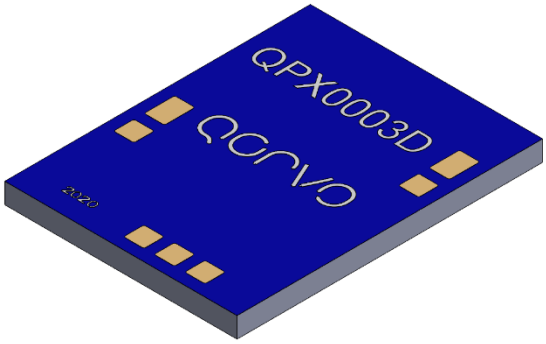
QPX0003D

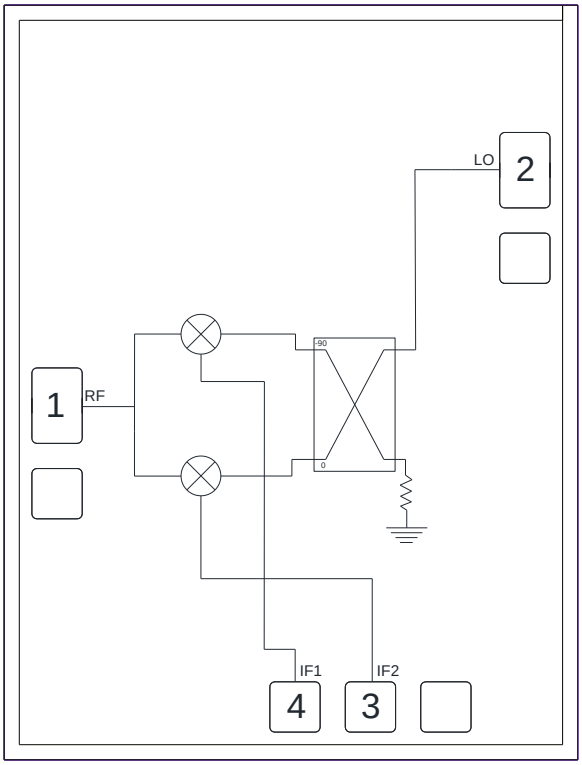
30-40 GHz I/Q Mixer

Product Overview

Qorvo's QPX0003D is a compact I/Q mixer in die form operating over the 30 to 40 GHz bandwidth that can be configured as an image reject mixer, a single sideband upconverter, or a QPSK modulator/demodulator. The QPX0003D utilizes two double balanced mixer cells and a 90º hybrid on the LO port. An external 90º hybrid on the IF port is required to complete the image rejection or sideband suppression. The QPX0003D is a smaller alternative to higher cost hybrid I/Q Mixers and single sideband upconverter assemblies.



Functional Block Diagram



Key Features

- I, Q outputs/inputs
- RF, LO Frequency Range: 30 to 40 GHz
- IF Frequency Range: DC – 5 GHz
- Low conversion loss of 7 dB at 35 GHz
- High image rejection of 25 dB
- High LO/RF isolation > 35 dB at 35 GHz
- Small die size

Performance is typical across frequency. Please reference electrical specification table and data plots for more details.

Applications

- Image reject downconversion
- Single-sideband modulation
- Low noise receiver systems
- Phase detection
- QPSK modulation/demodulation

Ordering Information

Part No.	Description
QPX0003D	30 to 40 GHz I/Q mixer die
QPX0003DS2	Sample, 2 pieces

Absolute Maximum Ratings

Parameter	Rating
LO, RF, or IF power, CW, 25 ºC	+25 dBm
Channel Temperate, Tch	150 °C
Operating Temperature	-55 to 85 °C
Storage Temperature	-55 to 150 °C

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.

Recommended Operating Conditions

Parameter	Min	Typ.	Max	Units
LO Drive Power	+11	+15	+21	dBm
RF input Power (downconversion)			+17	dBm
IF Input Power (upconversion)			+17	dBm
Temperature Range	-55	+25	+85	°C

