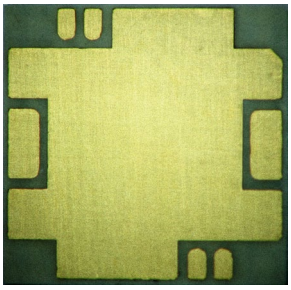
3.5-6.0 GHz
3W Power Amplifier Module

March 2010 - Rev 30-Mar-10

XP1044-QL
XRoHS

Features

- 34 dBm P1dB
- Pout 26 dBm @ EVM = 2.5% (PAR=9.17 dB)
- 46 dBm OIP3
- 18.5 dB Gain
- 8V Voltage Supply
- Input Internally Matched
- 7x7mm Surface Mount Package
- Ideal for WiMAX Applications @ 5.8 GHz and Applications between 4 GHz and 5 GHz



General Description

The XP1044 is a highly linear 2-stage power amplifier capable of 18.5 dB of gain, 34 dBm of power at 1 dB compression and is housed in an RoHS compliant 7x7mm package. The XP1044 provides less than 2.5% EVM at 26 dBm output power with 802.16 OFDM signal and peak to average ratio 9.17 dB. The input and output of the device are internally pre-matched facilitating a simplified input and output match. This product operates off an 8V voltage supply and requires negative voltage which is used for current control. The XP1044-QL is specifically designed for WiMAX applications between 4.9 GHz and 5.9 GHz, and the performance can be shifted by adding external matching components to cover applications between 3.5 GHz and 5.0 GHz.

Absolute Maximum Ratings

Drain Supply Voltage (Vd)	+9.0V
Gate Supply Voltage (Vg)	0V ~ -5V
RF Input Power (RFin)	+23 dBm
Stage 1 Current (Idd1)	375 mA
Stage 2 Current (Idd2)	750 mA
Power Dissipation (PDC)	9.0W
Storage Temperature	-55 to +150 °C
Junctions Temperature	175 °C
Operating Temperature	-40 °C to See Note 1
ESD (HBM)	Class 1A
Moisture Sensitivity Level	MSL3
Thermal Resistance (Rth)*	15.6 °C

*Thermal resistance of stage 2 only

(1) Calculate maximum operating backside temperature using: Tmax = 167 °C – [Vd*Idd2*Rth]. Thermal resistance of the 1st stage is 2x Rth of the output stage, and therefore Idd1 must not exceed ½ Idd2 for a specific maximum temperature

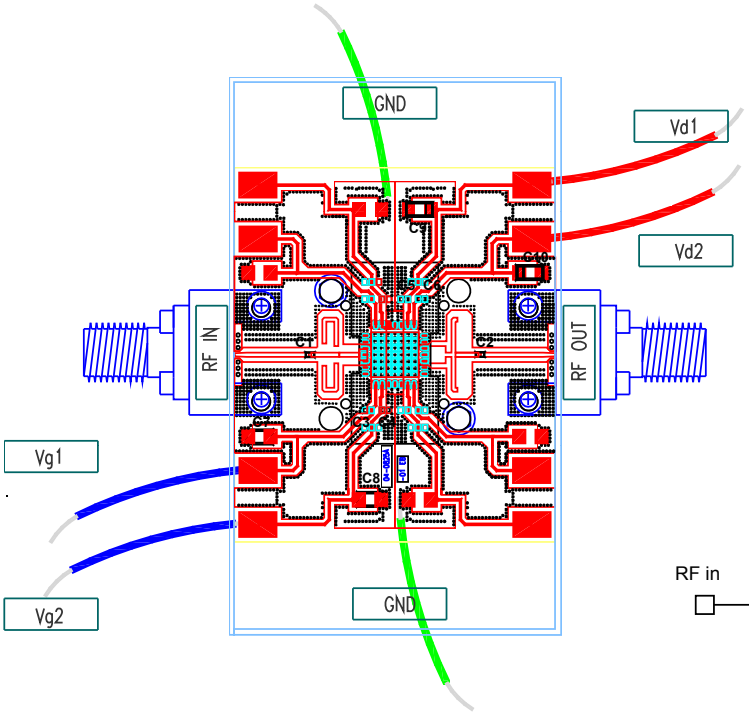
Electrical Characteristics (T=25 °C)

Unless otherwise specified, the following specifications are guaranteed at room temperature in a Mimix test fixture.

