



**SMD LED**  
**Product Data Sheet**  
**LTST-E133CEGBK**

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

**LITE-ON DCC**

**RELEASE**

**BNS-OD-FC001/A4**

## 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.

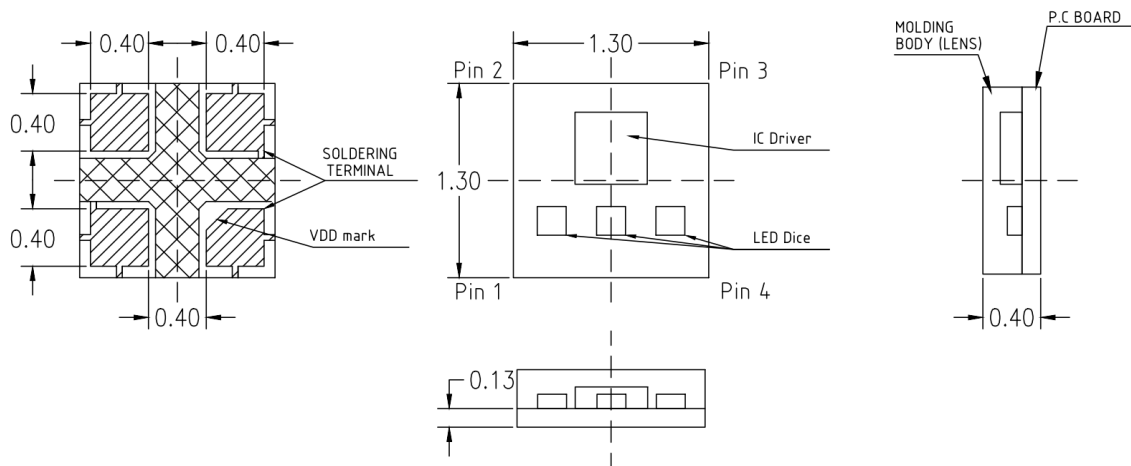
#### 1.1 Features

- 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  $\pm 0.15$  mm (.006") unless otherwise noted.

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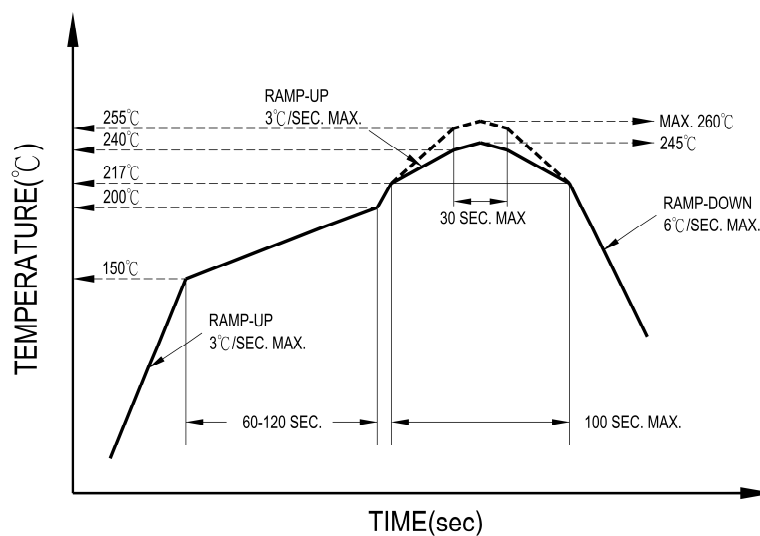
### 3. Rating and Characteristics

#### 3.1 Absolute Maximum Ratings at Ta=25°C

| 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 °C to + 85 °C     |      |
| Storage Temperature Range     | -30 °C to + 85 °C     |      |
| Infrared Soldering Condition  | 260 °C 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 85°C ◦

#### 3.2 Suggest IR Reflow Condition For Pb Free Process:



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### 3.3 Electrical / Optical Characteristics at Ta=25°C

| Parameter           | Symbol          | color | LTST-E133CEGBK |      |       | Unit | Test Condition                                       |
|---------------------|-----------------|-------|----------------|------|-------|------|------------------------------------------------------|
|                     |                 |       | MIN            | TYP. | MAX   |      |                                                      |
| Luminous Intensity  | IV              | Red   | 71.0           | -    | 180.0 | mcd  | @VDD 5V<br>Out R/G/B [7:0]=<br>8b'11111111<br>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 | $\lambda_d$     | Red   | 620.0          | -    | 628.0 | nm   | @VDD 5V<br>Out R/G/B [7:0]=<br>8b'11111111<br>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,  $\lambda_d$  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.

