

# RF, Microwave, and Millimeter Wave Products

Selection Guide 2020



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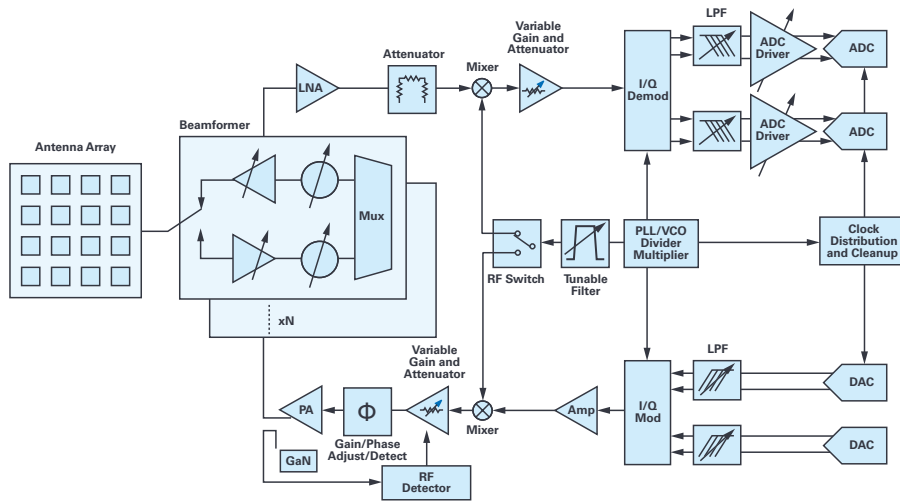
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# Introduction

## 1000+ Ways to Drive RF and Microwave Performance

A unique combination of design skills. Deep systems knowhow. A diverse range of process technologies including GaAs, GaN, SiGe, SOI, and CMOS. That's the difference behind the industry's broadest portfolio of RF ICs, covering the entire RF signal chain from bits-to-beams, and from dc to beyond 100 GHz. With over 1000 high performance RF ICs, and a wide range of single-chip and module package options, Analog Devices offers a rich selection of high performance RF function blocks, as well as highly integrated transceiver solutions for virtually every application serving the communications, test and measurement instrumentation, industrial, commercial, and military/aerospace markets. These products are supported by a full complement of RF design and development resources, including free design tools, FMC rapid prototyping platforms, Circuits from the Lab® reference designs, and EngineerZone® technical forums.

ADI is committed to providing the best possible long-term support and service to our customers for a positive, successful engagement experience. We are pleased to have the opportunity to provide innovative solutions to help you develop a smarter and more connected world.



# What's New in This Edition

## Low Noise Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADL8111	LNA	0.01 to 8	12.5	17	34	2.8	Internal	5	70	6 × 6 LGA	EAR99	ADL8111ACCZN
HMC8411	LNA	0.01 to 10	15.5	20	34	1.7	Internal	3, 5	55	2 × 2 LFCSP	EAR99	HMC8411LP2FE
HMC1040	LNA	10 to 44	21	14	25.5	2.5	Internal	2.5	70	Die	3A001.b.2.d	HMC1040

## Wideband Distributed Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC1022A	Power amp	0 to 48	11.5	21	29	5.5	Internal	10	150	Die	3A001.b.2.d	HMC1022A

## Linear and Power Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC1082	Driver amp	5.5 to 18	24	25.5	36	—	Internal	5	220	Die	EAR99	HMC1082CHIP
HMC1132	Power amp	27 to 32	24	29	37	5.5	Internal	5	650	5 × 5 LFCSP	3A001.b.2.d	HMC1132PM5E
HMC943A	Power amp	24 to 34	23	33	37.5	—	Internal	5.5	1300	5 × 5 LFCSP	3A001.b.2.d	HMC943APM5E
ADPA7002	0.5 W PA	20 to 44	15	28	40	—	Internal	5	600	Die	3A001.b.2.d	ADPA7002CHIP
ADPA7006	0.5 W WB PA	20 to 44	23.5	29	38	—	Internal	5	800	Die	3A001.b.4.e.1, DL3A001b4e1	ADPA7006CHIP
ADPA7001	0.125 W WB PA	50 to 95	14.5	17	25	—	Internal	3.5	350	Die	3A001.b.2.g	ADPA7001CHIPS

## GaN Power Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	P <sub>SAT</sub> (dBm)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC1099	10 W, GaN PA	0.01 to 1.1	18	30	47.5	5	Internal	41	28	100	5 × 5 LFCSP	EAR99	HMC1099PM5E
HMC8500	>10 W, GaN PA	0.01 to 2.8	15	40	47	4.5	Internal	40	28	100	5 × 5 LFCSP	EAR99	HMC8500PM5E
HMC1114	10 W, GaN PA	2.7 to 3.8	24	41.5	44	5	Internal	41.5	28	150	5 × 5 LFCSP	3A001.b.2.a.4	HMC1114PM5E
HMC8205	35 W, GaN PA	0.4 to 6	20	45	47	—	Internal	46	50	1300	Die	3A001.b.2.a.4	HMC8205BCHIPS
HMC8415	40 W, GaN PA	9 to 10.5	23	35	—	—	Internal	46	28	1000	6 × 6 LFCSP	3A001.b.2.b.2, DL3A001b2b2, EAR99	HMC8415LP6GE

## Digital Step Attenuators

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Atten Range (dB)	Step (dB)	Input IP3 (dBm)	P0.1 dB (dBm)	Control Input (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC939A	5-bit DSA	0.1 to 40	7	0 to 31	1	40	24	0/5	Die	EAR99	HMC939A
ADRF5720	6-bit DSA	9 kHz to 40	4.5	0 to 31.5	0.5	50	30	0/3.3	4 × 4 LGA	EAR99	ADRF5720BCCZN
ADRF5721	4-bit DSA	9 kHz to 40	3.4	0 to 30	2	50	30	0/3.3	2.5 × 2.5 LGA	EAR99	ADRF5721BCCZN
ADRF5730	6-bit DSA	0.1 to 40	4.8	0 to 31.5	0.5	50	30	0/3.3	4 × 4 LGA	EAR99	ADRF5730BCCZN
ADRF5731	4-bit DAS	0.1 to 40	3.5	0 to 30	2	50	30	0/3.3	2.5 × 2.5 LGA	EAR99	ADRF5731BCCZN

## Single, Double, and Triple Balanced Mixers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Noise Figure (dB)	Input P1dB (dBm)	LO Drive Nominal (dBm)	Package (mm)	ECCN Code	Ordering Part Number
LTC5555	Active with VGA	1.5 to 7	0.5 to 8	0.001 to 0.9	-62 to +9.2	22.6	50	55	15.1	10.8	0	4 × 5 QFN	EAR99	LTC5555IUFD#TRPBF
HMC773A	Passive	6 to 26	6 to 26	0 to 10	-10	21	39	33	10	12	13	Die	EAR99	HMC773A
HMC329A	Passive	24 to 32	24 to 32	0 to 8	-10.5	20	36.5	35.5	10.5	12	13	3 × 3 QFN	EAR99	HMC329ALC3B
HMC329A	Passive	22 to 38	22 to 38	0 to 8	-11	21	36	27	14	13.5	13	Die	EAR99	HMC329A
HMC774A	Passive	7 to 40	7 to 40	0 to 10	-11	20	32	50	12	12	13	Die	EAR99	HMC774A
HMC560A	Passive	24 to 40	24 to 40	0 to 17	-10.5	21	31	35	10.5	14	13	5 × 5 LFCSP	EAR99	HMC560ALM3

## I/Q Mixers and Image Reject Mixers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	Image Rejection (dB)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Input P1dB (dBm)	LO Drive Nominal (dBm)	Package (mm)	ECCN Code	Ordering Part Number
HMC908A	I/Q downconverter	9 to 12	8.5 to 15.5	0 to 3.5	11	0	25	46	26	-8	12	4 × 4 CLCC	EAR99	HMC908ALC5
HMC521A	I/Q and IRM	8.5 to 13.5	8.5 to 13.5	0 to 3.5	-9	16	27.5	39	18.5	8.3	15	4 × 4 LFCSP	EAR99	HMC521ALC4
HMC521A	I/Q and IRM	8.5 to 13.5	8.5 to 13.5	0 to 3.5	-7	17	21	38	18	8	15	Die	EAR99	HMC521ACHIPS
HMC8192	I/Q and IRM	20 to 42	20 to 42	0 to 5	-8.5	22	25	45	—	—	18	4 × 4 LFCSP	EAR99	HMC8192LG

## Subharmonic Mixers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Input P1dB (dBm)	Image Rejection (dB)	LO Drive (dBm)	Package (mm)	ECCN Code	Ordering Part Number
HMC798A	Subharmonic	24 to 34	12 to 18	0 to 4	-10.5	20	36	27	6	—	4	3.9 × 3.9 CLCC	EAR99	HMC798ALC4

## I/Q Downconverters/Receivers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	Image Rejection (dBc)	Noise Figure (dB)	LO Drive Nominal (dBm)	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADMV4420	K-band downconverter with PLL and VCO	16.95 to 22.05	16.35 to 21.15	0.9 to 2.5	36	-20	—	7	Internal VCO	5	380	5 × 5 LFCSP	5A991.b	ADMV4420ACPZ
ADMV1014	Wideband I/Q downconverter with 4× LO	24 to 44	5.4 to 10.25	0 to 6	17	0	30	5.5	0	3.3	437	5 × 5 LGA	EAR99	ADMV1014ACCZ
ADMV7410	E-band I/Q downconverter SiP	71 to 76	11.5 to 13	DC to 2	13	1	30	5	4	4, 2, 1.5	66, 175, 80	11 × 13 LGA_CAV	EAR99	ADMV7410BCEZ
ADMV7420	E-band I/Q downconverter SiP	81 to 86	13.2 to 14.6	DC to 2	10	1	30	5	4	4, 2, 1.5	66, 175, 80	11 × 13 LGA_CAV	EAR99	ADMV7420BCEZ

## I/Q Upconverters/Transmitters

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Output IP3 (dBm)	Sideband Rejection (dBc)	LO Drive Nominal	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADMV1013	Wideband I/Q upconverter with 4× LO	24 to 44	5.4 to 10.25	0 to 6	18	23	26	0	3.3	550	6 × 6 LGA	EAR99	ADMV1013ACCZ
ADMV7310	E-band I/Q upconverter SiP	71 to 76	11.8 to 12.7	DC to 2	35	31	20	4	—	—	16 × 14 LGA_CAV	EAR99	ADMV7310BCEZ
ADMV7320	E-band I/Q upconverter SiP	81 to 86	13.4 to 14.6	DC to 2	33	31	—	4	—	—	16 × 14 LGA_CAV	EAR99	ADMV7320BCEZ

## I/Q Upconverters/Downconverters/Transceivers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	LO Drive Nominal	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADMV1017	Integrated mmW 5G up/downconverter	24 to 29.5	Contact ADI	DC to 1.5 (BB), 3.5 to 10.5 (IF)	0	—	—	9 × 8 FCCSP	EAR99	ADMV1017BCCZ

## 24 GHz ADAS Radar Solutions

Part Number	Description	Function	RF (GHz)	Signal Bandwidth (MHz)	Phase Noise @ 10 MHz Offset (dBc/Hz)	Output Power (dBm)	Input	ADC Resolution	V <sub>TUNE</sub> (V)	Power (W)	Package (mm)	ECCN Code	Ordering Part Number
ADF5902	ISM band, 2-ch FMCW transmitter with integrated FMCW PLL	Tx MMIC	24 to 24.25	250	-128	2 to 12	Single ended	8-bit	1 to 2.8	0.002	5 × 5 LFCSP	EAR99	ADF5902WCCPZ

## Fractional-N/Integer-N PLLs

Part Number	Description	Frequency (GHz)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADF41513	Frac-N/int-N	1 to 26.5	-235	250	3.3	95.1	4 × 4 LFCSP	5A991.b	ADF41513BCPZ

## Wideband Fractional-N/Integer-N PLLs with Integrated VCO

Part Number	Description	Frequency (GHz)	Open-Loop VCO Phase Noise @ 100 kHz (dBc/Hz)	Open-Loop VCO Phase Noise @ 1 MHz (dBc/Hz)	F <sub>OUT</sub>	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADF5610	Wideband frac-N/int-N PLL and VCO	0.057 to 14.6	-114	-135	10	-229	100	3.3/5	126.7/110	7 × 7 LGA	EAR99	ADF5610BCCZ
ADF4372	Wideband frac-N/int-N PLL and VCO	0.062 to 16.0	-109	-133	8	-234	160	3.3/5	190/135	7 × 7 LGA	EAR99	ADF4372BCCZ
ADF4371	Wideband frac-N/int-N PLL and VCO	0.062 to 32.0	-100	-123	24	-234	160	3.3/5	190/135	7 × 7 LGA	EAR99	ADF4371BCCZ

## Ultrawideband VCOs

Part Number	Description	Frequency (GHz)	VCO Phase Noise @ 10 kHz (dBc/Hz)	VCO Phase Noise @ 100 kHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	V <sub>TUNE</sub> (V)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC6380	WB VCO with buffer	8 to 16	-64	-92	6	0 to 23	5	75	4 × 4 CLCC	EAR99	HMC6380LC4B
HMC8074	Quad-band VCO	8.3 to 15.2	-68	-98	0	0.5 to 13	4.75	60	6 × 6 LFCSP	EAR99	HMC8074LP6GE

## Wideband VCOs

Part Number	Description	Frequency (GHz)	VCO Phase Noise @ 10 kHz (dBc/Hz)	VCO Phase Noise @ 100 kHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	V <sub>TUNE</sub> (V)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC6475	WB VCO with buffer	3.9 to 7.5	-79	-106	5	0 to 23	5	53	4 × 4 CLCC	EAR99	HMC6475LC4B

## Tunable Low-Pass/Band-Pass Filters

Part Number	Description	Frequency (GHz)	Control	Cutoff Freq Range (MHz)	Stop-Band Frequency (Rej > 20 dB)	Tuning Response (ns)	Insertion Loss (dB)	Package (mm)	ECCN Code	Ordering Part Number
HMC890A	Tunable band-pass filter	1 to 1.9	f <sub>c</sub> and BW, analog 0 V to 14 V	10% f <sub>c</sub>	±10% f <sub>c</sub>	200	10	5 × 5 LFCSP	EAR99	HMC890ALP5E
HMC891A	Tunable band-pass filter	1.95 to 3.4	f <sub>c</sub> and BW, analog 0 V to 14 V	9% f <sub>c</sub>	±10% f <sub>c</sub>	200	10	5 × 5 LFCSP	EAR99	HMC891ALP5E
HMC881A	Tunable low-pass filter	0 to 4	f <sub>c</sub> , analog 0 V to 14 V	2.4 to 4	1.35 × f <sub>3dB</sub>	200	16.5	5 × 5 LFCSP	EAR99	HMC881ALP5E
HMC892A	Tunable band-pass filter	3.45 to 6.25	f <sub>c</sub> and BW, analog 0 V to 14 V	8.7% f <sub>c</sub>	±10% f <sub>c</sub>	200	9.6	5 × 5 LFCSP	EAR99	HMC892ALP5E
HMC882A	Tunable low-pass filter	3.95 to 6.9	f <sub>c</sub> , analog 0 V to 14 V	3.95 to 6.9	1.28 × f <sub>3dB</sub>	200	13	5 × 5 LFCSP	EAR99	HMC882ALP5E
ADMV8416	Tunable band-pass filter	7 to 16	f <sub>c</sub> , 0 V to 15 V, high/low band	16%	0.8 × f <sub>c</sub> , 1.17 × f <sub>c</sub>	200	8	6 × 6 LFCSP	EAR99	ADMV8416ACPZ
ADMV8420	Tunable band-pass filter	11 to 20	f <sub>c</sub> , analog 0 V to 14 V	20% f <sub>c</sub>	0.8 × f <sub>c</sub> to 1.2 × f <sub>c</sub>	200	5	4 × 4 LFCSP	EAR99	ADMV8420ACPZ
ADMV8432	Tunable band-pass filter	16 to 32	f <sub>c</sub> , 0 V to 15 V, high/low band	17%	0.75 × f <sub>c</sub> , 1.25 × f <sub>c</sub>	200	9	6 × 6 LFCSP	EAR99	ADMV8432ACPZ

## TruPwr rms Responding Detectors

Part Number	Description	Input Frequency (GHz)	Input Range (dBm)	Dynamic Range (dB)	V <sub>s</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADL5920	Directional bridge, dual rms detector	-0 to 7	-20 to +30	50	5	160	5 × 5 LFCSP	EAR99	ADL5920ACPZ-R2

## SPDT Switches

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Input P0.1dB (dBm)	Input IP3 (dBm)	Control Input (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
ADRF5019	Nonreflective	0.1 to 13	0.8	45	39	38	60	CMOS/LVTTL	3 × 3 LFCSP	EAR99	ADRF5019BCPZN
ADRF5027	SPDT, nonreflective	9 kHz to 44	2.2	48	—	—	54	0/3.3	3 × 3 LGA	EAR99	ADRF5027BCCZN
ADRF5026	SPDT, nonreflective	0.1 to 44	2.4	50	26	—	53	0/3.3	3 × 3 LGA	EAR99	ADRF5026BCCZN

## SP3T, SP4T, SP6T, SP8T Switches

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Input P0.1dB (dBm)	Input IP3 (dBm)	Control Input (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
ADRF5046	SP4T, reflective	0.1 to 44	2.5	33	—	27.5	50	0/3.3	3 × 3 LGA	EAR99	ADRF5046BCCZN

## Massive MIMO RF Front Ends

Part Number	Device Configuration	RF Features	Frequency (GHz)	Insertion Loss	Input Power	Gain	NF	Package (mm)	ECCN Code	Ordering Part Number
ADRF5549	Dual-channel	2-stage LNA, high power SPDT	1.8 to 2.8	0.6	49	35	1.4	6 × 6 LFCSP	EAR99	ADRF5549BCPZN
ADRF5545A	Dual-channel	2-stage LNA, high power SPDT	2.4 to 4.2	0.65	49	32	1.45	6 × 6 LFCSP	EAR99	ADRF5545ABCPZN

## Beamformers

Part Number	Description	Frequency (GHz)	Phase Adj Range (°)	Phase Adj Step (°)	Ampl Adj Range (dB)	Ampl Adj Step (dB)	Package (mm)	ECCN Code	Ordering Part Number
ADAR1000	4-ch, X-/Ku-band with unswitched Tx/Rx FE	8 to 16	360	2.8	31	0.5	7 × 7 LGA	EAR99	ADAR1000ACCZN

## Clock Dividers and Distribution

Part Number	Clock Function	Configuration/ Programming Interface	Number of Outputs	Output Frequency (MHz)	Output Logic	Power Dissipation (W)	Input Frequency (MHz)	Package (mm)	ECCN Code	Ordering Part Number
LTC6953	Clock distribution with sync	SPI	11	4500	CML	1.8	LF to 4500	7 × 8 LFCSP	EAR99	LTC6953IUUG#TRPBF

## Multioutput Clock Generators

Part Number	Supply Voltage (V)	Number of Reference Inputs	Number of Outputs	Number of Dividers	Number of Delay Lines	On-Chip VCO or DCO	Max Output Frequency (MHz)	Output Logic	Wideband Random Jitter (ps rms)	I/O Interface	Package (mm)	ECCN Code	Ordering Part Number
LTC6952	3.3/5	1	11	11	11	No	4500	CML	0.065	Serial with sync	7 × 8 LFCSP	EAR99	LTC6952IUUG#PBF

## Clock Buffers

Part Number	Supply Voltage (V)	Number of Inputs	Number of Outputs	Max Output Frequency (MHz)	Output Logic	Wideband Random Jitter (ps rms)	I/O Interface	Package (mm)	ECCN Code	Ordering Part Number
LTC6955	3.3	1	11	7500	CML	0.045	Pin select	7 × 8 LFCSP	EAR99	LTC6955IUUG#TRPBF
LTC6955-1	3.3	1	10/1	7500	CML	0.045	Pin select	7 × 8 LFCSP	EAR99	LTC6955IUUG-1#TRPBF

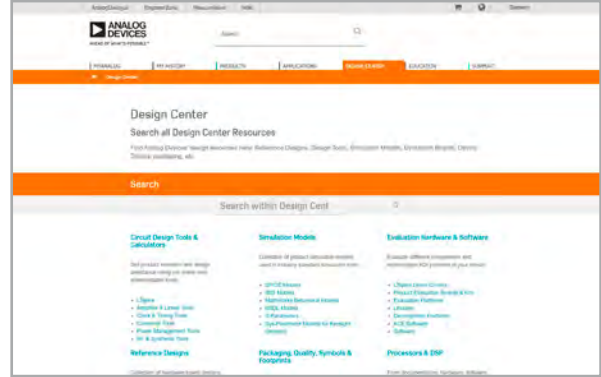
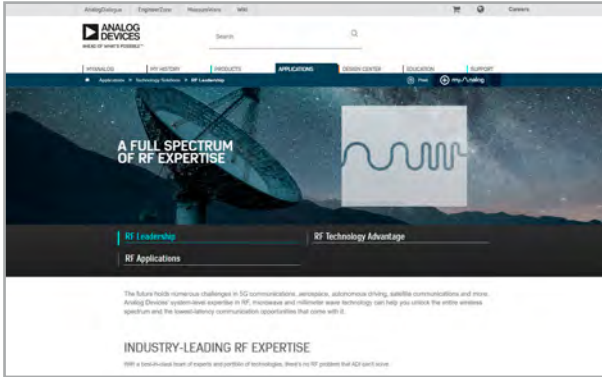


## New 5G mmWave Network Radio Solution and Massive MIMO Solution

ADI strives to provide the most advanced and most complete system solution whenever possible. Solutions may come in a combination of reference designs, single-chip functionality, multichip partitioning, module form, and/or with software algorithm. Our goal is to provide the optimal solution that enables our customers to solve their most challenging problems, add distinct features and values to differentiate themselves, and get to market with a competitive product at the fastest time.

For more information, please visit [analog.com/rf](http://analog.com/rf).

For design resources, visit [analog.com/en/design-center](http://analog.com/en/design-center).



## All Product Listings

RF and microwave technology is all around us—connecting us (ubiquitous mobility), guiding us (GPS/autonomous vehicle), moving us (aircraft), healing us (healthcare MRI scanners), and elevating us by making our everyday lives more efficient.

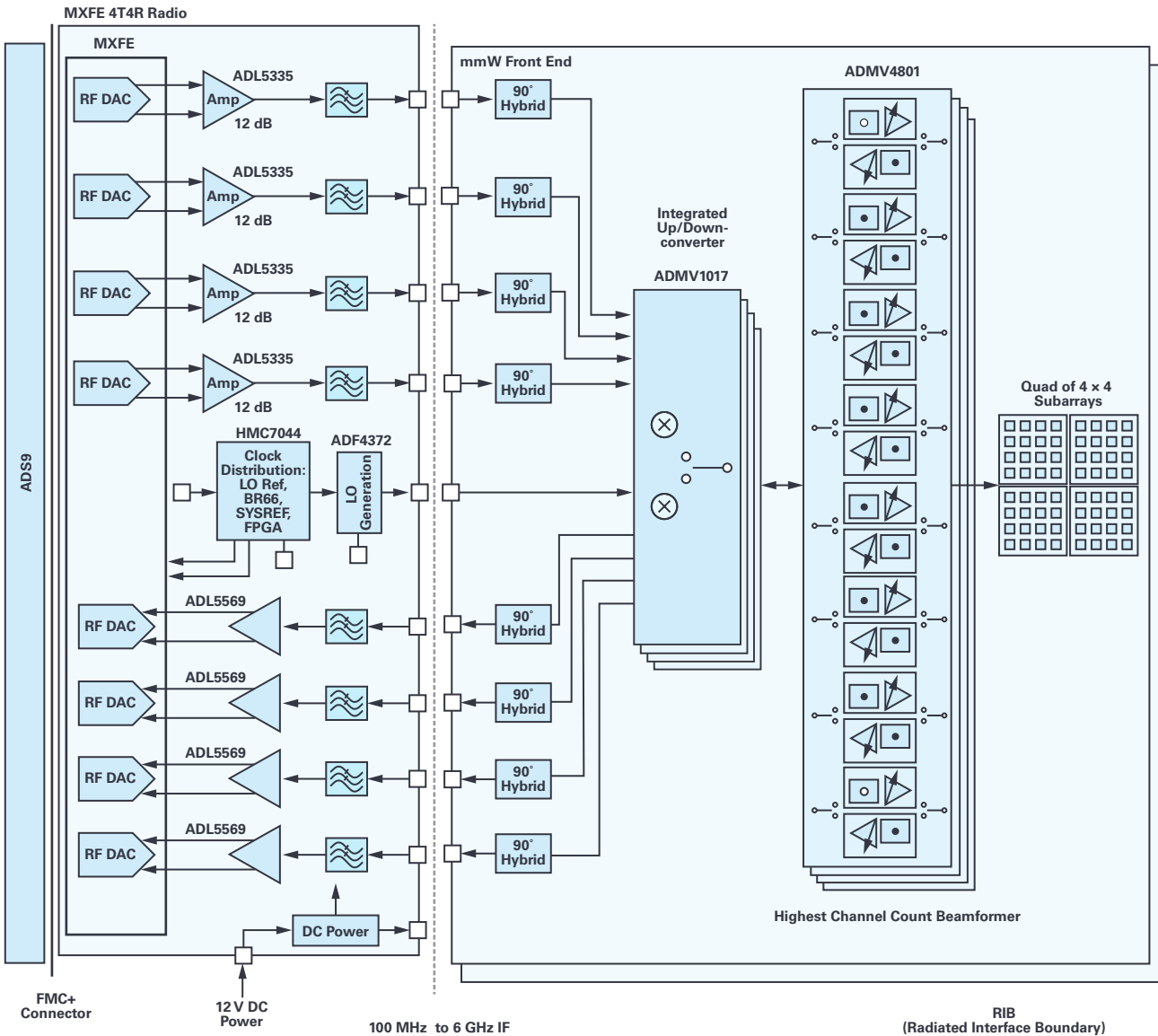


## Most Complete, Scalable 28 GHz 5G Network Radio Solution in the Industry

- ▶ 16-channel beamformer chip provides the highest density for small size and low cost
- ▶ Integrated up/downconverter offers highest performance and unmatched feature set
- ▶ Quad RF ADC and RF DAC support >2 GHz bandwidth for multigigabit wireless datalink

### Advantages

- ▶ Highest channel count for cost-effective scalability
- ▶ Smallest size for compact active antenna systems
- ▶ Flexible options for single polarization or horizontal and vertical polarization



#### AD9081: MxFE™ Quad, 16-Bit, 12 GSPS RF DAC and Quad, 12-Bit, 4 GSPS RF ADC

- ▶ Flexible reconfigurable radio common platform
- ▶ RF DAC/RF ADC BW of 5.2 GHz and 7.5 GHz
- ▶ On-chip PLL with multichip synchronization
- ▶ JESD204B (8b/10b, 16 Gbps) and JESD204C

#### ADMV1017: 24 GHz to 29.5 GHz Single-Chip Up/Downconverter

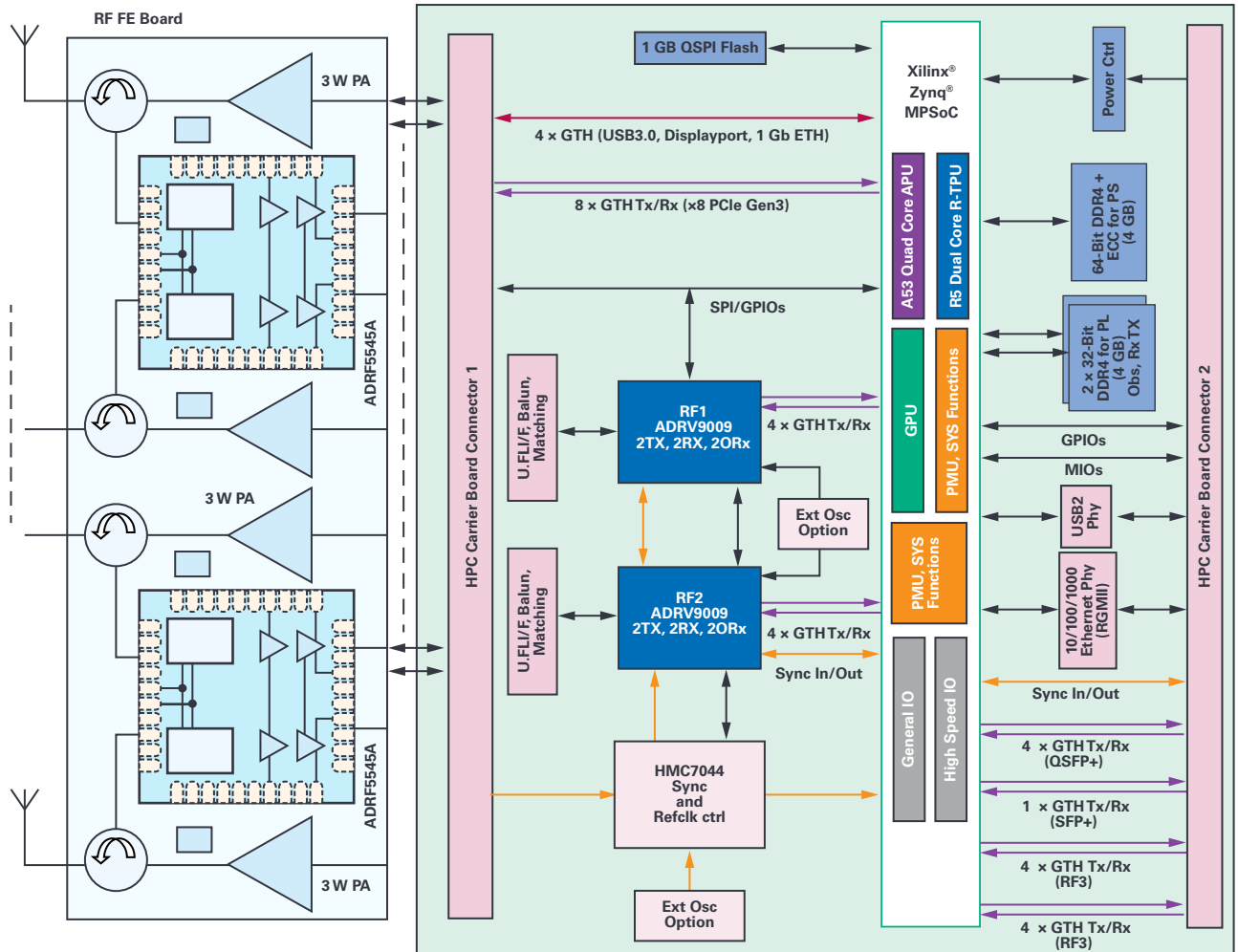
- ▶ Addressing n257, n258, n261 bands
- ▶ 1.5 GHz RF bandwidth
- ▶ Two up/downconversion modes
- ▶ LO doubler (x2) and quadrupler (x4) modes

#### ADMV4801/ADMV4821: 24 GHz to 29.5 GHz, 16-Channel Beamformer

- ▶ 16 selectable transmit/receive channels
  - ADMV4801: single polarization
  - ADMV4821: horizontal and vertical polarization
- ▶ Independent transmitter and receiver vector modulation control
- ▶ High resolution phase control
- ▶ High resolution DGAs for amplitude control
- ▶ Compact package

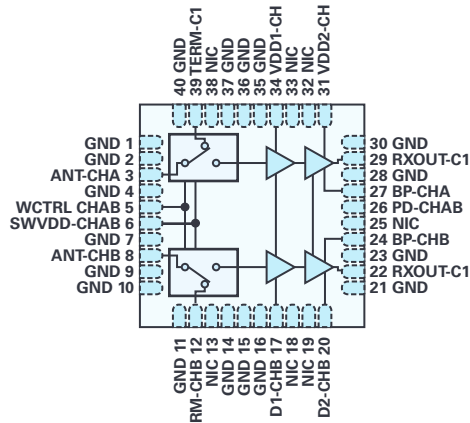
# Massive MIMO (M-MIMO): A Fast Track to the 5G Speed Race

A Complete 3.5 GHz M-MIMO Transceiver with RF Front-End Reference Design In Development Available Q4, 2019



## Dual-Channel Receiver Front Ends

- ▶ ADRF5545A: 2.4 GHz to 4.2 GHz
- ▶ ADRF5547: 3.7 GHz to 5.3 GHz
- ▶ ADRF5549: 1.8 GHz to 2.8 GHz

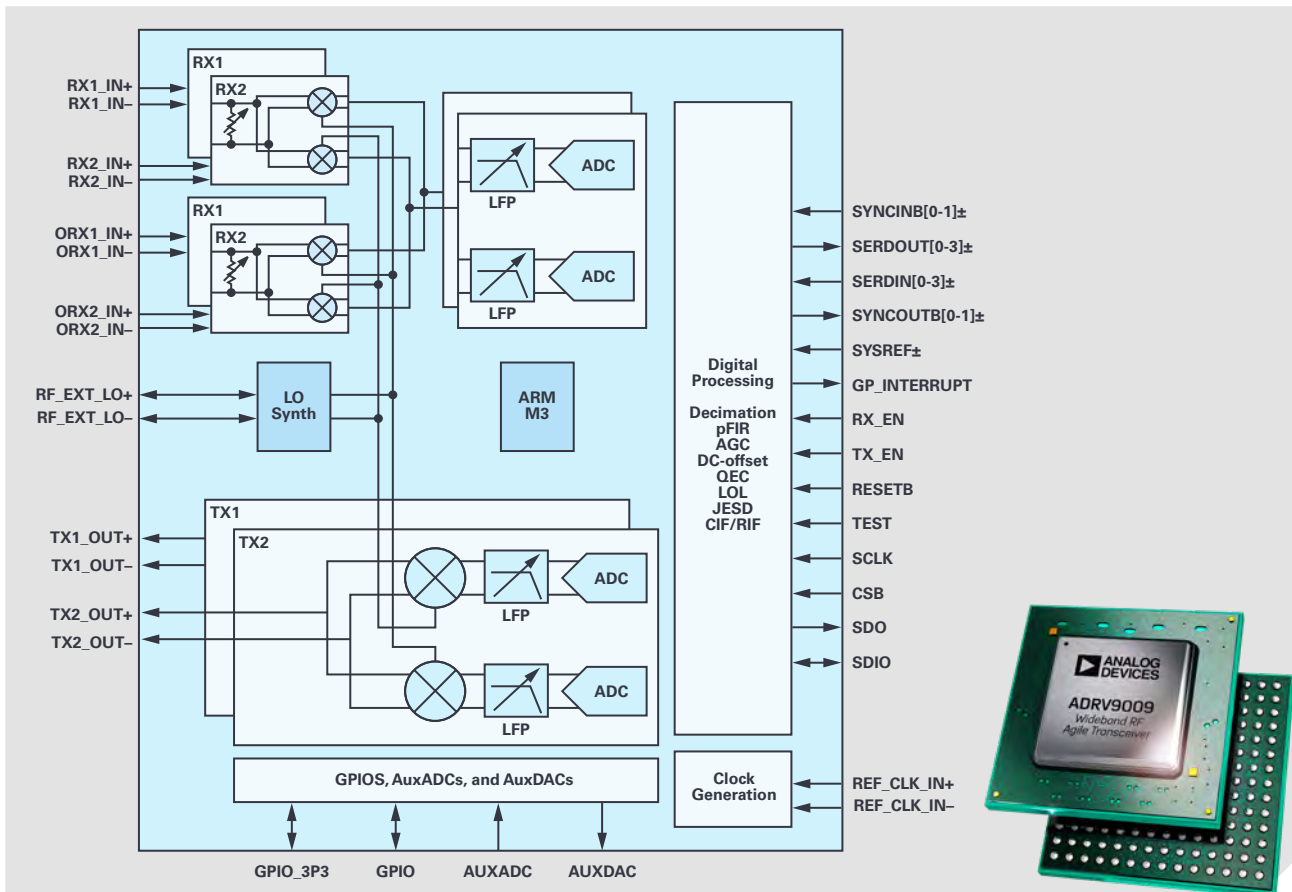


## Integrated High Power SPDT and 2-Stage LNA per Channel

- ▶ High power handling SPDT switch for LNA protection, solving a huge problem of protecting the receiver's front end in the presence of damaging RF power, while maintaining robust receiver performance.
  - 10 W continuous wave at 105°C, lifetime operation
  - 10 W LTE average power (9 dB PAR) at 105°C, lifetime operation
- 20 W LTE average power (9 dB PAR) at 105°C, single event
- ▶ Low noise figure: 1.45 dB at 3.6 GHz at receiver operation
- ▶ Low insertion loss: 0.65 dB at 3.6 GHz
- ▶ High channel isolation
- ▶ Integrated bias and matching circuits

## ADRV9009 SoM Development Platform: Wideband Integrated 2 × 2 Transceiver Can Multichannel Sync to Scale M-MIMO

- ▶ Operating frequency: 100 MHz to 6 GHz
- ▶ Dual transmitters, dual receivers and observation receivers with shared inputs
- ▶ Supports multichip LO phase synchronization
- ▶ Optimized for TDD operation
- ▶ Bandwidth: 200 MHz receiver, 450 MHz transmitter and observation receiver
- ▶ Integrated AGC, dc offset and quadrature error correction
- ▶ Interface: 12 Gbps JESD204B
- ▶ Rich suite of software support available
- ▶ Package: 12 mm × 12 mm BGA



# RF Amplifiers

## RF/IF Differential Amplifiers

Part Number	Description	Frequency (MHz)	Gain Range (dB)	Output IP3 (dBm)	2 <sup>nd</sup> /3 <sup>rd</sup> Harmonic (dBc)	Noise Figure at Max Gain (dB)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
LT1994	R/R output, resistor programmed	0 to 70	0 to 40	—	−88/−84	—	3, 5, ±5	14.8	3 × 3 DFN MSOP	EAR99	LT1994CDD#TRPBF LT1994IDD#TRPBF LT1994HDD#TRPBF LT19994MPDD#TRPBF LT19994CMS8#TRPBF LT19994IMS8#TRPBF
AD8372	Dual DVGA, 1 dB step	1 to 130	−9 to +32	35	−78/−85	7.9	5	212	5 × 5 LFCSP	EAR99	AD8372ACPZ-R7
LTC6403-1	Resistor programmed	0 to 200	0 to 40	28	−76/−74	10.8	3, 5	11	3 × 3 QFN	EAR99	LTC6403CUD-1#TRPBF LTC6403IUD-1#TRPBF
LT6402-6	Fixed 6 dB gain	0 to 300	6	36	−84/−84	12.6	5	30	3 × 3 QFN	EAR99	LT6402CUD-6#TRPBF LT6402IUD-6#TRPBF
LT6402-12	Fixed 12 dB gain	0 to 300	12	37	−82/−73	15.1	5	30	3 × 3 QFN	EAR99	LT6402CUD-12#TRPBF LT6402IUD-12#TRPBF
LT6402-20	Fixed 20 dB gain	0 to 300	20	36.5	−80/−80	12.5	5	30	3 × 3 QFN	EAR99	LT6402CUD-20#TRPBF LTC6402IUD-20#TRPBF
LTC6404-1	Unity-gain stable, resistor programmed	0 to 500	0	41.5	−102/−90	13.4	3, 5	27.8	3 × 3 QFN	EAR99	LTC6404CUD-1#TRPBF LTC6404IUD-1#TRPBF LTC6404HUD-1#TRPBF
AD8375	Dual DVGA, 1 dB step	15 to 630	−4 to +20	50	−85/−92	8.3	5	125	4 × 4 LFCSP	EAR99	AD8375ACPZ-R7
LT6411	Dual selectable gain	0.1 to 650	+1, −2, −1	30	−63/−52	24.7	5, 12	16	3 × 3 QFN	EAR99	LT6411CUD#TRPBF LT6411IUD#TRPBF
LTC6405	Resistor programmed	0 to 700	0 to 40	23.4	−82/−65	7.5	5	18	3 × 3 QFN	EAR99	LTC6405CUD#TRPBF LTC6405IUD#TRPBF
LT1993-10	Fixed 20 dB gain	0 to 700	20	40	−77/−67	12.7	5	100	3 × 3 QFN	EAR99	LT1993CUD-10#TRPBF LT1993IUD-10#TRPBF
ADL5201	DVGA, parallel and serial control, 0.5 dB step	10 to 700	−11.5 to +20	51	−89/−97	7.5	5	110	4 × 4 LFCSP	EAR99	ADL5201ACPZ-R7
ADL5202	Dual DVGA, parallel and serial control, 0.5 dB step	10 to 700	−11.5 to +20	50	−86/−105	7.5	5	210	6 × 6 LFCSP	EAR99	ADL5202ACPZ-R7
AD8376	Dual DVGA, 1 dB step	15 to 700	−4 to +20	50	−82/−91	8.7	5	250	5 × 5 LFCSP	EAR99	AD8376ACPZ-R7
AD8370	DVGA, <1 dB step	10 to 750	−8 to +34	35	−65/−62	7.2	3, 5	79	TSSOP	EAR99	AD8370AREZ-RL7
LT1993-2	Fixed 6 dB gain	0 to 800	6	38	−72/−69	12.3	5	100	3 × 3 QFN	EAR99	LT1993CUD-2#TRPBF LT1993IUD-2#TRPBF
LT1993-4	Fixed 12 dB gain	0 to 900	12	40	−76/−70	14.5	5	100	3 × 3 QFN	EAR99	LT1993CUD-4#TRPBF LT1993IUD-4#TRPBF
LTC6404-2	>6 dB gain resistor programmed	0 to 900	>6	45	−98/−98	10	3, 5	30.4	3 × 3 QFN	EAR99	LTC6404CUD-2#TRPBF LTC6404IUD-2#TRPBF LTC6404HUD-2#TRPBF
AD8350	Fixed-gain	1 to 900	15	28	−66/−65	6.8	5	28, 30	SOIC	EAR99	AD8350ARMZ15-REEL7
AD8350	Fixed-gain	1 to 900	20	28	−66/−65	6.8	5	28, 30	MSOP	EAR99	AD8350ARMZ20-REEL7
LTC6401-20	Fixed 20 dB gain	0 to 1300	20	30.5	−80/−57	6.4	3	50	3 × 3 QFN	EAR99	LTC6401CUD-20#TRPBF LTC6401IUD-20#TRPBF
LTC6421-20	Dual matched differential amplifiers	0 to 1300	20	33.2	−74/−78	6.2	3	80	3 × 4 QFN	EAR99	LTC6421CUDC-20#TRPBF LTC6421IUDC-20#TRPBF
LTC6432-15	Low noise to 100 kHz, fixed gain	0.1 to 1400	15.9	50.3	−92.2/−90	3.2	5	166	4 × 4 QFN	EAR99	LTC6432AIUF-15#TRPBF
LTC6432-15	Low noise to 100 kHz, fixed gain	0.1 to 1400	15.9	47	−92.2/−90	3.2	5	166	4 × 4 QFN	EAR99	LTC6432BIUF-15#TRPBF
LTC6410-6	Configurable R <sub>IN</sub>	0 to 1400	6	36	−85/−69	8	3, 5	125	3 × 3 QFN	EAR99	LTC6410CUD-6#TRPBF LTC6410IUD-6#TRPBF
LTC6401-26	Fixed 26 dB gain	0 to 1600	26	40	−81/−54	6.5	3	45	3 × 3 QFN	EAR99	LTC6401CUD-26#TRPBF LTC6401IUD-26#TRPBF
LTC6417	Differential buffer with fast clamp	0 to 1600	0	39	−100/−66	13	5	123	3 × 4 QFN	EAR99	LTC6417CUDC#TRPBF LTC6417IUDC#TRPBF
LTC6420-20	Dual matched differential amplifiers	0 to 1800	20	37.2	−80/−88	6.2	3	160	3 × 4 QFN	EAR99	LTC6420CUDC-20#TRPBF LTC6420IUDC-20#TRPBF
ADL5205	Dual DVGA, parallel and serial control, 1 dB step	0 to 1700	−9 to +26	48.5	−75/−87.5	6.6	3.3, 5	175	6 × 6 LFCSP	5A991.b	ADL5205ACPZ-R7
LTC6404-4	>12 dB gain resistor programmed	0 to 1700	>12	45.5	−100/−100	8	3, 5	31	3 × 3 QFN	EAR99	LTC6404CUD-4#TRPBF LTC6404IUD-4#TRPBF LTC6404HUD-4#TRPBF
LTC6400-20	Fixed 20 dB gain	0 to 1800	20	41.5	−74/−74	6.5	3	90	3 × 3 QFN	EAR99	LTC6400CUD-20#TRPBF LTC6400IUD-20#TRPBF

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools.

