

Keysight Technologies

Network Parameter Measurement:
Best Practices using the
Medalist i3070 In-Circuit Test

Software Release 7.20p

Application Note
Version 1.0

Introduction

This paper describes how to get the most from Network Parameter Measurement (NPM) capability on the Keysight Technologies, Inc. *Medalist* i3070 in-circuit test (ICT) system using enhancements in software version 7.20p. It is targeted at critical elements for NPM success. For general NPM and VTEP guidelines, refer to the white paper “Maximising Test Coverage with Keysight *Medalist* VTEP v2.0” found at www.keysight.com/see/vtep

NPM is a sensitive measurement requiring much greater care in fixturing and development than standard VTEP.

Fixturing considerations for NPM

A successful NPM fixture design must contain all of these elements:

- ▶ **VTEP Hardware and Sensor Mounting**

NPM requires that care be taken in mounting the VTEP sensor plates. The plate must cover the entire outline of the connector when engaged and not be rotated, elevated or misaligned.

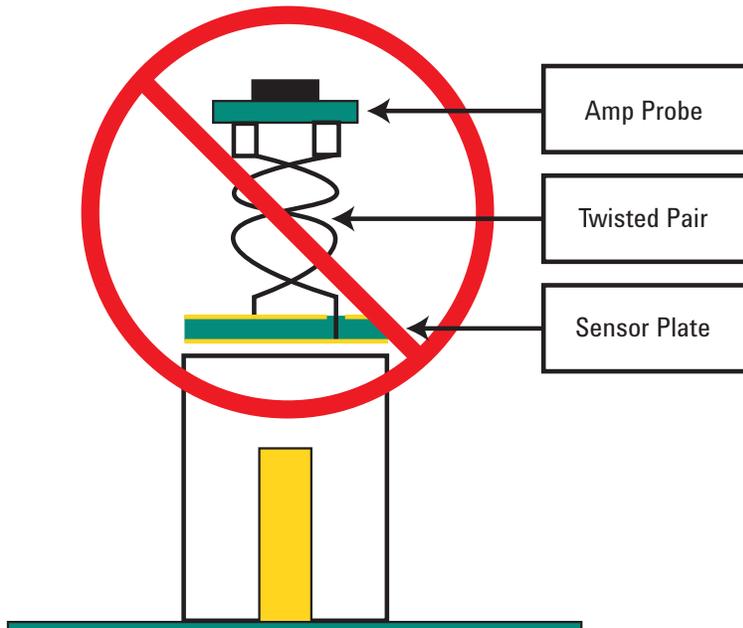
- ▶ **Sizing Sensor Plates**

Sensor plates should be sized to the outline of the device. While VTEP guidelines suggest sizing the plate slightly smaller than the device, this was targeted at ball-grid array (BGA) style devices and not connectors. For connectors, both standard VTEP and NPM will work best with the sensor sized to the outline of the device.

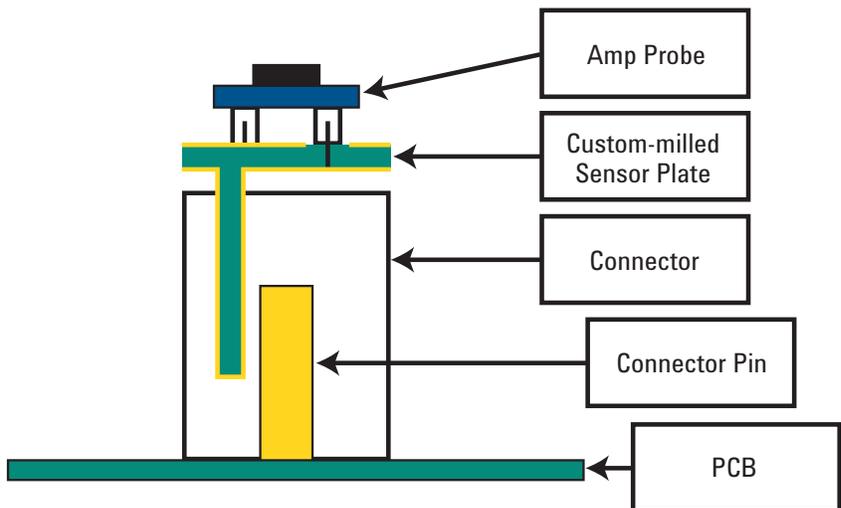
► Customizing Sensor Plates

When fabricating a custom sensor plate, follow the guidelines found in this white paper: "Maximising Test Coverage with Keysight Medalist VTEP v2.0".

WARNING: It can be of critical importance that the amp board be mounted directly to the sensor plate when using NPM. Never insert wiring at this interface. Doing so can inject significant noise into the measurements. *Proper mounting and wiring is extremely important when there are probes mounted on the same side of the fixture as the VTEP hardware. Often the probe wiring will couple to the wiring between the sensor plate and the amp and cause false readings. No probe should be within 1 cm of the VTEP sensor.*



Custom sensor plates can be milled from double-sided copper clad material to fit small geometry connectors and other devices. The diagram and photograph below show an L shaped sensor plate designed to fit into a small connector and yet provide ample space to mount the amp board to the plate.



