

## Product Description:

The TQ5638 is a CDMA Rx Receiver designed for KPCS-Band, Dual-Mode operation. The device supports KPCS CDMA and GPS. The IF range is from 80 MHz to 230MHz with external tuning. The Low Noise Amplifiers have an adjustable third order intercept (IP3) to minimize inter-modulation and cross-modulation effects. The mixers are designed for differential IF outputs (single-ended or differential IF for GPS modes), and they feature excellent linearity and low noise figure.

This device is available in a 4X4 mm MLF package with 24 pins. The TQ5638 front-end receiver is capable of meeting all electrical requirements in accordance with the TIA/EIA 98-C Wireless Communication standard.

## Selected Cascade Electrical Specifications:

Operating Mode (Cascade)	Cascade Gain (dB)	Cascade NF (dB)	Cascade IP3 (dBm)	Current (mA)
PCS-Band, High-Gain, High Linearity	26	2.2	-2.0	28
A-GPS	37	1.7	-17.5	19

Note 1: Test Conditions CDMA Mode:  $V_{CC}=2.75VDC$ ,  $T_c=25^{\circ}C$ , IS-95/98 Modulation, Data includes the following image reject filters (PCS – SAWTEK P/N 856080, GPS – SAWTEK P/N 856135)

## TQ5638

### PRELIMINARY DATA SHEET

## 2.8V SiGe Dual-Mode CDMA Rx Receiver

### Features

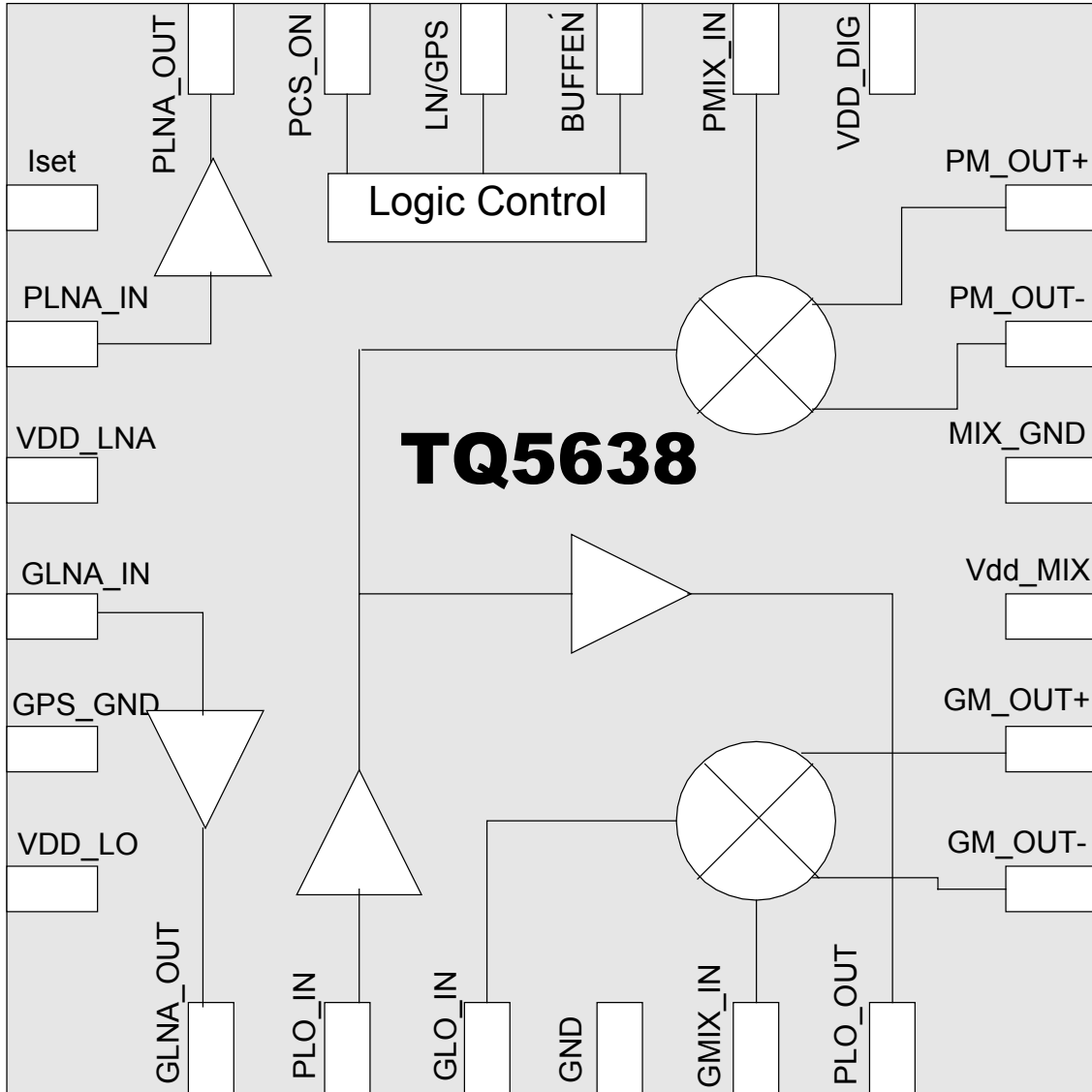
- KPCS-CDMA and GPS operation
- Excellent Cross Modulation Performance
- Low current consumption
- 9.0 dBm PCS LNA IIP3
- 11.0 dBm PCS Mixer IIP3
- Excellent Noise and Gain performance
- Adjustable third order intercept on LNA stage
- Flexible IF frequency range from 80 – 230 MHz
- TX LO Buffer included
- Small 4x4 Package
- Full ESD Protection
- Few external components

