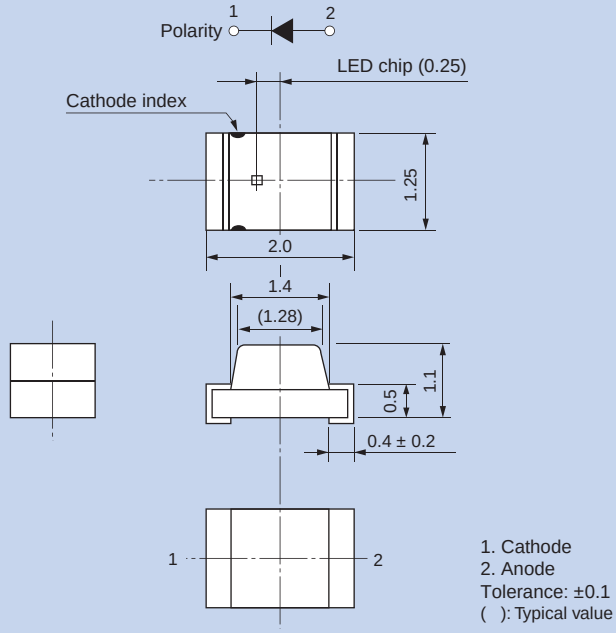
Features

- Package dimensions: 2.0 (L) x 1.25 (W) x 1.1 (H) mm
- High-brightness LEDs
- Suitable as general-brightness LED replacements to increase brightness or reduce power consumption.
- Low-profile package (t = 1.1 mm): Suitable for use as backlighting in thin equipment.



Package Dimensions

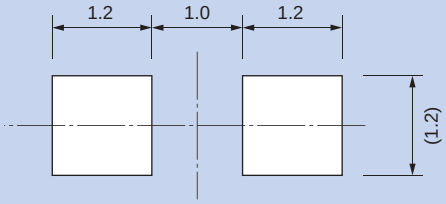
Unit: mm



1. Cathode
2. Anode
Tolerance: ±0.1
( ): Typical value

Land Pattern Dimensions for Reference Only

Unit: mm

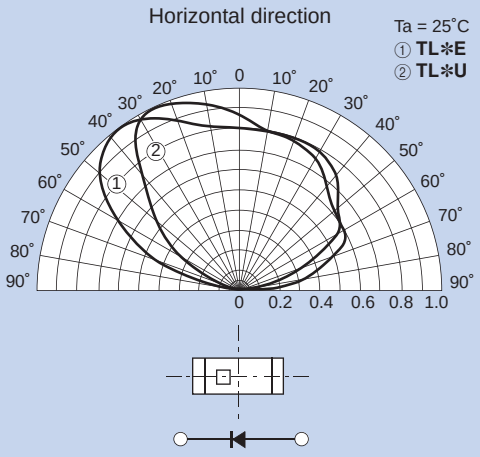


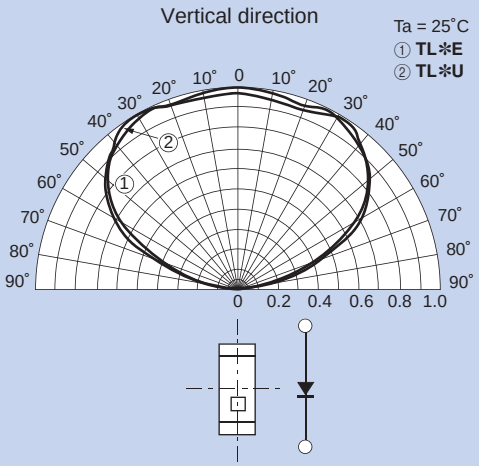
Tape and Reel Specifications

Designation	Units Per Reel
T02	3000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

Radiation Patterns





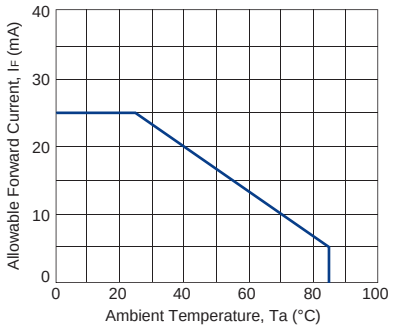
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻E Series (InGaAℓP)	**TLRE1002A(T02)**	25	4	60	–40 to 85	–40 to 100
	TLSE1002A(T02)	25	4	60	–40 to 85	–40 to 100
	TLOE1002A(T02)	25	4	60	–40 to 85	–40 to 100
	TLYE1002A(T02)	25	4	60	–40 to 85	–40 to 100
	TLPYE1002A(T02)	25	4	60	–40 to 85	–40 to 100
	TLGE1002A(T02)	25	4	60	–40 to 85	–40 to 100
	TLFGE1002A(T02)	25	4	60	–40 to 85	–40 to 100
	TLPGE1002A(T02)	25	4	60	–40 to 85	–40 to 100
TL✻U Series (InGaAℓP)	**TLRU1002A(T02)**	25	4	60	–40 to 85	–40 to 100
	TLSU1002A(T02)	25	4	60	–40 to 85	–40 to 100
	TLOU1002A(T02)	25	4	62.5	–40 to 85	–40 to 100
	TLAU1002A(T02)	25	4	62.5	–40 to 85	–40 to 100
	TLYU1002A(T02)	25	4	62.5	–40 to 85	–40 to 100
	TLGU1002A(T02)	25	4	62.5	–40 to 85	–40 to 100
	TLPGU1002A(T02)	25	4	62.5	–40 to 85	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 20 mA		Luminous Intensity I_V (mcd) @I_F = 20 mA		Available I_V bins #	Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			λp	λd	Min	Typ.		Typ.	Typ.
TL✻E Series (InGaAℓP)	☆**TLRE1002A(T02)**	Red	644	630	27.2	70	L/M/N/P	1.9	130 to 140
	☆**TLSE1002A(T02)**	Red	623	613	47.6	140	M/N/P/G	1.9	130 to 140
	☆**TLOE1002A(T02)**	Orange	612	605	47.6	180	M/N/P/G	2.0	130 to 140
	☆**TLYE1002A(T02)**	Yellow	590	587	27.2	105	L/M/N/P	2.0	130 to 140
	☆**TLPYE1002A(T02)**	Pure Yellow	583	580	27.2	70	L/M/N/P	2.0	130 to 140
	☆**TLGE1002A(T02)**	Green	574	571	27.2	70	L/M/N/P	2.0	130 to 140
	☆**TLFGE1002A(T02)**	Green	568	565	8.5	25	J/K/L/M	2.0	130 to 140
	☆**TLPGE1002A(T02)**	Pure green	562	558	4.76	18	H/J/K/L	2.1	130 to 140
TL✻U Series (InGaAℓP)	☆**TLRU1002A(T02)**	Red	644	630	4.76	45	H/J/K/L	2.0	120 to 130
	☆**TLSU1002A(T02)**	Red	636	623	27.2	60	L/M/N/P	2.0	120 to 130
	☆**TLOU1002A(T02)**	Orange	612	605	27.2	78	L/M/N/P	2.1	120 to 130
	☆**TLAU1002A(T02)**	Amber	596	592	8.5	30	J/K/L/M	2.1	120 to 130
	☆**TLYU1002A(T02)**	Yellow	590	587	8.5	30	J/K/L/M	2.1	120 to 130
	☆**TLGU1002A(T02)**	Green	574	571	8.5	30	J/K/L/M	2.1	120 to 130
	☆**TLPGU1002A(T02)**	Pure green	562	558	1.53	6	F/G/H/J	2.1	120 to 130

☆: Dry-packed

#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

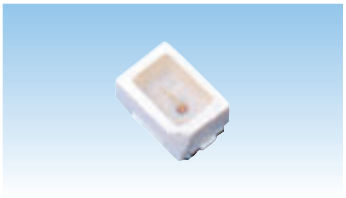
For board design considerations, refer to the relevant technical datasheet.

3. SMD LEDs

5 Mini PLCC Package: TL∗M1060(T18),TL∗F1060(T18),TL∗D1060(T18)

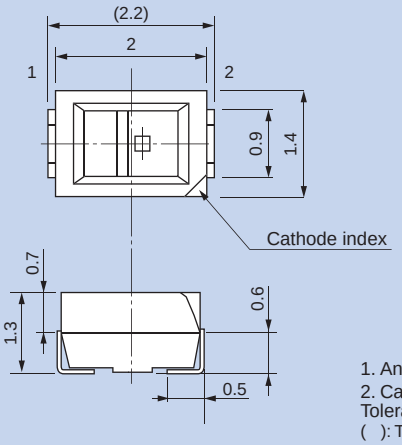
▶Features

- Package dimensions: 2.2 (L) x 1.4 (W) x 1.3 (H) mm
- The heat-resistant casing provides support for an extended operating temperature range.
  - Operating temperature: Topr = –40 to 100˚C



▶Package Dimensions

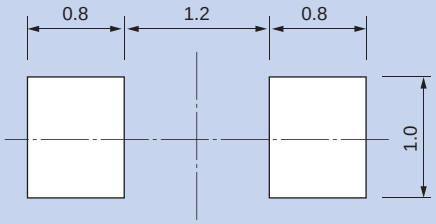
Unit: mm



1. Anode
2. Cathode
Tolerance: ±0.2
( ): Typical value

▶Land Pattern Dimensions for Reference Only

Unit: mm



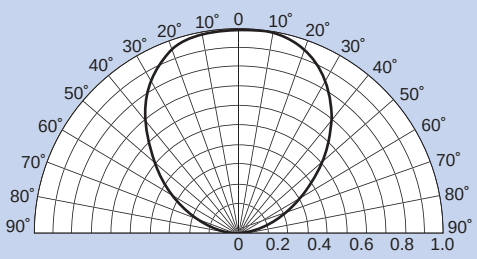
▶Tape and Reel Specifications

Designation	Units Per Reel
T18	3000 pcs/reel

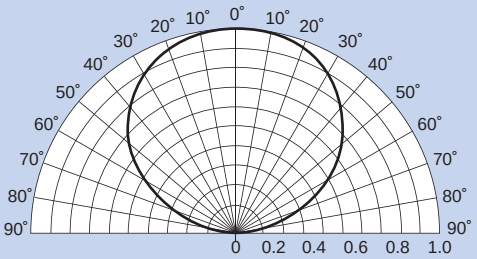
* See pages 48 and 49 for the reel and tape dimensions.

▶Radiation Pattern

TL∗F1060,TL∗D1060 Ta = 25˚C



TL∗M1060 Ta = 25˚C



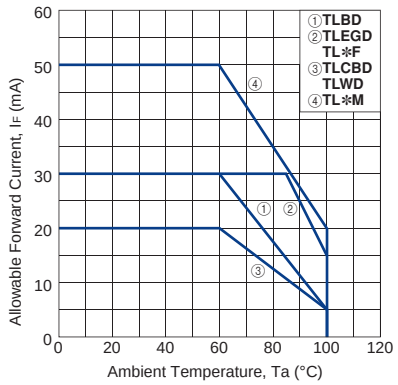
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻M Series (InGaAℓP)	NEW ☆TLRM1060(T18)	50	4	125	–40 to 100	–40 to 100
	NEW ☆TLRMM1060(T18)	50	4	125	–40 to 100	–40 to 100
	NEW ☆TLSM1060(T18)	50	4	125	–40 to 100	–40 to 100
	NEW ☆TLOM1060(T18)	50	4	125	–40 to 100	–40 to 100
	NEW ☆TLYM1060(T18)	50	4	125	–40 to 100	–40 to 100
TL✻F Series (InGaAℓP)	TLRF1060(T18)	30	15	75	–40 to 100	–40 to 100
	TLSF1060(T18)	30	15	75	–40 to 100	–40 to 100
	TLOF1060(T18)	30	15	75	–40 to 100	–40 to 100
	TLYF1060(T18)	30	15	75	–40 to 100	–40 to 100
	TLPYF1060(T18)	30	15	75	–40 to 100	–40 to 100
	TLGF1060(T18)	30	15	75	–40 to 100	–40 to 100
	TLFGF1060(T18)	30	15	75	–40 to 100	–40 to 100
	TLPGF1060(T18)	30	15	75	–40 to 100	–40 to 100
TL✻D Series (InGaN)	TLEGD1060(T18)	30	4	120	–40 to 100	–40 to 100
	TLBD1060(T18)	30	4	120	–40 to 100	–40 to 100
	TLCBD1060(T18)	20	4	76	–40 to 100	–40 to 100
	TLWD1060(T18)	20	4	76	–40 to 100	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 20 mA		Luminous Intensity I_V (mcd) @I_F = 20 mA			Available I_V bins #	Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			λp	λd	Min	Typ.	Max		Typ.	Typ.
TL✻M Series (InGaAℓP)	NEW ☆TLRM1060(T18)	Red	644	630	160	350	800	SA/TA/UA	2.1	120
	NEW ☆TLRMM1060(T18)	Red	636	626	160	450	800	SA/TA/UA	2.1	120
	NEW ☆TLSM1060(T18)	Red	623	613	250	650	1250	TA/UA/VA	2.1	120
	NEW ☆TLOM1060(T18)	Orange	612	605	250	650	1250	TA/UA/VA	2.2	120
	NEW ☆TLYM1060(T18)	Yellow	592	590	250	600	1250	TA/UA/VA	2.2	120
TL✻F Series (InGaAℓP)	☆TLRF1060(T18)	Red	644	630	40	100	320	PA/QA/RA/SA	2.0	100
	☆TLSF1060(T18)	Red	623	613	100	200	500	RA/SA/TA	2.0	100
	☆TLOF1060(T18)	Orange	612	605	100	220	500	RA/SA/TA	2.0	100
	☆TLYF1060(T18)	Yellow	590	587	63	180	320	QA/RA/SA	2.1	100
	☆TLPYF1060(T18)	Pure yellow	583	580	40	100	320	PA/QA/RA/SA	2.1	100
	☆TLGF1060(T18)	Green	574	571	40	80	320	PA/QA/RA/SA	2.1	100
	☆TLFGF1060(T18)	Green	568	565	25	50	125	NA/PA/QA	2.1	100
	☆TLPGF1060(T18)	Pure green	562	558	10	20	50	LA/MA/NA	2.1	100
TL✻D Series (InGaN)	☆TLEGD1060(T18)	Green	518	528	63	150	320	QA/RA/SA	3.3	110
	☆TLBD1060(T18)	Blue	468	470	25	60	125	NA/PA/QA	3.3	110
	☆TLCBD1060(T18)	Ice blue	–	♠0.2/0.3*	40*	90*	200*	PA/QA/RA	3.0*	110
	☆TLWD1060(T18)	White	–	♠0.31/0.30*	40*	90*	200*	PA/QA/RA	3.0*	110

☆: Dry-packed
* : I_F = 10 mA
♠: CIE1931 (typical chromaticity coordinate)
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

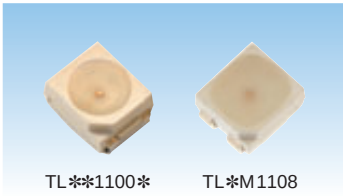
For board design considerations, refer to the relevant technical datasheet.

⑥ PLCC Packages: TL✻✻1108(T11),TL✻✻1109(T11),TL✻✻1100(T11)

▶InGaAℓP Series

▶Features

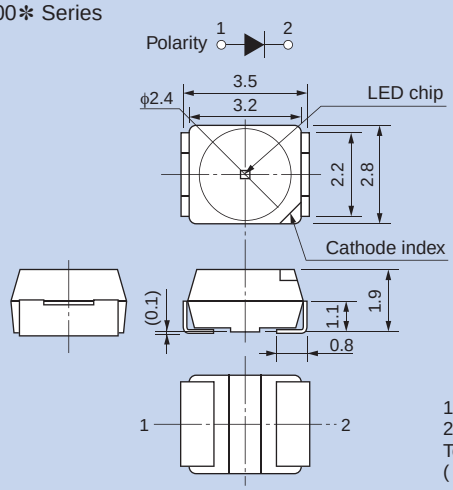
- Package dimensions: 3.5 (L) x 2.8 (W) x 1.9 (H) mm (TL✻✻1100✻ Series)
  3.5 (L) x 2.9 (W) x 1.9 (H) mm (TL✻M1108 Series)
- The heat-resistant casing provides support for extended operating temperature ranges.
  - Operating temperature: Topr = –40 to 100˚C TL✻M Series, TL✻K Series, TL✻H Series (green LEDs), TL✻E Series
  - Operating temperature: Topr = –40 to 110˚C TL✻H Series (except green LEDs)



▶Package Dimensions

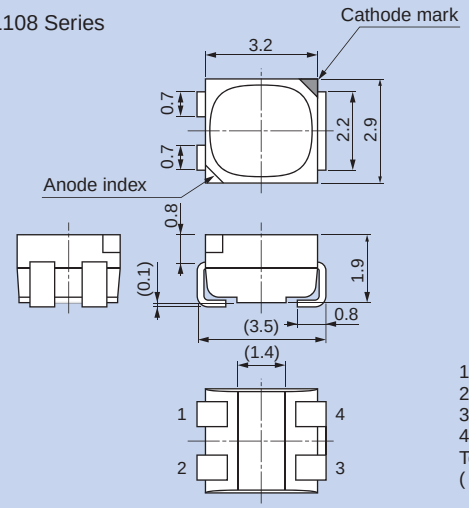
Unit: mm

TL✻✻1100✻ Series



1. Anode
2. Cathode
Tolerance: ±0.2
( ): Typical value

TL✻M1108 Series

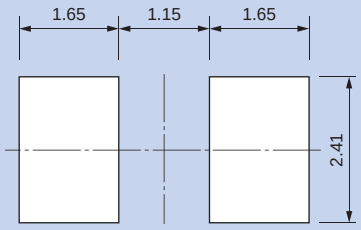


1. Anode
2. Cathode
3. Cathode
4. Cathode
Tolerance: ±0.2
( ): Typical value

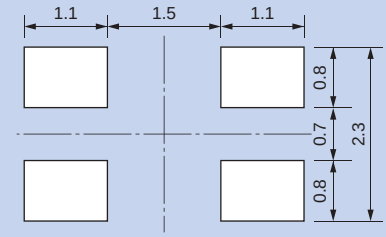
▶Land Pattern Dimensions for Reference Only

