TQP7M9105

1W High Linearity Amplifier

Applications

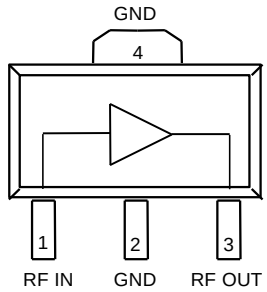
- Repeaters
- BTS Transceivers
- BTS High Power Amplifiers
- CDMA / WCDMA / LTE
- ISM Equipment
- General Purpose Wireless

3-pin SOT-89 Package

Product Features

- 50-1500 MHz
- +30 dBm P1dB at 940MHz
- +47 dBm Output IP3 at 940MHz
- 19.5 dB Gain at 940 MHz
- +5V Single Supply, 220 mA Current
- Internal RF overdrive protection
- Internal DC overvoltage protection
- On chip ESD protection
- SOT-89 Package

Functional Block Diagram



General Description

The TQP7M9105 is a high linearity, high gain 1W driver amplifier in industry standard, RoHS compliant, SOT-89 surface mount package. This InGaP/GaAs HBT delivers high performance across 0.05 to 1.5 GHz while achieving +47 dBm OIP3 and +30 dBm P1dB at 940 MHz while only consuming 220 mA quiescent current. All devices are 100% RF and DC tested.

The TQP7M9105 incorporates on-chip features that differentiate it from other products in the market. The amplifier has a dynamic active bias circuit that enable stable operation over bias and temperature variations and can provide a high linearity at back-off operation

The TQP7M9105 is targeted for use as a driver amplifier in wireless infrastructure where high linearity, medium power, and high efficiency are required. The device an excellent candidate for transceiver line cards and high power amplifiers in current and next generation multi-carrier 3G / 4G base stations.

Pin Configuration

Pin #	Symbol
1	RF Input
3	RF Output / Vcc
2, 4	Ground

Ordering Information

Part No.	Description
TQP7M9105	1 W High Linearity Amplifier
TQP7M9105-PCB900	860-960 MHz tuned EVB

Standard T/R size = 1000 pieces on a 7” reel.

Specifications

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-65 to 150°C
Device Voltage, V_{cc}	+8 V
RF Input Power CW , 50Ω, T=25°C	+30 dBm

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Operating Temp. Range	-40		+85	°C
V_{cc}		+5	+5.25	V
Tj (for>10^6 hours MTTF)			+170	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

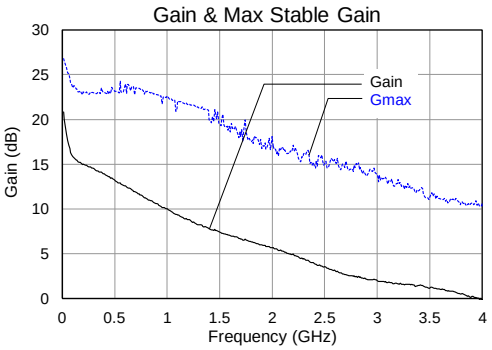
Electrical Specifications

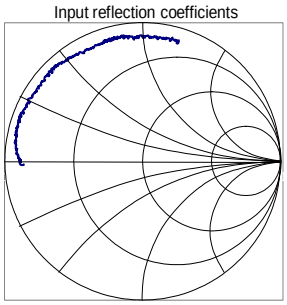
Test conditions unless otherwise noted: +25°C, +5V Vcc, 50 Ω system, tuned application circuit

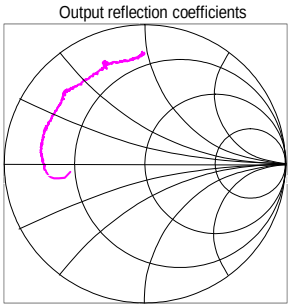
Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		50		1500	MHz
Test Frequency			940		MHz
Gain		17.5	19.4	20.5	dB
Input Return Loss			14		dB
Output Return Loss			15		dB
Output P1dB		+28.7	+30		dBm
Output IP3	Pout=+15 dBm/tone, Δf=1 MHz	+43.5	+47		dBm
WCDMA Channel Power [1]	At -50 dBc ACLR		+20.5		dBm
Noise Figure			6.3		dB
Vcc			+5		V
Quiescent Current, Icq		195	220	245	mA
Thermal Resistance (junction to base)			27.3		°C/W

Notes:
1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 9.7 dB at 0.01% Prob.