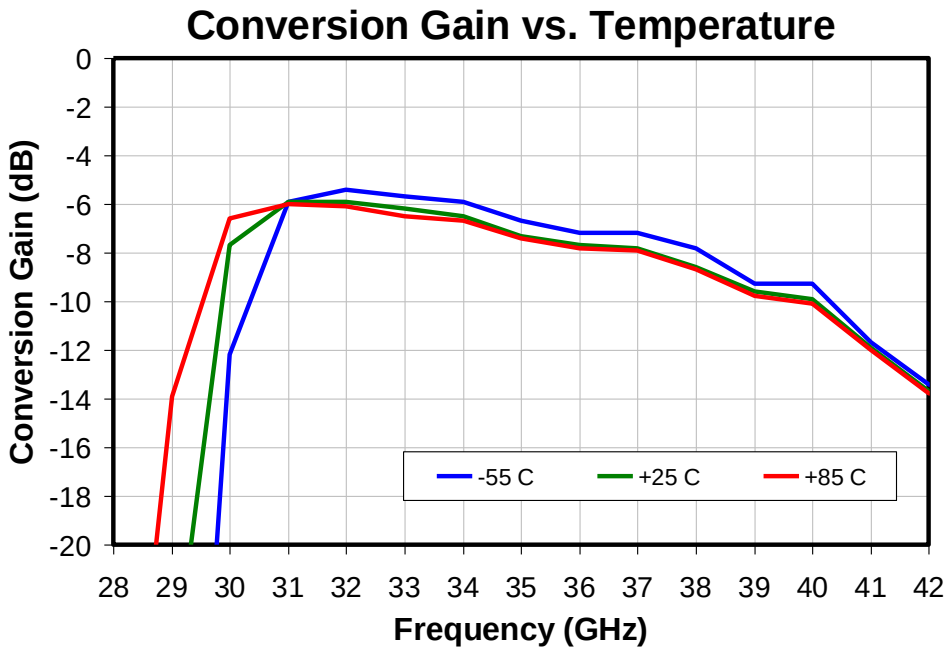
Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

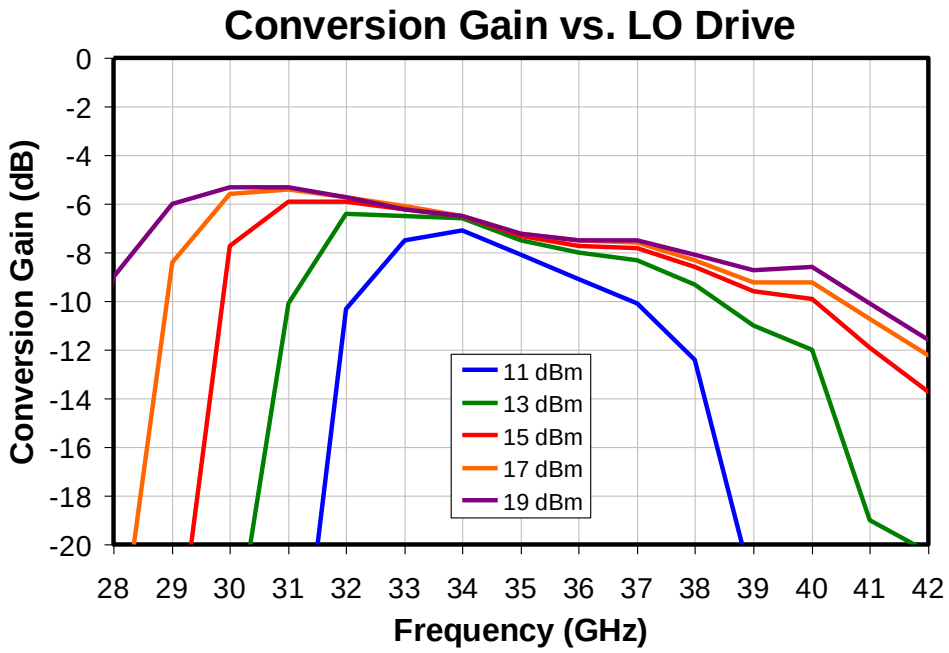
Electrical Specifications

Test conditions unless otherwise noted: 25 °C, IF = 100 MHz USB, LO = +15 dBm

Parameter		Min	Typ.	Max	Units
RF, LO Operational Frequency Range		30	–	40	GHz
IF Frequency Range		DC	–	5	GHz
Conversion Gain (with external hybrid)	RF, LO Frequency = 30 – 36 GHz	-11	-7	–	dB
	RF, LO Frequency = 36 – 40 GHz	-11	-9	–	
Image Rejection (with external hybrid)	RF, LO Frequency = 30 – 36 GHz	20	25	–	dB
	RF, LO Frequency = 36 – 40 GHz	15	17.5	–	
LO to RF Isolation	RF, LO Frequency = 30 – 36 GHz	–	35	–	dB
	RF, LO Frequency = 36 – 40 GHz	–	35	–	
LO to IF Isolation	RF, LO Frequency = 30 – 36 GHz	–	25	–	dB
	RF, LO Frequency = 36 – 40 GHz	–	22	–	
Input Power (P_{1dB})		–	+10	–	dBm
Input IP3		–	+18	–	dBm

