Keysight High Precision Electromagnetic Probe Tips

DS1203A High Precision Electromagnetic Probe Tips

KEYSIGHT

USER MANUAL

Notices

Trademark Acknowledgments

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, browse to one of the following URLs, according to the name of your product:

https://www.keysight.com/us/en/product/DS1203A/high-precision-electromagnetic-probe.html

To receive the latest updates by email, subscribe to Keysight Email Updates at the following URL:

https://support.keysight.com

Information on preventing instrument damage can be found at:

https://www.keysight.com/find/PreventingInstrumentDamage

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

https://www.keysight.com/find/techsupport

Product and Solution Cybersecurity

Keysight complies with multinational regulations for the cybersecurity of its own products and is committed to providing information to assist you in protecting your products and solutions from external cyber threats. For more information, see:

https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security.html

Keysight also recommends that you secure your IT environments using appropriate third-party tools. For instruments that run the Microsoft Windows operating system, Keysight concurs with Microsoft's recommendations for ensuring that the instrument is protected:

— Get the latest critical Windows updates

— For network-connected instruments, use an Internet firewall (in Keysight instruments, Windows Firewalls enabled by default)

— For network-connected instruments, use up-to-date antivirus and anti-spyware software

Responsible Disclosure Program

Keysight recommends that security researchers share the details of any suspected vulnerabilities across any asset owned, controlled, or operated by Keysight (or that would reasonably impact the security of Keysight and our users) using this form:

https://www.keysight.com/us/en/contact/responsible-disclosure-program.html

Report a Product Cybersecurity Issue

If you discover a cybersecurity issue that you suspect may involve Keysight's proprietary software, or third-party software supplied by Keysight as part of a product, or that may affect the operation of Keysight products, we encourage you to report it to us using this form:

https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security.html

Contents

Manufacturer Address

Keysight Technologies Netherlands Riscure B.V.

Delftechpark 49

2628 XJ Delft, The Netherlands

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

Before operation, you should review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

General

WARNING This product has been manufactured and tested according to international safety standards. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

WARNING **Use only the Keysight supplied power cord or cords with the same or better electrical rating.**

Using other power cords may present a fire hazard or cause serious to deadly injury.

WARNING **Use only the Keysight supplied power supply.**

Using other power supplies may present a fire hazard or cause serious to deadly injury.

Before Applying Power

Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.

Do not Operate in Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Instrument Markings

Instrument Marking	Description
	The instruction manual symbol. The product is marked with this warning symbol when it is necessary for the user to refer to the instructions in the manual.
	Direct Current
	Alternate Current

Specification

Environmental Specifications

Parameter	Description	Comment
Ambient operating temperature	10 – 30 °C	
Ambient non-operating temperature	-10 – 50 °C	
Humidity	< 90 %	Non-condensing
Operating altitude	Up to 2000 m	
Overvoltage category	II	
Pollution degree	2	For indoor use only

Electrical Specifications

For detailed power input ratings of this product please refer to the rating label placed on the product.

Electrical Specifications (AC Adaptors)

Parameter	Description	Comment
Line Voltage	100 – 240 V~	
Line Frequency	50 – 60 Hz	
Input Current	1.0 A max.	
Line Voltage Fluctuations	± 10 %	
Output Voltage	6 / 12 / 15 / 24 V⎓	Depending on model
Output power	36 W max.	

Electrical Specifications (Keysight U8002A Power Supply)

If your product is delivered with a Keysight Technologies U8002A Power Supply, please also review the U8002A Power Supply and its manual for safety markings and instructions. You must also follow these to ensure safe operation and to maintain the instrument in safe condition.

Physical Specifications

The physical specification of the product, in detail the dimensions and the weight is documented in the specific User Manual delivered with your product.

Cleaning the instrument

WARNING

To prevent electrical shock, disconnect the instrument from mains before cleaning.

Use a dry cloth slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

Connections to External Circuits

All external I/O connections are supplied by non-hazardous voltages supplied by circuits of limited energy.

