CONTENTS:

TITLE: Procedure for Testing the Silicon Hybrid Receivers H1x

1. **Purpose:**
   1.1. Test the Silicon Hybrids H1x

2. **Equipment:**
   2.1. Keithley 6487 or equivalent high voltage source
   2.2. HP 3561A Dynamic Signal Analyzer
   2.3. Probes and multimeter
   2.4. Tektronix DPO3052
   2.5. California Scientific V-226 VCSEL source
   2.6. Light Source, Chopper and Monochromator
   2.7. DC regulated power supply
   2.8. Twisted pair wires with banana plugs on both ends suitable to handle up to 500VDC
   2.9. Test Box – TB41CGH2N

3. **Materials:**
   3.1. Device to be tested and the measurement box

4. **Safety:**
   4.1. Keep hands clear of the device under test as high voltage is present during the test
   4.2. Do not remove the part from socket while under test and when the high voltage supply is ON

5. **Set-up/Housekeeping:**
   5.1. No food and drinks are allowed in the test area
   5.2. Gloves or finger cots will be worn while testing

6. Procedure:

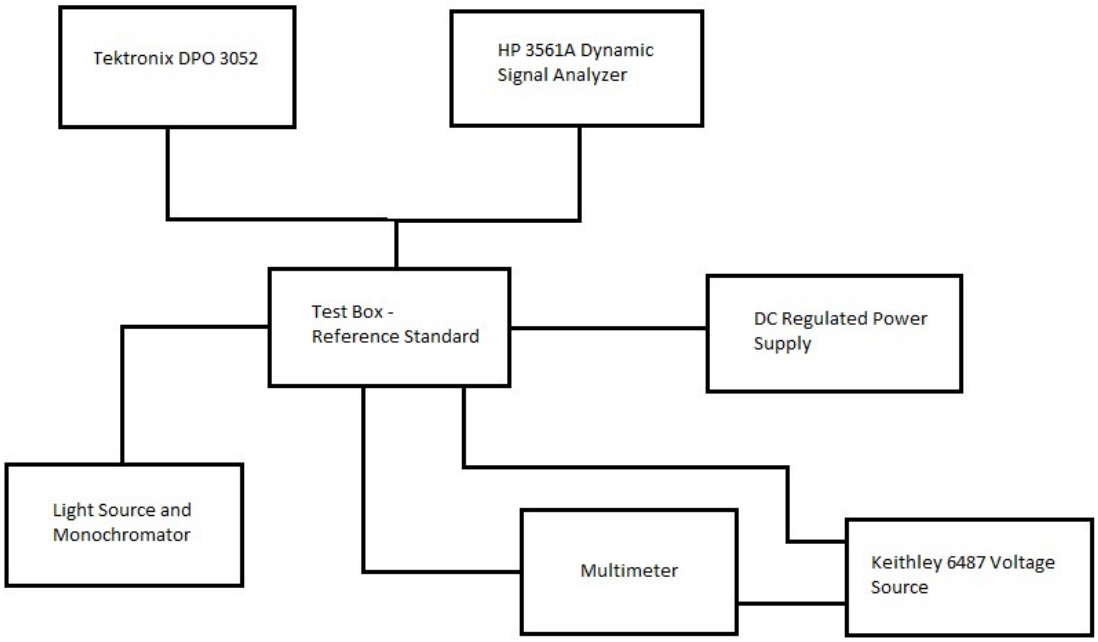


Fig 1: Reference Standard Test Setup to measure the output power from the setup

PART I: To measure the light power from the test setup

6.1. Insert the Reference Standard in the measurement box and apply 0V bias
6.2. Provide the +/- 5V supply voltage to the amplifier supply
6.3. Insert chopper across the light source to get the AC signal
6.4. Focus the light on the Standard making sure that light beam is completely contained within the Standard. The output signal can be observed on the HP 3561A dynamic signal analyzer.
6.5. The chopper frequency is 800Hz. On HP 3561A dynamic signal analyzer, adjust the frequency settings to read the correct output value of the signal in volts. Divide the signal by the resistance in the box to get the signal in I(A).
6.6. Depending on the wavelength of the monochromator, we know the value of the Responsivity (A/W) of the Reference Standard. Divide the signal I(A) by the responsivity to get the light power from the test setup.

