

# 37.0-42.0 GHz GaAs Power Amplifier QFN, 7x7mm



September 2007 - Rev 25-Sep-07

XP1031-QK  
RoHS

## Features

- ✕ Linear Power Amplifier
- ✕ Output Power Adjust
- ✕ 23.0 dB Small Signal Gain
- ✕ +25.0 dBm P1dB Compression Point
- ✕ +35.0 dBm OIP3



## General Description

Mimix Broadband's four stage 37.0-42.0 GHz SMD GaAs MMIC power amplifier has a small signal gain of 23.0 dB with a +35.0 dBm Output Third Order Intercept. This MMIC uses Mimix Broadband's 0.15  $\mu\text{m}$  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

Supply Voltage (Vd)	+6.0 VDC
Supply Current (Id)	800 mA
Gate Bias Voltage (Vg)	+0.3 VDC
Input Power (Pin)	+5.0 dBm
Storage Temperature (Tstg)	-65 to +165 deg C
Operating Temperature (Ta)	-55 to MTTF Table <sup>1</sup>
Channel Temperature (Tch)	MTTF Table <sup>1</sup>
ESD - Human Body Model	Class 1A
ESD - Machine Body Model	Class M1

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

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

Parameter	Units	Min.	Typ.	Max.
Frequency Range (f)	GHz	37.0	-	42.0
Input Return Loss (S11)	dB	4.0	5.0	-
Input Return Loss (S11) with External Match	dB	8.0	10.0	-
Output Return Loss (S22)	dB	8.0	12.0	-
Small Signal Gain (S21)	dB	21.0	23.0	-
Gain Flatness ( $\Delta S21$ )	dB	-	+/-1.0	-
Reverse Isolation (S12)	dB	-	45.0	-
Output Power for 1dB Compression (P1dB)	dBm	-	+25.0	-
Output IM3 with Pout (scl) = 18 dBm	dBc	28.0	+35.0	-
Output IM3 with Pout (scl) = 15 dBm	dBc	38.0	40.0	-
Drain Bias Voltage (Vd)	VDC	-	+5.0	+5.5
Gate Bias Voltage (Vg)	VDC	-1.0	-0.3	0.0
Supply Current (Id1) (Vd=5.0V, Vg=-0.7V Typical)	mA	-	600	675

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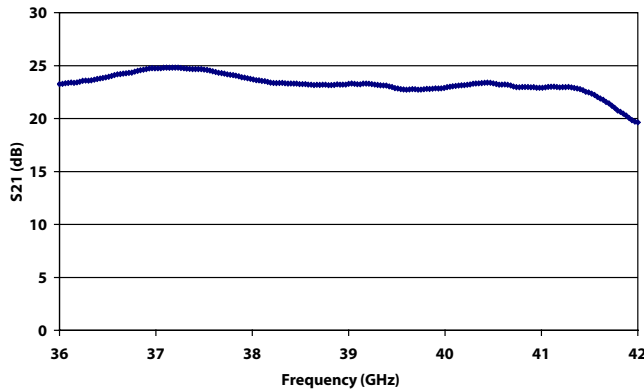


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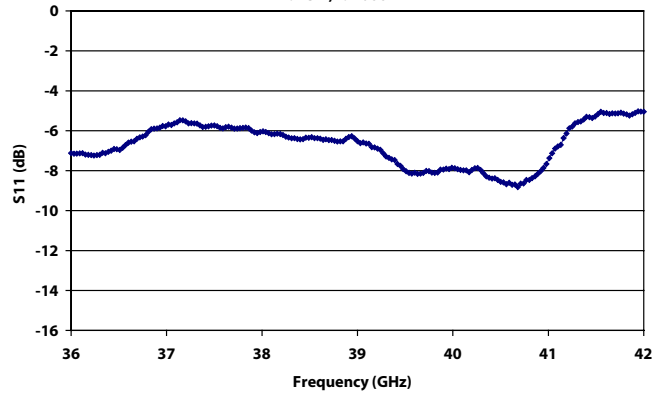
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## Power Amplifier Measurements

