DATASHEET

RF to IF Dual Downconverting Mixer **1400 - 2200 MHz F1152NBGI**

General Description

This document describes the specifications for the IDTF1152 Zero-Distortion™ RF to IF Downconverting Mixer. This device is part of a series of 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 F1152 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 Low Side Injection or from 1400 to 1700 MHz with High Side Injection. IF frequencies from 50 to 350 MHz are supported. Nominally, the device offers +43 dBm Output IP3 with 327 mA of I_{CC}. Alternately one can adjust 4 resistor values and a toggle pin to run the device in low current mode with +40 dBm Output IP3 and 232 mA of I_{CC}.

Competitive Advantage

In typical basestation receivers the RF to IF mixer dominates the linearity performance for the entire receive system. The Zero-Distortion™ family of 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. Zero-Distortion™ technology allows realization of either benefit.

- ✓ $IP3_O$: ⇑ **9 dB** STD Mode, ⇑ **6 dB** LC Mode
- ✓ Dissipation: ⇓ **40%** LC Mode, ⇓ **12%** STD Mode
- ✓ Allows for higher RF gain improving **Sensitivity**

Zero-Distortion™

Part# Matrix

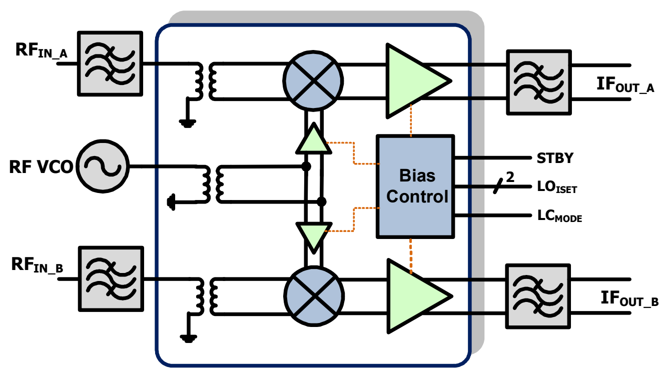
Part#	RF freq range	UTRA bands	IF freq range	Typ. Gain	Injection
F1100	698 - 915	5,6,8,12,13,14,17 ,19,20	50 - 450	8.5	High Side
F1102	698 - 915	5,6,8,12,13,14,17 ,19,20	50 - 250	8.5	Both
F1150	1700 - 2200	1,2,3,4,9,10, 33, 34,35, 36, 37,39	50 - 450	8.5	High Side
F1152	**1400 - 2200**	**1,2,3,4,9,10,11[1], 21[1], 24[1], 33, 34,35, 36, 37,39**	**50 - 350**	**8.5**	**Low Side**
F1162	2300 – 2700	7,38,40,41	50 – 500	8.9	Both

1 – *with High side injection*

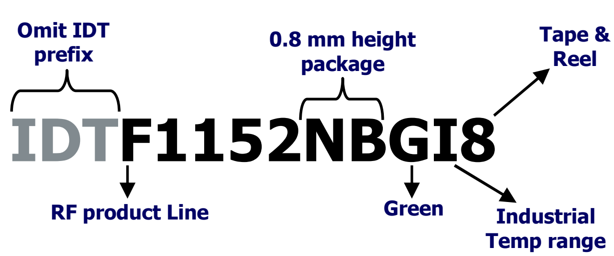
Features

- Dual Path for Diversity Systems
- Ideal for Multi-Carrier Systems
- 8.5 dB Gain
- Ultra linear **+43 dBm $IP3_O$**
- Low NF < 10 dB
- 200 Ω output impedance
- Ultra high +13 dBm $P1dB_I$
- **Pin Compatible** w/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} = 232 mA**
- Standard Mode: I_{CC} = 327 mA
- NOTE production BOM on p. 20

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-, LO1_ADJ, LO2_ADJ	-0.3V to (VCC_ + 0.3V)
LO_IN, LO_IN_ALT, RF_A, RF_B	-0.3V to +0.3V
IF_BiasA, IF_BiasB to GND	-0.3V to +0.3V
RF Input Power (RF_IN[A+, A-, B+, B-])	+20dBm
Continuous Power Dissipation	2.2W
θ_{JA} (Junction – Ambient)	+35°C/W
θ_{JC} (Junction – Case) The Case is defined as the exposed paddle	+2.5°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.

IDTF1152 SPECIFICATION

Specifications apply at V_{CC} = +5.00V, T_C = +25°C F_{RF} = **1850 MHz**, F_{IF} = **200MHz**, P_{LO} = 0 dBm, 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}	***-100***		***-20***	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 ▪ Total Both Channels	I_{STD}		***327***	***380***[1]	mA
Supply Current	Total V_{CC} , LC Mode ▪ LC_{MODE} = GND ▪ EVkit BOM = LC Mode ▪ Total Both Channels	I_{LC}		***232***	***260***	mA
Supply Current	Standby Mode ▪ STBY = V_{IH} ▪ Total Both Channels	I_{STBY}		***17***	***26***	mA
RF Freq Range	Operating Range (low side injection)	F_{RF}		1700 to 2200		MHz
RF Freq Range	Operating Range (hi-side inj. with RF match p. 20)			1400 - 1700		MHz
IF Freq Range	Operating Range	F_{IF}		50 to 350		MHz
LO Freq Range	Low Side Injection	F_{LO}		1350 to 2100		MHz
LO Power		P_{LO}		-3 to +6		dBm
RF Input Impedance	Single Ended *Return Loss ~17 dB*	Z_{RF}		50		Ω
IF Output Impedance	Differential *Return Loss ~ 13 dB*	Z_{IF}		200		Ω
LO port Impedance	Single Ended *Return Loss ~15 dB*	Z_{LO}		50		Ω
Settling Time	• Pin = -13 dBm • Gate STBY from V_{IH} to V_{IL} • Time for IF Signal to settle to within 0.1 dB of final value	T_{SETT}		0.155		µsec
Gain STD Mode	Conversion Gain • F_{RF} = 1710 MHz • LC_{MODE} = V_{IH} • EVkit BOM = STD Mode • F_{IF} = 200 MHz	G_{STD}	***7.6***	***8.5***	***9.5***	dB

IDTF1152 SPECIFICATION (CONTINUED)

Parameter	Comment	Symbol	min	typ	max	units
Gain LC Mode	Conversion Gain • F_{RF} = 2050 MHz • LC_{MODE} = GND • EVkit BOM = LC Mode • F_{IF} = 200 MHz	G_{LC}	***7.1***	***8.0***	***9.1***	dB
NF STD Mode	Noise Figure	NF_{STD}		10		dB
NF LC Mode	Noise Figure • LC_{MODE} = GND • EVkit BOM = LC Mode • F_{IF} = 200 MHz	NF_{LC}		9.6		dB
NF w/Blocker	▪ +100 MHz offset blocker ▪ P_{IN} = +4 dBm ▪ F_{IF} = 250 MHz	NF_{BLK}		16.5		dB
Output IP3 – Narrowband	▪ P_{IN} = -5 dBm per tone ▪ 800 KHz Tone Separation	$IP3_{O1}$	39[2]	43		dBm
Output IP3 – Wideband	▪ P_{IN} = -5 dBm per tone ▪ 30 MHz Tone Separation	$IP3_{O2}$		42		dBm
Output IP3 – LC_{MODE}	▪ P_{IN} = -10 dBm per tone ▪ F_{IF} = 200 MHz ▪ 800 KHz Tone Separation ▪ LC_{MODE} = GND ▪ EVKit BOM = LC Mode	$IP3_{O3}$	***36***	***41***		dBm
2RF – 2LO rejection	▪ P_{RF} = -10 dBm ▪ Frequency = F_{RF} - ½ F_{IF}	2x2		-72		dBc
1 dB Compression	▪ Input referred	$P1dB_{I1}$	11.5	13.2		dBm
1 dB Compression - LC_{MODE}	▪ Input referred ▪ LC_{MODE} = GND ▪ EVKit BOM = LC Mode ▪ F_{IF} = 200 MHz	$P1dB_{I2}$	***8***	***10.8***		dBm
Gain Comp. w/blocker	▪ Blocker → unmodulated tone ▪ P_{IN} = +8 dBm, -100 MHz offset ▪ Signal Pin Tone = -20 dBm ▪ Measure ΔG of signal ▪ F_{IF} = 250 MHz	ΔG_{AC}		0.15		dB
Channel Isolation	IF_B Pout vs. IF_A w/ RF_A input	ISO_C	45	49		dB
LO to IF leakage		ISO_{LI}		-22	-15	dBm
RF to IF leakage	Pin = -10 dBm	ISO_{RI}		-32	-25	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

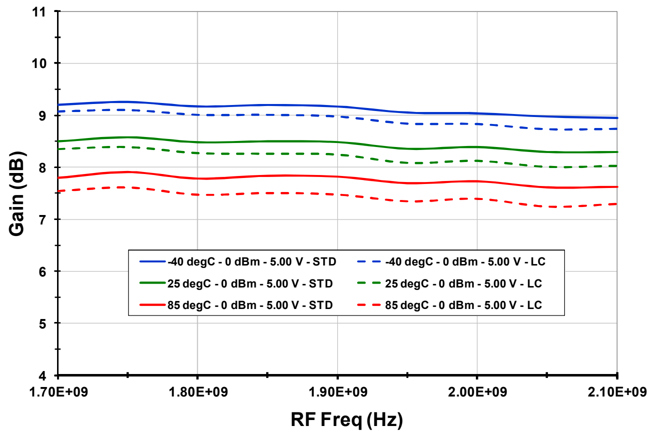
TYPICAL OPERATING CONDTIONS

Unless otherwise Noted, the following Apply to the Typ Ops Graphs

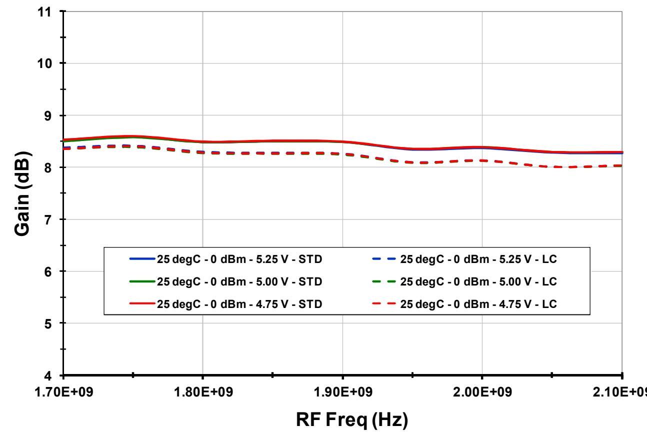
- **Low Side Injection, 200 MHz IF, 800 KHz Tone Spacing**
- **RF frequency = 1850 MHz for single point measurements**
- **Average of Channel A & Channel B**
- **Pin = – 10 dBm (all graphs, note exception immediately below)**
- **Pin = -5 dBm (STD Mode IP3 Traces)**
- **LO port = Pin 19 (Main Port)**
- **Listed Temperatures are Case Temperature (T_C = Case Temperature)**
- **Where noted, T_A or T_{AMB} = Ambient Temperature**

