

Product Document



Datasheet

DS000744

TARA2000-940-N-AUT

Automotive High-Power Flood Illuminator

v3-00 • 2023-Mar-28

Abstract

The TARA2000-940-N-AUT is a small form factor surface mount infrared laser illuminator enabling 2D and 3D use cases on a variety of platforms for in-cabin sensing applications.

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1 General Description

1.1 Key Benefits & Features

The TARA2000-940-N-AUT module is specifically designed for monochromatic, infrared, high-power, uniform illumination.

The compact modules are assembled with ams OSRAM state-of-the-art component manufacturing processes and are reflow solderable. Those modules, using laser illumination, allow improved efficiency, reduced footprint, and overall improved system performance.

Figure 1:
Added Value Overview

| Benefits | Features |
|----------------------------|---|
| Small package size | 4.1 mm x 4.1 mm x 1.38 mm ± 0.100 mm |
| Power efficient | High power conversion efficiency |
| Easy component mounting | Standard lead-free solder reflow compatible |
| Uniform power distribution | 100% tested for uniformity in the far field |
| Automotive qualified | AEC-Q102 standard |
| Safety compliance | ISO2626 compliant |
| Safety ASIL level | ASIL A |
| Full traceability | Unit level track with 2D barcode |

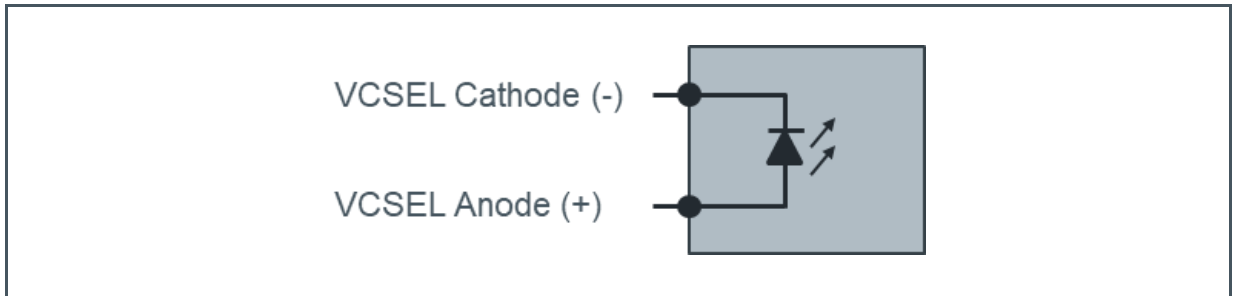
1.2 Applications

- Illumination for 3D Time-of-Flight and 2D Near-Infrared Cameras for in-cabin sensing
- Driver Monitoring
- In-Cabin Monitoring

1.3 Block Diagram

The functional block of this device is shown below:

Figure 2:
Functional Block of TARA2000-940-N-AUT



1.4 Other General Characteristics

Some additional features of this device are shown below:

Figure 3:
Additional Characteristics

| Parameter | Value |
|-------------------------------|---------------------------|
| Light Source | VCSEL |
| Electrical Contacts | Anode/Cathode on backside |
| Number of Electrical Contacts | 1x Cathode ; 1x Anode |
| Assembly Type | Reflow Compatible |

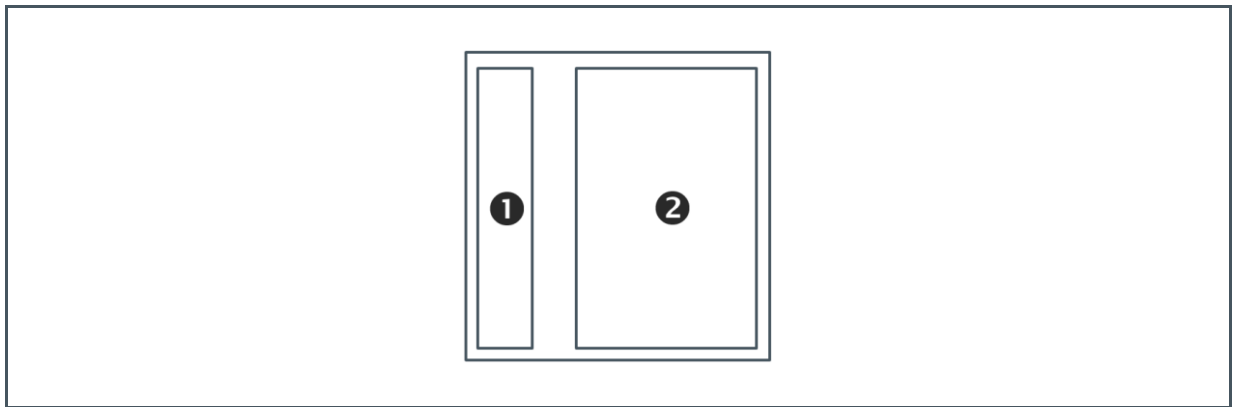
2 Ordering Information

| Ordering Code | Description | Delivery Form | Delivery Quantity |
|---------------|--------------------|---------------|-------------------|
| ATBA-00 | TARA2000-940-N-AUT | Tape & Reel | 4000 pcs/reel |

3 Pin Assignment

3.1 Pin Diagram

Figure 4:
Pin Diagram: Module Bottom View



3.2 Pin Description

Figure 5:
Pin Description of TARA2000-940-N-AUT

| Pin Number | Pin Name | Description |
|------------|----------|-------------|
| 1 | Anode | VCSEL Power |
| 2 | 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.

