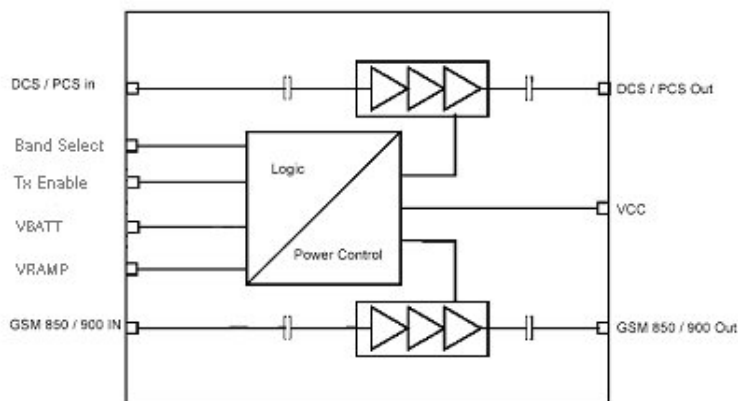


Quad-Band GSM/EDGE Polar Power Amplifier Module

Functional Block Diagram



Product Description

The TQM7M5003 is a small (7x7mm), GSM/EDGE PAM for handset applications. This module has been optimized for excellent EDGE efficiency, ACPR and EVM in an open loop polar modulation environment at EDGE class E2+ operation while maintaining high GSM/GPRS efficiency. The TQM7M5003 is fan-out compatible with TriQuint's other power amplifier modules.

High reliability is assured by utilizing TriQuint's 3rd generation InGaP HBT technology and by TriQuint's proven module design techniques.

Electrical Specifications

Parameter	850 Band			900 Band			DCS Band			PCS Band		
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
GSM Pout	34.5	35		34.5	35		32	33		32	33	
Efficiency	43	51		50	56		42	50		45	53	
Pin	0	3	6	0	3	6	0	3	6	0	3	6
EDGE Pout		29			29			28			28	
Efficiency	19	23		20	24		22	25		26	29	
ACPR (400KHz)			-58			-58			-58			-58
Pin	0	3	6	0	3	6	0	3	6	0	3	6

Features

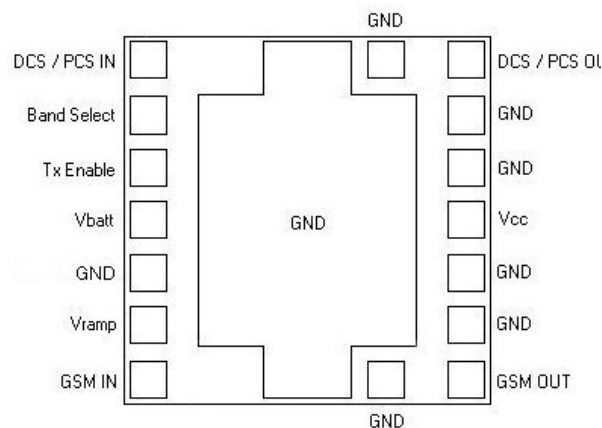
- GSM/EDGE Multi-Mode Capability
- Optimized for Operation with Qualcomm's Multi-mode Chip Sets
- - 38dB Typical ACPR (200KHz)
- - 66dB Typical ACPR (400 KHz)
- - 76dB Typical ACPR (600 KHz)
- 1% Typical EVM rms
- > 50dB Typical Dynamic Range
- GPRS Class 12
- Internally Matched Input and Output
- RoHS compliant, MSL3 260C

Applications

- GSM/EDGE Handsets
- GSM/EDGE Wireless Cards and Data Links

Package Style

Package Size: LGA 7 x 7 x 1.1 mm
Top View



Quad-Band GSM/EDGE Polar Power Amplifier Module

Absolute Maximum Ratings

Symbol	Parameter	Absolute Maximum Value	Units
V _{BATT}	Positive Supply Voltage	-0.5 to +5.5	VDC
V _{RAMP}	Power Control Voltage	-0.3 to +2.5	VDC
δ	Duty Cycle at Maximum Power	50	%
T _{STG}	Storage Temperature	-55 to +150	°C
T _C	Operating Case Temperature	-30 to +85	°C
P _I	Maximum Input Power	+11.5	dBm

