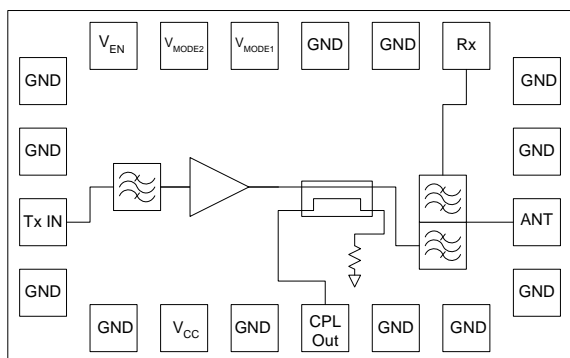


Tritium II PA-Duplexer Module™ CDMA AWS Band

Functional Block Diagram



Product Description

The TQM653029 is a fully matched CDMA AWS band PA-Duplexer module for use in mobile phones and part of TriQuint’s Tritium® II product family. The module is designed with a focus on size, current consumption and phone layout simplicity. Within a compact area of only 28mm², the module integrates a single-ended transmit filter, duplexer, high efficiency PA die, RF power coupler, matching and built in voltage regulator functionality eliminating the need for external switch circuitry. With an RF power output up to 26dBm the TQM653029 meets the strict ACPR/ALTR requirements of multi-band, feature-rich CDMA2000 handset designs.

The module will provide the lowest overall current consumption available in the market based on the current sub-urban CDG (CDMA Development Group) curve by providing a 3 Gain state amplifier. In Low-Power mode operation a quiescent current of only 6mA will allow the module to achieve an overall average current of less than 50mA. The pin layout is optimized for use with new CDMA discrete and packaged transceiver solutions although its operation is backwards compatible with existing chipsets.

Electrical Specifications

Test Conditions V_{CC}=3.4V, V_{EN}=High, T=25°C

Parameter	Typ	Units
Frequency	1733	MHz
Max P _{OUT}	26	dBm
ACPR (±1.25MHz offset)	-50	dBc
ALTR (±1.98MHz offset)	-60	dBc
Current Consumption (at +25.5dBm Pout)	400	mA
Quiescent Current in LPM	6	mA
Leakage at Rx Port	-31	dBm
Rx Noise	-182	dBm/Hz

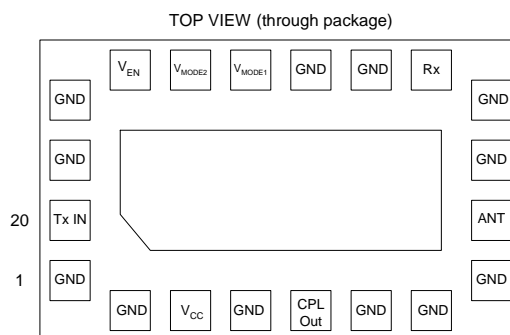
Features

- Compact 7.0x4.0x1.1mm module replacing more than 12 discrete components
- Integrated duplexer, single-ended Tx filter, PA die, RF power coupler and matching
- Built-in voltage regulator functionality eliminating any external switch circuitry
- High efficiency three gain state PA for lowest overall current consumption
- Typical quiescent current values:
 Low Power Mode (LPM) = 6mA
 Medium Power Mode (MPM) = 20mA
 High Power Mode (HPM) = 90mA
- Low Current Consumption
 Typical: 400 mA @ +25.5dBm
 Typical: 360 mA @ +24.5dBm
 Typical: 45 mA @ +13dBm
- Excellent ACPR
 Typical: -50 dBc @ +/- 1.25MHz offset
- Excellent ALTR
 Typical: -60 dBc @ +/- 1.98 MHz offset
- Lead-free 260°C RoHS Compliant
- Halogen-free (HF) Compliant

Applications

- IS-95/98/CDMA2000
- EVDO Rev A Compliant
- Tri-band CDMA Handsets

Package Style



Tritium II PA-Duplexer Module™ CDMA AWS Band

Absolute Maximum Ratings

Symbol	Parameter	Absolute Maximum Value	Units
V _{CC}	Supply Voltage with no RF applied	+6.0	V
	Supply Voltage with RF applied	+4.5	V
V _{MODE1} , V _{MODE2}	Mode Control Voltages	+2.7	V
P _{IN}	Input RF Power at Tx Port	+10	dBm
	Input RF Power at Antenna Port	+30	dBm
	Input RF Power at Rx Port	+10	dBm
T _C	Case Temperature, Survival	-35 to +85	°C
T _{STG}	Storage Temperature	-55 to +125	°C
ESD	ESD meets class 1B Human Body Model (HBM) rating under the conditions in JESD22-A114-E.		