Figure 6
Absolute Maximum Ratings of TARA2000-940-N-AUT

| Symbol | Parameter | Min | Max | Unit | Comments |
|--|------------------------------------|-----------|-----|------|---|
| Electrical Parameters | | | | | |
| $I_{F,LD}$ | Laser Diode Forward Current | | 10 | A | Duty cycle = 1% Pulse width = 100 μ s @ 25 °C |
| $V_{R,LD}$ | Laser Diode Reverse | | 5 | V | DC mode @ 25 °C |
| $I_{R,LD}$ | Laser Diode Reverse Current | | 25 | nA | DC mode @ 25 °C |
| Electrostatic Discharge | | | | | |
| ESD_{HBM} | Electrostatic Discharge HBM | ± 2 | | kV | JEDEC JS-001-2017 |
| ESD_{CDM} | Electrostatic Discharge CDM | ± 750 | | V | JEDEC JS-002-2018 |
| Temperature Ranges and Storage Conditions | | | | | |
| T_A | Operating Ambient Temperature | -40 | 105 | °C | |
| T_{STRG} | Storage Temperature Range | -40 | 125 | °C | |
| RH_{NC} | Relative Humidity (non-condensing) | | 85 | % | |
| MSL | Moisture Sensitivity Level | | 3 | | Maximum floor life time of 168h JESD22-A113D |

5 Performance Characteristics

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

5.1 Electrical Characteristics

Figure 7:
Electrical Parameters

| Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-----|-----|------|------|
| Optical Output Power ⁽¹⁾ | Pulse width=100 μ s, Duty cycle = 2%, @ 5 A @ 25 °C | 3.1 | | 4.3 | W |
| Operating Voltage ⁽¹⁾ | Pulse width=100 μ s, Duty cycle = 2%, @ 5 A @ 25 °C | 1.9 | | 2.6 | V |
| Slope Efficiency | Pulse width=100 μ s, Duty cycle = 2%, @ 5 A @ 25 °C | 0.7 | | 1.05 | W/A |
| Threshold Current | Pulse width=100 μ s, Duty cycle = 2%, @ 25 °C | 0.2 | | 1.1 | A |
| Power Conversion Efficiency | Pulse width=100 μ s, Duty cycle = 2%, @ 5 A @ 25 °C | 31 | | 45 | % |

(1) Depending on driving conditions and thermal management

5.2 Optical Characteristics

Figure 8:
Optical Parameters

| Parameter | Condition | Min | Typ | Max | Unit |
|-------------------------------|--|-----|-----|-----|------|
| Wavelength | Pulse width=100 μ s, Duty cycle = 2%, @ 4 A @ 25 $^{\circ}$ C | 932 | 940 | 948 | nm |
| Spectral Width ⁽¹⁾ | Pulse width=100 μ s, Duty cycle = 2%, @ 4 A @ 25 $^{\circ}$ C | 0.1 | | 3 | nm |

(1) Full width at half maximum

Figure 9:
Field of Illumination (FOI)

| Parameter | Condition | Min | Typ | Max | Unit |
|----------------------------------|--|-----|-----|-----|------|
| Horizontal FOI ⁽¹⁾⁽²⁾ | Pulse width = 100 μ s, Duty cycle = 2%, @ 4 A @ 25 $^{\circ}$ C | 56 | 59 | 62 | deg |
| Vertical FOI ⁽¹⁾⁽²⁾ | Pulse width = 100 μ s, Duty cycle = 2%, @ 4 A @ 25 $^{\circ}$ C | 39 | 42 | 45 | deg |

