HITTITE PRODUCT SHOWCASE

**0.5 dB LSB 6-Bit Digital Attenuator**

- **HMC425LP3**
- 3.0 - 8.0 GHz
- Insertion Loss: 3.8 dB @ 8 GHz
- Attenuation Range: 31.5 dB @ 8 GHz
- Return Loss: 15 dB @ 8 GHz

**See Page 2**

**Double-Balanced High IP3 Mixer**

- **HMC410MS8G**
- 9.0 - 15.0 GHz
- Input IP3: +24 dBm
- Conversion Loss: 8.0 dB
- LO/RF Isolation: 40 dB
- LO/IF Isolation: 37 dB
- No External Components

**See Page 4**

**SP2T Non-Reflective Broadband Switch**

- **HMC347LP3**
- DC - 15.0 GHz
- High Isolation: 45 dB @ 10 GHz
- Low Insertion Loss: 1.6 dB @ 10 GHz
- Negative Control Voltage Logic Lines: -5/0V

**See Page 5**
HMC424  
**0.5 dB LSB GaAs MMIC 6-Bit Digital Attenuator, DC - 13.0 GHz**

**General Description**

The HMC424 die is a broadband 6-bit GaAs IC digital attenuator MMIC chip. Covering DC to 13 GHz, the insertion loss is 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. Six control voltage inputs, toggled between 0 and -5V, are used to select each attenuation state. A single Vee bias of -5V allows operation at frequencies down to DC. The HMC424 is ideal for Fiber Optics, Microwave Radio, Military & Space, and VSAT Radios applications.

**Features**

- Attenuation Range: 0.5 to 31.5 dB
- Insertion Loss: 3.0 dB Typical
- Return Loss: 15 dB Typical

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HMC424LP3  
**0.5 dB LSB GaAs MMIC 6-Bit Digital Attenuator, DC - 13.0 GHz**

**General Description**

The HMC424LP3 is a broadband 6-bit GaAs IC digital attenuator in a low cost leadless surface mount package. Covering DC to 13 GHz, the insertion loss is 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. Six control voltage inputs, toggled between 0 and -5V, are used to select each attenuation state. A single Vee bias of -5V allows operation at frequencies down to DC. The HMC424LP3 is ideal for Fiber Optics, Microwave Radio, Military & Space, UNII & HiperLAN, VSAT, WLL, MMDS and ISM applications.

**Features**

- Attenuation Range: 0.5 to 31.5 dB
- Insertion Loss: 3.5 dB Typical
- 9 mm² SMT Plastic Package

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HMC425  
**0.5 dB LSB GaAs MMIC 6-Bit Digital Positive Control Attenuator, 2.4 - 8.0 GHz**

**General Description**

The HMC425 die is a broadband 6-bit GaAs IC digital attenuator MMIC chip. Covering 2.4 to 8.0 GHz, the insertion loss is less than 3.5 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 +40 dBm. Six control voltage inputs, toggled between 0 and +3 to +5V, are used to select each attenuation state. A single Vdd bias of +3 to +5V is required. The HMC425 is ideal for Fiber Optics, Microwave Radio, Military & Space, and VSAT Radios applications.

**Features**

- Positive Bias/Control
- Attenuation Range: 0.5 to 31.5 dB
- Insertion Loss: 2.5 dB Typical
- Return Loss: 15 dB Typical
HMC425LP3  0.5 dB LSB GaAs MMIC 6-Bit Digital Positive Control Attenuator, 3.0 - 8.0 GHz

**Features**
- Positive Bias/Control
- Attenuation Range: 0.5 to 31.5 dB
- Insertion Loss: 2.8 dB Typical
- 9 mm² SMT Plastic Package

**General Description**
The HMC425LP3 is a broadband 6-bit GaAs IC digital attenuator in a low cost leadless surface mount package. Covering 2.4 to 8.0 GHz, the insertion loss is less than 3.8 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 +40 dBm. Six control voltage inputs, toggled between 0 and +3 to +5V, are used to select each attenuation state. A single Vdd bias of +3 to +5V is required. The HMC425LP3 is ideal for Fiber Optics, Microwave Radio, Military & Space, UNII & HiperLAN, VSAT, WLL, MMDS and ISM applications.

