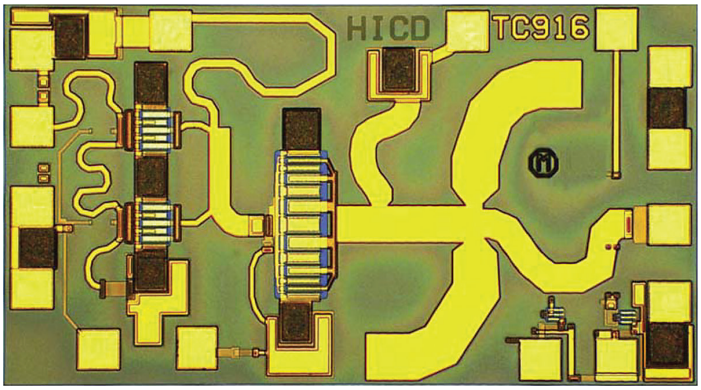
Keysight Technologies
HMMC-5032 17.7–32 GHz Amplifier
1GG6-8009

Data Sheet



Features

- 22 dBm output $P_{(-1\ dB)}$
- 8 dB gain
- 50 Ω input/output matching
- Small size
- Bias: 4.5 volts, 250 mA

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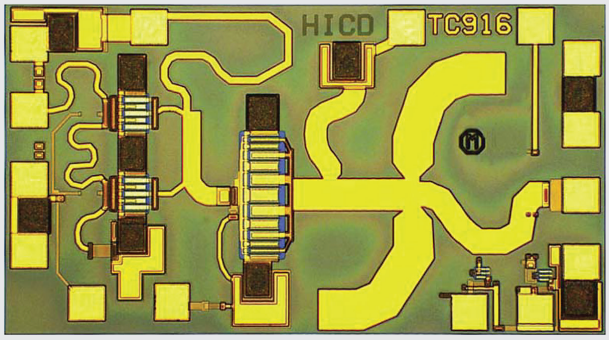
Description

The HMMC-5032 is a MMIC power amplifier designed for use in wireless transmitters that operate within the 17.7 GHz to 32 GHz range. It provides 22 dBm of output power and 8 dB of small-signal gain from a small easy-to-use device. The HMMC-5032 was designed to be driven by the HMMC-5040 (20-40 GHz) or the HMMC-5618 (5.9-20 GHz) MMIC amplifier for linear transmit applications. This device has input and output matching circuitry for use in 50 Ω environments.



Chip Size:
1370 x 770 µm (53.3 x 30.0 mils)
Chip Size Tolerance:
±10 µm (±0.4 mils)
Chip Thickness:
127 ± 15 µm (5 ±0.6 mils)
Pad Dimensions:
80 × 80 µm (3.2 × 3.2 mils)

Absolute Maximum Ratings[1]

Symbol	Parameters/conditions	Min.	Max.	Units
$V_{D1,2}$	Drain supply voltages		5	Volts
$V_{G1,2}$	Gate supply voltages	–3.0	0.5	Volts
Det. bias	Applied detector bias (optional)		5	Volts
I_{DD}	Total drain current		460	mA
P_{in}	RF input power		23	dBm
T_{ch}	Channel temperature[2]		170	°C
T_A	Backside ambient temperature	–55	+95	°C
T_{st}	Storage temperature	–65	+170	°C
T_{max}	Maximum assembly temperature		300	°C

1. Absoute maximum ratings for continuous operation unless otherwise noted.
2. Refer to DC specifications/physical properties table for derating information.

DC Specifications/Physical Properties[1]

Symbol	Parameters/conditions	Typ.	Min.	Max.	Units
$V_{D1,2}$	Drain supply operating voltages	4.5	2	5	Volts
I_{D1}	First stage drain supply current (V_{DD} = 4.5 V, $V_{G1} \cong$ –0.8 V)	100		140	mA
I_{D2}	Second stage drain supply current (V_{DD} = 4.5 V, $V_{GG} \cong$ –0.8 V)	150		320	mA
$V_{G1,2}$	Gate supply operating voltages ($I_{DD} \cong$ 250 mA)	–0.8			Volts
V_P	Pinch-off voltage (V_{DD} = 4.5 V, I_{DD} 10 mA)	–1.2	–2		Volts
Det. bias	Detector bias voltage (optional)	$V_{D1,2}$		5	Volts
θ_{ch-bs}	Thermal resistance[2] (channel-to-backside at T_{ch} = 160 °C)	67			°C/watt
T_{ch}	Channel temperature[3] (TA = 85 °C, MTTF > 10^6 hrs V_{DD} = 4.5 V, I_{DD} = 250 mA)	160			°C

