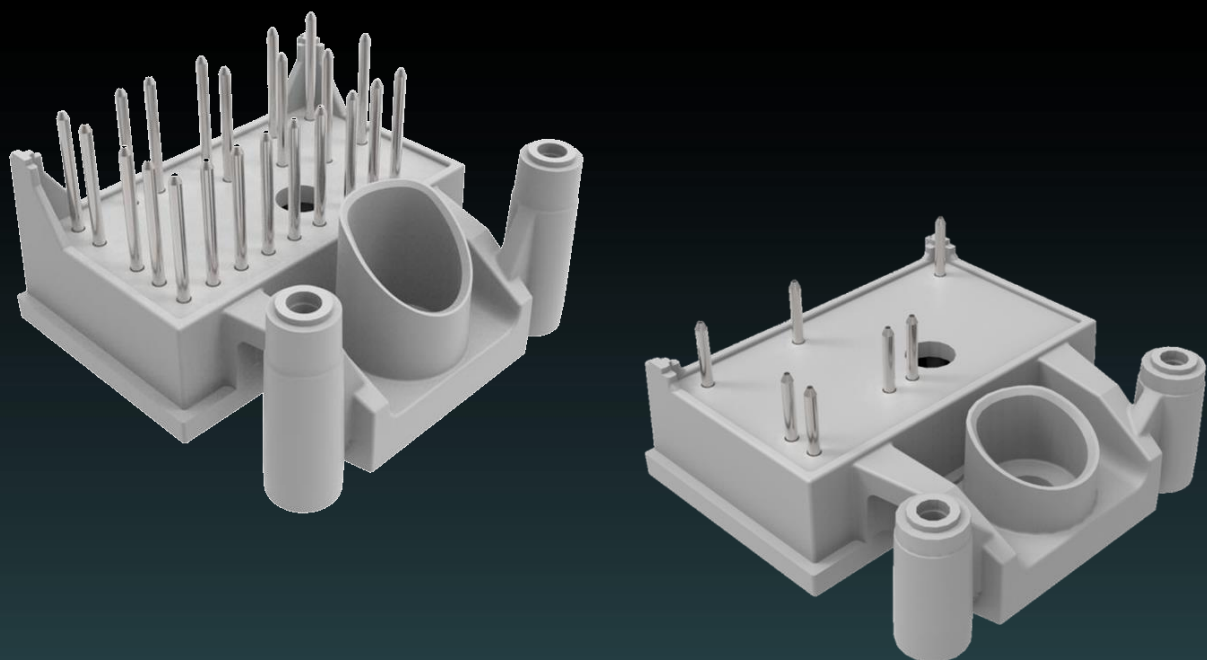




Vincotech

# Handling Instructions

for *flow* 0B packages



***This document is valid for all type of flow 0B modules:  
12 mm & 17 mm housing with solder pins***

**Date:** 11.06.2020

**Revision:**

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**Rev. 05**

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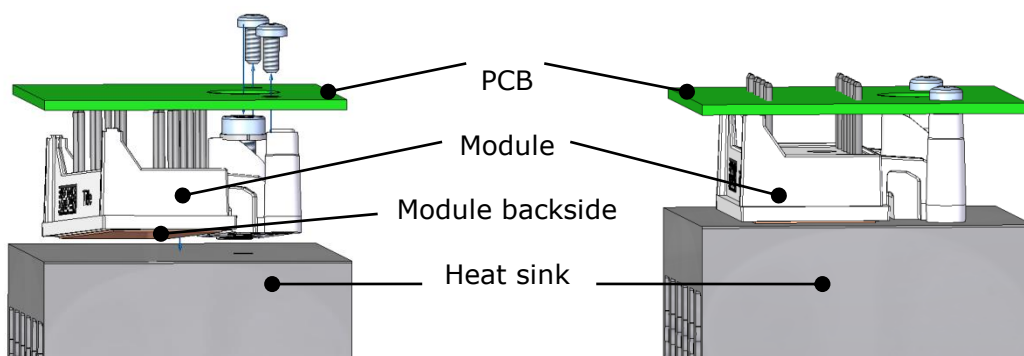
## Revision History

<b>Date</b>	<b>Revision Level</b>	<b>Description</b>	<b>Page Number(s)</b>
12.11.2013	01	New document	
04.07.2014	02	Change on housing design	3,4,5
05.06.2015	03	Change format; change preliminary to final ver.	all
31.05.2018	04	12mm type: Section 1; Correction: Section 5.3; Updates: Section 8, 9.1, 9.2.5, 9.3	5,11,13,15,17
17.07.2018	04.1	Correction: Section 1	3
11.06.2020	05	Changes: Section 1 Updates: Section 3, 6.2, 7, 9, 9.1.1, 9.1.5	5, 8, 11,13, 15, 17



## 1 General assembly instructions

The *flow0B* type modules have to be mounted **first** to PCB, and afterwards fixed to heat sink. The electrical connections between module and PCB are made by soldering. It is also required to fix the PCB to the heat sink with threaded spacers. The number and the position of the fixing points depend on the design of the circuit and location of different masses like capacitors or inductors and the environment of the system. General recommendation cannot be given.



