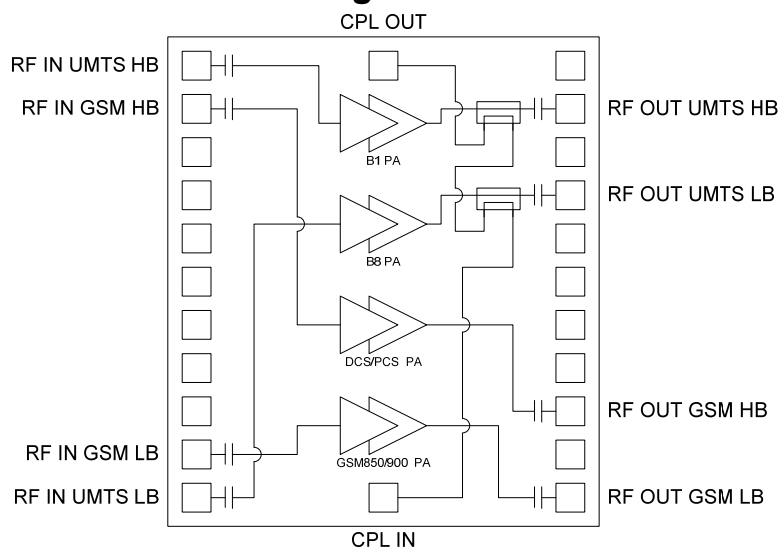


**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

Functional Block Diagram



Product Description

The TQM7M9023 is a fully matched multimode multiband Power Amplifier Module that supports Quad-band GSM/EDGE Linear, W/CDMA & LTE Band 1, and low band WCDMA/LTE (externally tuned for either Band 5 or Band 8). The GSM PA output power is controlled by the input power coming from the transceiver in both GMSK and 8PSK modes. The 3-Gain state WCDMA PA operates in LPM, MPM and HPM to maximize talk time over the entire range of operating conditions. It also includes a coupler and built-in regulator, ideal for today's extremely small data enabled phones. The TQM7M9023 is designed on TriQuint's GaAs HBT technology with CuFlip® assembly offering state of the art reliability, temperature stability and ruggedness. Its RF performance meets the stringent linearity requirements for multi-mode operation.

Electrical Specifications

Parameter	GSM850/900	DCS/PCS	UMTS B1	UMTS B5	UMTS B8	Units
	Typ	Typ	Typ	Typ	Typ	
HPM Pout	35	33	28	28.25	28.25	dBm
HPM PAE	55	50	40	40	40	%
LPM ICC @ 3.5dBm Pout			8	8	8	mA
HPM ICC@P _{sat}	1.5	1	0.46	0.46	0.46	A

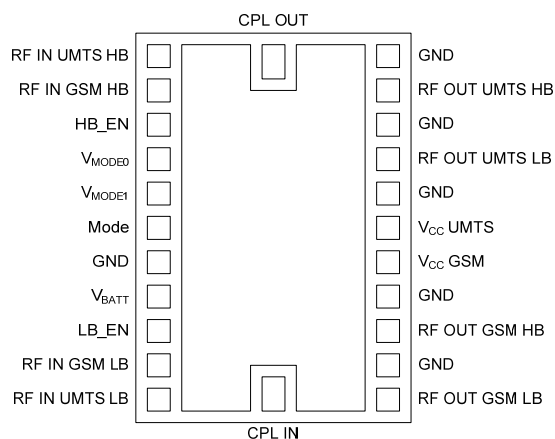
Features

- Quad-Band Linear GSM/EDGE
- UMTS B1 and B5/8
- Input power controlled – GMSK and 8PSK
- GSM LB has 3 modes – HP, MP, LP
- GSM HB has 2 modes – HP, LP
- W/CDMA has 3 modes – HP, MP, LP
- HBT/PHEMT / CuFlip® PA Technology
- Integrated coupler
- Built-in voltage regulator
- 50Ω input and Output Impedance
- Lead-free 260°C / RoHS / Halogen-free
- 24 Pin 5x7.5mm Package