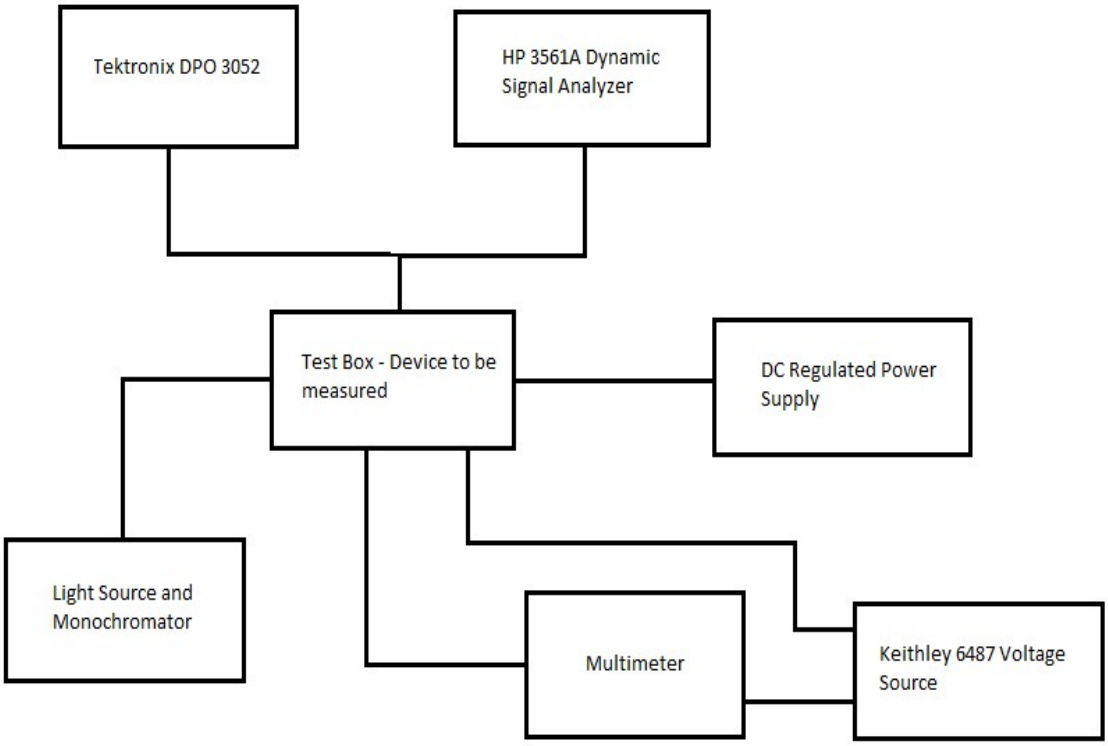


Fig. 2 Test Setup for the Device

PARTII: To measure the Vop and Vbd of the device

6.7. Now connect the hybrid device under measurement in the test box (TB41CGH2N) with the right polarity

6.8. Provide the +/- 5V supply voltage to the amplifier supply

6.9. Focus the light on the device making sure the beam is completely contained within DUT active area and at the same time, watch the output signal on HP 3561A dynamic signal analyzer

6.10. Look at the datasheet for minimum Responsivity value for the device and start increasing the bias voltage across the APD to get corresponding signal.

6.11. To calculate the expected value of the signal on HP 3561A dynamic signal, use the light power value from PART I.

6.12. Every Hybrid H1x has a particular feedback value Rf
The expected value of the signal = Power (W) * Responsivity (A/W) * Rf

6.13. Now increase the bias voltage to get the expected signal. The voltage at which we get the signal, this bias voltage is called as **operating voltage (Vop)**

6.14. Now turn off the light. Increase the bias voltage to find out the **breakdown voltage (Vbd)** at Id = 10uA using multimeter. The multimeter is connected in series with the bias voltage

PART III: Measure Parameters: Noise, signal swing and NEP

6.15. Focus the light using LED light source and function generator. Apply the **Vop** across the device for measurement

6.16. The frequency of operation can be changed using function generator and see the output waveform using Tektronix DPO3052. **The signal swing has to be more than 3V**

6.17. Place the steel lid on the measurement box so that the device noise is measured in the dark

6.18. Load the program NOISE setup by pressing RECALL→ Catalog ON → Use CAT Filename → Recall state

6.19. Set frequency on the HP dynamic signal analyzer as center frequency = 100kHz and define span = 1KHz. Also set AVG to RMS and set number of samples to 100

6.20. Press 'Range' → 'Single Auto Rng'

6.21. Press the 'Start' button on the HP dynamic signal analyzer which measures the average filtered noise

6.22. At the bottom of the screen of HP dynamic signal analyzer, one can note down the **rms value of the noise density**. Divide the RMS value by responsivity to get the **NEP (Noise Equivalent Power)**

6.23. STOP the measurement by turning off the supply and the bias voltage

6.24. Remove the device and place it safely in a tray

7. Start-up/Shutdown Procedures

7.1. Engineering will start and shutdown all equipment

8. Records:

8.1. All data will be stored on the local computer and uploaded to the shared drive at the end of testing for the day

TITLE: Procedure for Testing the Silicon Hybrid Receivers H2-H5

Test Procedure remains very similar to H1X but few important changes to keep in mind are as follows:

1) Provide the + 5V supply voltage to the amplifier supply of H3, H4 and +3.3V supply voltage for H2,H5 receiver. The supply current is around 20-30mA at the specified voltage.

