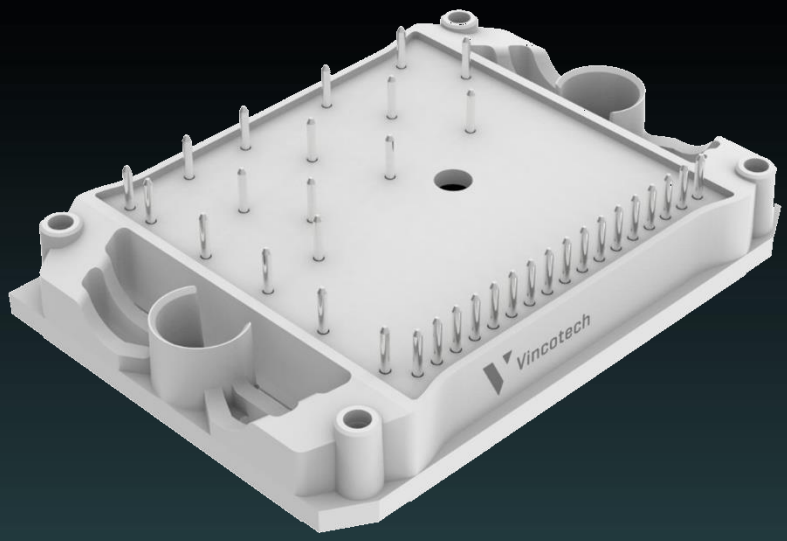
Vincotech

Handling Instructions

for *flow* 1C packages



This document is valid for all type of flow 1C modules with solder pins

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Created by:	**M. Buza**	**Rev. 01**	

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Revision History

Date	Revision Level	Description	Page Number(s)
10.03.2018	01	Initial release	

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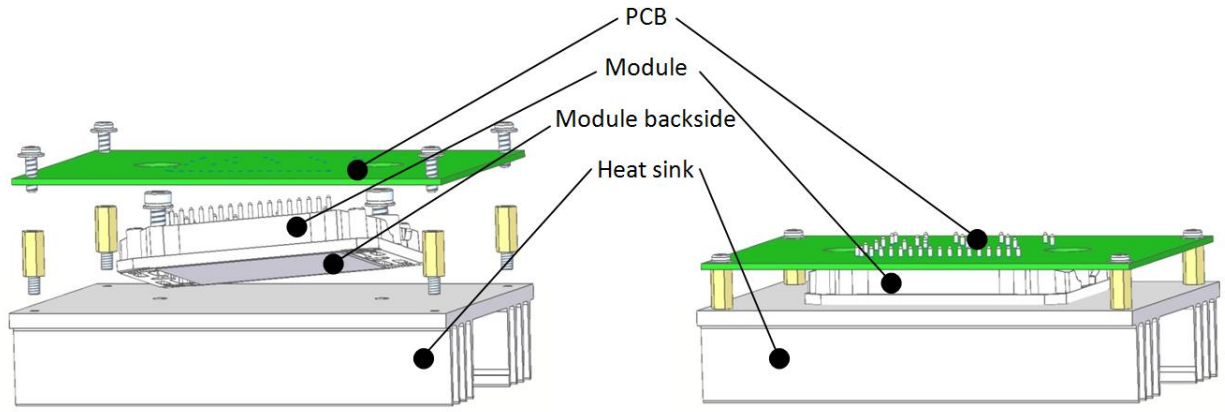
1 General assembly instructions

The *flow 1C* type modules have to be mounted to a PCB. The electrical connections between module and the PCB can be made by soldering. In applications where the module is attached to a heat sink, the PCB must also be attached to this heat sink. Figure 1 shows how this attachment can be achieved with threaded spacers.



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 12 mm, defined by the module type. PCB spacers can be used to obtain the correct spacing. The number and the position of the fixing points depend on the design of the circuit, the location of different masses like capacitors or inductors and the environment of the system. General recommendation cannot be given. For recommended heights of these spacers see the sections of mounting options (6).