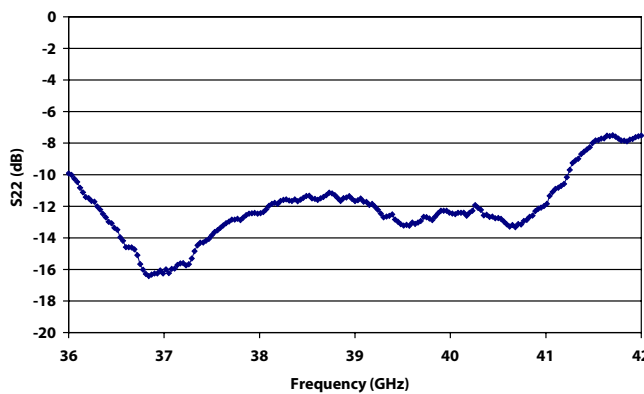
XP1031-QK: Small Signal Gain (S21)  
Vd=5 V, Id=600mA



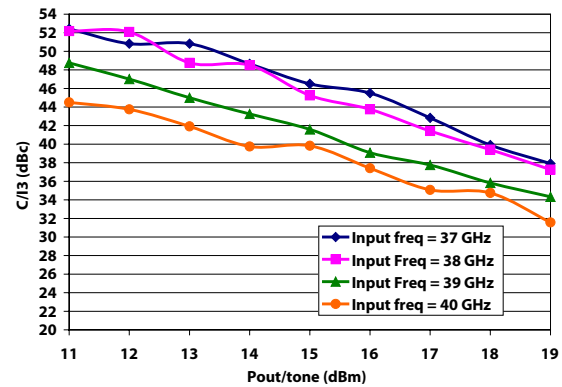
XP1031-QK: Input Return Loss (S11)  
Vd=5 V, Id=600mA



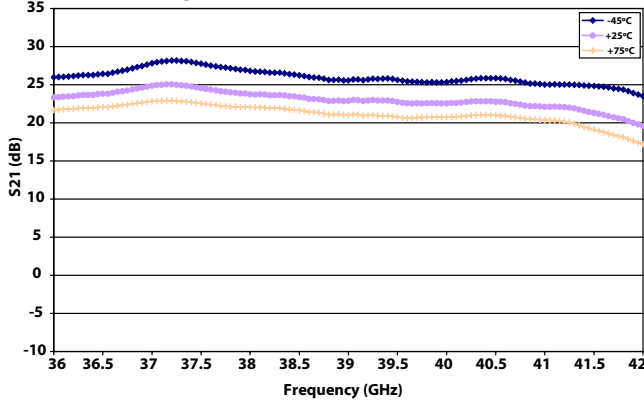
XP1031-QK: Output Return Loss (S22)  
Vd=5 V, Id=600mA



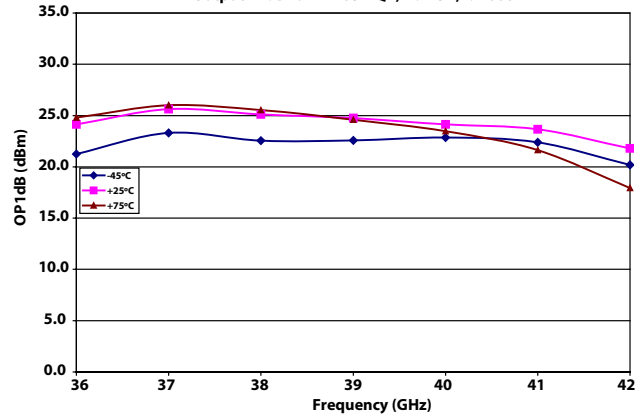
XP1031-QK: Intermodulation Performance  
(Vd=5V, Vg=-0.32V, Id=600 mA, Δf = 10 MHz)



Small Signal Gain S21 (dB) for XP1031-QK (Vd=5V, Id=600 mA)



