NEW RF TO MILLIMETERWAVE IC PRODUCTS FROM HITTITE

INSIDE.....

* 21 NEW PRODUCTS RELEASED!

Product Showcase

1 Watt, DC - 20 GHz PA

HMC559

• Gain: 14 dB
• ± 0.7 dB Gain Flatness
• 50 Ohm Matched I/Os

See Page 2

I/Q Mixer / IRM Module

HMC-C009

• Image Rejection: 37 dB
• LO to RF Isolation: 41 dB
• Input IP3: +23 dBm

See Page 2

SPDT T/R Switch

HMC595

• Input IP3: +65 dBm
• Positive Control
• Low Insertion Loss: 0.3 dB
• P0.1dB: +39 dBm

See Page 4

Attenuation Accuracy Improved!

See Page 7

WIDEBAND VCO TUNES FROM 8.0 TO 12.5 GHz!

Low SSB Phase Noise and Compact 4 x 4 mm SMT Footprint

The highly anticipated wideband VCO from Hittite is here! Complementing our line of GaAs HBT Voltage Controlled Oscillators and Phase Locked Oscillators, Hittite is pleased to introduce the HMC588LC4B Wideband 8 to 12.5 GHz VCO.

The HMC588LC4B incorporates a resonator, negative resistance device, and varactor diode in a single 4 x 4 mm RoHS compliant SMT package. This fully integrated MMIC based VCO exhibits a very low SSB Phase Noise of -93 dBc/Hz at 100 kHz offset, and delivers +5 dBm of output power with +/-0.5 dB typical variation across the entire tuning bandwidth.

(Continued on page 6)

DIGITAL ATTENUATOR OFFERS 0.25 dB RESOLUTION!

New Digital Attenuator Family Offers High Linearity & High Accuracy

New from Hittite are five GaAs MMIC Digital Attenuators which offer resolution to 0.25 dB, excellent accuracy, wide bandwidth, operation to near DC, and RoHS compliance. Each of these SMT packaged digital attenuators are operated with a single TTL/CMOS control line per bit, and each deliver high input IP3 without the use of a noisy internal negative voltage generator as required by silicon based alternatives.

The HMC539LP3 is a 5-bit, GaAs MMIC Digital Attenuator with an attenuation range of 0.25 dB to 7.75 dB. This versatile attenuator is alone in the marketplace with its ultra fine resolution and its +/- 0.2 dB state error. The HMC539LP3 operates from DC to 4 GHz delivering high input IP3 of +50 dBm and low insertion loss of 0.7 dB. This highly accurate Digital Attenuator is an excellent alternative to MESFET voltage variable

(Continued on page 6)

AMPLIFIER DESIGNER’S KITS NOW AVAILABLE!

Evaluation Boards & ICs Reduce Design Cycle Time

RF/Microwave design engineers can now obtain pre-packaged Designer’s Kits which enable them to quickly assess which Hittite product is the best choice for their application. The end result is designs that go to layout more quickly and with fewer subsequent changes. Each Hittite Designer’s Kit contains an assembled & tested connectorized evaluation board, and 5 to 10 ICs of each part included in the kit.

Amplifier Gain Block (DK-001) and Attenuator (DK-004) Designer’s Kits are available now. These will be followed by the release of additional kits from across Hittite’s product line in the coming months.

DK-001 and DK004 Designer’s Kits are available from stock and can be ordered on-line. A full description and parts list for each Designer’s Kit is available at www.hittite.com.
HMC562

**Wideband Driver Amplifier MMIC, 2 - 35 GHz**

**Features**
- P1dB Output Power: +18 dBm
- Gain: 12 dB
- Noise Figure: 4 dB
- Supply Voltage: +8.0V @ 96 mA
- 50 Ohm Matched I/Os

**Ideal for Test Equipment!**
The HMC562 is a GaAs MMIC PHEMT distributed amplifier die which operates between 2 and 35 GHz. The amplifier provides 12 dB of gain and +18 dBm of output power at 1 dB gain compression while consuming only 96 mA from a +8V supply. The HMC562 is ideal for Test Equipment, EW, ECM and radar applications. The amplifier I/O’s are internally matched to 50 Ohms for ease of integration into Multi-Chip-Modules (MCMs).

