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LED Lamps InGaN and Phosphor

TL2FL-DW1,L

LETERAS™

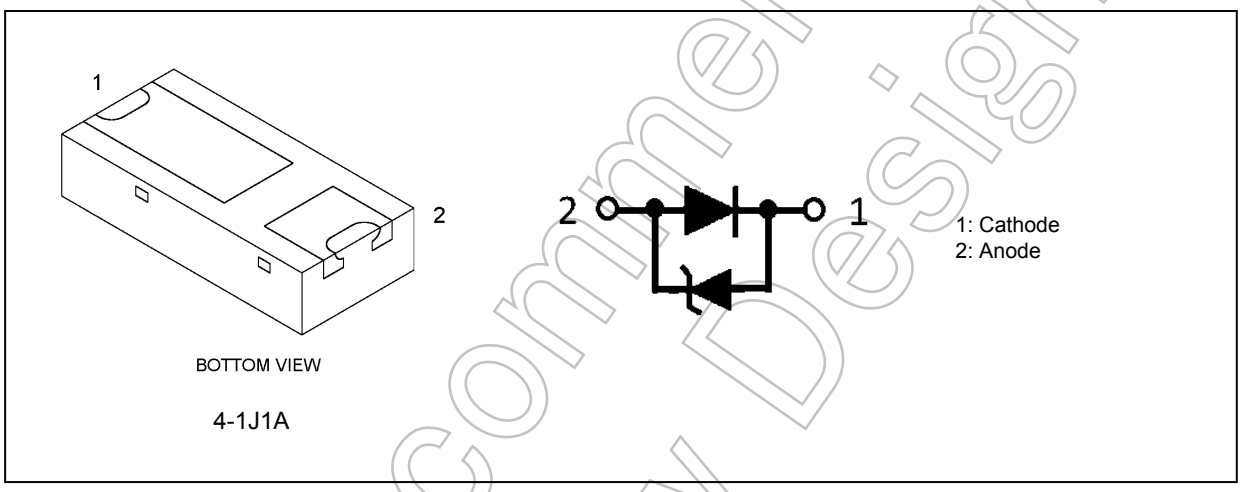
1. Applications

- General Lighting

2. Features

(1) Size: 3.0 (L) mm × 1.4 (W) mm × 0.67 (H) mm
(2) High luminous flux LED: 22.9 lm (typ.) @I_F = 65 mA
(3) Color: White (color temperature: 6500 K (typ.))
(4) Operating temperature range: T_{opr} = -40 to 100 °C
(5) Reflow-soldering is available.

3. Packaging and Pin Assignment



Start of commercial production
2014-02

2014-02-12
Rev.2.0

4. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics		Symbol	Rating	Unit
Forward current (DC)	See Fig. 4.1.	I_F	100	mA
Power dissipation		P_D	0.33	W
Operating temperature		T_{opr}	-40 to 100	°C
Storage temperature		T_{stg}	-40 to 100	
Junction temperature		T_j	125	

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

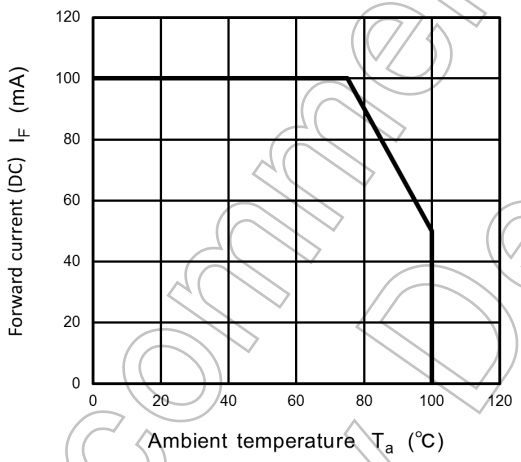


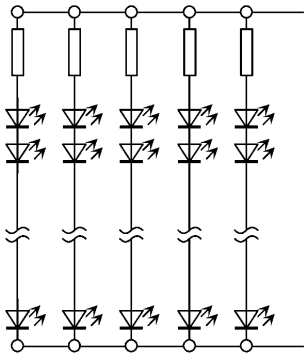
Fig. 4.1 I_F - T_a (Note 1), (Note 2)

Note 1: The junction-to-ambient thermal resistance, $R_{th(j-a)}$, should be kept below 83 °C/W so that this product is not exposed to a condition beyond the absolute maximum ratings.
$R_{th(j-a)}$: Thermal resistance from the LED junction to ambient temperature

Note 2: This LED has a relatively large (mid-range) operating power. When it is mounted in a narrow space or together with other components, they have mutual effects on their thermal characteristics; most notably, $R_{th(j-a)}$ affects their junction temperatures. Therefore, care should be exercised to thermal management and PCB selection.
If this LED operates at high temperatures, be sure to provide adequate heat dissipation by using an MCP, thermally enhanced PCB and the like, and perform thorough evaluation.

