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OSRAM
Opto Semiconductors

Firefly® E1608 and Firefly® E2218 — Details on handling and processing

Application Note

Valid for:
Firefly® E1608
Firefly® E2218

Abstract

For wearable applications like fitness tracking, health monitoring or similar OSRAM Opto Semiconductors offers especially small and compact top emitter as the Firefly® E1608 and Firefly® E2218.

The following application note provides a short product introduction followed by handling and processing information for an appropriate implementation of the LED.

For more information on health monitoring applications and appropriate products, please refer to the application note “AN147_Health monitoring”.

Further information:
AN147_Health monitoring
AN036_Processing of SMD LED

Author: Retsch Stefanie / Lex, Florian

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A. Basic information

Wearable applications can be realized with integrated solutions (emitters and detectors integrated in a single package) or through discrete components (single LEDs and photo-detectors). For both variations OSRAM Opto Semiconductors offers suitable products.

A system setup with discrete components offers more design freedom. Depending on the system requirements, various geometries can be selected and different components can be combined. For these application cases, the use of the Firefly® E1608 or Firefly® 2218 as emitters are the right choice. (Table 1 provides an product overview.)

Due to its compact size the Firefly® E1608 enables flexible product designs. It allows to combine different wavelengths and typical brightness levels, all matching the application.

For highest system efficiency a more efficient chip in a larger package design is used at the Firefly® 2218. This enables a long battery life in wearable applications.

Table 1: Product overview

	Firefly® E1608	Firefly® 2218
		
Properties	Compact package size Enables flexible product designs	Highest system efficiency More efficient chip
Package Size	1.6 x 0.6 x 0.8 mm³	2.2 x 1.8 x 0.6 mm³
ESD stability	2 kV “Class 2 HBM”	8 kV “Class 3B HBM”

For more information on health monitoring application, suitable photo-detectors and system setup recommendations, please refer to the application note “Health monitoring”.

B. Handling and assembly information

The Firefly® E1608 and the Firefly® E2218 have been designed to be very robust packages. The following part provides handling and assembly information. As is the case for all LEDs from OSRAM Opto Semiconductors, the LEDs also fulfills the current RoHS guidelines (European Union and China) and therefore contains no lead or other defined hazardous substances.

ESD stability

Firefly® E1608. Although there is no additional ESD protection included, the LED provides 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 Firefly® E1608 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.

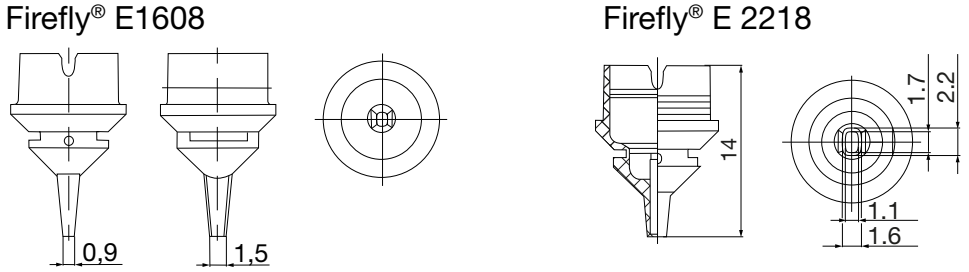
Firefly® E2218. As an additional ESD protection is included the LED provides ESD stability of up to 8 kV. It is assigned to the “Class 3B HBM” category in accordance with ANSI / ESDA / JEDEC JS-001. With this class the Firefly® E2218 can be considered as uncritical for processing and assembly by state of the art SMT equipment aligned with ESD precautions. To achieve higher ESD protection on the system level, additional ESD protection must be applied.

Pick and place

Although manual handling and assembly is possible, automatic placement is recommended.

An automatic assembly process is recommended. Figure 1 shows recommended nozzles for automated placement machines.

