



#### **Typical Applications**

The HMC1042LC4 is Ideal for:

- Point-to-Point Radio
- Point-to-Multi-Point Radio
- Test Equipment & Sensors
- Military End Use

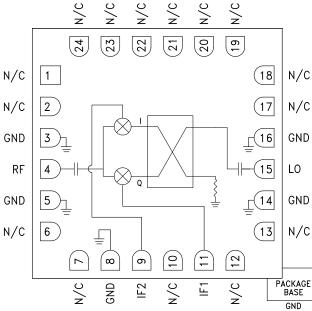
## HMC1042LC4

### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

#### Features

Wide IF Bandwidth: DC - 3.5 GHz Image Rejection: 30 dBc LO to RF Isolation: 40 dB High Input IP3: +22 dBm 24 Lead 4 x 4 mm SMT Package: 16 mm<sup>2</sup>

#### Functional Diagram



#### **General Description**

The HMC1042LC4 is a compact I/Q MMIC mixer in a leadless "Pb free" SMT package, which can be used as either an Image Reject Mixer or a Single Sideband Upconverter. The mixer utilizes two standard Hittite double balanced mixer cells and a 90° hybrid fabricated in a GaAs MESFET process. A low frequency quadrature hybrid was used to produce a 2000 MHz USB IF output. This product is a much smaller alternative to hybrid style Image Reject Mixersand Single Sideband Upconverter assemblies. The HMC1042LC4 eliminates the need for wire bonding and allows the use of surface mount manufacturing techniques.

#### Electrical Specifications, $T_{a} = +25 \text{ °C}$ , IF= 2 GHz, USB, LO = +15 dBm<sup>[1]</sup>

Parameter	Min.	Тур.	Max.	Min.	Тур.	Max.	Units
Frequency Range, RF/LO	15 - 25		25 - 33.5			GHz	
Frequency Range, IF	DC - 3.5		DC - 3.5			GHz	
Conversion Loss (As IRM)		9	12		11	14	dB
Image Rejection	16	24		16	30		dB
LO to RF Isolation	35	40		33	43		dBc
LO to IF Isolation		35			45		dB
IP3 (Input)		20			22		dBm
Amplitude Balance <sup>[2][3]</sup>		±0.5			±0.5		dB
Phase Balance <sup>[2] [3]</sup>		±2.5			±2.5		Deg

[1] Unless otherwise noted, all measurements performed as downconverter.

[2] Data taken without external 90° hybrid.

[3] Data taken with IF = 100 MHz

# HMC1042\* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

### COMPARABLE PARTS

View a parametric search of comparable parts.

#### EVALUATION KITS

HMC1042LC4 Evaluation Board

#### **DOCUMENTATION**

#### **Data Sheet**

HMC1042 Data Sheet

#### REFERENCE MATERIALS

#### **Quality Documentation**

Semiconductor Qualification Test Report: MESFET-B (QTR: 2013-00245)

### DESIGN RESOURCES

- HMC1042 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

### DISCUSSIONS

View all HMC1042 EngineerZone Discussions.

### SAMPLE AND BUY

Visit the product page to see pricing options.

### TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

### DOCUMENT FEEDBACK

Submit feedback for this data sheet.



v04.0614

### GaAs MMIC I/Q MIXER 15 - 33.5 GHz



Data Taken As IRM with External IF 90° Hybrid, IF = 2000 MHz

Conversion Gain, USB vs. Temperature

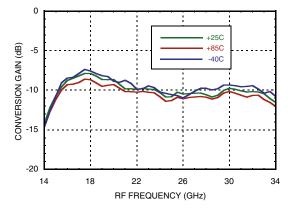
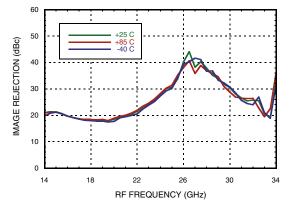
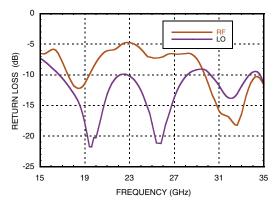