Note: Stresses above those listed under absolute maximum ratings may cause permanent and functional damage to the device. Exposure exceeding absolute maximum rating conditions for extended periods may affect device reliability. The part may not survive all maximums applied simultaneously.

DC Electrical Characteristics

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Supply Voltage (V _{CC})	No RF	3.2	3.8	6.0	V
	HPM, MPM, LPM with RF	3.2	3.8	4.2	V
	Ruggedness Testing			4.7	V
PA Enable Digital Control Voltage (V _{EN})	Low – PA off	0.0		0.5	V
	High – PA Enabled	2.0		2.7	V
PA Bias Mode Control Voltages (V _{MODE1} , V _{MODE2})	V _{MODE1} / V _{MODE2} = Low	0.0		0.5	V
	V _{MODE1} / V _{MODE2} = High	2.0		2.7	V
Control Line Current (I _{CONTROL})	All control lines (sink or source current)			1	mA
Leakage Current (I _{LEAK})	Total current on all pins; T=-20to+85°C, V _{CC} =4.7V, V _{EN} =0V		5	15	µA
Turn on/off time ¹ (T _{ON-DC} , T _{OFF-DC})				20	µs
Gain switching time (T _{MODE})	High-Mid-Low			6	µs
Ambient Operating Temperature		-30		+85	°C

*Note 1: Definition of switching time: T_{ON-DC} = The time required to obtain the idle bias condition ±10% from a zero bias condition with RF signal applied
T_{OFF-DC} = The time required for the bias current (idle current) to decrease to < 100µA*

Tritium II PA-Duplexer Module™ CDMA AWS Band

Power Range Truth Table

Mode of Operation	V _{EN}	V _{MODE1}	V _{MODE2}	V _{CC}
Power Down / PA Off	Low	X	X	ON
Stand-by mode N/A	N/A	N/A	N/A	N/A
High Power Mode – HPM (-50 dBm < P _{OUT} < +26 dBm)	High	Low	High	ON
Medium Power Mode – MPM (-50 dBm < P _{OUT} < +16 dBm)	High	High	High	ON
Low Power Mode – LPM (-50 dBm < P _{OUT} < +13 dBm)	High	X	Low	ON

Tx to Antenna Port RF Electrical Characteristics¹

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
RF Frequency		1711.25	-	1753.75	MHz
Maximum Output Power	HPM, V _{CC} =3.4 – 4.2V, -30°C<T<60°C	26	-	-	dBm
	MPM, V _{CC} =3.4 – 4.2V, -30°C<T<60°C	16	-	-	dBm
	LPM, V _{CC} =3.4 – 4.2V, -30°C<T<60°C	13	-	-	dBm
Maximum Input Power	HPM	7	-	-	dBm
	MPM	9	-	-	dBm
	LPM	9	-	-	dBm
Tx Gain	HPM	21	26	30	dB
	MPM	10	13	17	dB
	LPM	7	10	15	dB
Step Function Droop ²	HPM, 25°C, 25dBm, over 400ms	-	-	0.3	dB
Tx Gain in GPS Band		-	-	-38	dB
Gain Flatness vs. Frequency	3.4V, 25°C, P _o = 25dBm	-	-	±2.0	dB
	3.4V, 25°C, P _o = 16dBm	-	-	±1.5	dB
	3.4V, 25°C, P _o = 13dBm	-	-	±1.5	dB
Gain Flatness vs. Power	3.4V, 25°C, P _o = (MP _{max} - 20) - HP _{max}	-	-	±2.0	dB
	3.4V, 25°C, P _o = (LP _{max} - 10) - MP _{max}	-	-	±1.5	dB
	3.4V, 25°C, P _o = -54dBm - LP _{max}	-	-	±1.5	dB
Tx VSWR	Tx in port	-	-	2.5:1	
Adjacent Channel Power	HPM, 3.8V, 26dBm, 25°C	-	-50	-45	dBc
	HPM, 3.4V, 25dBm, 70°C	-	-50	-42	dBc
	MPM, 16dBm	-	-50	-42	dBc
	LPM, 13dBm	-	-50	-42	dBc
Alternate Channel Power	HPM, 3.8V, 26dBm, 25°C	-	-60	-53	dBc
	HPM, 3.4V, 25dBm, 70°C	-	-60	-50	dBc
	MPM, 16dBm	-	-58	-51	dBc
	LPM, 13dBm	-	-58	-51	dBc
Power Efficiency	HPM, 3.4V, 25°C, 25dBm	-	22	-	%
BC15 Tx Noise in BC15 Rx Band	HPM, N _{IN} at Ant port = -135dBm/Hz	-	-	-183	dBm/Hz
	MPM, N _{IN} at Ant port = -135 – (HP _{MAX} – MP _{MAX}) dBm/Hz	-	-	-183	dBm/Hz
	LPM, N _{IN} at Ant port = -135 – (HP _{MAX} – LP _{MAX}) dBm/Hz	-	-	-183	dBm/Hz
Tx Noise in GPS Band	N _{IN} at Ant port = -135 dBm/Hz, -30°C<T<25°C	-	-	-166	dBm/Hz
	N _{IN} at Ant port = -135 dBm/Hz, 25°C<T<70°C	-	-	-169	dBm/Hz
Harmonics		-	-66	-	dBc
Stability (all spurious)	Load VSWR = 10:1 @ all angles	-	-	-90	dBc