TYPICAL OPERATING CONDITIONS (-1-)

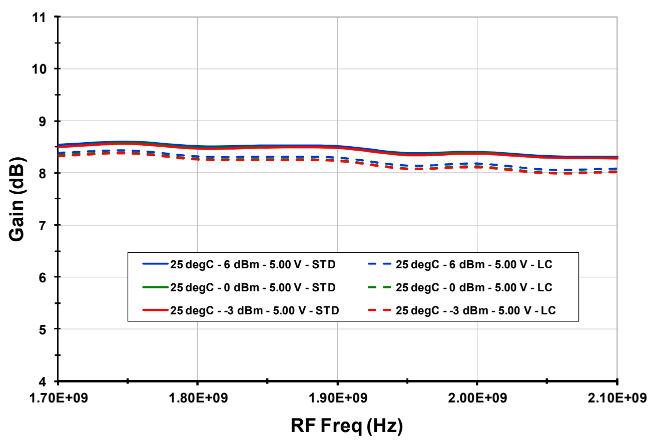
Gain vs. T_{CASE}



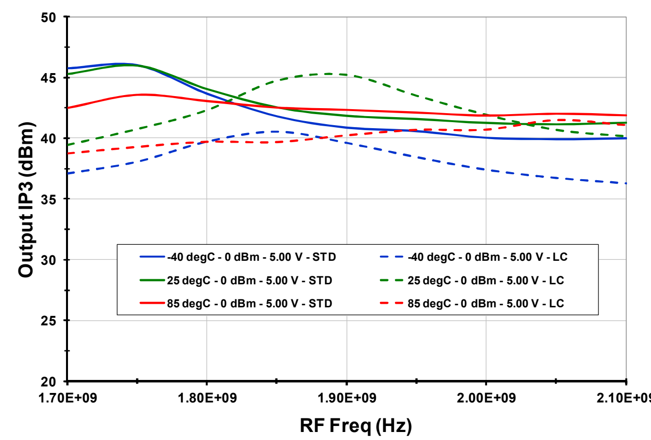
Gain vs. V_{CC}



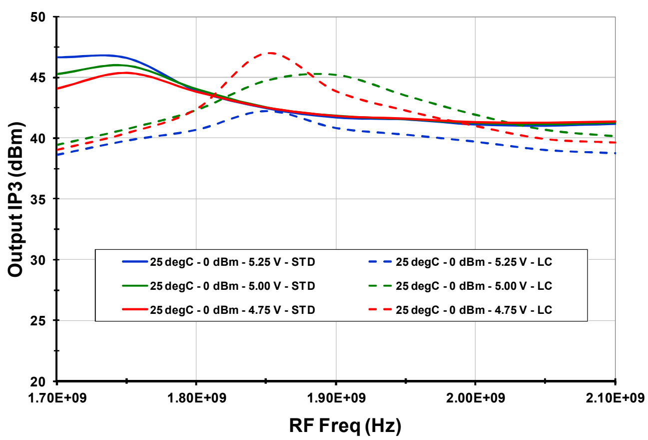
Gain vs. LO Level



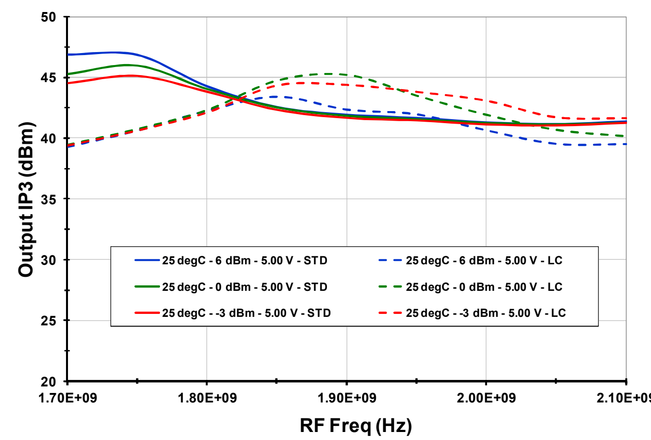
Output IP3 vs. T_{CASE}



Output IP3 vs. V_{CC}

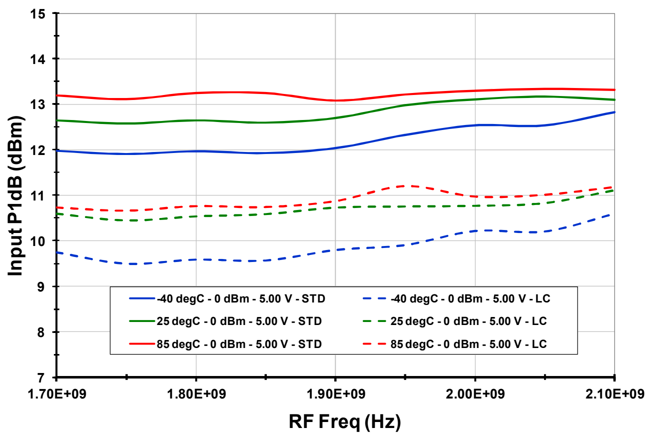


Output IP3 vs. LO Level

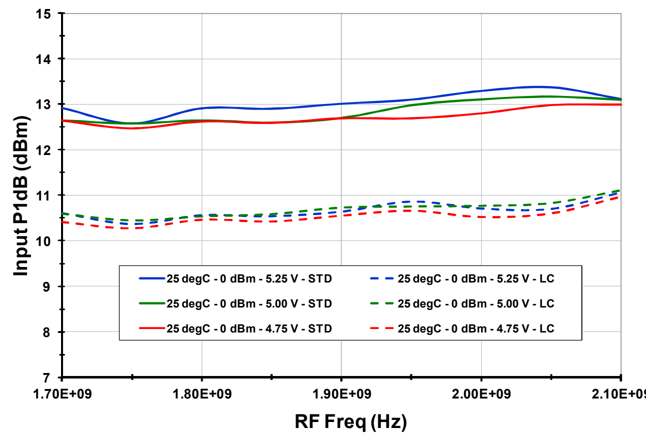


TYPICAL OPERATING CONDITIONS (-2-)