5. Handling Precautions

- This product is sensitive to electrostatic and care must be fully taken when handling products. Particularly in the case that an overvoltage shall be applied, the overflowed energy may cause damage to or possibly result in destruction of the product. Users shall take absolutely secure countermeasures against electrostatic and surge when handling the product.
- A damage to the device might create a tiny leakage path, which causes the LED lamp not to light up in the low-current region or causes a drop in the V_F rise voltage.
  Failure criterion: $I_F \geq 0.5$ mA @ $V_F = 2$ V
- If multiple LEDs are connected in parallel, they will experience variations in the forward current due to the characteristics differences in forward voltage. Ensure that the forward current of all the LEDs fall within the intended range of the system design, for example, by inserting current-limiting resistors to each LED string.



Circuit Example

- Since this product is 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.)
- Generally, GaN-based LEDs exhibit instability or significant device-to-device variations in the relative luminous flux in the low-current region. To avoid these problems, an application system should be designed in such a manner that the GaN-based LEDs are driven with a forward current of 2 mA or higher.
- When the device is used in places that are likely to be exposed to condensation, salt or corrosive gas, the effect on its performance and reliability must be thoroughly verified.
- Please note the handling of products during evaluation.
  (1) Please do not apply pressure to the upper surface of the product with finger, tweezers, and others. Failure of product to light up may occur due to package deformation, wire deformation and/or disconnection.
  (2) Should tweezers be used in product handling, one with flat surfaces is recommended.
  (3) Please handle the product widthwise.
  (4) Please do not drop the product. There is a possibility for package transformation etc. to occur when the product is dropped.
  (5) Please do not stack the printed circuit boards on which the product is mounted to prevent damages to product surface. Also, please note not to damage the surface of the product with cushioning material etc. Surface damage to the product may influence their optical characteristics.
  (6) Solder, flux, paper or heat-sensitive materials that might be deformed or discolored at high temperatures should not be left on the surface of an LED lamp.

6. Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Forward voltage See Table 6.1.	V_F		I_F = 65 mA	2.7	2.82	3.3	V
Reverse voltage	V_R		I_R = 1 mA	—	0.75	—	V
Thermal resistance (junction-to-soldering point)	$R_{th(j-s)}$	(Note 1)	I_F = 65 mA	—	30	—	°C/W

Note 1: $R_{th(j-s)}$: Thermal resistance from the LED junction to solder point.

Table 6.1 Forward Voltage Rank (Note)

Rank	Test Condition	Forward Voltage (Min)	Forward Voltage (Max)	Unit
1	I_F = 65 mA, T_a = 25 °C, Tolerance ±0.1 V	2.7	2.9	V
2		2.9	3.1	
3		3.1	3.3	

Note: This LED lamp is sorted into forward voltage (V_F) ranks shown above. Each reel includes the same rank LEDs. Let the delivery ratio of each rank be unquestioned.

7. Optical Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Chromaticity	C_x	(Note 1)	I_F = 65 mA	—	—	—	—
	C_y	(Note 1)		—	—	—	
Luminous flux	ϕ_V	(Note 2)		21.4	22.9	25.5	lm
Color temperature	CCT			—	6500	—	K
Color rendering index	Ra	(Note 3)		80	—	—	—

Note 1: See Fig. 7.1 and Table 7.1 for chromaticity rank.
Note 2: See Table 7.2 for luminous flux rank.
Note 3: Tolerance: ±2

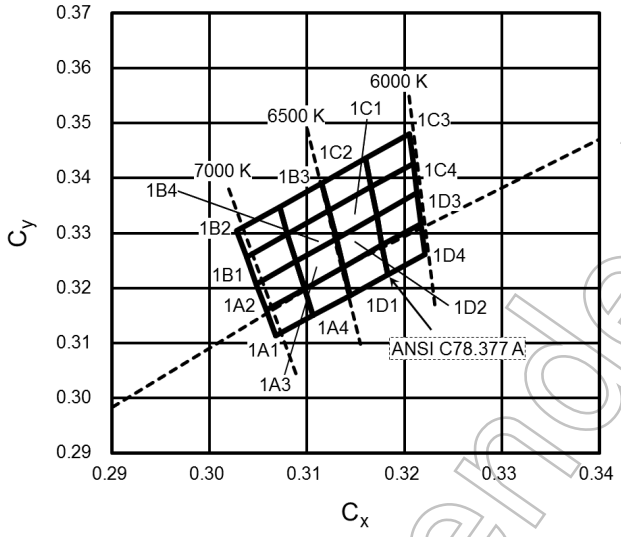


Fig. 7.1 Chromaticity Rank (Note)