1. Figure: Module with PCB and heat sink

The distance between the top surface of the heat sink and the bottom plane of the PCB is defined by the module type, which can be 12 mm or 17 mm.

Recommendation for spacer height:

- 12<sup>-0.1</sup> mm
- 17<sup>-0.1</sup> mm

During the handling process, special care should be taken with the solder pins, especially if the pins get stuck due to bent pins or tight hole diameter.

### **Important!**

During the assembly process, solder pins must not be pushed! During the handling process, special care should be taken with the solder pins, especially if the pins get stuck due to bent pins or tight hole diameter.

The tension of the pin must not exceed  $\pm 5$  N at a maximum substrate temperature of 100 °C.

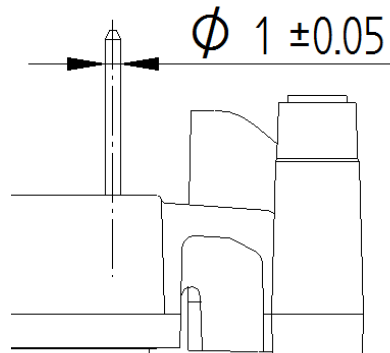


## 2 Specification for PCBs

- Printed board material meets the requirements of IEC 61249-2-7;
- The number of conductive layers is not limited.

### 2.1 Specification for modules with solder pins

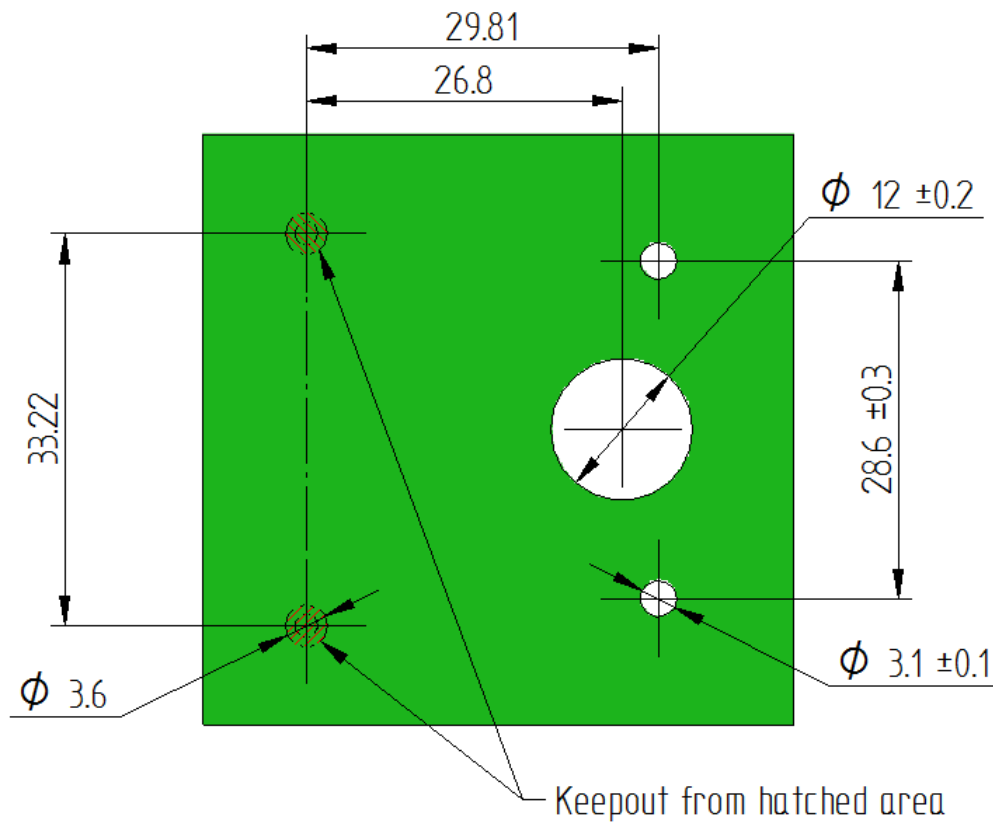
- The module must be fixed to the PCB with 2 screws (type BN82428, D=2.5 mm and L=6 mm) before soldering the pins into the PCB. Mounting torque: 0.4 Nm.
- After screwing, all pins must be soldered into the PCB. The hole diameters on the PCB has to be designed according to the soldering pin diameter which is  $\varnothing 1 \pm 0.05$  mm. For further dimensions or 3D model please contact your local sales manager.



