HITTITE EXPANDS POWER DETECTOR PRODUCT LINE

Two New Power Detectors Cover Applications from 1 MHz to 8 GHz

Hittite Microwave is pleased to announce two new high performance product additions to the current family of Power Detectors. These new power detectors offer improved video bandwidth (HMC601LP4E) and improved dynamic range as well as RF input bandwidth from 1 MHz to 8 GHz (HMC602LP4E).

The HMC602LP4(E) Logarithmic Detector/Controller delivers extremely high dynamic range and conversion accuracy over an input RF frequency range of 1 MHz to 8 GHz. The HMC602LP4(E) converts RF signals at its differential input, to a proportional output DC voltage. Featuring ±1 dB dynamic range of 59 dB with an input frequency of 900 MHz and a ±3 dB dynamic range of 58 dB at 8 GHz, the HMC602LP4(E) offers excellent stability over its operating temperature range of -40°C to +85°C. In logarithmic detection mode the

WIDEBAND VCO MODULES ACHIEVE LOW PHASE NOISE

3 New VCOs Cover 4 to 12.5 GHz in Rugged, RoHS Compliant Modules

Complementing our extensive line of SiGe and InGaP MMIC Voltage Controlled Oscillators and Phase Locked Oscillators, Hittite is pleased to introduce three new wideband VCOs which are offered in a connectorized hermetic module format. These rugged, RoHS compliant modules uniquely combine the attributes of low phase noise, high output power and wide tuning bandwidth, making them ideal for Test and Measurement, Military, Industrial, and Laboratory applications from 4 to 12.5 GHz.

The HMC-C028, HMC-C029 and HMC-C030 Wideband VCO Modules offer a complete solution by incorporating the resonator, negative resistance device, varactor diode and DC voltage regulator. These wideband VCO modules exhibit SSB Phase Noise as low...
HMC590 & HMC590LP5(E)  
**GaAs PHEMT 1 Watt Power Amplifier, 6 to 10 GHz**

**Features**
- Saturated Output Power: +31.5 dBm @ 25% PAE
- Output IP3: +40 dBm
- Gain: 25 dB
- DC Supply: +7.0V @ 820mA
- 50 Ohm Matched Input/Output

**High Gain & Output Power**

The HMC590 & HMC590LP5(E) are high dynamic range GaAs PHEMT MMIC 1 Watt Power Amplifiers which operate from 6 to 10 GHz. These amplifiers provide 25 dB of gain, +31.5 dBm of saturated output power and 25% PAE from a +7.0V supply. Output IP3 is +40 dBm typical. The RF I/Os are DC blocked and matched to 50 Ohms. The HMC590 is ideal for Multi-Chip-Modules (MCMs) and Hybrid assemblies, while the HMC590LP5(E) is intended for SMT applications.

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HMC591 & HMC591LP5(E)  
**GaAs PHEMT 2 Watt Power Amplifier, 6 to 10 GHz**

**Features**
- Saturated Output Power: +34 dBm @ 27% PAE
- Output IP3: +43 dBm
- Gain: 23.5 dB
- DC Supply: +7.0V @ 1340mA
- 50 Ohm Matched Input/Output

**High Efficiency, High Output IP3**

The HMC591 & HMC591LP5(E) are high dynamic range GaAs PHEMT MMIC 2 Watt Power Amplifiers which operate from 6 to 10 GHz. These amplifiers provide 23.5 dB of gain, +34 dBm of saturated power, and 27% PAE from a +7.0V supply. Output IP3 is +43 dBm typical and the RF I/Os are DC blocked and matched to 50 Ohms. The HMC591 is ideal for Multi-Chip-Modules (MCMs) and Hybrid assemblies, while the HMC591LP5(E) is intended for SMT applications.