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

Operating Parameters

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Supply Voltage, V _{BATT}		3.0	3.5	4.8	V _{dc}
Transmit Enable, TX_EN Voltage	Logic High	1.25		3	V
	Logic Low	-0.2		0.4	V
Transmit Enable, TX_EN Current	Logic High			10	μA
	Logic Low			1	μA
Band Select Voltage	Logic High: DCS	1.25		3	V
	Logic Low: GSM	-0.2		0.4	V
Band Select Current- DCS/GSM	High/Low			10	μA
Leakage Current TX_EN Low	V _{ramp} = 0.2V; T = -25°C, +85°C		5	15	μA
Input and Output Load Impedance			50		Ω
V _{ramp} MIN			0	0.25	V
V _{ramp}		0		1.6	V
V _{ramp} Input Current	V _{ramp} = 0.2V, 1.6V			10	μA
Operating Case Temperature		-25		+85	°C

Quad-Band GSM/EDGE Polar Power Amplifier Module

Low Band General Characteristics

Standard Conditions: BS = L, V_{BATT} = 3.5V, V_{RAMP} = 1.6V, P_{IN} = 3 dBm, TX_EN = H, T_C = 25°C, Duty Cycle = 25%

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Input VSWR				2.5:1	
Stability	All Spurs < -36dBm; T _C = 25°C	8:1			
Ruggedness	No Permanent Damage to Device, T _C = 25°C	10:1			
Continuous operations	No Permanent Damage under forced 3.0A continuous operations for ≥30min (P _{out} cal in 50Ω = 35.0dBm)	6:1			
Harmonics					
2fo			-20	-10	dBm
3fo, 4fo			-25	-10	dBm
5fo – 8fo				-15	dBm
Rx Band Noise	Standard Conditions (except Pin=2dBm, Duty Cycle=12.5%)				
869 ≤ f ≤ 894 MHz			-84.5	-82.5	dBm
925 < f < 935 MHz			-77	-74	dBm
935 ≤ f ≤ 960 MHz			-84.5	-82.5	dBm
Cross Band Isolation (power at DCS when EGSM is active)	BS = L; 1710 ≤ f ≤ 1785 MHz		-25		dBm
Off Isolation 1	TX_EN = L		-35	-30	dBm
Off Isolation 2	TX_EN = H; V _{RAMP} = 0.23V		-16		dBm
Power Control Range			51		dB
TX_EN Switching Time				2	μS
Rise Time	from P _{OUT} = -30dBm to P _{OUT} = P _{MAX}			1	μS
Fall Time	from P _{OUT} = -30dBm to P _{OUT} = P _{MAX}			1	μS
ESD					
CDM per JESD22-C101		500			V
HBM per JESD22-A114-B		500			V
I _{BATT}	V _{ramp} =1.6V		1.8	2.3	A

Quad-Band GSM/EDGE Polar Power Amplifier Module

Low Band GMSK Characteristics

Standard Conditions: BS = L, V_{BATT} = 3.5V, V_{RAMP} = 1.6V, P_{IN} = 3 dBm, TX_EN = H, T_C = 25°C, Duty Cycle = 25%

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency Range- f		824		849	MHz
		880		915	MHz
Input Power for P _{out} max.- P _{IN}		0	3	6	dBm
Output Power- P _{OUT}		34.5	35		dBm
Output Power Degradation	V _{BATT} = 3.0V, P _{IN} = P _{IN MIN} , T _{MIN} < T _C < T _{MAX}	32.5			dBm
Power Added Efficiency- η	824 – 849 MHz, P _{OUT} = P _{OUT MAX}	43	51		%
	880 – 915 MHz, P _{OUT} = P _{OUT MAX}	50	56		%

Low Band 8PSK Characteristics

Standard Conditions: BS = L, V_{BATT} = 3.5V, V_{RAMP} = 1.6V, P_{IN} = 3 dBm, TX_EN = H, T_C = 25°C, Duty Cycle = 25%

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency Range- f		824		849	MHz
		880		915	MHz
Input Power for P _{out} max.- P _{IN}		0	3	6	dBm
Power Added Efficiency- η	824 – 849 MHz, V _{RAMP} adjusted for P _{OUT} = 29dBm	19	23		%
	880 – 915 MHz, V _{RAMP} adjusted for P _{OUT} = 29dBm	20	24		%
ACPR	In TriQuint EDGE Polar Emulator;				
200 kHz	P _{OUT} = 29dBm			-34	dBc/30kHz
400 kHz				-58	dBc/30kHz
600 kHz				-64	dBc/30kHz
1800 kHz				-68	dBc/100kHz
EVM rms	In TriQuint EDGE Polar Emulator		1	5	%

