Microwave Solutions

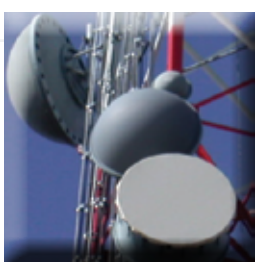
Analog, Digital & Mixed-Signal ICs, Modules, Subsystems & Instrumentation

Communication, Test & Measurement & Sensor Solutions, 2 to 86 GHz

- ***Microwave Radio Links***
- ***Point-to-Multi-Point Radios***
- ***Test & Measurement Equipment***
- ***Sensors & Radar***
- ***VSAT***

Microwave Solutions

Having built a strong reputation for technical innovation and product quality, Hittite Microwave has developed a broad portfolio of microwave & millimeterwave products to meet the demanding requirements of Communication, Test & Measurement and Sensor applications.

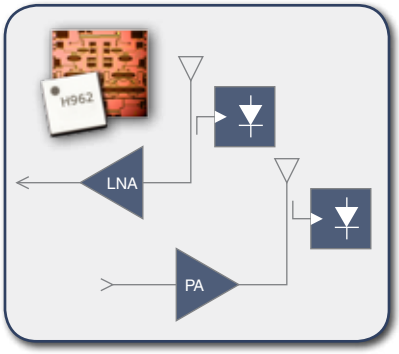


Hittite
MICROWAVE PRODUCTS
FROM ANALOG DEVICES

Introduction

The Microwave Designer's Trusted Component Source

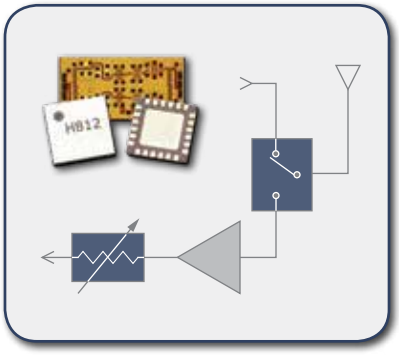
Hittite Microwave Corporation offers the Industry's most complete standard and custom product lines of GaAs, SiGe, BiCMOS and GaN MMIC die and SMT components for Microwave and Millimeterwave applications, including solutions for: Transmit, Receive, LO Generation & LO Distribution Subsystems. Hittite's tried and trusted solutions span a wide range of communications bands including: 6 to 42 GHz for microwave radio backhaul, the 57 to 66 GHz ISM band for picocell backhaul, and the 71 to 76/81 to 80 GHz E-Band. Having built a strong reputation for technical innovation and product quality, Hittite Microwave has developed a broad portfolio of microwave & millimeterwave products to meet the demanding requirements of Communication, Test & Measurement and Sensor applications.



Amplification, Power Control & Power Detection, Page 4

Hittite has offered Amplifiers for microwave & millimeterwave frequency bands since 1996 enabling designers to miniaturize and improve systems for Microwave Radio, VSAT, Test & Measurement and Sensor applications.

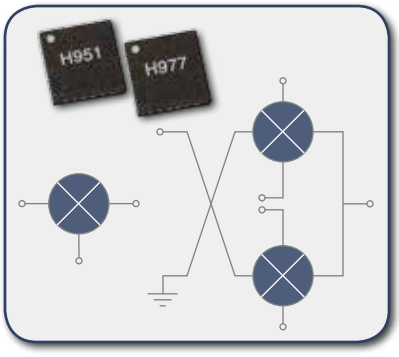
- **Operating Frequency: 6 to 86 GHz**
- **Gain as High as 36 dB**
- **Noise Figure as Low as 1.7 dB**
- **P1dB Up to +38 dBm/OIP3 Up to +48 dBm**
- **RMS, Log & SDLVA IC Detectors to 30 GHz**



Control Devices, Page 6

Hittite's Control Devices have been used in leading microwave and millimeterwave applications for Point-to-Point and Point-to-Multi-Point Radio, Test & Measurement and Sensor applications since 1992.

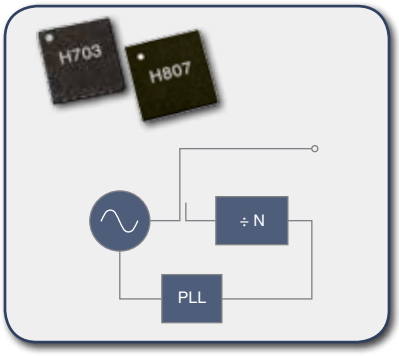
- **Insertion Loss as Low as 1.5 dB**
- **High Power Handling P1dB as High as +34 dBm**
- **Excellent Port-to-Port Isolation of Up to 50 dB**
- **Multi-Throw Products Available for Design Flexibility**
- **Wideband Performance from DC to 40 GHz**



Frequency Conversion, Page 7

Hittite pioneered the introduction of MMIC Mixers and Downconverters into microwave systems starting in 1992 by offering unique features for frequency conversion applications.

- **Operating Frequency: 6 to 90 GHz**
- **Conversion Gain Up to 16.5 dB, NF to 2.2 dB**
- **Direct Modulators & Demodulators, Receivers & Transmitters**
- **Excellent LO to RF Isolation of 50 dB+**



LO & Clock Generation, Page 8

Hittite leads the way in GaAs and SiGe MMIC VCOs, PLLs, PLLs + VCOs, Phase Frequency Detectors, Dividers and Multipliers for microwave and millimeterwave systems since 1997.

- **Single Chip Integrated PLLs with VCOs**
- **Fractional and Integer Mode Synthesizer ICs**
- **Wideband Octave & Low Cost Narrowband VCOs covering 2.05 to 26.8 GHz**
- **PLL + VCOs for Precision System Clocks**
- **Frequency Multipliers to 90 GHz**

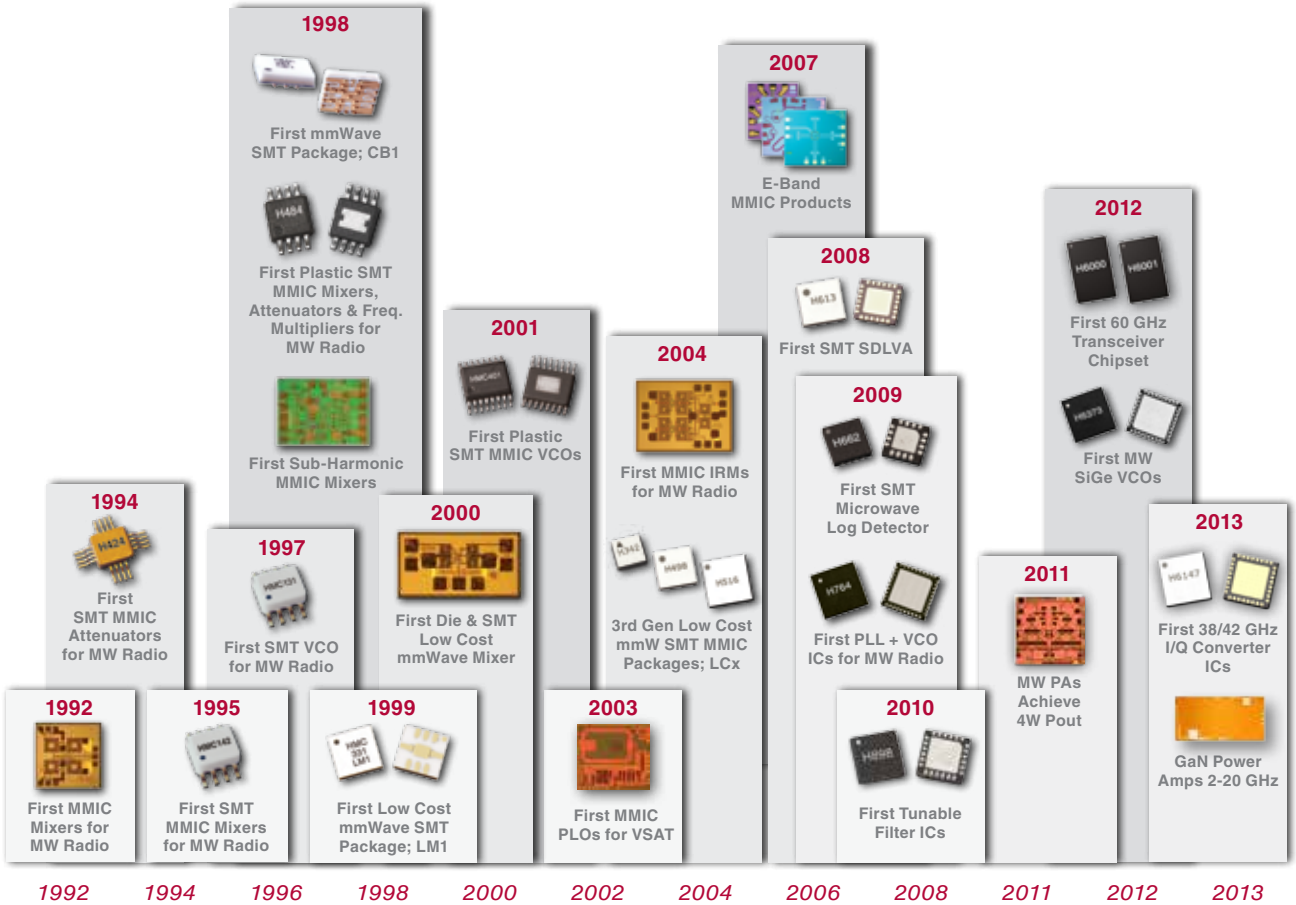
MICROWAVE SOLUTIONS

Our Rich History of MMIC Design

Hittite MICROWAVE PRODUCTS FROM ANALOG DEVICES

28 Years of Microwave IC Component Innovation & Advancement

Hittite has a rich history that spans 28 years of Microwave and Millimeterwave IC development for communications, sensors, and test/medical equipment. Our MMIC experience is broad and diverse and encompasses a wide variety of products for Transmit, Receive, LO Generation, and LO Distribution Subsystems. This guide provides an introduction to our microwave and millimeterwave product lines and individual products.



