# RFMX2015

## DIFFERENTIAL IF DOWN-CONVERTER 2300MHZ TO 2700MHZ

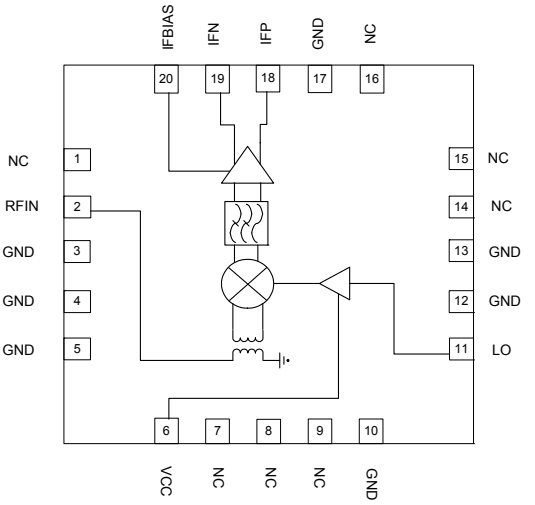
**Package: MCM, 20-Pin, 5.2mmx5.2mm**

## Features

- RF: 2300MHz to 2700MHz
- LO: 2000MHz to 3000MHz
- IF: 50MHz to 300MHz
- Operates Both High and Low-Side LO
- Conversion Gain: 9.8dB (IF=150MHz)
- Input IP3: 29dBm
- Input P1dB: 11dBm
- Adjustable Current and IP3 (via IFBIAS)
- Single +5V Supply

## Applications

- 3G Infrastructure
- WiBro, WiMax LTE
- Wireless Backhaul
- High Performance Communications Systems
- GMSK, QPSK, DQPSK, QAM Modulation




Functional Block Diagram

## Product Description

The RFMX2015 is a high-linearity, down-converter module designed for use in 3G, LTE, and other high performance communications systems. The RFMX2015 contains an integrated LO buffer amp and a passive mixer core with an amplified differential IF output. The integrated LO buffer lowers the LO drive requirement to a friendly 0dBm typical. The RFMX2015 supports both low and high-side LO injection for IF frequencies up to 300MHz. The RFMX2015 also offers an adjustable IP3 range via the IFBIAS pin. Users can lower the IF amplifier DC current to save DC power when they don't require the device's peak linearity performance.

### Ordering Information

| | |
|---|---|
| RFMX2015SQ | Sample Bag with 25 pieces |
| RFMX2015SR | 7” Reel with 100 pieces |
| RFMX2015TR7 | 7” Reel with 750 pieces |
| RFMX2015TR13 | 13” Reel with 2500 pieces |
| RFMX2015PCK-410 | 2300MHz to 2700MHz PCBA with 5-piece Sample Bag |

### Optimum Technology Matching® Applied

| | | | |
|---|---|---|---|
| ☐ GaAs HBT | ☐ SiGe BiCMOS | ☐ GaAs pHEMT | ☐ GaN HEMT |
| ☑ GaAs MESFET | ☐ Si BiCMOS | ☐ Si CMOS | ☐ BiFET HBT |
| ☑ InGaP HBT | ☑ SiGe HBT | ☐ Si BJT | ☐ LDMOS |





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## Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|---|---|
| Supply Voltage ($V_{CC}$) | 5.5 | V |
| Maximum RF Input Power | 18 | dBm |
| Maximum LO Input Power | 10 | dBm |
| Maximum Power Dissipation | 1.5 | W |
| Operating Temperature Range | -40 to +85 | °C |
| Storage Temperature Range | -40 to +150 | °C |
| Maximum Junction Temperature | +150 | °C |
| ESD Rating - Human Body Model | Class 1A | |
| Moisture Sensitivity Level | MSL 3 | |

**Caution!** ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EUDirective2002/95/EC (at time of this document revision).



| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| **General Performance** | | | | | |
| Conversion Gain | 8.8 | 9.8 | 10.8 | dB | $f_{RF}$=2560MHz, $f_{LO}$=2410MHz |
| Input Third Order Intercept | 27 | 29 | | dBm | $f_{RF1}$=2560MHz, $f_{RF2}$=2561MHz, $f_{LO}$=2410MHz, -5dBm/tone |
| Input 1dB Compression Point | | 11 | | dBm | $f_{RF}$=2560MHz, $f_{LO}$=2410MHz |
| Noise Figure | | 13.5 | | dB | SSB NF, $f_{RF}$=2500MHz, $f_{LO}$=2350MHz |
| LO Leakage at RF Port | | -21 | | dBm | LO=-3dBm |
| LO Leakage at IF Port | | -25 | | dBm | LO=-3dBm |
| RF to IF Isolation | | 42 | | dB | LO=-3dBm, $P_{RF}$=0dBm |
| 2RF to 2LO Spurious Response | | -62 | | dBc | $P_{RF}$=-5dBm |
| 3RF to 3LO Spurious Response | | -75 | | dBc | $P_{RF}$=-5dBm |
| **RF Interface** | | | | | |
| Frequency Range | 2300 | | 2700 | MHz | |
| Input Return Loss | | >12 | | dB | IF port terminated, LO=0dBm |
| Input Impedance | | 50 | | Ω | |
| **LO Interface** | | | | | |
| Frequency Range | 2000 | | 3000 | MHz | |
| LO Input Power | -3 | 0 | 3 | dBm | |
| Return Loss | | >12 | | dB | IF port terminated |
| Impedance | | 50 | | Ω | |
| **IF Interface** | | | | | |
| Frequency Range | 50 | | 300 | MHz | |
| Output Return Loss | | >12 | | dB | $f_{IF}$<150 MHz |
| Differential Output Impednace | | 200 | | Ω | |
| **Power Supply** | | | | | |
| Supply Voltage ($V_{CC}$) | 4.75 | 5 | 5.25 | V | |
| Supply Current ($I_{CC}$) | 175 | 200 | 240 | mA | Sum of all currents. |
| Thermal Resistance of LO Amp | | 93 | | C/W | Based on LO Amp current (pin 6) |
| Thermal Resistance of IF Amp | | 88 | | C/W | Based on IF Amp current (pins 18 and 19) |

Notes:
1. Data shown for $V_{CC}$=5.0V, LO Power=0dBm, T=25°C, $f_{RF}$=2500 MHz, $f_{LO}$=2350 MHz
2. All measurements performed with an RFMD IF BALUN (P/N RFXF2553) on the EVM.


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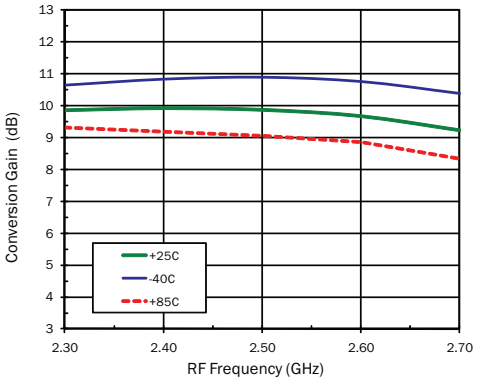
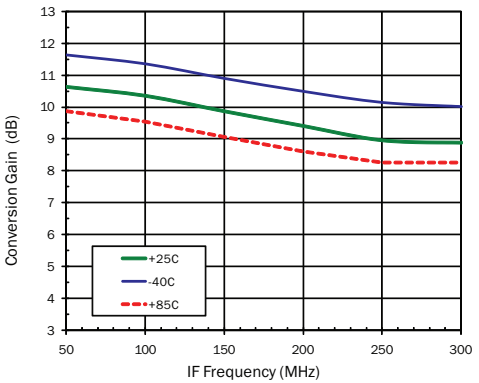
## Typical Performance: $V_{CC}$=5.0V, $P_{LO}$=0dBm, $P_{RF}$=0dBm, $f_{IF}$=150MHz, Unless Otherwise Noted.

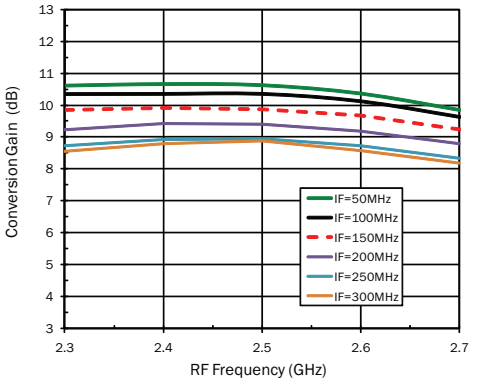
Gain vs. RF Frequency (Low Side LO)



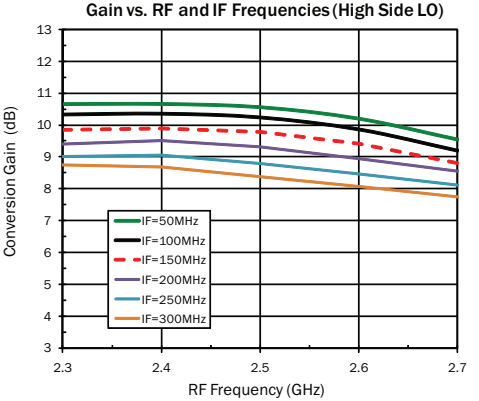

Gain vs. IF Frequency (RF=2500MHz, LS LO)



