



Probing Solutions.
Made in Germany.

EN



BumbleBee[®] Series

High Voltage Differential Probes

400 MHz, ± 2000 V

Datasheet



About BumbleBee®

The PMK BumbleBee® high voltage differential probe offers industry leading performance needed for today's power designs, especially those using wide bandgap devices, such as SiC and GaN. BumbleBee's® best-in-class 400MHz bandwidth combined with its $\pm 2000\text{V}$ input voltage range and exceptional CMRR up to 80dB provides the ability to accurately capture the most challenging floating measurements. The probe's performance makes it an ideal choice for designing and evaluating power circuits, such as measurements in switching power supplies, motor drives, inverter, IGBT circuits and frequency converters. BumbleBee's® four selectable input attenuator ranges, 50X, 100X, 250X and 500X, provides the user with the ability to select the voltage ranges needed with the lowest noise and best resolution possible. The probe is compatible with any oscilloscope with a 50Ω input impedance and has DC output offset correction up to $\pm 4\text{V}$ (output referred).

BumbleBee® can be controlled from the controls located on the probe head 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 have a USB interface as well as an optional LAN interface. The new AP-01, 1 channel battery pack power supply, provides >8hrs 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, KAL-DAKKS-BB.

Measurement Principle

The high voltage differential probe consists of two balanced precision attenuators, which are differentially matched. The attenuators scale the input voltage before passing into the differential amplifier. The output of the differential is fed over a driver stage to the 50Ω input of a measuring device.

Specifications

Electrical Specifications ¹				
Attenuation (< $\pm 1\%$ guaranteed)	50:1	100:1	250:1	500:1
Bandwidth (-3dB) Small Signal (guaranteed)	400MHz			
Rise time (10% - 90%) Small Signal	1.0ns		0.9ns	
Maximum Rated Input Voltages ³				
No Measurement Category	6000V transient Overvoltage 2000Veff.			
CAT III	1000V			
Pollution Degree	2			
Max. Differential Input Voltage (DC + AC peak)	$\pm 200\text{V}$	$\pm 400\text{V}$	$\pm 1000\text{V}$	$\pm 2000\text{V}$
Common Mode Voltage	$\pm 2000\text{V peak}$ (1400V RMS)			
DC Gain Accuracy	$\pm 0.7\%$	$\pm 0.7\%$	$\pm 0.35\%$	$\pm 0.35\%$
Offset ⁴				
Offset Correction	$\pm 4\text{V}$			
Offset Resolution	min. 13bit/V (min. 1mV)			
Offset Drift	$150\mu\text{V} / ^\circ\text{C}$	$150\mu\text{V} / ^\circ\text{C}$	$40\mu\text{V} / ^\circ\text{C}$	$40\mu\text{V} / ^\circ\text{C}$
Propagation Delay ($\pm 0.5\text{ns}$)	12ns (2m) / 28ns (6m) / 32.5ns (7m)			
Noise (AC RMS) ²	55mV	55mV	75mV	75mV
Input Impedance				
Each Input to Ground	$5\text{M}\Omega \parallel 4\text{pF}$			
Differential Input Impedance	$10\text{M}\Omega \parallel 2\text{pF}$			
Input Coupling of the Measuring Instrument	50Ω			
Common Mode Rejection (CMRR)	DC	80dB	10MHz	50dB
	100kHz	70dB	50MHz	45dB
	1MHz	70dB	100MHz	40dB
	3.2MHz	62dB	400MHz	35dB