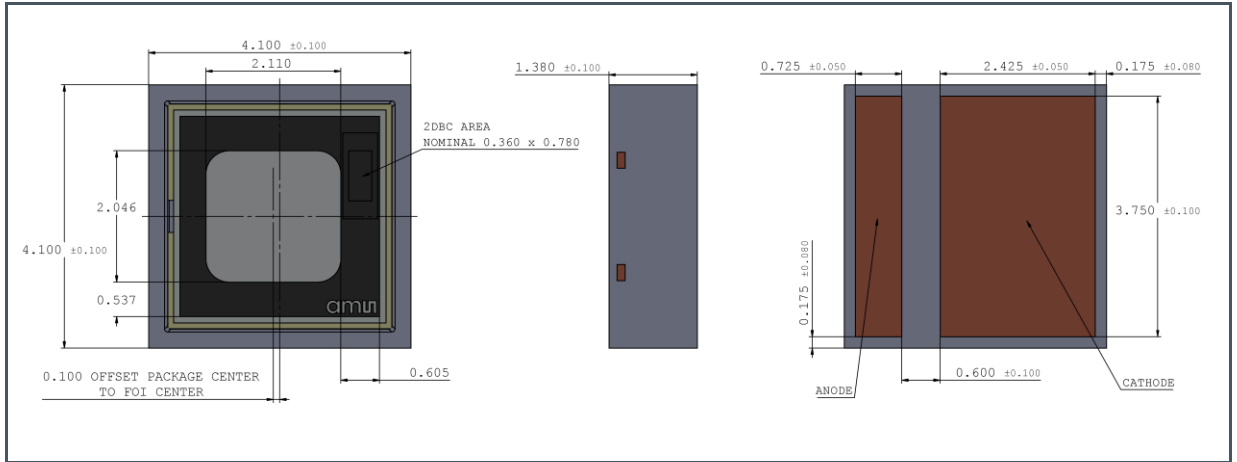
(1) Angle at 50% level normalized to the centroid

(2) Based on irradiance (W/m^2)

6 Package Drawings

The drawing below is showing the module size and tolerances of the TARA2000-940-N-AUT module.

Figure 10:
Package Dimensions⁽¹⁾



(1) All dimensions in mm

Figure 11:
Top and Bottom View

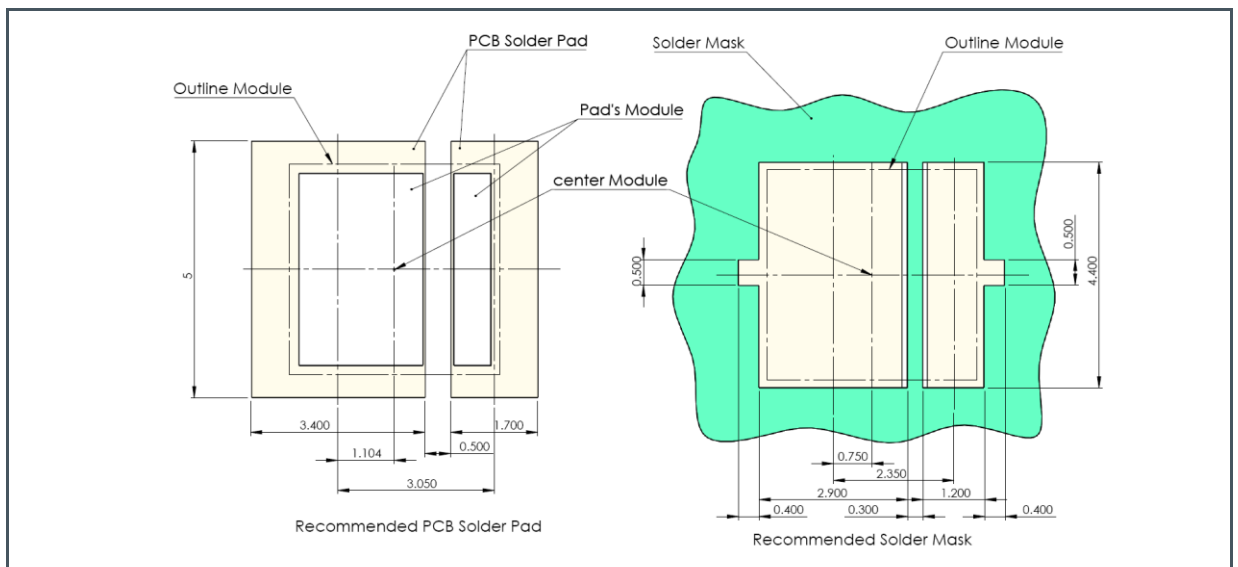


7 Application Information

7.1 PCB Pad Layout and Solder Mask Recommendation

The drawing below is 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 12:
Recommended PCB Pad Layout (top view)⁽¹⁾