Typical Performance – Data Taken as IRM with External IF Hybrid, IF=100 MHz USB





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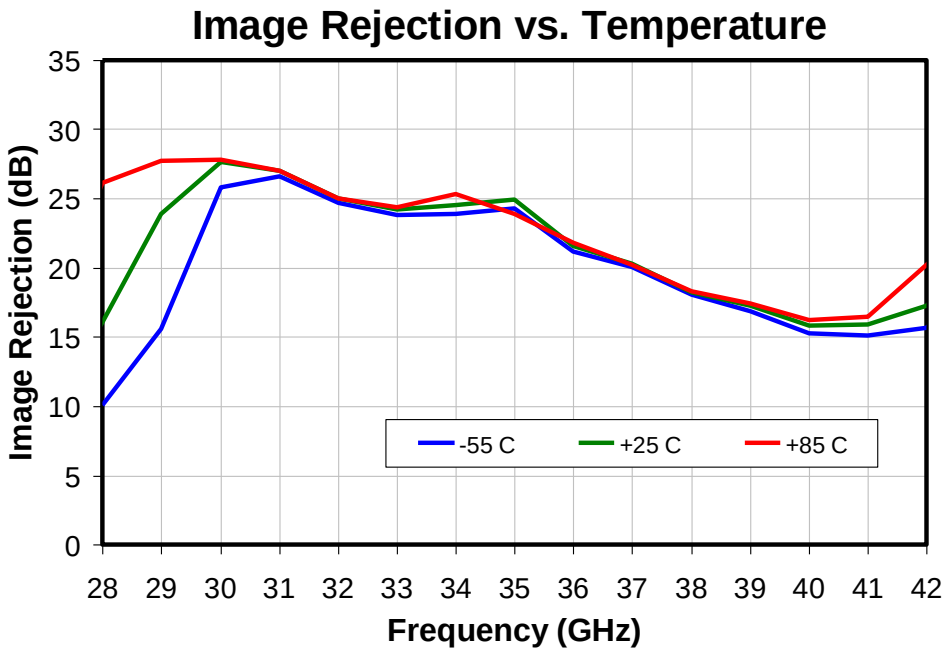