Applications

- GSM/EDGE/WEDGE Applications
- WCDMA B1/8 or B1/5 Applications
- WCDMA B1/5/8 Applications (w/ external switch)
- HSDPA/HSUPA/HSPA+ Applications
- LTE Applications / EVDO revA B1&B5

Package Style



24-Pin Laminate Module
Top View

Data Sheet

For additional information and the latest specifications, see our website: www.triquint.com
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5.0x7.5mm Multimode Multiband Power Amplifier (MMPA) (Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)

Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Positive Supply voltage	V _{BATT} , V _{CC}	-0.5 to +5.5	V
Control Voltages (enable, V _{MODE0} , V _{MODE1})	LB_EN, HB_EN, V _{MODE0} , V _{MODE1}	-0.5 to +5.5	V
Input RF Power	P _{IN}	+15	dBm
Storage Temperature	T _{storage}	-30 to +150	°C
Operating Case (ambient) Temperature	T _{case}	-20 to +90	°C
HBM ESD	ESD	Class 1C	
Peak Reflow Temperature	T _{max}	260	°C
Ruggedness (P _{out} ≤ max power, all phases)	Ruggedness	10:1	VSWR
Duty Cycle at Maximum Power	δ	50	%
Moisture Sensitivity Level	MSL	MSL3	

Note 1: Stresses greater than the listed absolute maximum ratings may cause permanent and functional damage to the device.

Note 2: Exposure exceeding absolute maximum rating conditions for extended periods may affect device reliability

Note 3: ESD HBM meets conditions defined in JESD22-A114-E.

Note 4: Part may not survive all maximums applied simultaneously

Operating Parameters

DC Supply	Condition	Min	Typ	Max	Unit
Supply voltage (V _{BATT} , V _{CC})	GMSK Operation	3.0	3.5	4.5	V
	8PSK Operation	3.2	3.5	4.2	V
	WCDMA Operation	3.2	3.4	4.2	V
	WCDMA Operation with DCDC	1.0		4.0	V
V _{MODE0} , V _{MODE1} (digital control) LB_EN, HB_EN	Low	0		0.5	V
	High	1.35	1.8	3.1	V
	Current			0.1	mA
Rise Time	From P _{out} = -30 dBm to P _{out} = P _{max}			1	μs
Fall Time	From P _{out} = -30 dBm to P _{out} = P _{max}			1	μs
Operating Case Temperature		-20		+85	°C
UMTS Turn on/off time	DC: I _{cc} to within 90% of final value			20	μs
	RF: P _{out} within 1dB of final value			6	μs
Mode switching time	With PA_ON = high			2	μs

5.0x7.5mm Multimode Multiband Power Amplifier (MMPA) (Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)

Modes of Operation

Mode of Operation	LB_EN	HB_EN	Mode	V _{MODE0}	V _{MODE1}	V _{BATT}	V _{CC}
Powerdown	Low	Low	X ¹	X ¹	X ¹	On	On
GSM 850/900 – High-power mode	High	Low	Low	Low	Low	On	On
GSM 850/900 – Medium-Power mode	High	Low	Low	Low	High	On	On
GSM 850/900 – Low-power mode	High	Low	Low	High	Low	On	On
DCS/PCS – High-power mode	Low	High	Low	Low	Low	On	On
DCS/PCS – Low-power mode	Low	High	Low	High	Low	On	On
UMTS Band 5/8 – High-power mode	High	Low	High	Low	X	On	On
UMTS Band 5/8 – Medium Power mode	High	Low	High	High	Low	On	On
UMTS Band 5/8 – Low-Power mode	High	Low	High	High	High	On	On
UMTS Band 5/8 – Optional Lower Vcc	High	Low	High	High	High	On	1.5V
UMTS Band 1 – High-power mode	Low	High	High	Low	X	On	On
UMTS Band 1 – Medium Power mode	Low	High	High	High	Low	On	On
UMTS Band 1 – Low-Power mode	Low	High	High	High	High	On	On
UMTS Band 1 – Optional Lower Vcc	Low	High	High	High	High	On	1.5V

Note 1: Logic input currents will be minimized when Mode, V_{mode0} and V_{mode1} are low.