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HMC592  
**GaAs PHEMT 1 Watt Power Amplifier, 10 - 13 GHz**

**Features**
- Saturated Output Power: +30.5 dBm @ 23% PAE
- Output IP3: +38 dBm
- Gain: 20 dB
- DC Supply: +7.0V @ 820mA
- 50 Ohm Matched Input/Output

**No External Matching Required**

The HMC592 is a high dynamic range GaAs PHEMT MMIC 1 Watt Power Amplifier which operates from 10 to 13 GHz. This amplifier die provides 20 dB of gain, +30.5 dBm of saturated power, and 23% PAE from a +7.0V supply. Output IP3 is +38 dBm typical. The RF I/Os are DC blocked and matched to 50 Ohms for ease of integration into Multi-Chip-Modules (MCMs). All data is taken with the chip in a 50 ohm test fixture connected via 0.025mm (1 mil) diameter wire bonds of minimal length 0.31mm (12 mils).
HMC580ST89(E)  
**InGaP HBT Gain Block MMIC Amplifier, DC - 1.0 GHz**

**Features**
- **P1dB Output Power:** +22 dBm
- **Gain:** 18 dB
- **Output IP3:** +37 dBm
- **Cascadable 50 Ohm I/Os**
- **Single Supply:** +5V @ 88mA

**High IP3 IF Amplifier**
The HMC580ST89(E) is an InGaP Hetero-junction Bipolar Transistor (HBT) Gain Block MMIC SMT amplifier. The gain block can be used as a cascadable 50 Ohm RF or IF gain stage as well as a PA or LO driver with up to +26 dBm output power. The HMC580ST89(E) offers 22 dB of gain with a +37 dBm output IP3 at 250 MHz, and can operate directly from a +5V supply. The HMC580ST89(E) exhibits excellent gain and output power stability over temperature, while requiring no external matching components.

HMC589ST89(E)  
**InGaP HBT Gain Block MMIC Amplifier, DC - 4.0 GHz**

**Features**
- **P1dB Output Power:** +19 dBm to 2.5 GHz
- **Gain:** 21 dB @ 1 GHz, 19 dB @ 2 GHz
- **Output IP3:** +33 dBm
- **Single Supply:** +5V @ 82mA

**Ideal for Cellular/3G/WiMAX**
The HMC589ST89(E) is an InGaP HBT Gain Block MMIC SMT amplifier covering DC to 4 GHz and packaged in an industry standard SOT89. The amplifier can be used as a cascadable 50 Ohm RF or IF gain stage as well as a LO or PA driver with up to +19 dBm P1dB output power. The HMC589ST89(E) offers 20 dB gain and +33 dBm output IP3 at 1 GHz while requiring only 82 mA from a single positive supply. The HMC589ST89(E) InGaP HBT gain block offers excellent output power and gain stability over temperature.

HMC573LC3B  
**GaAs MMIC x2 Active Freq. Multiplier, 8 - 22 GHz Output**

**Features**
- **High Output Power:** +12 dBm
- **Low Input Power Drive:** 0 to +6 dBm
- **Fo Isolation:** >20 dBc @ Fout = 16 GHz
- **SSB Phase Noise:** -134 dBc/Hz @ 100 kHz

**Consistent Output Power**
The HMC573LC3B is a x2 active broadband frequency multiplier utilizing GaAs PHEMT technology in a leadless RoHS compliant SMT package. When driven by a +5 dBm signal, the multiplier provides +12 dBm typical output power from 8 to 22 GHz. The Fo and 3Fo isolations are >20 dBc and >25 dBc respectively at 16 GHz. The HMC573LC3B is ideal for use in LO multiplier chains yielding reduced parts count vs. traditional approaches. The low additive SSB Phase Noise helps maintain good system noise performance.
**HMC277MS8(E)**

**GaAs MMIC Single-Balanced Mixer, 0.7 - 1.2 GHz**

**Features**
- Passive Topology
- High LO/RF Isolation: 26 dB
- Input IP3: +21 dBm
- Conversion Loss: 8 dB
- RoHS Compliant MSOP-8 Package

**Upconversion or Downconversion**

The HMC277MS8(E) general purpose single-balanced mixer in a 8 lead plastic surface mount Mini Small Outline Package (MSOP). This passive MMIC mixer is constructed of GaAs Schottky diodes and a novel planar transformer balun on the chip. The HMC277MS8(E) requires no external matching components, and is ideal for upconverter and downconverter applications. This product is pin-for-pin compatible with the HMC272MS8(E) single-balanced mixer, which operates from 1.7 to 3.0 GHz.

