Hittite HBT Amplifier Product Line Announced!

_HBT MMICs Combine High Performance Design Expertise With InGaP GaAs Technology._

Hittite has introduced five new InGaP HBT amplifiers that can now supply the Wireless Market from DC to 7 GHz. These new amplifiers come in small low cost surface mount SOT26 packages, and operate from a single positive supply. The amplifiers can be used over a wide band, or externally matched for peaked performance for narrow band applications.

(Cont. on pg 6)

_HITTITE MICROWAVE CORPORATION_

**New HomeRF & Bluetooth Class 2 & Class 3 RFIC Transceiver Available!**

Hittite Microwave Corporation introduces a compact 2.4 GHz transceiver ideal for HomeRF & Bluetooth applications. The RFIC is designed to operate in conjunction with National Semiconductor’s LMX3162 single chip baseband ASIC.

Hittite’s HMC310MS8G RFIC transceiver integrates a receiver LNA, a transmitter amplifier, Rx/Tx switch and control logic onto a single chip, which is then assembled into a low cost plastic package.

(Cont. on pg 6)

**INSIDE.....**

***12 NEW AMPLIFIERS RELEASED!*...**

...COVERING THE FOLLOWING BANDWIDTHS:

* PCS
* WCDMA
* UNII & HiperLAN
* 2.4 ISM & BLUETOOTH

* PRODUCT DATA SHEETS AVAILABLE ONLINE AT WWW.HITTITE.COM!

**OFF-THE-SHELF**

AUTUMN 2000

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<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Freq. Range (GHz)</th>
<th>Features</th>
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<tbody>
<tr>
<td>HMC313</td>
<td>Broadband HBT Darlington Amplifier</td>
<td>DC - 6 GHz</td>
<td>16 dB Gain, Saturated power of +17 dBm.</td>
</tr>
<tr>
<td></td>
<td>Amplifier Gain Block</td>
<td></td>
<td></td>
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<tr>
<td>HMC314</td>
<td>HBT Amplifier with Power Down</td>
<td>700 MHz - 4 GHz</td>
<td>10 dB Gain, Saturated power of +22 dBm.</td>
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<tr>
<td></td>
<td>HBT Darlington Amplifier</td>
<td></td>
<td></td>
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<tr>
<td>HMC315</td>
<td>Ultra Broadband HBT</td>
<td>DC - 7 GHz</td>
<td>13 dB Gain, Saturated power of +14 dBm.</td>
</tr>
<tr>
<td></td>
<td>Darlington Amplifier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMC323</td>
<td>HBT Darlington Driver Amplifier</td>
<td>DC - 3 GHz</td>
<td>12 dB Gain, Saturated power of +23 dBm.</td>
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<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>HMC324</td>
<td>HBT Darlington Driver Amplifier</td>
<td>DC - 3 GHz</td>
<td>Same performance as HMC323 with two</td>
</tr>
<tr>
<td></td>
<td>DC - 3 GHz Unconnected Dual Amplifier</td>
<td></td>
<td>amplifiers in single SOT26, ideal for</td>
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<td></td>
<td></td>
<td></td>
<td>balanced designs.</td>
</tr>
</tbody>
</table>

(Cont. on pg 6)
**HMC313**  
**General Description**  
The HMC313 is a high efficiency GaAs Heterojunction Bipolar Transistor (HBT) MMIC amplifier that operates from a single Vcc supply. The surface mount SOT26 amplifier can be used as a broadband gain stage or used with external matching for optimized narrow band applications. With Vcc biased at +5V, the HMC313 offers 16 dB of gain and +13 dBm of saturated power while only requiring 40mA of current. Using a Darlington feedback pair results in reduced sensitivity to normal process variations and provides a good 50-ohm input/output port match. This amplifier is ideal as a driver and amplifier for 2.2 - 2.7 GHz MMDS, 3.5 GHz Wireless Local Loop Applications (WLL), 5.0 - 6.0 GHz UNII and HiperLAN applications.

**Features**  
DC to 6 GHz Operation  
16 dB Small Signal Gain  
Excellent Gain Flatness  
+13 dBm Output Power  
High Reliability GaAs HBT Process  
Surface Mount Plastic SOT26 Package

**HMC314**  
**General Description**  
The HMC314 is a high efficiency GaAs Heterojunction Bipolar Transistor (HBT) MMIC amplifier that operates from a single positive supply. This amplifier also incorporates a power down feature. When the "Vpd" pin is activated, the amplifier will shut down. The surface mount SOT26 amplifier can be used as a broadband gain stage or used with external matching for optimized narrow band applications. The amplifier provides 10 dB of gain and +22 dBm of saturated power while operating from a single positive +5V supply. The HMC314 is optimized in gain and return loss for the MMDS (2.2-2.7 GHz) and Wireless Local Loop Applications (3.5 GHz) bands. At a height of 1.45mm, the SOT26 is ideal for low profile portable wireless devices and WLAN systems.

