LITEON
OPTOELECTRONICS

SMD LED

Product Data Sheet

LTSA-E27CQEGBW

Spec No.：

Created Date: 2025/10/28

Revision: 4.0

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Rev	Description	By	Date
1.0	New data sheet	Chris HL Tsai	2024/03/19
2.0	Add Spectrum Information	Chris HL Tsai	2024/04/10
3.0	Modify Spec. According to IC Optimization	Anjie Chen	2024/12/12
4.0	Add Recommended Pick-and-Place Tools	Anjie Chen	2025/10/28
Above data for PD and Customer tracking only			

Customer Name:

Customer Signature: **Print Name:**

LiteON Sales Signature: **Print Name:**

SMD LED
LTSA-E27CQEGBW

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

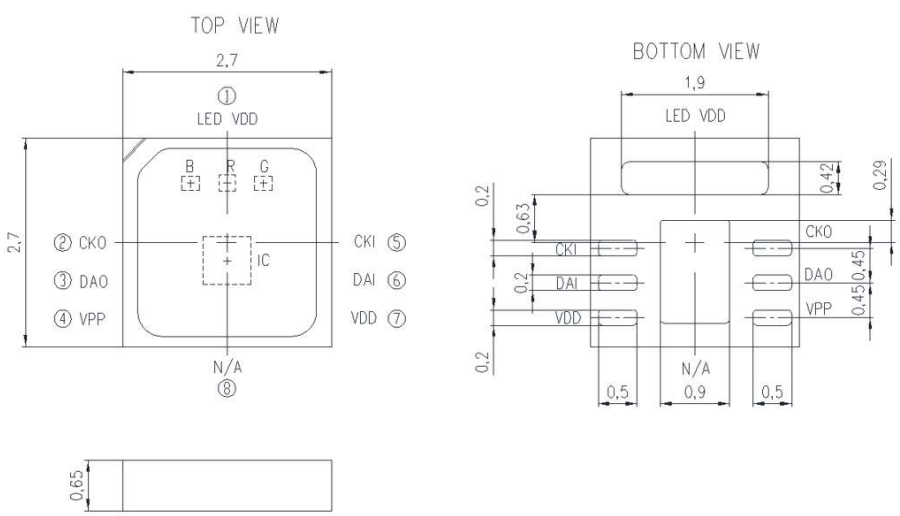
- Meet RoHS
- Ultra Bright InGaN / AlInGaP LED Chips
- Package in 8mm Tape On 7" Diameter Reels
- Thin (0.65 mm) Chip LED and EIA STD Package
- Preconditioning: Accelerate to JEDEC Level 2
- Compatible with Automatic Placement Equipment
- Compatible with Infrared Reflow Solder Process
- 8~16 Bits 3 Channels IC Embedded
- Temperature Compensation for LED
- CRC Protected Serial Communication
- Watchdog Function to Prevent Flicking Caused by Hot-plug
- Support Sleep Mode and Low Standby Power Consumption
- Based on AEC-Q102 and Corrosion Robustness Class: 1B

1.2 Applications

- Automotive: Accessary applications

2. Package Dimensions / Pin Configuration

2.1 Package Dimensions



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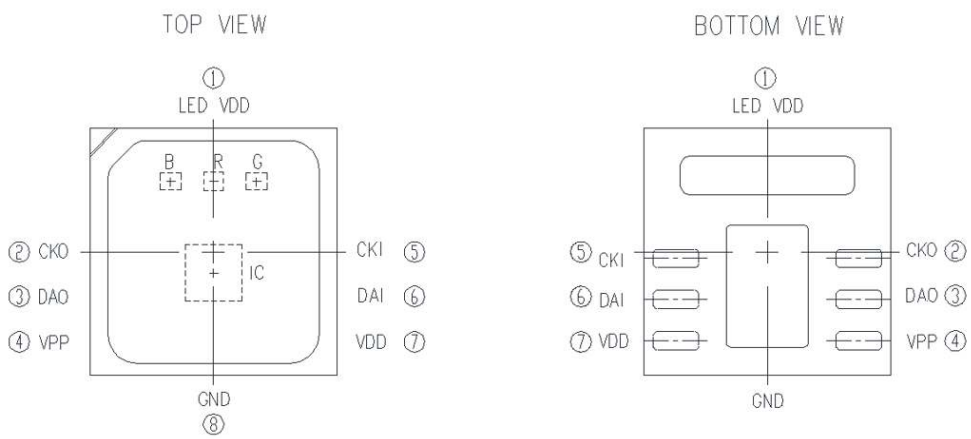
Part No.	Lens Color	Source Color
LTSA-E27CQEGBW	Diffused	AlInGaP Red
		InGaN Green
		InGaN Blue

Notes:

1. All dimensions are in millimeters
2. Tolerance is ±0.2 mm unless otherwise noted

2.2 Pin Configuration



	Symbol	Function description
1	LED VDD	LED Supply Voltage
2	CKO	Clock Signal Output
3	DAO	Serial Data Output
4	VPP	OTP Power Supply
5	CKI	Clock Signal Input
6	DAI	Serial Data Input
7	VDD	Supply Voltage
8	GND	Ground Terminal

Notes:

1. LED VDD and VDD need to supply voltage together
2. VPP at 9.0~10V when OTP Memory Program.
3. VPP at 5V when OTP Read and Standby.

