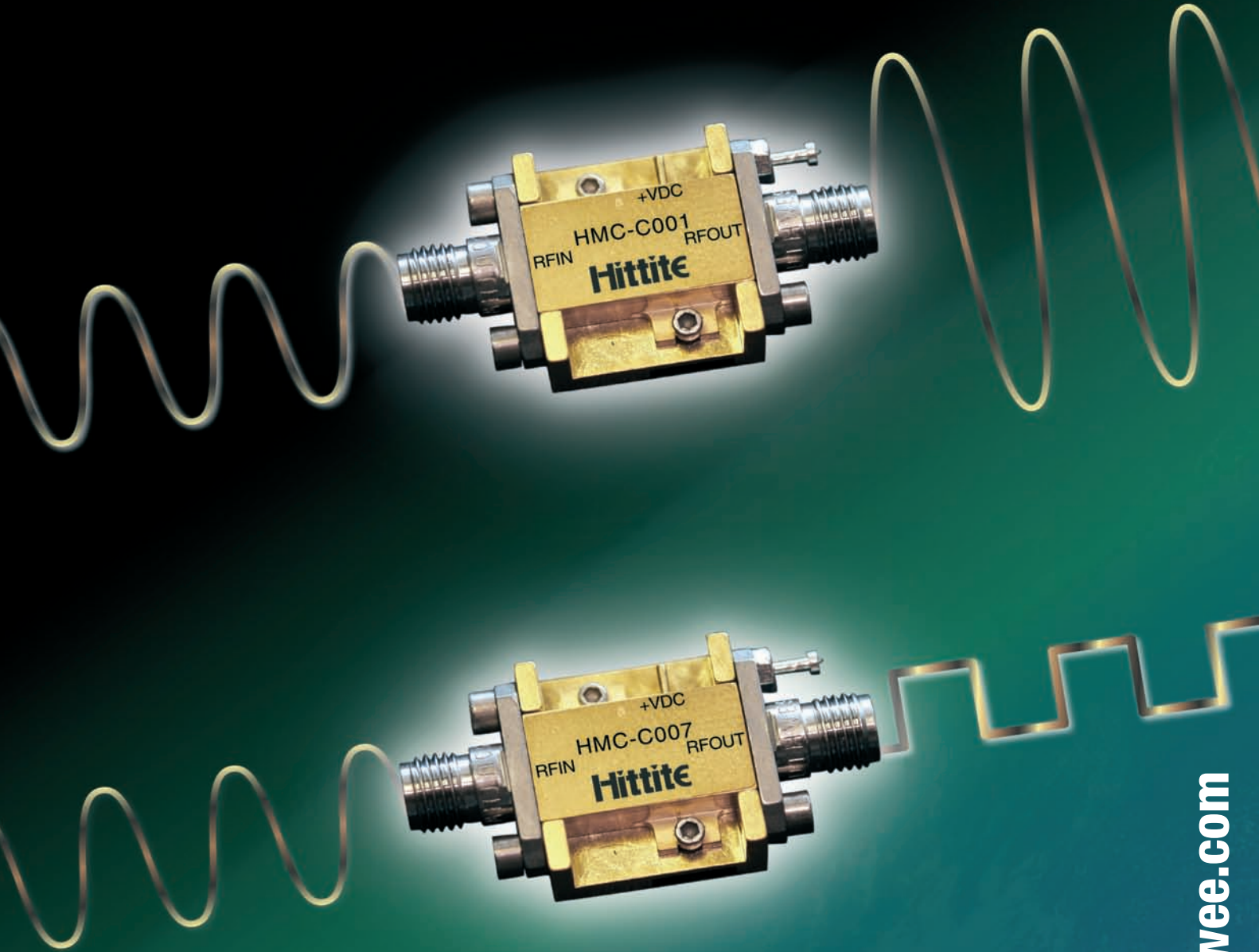


MICROWAVE ENGINEERING

EUROPE



Wideband MMIC modules designed for noise and linearity performance
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Wideband amplifier and prescaler modules cover DC to 20GHz

By Norm Hildreth, Hittite Microwave

Over the last 20 years, progress in MMIC technology has enabled design engineers to miniaturise circuits, integrate system functionality and improve performance for cellular, broadband and microwave applications. While much of the focus has been to develop MMICs in smaller package and chip-scale formats, there remains a significant demand for these same products in high performance RF and microwave modules for telecom, test equipment, industrial, laboratory, military and space end use applications.

