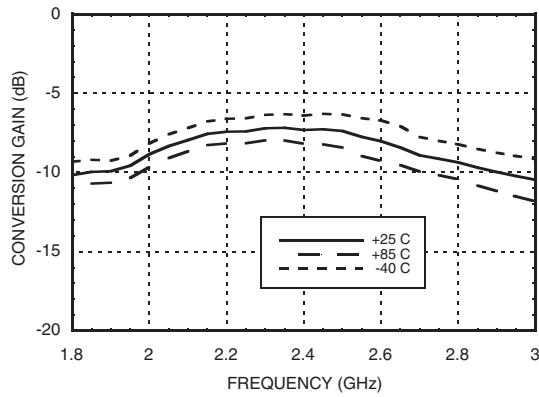




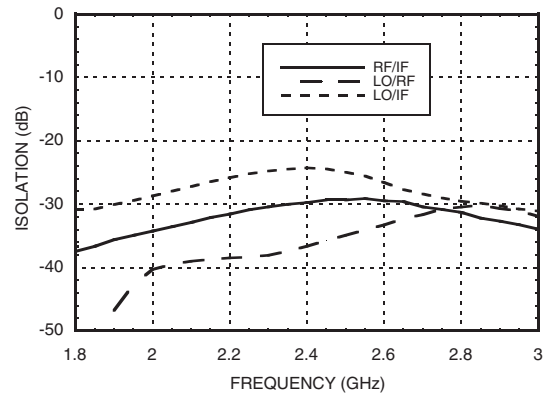
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BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 2.0 - 2.7 GHz

