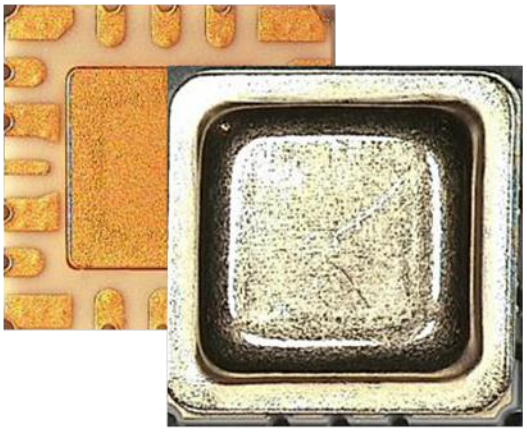
MECFCIFKUP

0.5 - 4 GHz to 10.5 – 13 GHz UpConverter



Product Description

MECFCIFKUP is a IF to Ka band frequency converter. It is based on a 0.25 µm GaAs pHEMT space evaluated process.

The MECFCIFKUP integrates 9 dB of continuous gain variation of the LO buffer amplifier, it can be changed either statically or dynamically by means a control voltage. The LO buffer gain variation feature allows great flexibility in its integration within different systems requiring different LO input power.

The MECFCIFKUP performance remain quite uniform as a function of the LO input power from -7 to +2 dBm.

The MMIC is assembled in a hermetically sealed SMT ceramic package suitable for space applications.

Main Features

- 0.25 µm GaAs pHEMT space evaluated process
- Full flat performance in the frequency bands:
  - IF: 0.5 – 2.5 GHz
  - LO: 8.1 – 12.4 GHz
  - RF: 10.5 – 13 GHz
- Mild roll-off of performance in the frequency bands:
  - RF: 0.5 – 4 GHz
  - LO: 6.6 – 12.4 GHz
  - IF: 10.5 – 13 GHz
- -7 to +2 dBm of LO input power with same conversion performance
- Fixed Bias: VDD = 3 V, Idq = 72 mA
- LO power control: VC2 = -5 to 0 V
- Fully matched to 50 Ω, with integrated RF to DC decoupling
- Assembled in a hermetically sealed SMT ceramic package

Applications

- Radar
- Defence
- Space
- Itar-free

Main Characteristics

Test Conditions: Tbase_plate = 25°C, Vdd = 3.0 V, Idq = 72 mA

Performance Parameter	Min.	Typ	Max	Units
Input Frequency Range	0.5		4.0	GHz
Output Frequency Range	10.5		13.0	GHz
LO Frequency Range	6.6		12.4	GHz
IF Input Power Range			0	dBm
LO Input Power Range	-7.0		2.0	dBm
Maximum Conversion Loss For LO > 8.1GHz For LO < 8.1GHz			 6.5 10.0	 dB dB
Conversion Loss Tolerance For LO > 8.1GHz For LO < 8.1GHz		 ± 1.0 ± 1.5		 dB dB
Conversion Loss Flatness		1.0		dB
Conversion Loss Variation vs. Temperature			0.7	dB
Conversion Gain Variation over life		0.5		dB
Conversion Gain Variation with LO Drive Level		1.5		dB
Noise Figure (SSB) For LO > 8.1GHz For LO < 8.1GHz			 6.5 10.0	dB
Output P1dB	1.0			dBm
Output IP2 level	25.0			dBm
Output IP3 level	5.0			dBm
LO signal level at RF port			-45	dBm
LO to RF Isolation For LO input power < -3dBm For LO input power >= -3dBm	 8.0 15.0			 dB dB
LO signal level at IF port			-55	dBm
IF to RF Isolation	20.0			dB
LO to IF Isolation	20.0			dB
Input Return Loss	8.0			dB
Output Return Loss	7.5			dB
LO Input Return Loss	12.0			dB
In-band Mixing Spurious Levels	50.0			dBc

0.5 - 4 GHz to 10.5 – 13 GHz UpConverter

Performance Parameter	Min.	Typ	Max	Units
Close to In-band Mixing Spurious Level	50.0			dBc
2LO x -RF Spurious	5.0			dBc
IF Spurious Harmonic Level	50			dBc
Power Supply Induced Spurious Level	83.0			dBc
Nominal Drain Supply Voltage		+3.0		V
Gate Supply Voltage		-0.45		V
Control Voltage Levels	-5.0		0	V
Supply Voltage Noise/Ripple		30		mVpp
Supply Voltage Noise/Ripple Frequency	30		1M	Hz
Power Consumption			0.26	W
Packaged Component Size Body Dimensions Package Height		 6 x 6 2.5		 mm^2 mm

Absolute Maximum Rating

Symbol	Parameter	Values	Unit
VD_max	Maximum Supply Bias Voltage	4.0	V
Vg_min	Negative Gate Bias Voltage	-1.5	V
Tj	Maximum junction temperature	175	°C
PDC_max	Maximum DC power (at 85 °C of baseplate and VD_max)	380	mW
Pin_RF	Maximum RF Input Power Range	13.0	dBm
Pin_LO	Maximum LO Input Power Range	10 @ PLO [-3, +2] 6 @ PLO [-7, -4]	dBm

Thermal and Reliability Information

Conditions	Parameter	Values	Unit
Worst case operating conditions: VD = 3.0 V, ID = 87 mA VC2 = -1.5V P_RF = -20 dBm P_LO = +2 dBm Pdiss = 260 mW Tbaseplate = 85°C	Equivalent Thermal Resistance	154	°C/W
	Channel Temperature	125	°C
	Mean Time Failure	**> 2E+7**	**Hrs**

Test Setup

Example optimal bias and control voltages

LO Buffer		Unit
VD2	3.0	V
VG2	-0.45 (typ.)	V
ID2q	72	mA

LO power window	
VC2	*P_LO*
-4.5 V	[-7, -4] dBm
-3.0 V	[-3, -1] dBm
-1.5 V	[0, +2] dBm

Control Voltage VC2 is chosen to equalize the conversion performance in 3 different sets of P_LO (see table above) at the centre frequencies of the conversion matrix.

