

# 18.0-21.0/36.0-42.0 GHz Doubler and Power Amplifier, QFN, 7x7mm



October 2006 - Rev 04-Oct-06

**X**X1001-QK  
**X**RoHS

## Features

- X** Integrated Doubler and Power Amplifier
- X** Excellent Saturated Output Stage
- X** +25.0 dBm Output Power
- X** 50.0 dBc Fundamental Suppression



## General Description

Mimix Broadband's 18.0-21.0/36.0-42.0 GHz GaAs doubler integrates a doubler, a buffer amplifier and 4-stage power amplifier. The device provides better than +25.0 dBm output power and has excellent fundamental rejection. The device comes in a 7x7mm QFN package that is RoHS compliant. This device is well suited for Millimeter-wave Point-to-Point Radio, LMDS, SATCOM and VSAT applications.

## Absolute Maximum Ratings

Supply Voltage (Vd)	+6.0 VDC
Supply Current (Id)	800 mA
Gate Bias Voltage (Vg)	+0.3 VDC
Input Power (RF Pin)	TBD
Storage Temperature (Tstg)	-65 to +165 °C
Operating Temperature (Ta)	-55 to MTTF Table <sup>1</sup>
Channel Temperature (Tch)	MTTF Table <sup>1</sup>

(1) Channel temperature affects a device's MTTF. It is recommended to keep channel temperature as low as possible for maximum life.

## Electrical Characteristics (Ambient Temperature T = 25 °C)

Parameter	Units	Min.	Typ.	Max.
Input Frequency Range (fin)	GHz	18.0	-	21.0
Output Frequency Range (fout)	GHz	36.0	-	42.0
Input Return Loss (S11)	dB	-	TBD	-
Output Return Loss (S22)	dB	-	12.0	-
Fundamental Rejection	dBc	-	50.0	-
RF Input Power (RF Pin)	dBm	-	0.0	-
Output Power at 0.0 dBm Pin (Pout)	dBm	-	+26.0	-
Drain Supply Voltage (Vd1) Doubler	V	-	2.5	3.0
Drain Supply Voltage (Vd2) Buffer Amp	V	-	3.0	4.0
Drain Supply Voltage (Vd3,4,5,6) PA	V	-	4.5	5.5
Gate Supply Voltage (Vg1) Doubler	V	-	-1.2	-
Drain Supply Current (Id1) Doubler	mA	-	<1.0	-
Drain Supply Current (Id2) Buffer	mA	-	20	25
Drain Supply Current (Id3,4,5,6) (Vg=-0.7V Typical) PA	mA	-	530	600



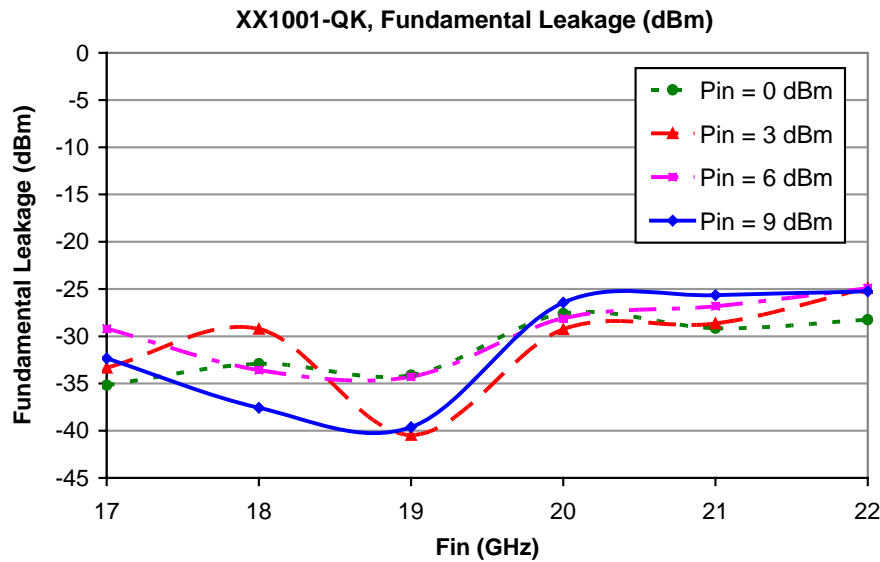
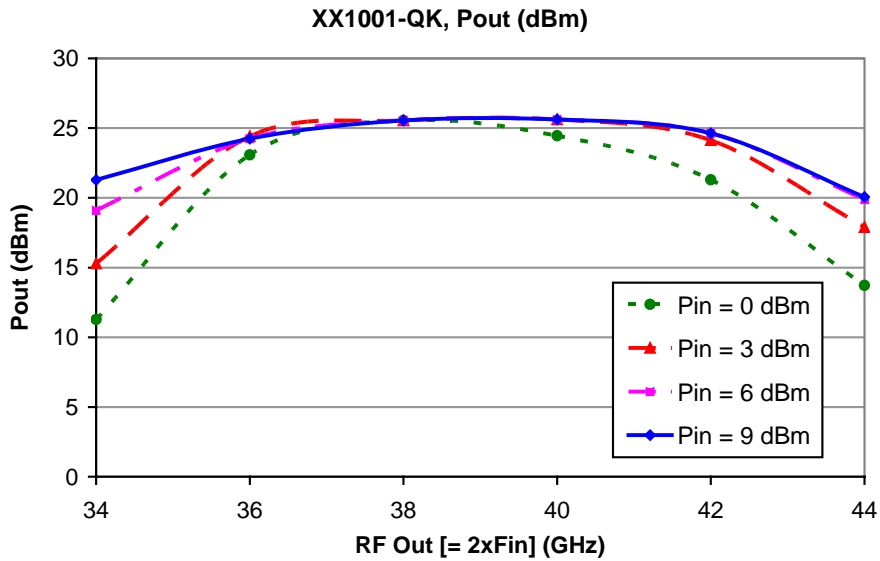
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## Measured Performance at Nominal Conditions