Output P1dB for XP1031-QK, Vd= 5V, Id=600 mA



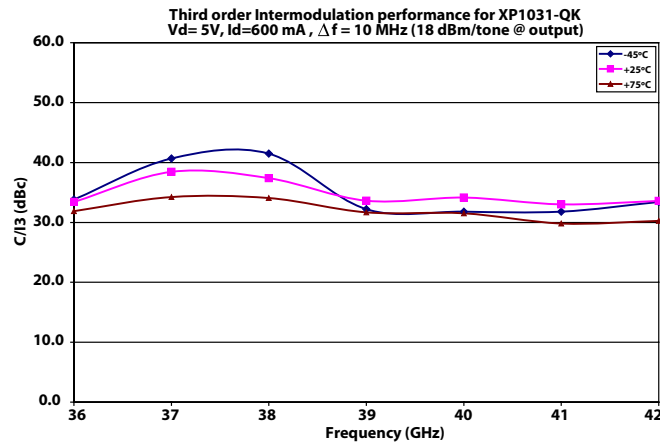
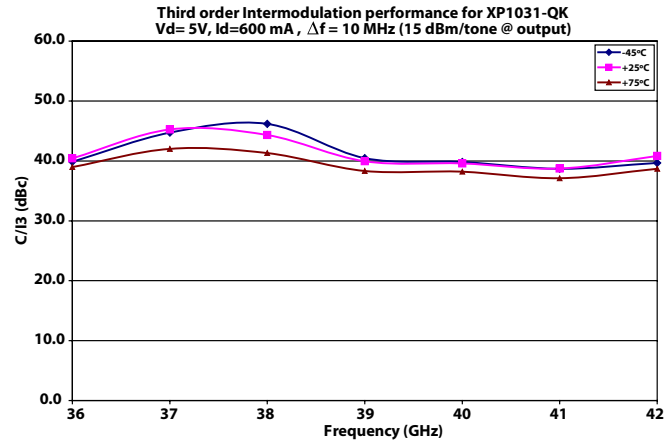
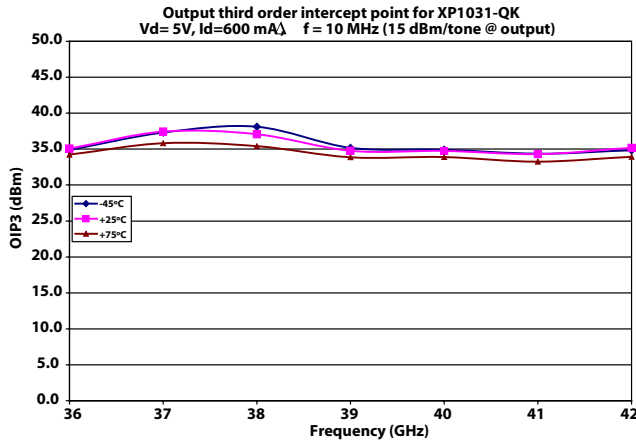
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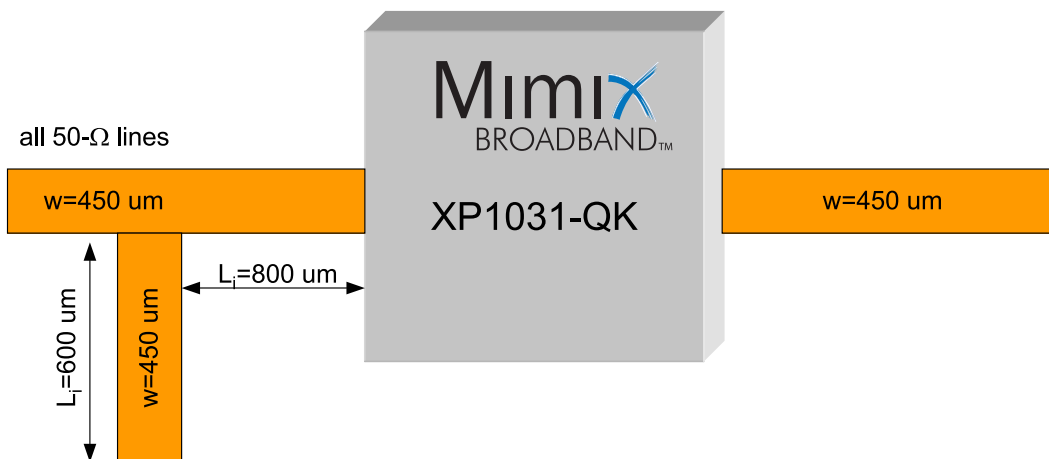
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## Power Amplifier Measurements (cont.)



