HMC & UMS Announce Millimeter Wave Product Development Agreement

Hittite Microwave Corporation (HMC) & United Monolithic Semiconductor (UMS) announced their agreement where HMC will add to their recently introduced SMT BGA packaged millimeter wave MMIC product line utilizing selected UMS MMIC die. These new products will address point-to-point/multi-point, LMDS, K/Ka-band satellite ground terminals and point-to-point radios for performance improvement and size/cost reduction; HMC258CB1 [14 - 20 GHz], HMC264CB1 [20 - 30 GHz] and HMC265CB1 [20 - 31] GHz.

The "CB1" BGA is a low cost, leadless ceramic package utilizing copper-silver alloy non-collapsing hard balls. The base of the package is a single layer, conventional thin-film ceramic substrate with tungsten-copper vias. A ceramic lid is epoxy sealed creating a moisture resistant, non-hermetic assembly ready for automatic pick-and-place onto a PCB.

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Hittite Microwave Corporation

Designers of millimeter and microwave radios now have access to advanced MMICs in a rugged SMT packaged format. Hittite Microwave has introduced the first mixer/converter MMICs in ceramic Ball Grid Array (BGA) SMT packages covering 14 to 31 GHz. Three products have been released specifically for applications in LMDS, K/Ka-band satellite ground terminals and point-to-point radios for performance improvement and size/cost reduction; HMC258CB1 [14 - 20 GHz], HMC264CB1 [20 - 30 GHz] and HMC265CB1 [20 - 31] GHz.

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HMC, based in Woburn, Massachusetts, USA, is a manufacturer of MMIC based products covering RF to 40 GHz. UMS, based in Orsay, France, offers advanced commercial PHEMT & Schottky Diode foundry services as well as MMIC based products covering RF to 60 GHz. Both companies supply MMICs to commercial, space and military communication markets.

New Products Showcased at Anaheim MTT-S

The 1999 IEEE MTT-S International Microwave Symposium & Exhibition held in Anaheim, CA (June 13-19) marked the introduction of 13 new MMIC products, covering DC-40 GHz, from Hittite Microwave and the new June 1999 standard products CD-ROM catalog. These products are featured in this edition of OFF-THE-SHELF.

The products include 8 new millimeter wave MMICs consisting of 4 LNAs with 2 to 3.5 dB NF, collectively covering 15 to 40 GHz, 3 ceramic BGA mmwave mixer ICs discussed in the above article, and the HMC283 17 to 40 GHz medium power amplifier with 21dB gain and +21dBm Psat output power. The HMC279MS8G driver amplifier is an industry first low cost solution for MMDS, 3.5WLL, and 3.7-4.2GHz VSAT transmit applications. An alternative to bulky hybrid modulators, the HMC267OS16GQPSK 0/+5V controlled modulator will provide a fresh

Data sheets & S-Parameters can be found in the new 1999 CD-ROM

21 Cabot Road, Woburn, MA 01801 Phone: (781) 933-7267 Fax: (781) 932-8903
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 Multi-Chip Modules (MCMs) due to its small (1.62 mm²) size. The chip utilizes a GaAs PHEMT process offering 20 dB gain and +21 dBm output power from a bias supply of +3.5V @ 300mA. This medium PA can be used in millimeterwave point-to-point radios, Local Multi-Point Distribution Systems (LMDS), VSAT, and other SATCOM applications. The HMC283 may be used as a frequency doubler. A B.I.T. (Built-In-Test) pad (Vdet) allows monitoring of a DC voltage that is representative of the microwave output power. All data is with the chip in a 50 ohm test fixture connected via ribbon bonds of minimal length.