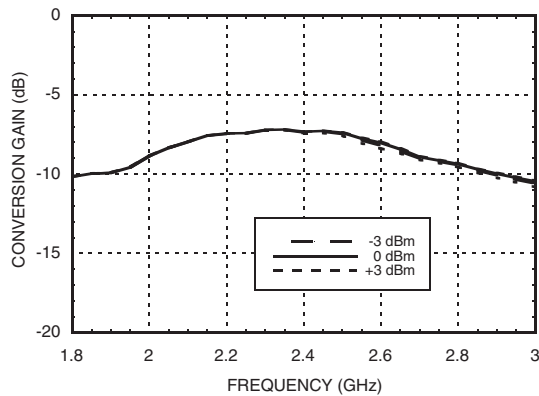
Conversion Gain vs. Temperature



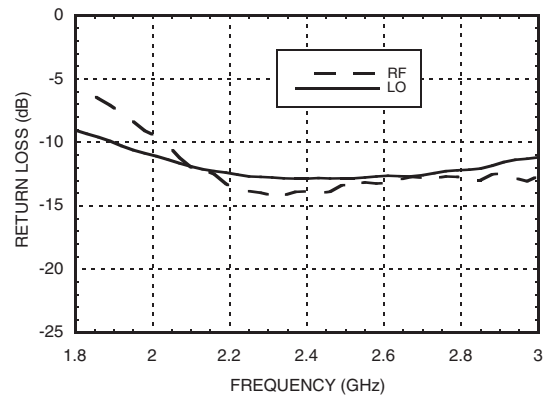
Isolation



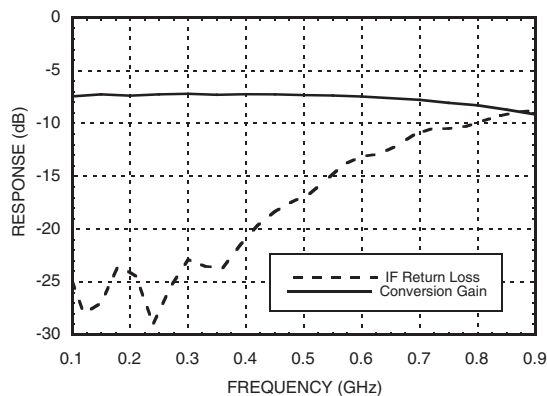
Conversion Gain vs. LO Drive



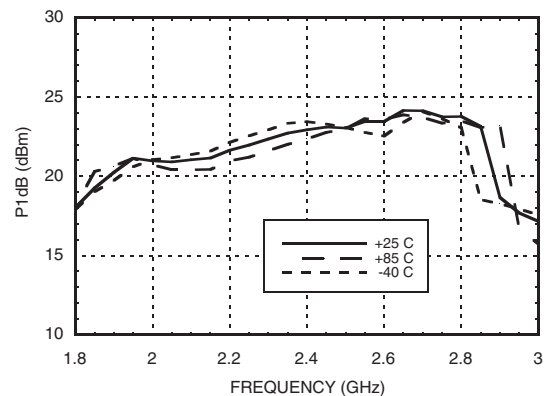
Return Loss



IF Bandwidth (LO = 2.8 GHz)



Input P1dB vs. Temperature

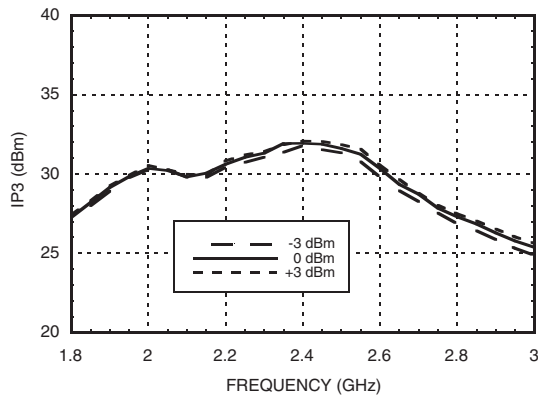




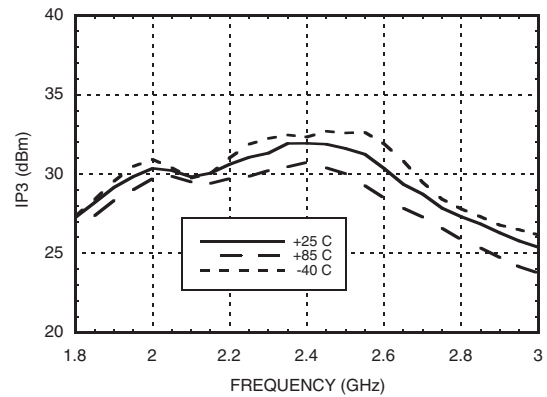
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BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 2.0 - 2.7 GHz

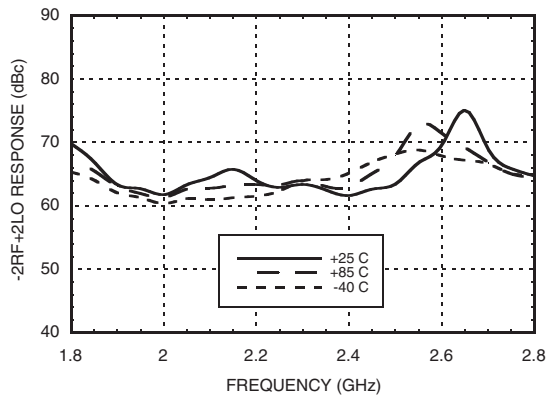
Input IP3 vs. LO Drive ^[1]



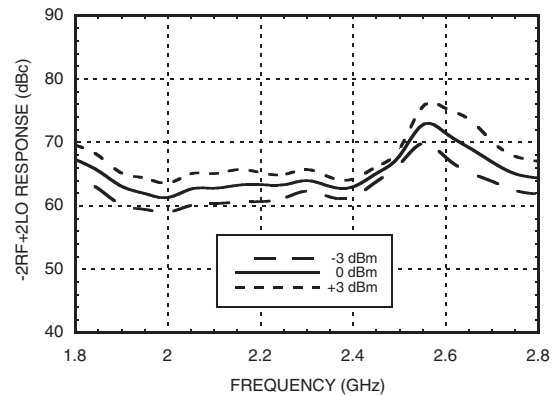
Input IP3 vs. Temperature ^[1]