Device Characterization Data







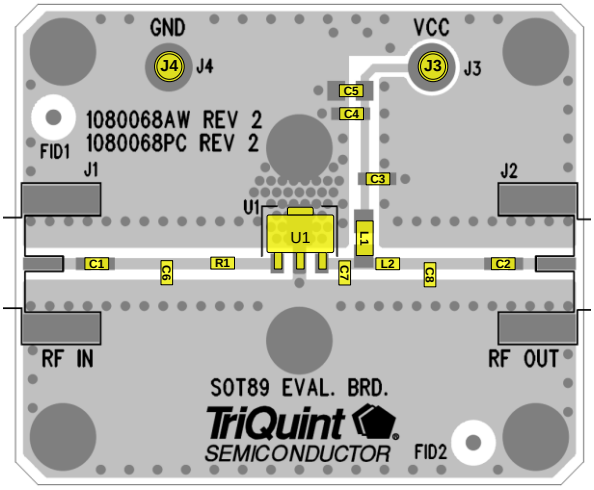
Note: The gain for the unmatched device in 50 ohm system is shown as the trace in black color, [gain (S(21)]. For a tuned circuit at a particular frequency, it is expected that actual gain will be higher, up to the maximum stable gain. The maximum stable gain is shown as the blue trace [Gain (MAX)]. The impedance plots are shown from 0.01 – 6 GHz.

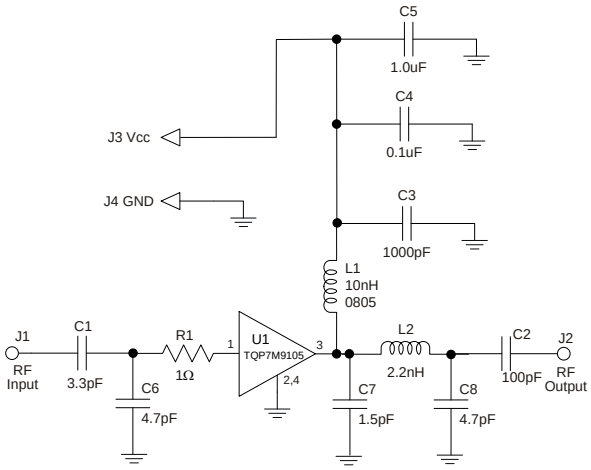
S-Parameter Data

V_{cc} = +5 V, I_{cq} = 220 mA, T = +25°C, unmatched 50 ohm system, calibrated to device leads

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
0.05	-1.06	-178.68	17.88	154.59	-36.95	1.89	-3.39	-171.92
0.1	-1.08	-179.98	16.04	154.96	-37.20	3.77	-3.00	-176.29
0.2	-1.01	179.18	15.20	150.91	-37.52	7.85	-2.91	-179.66
0.4	-0.75	176.01	14.04	134.55	-36.48	11.27	-2.73	176.91
0.6	-0.57	171.34	12.73	120.33	-35.65	11.92	-2.52	173.48
0.8	-0.51	166.55	11.29	108.35	-35.14	9.35	-2.51	169.15
1.0	-0.51	163.55	10.11	98.59	-34.89	11.74	-2.50	165.78
1.2	-0.54	161.26	8.87	90.63	-34.56	11.00	-2.52	163.07
1.4	-0.57	157.96	7.85	82.50	-34.07	10.99	-2.61	160.70
1.6	-0.62	154.88	7.10	75.78	-33.47	10.29	-2.57	158.17
1.8	-0.66	150.04	6.35	67.47	-33.19	11.13	-2.66	155.39
2.0	-0.60	144.26	5.75	59.82	-32.84	4.95	-2.64	151.03
2.2	-0.56	139.27	4.95	51.93	-32.47	3.98	-2.59	146.61
2.4	-0.75	135.92	3.91	45.80	-32.62	1.55	-2.57	141.55
2.6	-0.58	132.79	3.16	40.57	-32.36	2.07	-2.28	139.39
2.8	-0.55	132.30	2.52	36.55	-32.25	2.62	-2.33	138.20
3.0	-0.64	129.89	2.01	31.75	-31.94	0.51	-2.37	136.78
3.2	-0.69	126.19	1.69	26.65	-31.44	1.40	-2.40	135.83
3.4	-0.84	121.41	1.48	20.86	-30.84	-2.57	-2.54	133.06
3.6	-0.93	115.44	1.06	12.97	-30.84	-4.71	-2.68	126.60
3.8	-0.85	110.18	0.51	5.81	-30.20	-10.30	-2.63	119.65
4.0	-0.80	106.76	-0.04	-0.51	-30.40	-11.85	-2.51	114.02

