ML485

1.5-3.2 GHz High IP3 Mixer with Integrated LO Amp

TriQuint SEMICONDUCTOR

Applications

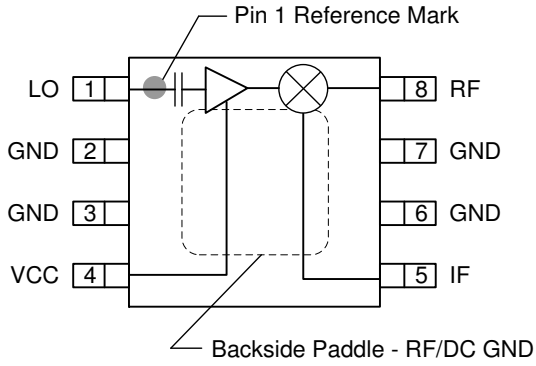
- PCS / 3G Base station / Repeaters
- WCDMA / LTE
- WiMax / WiBro
- ISM / Fixed Wireless
- HPA Feedback Paths

MSOP 8 Package

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: 50 – 300 MHz
- +5V Supply @ 40 mA
- 0 dBm Drive Level
- RoHS-compliant MSOP8 (14 mm^2)

Functional Block Diagram



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 +35 dBm 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

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_{CC}	4.75	5.0	5.25	V
T_{CASE}	-40		+85	°C
Tj for >10^6 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_{CC} =+5V, Temp=+25°C, 50 Ω system. (see note 1)

Parameter	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Units
RF Freq Range	1700-1800			1800-2200			2300-2400			2500-2700			MHz
LO Freq Range	1400-1750			1500-2150			2000-2350			2200-2650			MHz
IF Freq Range	50-300			50-300			50-300			50-300			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

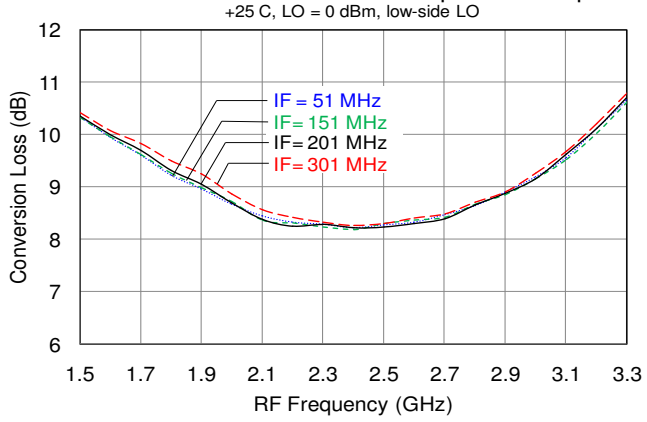
Notes:

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

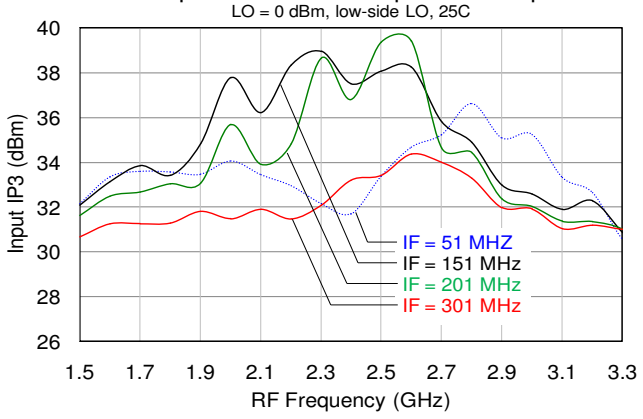
Performance Plots

Test conditions unless otherwise noted: V_{CC} =+5V, Temp=+25°C, 50 Ω system.

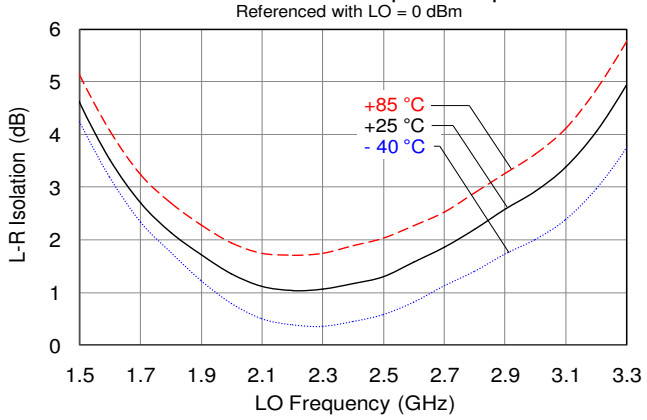
Conversion Loss vs. RF Freq. vs. IF Freq.
+25 C, LO = 0 dBm, low-side LO