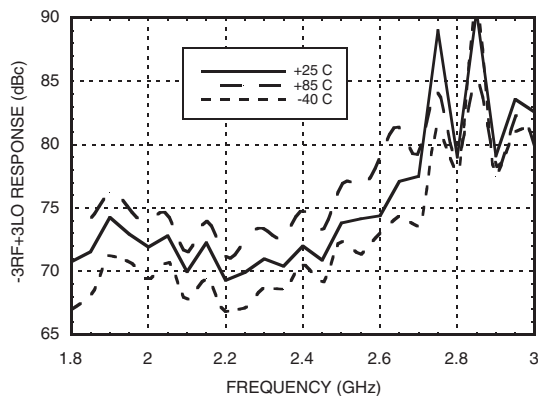
-2RF +2LO Response vs. Temperature ^[2]



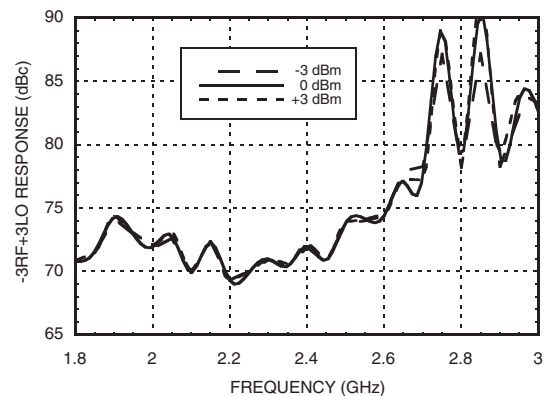
-2RF +2LO Response vs. LO Drive ^[2]



-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

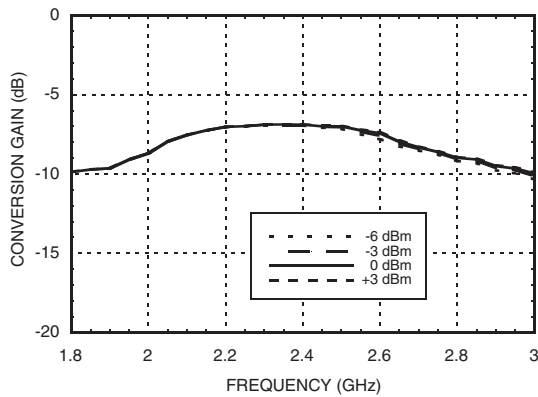
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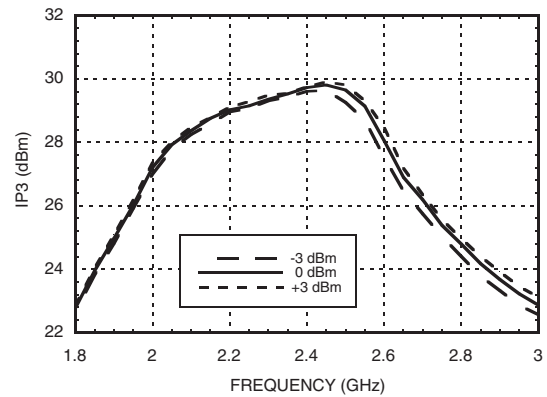
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BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 2.0 - 2.7 GHz

**Upconverter Performance
Conversion Gain vs. LO Drive**



**Upconverter Performance
Input IP3 vs. LO Drive [1]**



Absolute Maximum Ratings

RF / IF Input (Vcc1, 2, 3 = +5V)	+23 dBm
LO Drive (Vcc1, 2, 3 = +5V)	+10 dBm
Vcc1, 2, 3	+5.5V
Channel Temperature	125 °C
Continuous P _{diss} (T = 85°C) (derate 25 mW/°C above 85°C)	1 W
Thermal Resistance (channel to ground paddle)	40 °C/W
Storage Temperature	-65 to 150 °C
Operating Temperature	-40 to +85 °C

MxN Spurious @ IF Port

mRF	nLO				
	0	1	2	3	4
0	xx	23	34	34	38
1	28	0	46	42	55
2	73	73	52	66	85
3	109	81	94	67	96
4	120	117	120	111	110

RF Freq. = 2.5 GHz @ 0 dBm
LO Freq. = 2.8 GHz @ 0 dBm
All values in dBc below IF power level (-1RF + 1LO).