¹ Determined when using a PS-02 power supply at +23°C ambient temperature

² Related to the input. Wideband noise DC - 30MHz

³ As defined within IEC 61010-031. See definitions explained on page 18 and 19

⁴ Referred to the output

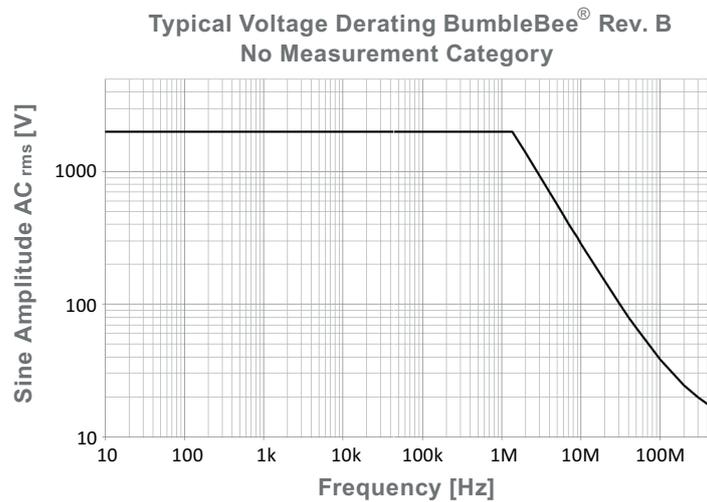
Mechanical Specifications	
Weight (probe only)	370 g
Cable Length	2 m or 6 m
Input Lead Length	25 cm
Input Lead Connectors	2 mm x 4 mm (male)
Output Connector	BNC (male)

Environmental Specifications		
Altitude	operating	up to 2000 m
	non-operating	up to 15000 m
Temperature Range	operating	0 °C to +50 °C
	non-operating	-40 °C to +71 °C
Maximum Relative Humidity	operating	80 % relative humidity for temperatures up to +31 °C, decreasing linearly to 40 % at +50 °C
	non-operating	95 % relative humidity for temperatures up to +40 °C

Typical Voltage Derating



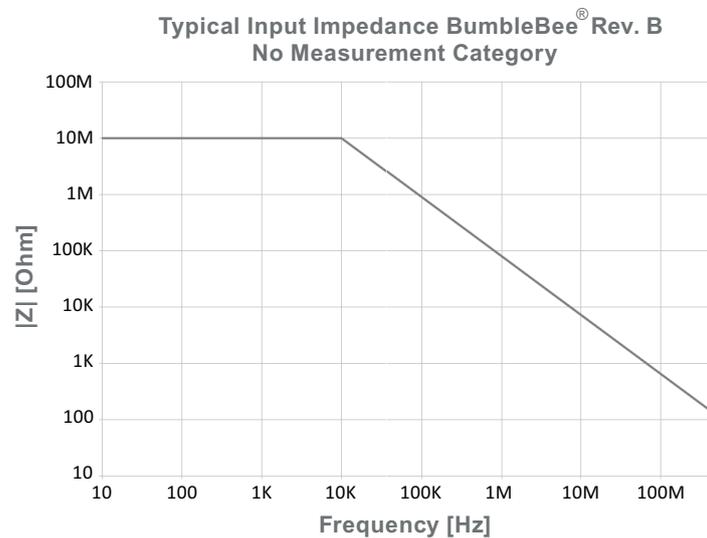
Note that the max. input voltage rating of the probe decreases as the frequency of the applied sine signal increases.