**Features**

**HIGH GAIN:**
21 dB

**Psat OUTPUT POWER**
+21dBm

**WIDEBAND PERFORMANCE:**
17 - 40 GHz

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

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The HMC282 chip is a four stage GaAs MMIC Low Noise Amplifier (LNA) which covers the frequency range of 34 to 40 GHz. The chip can easily be integrated into Multi-Chip Modules (MCMs) due to its small (2.30 mm²) size. The chip utilizes a GaAs PHEMT process offering 26 dB gain from a bias supply of +3.5V @ 85 mA with a noise figure of 3.5 dB. This LNA can be used in millimeterwave point-to-point radios, VSAT, and other SATCOM applications. The HMC282 may be used in conjunction with the HMC259 mixer to realize a millimeterwave system receiver.

**Features**

**GREAT NOISE FIGURE:**
3.5 dB

**STABLE GAIN vs. TEMPERATURE:**
26dB ± 1.2 dB

**SMALL SIZE :**
1.11 mm x 2.07 mm

**IDEAL FOR 38 GHz RADIOS, E1 & T1**

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The HMC281 chip is a three stage GaAs MMIC Low Noise Amplifier (LNA) which covers the frequency range of 18 to 32 GHz. The chip can easily be integrated into Multi-Chip Modules (MCMs) due to its small (1.62 mm²) size. The chip utilizes a GaAs PHEMT process offering 22 dB gain from a bias supply of +3.5V @ 60 mA with a noise figure of 2.5 dB. This LNA can be used in millimeterwave point-to-point radios, LMDS, VSAT, and other SATCOM applications. All data is with the chip in a 50 ohm test fixture connected via ribbon bonds of minimal length. The HMC281 may be used in conjunction with the HMC143, HMC203, HMC258, HMC284, or HMC265 mixers to realize a microwave or millimeterwave system receiver.

**Features**

**EXCELLENT NOISE FIGURE:**
2.5 dB

**STABLE GAIN vs. TEMPERATURE:**
22 dB ± 2 dB

**WIDEBAND PERFORMANCE :**
18 - 32 GHz

**SMALL SIZE :**
0.97 mm x 1.67 mm
**HMC265CB1**

**General Description**
The HMC265CB1 is a 20 – 31 GHz surface mount sub - harmonically pumped (x2) MMIC downconverter with integrated LO & IF amplifiers in a rugged Ball Grid Array (BGA) package. The 2LO to RF & IF isolations are an excellent 30 & 50 dB respectively, 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 downconverter 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.

**Features**
- **RUGGED SMT BGA PACKAGE**
- **INTEGRATED LO AMPLIFIER:**
  - -4dBm INPUT
- **SUB-HARMONICALLY PUMPED (x2) LO**
- **INTEGRATED IF AMPLIFIER:**
  - 3 dB CONVERSION GAIN

**Conversion Gain vs. Temperature**
@ LO = - 4 dBm Vdd= +4V

**HMC264CB1**

**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**
- **RUGGED SMT BGA PACKAGE**
- **INTEGRATED LO AMPLIFIER:**
  - -4dBm INPUT
- **SUB-HARMONICALLY PUMPED (x2) LO**
- **HIGH 2LO/RF ISOLATION:**
  - > 35dB

**Conversion Gain vs. Temperature**
@ LO = - 4 dBm Vdd= +4V

**HMC258CB1**

**General Description**
The HMC258CB1 is a 14 – 20 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 38 dB, eliminating the need for additional filtering. The LO amplifier is a single bias (+5V) two stage design with only 0dBm drive requirement. This MESFET based single-ended mixer chip was designed to be used in LMDS, microwave point-to-point radios, VSAT and other SATCOM applications. All data is with the non-hermetic, epoxy sealed BGA packaged device mounted in a 50 ohm test fixture. Utilizing the HMC258CB1 eliminates the need for wirebonding, thereby providing a consistent connection interface for the customer.