Typical (recommended) assembly sequence:

1. Attach module to the PCB
2. Position and fix the assembled PCB with spacers to the heat sink
3. Fix the module to the heat sink

During assembly process, a single pin is not allowed to be drawn or pushed more than ±0.2 mm or load with a force greater than 35 N.

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

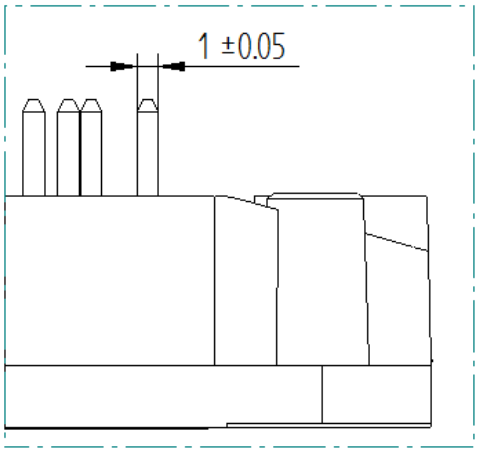
2 Specification for PCBs

- 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 attached to the PCB with 4 screws into the appropriate holes.
- After screwing the module to the PCB, all pins must be soldered. The hole diameters on the PCB have to be designed according to the soldering pin diameter which is Ø 1 mm ±0.05 mm.

For further dimensions or a 3D model please contact your local sales manager.



2. Figure: Solder pin diameter

3 Specification for heat sink

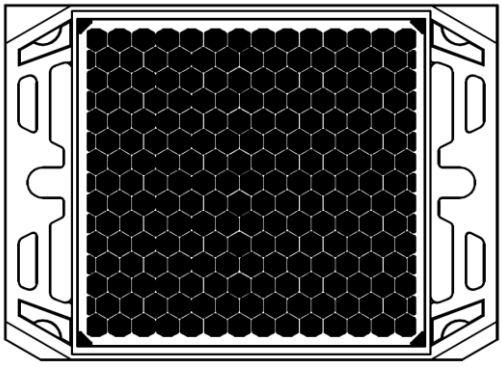
The whole heat sink surface under the module must be plane, clean and free of particles.

- The flatness tolerance should be: < 25 µm under the module.
- In case the thermal paste thicker than 50 µm the flatness tolerance can be < 50 µm accordingly.
  (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 µm.

4 Specification for thermal interface materials

4.1 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 3. Figure. The proposed thermal paste applying technology is screen printing. For a drawing of the thermal paste pattern please contact your local sales representative.



3. Figure: Thermal paste honeycomb pattern

The recommended thermal paste thickness is 90±20 µm in both cases. In the case of the thermal paste is thicker than the recommended that will increase the thermal resistance (R_{th}).

4.2 OPTION 2: Pre-applied thermal interface material

- The modules may have been already pre-printed with thermal interface material.
- Further information about using modules with pre-applied TIM see the application note for "*Power modules with Phase-Change Material*" on Vincotech's website

5 Specification for fastening screws to the heat sink

- Screws M4 (recommended screw type DIN 7984)
- Min. length of the screw in the heat sink: 6 mm
- Flat washer ISO 7092 (DIN 433)
- Spring washer DIN127 or DIN 128
- Mounting torque: 1.6 Nm < M_s < 2 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.

