

# STK5MFU3C1AGEVB

## STK5MFU3C1A-E Evaluation Board User's Manual



ON Semiconductor®

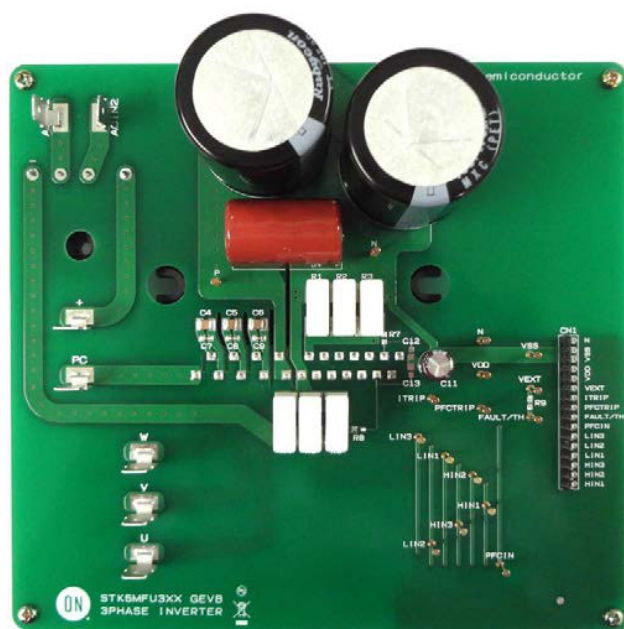
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### Introduction

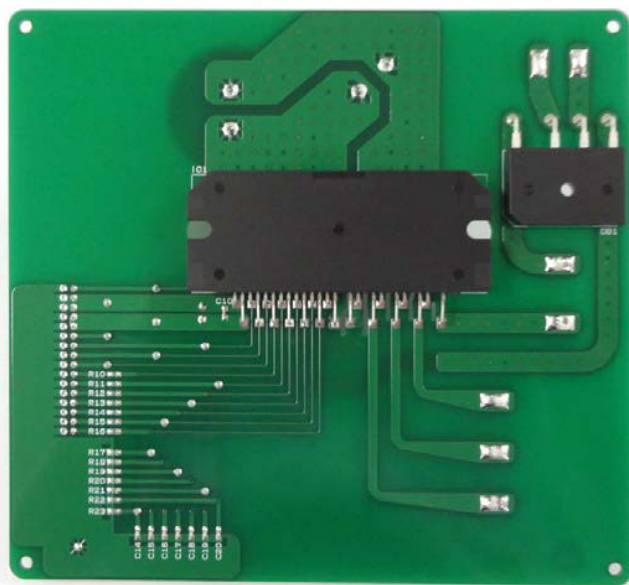
STK5MFU3C1AGEVB includes the basic external components needed for the operation of STK5MFU3C1A-E (SIP28 78x31.1 / 2in1 PFC and Inverter / 1shunt) and enables to evaluate this model.

### EVAL BOARD USER'S MANUAL

| ONPN of EVAL Board | ONPN of IPM   | Io   |
|--------------------|---------------|------|
| STK5MFU3C1AGEVB    | STK5MFU3C1A-E | 30 A |



