

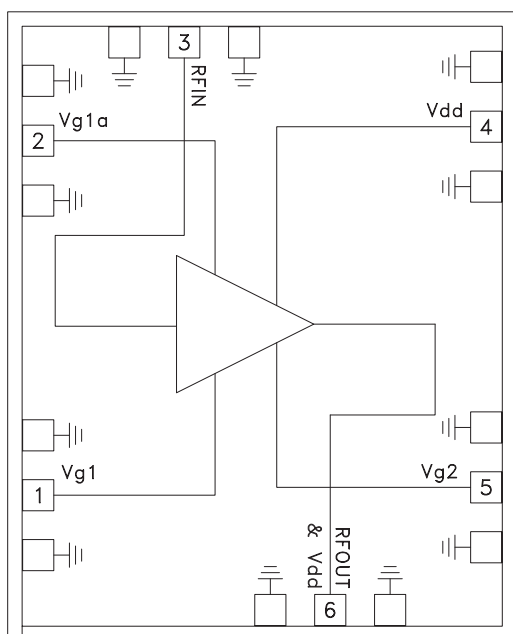
GaAs HEMT MMIC MODULATOR DRIVER AMPLIFIER, DC - 43 GHz

Typical Applications

This HMC-AUH232 is ideal for:

- 40 Gb/s Lithium Niobate/ Mach Zender Fiber Optic Modulators
- Broadband Gain Block for Test & Measurement Equipment
- Broadband Gain Block for RF Applications
- Military & Space

Functional Diagram



Features

- Small Signal Gain: 12 dB
- Output Voltage: up to 8V pk-pk
- Single-Ended I/Os
- High Speed Performance: 46 GHz 3 dB Bandwidth
- Low Power Dissipation: 0.9 W
- Small Die Size: 2.1 x 1.70 x 0.1 mm

General Description

The HMC-AUH232 is a GaAs MMIC HEMT Distributed Driver Amplifier die which operates between DC and 43 GHz and provides a typical 3 dB bandwidth of 46 GHz. The amplifier provides 12 dB of small signal gain while requiring only 180 mA from a +5V supply voltage. The HMC-AUH232 exhibits very good gain and phase ripple to 40 GHz, and can output up to 8V peak-to-peak with low jitter, making it ideal for use in broadband wireless, fiber optic communication and test equipment applications. The amplifier die occupies less than 3.6 mm² which facilitates easy integration into Multi-Chip-Modules (MCMs). The HMC-AUH232 requires external bias-tee as well as off-chip blocking components and bypass capacitors for the DC supply lines. A gate voltage adjust, Vg2 is provided for limited gain adjustment, while Vg1a adjusts the bias current for the device.

Electrical Specifications*, $T_A = +25^\circ\text{C}$

Parameter	Min.	Typ.	Max.	Units
Frequency Range	DC - 43			GHz
Small Signal Gain	0.5 - 5.0 GHz	12	14	dB
	35 - 45 GHz	10	12.5	dB
Input Return Loss		10		dB
Output Return Loss		8.5		dB
Supply Current		180	225	mA
3 dB Bandwidth	43	46		GHz
Gain Ripple (5 to 35 GHz)		±0.6	±1	dB
Group Delay Variation ⁽¹⁾	0.5 - 5.0 GHz	±14	±20	pS
	5 - 30 GHz	±10	±11	pS
	30 - 45 GHz	±22	±25	pS

**GaAs HEMT MMIC MODULATOR
DRIVER AMPLIFIER, DC - 43 GHz**
Electrical Specifications (Continued)*

Parameter	Min.	Typ.	Max.	Units
10% to 90% Rise / Fall Time ^[2]		6 - 12		pS
Output Voltage Level ^[3]		8		V _{P-P}
Additive jitter (RMS)		0.4		pS
1 dB Output Gain Compression Point at 20 GHz		16.5		dBm
Output Power	20 GHz @ Pin= 15 dBm ^[4]	22	22	dBm
	40 GHz @ Pin= 15 dBm ^[4]	17	19.5	dBm
Power Dissipation		0.9	1.25	W
Noise Figure	5 GHz	5.4		dB
	10 & 15 GHz	4.2		dB
	20 GHz	4.6		dB
	25 GHz	5.4		dB
	30 GHz	8.3		dB
	35 GHz	7.4		dB
	40 GHz	9.1		dB

[1] Measured with a 1 GHz aperture

[2] Measurement limited by rise/fall time of input reference signal

[3] With a 2.7 V_{P-P} input signal

*Unless otherwise indicated, all measurements are from probed die

[4] Verified at RF on-wafer probe. VG1 is adjusted until the drain current is 200 mA and VG2=1.5 V. The drain voltage is applied through the RF output port using a bias tee with 5 volts on the bias Tee.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
Positive Supply Voltage	V _D		5	6	V
Positive Supply Current	I _D	150	180	225	mA
RF Input Power			12	16	dBm
Bias Current Adjust	V _{G1A}	-1.5	-0.2		V
Output Voltage Adjust	V _{G2}	0	1.5	2	V
Operating Temperature	T _{OP}	0	25	85	°C
Power Dissipation	P _D		0.9	1.25	W