Application Circuit 860-960 MHz (TQP7M9105-PCB900)





Notes:

1. See Evaluation Board PCB Information section for PCB material and stack-up.
2. Components shown on the silkscreen but not on the schematic are not used.
3. The recommended component values are dependent upon the frequency of operation.
4. All components are of 0603 size unless stated on the schematic.
5. Critical component placement locations:

   Distance from U1 Pin 1 Pad (left edge) to R1 (right edge): 100 Mils (4.85°at 940 MHz)
   Distance from U1 Pin 1 Pad (left edge) to C6 (right edge): 270 Mils (13.1° at 940 MHz)
   Distance from U1 Pin 3 Pad (right edge) to C7 (left edge): 40 Mils (1.94° at 940 MHz)
   Distance from U1 Pin 3 Pad (right edge) to L2 (left edge): 120 Mils (5.82° at 940 MHz)
   Distance from U1 Pin 3 Pad (right edge) to C8 (left edge): 260 Mils (12.6° at 940 MHz)

Bill of Material

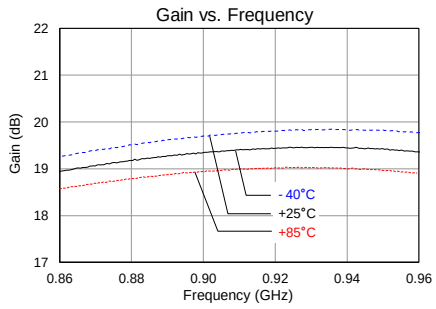
Ref Des	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board	TriQuint	1080068
U1	n/a	TQP7M9105 Amplifier, SOT-89 pkg.	TriQuint	1077953
C1	3.3 pF	Cap., Chip, 0603, +/-0.1pF, 50V, Accu-P	AVX	06035J3R3ABSTR
C2	100 pF	Cap., Chip, 0603, 5%, 50V, NPO/COG	various	
C3	1000pF	Cap., Chip, 0603, 5%, 50V, NPO/COG	various	
C4	0.1 uF	Cap., Chip, 0603, 10%, 16V, X7R	various	
C5	1.0 uF	Cap., Chip, 0603, 10%, 10V, X5R	various	
C7	1.5 pF	Cap., Chip, 0603, +/-0.05pF, 50V, Accu-P	AVX	06035J1R5ABSTR
C6, C8	4.7 pF	Cap., Chip, 0603, +/-0.05pF, 50V, Accu-P	AVX	06035J4R7ABSTR
L1	10 nH	Inductor, 0805, 5%, Coilcraft CS Series	Coilcraft	0805CS-100XJLB
L2	2.2 nH	Inductor, 0603, +/-0.3 nH	Toko	LL1608-FSL2N2S
R1	1 Ω	Resistor, Chip, 0603, 5%, 1/16W	various	