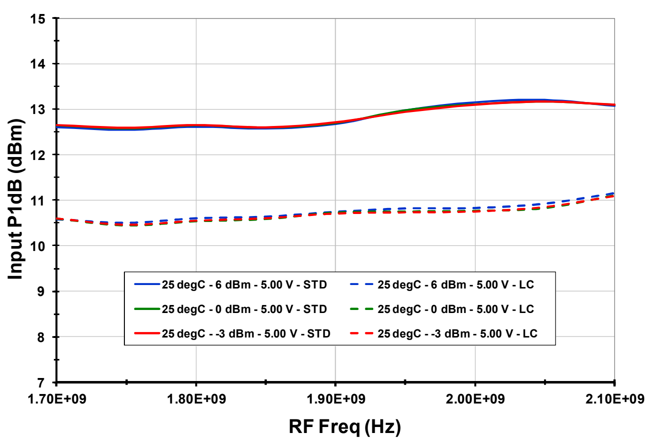
P1dB vs. T_{CASE}



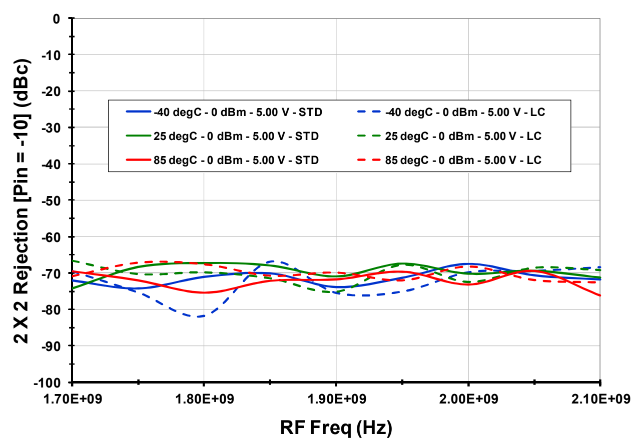
P1dB vs. V_{CC}



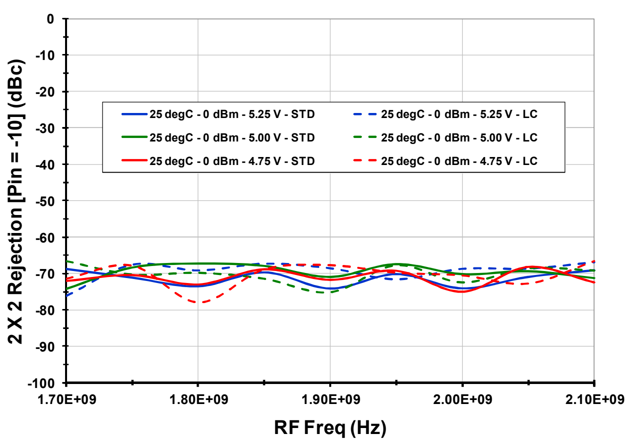
P1dB vs. LO Level



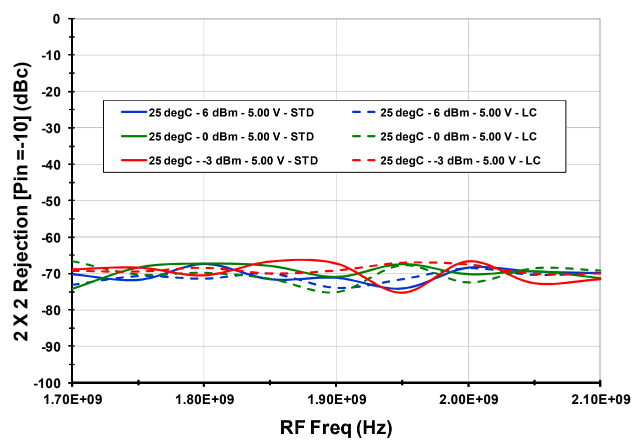
2RF x 2LO rejection vs. T_{CASE}



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

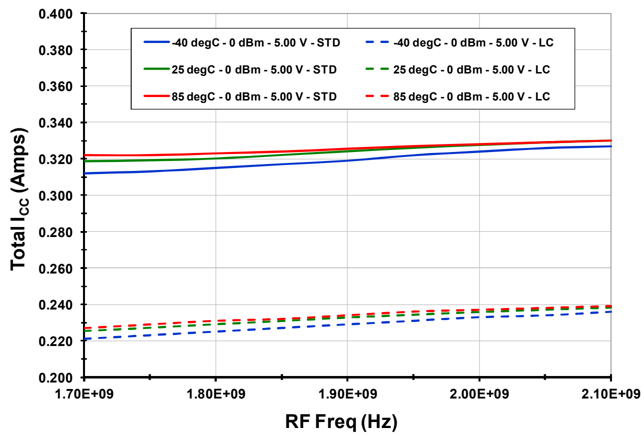


2RF x 2LO rejection vs. LO Level

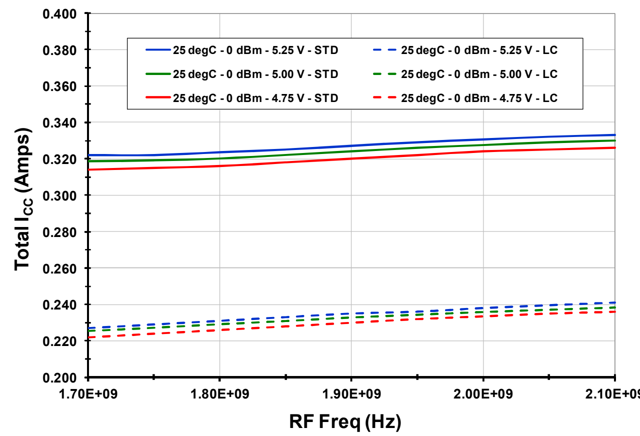


TYPICAL OPERATING CONDITIONS (-3-)

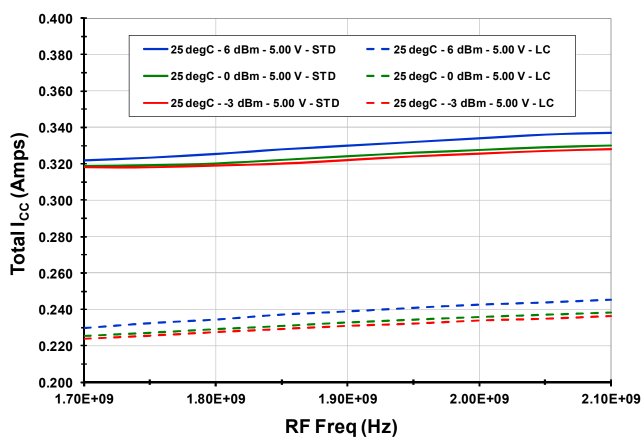
I_{CC} vs. T_{CASE}



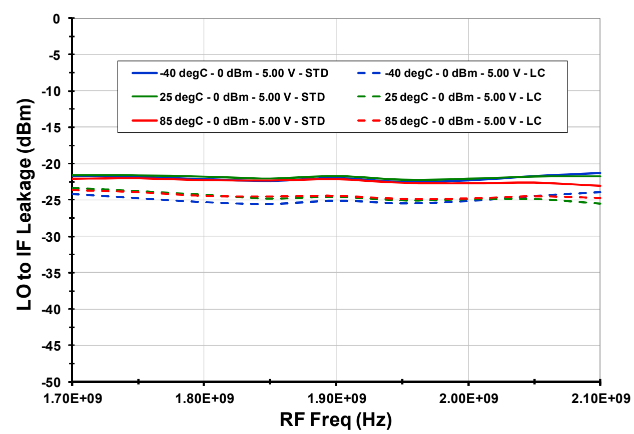
I_{CC} vs. V_{CC}



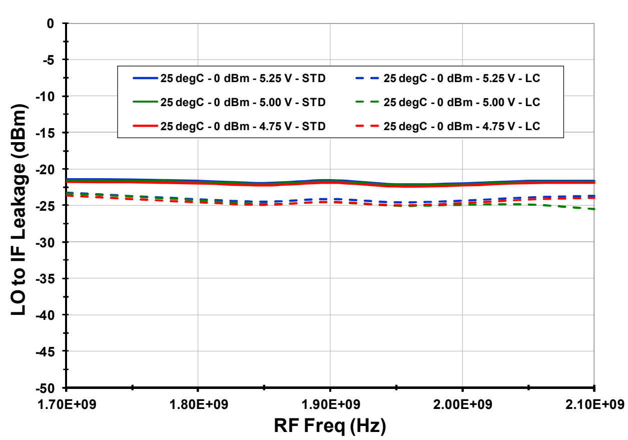
I_{CC} vs. LO Level



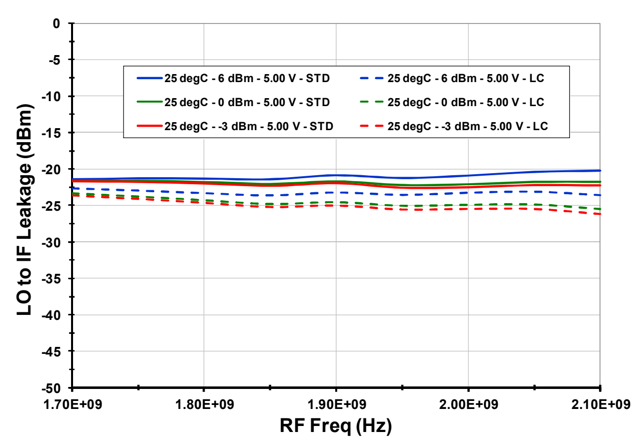
LO-IF Leakage vs. T_{CASE}



LO-IF Leakage vs. V_{CC}

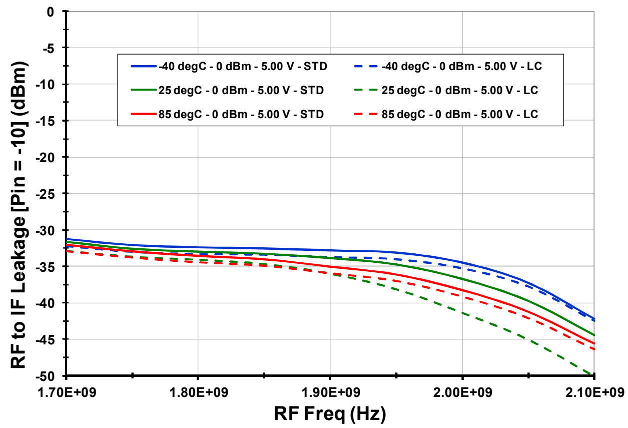


LO-IF Leakage vs. LO Level

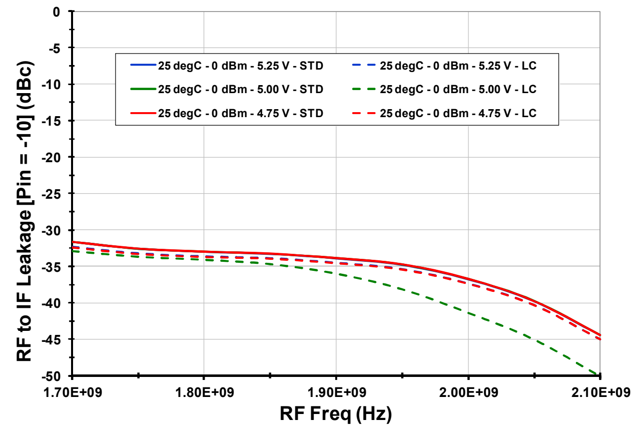


TYPICAL OPERATING CONDITIONS (-4-)

