BRIGHTEK
BRIGHTEK (EUROPE) LIMITED
Brighten Up The World With LED !

ISO/TS 16949:2009 | BS EN ISO 14001:2004 | QC 080000 | IECQ HSPM

PRODUCT DATASHEET

ATTENTION
OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

- ▶ EMC SMD with IC
- ▶ 3023 IC 0.9t
- ▶ Red/Green/Blue

Release Date: 09 August 2024 Version: A1.4

N0M61S01IC (CD3023VGBMG01)

3023 IC Integrated

3023 IC-Integrated

RoHS Compliant

AUTOMOTIVE AEC-Q100 AUTOMOTIVE AEC-Q102

FEATURES:

- **Package:** EMC 8-Pins STD Package with Integrated IC
- **Forward Current:** 25mA
- **Forward Voltage (typ.):** +4.5~+5.5V
- **Luminous Intensity (typ.):** 390/910/100mcd*; mixed white: 1400mcd
- **Colour:** Red/Green/Blue
- **IC Feature:**
  - Low thermal resistance.
  - 488Hz PWM with 12-bit resolution.
  - Bi-directional, half-duplex, 2M-bit/s, serial commun-ication.
  - Build-in temperature sensor.
  - 8-bit brightness resolution for red, green, and blue.
  - Build-in diagnostic functions.
  - Temperature compensation on red for constant brightness.
  - Calibration values for accurate white point of LED drivers.
- **Soldering methods:** IR Reflow soldering
- **MSL Level:** acc. to JEDEC Level 2a
- **Packing:** 8mm tape with max.2000pcs/reel, ø180mm (7’’)

* in order of Red/Green/Blue

APPLICATIONS:

- Automotive Interior & Exterior
- Status Indicator
- Home Appliance
- Decoration Lighting
- Full Colour LED Strip
- Gaming Device
- Guardrail Tube
- Indoor Display Screen

CHARACTERISTICS:

Absolute Maximum Characteristics (Ta=25°C)

Parameter	Symbol	Ratings	Unit
IC Power Supply Voltage	V_{DD}	7	V
Operating Junction Temperature	T_{OP}	125	°C
Storage Temperature	T_{STG}	125	°C
Soldering Temperature [1]	T_{OPR}	260	°C
Electrostatic discharge (HBM)	ESD	2000	V
Rth-js Real Colour Set Point (255,255,255)	$R_{th\text{-}js}$	30	K/W

1. The maximum soldering time is 10s in T_{SD}.
2. The IC power supply voltage is not allowed to exceed 7.0V.

Recommend Operating Conditions

Parameter	Symbol	Ratings	Unit
IC Power Supply Voltage	V_{DD}	4.5~5.5	V
Ambient Temperature Range	T_a	-40~+110	°C

LED Driver Interface (Ta=25°C)

Parameter	Symbol	Ratings	Unit
PWM Frequency	f_{PWM}	122~488	Hz
PWM Pulse Length	t_{PWM}	2~2050	µs

Switching Characteristics (Ta=25°C)

Parameter	Symbol	Ratings	Unit
Power on Reset	VDD	3.2~3.3	V
Under Voltage - Lockout	V_{UVLO}	3.1~3.2	V

Electrical & Optical Characteristics (Ta=25°C, V_{DD}=5V)

Parameter		Symbol	Values			Unit	Test Condition
			Min.	Typ.	Max.		
Luminous Intensity	R	I_V	---	390	---	mcd	(255,0,0)
	G		---	910	---		(0,255,0)
	B		---	100	---		(0,0,255)
	W		---	1400	---		(255,255,255)
Dominant Wavelength	R	λ_D	---	621	---	nm	(255,0,0)
	G		---	526	---		(0,255,0)
	B		---	467	---		(0,0,255)
Calibrated White [1]	Cx	---	---	0.3127	---	---	(255,255,255)
	Cy		---	0.3290	---	---	
Viewing Angle		$2\theta_{1/2}$	---	120	---	deg	(255,255,255)

1. Above luminous intensity represents brightness at 100% colour set point (255,255,255).
2. Tolerance of measurement: luminous intensity: ±10%, white colour coordinate: ±0.005, dominant wavelength: ±1nm.

Serial Interface (Ta=25°C)

Parameter	Symbol	Ratings	Unit
Input High Voltage	V_{IH}	1.08~VDD	V
Input Low Voltage	V_{IL}	0~1.04	V
Minimal Differential Input Amplitude (typ.)	V_{min}	60	mV
Maximal Differential Input Amplitude (typ.)	V_{max}	250	mV
Differential Output High Voltage (typ.)	V_{OH}	250	mV
Differential Output High Voltage (typ.)	V_{OL}	0	mV

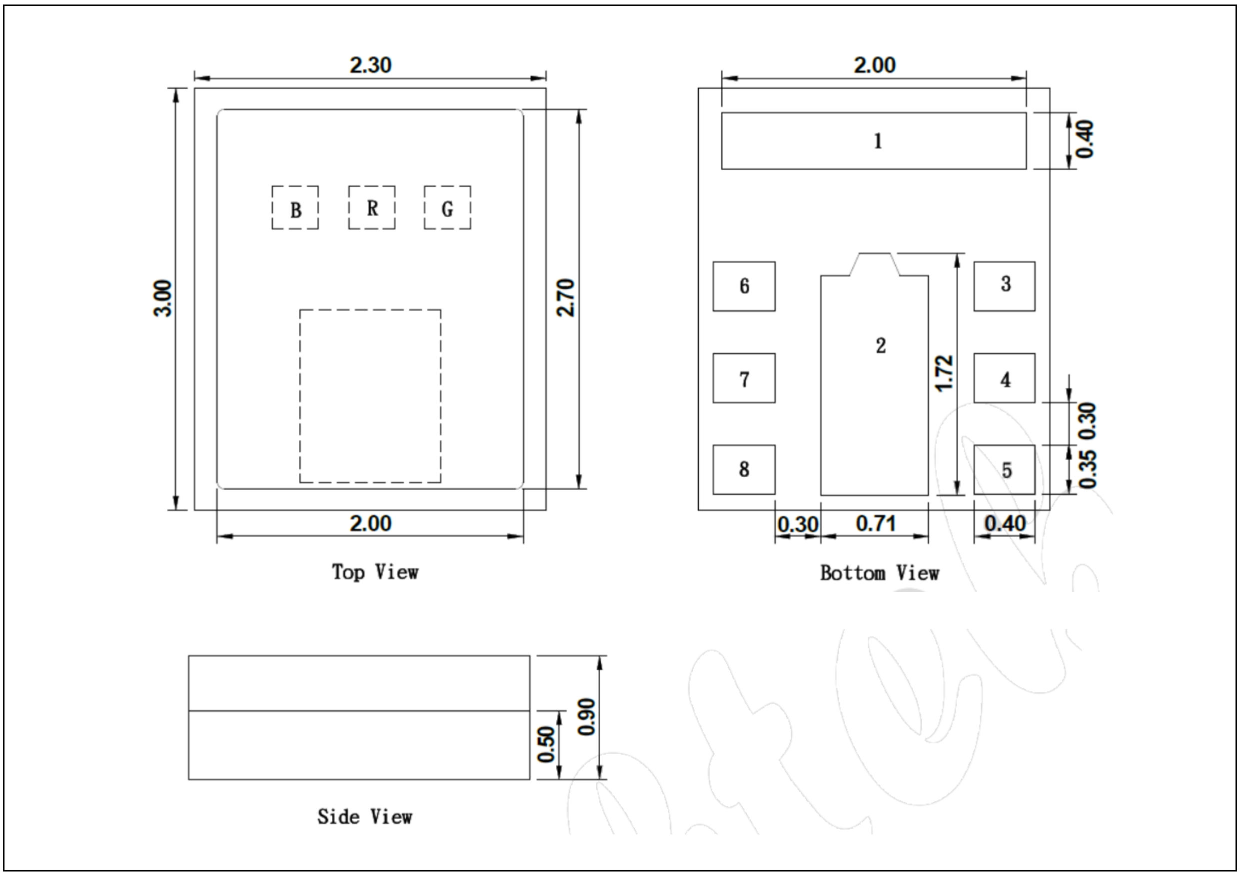
Current Consumptions (Ta=25°C)

Parameter		Symbol	Values			Unit	Test Condition
			Min.	Typ.	Max.		
Current Average	R	I_{AVG}	0*	12.7	---	mA	---
	G		0*	12.8	---		---
	B		0*	9.0	---		---
Current Peak	R	I_{PEAK}	0*	---	25	mA	---
	G		0*	---	80		---
	B		0*	---	80		---
Driver		I_{VDD}	0.9	1.0	1.1	mA	(255,255,255)

* LED current set to zero by command.