2) The maximum output swing spec is as follows:

Receiver Type	Rf (kohm)	VOUT (mVp-p)			Comments
		Min	Typ	Max	
H2	54	170	250	450	200 ohm load between OUT+ and OUT-
H3	20		600		50ohm Load
			1000		Infinite Load
H4	8		260	450	100 ohm load between OUT+ and OUT-
H5	4.4	170	260	375	CML, On-Chip 50 Ω Termination (AC or DC Termination)

TITLE: Procedure for Testing the Silicon Hybrid Receivers H0

Test Procedure remains very similar to H1X but few important changes to keep in mind are as follows:

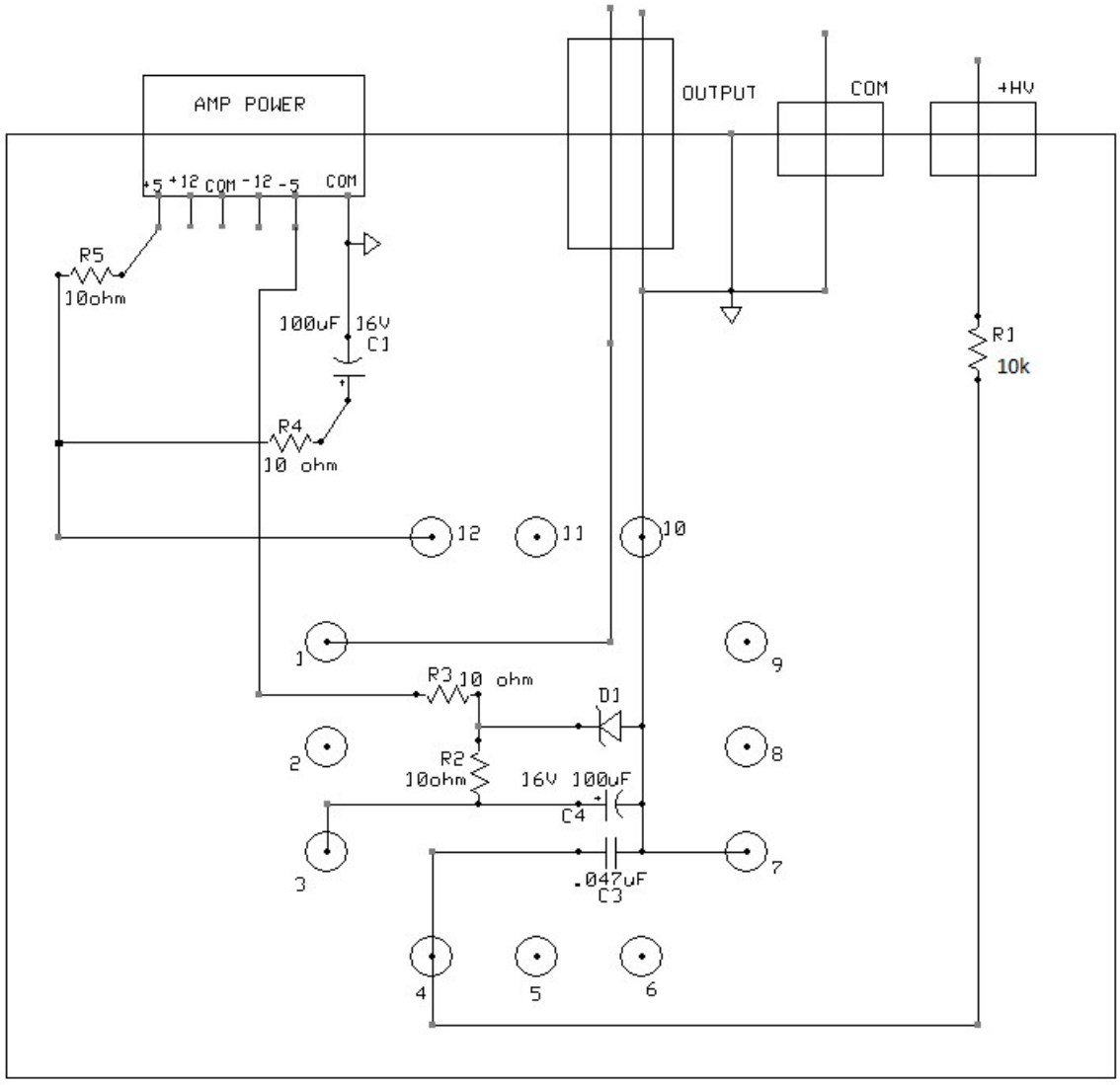
1) Provide the +/- 5V supply voltage to the amplifier supply of H0 receiver. The supply current is around 10-20mA for the positive and negative supply voltage. With the increase in the APD bias voltage and light signal, the swing of the output signal starts to increase. In the meanwhile, the supply current of the negative supply starts to increase simultaneously. It depends on the swing of the output signal and the load connected at the output.

