

Handling Instructions

for flow **OB** packages



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

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Revision History

Date	Revision Level	Description	Page Number(s)
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

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General assembly instructions 1

The *flow*0B 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^{-0.1} mm
- 17^{-0.1} mm

During assembly the pins are not to be drawn or pushed more than ± 0.2 mm or loaded with a force bigger than 35 N. The tension of the pin must not exceed ± 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 \emptyset 1±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 thermal properties are not affected if the dimensions of the surface imperfections are within the following values.

- Polishing is allowed on the whole nickel plated surface if copper doesn't become visible.
- If copper becomes visible, the unit is scratched and the following acceptance critera should be used. The depth and width of the scratch can't exceed 200 μ m and 800 μ m, respectively. The length of the scratch does not matter but the total area of scratches must not exceed 5 % of the total substrate surface.
- The diameter and depth of etching holes have to be below 1000 μm and 200 $\mu m,$ respectively.



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: $< 25 \ \mu m$ in general.
- In case the thermal paste thicker than 50 μm the flatness tolerance can be < 50 μm.
 (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: $R_z < 10 \ \mu m$.
- 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 μ m ± 15 μ m in this case.

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



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 μ m. Thicker foils could cause the ceramic substrate to break and increase the thermal resistance.
- Recommended foil type: Kunze Folien KU-ALC5 or ALF5
- Recommended foil dimensions: see below.



9. Figure: Recommended thermal foil dimensions

- The thickness of the foil is less than 80 µm.
- 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 ± 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 Nm < $M_{\rm s}$ < 2.2 Nm



7 Recommendation for soldering



10. Figure: Plated through hole, good 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.

7.1 Wave soldering of modules with solder pins



11. Figure: Typical profile for wave soldering

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7.2 Hand soldering parameters

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



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 Storage and transportation 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

These classes are defined in the IEC 60721-3-1 and IEC 60721-3-2 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 Vibration resistance

In addition to the vibration parameters defined in 1M2 and 2M2 classes, the *flow 1* package modules are qualified with the environmental test in accordance to the standard IEC 60068-2-6:2007 standard with the following severity:

Frequency range:	10 Hz to 26.6 Hz
displacement amplitude:	3.5 mm (7 mm peak-to-peak)
Frequency range:	26.6 Hz to 500 Hz
peak acceleration:	10 G (98.1 m/s²)
Duration:	2 hours
Number of axes:	3

These parameters are more severe than the parameters of the 1M2 and 2M2 classes.

9.2 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.

9.2.1 Climatic conditions

1K2	
Air temperature:	5 °C to 40 °C
Humidity:	5 % to 85 % RH but max. 1 g/m ³ to 25 g/m ³ absolute
Rate of change of temperature:	0.5 °C/min
Air pressure:	70 kPa to 106 kPa



Solar radiation:	700 W/m ²
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 ²
Movement of surrounding air:	No
Precipitation:	No
Heat radiation:	No
Water from other sources than rain:	No
Wetness:	No

9.2.2 Biological conditions

1B1 Flora and fauna:	Negligible
2B1	
Flora and fauna:	No

9.2.3 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 ³
Hydrogen sulphide:	0.01 mg/m ³
Chlorine:	0.01 mg/m ³
Hydrogen chloride:	0.01 mg/m ³
Hydrogen fluoride:	0.003 mg/m ³
Ammonia:	0.3 mg/m ³
Ozone:	0.01 mg/m ³
Nitrogen oxides:	0.1 mg/m ³ (Expressed in equivalent values of Nitrogen dioxide.)



2C2	
Sea salts:	none
Sulphur dioxide:	0.1 mg/m ³
Hydrogen sulphide:	0.01 mg/m ³
Nitrogen oxides:	0.1 mg/m^3 (Expressed in the equivalent values of Nitrogen dioxide.)
Ozone:	0.01 mg/m ³
Hydrogen chloride:	0.1 mg/m ³
Hydrogen fluoride:	0.003 mg/m ³
Ammonia:	0.3 mg/m ³

9.2.4 Mechanically active substances

1S2	
Sand:	30 mg/m ³
Dust (suspension):	0.2 mg/m ³
Dust (sedimentation):	1.5 mg/(m ² h)
2S1	
Sand in air:	No
Dust (sedimentation):	No

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9.2.5 Mechanical Conditions

```
1M2
Stationary vibration, sinusoidal
       Please see section 9.1.
Non stationary vibration, including shock
       Shock response spectrum type L
       peak acceleration:
                              40 \text{ m/s}^2
Static load:
                              5 kPa
2M2*
Stationary vibration sinusoidal
       Please see section 9.1.
Stationary vibration, random
       Acceleration
                              1 \text{ m}^2/\text{s}^3
       spectral density:
       Frequency range:
                              10 Hz to 200 Hz, and
       Acceleration
                              0.3 \text{ m}^2/\text{s}^3
       spectral density:
       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.
                              100 m/s<sup>2</sup>
       peak acceleration:
       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	Drop Heights [mm]		
[kg]	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	
Number of Drops	3	7	
Toppling	Around any of th	ne edges.	
Rolling, pitching		-	
Angle:	±35°		
Period:	8 s		

35° may occur for short time periods but 22.5° may persist permanently. Acceleration 20 m/s²

Static load:

10 kPa



9.3 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. 32. Figure shows the trays in wrong and in good positioning.



27. Figure Layer of trays



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.