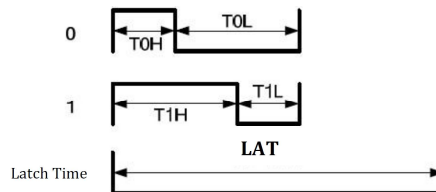
### 1.4 Electrical Characteristics (Ta=-20~+85°C, V<sub>SS</sub>=0V, unless otherwise specified)

| 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 <sub>IH</sub> | D <sub>IN</sub> , SET | 3.0            | -    | -                  | V    |
|                                         | V <sub>IL</sub> | D <sub>IN</sub> , SET | -              | -    | 0.3V <sub>DD</sub> | V    |
| IC Working Current                      | IDD             | ALL '0' DATA          | -              | 0.8  | -                  | mA   |

## SMD LED LTST-E133CEGBK

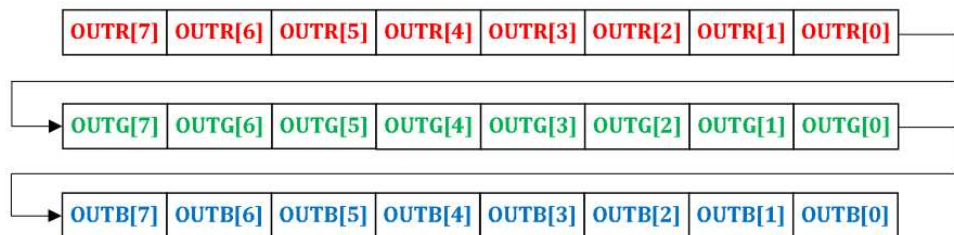
### 3.5 Data transfer time

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

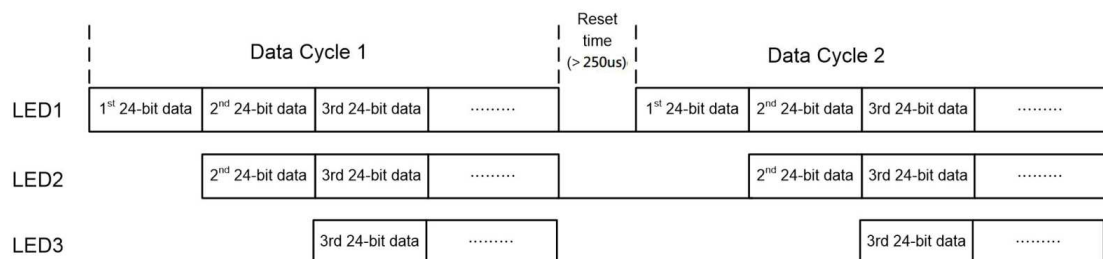


| Item            | Description             | Typical | Allowance |
|-----------------|-------------------------|---------|-----------|
| T <sub>0H</sub> | 0 code, High-level time | 300ns   | ± 150ns   |
| T <sub>0L</sub> | 0 code, Low-level time  | 900ns   | ± 150ns   |
| T <sub>1H</sub> | 1 code, High-level time | 900ns   | ± 150ns   |
| T <sub>1L</sub> | 1 code, Low-level time  | 300ns   | ± 150ns   |
| LAT             | Latch time              | >250us  | -         |

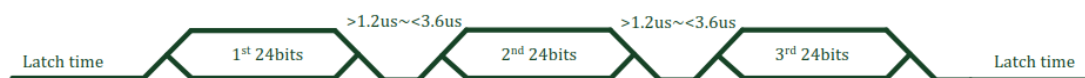
#### ■ Single Data in 24-bit for RGB



#### ■ Data Communication



#### ■ Time Interval between 24bits signal



## SMD LED LTST-E133CEGBK

### 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%

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### ■ 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