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Tritium II PA-Duplexer Module™ CDMA AWS Band

Tx to Antenna Port RF Electrical Characteristics¹ (cont.)

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Ruggedness	HPM, Load VSWR = 10:1 @ all angles, No Damage			26	dBm
	MPM, Load VSWR = 10:1 @ all angles, No Damage			16	dBm
	LPM, Load VSWR = 10:1 @ all angles, No Damage			13	dBm
CDG Current ³	V _{CC} = 3.8V, 25°C	-	-	50	mA
PA Switching Time: Rise / Fall ⁴	0dB < P _{OUT} < 5dBm	-	-	6.0	µs
Code Domain Power ⁵	25°C < T < 60°C	23	-	-	dB
Code Channel Reverse Plot Power Accuracy	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 9600 rate	3.50	-	4.00	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 9600 rate	3.50	-	4.00	
Convolution Encoding	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 19.2K rate	3.38	-	3.88	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 19.2K rate	6.00	-	6.50	
	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 38.4K rate	2.13	-	2.63	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 38.4K rate	7.25	-	7.75	
	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 76.8K rate	0.88	-	1.38	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 76.8K rate	8.75	-	9.25	
	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 153.6K rate	-1.00	-	-0.50	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 153.6K rate	10.25	-	10.75	
Code Channel Reverse Pilot Power Accuracy	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 19.2K rate	3.250	-	3.750	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 19.2K rate	5.250	-	5.750	
Turbo Encoding	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 38.4K rate	2.250	-	2.750	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 38.4K rate	6.750	-	7.250	
	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 76.8K rate	1.125	-	1.625	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 76.8K rate	8.250	-	8.750	
	HPM, 5.5dBm P _{OUT} , R-FCH to R-Pilot @ 153.6K rate	-0.625	-	-0.125	
	HPM, 5.5dBm P _{OUT} , R-SCH to R-Pilot @ 153.6K rate	9.250	-	9.750	

Note 1: Test Conditions: V_{CC1}=3.8VDC, T_C = 25°C unless otherwise specified.

Note 2: With the module in high gain mode steps the RF signal from -80dBm a level such that PO = POUT (H). The rise time for the step in the input power shall not exceed 250ns

Note 3: Total current integrated across CDMA suburban CDG curve. Includes additional current contribution from RFT.

Note 4: Rise: time required to go from (Pout - 30 dB) to (Pout ± 1 dB); Fall: time required to reach (Pout - 30 dB) from (Pout ± 1 dB) when input signal removed.

Note 5: To be measured at Pout = 26dBm. Refer to IS98E section 4.3.5.

Rx to Antenna Port RF Electrical Characteristics

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency		2110	-	2155	MHz
Mid Band Insertion Loss	2115 – 2150 MHz	-	2.0	2.8	dB
Band Edge Insertion Loss	2110-2115 MHz and 2150-2155 MHz	-	2.5	3.0	dB
Rx VSWR	ANT and Rx ports	-	-	2.5:1	
Attenuation	BCO Tx 824-849 MHz	45	-	-	dB
	BC1 Tx 1850-1910 MHz	45	-	-	dB
	BC4 Tx 2400-2484 MHz	45	-	-	dB
	BC15 Tx 1710-1755 MHz	50	-	-	dB
	Rx 2 nd Harmonic 4200-4310 MHz	25	-	-	dB
	Rx 3 rd Harmonic 6330-6465 MHz	30	-	-	dB
	Rx 4 th Harmonic 8400-8620 MHz	17	-	-	dB
Triple Beat Test ¹		86			dB

Note 1: Ratio of CW jammer to triple beat product at Rx port (HPM only). Triple beat frequencies: Ant input = 2115, 2132.5, 2150 MHz; Tone 1 = 1715, 1732.5, 1750 MHz; Tone 2 = 1716, 1733.5, 1751 MHz

Data Sheet

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Tritium II PA-Duplexer Module™ CDMA AWS Band

Tx to Rx Port RF Electrical Characteristics

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Small Signal Gain		-	-	-47	dB
Tx Leakage	25.5 dBm, 3.8V, 25°C < T < 60°C	-	-31	-26.8	dBm

