

The 4002 Phase-Gain detector module is a perfect complement to 5007/5008 and ideal for many experimental RF applications. Enhances the performance of the AD8302 based core.



**Features**

- Compact, fully enclosed, EMI shielded
- 50Ω matched RF input ports
- SMA connectors on RF inputs and detector outputs
- 3.6V to 9V dc input with reverse polarity protection

**Applications**

- RF power control
- Reflected power monitoring
- Log ratio measurements
- Impedance measurements
- Phase matching
- Phase detecting
- RF Mixer
- Frequency comparison down to 0Hz

**Specifications (preliminary):**

**General**

Parameter	Test Condition	Min	Typ	Max	units
Input Frequency Range	From 50Ω source, useful response to 3GHz. Can be used to below 10MHz with external lowpass filter.	10		2700	MHz
Gain Range	Input at -30dBm		±30		dB
Phase Range	Input at -30dBm		±90		Degrees
Supply Voltage	Absolute maximum is ±16Vdc	3.6	5	9	V
Supply Current			10		mA

**Inputs**

Parameter	Test	Min	Typ	Max	units
Input Impedance			50		Ω
Input Return Loss	0~500MHz 500~1000MHz 1000~2000MHz			20 15 10	dB
Input Coupling	RF input ports are dc coupled and dc voltages should be limited to 2V maximum.				

**Magnitude Output**

Parameter	Test	Min	Typ	Max	units
Output Scale	Both inputs at -30dBm 900MHz		30		mV/dB
Maximum Output	RF1=0dBm RF2=-30dBm		1.8		V
Center Scale	RF1=RF2=-30dBm		900		mV
Output current	Sink or source		8		mA
Bandwidth	Small Signal		10		MHz
Rise/fall time	20dB change		100		ns

**Phase Output**

Parameter	Test	Min	Typ	Max	units
Maximum Output	0deg. phase difference		1.8		V
Minimum Output	180deg. phase difference		30		mV
Center Scale	Phase difference ±90deg.		900		mV
Output current	Sink or source		8		mA
Bandwidth	Small Signal		10		MHz
Rise/fall time	20dB change		100		ns

Note:(bandwidth and rise time limited by internal filter capacitor size. Contract Valon for increase BW options)

**Reference Output**

Output Voltage		1.7	1.8	1.9	V
Output Current			5		Ma

**Dynamic Range at 100MHz**

Parameter	Test	Min	Typ	Max	units
MAG Linearity	±1dB linearity, -30dBm Ref		58		dB
MAG Slope			29		mV/dB
MAG balance	RF1=RF2=-5dBm to -50dBm		0.2		dB
Phase Linearity	±1deg. linear		145		deg.
Phase Slope	From linear +90deg to -90 deg		10		mV/deg.
Phase Balance	RF1=RF2=-5dBm to -50dBm		0.7		deg.

**Dynamic Range at 900MHz**

Parameter	Test	Min	Typ	Max	units
MAG Linearity	±1dB linearity, -30dBm Ref		58		dB
MAG Slope			28.7		mV/dB
MAG balance	RF1=RF2=-5dBm to -50dBm		0.2		dB
Phase Linearity	±1deg. linear		143		deg.
Phase Slope	From linear +90deg to -90 deg		10.1		mV/deg.
Phase Balance	RF1=RF2=-5dBm to -50dBm		0.8		deg.

**Dynamic Range at 1900MHz**

Parameter	Test	Min	Typ	Max	units
MAG Linearity	±1dB linearity, -30dBm Ref		57		dB
MAG Slope			27.5		mV/dB
MAG balance	RF1=RF2=-5dBm to -50dBm		0.2		dB
Phase Linearity	±1deg. linear		128		deg.
Phase Slope	From linear +90deg to -90 deg		10		mV/deg.
Phase Balance	RF1=RF2=-5dBm to -50dBm		1		deg.