***NOTE**: This is an example setup to make the converter work with three different sets of LO power. The LO gain variation feature can be exploited to continuosly optimize the conversion performance as a function of the LO power.*

Measured Frequency Conversions

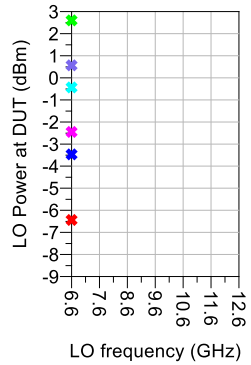
LO freq	6.6	LO freq	7.35	LO freq	8.1	LO freq	9.2	LO freq	10.25	LO freq	11.3	LO freq	12.4	GHz
Syn. #	1	Syn. #	2	Syn. #	3	Syn. #	4	Syn. #	5	Syn. #	6	Syn. #	7	
IF freq.	RF freq	IF freq.	RF freq	IF freq.	RF freq	IF freq.	RF freq	IF freq.	RF freq	IF freq.	RF freq	IF freq.	RF freq	
								0.5	10.75	0.5	11.8	0.5	12.9	
						1	10.2	1	11.25	1	12.3	1	13.4	
				1.5	9.6	1.5	10.7	1.5	11.75	1.5	12.8	1.5	13.9	
				2	10.1	2	11.2	2	12.25	2	13.3			
		2.5	9.85	2.5	10.6	2.5	11.7	2.5	12.75	2.5	13.8			
3	9.6	3	10.35	3	11.1	3	12.2	3	13.25					
3.5	10.1	3.5	10.85	3.5	11.6	3.5	12.7	3.5	13.75					
4	10.6	4	11.35	4	12.1	4	13.2							
GHz	GHz	GHz	GHz	GHz	GHz	GHz	GHz	GHz	GHz	GHz	GHz	GHz	GHz	

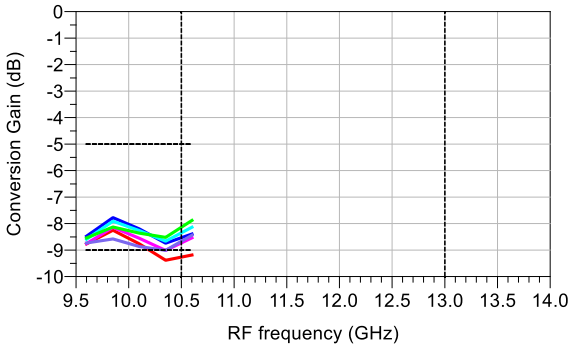
F_LO = 6.6 GHz Vs. State Vs. P_LO

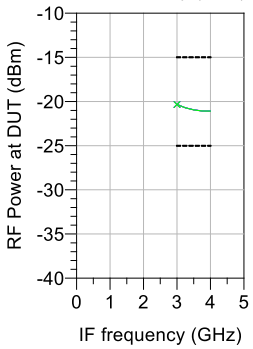
Line colours correspond to the set P_LO:

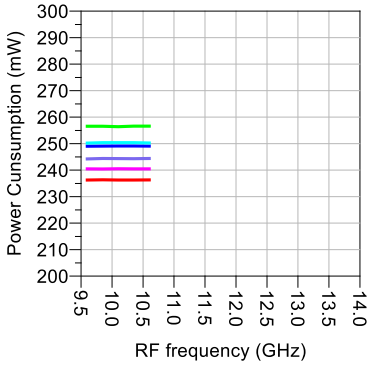
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm

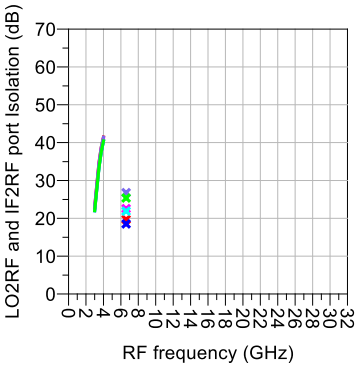
Spur1 = (2, -1); Spur2 = (2, -2); Spur3 = (3, -3)

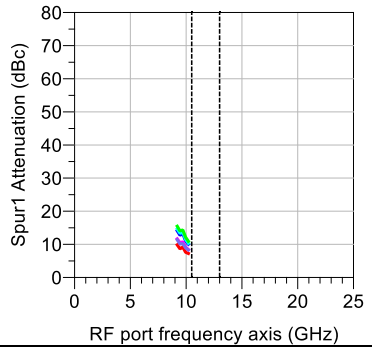


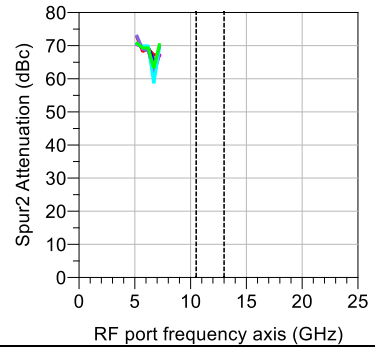


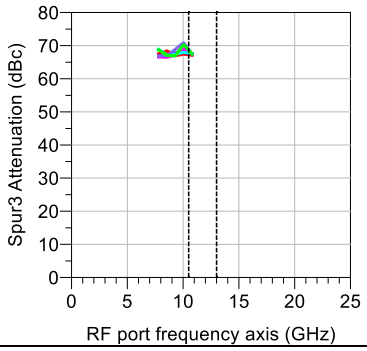


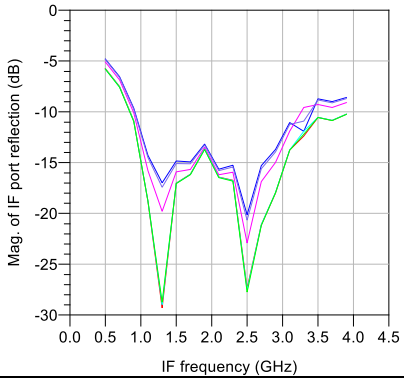


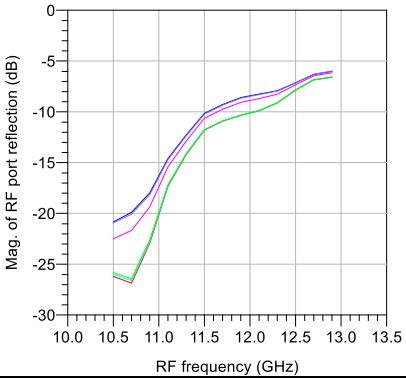










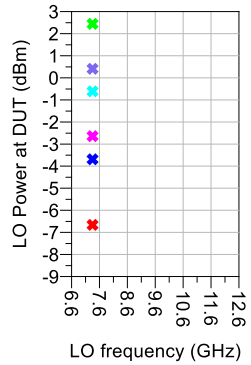


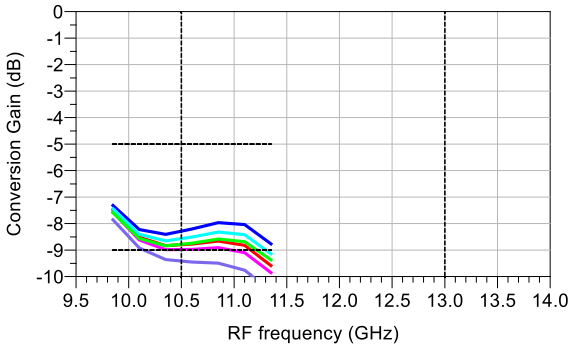
F_LO = 7.35 GHz Vs. State Vs. P_LO

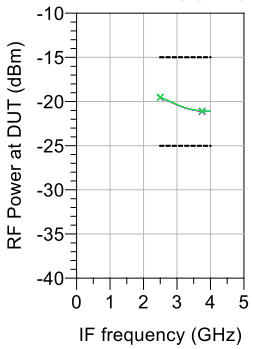
Line colours correspond to the set P_LO:

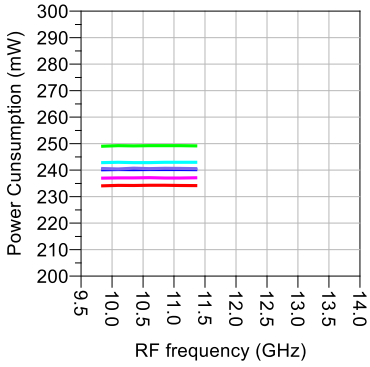
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm

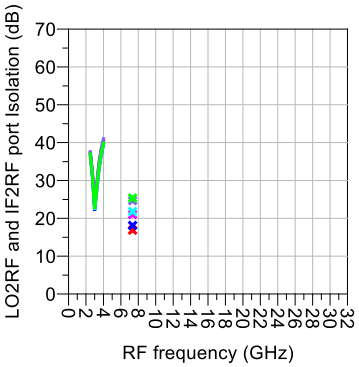
Spur1 = (2, -1); Spur2 = (2, -2); Spur3 = (3, -3)

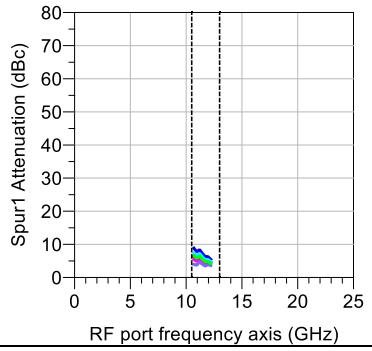


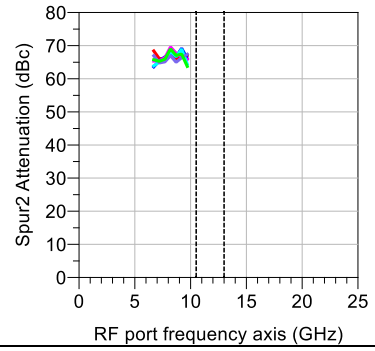


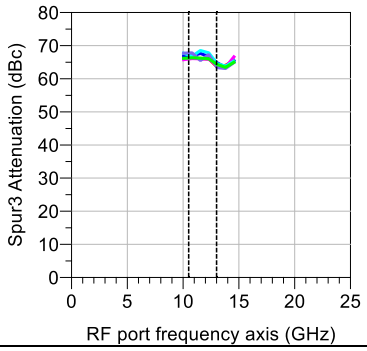


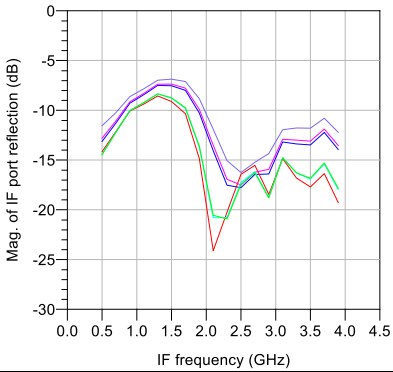


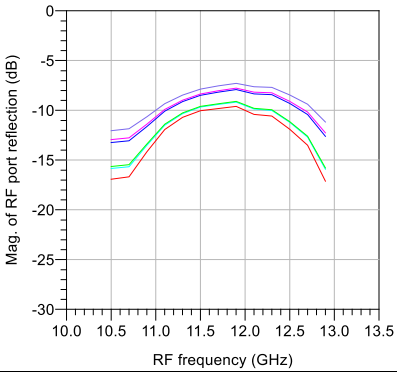










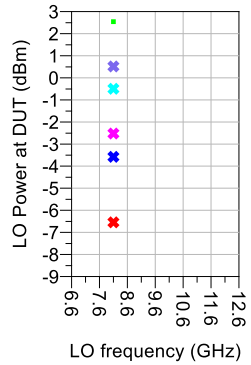


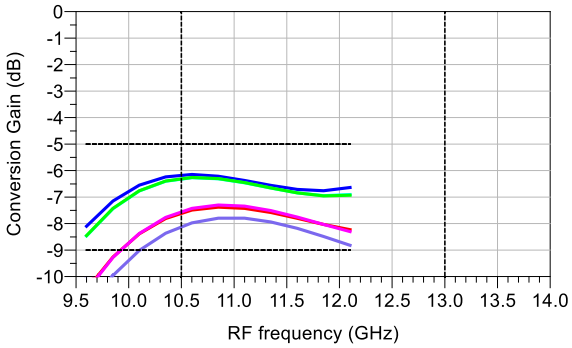
F_LO = 8.1 GHz Vs. State Vs. P_LO

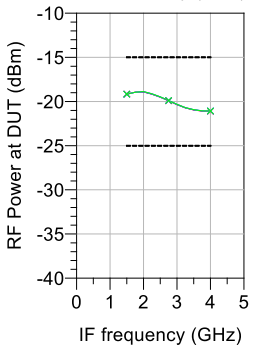
Line colours correspond to the set P_LO:

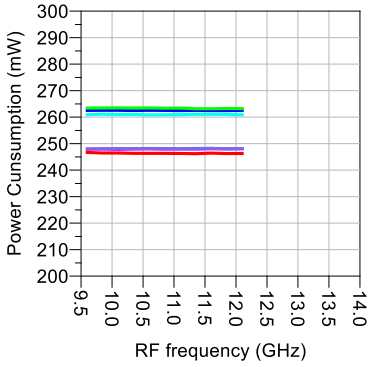
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm

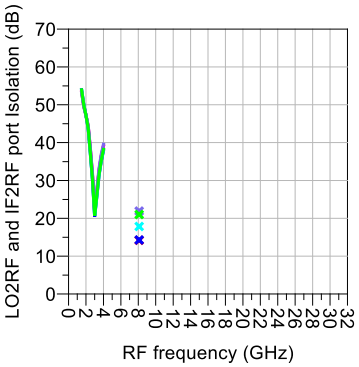
Spur1 = (2, -1); Spur2 = (2, -2); Spur3 = (3, -3)

