60 dB, LOGARITHMIC DETECTOR / CONTROLLER, 1 - 10000 MHz

Typical Applications

The HMC611 is ideal for:

• Cellular/PCS/3G

• WiMAX, WiBro, WLAN, Fixed Wireless & Radar

• Power Monitoring & Control Circuitry

• Receiver Signal Strength Indication (RSSI)

• Automatic Gain & Power Control

Features

Wide Dynamic Range: Up to 70 dB

High Accuracy: ±1 dB with 51 dB Range Up to 8 GHz

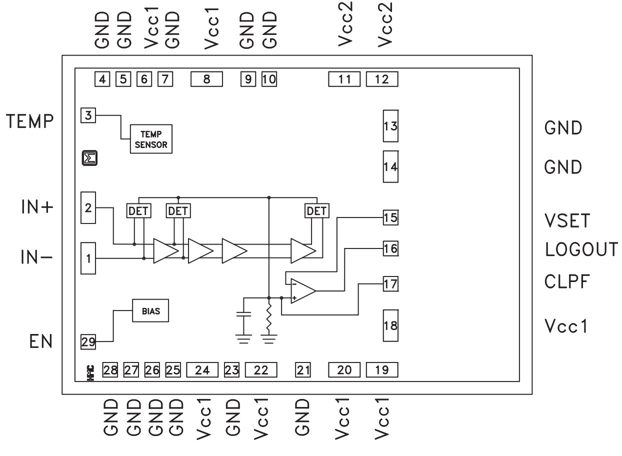
Supply Voltage: +5V

Excellent Stability over Temperature

Buffered Temperature Sensor Output

Die Size: 1.75 x 1.41 x 0.25 mm

Functional Diagram



General Description

The HMC611 SiGe BiCMOS Logarithmic Detector/ Controller generates a voltage that is proportional to the log of the RF power envelop presented to its input. The HMC611 employs a successive compression topology which delivers extremely high dynamic range and conversion accuracy over a wide input frequency range. As the input power is increased, successive amplifiers move into saturation one by one creating an accurate approximation of the logarithm function. The output of a series of square law detectors is summed, converted into voltage domain and buffered to drive the LOGOUT output. For detection mode, the LOGOUT pin is shorted to the VSET input, and will provide a nominal logarithmic slope of -25 mV/dB and an intercept of 18 dBm (22 dBm for $f \geq 5.8$ GHz). The HMC611 can also be used in the controller mode where an external voltage is applied to the VSET pin, to create an AGC or APC feedback loop.

Electrical Specifications, T_A = +25C[1], Vcc1 = 5V, Vcc2 = 5v

Parameter	Typ.	Typ.	Typ.	Typ.	Typ.	Units
Input Frequency	1 - 3600	5800	7000	8000	10000	MHz
±3 dB Dynamic Range	70	66	62	59	50	dB
±3 dB Dynamic Range Center	-25	-23	-21	-20	-15	dBm
±1 dB Dynamic Range	60	61	58	52	42	dB
Output Intercept	18	25	23	22	21	dBm
Output Slope	-25	-24	-26	-28	-32	mV/dB

[1] Detector mode measurements; LOGOUT (Pin 18) is shorted to VSET (Pin 17).

Electrical Specifications, (continued)

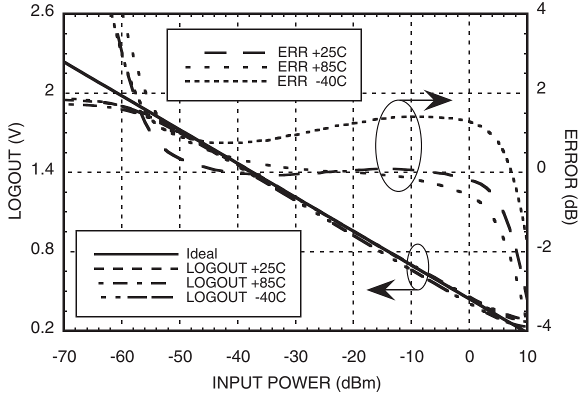
Parameter	Conditions	Min.	Typ.	Max.	Units
LOGOUT Interface					
Output Voltage Range		0		Vcc -1.0	V
Output Rise Time [3] / Fall Time [4]			10 / 10		ns
VSET Interface					
Input Impedance			30		kΩ
Input Voltage Range			0.25 to 1.35		V
Low Frequency Gain	VSET to LOGOUT		56		dB
Open Loop Corner Frequency [2]			700		kHz
Power Down (EN) Interface					
Voltage Range for Normal Mode		0.8 x Vcc [1]		Vcc [1]	V
Voltage Range for Powerdown Mode		0		0.2 x Vcc [1]	V
Threshold Voltage			Vcc [1]/2		V
Power Supply (Vcc1, Vcc2)					
Operating Voltage Range		4.5		5.5	V
Supply Current in Normal Mode			103	120	mA
Supply Current in Power Down Mode			1		mA