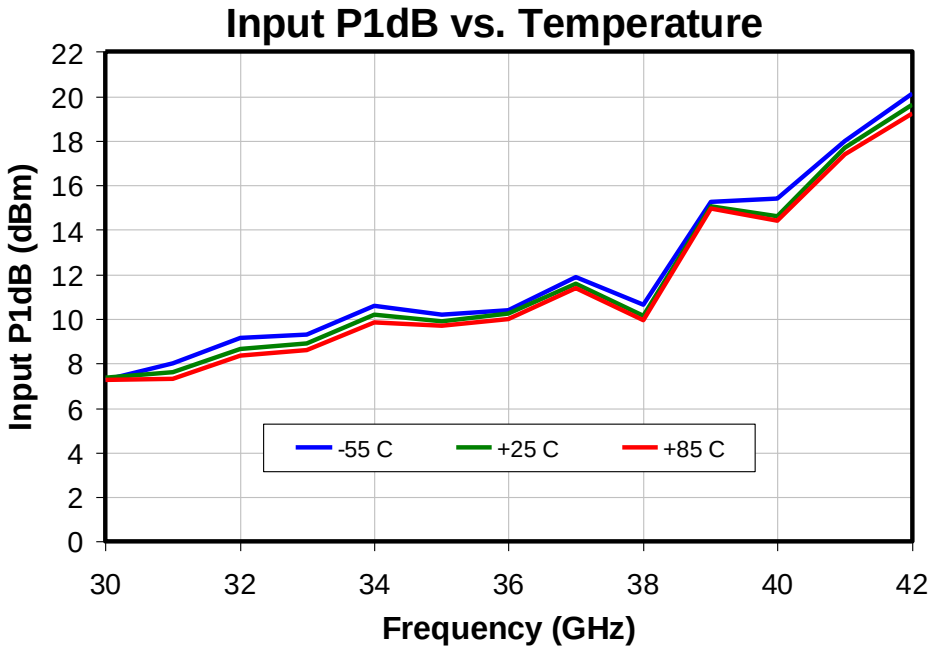

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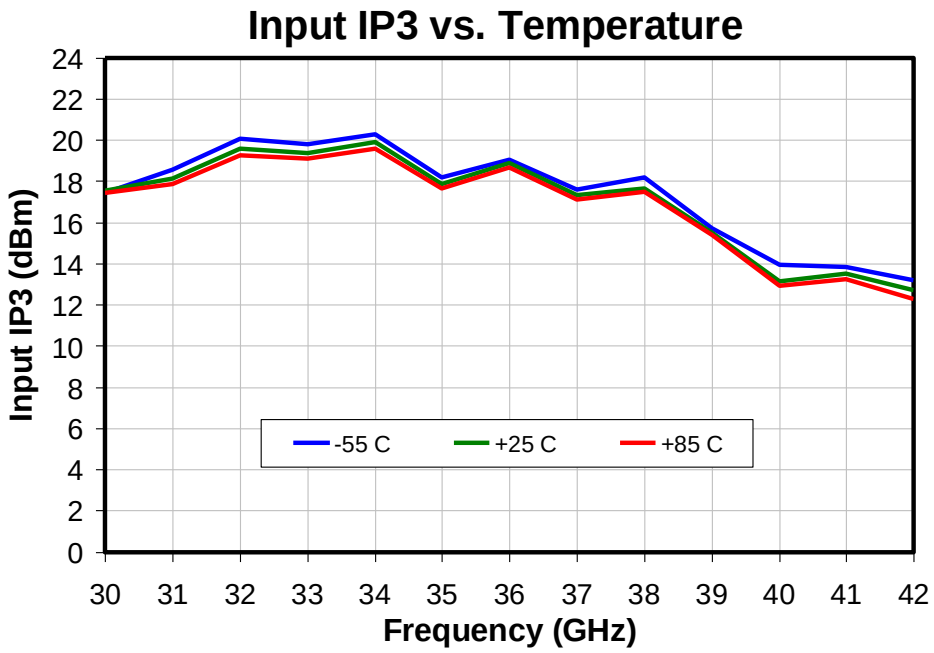