Coupled Port RF Electrical Characteristics

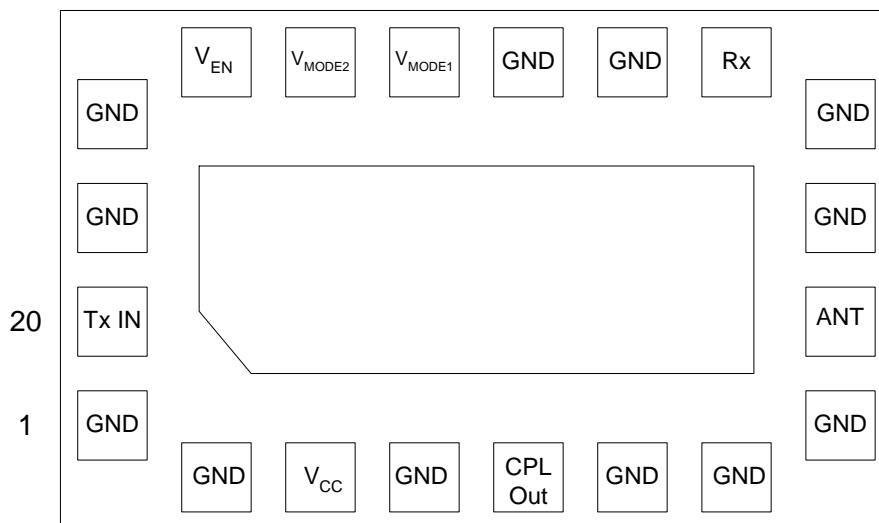
Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Tx Power at Coupled Port	Over freq & temp relative to ANT power	-23	-	-18	dBc
Output Impedance		-	50	-	Ω
VSWR	HPM, Coupled Port	-	-	2.5:1	
Directivity Error ¹	HPM, 3.5:1 @ all angles, 22dBm < P _{OUT} < 26dBm	-4.0	-	0.5	dB
Temp Variation	HPM, 25dBm, 50Ω load at ANT, 3.8V, -30°C < T < 85°C	-0.5	-	0.5	dB

Note 1: Set the input power using a 50 Ohm load, then measure variation in output power for the same coupled power. The coupled power should be adjusted to remain constant.

Tritium II PA-Duplexer Module™ CDMA AWS Band

Pin Out and Assignments

TOP VIEW (through package)