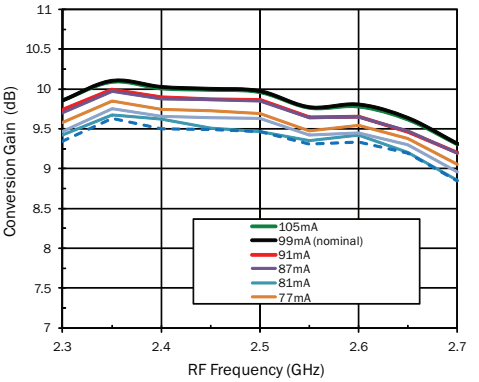

Gain vs. RF and IF Frequencies (Low Side LO)



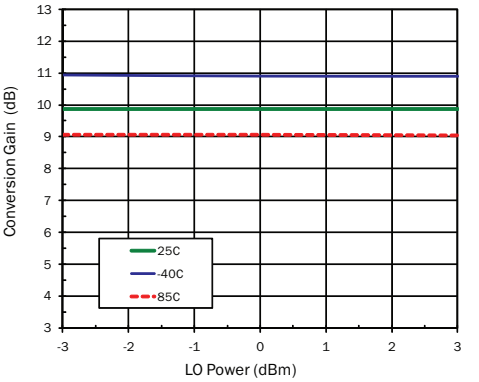

Gain vs. RF and IF Frequencies (High Side LO)




Gain vs. IF Amp Current (varied IFBIAS, LS LO)

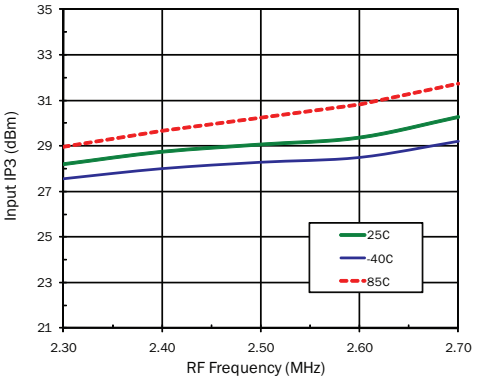



Gain vs. LO Power (RF=2500MHz, LS LO)

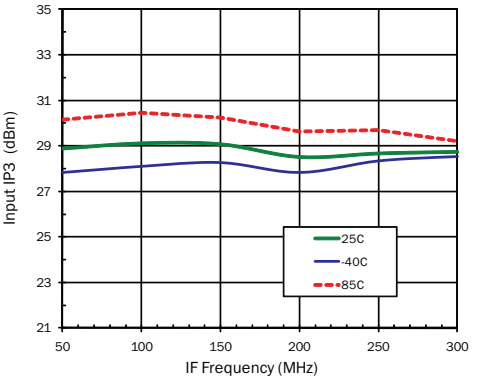


## Typical Performance - $V_{CC}$=5.0V, $P_{LO}$=0dBm, $P_{RF}$=0dBm, $f_{IF}$=150MHz, Unless Otherwise Noted.

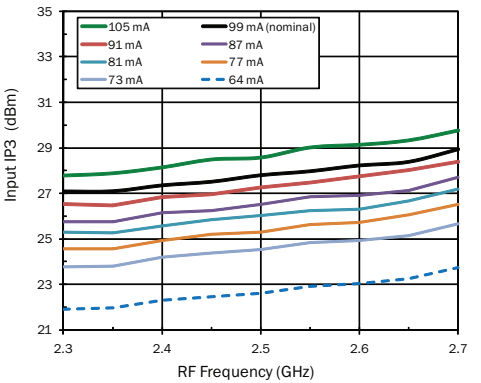
Input IP3 vs. RF Frequency (Low Side LO)



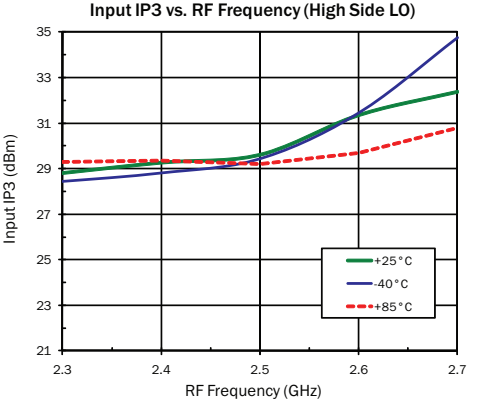

Input IP3 vs. IF Frequency (RF=2500MHz, LS LO)