**Conversion Gain vs. LO Drive**

**HMC524LC3B**

**GaAs MMIC I/Q Mixer, 22 - 32 GHz**

**Features**
- Wideband IF Bandwidth: DC - 4.5 GHz
- Image Rejection: 20 dB
- LO to RF Isolation: 45 dB
- High Input IP3: +20 dBm

**Excellent Image Rejection**

The HMC524LC3B is a compact I/Q MMIC mixer which can be used as either an Image Reject Mixer or a Single Sideband Upconverter. The chip utilizes standard Hittite mixer cells and a 90 degree hybrid fabricated in a GaAs MESFET process. This product is a much smaller alternative to hybrid style Image Reject mixers and single sideband upconverter assemblies. The wide IF bandwidth and high isolation enable various Tx and Rx frequency plans.

**Image Rejection vs. Temperature**

**HMC-C035**

**GaAs MMIC Double-Balanced Mixer Module, 23 - 37 GHz**

**Features**
- Wide IF Bandwidth: DC - 13 GHz
- Input IP3: +19 dBm
- LO/RF Isolation: 35 dB
- Hermetically Sealed Module
- Field Replaceable Coaxial Connectors

**Ultra-Wide IF Bandwidth**

The HMC-C035 is a wideband double-balanced mixer which can be used as an upconverter or downconverter between 23 and 37 GHz. The HMC-C035 provides excellent, LO to RF, and LO to IF suppression due to optimized balun structures. The passive mixer operates with LO drive levels from +11 to +15 dBm and requires no DC bias. The HMC-C035 may also be used as a Bi-Phase Modulator/Demodulator or phase comparator. Removable coaxial connectors can be detached for drop-in microstrip or coplanar circuit applications.
**HMC-C039 / C040**

**GaAs HBT Frequency Divider Modules to 18 GHz**

**New Prescalers Provide Rare Divide-by-5 & Divide-by-10 Functionality!**

The HMC-C039 is a Divide-by-5 Prescaler Module which operates from 500 MHz to 7 GHz, and the HMC-C040 is a Divide-by-10 Prescaler Module which operates from 500 MHz to 17 GHz.

The HMC-C039 and the HMC-C040 are low noise, static frequency dividers which accept a wide input power range of -15 dBm to +10 dBm at midband, and deliver -1 dBm of Output Power. Both of these divider modules exhibit very low additive single sideband phase noise of -155 dBc/Hz at 100 kHz offset, making them ideal for use in high frequency Phase Locked Loops (PLL), and in Local Oscillator (LO) applications in military EW/ECM, space, test equipment, wideband telecom, microwave radio and industrial bands from 0.5 to 17 GHz.

These unique divider modules utilize InGaP GaAs HBT technology, and operate from a single supply of +5V. The HMC-C039 and HMC-C040 are footprint compatible with the previously released, HMC-C005, HMC-C006 and HMC-C007 prescaler modules which offer divide ratios of 2, 4 and 8 respectively.

**Features**
- Ultra Low SSB Phase Noise
- Wide Input Power Range
- Single DC Supply: +5V
- Hermetically Sealed Module
- Field Replaceable
- SMA connectors
- -55 to +85°C Operation

**Applications**
- Pt to Pt / Multi-Pt Radios
- VSAT Radios
- Military & Space
- Test Instrumentation
- Fiber Optics

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**HMC510 / 534 / 583 / 584LP5(E)**

**MMIC VCOs w/ Fo/2 & ÷4, 8.45 to 13.9 GHz**

**Versatile InGaP HBT MMIC VCOs Feature Multiple Outputs!**

Four new InGaP HBT MMIC VCOs have been added to our extensive VCO product line. Ideal for Test Equipment, Industrial Control, VSAT, Point-to-Point/Point-to-Multi-Point Radio and Military applications from 8.45 to 13.9 GHz, these MMIC VCOs are packaged in footprint compatible leadless QFN 5 x 5 mm surface mount packages, and require no external matching components.

The HMC510LP5(E), HMC534LP5(E), HMC583LP5(E) and HMC584LP5(E) are fully integrated VCOs featuring SSB phase noise as low as -116 dBc/Hz for Fo output, with half frequency (Fo/2) and divide-by-4 outputs. These VCO products integrate resonators, negative resistance devices, and varactor diodes, and exhibit excellent phase noise performance over temperature, shock, and process variations due to the oscillator’s monolithic structure. The power output from these MMIC VCOs is typically between +10 dBm and +13 dBm from a +5V supply and the divide-by-4 function can be disabled to reduce bias current by approximately 20% when not required.