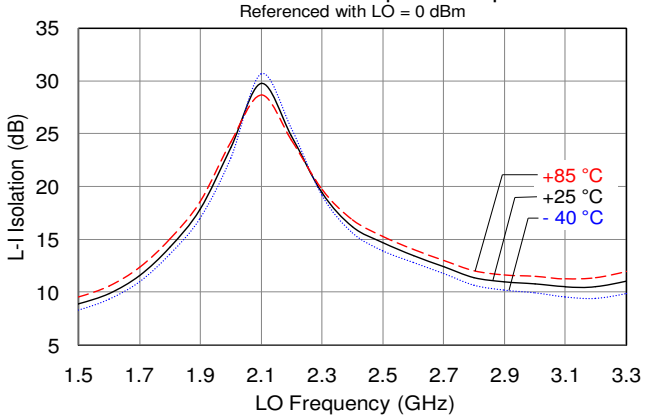
Input IP3 vs. RF Freq. vs. IF Freq.
LO = 0 dBm, low-side LO, 25C



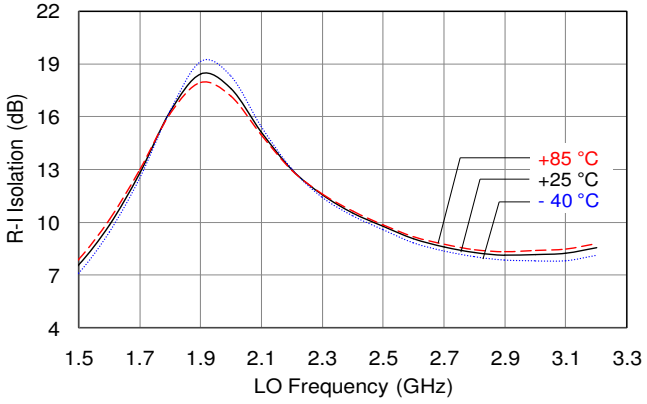
L-R Isolation vs. LO Freq. vs.Temperature
Referenced with LO = 0 dBm



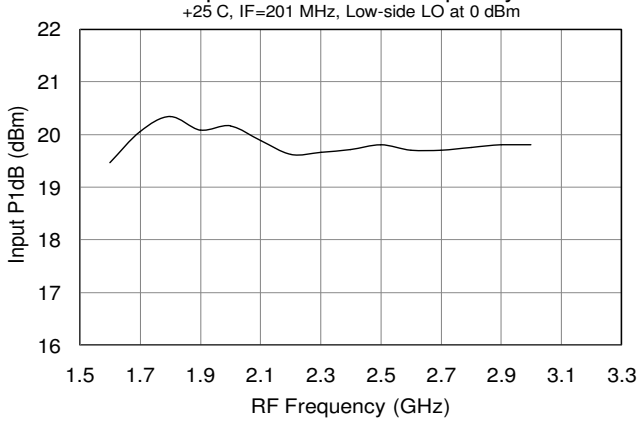
L-I Isolation vs. LO Freq. vs. Temperature
Referenced with LO = 0 dBm



R-I Isolation vs. LO Freq. vs. Temperature
Referenced with LO = 0 dBm



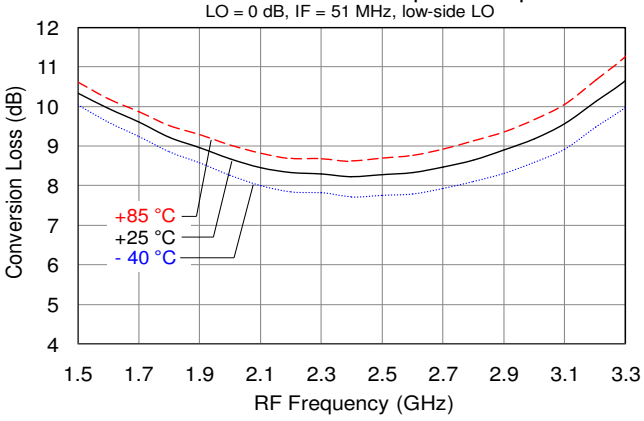
Input P1dB vs. RF Frequency
+25 C, IF=201 MHz, Low-side LO at 0 dBm