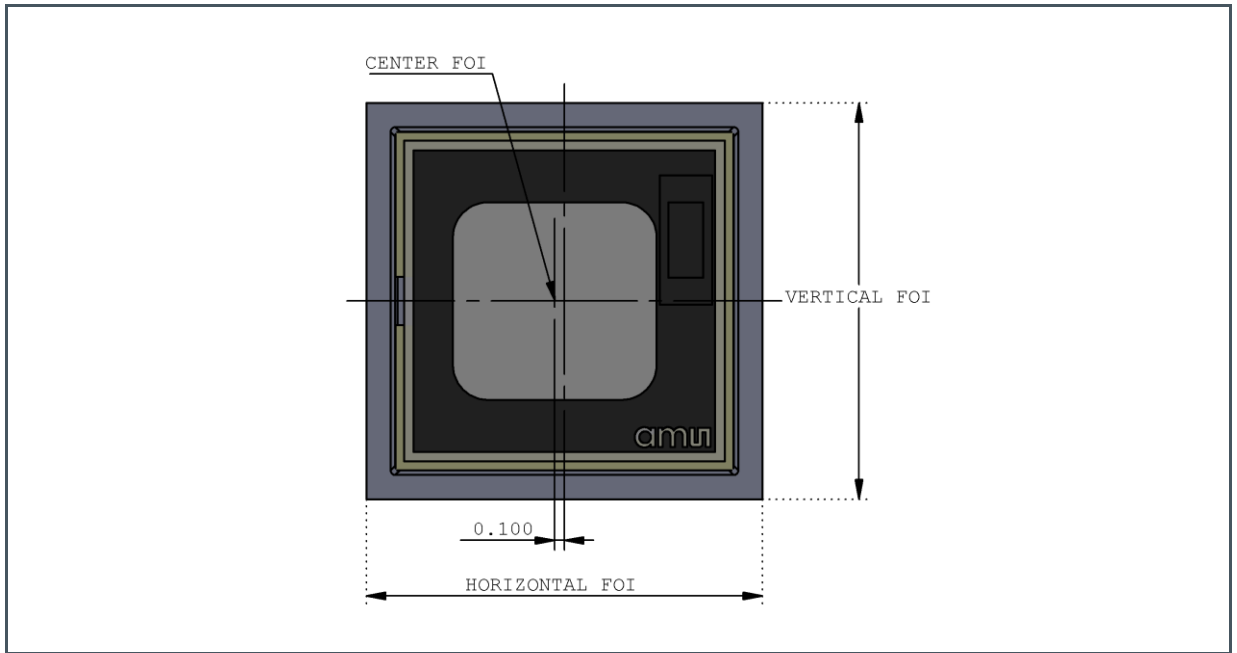


(1) All dimensions in mm.

7.2 Orientation of the Field of Illumination

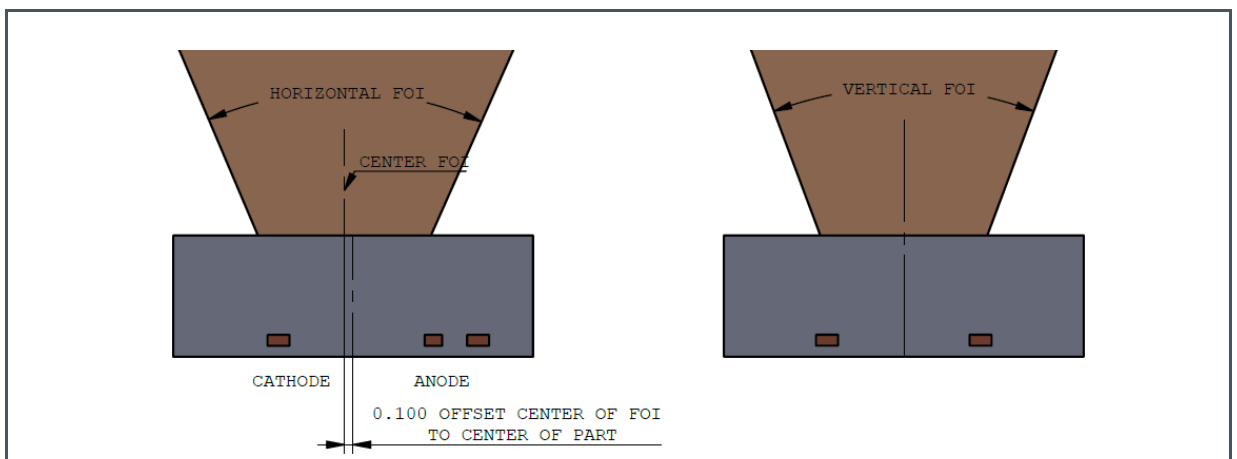
The drawings below are showing the emitting area of the TARA2000-940-N-AUT module.

Figure 13:
FOI Orientation Regarding Module Footprint



(1) All dimensions in mm.

Figure 14:
FOI Projection



(1) All dimensions in mm.