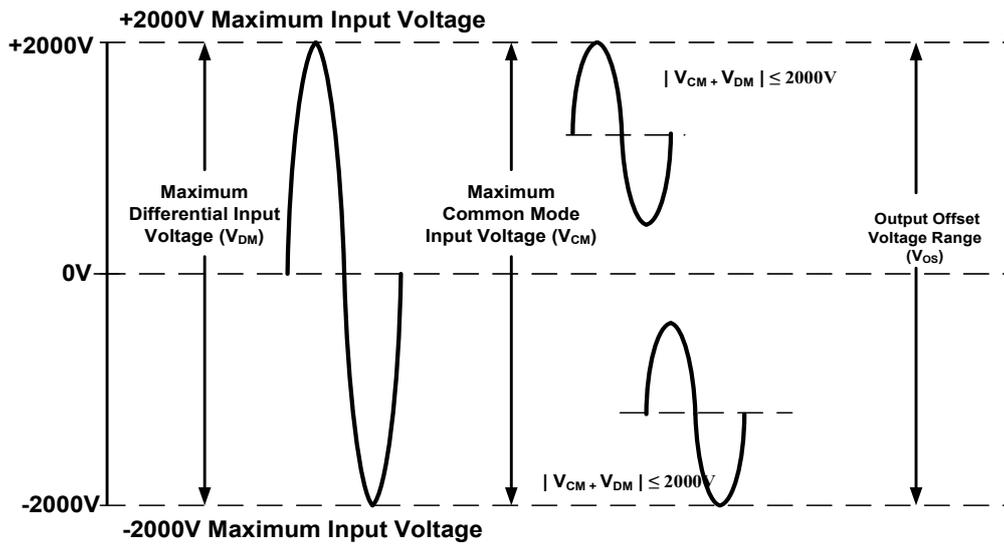
Typical Input Impedance



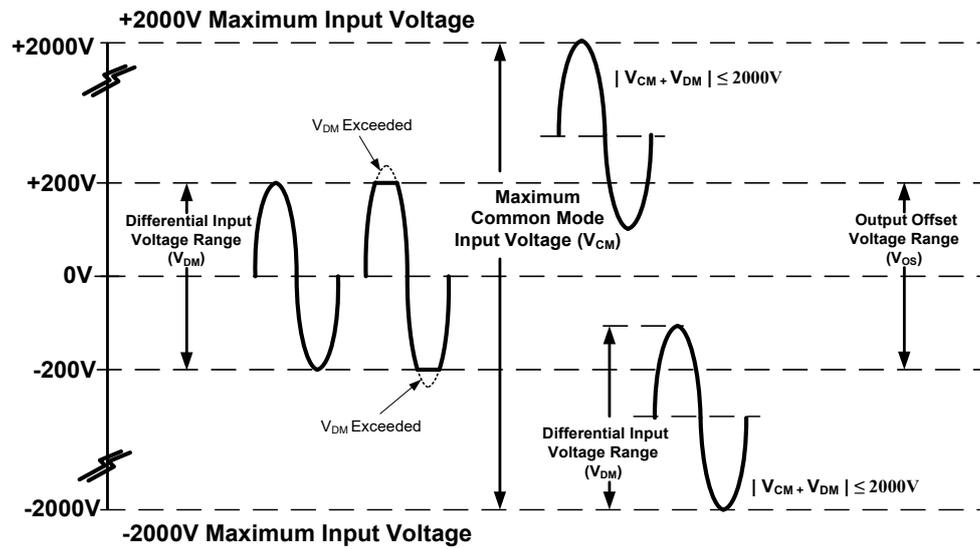
Note that the input impedance of the probe decreases as the frequency of the applied signal increases.