Image Rejection, USB vs. Temperature



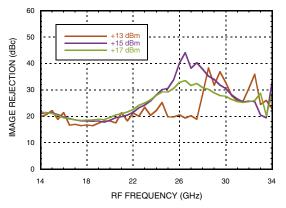
Return Loss [1]



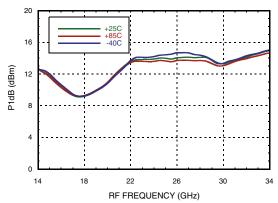
[1] Data taken without external 90° hybrid.

13 dBr CONVERSION GAIN (dB) dBm -10 -15 -20 34 14 18 22 26 30 **RF FREQUENCY (GHz)** 

Image Rejection, USB vs. LO Drive



Input P1dB, USB vs. Temperature



Conversion Gain, USB vs. LO Drive

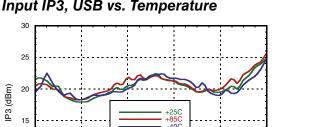
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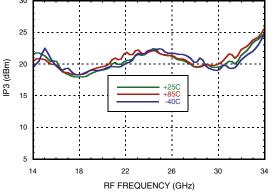
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### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

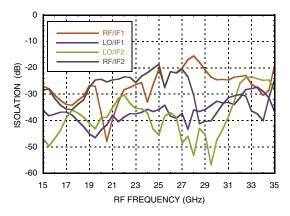


Data Taken As IRM with External IF 90° Hybrid, IF = 2000 MHz

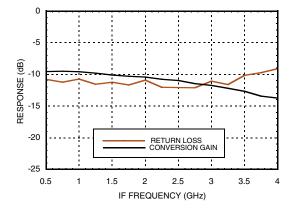
Input IP3, USB vs. Temperature



Isolation



IF Bandwidth [1]

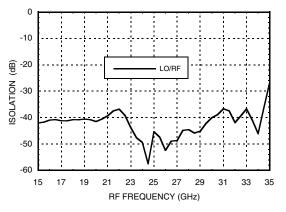


[1] Data taken without external 90° hybrid. [2] Data taken with IF = 100 MHz.

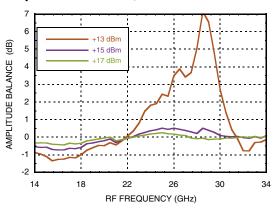
30 25 IP3 (dBm) 20 15 +13 dBm +15 dBm +17 dBm 10 5 18 22 26 30 34 14 RF FREQUENCY (GHz)

Input IP3, USB vs LO Drive

LO/RF Isolation



Amplitude Balance, USB vs. LO Drive [1] [2]



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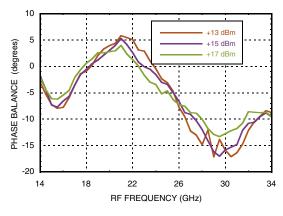
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### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

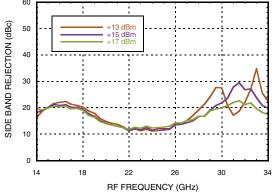
**BoHS** 

Data Taken As IRM with External IF 90° Hybrid, IF = 2000 MHz

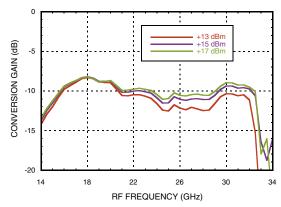




**Upconverter Performance Sideband** Rejection, USB vs. LO Drive



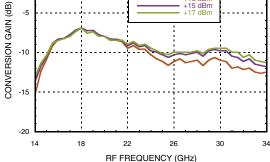
Conversion Gain, LSB vs. LO Drive



[1] Data taken without external 90° hybrid. [2] Data taken with IF = 100 MHz.

