OSRAM
Opto Semiconductors

OSIRE® E3323 with Dot Matrix Code

Application Note

Valid for:
KRTB DWLM31.32
KRTB DWLM32.32

Abstract

Dynamic light functions for automotive interiors are becoming more and more important and popular since they can direct the driver's attention to certain traffic situations. In addition, individual user-adjustable color settings and scenarios can have a positive effect on the driver's general mood and awareness. In order to allow the easy implementation of such functions we provide the OSIRE® E3323 with enhanced features. Compared to traditional RGB LEDs, each LED carries a unique Dot Matrix Code (DMC) that allows a simplified end-of-line calibration. This application note describes how to read and align the DMC with the measurement data provided by OSRAM Opto Semiconductors. In addition, important assembly and handling recommendations are provided.

Further mechanical information:
ESD protection while handling LEDs
Preventing LED failures caused by corrosive materials

Author: Retsch Stefanie / Stigler Sebastian

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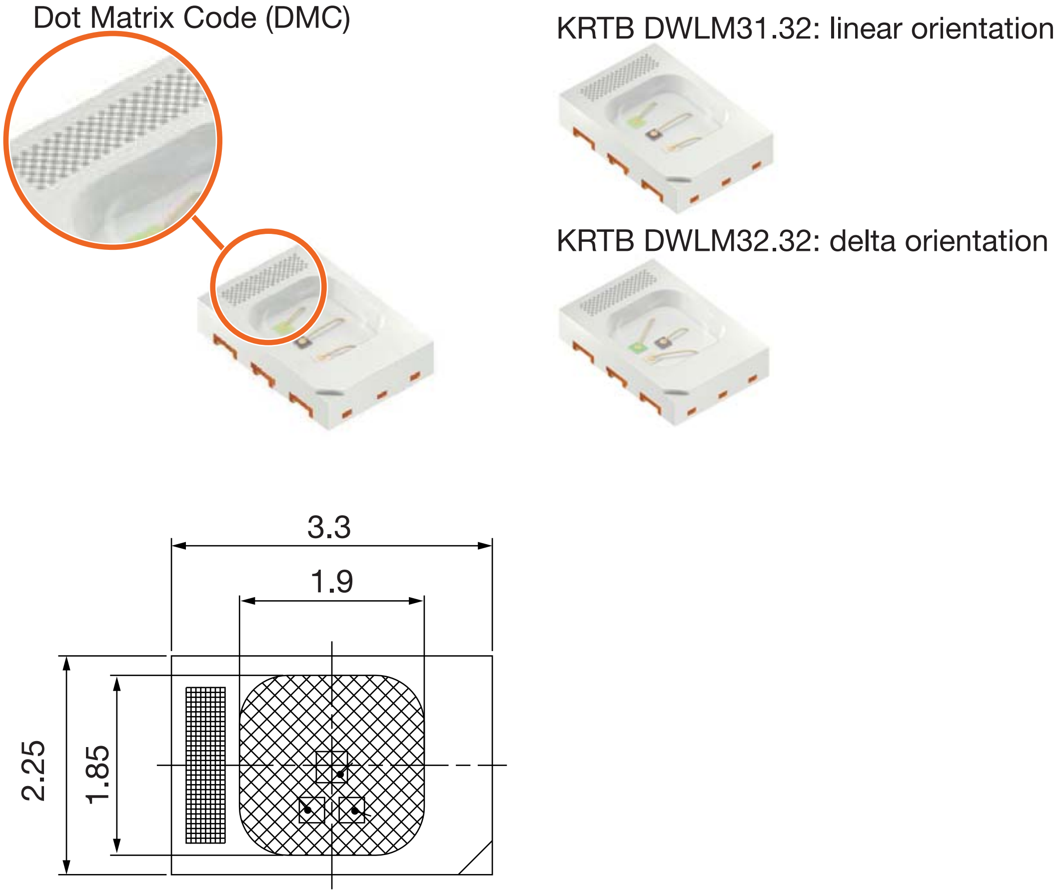
A. The OSIRE® E3323 with Dot Matrix Code (DMC)

The OSIRE® E3323 is a three-colored LED (red, blue and green) with a Dot Matrix Code (DMC) on top of the package, see Figure 1. Each DMC is a unique, non-sequential 9-digit code consisting of 5 letters and 4 figures. On the small package of 3.3 mm x 2.3 mm x 0.7 mm the DMC size is 1.6 mm x 0.4 mm. The LED with a common anode design is available in two different versions:

- a narrow linear arrangement of the RGB chips
- a delta arrangement of the RGB chips

Figure 1: OSIRE® E3323 with Dot Matrix Code (DMC)



The advantage of this LED is that the customer's end-of-line calibration is easier to achieve because the optical measurement data are provided. The tolerances of each LED can be compensated, which means that within a defined gamut all the LED variations are equal. The required measurement values for each individual component are provided in a csv-file. For more information on how to calibrate the specific parameters, see chapter "B. Benefits and use of DMC data"

How to read the DMC

The DMC with its dimensions of 1.6 mm x 0.4 mm has a 50 µm pixel size and can be decoded with a barcode reader. OSRAM Opto Semiconductors has successfully tested the following barcode readers:

- Microscan Systems, Inc. "MICROHAWK® ID-40"

  Resolution: 1280 x 960

  Field of view: 37 mm at 50 mm distance

- Keyence "SR-2000"