Unit: mm

TL✻✻1100✻ Series



TL✻M1108 Series

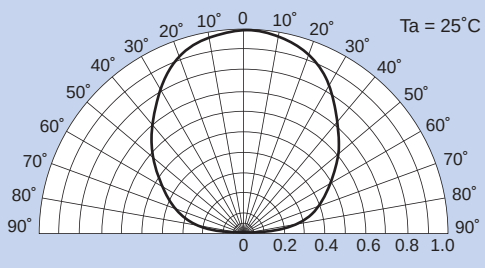


▶Tape and Reel Specifications

Designation	Units Per Reel
T11	2000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

▶Radiation Pattern



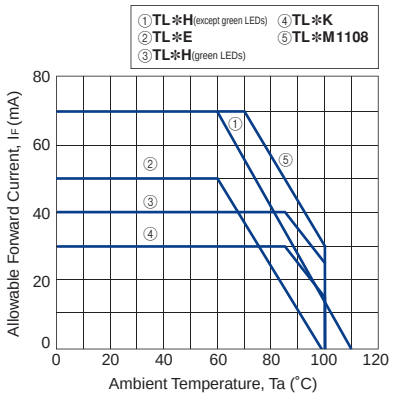
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻M Series (InGaAℓP) PLCC-4	NEW TLRM1108(T11)	70	4	203	–40 to 100	–40 to 100
	NEW TLRMM1108(T11)	70	4	203	–40 to 100	–40 to 100
	NEW TLSM1108(T11)	70	4	203	–40 to 100	–40 to 100
	NEW TLOM1108(T11)	70	4	203	–40 to 100	–40 to 100
	NEW TLYM1108(T11)	70	4	203	–40 to 100	–40 to 100
TL✻K Series (InGaAℓP) PLCC-2	TLRK1100C(T11)	30	4	75	–40 to 100	–40 to 100
	TLRMK1100C(T11)	30	4	75	–40 to 100	–40 to 100
	TLSK1100C(T11)	30	4	75	–40 to 100	–40 to 100
	TLOK1100C(T11)	30	4	75	–40 to 100	–40 to 100
	TLYK1100C(T11)	30	4	75	–40 to 100	–40 to 100
TL✻H Series (InGaAℓP) PLCC-2	NEW TLRH1100D(T11)	70	4	161	–40 to 110	–40 to 110
	NEW TLRMH1100D(T11)	70	4	161	–40 to 110	–40 to 110
	NEW TLSH1100D(T11)	70	4	161	–40 to 110	–40 to 110
	NEW TLOH1100D(T11)	70	4	161	–40 to 110	–40 to 110
	NEW TLYH1100D(T11)	70	4	161	–40 to 110	–40 to 110
	TLGH1100B(T11)	40	4	100	–40 to 100	–40 to 100
	TLFGH1100B(T11)	40	4	100	–40 to 100	–40 to 100
	TLPGH1100B(T11)	40	4	100	–40 to 100	–40 to 100
TL✻E Series (InGaAℓP) PLCC-2	NEW TLRE1100D(T11)	50	4	120	–40 to 100	–40 to 100
	NEW TLSE1100D(T11)	50	4	120	–40 to 100	–40 to 100
	NEW TLOE1100D(T11)	50	4	120	–40 to 100	–40 to 100
	NEW TLYE1100D(T11)	50	4	120	–40 to 100	–40 to 100
	NEW TLGE1100D(T11)	50	4	120	–40 to 100	–40 to 100
	NEW TLFGE1100D(T11)	50	4	120	–40 to 100	–40 to 100
	NEW TLPGE1100D(T11)	50	4	120	–40 to 100	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 20 mA		Luminous Intensity I_V (mcd) @I_F = 20 mA			Available I_V bins #	Forward Voltage V_F (V)	Viewing Angle 2θ1/2 (˚)	Forward Current (DC) I_F (mA)
			λp	λd	Min	Typ.	Max		Typ.	Typ.	
TL✻M Series (InGaAℓP) PLCC-4	NEW ☆TLRM1108(T11)	Red	644	630	630	1300	3200	VA/WA/XA	2.5	120	50
	NEW ☆TLRMM1108(T11)	Red	636	626	630	1600	3200	VA/WA/XA	2.5	120	50
	NEW ☆TLSM1108(T11)	Red	623	613	1000	2400	5000	WA/XA/YA	2.5	120	50
	NEW ☆TLOM1108(T11)	Orange	612	605	1000	2500	5000	WA/XA/YA	2.55	120	50
	NEW ☆TLYM1108(T11)	Yellow	592	590	1000	2200	5000	WA/XA/YA	2.55	120	50
TL✻K Series (InGaAℓP) PLCC-2	☆TLRK1100C(T11)	Red	644	630	100	300	500	RA/SA/TA	2.1	120	20
	☆TLRMK1100C(T11)	Red	636	626	160	400	800	SA/TA/UA	2.1	120	20
	☆TLSK1100C(T11)	Red	623	613	250	500	1250	TA/UA/VA	2.1	120	20
	☆TLOK1100C(T11)	Orange	612	605	250	500	1250	TA/UA/VA	2.1	120	20
	☆TLYK1100C(T11)	Yellow	592	590	160	400	800	SA/TA/UA	2.2	120	20
TL✻H Series (InGaAℓP) PLCC-2	NEW ☆TLRH1100D(T11)	Red	644	630	63	150	320	QA/RA/SA	2.05	120	20
	NEW ☆TLRMH1100D(T11)	Red	636	626	63	150	500	QA/RA/SA/TA	2.05	120	20
	NEW ☆TLSH1100D(T11)	Red	623	613	160	260	800	SA/TA/UA	2.1	120	20
	NEW ☆TLOH1100D(T11)	Orange	612	605	160	270	800	SA/TA/UA	2.1	120	20
	NEW ☆TLYH1100D(T11)	Yellow	590	587	100	220	500	RA/SA/TA	2.1	120	20
	☆TLGH1100B(T11)	Green	574	571	63	150	320	QA/RA/SA	2.1	120	20
	☆TLFGH1100B(T11)	Green	568	565	40	70	200	PA/QA/RA	2.1	120	20
	☆TLPGH1100B(T11)	Pure green	562	558	16	35	80	MA/NA/PA	2.15	120	20
TL✻E Series (InGaAℓP) PLCC-2	NEW ☆TLRE1100D(T11)	Red	644	630	40	120	320	PA/QA/RA/SA	2.05	120	20
	NEW ☆TLSE1100D(T11)	Red	623	613	63	210	500	QA/RA/SA/TA	2.05	120	20
	NEW ☆TLOE1100D(T11)	Orange	612	605	63	210	500	QA/RA/SA/TA	2.05	120	20
	NEW ☆TLYE1100D(T11)	Yellow	590	587	63	180	500	QA/RA/SA/TA	2.1	120	20
	NEW ☆TLGE1100D(T11)	Green	574	571	40	100	320	PA/QA/RA/SA	2.1	120	20
	NEW ☆TLFGE1100D(T11)	Green	568	565	25	45	125	NA/PA/QA	2.1	120	20
	NEW ☆TLPGE1100D(T11)	Pure green	562	558	10	25	50	LA/MA/NA	2.1	120	20

☆: Dry-packed

#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

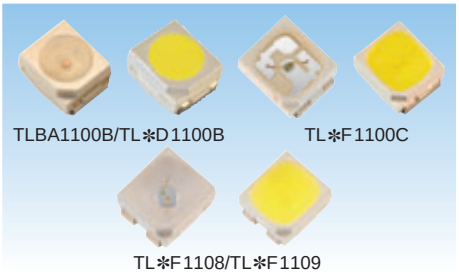
For board design considerations, refer to the relevant technical datasheet.

3. SMD LEDs

▶InGaN and GaN Series

▶Features

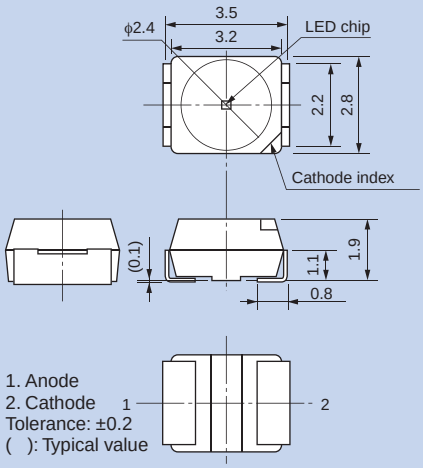
- Package dimensions: 3.5 (L) x 2.8 (W) x 1.9 (H) mm (TL✻D Series/TLBA1100B)
  3.5 (L) x 2.9 (W) x 1.9 (H) mm
  (TL✻F1100C Series/TL✻F1108 Series/TL✻F1109 Series)
- The heat-resistant casing provides support for an extended operating temperature range.
  - Operating temperature: Topr = –40 to 100˚C



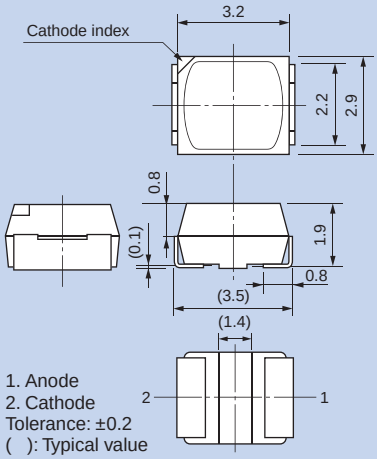
▶Package Dimensions

Unit: mm

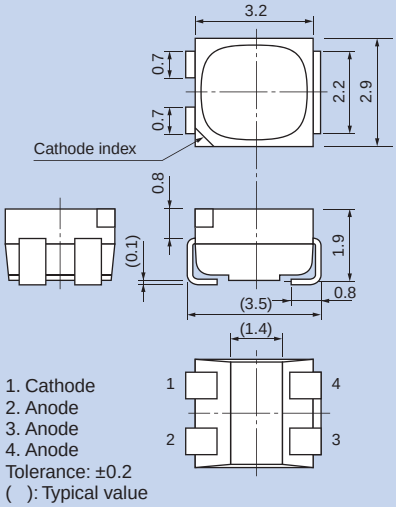
TL✻D1100B Series/TLBA1100B



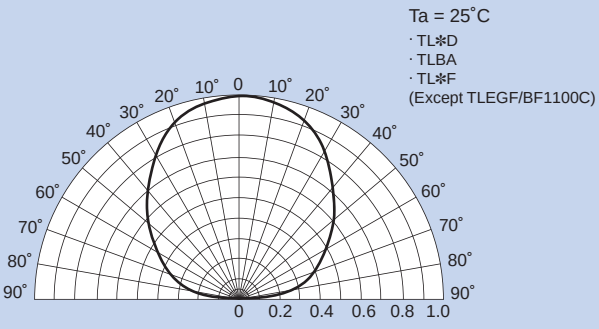
TL✻F1100C Series

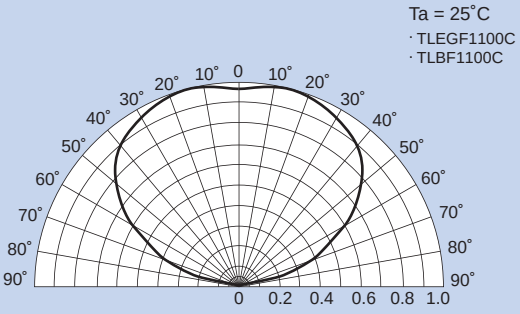


TL✻F1108 Series/TL✻F1109 Series



▶Radiation Pattern

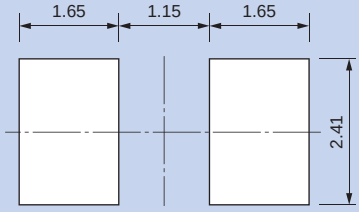




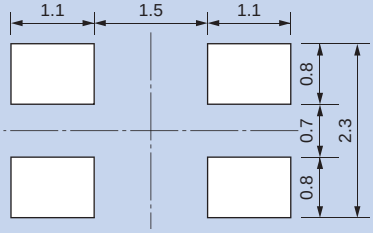
▶Land Pattern Dimensions for Reference Only

Unit: mm

TL✻✻1100 Series



TL✻✻1108 Series/TL✻✻1109 Series



▶Tape and Reel Specifications

Designation	Units Per Reel
T11	2000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

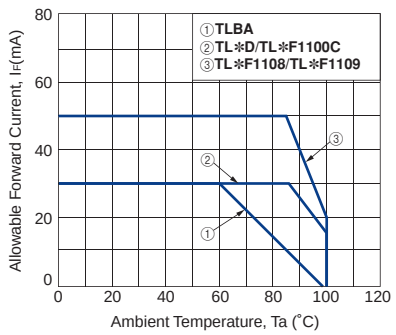
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻F Series (InGaN) PLCC-2	**TLEGF1100C(T11**	30	4	114	–40 to 100	–40 to 100
	TLBF1100C(T11	30	4	114	–40 to 100	–40 to 100
TL✻D Series (InGaN) PLCC-2	**TLEGD1100B(T11**	30	4	120	–40 to 100	–40 to 100
	TLBD1100B(T11	30	4	120	–40 to 100	–40 to 100
	TLCBD1100B(T11)	30	4	120	–40 to 100	–40 to 100
TL✻A Series (GaN) PLCC-2	**TLBA1100B(T11)**	30	4	126	–40 to 100	–40 to 100
TLW✻F Series (InGaN) PLCC-2	**TLWF1100C(T11, etc.**	30	4	114	–40 to 100	–40 to 100
TLWD Series (InGaN) PLCC-2	**TLWD1100B(T11**	30	4	120	–40 to 100	–40 to 100
TLW✻F Series (InGaN) PLCC-4	NEW **TLEGF1108(T11**	50	4	200	–40 to 100	–40 to 100
	NEW **TLBF1108(T11**	50	4	200	–40 to 100	–40 to 100
TLW✻F Series (InGaN) PLCC-4	NEW **TLWF1108(T11, etc.**	50	4	200	–40 to 100	–40 to 100
	NEW **TLWF1109(T11, etc.**	50	–	200	–40 to 100	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 20 mA		Luminous Intensity I_V (mcd) @I_F = 20 mA			Available I_V bins #	Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			λp	λd	Min	Typ.	Max		Typ.	Typ.
TL✻F Series (InGaN) PLCC-2	☆**TLEGF1100C(T11**	Green	518	528	400	700	1250	UA1/UA2/VA1/VA2	3.2	120
	☆**TLBF1100C(T11**	Blue	468	470	200	300	500	SA2/TA1/TA2	3.2	120
TL✻F Series (InGaN) PLCC-4	NEW ☆**TLEGF1108(T11**	Green	518*	528*	1000*	2000*	3200*	WA1/WA2/XA1/XA2	3.5*	120
	NEW ☆**TLBF1108(T11**	Blue	468*	470*	400*	560*	1250*	UA1/UA2/VA1/VA2	3.5*	120
TL✻D Series (InGaN) PLCC-2	☆**TLEGD1100B(T11**	Green	518	528	100	200	500	RA/SA/TA	3.3*	120
	☆**TLBD1100B(T11**	Blue	468	470	40	70	200	PA/QA/RA	3.3	120
	☆**TLCBD1100B(T11**	Ice blue	Cx = 0.2/Cy = 0.3**		32**	90**	160**	NA2/PA1/PA2 QA1/QA2/RA1	3.0**	120
TL✻A Series (GaN) PLCC-2	☆**TLBA1100B(T11)**	Blue	428**	465**	4**	7**	20**	JA/KA/LA	3.7**	120

☆: Dry-packed
* : I_F = 40 mA, ** :I_F = 10 mA
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

@Ta = 25˚C

Series Name	Part Number	Color (Typical color temperature)	Typical Chromaticity Coordinates Cx, Cy @I_F = 20 mA		Luminous Intensity I_V (mcd) @I_F = 20 mA			Available I_V bins #	Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			Cx	Cy	Min	Typ.	Max		Typ.	Typ.
TLW✻F Series (InGaN) PLCC-2	☆**TLWF1100C(T11**	White (6500 K)	0.31	0.30	1000	1600	2500	WA1/WA2/XA1	3.2	120
	☆**TLWNF1100C(T11**	White (5000 K)	0.345	0.35	1000	1600	2000	WA1/WA2	3.2	120
	☆**TLWLF1100C(T11**	White (3000 K)	0.44	0.40	800	1160	1600	VA2/WA1	3.2	120
TLW✻F Series (InGaN) PLCC-4	NEW ☆**TLWF1108(T11**	White (6500 K)	0.31**	0.30**	2000**	3200**	5000**	XA2/YA1/YA2	3.5**	120
	NEW ☆**TLWNF1108(T11**	White (5000 K)	0.345**	0.35**	2000**	3200**	5000**	XA2/YA1/YA2	3.5**	120
	NEW ☆**TLWLF1108(T11**	White (3000 K)	0.44**	0.40**	1600**	2500**	5000**	XA1/XA2/YA1//YA2	3.5**	120
	NEW ☆**TLWF1109(T11***	White (6500 K)	0.31**	0.30**	2000**	3200**	5000**	XA2/YA1/YA2	3.5**	120
	NEW ☆**TLWNF1109(T11***	White (5000 K)	0.345**	0.35**	2000**	3200**	5000**	XA2/YA1/YA2	3.5**	120
	NEW ☆**TLWLF1109(T11***	White (3000 K)	0.44**	0.40**	1600**	2500**	5000**	XA1/XA2/YA1/YA2	3.5**	120
TLWD Series (InGaN)	☆**TLWD1100B(T11**	White	0.32	0.31	63	180	320	QA/RA/SA	3.3	120

☆: Dry-packed
* : With Zener diode
**: I_F = 40 mA
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

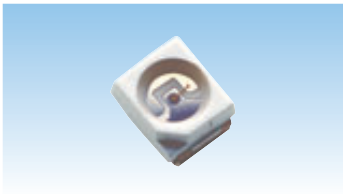
For board design considerations, refer to the relevant technical datasheet.