Recommended GSM Power Levels for each Mode of Operation

GMSK Modes	PCL	Output Power Range
Low band – High-power mode	5-6	30.5 dBm < P _{OUT} ≤ Psat
Low band – Medium power mode	7-13	16 dBm < P _{OUT} ≤ 30.5 dBm
Low band – Low-power mode	14-19	P _{OUT} ≤ 16 dBm
High band – High-power mode	0-7	16 dBm < P _{OUT} ≤ Psat
High band – Low-power mode	8-15	P _{OUT} ≤ 16 dBm

Recommended EDGE Power Levels for each Mode of Operation

8PSK Modes	PCL	Output Power Range
Low band – High power mode	8-9	23 dBm < P _{OUT} ≤ 29dBm
Low band – Medium power mode	10-15	14 dBm ≤ P _{OUT} ≤ 23dBm
Low band – Low-power mode	16-19	P _{OUT} ≤ 12 dBm
High band – High-power mode	0-10	10 dBm < P _{OUT} ≤ 28dBm
High band – Low-power mode	11-15	P _{OUT} ≤ 10 dBm

Recommended WCDMA Power Levels for each Mode of Operation

8PSK Modes	Output Power Range
Band 5/8 – High power mode	17 dBm < P _{OUT} ≤ 28.25 dBm
Band 5/8 – Medium power mode	9 dBm ≤ P _{OUT} ≤ 17 dBm
Band 5/8 – Low-power mode / Optional Lower Vcc	P _{OUT} < 9 dBm
Band 1 – High-power mode	17 dBm < P _{OUT} ≤ 28 dBm
Band 1 – Medium power mode	8 dBm ≤ P _{OUT} ≤ 17 dBm
Band 1 – Low-power mode / Optional Lower Vcc	P _{OUT} ≤ 8 dBm

Data Sheet

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

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**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
 (Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**
GSM 850/GSM 900 Band Electrical Characteristics¹

Parameter	Conditions	Min	Typ	Max	Units
Operating frequency range	GSM 850	824		849	MHz
	GSM 900	880		915	MHz
Input power				9	dBm
Maximum output power	GMSK HPM	34.5	35		dBm
	GMSK HPM (degraded power)	32.5			dBm
	8PSK (RMS power)		29		dBm
	Low Power Mode	14.0			dBm
Power added efficiency (PAE)	GMSK HPM, P _{OUT} = P _{SAT} _HPM		55		%
	GMSK MPM, P _{OUT} = P _{SAT} _MPM		41		%
	8PSK HPM, P _{OUT} = 29dBm		28		%
	GMSK LPM I _{BATT} , P _{OUT} = 6dBm		70		mA
Gain	High-power mode P _{OUT} = 34.5 dBm	26.5		33.5	dB
	Medium-power mode P _{OUT} = 30.5 dBm	23.5		31.0	dB
	Low-Power mode P _{OUT} = 14 dBm	13		22.0	dB
Gain variations – T _C	-25 < T _C < 90°C (all modes)		±1.5		dB
Gain variations – V _{BATT}	3.2 < V _{BATT} < 4.2V (all modes)		±1		dB
EDGE ACPR ²	±400 kHz, P _{OUT} ≥ 28dBm		-60	-57	dBc/30 kHz
	±400 kHz, All power levels		-45	-40	dBm/30kHz
	±600 kHz, P _{OUT} ≥ 19dBm		-70	-63	dBc/30 kHz
	±600 kHz, All power levels		-60	-55	dBm/30kHz
EDGE EVM	All modes			3	%
Rx Band noise	Rx=869-894 MHz		-87		dBm/100 kHz
	Rx=925-935 MHz		-84		dBm/100 kHz
	Rx=935-960 MHz		-87		dBm/100 kHz
Harmonics	2 fo, P _{OUT} ≤ 34.5dBm			-10	dBm
	3fo-5fo, P _{OUT} ≤ 34.5dBm			-15	dBm
Input Impedance			2:1		VSWR
Stability	Load VSWR ≤ 8:1 in band, all phase angles			-36	dBm
Ruggedness	P _{OUT} ≤ 34.5dBm	10:1			