**Features**
- Fo, Fo/2 & ÷4 Outputs
- Pout: +10 to +15 dBm
- Low SSB Phase Noise: -116 dBc/Hz @ 100 kHz typ.
- No External Resonator Required
- RoHS Compliant 5x5 mm QFN Leadless SMT Packages

**Applications**
- VSAT Radio
- Point-to-Point & Multi-Point Radio
- Test Equipment & Industrial Sensors
- Military Systems

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**New MMIC VCO Family Typical Performance**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Fo Frequency (GHz)</th>
<th>Fo/2 Frequency (GHz)</th>
<th>Fo Output Power (dBm)</th>
<th>Fo/2 Output Power (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC510LP5(E)</td>
<td>8.45 - 9.55</td>
<td>4.23 - 4.78</td>
<td>+13</td>
<td>+6.5</td>
</tr>
<tr>
<td>HMC534LP5(E)</td>
<td>10.6 - 11.8</td>
<td>5.3 - 5.9</td>
<td>+11</td>
<td>+5.5</td>
</tr>
<tr>
<td>HMC583LP5(E)</td>
<td>11.5 - 12.8</td>
<td>5.75 - 6.4</td>
<td>+11</td>
<td>+5.5</td>
</tr>
<tr>
<td>HMC584LP5(E)</td>
<td>12.5 - 13.9</td>
<td>6.25 - 6.95</td>
<td>+10</td>
<td>+5</td>
</tr>
</tbody>
</table>

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**VCO Functional Diagram**
**WIDEBAND VCO MODULES ACHIEVE LOW PHASE NOISE**  
... (continued from page 1)

Hittite Wideband Connectorized VCO Typical Performance

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Frequency (GHz)</th>
<th>Tuning Voltage (V)</th>
<th>Output Power (dBm)</th>
<th>10kHz SSB Phase Noise (dBc/Hz)</th>
<th>100kHz SSB Phase Noise (dBc/Hz)</th>
<th>Frequency Pushing (MHz/V)</th>
<th>Bias Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC-C028</td>
<td>4 - 8</td>
<td>0 to +18</td>
<td>+20</td>
<td>-65</td>
<td>-93</td>
<td>0.2</td>
<td>+8V to +15V @ 185mA</td>
</tr>
<tr>
<td>HMC-C029</td>
<td>5 - 10</td>
<td>0 to +20</td>
<td>+21</td>
<td>-63</td>
<td>-92</td>
<td>0.2</td>
<td>+8V to +15V @ 195mA</td>
</tr>
<tr>
<td>HMC-C030</td>
<td>8 - 12.5</td>
<td>0 to +13</td>
<td>+21</td>
<td>-59</td>
<td>-83</td>
<td>0.2</td>
<td>+8V to +15V @ 195mA</td>
</tr>
</tbody>
</table>

**HITTITE EXPANDS POWER DETECTOR PRODUCT LINE**  
... (continued from page 1)

HMC602LP4(E) provides a nominal logarithmic slope of -25 mV/dB. The HMC602LP4(E) is ideal for RSSI measurement in cellular, broadband, test equipment, and wideband communications. As well as RF transmitter setpoint control and level monitoring in those applications.

The RF input is internally matched to 50 Ohms, and the device operates with a supply voltage of +5V, consuming 102 mA. A power down feature may be used to reduce the power consumption to less than 1.5 mW. The HMC602LP4(E) also features a buffered temperature sensor output which allows for additional system monitoring.

The HMC601LP4(E) is a 70 dB Logarithmic Detector/Controller which maintains a very high degree of log conformance over signal frequencies from 10 MHz to 3 GHz, with acceptable characteristics up to 4 GHz at reduced dynamic range.

For example, the HMC601LP4(E) provides a ±3 dB dynamic range of 76 dB with an input frequency of 900 MHz, and a ±3 dB dynamic range of 73 dB at 1900 MHz.