Note: Test conditions: I_F = 65 mA, T_a = 25 °C, Tolerance: ±0.01

Table 7.1 Chromaticity Rank (Note)

Rank	C_x	C_y	Rank	C_x	C_y
1A1	0.3068	0.3113	1C1	0.3130	0.3290
	0.3058	0.3160		0.3123	0.3341
	0.3098	0.3199		0.3166	0.3384
	0.3106	0.3150		0.3172	0.3332
1A2	0.3058	0.3160	1C2	0.3123	0.3341
	0.3048	0.3207		0.3115	0.3391
	0.3089	0.3249		0.3160	0.3436
	0.3098	0.3199		0.3166	0.3384
1A3	0.3098	0.3199	1C3	0.3166	0.3384
	0.3089	0.3249		0.3160	0.3436
	0.3130	0.3290		0.3205	0.3481
	0.3137	0.3238		0.3209	0.3427
1A4	0.3106	0.3150	1C4	0.3172	0.3332
	0.3098	0.3199		0.3166	0.3384
	0.3137	0.3238		0.3209	0.3427
	0.3144	0.3186		0.3213	0.3373
1B1	0.3048	0.3207	1D1	0.3144	0.3186
	0.3038	0.3256		0.3137	0.3238
	0.3080	0.3298		0.3177	0.3278
	0.3089	0.3249		0.3183	0.3224
1B2	0.3038	0.3256	1D2	0.3137	0.3238
	0.3028	0.3304		0.3130	0.3290
	0.3072	0.3348		0.3172	0.3332
	0.3080	0.3298		0.3177	0.3278
1B3	0.3080	0.3298	1D3	0.3177	0.3278
	0.3072	0.3348		0.3172	0.3332
	0.3115	0.3391		0.3213	0.3373
	0.3123	0.3341		0.3217	0.3317
1B4	0.3089	0.3249	1D4	0.3183	0.3224
	0.3080	0.3298		0.3177	0.3278
	0.3123	0.3341		0.3217	0.3317
	0.3130	0.3290		0.3221	0.3261

Note: This LED lamp is sorted into chromaticity coordinate groups shown above. Each reel includes the same rank LEDs. Let the delivery ratio of each rank be unquestioned.

Table 7.2 Luminous Flux Rank (Note)

Rank	Test Condition	Luminous Flux (Min)	Luminous Flux (Max)	Unit
E13D	I_F = 65 mA, T_a = 25 °C, Tolerance ±10 %	21.4	22.4	lm
E14A		22.4	23.3	
E14B		23.3	24.4	
E14C		24.4	25.5	

Note: This LED lamp is sorted into luminous flux ranks shown above. Each reel includes the same rank LEDs. Let the delivery ratio of each rank be unquestioned.

Rank notations: The luminous flux, chromaticity and V_F ranks are printed on labels as shown below:

Example: 1A1 E14A 2
1A1: Chromaticity rank
E14A: Luminous flux rank
2: V_F rank

8. Characteristics Curves (Note)

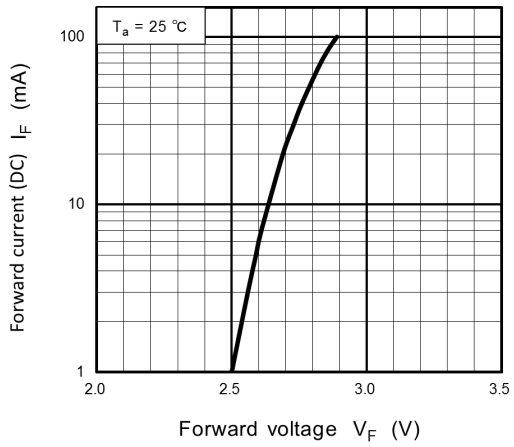


Fig. 8.1 I_F - V_F

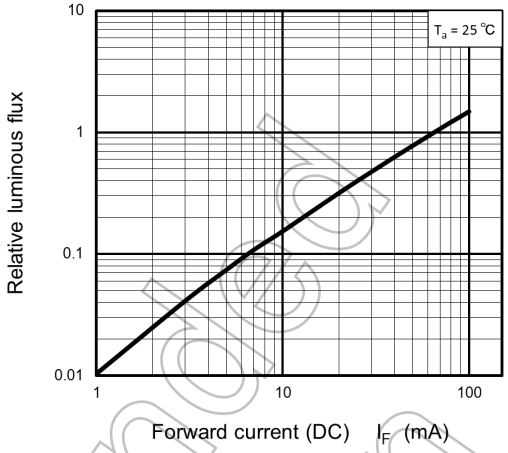


Fig. 8.2 Relative Luminous Flux - I_F

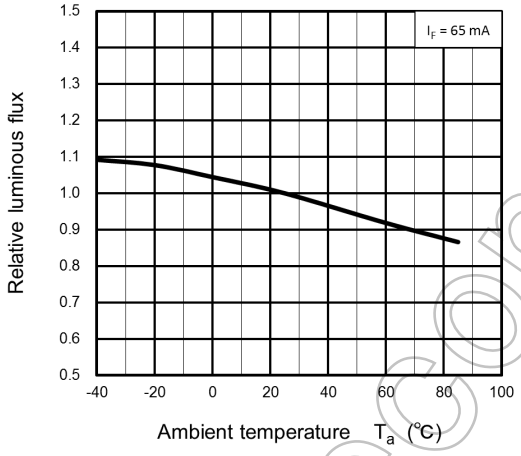


Fig. 8.3 Relative Luminous Flux - T_a

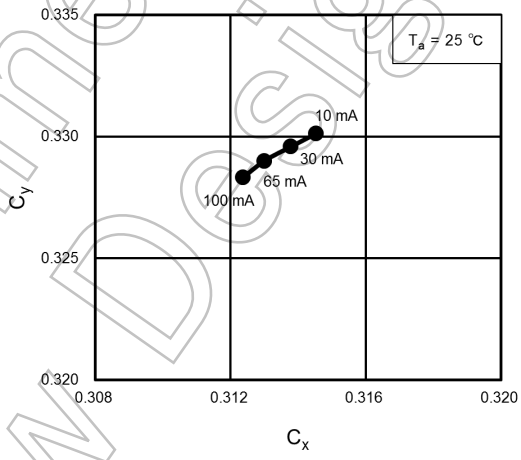


Fig. 8.4 Chromaticity - I_F

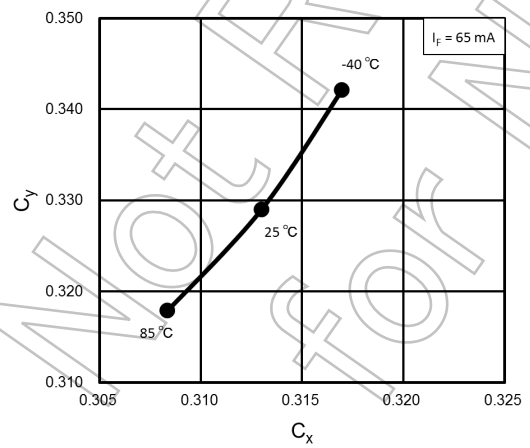


Fig. 8.5 Chromaticity - T_a

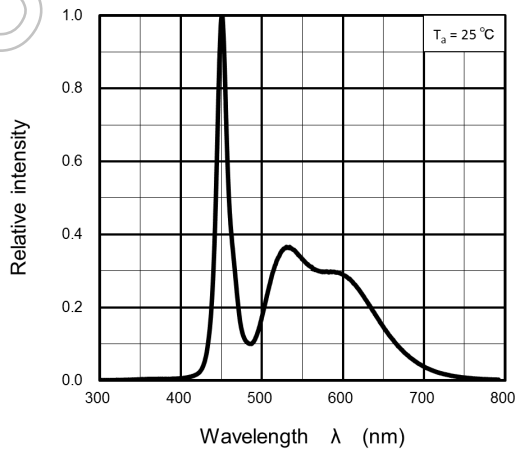


Fig. 8.6 Wavelength Characteristic

T_a = 25 ℃

I_F = 65 mA

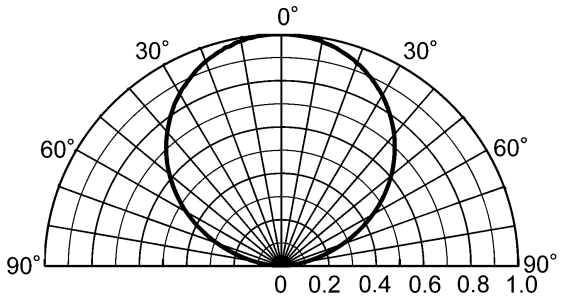


Fig. 8.7 Radiation Pattern

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

9. Packing

9.1. Moisture-Proof Packing

These LED devices are packed in an aluminum envelope with a silica gel and a moisture indicator to avoid moisture absorption. The optical characteristics of the device may be affected by exposure to moisture in the air before soldering and the device should therefore be stored under the following conditions:

- This moisture proof bag may be stored unopened within 12 months at the following conditions.
  Temperature: 5 ℃ to 30 ℃
  Humidity: 90 % (max)
- After opening the moisture proof bag, the device should be assembled within 4 weeks in an environment of 5 ℃ to 30 ℃/60 % RH or below.
- If upon opening, the moisture indicator card shows humidity 30 % or above (Color of indication changes to pink) or the expiration date has passed, the device should be baked in taping with reel.
  After baking, use the baked device within 72 hours, but perform baking only once.
  Baking conditions: 60 ± 5 ℃, for 12 to 24 hours.
  Expiration date: 12 months from sealing date, which is imprinted on the label affixed.
- 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.
- If the packing material of laminate would be broken, the hermeticity would deteriorate. Therefore, do not throw or drop the packed devices.