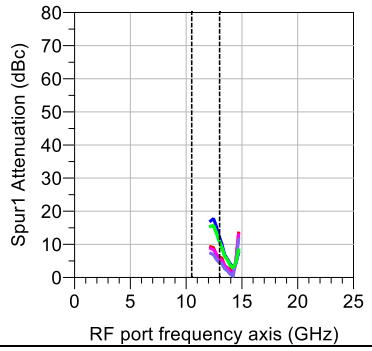


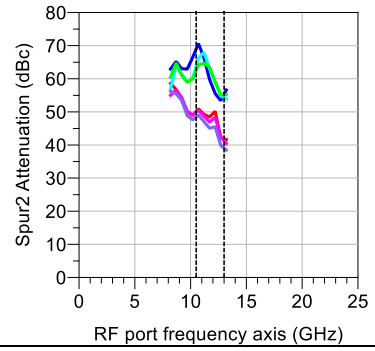


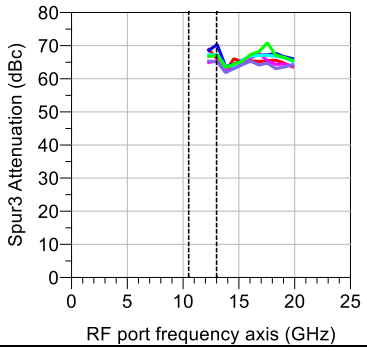


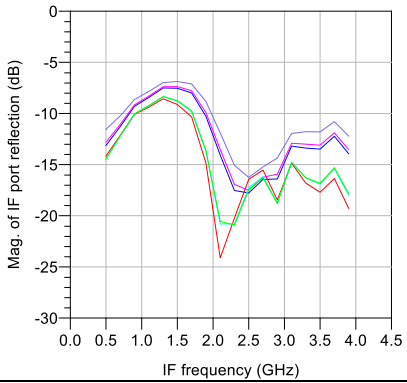


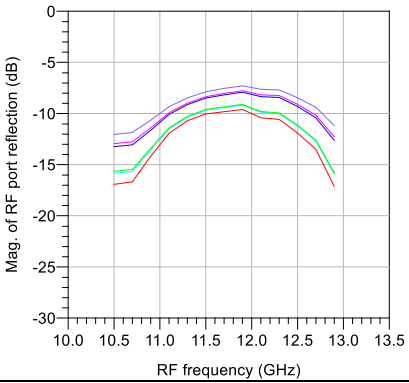










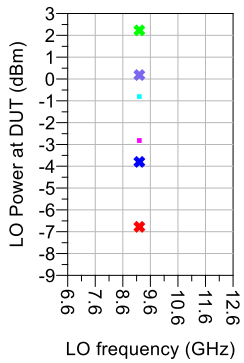


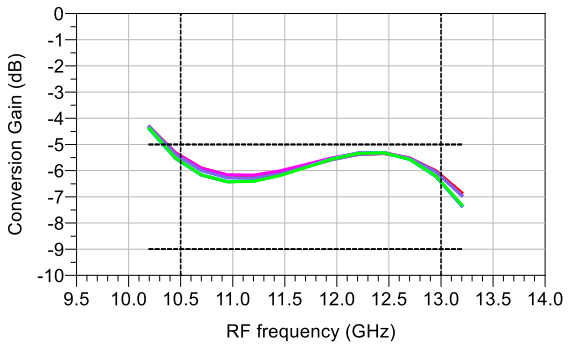
F_LO = 9.2 GHz Vs. State Vs. P_LO

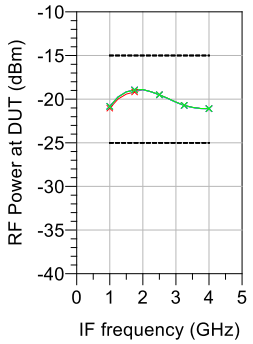
Line colours correspond to the set P_LO:

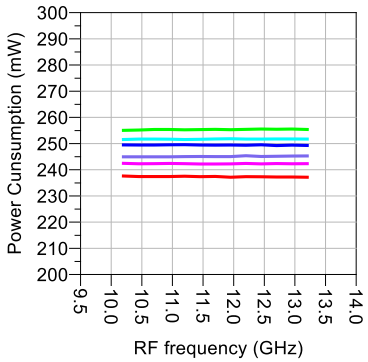
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm

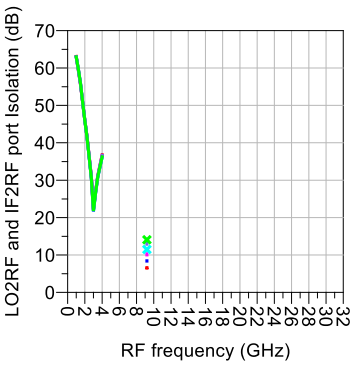
Spur1 = (2, -1); Spur2 = (2, -2); Spur3 = (3, -3)

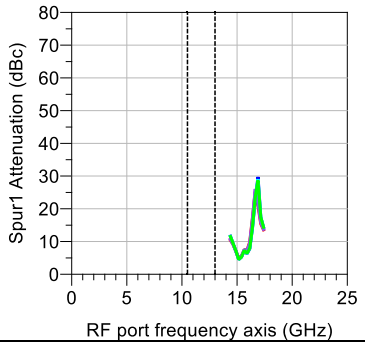


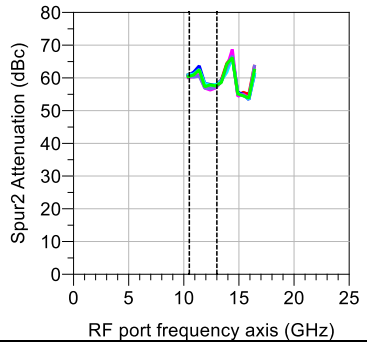


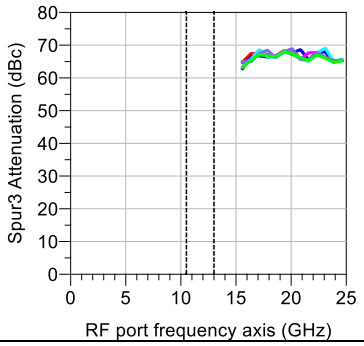


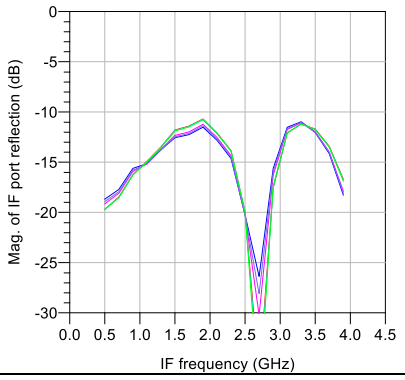


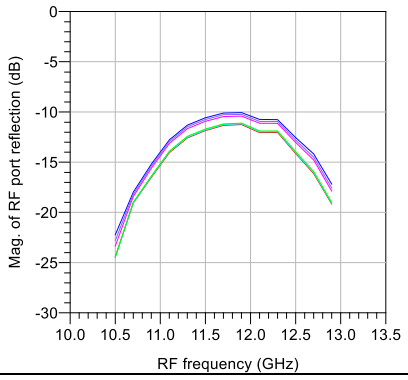










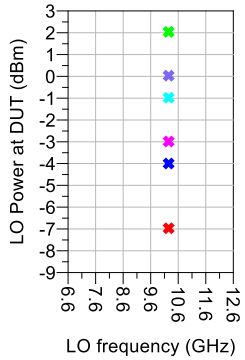


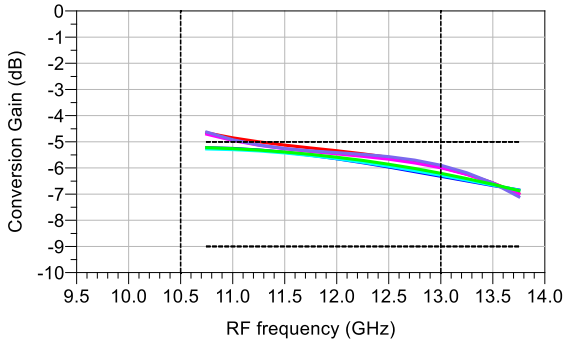
F_LO = 10.25 GHz Vs. State Vs. P_LO

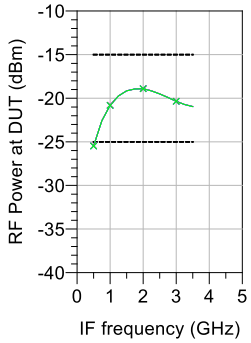
Line colours correspond to the set P_LO:

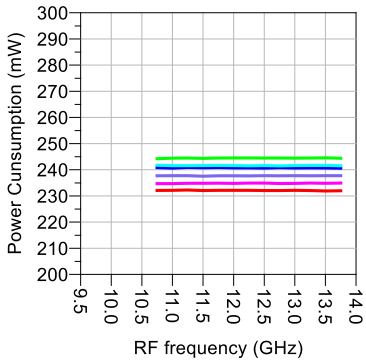
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm

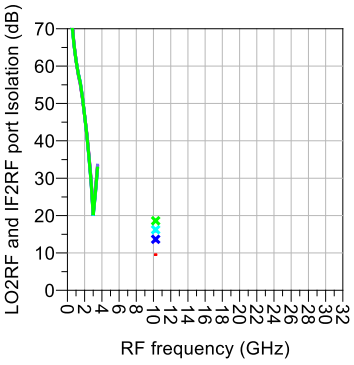
Spur1 = (2, -1); Spur2 = (2, -2); Spur3 = (3, -3)

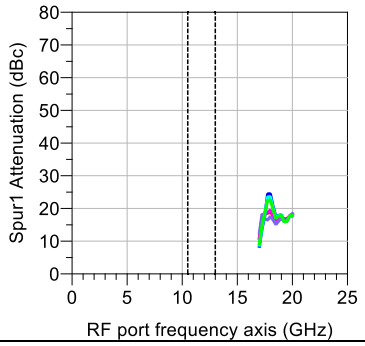


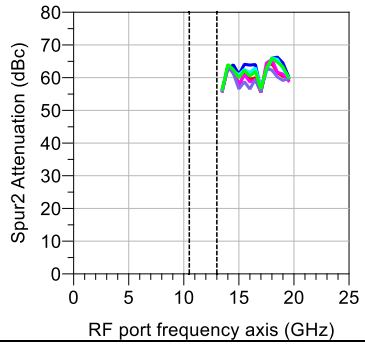


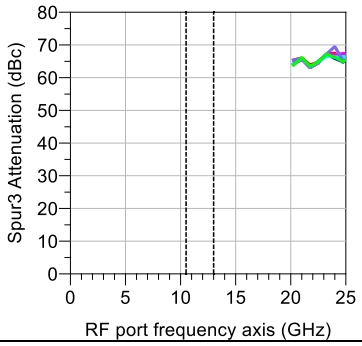


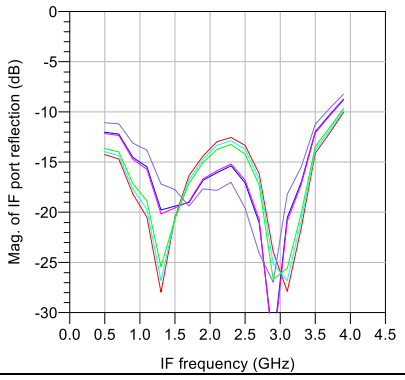


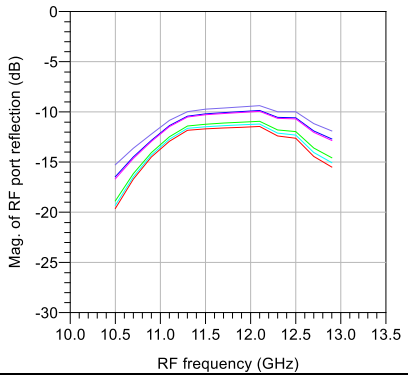










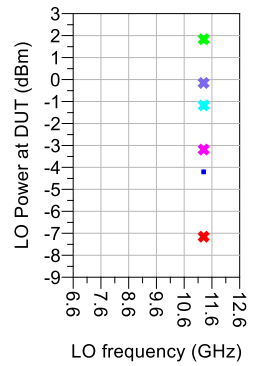


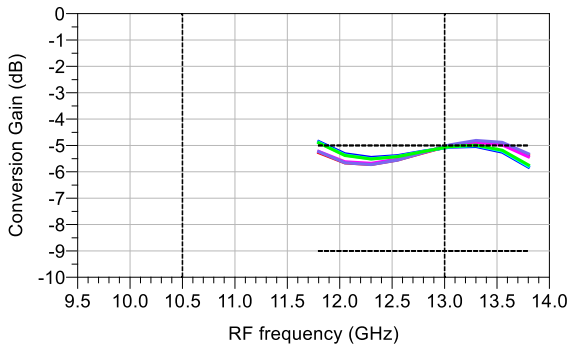
F_LO = 11.3 GHz Vs. State Vs. P_LO

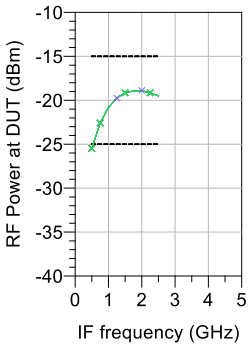
Line colours correspond to the set P_LO:

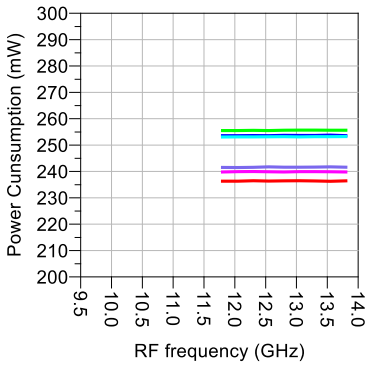
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm

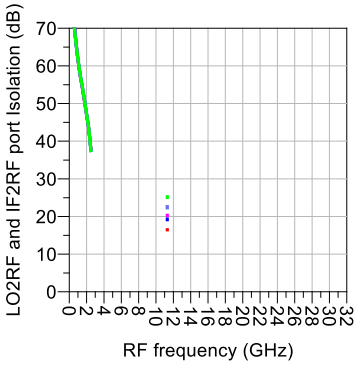
Spur1 = (2, -1); Spur2 = (2, -2); Spur3 = (3, -3)