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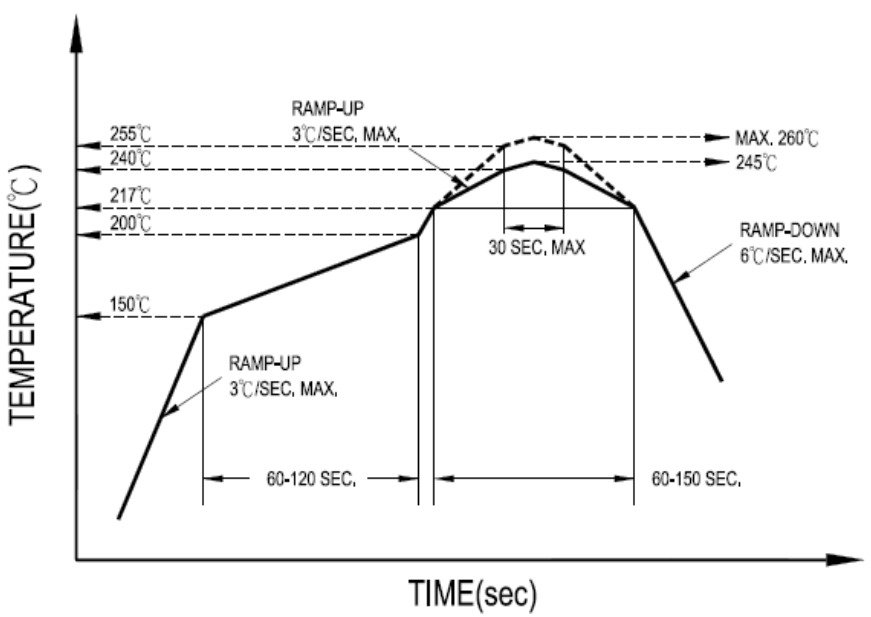
3. Rating and Characteristics

3.1 Absolute Maximum Ratings at Ta=25°C

Parameter	Symbol	Rating	Unit
IC Supply Voltage	VDD	5.5	V
LED Current of Output	Iout	60	mA
Clock Frequency	f_{CK}	15	MHz
Junction Temperature	Tj	125	°C
Operating Temperature Range	-40 ºC to + 110 ºC		
Storage Temperature Range	-40 ºC to + 110 ºC		
Infrared Soldering Condition	260 °C For 10 Seconds		

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	MIN	TYP.	MAX	Unit	Test Condition (Color Setpoint) Note 3
Supply Voltage	VDD	-	3.3	5	5.5	V	
Red Current	If	Red		30		mA	(255,0,0)
Green Current	If	Green		46		mA	(0,255,0)
Blue Current	If	Blue		20		mA	(0,0,255)
Luminous Intensity	Iv	Red	475	950	1900	mcd	(255,0,0)
		Green	1085	2170	4000	mcd	(0,255,0)
		Blue	190	380	750	mcd	(0,0,255)
Dominant Wavelength	λd	Red	615	620	625	nm	(255,0,0)
		Green	520	525	530	nm	(0,255,0)
		Blue	460	465	470	nm	(0,0,255)
Chromaticity Coordinates	x	Calibrated White		0.3127			(255,255,255) Note 1
	y	Calibrated White		0.3290			
Luminous Intensity	IV	Calibrated White		3500		mcd	(255,255,255) Note 1
Viewing Angle	$2\theta_{1/2}$	-		120		deg	Note 2
Rth JS elec	Rth_{JSelec}			63		K/W	
Rth JS real	Rth_{JSreal}			73		K/W	

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. Other electrical characteristics refer to application note for IC.
3. The test condition is set to 8-bit PWM.

