



## Features

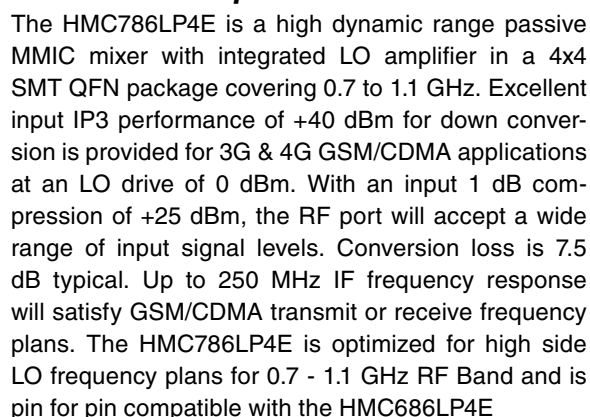
High Input IP3: +38 dBm

- 7.5 dB Conversion Loss @ 0 dBm LO

Optimized for High Side LO Input

24 Lead 4x4mm SMT Package: 16mm<sup>2</sup>

### General Description



$T_A = +25^\circ \text{C}$ ,  $LO = 0 \text{ dBm}$ ,  $V_{cc} = V_{cc1, 2, 3} = +5\text{V}$ ,  $G\_Bias = +2.5\text{V}^*$

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range, RF	0.7 - 1.1			0.824 - 0.915			GHz
Frequency Range, LO	0.75 - 1.35			0.974 - 1.065			GHz
Frequency Range, IF	50 - 250			150			MHz
Conversion Loss		7.5	9.5		7.5	9.5	dB
Noise Figure (SSB)		7.5			7.5		dB
IP3 (Input)		36			38		dBm
1 dB Compression (Input)		26			27		dBm
LO to RF Isolation	18	24		18	23		dB
LO to IF Isolation	23	30		23	30		dB
RF to IF Isolation	25	39		30	40		dB
LO Drive Input Level (Typical)	-1 to +6			-1 to +6			dBm
Supply Current (Icc total)	120	130	140	120	130	140	mA

\* Unless otherwise noted all measurements performed as downconverter with high side LO & IF = 150 MHz.

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## BICMOS MIXER W/ INTEGRATED LO AMPLIFIER, 700 - 1100MHz

### Upconverter Electrical Specifications,

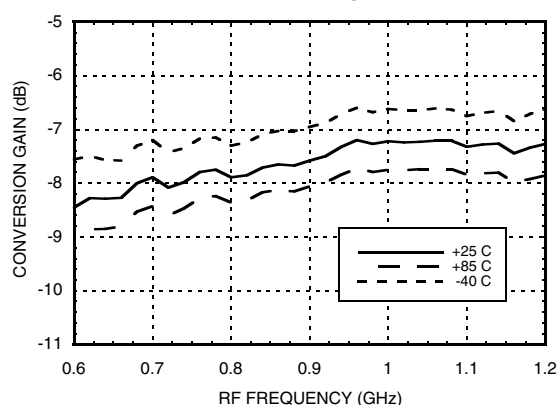
$T_A = +25^\circ\text{C}$ , LO = 0 dBm, Vcc = Vcc1, 2, 3 = +5V, G\_Bias = +2.5V \*

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range, RF		0.7 - 1.1		0.860 - 0.960			GHz
Frequency Range, LO		0.75 - 1.35		0.980 - 1.080			GHz
Frequency Range, IF		50 - 250		120			MHz
Conversion Loss		7.5	9.5		7.5	9.5	dB
IP3 (Input)		33		36			dBm
1 dB Compression (Input)		24		24			dBm
LO Drive Input Level (Typical)		-1 to +6		-1 to +6			dBm
Supply Current (Icc total)	120	130	140	120	130	140	mA

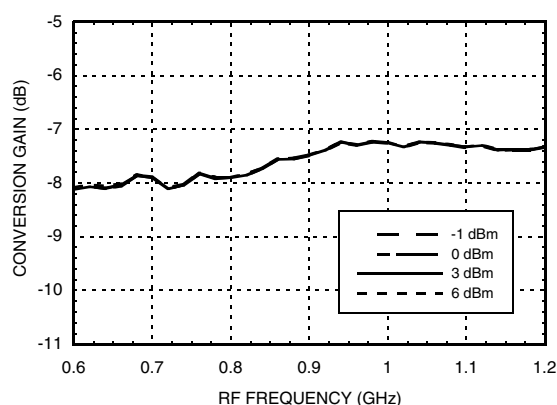
\*Unless otherwise noted all measurements performed as upconverter with high side LO & IF = 120 MHz.