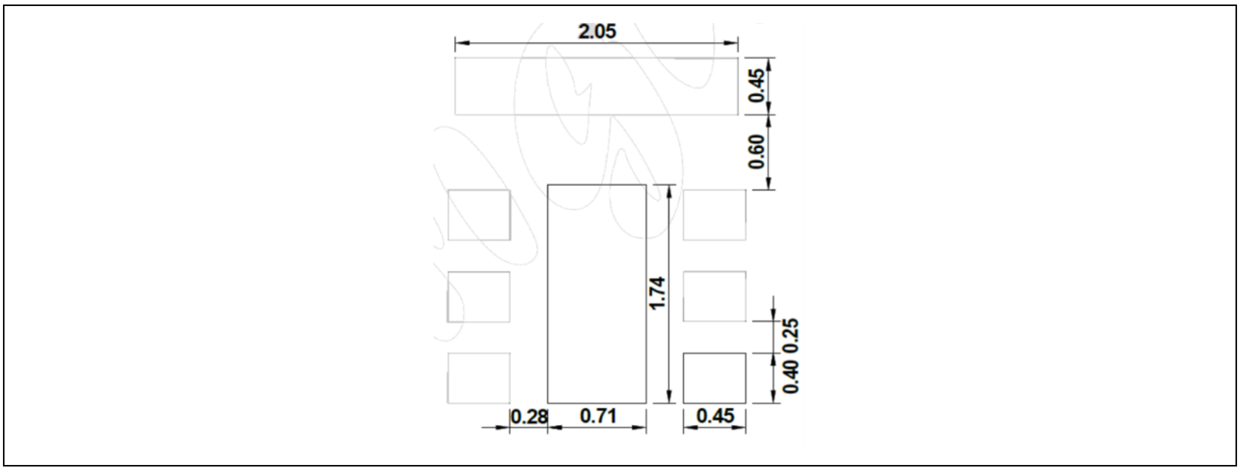
OUTLINE DIMENSION:

Package Dimension:



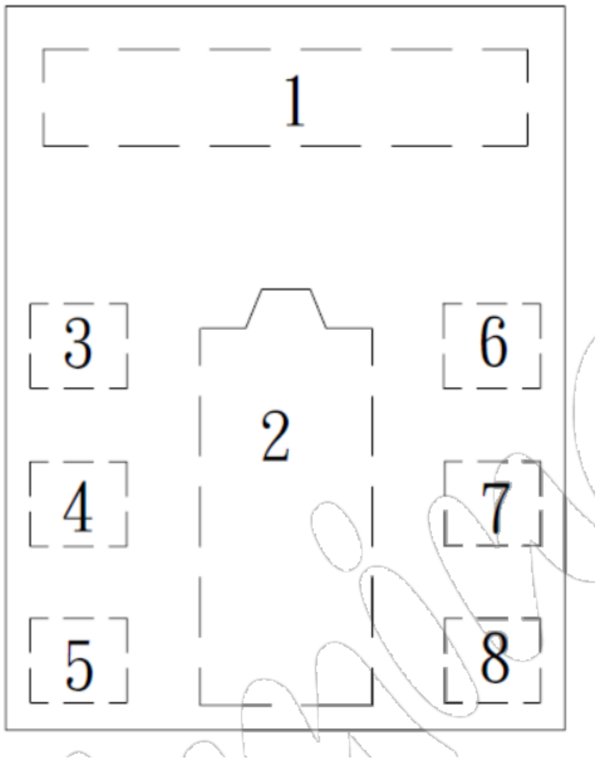
1. All dimensions are in millimetre (mm).
2. Tolerance ±0.1mm, unless otherwise noted.

Recommended Soldering Pad Dimension:



1. Dimensions are in millimetre (mm).
2. Tolerance ±0.1mm with angle tolerance ±0.5°.

PIN CONFIGURATION:



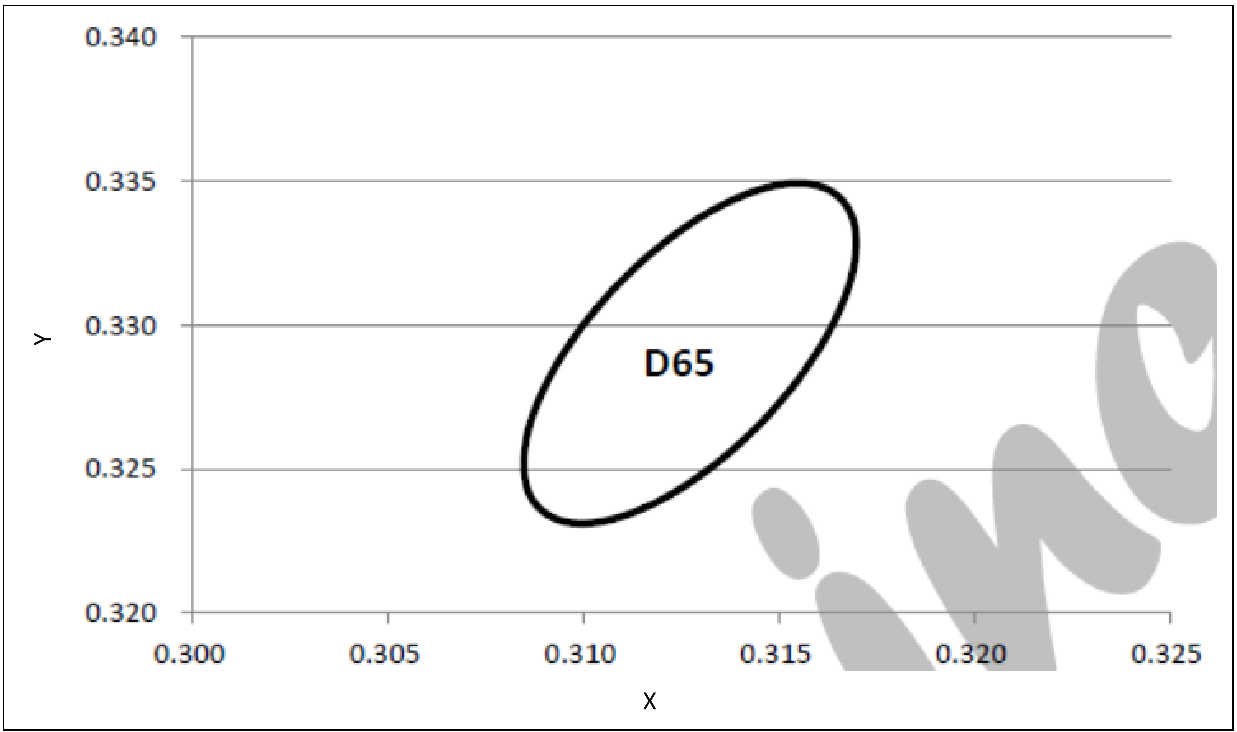
No.	Symbol	Function Description
1	VDD	Supply voltage for R/G/B
2	GND	Ground
3	SiO1_P	Serial communication interface master side, positive polarity
4	SiO1_N	Serial communication interface master side, negative polarity
5	PRG	Must be connected to GND for proper operation
6	SiO2_P	Serial communication interface slave side, positive polarity
7	SiO2_N	Serial communication interface slave side, negative polarity
8	VDD	Supply voltage

LOOKUP TABLE:

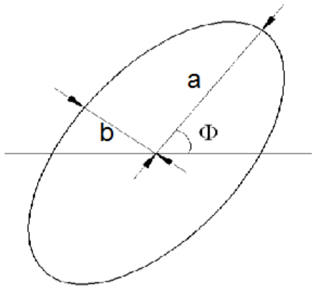
Lookup Table for red LED non-linear temperature compensation:

LUT	Values
LUT_10	155
LUT_9	163
LUT_8	176
LUT_7	194
LUT_6	212
LUT_5	236
LUT_4	262
LUT_3	299
LUT_2	350
LUT_1	405
LUT_0	511

CIE CHROMATICITY DIAGRAM:

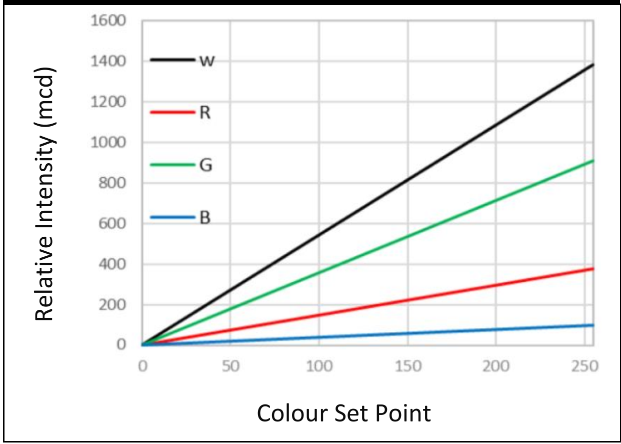


Chromaticity Coordinates Classifications:

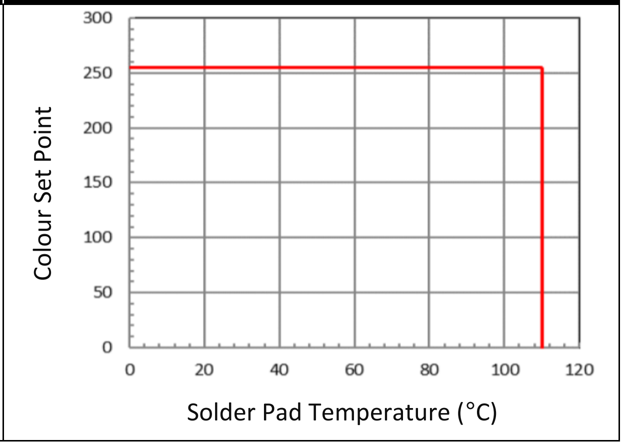
	Code	Centre		Radius		Angle
		X	Y	a	b	Φ
	D65	0.3127	0.3290	0.00669	0.00285	58.57

ELECTRO-OPTICAL CHARACTERISTICS:

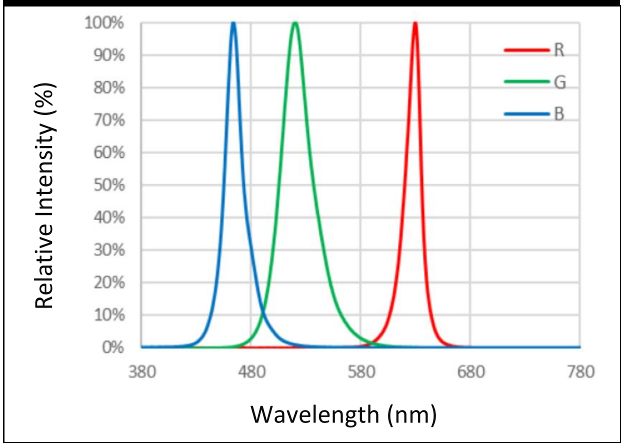
Relative Intensity v.s. Colour Set Point
(Iv=f(color set point); Tj=25°C; DIM0)



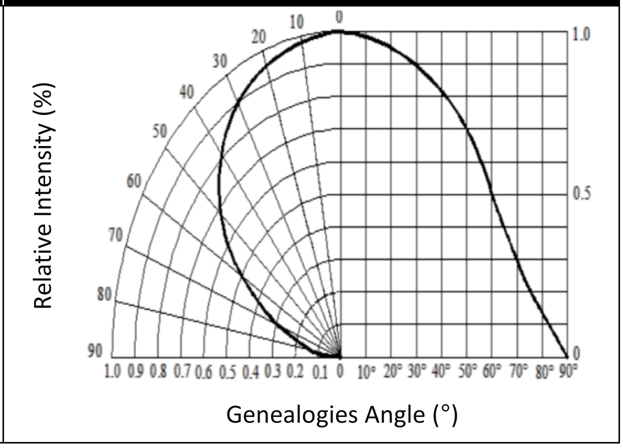
Max. Colour Set Point v.s. Temperature
(Colour Set Point=f(T); Color Set Point=(255,255,255))



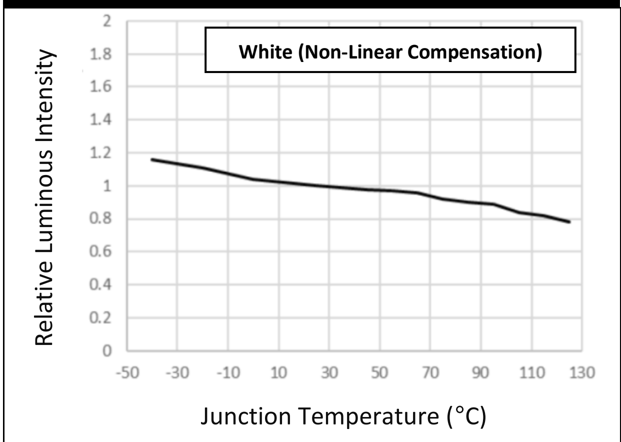
Relative Spectral Distribution
(Tj=25°C; Colour Set Point=(255,255,255))



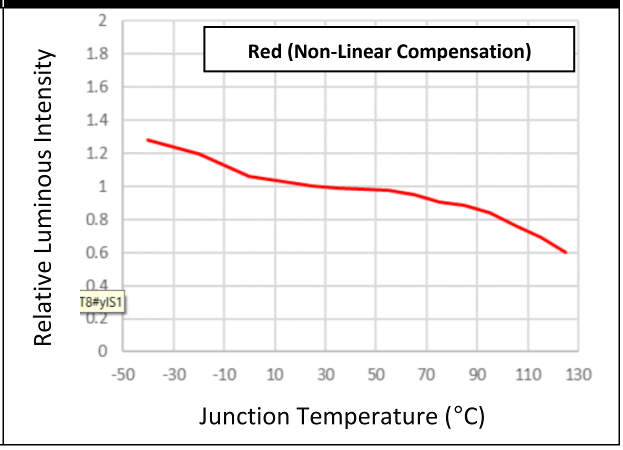
Directive Radiation
(Colour Set Point=(255,255,255))



Relative Intensity v.s. Junction Temperature
(Iv/Iv(25°C)=f(Tj); Colour Set Point=(255,255,255))

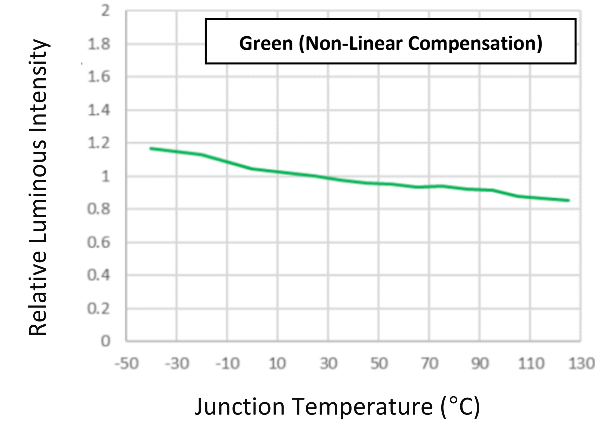


Relative Intensity v.s. Junction Temperature
(Iv/Iv(25°C)=f(Tj); Colour Set Point=(255,0,0))

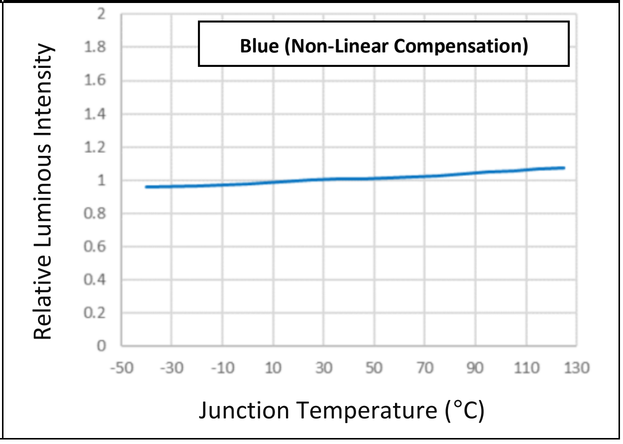


ELECTRO-OPTICAL CHARACTERISTICS:

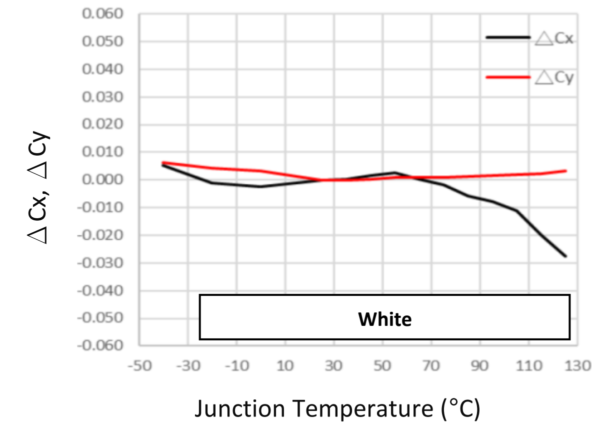
Relative Intensity v.s. Junction Temperature
(Iv/Iv(25˚C)=f(Tj); Colour Set Point=(0,255,0))



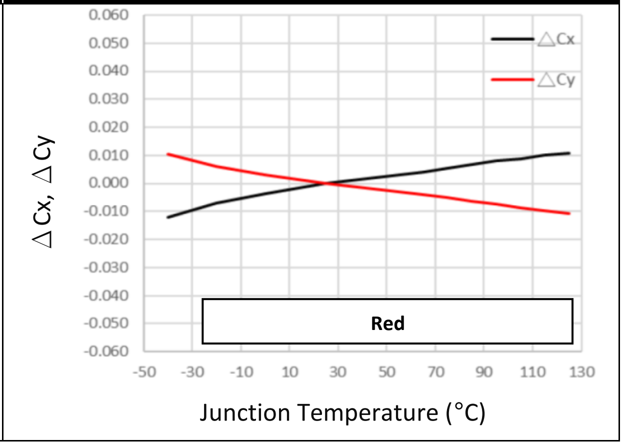
Relative Intensity v.s. Junction Temperature
(Iv/Iv(25˚C)=f(Tj); Colour Set Point=(0,0,255))



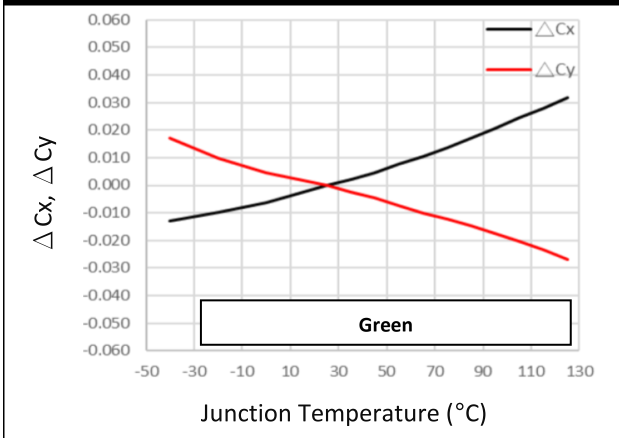
Chromaticity Coordinate Shift v.s. Temperature
(ΔCx, ΔCy (25˚C)=f(Tj); Colour Set Point=(255,255,255))



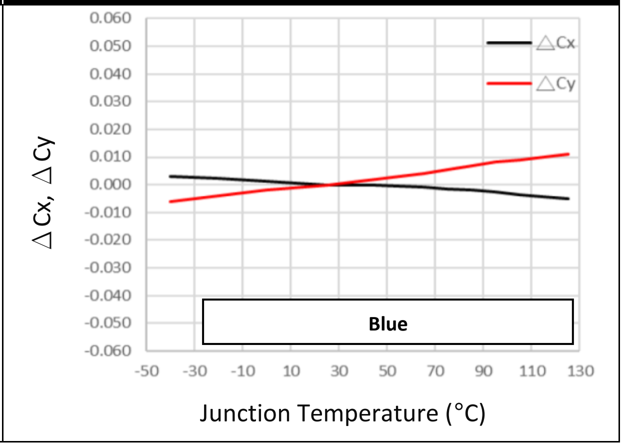
Relative Intensity v.s. Junction Temperature
(ΔCx, ΔCy (25˚C)=f(Tj); Colour Set Point=(255,0,0))