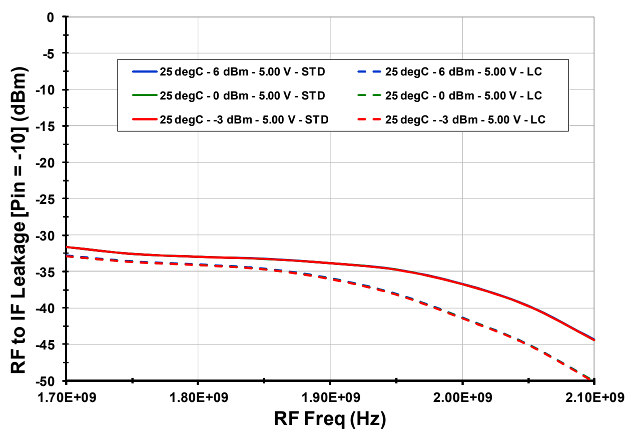
RF-IF Leakage vs. T_{CASE}



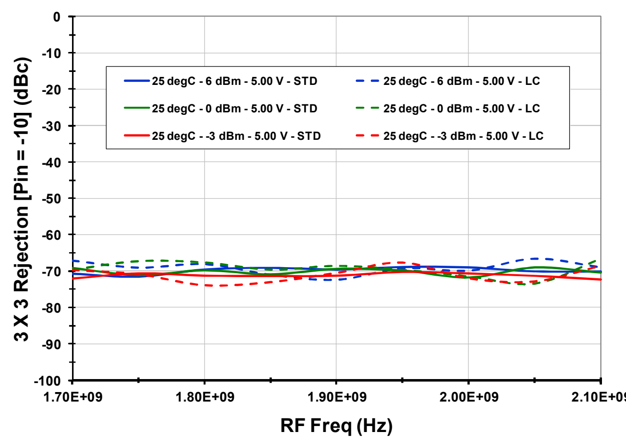
RF-IF Leakage vs. V_{CC}



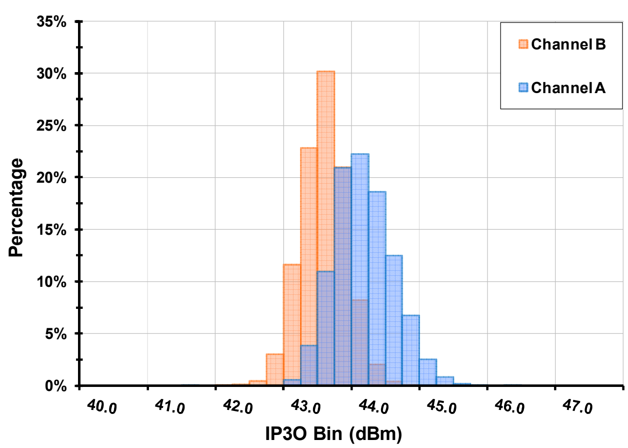
RF-IF Leakage vs. LO Level



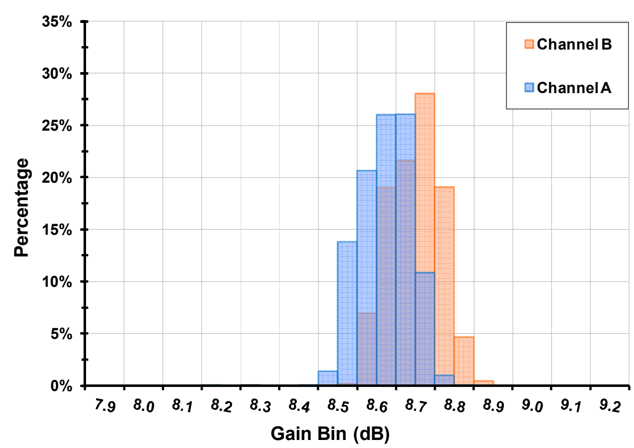
3RF X 3LO Rejection vs. LO Level



$IP3_O$ Distribution (F_{RF} = 1850MHz, LC mode, N = 3168)

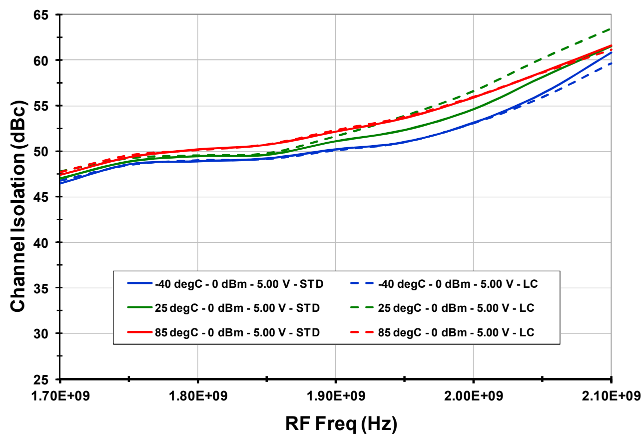


Gain Distribution (F_{RF} = 1710MHz, STD mode, N = 3168)

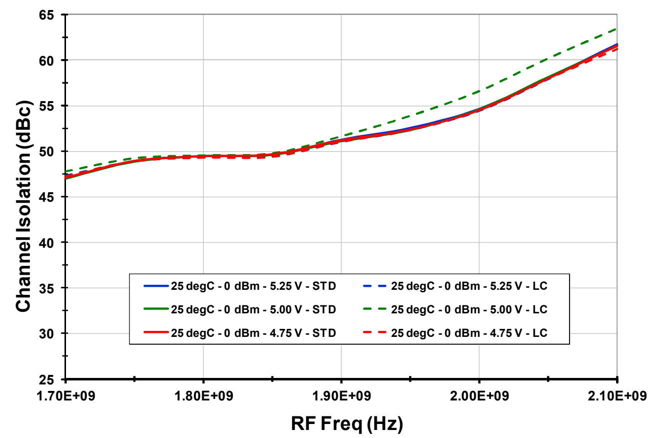


TYPICAL OPERATING CONDITIONS (-5-)

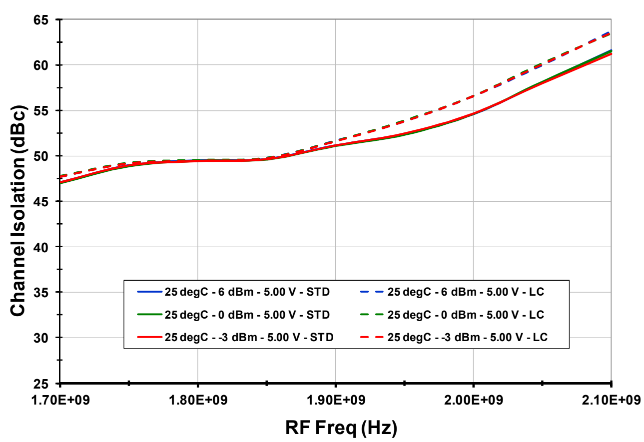
Channel Isolation vs. T_{CASE}



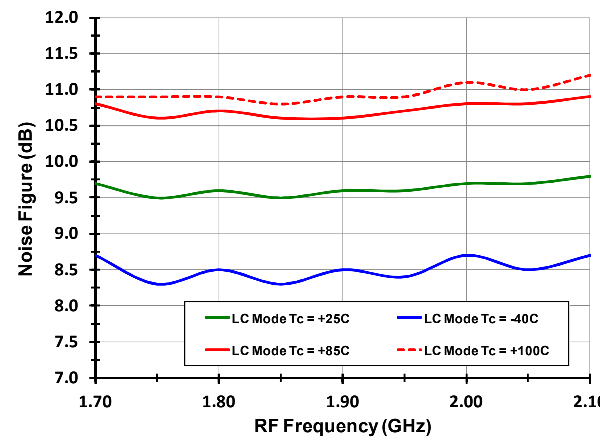
Channel Isolation vs. V_{CC}



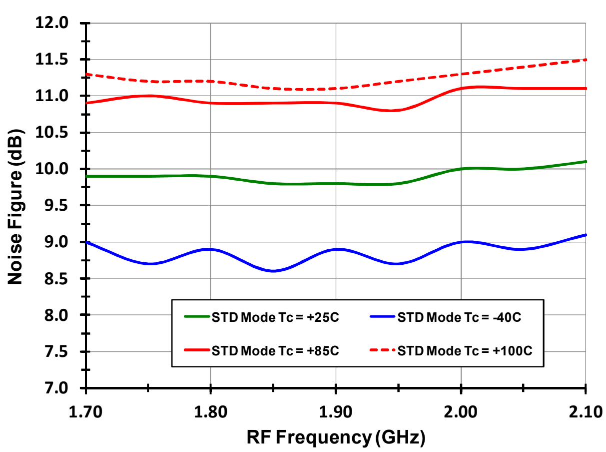
Channel Isolation vs. LO Level



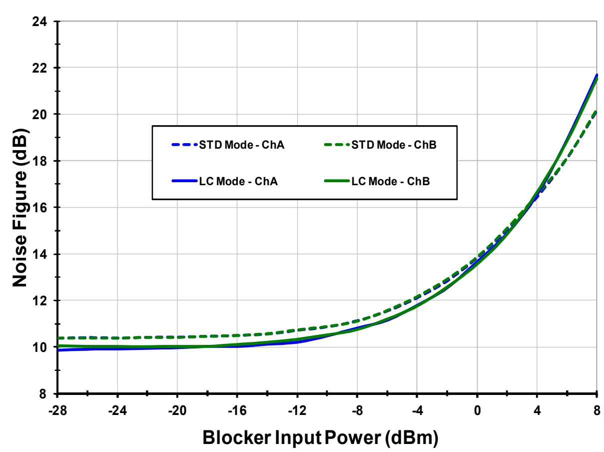
Noise Figure vs. T_{CASE} (LC Mode)



Noise Figure vs. T_{CASE} (STD Mode)

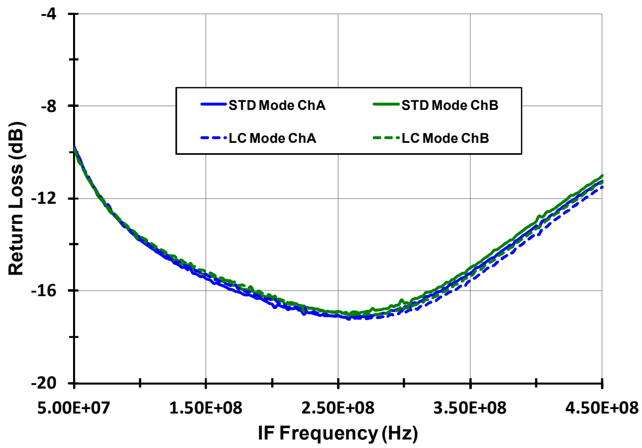


NF vs. Blocker (RF = 1850 MHz, IF = 250 MHz, T_A = 25C)

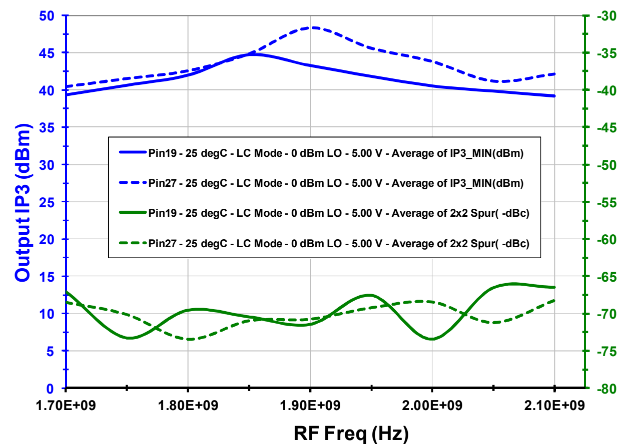


TYPICAL OPERATING CONDITIONS (-6-)