### System Advantage

- Most compact integrated receiver for KPCS CDMA and A-GPS applications
- IS-98 IMD requirements met with 2 gain states simplifying calibration procedures
- High mixer linearity eliminates potential call drop issues associated with gain switching
- Enhanced PCS linearity enables use of FBAR or SAW PCS duplexers
- Best I in class A-GPS cascade gain for maximum takeover

### Applications

- KPCS band/A-GPS CDMA (IS-95/98) based mobile phones



**Pin Descriptions:**

<b>Pin Name</b>	<b>Pin #</b>	<b>Description and Usage</b>
Iset_PCS	1	Bias resistor for PCS LNA.
PLNA_IN	2	PCS LNA input. Requires a blocking capacitor, which may be used as part of the input-matching network.
Vdd_LNA	3	Power supply pin for PCS and GPS LNAs. Bypass with a capacitor as close to the pin as possible.
GLNA_IN	4	GPS LNA input. Requires LC match.
GPS_GND	5	GPS Ground.
Vdd_LO	6	Supply voltage for LO buffers.
GPS_LNA_OUT	7	GPS LNA output.
PLO_IN	8	PCS LO input.
GLO_IN	9	GPS LO input.
GND	10	Ground.
GPS_Mix_IN	11	GPS Mixer input.
PLO_OUT	12	PCS LO buffer output. Does not require a blocking capacitor.
GPS_Mix_OUT-	13	Negative GPS IF output.
GPS_Mix_OUT+	14	Positive GPS IF output.
Vcc_Mix	15	Supply voltage for all mixers.
MIX_GND	16	Mixer Ground.
PCDMA_OUT-	17	Negative CDMA output.
PCDMA_OUT+	18	Positive CDMA output.
Vdd_DIG	19	Supply voltage for Logic Control Circuits.
PM_IN	20	PCS Mixer RF input.
BUFFEN	21	LO output buffer enable. Set BUFFEN pin HIGH to power up the PCS LO buffer output.
LIN/GPS	22	Logic input for high or low linearity. Logic HIGH selects High Linearity.
PCS_ON	23	Power on for PCS. Logic HIGH selects PCS Band.
PLNA_OUT	24	PCS LNA output. Requires a pull-up inductor to Vcc and a series blocking capacitor, which can be used as part of the output-matching network.

# TQ5638-Preliminary Data Sheet

## Absolute Maximum Ratings

Symbol	Parameter	Absolute Maximum Value	Units
$V_{CC\_LNA}, V_{CC\_LO\_Tx}, V_{CC\_MIX}, V_{CC\_DIG}$	Power Supply Voltage	-0.5 to 4.0	VDC
PCS_ON, LIN/GPS, BUFFEN	Logic Control Lines	-0.5 to 4.0	VDC
$I_{CC\_LNA}, I_{CC\_LO\_Tx}, I_{CC\_MIX}, I_{CC\_DIG}$	Supply Currents	50	mA
PLO_IN, GLO_IN	LO Input Levels	+5.0	dBm
PLNA_IN, GPS_LNA_IN	LNA Input	+5.0	dBm
$I_{SET\_PCS}$	LNA IP3 Adjustment Input	1	mA
$T_C$	Case Temperature, Survival	-40 to +100	°C
$T_{STG}$	Storage Temperature	-40 to +150	°C

Note: The part may not survive all maximums applied simultaneously.