1. Backside ambient operating temperature T_A = 25 °C unless otherwise noted.
2. Thermal resistance (°C/watt) at a channel temperature T (°C) can be estimated using the equation: $\theta(T) =\sim \theta_{ch-bs}$ x [T(°C)+273] / [160 °C+273].
3. Derate MTTF by a factor of two for every 8°C above T_{ch}.

RF Specifications

(T_A = 25 °C, Z_0 = 50 Ω, V_{DD} = 4.5 V, I_{DD} = 250 mA)

Symbol	Parameters/conditions	Low band specifications			Upper band specifications			Units
		Typ	Min	Max	Typ	Min	Max	
BW	Operating bandwidth		17.7	26.5		25	31.5	GHz
Gain	Small signal gain	8	7		7	6		dB
ΔGain/ΔT	Temperature coefficient of gain	0.02			0.02			dB/°C
$P_{-1\ dB}$	Output power at 1 dB gain	22	21		22	21		dBm
P_{SAT}	Saturated output power[1]	24			24			dBm
$(RL_{in})_{Min}$	Minimum input return loss	9	8		15	10		dB
(RL_{out}) Min	Minimum output return loss	10	9		20	15		dB
Isolation	Minimum reverse isolation	35			30			dB

1. Devices operating continuously beyond 1 dB gain compression may experience power degradation.

Applications

The HMMC-5032 MMIC is a broadband power amplifier designed for use in transmitters that operate in various frequency bands between 17.7 GHz and 32 GHz. It can be attached to the output of the HMMC-5040 (20-40 GHz) or the HMMC-5618 (5.9-20 GHz) MMIC amplifier, increasing the power handling capability of transmitters requiring linear operation.

Biasing and Operation

The recommended DC bias condition is with both drains (VD1 and VD2) connected to single 4.5 volt supply and both gates (VG1 and VG2) connected to an adjustable negative voltage supply. The gate voltage is adjusted for a total drain supply current of typically 250 mA.

The RF input and output are AC-coupled.

An optional output power detector network is also provided. Detector sensitivity can be adjusted by biasing the diodes with typically 1 to 5 volts applied to the det-bias terminal. Simply connecting det-bias to the VD2 supply is a convenient method of biasing this detector network. The differential voltage between the det-ref and det-out bonding pads can be correlated to the RF power emerging from the RF output port.

No ground wires are needed because ground connections are made with plated through-holes to the backside of the device.

Assembly Techniques

It is recommended that the electrical connections to the bonding pads be made using 0.7-1.0 mil diameter gold wire. The microwave/millimeter-wave connections should be kept as short as possible to minimize inductance. For assemblies requiring long bond wires, multiple wires can be attached to the RF bonding pads.

GaAs MMICs are ESD sensitive. ESD preventive measures must be employed in all aspects of storage, handling, and assembly.

MMIC ESD precautions, handling considerations, die attach and bonding methods are critical factors in successful GaAs MMIC performance and reliability.

GaAs MMIC ESD, Die Attach and Bonding Guidelines, Application Note (5991-3484EN) provides basic information on these subjects.

Additional References:

HMMC-5040 and HMMC-5032 Demo, 20-32 GHz High Gain Medium Power Amp - Technical Overview (5989-6449EN)

HMMC-5032 Intermodulation Distortion - Data Sheet (5989-6209EN)