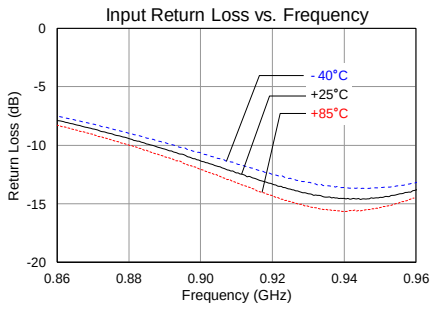
Typical Performance 860-960 MHz (TQP7M9105-PCB900)

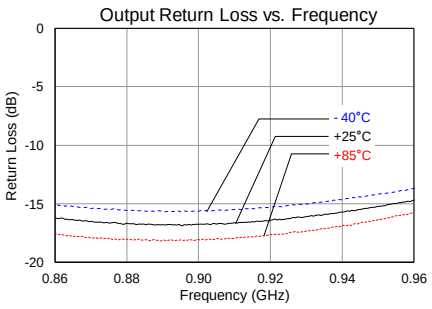
Frequency	MHz	860	880	900	920	940	960
Gain	dB	18.9	19.2	19.3	19.4	19.4	19.3
Input Return Loss	dB	-7.9	-9.5	-11.3	-13	-14	-13
Output Return Loss	dB	-16.2	-16.7	-16.8	-15	-15	-14
Output P1dB	dBm	+29	+29.2	+29.5	+29.9	+30.0	+29.8
Output IP3 (+15 dBm/tone, Δf = 1 MHz)	dBm	+48	+50.2	+50.6	+49.5	+49.2	+49
WCDMA Channel power (at -50 dBc ACLR) (1)	dBm	20	20.2	20.5	+20.5	+20.5	+20.5
Noise Figure	dB	6.8	6.6	6.4	6.4	6.4	6.3
Supply Voltage, Vcc	V	+5					
Quiescent Collector Current, Icq	mA	220					

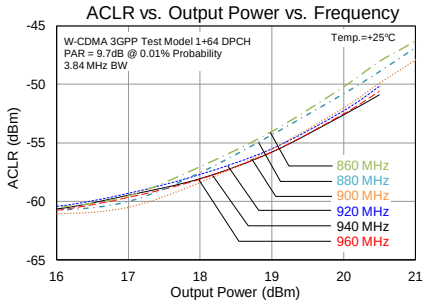
Notes:
1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, PAR = 9.7 dB at 0.01% Prob.

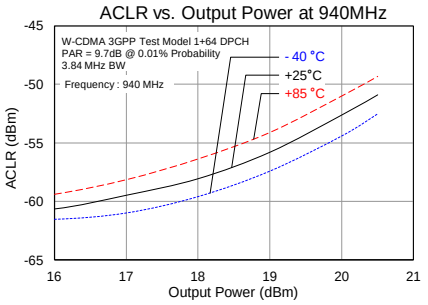
RF Performance Plots 860-960 MHz (TQP7M9105-PCB900)