[1] Vcc= Vcc1= Vcc2= +5V
[2] This parameter describes the open loop gain bandwidth of the HMC611 output amplifier with no feedback from VSET to LOGOUT.
[3] -10 dBm Input Pulsed; measured from 10% to 70%; C9 removed from board
[4] -10 dBm Input Pulsed; measured from 90% to 10%; C9 removed from board

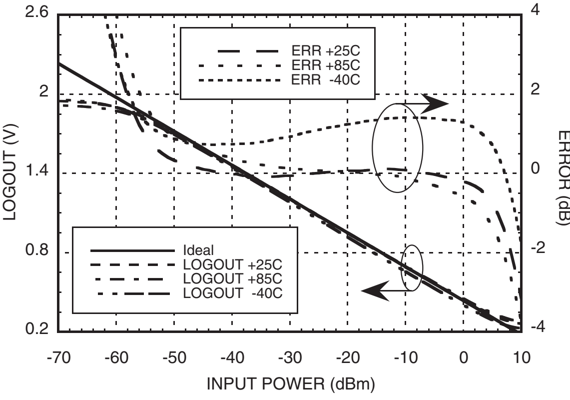
Test Conditions

Parameter	Condition
Vcc1 = Vcc2	+5V
Input Zo - w/ 68 Ω Term Resistor at IN+	50 Ω
T_A	+25 C
Fin (CW)	900 MHz
IN- Port connected to ground through a 1000pF capacitor	

LOGOUT Voltage & Error vs. Input Power, Fin = 50 MHz

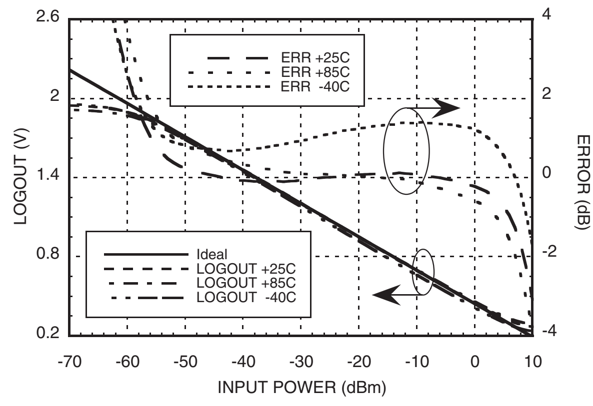


LOGOUT Voltage & Error vs. Input Power, Fin = 100 MHz

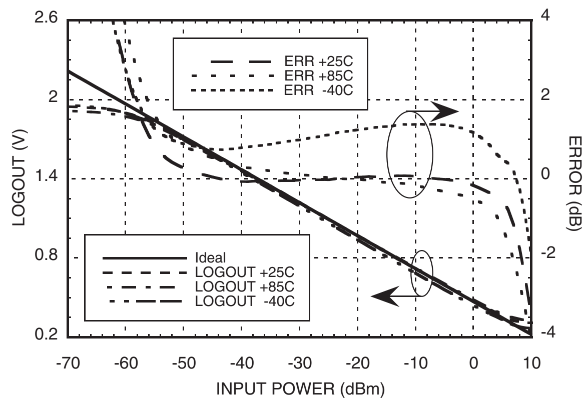


Unless otherwise noted: Vcc1, Vcc2 = +5V, T_A = +25C

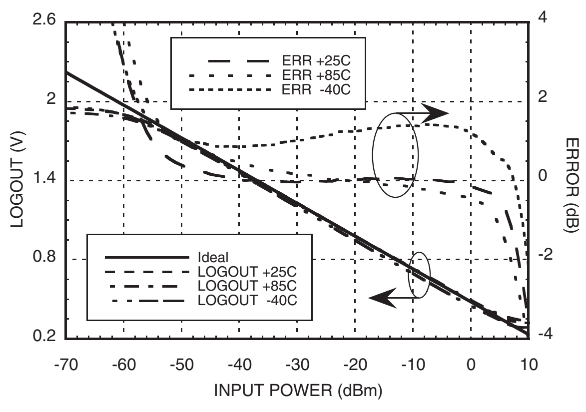
LOGOUT Voltage & Error vs. Input Power, Fin = 900 MHz