## General Electrical Characteristics<sup>1,2,3</sup>

Parameter	Conditions	Min.	Typ/Nom	Max.	Units	
LO Frequency Range	PCS Band	1840	1855	1870	MHz	
	A-GPS Band		1575.42		MHz	
	KPCS Band, IF=220.38MHz	Low	1620		1650	MHz
		High	2060		2090	MHz
	GPS Band, IF=220.38MHz	Low		1355.04		MHz
		High		1795.80		MHz
IF Range	PCS, and GPS Bands	80	220.38	230	MHz	
LO Input Power Level	PCS, and GPS Bands	-10	-5	0	dBm	
LO Tx Buffer Output Power Level	PCS Band	-8	-3		dBm	

**Note 1:** Test Conditions:  $V_{CC}=2.75VDC$ ,  $T_C = 25^\circ C$  unless otherwise specified.

**Note 2:** Min./Max. limits are at +25°C case temperature unless otherwise specified.

**Note 3:** TriQuint Test Board.

**Cascade RF Electrical Characteristics (PCS Band, CDMA Modulation)<sup>1,2</sup>**

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
<b>High Gain, High-Linearity Mode</b>		BAND_SEL = Low, Gain = High, LIN/GPS = High			
Cascade Conversion Gain			26.3		dB
Cascade Noise Figure			2.2		dB
Cascade Input IP3			-2		dBm
Supply Current			28		mA
<b>High Gain, Low-Linearity Mode</b>		BAND_SEL = Low, Gain = High, LIN/GPS = Low			
Cascade Conversion Gain			25.3		dB
Cascade Noise Figure			2.3		dB
Cascade Input IP3			-5.5		dBm
Supply Current			20.5		mA

**Note 1:** Test conditions (devices screened for Conversion Gain, Noise Figure and IIP3 to the above limits): V<sub>cc</sub>=2.75V, RF=1855MHz, LO=1635MHz, IF=220MHz, LO input = -5.0dBm, RF input = -35dBm (High Gain Mode), unless otherwise specified. TriQuint Test Board. Data includes image reject filter (SAWTEK P/N 856080), **Note 2:** Min./Max. limits are at +25 °C case temperature unless otherwise specified.

**Cascade RF Electrical Characteristics (GPS Band)<sup>1,2</sup>**

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
<b>GPS Mode</b>		BAND_SEL = Low, Gain = Low, LIN/GPS = High			
Cascade Conversion Gain			37.0		dB
Cascade Noise Figure			1.7		dB
Cascade Input IP3			-17.5		dBm
Supply Current			18.5		mA

**Note 1:** Test conditions (devices screened for Conversion Gain, Noise Figure and IIP3 to the above limits): V<sub>cc</sub>=2.75V, RF=1575.42MHz, LO=1355.04MHz, IF=220.38MHz, LO input = -5.0dBm, RF input = -50dBm. TriQuint Test Board. Data includes image reject filter (SAWTEK P/N 856135)

**Note 2:** Min./Max. limits are at +25 °C case temperature unless otherwise specified.

**DC Supply Electrical Characteristics (All-Modes)<sup>1,2</sup>**

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Supply Voltage		2.7	2.75	3.3	V
Control Voltage High		1.7			V
Control Voltage Low				0.5	V
LO Rx Buffer Supply Current			7		mA
LO Tx Buffer Current	BUFFEN=High		6		mA
Logic Current	Low, High	-5		100	μA
Power Down Supply Current	PCS_ON= Low, LIN/GPS = Low			10	μA

# TQ5638-Preliminary Data Sheet

**Note 1:** Test conditions:  $V_{cc}=2.75V$

**Note 2:** Min./Max. limits are at +25 °C case temperature unless otherwise specified.

## Typical Electrical Characteristics (PCS Band)-LNA and Mixer only<sup>1,2</sup>

Parameter	Conditions	Gain (dB)	NF (dB)	IIP3 (dBm)
<b>High Gain, High-Linearity Mode</b>				
	PCSon = High, LIN/GPS = High			
PCS LNA		15.5	1.6	8.9
PCS Mixer		13.7	6.2	11
<b>High Gain, Low-Linearity Mode</b>				
	PCSon = High, LIN/GPS = Low			
PCS LNA		15.1	1.7	7.9
PCS Mixer		13.3	6.0	7.8

