SMD LED
Product Data Sheet
LTST-E133CEGBK

Spec No. :DS22-2021-0144
Effective Date: 02/12/2022
Revision: C

SMD LED
LTST-E133CEGBK

1. Description

SMD LED lamps from Lite-On are available in miniature sizes and special configurations for automated PC board assembly and space-sensitive applications. These SMD LED lamps are suitable for use in a wide variety of electronic equipment, including cordless and cellular phones, notebook computers, network systems, home appliances, and indoor signboard applications.

1.1 Features

- Meet RoHS.
- Ultra Bright InGaN / AlInGaP Chip LED.
- 3 channel output with 8 Bits IC driver.
- Each of the colors can achieve 256 brightness steps and scan frequency is no less than 800 KHz.
- Package in 8mm tape on 7" diameter reels.
- EIA STD Package.
- I.C. Compatible.
- Compatible with Automatic Placement Equipment.
- Compatible with Infrared Reflow Solder Process.

1.2 Applications

- Telecommunication, Office automation, home appliances, industrial equipment
- Keypad/Keyboard Backlighting
- Status indicator
- Micro-displays
- Signal and Symbol Luminary

2. Package Dimensions
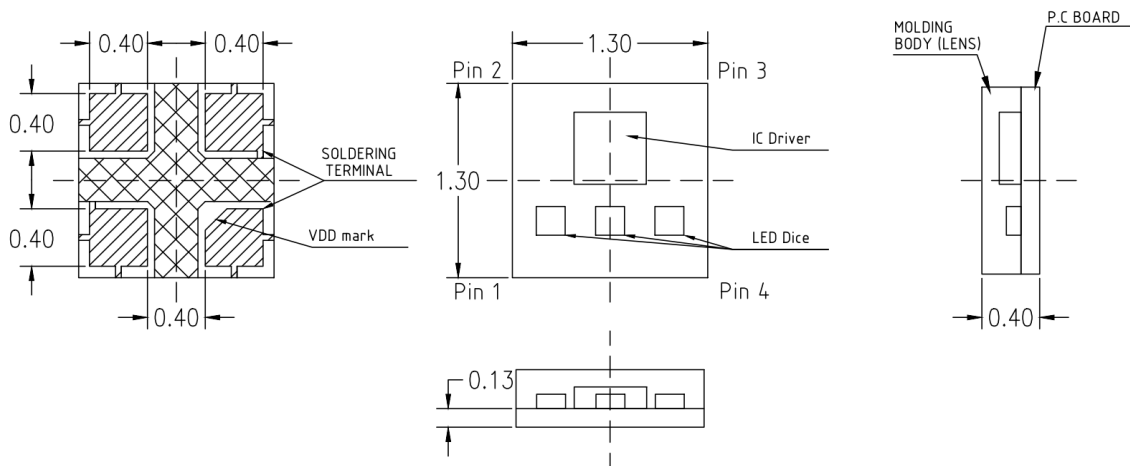
Part No.	Lens Color	Source	PIN No.	Symbol	Function description
LTST-E133CEGBK	Water Clear	AlInGaP Red	1	VDD	Power supply LED
		InGaN Green	2	DIN	Control data signal input
		InGaN Blue	3	VSS	Ground
			4	DOUT	Control data signal output

Notes:

1. All dimensions are in millimeters (inches).
2. Tolerance is ±0.15 mm (.006") unless otherwise noted.

Part No. : LTST-E133CEGBK
BNS-OD-FC002/A4

SMD LED
LTST-E133CEGBK

3. Rating and Characteristics

3.1 Absolute Maximum Ratings at Ta=25℃

Parameter	LTST-E133CEGBK	Unit
Power Dissipation (P)	88	mW
IC Power supply voltage (VDD)	+4.2~+5.5	V
Total DC Current (IF)	16	mA
Operating Temperature Range	-20 ºC to + 85 ºC	
Storage Temperature Range	-30 ºC to + 85 ºC	
Infrared Soldering Condition	260 ℃ For 10 Seconds	

Note: The LED with IC embedded needs to work with good heat sink system to keep the working temperature (Measure on