## Application Information - Test Assembly



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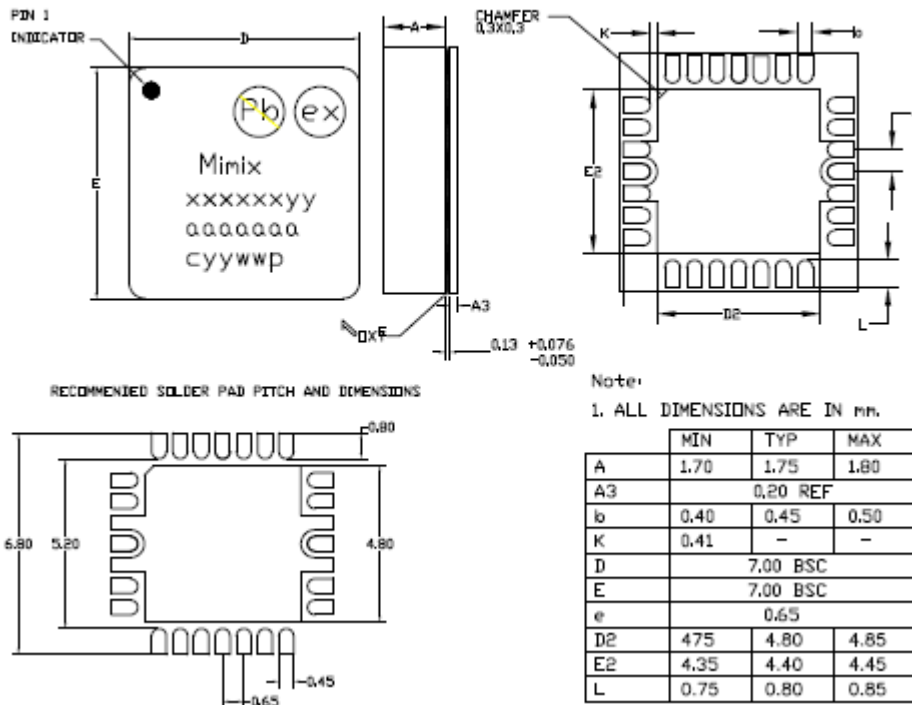
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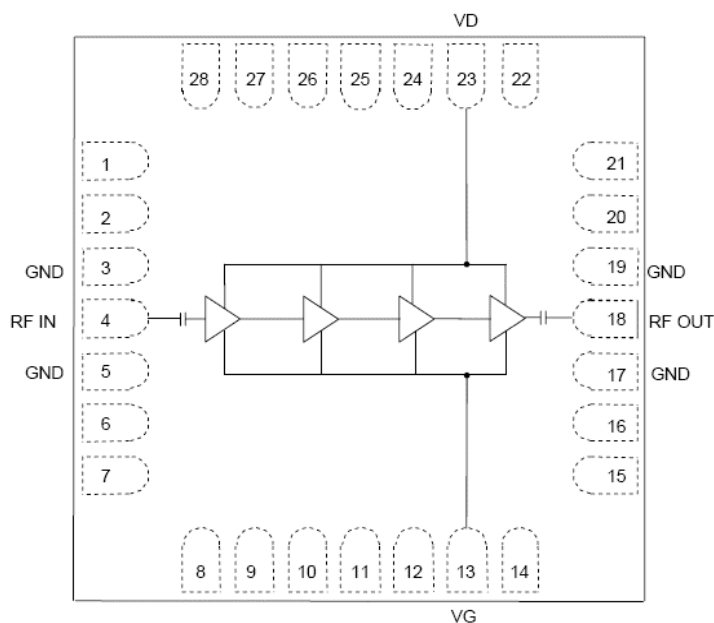
## Physical Dimensions/Layout

