Wireless Symposium 2000 is Stage for New Product Introductions

Wireless Symposium/Portable by Design 2000 held in San Jose, CA (February 21-25) marked the introduction of 16 new MMIC products, covering DC-40 GHz, from Hittite Microwave and the new FEBRUARY 2000 DESIGNERS GUIDE standard products catalog.

The HMC280MS8G plastic SMT power amp rounds out HMC’s HIPERLAN & U-Nii 5.2 & 5.8 GHz product set. With 18 dB of gain and +24 dBm PSAT at 3.6V bias the PA will complement the low cost switches, mixers, frequency doubler & dividers already in production. For the same WLAN band, the HMC189MS8 doubler requires only +10 dBm input for a 4 to 8 GHz output.

Covering 18 to 40 GHz, 3 new millimeter wave MMIC mixer chips, including sub-harmonic x2 LO (HMC266) and fundamental LO (HMC292 & HMC294) double-balanced products, will now bring the total mmWave mixer product offering to 7. The HMC261CB1 is the first SMT mmWave driver amp for 20 to 32 GHz PT-to-PT radio, SATCOM, andLMDS and puts out +14 dBm.

Cellular, DBS, and cable modem signal routing applications will make

mmWave Product Line Expands!

Hittite Microwave now offers from stock one of the most comprehensive millimeterwave MMIC product lines in the industry including mixers, amplifiers, converters, LNAs & frequency multipliers. The millimeterwave selection guide shown below matches the HMC

(cont on pg 6)
HMC294
DOUBLE-BALANCED PASSIVE MMIC MIXER 25-40 GHz

General Description
The HMC294 chip is a miniature passive double-balanced mixer which can be used as an up or downconverter from 25 - 40 GHz in a small chip area of 1.70 mm². Excellent isolations are provided by on-chip baluns, which require no external components and no DC bias. The mixer chip is designed to be used in Local Multi-Point Distribution Systems (LMDS), microwave point to point radios, and SATCOM applications. All data is measured with the chip in a 50 ohm test fixture connected via 0.076 mm (3 mil) gold ribbon of minimal length < 0.31 mm (<12 mils). This device is a much smaller and more reliable replacement to hybrid diode mixer designs.

Features
- INPUT IP3: +20 dBm
- LO/RF ISOLATION: 30 to 45 dB
- P1dB INPUT: +12 dBm
- SMALL SIZE: 0.88 mm x 1.93 mm

HMC292
DOUBLE-BALANCED PASSIVE MMIC MIXER 18-32 GHz

General Description
The HMC292 chip is a miniature passive double-balanced mixer which can be used as an up or downconverter from 18 - 32 GHz in a small chip area of 0.93 mm². Excellent isolations are provided by on-chip baluns, which require no external components and no DC bias. The mixer chip is designed to be used in Local Multi-Point Distribution Systems (LMDS), microwave point to point radios, and SATCOM applications. All data is measured with the chip in a 50 ohm test fixture connected via 0.025 mm (1 mil) diameter wire bonds of minimal length < 0.31 mm (<12 mils). This complete mixer IC is priced competitively against hybrid diode quad designs.

Features
- INPUT IP3: +19 dBm
- LO/RF ISOLATION: 33 to 43 dB
- BROADBAND IF: DC-8 GHz
- SMALL SIZE: 0.89 mm x 1.04 mm

HMC266
GaAs MMIC SUB-HARMONICALLY PUMPED MIXER 20-40 GHz

General Description
The HMC266 chip is a broadband sub-harmonically pumped (x2) balanced MMIC passive mixer which can be used as an up or downconverter in a small overall chip area of 1.9 mm². The 2LO to RF isolation is excellent (> 45 dB) eliminating the need for additional filtering. This mixer chip is designed to be used in 23, 26 & 38GHz point to point radios, Local Multi-Point Distribution Systems (LMDS), and SATCOM applications. All data is with the chip in a 50 ohm test fixture connected via 0.076 mm (3 mil) ribbon bonds of minimal length <0.31 mm (<12 mils). This device is a much smaller and more reliable replacement to hybrid diode mixer designs.