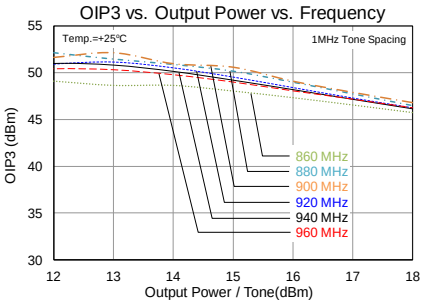


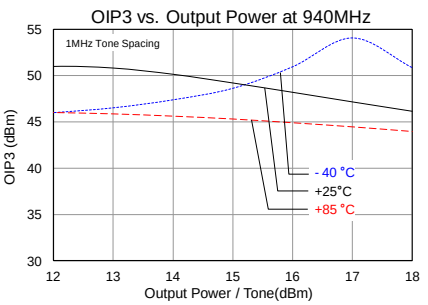


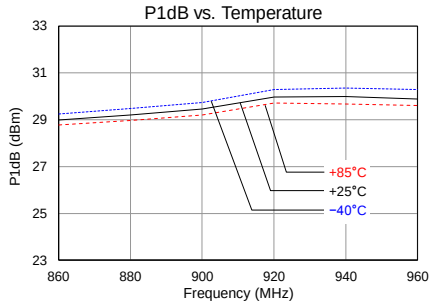


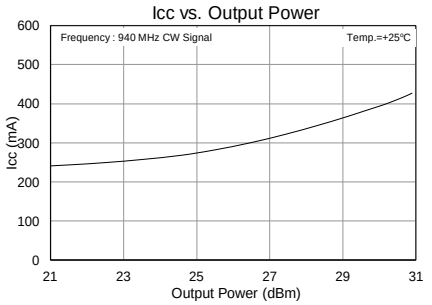




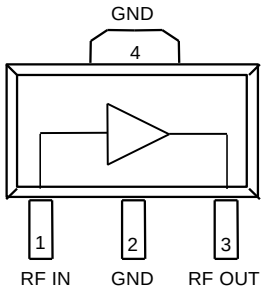








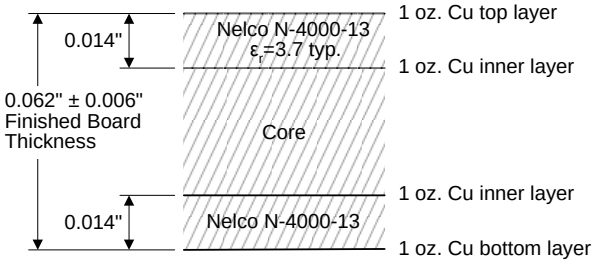
Pin Configuration and Description



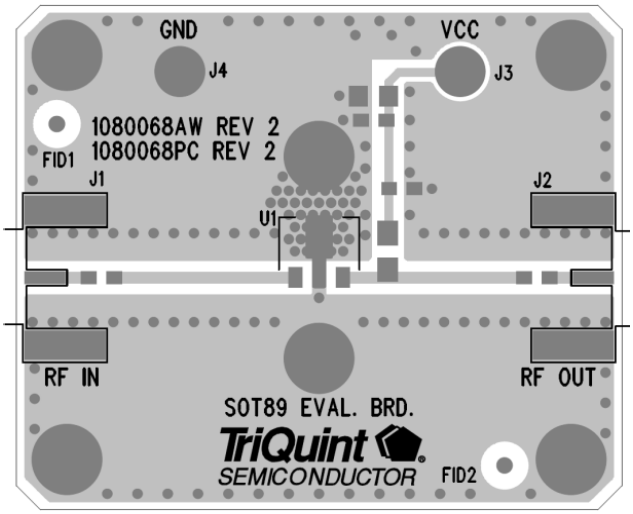
Pin	Symbol	Description
1	RF IN	RF Input. Requires external match for optimal performance. External DC Block required.
2, 4	GND	RF/DC Ground Connection
3	RFout / Vcc	RF Output. Requires external match for optimal performance. External DC Block and supply voltage is required.

Evaluation Board PCB Information

TriQuint PCB 1080068 Material and Stack-up



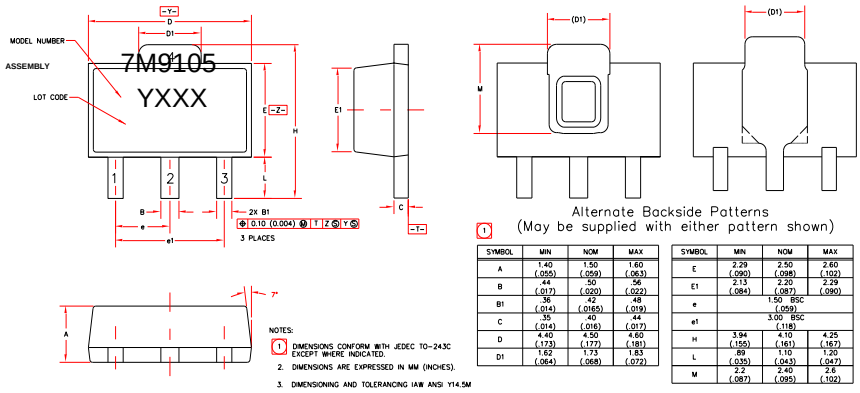
50 ohm line dimensions: width = .031”, spacing = .035”.



