

EM-FI Probe Tips

Quick Start Guide

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The probe tips must be used according to the EM-FI Probe Tips user guide. Any operation related to maintenance, repair or calibration must be carried out by qualified personnel. Consequently, in case of failure, contact Riscure to find out about the procedure to follow.

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What is in the box

The box contains a set of probe tips.

Note: This document describes all available probe tips. You may have ordered a package with a subset of these tips.



Box content checklist

Qty [1]	Description		Identifier [2]
4	EM-FI Classic tips (optional ^[3]) - black (ø 1.5 and 4 mm) - red (ø 1.5 and 4 mm)		
3	EM-FI High precision tips (optional ^[3]) - White (ø 0.3 mm) - Yellow (ø 0.5 mm) - Green (ø 0.75 mm)		
1	EM-FI Crescent tip (optional ^[3])		
4	EM-FI BBI tips (optional ^[3]) - blue - green - red - black		
-	This "EM-FI Probe Tips - Quick Start Guide"		

^[1] The amount or number of registered items (quantity, Qty)

^[2] Identifier used in this document to refer to the item

^[3] Optional: your package may contain a subset of these probe tips depending on your purchase.

What does it do

The EM-FI 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 EM-FI Transient 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.

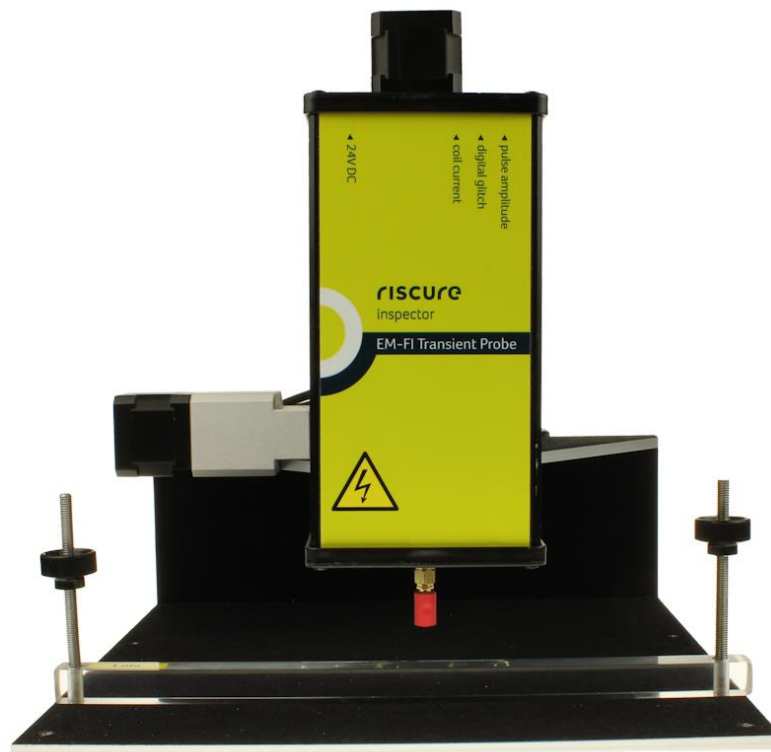


Figure 1 The EM-FI Transient Probe fitted with a red Classic probe tip.

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. A best practice is the execution of trial perturbations with each tip and 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 tips.

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. A best practice is the execution of trial perturbations with each tip and 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 2 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

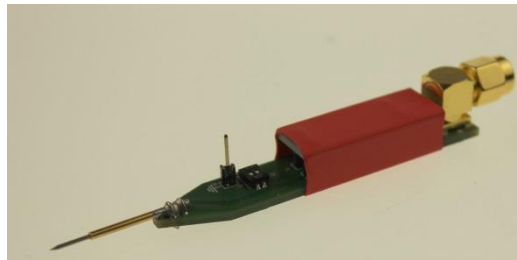


Figure 5 EM-FI BBI probe tip

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 EM-FI Transient Probe.

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

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

Measurements are performed at 100% power and with a 20 ns trigger pulse for the EM-FI Transient Probe.