### Downconverter Performance

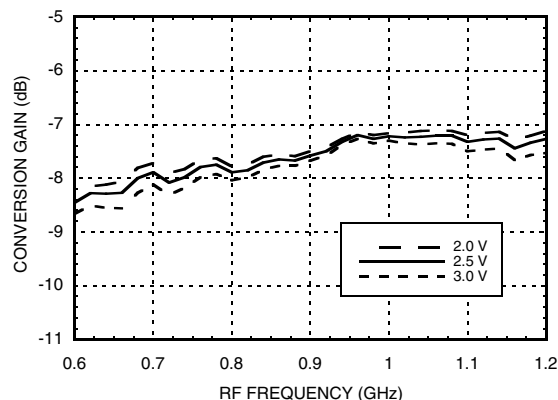
#### Conversion Gain vs. Temperature

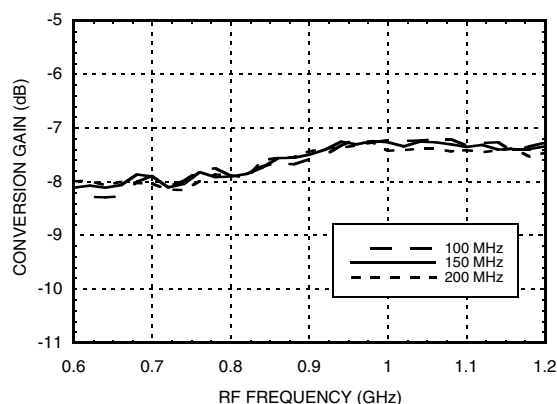
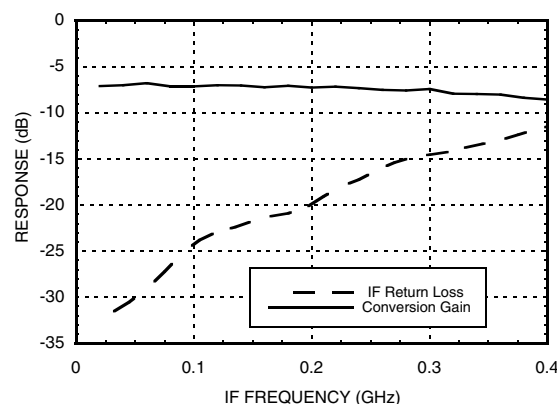
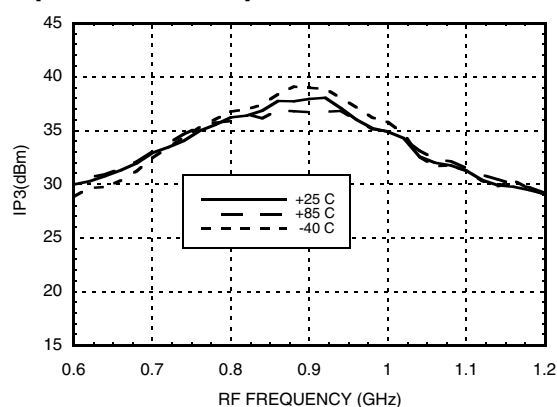
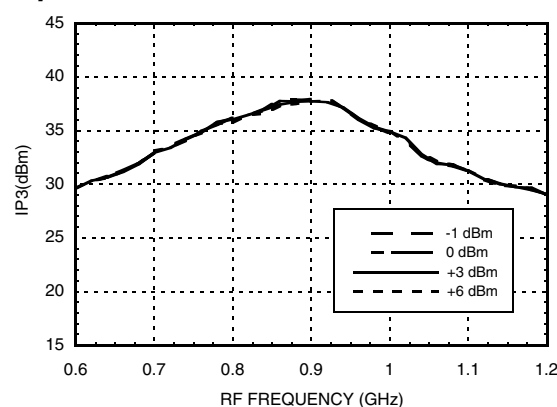
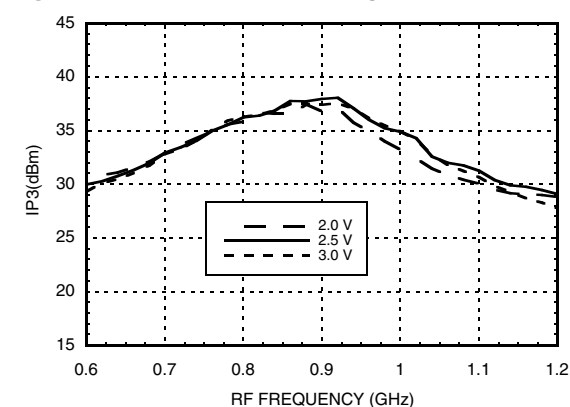
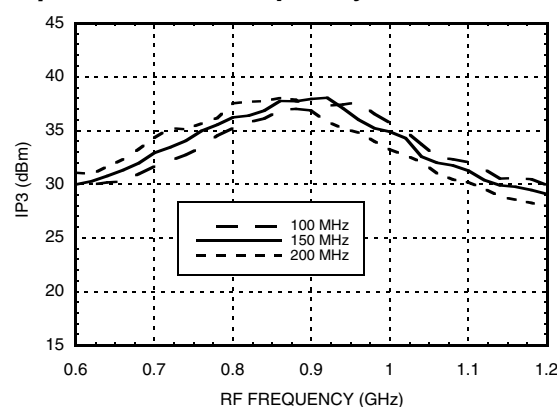


