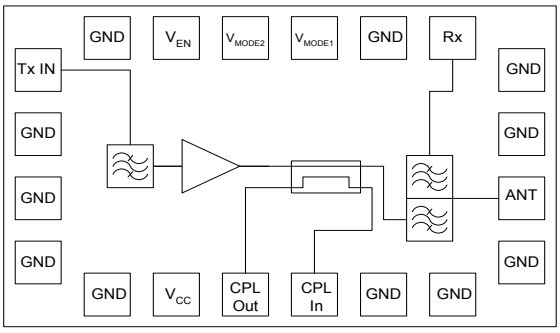
TQM613029

Data Sheet

Tritium II PA-Duplexer Module™ CDMA Cellular Band

Functional Block Diagram



Product Description

The TQM613029 is a fully matched CDMA cellular band PA-Duplexer module for use in mobile phones as 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 28mm^2, 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 25dBm the TQM613029 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 5mA 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=25ºC

Parameter	Typ	Units
Frequency	824 - 848	MHz
Max P_{OUT}	26	dBm
ACPR (±885kHz offset) at Max P_{OUT}	-50	dBc
ALTR (±1.98MHz offset) at Max P_{OUT}	-60	dBc
Current Consumption (at +25dBm Pout)	380	mA
Quiescent Current in LPM	5	mA
Leakage at Rx Port	-30	dBm
Rx Noise	-183	dBm/Hz

Absolute Maximum Ratings

Features

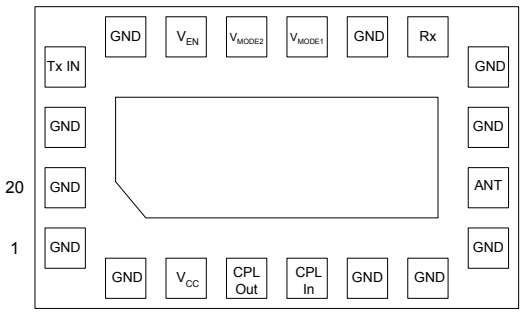
- Compact 7.0x4.0x1.1mm module replacing more than 12 discrete components
- Integrated duplexer, single-ended Tx filter, PA die, RF power coupler and matching
- Built-in voltage regulator functionality eliminating any external switch circuitry
- High efficiency three gain state PA for lowest overall current consumption
- Typical quiescent current values:
  - Low Power Mode (LPM) = 5mA
  - Medium Power Mode (MPM) = 20mA
  - High Power Mode (HPM) = 80mA
- Low Current Consumption
  - Typical: 380 mA @ +25dBm
  - Typical: 23 mA @ +8dBm
- Excellent ACPR
  - Typical: -50 dBc @ +/- 885kHz offset
- Excellent ALTR
  - Typical: -60 dBc @ +/- 1.98 MHz offset
- Lead-free 260°C RoHS Compliant
- Halogen Free (HF)

Applications

- IS-95/98/CDMA2000
- EVDO Rev A Compliant

Package Style

TOP VIEW (through package)



Tritium II PA-Duplexer Module™ CDMA Cellular Band

Symbol	Parameter	Absolute Maximum Value	Units
V_{CC}	Supply Voltage with no RF applied	+6.0	V
	Supply Voltage with RF applied	+4.7	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	Human Body Model (JESD22-A114) at ANT, Tx_{IN}, and Rx	±300	V
	Human Body Model (JESD22-A114) at all other ports	>±2000	V
	Machine Model (JESD22-A115) at ANT, Tx_{IN}, and Rx	±110	V
	Machine Model (JESD22-A115) at all other ports	±170	V

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	1.8		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	1.8		2.7	V
Control Line Current ($I_{CONTROL}$)	All control lines (source or sink 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
Case Temperature ($TEMP_{CASE}$)		-35		+95	°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 Cellular 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} < +14 dBm)	High	High	High	ON
Low Power Mode – LPM (-50 dBm < P_{OUT} < +8 dBm)	High	X	Low	ON