10. Mounting

10.1. Mounting Precautions

- Do not apply mechanical stress to the resin body at high temperature.
  The time taken for a device to return to the room temperature after reflow soldering depends on the mounting board and environmental conditions.
- 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.

10.2. Soldering

Following show examples of reflow soldering.

- Temperature Profile (see following figures.)

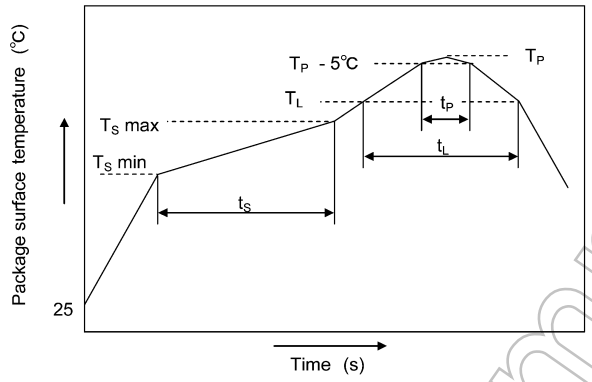


Fig. 10.2.1 Temperature Profile for Lead(Pb)-free Soldering (example)

	Symbol	Min	Max	Unit
Ramp-up rate (25 to 150°C)		1	3	°C/s
Preheat temperature	T_S	150	200	°C
Preheat time	t_S	60	120	s
Ramp-up rate (T_L to T_P)		1	3	°C/s
Liquidous temperature	T_L	217		°C
Time above T_L	t_L	60	100	s
Peek temperature	T_P		260	°C
Time within 5°C of actual peek temperature	t_P		30	s
Ramp-down rate (T_P to T_L)			6	°C/s

Table 10.2.1 Temperature Profile for Lead(Pb)-free Soldering (example)

- The product is evaluated using above reflow soldering conditions. No additional test is performed exceed the condition as a evaluation. Please perform reflow soldering under the above conditions.
- Please perform the first reflow soldering with reference to the above temperature profile and within 4 weeks of opening the package.
- If a second reflow process is necessary, reflow soldering should be performed within 168 h of the first reflow under the above conditions. Storage conditions before the second reflow soldering: 30 °C, 60 % RH (max)
- Do not perform wave soldering.
- When any soldering corrections are made manually, a hot-plate should be used.
  (only once at each soldering point)

10.3. Land Pattern Dimensions (for reference only)

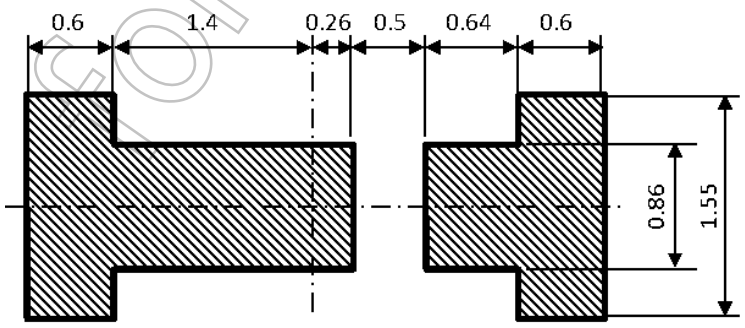


Fig. 10.3.1 (Unit: mm)

11. Cleaning

- Flux cleaning should be completed free of residual reactive ion such as Na, Cl, etc. Organic solvent acts upon water and generates corrosive gas such as hydrogen chloride. There are some cases where the device is degraded.
- Effective solvent seriously affects package and resin, and may cause inferior device. In actually using it, please sufficiently check whether there is nothing inferior on the device.
- Ultrasonic cleaning that provides effective cleaning for short time much affects on the device. so coherence between resin and lead metal is degraded by cleaning solvent during long ultrasonic cleaning. We recommend to take ultrasonic cleaning for the device at a minimum range. The influences on a device is occurred by the output of an ultrasonic wave and set board, please sufficiently check whether there is nothing inferior on the device.