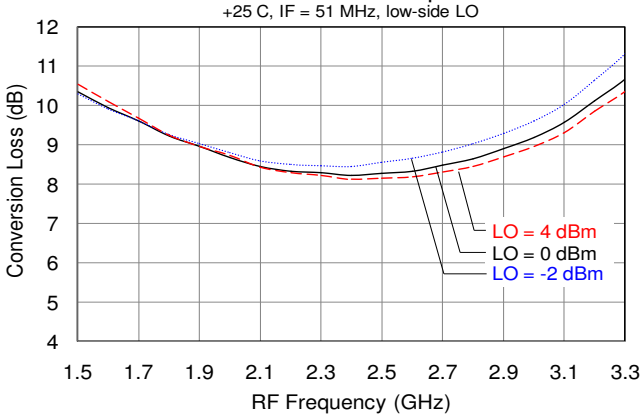
Performance Plots

Test conditions unless otherwise noted: V_{CC} =+5V, Temp=+25°C, 50 Ω system.

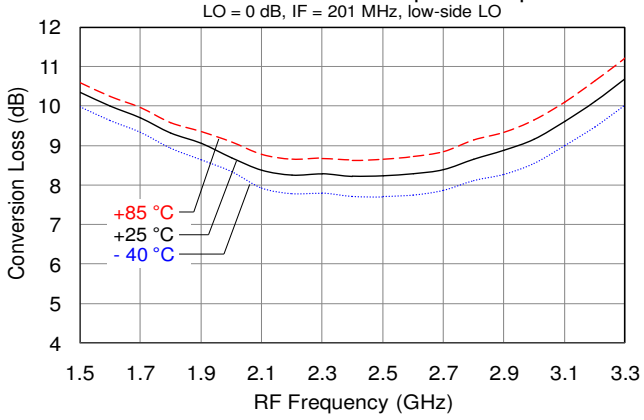
Conversion Loss vs. RF Freq. vs. Temperature
LO = 0 dB, IF = 51 MHz, low-side LO



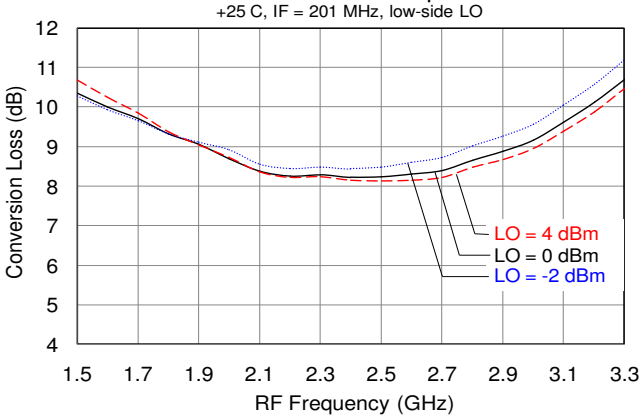
Conversion Loss vs. RF Freq. vs. LO Power
+25 C, IF = 51 MHz, low-side LO



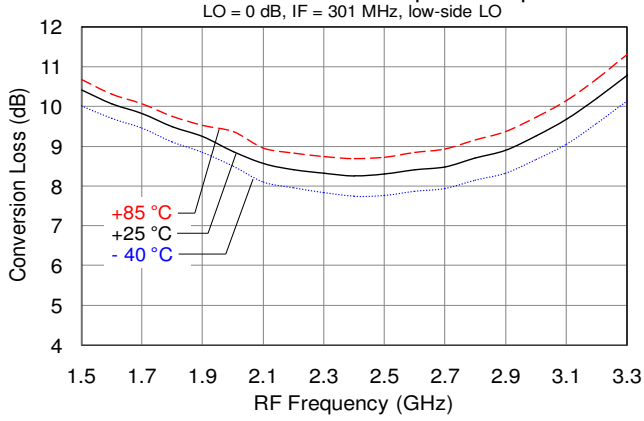
Conversion Loss vs. RF Freq. vs. Temperature
LO = 0 dB, IF = 201 MHz, low-side LO