The HMC601LP4(E) is pin-compatible with the recently released HMC600LP4(E), but provides much wider video bandwidth, exhibiting an output rise time of 15 ns, and an output fall time in the order of 34 ns. These rise/fall times make the HMC601LP4(E) particularly suitable for detection of RF bursts in applications requiring pulse rates up to 20 MHz. The HMC601LP4(E) RF input is internally matched to 50 Ohms, and operates with a supply voltage range of +2.7 to +5.5V, consuming only 30 mA.

The HMC600LP4(E), HMC601LP4(E) and HMC602LP4(E) are housed in 4x4 mm plastic leadless surface mount packages, are specified for operation over -40°C to +85°C temperature range, and are available from stock. Detailed datasheets for these products may be found at www.hittite.com.
**Hittite Opens New Design Center!**

Hittite is pleased to introduce the establishment of an integrated circuit (IC) design center located in Ottawa, Ontario, Canada. The center is operational and staffed with a team of engineers who bring a complementary design capability which will immediately contribute to our product expansion plan.

**First Edition Microwave Modules & Subsystems Catalog!**

Hittite’s connectorized module products are now conveniently featured in a new Microwave Modules and Subsystems catalog as well as our website. This first edition Microwave Modules and Subsystems Catalog features full specifications on 42 RF/microwave components and synthesizers which are ideal for Test and Measurement, Telecom, Military and Space applications.

The catalog is organized by product line and includes Amplifiers, Attenuators, Frequency Dividers/ Multipliers, Mixers, Phase Shifters, Switches, Synthesizers and VCOs. Request your copy of the new Microwave Modules and Subsystems catalog at www.hittite.com by selecting the “Submit Inquiry” button.

**Hittite Adds 2 New Representatives!**

TEQ Sales to Cover IL & WI

TEQ Sales now offers full support to Hittite’s growing customer base in Illinois and Wisconsin. TEQ Sales in Illinois can be contacted at 847-742-3767, 847-742-3947 (fax) or at TEQSalesIL@teqsales.com. TEQ Sales in Wisconsin can be contacted at 262-780-0340, 262-780-0342 (fax) or at TEQSalesWI@teqsales.com.

Schillinger Associates to Cover IN, KY, MI & OH

Schillinger Associates, Inc. now offers full support to Hittite’s growing customer base in Indiana, Kentucky, Michigan and Ohio. Schillinger Associates, Inc. can be contacted at 765-457-7241, 765-457-7732 (fax) or administr@rai-rep.com.

**Connectorized Module Products are RoHS Compliant!**

Hittite is committed to meeting the Restriction of Hazardous Substances (RoHS) European Union directive. We are pleased to announce that all of our Connectorized Microwave Modules are now RoHS or RoHS-5 compliant, while also meeting stringent military solder material requirements. Please see the RoHS Compliant Components section at www.hittite.com.
What We Do

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

- Power Amplifiers
- Gain Blocks
- Driver Amplifiers
- LNAs
- Wideband Amps
- Track-and-Hold Amplifiers
- Attenuators
- Phase Shifters
- Switches
- Transceivers
- Power Detectors
- Mixers
- Converters
- VCOs
- Freq. Dividers
- IRMs
- Modulators
- PLOs / PLLs
- Demodulators
- Synthesizers

We also design and supply highly integrated custom ICs, modules and subsystems that combine multiple functions for specific requirements. We select the most appropriate semiconductor and package technologies, uniquely balancing digital and analog integration techniques.

Our custom and standard products support a wide range of wireless / wired communications and radar applications for the following markets:

- **Automotive**
  - Telematics & Sensors

- **Broadband**
  - CATV, DBS, WiMAX, WLAN, Fixed Wireless & UWB

- **Cellular Infrastructure**
  - GSM, GPRS, CDMA, WCDMA, & UMTS

- **Fiber Optic**
  - OC-48 to OC-768

- **Microwave & mmWave Communications**
  - Backhaul Radio Links
  - Multi-Pt Radios & VSAT

- **Military**
  - C3I, ECM & EW

- **Space**
  - Payload Electronics

- **Test & Measurement**
  - Commercial / Industrial Sensors & Test Equipment

Every component is backed by Hittite Microwave’s commitment to total quality. HMC is ISO 9001:2000 and ISO/TS 16949:2002 certified. 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.

Order On-line at: www.hittite.com