#### Conversion Gain vs. LO Drive



#### Conversion Gain vs. G\_Bias voltage




**BICMOS MIXER W/ INTEGRATED  
LO AMPLIFIER, 700 - 1100MHz**
**Downconverter Performance**
**Conversion Gain vs. IF Frequency**

**IF Bandwidth (LO = 1.1 GHz)**

**Input IP3 vs. Temperature <sup>[1]</sup>**

**Input IP3 vs. LO Drive <sup>[1]</sup>**

**Input IP3 vs. G\_Bias Voltage <sup>[1]</sup>**

**Input IP3 vs. IF Frequency <sup>[1]</sup>**


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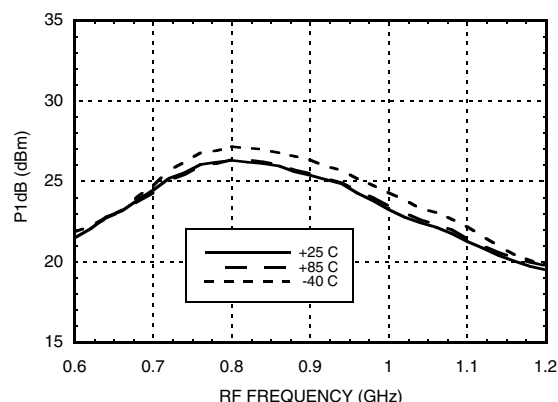
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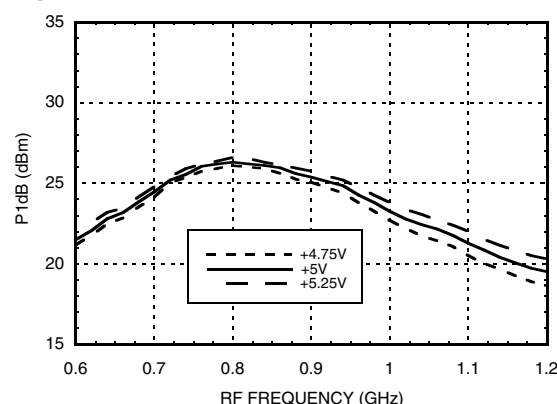
## BICMOS MIXER W/ INTEGRATED LO AMPLIFIER, 700 - 1100MHz

### Downconverter Performance

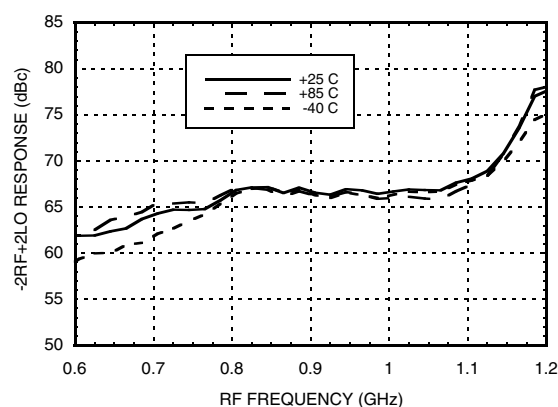
**Input P1dB vs. Temperature**



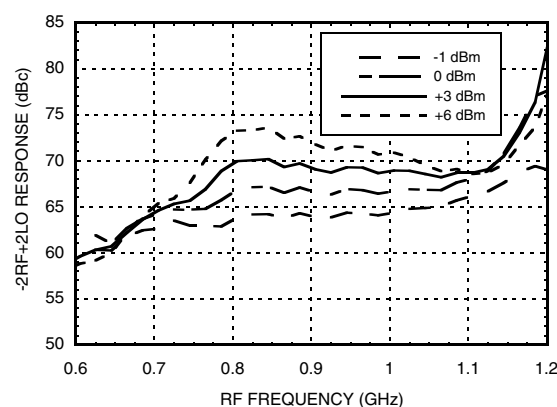
**Input P1dB vs. Vcc**



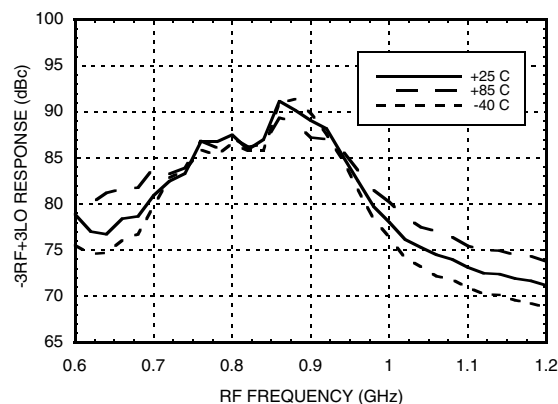
**-2RF +2LO Response vs. Temperature [2]**