QK - MSL, Gross Leak Test Compliant

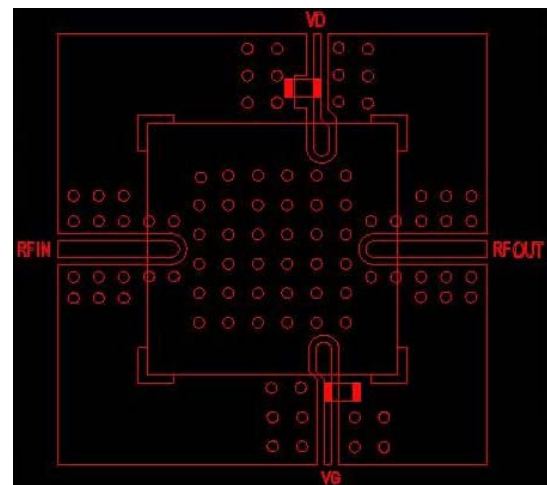


Pin	Description
3	Ground
4	RF Input
5	Ground
13	Vg
17	Ground
18	RF Out
19	Ground
23	Vd

## Functional Block Diagram/Board Layout



Bypass Capacitors - See App Note [2]



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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 ( $\sim 0.01 \mu F$ ) as close to the package as possible.

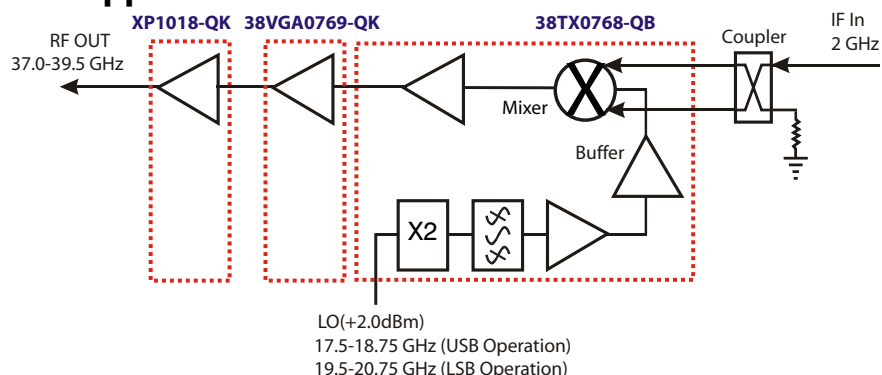
## MTTF Tables (TBD)

These numbers were calculated based on accelerated life test information and thermal model analysis received from the fabricating foundry.

Backplate Temperature	Channel Temperature	Rth	MTTF Hours	FITs
55 deg Celsius	deg Celsius	C/W	E+	E+
75 deg Celsius	deg Celsius	C/W	E+	E+
95 deg Celsius	deg Celsius	C/W	E+	E+

Bias Conditions:  $V_d=4.0V, I_d=400 \text{ mA}$

## Typical Application



Mimix Broadband MMIC-based 37.0-40.0 GHz Transmitter Block Diagram

(Changing LO and IF frequencies as required allows design to operate as high as 40.0 GHz)

Mimix Broadband's 37.0-40.0 GHz 38TX0768 GaAs MMIC Transmitter can be used in saturated radio applications and linear modulation schemes up to 128 QAM. The transmitter can be used in upper and lower sideband applications from 37.0-40.0 GHz.

## Factory Automation and Identification

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

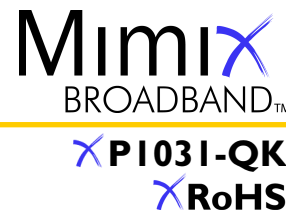
**Tape and Reel Packaging per the following conditions:**

- 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 -000T 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.

### Part Number for Ordering

XP1031-QK-0L00  
XP1031-QK-EV1

### Description

Gold plated RoHS compliant 7x7 28L QFN surface mount package in bulk quantity  
XP1018-QK evaluation board