WARNING

All external inputs connected to ports shall provide reinforced or double insulation against hazardous voltages for protection against electric shock and shall have voltage below 30 Vrms and 42.4 Vpeak or 60 VDC.

CAUTION

Connecting an instrument to voltages other than rated may introduce excessive voltage and damage the device. Excessive voltage can lead to thermal stress, breakdown of insulating materials, or direct electrical failure, necessitating repairs or replacements. Always refer to product model specifications to avoid such damage.

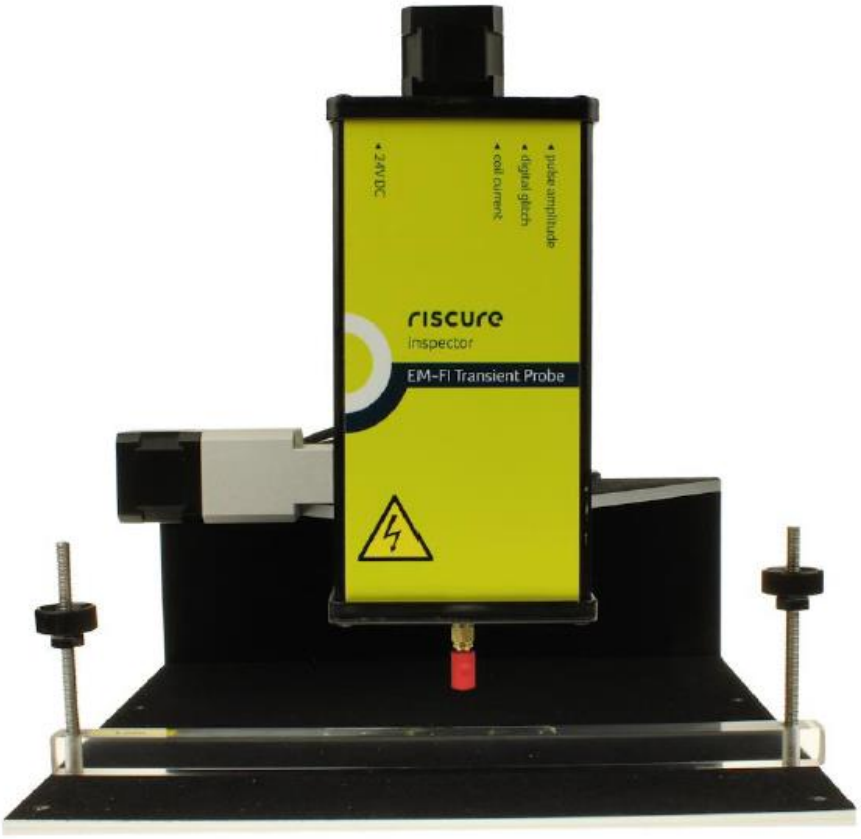
What It Does

The High Precision Electromagnetic Probe Tips are used for electromagnetic fault injection (EM-FI) attacks on semiconductor targets, for example smart cards.

The tips are designed to fit on the Unidirectional Fault Injection Probe and are easily replaceable.

The different tips enable a pulsed high voltage, provided by the EM-FI Transient Probe, to be transferred into a spot-sized, electrical or electromagnetical perturbation.

Figure 1 The Unidirectional Fault Injection Probe fitted with a red Classic probe tip



EM-FI Classic Probe Tip

Figure 2 EM-FI Classic probe tips

The Classic probe tip is made of a copper winding around a ferrite core.

An electric current pulse through the winding generates a transient electromagnetic field. This field penetrates an encapsulation and any deeper metal layers.

By orienting the probe perpendicular to the target surface, the direction of the EM field will also be perpendicular to the target surface. The perturbation is most effective in (un)intended circuit loops, for example between neighboring logic gates and shared power lines.

The red and black tips differ only in a reversed winding. The best practice is the execution of trial perturbations with each tip and to select the tip which gives the best results.

When the required penetration distance is more than 1.5 mm, for example due to the thickness of encapsulation, use the larger diameter tip.

EM-FI High Precision Tips

Figure 3 EM-FI High precision tip

Similar to the Classic probe tips.
The High precision tips are made of a copper winding around a ferrite core.