2) The output swing spec is as follows:

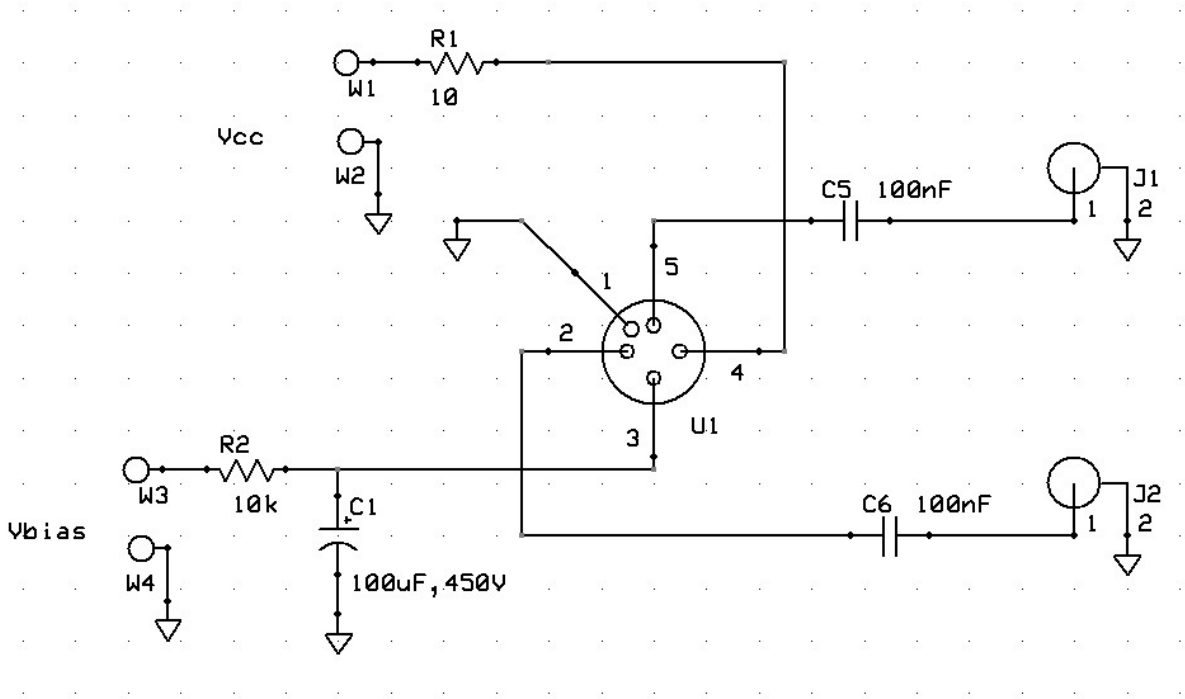
Receiver Type	Rf (kohm)	VOUT (V)	Comments
		Typ	
H0	50	1.5	50 ohm Load

