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#### **Typical Applications**

The HMC622LP4 / HMC622LP4E is ideal for:

- PCS / 3G Infrastructure
- Base Stations & Repeaters
- WiMAX & WiBro
- Broadband & Fixed Wireless

# HMC622LP4 / 622LP4E

## GaAs MMIC MIXER w/ INTEGRATED IF & LO AMPLIFIER, 1.8 - 3.9 GHz

#### Features

High Input IP3: +23 dBm Low Input LO Drive: 0 to +6 dBm High LO to RF Isolation: 33 dB High Conversion Gain: 9 dB Can be used for upconversion or downconversion 24 Lead 4x4mm SMT Package: 16mm<sup>2</sup>

#### **Functional Diagram**



#### **General Description**

The HMC622LP4E is a highly integrated converter IC that operates from 1.8 to 3.9 GHz for both upconversion and downconversion applications. The HMC622LP4E incorporates a high dynamic range, double-balanced mixer core with integrated LO and IF amplifiers, making it ideal for compact transceiver applications in GSM, WCDMA, TD-SCDMA, WiBro and WiMAX. This versatile converter RFIC operates with a low LO input power level of only +3 dBm, provides up to 10 dB conversion gain, and exhibits +23 dBm Input IP3 in downconversion mode. This RFIC provides up to 12 dB conversion gain in upconverter mode. Specific evaluation boards are available for both upconversion and downconversion modes.

#### Electrical Specifications, $T_{A} = +25^{\circ}$ C, LO = +3 dBm, VddIF = BIAS = +5V\*

Parameter	Min.	Тур.	Max.	Units
Frequency Range, RF, LO		1.8 - 3.9		GHz
Frequency Range, IF		200 - 550		MHz
Conversion Gain	5	9		dB
Noise Figure (SSB), IF=468 MHz		10		dB
LO to RF Isolation	27	33		dB
LO to IF Isolation	3	11		dB
IP3 (Input)		23		dBm
1 dB Compression (Input), IF=400 MHz		12		dBm
LO Drive Input Level (Typical)	0 to +6		dBm	
Supply Current (IddIF + IBIAS)		175	220	mA

\*Unless otherwise noted, all measurements performed as a downconverter and configured as shown in the downconverter mode application circuit, IF=250 MHz

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#### Conversion Gain vs. Temperature



Conversion Gain vs. LO Drive



Upconverter Performance Conversion Gain vs. LO Drive





Return Loss



IF Bandwidth, LO = 2 Ghz



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#### Input IP3 vs. Temperature



Input IP2 vs. Temperature



Input P1dB vs. Temperature, IF= 250 MHz



#### Input IP3 vs. LO Drive



Input IP2 vs. LO Drive



Input P1dB vs. Temperature, IF= 400 MHz



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## MxN Spurious @ IF Port

	nLO				
mRF	0	1	2	3	4
0	xx	1	38	18	336
1	6	0	27	47	66
2	83	47	41	57	68
3	114	113	74	60	77
4	118	119	119	94	99
RF Freq. = 2.1 GHz @ -10 dBm LO Freq. = 2.0 GHz @ +3 dBm All values in dBc relative to the IF power level.					

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#### Harmonics of LO

	nLO Spur @ RF Port			
LO Freq. (GHz)	1	2	3	4
1.4	39	20	26	37
1.6	35	17	28	27
1.8	34	17	38	38
2.0	32	17	33	42
2.2	33	18	27	44
2.6	33	26	35	41
3.0	31	17	38	40
3.4	33	19	37	39
3.8	31	26	38	43

LO = +3 dBm

All values in dBc below input LO level measured at RF port.

#### Absolute Maximum Ratings

RF / MIX IF Input (VddIF = +5V)	+22 dBm
LO Drive (BIAS = +5V)	+10 dBm
IFIN	+15 dBm
BIAS	+7 Vdc
Vdd IF	+8 Vdc
Junction Temperature	150 °C
Continuous Pdiss (T = 85°C) (derate 14.9 mW/°C above 85°C)	0.97 W
Thermal Resistance (junction to ground paddle)	67.2 °C/W
Storage Temperature	-65 to +150°C
Operating Temperature	-40 to +85°C
ESD Sensitivity (HBM)	Class 1A

### **Typical Supply Current**

VddIF, BIAS	IddIF + IBIAS
+5	175 mA

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ELECTROSTATIC SENSITIVE DEVICE OBSERVE HANDLING PRECAUTIONS



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## GaAs MMIC MIXER w/ INTEGRATED IF & LO AMPLIFIER, 1.8 - 3.9 GHz



#### **Outline Drawing**



#### Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[3]</sup>
HMC622LP4	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 <sup>[1]</sup>	H622 XXXX
HMC622LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	<u>H622</u> XXXX