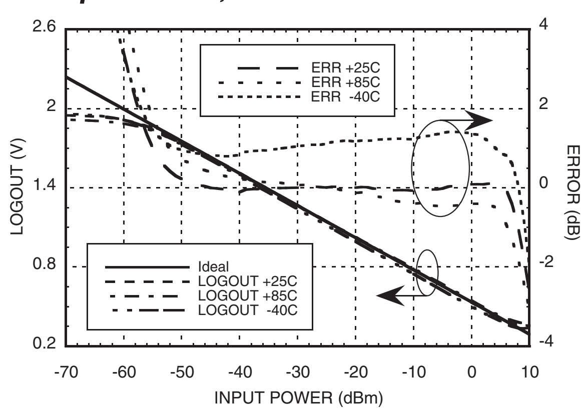
LOGOUT Voltage & Error vs. Input Power, Fin = 1900 MHz



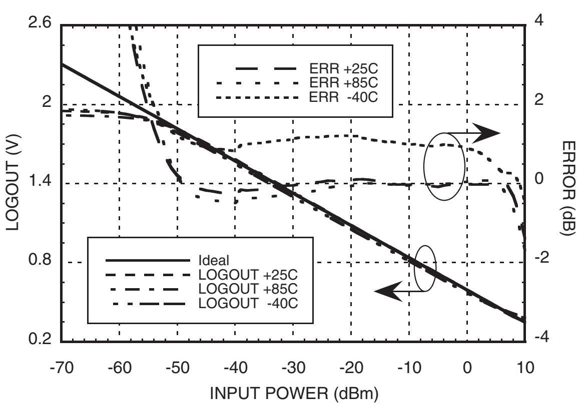
LOGOUT Voltage & Error vs. Input Power, Fin = 2200 MHz



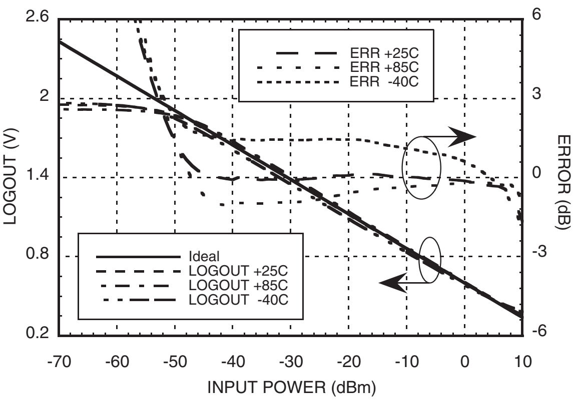
LOGOUT Voltage & Error vs. Input Power, Fin = 3600 MHz