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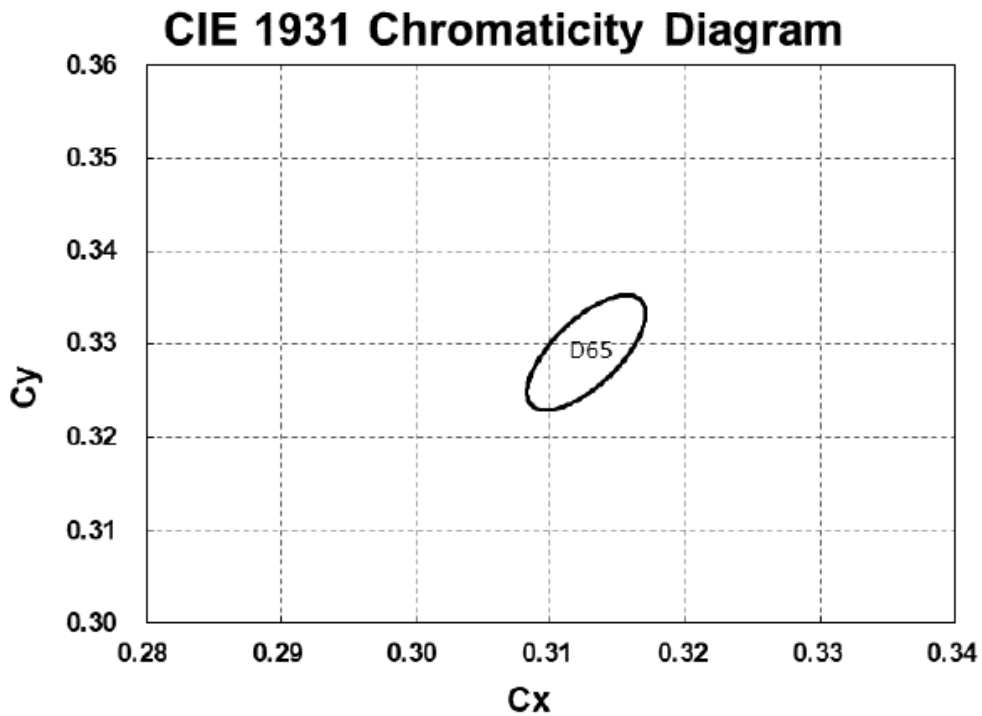
4. Bin Rank



Rank	Description	CIE-X	CIE-Y	A	B	Theta
D65	Macadams 3 steps	0.3127	0.3290	0.00669	0.00285	58.57

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5. Typical Electrical / Optical Characteristics Curves.

Fig.1 Relative Intensity vs. Wavelength (25°C Ambient Temperature)

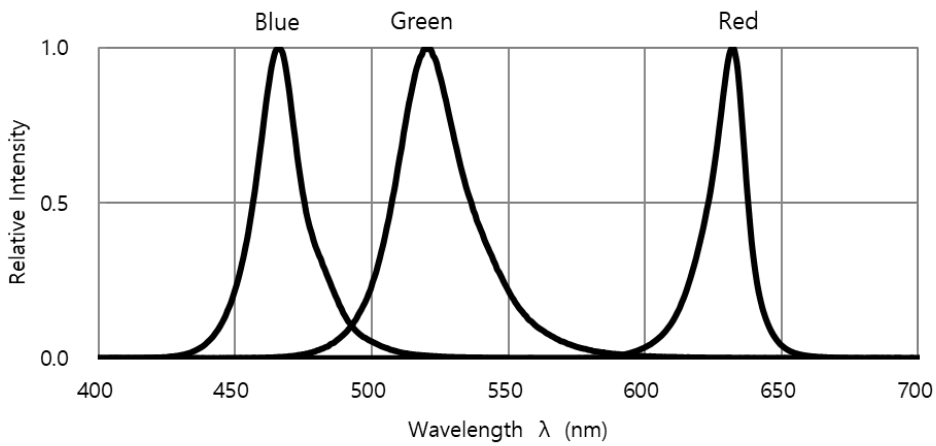


Fig. 1 RELATIVE INTENSITY VS. WAVELENGTH

Fig.2 Max. Color Setpoint Vs Temperature

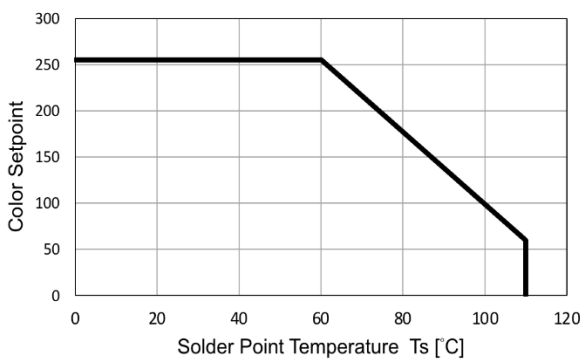
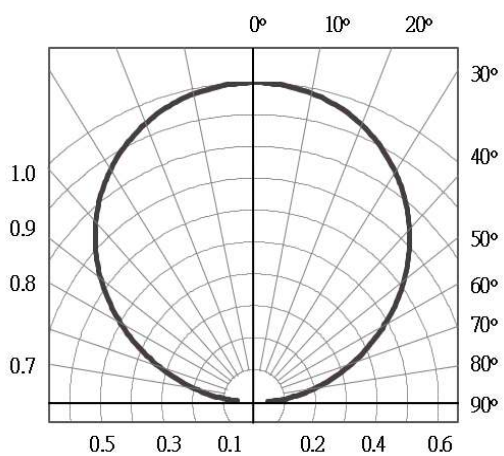


Fig.3 Spatial Distribution (Ta=25°C)