HMC559

**1 Watt Wideband Power Amplifier MMIC, DC - 20 GHz**

**Features**
- Saturated Output Power: +30 dBm
- Gain: 14 dB
- ± 0.7 dB Gain Flatness
- Supply Voltage: +10V @ 375 mA
- 50 Ohm Matched I/Os

**Flat Gain, Consistent Power!**
The HMC559 is a GaAs MMIC PHEMT distributed power amplifier die which operates from DC to 20 GHz. The amplifier provides 14 dB of gain, +30 dBm Psat and +29 dBm of output power at 1 dB gain compression while consuming 375 mA from a +10V supply. Gain flatness is excellent from 2 to 18 GHz making the HMC559 ideal for EW, ECM and radar applications. The HMC559 amplifier I/O’s are internally matched to 50 Ohms for ease of integration into Multi-Chip-Modules (MCMs).

HMC-C009

**Connectorized I/Q Mixer Module, 4.0 - 8.5 GHz**

**Features**
- Image Rejection: 37 dB
- Wide IF Bandwidth: DC - 3.5 GHz
- LO to RF Isolation: 41 dB
- High Input IP3: +23 dBm
- Hermetically Sealed Module
- Field Replaceable SMA Connectors

**Excellent Image Rejection!**
The HMC-C009 is a passive I/Q MMIC mixer module which can be used as either an Image Reject Mixer or a Single Sideband Converter. The module utilizes two double balanced mixer cells and a 90 degree hybrid fabricated in a GaAs MESFET process. This MMIC based module is a more reliable and consistent alternative to hybrid style Image Reject Mixers and Single Sideband Converter assemblies. The module features removable SMA connectors which can be detached to allow direct connection of the I/O pins to a microstrip or coplanar circuit.
**HMC451LC3**

**Medium Power Amplifier, 5 - 20 GHz**

**Features**

- Gain: 19 dB
- Saturated Power: +21 dBm @ 21% PAE
- Output IP3: +30 dBm
- RoHS Compliant Package

**Versatile Driver Amplifier!**

The HMC451LC3 is a GaAs PHEMT MMIC Medium Power Amplifier in a leadless RoHS compliant SMT package. Operating between 5 and 20 GHz, the amplifier provides 19 dB of gain, +21 dBm of saturated power and 21% PAE from a +5.0 V supply. This 50 Ohm matched amplifier does not require any external components, making it an ideal linear gain block or LO driver for Hittite mixers.

**Gain & Psat vs. Temperature**

Gain (dB) & Psat (dBm)

FREQUENCY (GHz)

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**HMC486**

**2 Watt, 50 Ohm Matched Power Amplifier MMIC, 7 - 9 GHz**

**Features**

- Saturated Output Power: +34 dBm @ 24% PAE
- Output IP3: +40 dBm
- Gain: 26 dB
- Single Supply Voltage +7.0V @ 1300 mA
- 50 Ohm Matched I/Os

**PA for Microwave Radio!**

The HMC486 is a high dynamic range GaAs PHEMT MMIC 2 Watt Power Amplifier which operates from 7 to 9 GHz. This amplifier die provides 26 dB of gain, +34 dBm of saturated power and 24% PAE from a +7.0 V supply. Output IP3 is +40 dBm typical. The RF I/Os are DC blocked and matched to 50 Ohms for ease of integration into Multi-Chip-Modules (MCMs). This die is also available in a 5 x 5 mm SMT RoHS compliant package (HMC486LP5E).

**Gain & Psat vs. Temperature**

Gain (dB) & Psat (dBm)

FREQUENCY (GHz)

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**HMC448LC3B / 449LC3B**

**x2 Active Multipliers Covering 19 to 33 GHz**

**Features**

- Output Power: +9 to +11 dBm
- Wide Input Power Range: -4 to +6 dBm
- Fo Isolation: 35 dBc @ Fout= 20 GHz
- 26 dBc @ Fout= 30 GHz
- 100 kHz SSB Phase Noise: -135 & -132 dBc/Hz
- RoHS Compliant Package