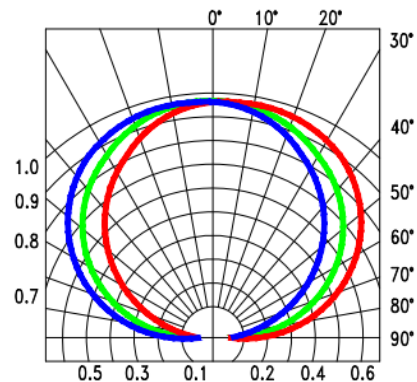
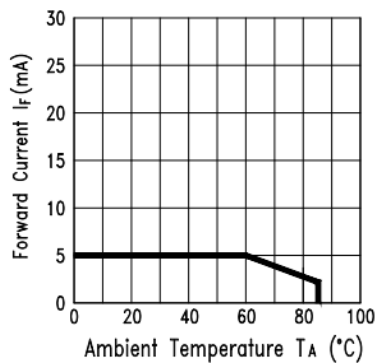
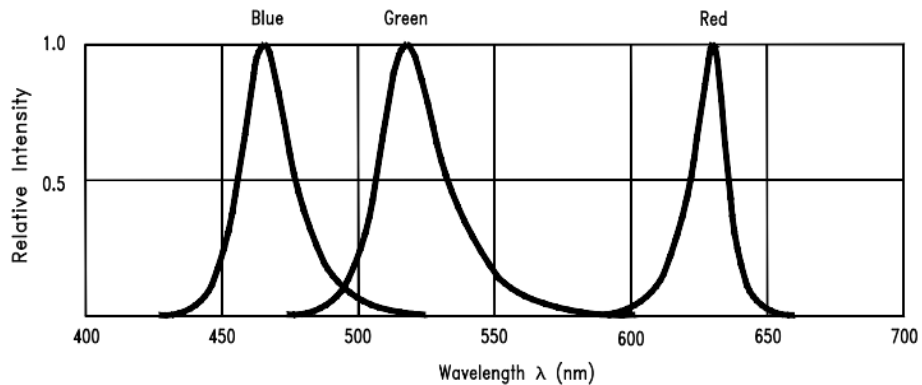
| Dominant Wavelength Color : <u>Blue</u> , Unit : nm @ Out B [7:0]= 8b'11111111 |          |          |
|--------------------------------------------------------------------------------|----------|----------|
| Bin Code                                                                       | Bin Code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

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

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LTST-E133CEGBK**

**5. Typical Electrical / Optical Characteristics Curves.**

(25°C Ambient Temperature Unless Otherwise Noted)



## SMD LED LTST-E133CEGBK

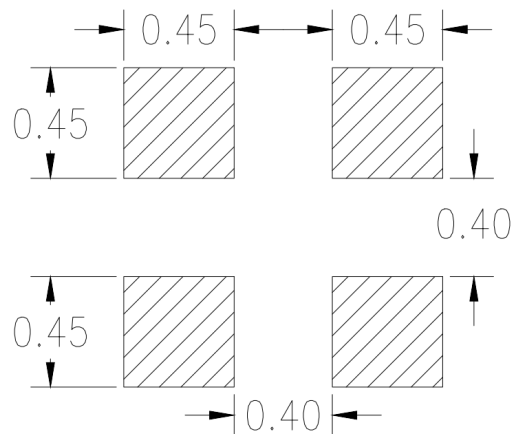
### 6. User Guide

#### 6.1 Cleaning

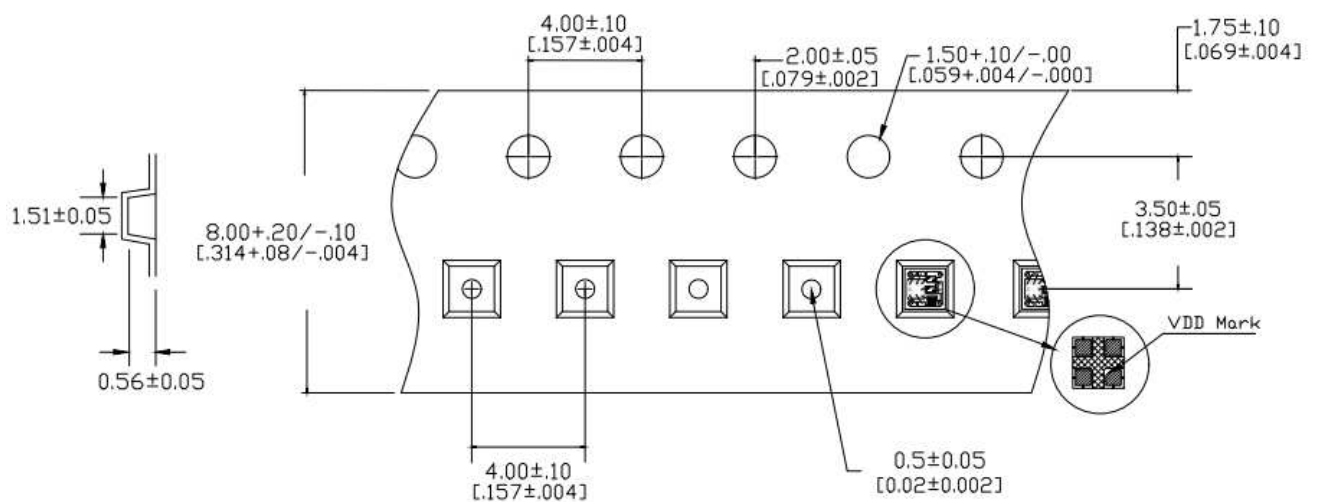
Do not use unspecified chemical liquid to clean LED they could harm the package.