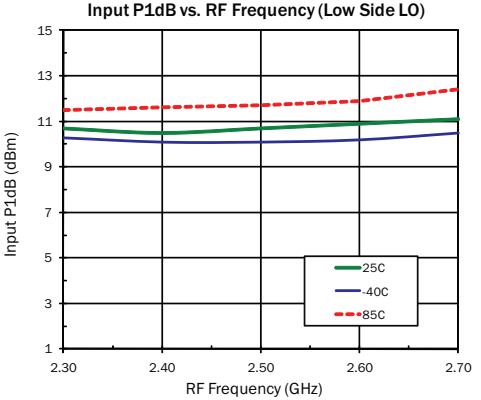

IIP3 vs. IF Amp Current (varied IFBIAS, LS LO)



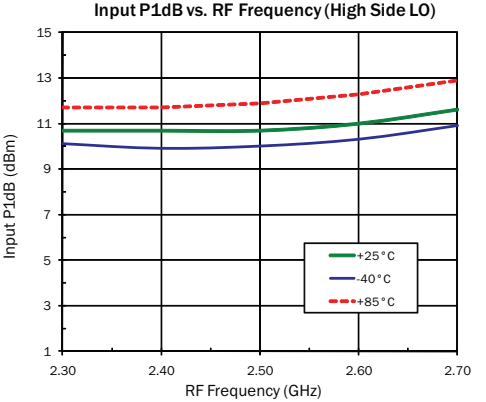

Input IP3 vs. RF Frequency (High Side LO)




Input P1dB vs. RF Frequency (Low Side LO)




Input P1dB vs. RF Frequency (High Side LO)



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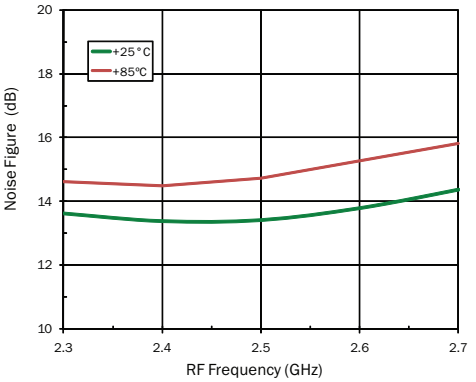
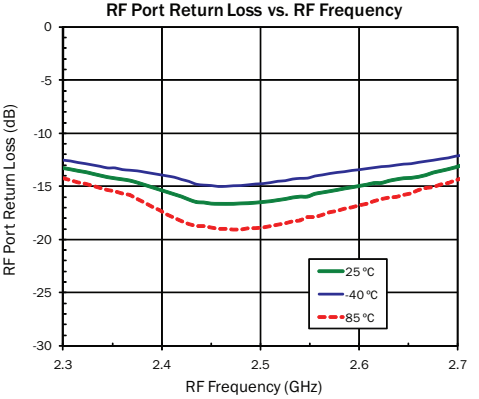
## Typical Performance - $V_{CC}$=5.0V, $P_{LO}$=0dBm, $P_{RF}$=0dBm, $f_{IF}$=150MHz, Unless Otherwise Noted.

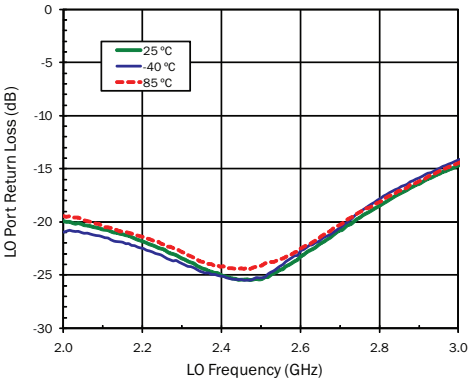
NF vs. RF Frequency (IF=150MHz) (LS LO)