## RF/IF Differential Amplifiers (Continued)

Part Number	Description	Frequency (MHz)	Gain Range (dB)	Output IP3 (dBm)	2 <sup>nd</sup> /3 <sup>rd</sup> Harmonic (dBc)	Noise Figure at Max Gain (dB)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
LTC6400-14	Fixed 14 dB gain	0 to 1900	14	38	-78/-74	7.7	3	85	3 × 3 QFN	EAR99	LTC6400CUD-14#TRPBF
LTC6400-26	Fixed 26 dB gain	0 to 1900	26	38	-83/-72	6.9	3	85	3 × 3 QFN	EAR99	LTC6400CUD-26#TRPBF LTC6400IUD-26#TRPBF
LTC6401-14	Fixed 14 dB gain	0 to 2000	14	33	-79/-57	7.4	3	45	3 × 3 QFN	EAR99	LTC6401CUD-14#TRPBF LTC6401IUD-14#TRPBF
LTC6430-15	Fixed 15.2 dB gain	20 to 2000	15.2	50	-80.5/-87	3	5	160	4 × 4 QFN	EAR99	LTC6430AIUF-15#TRPBF
LTC6430-15	Fixed 15.2 dB gain	20 to 2000	15.2	47	-80.5/-87	3	5	160	4 × 4 QFN	EAR99	LTC6430BIUF-15#TRPBF
LTC6430-20	Fixed 20 dB gain	20 to 2060	20.8	51	-79.8/ -80.9	2.9	5	170	4 × 4 QFN	EAR99	LTC6430AIUF-20#TRPBF
LTC6430-20	Fixed 20 dB gain	20 to 2060	20.8	47	-79.8/ -80.9	2.9	5	170	4 × 4 QFN	EAR99	LTC6430BIUF-20#TRPBF
LTC6416	Differential buffer with prog output clamp	0.1 to 2000	0	40	-75/-59	6.4	3	42	3 × 2 DFN	EAR99	LTC6416CDD#TRPBF LTC6416IDD#TRPBF
LTC6400-8	Fixed 8 dB gain	0 to 2200	8	37.5	-86/-71	7.7	3	85	3 × 3 QFN	EAR99	LTC6400CUD-8#TRPBF LTC6400IUD-8#TRPBF
LTC6401-8	Fixed 8 dB gain	0 to 2200	8	33.5	-78/-59	12.3	3	45	3 × 3 QFN	EAR99	LTC6401CUD-8#TRPBF LTC6401IUD-8#TRPBF
AD8351	Resistor programmed	10 to 2200	0 to 26	31	-79/-81	15.5	3, 5	28	MSOP	EAR99	AD8351ACPZ-R7
AD8352	Resistor programmed	10 to 2200	3 to 25	41	-83/-82	15.5	3, 5	37	3 × 3 LFCSP	EAR99	AD8352ACPZ-R7
ADL5561	Pin strap	10 to 2900	6, 12, 15.5	49	-95/-87	8	3.3	40	3 × 3 LFCSP	EAR99	ADL5561ACPZ-R7
LTC6406	Resistor programmed	0 to 3000	0 to 40	24.4	-77/-65	7.5	3	18	3 × 3 QFN MSOP	EAR99	LTC6406CUD#TRPBF LTC6406IUD#TRPBF LTC6406CMS8E#TRPBF LTC6406IMS8E#TRPBF
ADA4961	DVGA, parallel and serial control, 1 dB step	10 to 3200	-3 to +18	50	-84/-100	5.6	3, 5	150	4 × 4 LFCSP	EAR99	ADA4961ACPZN-R7
ADL5562	Pin strap	0 to 3300	6, 12, 15.5	47	-104/-87	7.3	3.3	80	3 × 3 LFCSP	EAR99	ADL5562ACPZ-R7
ADL5567	Dual	0 to 4300	20	49.8	-94/-103	7.1	3.3, 5	148	4 × 4 LFCSP	EAR99	ADL5567ACPZN-R7
ADL5566	Dual	0 to 4500	16	51	-94.7/ -100	6.58	3, 5	140, 160	4 × 4 LFCSP	EAR99	ADL5566ACPZ-R7
ADL5569	Differential amplifier/ ADC driver	0 to 6500	20	41	-78/-71	9.3	5	86	2.5 × 3 LFCSP	EAR99	ADL5569BCPZ
ADL5565	Pin strap	0 to 7000	6, 12, 15.5	53	-108/-103	8.7	3, 5	70, 80	3 × 3 LFCSP	EAR99	ADL5565ACPZ-R7
LTC6409	Resistor programmed	0 to 10,000	0 to 52	39	-88/-93	6.9	3, 5	52	3 × 2 QFN	EAR99	LTC6409CUD#TRPBF LTC6409IUD#TRPBF LTC6409HUID#TRPBF
LTC6419	Dual, resistor programmed	0 to 10,000	0 to 52	33.5	-85/-83	6.9	3, 5	104	4 × 3 LQFN	EAR99	LTC6419IV#PBF LTC6419HV#PBF

## Low Noise Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1 (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC356	LNA	0.35 to 0.55	17	21	38	1	External	5	104	3 × 3 LFCSP	EAR99	HMC356LP3E
HMC549	LNA	0.04 to 0.96	5	12	27	3.5	Internal	5	120	MSOP	EAR99	HMC549MS8GE
HMC373	LNA	0.7 to 1	14	20	35	1	Internal	5	90	3 × 3 LFCSP	EAR99	HMC373LP3E
HMC376	LNA	0.7 to 1	15	21	36	0.7	Internal	5	73	3 × 3 LFCSP	EAR99	HMC376LP3E
HMC372	LNA	0.7 to 1	15	21	34	1	External	5	100	3 × 3 LFCSP	EAR99	HMC372LP3E
HMC618A	LNA	1.2 to 2.2	19	20	36	0.75	External	5	117	3 × 3 LFCSP	EAR99	HMC618ALP3E
HMC375	LNA	1.7 to 2.2	17	18	34	0.9	External	5	136	3 × 3 LFCSP	EAR99	HMC375LP3E
HMC382	LNA	1.7 to 2.2	17	16	30	1	Internal	5	67	3 × 3 LFCSP	EAR99	HMC382LP3E
HMC374	LNA	0.3 to 3	15	22	37	1.5	Internal	5	90	SOT-26	EAR99	HMC374E
HMC374*	LNA	0.3 to 3	15	17	35	1.6	Internal	3.3	75	SC70	EAR99	HMC374SC70E
ADL5521	LNA	0.4 to 4	20.8	22	37	0.9	External	5	60	3 × 3 LFCSP	5A991.b	ADL5521ACPZ-R7
ADL5523	LNA	0.4 to 4	21.5	21	34	0.8	External	5	60	3 × 3 LFCSP	5A991.b	ADL5523ACPZ-R7
HMC717A	LNA	4.8 to 6	14.5	18	29.5	1.3	External	5	68	3 × 3 LFCSP	EAR99	HMC717ALP3E
HMC392A	LNA	3.5 to 7	17.2	19.5	32.5	1.7	Internal	5	59	Die	EAR99	HMC392A
HMC392A	LNA	3.5 to 8	17	19	34.5	1.8	Internal	5	61	4 × 4 LFCSP	EAR99	HMC392ALC4

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Low Noise Amplifiers (Continued)

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>s</sub> (V)	I <sub>sy</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADL8111 <b>New</b>	LNA	0.01 to 8	12.5	17	34	2.8	Internal	5	70	6 × 6 LGA	EAR99	ADL8111ACCZN
ADL5721	LNA	5.9 to 8.5	25.9	16.6	29.9	1.6	Internal	3.3	86.5	2 × 2 LFCSP	EAR99	ADL5721ACPZN-R7
HMC8410	LNA	0.01 to 10	19.5	21.5	33	1.1	Internal	5	65	2 × 2 LFCSP	EAR99	HMC8410LP2FE
HMC8410	LNA	0.01 to 10	19	21	33	1.3	Internal	5	65	Die	EAR99	HMC8410
HMC8411 <b>New</b>	Wideband LNA	0.01 to 10	15	20	34	1.7	Internal	3, 5	55	2 × 2 LFCSP	EAR99	HMC8411LP2FE
HMC902*	LNA	5 to 10	19	16	28	1.8	Internal	3.5	80	3 × 3 LFCSP	EAR99	HMC902LP3E
HMC902	LNA	5 to 10	20	16	28	1.6	Internal	3.5	80	Die	EAR99	HMC902
HMC753	LNA	1 to 11	17	18	30	1.5	Internal	5	55	4 × 4 LFCSP	EAR99	HMC753LP4E
ADL5723	LNA	10.1 to 11.7	24.5	14.5	26.7	2.2	Internal	3.3	109.1	2 × 2 LFCSP	EAR99	ADL5723ACPZN-R7
HMC-ALH444	LNA	1 to 12	17	19	28	1.5	Internal	5	55	Die	EAR99	HMC-ALH444
HMC772	LNA	2 to 12	15	13	25	1.8	Internal	4	45	4 × 4 LFCSP	EAR99	HMC772LC4
HMC564	LNA	7 to 14	17	12	24	1.8	Internal	3	51	Die	EAR99	HMC564
HMC564*	LNA	7 to 14	17	13	25	1.8	Internal	3	51	4 × 4 LFCSP	EAR99	HMC564LC4
ADL5724	LNA	12.7 to 15.4	26.4	15.4	28.4	2.1	Internal	3.3	109.7	2 × 2 LFCSP	EAR99	ADL5724ACPZN-R7
HMC490	LNA	12 to 16	27	25	35	2.5	Internal	5	200	5 × 5 LFCSP	EAR99	HMC490LP5E
HMC490	LNA	12 to 17	27	26	35	2	Internal	5	200	Die	EAR99	HMC490
HMC903*	LNA	6 to 17	18	14	25	1.7	Internal	3.5	80	3 × 3 LFCSP	EAR99	HMC903LP3E
HMC903	LNA	6 to 18	19	15	27	1.6	Internal	3.5	90	Die	EAR99	HMC903
HMC516*	LNA	9 to 18	20	13	25	2	Internal	3	65	5 × 5 LFCSP	EAR99	HMC516LC5
HMC516	LNA	9 to 18	21	13	20	2	Internal	3	65	Die	EAR99	HMC516
ADL5725	LNA	17.7 to 19.7	27.8	13.8	26.3	2.4	Internal	3.3	108	2 × 2 LFCSP	EAR99	ADL5725ACPZN-R7
HMC-ALH435	LNA	5 to 20	13	16	25	2.2	Internal	5	30	Die	EAR99	HMC-ALH435
HMC565	LNA	6 to 20	21	10	20	2.5	Internal	3	53	5 × 5 LFCSP	EAR99	HMC565LC5
HMC565	LNA	6 to 20	22	10	20	2.3	Internal	3	53	Die	EAR99	HMC565
ADL5726	LNA	21.2 to 23.6	24.7	15.2	25.7	3.3	Internal	3.3	92.4	2 × 2 LFCSP	EAR99	ADL5726ACPZN-R7
HMC342	LNA	13 to 25	20	5	13	3.5	Internal	3	43	Die	EAR99	HMC342
HMC342*	LNA	13 to 25	22	9	20	3.5	Internal	3	43	3 × 3 LFCSP	EAR99	HMC342LC4
HMC517*	LNA	17 to 26	19	13	23	2.5	Internal	3	67	4 × 4 LFCSP	EAR99	HMC517LC4
HMC517	LNA	17 to 26	20	11	23	2	Internal	3	65	Die	EAR99	HMC517
HMC963*	LNA	6 to 26.5	22	10	18	2.5	Internal	3.5	45	4 × 4 LFCSP	EAR99	HMC963LC4
HMC962*	LNA	7.5 to 26.5	13	13	23	2.5	Internal	3.5	70	4 × 4 LFCSP	EAR99	HMC962LC4
HMC-ALH311	LNA	22 to 26.5	25	12	—	3	Internal	2.5	54	Die	5A991.h	HMC-ALH311
HMC-ALH216	LNA	14 to 27	18	14	—	2.5	Internal	4	90	Die	5A991.h	HMC-ALH216
HMC504	LNA	14 to 27	19.5	17	26	2.2	Internal	4	90	4 × 4 LFCSP	5A991.h	HMC504LC4B
HMC-ALH476	LNA	14 to 27	20	14	—	2	Internal	4	90	Die	5A991.h	HMC-ALH476
HMC751	LNA	17 to 27	25	13	25	2.2	Internal	4	73	4 × 4 LCC	EAR99	HMC751LC4
HMC8401	LNA	0.01 to 28	14.5	16.5	26	1.5	Internal	7.5	60	Die	EAR99	HMC8401
HMC7950	LNA	2 to 28	15	16	26	2	Internal	5	64	6 × 6 QFN	EAR99	HMC7950LS6
HMC752	LNA	24 to 28	25	13	26	2.5	Internal	3	70	4 × 4 LFCSP	EAR99	HMC752LC4
HMC341	LNA	21 to 29	13	6	16	2.5	Internal	3	30	Die	EAR99	HMC341
HMC341	LNA	21 to 29	13	8	19	2.5	Internal	3	35	3 × 3 LFCSP	EAR99	HMC341LC3B
HMC8400	LNA	0.2 to 30	13.5	14.5	26.5	2	Internal	5	67	Die	3A001.b.2.d	HMC8400
HMC8402	LNA	2 to 30	13.5	21.5	26	2	Internal	7	68	Die	3A001.b.2.d	HMC8402
HMC519*	LNA	18 to 31	14.4	11	23	3	Internal	3	75	4 × 4 LFCSP	EAR99	HMC519LC4
HMC519	LNA	18 to 31	15	14	23	3	Internal	3	75	Die	EAR99	HMC519
HMC518	LNA	20 to 32	15	12	23	3	Internal	3	65	Die	3A001.b.2.d	HMC518
HMC-ALH364	LNA	24 to 32	21	7	—	2	Internal	5	68	Die	3A001.b.2.d	HMC-ALH364
HMC-ALH313	LNA	27 to 33	20	12	—	3	Internal	2.5	52	Die	3A001.b.2.d	HMC-ALH313
HMC263	LNA	24 to 36	20	8	18	2.2	Internal	3	58	3 × 3 LFCSP	3A001.b.2.d	HMC263LP4E
HMC263	LNA	24 to 36	22	8	17	2	Internal	3	58	Die	3A001.b.2.d	HMC263
HMC566	LNA	29 to 36	20	12	24	2.8	Internal	3	80	Die	3A001.b.2.d	HMC566
HMC566	LNA	29 to 36	21	12	24	2.8	Internal	3	82	4 × 4 LFCSP	3A001.b.2.d	HMC566LP4E
HMC-ALH445	LNA	18 to 40	10	12	—	3.9	Internal	5	45	Die	3A001.b.2.d	HMC-ALH445
HMC-ALH140	LNA	24 to 40	11.5	15	—	4	Internal	4	60	Die	3A001.b.2.d	HMC-ALH140
HMC-ALH244	LNA	24 to 40	12	13	—	3.5	Internal	4	45	Die	3A001.b.2.d	HMC-ALH244
HMC-ALH369	LNA	24 to 40	22	11	—	2	Internal	5	66	Die	3A001.b.2.d	HMC-ALH369
HMC1040	LNA	20 to 43.5	22	12	22	2.7	Internal	2.5	70	3 × 3 LFCSP	3A001.b.2.d	HMC1040LP3CE

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave





## Gain Blocks and Driver Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SV</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADL5534	Gain block	0.02 to 0.5	21	20	40	2.5	Internal	5	98	5 × 5 LFCSP	EAR99	ADL5534ACPZ-R7
ADL5531	Gain block	0.02 to 0.5	20.9	20	41	2.5	Internal	5	100	3 × 3 LFCSP	EAR99	ADL5531ACPZ-R7
ADL5536*	Gain block	0.02 to 1	20	20	45	2.6	Internal	5	105	SOT-89	EAR99	ADL5536ARKZ-R7
ADL5535*	Gain block	0.02 to 1	16	19	46	3.2	Internal	5	97	SOT-89	EAR99	ADL5535ARKZ-R7
ADL5530	Gain block	0 to 1	16.8	22	37	3	Internal	3	110	2 × 3 LFCSP	EAR99	ADL5530ACPZ-WP
LTC6433-15	Gain block	0.0001 to 1.4	15.9	19.2	47	3.22	Internal	5	95	4 × 4 QFN	EAR99	LTC6433AIUF-15#TRPBF
LTC6433-15	Gain block	0.0001 to 1.4	15.9	19.2	45	3.22	Internal	5	95	4 × 4 QFN	EAR99	LTC6433BIUF-15#TRPBF
LTC6431-20	Gain block	0.02 to 1.4	20.8	22	46.2	2.6	Internal	5	93	4 × 4 QFN	EAR99	LTC6431AIUF-20#TRPBF
LTC6431-20	Gain block	0.02 to 1.4	20.8	22	45.7	2.6	Internal	5	93	4 × 4 QFN	EAR99	LTC6431BIUF-20#TRPBF
LTC6431-15	Gain block	0.02 to 1.7	15.5	20.6	47	3.33	Internal	5	85.1	4 × 4 QFN	EAR99	LTC6431AIUF-15#TRPBF
LTC6431-15	Gain block	0.02 to 1.7	15.5	20.6	45.5	3.33	Internal	5	85.1	4 × 4 QFN	EAR99	LTC6431BIUF-15#TRPBF
AD8354	Gain block	0.001 to 2.7	20	5	19	4.2	Internal	3	25	2 × 3 LFCSP	EAR99	AD8354ACPZ-REEL7
AD8353	Gain block	0.001 to 2.7	20	9	24	5.6	Internal	3	42	2 × 3 LFCSP	EAR99	AD8353ACPZ-REEL7
HMC741*	Gain block	0.05 to 3	20	19	42	2.5	Internal	5	96	SOT-89	EAR99	HMC741ST89E
HMC740*	Gain block	0.05 to 3	15	18	40	3.5	Internal	5	88	SOT-89	EAR99	HMC740ST89E
ADL5601*	Gain block	0.05 to 4	15	19	43	3.7	Internal	5	83	SOT-89	EAR99	ADL5601ARKZ-R7
ADL5602*	Gain block	0.05 to 4	19.3	19	42	3.3	Internal	5	89	SOT-89	EAR99	ADL5602ARKZ-R7
HMC395	Gain block	0 to 4	15	15	28	4.5	Internal	5	54	Die	EAR99	HMC395
HMC589A*	Gain block	0 to 4	21	21	33	4.5	Internal	5	82	SOT-89	EAR99	HMC589AST89E
HMC636*	Gain block	0.2 to 4	13	22	40	2.2	Internal	5	155	SOT-89	EAR99	HMC636ST89
HMC480*	Gain block	0 to 5	19	20	34	2.9	Internal	8	82	SOT-89	EAR99	HMC480ST89
HMC313	Gain block	0 to 6	17	14	27	6.5	Internal	5	50	SOT-26	EAR99	HMC313
ADL5545*	Gain block	0.03 to 6	24.1	18	36	2.9	Internal	5	56	SOT-89	EAR99	ADL5545ARKZ-R7
ADL5544*	Gain block	0.03 to 6	17.4	18	35	2.9	Internal	5	55	SOT-89	EAR99	ADL5544ARKZ-R7
ADL5610*	Gain block	0.03 to 6	18.4	21	38	2.1	Internal	5	91	SOT-89	EAR99	ADL5610ARKZ-R7
ADL5611*	Gain block	0.03 to 6	22.1	21	39	2.1	Internal	5	91	SOT-89	EAR99	ADL5611ARKZ-R7
ADL5542	Gain block	0.05 to 6	18.7	18	39	3.2	Internal	5	93	3 × 3 LFCSP	EAR99	ADL5542ACPZ-R7
ADL5541	Gain block	0.05 to 6	14.7	16	39	3.8	Internal	5	90	3 × 3 LFCSP	EAR99	ADL5541ACPZ-R7
HMC311*	Gain block	0 to 6	15	16	32	5	External	5	55	SOT-89	EAR99	HMC311ST89E
HMC311*	Gain block	0 to 6	14.5	16	32	4.5	External	5	55	3 × 3 LFCSP	EAR99	HMC311LP3E
HMC311*	Gain block	0 to 8	15	15	30	5	External	5	55	SC70	EAR99	HMC311SC70E
HMC396	Gain block	0 to 8	12	14	30	6	Internal	5	56	Die	EAR99	HMC396
HMC405	Gain block	0 to 10	16	13	25	4	Internal	5	50	Die	EAR99	HMC405
HMC397	Gain block	0 to 10	15	13	24	4.5	Internal	5	56	Die	EAR99	HMC397
HMC788A	Gain block	0 to 10	14	20	33	7	Internal	5	76	2 × 2 LFCSP	EAR99	HMC788ALP2E
HMC3587	Gain block	-0 to 10	14.5	11	25	3.5	Internal	5	44	3 × 3 LFCSP	EAR99	HMC3587LP3BE
HMC3653*	Gain block	0.007 to 15	15	15	28	4	Internal	5	44	3 × 3 LFCSP	EAR99	HMC3653LP3BE
ADL5605	1 W driver amp	0.7 to 1	23	31	44	4.8	External	5	307	4 × 4 LFCSP	EAR99	ADL5605ACPZ-R7
ADL5320*	0.25 W driver amp	0.4 to 2.7	13.2	26	42	4.4	External	3.3	47	SOT-89	EAR99	ADL5320ARKZ-R7
ADL5604	1 W driver amp	0.7 to 2.7	12.2	29	42	4.6	External	5	318	4 × 4 LFCSP	EAR99	ADL5604ACPZ-R7
ADL5606	1 W driver amp	1.8 to 2.7	24.3	31	46	4.7	External	5	362	4 × 4 LFCSP	EAR99	ADL5606ACPZ-R7
HMC789*	0.25 W driver amp	0.7 to 2.8	18	25	42	3.8	External	5	125	SOT-89	EAR99	HMC789ST89E
ADL5324*	0.5 W driver amp	0.4 to 4	14	29	44	3.5	External	3.3	60	SOT-89	EAR99	ADL5324ARKZ-R7

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Gain Blocks and Driver Amplifiers (Continued)

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SV</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADL5321*	0.25 W driver amp	2.3 to 4	14	26	41	4	External	3.3	37	SOT-89	EAR99	ADL5321ARKZ-R7
HMC326	0.25 W driver amp	3 to 4.5	21	24	36	5	Internal	5	130	MSOP	EAR99	HMC326MS8G

## Wideband Distributed Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SV</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC637A*	Distributed	0 to 6	13	29	44	5	Internal	12	400	5 × 5 LFCSP	EAR99	HMC637ALP5E
HMC637A	1 W, output distributed	0 to 6	14	30.5	41	4	Internal	12	400	Die	EAR99	HMC637A
HMC637B	Distributed	0 to 7.5	15.5	28	39	3.5	Internal	12	345	5 × 5 LFCSP	EAR99	HMC637BPM5E
HMC659	Distributed	0 to 15	19	27	35	2	Internal	8	300	Die	EAR99	HMC659
HMC659*	Distributed	0 to 15	19	28	35	2.5	Internal	8	300	5 × 5 LFCSP	EAR99	HMC659LC5
HMC633	Distributed	5 to 17	29	23	30	8	Internal	5	180	Die	EAR99	HMC633
HMC633*	Distributed	5.5 to 17	30	23	30	8	Internal	5	180	4 × 4 LFCSP	EAR99	HMC633LC4
HMC459	Distributed	0 to 18	17	25	32	3	Internal	8	290	Die	EAR99	HMC459
HMC606	Low phase noise	2 to 18	12.5	13	22	7	Internal	—	64	Die	EAR99	HMC606
HMC606*	Low phase noise	2 to 18	13.5	15	—	—	—	—	—	5 × 5 LFCSP	EAR99	HMC606LC5
HMC1049	LNA, distributed	0.3 to 19	16	15	27	1.7	Internal	7	70	Die	EAR99	HMC1049
HMC1049*	LNA, distributed	0.3 to 20	15	15	29	1.8	Internal	7	70	5 × 5 LFCSP	EAR99	HMC1049LP5E
HMC559	Distributed	0 to 20	14	28	36	4	Internal	10	400	Die	EAR99	HMC559
HMC460	Distributed	0 to 20	14	16	29	2.5	Internal	8	75	Die	EAR99	HMC460
HMC460*	Distributed	0 to 20	14	17	30	2.5	Internal	8	75	5 × 5 LFCSP	EAR99	HMC460LC5
HMC465	Distributed	0 to 20	17	22	30	2.5	Internal	8	160	Die	EAR99	HMC465
HMC465*	Distributed	0 to 20	15	23	28	3	Internal	8	160	5 × 5 LFCSP	EAR99	HMC465LP5
HMC-ALH482	LNA, distributed	2 to 20	16	14	—	1.7	Internal	4	45	Die	EAR99	HMC-ALH482
HMC-ALH102	Distributed	2 to 20	10	10	—	2.5	Internal	2	55	Die	EAR99	HMC-ALH102
HMC464	Distributed	2 to 20	16	26	30	4	Internal	8	290	Die	EAR99	HMC464
HMC464*	Distributed	2 to 20	14	26	30	4	Internal	8	290	5 × 5 LFCSP	EAR99	HMC464LP5E
HMC463	Distributed	2 to 20	14	16	28	2.5	Internal	5	60	Die	EAR99	HMC463
HMC463*	Distributed	2 to 20	13	18	26	3	Internal	5	60	5 × 5 LFCSP	EAR99	HMC463LP5
HMC463	Distributed	2 to 20	14	18	28	2.5	Internal	5	60	LFCSP	EAR99	HMC463LH250
HMC462	Distributed	2 to 20	15	15	27	2.5	Internal	5	63	Die	EAR99	HMC462
HMC462*	Distributed	2 to 20	13	14	25	2.5	Internal	5	66	5 × 5 LFCSP	EAR99	HMC462LP5
HMC634	Distributed	5 to 20	22	23	31	7.5	Internal	5	180	Die	EAR99	HMC634
HMC634*	Distributed	5 to 20	21	22	29	7.5	Internal	5	180	4 × 4 LFCSP	EAR99	HMC634LC4
HMC998A	2 W, distributed	0 to 22	14.5	32.5	43	2.5	Internal	15	500	Die	EAR99	HMC998A
HMC998A	2 W, distributed	0 to 22	15	32	42	3	Internal	15	500	5 × 5 LFCSP	EAR99	HMC998APM5E
HMC797A	1 W, distributed	0 to 22	15	29	41	3	Internal	10	400	Die	EAR99	HMC797A
HMC797A*	1 W, distributed	0 to 22	15	29	41	3.5	Internal	10	400	5 × 5 LFCSP	EAR99	HMC797APM5E
HMC907A	0.6 W, distributed	0.2 to 22	14	28	41	3	Internal	10	350	Die	EAR99	HMC907A
HMC907A	0.6 W, distributed	0.2 to 22	14	28	40	3	Internal	10	350	5 × 5 LFCSP	EAR99	HMC907APM5E
HMC994A	0.8 W, distributed	0 to 28	15	28	38	3.5	Internal	10	250	5 × 5 LFCSP	EAR99	HMC994APM5E

— = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Wideband Distributed Amplifiers (Continued)

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC994A	0.5 W, distributed	0 to 30	14.5	28	39	3.5	Internal	10	250	Die	EAR99	HMC994A
HMC562	Distributed	2 to 35	12.5	18	27	3	Internal	8	80	Die	3A001.b.2.d	HMC562
HMC-AUH249	Distributed	0 to 35	15	21	—	—	Internal	5	200	Die	3A001.b.2.d	HMC-AUH249
HMC930A	0.25 W, distributed	0 to 40	13	22	33.5	5	Internal	10	175	Die	3A001.b.2.d	HMC930A
HMC5805A*	0.25 W, distributed	0 to 40	11.5	24.5	29	4	Internal	10	175	6 × 6 LFCSP	3A001.b.2.d	HMC5805ALS6
HMC635	Distributed	18 to 40	19.5	23	29	8	Internal	5	280	Die	3A001.b.2.d	HMC635
HMC635	Distributed	18 to 40	18.5	22	27	8	Internal	5	280	4 × 4 LFCSP	3A001.b.2.d	HMC635LC4
HMC-AUH232	Distributed	0 to 45	14	17	—	4.2	Internal	5	180	Die	3A001.b.2.d	HMC-AUH232
HMC1022A <b>New</b>	Power amp	0 to 48	11.5	21	29	5.5	Internal	10	150	Die	3A001.b.2.d, DL3A0011b2d	HMC1022A
HMC1127	Distributed	2 to 50	14	12	22	—	—	5	65	Die	3A001.b.2.d	HMC1127
HMC1126	Distributed	2 to 50	11	15	28	—	—	5	66	Die	3A001.b.2.d	HMC1126
HMC-AUH312	Distributed	0.5 to 65	10	—	—	—	Internal	8	60	Die	3A001.b.2.f	HMC-AUH312

## Linear and Power Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC450	0.7 W driver	0.8 to 1	26	26	40	8	External	5	310	QSOP	EAR99	HMC450QS16GE
HMC453	1.6 W PA	0.4 to 2.2	22	33	50	6.5	External	5	725	QSOP	EAR99	HMC453QS16GE
HMC452*	1 W PA	0.4 to 2.2	21	30	49	7.5	External	5	510	SOT-89	EAR99	HMC452ST89
HMC452	1 W PA	0.4 to 2.2	23	30	48	7	External	5	485	QSOP	EAR99	HMC452QS16GE
HMC453*	1.6 W PA	0.45 to 2.2	21	32	49	6.5	External	5	725	SOT-89	EAR99	HMC453ST89
HMC457	1 W PA	1.7 to 2.2	27	31	46	5	External	5	500	QSOP	EAR99	HMC457QS16G
HMC454*	0.5 W PA	0.4 to 2.5	13	27	42	6	External	5	150	SOT-89	EAR99	HMC454ST89
HMC455	0.5 W PA	1.7 to 2.5	13	27	42	—	External	5	150	3 × 3 LFCSP	EAR99	HMC455LP3E
HMC414	1 W PA	2.2 to 2.8	20	27	39	—	External	5	300	MSOP	EAR99	HMC414MS8GE
HMC409	1 W PA	3.3 to 3.8	31	31	46	5.8	External	5	615	3 × 3 LFCSP	EAR99	HMC409LP4E
HMC327*	0.5 W PA	3 to 4	21	27	40	5	Internal	5	250	MSOP	EAR99	HMC327MS8GE
HMC415	0.2 W driver	4.9 to 5.9	20	22	32	6	External	3	285	3 × 3 LFCSP	EAR99	HMC415LP3E
HMC408	1 W PA	5.1 to 5.9	20	30	43	6	External	5	750	3 × 3 QFN	EAR99	HMC408LP3E
HMC406*	0.25 W PA	5 to 6	17	27	38	6	Internal	5	300	MSOP	3A001.a.11.b, DL3A001a11b, EAR99	HMC406MS8GE
HMC407	0.32 W PA	5 to 7	15	25	40	5.5	Internal	5	230	MSOP	EAR99	HMC407MS8GE
HMC1121	4 W PA	5.5 to 8.5	27	36	44	—	Internal	7	2200	6 × 6 LFCSP	3A001.b.2.d	HMC1121LP6GE
HMC7357	2 W PA	5.5 to 8.5	29	35	42	—	Internal	8	1200	4 × 4 QFN	EAR99	HMC7357LP5GE
HMC591	2 W PA	6 to 9.5	18	33	41	—	Internal	7	1340	5 × 5 QFN	EAR99	HMC591LP5E
HMC591	2 W PA	6 to 10	23	33	43	—	Internal	7	1340	Die	EAR99	HMC591
HMC590	1 W PA	6 to 10	25	32	41	—	Internal	7	820	Die	EAR99	HMC590
HMC590	1 W PA	6 to 10	21	31	40	—	Internal	7	820	5 × 5 QFN	EAR99	HMC590LP5E
HMC608	0.5 W driver	9.5 to 11.5	29	27	33	6	Internal	5	310	4 × 4 QFN	EAR99	HMC608LC4
HMC487	2 W PA	9 to 12	20	32	36	8	Internal	7	1300	5 × 5 QFN	EAR99	HMC487LP5E
HMC441	0.06 W driver	6.5 to 13.5	14	18	29	4.5	Internal	5	95	3 × 3 QFN	EAR99	HMC441LP3
HMC952A	2 W PA	9 to 14	33	36	43	—	Internal	6	1400	5 × 5 LFCSP	EAR99	HMC952ALP5GE
HMC441	0.08 W driver	7 to 15.5	16	19	30	4.5	Internal	5	90	1 × 1 QFN	EAR99	HMC441LM1
HMC441	0.08 W driver	7 to 15.5	15	20	32	4.8	Internal	5	90	5 × 5 LFCSP	EAR99	HMC441LH5
HMC1082*	0.25 W driver	5.5 to 18	22	24	35	—	Internal	5	220	4 × 4 QFN	EAR99	HMC1082LP4E
HMC441	0.08 W driver	6 to 18	16	20	32	4.5	Internal	5	95	Die	EAR99	HMC441
HMC441*	0.1 W driver	6 to 18	17	20	32	4.5	Internal	5	95	3 × 3 QFN	EAR99	HMC441LC3B
HMC451	0.1 W driver	5 to 20	22	20	30	—	Internal	5	127	Die	EAR99	HMC451
HMC451*	0.08 W driver	5 to 20	19	19	30	7	Internal	5	114	3 × 3 QFN	EAR99	HMC451LC3
HMC6981	2 W PA	15 to 20	26	34	44	—	External	6	1100	6 × 6 QFN	EAR99	HMC6981LS6
HMC498	0.25 W driver	17 to 24	24	25	34	—	Internal	5	250	Die	EAR99	HMC498
HMC498*	0.3 W driver	17 to 24	22	25	36	4	Internal	5	250	4 × 4 QFN	EAR99	HMC498LC4
HMC442	0.1 W driver	17.5 to 24	14	22	28	6.5	Internal	5	85	1.35 LCC	EAR99	HMC442LM1

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Linear and Power Amplifiers (Continued)

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	V <sub>S</sub> (V)	I <sub>SR</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC-APH518	1 W PA	21 to 24	17	31	39	—	Internal	5	950	Die	3A001.b.2.c	HMC-APH518
HMC442	0.14 W driver	17.5 to 25.5	15	22	28	5.5	Internal	5	84	Die	EAR99	HMC442
HMC442	0.16 W driver	17.5 to 25.5	13	22	27	8	Internal	5	84	3 × 3 QFN	EAR99	HMC442LC3B
HMC-APH462	1 W PA	15 to 27	17	29	37	—	Internal	5	1440	Die	EAR99	HMC-APH462
HMC863A	0.5 W PA	24 to 29.5	24	27	38.5	4.5	Internal	5.5	350	4 × 4 QFN	EAR99	HMC863ALC4
HMC383	0.04 W driver	12 to 30	16	16	25	7	Internal	5	100	Die	EAR99	HMC383
HMC383*	0.04 W driver	12 to 30	15	17	25	7.5	Internal	5	100	4 × 4 QFN	EAR99	HMC383LC4
HMC-APH196	0.016 W driver	17 to 30	20	24	31	—	Internal	5	400	Die	EAR99	HMC-APH196
HMC943A <b>New</b>	2 W PA	24 to 34	23	33	37.5	—	Internal	5.5	1300	5 × 5 LFCSP	3A001.b.2.d	HMC943APM5E
HMC-APH460	0.5 W PA	27 to 31.5	14	28	37	—	Internal	5	900	Die	EAR99	HMC-APH460
HMC7441	2 W PA	27.5 to 31.5	23	34	38	—	Internal	6	1000	Die	3A001.b.2.d	HMC7441
HMC499	0.25 W driver	21 to 32	16	24	33	—	Internal	5	200	Die	3A001.b.2.d	HMC499
HMC499*	0.2 W driver	21 to 32	17	23	34	5	Internal	5	200	4 × 4 QFN	3A001.b.2.d	HMC499LC4
HMC1132 <b>New</b>	1 W PA	27 to 32	24	29	37	5.5	Internal	5	650	5 × 5 LFCSP	3A001.b.2.d	HMC1132PM5E
HMC-APH596*	0.25 W driver	16 to 33	17	24	33	—	Internal	5	400	Die	5A991.h	HMC-APH596
HMC906A	2 W PA	27.3 to 33.5	26.5	33	43	—	Internal	5	1200	Die	3A001.b.2.d	HMC906A
HMC1131	0.2 W driver	24 to 35	22	24	35	—	Internal	5	225	4 × 4 LFCSP	3A001.b.2.d	HMC1131LC4
HMC7229	1 W PA	33 to 40	24.5	31.5	39.5	—	Internal	6	1200	Die	3A001.b.2.d	HMC7229
HMC7229	1 W PA	37 to 40	24	32	40	—	Internal	6	1200	6 × 6 LFCSP	3A001.b.2.d	HMC7229LS6
HMC-AUH256	0.1 W driver	17.5 to 41	21	20	27	—	Internal	5	295	Die	3A001.b.2.d	HMC-AUH256
HMC-ABH264	0.06 W driver	34 to 42	19	18	29	6.5	Internal	5	120	Die	3A001.b.2.d	HMC-ABH264
ADPA7002	0.5 W PA	20 to 44	15	28	40	—	Internal	5	600	Die	3A001.b.2.d	ADPA7002CHIP
ADPA7006 <b>New</b>	0.5W WB PA	20 to 44	23.5	29	38	—	Internal	5	800	Die	3A001.b.4.e.1, DL3A001b4e1	ADPA7006CHIP
HMC-ABH209	0.04 W driver	55 to 65	13	16	25	—	Internal	5	80	Die	3A001.b.2.f	HMC-ABH209
HMC-ABH241	0.05 W driver	50 to 66	24	17	25	—	Internal	5	220	Die	3A001.b.2.f	HMC-ABH241
HMC1144	0.126 W driver	40 to 70	19	21	28	—	Internal	4	320	Die	3A001.b.2.f	HMC1144
ADMV7710	1 W PA	71 to 76	24	28	34	—	Internal	4	800	Die	5A991.b, EAR99	ADMV7710CHIPS
HMC-AUH318	0.056 W driver	71 to 76	24	18	—	—	Internal	4	130	Die	3A001.b.2.g	HMC-AUH318
HMC-AUH320	0.03 W driver	71 to 86	15	15	—	—	Internal	4	130	Die	3A001.b.2.f	HMC-AUH320
ADMV7810	1 W PA	81 to 86	20	28	33	—	Internal	4	800	Die	5A991.b, EAR99	ADMV7810CHIPS
HMC-AUH317	0.056 W driver	81 to 86	22	18	—	—	Internal	4	160	Die	3A001.b.2.g	HMC-AUH317
ADPA7001	0.056 W PA	50 to 95	14.5	17	25	—	Internal	3.5	350	Die	3A001.b.2.g	ADPA7001CHIPS

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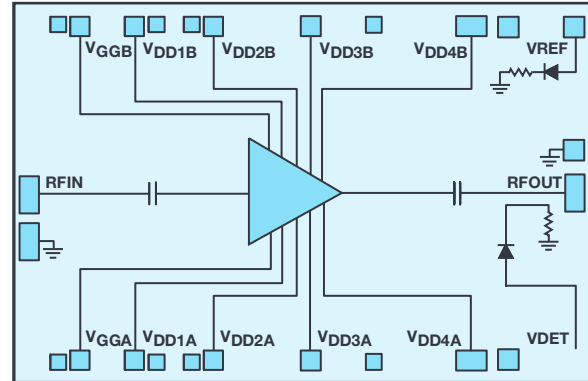
## ADPA7006: GaAs pHEMT 20 GHz to 44 GHz, 0.5 W Power Amplifier (Die)

### Key Features

- ▶ High P1dB: 29 dBm
- ▶  $P_{SAT}$ : 29.5 dBm
- ▶ Gain: 23.5 dB
- ▶ Output IP3: 38 dBm
- ▶ Supply: 5 V at 800 mA
- ▶ 50  $\Omega$  matched input and output

### Applications

- ▶ Millimeter wave 5G network radios
- ▶ Microwave links
- ▶ Transmit PA modules
- ▶ Military radios



## GaN Power Amplifiers

Part Number	Description	Frequency (GHz)	Gain (dB)	Output P1dB (dBm)	Output IP3 (dBm)	Noise Figure (dB)	Device Match	$P_{SAT}$ (dBm)	$V_S$ (V)	$I_{SY}$ (mA)	Package (mm)	ECCN Code	Ordering Part Number
<b>HMC1099</b> <i>New</i>	10 W, GaN PA	0.01 to 1.1	18	30	47.5	5	Internal	41	28	100	5 × 5 LFCSP	EAR99	HMC1099PM5E
<b>HMC8500*</b> <i>New</i>	>10 W, GaN PA	0.01 to 2.8	15	40	47	4.5	Internal	40	28	100	5 × 5 LFCSP	EAR99	HMC8500PM5E
<b>HMC1114</b> <i>New</i>	10 W, GaN PA	2.7 to 3.8	24	41.5	44	5	Internal	41.5	28	150	5 × 5 LFCSP	3A001.b.2.a.4	HMC1114PM5E
<b>HMC8205</b>	35 W, GaN PA	0.3 to 6	20	45	47	—	Internal	46	50	1300	LDCC (flange)	3A001.b.2.a.4	HMC8205BF10
<b>HMC8205</b> <i>New</i>	35 W, GaN PA	0.4 to 6	20	45	47	—	Internal	46	50	1300	Die	3A001.b.2.a.4	HMC8205BCHIPS
<b>HMC1086</b>	25 W, GaN PA	2 to 6	22	41	48	14	Internal	44.5	28	1100	Die	3A001.b.2.a.4	HMC1086
<b>HMC1086</b>	25 W, GaN PA	2 to 6	22	41	46	14	Internal	44.5	28	1100	Flange	3A001.b.2.a.4	HMC1086F10
<b>HMC8415</b> <i>New</i>	40 W, GaN PA	9 to 10.5	23	35	—	—	Internal	46	28	1000	6 × 6 LFCSP	3A001.b.2.b.2, DL3A001b2b2, EAR99	HMC8415LP6GE
<b>HMC1087</b>	8 W, GaN PA	2 to 20	11	38	44	5.5	Internal	39	28	850	Die	3A001.b.2.c	HMC1087
<b>HMC1087</b>	8 W, GaN PA	2 to 20	11	38	44	5.5	Internal	39	28	850	Flange	3A001.b.2.c	HMC1087F10

## Active Bias Controllers

Part Number	Description	$V_{SUPPLY}$ (V)	$V_{SUPPLY}$ Drain (V)	$I_{DRAIN}$ (mA)	$I_{GATE}$ Drive (mA)	$V_{GATE}$ (V)	Over/Under $I_{DRAIN}$ Alarm	Low $V_{SUPPLY}$ Alarm	Package (mm)	ECCN Code	Ordering Part Number
<b>HMC920</b>	Active bias controller	5 to 16.5	3 to 15	0 to 500	-4 to +4	-2.5 to +2	Yes	Yes	5 × 5 LFCSP	EAR99	HMC920LP5E
<b>HMC980</b>	Active bias controller	5 to 16.5	5 to 16.5	0.05 to 1600	-4 to +4	-2.46 to +2.04	Yes	No	Die	EAR99	HMC980
<b>HMC980*</b>	Active bias controller	5 to 16.5	5 to 16.5	0.05 to 1600	-4 to +4	-2.46 to +2.04	Yes	No	4 × 4 LFCSP	EAR99	HMC980LP4E
<b>HMC981</b>	Active bias controller	4 to 12	4 to 12	20 to 200	-0.8 to +0.8	-2.5 to +2	No	No	Die	EAR99	HMC981
<b>HMC981*</b>	Active bias controller	4 to 12	4 to 12	20 to 200	-0.8 to +0.8	-2.5 to +2	No	No	3 × 3 LFCSP	EAR99	HMC981LP3E

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

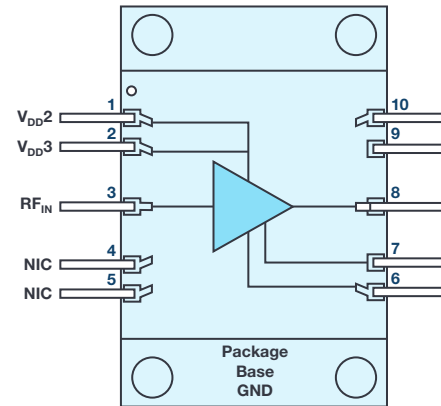
# HMC8205BF10: 0.3 GHz to 6 GHz, 35 W GaN Power Amplifier

## Key Features

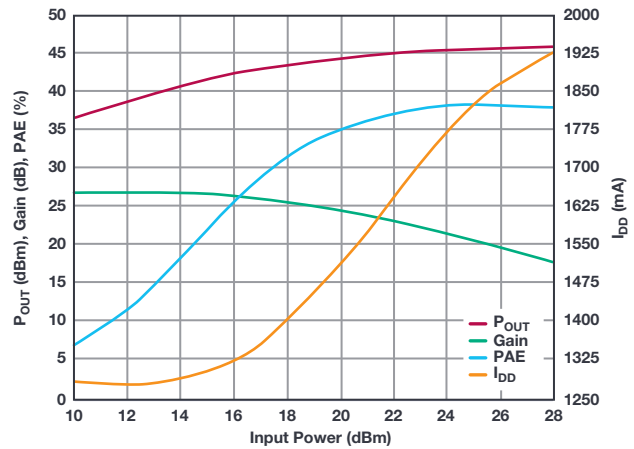
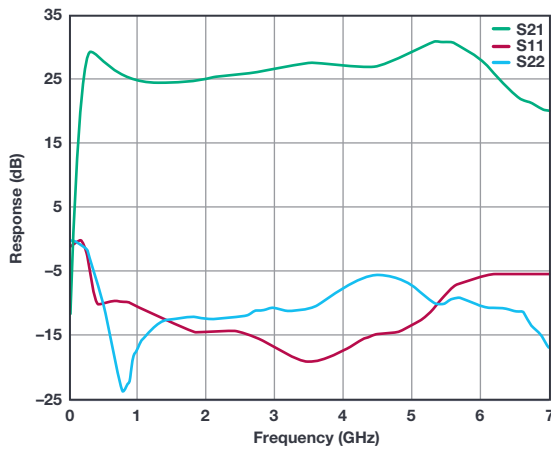
- ▶ Wide instantaneous bandwidth: 300 MHz to 6 GHz (2 dB flatness)
- ▶ High saturated power ( $P_{SAT}$ ) of >45.5 dBm (35 W) typical
- ▶ Supports pulsed and CW output power
- ▶ Typical PAE of 38%
- ▶ Output IP3 (OIP3) of 47 dBm
- ▶ Return loss:
  - 12 dB (0.3 to 3 GHz)
  - 10 dB (3 to 6 GHz)
- ▶ 10-lead flange mount packaging