2. Figure: Solder pin diameter



## 2.2 Required PCB cutouts for screwing holes



3. Figure: PCB cutouts for two-clip modules with solder pins

In the keepout area it is not allowed to be any PCB component between module and PCB.

### 3 Specification for module backside surface

The module backside is important for the thermal management of the power module. Imperfection is allowed if it does not lead to an  $R_{th}$  increase of  $>2\%$  (assembled acc. VIN instruction). Acceptance criteria for module backside surface:

Polishing (see figure 5.):

- Polishing have to be accepted
- Polishing of modules with Ni plated surface is acceptable if copper doesn't become visible (if the copper is visible, see criteria for scratches)

Steps, Flash (see figure 4.):

- Max height of  $10\ \mu\text{m}$

Scratches (see figure 4.):

- Max depth of  $300\ \mu\text{m}$
- Max width of  $600\ \mu\text{m}$
- The scratched area must not exceed 5 % of the total substrate surface.

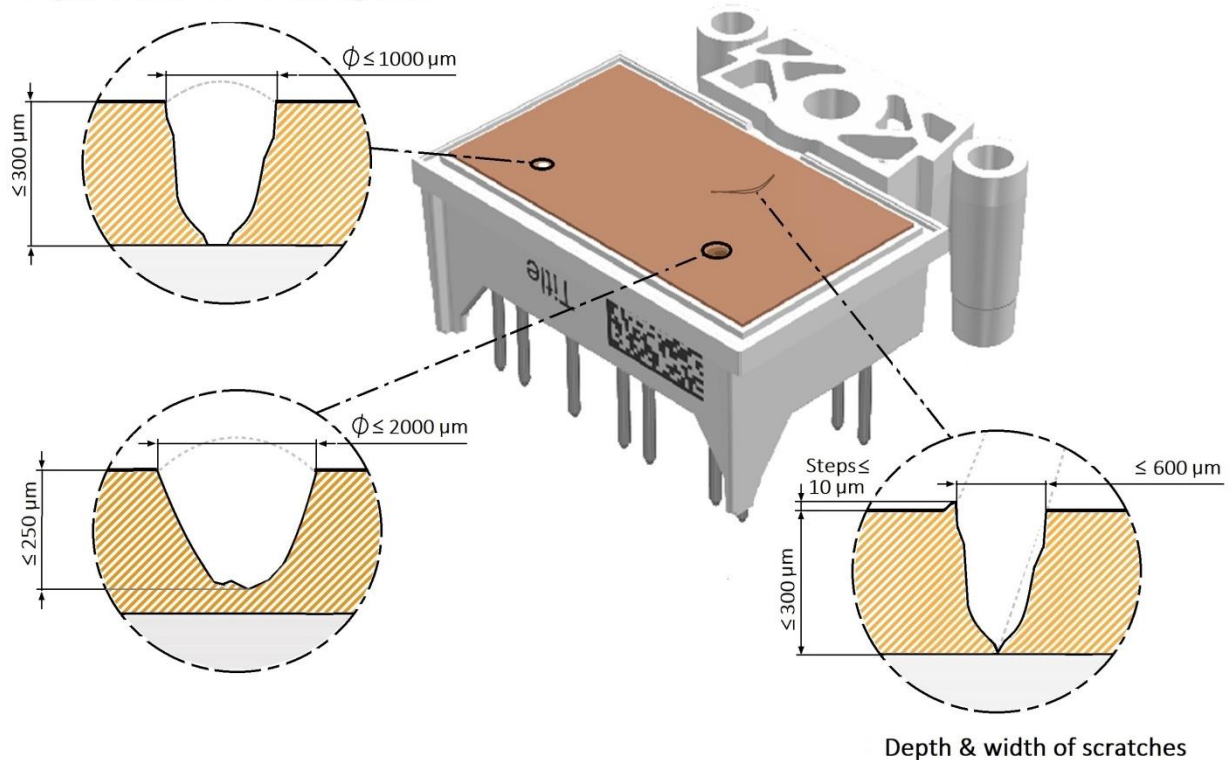
Etching holes (see figure 4.):

- Max diameter of  $1000\ \mu\text{m}$  and max. depth of  $300\ \mu\text{m}$
- Max diameter of  $2000\ \mu\text{m}$  and max depth of  $250\ \mu\text{m}$

Other (see figure 6, 7.):

- Discolorations and fingerprints are only surface imperfections (cosmetic) and do not affect the module's functionality

Depth & diameter of etching holes

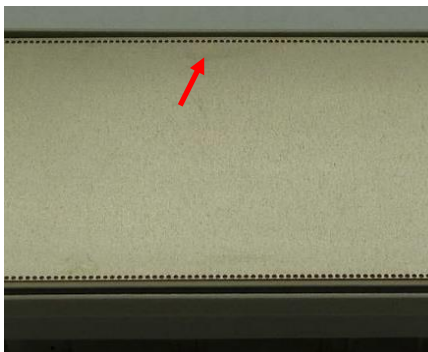


4. Figure: Scratch and etching hole dimensions





5. Figure: Polished surface



6. Figure: Discoloration of substrate



7. Figure: Fingerprint on the surface

## 4 Specification for heat sink

The whole heat sink surface under the module must be plane, clean and free of particles.

