Manual for DeltaSense SgD1G5DP1KA1 Differential Active Probe

SIGNIFICANT DEVICES PTY LTD

Warning

DeltaSense SgD1G5DP1KA1Probe kit contains Copper Beryllium components!

For these components in the DeltaSense kit:

- 22mm long 1mm diameter solid sharp pins
- 0.25mm diameter solid wire,

Significant Devices advises that they are made of BeCu (Beryllium 2% Copper 98%) and issues the following warnings:

- ***Do not*** *ingest or inhale.* This may cause death. If ingestion or inhalation occurs, seek medical assistance.
- ***Do not*** *grind, saw, sand, polish, sharpen or perform any action which could result in BeCu dust*, as this could be inhaled. Inhaling particulates containing Beryllium may cause a serious, chronic lung disease called Chronic Beryllium Disease (CBD). Over time, lung disease can be fatal.
- ***Do not*** *make in to jewelry or wear on skin for extended periods.* This may cause skin irritation. Beryllium particulates lodged under the skin may induce sensitization and skin lesions.

The health effect of ingestion of Beryllium in the form found in this product is unknown. Copper Beryllium in solid form, as contained in the finished product, presents no special health risks.

Please read this Limited Warranty & Disclaimer before using your product.

If terms are not acceptable, return the unopened product container at once. By using this product or breaking the tamper evident seal the user or buyer accepts the following Limited Warranty and Disclaimer:

LIMITED WARRANTY AND DISCLAIMER.

The manufacturer warrants that:

(a) this product is reasonably fit for the purposes set forth in the directions for use when it is used in accordance with such directions; and

(b) the directions, warnings and other statements in this manual and/or website and/or on product labels are based upon responsible information from evaluation of reasonable tests of effectiveness and use. Tests have not been made on all varieties of plants or in all states or under all conditions.

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INTERPRETATION

Words conveying the singular shall, where required or appropriate, be deemed to mean and include the plural. Words conveying the feminine gender shall be deemed to mean and include the masculine gender.

The decision of Significant Devices Pty Ltd, its parent or affiliated companies, as to the interpretation of any written material inclusive of websites, product labels, printed material, and advertisements inclusive of punctuation, shall be final.

TABLE OF CONTENTS

1. FEATURES

- Elegant, compact and easy to use
- The small probe head and ultra-flexible cable can reach tight places
- Low power 1.5W head minimises heat loading
- Wide temperature range -10°C to 50°C
- Compatible with all brands of oscilloscopes
- 3 year limited warranty and 30 day money back guarantee (see conditions in Section 7)

2. ACCESSORIES

These are included in the DeltaSense kit (Figure 2):

- BNC and SMA connection points
- Micro test points for SMD pad and 0.3mm via connections
- Mini hooks for SMD pins
- Alligator clips for larger connections
- 50 Ohm inline terminator (for use with non 50 Ohm oscilloscopes and for AC coupling)
- Earthing wire for noise reduction
- 5 pairs of colour identification rings
- Universal power supply
- Pack of replaceable BeCu probe pins
- Pack of spring-loaded pogo probe pins

Figure 2: Accessories in DeltaSense kit

3. SPECIFICATIONS

3.1 PERFORMANCE

3dB frequency range	DC-1.5GHz
0.5dB frequency range	DC-1GHz #1
Single ended input capacitance	< 0.5pf
Input capacitance between lines	< 0.25pf
Single ended input resistance	100kOhm #2
Input resistance between lines	200kOhm #2
Input offset voltage	< 10mV
Absolute maximum input voltage	+/- 70V #3
Input voltage working range	+/- 55V #3
Input voltage linear range	+/- 50V #3
Differential linear range	+/- 15V
CMRR 1-2GHz	> 25 dB
CMRR @100MHz	38 dB
CMRR <1MHz	>40 dB

Notes:
#1 Return for calibration if non conformal
#2 +/-2% small signal when probe is powered
#3 With respect to Gnd/Earth of oscilloscope

3.2 ABSOLUTE MAXIMUM RATINGS

- Input range +/-70V with respect to Gnd of oscilloscope.
- Power supply 9 - 16V.
- Power supply with respect to Gnd of oscilloscope +/- 100V max.