Relative Intensity v.s. Junction Temperature
(ΔCx, ΔCy (25˚C)=f(Tj); Colour Set Point=(255,0,0))

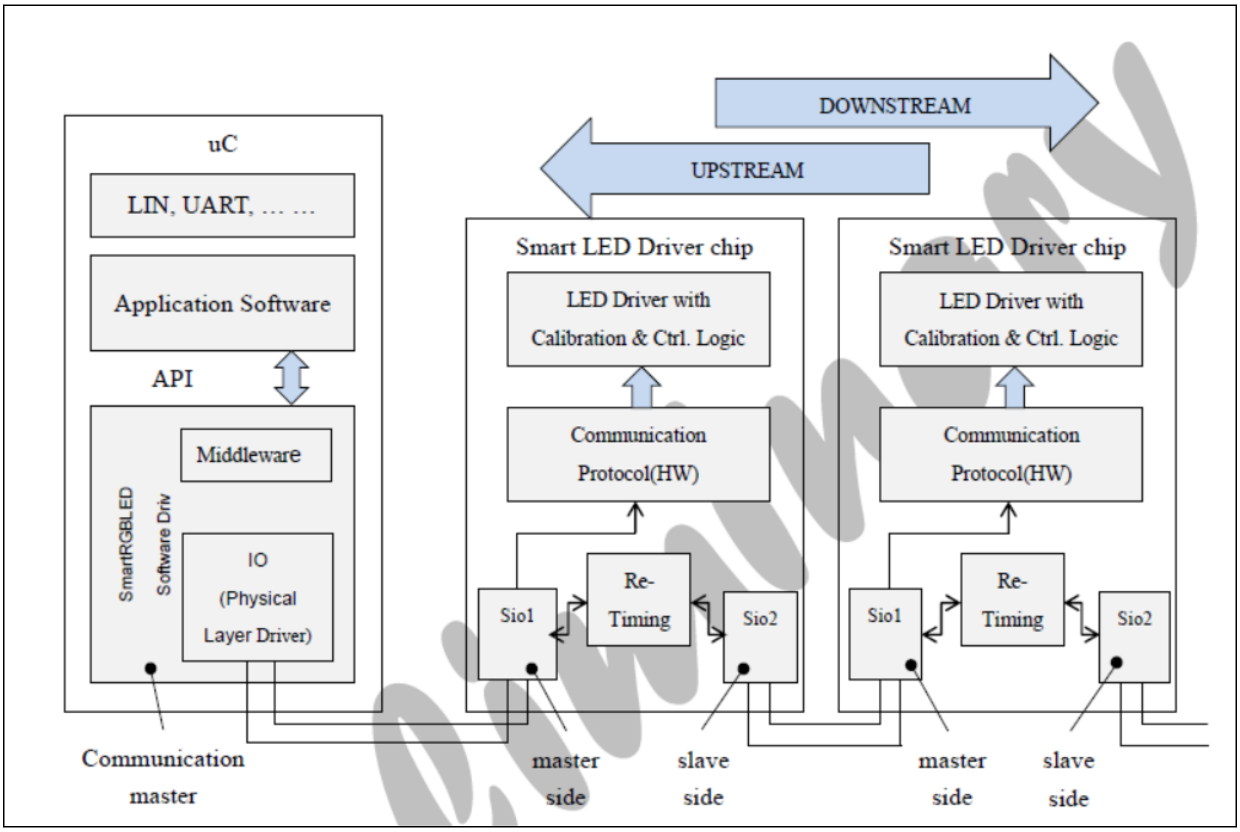


Relative Intensity v.s. Junction Temperature
(ΔCx, ΔCy (25˚C)=f(Tj); Colour Set Point=(255,0,0))



FUNCTION DESCRIPTION (BI-DIRECTIONAL / SINGLE ENDED AND DIFFERENTIAL):

Serial Communication:



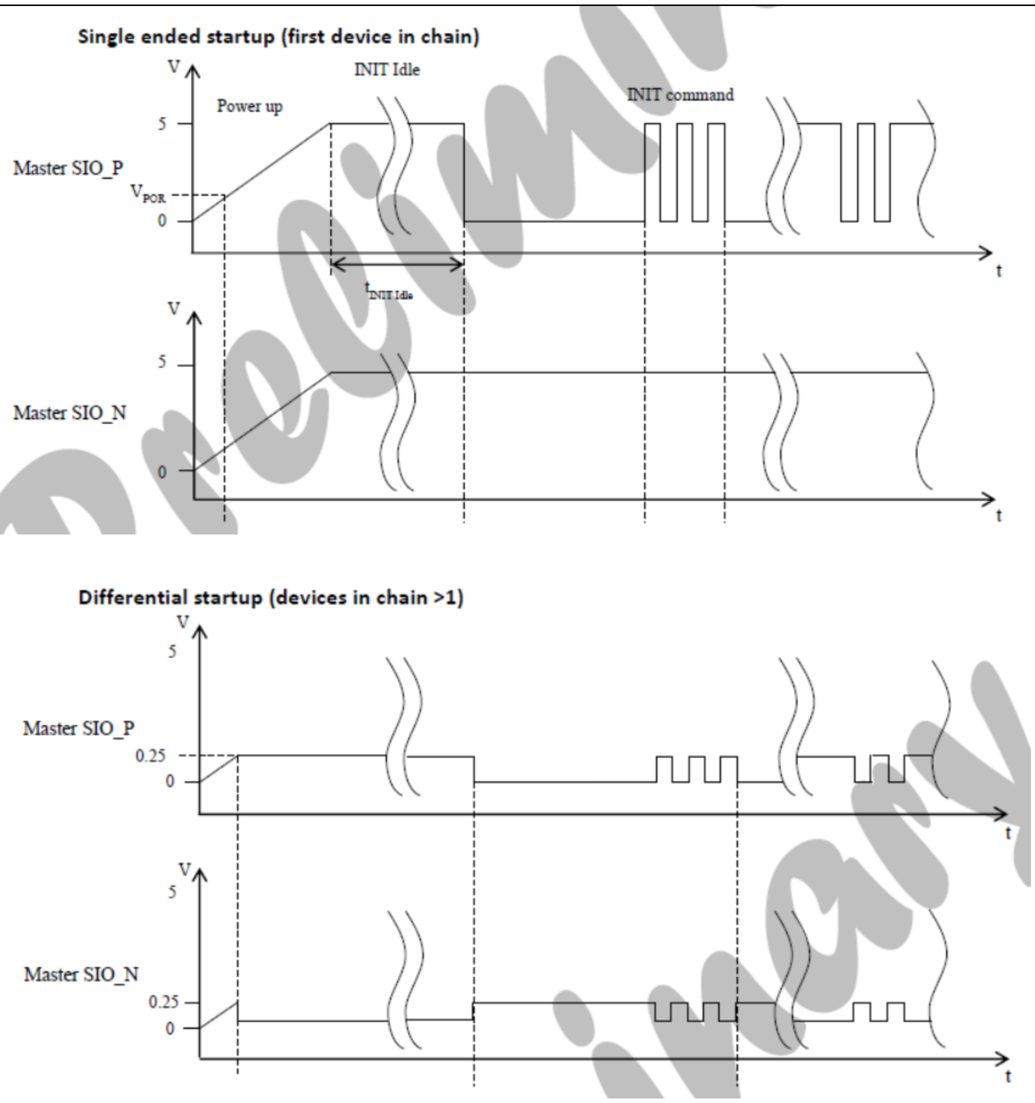
The attachment to the adjacent devices in the chain is made up by two bidirectional differential serial communication lines. The direction towards the controlling microcontroller device is referred to as the "upstream" connection. The opposite direction towards the end of the chain is the "downstream" link. Both links are controlled by the communication unit. Incoming command frames from upstream and responses from downstream are passed to the main unit which is responsible for command processing and overall device control. Commands always originate from the controlling microcontroller. The microcontroller is referred to as the "host" in this document.

The gross data rate on the serial line is 2Mbit/s, i.e. each bit has a nominal duration of 500 ns. As the on-die oscillator has a very limited accuracy, the actual bit time may vary significantly. The whole system is designed for a maximum oscillator variance of ±30%. With the nominal oscillator frequency being 16 MHz, the actual frequency range is 11.2-20.8MHz.

The device directly attached to the host does not use the differential line mode on the upstream side. Instead, a single-ended line mode is used. The single-ended mode is intended to allow for an easy attachment to industry standard microcontrollers. Both single-ended lines require an external pull-up at the microcontroller to 5V.

(1) Automatic Detection of the Serial Line Mode

During start-up, the devices automatically detect the mode of the upstream and the downstream link. The upstream link may be either single-ended or differential. If a device detects the upstream to be single-ended, it is the first in the chain of LEDs. The downstream link may be either differential or unconnected, i.e. the device is the last in the chain of LEDs. After power-up, an idle of $t_{INIT\ Idle}$ = 150µs is recommended before the initialization. If during the initialization, while receiving the enumeration command, the master SIO_N pin is single ended high (5V), the device is switched into single ended communication mode for this port. The detected mode is stored and used for all following communications until a power cycle or a reset command.