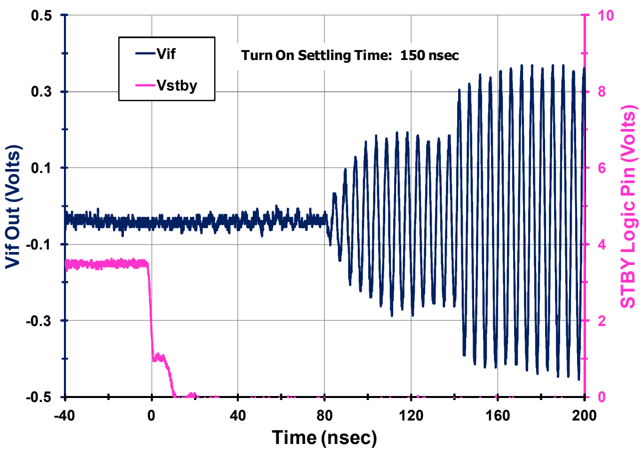
EVkit IF Port Match (T_A = 25C)



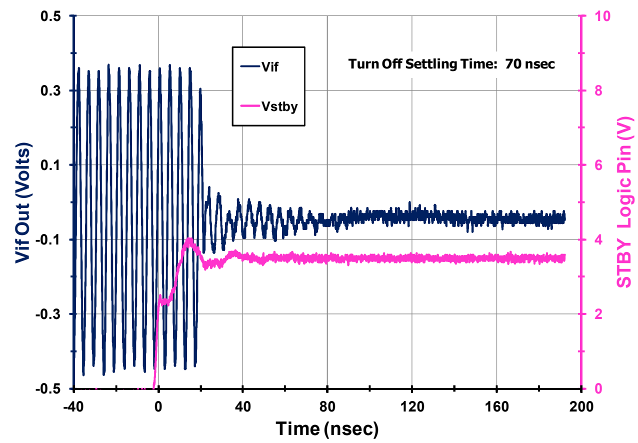
Alt. LO port (pin27) vs. Main LO port (pin19)



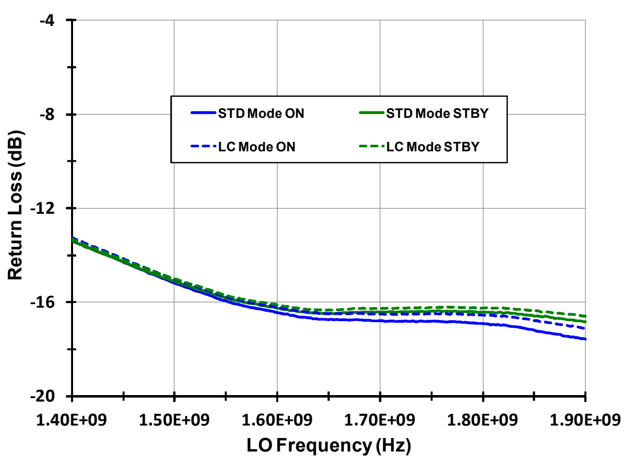
Settling Time (STBY -> V_{IL})



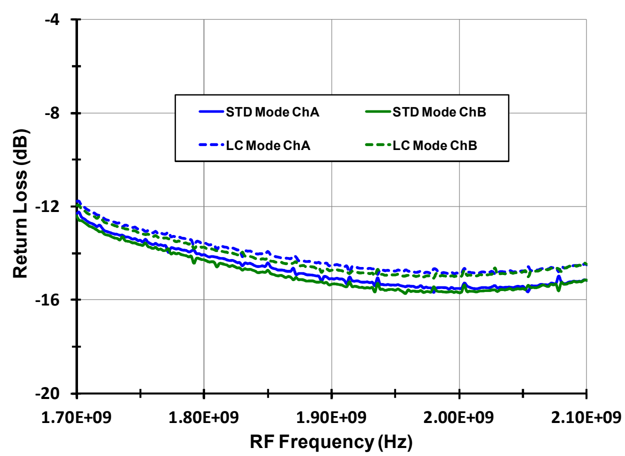
Settling Time (STBY -> V_{IH})



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

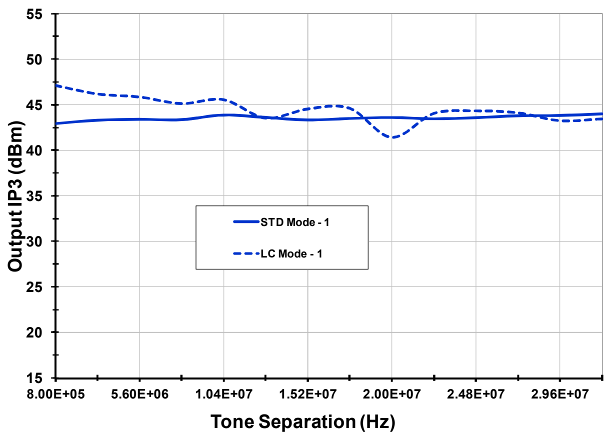


EVkit RF Port Match (T_A = 25C)

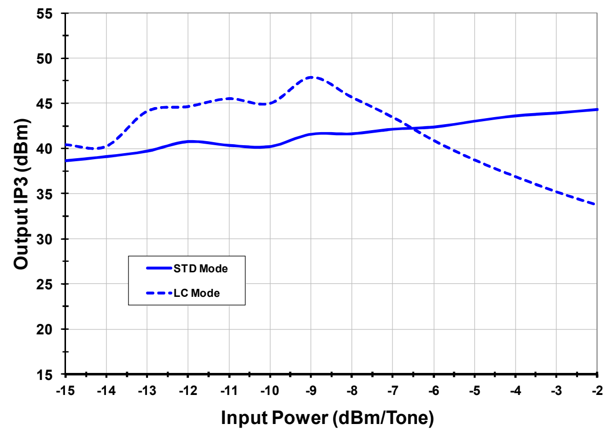


Typical Operating Conditions (-7-)

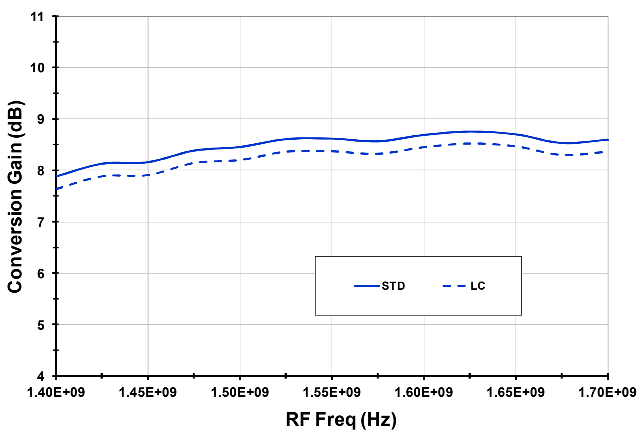
$IP3_O$ vs. Tone Δf (T_A = 25C, Freq = 1850 MHz)



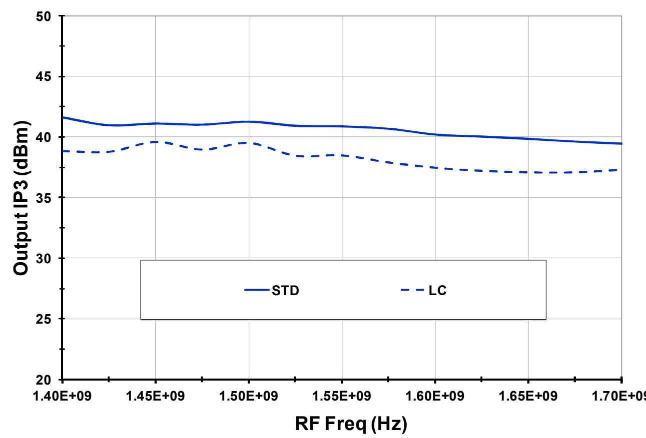
$IP3_O$ vs. P_{IN} (T_A = 25C, Freq = 1850 MHz)



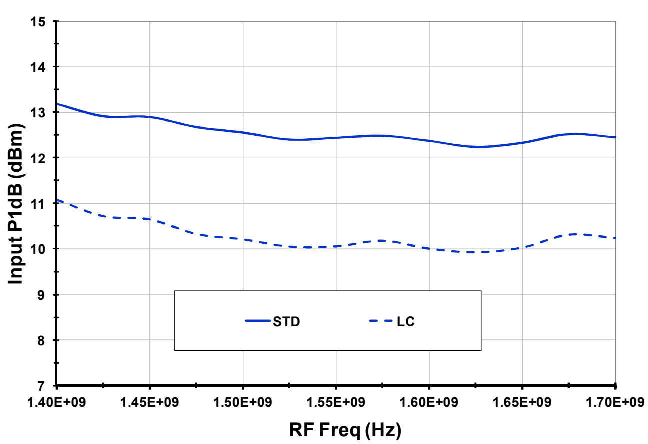
Hi-side Injection Gain (Bands 11, 21, 24 see p. 20)



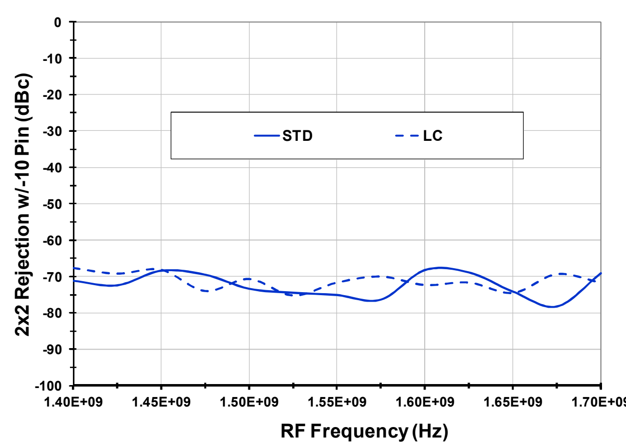
Hi-side Injection Output IP3 (Bands 11, 21, 24)



Hi-side Injection $P1dB_I$ (Bands 11, 21, 24)

