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## Applications

- PCS / 3G Base station / Repeaters
- WCDMA / LTE
- WiMax / WiBro
- ISM / Fixed Wireless
- HPA Feedback Paths

## Product Features

- High Dynamic Range Mixer
- Integrated LO Driver
- +35 dBm Input IP3
- 8 dB Conversion Loss
- RF: 1500 – 3200 MHz
- LO: 1400 – 3500 MHz
- IF: 40 – 300 MHz
- +5 V Supply at 40 mA
- 0 dBm Drive Level
- RoHS-compliant MSOP8 (14 mm<sup>2</sup>)

## General Description

The ML485 high linearity converter combines a passive GaAsFET mixer with an integrated LO driver in an ultra-small lead-free/green/RoHS-compliant MSOP-8 package. The double-balanced integrated IC is able to operate across a wide 1.5–3.2 GHz frequency range to achieve +35dBm Input IP3 while drawing a very low 40mA current. The ML485 can be used as an up-converter or down-converter in a low-side or high-side LO configuration.

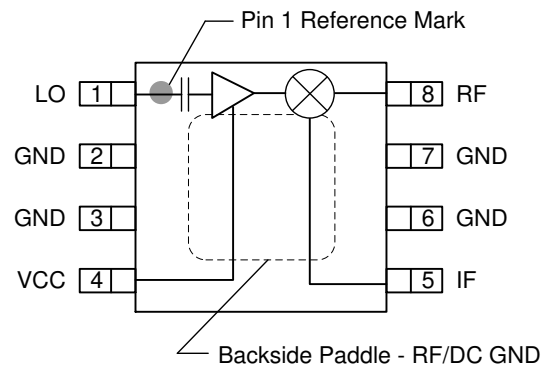
A LO buffer amplifier is integrated on the chip to allow for operation directly from a synthesizer requiring only 0 dBm of LO drive level. The dual-stage LO driver provides a stable input power level into the mixer to allow for consistent performance over a wide range of LO power levels. The converter requires no external baluns and supports a wide range of IF frequencies.

Typical applications include frequency up/down conversion, modulation and demodulation for receivers and transmitters used in 2.5G and 3G mobile infrastructure. Due to the wide frequency range of operation, the converter can also be used for WiMAX, WiBro, ISM, LTE and fixed wireless applications



MSOP 8 Package

## Functional Block Diagram



## Pin Configuration

| Pin No.         | Symbol |
|-----------------|--------|
| 1               | LO     |
| 2, 3, 6, 7      | GND    |
| 4               | Vcc    |
| 5               | IF     |
| 8               | RF     |
| Backside Paddle | GND    |

## Ordering Information

| Part No.  | Description                            |
|-----------|----------------------------------------|
| ML485-G   | 1.5–3.2 GHz Mixer w/ Integrated LO Amp |
| ML485-PCB | Fully Assembled Evaluation Board       |

Standard T/R size = 1000 pieces on a 7" reel

### Absolute Maximum Ratings

| Parameter                       | Rating         |
|---------------------------------|----------------|
| Storage Temperature             | -65 to +150 °C |
| DC Voltage                      | +7 V           |
| Input IF / RF Power, CW, +25 °C | +27 dBm        |
| LO Power                        | +10 dBm        |

Operation of this device outside the parameter ranges given above may cause permanent damage.

### Recommended Operating Conditions

| Parameter                                      | Min   | Typ  | Max   | Units |
|------------------------------------------------|-------|------|-------|-------|
| V <sub>CC</sub>                                | +4.75 | +5.0 | +5.25 | V     |
| T <sub>CASE</sub>                              | -40   |      | +85   | °C    |
| T <sub>j</sub> for >10 <sup>6</sup> hours MTTF |       |      | +150  | °C    |

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

### Electrical Specifications

Test conditions unless otherwise noted: V<sub>CC</sub> = +5 V, Temp = +25 °C, 50 Ω system. (see note 1)