Recommended init idle

Parameter	Description	Values		Unit
$t_{INIT\ Idle}$	Init idle directly after power up	min.	150	us
		max.	-	

(2) Half-Duplex Communication

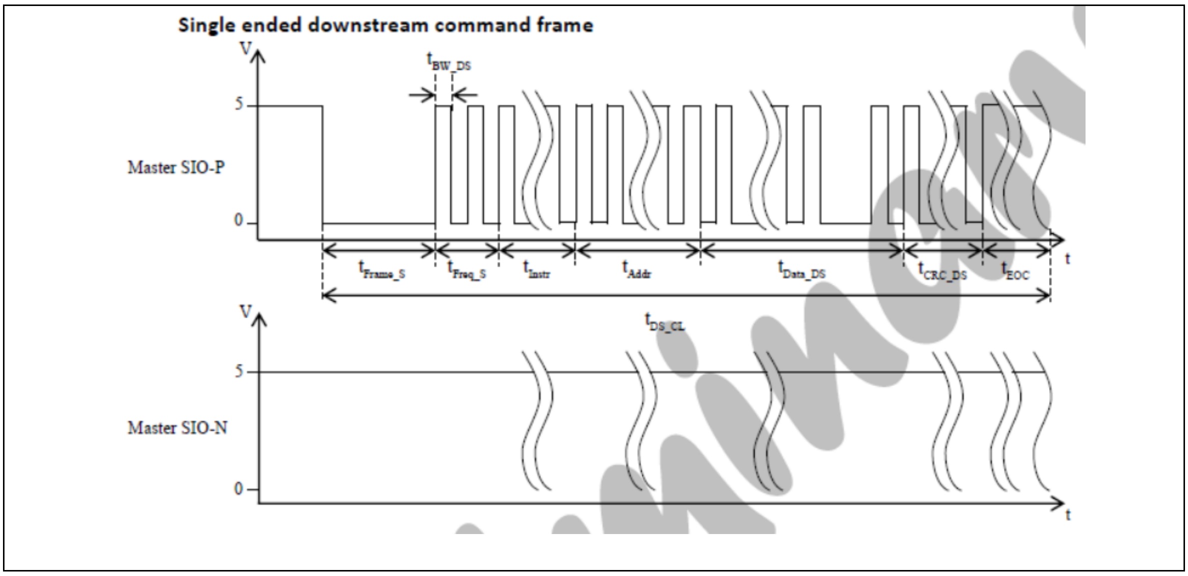
The communication operates in a strict master slave manner. I.e. the microcontroller as the master always initiates a communication. Depending on the type of command the LED devices may send a response (read access) or just silently execute the command (write access). There are three basic types of commands which are described in the following.

(3) Basic Frame Format

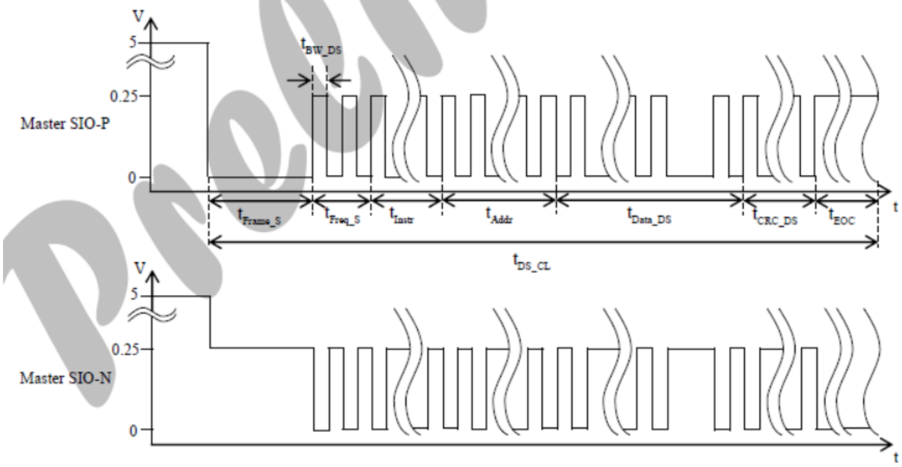
Commands and the response to commands are transmitted with serial frames. A serial frame always consist of a frame_sync section, followed by a frequency_sync section, followed by a run length coded command section and finally terminated with an optional CRC section. The command and the CRC sections differ in length between downstream and upstream frames.

The chosen bit encoding ensures a maximum number of adjacent zeros of 4 and a maximum number of adjacent ones of 5 on the serial line. Some of the bit patterns which cannot occur during regular data transmission are used for special purposes. A pattern of 6 or more 1-bits is considered as the bus-idle condition. The bus is idle, when no communication is currently ongoing. A pattern of 15 0-bits is recognized as the so-called frame synchronization. This is the sequence to begin a new frame. The pattern “10101” is the so-called frequency synchronization pattern. It is used after the frame synchronization to determine the transmitter’s gross data rate.

Downstream communication is defined as data inputs at SIO1 and outputs at SIO2. This is the data flow for write commands. Upstream respectively is defined as data inputs at SIO2 and outputs at SiO1. This is the data flow for the read response.



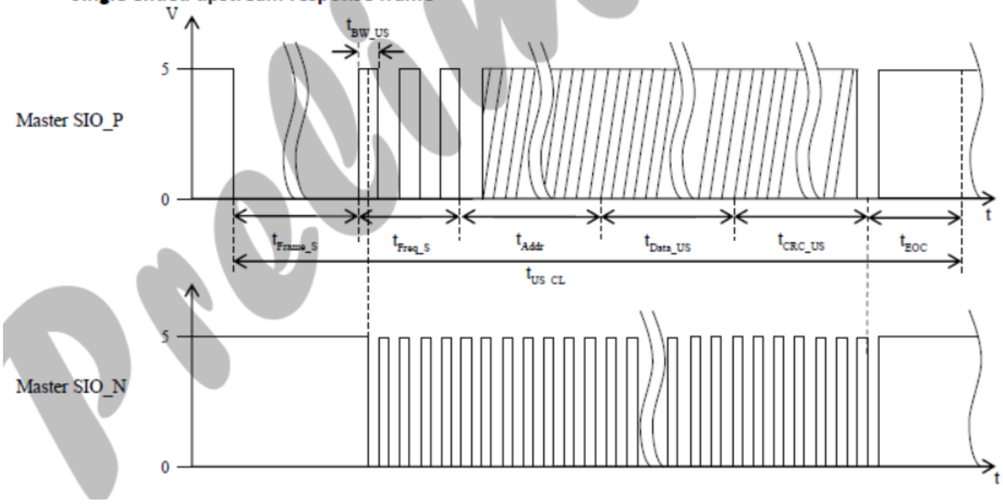
Differential downstream command frame



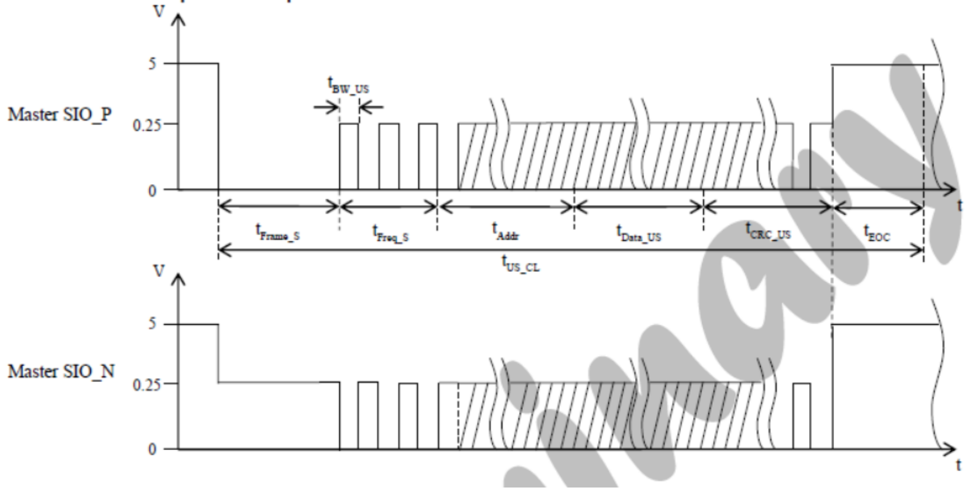
Downstream command frame parameters

Parameter	Description	Values		Unit
t_{BW_DS}	Downstream bit width	min.	350	ns
		typ.	500	
		max.	650	
t_{DS_CL}	Downstream command length	-	-	-
	CRC enabled	typ.	86 x t_{BW_DS}	ns
	CRC disabled	typ.	76 x t_{BW_DS}	ns
t_{Frame_S}	Frame sync	typ.	15 x t_{BW_DS}	ns
t_{Freq_S}	Frequency sync	typ.	5 x t_{BW_DS}	ns
t_{Inst}	Instruction	typ.	5 x t_{BW_DS}	ns
t_{Addr}	Address	typ.	15 x t_{BW_DS}	ns
t_{Data_DS}	Downstream Data	typ.	30 x t_{BW_DS}	ns
t_{CRC_DS}	CRC downstream	typ.	10 x t_{BW_DS}	ns
t_{EOC}	End of command Idle	typ.	6 x t_{BW_DS}	ns

Single ended upstream response frame



Differential upstream response frame



Upstream command frame parameters

Parameter	Description	Values		Unit
t_{BW_US}	Upstream bit width	min.	350	ns
		typ.	500	
		max.	650	
t_{US_CL}	Upstream command length	-	-	-
	CRC enabled	typ.	61 x t_{BW_DS}	ns
	CRC disabled	typ.	56 x t_{BW_DS}	ns
t_{Frame_S}	Frame sync	typ.	15 x t_{BW_DS}	ns
t_{Freq_S}	Frequency sync	typ.	5 x t_{BW_DS}	ns
t_{Addr}	Address	typ.	15 x t_{BW_DS}	ns
t_{Data_US}	Upstream Data	typ.	15 x t_{BW_DS}	ns
t_{CRC_US}	CRC upstream	typ.	5 x t_{BW_DS}	ns
t_{EOC}	End of command Idle	typ.	6 x t_{BW_DS}	ns

(4) Bit Retransmission

To ensure a correct bit-timing, the forwarded data is regenerated with the clock of the device. The retransmission starts with its own frame-sync when it can be guaranteed that a valid frame-sync timing can be created. A new frequency synchronization is only created after the freq-sync on the reception side has been received (the first four bits). Therefore, the minimum propagation delay tpd introduced by the retransmission is four bits widths t_{BW}.