3. SMD LEDs

⑦ PLCC Packages: TL∗H1106(T11)

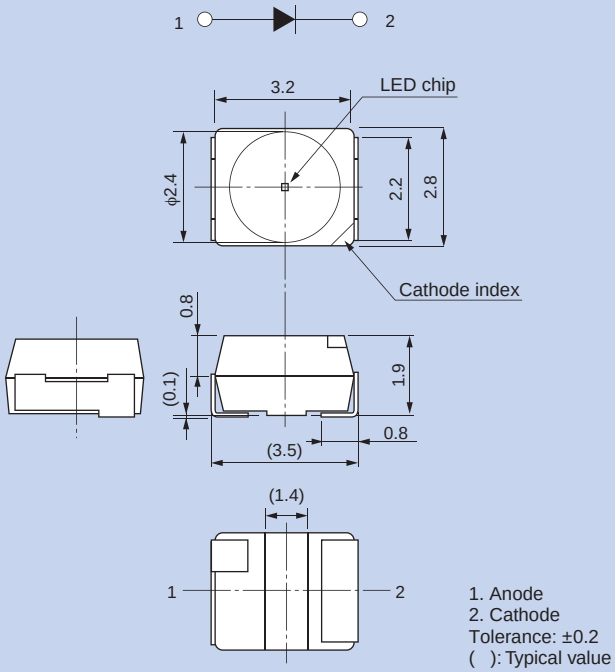
▶Features

- Package dimensions: 3.5 (L) x 2.8 (W) x 1.9 (H) mm
- High-current drive
- The heat-resistant casing provides support for an extended operating temperature range.
  - Operating temperature: Topr = –40 to 100˚C



▶Package Dimensions

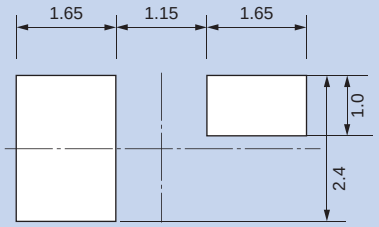
Unit: mm



1. Anode
2. Cathode
Tolerance: ±0.2
( ): Typical value

▶Land Pattern Dimensions for Reference Only

Unit: mm

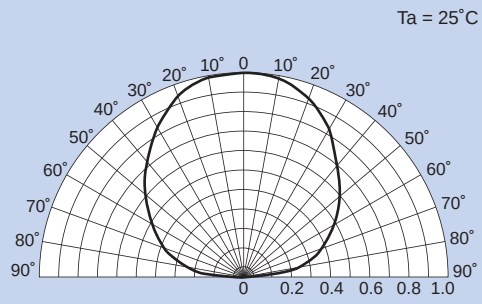


▶Tape and Reel Specifications

Designation	Units Per Reel
T11	2000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

▶Radiation Pattern



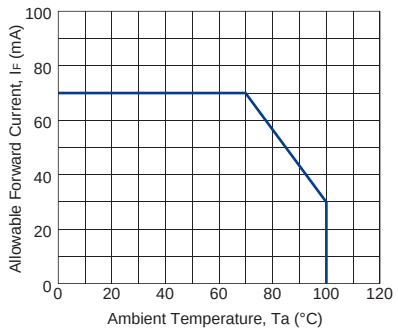
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻H Series (InGaAℓP)	**TLRH1106(T11)**	70	4	175	–40 to 100	–40 to 100
	TLRMH1106(T11)	70	4	175	–40 to 100	–40 to 100
	TLSH1106(T11)	70	4	175	–40 to 100	–40 to 100
	TLOH1106(T11)	70	4	175	–40 to 100	–40 to 100
	TLYH1106(T11)	70	4	175	–40 to 100	–40 to 100
	TLGH1106(T11)	70	4	175	–40 to 100	–40 to 100

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

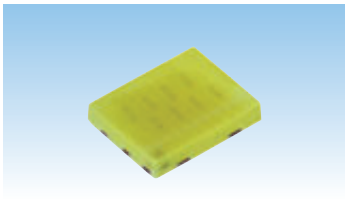
Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 50 mA		Luminous Intensity I_V (mcd) @I_F = 50 mA			Available I_V bins #	Forward Voltage V_F (V) @I_F = 50 mA	Viewing Angle 2θ1/2 (˚)
			λp	λd	Min	Typ.	Max		Typ.	Typ.
TL✻H Series (InGaAℓP)	☆**TLRH1106(T11)**	Red	644	630	160	380	800	SA/TA/UA	2.1	120
	☆**TLRMH1106(T11)**	Red	636	626	160	380	800	SA/TA/UA	2.1	120
	☆**TLSH1106(T11)**	Red	623	613	250	500	1250	TA/UA/VA	2.2	120
	☆**TLOH1106(T11)**	Orange	612	605	250	600	1250	TA/UA/VA	2.2	120
	☆**TLYH1106(T11)**	Yellow	590	587	250	450	1250	TA/UA/VA	2.2	120
	☆**TLGH1106(T11)**	Green	574	571	100	200	500	RA/SA/TA	2.2	120

☆: Dry-packed
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

For board design considerations, refer to the relevant technical datasheet.

⑧ High-Flux White LED Lamps for General Lighting (See-Through Type): TL19W01-✻(T32

▶Features

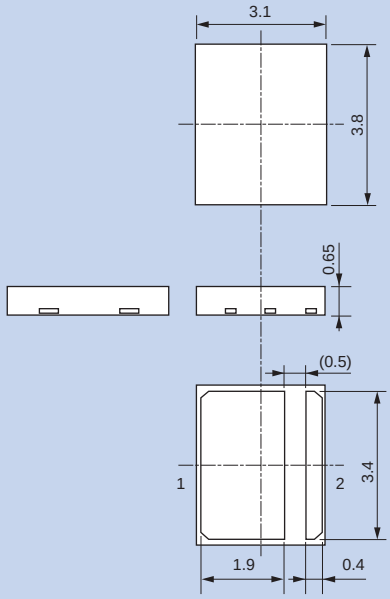


- Up to 120-lm/W efficiencies (1-W type LEDs)*
- Industry's thinnest package for 1-W type white LEDs*
- Wide viewing angle: 130 to 140° (typ.)
- Color variations: 6500 to 3000 K (as per the ANSI C78.377 standard)
- LEDs with high color-rendering performance close to natural light are also offered.

* As of October 2010

▶Package Dimensions

Unit: mm



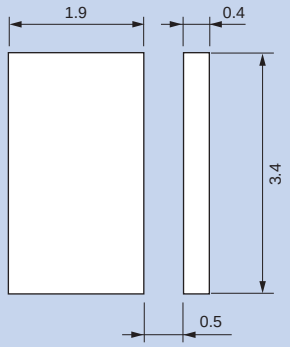
1. Cathode
2. Anode

Tolerance: ±0.1

( ): Typical value

▶Land Pattern Dimensions for Reference Only

Unit: mm



▶Tape and Reel Specifications

Designation	Units Per Reel
T32	1000 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

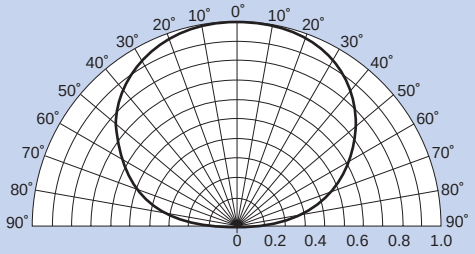
▶Radiation Patterns

Unit: mm

TL19W01-✻

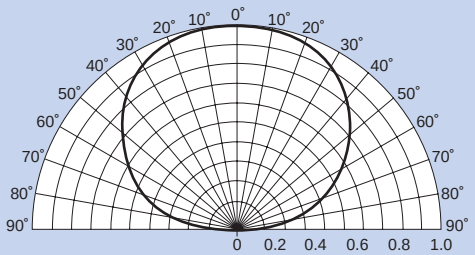
✻: D, N

Ta = 25˚C



TL19W01-✻

✻: W, WW, L, NH1, WH1, WWH1, LH1, NH2, LH2



For board design considerations, refer to the relevant technical datasheet.

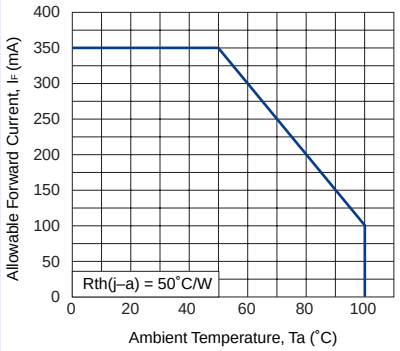
▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Type	Part Number	Forward Current (DC) I_F (mA)*1	Forward Current (Pulsed) (mA)*2	Power Dissipation P_D (W)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)	Junction Temp. (˚C)
TL19W01 Series (InGaN)	High efficiency	NEW TL19W01-D(T32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-N(T32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-W(T32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-WW(T32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-L(T32	350	400	1.33	–40 to 100	–40 to 100	120
	Medium color rendering (Ra85)	NEW TL19W01-NH1(T32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-WH1(T32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-WWH1(32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-LH1(T32	350	400	1.33	–40 to 100	–40 to 100	120
	High color rendering (Ra92)	NEW TL19W01-NH2(T32	350	400	1.33	–40 to 100	–40 to 100	120
		NEW TL19W01-LH2(T32	350	400	1.33	–40 to 100	–40 to 100	120

*2: Pulse width = 10 ms, duty = 1/10

*Allowable Forward Current vs. Ambient Temperature

I_F –T_a



The junction-to-ambient thermal resistance, Rth(j-a), should be kept below 50˚C/W so that the device is not exposed to a condition beyond the absolute maximum ratings.

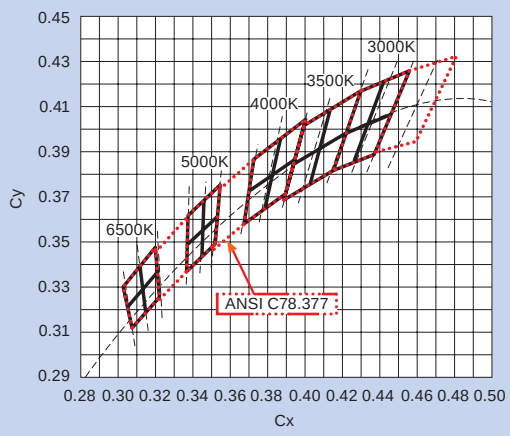
▶Electrical and Optical Characteristics

@Ta = 25˚C, I_F = 300mA

Series Name	Type	Part Number	Color Temperature (K)	Luminous Flux (lm)	Available F bins #	Cx/Cy	Ra	Forward Voltage (V)	Forward Current (DC) (mA)
TL19W01 Series (InGaN)	High efficiency	NEW TL19W01-D(T32	6500	110	B09/B10/B11/B12	0.313/0.329	65	3.3	300
		NEW TL19W01-N(T32	5000	120	B10/B11/B12/B13	0.345/0.355	65	3.3	300
		NEW TL19W01-W(T32	4000	110	B09/B10/B11/B12	0.382/0.380	65	3.3	300
		NEW TL19W01-WW(T32	3500	100	B08/B09/B10/B11	0.407/0.392	65	3.3	300
		NEW TL19W01-L(T32	3000	100	B08/B09/B10/B11	0.434/0.403	70	3.3	300
	Medium color rendering (Ra85)	NEW TL19W01-NH1(T32	5000	95	B07/B08/B09/B10/B11	0.345/0.355	85	3.3	300
		NEW TL19W01-WH1(T32	4000	90	B07/B08/B09/B10	0.382/0.380	85	3.3	300
		NEW TL19W01-WWH1(32	3500	85	B06/B07/B08/B09/B10	0.407/0.392	85	3.3	300
		NEW TL19W01-LH1(T32	3000	85	B06/B07/B08/B09/B10	0.434/0.403	85	3.3	300
	High color rendering (Ra92)	NEW TL19W01-NH2(T32	5000	90	B07/B08/B09/B10	0.345/0.355	92	3.3	300
		NEW TL19W01-LH2(T32	3000	80	B06/B07/B08/B09	0.434/0.403	92	3.3	300

#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

▶Chromaticity Ranks



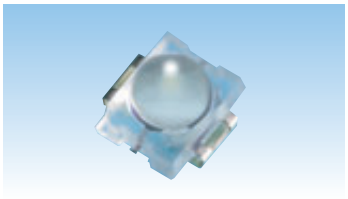
For board design considerations, refer to the relevant technical datasheet.

3. SMD LEDs

⑨ ϕ3.6-mm Lens-top Package: TL∗M1050(T20), TL∗H1050(T20), TL∗F1050(T20), TL∗D1050(T20)

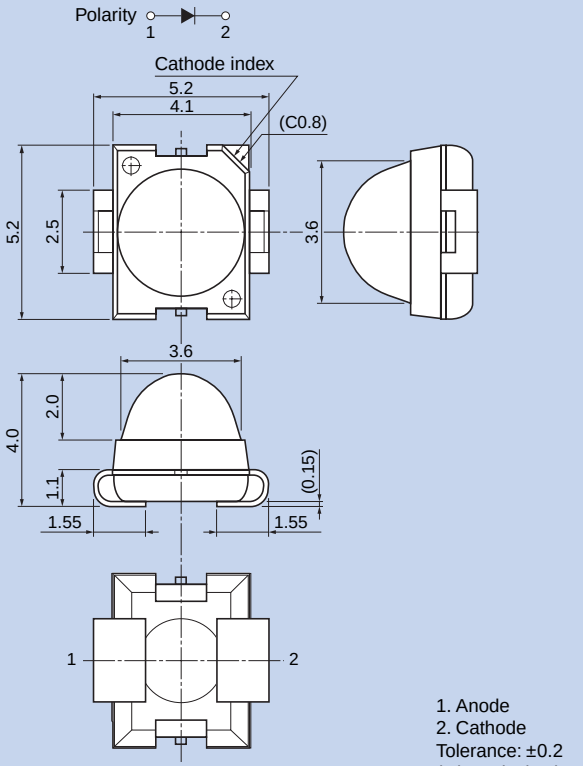
▶Features

- Package dimensions: 5.2(L) x 5.2(W) x 4.0(H) mm
  ϕ 3.6-mm round transparent lens-top
- The heat-resistant casing provides support for extended operating temperature ranges.
  • Operating temperature: Topr = −40 to 100˚C (TLBD1050: −40 to 85˚C)



▶Package Dimensions

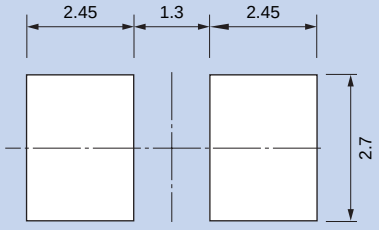
Unit: mm



1. Anode
2. Cathode
Tolerance: ±0.2
( ): Typical value

▶Land Pattern Dimensions for Reference Only

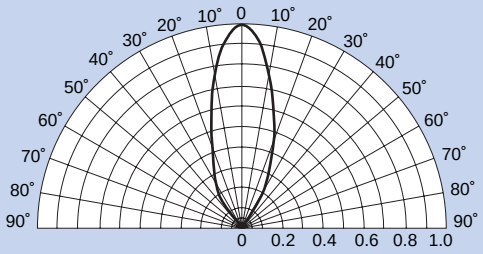
Unit: mm



▶Radiation Patterns

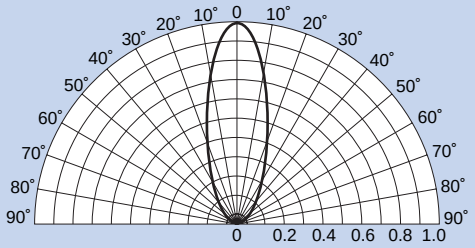
TL∗M1050

Ta = 25˚C



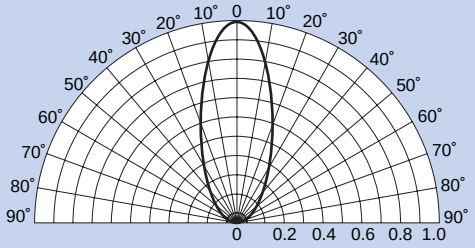
TL∗H1050, TL∗F1050

Ta = 25˚C



TL∗D1050

Ta = 25˚C



▶Tape and Reel Specifications

Designation	Units Per Reel
T20	400 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

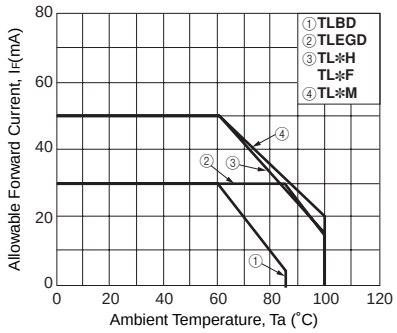
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻M1050 Series (InGaAℓP)	**TLRM1050(T20)**	50	4	135	–40 to 100	–40 to 110
	TLRMM1050(T20)	50	4	135	–40 to 100	–40 to 110
	TLSM1050(T20)	50	4	135	–40 to 100	–40 to 110
	TLOM1050(T20)	50	4	135	–40 to 100	–40 to 110
	TLYM1050(T20)	50	4	135	–40 to 100	–40 to 110
TL✻H1050 Series (InGaAℓP)	**TLRMH1050(T20)**	50	4	120	–40 to 100	–40 to 110
	TLSH1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLOH1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLYH1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLGH1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLFGH1050(T20)	50	4	120	–40 to 100	–40 to 110
TL✻F1050 Series (InGaAℓP)	**TLRMF1050(T20)**	50	4	120	–40 to 100	–40 to 110
	TLSF1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLOF1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLYF1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLGF1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLFGF1050(T20)	50	4	120	–40 to 100	–40 to 110
	TLPGF1050(T20)	50	4	120	–40 to 100	–40 to 110
TL✻D1050 Series (InGaN)	**TLEGD1050(T20)**	30	4	120	–40 to 100	–40 to 110
	TLBD1050(T20)	30	4	120	–40 to 85	–40 to 110

