

APPLICATIONS INFORMATION

Application Note
AN26020

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 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 the PWB. Since the $R_{\theta JA}$ 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:

- Drill a small hole in the PWB through the exposed pad footprint..
- Solder the device to the PWB.
- 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
- Allow the epoxy to harden.
- Power up the device for at least 20 minutes for it to reach thermal equilibrium
- The thermocouple indicates the exposed pad temperature. From this the pad-to-ambient thermal resistance can be calculated:

$$R_{\theta PA} = (T_{\text{Pad}} - T_{\text{Ambient}}) / \text{Power}$$

- By combining $R_{\theta PA}$ with the junction-to-package thermal resistance ($R_{\theta JP}$) from [Allegro's thermal web page](#), the die junction-to-ambient thermal resistance ($R_{\theta JA}$) can then be computed:

$$R_{\theta JA} = R_{\theta JP} + R_{\theta PA}$$

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