NORDIC SEMICONDUCTOR

# QFN Soldering Reflow Guidelines

# nAN400-08

# Application Note

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### Revision History

| Date | Version | Description |
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| January 2004 | 1.0 | |
| December 2006 | 1.1 | Added note on wetting of package side wall. |

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# 1 Introduction

The electronic manufacturing industry is moving towards environmentally safe lead-free, or Green, assembly processes. Factors that should be considered when switching to lead-free soldering materials are:

- Circuit board thickness
- Surface finish
- Fabrication complexity
- Assembly process compatibility

This application note focuses on solder reflow recommendations for QFN packages with Tin/Lead and Matte Tin (Green) finishes.

**Note:** The wetting of the package side wall is not guaranteed. This is because the QFN package is by design a “contact down” package. The sidewalls of the leads are not plated since they are exposed by the singulation step, which takes place after the plating. Depending on the surface state of the bare copper the sidewalls of the leads may not wet during soldering. Please see Figure 1. ”The QFN package is by design a “contact down” package”.

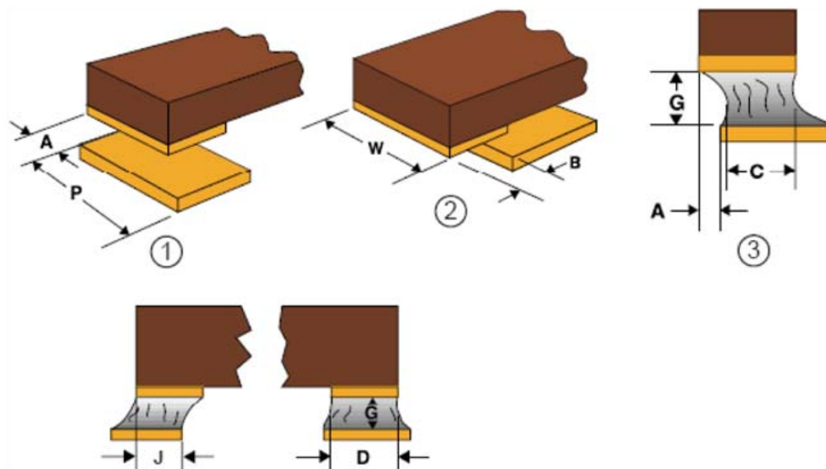


*Figure 1. The QFN package is by design a “contact down” package*



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## 2 Solder reflow process basics

Lead-free soldering processes have been available for some years. However, they do not always meet the same physical criteria for attachments as soldering alloys containing lead. In the past, the most common soldering alloy for joining electronic components was the mixture of 63% tin and 37% lead. This composition of Tin and Lead provided excellent bonding strength as well as enough elasticity to withstand the thermal stresses in the product's operating environment. As electronic companies began to reduce or even eliminate the lead alloy component in their products, these attributes were often adversely affected.

We recommend using the solder profiles shown in Figure 2. "Recommended reflow profile for 63/37 solder paste for QFN with tin/lead plating" and Figure 3. "Recommended solder reflow profile for lead-free (Green) solder paste for Green QFN packages" for soldering QFN packages. However, factors such as circuit board thickness, size, other semiconductor packages, passive components and reflow equipment may affect the total profile time.

### 2.1 Tin/Lead Solder reflow profile

The tin/lead solder reflow process typically undergoes four transitions as shown in Figure 2. "Recommended reflow profile for 63/37 solder paste for QFN with tin/lead plating".

- Heating up from 25 to 140 °C at a rate of 1~3 °C/sec.
- Preheat at 140-150 °C for 120 ~ 150 seconds
- Solder reflow. Ramp up temperature at 2-3 °C/sec to a peak temperature of 220-225 °C. Temperature over 183 °C for 45 ~ 75 sec.
- Cooling down to room temperature at 2-4 °C/sec to avoid undesired intermetallic compound layer.