| Parameter              | Min         | Typ | Max | Min         | Typ | Max | Min         | Typ   | Max | Min         | Typ   | Max | Units |
|------------------------|-------------|-----|-----|-------------|-----|-----|-------------|-------|-----|-------------|-------|-----|-------|
| RF Frequency Range     | 1700 – 1800 |     |     | 1800 – 2200 |     |     | 2300 – 2400 |       |     | 2500 – 2700 |       |     | MHz   |
| LO Frequency Range     | 1400 – 1750 |     |     | 1500 – 2150 |     |     | 2000 – 2350 |       |     | 2200 – 2650 |       |     | MHz   |
| IF Freq Range          | 40 – 300    |     |     | 40 – 300    |     |     | 40 – 300    |       |     | 40 – 300    |       |     | MHz   |
| SSB Conversion Loss    |             | 9.4 |     |             | 8.7 | 10  |             | 8.5   |     |             | 9     |     | dB    |
| Input IP3 (see note 2) | +28         | +34 |     | +30         | +35 |     |             | +37   |     |             | +36   |     | dBm   |
| LO Leakage RF Port     |             | -5  |     |             | -2  |     |             | -1    |     |             | -1    |     | dBm   |
| LO Leakage IF Port     |             | -11 |     |             | -18 |     |             | -25   |     |             | -15   |     | dBm   |
