

FEATURES

- Wide bandwidth: 1 MHz to 10 GHz**
- High accuracy: ± 1.0 dB over temperature**
- 45 dB dynamic range up to 8 GHz**
- Stability over temperature: ± 0.5 dB**
- Low noise measurement/controller output VOUT**
- Pulse response time (fall/rise): 6 ns/10 ns**
- Small footprint: 2 mm \times 3 mm LFCSP**
- Supply operation: 3.0 V to 5.5 V @ 22 mA**
- Fabricated using high speed SiGe process**

APPLICATIONS

- RF transmitter PA setpoint controls and level monitoring**
- Power monitoring in radiolink transmitters**
- RSSI measurement in base stations, WLANs, WiMAX, and radars**

GENERAL DESCRIPTION

The AD8319 is a demodulating logarithmic amplifier, capable of accurately converting an RF input signal to a corresponding decibel-scaled output. It employs the progressive compression technique over a cascaded amplifier chain, each stage of which is equipped with a detector cell. The device can be used in either measurement or controller modes. The AD8319 maintains accurate log conformance for signals of 1 MHz to 8 GHz and provides useful operation to 10 GHz. The input dynamic range is typically 45 dB (re: 50 Ω) with error less than ± 3 dB. The AD8319 has 6 ns/10 ns (fall time/rise time) response time that enables RF burst detection to a pulse rate of beyond 50 MHz. The device provides unprecedented logarithmic intercept stability vs. ambient temperature conditions. A supply of 3.0 V to 5.5 V is required to power the device. Current consumption is typically 22 mA, and it decreases to 200 μ A when the device is disabled. The AD8319 can be configured to provide a control voltage to a power amplifier or a measurement output from the VOUT pin. Because the output can be used for controller applications, special attention was paid to minimize wideband noise. In this mode, the setpoint control voltage is applied to the VSET pin.

FUNCTIONAL BLOCK DIAGRAM

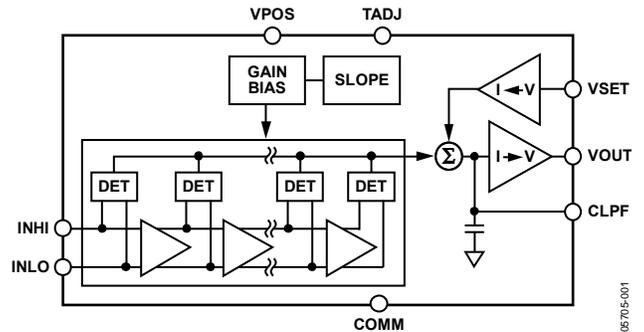


Figure 1.

The feedback loop through an RF amplifier is closed via VOUT, the output of which regulates the output of the amplifier to a magnitude corresponding to VSET. The AD8319 provides 0 V to ($V_{POS} - 0.1$ V) output capability at the VOUT pin, suitable for controller applications. As a measurement device, VOUT is externally connected to VSET to produce an output voltage, V_{OUT} , that is a decreasing linear-in-dB function of the RF input signal amplitude.

The logarithmic slope is -22 mV/dB, determined by the VSET interface. The intercept is 15 dBm (re: 50 Ω , CW input) using the INHI input. These parameters are very stable against supply and temperature variations.

The AD8319 is fabricated on a SiGe bipolar IC process and is available in a 2 mm \times 3 mm, 8-lead LFCSP for an operating temperature range of -40°C to $+85^{\circ}\text{C}$.

Rev. B

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SPECIFICATIONS

$V_{POS} = 3\text{ V}$, $C_{LPF} = 1000\text{ pF}$, $T_A = 25^\circ\text{C}$, $52.3\ \Omega$ termination resistor at INHI, unless otherwise noted.