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 20 mA		Luminous Intensity Iv (mcd) @I_F = 20 mA		Available Iv bins #	Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			λp	λd	Min	Typ.		Typ.	Typ.
TL✻M1050 Series (InGaAℓP)	☆**TLRM1050(T20)**	Red	644	630	630	1800	VA/WA/XA	2.3	35
	☆**TLRMM1050(T20)**	Red	636	626	1000	2000	WA/XA/YA	2.3	35
	☆**TLSM1050(T20)**	Red	623	613	1600	2800	XA/YA/ZA	2.3	35
	☆**TLOM1050(T20)**	Orange	612	605	1600	3500	XA/YA/ZA	2.3	35
	☆**TLYM1050(T20)**	Yellow	592	590	1600	3000	XA/YA/ZA	2.3	35
TL✻H1050 Series (InGaAℓP)	☆**TLRMH1050(T20)**	Red	636	626	272	700	Q/R/S	2.0	30
	☆**TLSH1050(T20)**	Red	623	613	476	1400	R/S/T	2.0	30
	☆**TLOH1050(T20)**	Orange	612	605	476	1500	R/S/T	2.0	30
	☆**TLYH1050(T20)**	Yellow	590	587	476	1000	R/S	2.1	30
	☆**TLGH1050(T20)**	Green	574	571	272	600	Q/R	2.1	30
	☆**TLFGH1050(T20)**	Green	568	565	85	250	N/P/Q	2.1	30
TL✻F1050 Series (InGaAℓP)	☆**TLRMF1050(T20)**	Red	636	626	250	700	TA/UA/VA/WA	2.0	30
	☆**TLSF1050(T20)**	Red	623	613	630	1400	VA/WA/XA	2.0	30
	☆**TLOF1050(T20)**	Orange	612	605	630	1500	VA/WA/XA	2.0	30
	☆**TLYF1050(T20)**	Yellow	590	587	630	1000	VA/WA/XA	2.1	30
	☆**TLGF1050(T20)**	Green	574	571	400	900	UA/VA/WA	2.2	30
	☆**TLFGF1050(T20)**	Green	568	565	160	370	SA/TA/UA	2.3	30
	☆**TLPGF1050(T20)**	Pure green	562	558	100	180	RA/SA/TA	2.3	30
TL✻D1050 Series (InGaN)	☆**TLEGD1050(T20)**	Green	518	528	476	1300	R/S/T	3.3	40
	☆**TLBD1050(T20)**	Blue	468	470	153	400	P/Q/R	3.3	40

☆: Dry-packed

#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

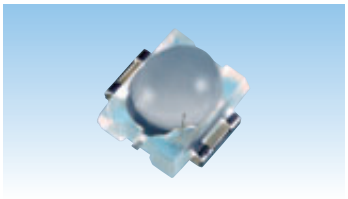
For board design considerations, refer to the relevant technical datasheet.

3. SMD LEDs

⑩ 3.6 x 4.4 mm Oval Lens-top Package: TL∗M1052(T20), TL∗H1052(T20), TL∗F1052(T20), TL∗D1052(T20)

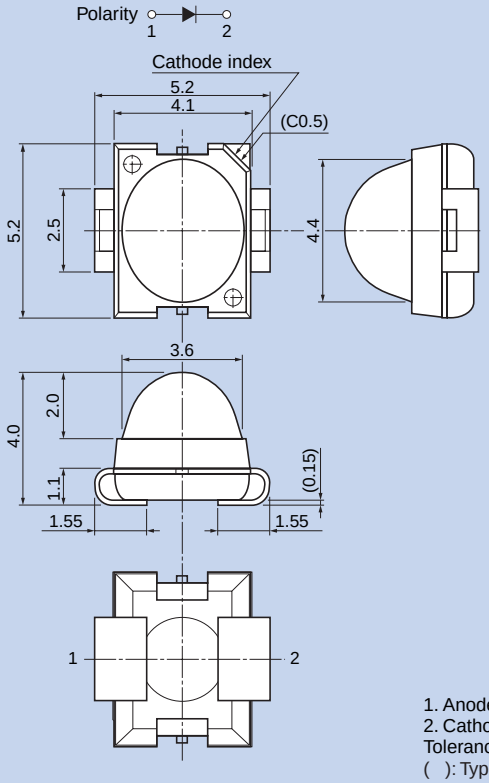
▶Features

- Package dimensions: 5.2(L) x 5.2(W) x 4.0(H) mm
  ϕ 3.6 × 4.4 mm oval transparent lens-top
- The heat-resistant casing provides support for extended operating temperature ranges.
  • Operating temperature: Topr = −40 to 100˚C (TLBD1052: −40 to 85˚C)



▶Package Dimensions

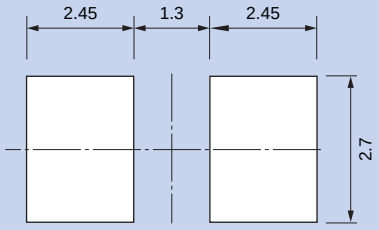
Unit: mm



1. Anode
2. Cathode
Tolerance: ±0.2
( ): Typical value

▶Land Pattern Dimensions for Reference Only

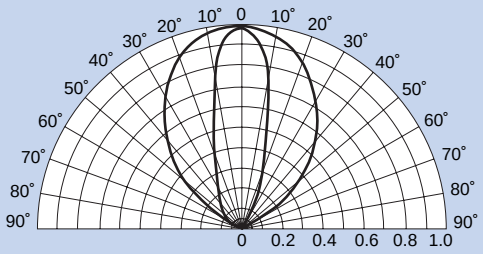
Unit: mm



▶Radiation Patterns

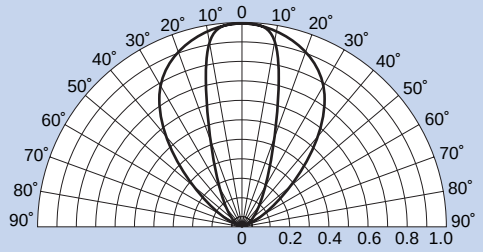
TL∗M1052

Ta = 25˚C



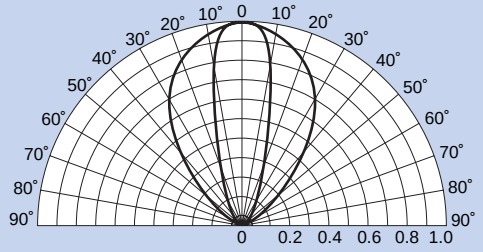
TL∗H1052, TL∗F1052

Ta = 25˚C



TL∗D1052

Ta = 25˚C



▶Tape and Reel Specifications

Designation	Units Per Reel
T20	400 pcs/reel

* See pages 48 and 49 for the reel and tape dimensions.

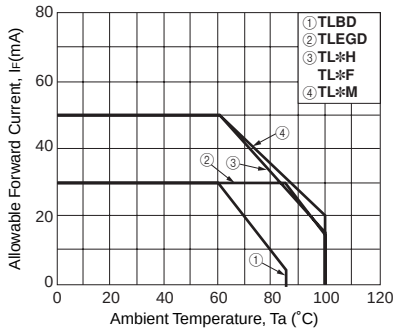
For board design considerations, refer to the relevant technical datasheet.

▶Absolute Maximum Ratings (Ta = 25˚C)

Series Name	Part Number	Forward Current (DC) I_F (mA)(*)	Reverse Voltage V_R (V)	Power Dissipation P_D (mW)	Operating Temperature T_{opr} (˚C)	Storage Temperature T_{stg} (˚C)
TL✻M1052 Series (InGaAℓP)	**TLRM1052(T20)**	50	4	135	–40 to 100	–40 to 110
	TLRMM1052(T20)	50	4	135	–40 to 100	–40 to 110
	TLSM1052(T20)	50	4	135	–40 to 100	–40 to 110
	TLOM1052(T20)	50	4	135	–40 to 100	–40 to 110
	TLYM1052(T20)	50	4	135	–40 to 100	–40 to 110
TL✻H1052 Series (InGaAℓP)	**TLRMH1052(T20)**	50	4	120	–40 to 100	–40 to 110
	TLSH1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLOH1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLYH1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLGH1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLFGH1052(T20)	50	4	120	–40 to 100	–40 to 110
TL✻F1052 Series (InGaAℓP)	**TLRMF1052(T20)**	50	4	120	–40 to 100	–40 to 110
	TLSF1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLOF1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLYF1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLGF1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLFGF1052(T20)	50	4	120	–40 to 100	–40 to 110
	TLPGF1052(T20)	50	4	120	–40 to 100	–40 to 110
TL✻D1052 Series (InGaN)	**TLEGD1052(T20)**	30	4	120	–40 to 100	–40 to 110
	TLBD1052(T20)	30	4	120	–40 to 85	–40 to 110

* Allowable Forward Current vs. Ambient Temperature

I_F –T_a



▶Electrical and Optical Characteristics

@Ta = 25˚C

Series Name	Part Number	Color	Typical Emission Wavelength (nm) @I_F = 20 mA		Luminous Intensity I_V (mcd) @I_F = 20 mA			Available I_V bins #	Forward Voltage V_F (V) @I_F = 20 mA	Viewing Angle 2θ1/2 (˚)
			λp	λd	Min	Typ.	Max		Typ.	Typ.
TL✻M1052 Series (InGaAℓP)	☆**TLRM1052(T20)**	Red	644	630	630	1200	3200	VA/WA/XA	2.3	30/85
	☆**TLRMM1052(T20)**	Red	636	626	630	1300	3200	VA/WA/XA	2.3	30/85
	☆**TLSM1052(T20)**	Red	623	613	1000	1900	5000	WA/XA/YA	2.3	30/85
	☆**TLOM1052(T20)**	Orange	612	605	1000	2200	5000	WA/XA/YA	2.3	30/85
	☆**TLYM1052(T20)**	Yellow	592	590	1000	1900	5000	WA/XA/YA	2.3	30/85
TL✻H1052 Series (InGaAℓP)	☆**TLRMH1052(T20)**	Red	636	626	153	450	1290	P/Q/R	2.0	30/85
	☆**TLSH1052(T20)**	Red	623	613	272	900	2300	Q/R/S	2.0	30/85
	☆**TLOH1052(T20)**	Orange	612	605	476	1000	2300	R/S	2.0	30/85
	☆**TLYH1052(T20)**	Yellow	590	587	272	750	2300	Q/R/S	2.1	30/85
	☆**TLGH1052(T20)**	Green	574	571	153	400	1290	P/Q/R	2.1	30/85
	☆**TLFGH1052(T20)**	Green	568	565	85	190	736	N/P/Q	2.1	30/85
TL✻F1052 Series (InGaAℓP)	☆**TLRMF1052(T20)**	Red	636	626	160	450	800	SA/TA/UA	2.0	30/85
	☆**TLSF1052(T20)**	Red	623	613	400	900	2000	UA/VA/WA	2.0	30/85
	☆**TLOF1052(T20)**	Orange	612	605	400	1000	2000	UA/VA/WA	2.0	30/85
	☆**TLYF1052(T20)**	Yellow	590	587	250	750	2000	TA/UA/VA/WA	2.1	30/85
	☆**TLGF1052(T20)**	Green	574	571	250	600	1250	TA/UA/VA	2.2	30/85
	☆**TLFGF1052(T20)**	Green	568	565	100	280	800	RA/SA/TA/UA	2.3	30/85
	☆**TLPGF1052(T20)**	Pure green	562	558	63	140	320	QA/RA/SA	2.3	30/85
TL✻D1052 Series (InGaN)	☆**TLEGD1052(T20)**	Green	518	528	272	850	2300	Q/R/S	3.3	30/75
	☆**TLBD1052(T20)**	Blue	468	470	85	300	736	N/P/Q	3.3	30/75

☆: Dry-packed

#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

For board design considerations, refer to the relevant technical datasheet.

NOTE

4. Through-Hole LEDs

❶ Electrical and Optical Characteristics

Toshiba offers a number of high-brightness LED series using Four-Element (InGaAℓP) chips and optimum lenses. You can select an appropriate product for your application.

Series Name	Absolute Maximum Ratings					Electrical / Optical Characteristics				
	DC forward current I_F (mA)	DC reverse voltage V_R (V)	Power dissipation P_D (mW)	Operating temperature T_{opr} (°C)	Storage temperature T_{stg} (°C)	Forward voltage V_F (V)			Dominant Wavelength, λd (nm)	
						typ.	max	I_F (mA)	typ.	I_F (mA)
TLRH Series	50	4	120	–40 to 100	–40 to 120	1.9	2.4	20	630	20
TLRE Series	50	4	120	–40 to 100	–40 to 120	1.9	2.4	20	630	20
TLRMK Series	50	4	130	–40 to 100	–40 to 120	2.15	2.5	20	626	20
TLRMH Series	50	4	120	–40 to 100	–40 to 120	1.9	2.4	20	626	20
TLRME Series	50	4	120	–40 to 100	–40 to 120	1.9	2.4	20	626	20
TLSH Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	613	20
TLSE Series	50	4	120	–40 to 100	–40 to 120	1.9	2.4	20	613	20
TLOH Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	605	20
TLOE Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	605	20
TLYK Series	50	4	130	–40 to 100	–40 to 120	2.25	2.5	20	590	20
TLYH Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	587	20
TLYE Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	587	20
TLPYE Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	580	20
TLGE Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	571	20
TLGU Series	30	4	72	–40 to 100	–40 to 120	2.1	2.4	20	571	20
TLFGE Series	50	4	120	–40 to 100	–40 to 120	2.0	2.4	20	565	20
TLPGE Series	50	4	120	–40 to 100	–40 to 120	2.1	2.4	20	558	20
TLPGU Series	30	4	72	–40 to 100	–40 to 120	2.1	2.4	20	558	20
TLRMHGH Series	50 (Total)	4	120	–40 to 100	–40 to 120	1.95	2.4	20	626	20
						2.05	2.4		571	

* For board design consideration, refer to the relevant technical datasheet.

❷ Package Selection Guide

Package Size	Viewing Angle	Part Number
ϕ5	5°	23TP
	7°	20TP, 20CP
	12°	38TP
	18°	19TP, 19CP
	20°	17TP, 17CP
	23°	37TP
	25°	16TP, 16CP, 17DP
	30°	18TP, 18CP, 30TP, 16TAP
	33°	30TP *TL✻H Series
	40°	30MP
	45°	13CP
	55°	13DP
	75°	25TP
	130°	11TP
Arched, 5 x 2.5	10°	33TP, 33CP

Package Size	Viewing Angle	Part Number
Oval, 5 x 5.8	30°/50°	27C
	40°/70°	27T
Oval, 4.3 x 5	80°/50°	28C
	70°/50°	28C *TL✻H Series
ϕ3	10°	50T *TL✻U Series
	16°	50T, 50C
	40°	53T, 53C *TL✻U Series
	45°	53T
	50°	53D
	80°	62T, 68TG, 68CG
	100°	68DG
	120°	60T

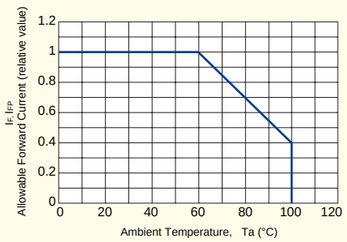
* For details, refer to the product lists on pages 34 to 43.