LED soldering pad) under 85ºC。

3.2 Suggest IR Reflow Condition For Pb Free Process:
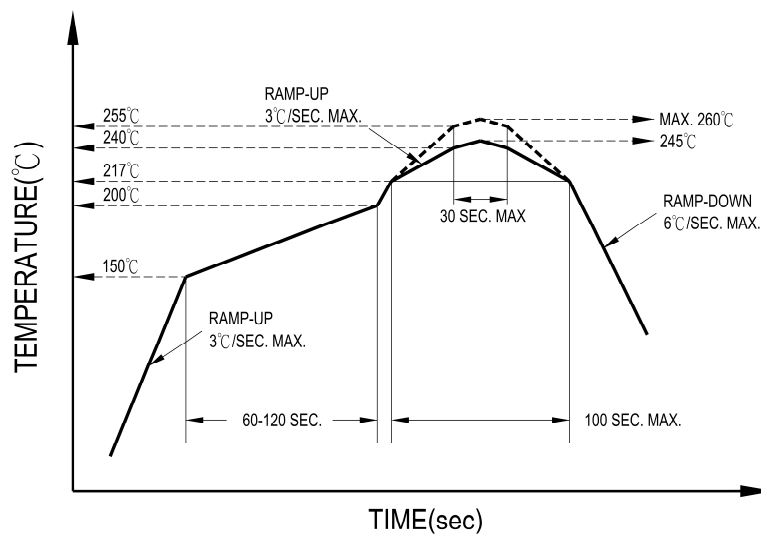
3.3 Electrical / Optical Characteristics at Ta=25℃

Parameter	Symbol	color	LTST-E133CEGBK			Unit	Test Condition
			MIN	TYP.	MAX		
Luminous Intensity	IV	Red	71.0	-	180.0	mcd	@VDD 5V Out R/G/B [7:0]= 8b'11111111 Note 1
		Green	180.0	-	355.0		
		Blue	35.5	-	71.0		
Viewing Angle	$2\theta_{1/2}$	-	120			deg	Note 2 (Fig.5)
Dominant Wavelength	λd	Red	620.0	-	628.0	nm	@VDD 5V Out R/G/B [7:0]= 8b'11111111 Note 3
		Green	522.0	-	530.0		
		Blue	464.0	-	472.0		

Notes:

1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.

2. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

3. The dominant wavelength, λd is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.

4. Caution in ESD:

   Static Electricity and surge damages the LED. It is recommend to use a wrist band or anti-electrostatic glove when handling the LED. All devices, equipment and machinery must be properly grounded.
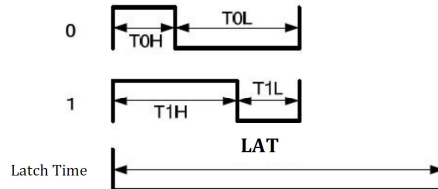
1.4 Electrical Characteristics (Ta=-20~+85℃, V ss=0V, unless otherwise specified)

Parameter	Symbol	Condition	LTST-E133CEGBK			Unit
			MIN	TYP.	MAX	
IC Output Current (to R/G/B separately)	IF	VDD=5V	-	5	-	mA
Input voltage level	V_{IH}	D_{IN}, SET	3.0	-	-	V
	V_{IL}	D_{IN}, SET	-	-	$0.3V_{DD}$	V
IC Working Current	IDD	ALL '0' DATA	-	0.8	-	mA

SMD LED
LTST-E133CEGBK

3.5 Data transfer time

■ **Timing Wave Form (TH+TL=1.2μs±300ns)**

Item	Description	Typical	Allowance
T_{0H}	0 code, High-level time	300ns	± 150ns
T_{0L}	0 code, Low-level time	900ns	± 150ns
T_{1H}	1 code, High-level time	900ns	± 150ns
T_{1L}	1 code, Low-level time	300ns	± 150ns
LAT	Latch time	>250us	-

