RF to IF Dual Downconverting Mixer

400 – 1000 MHz F1102NBGI

GENERAL DESCRIPTION

This document describes the specifications for the IDTF1102 Zero-Distortion™ RF to IF Downconverting Mixer. This device is part of a series of downconverting mixers covering all UTRA bands. See the Part# Matrix for the details of all devices in the series.

The F1102 dual channel device operates with a single 5V supply. It is optimized for operation in a Multi-carrier BaseStation Receiver for RF bands from 698 to 915 MHz with High or Low Side Injection. IF frequencies from 50 to 300 MHz are supported. The F1102 also supports the 400 MHz RF bands with some simple external matching modifications (see page 25). Nominally, the device offers +43 dBm Output IP3 with 330 mA of I_CCC. Alternately one can adjust 4 resistor values and a toggle pin to run the devices in low current mode (LC mode) with +36 dBm Output IP3 and 235 mA of I_CCC.

COMPETITIVE ADVANTAGE

In typical basestation receivers the mixer limits the linearity performance for the entire receive system. The F1102 with Zero-Distortion technology dramatically improves the maximum IM3 interference that the BTS can withstand at a desired Signal to Noise Ratio (SNR.) Alternately, one can run the device in LC Mode to reduce Power consumption significantly.

- IP3_o: ↑ 7 dB STD Mode,
  ↑ 3 dB LC Mode
- Dissipation: ↓ 40% LC Mode, ↓ 12% STD Mode
- Allows for higher RF gain improving Sensitivity

FEATURES

- Dual Path for Diversity Systems
- Ideal for Multi-Carrier Systems
- 9.0 dB Gain
- Ultra linear:
  - +43 dBm IP3_o (STD Mode)
  - +36 dBm IP3_o (LC Mode)
- Low NF < 10 dB
- Extended LO level range for MIMO (-6 dBm)
- 200 Ω output impedance
- Ultra high +13 dBm P1dB_o
- 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_CCC = 235 mA
- Standard Mode: I_CCC = 330 mA

PART# MATRIX

<table>
<thead>
<tr>
<th>Part#</th>
<th>RF freq range</th>
<th>UTRA bands</th>
<th>IF freq range</th>
<th>Typ. Gain</th>
<th>Injection</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1100</td>
<td>698 - 915</td>
<td>6,8,12,13,14,17,19,20</td>
<td>150 - 450</td>
<td>8.3</td>
<td>High Side</td>
</tr>
<tr>
<td>F1102</td>
<td>400 - 1000</td>
<td>6,8,12,13,14,17,19,20</td>
<td>50 - 300</td>
<td>9.0</td>
<td>Both</td>
</tr>
<tr>
<td>F1150^1</td>
<td>1700 - 2200</td>
<td>2,3,4,9,10,21,24,33,34,35,36,37,39</td>
<td>50 - 450</td>
<td>8.5</td>
<td>High Side</td>
</tr>
<tr>
<td>F1152</td>
<td>1400 - 2200</td>
<td>1,2,3,4,9,10,21,24,33,34,35,36,37,39</td>
<td>50 - 350</td>
<td>8.5</td>
<td>Low Side</td>
</tr>
<tr>
<td>F1162</td>
<td>2200 – 2700</td>
<td>7,33,34,35,36,37,39</td>
<td>50 – 500</td>
<td>8.8</td>
<td>Low Side</td>
</tr>
</tbody>
</table>

1 = with High side injection
2 = With High side or Low side injection

ORDERING INFORMATION

IDTF1102NBGI8

0.8 mm height package
Tape & Reel

RF product Line

IDT Zero-Distortion™ Mixer

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**ABSOLUTE MAXIMUM RATINGS**