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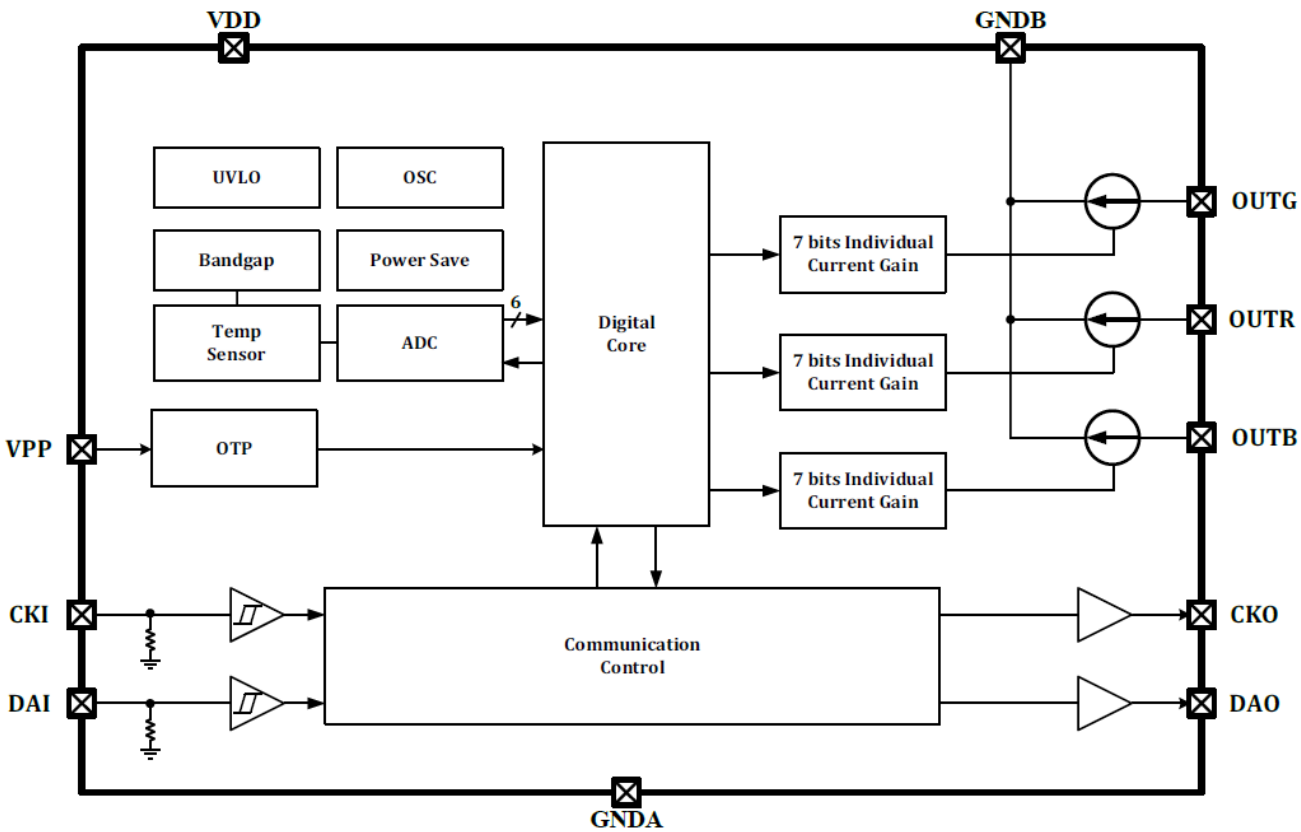
6. Functional Block



6.1 Description

This device is a three-channel constant current LED driver and control IC. Each LED output supports 7 bits current adjustment for output current setting and maximum 16 bits PWM for smooth LED dimming control. The maximum output current of each output is 60mA.

This device also has LED diagnostic functions to measure the LED chip temperature, which is applied to the built-in temperature compensation algorithm for red LED to provide constant luminance over wide operating temperature range.

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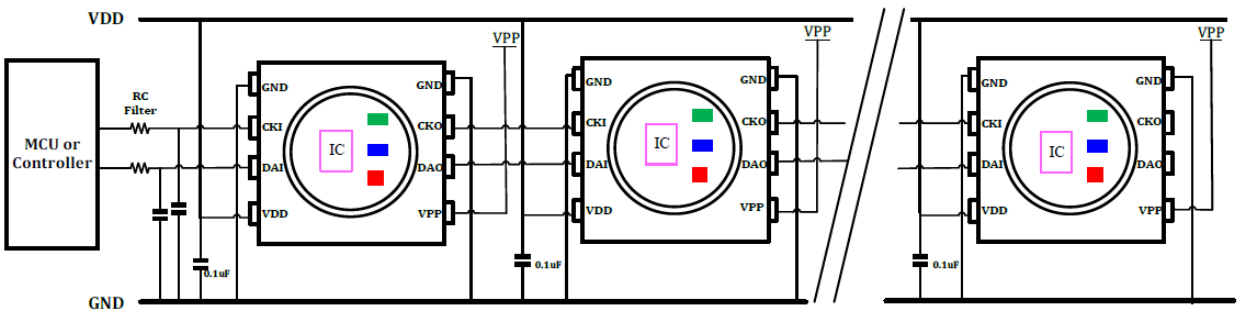
6.2 Application Circuit