## Applications

- ▶ Military jammers
- ▶ Test and measurement
- ▶ Wireless infrastructure
- ▶ Commercial and military radars
- ▶ General-purpose transmitter amplifiers



NIC = Not Internally Connected



# Variable Gain Amplifiers

## Analog Controlled VGAs

Part Number	Description	Bandwidth (GHz)	Gain Range (dB)	Output IP3 (dBm)	Noise Figure (dB)	V <sub>s</sub> (V)	I <sub>s</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
AD8367	Single-ended, with AGC	LF to 0.5	-2.5 to +42.5	36.5	6.2	3 to 5	26	TSSOP	EAR99	AD8367ARUZ
AD8368	Single-ended, with AGC	LF to 0.8	-12 to +22	34	9.5	5	60	4 × 4 LFCSP	EAR99	AD8368ACPZ-REEL7
LTC6412	Analog VGA	LF to 0.8	-14.9 to +17.1	38	10	3.3	110	4 × 4 QFN	EAR99	LTC6412CUF#TRPBF LTC6412IUF#TRPBF
ADL5336	Cascadable, with programmable rms detector	LF to 1	-25.4 to +34.7	28	7.1	5	80	5 × 5 LFCSP	5A991.g	ADL5336ACPZ-R7
ADL5331	Differential Tx VGA	LF to 1.2	—	47	9	5	240	4 × 4 LFCSP	EAR99	ADL5331ACPZ-R7
ADL5330	Differential Tx VGA	LF to 3	-32 to +21	31.5	9	5	215	4 × 4 LFCSP	EAR99	ADL5330ACPZ-R2
ADL5246	Variable gain LNA/driver amp	0.6 to 3	-12 to +31.5	37	1.8	3.3, 5	141, 270	5 × 5 LFCSP	5A991.b	ADL5246ACPZN-R7
HMC996	Analog VGA	5 to 12	-3.5 to +18.5	34	2	5	120	4 × 4 LFCSP	EAR99	HMC996LP4E
HMC694	Analog VGA	6 to 17	0 to +23	30	5	5	170	Die	EAR99	HMC694
HMC694	Analog VGA	6 to 17	0 to +23	30	6	5	170	4 × 4 LFCSP	EAR99	HMC694LP4E
HMC997	Analog VGA	17 to 27	5.5 to 20.5	30	3.5	5	170	4 × 4 LFCSP	EAR99	HMC997LC4
HMC6187	Analog VGA	27 to 31.5	6 to 19	31	4.5	5	230	4 × 4 LFCSP	3A001.b.2.d	HMC6187LP4E
HMC8120	Analog VGA/driver amp	71 to 76	15	30	—	4	250	Die	5A991.b	HMC8120
HMC8121	Analog VGA/driver amp	81 to 86	17	27.5	—	4	265	Die	5A991.b	HMC8121


## Digitally Controlled VGAs

Part Number	Description	Bandwidth (GHz)	Gain Range (dB)	Step (dB)	Output IP3 (dBm)	Noise Figure (dB)	V <sub>s</sub> (V)	I <sub>s</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC960	Programmable, dual	LF to 0.13	0 to +40	0.5	30	6	5	70	4 × 4 LFCSP	EAR99	HMC960LP4E
AD8372	Dual-channel diff VGA with serial/parallel control	0 to 0.1	-9 to +32	1	35	7.9	5	2 × 106	5 × 5 LFCSP	EAR99	AD8372ACPZ-R7
LT5524	Diff VGA with parallel control	LF to 0.54	4.5 to 27	1.5	40	8.6	5	75	20-lead TSSOP	EAR99	LT5524EFE#TRPBF
AD8366	Diff VGA	LF to 0.6	4.5 to 20.25	0.25	45	11.4	5	2 × 90	5 × 5 LFCSP	EAR99	AD8366ACPZ-R7
AD8369	Diff VGA	LF to 0.63	-5 to +40	3	19.5	7	3 to 5	37	TSSOP	EAR99	AD8369ARUZ
AD8375	Dual diff VGA	LF to 0.7	-4 to +20	1	50	8.3	5	125	4 × 4 LFCSP	EAR99	AD8375ACPZ-R7
AD8376	Diff VGA parallel/serial control	LF to 0.8	-4 to +20	1	50	8.7	5	2 × 125	5 × 5 LFCSP	EAR99	AD8376ACPZ-R7
ADL5201	Dual diff VGA parallel/serial control	LF to 0.9	-11.5 to +20	0.5	50	7.5	5	110	4 × 4 LFCSP	EAR99	ADL5201ACPZ-R7
LT5514	Diff VGA with parallel control	LF to 0.85	10.5 to 33	1.5	47	7.4	5	148	20-lead TSSOP	EAR99	LT5514EFE#TRPBF
ADL5202	Diff VGA	LF to 0.75	-11.5 to +20	0.5	50	7.5	5	2 × 110	6 × 6 LFCSP	EAR99	ADL5202ACPZ-R7
AD8370	5-bit diff VGA	0.03 to 0.4	-8 to +34	Variable	35	7.2	3 to 5	79	TSSOP	EAR99	AD8370AREZ
LT5554	Diff VGA with parallel control	LF to 1	1.725 to 17.6	0.125	47	10	5	110	5 × 5 QFN	EAR99	LT5554IUF#TRPBF
HMC680	Dual VGA	LF to 0.6	-4 to +19	1	40	5	5	250	4 × 4 LFCSP	EAR99	HMC680LP4E
HMC628	5-bit VGA	0.05 to 0.8	-8 to +15	1	35	5	5	65	4 × 4 LFCSP	EAR99	HMC628LP4E
ADL5240	Gain block/VGA parallel/serial control	0.1 to 4	-13.1 to +18	0.5	38	4.9	5	93	5 × 5 LFCSP	5A991.b	ADL5240ACPZ-R7
ADL5243	Gain block/VGA/driver amp parallel/serial control	0.1 to 4	-1.2 to +31.3	0.5	40	3.1	5	175.5	5 × 5 LFCSP	5A991.b	ADL5243ACPZ-R7
HMC742A	6-bit VGA serial/parallel control	0.5 to 4	-19.5 to +12	0.5	39	4	5	150	5 × 5 LFCSP	EAR99	HMC742ALP5E
ADL5335	Differential-in, single-ended out, serial control	0.7 to 4.2	-8 to +12	0.5	33	5.4	5	125	4 × 4 LFCSP	5A991.g	ADL5335ACPZN
HMC625B	Gain block/VGA/driver amp parallel/serial control	0 to 5	-13.5 to +18	0.5	33	6	5	87.5	5 × 5 LFCSP	EAR99	HMC625BLP5E

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools.

## Baseband Programmable VGA Filters

Part Number	Description	Bandwidth (MHz)	Gain Range (dB)	Output IP3 (dBm)	Noise Figure (dB)	V <sub>S</sub> (V)	I <sub>S</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
<a href="#">ADRF6516</a>	Dual, with variable LPF	LF to 31	-5 to +45	40	25	3.3	360	5 × 5 LFCSP	EAR99	<a href="#">ADRF6516ACPZ-R7</a>
<a href="#">ADRF6510</a>	Dual, with variable LPF	LF to 31	-5 to +45	27	28	5	258	5 × 5 LFCSP	EAR99	<a href="#">ADRF6510ACPZ-R7</a>
<a href="#">HMC900</a>	Dual, with programmable LPF	3.5 to 50	0/10	30	12	5	130	5 × 5 LFCSP	EAR99	<a href="#">HMC900LP5E</a>
<a href="#">HMC1023</a>	Dual, with programmable LPF	5 to 72	0/10	30	10	5	240	5 × 5 LFCSP	EAR99	<a href="#">HMC1023LP5E</a>
<a href="#">AD8366</a>	Dual	LF to 600	4.5 to 20.25	38	11.4	5	180	5 × 5 LFCSP	EAR99	<a href="#">AD8366ACPZ-R7</a>
<a href="#">ADRF6518</a>	Dual, with variable LPF	LF to 1100	-36 to +66	36	16	3.3	360	5 × 5 LFCSP	EAR99	<a href="#">ADRF6518ACPZ-R7</a>
<a href="#">ADRF6520</a>	Dual, with selectable LPF for E-band	LF to 1250	-6 to +54	27 dBV	11	3.3	420	5 × 5 LFCSP	5A991.b	<a href="#">ADRF6520ACPZ-R7</a>

 = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools.



# Attenuators

## Digital Step Attenuators

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Atten Range (dB)	Step (dB)	Input IP3 (dBm)	PO.1 dB (dBm)	Control Input (VDC)	Package (mm)	ECCN Code	Ordering Part Number
HMC759	7-bit serial DSA	0.01 to 0.3	3.3	0 to 35	0.25	40	—	0/+5	3 × 3 LFCSP	EAR99	HMC759LP3E
HMC470A	5-bit DSA	0 to 3	1.7	0 to 32.3	1	48	27	0/+5	3 × 3 LFCSP	EAR99	HMC470ALP3E
HMC424A	6-bit DSA	0.1 to 3	3	0 to 31.5	0.5	46	23	0/−5	MSOP	EAR99	HMC424AG16
HMC1095	6-bit DSA	0 to 3	1.3	0 to 32.8	0.5	57	30	0/+5	4 × 4 LFCSP	EAR99	HMC1095LP4E
HMC8073	6-bit serial DSA	0.6 to 3	1.1	0 to 34	0.5	52	28	TTL/CMOS	3 × 3 LFCSP	EAR99	HMC8073LP3DE
HMC273A	5-bit DSA	0.7 to 3.7	2.8	0 to 32.9	1	48	—	3.3 to 5	MSOP	EAR99	HMC273AMS10GE
HMC306A	5-bit DSA	0.7 to 3.8	1.5	0 to 16.8	0.5	52	25	3.3 to 5	MSOP	EAR99	HMC306AMS10
HMC472A	6-bit DSA	0 to 3.8	1.7	0 to 32.9	0.5	54	30	0/+5	4 × 4 LFCSP	EAR99	HMC472ALP4E
HMC291S	2-bit DSA	0.7 to 4	0.9	0 to 12.7	4	54	26	3.3 to 5	SOT-26	EAR99	HMC291SE
HMC539A	5-bit DSA	0 to 4	1	0 to 8.45	0.25	50	28	0/+5	3 × 3 LFCSP	EAR99	HMC539ALP3E
HMC542B	6-bit serial DSA	0 to 4	1.7	0 to 32.9	0.5	50	30	0/+5	4 × 4 LFCSP	EAR99	HMC542BLP4E
HMC468A	3-bit DSA	0 to 6	0.7	0 to 7.7	1	55	26	0/+5	3 × 3 LFCSP	EAR99	HMC468ALP3E
HMC629A	4-bit serial/parallel DSA	0 to 6	2.5	0 to 45	3	50	—	0/+5	4 × 4 LFCSP	EAR99	HMC629ALP4E
HMC1122	6-bit DSA	0.1 to 6	1.2	0 to 33	0.5	55	30	3.3 to 5	4 × 4 LFCSP	EAR99	HMC1122LP4ME
HMC792A	6-bit serial DSA	0 to 6	1.8	0 to 17.5	0.25	53	31	0/+5	4 × 4 LFCSP	EAR99	HMC792ALP4E
HMC624A	6-bit serial/parallel DSA	0 to 6	2.2	0 to 33	0.5	55	30	0/+5	4 × 4 LFCSP	EAR99	HMC624ALP4E
HMC1119	7-bit serial/parallel DSA	0.1 to 6	1.5	0 to 33.5	0.25	54	30	TTL/CMOS	4 × 4 LFCSP	EAR99	HMC1119LP4ME
HMC305S	5-bit, glitch free DSA	0.4 to 7	1.4	0 to 17	0.5	52	28	TTL/CMOS	4 × 4 LFCSP	EAR99	HMC305SLP4E
HMC540S	4-bit parallel DSA	0.1 to 8	0.8	0 to 15.7	1	54	31	TTL/CMOS	3 × 3 LFCSP	EAR99	HMC540SLP3E
HMC425A	6-bit DSA	2.2 to 8	3.6	0 to 31.5	0.5	45	24	0/+5	3 × 3 LFCSP	EAR99	HMC425ALP3E
HMC802A	1-bit DSA	0 to 10	1.5	0 to 20	20	55	30	0/+5	3 × 3 LFCSP	EAR99	HMC802ALP3E
HMC424A	6-bit DSA	0 to 13	3.3	0 to 34.4	0.5	42	24	0/−5	Die	EAR99	HMC424A
HMC424A	6-bit DSA	0 to 13	3.3	0 to 35.5	0.5	42	23	0/−5	3 × 3 QFN	EAR99	HMC424ALP3E
HMC424A	6-bit DSA	0.1 to 13	3.3	0 to 34.3	0.5	42	23	0/−5	5 × 5 QFN	EAR99	HMC424ALH5
HMC1019A*	5-bit DSA	0.1 to 30	4	0 to 15.5	0.5	45	25	0/+5	4 × 4 LFCSP	EAR99	HMC1019ALP4E
HMC1018A*	5-bit DSA	0.1 to 30	5.5	0 to 35.5	1	42	22	0/+5	4 × 4 LFCSP	EAR99	HMC1018ALP4E
HMC941A	5-bit DSA	0.1 to 30	4	0 to 18	0.5	43	24	0/+5	Die	EAR99	HMC941A
HMC941A	5-bit DSA	0.1 to 33	4	0 to 18	0.5	43	24	0/+5	4 × 4 LFCSP	EAR99	HMC941ALP4E
HMC939A	5-bit DSA	0.1 to 33	5.5	0 to 31	1	43	23	0/+5	4 × 4 LFCSP	EAR99	HMC939ALP4E
HMC939A <i>New</i>	5-bit DSA	0.1 to 40	7	0 to 31	1	40	24	0/+5	Die	EAR99	HMC939A
ADRF5720* <i>New</i>	6-bit DSA	9 kHz to 40	4.5	0 to 31.5	0.5	50	30	CMOS/LVTTL	4 × 4 LGA	EAR99	ADRF5720BCCZN
ADRF5721* <i>New</i>	4-bit DSA	9 kHz to 40	3.4	0 to 30	2	50	30	CMOS/LVTTL	2.5 × 2.5 LGA	EAR99	ADRF5721BCCZN
ADRF5730* <i>New</i>	6-bit DSA	0.1 to 40	4.8	0 to 31.5	0.5	50	30	CMOS/LVTTL	4 × 4 LGA	EAR99	ADRF5730BCCZN
ADRF5731* <i>New</i>	4-bit DAS	0.1 to 40	3.5	0 to 30	2	50	30	CMOS/LVTTL	2.5 × 2.5 LGA	EAR99	ADRF5731BCCZN
ADRF5740 <i>Upcoming</i>	4-bit DSA	0.1 to 60	2.4	0 to 22	2	44	TBD	CMOS/LVTTL	2.5 × 2.5 LGA	EAR99	ADRF5740BCCZN

## Voltage Variable Attenuators

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Attenuation Range (dB)	Input IP3 (dBm)	Control Input (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC973A*	Analog VVA	0.5 to 6	3.5	3.5 to 29.5	35	0 to +5	3 × 3 LFCSP	EAR99	HMC973ALP3E
HMC346A	Analog VVA	0 to 8	2.1	5 to 29	30	0 to −5	MSOP	EAR99	HMC346AMS8GE
HMC346A	Analog VVA	0 to 14	2.7	5 to 30	30	0 to −5	3 × 3 LFCSP	EAR99	HMC346ALP3E
HMC346A	Analog VVA	0 to 18	2.8	5 to 30	30	0 to −5	3 × 3 LFCSP	EAR99	HMC346ALC3B
HMC712A	Analog VVA	5 to 26.5	3.5	10 to 42	32	0 to −5	3 × 3 LFCSP	EAR99	HMC712ALP3CE
HMC-VVD102	Analog VVA	17 to 27	1.5	1.5 to 19.5	17	−4 to +4	Die	5A991.h	HMC-VVD102
HMC812A	Analog VVA	5 to 30	2.2	3 to 33	28	0 to −5	4 × 4 LFCSP	EAR99	HMC812ALC4
HMC985A	Analog VVA	10 to 40	3	3 to 33	33	0 to −3	4 × 4 LFCSP	EAR99	HMC985ALP4KE
HMC985A	Analog VVA	20 to 50	3.5	3 to 33	30	0 to −3	Die	EAR99	HMC985A
HMC-VVD106	Analog VVA	35 to 50	1.5	1.5 to 23.5	17	0 to +4	Die	5A991.h	HMC-VVD106
HMC-VVD104	Analog VVA	70 to 86	2	2 to 16	—	−5 to +5	Die	5A991.h	HMC-VVD104

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Fixed Attenuators

Part Number	Description	Frequency (GHz)	Nominal Attenuation Range (dB)	Attenuation Accuracy	Max Input Power (dBm)	Package (mm)	ECCN Code	Ordering Part Number
HMC652*	Fixed passive	0 to 25	2	±0.5	27	2 × 2 QFN	EAR99	HMC652LP2E
HMC653*	Fixed passive	0 to 25	3	±0.5	26	2 × 2 QFN	EAR99	HMC653LP2E
HMC654*	Fixed passive	0 to 25	4	±0.5	25	2 × 2 QFN	EAR99	HMC654LP2E
HMC655	Fixed passive	0 to 25	6	±0.5	25	2 × 2 QFN	EAR99	HMC655LP2E
HMC656*	Fixed passive	0 to 25	10	±1.5	25	2 × 2 QFN	EAR99	HMC656LP2E
HMC657	Fixed passive	0 to 25	15	±2	25	2 × 2 QFN	EAR99	HMC657LP2E
HMC658	Fixed passive	0 to 25	20	±2	25	2 × 2 QFN	EAR99	HMC658LP2E
HMC650	Through line	0 to 50	0.15	±0.2	—	Die	EAR99	HMC650
HMC651	Through line	0 to 50	0.15	±0.2	—	Die	EAR99	HMC651
HMC652	Fixed passive	0 to 50	2	±0.2	27	Die	EAR99	HMC652
HMC653	Fixed passive	0 to 50	3	±0.2	26	Die	EAR99	HMC653
HMC654	Fixed passive	0 to 50	4	±0.2	25	Die	EAR99	HMC654
HMC655	Fixed passive	0 to 50	6	±0.5	25	Die	EAR99	HMC655
HMC656	Fixed passive	0 to 50	10	±0.1	25	Die	EAR99	HMC656
HMC657	Fixed passive	0 to 50	15	±0.4	25	Die	EAR99	HMC657
HMC658	Fixed passive	0 to 50	20	±0.5	25	Die	EAR99	HMC658

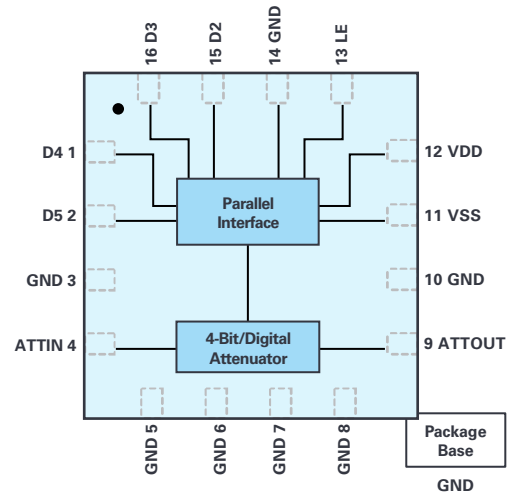
## ADRF5740: 100 MHz to 60 GHz Wideband SOI Digital Attenuator

### Key Features

- ▶ 22 dB attenuation range, 2 dB steps
- ▶ Low insertion loss:
  - 1.7 dB up to 26 GHz
  - 2.5 dB up to 44 GHz
  - 2.9 dB up to 50 GHz
- ▶ Accurate attenuation: ±0.2 dB +4% of attenuation state
- ▶ High IP3: 44 dBm
- ▶ Input handling power: 24 dBm
- ▶ Positive logic attenuation control
- ▶ ±3 V supply, <110 μA
- ▶ Tiny 2.5 mm × 2.5 mm LGA package

### Applications

- ▶ Millimeter wave 5G network radios
- ▶ Test and instrumentation
- ▶ Military/aerospace electronics
- ▶ Satellite radio



# RF Mixers

## Single, Double, and Triple Balanced Mixers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Noise Figure (dB)	Input P1dB (dBm)	LO Drive Nominal (dBm)	Package (mm)	ECCN Code	Ordering Part Number
AD831	Active	0 to 0.5	0 to 0.5	0 to 0.2	0	24	70	30	10.3	10	-10	PLCC	5A991.b	AD831APZ
HMC684	With LO amp	0.7 to 1	0.6 to 1	0 to 0.45	-7	32	23	30	7	25	0	4 × 4 LFCSP	EAR99	HMC684LP4E
HMC683	Dual Rx with LO amp	0.7 to 1	0.57 to 0.9	0.06 to 0.5	7.5	23	16	20	11	11	0	6 × 6 LFCSP	EAR99	HMC683LP6CE
AD8344	Active Rx	0.4 to 1.2	0.47 to 1.6	0.07 to 0.4	4.5	24	48	23	10.5	24	0	3 × 3 LFCSP	5A991.b	AD8344ACPZ-REEL7
LTC5540	Passive, with IF gain	0.6 to 1.3	0.7 to 1.2	0.005 to 0.5	7.9	25.9	33	42	9.9	11	0	5 × 5 QFN	EAR99	LTC5540IUH#TRPBF
LT5519	Active upconverting mixer	0.7 to 1.4	0.3 to 1.8	LF to 0.4	-0.6	17.1	39	35	13.6	5.5	-5	4 × 4 QFN	EAR99	LT5519EUF#TRPBF
HMC686	With LO amp	0.7 to 1.5	0.85 to 1.5	0 to 0.5	-7.5	34	26	41	7.5	24	0	4 × 4 LFCSP	EAR99	HMC686LP4E
LTC5590	Dual passive, with IF gain	0.6 to 1.7	0.7 to 1.5	0.005 to 0.5	8.7	26	39	28	9.7	10.7	0	5 × 5 QFN	EAR99	LTC5590IUH#TRPBF
LT5526	Active low power mixer	LF to 2	LF to 2.5	LF to 1	0.4	14.1	50	34	13.7	1	-5	4 × 4 QFN	EAR99	LT5526EUF#TRPBF
HMC687*	With LO amp	1.7 to 2.2	1.7 to 2.4	0 to 0.5	-8	35	32	29	8	23	0	4 × 4 QFN	EAR99	HMC687LP4E
HMC685	With LO amp	1.7 to 2.2	1.5 to 2.2	0 to 0.5	-8	35	30	30	8	24	0	4 × 4 QFN	EAR99	HMC685LP4E
HMC682	Dual Rx with LO amp	1.7 to 2.2	1.4 to 2	0.06 to 0.4	6	25	25	22	12	15	0	6 × 6 QFN	EAR99	HMC682LP6CE
LT5520	Active upconverting mixer	1.3 to 2.3	0.9 to 2.7	DC to 0.4	-1	15.9	36	30	15	4	-5	4 × 4 QFN	EAR99	LT5520EUF#TRPBF
LTC5541	Passive, with IF gain	1.3 to 2.3	1.4 to 2	0.005 to 0.5	7.8	26.4	33	38	9.6	11.3	0	5 × 5 QFN	EAR99	LTC5541IUH#TRPBF
LTC5591	Dual passive, with IF gain	1.3 to 2.3	1.4 to 2.1	0.005 to 0.5	8.5	26.2	37	40	9.9	10.7	0	5 × 5 QFN	EAR99	LTC5591IUH#TRPBF
AD8343	Active	0 to 2.5	0 to 2.5	0 to 2.5	7	17	18	44	14	3	-10	TSSP	5A991.b	AD8343ARUZ
LT5525	Active low power mixer	0.8 to 2.5	0.5 to 3	LF to 1	-2	17.6	40	40	15.1	4	-5	4 × 4 QFN	EAR99	LT5525EUF#TRPBF
LT5578	Active upconversion mixer	0.4 to 2.7	0.4 to 3	LF to 0.6	-0.7	25	49	22	10.5	10	0	5 × 5 QFN	EAR99	LT5578IUH#TRPBF
LT5522	Active	0.4 to 2.7	0.4 to 2.7	LF to 1	-0.1	21.5	45	60	13.9	8	-5	4 × 4 QFN	EAR99	LT5522EUF#TRPBF
LTC5542	Passive, with IF gain	1.6 to 2.7	1.7 to 2.5	0.005 to 0.5	8	26.8	35	45	9.9	11.3	0	5 × 5 QFN	EAR99	LTC5542IUH#TRPBF
LTC5592	Dual passive, with IF gain	1.6 to 2.7	1.5 to 2.5	0.005 to 0.5	8.3	27.3	35	38	9.8	11	0	5 × 5 QFN	EAR99	LTC5592IUH#TRPBF
HMC689	With LO amp	2 to 2.7	2 to 3	0 to 0.8	-7.5	32	34	26	7.5	23	0	4 × 4 QFN	EAR99	HMC689LP4E
HMC688	With LO amp	2 to 2.7	1.7 to 2.4	0 to 0.7	-7.5	35	25	27	7.5	25	0	4 × 4 QFN	EAR99	HMC688LP4E
LT5512	Active	0 to 3	0 to 3	0 to 2	0	21	40	35	11	10.1	-10	4 × 4 QFN	EAR99	LT5512EUF#TRPBF
LT5511	Active upconverting mixer	0.01 to 3	0.03 to 2.7	0.001 to 0.3	0	17	36	—	15	5.9	-10	TSSOP	EAR99	LT5511EFE#TRPBF
LTC5551	Ultrahigh dynamic range passive	0.3 to 3.5	0.2 to 3.5	0.005 to 1	2.4	35.5	27	30	9.7	18	0	4 × 4 QFN	EAR99	LTC5551IUH#TRPBF
LT5527	Active	0.4 to 3.7	0.38 to 3.5	LF to 0.6	2.3	23.5	45	60	12.5	9	0	4 × 4 QFN	EAR99	LT5527EUF#TRPBF
AD8342	Active	0.001 to 3.8	0.001 to 4.1	0 to 2.4	3.7	23	55	27	12.2	8	0	3 × 3 LFCSP	5A991.b	AD8342ACPZ-R2

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Single, Double, and Triple Balanced Mixers (Continued)

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Noise Figure (dB)	Input P1dB (dBm)	LO Drive Nominal (dBm)	Package (mm)	ECCN Code	Ordering Part Number
LT5557	Active, medium power	0.4 to 3.8	0.38 to 4.2	DC to 0.6	2.9	24.7	46	50	11.7	8.8	0	4 × 4 QFN	EAR99	LT5557EUF#TRPBF
LT5579	Active upconversion mixer	0.9 to 3.8	0.75 to 4.3	LF to 1	1.3	27.5	36	26	12	13.7	0	5 × 5 QFN	EAR99	LT5579IUH#TRPBF
HMC666	With LO amp	3.1 to 3.9	2.8 to 3.6	0 to 0.8	-9	31	27	29	9	23	0	4 × 4 LFCSP	EAR99	HMC666LP4E
LT5560	Active low power	0 to 4	0 to 4	0 to 4	2.4	9	52	41	9.3	-2.8	-2	3 × 3 DFN	EAR99	LT5560EDD#TRPBF
ADL5350	Passive	0.001 to 4	0.001 to 4	0.001 to 4	-6.7	25	13	29	6.4	19	4	2 × 3 LFCSP	5A991.b	ADL5350ACPZ-R2
LTC5569	Dual active	0.3 to 4	0.35 to 4.5	LF to 1.6	2	26.8	54	40	11.7	10.2	0	4 × 4 QFN	EAR99	LTC5569IUF#TRPBF
LTC5567	Active	0.3 to 4	0.3 to 4.5	0.005 to 2.5	1.9	26.9	60	42	11.8	10.1	0	4 × 4 QFN	EAR99	LTC5567IUF#TRPBF
LTC5543	Passive, with IF gain	2.2 to 4	2.4 to 3.6	0.005 to 0.6	8.4	24.5	29	37	10.2	10.9	0	5 × 5 QFN	EAR99	LTC5543IUH#TRPBF
HMC213B	Passive	1.5 to 4.5	1.5 to 4.5	0 to 1.5	-10	21	32	30	10	11	13	MSOP	EAR99	HMC213BMS8GE
LTC5593	Dual passive, with IF gain	2.3 to 4.5	2.1 to 3.8	0.005 to 0.6	8.5	27.7	35	44	9.5	10.4	0	5 × 5 QFN	EAR99	LTC5593IUH#TRPBF
LTC5510	Active	0.001 to 6	0.001 to 6.5	0.001 to 6	1.1	25	65	35	11.6	11.5	0	4 × 4 QFN	EAR99	LTC5510IUF#TRPBF
ADL5801	Active	0.001 to 6	0.001 to 6	0.001 to 0.6	1.8	29	31	27	9.75	13	0	4 × 4 LFCSP	5A991.b	ADL5801ACPZ-R7
ADL5802	Dual active	0.1 to 6	0.1 to 6	0 to 3	1.5	28	30	37	11	12	0	4 × 4 LFCSP	5A991.b	ADL5802ACPZ-R7
LTC5577	Active	0.3 to 6	0.3 to 6	0.001 to 1.5	0.7	30.2	67	35	11.8	15.2	0	4 × 4 QFN	EAR99	LTC5577IUF#TRPBF
LTC5566	Dual active, with IF VGA	0.3 to 6	0.15 to 6	0.001 to 0.5	-1.6 to +10.6	24.1	58	47	13	6.1 to 13.3	0	5 × 5 QFN	EAR99	LTC5566IUH#TRPBF
LTC5544	Passive, with IF gain	4 to 6	4.2 to 5.8	0.005 to 1	7.4	25.9	30	28	11.3	11.4	0	5 × 5 QFN	EAR99	LTC5544IUF#TRPBF
LTC5562	Active low power	LF to 7	DC to 9	DC to 7	1	18	34	38	14.6	5	-1	2 × 2 QFN	EAR99	LTC5562IUC#TRPBF
<b>New</b> LTC5555	Active with VGA	1.5 to 7	0.5 to 8	0.001 to 0.9	-6.2 to +9.2	22.6	50	55	15.1	10.8	0	4 × 5 QFN	EAR99	LTC5555IUDF#TRPBF
LTC5556	Dual active, with VGA	1.5 to 7	0.5 to 8	0.001 to 0.9	-6.1 to +9.1	23	46	—	15.2	10.9	0	5 × 5 QFN	EAR99	LTC5556IUH#TRPBF
HMC557A	Passive	2.5 to 7	2.5 to 7	0 to 3	-7	22	47	34	7	10	15	4 × 4 LFCSP	EAR99	HMC557ALC4
HMC219B	Passive	2.5 to 7	2.5 to 7	0 to 3	-9	18	40	35	9	11	13	MSOP	EAR99	HMC219BMS8GE
LTC5576	Active upconversion mixer	3 to 8	1 to 8	0.03 to 6	-0.6	25.6	40	35	14.1	10.4	0	4 × 4 QFN	EAR99	LTC5576IUF#TRPBF
HMC218B	Passive	3.5 to 8	3.5 to 8	0 to 1.6	-7	17	38	32	7	10	13	MSOP	EAR99	HMC218BMS8GE
HMC129A	Passive	4 to 8	4 to 8	0 to 3	-7	17	40	40	7	10	15	4 × 4 LFCSP	EAR99	HMC129ALC4
HMC787A*	Passive	3 to 10	3 to 10	0 to 4	-9	24	43	26	9	17	13	3 × 3 LFCSP	EAR99	HMC787ALC3B
HMC220B	Passive	5 to 12	5 to 12	0 to 4	-10	18	57	38	10	9.5	10	MSOP	EAR99	HMC220BMS8GE
LTC5548	With 2× LO	2 to 14	1 to 12	DC to 6	-10.2	18.7	29	32	9.6	15.2	0	3 × 2 QFN	EAR99	LTC5548IUDB#TRPBF
LTC5549	With 2× LO	2 to 14	1 to 12	0.5 to 6	-10.8	22.8	30	23	10.4	14.3	0	3 × 2 QFN	EAR99	LTC5549IUDB#TRPBF
HMC558A*	Passive	5.5 to 14	5.5 to 14	0 to 6	-9	22	33	33	7.5	11.5	15	3 × 3 LFCSP	EAR99	HMC558ALC3B
HMC553A	Passive	6 to 14	6 to 14	0 to 5	-9	22	37	33	7.5	11.5	13	3 × 3 LFCSP	EAR99	HMC553ALC3B

— = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Single, Double, and Triple Balanced Mixers (Continued)

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Noise Figure (dB)	Input P1dB (dBm)	LO Drive Nominal (dBm)	Package (mm)	ECCN Code	Ordering Part Number
HMC412B	Passive	9 to 15	9 to 15	0 to 2.5	-8.4	18	44	41	8.4	11	13	MSOP	EAR99	HMC412BMS8GE
HMC1048A*	Passive	2.25 to 18	2.25 to 18	0 to 4	-10	20	30	30	10	11	13	3 × 3 LFCSP	EAR99	HMC1048ALC3B
LTC5553	With integ LO buffer	3 to 20	1 to 20	0.5 to 9	-11.6	21.5	32	20	12.1	14.8	0	3 × 2 QFN	EAR99	LTC5553IUDB#TRPBF
LTC5552	With integ LO buffer	3 to 20	1 to 20	DC to 6	-10.8	18.5	24	19	11.7	14.8	0	3 × 2 QFN	EAR99	LTC5552IUDB#TRPBF
HMC554A*	Passive	10 to 20	10 to 20	0 to 6	-8.5	20	37	41	9.5	21	13	3 × 3 LFCSP	EAR99	HMC554ALC3B
HMC773A*	Passive	6 to 26	6 to 26	0 to 8	-9	19	37	37	9	10	13	3 × 3 LFCSP	EAR99	HMC773ALC3B
<b>HMC773A New</b>	Passive	6 to 26	6 to 26	0 to 10	-10	21	39	33	10	12	13	Die	EAR99	HMC773A
HMC260A*	Passive	10 to 26	10 to 26	0 to 8	-9	23	40	43	10	13	13	3 × 3 LFCSP	EAR99	HMC260ALC3B
HMC260A	Passive	10 to 26	10 to 26	0 to 8	-8.5	22	40	37	11.5	12	13	Die	EAR99	HMC260A
HMC292A*	Passive	14 to 30	14 to 30	0 to 8	-9	19	48	40	10.5	12	13	3 × 3 LFCSP	EAR99	HMC292ALC3B
HMC292A	Passive	14 to 32	14 to 32	0 to 8	-9	20	46	34	11	12	13	Die	EAR99	HMC292A
<b>HMC329A* New</b>	Passive	24 to 32	24 to 32	0 to 8	-10.5	20	36.5	35.5	10.5	12	13	3 × 3 QFN	EAR99	HMC329ALC3B
HMC1106	Passive	15 to 36	20 to 50	0 to 24	-11	16	38	32	9	0	15	Die	EAR99	HMC1106
HMC774A*	Passive	7 to 34	7 to 34	0 to 8	-12	20	30	23	12	12	15	3 × 3 LFCSP	EAR99	HMC774ALC3B
<b>HMC774A* New</b>	Passive	7 to 40	7 to 40	0 to 10	-11	20	32	50	12	12	13	Die	EAR99	HMC774A
<b>HMC560A* New</b>	Passive	22 to 38	22 to 38	0 to 18	-11	19.5	38	31	11.5	11.5	13	5 × 5 LGA	EAR99	HMC560ALM3
<b>HMC329A New</b>	Passive	22 to 38	22 to 38	0 to 8	-11	21	36	27	14	13.5	13	Die	EAR99	HMC329A
HMC-MDB169	Passive	54 to 64	54 to 64	0 to 5	-8	13	30	25	8	4	13	Die	5A991.h	HMC-MDB169
HMC1081	Passive	50 to 75	40 to 85	0 to 26	-7.5	16	30	20	7.5	10	12	Die	EAR99	HMC1081
HMC-MDB277	Passive	70 to 90	70 to 90	0 to 18	-12	—	—	—	—	—	14	Die	5A991.h	HMC-MDB277

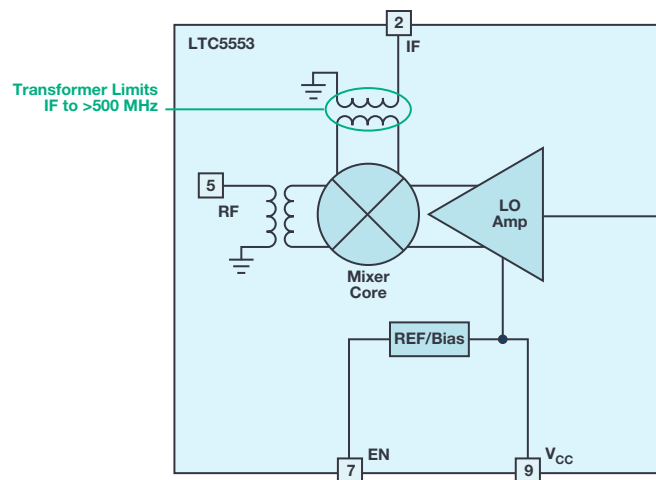
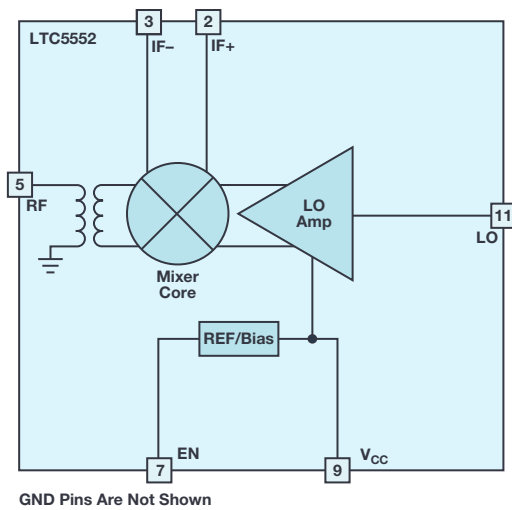
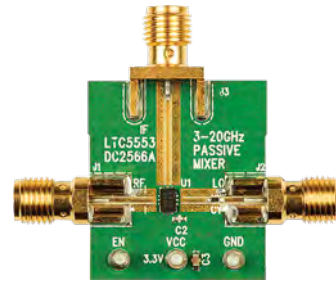
■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

# LTC5552/LTC5553: 3 GHz to 20 GHz Wideband Mixer with LO Amp

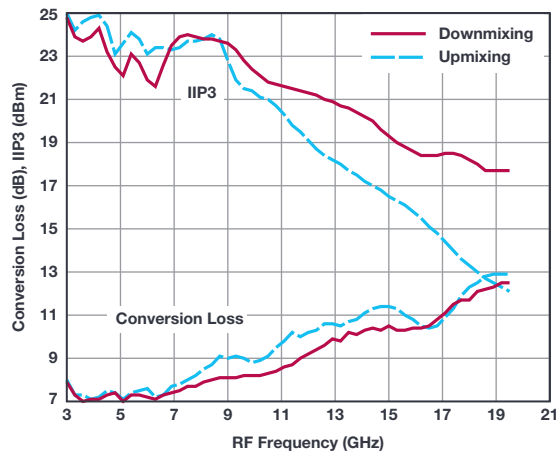
## Key Features

- ▶ Integrated LO buffer: 0 dBm LO drive
- ▶ Ultrawideband matched over full RF and LO frequency range
- ▶ Bidirectional up/downconversion
- ▶ Tiny 3 mm × 2 mm solution

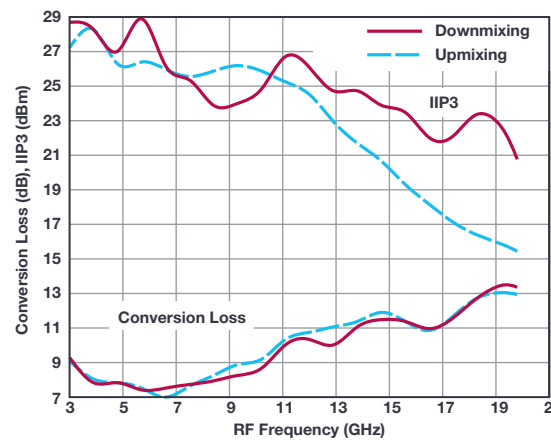
Specification	LTC5552	LTC5553
IF (GHz, 50 Ω)	DC to 6	0.5 to 9
LO (50 Ω matched)	1 GHz to 20 GHz	1 GHz to 20 GHz
Conversion loss	10.8 dB	11.6 dB
Input IP3	18.3 dBm	21.5 dBm
Noise figure	11.7 dB	12.8 dB
P1dB	14.6 dBm	16 dBm



Conversion Loss and IIP3 vs. RF Frequency (Low-Side LO, IF = 240 MHz)



Conversion Loss and IIP3 (Low-Side LO, IF = 1890 MHz)



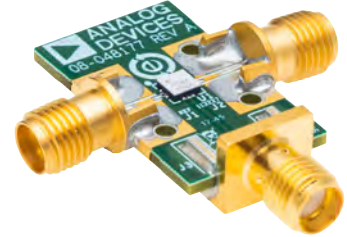
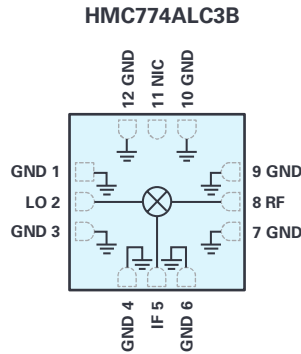
## HMC774A: 7 GHz to 34 GHz Ultrawideband Double Balanced Mixer

### Key Features

- ▶ Up/downconversion mixing
- ▶ 20 dBm IIP3
- ▶ 10 dB noise figure
- ▶ Wide IF bandwidth: dc to 8 GHz
- ▶ High LO to RF isolation: 30 dB
- ▶ 2.9 mm × 2.9 mm ceramic LCC

### Applications

- ▶ Point-to-point microwave links
- ▶ Point-to-multipoint very small aperture terminals (VSAT)
- ▶ Test equipment
- ▶ Military/aerospace radars and radio



## I/Q Mixers and Image Reject Mixers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	Image Rejection (dB)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Input P1dB (dBm)	LO Drive Nominal (dBm)	Package (mm)	ECCN Code	Ordering Part Number
HMC8193	I/Q and IRM	2.5 to 8.5	2.5 to 8.5	0 to 4	-9	20	25	48	38	13	18	4 × 4 LFCSP	EAR99	HMC8193LC4
HMC525A	I/Q and IRM	4 to 8.5	4 to 8.5	0 to 3.5	-8	20	30	47	23	13	15	4 × 4 LFCSP	EAR99	HMC525ALC4
HMC520A	I/Q and IRM	6 to 10	6 to 10	0 to 3.5	-8	19	23	43	25	10	15	4 × 4 LFCSP	EAR99	HMC520ALC4
HMC1056	I/Q and IRM	8 to 12	8 to 12	0 to 4	-8	18	21	40	37	9	10	4 × 4 LFCSP	EAR99	HMC1056LP4BE
HMC521A <b>New</b>	I/Q and IRM	8.5 to 13.5	8.5 to 13.5	0 to 3.5	-9	16	27.5	39	18.5	8.3	15	4 × 4 LFCSP	EAR99	HMC521ALC4
HMC521A <b>New</b>	I/Q and IRM	8.5 to 13.5	8.5 to 13.5	0 to 3.5	-7	17	21	38	18	8	15	Die	EAR99	HMC521ACHIPS
HMC8191*	I/Q and IRM	6 to 26.5	6 to 26.5	0 to 5	-9	24	25	40	40	15	18	4 × 4 LFCSP	EAR99	HMC8191LC4
HMC1063	I/Q and IRM	24 to 28	24 to 28	0 to 3	-9.5	17	21	38	40	8	10	3 × 3 LFCSP	EAR99	HMC1063LP3E
HMC524A	I/Q and IRM	22 to 32	22 to 32	0 to 4.5	-9	18	26	35	25	17	17	3 × 3 LFCSP	EAR99	HMC524ALC3B
HMC-MDB172	I/Q and IRM	19 to 33	19 to 33	0 to 5	-8	17	25	35	23	8	16	Die	5A991.h	HMC-MDB172
HMC8192 <b>New</b>	I/Q and IRM	20 to 42	20 to 42	0 to 5	-8.5	22	25	45	—	—	18	4 × 4 LFCSP	EAR99	HMC8192LG
HMC-MDB171	Subharmonic I/Q	35 to 45	35 to 45	0 to 5	-12.5	17	25	35	20	8	16	Die	5A991.h	HMC-MDB171
HMC-MDB218	Subharmonic I/Q	54 to 64	27 to 32	0 to 3	-12.5	7	30	30	30	-2	10	Die	5A991.h	HMC-MDB218

