IIM46230/IIM46234 Motion Handling and Assembly Guide

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1 PURPOSE AND SCOPE

This document provides general information and reference guidelines for handling and assembling TDK InvenSense IIM 46230/IIM 46234 sensors. Design rules and soldering recommendations included in this document represent the best practices to achieve a high level of performance in terms of accuracy and stability.

2 MANUFACTURING RECOMMENDATIONS

State-of-the-art performances for the IIM46230/IIM46234 can be obtained by implementing multiple strategies to ensure an adequate level of mechanical decoupling from the PCB to the sensor. Recommendations for PCB drawing, solder mask definition, and stencil design are just some of the factors that must be accounted for to achieve optimal sensor behavior. Setting a proper clearance between the PCB solder mask and the bottom of the package helps to improve the overall performance while avoiding any stress due to the mismatch between the Coefficient of Linear Thermal Expansion (CTE) of the package material and the PCB.

Any material used in the surface-mount assembly process of the IIM46230/IIM46234 connector should be free of restricted RoHS elements or compounds. Pb-free solders should be used for assembly.

For critical applications needing a superior level of accuracy, TDK InvenSense can provide support on how to implement on-board calibration. Additional information is available upon request.

2.1. COMPONENT PLACEMENT

For accurate IIM46230/IIM46234 connector placement, keep an adequate distance from sources of thermomechanical stress when possible.

Place large insertion components, such as keyboards or push buttons, connectors, shielding boxes, and mounting holes, as far away possible from the IIM46230/IIM46234 connector sensor. Apply the same strategy to components that can generate PCB self-heating with high transient slope, like processors, batteries, power, and recharging circuits.

Maintain generally accepted industry design practices for component placement near the device to prevent noise coupling, avoiding the neighborhood of any vibration sources like a vibrator motor, speaker, buzzer, etc.

If a flexible PCB must be used, place the IIM46230/IIM46234 in the most rigid location and preferably in a region that is not subjected to changes in deflection during the application use cases.

Place decoupling capacitors (if needed) as close as possible to the power supply lands of the IIM46230/IIM46234. Passive components values can be found into the IIM46230/IIM46234 datasheet specification.

2.2. PCB DESIGN

To achieve optimal performance of IIM46230/IIM46234 devices, the PCB footprint design should be as symmetrical as possible to avoid tilt caused by asymmetrical solder paste quantity.

Apart from the lands, the top metal layer should not be below the sensor footprint (no traces, not ground plane, no exposed pad connection, no solder mask). The lands should be limited within the boundary of chip and PCB land sizes must be designed to match the component pad sizes that are listed in the Package Dimensions section of the datasheet.

All the traces must be routed straight to the lands. The lands that must be connected have to be shorted outside the perimeter of the package.

TDK InvenSense products have very low active and standby current consumption. The exposed center pad is not internally connected, and it is not required for heat sinking. The exposed center die pad must not be soldered to the PCB and must be left unconnected.

PCB vias must be placed outside the sensor footprint. No vias can be placed below the package or inside the lands area.

To avoid harmonic coupling, do not route active signals in non-shielded signal planes directly below the sensor package.

To achieve the best performance, the copper thickness should be at least 1 oz (35 µm).

2.3. SOLDERING RECOMMENDATION FOR IIM46234/IIM46230 CONNECTOR

TDK InvenSense recommends designing the PCB pad layout following the guidelines described in Figure 1 and Figure 2. While PCB manufacturing only solder the connector. Connector can be found at Samtec with part number CLM-110-02-H-D-P-TR.

To achieve optimal performance of IIM46230/IIM46234 motion devices, TDK InvenSense strongly recommends not placing solder mask below the IIM46230/IIM46234 connector.

