

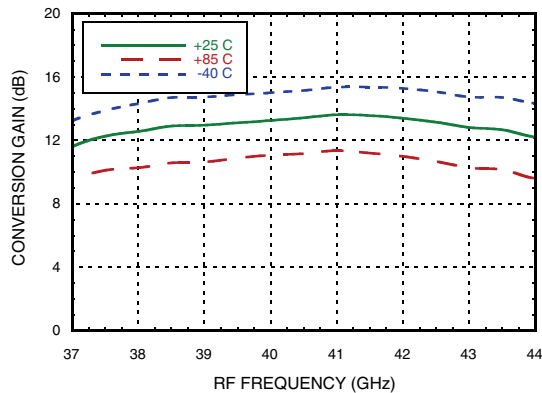




GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz

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

Conversion Gain, USB vs. Temperature



Conversion Gain, USB vs. LO Drive

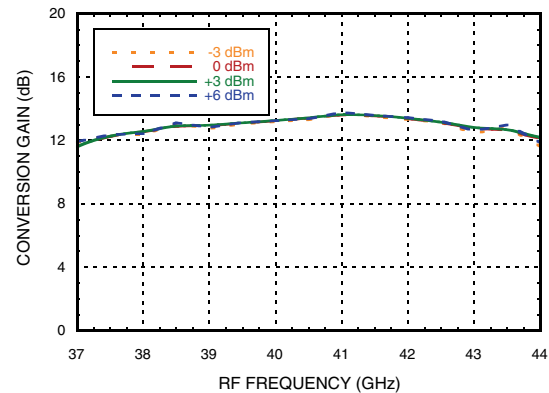
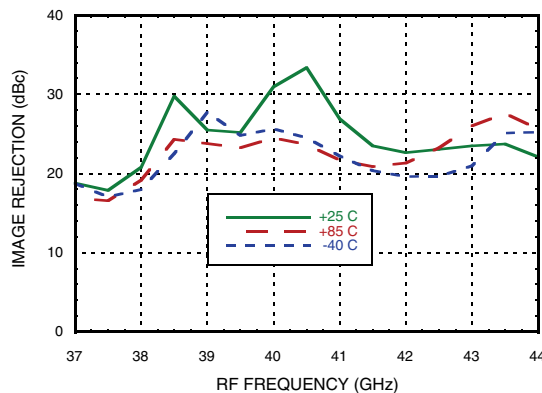
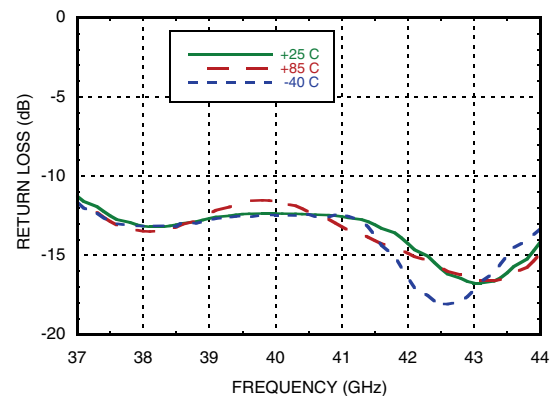


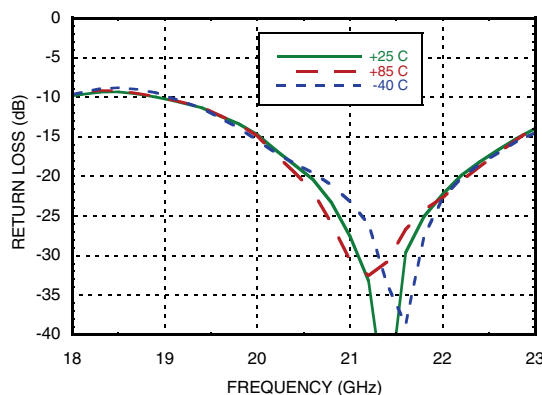
Image Rejection vs. Temperature



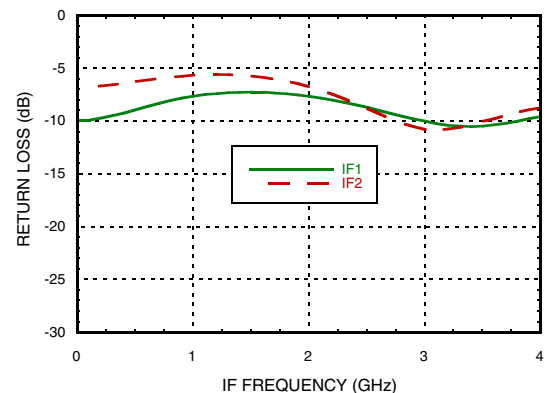
RF Return Loss



LO Return Loss vs. Temperature



IF Return Loss ^[1]