Typical Supply Current vs. Vcc

Vcc1, 2, 3 (V)	I _{cc} total (mA)
4.75	140
5.00	152
5.25	164

Downconverter will operate over full voltage range shown above.



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

Harmonics of LO

LO Freq. (GHz)	nLO Spur @ RF Port			
	1	2	3	4
2.1	32	26	55	29
2.2	30	26	51	30
2.3	29	27	42	29
2.4	28	26	44	29
2.5	26	25	41	26
2.6	25	24	42	26
2.7	24	23	42	22
2.8	25	24	40	26
2.9	26	22	38	34

LO = 0 dBm
All values in dBc below input LO level measured at RF port.

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



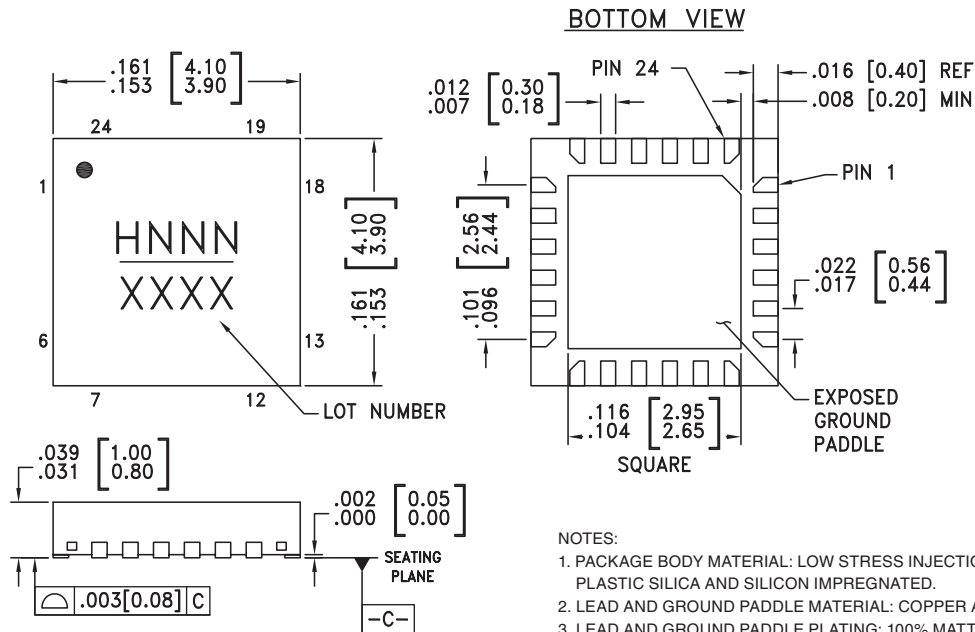
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HMC689LP4 / 689LP4E

BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 2.0 - 2.7 GHz

Outline Drawing



- NOTES:
1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON 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 0.25mm MAX.
 7. PACKAGE WARP SHALL NOT EXCEED 0.05mm
 8. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
 9. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking ^[3]
HMC689LP4	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 ^[1]	H689 XXXX
HMC689LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 ^[2]	H689 XXXX

[1] Max peak reflow temperature of 235 °C
 [2] Max peak reflow temperature of 260 °C
 [3] 4-Digit lot number XXXX