12. Tape Specifications

12.1. Product Naming Conventions

The type of package used for shipment is denoted by a symbol suffix after the part number. The method of classification is as below. (this method, however does not apply to products whose electrical characteristics differ from standard Toshiba specifications)

Example: TL2FL-DW1,L
Toshiba part number: TL2FL-DW1
Packing type: L (Taping)

12.2. Handling Precautions

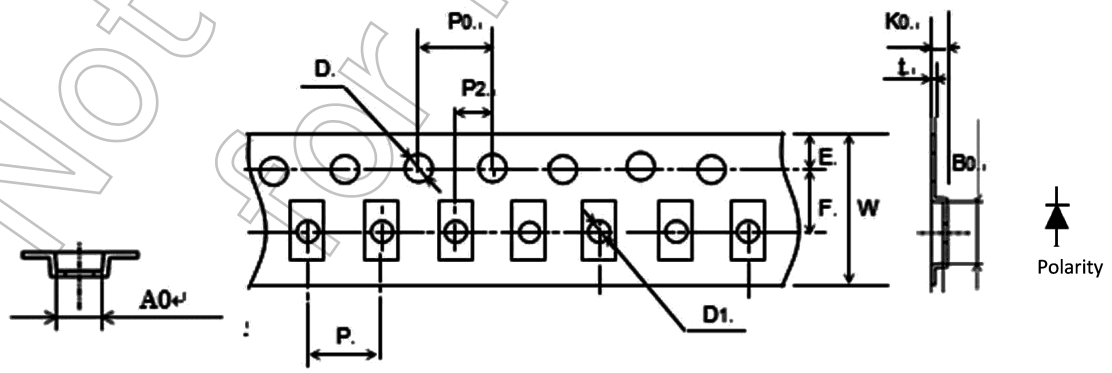
(1) The tape is antistatic-coated. However, if the tape is charged with excess static electricity, devices might cling to the tape or waggle in the tape when the cover tape peeled off. Be aware of the following to avoid this:

- Use an ionizer to neutralize the ions when utilizing an automatic mounter.
- For transport and temporary storage of devices, use containers (boxes, jigs, bags) that are made with antistatic materials or materials that dissipate static electricity.

12.3. Tape Dimensions

Table 12.3.1 Tape Dimensions (Unit: mm)

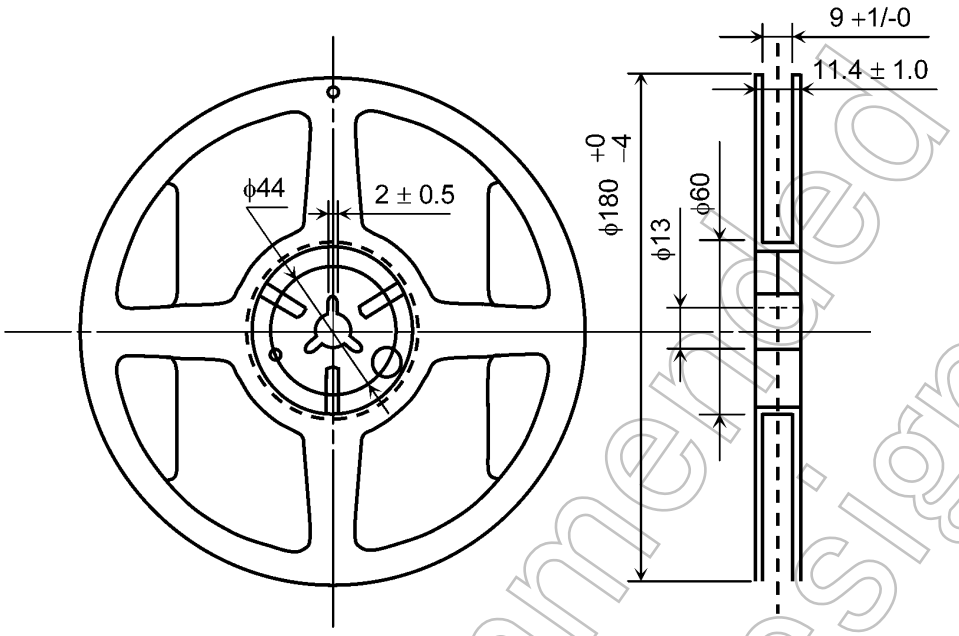
	D	E	P_0	t	F	D_1	P_2	W	P	A_0	B_0	K_0
Dimensions	1.5	1.75	4.0	0.2	3.5	1.0	2.0	8.0	4.0	1.6	3.25	0.82
Tolerance	+0.1/-0	±0.1	±0.1	±0.05	±0.05	±0.1	±0.05	±0.2	±0.1	±0.1	±0.1	±0.05



