Belago1.2

Datasheet

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Belago1.2 Dot-pattern infrared illuminator

1 General description

The Belago1.2 infrared illuminator is the most compact dot-projector for stereoscopic imaging available today. It produces a high-contrast, high dot density pattern that stereo-matching algorithms can use to mitigate the problem of lack of texture, and to produce high-accuracy depth maps.

Belago1.2 enables active stereoscopic imaging to be implemented on a variety of platforms, from robotics to mobile devices.

1.1 Key benefits & features

Stereoscopic imaging systems often suffer from impaired performance when the scene lacks features: An example is a flat, smooth surface such as a wall. In such cases, the 3D information captured by stereoscopic imaging systems is typically incomplete or inaccurate. Furthermore, the search for features in the images often results in high computational loading.

ams OSRAM has developed a unique, proprietary solution to this problem. The Belago1.2 infrared illuminator, the most compact dot-projector for stereoscopic imaging available today, produces a high-contrast, high density dot pattern that stereo-matching algorithms can use to mitigate the problem of lack of texture, and to produce high-accuracy depth maps. The presence of the infrared pattern also reduces considerably the computational load imposed by the software, as it offers many features to facilitate matching of the left and right images.

Belago1.2 enables active stereoscopic imaging to be implemented on a variety of platforms, from robotics to mobile devices.

Belago1.2 provides a feedback loop, integrated on the lens, that allows monitoring of a lens or package damage by the operating platform.

The benefits and features of Belago1.2, Dot-Pattern Infrared Illuminator for 3D Stereoscopic Imaging, are listed below:

Table 1: Added value of using Belago1.2

Benefits	Features
Small package size	4.2mm x 3.6mm x 3.325mm
Module height compatible with integration in mobile platforms	3.325mm ± 0.05
Power efficient	High optical efficiency, high VCSEL efficiency
Easy component mounting	Standard lead-free solder reflow compatible
Randomized high density, high contrast dot pattern	Optimized for Active stereo vision systems
Eye safety	Integrated feedback loop on the lens

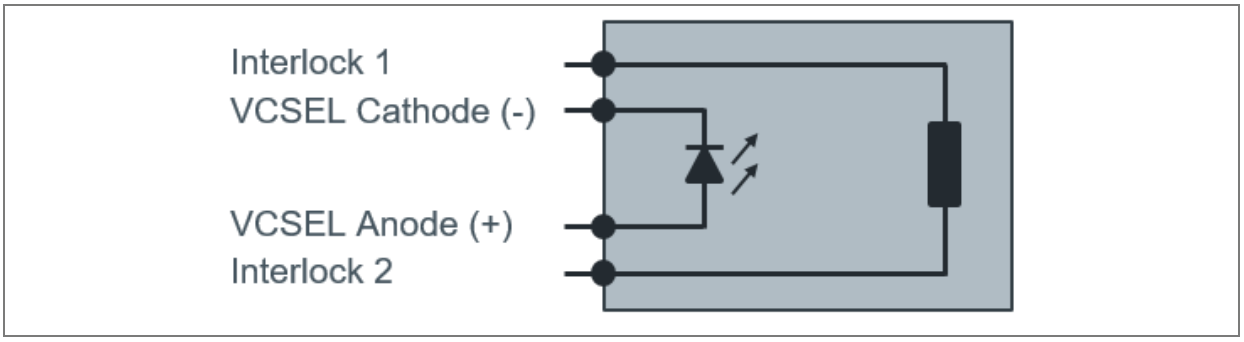
1.2 Applications

- Active stereo 3D sensors
- Integrated mobile 3D sensors
- Integrated tablets and all-in-one 3D sensors
- Front-facing and world-facing 3D cameras

1.3 Block diagram

The functional blocks of this device are shown below:

Figure 1: Functional blocks of Belago1.2



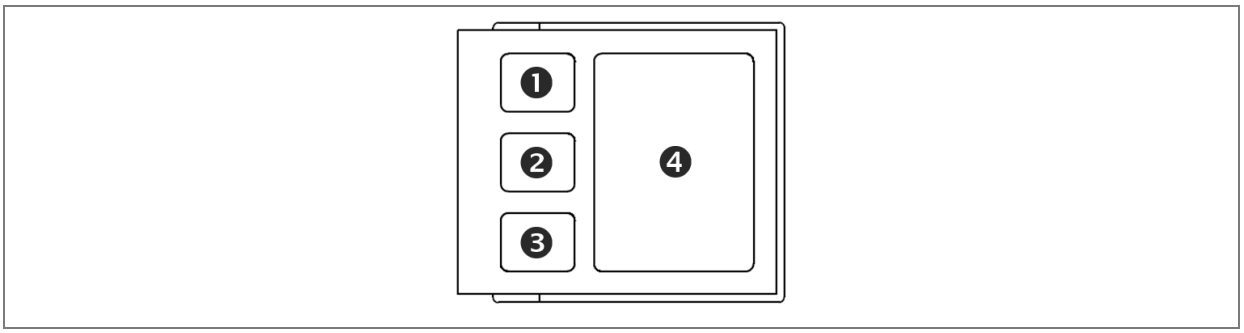
2 Ordering information

Ordering code	Description	Delivery form	Delivery quantity
AQAA-30 / Q65114A0198	Belago1.2 Dot Pattern Illuminator	Tape	980 pcs (2 trays)