HMC346  GaAs MMIC Voltage-Variable Attenuator, DC - 20.0 GHz

**Features**
- Insertion Loss: 1.7 dB Typical
- Attenuation Range: > 30 dB
- 0.73 mm² Die Size
- Single Voltage Control

**General Description**
The HMC346 die is an absorptive Voltage Variable Attenuator (VVA) operating from DC - 20 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 30 dB amplitude range. For plastic packaged version, see the HMC346MS8G which operates from DC - 8 GHz. The HMC346 is ideal for Broadband Telecom, Microwave Radio & VSAT, Military Radios, Radar, & ECM, and Test Instrumentation applications.

HMC346LP3  GaAs MMIC Voltage-Variable Attenuator, DC - 15.0 GHz

**Features**
- Attenuation Range: >30 dB
- Insertion Loss: 1.8 dB Typical
- 9 mm² SMT Plastic Package

**General Description**
The HMC346LP3 is an absorptive Voltage Variable Attenuator (VVA) in a low cost leadless surface mount plastic package operating from DC - 14 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 30 dB amplitude range. This VVA is an excellent alternative to the HMC121C8. HMC346LP3 is ideal for Broadband Telecom, Microwave Radio & VSAT, Military Radios, Radar, & ECM, and Test Instrumentation applications.
HMC410MS8G  GaAs MMIC Double-Balanced High IP3 Mixer, 9.0 - 15.0 GHz

General Description
The HMC410MS8G is a passive double balanced high IP3 mixer that operates between 9 GHz and 15 GHz. The HMC410MS8G operates with LO drive levels between +13 dBm and +19 dBm, and provides 8 dB conversion loss across the entire specified frequency band. This mixer requires no external components or bias. The HMC410MS8G is ideal for Long Haul Radio platforms, Microwave Radios, Point-to-Point Radios and VSAT applications.

Features
- Input IP3: +24 dBm
- Conversion Loss/Noise Figure: 8.0 dB
- LO/RF Isolation: 40 dB
- LO/IF Isolation: 37 dB
- No External Components

HMC422MS8  GaAs MMIC Mixer w/Integrated LO Amplifier, 1.2 - 2.5 GHz

General Description
The HMC422MS8 is a double balanced mixer IC with an integrated LO amplifier. This mixer can operate as an upconverter or downconverter between 1.2 GHz and 2.5 GHz. With the integrated LO amplifier, the mixer requires an LO drive level of only 0 dBm, and requires only 30mA from a single positive +3V rail. The mixer has 8 dB of conversion loss, an input P1dB of +8 dBm and an input third order intercept point of +15 dBm at 2 GHz. The HMC422MS8 is ideal for MMDS & ISM, Wireless Local Loop, WirelessLAN, and Cellular Infrastructure applications.

Features
- Integrated LO Amplifier: +3V @ 30 mA
- Low LO Drive: 0 dBm
- RF/LO Isolation: 33 dB Typical
- Input IP3: +15 dBm

HMC423MS8  GaAs MMIC Mixer w/Integrated LO Amplifier, 0.6 - 1.3 GHz

General Description
The HMC423MS8 is a double balanced mixer IC with an integrated LO amplifier. This mixer can operate as an upconverter or downconverter between 0.6 GHz and 1.3 GHz. With the integrated LO amplifier, the mixer requires an LO drive level of only 0 dBm, and requires only 15mA from a single positive +3V rail. The mixer has 8 dB of conversion loss, an input P1dB of +8 dBm and an input third order intercept point of +15 dBm at 1.3 GHz. The HMC423MS8 is ideal for Basestation Infrastructure, Portable Wireless, CATV/DBS, and ISM applications.

Features
- Integrated LO Amplifier: +3V @ 15 mA
- Low LO Drive: 0 dBm
- RF/LO Isolation: 33 dB Typical
- Input IP3: +15 dBm
**HMC321LP4**  
**GaAs MMIC SP8T Non-Reflective Positive Control Switch, DC - 8.0 GHz**

**General Description**

The HMC321LP4 is a broadband non-reflective GaAs MESFET SP8T switch in a low cost leadless surface mount package. 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 three. The switch operates using a positive control voltage of 0/+5 volts, and requires a fixed bias of +5V. This switch is suitable for usage in 50-Ohm or 75-Ohm systems. The HMC321LP4 is ideal for Broadband, Fiber Optics, Switched Filter Banks, and Wireless below 8 GHz applications.

