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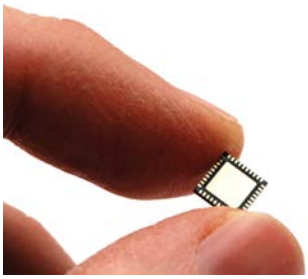

QFP/QFN Device Moisture Sensitivity Guide

7 December 2012

Q:

Why do packaged chips from Intan Technologies arrive in sealed packages with desiccant and moisture sensitivity labels? What handling and storage precautions should I observe?

A:

All plastic QFP (quad flat package) and QFN (quad flat, no leads) packages used to encapsulate integrated circuits absorb moisture from the air, even at moderate levels of ambient humidity. The small amount of water absorbed by the plastic has no effect on the operation of the microchip inside, but it can cause device failure during high-temperature reflow soldering procedures, so care must be taken to keep QFP/QFN parts dry prior to assembly on printed circuit boards (PCBs).

When a device is being soldered, the high temperatures cause trapped internal moisture to expand. This expanding wafer vapor can cause bond wires to separate from the chip, leading to open circuits on some of the I/O pins. Sometimes the damage is subtle and merely weakens bond wires that then separate from the chip later if the PCB experiences moderate physical deformations. In either case, the result is dead amplifier channels (in the case of an open-circuited input pin) or whole-chip pathologies (in the case of an open-circuited control or power pin).

A device's degree of sensitivity to moisture is indicated by the industry standard Moisture Sensitivity Level, or MSL. QFN-packaged devices from Intan Technologies, such as the RHA2000 and RHD2000 series of biopotential recording chips, have an MSL of 3, as do other QFN packages across the semiconductor industry. An MSL of 3 requires that devices must be soldered within 168 hours (7 days) of exposure to ambient atmospheric conditions, which is defined as less than 30ºC and less than 60% RH (relative humidity).

As many industries move to Pb-free RoHS (Restriction of Hazardous Substances) soldering protocols, temperatures used for reflow soldering are increasing to 260ºC in some cases. Higher temperatures place more strain on packaged chips containing residual moisture. For this reason, some groups now recommend that the MSL rating of a part be increased by one if RoHS assembly is used. The requirements for an MSL of 4 state that devices must be soldered within 72 hours (3 days) of exposure to ambient humidity.

If the devices will not be soldered within this time frame, they should be stored at less than 10% RH to prevent moisture from diffusing into the package. A vacuum-sealed bag with desiccant packs (like the type used by Intan Technologies for shipping) keeps parts dry for several years if it remains unopened. Storage in a zipper-resealable bag with desiccant packs may maintain sufficiently low humidity for a few months, but is not a viable long-term storage solution.

If packaged devices are exposed to ambient humidity for longer than the duration specified by their MSL, they must be dry baked before soldering. Most PCB assembly companies have the capability to bake parts to safely remove any absorbed moisture prior to soldering. The typical procedure for baking is to bring the devices to 125ºC for 8-24 hours. An alternative low-temperature dry baking procedure is to store devices at 40ºC and less than 5% RH for 192 hours (8 days).

Companies like Totech and McDry manufacture dry cabinets that maintain very low humidity levels (often less than 1% RH) and can be used for long-term storage of moisture sensitive components outside of sealed bags. Some of these cabinets also have built-in heaters and may be used for low-temperature dry baking. (See the Totech SD-151-21 dry cabinet with SH 230-1 heater option.)