Quad-Band GSM/EDGE Polar Power Amplifier Module

High Band General Characteristics

Standard Conditions: BS = H, V_{BATT} = 3.5V, V_{RAMP} = 1.6V, P_{IN} = 3 dBm, TX_EN = H, T_C = 25°C, Duty Cycle = 25%

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Input VSWR				2.5:1	
Stability	All Spurs < -36dBm; T = 25°C	8:1			
Ruggedness	No Permanent Damage to Device. T = 25°C	10:1			
Harmonics					
2fo			-20	-10	dBm
3fo			-25	-10	dBm
4fo – 8fo				-10	dBm
Rx Band Noise	Standard Conditions (except Pin=2dBm, Duty Cycle=12.5%)				
1805 – 1880 MHz			-82	-77	dBm
1930 – 1990 MHz			-82	-77	dBm
Off Isolation 1	TX_EN = L		-35	-30	dBm
Off Isolation 2	TX_EN = H; V _{RAMP} = 0.23V		-20		
Power Control Range			53		dB
TX_EN Switching Time				2	μs
Rise Time	(from P _{OUT} = -30dBm to P _{OUT} = P _{MAX})			1	μs
Fall Time	(from P _{OUT} = -30dBm to P _{OUT} = P _{MAX})			1	μs
ESD					
CDM per JESD22-C101		500			V
HBM per JESD22-A114-B		500			V
I _{BATT}	V _{ramp} =1.6V		1.1	1.7	A

Quad-Band GSM/EDGE Polar Power Amplifier Module

High Band GMSK Mode Characteristics

Standard Conditions: BS = H, V_{BATT} = 3.5V, V_{RAMP} = 1.6V, P_{IN} = 3 dBm, TX_EN = H, T_C = 25°C, Duty Cycle = 25%

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency Range- f		1710		1785	MHz
		1850		1910	MHz
Input Power for Pout max.- P _{IN}		0	3	6	dBm
Output Power- P _{OUT}		32	33		dBm
Output Power Degradation	V _{BATT} = 3.0V, P _{IN} = P _{IN MIN} , T _{MIN} < T _C < T _{MAX}	30			dBm
Power Added Efficiency- η	1710 – 1785 MHz, P _{OUT} = P _{OUT MAX}	42	50		%
	1850 – 1910 MHz, P _{OUT} = P _{OUT MAX}	45	53		%

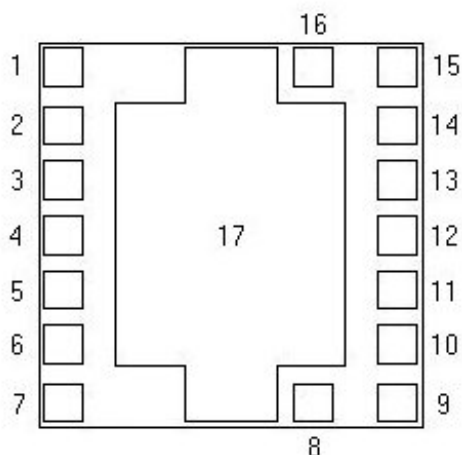
High Band 8PSK Characteristics

Standard Conditions: BS = H, V_{BATT} = 3.5V, V_{RAMP} = 1.6V, P_{IN} = 3 dBm, TX_EN = H, T_C = 25°C, Duty Cycle = 25%

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency Range- f		1710		1785	MHz
		1850		1910	MHz
Input Power for Pout max.- P _{IN}		0	3	6	dBm
Power Added Efficiency- η	1710 – 1785 MHz, V _{RAMP} adjusted for P _{OUT} = 28dBm	22	25		%
	1850 – 1910 MHz, V _{RAMP} adjusted for P _{OUT} = 28dBm	26	29		%
ACPR	In TriQuint EDGE Polar Emulator;				
200 kHz	P _{OUT} = 28dBm			-34	dBc/30kHz
400 kHz				-58	dBc/30kHz
600 kHz				-64	dBc/30kHz
1800 kHz				-68	dBc/100kHz
EVM	In TriQuint EDGE Polar Emulator		1	5	%