Propagation delay

Parameter	Description	Values		Unit
t_{pd}	Propagation delay	min.	2	us
		typ.	4	
		max.	5.2	

To guarantee a correct bit-timing the device uses its own clock as reference and will never transmit faster than its own bit-timing defines, but if the received freq-sync was slower, this timing is used for the retransmission.

The retransmission uses a FIFO to compensate for speed differences between reception and transmission.

Due to the variance in the oscillator clocks of different devices, after each transmission a pause of 43% of the nominal transmission time has to be introduced. If the transmission is created by a chip with ±30% oscillator clock variation the time has to be increased to a total of 70% of the transmission duration.

(5) Initialization

The INIT command is always the first command to be transmitted after power-up or reset. If any command is received by a device before initialization, the command is always considered as illegal and the error status bit for an undefined command is set.

This may happen in the chain's first device only, as a non-initialized device does not forward received messages.

If the first device in the chain receives an INIT command, it takes the received address as its own device address and afterwards transmits another INIT frame to the next device in the chain. It increments the address before the transmission.

As the adjacent devices proceed in the same manner, the devices in the chain get enumerated with ascending addresses. When the final device in the chain recognizes there is no receiving device at its downstream link, it transmits a response frame upstream. The response frame to an INIT command carries the configuration word read from the OTP. It also transmits the own devices address just initialized.

All upstream devices wait for the responses to be received and forward them towards the microcontroller. If a frame with an address equal to the adjacent device address (own address plus one) is received, the own response to the INIT command is transmitted thereafter. If the first device has transmitted its response frame, the chain is ready to process regular commands (non-INIT frames).

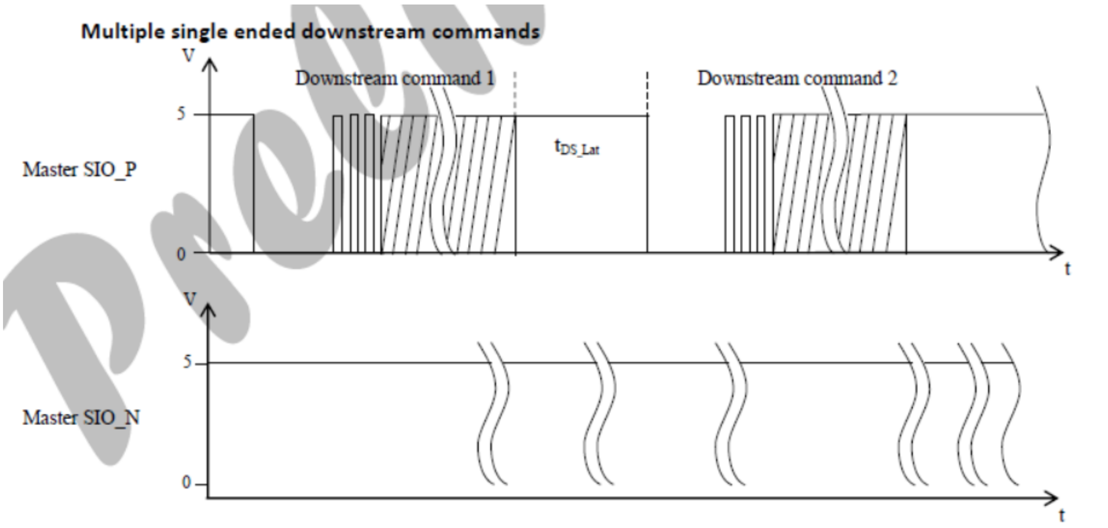
As soon as a device is initialized, it unconditionally forwards incoming correct frames (Frame-Sync, Freq-Sync and the RLC coding as well as the frame length are checked) to the adjacent node in the chain.

Frames received from upstream are forwarded downstream and vice versa. If an error is detected the forwarding is stopped for this frame.

Parameter	Description	Values		Unit
T_{INIT}	Initialization duration	min.	n x (t_{DS_CL} + t_{US_CL} + 2 x t_{PD})	ns

(6) Write Access

Most commands of the LED Controller are write-only commands. I.e. the devices receive a command frame and execute the appropriate actions without any further communication. A write access command may be directed to a single device (unicast), to all devices (broadcast), or to a defined group of devices (multicast). As every command frame is forwarded downstream irrespective of its destination address, all stations always receive all commands. Only its execution depends on the commands destination address. To avoid communication issues, it is recommended to wait 30% of the command length between two consecutive commands.



Recommended latency between downstream commands

Parameter	Description	Values		Unit
t_{DS_lat}	Latency beween two downstream commands	min.	0.3 x t_{DS_CL}	ns

(7) Read Access

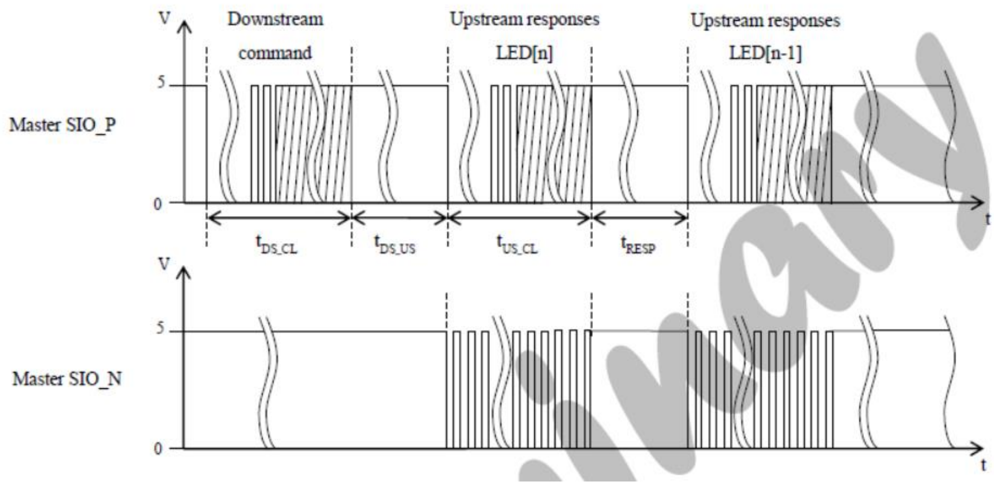
A read access consists of two phases, the command and the response phase. The command phase uses downstream communication and the response phase uses upstream communication. Commands for read access do not use the command address, i.e. these commands may not be directed to a device based on the device address.

There are two commands for read access, READ and PING. The READ command retrieve a status information from all devices and the PING command is used to check the device chain's integrity. Only the final node in the chain responds to a PING command.

A READ command is first received by all devices via the frame in downstream direction. The last node in the chain then immediately transmits its response frame upstream. The response frame's data field depends on the actual READ command. The response frame's address field is set according to the own device's address. All the nodes upstream forward all received response frames until a frame with the address of their adjacent node is received. Then the respective node transmits its own response frame. This procedure lasts until the chain's first node has transmitted its response frame.

A PING command is similar to a READ command, but only the last device in the chain responds to a PING. Thus the PING command is executed much faster than a regular READ command.

Single ended read command & responses



Down- and upstream delay, delay between responses

Parameter	Description	Formula	Unit
t_{DS_US}	Delay between down- and upstream	$t_{DS\_CL} + t_{US\_CL} + 2 \times n \times t_{PD}$	ns
t_{RESP}	Delay between responses	-	-
	Oscillator variation of adjacent devices < ±30%	$0.43 \times t_{US\_CL}$	ns
	Oscillator variation of adjacent devices > ±30%	$0.7 \times t_{US\_CL}$	ns

(8) Timeouts

The INIT, all the READ_*, and the PING command initiate upstream data transmission. With the INIT and the read commands all nodes are expected to send a response to the host. The PING requires only the last node in the LED chain to respond. However, in all cases each node needs to await all responses originating from the nodes downstream. Thereafter either the node's own response is transmitted or new commands are accepted. Only the last node in the LED chain may immediately transmit its response.

In case there is an error with the chain downstream, not all expected responses may arrive. Thus each of the commands expecting a response waits for a certain time only and then returns to its previous state without having transmitted the node's response data.

The lengths of the timeouts depend on the respective command. They are calculated to account for the worst case oscillator frequency tolerance. I.e. the waiting node has a high speed clock and all the nodes waited for have a low speed clock. The hardware implementation uses an internally divided clock for the timeout counter:

$F[timeout]=F[osc]/2^{14}$

With the nominal clock frequency of 16MHz the counter's resolution results to 1.024ms.