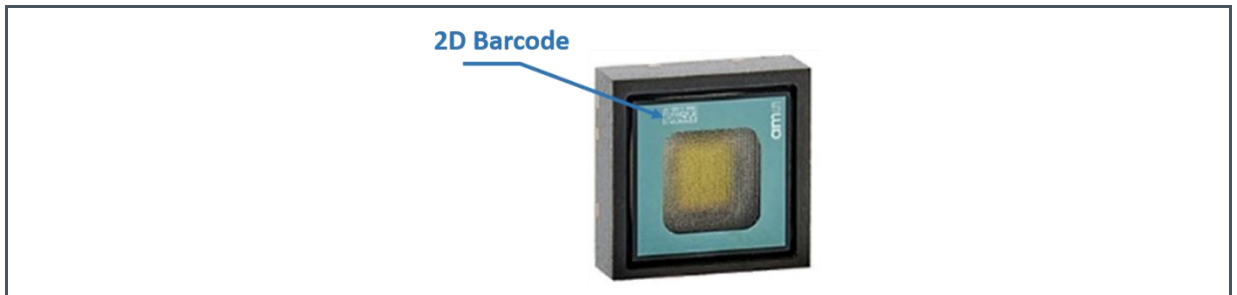
7.3 Information on the 2D Barcode

The figure below shows the 2D barcode on the module that can be used for traceability purpose. The 2D barcode has 14 characters and contains the following information:

- Optics Lot number
- Year / Month / Day of manufacturing
- Lot running number and row & column coordinates located in the wafer
- Build type
- Configuration details

The module lot number can be traced back through module traceability report by referencing to the optics lot number.

Figure 15:
2D Barcode Location on the Module



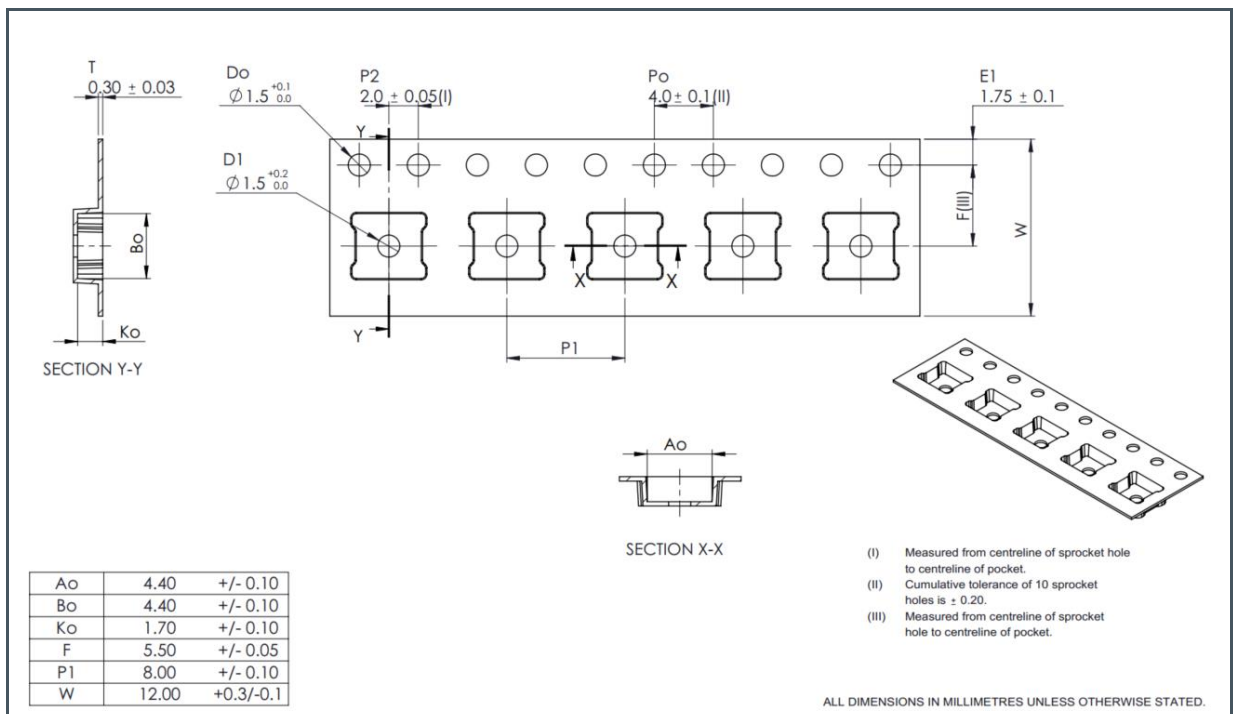
8 Tape & Reel Information

8.1 Overview

Sampling Shipments: The modules are shipped in tape & reel

MP Shipments: The modules are shipped in tape & reel

Figure 16:
Carrier Tape Dimensions and Overview⁽¹⁾⁽²⁾⁽³⁾



- (1) Cover tape dimensions are 9.3 mm.
- (2) Device pin 1 oriented towards tape holes.
- (3) Reference material: Polystyrene carrier and Polyester clear tape

8.2 Plastic Reel & MBB Bag

Reels are individually labeled and put inside a Moisture Barrier Bag (MBB). The label information is as follows:

- Part number
- Lot number
- Date code manufacturing
- Manufacturing country
- Expire date
- VCSEL batch
- Quantity
- Supplier information

Figure 17:
Shipping Label Example

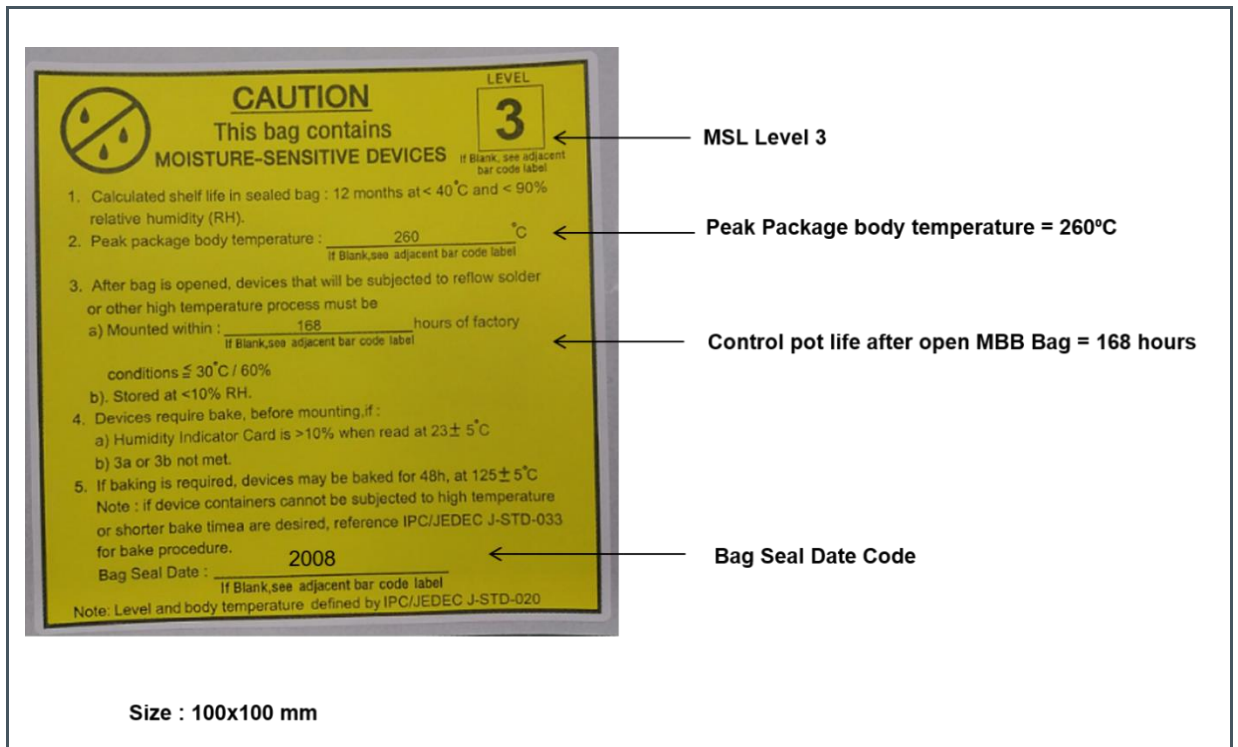
| | | | | |
|--|----|---------------|--|-----------------------------|
| | SN | Field | Definition | Remarks |
| | 1 | Part No | Part Number | Product Device/Config |
| | 2 | PT Lot No | Lot Number | Lot Number from system |
| | 3 | Date Code 1 | Date Code manufacturing | 20 = year 2020, 08= week 08 |
| | 4 | Date Code 2 | Date Code Lot 2 (merge lot) | |
| | 5 | COO | Manufacturing Country | TH= Thailand |
| | 6 | Expire date | Expire date about 1 year from manufacturing date | 1 year from date code |
| | 7 | Wafer No | VCSEL batch | |
| | 8 | Wafer No 2 | VCSEL batch 2 (merge lot) | |
| | 9 | Quantity | Quantity of unit | |
| | 10 | Supplier info | 2D code information | |

Label Size : 80x48 mm

8.3 MSL Label

The Moisture Sensitivity Level information is mentioned in the MBB Bag as shown in the figure below.


Figure 18:
MSL Label Example on MBB Bag



8.4 Label at Outer Box

The outer box containing all the plastic reels contain information as shown in the figure below.