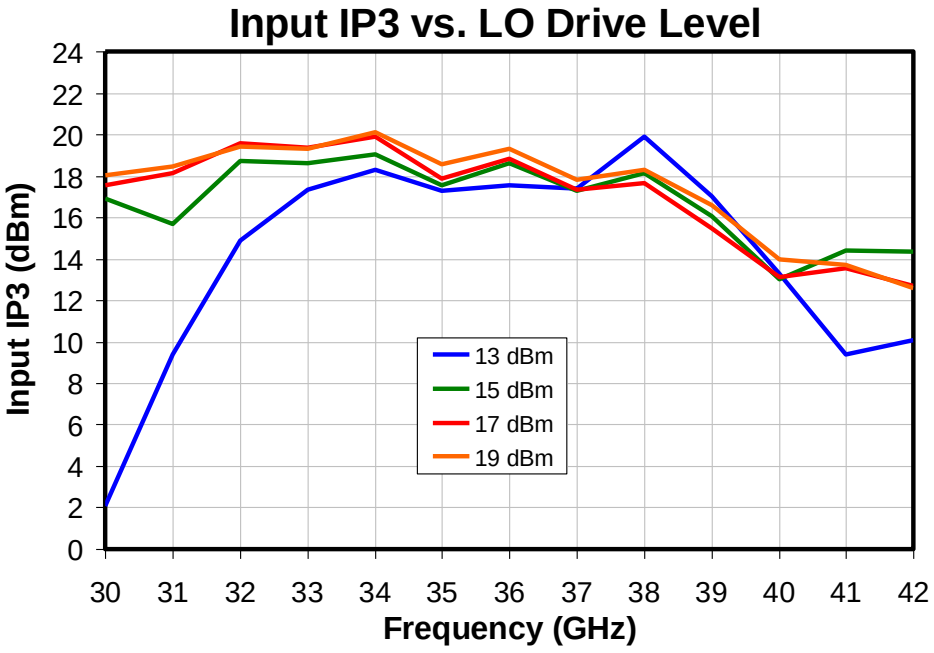
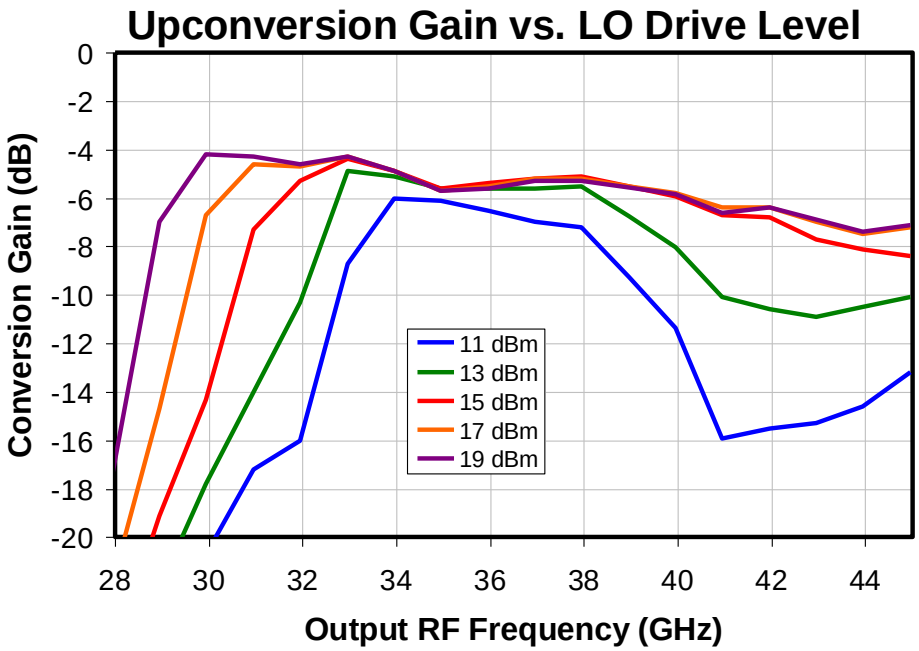
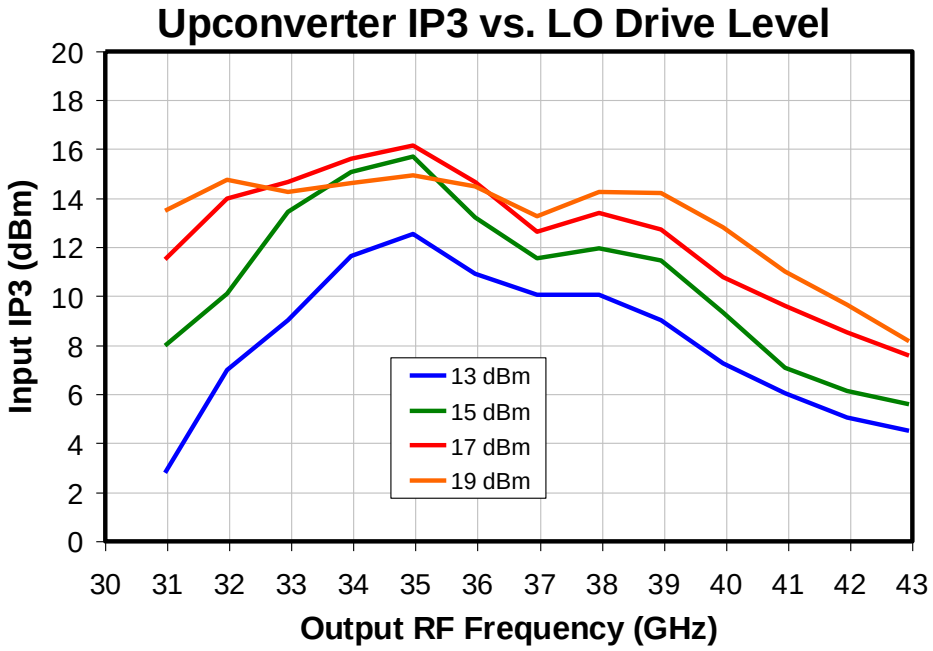