■ **Single Data in 24-bit for RGB**
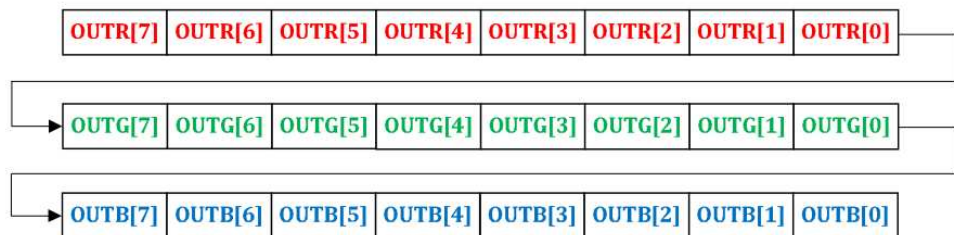
■ **Data Communication**
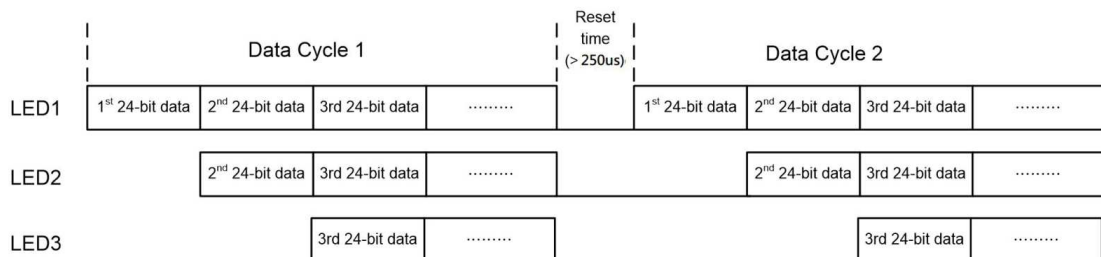
■ **Time Interval between 24bits signal**
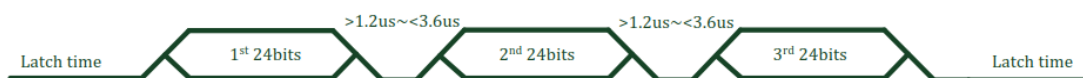
Part No. : LTST-E133CEGBK
BNS-OD-FC002/A4

4. Bin Rank

4.1 Bin code list

■ **IV Rank**

Luminous Intensity Color : <u>Red</u> , Unit : mcd @ Out R [7:0]= 8b'11111111		
Bin Code	Min.	Max.
Q1	71.0	90.0
Q2	90.0	112.0
R1	112.0	140.0
R2	140.0	180.0

Tolerance on each Luminous Intensity bin is +/- 15%

Luminous Intensity Color : <u>Green</u> , Unit : mcd @ Out G [7:0]= 8b'11111111		
Bin Code	Bin Code	Bin Code
S1	180.0	224.0
S2	224.0	280.0
T1	280.0	355.0

Tolerance on each Luminous Intensity bin is +/- 15%

Luminous Intensity Color : <u>Blue</u> , Unit : mcd @ Out B [7:0]= 8b'11111111		
Bin Code	Bin Code	Bin Code
N2	35.5	45.0
P1	45.0	56.0
P2	56.0	71.0

Tolerance on each Luminous Intensity bin is +/- 15%

■ **Hue Rank**

Dominant Wavelength Color : <u>Red</u> , Unit : nm @ Out R [7:0]= 8b'11111111		
Bin Code	Bin Code	Bin Code
U	620.0	624.0
V	624.0	628.0

Tolerance for each Dominate Wavelength bin is +/- 1nm

Dominant Wavelength Color : <u>Green</u> , Unit : nm @ Out G [7:0]= 8b'11111111		
Bin Code	Bin Code	Bin Code
P	522.0	526.0
Q	526.0	530.0

Tolerance for each Dominate Wavelength bin is +/- 1nm

Dominant Wavelength Color : <u>Blue</u> , Unit : nm @ Out B [7:0]= 8b'11111111		
Bin Code	Bin Code	Bin Code
C	464.0	468.0
D	468.0	472.0

Tolerance for each Dominate Wavelength bin is +/- 1nm

5. Typical Electrical / Optical Characteristics Curves.

(25℃ Ambient Temperature Unless Otherwise Noted)
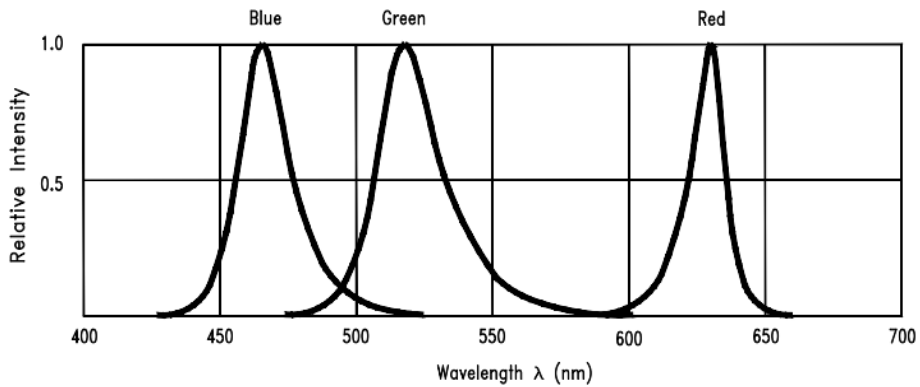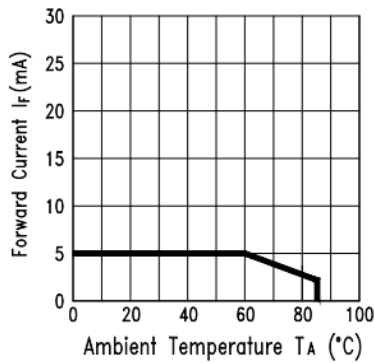