| RF-IF Isolation        |             | 13  |     |             | 16  |     |             | 14    |     |             | 11    |     | dB    |
| RF Return Loss         |             | 13  |     |             | 13  |     |             | 15    |     |             | 16    |     | dB    |
| IF Return Loss         |             | 14  |     |             | 14  |     |             | 14    |     |             | 14    |     | dB    |
| LO Return Loss         |             | 10  |     |             | 10  |     |             | 12    |     |             | 13    |     | dB    |
| Input P1dB             |             | +20 |     |             | +20 |     |             | +19.5 |     |             | +19.5 |     | dBm   |
| LO Drive Level         | -2          | 0   | +4  | -2          | 0   | +4  | -2          | 0     | +4  | -2          | 0     | +4  | dBm   |

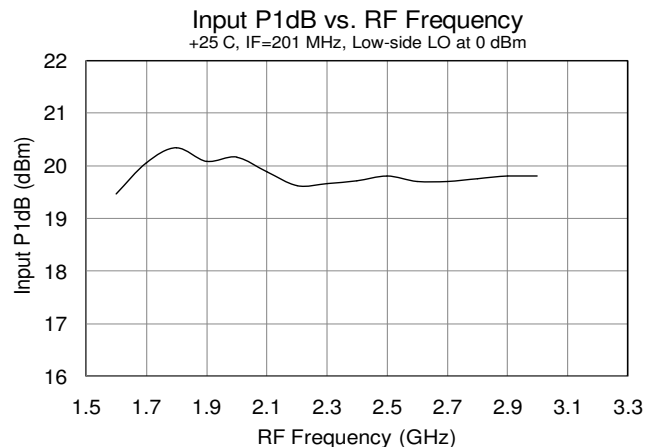
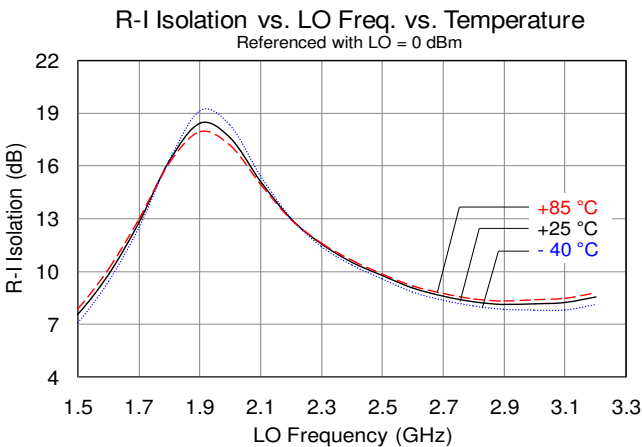
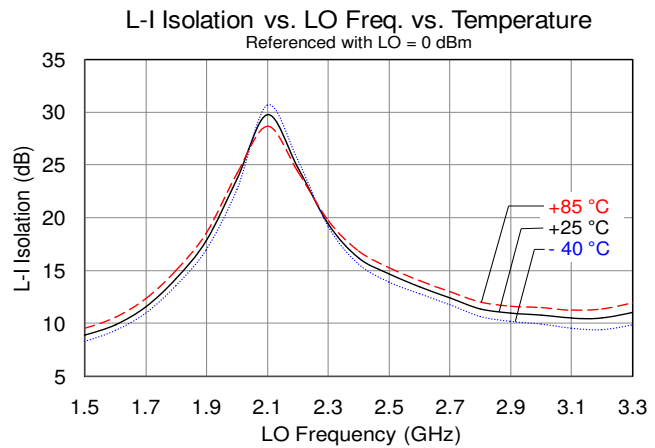
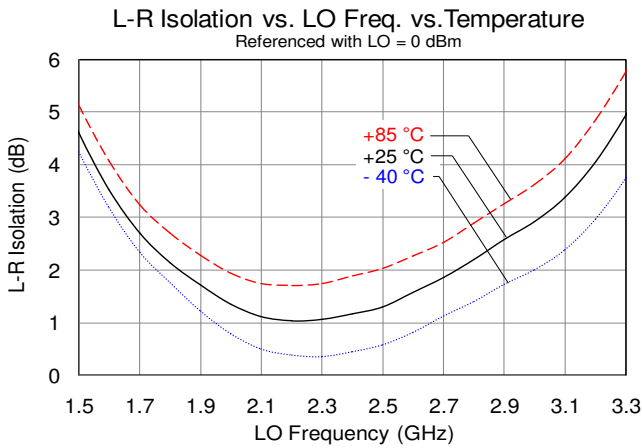
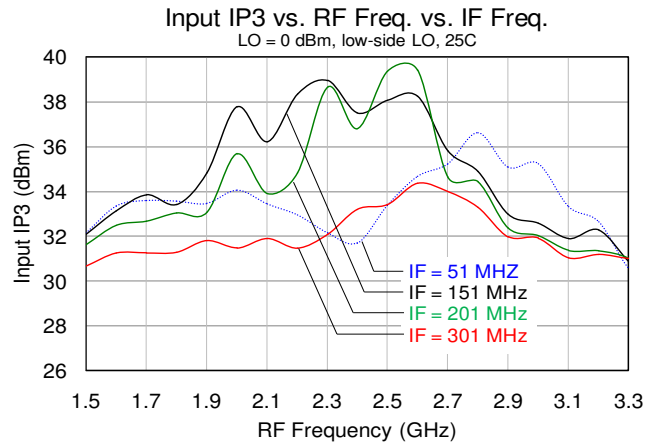
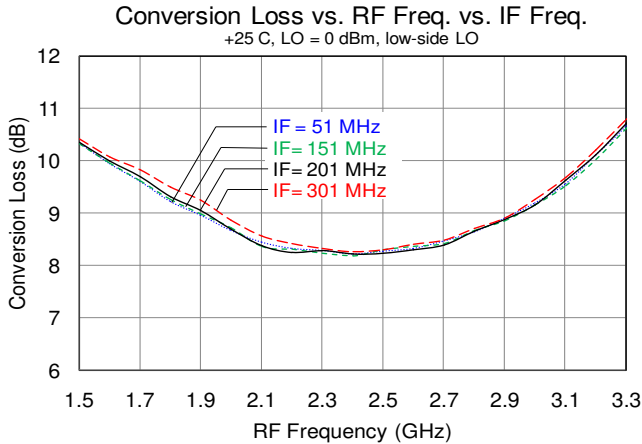
| Parameter                       | Min | Typ | Max | Units |
|---------------------------------|-----|-----|-----|-------|
| Supply Voltage                  |     | +5  |     | V     |
| Supply Current                  |     | 40  |     | mA    |
| Thermal Resistance (see note 3) |     |     | 84  | °C/W  |

