

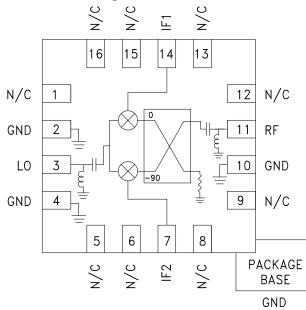


# Typical Applications

The HMC1063LP3E is ideal for:

- Point-to-Point and Point-to-Multi-Point Radio
- Military Radar, EW & ELINT
- Satellite Communications
- Sensors

#### **Functional Diagram**



# HMC1063LP3E

# GaAs MMIC I/Q MIXER 24 - 28 GHz

#### Features

Low LO Power: 10 dBm Wide IF Bandwidth: DC - 3 GHz Image Rejection: 21 dBc LO / RF Isolation: 40 dB High Input IP3: 17 dBm 16 Lead 3x3 mm SMT Package: 9 mm<sup>2</sup>

#### **General Description**

The HMC1063LP3E 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 degree hybrid fabricated in a GaAs Schottky diode process. A low frequency quadrature hybrid was used to produce a 1000 MHz LSB IF output. This product is a much smaller alternative to hybrid style Image Reject Mixers and Single Sideband Upconverter assemblies. The HMC1063LP3E eliminates the need for wire bonding and allows the use of surface mount manufacturing techniques.

# Electrical Specifications <sup>[1][2]</sup>, $T_A = +25^{\circ}C$ , IF = 1000 MHz, LSB, LO = +10 dBm

Parameter	Min.	Тур.	Max.	Min.	Тур.	Max.	Units
Frequency Range, RF		24 - 27			27-28		GHz
Frequency Range, LO		21 - 30		24 - 31		GHz	
Frequency Range, IF		DC - 3			DC - 3		GHz
Conversion Gain	-11.5	-9.5		-11.5	-9.5		dB
Image Rejection	15	21		13	21		dBc
LO to RF Isolation	30	42		28	36		dB
LO to IF Isolation		40			40		dB
IP3 (Input)		18			16		dBm
Amplitude Balance <sup>[2]</sup>		1			1		dB
Phase Balance <sup>[2]</sup>		-2			+2		Deg

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

[2] Data taken without external 90° hybrid.

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# GaAs MMIC I/Q MIXER 24 - 28 GHz

Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 1000 MHz

#### Conversion Gain, LSB vs. Temperature

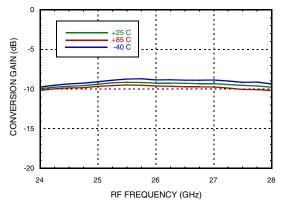
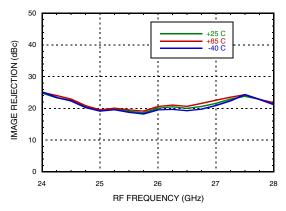
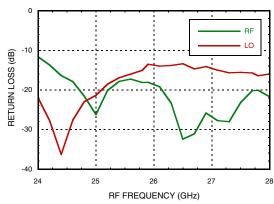


Image Rejection, LSB vs. Temperature



**Return Loss** 



<sup>[1]</sup> Data taken without external IF 90° hybrid

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# Conversion Gain, LSB vs. LO Drive

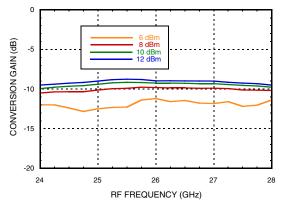
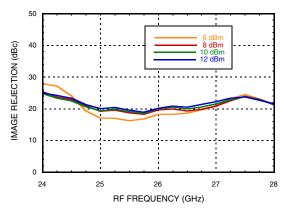
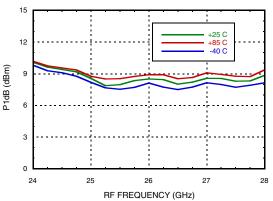


Image Rejection, LSB vs. LO Drive



# Input P1dB, LSB vs. Temperature



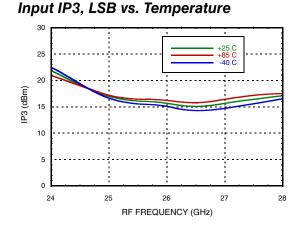


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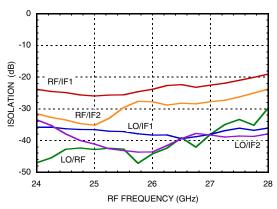


# GaAs MMIC I/Q MIXER 24 - 28 GHz

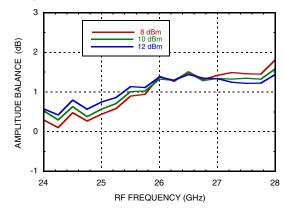
Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 1000 MHz



Isolations

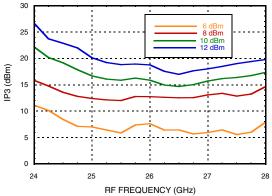


Amplitude Balance, LSB vs. LO Drive

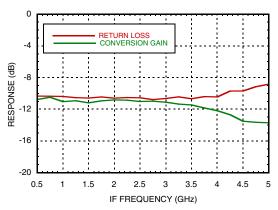


\* Conversion gain data taken with external IF hybrid.