MICROWAVE SOLUTIONS

Our Products are Available in Die, SMT or Connectorized Package Formats!

Hittite's website contains full datasheets, application notes, as well as ordering information for our complete product offering of over 1095 products across 36 product lines.

Amplification, Power Control & Power Detection

HMC1040LP3CE - Low Noise Amplifier, 24 to 43.5 GHz

Features

- Low Noise Figure: 2.2 dB
- High Gain: 23 dB
- High P1dB Output Power: +12 dBm
- High Output IP3: +22 dBm
- 2.5V Single Supply & 50 Ohm I/Os

A Selection of LNAs to 86 GHz

	Frequency (GHz)	Gain (dB)	OIP3 (dBm)	NF (dB)	P1dB (dBm)	Bias Supply	Package	ECCN Code	Part Number
	0.3 - 20	16	27	1.7	15	+7.0V @ 70mA	Chip	EAR99	**HMC1049**
	0.3 - 20	15	29	1.8	15	+7.0V @ 70mA	LP5	EAR99	**HMC1049LP5E**
	5 - 10	20	28	1.6	16	+3.5V @ 80mA	Chip	EAR99	**HMC902**
	5 - 10	19	28	1.8	16	+3.5V @ 80mA	LP3	EAR99	**HMC902LP3E**
	6 - 18	19	27	1.6	15	+3.5V @ 90mA	Chip	EAR99	**HMC903**
	6 - 17	18	25	1.7	14	+3.5V @ 80mA	LP3	EAR99	**HMC903LP3E**
	6 - 26.5	22	18	2.5	10	+3.5V @ 45mA	LC4	EAR99	**HMC963LC4**
	7.5 - 26.5	13	23	2.5	13	+3.5V @ 70mA	LC4	EAR99	**HMC962LC4**
NEW!	24 - 43.5	22	22	2.7	12	+2.5V @ 70mA	LP3C	EAR99	**HMC1040LP3CE**
	57 - 65	21	-	4	12	+2.5V @ 64mA	Chip	3A001.b.2.f	**HMC-ALH382**[1]
	71 - 86	14	-	5	7	+2V @ 50mA	Chip	3A001.b.2.f	**HMC-ALH509**

[1] Amplifiers that benefit from Hittite Active Bias Controllers.

HMC6981LS6 - 2 Watt Power Amplifier, 15 - 20 GHz

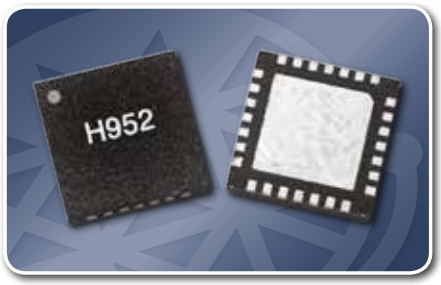
Features

- High Saturated Output Power: +34.5 dBm @ 25 % PAE
- P1dB output Power:+33.5 dBm
- High Output IP3: +43.5 dBm
- Supply Voltage: +6V @ 1100 mA
- 50 Ohm I/Os

A Selection of Power Amplifiers to 86 GHz

	Frequency (GHz)	Gain (dB)	OIP3 (dBm)	NF (dB)	P1dB (dBm)	Bias Supply	Package	ECCN Code	Part Number
	12.5 - 15.5	27	40	-	32	+6V @ 1200mA	LP5	3A001.b.2.b	**HMC965LP5E**
NEW!	15 - 20	26	43.5	-	33.5	+6V @ 1100mA	LS6	3A001.b.2.c	**HMC6981LS6**
	27.5 - 33.5	24	40	-	29	+6V @ 600mA	Chip	3A001.b.2.d	**HMC1024**
	29 - 37	22	42	6	32	+6V @ 1200mA	Chip	3A001.b.2.d	**HMC1029**
	33.5 - 46.5	21	35	-	24.5	+6V @ 500mA	Chip	3A001.b.2.d	**HMC1014**
	37 - 40	21	38	-	30.5	+6V @ 900mA	Chip	3A001.b.2.d	**HMC968**
	40 - 43.5	22	38	-	29	+6V @ 900mA	Chip	EAR99	**HMC969**
	71 - 86	16	50	-	+15	+4V @ 130mA	Chip	3A001.b.2.f	**HMC-AUH320**

HMC952LP5GE - 2 Watt Power Amplifier with Power Detector, 9 - 14 GHz



Features

- High P1dB Output Power: +34 dBm
- High Psat Output Power: +35 dBm
- High Gain: 33 dB
- High Output IP3: +43 dBm
- 6V Single Supply & 50 Ohm I/Os

A Selection of Power Amplifiers with Internal Power Detectors

Frequency (GHz)	Gain (dB)	OIP3 (dBm)	NF (dB)	P1dB (dBm)	Bias Supply	Package	ECCN Code	Part Number
9 - 14	36	42	5	34.5	+6V @ 1400mA	Chip	3A001.b.2.b	**HMC952**
9 - 14	33	43	-	34	+6V @ 1400mA	LP5G	3A001.b.2.b	**HMC952LP5GE**
9 - 14	34	43	-	36.5	+7V @ 2400mA	Chip	3A001.b.2.b	**HMC1053**
12 - 16	27	41	-	34.5	+7V @ 1200mA	LP5G	3A001.b.2.b	**HMC995LP5GE**

A Selection of Power Detectors

Frequency (GHz)	Dynamic Range (dB)	RSSI Slope (mV/dB)	RF Threshold Level (dBm)	Bias Supply	Package	ECCN Code	Part Number
DC - 3.9	72 ± 1	35	-68	+5V @ 55mA	LP4	EAR99	**HMC1020LP4E**
DC - 3.9	70 ± 1	38.5	-66	+5V @ 143mA	LP5	EAR99	**HMC1030LP5E**
DC - 5.8	40 ± 1	37	-69	+5V @ 42mA	LP4	EAR99	**HMC909LP4E**
1 - 23	54 ±3	14.2	-52	+3.3V @ 91mA	LP3	EAR99	**HMC948LP3E**
8 - 30	54	+13	-127	+3.3V @ 88mA	PCB	EAR99	**HMC662LP3E**

HMC996LP4E - Analog Variable Gain Amplifier, 5 - 12 GHz

Features

- Wide Gain Control Range: 22 dB
- Single Control Voltage: -1 to -4.5V
- Output IP3 at Maximum Gain: +34 dBm
- Output P1dB: +22 dBm
- No External Matching Required

A Selection of Analog Variable Gain Amplifiers

	Frequency (GHz)	Gain Control Range (dB)	NF (dB)	OIP3 (dBm)	P1dB (dBm)	Bias Supply	Package	ECCN Code	Part Number
	.5 - 6	-35 to 15	7.5	28	21	+5V @ 90mA	LP5	EAR99	**HMC972LP5E**
	2.3 - 2.5	-9 to 21	2.5	7	3	+3 @ 9mA	MS8	EAR99	**HMC287MS8**
NEW!	5 - 12	22	2	34	23	+5V @ 120mA	LP4	EAR99	**HMC996LP4E**
	6 - 17	1 to 24	5	30	22	+5V @ 170mA	Chip	EAR99	**HMC694**
	6 - 17	0 to 23	6	30	22	+5V @ 175mA	LP4	EAR99	**HMC694LP4E**
NEW!	17 - 27	5 to 21	4	30	23	+5V @ 190mA	LC4	EAR99	**HMC997LC4**

Control Devices

HMC985LP4KE - Analog Voltage Variable Attenuator, 10 - 40 GHz

Features

- *Wide Bandwidth: 10 - 40 GHz*
- *Excellent Linearity: +32 dBm Input IP3*
- *Wide Attenuation Range: 35 dB*
- *No External Matching*
- *24 Lead 4x4 mm SMT Package: 16 mm²*

A Selection of Voltage Variable Attenuators to 27 GHz

	Frequency (GHz)	Insertion Loss (dB)	Attenuation Range (dB)	IIP3 (dBm)	Control Input (Vdc)	Package	ECCN Code	Part Number
	5 - 26.5	3.5	0 to 28	32	0 to -3V	LP3C	EAR99	**HMC712LP3CE**
	5 - 30	2.5	0 to 30	32	0 to -3V	Chip	EAR99	**HMC712**
	5 - 30	2	0 to 30	28	0 to -3V	LC4	EAR99	**HMC812LC4**
NEW!	10 - 40	3	0 to 35	33	0 to +3V	LP4K	EAR99	**HMC985LP4KE**
	17 - 27	1.5	0 to 22	17	-4V to +4V	Chip	5A991.h	**HMC-VVD102**
	20 - 50	3	0 to 35	33	0 to -3V	Chip	EAR99	**HMC985**
	36 - 50	1.5	0 to 22	17	0 to +4V	Chip	5A991.h	**HMC-VVD106**
	70 - 86	2	0 to 14	-	-5V to +5V	Chip	5A991.h	**HMC-VVD104**

HMC1084LC4 - GaAs MMIC SP4T Reflective Switch, 23 - 30 GHz

Features

- *Broadband Performance: 23 - 30 GHz*
- *High Isolation: 26 dB*
- *Insertion loss: 2.8 dB*
- *Excellent Power Handling: >27 dBm*
- *24 Lead 4x4 mm SMT Package*

A Selection of SP4T Switches

	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Control Input (Vdc)	Package	ECCN Code	Part Number
	DC - 18	2.1	42	24	0/-5V	Chip	EAR99	**HMC641**
	DC - 20	2.1	42	23	0/-5V	LC4	EAR99	**HMC641LC4**
	DC - 20	2.3	45	22	0/-5V	LP4	EAR99	**HMC641LP4E**
	23 - 30	2.8	35	25	0/-3V	LC4	EAR99	**HMC944LC4**
NEW!	23 - 30	2.8	26	-	0/-3V	LC4	EAR99	**HMC1084LC4**

A Selection of PIN Switches

Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Control Input (Vdc)	Package	ECCN Code	Part Number
2 - 50	0.9	45	27	-10/+1.5	Chip	EAR99	**HMC975**
8 - 21	1.2	40	33	-10/+1.5	Chip	EAR99	**HMC970**
18 - 40	1.4	40	34	-10/+1.5 (30 mA)	Chip	EAR99	**HMC971**
55 - 86	2	30	-	-5/+5	Chip	5A991.h	**HMC-SDD112**