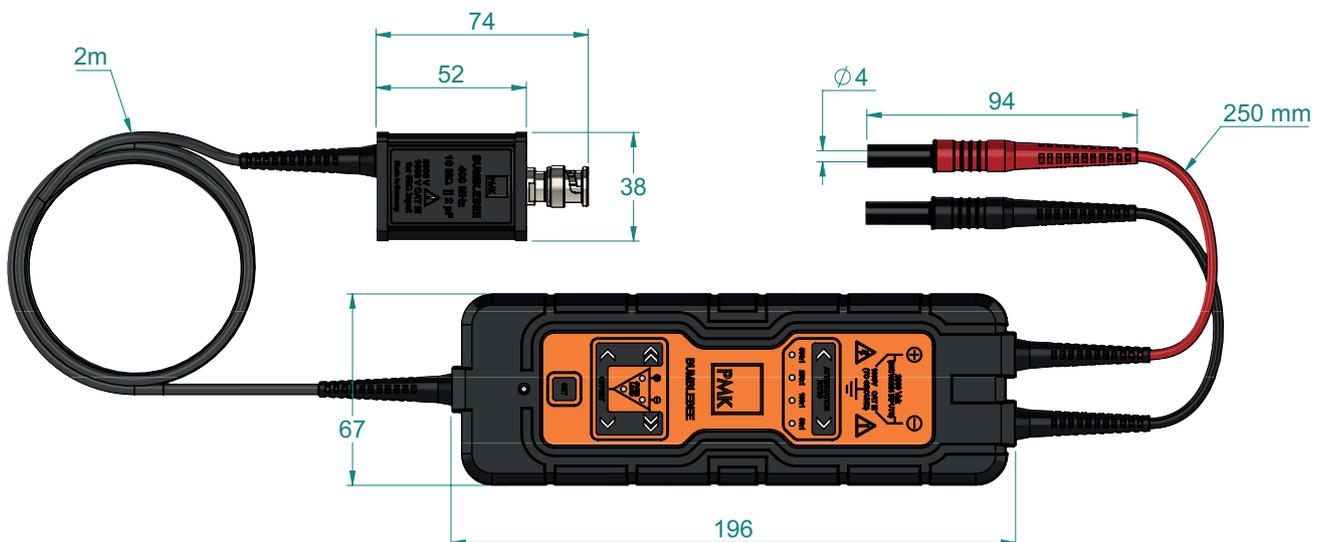
Maximum Input Voltage, 500:1 Range



Maximum Input Voltage, 50:1 Range

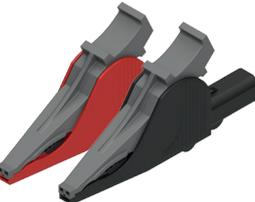


Dimensions



Probe Accessories

The parts supplied are **"highlighted"**, see also "Scope of Delivery". A power supply with remote control capabilities or a battery pack for portable use are optional.

<p>890-880-101* Set of 10 Contact Pins 0.64 mm</p> 	<p>890-808-105 2-Footer (black)</p> 	
<p>890-880-102* Set of 4 Spring Tips (fine)</p> 	<p>890-880-103* Pair of Probe Tip Adapters 4 mm to 0.8 mm (black)</p> 	<p>890-880-104 Twinholder M6</p> 
<p>890-880-106* Pair of Mini Spring Tip Probes 4 mm (black, red)</p> 	<p>890-880-109* Pair of Magnet Connectors 4 mm (black, red)</p> 	<p>890-880-113* Pair of Clamps, Rotating Grip Jaw (black, red)</p> 
<p>890-880-107* Pair of Spade Terminals, wide (black, red)</p> 	<p>890-880-110* Pair of Spade Terminals, narrow (black, red)</p> 	<p>890-880-114* Pair of Clamps, Jaws (black, red)</p> 
<p>890-880-108* Pair of Safety Alligatorclips, big (black, red)</p> 	<p>890-880-111* Pair of Safety Alligatorclips, small (black, red)</p> 	<p>890-880-115* Pair of Clamps, Hook (black, red)</p> 
<p>890-880-112* Pair of Rail Clip Connectors 4 mm (black, red)</p> 	<p>D010031** 50Ω BNC Feedthrough, 1GHz / 0.5W</p> 	<p>890-520-900 / 890-520-915* Power Supply Cable (0.5 m / 1.5 m)</p> 
		<p>Power Supplies</p> <ul style="list-style-type: none"> - PS-02 (2 Channel with USB) 889-09V-PS2 - PS-02-L (2 Channel with LAN and USB) 889-09V-PS2-L - PS-03 (4 Channel with USB) 889-09V-PS3 - PS-03-L (4 Channel with LAN and USB) 889-09V-PS3-L - AP-01 (Battery Pack, 1 Channel) 889-09V-AP01 
		<p>016-397-055 Carrying Case "Heavy Duty" with Foam Inlays (black)</p> 

* See ratings for these accessories on page 6.

** For use if only 1MΩ oscilloscope is available.



The accessories provided with the probe have been safety tested. Do not use any other accessories than those "originally" provided.