Note 1: Performance referenced to module pin under the following conditions unless otherwise specified: T=25°C, V_{CC}=3.5V, duty =25%, pulse width =1154us, LB_EN = High

Note 2: ACPR spec referenced in dBc is relaxed by 1dB for every 1dB P_{OUT} change for all power levels less than 28dBm for ±400kHz and all power levels less than 19dBm for ±600kHz. ACPR spec referenced in dBm holds for all power levels and all modes.

5.0x7.5mm Multimode Multiband Power Amplifier (MMPA) (Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)

DCS 1800/PCS 1900 Band Electrical Characteristics¹

Parameter	Conditions	Min	Typ	Max	Units
Operating frequency range	DCS 1800	1710		1785	MHz
	PCS 1900	1850		1910	MHz
Input power				6	dBm
Maximum output power	GMSK High Power Mode	32.2	33		dBm
	GMSK HPM (degraded power)	30.3			dBm
	8PSK (RMS power)		28		dBm
	Low Power Mode	14.0	20		dBm
Power added efficiency (PAE)	GMSK HPM, P _{OUT} = P _{SAT_HPM}		50		%
	GMSK LPM, P _{OUT} = P _{SAT_LPM}		23		%
	8PSK HPM, P _{OUT} = 28 dBm		30		%
	GMSK LPM I _{BATT} , P _{OUT} = 1dBm		45		mA
Gain	High Power Mode P _{OUT} = 32.0 dBm	27.0		32.5	dB
	Low Power Mode P _{OUT} = 14 dBm	13		22	dB
Gain variations – T _c	-25 ≤ T _c ≤ 90°C		±1.5		dB
Gain variations – V _{BATT}	3.2 ≤ V _{BATT} ≤ 4.2V		±1		dB
EDGE ACPR ²	±400 kHz, P _{OUT} ≥ 28dBm		-60	-57	dBc/30 kHz
	±400 kHz, All power levels		-45	-40	dBm/30kHz
	±600 kHz, P _{OUT} ≥ 14dBm		-73	-65	dBc/30 kHz
	±600 kHz, All power levels		-60	-55	dBm/30kHz
EDGE EVM	All modes			3	%
Rx band Noise	Rx=1805-1880 MHz		-83		dBm/100 kHz
	Rx=1930-1990 MHz		-83		dBm/100 kHz
Harmonics	2 fo, P _{OUT} ≤ 32.3dBm			-10	dBm
	3fo-5fo, P _{OUT} ≤ 32.3dBm			-15	dBm
Input Impedance	HPM, MPM		2.0:1		VSWR
	LPM		2.5:1		VSWR
Stability	Load VSWR ≤ 8:1 in band, all phase angles			-36	dBm
Ruggedness	P _{OUT} ≤ 32.3dBm	10:1			

Note 1: Performance referenced to module pin under the following conditions unless otherwise specified: T=25°C, V_{cc}=3.5V, duty =25%, pulse width =1154us, HB_EN = High

Note 2: ACPR spec referenced in dBc is relaxed by 1dB for every 1dB P_{OUT} change for all power levels less than 28dBm for ±400kHz and all power levels less than 14dBm for ±600kHz. ACPR spec referenced in dBm holds for all power levels and all modes.