3 Pin assignment

3.1 Pin diagram

Figure 2: Pin diagram of Belago1.2



3.2 Pin description

Table 2: Pin description of Belago1.2

Pin number	Pin name	Description
1	Sense 1	Resistive Interlock connection
2	Anode	VCSEL Power
3	Sense 2	Resistive Interlock connection
4	Cathode	VCSEL Power

4 Absolute maximum ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated under “Operating Conditions” is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 3: Absolute maximum ratings of Belago1.2

Symbol	Parameter	Min	Max	Unit	Comments
Electrical Parameters					
V_F	Forward voltage		3	V	25°C, Pulse >10ns
I_F	Forward current		7	A	25°C, Pulse >10ns
I_{rev}	Reverse current		10	µA	25°C instantaneous
Continuous Power Dissipation (T_{Case} = 70 °C)					
P_T	Continuous power dissipation		1000	mW	Input power
Temperature Ranges and Storage Conditions					
T_{STRG}	Storage temperature range	-40	85	°C	
T_{Op}	Operating temperature	0	85	°C	IPC/JEDEC J-STD-020
MSL	Moisture sensitivity level	3			JESD22-A113D

5 Belago1.2 specification

Table 4: Individual emitter characteristics

Parameter	Condition[1]	Min	Typ	Max	Unit
Horizontal FOI 50% (deg)	Full width half max. At Iop=700 mA At RT, 1 ms / 30 fps	56	60	64	deg
Vertical FOI 50% (deg)	Full width half max. At Iop=700 mA At RT, 1 ms / 30 fps	74	78	82	deg
Number of dots	@Camera FOV[2] 56°x74°	11000	12000		Dots
Contrast[3]		7.5			
Wavelength	At Iop=700 mA At RT, 1 ms / 30 fps	933	940	947	nm
Spectral width	Full width half max At Iop=700 mA At RT, 1 ms / 30 fps	0	1.5	3	nm

Parameter	Condition[1]	Min	Typ	Max	Unit
Wavelength shift with temperature			0.065	0.075	nm/°C
Thermal resistance	@ 100% duty cycle		26		K/W
Operating temperature	Heat sink temperature	10		60 (85)	°C
Storage temperature		-40		85	°C

(1) Specified temperatures refer to the emitter case temperature (the emitter is mounted on a temperature-controlled stage); RT stands for Room Temperature (25°C).
(2) Difference between FOI and Camera FOV, see Figure 3.
(3) Contrast is defined as the ratio of the 95th percentile of the dot intensity over the median intensity of the background.

The FOI definition is portrait as shown below.