- VCC to GND: -0.3V to +5.5V
- STBY, LC\textsubscript{MODE}: -0.3V to (VCC\textsubscript{+} + 0.3V)
- IF\textsubscript{A+}, IF\textsubscript{B+}, IF\textsubscript{A-}, IF\textsubscript{B-}, LO\textsubscript{1_ADJ}, LO\textsubscript{2_ADJ}: -0.3V to (VCC\textsubscript{+} + 0.3V)
- LO\textsubscript{IN}, LO\textsubscript{IN_ALT}, RF\textsubscript{A}, RF\textsubscript{B}: -0.3V to +0.3V
- IF\textsubscript{BiasA}, IF\textsubscript{BiasB} to GND: -0.3V to +0.3V
- RF Input Power (RF\textsubscript{A}, RF\textsubscript{B}): +20dBm
- Continuous Power Dissipation: 2.2W
- θ\textsubscript{JA} (Junction – Ambient): +35°C/W
- θ\textsubscript{JC} (Junction – Case) The Case is defined as the exposed paddle: +2.5°C/W
- Operating Temperature Range (Case Temperature): T\textsubscript{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.**
# IDTF1102 Specification (400 – 1000 MHz Mixer w/High or Low Side Injection)

Specifications apply at $V_{CC} = +5.0\,V$, $F_{RF} = 850\,MHz$, $F_{F} = 200\,MHz$, Hi-Side, $P_{LO} = 0\,\text{dBm}$, $T_{C} = +25^\circ\text{C}$, $STBY = \text{GND}$, $LC\_MODE = V_{IH}$ (STD Mode), EVKit BOM = Standard Mode, Transformer Loss included (not de-embedded) unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Comment</th>
<th>Symbol</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Input High</td>
<td>For Standby, $LC_MODE$ Pins</td>
<td>$V_{IH}$</td>
<td>2</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Logic Input Low</td>
<td>For Standby, $LC_MODE$ Pins</td>
<td>$V_{IL}$</td>
<td>0.8</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Logic Current</td>
<td>For Standby Pin</td>
<td>$I_{IH, IL}$</td>
<td>-30</td>
<td>+30</td>
<td></td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Logic Current</td>
<td>$LC_MODE$ Pin</td>
<td>$I_{IH, IL}$</td>
<td>-100</td>
<td>-20</td>
<td></td>
<td>$\mu$A</td>
</tr>
<tr>
<td>Supply Voltage(s)</td>
<td>All $V_{CC}$ pins</td>
<td>$V_{CC}$</td>
<td>4.75 to 5.25</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>Case Temperature</td>
<td>$T_{CASE}$</td>
<td>-40 to +100</td>
<td></td>
<td></td>
<td>$\text{degC}$</td>
</tr>
<tr>
<td>Supply Current</td>
<td>Total $V_{CC}$ , STD Mode</td>
<td>$I_{STD}$</td>
<td>330</td>
<td>370$^f$</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Supply Current</td>
<td>Total $V_{CC}$ , LC Mode</td>
<td>$I_{LC}$</td>
<td>235</td>
<td>260</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Supply Current</td>
<td>Standby Mode</td>
<td>$I_{STBY}$</td>
<td>22</td>
<td>30</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>RF Freq Range</td>
<td>Operating Range</td>
<td>$F_{RF}$</td>
<td>400$^f$ – 1000</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>IF Freq Range</td>
<td>Operating Range</td>
<td>$F_{IF}$</td>
<td>50 to 300</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>LO Freq Range</td>
<td>Operating LO Range</td>
<td>$F_{LO}$</td>
<td>500 to 1150</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>LO Power</td>
<td>Operating LO Range</td>
<td>$P_{LO}$</td>
<td>-6 to +6</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>RF Input Impedance</td>
<td>Single Ended (\text{Return Loss ~17 dB})</td>
<td>$Z_{RF}$</td>
<td>50</td>
<td></td>
<td></td>
<td>$\Omega$</td>
</tr>
<tr>
<td>IF Output Impedance</td>
<td>Differential (\text{Return Loss ~13 dB})</td>
<td>$Z_{IF}$</td>
<td>200</td>
<td></td>
<td></td>
<td>$\Omega$</td>
</tr>
<tr>
<td>LO port Impedance</td>
<td>Single Ended (\text{Return Loss ~15 dB})</td>
<td>$Z_{LO}$</td>
<td>50</td>
<td></td>
<td></td>
<td>$\Omega$</td>
</tr>
<tr>
<td>Settling Time</td>