Quad-Band GSM/EDGE Polar Power Amplifier Module

Pin-Out Diagram



Pin Descriptions

Pin #	Description	Function
1	DCS / PCS In	DCS / PCS RF input
2	Band Select	Band Select Pin (Low -> Low-Band mode active; High -> High-Band mode active)
3	Tx Enable	Digital Transmit Enable Signal. When activated (TX_EN = high), all bands of the PA will be enabled for operation.
4	Vbatt	Battery supply voltage
5	GND	Ground
6	Vramp	DAC Control Signal for output power setting, nominal 0.2 .. 1.6 V
7	GSM In	GSM RF Input
9	GSM Out	GSM RF Output
12	Vcc	Internal Voltage – no external connection
15	DCS / PCS Out	DCS / PCS RF output
8, 10, 11, 13, 14, 16, 17	GND	Ground

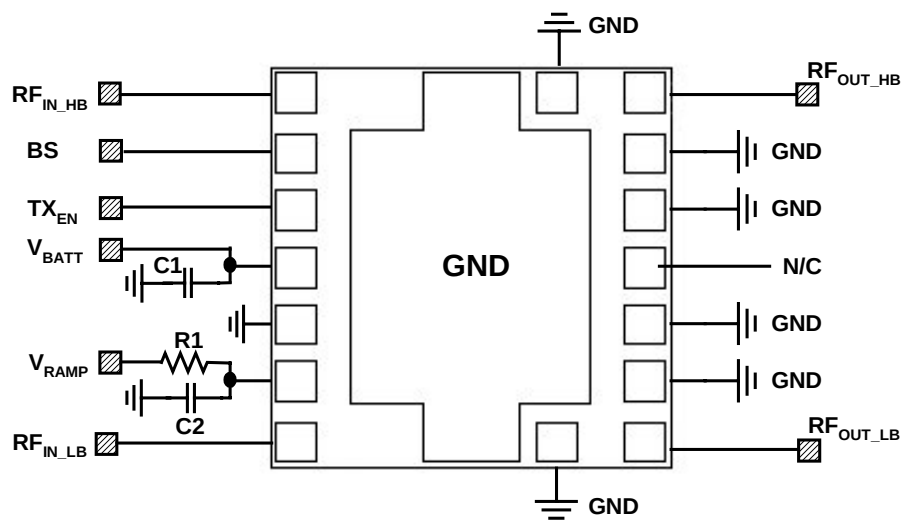
Quad-Band GSM/EDGE Polar Power Amplifier Module

Logic Table

Operating Mode	Band Select	Tx Enable	Vramp
GMSK, High Band	High	High - Enabled	0.2 to 1.6 VDC
		Low - Disabled	
GMSK, Low Band	Low	High - Enabled	0.2 to 1.6 VDC
		Low - Disabled	
EDGE, Low Band	Low	High - Enabled	0.2 to 1.6 VDC
		Low - Disabled	
EDGE, High Band	High	High - Enabled	0.2 to 1.6 VDC
		Low - Disabled	
PA Off	X	Low	X
X-Don't Care			

Quad-Band GSM/EDGE Polar Power Amplifier Module

Typical Application / Test Circuit



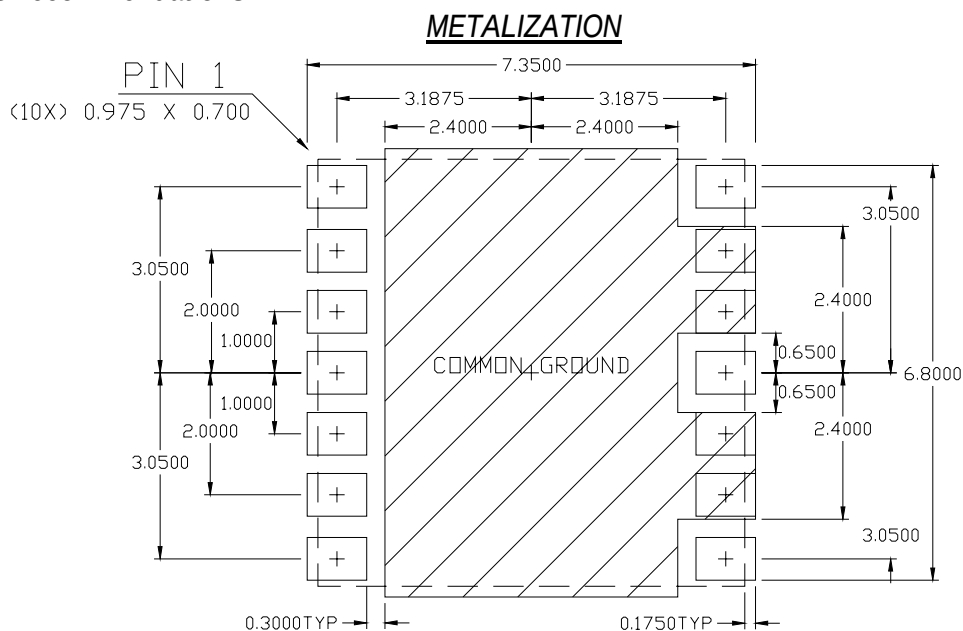
Bill of Material for TQM7M5003 Power Amplifier Module Application/Test Circuit¹