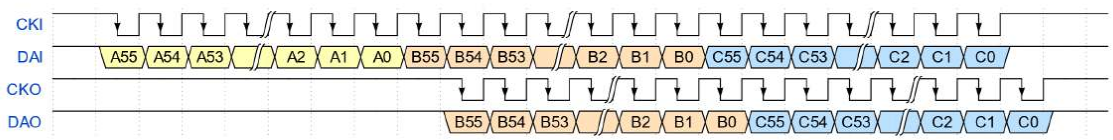


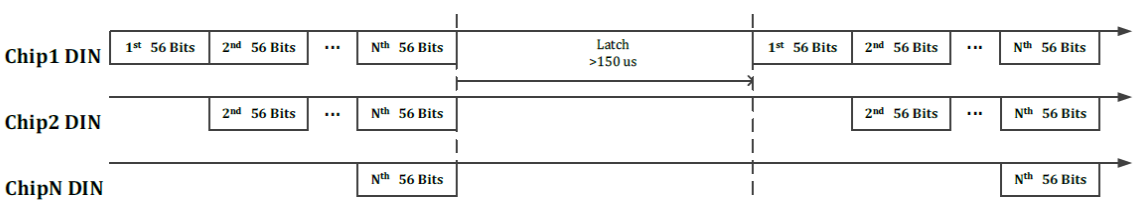
Notes:

1. The RC Filter of CKI and DAI pins must be added or reserved on the board for better waveform of signals in different applications. The value is subject to the practical system environment.
2. The by-pass capacitor of VDD pin is necessary to be added on the board for the stability of chip operation. The suggested value of capacitor is 0.1uF.
3. The VPP pin must connect to a voltage above 9V for OTP programming function.

6.3 Data Communication of cascading chips

Each chip needs 56 bits command data set by Primary Register and 56 bits PWM data for image display.
The CKI and DAI have to set at high level at power on and the first 56bits data must be the Primary Register data.
All chips will latch the command data or PWM data when the CKI keeps at high level over 150us (Latch).
The data sequence is shown below and the MSB bit is sent firstly.





6.4 Register Mapping

Bit	Definition	Default Value	Description
55:51	CRC	5b'x_xxxx	CRC 5 check sum
50:48	CMD	3'b010 (Default)	Command type selection
47:0	REG		Based on CMD to set the functions

6.5 Command Type Selection

Bit [50:48]	Definition	Default Value
3'b000	Reserved	Reserved
3'b001	PWM Data Program	PWM grayscale setting for each output
3'b010	Primary Register	Functions setting
3'b011	Reserved	Reserved
3'b100	OTP Memory Program	Write into OTP memory
3'b101	OTP Memory Read	Read out OTP memory setting value
3'b110	OTP Register Program	Write into OTP register
3'b111	OTP Register Read	Read out OTP register setting value

6.6 PWM Data Format

PWM data can be controlled and designed by LED pixel oriented. A LED lamp unit usually contains red, green, and blue LED chips, respectively, to the three pins of OUTR, OUTG and OUTB. The corresponding control data sequence is set from high to low bits. This device implements the 16 bits PWM grayscales for each output and each IC needs to send 56 bits PWM data. The data sequence is shown below and the MSB is sent firstly.

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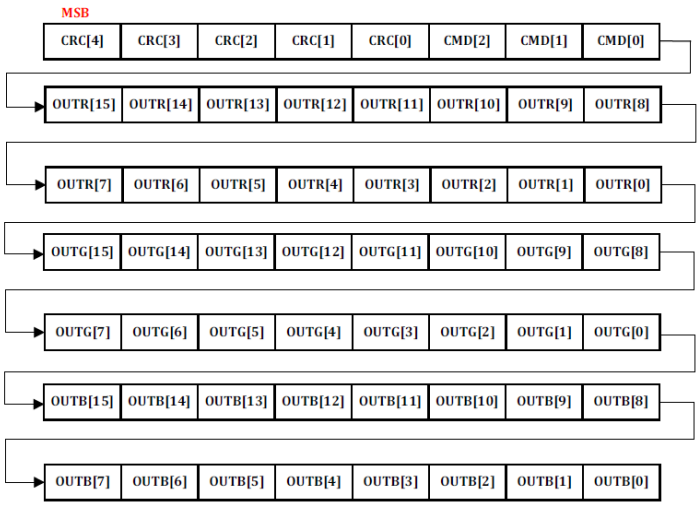
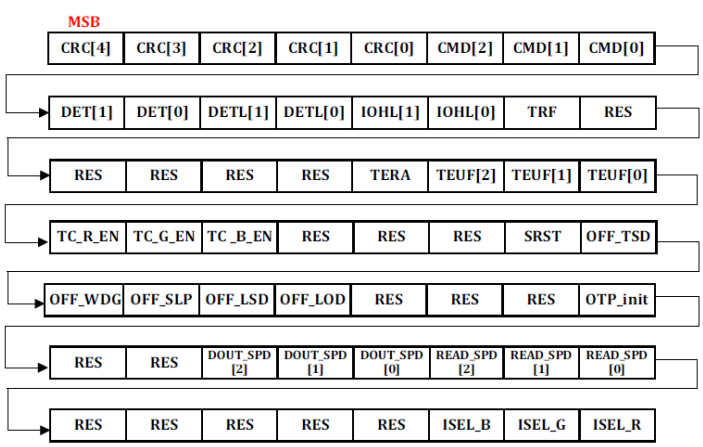