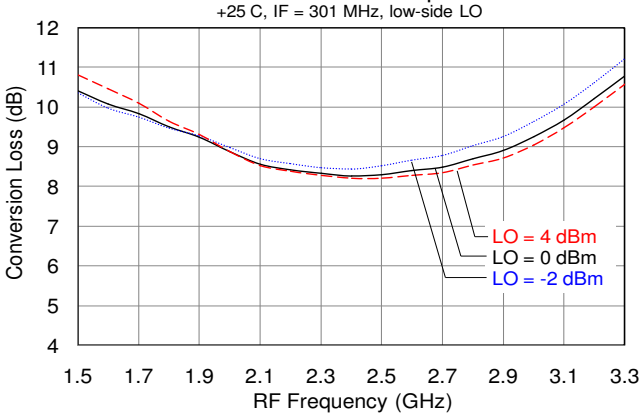
Conversion Loss vs. RF Freq. vs. LO Power
+25 C, IF = 201 MHz, low-side LO



Conversion Loss vs. RF Freq. vs. Temperature
LO = 0 dB, IF = 301 MHz, low-side LO



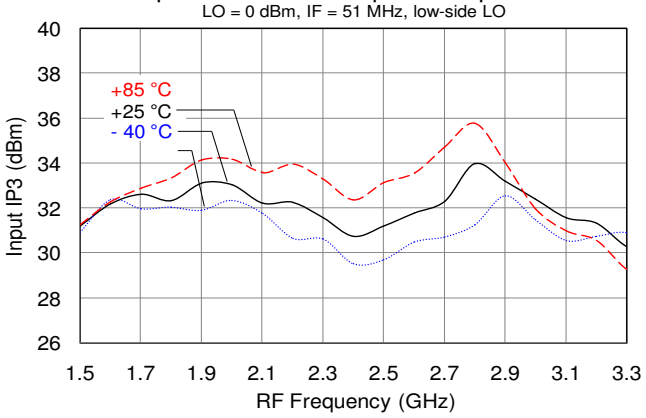
Conversion Loss vs. RF Freq. vs. LO Power
+25 C, IF = 301 MHz, low-side LO



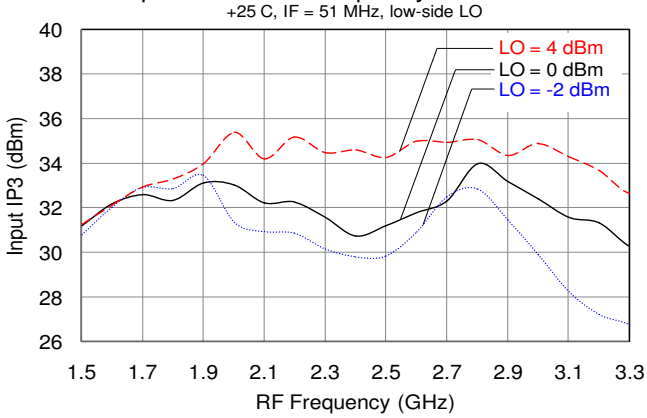
Performance Plots

Test conditions unless otherwise noted: V_{CC} =+5V, Temp=+25°C, 50 Ω system.

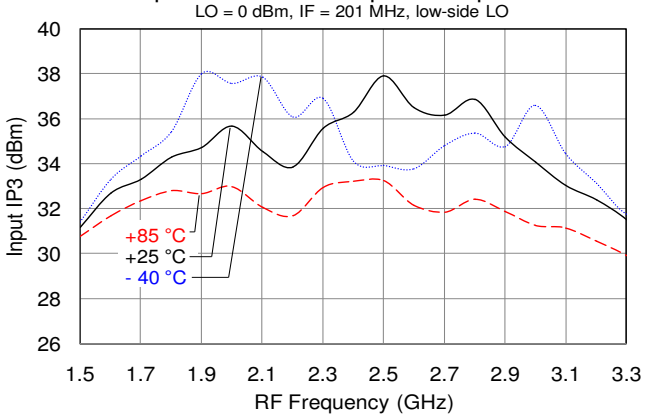
Input IP3 vs. RF Freq. vs. Temperature
LO = 0 dBm, IF = 51 MHz, low-side LO