**Features**

- High Isolation: >30 dB @ 6 GHz
- Integrated Positive Supply
- 3:8 TTL Decoder
- 16 mm² SMT Plastic Package

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**HMC345LP3**  
**GaAs MMIC SP4T Non-Reflective Positive Control Switch, DC - 8.0 GHz**

**General Description**

The HMC345LP3 is a broadband non-reflective GaAs MESFET SP4T switch in a low cost leadless surface mount package. 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 positive control voltage of 0/+5V, and requires a fixed bias of +5V. This switch is suitable for usage in DC - 8.0 GHz 50-Ohm or 75-Ohm systems. The HMC345LP3 is ideal for Broadband, Fiber Optics, Switched Filter Banks, and Wireless below 8 GHz applications.

**Features**

- High Isolation: 35 dB @ 6 GHz
- Integrated Positive Supply
- 2:4 TTL Decoder
- 9 mm² SMT Plastic Package

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**HMC347LP3**  
**GaAs MMIC SP2T Non-Reflective Positive Control Switch, DC - 15.0 GHz**

**General Description**

The HMC347LP3 is a broadband non-reflective GaAs MESFET SPDT switch in a low cost leadless surface mount plastic package. Covering DC to 15 GHz, the switch offers high isolation and low insertion loss. The switch features >50 dB isolation up to 3 GHz and >40 dB isolation up to 13 GHz. The switch operates using complementary negative control voltage logic lines of -5/0V and requires no bias supply. This SPDT is an excellent alternative to the HMC132C8 SPDT. The HMC347LP3 is ideal for Broadband, Fiber Optics, Microwave Radio & VSAT, Military Radios, Radar, & ECM, and Test Instrumentation applications.

**Features**

- Broadband Performance
- High Isolation: 45 dB @ 10 GHz
- Low Insertion Loss: 1.6 dB @ 10 GHz
- 9 mm² SMT Plastic Package
APPLICATION SOLUTIONS!

**New Web-Based Product**

**Cross Reference Search Engine...** (continued from page 1)

The Product Cross Reference search engine page can be accessed via www.hittite.com. Select the “Product Cross Reference” button on the main navigation bar under the product category listing on the left side of the screen. To search, simply select the manufacturer and the manufacturer’s part number from the pull down menus and submit the inquiry.

The search engine will work to provide the nearest Hittite product equivalents. These are displayed by performance within the relative low, mid and high frequency bands of the products and with and without consideration to package type. Search result line items can be deleted or saved and emailed to a user’s address with ease. In the screenshot example a number of competitors’ products and their Hittite nearest equivalents are shown.

The search engine was designed to be easily maintained and updated with new Hittite and competitor parts. Links to an On-Line Demonstration and General Help are available on the Product Cross Reference search engine page. Try it today!

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**Handling, Mounting, & Bonding GaAs MMIC Die**

With the increasing emphasis on microwave and millimeter wave communication systems such as point to point & multi-point radios, and SATCOM, the demand for die level product is high.

HMC is a high volume supplier of commercial and space screened die. Here are some guidelines to handling, mounting, and bonding GaAs MMIC die. See our January 2002 Designers’ Guide for a full version of this application note.

**Handling Precautions**

Follow these precautions to avoid permanent damage:

- **Shipment & Storage:** HMC packs and ships all die in either waffle-pak or vacuum release Gel-Pak™ carriers. A maximum of 25 die per pack is shipped. Store die-packs in a nitrogen dry box.
- **Cleanliness:** Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.
- **Static Sensitivity:** Follow ESD precautions to protect against > ± 250V ESD strikes.
- **Transients:** Suppress instrument and bias supply transients while bias is applied.
- **General Handling:** Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers and avoid contact with the surface of the chip.

**Mounting**

- **Eutectic Die Attach:** An 80/20 gold tin preform is recommended with a work surface temperature of 255 deg C and a tool temperature of 285 deg C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be 290 deg C. DO NOT expose the chip to a temperature greater than 320 deg C for more than 20 seconds.
- **Epoxy Die Attach:** Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer’s schedule.

**Wire Bonding**

Use 1.0 mil diameter pure gold wire. Thermosonic wire bonding with a nominal stage temperature of 150 deg C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. RF bonds should be as short as possible.
**New 2002 Designer’s Guide Available!**

**Catalog & CD-ROM Versions**

Hittite Microwave announces the availability of the new 2002 Designers’ Guide in both traditional catalog hard-copy and “real-time” CD-ROM formats. Design engineers will find SMT packaged and die component RFIC and MMIC solutions for their Cellular/PCS/3G, Broadband, Microwave/Millimeterwave and Military/Space applications.