**Features**  
0.7 to 4 GHz Operation  
10 dB Small Signal Gain  
Excellent Gain Flatness  
+22 dBm Output Power  
High Reliability GaAs HBT Process  
Surface Mount Plastic SOT26 Package

**HMC315**  
**General Description**  
The HMC315 is an ultra broadband high efficiency GaAs Heterojunction Bipolar Transistor (HBT) MMIC amplifier that operates from a single positive supply. The surface mount SOT26 amplifier can be used as a broadband gain stage or used with external matching for optimized narrow band applications. The Darlington configuration results in reduced sensitivity to normal process variations and provides a good 50-ohm input/output port match. The amplifier provides 13 dB of gain and +14 dBm of saturated power while operating from a single positive +5V supply. The HMC315 is ideal for fiber optic OC-48 systems, microwave test instrumentation, or broadband mobile radio platforms.
HMC323
InGaP GaAs HBT Driver Amplifier, DC - 3 GHz

General Description
The HMC323 is a high efficiency GaAs Heterojunction Bipolar Transistor (HBT) MMIC amplifier that operates from a single Vcc supply. The surface mount SOT26 amplifier can be used as a broadband gain stage or used with external matching for optimized narrow band applications. With Vcc biased at +7V, the HMC323 offers 12 dB of gain and +23 dBm of saturated power while only requiring 68mA of current. Using a Darlington feedback pair results in reduced sensitivity to normal process variations and provides a good 50-ohm input/output port match. This amplifier is ideal for RF systems where high linearity is required including 2.2 - 2.7 GHz MMDS, 3.5 GHz Wireless Local Loop Applications (WLL), 5 - 6 GHz GHz UNII and HiperLAN applications.

Features
DC to 3 GHz Operation
12 dB Small Signal Gain
Excellent Gain Flatness
+23 dBm Output Power
High Reliability GaAs HBT Process
Surface Mount Plastic SOT26 Package

HMC324
InGaP GaAs HBT Driver Amplifier, DC - 3 GHz Unconnected Dual Amplifier

General Description
The HMC324 is a high efficiency GaAs Heterojunction Bipolar Transistor (HBT) MMIC amplifier that contains two unconnected amplifiers in parallel inside a single miniature SOT26 package. When used in conjunction with an external balun, the outputs of the amplifier can be combined to reduce the 2nd harmonic distortion that is generated by the amplifier. With Vcc at +7V, the HMC324 offers 14 dB of gain and with power combining and harmonic cancellation, +24.7 dBm of output power can be achieved. Using a Darlington feedback pair results in reduced sensitivity to normal process variations and provides a good 50-ohm input/output port match. This amplifier is ideal for RF systems where high linearity is required. The design can operate in 50-ohm and 75-ohm systems which makes it ideal for CATV head-end and modem, and MCNS applications.

Features
DC to 3 GHz Operation
11 dB Small Signal Gain
Excellent Gain Flatness
+24.7 dBm Output Power
High Reliability GaAs HBT Process
Surface Mount Plastic SOT26 Package

HMC308
General Purpose MESFET Amplifier, 1.3 - 3 GHz 3v to 5v Operation

General Description
The HMC308 is a low cost MESFET MMIC amplifier that operates from a single +3 to +5v Vdd supply. The surface mount SOT26 amplifier can be used as a broadband amplifier stage or used with external matching for optimized narrow band applications. With Vdd biased at +3v, the HMC308 offers 18 dB of gain and +13 dBm of saturated power while only requiring 40mA of current. This amplifier is ideal as a driver amplifier on transmitters, for usage as a local oscillator (LO) amplifier to increase drive levels for passive mixers in the PCS, DECT, WCDMA or 2.2 - 2.7 GHz MMDS bands. The amplifier occupies 0.118” x 0.118”, making it ideal for compact radio designs.