Mechanical Information

Package Marking and Dimensions

Marking: Part number – 7M9105
Assembly code - YXXX

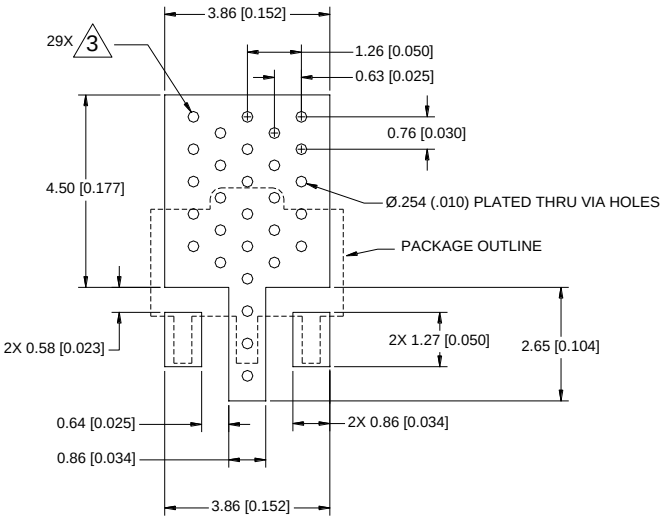


SYMBOL	MIN	NOM	MAX
A	1.40 (.055)	1.50 (.059)	1.60 (.063)
B	.44 (.017)	.50 (.020)	.56 (.022)
B1	.36 (.014)	.42 (.0165)	.48 (.019)
C	.35 (.014)	.40 (.016)	.44 (.017)
D	4.40 (.173)	4.50 (.177)	4.60 (.181)
D1	1.62 (.064)	1.73 (.068)	1.83 (.072)

SYMBOL	MIN	NOM	MAX
E	2.29 (.090)	2.50 (.098)	2.60 (.102)
E1	2.13 (.084)	2.20 (.087)	2.29 (.090)
e		1.50 BSC (.059)	
e1		3.00 BSC (.118)	
H	3.94 (.155)	4.10 (.161)	4.25 (.167)
L	.89 (.035)	1.10 (.043)	1.20 (.047)
M	2.2 (.087)	2.40 (.095)	2.6 (.102)

NOTES:
1. DIMENSIONS CONFORM WITH JEDEC TO-243C EXCEPT WHERE INDICATED.
2. DIMENSIONS ARE EXPRESSED IN MM (INCHES).
3. DIMENSIONING AND TOLERANCING IAW ANSI Y14.5M

PCB Mounting Pattern



NOTES:

1. The pad pattern shown has been developed and tested for optimized assembly at TriQuint Semiconductor. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from supplier to supplier, careful process development is recommended.
2. All dimensions are in millimeters [inches]. Angles are in degrees.
3. Use 1 oz. copper minimum for top and bottom layer metal.
4. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25mm (0.10”).
5. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.
6. Place mounting screws near the part to fasten a back side heat sink.
7. Do not apply solder mask to the back side of the PC board in the heat sink contact region.
8. Ensure that the backside via region makes good physical contact with the heat sink.

Product Compliance Information

ESD Information

Caution! ESD-Sensitive Device

ESD Rating:	Class 1C
Value:	≥ 1000 V and < 2000 V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

ESD Rating:	Class IV
Value:	≥ 2000 V min
Test:	Charged Device Model (CDM)
Standard:	JEDEC Standard JESD22-C101

MSL Rating

Moisture Sensitivity Level (MSL) 3 at 260°C convection reflow per JEDEC standard IPC/JEDEC J-STD-020.

Solderability

Package lead plating: NiPdAu

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

RoHS Compliance

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_40_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

Web: www.triquint.com **Tel:** +1.503.615.9000
Email: info-sales@tqs.com **Fax:** +1.503.615.8902

For technical questions and application information: **Email:** sjcapplications.engineering@tqs.com

Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

TriQuint products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.