Bit	Definition	Default Value	Description
55:51	CRC	5b'x_xxxx	CRC check sum
50:48	CMD	3'b001	001: PWM data program
47:32	PWM_R	16'b0000_0000_0000_0000	16bits PWM grayscale setting for OUTR
31:16	PWM_G	16'b0000_0000_0000_0000	16bits PWM grayscale setting for OUTG
15:0	PWM_B	16'b0000_0000_0000_0000	16bits PWM grayscale setting for OUTB

6.7 Primary Register

This device has 56 bits command data for function setting. The data sequence and description of functions are shown below and the MSB is sent firstly.



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Bit	Definition	Default Value	Description
55:51	CRC	5b'x_xxxx	CRC check sum
50:48	CMD	3b'010	010: Primary Register
47:46	DET	2b'00	Detection mode selection 00: No detections, 01: LSD, 10: LOD, 11: Thermal (THD)
45:44	DETL	2b'10	LOD/LSD detection threshold voltage setting for OUTR/G/B
43:42	IOHL	2b'10	The current level of IOH/IOL for DAO/CKO 00: LV0 (the lowest) , 01: LV1 , 10: LV2, 11: LV2
41	TRF	1b'0	Outputs turn on slew rate level setup 0: slow 1: fast
40:36	RES	5b'00000	Reserved
35	TERA	1b'0	Running average function for temperature compensation 0: disable 1: enable
34:32	TEUF	3b'000	Temperature compensation data update frequency 000: 1-frame, 001: 4-frame, 010: 8-frame, 011: 16-frame 100: 32-frame, 101: 64-frame, 110: 128-frame, 111: 256-frame
31	TC_R_EN	1b'0	R LED Temperature compensation function 0: disable 1: enable
30	TC_G_EN	1b'0	G LED Temperature compensation function 0: disable 1: enable
29	TC_B_EN	1b'0	B LED Temperature compensation function 0: disable 1: enable
28:26	RES	3b'000	Reserved

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25	SRST	1b'0	Software Reset Display function 1: reset display data (write only)
24	OFF_TSD	1b'0	Over temperature protection function 0: enable 1: disable
23	OFF_WDG	1b'0	Watchdog function 0: enable 1: disable
22	OFF_SLP	1b'0	Sleep mode function 0: enable 1: disable
21	OFF_LSD	1b'0	Short mark function 0: enable 1: disable
20	OFF_LOD	1b'0	Open mark function 0: enable 1: disable
19:17	RES	3b'000	Reserved
16	OTP_init	1b'1	OTP read all address at OTP_init turn low level 0: OTP_init state set as low level 1: OTP_init state set as high level
15:14	RES	2b'00	Reserved
13:11	DOUT_SPD	3b'000	DAO frequency selection for data transmission
10:8	READ_SPD	3b'000	CKO/DAO frequency selection for detection data report and OTP read
7:3	RES	5b'00000	Reserved
2	ISEL_B	1b'1	Maximum IOUT set for B LED 0: 30mA, 1: 60mA
1	ISEL_G	1b'1	Maximum IOUT set for G LED 0: 30mA, 1: 60mA
0	ISEL_R	1b'1	Maximum IOUT set for R LED 0: 30mA, 1: 60mA

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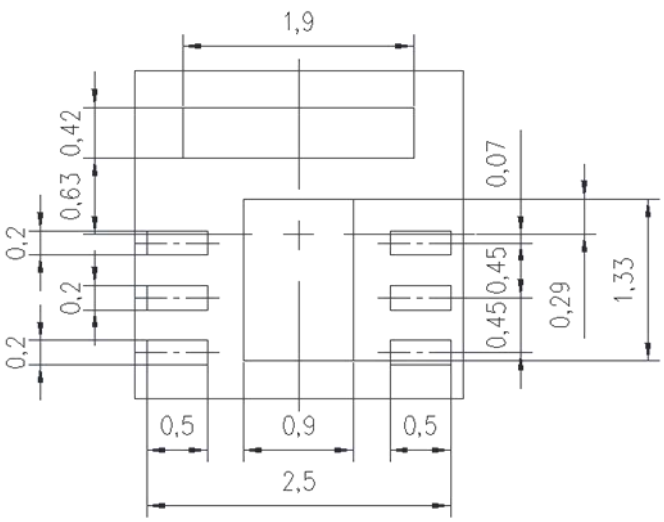
7. User Guide