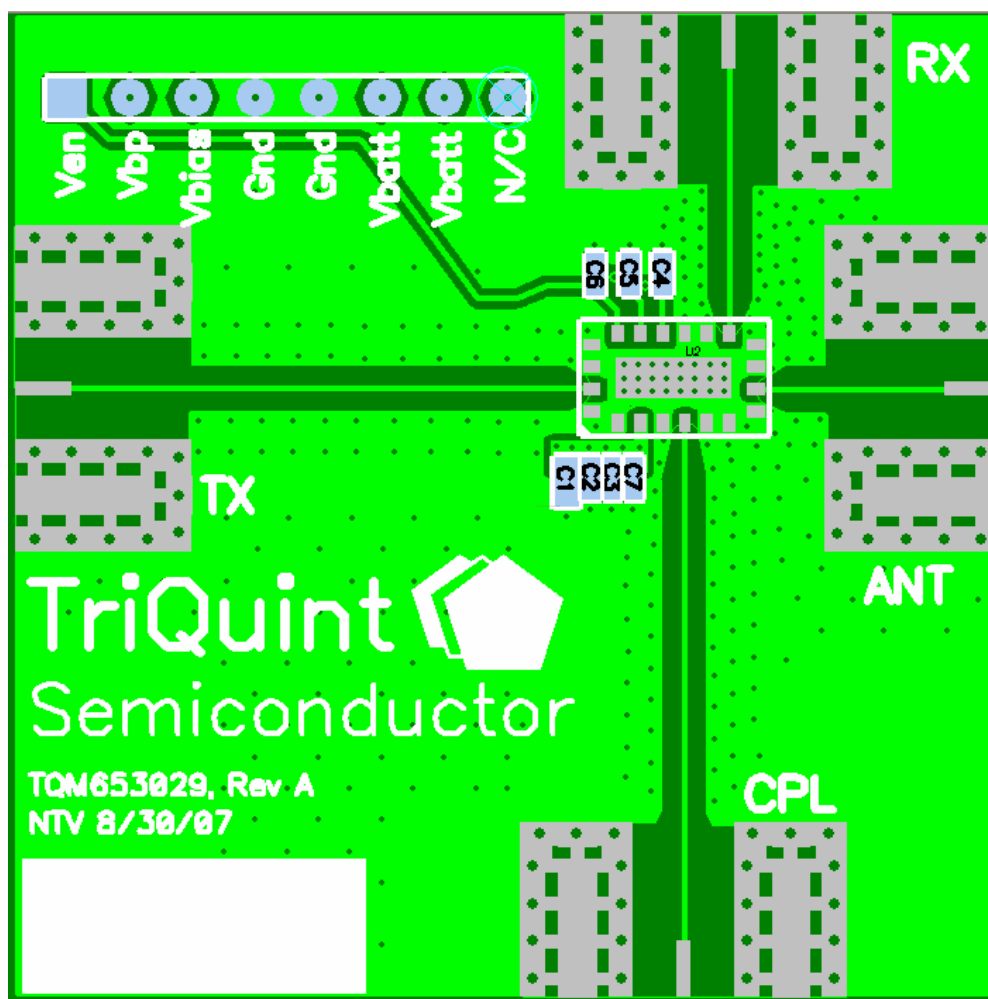


Pin	Symbol	Description
1	GND	Ground
2	GND	Ground
3	V _{CC}	Supply Voltage
4	GND	Ground
5	CPL Out	Directional Coupler Output
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	ANT	Duplexer ANT Port
10	GND	Ground
11	GND	Ground
12	Rx	Duplexer Rx Output Port
13	GND	Ground
14	GND	Ground
15	V _{MODE1}	Control for high and medium power modes
16	V _{MODE2}	Control for low power mode
17	V _{EN}	Enable Control
18	GND	Ground
19	GND	Ground
20	Tx IN	Tx Input

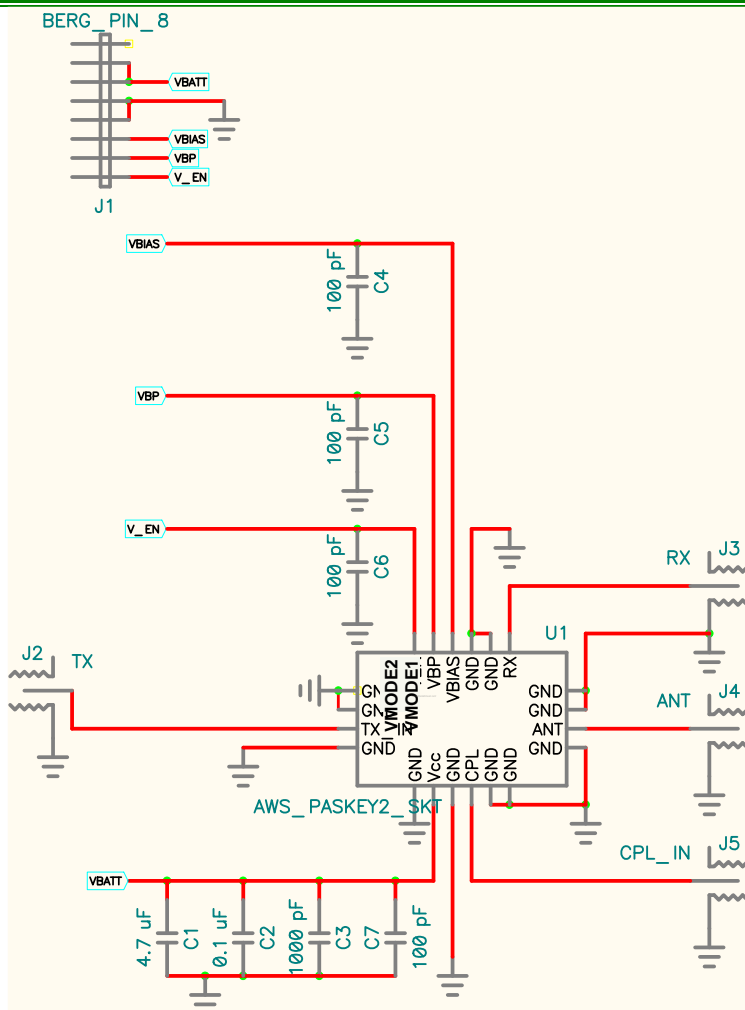
Tritium II PA-Duplexer Module™ CDMA AWS Band

Applications information; tuning procedures; board layout precautions

TriQuint offers our customers the below evaluation board as a means for testing and analysis of the TQM653029. The evaluation board schematic and picture are provided for preliminary analysis and design. The following figures show the TriQuint application board and the schematic of the board followed by the power-up/power-down sequence instructions