Features
- INPUT IP3: Up to +18 dBm
- SUB-HARMONICALLY PUMPED x2 LO (10 - 20 GHz)
- SMALL SIZE: 1.32 mm x 1.47 mm
- SATISFY ALL BROADBAND REQ'TS IN ONE MIXER!
MEET THE “LAST MILE” CHALLENGE

HMC261CB1
MMIC SMT DISTRIBUTED AMPLIFIER
20 - 32 GHz

**General Description**
The HMC261CB1 is a GaAs MMIC distributed amplifier which covers the frequency range of 20 to 32 GHz in a Ball Grid Array (BGA) SMT package. The packaged chip utilizes a GaAs PHEMT process, operating from a single bias supply of +3 to +4V, with a P1dB output power of +12 dBm. This amplifier can be used in microwave & millimeter wave point-to-point radios, Local Multi-Point Distribution Systems (LMDS), VSAT, and other SATCOM applications. Utilizing the HMC261CB1 eliminates the need for wirebonding, thereby providing a consistent connection interface for the customer. This amplifier complements HMC’s line of SMT BGA packaged millimeterwave mixers; HMC258CB1, HMC264CB1, and HMC265CB1.

**Features**
- SMT BGA PACKAGE
- NO WIREBONDS!

- **Psat OUTPUT POWER:**
  +14 dBm

- **SINGLE POSITIVE SUPPLY:**
  +3V to +4V

HMC264CB1
HMC264CB1 SUB-HARMONIC SMT MIXER 20 - 30 GHz

**General Description**
The HMC264CB1 is a 20 – 30 GHz surface mount sub - harmonically pumped (x2) MMIC mixer with an integrated LO amplifier in a rugged Ball Grid Array (BGA) package. The 2LO to RF isolation is an excellent 30 to 38 dB, eliminating the need for additional filtering. The LO amplifier is a single bias (+3V to +4V) two stage design with only ~4 dBm drive requirement. This GaAs PHEMT based mixer chip was designed to be used in LMDS, microwave point-to-point radios, and SATCOM applications. All data is with the non-hermetic, epoxy sealed BGA packaged device mounted in a 50 ohm test fixture. Utilizing the HMC264CB1 eliminates the need for wirebonding, thereby providing a consistent connection interface for the customer.

**Features**
- SMT BGA PACKAGE
- NO WIREBONDS!

- **INTEGRATED LO AMPLIFIER:**
  -4dBm/INPUT

- **SUB-HARMONICALLY PUMPED**
  x2 LO (10 to 15 GHz)

- **HIGH 2LO/RF ISOLATION:**
  >35dB

HMC283
MMIC MEDIUM POWER AMPLIFIER
17 - 40 GHz

**General Description**
The HMC283 chip is a four stage GaAs MMIC Medium Power Amplifier (MPA) which covers the frequency range of 17 to 40 GHz. The chip can easily be integrated into MCMs due to its small 1.62 mm² size. The chip utilizes a GaAs PHEMT process offering 21 dB gain and +21 dBm output power from a bias supply of +3.5V at 300 mA. This MPA is ideal for millimeterwave point-to-point radios, LMDS, and SATCOM applications. The HMC283 may be used as a frequency doubler. A B.I.T. (Built-In-Test) pad (Vdet) allows monitoring microwave output power: All data is with the chip in a 50 ohm test fixture connected via ribbon bonds of minimal length 0.31 mm(<12 mils).