Notes:

- Specifications are shown with 0dBm LO drive and IF = 200 MHz in a down converting configuration with a low-side LO.
- IIP3 is measured with Δf = 1 MHz with RFin = 0 dBm / tone.
- Thermal resistance is specified junction to case.

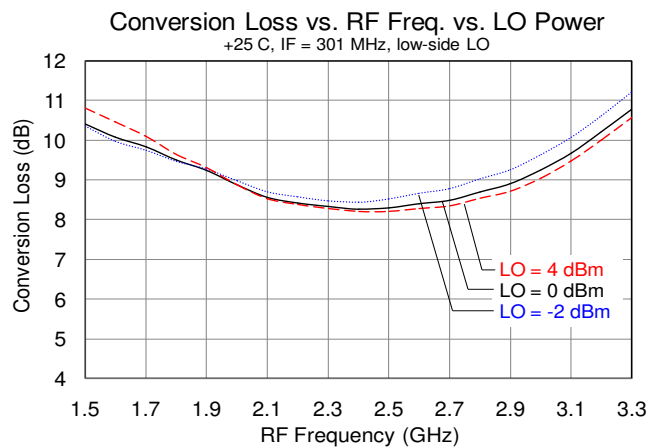
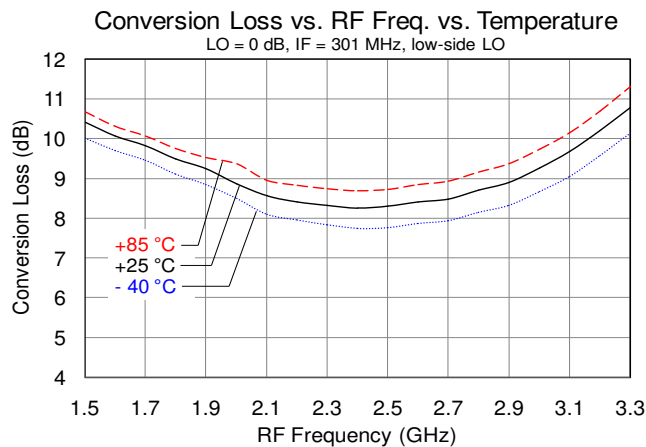
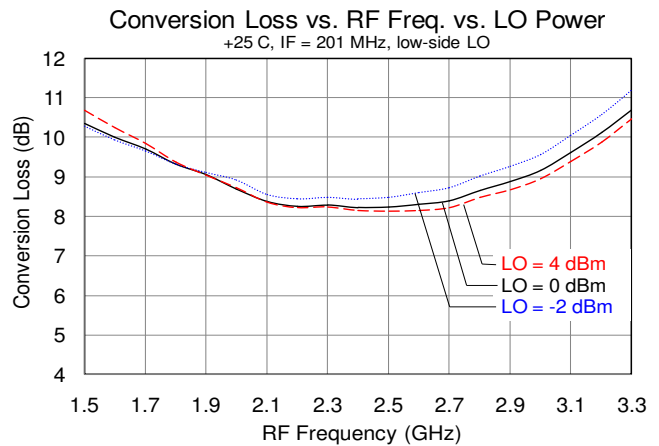
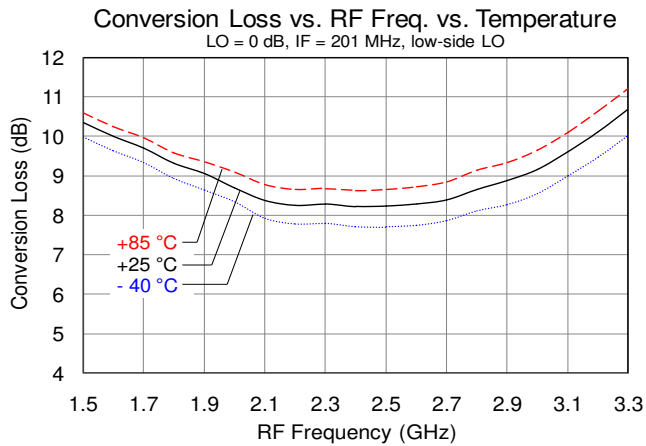
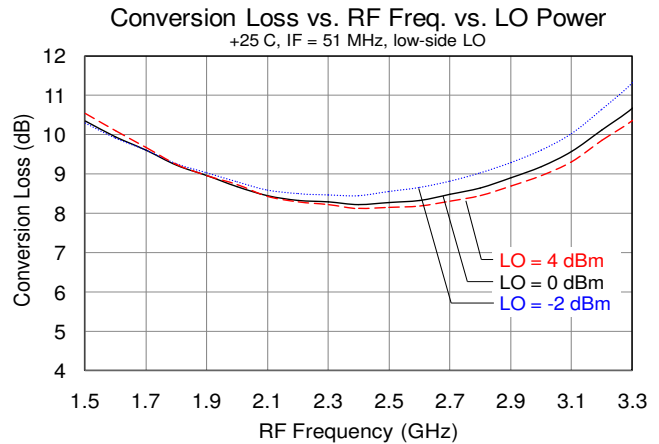
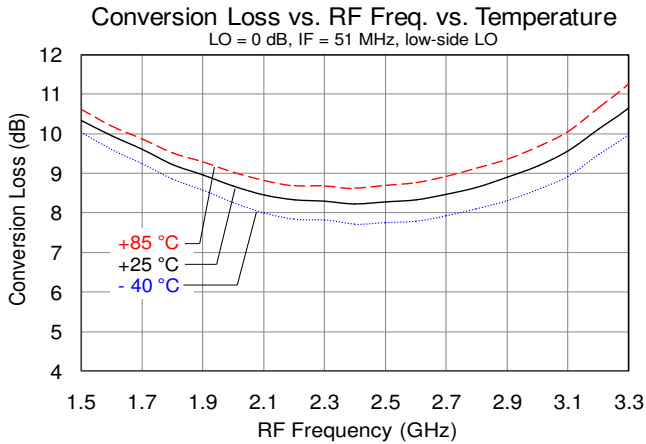
**Performance Plots**

Test conditions unless otherwise noted:  $V_{CC} = +5\text{ V}$ ,  $\text{Temp} = +25\text{ }^\circ\text{C}$ ,  $50\ \Omega$  system.