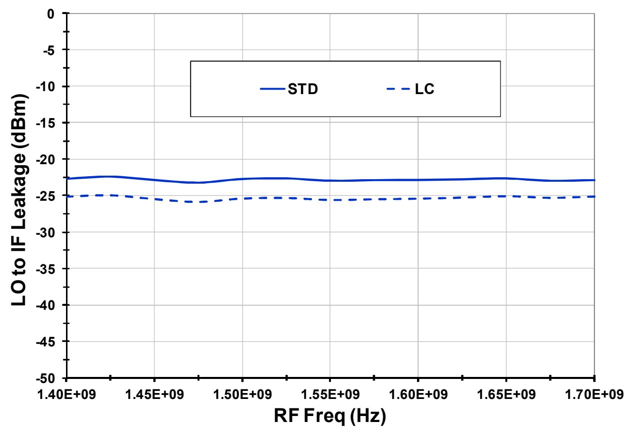


Hi-side Injection 2x2 (Bands 11, 21, 24)

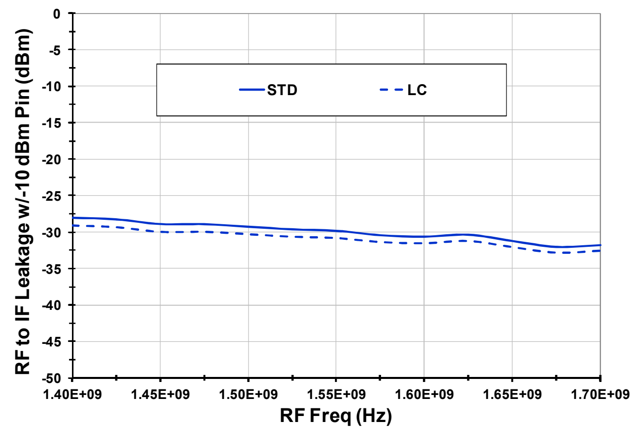


TYPICAL OPERATING CONDITIONS (-8-)

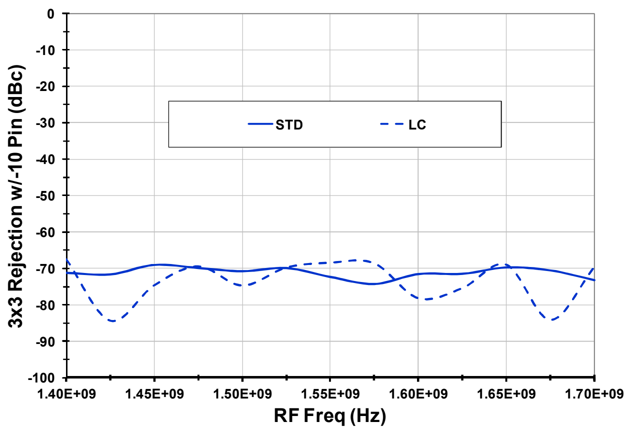
Hi-side Injection LO to IF (Bands 11, 21, 24)



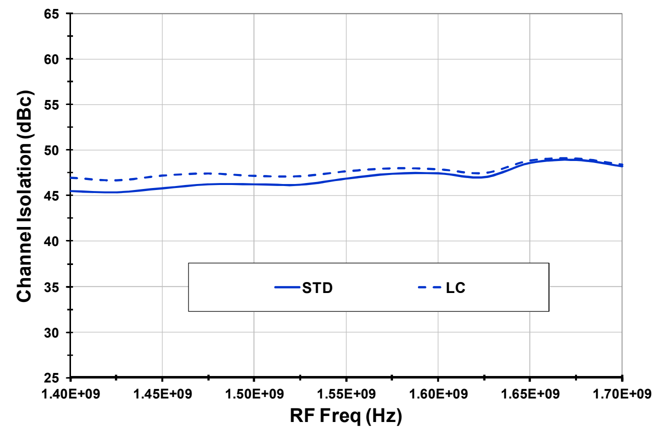
Hi-side Injection RF to IF (Bands 11, 21, 24)



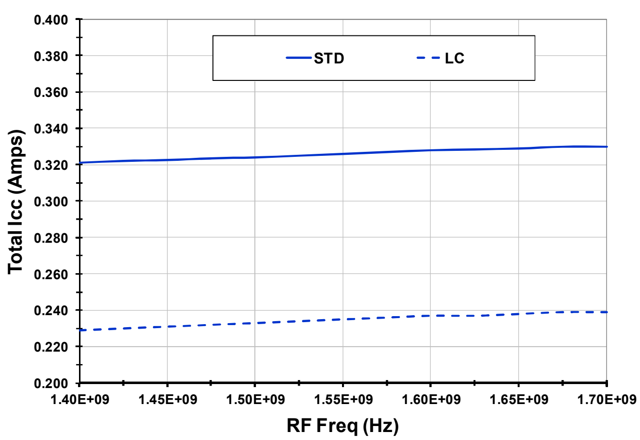
Hi-side Injection 3x3 (Bands 11, 21, 24)



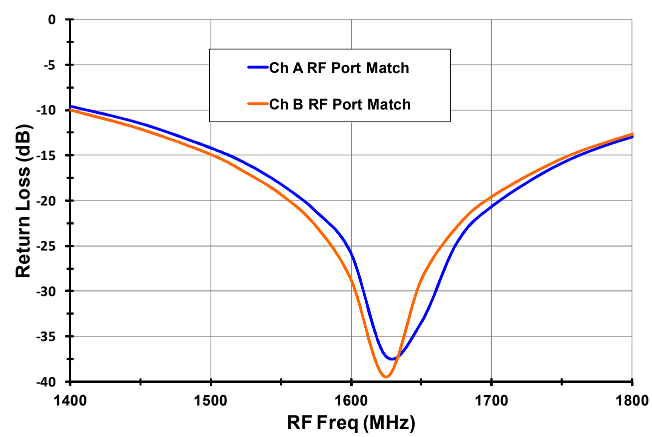
Hi-side Injection Channel Iso (Bands 11, 21, 24)



Hi-side Injection I_{CC} (Bands 11, 21, 24)

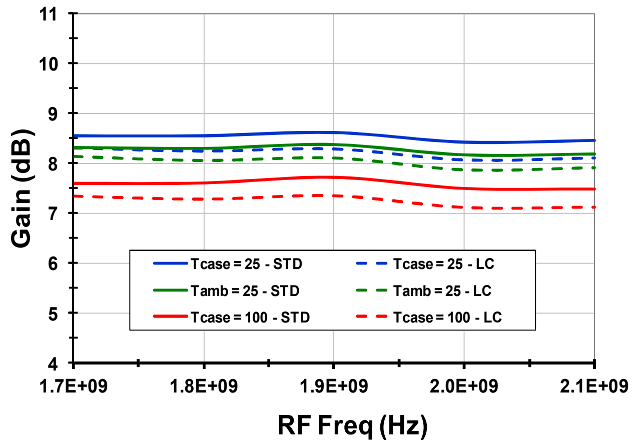


Hi-side Injection RF Port Matches (see p. 22)

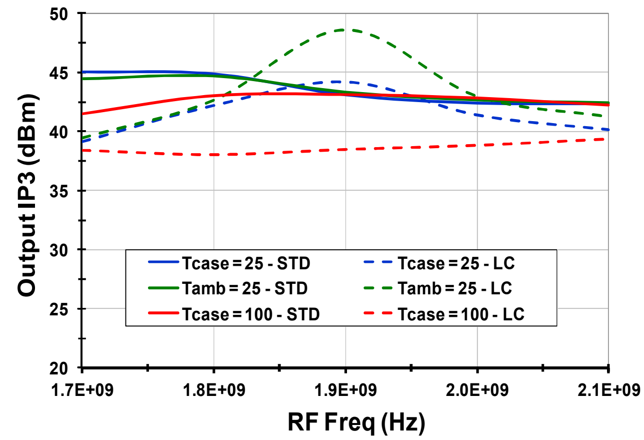


HIGH TEMPERATURE OPERATING CONDITIONS (-1-)

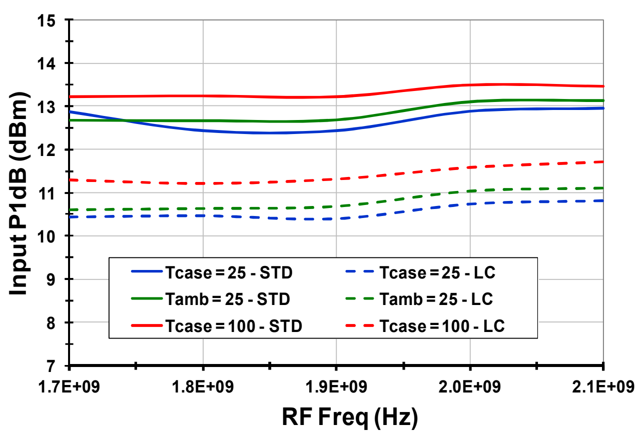
Gain at Normal and High (+100C) Temps



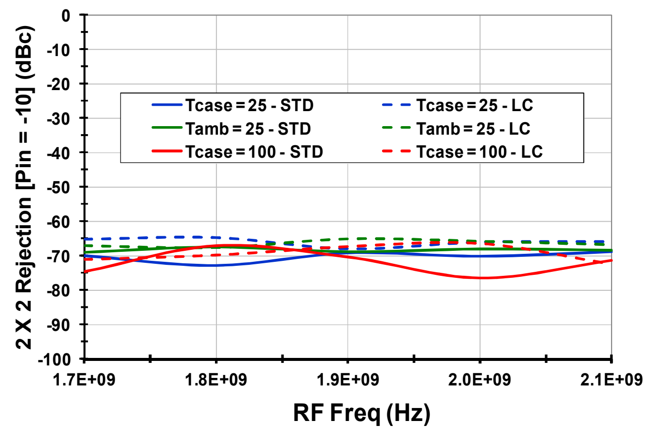
Output IP3 at Normal and High (+100C) Temps



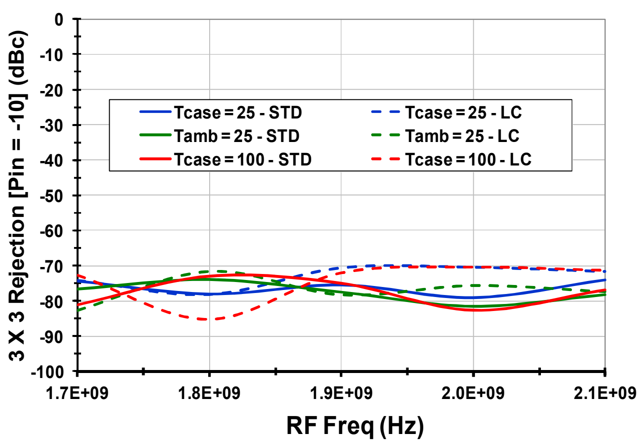
Input P1dB at Normal and High (+100C) Temps