Figure 19:
Label at Outer Box Example



Size : 140x80 mm

| S N | Field | Definition | Remarks |
|--------|------------------------------------|---------------------------|--|
| 1 | (P) Material No (Customer Part No) | Material Number | Customer partnumber for shipping label |
| 2 | Vendor P/N | Manufacturing part number | Marketing / Ordering Code |
| 3 | Vendor | Manufacturing part number | Vendor Code (for shipping label) |
| 4 | (Q) Quantity | Package quantity | built quantity |
| 5 | (4L) Country of Assembly | Country of Origin | this is similar with Country of Origin |
| 6 | (K) Trans. ID (Customer P.O No) | Need Info | Customer PO from Picklist |
| 7 | (P) SEC | Need Info | Customer partnumber for shipping label |
| 8 | MPN | Material Number | SAP MatNr |
| 9 | (2S) Shipment ID | Need Info | Picklist Generated - Hana generated |
| 10 | (3S) Package ID | Need Info | HUMO Identification - Hana generated |
| 11 | Gross Weight | Weight | actual weight of box for shipment |

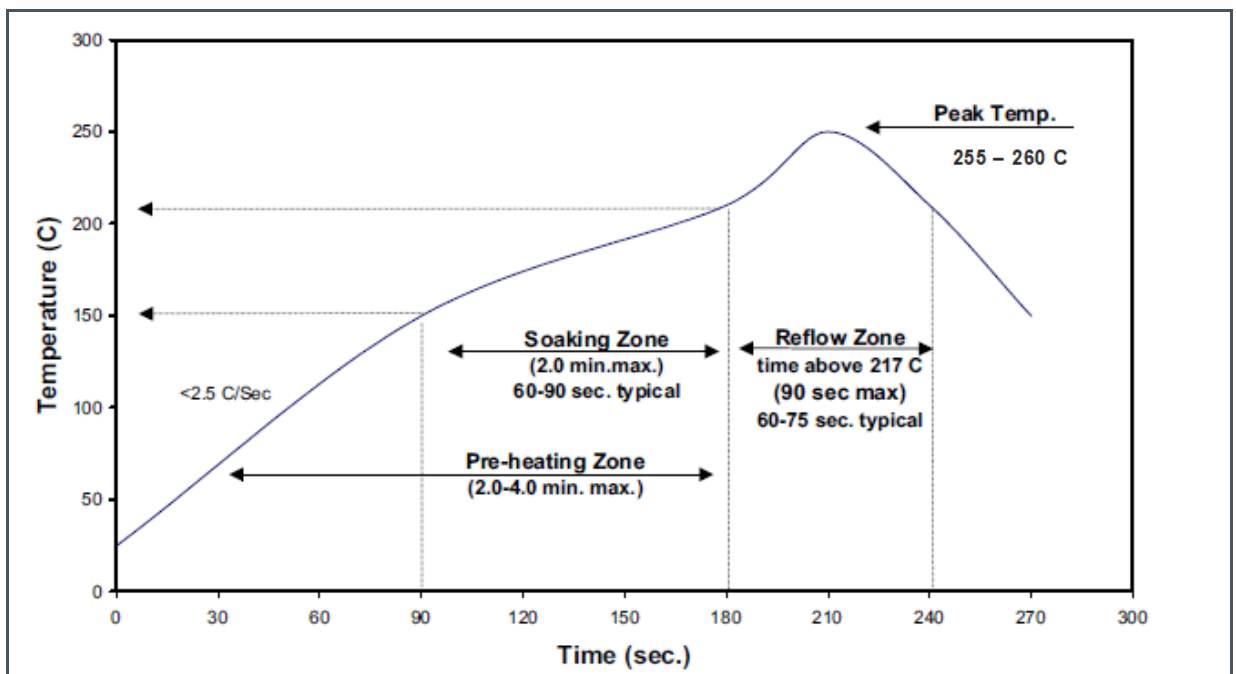
9 Soldering & Storage Information

9.1 Soldering Information

The TARA2000-940-N-AUT modules have been tested for lead-free solder reflow compatibility with peak temperatures up to 260 °C.

Although an example reflow profile is provided in the following figure, the exact reflow profile may depend on exact solder used.

Figure 20:
Solder Reflow Profile Graph Example (for reference only)



Attention

- 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 “no clean 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.

9.2 Storage Information

Moisture sensitivity optical characteristics of the device can be adversely affected during the soldering process by the release and vaporization of moisture that has been previously absorbed into the package. To ensure the package contains the smallest amount of absorbed moisture possible, each device is baked prior to being dry packed for shipping. Devices are dry packed in a sealed aluminized envelope called a moisture-barrier bag with silica gel to protect them from ambient moisture during shipping, handling, and storage before use.

9.3 Shelf Life

The calculated shelf life of the device in an unopened moisture barrier bag is 12 months from the date code on the bag when stored under the following conditions:

- Shelf Life: 12 months
- Ambient Temperature: <40°C
- Relative Humidity: <90%

Rebaking of the devices will be required if the devices exceed the 12 month shelf life and the Humidity Indicator Card shows that the devices were exposed to conditions beyond the allowable moisture region.