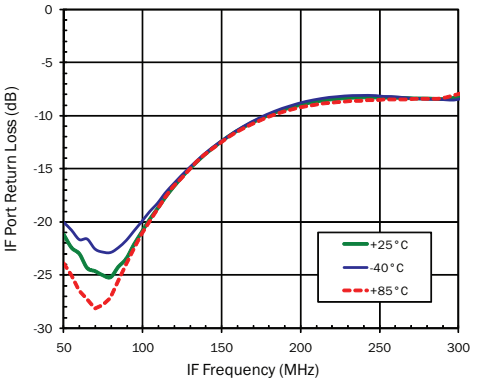

RF Port Return Loss vs. RF Frequency



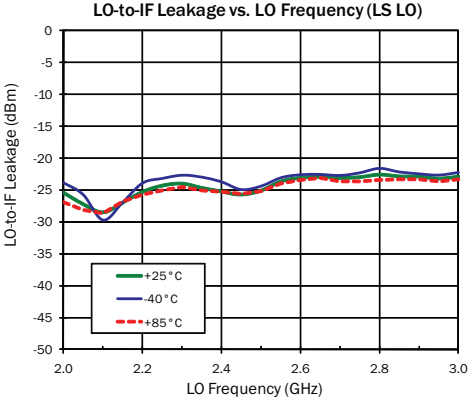

LO Port Return Loss vs. LO Frequency



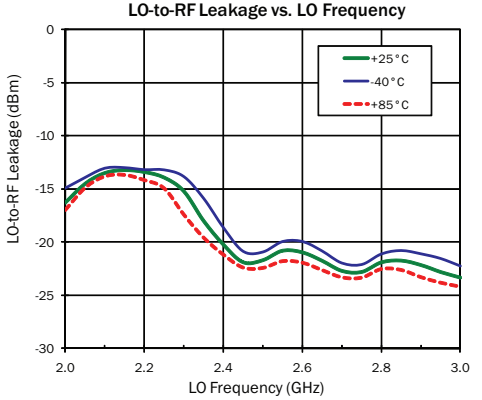

IF Port Return Loss vs. IF Frequency




LO-to-IF Leakage vs. LO Frequency (LS LO)

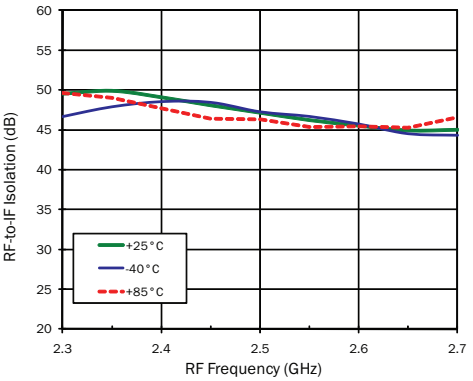



LO-to-RF Leakage vs. LO Frequency

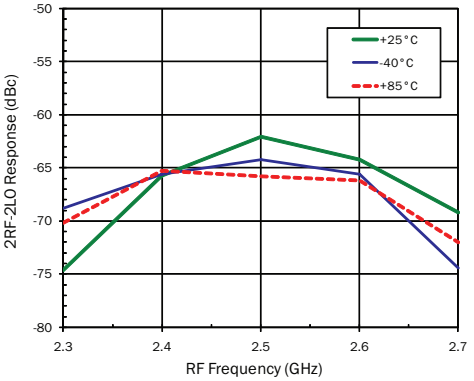


## Typical Performance - $V_{CC}$=5.0V, $P_{LO}$=0dBm, $P_{RF}$=0dBm, $f_{IF}$=150MHz, Unless Otherwise Noted.

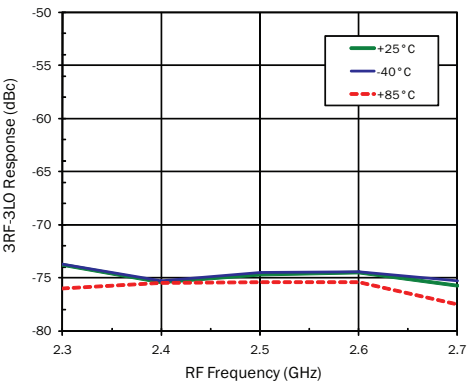
RF-to-IF Isolation vs. RF Frequency (Low Side LO)



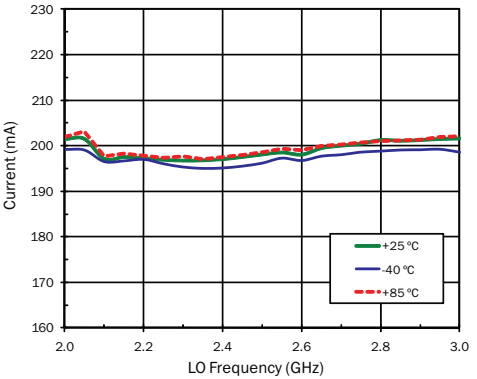

2RF-2LO Response vs. RF Frequency (LS LO)