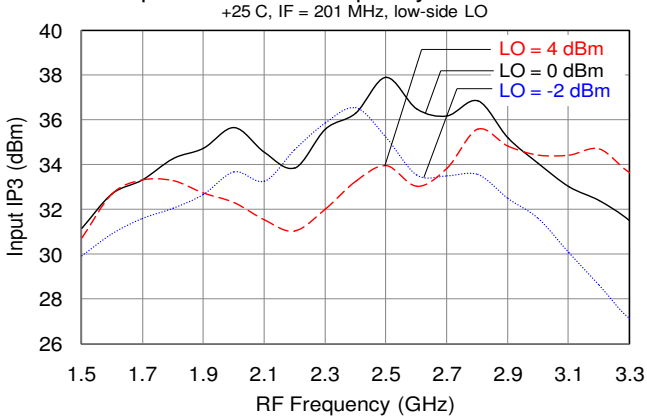
Input IP3 vs. RF Frequency vs. LO Power
+25 C, IF = 51 MHz, low-side LO



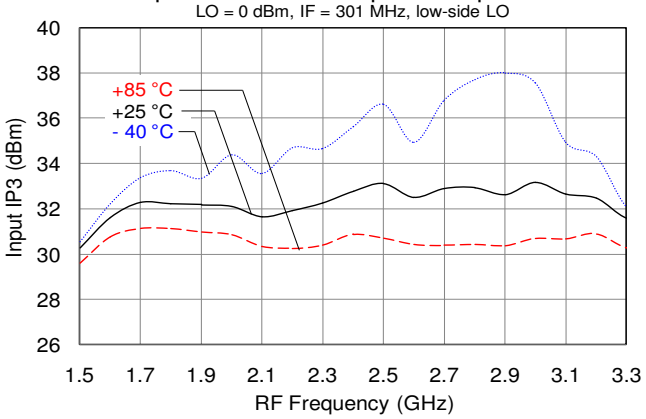
Input IP3 vs. RF Freq. vs. Temperature
LO = 0 dBm, IF = 201 MHz, low-side LO



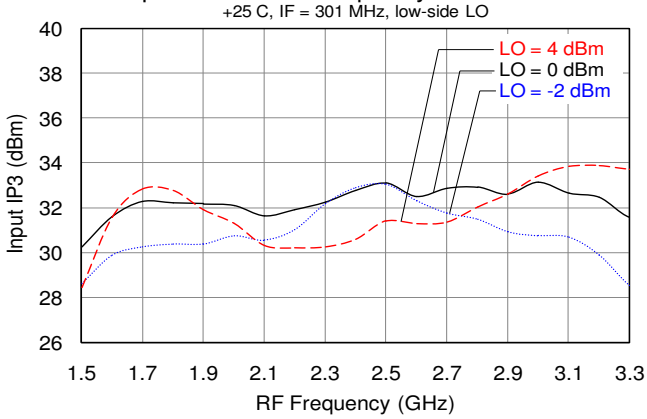
Input IP3 vs. RF Frequency vs. LO Power
+25 C, IF = 201 MHz, low-side LO



Input IP3 vs. RF Freq. vs. Temperature
LO = 0 dBm, IF = 301 MHz, low-side LO

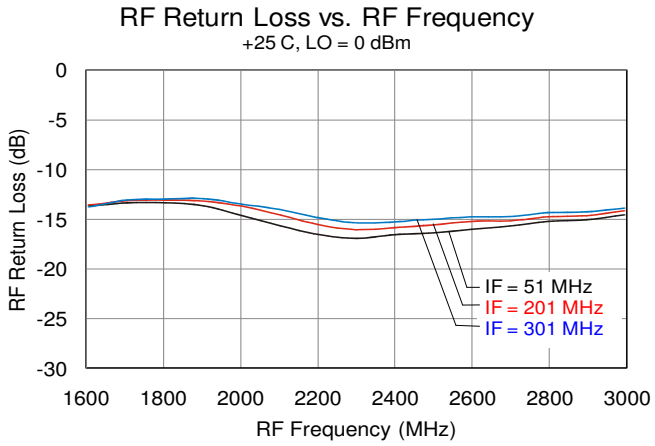


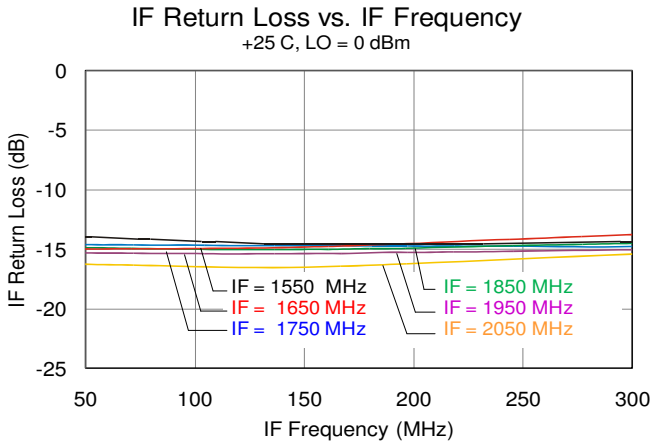
Input IP3 vs. RF Frequency vs. LO Power
+25 C, IF = 301 MHz, low-side LO

