

37.0-40.0 GHz GaAs Power Amplifier QFN, 7x7mm



August 2009 - Rev 26-Aug-09

XP1031-QK
RoHS

Features

- ✕ Linear Power Amplifier
- ✕ Output Power Adjust
- ✕ 25.0 dB Small Signal Gain
- ✕ +25.0 dBm P1dB Compression Point
- ✕ +35.5 dBm OIP3



General Description

Mimix Broadband's four stage 37.0-40.0 GHz SMD GaAs MMIC power amplifier has a small signal gain of 25.0 dB with a +35.5 dBm Output Third Order Intercept. This MMIC uses Mimix Broadband's GaAs PHEMT device model technology, and is based upon electron beam lithography to ensure high repeatability and uniformity. The device comes in a RoHS compliant 7x7mm QFN Surface Mount Package offering excellent RF and thermal properties. This device is well suited for Millimeter-wave Point-to-Point Radio, LMDS, SATCOM and VSAT applications.

Absolute Maximum Ratings^{1,2}

Supply Voltage (Vd)	+4.3V
Supply Current (Id)	800 mA
Gate Bias Voltage (Vg)	-1.5V < Vg < 0V
Input Power (Pin)	+10 dBm
Abs. Max. Junction/Channel Temp	See MTTF Graph 1
Max. Operating Junction/Channel Temp	175 °C
Continuous Power Dissipation (P _{diss}) at 85 °C	2.80 W
Thermal Resistance (T _{channel} =150 °C)	23 °C/W
Operating Temperature (Ta)	-40 to +85 °C
Storage Temperature (T _{stg})	-65 to +150 °C
Mounting Temperature	See solder reflow profile
ESD Min. - Machine Model (MM)	Class A
ESD Min. - Human Body Model (HBM)	Class 1A
MSL Level	MSL3

(1) Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

(2) For saturated performance it recommended that the sum of (2*V_{dd} + abs(V_{gg})) < 9V

Electrical Characteristics for 37 - 40 GHz (Ambient Temperature T = 25 °C)

Parameter	Units	Min.	Typ.	Max.
Frequency Range (f)	GHz	37.0	-	40.0
Input Return Loss (S11)	dB	10.0	14.0	-
Output Return Loss (S22)	dB	4.0	8.0	-
Small Signal Gain (S21)	dB	23.0	25.0	-
Gain Flatness (ΔS21)	dB	-	+/-1.0	-
Reverse Isolation (S12)	dB	40	50	-
Output Power for 1dB Compression (P1dB)	dBm	-	25.0	-
Output IMD3 with P _{out} (scl) = 18 dBm	dBc	28.0	35.0	-
Output IMD3 with P _{out} (scl) = 15 dBm	dBc	38.0	41.0	-
Drain Bias Voltage (Vd)	VDC	-	3.5	4.0
Gate Bias Voltage (Vg)	VDC	-1.0	-0.3	-0.1
Supply Current (Id1) (Vd=4.0V, Vg=-0.3V)	mA	-	600	675

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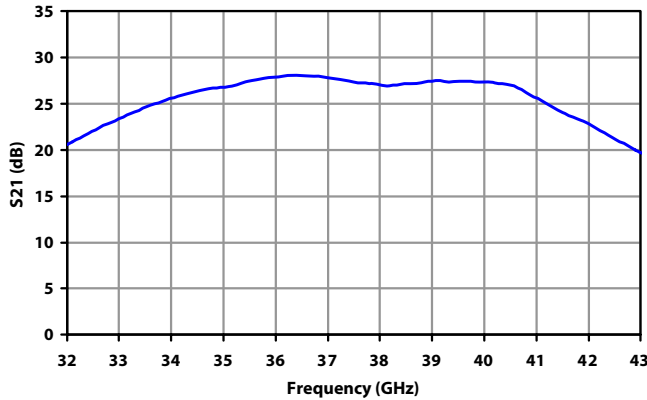