<td>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</td>
<td>$T_{SETT}$</td>
<td>0.175</td>
<td></td>
<td></td>
<td>$\mu$sec</td>
</tr>
<tr>
<td>Gain STD Mode</td>
<td>Conversion Gain \ $F_{RF} = 698,MHz$ \ $LC_MODE = V_{IH}$ \ EVKit BOM = STD Mode \ $F_{F} = 150,MHz$ (Low Side Inj.)</td>
<td>$G_{STD}$</td>
<td>8.5</td>
<td>9.2</td>
<td>9.9</td>
<td>dB</td>
</tr>
<tr>
<td>Gain LC Mode</td>
<td>Conversion Gain \ $F_{RF} = 915,MHz$ \ $LC_MODE = \text{GND}$ \ EVKit BOM = LC Mode \ $F_{F} = 200,MHz$ (High Side Inj.)</td>
<td>$G_{LC}$</td>
<td>7.8</td>
<td>8.5</td>
<td>9.2</td>
<td>dB</td>
</tr>
</tbody>
</table>
### IDTF1102 SPECIFICATION (CONTINUED)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Comment</th>
<th>Symbol</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>NF STD Mode</td>
<td>• LC_MODE = V_IN &lt;br&gt;• EVkit BOM = STD Mode &lt;br&gt;• F_RF = 200 MHz (High Side Inj.)</td>
<td>NF_STD</td>
<td>9.5</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>NF LC Mode</td>
<td>• LC_MODE = GND &lt;br&gt;• EVkit BOM = LC Mode &lt;br&gt;• F_IF = 200 MHz (High Side Inj.)</td>
<td>NF_LC</td>
<td>9.3</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>NF w/Blocker</td>
<td>• -100 MHz offset blocker &lt;br&gt;• P_IN = +10 dBm &lt;br&gt;• F_RF = 200 MHz</td>
<td>NF_BLK</td>
<td>21.7</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output IP3 – Narrowband</td>
<td>• P_IN = -10 dBm per tone &lt;br&gt;• 800 KHz Tone Separation &lt;br&gt;• F_RF = 200 MHz (High Side Inj.) &lt;br&gt;• F_IF = 850 MHz</td>
<td>IP3_O1</td>
<td>39²</td>
<td>43</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Output IP3 – Wideband</td>
<td>• P_IN = -10 dBm per tone &lt;br&gt;• 15 MHz Tone Separation &lt;br&gt;• F_RF = 200 MHz (High Side Inj.)</td>
<td>IP3_O2</td>
<td>42</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Output IP3 – LC_MODE</td>
<td>• P_IN = -10 dBm per tone &lt;br&gt;• F_IF = 200 MHz (High Side Inj.) &lt;br&gt;• 800 KHz Tone Separation &lt;br&gt;• LC_MODE = GND</td>
<td>IP3_O3</td>
<td>33</td>
<td>36</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>2RF – 2LO rejection</td>
<td>• P_RF = -10 dBm &lt;br&gt;• Frequency = F_RF + ½ F_IF</td>
<td>2x2</td>
<td>-78</td>
<td></td>
<td></td>
<td>dBc</td>
</tr>
<tr>
<td>1 dB Compression</td>
<td></td>
<td>P1DB_I1</td>
<td>11.9</td>
<td>12.5</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>1 dB Compression - LC_MODE</td>
<td></td>
<td>P1DB_I2</td>
<td>9.0</td>
<td>10.2</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Gain Comp. w/blocker</td>
<td>• Blocker \rightarrow unmodulated tone &lt;br&gt;• P_IN = +8 dBm, 20 MHz offset &lt;br&gt;• Signal Pin Tone = -20 dBm &lt;br&gt;• Measure ΔG of signal</td>
<td>ΔG_AC</td>
<td>0.15</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Spur: 5RF X -4LO</td>
<td>• F_LO = 1087.5 MHz &lt;br&gt;• F_IF = 190 MHz (High Side Inj.) &lt;br&gt;• Desired F_IF = 897.5 MHz &lt;br&gt;• Spur Freq = 908 MHz</td>
<td>SPUR_1</td>
<td>-97</td>
<td>-89</td>
<td></td>
<td>dBc</td>
</tr>
<tr>
<td>Channel Isolation</td>
<td>IF_B Pout vs. IF_A w/ RF_A input</td>
<td>ISO_C</td>
<td>45</td>
<td>51</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>LO to IF leakage</td>
<td></td>
<td>ISO_LI</td>
<td>-22</td>
<td>-15</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>RF to IF leakage</td>
<td>Pin = -10 dBm</td>
<td>ISO_RI</td>
<td>-26</td>
<td>-20</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>LO to RF leakage</td>
<td></td>
<td>ISO_LR</td>
<td>-40</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
</tbody>
</table>