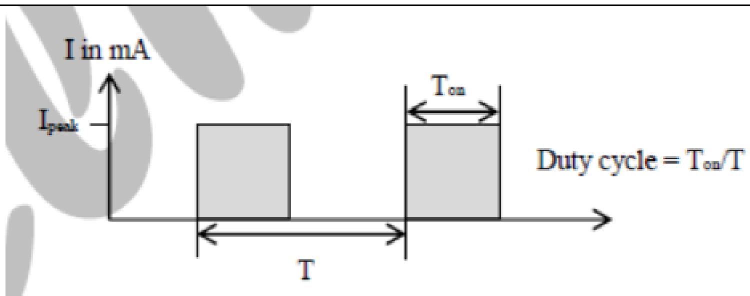
Timeouts

Command	Max. counter value	Min. timeout	Mom. timeout	Max. timeout	Unit
INIT	992	780.6	1015.3	1451.2	ms
READ_*	427	335.6	436.7	624.6	ms
PING	62	48.0	63.0	90.7	ms

PWM Units:

(1) Basic Mode of Operation

The LED controller device incorporates three independent PWM channels, one for each LED.



PWM signal

The resolution is 12 bit. The supported duty cycles are 0/4095 to 4095/4095. The nominal PWM output frequency is $16MHz / 2^{15}$ = 488.3Hz. The frequency is reduced to the half or the quarter of this frequency with low duty cycles. This ensures a minimum on-time of 2µs for the LEDs. The minimum output frequency is 122Hz. The output frequency is not derived from the actual PWM duty cycle but from the RGB value received from the host. As the DIM command also has impact to the LED intensity, it is accounted for as well. The actual relationship is given in the following table.

DIM parameter relationships between RGB parameters and PWM frequencies

DIM Parameter	RGB Parameter	PWM Frequency in Hz
0	8…255	488
	4…7	244
	0…3	122
1	16…255	488
	8…15	244
	0…7	122
2	32…255	488
	16…31	244
	0…15	122
3	64…255	488
	32…63	244
	0…31	122

The output frequency is determined independently for each of the PWM channels

(2) Update

When a new PWM duty cycle has to be applied, this is always done at the end of a PWM cycle. I.e. the PWM always completes an output cycle using the previously active duty cycle and starts the next output cycle using the updated duty cycle.

(3) Phase Shift

In order to spread the current consumption of the LEDs over time, a phase shift can be set between the three PWM channels. This optional function can be enabled/disabled during device initialization.

If the phase shift is deactivated, the red channel controls all three outputs and thus provides the temperature compensation function for all three channels.

If the phase shift is enabled, it retains even if the output frequency of the channels is different. If a channel is operating at a lower frequency, it may be considered to leave out one or three full PWM cycles. When leaving power save mode, the channels are restarted appropriately to again obtain the correct phase shift.

The fixed phase shift is defined in the following table. Please note the absolute phase shift times are nominal values. I.e. they are subject to vary with the internal oscillator's frequency.

Phase shift

PWM Channel	Rel. Phase Shift	PWM Frequency in Hz	Unit
Green	0%	0	µs
Red	25%	512	µs
Blue	75%	1536	µs

(4) Power Save Mode

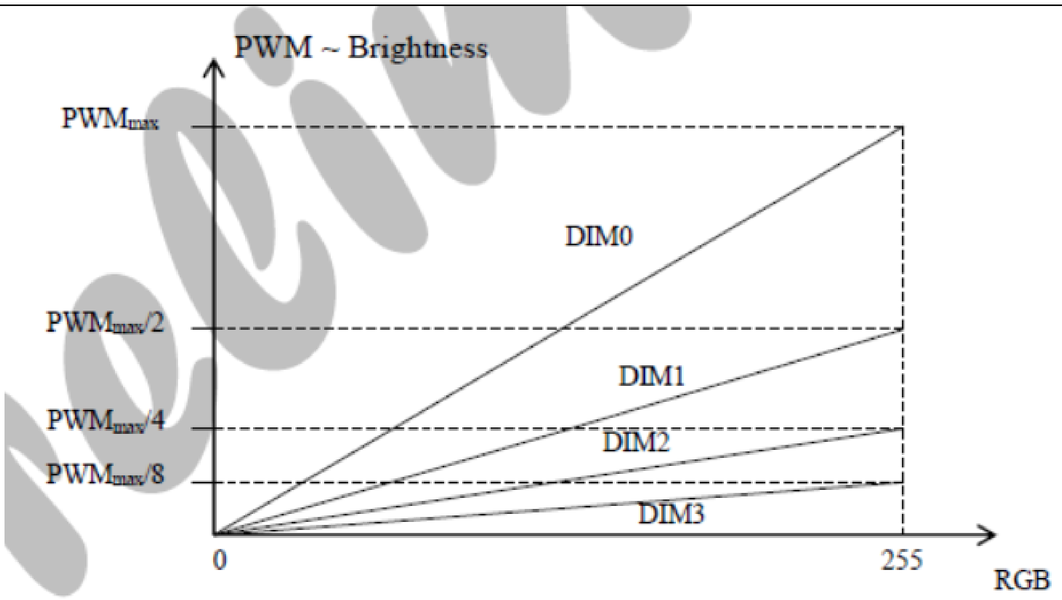
When all LED channels are set to an intensity of 0, the device enters a power save mode for the current sources driving the LEDs. I.e. the Set_RGB command must be issued with an RGB value of 0x000000 to enter the power save mode.

Recovering from this mode does not require any particular measures. I.e. the host just needs to issue a Set_RGB command with the data field different from 0x000000 and the current sources are restarted again. There is a delay of approx. 1µs before the restart of the green PWM channel (no phase shift applies to the green channel).

This is due to an internal ramp-up required by the analog circuitry. The same procedure is applied after device power-up or a hardware reset, as the initial RGB value is 0x000000. I.e. the LEDs are all turned off after power-up or a hardware reset.

DIM Function for Accurate Low Light Colours:

To extend the SET_RGB command's resolution for accurate low light colors, the INLC100Q16 provides the DIM command. The command divides the PWM duty cycles computed from the RGB setting. There are four divisors available. Details are shown in Below Figure and Table.

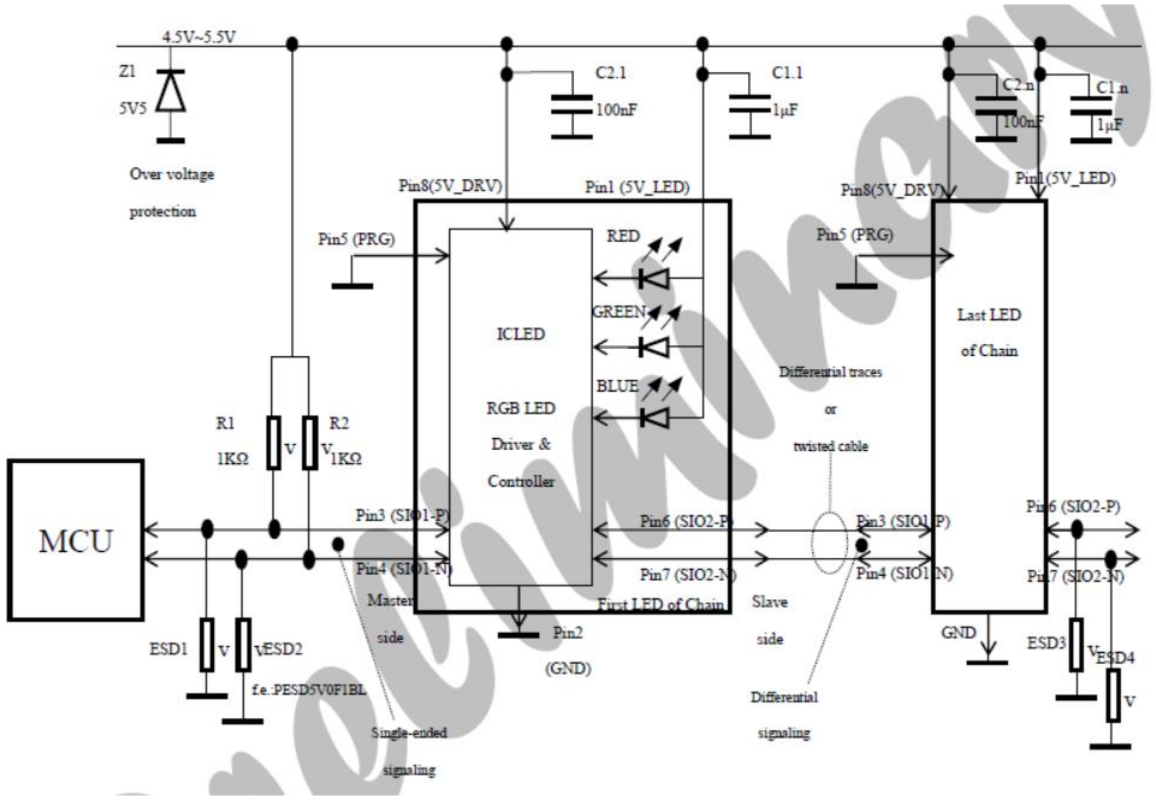


DIM Function

DIM	Relative PWM Range	Virtual Resolution = $\log_2 256$ / Relative PWM Range
0	1	8bit
1	1/2	9 bit
2	1/4	10 bit
3	1/8	11 bit

Application Circuit:

Typical application circuit:

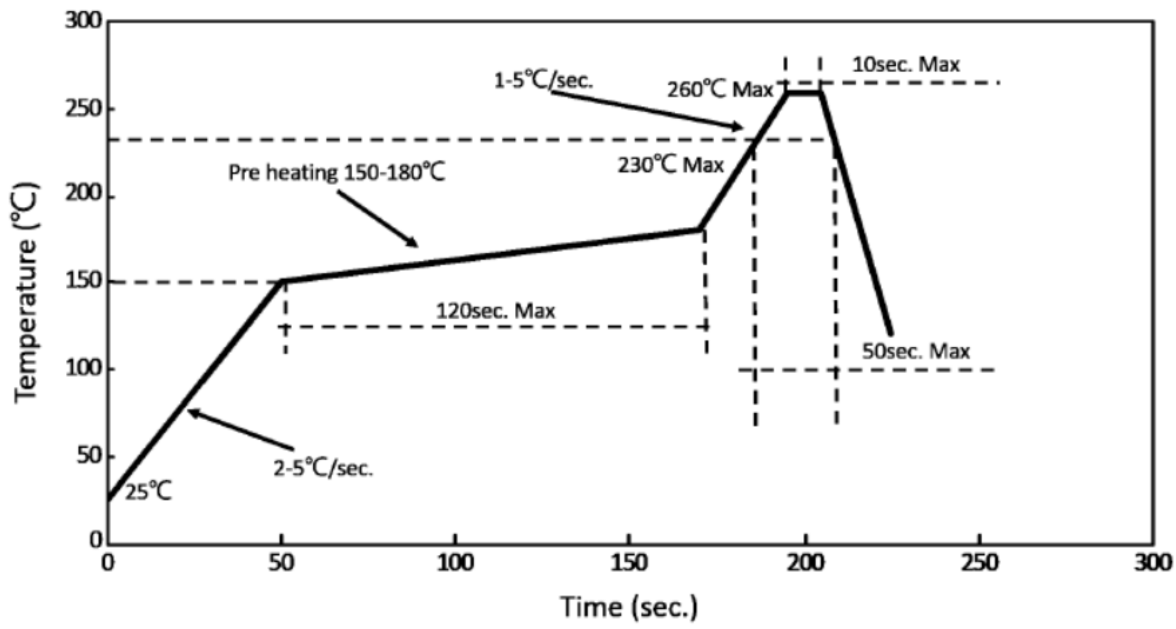


Note:

1. The signal pin of each LED shall be connected with an ESD tube in parallel with GND to avoid external static electricity damage to the LED.
2. In addition, the signal input pin of the first LED needs a 1K ohm resistor in parallel with VDD. The purpose is to reduce the damage caused by the MCU output signal. Please refer to the applied circuit diagram for the resistance signal.
3. The power supply pin of each LED needs a bypass capacitor in parallel with GND to reduce the damage caused by power supply. Please refer to the applied circuit diagram for the type of capacitor.
4. SIO2-P and SIO2-N should connect with ESD tube, it's to avoid the air static inside the car damaging the last LED.

RECOMMENDED SOLDERING PROFILE:

Lead-free Solder IR Reflow:



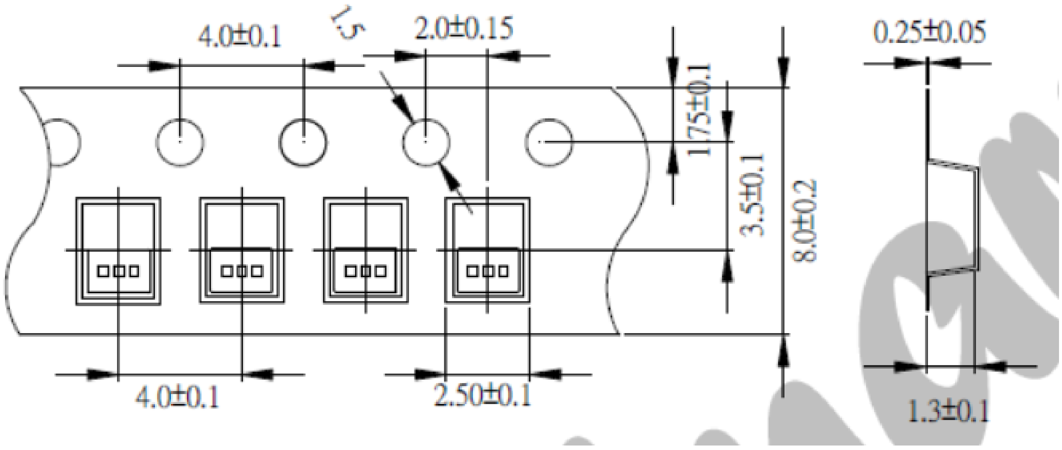
Note:

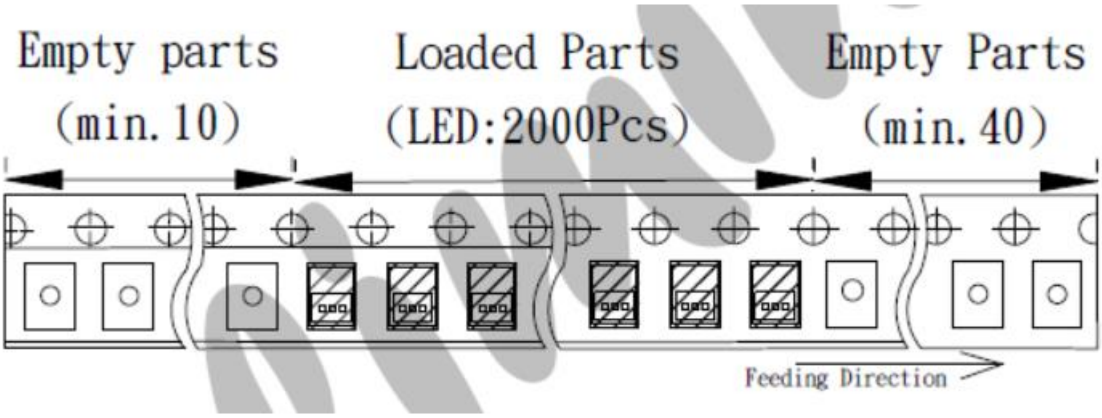
1. We recommend the reflow temperature 240°C (±5°C). The maximum soldering temperature should be limited to 260°C.
2. Maxima reflow soldering: 3 times.
3. Before, during, and after soldering, should not apply stress on the components and PCB board.

PACKING SPECIFICATION:

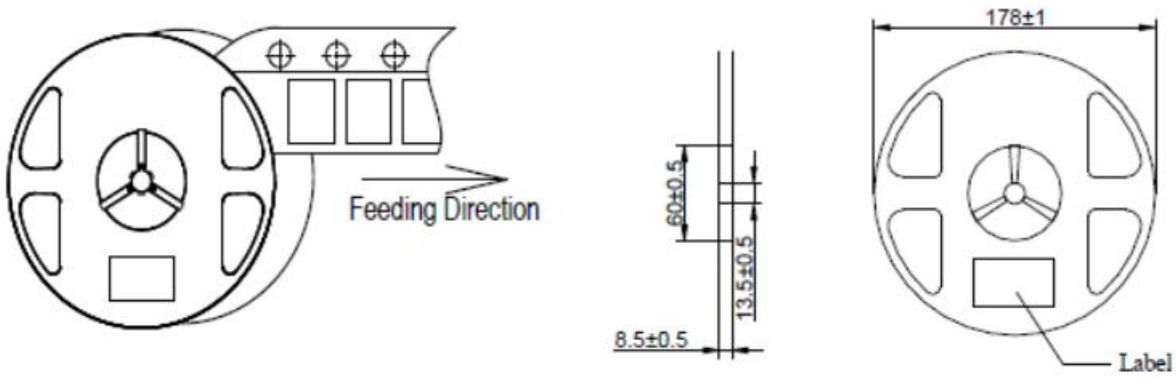
Reel Dimension:

Max.2000pcs/reel





The cathode is oriented towards the tape sprocket hole in accordance with ANSI/EIA RS-481 specifications.



PRECAUTIONS OF USE:

Storage:

It is recommended to store the products in the following conditions:

- Humidity: 60% R.H. Max.
- Temperature: 5°C~30°C (41°F ~86°F).

Shelf life in sealed bag: 12 months at 5°C~30°C and <60% R.H.

Once the package is opened, the products should be used within 1 week. Otherwise, they should be kept in a damp-proof box with descanting agent stored at R.H.<10% and apply baking before use.

Over-Current Proof:

Must apply resistors for protection otherwise slight voltage shift will cause big current change and burn-out will happen.

Baking:

It is recommended to bake the LED before soldering if the pack has been unsealed for longer than 24hrs. The suggested baking conditions are as followings:

- 60±3°C x 6hrs and <5%RH, taped / reel package.

It's normal to see slight color fading of carrier (light yellow) after baking in process.

Cleaning:

Use alcohol-based cleaning solvents such as isopropyl alcohol to clean the LED carrier / package. Avoid putting any stress force directly on to the LED lens.

ESD (Electrostatic Discharge):

Static Electricity or power surge will damage the LED. Use of a conductive wrist band or anti-electrosatic glove is recommended when handing the LED all time. All devices, equipment, machinery, work tables, and storage racks must be properly grounded.

BRIGHTEK
BRIGHTEK (EUROPE) LIMITED

REVISION RECORD:

Version	Date	Summary of Revision
A1.0	21/05/2022	Datasheet set-up.
A1.1	01/06/2022	Add product picture.
A1.2	20/05/2023	Revise package drawing.
A1.3	21/05/2023	Revise storage and soldering temperature.
A1.4	09/08/2024	Add electro-optical characteristic curves.