Figure 3: Definition of FOI

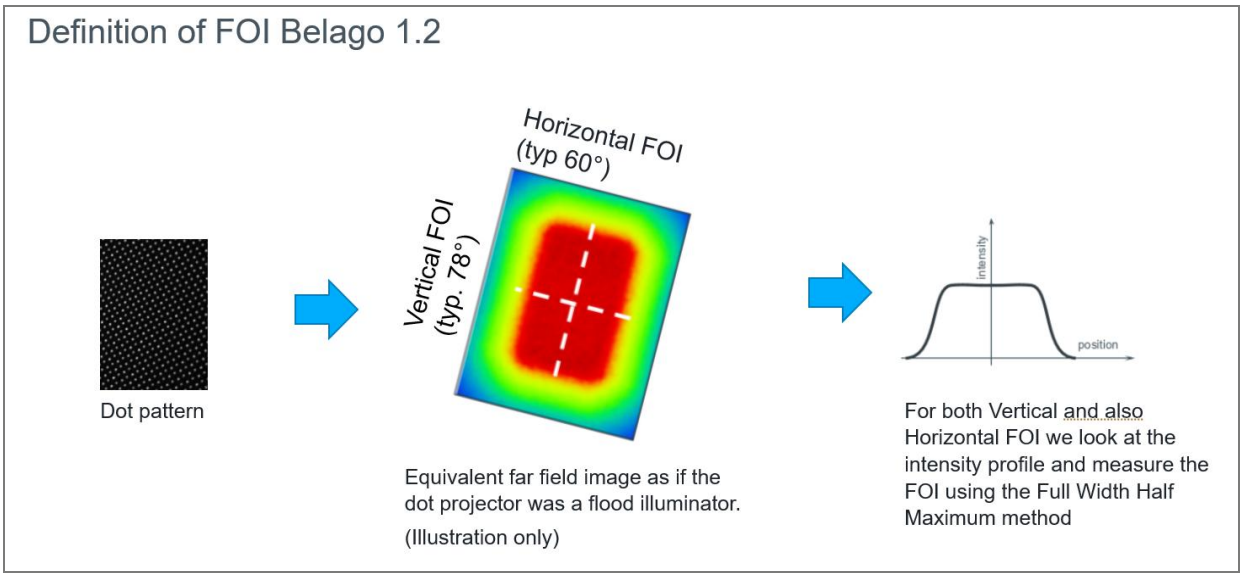


Table 5: Other general characteristics

Parameter	Value
Light source	VCSEL
Pattern rotation(1) (test value)	15°±1.5°
Dimensions (X Y Z) (mm^3)	4.2 x 3.6 x 3.325
Electrical contacts	Anode and cathode on backside
Number of electrical contacts	1x cathode and 1x anode 2x sense
Assembly type	Reflow compatible

(1) Characterization value of 10 samples during development and process stability.

6 Electrical characteristics

All limits are guaranteed. The parameters with Min and Max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

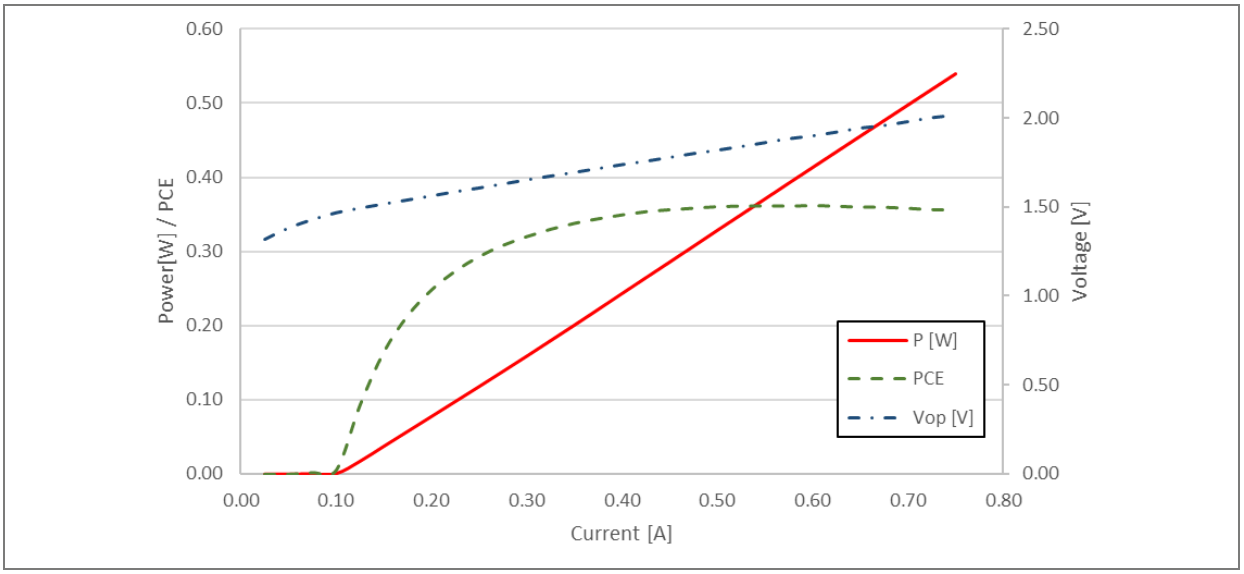
Table 6: Electrical characteristics of Belago1.2

Symbol	Parameter	Conditions(1)	Min	Typ	Max	Unit
$I_{op,pulsed\ long}$	Operating current	At RT, 10 ms / 30 fps		350		mA
$P_{op,pulsed\ long}$	Operating power	At Iop=350 mA At RT, 10 ms / 30 fps	150		250	mW
$V_{op,pulsed\ long}$	Operating voltage	At Iop=350 mA At RT, 10 ms / 30 fps	1.35		1.95	V
$I_{op,\ pulsed\ short}$	Operating current	At RT, 1 ms / 30 fps		700		mA
$P_{op,\ pulsed\ short}$	Operating power	At Iop=700 mA At RT, 1 ms / 30 fps	460		600	mW
$V_{op,\ pulsed\ short}$	Operating voltage	At Iop=700 mA At RT, 1 ms / 30 fps	1.65		2.25	V
PCE_{op}	Operating PCE	At Iop=350-700 mA At RT, 1 ms / 30 fps	27	33		%
$R_{Interlock}$	Resistance	At RT	10.8	15	21	kOhm
t_{rise}	Rise time				5	ns
I_{th}	Threshold current	At RT	50		150	mA

(1) Specified temperatures refer to the emitter case temperature (the emitter is mounted on a temperature-controlled stage); RT stands for Room Temperature (25°C).
(2) Pulsed operating condition as reference parameter set.