Rating Accessories

Part No.	Model	Rated Input Voltage
890-880-115	Clamp, hook	1000V CATII
890-880-114	Clamp, jaws	1000V CATIII
890-880-113	Clamp, rotating grip jaw	1000V CATII
890-880-101	Contact pin 0.64 mm	Not applicable
890-880-116	4 mm coupler f-f	30VAC / 60V DC
890-880-109	Magnet connector	30VAC / 60V DC
890-880-106	Mini spring tip probes 4 mm	600V CATII
890-520-900 / 890-520-915	Power supply cable	30VAC / 60V DC
890-880-103	Probe tip adapter 4 mm to 0.8mm	1000V CATII
889-09V-PS2 / 889-09V-PS3	Power supply	100-240V AC / 50-60Hz
890-880-112	Rail clip connector	600V CATIII
890-880-108	Safety alligator clip, big	1000V CATIII
890-880-111	Safety alligator clip, small	600V CATII
890-880-107	Spade terminal, wide	30VAC / 60V DC
890-880-110	Spade terminal, narrow	30VAC / 60V DC
890-880-102	Spring tip (fine)	Not applicable

Scope of Delivery

Accessories delivered with each probe are highlighted in the graphical overview on page 5.



The accessories provided with the probe have been safety tested. Do not use any other accessories than those “originally” provided.

Order No.	Item	Qty
---	Probe BumbleBee® Rev. 2020, 2 m or 6 m version	1
---	Calibration certificate	1
M80-BUMBLBEE-501	Manual	1
890-808-105	2-footer	2
890-880-102	Set of 4 spring tips (fine)	1
016-397-049	Carrying case with foam inlay (black)	1
890-880-116	4 mm coupler f-f (red)	1
890-880-109	Pair of magnet connectors 4 mm (black, red)	1
890-880-115	Pair of clamps, hook (black & red)	1
890-880-114	Pair of clamps, jaws (black & red)	1
890-880-113	Pair of clamps, rotating grip jaw (black & red)	1
890-880-103	Pair of probe tip adaptors 4 mm to 0.8mm (2x black)	1
890-880-108	Pair of safety alligator clips, big (black & red)	1
890-880-111	Pair of safety alligator clips, small (black & red)	1
890-880-110	Pair of spade terminals, narrow (black & red)	1
890-880-107	Pair of spade terminals, wide (black, red)	1
890-880-106	Pair of mini spring tip probes 4 mm (black, red)	1
890-880-101	Set of 10 contact pins 0.64 mm	1

Ordering Information

The power supply must be ordered separately.

Models	
Order No.	Item
880-102-504	4x BumbleBee® Rev. B, 2m (Quad pack inclusive power supply PS03-L)
880-102-501	BumbleBee® Rev. B, 2m (without power supply)
880-106-501	BumbleBee® Rev. B, 6m (without power supply)
880-107-501	BumbleBee® Rev. B, 7m (without power supply)

Optional Accessories and Calibration

Order No.	Item
KAL-DAKKS-BB	Calibration according to ISO17025
016-397-055	Carrying case "HeavyDuty" with foam inlays (black)
890-880-106	Pair of mini spring tip probes 4 mm
890-880-109	Magnet adaptors
890-880-112	Pair of rail clip connectors 4 mm (black, red)
890-880-107	Wide spare terminals
890-880-104	Twinholder M6
KAL-BB2	Factory re-calibration with adjustment
D010031	50Ω BNC Feedthrough, 1GHz / 0.5W

Power Supplies

Order No.	Item
889-09V-PS2	PS-02 (2 Channel with USB)
889-09V-PS2-L	PS-02-L (2 Channel with LAN and USB)
889-09V-PS3	PS-03 (4 Channel with USB)
889-09V-PS3-L	PS-03-L (4 Channel with LAN and USB)
889-09V-AP01	AP-01 (Battery Pack, 1 Channel)
890-520-900	Power Supply Cable (0,5m)*
890-520-915	Power Supply Cable (1,5m)

* The power supply cable (0.5 m), is included as standard with all power supplies.

Manufacturer

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