Parameter	Units	Min.	Typ.	Max.
Frequency Range (f)	GHz	4.9	5.8	5.9
Power Gain	dB	16.5	18.5	
Linear Power (@ EVM=2.5%, OFDM, 802.16 PAR=9.17 dB)	dBm		26.0	
Input Return Loss (S11)	dB		-10.0	
Output IP3 @ 22 dBm/Tone	dBm	44	46.0	
Noise Figure	dB		5	
Output P1dB	dBm	32.5	34.0	
Stage 1 Supply Current (Idd1)	mA		300	
State 2 Supply Current (Idd2)	mA		600	
Stage 1 Gate Voltage (Vg1)	V	-1.2	-0.85	-0.5
Stage 2 Gate Voltage (Vg2)	V	-1.2	-0.85	-0.5
Supply Voltage (Vd1 & Vd2)	V		8.0	

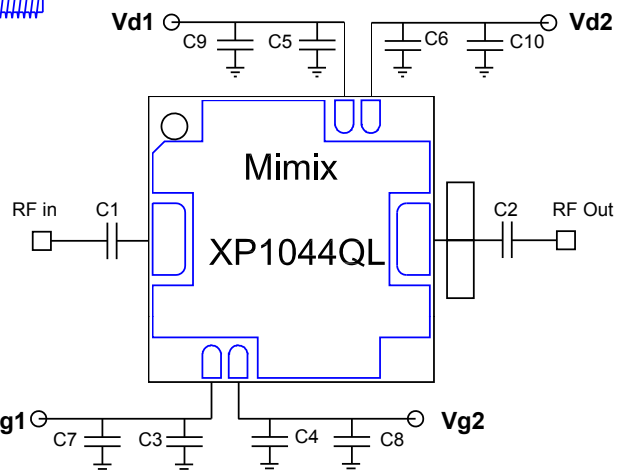
In production test Idd1 is set to 300mA and Idd2 is set to 600 mA by varying Vg1 and Vg2.

Evaluation Board Layout: EV1 (4.9 GHz ~ 5.9 GHz)

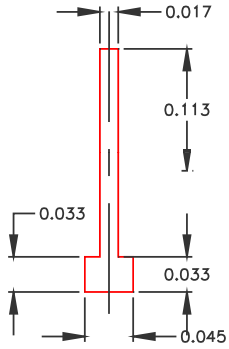


Ref Designator	Description	QTY
C1 , C2	10.0 pF 0402 Capacitor	1
C3, C4, C5, C6	1000 pF 0402 Capacitor	4
C7, C8, C9, C10	1 uF A-Case Capacitor	4

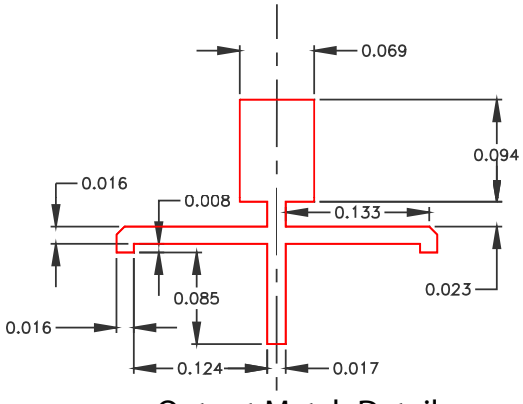
Material: Rogers 4003
Thickness: 8mil



Dimensions are in inches.



Input Match Details

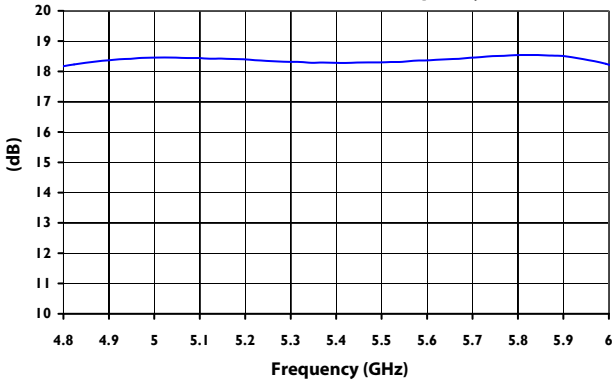


Output Match Details

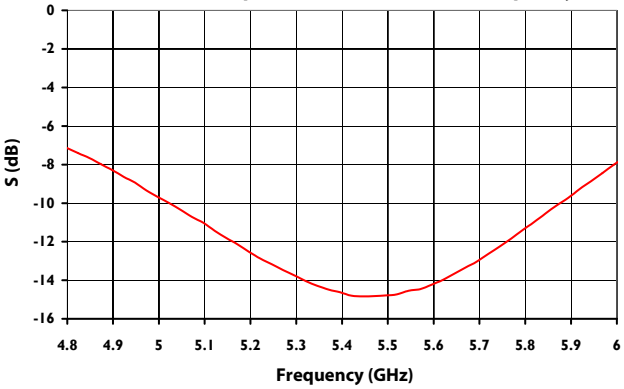
For improved performance at 6 GHz the thick transmission line (W=0.069") on the output can be extended to touch the two open stubs.