Tx to Antenna Port RF Electrical Characteristics[1]

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
RF Frequency		824.70	-	848.31	MHz
Maximum Output Power	HPM, V_{CC}=3.4 – 4.2V, 25ºC<T<60ºC	26	-	-	dBm
	MPM. V_{CC}=3.4 – 4.2V, 25ºC<T<60ºC	14	-	-	dBm
	LPM, V_{CC}=3.4 – 4.2V, 25ºC<T<60ºC	8	-	-	dBm
Maximum Input Power	HPM	7	-	-	dBm
	MPM	9	-	-	dBm
	LPM	9	-	-	dBm
Tx Gain	HPM	22	26	31	dB
	MPM	12	16	20	dB
	LPM	5	9	13	dB
Step Function Droop[2]	HPM, 25ºC, 25dBm, over 400ms	-	-	0.3	dB
Tx Gain in GPS Band		-	-	-44	dB
Gain Flatness vs Frequency	HPM	-	-	±2.0	dB
	MPM	-	-	±1.5	dB
	LPM	-	-	±1.5	dB
Gain Flatness vs Power	HPM	-	-	±2.0	dB
	MPM	-	-	±1.5	dB
	LPM	-	-	±1.5	dB
Tx VSWR	Tx in port	-	-	2.5:1	
Adjacent Channel Power	HPM, 3.8V, 26dBm, 25ºC	-	-50	-45	dBc
	HPM, 3.8V, 25dBm, 25ºC	-	-53	-48	dBc
	HPM, 3.4V, 25dBm, 70ºC	-	-50	-45	dBc
	MPM, 14dBm	-	-50	-45	dBc
	LPM, 8dBm	-	-50	-45	dBc
Alternate Channel Power	HPM, 3.8V, 26dBm, 25ºC	-	-59	-57	dBc
	HPM, 3.8V, 25dBm, 25ºC	-	-59	-57	dBc
	HPM, 3.4V, 25dBm, 70ºC	-	-59	-57	dBc
	MPM, 14dBm	-	-59	-57	dBc
	LPM, 8dBm	-	-59	-57	dBc
Power Efficiency	HPM, 3.4V, 25ºC, 25dBm	-	22	-	%

Tritium II PA-Duplexer Module™ CDMA Cellular Band

Tx to Antenna Port RF Electrical Characteristics[1] (cont.)

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
BC0 Tx Noise in BC0 Rx Band	HPM, N_{IN} at Ant port = -135dBm/Hz	-	-182	-179	dBm/Hz
	MPM, N_{IN} at Ant port = -135 – (HP_{MAX} – MP_{MAX}) dBm/Hz	-	-	-179	dBm/Hz
	LPM, N_{IN} at Ant port = -135 – (HP_{MAX} – LP_{MAX}) dBm/Hz	-	-	-179	dBm/Hz
Tx Noise in GPS Band	N_{IN} at Ant port = -135 dBm/Hz	-	-172	-	dBm/Hz
Harmonics		-	-	-45	dBc
Stability (all spurious)	Load VSWR = 10:1 @ all angles	-	-	-90	dBc
Ruggedness	HPM, Load VSWR = 10:1 @ all angles, No Damage		26dBm		
	MPM, Load VSWR = 10:1 @ all angles, No Damage		14dBm		
	LPM, Load VSWR = 10:1 @ all angles, No Damage		8dBm		
Current Draw	HPM, 3.8V, 25ºC, 25dBm	-	380	-	mA
CDG Current[3]	V_{CC} = 3.8V, 25ºC	-	-	45	mA
PA Switching Time: Rise / Fall[4]	0dB < P_{OUT} < 5dBm	-	-	6.0	µs
Code Domain Power[5]	25ºC < T < 60ºC	23	-	-	dB
Code Channel Reverse Plot Power	HPM, 5.5dBm P_{OUT}, R-FCH to R-Pilot @ 9600 rate	3.50	-	4.00	
Accuracy	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	HPM, 5.5dBm P_{OUT}, R-FCH to R-Pilot @ 19.2K rate	3.250	-	3.750	
Accuracy	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 to the module shall not exceed 250ns
Note 3: Total current integrated across CDMA suburban CDG curve.
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.