4. Through-Hole LEDs

③ High-Brightness Red LED Lamps

@Ta = 25˚C

Series Name	Package Size (mm)	Viewing Angle 2θ1/2	Luminous Intensity, Iv (mcd) @IF = 20 mA		Available bins #	Part Number	Typical Emission Wavelength @IF = 20 mA		Lens Color	Absolute Maximum Ratings		Package Reference Number	Applications
			Min	Typ.			λd (nm)	λp (nm)		Operating temperature	DC forward current, IF (mA)		
TL✻K Series (InGaAℓP)	ϕ5	23˚	1530	5600	T/U/V	**TLRMK37TP(F)**	626	636	Transparent	✻1	50	ϕ5-13	Pilot lamps (narrow range)
		30˚	1530	5400	T/U/V	**TLRMK16TAP(F)**	626	636	Transparent	✻1	50	ϕ5-3	Message boards, Backlighting
TL✻H Series (InGaAℓP)	ϕ5	7˚	4760	11000	V/W/X	**TLSH20TP(F)**	613	623	Transparent	✻1	50	ϕ5-1	Pilot lamps (narrow range)
			2720	9000	U/V/W	**TLRMH20TP(F)**	626	636	Transparent	✻1	50	ϕ5-1	
		12˚	2720	6500	U/V/W	**TLSH38TP(F)**	613	623	Transparent	✻1	50	ϕ5-4	
			1530	4800	T/U/V	**TLRMH38TP(F)**	626	636	Transparent	✻1	50	ϕ5-4	
		20˚	1530	4500	T/U/V	**TLSH17TP(F)**	613	623	Transparent	✻1	50	ϕ5-2	Message boards, Backlighting
			850	3200	S/T/U	**TLRMH17TP(F)**	626	636	Transparent	✻1	50	ϕ5-2	
			850	2000	S/T/U	**TLRH17TP(F)**	630	644	Transparent	✻1	50	ϕ5-2	Pilot lamps (narrow range)
		25˚	850	1900	S/T/U	**TLSH16TP(F)**	613	623	Transparent	✻1	50	ϕ5-3	Message boards, Backlighting
			476	1500	R/S/T	**TLSH16CP(F)**	613	623	Red transparent	✻1	50	ϕ5-3	
			476	1500	R/S/T	**TLRMH16TP(F)**	626	636	Transparent	✻1	50	ϕ5-3	
			476	1300	R/S/T	**TLRMH16CP(F)**	626	636	Red transparent	✻1	50	ϕ5-3	
		33˚	476	1300	R/S/T	**TLSH30TP(F)**	613	623	Transparent	✻1	50	ϕ5-14	
			476	950	R/S/T	**TLRMH30TP(F)**	626	636	Transparent	✻1	50	ϕ5-14	
			272	680	Q/R/S	**TLRH30TP(F)**	630	644	Transparent	✻1	50	ϕ5-14	
		40˚	272	600	Q/R/S	**TLRMH30MP(F)**	624	634	Milky white diffused	✻1	50	ϕ5-14	
	ϕ3	16˚	2720	4700	U/V/W	**TLSH50T(F)**	613	623	Transparent	✻1	50	ϕ3-3	Pilot lamps
			850	2000	S/T/U	**TLRH50T(F)**	630	644	Transparent	✻1	50	ϕ3-3	
		80˚	47.6	180	M/N/P	**TLRH62T(F)**	630	644	Transparent	✻1	50	ϕ3-2	Backlighting (wide range)
	Oval, 5 x 5.8	40˚/ 70˚	153	450	P/Q/R	**TLRH27T(F)**	630	644	Transparent	✻1	50	Oval-1	Message boards
TL✻E Series (InGaAℓP)	ϕ5	7˚	4760	12000	V/W/X	**TLRME20CP(F)**	626	636	Red transparent	✻1	50	ϕ5-1	Message boards, Backlighting
			2720	9000	U/V/W	**TLSE20TP(F)**	613	623	Transparent	✻1	50	ϕ5-1	
			2720	8000	U/V/W	**TLRME20TP(F)**	626	636	Transparent	✻1	50	ϕ5-1	
			2720	7000	U/V/W	**TLRE20TP(F)**	630	644	Transparent	✻1	50	ϕ5-1	
		20˚	850	3000	S/T/U	**TLSE17TP(F)**	613	623	Transparent	✻1	50	ϕ5-2	Backlighting (wide range)
			850	2400	S/T/U	**TLRME17TP(F)**	626	636	Transparent	✻1	50	ϕ5-2	
			476	1500	R/S/T	**TLRE17TP(F)**	630	644	Transparent	✻1	50	ϕ5-2	
		25˚	476	1500	R/S/T	**TLSE16TP(F)**	613	623	Transparent	✻1	50	ϕ5-3	
			476	1000	R/S/T	**TLSE16CP(F)**	613	623	Red transparent	✻1	50	ϕ5-3	
			272	1200	Q/R/S	**TLRME16TP(F)**	626	636	Transparent	✻1	50	ϕ5-3	
			272	800	Q/R/S	**TLRE16TP(F)**	630	644	Transparent	✻1	50	ϕ5-3	
			272	800	Q/R/S	**TLRME16CP(F)**	626	636	Red transparent	✻1	50	ϕ5-3	
			153	600	P/Q/R	**TLRE16CP(F)**	630	644	Red transparent	✻1	50	ϕ5-3	
			153	500	P/Q/R	**TLRME17DP(F)**	626	636	Red diffused	✻1	50	ϕ5-2	
		30˚	272	1000	Q/R/S	**TLSE30TP(F)**	613	623	Transparent	✻1	50	ϕ5-14	Message boards, Backlighting
			153	600	P/Q/R	**TLRE30TP(F)**	630	644	Transparent	✻1	50	ϕ5-14	
		75˚	47.6	150	M/N/P	**TLRE25TP(F)**	630	644	Transparent	✻1	50	ϕ5-6	Pilot lamps
		130˚	8.5	20	J/K/L	**TLRE11TP(F)**	630	644	Transparent	✻1	50	ϕ5-7	

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	–40 to 100˚C
Storage Temperature	–40 to 120˚C

* For board design considerations, refer to the relevant technical datasheet.
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

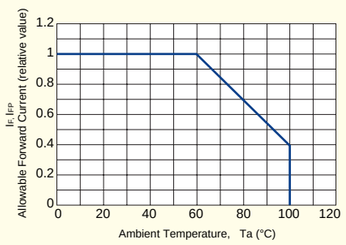
4. Through-Hole LEDs

❸ High-Brightness Red LED Lamps (continued)

@Ta = 25˚C

Series Name	Package Size (mm)	Viewing Angle 2θ1/2	Luminous Intensity, Iv (mcd) @IF = 20 mA		Available bins #	Part Number	Typical Emission Wavelength @IF = 20 mA		Lens Color	Absolute Maximum Ratings		Package Reference Number	Applications
			Min	Typ.			λd (nm)	λp (nm)		Operating temperature	DC forward current, IF (mA)		
TL✻E Series (InGaAℓP)	ϕ3	16˚	1530	3500	T/U/V	**TLRME50C(F)**	626	636	Red transparent	✻1	50	ϕ3-3	Pilot lamps
			1530	3500	T/U/V	**TLSE50T(F)**	613	623	Transparent	✻1	50	ϕ3-3	
			850	2500	S/T/U	**TLRME50T(F)**	626	636	Transparent	✻1	50	ϕ3-3	
			850	2200	S/T/U	**TLRE50T(F)**	630	644	Transparent	✻1	50	ϕ3-3	
		45˚	272	800	Q/R/S	**TLSE53T(F)**	613	623	Transparent	✻1	50	ϕ3-4	
			272	600	Q/R/S	**TLRME53T(F)**	626	636	Transparent	✻1	50	ϕ3-4	
			153	400	P/Q/R	**TLRE53T(F)**	630	644	Transparent	✻1	50	ϕ3-4	
		80˚	85	330	N/P/Q	◆ **TLRME68TG(F)**	626	636	Transparent	✻1	50	ϕ3-5	Backlighting (wide range)
			85	260	N/P/Q	◆ **TLRME68CG(F)**	626	636	Red transparent	✻1	50	ϕ3-5	
			85	200	N/P/Q	**TLSE62T(F)**	613	623	Transparent	✻1	50	ϕ3-2	
			47.6	180	M/N/P	**TLRME62T(F)**	626	636	Transparent	✻1	50	ϕ3-2	
			47.6	120	M/N/P	**TLRE62T(F)**	630	644	Transparent	✻1	50	ϕ3-2	
		100˚	47.6	140	M/N/P	◆ **TLRME68DG(F)**	626	636	Red diffused	✻1	50	ϕ3-5	
		120˚	15.3	45	K/L/M	**TLRE60T(F)**	630	644	Transparent	✻1	50	ϕ3-1	
	Oval, 5 x 5.8	30˚/ 50˚	272	750	Q/R/S	**TLSE27C(F)**	613	623	Red transparent	✻1	50	Oval-1	Message boards
			153	400	P/Q/R	**TLRME27C(F)**	626	636	Red transparent	✻1	50	Oval-1	
			85	300	N/P/Q	**TLRE27C(F)**	630	644	Red transparent	✻1	50	Oval-1	
	Oval, 4.3 x 5	80˚/ 50˚	85	200	N/P/Q	**TLRE28C(F)**	630	644	Red transparent	✻1	50	Oval-2	Message boards
			85	200	N/P/Q	**TLRME28C(F)**	626	636	Red transparent	✻1	50	Oval-2	
			85	300	N/P/Q	**TLSE28C(F)**	613	623	Red transparent	✻1	50	Oval-2	

◆: Designed for flush mounting.
* For board design considerations, refer to the relevant technical datasheet.
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

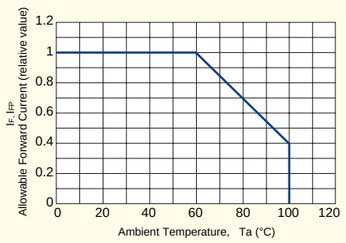
Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	–40 to 100˚C
Storage Temperature	–40 to 120˚C

❹ High-Brightness Orange LED Lamps

@Ta = 25˚C

Series Name	Package Size (mm)	Viewing Angle 2θ1/2	Luminous Intensity, Iv (mcd) @IF = 20 mA		Available bins #	Part Number	Typical Emission Wavelength @IF = 20 mA		Lens Color	Absolute Maximum Ratings		Package Reference Number	Applications
			Min	Typ.			λd (nm)	λp (nm)		Operating temperature	DC forward current, IF (mA)		
TL✻H Series (InGaAℓP)	ϕ5	7˚	4760	15000	V/W/X	**TLOH20TP(F)**	605	612	Transparent	✻2	50	ϕ5-1	Pilot lamps (narrow range)
		12˚	2720	7500	U/V/W	**TLOH38TP(F)**	605	612	Transparent	✻2	50	ϕ5-4	
		20˚	1530	5000	T/U/V	**TLOH17TP(F)**	605	612	Transparent	✻2	50	ϕ5-2	
		25˚	850	2300	S/T/U	**TLOH16TP(F)**	605	612	Transparent	✻2	50	ϕ5-3	Message boards, Backlighting
			850	2100	S/T/U	**TLOH16CP(F)**	605	612	Orange transparent	✻2	50	ϕ5-3	
		33˚	476	1600	R/S/T	**TLOH30TP(F)**	605	612	Transparent	✻2	50	ϕ5-14	
	ϕ3	16˚	1530	5800	T/U/V	**TLOH50T(F)**	605	612	Transparent	✻2	50	ϕ3-3	Pilot lamps
		80˚	153	550	P/Q/R	**TLOH62T(F)**	605	612	Transparent	✻2	50	ϕ3-2	Backlighting (wide range)
TL✻E Series (InGaAℓP)	ϕ5	7˚	4760	10000	V/W/X	**TLOE20TP(F)**	605	612	Transparent	✻2	50	ϕ5-1	Pilot lamps (narrow range)
		20˚	1530	4500	T/U/V	**TLOE17TP(F)**	605	612	Transparent	✻2	50	ϕ5-2	
			1530	3500	T/U/V	**TLOE17CP(F)**	605	612	Orange transparent	✻2	50	ϕ5-2	
		25˚	850	2000	S/T/U	**TLOE16TP(F)**	605	612	Transparent	✻2	50	ϕ5-3	Message boards, Backlighting
			476	1600	R/S/T	**TLOE16CP(F)**	605	612	Orange transparent	✻2	50	ϕ5-3	
		30˚	476	1400	R/S/T	**TLOE30TP(F)**	605	612	Transparent	✻2	50	ϕ5-14	
		75˚	153	350	P/Q/R	**TLOE25TP(F)**	605	612	Transparent	✻2	50	ϕ5-6	Backlighting (wide range)
		130˚	27.2	65	L/M/N	**TLOE11TP(F)**	605	612	Transparent	✻2	50	ϕ5-7	
	ϕ3	16˚	2720	7000	U/V/W	**TLOE50C(F)**	605	612	Orange transparent	✻2	50	ϕ3-3	Pilot lamps
			1530	4500	T/U/V	**TLOE50T(F)**	605	612	Transparent	✻2	50	ϕ3-3	
		45˚	272	1000	Q/R/S	**TLOE53T(F)**	605	612	Transparent	✻2	50	ϕ3-4	Backlighting (wide range)
		80˚	153	350	P/Q/R	**TLOE62T(F)**	605	612	Transparent	✻2	50	ϕ3-2	
		120˚	27.2	100	L/M/N	**TLOE60T(F)**	605	612	Transparent	✻2	50	ϕ3-1	
	Oval, 5 x 5.8	30˚/ 50˚	272	800	L/M/N	**TLOE27C(F)**	605	612	Orange transparent	✻2	50	Oval-1	Message boards
	Oval, 4.3 x 5	80˚/ 50˚	153	500	P/Q/R	**TLOE28C(F)**	605	612	Orange transparent	✻2	50	Oval-2	
	Arched, 5 x 2.5	10˚	1530	4000	T/U/V	**TLOE33CP(F)**	605	612	Orange transparent	✻2	50	Arched-1	Backlighting

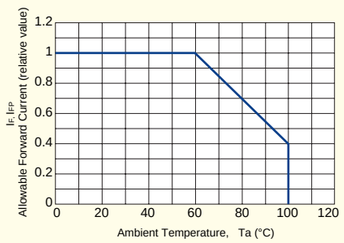
* For board design considerations, refer to the relevant technical datasheet.
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

Characteristics	✻2
Forward Current Derating Curve	
Operating Temperature	–40 to 100˚C
Storage Temperature	–40 to 120˚C

⑤ High-Brightness Yellow LED Lamps

@Ta = 25˚C

Series Name	Package Size (mm)	Viewing Angle 2θ1/2	Luminous Intensity, Iv (mcd) @IF = 20 mA		Available bins #	Part Number	Typical Emission Wavelength @IF = 20 mA		Lens Color	Absolute Maximum Ratings		Package Reference Number	Applications
			Min	Typ.			λd (nm)	λp (nm)		Operating temperature	DC forward current, IF (mA)		
TL✻K Series (InGaAℓP)	ϕ5	23˚	2720	6800	U/V/W	**TLYK37TP(F)**	590	594	Transparent	✻1	50	ϕ5-13	Pilot lamps (narrow range)
		30˚	2720	5900	U/V/W	**TLYK16TAP(F)**	590	594	Transparent	✻1	50	ϕ5-3	Message boards, backlighting
TL✻H Series (InGaAℓP)	ϕ5	7˚	4760	13000	V/W/X	**TLYH20TP(F)**	587	590	Transparent	✻1	50	ϕ5-1	Pilot lamps (narrow range)
		12˚	2720	7000	U/V/W	**TLYH38TP(F)**	587	590	Transparent	✻1	50	ϕ5-4	
		20˚	1530	4800	T/U/V	**TLYH17TP(F)**	587	590	Transparent	✻1	50	ϕ5-2	
		25˚	850	2200	S/T/U	**TLYH16TP(F)**	587	590	Transparent	✻1	50	ϕ5-3	Message boards Backlighting
			850	2000	S/T/U	**TLYH16CP(F)**	587	590	Yellow transparent	✻1	50	ϕ5-3	
		33˚	476	1350	R/S/T	**TLYH30TP(F)**	587	590	Transparent	✻1	50	ϕ5-14	
	ϕ3	16˚	1530	4400	T/U/V	**TLYH50T(F)**	587	590	Transparent	✻1	50	ϕ3-3	Pilot lamps
		80˚	272	520	Q/R/S	◆ **TLYH68TG(F)**	587	590	Transparent	✻1	50	ϕ3-5	Backlighting (wide range)
			153	400	P/Q/R	**TLYH62T(F)**	587	590	Transparent	✻1	50	ϕ3-2	
	Oval, 5 x 5.8	40˚/ 70˚	272	900	Q/R/S	**TLYH27T(F)**	587	590	Transparent	✻1	50	Oval-1	Message boards
	Oval, 4.3 x 5	70˚/ 50˚	272	750	Q/R/S	**TLYH28C(F)**	587	590	Yellow transparent	✻1	50	Oval-2	
TL✻E Series (InGaAℓP)	ϕ5	5˚	2720	8000	U/V/W	**TLPYE23TP(F)**	580	583	Transparent	✻1	50	ϕ5-9	Pilot lamps (narrow range)
		7˚	2720	9500	U/V/W	**TLYE20TP(F)**	587	590	Transparent	✻1	50	ϕ5-1	
		18˚	476	2000	R/S/T	**TLPYE19TP(F)**	580	583	Transparent	✻1	50	ϕ5-10	
		20˚	850	3000	S/T/U	**TLYE17CP(F)**	587	590	Yellow transparent	✻1	50	ϕ5-2	
			850	3000	S/T/U	**TLYE17TP(F)**	587	590	Transparent	✻1	50	ϕ5-2	
		25˚	476	1500	R/S/T	**TLYE16TP(F)**	587	590	Transparent	✻1	50	ϕ5-3	Message boards Backlighting
			476	1200	R/S/T	**TLYE16CP(F)**	587	590	Yellow transparent	✻1	50	ϕ5-3	
		30˚	476	1300	R/S/T	**TLYE30TP(F)**	587	590	Transparent	✻1	50	ϕ5-14	
			272	750	Q/R/S	**TLPYE18TP(F)**	580	583	Transparent	✻1	50	ϕ5-11	
		75˚	85	300	N/P/Q	**TLYE25TP(F)**	587	590	Transparent	✻1	50	ϕ5-6	Backlighting (wide range)
		130˚	15.3	45	K/L/M	**TLYE11TP(F)**	587	590	Transparent	✻1	50	ϕ5-7	
	ϕ3	16˚	1530	3500	T/U/V	**TLYE50C(F)**	587	590	Yellow transparent	✻1	50	ϕ3-3	Pilot lamps
			1530	3500	T/U/V	**TLYE50T(F)**	587	590	Transparent	✻1	50	ϕ3-3	
			850	2500	S/T/U	**TLPYE50T(F)**	580	583	Transparent	✻1	50	ϕ3-3	
		45˚	272	800	Q/R/S	**TLYE53T(F)**	587	590	Transparent	✻1	50	ϕ3-4	
			153	450	P/Q/R	**TLPYE53T(F)**	580	583	Transparent	✻1	50	ϕ3-4	
		80˚	85	340	N/P/Q	◆ **TLYE68TG(F)**	587	590	Transparent	✻1	50	ϕ3-5	Backlighting (wide range)
			85	300	N/P/Q	◆ **TLYE68CG(F)**	587	590	Yellow transparent	✻1	50	ϕ3-5	
			85	250	N/P/Q	**TLYE62T(F)**	587	590	Transparent	✻1	50	ϕ3-2	
			47.6	150	M/N/P	**TLPYE62T(F)**	580	583	Transparent	✻1	50	ϕ3-2	
		100˚	47.6	150	M/N/P	◆ **TLYE68DG(F)**	587	590	Yellow diffused	✻1	50	ϕ3-5	
		120˚	27.2	85	L/M/N	**TLYE60T(F)**	587	590	Transparent	✻1	50	ϕ3-1	
	Oval, 5 x 5.8	30˚/ 50˚	272	650	L/M/N	**TLYE27C(F)**	587	590	Yellow transparent	✻1	50	Oval-1	Message boards
	Oval, 4.3 x 5	80˚/ 50˚	153	350	P/Q/R	**TLYE28C(F)**	587	590	Yellow transparent	✻1	50	Oval-2	
	Arched, 5 x 2.5	10˚	476	1400	R/S/T	**TLPYE33CP(F)**	580	583	Yellow transparent	✻1	50	Arched-1	Backlighting
			1530	3500	T/U/V	**TLYE33CP(F)**	587	590	Yellow transparent	✻1	50	Arched-1	