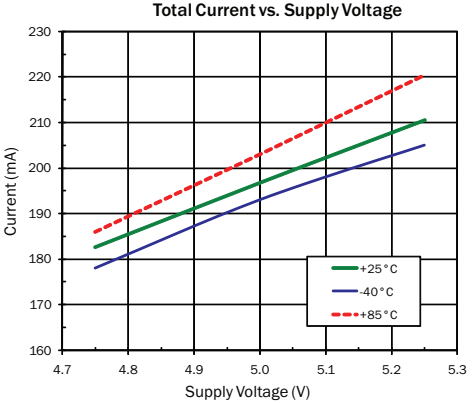

3RF-3LO Response vs. RF Frequency (LS LO)



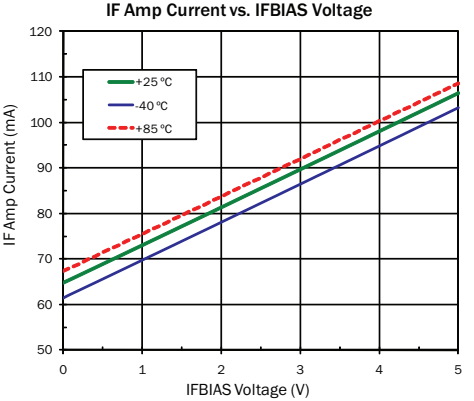

Total Current vs. LO Frequency (Low Side LO)