Tritium II PA-Duplexer Module™ CDMA Cellular Band

Rx to Antenna Port RF Electrical Characteristics

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency		869	-	894	MHz
Insertion Loss	869 – 894 MHz, -30ºC < T < 85ºC	-	2.6	3.5	dB
Rx VSWR	ANT and Rx ports	-	-	2.5:1	
Attenuation	BCO Tx 824-849 MHz	45	-	-	dB
	BC1 Tx 1850-1910 MHz	35	-	-	dB
	ISM Tx 2400-2484 MHz	35	-	-	dB
	Rx 2nd Harmonic 1738-1788MHz	30	-	-	dB
	Rx 3rd Harmonic 2607-2682 MHz	30	-	-	dB
	Rx 4th Harmonic 3476-3576 MHz	20	-	-	

Tx to Rx Port RF Electrical Characteristics

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Tx Leakage	25.5 dBm, 3.8V, 25ºC < T < 60ºC	-	-32	-27	dBm

Coupled Port RF Electrical Characteristics

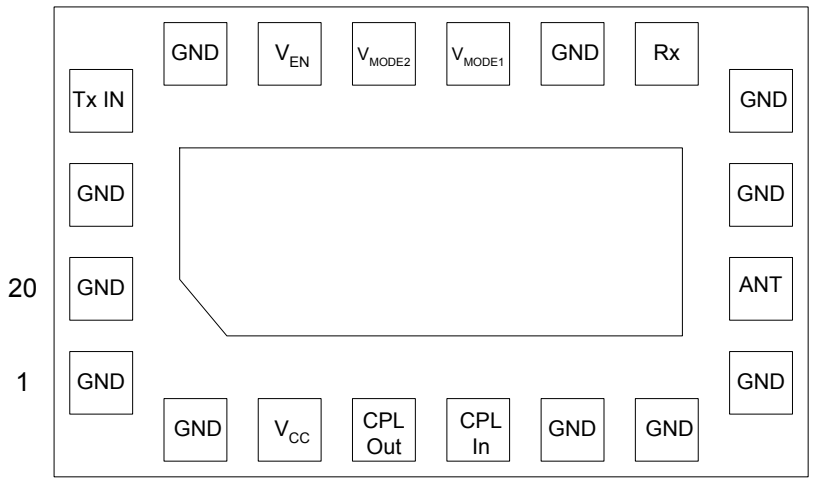
Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Tx Power at Coupled Port	Over freq relative to P_{OUT}, 16dBm < P_{OUT} < 26dBm, CPL_IN = 50Ω, 25ºC< <55ºC	-24	-21	-19	dBc
Coupler Loss	CPLin to CPLout	-	-	2.0	dBm
Output Impedance		-	50	-	Ω
VSWR	HPM, Coupled Port	-	-	2.0:1	
Variation in Delivered Power[1]	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, -30ºC < T < 85ºC	-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 Cellular Band

Pin Out and Assignments

TOP VIEW (through package)

