



# CITCRYO4-16

## Cryogenic HEMT Low Noise Amplifier

### KEY FEATURES

- Very low noise, of the order of 5K over an extremely wide bandwidth, 4 to 16 GHz. Usable from 3 to 18 GHz.
- Operates with wide range of DC supply voltage.
- Provides usable gain and noise at DC power as low as 10 mW.
- Input return loss is  $<-10$  dB from 4 to 16 GHz.

### PERFORMANCE FEATURES

- RF frequency
  - 4 to 16 GHz
- Gain
  - $38 \text{ dB} \pm 2 \text{ dB}$
- Average noise temperature
  - $<5$  Kelvin
- Average noise figure
  - $<0.08 \text{ dB}$

### APPLICATIONS

- ✓ Radio astronomy arrays
- ✓ Satellite and Space Communication
- ✓ Research & development



## Description

- The CITCRYO4-16 is a GaAs HEMT cryogenic, low noise, broadband amplifier. It utilizes SMA jacks for RF-input and output and a 4-pin 2 mm pitch header for DC bias. The amplifier requires one drain voltage in the 0.6V to 1.5V range and one gate voltage in the -3V to +1V range. If desired, the gate supply can be eliminated (open pins on Vg1 and Vg2) at slightly less than optimum performance.
- The amplifier may be operated at room temperature to give a noise figure  $<1.7 \text{ dB}$  and gain 30 dB. Note that a more negative gate supply voltage, typically -1.5V, is required at room temperature. However, the amplifier is not damaged if the gate voltage for cryogenic operation, typically 0V, is applied at room temperature (though the gain is very low). Input and output return loss change very little from 300K to 4K.

## Electrical Specifications @ 12 K

Description	Typical	Minimum	Maximum
RF Frequency		4 GHz	16 GHz
Gain	38 dB	38 dB $\pm$ 2 dB	
Noise Temperature	< 5 K		
IRL (-20log S <sub>11</sub>  )		< -10 dB (8-16 GHz)	
ORL (-20log S <sub>22</sub>  )		< -10 dB (3-16 GHz)	
Drain Voltage	1.2 V	0.6 V	1.5 V

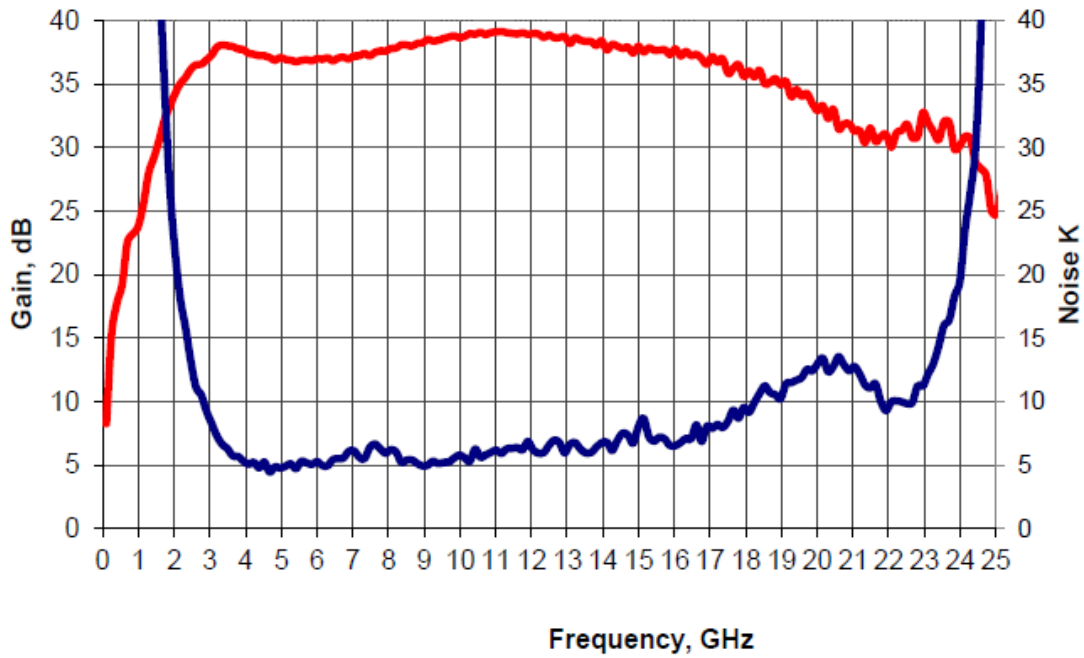
## Electrical Specifications @ 300 K

Description	Typical	Minimum	Maximum
RF Frequency		4 GHz	16 GHz
Gain	38 dB	38 dB $\pm$ 2 dB	
Noise Temperature	120 K		
IRL (-20log S <sub>11</sub>  )		< -10 dB (8-16 GHz)	
ORL (-20log S <sub>22</sub>  )		< -10 dB (3-16 GHz)	
DC Voltage	1.5 V	0.6 V	1.5 V