3.3 DETAILED PERFORMANCE

Figures 3.3a and 3.3b show the performance of DeltaSense SgD1G5DP1KA1.

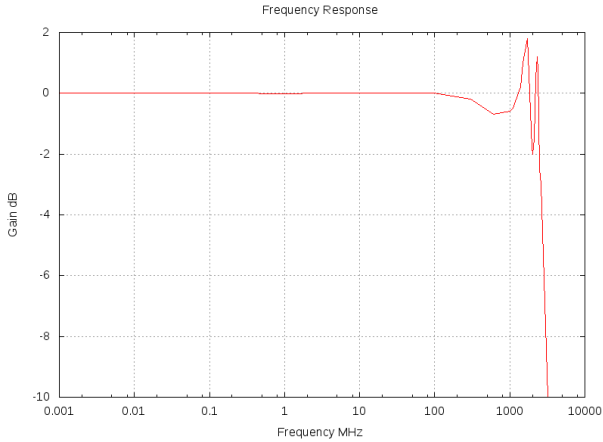

Figure 3.3a. Frequency response

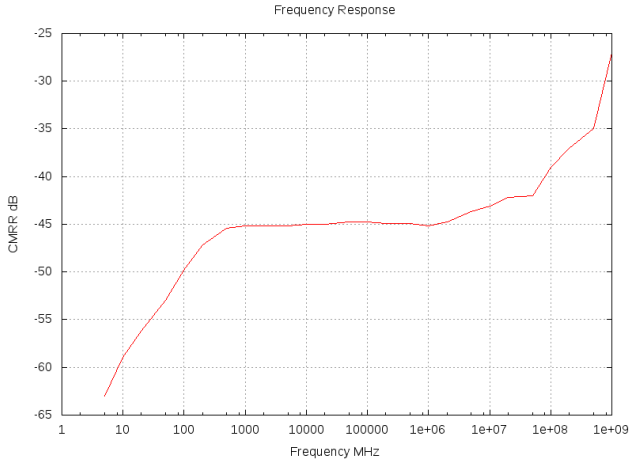

Figure 3.3b. Common mode rejection ratio

4. USING DELTASENSE

4.1 PROBING TECHNIQUES

4.1.1 Micro Test Points

The DeltaSense SgD1G5DP1KA1 kit includes a set of micro leads to allow ease of connecting and reconnecting to small signals on test boards. The micro leads contain a receptacle for pins from 0.2-0.3mm (8mil -12mil) diameter. A length of 0.25mm Cu98Be2 wire is also included. This can be cut and soldered (refer to the Warning at the beginning of this manual for details on proper handling of CuBe) into 0.3mm via to form simple pinpoints. Alternatively, Millmax 4353-0-00-15-00-00-33-0 pins can be attached to PCB SMD as test points.

4.1.2 High Speed

Measuring signals at low frequency or with slow edge rates is a simple task of connecting and measuring. However, at higher frequencies or edge rates, more care is needed. The higher the frequency, the shorter the unterminated leads must be. The inputs to DeltaSense SgD1G5DP1KA1 are high impedance and hence unterminated. To assist with a wide range of applications, several hookup lead options are provided. The shortest leads possible should be used to yield the best signal quality. It is also important to reduce the area inside the current loop made from the positive to negative lead. As a rough rule of thumb, lead length should be less then $\lambda/50$ for an analogue signal, where λ is the highest signal of interest. For example, 100MHz leads should be less than 6cm (2.2”). With digital signals, rise time

is critical. Leads should be less than 4cm (1.57") for a 2ns rise time. Lead length can increase with rise time.