7.1 Cleaning

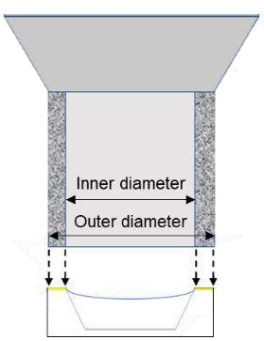
Do not use unspecified chemical liquid to clean LED they could harm the package.
If clean is necessary, immerse the LED in ethyl alcohol or in isopropyl alcohol at normal temperature for less one minute.

7.2 Recommend Printed Circuit Board Attachment Pad



7.3 Recommended Pick-and-Place Tools

For SMD LEDs, the encapsulant is typically made of polymer materials such as silicone or epoxy. These polymers exhibit both elastic and glassy physical properties, making them sensitive to mechanical stress. Therefore, it is strongly recommended not to touch or press the encapsulant at any time, as this may damage the internal structure of the LED. Since the plastic reflector bowl is significantly harder than the encapsulant, the surface of the reflector is more suitable for pick-and-place operations using a nozzle.



Nozzle Selection Guidelines:

1. The inner diameter of the nozzle should be larger than the inner area of the reflector bowl, but smaller than the outer dimensions of the LED package.
2. The outer diameter of the nozzle should match the outer edge of the reflector bowl.
3. If the above two conditions cannot be met, the inner diameter may be smaller than the inner area of the reflector bowl, but the outer diameter must be larger than the inner area to ensure proper contact.

The image on the left illustrates the recommended nozzle contact area. The yellow shell portion represents the area that can be contacted, while the blue encapsulant region indicates the area that should not be touched or pressed. Contact with the blue encapsulant region may cause the LED to stick to the nozzle or even result in damage.

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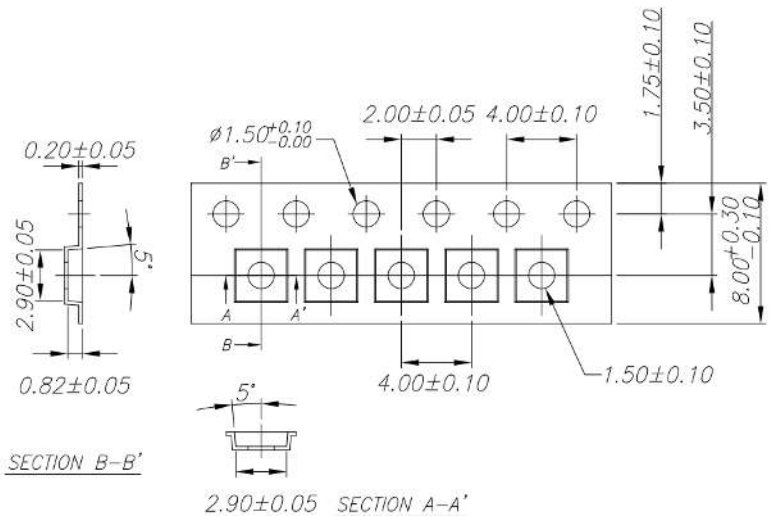
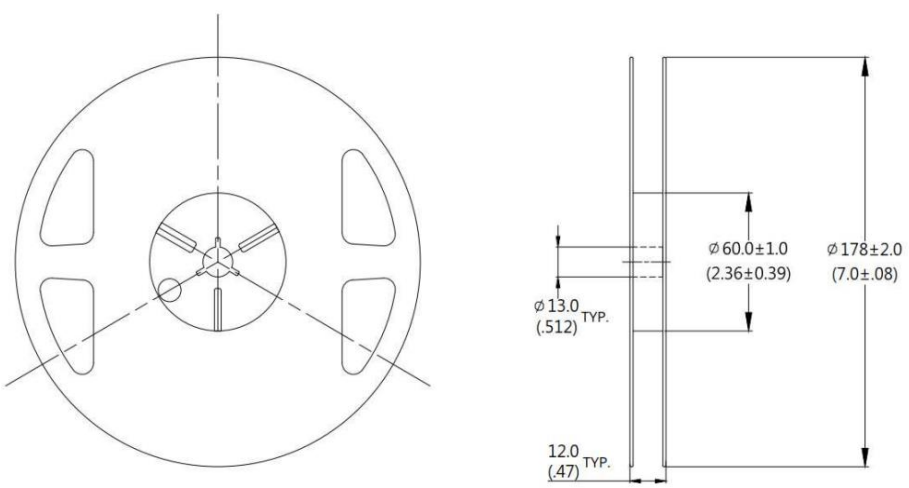
7.4 Package Dimensions of Tape and Reel



Notes:

1. All dimensions are in millimeters.

7.5 Package Dimensions of Reel



Notes:

1. Empty component pockets sealed with top cover tape.
2. 7- inch reel-2000 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

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8. Cautions

8.1 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).