Reliability Characteristics

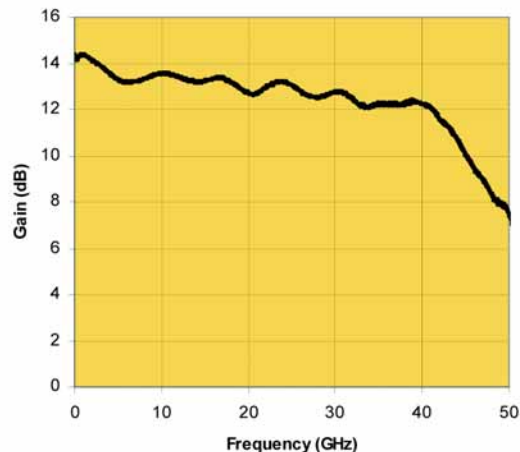
Parameter	Symbol	Typ.	Units
Activation Energy	E _A	1.7	eV
Median time to Failure (MTF) @125 °C Channel Temperature	MTF	6 x 10 ⁹	Hours

Thermal Characteristics

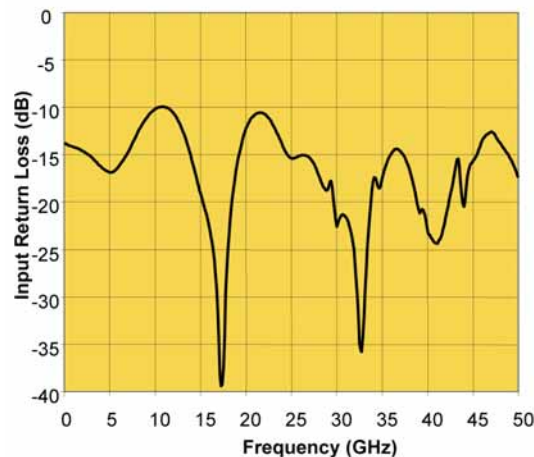
Parameter	P _{DISS} (W)	T _{BASE} (°C)	T _{CH} (°C)	R (°C/W)	MTF (Hrs)
Thermal Resistance to back side of chip	1.25	85	145	48	5.8 x 10 ⁸
Thermal resistance to backside of carrier using 25.4 um of 84-1LMIT epoxy	1.25	85	155	56	1.8 x 10 ⁸
Thermal Resistance to back side of chip	1.25	110	170	48	3.9 x 10 ⁷
Thermal resistance to backside of carrier using 25.4 um of 84-1LMIT epoxy	1.25	110	180	56	1.4 x 10 ⁷