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HMC689LP4 / 689LP4E

BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 2.0 - 2.7 GHz

Pin Descriptions

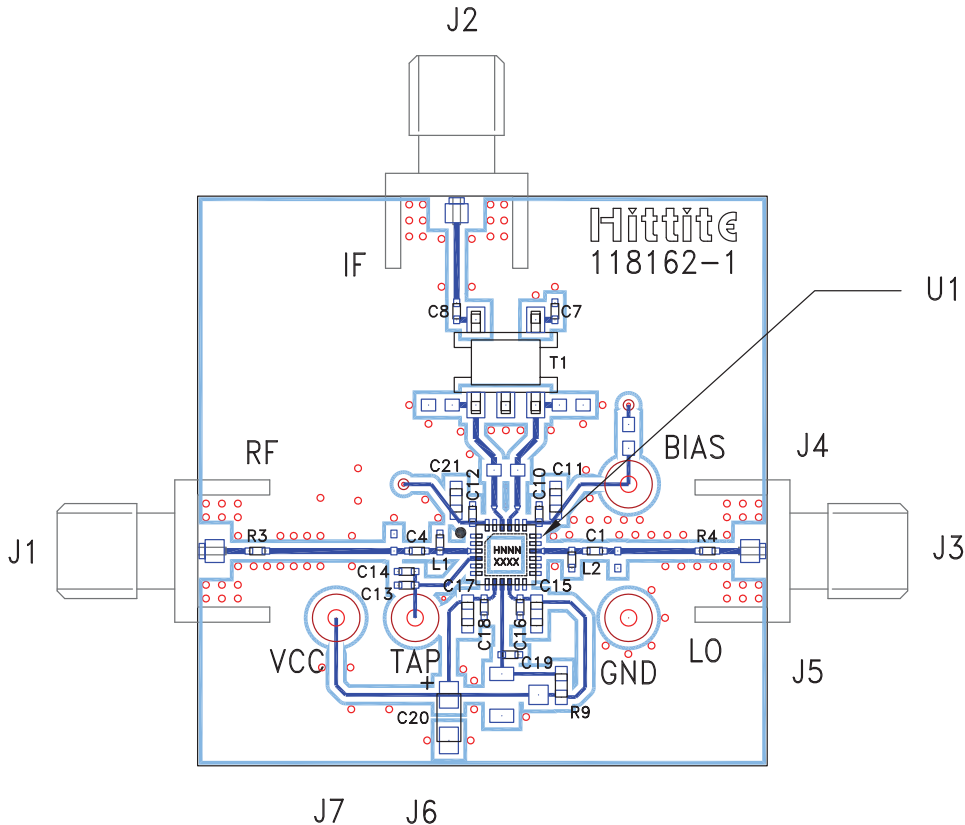
Pin Number	Function	Description	Interface Schematic
1, 6, 7, 11 - 14, 18, 20, 23	N/C	No connection. These pins may be connected to RF ground. Performance will not be affected.	
2, 5, 15, 17	GND	Package bottom must be connected to RF/DC ground.	
3	RF	This pin is matched single-ended to 50 ohms and DC shorted to ground through a balun.	
4	TAP	Center tap of secondary side of the internal RF balun. Short to ground with zero ohms close to the IC.	
8, 10, 24	Vcc1, Vcc2, Vcc3	Power supply voltage. See application circuit for required external components.	
9	LO_BIAS	Adjust the LO buffer current through an external resistor. See application circuit for required external components.	
16	LO	This pin is matched single-ended to 50 ohms and DC shorted to ground through a balun.	
19	G_BIAS	External optional bias. See application circuit for required external components. Apply +2.8V for nominal performance	
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.	



HMC689LP4 / 689LP4E

BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 2.0 - 2.7 GHz

Evaluation PCB



List of Materials for Evaluation PCB 120974 [1]

Item	Description
J1 - J3	SMA Connector
J4 - J7	DC Pin
C1, C4	1.5 pF Capacitor, 0402 Pkg.
C7, C8, C13	10 nF Capacitor, 0402 Pkg.
C10, C12, C16, C18	1 nF Capacitor, 0402 Pkg.
C11, C15, C17, C21	0.1 μF Capacitor, 0402 Pkg.
C14, C19	22 pF Capacitor, 0402 Pkg.
L1	7.5 nH Inductor, 0402 Pkg
L2	8.2 nH Inductor, 0402 Pkg.
C20	4.7 μF Case A, Tantalum
R3, R4	0 Ohm Resistor, 0402 Pkg.
R9	215 Ohm Resistor, 0603 Pkg.
T1	1:1 Transformer - Tyco MABACT0039
U1	HMC689LP4(E) Downconverter
PCB [2]	118162 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25R, FR4

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.