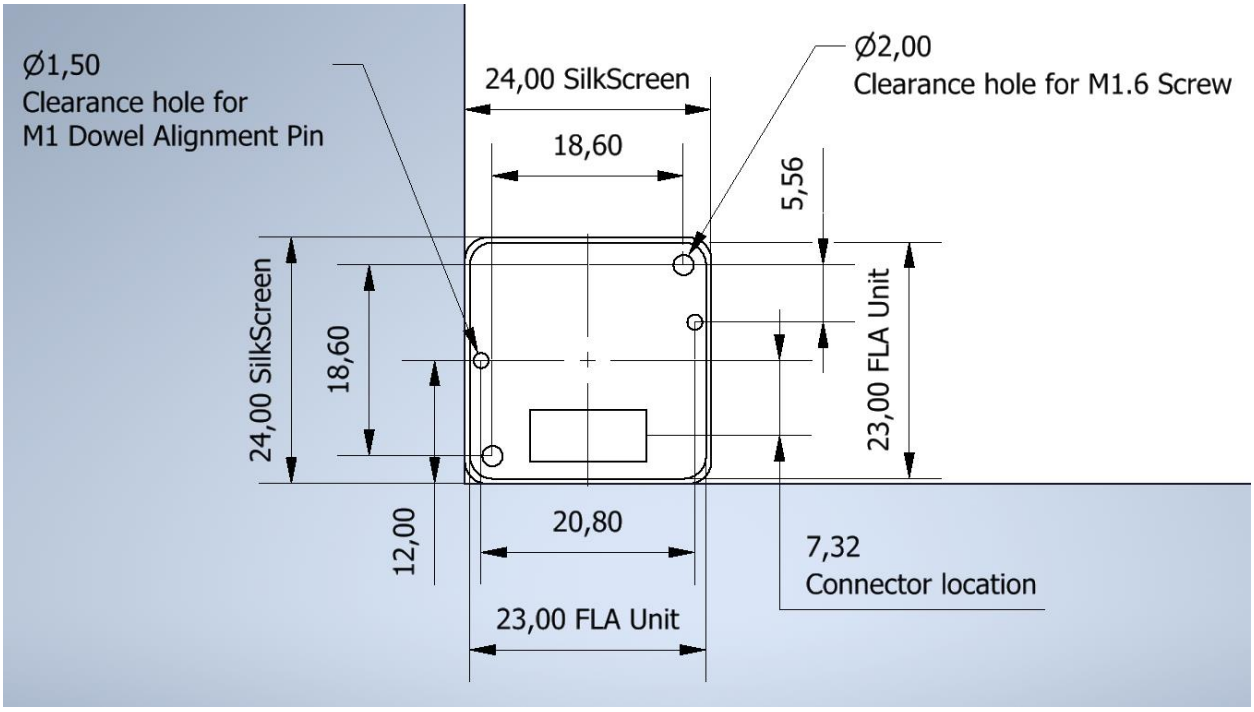
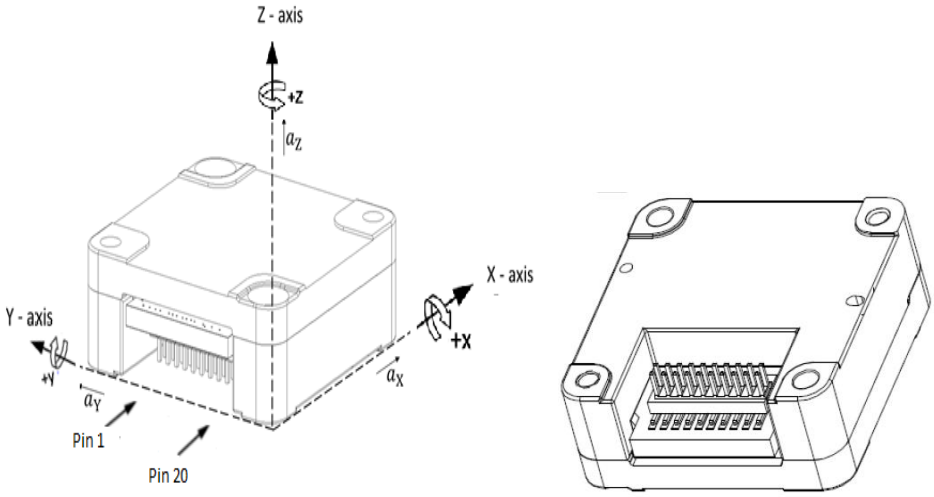


Figure 1. IIM46230/IIM46234 Sensor footprint



a) Top View **b) Bottom View**

Figure 2. IIM46230/IIM46234 Views

2.3.1. Mounting best practices

Follow the rules below when installing the IIM-46234 & IIM-46230 into a system to prevent irregular force profiles which can introduce bias errors in the sensors:
• Avoid any translational force (in the X, Y axis) on the electrical connector (as shown in Figure 18)
• Use M1.6 screws for the passthrough holes to install the IMUs on the PCB with the mating connector.
• Apply a suggested torque setting of 0.15 Nm uniformly on the two screws to avoid any unwanted warpage in the module.
• Care should be taken that the exposed dowel pin is less than 2.7 mm alignment pin hole on the IMUs, use the table below to determine the alignment dowel length

Description Of Stackup	Length	Units
Drill dept of the IMUs alignment hole	2.7	mm
Thickness of the customer PCB	2	mm
Drill dept of the customer alignment hole	4	mm
Length of Dowel from Section 4.3	8	mm
Mechanical/Tolerance clearance	**-0.7**	mm

Table 1. Alignment Dowel Length

2.4. IIM46230/IIM46234 HANDLING INSTRUCTIONS

Unlike conventional IC products in similar packages, IIM46230/IIM46234 devices contain moving micromechanical structures. Therefore, IIM46230/IIM46234 devices require different handling precautions than conventional ICs prior to mounting onto PCBs.