HMC1057 & HMC1058 - Sub-Harmonic MMIC Mixers, 71 - 86 GHz

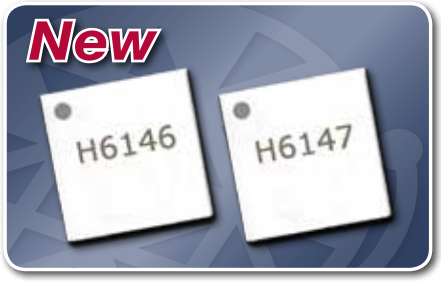
Features

- Passive: No DC Bias Required
- Wide IF Bandwidth: DC to 12 GHz
- High LO/RF Isolation: up to 30 dB
- High 2LO/RF Isolation: up to 50 dB
- Upconversion & Downconversion

A Selection of Wideband Double-Balanced & Sub-Harmonic Mixers

	RF/LO Frequency (GHz)	IF Frequency (GHz)	Conversion Gain (dB)	LO/RF Isolation (dB)	IIP3 (dBm)	Package	ECCN Code	Part Number
	2 - 18	DC - 4	-10	35	23	LC3B	EAR99	HMC1048LC3B
	3 - 10	DC - 4	-9	55	23	LC3B	EAR99	HMC787LC3B
	6 - 26	DC - 10	-9	38	22	Chip	EAR99	HMC773
	6 - 26	DC - 8	-9	38	22	LC3B	EAR99	HMC773LC3B
	7 - 34	DC - 8	-11	35	22	LC3B	EAR99	HMC774LC3B
	7 - 43	DC - 10	-9	35	22	Chip	EAR99	HMC774
	17.7 - 23.6	DC - 3.5	15	40	13	LC5	EAR99	HMC711LC5
	24 - 34	DC - 4	-10	30	22	LC4	EAR99	HMC798LC4
	26 - 32	16 - 22	-10	45	23	LC3	EAR99	HMC1043LC3
NEW!	71 - 86	DC - 12	-10	30	13	Chip	EAR99	HMC1057
NEW!	71 - 86	DC - 12	-11	28	6	Chip	EAR99	HMC1058

5.5 - 44 GHz I/Q Upconverters & I/Q Downconverters



Features

- Up to 13 dB Conversion Gain
- Excellent Sideband Rejection to 25 dBc
- 2LO to RF Isolation: 45 dB
- Low Noise Figure of 3 dB

A Selection of I/Q Upconverters/Transmitters

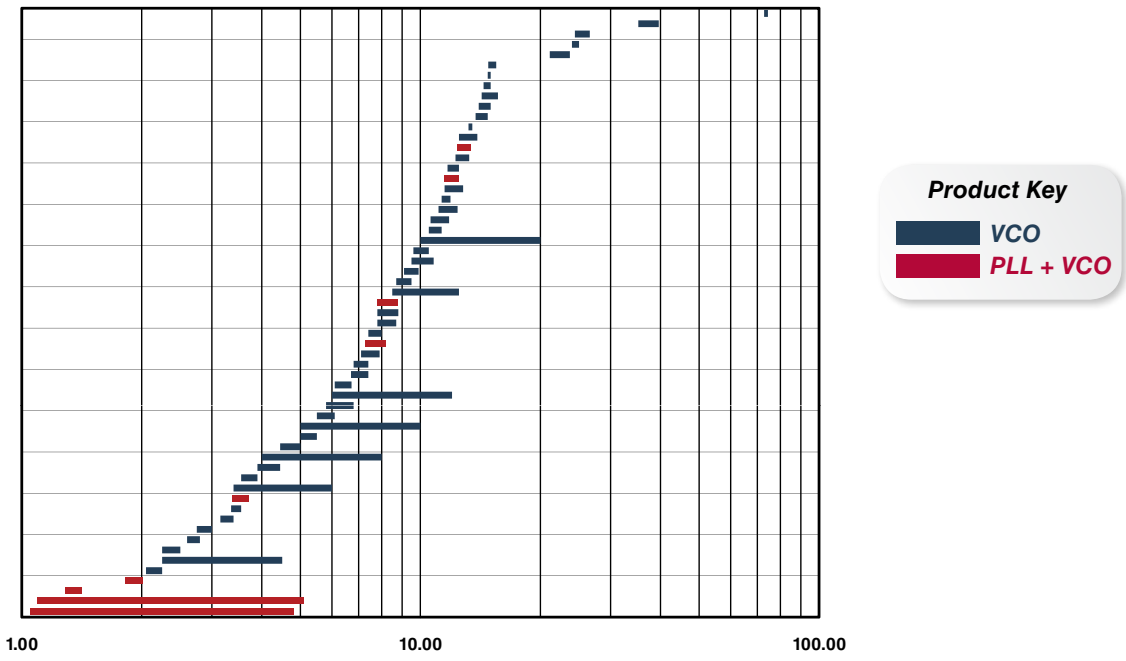
	RF/LO Frequency (GHz)	IF Frequency (GHz)	Conversion Gain (dB)	Sideband Rejection (dB)	OIP3 (dBm)	Package	ECCN Code	Part Number
	5.5 - 8.6	DC - 3	16.5	-30	29	LC5	EAR99	HMC925LC5
	10 - 16	DC - 3	15	-30	14	LC5	EAR99	HMC924LC5
	11 - 17	DC - 3.75	15	-20	26	LC5	EAR99	HMC709LC5
	17.7 - 23.6	DC - 3.5	15	-35	35	LC5	EAR99	HMC819LC5
	21 - 27	DC - 3.75	12	-20	27	LC5	EAR99	HMC815LC5
NEW!	37 - 40	DC - 4	10	17	27	LC5A	EAR99	HMC6787ALC5A
NEW!	40 - 44	DC - 4	12	25	27	LC5A	EAR99	HMC6146BLC5A

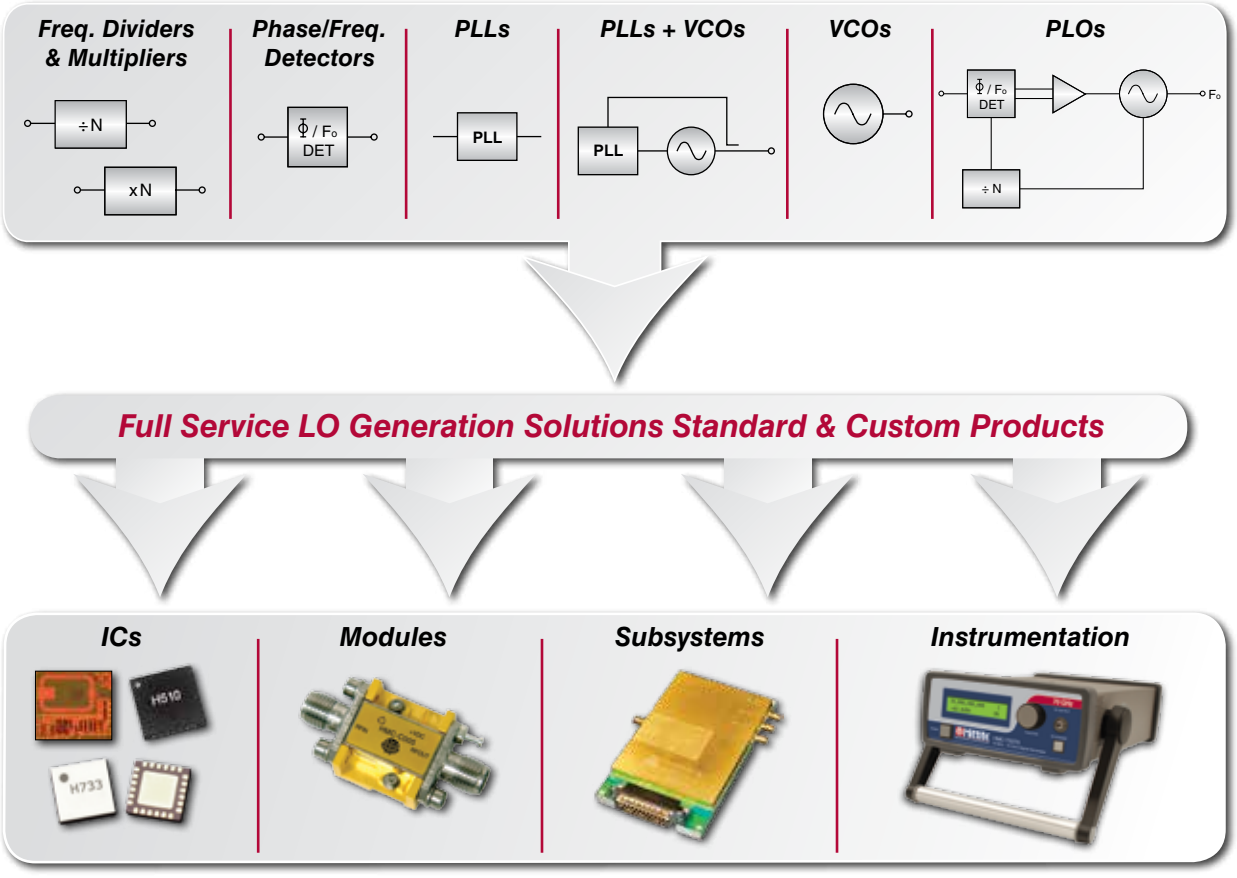
A Selection of I/Q Downconverters/Receivers