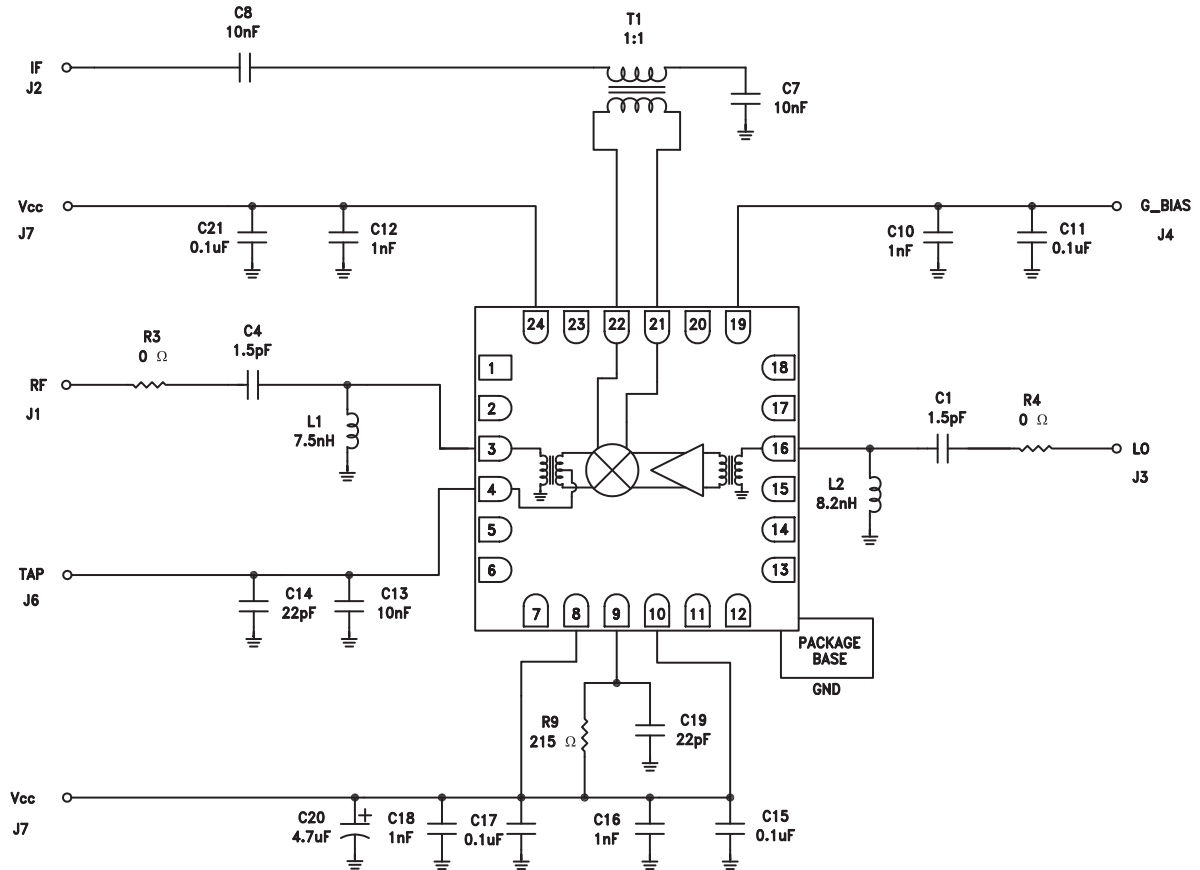
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BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 2.0 - 2.7 GHz

Application Circuit



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