- The flatness tolerance should be:  $< 25 \mu\text{m}$  in general.
- In case the thermal paste thicker than  $50 \mu\text{m}$  the flatness tolerance can be  $< 50 \mu\text{m}$ .  
(A flatness tolerance specifies a tolerance zone defined by two parallel planes within which the surface must lie.)
- The surface roughness should be less than:  $R_z < 10 \mu\text{m}$ .
- Heat sink surface imperfections should be within the values described for the module backside surface (please refer to section 3).

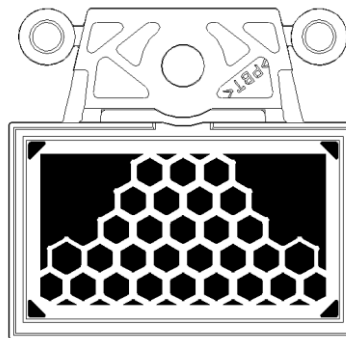
## 5 Specification for thermal interface materials

### 5.1 OPTION 1: Thermal paste:

- A. Apply a homogeneous layer of thermal conductive paste over the whole backside of the module, with a roller or spatula.
- B. Apply thermal paste in a honeycomb pattern, seen on 8. Figure:.. The preferred technology for paste application is screen printing. For a drawing of the pattern please contact your local sales representative.

The recommended thermal paste thickness is  $55 \mu\text{m} \pm 15 \mu\text{m}$  in this case.

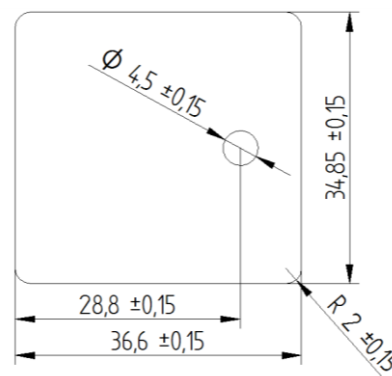
Thermal paste thicker than recommended will increase thermal resistance ( $R_{th}$ ).



8. Figure: Thermal paste honeycomb pattern

### 5.2 OPTION 2: Thermal foil:

- A thermal foil comprising of an aluminium core layer and two outer layers of phase change material should be used.
- The total thickness of the foil has to be less than  $80 \mu\text{m}$ . Thicker foils could cause the ceramic substrate to break and increase the thermal resistance.
- Recommended foil type: ALC5 or ALF5 (Boyd Corporation)
- Recommended foil dimensions: see below.



9. Figure: Recommended thermal foil dimensions

- The thickness of the foil is less than  $80 \mu\text{m}$ .
- Material of the foil is aluminum, covered with a phase change material.



### 5.3 OPTION 3: Pre-applied thermal interface material

- The modules may have already been pre-printed with thermal interface material.
- For types which can be supplied with pre-applied TIM please contact your local sales representative.

## 6 Specification for fastening screws to the heat sink

- Screws M4 (recommended screw type DIN 7984)
- Min. depth of the screw in the heat sink: 6 mm
- Flat washer ISO 7092 (DIN 433)
- Spring washer DIN127 or DIN 128
- Mounting torque:  $2 \text{ Nm} < M_s < 2.2 \text{ Nm}$

A torque wrench shall be used to tighten the mounting screws at the specified torque as excessive torque may result in damage or degradation of the device. The inaccuracy of torque wrench tightening method can range up to  $\pm 12\%$ . This has to be taken into account to prevent over-tightening the fastener.

Due to excessive temperature fluctuations washers should be used to prevent the loosening of the screws. After accurate tightening of the screws the spring washer exerts a constant force on the joint. The flat washer distributes this force on the plastic surface.

### 6.1 Screw with pre-assembled washers

Screws with pre-assembled washers (SEMS or kombi screws) combine the screw and the washers into a single component. These screws eliminate the need to slip the washers into place by hand, boosting the speed and efficiency of the assembly process. The specifications of these screws are provided below:

- Screw size M4 according to DIN 6900 (ISO 10644; JIS B1188)
- Flat washer according to DIN 6902 Type C (ISO 10673 Type S; JIS B1256)
- Split lock spring washer according to DIN 6905 (JIS B1251)
- Mounting torque range:  $2 \text{ Nm} < M_s < 2.2 \text{ Nm}$

### 6.2 Mounting with automatic screwdriver

For a fast, reliable and repeatable screwing process an automatic screwdriver with two stage tightening method is recommended. The screwdriver starts fast in the first stage and slows down after the first target torque is reached to accurately tighten the screw to the final target. For torque and speed recommendations see below the curves (10. Figure:) and values:

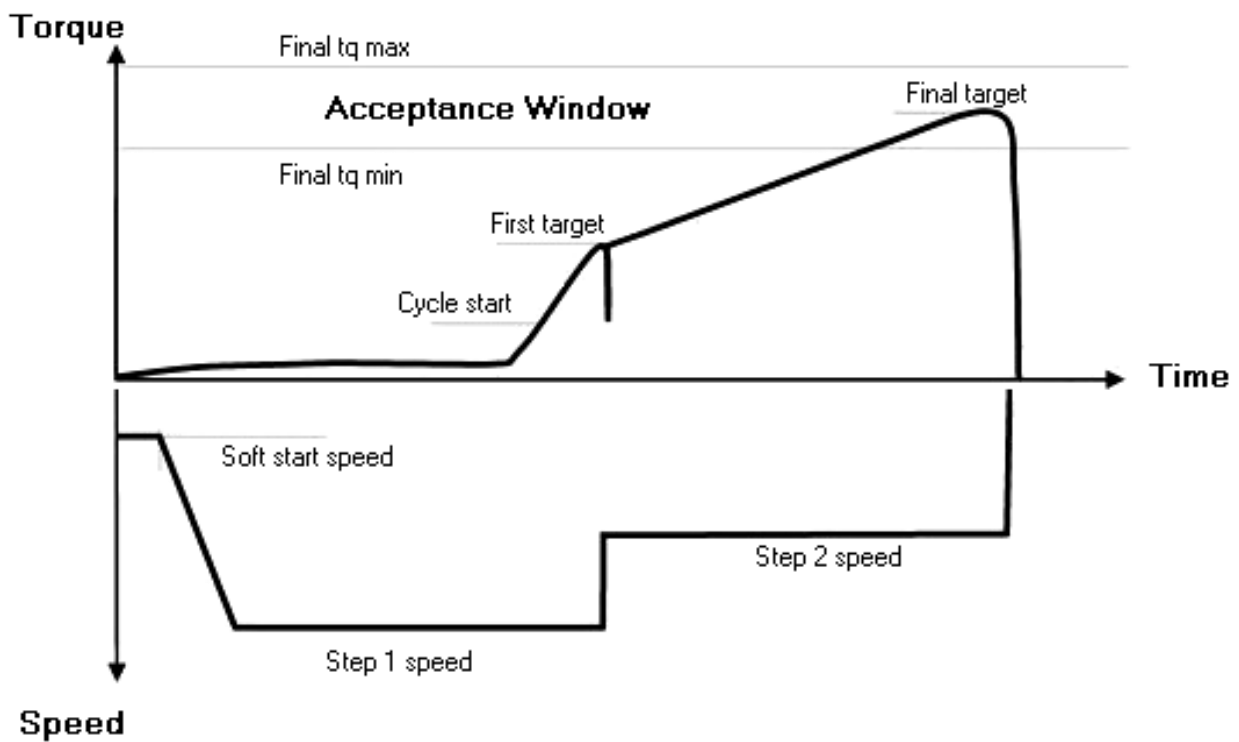
Torque

- Cycle start: 0.3 Nm
- First target: 0.5 Nm
- Final tq min.: 1.6 Nm
- Final target: 1.8 Nm
- Final tq max.: 2 Nm



Speed

- Soft start speed: 96 rpm
- Step 1 speed: max. 650 rpm
- Step 2 speed: max. 12 rpm

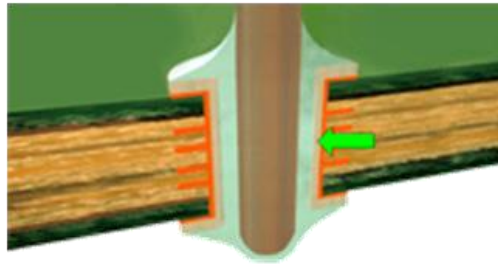


10. Figure: Recommended torque and speed curve



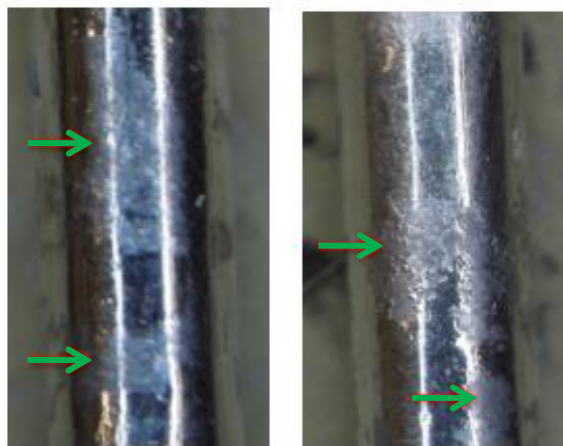
## 7 Recommendation for soldering

- Plated through holes should exhibit a vertical solder fill of 100 %, with a fully formed fillet on the solder side and evidence of 100 % wetting on the component side lead, barrel and pad.