9.4 Floor Life

The module has been assigned a moisture sensitivity level of MSL 3. As a result, the floor life of devices removed from the moisture barrier bag is 168 hours from the time the bag was opened, provided that the devices are stored under the following conditions:

- Floor Life: 168 hours
- Ambient Temperature: <30°C
- Relative Humidity: <60%

If the floor life or the temperature/humidity conditions have been exceeded, the devices must be rebaked prior to solder reflow or dry packing.

9.5 Rebaking Instructions

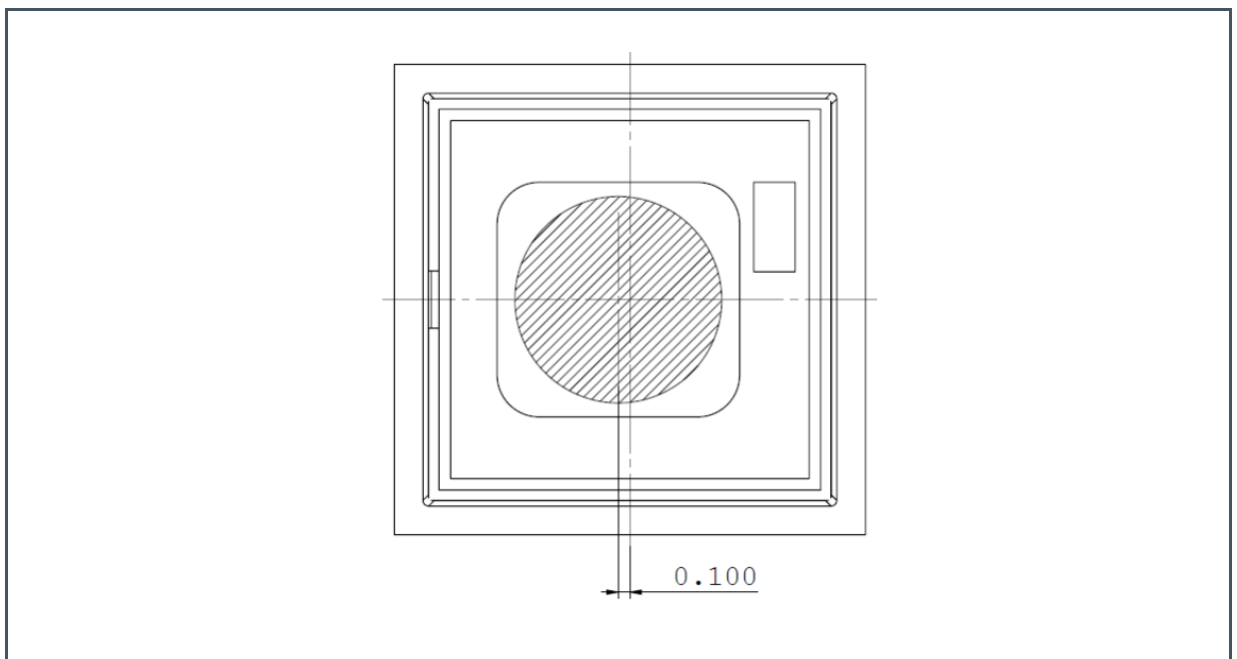
When the shelf life or floor life limits have been exceeded, rebaking is required based on recommended baking conditions (7h at 105 °C).

10 Handling

10.1 Pick Up

Recommended pick up position on the top window (hatched area in the figure), touching directly the glass.

Figure 21:
Pick Up Location⁽¹⁾



(1) All dimensions in mm.

11 Appendix

11.1 RoHS Compliance

The TARA2000-940-N-AUT module is RoHS compliant.

11.2 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 and IEC 62471.

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



CAUTION

- Avoid direct eye exposure except as may be determined and directed by purchaser.
- Appropriate protective eyewear should be worn when operating.
- Use of magnifying optical instruments with this component may increase eye hazard.
- Avoid obstructing fully the optical path, due to risk for the lens to melt and cause eye hazard.
- Obstructing, redirecting or focusing the optical power back to the module is considered a device misuse and can potentially lead to a health hazard.

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

11.3 Symbols and Abbreviations

Figure 22:
Symbols and Abbreviations Used in the Datasheet

| Symbol/Abbreviation | Description |
|---------------------|--|
| DI | Deionized |
| FOI | Field of Illumination |
| FWHM | Full Width at Half Maximum |
| ID | Identification |
| IR | Infrared |
| LD | Laser Diode |
| LI | Light-Current |
| LIV | Light-Current-Voltage |
| MP | Mass Production |
| MSL | Moisture Sensitivity Level |
| RoHS | Restriction of Hazardous Substances |
| SMT | Surface Mount Technology |
| VCSEL | Vertical Cavity Surface Emitting Laser |

12 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 version to current revision v3-00 | 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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