5.1 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: 1.6 Nm < M_s < 2 Nm

5.2 Mounting with automatic screwdriver

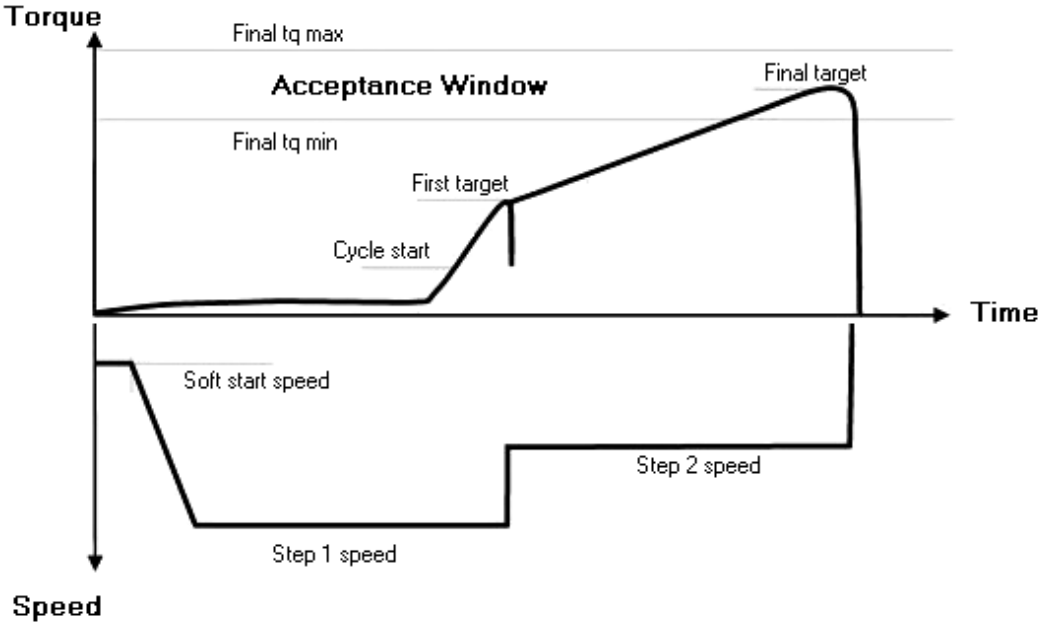
For a fast, reliable and repeatable screwing process an automatic screwdriver with two stage tightening method is recommended. The screwdriver starts fast in the first stage and slows down after the first target torque is reached to accurately tighten the screw to the final target. For torque and speed recommendations see below the curves (4. 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



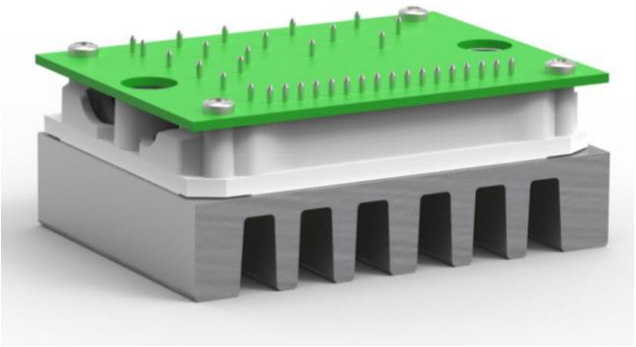
4. Figure: Recommended torque and speed curve

6 Mounting options of modules with solder pins

For minimum overhang of the pins IPC-A-610E standard and the module datasheet drawing should be considered.

6.1 Using screws to fix the module to the PCB

- Insert the module pins into the PCB
- Fix the module to the PCB with 4 screws by the towers before soldering (for screws min. ø2.8 mm hole is needed on PCB). Screw type: BN82428, D = 2.5 mm and L = 6 mm with a mounting torque: 0.4 Nm.
- Recommendation for spacer height is $11.2^{-0.1}$ mm.

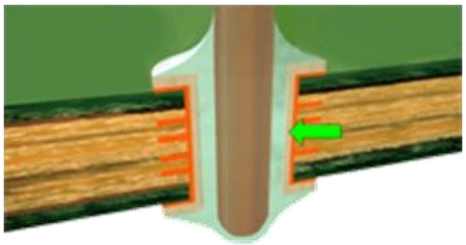


5. Figure: Assembly illustration

6.2 Using soldering jig (without using screws)

- Insert the module pins into the PCB
- Fix the module to the PCB with soldering jig before soldering
- The height of the spacers depends on the distance between the soldering jig and PCB thickness.