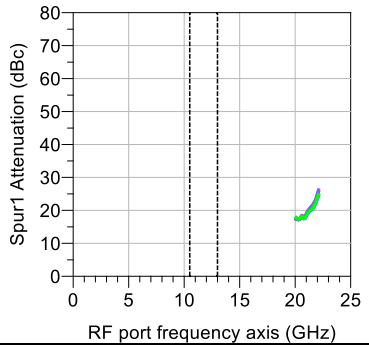


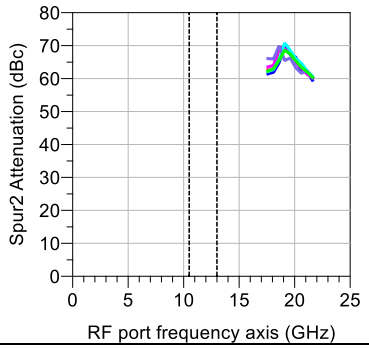


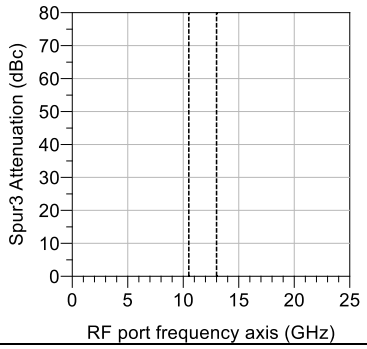


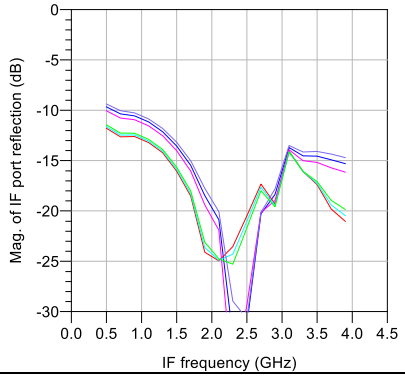


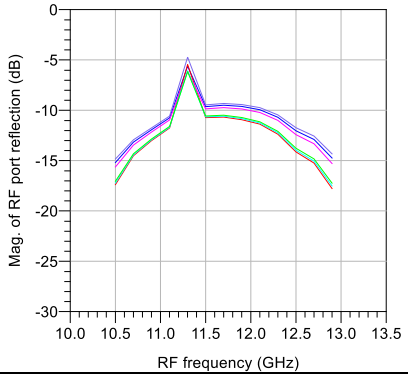










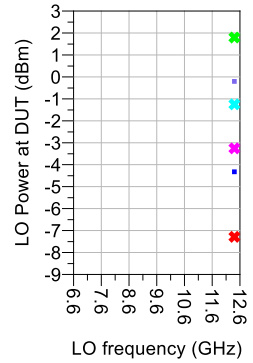


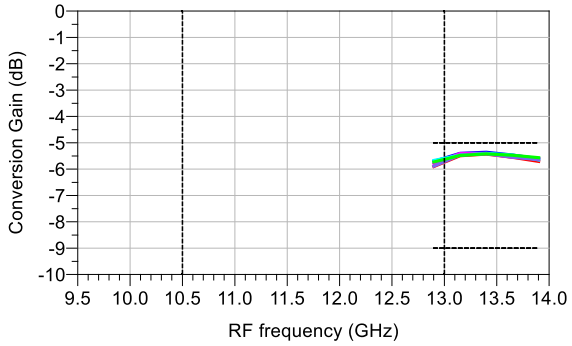
F_LO = 12.4 GHz Vs. State Vs. P_LO

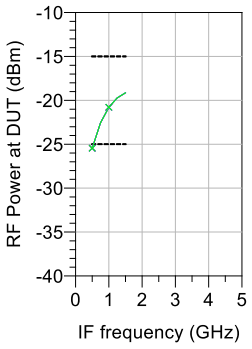
Line colours correspond to the set P_LO:

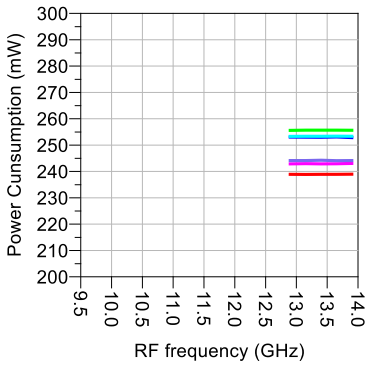
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm

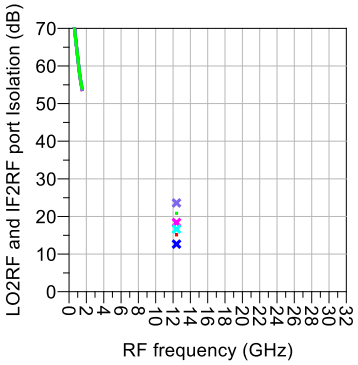
Spur1 = (2, -1); Spur2 = (2, -2); Spur3 = (3, -3)