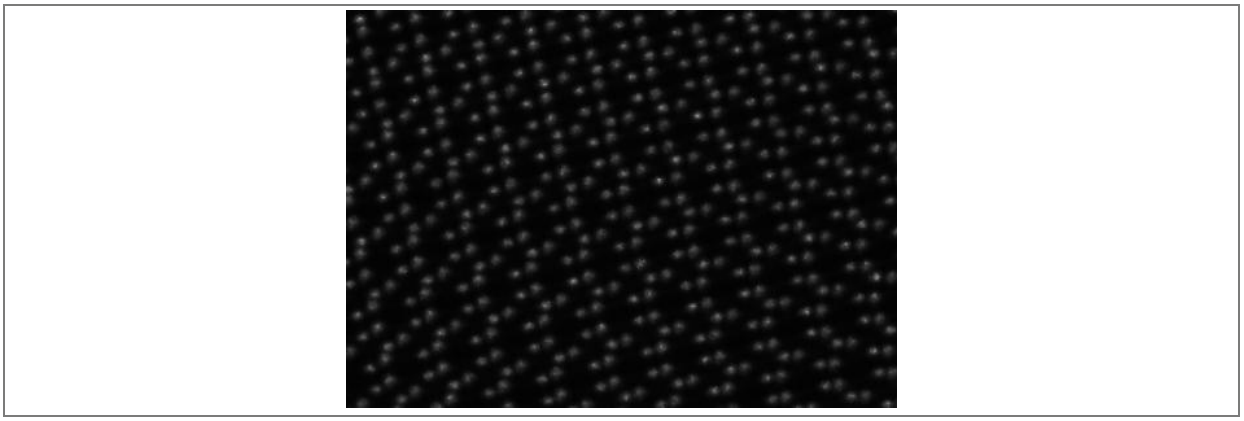
6.1 Typical operating characteristics

Figure 4: Electro-optical performance



(1) @25deg, Ti=1ms,30fps, 0.7A

Figure 5: Projected dot pattern



(1) Projected dots pattern measured from Belago1.2 (cropped image showing the central portion of the FOI).

6.2 Imaging setup

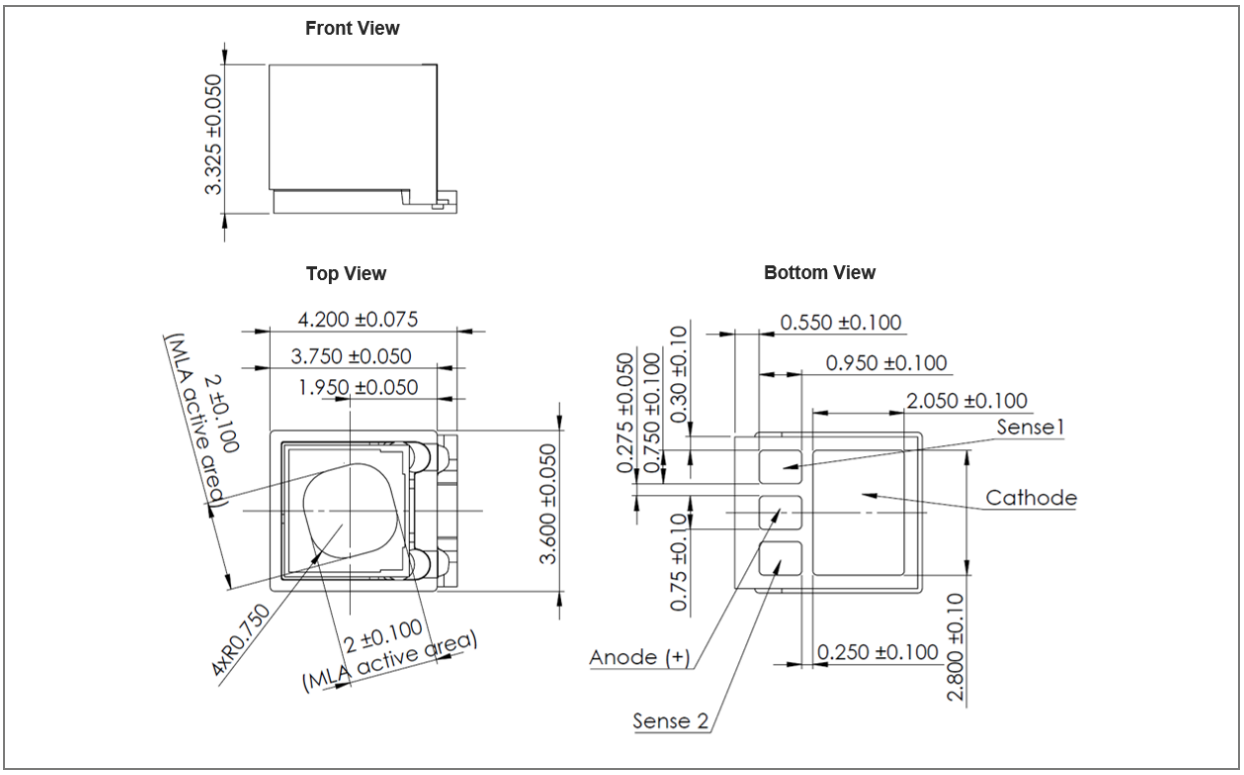
For the pattern characterization, the output is projected onto a white, matte-finished target board (Lambertian surface), at a distance. Images are taken inside a dark chamber with a monochrome CCD camera and a wide angle objective.

