



## PROCEDURE FOR MEASURING PAD-TO-AMBIENT THERMAL RESISTANCE ( $R_{\theta PA}$ ) FOR EXPOSED PAD PACKAGES

### SCOPE

For devices with an exposed die pad, the die-to-exposed pad thermal resistance ( $R_{\theta JP}$ ) is independent of the printed wiring board (PWB) on which the device is mounted. The value of pad-to-ambient thermal resistance ( $R_{\theta PA}$ ) can be measured using a simple experiment. From the measured value of  $R_{\theta PA}$  and a known  $R_{\theta JP}$ , one can compute the value of die junction-to-ambient thermal resistance ( $R_{\theta JA}$ ) of the device when mounted on any type of PWB. Since  $R_{\theta JA}$  is affected by the PWB, computing  $R_{\theta JA}$  using this procedure offers a convenient way to estimate and compare the thermal performance of various PWBs.

### PROCEDURE FOR MEASURING PAD-TO-AMBIENT THERMAL RESISTANCE ( $R_{\theta PA}$ )

The customer can measure the  $R_{\theta PA}$  for the package on their PWB by using the following procedure:

1. Drill a small hole in the PWB through the exposed pad footprint.
2. Solder the device to the PWB.
3. Insert a fine wire thermocouple into the exposed pad through the hole in the PWB so that it is touching the exposed pad, and then secure it with a thermally conductive epoxy.
  - Recommended fine-wire thermocouple: Omega 5SC-TT-K-30-36.
  - Recommended thermally conductive epoxy: Omega Bond 101.
4. Allow the epoxy to harden.
5. Power up the device for at least 20 minutes for it to reach thermal equilibrium.
6. The thermocouple indicates the exposed pad temperature. From this, the pad-to-ambient thermal resistance can be calculated:  $R_{\theta PA} = (T_{\text{pad}} - T_{\text{Ambient}}) / \text{Power}$ .
7. By combining  $R_{\theta PA}$  with the junction-to-package thermal resistance ( $R_{\theta JP}$ ) from Allegro's [package thermal characteristics](#) document<sup>[1]</sup>, the die junction-to-ambient thermal resistance ( $R_{\theta JA}$ ) can then be computed:  $R_{\theta JA} = R_{\theta JP} + R_{\theta PA}$ .

[1] <https://www.allegromicro.com/-/media/files/packaging/thermal-characteristics/package-thermal-characteristics.pdf>

*Revision History*

Number	Date	Description
-	September 30, 2004	Initial release
1	March 21, 2022	Minor editorial updates
2	March 26, 2024	Fixed link (page 1)

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