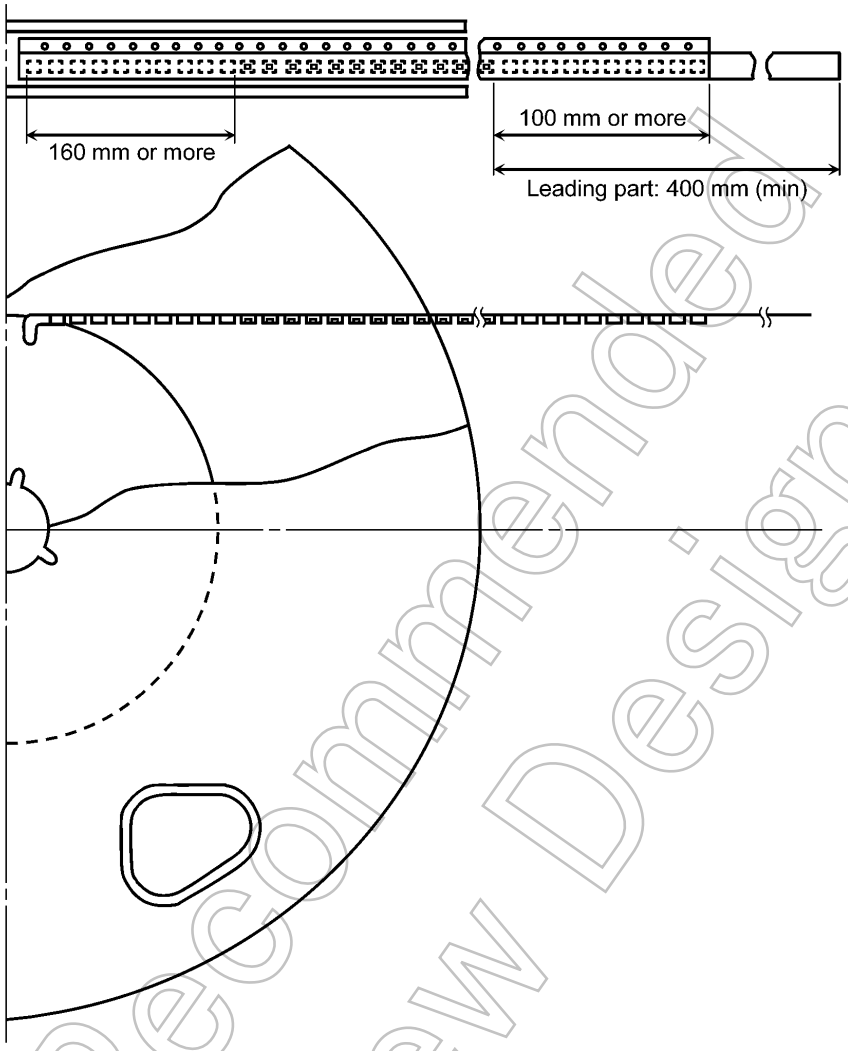
12.4. Reel Specification

12.4.1. Reel Dimensions

Unit: mm



12.4.2. Tape Leader and Trailer



12.5. Packing Form

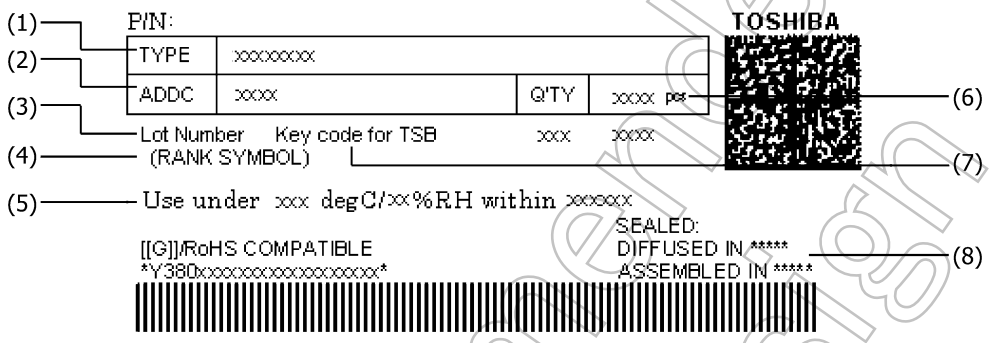
Each reel is sealed in an aluminum pack with silica gel. Packing quantity is as shown below.

- Reel: 4,000 pcs
- Carton: 20,000 pcs
- Sealed aluminum pack with silica gel

12.6. Label Format

Label example for TL2FL-DW1,L and label location are as shown below.

12.6.1. Label Example



12.6.2. Label Details

No. (# refer to the above label example)	Information for Toshiba Use	Remarks
(1)	Part No.	TL2FL-DW1,L
(2)	ADD code	(S
(3)	Lot code	Example: 270xxxxx
(4)	Rank symbol	Example: 1A1E14A2
(5)	Storage condition after opening	Use under 5 - 30 °C/60 %RH within 4 weeks
(6)	Packing quantity	Example: 4,000 pcs
(7)	Key code	Example: 12345
(8)	Country of origin	Example: CHINA

