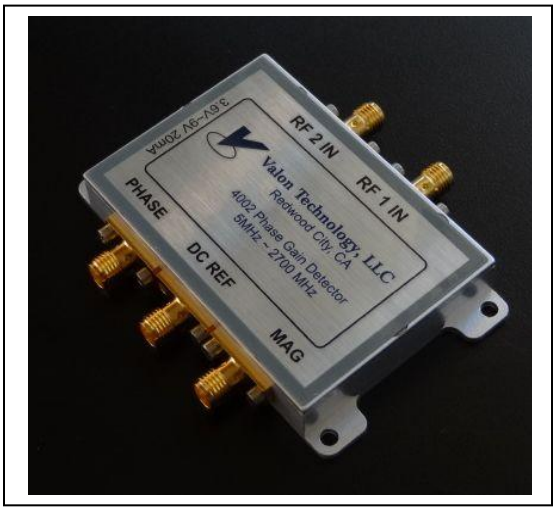
**4002 Phase-Gain Detector Module**
5MHz to 2700MHz Dual Log Amps with Phase Detector

The **Valon 4002 Phase-Gain detector module** is a perfect complement to any of our synthesizers and ideal for many experimental RF applications. The 4002 provides relative Gain and Phase information for RF signals in the 10MHz to 2700MHz. It is based on the Analog Devices AD8302 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

**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<br>500~1000MHz<br>1000~2000MHz | | | 20<br>15<br>10 | dB |
| Input Coupling | RF input ports are dc coupled and dc voltages should be limited to 2V maximum. | | | | |

**Mag**nitude **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**

| | | | | | |
|---|---|---|---|---|---|
| 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. Contact 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. |

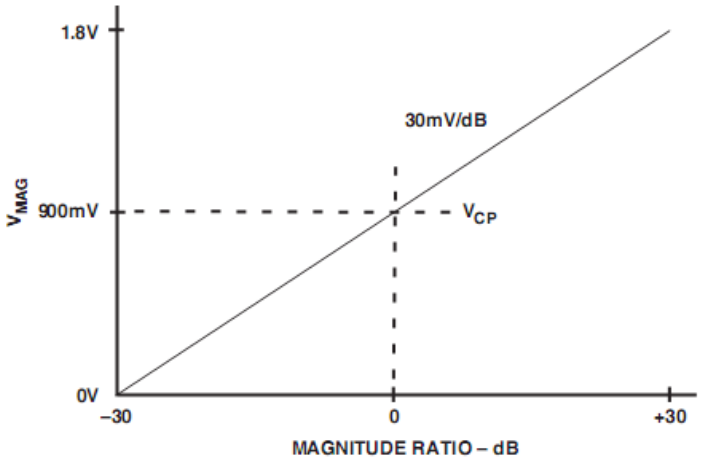
**Dynamic Range at 2200MHz**

| 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. |

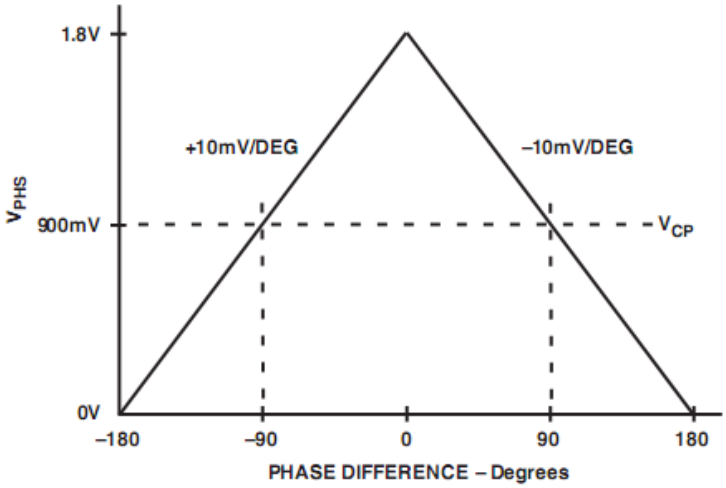
## Typical output Characteristics

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= -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