**Note 1:** Test conditions:  $V_{cc}=2.75V$ ,  $T_c=+25\text{ }^\circ\text{C}$ ,  $R_F=1855\text{MHz}$ ,  $LO=1635\text{MHz}$ ,  $IF=220\text{MHz}$ ,  $LO\text{ input} = -5.0\text{dBm}$ ,  $RF\text{ input} = -25\text{dBm}$  (High Gain Mode), unless otherwise specified. TriQuint Test Board.

## Typical Electrical Characteristics (GPS Band)-LNA and Mixer only<sup>1</sup>

Parameter	Conditions	Gain (dB)	NF (dB)	IIP3 (dBm)
<b>A-GPS Mode</b>				
	PCSon = Low, LIN/GPS = High			
GPS LNA		20.0	1.5	-3.8
GPS Mixer		17.6	5.9	0

**Note 1:** Test conditions:  $V_{cc}=2.75V$ ,  $T_c=+25\text{ }^\circ\text{C}$ ,  $R_F=1575.42\text{MHz}$ ,  $LO=1355.04\text{MHz}$ ,  $IF=220\text{MHz}$ ,  $LO\text{ input} = -5.0\text{dBm}$ ,  $RF\text{ input} = -35\text{dBm}$  (High Gain Mode), unless otherwise specified. TriQuint Test Board.

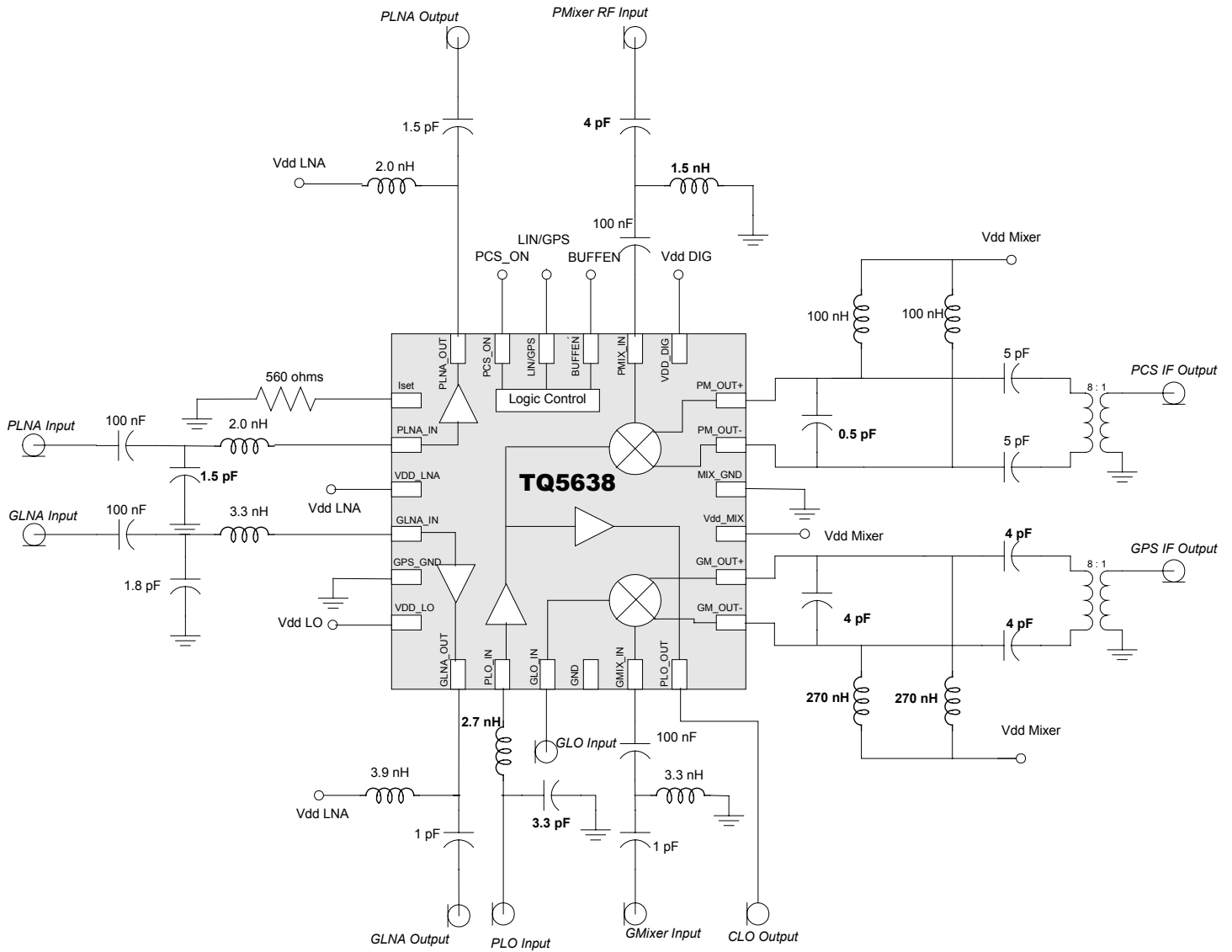
**Mode Programming Truth Table<sup>1</sup>**