Fig.1 Relative Intensity vs. Wavelength
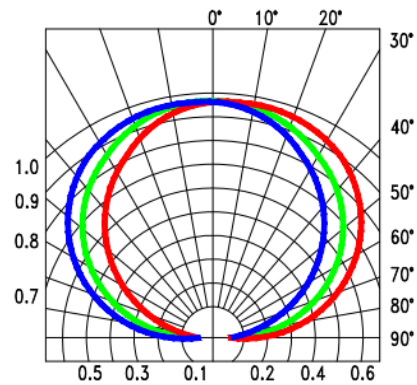

Fig.2 Forward Current
Derating Curve

Fig.3 Spatial Distribution

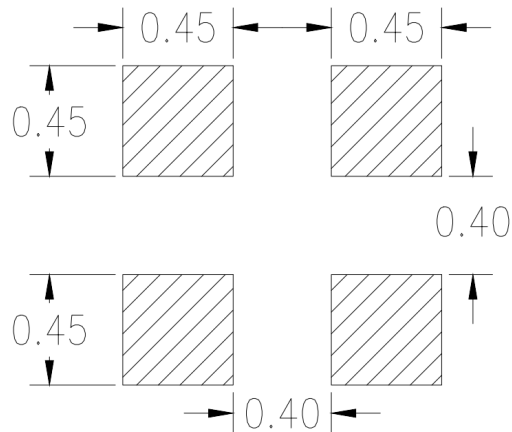Part No. : LTST-E133CEGBK
BNS-OD-FC002/A4

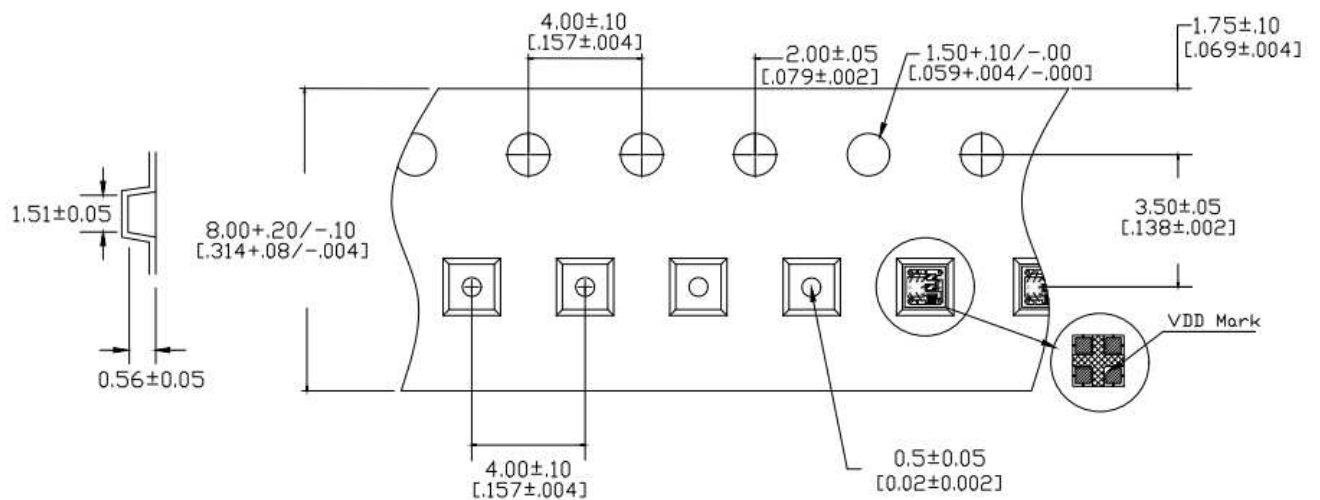# 6. User Guide

6.1 Cleaning

Do not use unspecified chemical liquid to clean LED they could harm the package.