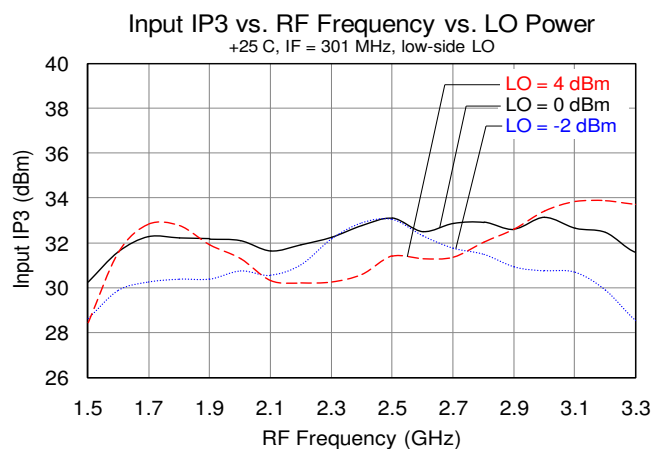
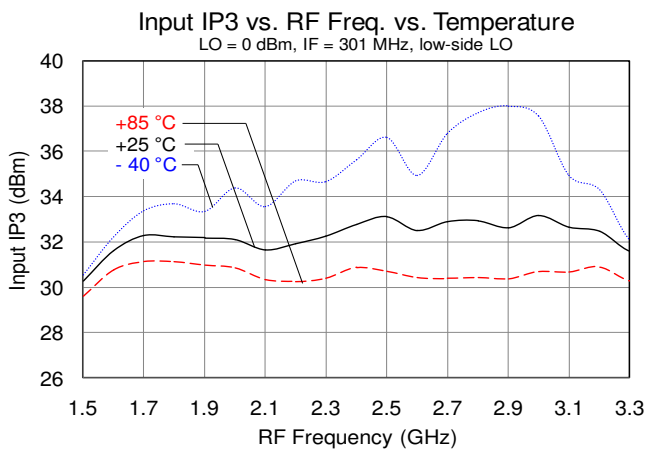
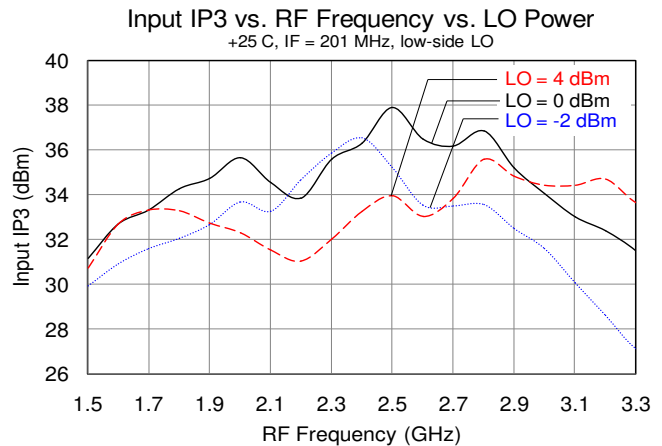
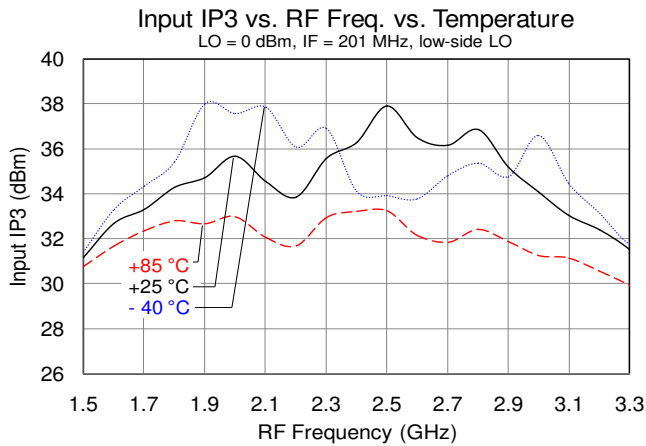
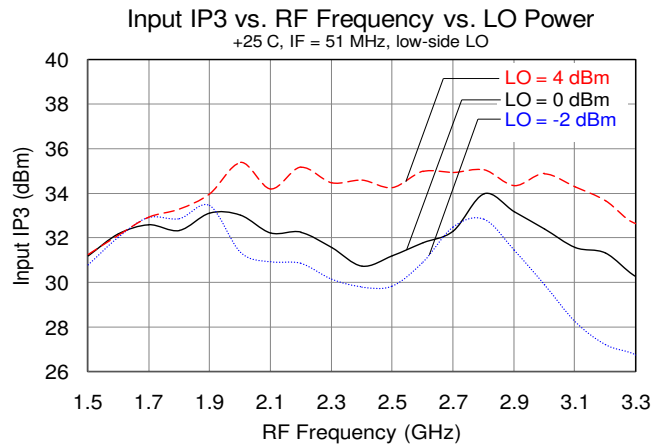
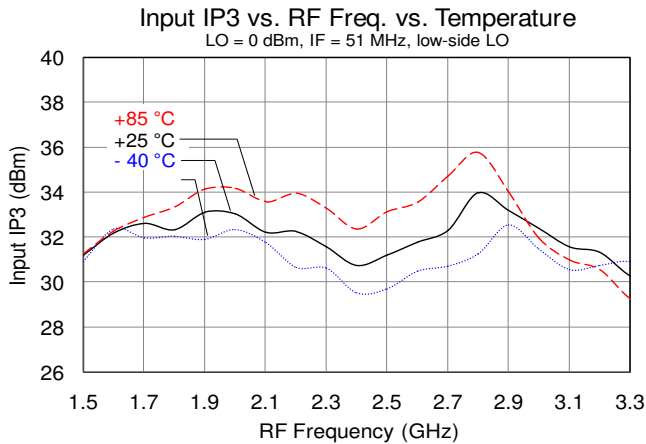
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Test conditions unless otherwise noted:  $V_{CC} = +5\text{ V}$ ,  $\text{Temp} = +25\text{ }^\circ\text{C}$ ,  $50\ \Omega$  system.