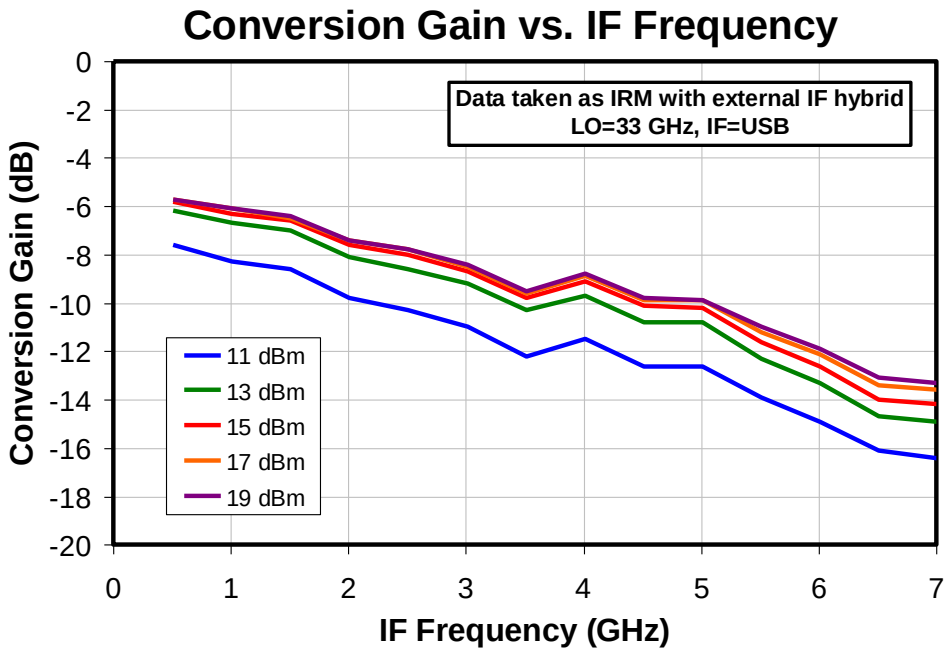


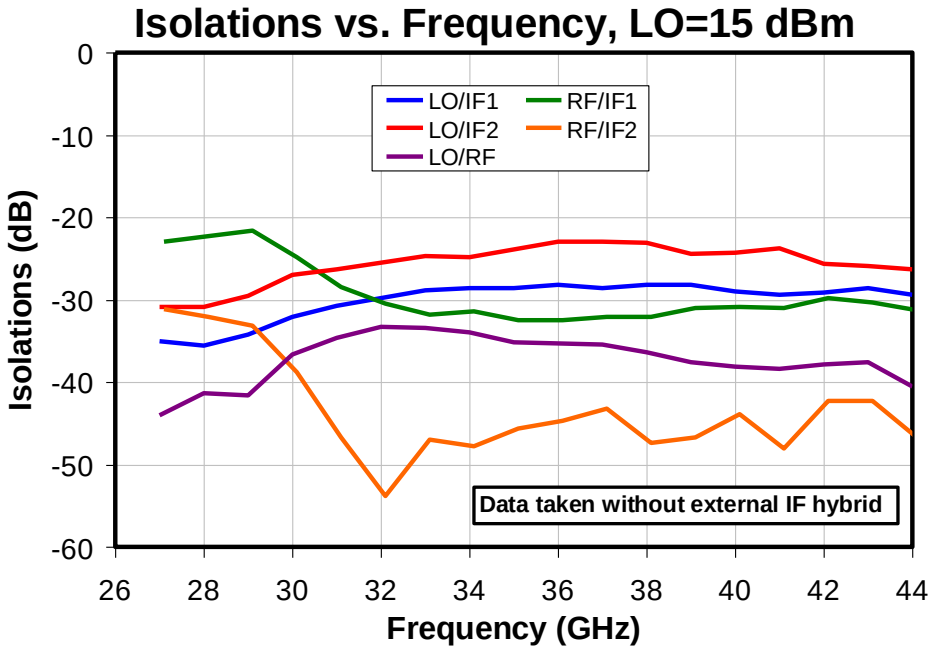
Typical Performance – Data Taken as Upconverter with External IF Hybrid, IF=950 MHz USB





Typical Performance





Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, CW, Frequency = 35 GHz, LO P_{IN} = 17 dBm (0.05 W), P_{DISS} = 0.05 W	400	ºC/W
Channel Temperature (T_{CH}) (1)		105	°C
Median Lifetime (T_M)		4.0E6	Hrs

Notes:
1. Measured to the back of the die.

