

# Enabling AOI for leadless DFN packages with side wettable flanks

Automated optical inspection (AOI) of solder joints on automotive PCB assemblies is only possible if there is a visible solder filet. By offering a range of leadless SMD packages with side-wettable flanks, Nexperia is enabling automotive designers to increase component density while maintaining quality standards.

One challenge all designers face is the constant pressure of adding more functionality within ever tighter space constraints. For most industries that has led to greater use of small leadless packages that also help increase component density, reduce height and optimize thermal performance. However, as the connection is underneath the package's body, the solder connection quality of D(Q)FN packages can only be fully inspected by costly x-ray processes.

Maintaining the high safety and reliability standards required by industries like automotive while using less costly yet very efficient automated optical inspection (AOI), is only possible with packages that allow a visible solder joint to develop. This is normal with leaded packages, but to solve this challenge with D(Q)FN packages Nexperia has developed several techniques to create either dimples or side-wettable flanks that allow a solder meniscus to form and create a visible solder filet.

## Side-wettable flanks and the solder guarantee

For DFN packages with up to four pads (more if multiple pads are fused together) on opposite sides of the package, we use a technique where the side flanks are covered with plated tin in the same electro galvanic plating step as used for the bottom pads. The exposed tin-plated side-wettable flanks (SWF) guarantee the complete side pad surface will be wetted with solder during the reflow soldering process. Also, the plating layer on the side flank is as thick as on the bottom pads, around 10 µm, ensuring a wettable surface even after long periods of storage. The figure below shows examples of the optical appearance of side flanks after soldering for a [DFN2020-6](#) package with and without side-



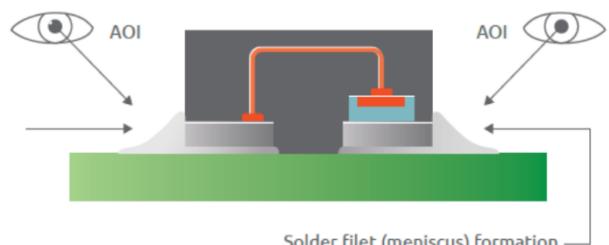
100% solder wetting solution with new 2x2 mm leadless package DFN2020MD-6  
 ➤ Optimal visual solder inspection  
 ➤ High-quality solder connections



➤ No complete wetting on side pad  
 ➤ Quality of solder connection difficult to determine  
 ➤ Very limited options for optical solder inspection

AOI example comparison of a DFN2020-6 package with SWF versus bare Cu side flanks after soldering

Side-wettable flanks facilitate a reliable AOI capability for DFN packages, eliminating the need for costly x-ray inspection. An additional benefit of DFN packages with SWF comes from the mechanical robustness of the bond to the PCB, which is better than devices without side-wettable flanks.



AOI enabled DFN package with Side-Wettable Flanks (SWF)

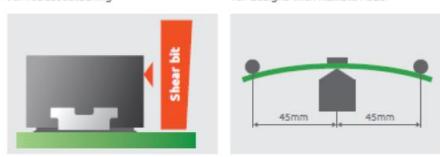
One condition for SWF is that the PCB solder pad size must be larger than the package dimension, to allow space for the solder to build a meniscus or filet. Suppliers include this extra space in their solder footprint recommendations

## Shear strength

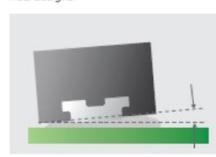
As shown below the shear force required to dislocate a SWF-enabled package off the PCB is increased due to the meniscus that is formed after soldering. Shear Force data for 80 samples of a [DFN2020-6](#) package with and without side-wettable flanks have been collected. The results show SWF improves the shear force by about 10%, and the standard deviation is also improved.

#### Improved mechanical robustness

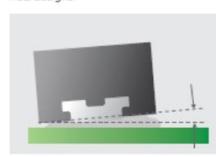
**Maximum shear force**  
Optimized for high shear forces  
for robust soldering



**Maximum board bending**  
Very high board bending capability  
for designs with flexible PSBs

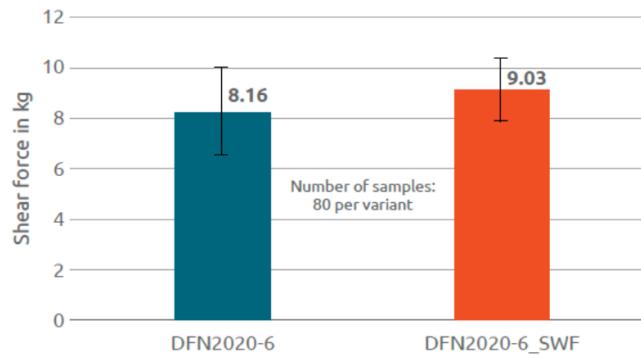


**Minimum tilting angle**  
Reduced tilting angle for ultra flat  
PSB designs



*Board level robustness improvements of DFN packages  
with side-wettable flanks*

#### Shear force average and standard deviation



*Shear Test on PCB for a DFN2020-6 package with and  
without SWF*

Board bending tests also confirm an increased robustness for DFN devices with SWF, because the package solder pads achieve a better anchoring to the plastic body. Board bending depth for the [DFN1006D-2](#) package with SWF is up to 14 mm, while for some passive chip components of the same size the bending depth is often specified to only 1 mm.

#### A full portfolio of SWF options

Nexperia currently offers [10 automotive qualified leadless package options with SWF](#) across its full product portfolio and will release three additional packages in 2020. These include the 3-pin packages DFN1110 and DFN1412 as well as a new 2-pin package in 1006 size. By featuring side-wettable flanks they allow a visible solder joint to develop enabling automatic optical inspection. At the same time, they help save space in vehicles while maintaining the high safety and reliability standards needed in automotive applications.