Tritium II PA-Duplexer Module™ CDMA AWS Band



Applications Information: Power Up/Down Sequences

Power-Up Sequence			Power-Down Sequence		
Sequence	PIN	Description	Sequence	PIN	Description
1	V _{CC}	Apply Battery Voltage	1	RF	Remove RF
2	V _{MODE1}	Set PA Mode 1 bit	2	V _{EN}	Disable PA
3	V _{MODE2}	Set PA Mode 2 bit	3	V _{MODE1}	Set V _{MODE1} = 0V
4	V _{EN}	Enable PA	4	V _{MODE2}	Set V _{MODE2} = 0V
5	RF	Apply RF	5	V _{CC}	Remove Battery Voltage

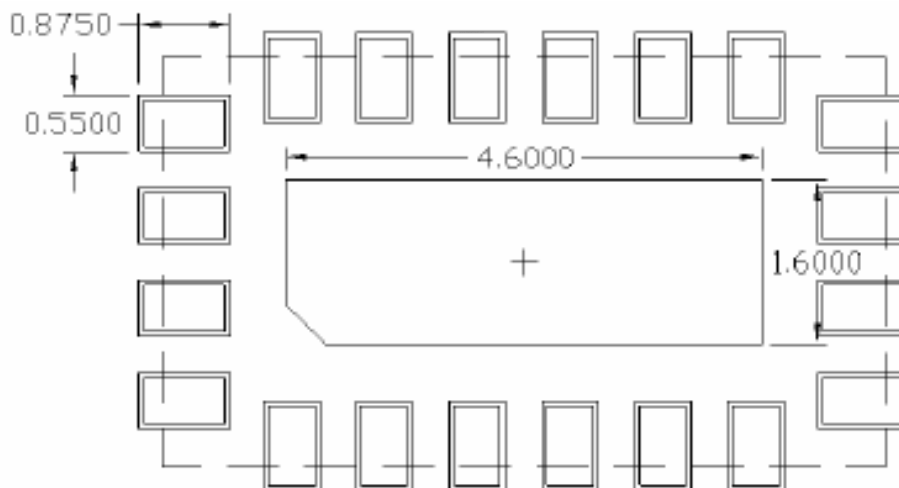
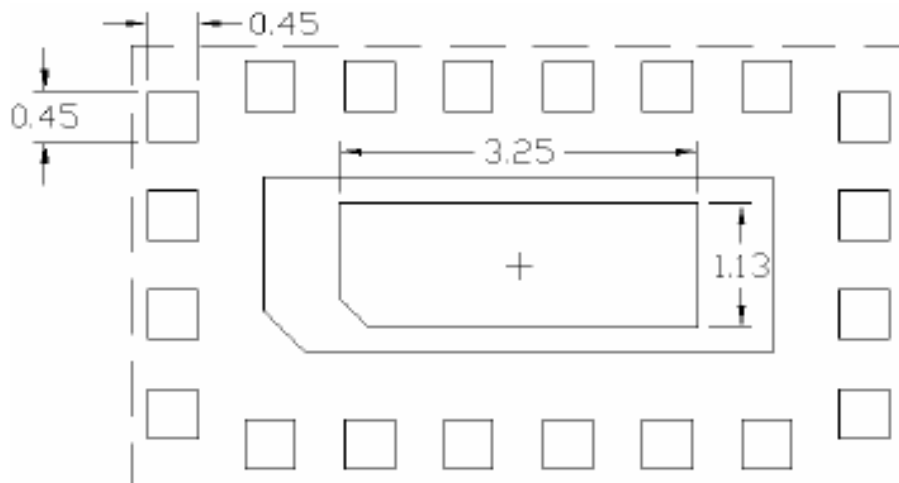
PC Board Layout recommendations

