

Contacting Solutions for Reliable, Repeatable Test Results on NiPdAu Packages

The ROHS lead-free initiative was a significant market inflection point in the semiconductor package industry.

The processes for packaging and testing integrated circuits went through a metamorphosis. Tin-lead-coated lead frames had to be transitioned to lead-free plating materials. For the non-array packages such as QFNs, QFPs, and SOICs, the largest percentage of lead-free packages incorporate matte tin-plated pads or leads. However, there is a growing trend for companies to choose NiPd or NiPdAu plating instead of matte tin. Each package plating material poses its own set of challenges from device testing to printed circuit board assembly. Johnstech has designed Test Contactor solutions to meet these device testing challenges on multiple package plating types. This brochure specifically outlines the challenges of designing Test Contactors for NiPd and NiPdAu plated packages.

Your Contact For Higher Performance

Johnstech[®]

Advantages of NiPdAu

There are several reasons for this transition to NiPdAu plated packages.

1. Device users in high reliability applications such as medical, military, automotive and telecom had concerns about tin whisker growth in some matte tin packages under certain conditions. To limit the liability in high-reliability end-user applications, more testing and inspection is often required. This can lead to higher cost of test. While it is true that there are ROHS exemptions in some of these high reliability applications, many related applications still do not allow the use of tin-lead plated packages. Therefore, the manufacturer must choose between matte tin and NiPdAu for their package plating.

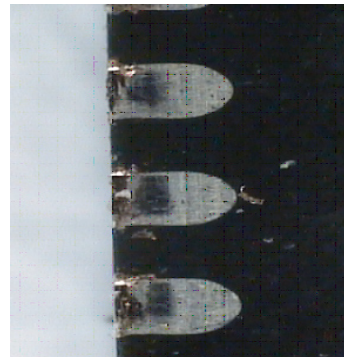
2. Matte tin-plated packages are prone to the buildup of tin oxides during package testing. When testing these parts, the contacting (socket) technology can build-up with these oxides, which increases the contact resistance (in an absolute sense) and increases the variation of the contact resistance (standard deviation). On the other hand, NiPdAu plated devices do not include tin, and therefore are not susceptible to the same tin oxide build-up as their matte tin package counterparts. Test Contactors such as those provided by Johnstech that include a self-cleaning wipe function significantly reduce the fluctuation in contact resistance, whether from oxide buildup in matte tin or other material residues associated with other platings.

While many manufacturers initially opted for matte tin packages due to the perceived lower acquisition costs, the bottom line is that many manufacturers are migrating to NiPdAu packages. In many cases, their overall costs are actually reduced due to the elimination of the additional tin whisker monitoring that was required with matte tin and the higher OEE that is gained by the reduction in cleaning frequency on the test floor.

Challenges of NiPdAu

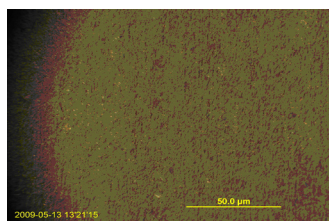
While NiPdAu packages exhibit the benefits described earlier, there remain numerous challenges.

1. The hard and often rough surface finish of NiPd and NiPdAu packages can cause excessive contact wear in Test Contactors and sockets.
2. Package singulation is often accomplished by sawing the NiPdAu plated lead frames. This can leave a sharp burr on the edge of the package, leading to potential additional contact wear. Additionally, if the burr is dislodged during the handling or contacting process, the debris can cause more frequent cleaning cycles. Refer to the photo below.
3. NiPdAu packages are not always clean and free of residues, adhesives, and debris. While oxides are not the issue like in matte tin packages, the presence of these contaminants can result in more frequent cleaning cycles. Having a self-cleaning contact wipe can extend the cleaning cycle interval, thus improving the MTBA.

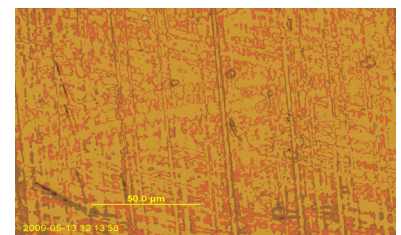


Variation in NiPd and NiPdAu Package Platings

Some package vendors use NiPd plating while others add a thin layer of gold to produce a NiPdAu plating. The texture and consistency of NiPd or NiPdAu can differ significantly among manufacturers. For example, the photos shown here illustrate how the texture and grain structure can vary between two different package platings.



NiPd



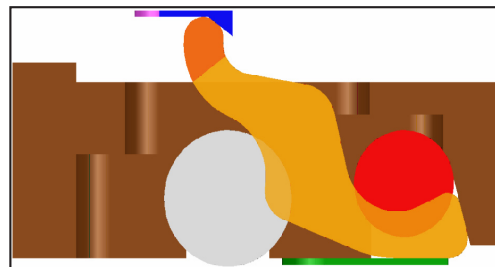
NiPdAu

Contact Life Depends on Many Factors

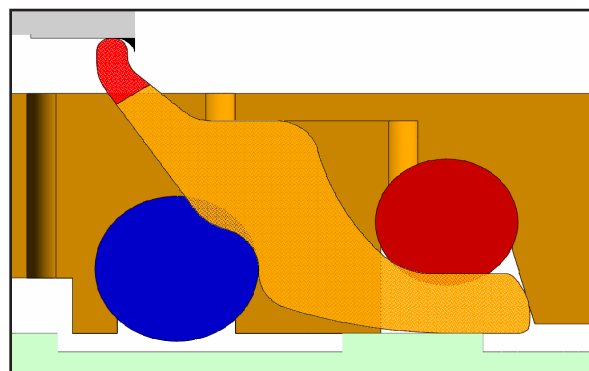
Since NiPd and NiPdAu platings are much harder and rougher than their matte tin counterparts, Test Contactors or sockets must be designed to withstand these challenges. Contact life depends not only on the package material plating properties, but it can vary even more significantly based on the handler-to-Contactor interface, handler velocity, whether auto alignment plates are used, alignment plate opening size and tolerances, and test temperature. Johnstech offers worldwide service and support to ensure the handler interface is optimized for highest yields, longest contact life, and extended MTBA.

New Johnstech ROL™ Technology Low-Force XL Contacts

Johnstech has developed the new Low-Force XL Series Contacts for the Pad ROL™200 and ROL™100A Contactors for NiPd and NiPdAu package applications. The new Low-Force XL (extended life) Contacts work in concert with new elastomers to provide an optimized contacting system for maximum contact life. The Contactors are designed to deliver the proper amount of force to both the device-under-test and the load board pads for longer contact life, exceptional continuity, longer MTBA, and longer load board pad life. The Low-Force XL Contacts provide a self-cleaning wipe for excellent MTBA, even on NiPdAu surfaces that contain contaminants or debris. In addition, the contact motion is designed to avoid package burrs, resulting in less debris generation and longer contact life. The contact profiles and elastomers for the Pad ROL™100A Series and Pad ROL™200 Series configured for NiPd and NiPdAu applications are shown here.



Pad ROL™100A Series



Pad ROL™200 Series

Customer Production Performance Improvements

Customer production testing with the new Low-Force XL Contacts has provided solid performance results. They have experienced higher yields, improved continuity, longer load board pad life, and extended MTBA. Customers have seen significant improvements in contact life, often beyond 350,000 cycles, even with the most challenging NiPdAu and NiPd package platings.

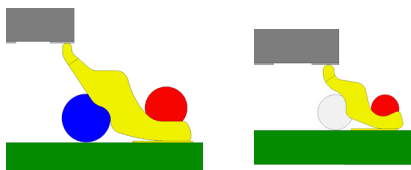


Johnstech Services

Johnstech offers a full line of technical services to assist you in achieving the highest level of performance. One of the services that is particularly powerful and effective for IC package testing is Johnstech's use of HFSS and ADS software to model the electrical performance of the Contactor and the interface to the device and load board pads. This provides direction to select the best Contactor ground configuration for the application and to design the optimal load board trace layout, which are both vital to optimizing the overall system electrical performance.

Contact Johnstech

To learn more about Johnstech's patented solutions and services that maximize your precision analog testing performance, reduce your engineering risk, and provide repeatable production test results, contact your local Johnstech Sales Representative at www.johnstech.com.



Pad ROL™200/ROL™100A Series Performance Comparison

The Low-Force XL Contacts are available for both the Pad ROL™100A and Pad ROL™200. The choice of Contactor usually depends on the electrical performance required for the device under test. Here is a summary of the performance differences between the two products.

Electrical Specifications (NiPdAu Configuration)	Pad ROL™ 200 Series	Pad ROL™ 100A Series
Inductance:	Self: 0.50 nH Mutual: 0.13 nH	0.33 nH 0.15 nH
Capacitance:	Ground: 0.30 pF Mutual: 0.12 pF	0.13 pF 0.05 pF
S_{21} Insertion Loss:	-1dB @ 17.3 GHz	-1dB @ 39.3 GHz
S_{11} Return Loss:	-20dB @ 5.2 GHz	-20 dB @ 16.1 GHz
S_{41} Crosstalk:	-20dB @ 28.7 GHz	-20 dB @ 40 GHz
Current Carrying Capability:	4 A	4 A
Compliance:	0.20 mm	0.175 – 0.20 mm

Contactor configuration also available for Matte Tin packages. See website for specifications.

Applications

The Pad ROL™100A and ROL™200 are used extensively for RF/wireless, precision analog, and high speed digital devices that require the highest electrical and mechanical performance for engineering and production applications. Offering the highest electrical performance, the ROL™-series lowers your engineering risk and allows you to set tighter guard bands. With the consistent results it provides, ROL™-series provides the robust mechanical performance and site-to-site repeatability in production applications to increase your yields and maximize your OEE.

Summary

The new Johnstech Low-Force XL Contacts for the Pad ROL™100A and ROL™200 Contactors stand up to the challenges of NiPdAu and NiPd packages. Furthermore, the price of the XL Contacts has been significantly reduced compared to the previous Eco™-1 Contacts. The extended contact life and lower spares costs will lower your overall cost of test. Refer to www.johnstech.com for technical product information, or to contact your local Johnstech Representative.