Typical Performance: (EV1, Idq1 = 300 mA, Idq2 = 600 mA)

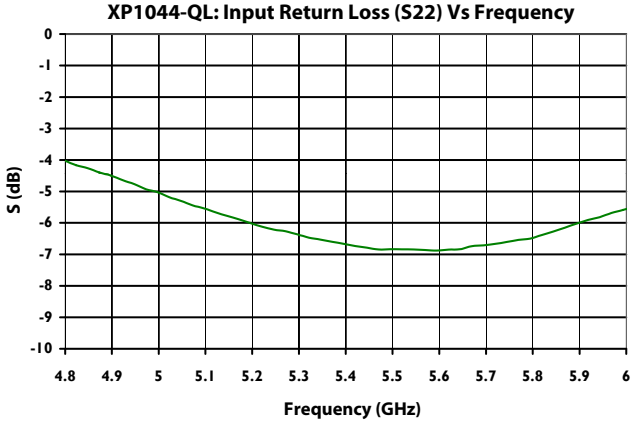
XP1044-QL: Gain Vs Frequency



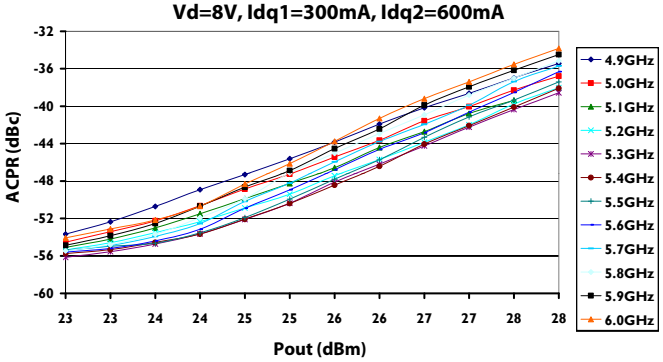
XP1044-QL: Input Return Loss (S11) Vs Frequency



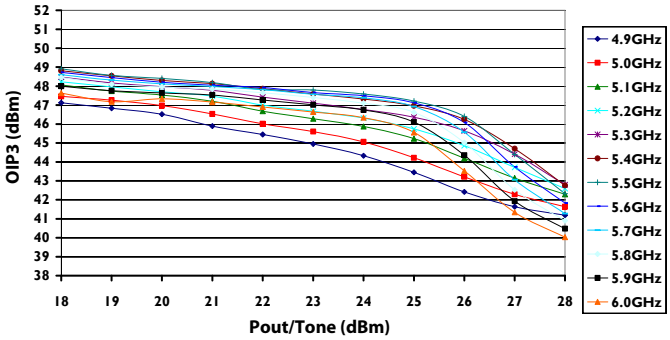
XP1044-QL: Input Return Loss (S22) Vs Frequency



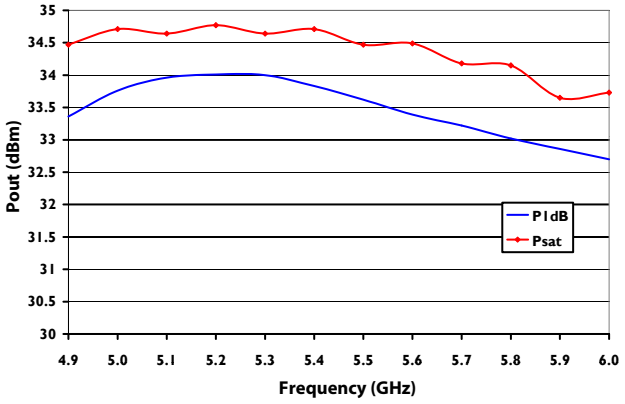
XP1044-QL: WCDMA 3GPP Downlink ACPR vs. Pout
Vd=8V, Idq1=300mA, Idq2=600mA