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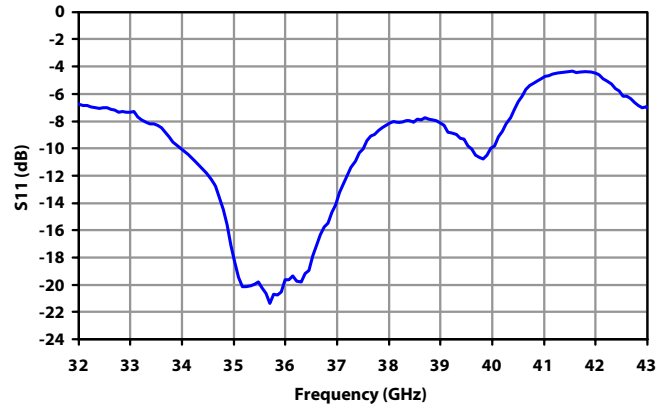
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Power Amplifier Measurements

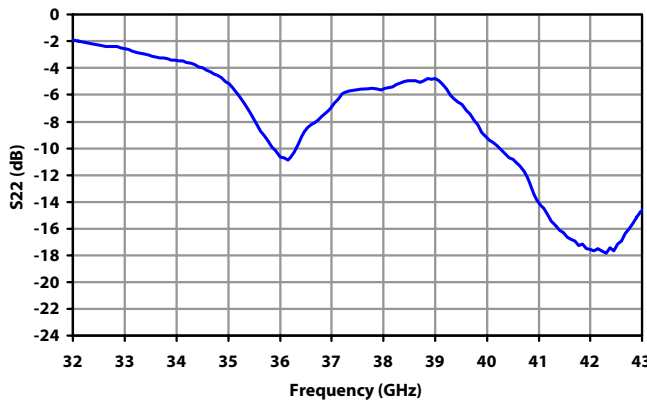
XP1031-QK-0N00: Small Signal Gain (S21)
Vd=4.0V, Id=600mA



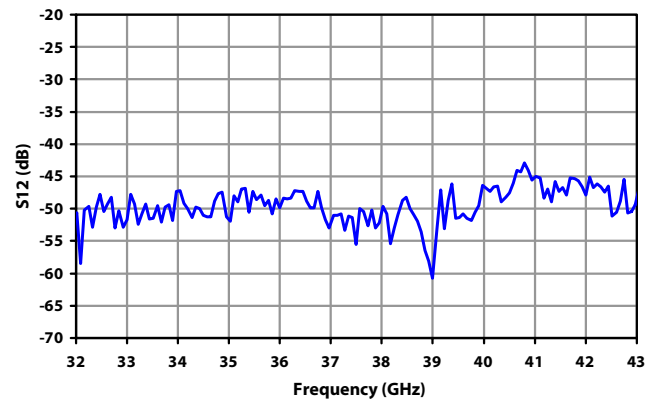
XP1031-QK-0N00: Input Return Loss (S11)
Vd=4.0V, Id=600mA



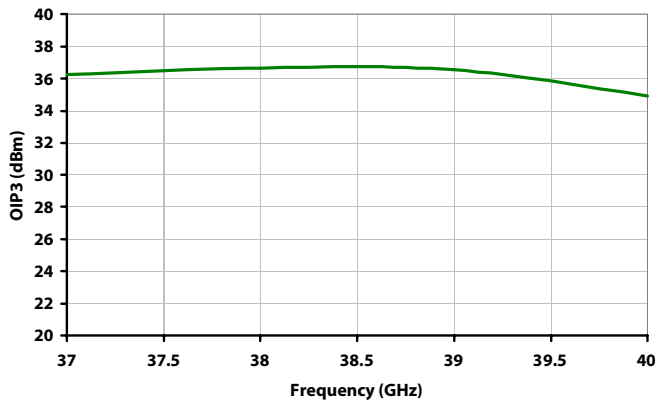
XP1031-QK-0N00: Output Return Loss (S22)
Vd=4.0V, Id=600mA