## Subharmonic Mixers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Input P1dB (dBm)	Image Rejection (dB)	LO Drive (dBm)	Package (mm)	ECCN Code	Ordering Part Number
HMC337	Subharmonic	17 to 25	9 to 12	0 to 3	-9	10	27	47	0	—	-5	Die	EAR99	HMC337
HMC264	Subharmonic	20 to 30	10 to 15	0 to 4	-9	12	35	40	4	—	-4	3 × 3 QFN	EAR99	HMC264LM3
HMC264	Subharmonic	21 to 31	10.5 to 15.5	0 to 6	-9	12	30	40	3	—	-4	3 × 3 LFCSP	EAR99	HMC264LC3B
HMC264	Subharmonic	20 to 32	10 to 16	0 to 6	-10	13	37	40	4	—	-4	Die	EAR99	HMC264
HMC265	Subharmonic	20 to 31	10 to 15.5	0.7 to 3	3	10	28	47	2	—	-4	3 × 3 QFN	EAR99	HMC265LM3
HMC265	Subharmonic	20 to 32	10 to 16	0.7 to 3	3	10	30	55	2	—	-4	Die	EAR99	HMC265

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Subharmonic Mixers (Continued)

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	LO/RF Isolation (dB)	LO/IF Isolation (dB)	Input P1 dB (dBm)	Image Rejection (dB)	LO Drive (dBm)	Package (mm)	ECCN Code	Ordering Part Number
HMC338	Subharmonic	26 to 33	13 to 16.5	0 to 2.5	-9	10	32	40	1	—	-5	Die	5A991.b	HMC338
HMC338	Subharmonic	24 to 34	12 to 16.5	0 to 3	-11	13	33	50	5	—	-5	3 × 3 LFCSP	5A991.b	HMC338LC3B
<b>HMC798A New</b>	Subharmonic	24 to 34	12 to 18	0 to 4	-10.5	20	36	27	6	—	4	3.9 × 3.9 CLCC	EAR99	HMC798ALC4
HMC404	Subharmonic I/Q	26 to 33	13 to 16.5	0 to 3	-11	16	35	35	6	22	2	Die	EAR99	HMC404
HMC339	Subharmonic	33 to 42	16.5 to 21	0 to 3	-10	10	37	40	0	—	2	Die	EAR99	HMC339
HMC1093	Subharmonic	37 to 46.5	8.5 to 11	0 to 7.5	-11	26	15	18	18	—	-1	Die	EAR99	HMC1093
HMC1057	Subharmonic I/Q	71 to 86	29 to 43	0 to 12	-12	13	50	30	0	16	13	Die	EAR99	HMC1057
HMC1058	Subharmonic	71 to 86	29 to 43	0 to 12	-11	6	28	20	0	—	9	Die	EAR99	HMC1058

## I/Q Downconverters/Receivers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	Image Rejection (dBc)	Noise Figure (dB)	LO Drive Nominal (dBm)	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC951A	Low noise, I/Q downconverter	5.6 to 8.6	4.5 to 12.1	DC to 3.5	13	3	32	2	0	5	155	4 × 4	EAR99	HMC951ALP4E
HMC951B	I/Q downconverter	5.6 to 8.6	5.6 to 8.6	0 to 3.5	13	1	24	2	2	3.5	160	4 × 4 LFCSP	EAR99	HMC951BLP4E
HMC8108	I/Q downconverter	9 to 10	9 to 10	0.02 to 1	13	6	20	2	-5	3, 3, 1.5	20, 30, 40	5 × 5 LFCSP	EAR99	HMC8108LC5
<b>HMC908A New</b>	I/Q downconverter	9 to 12	8.5 to 15.5	0 to 3.5	11	0	25	46	26	-8	12	4 × 4 CLCC	EAR99	HMC908ALC5
ADMV1010	I/Q downconverter	12.6 to 15.4	9 to 12.6	2.7 to 3.5	15	1	25	2	0	4	160	4.9 × 4.9 LCC	EAR99	ADMV1010AEZ
HMC1113	I/Q downconverter	10 to 16	10 to 16	0 to 3.5	12	1	25	2	6	3, 4	160	5 × 5 LFCSP	EAR99	HMC1113LP5E
HMC966	I/Q downconverter	17 to 20	7.5 to 11.75	0 to 3.5	14	0	40	3	6	3.5	160	4 × 4 LFCSP	EAR99	HMC966LP4E
HMC570	I/Q downconverter	17 to 21	7 to 12	0 to 3.5	12	1	22	4	3.5	3.5	125	Die	EAR99	HMC570
HMC570	I/Q downconverter	17 to 21	7 to 12	0 to 3.5	10	2	17	3	4	3.5	125	5 × 5 LFCSP	EAR99	HMC570LC5
ADMV4420	K-band downconverter with PLL and VCO	16.95 to 22.05	16.35 to 21.15	0.9 to 2.5	36	-20	—	7	Internal VCO	5	380	5 × 5 LFCSP	5A991.b	ADMV4420ACPZ
ADMV1012	I/Q downconverter	17.5 to 24	7 to 13.5	2.5 to 3.5	15	3	25	2.1	0	3.3	238	4.9 × 4.9 LCC	EAR99	ADMV1012AEZ
HMC904	I/Q downconverter	17 to 24	7.5 to 12.3	0 to 3.5	12	0	32	3	4	3.5	160	5 × 5 LFCSP	EAR99	HMC904LC5
HMC967	I/Q downconverter	21 to 24	8.8 to 13.5	0 to 3.5	15	1	25	3	6	3.5	170	4 × 4 LFCSP	EAR99	HMC967LP4E
HMC571	I/Q downconverter	21 to 25	9 to 14	0 to 3.5	11	5	24	3	4	3.5	125	Die	EAR99	HMC571
HMC571	I/Q downconverter	21 to 25	9 to 14	0 to 3.5	11	6	23	3	4	3.5	125	5 × 5 LFCSP	EAR99	HMC571LC5
HMC572	I/Q downconverter	23 to 28	9 to 15.5	0 to 3.5	10	6	20	4	4	3.5	125	5 × 5 LFCSP	EAR99	HMC572LC5
HMC977	I/Q downconverter	20 to 28	8.3 to 15.7	0 to 3.5	14	2	21	3	6	3.5	170	4 × 4 LFCSP	EAR99	HMC977LP4E
HMC1065	I/Q downconverter	27 to 34	11.5 to 19	0 to 4	12	-2	17	3	2	3	240	4 × 4 LFCSP	EAR99	HMC1065LP4E
<b>ADMV1014* New</b>	Wideband I/Q downconverter with 4× LO	24 to 44	5.4 to 10.25	0 to 6	17	0	30	5.5	0	3.3	437	5 × 5 LGA	EAR99	ADMV1014ACCZ
HMC6147A	I/Q downconverter	37 to 44	16.5 to 22	0 to 4	13	2	25	4	3	3	225	5 × 5 LFCSP	EAR99	HMC6147ALC5A
HMC6789B	I/Q downconverter	37 to 44	16.5 to 24	0 to 4	14	—	14	3.5	3	3, 3	150, 75	5 × 5 LFCSP	EAR99	HMC6789BLC5A

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave



## I/Q Downconverters/Receivers (Continued)

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Input IP3 (dBm)	Image Rejection (dBc)	Noise Figure (dB)	LO Drive Nominal (dBm)	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC7586	E-band I/Q downconverter	71 to 76	11.83 to 14.33	0 to 10	12.5	-1	28	5	2	4, 1.5, 3	175, 80, 50	Die	5A991.b	HMC7586
HMC8326	E-band I/Q downconverter SiP	71 to 76	11.5 to 13	0 to 2	12	1	30	6	4	4, 1.5, 3	175, 80, 50	SiP	5A991.b, EAR99	HMC8326LG
<b>ADMV7410</b> <b>New</b>	E-band I/Q downconverter SiP	71 to 76	11.5 to 13	DC to 2	13	1	30	5	4	4, 2, 1.5	66, 175, 80	11 × 13 LGA_CAV	EAR99	ADMV7410BCEZ
HMC7587	E-band I/Q downconverter	81 to 86	11.83 to 14.33	0 to 10	10	-2	30	6	2	4, 1.5, 3	175, 80, 50	Die	5A991.b	HMC7587
HMC8327	E-band I/Q downconverter SiP	81 to 86	13.2 to 14.6	0 to 2	8.5	2	30	6	4	4, 1.5, 3	175, 80, 50	SiP	5A991.b, EAR99	HMC8327LG
<b>ADMV7420</b> <b>New</b>	E-band I/Q downconverter SiP	81 to 86	13.2 to 14.6	DC to 2	10	1	30	5	4	4, 2, 1.5	66, 175, 80	11 × 13 LGA_CAV	EAR99	ADMV7420BCEZ

## I/Q Upconverters/Transmitters

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	Output IP3 (dBm)	Sideband Rejection (dBc)	LO Drive Nominal	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC6505A	I/Q upconverter	5.6 to 8.6	2.5 to 11.6	0 to 3	15	35	22	4	5	225	5 × 5 LFCSP	EAR99	HMC6505ALC5
ADMV1009	Differential I/Q upconverter	12.7 to 15.4	9 to 12.6	2.8 to 4	21	35	20	0	+5, -1.1	250, 60	5 × 5 LFCSP	EAR99	ADMV1009AEZ
HMC7911	I/Q upconverter	17 to 20	8.5 to 11.75	0 to 3.5	18	33	30	4	5	320	5 × 5 LFCSP	EAR99	HMC7911LP5E
ADRF6780	Wideband I/Q upconverter	5.9 to 23.6	5.4 to 14	0 to 3.5	13	26	25	0	3.3, 5	400, 160	5 × 5 LFCSP	5A991.h	ADRF6780ACPZN-R7
ADMV1011	I/Q upconverter	17 to 24	8 to 12	2 to 4	21	33	32	0	+3.5, +5, -1.8	160, 220, 75	4.9 × 4.9 LCC	EAR99	ADMV1011AEZ
HMC7912	I/Q upconverter	21 to 24	8.75 to 12	0 to 3.5	15	33	22	4	5	320	5 × 5 LFCSP	EAR99	HMC7912LP5E
HMC815B*	I/Q upconverter	21 to 27	10.5 to 14.5	0 to 3.75	12	27	22	4	4.5	350	5 × 5 LFCSP	EAR99	HMC815BLC5
HMC6787A	I/Q upconverter	37 to 40	16.5 to 22	0 to 4	10	26	17	4	3	350	5 × 5 LFCSP	EAR99	HMC6787ALC5A
<b>ADMV1013*</b> <b>New</b>	Wideband I/Q upconverter with 4× LO	24 to 44	5.4 to 10.25	0 to 6	18	23	26	0	3.3	550	6 × 6 LGA	EAR99	ADMV1013ACCZ
HMC6146B	I/Q upconverter	40 to 44	18 to 22	0 to 4	11	28	18	4	3	350	5 × 5 LFCSP	EAR99	HMC6146BLC5A
HMC8118	E-band I/Q upconverter	71 to 76	11.83 to 14.33	0 to 10	11	—	22	2	4, 1.5	175, 80	Die	5A991.b	HMC8118
<b>ADMV7310</b> <b>New</b>	E-band I/Q upconverter SiP	71 to 76	11.8 to 12.7	DC to 2	35	31	20	4	—	—	16 × 14 LGA_CAV	EAR99	ADMV7310BCEZ
HMC7584	E-band I/Q upconverter SiP	71 to 76	11.8 to 12.7	0 to 2	27.5 to 39	31	20	4	+4, -1, +1.5	905	SiP	5A991.b, EAR99	HMC7584LG
HMC8119	E-band I/Q upconverter	81 to 86	11.83 to 14.33	0 to 10	10	—	22	2	4, 1.5	175, 80	Die	5A991.b	HMC8119
<b>ADMV7320</b> <b>New</b>	E-band I/Q upconverter SiP	81 to 86	13.4 to 14.6	DC to 2	33	31	—	4	—	—	16 × 14 LGA_CAV	EAR99	ADMV7320BCEZ
HMC7585	E-band I/Q upconverter SiP	81 to 86	13.4 to 14.6	0 to 2	27.5 to 39	30	20	4	4, 1.5, 3	905	SiP	5A991.b, EAR99	HMC7585LG

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## ADMV1013: 24.5 to 43.5 GHz Wideband Microwave Upconverter

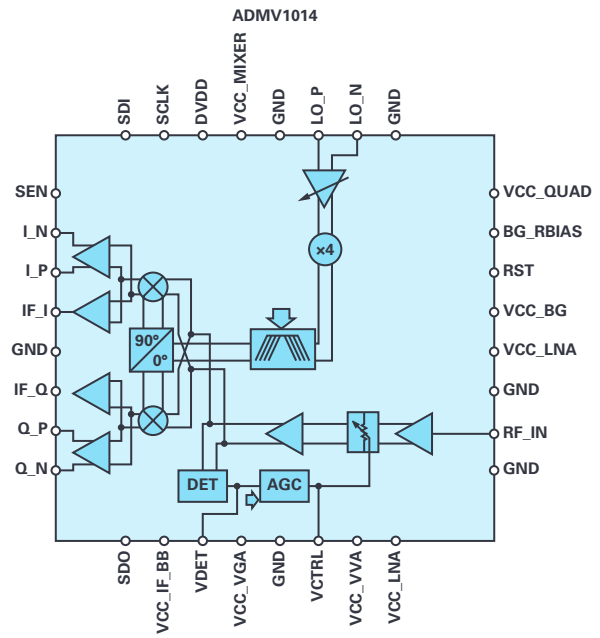
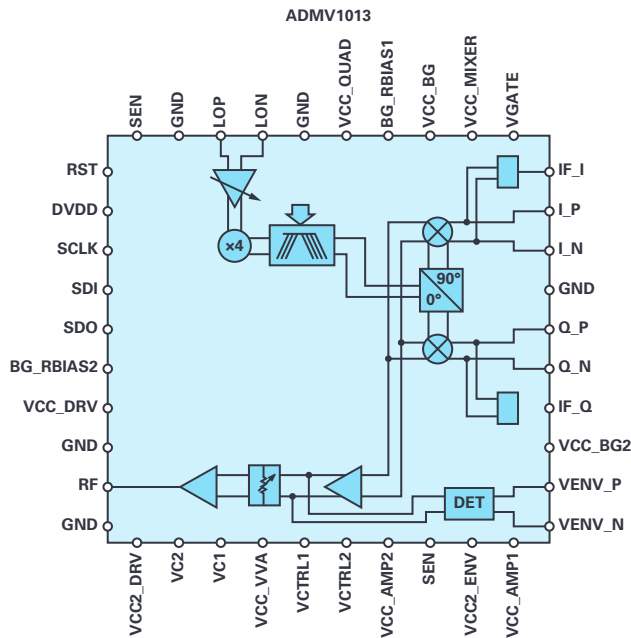
## ADMV1014: 24.5 to 43.5 GHz Wideband Microwave Downconverter

### ADMV1013 Key Features

- ▶ DC to 6 GHz I/Q input bandwidth
- ▶ Two upconversion modes:
  - Direct conversion from BB I/Q to RF
  - Single sideband upconversion from IF
- ▶ 0 dBm LO drive
- ▶ On-chip 4× LO input: 5.4 GHz to 11.75 GHz
- ▶ Conversion gain: 14 dB
- ▶ Output IP3: 24 dBm
- ▶ Sideband suppression: 25 dB
- ▶ SPI tunable sideband suppression, gain, and filter
- ▶ 6 mm × 6 mm CSP package

### ADMV1014 Key Features

- ▶ DC to 6 GHz I/Q output bandwidth
- ▶ Two downconversion modes:
  - Direct conversion from RF to baseband I/Q
  - Image-reject downconversion to complex IF
- ▶ 0 dBm LO drive
- ▶ On-chip 4× LO input: 5.4 GHz to 11.75 GHz
- ▶ Conversion gain: 20 dB
- ▶ NF: 3.5 dB
- ▶ Input IP3: -4 dBm
- ▶ Sideband suppression: 28 dB
- ▶ SPI tunable sideband suppression and gain
- ▶ 5 mm × 5 mm CSP package



## Mixers with Integrated LO

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Power Gain (dB)	PLL Phase Noise @ 10 kHz Offset (dBc/Hz)	VCO Phase Noise @ 1 MHz Offset (dBc/Hz)	Input IP3 (dBm)	Noise Figure (dB)	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC1190A	Dual Rx with frac-N PLL and VCO	0.7 to 2.39	0.05 to 4	0.05 to 0.35	8.9	-118	-139	27	9	5, 3.3	—	6 × 6 LFCSP	5A991.h	HMC1190ALP6NETR
ADRF6655	With PLL and VCO	0.1 to 2.5	1.05 to 2.3	LF to 2.2	6	-83	-136	29	12	5	260 to 285	6 × 6 LFCSP	5A991.b	ADRF6655ACPZ-R7
ADRF6601	With PLL and VCO	0.3 to 2.5	0.75 to 1.16	0 to 0.5	6.7	-99	-135	30.9	13.5	5	253 to 281	6 × 6 LFCSP	5A991.b	ADRF6601ACPZ-R7
ADRF6620	Rx mixer with IF, DGA, frac-N PLL, and VCO	0.7 to 2.5	0.35 to 2.85	—	9	-81	-110	40	19	5	260, 340	7 × 7 LFCSP	5A991.h	ADRF6620ACPZ-R7
ADRF6612	Dual Rx mixer with tunable balun, PLL, and VCO	0.7 to 3	0.2 to 2.7	0.04 to 0.5	9.3	-80	-138	28	11.3	5, 3.6	260, 260	7 × 7 LFCSP	5A991.g	ADRF6612ACPZ-R7
ADRF6614	Dual Rx mixer with tunable balun, PLL, and VCO	0.7 to 3	0.2 to 2.7	0.02 to 0.5	9.3	MC-GSM compliant	MC-GSM compliant	28	11.3	5, 3.6	260, 260	7 × 7 LFCSP	5A991.h	ADRF6614ACPZ-R7
ADRF6602	With PLL and VCO	1 to 3.1	1.55 to 2.15	0 to 0.5	6.5	-92	-128	29.5	12	5	235 to 263	6 × 6 LFCSP	5A991.b	ADRF6602ACPZ-R7
ADRF6603	With PLL and VCO	1.1 to 3.2	2.1 to 2.6	0 to 0.5	6.7	-88	-128	29.3	15.6	5	235 to 261	6 × 6 LFCSP	5A991.b	ADRF6603ACPZ-R7
ADRF6604	With PLL and VCO	1.2 to 3.6	2.5 to 2.9	0 to 0.5	6.8	-87	-126	27	15.5	5	135 to 276	6 × 6 LFCSP	5A991.b	ADRF6604ACPZ-R7
ADRF6658	Dual Rx with IF amp	0.69 to 3.8	—	—	Programmable 26.5	—	—	12 to 29	13	3.3	Selectable 260 to 440	7 × 7 LFCSP	5A991.h	ADRF6658BCPZ-RL7

## ADMV1017: 24 GHz to 29.5 GHz Up/Downconverter for mmWave 5G Radios

### Key Features

- ▶ 3GPP 5G network compliant core supports n257, n258, n261 bands radios
- ▶ Best-in-class performance
- ▶ 1.5 GHz RF bandwidth
- ▶ Two conversion modes:
  - Direct conversion I/Q baseband
  - IF conversion I/Q
- ▶ High level integration eases design, reduces size
- ▶ Integrated LO doubler and quadrupler with harmonic filter
- ▶ Integrated variable gain controlled amplifiers

### Applications

- ▶ Millimeter wave 5G network radio
- ▶ 5G microwave backhaul
- ▶ Private communications networks
- ▶ Millimeter wave test equipment



## I/Q Upconverters/Downconverters/Transceivers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	LO Drive Nominal (dBm)	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)
ADMV1017 <b>New</b>	Integrated mmW 5G Up/downconverter	24 to 29.5	Contact ADI	DC to 1.5 (BB), 3.5 to 10.5 (IF)	—	—	—	Contact ADI

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools.

# I/Q Modulators and Demodulators

## I/Q Modulators

Part Number	Description	RF Frequency (GHz)	LO Spur (dBm)	Sideband Suppression (dBc)	Noise (dBm/Hz)	Output P1dB (dBm)	Output IP3 (dBm)	Baseband Bandwidth @ 3 dB (MHz)	V <sub>s</sub> (V)	I <sub>sy</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADL5590	Narrow-band	0.869 to 0.9	—	-50	-157	16	29	250	5	170	6 × 6 LFCSP	5A991.b	ADL5590ACPZ-R7
AD8345	Low power	0.14 to 1	-42	-42	-155	2.5	25	80	3, 5	58, 62	TSSOP	5A991.b	AD8345AREZ
ADL5370	Narrow-band	0.3 to 1	-50	-41	-160	11	24	500	5	205	4 × 4 LFCSP	5A991.b	ADL5370ACPZ-R7
LT5568	Wideband	0.7 to 1.05	-43	-46	-160.3	8.3	22.9	380	5	117	4 × 4 QFN	EAR99	LT5568EUF#TRPBF
LT5568-2	GSM optimized	0.7 to 1.05	-43	-52	-159.4	8.6	22.9	380	5	110	4 × 4 QFN	EAR99	LT5568-2EUF#TRPBF
LT5558	Narrow-band	0.6 to 1.1	-43.7	-49	-158	7.8	22.4	400	5	108	4 × 4 QFN	EAR99	LT5558EUF#TRPBF
LT5571	Narrow-band	0.62 to 1.1	-42	-53	-159	8.1	21.7	400	5	97	4 × 4 QFN	EAR99	LT5571EUF#TRPBF
LTC5599	Low power	0.03 to 1.3	-51.5	-52.6	-156.7	5	20.8	57	3.3	28	4 × 4 QFN	EAR99	LTC5599IUF#TRPBF
ADL5371	Narrow-band	0.5 to 1.5	-50	-55	-159	14.5	27	500	5	175	4 × 4 LFCSP	5A991.b	ADL5371ACPZ-R7
LTC5598	Wideband	0.005 to 1.6	-51	-55	-160.9	8.4	25.5	400	5	165	4 × 4 QFN	EAR99	LTC5598IUF#TRPBF
ADL5591	Narrow-band	0.805 to 1.905	—	-47	-157	16	30	250	5	170	6 × 6 LFCSP	5A991.b	ADL5591ACPZ-R7
ADL5386	VGA and AGC	0.05 to 2.2	-38	-46	-160	11.1	25	700	5	230	6 × 6 LFCSP	5A991.b	ADL5386ACPZ-R7
ADL5385	Broadband	0.3 to 2.2	-46	-50	-159	11	26	500	5	215	4 × 4 LFCSP	5A991.b	ADL5385ACPZ-R7
LT5528	Narrow-band	1.5 to 2.4	-42	-45	-159.3	7.9	21.8	400	5	125	4 × 4 QFN	EAR99	LT5528EUF#TRPBF
LT5572	Narrow-band	1.5 to 2.5	-39.4	-41.2	-158.6	9.3	21.6	460	5	120	4 × 4 QFN	EAR99	LT5572EUF#TRPBF
ADL5372	Narrow-band	1.5 to 2.5	-45	-45	-158	14.2	27	500	5	165	4 × 5 LFCSP	5A991.b	ADL5372ACPZ-R2
AD8346	Low power	0.8 to 2.5	-42	-36	-147	-3	20	70	3, 5	43, 45	TSSOP	5A991.b	AD8346ARUZ
AD8349	Low power	0.7 to 2.7	-45	-35	-155	7.6	21	160	5	135	TSSOP	5A991.b	AD8349AREZ
HMC795	With VGA	0.05 to 2.8	—	-53	-156	11	25	440	3.3, 5	127	5 × 5 QFN	EAR99	HMC795LP5E
ADL5373	Narrow-band	2.3 to 3	-32	-57	-157	13.8	26	500	5	174	4 × 4 LFCSP	5A991.b	ADL5373ACPZ-WP
HMC1097	Wideband	0.1 to 6	-40	-40	-162	11	29	700	5	170	4 × 4 LFCSP	EAR99	HMC1097LP4E
LTC5588-1	Wideband	0.2 to 6	-39.6	-56.6	-160.6	12	31	600	3.3	303	4 × 4 QFN	EAR99	LTC5588IPF-1#TRPBF
ADL5375	Broadband	0.4 to 6	-46	-52	-160	9.4	26.8	750	5	200	4 × 4 LFCSP	5A991.b	ADL5375-05ACPZ-R2
LTC5589	Low power	0.7 to 6	-40.2	-41.5	-158.1	3.9	17.5	167	3.3	29.5	4 × 4 QFN	EAR99	LTC5589IUF#TRPBF
ADRF6780	Wideband	5.9 to 23.6	-25	25	-147	11	27	750	3.3, 5	490, 160	5 × 5 LFCSP	5A991.h	ADRF6780ACPZN-R7

## I/Q Demodulators

Part Number	Description	RF Frequency (GHz)	Gain Error (dB)	Phase Error (°)	Noise Figure (dB)	Input P1dB (dBm)	Input IP3 (dBm)	Baseband Bandwidth @ 3 dB (MHz)	V <sub>s</sub> (V)	I <sub>sy</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
LT5546	Low power, 2× LO, 55 dB VGA	0.04 to 0.5	0.14	0.6	7.8	-10	-1	17	1.8 to 5.25	24	4 × 4 QFN	EAR99	LT5546EUF#TRPBF
LT5506	Low power, 2× LO, 55 dB VGA	0.04 to 0.5	0.2	0.6	6.8	-11.5	-0.5	8.8	1.8 to 5.25	26.6	4 × 4 QFN	EAR99	LT5506EUF#TRPBF
LT5517	Low frequency, 2× LO	0.04 to 0.9	0.03	0.7	12.4	10	21	130	5	90	4 × 4 QFN	EAR99	LT5517EUF#TRPBF
AD8348	Broadband, with VGA	0.05 to 1	0.25	0.5	10.75	13	28	125	3, 5	47, 51	TSSOP	5A991.b	AD8348ARUZ
LTC5584	Broadband	0.03 to 1.4	0.01	0.7	10	13.1	28	530	5	200	4 × 4 QFN	EAR99	LTC5584IUF#TRPBF
LT5516	Narrow-band	0.8 to 1.5	0.2	1	12.8	6.6	21.5	260	5	117	4 × 4 QFN	EAR99	LT5516EUF#TRPBF
ADL5387	2× LO, broadband	0.03 to 2	0.05	0.2	12	13	31	240	5	180	4 × 4 LFCSP	5A991.b	ADL5387ACPZ-WP
LT5515	Narrow-band	1.5 to 2.5	0.3	1	16.8	9	20	260	5	125	4 × 4 QFN	EAR99	LT5515EUF#TRPBF
ADL5382	Broadband	0.7 to 2.7	0.05	0.2	15.6	14.4	30.5	370	5	220	4 × 4 LFCSP	5A991.b	ADL5382ACPZ-WP
AD8347	I/Q demodulator and VGA	0.8 to 2.7	0.3	1	11	-2	11.5	65	3, 5	64, 68	4 × 4 LFCSP	5A991.b	AD8347ARUZ

## I/Q Demodulators (Continued)

Part Number	Description	RF Frequency (GHz)	Gain Error (dB)	Phase Error (°)	Noise Figure (dB)	Input P1dB (dBm)	Input IP3 (dBm)	Baseband Bandwidth @ 3 dB (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
LT5575	Broadband	0.8 to 2.7	0.01	0.4	12.7	11.2	22.6	490	5	132	4 × 4 QFN	EAR99	LT5575EUF#TRPBF
LTC5585	Broadband	0.4 to 4	0.05	0.7	12.7	16	25.7	530	5	200	4 × 4 QFN	EAR99	LTC5585IUF#TRPBF
ADL5380	Broadband	0.4 to 6	0.07	0.2	11.7	11.6	27.8	390	5	245	4 × 4 LFCSP	5A991.b	ADL5380ACPZ-WP
LTC5586	Ultrawideband, with VGA, digital IR cal	0.3 to 6	0.06	0.06	19.5	13	30	1000	5	440	5 × 5 QFN	EAR99	LTC5586IUH#TRPBF
LTC5594	Ultrawideband, with VGA, digital IR cal	0.3 to 9	0.06	1.6	21.2	4	27.8	1000	5	470	5 × 5 QFN	EAR99	LTC5594IUH#TRPBF

## I/Q Modulators with Integrated LO

Part Number	Description	RF Frequency (GHz)	PLL Phase Noise @ 10 kHz Offset (dBc/Hz)	PLL Phase Noise @ 1 MHz Offset (dBc/Hz)	LO Spur (dBm)	Sideband Suppression (dBc)	Noise (dBm/Hz)	Output P1dB (dBm)	Output IP3 (dBm)	Baseband Bandwidth @ 3 dB (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADRF6701	With integrated LO	0.4 to 1.25	-113	-135	-45	-40	-159.7	11.2	31.7	750	5	290	6 × 6 LFCSP	5A991.b	ADRF6701ACPZ-R7
ADRF6750	With integrated LO	0.95 to 1.575	-93	-133	-45	-45	-162	8.5	23	600	5	310	8 × 8 LFCSP	5A991.b	ADRF6750ACPZ-R7
ADRF6755	With integrated LO	0.1 to 2.4	-93	-133	-45	-45	-162	8	21	600	5	380	8 × 8 LFCSP	5A991.b	ADRF6755ACPZ
ADRF6702	With integrated LO	1.2 to 2.4	-110.8	-124.6	-40	-53.9	-159.6	13.6	30.1	750	5	290	6 × 6 LFCSP	5A991.b	ADRF6702ACPZ-R7
ADRF6703	With integrated LO	1.55 to 2.65	-98.8	-129.2	-40	-44	-159.7	13.5	32.7	750	5	290	6 × 6 LFCSP	5A991.b	ADRF6703ACPZ-R7
ADRF6720	With integrated LO	0.7 to 3	-91.5	-136.8	-40	-38	-157	12.7	35.7	1000	3.3	425	6 × 6 LFCSP	5A991.b	ADRF6720ACPZ-R7
ADRF6720-27*	With integrated LO	0.4 to 3	-92.4	-136.8	-44	-40.8	-159.5	10.8	31.1	1000	3.3	425	6 × 6 LFCSP	5A991.b	ADRF6720-27ACPZ-R7
ADRF6704	With integrated LO	2.05 to 3	-92.3	-125.2	-41	-37.7	-158.3	12.1	27.2	750	5	276	6 × 6 LFCSP	5A991.b	ADRF6704ACPZ-R7
HMC1197	With integrated LO	0.1 to 4	-110	-134.5	-40	-45	-160	11	30	600	5, 3.3	320	7 × 7 QFN	5A991.b	HMC1197LP7FE

\* = X-Microwave

## I/Q Demodulators with Integrated LO

Part Number	Description	RF Frequency (GHz)	PLL Phase Noise @ 10 kHz Offset (dBc/Hz)	PLL Phase Noise @ 1 MHz Offset (dBc/Hz)	Gain Error (dB)	Phase Error (°)	Noise Figure (dB)	Input P1dB (dBm)	Input IP3 (dBm)	Baseband Bandwidth @ 3 dB (MHz)	V <sub>s</sub> (V)	I <sub>sy</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADRF6806	With frac-N PLL and VCO	0.05 to 0.525	—	—	0.1	0.5	12.2	12.2	28.5	170	3, 5	86, 270	6 × 6 LFCSP	5A991.b	ADRF6806ACPZ-R7
ADRF6850	With frac-N PLL and VCO	0.1 to 1	-98	-136	0.1	0.5	11	12	22.5	300	3	350	8 × 8 LFCSP	5A991.b	ADRF6850BCPZ
ADRF6807	With frac-N PLL and VCO	0.7 to 1.05	-107	-137	0.1	0.5	13.1	12.8	26.7	170	3, 5	86, 227	6 × 6 LFCSP	5A991.b	ADRF6807ACPZ-R7
ADRF6801	With frac-N PLL and VCO	0.75 to 1.15	-88.3	-138.6	0.05	0.3	14.3	12.5	25	275	5	262	6 × 6 LFCSP	5A991.b	ADRF6801ACPZ-R7
ADRF6820	With frac-N PLL and VCO	0.695 to 2.7	-94.7	-141.5	0.1	0.5	20	14.5	37	1400	3.3, 5	83, 310	6 × 6 LFCSP	5A991.b	ADRF6820ACPZ-R7
ADRF6821	DPD receiver with frac-N PLL/VCO	0.45 to 2.8	-97	-138	0.12	<0.5	17	2	24	500	3.3	273, 303	8 × 8 LFCSP	5A991.b, EAR99	ADRF6821ACPZ

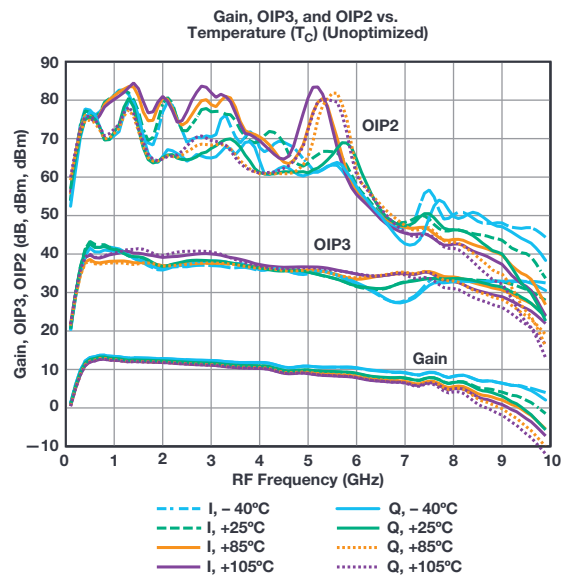
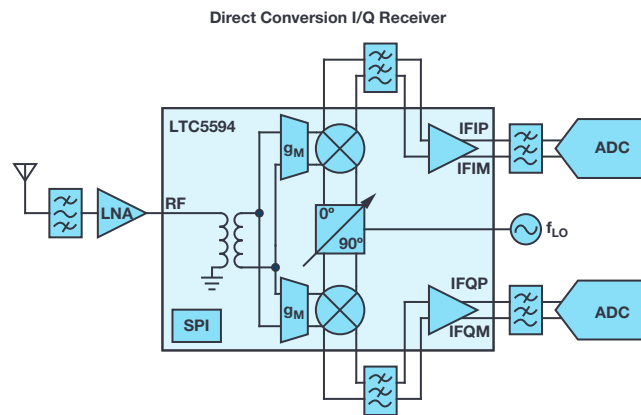
### LTC5594: 300 MHz to 9 GHz Ultrawideband Direct Conversion I/Q Demodulator

#### Key Features

- ▶ >1 GHz I/Q bandwidth
- ▶ 37 dB image rejection, adjustable to >60 dB
- ▶ Ultrawideband matched input 500 MHz to 9 GHz
- ▶ Superb OIP3: 37 dBm at 5.8 GHz
- ▶ On-chip adjustments via serial port
  - Gain with max gain of 11 dB, in 1 dB steps
  - I/Q phase imbalance
  - I/Q gain imbalance
  - I/Q dc offset null
  - LO frequency matching
  - I/Q HD2 and IM2
  - I/Q HD3 and IM3

#### Applications

- ▶ 5G base station fronthaul and backhaul
- ▶ Military satellites and receivers
- ▶ Microwave point-to-point radios
- ▶ Software-defined radios
- ▶ DPD observation receivers



# Integrated Transceivers, Transmitters, and Receivers

## Microwave and Millimeter Wave Integrated Transmitters/Receivers

### V-Band Transmitters/Receivers

Part Number	Description	Frequency (GHz)	I/Q Bandwidth (GHz)	Max Gain (dB)	RF Control Range (dB)	IF Control Range (dB)	IP3 (dBm)	Image/Sideband Rejection (dBc)	Noise Figure (dB)	P1dB (dBm)	Power Dissipation (W)	Package (mm)	ECCN Code	Ordering Part Number
HMC6300	60 GHz integrated transmitter	57 to 64	1.8	35	22	14	20 (OIP3)	40	—	12 (single end) 15 (balanced)	0.88 (single end) 1.0 (balanced)	BGA	5A991.h	HMC6300BG46
HMC6301	60 GHz integrated receiver	57 to 64	1.8	67	6	12 (analog) 15 (digital)	-9 (IIP3)	35	8	30	0.82 (single end) 0.57 (external LO)	BGA	5A991.h	HMC6301BG46

### E-Band Transmitters/Receivers

Part Number	Description	RF (GHz)	LO (GHz)	IF (GHz)	Conversion Gain (dB)	IP3 (dBm)	Image/Sideband Rejection (dBc)	Noise Figure (dB)	LO Drive Nominal (dBm)	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC7586	E-band I/Q receiver	71 to 76	11.83 to 14.33	0 to 10	12.5	-1 (IIP3)	28	5	2	4, 1.5, 3	175, 80, 50	Die	5A991.b	HMC7586
<b>ADMV7410</b> <b>New</b>	E-band I/Q downconverter SiP	71 to 76	11.5 to 13	DC to 2	13	1	30	5	4	4, 2, 1.5	66, 175, 80	11 × 13 LGA_CAV	EAR99	ADMV7410BCEZ
HMC8326	E-band I/Q downconverter SiP	71 to 76	11.5 to 13	0 to 2	12	1 (IIP3)	30	6	4	4, 1.5, 3	175, 80, 50	SiP	5A991.b, EAR99	HMC8326LG
HMC8118	E-band I/Q upconverter	71 to 76	11.83 to 14.33	0 to 10	11	—	22	—	2	4, 1.5	175, 80	Die	5A991.b	HMC8118
<b>ADMV7310</b> <b>New</b>	E-band I/Q upconverter SiP	71 to 76	11.8 to 12.7	DC to 2	35	31	20	26	4	—	—	16 × 14 LGA_CAV	EAR99	ADMV7310BCEZ
HMC7584	E-band I/Q upconverter SiP	71 to 76	11.8 to 17	0 to 2	27.5	31	20	4	—	+4, +4, +4, -1	—	SiP	5A991.b, EAR99	HMC7584LG
<b>ADMV7420</b> <b>New</b>	E-band I/Q downconverter SiP	81 to 86	13.2 to 14.6	DC to 2	10	1	30	5	4	4, 2, 1.5	66, 175, 80	11 × 13 LGA_CAV	EAR99	ADMV7420BCEZ
<b>ADMV7320</b> <b>New</b>	E-band I/Q upconverter SiP	81 to 86	13.4 to 14.6	DC to 2	33	31	—	—	—	—	—	16 × 14 LGA_CAV	EAR99	ADMV7320BCEZ
HMC7587	E-band I/Q Receiver	81 to 86	11.83 to 14.33	0 to 10	10	-2 (IIP3)	30	6	2	4, 1.5, 3	175, 80, 50	Die	5A991.b	HMC7587
HMC8327	E-band I/Q downconverter SiP	81 to 86	13.2 to 14.6	0 to 2	2	2 (IIP3)	30	6	4	4, 1.5, 3	175, 80, 50	SiP	5A991.b, EAR99	HMC8327LG
HMC8119	E-band I/Q upconverter	81 to 86	11.83 to 14.33	0 to 10	10	—	22	—	2	4, 1.5	175, 80	Die	5A991.b	HMC8119
HMC7585	E-band I/Q upconverter SiP	81 to 86	13.2 to 14.6	0 to 2	2	2	30	6	—	4, 1.5, 3	—	SiP	5A991.b, EAR99	HMC7585LG

## Intermediate Frequency Subsystems

Part Number	Description	RF (MHz)	IF (MHz)	Conversion Gain (dB)	RF VGA Dynamic Range (dB)	IF VGA Dynamic Range (dB)	Output IP3 (dBm)	Image Rejection (dBc)	Noise Figure (dB)	V <sub>SUPPLY</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC8100	Intermediate frequency receiver	800 to 4000	80 to 200	85	47	49	18	36	5	3.3	600	6 × 6 LFCSP	5A991.b	HMC8100LP6JE
HMC8200	Intermediate frequency transmitter	800 to 4000	200 to 700	34	35	—	31	15	6	3.3	540	5 × 5 LFCSP	5A991.b	HMC8200LP5ME

## 24 GHz ADAS Radar Solutions

Part Number	Description	Function	Frequency (GHz)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADF4158	6 GHz, frac-N FMCW ramping PLL	Ramp generator	0.5 to 6.1	-216	32	3	23	4 × 4 LFCSP	5A991.h	ADF4158CCPZ
ADF4159*	13 GHz, frac-N FMCW ramping PLL	Ramp generator	0.5 to 13	-224	110	3	33	4 × 4 LFCSP	5A991.h	ADF4159CCPZ

Part Number	Description	Function	RF (GHz)	Signal Bandwidth (MHz)	Phase Noise @ 10 MHz Offset (dBc/Hz)	Output Power (dBm)	Input	ADC Resolution	V <sub>TUNE</sub> (V)	Power (W)	Package (mm)	ECCN Code	Ordering Part Number
ADF5901	ISM band, 2-ch FMCW transmitter	Tx MMIC	24 to 24.25	250	-128	2 to 10	Single ended	8-bit	1 to 2.8	0.002	5 × 5 LFCSP	EAR99	ADF5901WCCPZ
ADF5902 <b>New</b>	ISM band, 2-ch FMCW transmitter with integrated FMCW PLL	Tx MMIC	24 to 24.25	250	-128	2 to 12	Single ended	8-bit	1 to 2.8	0.002	5 × 5 LFCSP	EAR99	ADF5902WCCPZ

Part Number	Description	Function	RF (GHz)	Signal Bandwidth (MHz)	Rx Channel Gain (dB)	P1dB (dBm)	RF/IF Isolation (dB)	Noise Figure (dB)	Package (mm)	ECCN Code	Ordering Part Number
ADF5904	ISM band, 4-ch receiver	Rx MMIC	24 to 24.25	250	22	-10	30	10	5 × 5 LFCSP	EAR99	ADF5904ACPZ

Part Number	Description	Function	Sample Rate (MSPS)	Gain (dB)	Low-Pass Filter BW (MHz)	SNR (dB)	SFDR (dB)	Noise (nV/√Hz)	Antialiasing Filter	Power (W)	Package (mm)	ECCN Code	Ordering Part Number
AD8283	6-ch, LNA/PGA/AAF with ADC	AFE	72	16 to 34 (programmable)	1 to 12 (programmable)	67	68	3.5	Included	0.17	10 × 10 LFCSP	—	AD8283WBCPZ
AD8284	6-ch, LNA/PGA/AAF with ADC	AFE	60	17 to 35 (programmable)	9 to 15 (programmable)	67	68	3.5	Included	0.345	10 × 10 TQFP	—	AD8284WCSVZ
ADAR7251	4-ch, 16-bit, continuous time data acquisition ADC	AFE	0.3 to 1.2	0 to 45 (programmable)	—	—	—	2.4	Not required	0.4	7 × 7 LFCSP	—	ADAR7251WBCSZ

Part Number	Description	Function	Operating Frequency (MHz)	Core	On-Chip L1 SRAM (kB)	On-Chip L2 SRAM (MB)	On-Chip L2 ROM (kB)	On-Chip RAM (MB)	On-Chip ROM (MB)	Power (W)	Package (mm)	ECCN Code	Ordering Part Number
ADSP-BF70x	Low power ADSP-BF70x series of Blackfin+ embedded DSP processors with 512 kB L2 SRAM and DDR2/LPDDR interface	DSP	200 to 400	16-bit 32-bit	136	256	512	—	—	<1	12 × 12 LFCSP 12 × 12 BGA	5A992.c, EAR99	ADSP-BF702/ ADSP-BF703/ ADSP-BF704/ ADSP-BF705/ ADSP-BF706/ ADSP-BF707
ADSP-2147x	ADSP-2147x SHARC DSP	DSP	200 to 300	32-bit 40-bit	—	—	—	2 to 5	4	—	LFCSP BGA	—	—

Additional PLLs can be found in the Clock Generation and Distribution section on page 71.