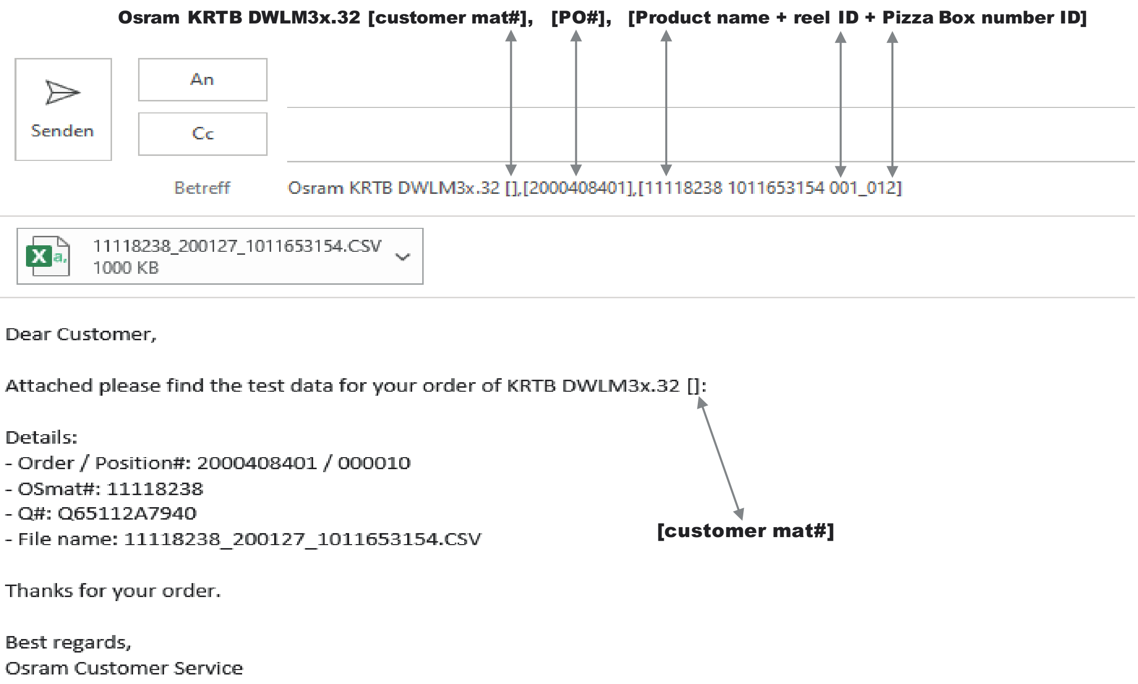
  Resolution: 2048 x 1536

  Field of view: 32 mm x 24 mm at 100 mm distance

How to receive the look-up file with measurement data

The matching measurement data for reading the DMC can be found in a look-up file provided by OSRAM Opto Semiconductors. As a first step, this file is supplied by e-mail. Therefore three email addresses can be specified (e-mail addresses must be provided to the distributor or contact person during the ordering process). The look-up file in ".csv" format will be sent to the specified email addresses as soon as the delivery note is created, the following day at the latest. In a later phase, the look-up table will be available via a web portal. Figure 2 shows a sample e-mail.

Figure 2: Sample e-mail sent to the customer



Matching the DMC-ID with the look-up file

Each unique DMC-ID allows to identify the electro-optical test data for the individual OSIRE® E3323 in the csv file. The measurement data is created at two different currents, 10 mA and 50 mA. This enables higher accuracy for brightness changes via the current for bright and dark applications. The measurement data provides:

- the colorimetric properties
- the luminous intensity
- the forward voltage

Figure 3 shows the structure of the measurement file.

Figure 3: DMC ID measurement file explanation

A B C D E

							Parameter grouping
							Chip color
Calendar Week	Pocket Position	DMC	Delivery ID	Handling Unit	Reel Label	Dry Pack Label	Product Box Label
202001	1	NRW1E1101	5001387488	76018924	1011650275002	1011650275020	1011650275023
202001	2	NRW1C1126	5001387488	76018924	1011650275002	1011650275020	1011650275023
202001	3	NRW1I0701	5001387488	76018924	1011650275002	1011650275020	1011650275023
202001	4	NRW1E0539	5001387488	76018924	1011650275002	1011650275020	1011650275023
202001	5	NRW1A0416	5001387488	76018924	1011650275002	1011650275020	1011650275023

Pocket Position	CX	CX	CX	CX	CX	CX	CY	CY	CY	CY	CY	CY
	BLUE	BLUE	GREEN	GREEN	RED	RED	BLUE	BLUE	GREEN	GREEN	RED	RED
	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05
1	0,1331	0,1386	0,2039	0,1614	0,6941	0,695	0,0599	0,0506	0,7343	0,7219	0,3048	0,3043
2	0,1335	0,1392	0,2114	0,1657	0,6928	0,6939	0,0587	0,0493	0,7308	0,7224	0,3057	0,3054
3	0,1351	0,1402	0,2134	0,1685	0,695	0,695	0,0554	0,0474	0,731	0,7231	0,3048	0,3044
4	0,1343	0,1396	0,2137	0,1674	0,6946	0,6955	0,0576	0,0488	0,7291	0,7235	0,3044	0,3039
5	0,1346	0,1397	0,2121	0,1665	0,6925	0,6931	0,0567	0,0482	0,7309	0,7233	0,3069	0,3063

Pocket Position	IV	IV	IV	IV	IV	IV	UF	UF	UF	UF	UF	UF
	BLUE	BLUE	GREEN	GREEN	RED	RED	BLUE	BLUE	GREEN	GREEN	RED	RED
	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05
1	0,2703	0,8977	1,2328	3,6439	0,5629	2,6489	2,6873	2,8976	2,4485	2,8404	1,9351	2,306
2	0,2678	0,8836	1,2509	3,7438	0,5816	2,7341	2,7122	2,9234	2,4246	2,8	1,9344	2,2859
3	0,2616	0,89	1,2431	3,7034	0,5842	2,7529	2,675	2,8791	2,4276	2,8024	1,9407	2,3217
4	0,2627	0,8785	1,2393	3,7209	0,564	2,6496	2,7071	2,9186	2,4231	2,7983	1,9351	2,2973
5	0,2622	0,8854	1,2489	3,7318	0,6021	2,8352	2,6733	2,8703	2,4297	2,8105	1,9382	2,2991

A Pocket number and DMC ID

Pocket Position	DMC
1	NRW1E1101
2	NRW1C1126
3	NRW1I0701

B Barcode product label information

Delivery ID	Handling Unit	Reel Label	Dry Pack Label	Product Box Label
5001387488	76018924	1011650275002	1011650275020	1011650275023
5001387488	76018924	1011650275002	1011650275020	1011650275023
5001387488	76018924	1011650275002	1011650275020	1011650275023

C Colorimetic (Cx and Cy)

Order colors: red / green / blue

Order current: 10 mA / 50 mA

CX	CX	CX	CX	CX	CX	CY	CY	CY	CY	CY	CY
BLUE	BLUE	GREEN	GREEN	RED	RED	BLUE	BLUE	GREEN	GREEN	RED	RED
0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05	0,01	0,05
0,1331	0,1386	0,2039	0,1614	0,6941	0,695	0,0599	0,0506	0,7343	0,7219	0,3048	0,3043
0,1335	0,1392	0,2114	0,1657	0,6928	0,6939	0,0587	0,0493	0,7308	0,7224	0,3057	0,3054
0,1351	0,1402	0,2134	0,1685	0,695	0,695	0,0554	0,0474	0,731	0,7231	0,3048	0,3044

D Luminous intensity Iv in cd

Order colors: red / green / blue

Order current: 10 mA / 50 mA

IV	IV	IV	IV	IV	IV
BLUE	BLUE	GREEN	GREEN	RED	RED
0,01	0,05	0,01	0,05	0,01	0,05
0,2703	0,8977	1,2328	3,6439	0,5629	2,6489
0,2678	0,8836	1,2509	3,7438	0,5816	2,7341
0,2616	0,89	1,2431	3,7034	0,5842	2,7529

