

NEW MICROSYNTH™ INTEGRATED HERMETIC SYNTHESIZER MODULE

Feature Article from Hittite Microwave Corporation

Frequency synthesis is the cornerstone of all RF and microwave systems. Often dictated by specifications that push technological, spatial and economic envelopes, the design and implementation of frequency sources can often run into hurdles that force performance, schedule, or cost compromises.

Hittite Microwave has one of the most comprehensive product portfolios and knowledge base that serves this critical function. The new MicroSynth™ integrated hermetic synthesizer product platform extends that portfolio by integrating many functions into one compact module. By leveraging its industry leading library of catalog and custom integrated circuits, Hittite is in a unique position to offer “best-in-class” integrated synthesizer solutions. Integrating a phase lock loop (PLL), broadband voltage-controlled oscillator (VCO), microwave amplifier and active loop filter, the HMC-C070 MicroSynth™ combines high performance SiGe, GaAs pHEMT and InGaP HBT technologies (see **Figure 1**), rugged construction, and an incredibly small form factor of 3.7 cm³ (0.226 in³). In addition, the modular

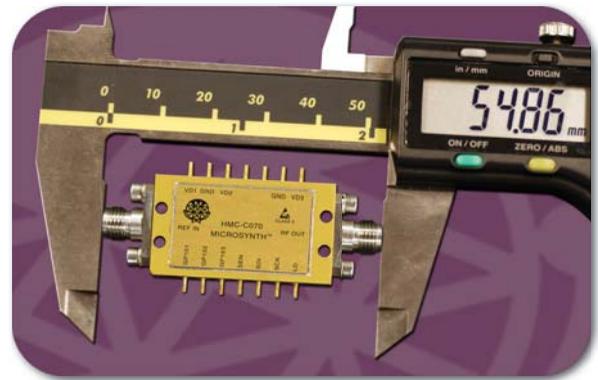


Figure 1: HMC-C070 MicroSynth™ Module

nature of the design allows Hittite to provide customized designs to optimize performance for a given application and frequency range.

The HMC-C070 integrated hermetic synthesizer operates from 5.5 to 10.5 GHz and provides 22 dBm of output power across that band. **Table 1** details the electrical performance of the HMC-C070. The HMC-C070 also features fully integrated low noise regulators and an output buffer amplifier that results in superior ripple rejection, and pushing and pulling insensitivity. The HMC-C070 has been fully characterized over temperature; Figures 2 and 3 illustrate the power and phase noise performance over temperature, respectively. At 22 dBm of output power, the HMC-C070 can drive multiple high linearity mixers or provide enough additional power to overcome filter losses that may be required by some stringent system specifications.

At the core of the HMC-C070 design is a Hittite SiGe Fractional-N PLL chip that provides features such as frequency sweeping with programmable ramp and dwell times, frequency hopping, charge pump optimization, temperature monitoring, lock detection, hardware/software triggering, and three general-purpose I/O pins that can be programmed to drive subsequent serially-controlled devices.

The MicroSynth™ product has been designed to accept a 10 MHz reference signal. This value was chosen due to the

Table 1: HMC-C070 MicroSynth™ Integrated Hermetic Synthesizer Module Specifications

Specification	Performance	Units
Frequency Range	5.5 to 10.5	GHz
Step Size (min)	1.2	Hz
Output Power	22	dBm
Loop Bandwidth (nominal)	100	kHz
Reference Spur	-60	dBc
SSB Phase Noise		
@ 100 Hz Offset	-80	dBc/Hz
@ 1 kHz Offset	-88	dBc/Hz
@ 10 kHz Offset	-88	dBc/Hz
@ 100 kHz Offset	-92	dBc/Hz
@ 1 MHz Offset	-117	dBc/Hz
Reference Frequency Input	10	MHz
Bias Supply	Vcc = +20 V @ 30 mA +6 V @ 250 mA +3.6 V @ 100 mA	