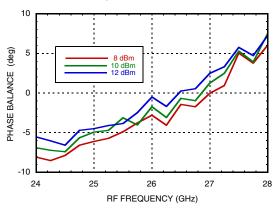
Input IP3, LSB vs. LO Drive



#### IF Bandwidth\*



Phase Balance, LSB vs. LO Drive



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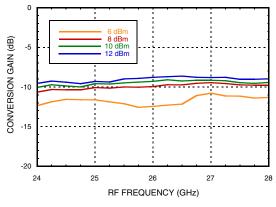
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# GaAs MMIC I/Q MIXER 24 - 28 GHz

Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 1000 MHz

Upconverter Performance, Conversion Gain, LSB vs. LO Drive



Conversion Gain, USB vs. Temperature

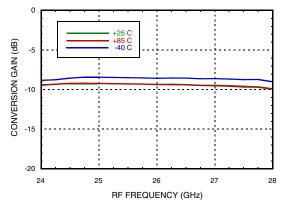
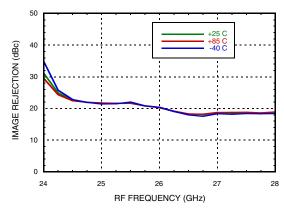
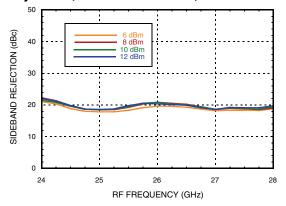


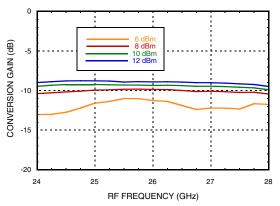
Image Rejection, USB vs. Temperature



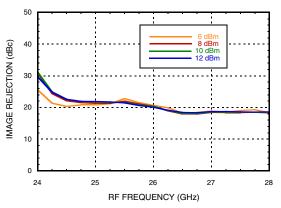
Upconverter Performance, Sideband Rejection, LSB vs. LO Drive,



Conversion Gain, USB vs. LO Drive



# Image Rejection, USB vs. LO Drive



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+25 C +85 C -40 C

27

28

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# GaAs MMIC I/Q MIXER 24 - 28 GHz

Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 1000 MHz

30

25

20

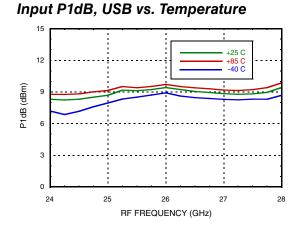
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5

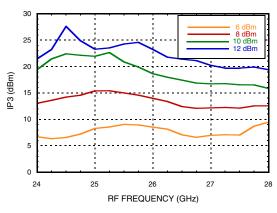
0

24

(mBb) 12 12



Input IP3, USB vs. LO Drive

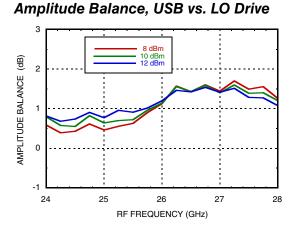


RF FREQUENCY (GHz)

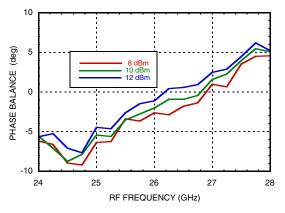
26

25

Input IP3, USB vs. Temperature



#### Phase Balance, USB vs. LO Drive



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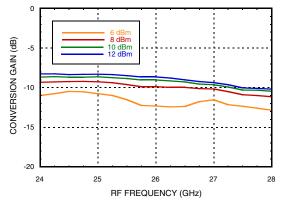
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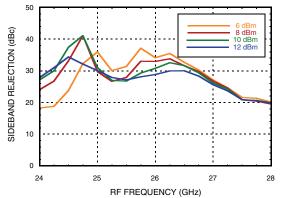
# GaAs MMIC I/Q MIXER 24 - 28 GHz