Top View



Bottom View

Figure 1. Evaluation Board Photos

# STK5MFU3C1AGEVB

## CIRCUIT DIAGRAM

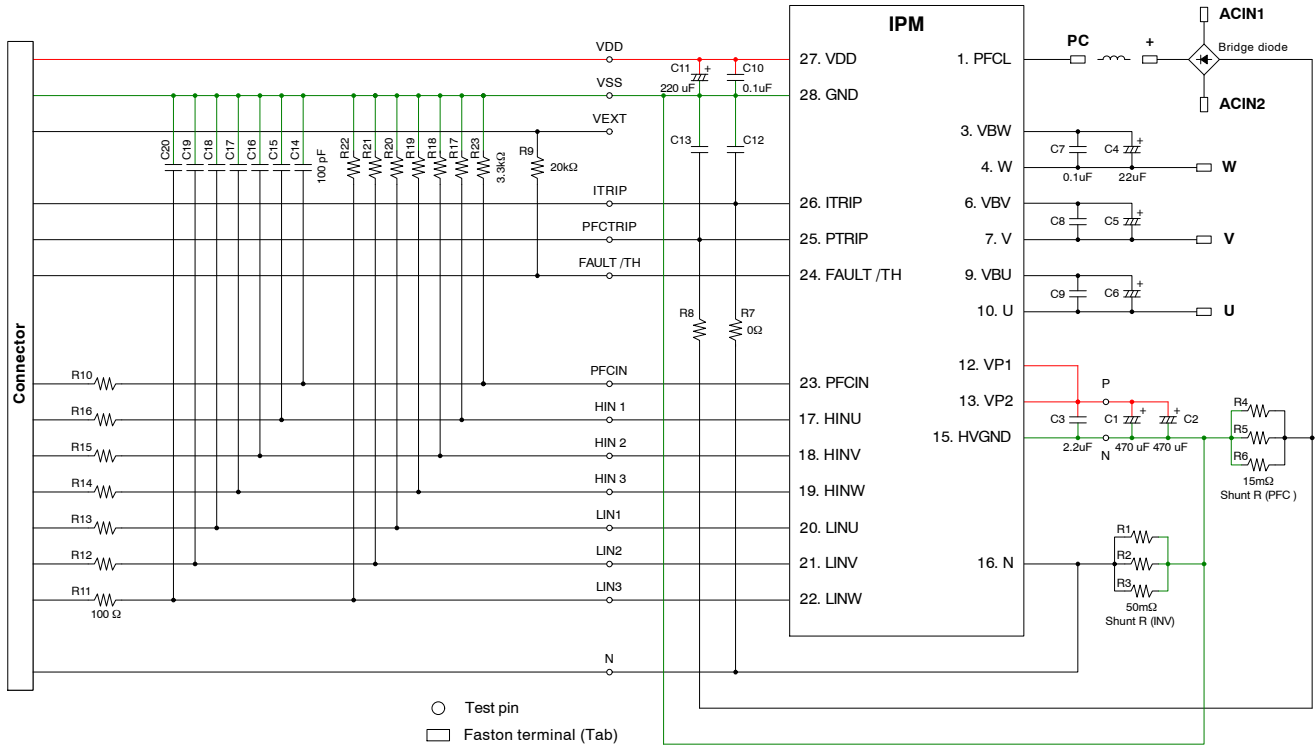
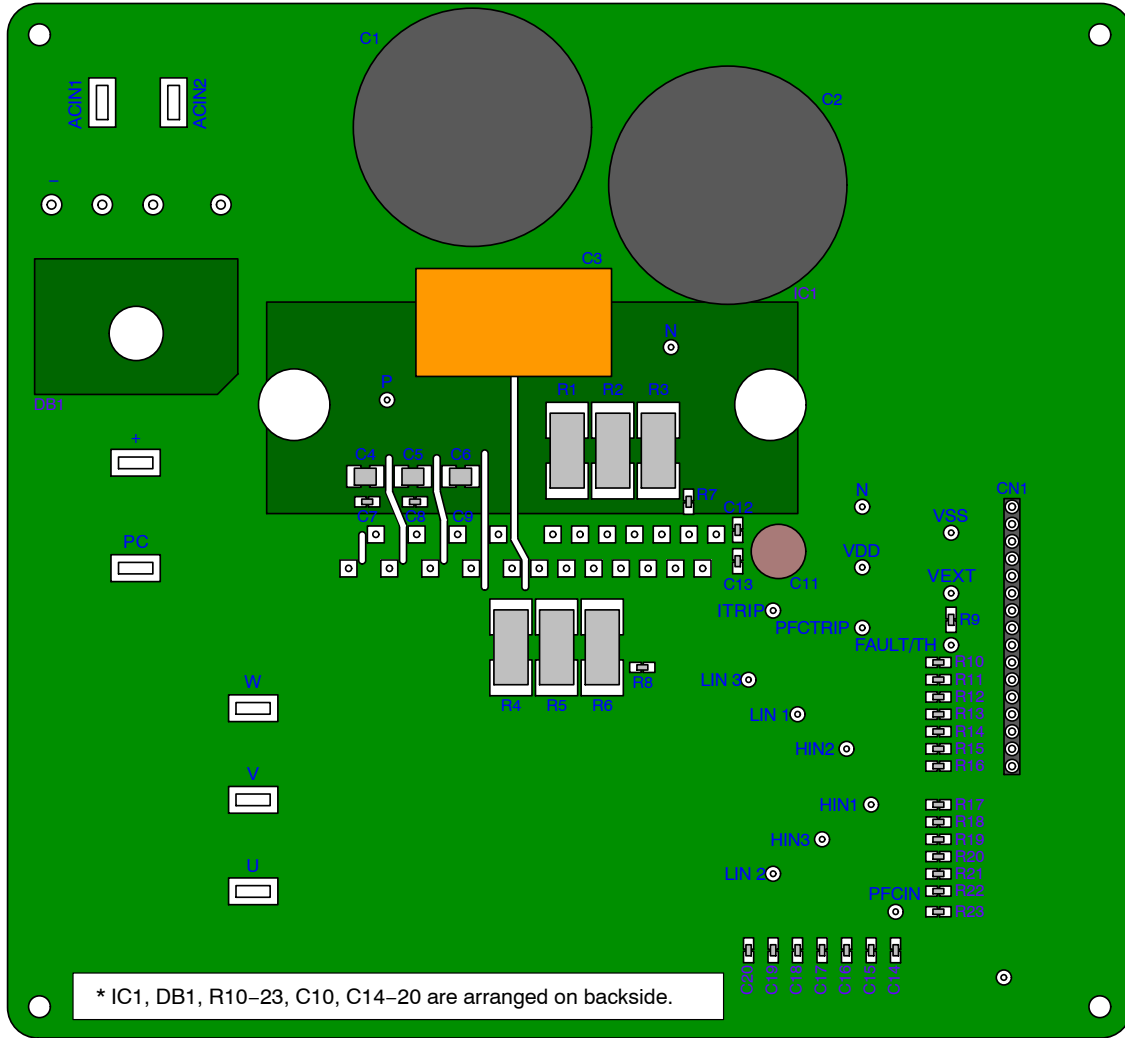