LOGOUT Voltage & Error vs. Input Power, Fin = 5800 MHz



LOGOUT Voltage & Error vs. Input Power, Fin = 7000 MHz



Unless otherwise noted: Vcc1, Vcc2 = +5V, T_A = +25C

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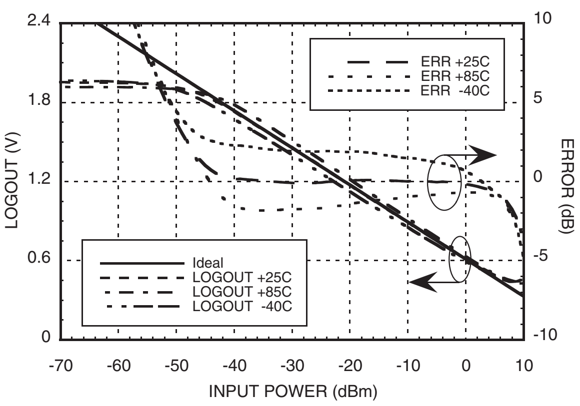
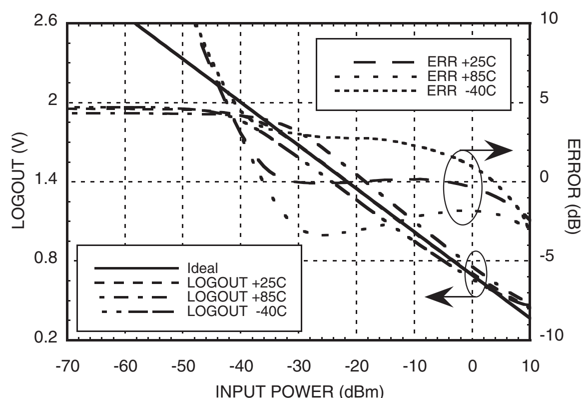
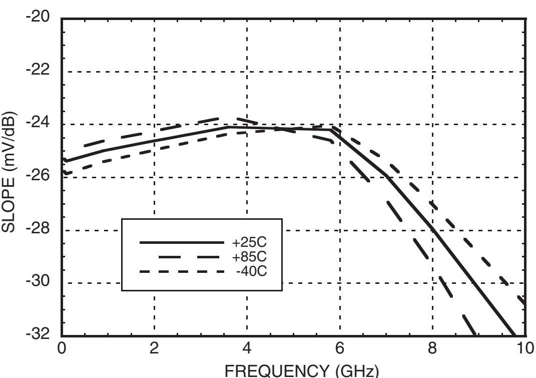
LOGOUT Voltage & Error vs. Input Power, Fin = 8000 MHz