Total Current vs. Supply Voltage




IF Amp Current vs. IFBIAS Voltage



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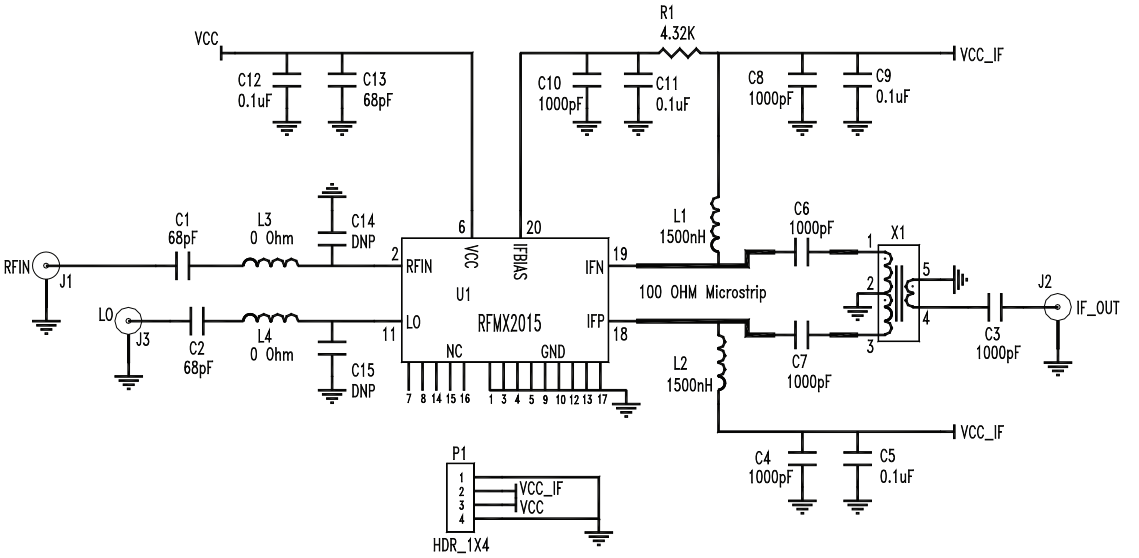
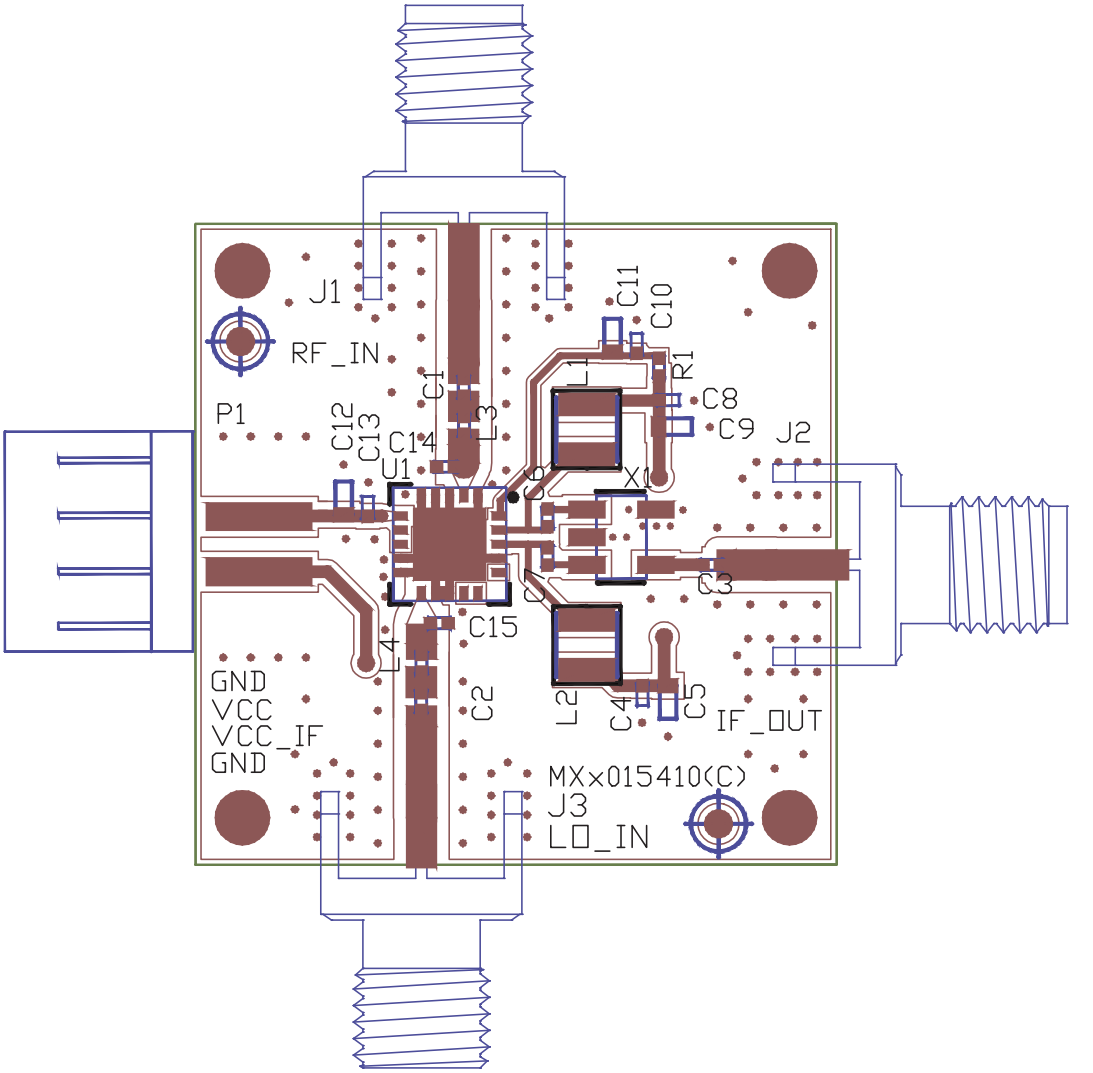
## Evaluation Board Schematic




## Evaluation Board Bill of Materials

| Description | Reference Designator | Manufacturer | Manufacturer's P/N |
|---|---|---|---|
| PCB | | | MXx015410(C) |
| 2.5GHz Differential IF Down-converter module | U1 | RFMD | RFMX2015 |
| CAP, 68 PF, 5%, 50V, C0G, 0402 | C1, C2, C13 | Murata | GRM1555C1H680JZ01D |
| CAP, 1000pF, 10%, 50V, X7R, 0402 | C3, C4, C6, C7, C8, C10 | Murata | GRM155R71H102KA01E |
| CAP, 0.1uF, 10%, 16V, X7R, 0603 | C5, C9, C11, C12 | Murata | GRM188R71C104KA01D |
| CONN, SMA, END LNCH, MINI, FLT, 0.062" | J1, J2, J3 | Emerson | 142-0741-851 |
| IND, 1500nH, 5%, W/W, 1008 | L1, L2 | Coilcraft | 1008CS-152XJBC |
| CONN, HDR, ST, PLRZD, 4-PIN, 0.100" | P1 | ITW Pancon | MPSS100-4-C |
| RES, 4.32K, 1%, 1/16W, 0402 | R1 | Vishay | CRCW0402 4K32 1% 100 RT7 |
| RES, 0Ω, 0402 | L3, L4 | Kamaya, Inc | RMC1/16SJPTH |
| DNP | C14, C15 | | |
| RFXF2553, Welded 350 MHZ 1:4 Transformer | X1 | RFMD | RFXF2553 |