	RF/LO Frequency (GHz)	IF Frequency (GHz)	Conversion Gain (dB)	Noise Figure (dB)	Image Rejection (dBc)	IIP3 (dBm)	Package	ECCN Code	Part Number
	5.6 - 8.6	DC - 3.5	13	2.3	20	3	LP4	EAR99	HMC951LP4E
	9 - 12	DC - 3.5	11	2.2	25	2	LC5	EAR99	HMC908LC5
	17 - 20	DC - 3.5	14	2.5	40	0	LP4	EAR99	HMC966LP4E
	17 - 24	DC - 3.5	12	2.2	30	0	LC5	EAR99	HMC904LC5
	21 - 24	DC - 3.5	15	2.5	25	1	LP4	EAR99	HMC967LP4E
	20 - 28	DC - 3.5	14	2.5	21	1	LP4	EAR99	HMC977LP4E
NEW!	27 - 34	DC - 4	12	-	17	2	LP4	EAR99	HMC1065LP4E
NEW!	37 - 44	DC - 4	13	-	25	2	LC5A	EAR99	HMC6147ALC5A

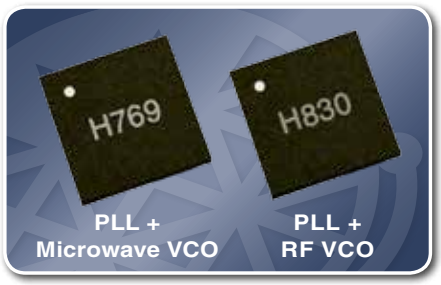
LO Generation

MMIC VCO & PLL + VCO IC Frequency Coverage, 2.5 MHz to 24 GHz





PLLs with Integrated VCOs Cover 2.5 MHz to 13.4 GHz



Features

- **Ultra Low Phase Noise:**
  -110 dBc/Hz in band typ. for the HMC830LP6GE
  -106/102 dBc/Hz (int/frac) @ 10 KHz (with 50 MHz ref.) for the HMC769LP6CE
- **Fully Integrated LO Solution Just Add Crystal Reference & Loop Filter**
- **6x6 mm QFN Package**

Low Phase Noise PLLs with Integrated VCOs

	Frequency (MHz)	Closed Loop SSB Phase Noise @ 10 kHz Offset	Open Loop VCO Phase Noise @ 1 MHz Offset	Pout (dBm)	RMS Jitter Fractional Mode (fs)	Integrated PN Fractional Mode (deg rms)	ECCN Code	Part Number
	fo/2							
	665 - 825	-118 dBc/Hz	-148 dBc/Hz	11	180	0.05	3A001.a.11.b	**HMC822LP6CE**
	795 - 945	-123 dBc/Hz	-148 dBc/Hz	10	180	0.06	3A001.a.11.b	**HMC838LP6CE**
	780 - 870	-116 dBc/Hz	-148 dBc/Hz	14	180	0.06	3A001.a.11.b	**HMC824LP6CE**
	860 - 1040	-118 dBc/Hz	-147 dBc/Hz	10	180	0.07	3A001.a.11.b	**HMC821LP6CE**
	990 - 1105	-114 dBc/Hz	-146 dBc/Hz	11	180	0.07	3A001.a.11.b	**HMC826LP6CE**
	1025 - 1150	-123 dBc/Hz	-147 dBc/Hz	12	180	0.07	3A001.a.11.b	**HMC837LP6CE**
	1050 - 1205	-121 dBc/Hz	-146 dBc/Hz	10	180	0.08	3A001.a.11.b	**HMC839LP6CE**
	1095 - 1275	-118 dBc/Hz	-147 dBc/Hz	10	180	0.08	3A001.a.11.b	**HMC820LP6CE**
	1310 - 1415	-121 dBc/Hz	-145 dBc/Hz	10	180	0.09	3A001.a.11.b	**HMC840LP6CE**
	fo							
	1285 - 1415	-112 dBc/Hz	-143 dBc/Hz	10	180	0.09	3A001.a.11.b	**HMC828LP6CE**
	1330 - 1650	-112 dBc/Hz	-142 dBc/Hz	6.5	180	0.11	3A001.a.11.b	**HMC822LP6CE**
	1590 - 1890	-118 dBc/Hz	-143 dBc/Hz	7.5	180	0.12	3A001.a.11.b	**HMC838LP6CE**
	1720 - 2080	-112 dBc/Hz	-141 dBc/Hz	6.5	180	0.13	3A001.a.11.b	**HMC821LP6CE**
	1815 - 2010	-112 dBc/Hz	-143 dBc/Hz	7.5	180	0.13	3A001.a.11.b	**HMC831LP6CE**
	2050 - 2300	-117 dBc/Hz	-141 dBc/Hz	10.5	180	0.15	3A001.a.11.b	**HMC837LP6CE**
	2100 - 2410	-115 dBc/Hz	-140 dBc/Hz	7.5	180	0.16	3A001.a.11.b	**HMC839LP6CE**
	2190 - 2550	-112 dBc/Hz	-141 dBc/Hz	6.5	180	0.17	3A001.a.11.b	**HMC820LP6CE**
	2620 - 2830	-115 dBc/Hz	-139 dBc/Hz	9	180	0.18	3A001.a.11.b	**HMC840LP6CE**
	2fo							
	2660 - 3300	-106 dBc/Hz	-136 dBc/Hz	-4	180	0.21	3A001.a.11.b	**HMC822LP6CE**
	3180 - 3780	-112 dBc/Hz	-135 dBc/Hz	-4	180	0.24	3A001.a.11.b	**HMC838LP6CE**
	3365 - 3705	-107 dBc/Hz	-135 dBc/Hz	0	190	0.25	3A001.a.11.b	**HMC836LP6CE**
	3440 - 4160	-106 dBc/Hz	-135 dBc/Hz	-4	180	0.27	3A001.a.11.b	**HMC821LP6CE**
	4100 - 4600	-111 dBc/Hz	-135 dBc/Hz	-0.5	180	0.30	3A001.a.11.b	**HMC837LP6CE**
	4200 - 4820	-108 dBc/Hz	-135 dBc/Hz	-4	180	0.31	3A001.a.11.b	**HMC839LP6CE**
	4380 - 5100	-106 dBc/Hz	-135 dBc/Hz	-4	180	0.33	3A001.a.11.b	**HMC820LP6CE**
	5240 - 5660	-109 dBc/Hz	-133 dBc/Hz	-3	180	0.37	3A001.a.11.b	**HMC840LP6CE**
	7300 - 8200	-101 dBc/Hz	-140 dBc/Hz	15	196	0.58	3A001.a.11.b	**HMC764LP6CE**
	7800 - 8800	-101 dBc/Hz	-140 dBc/Hz	13	193	0.61	3A001.a.11.b	**HMC765LP6CE**
	8450 - 9550	-107 dBc/Hz	-138 dBc/Hz	12	93	0.30	3A001.a.11.b	**HMC767LP6CE**
	350	-106 dBc/Hz	-140 dBc/Hz	12	50		3A001.a.11.b	**HMC769LP6CE**
	9600 - 10800	-106 dBc/Hz	-140 dBc/Hz	9	83	0.31	3A001.a.11.b	**HMC778LP6CE**
	11500 - 12500	-99 dBc/Hz	-134 dBc/Hz	10	181	0.81	3A001.a.11.b	**HMC783LP6CE**
	12400 - 13400	-98 dBc/Hz	-132 dBc/Hz	8	175	0.84	3A001.a.11.b	**HMC807LP6CE**
	Wideband Continuous Tuning							
NEW!	0.025 - 3.0	-114 dBc/Hz @ 2GHz	-139 dBc/Hz @ 2 GHz	7	159	0.114 @ 2 GHz	3A001.a.11.b	**HMC832LP6GE**
	0.025 - 6.0	-114 @ 2 GHz	-139 @ 2 GHz	-4	159	0.144 @ 2 GHz	3A001.a.11.b	**HMC833LP6GE**
	0.033 - 4.1	-105 dBc/Hz @ 4 GHz	-133 dBc/Hz @ 4 GHz	7	<160	0.23 @ 4 GHz	3A001.a.11.b	**HMC835LP6GE**
	0.045 - 1.05, 1.4 - 2.1, 2.8 - 4.2	-108 dBc/Hz @ 4 GHz	-134 dBc/Hz @ 4 GHz	4	159	0.229 @ 4 GHz	3A001.a.11.b	**HMC829LP6GE**
NEW!	25 - 3000	-114 dBc/Hz @ 2 GHz Fract. Mode	-141 dBc/Hz @ 2 GHz	6	159	0.13	3A001.a.11.b	**HMC830LP6GE**
	0.045 - 1.05 1.4 - 2.1 2.8 - 4.2 5.6 - 8.4	-108 @ 4 GHz	-134 @ 4 GHz	5, 2, 2, -10	159	0.23 @ 4 GHz	3A001.a.11.b	**HMC834LP6GE**

LO Generation (Continued)

Microwave VCO & PLO Solutions, 4 to 26.8 GHz

Hittite Microwave offers standard and custom LO Generation products from DC to 80 GHz. Our GaAs & SiGe MMIC VCOs integrate a resonator, negative resistance circuit & tuning varactor and/or dividers and buffer amplifiers. The accuracy & repeatability of MMIC wafer processing eliminates all tuning at our factory and yours.