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	–40 to 100˚C
Storage Temperature	–40 to 120˚C

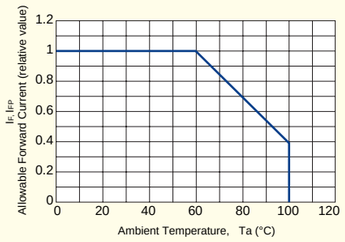
◆: Designed for flush mounting.
* For board design considerations, refer to the relevant technical datasheet.
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

4. Through-Hole LEDs

⑥ High-Brightness Green LED Lamps

@Ta = 25˚C

Series Name	Package Size (mm)	Viewing Angle 2θ1/2	Luminous Intensity, Iv (mcd) @IF = 20 mA		Available bins #	Part Number	Typical Emission Wavelength @IF = 20 mA		Lens Color	Absolute Maximum Ratings		Package Reference Number	Applications
			Min	Typ.			λd (nm)	λp (nm)		Operating temperature	DC forward current, IF (mA)		
TL✻H Series (InGaAℓP)	Oval, 4.3 x 5	70˚/ 50˚	47.6	170	M/N/P	**TLGH28C(F)**	571	574	Green transparent	✻1	50	Oval-2	Message boards
TL✻E Series (InGaAℓP)	ϕ5	5˚	2720	7000	U/V/W	**TLGE23TP(F)**	571	574	Transparent	✻1	50	ϕ5-9	Pilot lamps (narrow range)
			1530	5000	T/U/V	**TLFGE23TP(F)**	565	568	Transparent	✻1	50	ϕ5-9	
			850	3000	S/T/U	**TLPGE23TP(F)**	558	562	Transparent	✻1	50	ϕ5-9	
		18˚	476	1300	R/S/T	**TLGE19TP(F)**	571	574	Transparent	✻1	50	ϕ5-10	
			476	1100	R/S/T	**TLGE19CP(F)**	571	574	Green transparent	✻1	50	ϕ5-10	
			272	800	Q/R/S	**TLFGE19TP(F)**	565	568	Transparent	✻1	50	ϕ5-10	
			272	800	Q/R/S	**TLFGE19CP(F)**	565	568	Green transparent	✻1	50	ϕ5-10	
			153	500	P/Q/R	**TLPGE19TP(F)**	558	562	Transparent	✻1	50	ϕ5-10	
		30˚	85	300	N/P/Q	**TLFGE18TP(F)**	565	568	Transparent	✻1	50	ϕ5-11	Message boards Backlighting
			272	700	Q/R/S	**TLGE18TP(F)**	571	574	Transparent	✻1	50	ϕ5-11	
			153	500	P/Q/R	**TLGE18CP(F)**	571	574	Green transparent	✻1	50	ϕ5-11	
			85	200	N/P/Q	**TLPGE18TP(F)**	558	562	Transparent	✻1	50	ϕ5-11	
		75˚	27.2	90	L/M/N	**TLGE25TP(F)**	571	574	Transparent	✻1	50	ϕ5-6	
		130˚	8.5	20	J/K/L	**TLGE11TP(F)**	571	574	Transparent	✻1	50	ϕ5-7	
			2.72	8	G/H/J	**TLPGE11TP(F)**	558	562	Transparent	✻1	50	ϕ5-7	
	ϕ3	16˚	476	1500	R/S/T	**TLGE50T(F)**	571	574	Transparent	✻1	50	ϕ3-3	Pilot lamps
			272	1000	Q/R/S	**TLFGE50T(F)**	565	568	Transparent	✻1	50	ϕ3-3	
			272	1000	Q/R/S	**TLFGE50C(F)**	565	568	Green transparent	✻1	50	ϕ3-3	
			153	600	P/Q/R	**TLPGE50T(F)**	558	562	Transparent	✻1	50	ϕ3-3	
		45˚	153	400	P/Q/R	**TLGE53T(F)**	571	574	Transparent	✻1	50	ϕ3-4	
			85	200	N/P/Q	**TLFGE53T(F)**	565	568	Transparent	✻1	50	ϕ3-4	
			47.6	130	M/N/P	**TLPGE53T(F)**	558	562	Transparent	✻1	50	ϕ3-4	
		80˚	47.6	155	M/N/P	◆ **TLGE68TG(F)**	571	574	Transparent	✻1	50	ϕ3-5	Backlighting (wide range)
			47.6	110	M/N/P	◆ **TLGE68CG(F)**	571	574	Green transparent	✻1	50	ϕ3-5	
			47.6	110	M/N/P	**TLGE62T(F)**	571	574	Transparent	✻1	50	ϕ3-2	
			27.2	70	L/M/N	◆ **TLFGE68CG(F)**	565	568	Green transparent	✻1	50	ϕ3-5	
			27.2	70	L/M/N	**TLFGE62T(F)**	565	568	Transparent	✻1	50	ϕ3-2	
			15.3	45	K/L/M	**TLPGE62T(F)**	558	562	Transparent	✻1	50	ϕ3-2	
		100˚	15.3	45	K/L/M	◆ **TLGE68DG(F)**	571	574	Green diffused	✻1	50	ϕ3-5	
			15.3	30	K/L/M	◆ **TLFGE68DG(F)**	565	568	Green diffused	✻1	50	ϕ3-5	
		120˚	15.3	50	K/L/M	**TLGE60T(F)**	571	574	Transparent	✻1	50	ϕ3-1	
	Oval, 5 x 5.8	30˚/ 50˚	85	250	N/P/Q	**TLGE27C(F)**	571	574	Green transparent	✻1	50	Oval-1	Message boards
	Oval, 4.3 x 5	80˚/ 50˚	47.6	150	M/N/P	**TLGE28C(F)**	571	574	Green transparent	✻1	50	Oval-2	
	Arched, 5 x 2.5	10˚	153	400	P/Q/R	**TLFGE33CP(F)**	565	568	Green transparent	✻1	50	Arched-1	Backlighting
			272	800	Q/R/P	**TLGE33CP(F)**	571	574	Green transparent	✻1	50	Arched-1	
			476	1300	R/S/T	**TLGE33TP(F)**	571	574	Transparent	✻1	50	Arched-1	

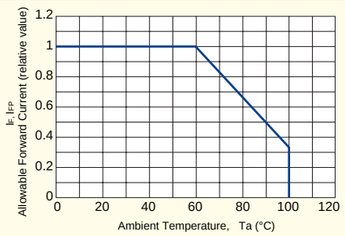
Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	–40 to 100˚C
Storage Temperature	–40 to 120˚C

◆: Designed for flush mounting.
✻ For board design considerations, refer to the relevant technical datasheet.
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

⑥ High-Brightness Green LED Lamps (continued)

@Ta = 25˚C

Series Name	Package Size (mm)	Viewing Angle 2θ1/2	Luminous Intensity, Iv (mcd) @IF = 20 mA		Available bins #	Part Number	Typical Emission Wavelength @IF = 20 mA		Lens Color	Absolute Maximum Ratings		Package Reference Number	Applications
			Min	Typ.			λd (nm)	λp (nm)		Operating temperature	DC forward current, IF (mA)		
TL✻U Series (InGaAℓP)	ϕ5	5˚	1530	4000	T/U/V	**TLGU23TP(F)**	571	574	Transparent	✻1	30	ϕ5-9	Pilot lamps (narrow range)
			476	1600	R/S/T	**TLPGU23TP(F)**	558	562	Transparent	✻1	30	ϕ5-9	
		30˚	85	200	N/P/Q	**TLGU18TP(F)**	571	574	Transparent	✻1	30	ϕ5-11	Message boards Backlighting
			27.2	90	L/M/N	**TLPGU18TP(F)**	558	562	Transparent	✻1	30	ϕ5-11	
			47.6	180	M/N/P	**TLGU18CP(F)**	571	574	Green transparent	✻1	30	ϕ5-11	
		45˚	47.6	120	M/N/P	**TLGU13CP(F)**	571	574	Green transparent	✻1	30	ϕ5-5	
			27.2	80	L/M/N	**TLPGU13CP(F)**	558	562	Green transparent	✻1	30	ϕ5-5	
		55˚	27.2	70	L/M/N	**TLGU13DP(F)**	571	574	Green diffused	✻1	30	ϕ5-5	
			15.3	35	K/L/M	**TLPGU13DP(F)**	558	562	Green diffused	✻1	30	ϕ5-5	
	ϕ3	10˚	476	1200	R/S/T	**TLGU50T(F)**	571	574	Transparent	✻1	30	ϕ3-3	Pilot lamps
			153	450	P/Q/R	**TLPGU50T(F)**	558	562	Transparent	✻1	30	ϕ3-3	
		40˚	47.6	170	M/N/P	**TLGU53T(F)**	571	574	Transparent	✻1	30	ϕ3-4	
			27.2	80	L/M/N	**TLPGU53T(F)**	558	562	Transparent	✻1	30	ϕ3-4	
			47.6	150	M/N/P	**TLGU53C(F)**	571	574	Green transparent	✻1	30	ϕ3-4	
			27.2	70	L/M/N	**TLPGU53C(F)**	558	562	Green transparent	✻1	30	ϕ3-4	
		50˚	27.2	80	L/M/N	**TLGU53D(F)**	571	574	Green diffused	✻1	30	ϕ3-4	Pilot lamps (narrow range)
			15.3	40	K/L/M	**TLPGU53D(F)**	558	562	Green diffused	✻1	30	ϕ3-4	
		80˚	27.2	70	L/M/N	**TLGU62T(F)**	571	574	Transparent	✻1	30	ϕ3-2	
			8.5	25	J/K/L	**TLPGU62T(F)**	558	562	Transparent	✻1	30	ϕ3-2	

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	–40 to 100˚C
Storage Temperature	–40 to 120˚C

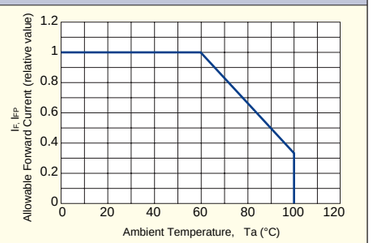
* For board design considerations, refer to the relevant technical datasheet.
#: For the available luminous intensity bins, contact your nearest Toshiba sales representative.

⑦ High-Brightness Dual-Color LED Lamps

@Ta = 25˚C

Series Name	Package Size (mm)	Viewing Angle 2θ1/2	Color	Luminous Intensity, Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength @IF = 20 mA		Lens Color	Absolute Maximum Ratings		Package Reference Number	Applications
				Min	Typ.		λd (nm)	λp (nm)		Operating temperature	DC forward current, IF (mA)		
TL✻H Series (InGaAℓP)	ϕ5	30˚/35˚	Red	476	1100	**TLRMHGH48T(F)**	626	636	Transparent	✻2	50✲	ϕ5-12	Message boards
			Green	272	500		571	574					
	ϕ5	40˚/50˚	Red	272	450	**TLRMHGH48M(F)**	626	636	White diffused	✻2	50✲	ϕ5-12	
			Green	153	220		571	574					

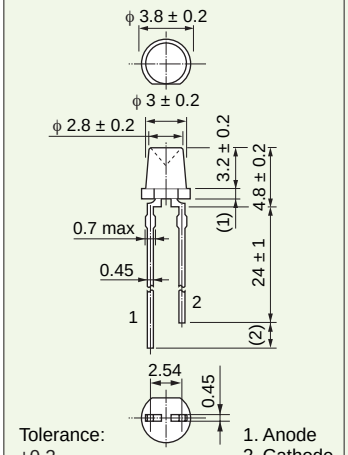
* For board design considerations, refer to the relevant technical datasheet.
✲ When turning on two elements simultaneously, the total current should be kept below the rated value.

Characteristics	✻3
Forward Current Derating Curve	
Operating Temperature	–40 to 100˚C
Storage Temperature	–40 to 120˚C

4. Through-Hole LEDs

8 Package Dimensions

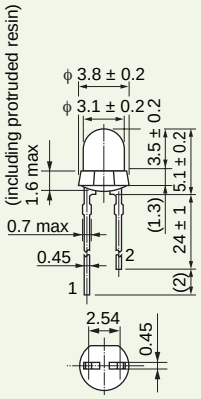
ϕ 3-1



Tolerance: ±0.2

1. Anode
2. Cathode

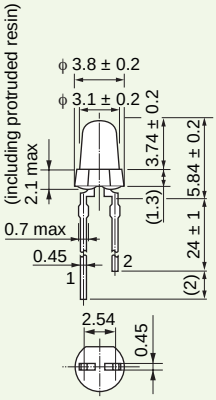
ϕ 3-2



Tolerance: ±0.2

1. Anode
2. Cathode

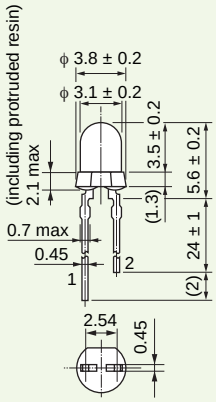
ϕ 3-3



Tolerance: ±0.2

1. Anode
2. Cathode

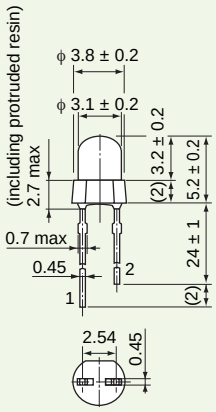
ϕ 3-4



Tolerance: ±0.2

1. Anode
2. Cathode

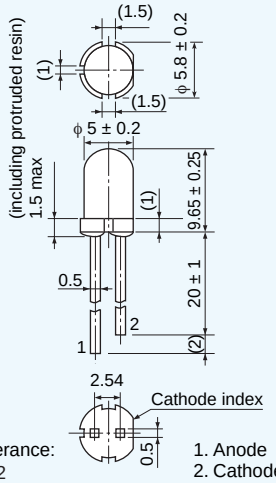
ϕ 3-5



Tolerance: ±0.2

1. Anode
2. Cathode

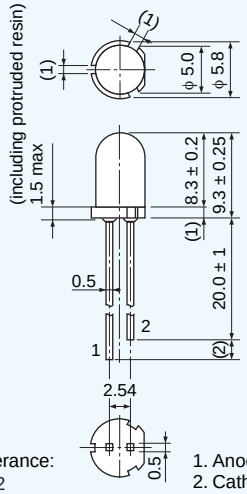
ϕ 5-1



Tolerance: ±0.2

1. Anode
2. Cathode

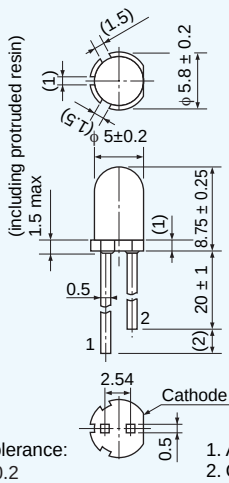
ϕ 5-2



Tolerance: ±0.2

1. Anode
2. Cathode

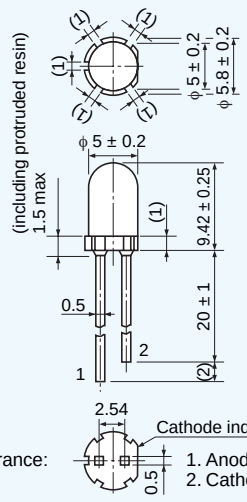
ϕ 5-3



Tolerance: ±0.2

1. Anode
2. Cathode

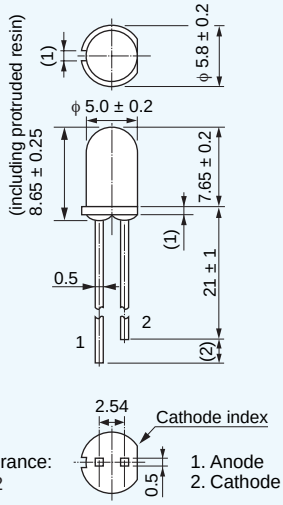
ϕ 5-4



Tolerance: ±0.2

1. Anode
2. Cathode

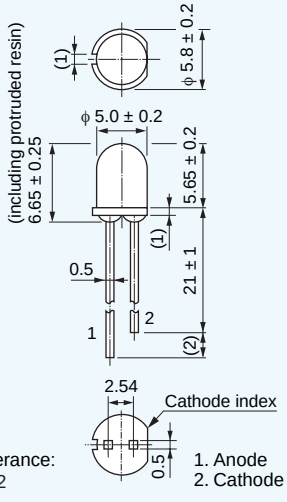
ϕ 5-5



Tolerance: ±0.2

1. Anode
2. Cathode

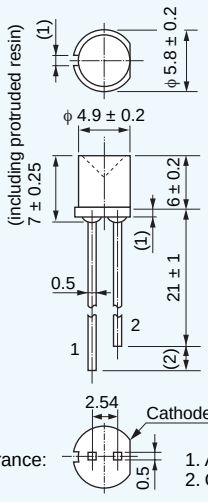
ϕ 5-6



Tolerance: ±0.2

1. Anode
2. Cathode

ϕ 5-7



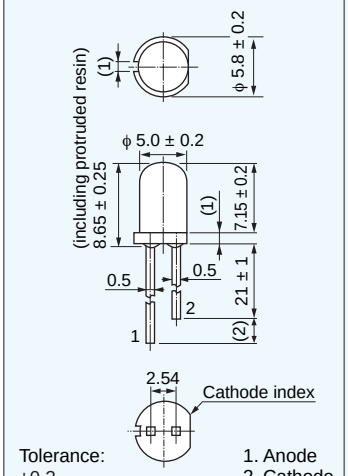
Tolerance: ±0.2

1. Anode
2. Cathode

* Values in parentheses are for reference only. * For board design considerations, refer to the relevant technical datasheet.