Component	Reference Designator	Part Number	Value	Size
Power Amplifier Module		TQM7M5003		17pin/7mm square
Capacitor	C1		220μF	1210
Resistor	R1		None	0402
Capacitor	C2		None	0402

Note 1: May vary due to printed circuit board layout and material

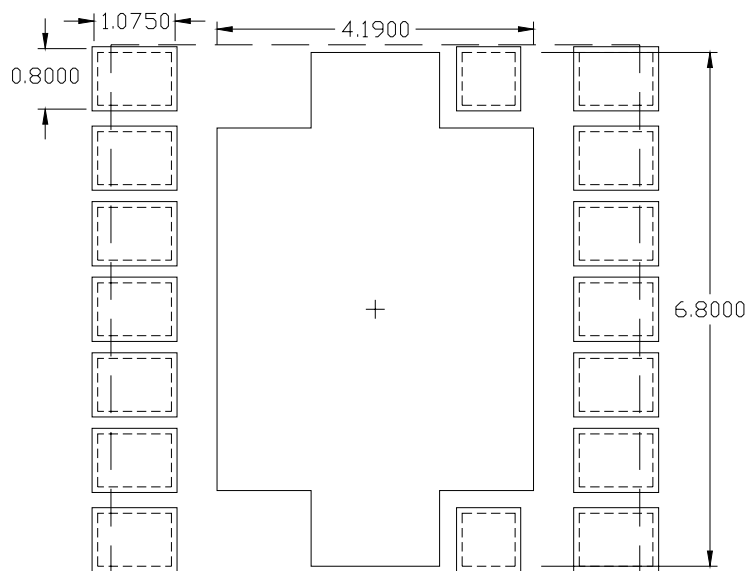
Quad-Band GSM/EDGE Polar Power Amplifier Module