[1] Max peak reflow temperature of 235  $^\circ\text{C}$ 

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

#### **Pin Descriptions**

Pin Number	Function	Description	Interface Schematic
1, 2, 4, 5, 6, 8, 11, 14, 15, 19, 20, 22 - 24	N/C	No connection. These pins may be connected to RF ground. Performance will not be affected.	
3	RF	This pin is DC coupled and matched to 50 Ohms.	RF O

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## GaAs MMIC MIXER w/ INTEGRATED IF & LO AMPLIFIER, 1.8 - 3.9 GHz



#### Pin Descriptions (Continued)

Pin Number	Function	Description	Interface Schematic
7	IFIN	This pin is matched to 50 ohms with a 51nH inductor to ground. See Application Circuit.	IFIN O
9	САР	AC ground. An external capacitor of 0.01 μF to ground is required for low frequency bypassing. See applica- tion circuit for further details.	VddIFO CAP O
10	MIXIF	This pin is DC coupled. For applications not requiring operation to DC, this port should be DC blocked exter- nally using a series capacitor whose value has been chosen to pass the necessary IF frequency range. For operation to DC, this pin must not source/sink more than 18 mA of current or part non-function and possible part failure will result.	
12	IFOUT	This pin is AC coupled and matched to 50 Ohms.	
13	VddlF	Power supply for IF amplifier. Choke inductor and bypass capacitor are required. See application circuit.	
16	MIXLO	This pin is DC coupled and matched to 50 Ohms. An off chip DC blocking capacitor is required.	MIXLO O
17	GND	Backside of package has exposed metal ground paddle that must also be connected to ground.	
18	BIAS	Power supply and RF Output of the LO amplifier. Three external bypass capacitors are recommended for optimum performance, as illustrated in the application circuit.	BIASO
21	LO	This pin is DC coupled and matched to 50 Ohms. An off chip DC blocking capacitor is required. See application circuit.	

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### GaAs MMIC MIXER w/ INTEGRATED IF & LO AMPLIFIER, 1.8 - 3.9 GHz



#### **Evaluation PCB - Upconverter Mode**



List of Materials for Evaluation PCB 119244 [1]

Item	Description
J1 - J3	PCB Mount SMA RF Connector
J4	DC Pin
C1, C2, C3	100 pF Chip Capacitor, 0402 Pkg.
C4, C6	1000 pF Chip Capacitor, 0603 Pkg.
C5, C7	2.2 µF Capacitor, Tantalum
C8	0.01 µF Chip Capacitor, 0402 Pkg.
L1	51 nH Chip Inductor, 0402 Pkg.
L2	18 nH Chip Inductor, 0402 Pkg.
L3	36 nH Chip Inductor, 0603 Pkg.
R1, R3, R4	0 Ohm Resistor, 0402 Pkg.
R5	18 Ohm Resistor, 1210 Pkg.
U1	HMC622LP4(E) - Upconverter
PCB <sup>[2]</sup>	119242 Evaluation Board

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

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The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.



## GaAs MMIC MIXER w/ INTEGRATED IF & LO AMPLIFIER, 1.8 - 3.9 GHz



#### **Evaluation PCB - Downconverter Mode**

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### List of Materials for Evaluation PCB 119328<sup>[1]</sup>

Item	Description
J1 - J3	PCB Mount SMA RF Connector
J4	DC Pin
C1, C2, C3	100 pF Chip Capacitor, 0402 Pkg.
C4, C6	1000 pF Chip Capacitor, 0603 Pkg.
C5, C7	2.2 µF Capacitor, Tantalum
C8	0.01 µF Chip Capacitor, 0402 Pkg.
L1	51 nH Chip Inductor, 0402 Pkg.
L2	18 nH Chip Inductor, 0402 Pkg.
L3	36 nH Chip Inductor, 0603 Pkg.
R2, R3, R4	0 Ohm Resistor, 0402 Pkg.
R5	18 Ohm Resistor, 1210 1/8 watt Pkg.
U1	HMC622LP4(E) - Downconverter
PCB [2]	119242 Evaluation Board

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

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### GaAs MMIC MIXER w/ INTEGRATED IF & LO AMPLIFIER, 1.8 - 3.9 GHz

#### Application Circuit - Upconverter Mode



Recommended Components Values (IF = 200 - 550 MHz)				
C1, C2, C3	100 pF Capacitor			
C4, C6	1000 pF Capacitor			
C5, C7	2.2 µF Capacitor, Tantalum			
C8	0.01 µF Capacitor			
L1	51 nH Inductor			
L2 18 nH Inductor				
L3	36 nH Inductor			
R5	18 Ohm (1/8 Watt)			

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#### Application Circuit - Downconverter Mode

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Becommended (	Components Values (IF = 200 - 550 MHz)		
C1, C2, C3 100 pF Capacitor			
C4, C6	1000 pF Capacitor		
C5, C7	2.2 µF Capacitor, Tantalum		
C8	0.01 µF Capacitor		
L1	51 nH Inductor		
L2	18 nH Inductor		
L3	36 nH Inductor		
R5	18 Ohm (1/8 Watt)		

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