Unit: mm

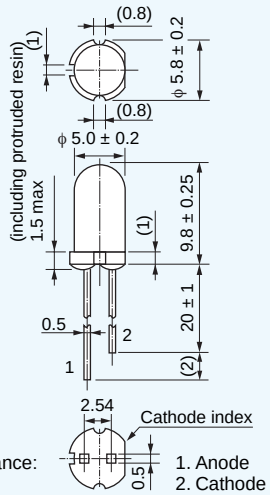
ϕ 5-8



Tolerance: ±0.2

1. Anode
2. Cathode

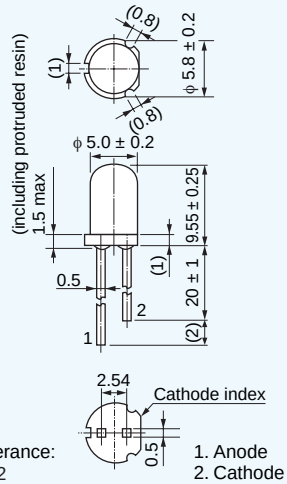
ϕ 5-9



Tolerance: ±0.2

1. Anode
2. Cathode

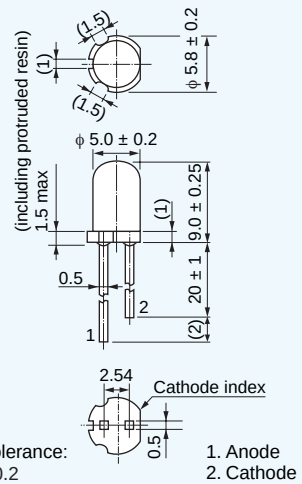
ϕ 5-10



Tolerance: ±0.2

1. Anode
2. Cathode

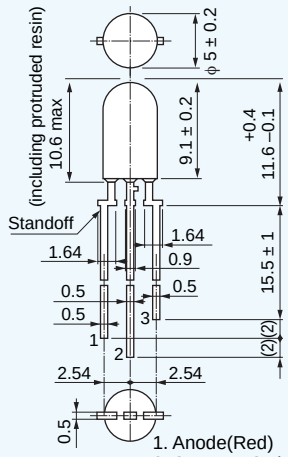
ϕ 5-11



Tolerance: ±0.2

1. Anode
2. Cathode

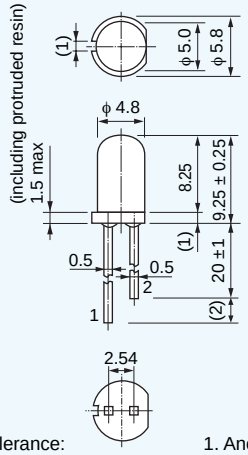
ϕ 5-12



Tolerance: ±0.2

1. Anode(Red)
2. Common Cathode
3. Anode(Green)

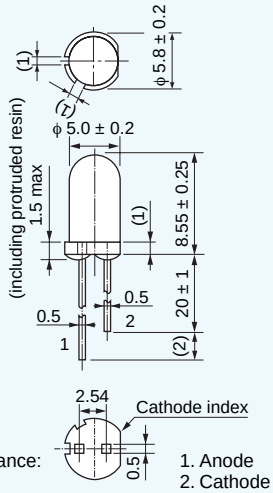
ϕ 5-13



Tolerance: ±0.2

1. Anode
2. Cathode

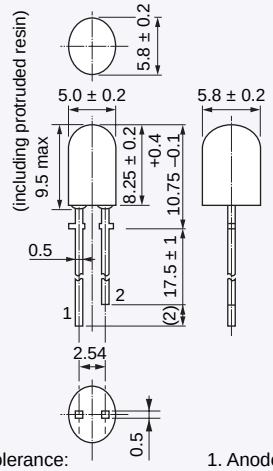
ϕ 5-14



Tolerance: ±0.2

1. Anode
2. Cathode

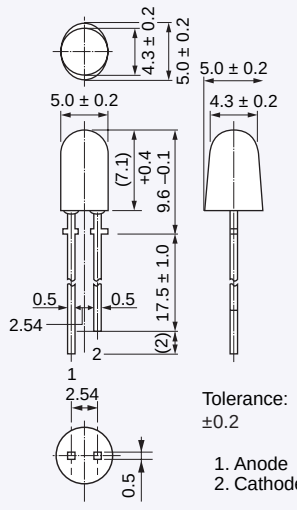
Oval-1



Tolerance: ±0.2

1. Anode
2. Cathode

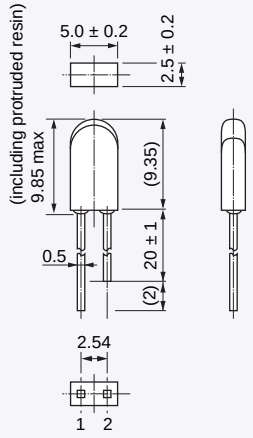
Oval-2



Tolerance: ±0.2

1. Anode
2. Cathode

Arched-1



Tolerance: ±0.2

1. Anode
2. Cathode

5. Packing Specifications

1 Through-Hole LEDs

Tape Packing

Designed for ø3-mm round, ø5-mm round and oval through-hole LED lamps
Available in tape and reel (spaced on 2.54- or 5-mm centers) suitable for automatic pick-and-place assembly
Available in both ammo pack and tape & reel

▶Part Number Format

Example:

TLRE16TP (TPK51, F)

Part number

Tape specification

Note

Note: [[G]]/RoHS COMPATIBLE

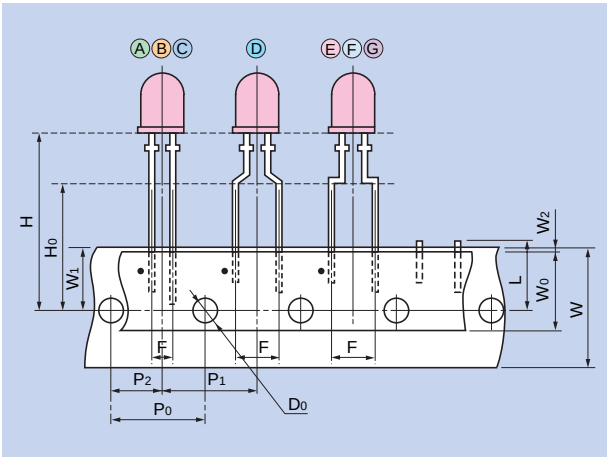
Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

▶Tape and Reel Specifications

The following table shows available taped packing options classified by packaging type, tape dimensions and lead polarity.

Tape Specifications			Device Positioning on Tape (see the left diagram below)
Reel pack		Ammo pack	
Anode first	Cathode first		
TPK1, K1	TPKR1, KR1	TPK51, K51	Ⓐ
TPK3, K3	TPKR3, KR3	TPK53, K53	Ⓑ
TPK5, K5	TPKR5, KR5	TPK55, K55	Ⓒ
TPJ1, J1	TPJR1, JR1	TPJ51, J51	Ⓓ
TPJ2, J2	TPJR2, JR2	TPJ52, J52	Ⓔ
TPJ3, J3	TPJR3, JR3	TPJ53, J53	Ⓕ
TPJ6, J6	TPJR6, JR6	TPJ56, J56	Ⓖ

▶Tape Format

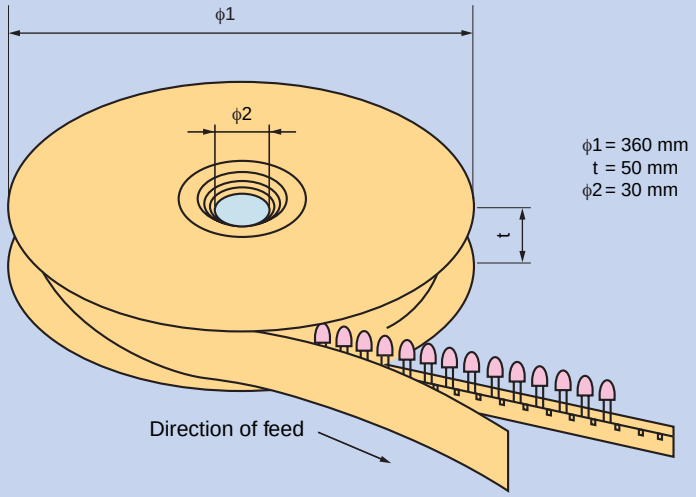


	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
H	23.35 ± 1	18.55 ± 1	17.0 ± 1	23.35 ± 1	20.5 ± 1	22.5 ± 1	23.35 ± 1
H_0	–			16.0 ± 0.5			
W	18.0 + 1 – 0.5						
W_0	6.0 ± 0.3 or 13.0 ± 0.3						
W_1	9.0 + 0.75 – 0.5						
W_2	≤ 0.5						
P_0	12.7						
P_1	12.7 ± 1 (component pitch)						
P_2	6.35 ± 1.3						
F	2.54 + 0.8 – 0.2			5.00 + 0.8 – 0.2			
L	11.0 max						
D_0	ϕ4.0 ± 0.2						

Through-hole LEDs packaged into tapes may differ in lead length described in the relevant technical datasheet.

▶Reel Pack

Reel Dimensions

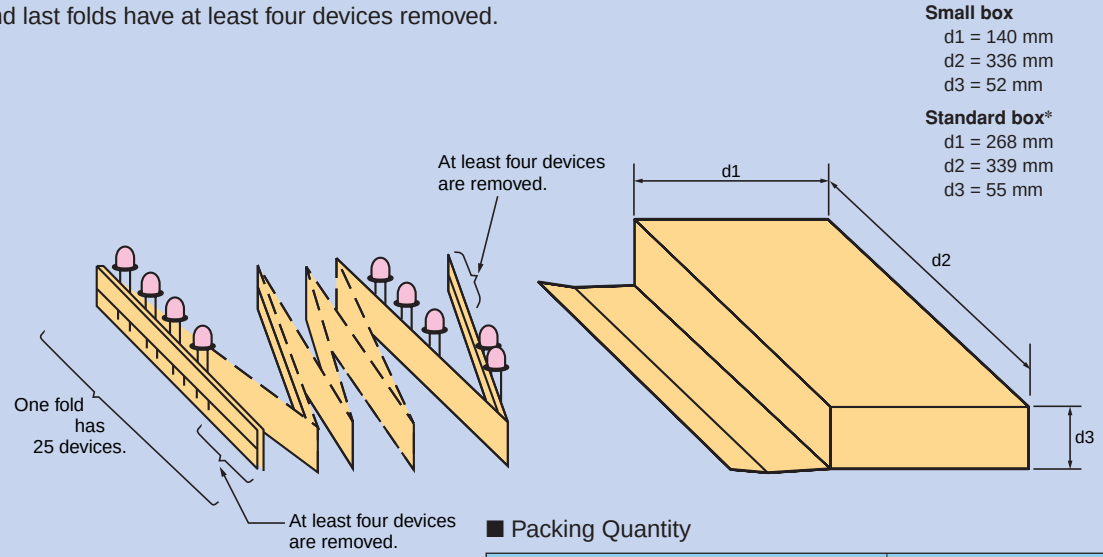


■ Packing Quantity

LED Type	Quantity Per Reel
ϕ3-mm series	2,000 pcs
ϕ5-mm and oval series	1,000 pcs

▶Ammo Pack

1. A tape is folded alternately, with 25 devices attached per fold.
2. The first and last folds have at least four devices removed.



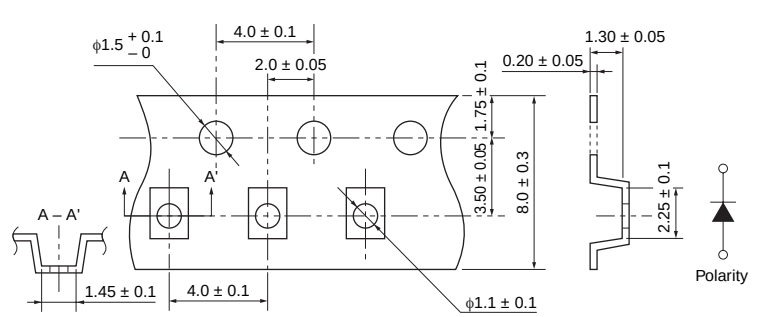
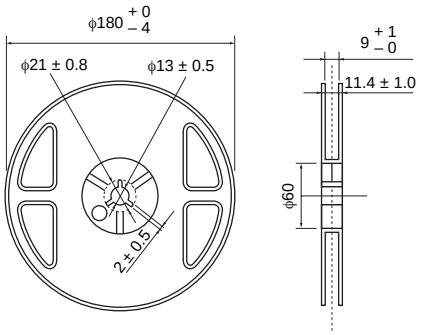
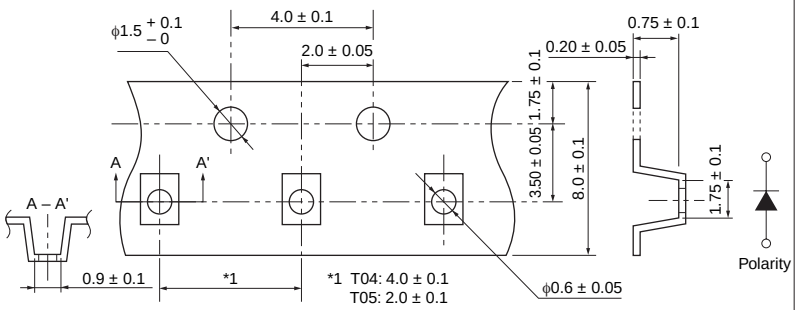
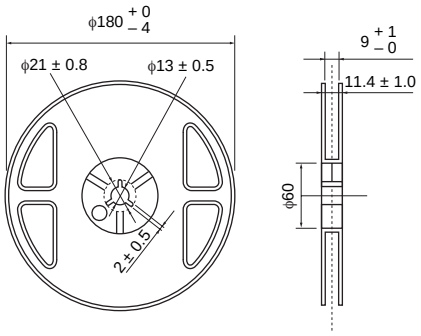
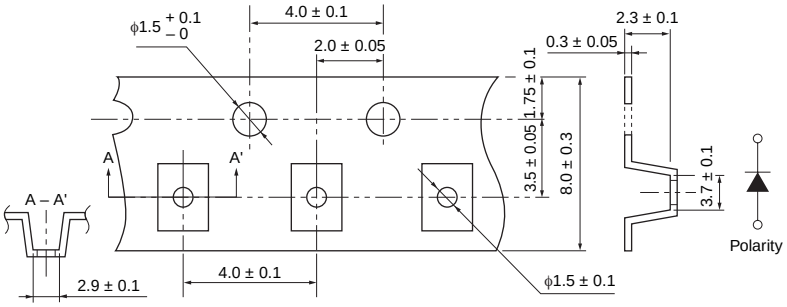
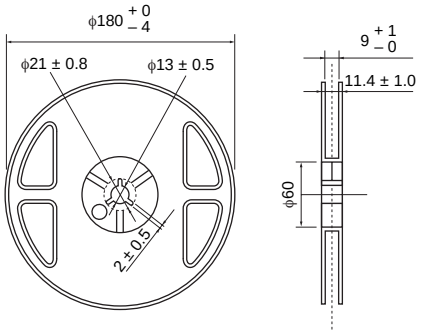
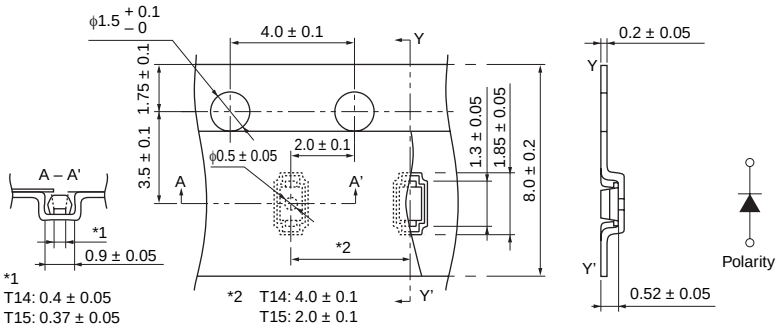
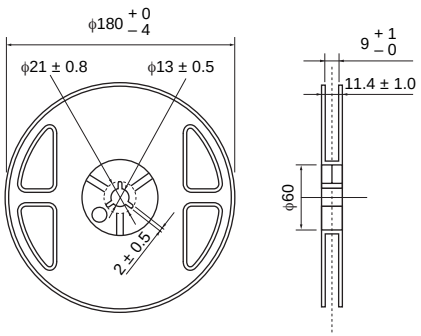
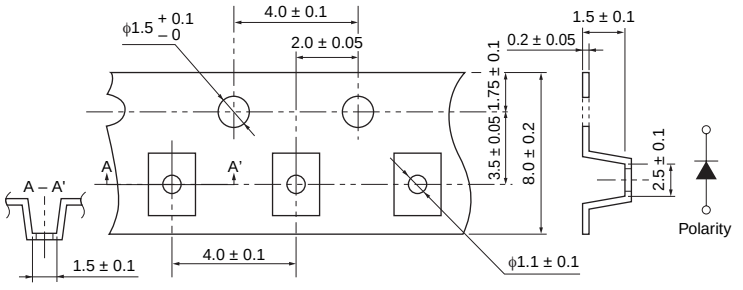
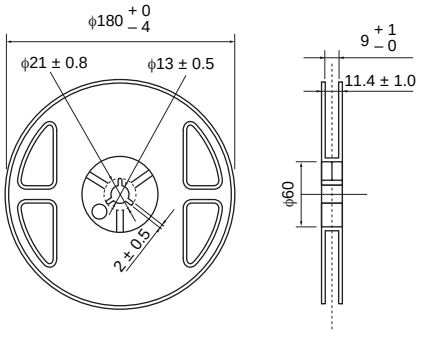
■ Packing Quantity

LED Type	Quantity Per Reel
ϕ3-mm series	2,000 or 4,000 pcs*
ϕ5-mm and oval series	1,000 or 2,000 pcs*