Hittite Microwave already has over 330 standard MMIC products, as well as design and manufacturing capabilities for both MMIC and module technologies, and has now introduced a new standard product line of connectorised hermetic modules. This new range includes four wideband low noise, driver and power amplifiers and three wideband prescalers with divide ratios of 2, 4 and 8 covering DC to 20GHz. All the module products are specified via detailed data sheets and are built to stock.

Amplifier modules

High performance wideband amplifiers that combine low noise figure, high linearity and temperature stability along with solid power and gain levels are essential to state-of-the-art microwave systems. A MMIC based approach increases reliability and decreases unit-to-unit performance variability by decreasing the discrete piece parts count Table 1 summarises the specifications for the wideband

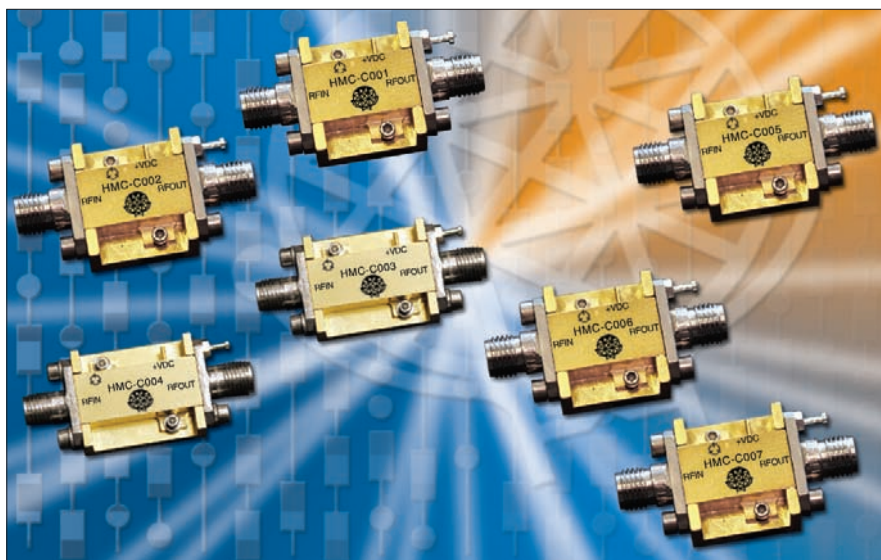


Figure 1: Hittite Microwave amplifier and prescaler module product family

MMIC amplifier module product family, which features fully matched (50Ω), unconditionally stable, DC power regulated and DC blocked low noise, driver and power amplifiers.

The HMC-C001 low noise amplifier module delivers a typical small signal gain of 15dB and a gain flatness of ± 0.5 dB across the entire 2 - 20GHz operating band. This high dynamic range LNA module offers a mid-band noise figure of 2.2dB and an output P1dB of +14dBm. The HMC-C002 LNA offers 4dB more P1dB, along with the same gain and noise figure as the HMC-C001.

The HMC-C003 power amplifier module delivers a typical small signal gain of 15dB and a +26dBm output

power across the full 2 - 20GHz operating band. The power amplifier module has a mid-band noise figure of 4dB and an output IP3 of +34dBm. Figure 1 shows the HMC-C003 broadband large and small signal characteristics, notably the stable output power over temperature. The HMC-C004 driver amplifier module offers 3dB less output power (+23dBm) and a lower noise figure than the HMC-C003 from 10MHz to 20GHz.