TDK InvenSense products have been qualified to an unpowered shock tolerance of 10,000g or 20,000g. Information for each component is available in the corresponding product datasheet.

- Do not drop individually packaged sensors or trays of sensors. Components placed in trays could be subject to excessive *g*-forces and stress.
- PCBs that incorporate mounted sensors should not be separated by manually snapping them apart. This could create excessive *g*-forces and stress.
- Do not clean IIM46230/IIM46234 in ultrasonic baths. Ultrasonic baths can induce MEMS damage if the bath energy causes excessive drive motion through resonant frequency coupling.
- Do not use any devices that are dropped inadvertently during handling.

2.5. ESD CONSIDERATIONS

Establish and use (Electrostatic Damage) ESD-safe handling precautions when unpacking and handling ESD-sensitive devices.

- Store ESD sensitive devices in ESD safe containers until ready for use. The tape and reel moisture-sealed bag is an ESD approved barrier. The best practice is to keep the units in the original moisture sealed bags until ready for assembly.
- TDK InvenSense products are qualified to meet HBM (Human Body Model) 2000V and CDM (Charged Device Model) 500V. Restrict all device handling to ESD protected work areas that measure less than 200V static charge. Ensure that all workstations and personnel are properly grounded to prevent ESD.

2.6. STORAGE SPECIFICATIONS

TDK InvenSense products conform to the storage specifications of IPC/JEDEC J-STD-020D.1:

Rating	After opening moisture-sealed bag
MSL 1	Unlimited (Storage Conditions: Ambient ≤30°C at 85%RH)
MSL 3	168 hours (Storage Conditions: Ambient ≤30°C at 60%RH)
MSL 5	48 hours (Storage Conditions: Ambient ≤30°C at 60%RH)

Table 2. Handling Conditions for Different MSL Ratings

2.7. STORAGE SPECIFICATIONS

TDK InvenSense products conform to the storage specifications of IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Level (MSL) 1.

Calculated shelf-life in moisture-sealed bag	12 months -- Storage Conditions: <40°C and <90% RH
After opening moisture-sealed bag	Unlimited hours -- Storage Conditions: Ambient ≤30°C at 85%RH

TDK InvenSense products conform to the storage specifications of IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Level (MSL) 3.

Calculated shelf-life in moisture-sealed bag	12 months -- Storage Conditions: <40°C and <90% RH
After opening moisture-sealed bag	168 hours -- Storage Conditions: Ambient ≤30°C at 60%RH

TDK InvenSense products conform to the storage specifications of IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Level (MSL) 5.

Calculated shelf-life in moisture-sealed bag	12 months -- Storage Conditions: <40°C and <90% RH
After opening moisture-sealed bag	48 hours -- Storage Conditions: Ambient ≤30°C at 60%RH

Notes: A attain the MSL rating for motion-based products, please refer to the qualification report for the details.

2.8. PACKAGE MARKING SPECIFICATION

- The serial ID unique for each device (same as the value of the SERIAL_NUM register)
- Lot Traceability code – XXX XXX YY WW XX
  Where YY – Year code and WW – Work Week

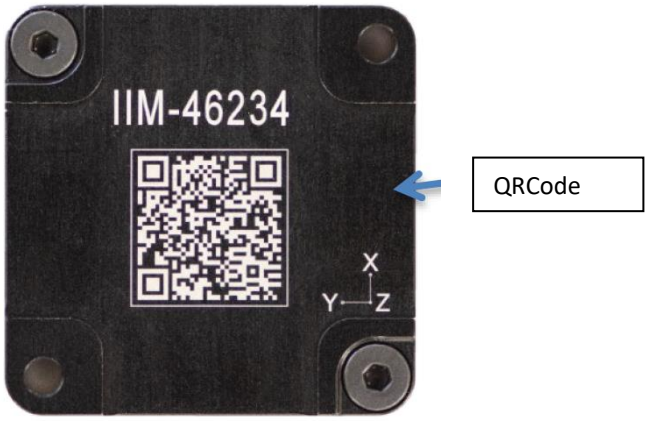


Figure 8. Part number package marking

3 REVISION HISTORY

Revision Date	Revision	Description
12/15/2022	1.0	Initial Release