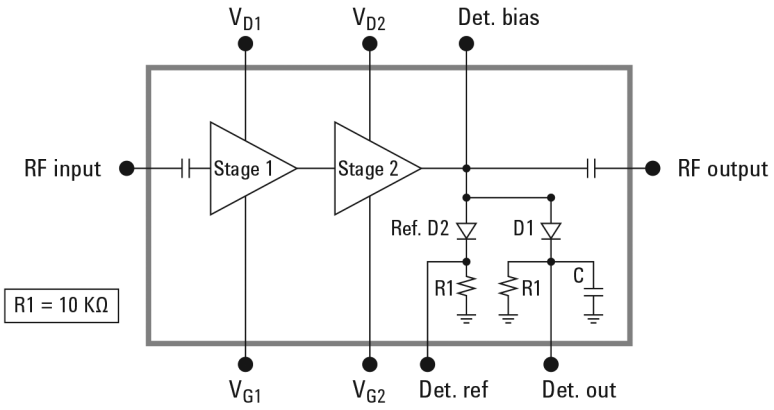


Figure 1. Simplified schematic diagram

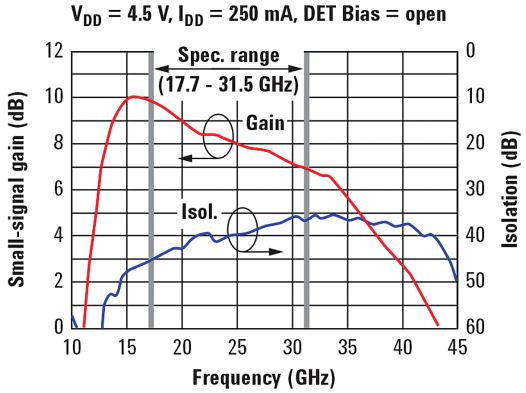


Figure 2. Gain and isolation vs. frequency

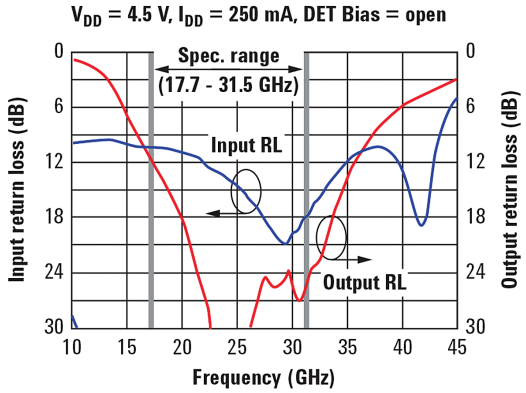


Figure 3. Input and output return loss vs. frequency

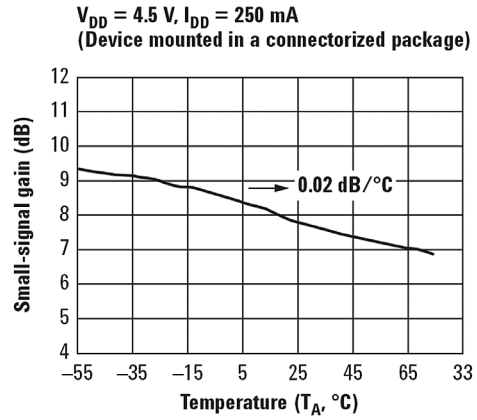


Figure 4. Gain vs. temperature

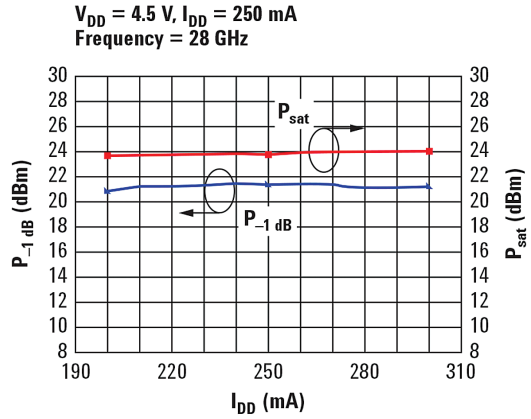


Figure 5. Output power vs. total drain current

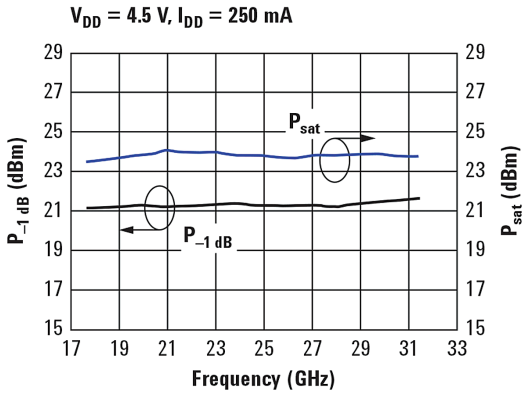


Figure 6. Output power vs. frequency

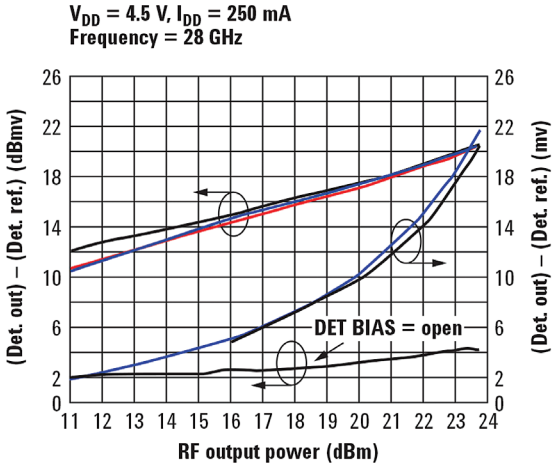


Figure 7. Detector voltages vs. output power for various detector bias voltage