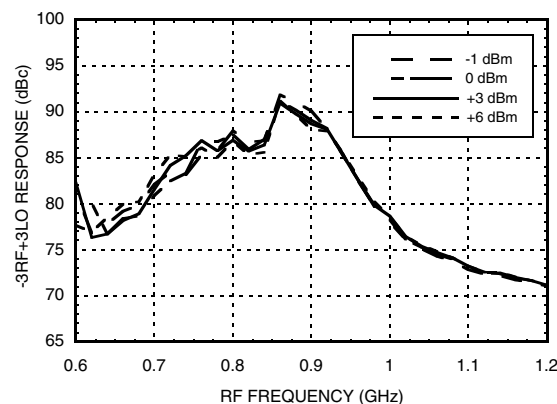
**-2RF +2LO Response vs. LO Drive [2]**



**-3RF +3LO Response vs. Temperature [2]**



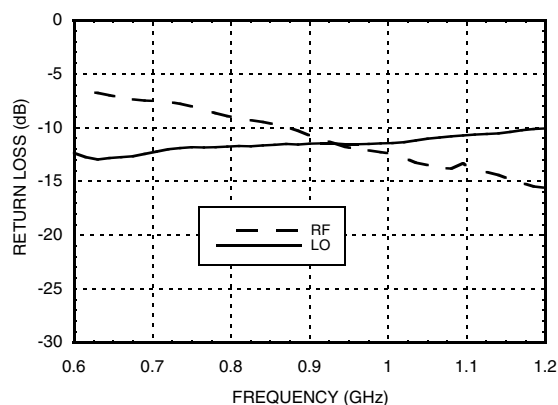
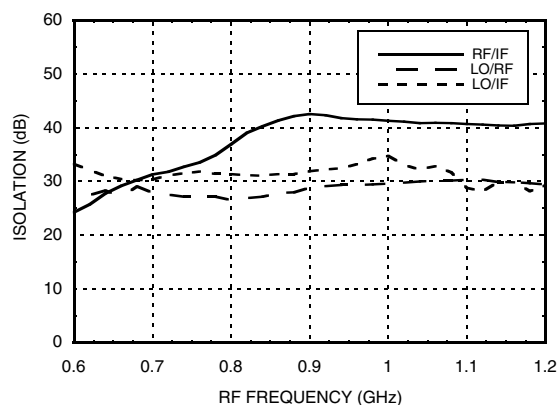
**-3RF +3LO Response vs. LO Drive [2]**



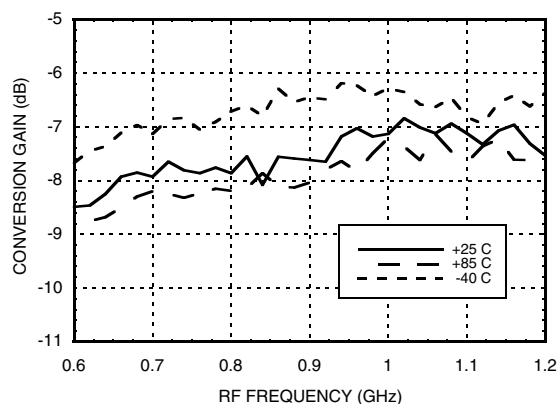
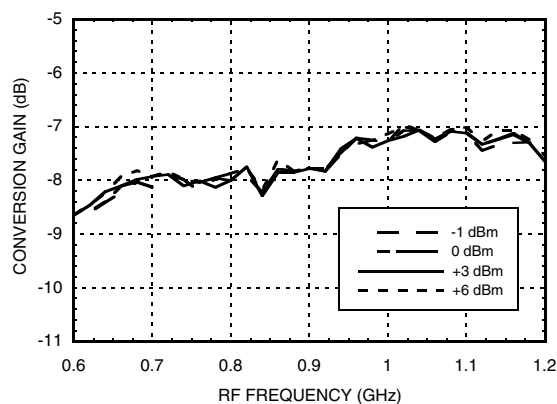
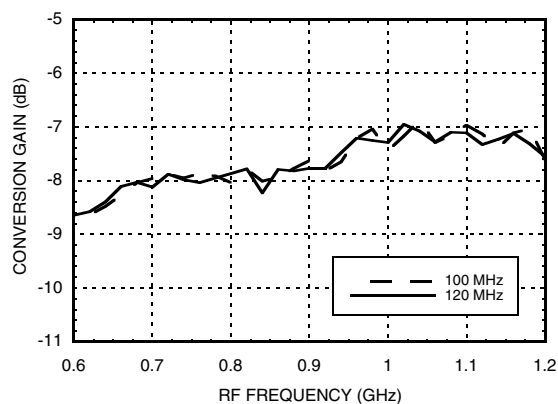
[1] Two-tone input power = +9 dBm each tone, 1 MHz spacing. [2] Referenced to RF Input Power at 0 dBm