XP1044-QL: OIP3 vs. Pout
Vd=8V, Idq1=300mA, Idq2=600mA

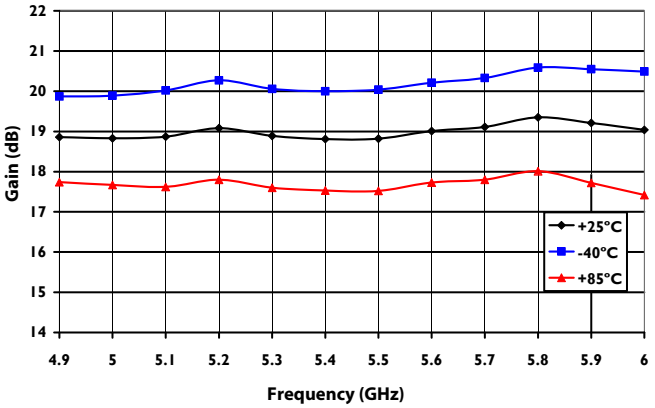


XP1044-QL: Power vs. Frequency
Vd=8V, Idq1 = 300mA, Idq2 = 600mA

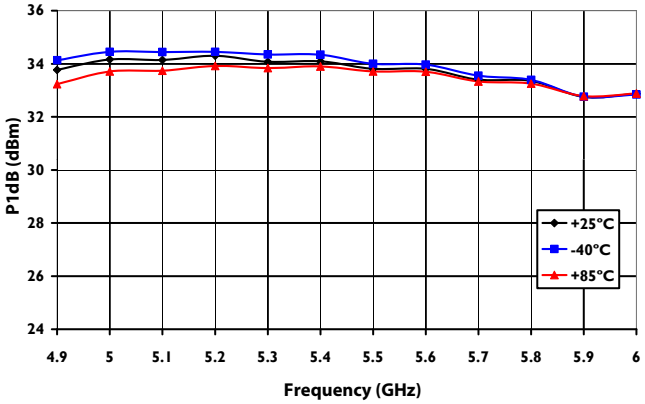


Typical Performance: (EV1, Idq1 = 300 mA, Idq2 = 600 mA, Over Temp)

