# Generic Specification—Baseplate Flatness of Power Modules

AN5731

## Introduction

This application note provides a generic specification for the baseplate flatness of the power modules. The baseplate flatness is crucial for ensuring optimal thermal contact with the heatsink. This ensures efficient operation and extends the lifespan of the power module. Proper flatness of the baseplate reduces thermal resistance, improves heat dissipation, and prevents overheating. It also enhances the mechanical stability and reliability of the module, especially in environments with varying thermal and mechanical stresses.

Effective thermal management is essential for maintaining the performance and reliability of electronic components, particularly in high-power applications. The baseplate serves as the primary interface for heat transfer from the power module to the heatsink.

Moreover, the baseplate flatness provides mechanical stability that ensures the power module remains securely mounted to the heatsink, even under conditions of thermal cycling and mechanical vibration. This stability is crucial for applications in harsh environments where the power module may be subjected to significant thermal and mechanical stresses.

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# 1. Baseplate Flatness Specification

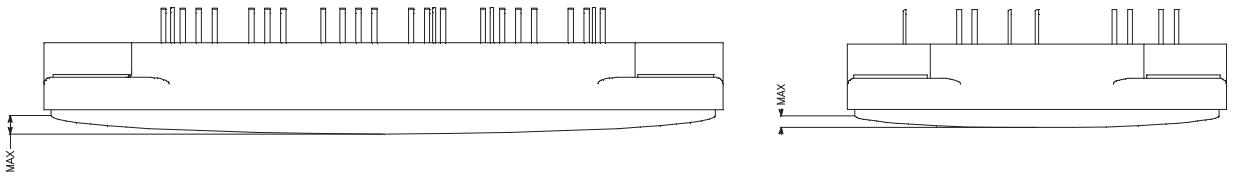
This section describes the baseplate flatness specification, unless otherwise indicated on the module data sheet.

## 1.1 Overall Convex Shape

The module is designed to have an overall convex shape of the baseplate. This design improves the contact with the heatsink after mounting. The convex shape is tested by measuring the bow between the middle of the module baseplate and the surrounding edges. Measurements are taken in both the length and width of the baseplate.

The following figure shows the overall convex shape of the baseplate.

**Figure 1-1.** Overall Convex Shape




Due to the specific design of each module, including substrate layout, die location, and die size, some cavities may occur in the profile of the baseplate when observed from the bottom. These cavities are of very limited depth due to the overall convex shape of the baseplate and have an insignificant impact on module performance. This is assuming that the module is mounted onto the heatsink according to the recommended mounting procedures, which include considerations for silicone grease application, heatsink flatness, mounting torque, and so on.

The following table lists the convexity values per package type for modules.

**Table 1-1.** Convexity Values Per Package Type

| Baseplate Type | Package | Tolerances (µm) | | | |
|---|---|---|---|---|---|
| | | Length | | Width | |
| | | Min. | Max. | Min. | Max. |
| Copper bases | DP2 | 0 | 100 | −15 | 40 |
| | J1 | 0 | 120 | — | — |
| | J3 | 0 | 140 | 0 | 110 |
| | LP2 | 0 | 120 | −15 | 40 |
| | LP4C | 0 | 100 | 0 | 100 |
| | LP8 | 0 | 140 | 0 | 80 |
| | LP8W | 0 | 140 | 0 | 110 |
| | LP14 | 0 | 200 | 0 | 130 |
| | SP1 | 0 | 40 | −15 | 40 |
| | SP2 | 0 | 70 | −15 | 30 |
| | SP3 | 0 | 70 | −15 | 40 |
| | SP4 | 0 | 120 | −15 | 50 |
| | SP6/SP6-P | 0 | 180 | 0 | 110 |
| | SP6C/SP6LI | 0 | 110 | −15 | 60 |
| | E2/P2 | 0 | 250 | — | — |
| | E3/P3 | 0 | 250 | — | — |
| | D1/D1P | 0 | 120 | — | — |
| | D3 new | 0 | 110 | −15 | 60 |
| | D4 new | 0 | 180 | 0 | 110 |
| AlSiC bases | LP8W | −70 | 200 | −70 | 150 |
| | LP14 | −70 | 200 | −50 | 150 |
| | SP1 | −20 | 40 | −15 | 40 |
| | SP3 | −50 | 80 | −15 | 40 |
| | SP4 | −40 | 140 | −15 | 40 |
| | SP6-P | 0 | 200 | 0 | 120 |
| | SP6C/SP6LI | 0 | 110 | −15 | 80 |
| | D1/D1P | 0 | 120 | — | — |
| Baseless | BL1 | −15 | 15 | — | — |
| | BL2 | −20 | 20 | — | — |
| | BL3 | −30 | 30 | −30 | 30 |

**Notes:** For modules that fail the final flatness requirements, a dielectric test is performed under screwing conditions.

- If dielectric test results are **GOOD**, accept the parts under waiver.
- If dielectric test results are **FAILED**, reject the parts.

For example, the maximum length flatness for LP8 is 140 µm. However, we may accept 150/160/170 µm if the module passes the dielectric test under screwing conditions.

# 2. Conclusion

Adhering to the specified baseplate flatness ensures optimal thermal performance and reliability of the power modules. Proper mounting techniques, including the use of appropriate thermal interface materials and correct mounting torque, are essential to maintain the designed convex shape and achieve the best thermal contact with the heatsink.

For more detailed information, see the specific module data sheet and follow the recommended mounting instructions.

# 3. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

| Revision | Date | Description |
|---|---|---|
| A | 12/2024 | Initial revision |

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