6.3 Hotspot detection

Every individual Belago1.2 emitter is inspected during production to detect the presence of hotspots and similar non-uniformities that cause excessive brightness of the infrared pattern and could be harmful to the human eye.

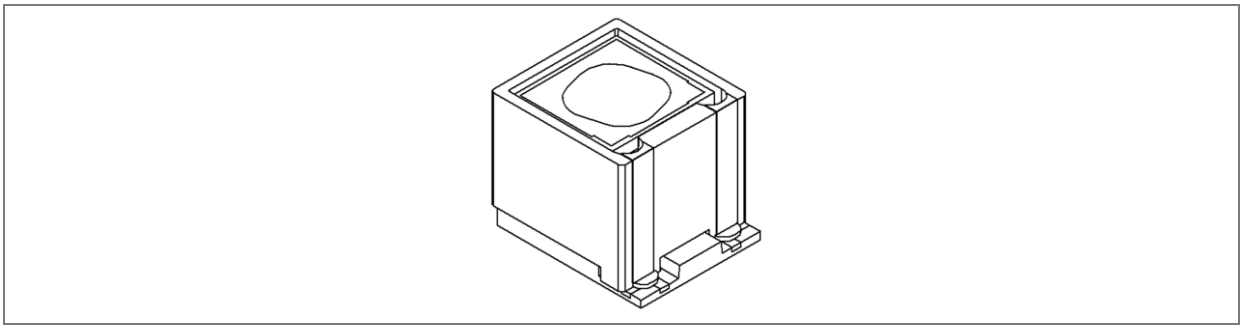
7 Mechanical drawings

Figure 6: Package dimensions



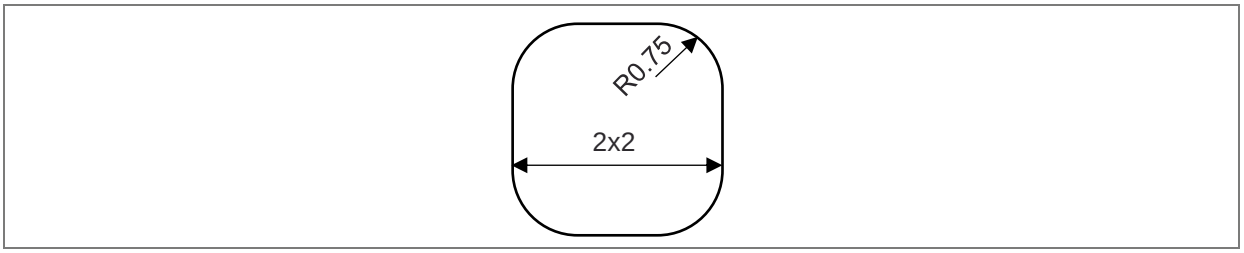
(1) Outline dimensions Belago1.2.
(2) All dimensions in mm.

Figure 7: 3D view



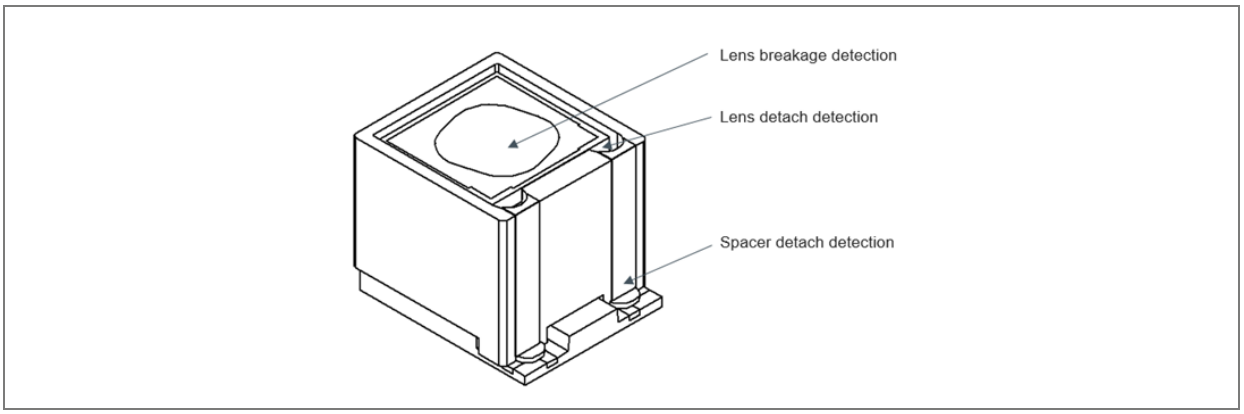
(1) 3D view

Figure 8: Optical aperture



(1) Optical aperture dimensions (defining the opening where the light is emitted through).
(2) All dimensions in mm.