An electric current pulse through the winding generates a transient electromagnetic field. This field penetrates an encapsulation and any deeper
metal layers.

By orienting the probe perpendicular to the target surface, the direction of the EM field will also be perpendicular to the target surface. The perturbation is most effective in (un)intended circuit loops, for example between neighboring logic gates and shared power lines.

The white, yellow, and green tip differ in diameter and windings. The best practice is the execution of trial perturbations with each tip and to select the tip which gives the best results.

When the required penetration distance is more than 1.5 mm, for example due to the thickness of encapsulation, use the larger diameter tip.

EM-FI Crescent Probe Tip

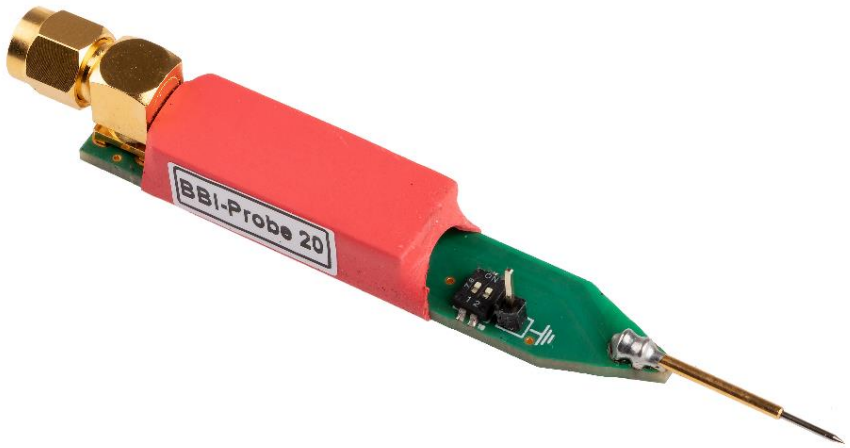
Figure 4 EM-FI Crescent probe tip

The Crescent probe tip is made of two windings around a ferrite ring with an air gap. An electric current pulse through the probe winding generates a transient electromagnetic field which bridges the air gap.

The direction of the EM field generated by the crescent probe tip differs from the classic probe tips. When the probe is oriented perpendicular to the target surface, the EM field in the air gap is directed along the surface. The perturbation is most effective in wiring (e.g., bus lines) in the direction perpendicular to the EM field and along the target surface.

EM-FI BBI Probe Tip

Figure 5 EM-FI BBI probe tip



The Body Biasing Injection (BBI) probe tip is designed for electrical perturbation through direct contact with the silicon substrate. The tip is an industrial grade construction using a spring-driven needle to ensure a solid contact.

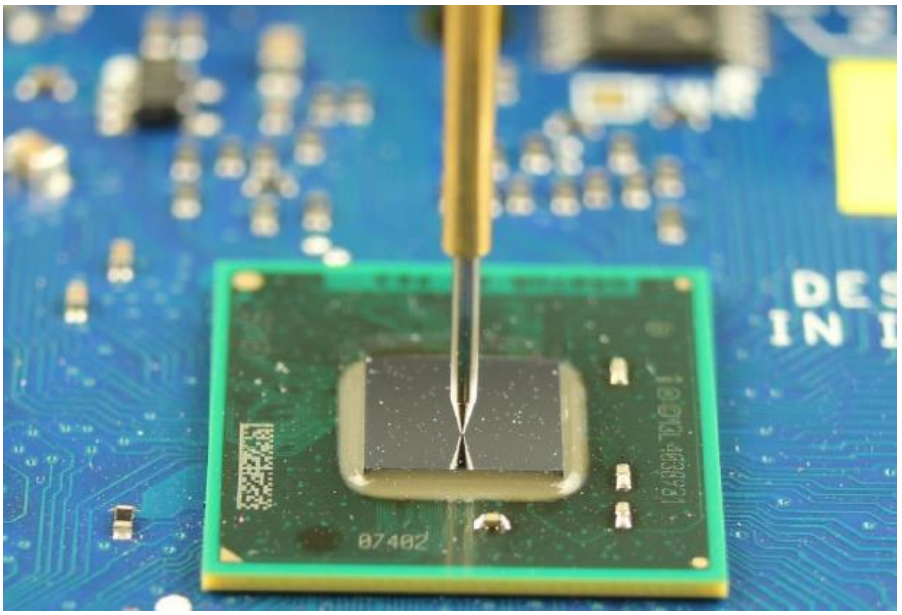
The body of BBI tip contains a small transformer which taps into the output voltage of the Unidirectional Fault Injection Probe.