**Ideal for LO Generation Chains!**

The HMC448LC3B / 449LC3B are x2 active broadband frequency multipliers utilizing GaAs PHEMT technology. When driven by a 0 dBm signal these multipliers provide +9 to +11 dBm typical output power from 19 to 25 GHz & 27 to 33 GHz. The HMC448LC3B / 449LC3B are ideal for use in LO multiplier chains and reduce parts count vs. discrete approaches. They provide low additive SSB Phase Noise of -135 & -132 dBc/Hz at 100 kHz offset and stable output power over temperature.
**HMC483MS8GE**

**Features**
- +35 dBm Input IP3
- Conversion Loss: 9 dB
- Low LO Drive: -4 to +4 dBm
- Single Positive Supply: 5V @ 50 mA
- RoHS Compliant SMT Package

The HMC483MS8GE is a high dynamic range passive MMIC mixer with integrated LO amplifier covering 0.7 to 1.4 GHz. Excellent input IP3 performance of +35 dBm for down conversion and +30 dBm for up conversion is provided for infrastructure applications. The DC to 350 MHz IF frequency response will satisfy many Tx or Rx frequency plans. The HMC483MS8GE is pin for pin compatible with the HMC485MS8G(E) which is a 1.7 - 2.4 GHz mixer w/LO amp.

**HMC241LP3E**

**Features**
- High Isolation: 40 dB
- Low Insertion Loss (2 GHz): 0.7 dB
- Single Positive Supply: Vdd = +5V
- Integrated 2:4 TTL Decoder
- RoHS Compliant SMT Package

The HMC241LP3E is a general purpose non-reflective SP4T switch in a low cost leadless surface mount package. Covering DC - 4.0 GHz, this switch offers high isolation and has a low insertion loss of 0.7 dB at 2 GHz. The switch offers a single positive bias and true TTL/CMOS compatibility. A 2:4 decoder is integrated on the switch requiring only 2 control lines and a positive bias to select each path, replacing 4 control lines normally required by GaAs SP4T switches.

**HMC574MS8(E) & 595(E)**

**Features**
- High P0.1dB Compression: +39 dBm @ +8V
- High Input IP3: +65 dBm
- Positive Control: 0/+3V to 0/+10V
- Low Insertion Loss: 0.3 dB
- RoHS Compliant “E” Packaging Available

The HMC574MS8(E) & HMC595(E) are low-cost SPDT switches for use in transmit/receive applications which require very low distortion at high incident power levels. These devices are especially suited for Cellular Infrastructure, WiMAX & WiBRO applications with only 0.3 dB loss and exceptional third order intercept performance of +65 dBm. These products are form, fit and function replacements for HMC174MS8 and HMC195, while offering superior electrical performance.
HERMETIC SMT COMPONENTS FOR Hi-REL APPLICATIONS

HMC141LH5
Double-Balanced Mixer, 7 - 14 GHz

Features
- Input IP3: +20 dBm
- Conversion Loss: 9 dB
- LO to RF Isolation: 35 dB

The HMC141LH5 is a passive double-balanced mixer that can be used as an upconverter or downconverter. The mixer can handle large signal levels due to the high third order intercept of +20 dBm. MMIC implementation provides exceptional balance in the circuit resulting in high LO/RF and LO/IF isolations and unit-to-unit consistency.

HMC441LH5
Medium Power Amplifier, 7 - 15.5 GHz

Features
- Gain: 15 dB
- Psat: +21.5 dBm
- Single Positive Supply: +5.0 V

The HMC441LH5 is a broadband 7 to 15.5 GHz GaAs PHEMT MMIC Medium Power Amplifier. The amplifier provides 15 dB of gain and +21.5 dBm of saturated power at 25% PAE from a +5.0V supply. This 50 Ohm matched amplifier does not require any external components making it an ideal linear gain block or driver amplifier.

HMC424LH5
6-Bit Digital Attenuator, DC - 13 GHz

Features
- 0.5 dB LSB Steps to 31.5 dB
- Single Control Line Per Bit
- +/- 0.5 dB Typical Bit Error

The HMC424LH5 is a broadband DC - 13 GHz 6-bit GaAs IC digital attenuator and with insertion loss less than 4 dB typical. The attenuator bit values are 0.5 (LSB), 1, 2, 4, 8, and 16 dB for a total attenuation of 31.5 dB. Attenuation accuracy is excellent at ± 0.5 dB typical step error with an IIP3 of +32 dBm. A single control per bit is used to select each attenuation state. A single Vee bias of -5V allows operation at frequencies down to DC.