[1] Data taken without external IF 90° hybrid

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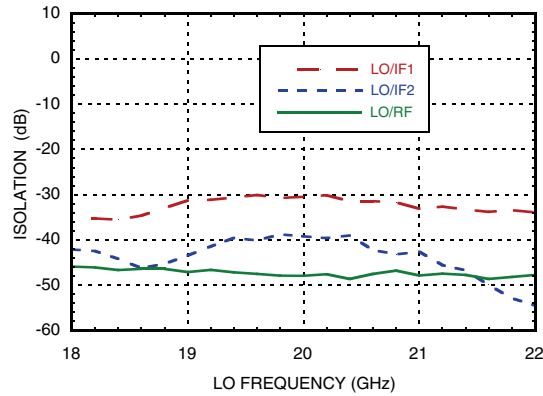
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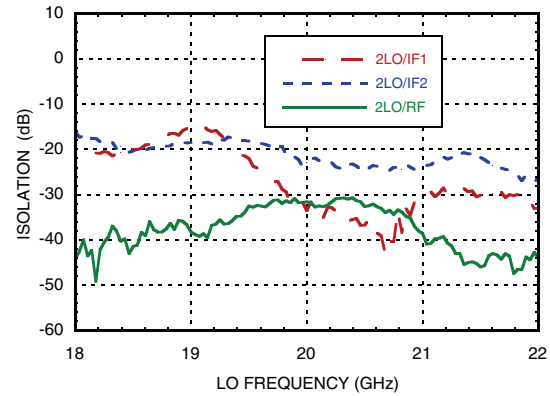
**GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz**

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

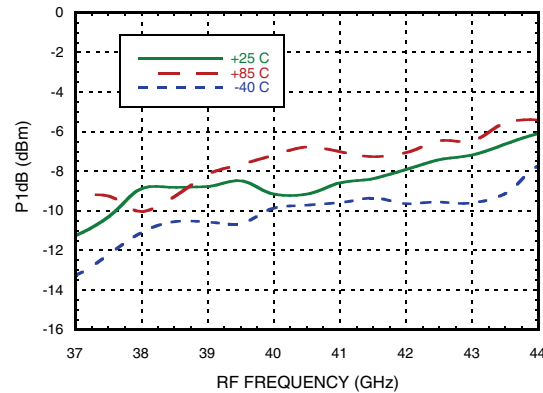
LO Isolation



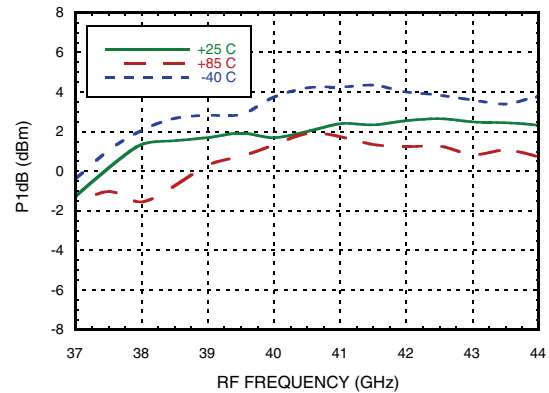
2LO Isolation



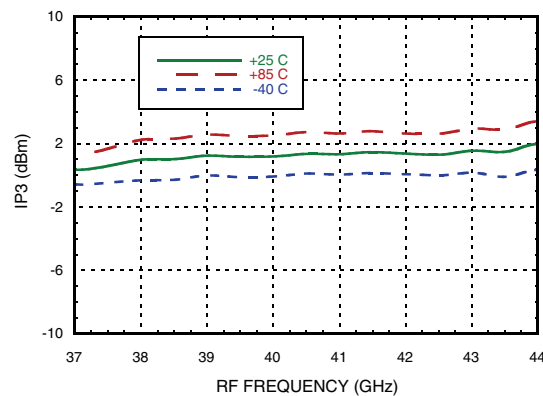
Input P1dB, USB vs. Temperature



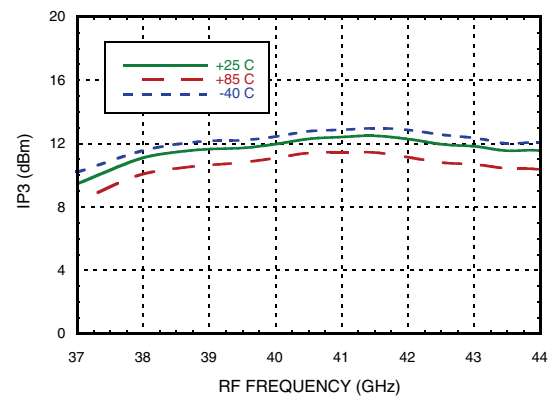
Output P1dB, USB vs. Temperature



Input IP3, USB vs. Temperature



Output IP3, USB vs. Temperature

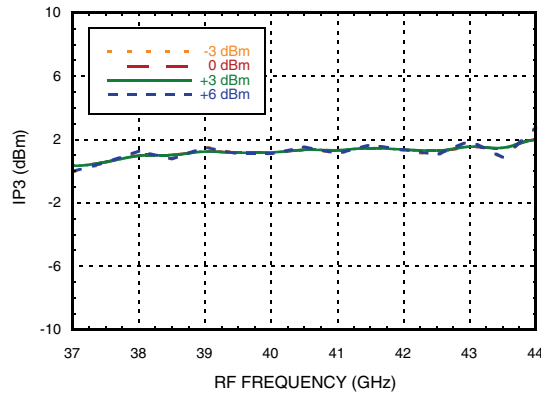




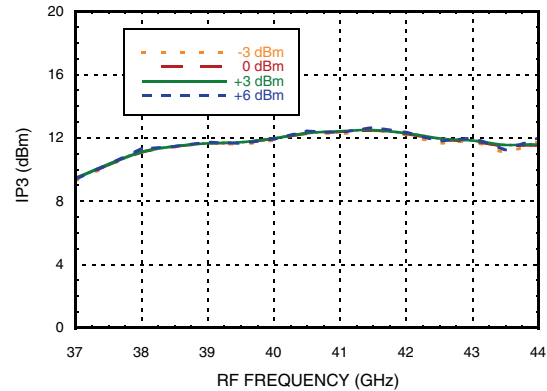
**GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz**