### Notes:

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
3. Normal RF range is 698 – 915 MHz. See Page 25 for modifications for 400 – 500 MHz operation
TYPICAL OPERATING CONDITIONS

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

- 800 KHz Tone Spacing
- High Side injection graphs with 200MHz IF (pages 6 – 10)
- Low Side injection graphs with 150MHz IF (pages 11 – 14)
- Average of Channel A & Channel B
- Pin = – 10 dBm per Tone
- LO port = Pin 19 (Main Port)
- Listed Temperatures are Case Temperature (T_C or T_CASE = Case Temperature)
- Where noted, T_A or T_AMB = Ambient Temperature
- Transformer losses are de-embedded
RF to IF Dual Downconverting Mixer

400 – 1000 MHz F1102NBGI

TYPICAL OPERATING CONDITIONS [IF = 200 MHz, High Side Injection] (-1-)

Gain vs. T\textsubscript{CASE}

Gain vs. V\textsubscript{CC}

Gain vs. LO Level

Output IP3 vs. T\textsubscript{CASE}

Output IP3 vs. V\textsubscript{CC}

Output IP3 vs. LO Level
TYPICAL OPERATING CONDITIONS [If = 200 MHz, High Side Injection] (-2-)

P1dB vs. $T_{\text{CASE}}$

P1dB vs. $V_{\text{CC}}$

P1dB vs. LO Level

2RF x 2LO rejection vs. $T_{\text{CASE}}$

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

2RF x 2LO Rejection vs. LO Level
RF to IF Dual Downconverting Mixer
400 – 1000 MHz  F1102NBGI

**TYPICAL OPERATING CONDITIONS** [IF = 200 MHz, High Side Injection] (-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**

- **RF Freq (MHz)**
  - 650 - 950

- **LO-IF Leakage (dBm)**
  - -50 to 0

- **I_{CC} (Amps)**
  - 0.200 to 0.400

- **V_{CC}**
  - 5.00 V

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**Graphs**

- Line graphs showing the relationship between various parameters as described in the typical operating conditions.

---

**Notes**

- jedeen
- magazine
- Wandel
- zeichnung
- grund
- Grund
- grund
- Grund
- grund
**RF to IF Dual Downconverting Mixer**

**400 – 1000 MHz**

**F1102NBGI**

**IDT Zero-Distortion™ Mixer**

**RevO, August 2012**

**DATASHEET**

**TYPICAL OPERATING CONDITIONS [IF = 200 MHz, High Side Injection]**

---

**RF-IF Leakage vs. **$T_{\text{CASE}}$**

- RF Freq (MHz) vs. RF to IF Leakage
- Temperature and Voltage Conditions

**RF-IF Leakage vs. **$V_{\text{CC}}$**

- RF Freq (MHz) vs. RF to IF Leakage
- Temperature and Voltage Conditions

**RF-IF Leakage vs. LO Level**

- RF Freq (MHz) vs. RF to IF Leakage
- Temperature and Voltage Conditions

**3RF X 3LO Rejection vs. **$T_{\text{CASE}}$**

- RF Freq (MHz) vs. 3RF X 3LO Rejection
- Temperature and Voltage Conditions

**3RF X 3LO Rejection vs. **$V_{\text{CC}}$**

- RF Freq (MHz) vs. 3RF X 3LO Rejection
- Temperature and Voltage Conditions

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

- RF Freq (MHz) vs. 3RF X 3LO Rejection
- Temperature and Voltage Conditions

---

**Typical Operating Conditions:**

- **RF Freq (MHz):** 650, 700, 750, 800, 850, 900, 950
- **Temperature:** -40°C, 25°C, 100°C
- **Voltage:** 5.00 V, 5.25 V, 4.75 V
- **Mixing Conditions:** High Side Injection