E Forward voltage in V

Order colors: red / green / blue

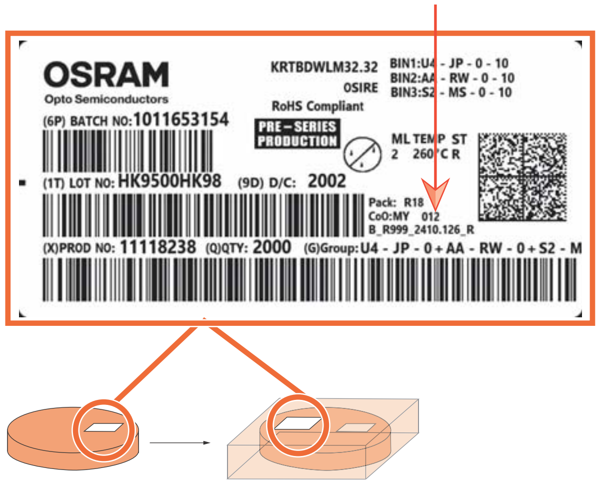
Order current: 10 mA / 50 mA

UF	UF	UF	UF	UF	UF
BLUE	BLUE	GREEN	GREEN	RED	RED
0,01	0,05	0,01	0,05	0,01	0,05
2,6873	2,8976	2,4485	2,8404	1,9351	2,306
2,7122	2,9234	2,4246	2,8	1,9344	2,2859
2,675	2,8791	2,4276	2,8024	1,9407	2,3217

The product label information listed in Figure 3 under point B can be found on all product labels. These are placed on the packaging (the dry pack and the reel). Figure 4 shows where the labels can be found and how they are composed.

Figure 4: Where to find the barcode product label information:

- The label for the Reel and Dry Pack only differs in this number
- No fixed numbers for Reel or Dry Pack
- The number of the Reel is smaller than the number of the Dry Pack



Reel
Dry pack

Example:

Reel Label	Dry Pack Label
1011653154 001	1011653154 010

B. Benefits and use of DMC data

The DMC data allows a simplified end-of line calibration for customers to achieve a suitable color control solution.

Methods to control both the LED color and intensity must be implemented to overcome the numerous challenges previously described in RGB LED systems. The main reasons for variations in the color output of RGB LEDs are differences in the intensity and wavelength within the individual bins and forward current and temperature dependencies.

To allow a proper color control of the RGB LEDs the following points have to be considered:

- Calibration
- Temperature stabilization
- Thermal management

Calibration

Many RGB modules can undergo a calibration procedure to maximize LED color and brightness consistency. Either populated on an open PCB or integrated into the final product, the module is pre-programmed with the LED's initial properties. During normal operation, the module utilizes this stored information and adjusts the driving conditions based on temperature measurement to achieve the desired color and intensity target.

Application-specific integrated circuits (ASICs) are available in many form factors and are integrated with a microprocessor, constant current controllers and on-board memory. They can be passively (generic) calibrated with the RGB LED's performance information, including the wavelength and intensity from prior measurements. In order to achieve good color accuracy, active calibration with the measured LED parameters on PCB, under the default driving conditions needs to be incorporated. While requiring a more complex production setup, active calibration does not require prior LED performance information. Calibration improves the module´s color accuracy, and allows for a more relaxed LED binning selection.

Color and brightness stabilization over temperature

RGB LEDs must be electrically driven by using a constant current source and the LED´s luminous intensity should be controlled through pulse width modulation (PWM). An on-board thermistor is required to measure the local temperature of the LED. This information is used by the microprocessor's algorithm to adjust the PWM duty cycles and thus compensate for shifts in the LED's wavelength and intensity. For detailed information on PWM please refer to the application note "Dimming InGaN LEDs".

The location of the thermistor is important for accurately determining the real-time thermal conditions of the RGB LED. With the red die being the most sensitive to temperature changes, OSRAM Opto Semiconductors recommends placing the thermistor near the red anode's footpad of the RGB LED. Some ASICs have a thermistor conveniently packaged inside the component to minimize design footprint requirements.

Thermal management

Thermal management is important to stabilize the LED's output and to avoid hight temperatures in order to increase the lifetime. The LED's p-n junction temperature (T_J) represents one of the major factors which influence the lifetime and the reliability of LEDs. Lower junction temperatures result in higher expected lifetimes. The maximum value allowed for T_J can be found in the product data sheet. Detailed information on this topic is provided in the application notes "Package related thermal resistance of LEDs" and "The thermal measurement point of LEDs".

Determining the junction temperature of RGB LEDs is challenging because the direct thermal measurement of the p-n junction is almost impossible. The measurement point and estimated junction temperature depend on the RGB LED's mode of operation. In general, the junction temperature can be theoretically calculated from the LED's thermal resistance and temperature readings from thermocouples placed as temperature sensors on the LED's solder joints.

Since RGB LEDs operate in various modes, only simulated examples of T_J can be provided. These simulations can be used as a starting point or as a first reference point. However, the junction temperature is dependent on the boundary conditions, which must be determined by the customer.

An example of a thermal simulation of the OSIRE® E3323 is provided to illustrate the procedure applied to determine the junction temperature of the LED. The simulation model and boundary conditions for this example are shown in Figure 5. Thermal simulations were performed to show the dependency of the junction temperature on the driving conditions of the LED. The simulation was performed for each single color, as shown in Figure 6 - Figure 8 at a peak current of 50 mA.

Figure 5: Boundary conditions of the thermal simulation of the junction temperatures T_J