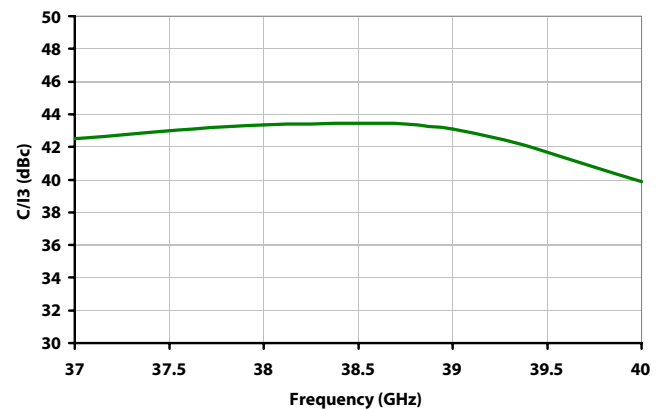
XP1031-QK-0N00: Reverse Isolation (S12)
Vd=4.0V, Id=600mA



XP1031-QK-0N00: OIP3 vs Frequency
Psc1=15dBm, Vd=4V, Id=600mA



XP1031-QK-0N00: C/I3 vs Frequency
Psc1=15dBm, Vd=4V, Id=600mA



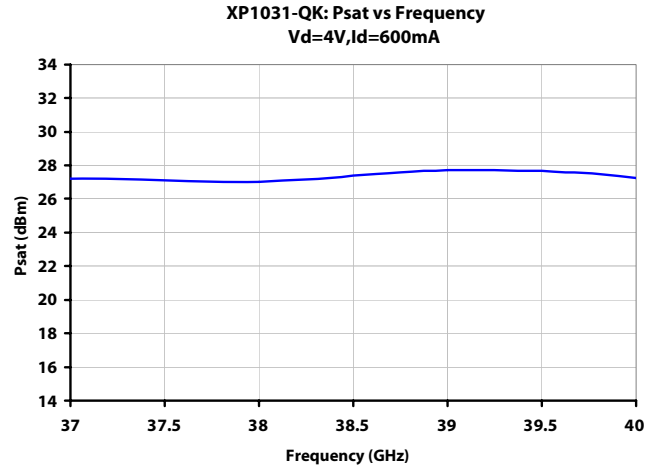
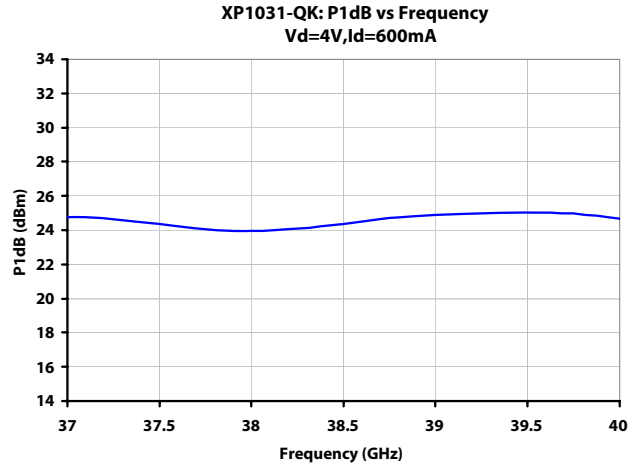
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Power Amplifier Measurements (cont.)