11. Figure: Plated through hole, good soldering

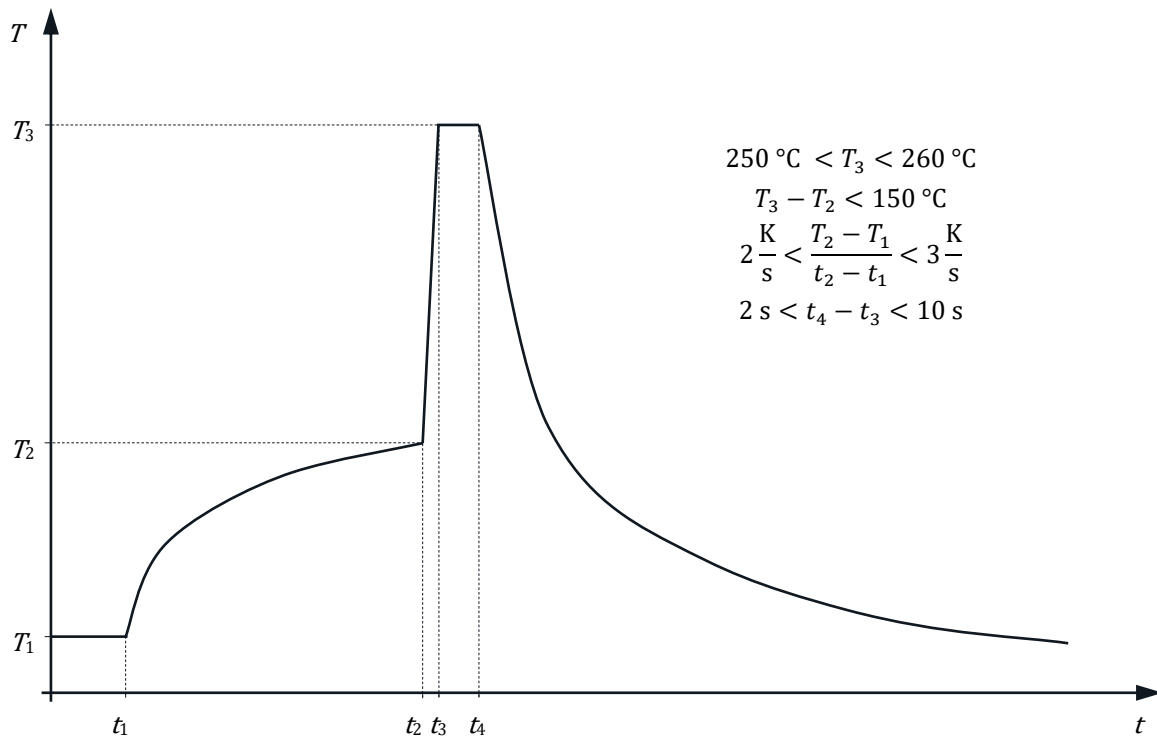
- The solder pins of the *flow OB* modules are plated with a nickel underlayer and a continuous tin finish to promote solderability. The tin finish can be discolored due to production process or storage conditions. This is merely a cosmetic imperfection and does not influence the solderability of pins. Different solder pins on the same module may exhibit different levels of discoloration as shown in the examples in 12. *Figure:* .



12. Figure: Examples of discolored solder pins



## 7.1 Wave soldering of modules with solder pins



13. Figure: Typical profile for wave soldering

## 7.2 Hand soldering parameters

- Max. solder iron temperature: 350 °C
- Max. contact time with component lead: 10 s
- Number of heat cycles: 3

## 8 ESD protection

Modules are sensitive to electrostatic discharge which can damage or destroy sensitive semiconductors. All modules are ESD protected in the shipment box by semi conductive plastic trays. During the handling and assembly of the modules it is recommended to wear a conductive grounded wrist band and ensure a conductive grounded working place.

Please take into consideration the following standards for handling electrostatic-sensitive devices: EN61340-5-1, ANSI S20.20

## 9 Environmental conditions

The modules can be subjected to environmental conditions characterized by the following classes:

Storage: 1K2 / 1B1 / 1C1 / 1S2 / 1M2



Transportation: 2K2 / 2B1 / 2C1 / 2S1 / 2M2

Operation: 3K3

These classes are defined in the IEC 60721-3-1 and IEC 60721-3-2 and IEC 60721-3-3 standards. The modules with wire pins have 1 year shelf life with the given storage conditions.

Flammability classification of the plastic material for *flow* 0B are V-0 and 5-VA (self-extinguishing, no dripping of flaming particles) according to UL 94, IEC 60695-11-10 and IEC 60695-11-20 test methods.