PC Board Layout Recommendations



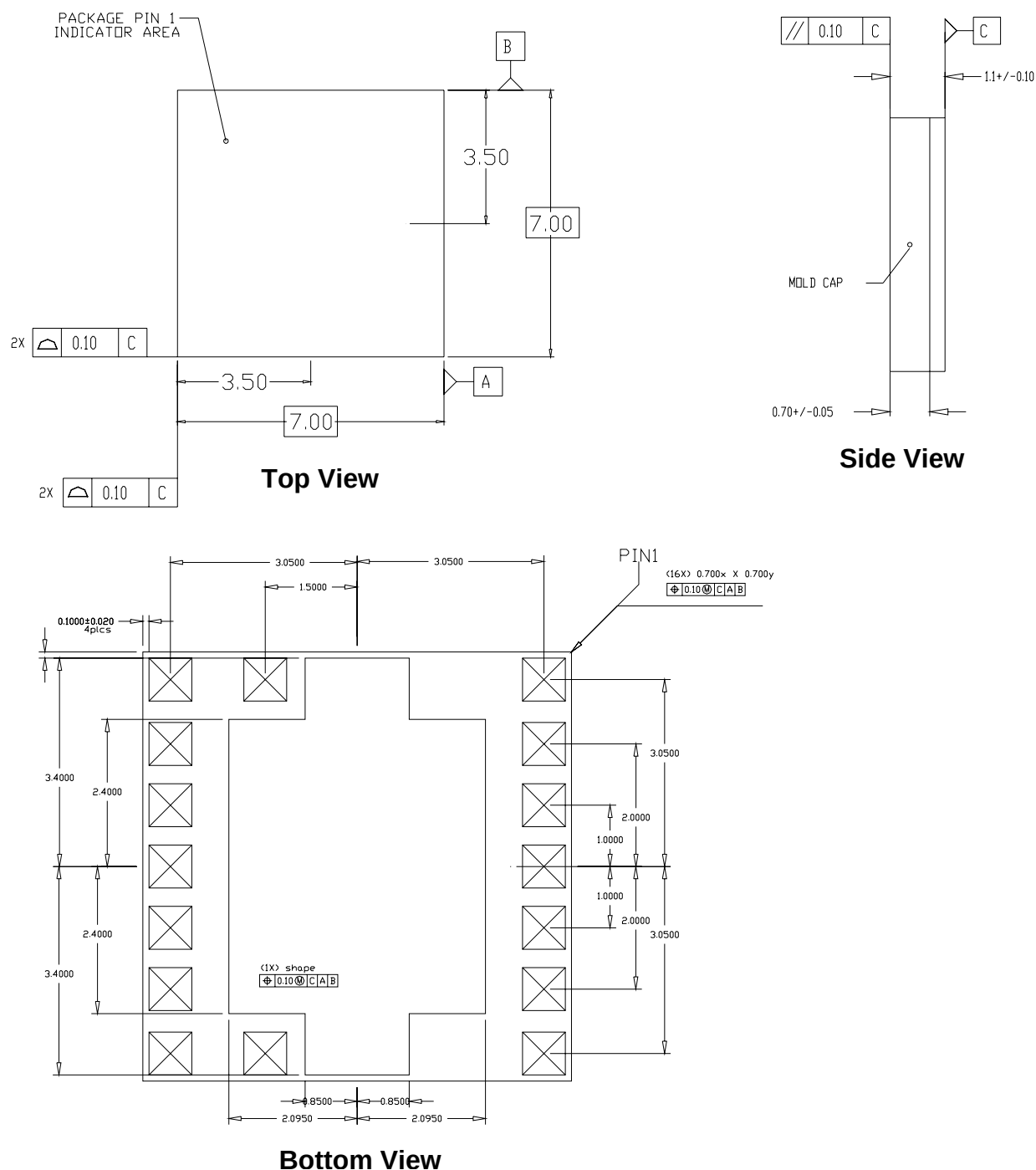
SOLDERMASK

Oversize pads 50um (2 MIL) per side
Center ground is 100% of exposed module plane



Quad-Band GSM/EDGE Polar Power Amplifier Module

Package Dimensional Drawings



Data Sheet: Subject to change without notice

For additional information and latest specifications, see our website: www.triquint.com