**Features**
- **HIGH GAIN:**
  21 dB

- **Psat OUTPUT POWER :**
  +21 dBm

- **OUTPUT IP3 :**
  +26 dBm

- **SMALL CHIP SIZE:**
  0.88 mm x 1.72 mm

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*OFF-THE-SHELF  FEBRUARY 2000*
HMC280MS8G
GaAs MMIC POWER AMPLIFIER
5.0 - 6.0 GHz

General Description
The HMC280MS8G is a ±3.6V GaAs MMIC power amplifier covering 5 to 6 GHz. The device is packaged in a low cost, SMT 8 lead MSOP plastic package with an exposed base paddle for improved RF ground and thermal dissipation. The amplifier provides 18 dB of gain and 24 dBm Psat while operating from a single positive supply. This amplifier is ideal for use in the UNII & HIPERLAN bands at 5.2GHz & 5.8GHz. External component requirements are minimal with the amplifier occupying less than 0.023 sq. in. (14.6 sq. mm). All data is taken with the amplifier assembled into a 50 ohm test fixture. For transmit / receive applications use either the HMC223MSB or HMC224MSB SPDT switches.

Features
Psat OUTPUT POWER:
+24 dBm

OUTPUT IP3:
+38 dBm

HIGH GAIN:
19 dB

SINGLE SUPPLY:
+3.6V to +5V

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HMC224MS8
GaAs MMIC 2WATT T/R SWITCH
5.0 - 6.0 GHz

General Description
The HMC224MS8 is a low-cost SPDT switch in an 8-lead MSOP package for use in transmit-receive applications. The device can control signals from 5.0 to 6.0 GHz and is especially suited for UNII & HIPERLAN 5.2 & 5.8 GHz applications with only 1.2 dB loss. The design provides exceptional power handling performance; input Pin = +31 dBm at 3 Volt bias. On-chip circuitry allows single positive supply operation at very low DC current with control inputs compatible with CMOS and most TTL logic families. No DC blocking capacitors are required on RF I/O ports and at <1 mm high the HMC224MS8 is especially suited for PCMCIA wireless LAN applications.

Features
INDUSTRY FIRST LOW COST
5-6 GHz SWITCH

ULTRA SMALL PACKAGE:
MSOP8

HIGH INPUT P1dB:
+33 dBm @ +5V

SINGLE POSITIVE SUPPLY:
+3 to +6V

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HMC218MS8
SMT DOUBLE-BALANCED PASSIVE MMIC MIXER 4.5 - 6 GHz

General Description
The HMC218MS8 is an ultra miniature double-balanced mixer in an 8 lead plastic surface mount MSOP. This passive MMIC mixer is constructed of GaAs Schottky diodes and novel planar transformer baluns on the chip. The device can be used as an up/downconverter, bi-phase [de]modulator or phase comparator for 5.2 GHz & 5.8 GHz UNII/HIPERLAN portable wireless applications because of its high dynamic input signal range, small size, and low cost. The MSOP8 package is the smallest footprint available for a complete double-balanced mixer, 0.118" x 0.190" (3.0mm x 4.9mm). At a height of 0.040" (1.0mm) this is the thinnest mixer package available today.

Features
ULTRA SMALL PACKAGE:
<1 mm High

IP3 (INPUT):
+18 dBm

LO/RF ISOLATION:
30 dB

LO DRIVE:
+7 to +13 dBm
HMC276QS24
GaAs MMIC 4 x 2 SWITCH MATRIX
700 - 2150 MHz

**General Description**

The HMC276QS24 is a low-cost 4x2 switch matrix in a 24-lead QSOPO package for use in RF multiplexing applications from 700 to 2150 MHz. A positive voltage controlled 4 bit decoder is integrated on the switch. The switch may be used in either 75 ohm or 50 ohm DBS, CATV, cable modem, or cellular systems.

Both switch outputs (OP1 & OP2) can independently select any of the four inputs (HH, HL, VH, VL) or simultaneously select the same inputs. The switch is bi-directional and input/output functionality may be interchanged. The recommended loading impedance is 62.5 ohms on each input (HH, HL, VH, VL) and 75 ohms on each output (OP1 & OP2).