8.2 Storage

This product is qualified as Moisture Sensitive Level 2 per JEDEC J-STD-020 Precaution when handing this moisture sensitive product is important to ensure the reliability of the product.
The package is sealed:
The LEDs should be stored at 30°C or less and 70%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 and 60% relative humidity.
It is recommended that LEDs out of their original packaging are IR-reflowed within one year. (MSL 2)
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 4 weeks should be baked at about 60 °C for at least 48 hours before solder assembly..

8.3 Cleaning

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

8.4 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 you 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.

8.5 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.
- Worktables, 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.

ESD-damaged LEDs will exhibit abnormal characteristics such as high reverse leakage current, low forward voltage, or "no light up" at low currents.

9. Reliability Test (According to AEC-Q102 rev -)

No.	Test item	Test condition	# of Lots	Sample size Per Lot	Reference standard
2	Pre-conditioning	MSL 2 125 ºC, 24 hrs baking Moisture Soak 85 ºC/60% 168 hrs (Interval: 15mins ~ 4 hours to do IR-Reflow) IR-reflow 3 times (260°C: 10 secs, Interval: 5mins ~ 60mins for each reflow)	3	104	JESD22 A-113
5a	High Temperature Operating Life (HTOL1)	Ta=110 ± 2°C IF: 5mA 1000 hrs	3	26	JESD22 A-108
5b	High Temperature Operating Life (HTOL2)	Ta=60 ± 2°C IF: 25mA 1000 hrs	3	26	JESD22 A-108
6a	Wet High Temperature Operating Life (WHTOL1)	Ta = 85 ± 2°C, 85 ± 5% RH IF: 15mA. Tj defined in the part specification. Operated with power cycle 30 min on / 30 min off for power > 200mW, others are DC drove.1000 hrs	3	26	JESD22-A101
6b	Wet High Temperature Operating Life (WHTOL2)	Ta = 85 ± 2°C, 85 ± 5% RH IF: 5mA. Tj defined in the part specification. Operated with power cycle 30 min on / 30 min off for power > 200mW, others are DC drove.1000 hrs	3	26	JESD22-A101
7	Temperature Cycling (TC)	-40°C(+0, -10) to 100°C(+15,-0) 15 min 15 min 15 min 1000 cycles	3	26	JESD22 A-104
8a	Power and Temperature Cycling (PTC)	-40°C(+0, -10) to 100°C(+15,-0) 15 min 15 min 15 min 5mA 1 cycle: 5 min. on / 5 min. off 1000 cycles	3	26	JESD22 A-105

10a	ESD Characterization (HBM)	HBM 2kV, 4kV, 6kV, 8kV	1	30	AEC-Q100-002
18a	Resistance to Solder Heat	Tsld=260°C, 10sec. 3times	3	10	JESD22-B106
19	Solderability	Tsld = 235± 5°C, 5sec, Leas-free Solder	3	10	JESD22-A113 J-STD-020
20	Pulse Operating Life (PLT)	Ta=55 ºC Operated with pulse with 100μs and duty cycle 3% IF: 60mA. 1000 hrs Test before and after PLT	3	26	JESD22-A108
21	Dew (DEW)	T cycling 30-65°C with dwell time at 65°C between 4h, transition time between 3h RH = 90%.Duration 1008 h, IF: 3mA 1000 hrs	3	26	EDEC JESD22-A100
22	Hydrogen Sulphide (H2S)	H2S: 15ppm, Ta=40 ºC, 90%RH 336hrs Test before and after FMG	3	26	IEC 60068-2-43
23	Flowing Mixed Gas (FMG)	Air temp. 25°C, 75% RH H2S concentration: 10 x 10-9 SO2 concentration: 200 x 10-9 NO2 concentration: 200 x 10-9 Cl2 concentration: 10 x 10-9 500 hrs Test before and after FMG	3	26	IEC 60068-2-60 Test method 4

Note: Classes of H2S&FMG reference following table

Class	Grade A	Grade B	Test Conditions
0	NA	Discoloration possible	Not tested
1	No visible discoloration	Discoloration possible	25°C / 75% RH / 200ppb SO2, 200ppb NO2, 10ppb H2S, 10ppb Cl2 / 500 hrs (IEC 60068-2-60 Test method 4)
2	No visible discoloration	Discoloration possible	25°C / 75% RH / 10ppm H2S / 500 hrs (IEC 60068-2-43)
3	No visible discoloration	Discoloration possible	40°C / 90% RH / 15ppm H2S / 336 hrs (IEC 60068-2-43)

By 50x microscope

10. Others

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