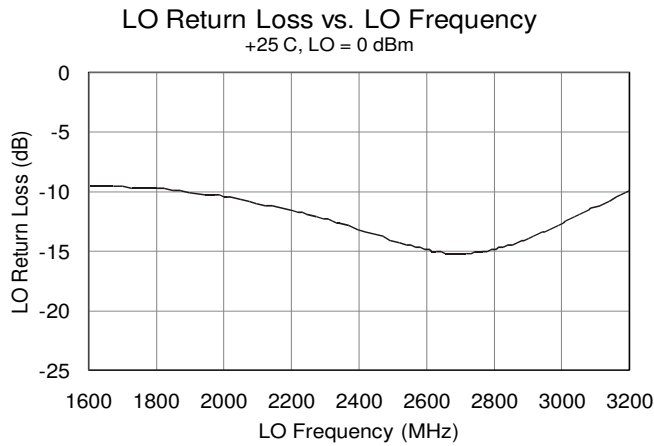
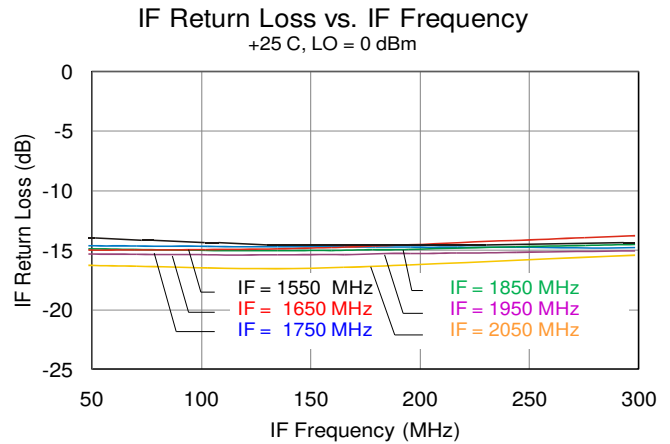
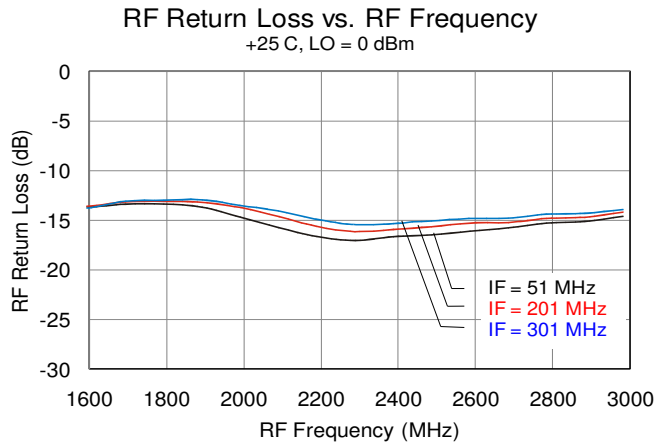
**Performance Plots**

Test conditions unless otherwise noted:  $V_{CC} = +5\text{ V}$ ,  $\text{Temp} = +25\text{ }^\circ\text{C}$ ,  $50\ \Omega$  system.