12.6.3. Label Location

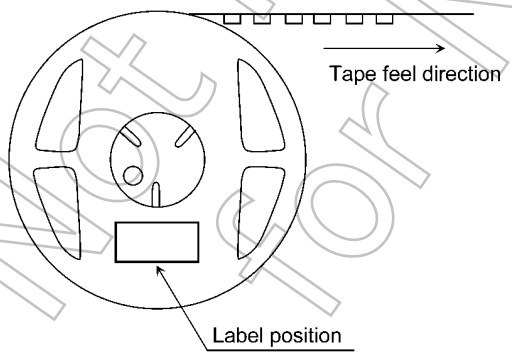


Fig. 12.6.3.1 Label Position on the Reel

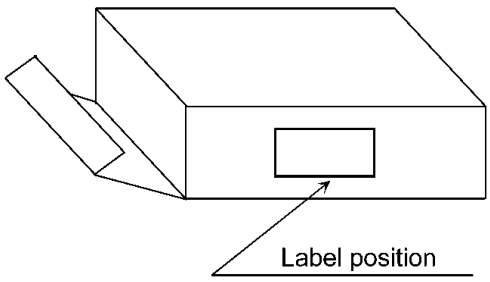
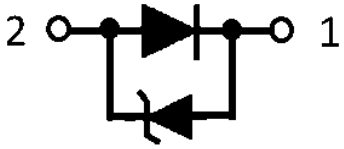


Fig. 12.6.3.2 Label Position on the Carton

Aluminum pack : The aluminum pack in which the reel is supplied also has the label attached to center of one side.

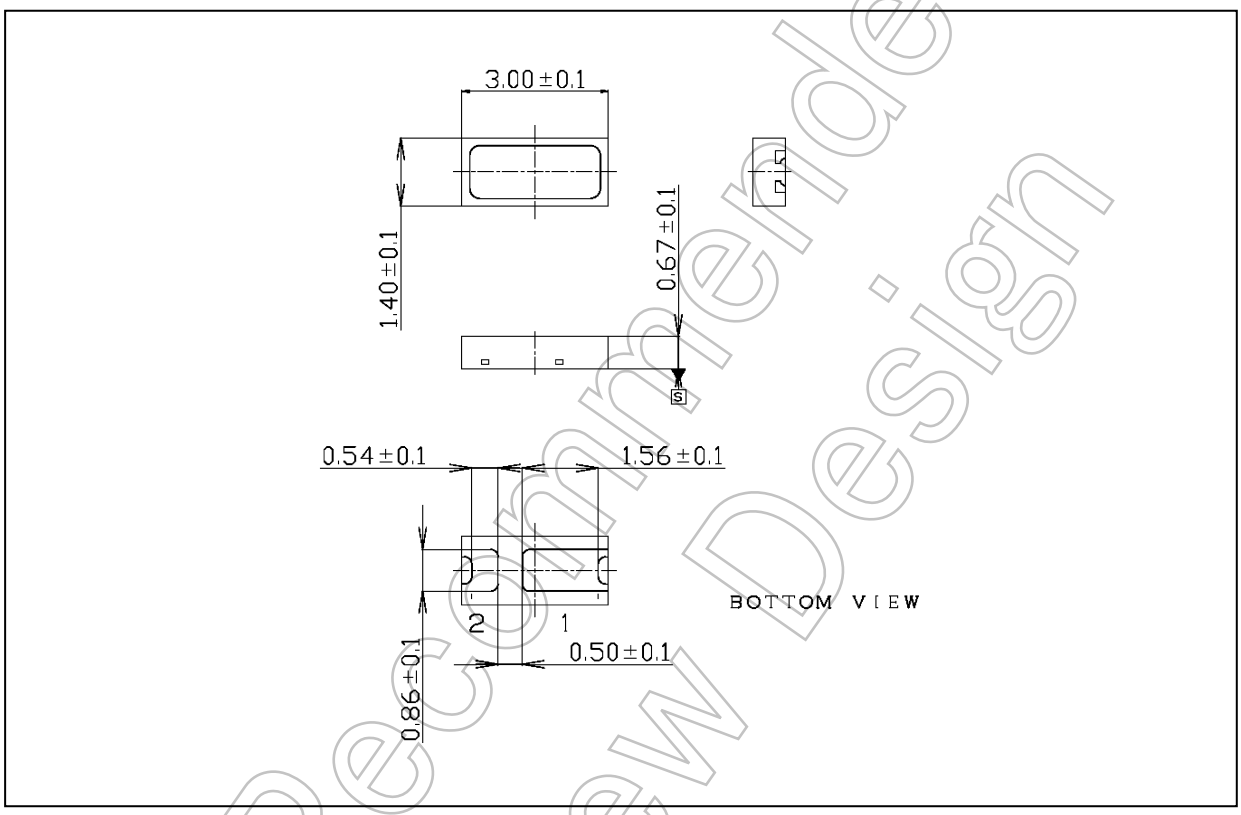
13. Internal Circuit



1: Cathode
2: Anode

Package Dimensions

Unit: mm



Weight: 0.009 g (typ.)

Package Name(s)
TOSHIBA: 4-1J1A

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