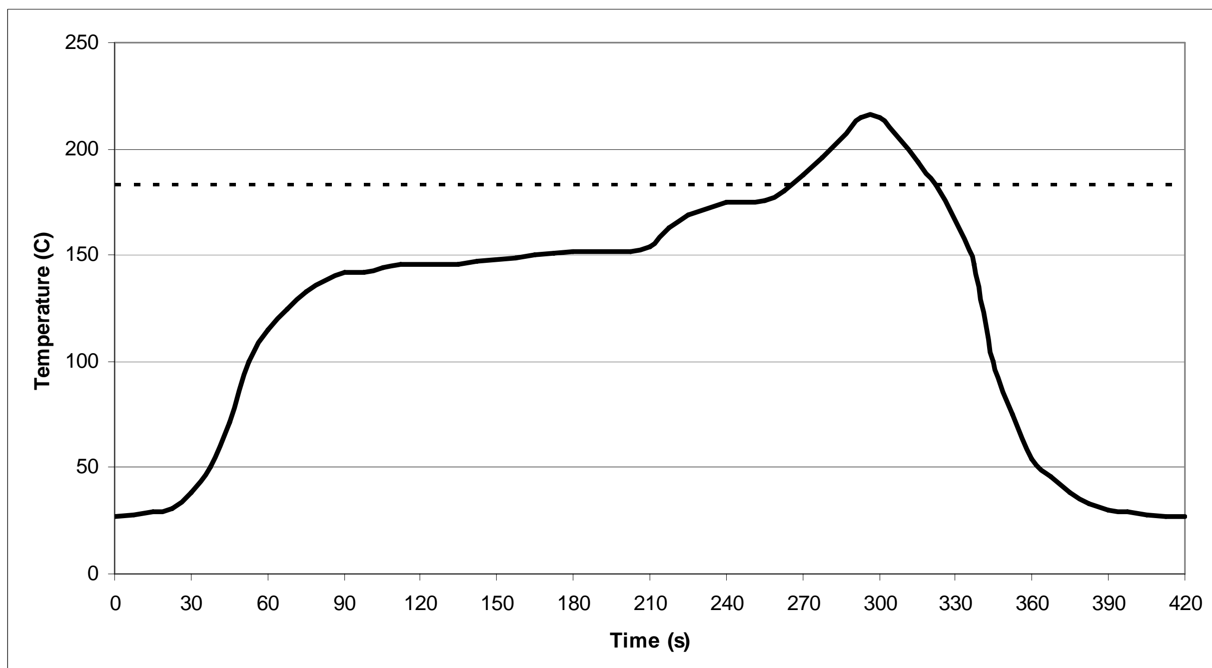


*Figure 2. Recommended reflow profile for 63/37 solder paste for QFN with tin/lead plating*



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## 2.2 Green (lead free) soldering reflow profile

Figure 3. ”Recommended solder reflow profile for lead-free (Green) solder paste for Green QFN packages” shows the reflow recommendations for our Green QFN packages. All green QFN packages have matte Tin plating.

The SnAgCu solder paste with a melting temperature of 217 °C is recommended for the Green (lead-free) reflow soldering process.

The tin/lead solder reflow process typically undergoes four transitions as shown in Figure 3. ”Recommended solder reflow profile for lead-free (Green) solder paste for Green QFN packages”.

- Heating up from 25 to 160 °C at a rate of 1~3 °C/sec.
- Preheat at 155-165 °C for 120 ~ 150 seconds
- Solder reflow. Ramp up temperature at 2-3 °C/sec to a peak temperature of 240-245 °C. Temperature over 217 °C for 40 ~ 60 sec.
- Cooling down to room temperature at 2-4 °C/sec to avoid undesired intermetallic compound layer.

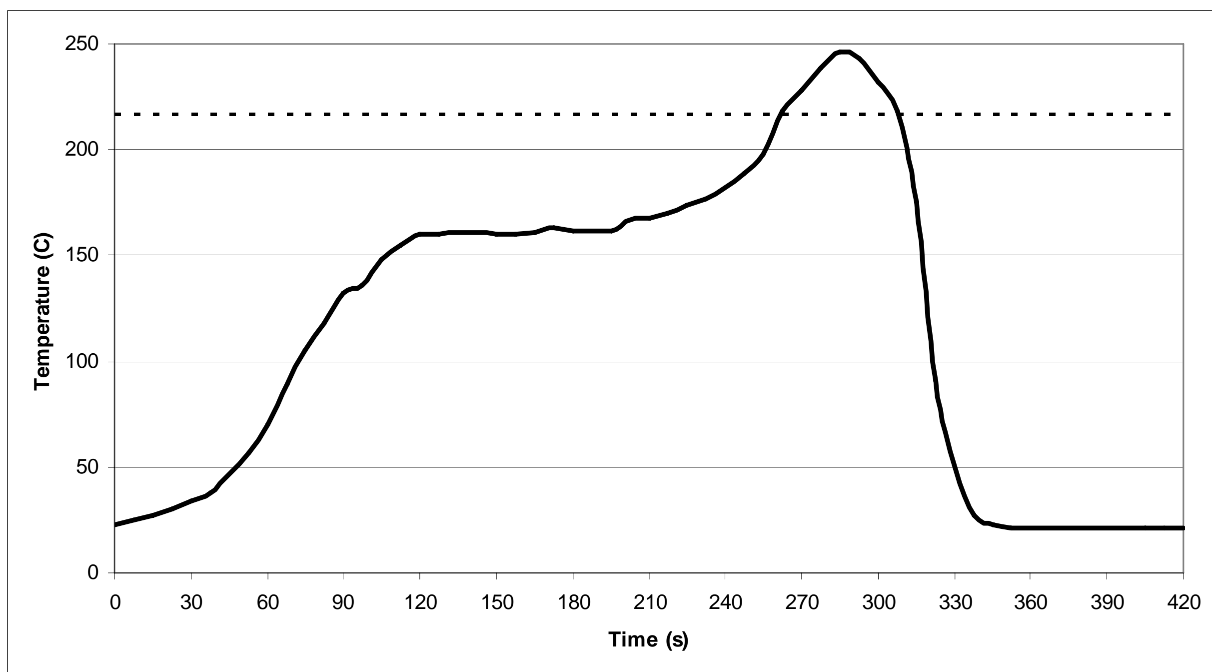


*Figure 3. Recommended solder reflow profile for lead-free (Green) solder paste for Green QFN packages*



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