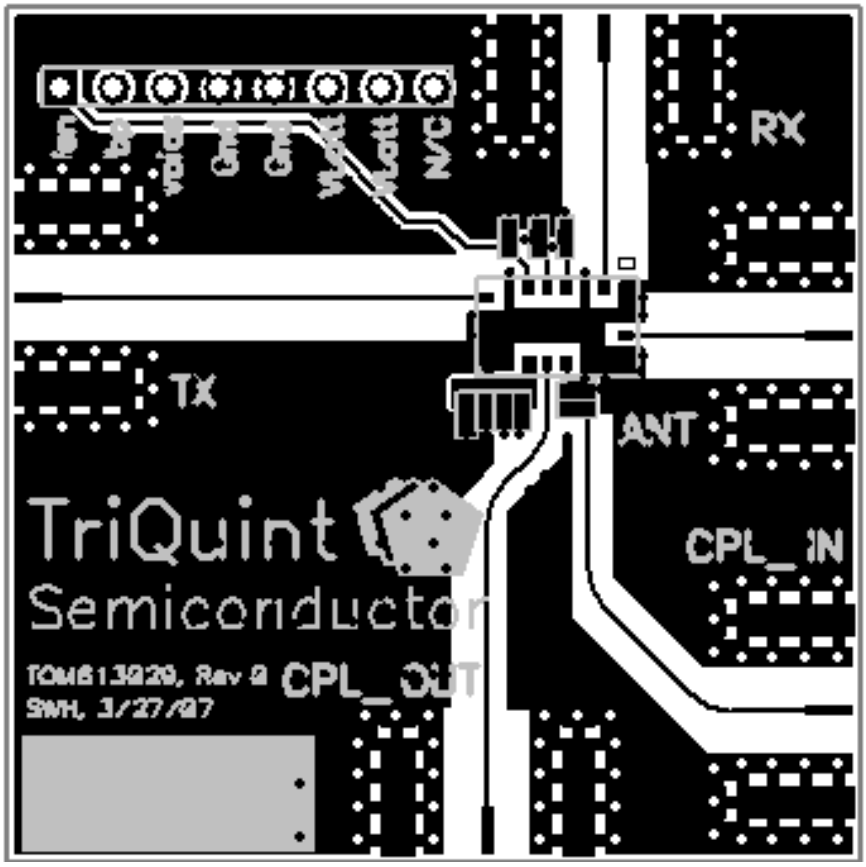


Pin	Symbol	Description
1	GND	Ground
2	GND	Ground
3	V_{CC}	Supply Voltage
4	CPLout	Directional Coupler Out
5	CPLin	Directional Coupler In (Coupler Termination Port)
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	ANT	Duplexer ANT Port
10	GND	Ground
11	GND	Ground
12	Rx	Duplexer Rx Output Port
13	GND	Ground
14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

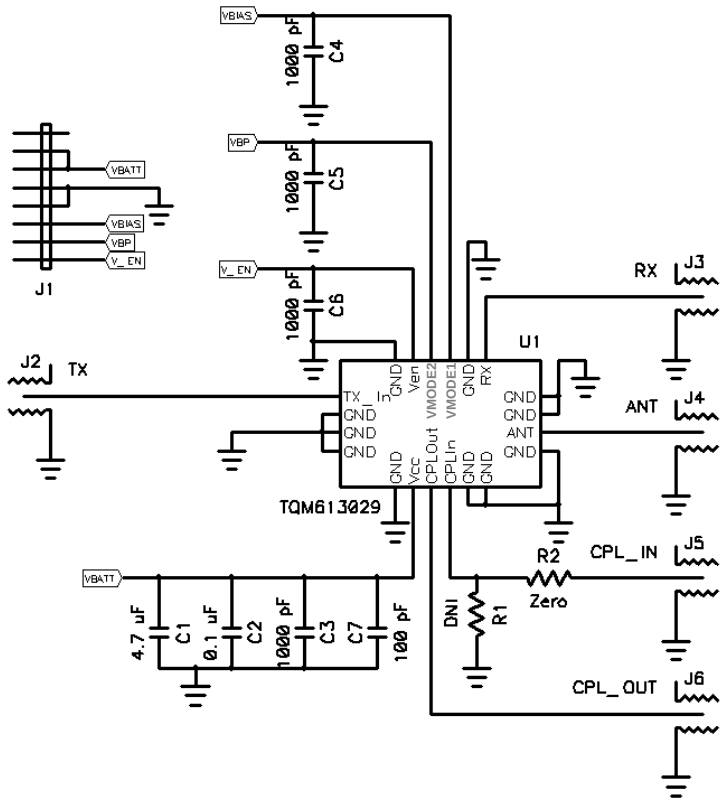
Tritium II PA-Duplexer Module™ CDMA Cellular Band