Voltage Controlled Oscillators, 4 to 26.8 GHz

Fo Frequency (GHz)	Fo/2 Frequency (GHz)	Fo Output Power (dBm)	10 kHz SSB Phase Noise (dBc/Hz)	100 kHz SSB Phase Noise (dBc/Hz)	Bias Supply	ECCN Code	Part Number
VCOs with Buffer							
5.8 - 6.8	-	10	-82	-105	3V @ 100 mA	EAR99	**HMC358MS8G**
5.0 - 5.5	-	2	-80	-103	3V @ 27 mA	EAR99	**HMC430LP4E**
5.5 - 6.1	-	2	-80	-102	3V @ 27 mA	EAR99	**HMC431LP4E**
6.1 - 6.72	-	4.5	-73	-101	+3V @ 31 mA	EAR99	**HMC466LP4E**
VCOs with Fo/2							
6.65 - 7.65	3.325 - 3.825	13	-90	-115	+5V @ 230mA	EAR99	**HMC507LP5E**
7.3 - 8.2	3.65 - 4.1	15	-90	-116	+5V @ 240mA	EAR99	**HMC508LP5E**
7.8 - 8.8	3.9 - 4.4	13	-90	-115	+5V @ 250mA	EAR99	**HMC509LP5E**
9.05 - 10.15	4.525 - 5.075	13	-88	-115	+5V @ 265mA	EAR99	**HMC511LP5E**
14.5 - 15.0	7.25 - 7.5	9	-80	-105	+4.2V @ 150mA	EAR99	**HMC736LP4E**
14.9 - 15.5	7.45 - 7.75	9	-80	-105	+4.2V @ 150mA	EAR99	**HMC737LP4E**
VCOs with Fo/2 & ÷4							
8.45 - 9.55	4.225 - 4.775	13	-92	-116	+5V @ 315mA	3A001.a.11.b	**HMC510LP5E**
9.5 - 10.8	4.75 - 5.4	11	-85	-110	+5V @ 350mA	3A001.a.11.b	**HMC530LP5E**
9.6 - 10.8	4.8 - 5.4	9	-85	-111	+5V @ 330mA	3A001.a.11.b	**HMC512LP5E**
10.43 - 11.46	5.215 - 5.73	7	-85	-110	+3V @ 275mA	3A001.a.11.b	**HMC513LP5E**
10.6 - 11.8	5.3 - 5.9	11	-82	-110	+5V @ 350mA	3A001.a.11.b	**HMC534LP5E**
11.1 - 12.4	5.55 - 6.2	9	-83	-110	+5V @ 350mA	3A001.a.11.b	**HMC582LP5E**
11.17 - 12.02	5.585 - 6.01	7	-87	-110	+3V @ 275mA	3A001.a.11.b	**HMC514LP5E**
11.5 - 12.5	5.75 - 6.25	10	-83	-110	+5V @ 200mA	3A001.a.11.b	**HMC515LP5E**
11.5 - 12.8	5.75 - 6.4	11	-80	-110	+5V @ 350mA	3A001.a.11.b	**HMC583LP5E**
12.4 - 13.4	6.2 - 6.7	8	-83	-110	+5V @ 260mA	3A001.a.11.b	**HMC529LP5E**
12.5 - 13.9	6.25 - 6.95	10	-81	-110	+5V @ 330mA	3A001.a.11.b	**HMC584LP5E**
13.6 - 14.9	6.8 - 7.45	7	-82	-110	+5V @ 260mA	3A001.a.11.b	**HMC531LP5E**
14.25 - 15.65	7.125 - 7.825	9	-80	-107	+5V @ 350mA	3A001.a.11.b	**HMC632LP5E**
VCOs with Fo/2 & ÷16							
20.9 - 23.9	10.45 - 11.95	9	-65	-95	+5V @ 200mA	3A001.a.11.b	**HMC738LP4E**
23.8 - 26.8	11.9 - 13.4	8	-64	-93	+5V @ 200mA	3A001.a.11.b	**HMC739LP4E**
VCOs with Divide-by 4 and 16							
8.6 - 10.2	-	18	-70	-100	+5V @ 220mA	3A001.a.11.b	**HMC734LP5E**
10.5 - 12.2	-	17	-75	-100	+5V @ 220mA	3A001.a.11.b	**HMC735LP5E**
23.8 - 24.8	-	12	-70	-95	+5V @ 220mA	3A001.a.11.b	**HMC533LP4E**
Wideband VCOs							
4 - 8	-	5	-75	-100	+5V @ 55mA	EAR99	**HMC586LC4B**
5 - 10	-	5	-65	-95	+5V @ 55mA	EAR99	**HMC587LC4B**
6 - 12	-	1	-65	-95	+5V @ 57mA	EAR99	**HMC732LC4B**
8 - 12.5	-	5	-65	-93	+5V @ 55mA	EAR99	**HMC588LC4B**
10 - 20	-	2	-60	-90	+5V @ 70mA	EAR99	**HMC733LC4B**

** HMC VCOs integrate resonator, negative resistance generator and tuning varactor circuits on-chip. No external components are required.*

Phase Locked Oscillator

Fo Frequency (GHz)	Fo Output Power (dBm)	10 kHz SSB Phase Noise (dBc/Hz)	100 kHz SSB Phase Noise (dBc/Hz)	Bias Supply	Package	ECCN Code	Part Number
14.7 - 15.4	9	-80	-110	+5V @ 340mA +12V @ 28mA	LP4	3A001.a.11.b	**HMC535LP4E**

Precision System Clock Generation & Distribution

See www.hittite.com for System Clock Components Including PLL + VCOs, Fanout Buffers, Selectable Dividers

Clock & Timing ICs

Hittite Microwave has developed a unique line of high performance clock distribution and clock generation products that enable the system designer maximize the performance from data converters. The HMC1032LP6GE and the HMC1034LP6GE are SMT packaged clock generators, which are ideal for a wide range of high performance cellular/4G infrastructure, fiber optic and networking applications, and deliver best-in-class jitter and industry-leading phase noise floor. Additionally, Hittite's clock distribution devices, such as the HMC988LP3E are used to distribute data converter sample clocks with negligible additive jitter. The clock distribution family offers best-in-class phase noise floor of <-165dBc/Hz and enables system designers to manage clock-to-date line setup and hold times and adjust the clock phases. Similarly, clock generators such as the HMC1031MS8E may find applications when the primary reference frequency needs to be multiplied up to a higher rate to drive the primary clock inputs in a system. Such multiplication is critical because the higher reference clocks improve phase noise, ADC/DAC SNR, clock generator jitter and PHY BERs.

HMC988LP3E - 3.3V Programmable Digital Delay & Divider IC, DC to 4 GHz

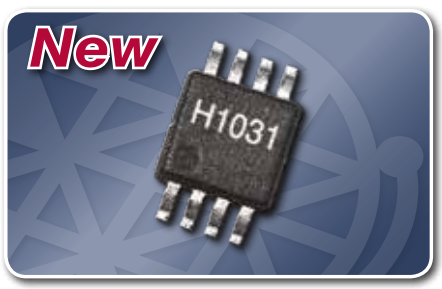
Features

- **Single Channel Clock Divider & Delay Management IC**
- **Programmable Clock Divide by 1/2/4/8/16/32**
- **Delay Adjustment in 1/2 Clock Cycles or in 60 Steps of 20 ps**
- **-170 dBc/Hz Phase Noise Floor for Negligible Jitter Contribution**
- **800 mVp-p LVPECL Output**
- **3.3V Operation (or 5V with Optional On-Chip Regulator)**

Clock Generation

	Max. Clock Rate (GHz)	Input	Output	Phase Jitter (12 k to 20 MHz)	Rise/Fall (ps)	Channel Skew (ps)	Power Supply (V)	Package	ECCN Code	Part Number
	8	LVPECL, LVDS, CML, CMOS	LVPECL	8 fsRMS	65	3.1	3.3	LP5	EAR99	**HMC987LP5E**
NEW!	4	LVPECL, LVDS, CML, CMOS	LVPECL	13 fsRMS	90	300 - 1500 Prog. Delay	5 or 3.3	LP3	EAR99	**HMC988LP3E**

HMC1031MS8E - Clock Generator with Integer-N PLL, 0.1 to 500 MHz



Features

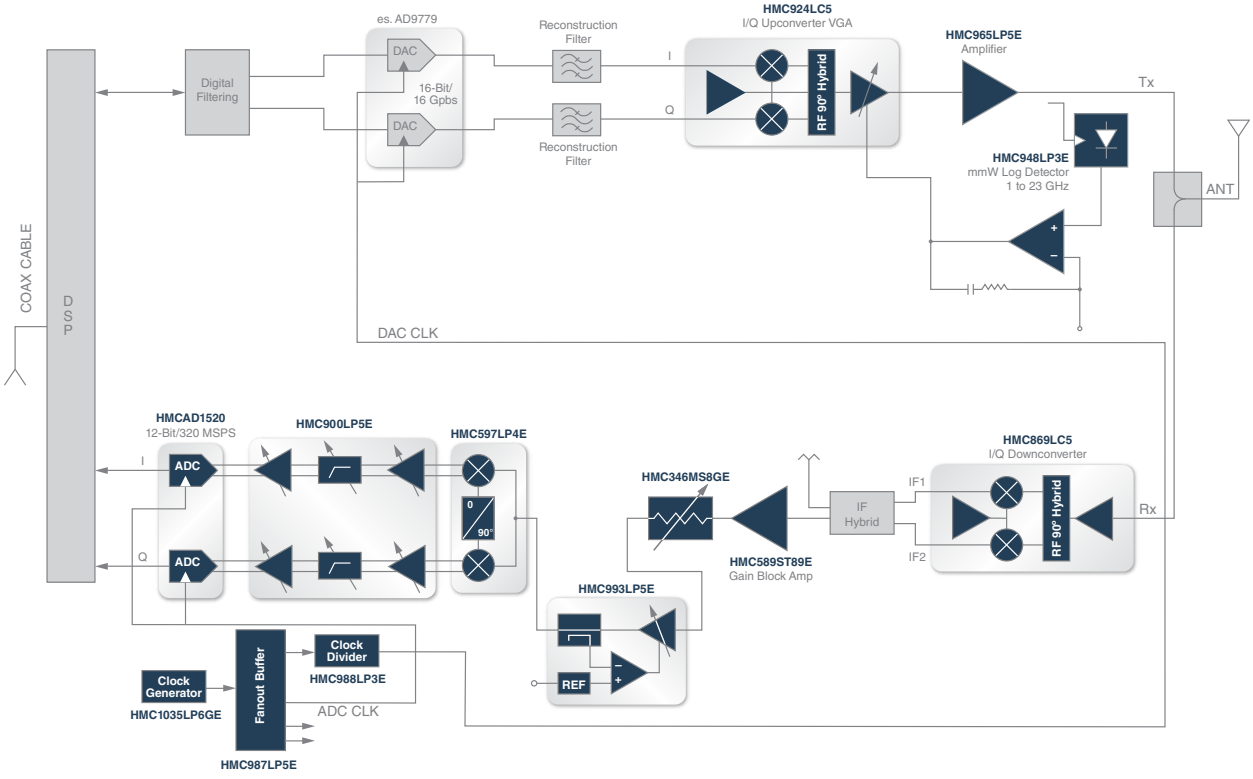
- **Integer-N PLL Clock Generator with External VCO/VCXO**
- **Ultra-Low Power Consumption: <2 mA Typical in Normal Operation**
- **Hardware Pin Programmable Reference Clock Multiplication Ratios of x1, x5, x10**
- **Phase Noise Floor (Figure of Merit): -208 dBc/Hz (Typical)**