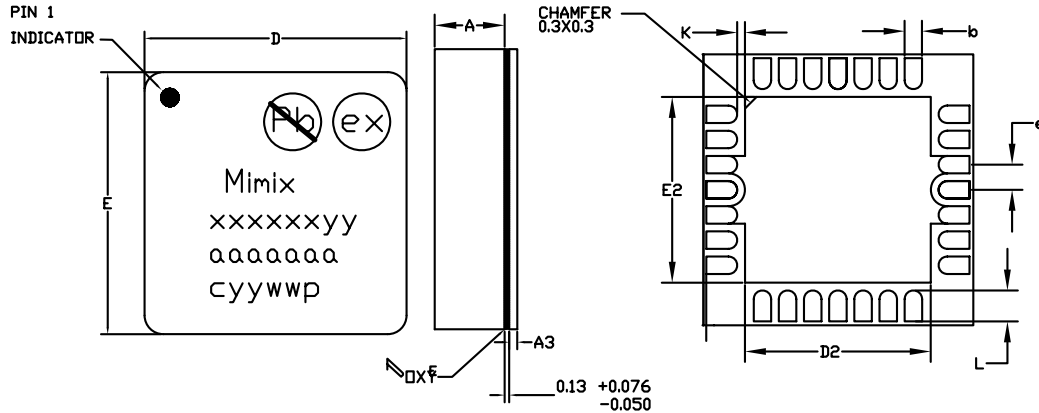
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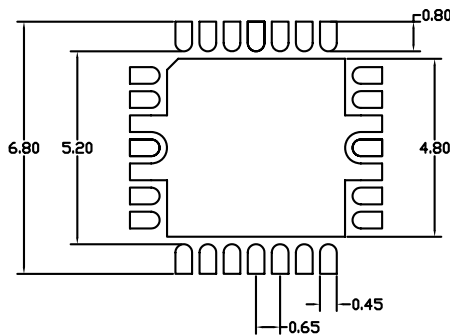
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## Physical Dimensions



RECOMMENDED SOLDER PAD PITCH AND DIMENSIONS



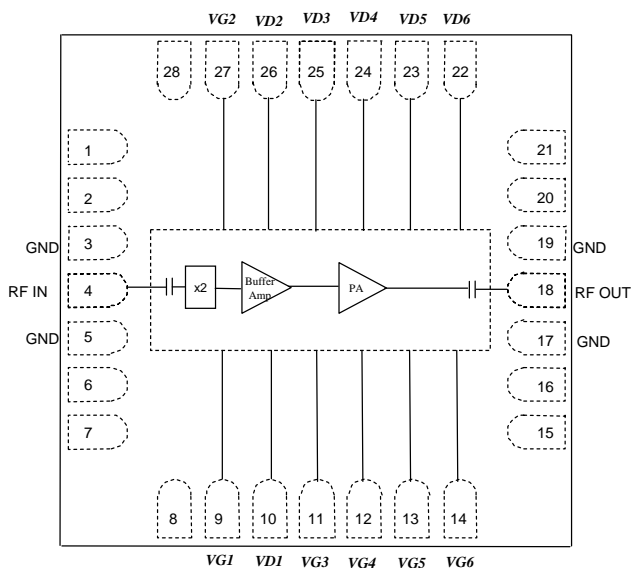
Note:

1. ALL DIMENSIONS ARE IN mm.

	MIN	TYP	MAX
A	1.70	1.75	1.80
A3	0.20 REF		
b	0.40	0.45	0.50
K	0.41	-	-
D	7.00 BSC		
E	7.00 BSC		
e	0.65		
D2	4.75	4.80	4.85
E2	4.35	4.40	4.45
L	0.75	0.80	0.85

(Note: Engineering designator is 20DBL0832)

## Functional Schematic



## Pin Designations

Pin Number	Pin Name	Pin Function	Nominal Value	Units
3	GND	Ground		
4	RF IN	RF Input		
5	GND	Ground		
9	VG1	Gate bias (doubler)	-1.2	Volts
10	VD1	Drain bias (doubler)	2.5	Volts
11	VG2	Gate bias (Buffer Amp)	-1.2	Volts
12	VG3	Gate bias (PA)	-1.2	Volts
13	VG4	Gate bias (PA)	-1.2	Volts
14	VG5	Gate bias (PA)	-1.2	Volts
14	VG6	Gate bias (PA)	-1.2	Volts
17	GND	Ground		
18	RF Out	Output RF		
19	GND	Ground		
22	VD6	Drain bias (PA)	4.5	Volts
23	VD5	Drain bias (PA)	4.5	Volts
24	VD4	Drain bias (PA)	4.5	Volts
25	VD3	Drain bias (PA)	4.5	Volts
26	VD2	Drain bias (Buffer Amp)	3	Volts
27	VG2	Gate bias (PA)	-1.2	Volts

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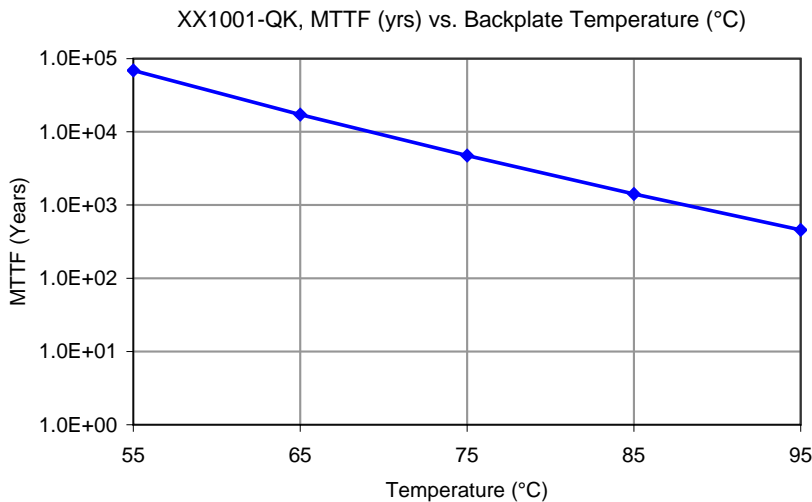
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## Recommended Layout

**App Note [1] Biasing** - It is recommended to separately bias each amplifier stage Vd1 through Vd6 at Vd1=2.5V, Vd2=3.0V, Vd(3,4,5,6)=4.5V with Id1<1mA, Id2=20mA, Id3=40mA, Id4=70mA, Id5=150mA, Id6=270mA. Separate biasing is recommended if the amplifier is to be used at high levels of saturation, where gate rectification will alter the effective gate control voltage. As shown in the bonding diagram, it is possible to parallel stages Vd(3,4,5) with Id(3,4,5)=260mA while maintaining satisfactory performance. For non-critical applications it is possible to parallel stages Vd(3,4,5,6) together and adjust the common gate voltage Vg(3,4,5,6) for total drain current Id(total)=530mA. 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 -0.7V. 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.

## MTTF Tables

MTTF is calculated from accelerated life-time data of single devices and assumes an isothermal back-plate.



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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. The package is a low-cost plastic package. 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% matt 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.

### Part Number for Ordering Description

XX1001-QK-0L00      Ni/Pd/Au plated RoHS compliant QFN 7x7 28L surface mount package in bulk quantity  
XX1001-QK-0L0T      Ni/Pd/Au plated RoHS compliant QFN 7x7 28L surface mount package in tape and reel  
XX1001-QK-EV1      XX1001-QK Evaluation Module

We also offer this part with alternative plating options. Please contact your regional sales manager for more information regarding different plating types.