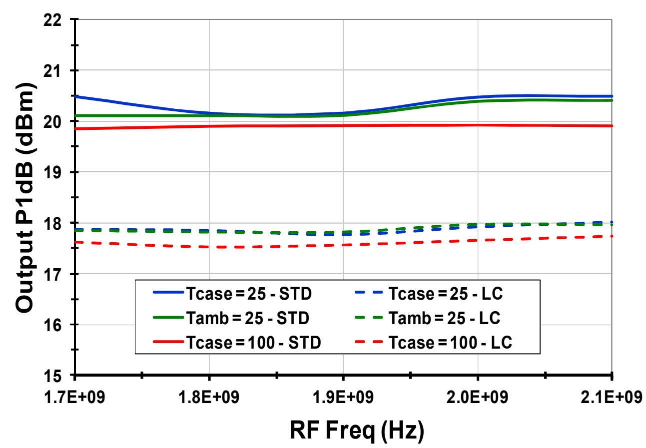
2RF X 2LO at Normal and High (+100C) Temps



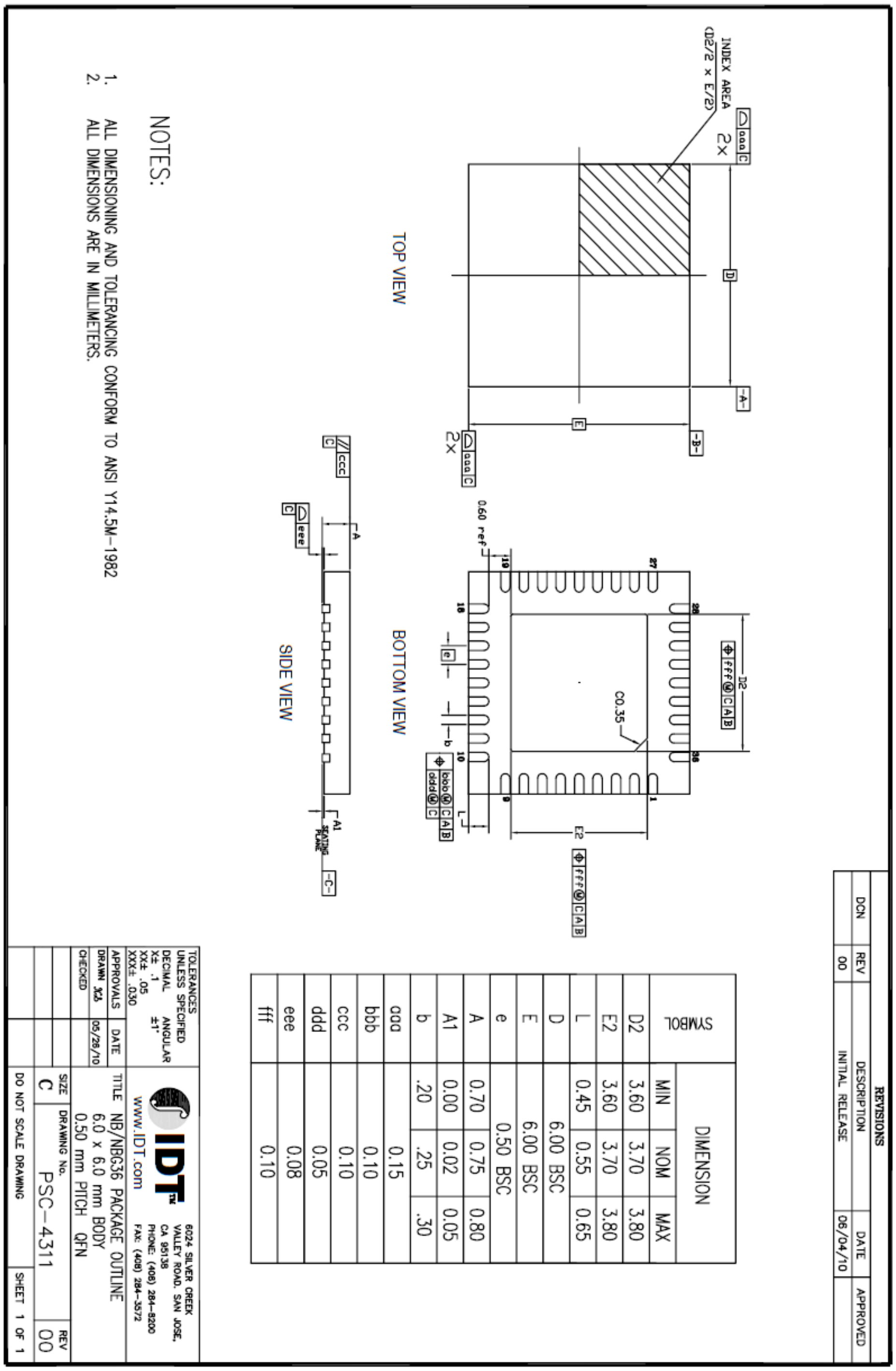
3RF X 3LO at Normal and High (+100C) Temps



Output P1dB at Normal and High (+100C) Temps



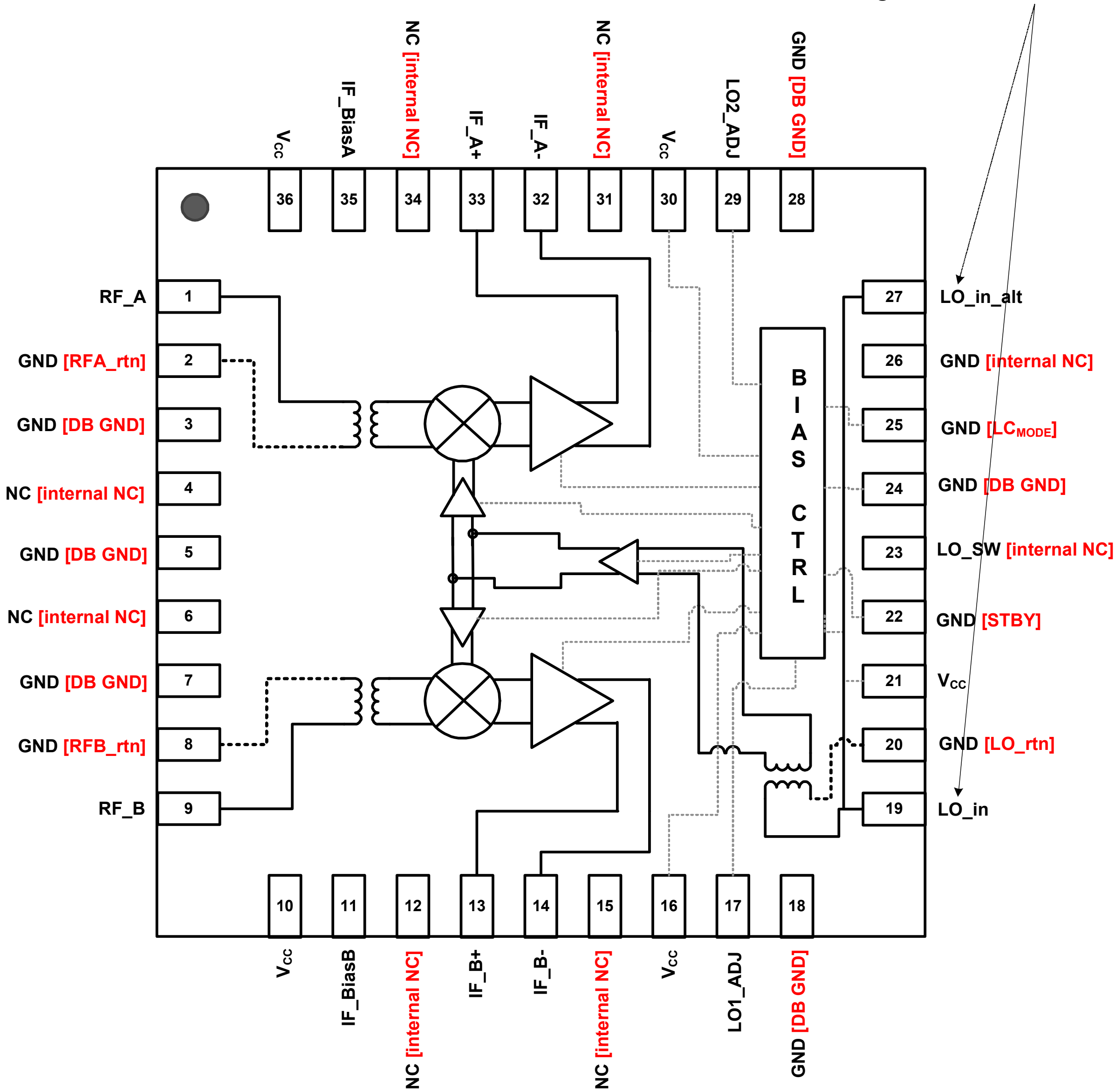
PACKAGE DRAWING (6X6 QFN)



PINOUTS

Black Text denotes recommended external connection
Red Text denotes internal Function or Connection
- **DB GND = Downbonded to Paddle**
- **Internal NC = Pin not connected**