If clean is necessary, immerse the LED in ethyl alcohol or in isopropyl alcohol at normal temperature for less one minute.

6.2 Recommend Printed Circuit Board Attachment Pad

6.3 Package Dimensions of Tape And Reel

Note:

1. All dimensions are in millimeters (inches).

6.4 Package Dimensions of Reel

$\phi 60.0 \pm 1.0$
(2.36 ± 0.39)

$\phi 178 \pm 2.0$
$(7.0 \pm .08)$

$\phi 13.0$ TYP.
$(.512)$

12.0 TYP.
$(.47)$
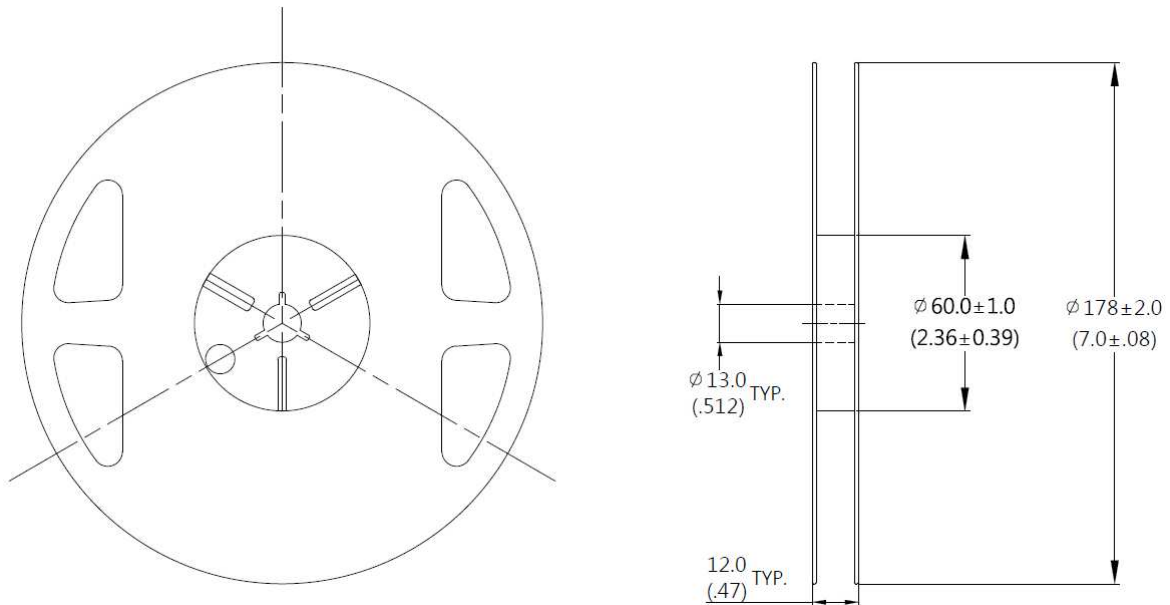
Notes:

1. Empty component pockets sealed with top cover tape.

2. 7 inch reel-4000 pieces per reel.

3. Minimum packing quantity is 500 pieces for remainders.

4. The maximum number of consecutive missing lamps is two.

5. In accordance with ANSI/EIA 481 specifications.

7. Cautions

7.1 Application

The LEDs described here are intended to be used for ordinary electronic equipment (such as office equipment, communication equipment and household applications).Consult Liteon's Sales in advance for information on applications in which exceptional reliability is required, particularly when the failure or malfunction of the LEDs may directly jeopardize life or health (such as in aviation, transportation, traffic control equipment, medical and life support systems and safety devices).

7.2 Storage

The package is sealed:

The LEDs should be stored at 30℃ or less and 90%RH or less. And the LEDs are limited to use within one year, while the LEDs is packed in moisture-proof package with the desiccants inside.

The package is opened:

The storage ambient for the LEDs should not exceed 30℃ temperature or 60% relative humidity.

It is recommended that LEDs out of their original packaging are IR-reflowed within one week. (MSL 3).

For extended storage out of their original packaging, it is recommended that the LEDs be stored in a sealed container with appropriate desiccant, or in a desiccators with nitrogen ambient.