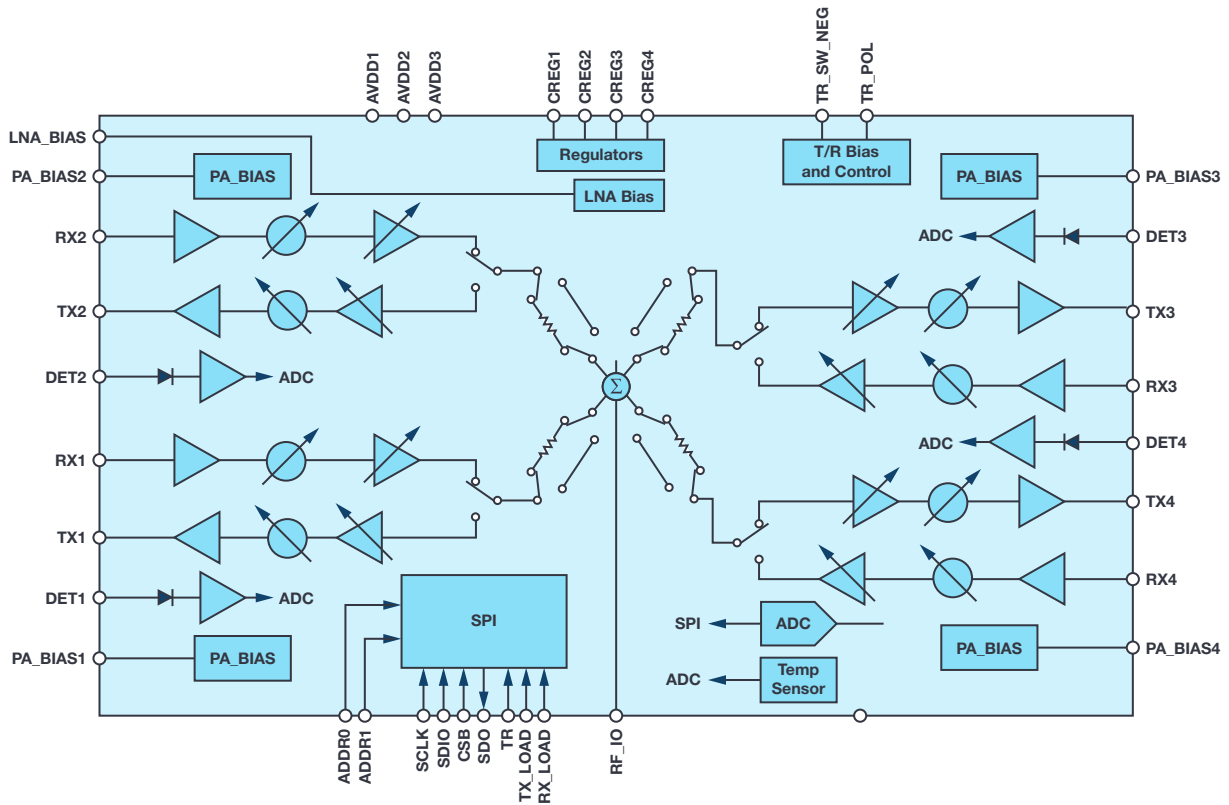
\* = X-Microwave



# ADAR1000: 4-Channel X-/Ku-Band Beamformer

## Key Features

- ▶ 8 GHz to 16 GHz frequency range
- ▶ Half-duplex to transmit and receive
- ▶ Single pin transmit/receive control
- ▶ 360° phase control, <math><2.8^\circ</math> phase resolution
- ▶ 31 dB gain control, 0.5 dB resolution
- ▶ Single-ended RF pins
- ▶ Bias and control for external transmit/receive modules
- ▶ Memory for prestored beam positions
- ▶  $\pm 2$  dB power detector
- ▶  $\pm 10^\circ$  temperature sensor
- ▶ Auxiliary 8-bit ADC for power detectors and temperature sensors
- ▶ Supports low power modes
- ▶ 4-wire SPI interface



## RadioVerse Integrated Transceivers

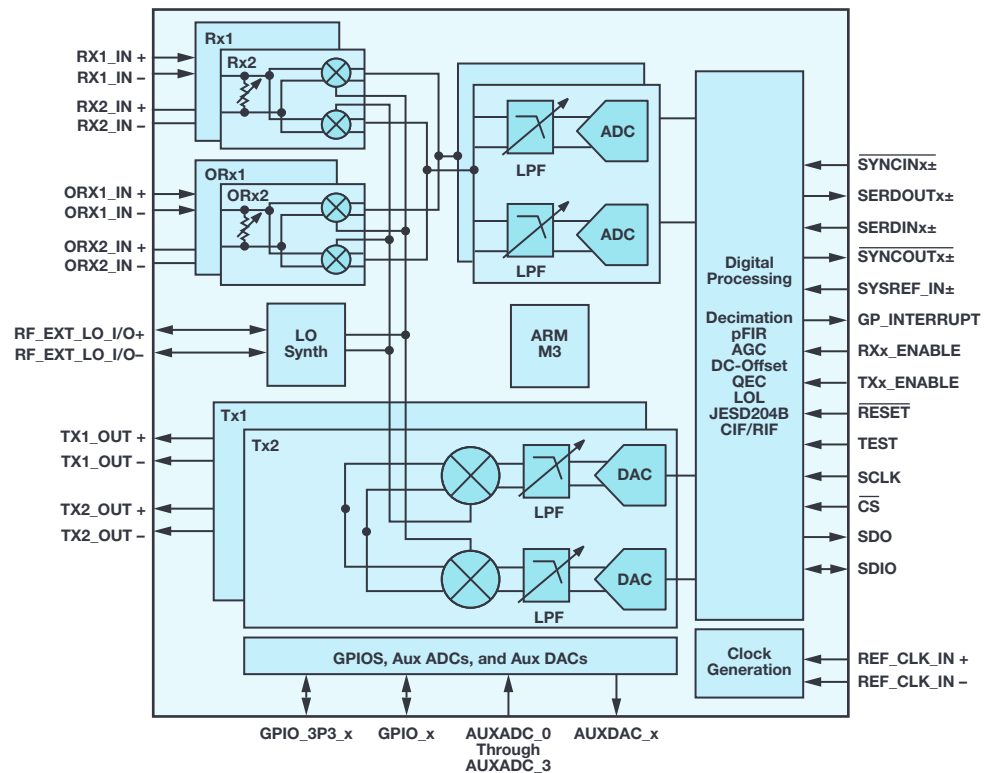
Part Number	Product Features	Functionality	RF Tuning Range	Bandwidth	Rx Image Rejection (dB)	Rx NF/IIP3	Tx OIP3 (dBm)	EVM (dB)	Package Size (mm)	DPD Engine
AD9361	General-purpose SDR; low power; JESD207 CMOS/LVDS	2 Rx, 2 Tx	70 MHz to 6 GHz	56 MHz	50	3 dB/-14 dBm	19	-40	10 x 10	—
AD9364	General-purpose SDR; low power; JESD207 CMOS/LVDS	1 Rx, 1 Tx	70 MHz to 6 GHz	56 MHz	50	3 dB/-14 dBm	19	-40	10 x 10	—
AD9363	General-purpose SDR; low power; CMOS/LVDS digital	2 Rx, 2 Tx	325 MHz to 3.8 GHz	20 MHz	50	3 dB/-14 dBm	19	-34	10 x 10	—
AD9371	Improved dynamic range; scalable MIMO; 6 Gbps JESD204B	2 Tx, 2 Rx, ORx, and SnRx	300 MHz to 6 GHz	100 MHz Rx, 250 MHz Tx, ORx	75	13.5 dB/+22 dBm	27	-40	12 x 12	—
AD9375	Improved dynamic range; low power DPD; scalable MIMO; 6 Gbps JESD204B	2 Tx, 2 Rx, ORx, and SnRx	300 MHz to 6 GHz	100 MHz Rx, 250 MHz Tx, ORx	75	13.5 dB/+22 dBm	27	-40	12 x 12	Linearization bandwidth up to 40 MHz
ADRV9009	Multichip sync for massive MIMO; integrated AGC, dc offset, QEC correction; digital filters; 12 Gbps JESD204B	2 Tx, 2 Rx, (TDD)	100 MHz to 6 GHz	200 MHz Rx, 450 MHz Tx, ORx	75	12 dB/+15 dBm	27	-43	12 x 12	—
ADRV9008-1/ ADRV9008-2	Multichip sync for massive MIMO; integrated AGC, dc offset, QEC correction; digital filters; 12 Gbps JESD204B	2 Rx, 2 Tx, 1 ORx (FDD)	100 MHz to 6 GHz	200 MHz Rx, 450 MHz Tx, ORx	75	12 dB/+15 dBm	27	-43	12 x 12	—

# ADRV9009: Widest Bandwidth, Highest Performance Integrated Transceiver Supports Massively Parallel MIMO

## Key Features

- ▶ Operating frequency: 100 MHz to 6 GHz
- ▶ Functionality: dual transmitters, dual receivers, and observation receivers with shared inputs
- ▶ Supports multichip LO phase synchronization
- ▶ Optimized for TDD operation
- ▶ Bandwidth: 200 MHz receiver, 450 MHz transmitter, and observation receiver
- ▶ Integrated AGC, dc offset, and quadrature error correction
- ▶ Integrated digital filtering
- ▶ Interface: 12 Gbps JESD204B
- ▶ Power consumption: 4.6 W\*
- ▶ Package: 12 mm × 12 mm BGA
- ▶ Single-chip TDD solution replaces over 20 discrete radio components, reducing complexity, SWaP, and costs
- ▶ Multichip sync capability simplifies digital beamforming for massive MIMO and phased array designs
- ▶ Fast time to market development

\*For 50% transmit/receive duty cycle, ORx on, 200 MHz/450 MHz bandwidth, 0 dB attenuation



# PLL/Synthesizers

## Integer-N PLLs

Part Number	Description	Frequency (GHz)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADF4001	Integer-N	0.01 to 0.2	-217	—	2.7 to 5.5	4.5	4 × 4 LFCSP	5A991.b	ADF4001BCPZ-RL7
ADF4002	Integer-N	0.005 to 0.4	-222	104	3	5	4 × 4 LFCSP	5A991.b	ADF4002BCPZ-RL7
HMC1031	Integer-N	0 to 0.5	-208	140	3	2	MSOP	EAR99	HMC1031MS8E
ADF4110	Integer-N	0.05 to 0.55	-213	—	2.7 to 5.5	4.5	4 × 4 LFCSP	5A991.b	ADF4110BCPZ-RL7
ADF4116	Integer-N	0.08 to 0.55	-211	55	2.7 to 5.5	4.5	TSSOP	5A991.b	ADF4116BRUZ-REEL7
ADF4111	Integer-N	0.08 to 1.2	-213	—	2.7 to 5.5	4.5	TSSOP	5A991.b	ADF4111BRUZ-RL7
ADF4117	Integer-N	0.1 to 1.2	-213	55	2.7 to 5.5	4.5	TSSOP	5A991.b	ADF4117BRUZ
ADF4212L	Integer-N	0.2 to 2.4	-215	75	3	7.5	TSSOP	5A991.b	ADF4212LBRUZ
HMC440	Integer-N	0.01 to 2.8	-233	1300	5	250	QSOP	3A001.a.11.b	HMC440QS16GE
HMC4069	Integer-N	0.01 to 2.9	-233	1300	5	295	4 × 4 LFCSP	3A001.a.11.b	HMC4069LP4E
ADF4118	Integer-N	0.1 to 3	-216	55	2.7 to 5.5	6.5	TSSOP	5A991.b	ADF4118YRUZ-RL7
ADF4113	Integer-N	0.2 to 3.7	-217	—	2.7 to 5.5	8.5	4 × 4 LFCSP	5A991.b	ADF4113BCPZ-RL7
ADF4113HV	Integer-N	0.2 to 3.7	-212	5	2.7 to 5.5	11	4 × 4 LFCSP	5A991.b	ADF4113HVBCPZ-RL7
LTC6945	Integer-N	0.35 to 6	-226	100	3.3	110	4 × 5 LFCSP	EAR99	LTC6945IUFD#TRPBF
ADF4106	Integer-N	0.5 to 6	-223	104	3	13	4 × 4 LFCSP	5A991.b	ADF4106BCPZ-R7
HMC698	Integer-N	0.08 to 7	-233	1300	5	310	5 × 5 LFCSP	3A001.a.11.b	HMC698LP5E
HMC699	Integer-N	0.16 to 7	-233	1300	5	310	5 × 5 LFCSP	3A001.a.11.b	HMC699LP5E
ADF4107	Integer-N	1 to 7	-223	104	3	17	4 × 4 LFCSP	5A991.b	ADF4107BCPZ-REEL7
ADF4007	Integer-N	1 to 7.5	-219	120	3	15	4 × 4 LFCSP	5A991.b	ADF4007BCPZ-RL7
ADF4108	Integer-N	1 to 8	-223	104	3	15	4 × 4 LFCSP	5A991.b	ADF4108BCPZ-RL7
ADF41020	Integer-N	4 to 18	-221	100	3	30	4 × 4 LFCSP	5A991.b	ADF41020BCPZ-RL7

## Fractional-N/Integer-N PLLs

Part Number	Description	Frequency (GHz)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADF4150HV	Frac-N/int-N PLL, 30 V charge pump	0.3 to 3	-213	26	3.3	50	5 × 5 LFCSP	5A991.b	ADF4150HVBCPZ-RL7
ADF4252	Frac-N/int-N PLLs	0.25 to 3	-214	RF PFD 30 IF PFD 55	3	13	4 × 4 LFCSP	5A991.b	ADF4252BCPZ-R7
ADF4193	Frac-N/int-N PLLs	0.4 to 3.5	-216	30	3	68	5 × 5 LFCSP	5A991.h	ADF4193BCPZ-RL7
ADF4151	Int-N and frac-N	0.5 to 3.5	-221	32	3.3	42	5 × 5 LFCSP	5A991.b	ADF4151BCPZ-RL7
ADF4153A	Frac-N/int-N PLLs	0.5 to 4	-223	32	3	20	TSSOP	5A991.b	ADF4153ABRUZ
ADF4153A	Frac-N/int-N PLLs	0.5 to 4	-223	32	3	20	4 × 4 LFCSP	5A991.b	ADF4153ABCPZ-RL7
ADF4153	Frac-N/int-N PLLs	0.5 to 4	-220	32	3	20	TSSOP	5A991.b	ADF4153BRUZ-RL7
ADF4153	Frac-N/int-N PLLs	0.5 to 4	-220	32	3	20	4 × 4 LFCSP	5A991.b	ADF4153BCPZ-RL7
ADF4154	Frac-N/int-N PLLs	0.5 to 4	-220	32	3	20	TSSOP	5A991.b	ADF4154BRUZ-RL7
ADF4154	Frac-N/int-N PLLs	0.5 to 4	-220	32	3	20	4 × 4 LFCSP	5A991.b	ADF4154BCPZ-RL7
ADF4150	Frac-N/int-N PLLs	0.031 to 4.4	-223	32	3.3	50	4 × 4 LFCSP	5A991.b	ADF4150BCPZ-RL7
ADF4152HV	Frac-N/int-N PLL, 30 V charge pump	0.5 to 5	-213	26	3.3	50	5 × 5 LFCSP	5A991.b	ADF4152HVBCPZ-RL7
LTC6947	Frac-N/int-N PLLs	0.35 to 6	-226	76/100	3.3	110	4 × 5 LFCSP	EAR99	LTC6947IUFD#TRPBF
ADF4196	Int-N and frac-N	0.4 to 6	-216	25	3	68	5 × 5 LFCSP	5A991.b	ADF4196BCPZ-RL7
ADF4157	Frac-N/int-N PLLs	0.5 to 6	-211	32	3	23	TSSOP	5A991.b	ADF4157BRUZ-RL7
ADF4157	Frac-N/int-N PLLs	0.5 to 6	-211	32	3	23	4 × 4 LFCSP	5A991.b	ADF4157BCPZ-RL7
ADF4158	Int-N and frac-N	0.5 to 6.1	-216	32	3	23	4 × 4 LFCSP	5A991.b	ADF4158CCPZ-RL7
ADF4156	Frac-N	0.5 to 6.2	-220	32	3	26	TSSOP	5A991.b	ADF4156BRUZ-RL7
ADF4156	Frac-N	0.5 to 6.2	-220	32	3	26	4 × 4 LFCSP	5A991.b	ADF4156BCPZ-RL7
HMC704	Frac-N	-0 to 8	-230	100	3.3, 5	52, 6	4 × 4 LFCSP	EAR99	HMC704LP4E
HMC703	Frac-N with sweeper	-0 to 8	-230	100	3.3, 5	54, 7	4 × 4 LFCSP	EAR99	HMC703LP4E
HMC701	Frac-N with sweeper	-0 to 8	-221	70	3.3, 5	90, 37	6 × 6 LFCSP	EAR99	HMC701LP6CE
HMC700	Frac-N with sweeper	-0 to 8	-221	70	3.3, 5	90, 5.5	4 × 4 LFCSP	EAR99	HMC700LP4E
ADF4155	Int-N and frac-N	0.5 to 8	-223	125	3.3	38	4 × 4 LFCSP	5A991.b	ADF4155BCPZ-RL7
ADF4159*	Swept frequency int-N and frac-N	0.5 to 13	-224	110	3	33	4 × 4 LFCSP	5A991.b	ADF4159CCPZ-RL7
ADF4169*	Frac-N/int-N PLLs	0.5 to 13.5	-224	130	3.3	65	4 × 4 LFCSP	5A991.b	ADF4169CCPZ-RL7
HMC702	Frac-N with sweeper	-0 to 14	-221	70	3.3, 5	135, 26	6 × 6 LFCSP	EAR99	HMC702LP6CE

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

Additional PLLs can be found in the Clock Generation and Distribution section on page 71

## Fractional-N/Integer-N PLLs (Continued)

Part Number	Description	Frequency (GHz)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
<b>ADF41513</b> <b>New</b>	Frac-N/int-N	1 to 26.5	-235	250	3.3	95.1	4 × 4 LFCSP	5A991.b	ADF41513BCPZ

## Integer-N PLLs with Integrated VCOs

Part Number	Description	Frequency (GHz)	Open-Loop VCO Phase Noise @ 100 kHz (dBc/Hz)	@ F <sub>OUT</sub> (GHz)	Divider	VCO Tuning Inductor	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADF4360-9*	Int-N PLLs with VCO	-0 to 0.2	-120	0.16	/2 to /62	Ext L sets frequency range	-218	8	3.3	20 to 40	4 × 4 LFCSP	5A991.b	ADF4360-9BCPZRL7
ADF4360-8*	Int-N PLLs with VCO	0.065 to 0.4	-120	0.16	No	Ext L sets frequency range	-216	8	3.3	20 to 40	4 × 4 LFCSP	5A991.b	ADF4360-8BCPZRL7
ADF4360-6*	Int-N PLLs with VCO	1.05 to 1.25	-110	1.15	/1, /2	Internal	-216	8	3.3	25 to 45	4 × 4 LFCSP	5A991.b	ADF4360-6BCPZRL7
ADF4360-5*	Int-N PLLs with VCO	1.2 to 1.4	-110	1.3	/1, /2	Internal	-216	8	3.3	25 to 45	4 × 4 LFCSP	5A991.b	ADF4360-5BCPZRL7
ADF4360-4*	Int-N PLLs with VCO	1.45 to 1.75	-110	1.6	/1, /2	Internal	-216	8	3.3	25 to 50	4 × 4 LFCSP	5A991.b	ADF4360-4BCPZRL7
ADF4360-7*	Int-N PLLs with VCO	0.35 to 1.8	-116	0.5	/1, /2	Ext L sets frequency range	-216	8	3.3	25 to 45	4 × 4 LFCSP	5A991.b	ADF4360-7BCPZRL7
ADF4360-3*	Int-N PLLs with VCO	1.6 to 1.95	-110	1.8	/1, /2	Internal	-216	8	3.3	25 to 50	4 × 4 LFCSP	5A991.b	ADF4360-3BCPZRL7
ADF4360-2*	Int-N PLLs with VCO	1.85 to 2.17	-110	2	/1, /2	Internal	-216	8	3.3	25 to 50	4 × 4 LFCSP	5A991.b	ADF4360-2BCPZRL7
ADF4360-1*	Int-N PLLs with VCO	2.05 to 2.45	-110	2.25	/1, /2	Internal	-216	8	3.3	25 to 50	4 × 4 LFCSP	5A991.b	ADF4360-1BCPZRL7
ADF4360-0*	Int-N PLLs with VCO	2.4 to 2.75	-110	2.6	/1, /2	Internal	-216	8	3.3	25 to 50	4 × 4 LFCSP	5A991.b	ADF4360-0BCPZRL7
LTC6946-1	Int-N PLLs with VCO	0.373 to 3.74	-110	3	/1 to /6	Internal	-226	100	3.3/5	80/40	4 × 5 LFCSP	EAR99	LTC6946IUFD-1#TRPBF
LTC6946-2	Int-N PLLs with VCO	0.513 to 4.91	-106	4	/1 to /6	Internal	-226	100	3.3/5	80/40	4 × 5 LFCSP	EAR99	LTC6946IUFD-2#TRPBF
LTC6946-3	Int-N PLLs with VCO	0.640 to 5.79	-103	5	/1 to /6	Internal	-226	100	3.3/5	80/40	4 × 5 LFCSP	EAR99	LTC6946IUFD-3#TRPBF
LTC6946-4	Int-N PLLs with VCO	0.700 to 6.39	-101	6	/1 to /6	Internal	-226	100	3.3/5	80/40	4 × 5 LFCSP	EAR99	LTC6946IUFD-4#TRPBF

## Narrow-Band RF Fractional-N/Integer-N PLLs with VCOs

Part Number	Description	Frequency (GHz)	Open-Loop VCO Phase Noise @ 100 kHz (dBc/Hz)	Open-Loop VCO Phase Noise @ 1 MHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> Frac-N Mode (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC824	Frac-N PLL	0.78 to 0.87	-123	-148	14	-229	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC824LP6CE
HMC822	Frac-N PLL, triband VCO	0.665 to 0.825 1.33 to 1.65 2.66 to 3.3	-124 -118 -112	-148 -142 -136	+11 +6.5 +4	-229	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC822LP6CE
HMC838	Frac-N PLL, triband VCO	0.795 to 0.945 1.59 to 1.89 3.18 to 3.78	-123 -118 -112	-148 -118 -112	+10 +7.5 -4	-229	FVCO/20	3.3/5	51/77	6 × 6 LFCSP	EAR99	HMC838LP6CE
HMC821	Frac-N PLL, triband VCO	0.86 to 1.04 1.72 to 2.08 3.44 to 4.16	-122 -116 -110	-147 -141 -135	+10 +6.5 -4	-227	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC821LP6CE
HMC837	Frac-N PLL, triband VCO	1.025 to 1.15 2.05 to 2.3 4.1 to 4.6	-120 -114 -108	-147 -141 -135	+12 +10.5 -0.5	-230	FVCO/20	3.3/5	47/94	6 × 6 LFCSP	EAR99	HMC837LP6CE
HMC839	Frac-N PLL, triband VCO	1.05 to 1.205 2.1 to 2.41 4.2 to 4.82	-121 -116 -109	-146 -140 -135	+10 +7.5 -4	-229	FVCO/20	3.3/5	51/78	6 × 6 LFCSP	EAR99	HMC839LP6CE

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Narrow-Band RF Fractional-N/Integer-N PLLs with VCOs (Continued)

Part Number	Description	Frequency (GHz)	Open-Loop VCO Phase Noise @ 100 kHz (dBc/Hz)	Open-Loop VCO Phase Noise @ 1 MHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> Frac-N Mode (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC820	Frac-N PLL, triband VCO	1.095 to 1.275 2.19 to 2.55 4.38 to 5.1	-122 -116 -110	-147 -141 -135	+10 +6.5 -4	-227	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC820LP6CE
HMC840	Frac-N PLL, triband VCO	1.31 to 1.415 2.62 to 2.83	-117 -111	-145 -139	+10 +9	-230	FVCO/20	3.3/5	47/97	6 × 6 LFCSP	EAR99	HMC840LP6CE
HMC826	Frac-N PLL	0.99 to 1.105	-121	-146	11	-229	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC826LP6CE
HMC828	Frac-N PLL	1.285 to 1.415	-118	-143	10	-229	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC828LP6CE
HMC831	Frac-N PLL	1.815 to 2.01	-118	-143	7.5	-229	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC831LP6CE
HMC836	Frac-N PLL	3.365 to 3.705	-111	-136	0	-227	FVCO/20	3.3/5	51/97	6 × 6 LFCSP	EAR99	HMC836LP6CE

Additional PLLs can be found in the Clock Generation and Distribution section on page 71.

## Narrow-Band Fractional-N/Integer-N PLLs with Integrated VCOs

Part Number	Description	Frequency (GHz)	Open-Loop VCO Phase Noise @ 1 MHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> Frac-N Mode (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC764	Frac-N/int-N PLL with VCO	7.3 to 8.2	-140	15	-226	70	3.3/5	90/245	6 × 6 LFCSP	EAR99	HMC764LP6CE
HMC765	Frac-N/int-N PLL with VCO	7.8 to 8.8	-140	13	-226	70	3.3/5	90/245	6 × 6 LFCSP	EAR99	HMC765LP6CE
HMC767	Frac-N/int-N PLL with VCO	8.45 to 9.55	-138	12	-230	100	3.3/5	54/257	6 × 6 LFCSP	EAR99	HMC767LP6CE
HMC769	Frac-N/int-N PLL with VCO	9.05 to 10.15	-140	12	-230	100	3.3/5	54/272	6 × 6 LFCSP	EAR99	HMC769LP6CE
HMC778	Frac-N/int-N PLL with VCO	9.6 to 10.8	-140	9	-230	100	3.3/5	54/272	6 × 6 LFCSP	EAR99	HMC778LP6CE
HMC783	Frac-N/int-N PLL with VCO	11.5 to 12.5	-134	10	-226	70	3.3/5	90/145	6 × 6 LFCSP	EAR99	HMC783LP6CE
HMC807	Frac-N/int-N PLL with VCO	12.4 to 13.4	-132	8	-226	70	3.3/5	90/205	6 × 6 LFCSP	EAR99	HMC807LP6CE

## Wideband Fractional-N/Integer-N PLLs with Integrated VCOs

Part Number	Description	Frequency (GHz)	Open-Loop VCO Phase Noise @ 100 kHz (dBc/Hz)	Open-Loop VCO Phase Noise @ 1 MHz (dBc/Hz)	@ F <sub>OUT</sub> (GHz)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> Frac-N Mode (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC829	Wideband frac-N/int-N PLL and VCO	0.045 to 1.05 1.4 to 2.1 2.8 to 4.2	-108	-134	4	-227	100	3.3/5	52/185	6 × 6 LFCSP	EAR99	HMC829LP6GE
HMC834	Wideband frac-N/int-N PLL and VCO	0.045 to 1.05 1.4 to 2.1 2.8 to 4.2 5.6 to 8.4	-108	-134	4	-227	100	3.3/5	52/185	6 × 6 LFCSP	EAR99	HMC834LP6GE
HMC832	Wideband frac-N/int-N PLL and VCO	0.025 to 3	-116	-139	2	-226	100	3.3	219	6 × 6 LFCSP	5A991.b	HMC832LP6GE
HMC830	Wideband frac-N/int-N PLL and VCO	0.025 to 3	-116	-141	2	-227	100	3.3/5	52/185	6 × 6 LFCSP	5A991.b	HMC830LP6GE
LTC6948-1	Wideband frac-N/int-N PLL and VCO	0.373 to 3.74	-110	-130	3	-225	76	3.3/5	90/40	4 × 5 LFCSP	EAR99	LTC6948IUFD-1#TRPBF
HMC835*	Wideband frac-N/int-N PLL and VCO	0.033 to 4.1	-108	-134	4	-227	100	3.3/5	48/220	6 × 6 LFCSP	5A991.b	HMC835LP6GE
ADF4355-2*	Wideband frac-N/int-N PLL and VCO	0.055 to 4.4	-120	-142	2.2	-223	125	3.3/5	110/80	5 × 5 LFCSP	5A991.g	ADF4355-2BCPZ
ADF4351	Wideband frac-N/int-N PLL and VCO	0.035 to 4.4	-114	-134	2.2	-221	32	3.3	112 to 148	5 × 5 LFCSP	5A991.b	ADF4351BCPZ

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Wideband Fractional-N/Integer-N PLLs with Integrated VCOs (Continued)

Part Number	Description	Frequency (GHz)	Open-Loop VCO Phase Noise @ 100 kHz (dBc/Hz)	Open-Loop VCO Phase Noise @ 1 MHz (dBc/Hz)	@ F <sub>OUT</sub> (GHz)	Figure of Merit (dBc/Hz)	PFD <sub>MAX</sub> Frac-N Mode (MHz)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
ADF4350	Wideband frac-N/int-N PLL and VCO	0.1375 to 4.4	-114	-134	2.2	-220	32	3.3	112 to 136	5 × 5 LFCSP	5A991.b	ADF4350BCPZ
LTC6948-2	Wideband frac-N/int-N PLL and VCO	0.513 to 4.91	-105	-128	4	-225	76	3.3/5	90/40	4 × 5 LFCSP	EAR99	LTC6948IUFD-2#TRPBF
LTC6948-3	Wideband frac-N/int-N PLL and VCO	0.640 to 5.79	-103	-125	5	-225	76	3.3/5	90/40	4 × 5 LFCSP	EAR99	LTC6948IUFD-3#TRPBF
HMC833	Wideband frac-N/int-N PLL and VCO	0.025 to 6	-116	-141	2	-227	100	3.3/5	52/185	6 × 6 LFCSP	EAR99	HMC833LP6GE
LTC6948-4	Wideband frac-N/int-N PLL and VCO	0.700 to 6.39	-100	-122	6	-225	76	3.3/5	90/40	4 × 5 LFCSP	EAR99	LTC6948IUFD-4#TRPBF
ADF4355-3*	Wideband frac-N/int-N PLL and VCO	5.156 to 6.6	-118	-140	2.2	-223	125	3.3	146	5 × 5 LFCSP	5A991.b	ADF4355-3BCPZ
ADF4355*	Wideband frac-N/int-N PLL and VCO	0.055 to 6.8	-116	-138	2.2	-223	125	3.3/5	110/80	5 × 5 LFCSP	5A991.b	ADF4355BCPZ
ADF4356*	Wideband frac-N/int-N PLL and VCO	0.053 to 6.8	-115	-137	3.4	-227	125	3.3/5	110/80	5 × 5 LFCSP	5A991.b	ADF4356BCPZ
ADF5355*	Wideband frac-N/int-N PLL and VCO	0.053 to 13.6	-107	-129	10	-221	125	3.3/5	110/80	5 × 5 LFCSP	5A991.b	ADF5355BCPZ
ADF5356*	Wideband frac-N/int-N PLL and VCO	0.053 to 13.6	-107	-129	10	-227	125	3.3/5	110/80	5 × 5 LFCSP	EAR99	ADF5356BCPZ
ADF5610 <b>New</b>	Wideband frac-N/int-N PLL and VCO	0.057 to 14.6	-114	-135	10	-229	100	3.3/5	126.7/110	7 × 7 LGA	EAR99	ADF5610BCCZ
ADF4372 <b>New</b>	Wideband frac-N/int-N PLL and VCO	0.062 to 16.0	-116	-137	8	-234	160	3.3/5	190/135	7 × 7 LGA	EAR99	ADF4372BCCZ
ADF4371 <b>New</b>	Wideband frac-N/int-N PLL and VCO	0.062 to 32.0	-100	-123	24	-234	160	3.3/5	190/135	7 × 7 LGA	EAR99	ADF4371BCCZ

Additional PLLs can be found in the Clock Generation and Distribution section on page 56.

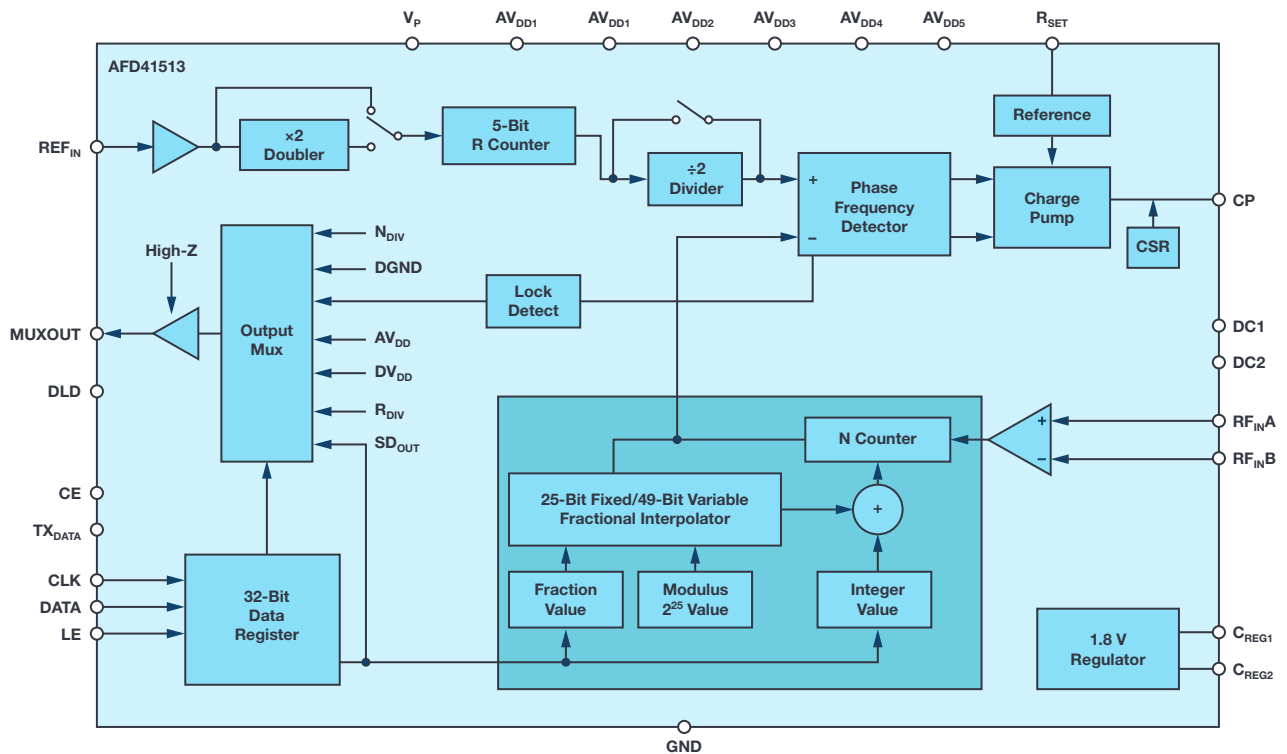
■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

# ADF41513: 1 GHz to 26.5 GHz Integer-N/Fractional-N PLL/Synthesizer

## Key Features

- ▶ 1 GHz to 26.5 GHz bandwidth
- ▶ Ultralow noise PLL: synthesizer noise floor; integer-N:  $-234$  dBc/Hz; fractional-N:  $-231$  dBc/Hz
- ▶ High maximum PFD frequency; integer-N: 250 MHz; fractional-N: 125 MHz
- ▶ 25-bit fixed/49-bit variable fractional modulus
- ▶ Single-ended reference input
- ▶ 3.3 V power supply, 3.3 V charge pump
- ▶ Integrated 1.8 V low drop out regulator
- ▶ Phase resync
- ▶ Programmable charge pump currents:  $16\times$  range
- ▶ Digital lock detect
- ▶ 3-wire serial interface with register readback option
- ▶ Hardware and software power-down mode

Sampling	Release
Now	October 2018



## ADF4371: 62.5 MHz to 32 GHz PLL and Ultralow Phase Noise VCO

*Best Harmonics, Excellent Phase Noise, Best Spurs, Widest Frequency Range, Integrated LDO Regulators*

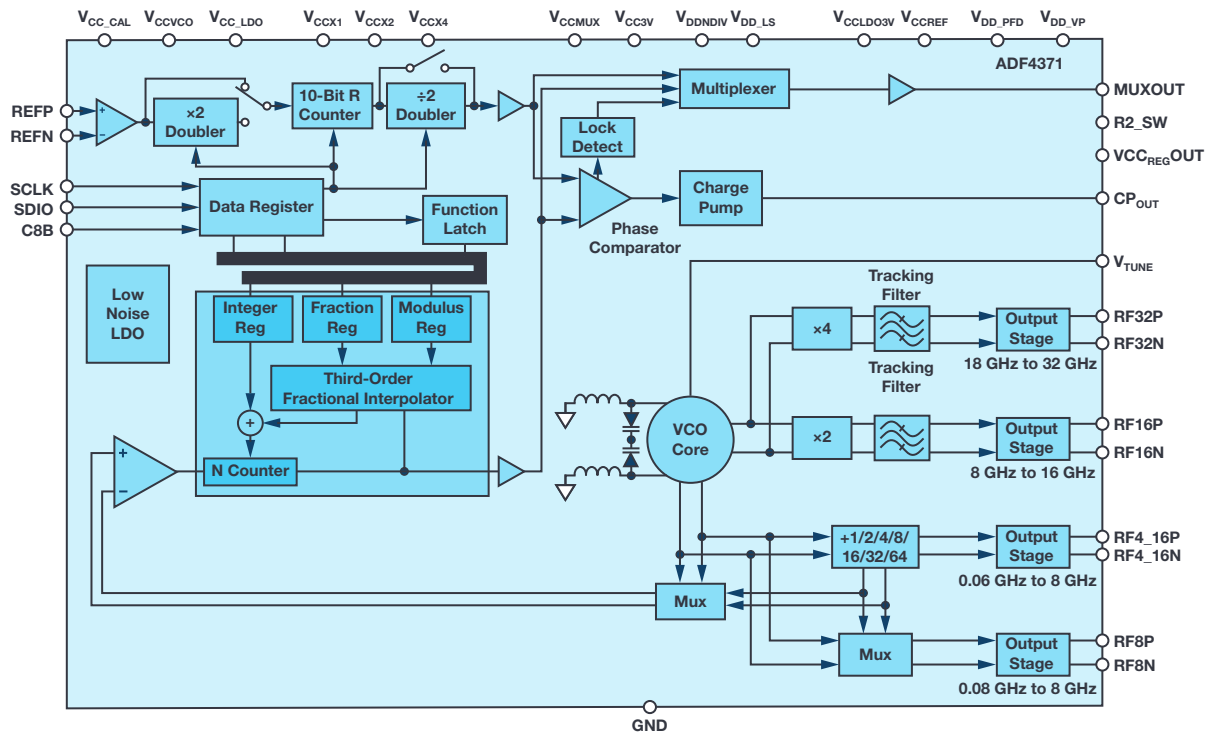
### Key Features

- ▶ RF bandwidth: 62.5 MHz to 32 GHz
- ▶ Low phase noise VCO:
  - -111 dBc/Hz at 100 kHz offset at 8 GHz
  - -134 dBc/Hz at 1 MHz offset at 8 GHz
  - -105 dBc/Hz at 100 kHz offset at 16 GHz
  - -128 dBc/Hz at 1 MHz offset at 16 GHz
  - -98 dBc/Hz at 100 kHz offset at 32 GHz
  - -122 dBc/Hz at 1 MHz offset at 32 GHz
  - High resolution 38-bit programmable modulus
- ▶ FOM: -234 dBc/Hz (integer-N); -232 dBc/Hz (fractional-N)

- ▶ 1/f FOM: -127.4 dBc/Hz
- ▶ Integrated tracking filters, integrated LDO regulators
- ▶ -100 dBc PFD spurs; -60 dBc IBS; -30 dBc 0.5 harmonic
- ▶ Max PFD frequency: 155 MHz (fractional-N); 250 MHz (integer-N)
- ▶ Phase adjust and resync
- ▶ 48-lead, 7 mm × 7 mm package

### Key Benefit and Applications

- ▶ Excellent bandwidth, phase noise, spurs, harmonics, subharmonics



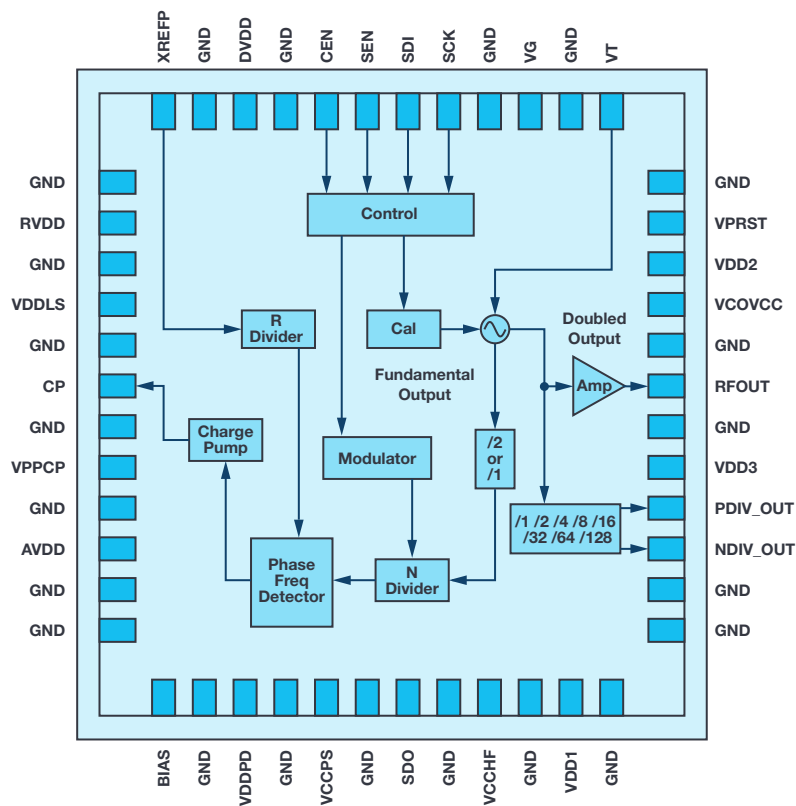


# ADF5610: 55 MHz to 15 GHz Wideband Synthesizer with Integrated VCO

## Low Spurious PLL Integrated with Lowest Phase Noise and Highest Output Power VCO

### Key Features

- ▶ RF output frequency range: 55 MHz to 15 GHz
- ▶ Industry-leading voltage-controlled oscillator performance
- ▶ Phase noise: -116 dBc/Hz typical at 100 kHz (7 GHz)
- ▶ Phase noise: -114 dBc/Hz typical at 100 kHz (10 GHz)
- ▶ Phase noise: -109 dBc/Hz max at 100 kHz (15 GHz)
- ▶ Fractional-N synthesizer FOM: -226 dBc/Hz
- ▶ Integer-N synthesizer FOM: -229 dBc/Hz
- ▶ High resolution, 24-bit  $\Sigma$ - $\Delta$  modulator
- ▶ Phase frequency detector (PFD) operation to 100 MHz
- ▶ Reference frequency operation to 350 MHz
- ▶ Maintains frequency lock over -40°C to +85°C
- ▶ Programmable  $\div$  by 1, 2, 4, 8, 16, 32, 64, or 128 output
- ▶ Analog and digital power supplies: 3.3 V, 3.8 V typical
- ▶ VCO power supplies: 5 V, typical
- ▶ Programmable output power level: up to 5 dBm
- ▶ Analog and digital lock detect



# LTC6952/LTC6953: Ultralow Jitter LF to 12 GHz JESD204B Converter Clock Distribution Solution

## LTC6952/LTC6953

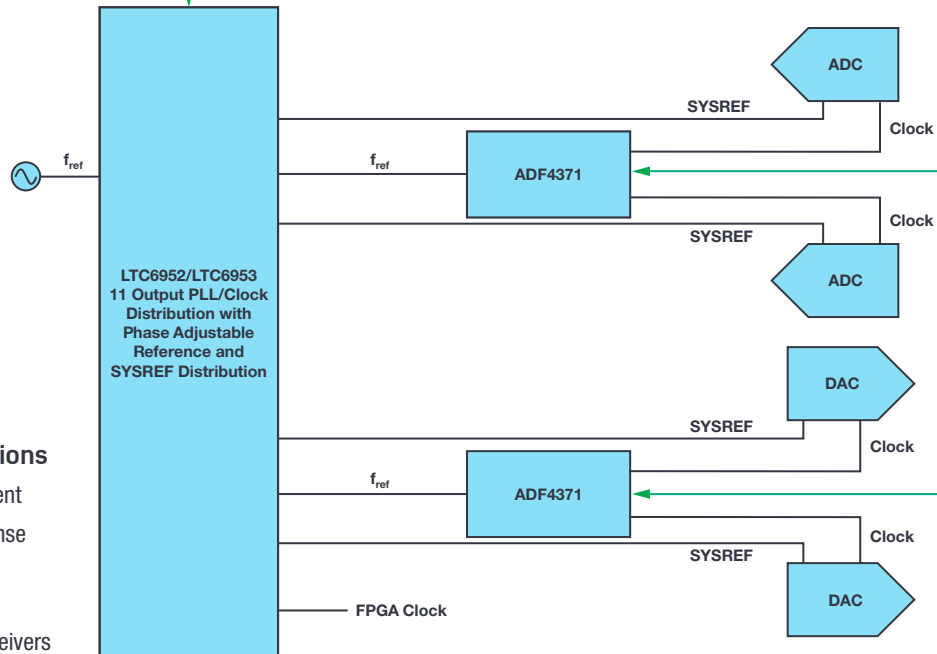
- ▶ 11 ultralow noise CML outputs
- ▶ 11 ps phase adjustment per output
- ▶ Reference and SYSREF distribution
- ▶ Pulsed and continuous SREF modes
- ▶ Reference clean up PLL (6952 only)
- ▶  $T_{RISE}/T_{FALL} = 45$  ps

## ADF4371

- ▶ 60 fs jitter (equivalent ADC SNR method)
- ▶ Dual outputs <8 GHz
- ▶ Single output 8 GHz to 16 GHz
- ▶ Output tracking filter for optimal ADC SFDR results

## Common Applications

- ▶ Test and measurement
- ▶ Aerospace and defense
- ▶ Communications
- ▶ High performance transmitters and receivers