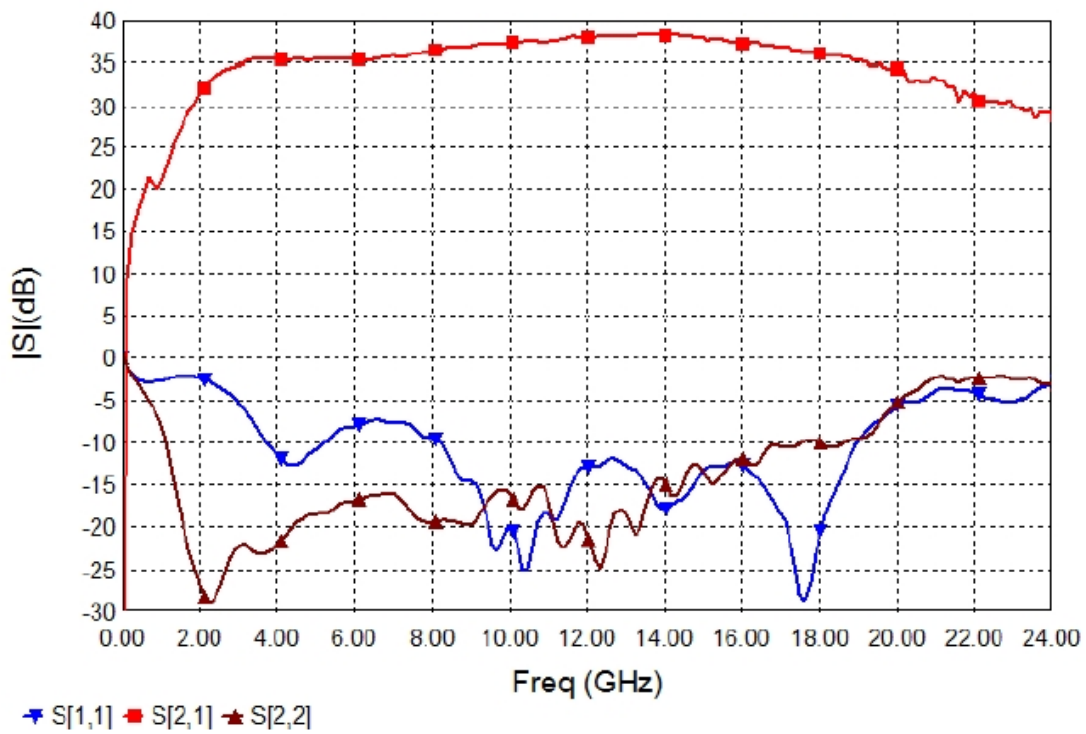
# Typical Test Results – Optimum DC Bias @ 19 K

## CITCRYO4-16 Noise and Gain

SN860D at 18K  
1.2V, 23mA, 0V Sep 2, 2014



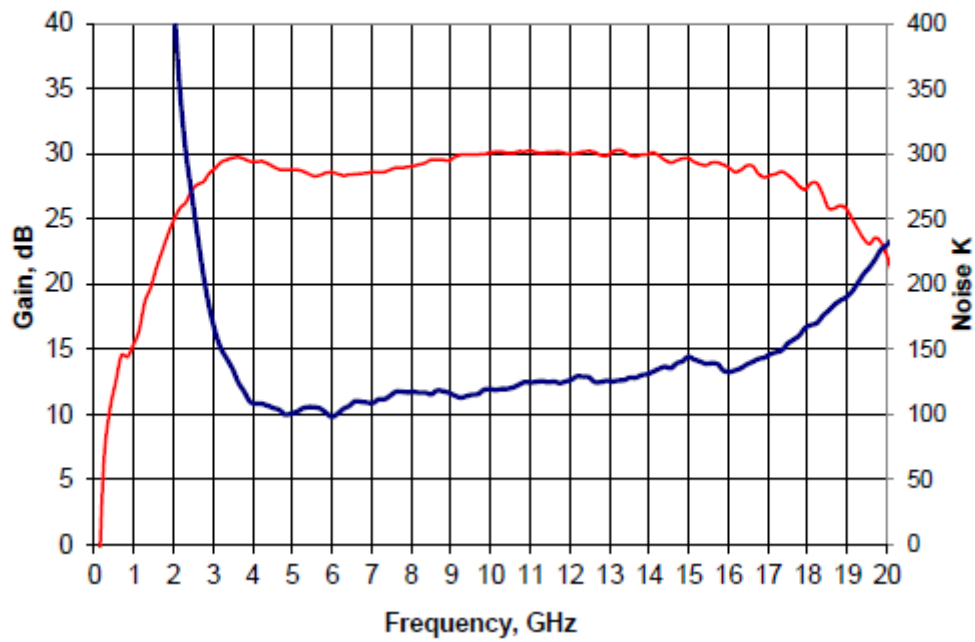
## CITCRYO4-16 SN855 19K, 1.2V, 21mA, 0V