Clock Generation

	Max. Clock Rate (MHz)	Typical Phase Jitter (fsRMS)	Phase Noice Floor (dBc/Hz)	Max. Reference Freq. (MHz)	Typical Power Consump. (W)	Figure of Merit (Frac/Int) (dBc/Hz)	Package	ECCN Code	Part Number
	350	116/75	-165	350	0.86	-227/230	LP6G	3A001.a.11.b	**HMC1032LP6GE**
NEW!	500	Defined by VCXO	Defined by VCXO	140	0.0064	-/-208	MS8	EAR99	**HMC1031MS8E**
NEW!	550	99	-163	350	0.64	-226/-227	LP6G	3A001.a.11.b	**HMC1033LP6GE**
	2500	97	-163	350	0.57	-226/-227	LP6G	3A001.a.11.b	**HMC1035LP6GE**
	3000	118/78	-165	350	0.86	-227/-230	LP6G	3A001.a.11.b	**HMC1034LP6GE**

Clock Generation (Continued)

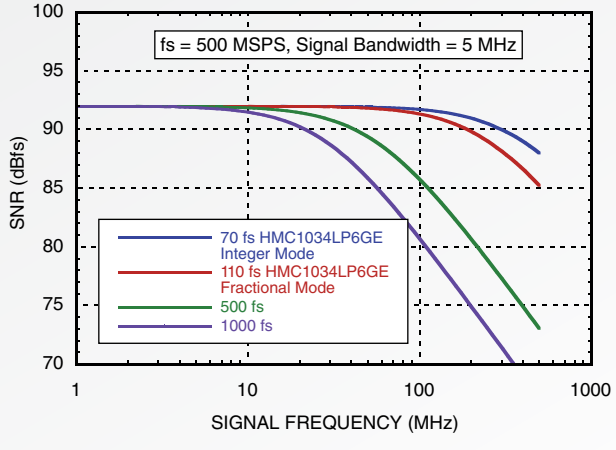
Microwave Radio Clocks & Timing Scheme



Data Converter Clocking with Hittite Clock Generators

Selecting the right components for clock generation and data conversion enables a designer to extract the best performance from a given architecture. Data converter dynamic range and linearity performance can be improved by careful consideration of clock generator characteristics.

Important criteria to consider when choosing a clock generator are phase jitter and phase noise floor, which impact the SNR of the data converter being clocked. As the graph below indicates, the low phase noise floor of the chosen clock generator as well as its low integrated phase jitter helps to minimize the SNR degradation at higher ADC/DAC frequencies in multi-acquisition applications. The HMC1034LP6GE with integer-mode configuration offers the lowest clock jitter and offers significant improvements over clock generators with higher jitter.



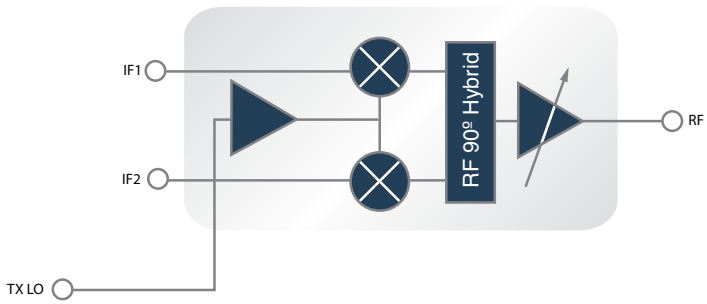
Hittite's clock & timing ICs are designed with data converter applications in mind, and work well with Hittite's high speed ADC devices. Our clock generators with industry's best close-in and far-from-carrier phase noise are ideally suited to extract the best performance from data converters.

Upconverters & Downconverters

Hittite Microwave combines best-in-class design expertise with advanced process capability to offer a variety of highly integrated, high performance microwave and millimeterwave solutions.

For the 6 to 42 GHz microwave radio market, Hittite offers single chip SiGe & GaAs MMIC upconverters/transmitters which include integrated I/Q mixer, VGA and LO buffer. SiGe & GaAs MMIC downconverters/receivers feature integrated LNA, I/Q mixer and LO buffer.

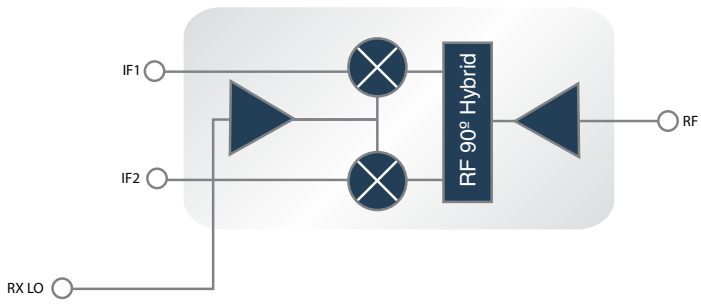
Single Sideband I/Q Upconverters, 6-42, 60, 70, 80 GHz



Features

- **Single Chip MMIC Design with Integrated I/Q Mixer, VGA & LO Buffer**
- **High OIP3: >+30 dBm**
- **Integrated VGA Options**
- **Low Cost QFN Packages**

Low Noise Converters, 6-42, 60, 70, 80 GHz



Features

- **Single Chip MMIC Design with Integrated LNA, I/Q Mixer & LO Buffer**
- **Low Noise Figure: <2 dB**
- **High Input IP3: up to +3 dBm**
- **Low Cost QFN Packages**

Integrated 6 to 80 GHz Solutions (Continued)

60 GHz Antenna-in-Package (AiP) Silicon Transceiver Chipset

Hittite Microwave offers new, highly integrated SiGe Transceiver Chipset Solutions, which are fabricated with Silicon Germanium (SiGe) BiCMOS semiconductor process technology and target 60 GHz applications such as short range Gbps data links, wireless sensors and test applications. Hittite's 60 GHz Transceiver Chipsets are available in bare die (chip) or plastic encapsulated AiP which support low cost surface mount PCB assembly. These chipsets not only solve many of the key technical challenges encountered at millimeterwave frequencies, but also enable turn-key multi-Gbps communication links at 60 GHz. Lower frequency baseband signals are directly translated to and from 60 GHz, minimizing the need for expensive and complex millimeterwave interconnection components on the printed circuit board.

HMC6000LP711E & HMC6001LP711E Features

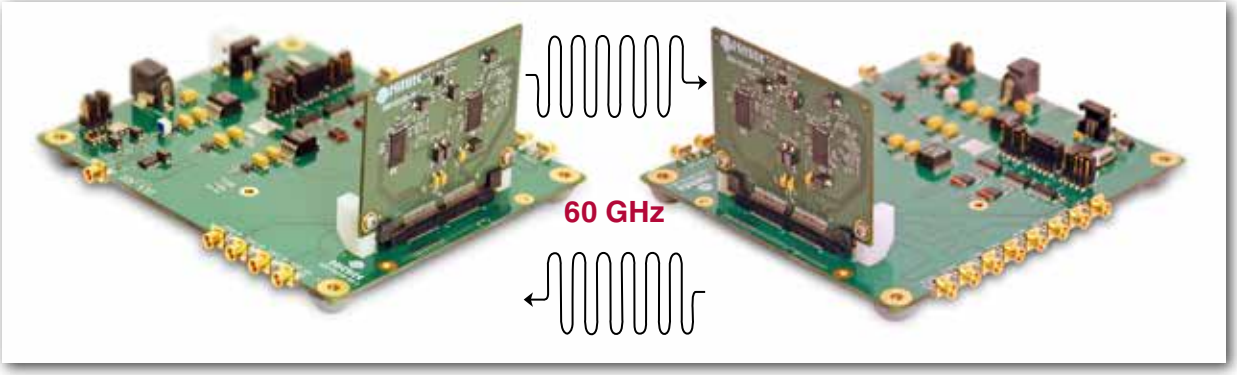
- **57 - 64 GHz Bandwidth**
- **Integrated Low Noise Synthesizer**
- **Antenna-in-Package (AiP), EIRP = 17.5 dBm**
- **Universal Analog I/Q Baseband Interface**
- **Three Wire Serial Interface**

60 GHz Transceiver Solutions

	Frequency (GHz)	Function	Antenna Gain (dBI)	P1dB (dBm)	NF (dB)	Max Gain (dB)	Gain Adjust (dB)	Phase Noise @ 1 MHz (dBc/Hz)	Power Dissipation (W)	Package	Part Number
	57 - 64	60 GHz Integrated Tx	-	12	-	38	17	-86	0.8	Chip	**HMC6000**
NEW!	57 - 64	60 GHz Tx w/Integrated Antenna	7.5	10	-	36	17	-86	0.8	AiP	**HMC6000LP711**
	57 - 64	60 GHz Integrated Rx	-	-	6	67	65	-86	0.6	Chip	**HMC6001**
NEW!	57 - 64	60 GHz Rx w/Integrated Antenna	6.5	-	8	65	65	-86	0.6	AiP	**HMC6001LP711**

EKIT01-HMC6450 - 60 GHz Transmit/Receive Antenna-in-Package Evaluation Kit

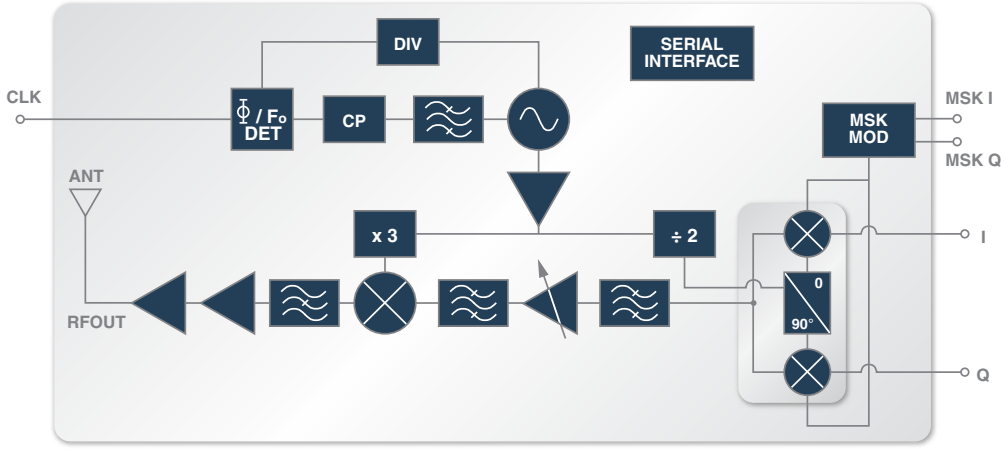
The EKIT01-HMC6450 is a complete 60 GHz AiP Transceiver Evaluation Kit containing both the HMC6000LP711E transmitter and the HMC6001LP711E receiver. Complete with configuration software, the EKIT01-HMC6450 provides the user with everything needed to set up a bidirectional millimeterwave link at 60 GHz with a range of 4 meters. A universal analog I and Q interface will translate baseband analog I and Q signals with single-sided bandwidth, out to 880 MHz, to and from the 60 GHz ISM band. The EKIT01-HMC6450 enables set-up of 60 GHz transmission in your lab within 30 minutes.