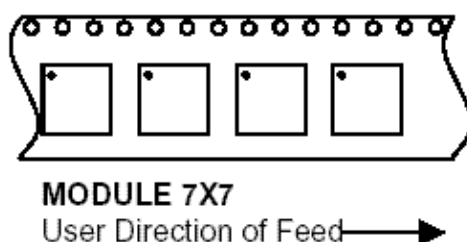
Revision J – July 28, 2006

Quad-Band GSM/EDGE Polar Power Amplifier Module

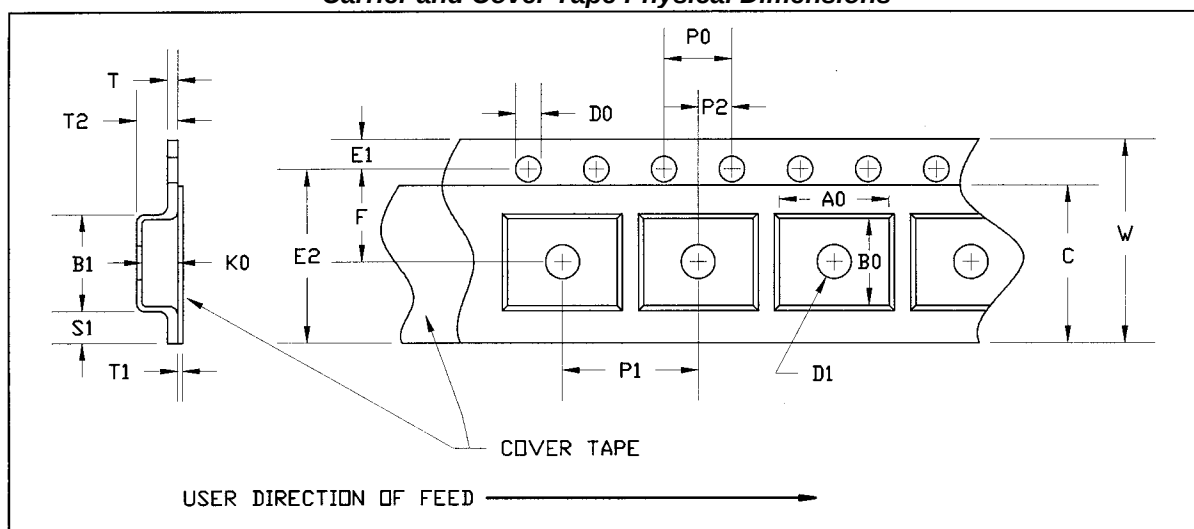
Tape and Reel*

*Provided as informational only. Please request TriQuint PKG.075 for controlling documentation.

Module Orientation



Carrier and Cover Tape Physical Dimensions



FIXED CARRIER AND COVER TAPE DIMENSIONS

PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
CAVITY	BOTTOM HOLE DIAMETER	D1	0.059	1.50
PERFORATION	DIAMETER	D0	0.059	1.50
	PITCH	P0	0.157	4.00
	POSITION	E1	0.069	1.75
CARRIER TAPE	THICKNESS	T	0.012	0.30
COVER TAPE	THICKNESS	T1	0.002	0.056

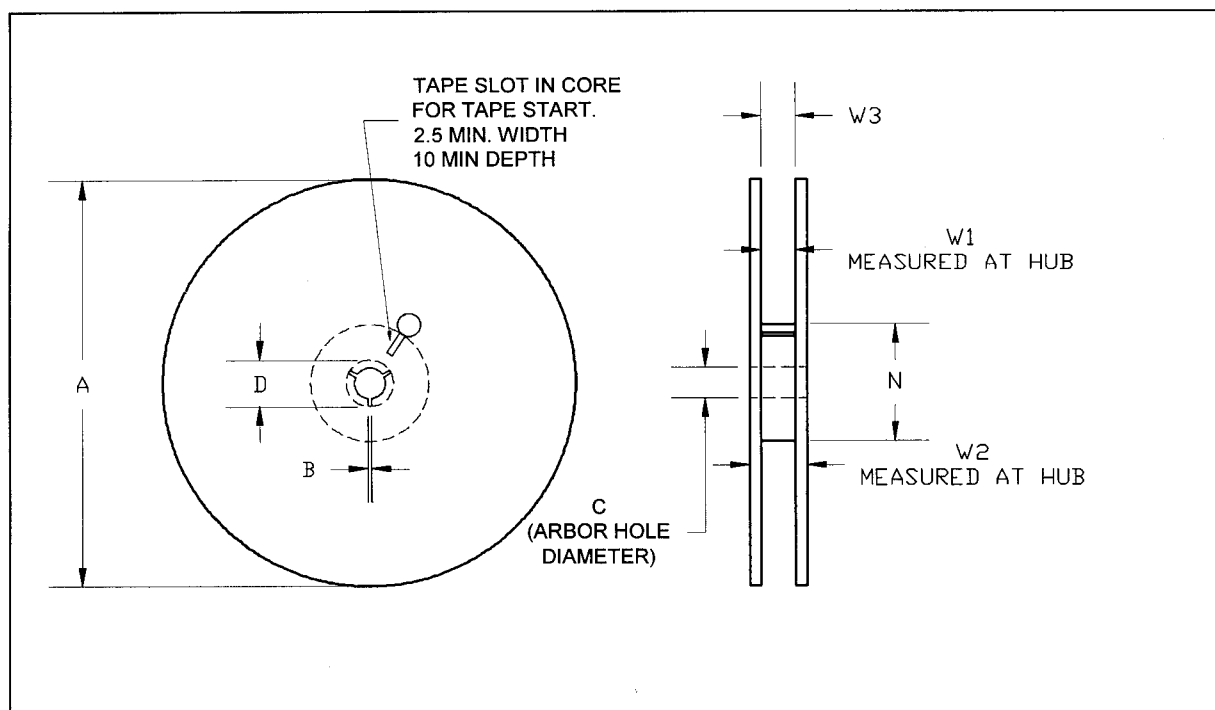
Quad-Band GSM/EDGE Polar Power Amplifier Module