LOGOUT Voltage & Error vs. Input Power, Fin = 10000 MHz

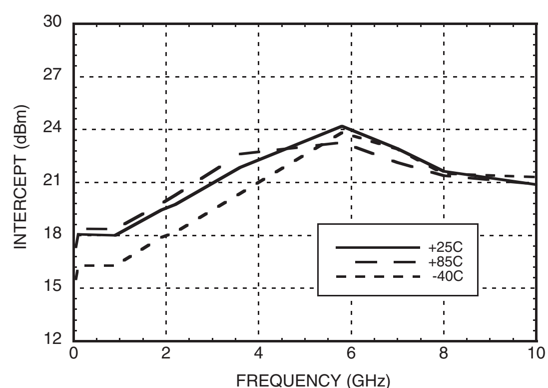


LOGOUT Slope vs. Frequency

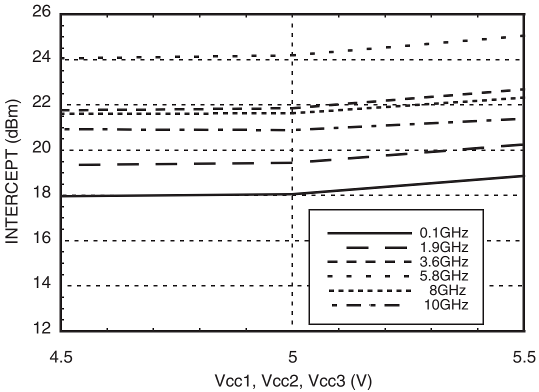


Unless otherwise noted: Vcc1, Vcc2 = +5V, T_A = +25C

LOGOUT Intercept vs. Frequency



LOGOUT Intercept vs. Supply Voltage



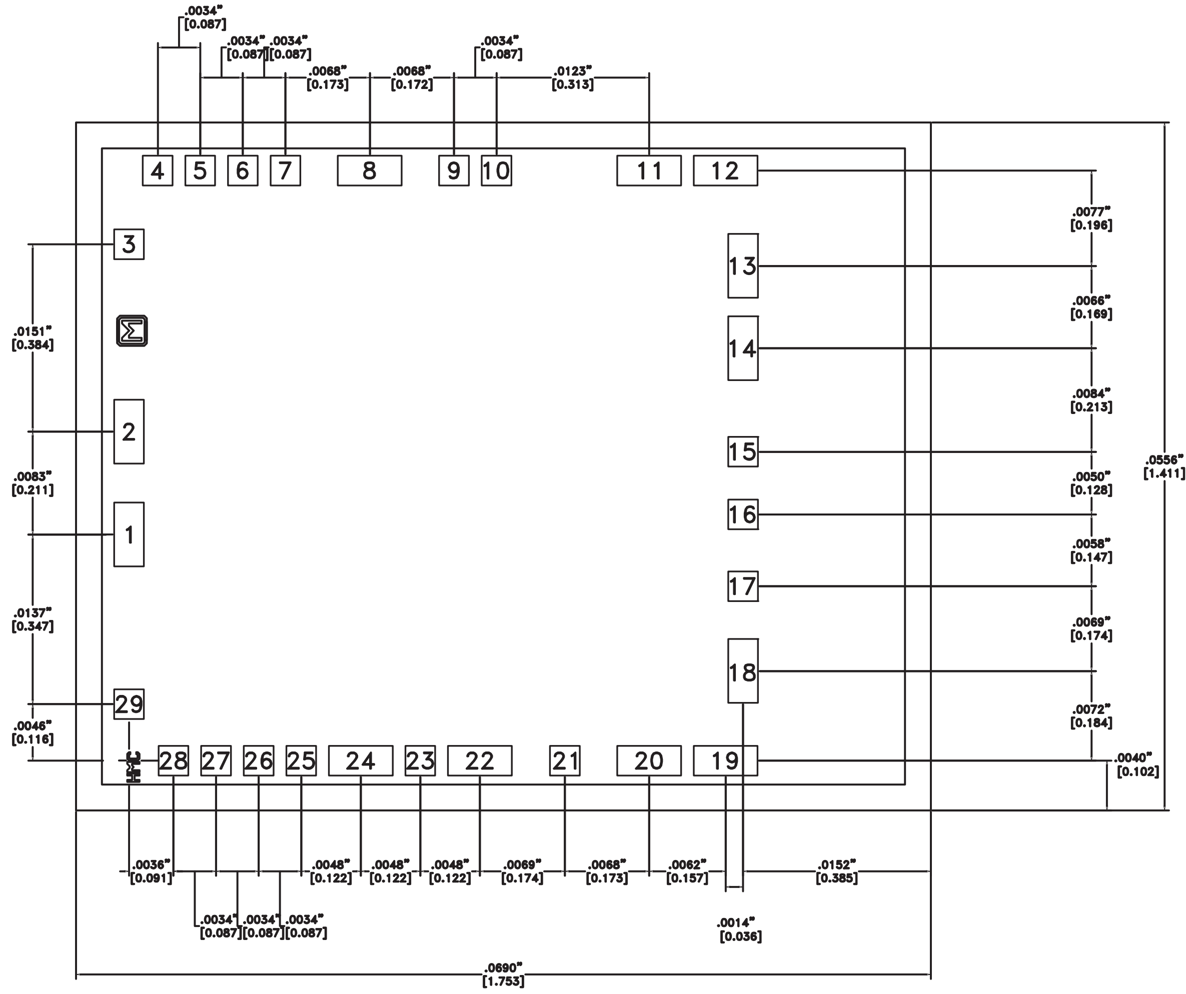
Absolute Maximum Ratings

Vcc1, Vcc2	+5.6V
EN	+5.6V
VSET Input Voltage	+5.6V
LOGOUT Output Current	3 mA
RF Input Power	+15 dBm
Junction Temperature	125 °C
Continuous Pdiss (T = 85°C) (Derate 21.6 mW/°C above 85°C)	0.86 Watts
Thermal Resistance (R_{th}) (junction to die bottom)	46.6 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

[1] Unless otherwise noted: Vcc1, Vcc2 = +5V, T_A = +25C

60 dB, LOGARITHMIC DETECTOR / CONTROLLER, 1 - 10000 MHz

Outline Drawing



Die Packaging Information [1]

Standard	Alternate
WP-3 (Waffle Pack)	[2]

[1] Refer to the "Packaging Information" section for die packaging dimensions.

[2] For alternate packaging information contact Hittite Microwave Corporation.

NOTES:
1. ALL DIMENSIONS IN INCHES [MILLIMETERS]
2. DIE THICKNESS IS 0.010 [0.25]
3. TYPICAL BOND PAD IS 0.0024 SQUARE
4. BOND PAD METALLIZATION: ALUMINUM
5. NO BACKSIDE METAL
6. NO CONNECTION REQUIRED FOR UNLABELED BOND PADS
7. OVERALL DIE SIZE IS ±.002

Die Pad Dimensions

Pads	Pad Size
1, 2, 8, 11 - 14, 18 - 20, 22, 24	0.0024 [0.061] x 0.0052 [0.131]
3 - 7, 9, 10, 15 - 17, 21, 23, 25 - 29	0.0024 [0.061] x 0.0024 [0.061]