4.1.3 Measuring Supply Noise and Signals with Large DC content

Most oscilloscopes have a limited offset range. This is a problem when measuring a small signal with a larger DC bias. AC coupling is helpful, but most high speed probes will not allow AC coupling due to the 50 Ohm load requirements. DeltaSense SgD1G5DP1KA1 overcomes this by the use of the external inline 50 Ohm load. This allows the oscilloscope to be set to AC coupled high impedance, thereby removing DC biasing while maintaining a very wide working bandwidth.

4.2 OPERATING CONDITIONS

4.2.1 Impedance

DeltaSense SgD1G5DP1KA1 must have a 50 Ohm load to work correctly. A feed-through 50 Ohm load is provided for use on oscilloscopes that do not have a 50 Ohm internal termination. If the load is not 50 Ohm, the frequency response will not be flat and may be distorted. If DeltaSense SgD1G5DP1KA1 is connected to a load larger than 50 Ohm, then the resulting signal will be too large for frequencies above 1KHz. Likewise, if the load impedance is too low, the signal amplitude will be low for frequencies above 1KHz. This behaviour is illustrated in Figure 4.2.1a and b.

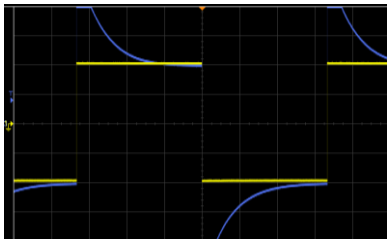

Figure 4.2.1a:150Hz input at 1MOhm load

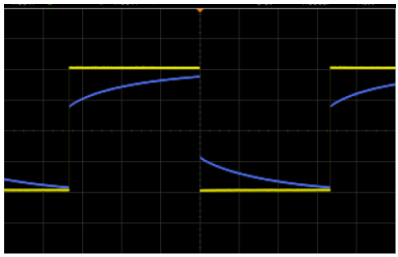

Figure 4.2.1b:150Hz input at 25 Ohm load

4.2.2 Bandwidth Extension

DeltaSense SgD1G5DP1KA1 -3dB bandwidth is 1.5GHz across all conditions. Under typical conditions, it is possible to measure up to 2.4GHz using the bandwidth extension feature (Figure 4.2.2). When working above 1GHz, care must be taken with the input set-up (as discussed in Section 4.1.2 High Speed). The use of very short fly wires is recommended.

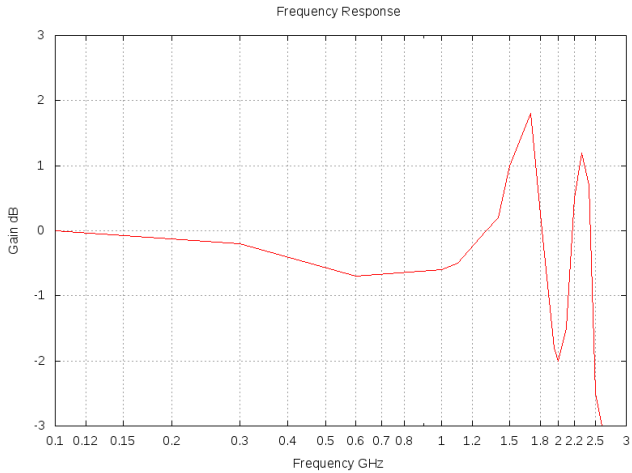

Figure 4.2.2 Typical Frequency Response

4.2.3 Temperature Range Extension

- DeltaSense SgD1G5DP1KA1's ambient temperature range is -10°C to 50°C (14F to 122F). This range can be extended with a few precautions.
- The cable will become brittle at colder temperatures. If the cable is held completely static, then DeltaSense SgD1G5DP1KA1 can be taken down to -40°C (-40°F).
- At high temperatures, the electronics in the probe tip can overheat. The ambient temperature can be increased by mounting the DeltaSense SgD1G5DP1KA1 to a heat sink using the M2.5 screw provided.
- The hard black anodised aluminium case of the probe head must be kept below 65°C. The DeltaSense SgD1G5DP1KA1 active probe head produces up to 1.6W of heating, thus heat sinking must be sized accordantly. If active cooling like a Peltier is used, then a limit of 90°C (194F) should still be applied to the cable.