Figure 2. Evaluation Board Schematic

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## PIN DESCRIPTION



**Figure 3. Transparent View from Top Side**

**U, V, W** : 3 phase inverter output

**VDD** : Control power supply

**VSS** : Signal GND

**PC** : Rectified AC Voltage input

**HINx, LINx, PFCIN** : Control signal input

**ITRIP** : Over-current protection for Inverter

**PFCTRIP** : Over-current protection for PFC

**VEXT** : FAULT/TH pull-up

Apply the logic I/O voltage

**FAULT/TH** : Fault output, Thermistor

**ACIN1, ACIN2** : Bridge diode AC voltage input

**+, -** : Bridge diode output

**R1-6** : Shunt resistor, 3 parallel connection

**R7 (, C12)** : RC filter for ITRIP

**R8 (, C13)** : RC filter for PFCTRIP

**R10-16, C14-20** : Low pass filter for signal input

Prevention malfunction by noise

**R17-23** : Pull-down to VSS for signal input

Prevention malfunction by external wiring

**C4-6** : Boot strap capacitor

**Blue** : Arranged on top side

**Purple** : Arranged on back side

\* C10 is arranged on back position of C12 and C13.

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## OPERATION PROCEDURE

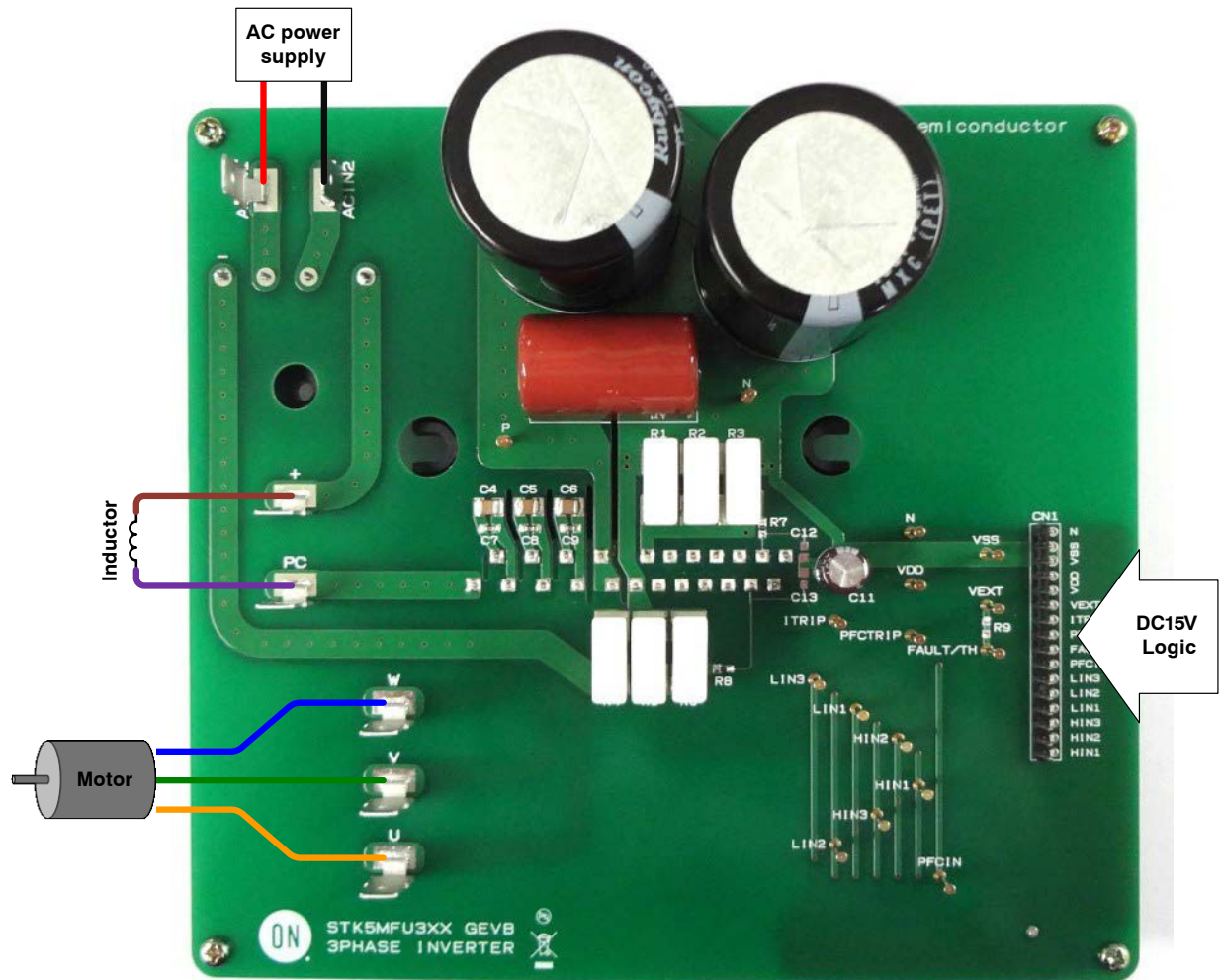


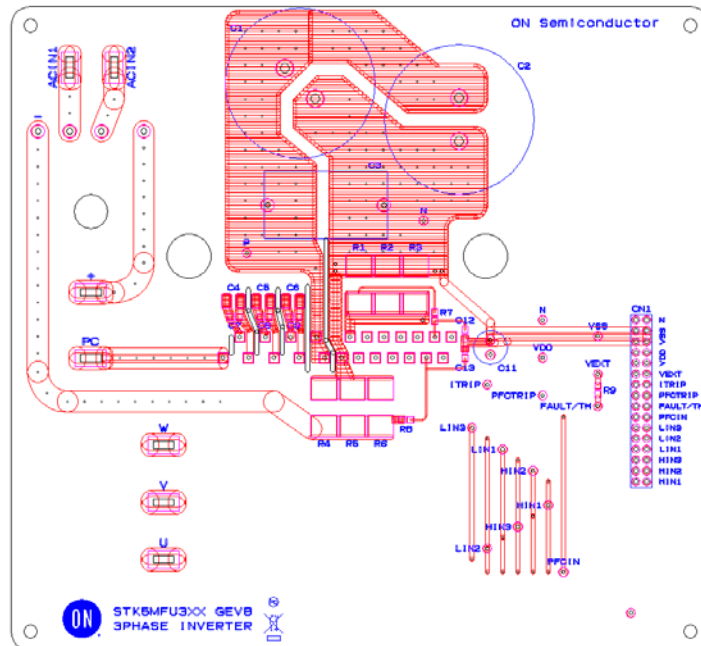
Figure 4. Connection Example

- Step 1. Connect IPM, the three power supplies, logic parts, inductor and the motor to the evaluation board, and confirm that each power supply is OFF at this time.
- Step 2. Apply DC15V to VDD and the logic I/O voltage to VEXT.
- Step 3. Perform a voltage setup according to specifications, and apply AC power supply between ACIN1 and ACIN2.