## Evaluation Board Assembly Drawing





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| Pin | Function | Description |
|---|---|---|
| 1 | NC | No Internal Connection. Can be NC or GND on the PCB |
| 2 | RFIN | RF Single-ended Input, External DC Block Required |
| 3 | GND | Ground |
| 4 | GND | Ground |
| 5 | GND | Ground |
| 6 | VCC | Supply Voltage to Mixer and LO Buffer Amplifier |
| 7 | NC | No Internal Connection. Can be NC or GND on the PCB |
| 8 | NC | No Internal Connection. Can be NC or GND on the PCB |
| 9 | NC | No Internal Connection. Can be NC or GND on the PCB |
| 10 | GND | Ground |
| 11 | LO | Local Oscillator Single-ended Input, External DC Block Required |
| 12 | GND | Ground |
| 13 | GND | Ground |
| 14 | NC | No Internal Connection. Can be NC or GND on the PCB |
| 15 | NC | No Internal Connection. Can be NC or GND on the PCB |
| 16 | NC | No Internal Connection. Can be NC or GND on the PCB. |
| 17 | GND | Ground |
| 18 | IFP | IF Differential Output and $V_{CC}$ for IF Amplifier (Collector Voltage) |
| 19 | IFN | IF Differential Output and $V_{CC}$ for IF Amplifier (Collector Voltage) |
| 20 | IFBIAS | IF Amplifier Current Control (40mA range)<br>Min Current: IFBIAS=0V (~65mA)<br>Max Current: IFBIAS=5V (~105mA)<br>Current Between 65mA to 105mA: IFBIAS Voltage Between 0V to 5V |

## IF Amplifier Current Adjustment Guidelines (IFBIAS Voltage)

| IF Amp Current (mA) | R1 Value (kΩ) | R1 Connection |
|---|---|---|
| 105 | 0.1 | IFBIAS to Vcc_IF |
| 99 | 4.32 | IFBIAS to Vcc_IF |
| 91 | 20 | IFBIAS to Vcc_IF |
| 87 | open | open circuit |
| 81 | 20 | IFBIAS to GND |
| 77 | 10 | IFBIAS to GND |
| 73 | 4.7 | IFBIAS to GND |
| 64 | 0.0 | IFBIAS to GND |

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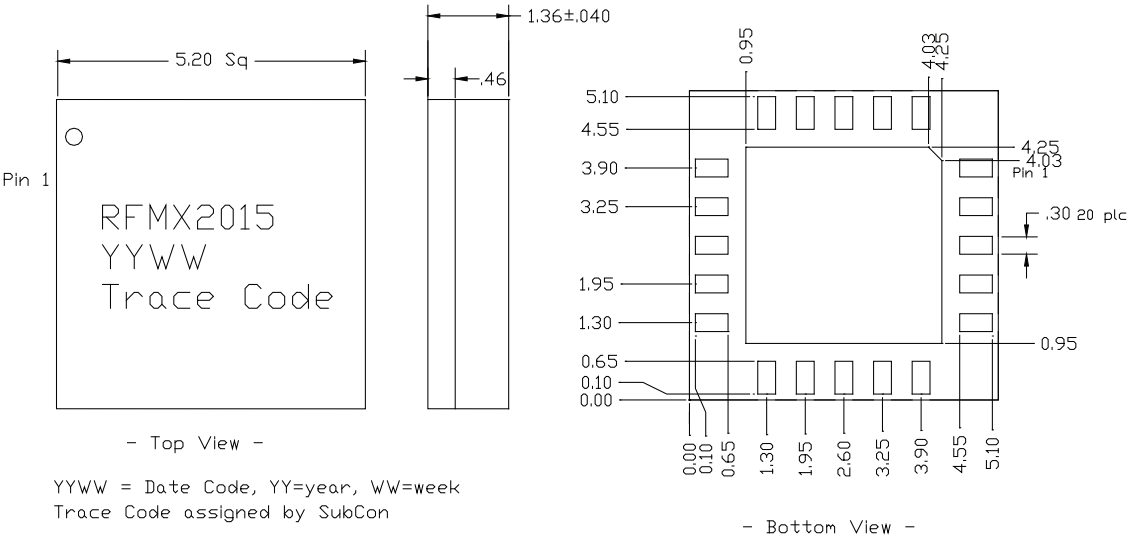
## Package Drawing

(Dimensions in millimeters)




YYWW = Date Code, YY=year, WW=week
Trace Code assigned by SubCon



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