Frequency divider modules

Modern frequency synthesis uses a combination of frequency multiplication and frequency division to generate the required data and carrier signals for telecom, industrial,

Frequency (GHz)	Function	Gain (dBm)	OIP3 (dBm)	NF (dB)	P1dB (dBm)	Part Number
2 - 20	Wideband LNA	15	+24	2.2	+14	HMC-C001
2 - 20	Wideband LNA	14	+26	2	+18	HMC-C002
2 - 20	Wideband PA	15	+34	4	+26	HMC-C003
0.01 - 20	Wideband Driver	16	+33	3	+23	HMC-C004

Table 1: Specifications of SMA connectorised wideband amplifier modules

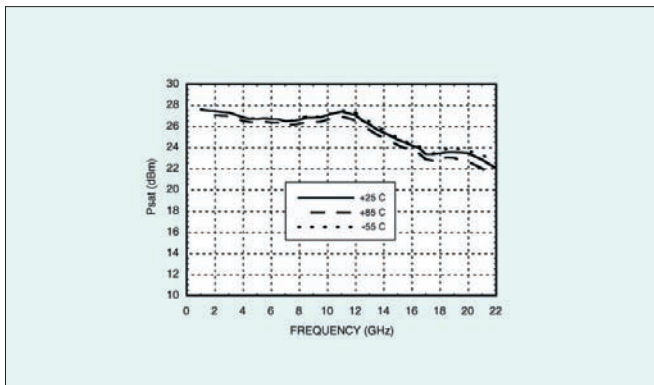
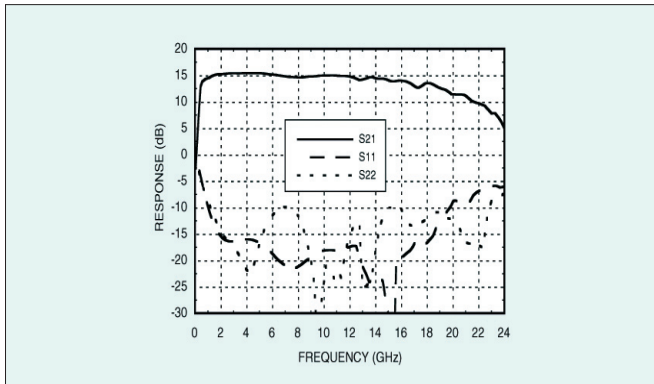


Figure 2: (a), top, frequency response and (b), above, saturated output performance of HMC-C003 SMA connectorised wideband power amplifier modules

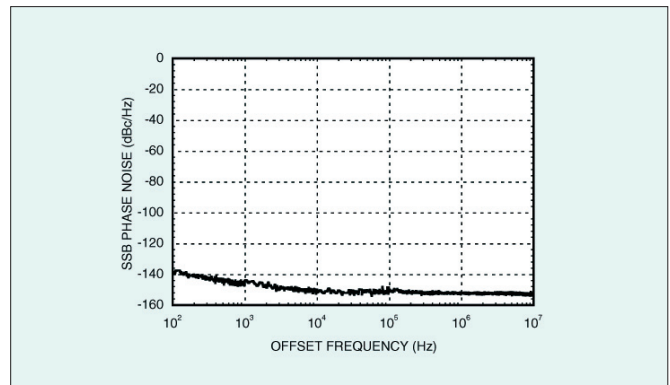
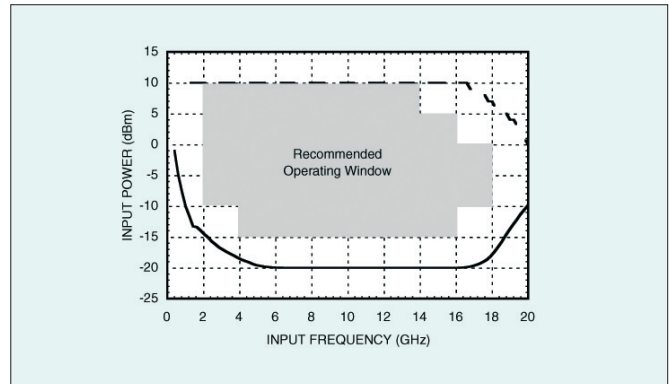


Figure 3: (a), top, input power characteristic and (b), above, SSB noise performance of HMC-C005 SMA connectorised wideband divide-by-2 prescaler

test and radar applications. Frequency division decreases the carrier frequency and changes the phase noise of the carrier by $20\log(1/M)$, where M is the division ratio. For the most part, frequency dividers are used in a phase-locked loop (PLL) to divide the voltage-controlled oscillator (VCO) output frequency down to the reference frequency in order to achieve phase/frequency locking. A key performance parameter for this function is low residual phase noise.

