



**Probing Solutions.
Made in Germany.**

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FireFly[®]

High Voltage Optically-Isolated Probe
> 1.5 GHz, > 180 dB CMRR

Preliminary Datasheet



About FireFly®

The FireFly® high voltage optically isolated probe offers industry leading performance that combines the ability to accurately resolve high bandwidth, small differential signals in the presence of large common mode voltages with its ultra-high common mode rejection performance across its entire bandwidth. With best-in-class > 1.5GHz bandwidth, wide differential input range, unmatched CMRR up to > 180dB (1 billion to 1 rejection), and a 60kV common mode, FireFly® is the ideal measurement solution for both GaN and SiC device characterization and system level design development.

PMK's new optically isolated interface and unique compact angled probe head design (patents pending) are the key attributes that set FireFly® apart from the other solutions in the market, providing very stable and accurate measurements over a wide temperature range and easy access to the measurement points in tight spaces.

The compact angled probe head design allows for shorter tip cables to be used, resulting in higher signal fidelity measurements and reduced stresses placed on the measurement test point. FireFly®'s wide selection of probe tip connections and accessories offer reliable, hands-free, high-fidelity connectivity to the measurement points. Using industry standard MMCX and square pins connections allow FireFly® to easily interface to test boards that have already been design with these test points. The FireFly® probe head is powered by an easy to change, rechargeable, industry standard 18650 battery that provides continuous operation for up to 30h at room temperature. FireFly® has a universal BNC output connector and is compatible with any oscilloscope with a 50Ω input impedance or 1MΩ input impedance and a 50Ω feed-through termination, allowing FireFly® to be used on any oscilloscope in the lab. For accurate deskew, each probe's unique propagation delay is measured and added to each probe label.

FireFly® can be controlled from the controls located on the interface box or via remote control. The „PMK Probe Control“ software provides the ability for the user to control the probe remotely via a computer, and provides the user with a graphical user interface. The software is free of charge, and included with PMK's 2ch and 4ch power supplies PS-02 and PS-03, which are required to power the probe. The PS-02 and PS-03 power supplies all have a USB interface and are available with optional LAN interface. The new AP-01, 1 channel battery pack power supply, provides >8h of portable and isolated operation which allows the user the flexibility of where the probe can be used. The AP-01 supplies power only to the probe with no software remote control.

ISO17025 calibration upon delivery or as re-calibration is possible on request.

Key Features

- Stable over wide temperature range, low offset drift
- Best-in-class > 1.5GHz bandwidth, 50% more bandwidth than the other solutions in the market.
- Unmatched <300ps rise time, >30% faster than as other solutions
- Ultra-high CMRR
 - More than one billion to one (> 1.000,000,000:1, >180dB) from DC to 500kHz
 - Ten thousand to one (10,000:1, 80dB) at 1GHz
- ±60kV common mode voltage
- Perfect for GaN and SiC devices
- Wide range of differential input voltages, coming soon
- Low DUT loading with replaceable high impedance probe tips
- <2% DC gain accuracy
- Compact probe head design
 - Easy access to measurement points
 - Multiple probes used in very confined areas
- Accurate deskew, probe's propagation delay measured and added to each probe label
- Auto-Zero without disconnecting from circuit under test, also via remote control
- Versatile and wide range of tip connectivity options
- Complete galvanic isolation
- Quiet operation, no fan
- Long >30h battery life at room temperature

Specifications

The final specification table is coming soon. This probe is not for handheld use, and can be used without probe tip. Observe adequate spacing between probe components and earth ground. Warm up time 20 minutes. Read the safety instructions before first use.