HMC344LH5
SP4T Switch, DC - 8 GHz

Features
- High Isolation: 50 dB
- Insertion Loss: 1.8 dB
- Integrated 2:4 TTL Decoder

The HMC344LH5 is a broadband non-reflective GaAs MESFET SP4T switch. Covering DC to 8 GHz, this switch offers high isolation and low insertion loss. This switch also includes an on board binary decoder circuit which reduces the required logic control lines to two. The switch operates using a negative control voltage of 0/-5V, and requires a fixed bias of -5V.
**Output power and phase noise performance are excellent over temperature due to the monolithic construction.**

The Vtune port of the VCO accepts an analog tuning voltage from 0 to +15 volts, and accommodates a very fast 65 MHz tuning bandwidth. The HMC588LC4B operates from a single +5V supply, consumes only 53 mA of current, and provides a single ended RF output which is matched to 50 Ohms. The low second harmonic suppression of -17 dBc allows designers to avoid having to use costly filtering approaches in order to meet system spurious requirements.

The HMC588LC4 VCO uniquely combines the attributes of low phase noise, compact size and wide tuning range, making it ideal for numerous applications including: Telecom, Military and Industrial/Medical Test & Measurement markets. This MMIC VCO helps designers achieve their goals for consistent performance from lot to lot, while the ultra small footprint of 4 x 4 mm requires up to 90% less PC board area when compared to traditional MCM and discrete hybrid VCO approaches.

HMC588LC4B samples and production quantities are available from stock. Custom narrow and wideband VCO products can be designed and manufactured for customer specific applications.

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**Attenuators...**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Frequency (GHz)</th>
<th>Function</th>
<th>Loss (dB)</th>
<th>Attenuation Range (dB)</th>
<th>IIP3 (dBm)</th>
<th>Control Input</th>
<th>Attenuation Accuracy at 2 GHz (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC539LP3(E)</td>
<td>DC - 4</td>
<td>5-Bit Digital</td>
<td>0.7</td>
<td>0.25 to 7.75</td>
<td>50</td>
<td>TTL / CMOS</td>
<td>+/- (0.2 + 2% of Attenu. Setting)</td>
</tr>
<tr>
<td>HMC540LP3(E)</td>
<td>DC - 5.5</td>
<td>4-Bit Digital</td>
<td>0.8</td>
<td>1 to 15</td>
<td>48</td>
<td>TTL / CMOS</td>
<td>+/- (0.2 + 3% of Attenu. Setting)</td>
</tr>
<tr>
<td>HMC541LP3(E)</td>
<td>DC - 5</td>
<td>1-Bit Digital</td>
<td>0.5</td>
<td>10</td>
<td>50</td>
<td>TTL / CMOS</td>
<td>+/- 0.2</td>
</tr>
<tr>
<td>HMC603MS10(E)</td>
<td>0.7 to 3</td>
<td>5-Bit Digital</td>
<td>1.3</td>
<td>0.5 to 15.5</td>
<td>48</td>
<td>0/+3V</td>
<td>+/- (0.25 + 3% of Attenu. Setting)</td>
</tr>
<tr>
<td>HMC603QS16(E)</td>
<td>0.7 to 3</td>
<td>5-Bit Digital</td>
<td>1.3</td>
<td>0.5 to 15.5</td>
<td>48</td>
<td>0/+3V</td>
<td>+/- (0.25 + 3% of Attenu. Setting)</td>
</tr>
</tbody>
</table>

These MMIC Digital Attenuators are ideal for applications in Cellular/PCS/3G repeaters & infrastructure, Test Equipment, and Fixed Wireless (including WiMAX and WiBro). The HMC539LP3, HMC540LP3 and HMC541LP3 are housed in leadless QFN 3 x 3 mm SMT packages, while the HMC603MS10 and the HMC603QS16 are housed in 8 lead MSOP and 16 lead QSOP SMT packages, respectively. RoHS compliant versions of each of these attenuators are available as the HMC539LP3E, HMC540LP3E, HMC541LP3E, HMC603MS10E and HMC603QS16E.