LEDs stored out of their original packaging for more than one week should be baked at about 60 deg C for at least 20 hours before solder assembly.

7.3 Cleaning

Use alcohol-based cleaning solvents such as isopropyl alcohol to clean the LED if necessary.

7.4 Soldering

Recommended soldering conditions:

Reflow soldering		Soldering iron	
Pre-heat	150~200℃	Temperature	300℃ Max.
Pre-heat time	120 sec. Max.	Soldering time	3 sec. Max.
Peak temperature	260℃ Max.		(one time only)
Soldering time	10 sec. Max.(Max. two times)		

Notes:

Because different board designs use different number and types of devices, solder pastes, reflow ovens, and circuit boards, no single temperature profile works for all possible combinations.

However, you can successfully mount your packages to the PCB by following the proper guidelines and PCB-specific characterization.

LITE-ON Runs both component-level verification using in-house **KYRAMX98** reflow chambers and board-level assembly. The results of this testing are verified through post-reflow reliability testing. Profiles used at LITE-ON are based on JEDEC standards to ensure that all packages can be successfully and reliably surface mounted.

Figure on page3 shows a sample temperature profile compliant to JEDEC standards. You can use this example as a generic target to set up your reflow process. You should adhere to the JEDEC profile limits as well as specifications and recommendations from the solder paste manufacturer to avoid damaging the device and create a reliable solder joint.

7.5 Driving Method

The LED needs to be incorporated with an appropriate controller to deliver PWM signals to each pixel. Below figure is shown as a reference design.
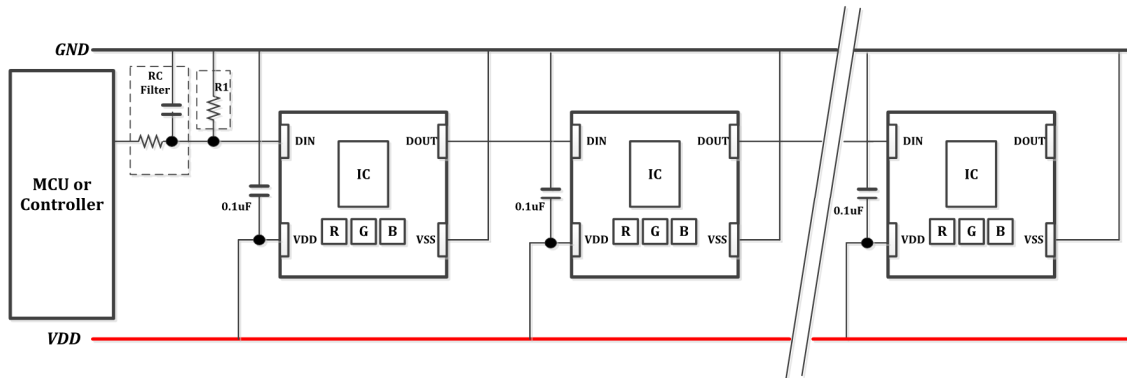
Cascading connection for normal driver IC embedded LEDs is shown. The data signal is transmitted one-by-one. The output of the previous one is connected to the input of the next one. As for the power positive and negative, all LED positives should be connected to VDD and all LED negatives should be connected to ground.

To ensure the function of LED driver IC work normally, every LED positive pin (should be IC Vcc and LED anode individually or commonly) need connect one capacitor. It can guarantee good power feed quality and cascade stability. The recommended capacitance value is 0.1uF. The capacitors should be placed as close to the LED pin as possible to maximize the effect. Besides, the quality of capacitors will affect the effect, too.

The RC filter is necessary to avoid the surge or noise to affect product work normally. The capacitance value 120pF and the resistance value 33ohm is just for reference. The most suitable value is calculated from fc=1/2πRC. The fc is different by cases and needs to be actually measured.

7.6 ESD (Electrostatic Discharge)

Static Electricity or power surge will damage the LED.
Suggestions to prevent ESD damage:

- Use of a conductive wrist band or anti-electrostatic glove when handling these LEDs.
- All devices, equipment, and machinery must be properly grounded.
- Work tables, storage racks, etc. should be properly grounded.
- Use ion blower to neutralize the static charge which might have built up on surface of the LED's plastic lens as a result of friction between LEDs during storage and handling.