WIDEBAND LOW NOISE AMPLIFIER, DC - 43 GHz

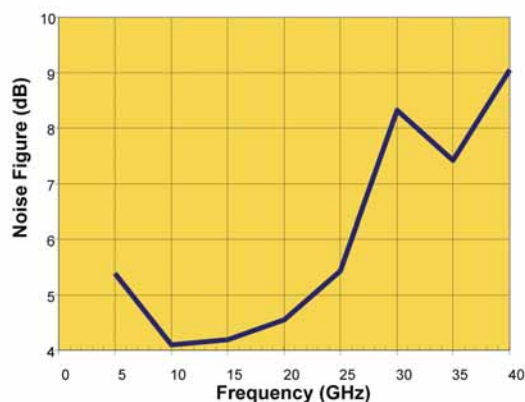
Gain vs. Frequency



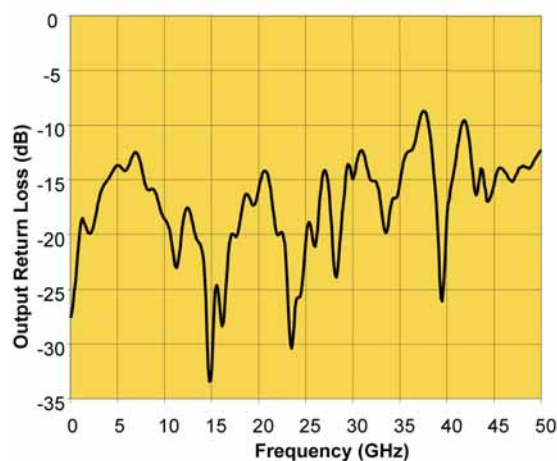
Input Return Loss vs. Frequency



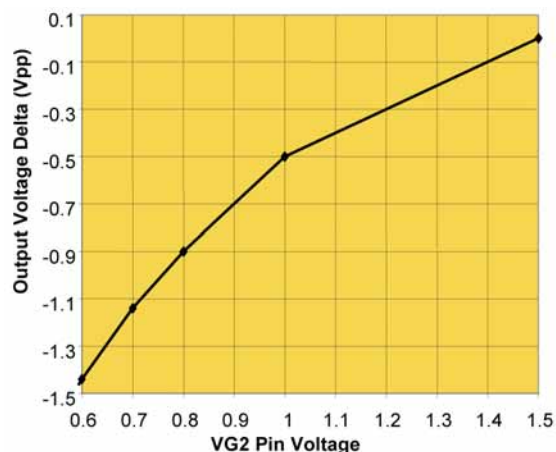
Noise Figure vs. Frequency



Output Return Loss vs. Frequency



Output Voltage Delta vs. Control Voltage



Note: Measured Performance Characteristics (Typical Performance at 25°C) $V_{g2} = 1.5V$, $V_{dd} = 5V$, $I_{dd} = 200\text{ mA}$ (Measured data obtained from die in a test fixture unless otherwise stated)

**WIDEBAND LOW NOISE
AMPLIFIER, DC - 43 GHz**

Absolute Maximum Ratings

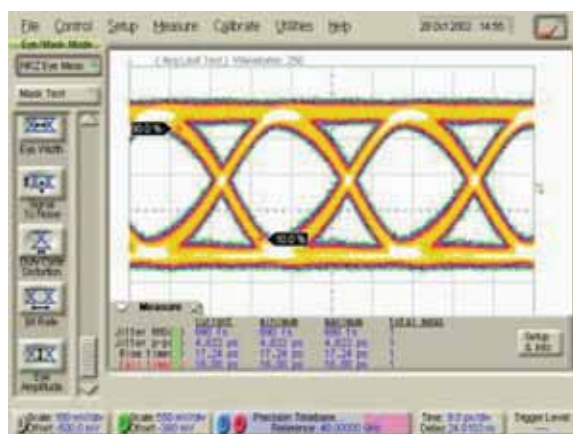
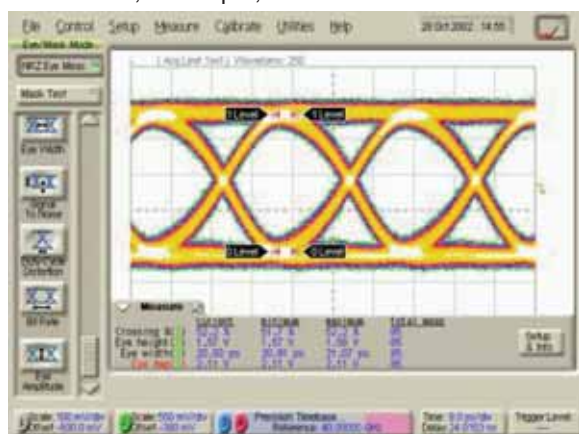
Drain Bias Voltage (Vdd)	+6 Vdc
Gain Bias Voltage (Vg1a)	-1.5 to 0 Vdc
Output Voltage Adjust (Vg2)	0 to +2 Vdc
RF Input Power	+18.5 dBm
40 Gb/s Input Voltage Pk-Pk (Vpp)	3V
Thermal Resistance (channel to die bottom)	48 °C/W
Channel Temperature	180 °C
Storage Temperature	-65 to +150 °C
Operating Temperature	-55 to +110 °C



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

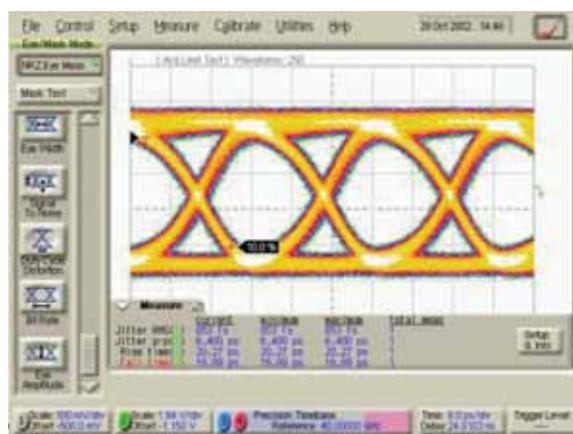
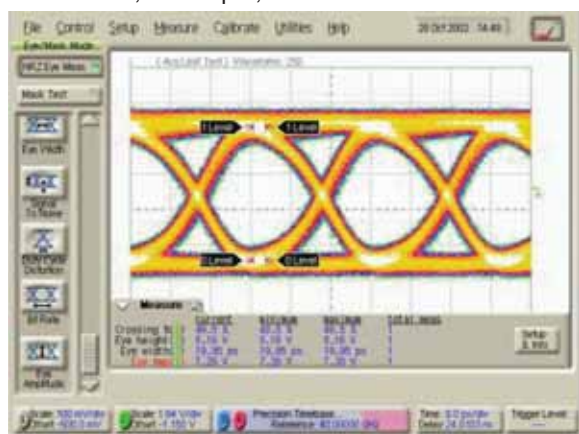
Input Reference Signal