Features
1.3 to 3.0 GHz
P1dB Output Power: +15 dBm @5V
Single Supply: +3V to +5V Operation
Surface Mount Plastic SOT26 Package

DATASHEETS AVAILABLE AT WWW.HITTITE.COM  AUTUMN 2000  3
HM C318MS8G
Variable Gain Low Noise Amplifier, 5.0 - 6.0 GHz 3v to 5v Operation

General Description
The HMC318MS8G is the industry’s first low cost C-band variable gain low noise amplifier (VGLNA) that serves the full UNII and HiperLAN bands. The HMC318MS8G operates using a single positive supply that can be set between +3v to +5v. When a control voltage of 0v to +3v is applied, the gain of the amplifier will decrease while maintaining excellent return loss performance. A maximum gain of 9 dB is achieved when Vctl is set to 0v and a minimum gain of -9 dB is achieved when Vctl is set to +3v.

Features
5.0 to 6.0 GHz with AGC
LNA with 18 dB Gain Control
+3V Operation
Low Noise Figure: 2.5 dB
Ultra Small 8 Lead MSOP: 14.8 mm² x 1mm High
No External Matching Required

HM C320MS8G
Fixed Gain Multi-Purpose LNA, 5.0 - 6.0 GHz with Selectable P1dB Performance

General Description
The HMC320MS8G is the industry’s first low cost C-band fixed gain low noise amplifier (LNA) that serves the full UNII and HiperLAN bands. The HMC320MS8G operates using a single positive supply that can be set at +3v to +5v. With +3v bias, the LNA provides a noise figure of 2.5 dB, 12 dB gain and better than 10 dB return loss across the UNII band. The HMC320MS8G also features adaptive biasing that allows the user to select the optimal P1dB performance for their system using an external set resistor on the “Vset” pin. P1dB performance can be set between a range of +1 dBm to +13 dBm. The low cost LNA uses an 8 leaded MSOP ground base surface mount plastic package, which occupies less than 14.8 mm².

Features
5.0 to 6.0 GHz
Selectable Functionality: LNA, Driver, or LO Buffer Amplifier
Adjustable P1dB: +1 to +13 dBm
+3V Operation
Ultra Small 8 Lead MSOP: 14.8 mm² x 1mm High

HM C286
Low Noise Amplifier in a Miniature SOT26 Package for 2.4GHz Applications

General Description
The HMC286 is a low cost Low Noise Amplifier (LNA) for 2.4 to 2.5 GHz spread spectrum applications including BLUETOOTH, HomeRF, 802.11 W LAN and 2.5 GHz radios. The LNA offers 16 dB of gain and a 1.8 dB noise figure from a single positive +3v supply that requires only 8mA. The typical output 1 dB compression point is +3 dBm and OIP3 is +12 dBm at 2.4 GHz. The compact LNA design utilizes on-chip matching for repeatable gain and noise figure performance. In addition, eliminating the external matching circuitry also reduces the overall size of the LNA function. The HMC286 was designed to meet the size constraints of PCMCIA platforms and uses the SOT26 package that occupies 0.118” x 0.118”, which makes it a small fully integrated solution that can be easily implemented with other 2.4 GHz ASICs.

Features
2.4 GHz LNA
Noise Figure: 1.8 dB
Gain: 16 dB
Single Supply: +3V
Ultra Small SOT26 Package
**HMC287MS8**  
**Variable Gain Low Noise Amplifier  
2.4 GHz Applications**

**General Description**
The HMC287MS8 is a low cost Low Noise Amplifier (LNA) for 2.4 to 2.5 GHz spread spectrum applications including BLUETOOTH, HomeRF, 802.11 WLAN and 2.5 GHz radios. The LNA offers 22 dB of gain and a 2.5 dB noise figure from a single positive +3V supply that requires only 9mA. The HMC287MS8G can be used as a variable gain LNA, offering 30 dB of gain control, which is controlled with a 0 to 3V analog voltage. When in the maximum gain state, the typical output 1 dB compression point is +3 dBm and OIP3 is +7 dBm. The compact LNA design utilizes on-chip matching for repeatable gain and noise figure performance. In addition, this on chip matching eliminates the need for external matching circuitry and reduces the overall size of the LNA function.

**Features**
- 2.4 GHz VGLNA
- LNA with 30 dB Gain Control
- Noise Figure: 2.5 dB
- +3V Operation
- Ultra Small 8 Lead MSOP: 14.8 mm² x 1mm High

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**HMC310MS8G**  
**2.4 GHz RFIC Integrated PA & LNA with Tx Rx Switch, 3v MSOP8G**

**General Description**
The HMC310MS8G is a multifunction RFIC that incorporates a power amplifier (PA) and low noise amplifier (LNA) with a transmit/receive switch for 2.4 GHz spread spectrum applications including BLUETOOTH, HomeRF, 802.11 WLAN, and 2.4 GHz ISM radios. The LNA offers 8 dB gain and 2.5 dB noise figure while the transmit switch path has 0.5 dB insertion loss and better than +30 dBm linear power handling. Using a single control line, the LNA is powered down when the switch Tx port is selected minimizing Id supply current to 5 mA in the Rx mode and 120 uA in the Tx mode at Vdd = +3V bias. The HMC310MS8 may be directly interfaced with popular 2.4 GHz transceiver chips. At a height of 0.040” (1.0mm), the MSOP8 package is ideal for low profile portable wireless devices.