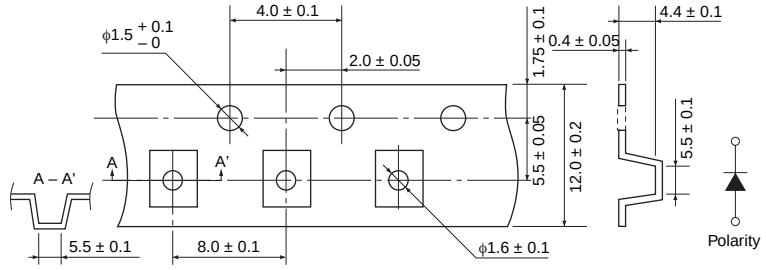
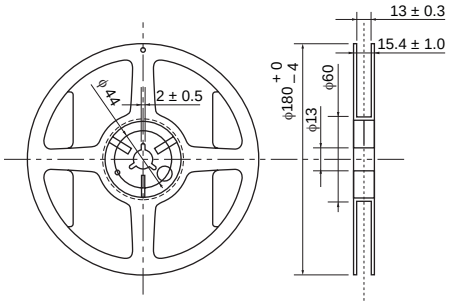
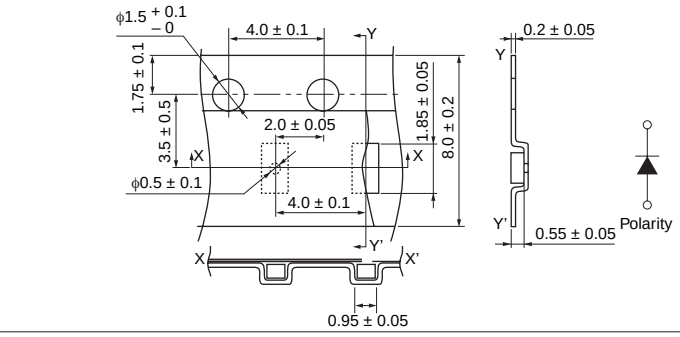
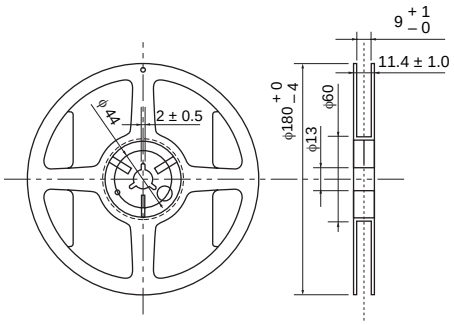
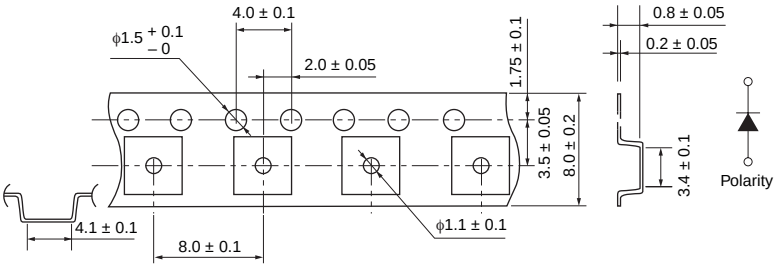
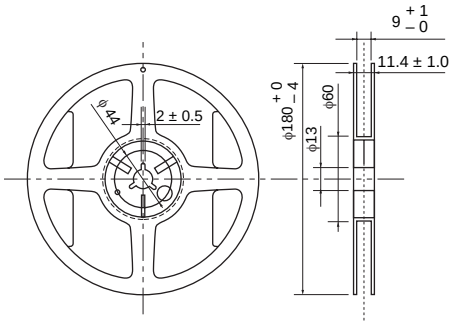
*: Typical quantity

5. Packing Specifications

2 SMD LEDs

	Tape Dimensions Unit: mm	Reel Dimensions Unit: mm
T02		
T04 T05		
T11		
T14 T15		
T18		

For board design considerations, refer to the relevant technical datasheet.

	Tape Dimensions Unit: mm	Reel Dimensions Unit: mm
T20		
T22		
T32		

For board design considerations, refer to the relevant technical datasheet.

6. Handling Precautions

1 Through-hole LEDs

1-1 Mounting on a Printed Circuit Board (PCB)

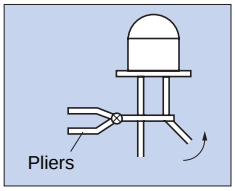
▶Soldering Conditions

Type of Soldering	Conditions	Precautions
Dip soldering	Solder temperature: 260°C max Dipping time: 3 seconds max Location: At least 2 mm away from resin body	○When the temperature of the device is rising, do not apply mechanical stress to it. ○During dip soldering, do not apply mechanical stress to the leads of a device; measures should also be taken to prevent any temperature rise in the device. ○You are advised to dissipate heat by gripping the leads with radio pliers or tweezers.
Manual soldering (using soldering iron)	Temperature at tip of iron: 300°C max Soldering iron capacity: 30 W max Soldering time: 3 seconds max Location: At least 2 mm away from resin body	

● Soldering precaution for flush-mount LEDs (with the G suffix)

Toshiba developed this type of LED for flush mounting onto through-hole double-sided PCBs. Compared with Toshiba's ø3-mm LEDs, the flush-mount LEDs are less affected by the mechanical stress that occurs during automatic mounting. However, if excessive stress is applied to the LED, the resin body may be damaged or the LED may be lose the ability to emit light. Before using the device, carefully read the precautions in the relevant technical datasheets.

1-2 Mounting Precautions



▶Lead Forming

The lead should be bent at a point at least 5 mm away from the bottom of the body resin, with the base firmly fixed by means of radio pliers. Do not apply stress to the base.

▶Mechanical Stress on Leads

If stress is applied to leads during soldering, or if excessive stress such as tension, twisting or compression is applied to leads immediately after soldering while the temperature is still high, the device may become open-circuited. To avoid this problem, the positions and directions of leads must be corrected after the device has cooled down to room temperature.

▶Cleaning

• Ultrasonic cleaning

The resin body may be degraded if ultrasonic cleaning is conducted using a solvent after soldering to remove flux, or if non-recommended chemicals are used for brushing.

Note: The amount of stress applied to a device during ultrasonic cleaning greatly varies, depending on the size of the cleaning tank, the output power of the oscillator, the size of the PCB, and the mounting method. Perform experiments under actual conditions.
Ultrasonic cleaning should normally be conducted with an ultrasonic output of 300 W or lower and should be completed within 30 seconds.
These requirements may vary according to the size of the cleaning tank and the PCB.

• Solvent

Depending on the solvent used, the resin body may be degraded. It is therefore necessary to confirm in advance that the solvent used for cleaning will not degrade the resin body. Also, the use of solvents containing freon is restricted so as to prevent destruction of the ozone layer. Before using any alternative cleaning agent, confirm that it will not degrade the resin body.

1-3 Four-Element LEDs

This type of visible LED lamp also emits some IR light. If a photodetector is located near the LED lamp, ensure that it will not be affected by this IR light.

1-4 Electrostatic Discharge

The devices with an InGaN LED chip are sensitive to electrostatic discharge. Users should follow ESD handling procedures. If excess voltage is applied, these devices may be damaged or permanently destroyed by its energy. To protect the devices from damage or degradation, it is required to implement adequate measures to eliminate or reduce ESD and voltage surges.

1-5 Applications

Since Toshiba's LED lamps are intended to be used for display lighting, the measurement standard is based on the spectral sensitivity of the human eye. It is not intended to be used for any applications other than display lighting (e.g., sensors and light communications systems.)

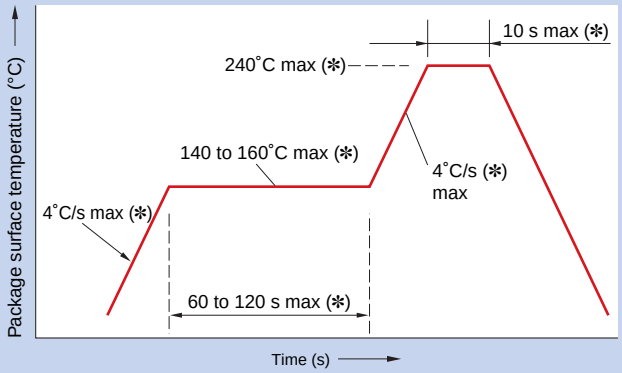
Refer to the relevant technical datasheet when using LED lamps.

② SMD LEDs

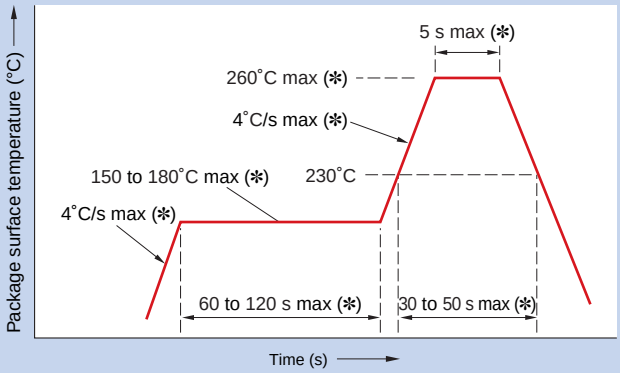
2-1 Soldering Conditions.

▶Temperature Profile (reflow soldering)

Temperature profile for Pb soldering (example)



Temperature profile for Lead(Pb)-free soldering (example)



(TL✻✻1100✻,1060,1106,1108,1109,1032,1034,1050 Series,TL19W Series)

The products are evaluated under the above reflow soldering conditions. No additional tests are performed for conditions exceeding the maximum ratings indicated. Be sure to perform reflow soldering under the above conditions.

▶Soldering Patterns

For series-specific soldering patterns.

▶Soldering Patterns

< 1002A and 1008A Series >

- The first reflow process should be performed under the above temperature profile within 168 hours after opening the bag. (Pb-free solder can not be used.)
- If a second reflow process is necessary, it should be performed within 168 hours from the first reflow under the above temperature profile. (Pb-free solder can not be used.)
- Storage conditions before the second reflow process: 30°C, 70% RH (max)
- Do not perform wave soldering.

< 1034, 1060, 1100✻ Series and TL19W Series >

- The first reflow process should be performed under the above temperature profile within 168 hours after opening the bag.
- If a second reflow process needs to be performed, it should be performed within 168 hours from the first reflow under the above temperature profile.
- Storage conditions before the second reflow process: 30°C, 60% RH (max)
- For flow soldering, contact your local Toshiba sales representative. (Flow soldering cannot be performed for the 1034, 1060, TL✻K1100C, TLW✻F1100C and TL19W Series.)

< 1032 Series >

- The first reflow process should be performed under the above temperature profile within 168 hours after opening the bag.
- If a second reflow process needs to be performed, it should be performed within 168 hours of the first reflow under the above temperature profile. Storage conditions before the second reflow process: 30°C, 70% RH (max)
- If wave soldering needs to be performed, contact your local Toshiba sales representative.

< 1050 and 1052 Series >

TL✻H1050, TL✻D1050, TL✻H1052 and TL✻D1052 Series

- The first reflow process should be performed under the above temperature profile within 72 hours after opening the bag.
- If a second reflow process needs to be performed, it should be performed within 72 hours of the first reflow under the above temperature profile. Storage conditions before the second reflow process: 5˚C to 30˚C, 70% RH (max)
- Do not perform wave soldering. (Soldering dipping is not also allowed.)

TL✻F1050, TL✻F1052, TL✻M1050 and TL✻M1052 Series

- The first reflow process should be performed under the above temperature profile within 168 hours after opening the bag.
- If a second reflow process needs to be performed, it should be performed within 168 hours of the first reflow under the above temperature profile. Storage conditions before the second reflow process: 5˚C to 30˚C, 70% RH (max)
- Do not perform wave soldering. (Soldering dipping is not also allowed.)

▶Manual Soldering

- Manual soldering with a soldering iron should meet the following conditions:
  Temperature at tip of iron: 300°C (max), 350°C (max) for the TL✻K1100C Series and the TL✻F105✻ Series
  Soldering iron capacity: 25 W
  Time: 3 seconds (max) (only once at each soldering point)
- For TL19W Series manual rework, use an electric hot plate. Don't use a solder iron. Only one repair can be tolerated per lead.

Refer to the relevant technical datasheet when using LED lamps.

6. Handling Precautions

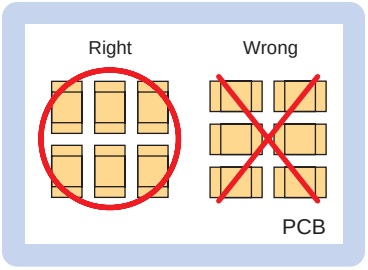
② SMD LEDs

2-2 Mounting Precautions

- Do not apply mechanical stress to the resin body at high temperature.
- The resin body is easily scratched. Avoid friction against hard materials.
- When installing an assembled board into equipment, ensure that the devices on the board do not contact with other components.
- LEDs should be mounted such that the direction of their electrodes is perpendicular to the long side of the PCB. Design the PCB to minimize any stress that will be applied to the LEDs even if the PCB warps.
- When LEDs are mounted onto a flexible PCB, ensure that there is no influence on their reliability.
- When cleaning is required after soldering, Toshiba recommends the following cleaning solvents. It is confirmed that these solvents have no effect on semiconductor devices in our dipping test (under the recommended conditions). In selecting the one for your actual usage, be sure to review your washing conditions, usage conditions and so on.

ASAHI CLEAN AK-225AES: made by Asahi Glass
KAO CLEAHROUGH 750H: made by Kao
PINE ALPHA ST-100S: made by Arakawa Chemical

Mounting example



2-3 Moisture-Proof Packing

Exposure to atmospheric moisture may affect the optical characteristics of LEDs. To avoid moisture absorption, they are packed in an aluminum envelope with a desiccant bag and a moisture indicator. Before soldering, they should be stored under the following conditions:

1. This moisture-proof bag may be stored unopened for 12 months at the following conditions:
   Temperature: 5°C to 30°C
   Humidity: 90% (max)
2. After opening the moisture-proof bag, the devices should be assembled within 168 hours in an environment of 5°C to 30°C/60% RH or below.(Refer to the relevant datasheet.)
   (The TL]H/]D1050 and TL]H/]D1052 Series should be assembled within 72 hours in an environment of 5°C to 30°C/70% RH or below.)
3. If, upon opening the moisture-proof bag, the moisture indicator card shows humidity above 30% (Color of indication changes to pink) or the expiration date has passed, the devices should be baked in tape-and-reel.
   After baking, use the baked devices within 72 hours, but perform baking only once.
   Baking conditions: 60 ± 5°C, for 12 to 24 hours.(for 24 to 48 hours for the TL*F1108,1109 and the TL19W Series)
   Expiration date: 12 months from sealing date, which is imprinted on the same side as this label affixed.
4. Repeated baking can cause the peeling strength of the taping to change, then leads to trouble in mounting. Furthermore, prevent the devices from being destructed against static electricity for baking of it.
5. If the packing material of laminate would be broken, the hermeticity would deteriorate. Therefore, do not throw or drop the packed devices.

2-4 Electrostatic Discharge

The devices with an InGaN LED chip are sensitive to electrostatic discharge. Users should follow ESD handling procedures. If excess voltage is applied, these devices may be damaged or permanently destroyed by its energy. To protect the devices from damage or degradation, it is required to implement adequate measures to eliminate or reduce ESD and voltage surges.

2-5 Applications

Since Toshiba's LED lamps are intended to be used for display lighting, the measurement standard is based on the spectral sensitivity of the human eye. It is not intended to be used for any applications other than display lighting (e.g., sensors and light communications systems.)

2-6 Four-Element LEDs

This type of visible LED lamp also emits some IR light. If a photodetector is located near the LED lamp, ensure that it will not be affected by this IR light.

Refer to the relevant technical datasheet when using LED lamps.

7. Design Considerations

▶Absolute Maximum Ratings

The absolute maximum ratings of a semiconductor device are a set of specified parameter values that must not be exceeded during operation, even for an instant. Even a single rating must not be exceeded at any moment. For the ratings of a specific device, refer to the relevant technical datasheet.

▶Recommended Operating Conditions

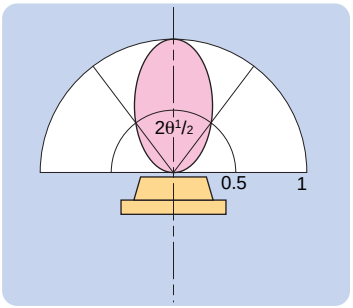
The recommended operating conditions for each device are those necessary to guarantee that the device will operate as specified in the datasheets. If greater reliability is required, the device maximum ratings should be derated for voltage, current, power and temperature. For details, refer to the relevant technical datasheets.

▶Temperature and Humidity Conditions

Compared with electromechanical components, semiconductor devices are generally highly sensitive to temperature.
Since the electrical characteristics of the device are subject to the operating temperature, circuit designers must be fully aware of its thermal characteristics and may need to derate the electrical ratings for temperature. Exposure to a condition beyond the guaranteed operating temperature may affect the electrical characteristics or result in device degradation.

▶Viewing Angle

Each LED has distinct viewing angle characteristics.
LEDs with viewing angles that best meet your requirements should be selected.
The viewing angle is based on the angle θ° between the axis on which the luminous intensity of light from the optical source is 100% and any axis on which the luminous intensity is 50%.
The angle between these two axes is referred to as the LED’ s half-angle value.
For the viewing angle of a specific LED, refer to the relevant technical datasheet.



▶Thermal Design

The failure rates of semiconductor devices greatly increase with operating temperatures. To achieve optimum reliability, observe the following precautions for thermal design:

- Keep the rise in ambient temperature (Ta) as low as possible.
- If the power dissipation of the device is relatively large, select the most appropriate circuit board material and consider using heatsinks or forced air cooling. Such measures will help lower the thermal resistance of the package.

▶Temperature Dependency

Because the recombination rate of the minority carriers in LEDs depends on temperature, the luminous intensity decreases as the temperature rises. To prevent a rise in LED’ s junction temperature due to power dissipation, Toshiba recommends pulse lighting or a thermally enhanced package. Ensure that there is no problem with the equipment.

▶Light Output Degradation

The lifetime of the LED is affected not only by the characteristics of the device, but also by the operating and environmental conditions. Therefore, when selecting LEDs and operating conditions, it is recommended to check the lifetime characteristics.
For product-specific reliability data including lifetime characteristics, contact your local Toshiba sales representative.

8. Product Index

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