Different tips are provided which vary in polarity and result voltage.

Color	Polarity	Voltage	Output
Red	Positive	+200V (± 20%)	15 ns
Blue	Positive	+ 33V (± 20%)	12 ns
Green	Negative	- 37V (± 20%)	20 ns
Black	Negative	-200V (± 20%)	23 ns

Measurements are performed at 100% power and with a 20 ns trigger pulse for the Unidirectional Fault Injection Probe.

Figure 6 The BBI tip applied to a chip



EM-FI BBI Probe Tip Advance Feature

With the advance feature of the BBI probe it is possible to generate a smoother transient pulse. To use this feature:

— Connect external ground pin of BBI probe to target ground.

— Set switches to appropriate position.

Figure 6 The BBI switch and external ground pin photo shows both switches #1 & #2 in “ON” position

Figure 7 External ground pin of the BBI connected to a header cable

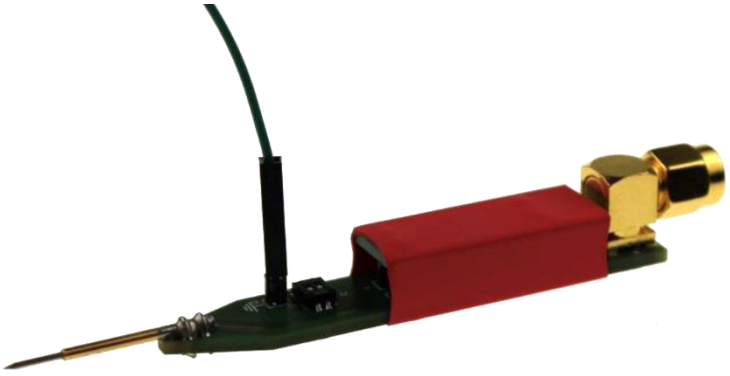


Figure 8 The Switches in the Default position. The GND is not connected to the Target Ground.