**Features**
- **RUGGED SMT BGA PACKAGE**
- **INTEGRATED LO AMPLIFIER:**
  - 0dBm INPUT
- **SUB-HARMONICALLY PUMPED (x2) LO**
- **LINEAR OPERATION:**
  - +13 dBm INPUT IP3

**Conversion Gain vs. Temperature**
@ LO = 0 dBm
HMC263
GaAs MMIC LOW NOISE AMPLIFIER
24 - 36 GHz

General Description
The HMC263 chip is a GaAs MMIC Low Noise Amplifier (LNA) which covers the frequency range of 24 to 36 GHz. The chip can easily be integrated into Multi-Chip Modules (MCMs) due to its small (3.29 mm²) size. The chip utilizes a GaAs PHEMT process offering 23 dB gain from a single bias supply of + 3V @ 46 mA with a noise figure of 2.3 dB. This LNA can be used in millimeterwave point-to-point radios, Local Multi-Point Distribution Systems (LMDS), VSAT, and other SATCOM applications. All data is with the chip in a 50 ohm test fixture connected via wire bonds of minimal length. The HMC263 may be used in conjunction with HMC259, HMC264, or HMC265 mixers to realize a millimeterwave system receiver.

Features
EXCELLENT NOISE FIGURE:
2.3 dB
STABLE GAIN vs. TEMPERATURE:
23 dB ± 2.0 dB
SINGLE SUPPLY:
+3V @ 46 mA
SMALL SIZE:
1.32 mm x 2.49 mm

HMC262
GaAs MMIC LOW NOISE AMPLIFIER
15 - 24 GHz

General Description
The HMC262 chip is a GaAs MMIC Low Noise Amplifier (LNA) which covers the frequency range of 15 to 24 GHz. The chip can easily be integrated into Multi-Chip Modules (MCMs) due to its small (2.75 mm²) size. The chip utilizes a GaAs PHEMT process offering 25 dB gain from a single bias supply of + 3V @ 36 mA with a noise figure of 2 dB. This LNA can be used in microwave & millimeter wave point-to-point radios, VSAT, and other SATCOM applications. All data is with the chip in a 50 ohm test fixture connected via wire bonds of minimal length. The HMC262 may be used in conjunction with HMC203, HMC258, HMC264, or HMC265 mixers to realize a microwave or millimeterwave system receiver.

Features
EXCELLENT NOISE FIGURE:
2 dB
STABLE GAIN vs. TEMPERATURE:
25 dB ± 1.5 dB
SINGLE SUPPLY:
+3V @ 36 mA
SMALL SIZE:
1.32 mm x 2.08 mm

HMC267QS16G
GaAs MMIC SMT QPSK MODULATOR
5 - 6 GHz

General Description
The HMC267QS16G QPSK Modulator is designed to phase-modulate an RF signal into quadrature phase states. The 5V differential voltages applied at the control ports define the phase state at the RF output port. The QPSK Modulator is ideal for 5.2 UNII and 5.8 ISM microwave radio applications. This IC product replaces larger, more expensive hybrid QPSK Modulators. Excellent amplitude and phase balance is provided by closely matched monolithic balun and FET circuits delivering 30 dBc of carrier suppression. The device also functions as an I/Q demodulator.

Features
LINEAR PERFORMANCE:
+20 dBm P1dB
30 dBc CARRIER SUPPRESSION
USE AS A MODULATOR OR DEMODULATOR
AMPLITUDE BALANCE:
1.0 ~ 1.5 dB
**HMC279MS8G**

**GaAs MMIC DRIVER AMPLIFIER**

2.5 - 4.2 GHz

**General Description**
The HMC279MS8G is a +3V GaAs MMIC driver amplifier covering the 2.5 - 4.2 GHz frequency range. The device is packaged in a surface mount MSOP plastic package with an exposed base paddle for improved RF ground. The amplifier provides greater than 36dB gain and +14 dBm P1dB operating from a single +3V supply @ only 60mA. This amplifier is ideal for use in MMDS 2.6-2.7GHz, 3.5 GHz WLL, and 3.7 - 4.2 GHz satellite receive and transmit bands. No external components are required while the amplifier occupies less than 0.023 sq. in. (14.6 sq. mm). All data is taken with the amplifier assembled into a 50 ohm test fixture with the exposed ground paddle connected to RF ground.