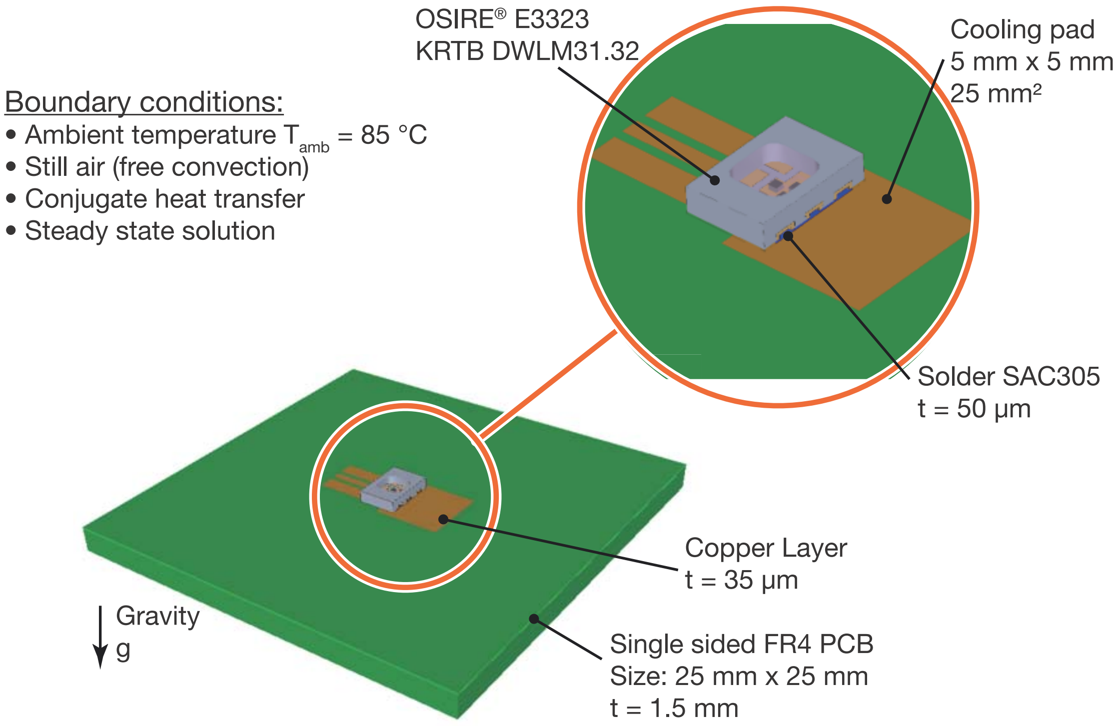


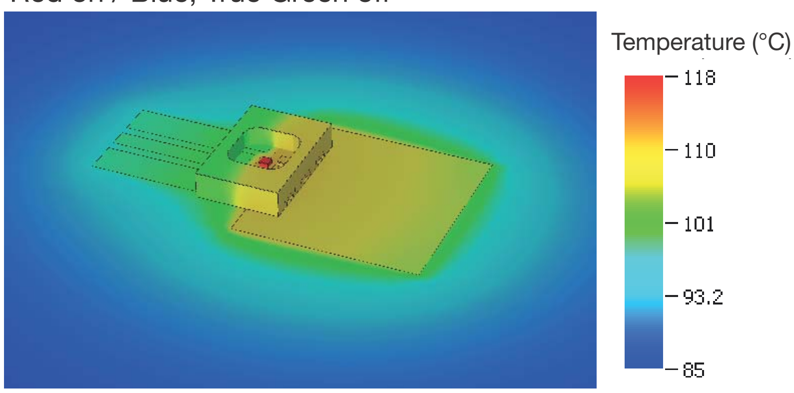
Figure 6: Thermal simulations of red @ 50 mA

Boundary conditions:
- Ambient temperature T_{amb} = 85 °C
- Still air (free convection)
- Conjugate heat transfer
- Steady state solution

Heat dissipation:

I_f		50 mA
U_f	25°C	2,4 V
U_f	85°C	2,277
typ. I_v	25°C	2700 mcd
typ. I_v	85°C	1536 mcd
typ. Phi_v	85°C	4,87 lm
P_el	85°C	0,114 W
typ. Phi_e	85°C	0,025 W
P_heat	85°C	0,089 W

OSIRE® E3323 KRTB DWMLM31.32
Red on / Blue, True Green off



max. Junction Temperature T_J = 118 °C
mean Solder Point Temperature T_S = 110 °C

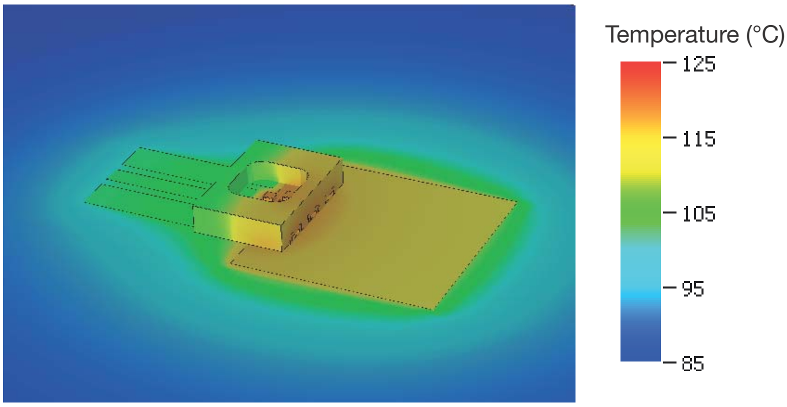
Figure 7: Thermal simulation of true green @ 50 mA

Boundary conditions:
- Ambient temperature T_{amb} = 85 °C
- Still air (free convection)
- Conjugate heat transfer
- Steady state solution

Heat dissipation:

I_f		50 mA
U_f	25°C	2,867 V
U_f	85°C	2,749
typ. I_v	25°C	4140 mcd
typ. I_v	85°C	3668 mcd
typ. Phi_v	85°C	11,13 lm
P_el	85°C	0,137 W
typ. Phi_e	85°C	0,022 W
P_heat	85°C	0,116 W

OSIRE® E3323 KRTB DWMLM31.32
True Green on / Blue, Red off



max. Junction Temperature T_J = 125 °C
mean Solder Point Temperature T_S = 118 °C

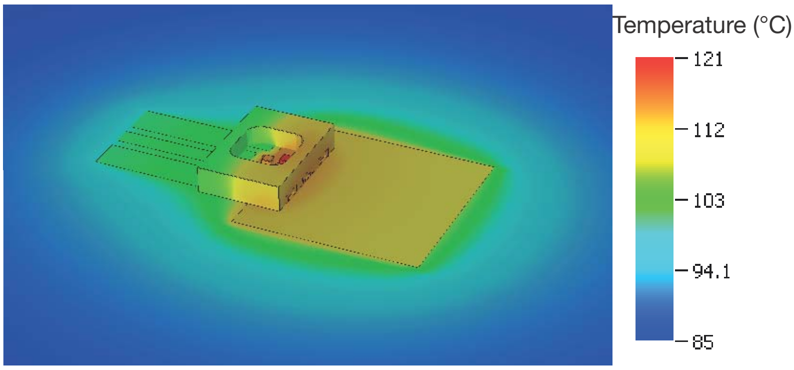
Figure 8: Thermal simulation of blue @ 50 mA

Boundary conditions:
- Ambient temperature T_{amb} = 85 °C
- Still air (free convection)
- Conjugate heat transfer
- Steady state solution

Heat dissipation:

I_f		50 mA
U_f	25°C	2,932 V
U_f	85°C	2,823
typ. I_v	25°C	720 mcd
typ. I_v	85°C	801 mcd
typ. Phi_v	85°C	2,41 lm
P_el	85°C	0,141 W
typ. Phi_e	85°C	0,035 W
P_heat	85°C	0,106 W

OSIRE® E3323 KRTB DWMLM31.32
Blue on / True Green, Red off



max. Junction Temperature T_J = 121 °C
mean Solder Point Temperature T_S = 115 °C

Furthermore, a simulation for driving all three dies at a peak current of 50 mA was executed. The estimation of heat dissipation at an ambient temperature of 85 °C is shown in Table 1. Figure 9 shows the thermal simulation of all three chips operating.