Figure 9: Safety interlock



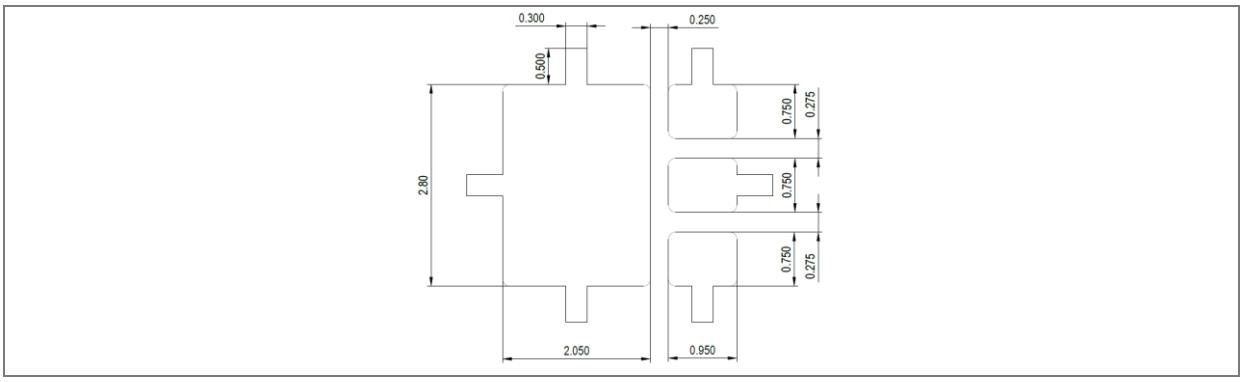
(1) Conductive loop covering the optical active area of the lens and connecting to the bottom side pads for module integrity monitoring. A damage of the module results in an open circuit.
(2) Resistance value should be in the specified range when module is operated, to ensure the functioning of the interlock.

8 Application information

8.1 PCB pad layout and solder mask recommendation

The drawings below are showing a recommendation for pad layouts and solder mask. This is only to be used as guide and not to be considered as a firm specification.

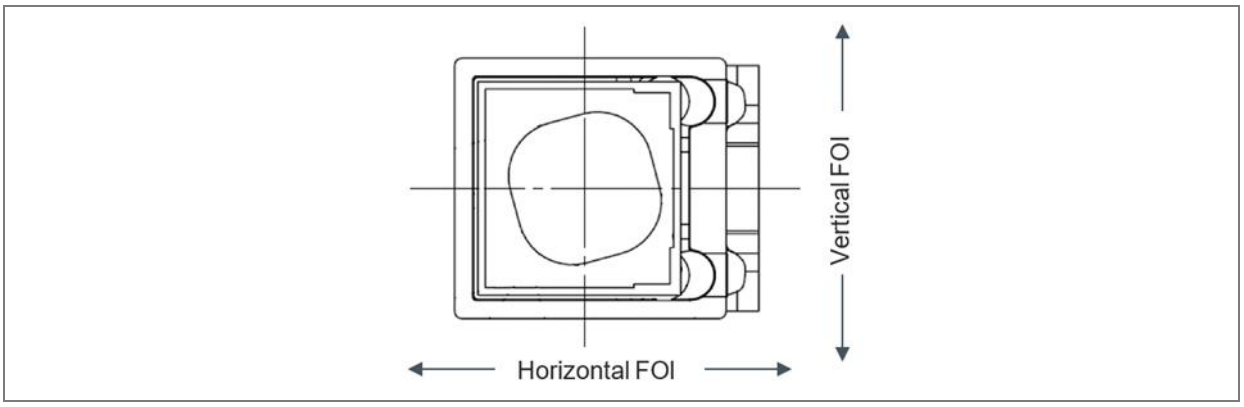
Figure 10: Solder mask layout



(1) All dimensions in mm.