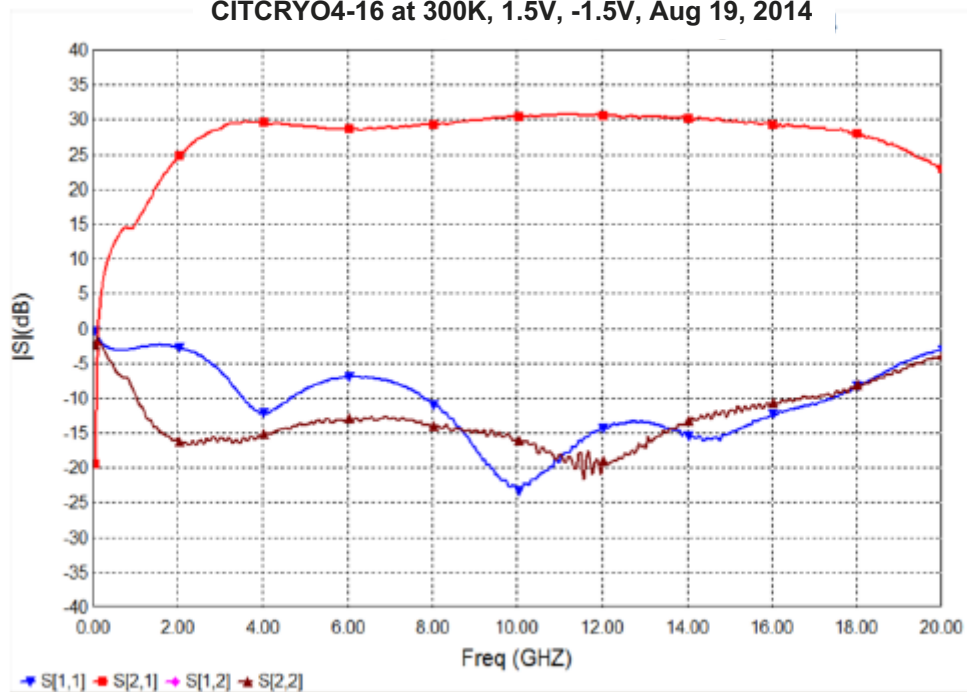
# Typical Test Results – Optimum DC Bias @ 300 K

CITCRYO4-16 Noise and Gain at 300K

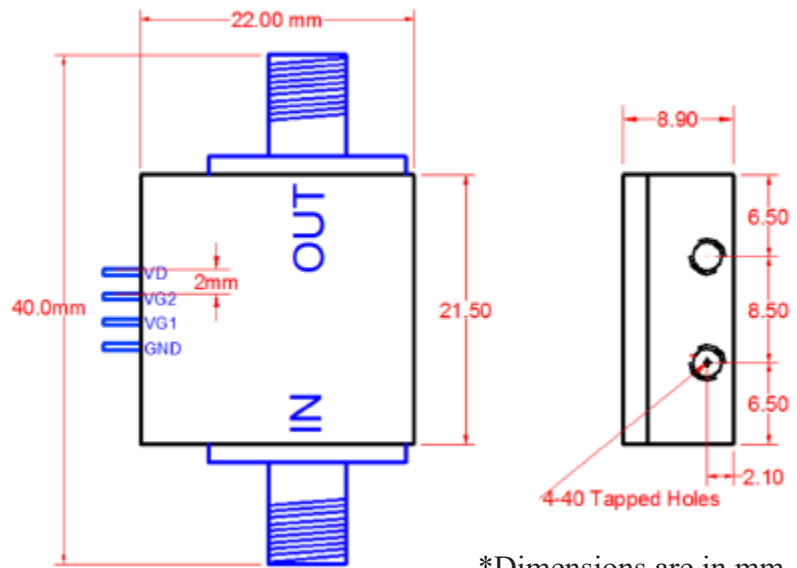
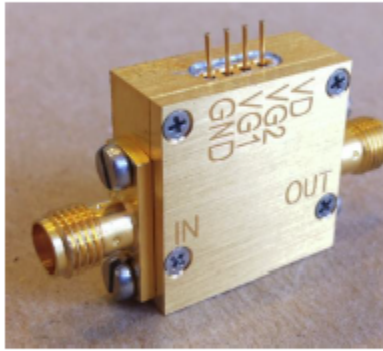
Vd=1.20V 37mA; Vg1= -.8V Vg2= -1.6V  
Module 855D Jul 20, 2014 File 3170



CITCRYO4-16 at 300K, 1.5V, -1.5V, Aug 19, 2014



# CAD Housing Drawing



\*Dimensions are in mm

## Optional Input Bias Tee

As an option, the amplifier can be supplied with a DC bias tee for an external device connected to the amplifier input. The bias tee is formed by two (2) resistors connected to the input; as shown in Figure 1. One (1) resistor can be used as a source of current and the other senses the voltage across the external device. Voltages applied to the bias tee have a small effect on amplifier operation. At 12 K, 20 K $\Omega$  resistors increase noise by 0.5 K.