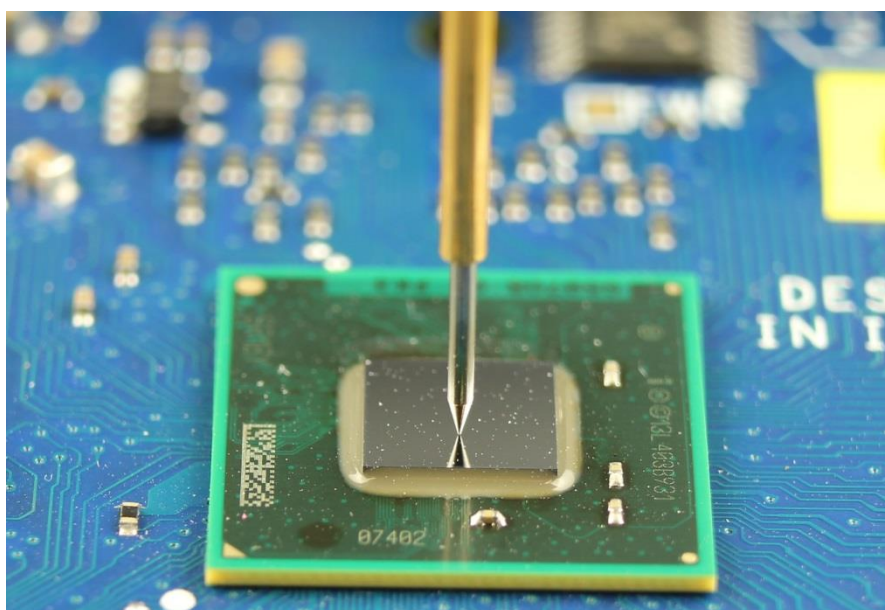


Figure 6 The BBI tip applied to a chip.

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.

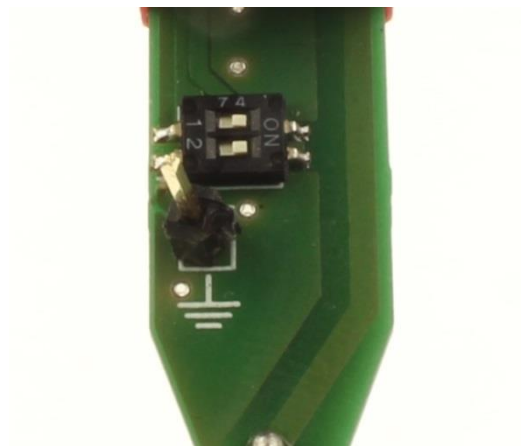


Figure 6 The BBI switch and external ground pin photo shows both switches #1 & #2 in “ON” position.

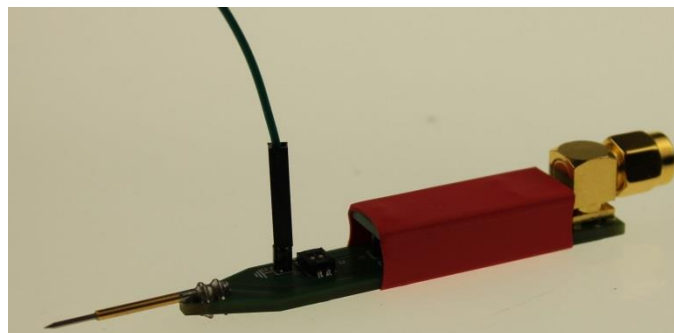


Figure 7 External ground pin of the BBI connected to a header cable.