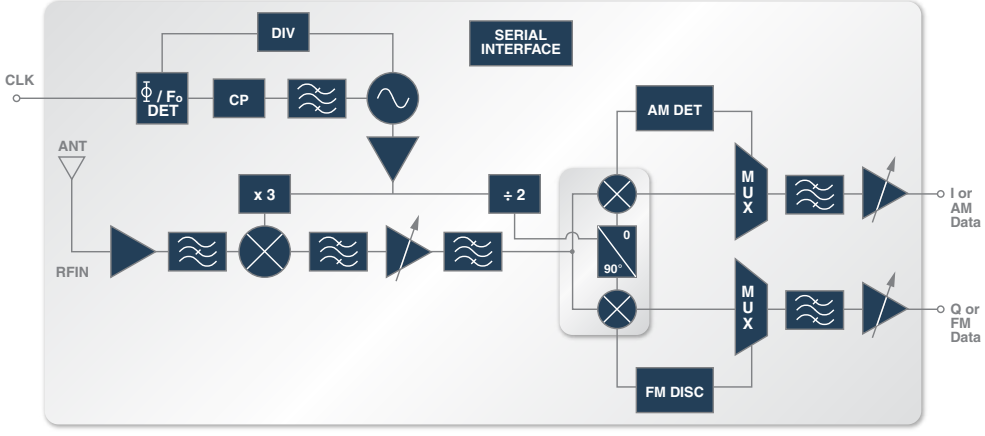
60 GHz Transceiver Chipset

A new highly integrated SiGe BiCMOS IC radio solution makes turnkey 60 GHz multi-Gbps communication links possible. Low frequency baseband signals are directly translated to and from 60 GHz, solving many of the key technical challenges encountered at millimeterwave frequencies.

HMC6000 Transmitter



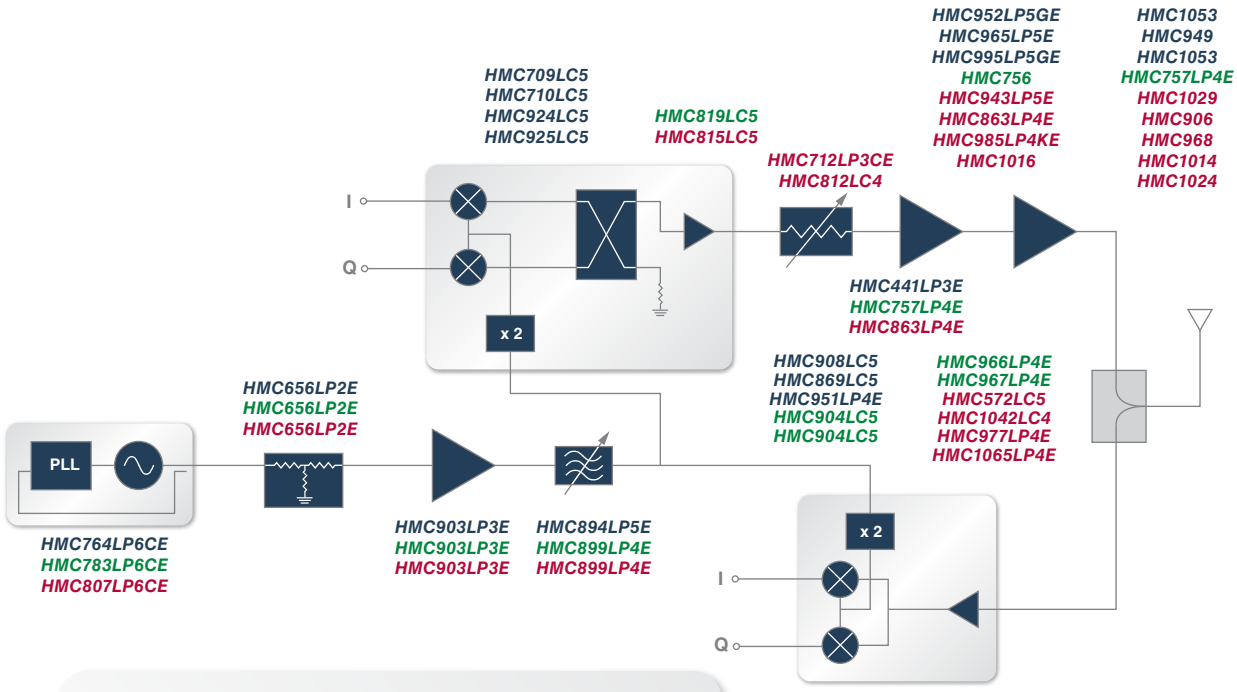
HMC6001 Receiver



Features

- High Output Power (+12 dBm) SiGe Transceiver
- 57 to 64 GHz Frequency Band Coverage
- Complete Baseband to RF Solution
- Integrated Frequency Synthesizer
- Universal I/Q Baseband Interface
- Up to 1.8 GHz RF Bandwidth

6 to 42 GHz Microwave Radio Backhaul Chipsets

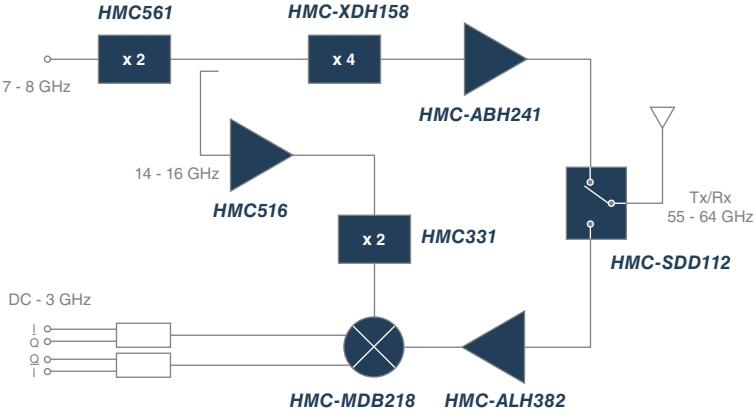


Features

- Integrated I/Q TX Upconverter IC with a x2 LO Buffer & a High Linearity Driver Amplifier
- High Linearity 17 - 24 GHz Power Amplifier with 40 dBm OIP3 & 32 dBm Output Power
- Low Noise Image Rejection Downconverter IC with an Integrated x2 LO Buffer
- Very Low Phase Noise PLL IC with an Integrated VCO

Product Key
6 to 15 GHz
18 to 23 GHz
26 to 42 GHz

Sub-Harmonic Option for 60 GHz Chipset

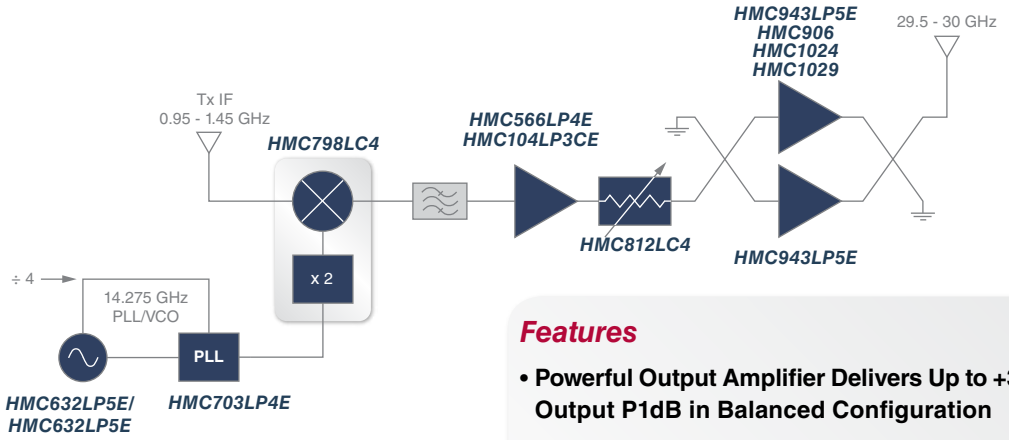


Applications

- Short Haul High Capacity Links
- Picocell Mobile Phone Links
- Network Backbone & Branch Links
- HDTV Wireless Broadcasting

Typical Microwave/Millimeterwave application is illustrated.
See the full product listing for alternatives to the select HMC products shown in each functional block.