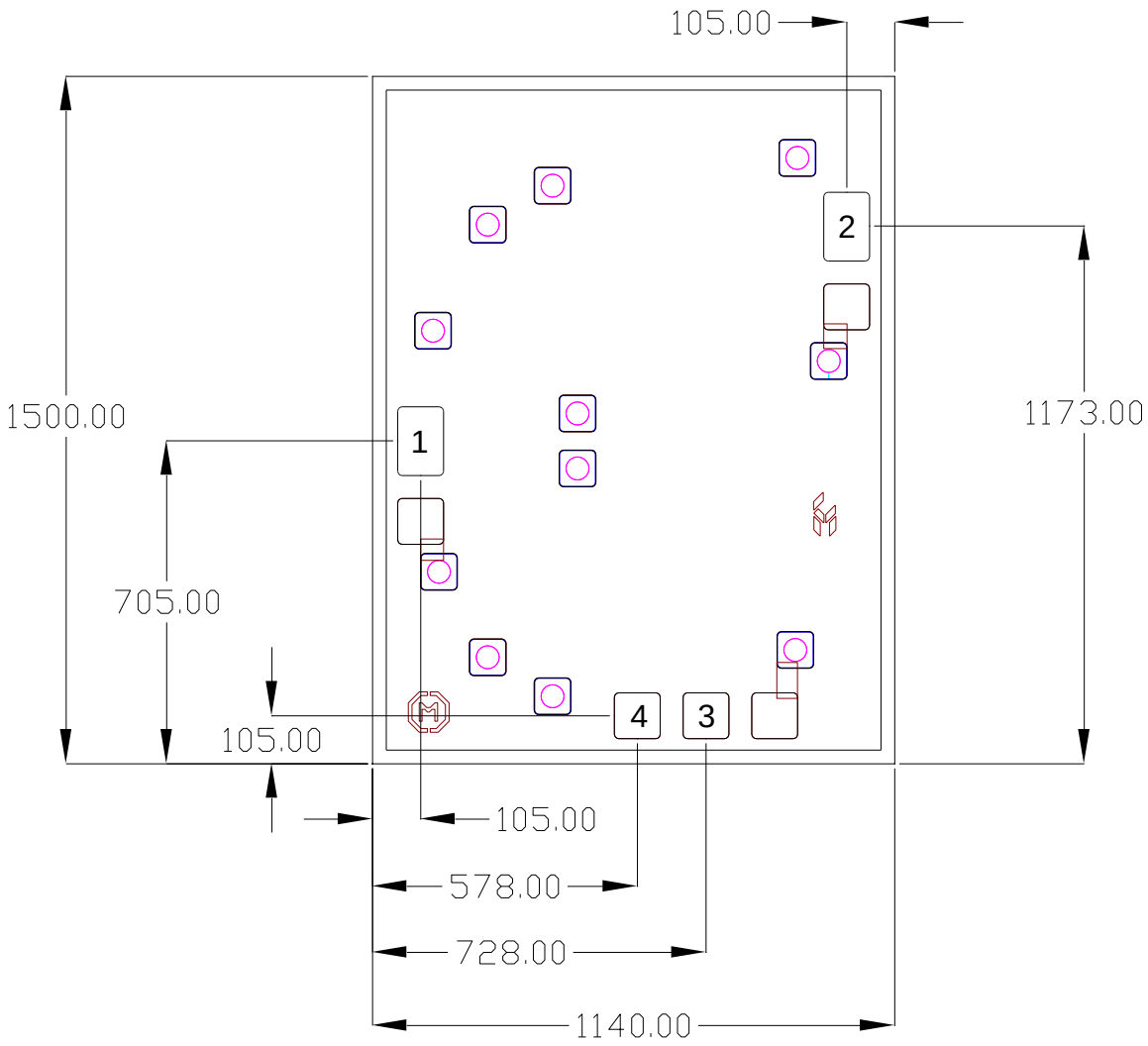
Spur Performance

	nLO				
mRF	0	1	2	3	4
0	x	0			
1	27	0	37		
2		63	47	59	
3				64	
4					

	nLO				
mRF	0	1	2	3	4
0	x	-3			
1	50	0	59		
2		56	48	55	
3				61	
4					

RF = 34.1 GHz, -10 dBm
LO = 34 GHz, +15 dBm
All values in dBc below IF output power level (1RF – 1LO)
Response to IF1 port shown in top table, IF2 port in bottom table
Data taken as downconverter with no IF hybrid

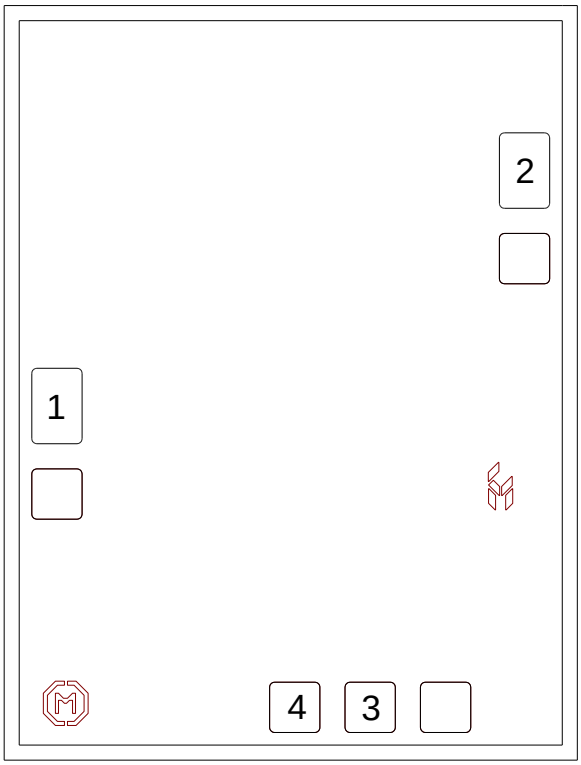
Mechanical Information



Notes:

1. All dimensions in microns.
2. No connection required for unlabeled grounds.
3. Backside is RF and DC ground.
4. Backside and bond pad metal: Gold.
5. Die is 100 um thick.
6. Bond pads (1) and (2) are 100 x 150 um, bond pads (3) and (4) are 100 x 100 um.

Pin Diagram



Bond Pad Description

Pad No.	Symbol	Pad Size (um)	Description
1	RF	100 x 150	This pin is DC coupled and matched to 50 Ohms.
2	LO	100 x 150	This pin is DC coupled and matched to 50 Ohms.
3, 4	IF2, IF1	100 x 100	These pins are DC coupled. For applications not requiring operation to DC, these ports should be DC blocked externally using a series capacitor whose value has been chosen to pass the necessary IF frequency range. For operation to DC, these pins must not source or sink more than 16 mA of current or part non-function or part failure may result.
Backside	Ground		Connect to RF / DC ground