Mode		Logic Inputs		
		PCSon	LIN/GPS	BUFFEN
Shut Down	All circuits off	Low	Low	X
PCS Mode	High-gain, high-linearity	High	High	X
	High-gain, low-linearity	High	Low	X
	Activate PCS LO Output Buffer	High	X	High
GPS Mode		Low	High	X

<sup>1</sup>The symbol X (“don’t care”) means a logic input does not affect an operating mode.

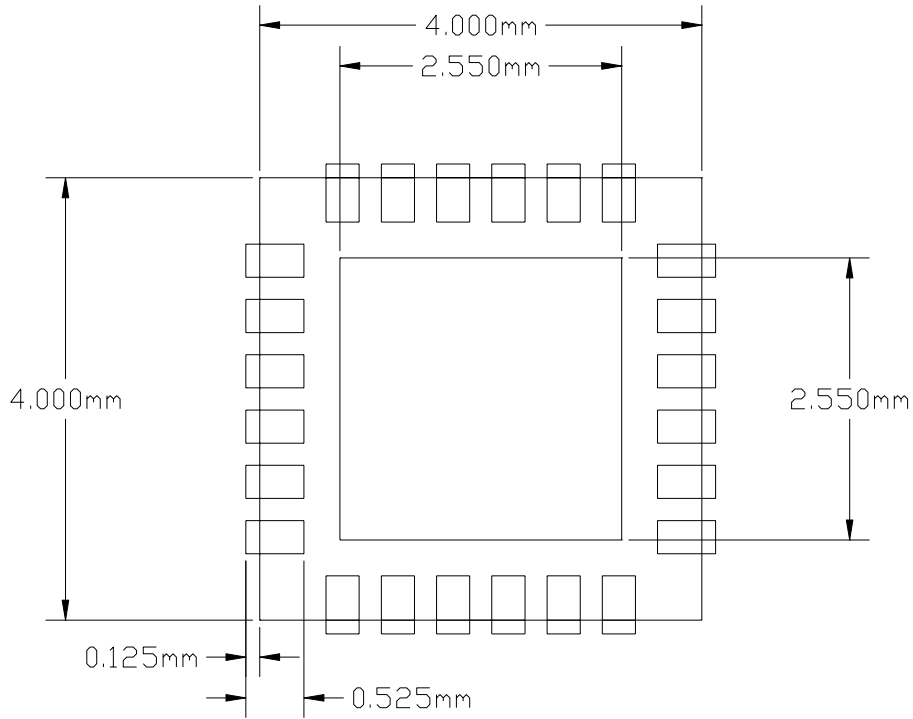
# TQ5638-Preliminary Data Sheet

## Application/Test Circuit:





**Recommended PC board layout to Accept 24 Pin Module Package:**

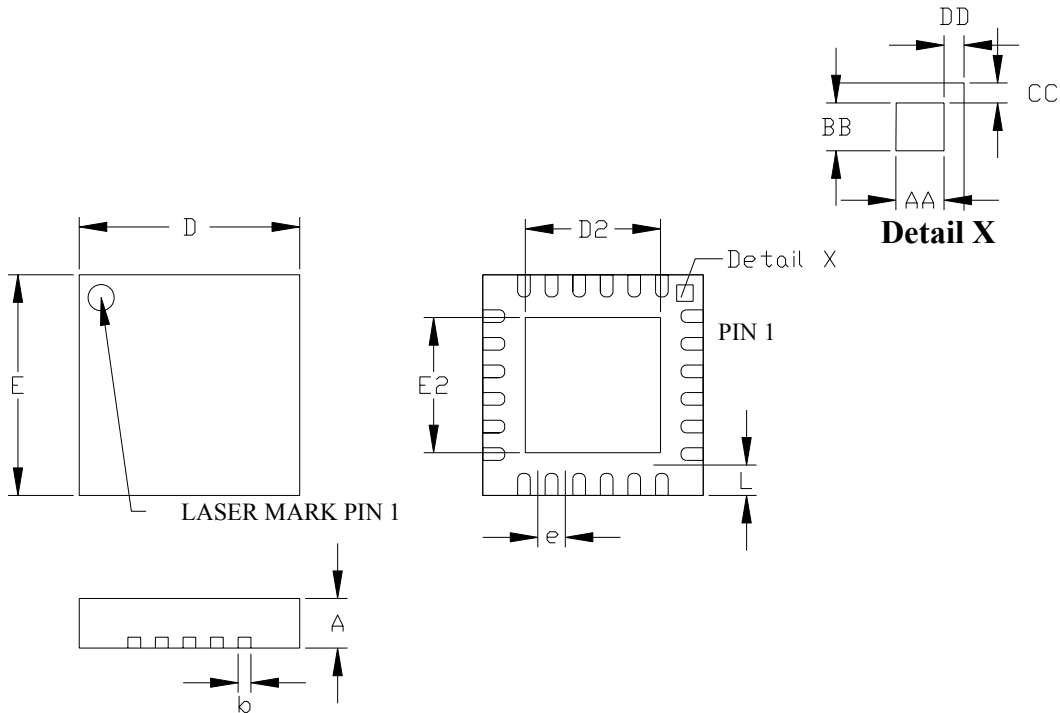


**Notes:**

- 1 Only ground signal traces are allowed directly under the package
- 2 Primary dimensions are in millimeters alternate dimensions are in inches.

# TQ5638-Preliminary Data Sheet

Package Type: 24 Pin Plastic Module Package



JEDEC DESIGNATION	DESCRIPTION	METRIC	ENGLISH	NOTE
A	OVERALL HEIGHT	0.90 +/- .10 mm	.035 +/- .004 in	1
b	TERMINAL WIDTH	0.23 +/- .07 mm	.009 +/- .003 in	1
D	PACKAGE LENGTH	4.00 mm BSC	.157 in	1
D2	EXPOSED PAD LENGTH	2.45 +/- .05 mm	.084 +/- .002 in	1
e	TERMINAL PITCH	0.50 mm BSC	.020 in	1
E	PACKAGE WIDTH	4.00 mm BSC	.157 in	1
E2	EXPOSED PAD WIDTH	2.45 +/- .05 mm	.084 +/- .002 in	1
L	TERMINAL LENGTH	0.40 +/- .10 mm	.016 +/- .004 in	1
AA	PIN 1 ID LENGTH	0.23 mm BSC 5	.009 in	1