**Performance Parameters:**

- **RF-IF Leakage:** Measured in dBm
- **3RF X 3LO Rejection:** Measured in dBc

---

**Graphs and Data Tables**

- Graphs showing RF-IF Leakage and 3RF X 3LO Rejection under various conditions.
- Data tables summarizing performance metrics at different temperatures and voltages.

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**IDT Zero-Distortion™ Mixer**

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**Typical Operating Conditions [IF = 200 MHz, High Side Injection]**

**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 = 850 MHz, IF = 200 MHz, $T_A = 25^\circ C$)**
RF to IF Dual Downconverting Mixer

**DATASHEET**

**RF to IF Dual Downconverting Mixer**

**400 – 1000 MHz**

**F1102NBGI**

**Typical Operating Conditions [IF = 150 MHz, Low Side Injection]**

**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**
RF to IF Dual Downconverting Mixer

400 – 1000 MHz  F1102NBGI

**Typical Operating Conditions [IF = 150 MHz, Low Side Injection]**

**P1dB vs. T\text{CASE}**

**P1dB vs. V\text{CC}**

**2RF x 2LO rejection vs. T\text{CASE}**

**2RF x 2LO rejection vs. V\text{CC}**

**2RF x 2LO rejection vs. LO Level**
**RF to IF Dual Downconverting Mixer**

**400 – 1000 MHz**  
**F1102NBGI**

**Typical Operating Conditions [IF = 150 MHz, Low Side Injection]**

### Current vs. Temperature

- **I<sub>CC</sub>** vs. **T<sub>CASE</sub>**

### Current vs. LO Level

- **I<sub>CC</sub>** vs. **V<sub>LO</sub>**

### LO-IF Leakage vs. Temperature

- **LO-IF Leakage** vs. **T<sub>CASE</sub>**

### LO-IF Leakage vs. Voltage

- **LO-IF Leakage** vs. **V<sub>CC</sub>**

### LO-IF Leakage vs. LO Level

- **LO-IF Leakage** vs. **V<sub>LO</sub>**
TYPICAL OPERATING CONDITIONS [IF = 150 MHz, Low Side Injection] (~9~)

**RF-IF Leakage vs. T\text{CASE}**

[Graph showing RF-IF leakage vs. T\text{CASE}]

**RF-IF Leakage vs. V\text{CC}**

[Graph showing RF-IF leakage vs. V\text{CC}]

**RF-IF Leakage vs. LO Level**

[Graph showing RF-IF leakage vs. LO Level]

**3RF X 3LO Rejection vs. T\text{CASE}**

[Graph showing 3RF X 3LO Rejection vs. T\text{CASE}]

**3RF X 3LO Rejection vs. V\text{CC}**

[Graph showing 3RF X 3LO Rejection vs. V\text{CC}]

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

[Graph showing 3RF X 3LO Rejection vs. LO Level]
RF to IF Dual Downconverting Mixer

400 – 1000 MHz F1102NBGI

TYPICAL OPERATING CONDITIONS [400 MHz Bands see modifications on p. 25] (-10-)

Gain vs. T_{CASE} (130 MHz IF)

Gain vs. LO Level (130 MHz IF)

Output IP3 vs. T_{CASE} (130 MHz IF)

Output IP3 vs. LO Level (130 MHz IF)

P1dB vs. LO Level (70 MHz IF)