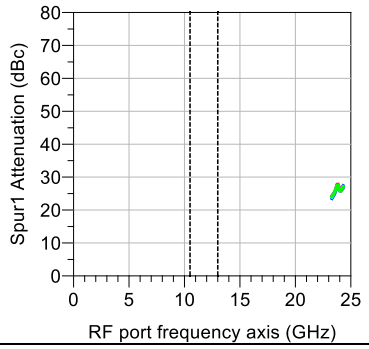


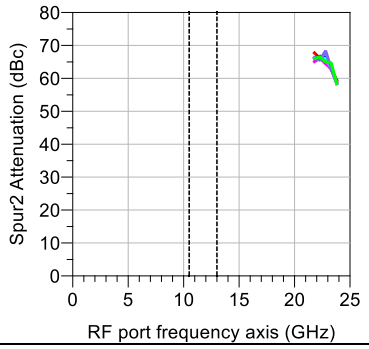


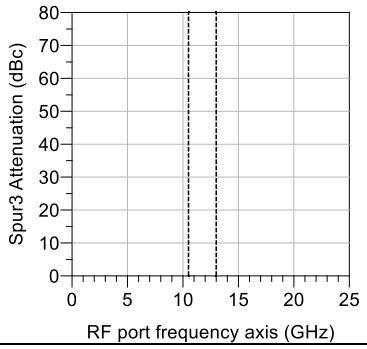


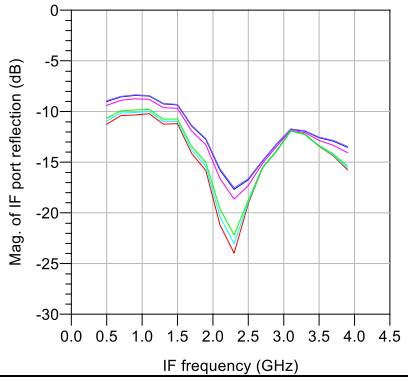


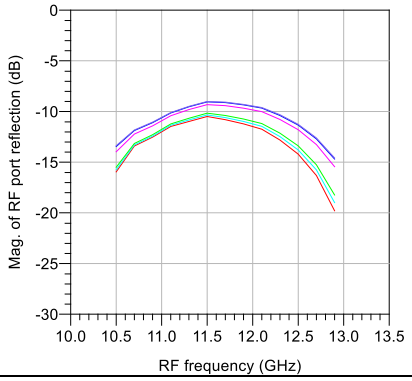








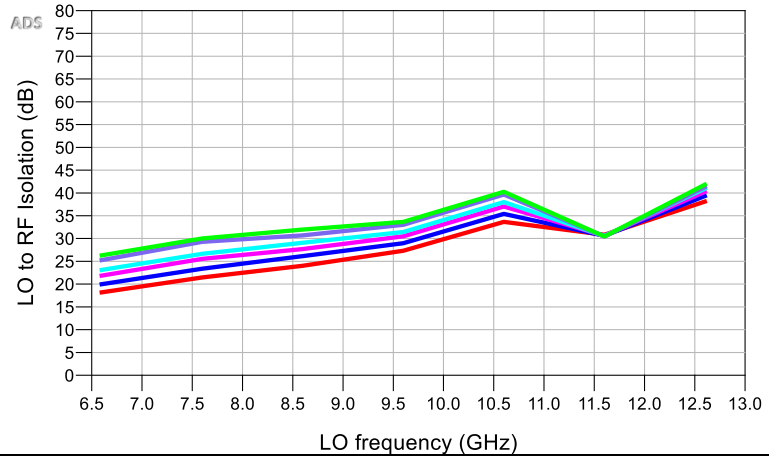




LO Isolation at RF port Vs. F_LO Vs. P_LO Window

Line colours correspond to the set P_LO:

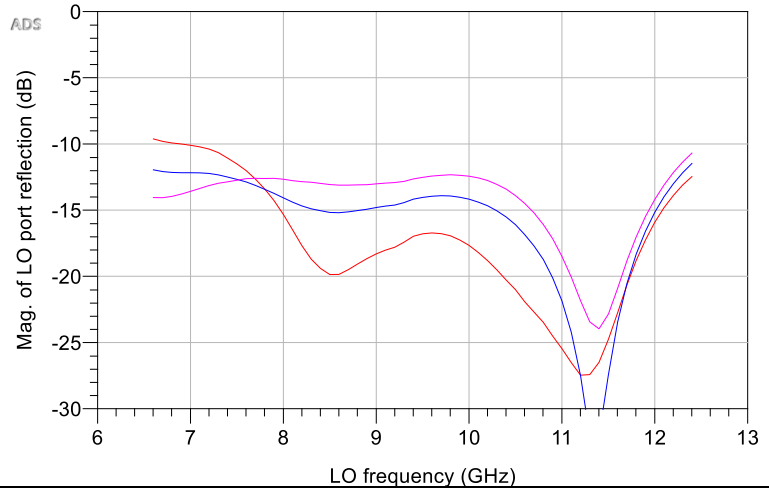
P_LO=-7dBm; P_LO=-4dBm; P_LO=-3dBm; P_LO=-1dBm; P_LO=0dBm; P_LO=2dBm;



LO port matching Vs. P_LO Window

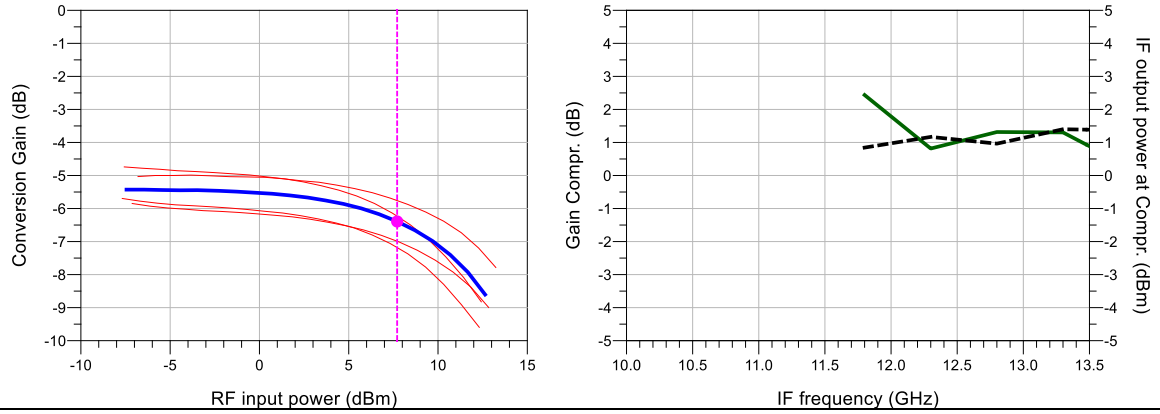
Line colours correspond to the set P_LO:

P_LO_W1: VC2=-5.0V; P_LO_W2: VC2=-4.0V; P_LO_W3: VC2=-2.8V

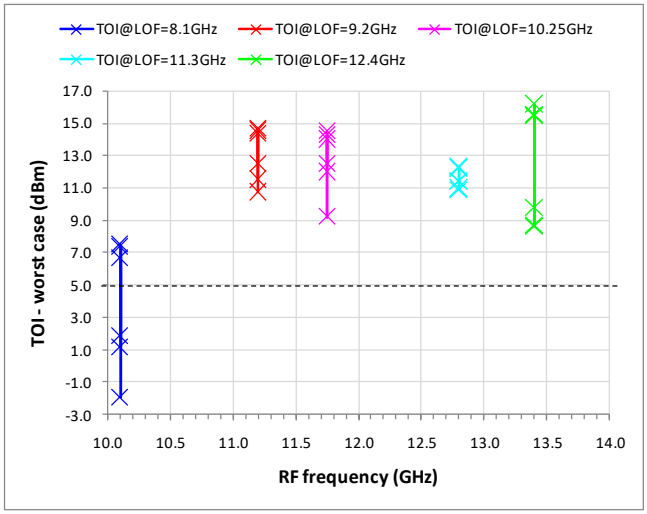
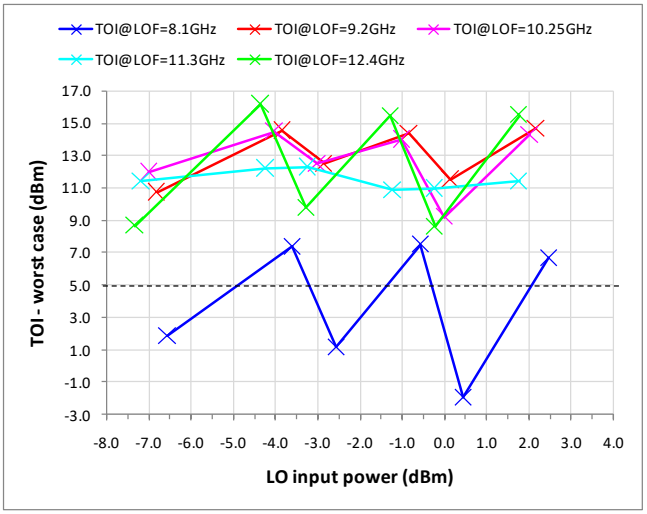