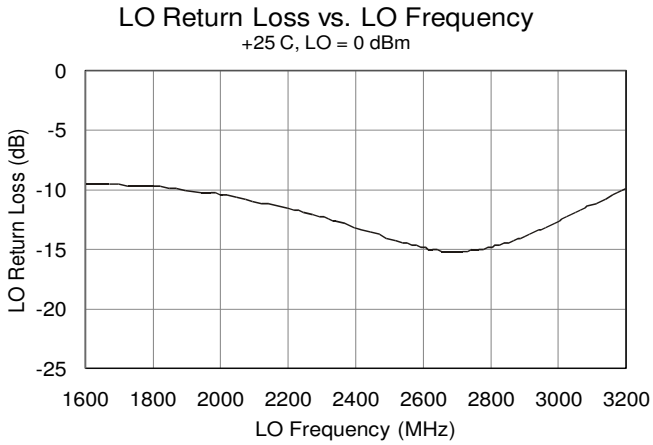


Performance Plots

Test conditions unless otherwise noted: V_{CC} =+5V, Temp=+25°C, 50 Ω system.





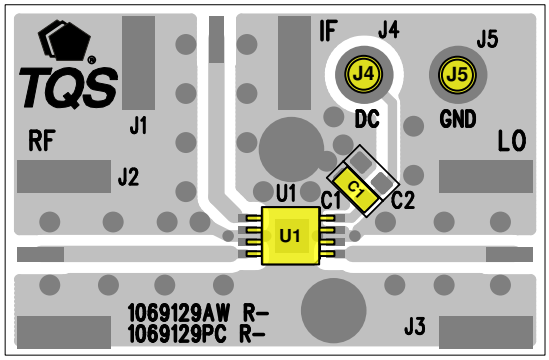


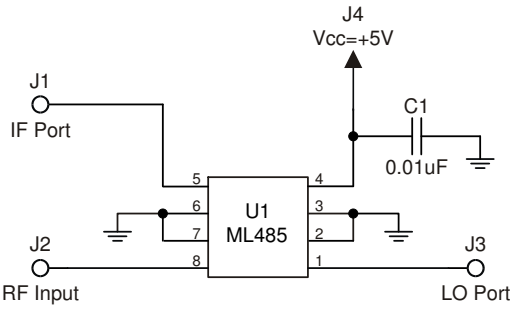
Spur Table

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.

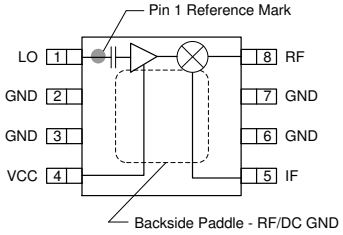
N \ M	0	1	2	3	4	5
0		2	22	35	18	85
1	3	0	30	23	47	35
2	47	81	39	51	57	70
3	87	80	94	72	78	81
4	95	93	91	93	88	88
5	95	95	95	92	95	95