Gain. USB vs. LO Drive +13 dBm +15 dBm +17 dBm -10

Upconverter Performance Conversion



Conversion Gain, LSB vs. Temperature

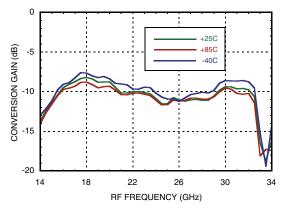
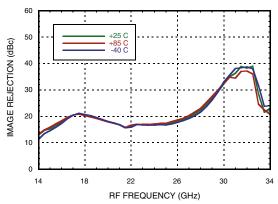


Image Rejection, LSB vs. Temperature



I/Q MIXER - SMT

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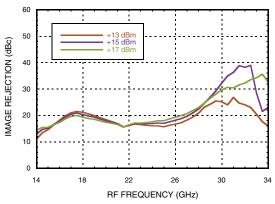
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### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

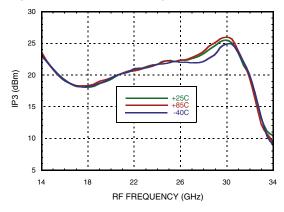
ROHS

Data Taken As IRM with External IF 90° Hybrid, IF = 2000 MHz

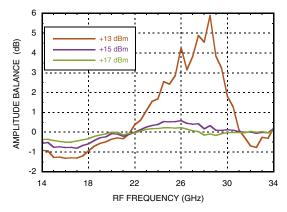
Image Rejection, LSB vs. LO Drive



Input IP3, LSB vs. Temperature



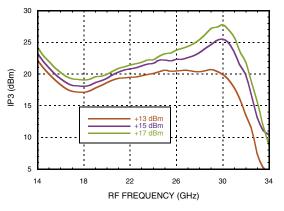
Amplitude Balance, LSB vs. LO Drive [1] [2]



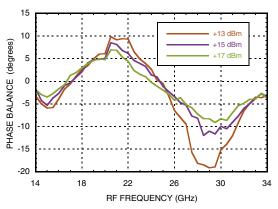
Data taken without external 90° hybrid.
Data taken with IF = 100 MHz.

Input P1dB, LSB vs. Temperature 16 P1dB (dBm) 12 +25 C +85 C -40 C 8 4 0 34 14 18 22 26 30 RF FREQUENCY (GHz)

Input IP3, LSB vs LO Drive



Phase Balance, LSB vs. LO Drive [1] [2]



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### GaAs MMIC I/Q MIXER 15 - 33.5 GHz



Data Taken As IRM with External IF 90° Hybrid, IF = 1000 MHz

Conversion Gain, USB vs. Temperature

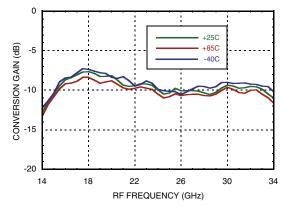
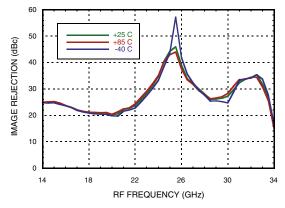
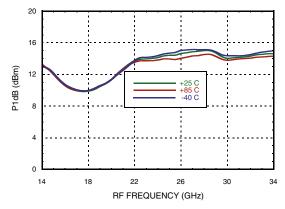


Image Rejection, USB vs. Temperature



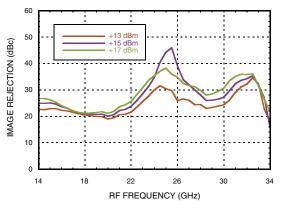
Input P1dB, USB vs. Temperature



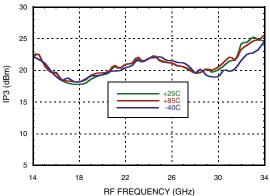
CONVERSION GAIN (dB) -10 -15 dBm dBm -17 dBn -20 18 22 26 30 34 14 RF FREQUENCY (GHz)