Electrical Specifications ¹							
FireFly®	FF-1500						
Bandwidth (-3dB)	SMA Input	FF-MMCX-1 V		FF-MMCX-10 V		FF-MMCX-50 V	
	> 1.5 GHz	> 1.5 GHz		> 1.3 GHz		> 1.3 GHz	
Rise time (10% - 90%)	SMA Input	FF-MMCX-1 V		FF-MMCX-10 V		FF-MMCX-50 V	
	<300 ps - preliminary	<300 ps - preliminary		<300 ps - preliminary		<300 ps - preliminary	
Differential Input Voltage & Input Impedance	Input/Tip Cable	Linear Input Voltage Range² (DC + Peak AC)		Input Attenuation		Input Impedance²	
	SMA Input	± 1 V		1X		200 kΩ 5.1 pF	
	FF-MMCX-1V	± 1 V		1X		50 Ω ³	
	FF-MMCX-10V	±10 V		10X		2 MΩ 3.4 pF	
	FF-MMCX-50V	± 50 V		50X		10 MΩ 2 pF	
Common Mode Rejection Ratio (CMRR) ⁴	Input/Tip Cable	DC	1 MHz	100 MHz	200 MHz	500 MHz	1 GHz
	SMA Input	> 180 dB	173 dB	105 dB	95 dB	90 dB	80 dB
	FF-MMCX-1V	> 180 dB	TBD	TBD	TBD	TBD	TBD
	FF-MMCX-10V	> 180 dB	TBD	TBD	TBD	TBD	TBD
	FF-MMCX-50V	> 180 dB	TBD	TBD	TBD	TBD	TBD
Common Mode Voltage ⁵ (Maximum Voltage to Earth)	± 60 kV (DC + Peak AC)						
Maximum Non-Destruct Differential Input Voltage (DC + Peak AC) ²	SMA Input	FF-MMCX-1V		FF-MMCX-10V		FF-MMCX-50V	
	5 V - preliminary	5 V - preliminary		50 V - preliminary		100 V - preliminary	
DC Gain Accuracy	<2 % ± DC Offset voltage - preliminary						
Noise (input referred) (Noise scales proportionally to tip attenuation)	SMA Input (1X): < 1.9 mV rms - preliminary With tip cable: (SMA Input noise) · (Tip cable input attenuation) ⁶						
DC Offset Voltage (input referred) (Offset voltage scales proportionally to tip attenuation)	SMA Input (1X): < 2 mV (After Auto-Zero) – preliminary With tip cable: (SMA Input offset voltage) · (Tip cable input attenuation) ⁷						
Propagation Delay	2 m fiber cable: 15 ns The probe specific value is measured and printed on interface box label, tip cable approx. 500 ps						
Battery Life (Continuous Operation)	> 30 h @ 22 °C – 25 °C > 20 h @ 0 °C, >4 h @ 50 °C (Dependent on probe head operating temperature)						
Output Termination & Coupling	50 Ω DC						
Laser Certification	IEC/EN 60825-1:2014; US 21CFR Part 1010; US 21CFR Part 1040						

This product comes with 2 years warranty. Specifications that are not marked with (*) as guaranteed are typical.

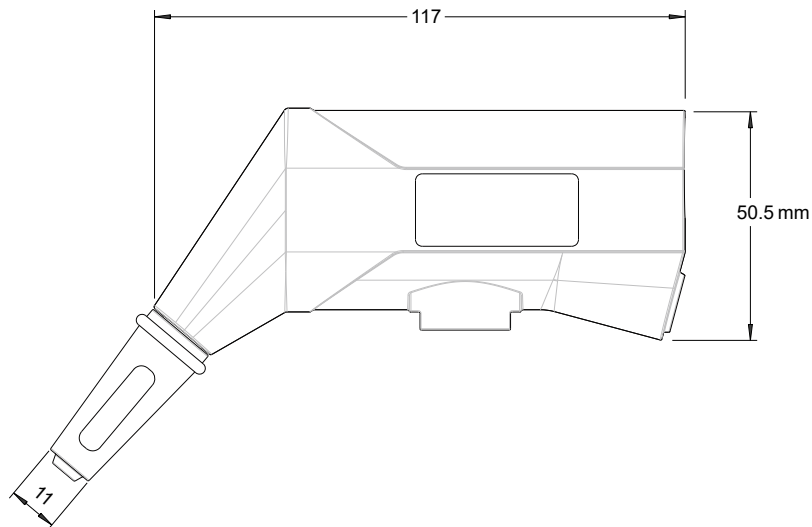
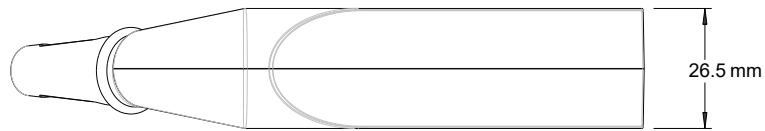
Notes:

- ¹ Determined when using a PS-02 power supply at +23 °C ambient temperature.
- ² For input voltage and input impedance derating graphs, see user manual.
- ³ Terminated, 50 Ω transmission line.
- ⁴ CMRR performance is > 180 dB below 500kHz. See CMRR graph.
- ⁵ Galvanically isolated FireFly® probe head through fiber optic connection.
- ⁶ Example: 10x tip FF-MMCX-10V noise = 10x SMA input noise.
- ⁷ Example: 10x tip FF-MMCX-10V offset = 10x SMA input offset.