PRBS=2³¹-1, 2.1V Input, Data rate of 40 Gb/s



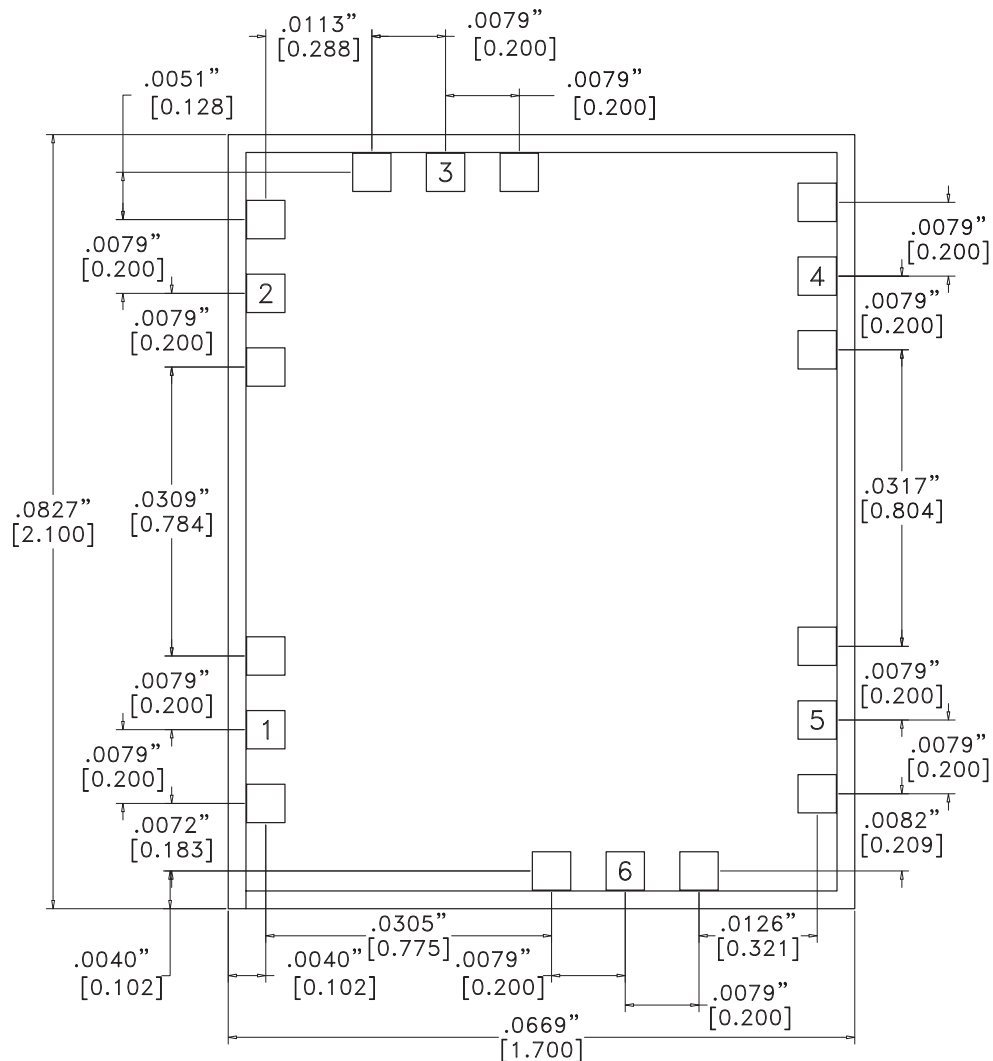
Output Reference Signal

PRBS=2³¹-1, 7.3V Input, Data rate of 40 Gb/s



Note: Measured Performance Characteristics (Typical Performance at 25°C) (Measured data obtained from die in a test fixture unless otherwise stated)

For price, delivery, and to place orders, please contact Hittite Microwave Corporation:
20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373
Order On-line at www.hittite.com

Outline Drawing

NOTES:

1. ALL DIMENSIONS ARE IN INCHES [MM].
2. TYPICAL BOND PAD IS .004" SQUARE.
3. BACKSIDE METALLIZATION: GOLD.
4. BACKSIDE METAL IS GROUND.
5. BOND PAD METALLIZATION: GOLD.
6. CONNECTION NOT REQUIRED FOR UNLABELED BOND PADS.
7. OVERALL DIE SIZE $\pm .002$ "