Working With QFN Power Modules

ABSTRACT

Texas Instruments Quad Flatpack No-lead (QFN) power modules allow for board miniaturization, and hold several advantages over other power module packages. The QFN packages have higher power density, a smaller routing area, improved thermal performance, and improved electrical parasitics. Additionally, the absence of external leads eliminates bent-lead concerns. These QFN packages have reliable solderability with either SnPb or Pb-free solder paste and are packaged to industry-standard tape-and-reel specifications.

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1 Prototyping

Prototyping is made easy using TI QFN power modules with standard pin size and pitch. Test boards can be built for evaluation using a standard rework station. The exposed QFN pads on the side of the device make it easy to visually inspect the pin connection to the PCB as shown in Figure 1.

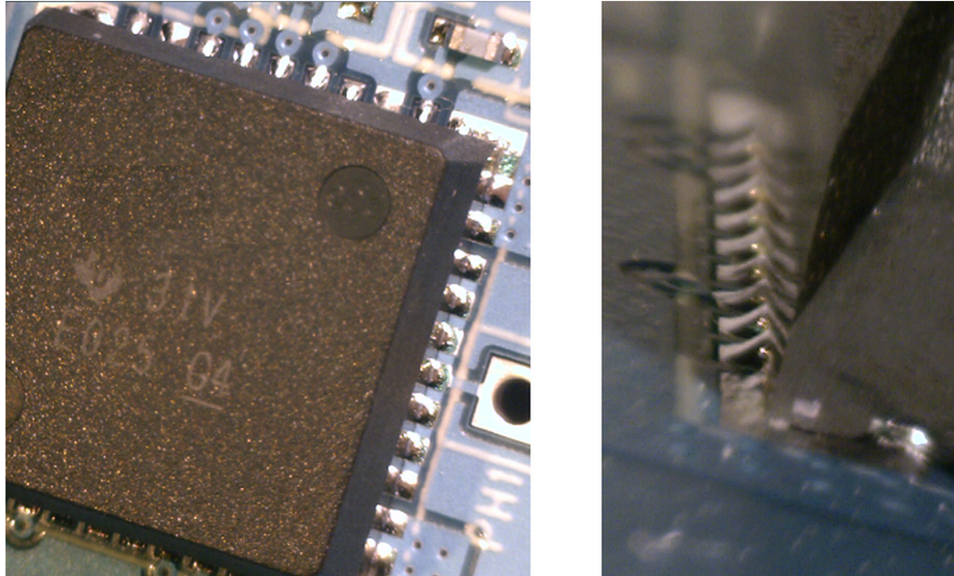

Figure 1. Sample PCB Board

2 Probing

TI QFN power modules have been engineered to have all internal electrical signals accessible from the perimeter of the device. This feature allows for easy probing of any signal or waveform during evaluation. The exposed QFN pads on the side of the device make it easy to probe and access all internal points.

3 Handling

The absence of protruding leads in QFN package devices eliminate the risk of bent leads during shipping or manufacturing. However, standard IC handling procedures are still required to be followed.

4 Thermal Performance

The QFN package has superior thermal performance compared to alternative package solutions. The exposed pads on the bottom of the device provide enhanced thermal performance, reducing theta junction-to-ambient thermal impedance. The internal copper lead-frame of the QFN power module provides an exceptional thermal path to the host PCB. This provides a more direct heat-sink path from the die to the board. The addition of thermal vias from the thermal pad to an internal ground plane will dramatically lower the package temperature.

5 Mechanical

Mechanical integrity of the mounted QFN package is greatly enhanced by the soldered exposed pads beneath the device. Shock and vibration susceptibility is reduced by soldering these pads to the PCB.

6 Removal and Rework

Removal of a QFN device requires heating the component and printed circuit board in order to reflow the solder attaching the component to the printed circuit board. Apply hot air directly to the component pins and top of the component by using a dedicated quad flat pack nozzle (see Figure 2) to concentrate the heat directly on the device. To accelerate the heating process, the board can be heated from the bottom using a hot air pre-heater.

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Once the solder has reflowed the device can be lifted using an IC vacuum. Once the component has been removed the solder must be removed using a conductive tool and de- soldering braid. Once the solder is removed the pad must be cleaned using appropriate flux remover.

To re-attach a new device, solder paste must be re-applied as described in the Soldering Requirements section of SLTA069. The solder must then be reflowed either as described in the Developing a Reflow Profile section of SLTA069, or in the same manner as was used to remove the device.

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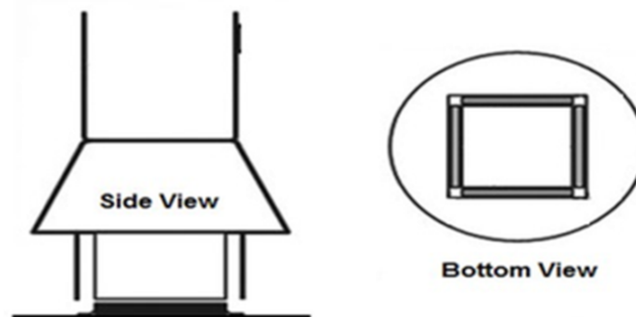

Figure 2. Quad Flat Pack Nozzle

7 MSL Compliance

QFN devices are classified to MSL levels per JEDEC standard J-STD-020. See the product datasheet for MSL classification.

8 Surface-Mount Soldering Qualification

QFN devices are qualified to have no degradation from reflow/IR soldering and aqueous washing by verification through rigorous testing. Sample batches are subjected to reflow through a convection reflow oven and an aqueous wash cleaner. The convection reflow oven is set to achieve maximum peak temperature on any pin or component. These parts are subsequently used for thermal shock, humidity, and life qualification testing. All products must pass this initial qualification testing with zero failures before being released to production.

For QFN soldering requirements, see *Soldering Requirements for BQFN Packages* (SLTA069).

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Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (July 2015) to A Revision	**Page**
• Reworded the solder qualification section	3

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