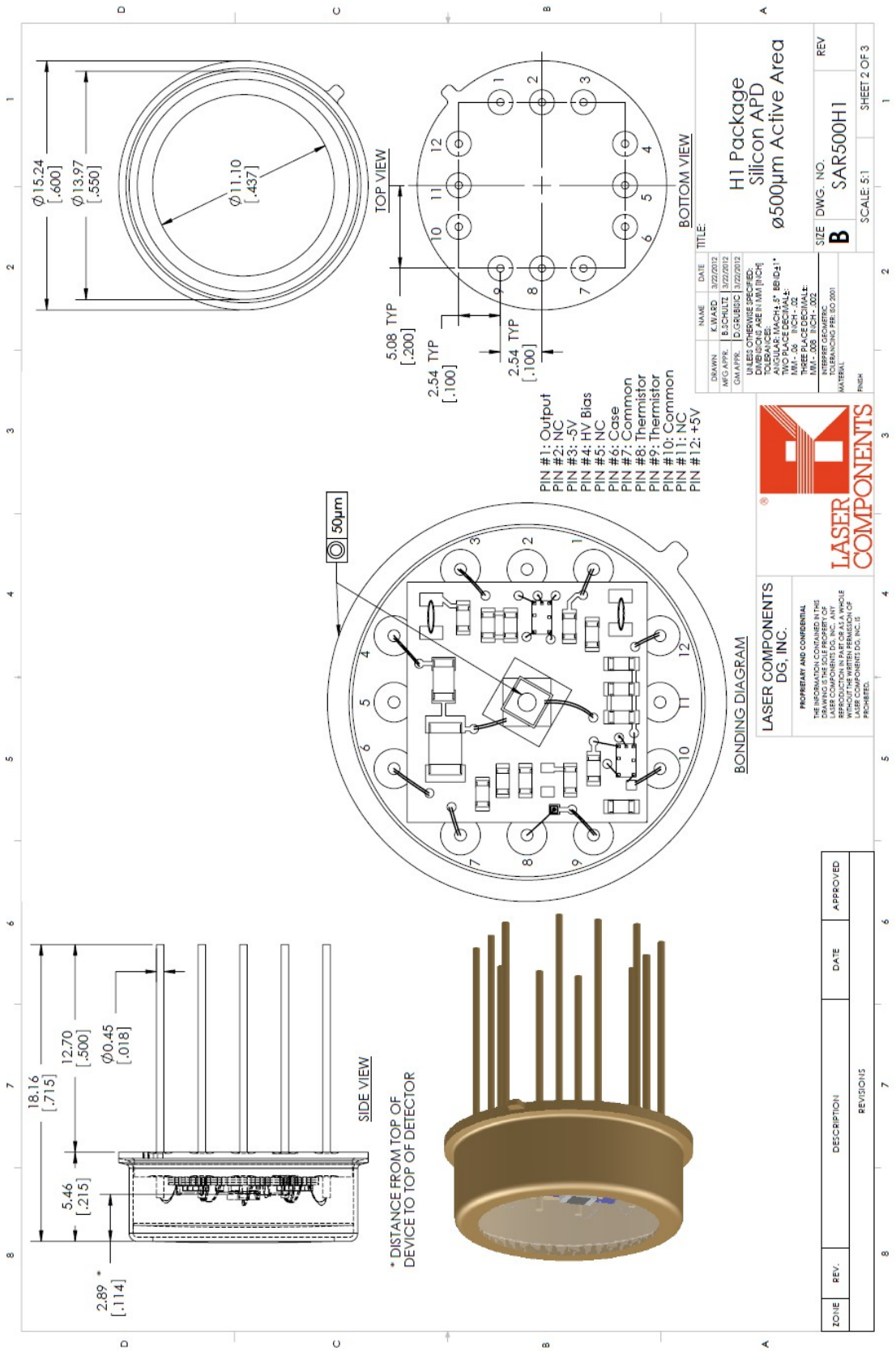
PCB Test Schematic

H1X Test Box Schematic:



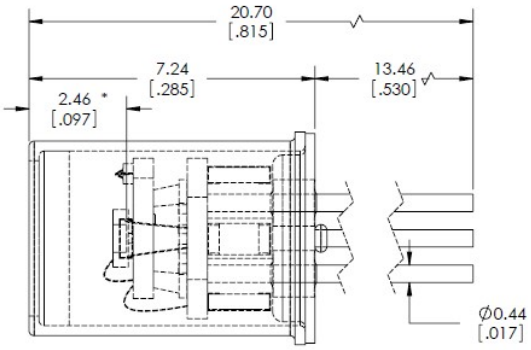
H2-H5 Test Box Schematic:




H1 Package
Silicon APD
ø500µm Active Area
SAR500H1
TOP VIEW
BOTTOM VIEW
SIDE VIEW
BONDING DIAGRAM
LASER COMPONENTS
LASER COMPONENTS DG, INC.
PIN #1: Output
PIN #2: NC
PIN #3: -5V
PIN #4: HV Bias
PIN #5: NC
PIN #6: Case
PIN #7: Common
PIN #8: Thermistor
PIN #9: Thermistor
PIN #10: Common
PIN #11: NC
PIN #12: +5V
* DISTANCE FROM TOP OF DEVICE TO TOP OF DETECTOR