**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

Test Signal Configuration

Parameter	Symbol	Definition
Voice, Rel99	TC1	HPSK modulated carrier in 3.84 MHz BW
		UL ref. Meas. Channel (12.2kbps) from 3GPP TS25.101 Annex A sec. A.2.1
		1 DPCCH@15ksps, Spread Code=0, Relative Power=-6.547 dB
		1 DPDCH@60ksps, Spread Code=16, Relative Power=-1.087 dB
		CW testing, input power adjusted to meet output power requirements
HSUPA, MPR=0dB	TC2	DPCCH@15ksps, Spread Code=0, Relative Power=-19.391 dB, Q Branch
		DPDCH@960ksps, Spread Code=1, Relative Power=-13.931 dB, I Branch
		HS-DPCCH@15ksps, Spread Code=64, Relative Power=-19.391 dB, Q Branch
		E-DPCCH@15ksps, Spread Code=1, Relative Power=-17.338 dB, I Branch
		E-DPDCH1@960ksps, Spread Code=2, Relative Power=-0.371dB, I branch
		CW testing, input power adjusted to meet output power requirements
EVDO Rev A	Rev A	EVDO Rev A signal using subtype 2 physical layer with a payload size of 4096 bits

5.0x7.5mm Multimode Multiband Power Amplifier (MMPA) (Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)

RF Electrical Characteristics – Band 1 ^{1,2}

Parameter	Power Mode	Conditions	Min	Typ	Max	Unit
Frequency	All modes	UMTS Band 1	1920	1950	1980	MHz
Maximum Output Power ³	HPM	WCDMA Rel99 waveform 2 (TC1)	28			dBm
	HPM	Worst case 3GPP; MPR = 0 dB (TC2)	27			dBm
	HPM	CDMA EVDO revA modulation	27			dBm
	HPM	LTE, MPR=0dB	27			dBm
Gain	HPM	$P_{OUT} \leq \text{max power}$	24		29	dB
	MPM	$P_{OUT} \leq 17\text{dBm}$ (16dBm 3GPP MPR = 0)	13		22	dB
	LPM	$P_{OUT} \leq 8\text{dBm}$ (6dBm 3GPP MPR = 0)	8		16	dB
Noise Power in Rx Band	All modes	190 MHz offset from Tx at all powers		-140		dBm/Hz
Quiescent Current (IcQ)	MPM	No RF Applied		15		mA
	LPM			5		mA
Supply Current	HPM	$P_{OUT} = 28\text{dBm}$		460		mA
	LPM	$P_{OUT} = 3.5\text{dBm}$		8		mA
Error Vector Magnitude (EVM)		$P_{OUT} \leq (\text{maximum power} - \text{MPR})$			2.5	% rms
UMTS Adjacent Channel Leakage Power Ratio (ACLR)	All modes	$\pm 5\text{MHz}$, $P_{OUT} \leq (\text{maximum power} - \text{MPR})$			-36	dBc
		$\pm 10\text{MHz}$, $P_{OUT} \leq (\text{maximum power} - \text{MPR})$			-46	dBc
LTE Adjacent Channel Leakage Power Ratio (ACLR)	All modes	E-UTRA _{ACLR} ; $P_{OUT} \leq (26.75\text{dBm} - \text{MPR})$			-33	dBc
		UTRA _{ACLR1} ; $P_{OUT} \leq (26.75\text{dBm} - \text{MPR})$			-36	dBc
		UTRA _{ACLR2} ; $P_{OUT} \leq (26.75\text{dBm} - \text{MPR})$			-39	dBc
Adjacent Channel Power Ratio (ACPR)	All modes	HPM $\leq 27\text{dBm}$; MPM $\leq 17\text{dBm}$; LPM $\leq 8\text{dBm}$ $\pm 1.98\text{MHz}$; $\pm 885\text{kHz}$			-44 -56	dBc / 30kHz dBc / 30kHz
Harmonic Suppression	H2	$P_{OUT} \leq \text{maximum power}$			-35	dBc
Harmonic Suppression	H3 and higher	$P_{OUT} \leq \text{maximum power}$			-42	dBc
GPS Noise	All modes	1574 – 1577 MHz		-140		dBm/Hz
GPS Band Gain		Where G is gain in Tx band			G-3	dB
ISM Noise	All modes	2400 – 2483.5 MHz		-143		dBm/Hz
ISM Band Gain		Where G is gain in Tx band			G-6	dB
Band 34 Noise	All modes	2010 – 2025 MHz, 100RB QPSK LTE signal centered at 1970MHz at LTE max power			-35	dBm/MHz
LTE NS_05 PHS Noise ⁴		1884.5 – 1919.6 MHz			-42	dBm/300kHz
Input Impedance VSWR	All modes	No external matching		2.0:1		
Stability (all spurious)	All modes	Load VSWR $\leq 6:1$ in band, all phases			-70	dBc
Coupling Factor	All modes			20		dB