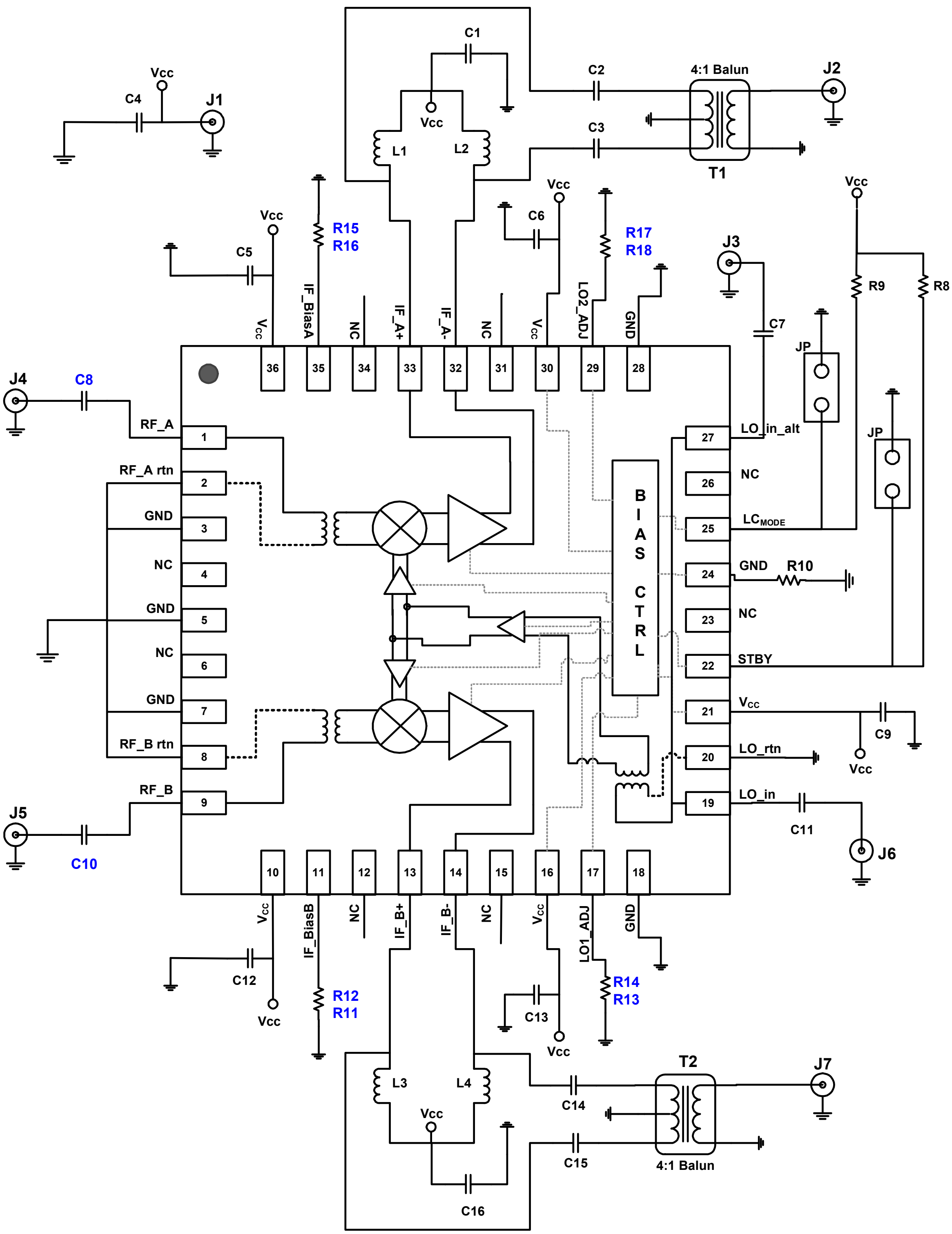
Please Note!
- **Only connect to one LO feed**
- **Choose Either Pin 19 or Pin 27**
- **Do not connect the unused LO pin to ensure good LO return loss**



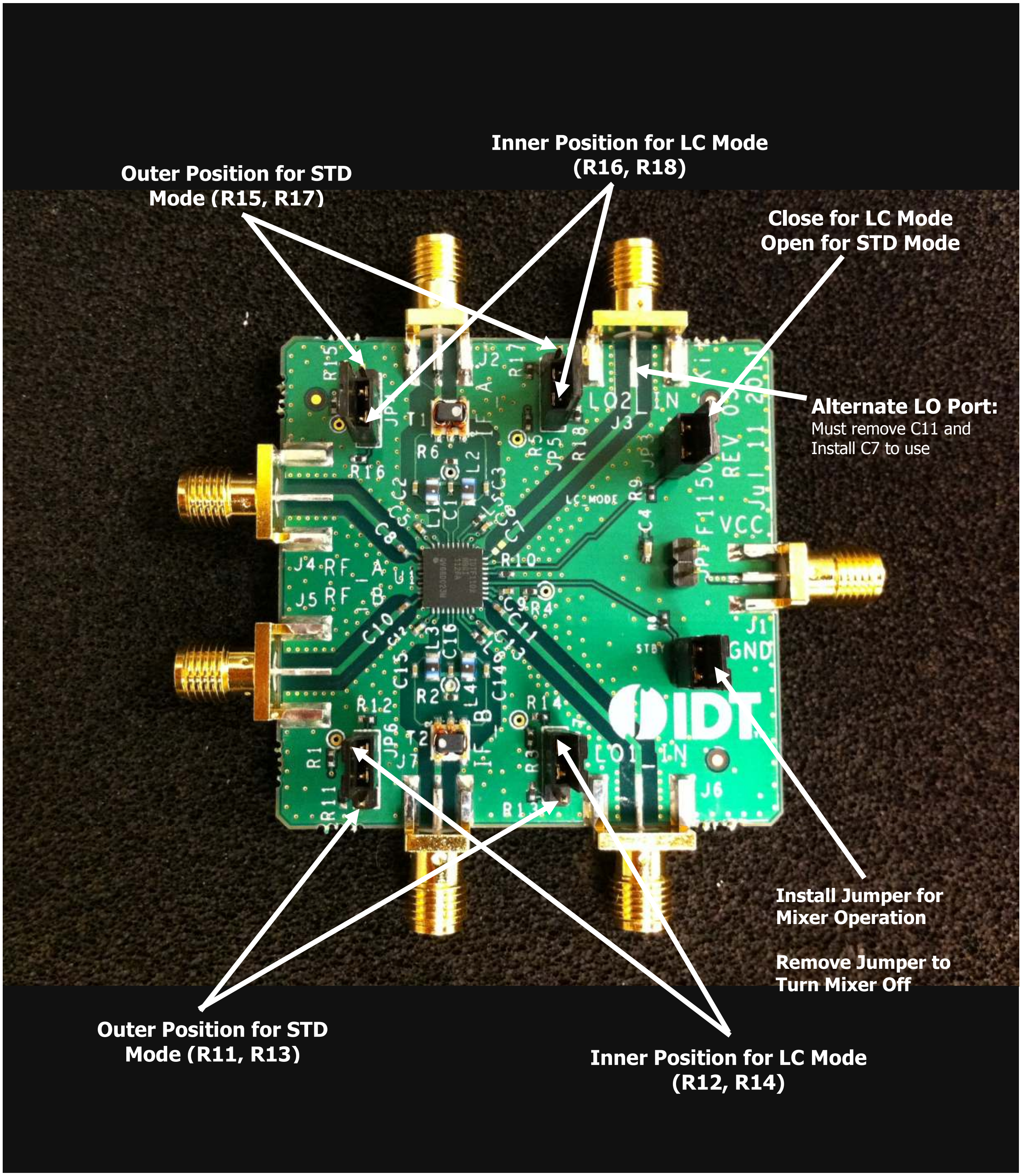
PIN DESCRIPTIONS

Pin	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, 24, 28	GND	Ground these pins.
4, 6, 12, 15, 31, 23, 26, 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 Supply. 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, 27	LO_in LO_in_alt	Local Oscillator Input. Connect the LO to this port through the recommended coupling capacitor. **Note that you can only drive one LO port at a time.** **Remove the series capacitor from the unused port.**
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.**

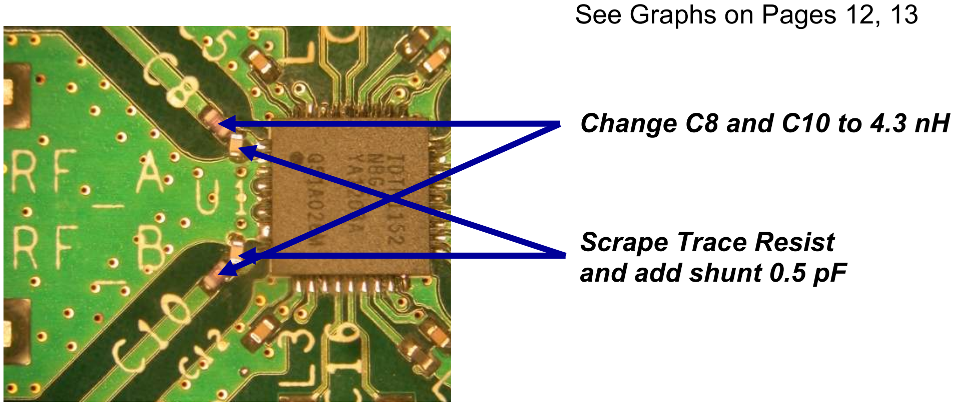
For Low Current Mode close the LC_{MODE} jumper in conjunction with positioning the 4 dual jumpers to select the resistors in **blue.**

F1152 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	39pF	0402	CAP CER 39PF 50V 5% C0G 0402	GRM1555C1H390JZ010	MURATA	C8,10,11	3
4	6pF	0402	Note: C7 and C11 cannot be installed together. C7 for Pin27 LO feed. C11 for Pin19 LO feed.			C7	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	220	0402	RES 220 OHM 1/10W 1% 0402 SMD	ERJ-2RKF2200X	Panasonic	**R13**	1
13	240	0402	RES 240 OHM 1/10W 1% 0402 SMD	ERJ-2RKF2400X	Panasonic	**R14**	1
14	2.15K	0402	RES 2.15K OHM 1/10W 1% 0402 SMD		Panasonic	**R18**	1
15	1.3K	0402	RES 1.3K OHM 1/10W 1% 0402 SMD	ERJ-2RKF1311X	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	F1152 **(Date Code >= 1201)**	QFN-36	Diversity Downconverter	IDTF1152NBGI	IDT	U1	1
20	PCB			F1152 EVKit Rev5			1

RF Matching for High Side Injection (1400 – 1700 MHz Bands 11, 21, 24)

See Graphs on Pages 12, 13



TOPMARKINGS

IDTF1152
NBGI
ZM1201A

Q03A026M
●

Part Number

***Date Code*: [xxYYWWx]**
(Work Week 1 of 2012)

Lot Code

***NOTE:* Production Devices are DateCode 1201 or later.**

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

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Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

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Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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