Conversion Gain, USB vs. LO Drive

Image Rejection, USB vs. LO Drive



Input IP3, USB vs. Temperature



I/Q MIXER - SMT

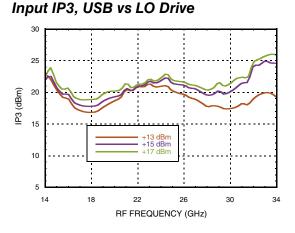
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GaAs MMIC I/Q MIXER 15 - 33.5 GHz



Conversion Gain, LSB vs. Temperature

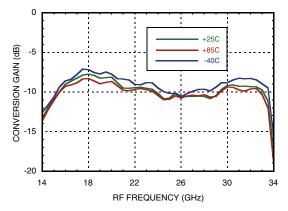
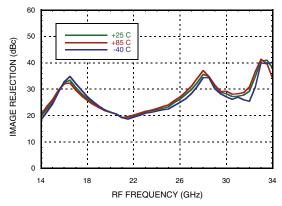


Image Rejection, LSB vs. Temperature



Conversion Gain, LSB vs. LO Drive

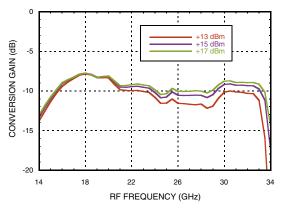
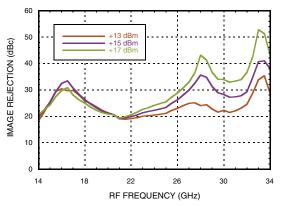


Image Rejection, LSB vs. LO Drive



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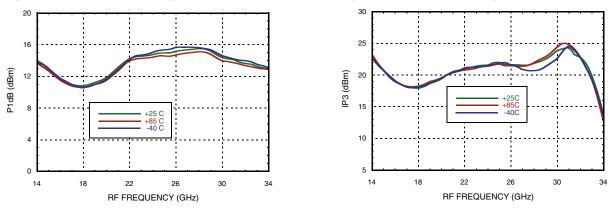
### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

Input IP3, LSB vs. Temperature

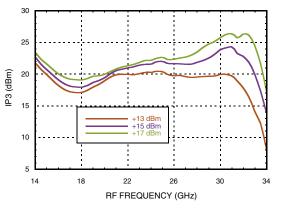


Data Taken As IRM with External IF 90° Hybrid, IF = 1000 MHz

Input P1dB, LSB vs. Temperature







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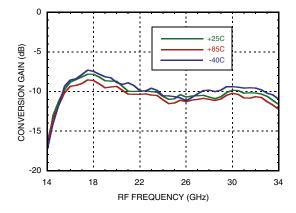


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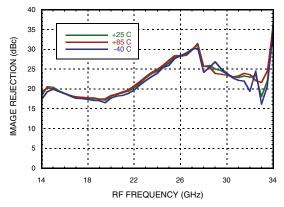
### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

Data Taken As IRM with External IF  $90^{\circ}$  Hybrid, IF = 2500 MHz

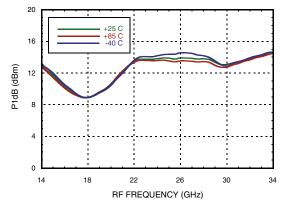
Conversion Gain, USB vs. Temperature



#### Image Rejection, USB vs. Temperature



Input P1dB, USB vs. Temperature



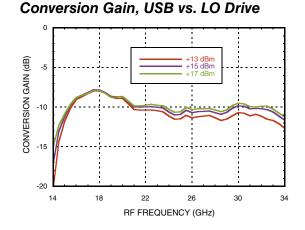
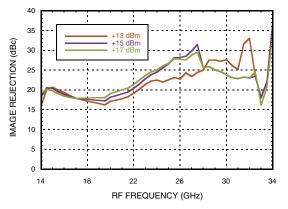
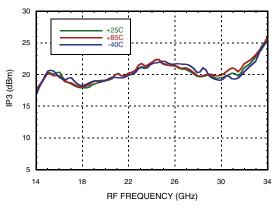