Note 1: RF measurements under the following conditions unless otherwise specified: VCC=3.4V, T=25°C, Note 1: Rel99 waveform.

Note 2: RF measurements shall be made with 3GPP (UTRAN/FDD UE) TS25.101 specification compliant waveforms. (a) Rel99 waveform (all beta_c, beta_d combinations) has very low peak-to-average power ratio and has its own requirement. MPR is the maximum power reduction, worse case MPR = 0dB waveforms across UMTS technologies are required to meet a 1 dB lower maximum power than Rel99.

Signal Configuration: 3GPP (DPCH + 1DPDCH) Up-Link unless specified otherwise.

Note 3: For VCC < 3.4V operation, up to a 0.5dB back-off is allowed for maximum power output. For VCC=3.4V, T=85°C, up to a 0.5dB back-off is allowed for maximum power output.

Note 4: P_{OUT} $\leq 28\text{dBm}$ for QPSK, 5MHz BW, 8RB; P_{OUT} $\leq 23\text{dBm}$ for QPSK, 10MHz BW, 50RB; P_{OUT} $\leq 22\text{dBm}$ for QPSK, 20MHz BW, 100RB

5.0x7.5mm Multimode Multiband Power Amplifier (MMPA) (Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)

RF Electrical Characteristics – Band 5 ^{1,2}

Parameter	Power Mode	Conditions	Min	Typ	Max	Unit
Frequency	All modes	UMTS Band 5	824		849	MHz
Maximum Output Power ³	HPM	WCDMA Rel99 waveform (TC1)	28.25			dBm
	HPM	Worst case 3GPP; MPR = 0 dB (TC2)	27.25			dBm
	HPM	LTE, MPR=0dB	27.25			dBm
	HPM	CDMA EVDO revA modulation	27			dBm
Gain	HPM	$P_{OUT} \leq \text{max power}$		27.6		dB
	MPM	$P_{OUT} \leq 17\text{dBm}$ (16dBm 3GPP MPR = 0)		18		dB
	LPM	$P_{OUT} \leq 9\text{dBm}$ (6dBm 3GPP MPR = 0)		11.7		dB
Noise Power in Rx Band	All modes	190 MHz offset from Tx at all powers		-133		dBm/Hz
Quiescent Current (IcQ)	MPM	No RF Applied		15		mA
	LPM			5		mA
Supply Current	HPM	$P_{OUT} = 28.25\text{ dBm}$		460		mA
	LPM	$P_{OUT} = 3.5\text{dBm}$		8		mA
Error Vector Magnitude (EVM)		$P_{OUT} \leq (\text{maximum power} - \text{MPR})$			3.35	% rms
		$P_{OUT} \leq (\text{maximum power} - \text{MPR} - 3\text{ dB})$			2.5	% rms
UMTS Adjacent Channel Leakage power Ratio (ACLR)	All modes ⁴	$\pm 5\text{ MHz}$, $P_{OUT} \leq (\text{maximum power} - \text{MPR})$			-36	dBc
		$\pm 10\text{ MHz}$, $P_{OUT} \leq (\text{maximum power} - \text{MPR})$			-46	dBc
LTE Adjacent Channel Leakage Power Ratio (ACLR)	All modes	E-UTRA _{ACLR} ; $P_{OUT} \leq (27\text{dBm} - \text{MPR})$			-33	dBc
		UTRA _{ACLR1} ; $P_{OUT} \leq (27\text{dBm} - \text{MPR})$			-36	dBc
		UTRA _{ACLR2} ; $P_{OUT} \leq (27\text{dBm} - \text{MPR})$			-39	dBc
Adjacent Channel Power Ratio (ACPR)	HPM $\leq 27\text{dBm}$	$\pm 885\text{kHz}$; $P_{out} \leq 27\text{dBm}$			-44	dBc/30kHz
	MPM $\leq 17\text{dBm}$ LPM $\leq 8\text{ dBm}$	$\pm 1.98\text{MHz}$; $P_{out} \leq 27\text{dBm}$			-56	dBc/30kHz
Harmonic Suppression	H2	$P_{out} \leq \text{maximum power}$			-35	dBc
Harmonic Suppression	H3 and higher	$P_{out} \leq \text{maximum power}$			-42	dBc
GPS Noise	All modes	1574 – 1577 MHz		-140		dBm/Hz
GPS Band Gain		Where G is gain in Tx band			G-25	dB
ISM Noise	All modes	2400 – 2483.5 MHz		-143		dBm/Hz
ISM Band Gain		Where G is gain in Tx band			G-30	dB
Input Impedance VSWR	All modes	No external matching		2:1		
Stability (all spurious)	All modes	Load VSWR $\leq 5:1$ in band, all phases		-70		dBc
Coupling Factor	All modes			20		dB