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**WIDEBAND VCO... (continued from page 1)**

[Graph showing output frequency vs. tuning voltage]

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**DIGITAL ATTENUATORS... (continued from page 1)**

[Table showing characteristics of digital attenuators]

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**New Autumn 2005 Selection Guide Released!**

Hittite Microwave Corporation is pleased to announce the release of the Autumn 2005 Product Selection Guide which summarizes over 369 products including 19 products new for autumn ’05. The selection guide organizes our portfolio by product line as well as by market applications including: Automotive, Broadband, Cellular, Microwave & mmWave, Test & Measurement, Fiber Optic, Military and Space.

This new Selection Guide contains over 41 new products released in 2005 which are not included in the 2005 Designer’s Guide Catalog.

Request your copy of the new Autumn Selection Guide at www.hittite.com by selecting the “SUBMIT INQUIRY” left hand navigation button. An updated version of Hittite’s CD-ROM is also available. New product data sheets can be found on-line.

**ATTENUATION ACCURACY IMPROVED!**

Hittite has improved the attenuation accuracy specifications for the HMC273MS10G(E), HMC306MS10(E), HMC470LP3(E), and HMC472LP4(E) GaAs MMIC Digital Attenuators.

For example, the attenuation accuracy of the HMC472LP4, 6 bit, 0.5 dB LSB Digital Attenuator has been significantly improved from ± (0.5 + 4% of atten. setting), to ± (0.2 + 3% of atten. setting) at 1.0 GHz.

These changes are reflected in the new versions of the product data sheets which are available at www.hittite.com.

**RoHS Compliant “GREEN” Product Update**

Hittite is committed to meeting the Restriction of Hazardous Substances (RoHS) European Union directive. All of our plastic packaged products are available as RoHS compliant and are designated with an “E” suffix in the part number; as in HMC174MS8E. “E” product data sheets can be found on www.hittite.com.

Currently Hittite offers 342 out of 369 catalog products as RoHS Compliant products. Please see the RoHS Compliant Components section at www.hittite.com for more details.
What We Do

Hittite Microwave Corporation is an innovative designer and manufacturer of analog and mixed-signal ICs, MIC modules and sub-assemblies for RF, microwave and millimeter-wave applications covering DC to 110 GHz. Our RFIC/MMIC products are developed using state-of-the-art GaAs, InGaP/GaAs, InP, SOI and SiGe semiconductor processes utilizing MESFET, pHEMT, mHEMT and HBT devices. Our products include:

- Power Amplifiers
- Gain Blocks
- Driver Amplifiers
- LNAs
- Attenuators
- Phase Shifters
- Switches
- Transceivers
- Mixers
- Converters
- IRMs
- Modulators
- VCOs
- Dividers/Detectors
- Multipiers
- PLOs / PLLs

We also design and supply highly integrated custom ICs, MCMs and sub-systems that combine multiple functions for specific requirements. We select the most appropriate semiconductor and package technologies, uniquely balancing digital and RF integration techniques, to produce a product that is easy and cost effective for our customers to use.

Our custom and standard products support a wide range of wireless / wired communications and radar applications including those listed below:

- Automotive
- Telematics & Sensors
- Broadband
- CATV, DBS, WiMAX, WLAN, Fixed Wireless & UWB
- Cellular / PCS / 3G
- Handset / Handheld, PLMR & Infrastructure
- Fiber Optic
- OC-48 to OC-192
- Microwave / mmWave Communications
- Pt to Pt / Multi-Pt Radios & VSAT
- Test & Measurement
- Commercial / Industrial Sensors & Test Equipment
- Military
- C3I, ECM & EW
- Space
- Payload Electronics

Every component is backed by Hittite Microwave’s commitment to total quality. HMC is ISO 9001:2000 certified, and every Hittite employee and subcontractor is responsible for maintaining the highest level of quality. We are constantly working towards improvement of our procedures and processes, thus providing our customers with products that meet or exceed all requirements, are delivered on-time and function reliably throughout their useful life.