Tape and Reel (continued)

MODULE -7X7 CARRIER AND COVER TAPE DIMENSIONS

PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
CAVITY	LENGTH	A0	0.291	7.4
	WIDTH	B0	0.291	7.4
	DEPTH	K0	0.079	2.0
	PITCH	P1	0.472	12.00
DISTANCE BETWEEN CENTERLINE	CAVITY TO PERFORATION LENGTH DIRECTION	P2	0.079	2.00
	CAVITY TO PERFORATION WIDTH DIRECTION	F	0.295	7.50
COVER TAPE	WIDTH	C	0.524	13.30
CARRIER TAPE	WIDTH	W	0.630	16.00

Reel Physical Dimensions



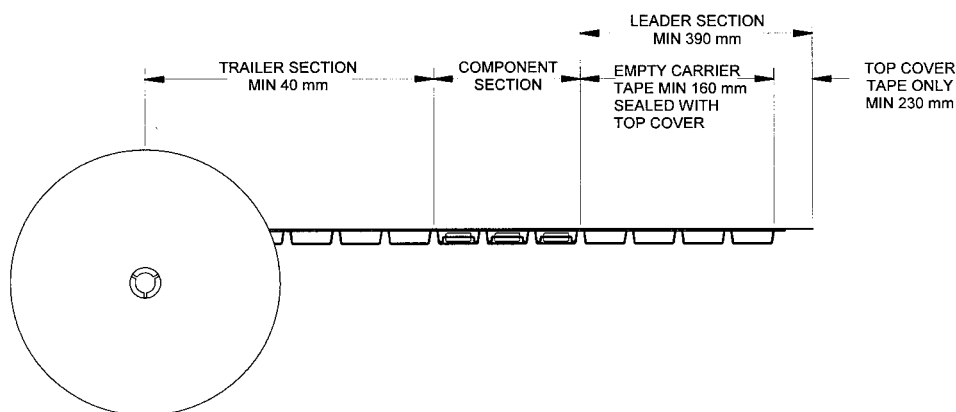
Quad-Band GSM/EDGE Polar Power Amplifier Module

Tape and Reel (continued)

Reel Dimensions for 16mm Carrier Tape

SOIC-14, SOIC-16 BATWING, QSOP 24, SSOP-24, TSSOP-20, TSSOP-28 and HP VFQFP-N 7x7 and SOT 223. Modules 6X6, 7X7, 8X8, 7X10, 5X9 and 9.55X8.75			13" REEL	
PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
FLANGE	DIAMETER	A	12.992	330.0
	THICKNESS	W2	0.874	22.2
	SPACE BETWEEN FLANGE	W1	0.661	16.8
HUB	OUTER DIAMETER	N	4.016	102.0
	ARBOR HOLE DIAMETER	C	0.512	13.0
	KEY SLIT WIDTH	B	0.079	2.0
	KEY SLIT DIAMETER	D	0.787	20.0

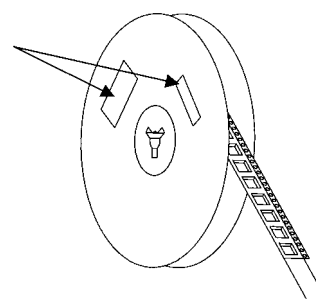
Tape Length



Label Placement

Product label, Mfg Label and ESD label are placed on the flange opposite to the sprockets in the carrier tape

Reel Quantity: 2500 / reel



Quad-Band GSM/EDGE Polar Power Amplifier Module

*Marking Diagram**

*Provided as informational only. Please request TriQuint MRK.TQM7M5003 for controlling documentation.



Top View

WHITE INK OR LASER MARK

Line 1: TriQuint logo

Line 2: 7M5003

Line 3: CCCC = Country Code (example: Philippines = PHIL)

Line 4: YYWW = Year and Work Week

Line 5: XXXX = Aa (2 letter vendor code) + Last 4 digits of TriQuint assembly lot number

Additional Information¹T

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

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Fax: (503) 615-8902

For technical questions and additional information on specific applications:

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