4.2.4 Power Supply Noise Prevention

DeltaSense SgD1G5DP1KA1 comes with an isolated 12V universal supply. A built-in power conditioning filter removes noise < 100Hz for this supply. However, there is still 0.3nf of power supply noise coupling capacitance, which may inject a few mV of noise into gnd. To prevent this, it is recommended that the optional 2mm banana socket be used for earthing. This earth point is located on the power box next to the supply (Figure 4.2.4). This node is high impedance and connected to the negative terminal of the 12V input. When this earth point is connected to the oscilloscope earth, all power supply noise is prevented. The 2mm banana socket for earthing may be left floating if needed.

Figure 4.2.4 Green banana socket is located adjacent to the power supply receptacle.

4.2.5 Maximising Common Mode Range

This section details how to use the DeltaSense SgD1G5DP1KA1 when the input voltage swing exceeds 50V. For example, if the switch mode power supply is running at 48V with a gate drive of 15V, this yields 63V on the gate with respect to gnd. This scenario results in a compressed signal and underestimation of ringing on the gate drive.

To achieve a true gate to source drive voltage measurement, employ the steps below:

- Drive the gnd of the device under test negative with respect to the earth of the oscilloscope. The centre point of the DeltaSense SgD1G5DP1KA1 range is the oscilloscope earth.
- Power the device under test from a floating supply.
- Use an extra supply to force the ground of the device under test to -30V with respect to the oscilloscope.

5. TROUBLE SHOOTING

No Signal
Check power light is green. Check SMA is tightly fixed.

Power light flashing
Over current protection is active. Power down and allow 1 minute to cool before restarting.

Signal too large
Check 50 Ohm load impedance is present. See Section 4.2.1 for details.

Signal too small
Check 50 Ohm load impedance is present. See Section 4.2.1 for details.

Signal noisy
Check hook up leads are firmly secured.

6. CALIBRATION

It is recommended that DeltaSense SgD1G5DP1KA1 probe be returned to Significant Devices Pty Ltd for calibration. However, for customers outside the warranty period who cannot spare the probe, calibration instructions are:

1. Measure pre-calibration response of positive and negative sides independently.
2. Remove the 4 hex screws on the sides of the tip of the probe using a 1.5mm hex key.
3. Slide off plastic tip cover.
4. On the back of the PCB, identify the 2 trim capacitors.
5. Ground the negative input and measure response of positive at 50MHz.
6. Adjust trim cap behind positive channel with a 0.8 mm flat ceramic driver to achieve correct response, taking care to recheck after the adjustment tool is removed.
7. Ground the positive input and measure the response of the negative at 50MHz.
8. Adjust the trim cap behind the negative channel to achieve the correct response, taking care to recheck after the adjustment tool is removed.
9. Switch back to the positive and repeat 2 more times.
10. Replace plastic tip.

The two compensation capacitors in the probe are dominant above 20MHz. They must be balanced, otherwise a notch filter response may form around 0.4GHz.
If more detailed calibration is required, return the probe to Significant Devices Pty Ltd.

7. WARRANTY

3 year Limited Warranty:

- DeltaSense SgD1G5DP1KA1 is covered for defects by a 3 year limited warranty.
- The warranty covers all manufacturing defects.
- The warranty does NOT cover: exceeding the absolute maximum voltage range.
- Input pins, clips, hook up leads and wires are considered consumable and only covered for 30 days.
- In the case of a faulty device, return to Significant Devices Pty Ltd for replacement.

30 day Money Back Guarantee:

If, for any reason, you are not completely satisfied with the DeltaSense SgD1G5DP1KA1, please return it in good working order, to Significant Devices Pty Ltd within 30 days of purchase to get a full refund. The refund will not cover any of the shipping costs.

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