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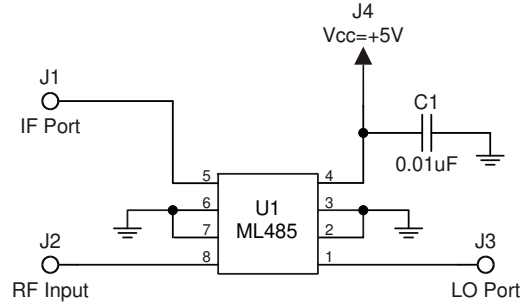
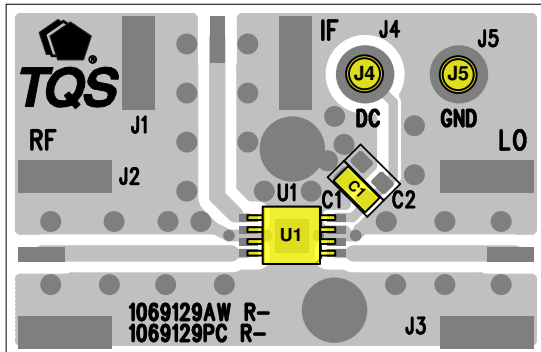


**Spur Table**

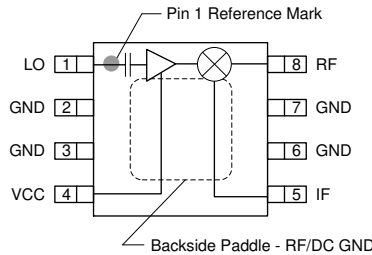
Spur table is  $N \times f_{RF} - M \times f_{LO}$  mixer spurious products for 0 dBm input power, unless otherwise noted.  
 RF Frequency = 1842 MHz, LO Frequency = 1642 MHz, All values in dBc relative to the IF Power Level.

|   |   | M  |    |    |    |    |    |
|---|---|----|----|----|----|----|----|
|   |   | 0  | 1  | 2  | 3  | 4  | 5  |
| N | 0 |    | 2  | 22 | 35 | 18 | 85 |
|   | 1 | 3  | 0  | 30 | 23 | 47 | 35 |
|   | 2 | 47 | 81 | 39 | 51 | 57 | 70 |
|   | 3 | 87 | 80 | 94 | 72 | 78 | 81 |
|   | 4 | 95 | 93 | 91 | 93 | 88 | 88 |
|   | 5 | 95 | 95 | 95 | 92 | 95 | 95 |

**Down Conversion Application Circuit: ML485-PCB**



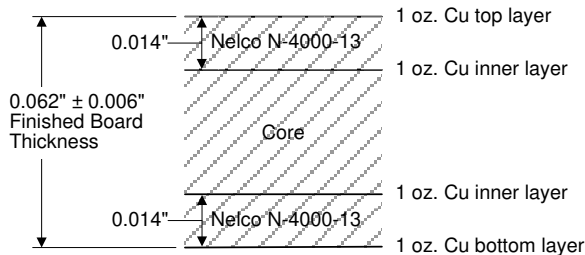
**Pin Configuration and Description**



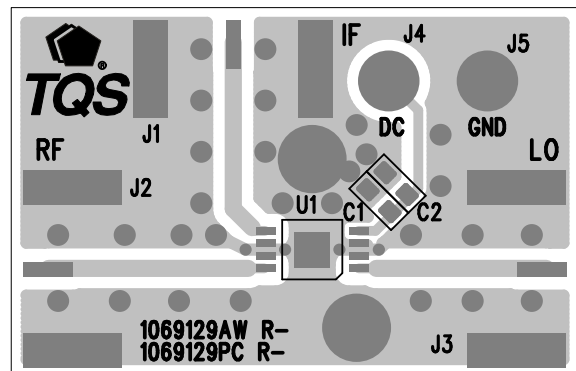
| Pin No.         | Symbol | Description                                                                                                             |
|-----------------|--------|-------------------------------------------------------------------------------------------------------------------------|
| 1               | LO     | Local Oscillator Injection. Internally DC Blocked                                                                       |
| 2, 3, 6, 7      | GND    | RF/DC Ground                                                                                                            |
| 4               | Vcc    | Supply voltage. An external bypass capacitor should be used near this pin.                                              |
| 5               | IF     | Intermediate Frequency                                                                                                  |
| 8               | RF     | Radio Frequency                                                                                                         |
| Backside Paddle | GND    | RF/DC Ground. Follow recommended via pattern and ensure good solder attach for best thermal and electrical performance. |

**Evaluation Board PCB Information**

Qorvo PCB 1069129 Material and Stack-up



50 ohm line dimensions: width = 0.026", spacing = 0.025"