## 9.1 Parameters of environment classes

The parameters detailed below are for informative purposes only. This section does not substitute the above mentioned standards. Please read the IEC 60721-3-1 and IEC 60721-3-2 standards for the description of the environment classes.

### 9.1.1 Climatic conditions

#### 1K2

Air temperature: 5 °C to 40 °C  
Humidity: 5 % to 85 % RH but max. 1 g/m<sup>3</sup> to 25 g/m<sup>3</sup> absolute  
Rate of change of temperature: 0.5 °C/min  
Air pressure: 70 kPa to 106 kPa  
Solar radiation: 700 W/m<sup>2</sup>  
Movement of surrounding air: 1 m/s  
Condensation: No  
Precipitation: No  
Water from other sources than rain: No  
Formation of ice and frost: No

#### 2K2

Temperature: -25 °C to 60 °C  
Change of temperature air/air: ±25 °C  
Relative humidity: not combined  
with rapid temperature changes: max. 75 % (at 30 °C temperature)  
Relative humidity: combined  
with rapid temperature changes: No  
Low air pressure: 70 kPa  
Change of air pressure: No  
Solar radiation: 700 W/m<sup>2</sup>  
Movement of surrounding air: No  
Precipitation: No  
Heat radiation: No  
Water from other sources than rain: No  
Wetness: No

#### 3K3

Relative humidity: 5% to 85%  
Absolute humidity: 1 g/m<sup>3</sup> to 25 g/m<sup>3</sup>  
Condensation: No  
Precipitation: No



Formation of ice: No

### 9.1.2 Biological conditions

1B1

Flora and fauna: Negligible

2B1

Flora and fauna: No

### 9.1.3 Chemically active substances

1C1

Sea and road salts: No (Salt mist may be present in sheltered locations of coastal areas.)

Sulphur dioxide: 0.1 mg/m<sup>3</sup>

Hydrogen sulphide: 0.01 mg/m<sup>3</sup>

Chlorine: 0.01 mg/m<sup>3</sup>

Hydrogen chloride: 0.01 mg/m<sup>3</sup>

Hydrogen fluoride: 0.003 mg/m<sup>3</sup>

Ammonia: 0.3 mg/m<sup>3</sup>

Ozone: 0.01 mg/m<sup>3</sup>

Nitrogen oxides: 0.1 mg/m<sup>3</sup> (Expressed in equivalent values of Nitrogen dioxide.)

2C2

Sea salts: none

Sulphur dioxide: 0.1 mg/m<sup>3</sup>

Hydrogen sulphide: 0.01 mg/m<sup>3</sup>

Nitrogen oxides: 0.1 mg/m<sup>3</sup> (Expressed in the equivalent values of Nitrogen dioxide.)

Ozone: 0.01 mg/m<sup>3</sup>

Hydrogen chloride: 0.1 mg/m<sup>3</sup>

Hydrogen fluoride: 0.003 mg/m<sup>3</sup>

Ammonia: 0.3 mg/m<sup>3</sup>

### 9.1.4 Mechanically active substances

1S2

Sand: 30 mg/m<sup>3</sup>

Dust (suspension): 0.2 mg/m<sup>3</sup>

Dust (sedimentation): 1.5 mg/(m<sup>2</sup>h)

2S1

Sand in air: No

Dust (sedimentation): No

### 9.1.5 Mechanical Conditions

1M2

Stationary vibration, sinusoidal

Frequency range: 2 Hz to 9 Hz





displacement amplitude: 1.5 mm  
Frequency range: 9 Hz to 200 Hz  
peak acceleration: 5 m/s<sup>2</sup>

Non stationary vibration, including shock  
Shock response spectrum type L  
peak acceleration: 40 m/s<sup>2</sup>

Static load: 5 kPa  
2M2\*

Stationary vibration sinusoidal  
Frequency range: 2 Hz to 9 Hz  
displacement amplitude: 3.5 mm  
Frequency range: 9 Hz to 200 Hz  
peak acceleration: 10 m/s<sup>2</sup>  
Frequency range: 200 Hz to 500 Hz  
peak acceleration: 15 m/s<sup>2</sup>

Stationary vibration, random  
Acceleration  
spectral density: 1 m<sup>2</sup>/s<sup>3</sup>  
Frequency range: 10 Hz to 200 Hz, and  
Acceleration  
spectral density: 0.3 m<sup>2</sup>/s<sup>3</sup>  
Frequency range: 200 Hz to 2000 Hz

The later range can be neglected transporting with vehicles with high damping.

Non stationary vibration, including shock  
Shock response spectrum type I.  
peak acceleration: 100 m/s<sup>2</sup>  
and  
Shock response spectrum type II.  
peak acceleration: 300 m/s<sup>2</sup>

\*Free fall: weight and drop height deviate from 2M2  
tested acc. to internal standard: F23047-A1004-S000-01-76

Specimen Weight [kg]	Drop Heights [mm]	
	Standard Level	Extra Level
up to 9,5 kg	460	760
over 9,5 to 18,6 kg	310	610
over 18,6 to 27,7 kg	200	460
over 27,7 kg	200	310
<b>Number of Drops</b>	<b>3</b>	<b>7</b>

Toppling Around any of the edges.