Mechanical Specifications	
Weight	Probe: 325 g Tip cable: 11 g
Fiber Cable Length	2 m (6.56 ft) - (From probe head to interface box)
Tip Cable Length	9.5 cm (3.74")
Input Interface	SMA, universal SMA (female) - Probe head
Output Interface	BNC, universal BNC (male) - Interface box

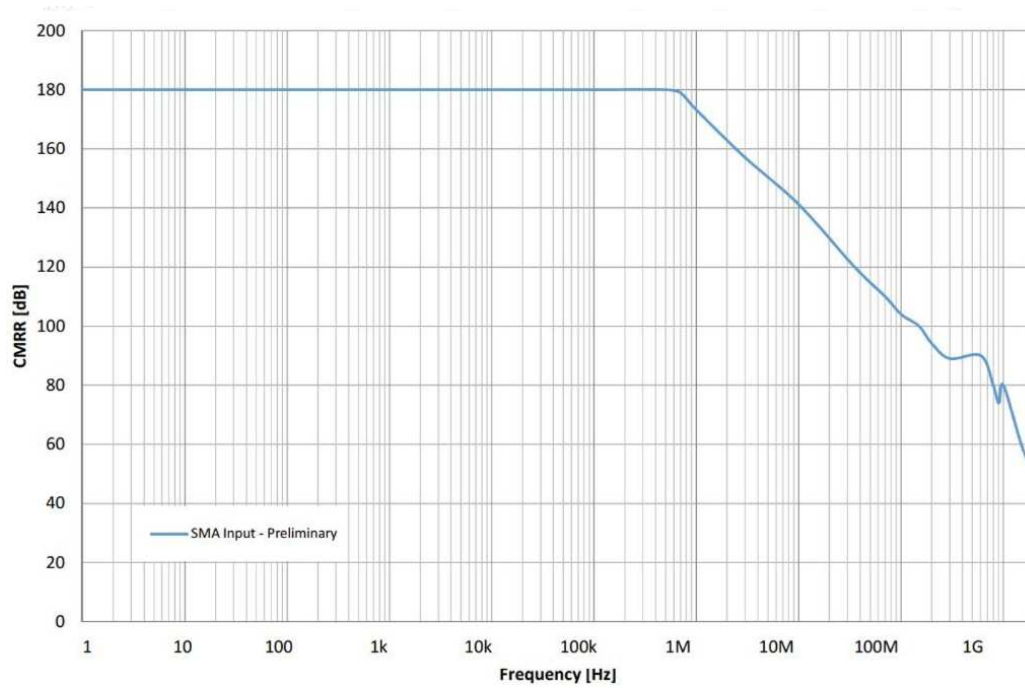
Environmental Specifications		
Altitude	Operating	up to 3000 m (9843 ft)
	Non-Operating	up to 15000 m (49213 ft)
Temperature Range	Operating	Tip cable: -40° C to +85° C Probe head: 0° C to +50° C Interface box: 0° C to +50° C
	Non-Operating	Tip cable: -40° C to +85° C Probe head: -20° C to +71° C Interface box: -20° C to +71° C
Maximum Relative Humidity	Operating	Tip cable: 5 % to 85 % RH (relative humidity) at up to +85°C, non-condensing Probe head: 5 % to 85 % RH (relative humidity) at up to +40° C, 5 % to 45 % RH above +40° C up to +50° C, non-condensing Interface box: 5 % to 85 % RH (relative humidity) at up to +40° C, 5 % to 45 % RH above +40° C up to +50° C, non-condensing
	Non-Operating	Tip cable: 5 % to 85 % RH (relative humidity) at up to +85°C, non-condensing Probe head: 5 % to 85 % RH (relative humidity) at up to +40° C, 5 % to 45 % RH above +40° C up to +71° C, non-condensing Interface box: 5 % to 85 % RH (relative humidity) at up to +40° C, 5 % to 45 % RH above +40° C up to +71° C, non-condensing

Dimensions



Typical Common Mode Rejection Ratio (CMRR)

FireFly® Typical CMRR Performance without input tip cable extension



Typical Maximum Differential Input Voltage (CW)



Note that the maximum input voltage rating of the probe decreases as the frequency of the applied signal increases.

The maximum input voltage derating is coming soon.