Image Rejection, USB vs. LO Drive



Input IP3, USB vs. Temperature



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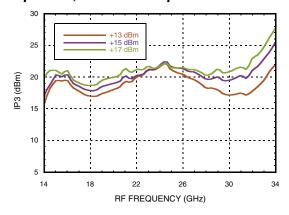
### HMC1042LC4

### GaAs MMIC I/Q MIXER 15 - 33.5 GHz



Data Taken As IRM with External IF 90° Hybrid, IF = 2500 MHz

Input IP3, USB vs. Temperature



Conversion Gain, LSB vs. Temperature

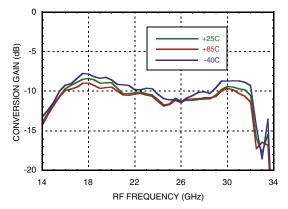
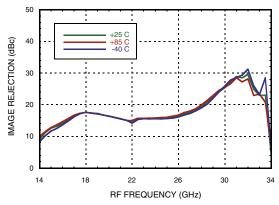


Image Rejection, LSB vs. Temperature



Conversion Gain, LSB vs. LO Drive

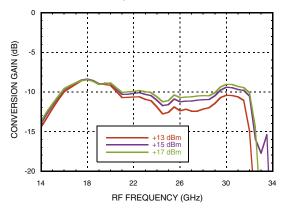
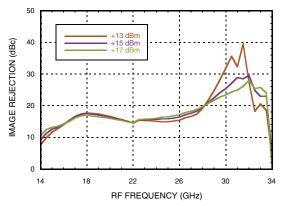


Image Rejection, LSB vs. LO Drive



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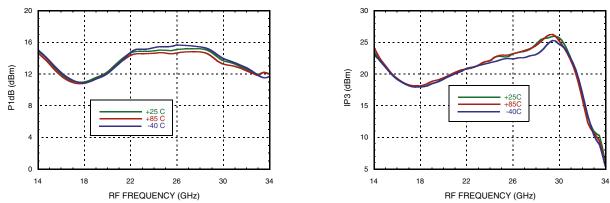
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### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

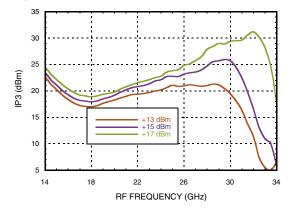
Input IP3, LSB vs. Temperature

Data Taken As IRM with External IF 90° Hybrid, IF = 2500 MHz

Input P1dB, LSB vs. Temperature



Input IP3, LSB vs LO Drive





### HMC1042LC4



#### Harmonics of LO

LO Freq. (GHz)	nLO Spur at RF Port				
	1	2	3		
13	43	40	45		
18	41	50	х		
23	44	44	х		
28	44	х	х		
33 36 X X					
LO = + 15 dBm Values in dBc below LO level measured at RF Port.					

### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

### **MxN Spurious Outputs**

	nLO				
mRF	0	1	2	3	4
0		14	34	25	х
1	21	х	38	58	66
2	81	82	63	64	85
3	67	79	84	82	88
4	х	65	76	85	89

ELECTROSTATIC SENSITIVE DEVICE OBSERVE HANDLING PRECAUTIONS

RF = 25 GHz @ -10 dBm

LO = 23 GHz @ +11 dBm

Data taken without IF hybrid

All values in dBc below IF power level

#### Absolute Maximum Ratings

RF / IF Input (LO = +18 dBm)	+18 dBm	
LO Drive	+20 dBm	
Channel Temperature	150 °C	
Continuous Pdiss (T = 85 °C) (derate 5.0 mW/°C above 85 °C)	328 mW	
Thermal Resistance (R <sub>TH</sub> ) (junction to package bottom)	198 °C/W	
Storage Temperature	-65 to +125 °C	
Operating Temperature	-40 to +85 °C	
ESD Sensitivity (HBM)	Class 1A	