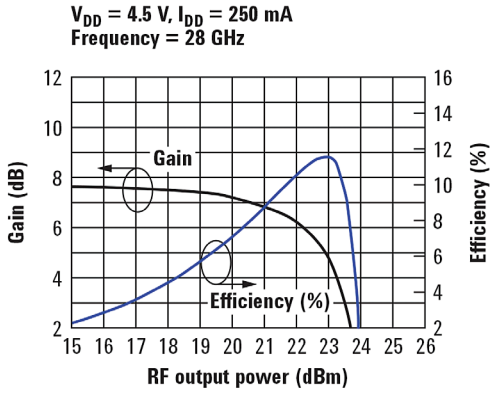


Figure 8. Gain compression and efficiency vs. power out

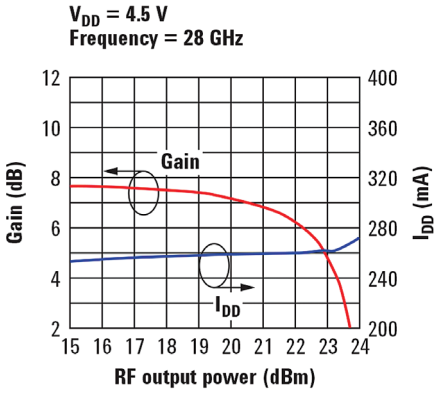


Figure 9. Gain and total drain current vs. output power

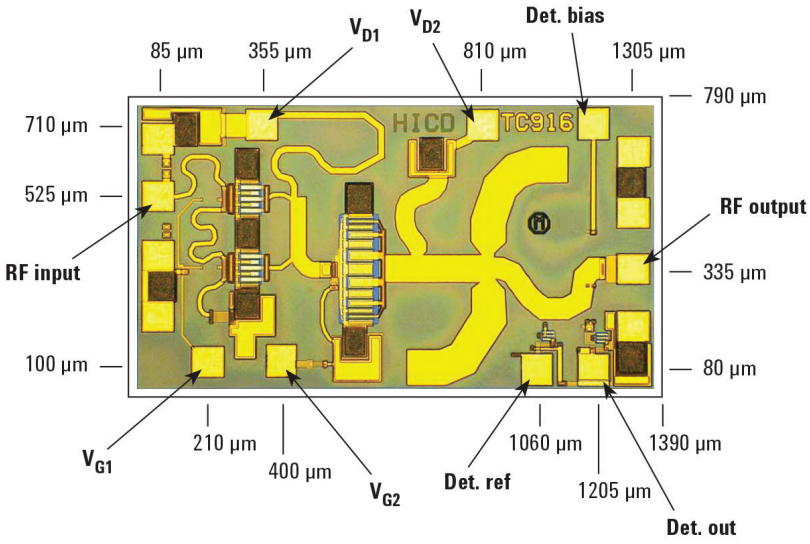


Figure 10. Bonding pad locations

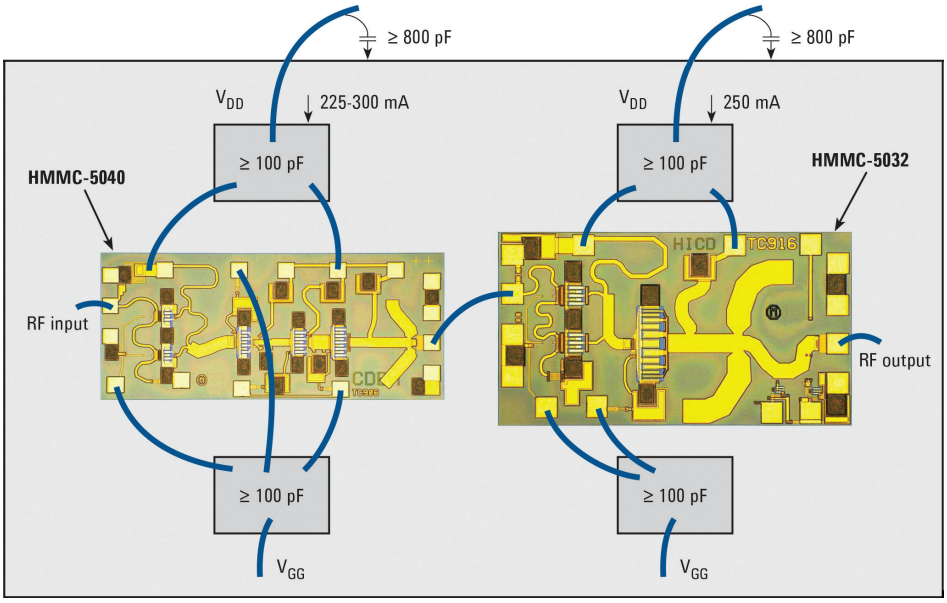


Figure 11. Assembly diagram illustrating the HMMC-5032 cascaded with the HMMC-5040 for 20-32 GHz applications

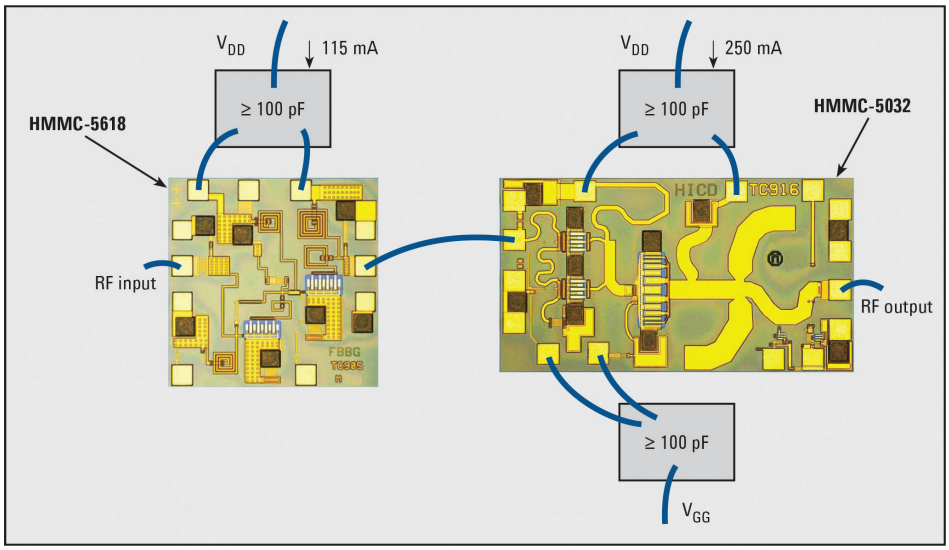


Figure 12. Assembly diagram illustrating the HMMC-5032 cascaded with the HMMC-5618 for 17.7-20 GHz applications

Notes

This data sheet contains a variety of typical and guaranteed performance data. The information supplied should not be interpreted as a complete list of circuit specifications. Customers considering the use of this, or other TCA GaAs ICs, for their design should obtain the current production specifications from Keysight Technologies, Inc.. In this data sheet the term typical refers to the 50th percentile performance. For additional information and support email: mmic_helpline@keysight.com.

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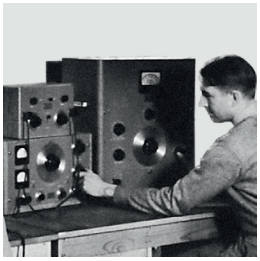

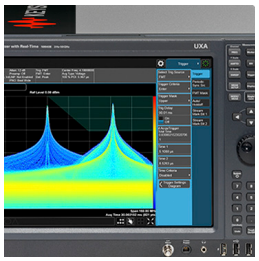

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