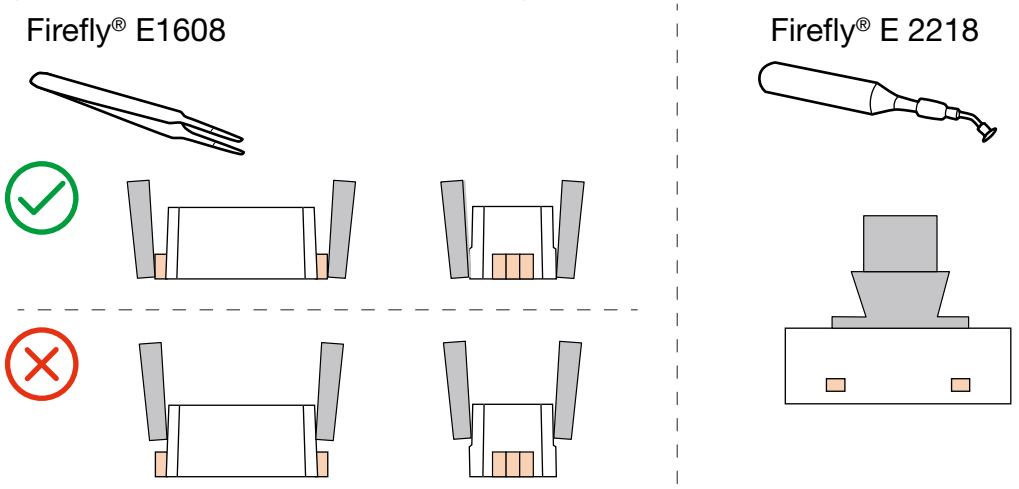
Figure 1: Recommended SIPLACE nozzle



Manual handling Firefly® E1608. Special care must be taken if the Firefly® E1608 is handled manually. The LED must not be lifted from the top, because high forces can cause damage to the surface. In addition, it is recommended to hold the LED package as shown in Figure 2 by using a tweezer and applying the force equally to the entire LED package.

Manual handling Firefly® E2218. In contrast to the Firefly® E1608, the Firefly® E2218 must not be taken by using a tweezer. If manual handling is necessary only vacuum tweezers are recommended like shown in Figure 2.