# Voltage Controlled Oscillators

## Low Current VCOs

Part Number	Description	Frequency (GHz)	VCO Phase Noise @ 10 kHz (dBc/Hz)	VCO Phase Noise @ 100 kHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	V <sub>TUNE</sub> (V)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC384	With buffer	2.05 to 2.25	-89	-112	3.5	0 to 10	3	35	4 × 4 LFCSP	EAR99	HMC384LP4E
HMC385	With buffer	2.25 to 2.5	-89	-115	4.5	0 to 10	3	35	4 × 4 LFCSP	EAR99	HMC385LP4E
HMC386	With buffer	2.6 to 2.8	-88	-115	5	0 to 10	3	35	4 × 4 LFCSP	EAR99	HMC386LP4E
HMC416	With buffer	2.75 to 3	-89	-114	4.5	0 to 10	3	37	4 × 4 LFCSP	EAR99	HMC416LP4E
HMC388	With buffer	3.15 to 3.4	-88	-113	4.9	0 to 10	3	39	4 × 4 LFCSP	EAR99	HMC388LP4E
HMC389	With buffer	3.35 to 3.55	-89	-112	4.7	0 to 10	3	41	4 × 4 LFCSP	EAR99	HMC389LP4E
HMC390	With buffer	3.55 to 3.9	-87	-112	4.7	0 to 10	3	42	4 × 4 LFCSP	EAR99	HMC390LP4E
HMC391	With buffer	3.9 to 4.45	-81	-106	5	0 to 10	3	30	4 × 4 LFCSP	EAR99	HMC391LP4E
HMC429	With buffer	4.45 to 5	-79	-105	4	0 to 10	3	30	4 × 4 LFCSP	EAR99	HMC429LP4E
HMC430	With buffer	5 to 5.5	-80	-103	2	0 to 10	3	27	4 × 4 LFCSP	EAR99	HMC430LP4E
HMC431	With buffer	5.5 to 6.1	-80	-102	2	0 to 10	3	27	4 × 4 LFCSP	EAR99	HMC431LP4E
HMC358	With buffer	5.8 to 6.8	-82	-110	11	0 to 10	3	100	MSOP	EAR99	HMC358MS8GE
HMC466	With buffer	6.1 to 6.72	-73	-101	4.5	0 to 10	3	13	4 × 4 LFCSP	EAR99	HMC466LP4E
HMC505	With buffer	6.8 to 7.4	-80	-106	11	1 to 11	3	80	4 × 4 LFCSP	EAR99	HMC505LP4E
HMC532	With buffer	7.1 to 7.9	-80	-101	14	1 to 13	3	85	4 × 4 LFCSP	EAR99	HMC532LP4E
HMC506	With buffer	7.8 to 8.7	-80	-103	14	1 to 11	3	77	4 × 4 LFCSP	EAR99	HMC506LP4E

## High Performance VCOs

Part Number	Description	Frequency (GHz)	Primary Divide Output (GHz)	VCO Phase Noise @ 10 kHz (dBc/Hz)	VCO Phase Noise @ 100 kHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	V <sub>TUNE</sub> (V)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC507*	With f0/2	6.65 to 7.65	3.325 to 3.825	-90	-115	13	2 to 13	5	230	5 × 5 LFCSP	EAR99	HMC507LP5E
HMC508*	With f0/2	7.3 to 8.2	3.65 to 4.1	-90	-116	15	2 to 13	5	240	5 × 5 LFCSP	EAR99	HMC508LP5E
HMC509*	With f0/2	7.8 to 8.8	3.9 to 4.4	-90	-115	13	2 to 13	5	250	5 × 5 LFCSP	EAR99	HMC509LP5E
HMC1160*	With f0/2	8.45 to 9.3	4.225 to 4.65	-90	-116	12	2 to 13	5	260	5 × 5 LFCSP	EAR99	HMC1160LP5E
HMC510*	With f0/2 and divide by 4	8.45 to 9.55	4.225 to 4.775	-92	-116	13	2 to 13	5	315	5 × 5 LFCSP	3A001.a.11.b	HMC510LP5E
HMC1161*	With f0/2	8.71 to 9.55	4.355 to 4.775	-90	-115	11	2 to 13	5	250	5 × 5 LFCSP	EAR99	HMC1161LP5E
HMC511*	With f0/2	9.05 to 10.15	4.525 to 5.075	-88	-115	13	2 to 13	5	265	5 × 5 LFCSP	EAR99	HMC511LP5E
HMC1162*	With f0/2	9.25 to 10.1	4.625 to 5.05	-86	-115	11	2 to 13	5	230	5 × 5 LFCSP	EAR99	HMC1162LP5E
HMC1163*	With f0/2	9.65 to 10.41	4.825 to 5.205	-87	-114	11	2 to 13	5	205	5 × 5 LFCSP	EAR99	HMC1163LP5E
HMC530*	With f0/2 and divide by 4	9.5 to 10.8	4.75 to 5.4	-85	-110	11	2 to 13	5	350	5 × 5 LFCSP	3A001.a.11.b	HMC530LP5E
HMC512*	With f0/2 and divide by 4	9.6 to 10.8	4.8 to 5.4	-85	-111	9	2 to 13	5	330	5 × 5 LFCSP	3A001.a.11.b	HMC512LP5E
HMC1164*	With f0/2	10.38 to 11.3	5.19 to 5.65	-86	-114	8	2 to 13	5	200	5 × 5 LFCSP	EAR99	HMC1164LP5E
HMC513*	With f0/2 and divide by 4	10.43 to 11.46	5.215 to 5.73	-85	-110	7	2 to 13	5	275	5 × 5 LFCSP	3A001.a.11.b	HMC513LP5E
HMC1165*	With f0/2	11.07 to 11.62	5.535 to 5.81	-88	-113	8	2 to 13	5	210	5 × 5 LFCSP	EAR99	HMC1165LP5E
HMC534*	With f0/2 and divide by 4	10.6 to 11.8	5.3 to 5.9	-82	-110	11	2 to 13	5	350	5 × 5 LFCSP	3A001.a.11.b	HMC534LP5E
HMC514*	With f0/2 and divide by 4	11.17 to 12.02	5.585 to 6.01	-87	-110	7	2 to 13	3	275	5 × 5 LFCSP	3A001.a.11.b	HMC514LP5E
HMC582*	With f0/2 and divide by 4	11.1 to 12.4	5.55 to 6.2	-83	-110	9	2 to 13	5	350	5 × 5 LFCSP	3A001.a.11.b	HMC582LP5E
HMC515*	With f0/2 and divide by 4	11.5 to 12.5	5.75 to 6.25	-83	-110	10	2 to 13	5	200	5 × 5 LFCSP	3A001.a.11.b	HMC515LP5E
HMC1166*	With f0/2	11.41 to 12.62	5.705 to 6.31	-89	-115	11	2 to 13	5	220	5 × 5 LFCSP	EAR99	HMC1166LP5E
HMC583*	With f0/2 and divide by 4	11.5 to 12.8	5.75 to 6.4	-80	-110	11	2 to 13	5	350	5 × 5 LFCSP	3A001.a.11.b	HMC583LP5E
HMC1167*	With f0/2	12.17 to 13.3	6.085 to 6.65	-86	-113	10	2 to 13	5	200	5 × 5 LFCSP	EAR99	HMC1167LP5E
HMC529*	With f0/2 and divide by 4	12.4 to 13.4	6.2 to 6.7	-83	-110	8	2 to 13	5	260	5 × 5 LFCSP	3A001.a.11.b	HMC529LP5E
HMC1168*	With f0/2	12.47 to 13.72	6.235 to 6.86	-85	-113	10	2 to 13	5	190	5 × 5 LFCSP	EAR99	HMC1168LP5E
HMC584*	With f0/2 and divide by 4	12.5 to 13.9	6.25 to 6.95	-81	-110	10	2 to 13	5	330	5 × 5 LFCSP	3A001.a.11.b	HMC584LP5E

\* = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## High Performance VCOs (Continued)

Part Number	Description	Frequency (GHz)	Primary Divide Output (GHz)	VCO Phase Noise @ 10 kHz (dBc/Hz)	VCO Phase Noise @ 100 kHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	V <sub>TUNE</sub> (V)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC1169*	With f0/2	12.92 to 14.07	6.46 to 7.035	-86	-113	11	2 to 13	5	220	5 × 5 LFCSP	EAR99	HMC1169LP5E
HMC531*	With f0/2 and divide by 4	13.6 to 14.9	6.8 to 7.45	-81	-110	10	2 to 13	5	330	5 × 5 LFCSP	3A001.a.11.b	HMC531LP5E
HMC632*	With f0/2 and divide by 4	14.25 to 15.65	7.125 to 7.825	-80	-107	9	2 to 13	5	350	5 × 5 LFCSP	3A001.a.11.b	HMC632LP5E

## Higher Power and Frequency VCOs

Part Number	Description	Frequency (GHz)	Primary Divide Output (GHz)	VCO Phase Noise @ 10 kHz (dBc/Hz)	VCO Phase Noise @ 100 kHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	V <sub>TUNE</sub> (V)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC734*	With divide by 4	8.6 to 10.2	2.15 to 2.55	-70	-100	18	1 to 13	5	218	5 × 5 LFCSP	3A001.a.11.b	HMC734LP5E
HMC735*	With divide by 4	10.5 to 12.2	2.625 to 3.05	-75	-100	17	1 to 13	5	217	5 × 5 LFCSP	3A001.a.11.b	HMC735LP5E
HMC736*	With f0/2	14.5 to 15	7.25 to 7.5	-80	-105	9	1 to 13	4.2	150	4 × 4 LFCSP	EAR99	HMC736LP4E
HMC738*	With f0/2 and divide by 16	20.9 to 23.9	10.45 to 11.95	-65	-95	9	1 to 13	5	200	4 × 4 LFCSP	3A001.a.11.b	HMC738LP4E
HMC533	With divide by 16	23.8 to 24.8	1.4875 to 1.55	-70	-95	12	1 to 13	5	220	4 × 4 LFCSP	3A001.a.11.b	HMC533LP4E
HMC739*	With f0/2 and divide by 16	23.8 to 26.8	11.9 to 13.4	-64	-93	8	1 to 13	5	200	4 × 4 LFCSP	3A001.a.11.b	HMC739LP4E

## Ultrawideband VCOs

Part Number	Description	Frequency (GHz)	VCO Phase Noise @ 10 kHz (dBc/Hz)	VCO Phase Noise @ 100 kHz (dBc/Hz)	P <sub>OUT</sub> (dBm)	V <sub>TUNE</sub> (V)	V <sub>CC</sub> (V)	I <sub>CC</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC6475 <b>New</b>	WB VCO with buffer	3.9 to 7.5	-79	-106	5	0 to 23	5	53	4 × 4 CLCC	EAR99	HMC6475LC4B
HMC586*	Wideband VCO	4 to 8	-75	-100	5	0 to 18	5	55	4 × 4 LFCSP	EAR99	HMC586LC4B
HMC587*	Wideband VCO	5 to 10	-65	-95	5	0 to 18	5	55	4 × 4 LFCSP	EAR99	HMC587LC4B
HMC732*	Wideband VCO	6 to 12	-65	-95	1	0 to 23	5	57	4 × 4 LFCSP	EAR99	HMC732LC4B
HMC8074 <b>New</b>	Quad-band VCO	8.3 to 15.2	-68	-98	0	0.5 to 13	4.75 (5 max)	60	6 × 6 LFCSP	EAR99	HMC8074LP6GE
HMC6380* <b>New</b>	WB VCO with buffer	8 to 16	-64	-92	6	0 to 23	5	75	4 × 4 CLCC	EAR99	HMC6380LC4B
HMC733*	Wideband VCO	10 to 20	-60	-90	2	-0.25 to +23	5	70	4 × 4 LFCSP	EAR99	HMC733LC4B

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

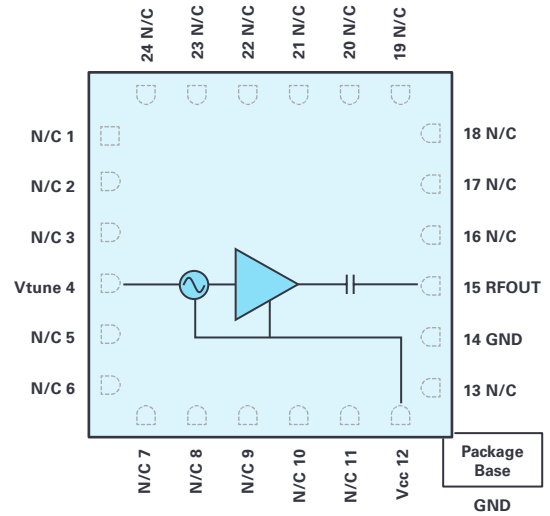
## HMC6475: 3.9 GHz to 7.5 GHz Wideband VCO with Buffer Amp

### Key Features

- ▶ Wide tuning bandwidth
- ▶ 5 dBm output power
- ▶ Low phase noise:  $-106$  dBc/Hz at 100 kHz
- ▶ No external resonator
- ▶ Single supply: 5 V/53 mA
- ▶ 4 mm × 4 mm ceramic LCC package

### Applications

- ▶ Radars
- ▶ Satcom
- ▶ Test and measurement



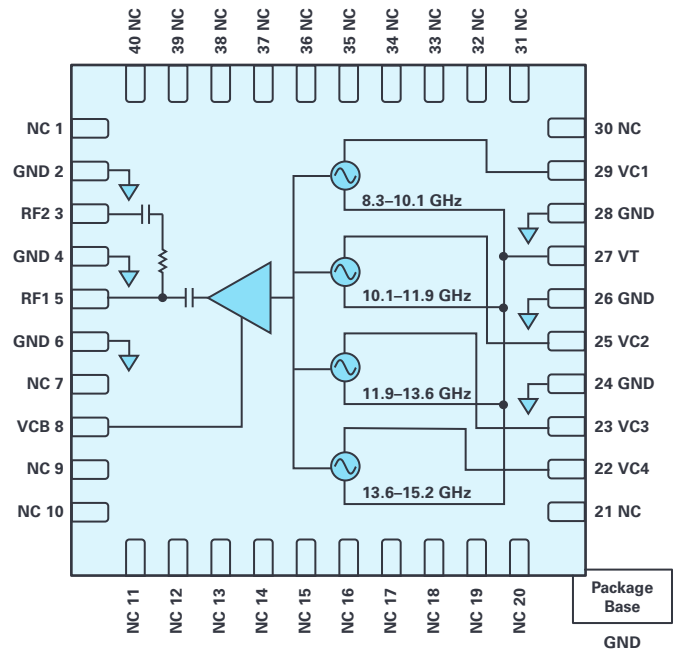
## HMC8074: 8.3 GHz to 15.2 GHz Wideband VCO

### Key Features

- ▶ Wideband tuning
- ▶ Dual output:
  - RF1 =  $-5$  to  $+6$  dBm
  - RF2 =  $-15$  to  $-4$  dBm
- ▶ Four independent VCO with common tuning
- ▶ No external resonator required
- ▶ 6 mm × 6 mm LFCSP package

### Applications

- ▶ Microwave point-to-point radios
- ▶ Millimeter wave 5G network radios
- ▶ Satellite communications
- ▶ Military and aerospace equipment
- ▶ Test and measurement



# Frequency Dividers, Multipliers, and Detectors

## Frequency Dividers, Prescalers, and Counters

Part Number	Description	Input Frequency (GHz)	Output Frequency (GHz)	Input Power (dBm)	Output Power (dBm)	Phase Noise @ 100 kHz Offset (dBc/Hz)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC794*	Programmable divide by n = 1 to 4	0.2 to 2	Variable	-2 to +10	10	-160	5	135	3 × 3 LFCSP	EAR99	HMC794LP3E
HMC394	5-bit counter, divide by n = 2 to 32	0.1 to 2.2	Variable	-15 to +10	4	-153	5	194	4 × 4 LFCSP	3A001.a.11.b	HMC394LP4E
HMC905*	Programmable divide by n = 1 to 4	0.4 to 6	Variable	0 to +10	3	-158	3.3	100	3 × 3 LFCSP	EAR99	HMC905LP3E
HMC705*	Programmable divide by n = 1 to 17	0.1 to 6.5	Variable	-15 to +10	0	-153	5	190	4 × 4 LFCSP	EAR99	HMC705LP4E
HMC983	48-bit Σ-Δ programmable	0 to 7	Variable	-15 to -30	2 V p-p into 100 Ω	-160	5, 3.3	1,244	5 × 5 LFCSP	EAR99	HMC983LP5E
HMC432*	Fixed divide by 2	0 to 8	0 to 4	-12 to +12	-3	-148	3	42	SOT-26	3A001.a.11.b	HMC432E
HMC361*	Fixed divide by 2	0 to 10	0 to 5	-15 to +10	3	-148	5	83	SOIC	3A001.a.11.b	HMC361S8GE
HMC361	Fixed divide by 2	0 to 12	0 to 6	-15 to +10	3	-148	5	83	Die	3A001.a.11.b	HMC361
HMC361*	Fixed divide by 2	0 to 13	0 to 6.5	-15 to +10	4	-148	5	83	Hermetic SMT	3A001.a.11.b	HMC361G8
HMC492*	Fixed divide by 2	0 to 18	0 to 9	-20 to +10	-4	-150	5	78	3 × 3 LFCSP	3A001.a.11.b	HMC492LP3E
ADF5000*	Fixed divide by 2	4 to 18	2 to 9	-10 to +10	-5	-147	3.3	30	3 × 3 LFCSP	EAR99	ADF5000BCPZ-RL7
HMC437*	Fixed divide by 3	0 to 7	0 to 2.334	-12 to +12	-1	-153	5	69	MSOP	3A001.a.11.b	HMC437MS8GE
HMC433*	Fixed divide by 4	0 to 8	0 to 2	-12 to +12	-2	-150	3	53	SOT-26	3A001.a.11.b	HMC433
HMC362	Fixed divide by 4	0 to 12	0 to 3	-15 to +10	-6	-149	5	68	Die	3A001.a.11.b	HMC362
HMC362*	Fixed divide by 4	0 to 12	0 to 3	-15 to +10	-6	-149	5	68	SOIC	3A001.a.11.b	HMC362S8GE
HMC365	Fixed divide by 4	0 to 13	0 to 3.25	-15 to +10	5	-151	5	120	Die	3A001.a.11.b	HMC365
HMC365*	Fixed divide by 4	0 to 13	0 to 3.25	-15 to +10	7	-151	5	120	Hermetic SMT	3A001.b.2.d	HMC365G8
HMC365*	Fixed divide by 4	0 to 13	0 to 3.25	-15 to +10	5	-151	5	120	SOIC	3A001.b.2.d	HMC365S8GE
HMC493*	Fixed divide by 4	0 to 18	0 to 4.5	-20 to +10	-4	-150	5	96	3 × 3 LFCSP	3A001.a.11.b	HMC493LP3E
ADF5001*	Fixed divide by 4	4 to 18	2 to 4.5	-10 to +10	-5	-150	3.3	30	3 × 3 LFCSP	EAR99	ADF5001BCPZ-RL7
HMC447*	Fixed divide by 4	10 to 26	2.5 to 5.5	-15 to +10	-4	-150	5	96	3 × 3 LFCSP	3A001.a.11.b	HMC447LC3
HMC438*	Fixed divide by 5	0 to 7	0 to 1.4	-15 to +10	-1	-153	5	80	MSOP	3A001.a.11.b	HMC438MS8GE
HMC434	Fixed divide by 8	0 to 8	0 to 1	-10 to +12	-2	-150	3	62	SOT-26	3A001.a.11.b	HMC434E
HMC862A	Programmable divider n = 1 to 8	0.1 to 24	Variable	-5 to +10	-3 to +6	-153	5	73	3 × 3 LFCSP	EAR99	HMC862ALP3E
HMC363*	Fixed divide by 8	0 to 12	0 to 1.5	-15 to +10	-6	-153	5	90	Die	3A001.a.11.b	HMC363
HMC363*	Fixed divide by 8	0 to 12	0 to 1.5	-15 to +10	4	-153	5	90	Hermetic SMT	3A001.a.11.b	HMC363G8
HMC363*	Fixed divide by 8	0 to 12	0 to 1.5	-15 to +10	-6	-153	5	90	SOIC	3A001.a.11.b	HMC363S8GE
HMC494*	Fixed divide by 8	0 to 18	0 to 2.25	-20 to +10	-4	-150	5	103	3 × 3 LFCSP	3A001.a.11.b	HMC494LP3E
ADF5002*	Fixed divide by 8	4 to 18	0.5 to 2.25	-10 to +10	-5	-153	3.3	30	3 × 3 LFCSP	EAR99	ADF5002BCPZ-RL7

## Frequency Multipliers—Active

Part Number	Description	Input Frequency (GHz)	Output Frequency (GHz)	Input Power (dBm)	Output Power (dBm)	100 kHz Phase Noise (dBc/Hz)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC1096	×2 active	1.9 to 2.8	3.7 to 5.6	0	12	-142	5	100	3 × 3 LFCSP	EAR99	HMC1096LP3E
HMC575	×2 active	3 to 4.5	6 to 9	3	17	-140	5	90	4 × 4 LFCSP	EAR99	HMC575LP4E
HMC369	×2 active	4.95 to 6.35	9.9 to 12.7	0	4	-142	5	46	3 × 3 LFCSP	EAR99	HMC369LP3E
HMC368	×2 active	4.5 to 8	9 to 16	2	13	-140	5	75	4 × 4 LFCSP	EAR99	HMC368LP4E
HMC561	×2 active	4 to 10.5	8 to 21	5	17	-139	5	98	Die	EAR99	HMC561
HMC561	×2 active	4 to 10.5	8 to 21	5	17	-139	5	98	3 × 3 LFCSP	EAR99	HMC561LP3E
HMC573*	×2 active	4 to 11	8 to 22	5	12	-134	5	92	3 × 3 LFCSP	EAR99	HMC573LC3B
HMC814	×2 active	6.5 to 12.3	13 to 24.6	4	17	-136	5	88	Die	EAR99	HMC814
HMC814*	×2 active	6.5 to 12.3	13 to 24.6	4	17	-136	5	88	3 × 3 LFCSP	EAR99	HMC814LC3B
HMC448	×2 active	9.5 to 12.5	19 to 25	0	11	-135	5	48	Die	EAR99	HMC448
HMC576	×2 active	9 to 14.5	18 to 29	3	17	-132	5	82	Die	EAR99	HMC576
HMC576*	×2 active	9 to 14.5	18 to 29	3	17	-132	5	82	3 × 3 LFCSP	EAR99	HMC576LC3B

☐ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Frequency Multipliers—Active (Continued)

Part Number	Description	Input Frequency (GHz)	Output Frequency (GHz)	Input Power (dBm)	Output Power (dBm)	100 kHz Phase Noise (dBc/Hz)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC942*	×2 active	12 to 15.5	25 to 31	4	17	—	4.5	214	4 × 4 LFCSP	EAR99	HMC942LP4E
HMC577*	×2 active	13.5 to 15.5	27 to 31	5	20	−128	5	213	4 × 4 LFCSP	EAR99	HMC577LC4B
HMC578	×2 active	12 to 16.5	24 to 33	3	17	−132	5	81	Die	EAR99	HMC578
HMC578*	×2 active	12 to 16.5	24 to 33	3	17	−132	5	81	3 × 3 LFCSP	EAR99	HMC578LC3B
HMC598	×2 active	11 to 23	22 to 46	5	15	—	5	175	Die	EAR99	HMC598
HMC579*	×2 active	16 to 23	32 to 46	3	9	−127	5	70	Die	EAR99	HMC579
HMC443*	×4 active	2.45 to 2.8	9 to 11.2	−15	4	−142	5	52	4 × 4 LFCSP	EAR99	HMC443LP4E
HMC695*	×4 active	2.85 to 3.3	11.4 to 13.2	−15	7	−140	5	60	4 × 4 LFCSP	EAR99	HMC695LP4E
HMC370*	×4 active	3.6 to 4.1	14.4 to 16.4	−15	0	−140	5	55	4 × 4 LFCSP	EAR99	HMC370LP4E
HMC1110	×6 active	11.83 to 14.33	71 to 86	3	13	—	4	255	Die	EAR99	HMC1110
HMC444*	×8 active	1.2375 to 1.4	9.9 to 11.2	−15	6	−136	5	68	4 × 4 LFCSP	EAR99	HMC444LP4E
HMC445*	×16 active	0.61875 to 0.6875	9.9 to 11	−15	7	−130	5	78	4 × 4 LFCSP	EAR99	HMC445LP4E

## Frequency Multipliers—Passive

Part Number	Description	Input Frequency (GHz)	Output Frequency (GHz)	Input Drive (dBm)	Conversion Loss (dB)	1 F0 Isolation (dB)	4 F0 Isolation (dB)	Package (mm)	ECCN Code	Ordering Part Number
HMC-XDB112	×2 passive	10 to 15	20 to 30	10 to 15	13	30	—	Die	5A991.h	HMC-XDB112
HMC1105*	×2 passive	20 to 40	40 to 80	11 to 15	11	41	46	Die	EAR99	HMC1105
HMC-XTB110	×3 passive	24 to 30	72 to 90	10 to 15	19	—	—	Die	5A991.h	HMC-XTB110

## Phase Frequency Detectors

Part Number	Description	Input Frequency (GHz)	Input Power (dBm)	10 kHz Phase Noise (dBc/Hz)	Output Level (mA)	V <sub>cc</sub> (V)	I <sub>cc</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC984	With charge pump	0 to 0.35	+3 to +12	—	0.02 to 2.5	5, 3	97, 27	4 × 4 LFCSP	EAR99	HMC984LP4E
HMC439	Ultralow phase noise	0.01 to 1.3	−10 to +10	−153	2 V p-p	5	96	QSOP	3A001.a.11.b	HMC439QS16GE
HMC3716	Ultralow phase noise	0.01 to 1.3	−10 to +5	−153	2 V p-p	5	115	4 × 4 LFCSP	3A001.a.11.b	HMC3716LP4E

# Tunable Low-Pass/Band-Pass Filters

Part Number	Description	Frequency (GHz)	Control	Cutoff Freq Range (MHz)	Stop Band Frequency (Rej > 20 dB)	Tuning Response (ns)	Return Loss (dB)	Package (mm)	ECCN Code	Ordering Part Number
HMC1044	Programmable, harmonic low-pass filter	0 to 3.025	Digital 3 bits	1000 to 3000	—	10	10	3 × 3 LFCSP	EAR99	HMC1044LP3E
HMC890A <i>New</i>	Tunable band-pass filter	1 to 1.9	$f_c$ and BW, analog 0 V to 14 V	10% $f_c$	$\pm 10\% f_c$	200	10	5 × 5 LFCSP	EAR99	HMC890ALP5E
HMC891A <i>New</i>	Tunable band-pass filter	1.95 to 3.4	$f_c$ and BW, analog 0 V to 14 V	9% $f_c$	$\pm 10\% f_c$	200	10	5 × 5 LFCSP	EAR99	HMC891ALP5E
HMC881A <i>New</i>	Tunable low-pass filter	0 to 4	$f_c$ , analog 0 V to 14 V	2.4 to 4	$1.35 \times f_{3dB}$	200	16.5	5 × 5 LFCSP	EAR99	HMC881ALP5E
HMC892A <i>New</i>	Tunable band-pass filter	3.45 to 6.25	$f_c$ and BW, analog 0 V to 14 V	8.7% $f_c$	$\pm 10\% f_c$	200	9.6	5 × 5 LFCSP	EAR99	HMC892ALP5E
HMC882A <i>New</i>	Tunable low-pass filter	3.95 to 6.9	$f_c$ , analog 0 V to 14 V	3.95 to 6.9	$1.28 \times f_{3dB}$	200	13	5 × 5 LFCSP	EAR99	HMC882ALP5E
ADMV8416 <i>New</i>	Tunable band-pass filter	7 to 16	$f_c$ , 0 V to 15 V, high/low band	16%	$0.8 \times f_c, 1.17 \times f_c$	200	8	6 × 6 LFCSP	EAR99	ADMV8416ACPZ
ADMV8420 <i>New</i>	Tunable band-pass filter	11 to 20	$f_c$ , analog 0 V to 14 V	22% $f_c$	$+20\% f_c, -40\% f_c$	200	8.5	4 × 4 LFCSP	EAR99	ADMV8420ACPZ
ADMV8432 <i>New</i>	Tunable band-pass filter	16 to 32	$f_c$ , 0 V to 15 V, high/low band	17%	$0.75 \times f_c, 1.25 \times f_c$	200	9	6 × 6 LFCSP	EAR99	ADMV8432ACPZ

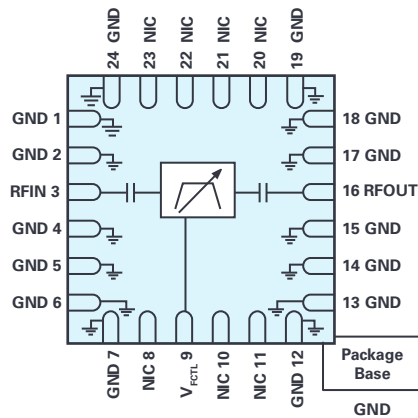
## ADMV8420: 10 GHz to 20 GHz Tunable Band-Pass Filter

### Key Features

- ▶ Excellent wideband rejection: <35 dB
- ▶ Fast tuning response: <300 ns typical
- ▶ Insertion loss: 5 dB
- ▶ Wideband tuning
- ▶ Minimum external component = compact solution
- ▶ 4 mm × 4 mm LFCSP package

### Applications

- ▶ Test and measurement equipment
- ▶ Radar and microwave receiver sensors
- ▶ Very small aperture terminal (VSAT)





# RF Power Detectors

## TruPwr rms Responding Detectors

Part Number	Description	Input Frequency (GHz)	Input Range (dBm)	Dynamic Range (dB)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
AD8361	Linear in V/V rms	LF to 2.5	-21 to +9	30	3 to 5	1.1	SOT-23	5A991.b	AD8361ARTZ-RL7
AD8361	Linear in V/V rms	LF to 2.5	-21 to +9	30	3 to 5	1.1	SOIC	5A991.b	AD8361ARMZ-REEL7
AD8364	Dual linear-in-dB	LF to 2.7	-58 to +2	60	5	70	5 × 5 LFCSP	5A991.b	AD8364ACPZ-WP
AD8362	Linear-in-dB	LF to 3.8	-55 to +12	65	5	20	TSSOP	5A991.b	AD8362ARUZ-REEL7
HMC1010	Linear-in-dB	0 to 3.9	-52 to +10	60	5	48	4 × 4 LFCSP	EAR99	HMC1010LP4E
HMC1020	Linear-in-dB	0 to 3.9	-64 to +7	71	5	55	4 × 4 LFCSP	EAR99	HMC1020LP4E
HMC1021	Linear-in-dB with envelope detector	0 to 3.9	-62 to +8	70	5	75	4 × 4 LFCSP	EAR99	HMC1021LP4E
HMC1030	Dual linear-in-dB with envelope detector	0 to 3.9	-61 to +10	70	5	143	5 × 5 LFCSP	EAR99	HMC1030LP5E
HMC1120	Linear-in-dB with envelope detector	0 to 3.9	-62 to +10	72	3	70	4 × 4 LFCSP	EAR99	HMC1120LP4E
HMC909	Linear-in-dB	0 to 5.8	-51 to -11	40	5	42	4 × 4 LFCSP	EAR99	HMC909LP4E
ADL5511	Linear in V/V rms with envelope detector	0 to 6	-30 to +17	47	5	21.5	4 × 4 LFCSP	EAR99	ADL5511ACPZ-R7
AD8363	Linear-in-dB	-0 to 6	-52 to +0	52	5	60	4 × 4 LFCSP	5A991.b	AD8363ACPZ-WP
LT5581	Linear-in-dB	0.01 to 6	-35 to +8	40	2.7 to 5	1.4	3 × 2 DFN	EAR99	LT5581IDD#TRPBF
LTC5587	Linear-in-dB, integrated 12-bit ADC	0.01 to 6	-35 to +8	40	3.3	3	3 × 3 DFN	EAR99	LTC5587IDD#TRPBF
LTC5583	Dual-channel, linear-in-dB, VSWR, peak detect	0.04 to 6	-57 to +3	60	3.3	80.5	4 × 4 QFN	EAR99	LTC5583IUF#TRPBF
ADL5501	Linear in V/V rms	0.05 to 6	-19 to +11	30	3 to 5	1.1	2 × 2 SC70	5A991.b	ADL5501AKSZ-R2
ADL5500	Linear in V/V rms	0.1 to 6	-20 to +10	30	3 to 5	1	1 × 1 WLCSP	5A991.b	ADL5500ACBZ-P7
ADL5903	Linear-in-dB	0.2 to 6	-22 to +13	35	3 to 5	2.5	2 × 2 LFCSP	5A991.b	ADL5903ACPZN-R7
ADL5502	Linear in V/V rms with peak/envelope detector	0.45 to 6	-25 to +12	37	3	3	3 × 3 WLCSP	5A991.b	ADL5502ACBZ-P7
ADL5504	Linear in V/V rms excellent rms accuracy	0.45 to 6	-22 to +15	35	3	1.8	1.2 × 0.8 WLCSP	5A991.b	ADL5504ACBZ-P7
ADL5505	Linear in V/V rms	0.45 to 6	-22 to +14	35	3	1.8	0.8 × 0.8 WLCSP	5A991.b	ADL5505ACBZ-P7
ADL5904	Linear-in-dB rms with threshold detector	0 to 6	-30 to +15	45	3.3	3	3 × 3 LFCSP	EAR99	ADL5904ACPZN-R7
ADL5920 <b>New</b>	Directional bridge, dual rms detector	-0 to 7	-20 to +30	50	5	160	5 × 5 LFCSP	EAR99	ADL5920ACPZ-R2
ADL5902	Linear-in-dB	0.05 to 9	-62 to +3	65	5	73	4 × 4 LFCSP	5A991.b	ADL5902ACPZ-WP
ADL5906	Linear-in-dB	0.01 to 10	-60 to +5	65	5	70	4 × 4 LFCSP	5A991.b	ADL5906ACPZN-R2
LTC5582	Linear-in-dB	0.04 to 10	-56 to +1	57	3.3	41.6	3 × 3 DFN	EAR99	LTC5582IDD#TRPBF
LTC5596	Linear-in-dB	0.1 to 40	-32 to +3	35	3.3	30	2 × 2 DFN	EAR99	LTC5596IDC#TRPBF

## Log Detectors/Amplifiers

Part Number	Description	Input Frequency (GHz)	Input Range (dBm)	Dynamic Range (dB)	Rise/Fall Time (ns)	V <sub>S</sub> (V)	I <sub>SY</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
AD8306	Log/limiting amplifier	0.005 to 0.4	-91 to +9	100	73/73	3 to 5	16	Die	EAR99	AD8306ACHIPS
AD8306	Log/limiting amplifier	0.005 to 0.4	-91 to +9	100	73/73	3 to 5	16	SOP	EAR99	AD8306ARZ-RL7
AD8310	Log detector	0 to 0.44	-90 to +5	95	15/30	3 to 5	8	Die	EAR99	AD8310ACHIPS
AD8310	Log detector	0 to 0.44	-90 to +5	95	15/30	3 to 5	8	MSOP	EAR99	AD8310ARMZ-REEL7
AD8307	Log detector	0 to 0.5	-75 to +17	92	400/400	3 to 5	8	SOIC	EAR99	AD8307ARZ-RL7
AD8307	Log detector	0 to 0.5	-75 to +17	92	400/400	3 to 5	8	PDIP	EAR99	AD8307ANZ
AD8309	Log/limiter amplifier	0.005 to 0.5	-76 to +20	100	400/400	3 to 5	16	TSSOP	EAR99	AD8309ARUZ-REEL7
LT5537	Log detector	<0.01 to 1	-71 to +12	83	110/115	2.7 to 5	13.5	3 × 2 DFN	EAR99	LT5537EDDB#TRPBF
AD8313	Log detector/controller	0.1 to 2.5	-72 to 0	70	60/60	3 to 5	13.7	MSOP	EAR99	AD8313ARMZ-REEL7
AD8314	Log detector/controller	0.1 to 2.7	-65 to -14	45	100/140	3 to 5	4.5	MSOP	EAR99	AD8314ARMZ-REEL7
AD8314	Log detector/controller	0.1 to 2.7	-65 to -14	45	100/140	3 to 5	4.5	2 × 3 LFCSP	EAR99	AD8314ACPZ-RL7
AD8302	Gain and phase detector	0 to 2.7	-60 to 0	60	50/60	3 to 5	19	TSSOP	EAR99	AD8302ARUZ-RL7
LT5504	Log detector	0.8 to 2.7	-67 to +3	75	200/150	2.7 to 5	14.7	MSOP	EAR99	LT5504EMS8#TRPBF
LT5534	Log detector	0.05 to 3	-55 to -3	60	40/70	2.7 to 5	7	2 × 2 SC70	EAR99	LT5534ESC6#TRPBF
HMC612	Log detector/controller	0 to 3	-65 to +5	70	19/100	3 to 5	29	4 × 4 LFCSP	EAR99	HMC612LP4E
AD8312	Log detector	0.05 to 3.5	-50 to +2	45	85/120	3 to 5	4.2	1 × 1.5 WLCSP	5A991.g	AD8312ACBZ-P2

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Log Detectors/Amplifiers (Continued)

Part Number	Description	Input Frequency (GHz)	Input Range (dBm)	Dynamic Range (dB)	Rise/Fall Time (ns)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
LT5538	Log detector	0.04 to 3.8	-65 to +1	70	100/180	3 to 5	29	3 × 3 DFN	EAR99	LT5538IDD#TRPBF
HMC600	Log detector/controller	0.05 to 4	-61 to 0	70	90/90	3 to 5	29	4 × 4 LFCSP	EAR99	HMC600LP4E
HMC601	Log detector/controller	0.01 to 4	-64 to +2	75	15/15	3 to 5	30	4 × 4 LFCSP	EAR99	HMC601LP4E
ADL5513	Log detector/controller	0.001 to 4	-64 to +6	80	20/21	3 to 5	31	3 × 3 WLCSF	EAR99	ADL5513ACPZ-WP
ADL5506	Log detector	0.03 to 4.5	-44 to +2	45	65/145	3 to 5	3.75	0.8 × 1.2 WLCSF	5A991.b	ADL5506ACBZ-R7
HMC713	Log detector/controller	0.05 to 8	-55 to 0	54	24/36	3 to 5	17	3 × 3 LFCSP	EAR99	HMC713LP3E
HMC713	Log detector/controller	0.05 to 8	-55 to 0	54	24/70	3 to 5	17	MSOP	EAR99	HMC713MS8E
AD8318	Log detector/controller	0.001 to 8	-60 to -3	60	10/12	5	68	4 × 4 LFCSP	EAR99	AD8318ACPZ-WP
HMC602	Log detector/controller	0.001 to 8	-55 to +8	70	9.5/10	5	113	4 × 4 LFCSP	EAR99	HMC602LP4E
AD8319	Log detector/controller	0.001 to 10	-54 to -4	45	10/6	3.3 to 5	22	2 × 3 LFCSP	EAR99	AD8319ACPZ-WP
AD8317	Log detector/controller	0.001 to 10	-59 to -4	55	10/6.1	3.3 to 5	22	2 × 2 LFCSP	EAR99	AD8317ACPZ-WP
AD8317	Log detector/controller	0.001 to 10	-59 to -4	55	10/6.1	3.3 to 5	22	Die	EAR99	AD8317ACHIPS
HMC611	Log detector/controller	0.001 to 10	-57 to +6	63	10/10	5	106	Die	EAR99	HMC611
HMC611	Log detector/controller	0.001 to 10	-57 to +6	69	10/10	5	106	4 × 4 LFCSP	EAR99	HMC611LP4E
ADL5519	Dual log detector/controller	0.001 to 10	-60 to -5	62	8/6	3.3 to 5	60	5 × 5 LFCSP	EAR99	ADL5519ACPZ-WP
HMC1094	Millimeter wave log detector	1 to 23	-47 to 0	50	12/65	3.3	85	3 × 3 LFCSP	EAR99	HMC1094LP3E
HMC948	Millimeter wave log detector	1 to 23	-40 to +10	54	5/7	3.3	91	3 × 3 LFCSP	EAR99	HMC948LP3E
HMC662	Millimeter wave log detector	8 to 30	-42 to +10	54	5/10	3.3	88	3 × 3 LFCSP	EAR99	HMC662LP3E
HMC7447	E-band detector	71 to 86	-0.5 to +23.5	24	—	—	—	Die	EAR99	HMC7447

## Envelope and Peak Detectors

Part Number	Description	Frequency (GHz)	Envelope Bandwidth (MHz)	Input Range (dBm)	Dynamic Range (dB)	Rise Time (ns)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
LTC5507	Schottky peak detector with gain compression	0.0001 to 1	1	-18 to +14	32	—	2.7 to 6	0.55	TSOT-23	EAR99	LTC5507ES6#TRPBF
LTC5509	Schottky peak detector with no gain compression	0.3 to 3	1.5	-18 to +7	25	—	2.7 to 6	0.58	SC70	EAR99	LTC5509ESC6#TRPBF
LTC5505-1	Schottky peak detector with gain compression	0.3 to 3	4	-20 to +18	38	—	2.7 to 6	0.5	SOT-23	EAR99	LTC5505-1ES5#TRPBF
LTC5505-2	Schottky peak detector with gain compression	0.3 to 3.5	4	-20 to +12	32	—	2.7 to 6	0.5	SOT-23	EAR99	LTC5505-2ES5#TRPBF
HMC1030	Dual rms linear-in-dB with envelope detector	0 to 3.9	150	-61 to +10	70	50	5	143	5 × 5 LFCSP	EAR99	HMC1030LP5E
HMC1120	Linear-in-dB with envelope detector	0.1 to 3.9	150	-60 to +10	70	200	3	70	4 × 4 LFCSP	EAR99	HMC1120LP4E
HMC1021	RMS detector with envelope tracker	0 to 3.9	150	-62 to +8	70	50	5	75	4 × 4 LFCSP	EAR99	HMC1021LP4E
ADL5502	RMS crest factor detector	0.45 to 6	10	-25 to +12	37	3000	3	3	3 × 3 WLCSF	5A991.b	ADL5502ACBZ-P7
ADL5910	Threshold detector	0 to 6	100	-30 to +15	45	12	3.3	3.5	3 × 3 LFCSP	EAR99	ADL5910ACPZN-R7
ADL5511	RMS linear-in-V/V with envelope detector	0 to 6	130	-30 to +17	47	4	5	21.5	4 × 4 LFCSP	EAR99	ADL5511ACPZ-R7
LTC5530	Schottky peak detector with gain adjust	0.3 to 7	2	-24 to +7	30	—	2.7 to 5.5	0.5	TSOT-23	EAR99	LTC5530ES6#TRPBF
LTC5531	Schottky peak detector with offset adjust	0.3 to 7	2	-24 to +7	30	—	2.7 to 5.5	0.5	TSOT-23	EAR99	LTC5531ES6#TRPBF
LTC5532	Schottky peak detector with gain and offset adjust	0.3 to 7	2	-24 to +7	30	—	2.7 to 5.5	0.5	TSOT-23	EAR99	LTC5532ES6#TRPBF
LTC5508	Schottky peak detector with gain compression	0.3 to 7	2	-24 to +12	36	—	2.7 to 6	0.55	SC70	EAR99	LTC5508ESC6#TRPBF
LTC5536	Schottky peak detector and 20 ns comparator	0.6 to 7	—	-20 to +12	32	20	2.7 to 5.5	2.1	TSOT-23	EAR99	LTC5536ES6#TRPBF
LTC5535	Schottky peak detector	0.6 to 7	12	-20 to +9	30	40	2.7 to 5.5	2	TSOT-23	EAR99	LTC5535ES6#TRPBF
LTC5533	Dual Schottky peak detector	0.3 to 11	2	-20 to +7	30	—	2.7 to 6	0.9	4 × 3 DFN	EAR99	LTC5533EDE#TRPBF
LTC5564	Ultrafast Schottky peak detector with 9 ns comparator	0.6 to 15	75	-10 to +16	26	7	3 to 5.5	44	3 × 3 QFN	EAR99	LTC5564IUD#TRPBF
ADL6010	Envelope detector	0.5 to 43.5	40	-30 to +15	45	4	5	3	2 × 2 LFCSP	5A991.b	ADL6010ACPZN-R7

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools.