Table 1: Estimation of heat dissipation @ T_{amb}=85°C (White point D65 / I_V=1.4 cd)

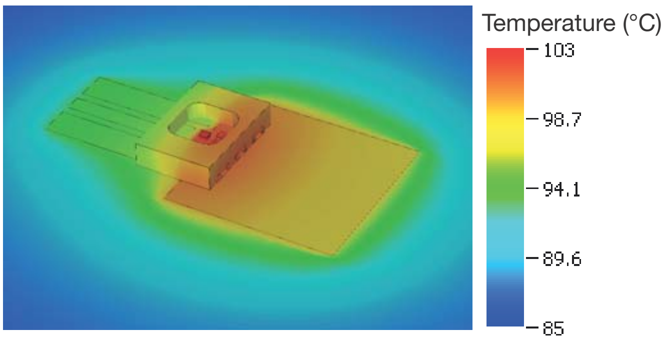
Chip	Peak I_F	Typ. V_F	Duty cycle	Avg. I_F	Avg. I_V	Avg. P_{el}	Avg. Φ_e	Avg. P_{heat}
True Green	50 mA	2.6 V	0.222	11 mA	840 mcd	29.0 mW	4.1 mW	24.4 mW
Blue	50 mA	2.8 V	0.118	6 mA	85 mcd	15.5 mW	3.6 mW	11.8 mW
Red	50 mA	2.3 V	0.145	7 mA	380 mcd	27.6 mW	6.7 mW	20.8 mW

Ambient Temperature T_{amb}=85°C / Still air (free convection) / Conjugate heat transfer / Steady state solution

Figure 9: Thermal simulation of all chips operated at 50 mA (I_V = 1.4 cd)

Boundary conditions:
- Ambient temperature T_{amb} = 85 °C
- Still air (free convection)
- Conjugate heat transfer
- Steady state solution

OSIRE® E3323 KRTB DWMLM31.32 @ peak IF:
Red 50 mA / Blue 50 mA / True Green 50 mA



Chip	DC	Heat dissipation	max. T_J	avg. solder temperature
True Green	0.22	24.4 mW	103 °C	
Blue	0.12	11.89 mW	102 °C	99.8 °C
Red	0.15	20.8 mW	103 °C	

Example of color mixing

This is a step-by-step guide to determine the PWM duty cycles (x) required for a measured RGB LED (A) to achieve a specified color target (T). The measurement values required can be taken from the corresponding Excel list, as described in the chapter " Matching the DMC-ID with the look-up file". According to the explanation in Figure 3, the values can be found as follows:

$Y_i = I_i$ $\rightarrow$ Part C (50mA or 10mA)

C_{xi}, C_{yi} $\rightarrow$ Part D

1. Take an optical measurement of the RGB LED for both brightness and color

points for each of the individual dies. Each die (i = R, G, B) will exhibit a luminous intensity (I_i) and a CIE color point (C_{xi}, C_{yi}).

E.g. Tristimulus or cd/lm with CIEx CIEy

2. Build the Tristimulus matrix (A) of the input RGB LED values.

$$A = \begin{bmatrix} X_R & X_G & X_B \\ Y_R & Y_G & Y_B \\ Z_R & Z_G & Z_B \end{bmatrix}$$

, with $Y_i = I_i$, $X_i = Y_i \cdot \frac{C_{xi}}{C_{yi}}$ and $Z_i = Y_i \cdot \frac{1 - C_{xi} - C_{yi}}{C_{yi}}$

Tristimulus values need to be adjusted as a function of the temperature based on the curves of the data sheet.

3. Set the color target T (in Tristimulus values) inside the gamut of the RGB LED's .

$$T = \begin{bmatrix} T_X \\ T_Y \\ T_Z \end{bmatrix}$$

, with $Y_i = I_i$, $X_i = Y_i \cdot \frac{C_{xi}}{C_{yi}}$ and $Z_i = Y_i \cdot \frac{1 - C_{xi} - C_{yi}}{C_{yi}}$

4. Allow x to be the PWM duty cycles required to reach the target.

$$x = \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

5. Solve the linear equation by inverse matrix or determinant calculations:

$$A \cdot x = T \rightarrow x = T \cdot (1/A)$$

The determinant of a 3x3 matrix can be calculated using the following equation:

$$R = \frac{det(A1)}{det(A)} = \frac{det\begin{bmatrix} T_X & X_G & X_B \\ T_Y & Y_G & Y_B \\ T_Z & Z_G & Z_B \end{bmatrix}}{det\begin{bmatrix} X_R & X_G & X_B \\ Y_R & Y_G & Y_B \\ Z_R & Z_G & Z_B \end{bmatrix}}$$

$$G = \frac{det(A2)}{det(A)} = \frac{det\begin{bmatrix} X_R & T_X & X_B \\ Y_R & T_Y & Y_B \\ Z_R & T_Z & Z_B \end{bmatrix}}{det\begin{bmatrix} X_R & X_G & X_B \\ Y_R & Y_G & Y_B \\ Z_R & Z_G & Z_B \end{bmatrix}}$$

$$B = \frac{det(A3)}{det(A)} = \frac{det\begin{bmatrix} X_R & X_G & T_X \\ Y_R & Y_G & T_Y \\ Z_R & Z_G & T_Z \end{bmatrix}}{det\begin{bmatrix} X_R & X_G & X_B \\ Y_R & Y_G & Y_B \\ Z_R & Z_G & Z_B \end{bmatrix}}$$

$$det\begin{bmatrix} a11 & a12 & a13 \\ a21 & a22 & a23 \\ a31 & a32 & a33 \end{bmatrix}$$

$$= a11 \cdot a22 \cdot a33 + a12 \cdot a23 \cdot a31 + a13 \cdot a21 \cdot a32$$
$$- (a12 \cdot a21 \cdot a33) - (a13 \cdot a22 \cdot a31) - (a23 \cdot a32 \cdot a11)$$

C. Assembly and handling recommendations

The use of any types of sharp object should generally be avoided, since this can damage the component. Generally the LED light emitting area should not be touched or punctured as this can damage the component.

As with all OSRAM Opto Semiconductors products, this product also complies with the current RoHS guidelines (European Union and China) and therefore contains no lead or other defined hazardous substances.

ESD stability

Although there is no additional ESD protection included, the LED provides an ESD stability of up to 2 kV. It is assigned to the “Class 2 HBM” category in accordance with ANSI / ESDA / JEDEC JS-001. With this class the LED can be considered as uncritical for processing and assembly by state-of-the-art SMT equipment aligned with ESD precautions. To achieve higher ESD protection on the system level, additional ESD protection must be applied.

Nevertheless, please be aware of ESD safety while handling LEDs. As a matter of principle, common ESD safety precautions must be observed during the handling, assembly and production of electronic devices (LEDs). For further information on ESD protection please refer to the “ESD protection while handling LEDs” application note.

Cleaning

Any direct mechanical or chemical cleaning of the LED should be avoided. Isopropyl alcohol (IPA) can be used if cleaning is mandatory. Other substances, and especially ultrasonic cleaning, are generally not recommended.