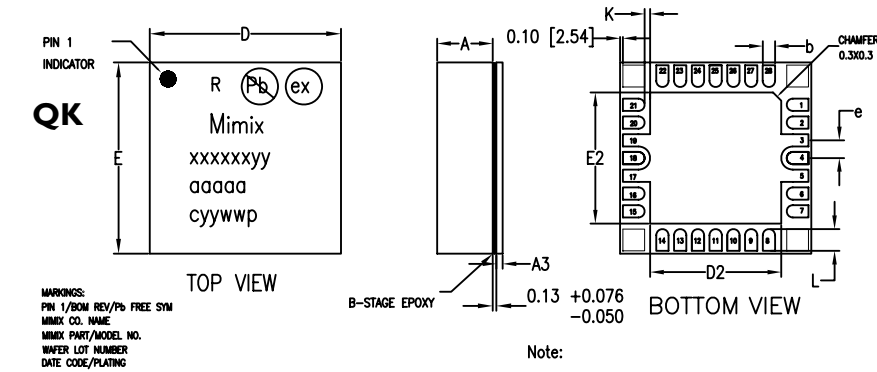


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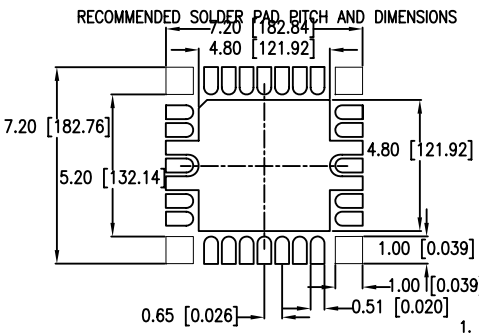
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Physical Dimensions/Layout



Pin Number	Pin Name	Pin Function	Nominal Value
3	GND	Ground	
4	RF IN	RF Input	2.8kΩ
5	GND	Ground	
13	VG	Gate bias for Stage1 to Stage 4	-0.3 V, >100kΩ
17	GND	Ground	
18	RF OUT	RF Output	0.5Ω
19	GND	Ground	
23	VD	Drain bias for stage 1 to stage 4	+4.0 V, 600mA, 0.5Ω
All other pins	NC	Not Connected	

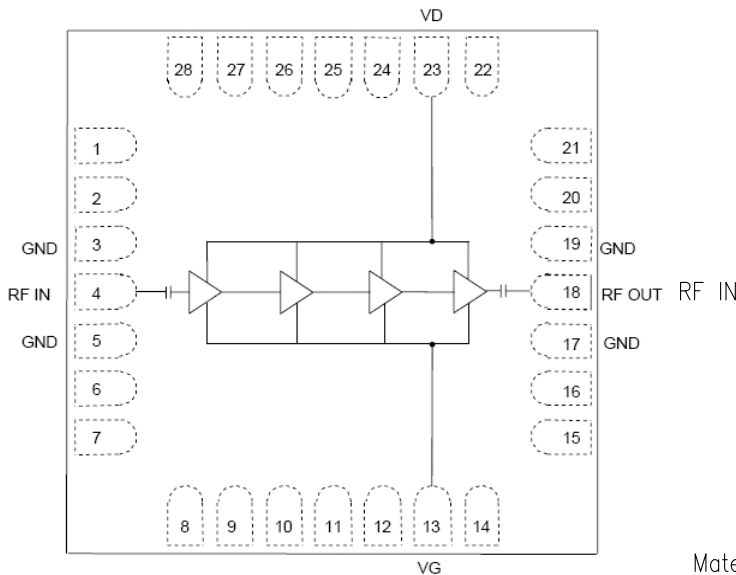


Note:
1. ALL DIMENSIONS ARE IN mm.