Table 1.

| Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------------------------------------------|-----------------------------------------------|-------|-----------------|-------|---------------------|
| SIGNAL INPUT INTERFACE | | | | | |
| Specified Frequency Range | INHI (Pin 1) | 0.001 | | 10 | GHz |
| DC Common-Mode Voltage | | | $V_{POS} - 0.6$ | | V |
| MEASUREMENT MODE | | | | | |
| VOUT (Pin 5) shorted to VSET (Pin 4), sinusoidal input signal | | | | | |
| $R_{TADJ} = 18\text{ k}\Omega$ | | | | | |
| $f = 900\text{ MHz}$ | | | | | |
| Input Impedance | $T_A = 25^\circ\text{C}$ | | 1500 0.33 | | ΩpF |
| $\pm 1\text{ dB}$ Dynamic Range | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$ | | 40 | | dB |
| Maximum Input Level | $\pm 1\text{ dB}$ error | | -3 | | dBm |
| Minimum Input Level | $\pm 1\text{ dB}$ error | | -43 | | dBm |
| Slope ¹ | | -25 | -22 | -19.5 | mV/dB |
| Intercept ¹ | | 12 | 15 | 21 | dBm |
| Output Voltage: High Power In | $P_{IN} = -10\text{ dBm}$ | | 0.57 | | V |
| Output Voltage: Low Power In | $P_{IN} = -40\text{ dBm}$ | | 1.25 | | V |
| $f = 1.9\text{ GHz}$ | | | | | |
| Input Impedance | $R_{TADJ} = 8\text{ k}\Omega$ | | 950 0.38 | | ΩpF |
| $\pm 1\text{ dB}$ Dynamic Range | $T_A = 25^\circ\text{C}$ | | 40 | | dB |
| Maximum Input Level | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$ | | 40 | | dB |
| Minimum Input Level | $\pm 1\text{ dB}$ error | | -4 | | dBm |
| Slope ¹ | $\pm 1\text{ dB}$ error | | -44 | | dBm |
| Intercept ¹ | | -25 | -22 | -19.5 | mV/dB |
| Output Voltage: High Power In | | 10 | 13 | 20 | dBm |
| Output Voltage: Low Power In | $P_{IN} = -10\text{ dBm}$ | | 0.53 | | V |
| | $P_{IN} = -35\text{ dBm}$ | | 1.19 | | V |
| $f = 2.2\text{ GHz}$ | | | | | |
| Input Impedance | $R_{TADJ} = 8\text{ k}\Omega$ | | 810 0.39 | | ΩpF |
| $\pm 1\text{ dB}$ Dynamic Range | $T_A = 25^\circ\text{C}$ | | 40 | | dB |
| Maximum Input Level | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$ | | 40 | | dB |
| Minimum Input Level | $\pm 1\text{ dB}$ error | | -5 | | dBm |
| Slope ¹ | $\pm 1\text{ dB}$ error | | -45 | | dBm |
| Intercept ¹ | | | -22 | | mV/dB |
| Output Voltage: High Power In | | | 13 | | dBm |
| Output Voltage: Low Power In | $P_{IN} = -10\text{ dBm}$ | | 0.5 | | V |
| | $P_{IN} = -35\text{ dBm}$ | | 1.18 | | V |
| $f = 3.6\text{ GHz}$ | | | | | |
| Input Impedance | $R_{TADJ} = 8\text{ k}\Omega$ | | 300 0.33 | | ΩpF |
| $\pm 1\text{ dB}$ Dynamic Range | $T_A = 25^\circ\text{C}$ | | 40 | | dB |
| Maximum Input Level | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$ | | 36 | | dB |
| Minimum Input Level | $\pm 1\text{ dB}$ error | | -6 | | dBm |
| Slope ¹ | $\pm 1\text{ dB}$ error | | -46 | | dBm |
| Intercept ¹ | | | -22 | | mV/dB |
| Output Voltage: High Power In | | | 10 | | dBm |
| Output Voltage: Low Power In | $P_{IN} = -10\text{ dBm}$ | | 0.46 | | V |
| | $P_{IN} = -40\text{ dBm}$ | | 1.14 | | V |