**Features**
- **EXCELLENT GAIN:** 36 dB
- **Psat OUTPUT POWER:** +14 dBm
- **SINGLE SUPPLY:** +3V @ 60 mA
- **ULTRA SMALL PACKAGE:** MSOP8
- **NO EXTERNAL MATCHING REQUIRED**

**Gain vs. Temperature**

**HMC221**

**GaAs MMIC SOT26 SPDT SWITCH**

DC - 3 GHz

**General Description**
The HMC221 is a low-cost SPDT switch in a 6-lead SOT26 plastic package for use in general switching applications which require very low insertion loss and very small size. The device can control signals from DC to 3.0 GHz and is especially suited for 900 MHz, 1.8-2.2GHz, and 2.4GHz ISM applications with less than 1dB loss. The design provides exceptional insertion loss performance, ideal for filter and receiver switching. RF1 or RF2 is a reflective short when “Off”. The two control voltages require a minimal amount of DC current and offer compatibility with most CMOS & TTL logic families. The HMC221 is especially suited for PCMCIA wireless card and cellular phone applications. See HMC197 for same performance in an alternate SOT26 pin-out.

**Features**
- **LOW INSERTION LOSS:** 0.4 dB
- **ULTRA SMALL PACKAGE:** SOT26
- **IP3 (INPUT):** +45 dBm
- **POSITIVE CONTROL:** 0/+3v @ 10 μA

**Insertion Loss and Isolation**

**HMC220MS8**

**GaAs MMIC SMT DOUBLE-BALANCED MIXER 5 - 12GHz**

**General Description**
The HMC220MS8 is an ultra miniature double-balanced mixer in an 8 lead plastic surface mount Mini Small Outline Package (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 or downconverter, bi-phase (de)modulator or phase comparator. It is especially suited for 5.9 to 11.7 GHz microwave radio and VSAT applications because of its high dynamic input signal range, small size, zero DC bias requirement and low cost. The consistent MMIC performance will improve system operation and assure regulatory compliance. The MSOP8 package is the smallest footprint available for a complete passive double-balanced mixer, 0.118” x 0.190” (3.0mm x 4.9mm).

**Features**
- **LOW COST PLASTIC CONVERTER** FOR MICROWAVE RADIOS & VSAT
- **ULTRA SMALL PACKAGE:** MSOP8
- **LINEAR PERFORMANCE:** +17 dBm INPUT IP3
- **WIDEBAND IF:** DC - 4 GHz

**Conversion Gain vs. Temperature @ LO = +10 dBm**
The Hittite Microwave SPNT switch product line includes non-reflective and reflective switches with on-board-decoders. The HMC165S14 SP4T, HMC182S14 SP4T, HMC172QS24 SP8T & HMC183QS24 SP8T are in industry standard plastic SOIC and QSOP packages.

The on-board-decoder technology developed by Hittite Microwave provides the user with the advantage of a simplified control interface. Decoder topologies for each switch style are as follows: 2:4 decoder = SP4T, 3:6 decoder = SP6T, and 3:8 = SP8T. This directly simplifies board layout by reducing the number of driver lines required to control the switch and reducing RF crosstalk. There is a ~Vee bias requirement of -5.0Vdc and the control lines accept negative logic voltages.

The switching elements of the circuit are depletion mode MESFETs (FETs). In standard operation the drain & source of each FET is held at DC ground with the gate potential of the FET held at 0 volts resulting in the low loss or “on” state. When the gate potential is held at -5 volts the high impedance or “off” state results. The system designer may not have negative multithrow switch. By the use of blocking capacitors, pull-up resistors, and careful attention to layout details of the PCB, the floating ground switch driver approach can be used with good results and a minimum of additional circuitry.

There must be a potential difference of > –3.5Vdc to < -7Vdc between the gate and drain-source channel to establish the pinch-off of the FET channel, therefore achieving the “off” state in the FET. This can be accomplished by holding the source and drain at +5 V and toggling the gate between 0 and +5 V to change the state of the FET. All DC bias points and control signals are therefore raised +5V from their normal 0 or –5V potentials.