For dusty LEDs, simple cleaning by means of purified compressed air (e.g. central supply or spray can) is recommended. In order to ensure that the compressed air does not contain any oil residues, the use of a spray can is recommended. A maximum pressure of 4 bar at a distance of 20 cm to the component is recommended.

In any case, all materials and methods should be tested beforehand, particularly as to whether or not damage can be associated with the component.

For further information please refer to the application note “Cleaning of LEDs”.

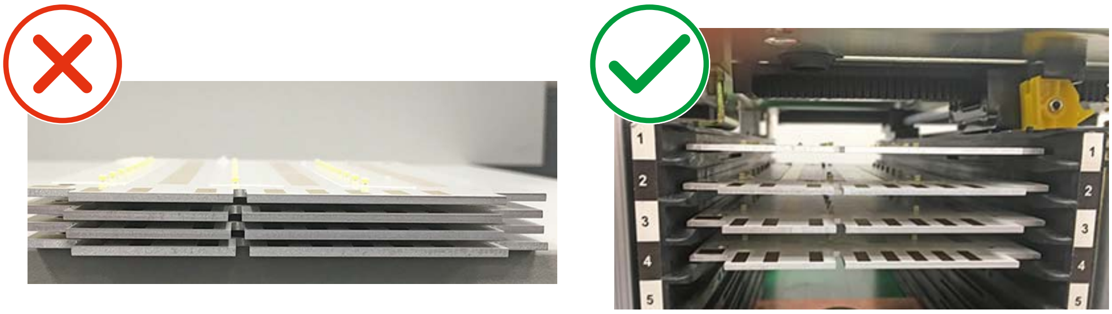
Precautions & storage

In general, LEDs are packaged in tape and on reels. For storage and dispatch, the reels are packed in vacuum-sealed dry bags together with desiccants. It is generally recommended to leave reels in their original package until they are assembled, and to store components under ambient conditions of ≤ 10 % RH during processing. Drying cabinets with dry nitrogen (N_2) or dry air are suitable for this type of storage. The OSIRE® E3323 complies with moisture-sensitive Level 2 (MSL 2) according to JEDEC J-STD- 020E.

Since the LEDs are generally supplied in tape with a dry pack, it should be factory-sealed when stored. The hermetically sealed package should only be opened immediately before mounting and processing, after which the remaining LEDs should be repacked according to the moisture level in the datasheet (see JEDEC J-STD-033 - Moisture Sensitivity Levels). For further information on dry packs please refer to the “Dry pack information” application note.

A suitable storage system should be used to ensure that assembled LED boards are not stacked on top of each other (Figure 10). To avoid the risk of damage to the assembled LEDs, make sure that they are not exposed to compression forces of any kind. Furthermore, the LED of the assemblies must also not be touched directly.

Figure 10: Correct storage

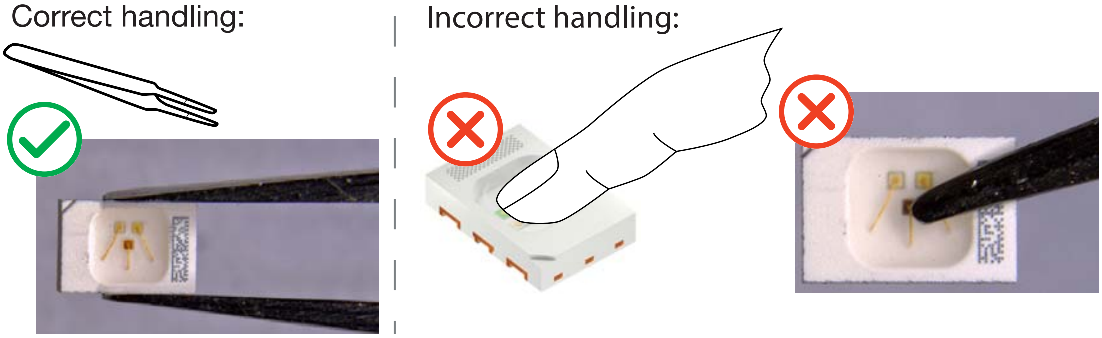


Manual handling

Further to the general guidelines for the handling of LEDs, additional care should be taken that mechanical stresses (e.g. sheering forces) on the elastic silicone encapsulation must be eliminated or reduced to the greatest extent possible (see also "Handling of silicone resin LEDs" application note). In general, any types of sharp object (e.g. forceps, fingernails, etc.) should be avoided in order to prevent stress to or penetration of the encapsulation, since this can lead to the impairment of the component.

Although manual handling and assembly is possible, automatic placement is strongly recommended. Special care must be taken if manual handling is necessary. The LED must not be lifted from the top, because this may cause damages to the surface. In addition, it is recommended to hold the LED package by using tweezers and applying the force equally to the entire LED package as shown in Figure 11.