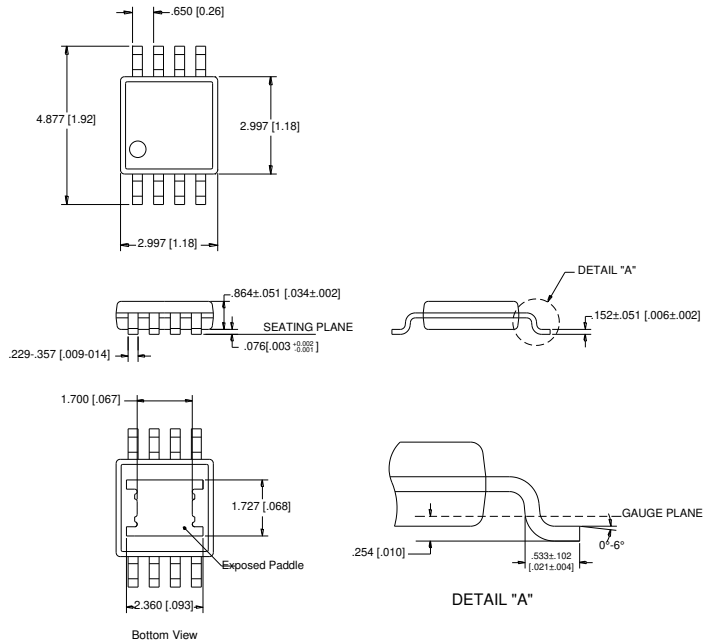


**Package Marking and Dimensions**

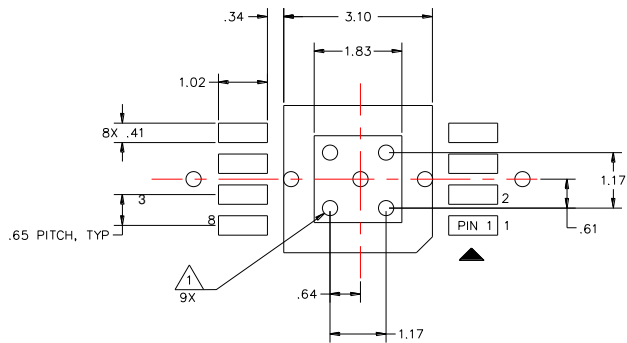
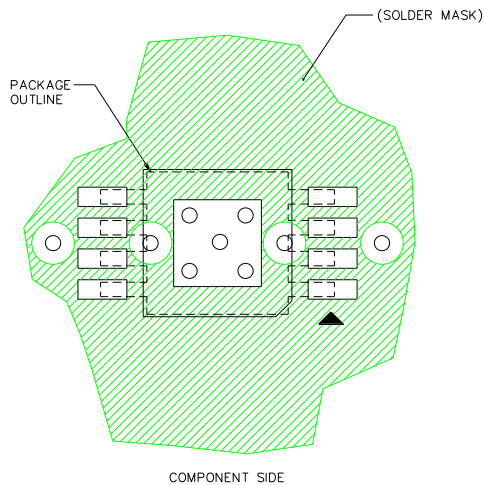
Marking: Part Code – M42  
Lot Code – YXX

NOTES:

1. All dimensions are in millimeters. Angles are in degrees.
2. Except where noted, this part outline conforms to JEDEC standard MO-187.
3. Dimension and tolerance formats conform to ASME Y14.4M-1994.
4. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012



**PCB Mounting Pattern**



NOTES:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.10").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

**Product Compliance Information**

**ESD Sensitivity Ratings**



Caution! ESD-Sensitive Device

ESD Rating: Class 0B  
Value:  $\geq 125$  V to  $< 250$  V  
Test: Human Body Model (HBM)  
Standard: ESDA/JEDEC Standard JS-001-2012

ESD Rating: Class C2  
Value:  $\geq 500$  V to  $< 1000$  V  
Test: Charged Device Model (CDM)  
Standard: JEDEC Standard JESD22-C101F

**MSL Rating**

MSL Rating: Level 2  
Test: 260 °C convection reflow  
Standard: JEDEC Standard IPC/JEDEC J-STD-020

**Solderability**

Compatible with both lead-free (260 °C maximum reflow temperature) and tin/lead (245 °C maximum reflow temperature) soldering processes.

Contact plating: Matte Tin

**RoHS Compliance**

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

**Important Notice**

For the latest specifications, additional product information, worldwide sales and distribution locations:

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**Email:** [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

For information about the merger of RFMD and TriQuint as Qorvo:

**Web:** [www.qorvo.com](http://www.qorvo.com)

For technical questions and application information:

**Email:** [sjapplications.engineering@qorvo.com](mailto:sjapplications.engineering@qorvo.com)

**Contact Information**

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