Rolling, pitching  
Angle: ±35°  
Period: 8 s

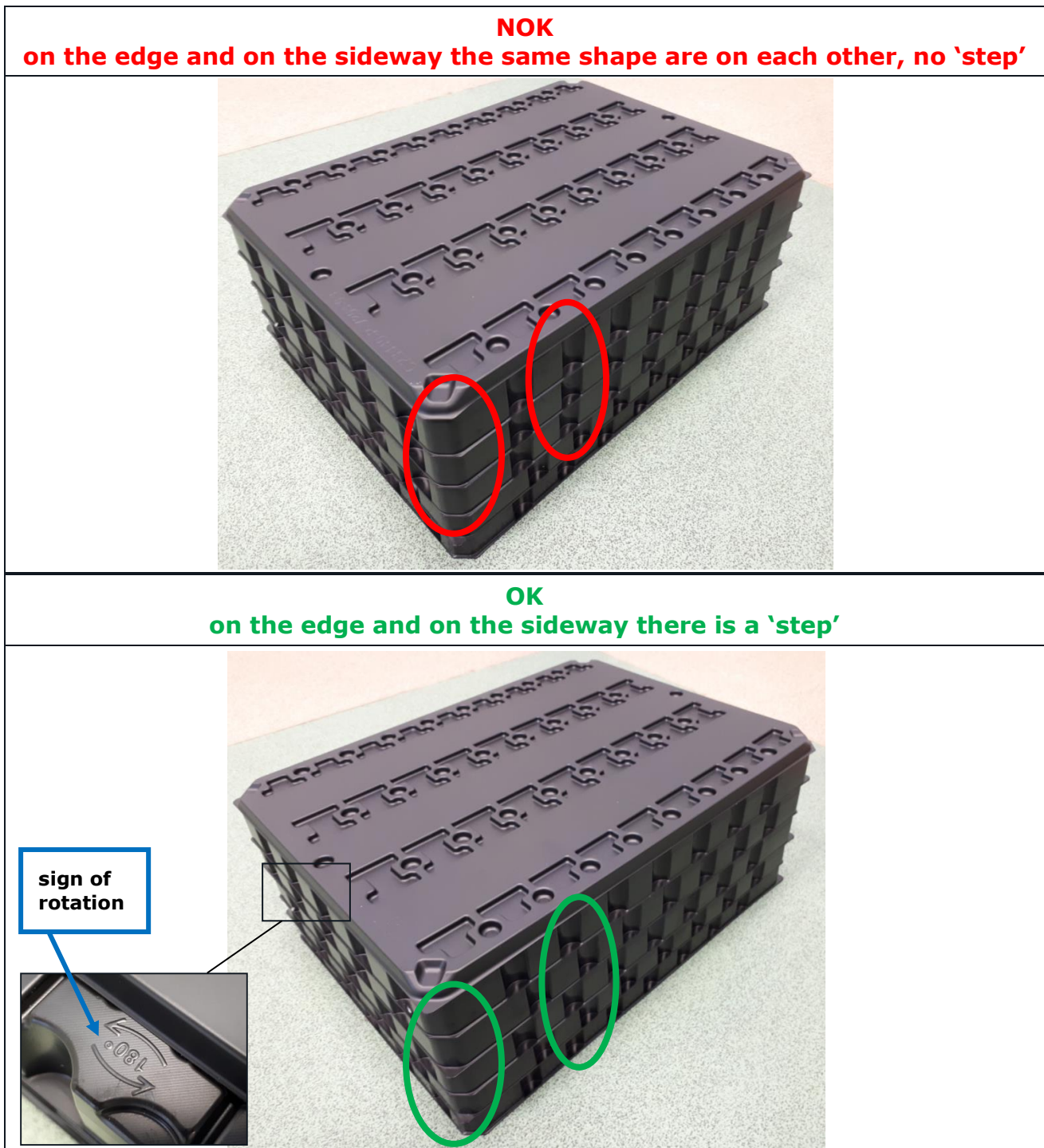
35° may occur for short time periods but 22.5° may persist permanently.

Acceleration 20 m/s<sup>2</sup>  
Static load: 10 kPa



## 9.2 Handling of trays

The modules are transported in layer of trays and every layer has to be rotated on each other by 180° to guarantee that all the modules are safe. This is also valid any time after unpacking. 14. Figure shows the trays in wrong and in good positioning.



14. Figure: Layer of trays



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## **10 Disclaimer**

The information and recommendations in this document are based on standards and common engineering practices. Customer specific applications and specifications may require additional processes and tests that may supersede those recommended in this document.