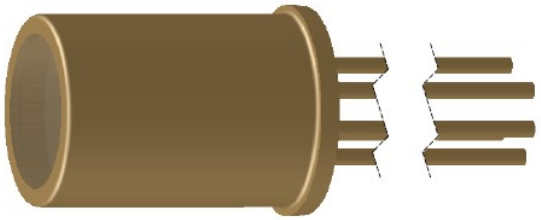
Component	Value
Feedback Resistor, R2	50kΩ ±1%
Feedback Capacitor, C2	30fF ±1%
OpAmp	ADA4817-1

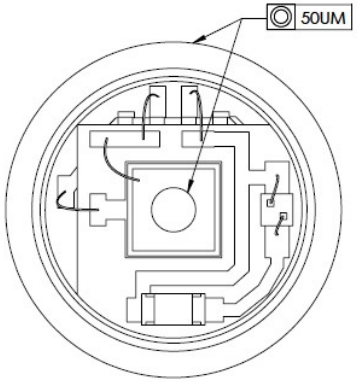
Note: APD Bias resistor not contained in the package.



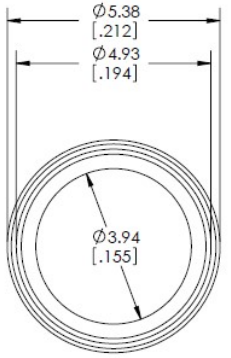
SIDE VIEW

* DISTANCE FROM TOP OF DEVICE TO TOP OF DETECTOR

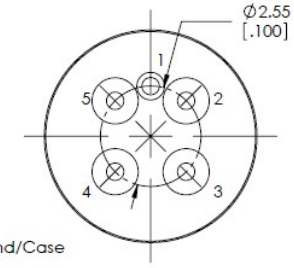




BONDING DIAGRAM



TOP VIEW



PIN #1: Ground/Case
PIN #2: Out
PIN #3: +5V
PIN #4: Vbias
PIN #5: -5V

BOTTOM VIEW

ZONE	REV.	DESCRIPTION	DATE	APPROVED
REVISIONS				

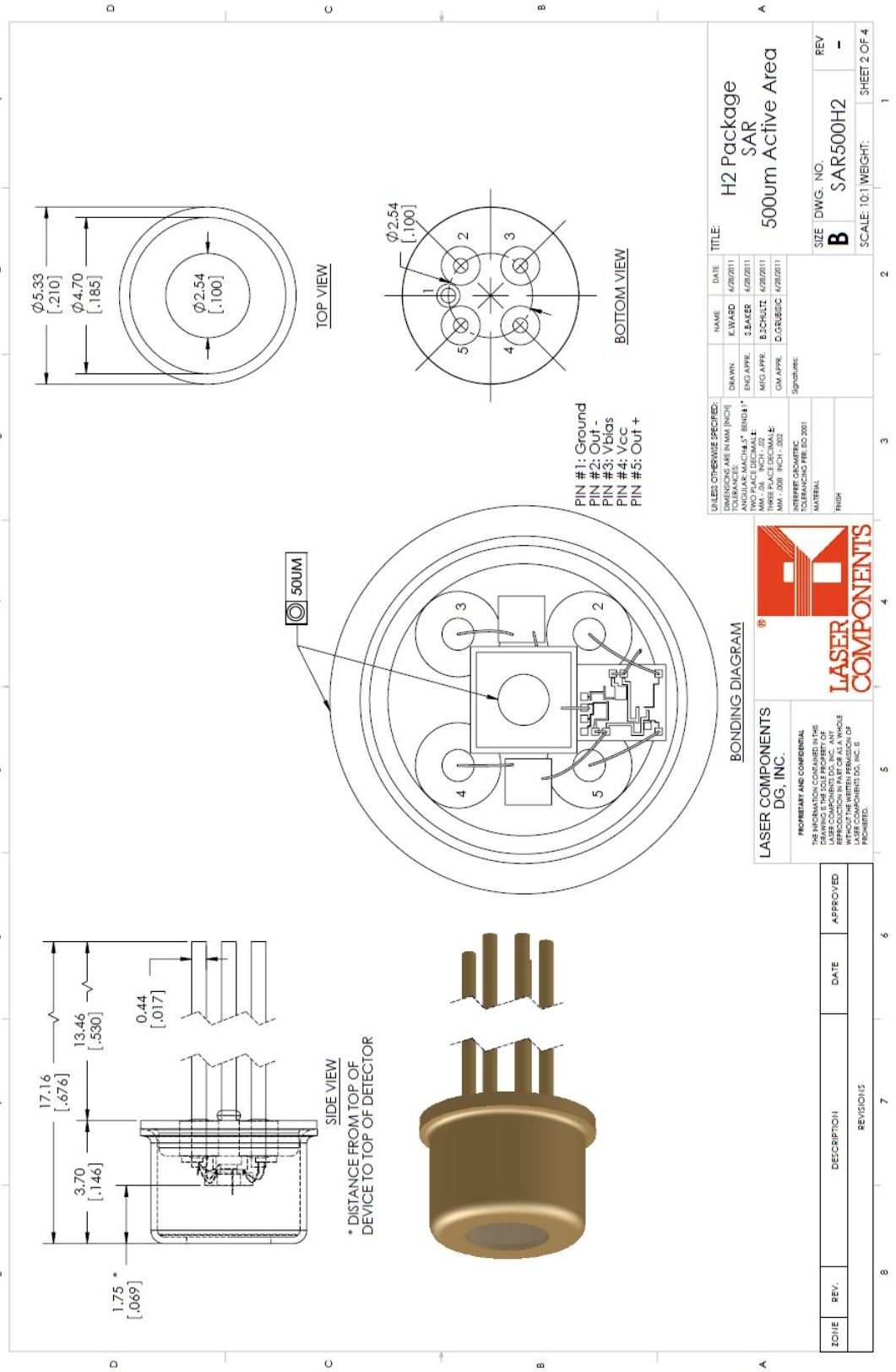
LASER COMPONENTS DG, INC.