The 1224 page 2002 Designers’ Guide catalog has added 48 new RFIC and MMIC products since the 2001 version. With details on standard products, custom products/screening, quality/reliability, application and packaging/layout information the Hittite Microwave catalog has become an indispensable desk reference for RF and microwave system design engineers.

The CD-ROM version of the 2002 Designers’ Guide is a “real-time” snapshot of Hittite’s product offering and features the complete catalog. Pages are displayed utilizing Adobe Acrobat Reader v4.0 or above. New products released after the hard-copy 2002 catalog publication will be placed on the CD addendum. Currently 11 new products have been included in the latest CD addendum. Many more are planned throughout the year. Updates to existing product data sheets, technical information as well as an archive of past issues of OFF-THE-SHELF newsletters will be included as well.

Full specifications are provided for over 185 components including: Amplifiers, Attenuators, Frequency Multipliers, Mixers, Modulators, Prescalers, Switches and VCOs covering DC to 40 GHz. Request your catalog or CD on-line at www.hittite.com

**Hittite Expands International Presence in Europe & Asia!**

Hittite Microwave has opened two new international offices in the Munich, Germany and Seoul, Korea metropolitan areas. These offices will support Hittite’s expanding customer base in Europe and Asia-Pacific respectively. They join Hittite’s existing London based office, Hittite Microwave Europe, Ltd. which opened in 2001. Together these offices will facilitate technical and commercial direct communications between Hittite Microwave USA and customers located worldwide.

Mr. Volker Schultz has been appointed as Sales Manager for Hittite Microwave Deutschland GmbH serving Germany, Austria and Switzerland. He will lead the office which is located in Rosenheim, one hour south of Munich. Mr. Schultz joins Hittite with over 15 years of experience in the RF and microwave components industry and will focus on sales and business development. He can be contacted via: phone +49 8031-947654; fax +49 8031-988833; email, schulz@hittite.com.

Mr. Thomas Hwang will lead the Seoul office as Asia-Pacific Branch Manager for Hittite Microwave Asia Co., Ltd. serving China, Japan, Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan. Mr. Hwang joins Hittite with over 15 years of RF and microwave components sales and application experience. His office will support customers’ inquiries both directly and through Hittite’s extensive Asian representative & distribution network. He can be contacted via: phone +82-2 559-0638; fax: +82-2 559-0639; email, hwang@hittite.com.

**Order Hittite Products On-Line!**

E-Commerce available now! Hittite customers can enjoy the convenience of on-line ordering at www.hittite.com. A selection of products and evaluation PC boards can be purchased on-line via a secure shopping cart interface. Payment is made using either MasterCard or VISA. Orders ship next business day after confirmation.

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What We Do

Hittite Microwave Corporation designs and manufacturers high volume integrated circuit (IC) products to support the expanding needs of high-speed voice and data transfer systems. Hittite’s product line of RF to millimeter wave components is recognized across the world because it offers a unique variety of functions and solutions for systems that operate between DC and 40 GHz.

All of Hittite’s high performance ICs are manufactured using cutting edge semiconductor processes, including GaAs InGaP HBT, SiGe, PHEMT, and MESFET technology. When designing a product, we select the most appropriate semiconductor and package technology, and then uniquely balance digital and RF integration techniques to produce a result that is easy and cost effective for our customers to use.

Our reputation of leading the industry with MMIC VCOs, mixers, switches, and surface mount millimeter wave components has opened up new opportunities for our customers. Regardless of frequency, we apply high volume manufacturing techniques across our product groups. Each year Hittite breaks through new technology barriers, and then applies the technology to produce millions of integrated circuits to satisfy our customers. Our customers can then address existing and create new markets for their products.

Products from our standard catalog are shipped to factories that are located across Asia, Australia, North America, South America, and Europe. Our customers manufacture many different types of systems for the wireless and telecommunications world including:

- Cellular, PCS, and 3G Platforms
- Broadband Wireless Systems for WLAN and LAST MILE INTERNET Radio Platforms
- Microwave/Millimeterwave Radio Links
- Cable Modem Systems for CATV
- DBS Consumer Electronic Systems
- Fiber Optic Systems from OC-48 to OC-192
- Two-way Pager Systems