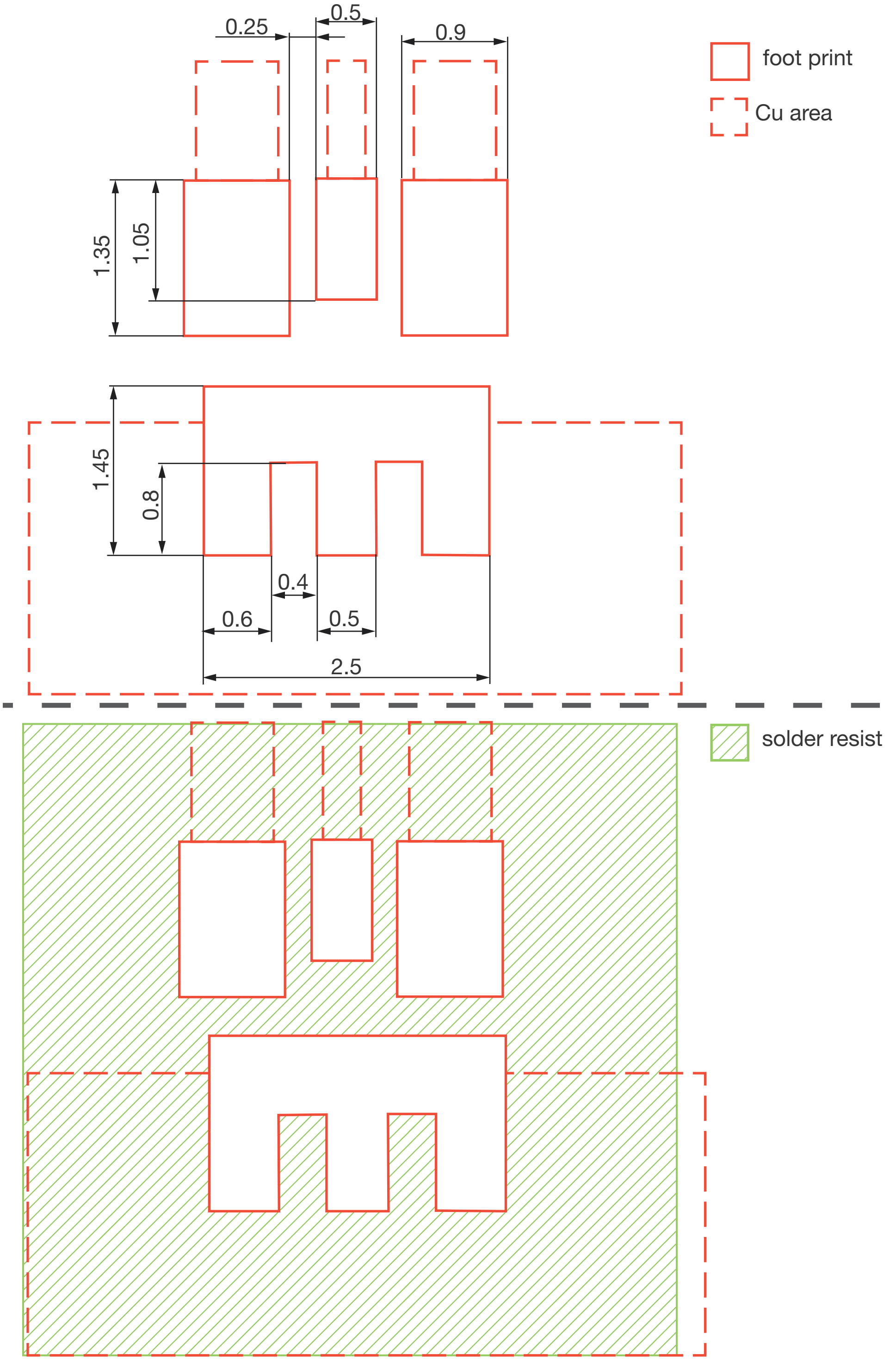
Figure 11: Recommended manual handling



Solder pad design

Since the solder pad effectively creates the direct contact between the LED and the circuit board, the design of the solder pad contributes decisively to the performance of the solder connection. The design has an influence on solder joint reliability and heat dissipation. In most cases, it is therefore advantageous to use the recommended solder pad (Figure 12), since it has been individually adapted to the properties and conditions of the LED. The corresponding solder pad is also indicated in the data sheet of each LED. Based on the solder pad design given, an optimized balance between good processability, the smallest possible positioning tolerance and a reliable solder connection can be achieved.

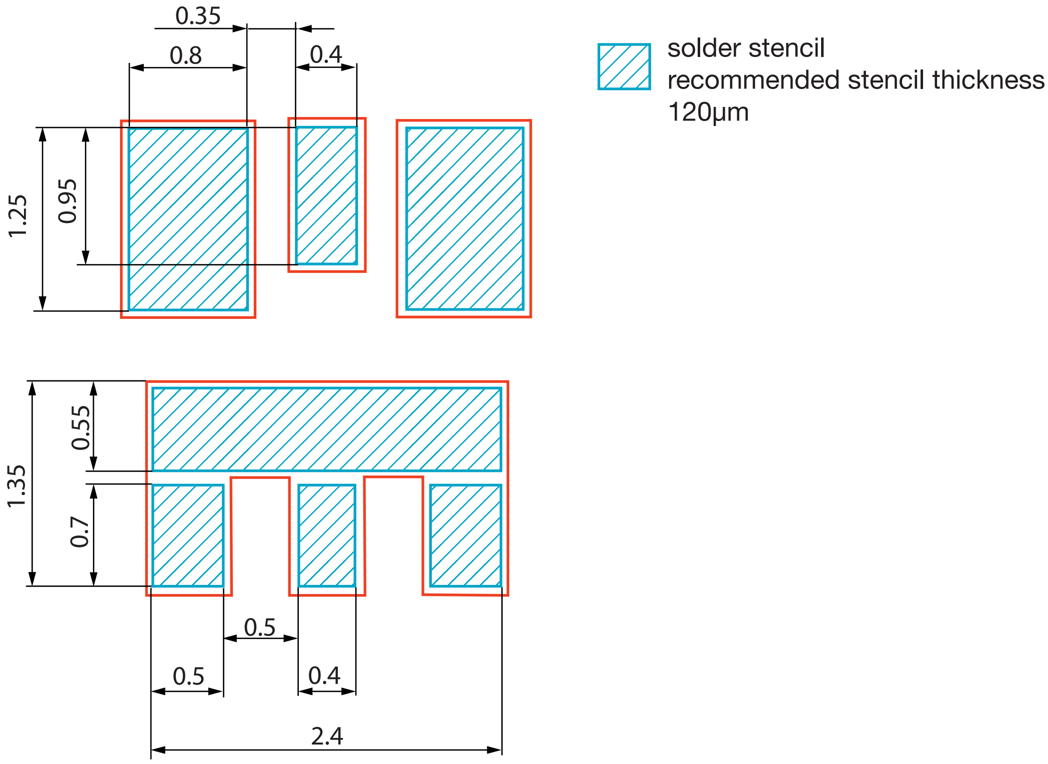
Figure 12: Recommended solder pad design



Solder stencil

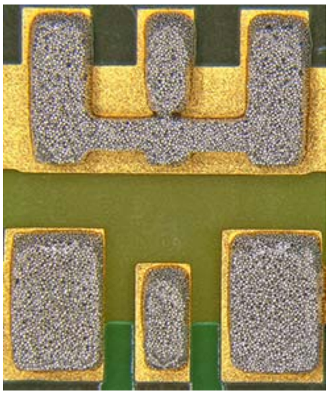
In the SMT process, solder paste is normally applied by stencil printing. The design of the printing stencil and an accurate working process influence the amount and quality of the paste deposit applied. Proper solder paste printing increases the solder quality. Effects such as solder bridges, solder spray and/or other soldering defects are largely determined by the design of the stencil apertures and the quality of the stencil printing (e.g. positioning, cleanliness of the stencil, etc.). For the OSIRE® E3323 a stencil thickness of 120 µm is recommended. A uniform solder joint thickness is recommended to produce reliable solder joints and obtain an appropriate optical alignment.

Figure 13: Recommended solder stencil



For the paste printing process OSRAM Opto Semiconductors has successfully used the standard SAC 305 Type 3 solder paste (HERAEUS F640 SAC 305 Type 3). For process evaluation, process control and failure prevention it is recommended to check the solder paste volume with SPI (Solder Paste Inspection) regularly. Figure 14 shows an example of proper solder paste printing.