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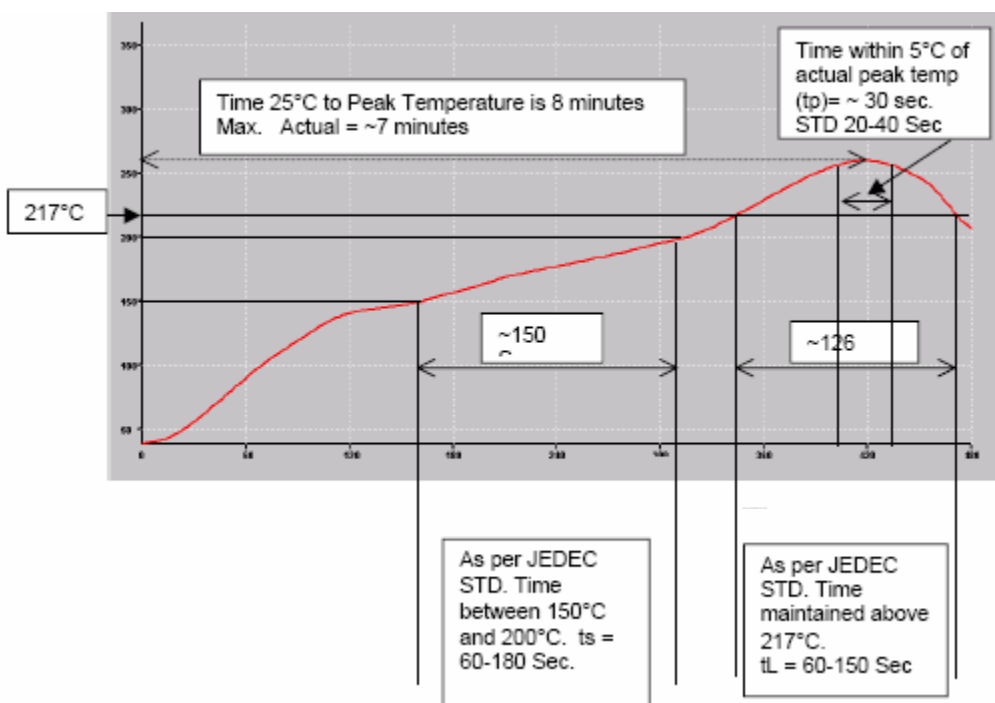
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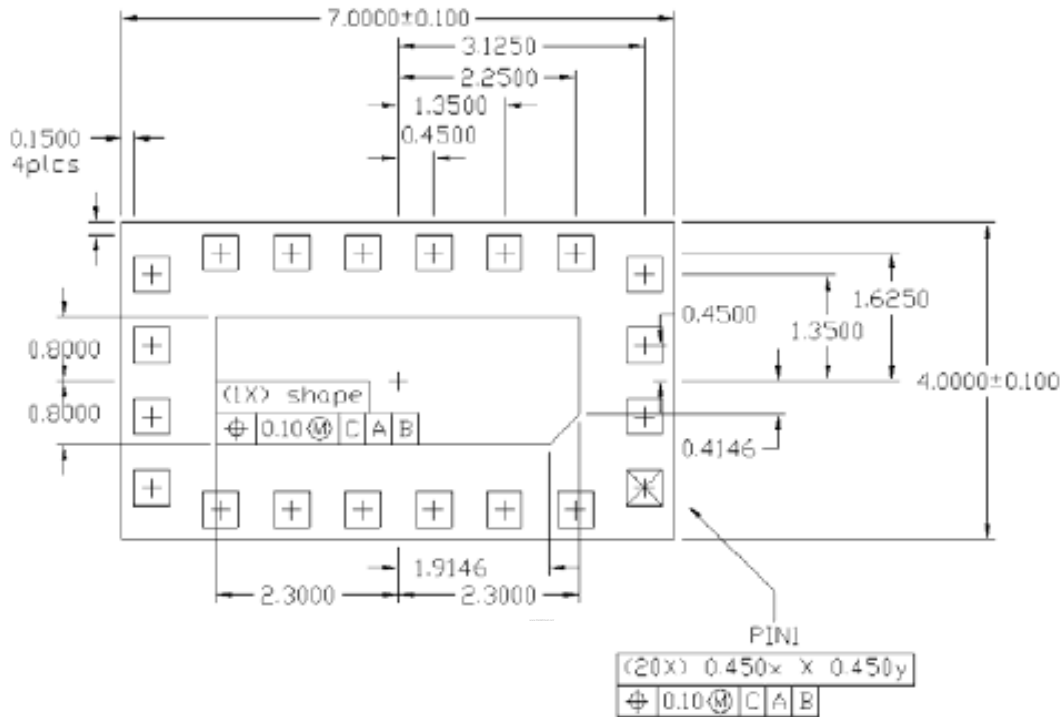
Recommended Reflow Profile

The TQM653029 is rated for 260°C reflow profile. Below is a general recommendation for 260°C reflow. The specific profile used will need to take into account the requirements of the board, other components, and the layout. The following recommendation should only be used as a guideline.