MICROSYNTH™ INTEGRATED HERMETIC SYNTHESIZER MODULE

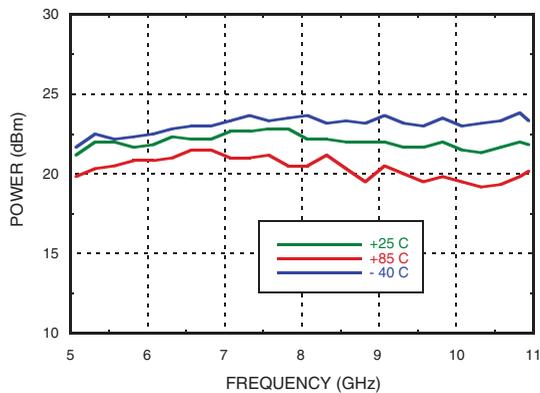


Figure 2: HMC-C070 MicroSynth™ Output Power vs. Temperature

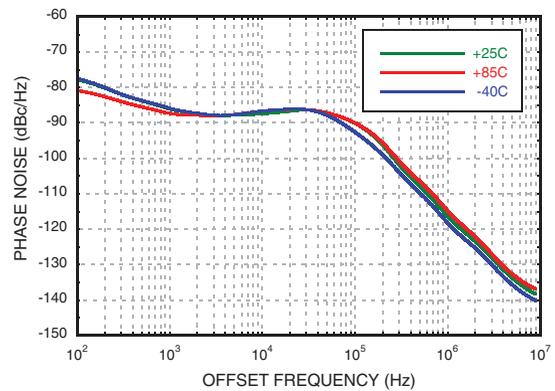


Figure 3: HMC-C070 MicroSynth™ Phase Noise vs. Temperature at 5.5 GHz

common availability of this frequency at the rear panel of most current test equipment. However, this reference frequency can range from 250 kHz to 75 MHz by modifying the loop filter design to optimize for the non-standard requirement. Higher reference frequencies are possible by use of internal prescalers or by using the higher reliability integer mode PLL ICs.

At 54.86 x 19.05 x 6.22 mm (2.16" x 0.75" x 0.245"), the HMC-C070 is a very compact module that is an order of magnitude smaller than competitive solutions. Without SMA connectors, the module length decreases to 31.24 mm (1.23").

Each MicroSynth™ module is an integrated single loop synthesizer. This synthesizer consists of core building blocks (PLL, microwave amplifier, wideband VCO) that can be swapped out to address a given application. Since these building blocks are all Hittite components, configuring a custom solution is more straightforward than having to secure die level solutions from multiple vendors. Naturally, custom solutions vary in development time and cost based on the complexity of the requirements and expected volumes. Hittite's depth and breadth of RF and microwave solutions provide multiple options to match custom requirements. Optional microwave processing functions (attenuators, switches, tunable MMIC filters, frequency dividers and multipliers) may be added to a MicroSynth™ product to achieve a custom solution to fit a customer's requirements.

Hittite currently has more than 45 catalog VCOs that range from 2 to 27 GHz with various bandwidths. The standard

MicroSynth™ products incorporate broadband VCOs, but if an application requires a higher performing, narrowband VCO, the unit can be modified easily to incorporate this requirement. The frequency range can be expanded further by the use of active multipliers and dividers to realize output frequencies as high as 64 GHz.

MicroSynth™ products are provided in hermetically sealed modules that can be up-screened in accordance with military or space specifications. The standard RF interfaces are field-replaceable SMA connectors with provisions for optional SMP style connectors or no connectors for microstrip mounting. This integrated ruggedness, flexibility and off-the-shelf availability provides a quick solution for system designers that could otherwise take several months of integrating and adjusting the right components to meet the desired electronic, environmental and form factor goals. For custom developments, screening requirements can be tailored toward higher standards or lower costs.

The integration of Hittite's SiGe, GaAs pHEMT and InGaP HBT semiconductor technologies and decades of frequency generation expertise has yielded a very high functioning, high performance synthesizer module platform. The HMC-C070 demonstrates an aggressive balance of performance, functionality and size. Any custom requirements can be met by leveraging Hittite's extensive library of catalog and custom integrated circuit solutions into a similar form factor. All connectorized module products, including the HMC-C070, are available from stock and can be ordered via the company's e-commerce site or via direct purchase order at www.hittite.com.