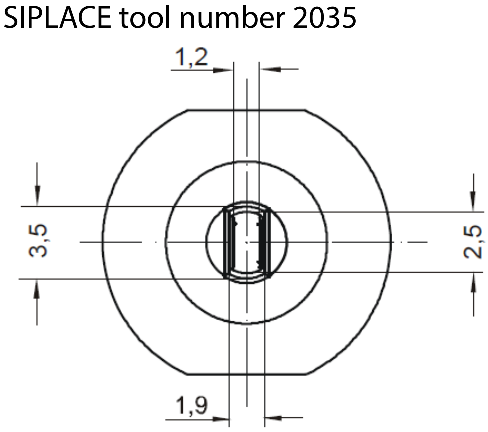
Figure 14: Proper solder paste printing



Pick-and-place nozzle design

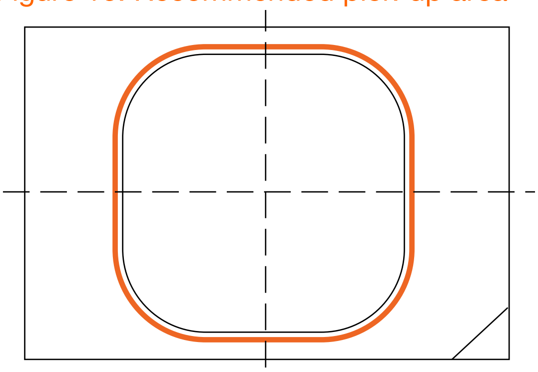
When processing by means of automated placement machines, care should be taken to use an appropriate pick-and-place tool and to ensure that the process parameters comply with the characteristics of the package. An example of a suitable pick-and-place nozzle is provided in the form of the SIPLACE tool number 2035, also shown in Figure 15.

Figure 15: Recommended pick-and-place nozzle from ASM Siplace



The light emitting area of the OSIRE® E3323 should not be touched, as mechanically sensitive parts such as LED chips and bond wires are located in this area. The sketch in Figure 16 describes the pick-up area for the nozzle.

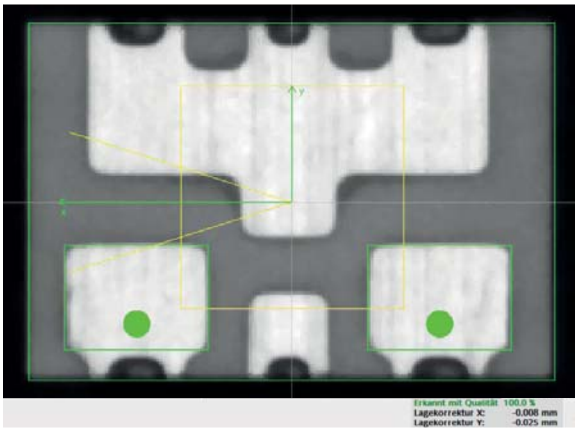
Figure 16: Recommended pick-up area



Vision System

Figure 17 shows an example of how to teach in the footprint of the OSIRE® E3323 in the ASM Siplace Vision System. For recognition purposes, it is recommended to teach in the terminals of the component backside and not the outline of the part (see Figure 17 green marked areas).

Figure 17: Teaching the OSIRE® E3323 into the ASM Siplace Vision System



Reflow soldering

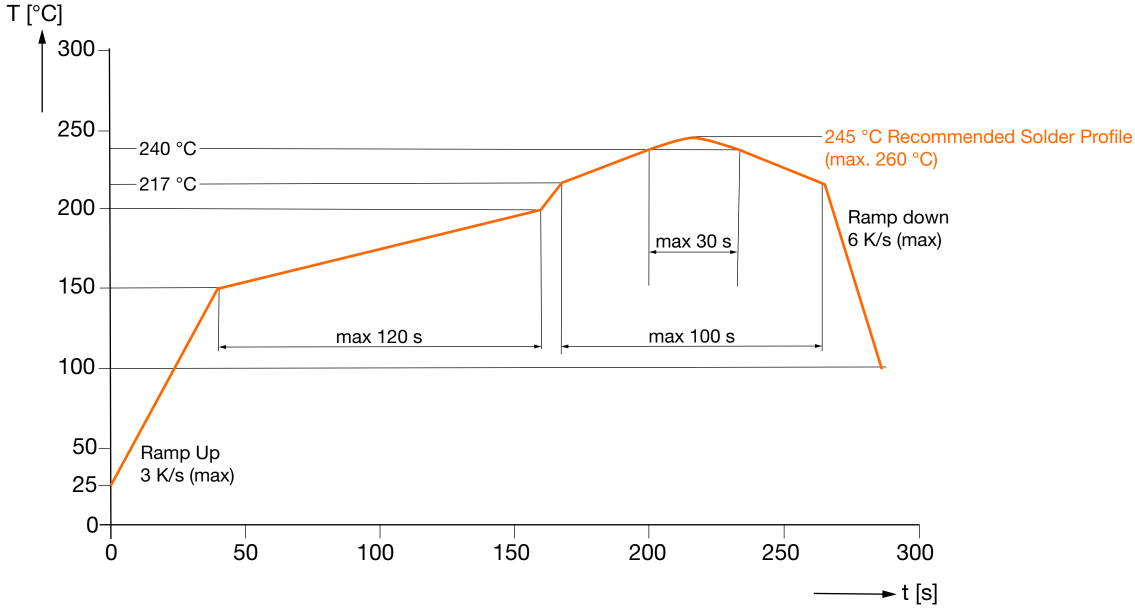
The OSIRE® E3323 features good self alignment during soldering, additionally supported by the four wetting indicators (Figure 18).

Figure 18: Wetting indicators of the OSIRE® E3323

Since the OSIRE® E3323 is generally compatible with existing industrial SMT processing methods, current populating techniques can be used for the mounting process. The individual soldering conditions for each LED type according to JEDEC can be found in the respective data sheet. A standard reflow soldering process with forced convection under standard N_2 atmosphere is recommended for mounting the component, in which a typical lead-free SnAgCu metal alloy is used as solder.

Figure 19 shows the temperature profile for lead-free soldering with the recommended peak temperature of 245 °C. In this context, it is recommended to check the profile on all new PCB materials and designs. As a good starting point, the recommended temperature profile provided by the solder paste manufacturer can be used. The maximum temperature and also the ramp-up and cool down gradient for the profile as specified in the data sheet should, however, not be exceeded.

Figure 19: Temperature profile for lead-free reflow soldering according to JEDEC J-STD-020E



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www.ledlightforyou.com

ABOUT OSRAM OPTO SEMICONDUCTORS

OSRAM, Munich, Germany is one of the two leading light manufacturers in the world. Its subsidiary, OSRAM Opto Semiconductors GmbH in Regensburg (Germany), offers its customers solutions based on semiconductor technology for lighting, sensor and visualization applications. OSRAM Opto Semiconductors has production sites in Regensburg (Germany), Penang (Malaysia) and Wuxi (China). Its headquarters for North America is in Sunnyvale (USA), and for Asia in Hong Kong. OSRAM Opto Semiconductors also has sales offices throughout the world. For more information go to www.osram-os.com.

OSRAM Opto Semiconductors GmbH

Head office:

Leibnizstr. 4
93055 Regensburg
Germany
www.osram-os.com