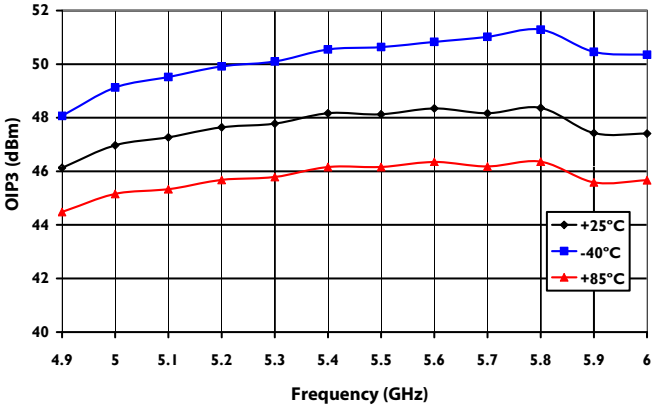
XP1044-QL: Gain vs. Frequency vs. Temp



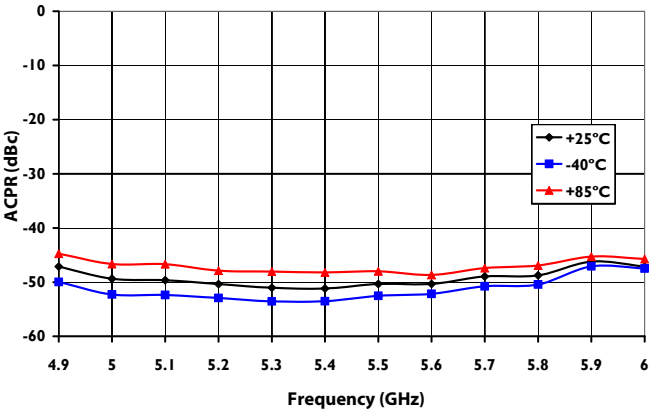
XP1044-QL: P1dB vs. Frequency vs. Temp



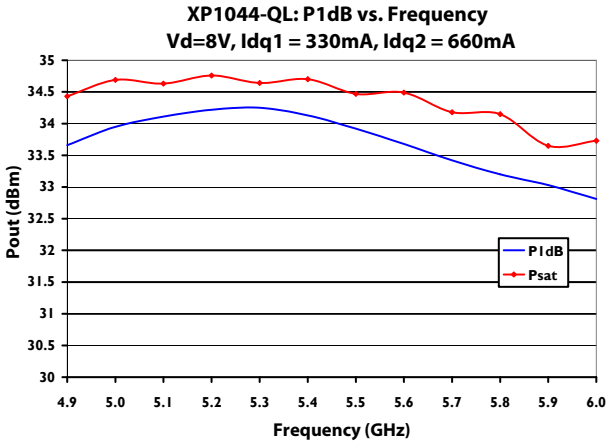
XP1044-QL: OIP3 vs. Frequency vs. Temp

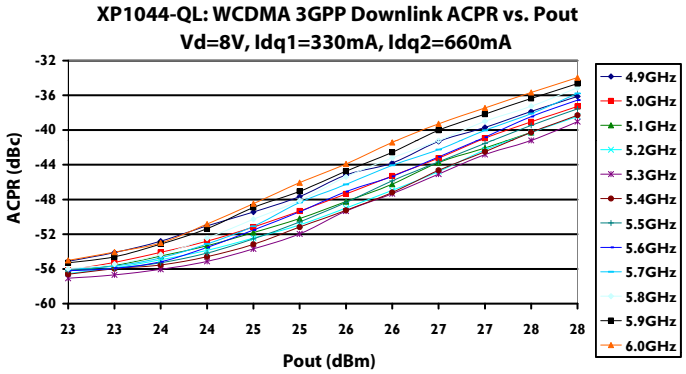


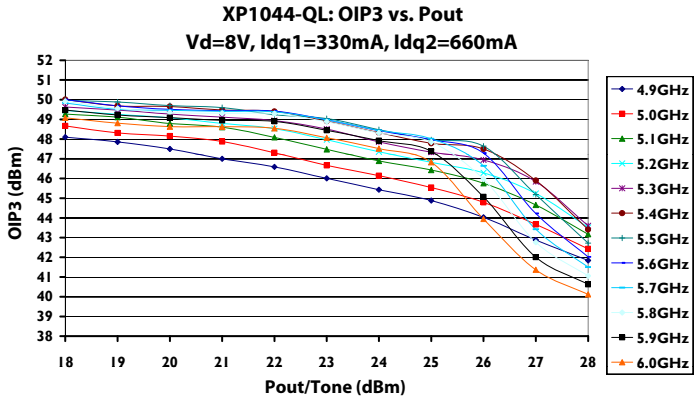
XP1044-QL: WCDMA ACPR vs. Frequency vs. Temp



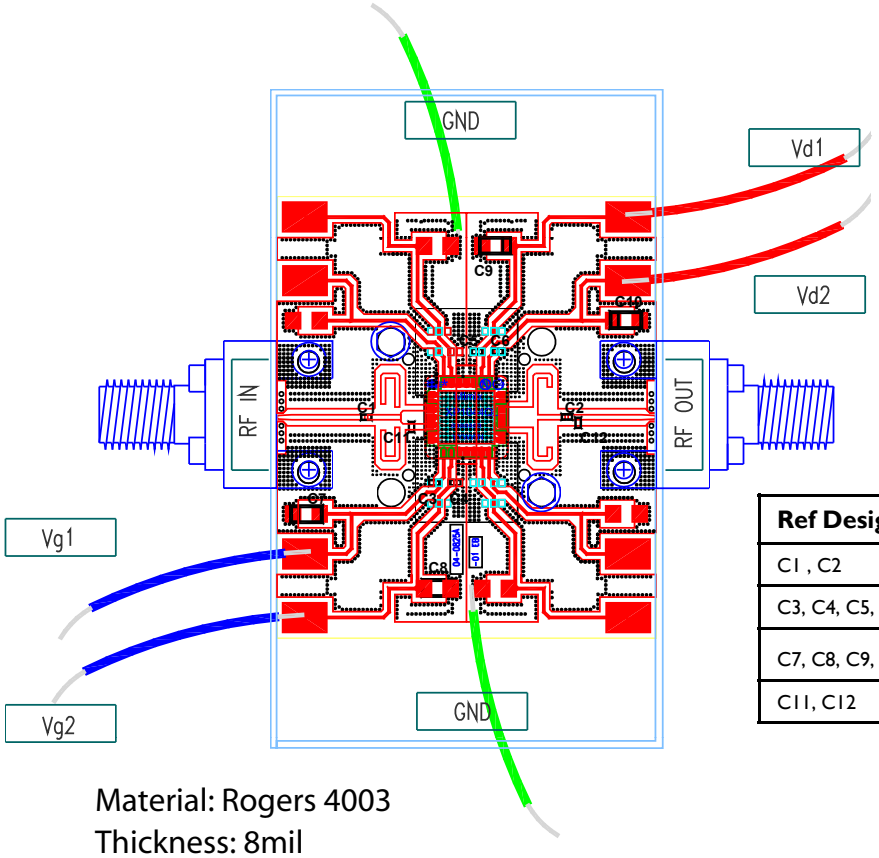
Typical Performance: (EV1, Idq1 = 330 mA, Idq2 = 660 mA)