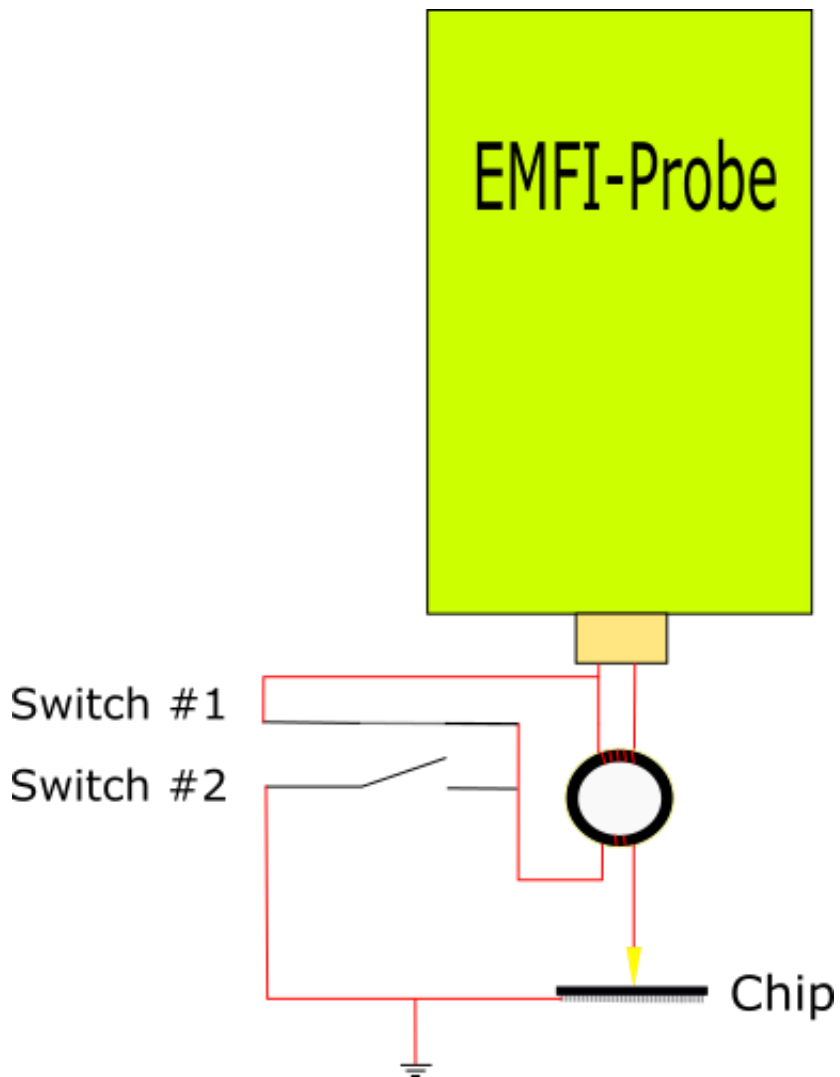


Figure 8 The Switches in the Default position. The GND is not connected to the Target Ground.