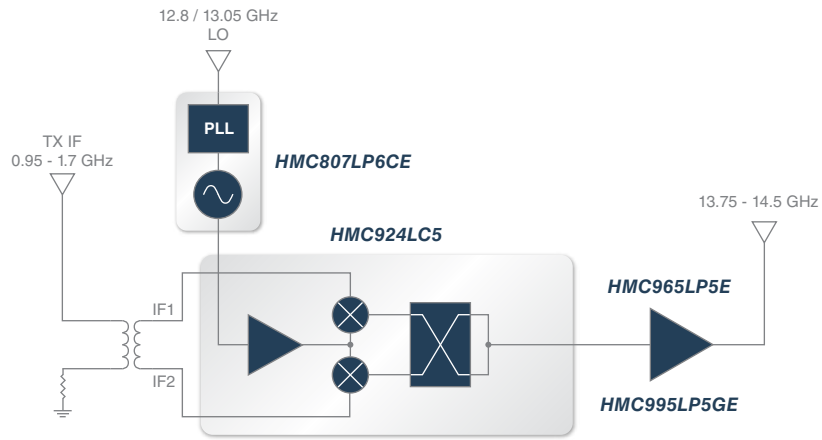
28 to 31.5 GHz Ka-Band VSAT Radio Chipset



Features

- **Powerful Output Amplifier Delivers Up to +37 dBm Output P1dB in Balanced Configuration**
- **Subharmonically Pumped Upconverter Mixer Simplifies LO Architecture**
- **Voltage Controlled Attenuator Provides Up to 30 dB of Range**

13.75 to 14.5 GHz Ku-Band VSAT Radio Chipset

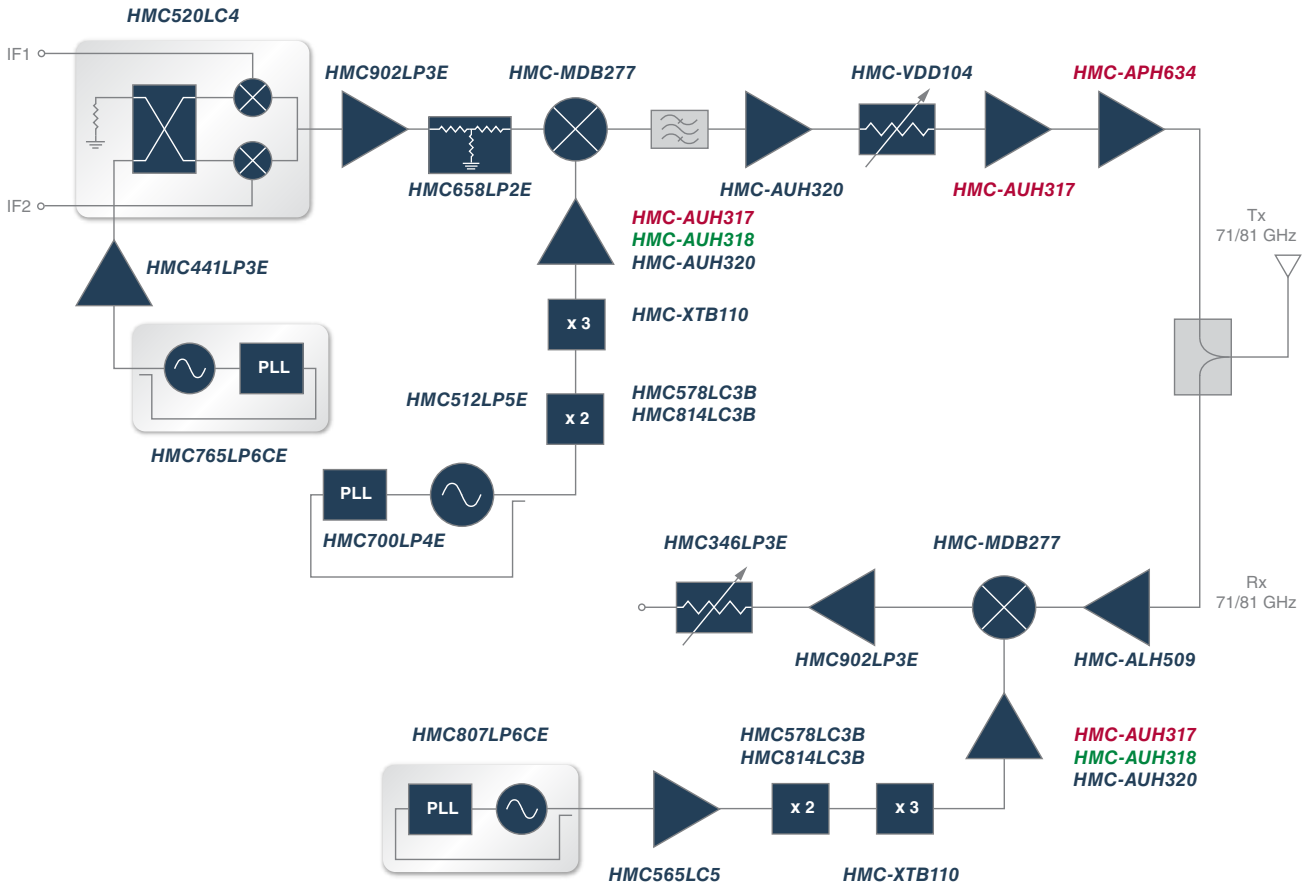


Features

- **Highly Integrated Upconverter Provides 22 to 42 dB Conversion Gain**
- **High Linearity Power Amplifier with +32 dBm P1dB & Up to +40 dBm Output IP3**
- **Integrated Variable Gain Amplifier Facilitates Temperature Compensation Loops**
- **Low Noise & Low Spurious PLL + VCO is Ideal or High QAM Block Upconverter Applications**

Typical Microwave/Millimeterwave application is illustrated.
See the full product listing for alternatives to the select HMC products shown in each functional block.

70/80 GHz E-Band Radio Chipset



Features

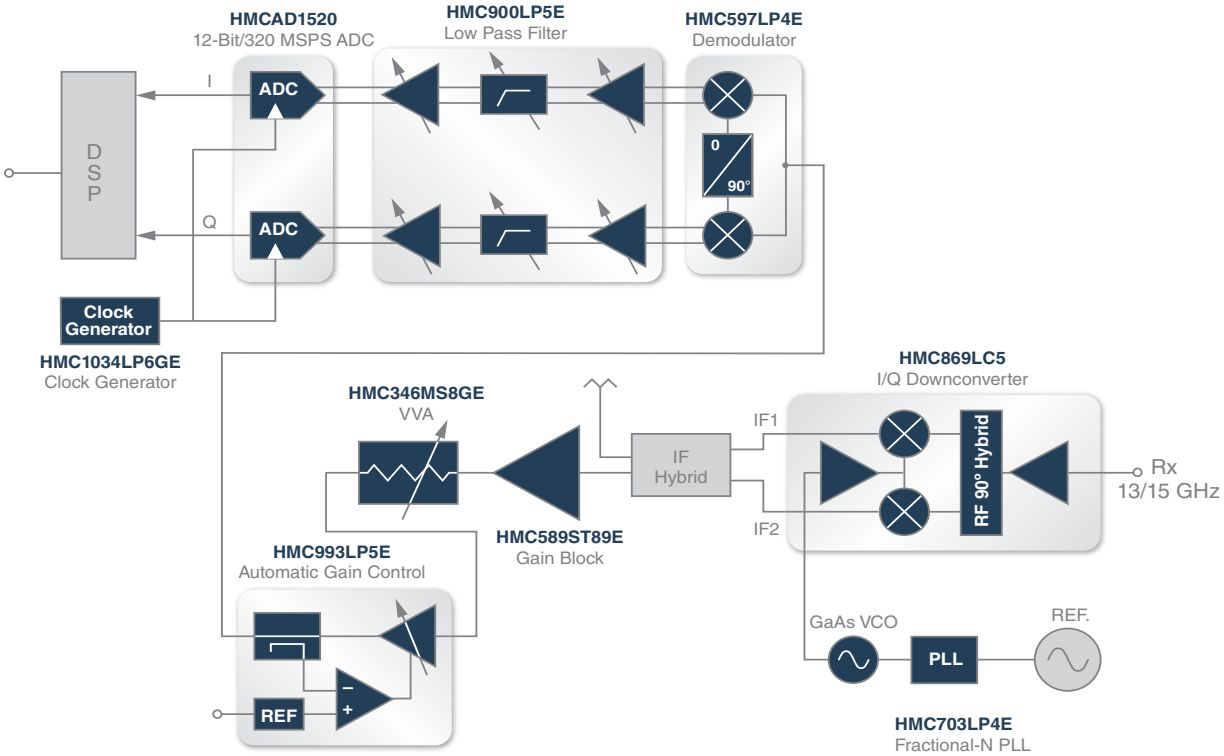
- *Numerous PLL and VCO Offerings Enable Flexible Transceiver Frequency Plans*
- *Voltage Variable Attenuators Facilitate Temperature Compensation Implementation*
- *High Linearity Power Amplifier & Low Noise Amplifier Combine to Increase Link Distance*
- *Double Balanced Mixer Architectures Improve System Spurious & Reduces Unwanted Emissions*

Product Key
72 & 82 GHz
72 GHz Only
82 GHz Only

Typical Microwave/Millimeterwave application is illustrated.
See the full product listing for alternatives to the select HMC products shown in each functional block.

In contrast to the super-heterodyne scheme where the received signal is first demodulated to an intermediate frequency, the zero-IF or direct-conversion scheme demodulates the received signal directly to baseband. This is achieved by using a local oscillator (LO) frequency that is very close to, or exactly the same as, the carrier signal frequency. The resulting signal is then fed into an ADC for conversion to a digital data stream.

MW/mmW Frequency Band	Hittite ADC	Performance
6-42 GHz	HMCAD1520	12-Bit Dual Channel ADC (320 MSPS)
50-75 GHz (V-Band)	HMCAD1511/13	8-Bit 1/2/4 Channel ADC (1 GSPS/500 MSPS/250 MSPS)
71-76 & 81-86 GHz (E-Band)	HMCAD1511/13	8-Bit 1/2/4 Channel ADC (1 GSPS/500 MSPS/250 MSPS)



Features

- ***Complete Signal Path Solution***
- ***Wideband PLL + VCO Generates Very Low Jitter ADC Clock***
- ***Multi mode Quad 14-Bit ADC Provides Superior Performance & Flexibility***
- ***Low Power Dissipation & Compact Package***

Typical Microwave/Millimeterwave application is illustrated.
See the full product listing for alternatives to the select HMC products shown in each functional block.

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