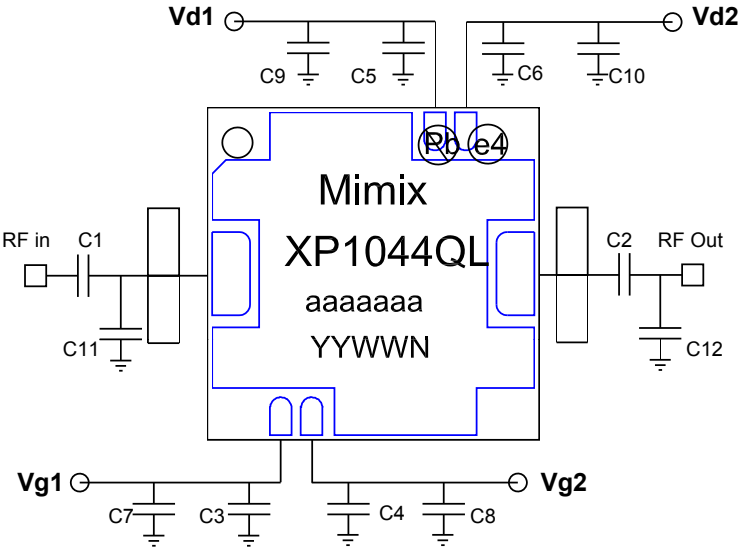


Evaluation Board Layout: EV2 (4.0 GHz ~ 5.0 GHz)



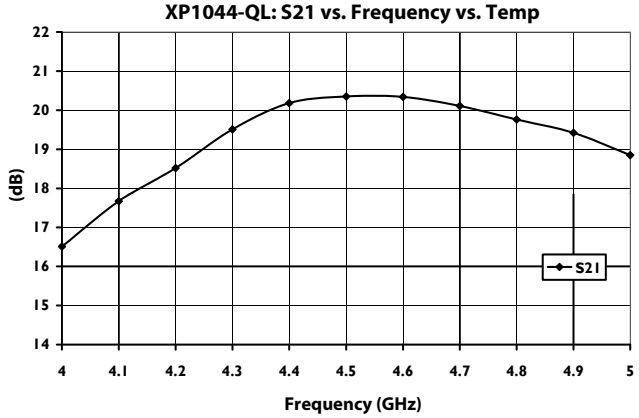
Ref Designator	Description	QTY
C1 , C2	10.0 pF 0402 Capacitor	1
C3, C4, C5, C6	1000 pF 0402 Capacitor	4
C7, C8, C9, C10	1 uF A-Case Capacitor	4
C11, C12	0.5 pF 0402 Capacitor	2

Material: Rogers 4003
Thickness: 8mil

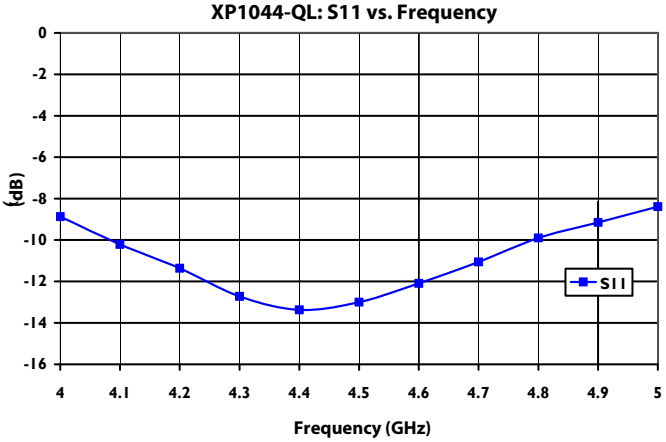


Typical Performance: (EV2, Idq1 = 300 mA, Idq2 = 600 mA)