BB	PIN 1 ID WIDTH	0.23 mm BSC 5	.009 in	1
CC	PIN 1 ID TO EDGE	0.18 mm BSC	.007 in	1
DD	PIN 1 ID TO EDGE	0.18 mm BSC	.007 in	1

Notes:

**PRIMARY DIMENSIONS ARE IN METRIC MILLIMETERS. THE ENGLISH EQUIVALENTS ARE CALCULATED AND SUBJECT TO ROUNDING ERROR.**

***Additional Information***

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

**Web: [www.triquint.com](http://www.triquint.com)      Tel: (503) 615-9000**  
**Email: [info\\_wireless@tqs.com](mailto:info_wireless@tqs.com)      Fax: (503) 615-8902**

For technical questions and additional information on specific applications:

**Email: [info\\_wireless@tqs.com](mailto:info_wireless@tqs.com)**

The information provided herein is believed to be reliable; TriQuint assumes no liability for inaccuracies or omissions. TriQuint assumes no responsibility for the use of this information, and all such information shall be entirely at the user's own risk. Prices and specifications are subject to change without notice. No patent rights or licenses to any of the circuits described herein are implied or granted to any third party.

TriQuint does not authorize or warrant any TriQuint product for use in life-support devices and/or systems.

Copyright © 2002 TriQuint Semiconductor, Inc. All rights reserved.

Revision 0.3 July 26, 2002