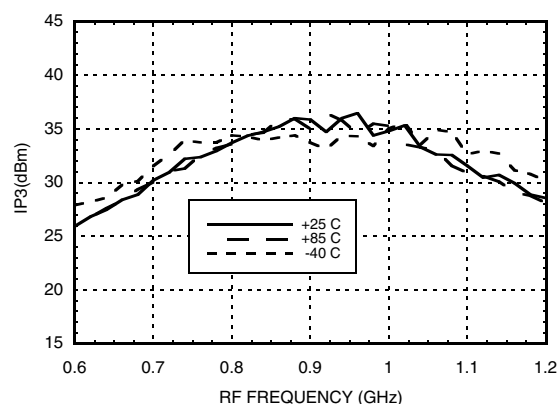
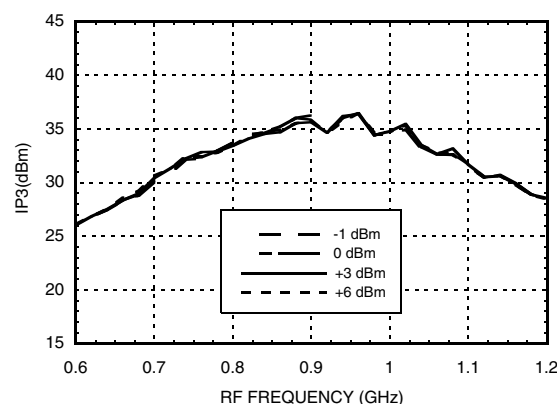
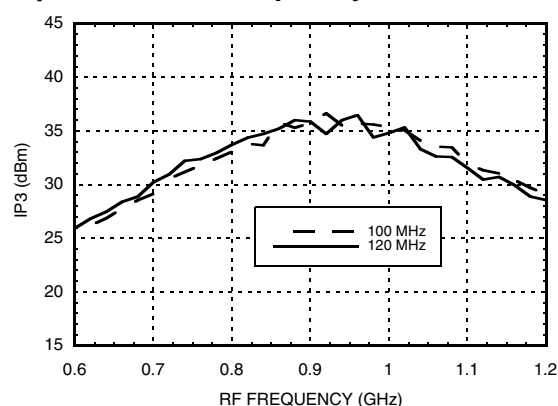
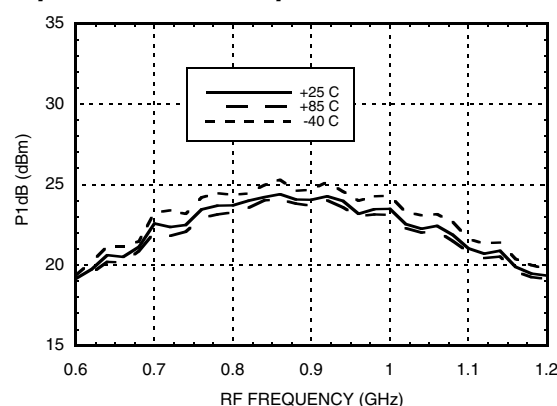


## BICMOS MIXER W/ INTEGRATED LO AMPLIFIER, 700 - 1100MHz

**Return Loss****Isolation**

### Upconverter Performance

**Conversion Gain vs. Temperature****Conversion Gain vs. LO Drive****Conversion Gain vs. IF Frequency**


**BICMOS MIXER W/ INTEGRATED  
LO AMPLIFIER, 700 - 1100MHz**
**Upconverter Performance**
**Input IP3 vs. Temperature <sup>[1]</sup>**

**Input IP3 vs. LO Drive <sup>[1]</sup>**

**Input IP3 vs. IF Frequency <sup>[1]</sup>**

**Input P1dB vs. Temperature**


[1] Two-tone input power = +9 dBm each tone, 1 MHz spacing.