8.2 Orientation of the field of illumination

Figure 11: FOI orientation

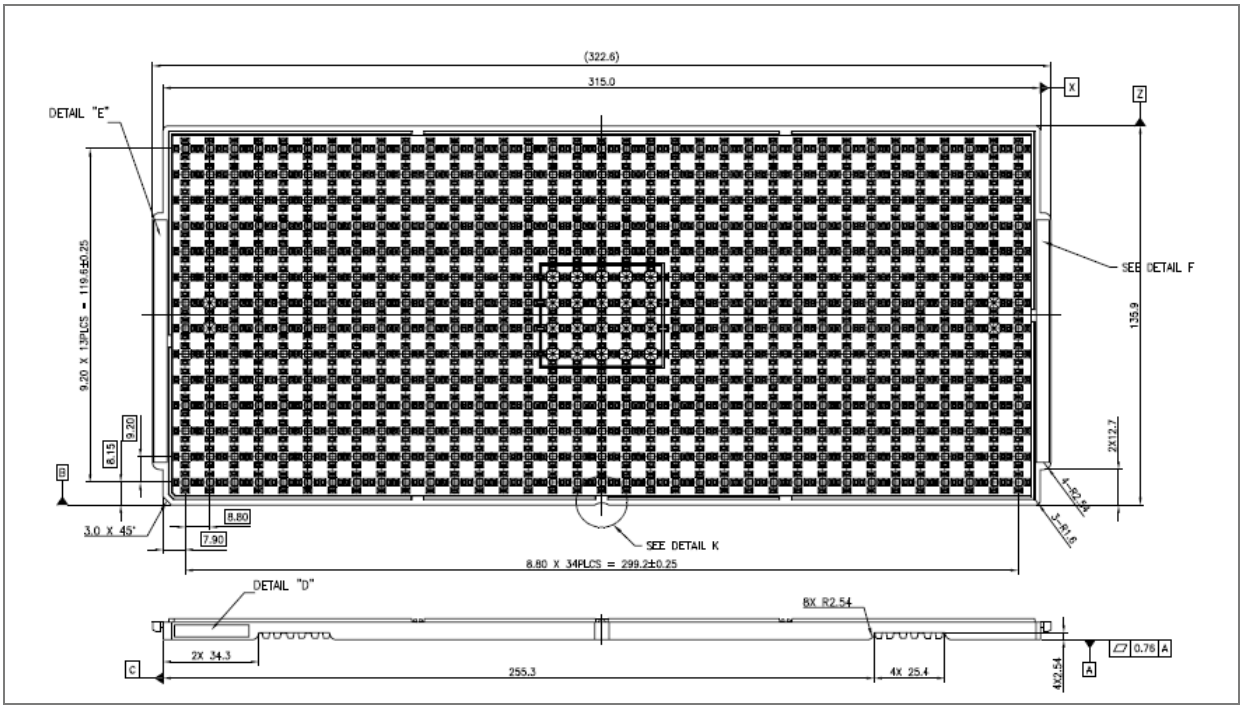


(1) Orientation of the Field of Illumination with respect to the Belago1.2 module.

9 Package information

9.1 Overview

Figure 12: Shipping tray dimensions and overview



9.2 Tray label

Trays are individually labeled. The label information is as follows:

- Part number (XXXX-XX)
- Tray ID
- Quantity
- Shipment Date
- Manufacturing country

The underlined items are included in the bar code.