Pad Descriptions

Pad Number	Function	Description	Interface Schematic
1, 2	IN-, IN+	RF Input pads. Connect RF to IN+, and AC couple IN- to ground for single-ended operation.	Vcc1 IN+ IN− 700Ω Vcc1
3	TEMP	Temperature sensor output pin	Vcc1, Vcc2, TEMP 5kΩ 250Ω
4, 5, 7, 9, 10, 13, 14, 21, 23, 25 - 28 Die Bottom	GND	Die bottom must be connected to RF and DC ground.	GND
6, 8, 18 - 20, 22, 24 11, 12	Vcc1 Vcc2	Bias supply. Connect supply voltage to these pins with appropriate filtering.	Vcc1, Vcc2
15	VSET	VSET input in controller mode. Short this pin to LOGOUT for detector mode.	Vcc2 200Ω VSET
16	LOGOUT	Logarithmic output that converts the input power to a DC level in detector mode. Short this pin to VSET for detector mode.	Vcc2 15Ω LOGOUT 550Ω

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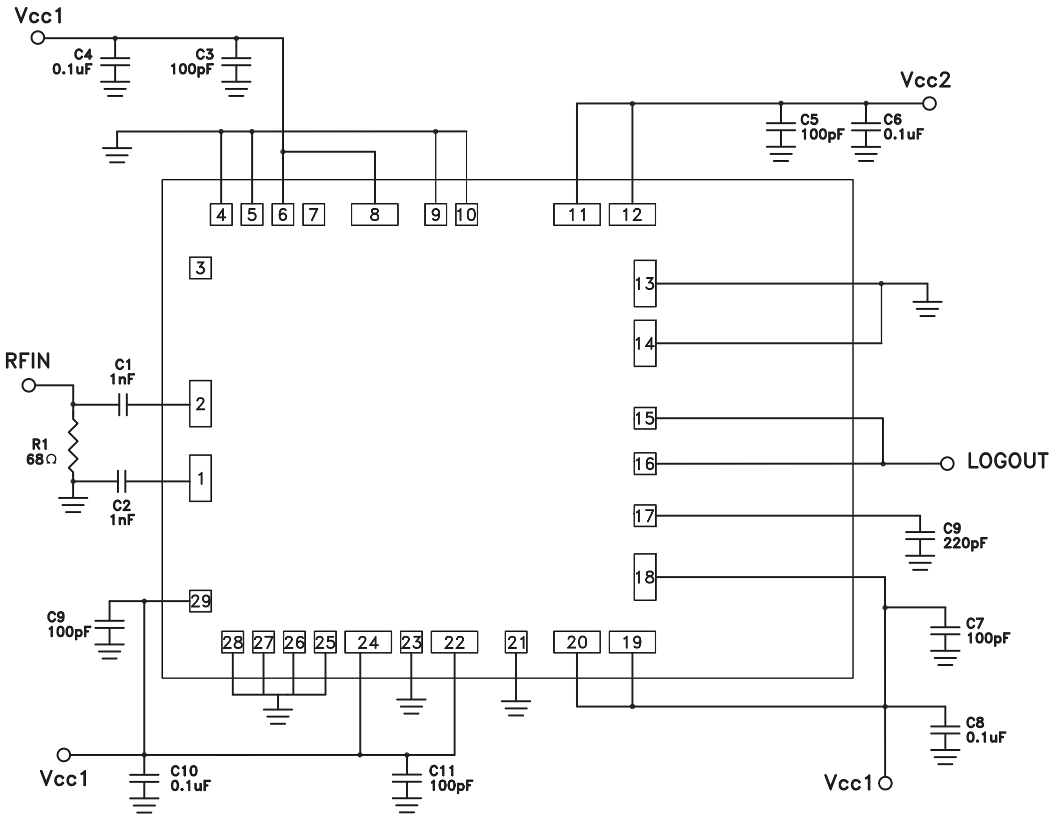
Pad Descriptions (Continued)

Pad Number	Function	Description	Interface Schematic
17	CLPF	Loop filter capacitor for output ripple filtering.	Vcc2 Vcc2 CLPF 2100Ω CIN
29	EN	Enable pad, connect to Vcc1 or Vcc2 for normal operation. Applying voltage <0.2 x (Vcc1, Vcc2) will initiate power saving mode.	Vcc1 Vcc1 EN

Application Circuit



Note 1: For detector mode, connect high impedance volt meter to the LOGOUT port. LOGOUT is shorted to VSET, as required for detector mode.