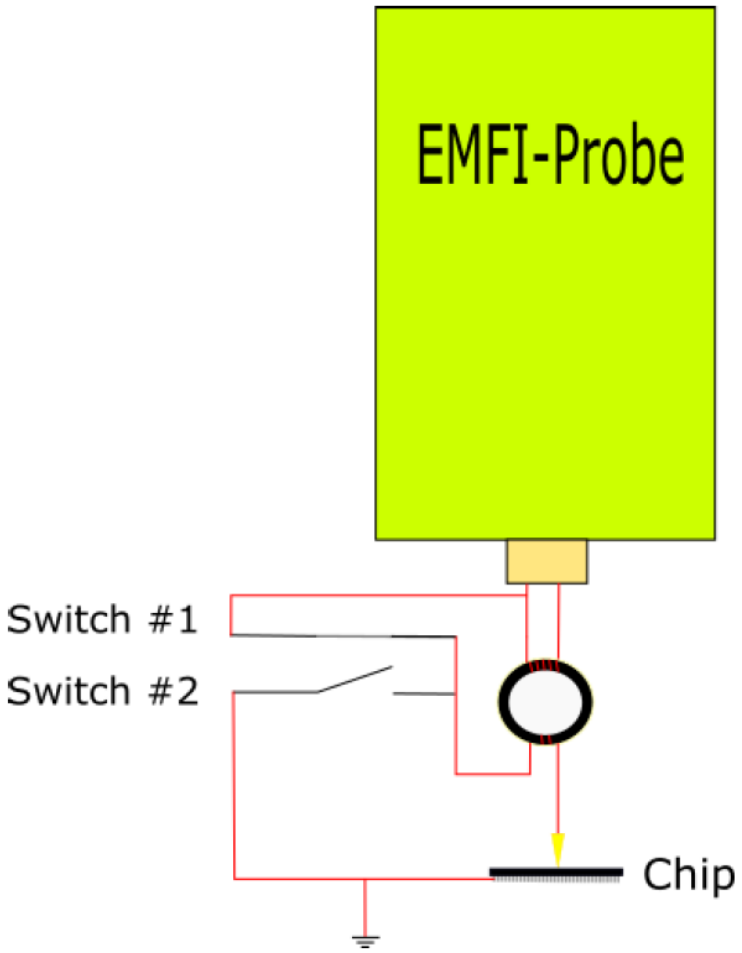


Figure 9 The Switches in the Advance position. The GND is connected to the Target Ground. Switch #1 is off, switch #2 is on.

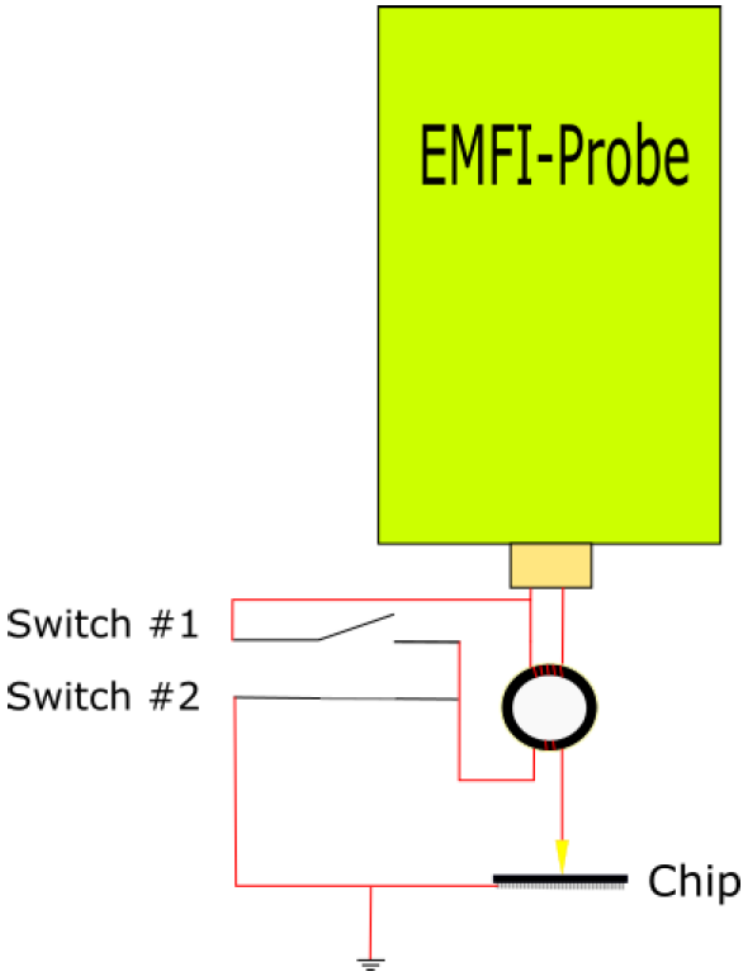


Figure 10 Pulse of red BBI probe with switch # 1 in the“ON” position and switch #2 in “OFF” position