**Features**
- Monolithic LNA & Switch IC
- Integrated Power Control:
- +3V Operation
- Ideal For 802.11, HomeRF, & Bluetooth Applications
- +3V Operation
- Ultra Small 8 Lead M SOP:  
  14.8 mm² x 1mm High
Next Generation HBT Amplifier Product Line...

Hittite’s MMIC designers focused on making the amplifier family ‘user friendly’ and electrically robust to ensure easy implementation. Hittite’s Product Validation Engineering completed a series of tests including ESD qualification, 3-temperature RF/DC characterization, and load pull stress testing on the designs. This Hittite validation process, which is unique to the industry, will ensure that Hittite’s HBT Amplifiers exceed our customer’s reliability requirements.

These five amplifiers offer gain levels of 12 dB to 16 dB with bandwidths of 3 GHz (HMC323), 6 GHz (HMC313) and 7 GHz (HMC315). A companion amplifier to the 2 GHz design (HMC324) features two amplifiers in a single SOT26 package. This allows the use of the design in a balanced configuration with superior power and 2nd harmonic performance. The 2 GHz designs can operate in 50Ω or 75Ω systems. Finally, the HMC314 exhibits a power level of +22 dBm from 0.5 to 4 GHz from a single 5V supply. All amplifiers require minimal off-chip components; typically input and output DC blocks, pull-up choke with optional resistor and decoupling capacitors.

New HomeRF & BLUETOOTH RFIC Transceiver...

uses a novel single positive control line to toggle the transceiver state as well as activate the power down circuitry.

The MMIC front-end requires no external components due to fully integrated features such as power down, RF matching and logic control. With full integration and a single control line, the total radio solution with both IC’s occupies minimal board area. The HMC310MS8G transceiver I/O pins, Logic, and voltage levels are set up for direct interface with National Semiconductor’s LMX3162.

The HMC310MS8G solves many timing issues of ½ duplex systems by using a single logic line to operate the T/R switch while simultaneously shutting down the bias voltage in the corresponding amplifier in either off-arm of the switch. The removal of amplifier bias also assists in the overall isolation of each T/R switch path, resulting in a reduced switch size and complexity. Since there is never a time when both amplifiers are active, the layout of the LNA with the transmitter amplifier can be greatly compacted. Hittite’s design approach results in the smallest chip size possible, to ensure the cost targets of this market can be met.

The HMC310MS8G allows the radio designer to create a compact low cost two IC solution for a 2.4 GHz radio. Contact Hittite Microwave Corporation for more information on implementing this and other architectures for BLUETOOTH and ISM band systems using our state of the art GaAs MMICs.
Broadband DC to 4 GHz Digital Attenuators Offer Low Bit Error!

Control of signal strength while maintaining signal integrity in the transmit and receive paths of wireless systems has always been a concern of RF design engineers. Hittite Microwave has introduced a family of seven low cost 2, 3, & 5 Bit Digital Attenuator (DATT) GaAs ICs. These products offer unprecedented bandwidth from DC to 4 GHz, positive bias & control and ± 0.2 to ± 0.5 dB typical accuracy in plastic packages as small as a 6 lead SOT26. Excellent input IP3 performance of +44 to +54 dBm characterizes these attenuators, satisfying today’s linearity requirements for cellular/PCS/3G/ISM and broadband datacom systems.

Data sheet specifications are targeted towards the frequency bands of 0.7 to 1.4 GHz (cellular, PDC, PHS), 1.4 to 2.3 GHz (PCS, 3G), 2.3 to 2.7 GHz (ISM, Home RF, Bluetooth, MMDS), and 2.7 to 3.7 GHz (WLL). Exceptional DC to 4 GHz performance allows the HMC307QS16G to address cable modem, instrumentation, and all IF applications down to “DC”.

GaAs IC Digital Attenuator Product Line!