P1dB vs. LO Level (130 MHz IF)
RF to IF Dual Downconverting Mixer

400 – 1000 MHz  F1102NBGI

**Typical Operating Conditions [400 MHz Bands see modifications on p. 25]** (-11-)

**2RF x 2LO vs. T\text{CASE} (130 MHz IF)**

**I\text{CC} vs. T\text{CASE} (130 MHz IF)**

**LO to IF Leakage vs. T\text{CASE} (130 MHz IF)**

**2RF x 2LO vs. LO Level (130 MHz IF)**

**I\text{CC} vs. LO Level (130 MHz IF)**

**LO to IF Leakage vs. LO Level (130 MHz IF)**
Typical Operating Conditions [400 MHz Bands see modifications on p. 25] (-12-)

RF to IF Leakage vs. T\(_{\text{CASE}}\) (130 MHz IF)

3RF x 3LO rejection vs. T\(_{\text{CASE}}\) (130 MHz IF)

Channel Isolation vs. LO level (130 MHz IF)

Noise Figure (T\(_{\text{CASE}}\) = 25C)
**RF to IF Dual Downconverting Mixer**

**400 – 1000 MHz**

**F1102NBGI**

**Typical Operating Conditions [General] (-13-)**

**EVkit IF Port Match (T_A = 25°C)**

![Graph showing IF return loss vs. IF freq (MHz)]

**5RF X -4LO Rejection (IF = 190 MHz, STD Mode)**

![Graph showing 5X-4 rejection (dB) vs. RF freq (MHz)]

**Settling Time (STBY -> V_IN)**

![Graph showing settling time vs. time (nsec)]

**EVkit LO Port Match (T_A = 25°C, P_meas = 0 dBm)**

![Graph showing LO return loss vs. LO freq (GHz)]

**EVkit RF Port Match (T_A = 25°C)**

![Graph showing RF return loss vs. RF freq (GHz)]
**Typical Operating Conditions [General] (-14-)**

**IP3 vs. ∆f (T_a = 25C, Freq = 850 MHz, IF = 200 MHz)**

**IP3 vs. P_{IN} (T_a = 25C, Freq = 850 MHz, IF = 200 MHz)**

**EVkit Input RF Trace Loss (T_a = 25C)**

**TC4-1T Transformer Loss**

**IP3 Distribution (F_{RF} = 850 MHz, LC mode, N = 1598)**

**Gain Distribution (F_{RF} = 915 MHz, LC mode, N = 1598)**
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

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF_A</td>
<td>Main Channel RF Input. Internally matched to 50Ω. DO NOT apply DC to these pins</td>
</tr>
<tr>
<td>2, 8, 20</td>
<td>RF_Artn, RF_Brtn, LO_rtn</td>
<td>Transformer Ground Returns. Ground these pins.</td>
</tr>
<tr>
<td>3, 5, 7, 18, 24, 28</td>
<td>GND</td>
<td>Ground these pins.</td>
</tr>
<tr>
<td>4, 6, 12, 15, 31, 23, 26, 34</td>
<td>N.C.</td>
<td>No Connection. Not internally connected. OK to connect to Vcc. OK to connect to GND</td>
</tr>
<tr>
<td>10, 16, 21, 30, 36</td>
<td>VCC</td>
<td>Power Supply. Bypass to GND with capacitors shown in the Typical Application Circuit as close as possible to pin.</td>
</tr>
<tr>
<td>9</td>
<td>RF_B</td>
<td>Diversity Channel RF Input. Internally matched to 50Ω</td>
</tr>
<tr>
<td>11</td>
<td>IF_BiasB</td>
<td>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</td>
</tr>
<tr>
<td>13, 14</td>
<td>IFB+, IFB-</td>
<td>Diversity Mixer Differential IF Output. Connect pullup inductors from each of these pins to VCC (see the Typical Application Circuit).</td>
</tr>
<tr>
<td>17</td>
<td>LO1_ADJ</td>
<td>Connect the specified resistor for either Standard or LC mode from this pin to ground to set the LO common buffer Icc</td>
</tr>
<tr>
<td>19, 27</td>
<td>LO_in, LO_in_alt</td>
<td>Local Oscillator Input. Connect the LO to this port through the recommended coupling capacitor. <strong>Note that you can only drive one LO port at a time. Remove the series capacitor from the unused port.</strong></td>
</tr>
<tr>
<td>25</td>
<td>LC_MODE</td>
<td>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.</td>
</tr>
<tr>
<td>22</td>
<td>STBY</td>
<td>STBY Mode. Pull this pin high for Standby mode (~20 mA). Pull low or Ground for normal Operation</td>
</tr>
<tr>
<td>29</td>
<td>LO2_ADJ</td>
<td>Connect the specified resistor for either Standard or LC mode from this pin to ground to set the LO drive buffers Icc</td>
</tr>
<tr>
<td>32, 33</td>
<td>IFA-, IFA+</td>
<td>Main Mixer Differential IF Output. Connect pullup inductors from each of these pins to VCC (see the Typical Application Circuit).</td>
</tr>
<tr>
<td>35</td>
<td>IF_BiasA</td>
<td>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</td>
</tr>
<tr>
<td>— EP</td>
<td>Exposed Pad</td>
<td>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.</td>
</tr>
</tbody>
</table>
### EVKit Picture/Layout/Operation