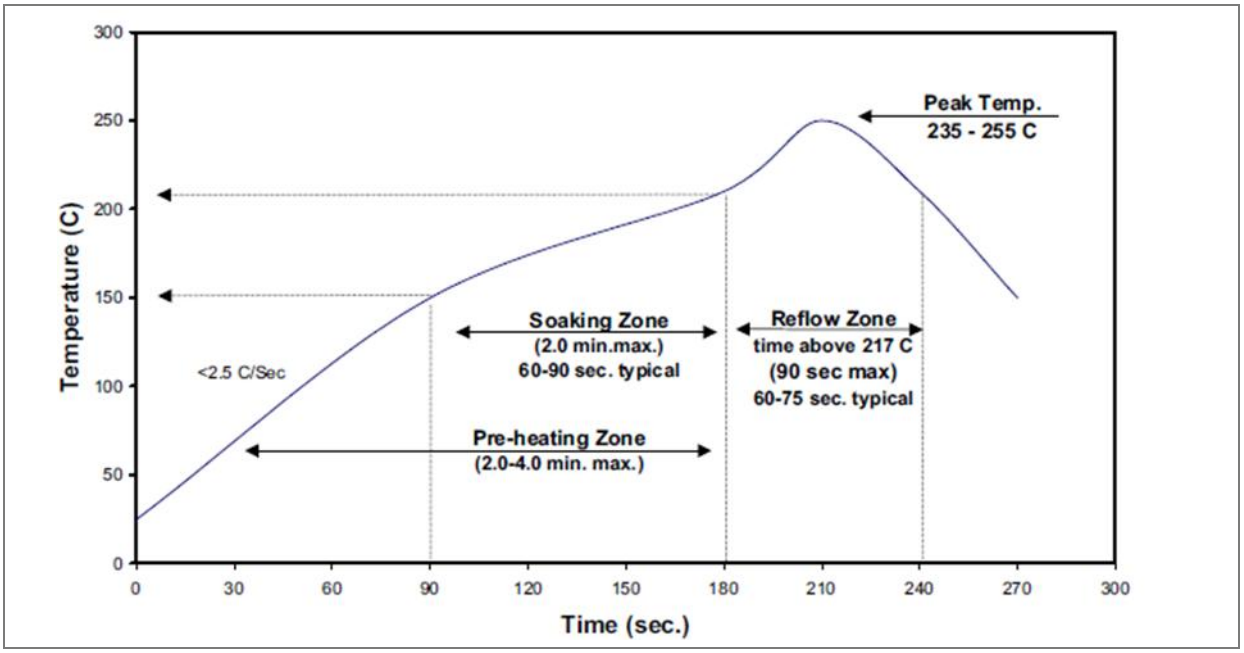
10 Soldering & storage information

Belago1.2 modules have been tested for lead-free solder reflow compatibility with peak temperatures up to 250°C (MSL3).

An example reflow profile is provided in Figure 13. The exact reflow profile may depend on exact solder used.

An example of solder paste that can be used is Tamura LFSOLDER TLF-204-NH(20-38).

Figure 13: Solder reflow profile graph



Attention:

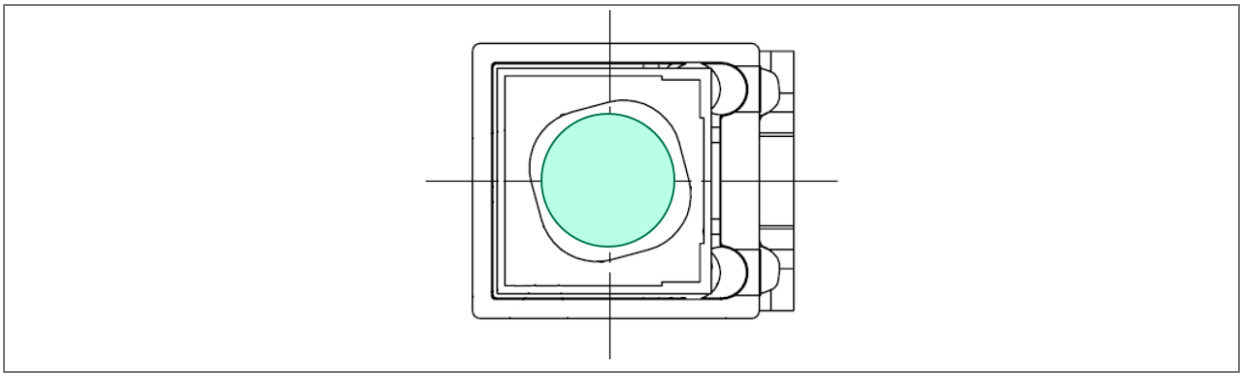
- The module contains a ventilation hole to allow pressure equalization with the ambient.
- It is not advised to proceed to cleaning after SMT reflow process.
- The modules MUST NOT be cleaned using ultrasonic cleaning.
- We suggest to use flux free solder paste and not to clean after SMT.
- In case a cleaning is un-avoidable, rinse with DI water, followed by a 2h bake @70°C

11 Handling

11.1 Pick up

Recommended pick up position on the top window (green circle), touching directly the glass.

Figure 14: Pick up location



(1) Picking area within green area.

12 Appendix

12.1 RoHS & REACH compliance

The Belago1.2 module is compliant with the European RoHS Directive 2002/95/EC (Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) and REACH (Registration, Authorization and Restriction of Chemicals, European Union Regulation (EC) 1907/2006).

12.2 Safety advice

Depending on the operational use of the device, the modules can emit highly concentrated non-visible infrared light, which can be hazardous to the human eyes. Products incorporating these modules may have to follow the safety precautions described by IEC 60825-1:2014.

This product emits infrared radiation and has not yet been classified under IEC 60825-1:2014. All appropriate safety precautions should be exercised in the operation and use of this product.

CAUTION:

1. Avoid direct eye exposure except as may be determined and directed by Purchaser.
2. Appropriate protective eyewear should be worn when operating.
3. Use of magnifying optical instruments with this component may increase eye hazard.

LASER PRODUCT
LASER RADIATION – AVOID DIRECT EYE EXPOSURE
WAVELENGTH: 940nm
MAXIMUM OUTPUT POWER: Depends on drive mode
WEAR PROTECTIVE GLASSES

13 Revision information

Document status	Product status	Definition
Product Preview	Pre-development	Information in this datasheet is based on product ideas in the planning phase of development. All specifications are design goals without any warranty and are subject to change without notice
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Changes from previous released version to current revision v1-00	Page
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- Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
- Correction of typographical errors is not explicitly mentioned.

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