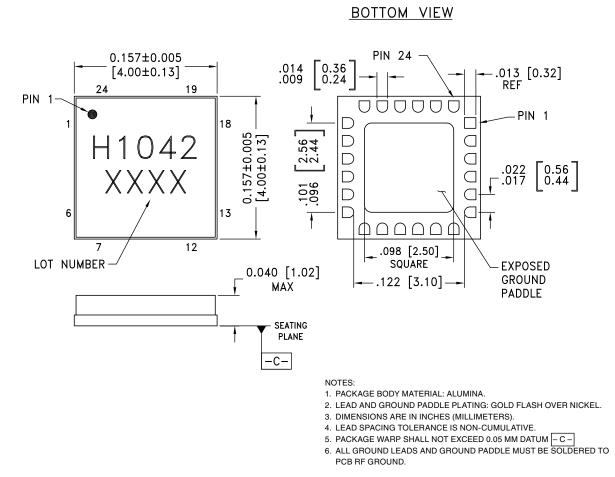
15 - 33.5 GHz

GaAs MMIC I/Q MIXER

v04.0614



#### **Outline Drawing**



#### **Package Information**

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[2]</sup>
HMC1042LC4	Alumina, White	Gold over Nickel	MSL3 <sup>[1]</sup>	H1042 XXXX

[1] Max peak reflow temperature of 260 °C [2] 4-Digit lot number XXXX

[2] 4-Digit lot number XXXX



v04.0614

### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

# RoHS V

### **Pin Descriptions**

Pin Number	Function	Description	Interface Schematic
1, 2, 6, 7, 10, 12, 13, 17-24	N/C	These pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally.	
3, 5, 8, 14, 16	GND	These pins and the exposed ground paddle must be connected to RF/DC ground.	
4	RF	This pin is AC coupled and matched to 50 Ohms.	RF ○
9	IF2	This pin is DC coupled. For application not requiring operation to DC, this port should be DC blocked externally using a series capacitor whose value has	IF1,IF2 0
11	IF1	been chosen to pass the necessary IF frequency range. For operation to DC, this pin must not source/sink more than 3 mA of current or product non-function and possible product failure will result.	
15	LO	This pin is AC coupled and matched to 50 Ohms from 15 to 33.5 GHz	



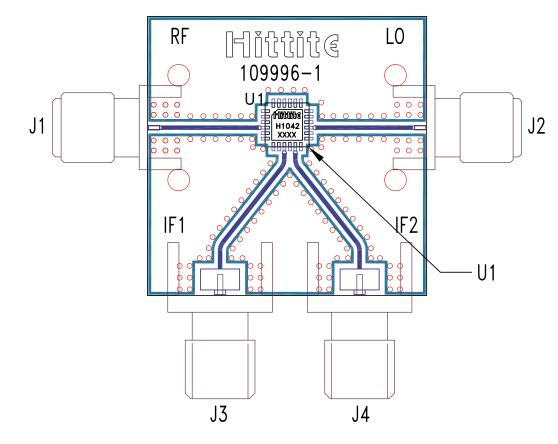
15 - 33.5 GHz

GaAs MMIC I/Q MIXER

v04.0614



#### Evaluation PCB



#### List of Materials for Evaluation PCB EVAL01-HMC1042LC4 [1]

Item	Description	
J1, J2	PCB Mount SMA RF Connector, SRI	
J3 - J4	PCB Mount SMA Connector, Johnson	
U1	HMC1042LC4	
PCB [2]	109996-1 Evaluation Board	

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the 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.

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### HMC1042LC4

### GaAs MMIC I/Q MIXER 15 - 33.5 GHz

ROHS V

Notes

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