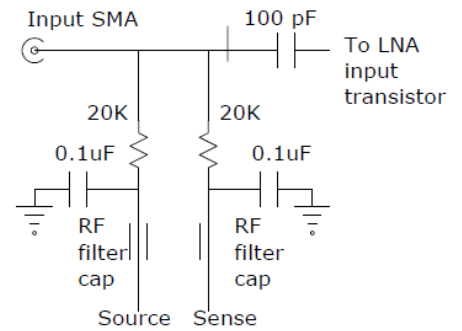
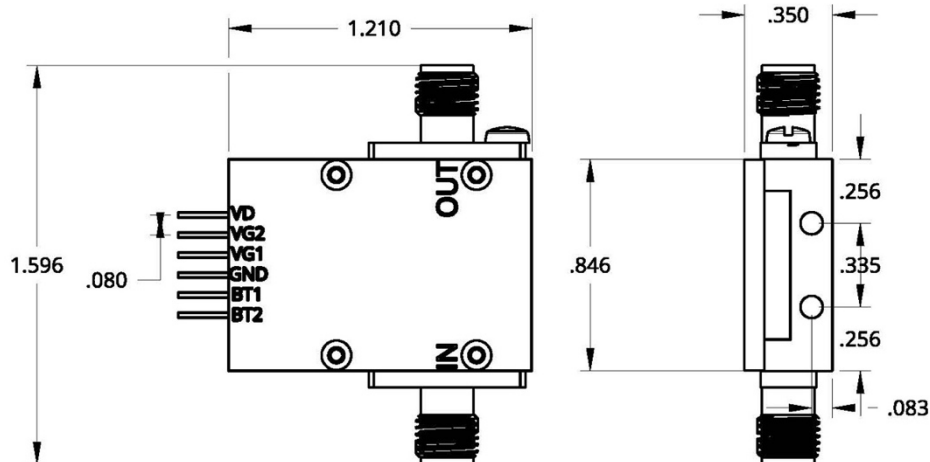


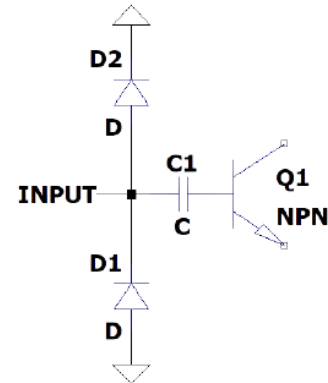
Figure 1. Bias Tee Schematic



# Optional Input Protection Diodes

As an option, the amplifier can be supplied with ESD protection & voltage spike protection at the RF input to the amplifier. There will be a slight degradation of the amplifier performance. Please note that the optional input protection diodes cannot be used if DC voltages are applied to the RF line using input bias tees.

To order an amplifier with internal bias resistors, add the resistance to the part #. For instance, CITCRYO4-16-PD.



**D1 & D2 = Input Protection Diodes**

Figure 2. Protection Diodes Schematic

## Product Care and Maintenance

- Use care to not bend (and break) the DC bias pin when tightening the output SMA connector.
- The amplifier should not be connected to the power supply when connecting the input connector.
- Set the power of Port 1 in your VNA to be less than -45 dB when testing the amplifier. Otherwise, the amplifier may saturate, and the data obtained will be incorrect.
- Do not attempt to open the amplifier.
- Electrostatic discharge may damage the amplifier.

## Contact Information

### Sales & Quotes

<b>Name</b>	Ms. Denise L. Smith
<b>Email Address</b>	<a href="mailto:Denise@CosmicMicroTech.com">Denise@CosmicMicroTech.com</a>
<b>Phone Number</b>	+1 (424) 456-7722
<b>Address</b>	15711 Condon Avenue, Unit A3, Lawndale, CA 90260, USA

### Technical Questions

<b>Name</b>	Mr. Stephen Smith
<b>Email Address</b>	<a href="mailto:Steve@CosmicMicroTech.com">Steve@CosmicMicroTech.com</a>
<b>Phone Number</b>	+1 (424) 456-7744
<b>Address</b>	15711 Condon Avenue, Unit A3, Lawndale, CA 90260, USA