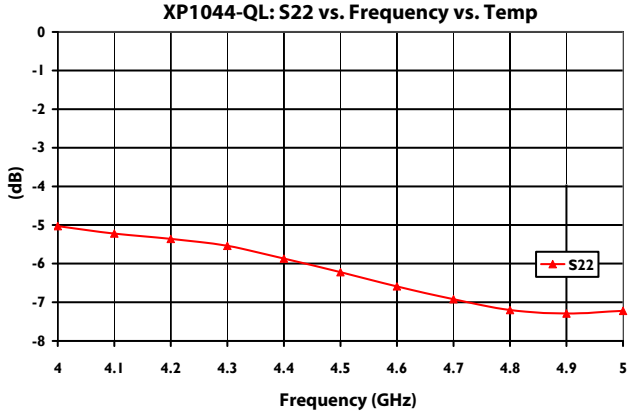
XP1044-QL: S21 vs. Frequency vs. Temp



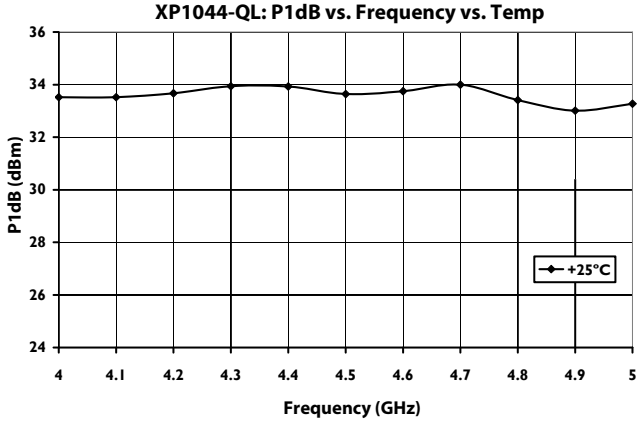
XP1044-QL: S11 vs. Frequency



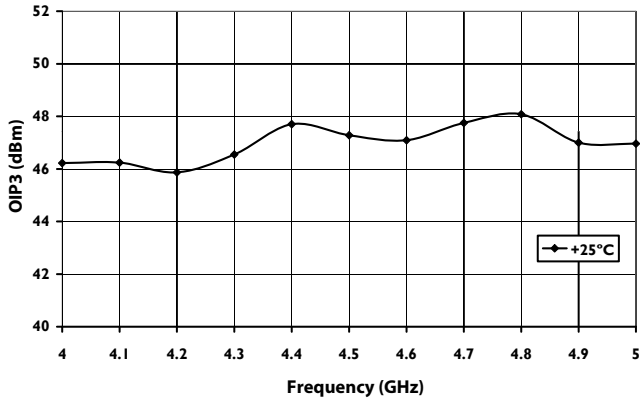
XP1044-QL: S22 vs. Frequency vs. Temp



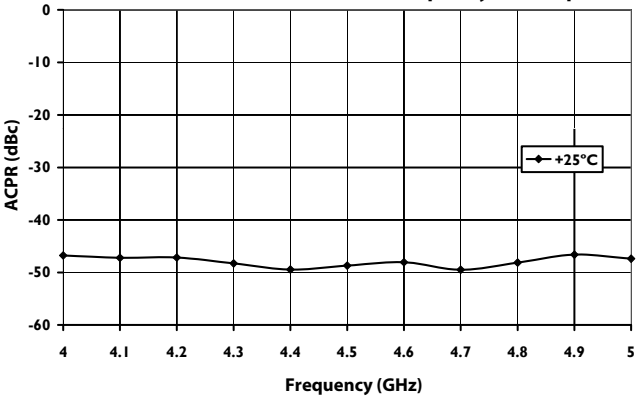
XP1044-QL: P1dB vs. Frequency vs. Temp



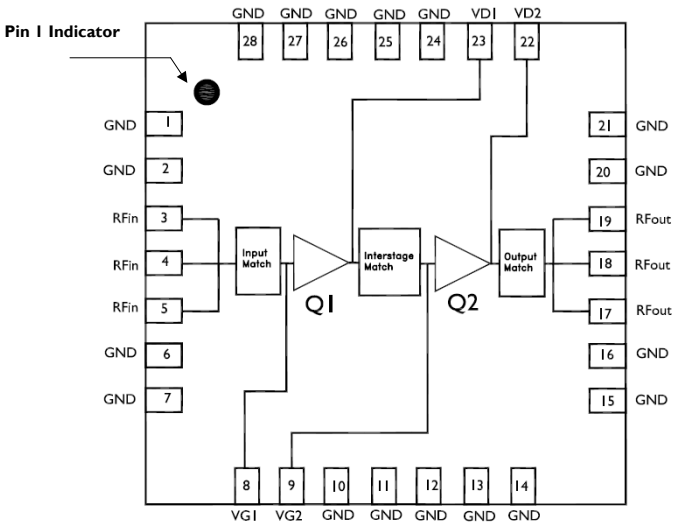
XP1044-QL: OIP3 vs. Frequency vs. Temp



XP1044-QL: WCDMA ACPR vs. Frequency vs. Temp



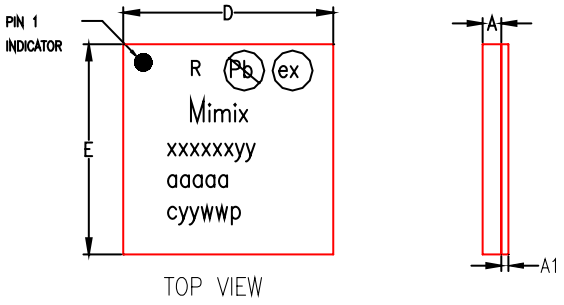
Pin Assignment

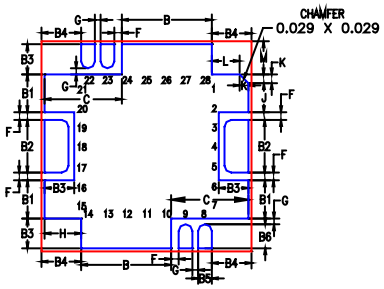


Pin-out Details

Pin #	Function	Description
3, 4, 5	RF IN	RF Input
8	VG1	Gate Voltage 1st Stage (Negative)
9	VG2	Gate Voltage 2nd Stage (Negative)
17, 18, 19	RF OUT	RF Output
23	VD1	Drain Voltage 1st Stage (Positive)
22	VD2	Drain Voltage 2nd Stage (Positive)
1, 2, 6, 7, 10, 11, 12, 13, 14, 15 16, 20, 21, 24, 25, 26, 27, 28	GND	

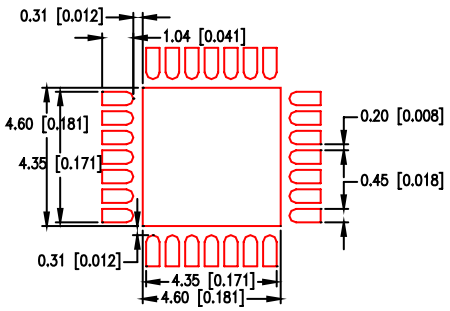
Physical Dimensions





MARKINGS:
PIN 1/BOM REV/Pb FREE SYM
MIMIX CO. NAME
MIMIX PART/MODEL NO.
WAFER LOT NUMBER
DATE CODE/PLATING

RECOMMENDED SOLDER PAD PITCH AND DIMENSIONS
DIMENSIONS ARE IN MM [INCHES]



NOTE:
1. ALL DIMENSIONS ARE IN MM AND INCHES.

	MIN	TYP	MAX	MIN	TYP	MAX
A	0.61	0.66	0.71	0.021	0.026	0.031
A1	–	0.20	–	–	0.008	–
B	0.40	3.00	0.50	0.113	0.118	0.023
B1	1.21	1.26	1.31	0.045	0.050	0.055
B2	1.70	1.75	1.80	0.064	0.069	0.074
B3	0.94	0.99	1.04	0.034	0.039	0.044
B4	1.27	1.32	1.37	0.047	0.052	0.057
B5	0.41	0.46	0.51	0.013	0.018	0.023
B6	0.75	0.80	0.85	0.026	0.031	0.036
C	2.47	2.52	2.57	0.094	0.099	0.104
D		7.00 BSC			0.276	
E		7.00 BSC			0.276	
F	0.20	0.25	0.30	0.005	0.010	0.015
G	0.14	0.19	0.24	0.002	0.007	0.012
H	1.17	1.22	1.27	0.043	0.048	0.053
J	0.92	0.97	1.02	0.033	0.038	0.043
K	0.24	0.29	0.34	0.006	0.011	0.016