AD8319

| Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------------------------|---------------------------------------------------------------------------------------------------|-----|------------------------|-----|--------|
| f = 5.8 GHz | R _{TADJ} = 500 Ω | | | | |
| Input Impedance | | | 110 0.05 | | Ω pF |
| ±1 dB Dynamic Range | T _A = 25°C | | 40 | | dB |
| | -40°C < T _A < +85°C | | 40 | | dB |
| Maximum Input Level | ±1 dB error | | -3 | | dBm |
| Minimum Input Level | ±1 dB error | | -43 | | dBm |
| Slope ¹ | | | -22 | | mV/dB |
| Intercept ¹ | | | 15 | | dBm |
| Output Voltage: High Power In | P _{IN} = -10 dBm | | 0.57 | | V |
| Output Voltage: Low Power In | P _{IN} = -40 dBm | | 1.25 | | V |
| f = 8.0 GHz | R _{TADJ} = open | | | | |
| Input Impedance | | | 28 0.79 | | Ω pF |
| ±1 dB Dynamic Range | T _A = 25°C | | 40 | | dB |
| | -40°C < T _A < +85°C | | 31 | | dB |
| Maximum Input Level | ±1 dB error | | -1 | | dBm |
| Minimum Input Level | ±1 dB error | | -41 | | dBm |
| Slope ² | | | -22 | | mV/dB |
| Intercept ² | | | 20 | | dBm |
| Output Voltage: High Power In | P _{IN} = -10 dBm | | 0.67 | | V |
| Output Voltage: Low Power In | P _{IN} = -40 dBm | | 1.34 | | V |
| OUTPUT INTERFACE | | | | | |
| VOUT (Pin 5) | | | | | |
| Voltage Swing | V _{SET} = 0 V; R _{FIN} = open | | V _{POS} - 0.1 | | V |
| | V _{SET} = 1.5 V; R _{FIN} = open | | 10 | | mV |
| Output Current Drive | V _{SET} = 0 V; R _{FIN} = open | | 10 | | mA |
| Small Signal Bandwidth | R _{FIN} = -10 dBm; from CLPF to VOUT | | 140 | | MHz |
| Output Noise | R _{FIN} = 2.2 GHz, -10 dBm, f _{NOISE} = 100 kHz, C _{LPF} = open | | 90 | | nV/√Hz |
| Fall Time | Input level = no signal to -10 dBm, 90% to 10%; C _{LPF} = 8 pF | | 18 | | ns |
| | Input level = no signal to -10 dBm, 90% to 10%; C _{LPF} = open; R _{OUT} = 150 Ω | | 6 | | ns |
| Rise Time | Input level = -10 dBm to no signal, 10% to 90%; C _{LPF} = 8 pF | | 20 | | ns |
| | Input level = -10 dBm to no signal, 10% to 90%; C _{LPF} = open; R _{OUT} = 150 Ω | | 10 | | ns |
| Video Bandwidth (or Envelope Bandwidth) | | | 50 | | MHz |
| VSET INTERFACE | | | | | |
| VSET (Pin 4) | | | | | |
| Nominal Input Range | R _{FIN} = 0 dBm; measurement mode | | 0.35 | | V |
| | R _{FIN} = -40 dBm; measurement mode | | 1.23 | | V |
| Logarithmic Scale Factor | | | -45 | | dB/V |
| Input Resistance | R _{FIN} = -20 dBm; controller mode; V _{SET} = 1 V | | 40 | | kΩ |
| TADJ INTERFACE | | | | | |
| TADJ (Pin 6) | | | | | |
| Input Resistance | TADJ = 0.9 V, sourcing 50 μA | | 40 | | kΩ |
| Disable Threshold Voltage | TADJ = open | | V _{POS} - 0.4 | | V |
| POWER INTERFACE | | | | | |
| VPOS (Pin 7) | | | | | |
| Supply Voltage | | 3.0 | | 5.5 | V |
| Quiescent Current | | 18 | 22 | 30 | mA |
| vs. Temperature | -40°C ≤ T _A ≤ +85°C | | 60 | | μA/°C |
| Disable Current | TADJ = VPOS | | 200 | | μA |

¹ Slope and intercept are determined by calculating the best fit line between the power levels of -40 dBm and -10 dBm at the specified input frequency.

² Slope and intercept are determined by calculating the best fit line between the power levels of -34 dBm and -16 dBm at 8.0 GHz.