SMD LED
LTST-E133CEGBK

8. Reliability Test

Classification	Test Item	Test Condition	Reference Standard
Endurance Test	Operation Life	Ta= Under Room Temperature As Per Data Sheet Maximum Rating *Test Time= 1000HRS (-24HRS,+72HRS)	MIL-STD-750D:1026 MIL-STD-883D:1005 JIS C 7021:B-1
	High Temperature High Humidity Storage	IR-Reflow In-Board, 2 Times Ta= 65±5℃,RH= 90～95% *Test Time= 240HRS±2HRS	MIL-STD-202F:103B JIS C 7021:B-11
	High Temperature Storage	Ta= 105±5℃ *Test Time= 1000HRS (-24HRS,+72HRS)	MIL-STD-883D:1008 JIS C 7021:B-10
	Low Temperature Storage	Ta= -55±5℃ *Test Time=1000HRS (-24HRS,+72H RS)	JIS C 7021:B-12
	Operating Life (High Humidity/Temp.)	Ta= 65±5℃,RH= 90～95% a) 40% Duty Cycle mode for 12mA IC solution (Around 5mA per chip) b) Continuous RGB drive for 5mA IC solution *Test Time= 500HRS±2HRS	-
Environmental Test	Temperature Cycling	105 ºC ～ 25 ºC ～ -55 ºC ～ 25 ºC 30mins 5mins 30mins 5mins 10 Cycles	MIL-STD-202F:107D MIL-STD-750D:1051 MIL-STD-883D:1010 JIS C 7021:A-4
	Thermal Shock	IR-Reflow In-Board, 2 Times 85 ± 5℃ ～ -40℃ ± 5℃ 10mins 10mins 10 Cycles	MIL-STD-202F:107D MIL-STD-750D:1051 MIL-STD-883D:1011
	Solder Resistance	T.sol= 260 ± 5 ºC Dwell Time= 10 ± 1secs	MIL-STD-202F:210A MIL-STD-750D:2031 JIS C 7021:A-1
	IR-Reflow	Ramp-up rate(217 ºC to Peak) +3 ºC / second max Temp. maintain at 175(±25) ºC 180 seconds max Temp. maintain above 217 ºC 60-150 seconds Peak temperature range 260 ºC +0/-5 ºC Time within 5℃ of actual Peak Temperature (tp) 10-30 seconds Ramp-down rate +6 ºC /second max	MIL-STD-750D:2031.2 J-STD-020D
	Solder ability	T.sol= 235 ± 5 ºC Immersion time 2±0.5 sec Immersion rate 25±2.5 mm/sec Coverage ≧95% of the dipped surface	MIL-STD-202F:208D MIL-STD-750D:2026 MIL-STD-883D:2003 IEC 68 Part 2-20 JIS C 7021:A-2

Part No. : LTST-E133CEGBK
BNS-OD-FC002/A4

9. Others

The appearance and specifications of the product may be modified for improvement without prior notice.

10. Suggested Checking List

Training and Certification
1. Everyone working in a static-safe area is ESD-certified?
2. Training records kept and re-certification dates monitored?

Static-Safe Workstation & Work Areas
1. Static-safe workstation or work-areas have ESD signs?
2. All surfaces and objects at all static-safe workstation and within 1 ft measure less than 100V?
3. All ionizer activated, positioned towards the units?
4. Each work surface mats grounding is good?

Personnel Grounding
1. Every person (including visitors) handling ESD sensitive(ESDS) items wears wrist strap, heel strap or conductive shoes with conductive flooring?
2. If conductive footwear used, conductive flooring also present where operator stand or walk?
3. Garments, hairs or anything closer than 1 ft to ESD items measure less than 100V*?
4. Every wrist strap or heel strap/conductive shoes checked daily and result recorded for all DLs?
5. All wrist strap or heel strap checkers calibration up to date?
Note: *50V for InGaN LED.

Device Handling
1. Every ESDS items identified by EIA-471 labels on item or packaging?
2. All ESDS items completely inside properly closed static-shielding containers when not at static-safe workstation?
3. No static charge generators (e.g. plastics) inside shielding containers with ESDS items?
4. All flexible conductive and dissipative package materials inspected before reuse or recycles?

Others
1. Audit result reported to entity ESD control coordinator?
2. Corrective action from previous audits completed?
3. Are audit records complete and on file?

Part No. : LTST-E133CEGBK
BNS-OD-FC002/A4