Data Taken as SSB Upconverter with External IF 90° Hybrid, IF = 1000 MHz

Upconverter Performance, Conversion Gain, USB vs. LO Drive



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



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# GaAs MMIC I/Q MIXER 24 - 28 GHz

Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 3000 MHz

# Conversion Gain, LSB vs. Temperature

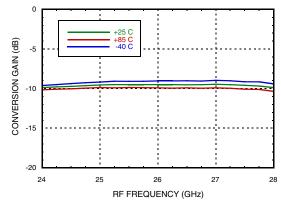
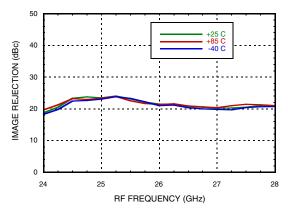
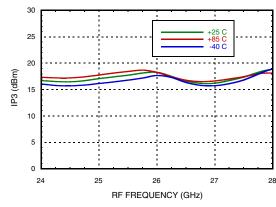


Image Rejection, LSB vs. Temperature



Input IP3, LSB vs. Temperature



# Conversion Gain, LSB vs. LO Drive

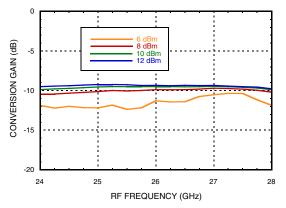
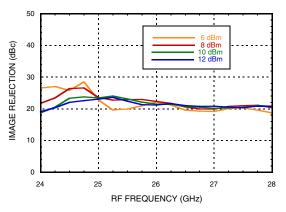
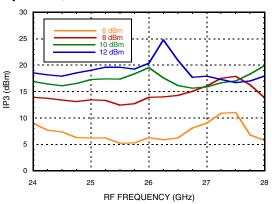


Image Rejection, LSB vs. LO Drive



Input IP3, LSB vs. LO Drive



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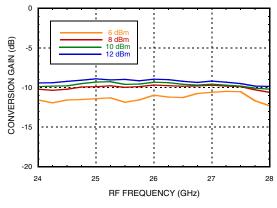
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# GaAs MMIC I/Q MIXER 24 - 28 GHz

Ďata Taken as SSB Downconverter with External IF 90° Hybrid, IF = 3000 MHz

Upconverter Performance, Conversion Gain, LSB vs. LO Drive



Conversion Gain, USB vs. Temperature

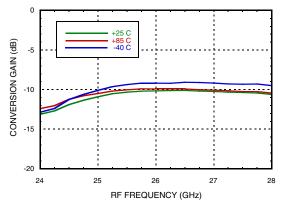
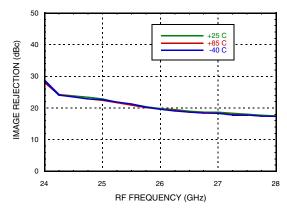
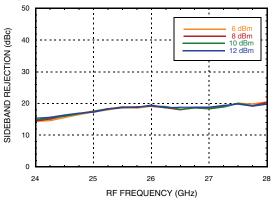


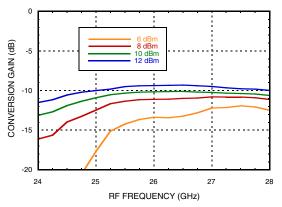
Image Rejection, USB vs. Temperature



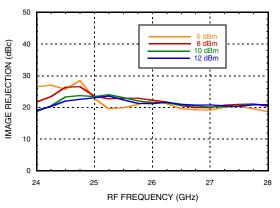
Upconverter Performance, Sideband Rejection, LSB vs. LO Drive,



Conversion Gain, USB vs. LO Drive



# Image Rejection, USB vs. LO Drive



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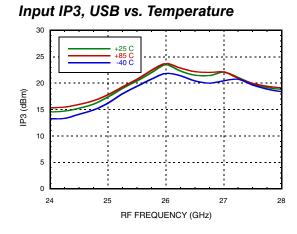




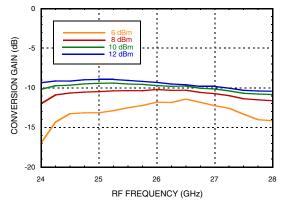
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# GaAs MMIC I/Q MIXER 24 - 28 GHz

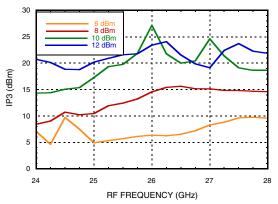
Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 3000 MHz



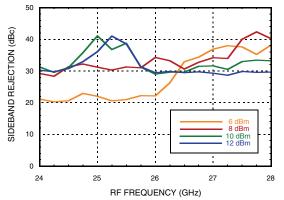
Upconverter Performance, Conversion Gain, USB vs. LO Drive



Input IP3, USB vs. LO Drive



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





# ROHS V

# GaAs MMIC I/Q MIXER 24 - 28 GHz

HMC1063LP3E

# Harmonics of LO

	nLO Spur at RF Port			
LO Freq. (GHz)	1	2	3	
23	36.6	43.3	х	
24	33.8	46.4	х	
25	32.1	49.4	х	
26	29.6	х	х	
27	31.8	х	х	
28	32.8	х	х	
LO = + 10 dBm Values in dBc below LO level measured at RF Port.				