**Features**

- 4x2 SWITCH MATRIX USING ONE IC
- 4x4 SWITCH MATRIX USING TWO IC’s
- INTEGRATED 4 BIT DECODER:
  +5V Supply
- 30 TO 50 dB ISOLATION
- FOR DBS SWITCHING APPLICATIONS

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HMC141C8
SMT DOUBLE-BALANCED PASSIVE MMIC MIXER 6 - 15 GHz

**General Description**

The HMC141C8 is a miniature double-balanced mixer in a non-hermetic ceramic surface mount package that can be used as an upconverter or downconverter. The device is a passive diode/balun type mixer with high dynamic range. The mixer can handle larger signal levels than most active mixers due to the high third order intercept. MMIC implementation provides exceptional balance in the circuit resulting in high LO/RF and LO/IF isolations and unit-to-unit consistency. This mixer has applications in point-to-point microwave radios and VSAT ground equipment where small size and surface mount compatibility are important.

**Features**

- CONVERSION LOSS: 8.5 dB
- LO TO RF AND IF ISOLATION: 30 to 43 dB
- SURFACE MOUNT, NO THRU HOLES
- INPUT IP3: +21 dBm

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HMC121C8
GaAs MMIC SMT VVA
DC - 10 GHz

**General Description**

The HMC121C8 is an absorptive Voltage Variable Attenuator (VVA) in a surface-mount package covering DC - 10 GHz. It features an on-chip reference attenuator for use with an external op-amp to provide simple single voltage attenuation control, 0 to -3V. The device is ideal in designs where an analog DC control signal must control RF signal levels over a 25 dB amplitude range. Applications include ADC circuits and temperature compensations of multiple gain stages in microwave point-to-point and VSAT radios.

**Features**

- WIDE BANDWIDTH: DC - 10 GHz
- LOW PHASE SHIFT VS. ATTENUATION
- 25 dB ATTENUATION RANGE
- SIMPLIFIED VOLTAGE CONTROL

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Layout Guidelines for MMIC Components

Low cost plastic and ceramic packaged products from HMC range in frequency from DC to 15 GHz for use in cellular, 3G communications, WLAN, microwave radio and VSAT applications. As new applications require higher frequencies, printed circuit board (PCB) design layout and material must be thoroughly examined. Design issues such as transitions from components & connectors, RF grounding, leakage & coupling between structures will be more sensitive at higher frequencies. With the proper design techniques presented here, excellent performance can be achieved.

The transmission line method that HMC recommends is a grounded Co-Planar Wave Guide (CPWG) design on a Roger’s 4350 material or equivalent. Tables I & B show the material and physical parameters for R4350 PCBs used by HMC. Table I B compares microstrip versus CPWG and shows the optimal DC to 15 GHz CPWG R4350 line width and gap. The 0.020” (0.51 mm) RF ground plane height is widely available prevents moding at these frequencies.

CPWG allows a 30% reduction in line width for 50-ohm lines permitting a larger ground plane between RF lines enhancing isolation and reducing leakage. It is necessary to have as many via holes connecting the top and bottom ground planes along the RF transmission lines. Separation between vias should be 1/20 λ or less and the edge of the vias should be offset 1 diameter distance from the edge of the ground plane.

To prevent RF leakage onto the DC bias lines below 3 GHz, it is necessary to damp the lines using RF bypass capacitors placed reasonably close to the MMIC lead. However, in the 10GHz range a 1/4 λ resonance may start to occur at a distance of a few tenths of an inch from the device. If the capacitors are not placed directly at the pin of the package, the distance from the package to the capacitor may be on the order of 1/4 λ, which will result in a RF open circuit being presented at the pin of the device. Series resistors on the bias and control lines may also be used to damp RF signal leakage. These resistors should be similar in value to the bias line impedance, approximately 80 - 120 ohms. Placement of the resistor should be as close to the MMIC leads as possible.

The design and layout guidelines presented are sufficient to achieve high performance from all of HMC’s SMT MMIC components. To accurately characterize these products a Line-Reflect-Match (LRM) calibration technique is used. This method uses a custom set of PCB calibration standards fabricated as a matching set with the actual evaluation PCB providing S-Parameter data de-embedded directly to the package leads. HMC has developed standards to characterize each of our products.