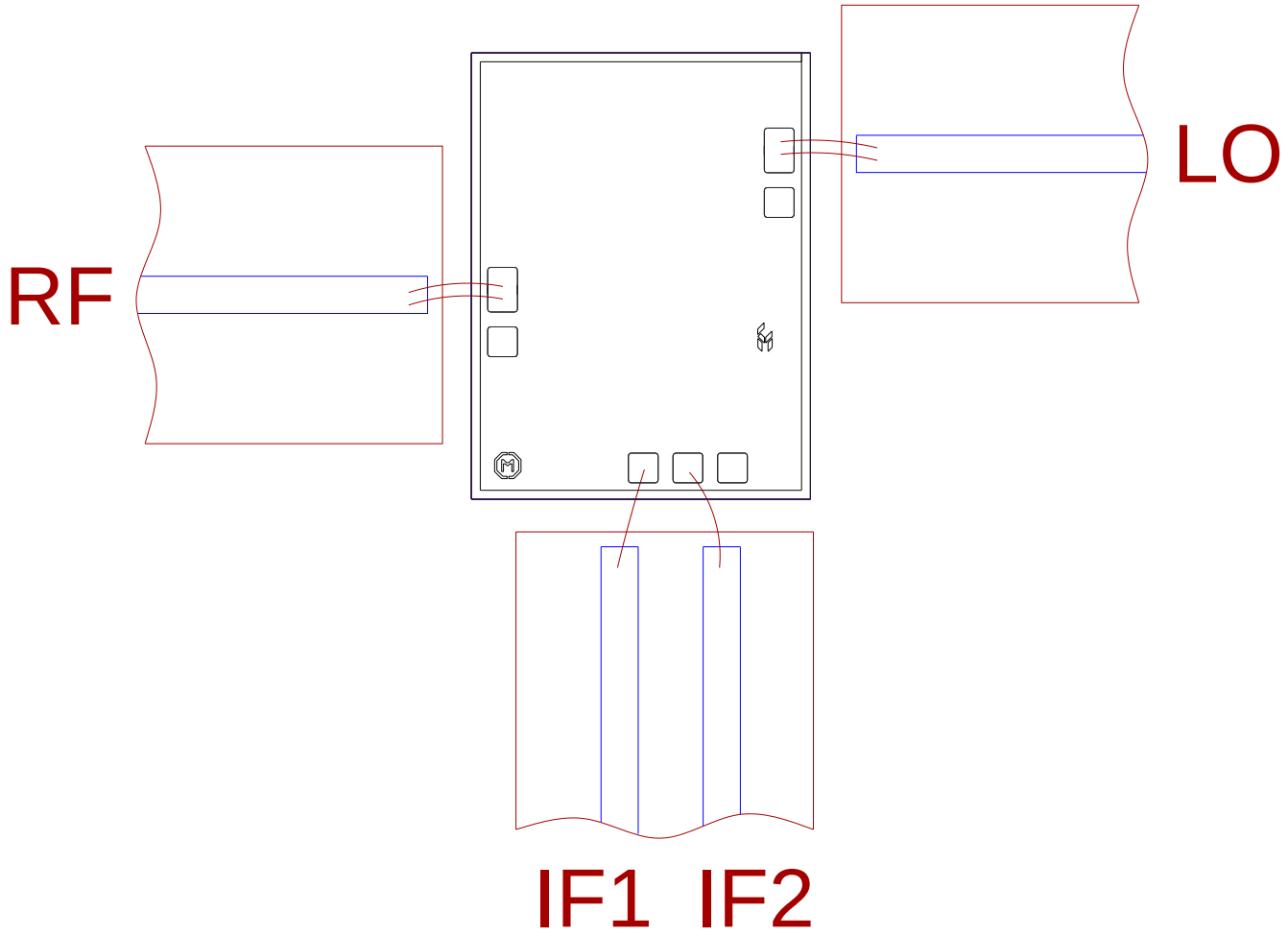
Assembly Guidelines

The backside of the QPX0003D is RF ground. Die attach should be accomplished with electrically and thermally conductive epoxy only. Eutectic attach is not recommended. Standard assembly procedures should be followed for high frequency devices. The top surface of the semiconductor should be made planar to the adjacent RF transmission lines.

RF connections should be made as short as possible to reduce the inductive effect of the bond wire. Use of a 0.8 mil thermosonic wedge bonding is highly recommended as the loop height will be minimized.

The semiconductor is 100 µm thick and should be handled by the sides of the die or with a custom collet. Do not make contact directly with the die surface as this will damage the monolithic circuitry. Handle with care.

Assembly Diagram



Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1A	ESDA / JEDEC JS-001-2012
MSL – Convection Reflow 235 °C	N/A	JEDEC standard IPC/JEDEC J-STD-020

Caution!
ESD-Sensitive Device

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

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

Contact Information

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

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