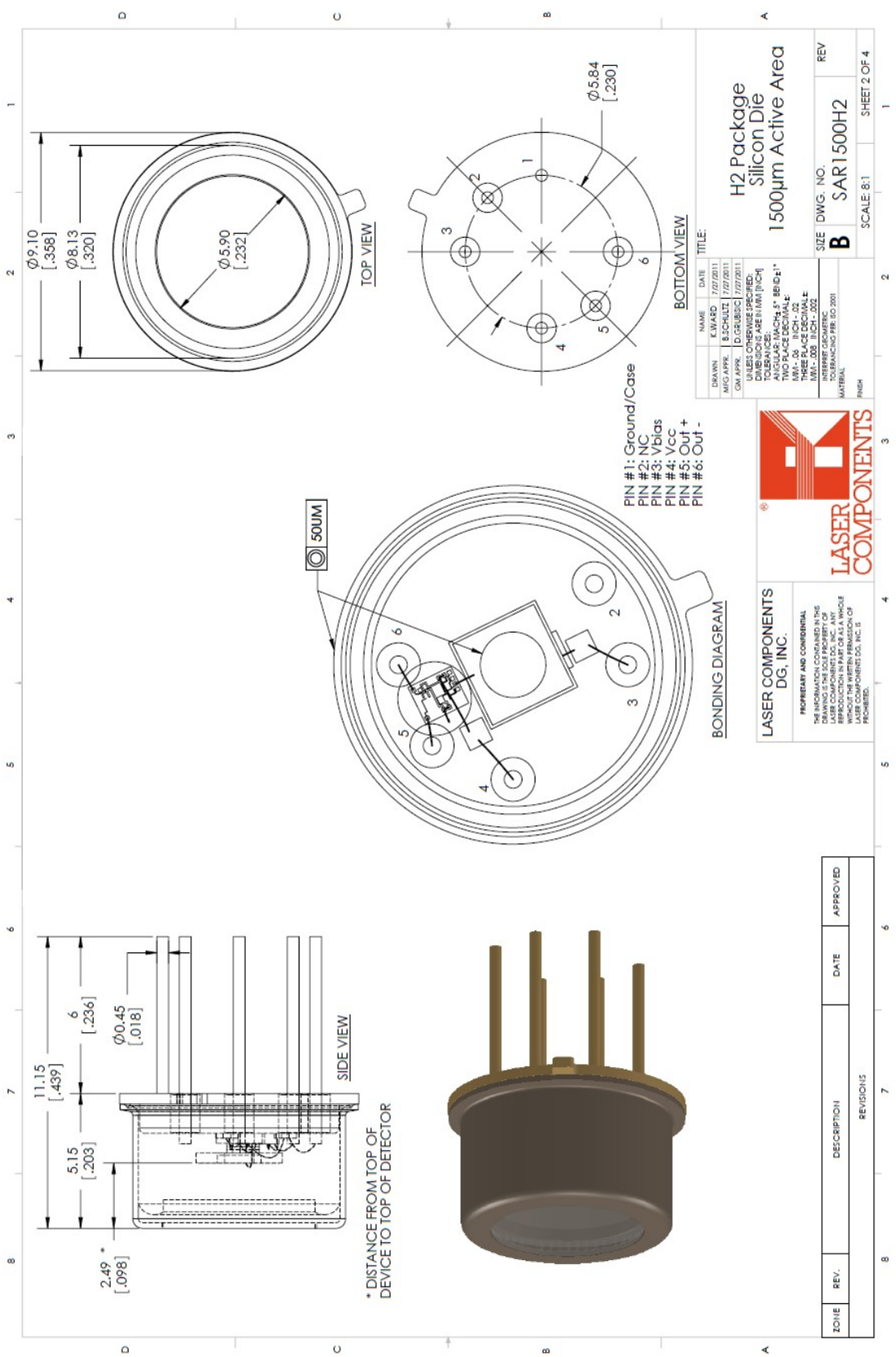
	NAME	DATE
DRAWN	K.WARD	4/6/2012
MFG APPR.	B.SCHULTZ	4/6/2012
QM APPR.	D.GRUBISIC	4/6/2012