**BICMOS MIXER W/ INTEGRATED  
LO AMPLIFIER, 700 - 1100MHz**
**Absolute Maximum Ratings**

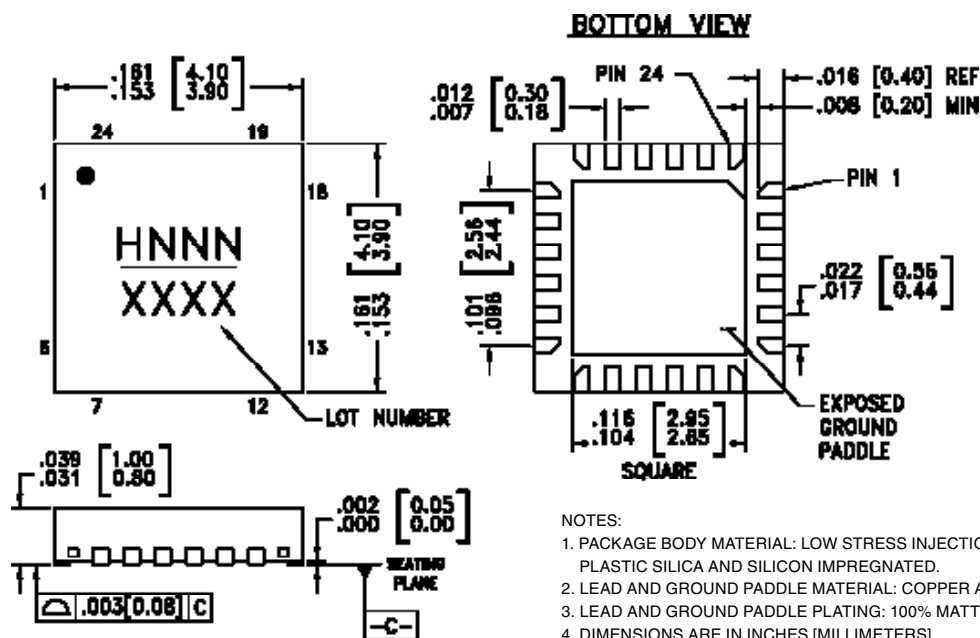
Vcc1, 2, 3	5.5 V
RF Input Power (Vcc1, 2, 3 = +5V)	+23 dBm
IF Input Power (Vcc1, 2, 3 = +5V)	+20 dBm
LO Drive (Vcc1, 2, 3 = +5V)	+10 dBm
Channel Temperature	125 °C
Continuous P <sub>diss</sub> (T = 85°C) (derate 27 mW/°C above 85°C)	1.0 W
Thermal Resistance (junction to ground paddle)	37 °C/W
Storage Temperature	-65 to 150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A

**Typical Supply Current vs. Vcc**

Vcc1, 2, 3 (V)	I <sub>cc</sub> total (mA)
4.75	120
5.00	130
5.25	145



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

**Outline Drawing**

**Package Information**

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[2]</sup>
HMC786LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 <sup>[1]</sup>	H786 XXXX


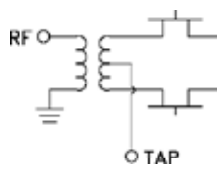
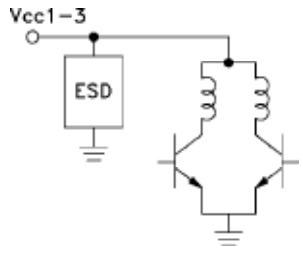
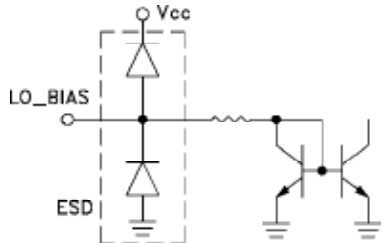
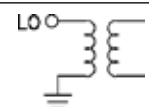
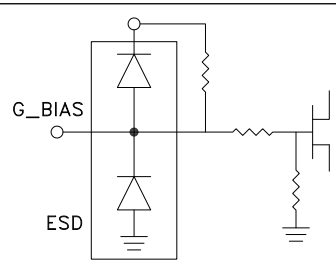
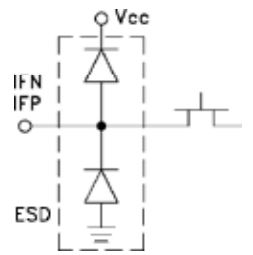
[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX

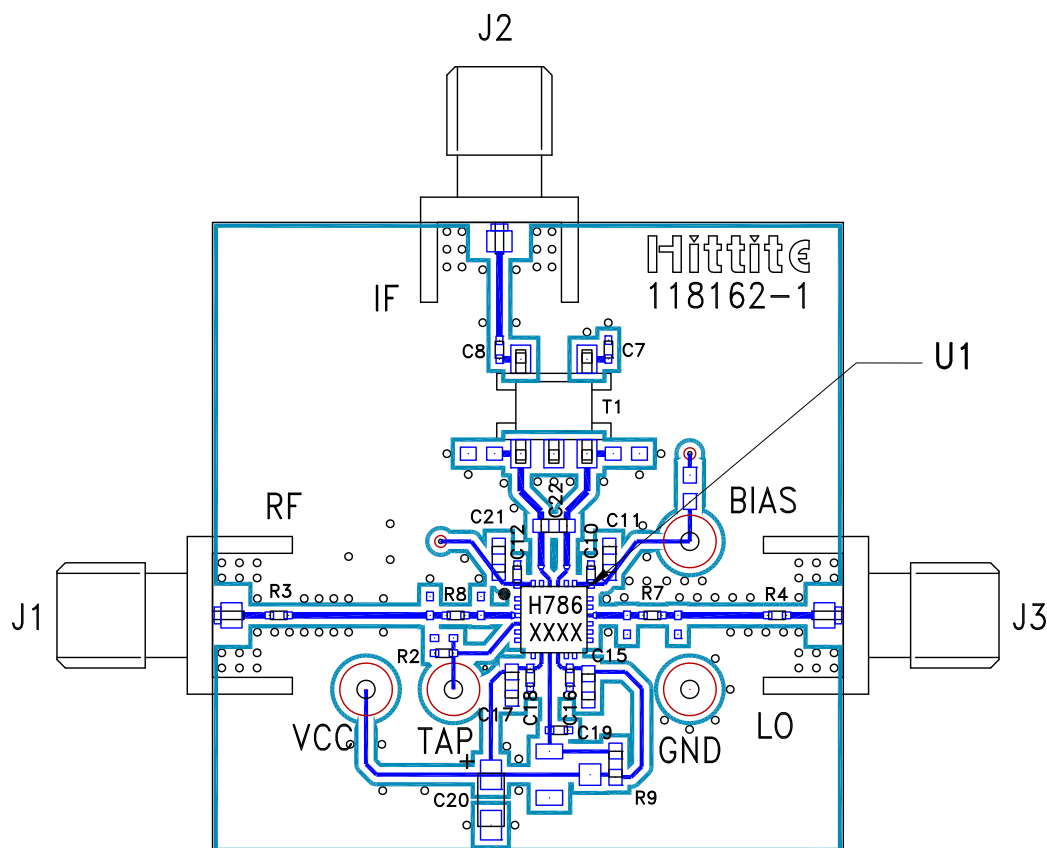
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**BICMOS MIXER W/ INTEGRATED  
LO AMPLIFIER, 700 - 1100MHz**
**Pin Descriptions**

Pin Number	Function	Description	Interface Schematic
1, 6, 7, 11 - 14, 18, 20, 23	N/C	No connection. These pins may be connected to RF ground. Performance will not be affected.	
2, 5, 15, 17	GND	These pins and package bottom must be connected to RF/DC ground.	
3	RF	This pin is matched single-ended to 50 Ohm and DC shorted to ground through a balun.	
4	TAP	Center tap of secondary side of the internal RF balun. Short to ground with a zero Ohms close to the package.	
8, 10, 24	Vcc1, Vcc2, Vcc3	Power supply voltage. See application circuit for required external components.	
9	LO_BIAS	LO buffer current adjustment pin. Adjust the LO buffer current through the external resistor R9 shown in the application circuit (connect 215 Ohms for nominal operation). This adjustment allows for a trade-off between power dissipation and linearity performance of the converter.	
16	LO	This pin is matched single-ended to 50 Ohm and DC shorted to ground through a balun.	
19	G_BIAS	External bias with a nominal value of 2.5V. See application circuit for recommended external components. G_Bias can be set to between 0 and 5Vdc. This adjustment allows for a trade off between conversion loss and linearity performance of the converter (see figures CG, IP3 vs. G_BIAS). The G_bias pin has an internal 15 KOhms resistance to ground and 15 KOhms to Vcc. Internal resistive divider sets 2.5 V for G_bias and can be changed externally.	
21, 22	IFN, IFP	Differential IF input / output pins matched to differential 50 Ohms. For applications not requiring operation to DC an off chip DC blocking capacitor should be used.	