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<thead>
<tr>
<th>Part Number</th>
<th>Features</th>
<th>Freq. Range (GHz)</th>
<th>Attenu. Step Sizes (dB)</th>
<th>Bit Error (dB)</th>
<th>Input IP3 (dBm)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC273MS10G</td>
<td>5 Bit 1 to 31 dB Pos. Bias</td>
<td>0.7 - 3.7</td>
<td>1, 2, 4, 8, 16</td>
<td>± 0.5</td>
<td>48</td>
<td>MSOP10</td>
</tr>
<tr>
<td>HMC307QS16G</td>
<td>5 Bit 1 to 31 dB Neg. Bias</td>
<td>DC - 4</td>
<td>1, 2, 4, 8, 16</td>
<td>± 0.5</td>
<td>44</td>
<td>GSOP16</td>
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<tr>
<td>HMC306MS10</td>
<td>5 Bit 0.5 to 15.5 dB Pos. Bias</td>
<td>0.7 - 3.7</td>
<td>0.5, 1, 2, 4, 8</td>
<td>± 0.25</td>
<td>52</td>
<td>MSOP10</td>
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<tr>
<td>HMC230MS8</td>
<td>3 Bit 4 to 28 dB Pos. Bias</td>
<td>0.75 - 2</td>
<td>4, 8, 16</td>
<td>± 0.5</td>
<td>46</td>
<td>MSOP8</td>
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<tr>
<td>HMC288MS8</td>
<td>3 Bit 2 to 14 dB Pos. Bias</td>
<td>0.7 - 3.7</td>
<td>2, 4, 8</td>
<td>± 0.3</td>
<td>51</td>
<td>MSOP</td>
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<tr>
<td>HMC291</td>
<td>2 Bit 4 to 12 dB Pos. Bias</td>
<td>0.7 - 4</td>
<td>4, 8</td>
<td>± 0.2</td>
<td>54</td>
<td>SOT</td>
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<tr>
<td>HMC290</td>
<td>2 Bit 2 to 6 dB Pos. Bias</td>
<td>0.7 - 4</td>
<td>2, 4</td>
<td>± 0.2</td>
<td>52</td>
<td>SOT</td>
</tr>
</tbody>
</table>

* ALL DATA IS MID-BAND TYPICAL.

The HMC306MS10 offers the least significant bit (LSB) step of 0.5 dB while maintaining a bit error of ± 0.25 dB. Both the HMC273MS10G and the HMC307QS16G offer traditional 1 dB LSB steps to a maximum of 31 dB. Occupying only 14.8 mm² in a 10 lead MSOP package, the HMC230MS8 is the smallest 5 bit 1 to 31 dB digital attenuator available today.

For minimal gain adjustment applications, the HMC290 and HMC291 provide 2 bit control in step sizes of 4 & 8 to 12 dB and 2 & 4 to 6 dB respectively. These products offer very low bit error of ± 0.2 dB typical with less than 0.9 dB reference insertion loss. Handset and basestation designers will find this performance a great alternative to lossy voltage variable attenuators.

All of the attenuators require a single control voltage for each attenuator bit, minimizing logic interface and package lead count. A single positive bias supplied through an external 5k ohm resistor is utilized by all products except the negative bias HMC307QS16G. Control and bias currents for each are 100 to 250 uA typical.

The seven digital attenuator ICs are manufactured on GaAs MESFET process. Standard fine lead pitch plastic packaging minimizes the footprint of each part from between 9 to 29.4 mm².
About Hittite Microwave

Hittite Microwave Corporation is an innovative designer and manufacturer of Monolithic Microwave Integrated Circuits (MMICs) and MMIC assemblies for RF and microwave applications. Founded in 1985, our company’s expertise in MMIC technology has enabled us to achieve the best price/performance value for each of the products we manufacture.

Hittite Microwave’s mission is to provide creative solutions for our customers:

We strive to be a leading and worldwide recognized supplier of microwave IC based products and components. Our products will be recognized both by their uncompromising high quality and by their unique functionality & performance. To achieve this goal, we shall rely on novel design concepts, advanced fabrication technologies, and fully automated manufacturing & test methods.

Our standard MMIC product line consists of over 100 gallium arsenide (GaAs) MMIC die and packaged die products covering DC - 40 GHz. Our standard and custom products support a wide range of wireless and wired communications applications, including:

- Voice: Cellular, PCS, and Satellite Telephony
- Data: WLAN, GPS, RFID, Cable Modem
- Broadband/Video: Microwave Telecom Link, VSAT, MMDS, LMDS, DBS, CATV
- Sensor: Military, Industrial, Commercial
- Military
- Space: Switching Matrices, Up/Down Conversion, RADAR

Quality is the cornerstone of our corporate mission and our commitment to customers. We keep this commitment throughout our organization. Hittite Microwave is certified for ISO 9001, the accepted standard worldwide for quality.

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