Down Conversion Application Circuit: ML485-PCB





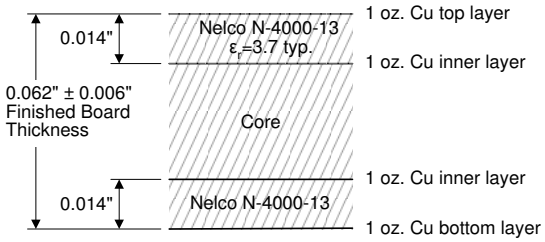
Pin Configuration and Description



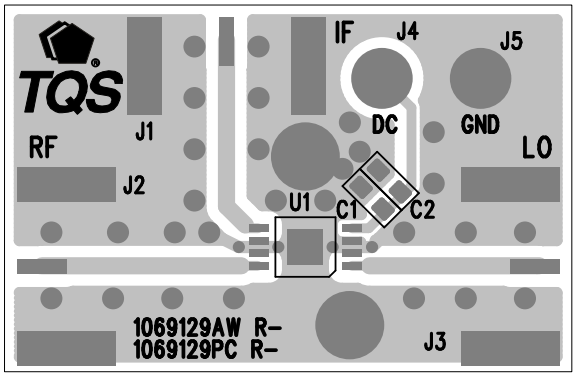
Pin No.	Symbol	Description
1	LO	Local Oscillator Injection. Internally DC Blocked
2, 3, 6, 7	GND	RF/DC Ground
4	Vcc	Supply voltage. An external bypass capacitor should be used near this pin.
5	IF	Intermediate Frequency
8	RF	Radio Frequency
Backside Paddle	GND	RF/DC Ground. Follow recommended via pattern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

Evaluation Board PCB Information

TriQuint PCB 1069129 Material and Stack-up



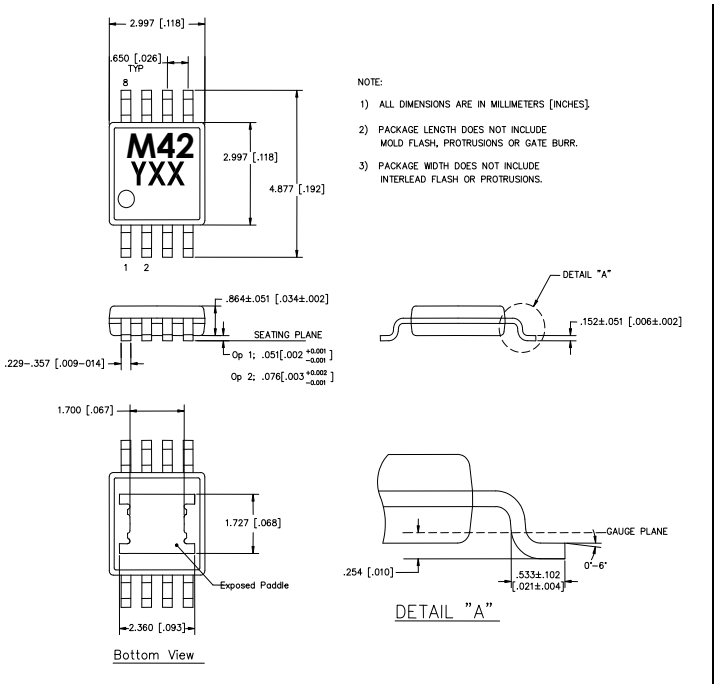
50 ohm line dimensions: width = 0.026", spacing = 0.025"



Mechanical Information

Package Marking and Dimensions

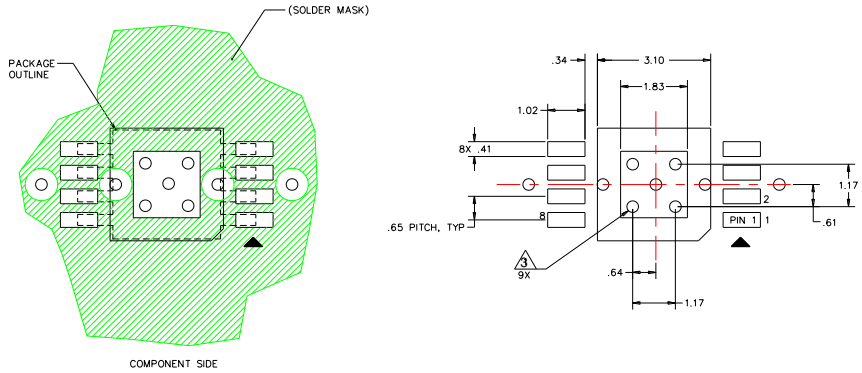
Marking: Part Code – M42
Lot Code – YXX



NOTES:

1. All dimensions are in millimeters. Angles are in degrees.
2. Except where noted, this part outline conforms to JEDEC standard MO-220, Issue E (Variation VGGC) for thermally enhanced plastic very thin fine pitch quad flat no lead package (QFN).
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 0
Value: Passes 200 V to <250 V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class III
Value: Passes ≥ 500 V min.
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101

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 max. reflow temperature) and tin/lead (245°C max. reflow temperature) soldering processes.

Package contact plating: NiPdAu

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 ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Important Notice

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

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Email: info-sales@tqs.com **Fax:** +1.503.615.8902

For technical questions and application information: **Email:** sjcapplications.engineering@tqs.com

Contact Information

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