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

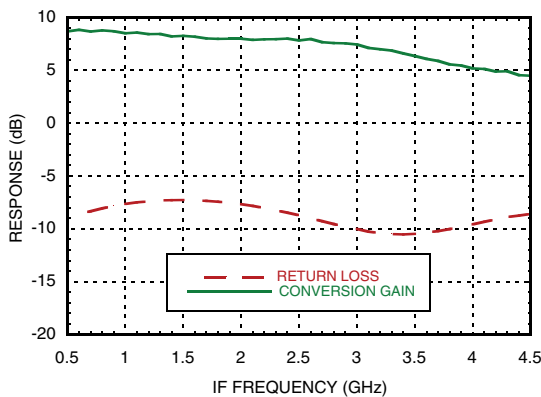
Input IP3, USB vs. LO Power



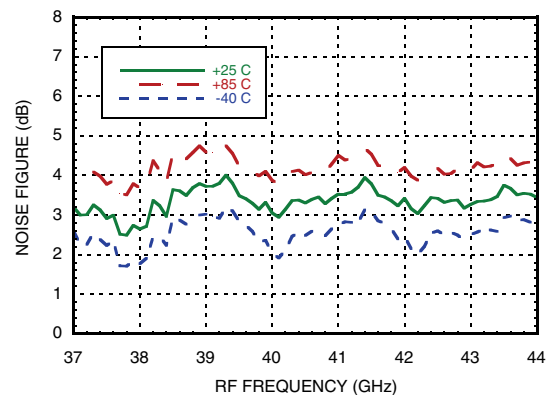
Output IP3, USB vs. LO Power



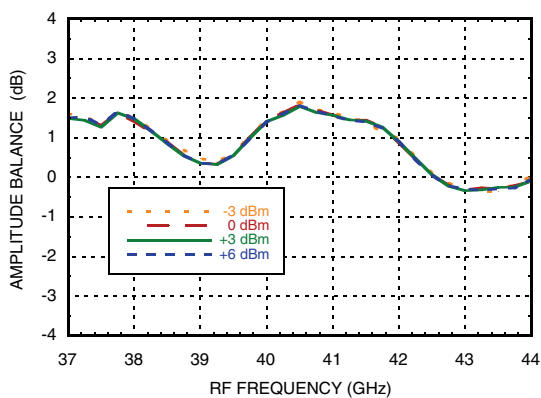
IF Bandwidth ^[1]



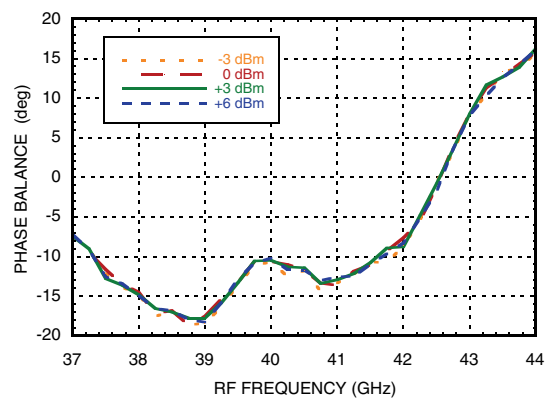
Noise Figure vs. Temperature



Amplitude Balance vs. LO Drive



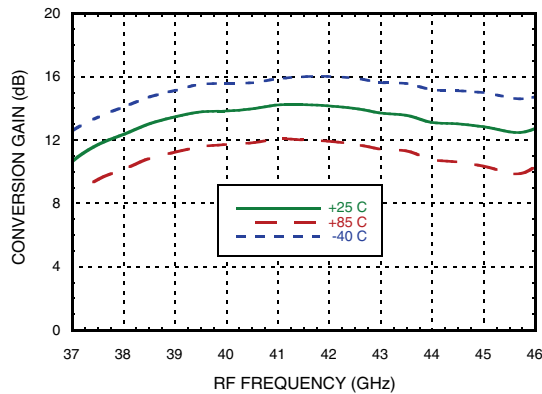
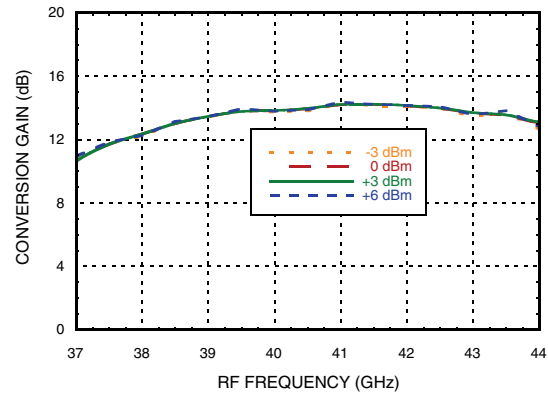
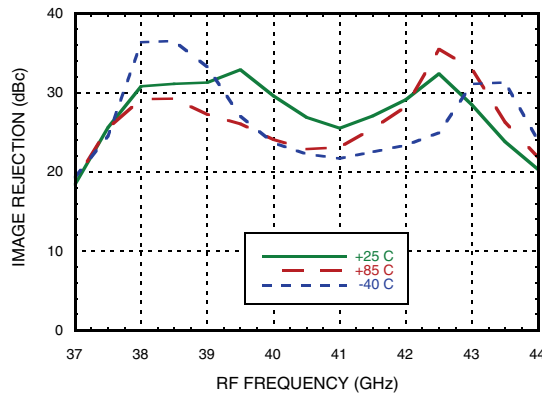
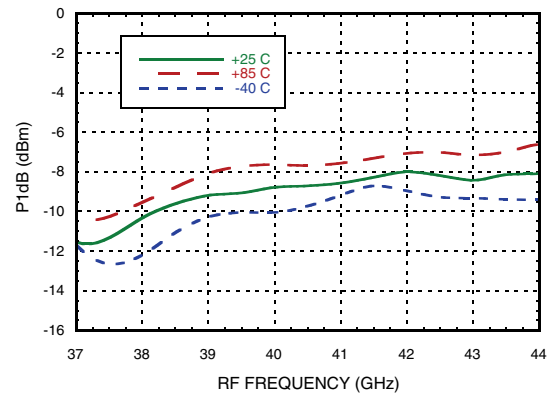
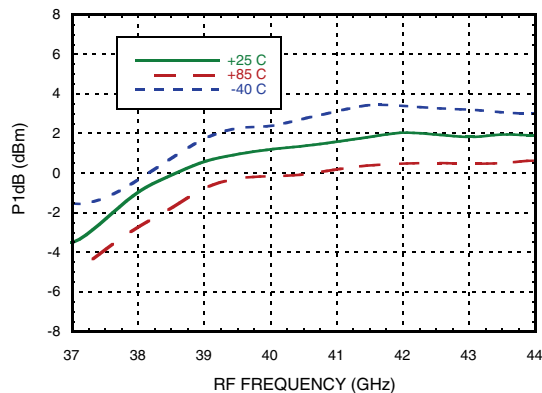
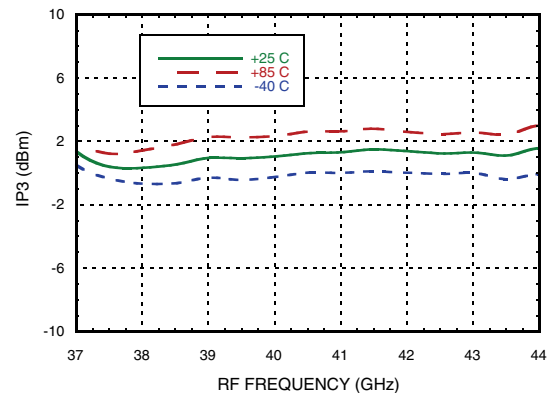
Phase Balance vs. LO Drive



[1] LO = 18GHz


**GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz**

Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 2000 MHz

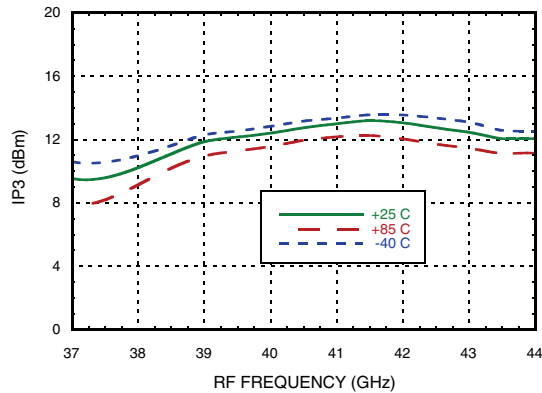
Conversion Gain, USB vs. Temperature

Conversion Gain, USB vs. LO Drive

Image Rejection vs. Temperature

Input P1dB, USB vs. Temperature

Output P1dB, USB vs. Temperature

Input IP3, USB vs. Temperature




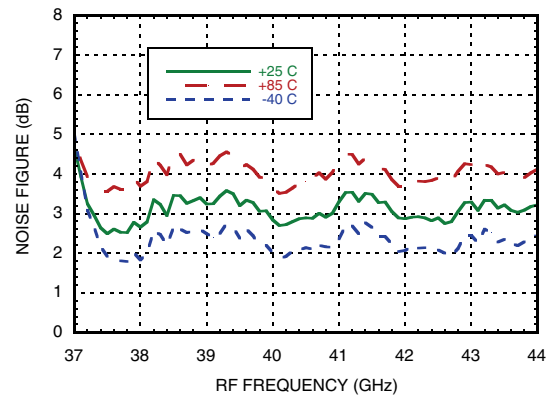
**GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz**

Data Taken as SSB Downconverter with External IF 90° Hybrid, IF = 2000 MHz

Output IP3, USB vs. Temperature



Noise Figure vs. Temperature



MxN Spurious Outputs [1][2]

| | nLO | | | | |
|-----|-----|----|----|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 38 | 21 | | |
| 1 | 17 | 48 | 0 | | |
| 2 | xx | xx | 47 | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |

RF = 40 GHz @ -8 dBm
LO = 19.5 GHz @ +4 dBm

MxN Spurious Outputs [1][2]

| | nLO | | | | |
|-----|-----|----|----|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 42 | 16 | | |
| 1 | 17 | 47 | 0 | | |
| 2 | xx | xx | 43 | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |

RF = 40 GHz @ -8 dBm
LO = 19.0 GHz @ +4 dBm

MxN Spurious Outputs [1][2]

| | nLO | | | | |
|-----|-----|----|----|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 44 | 20 | | |
| 1 | 17 | 41 | 0 | | |
| 2 | xx | xx | 50 | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |

RF = 40 GHz @ -8 dBm
LO = 18.5 GHz @ +4 dBm

[1] Data taken without external IF 90° hybrid

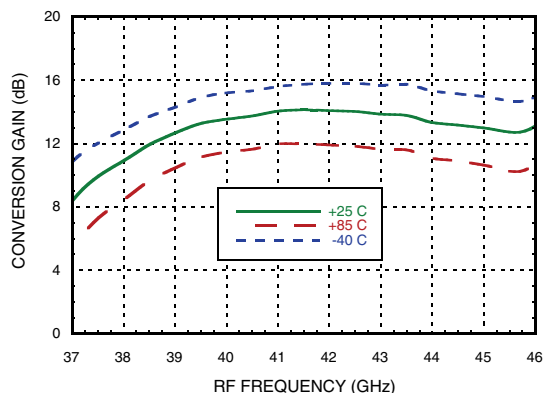
[2] All values in dBc below RF power level (2LO + IF) USB



**GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz**

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

Conversion Gain, USB vs. Temperature



Conversion Gain, USB vs. LO Drive

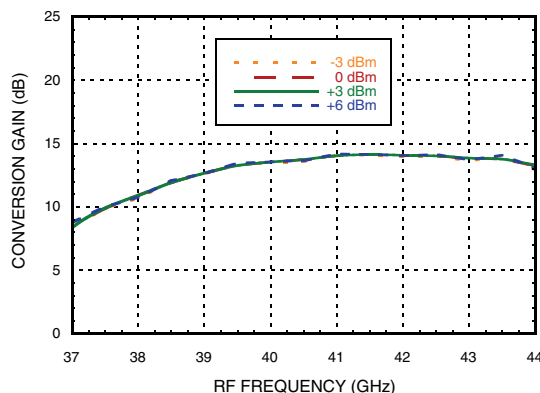
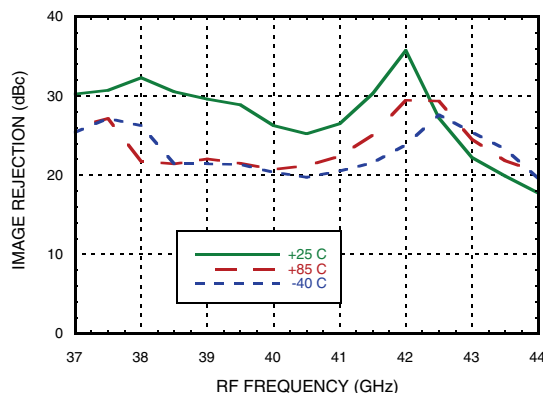
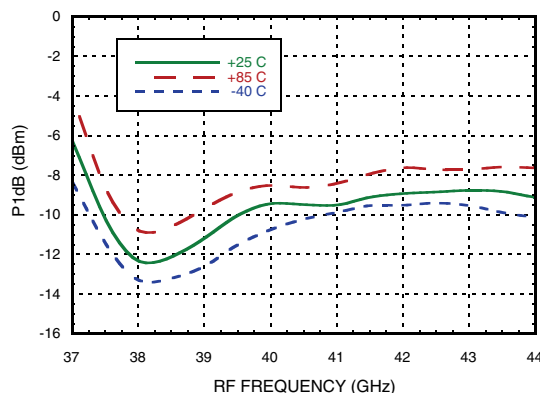


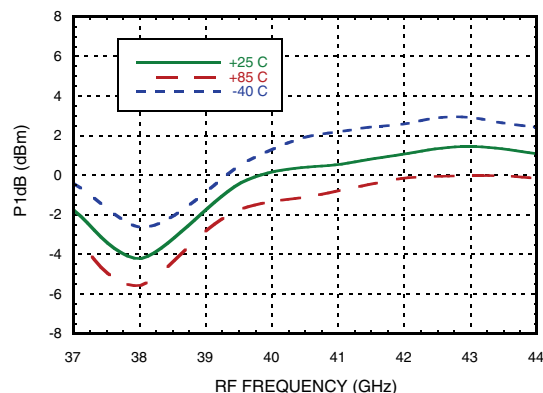
Image Rejection vs. Temperature



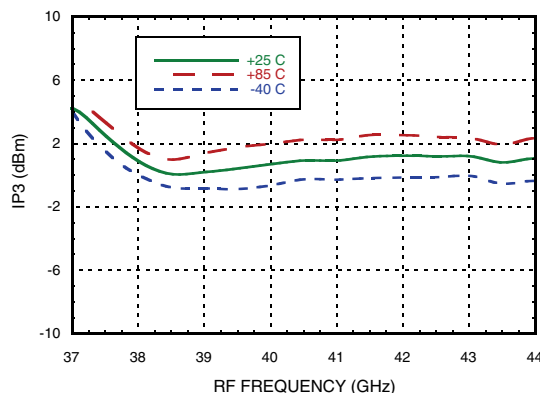
Input P1dB, USB vs. Temperature



Output P1dB, USB vs. Temperature



Input IP3, USB vs. Temperature

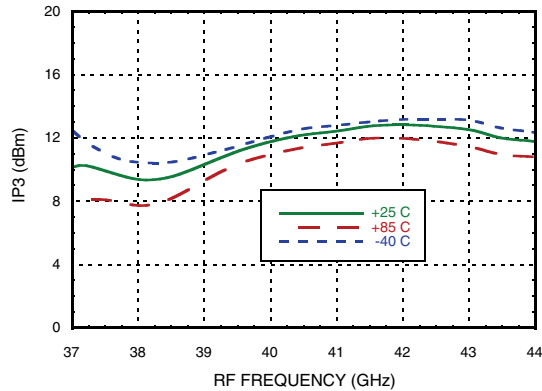




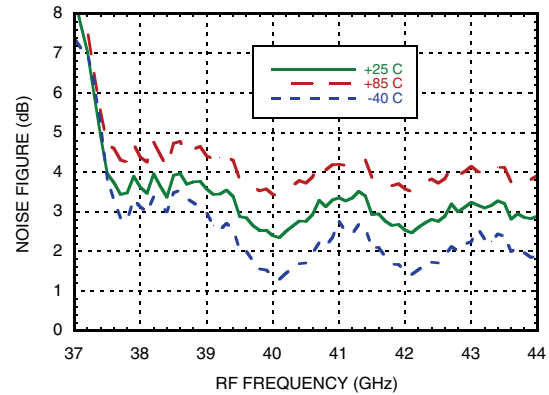
**GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz**

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

Output IP3, USB vs. Temperature



Noise Figure vs. Temperature

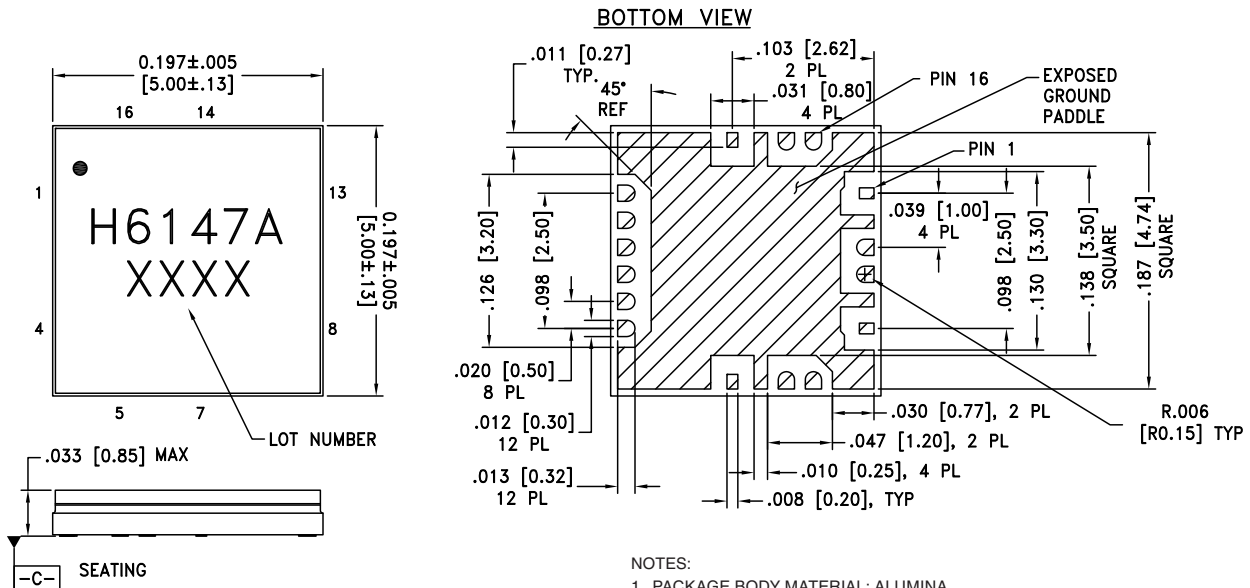



GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz
Absolute Maximum Ratings

| | |
|---|----------------|
| RF Input | +8 dBm |
| LO Input | +10 dBm |
| Bias Voltage, VDLO and VDRF | +3.5V |
| Channel Temperature | 175 °C |
| Continuous P _{diss} (T = 85°C) (derate 17.8 mW/°C above 85°C) | 1.6 W |
| Thermal Resistance (channel to ground paddle) | 56 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |
| ESD Sensitivity (HBM) | Class1A |



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

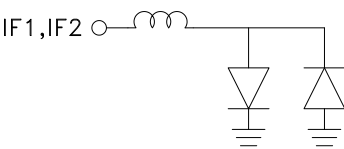
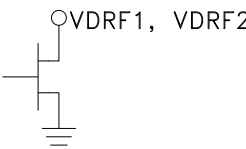
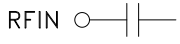

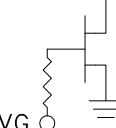
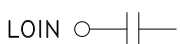
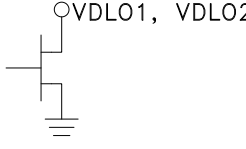
Outline Drawing

Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[2] |
|--------------|-----------------------|------------------|---------------------|--------------------------------|
| HMC6147ALC5A | Alumina, White | Gold over Nickel | MSL3 ^[1] | 6147A XXXX |

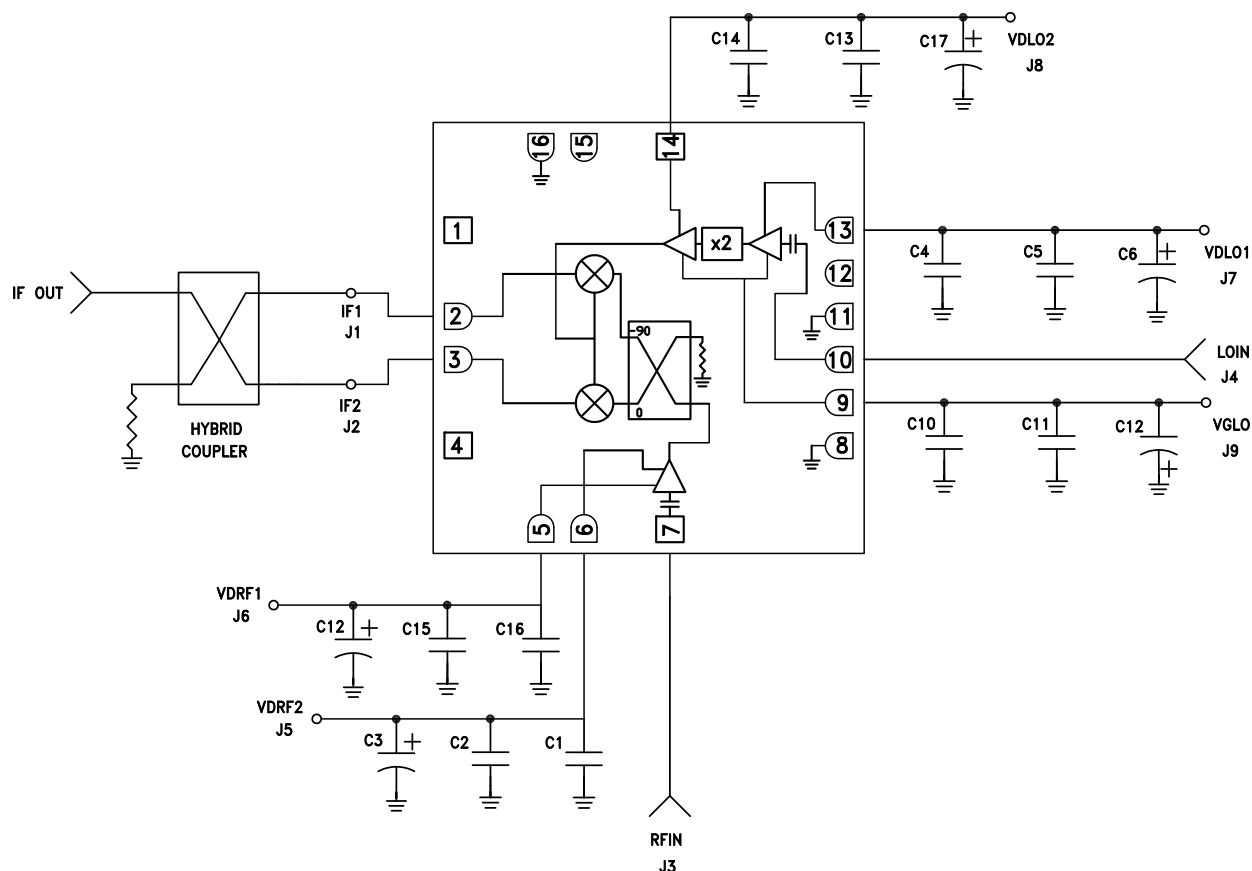
[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX


GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz
Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|-------------|----------|---|---|
| 1, 4, 12,15 | N/C | No connection required. The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. | |
| 2 | IF1 | These pins are DC coupled. For applications not requiring operation to DC this port should be DC blocked externally using a series capacitor whose value has been chosen to pass the necessary frequency range. For operation to DC, this pin must not sink / source more than 3 mA of current or part non-function and possible failure will result. |  |
| 3 | IF2 | | |
| 5 | VDRF1 | Bias for LNA. The recommended DC voltage is 3V |  |
| 6 | VDRF2 | | |
| 7 | RFIN | This pin is AC coupled and matched to 50 Ohms. |  |
| 8,11, 16 | GND | These pins and exposed ground paddle must be connected to RF/DC ground. |  |
| 9 | VG | Adjust VGLO for -1V to 0V to set the multiplier quiescent current to 150mA |  |
| 10 | LOIN | LO Input Port. The recommended LO Power is 0 to 6 dBm |  |
| 13 | VDLO1 | Bias for Multiplier input Buffer Amp. The recommended DC voltage is 3V |  |
| 14 | VDLO2 | Bias for Multiplier output Buffer Amp. The recommended DC voltage is 3V | |

Typical Application

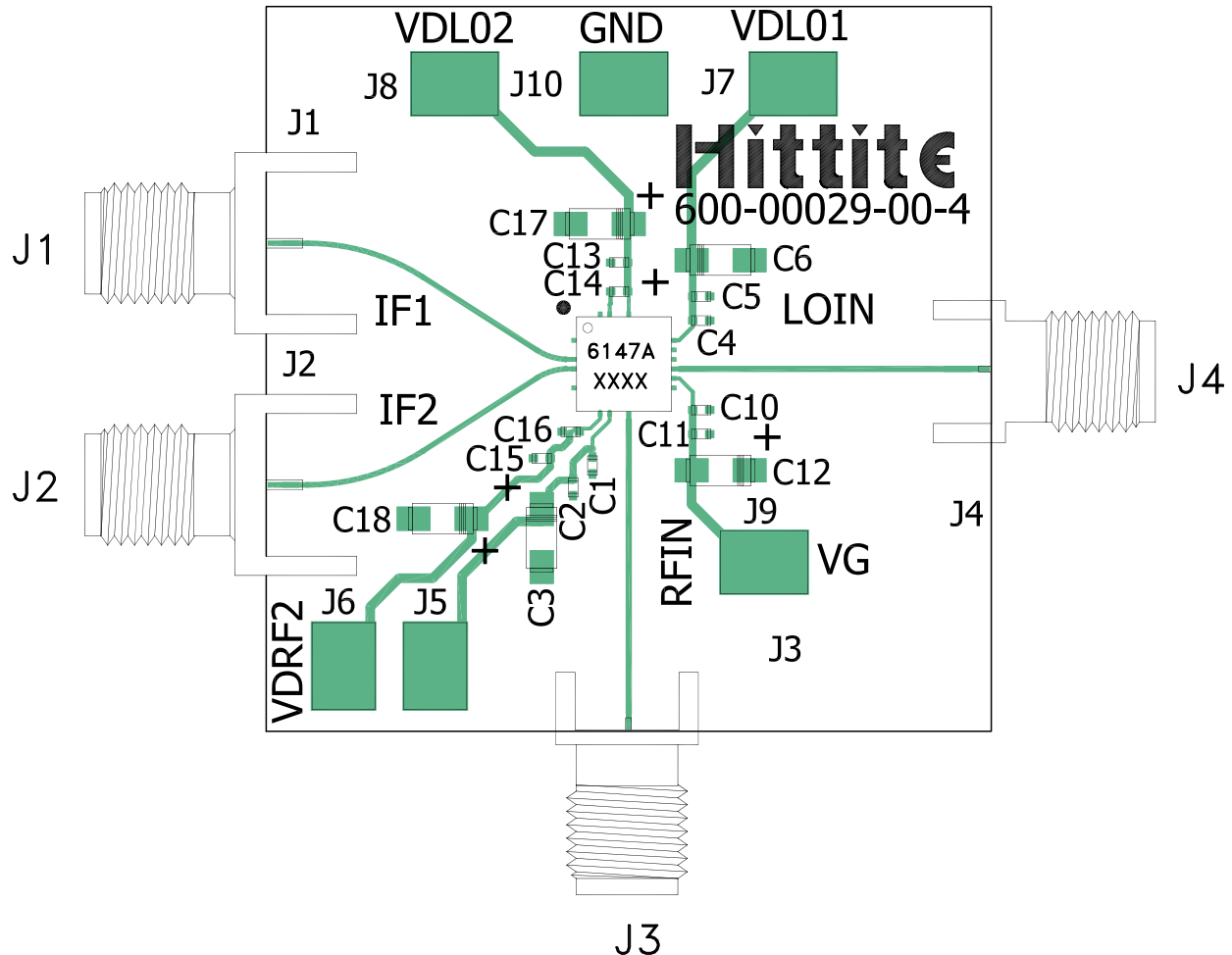


| | |
|-----------------------|------------------------------------|
| C1, C4, C10, C14, C16 | 100 pF Capacitor, 0402 Pkg. |
| C2, C5, C11, C13, C15 | 0.1uF Capacitor, 0402 Pkg. |
| C3, C6, C12, C17, C19 | 4.7 μ F Capacitor, Case A Pkg. |



GaAs MMIC I/Q DOWNCONVERTER
37 - 44 GHz

Evaluation PCB



List of Materials for Evaluation PCB Eval01-HMC6147ALC5A ^[1]

| Item | Description |
|-----------------------|-------------------------------|
| J1, J2 | SMA Connector |
| J3, J4 | K-Connector SRI |
| J5 - J10 | DC Pins |
| C1, C4, C10, C14, C16 | 100 pF Capacitor, 0402 Pkg. |
| C2, C5, C11, C13, C15 | 0.1 uF Capacitor, 0402 Pkg. |
| C3, C6, C12, C17, C18 | 4.7 uF Capacitor, Case A |
| U1 | HMC6147ALC5A Downconverter |
| PCB [2] | 600-00029-00 Evaluation Board |

[1] Reference this number when ordering complete evaluation PCB

[2] 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.