ABSOLUTE MAXIMUM RATINGS

Table 2.

| Parameter | Rating |
|----------------------------------------------|-----------------|
| Supply Voltage: V_{POS} | 5.7 V |
| V_{SET} Voltage | 0 to V_{POS} |
| Input Power (Single-Ended, re: 50 Ω) | 12 dBm |
| Internal Power Dissipation | 0.73 W |
| θ_{JA} | 55°C/W |
| Maximum Junction Temperature | 125°C |
| Operating Temperature Range | -40°C to +85°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 60 sec) | 260°C |

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION



ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

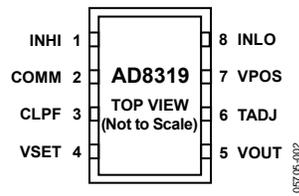


Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

| Pin No. | Mnemonic | Description |
|---------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | INHI | RF Input. Nominal input range of -50 dBm to 0 dBm, re: 50Ω ; ac-coupled RF input. |
| 2 | COMM | Device Common. Connect this pin to a low impedance ground plane. |
| 3 | CLPF | Loop Filter Capacitor. In measurement mode, this capacitor sets the pulse response time and video bandwidth. In controller mode, the capacitance on this node sets the response time of the error amplifier/integrator. |
| 4 | VSET | Setpoint Control Input for Controller Mode or Feedback Input for Measurement Mode. |
| 5 | VOUT | Measurement and Controller Output. In measurement mode, VOUT provides a decreasing linear-in-dB representation of the RF input signal amplitude. In controller mode, VOUT is used to control the gain of a VGA or VVA with a positive gain sense (increasing voltage increases gain). |
| 6 | TADJ | Temperature Compensation Adjustment. Frequency dependent temperature compensation is set by connecting a ground referenced resistor to this pin. |
| 7 | VPOS | Positive Supply Voltage, 3.0 V to 5.5 V. |
| 8 | INLO | RF Common for INHI. AC-coupled RF common. |
| | Paddle | The paddle is internally connected to COMM; solder to a low impedance ground plane. |

OUTLINE DIMENSIONS

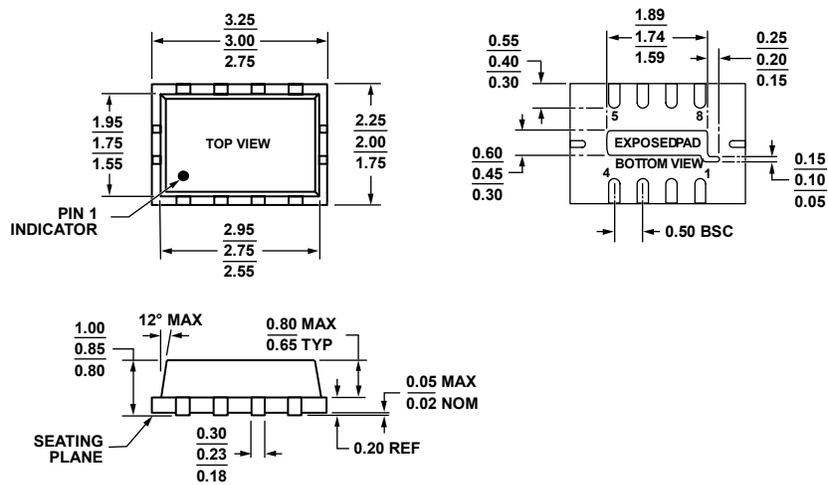


Figure 39. 8-Lead Lead Frame Chip Scale Package [LFCSP_VD]
 2 mm × 3 mm Body, Very Thin, Dual Lead
 (CP-8-1)
 Dimensions shown in millimeters

031207-A

ORDERING GUIDE

| Model | Temperature Range | Package Description | Package Option | Branding |
|----------------------------|-------------------|------------------------------|----------------|----------|
| AD8319ACPZ-R7 ¹ | -40°C to +85°C | 8-Lead LFCSP_VD | CP-8-1 | Q2 |
| AD8319ACPZ-R2 ¹ | -40°C to +85°C | 8-Lead LFCSP_VD | CP-8-1 | Q2 |
| AD8319ACPZ-WP ¹ | -40°C to +85°C | 8-Lead LFCSP_VD, Waffle Pack | CP-8-1 | Q2 |
| AD8319-EVALZ ¹ | | Evaluation Board | | |

¹ Z = RoHS Compliant Part.