Figure 2: Recommended manual handling

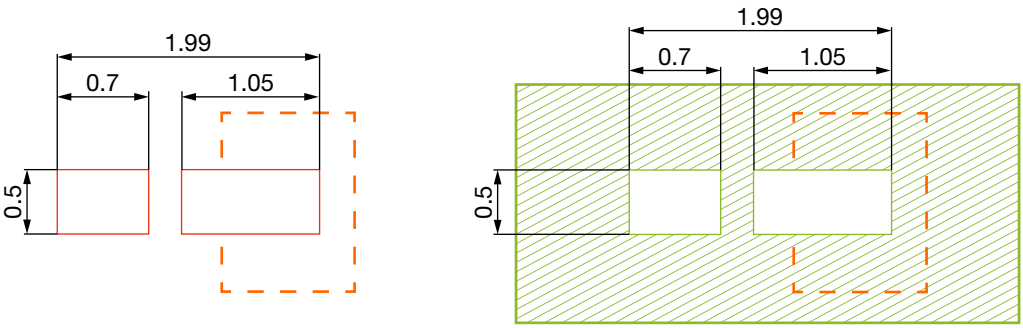


Solder pad design

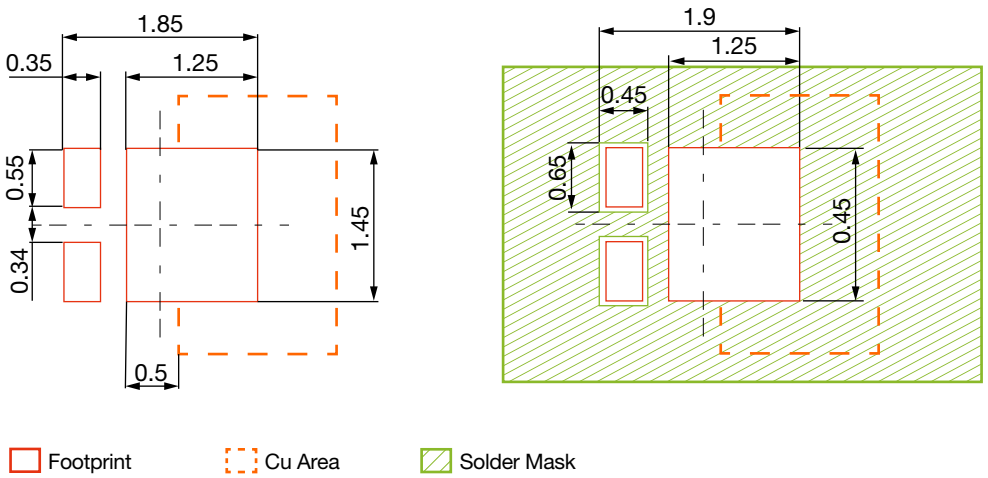
PCBs not only serve as a mechanical substrate and electrical contacting element for the components. In addition, modern circuit boards should also ensure stable characteristics within the circuitry. As the solder pad creates the direct contact between the LED and the circuit board, the design of the solder pad significantly determines the performance of the solder connection. The design influences the reliability of the solder and the heat dissipation. It is therefore recommended to use the solder pad shown in Figure 3, because it is individually adapted to the properties and conditions of the LED. The corresponding solder pad can also be found in the datasheet of each LED.

Figure 3: Recommended solder pad design

Firefly® E1608



Firefly® E 2218

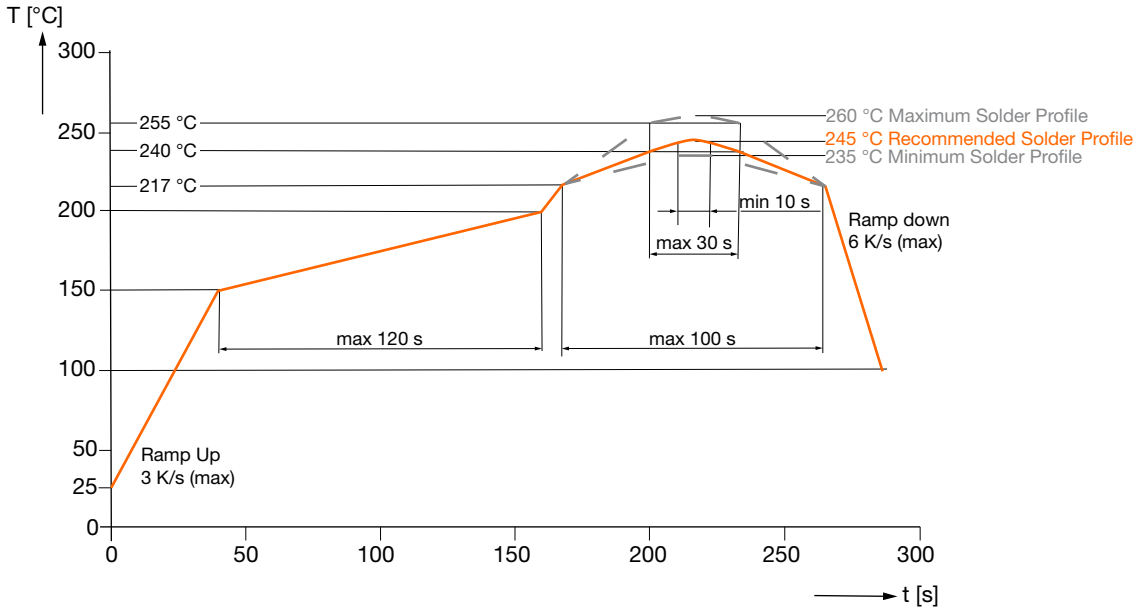


Footprint Cu Area Solder Mask

Assembly process

Since the Firefly® E1608 and the Firefly® E2218 is compatible with existing industrial SMT processing methods, state-of-the-art standard techniques can be used for mounting. The component is qualified for a standard Pb-free (lead-free) reflow soldering process with a maximum peak temperature of 260 °C (see Figure 4). For an optimized alignment it is recommended to check the profile on all new PCB materials and designs. The recommended temperature profile of the solder paste manufacturer can serve as a good starting point. The assemblies should be allowed to return to room temperature after soldering before subsequent handling or the next process step.