Conversion Gain Compression:
F_LO = 9.2 GHz at P_LO=-3dBm Vs. F_IF

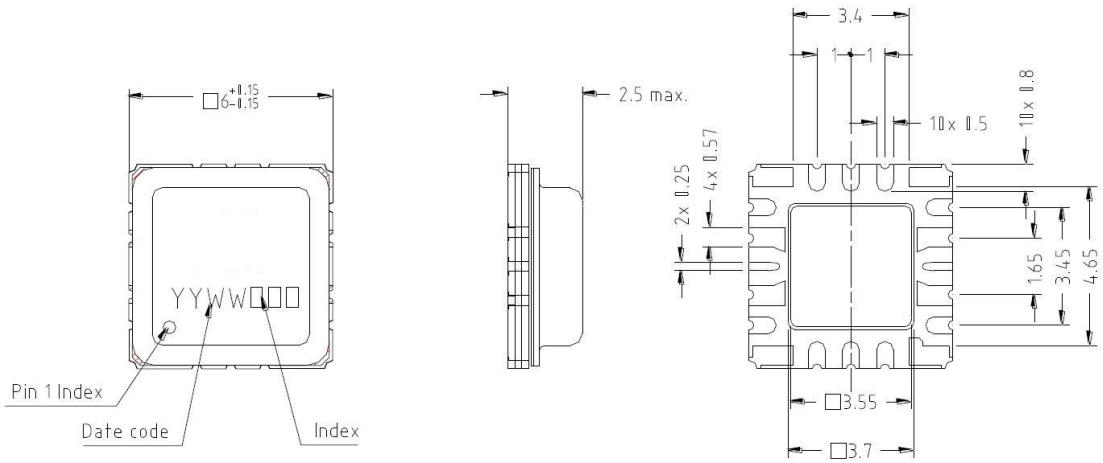
Compression curves
Compression curve at F_IF=1.5GHz;
P_RF at the chosen compression level at chosen F_IF;
Gain Compression as a function of the swept F_IF;
IF output power at the chose compression level;



Third Order Intercept Point

Worst Case TOI as a function of the RF frequency. P_RF (DCL) = -20 dBm	Worst Case TOI as a function of the P_LO power P_RF (DCL) = -20
	

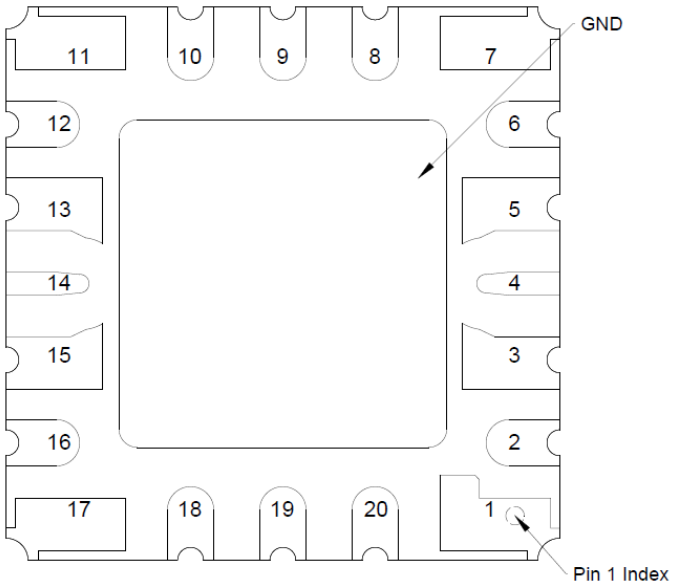
Package Outline



All dimensions are in mm.
Detailed package dimensions and characteristics are available upon request at **contact.mec@mec-mmic.com**

PIN Configuration & Assembly Recommendations

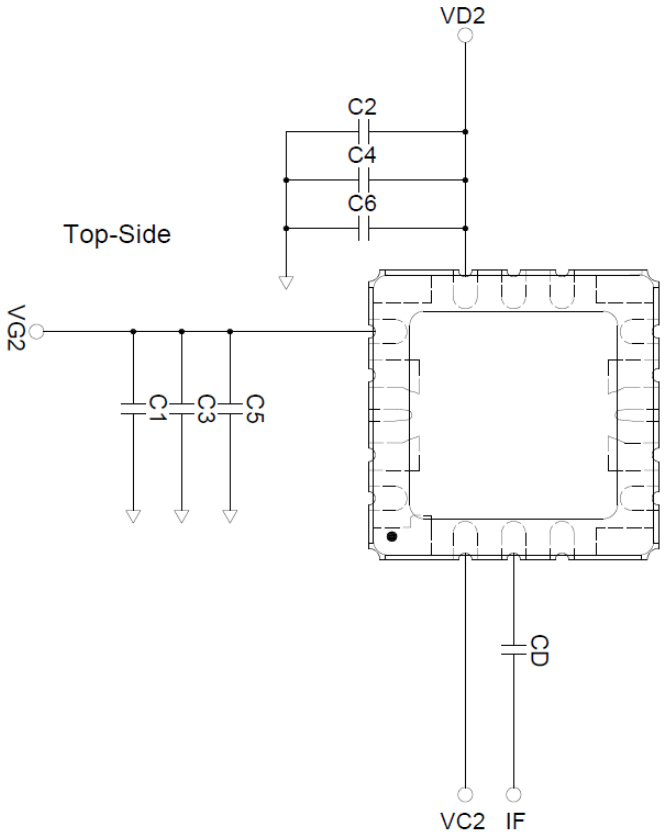
PIN-OUT From Case Back-Side



PIN #	Symbol	Description
4	LO	LO Signal
6	VG2	LO Buffer Gate Voltage
8	VD2	LO Buffer Drain Voltage
14	RF	RF Signal
19	IF	IF Signal
20	VC2	LO Buffer CTRL Voltage
1,3,5,7, 11,13,15,17	GND	
2,9,10, 12,16,18	NC	

It is strongly recommended to ground all pins marked "GND" through the PCB board.
Ensure that the PCB board is designed to provide the best possible ground to the package.

External Components Suggested



Ref.	Value	Description
CD	100 nF	Ultrabroadband Decoupling Capacitor
C1, C2	1 µF	Low Frequency Bypass Capacitor
C3, C4	12 nF	Low Frequency Bypass Capacitor
C5, C5	100 pF	Low Frequency Bypass Capacitor

Bias Procedure

Bias-Up

1. Vg set to -1.5 V.
2. Vd set to +3 V.
3. Adjust Vg until quiescent Id is 72 mA (Vg = -0.45 V Typical).
4. Apply RF signals.

Bias-Down

1. Turn off RF signals.
2. Reduce Vg to -1.5 V (Id0 ≈ 0 mA).
3. Set Vd to 0 V.
4. Set Vg to 0 V.

Contact Information

For additional technical Information and Requirements:

Email: contact.mec@mec-mmic.com

For sales Information and Requirements:

Email: sales@mec-mmic.com

Notice

The furbished information is believed to be reliable. However, performances and specifications contained herein are based on preliminary characterizations and then susceptible to possible variations. On the basis of customer requirements, the product can be tested and characterized in specific operating conditions and, if needed, tuned to meet custom specifications.