# **MxN Spurious Outputs**

	nLO				
mRF	0	1	2	3	4
0	ХХ	1	28	х	х
1	8	0	34	60	х
2	95	53	51	58	87
3	х	97	97	97	97
4	х	х	х	97	97
RF = 22 GHz @ -10 dBm					

RF = 22 GHz @ -10 dBm

LO = 23 GHz @ +10 dBm

Data taken without IF hybrid All values in dBc below IF power level

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# GaAs MMIC I/Q MIXER

HMC1063LP3E

24 - 28 GHz

# Absolute Maximum Ratings

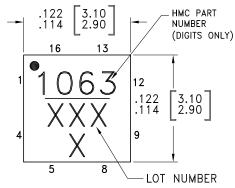
+11.5 dBm
+13 dBm
+14.5 dBm
175 °C
550 mW
164 °C/W
-65 to +150 °C
-40 to +85 °C
Class 1A

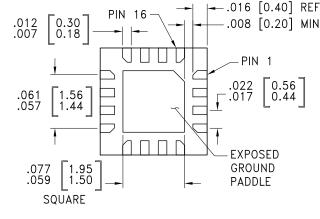


ELECTROSTATIC SENSITIVE DEVICE OBSERVE HANDLING PRECAUTIONS

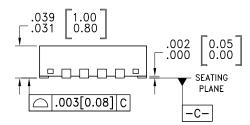
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# **Outline Drawing**





BOTTOM VIEW



NOTES:

- 1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILCON IMPREGNATED.
- 2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY.
- 3. LEAD AND GROUND PADDLE PLATING: 100% MATTE TIN.
- 4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
- 5. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
- 6. PAD BURR LENGTH SHALL BE 0.15mm MAX. PAD BURR HEIGHT SHALL BE 0.05mm MAX.
- 7. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
- ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

#### Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating [2]	Package Marking <sup>[1]</sup>
HMC1063LP3E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1	<u>H1063</u> XXXX

[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C

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# GaAs MMIC I/Q MIXER 24 - 28 GHz



# **Pin Descriptions**

Pin Number	Function	Description	Interface Schematic	
1, 5, 6, 8, 9, 12, 13, 15, 16	N/C	These pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally.		
2, 4, 10	GND	These pins and exposed ground paddle must be connected to RF/DC ground		
3	LO	This pin is DC coupled and matched to 50 Ohns		
7	IF2	Differential IF input pins. For applications not requiring operation to DC, an off chip DC blocking capacitor should be used. For operation to DC this pin must not source/sink		
14	IF1	more than 3 mA of currrent or part non function and and possible part failure will result.		
11	RFOUT	This pin is DC coupled and matched to 50 Ohms.		

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MIXERS - I/Q MIXERS, IRMS & RECEIVERS - SMT



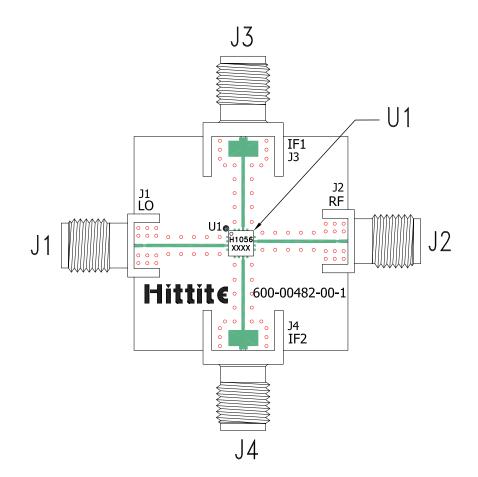
24 - 28 GHz

GaAs MMIC I/Q MIXER

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# **Evaluation PCB**



# List of Materials for Evaluation PCB EVAL01-HMC1063LP3 [1]

Item	Description	
J1, J2	PCB mount K Connector SRI	
J3, J4	PCB mount SMA Connector Johnson	
U1	HMC1063LP3E Downconverter	
PCB [2]	600-00482-00-1 Evaluation Board	

Reference this number when ordering complete evaluation PCB
Circuit Board Material: Arlon 25FR, FR4 or 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.





GaAs MMIC I/Q MIXER 24 - 28 GHz



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