- **Outer Position for STD Mode (R11, R13)**
- **Inner Position for LC Mode (R12, R14)**
- **Install Jumper for LC Mode**
- **Remove Jumper for STD Mode**
- **Alternate LO Port:**
  - Must remove C11 and install C7 to use
- **Install Jumper for Mixer Operation**
- **Remove Jumper to Turn Mixer Off**

---

**Recommended Use**

- **Outer Position for STD Mode (R15, R17)**
- **Install Jumper for LC Mode**
- **Remove Jumper for STD Mode**

---

**Important Notes**

- **Inner Position for LC Mode (R16, R18)**
- **Alternate LO Port:**
  - Must remove C11 and install C7 to use
- **Install Jumper for Mixer Operation**
- **Remove Jumper to Turn Mixer Off**
**EVKit BOM**

**Default 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.

**F1102 BOM**

<table>
<thead>
<tr>
<th>Item #</th>
<th>Value</th>
<th>Size</th>
<th>Desc</th>
<th>Mfr. Part #</th>
<th>Mfr. Part Reference</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10nF</td>
<td>0402</td>
<td>CAP CER 10000PF 16V 10% X7R 0402</td>
<td>GRM155R71C103KA01D</td>
<td>MURATA</td>
<td>C1,5,6,9,12,13,16</td>
</tr>
<tr>
<td>2</td>
<td>1000pF</td>
<td>0402</td>
<td>CAP CER 1000PF 50V C0G 0402</td>
<td>GRM1555C1H102A01D</td>
<td>MURATA</td>
<td>C2,3,14,15</td>
</tr>
<tr>
<td>3</td>
<td>150pF</td>
<td>0402</td>
<td>CAP CER 150PF 50V C0G 0402</td>
<td>GRM1555C1H151A01D</td>
<td>MURATA</td>
<td>C8,10,11</td>
</tr>
<tr>
<td>4</td>
<td>9 pF</td>
<td>0402</td>
<td>Note: C7 and C11 cannot be installed together.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10UF</td>
<td>0603</td>
<td>CAP CER 10UF 6.3V X5R 0603</td>
<td>GRM188R60J106ME47D</td>
<td>MURATA</td>
<td>C4</td>
</tr>
<tr>
<td>6</td>
<td>Header 2 Pin</td>
<td>TH 2</td>
<td>CONN HEADER VERT SGL 2POS GOLD</td>
<td>961102-6404-AR</td>
<td>MURATA</td>
<td>JP1,2,3</td>
</tr>
<tr>
<td>7</td>
<td>Header 3 Pin</td>
<td>TH 3</td>
<td>CONN HEADER VERT SGL 3POS GOLD</td>
<td>961103-6404-AR</td>
<td>MURATA</td>
<td>JP3,4,5,6,7</td>
</tr>
<tr>
<td>8</td>
<td>SMA END_LAUNCH 0.62</td>
<td>SMA END_LAUNCH (Small)</td>
<td>142-0711-821</td>
<td>Emerson Johnson</td>
<td>J1,2,7</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>SMA END_LAUNCH 0.62</td>
<td>SMA END_LAUNCH (Big)</td>
<td>142-0701-851</td>
<td>Emerson Johnson</td>
<td>J3,4,5,6</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>270nH</td>