## Envelope and Peak Detectors (Continued)

Part Number	Description	Frequency (GHz)	Envelope Bandwidth (MHz)	Input Range (dBm)	Dynamic Range (dB)	Rise Time (ns)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
<b>ADL6012</b> <b>Upcoming</b>	Envelope detector	2.0 to 43.5	500	-10 to +15	25	2	5	26	3 × 2 LFCSP	5A991.b, EAR99	ADL6012ACPZN-R7

## SDLVAs

Part Number	Description	Frequency (GHz)	Rise/Fall Time (ns)	Input Range (dBm)	Dynamic Range (dB)	Prop Delay (ns)	Threshold (dBm)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
HMC1013	High range SDLVA	0.5 to 18.5	4/10	-57 to +10	67	10	-62	3.3	183	4 × 4 LFCSP	EAR99	HMC1013LP4E
HMC613	SDLVA	0.1 to 20	4/18	-54 to +5	59	14	-54	3.3	83	4 × 4 LFCSP	EAR99	HMC613LC4B
HMC913	SDLVA	0.6 to 20	5/10	-54 to +5	59	14	-54	3.3	80	Die	EAR99	HMC913
HMC913	SDLVA	0.6 to 20	5/10	-54 to +5	59	14	-54	3.3	80	4 × 4 LFCSP	EAR99	HMC913LC4B
HMC813	SDLVA with limited output	1 to 26	4/10	-48 to +5	55	15	-53	3.3	150	Die	EAR99	HMC813
HMC813	SDLVA with limited output	1 to 26	5/10	-41 to +10	55	15	-53	3.3	150	4 × 4 LFCSP	EAR99	HMC813LC4B

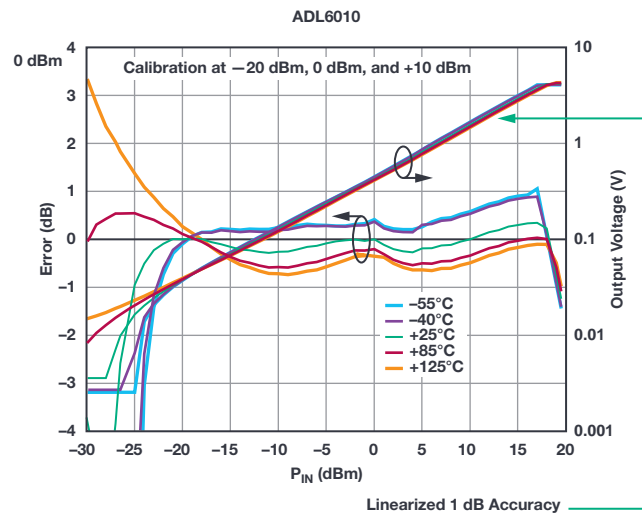
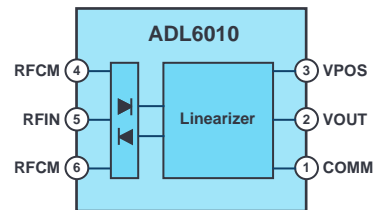
## ADL6010: Widest Bandwidth, Fastest Response Peak/Envelope Detector

### Features

- ▶ Linearized Schottky diode detector
- ▶ 50 Ω matched from 500 MHz to 43.5 GHz
- ▶ 45 dB dynamic range: -30 dBm to -15 dBm
- ▶ ±1 dB measurement accuracy over temperature
- ▶ 10 ns response time
- ▶ Log-linear in volts response
- ▶ 5 V/1.6 mA supply
- ▶ Small 2.05 mm × 2.05 mm LFCSP package
- ▶ A-grade: -40°C to +85°C
- ▶ S-grade: -55°C to +125°C available

### Applications

- ▶ Microwave backhaul
- ▶ Communications infrastructure
- ▶ Pulsed radar systems
- ▶ Test instrumentation
- ▶ Fast signal detect
- ▶ Optical communications



## LTC5596: Widest Bandwidth, Highest Sensitivity rms Detector

### Key Features

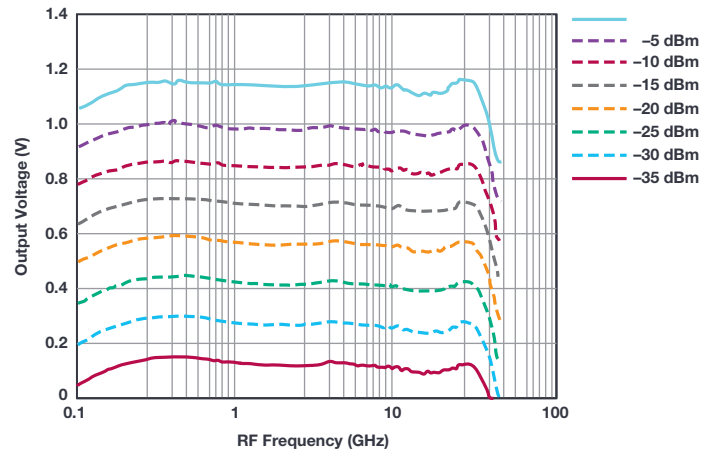
- ▶ 50  $\Omega$  matched from 100 MHz to 40 GHz
- ▶ 35 dB dynamic range: -37 dBm to -2 dBm
- ▶  $\pm 1$  dB measurement accuracy
- ▶ Log-linear in dB response
- ▶ 3.3 V/30 mA supply
- ▶ Small 2 mm  $\times$  2 mm, 8-lead DFN package
- ▶ I-grade: -40°C to +105°C case temperature
- ▶ H-grade: -40°C to +125°C case rated

### Applications

- ▶ Microwave backhaul
- ▶ Communications infrastructure
- ▶ Radar systems
- ▶ Test instrumentation
- ▶ Telematics



Output Voltage vs. Frequency



# High Speed Logic

## 1:2 and 1:4 Fanout Buffers

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing ( $V_{FPO}$ )	DC Power Consumption (mW)	DC Power Supply ( $V_{DC}$ )	Package (mm)	ECCN Code	Ordering Part Number
HMC720	1:2 fanout buffer	13/13	19/18	2	0.6 to 1.1	300	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC720LP3E
HMC724	1:2 fanout buffer	13/13	19/18	2	1.1	300	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC724LC3
HMC744	1:2 fanout buffer	13/13	22/20	2	0.6 to 1.2	290	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC744LC3
HMC850	1:2 fanout buffer	28/20	16/15	2	0.6 to 1.1	315	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC850LC3
HMC842	1:2 fanout buffer with adjustable $V_{OUT}$	45/28	11/11	3	0.4 to 1.2	465	-3.3	4 × 4 LFCSP	EAR99	HMC842LC4B
HMC940	1:4 fanout buffer	13/13	26/25	4	0.6 to 1.4	440	-3.3 or +3.3	4 × 4 LFCSP	EAR99	HMC940LC4B

## 2:1 Selectors

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing ( $V_{FPO}$ )	DC Power Consumption (mW)	DC Power Supply ( $V_{DC}$ )	Package (mm)	ECCN Code	Ordering Part Number
HMC858	2:1 differential selector	14/14	19/20	2	0.5 to 1.3	221	-3.3 or +3.3	4 × 4 LFCSP	EAR99	HMC858LC4B
HMC678	2:1 differential selector	13/13	17/15	—	0.6 to 1.2	250	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC678LC3C
HMC728	2:1 differential selector	13/13	17/15	—	1.1	250	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC728LC3C
HMC748	2:1 selector	13/13	22/22	2	0.6 to 1.2	250	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC748LC3C
HMC958	4:1 selector	14/14	17/17	2	0.5 to 1.3	294	-3.3 or +3.3	5 × 5 LFCSP	EAR99	HMC958LC5

## AND/NAND/OR/NOR

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing ( $V_{FPO}$ )	DC Power Consumption (mW)	DC Power Supply ( $V_{DC}$ )	Package (mm)	ECCN Code	Ordering Part Number
HMC722	AND/NAND/OR/NOR with adjustable $V_{OUT}$	13/13	19/18	2	0.6 to 1.1	230	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC722LC3C
HMC722	AND/NAND/OR/NOR	13/13	19/18	2	0.6 to 1.1	230	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC722LP3E
HMC726	AND/NAND/OR/NOR	13/13	19/18	2	1.1	230	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC726LC3C
HMC746	AND/NAND/OR/NOR	13/13	22/21	2	0.6 to 1.2	230	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC746LC3C
HMC843	AND/NAND/OR/NOR	45/45	10/10	2	0.2 to 0.9	520	-3.3	4 × 4 LFCSP	EAR99	HMC843LC4B

## Clock Dividers

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing ( $V_{FPO}$ )	DC Power Consumption (mW)	DC Power Supply ( $V_{DC}$ )	Package (mm)	ECCN Code	Ordering Part Number
HMC959	Clock divide by 4	—/26	19/19	2	0.8 to 1.8	281	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC959LC3
HMC859	Clock divide by 8	—/26	19/17	2	0.8 to 1.8	520	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC859LC3

## D-Type Flip Flops

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing ( $V_{FPO}$ )	DC Power Consumption (mW)	DC Power Supply ( $V_{DC}$ )	Package (mm)	ECCN Code	Ordering Part Number
HMC953	Dual D-type flip flop with common	14/14	22/20	2	0.6 to 1.3	442	-3.3 or +3.3	4 × 4 LFCSP	EAR99	HMC953LC4B
HMC723	D-type flip flop with adjustable $V_{OUT}$	13/13	19/17	2	0.7 to 1.3	264	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC723LC3C
HMC723	D-type flip flop	13/13	19/17	2	0.7 to 1.3	260	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC723LP3E
HMC727	D-type flip flop	13/13	19/17	2	1.1	260	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC727LC3C
HMC747	D-type flip flop	13/13	22/20	2	0.7 to 1.2	264	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC747LC3C
HMC853	D-type flip flop	28/28	15/14	2	0.7 to 1.3	260	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC853LC3
HMC841	D-type flip flop	43/43	12/12	2	0.2 to 0.85	630	-3.3	4 × 4 LFCSP	EAR99	HMC841LC4B

## T-Type Flip Flops

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing (V <sub>PPD</sub> )	DC Power Consumption (mW)	DC Power Supply (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC679	T-flip flop with reset	26/26	18/17	2	0.4 to 1.1	270	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC679LC3C
HMC729	T-flip flop with reset	26/26	18/17	2	1.1	270	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC729LC3C
HMC749	T-flip flop with reset	26/26	18/17	2	0.6 to 1.2	270	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC749LC3C

## XORs/XNORs

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing (V <sub>PPD</sub> )	DC Power Consumption (mW)	DC Power Supply (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC721	XOR/XNOR with adjustable V <sub>OUT</sub>	13/13	19/18	2	0.6 to 1.2	230	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC721LC3C
HMC721	XOR/XNOR	13/13	19/18	2	0.6 to 1.2	230	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC721LP3E
HMC725	XOR/XNOR	13/13	19/18	2	1.1	230	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC725LC3C
HMC745	XOR/XNOR	13/13	21/19	2	0.6 to 1.2	240	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC745LC3
HMC851	XOR/XNOR	28/28	15/14	2	0.6 to 1.4	241	-3.3 or +3.3	3 × 3 LFCSP	EAR99	HMC851LC3C
HMC844	XOR/XNOR	45/28	11/10	2	0.2 to 0.85	512	-3.3	4 × 4 LFCSP	EAR99	HMC844LC4B

## Muxes and Demuxes

Part Number	Description	Data/Clock Rate (Gbps/GHz)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing (V <sub>PPD</sub> )	DC Power Consumption (mW)	DC Power Supply (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC954	2:1 mux	23/16	15/15	—	0.8 to 1.5	480	-3.3 or +3.3	4 × 4 LFCSP	EAR99	HMC954LC4B
HMC854	4:1 mux	28/14	16/16	4	0.7 to 1.25	510	-3.3 or +3.3	5 × 5 LFCSP	EAR99	HMC854LC5
HMC847	4:1 mux	45/22.5	11/12	3	0.25 to 0.9	1782	+3.3	5 × 5 LFCSP	EAR99	HMC847LC5
HMC955	1:2 mux with high speed invert	32/16	19/18	<3	0.5 to 1.2	644	-3.3 or +3.3	4 × 4 LFCSP	EAR99	HMC955LC4B
HMC855	1:4 demux	28/14	22/22	—	0.45 to 1.14	644	-3.3 or +3.3	5 × 5 LFCSP	EAR99	HMC855LC5
HMC848	1:4 demux	45/22.5	25/21	4	0.3 to 1.0	1782	+3.3	5 × 5 LFCSP	EAR99	HMC848LC5

## Datapath Signal Conditioners

Part Number	Description	Data Rate (Gbps)	Rise/Fall Time (ps)	Dequalization Type	Differential Output Swing (V <sub>PPD</sub> )	DC Power Consumption (mW)	DC Power Supply (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC7545	Signal conditioner	14.2	25/25	Feed forward equalizer	0.4 to 0.9	340	3.3	7 × 4 LFCSP	EAR99	HMC7545ABLP47E
HMC6545	Linear equalizer	32	16/16	Continuous time linear equalizer	0.4 to 0.96	430	2.5 or 3.3	5 × 5 LFCSP	EAR99	HMC6545LP5E

## Track-and-Hold Data

Part Number	Description	Sampling Rate (Gbps/GHz)	Bandwidth (GHz)	Rank	Aperture Jitter (fs)	DC Power Consumption (mW)	DC Power Supply (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC1061	Track-and-hold	4	DC to 18	Dual	<70	2340	-4.75 and +2	5 × 5 LFCSP	EAR99	HMC1061LC5
HMC760	Track-and-hold	4	DC to 5	Single	<70	1420	-4.75 and +2	4 × 4 LFCSP	EAR99	HMC760LC4B
HMC661	Track-and-hold	4	DC to 18	Single	<70	1590	-4.75 and +2	4 × 4 LFCSP	EAR99	HMC661LC4B

## Digital Crosspoint Switches

Part Number	Description	Data Rate (Gbps)	Rise/Fall Time (ps)	Deterministic Jitter (ps)	Differential Output Swing (V <sub>PPD</sub> )	DC Power Consumption (mW)	DC Power Supply (V <sub>DC</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC1027	13 × 13 crosspoint switch	14.2	22/23	0.05 to 2	0.4 to 0.8	1200	2.5 and 3.3	14 × 14 BGA	EAR99	HMC1027BG

# RF Switches

## Massive MIMO RF Front Ends

Part Number	Device Configuration	RF Features (GHz)	Frequency Response RF (GHz)	Insertion Loss (dB)	Input Power (dBm)	Gain (V/V)	NF (dB)	Package (mm)	ECCN Code	Ordering Part Number
<b>ADRF5549</b> <i>New</i>	Dual-channel	2-stage LNA, high power SPDT	1.8 to 2.8	0.6	49	35	1.4	6 × 6 LFCSP	EAR99	ADRF5549BCPZN
<b>ADRF5545A</b> <i>New</i>	Dual-channel	2-stage LNA, high power SPDT	2.4 to 4.2	0.65	49	32	1.45	6 × 6 LFCSP	EAR99	ADRF5545ABCPZN
<b>ADRF5547</b> <i>Upcoming</i>	Dual-channel	2-stage LNA, high power SPDT	3.7 to 5.3	0.7	49	32	1.6	6 × 6 LFCSP	EAR99	ADRF5547BCPZN

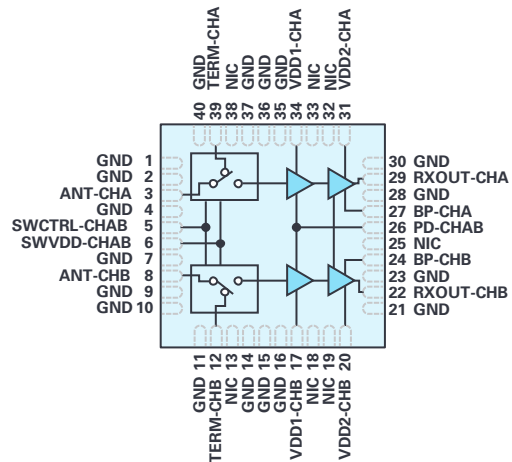
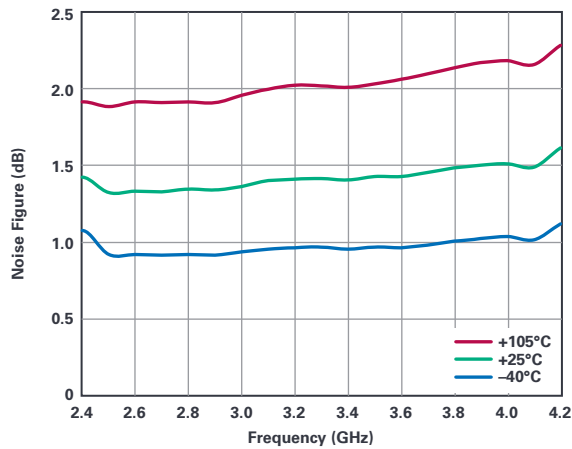
### ADRF5545A: Dual-Channel, 2.4 GHz to 4.2 GHz M-MIMO Receiver Front End

#### Key Features

- ▶ Integrated dual-channel, 2-stage LNA with high power SPDT switch
- ▶ High RF input power handling: 10 Watts
- ▶ High gain (32 dB) and low gain (16 dB) mode
- ▶ Low noise figure: 1.45 dB typical at 3.6 GHz
- ▶ Low insertion loss: 0.65 dB typical
- ▶ Single-supply operation
- ▶ Small 6 mm × 6 mm package

#### Applications

- ▶ Massive MIMO transceivers
- ▶ 4G/5G small cell base stations
- ▶ Software-defined radios



## SPST Switches

Part Number	Description	RF Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dB)	Input P0.1 dB (dB)	Input IP3 (dBm)	Control Input (V <sub>cc</sub> )	Package (mm)	ECCN Code	Ordering Part Number
ADG901*	Absorptive	0 to 2.5	0.8	40	17	—	36	CMOS/LVTTL	MSOP	EAR99	ADG901BRMZ
ADG902*	Reflective	0 to 2.5	0.8	40	17	—	36	CMOS/LVTTL	MSOP	EAR99	ADG902BRMZ
HMC1055	Nonreflective	0 to 3.5	0.6	36	32	28	63	0/3	SOT-26	EAR99	HMC1055LP2CE
HMC550A	Fail-safe	0 to 6	0.7	25	—	32	52	0/2.2 to 5	SOT-26	EAR99	HMC550AE

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## SPDT Switches

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Input P0.1dB (dBm)	Input IP3 (dBm)	Control Input (V <sub>cc</sub> )	Package (mm)	ECCN Code	Ordering Part Number
ADG918*	Absorptive	0 to 2	0.8	43	17	—	36	CMOS/LVTTL	MSOP	EAR99	ADG918BRMZ
ADG919*	Reflective	0 to 2	0.8	43	17	—	36	CMOS/LVTTL	MSOP	EAR99	ADG919BRMZ
ADG936	Dual absorptive	0 to 2	0.9	36	16	—	32	CMOS/LVTTL	TSSOP	EAR99	ADG936BRUZ
ADG936-R	Dual switch	0 to 2	0.9	36	16	—	32	CMOS/LVTTL	TSSOP	EAR99	ADG936BRUZ-R
HMC199A	Dual switch	0 to 2.5	0.4	25	28	27	55	0/5	MSOP	EAR99	HMC199AMS8E
HMC546	10 W, fail-safe	0.2 to 2.7	0.4	22	—	41	64	0/3 to 8	MSOP	EAR99	HMC546MS8GE
HMC546	10 W, fail-safe	0.2 to 2.7	0.3	27	—	21	45	0/3 to 8	2 × 2 DFN	EAR99	HMC546LP2E
HMC197B	Reflective	0 to 3	0.4	28	30	28	45	0/3	SOT-26	EAR99	HMC197BE
HMC194A	High isolation	0 to 3	0.5	55	30	28	53	0/5	8-lead MSOP	EAR99	HMC194AMS8E
HMC221B	Reflective	0 to 3	0.4	29	30	27	55	0/3	SOT-26	EAR99	HMC221BE
HMC190B	Reflective	0 to 3	0.4	30	30	27	55	0/3	8-lead MSOP	EAR99	HMC190BMS8E
HMC545A	Reflective	0 to 3	0.27	31	30	27	46	0/3.3 to 5	QSOP	EAR99	HMC545AE
HMC284A	Nonreflective	0 to 3.5	0.5	45	29	27	50	0/5	8-lead MSOP	EAR99	HMC284AMS8GE
ADRF5130	44 W, reflective	0.7 to 3.5	0.7	41	—	46	65	TTL/CMOS	3 × 3 LFCSP	EAR99	ADRF5130BCPZ
HMC349A	High isolation	0.1 to 4	1.2	57	34	30	53	0/5	4 × 4 LFCSP	EAR99	HMC349ALP4CE
HMC349A	High isolation	0.1 to 4	1.8	45	34	32	53	0/5	MSOP	EAR99	HMC349AMS8GE
HMC435A	Nonreflective	0 to 4	1.2	40	30	27	51	0/5	MSOP	EAR99	HMC435AMS8GE
ADRF5160	80 W, Reflective	0.7 to 4	0.8	40	—	47	70	TTL/CMOS	5 × 5 LFCSP	EAR99	ADRF5160BCPZ-R7
ADRF5132	20 W, reflective	0.7 to 5	0.65	42	—	42.5	65	TTL/CMOS	3 × 3 LFCSP	EAR99	ADRF5132BCPZN
HMC849A	Nonreflective	0 to 6	0.9	60	34	32	52	0/3 to 5	4 × 4 LFCSP	EAR99	HMC849ALP4CE
HMC8038	Nonreflective	0.1 to 6	0.8	60	36	35	60	5 V to 1.8 V logic	4 × 4 LFCSP	EAR99	HMC8038LP4CE
HMC270A	Nonreflective	0 to 8	1	45	28	—	42	0/-5	MSOP	EAR99	HMC270AMS8GE
HMC232A	High isolation	0 to 12	1.5	57	30	27	47	0/-5	4 × 4 LFCSP	EAR99	HMC232ALP4E
HMC1118	Nonreflective	9 kHz to 13	0.68	48	37	35	62	CMOS/LVTTL	3 × 3 LFCSP	EAR99	HMC1118LP3DE
ADRF5019 <b>New</b>	Nonreflective	0.1 to 13	0.8	45	39	38	60	CMOS/LVTTL	3 × 3 LFCSP	EAR99	ADRF5019BCPZN
HMC347A	Nonreflective	0.1 to 14	2.1	46	29	—	47	0/-5	3 × 3 LFCSP	EAR99	HMC347ALP3E
HMC347A	Nonreflective	0.1 to 20	1.7	45	29	—	45	0/-5	Die	EAR99	HMC347A
HMC347B	Nonreflective	0.1 to 20	1.7	45	25	—	41	—	Die	EAR99	HMC347B
HMC547A	Nonreflective	0 to 20	2	45	23	—	47	0/-5	3 × 3 LFCSP	EAR99	HMC547ALP3E
HMC547A	Nonreflective	0 to 28	1.9	45	22	—	41	0/-5	3 × 3 LFCSP	EAR99	HMC547ALC3
ADRF5020*	Nonreflective	0.1 to 30	1.4	56	27	—	50	CMOS/LVTTL	3 × 3 LGA	EAR99	ADRF5020BCCZN
ADRF5021*	Nonreflective	9 kHz to 30	2	60	—	27	52	CMOS/LVTTL	3 × 3 LGA	EAR99	ADRF5021BCCZN
ADRF5300 <b>Upcoming</b>	SPDT with neg. supply	24 to 32	1.1	38	—	37	52	CMOS/LVTTL compatible	3 × 3 LGA	EAR99	ADRF5300BCCZN
ADRF5026 <b>New</b>	SPDT, nonreflective	0.1 to 44	2.4	50	26	—	53	CMOS/LVTTL	3 × 3 LGA	EAR99	ADRF5026BCCZN
ADRF5027 <b>New</b>	SPDT, nonreflective	9 kHz to 44	2.2	48	—	—	54	CMOS/LVTTL	3 × 3 LGA	EAR99	ADRF5027BCCZN
ADRF5024	SPDT, reflective	0.1 to 44	1.4	36	—	27	50	CMOS/LVTTL	2.25 × 2.25 LGA	EAR99	ADRF5024BCCZN
ADRF5025	SPDT, reflective	9 kHz to 44	1.4	36	—	27	50	CMOS/LVTTL	2.25 × 2.25 LGA	EAR99	ADRF5025BCCZN
ADRF5301 <b>Upcoming</b>	SPDT with neg. supply	35 to 44	1.8	28	—	37	52	CMOS/LVTTL compatible	3 × 3 LGA	EAR99	ADRF5301BCCZN
HMC986A	Reflective	0.1 to 50	1.7	36	25	21	40	0/-3	Die	EAR99	HMC986A
HMC-SDD112	Pin MMIC	55 to 86	2	30	—	—	—	-1	Die	5A991.h	HMC-SDD112
HMC646	40 W T/R	0.1 to 2.1	0.7	32	—	46	74	0/3 to 8	2 × 2 LFCSP	EAR99	HMC646LP2E
HMC574A	5 W, T/R	0 to 3	0.25	30	38	36	63	0/3 to 8	8-lead MSOP	EAR99	HMC574AMS8E
HMC595A	3 W, T/R	0 to 3	0.25	30	38	36	64	0/3 to 10	SOT-26	EAR99	HMC595AE
HMC544A	T/R	0 to 4	0.25	23	39	37	55	0/3 to 5	SOT-26	EAR99	HMC544AE
HMC784A	10 W, T/R	0.1 to 4	0.4	28	38	36	62	0/3 to 8	MSOP	EAR99	HMC784AMS8GE
HMC536	T/R	0 to 6	0.5	27	—	33	52	0/3 to 5	8-lead MSOP	EAR99	HMC536MS8GE
HMC536	T/R	0 to 6	0.7	30	—	34	52	0/3 to 5	2 × 2 DFN	EAR99	HMC536LP2E

— = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave



## SP3T, SP4T, SP6T, SP8T Switches

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Input P0.1dB (dBm)	Input IP3 (dBm)	Control Input (V <sub>cc</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC245A	SP3T	0 to 2.5	0.5	44	26	24	48	TTL/CMOS	TSSOP	EAR99	HMC245AQS16E
ADG904	SP4T, absorptive	0 to 2.5	0.4	37	16	—	31	CMOS/LVTTL	TSSOP LFCSP	EAR99	ADG904BCPZ ADG904BRUZ
ADG904-R	SP4T, reflective	0 to 2.5	0.4	37	16	—	31	CMOS/LVTTL	TSSOP LFCSP	EAR99	ADG904BCPZ-R-REEL ADG904BRUZ-R
HMC252A	SP6T	0 to 3	0.8	45	24	—	47	0/3.3 to 5	QSOP	EAR99	HMC252AQS24E
HMC253A	SP8T	0 to 3.5	1.2	36	24	20	43	TTL/CMOS	4 × 4 LFCSP	EAR99	HMC253ALC4
HMC253A	SP8T	0 to 3.5	1.2	36	24	20	43	TTL/CMOS	QSOP	EAR99	HMC253AQS24E
HMC241A	SP4T	0 to 4	0.7	43	30	26	47	TTL/CMOS	3 × 3 LFCSP	EAR99	HMC241ALP3E
HMC241A	SP4T	0 to 4	0.8	41	29	26	48	TTL/CMOS	TSSOP	EAR99	HMC241AQS16E
HMC244A	SP4T	0 to 4	0.7	40	26	22	47	TTL/CMOS	Hermetic SMT	EAR99	HMC244AG16
HMC7992	SP4T	0.1 to 6	0.7	45	35	33	58	5 to 1.8 V logic	3 × 3 LFCSP	EAR99	HMC7992LP3DE
ADRF5250	SP5T	0.1 to 6	1.5	50	—	34	57	1.8 V logic	4 × 4 LFCSP	EAR99	ADRF5250BCPZ
HMC322A	SP8T	0 to 8	2.5	35	26	22	40	0/−5	4 × 4 LFCSP	EAR99	HMC322ALP4E
HMC344A	SP4T	0.1 to 8	2.1	32	28	19	44	0/−5	3 × 3 LFCSP	EAR99	HMC344ALP3E
HMC345A	SP4T	0 to 8	2.2	32	21	19	45	0/5	3 × 3 LFCSP	EAR99	HMC345ALP3E
HMC321A	SP8T	0.1 to 8	2.5	35	23	—	40	0/5	4 × 4 LFCSP	EAR99	HMC321ALP4E
ADRF5040	SP4T	−0 to 12	0.8	34	—	34	58	CMOS/LVTTL	4 × 4 LFCSP	EAR99	ADRF5040
HMC641A	SP4T	0.1 to 18	2.1	42	25	—	41	0/−5	Die	EAR99	HMC641A
HMC641A	SP4T	0 to 20	2.3	43	22	—	38	0/−5	4 × 4 LFCSP	EAR99	HMC641ALC4
HMC641A	SP4T	0 to 20	2.3	41	22	—	36	0/−5	4 × 4 LFCSP	EAR99	HMC641ALP4E
ADRF5044	SP4T	0.1 to 30	2.9	43	28	26	50	CMOS/LVTTL	4 × 4 LGA	EAR99	ADRF5044BCCZN
HMC1084	SP4T	23 to 30	2.8	26	—	—	47	0/−3	4 × 4 LFCSP	EAR99	HMC1084LC4
ADRF5045	SP4T	−0 to 30	2.9	45	28	26	50	CMOS/LVTTL	4 × 4 LGA	EAR99	ADRF5045BCCZN
<b>New</b> ADRF5046	SP4T, reflective	0.1 to 44	2.5	33	—	27.5	50	CMOS/LVTTL	3 × 3 LGA	EAR99	ADRF5046BCCZN
<b>Upcoming</b> ADRF5047	SP4T, reflective	9 kHz to 44 kHz	2.7	37	—	27	50	CMOS/LVTTL	3 × 3 LGA	EAR99	ADRF5047BCCZN

## Bypass, Diversity, Matrix, and Transfer

Part Number	Description	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Input P0.1 dB (dBm)	Input IP3 (dBm)	Control Input (V <sub>cc</sub> )	Package (mm)	ECCN Code	Ordering Part Number
HMC596	4 × 2 matrix	0.2 to 3	6.5	43	22	—	27	0/3 to 5	4 × 4 LFCSP	EAR99	HMC596LP4E
HMC427A	Transfer	0.1 to 8	1.6	38	30	—	47	0/5	3 × 3 LFCSP	EAR99	HMC427ALP3E

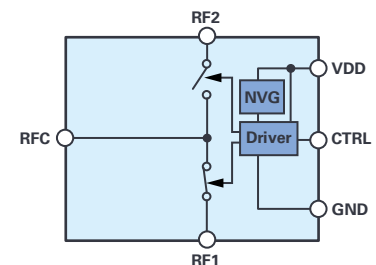
### ADRF5300: 24 GHz to 32 GHz Silicon SPDT Switch ADRF5301: 35 GHz to 44 GHz Silicon SPDT Switch

#### Key Features

- ▶ Reflective design
- ▶ Very low insertion loss:
  - 1.1 dB at 30 GHz (ADRF5300)
  - 1.8 dB at 44 GHz (ADRF5301)
- ▶ Single supply (internal negative supply)
- ▶ High IP3: 52 dBm
- ▶ 28 dBm switch power handling
- ▶ <52 ns switch settling time
- ▶ 3 mm × 3 mm LGA package

#### Applications

- ▶ Industrial scanners
- ▶ Test instrumentation
- ▶ Millimeter wave 5G network radios
- ▶ Military radios, radars, ECM
- ▶ Microwave radios
- ▶ Satellite communications



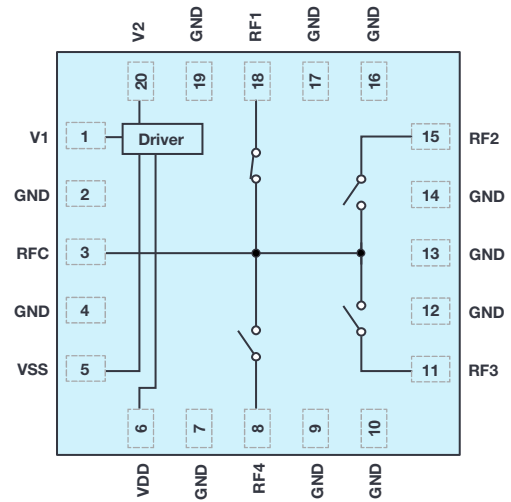
**ADRF5046:** 100 MHz to 44 GHz, Silicon SP4T Switch  
**ADRF5047:** 9 kHz to 44 GHz, Silicon SP4T Switch

**Key Features**

- ▶ Ultrawide bandwidth
- ▶ Reflective design
- ▶ Low insertion loss:
  - ▶ 1.5 dB to 18 GHz
  - ▶ 2.5 dB to 40 GHz
  - ▶ 3.0 dB to 44 GHz
- ▶ High isolation: >31 dB
- ▶ High IP3: 50 dBm typical
- ▶ 27 dBm switch power handling
- ▶ Fast switching and settling time:
  - ▶ 50 ns to 0.1 dB (ADRF5046)
  - ▶ 5.2  $\mu$ s to 0.1 dB (ADRF5047)
- ▶ Positive logic control
- ▶ 3 mm  $\times$  3 mm LGA package

**Applications**

- ▶ Industrial scanners
- ▶ Test instrumentation
- ▶ 4G/5G infrastructure radios
- ▶ Military radios, radars, and ECM equipment
- ▶ Microwave radios



# Connectorized Modules

## Connectorized Amplifier Modules

Part Number	Function	Frequency (GHz)	Gain (dB)	OIP3 (dBm)	NF (dB)	P1dB (dBm)	Bias Supply	Package/Connector Type	ECCN Code
HMC-C045	Wideband LNA	1.8 to 4.2	26	26	0.7	15.5	12 V @ 112 mA	C-10/SMA	EAR99
HMC-C048	Wideband LNA	5 to 9	22.5	25	1.75	15	12 V @ 105 mA	C-10/SMA	EAR99
HMC-C059	Wideband LNA	1 to 12	16	30	1.8	16	6 V @ 60 mA	C-10B/SMA	EAR99
HMC-C016	Wideband LNA	7 to 17	22	25	2	14	8 V @ 93 mA	C-1/SMA	EAR99
HMC-C001	Wideband LNA	2 to 20	15	25	2.5	14	12 V @ 65 mA	C-1/SMA	EAR99
HMC-C002	Wideband LNA	2 to 20	14	26	2	18	12 V @ 60 mA	C-2/SMA	EAR99
HMC-C022	Wideband LNA	2 to 20	14	27	2	16	8 V @ 75 mA	C-2B/SMA	EAR99
HMC-C017	Wideband LNA	17 to 27	18	25	3	14	8 V @ 96 mA	C-1B/2.92 mm	EAR99
HMC-C027	Wideband LNA	29 to 36	20	22	2.9	11	3 V @ 80 mA	C-10/2.92 mm	3A001.b.4.c
HMC-C004	Wideband driver	0.01 to 20	16	33	3	23	12 V @ 195 mA	C-3/SMA	3A001.b.4.f
HMC-C024	Wideband driver	0.01 to 20	15	30	3	23	12 V @ 225 mA	C-3B/SMA	3A001.b.4.f
HMC-C038	Wideband driver	2 to 35	12	29	3	18	11 V @ 92 mA	C-10/2.92 mm	3A001.b.4.c
HMC-C074	Wideband PA	0.01 to 6.0	13	40	5	29.5	-5 V @ 5 mA	C-17/SMA	EAR99
HMC-C075	Wideband PA	0.01 to 6.0	24	42	5	29.5	-5 V @ 5 mA	C-17/SMA	EAR99
HMC-C036	Wideband PA	0.01 to 15	12	36	4	28	11 V @ 360 mA	C-10B/SMA	3A001.b.4.f
HMC-C037	Wideband PA	0.01 to 15	12	36	4	28	11 V @ 360 mA	C-12/SMA	3A001.b.4.f
HMC6980	Wideband PA	0.01 to 20	12	28	4.5	28	11 V @ 345 mA	C-10B/SMA	EAR99
HMC-C582	Wideband PA	0.1 to 20	20	34	5	26	15 V @ 700 mA	Contact factory	EAR99
HMC-C003	Wideband PA	2 to 20	15	34	4	26	12 V @ 310 mA	C-2/SMA	3A001.b.4.f
HMC-C023	Wideband PA	2 to 20	15	34	4	26	12 V @ 310 mA	C-2B/SMA	3A001.b.4.f
HMC-C026	Wideband PA	2 to 20	31	33	3	26	12 V @ 400 mA	C-3B/SMA	3A001.b.4.f
HMC-C020	Wideband PA	17 to 24	22	33	3.5	24	8 V @ 250 mA	C-10/2.92 mm	EAR99
HMC-C021	Wideband PA	21 to 31	15	32	5	24	8 V @ 215 mA	C-10/2.92 mm	3A001.b.4.c
HMC7891	Limiting amplifier	2 to 18	45	—	3.5	11	8 V @ 300 mA	Contact factory	EAR99

## Connectorized High Power Amplifier Modules

Part Number	Function	RF Frequency (GHz)	Power (W)	CW or Pulsed	ECCN Code
HMC7748	High power amp	2 to 6	25	CW	EAR99
HMC7885	High power amp	2 to 6	32	CW	3A001.b.2.a.4
HMC8113	High power amp	2 to 6	500	CW	3A001.b.4.a.4
HMC8114	High power amp	5.8 to 18	90	CW	3A001.b.4.a.4
HMC7054	High power amp	29 to 31	10	CW	5A991.b

## Connectorized Low Phase Noise Amplifier Modules

Part Number	Function	Frequency (GHz)	Gain/NF (dB)	OIP3 (dBm)	10 kHz Phase Noise (dBc/Hz)	P1dB/P <sub>SAT</sub> (dBm)	Bias Supply	Package/Connector Type	ECCN Code
HMC-C077	Low phase noise	1.5 to 5.0	14/4.5	26.5	-171	17/22	7 V @ 170 mA	C-16/SMA	EAR99
HMC-C079	Low phase noise	3 to 8	42/984	33	-168	22/25	7 V @ 300 mA	C-16/SMA	EAR99
HMC-C072	Low phase noise	6 to 12	11/4.5	34	-176	20/22	7 V @ 170 mA	C-16/SMA	EAR99
HMC-C076	Low phase noise	7 to 11	42/984	33	-170	22/25	7 V @ 300 mA	C-16/SMA	EAR99
HMC-C050	Low phase noise	2 to 18	13.5/5	22.5	-160	15/18.5	5 V @ 80 mA	C-1/SMA	EAR99

## Connectorized Switches—SPST, SPDT, and SP4T

Part Number	Function	Frequency (GHz)	Insertion Loss (dB)	Isolation (dB)	Input P1dB (dBm)	Switching Speed (ns)	Package/Connector Type	ECCN Code
HMC-C058	SPDT, high isolation	DC to 18	2	55	27	3	C-14/SMA	EAR99
HMC-C019	SPST, high isolation	DC to 20	3	100	23	8.5	C-9/SMA	EAR99
HMC-C011	SPDT, high isolation	DC to 20	2	40	23	5	C-5/SMA	EAR99
HMC-C071	SP4T, high isolation	DC to 20	3	40	24	14	C-15/SMA	EAR99
HMC-C583	SPST NR, high isolation	0.1 to 40	7	50	21	10	Contact factory	EAR99

## Connectorized Attenuators—Digital and Analog

Part Number	Function	Frequency (GHz)	Loss (dB)	Attenuation Range (dB)	IIP3 (dBm)	Control Input (V <sub>DC</sub> )	Package/Connector	ECCN Code
HMC-C053	Analog VVA	DC to 20	5.5	35	10	–5	C-10/SMA	EAR99
HMC-C018	6-bit DATT	DC to 13	3.6	0.5 to 31.5	32	Serial/CMOS	C-6/SMA	EAR99
HMC-C025	6-bit DATT	DC to 13	3.2	0.5 to 31.5	38	0/5	C-6/SMA	EAR99
HMC-C584	6-bit DATT	0.1 to 40	7	31	38	CMOS	C-6/SMA	EAR99

## Connectorized Block Upconverters

Part Number	Function	Frequency (GHz)	IF Frequency (GHz)	Conversion Gain (dB)	Spurious Rejection (dBc)	Power Output	Package	ECCN Code
HMC7056	Ka-band upconverter with HPA	29 to 31	1 to 2	65	–60	37 dBm (PLINEAR)	Module	5A991.b

## Connectorized Frequency Dividers (Prescalers)

Part Number	Function	Input Frequency (GHz)	Input Power (dBm)	Output Power (dBm)	100 kHz SSB Phase Noise (dBc/Hz)	Bias Supply	Package/Connector Type	ECCN Code
HMC-C039	Divide-by-5	0.5 to 8	–15 to +10	–1	–155	5 V @ 80 mA	C-1/SMA	3A001.a.11.b
HMC-C040	Divide-by-10	0.5 to 17	–15 to +10	–1	–155	5 V @ 152 mA	C-1/SMA	3A001.a.11.b
HMC-C005	Divide-by-2	DC to 18	–15 to +10	–4	–150	5 V @ 75 mA	C-1/SMA	3A001.a.11.b
HMC-C006	Divide-by-4	DC to 18	–15 to +10	–4	–150	5 V @ 93 mA	C-1/SMA	3A001.a.11.b
HMC-C007	Divide-by-8	DC to 18	–15 to +10	–4	–150	5 V @ 98 mA	C-1/SMA	3A001.a.11.b

## Connectorized Frequency Multipliers—Active

Part Number	Function	Input Frequency (GHz)	Output Frequency (GHz)	Input Power (dBm)	Output Power (dBm)	100 kHz SSB Phase Noise (dBc/Hz)	Package/Connector Type	ECCN Code
HMC-C031	×2 active	3 to 5	6 to 10	3	17	–140	C-10/SMA	EAR99
HMC-C056	×2 active	4.0 to 10.5	8 to 21	6	14	–142	C-10/SMA	EAR99
HMC-C032	×2 active	9.0 to 14.5	18 to 29	3	16	–132	C-10/2.92 mm	EAR99
HMC-C033	×2 active	12.0 to 16.5	24 to 33	3	17	–132	C-10/2.92 mm	EAR99
HMC-C034	×2 active	16 to 23	32 to 46	3	13	–130	C-10/2.92 mm	EAR99

## Connectorized I/Q Mixers

Part Number	Function	RF/LO Frequency (GHz)	IF Frequency (GHz)	Conversion Gain (dB)	Image Rejection (dB)	IIP3 (dBm)	Package/Connector Type	ECCN Code
HMC-C009	I/Q mixer/IRM	4 to 8.5	DC to 3.5	–7.5	35	23	C-4/SMA	EAR99
HMC-C041	I/Q mixer/IRM	6 to 10	DC to 3.5	–7.5	35	25	C-4/SMA	EAR99
HMC-C042	I/Q mixer/IRM	8.5 to 13.5	DC to 2	–8	28	25	C-4/SMA	EAR99
HMC-C043	I/Q mixer/IRM	11 to 16	DC to 3.5	–9	30	28	C-4/SMA	EAR99
HMC-C044	I/Q mixer/IRM	15 to 23	DC to 3.5	–8	30	25	C-4/2.92 mm and SMA	EAR99
HMC-C046	I/Q mixer/IRM	20 to 31	DC to 4.5	–10	24	22.5	C-4B/2.92 mm and SMA	EAR99
HMC-C047	I/Q mixer/IRM	30 to 38	DC to 3.5	–10.5	15	19	C-4/2.92 mm and SMA	EAR99

■ = Simulation models available in ADI's ADIsimRF and/or ADIsimPLL simulation tools. \* = X-Microwave

## Connectorized Mixers

Part Number	Function	RF Frequency (GHz)	IF Frequency (GHz)	Conversion Gain (dB)	LO/RF Isolation (dB)	IIP3 (dBm)	Package/Connector Type	ECCN Code
HMC-C049	Double balanced, 13 dBm LO	7 to 14	DC to 5	-7	48	20	C-11/SMA	EAR99
HMC-C051	Double balanced, 13 dBm LO	11 to 20	DC to 6	-7	43	18	C-11/2.92 mm and SMA	EAR99
HMC-C014	Double balanced, 13 dBm LO	16 to 32	DC to 8	-8	35	19	C-11/2.92 mm and SMA	EAR99
HMC-C035	Double balanced, 13 dBm LO	23 to 37	DC to 13	-9	35	19	C-11/2.92 mm and SMA	EAR99
HMC-C015	Double balanced, 13 dBm LO	24 to 38	DC to 8	-8.5	35	20	C-11/2.92 mm and SMA	EAR99

## Connectorized Phase Shifters—Analog

Part Number	Function	Frequency (GHz)	Insertion Loss (dB)	Phase Range (°)	2 <sup>nd</sup> Harmonic PIN = 10 dBm (dBc)	Control Voltage Range (VDC)	Package/Connector Type	ECCN Code
HMC-C010	Analog	6 to 15	7	750 @ 6 GHz, 450 @ 15 GHz	40	0 V to 5 V	C-1/SMA	EAR99

## Connectorized Successive Detection Log Video Amplifiers (SDLVAs)

Part Number	Function	Frequency (GHz)	Dynamic Range (dB)	RSSI Slope (mV/dB)	RF Threshold Level (dBm)	Bias Supply	Package/Connector Type	ECCN Code
HMC-C088	SDLVA	1 to 20	59	14	-54	7 V to 16 V @ 86 mA	C-10	EAR99

## Connectorized Dielectric Resonator Oscillators (DROs)

Part Number	Function	Frequency (GHz)	Output Power (dBm)	10 kHz SSB Phase Noise (dBc/Hz)	100 kHz SSB Phase Noise (dBc/Hz)	Frequency Drift (ppm/°C)	Bias Supply	Package/Connector Type	ECCN Code
HMC-C200	Dielectric resonator oscillator	8.0 to 8.3	14.5	-122	-140	2	6 V to 15 V @ 125 mA	C-18/SMA	EAR99

## Connectorized Voltage Controlled Oscillators (VCOs)

Part Number	Function	Frequency (GHz)	Output Power (dBm)	10 kHz SSB Phase Noise (dBc/Hz)	100 kHz SSB Phase Noise (dBc/Hz)	Bias Supply	Package/Connector Type	ECCN Code
HMC-C028	Wideband VCO	4 to 8	20	-75	-95	12 V @ 185 mA	C-1/SMA	EAR99
HMC-C029	Wideband VCO	5 to 10	20	-64	-93	12 V @ 195 mA	C-1/SMA	EAR99
HMC-C030	Wideband VCO	8 to 12.5	21	-59	-83	12 V @ 195 mA	C-1/SMA	EAR99
HMC-C073	VCO	38.4 to 43.2	13	-74	-98	5 V @ 350 mA	C-19/2.4 mm	EAR99