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

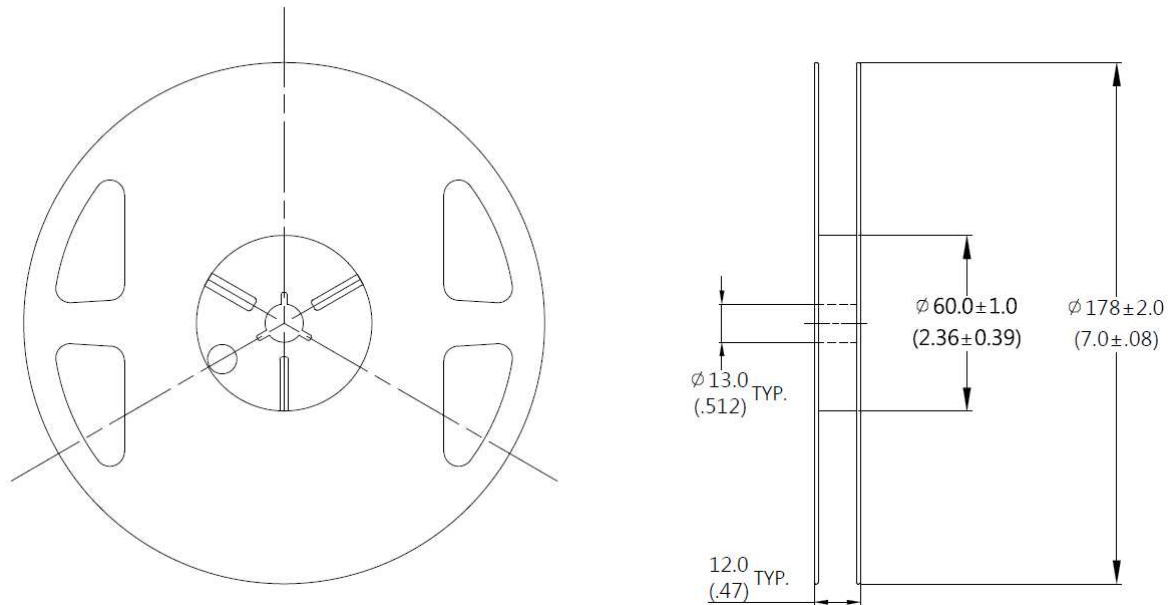


#### Note:

1. All dimensions are in millimeters (inches).

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### 6.4 Package Dimensions of Reel



#### 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.

## SMD LED LTST-E133CEGBK

### 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°C 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°C 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°C                     | Temperature    | 300°C Max.      |
| Pre-heat time    | 120 sec. Max.                 | Soldering time | 3 sec. Max.     |
| Peak temperature | 260°C 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.

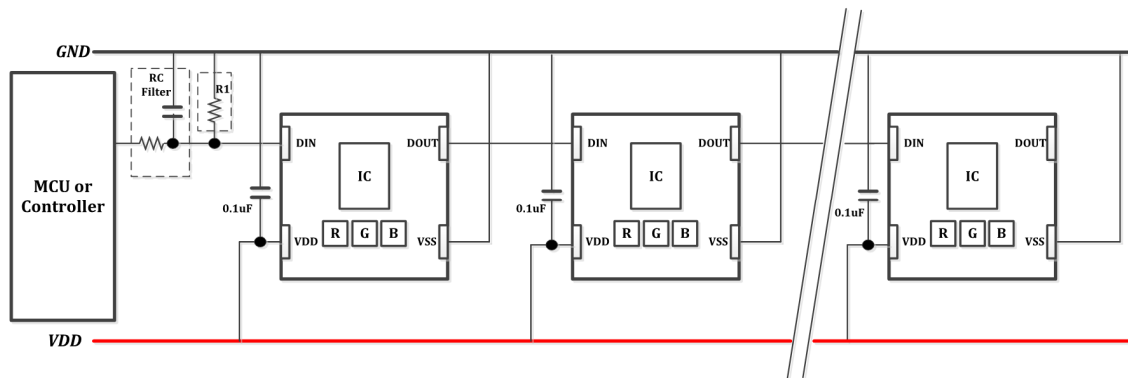
LITE-ON Runs both component-level verification using in-house **KYRAMX98** reflow chambers and board-level assembly. The results of this testing are verified through post-reflow reliability testing. Profiles used at LITE-ON are based on JEDEC standards to ensure that all packages can be successfully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

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

## **SMD LED LTST-E133CEGBK**

### **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?