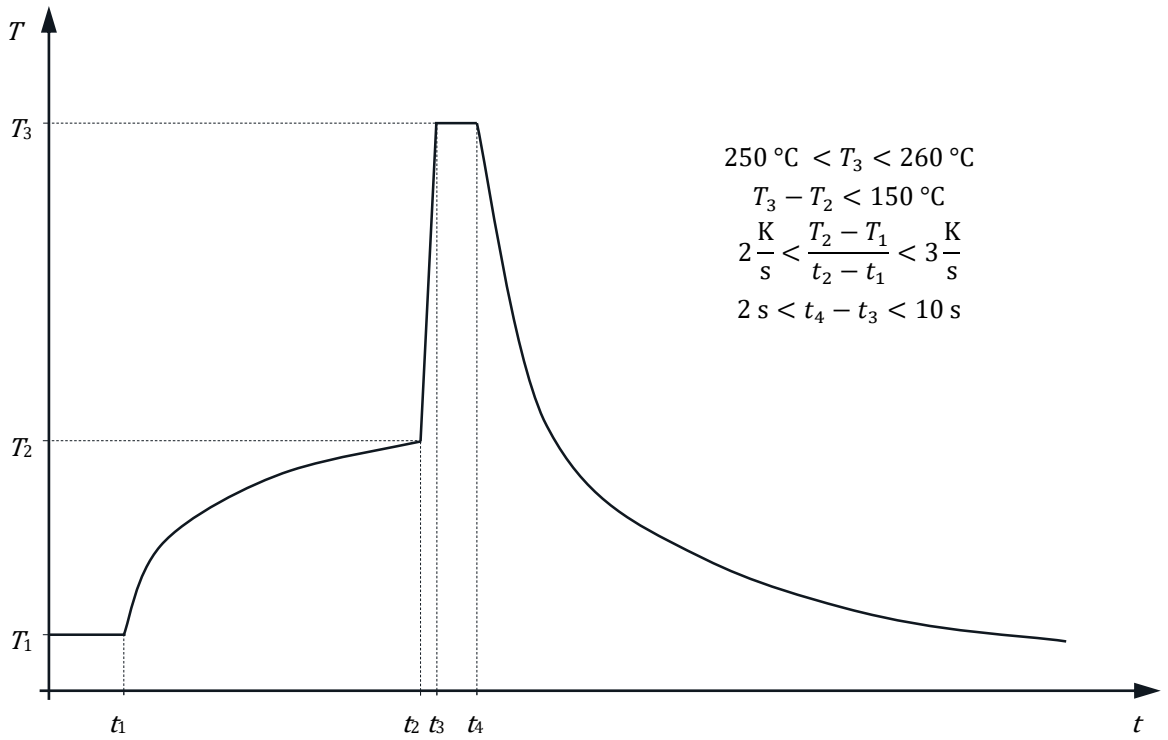
7 Recommendation for soldering



6. Figure: Plated through hole, good soldering

Plated through holes should exhibit a vertical solder fill of 75 %, with a fully formed fillet on the solder side and evidence of 75 % wetting on the component side lead, barrel and pad.

7.1 Wave soldering of modules with solder pins



7. 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 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 1C* 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^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

9.1.2 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 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

9.1.4 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

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/s2

Non stationary vibration, including shock

Shock response spectrum type L	
Peak acceleration:	40 m/s^2
Duration	22 ms

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/s2
Frequency range:	200 Hz to 500 Hz
peak acceleration:	15 m/s2

Stationary vibration, random

Acceleration spectral density:	1 m^2/s^3
Frequency range:	10 Hz to 200 Hz
Acceleration spectral density:	0.3 m^2/s^3
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^2
Shock response spectrum type II.	
Peak acceleration:	300 m/s^2

Free fall: 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
Number of Drops	**3**	**7**

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^2
Static load	10 kPa

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 than may differ of supersede those recommended in this document.