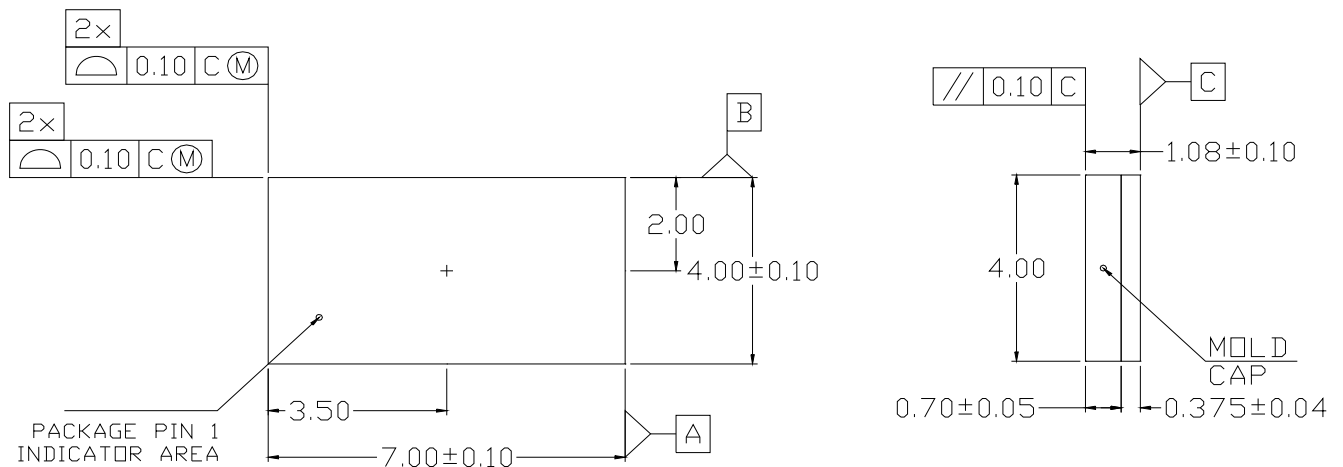


Tritium II PA-Duplexer Module™ CDMA AWS Band

Package Dimensions



Bottom View



Package Drawing

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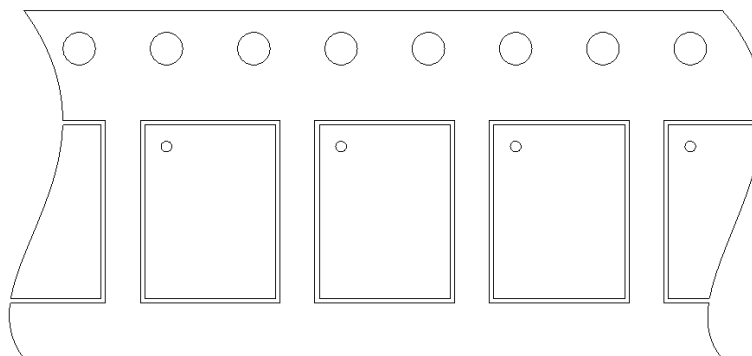
Package Marking

TOP MARK



- 1) Line 1: Product code = TQM653029
- 2) Line 2: Country Code = CCCC (USA = United States, PHIL = Philippines)
- 3) Line 3: AaXXXX-Z = Aa = Vendor code + XXXX = TriQuint Lot Number + Z = Sub lot # (1, 2, 3, ...)
- 4) Line 4: YYWW = Year and Work Week

Tape and Reel Specification:



MODULE 4x7 and 5x8
User Direction of Feed →

Carrier tape - 3M part # 3M053091, Ao = 4.55mm, Bo = 7.60mm, Ko = 1.73mm, width = 16mm, pitch = 8mm
Cover tape - 3M part # 2678 13.3mm wide

Note: Packaged quantity is 2,500 per reel

Shipment Box & Label Description:

Data Sheet

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Tritium II PA-Duplexer Module™ CDMA AWS Band

Tape & Reels will be packaged in a dry-pack bag and then in a shipment box. The box dimensions will depend on the number of reels shipped in each box and are noted in the table below. The box label and a description of each item on the label are also shown below.

13 Inch x16mm--Drypack		
Box Size	Reel Qty/Box	Empty Box Wt w/ Packing
15x15x7	3	2
18x15x11	5	2.36
17x16x17	9	2.76



Format: 4 * 6.5 in 102 * 166 mm Code 39 1:2	Ship From: TRIQUINT SEMICONDUCTOR, INC 2300 NE BROOKWOOD PARKWAY HILLSBORO, OR 97124	Ship To: Recipient Address Information Here
Supplier Code: 10 Character Max. + TQS Shipper Number. (Pkg. ID/Serial Number)	(3S) Pkg ID: 581+23047123 	
Customer Purchase Order. 20 Character Max.	(K) Trans ID: 812934657 	
Customer Part Number. 22 Character Max.	(P) CPN: 5871-2489 	
Quantity.	(Q) QTY: 20000 	
Supplier Product Number. 21 Character Max.	(1P) SPN: TQD777001 	
Box Count (1/3, 2/3, etc.)	(13Q) Pkg Count: 1/1 	
	MPN: 1005859	
	Package Weight 3.0 LB / 1.36 KG	

All Barcodes Contain Data Identifier Followed by Data, e.g. K812934657

Manufacturer's Part Number

Additional Information¹

¹ For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

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Tritium II PA-Duplexer Module™ CDMA AWS Band

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

This part is Halogen-Free.

The part is rated Moisture Sensitivity Level 3 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

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For technical questions and additional information on specific applications:

Email: info_wireless@tqs.com

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