Applications information; tuning procedures; board layout precautions

TriQuint offers our customers the below evaluation board as a means for testing and analysis of the TQM613029. 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 Cellular Band

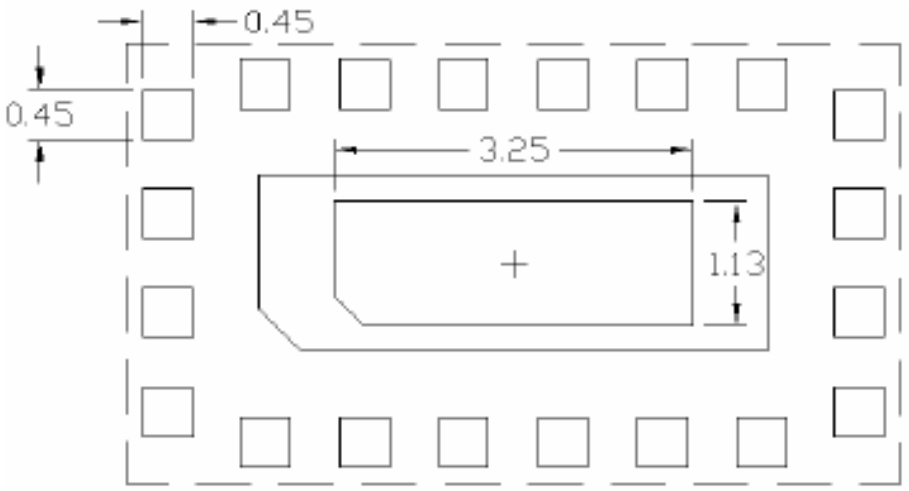


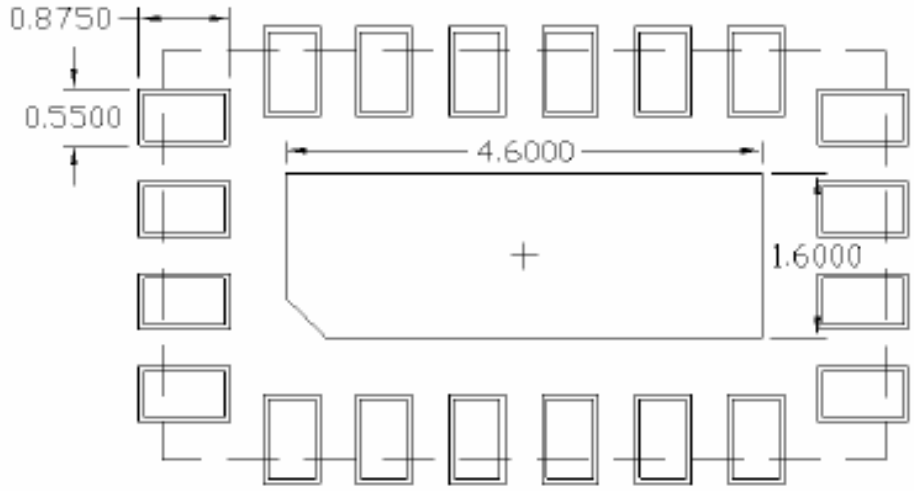
Applications Information: Power Up/Down Sequences

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_{MODE1}= 0V
5	RF	Apply RF	5	V_{CC}	Remove Battery Voltage