Table 2 summarises a new class of GaAs/InGaP static frequency divider module solutions featuring division ratios of 2, 4 and 8, wide input power range and low residual phase noise at frequencies from 0.5 to 18GHz. The HMC-C005 low noise divide-by-2 static prescaler module is typical of the

dividers in the product family. Figure 2 shows the +15dBm to +10dBm input power sensitivity and low additive 100kHz SSB phase noise of -150dBc/Hz of the HMC-C005.

Module packaging

The new modules utilise flanged, hermetically sealed, gold plated housings which can be either fastened mechanically or mounted using eutectic, depending on the preference of the user. Removable SMA connectors are provided to allow mating with standard coaxial cable assemblies. They can also be detached rapidly for drop-in installation and direct connection of the module RF input and output pins to a microstrip or coplanar circuit.

All of these amplifier and prescaler

modules operate from a single positive supply. The amplifiers incorporate rugged DC power conditioning circuitry, including negative voltage generation and bias polarity sequencing.

Summary

A new range of connectorised amplifiers and frequency dividers has been presented, and will be followed by additional attenuator, switch, mixer, VCO and power amplifier module offerings.

Company Information

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Table 2: Specifications of SMA connectorised wideband frequency divider (prescaler) product line

Input Freq. (GHz)	Function	Input Power (dBm)	Output Power (dBm)	100kHz SSB Phase Noise (dBc/Hz)	Bias Supply	Part Number
DC - 18	Divide-by-2	-15 to +10	-4	-150	+5V @ 75 mA	HMC-C005
DC - 18	Divide-by-4	-15 to +10	-4	-150	+5V @ 93 mA	HMC-C006
DC - 18	Divide-by-8	-15 to +10	-4	-150	+5V @ 98 mA	HMC-C007

MICROWAVE MODULES

NEW CONNECTORIZED STANDARD PRODUCT LINES INTRODUCED!

WIDEBAND AMPLIFIERS



- ◆ LNAs, PAs & Drivers
- ◆ Covering 0.01 - 20 GHz
- ◆ Noise Figure as Low as 2 dB
- ◆ Output Power to +26 dBm
- ◆ Regulated Single Supply & Bias Sequencing
- ◆ 50 Ohm Matched I/Os

WIDEBAND PRESCALERS



- ◆ ÷2, ÷4 & ÷8
- ◆ Covering 0.5 - 18 GHz F_{in}
- ◆ 100 kHz SSB
Phase Noise: -150 dBc/Hz
- ◆ Wide Input Power Range
- ◆ Single +5V Supply

SMA CONNECTORIZED AMPLIFIER MODULES

Frequency (GHz)	Function	Gain (dB)	OIP3 (dBm)	NF (dB)	P1dB (dBm)	Part Number
2 - 20	Wideband LNA	15	24	2.2	14	HMC-C001
2 - 20	Wideband LNA	14	26	2	18	HMC-C002
2 - 20	Wideband PA	15	34	4	26	HMC-C003
0.01 - 20	Wideband Driver	16	33	3	23	HMC-C004

SMA CONNECTORIZED FREQUENCY DIVIDER MODULES

Frequency (GHz)	Function	Input Power (dBm)	Output Power (dBm)	100kHz SSB Phase Noise (dBc/Hz)	Bias Supply	Part Number
DC - 18	Divide-by-2	-15 to +10	-4	-150	+5V @ 75 mA	HMC-C005
DC - 18	Divide-by-4	-15 to +10	-4	-150	+5V @ 93 mA	HMC-C006
DC - 18	Divide-by-8	-15 to +10	-4	-150	+5V @ 98 mA	HMC-C007

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