Figure 4: Temperature profile for lead-free reflow soldering according to JEDEC JSTD-020E



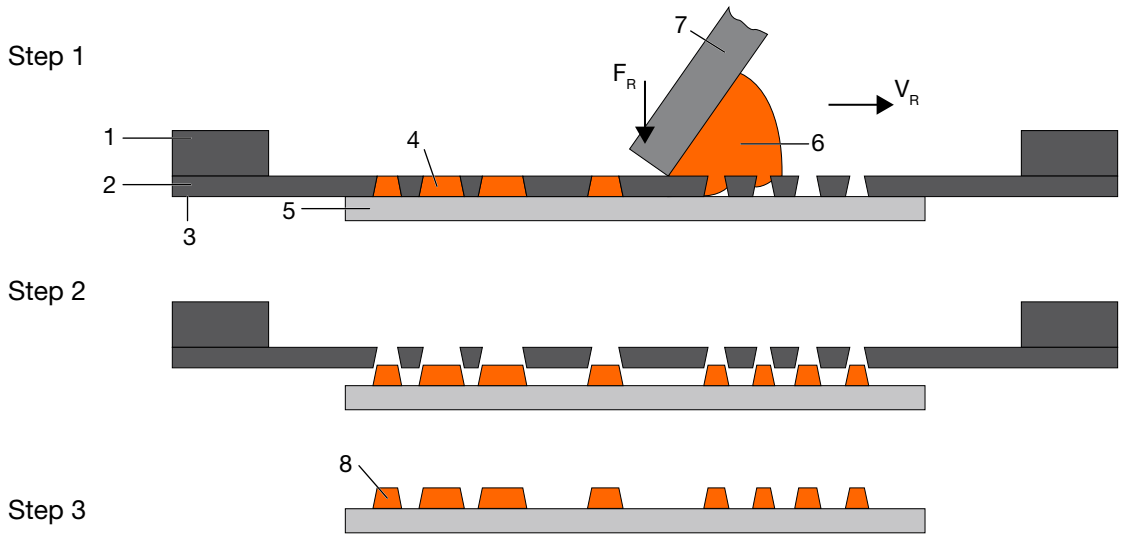
For more detailed information concerning the general processing of SMD LEDs please refer to the application note "Processing of SMD LED".

Solder quality

Uniform thickness of the solder joint is essential in order to produce reliable solder joints and achieve an appropriate optical alignment. To achieve optimum solder joint connectivity results, soldering with a standard nitrogen atmosphere is recommended.

The design of the printing stencil and an accurate working process have a significant influence on the solder quality of the component. The solder paste printing process is the most critical process in the entire process chain, as most failures occur during the SMT assembly process. In industry, commonly laser cut stencils usually made from stainless steel (CrNi) or electroformed stencils (Ni), are used. Aperture sidewalls are typically trapezoidal (5°) to ensure a uniform release of the paste and to reduce solder smearing or so called edge tears. Figure 5 shows a schematic diagram of the solder paste printing process.

Figure 5: Solder paste printing process

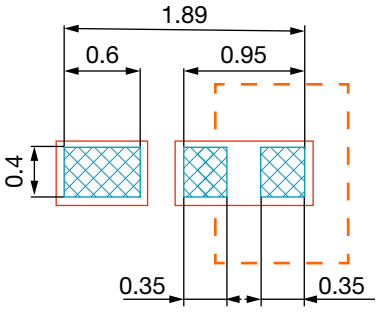


1	Printing Plate	5	Substrate
2	Stencil	6	Solder Paste
3	Stencil Mounting	7	Spreader
4	Printing Patter	8	Printed Pattern
V_R	Spreader Speed	F_R	Spreader Force

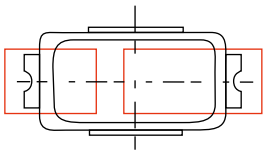
In order to achieve a high quality in the solder process, the solder paste must be applied in the exact position, geometry and precise volume as required. The volume of the printed solder paste is determined by the stencil aperture (opening of the stencil) and the stencil thickness. Figure 6 shows the geometry recommended for the solder stencil.