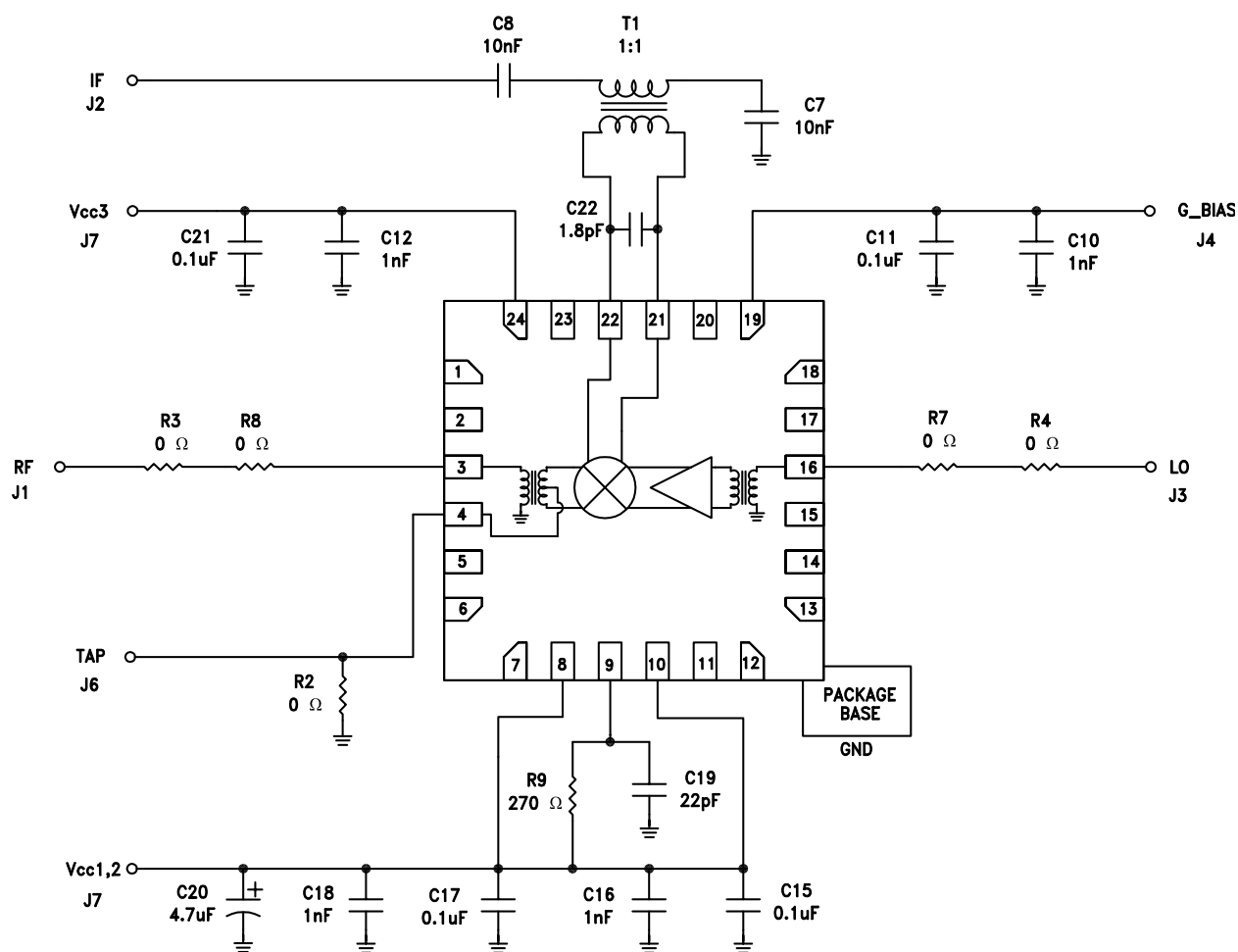

**BICMOS MIXER W/ INTEGRATED  
LO AMPLIFIER, 700 - 1100MHz**
**Evaluation PCB**

**List of Materials for Evaluation PCB 121769 [1]**

Item	Description
J1 - J3	SMA Connector
J4 - J7	DC Pin
C7, C8	10 nF Capacitor, 0402 Pkg.
C10, C12, C16, C18	1 nF Capacitor, 0402 Pkg.
C11, C15, C17, C21	0.1 $\mu$ F Capacitor, 0402 Pkg.
C19	22 pF Capacitor, 0402 Pkg.
C20	4.7 $\mu$ F Case A, Tantulum
C22	1.8 pF Capacitor, 0603 Pkg.
R2 - R4, R7, R8	0 Ohm Resistor, 0402 Pkg.
R9	270 Ohm Resistor, 0603 Pkg.
T1	1:1 Transformer - Tyco MABA CT0039
U1	HMC786LP4E
PCB [2]	118162 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25 FR

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.


**BICMOS MIXER W/ INTEGRATED  
LO AMPLIFIER, 700 - 1100MHz**
**Application Circuit**


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