<td>0805</td>
<td>0805C8 (2012) Ceramic Chip Inductor</td>
<td>B0805C8-271KXLB</td>
<td>COILCRAFT</td>
<td>L1,2,3,4</td>
</tr>
<tr>
<td>11</td>
<td>27</td>
<td>0402</td>
<td>RES 27 OHM 1/10W 1% 0402 SMD</td>
<td>ERJ-2KRF27R0X</td>
<td>Panasonic</td>
<td>R11,15</td>
</tr>
<tr>
<td>12</td>
<td>62</td>
<td>0402</td>
<td>RES 62.0 OHM 1/10W 1% 0402 SMD</td>
<td>ERJ-2KRF52R0X</td>
<td>Panasonic</td>
<td>R12,5</td>
</tr>
<tr>
<td>13</td>
<td>91</td>
<td>0402</td>
<td>RES 91.0 OHM 1/10W 1% 0402 SMD</td>
<td>ERJ-2KRF91R0X</td>
<td>Panasonic</td>
<td>R13</td>
</tr>
<tr>
<td>14</td>
<td>180</td>
<td>0402</td>
<td>RES 180 OHM 1/10W 1% 0402 SMD</td>
<td>ERJ-2KRF180R0X</td>
<td>Panasonic</td>
<td>R14</td>
</tr>
<tr>
<td>15</td>
<td>1.91K</td>
<td>0402</td>
<td>RES 1.91K OHM 1/10W 1% 0402 SMD</td>
<td>ERJ-2KRF1911X</td>
<td>Panasonic</td>
<td>R17</td>
</tr>
<tr>
<td>16</td>
<td>1.21K</td>
<td>0402</td>
<td>RES 1.21K OHM 1/10W 1% 0402 SMD</td>
<td>ERJ-2KRF1211X</td>
<td>Panasonic</td>
<td>R17</td>
</tr>
<tr>
<td>17</td>
<td>47K</td>
<td>0402</td>
<td>RES 47.0K OHM 1/16W 1% 0402 SMD</td>
<td>RC0402FR-0747XL</td>
<td>Yageo</td>
<td>R8,9</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0402</td>
<td>RES 0.0 OHM 1/10W 0402 SMD</td>
<td>ERJ-2GE0R00X</td>
<td>Panasonic</td>
<td>R1,2,3,4,5,6,7,10</td>
</tr>
<tr>
<td>19</td>
<td>4:1 Balun</td>
<td>SM-22</td>
<td>4:1 Center Tap Balun</td>
<td>TC4-1TG2+</td>
<td>Mini Circuits</td>
<td>T1,2</td>
</tr>
<tr>
<td>20</td>
<td>F1102</td>
<td>QFN-36</td>
<td>Diversity Downconverter (400 - 1000 MHz)</td>
<td>F1102NBGI</td>
<td>IDT</td>
<td>U1</td>
</tr>
<tr>
<td>21</td>
<td>PCB</td>
<td></td>
<td>EV Kit</td>
<td>F1102 EVkit Rev5</td>
<td>IDT</td>
<td>U1</td>
</tr>
</tbody>
</table>

**Modified BOM and EVKit (for 400 MHz bands):**

EVKit Modifications for High Side Injection 400 MHz operation (see TOCs on pages 15 – 17)

- Scrape resist from ground and add shunt 8 pF
- Replace C8 and C10 with 18 pF
- Scrape resist from ground and add shunt 1.8 pF
- Replace C11 with 6.8 pF
**Top Markings**

- **Part Number**: IDTF1102NBGI
- **Date Code**: [xxYYWWx] (Work Week 8 of 2012)
- **Lot Code**: Q21A029M

**NOTE:** Production Devices are Date Code 1208 or later.
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