Enhanced Guarding

Software release 7.20p includes an enhanced guarding feature. Enhanced guarding provides an improved guard path (lower impedance) for better VTEP and NPM measurements. Enhanced guarding should always be used with NPM.

Enhanced guarding is specified by adding “throughput adjustment 4” to the VTEP source. The process to add enhanced guarding is:

1. Add “default throughput adjustment 4” to the VTEP source
2. Compile the modified test.
3. Run Auto Debug.

► Why is it important?

Some DUTs have devices with pins that are connected through low-valued resistors to a fixed node. When these are guarded during the VTEP test, the small guard path impedance forms a voltage divider that allows the stimulus to leak into the fixed node. These many small signals sum together and cause the reading for the stimulus pin to be higher. This can mask an open.

► What does it do?

A new option is available to close the hybrid card switched ground connections automatically when running a VTEP test. This dramatically reduces the guard path impedance and improves the VTEP reading. The new guarding will not impact throughput and will not cause a ‘short to system ground’ error.

► When should it be used?

Enhanced guarding will improve all VTEP tests and should be used for every new development. Enhanced guarding should be added to existing boards when Auto Debug is run. After adding “throughput adjustment 4” to a test, some pins will have a lower nominal reading.

► Will enhanced guarding be added automatically?

Enhanced guarding will automatically be added to all new tests but will not automatically be added to existing tests. New tests will have enhanced guarding added to the sources as the default during program generation. The user must run Auto Debug after adding enhanced guarding. Auto Debug will preserve but not add enhanced guarding.

Supported Connectors

NPM relies on the network parameter measurements of the connector to detect opens on power and ground pins. These network parameters are described in connector models. These connector models are supplied by Keysight. New models for connectors not currently supported can be requested through www.keysight.com/see/vtep

The connectors and mounting styles in the following tables have been tested by Keysight. Other connector types or mounting styles in manufacturing may yield unsatisfactory results, such as test escapes or false positive calls.

► NPM Connector Measurements

The standard VTEP measurement of the signal pins on a connector must be at least 50fF and ideally 75fF – 100fF for NPM to successfully test the connector.

► NPM Connector Models

These connector models are supplied in the 3070 library structure beginning with the 7.2 software upgrade at:

`$Keysight\CT_ROOT\library\supplemental\connectors`

The following connectors and socket have NPM models at software release 7.20p:

Description	Mounting Technology	Typical Manufacturer Part Numbers	3070 Connector Model Name
FBD, 240 pins DDR II	SMT, TH	AT54007-H3BF-4F	fbdddr2_240_pin
DIMM, 240 pins DDR II	SMT, TH	1775805-1	ddr2_240_pin
PCI Express 32X	SMT, TH	2EG0E017-D2D-DF	pci_express_32x
PCI Express 16X	SMT, TH	2EG38211-D2D-4F	pci_express_16x
PCI Express 8X	SMT, TH	2EG08211-D2D-DF	pci_express_8x
PCI Express 4X	SMT, TH	2EG03211-D2D-DF	pci_express_4x
PCI Express 1X	SMT, TH	22EG01811-D2D-DF	pci_express_1x
Serial ATA 22 pins	SMT	LD11223-S03	sata_22_pin
Metral® 11Row	Press Fit	2H251103-NC201	metral_11_row
FH B-T-B 0.8mm, 80 pins	SMT	177983	08mmfh_80
775 pin LGA CPU socket	BGA	PE077507-2041-01	lga_775
1207 pin LGA CPU socket	BGA	PE120703-3741	lga_1207

With the 7.20p release model files can be in any directory pointed to by the LIBRARY_OPTIONS in the board file such as the board directory under CUSTOM_LIB or in the standard location on the test head controller at:

\$KeysightICT_ROOT/library/supplemental/connectors

Debug considerations for npm

▶ Auto Debug

Always use ADB to debug the “testjet_gx” file on a known good board (KGB). Remember that VTEP measurements are made for signal pins first. If these pass, then NPM is executed for the power, ground and fixed pins as defined in the connector model and map file. The KGB used for NPM needs to be a good representation of the boards being built. If process or part changes are causing NTF failures, a new boards from the current run should be Auto Debugged.

▶ Fault Insertion

When inserting faults on a connector to determine the NPM coverage, only single faults should be inserted at a time. In a typical manufacturing environment, connectors with a large number of faults will fail standard VTEP testing.

Summary

Proper grounding is becoming increasingly crucial with higher on-board signal speeds; for example, on PCIe, DDR and SATA connectors. NPM allows users to detect opens on power and ground pins on such connectors -- something that only recently, many industry players had conceded as beyond existing test capabilities. By following the pointers outlined in this paper, users can achieve the maximum benefits offered by NPM along with other test capabilities available on their Medalist i3070 in-circuit tester.

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