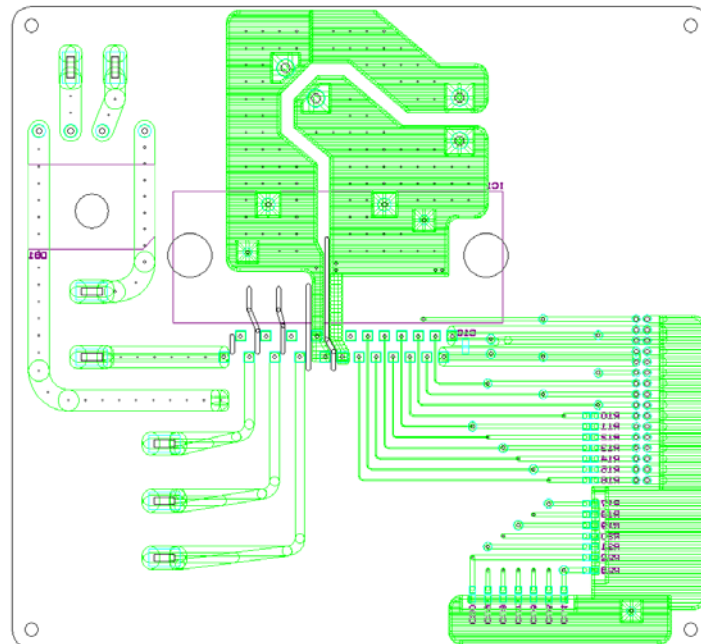
- Step 4. The IPM will start when signals are applied. The low-side inputs must be switched on first to charge up the bootstrap capacitors.

NOTE: When turning off the power supply part and the logic part, please carry out in the reverse order to above steps.

## LAYOUT



Top Side



Back Side

**Figure 5. Evaluation Board Layout (Top View)**

Length: 152 mm

Side: 165 mm

Thickness: 1.6 mm

Rigid double-sided substrate (Material: FR-4)

Both sides resist coating

Copper foil thickness: 70  $\mu\text{m}$

# STK5MFU3C1AGEVB

## BILL OF MATERIALS

Table 1. BILL OF MATERIALS

| Designator                                                               | Qty | Description                      | Value               | Tolerance | Foot-print   | Manufacturer     | Manufacturer Part number | Substitution Allowed |
|--------------------------------------------------------------------------|-----|----------------------------------|---------------------|-----------|--------------|------------------|--------------------------|----------------------|
| R1 – R3                                                                  | 3   | Metal plate resistor             | 50 mΩ / 5 W         | ±10%      |              | KOA              | BPR58C50LK               | YES                  |
| R4 – R6                                                                  | 3   | Metal plate resistor             | 15 mΩ / 5 W         | ±10%      |              | KOA              | BPR58C15LK               | YES                  |
| R7, R8                                                                   | 2   |                                  | 0 Ω                 |           | SMD 1608     | KOA              | RK73Z1JTDD               | YES                  |
| R9                                                                       | 1   |                                  | 20 kΩ / 0.1 W       | ±1%       | SMD 1608     | KOA              | RK73H1JTDD2002F          | YES                  |
| R10 – R16                                                                | 7   |                                  | 100 Ω / 0.1W        | ±1%       | SMD 1608     | KOA              | RK73H1JTDD1000F          | YES                  |
| R17 – R23                                                                | 7   |                                  | 3.3 kΩ / 0.1 W      | ±1%       | SMD 1608     | KOA              | RK73H1JTDD3301F          | YES                  |
| C1, C2                                                                   | 2   | Aluminum electrolytic capacitor  | 470 μF / 450 V      | ±20%      | Through-hole | Rubycon          | 450MXC470MEFCSN35X50     | YES                  |
| C3                                                                       | 1   | Film capacitor                   | 2.2 μF / 630 V      | ±5%       | Through-hole | PANASONIC        | ECQE6225JT               | YES                  |
| C4 – C6                                                                  | 3   |                                  | 22 μF / 25 V        | ±20%      | SMD 3225     | MURATA           | GRM32ER71E226ME15L       | YES                  |
| C7 – C10                                                                 | 4   |                                  | 0.1 μF / 50 V       | ±10%      | SMD 1608     | MURATA           | GRM188B31H104K           | YES                  |
| C11                                                                      | 1   | Aluminum electrolytic capacitor  | 220 μF / 35 V       | ±20%      | Through-hole | Nippon Chemi-Con | EKMG350ELL221MHB5D       | YES                  |
| C12, C13                                                                 | 2   |                                  | NC                  |           |              |                  |                          |                      |
| C14 – C20                                                                | 7   |                                  | 100 pF / 50 V       | ±5%       | SMD 1608     | MURATA           | GRM1882C1H101J           | YES                  |
| DB1                                                                      | 1   | Bridge diode                     | 25 A / 800 V        |           | Through-hole | Shindengen       | D25XB80                  | YES                  |
| CN1                                                                      | 1   | Connector                        | 16 pin / 2.54 pitch |           | Through-hole | Hirose           | A2-16PA-2.54DSA(71)      | YES                  |
| VSS, VDD, VEXT, N, ITRIP, PFCTrip, FAULT/TH, PFCIN, HIN1-3, LIN1-3, P, N | 16  | Test pin                         |                     |           | Through-hole | Mac8             | ST-1-3                   | YES                  |
| U, V, W, +, PC, ACIN1, ACIN2                                             | 7   | Faston terminal (Tab)            |                     |           | Through-hole |                  |                          | YES                  |
| IC1                                                                      | 1   | Boost PFC + 3 Phase Inverter IPM |                     |           | Through-hole | ON Semiconductor | STK5MFU3C1A-E            | NO                   |