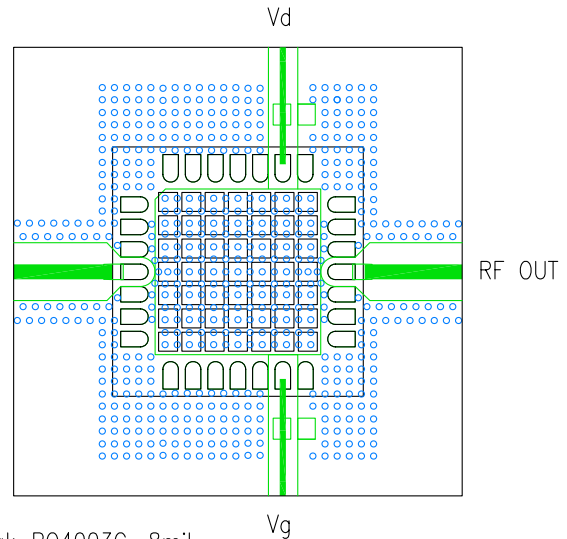
	MIN	TYP	MAX
A	1.20	1.25	1.30
A3	0.10 - 0.20 REF		
b	0.40	0.45	0.50
K	0.20	-	-
D	7.00 BSC		
E	7.00 BSC		
e	0.65		
D2	4.75	4.80	4.85
E2	4.75	4.80	4.85
L	0.75	0.80	0.85

1. VIEWS ARE NOT TO SCALE; USE DIMENSIONS AND TABLE.

Functional Block Diagram/Board Layout



Bypass Capacitors - See App Note [2]



Material: R04003C, 8mil
Capacitors: 10nF/1uF

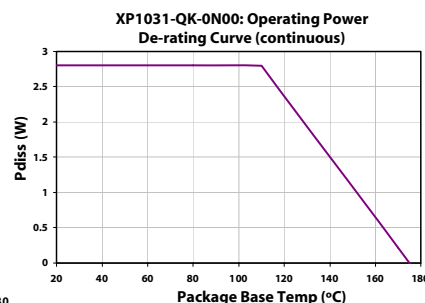
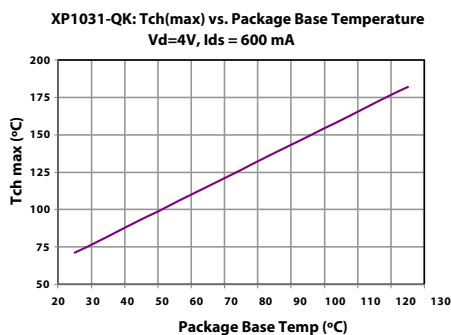
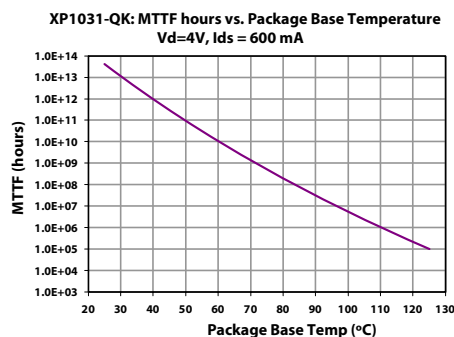
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App Note [1] Biasing - It is recommended to bias the amplifier with $V_d=4.0V$ and $I_d=600mA$. It is also recommended to use active biasing to keep the currents constant as the RF power and temperature vary; this gives the most reproducible results. Depending on the supply voltage available and the power dissipation constraints, the bias circuit may be a single transistor or a low power operational amplifier, with a low value resistor in series with the drain supply used to sense the current. The gate of the pHEMT is controlled to maintain correct drain current and thus drain voltage. The typical gate voltage needed to do this is $-0.3V$. Typically the gate is protected with Silicon diodes to limit the applied voltage. Also, make sure to sequence the applied voltage to ensure negative gate bias is available before applying the positive drain supply.