Note 2: For controller mode, remove short between LOGOUT and VSET. In controller mode, the LOGOUT output can be used to drive a variable gain amplifier, or a variable attenuator, either directly or through a buffer or microcontroller. VSET should be connected to an external control voltage, typically between +0.6 and +1.9V.

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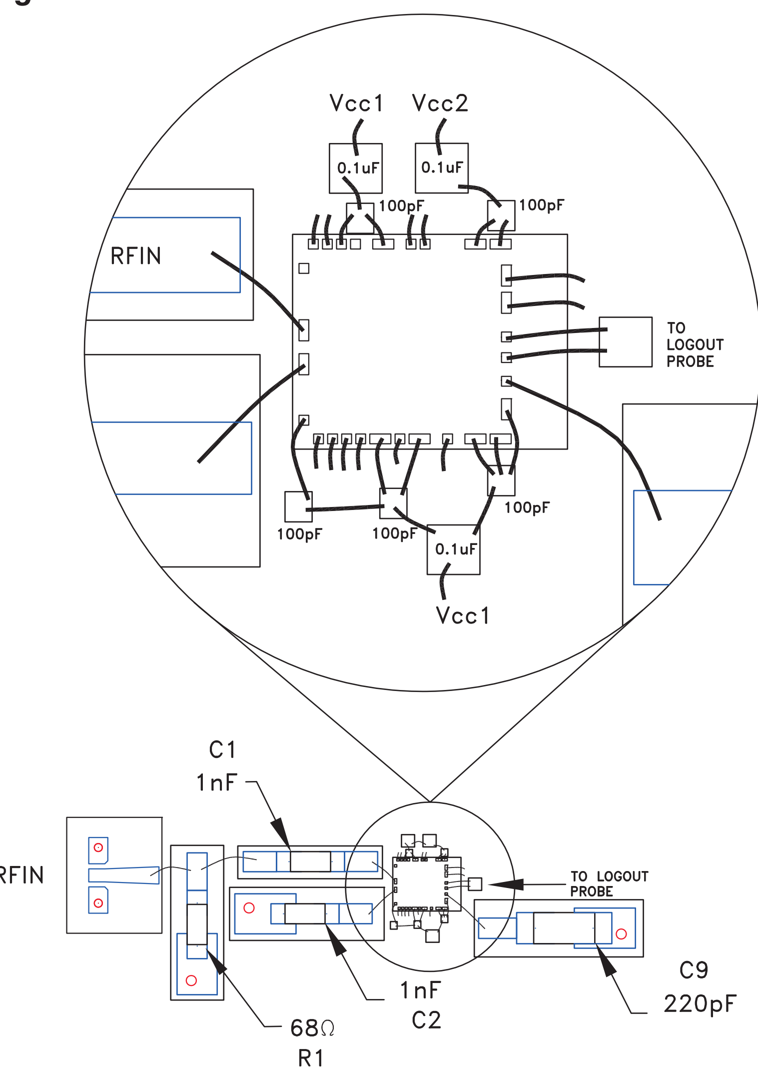
Assembly Diagram



Mounting & Bonding Techniques for MMICs

The die should be attached directly to the ground plane with epoxy (see HMC general Handling, Mounting , Bonding Note).

50 Ohm Microstrip transmission lines on 0.254mm (10 mil) thick alumina thin film substrates are recommended for bringing RF to and from the chip (Figure 1).

Microstrip substrates should be placed as close to the die as possible in order to minimize bond wire length. Typical die-to-substrate spacing is 0.076mm to 0.152 mm (3 to 6 mils).

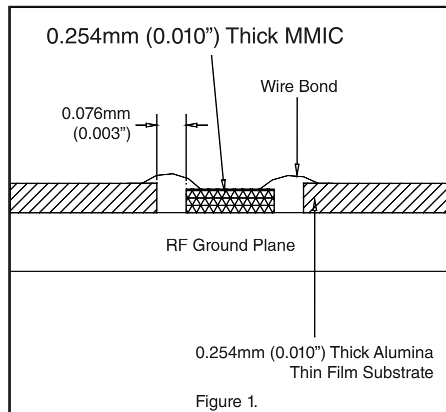


Figure 1.

Handling Precautions

Follow these precautions to avoid permanent damage.

Storage: All bare die are placed in either Waffle or Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.

Static Sensitivity: Follow ESD precautions to protect against ESD strikes.

Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.

General Handling: The chip may be handled by a vacuum collet or with a sharp pair of tweezers.

Mounting

Epoxy Die Attach: Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

Notes: