# RF to IF Dual Downconverting Mixer

**1700 - 2200 MHz F1150NBGI**

## General Description

This document describes the specifications for the IDTF1150 Zero-Distortion™ RF to IF Downconverting Mixer. This device is part of a series of downconverting mixers offered with high side or low side injection options for all UTRA bands. See the Part# Matrix for the details of all devices in this series.

The F1150 dual channel device is designed to operate with a single 5V supply. It is optimized for operation in a Multi-mode, Multi-carrier BaseStation Receiver for RF bands from 1700 - 2200 MHz with High Side Injection. IF frequencies from 50 to 450 MHz are supported. Nominally, the device offers +40 dBm Output IP3 with 335 mA of $I_{CC}$. Alternately one can adjust 4 resistor values and a toggle pin to run the device in low current mode with +36 dBm Output IP3 and 235 mA of $I_{CC}$.

## Competitive Advantage

In typical basestation receivers the RF to IF mixer dominates the linearity performance for the entire receive system. Zero-Distortion mixers dramatically improve the maximum signal levels ($IM_3$ tones) that the BTS can withstand at a desired Signal to Noise Ratio (SNR.) Alternately, one can run the device in Low Current Mode to reduce Power consumption significantly. IDT's innovative design allows realization of either benefit.

- ✓ $IP3_O$: ⇑ **5 dB** STD Mode, ⇑ **2 dB** LC Mode
- ✓ Dissipation: ⇓ **40%** LC Mode, ⇓ **12%** STD Mode
- ✓ Allows for higher RF gain improving **Sensitivity**


## Part# Matrix

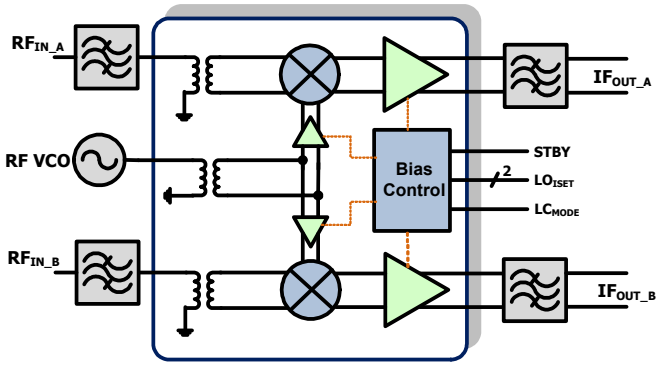
| Part# | RF freq range | UTRA bands | IF freq range | Typ. Gain | Injection |
|---|---|---|---|---|---|
| F1100 | 698 - 915 | 5,6,8,12,13,14,17 ,19,20 | 50 - 450 | 8.5 | High Side |
| F1102 | 698 - 915 | 5,6,8,12,13,14,17 ,19,20 | 50 - 250 | 8.5 | Both |
| **F1150** | **1700 - 2200** | **1,2,3,4,9,10, 33, 34,35, 36, 37,39** | **50 - 450** | **8.5** | **High Side** |
| F1152 | 1400 - 2200 | 1,2,3,4,9,10,11 21[1], 24[1], 33, 34,35, 36, 37,39 | 50 - 350 | 8.4 | Low Side |
| F1162 | 2200 – 2700 | 7,38,40,41[2] | 50 – 500 | 8.9 | Both |

*1 – with High side injection*
*2 – With High side or Low side injection*

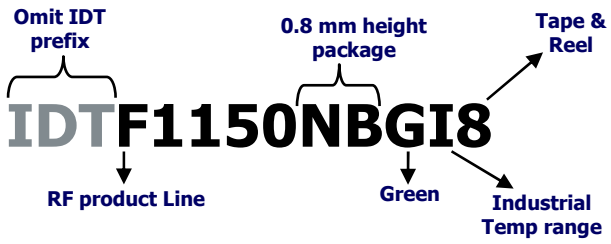
## Features

- Dual Path for Diversity Systems
- Ideal for Multi-Carrier Systems
- 8.5 dB Gain (200 MHz IF)
- Ultra linear +38 dBm $IP3_O$ (350 MHz IF)
- Ultra linear **+40 dBm $IP3_O$ (200 MHz IF)**
- Low NF < 10 dB
- 200 Ω output impedance
- Ultra high +13 dBm $P1dB_I$
- **Pin Compatible** with existing solutions
- 6x6 36 pin package
- **Power Down mode**
- < 200 nsec settling from Power Down
- Minimizes Synth pulling in Standby Mode
- Low Current Mode : **$I_{CC}$ = 235 mA**
- Standard Mode: $I_{CC}$ = 335 mA

## Device Block Diagram




## Ordering Information



## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| VCC to GND | -0.3V to +5.5V |
| STBY, $LC_{MODE}$ | -0.3V to (VCC_ + 0.3V) |
| IF_A+, IF_B+, IF_A-, IF_B-, LO_IN | -0.3V to (VCC_ + 0.3V) |
| LO1_ADJ, LO2_ADJ, IF_BiasA, IF_BiasB to GND | -0.3V to +1.2V |
| RF Input Power (RF_IN[A+, A-, B+, B-]) | +20dBm |
| Continuous Power Dissipation | 2.2W |
| $\theta_{JA}$ (Junction – Ambient) | +35°C/W |
| $\theta_{JC}$ (Junction – Case) The Case is defined as the exposed paddle | +2.1°C/W |
| Operating Temperature Range (Case Temperature) | $T_C$ = -40°C to +100°C |
| Maximum Junction Temperature | 150°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (soldering, 10s) . | +260°C |

*Stresses above those listed above may cause permanent damage to the device. Functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

## IDTF1150 SPECIFICATION (1700 – 2200 MHz MIXER W/HIGH SIDE INJECTION)

Specifications apply at $V_{CC}$ = +5.0V, $F_{RF}$ = **1850 MHz**, $F_{IF}$ = **350MHz**, $P_{LO}$ = 0 dBm, $T_C$ = +25°C, STBY = GND, $LC_{MODE}$ = $V_{IH}$ (STD Mode), EVKit BOM = Standard Mode, Transformer Loss included (not de-embedded) unless otherwise noted.

| Parameter | Comment | Symbol | min | typ | max | units |
|---|---|---|---|---|---|---|
| Logic Input High | For Standby, $LC_{MODE}$ Pins | $V_{IH}$ | ***2*** | | | V |
| Logic Input Low | For Standby, $LC_{MODE}$ Pins | $V_{IL}$ | | | ***0.8*** | V |
| Logic Current | For Standby, $LC_{MODE}$ Pins | $I_{IH}$, $I_{IL}$ | ***-30*** | | ***+30*** | µA |
| Supply Voltage(s) | All $V_{CC}$ pins | $V_{CC}$ | | 4.75 to 5.25 | | V |
| Operating Temperature Range | Case Temperature | $T_{CASE}$ | | -40 to +100 | | degC |
| Supply Current | Total $V_{CC}$ , STD Mode<br>▪ Total Both Channels | $I_{STD}$ | | ***334*** | ***375*** | mA |
| Supply Current | Total $V_{CC}$ , LC Mode<br>▪ $LC_{MODE}$ = GND<br>▪ EVkit BOM = LC Mode<br>▪ Total Both Channels | $I_{LC}$ | | ***235*** | ***260*** | mA |
| Supply Current | Standby Mode<br>▪ STBY = $V_{IH}$<br>▪ Total Both Channels | $I_{STBY}$ | | ***23*** | ***30*** | mA |
| RF Freq Range | Operating Range | $F_{RF}$ | | 1700 to 2200 | | MHz |
| IF Freq Range | Operating Range | $F_{IF}$ | | 50 to 450 | | MHz |
| LO Freq Range | High Side Injection | $F_{LO}$ | | 1750 to 2650 | | MHz |
| LO Power | | $P_{LO}$ | | -3 to +6 | | dBm |
| RF Input Impedance | Single Ended<br>*Return Loss ~17 dB* | $Z_{RF}$ | | 50 | | Ω |
| IF Output Impedance | Differential<br>*Return Loss ~ 13 dB* | $Z_{IF}$ | | 200 | | Ω |
| LO port Impedance | Single Ended<br>*Return Loss ~15 dB* | $Z_{LO}$ | | 50 | | Ω |
| Settling Time | • Pin = -13 dBm<br>• Gate STBY from $V_{IH}$ to $V_{IL}$<br>• Time for IF Signal to settle to within 0.1 dB of final value | $T_{SETT}$ | | 0.155 | | µsec |
| Gain STD Mode | Conversion Gain<br>• $F_{RF}$ = 1710 MHz<br>• $LC_{MODE}$ = $V_{IH}$<br>• EVkit BOM = STD Mode<br>• $F_{IF}$ = 350 MHz | $G_{STD}$ | ***7.0*** | ***8.1*** | ***8.6*** | dB |
| Gain LC Mode | Conversion Gain<br>• $F_{RF}$ = 2050 MHz<br>• $LC_{MODE}$ = GND<br>• EVkit BOM = LC Mode<br>• $F_{IF}$ = 200 MHz | $G_{LC}$ | ***7.2*** | ***8.2*** | ***8.8*** | dB |
| NF STD Mode | Noise Figure | $NF_{STD}$ | | 10 | | dB |

## IDTF1150 SPECIFICATION (CONTINUED)

| Parameter | Comment | Symbol | min | typ | max | units |
|---|---|---|---|---|---|---|
| NF LC Mode | Noise Figure<br>• $LC_{MODE}$ = GND<br>• EVkit BOM = LC Mode<br>• $F_{IF}$ = 200 MHz | $NF_{LC}$ | | 9.6 | | dB |
| NF w/Blocker | ▪ -100 MHz offset blocker<br>▪ $P_{IN}$ = +4 dBm<br>▪ $F_{IF}$ = 250 MHz | $NF_{BLK}$ | | 17.5 | | dB |
| Output IP3 – Narrowband | ▪ $P_{IN}$ = -10 dBm per tone<br>▪ 800 KHz Tone Separation | $IP3_{O1}$ | 36 | 38 | | dBm |
| Output IP3 – Wideband | ▪ $P_{IN}$ = -10 dBm per tone<br>▪ 30 MHz Tone Separation | $IP3_{O2}$ | | 37 | | dBm |
| Output IP3 – $LC_{MODE}$ | ▪ $P_{IN}$ = -5 dBm per tone<br>▪ $F_{RF}$ = 1850 MHz<br>▪ $F_{IF}$ = 200 MHz<br>▪ 800 KHz Tone Separation<br>▪ $LC_{MODE}$ = GND<br>▪ EVKit BOM = LC Mode | $IP3_{O3}$ | ***33*** | ***36*** | | dBm |
| 2RF – 2LO rejection | ▪ $P_{RF}$ = -10 dBm<br>▪ Frequency = $F_{RF}$ + ½ $F_{IF}$ | 2x2 | | -74 | -64 | dBc |
| 1 dB Compression | ▪ Input referred | $P1dB_{I1}$ | 12 | 12.8 | | dBm |
| 1 dB Compression - $LC_{MODE}$ | ▪ Input referred<br>▪ $LC_{MODE}$ = GND<br>▪ EVKit BOM = LC Mode<br>▪ $F_{IF}$ = 200 MHz | $P1dB_{I2}$ | ***8*** | ***10.6*** | | dBm |
| Gain Comp. w/blocker | ▪ Blocker → unmodulated tone<br>▪ $P_{IN}$ = +8 dBm, -100 MHz offset<br>▪ Signal Pin Tone = -20 dBm<br>▪ Measure ΔG of signal<br>▪ $F_{IF}$ = 250 MHz | $\Delta G_{AC}$ | | 0.15 | | dB |
| Channel Isolation | IF_B Pout vs. IF_A w/ RF_A input | $ISO_C$ | | 52 | | dB |
| LO to IF leakage | | $ISO_{LI}$ | | -39 | -35 | dBm |
| RF to IF leakage | Pin = -10 dBm | $ISO_{RI}$ | | -30 | -22.5 | dBm |
| LO to RF leakage | | $ISO_{LR}$ | | -40 | | dBm |

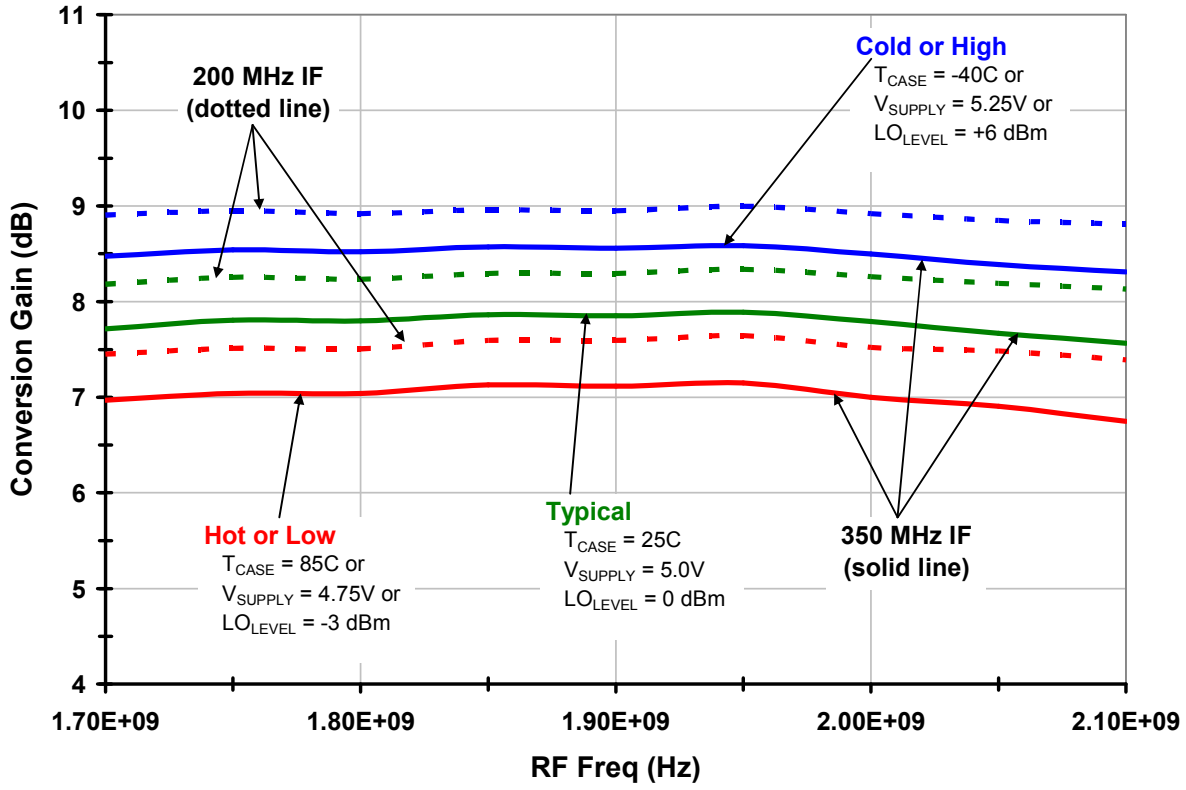
1 – Items in min/max columns in ***bold italics*** are Guaranteed by Test

2 – All other Items in min/max columns are Guaranteed by Design Characterization

## TYPICAL OPERATING CONDTIONS

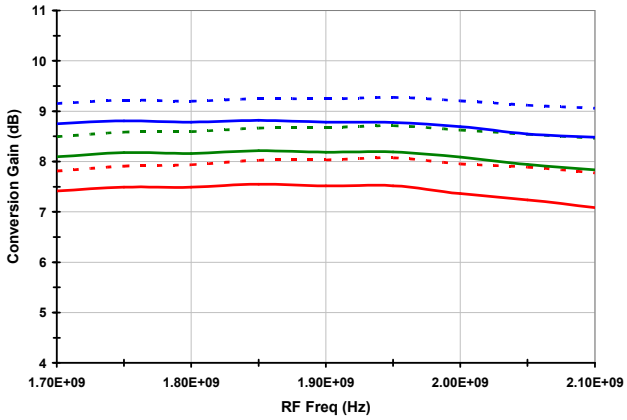
### Unless otherwise Noted, the following Apply

- High Side Injection, 350 MHz IF & 200 MHz IF
- RF frequency = 1850 MHz for single point measurements
- Average of Channel A & Channel B
- Pin = -10 dBm, 800KHz Tone Spacing
- Use the Decoder example below for the Typ Op graphs on pages 6 – 10 & 13 - 17

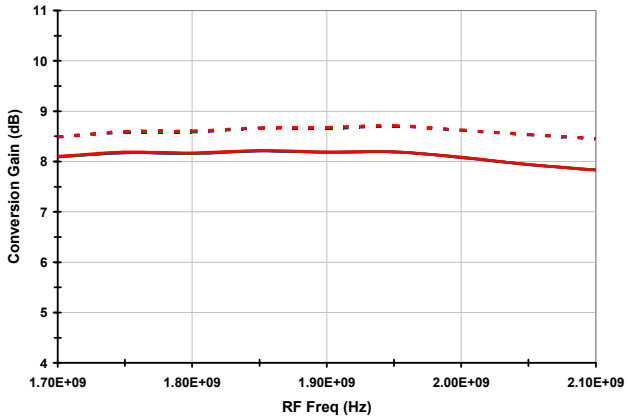


## TYPICAL OPERATING CONDITIONS STD MODE (1) – SEE TRACE DECODER ON PAGE 5

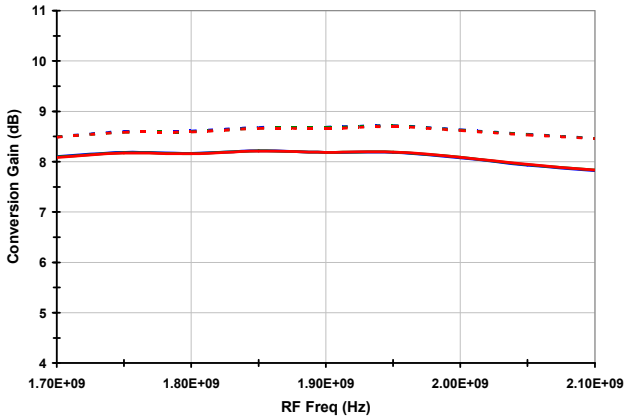
### Gain vs. Temperature



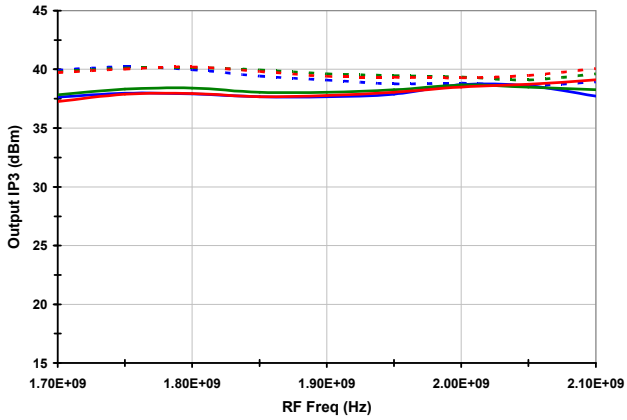

### Gain vs. $V_{CC}$



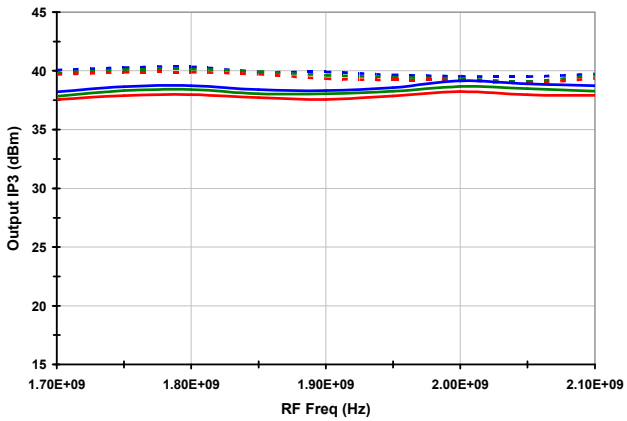

### Gain vs. LO Level



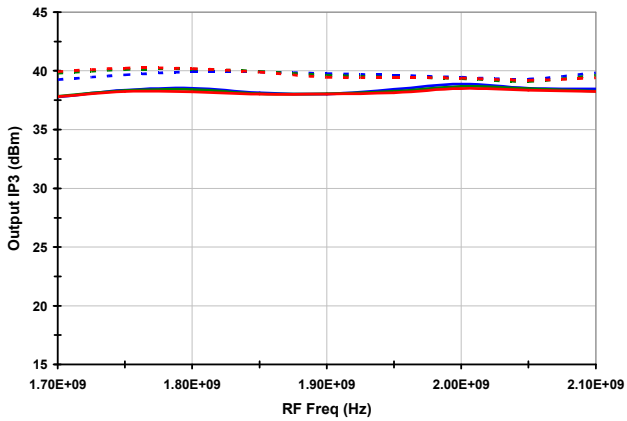

### Output IP3 vs. Temperature




### Output IP3 vs. $V_{CC}$

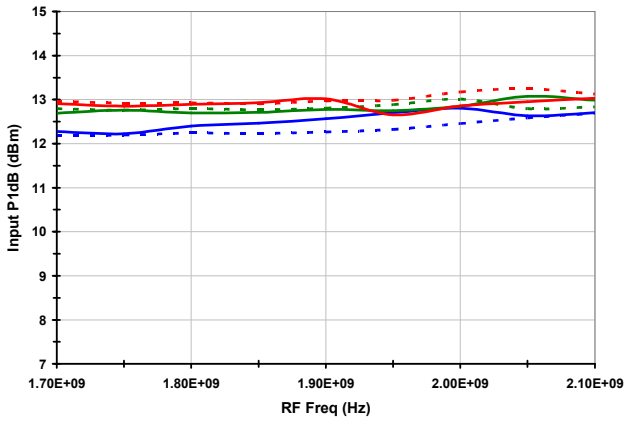



### Output IP3 vs. LO Level

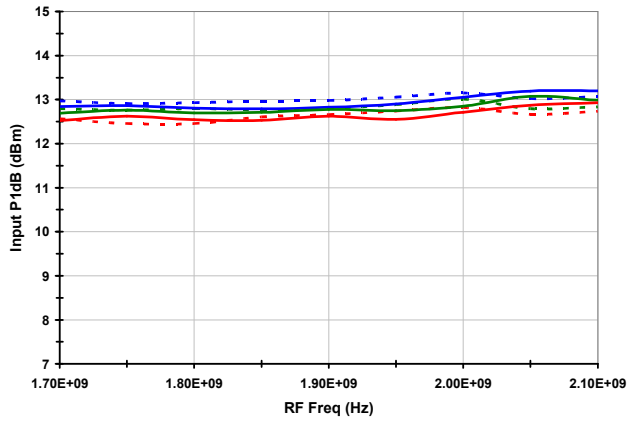


## TYPICAL OPERATING CONDITIONS STD MODE (2) - SEE TRACE DECODER ON PAGE 5

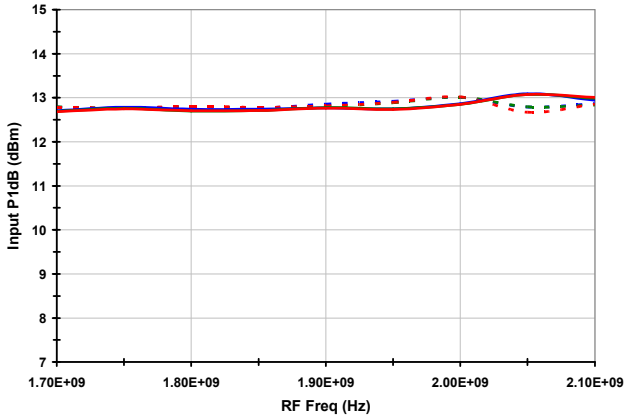
### P1dB vs. Temperature



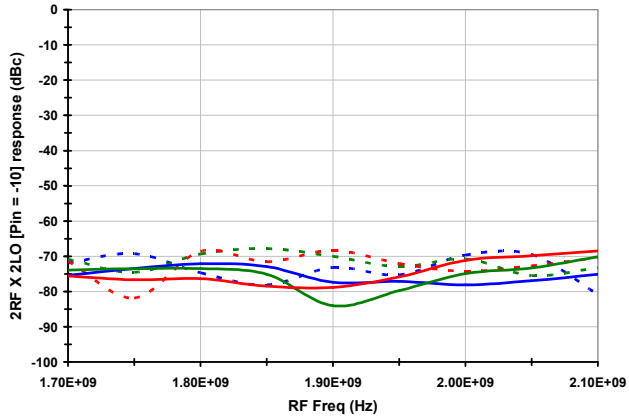

### P1dB vs. $V_{CC}$



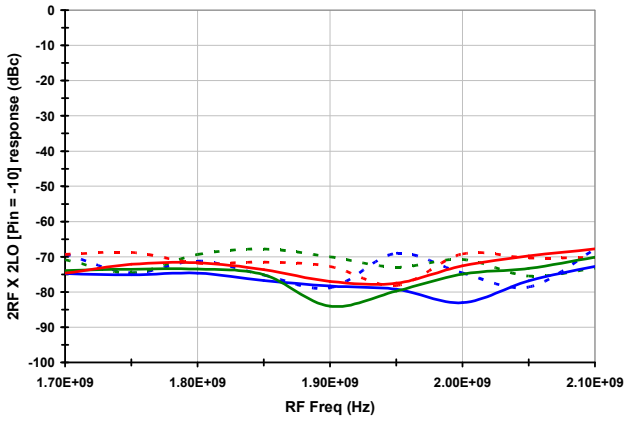

### P1dB vs. LO Level



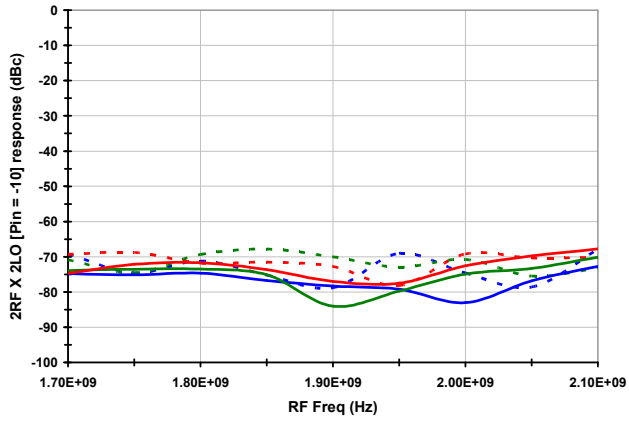

### 2RF x 2LO rejection vs. Temperature




### 2RF x 2LO Rejection vs. $V_{CC}$

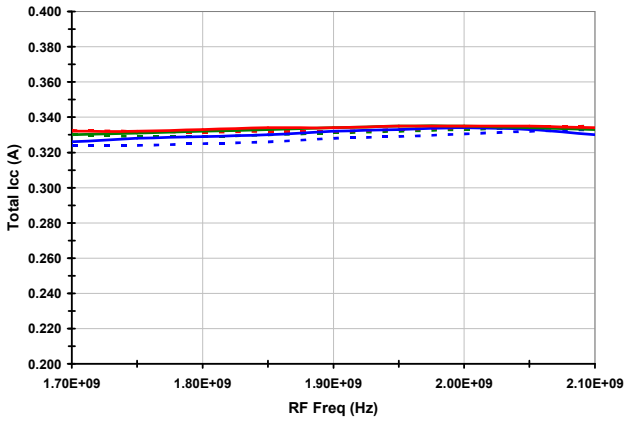



### 2RF x 2LO rejection vs. LO Level

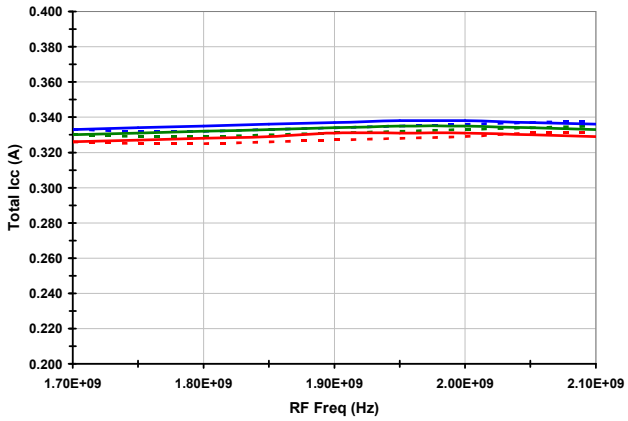


## TYPICAL OPERATING CONDITIONS STD MODE (3) – SEE TRACE DECODER ON PAGE 5

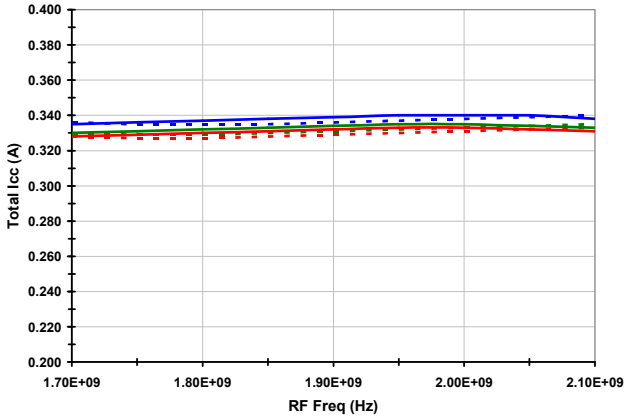
### $I_{CC}$ vs. Temperature



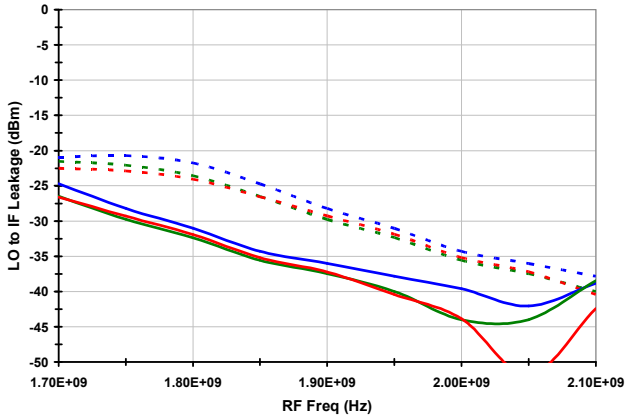

### $I_{CC}$ vs. $V_{CC}$



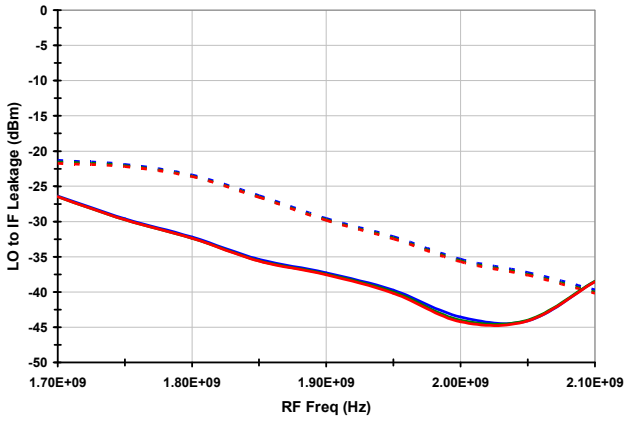

### $I_{CC}$ vs. LO Level



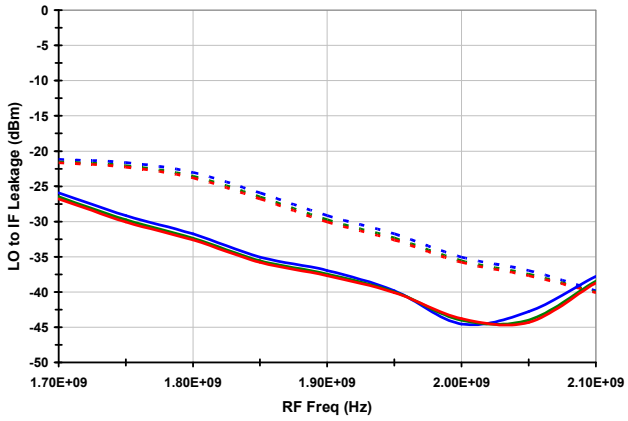

### LO-IF Leakage vs. Temperature




### LO-IF Leakage vs. $V_{CC}$

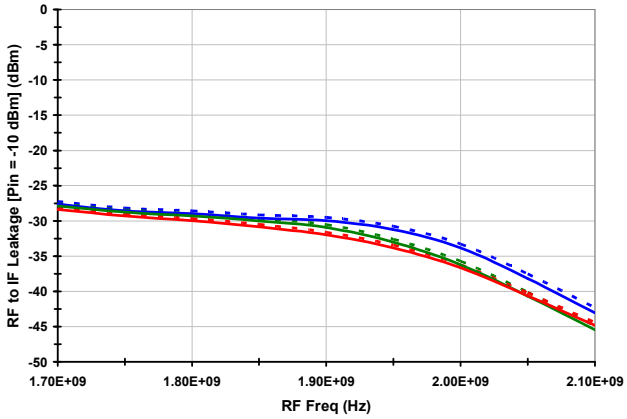



### LO-IF Leakage vs. LO Level

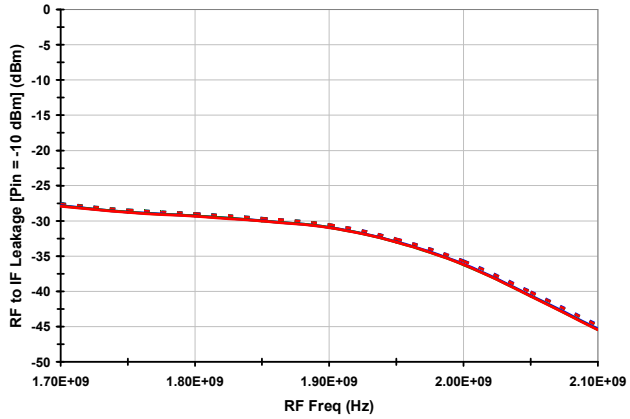


## TYPICAL OPERATING CONDITIONS STD MODE (4) – SEE TRACE DECODER ON PAGE 5

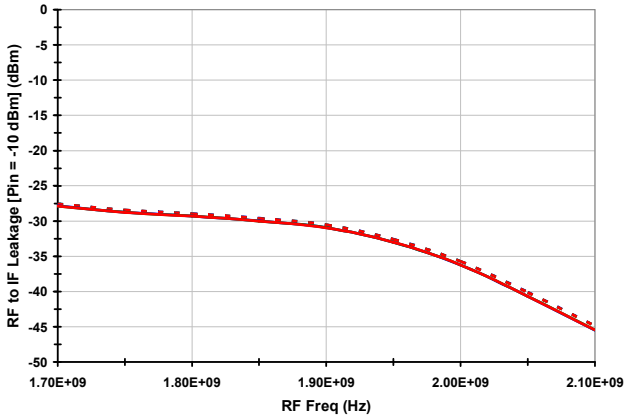
### RF-IF Leakage vs. Temperature



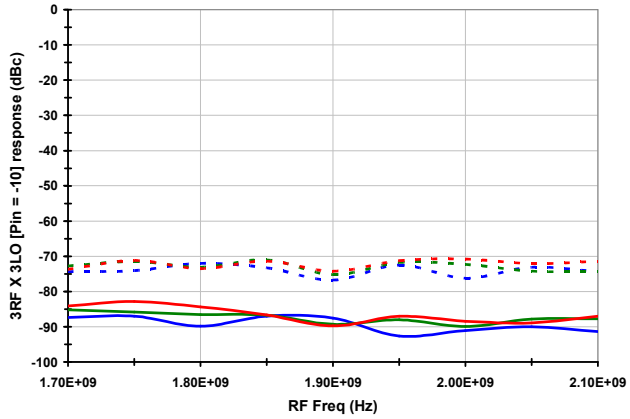

### RF-IF Leakage vs. $V_{CC}$



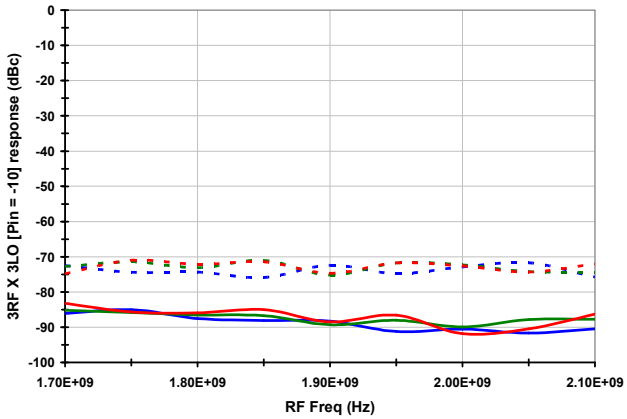

### RF-IF Leakage vs. LO Level



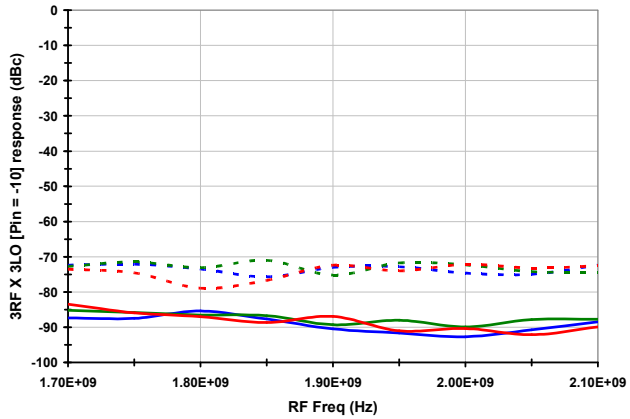

### 3RF X 3LO Rejection vs. Temperature




### 3RF X 3LO Rejection vs. $V_{CC}$

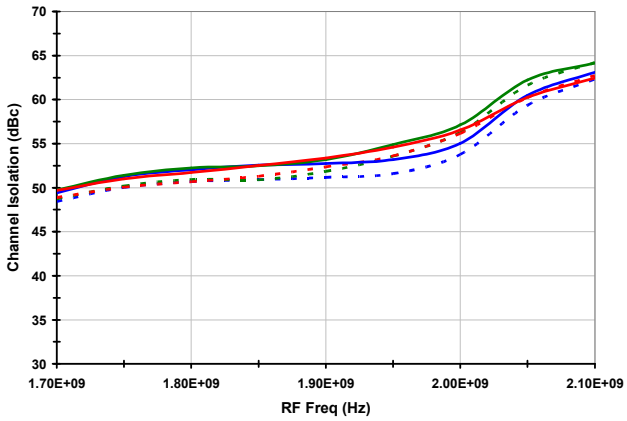



### 3RF X 3LO Rejection vs. LO Level

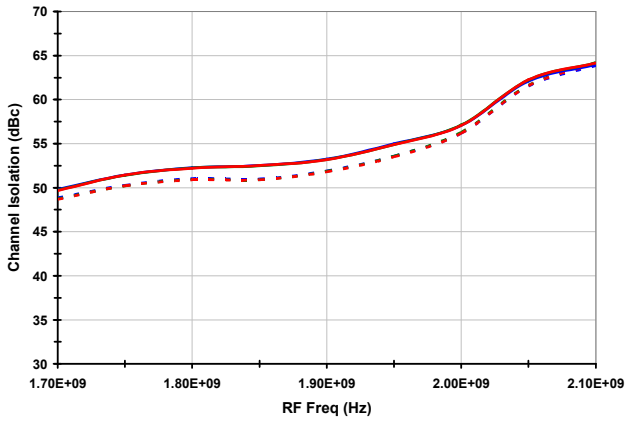


## TYPICAL OPERATING CONDITIONS STD MODE (5) – SEE TRACE DECODER ON PAGE 5

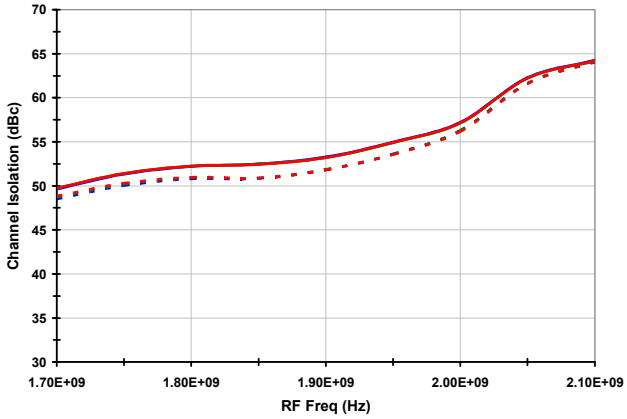
### Channel Isolation vs. Temperature



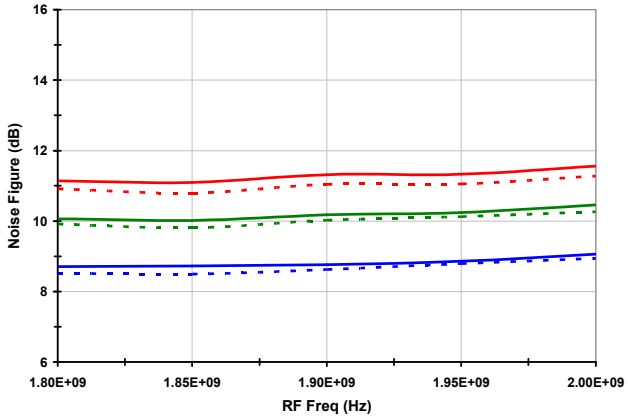

### Channel Isolation vs. $V_{CC}$



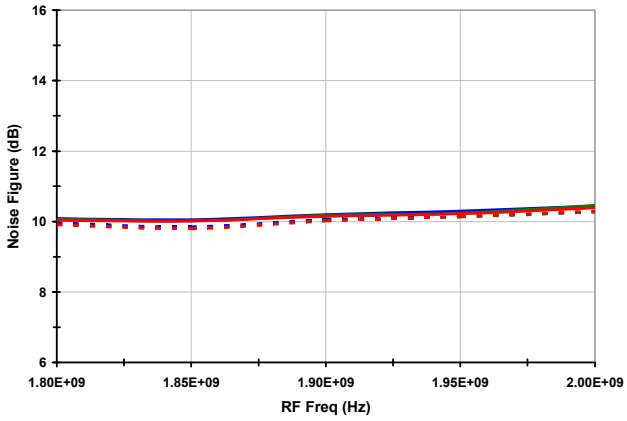

### Channel Isolation vs. LO Level



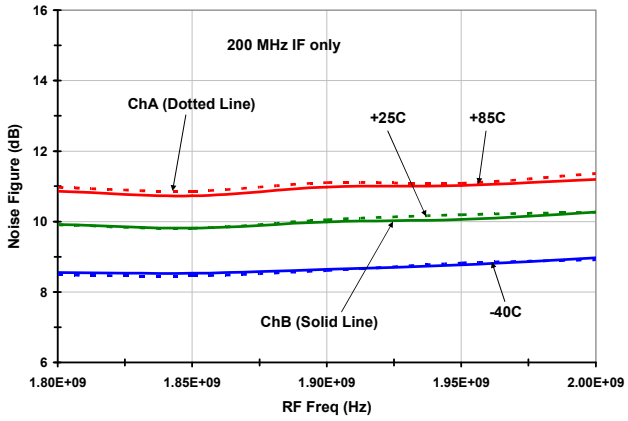

### Noise Figure vs. Temperature




### Noise Figure vs. $V_{CC}$

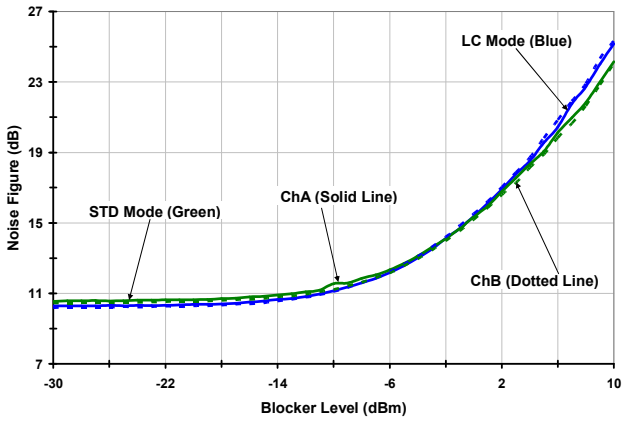



### Noise Figure ChA vs. ChB

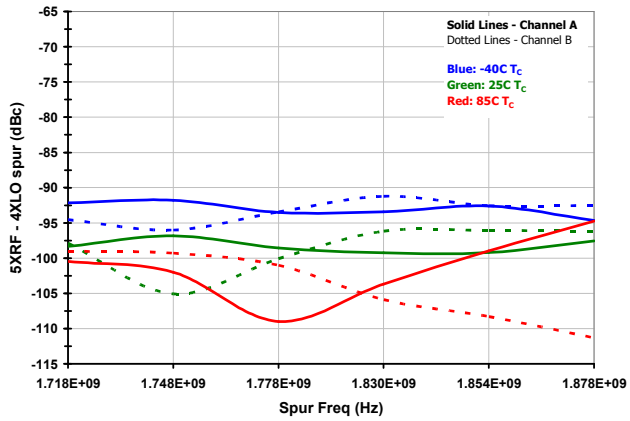


## TYPICAL OPERATING CONDITIONS – GENERAL (-1-)

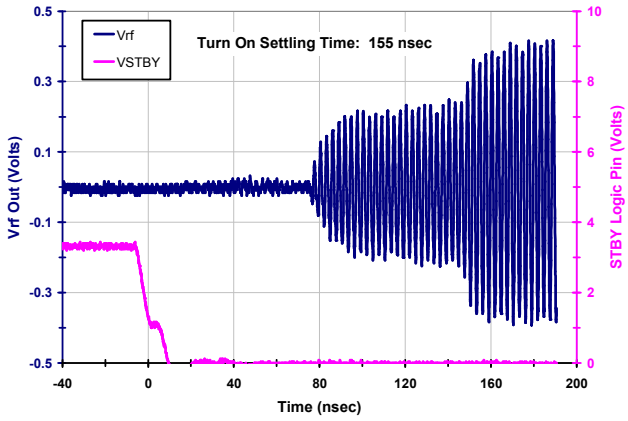
### NF v. Blocker (RF = 1850 MHz, IF = 250 MHz, $T_A$ = 25C)



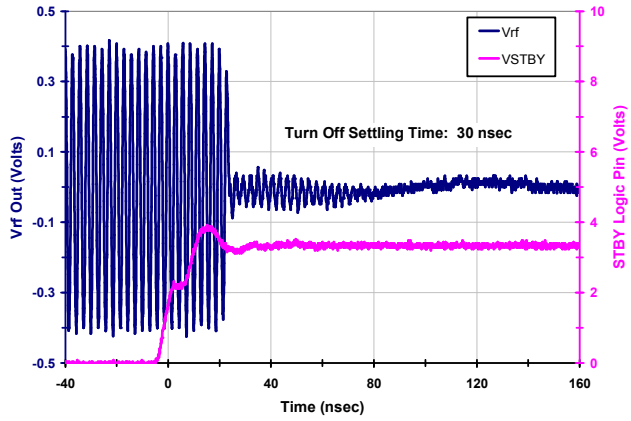

### 5x-4 Spur (+5 dBm Pin, IF = 350 MHz, STD Mode)



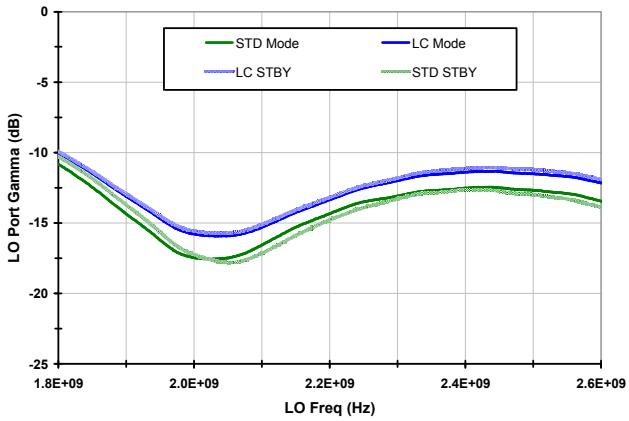

### Settling Time (STBY -> $V_{IL}$)



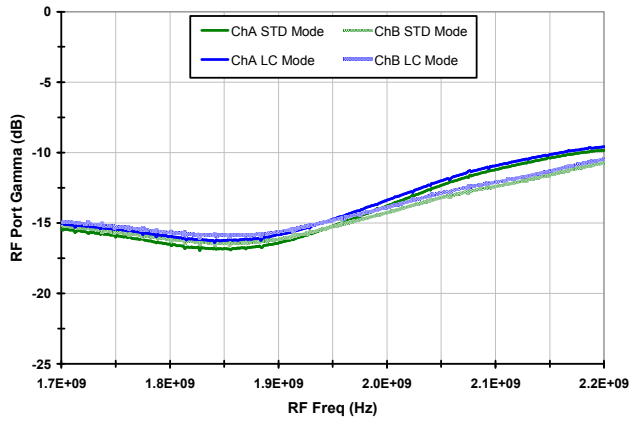

### Settling Time (STBY -> $V_{IH}$)




### EVKit LO Port Match ($T_A$ = 25C, $P_{MEAS}$ = 0 dBm)

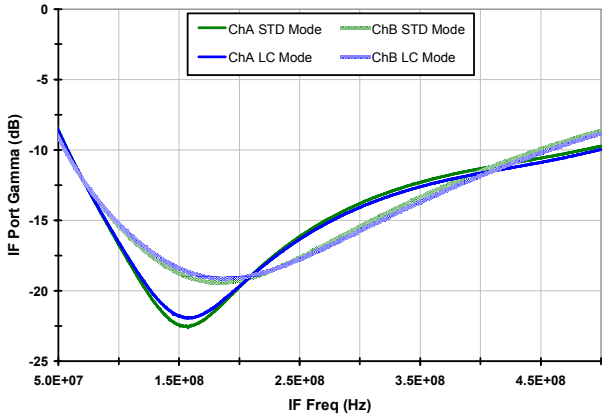



### EVkit RF Port Match ($T_A$ = 25C)

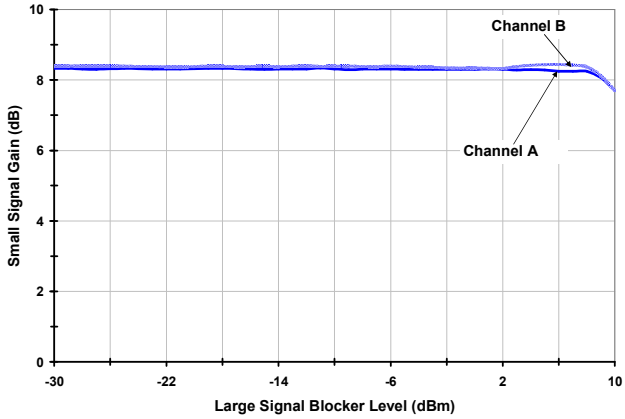


## TYPICAL OPERATING CONDITIONS – GENERAL (-2-)

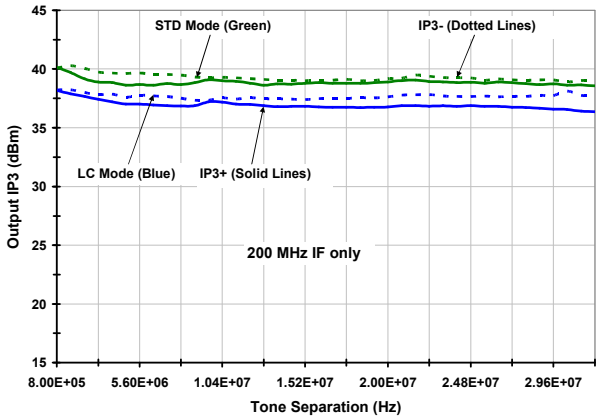
### EVkit IF Port Match ($T_A$ = 25C)



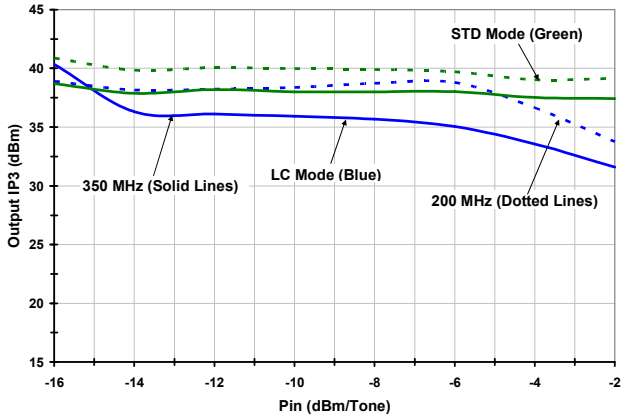

### Small Signal Compression (IF = 250 MHz, STD Mode)



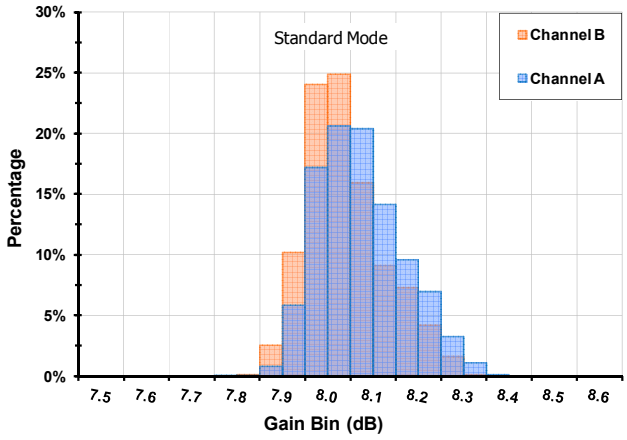

### $IP3_O$ vs. Tone Δf ($T_A$ = 25C, Freq = 1850 MHz)



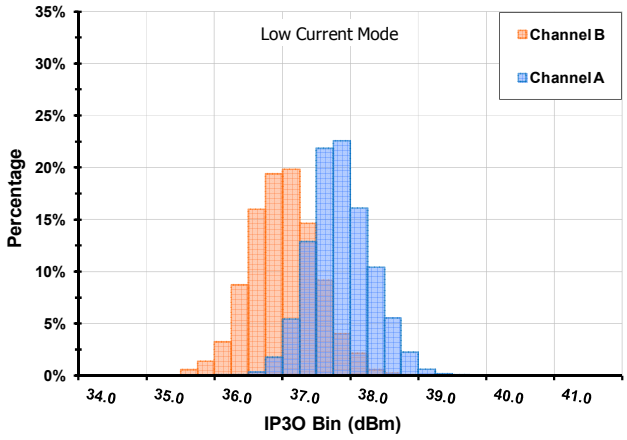

### $IP3_O$ vs. RF Power ($T_A$ = 25C, Freq = 1850 MHz)




### Gain Distribution (N = 2348, $F_{RF}$ = 1710M , $F_{IF}$ = 350M)

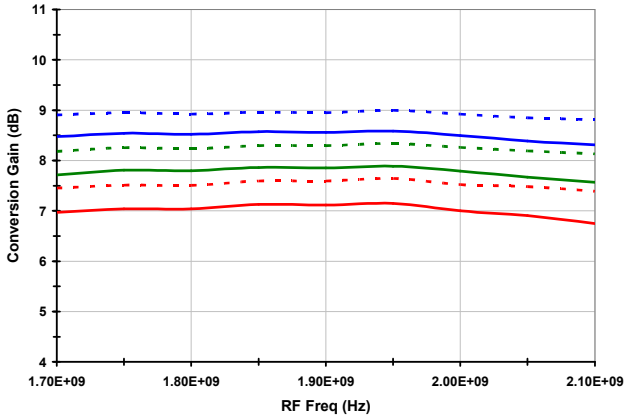



### $IP3_O$ Distribution (N = 2348, $F_{RF}$ = 1850M , $F_{IF}$ = 200M)

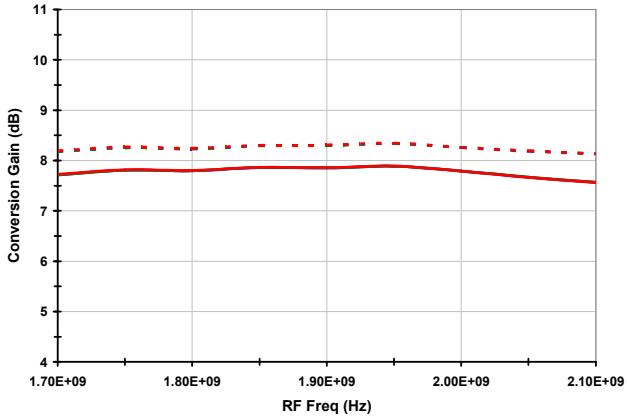


## TYPICAL OPERATING CONDITIONS LC MODE (1) – SEE TRACE DECODER ON PAGE 5

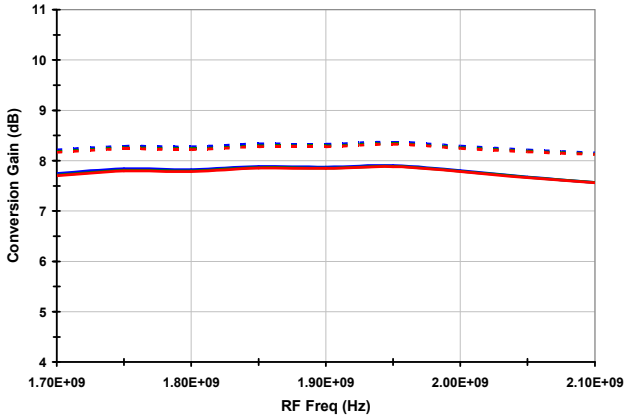
### Gain vs. Temperature



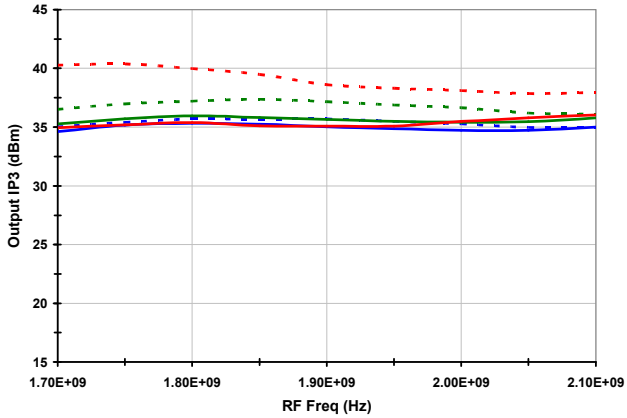

### Gain vs. $V_{CC}$



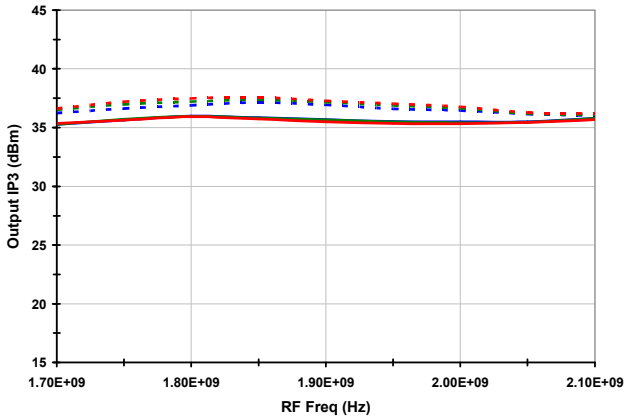

### Gain vs. LO Level



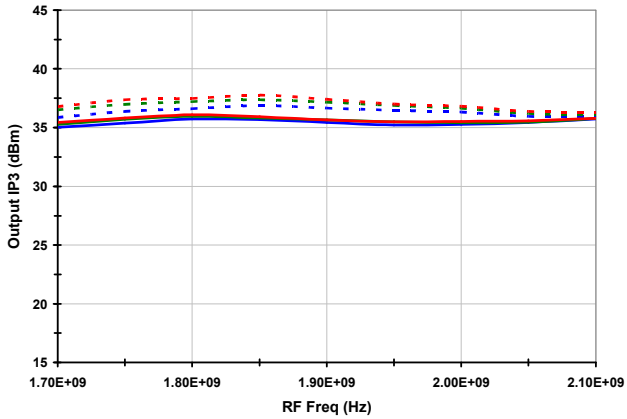

### Output IP3 vs. Temperature




### Output IP3 vs. $V_{CC}$

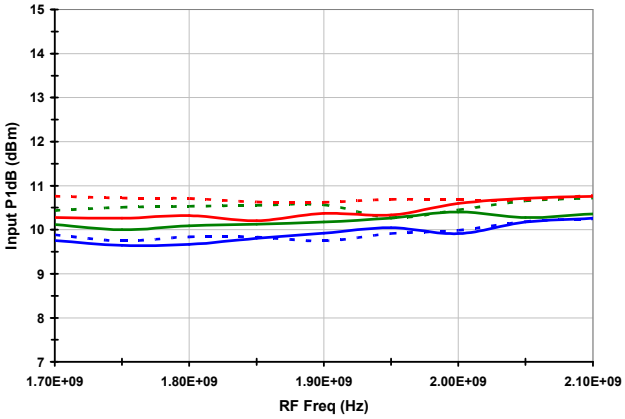



### Output IP3 vs. LO Level

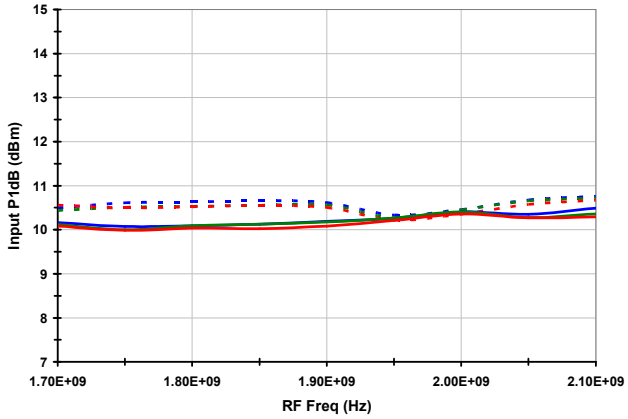


## TYPICAL OPERATING CONDITIONS LC MODE (2) - SEE TRACE DECODER ON PAGE 5

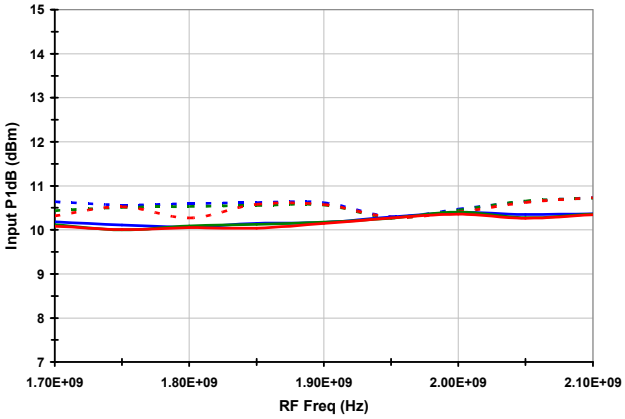
### P1dB vs. Temperature



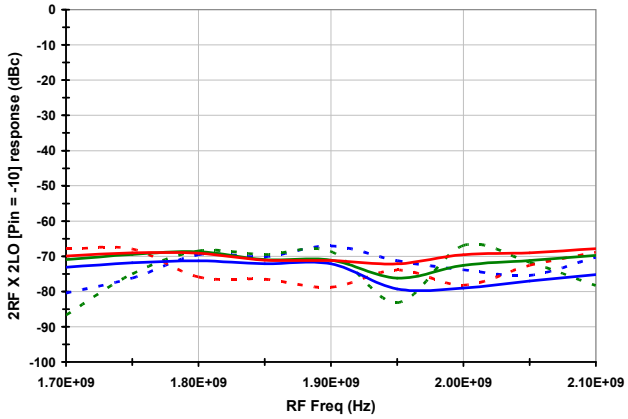

### P1dB vs. $V_{CC}$



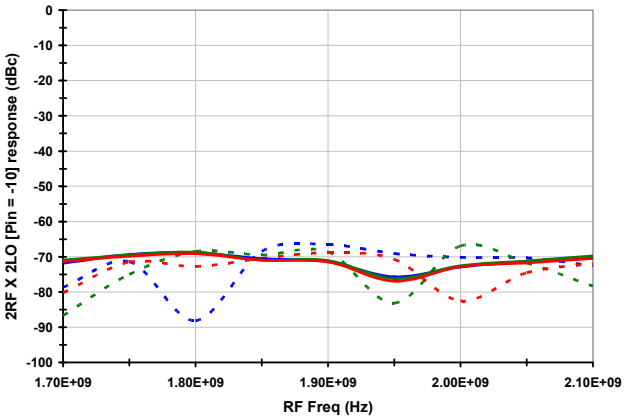

### P1dB vs. LO Level



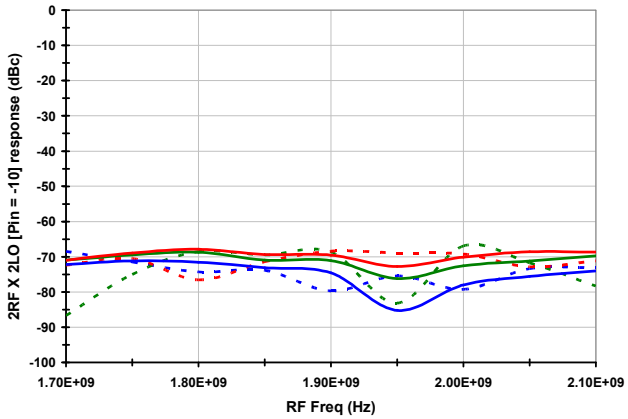

### 2RF x 2LO rejection vs. Temperature




### 2RF x 2LO Rejection vs. $V_{CC}$

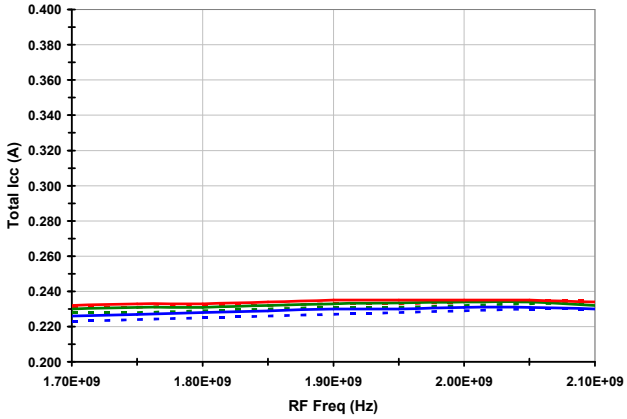



### 2RF x 2LO rejection vs. LO Level

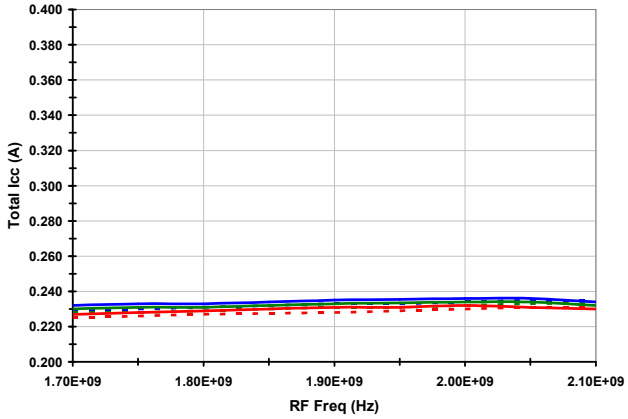


## TYPICAL OPERATING CONDITIONS LC MODE (3) – SEE TRACE DECODER ON PAGE 5

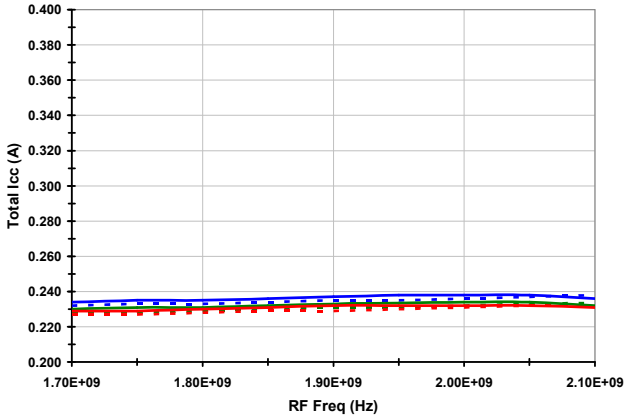
### $I_{CC}$ vs. Temperature



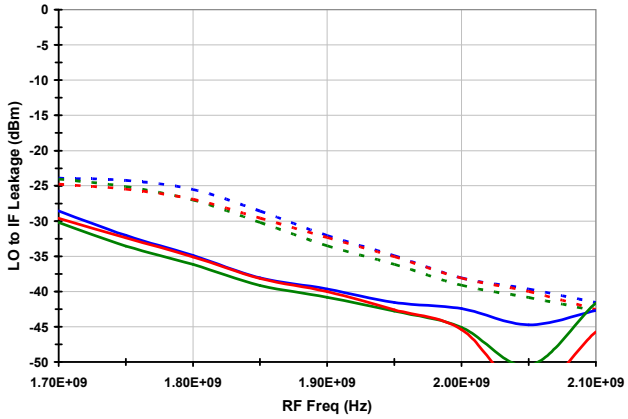

### $I_{CC}$ vs. $V_{CC}$



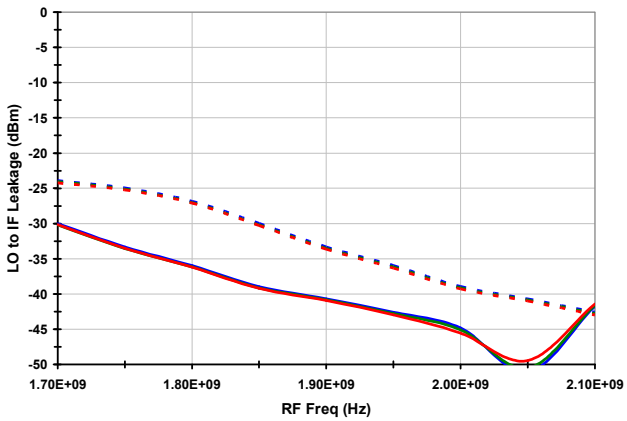

### $I_{CC}$ vs. LO Level



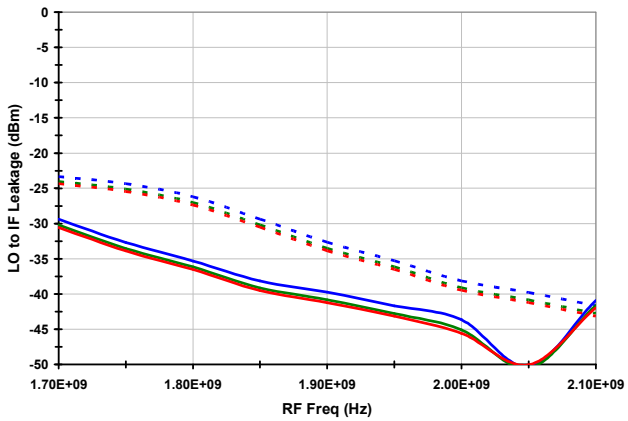

### LO-IF Leakage vs. Temperature




### LO-IF Leakage vs. $V_{CC}$

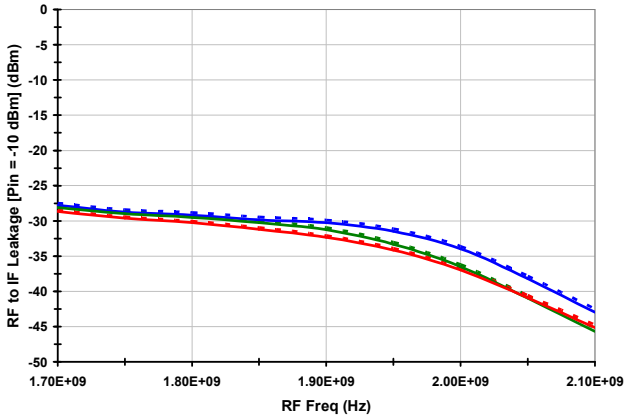



### LO-IF Leakage vs. LO Level

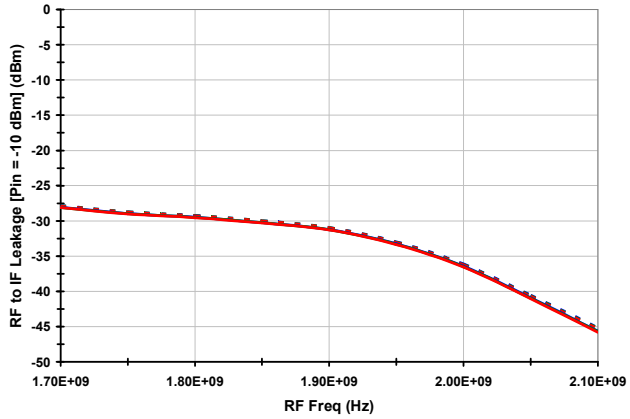


## TYPICAL OPERATING CONDITIONS LC MODE (4) – SEE TRACE DECODER ON PAGE 5

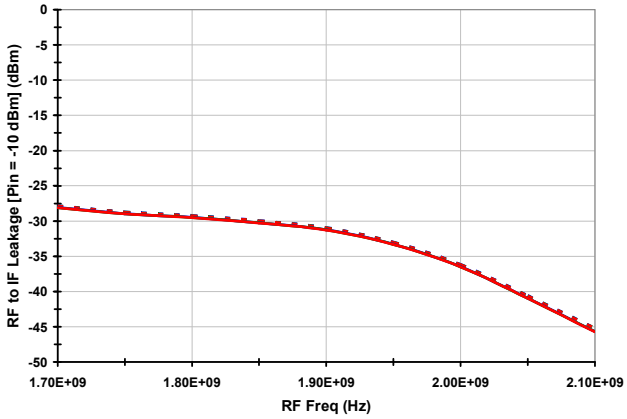
### RF-IF Leakage vs. Temperature



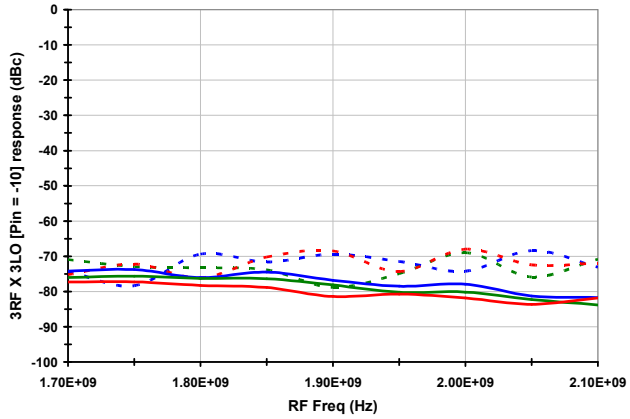

### RF-IF Leakage vs. $V_{CC}$



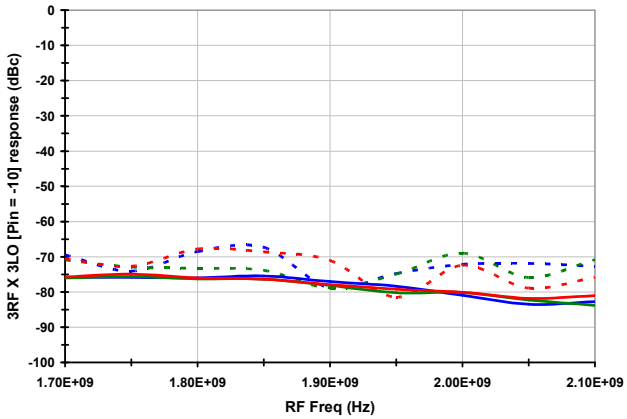

### RF-IF Leakage vs. LO Level



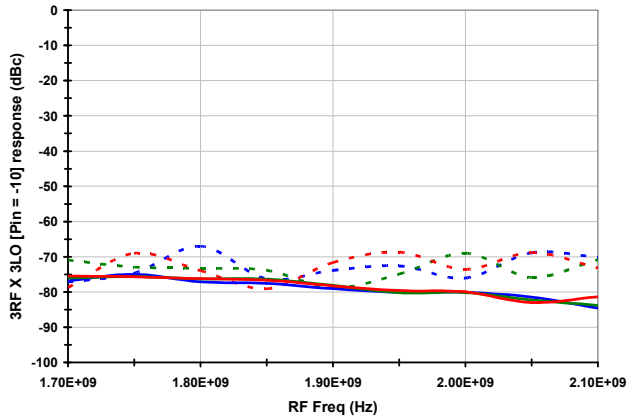

### 3RF X 3LO Rejection vs. Temperature




### 3RF X 3LO Rejection vs. $V_{CC}$

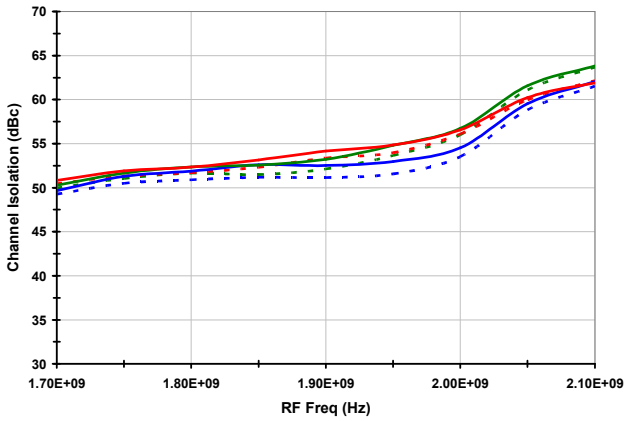



### 3RF X 3LO Rejection vs. LO Level

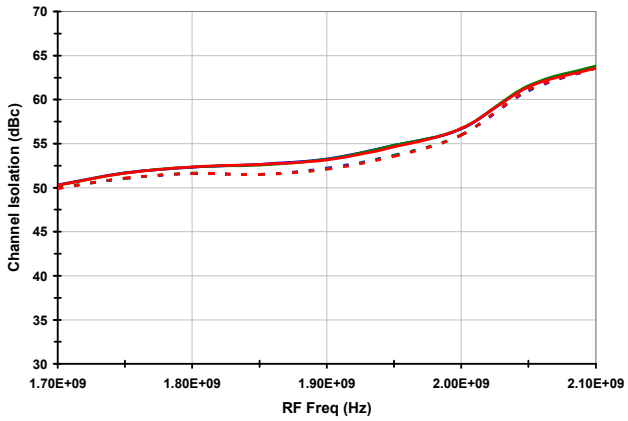


## TYPICAL OPERATING CONDITIONS LC MODE (5) – SEE TRACE DECODER ON PAGE 5

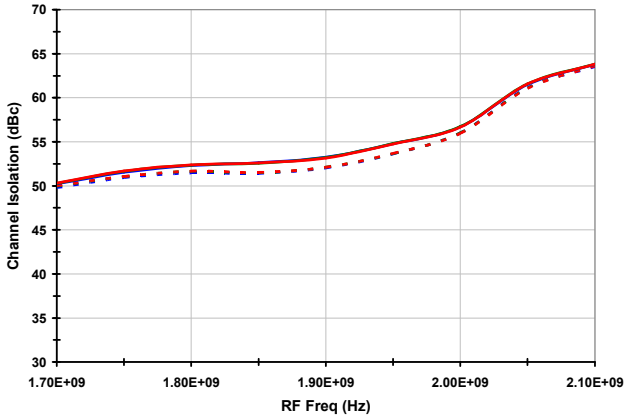
### Channel Isolation vs. Temperature



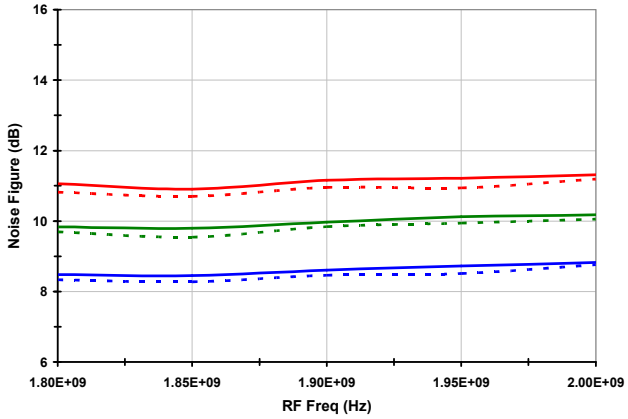

### Channel Isolation vs. $V_{CC}$



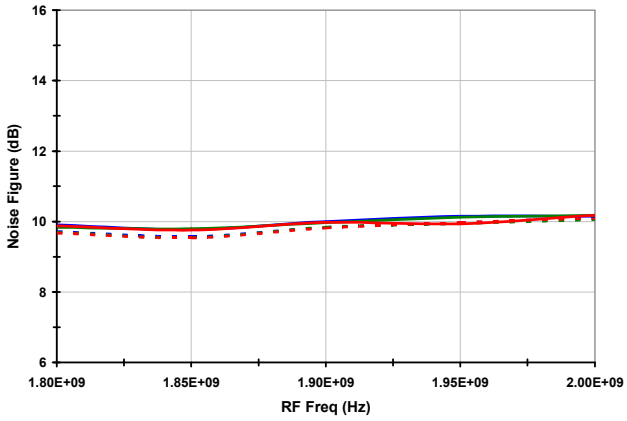

### Channel Isolation vs. LO Level



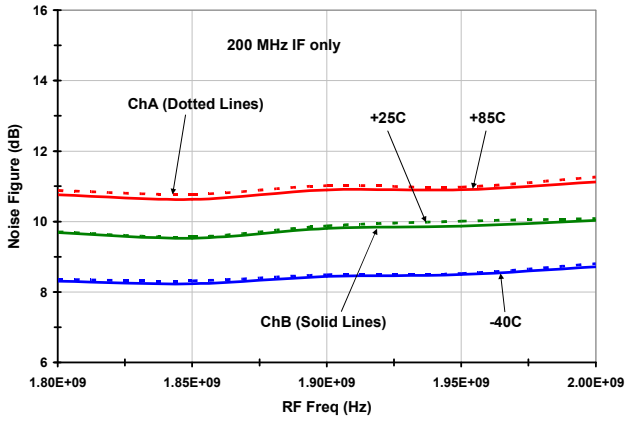

### Noise Figure vs. Temperature




### Noise Figure vs. $V_{CC}$

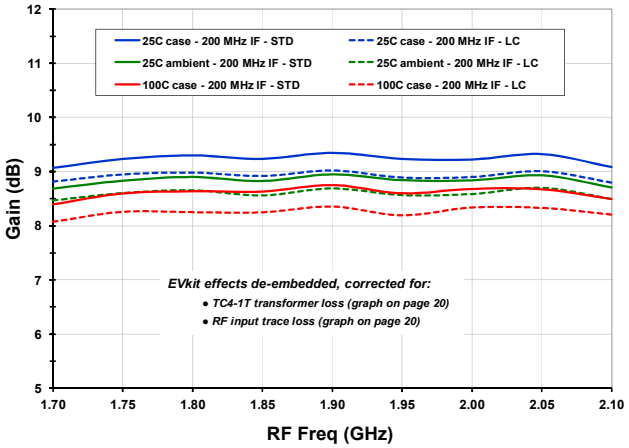



### Noise Figure ChA vs. ChB

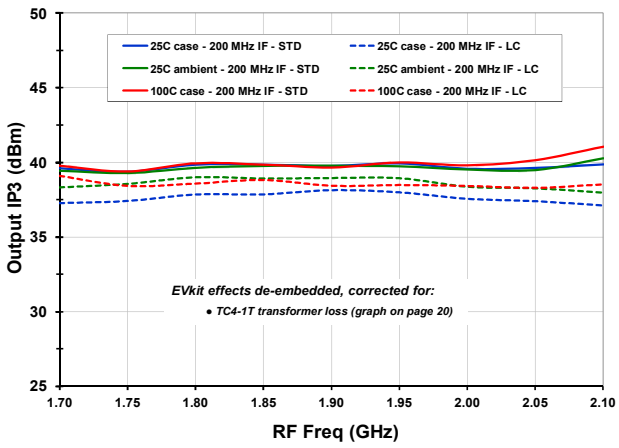


## HIGH TEMP OPERATING CONDITIONS [200 MHz IF] (1)

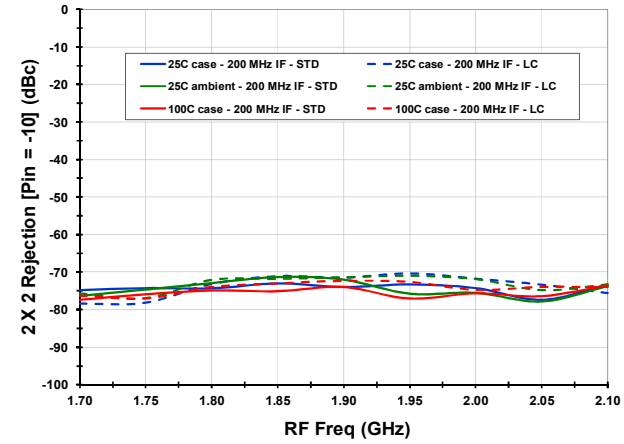
### Gain [EVKit de-embedded]



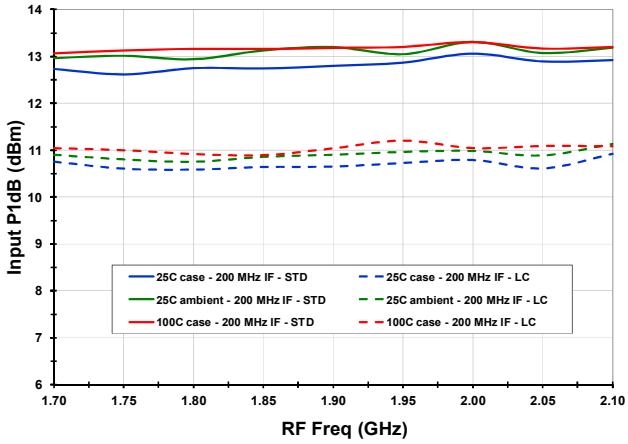

### Output IP3 [EVkit de-embedded]



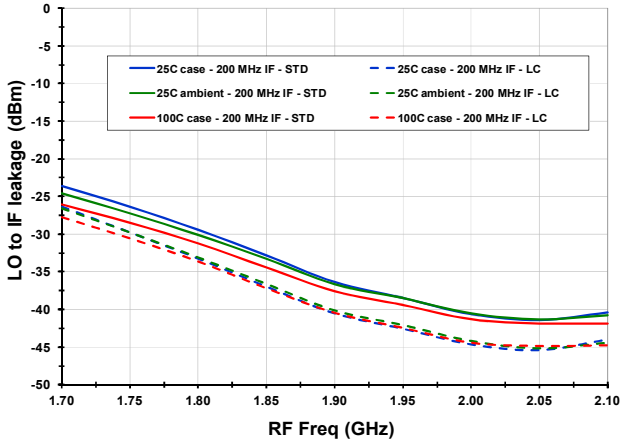

### 2RF x 2LO rejection



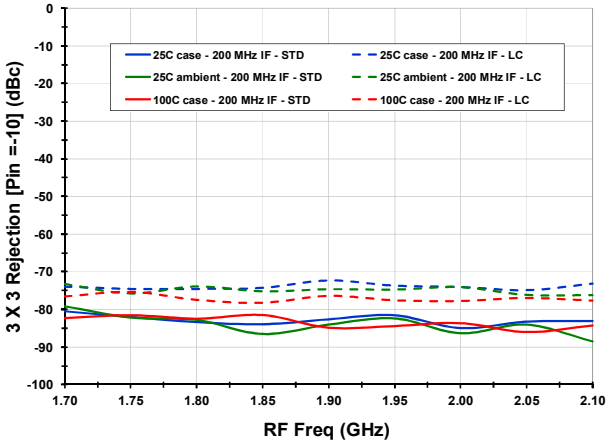

### Input 1dB Compression




### LO - IF leakage

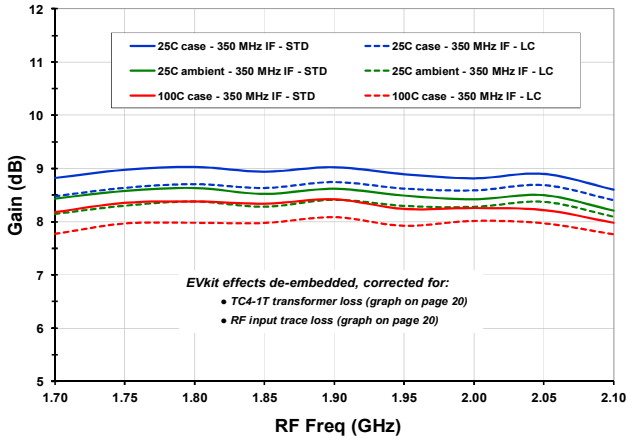



### 3RF x 3LO rejection

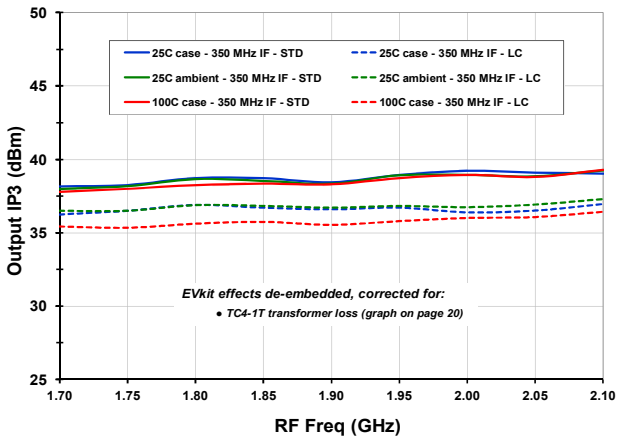


## HIGH TEMP OPERATING CONDITIONS [350 MHz IF] (2)

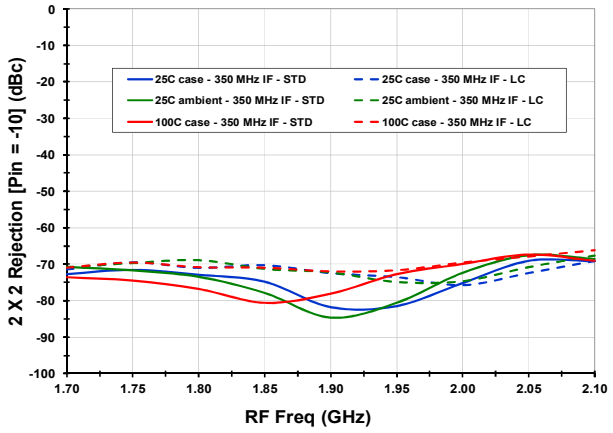
### Gain [EVKit de-embedded]



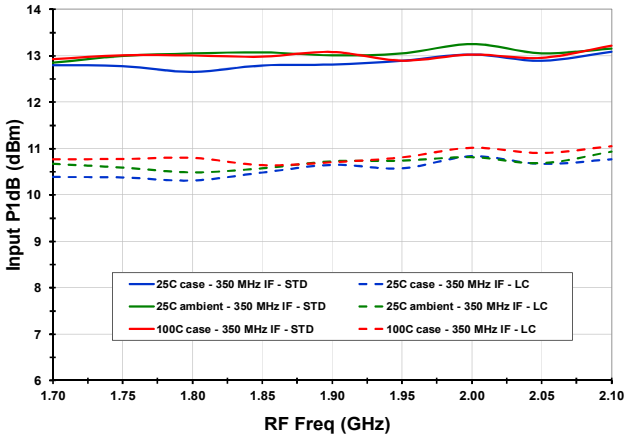

### Output IP3 [EVkit de-embedded]



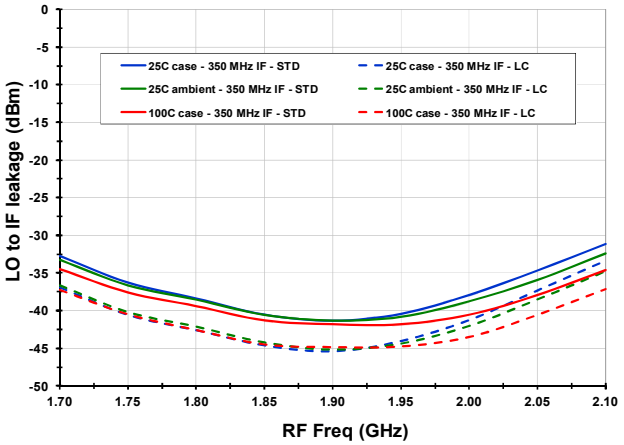

### 2RF x 2LO rejection



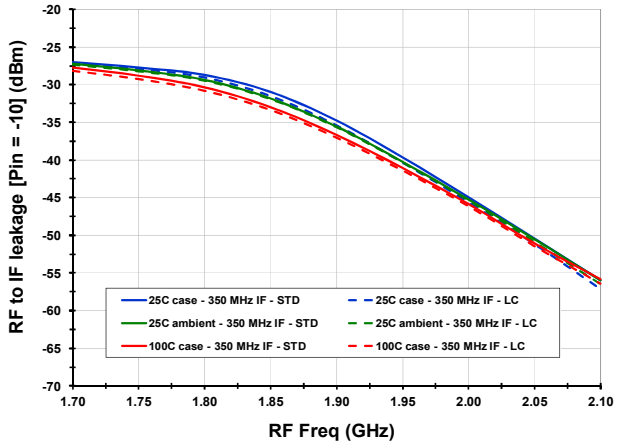

### Input 1dB Compression




### LO - IF leakage

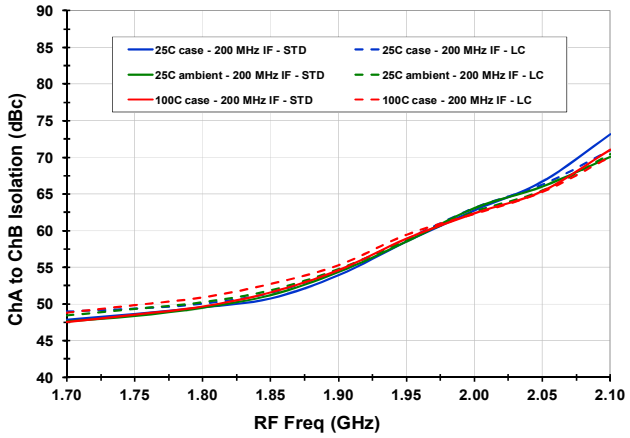



### RF – IF leakage

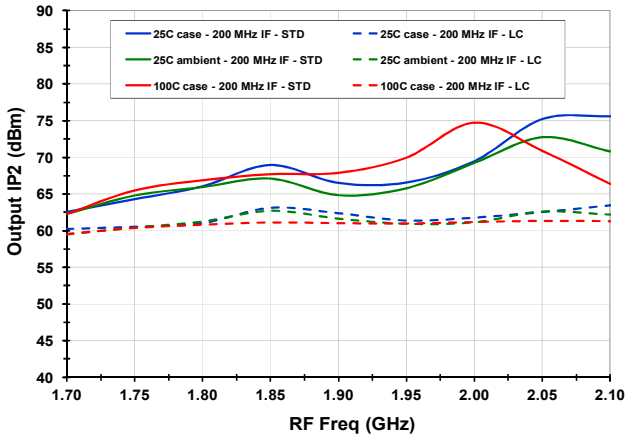


## HIGH TEMP OPERATING CONDITIONS [GENERAL] (3)

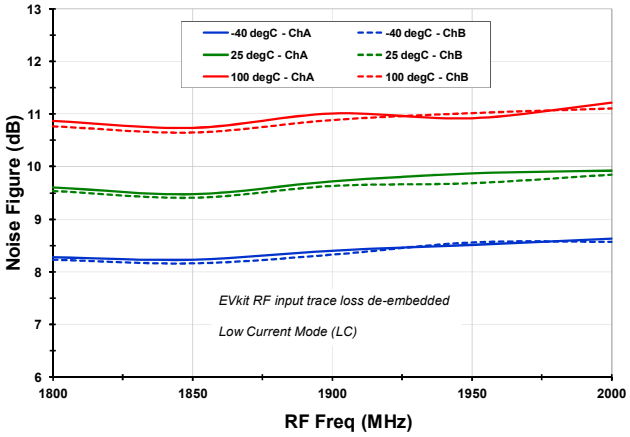
### Channel Isolation



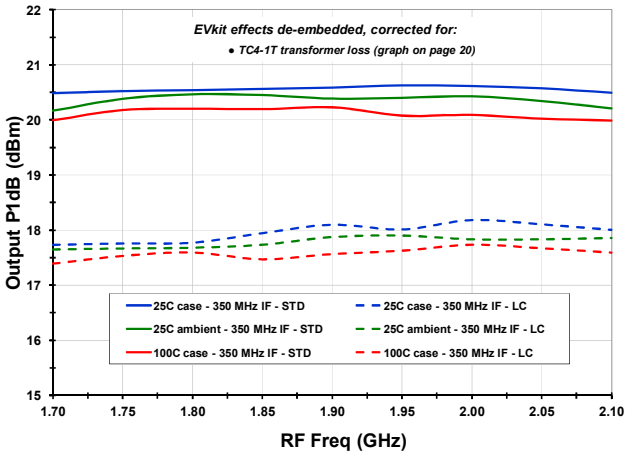

### Output IP2



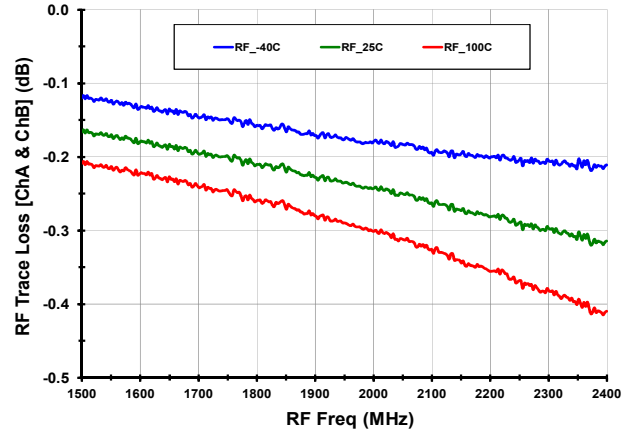

### Noise Figure [EVkit de-embedded]



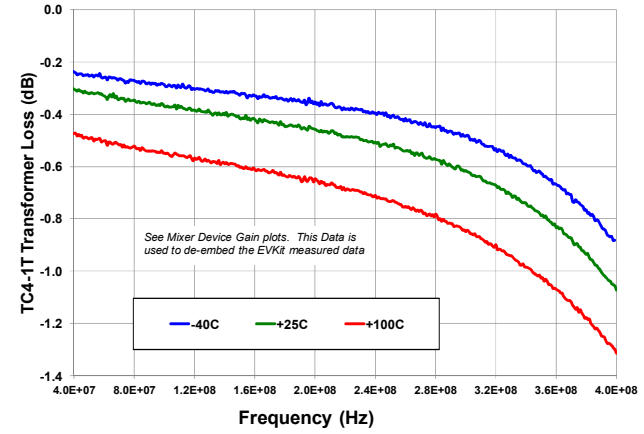

### Output 1dB Compression [EVkit de-embedded]



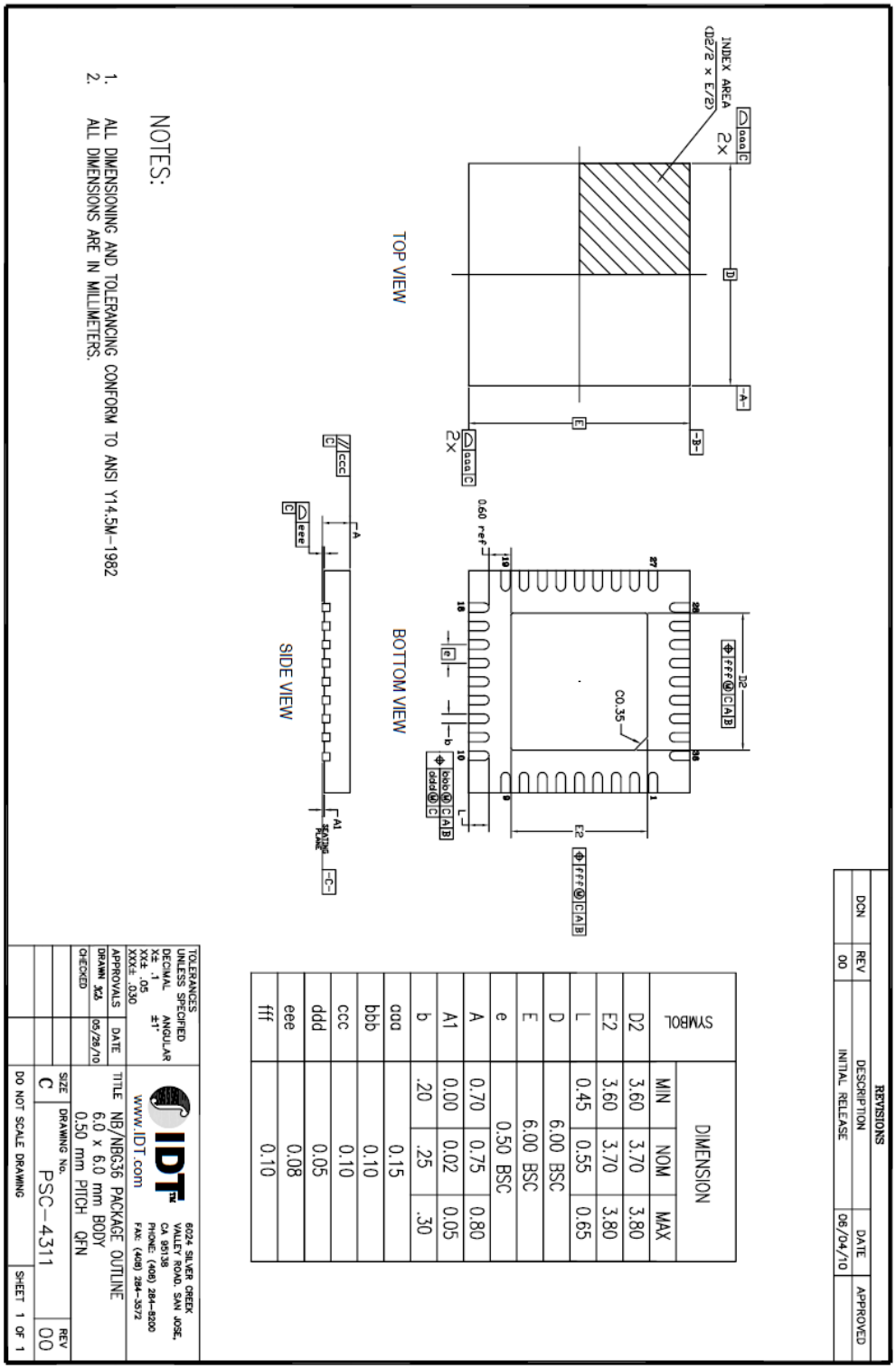

### EVkit RF trace loss




### EVkit Transformer Loss



## PACKAGE DRAWING (6x6 QFN)

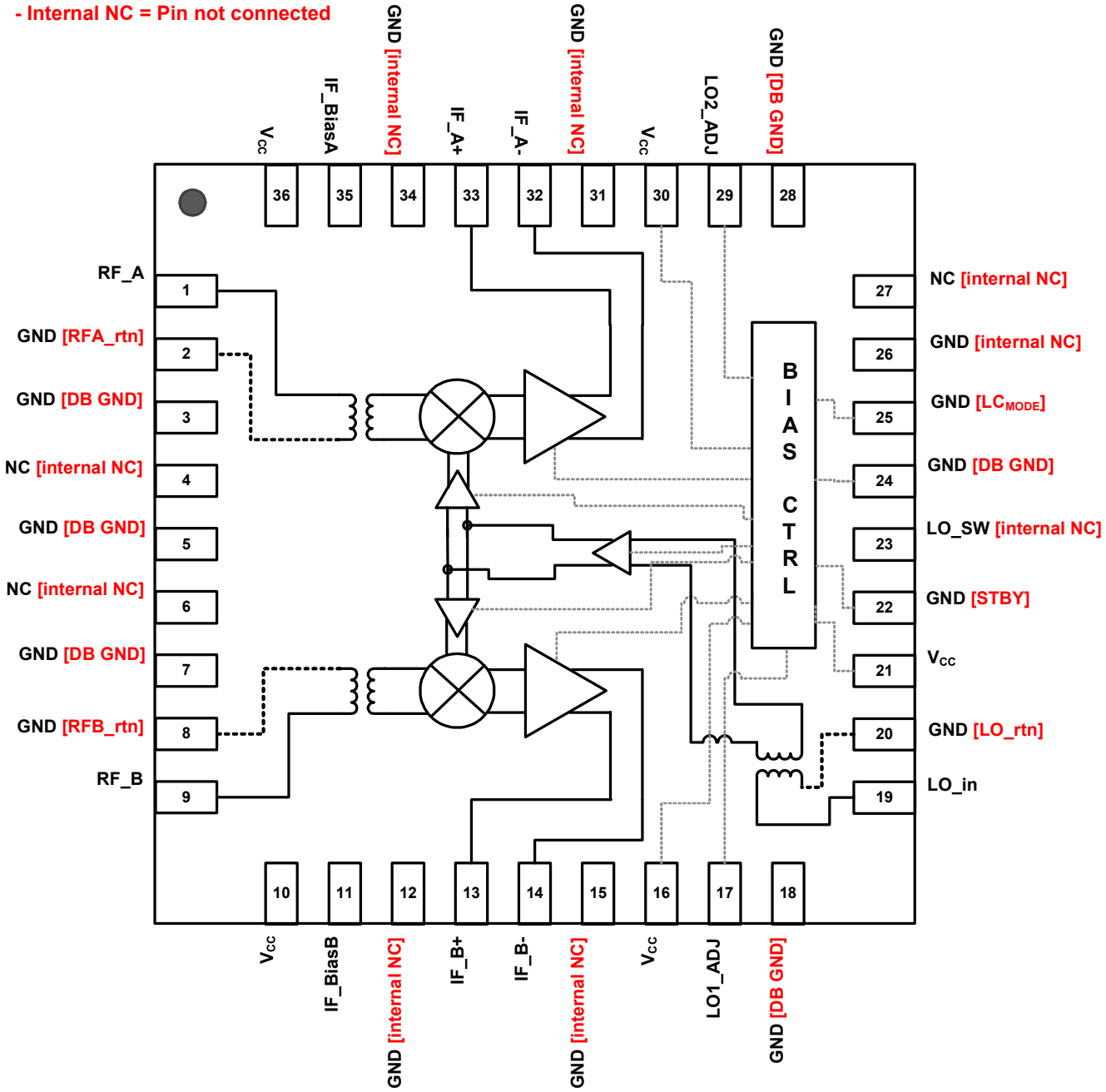


## PINOUTS

**Black Text denotes recommended external connection**

**Red Text denotes internal Function or Connection**

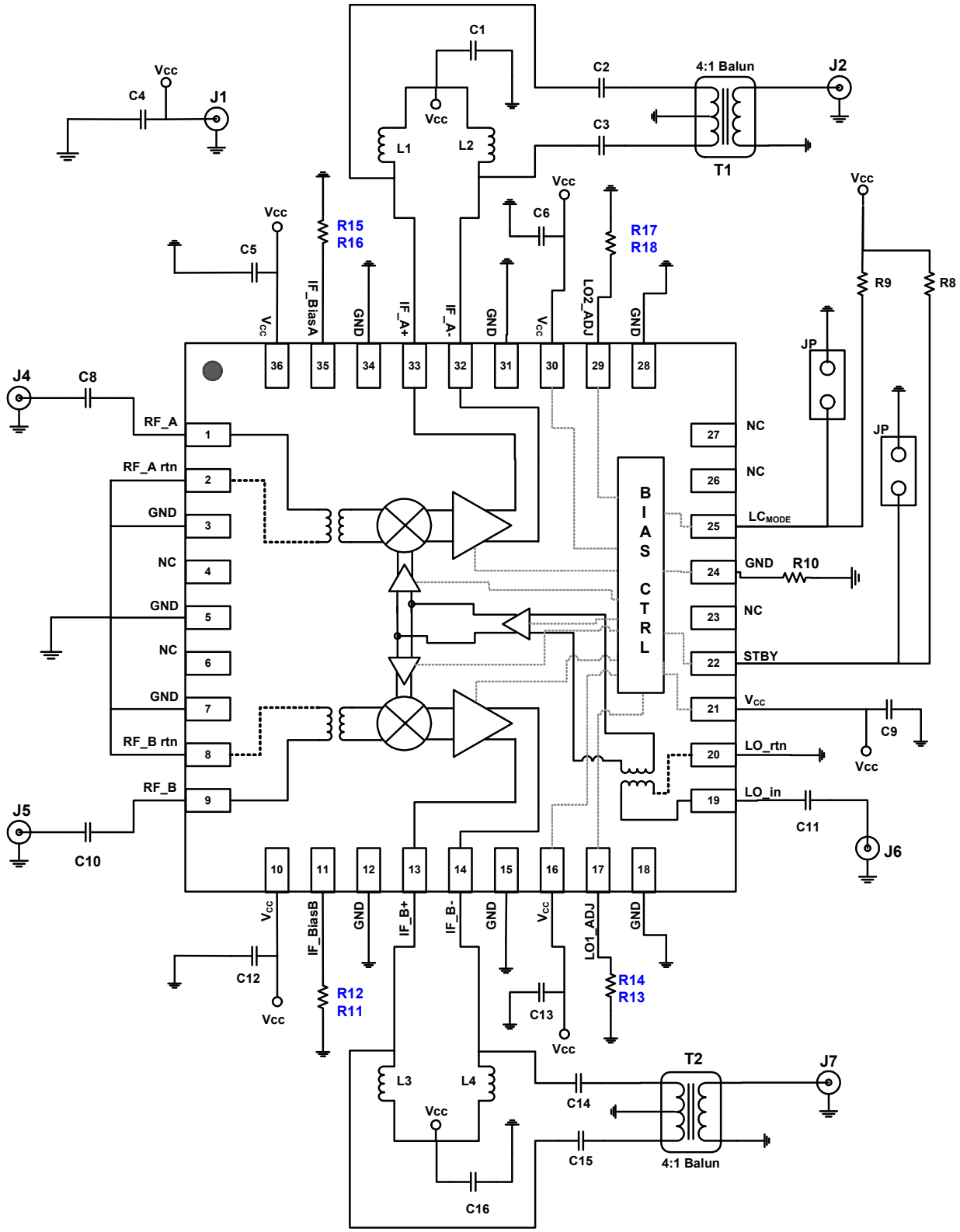
- DB GND = Downbonded to Paddle
- Internal NC = Pin not connected



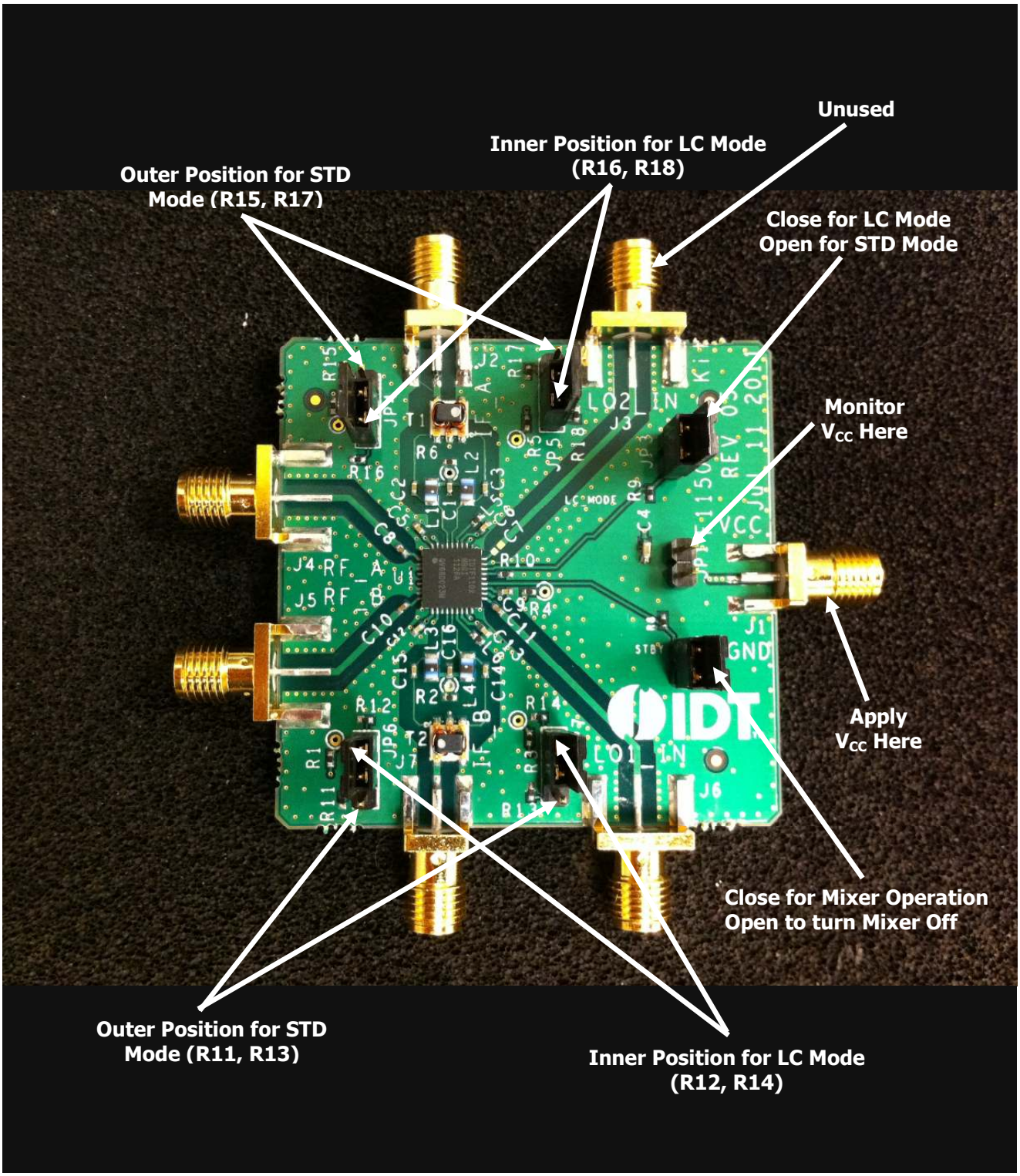
## PIN DESCRIPTIONS

| Pin(s) | Name | Function |
|---|---|---|
| 1 | RF_A | Main Channel RF Input. Internally matched to 50Ω. DO NOT apply DC to these pins |
| 2, 8, 20 | RF_Artn, RF_Brtn, LO_rtn | Transformer Ground Returns. Ground these pins. |
| 3, 5, 7,18, 22, 24, 28 | GND | Ground these pins. |
| 4, 6, 12, 15, 31, 23, 26, 27, 34 | N.C. | No Connection. Not internally connected. OK to connect to Vcc. OK to connect to GND |
| 10, 16, 21, 30, 36 | VCC | Power Supplies. Bypass to GND with capacitors shown in the Typical Application Circuit as close as possible to pin. |
| 9 | RF_B | Diversity Channel RF Input. Internally matched to 50Ω |
| 11 | IF_BiasB | Connect the specified resistor from this pin to ground to set the bias for the Diversity IF amplifier. This is NOT a current set resistor |
| 13, 14 | IFB+, IFB- | Diversity Mixer Differential IF Output. Connect pullup inductors from each of these pins to VCC (see the Typical Application Circuit). |
| 17 | LO1_ADJ | Connect the specified resistor for either Standard or LC mode from this pin to ground to set the LO common buffer Icc |
| 19 | LO_in | Local Oscillator Input. Connect the LO to this port through a series 3 pF capacitor |
| 25 | LC_MODE | Low_Current Mode. Set this pin to low or ground for LC mode. Set to high or No-Connect for Standard mode. There is an internal pull-up resistor. |
| 22 | STBY | STBY Mode. Pull this pin high for Standby mode (~20 mA). Pull low or Ground for normal Operation |
| 29 | LO2_ADJ | Connect the specified resistor for either Standard or LC mode from this pin to ground to set the LO drive buffers Icc |
| 32, 33 | IFA-, IFA+ | Main Mixer Differential IF Output. Connect pullup inductors from each of these pins to VCC (see the Typical Application Circuit). |
| 35 | IF_BiasA | Connect the specified resistor from this pin to ground to set the bias for the Main IF amplifier. This is NOT a current set resistor |
| | — EP | Exposed Pad. Internally connected to GND. Solder this exposed pad to a PCB pad that uses multiple ground vias to provide heat transfer out of the device into the PCB ground planes. These multiple via grounds are also required to achieve the noted RF performance. |
| | | |

## EVKIT SCHEMATIC



## EVKIT PICTURE/LAYOUT/OPERATION



## EVKIT BOM

For Standard Mode, Open the $LC_{MODE}$ jumper in conjunction with positioning the 4 dual jumpers to select the resistors in **red.**

For Low Current Mode close the $LC_{MODE}$ jumper in conjunction with positioning the 4 dual jumpers to select the resistors in **blue.**

**F1150 BOM**

| Item # | Value | Size | Desc | Mfr. Part # | Mfr. | Part Reference | Qty |
|---|---|---|---|---|---|---|---|
| 1 | 10nF | 0402 | CAP CER 10000PF 16V 10% X7R 0402 | GRM155R71C103KA01D | MURATA | C1,5,6,9,12,13,16 | 7 |
| 2 | 1000pF | 0402 | CAP CER 1000PF 50V C0G 0402 | GRM1555C1H102JA01D | MURATA | C2,3,14,15 | 4 |
| 3 | 1.2nH | 0402 | 0402CS-1N2XJLU Ceramic Chip Inductor | 0402CS-1N2XJLU | COILCRAFT | C8,10 | 2 |
| 4 | 3pF | 0402 | CAP CER 3PF 0402 | GRM1555C1H3R0CZ01D | MURATA | C11 | 1 |
| 5 | 10uF | 0603 | CAP CER 10UF 6.3V X5R 0603 | GRM188R60J106ME47D | MURATA | C4 | 1 |
| 6 | Header 2 Pin | TH 2 | CONN HEADER VERT SGL 2POS GOLD | 961102-6404-AR | 3M | JP1,2,3 | 3 |
| 7 | Header 3 Pin | TH 3 | CONN HEADER VERT SGL 3POS GOLD | 961103-6404-AR | 3M | JP4,5,6,7 | 4 |
| 8 | SMA_END_LAUNCH | .062 | SMA_END_LAUNCH | 142-0711-821 | Emerson Johnson | J1,2,3,4,5,6,7 | 7 |
| 9 | 270nH | 0805 | 0805CS (2012) Ceramic Chip Inductor | 0805CS-271XJLB | COILCRAFT | L1,2,3,4 | 4 |
| 10 | 27 | 0402 | RES 27 OHM 1/10W 1% 0402 SMD | ERJ-2RKF27R0X | Panasonic | **R11,15** | 2 |
| 11 | 63 | 0402 | RES 63 OHM 1/10W 1% 0402 SMD | ERJ-2RKF63R0X | Panasonic | **R12,16** | 2 |
| 12 | 91 | 0402 | RES 91.0 OHM 1/10W 1% 0402 SMD | ERJ-2RKF91R0X | Panasonic | **R13** | 1 |
| 13 | 180 | 0402 | RES 180 OHM 1/10W 1% 0402 SMD | ERJ-2RKF1800X | Panasonic | **R14** | 1 |
| 14 | 1.91K | 0402 | RES 1.91K OHM 1/10W 1% 0402 SMD | ERJ-2RKF1911X | Panasonic | **R18** | 1 |
| 15 | 1.21K | 0402 | RES 1.21K OHM 1/10W 1% 0402 SMD | ERJ-2RKF1211X | Panasonic | **R17** | 1 |
| 16 | 47K | 0402 | RES 47.0K OHM 1/16W 1% 0402 SMD | RC0402FR-0747KL | Yageo | R8,9 | 2 |
| 17 | 0 | 0402 | RES 0.0 OHM 1/10W 0402 SMD | ERJ-2GE0R00X | Panasonic | R1,2,3,4,5,6,7,10 | 10 |
| 18 | 4:1 Balun | SM-22 | 4:1 Center Tap Balun | TC4-1TG2+ | Mini Circuits | T1,2 | 2 |
| 19 | F1150ZM (021) | QFN-36 | Diversity Downconverter | | IDT | U1 | 1 |
| 20 | PCB | | | F1150 EVKit Rev5 | | | 1 |

## TOPMARKINGS