L	0.88	0.93	0.97	0.031	0.036	0.041
M	1.05	1.10	1.15	0.038	0.043	0.048

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

App Note [1] Biasing - The XP1044-QL requires power supply sequencing. Negative voltage supply (VG) needs to be turned on first and then positive voltage can be applied to the drain (VD). When turning off the device, the positive supply (VD) should be turned off first and then negative voltage (VG) can be removed.

The gate voltage is adjusted in order to set the drain current to the desired level. The gate voltage required to achieve a certain current can vary over temperature and from one device to another due to pinch-off voltage variation. Constant drain current can be achieved by implementing an active bias circuit which allows for temperature compensation and eliminates the effect of pinch off voltage variation.

The input stage transistor periphery is half of the output stage transistor periphery and therefore the gate voltages needed to set the first stage current to 300mA and the second stage current to 600mA are the same. The gate voltages can be connected together and a single active bias circuit can be implemented adding a total of 6 components at a cost of approximately $0.15.

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. Care should be taken not to apply heavy pressure to the top or base material to avoid package damage. 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.

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	Description
XP1044-QL-0N00	Ni/Au plated RoHS compliant 7x7mm surface mount package in bulk quantity
XP1044-QL-EV1	Evaluation Board with SMA connectors for 4.9 GHz ~ 5.9 GHz
XP1044-QL-EV2	Evaluation Board with SMA connectors for 4.0 GHz ~ 5.0 GHz