An example of this floating ground technique using microstrip transmission lines is shown in Figure 1 for the HMC182S14 SP4T non-reflective switch. The switch shunt FET sources are pulled to +5 volts through the 270 nH inductor (L1) applying bias to the floating ground plane. The switch FET drains are held at +5 volts potential via the 10 Kohm resistor (R1) and capacitor (C9) arrangement shown at the RF Common node. RF/DC ground connections must have many via holes to ensure a low impedance path to ground. C1-C10 dc block, decoupling & bypass applications should be 100 pF to 0.01 uF. The bypass capacitors C1-C4 should be placed as close to the floating ground plane as possible to minimize ground inductance and maximize isolation.

The bias pin, Vee, of the HMC182S14 must now be held to 0 Vdc (DC ground) versus its normal floating bias of –5Vdc. Direct connection to the HMC182S14 switch A & B control lines by any positive logic driver device is now possible.

See page 8-30 of the Hittite Microwave Corporation catalog or the Application Note section of the web site or CD ROM for a more detailed version of this application note. Look for positive bias versions of the HMC SPNT switch product line coming in the Fall of ‘99!

Ball Grid Array SMT mmWave Products
(con't from pg. 1)
SMT packages, manufacturers of mm wave radios can eliminate chip-to-substrate wirebond parasitics or discrete-to-discrete PCB losses & matching circuits. The result will be a smaller circuit area, reduced component count & vendor base, improved reliability, performance and cost.

Our new mm wave BGA products are based upon the existing HMC258, HMC264 and HMC265 mixer/converter bare die. Utilizing MESFET and PHEMT processes the die and BGA packaged versions offer sub-harmonic (x2) local oscillator inputs (7 to 16 GHz) with LO drives of ~ 4 to 0 dBm.

Introduced inside this issue of OFF-THE-SHELF these mm wave SMT products are available in sample to production quantities from stock! Detailed data sheets can be found on our June ‘99 updated web site, www.hittite.com. Look for 20 - 40 GHz LNAs & medium PAs offered in mm wave BGA SMT packages in Autumn ‘99!

New Products Showcased.....
(con't from pg. 1)
monolithic approach to 5.2 UNII and 5.8 ISM radio applications. The HMC220MS8 low cost linear SMT mixer will provide an excellent converter solution for 5.9 – 11.7 GHz microwave radio designers. Completing the new offering is the HMC221, very low cost SPDT switch in a SOT26 package.

Full data sheets with Hittite Microwave’s Guarantee of Electrical Performance Over Temperature are available on the new June 1999 web site, www.hittite.com. As always these products are available immediately from stock!
NEW MILLIMETER WAVE PRODUCTS

AD FEATURED IN MAJOR TRADE MAGAZINES!

WHAT'S NEW?

Hittite Microwave
Web Site Update

Hittite Microwave Corporation announces the release of its June 1999 web site. The web site presents the complete June edition of the Hittite Microwave catalog with full data sheets in PDF format, s-parameters of selected products, a mixer spur chart calculator and general company information. Over 80 MMIC die, ceramic packaged die, and plastic packaged die are featured covering dc-40 GHz. This is the first major update since February '99.

Browse the                         section to view the thirteen new products that have been released this month. These include 8 millimeterwave MMIC LNAs, mixers, and amplifier die as well as switches, mixers, and modulators for wireless applications. Our millimeterwave product line now totals 13 products, including SMT BGA products.

With the ten products released in February ’99, a total of 23 new products have been added since January 1st. New information on HMC’s commercial, military, and space level processing and qualification capabilities are presented as well. The design and supply of MMIC products for customer specific applications is featured also. www.hittite.com

NEW  EUROPEAN
SALES REP

Hittite Microwave is pleased to announce that TRANSTECH Hochfrequenz, located in Wettingen, will exclusively represent Hittite Microwave in Switzerland.

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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 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 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 80 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** C^3^, 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.*