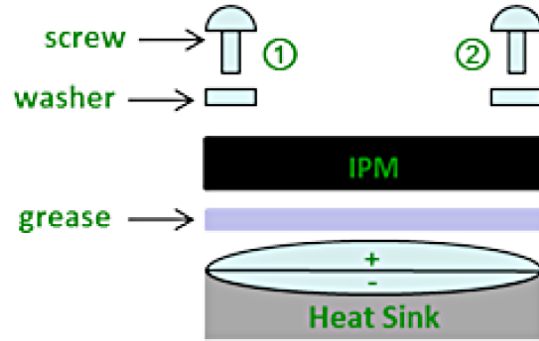
NOTE: All components are lead free.

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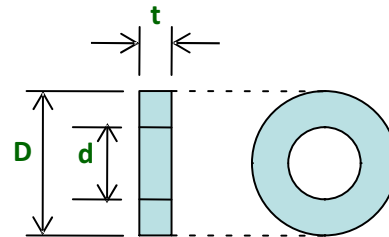
## HEAT SINK MOUNTING

**Table 2. MOUNTING CONDITION**

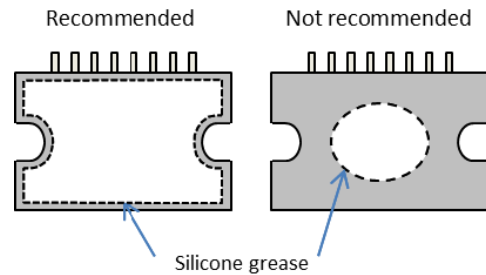
| Item      | Recommended Condition                                                                                                                                                                                                                                        |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pitch     | 70.0 ± 0.1 mm (Please refer to Package Outline Diagram)                                                                                                                                                                                                      |
| Screw     | Diameter: M4<br>Bind machine screw, Truss machine screw, Pan machine screw                                                                                                                                                                                   |
| Washer    | Plane washer<br>The size is D = 9.0 mm, d = 4.3 mm and t = 0.8 mm<br>JIS B 1256 (Figure 7.)                                                                                                                                                                  |
| Heat Sink | Material: Aluminum or Copper<br>Warpage (the surface that contacts IPM):<br>-50 to 100 μm<br>Screw holes must be countersunk.<br>No contamination on the heat sink surface that contacts IPM.                                                                |
| Torque    | Temporary tightening: 20 to 30% of final tightening on first screw<br>Temporary tightening: 20 to 30% of final tightening on second screw<br>Final tightening: 0.79 to 1.17 Nm on first screw<br>Final tightening: 0.79 to 1.17 Nm on second screw           |
| Grease    | Silicone grease<br>Thickness: 100 to 200 μm<br>Uniformly apply silicone grease to whole back.<br>Thermal foils are only recommended after careful evaluation.<br>Thickness, stiffness and compressibility parameters have a strong influence on performance. |



**Figure 6. Mounting Composition**



**Figure 7. Size of Washer**



**Figure 8. Uniform Application of Thermal Grease**

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