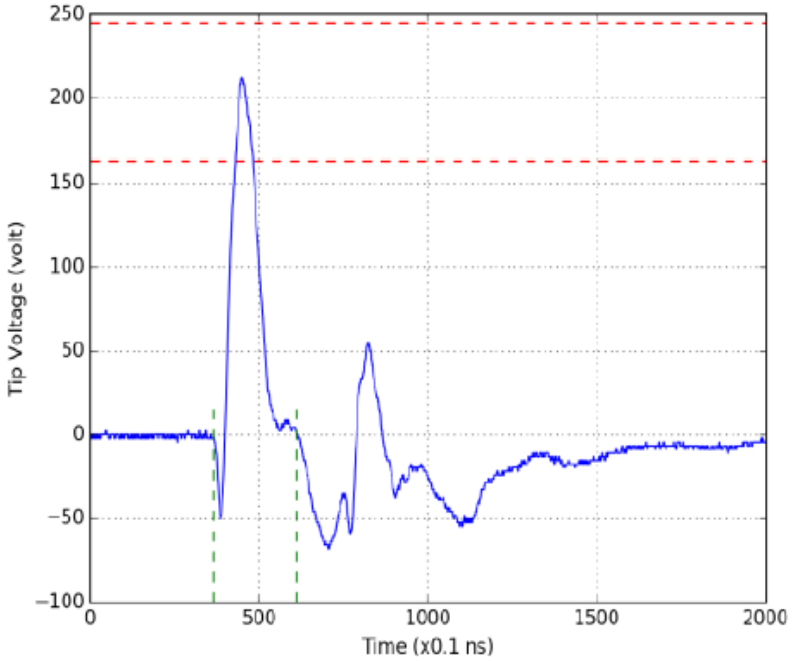
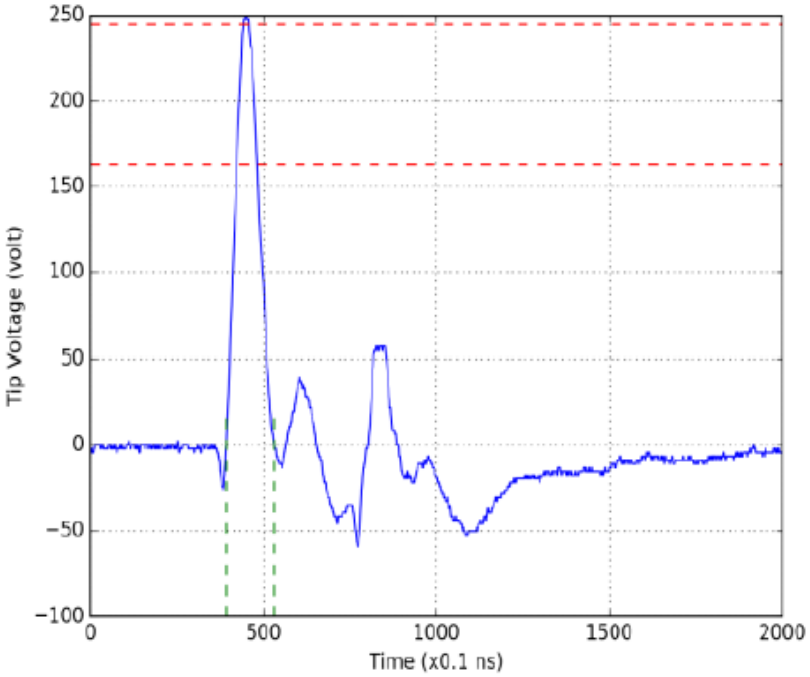


Figure 11 Pulse of red BBI probe with switch # 1 in the “OFF” position, switch #2 in “ON” position and with external ground pin connected to target ground



Help and Troubleshooting

Common problems

No issues.

Interoperability issues

Using BBI tips with Probe Station

NOTE A BBI tip is spring driven and exerts a force onto the target's surface when moving sideways, so there is a risk of damaging the surface.

Solution: An updated Probe Station driver is available which enables a hopping mode motion by retracting the probe before any lateral displacement. Refer to the support portal.

When working with the Probe Station you might want to adjust the bracket of the EM-FI to the bottom two holes.

By doing this the Z-axis of the Probe Station does not have to extend that far to place the tip of the BBI probe on the target chip.

Figure 10 The EM-FI bracket

Still have questions?

Visit the Keysight Support Portal: http://support.keysight.com.

Technical Specifications

Operational conditions

— Room temperature 20 – 30 °C, (68 – 86 °F).

Probe characteristics

— Probe characteristics are detailed in the “Unidirectional Fault Injection Probe Datasheet,” available on request from Support.

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