Tritium II PA-Duplexer Module™ CDMA Cellular Band

PC Board Layout recommendations

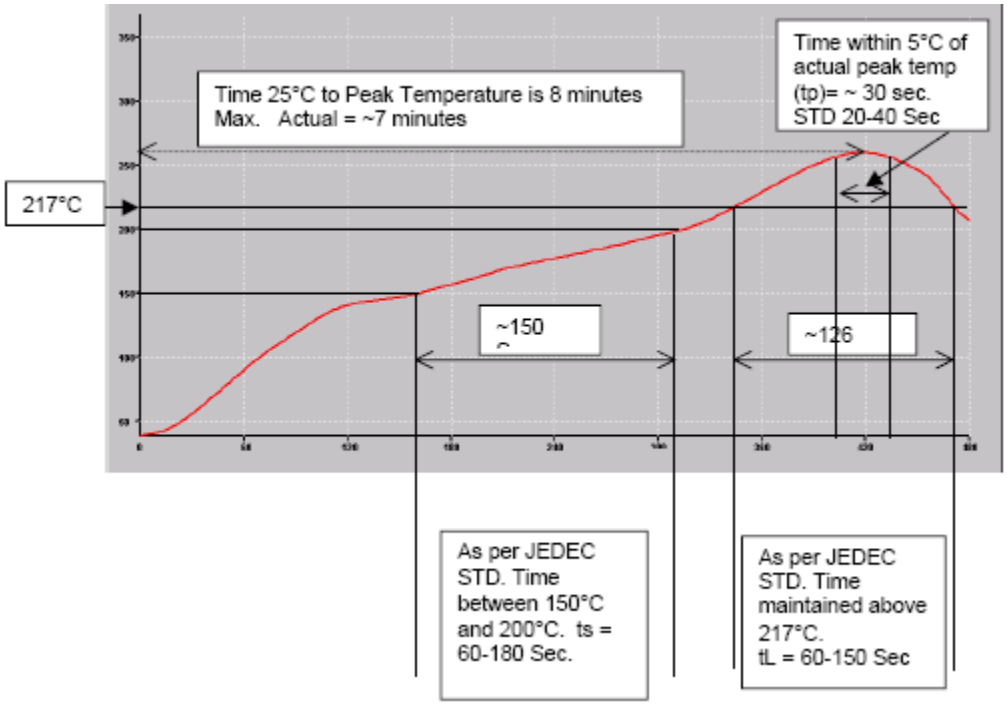




Tritium II PA-Duplexer Module™ CDMA Cellular Band

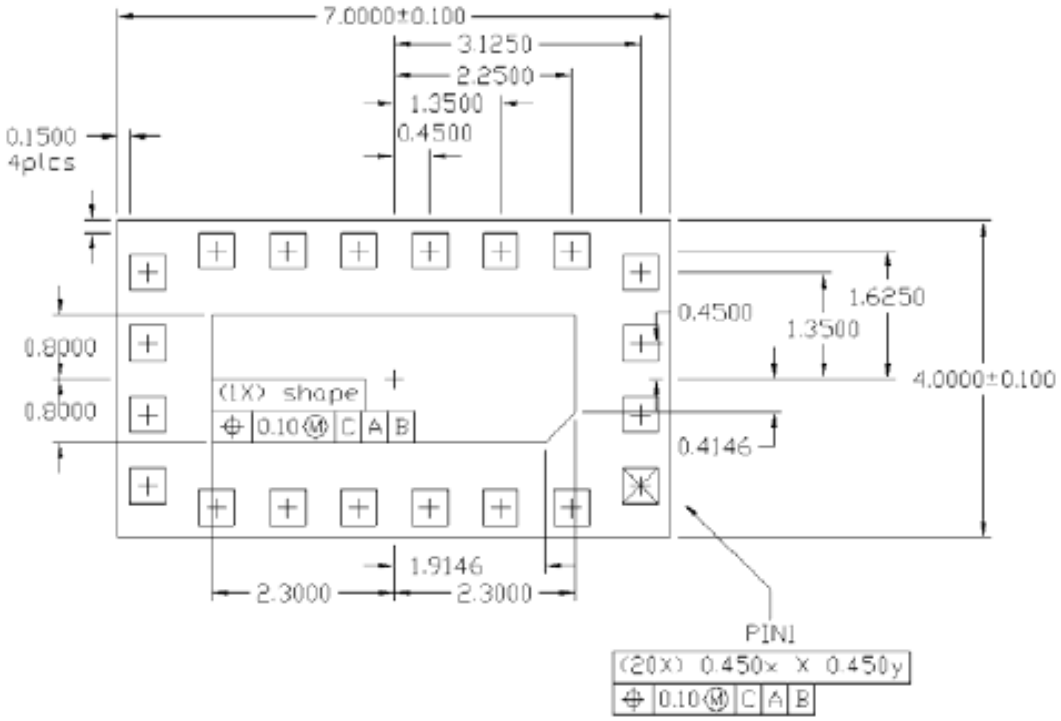
Recommended Reflow Profile

The TQM613029 is rated for 260ºC reflow profile. Below is a general recommendation for 260ºC 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.

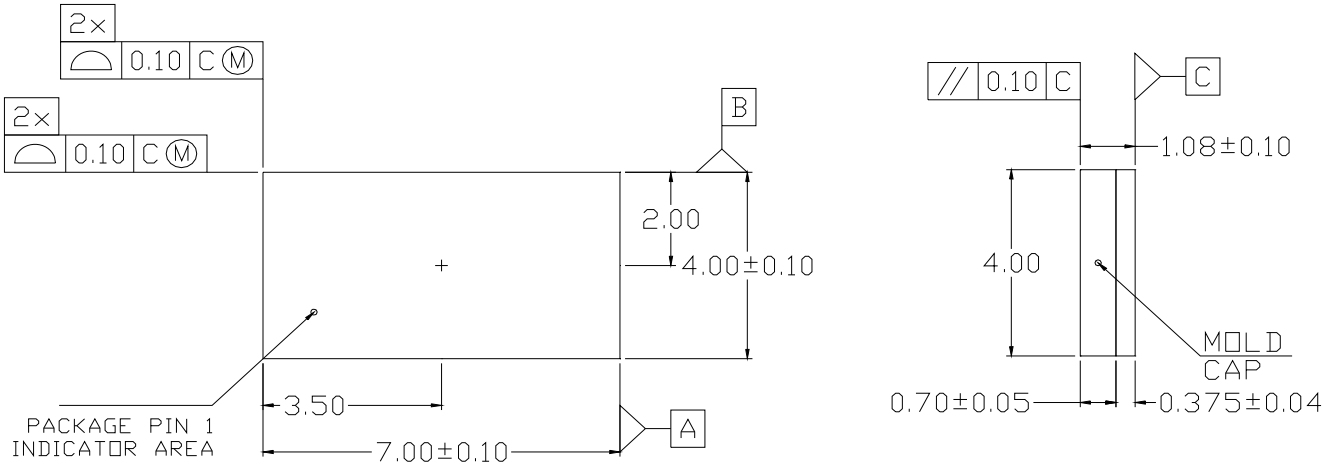


Tritium II PA-Duplexer Module™ CDMA Cellular Band

Package Dimensions



Bottom View



Package Drawing

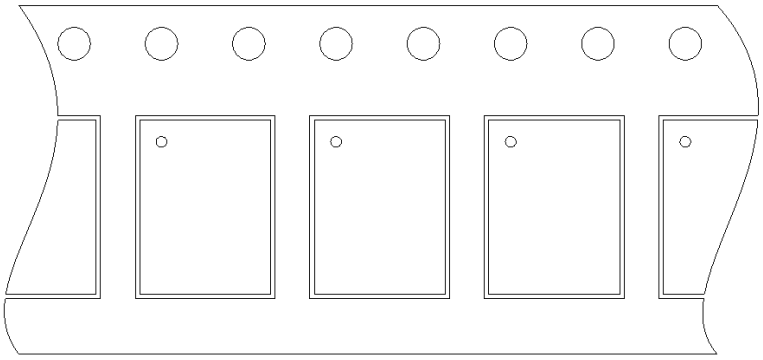
Tritium II PA-Duplexer Module™ CDMA Cellular Band

Package Marking

TOP MARK

1) Line 1: Product code = TQM613029
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

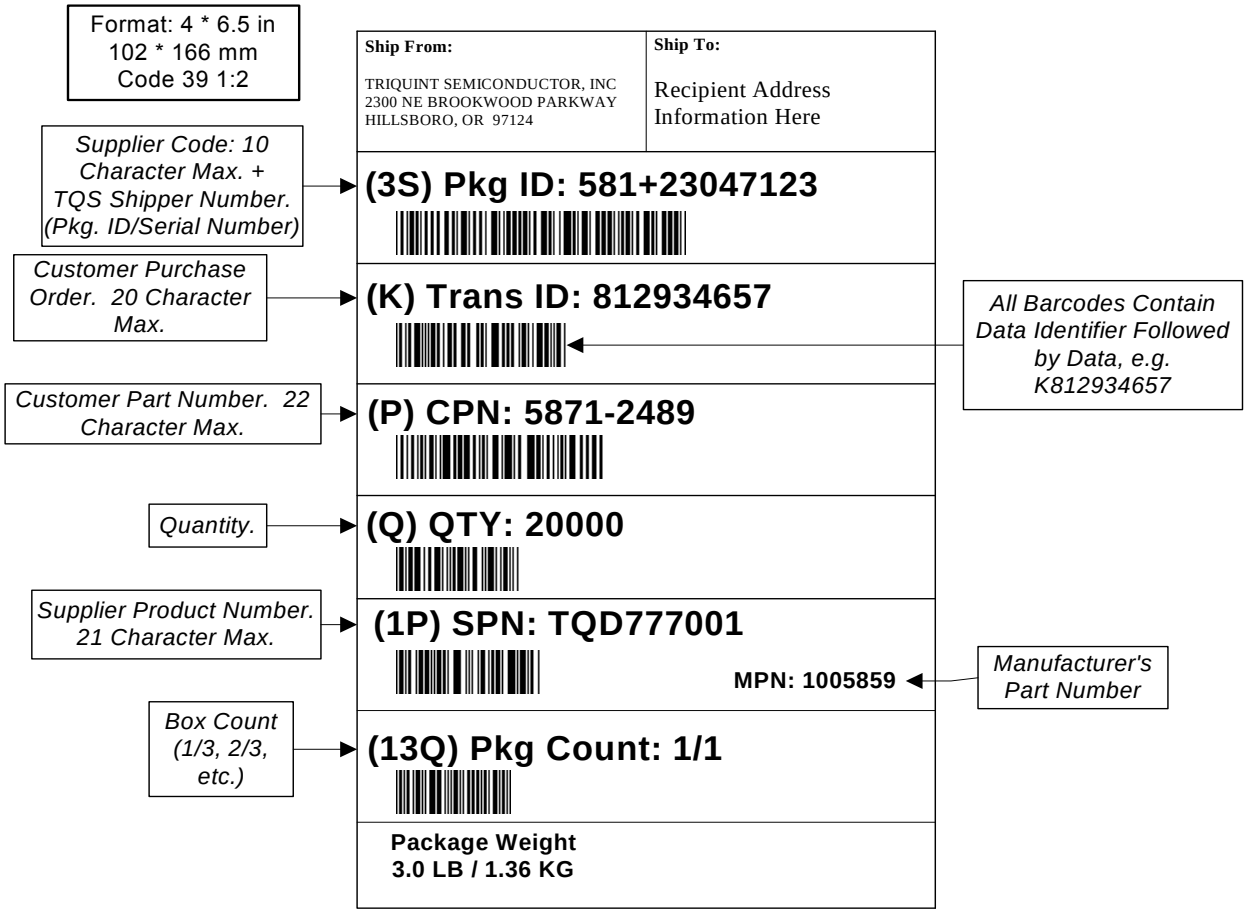
Note: Packaged quantity is 2,500 per reel

Tritium II PA-Duplexer Module™ CDMA Cellular Band

Shipment Box & Label Description:

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



Tritium II PA-Duplexer Module™ CDMA Cellular Band

Additional Information [1]

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

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

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

Web: www.triquint.com Tel: (503) 615-9000

Email: info_wireless@tqs.com Fax: (503) 615-8902

For technical questions and additional information on specific applications:

Email: info_wireless@tqs.com