## Connectorized Synthesized Solutions—MicroSynth

Part Number	Function	Frequency (GHz)	Minimum Step Size Resolution (Hz)	Reference Frequency (MHz)	SSB Phase Noise @ 100 kHz Offset (dBc/Hz)	Output Power (dBm)	Bias Supply	Package/Connector Type	ECCN Code
HMC-C083	MicroSynth synthesizer	2 to 6	0.6	10	-93	17	20 V @ 7 mA, 6 V @ 330 mA	C-20/SMA	EAR99
HMC-C070	MicroSynth synthesizer	5.5 to 10.5	1.2	10	-92	21	20 V @ 20 mA, 6 V @ 300 mA, 3.6 V @ 100 mA	C-20/SMA	EAR99

# Beamformers, Phase Shifters, and Vector Modulators

## Beamformers

Part Number	Description	Frequency (GHz)	Phase Adj Range (°)	Phase Adj Step (°)	Ampl Adj Range (dB)	Ampl Adj Step (dB)	Package (mm)	ECCN Code	Ordering Part Number
<b>ADAR1000</b> <i>New</i>	4-ch, X-/Ku-band with unswitched Tx/Rx FE	8 to 16	360	2.8	31	0.5	7 × 7 LGA	EAR99	<a href="#">ADAR1000ACCZN</a>
<b>ADMV4801</b> <i>Upcoming</i>	16-ch, single polarization, with switched Tx/Rx FE	24 to 29.5	Contact ADI	Contact ADI	Contact ADI	Contact ADI	Contact ADI	5A991.b, EAR99	Contact ADI
<b>ADMV4821</b> <i>Upcoming</i>	2 × 8-ch, dual polarization, with switched Tx/Rx FE	24 to 29.5	Contact ADI	Contact ADI	Contact ADI	Contact ADI	Contact ADI	5A991.b, EAR99	Contact ADI

## Analog Phase Shifters

Part Number	Description	Frequency (GHz)	Loss (dB)	Phase Range @ Min Frequency (°)	Phase Range @ Max Frequency (°)	2 <sup>nd</sup> Harmonic @ Pin = -10 dBm (dBc)	Input IP3 (dBm)	Control Voltage Range (V)	Package (mm)	ECCN Code	Ordering Part Number
<b>HMC247</b>	Analog phase shifter	5 to 18	4	400	120	-80	32	0 to -10	Die	EAR99	<a href="#">HMC247</a>
<b>HMC877</b>	Analog time delay/phase shifter	8 to 23	—	504	485	-35	—	2.7 to 3.9	3 × 3 SMT	EAR99	<a href="#">HMC877LC3</a>

## Digital Phase Shifters

Part Number	Description	Frequency (GHz)	Loss (dB)	Phase Range Frequency (°)	Phase Adjust Resolution	RMS Phase Error (°)	Input IP3 (dBm)	Input P1dB (dBm)	Package (mm)	ECCN Code	Ordering Part Number
<b>HMC936A*</b>	6-bit digital phase shifter	1.2 to 1.4	5	360	6-bit, 5.625°	1.2	45	29	6 × 6 LFCSP	EAR99	<a href="#">HMC936ALP6E</a>
<b>HMC648A*</b>	6-bit digital phase shifter	2.9 to 3.9	5	360	6-bit, 5.625°	1.2	45	31	6 × 6 LFCSP	EAR99	<a href="#">HMC648ALP6E</a>
<b>HMC649A*</b>	6-bit digital phase shifter	3 to 6	8	360	6-bit, 5.625°	4	40	31	6 × 6 LFCSP	EAR99	<a href="#">HMC649ALP6E</a>
<b>HMC1133</b>	6-bit digital phase shifter	5 to 6	5	360	6-bit, 5.625°	2.8	46	30	5 × 5 LFCSP	EAR99	<a href="#">HMC1133LP5E</a>
<b>HMC543A</b>	4-bit digital phase shifter	8 to 12	6.5	360	4-bit, 22.5°	4	40	24.5	4 × 4 LFCSP	EAR99	<a href="#">HMC543ALC4B</a>
<b>HMC642A</b>	6-bit digital phase shifter	9 to 12.5	7	360	6-bit, 5.625°	4.5	35	30	5 × 5 LFCSP	EAR99	<a href="#">HMC642ALC5</a>
<b>HMC644A</b>	5-bit digital phase shifter	15 to 18.5	7.5	360	5-bit, 11.25°	3.5	40	23	5 × 5 LFCSP	EAR99	<a href="#">HMC644ALC5</a>
<b>HMC647A*</b>	6-bit digital phase shifter	2.5 to 31	4	360	6-bit, 5.625°	1.5	50	31	6 × 6 LFCSP	EAR99	<a href="#">HMC647ALP6E</a>

## Vector Modulators

Part Number	Description	Frequency (GHz)	I/Q Bandwidth (MHz)	Noise Floor (dBm/Hz)	Gain Range (dB)	Phase Range (°)	Input IP3 (dBm)	P1dB (dBm)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
<b>HMC630</b>	Vector modulator	0.7 to 1	180	-162	40	360	34	17	8	92	3 × 3 LFCSP	EAR99	<a href="#">HMC630LP3E</a>
<b>AD8340</b>	Vector modulator	0.7 to 1	230	-149	—	360	—	11	5	130	4 × 4 LFCSP	5A991.b	<a href="#">AD8340ACPZ-WP</a>
<b>HMC500</b>	Vector modulator	1.8 to 2.2	150	-162	40	360	33	16	8	90	3 × 3 LFCSP	EAR99	<a href="#">HMC500LP3E</a>
<b>ADL5390</b>	Vector modulator	0.2 to 2.4	230	-150	—	360	—	13	5	130	4 × 4 LFCSP	5A991.b	<a href="#">ADL5390ACPZ-REEL7</a>
<b>AD8341</b>	Vector modulator	1.5 to 2.4	230	-151	—	360	—	8.5	5	130	4 × 4 LFCSP	5A991.b	<a href="#">AD8341ACPZ-WP</a>
<b>HMC631</b>	Vector modulator	1.8 to 2.7	160	-160	40	360	35	21	8	93	3 × 3 LFCSP	EAR99	<a href="#">HMC631LP3E</a>

## Analog Multipliers

Part Number	Description	Frequency (GHz)	Dynamic Range (dB)	Accuracy (dB)	Response Time (ns)	V <sub>s</sub> (V)	I <sub>sv</sub> (mA)	Package (mm)	ECCN Code	Ordering Part Number
<b>ADL5391</b>	RF/IF multiplier	0 to 2	60	±0.2	60	4.75 to 5.5	135	3 × 3 LFCSP	5A991.b	<a href="#">ADL5391ACPZ-WP</a>

\* = X-Microwave

# Timing ICs and Clocks

## Clock Dividers and Distribution

Part Number	Clock Function	Configuration/ Programming Interface	Number of Outputs	Output Frequency (MHz)	Output Logic	Power Dissipation (W)	Input Frequency (MHz)	Package (mm)	ECCN Code	Ordering Part Number
AD9513	Distribution	Pin select	3	250	CMOS, LVDS	0.46	0 to 1600	5 × 5 LFCSP	EAR99	AD9513BCPZ-REEL7
LTC6954-1	Distribution	SPI	3	1400	LVPECL	1	1 to 1400	4 × 7 LFCSP	EAR99	LTC6954IUFF-1#TRPBF
LTC6954-2	Distribution	SPI	3	1400	CMOS, LVDS, LVPECL	0.94	1 to 1400	4 × 7 LFCSP	EAR99	LTC6954IUFF-2#TRPBF
LTC6954-3	Distribution	SPI	3	1400	CMOS, LVDS, LVPECL	0.9	1 to 1400	4 × 7 LFCSP	EAR99	LTC6954IUFF-3#TRPBF
LTC6954-4	Distribution	SPI	3	1400	CMOS, LVDS	0.9	1 to 1400	4 × 7 LFCSP	EAR99	LTC6954IUFF-4#TRPBF
AD9515	Distribution	Pin select	2	1600	CMOS, LVDS, LVPECL	0.37	0 to 1600	5 × 5 LFCSP	EAR99	AD9515BCPZ-REEL7
HMC7043	Distribution	SPI	14	3200	CMOS, LVDS, LVPECL, CML	1.5	200 to 6000	7 × 7 LFCSP	EAR99	HMC7043LP7FE
HMC6832	Distribution	Pin select	8	3500	LVDS, LVPECL	0.5	10 to 3500	5 × 5 LFCSP	EAR99	HMC6832ALP5LE
LTC6953 <i>New</i>	Clock distribution with sync	SPI	11	4500	CML	1.8	LF to 4500	7 × 8 LFCSP	EAR99	LTC6953IUKG#TRPBF

## Multioutput Clock Generators

Part Number	Supply Voltage (V)	Number of Reference Inputs	Number of Outputs	Number of Dividers	Number of Delay Lines	On-Chip VCO or DCO	Max Output Frequency (MHz)	Output Logic	Wideband Random Jitter (ps rms)	I/O Interface	Package (mm)	ECCN Code	Ordering Part Number
AD9522-0	3.3	2	24/12	4	0	Yes	800	LVDS, CMOS	<0.4	Serial with EEPROM	64-lead LFCSP	EAR99	AD9522-0BCPZ-REEL7
AD9523	3.3	2	14	14	0	Yes	1000	CMOS, HSTL, LVDS, LVPECL	0.225	Serial	72-lead LFCSP	EAR99	AD9523BCPZ-REEL7
AD9524	3.3	2	6	6	0	Yes	1000	CMOS, HSTL, LVDS, LVPECL	0.225	Serial	48-lead LFCSP	EAR99	AD9524BCPZ-REEL7
AD9510	3.3	1	8	8	2	No	1200	CMOS, LVDS, LVPECL	0.225	Serial	64-lead LFCSP	EAR99	AD9510BCPZ-REEL7
AD9511	3.3	1	5	5	1	No	1200	CMOS, LVDS, LVPECL	0.225	Serial	48-lead LFCSP	EAR99	AD9511BCPZ-REEL7
LTC6950	3.3	1	5	5	0	No	1400	CMOS, LVDS, LVPECL	0.115	Serial	48-lead LFCSP	EAR99	LTC6950IUHH#TRPBF
AD9516-4	3.3	2	14	5	4	Yes	1800	CMOS, LVDS, LVPECL	<0.4	Serial	64-lead LFCSP	EAR99	AD9516-4BCPZ-REEL7
AD9517-4	3.3	2	12	6	4	Yes	1800	CMOS, LVDS, LVPECL	0.275	Serial	48-lead LFCSP	EAR99	AD9517-4ABCPZ-RL7
AD9518-4	3.3	2	6	3	0	Yes	1800	LVPECL	0.225	Serial	48-lead LFCSP	EAR99	AD9518-4ABCPZ-RL7
AD9516-3	3.3	2	14	5	4	Yes	2250	CMOS, LVDS, LVPECL	<0.4	Serial	64-lead LFCSP	EAR99	AD9516-3BCPZ-REEL7
AD9517-3	3.3	2	12	6	4	Yes	2250	CMOS, LVDS, LVPECL	0.275	Serial	48-lead LFCSP	EAR99	AD9517-3ABCPZ-RL7
AD9518-3	3.3	2	6	3	0	Yes	2250	LVPECL	0.225	Serial	48-lead LFCSP	EAR99	AD9518-3ABCPZ-RL7
AD9520-3	3.3	2	12/24	4	0	Yes	1800, 2250	CMOS, LVPECL	0.225	Serial	64-lead LFCSP	EAR99	AD9520-3BCPZ-REEL7
AD9516-2	3.3	2	14	5	4	Yes	2335	CMOS, LVDS, LVPECL	<0.4	Serial	64-lead LFCSP	EAR99	AD9516-2BCPZ-REEL7
AD9517-2	3.3	2	12	6	4	Yes	2335	CMOS, LVDS, LVPECL	0.275	Serial	48-lead LFCSP	EAR99	AD9517-2ABCPZ-RL7
AD9518-2	3.3	2	6	3	0	Yes	2335	LVPECL	0.225	Serial	48-lead LFCSP	EAR99	AD9518-2ABCPZ-RL7
AD9520-2	3.3	2	12/24	4	0	Yes	2335	CMOS, LVPECL	0.225	Serial	64-lead LFCSP	EAR99	AD9520-2BCPZ-REEL7
AD9516-5	3.3	2	14	5	4	No	2400	CMOS, LVDS, LVPECL	<0.4	Serial	64-lead LFCSP	EAR99	AD9516-5BCPZ-REEL7
AD9520-5	3.3	2	12/24	4	0	No	2400	CMOS, LVPECL	0.225	Serial	64-lead LFCSP	EAR99	AD9520-5BCPZ-REEL7

## Multiooutput Clock Generators (Continued)

Part Number	Supply Voltage (V)	Number of Reference Inputs	Number of Outputs	Number of Dividers	Number of Delay Lines	On-Chip VCO or DCO	Max Output Frequency (MHz)	Output Logic	Wideband Random Jitter (ps rms)	I/O Interface	Package (mm)	ECCN Code	Ordering Part Number
LTC6951	3.3/5	1	5	5	0	Yes	2500	LVDS, CML	0.105	Serial	40-lead LFCSP	EAR99	LTC6951IUHF#TRPBF
AD9517-1	3.3	2	12	6	4	Yes	2650	CMOS, LVDS, LVPECL	0.275	Serial	48-lead LFCSP	EAR99	AD9517-1ABCPZ-RL7
AD9516-1	3.3	2	14	5	4	Yes	2650	CMOS, LVDS, LVPECL	<0.4	Serial	64-lead LFCSP	EAR99	AD9516-1BCPZ-REEL7
AD9518-1	3.3	2	6	3	0	Yes	2650	LVPECL	0.225	Serial	48-lead LFCSP	EAR99	AD9518-1ABCPZ-RL7
AD9520-1	3.3	1	12	4	4	Yes	2650	LVPECL, CMOS	0.33	Serial	9 × 9 LFCSP	EAR99	AD9520-1BCPZ-REEL7
LTC6951-1	3.3/5	1	5	5	5	Yes	2700	LVDS, CML	0.115	Serial	5 × 7 LFCSP	EAR99	LTC6951IUHF-1#TRPBF
AD9516-0	3.3	1	14	5	5	No	2950	CMOS, LVDS, LVPECL	<0.4	Serial	9 × 9 LFCSP	EAR99	AD9516-0BCPZ-REEL7
AD9517-0	3.3	1	12	4	4	Yes	2950	CMOS, LVDS, LVPECL	0.275	Serial	7 × 7 LFCSP	EAR99	AD9517-0ABCPZ-RL7
AD9518-0	3.3	1	3	3	3	Yes	2950	LVPECL	0.225	Serial	7 × 7 LFCSP	EAR99	AD9518-0ABCPZ-RL7
AD9520-0	3.3	1	12/24	4	4	Yes	2950	LVPECL, CMOS	0.225	Serial with EEPROM	9 × 9 LFCSP	EAR99	AD9520-0BCPZ-REEL7
HMC7044	3.3	4	14	14	14	Yes	3200	CMOS, LVDS, LVPECL	0.044	Serial	10 × 10 LFCSP	EAR99	HMC7044LP10BETR
AD9525	3.3	3	9	0	0	No	3600	LVPECL, CMOS	0.08	Serial	7 × 7 LFCSP	EAR99	AD9525BCPZ-REEL7
AD9522-1	3.3	1	12/24	4	4	Yes	2650	LVPECL, CMOS	0.08	Serial with EEPROM	9 × 9 LFCSP	EAR99	AD9522-1BCPZ-REEL7
AD9522-2	3.3	1	12/24	4	4	Yes	2400	LVPECL, CMOS	0.242	Serial with EEPROM	9 × 9 LFCSP	EAR99	AD9522-2BCPZ-REEL7
AD9522-3	3.3	1	12/24	4	4	Yes	2250	LVPECL, CMOS	0.242	Serial with EEPROM	9 × 9 LFCSP	EAR99	AD9522-3BCPZ-REEL7
AD9522-4	3.3	1	12/24	4	4	Yes	1800	LVPECL, CMOS	0.242	Serial with EEPROM	9 × 9 LFCSP	EAR99	AD9522-4BCPZ-REEL7
AD9522-5	3.3	1	12/24	4	4	No	2400	LVPECL, CMOS	0.242	Serial with EEPROM	9 × 9 LFCSP	EAR99	AD9522-5BCPZ-REEL7
AD9523-1	3.3	2	14/29	14	14	Yes	3100	LVPECL, LVCMOS	0.124	Serial with EEPROM	10 × 10 LFCSP	EAR99	AD9523-1BCPZ-REEL7
<b>LTC6952</b> <b>New</b>	3.3/5	1	11	11	11	No	4500	CML	0.065	Serial with sync	7 × 8 LFCSP	EAR99	LTC6952IUKG#PBF



## Clock Generators and Synchronizers

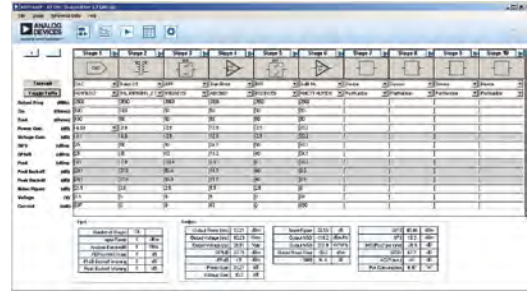
Part Number	Supply Voltage (V)	Number of Reference Inputs	Number of Outputs	Number of Dividers	Number of Delay Lines	On-Chip VCO or DCO	Max Output Frequency (MHz)	Output Logic	Wideband Random Jitter (ps rms)	I/O Interface	Package (mm)	ECCN Code	Ordering Part Number
AD9547	1.8, 3.3	2	2	2	1	Yes	450	LVDS, LVPE	0.7	Serial	64-lead LFCSP	EAR99	AD9547BCPZ-REEL7
AD9548	1.8, 3.3	8	8	4	1	Yes	450	LVDS, LVPECL, CMOS	0.7	Serial	88-lead LFCSP	EAR99	AD9548BCPZ-REEL7
AD9549	1.8, 3.3	2	2	1	0	Yes	750	CMOS, HSTL	0.6	Serial	64-lead LFCSP	EAR99	AD9549ABCPZ-REEL7
AD9550	1.8, 3.3	1	2	2	0	Yes	810	LVPECL, LV	0.5	N/A	32-lead LFCSP	EAR99	AD9550BCPZ-REEL7
AD9553	1.8, 3.3	3	2	2	0	Yes	810	LVDS, LVPE	0.5	Serial	32-lead LFCSP	EAR99	AD9553BCPZ-REEL7
AD9552	1.8, 3.3	2	2	2	0	Yes	900	LVDS, LVPE	0.5	Serial	32-lead LFCSP	EAR99	AD9552BCPZ-REEL7
AD9557	1.8, 3.3	2	2	2	0	Yes	1250	HSTL, LVDS	0.5	Serial	40-lead LFCSP	EAR99	AD9557BCPZ-REEL7
AD9558	1.8, 3.3	4	6	4	0	Yes	1250	HSTL, LVDS	0.5	Serial	64-lead LFCSP	EAR99	AD9558BCPZ-REEL7
AD9559	1.8, 3.3	4	4	4	0	Yes	1250	HSTL, LVDS	0.5	Serial	72-lead LFCSP	EAR99	AD9559BCPZ-REEL7

## Clock Buffers

Part Number	Supply Voltage (V)	Number of Inputs	Number of Outputs	Max Output Frequency (MHz)	Output Logic	Wideband Random Jitter (ps rms)	I/O Interface	Package (mm)	ECCN Code	Ordering Part Number
LTC6957-1	3.3	1	2	300	LVPECL	0.12	—	12-lead QFN, LFCSP	EAR99	LTC6957IDD-1#TRPBF
LTC6957-2	3.3	1	2	300	LVDS	0.12	—	12-lead QFN, LFCSP	EAR99	LTC6957IDD-2#TRPBF
LTC6957-3	3.3	1	2	300	CMOS	0.12	—	12-lead QFN, LFCSP	EAR99	LTC6957IDD-3#TRPBF
LTC6957-4	3.3	1	2	300	CMOS	0.12	—	12-lead QFN, LFCSP	EAR99	LTC6957IDD-4#TRPBF
ADCLK854	1.8	2	12	1200	LVDS, CMOS	0.15	—	48-lead LFCSP	EAR99	ADCLK854BCPZ-REEL7
ADCLK846	1.8	1	6	1200	LVDS, CMOS	0.15	—	24-lead LFCSP	EAR99	ADCLK846BCPZ-REEL7
HMC6832	2.5 or 3.3	2	8	3500	LVDS, LVPECL	0.01	Pin select	28-lead LFCSP	EAR99	HMC6832ALP5LE
ADCLK946	3.3	1	6	4800	LVPECL	0.075	—	24-lead LFCSP	EAR99	ADCLK946BCPZ-REEL7
ADCLK954	3.3	2	12	4800	LVPECL	0.075	—	40-lead LFCSP	EAR99	ADCLK954BCPZ-REEL7
ADCLK905	2.5 to 3.3	1	1	6000	ECL, PECL, LVPECL	0.06	—	16-lead LFCSP	EAR99	ADCLK905BCPZ-WP
ADCLK907	2.5 to 3.3	2	2	6000	ECL, PECL, LVPECL	0.06	—	16-lead LFCSP	EAR99	ADCLK907BCPZ-WP
ADCLK925	2.5 to 3.3	1	2	6000	ECL, PECL, LVPECL	0.06	—	16-lead LFCSP	EAR99	ADCLK925BCPZ-WP
ADCLK914	3.3	1	1	7500	HVDS, CML	0.11	—	16-lead LFCSP	EAR99	ADCLK914BCPZ-WP
LTC6955 <b>New</b>	3.3	1	11	7500	CML	0.045	Pin select	7 × 8 LFCSP	EAR99	LTC6955IUJK#TRPBF
LTC6955-1 <b>New</b>	3.3	1	10/1	7500	CML	0.045	Pin select	7 × 8 LFCSP	EAR99	LTC6955IUJK-1#TRPBF
HMC987	3.3	1	9	8000	LVPECL, LVDS, CML, CMOS	0.05	Serial	32-lead 5 × 5 LFCSP	EAR99	HMC987LP5E

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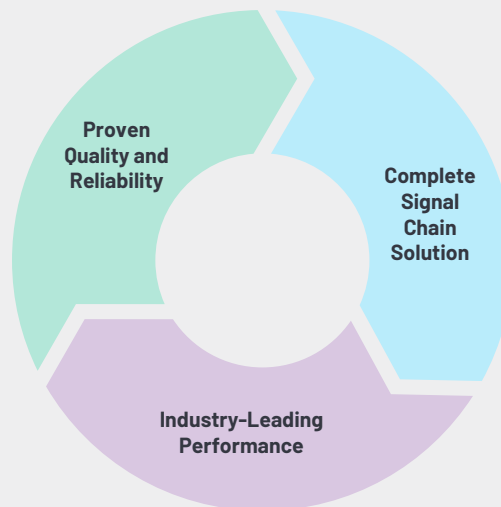


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AD8348	36	AD9525	72	ADF4360-3	44	ADL5502	57	ADMV1017	35
AD8349	36	AD9547	73	ADF4360-4	44	ADL5502	58	ADMV4420	6
AD8350	13	AD9548	73	ADF4360-5	44	ADL5504	57	ADMV4420	32
AD8351	14	AD9549	73	ADF4360-6	44	ADL5505	57	ADMV4801	70
AD8352	14	AD9550	73	ADF4360-7	44	ADL5506	58	ADMV4821	70
AD8353	17	AD9552	73	ADF4360-8	44	ADL5511	57	ADMV7310	6
AD8354	17	AD9553	73	ADF4360-9	44	ADL5511	58	ADMV7310	39
AD8361	57	AD9557	73	ADF4371	7	ADL5513	58	ADMV7320	6
AD8362	57	AD9558	73	ADF4371	46	ADL5519	58	ADMV7320	33
AD8363	57	AD9559	73	ADF4372	7	ADL5521	14	ADMV7320	39
AD8364	57	ADA4961	14	ADF4372	46	ADL5523	14	ADMV7410	6
AD8366	23	ADAR1000	8	ADF5000	54	ADL5530	17	ADMV7410	33
AD8366	24	ADAR1000	70	ADF5001	54	ADL5531	17	ADMV7410	39
AD8367	23	ADAR7251	40	ADF5002	54	ADL5534	17	ADMV7420	6
AD8368	23	ADCLK846	73	ADF5355	46	ADL5535	17	ADMV7420	33
AD8369	23	ADCLK854	73	ADF5356	46	ADL5536	17	ADMV7420	39
AD8370	13	ADCLK905	73	ADF5610	7	ADL5541	17	ADMV7710	20
AD8370	23	ADCLK907	73	ADF5610	46	ADL5542	17	ADMV7810	20
AD8372	13	ADCLK914	73	ADF5901	40	ADL5544	17	ADMV8416	7
AD8372	23	ADCLK925	73	ADF5902	7	ADL5545	17	ADMV8416	56
AD8375	13	ADCLK946	73	ADF5902	40	ADL5561	14	ADMV8420	7
AD8375	23	ADCLK954	73	ADF5904	40	ADL5562	14	ADMV8420	56
AD8376	13	ADF4001	43	ADF41020	43	ADL5565	14	ADMV8432	56
AD8376	23	ADF4002	43	ADF41513	7	ADL5566	14	ADPA7001	5
AD9361	41	ADF4007	43	ADF41513	44	ADL5567	14	ADPA7001	20
AD9363	41	ADF4106	43	ADG901	63	ADL5569	14	ADPA7002	5
AD9364	41	ADF4107	43	ADG902	63	ADL5590	36	ADPA7002	20
AD9371	41	ADF4108	43	ADG904	65	ADL5591	36	ADPA7006	5
AD9375	41	ADF4110	43	ADG904-R	65	ADL5601	17	ADPA7006	20
AD9510	71	ADF4111	43	ADG918	64	ADL5602	17	ADRF5019	8
AD9511	71	ADF4113	43	ADG919	64	ADL5604	17	ADRF5019	64
AD9513	71	ADF4113HV	43	ADG936	64	ADL5605	17	ADRF5020	64
AD9515	71	ADF4116	43	ADG936-R	64	ADL5606	17	ADRF5021	64
AD9516-0	72	ADF4117	43	ADL5201	13	ADL5610	17	ADRF5024	64
AD9516-1	72	ADF4118	43	ADL5201	23	ADL5611	17	ADRF5025	64
AD9516-2	71	ADF4150	43	ADL5202	13	ADL5721	15	ADRF5026	8
AD9516-3	71	ADF4150HV	43	ADL5202	23	ADL5723	15	ADRF5026	64
AD9516-4	71	ADF4151	43	ADL5205	13	ADL5724	15	ADRF5027	8
AD9516-5	71	ADF4152HV	43	ADL5240	23	ADL5725	15	ADRF5027	64
AD9517-0	72	ADF4153	43	ADL5243	23	ADL5726	15	ADRF5040	65
AD9517-1	72	ADF4153A	43	ADL5246	23	ADL5801	28	ADRF5044	65

ADRF5045	65	HMC219B	28	HMC395	17	HMC508	51	HMC596	65
ADRF5046	8	HMC220B	28	HMC396	17	HMC509	51	HMC598	55
ADRF5046	65	HMC221B	64	HMC397	17	HMC510	51	HMC600	58
ADRF5047	65	HMC232A	64	HMC404	32	HMC511	51	HMC601	58
ADRF5130	64	HMC241A	65	HMC405	17	HMC512	51	HMC602	58
ADRF5132	64	HMC244A	65	HMC406	19	HMC513	51	HMC606	18
ADRF5160	64	HMC245A	65	HMC407	19	HMC514	51	HMC608	19
ADRF5250	65	HMC247	70	HMC408	19	HMC515	51	HMC611	58
ADRF5300	64	HMC252A	65	HMC409	19	HMC516	15	HMC612	57
ADRF5301	64	HMC253A	65	HMC412B	29	HMC517	15	HMC613	59
ADRF5545A	8	HMC260A	29	HMC414	19	HMC518	15	HMC618A	14
ADRF5545A	63	HMC263	15	HMC415	19	HMC519	15	HMC624A	25
ADRF5547	63	HMC264	31	HMC416	51	HMC520A	31	HMC625B	23
ADRF5549	8	HMC265	31	HMC424A	25	HMC521A	6	HMC628	23
ADRF5549	63	HMC270A	64	HMC425A	25	HMC521A	31	HMC629A	25
ADRF5720	5	HMC273A	25	HMC427A	65	HMC524A	31	HMC630	70
ADRF5720	25	HMC284A	64	HMC429	51	HMC525A	31	HMC631	70
ADRF5721	5	HMC291S	25	HMC430	51	HMC529	51	HMC632	52
ADRF5721	25	HMC292A	29	HMC431	51	HMC530	51	HMC633	18
ADRF5730	5	HMC305S	25	HMC432	54	HMC531	52	HMC634	18
ADRF5730	25	HMC306A	25	HMC433	54	HMC532	51	HMC635	19
ADRF5731	5	HMC311	17	HMC434	54	HMC533	52	HMC636	17
ADRF5731	25	HMC313	17	HMC435A	64	HMC534	51	HMC637A	18
ADRF5740	25	HMC321A	65	HMC437	54	HMC536	64	HMC637B	18
ADRF6510	24	HMC322A	65	HMC438	54	HMC539A	25	HMC641A	65
ADRF6516	24	HMC326	18	HMC439	55	HMC540S	25	HMC642A	70
ADRF6518	24	HMC327	19	HMC440	43	HMC542B	25	HMC644A	70
ADRF6520	24	HMC329A	5	HMC441	19	HMC543A	70	HMC646	64
ADRF6601	35	HMC329A	29	HMC442	19	HMC544A	64	HMC647A	70
ADRF6602	35	HMC337	31	HMC442	20	HMC545A	64	HMC648A	70
ADRF6603	35	HMC338	32	HMC443	55	HMC546	64	HMC649A	70
ADRF6604	35	HMC339	32	HMC444	55	HMC547A	64	HMC650	26
ADRF6612	35	HMC341	15	HMC445	55	HMC549	14	HMC651	26
ADRF6614	35	HMC342	15	HMC447	54	HMC550A	63	HMC652	26
ADRF6620	35	HMC344A	65	HMC448	54	HMC553A	28	HMC653	26
ADRF6655	35	HMC345A	65	HMC450	19	HMC554A	29	HMC654	26
ADRF6658	35	HMC346A	25	HMC451	19	HMC557A	28	HMC655	26
ADRF6701	37	HMC347A	64	HMC452	19	HMC558A	28	HMC656	26
ADRF6702	37	HMC347B	64	HMC453	19	HMC559	18	HMC657	26
ADRF6703	37	HMC349A	64	HMC454	19	HMC560A	5	HMC658	26
ADRF6704	37	HMC356	14	HMC455	19	HMC560A	29	HMC659	18
ADRF6720	37	HMC358	51	HMC457	19	HMC561	54	HMC661	62
ADRF6720-27	37	HMC361	54	HMC459	18	HMC562	19	HMC662	58
ADRF6750	37	HMC362	54	HMC460	18	HMC564	15	HMC666	28
ADRF6755	37	HMC363	54	HMC462	18	HMC565	15	HMC678	61
ADRF6780	33	HMC365	54	HMC463	18	HMC566	15	HMC679	62
ADRF6780	36	HMC368	54	HMC464	18	HMC570	32	HMC680	23
ADRF6801	38	HMC369	54	HMC465	18	HMC571	32	HMC682	27
ADRF6806	38	HMC370	55	HMC466	51	HMC572	32	HMC683	27
ADRF6807	38	HMC372	14	HMC468A	25	HMC573	54	HMC684	27
ADRF6820	38	HMC373	14	HMC470A	25	HMC574A	64	HMC685	27
ADRF6821	38	HMC374	14	HMC472A	25	HMC575	54	HMC686	27
ADRF6850	38	HMC375	14	HMC480	17	HMC576	54	HMC687	27
ADRV9008-1	41	HMC376	14	HMC487	19	HMC577	55	HMC688	27
ADRV9008-2	41	HMC382	14	HMC490	15	HMC578	55	HMC689	27
ADRV9009	41	HMC383	20	HMC492	54	HMC579	55	HMC694	23
ADSP-2147x	40	HMC384	51	HMC493	54	HMC582	51	HMC695	55
ADSP-BF70x	40	HMC385	51	HMC494	54	HMC583	51	HMC698	43
HMC129A	28	HMC386	51	HMC498	19	HMC584	51	HMC699	43
HMC190B	64	HMC388	51	HMC499	20	HMC586	52	HMC700	43
HMC194A	64	HMC389	51	HMC500	70	HMC587	52	HMC701	43
HMC197B	64	HMC390	51	HMC504	15	HMC589A	17	HMC702	43
HMC199A	64	HMC391	51	HMC505	51	HMC590	19	HMC703	43
HMC213B	28	HMC392A	14	HMC506	51	HMC591	19	HMC704	43
HMC218B	28	HMC394	54	HMC507	51	HMC595A	64	HMC705	54

HMC712A.....	25	HMC826.....	45	HMC951B.....	32	HMC1099.....	21	HMC7585.....	39
HMC713.....	58	HMC828.....	45	HMC952A.....	19	HMC1105.....	55	HMC7586.....	33
HMC717A.....	14	HMC829.....	45	HMC953.....	61	HMC1106.....	29	HMC7586.....	39
HMC720.....	61	HMC830.....	45	HMC954.....	62	HMC1110.....	55	HMC7587.....	33
HMC721.....	62	HMC831.....	45	HMC955.....	62	HMC1113.....	32	HMC7587.....	39
HMC722.....	61	HMC832.....	45	HMC958.....	61	HMC1114.....	5	HMC7748.....	67
HMC723.....	61	HMC833.....	46	HMC959.....	61	HMC1114.....	21	HMC7885.....	67
HMC724.....	61	HMC834.....	45	HMC960.....	23	HMC1118.....	64	HMC7891.....	67
HMC725.....	62	HMC835.....	45	HMC962.....	15	HMC1119.....	25	HMC7911.....	33
HMC726.....	61	HMC836.....	45	HMC963.....	15	HMC1120.....	57	HMC7912.....	33
HMC727.....	61	HMC837.....	44	HMC966.....	32	HMC1120.....	58	HMC7950.....	15
HMC728.....	61	HMC838.....	44	HMC967.....	32	HMC1121.....	19	HMC7992.....	65
HMC729.....	62	HMC839.....	44	HMC973A.....	25	HMC1122.....	25	HMC8038.....	64
HMC732.....	52	HMC840.....	45	HMC977.....	32	HMC1126.....	19	HMC8073.....	25
HMC733.....	52	HMC841.....	61	HMC980.....	21	HMC1127.....	19	HMC8074.....	7
HMC734.....	52	HMC842.....	61	HMC981.....	21	HMC1131.....	20	HMC8074.....	52
HMC735.....	52	HMC843.....	61	HMC983.....	54	HMC1132.....	5	HMC8100.....	40
HMC736.....	52	HMC844.....	62	HMC984.....	55	HMC1132.....	20	HMC8108.....	32
HMC738.....	52	HMC847.....	62	HMC985A.....	25	HMC1133.....	70	HMC8113.....	67
HMC739.....	52	HMC848.....	62	HMC986A.....	64	HMC1144.....	20	HMC8114.....	67
HMC740.....	17	HMC849A.....	64	HMC987.....	73	HMC1160.....	51	HMC8118.....	33
HMC741.....	17	HMC850.....	61	HMC994A.....	18	HMC1161.....	51	HMC8118.....	39
HMC742A.....	23	HMC851.....	62	HMC994A.....	19	HMC1162.....	51	HMC8119.....	39
HMC744.....	61	HMC853.....	61	HMC996.....	23	HMC1163.....	51	HMC8120.....	23
HMC745.....	62	HMC854.....	62	HMC997.....	23	HMC1164.....	51	HMC8121.....	23
HMC746.....	61	HMC855.....	62	HMC998A.....	18	HMC1165.....	51	HMC8191.....	31
HMC747.....	61	HMC858.....	61	HMC1010.....	57	HMC1166.....	51	HMC8192.....	6
HMC748.....	61	HMC859.....	61	HMC1013.....	59	HMC1167.....	51	HMC8192.....	31
HMC749.....	62	HMC862A.....	54	HMC1018A.....	25	HMC1168.....	51	HMC8193.....	31
HMC751.....	15	HMC863A.....	20	HMC1019A.....	25	HMC1169.....	52	HMC8200.....	40
HMC752.....	15	HMC877.....	70	HMC1020.....	57	HMC1190A.....	35	HMC8205.....	5
HMC753.....	15	HMC881A.....	7	HMC1021.....	57	HMC1197.....	37	HMC8205.....	21
HMC759.....	25	HMC881A.....	56	HMC1021.....	58	HMC3587.....	17	HMC8325.....	16
HMC760.....	62	HMC882A.....	7	HMC1022A.....	5	HMC3653.....	17	HMC8326.....	33
HMC764.....	45	HMC882A.....	56	HMC1022A.....	19	HMC3716.....	55	HMC8326.....	39
HMC765.....	45	HMC890A.....	7	HMC1023.....	24	HMC4069.....	43	HMC8327.....	33
HMC767.....	45	HMC890A.....	33	HMC1027.....	62	HMC5805A.....	19	HMC8327.....	39
HMC769.....	45	HMC890A.....	56	HMC1030.....	57	HMC6146B.....	33	HMC8400.....	15
HMC772.....	15	HMC891A.....	7	HMC1030.....	58	HMC6147A.....	32	HMC8401.....	15
HMC773A.....	5	HMC891A.....	56	HMC1031.....	43	HMC6187.....	23	HMC8402.....	15
HMC773A.....	29	HMC892A.....	7	HMC1040.....	5	HMC6300.....	39	HMC8410.....	15
HMC774A.....	5	HMC892A.....	56	HMC1040.....	15	HMC6301.....	39	HMC8411.....	5
HMC774A.....	29	HMC900.....	24	HMC1040.....	16	HMC6380.....	7	HMC8411.....	15
HMC778.....	45	HMC902.....	15	HMC1044.....	56	HMC6380.....	52	HMC8415.....	5
HMC783.....	45	HMC903.....	15	HMC1048A.....	29	HMC6475.....	7	HMC8415.....	21
HMC784A.....	64	HMC904.....	32	HMC1049.....	18	HMC6475.....	52	HMC8432.....	7
HMC787A.....	28	HMC905.....	54	HMC1055.....	63	HMC6505A.....	33	HMC8500.....	5
HMC788A.....	17	HMC906A.....	20	HMC1056.....	31	HMC6545.....	62	HMC8500.....	21
HMC789.....	17	HMC907A.....	18	HMC1057.....	32	HMC6787A.....	33	HMC-ABH209.....	20
HMC792A.....	25	HMC908A.....	6	HMC1058.....	32	HMC6789B.....	32	HMC-ABH241.....	20
HMC794.....	54	HMC908A.....	32	HMC1061.....	62	HMC6832.....	71	HMC-ABH264.....	20
HMC795.....	36	HMC909.....	57	HMC1063.....	31	HMC6832.....	73	HMC-ALH102.....	18
HMC797A.....	18	HMC913.....	59	HMC1065.....	32	HMC6980.....	67	HMC-ALH140.....	15
HMC798A.....	6	HMC920.....	21	HMC1081.....	29	HMC6981.....	19	HMC-ALH216.....	15
HMC798A.....	32	HMC930A.....	19	HMC1082.....	5	HMC7043.....	71	HMC-ALH244.....	15
HMC802A.....	25	HMC936A.....	70	HMC1082.....	19	HMC7044.....	72	HMC-ALH311.....	15
HMC807.....	45	HMC939A.....	5	HMC1084.....	65	HMC7054.....	67	HMC-ALH313.....	15
HMC812A.....	25	HMC939A.....	25	HMC1086.....	21	HMC7056.....	68	HMC-ALH364.....	15
HMC813.....	59	HMC940.....	61	HMC1087.....	21	HMC7229.....	20	HMC-ALH369.....	15
HMC814.....	54	HMC941A.....	25	HMC1093.....	32	HMC7357.....	19	HMC-ALH376.....	16
HMC815B.....	33	HMC942.....	55	HMC1094.....	58	HMC7441.....	20	HMC-ALH382.....	16
HMC820.....	45	HMC943A.....	5	HMC1095.....	25	HMC7447.....	58	HMC-ALH435.....	15
HMC821.....	44	HMC943A.....	20	HMC1096.....	54	HMC7545.....	62	HMC-ALH444.....	15
HMC822.....	44	HMC948.....	58	HMC1097.....	36	HMC7584.....	39	HMC-ALH445.....	15
HMC824.....	44	HMC951A.....	32	HMC1099.....	5	HMC7585.....	33	HMC-ALH476.....	15

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HMC-ALH508.....	16	HMC-C059.....	67	LT6402-20.....	13	LTC6410-6.....	13
HMC-ALH509.....	16	HMC-C070.....	69	LT6411.....	13	LTC6412.....	23
HMC-APH196.....	20	HMC-C071.....	68	LTC5505-1.....	58	LTC6416.....	14
HMC-APH460.....	20	HMC-C072.....	67	LTC5505-2.....	58	LTC6417.....	13
HMC-APH462.....	20	HMC-C073.....	69	LTC5507.....	58	LTC6419.....	14
HMC-APH518.....	20	HMC-C074.....	67	LTC5508.....	58	LTC6420-20.....	13
HMC-APH596*.....	20	HMC-C075.....	67	LTC5509.....	58	LTC6421-20.....	13
HMC-AUH232.....	19	HMC-C076.....	67	LTC5510.....	28	LTC6430-15.....	14
HMC-AUH249.....	19	HMC-C077.....	67	LTC5530.....	58	LTC6430-15.....	14
HMC-AUH256.....	20	HMC-C079.....	67	LTC5531.....	58	LTC6430-20.....	14
HMC-AUH312.....	19	HMC-C083.....	69	LTC5532.....	58	LTC6430-20.....	14
HMC-AUH317.....	20	HMC-C088.....	69	LTC5533.....	58	LTC6431-15.....	17
HMC-AUH318.....	20	HMC-C200.....	69	LTC5535.....	58	LTC6431-15.....	17
HMC-AUH320.....	20	HMC-C582.....	67	LTC5536.....	58	LTC6431-20.....	17
HMC-C001.....	67	HMC-C583.....	68	LTC5540.....	27	LTC6431-20.....	17
HMC-C002.....	67	HMC-C584.....	68	LTC5541.....	27	LTC6432-15.....	13
HMC-C003.....	67	HMC-MDB169.....	29	LTC5542.....	27	LTC6432-15.....	13
HMC-C004.....	67	HMC-MDB171.....	31	LTC5543.....	28	LTC6433-15.....	17
HMC-C005.....	68	HMC-MDB172.....	31	LTC5544.....	28	LTC6433-15.....	17
HMC-C006.....	68	HMC-MDB218.....	31	LTC5548.....	28	LTC6945.....	43
HMC-C007.....	68	HMC-MDB277.....	29	LTC5549.....	28	LTC6946-1.....	44
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HMC-C016.....	67	HMC-XTB110.....	55	LTC5556.....	28	LTC6948-2.....	46
HMC-C017.....	67	LT1993-2.....	13	LTC5562.....	28	LTC6948-3.....	46
HMC-C018.....	68	LT1993-4.....	13	LTC5564.....	58	LTC6948-4.....	46
HMC-C019.....	68	LT1993-10.....	13	LTC5566.....	28	LTC6950.....	71
HMC-C020.....	67	LT1994.....	13	LTC5567.....	28	LTC6951.....	72
HMC-C021.....	67	LT5504.....	57	LTC5569.....	28	LTC6951-1.....	72
HMC-C022.....	67	LT5506.....	36	LTC5576.....	28	LTC6952.....	8
HMC-C023.....	67	LT5511.....	27	LTC5577.....	28	LTC6952.....	72
HMC-C024.....	67	LT5512.....	27	LTC5582.....	57	LTC6953.....	8
HMC-C025.....	68	LT5514.....	23	LTC5583.....	57	LTC6953.....	71
HMC-C026.....	67	LT5515.....	36	LTC5584.....	36	LTC6954-1.....	71
HMC-C027.....	67	LT5516.....	36	LTC5585.....	37	LTC6954-2.....	71
HMC-C028.....	69	LT5517.....	36	LTC5586.....	37	LTC6954-3.....	71
HMC-C029.....	69	LT5519.....	27	LTC5587.....	57	LTC6954-4.....	71
HMC-C030.....	69	LT5520.....	27	LTC5588-1.....	36	LTC6955.....	8
HMC-C031.....	68	LT5522.....	27	LTC5589.....	36	LTC6955.....	73
HMC-C032.....	68	LT5524.....	23	LTC5590.....	27	LTC6955-1.....	8
HMC-C033.....	68	LT5525.....	27	LTC5591.....	27	LTC6955-1.....	73
HMC-C034.....	68	LT5526.....	27	LTC5592.....	27	LTC6957-1.....	73
HMC-C035.....	69	LT5527.....	27	LTC5593.....	28	LTC6957-2.....	73
HMC-C036.....	67	LT5528.....	36	LTC5594.....	37	LTC6957-3.....	73
HMC-C037.....	67	LT5534.....	57	LTC5596.....	57	LTC6957-4.....	73
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