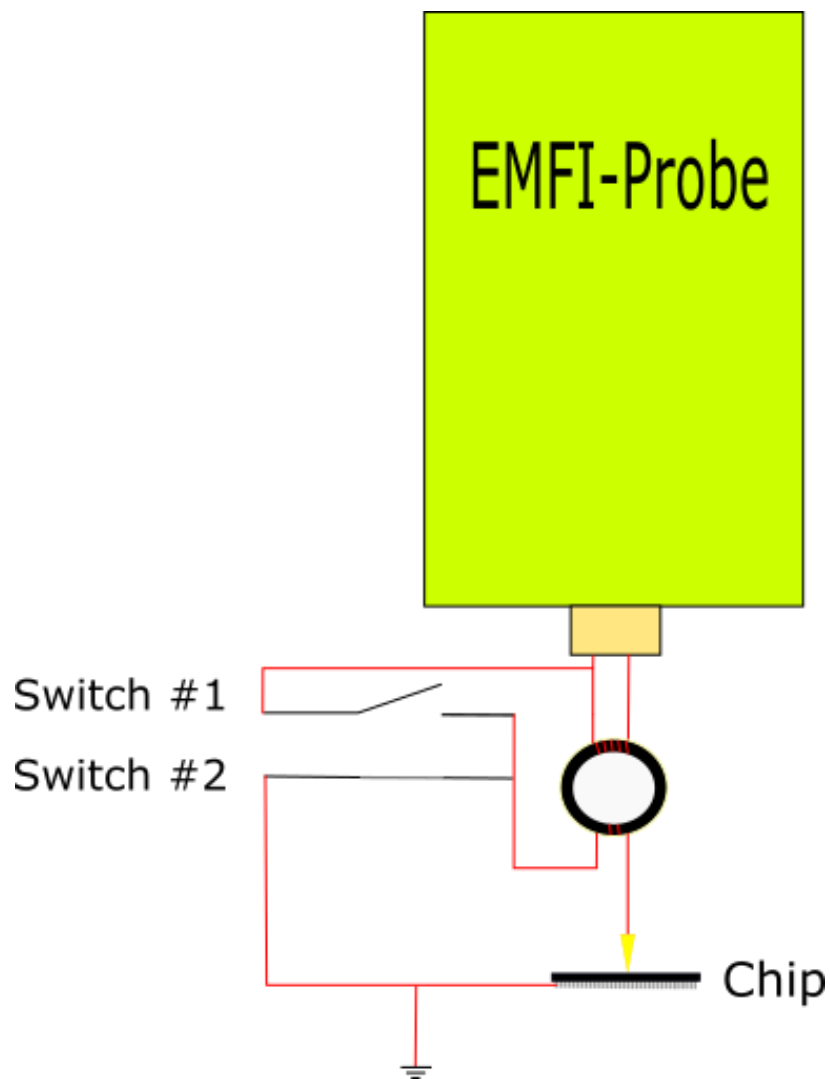


Figure 9 The Switches in the Advance position. The GND is connected to the Target Ground. Switch #1 is off, switch #2 is on.

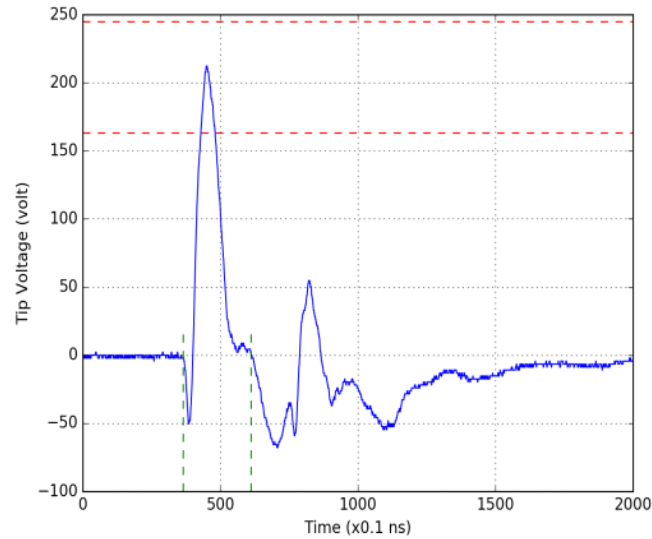


Figure 10 Pulse of red BBI probe with switch # 1 in the “ON” position and switch #2 in “OFF” position.

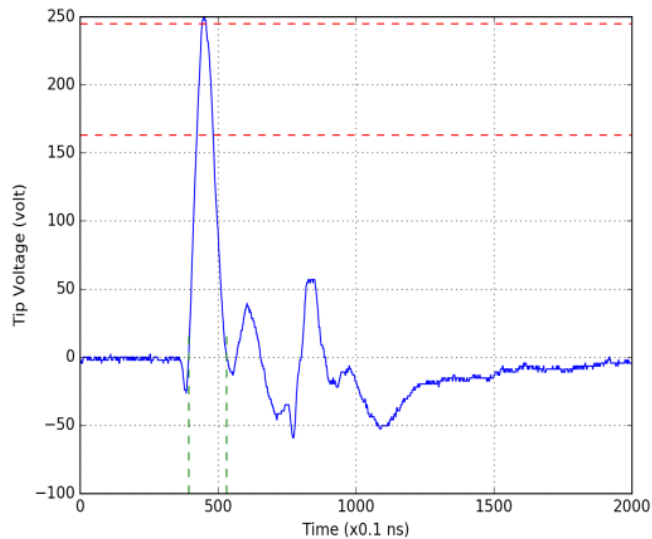


Figure 11 Pulse of red BBI probe with switch # 1 in the “OFF” position, switch #2 in “ON” position and with external ground pin connected to target ground.

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 Riscure Support Portal: <http://support.riscure.com>

Technical specifications

Operational conditions

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

Probe characteristics

- Probe characteristics are detailed in the “EM-FI Transient Probe Datasheet”, available on request from Support.