



TDK Innoveta Inc.

3320 MATRIX DRIVE
SUITE 100
RICHARDSON, TX 75082

date: January 12, 2006

from: John Larkin,
Director of Quality
TDK Innoveta Inc.
Tel. (214) 239-3100, x8866
Fax. (214) 239-3102

subject: Tin Whisker Study for RoHS Products

Technical Memorandum

Two factors are involved in assuring that TDK Innoveta's product line of DC-DC power modules, or "bricks", meet the future needs of the high reliability electronics market. One factor is the global trend toward more environmentally friendly products, encompassing the EC's "RoHS" directive and Japan's corporate initiatives, e.g. the Sony Green Partner program. The second factor is the concern expressed by a number of organizations about the potential for Pb-free terminations and solder connections to become a source of tin "whiskers". Some have chosen to take the exemptions offered by RoHS for Sn-Pb soldering; however, the general trend seems to be toward providing Pb-free components and products. TDK Corporation has elected to move all products to Pb-free, RoHS-compliant construction whenever possible.

In order to demonstrate the reliability of TDK Innoveta's products built with Pb-free component terminations and Pb-free solder paste, we performed a tin whisker study in 2005. The purpose of the test is to demonstrate that whiskers of sufficient length to cause electrical shorts are not likely given the plating finishes, form factors and conductor spacing used in TDK Innoveta designs.

Tin Whisker Test Method

There is not a universal standard for tin whisker testing. However, a preliminary document produced by the iNEMI Tin Whisker Users Group (July 2004) was available at the time of our testing, titled *Tin Whisker Acceptance Test Requirements*. This document has been adopted by many users and has also been submitted to JEDEC and IPC for formal standards creation.

Since our testing began, another related document was released, EIA/JEDEC JESD22A121, *Measuring Whisker Growth on Tin and Tin Alloy Surface Finishes*, published in May 2005, (based on recommendations of the iNEMI Tin Whisker Accelerated Test Project). All iNEMI documents are available at http://www.nemi.org/projects/ese/tin_whisker_activities.html.

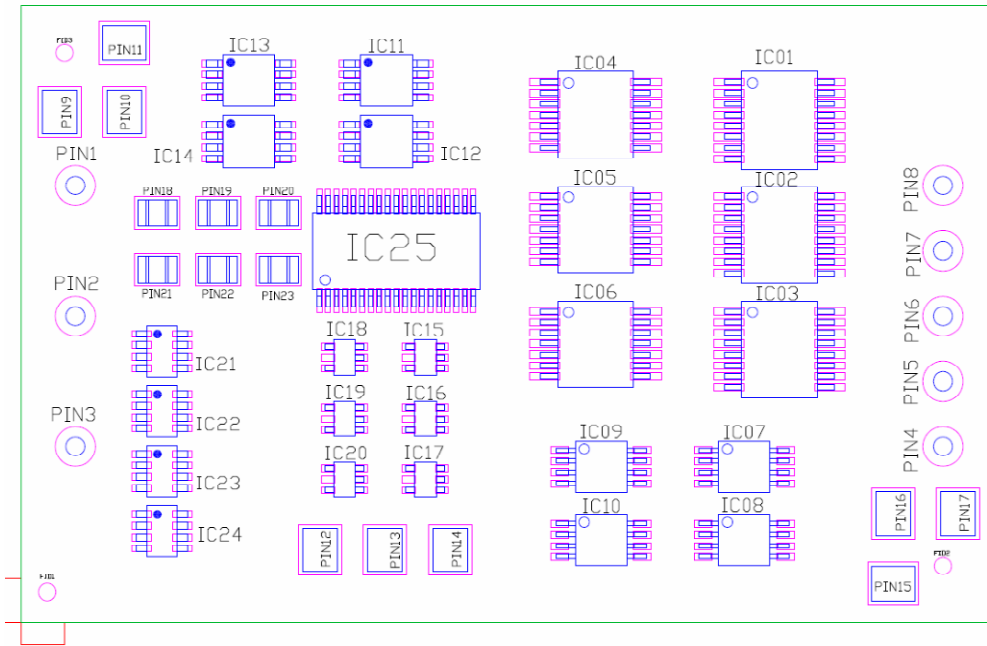
Based on the work done at iNEMI, we followed the test method outlined in Table 1 below.

Table 1. Tin Whisker Test Conditions

Cell #	Test Condition	Length of Test	Pre-conditioning	No. of Leads	No. of Coupons
1	Room Temp Storage	4000 Hours	4 Weeks @ RT	90	3
2			4 Weeks @ RT + Assembly @ 215°C	90	3
3			4 Weeks @ RT + Assembly @ 255°C	90	3
4	Humidity Aging @ 60°C, 93% RH	2000 Hours	4 Weeks @ RT	90	3
5			4 Weeks @ RT + Assembly @ 215°C	90	3
6			4 Weeks @ RT + Assembly @ 255°C	90	3
7	Temperature Cycling @ -40°C to +85°C	1000 Cycles	4 Weeks @ RT + Assembly @ 215°C	90	3
8			4 Weeks @ RT + Assembly @ 255°C	90	3
9	Storage + Bias @ 5VDC	4000 Hours	4 Weeks @ RT + Assembly @ 215°C	90	3

A special test vehicle, or coupon, was designed to reflect the smallest conductor spacing and the most critical terminations used in our DC-DC converter product line. Thus, the test coupon consisted of several fine-pitch component lands, and representative input/output terminal lands or through-holes.

Figure 1. Test Coupon



Tin Whisker Test Results

The results of the whisker test are summarized below in Table 2.

Table 2. Results

Cell #	Test Condition	Length of Test	Pre-conditioning	No. of Leads	No. of Whiskers
1	Room Temp Storage	4000 Hours	4 Weeks @ RT	90	0
2			4 Weeks @ RT + Assembly @ 215°C	90	0
3			4 Weeks @ RT + Assembly @ 255°C	90	0
4	Humidity Aging @ 60°C, 93% RH	2000 Hours	4 Weeks @ RT	90	0
5			4 Weeks @ RT + Assembly @ 215°C	90	0
6			4 Weeks @ RT + Assembly @ 255°C	90	0
7	Temperature Cycling @ -40°C to +85°C	1000 Cycles	4 Weeks @ RT + Assembly @ 215°C	90	0
8			4 Weeks @ RT + Assembly @ 255°C	90	0
9	Storage + Bias @ 5VDC	4000 Hours	4 Weeks @ RT + Assembly @ 215°C	90	-

Cells 1 – 3 were performed at the TDK Innoveta location under normal office storage conditions. We inspected the coupons under a 30X microscope and found ***no evidence of whisker growth on the samples.***

Cells 4 – 6 were performed at a TDK subsidiary laboratory. SEM-EDX results are shown in the attached reports. ***No whiskers were present that failed the NEMI criteria.***

Cells 7 – 8 were also performed at a TDK subsidiary laboratory. SEM-EDX results are shown in the attached reports. ***No whiskers were present that failed the NEMI criteria.***

Cell 9 was not performed due to lack of facilities/capacity.

Based on the tests performed, the samples **passed** the tin whisker test. Further details are available upon request. Please direct all inquiries to:

Customer Service
TDK Innoveta Inc.
1-877-498-0099
support@tdkinnoveta.com