See www.hittite.com/pdf/layout.pdf for the full text of this application note. Evaluation boards are supplied with samples upon request. Layout files are also available for customers to include in their design.

Wireless 2000...

(cont from pg 1)

use of 5 new positive bias multi-throw switches with onboard TTL drivers covering up to 6 GHz. SP4T, 6T, & 8T functions are offered as well as an industry first 4 x 2 monolithic matrix IC. The:HMC284MSBG SPDT yields more than 45 dB isolation while the HMC226 handles T/R switch applications with a +61 dBm IIP3. For 3G, WLL, and MMDS engineers, the HMC285 very low cost mixer packs a +21 dBm IIP3 in a ultra small SOT26.

Inside this issue of OFF-THE-SHELF each new product is featured. Full data sheets with Hittite Microwave’s Guarantee of Electrical Performance Over Temperature are available in the new FEBRUARY 2000 catalog or on the web site. These products are available immediately from stock!

mmWave Products...

(cont from pg 1)

MMIC chip product to the Broadband Wireless Access (BWA) applications from 17 to 40 GHz. This issue of OFF-THE-SHELF features 3 new MMIC mixer chips; HMC266 20-40 GHz with sub-harmonic x2 LO, HMC292 double-balanced 18-32 GHz, & HMC294 double-balanced 25-40 GHz, and the broadband HMC261CB1 +14 dBm driver amp in a SMT BGA package.

There are now 14 chip & 4 SMT millimeterwave products to choose from and more to be released in 2000! All of these products are featured in the new FEBRUARY 2000 DESIGNER’S GUIDE standard products catalog and on our web site, www.hittite.com. Call or email today!
WHAT'S NEW?

February 2000 Catalog Now Available!

Hittite Microwave announces the release of its 2000 catalog. This 600-page February 2000 Designer’s Guide includes over 16 new MMIC product data sheets, as well as new wireless application selection guides, application notes, and major trade journal article reprints. Over 95 products covering DC to 40 GHz are detailed. Catalogs can be requested by faxing the request form below or emailing your request to hmcsales@hittite.com.

Hittite Promotions

Norman G. Hildreth, Jr. is promoted to Director of Marketing and Business Development. In this position, Norm will be responsible for the development of marketing/product plans, long term business plans, strategic relations, and promotional media. Norm has served the company as Director of Sales in the past three years.

Stephen G. Daly is promoted to Director of Sales. Steve will be responsible for managing the HMC inside & outside sales force and growing the company's product bookings and market share. In recent years, Steve has contributed to Hittite’s growth in his capacity as Principal Sales and Application Engineer.

WELCOME NEW SALES REPS

Hittite Microwave is pleased to announce the following appointments;

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SSS Technology, Inc.

Phone: 480-733-4146

Email: towns471@prodigy.net

**No. Illinois**

TK Technologies, Inc.

Phone: 847-559-1075

Email: TKusTKT@aol.com

**Israel**

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Phone: +972-3294-1055

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- Future issues of OFF-THE-SHELF
- Please remove me from your mailing list!
- September 1999 CD Catalog
- Full-Line February 2000 Catalog
- Reprint of Microwave Journal cover feature
- Please have a Sales & Application Engineer contact me!

Company Name ________________________________ Title ________________________________

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Product Interest:

- MIXERS
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Please fax this form to: HMC Sales Department, 978-250-3373

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So. CA

SSS Technology Inc. 818-369-2866

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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 1986, 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 for both commercial, military, and space markets. 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 advanced design concepts, best available fabrication technology, and automated manufacturing & test methods.

Our standard MMIC product line consists of over 95 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, Data Over Cable
- Broadband/Video
- Microwave Telecom Link, VSAT, MMDS, LMDS, DBS, CATV
- Sensor
- Military, Industrial, Commercial
- Military
- C3, EW, ECM, RADAR
- 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.