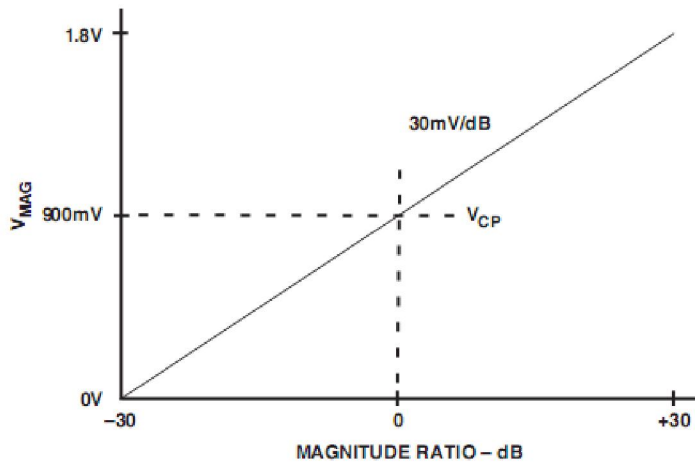
**Dynamic Range at 2200MHz**

Parameter	Test	Min	Typ	Max	units
MAG Linearity	±1dB linearity, -30dBm Ref		53		dB
MAG Slope			27.5		mV/dB
MAG balance	RF1=RF2=-5dBm to -50dBm		0.2		dB
Phase Linearity	±1deg. linear		115		deg.
Phase Slope	From linear +90deg to -90 deg		10		mV/deg.
Phase Balance	RF1=RF2=-5dBm to -50dBm		3		deg.

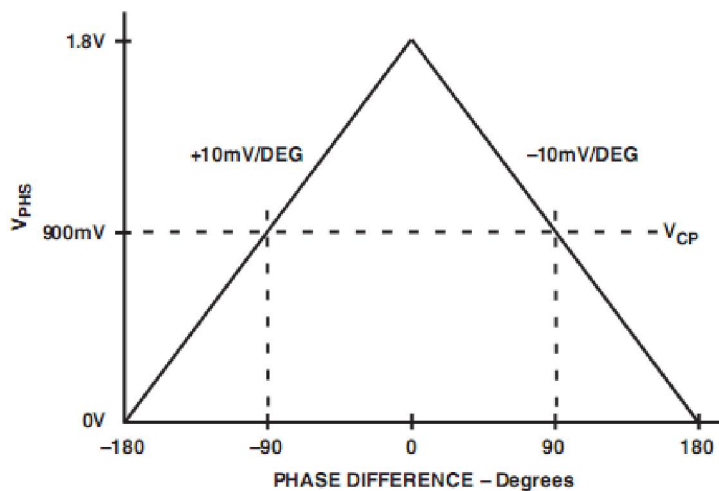
### Typical output Characteristics

The plots below are typical characteristics of the AD8304 analog detector used in the 4002 Phase Gain detector module.

The MAG output will provide a signal level that is proportional to the relative difference between RF1 and RF2. Typically when amplitude (magnitude) of RF1=RF2 at -30dBm then the Magnitude Output will be 900mV as show below. The output will change at a rate of 30mV/dB as the relative difference between these two inputs change. Performance parameters such as linearity and noise are affected by signal level and frequency.



The PHASE output will provide a signal level that is proportional to the relative phase difference between RF1 and RF2. Typically when the phase of RF1 leads RF2 by 90 degrees then the Phase Output will be 900mV. As the phase of RF1 increases from 90 degrees relative to RF2 the output will decrease at a rate of 10mV/degree. As with the Magnitude Output, performance parameters such as linearity and noise will be affected by signal level and frequency.



The DC Reference Output provides a 1.8V signal that can be used with the Magnitude and Phase output signals as a reference. This signal can be used in a bridge circuit

to provide a convenient zero reference when the RF inputs are equal and the phase is at 90 degrees.

**Mechanical Dimensions**