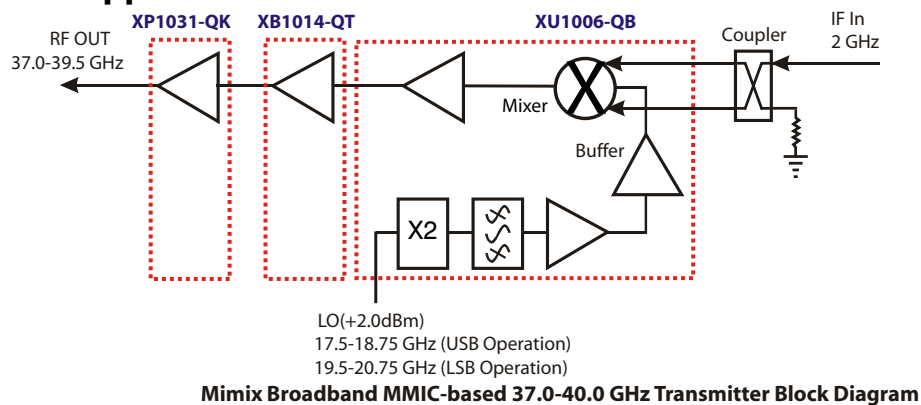
App Note [2] Bias Arrangement -

Each DC pin (V_d and V_g) needs to have DC bypass capacitance (10 nF/1 uF) as close to the package as possible.

MTTF



Typical Application



Factory Automation and Identification

Mimix Designator	Package Type	Number of leads offered	W Tape Width	P ₁ Component Pitch	P ₀ Hole Pitch	Reel Diameter	Units per Reel
-QK	QFN (7x7mm)	28	16mm	12mm	4mm	329mm (13in)	1000

Tape and Reel Packaging per the following conditions:

Tape Width:	16 mm
Tape Pitch (part to part):	12 mm
Component Orientation:	Parts are to be oriented with the PIN 1 closest to the tape's round sprocket holes on the tape's trailing edge.
Reel Diameter:	329 mm (13 inch)

Note: Tape and Reel packaging is ordered with a -0N0T suffix. Package is available in 500 unit reels through designated sales channels. Minimum order quantities should be discussed with your local sales representative.

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Handling and Assembly Information

CAUTION! - Mimix Broadband MMIC Products contain gallium arsenide (GaAs) which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not ingest.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

Life Support Policy - Mimix Broadband's products are not authorized for use as critical components in life support devices or systems without the express written approval of the President and General Counsel of Mimix Broadband. As used herein: (1) Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user. (2) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Package Attachment - This packaged product from Mimix Broadband is provided as a rugged surface mount package compatible with high volume solder installation. Vacuum tools or other suitable pick and place equipment may be used to pick and place this part. Care should be taken to ensure that there are no voids or gaps in the solder connection so that good RF, DC and ground connections are maintained. Voids or gaps can eventually lead not only to RF performance degradation, but reduced reliability and life of the product due to thermal stress.

Typical Reflow Profiles

Reflow Profile	SnPb	Pb Free
Ramp Up Rate	3-4 °C/sec	3-4 °C/sec
Activation Time and Temperature	60-120 sec @ 140-160 °C	60-180 sec @ 170-200 °C
Time Above Melting Point	60-150 sec	60-150 sec
Max Peak Temperature	240 °C	265 °C
Time Within 5 °C of Peak	10-20 sec	10-20 sec
Ramp Down Rate	4-6 °C/sec	4-6 °C/sec

Mimix Lead-Free RoHS Compliant Program - Mimix has an active program in place to meet customer and governmental requirements for eliminating lead (Pb) and other environmentally hazardous materials from our products. All Mimix RoHS compliant components are form, fit and functional replacements for their non-RoHS equivalents. Lead plating of our RoHS compliant parts is 100% matte tin (Sn) over copper alloy and is backwards compatible with current standard SnPb low-temperature reflow processes as well as higher temperature (260°C reflow) "Pb Free" processes.

Ordering Information

Part Number for Ordering

XP1031-QK-0N00
XP1031-QK-0N0T
XP1031-QK-EV1

Description

Ni/Au plated RoHS compliant 7x7 28L surface mount package in bulk quantity
Ni/Au plated RoHS compliant 7x7 28L surface mount package in tape and reel
XP1031-QK evaluation board



Caution: ESD Sensitive
Appropriate precautions in handling, packaging
and testing devices must be observed.

Proper ESD procedures should be followed when handling this device.

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