Figure 6: Recommended solder stencil geometry

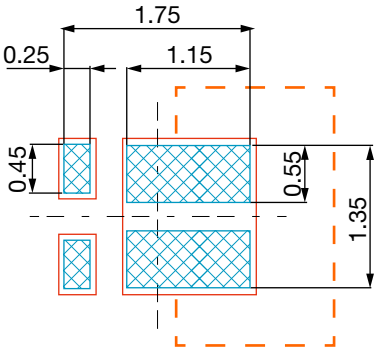
Firefly® E1608



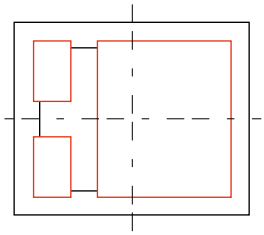
Component location on pad



Firefly® E 2218



Component location on pad



Footprint Cu Area Solder Stencil

The solder joint thickness (standoff height) of the electrical leads should be typically between 50 µm to 75 µm, which is directly influenced by the amount of solder paste that is printed on the center thermal pad (heat slug) area. The stencil thickness used in industry SMT assembly processes varies in a range from 100 µm to 150 µm (0,004 in to 0,006 in). For the Firefly® E1608 and Firefly® E2218 a stencil thickness of 120 µm is recommended. However, the actual stencil thickness depends on the other SMD components on the PCB.

Cleaning

From today's perspective any direct mechanical or chemical cleaning of the Firefly® E1608 and Firefly® E2218 is forbidden. Isopropyl alcohol (IPA) can be used if cleaning is mandatory. Other substances, and especially the ultrasonic cleaning should be avoided, as they can damage the LED.

For more information on correct cleaning refer to the application note "Cleaning of LEDs".

Dusty LEDs can be cleaned by means of using pure compressed air (e.g. central supply or spray can). Please consider that the used compressed air is oil-free, therefore the use of a spray can is preferred. Recommended is a pressure of maximum 4 bar with a distance of 20 cm to the component.

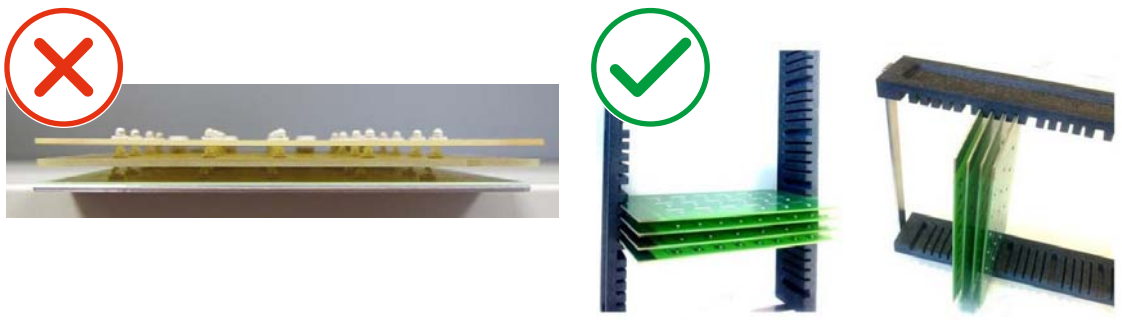
In any case, all materials and methods should be tested in advance.

Storage

Since the Firefly® E1608 and the Firefly® E2218 is 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).

Assembled LED boards should not be stacked on top of each other and a correct storage system should be used (Figure 7). 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 7: Correct storage



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www.ledlightforyou.com

ABOUT OSRAM OPTO SEMICONDUCTORS

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OSRAM Opto Semiconductors GmbH

Head office:

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

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