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MM [INCH]
TOLERANCES:
ANGULAR: MACH± .5° BEND± 1°
TWO PLACE DECIMAL±:
MM - .06 INCH - .02
THREE PLACE DECIMAL±:
MM - .008 INCH - .002
INTERPRET GEOMETRIC TOLERANCING PER: ISO 2001
MATERIAL
FINISH

TITLE:
H0 Package
Silicon Die
500µm Active Area

SIZE	DWG. NO.	REV
B	SAR500H0	
SCALE: 10:1	SHEET 2 OF 3	


TOP VIEW
BOTTOM VIEW
SIDE VIEW
* DISTANCE FROM TOP OF DEVICE TO TOP OF DETECTOR
BONDING DIAGRAM
50UM
PIN #1: Ground
PIN #2: Out -
PIN #3: Vbias
PIN #4: Vcc
PIN #5: Out +
Ø5.33 [.210]
Ø4.70 [.185]
Ø2.54 [.100]
17.16 [.676]
13.46 [.530]
3.70 [.146]
1.75 * [.069]
0.44 [.017]
LASER COMPONENTS DG, INC.
LASER COMPONENTS
H2 Package
SAR
500um Active Area
SAR500H2
SCALE: 10:1 WEIGHT:
SHEET 2 OF 4
ZONE
REV.
DESCRIPTION
DATE
APPROVED
REVISIONS


TOP VIEW
BOTTOM VIEW
SIDE VIEW
BONDING DIAGRAM
* DISTANCE FROM TOP OF DEVICE TO TOP OF DETECTOR
PIN #1: Ground/Case
PIN #2: NC
PIN #3: Vbias
PIN #4: Vcc
PIN #5: Out +
PIN #6: Out -
50UM
H2 Package
Silicon Die
1500µm Active Area
SAR1500H2
LASER COMPONENTS
LASER COMPONENTS DG, INC.
PROPRIETARY AND CONFIDENTIAL
REVISIONS
ZONE
REV.
DESCRIPTION
DATE
APPROVED

Handling the Receivers when they arrive:

Positive bias configuration is supplied as standard but negative can be ordered by request. Please ensure that the correct APD bias polarity is being supplied. However a current limiting resistor must be placed in series with the avalanche photodiode bias voltage to limit the current into the transimpedance amplifier. All series will handle a maximum current of 1mA of bias on the APD. Please ensure that the APD bias is limited to less than 1mA. Use the supplied, serialized datasheet for each device for correct operating bias voltage and maximum bias voltage (Vbd) that can be used.
Failure to limit the current may result in permanent damage to the device.

Testing Precautions:

1) Use proper ESD precautions when handling receivers
2) Connect the device to be measured correctly with the help of the product outline drawing (POD). If the device pins are not connected in the right direction, chances are that APD die or amplifier used in the Hybrid device will be permanent damaged
3) Ambient temperature and external light affects the operation of the device. If the device is operating in an environment with a high ambient temperature a heat sink is required
4) Avoid applying negative bias on the APD and maximum current of 1mA for positive bias configured receiver
5) To avoid impedance mismatch, which causes oscillations, use proper load resistor located as close as possible to the receiver
6) It is ideal to gradually apply supply and bias voltage, rather than in a surge
7) Avoid intense mechanical shock and vibration