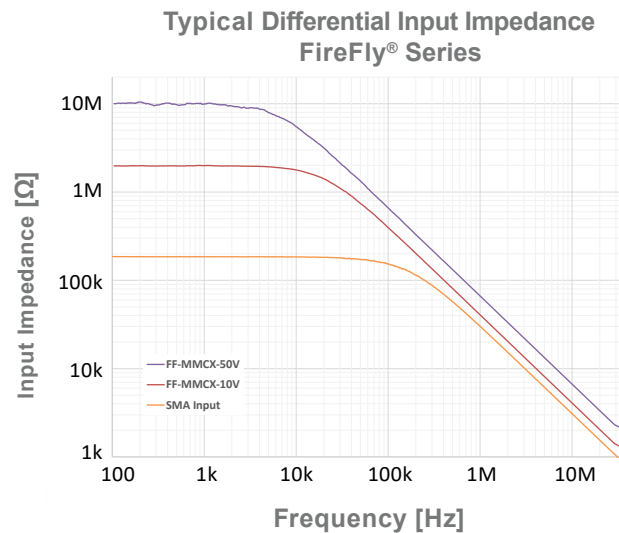
Typical Frequency Response

The typical frequency response is coming soon.

Typical Differential Input Impedance



The input impedance of the probe decreases as the frequency of the applied signal increases.



Scope of Delivery

The full overview of the scope of delivery is coming soon. The following table list the accessories that are shipped with the probe. The power supply is required and must be ordered separately.

Qty	Article-number	Description	Picture
1	FF-1500	FireFly® Probe, >1.5GHz base probe, SMA input (tips ordered separately). interface box power supply required and ordered separately.hh	
1	n/a	Factory calibration certificate	n/a
1	n/a	Safety manual – Read before first use	n/a
2	FF-BAT-18650	Rechargeable FireFly® battery, Lithium-Ion 18650	TBD
1	890-520-900	Power supply cable 0.5m for PS02/PS03/AP01 power supply models	
1	FF-2FOOTER	Probe holder 2 Footer (Bipod)	TBD
	TBD	Set marker bands (4 x 4 Colors) FireFly®	TBD


Ordering Information

The power supply must be ordered separately.

Models	
Order No.	Item
FF-1500	FireFly®, >1.5GHz base probe, >160dB, SMA input, BNC output

Optional Accessories and Calibration

The full overview of the optional accessories is coming soon.

Article number	Description	Picture
FF-CHARGERx	Charger, 4 slots / 8 slots model	TBD
FF-KIWI	Probe holder Kiwi	TBD
FF-MMCX-1V	Probe tip cable MMCX, ±1V, 1x attenuation, >1.5GHz	TBD
FF-MMCX-10V	Probe tip cable MMCX, ±10V, 10x attenuation >1.3GHz	TBD
FF-MMCX-50V	Probe tip cable MMCX, ±50V, 50x attenuation >1.3GHz	TBD
FF-SQ-MMCX5	Probe tip adapter MMCX to 0.025" (0.635 mm) square pins with 0.100" (2.54 mm) space, pack of 5	TBD
D010031	50Ω BNC feedthrough for use with 1MΩ oscilloscope inputs, 0.5W	
KAL-FF	Factory re-calibration with adjustment	n/a
FF-2FOOTER	Probe holder 2 Footer (Bipod)	TBD
<i>coming soon</i>	<p>Future enhancements:</p> <ul style="list-style-type: none"> • Probe tip, ±250V, 250x attenuation • Probe tip, ±500V, 500x attenuation • Probe tip, ±1000V, 1000x attenuation • Probe tip, ±2500V, 2500x attenuation • New connectivity solutions • Power-Over-Fiber adaptor <p><i>If you need any non-published accessory, please contact us via sales@pmk.de</i></p>	
KAL-DAKKS-FF	ISO 17025 (re-)calibration	n/a

Power Supplies

Order No.	Item
889-09V-PS2	PS-02 (2 channels, with USB interface for remote control)
889-09V-PS2-L	PS-02-L (2 channels, with LAN and USB interface for remote control)
889-09V-PS3	PS-03 (4 channels, with USB interface for remote control)
889-09V-PS3-L	PS-03-L (4 channels, with LAN and USB interface for remote control)
889-09V-AP01	AP-01 (battery pack, 1 channel, no remote control)
890-520-900	Power supply cable (0,5 m)*
890-520-915	Power supply cable (1,5 m)

* The power supply cable (0.5 m) is included as standard with all PMK probes requiring a PS02/03/AP01 power supply.

Manufacturer

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