Note 1: RF measurements under the following conditions unless otherwise specified: VCC=3.4V, T=25°C, Zin/Zout=50ohm, Rel99 waveform. All measurements are based upon tuning optimized for Band 5 performance. Please see application note for more information.

Note 2: RF measurements shall be made with 3GPP (UTRAN/FDD UE) TS25.101 specification compliant waveforms. (a) Rel99 waveform (all beta_c, beta_d combinations) has very low peak-to-average power ratio and has its own requirement. MPR is the maximum power reduction, worse case MPR = 0dB waveforms across UMTS technologies are required to meet a 1 dB lower maximum power than Rel99. Signal Configuration: 3GPP (DPCCH + 1DPDCH) Up-Link unless specified otherwise.

Note 3: For VCC < 3.4V operation, up to a 0.5dB back-off is allowed for maximum power output. For VCC=3.4V, T=85°C, up to a 0.5dB back-off is allowed for maximum power output.

5.0x7.5mm Multimode Multiband Power Amplifier (MMPA) (Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)

RF Electrical Characteristics – Band 8^{1,2}

Parameter	Power Mode	Conditions	Min	Typ	Max	Unit
Frequency	All modes	UMTS Band 8	880		915	MHz
Maximum Output Power ³	HPM	WCDMA Rel99 waveform (TC1)	28.25			dBm
	HPM	Worst case 3GPP; MPR = 0 dB (TC2)	27.25			dBm
	HPM	LTE, MPR = 0dB	27.25			dBm
Gain	HPM	P _{OUT} ≤ max power	24.5		29.5	dB
	MPM	P _{OUT} ≤ 17dBm (16dBm 3GPP MPR = 0)	13		22	dB
	LPM	P _{OUT} ≤ 9dBm (6dBm 3GPP MPR = 0)	8		16	dB
Noise Power in Rx Band	All modes	190 MHz offset from Tx at all powers		-137		dBm/Hz
Quiescent Current (I _{cQ})	MPM	No RF Applied		15		mA
	LPM			5		mA
Supply Current	HPM	P _{OUT} = 28.25 dBm		465		mA
	LPM	P _{OUT} = 3.5dBm		8		mA
Error Vector Magnitude (EVM)		P _{OUT} ≤ (maximum power – MPR)			3.35	% rms
		P _{OUT} ≤ (maximum power – MPR – 3 dB)			2.5	% rms
UMTS Adjacent Channel Leakage power Ratio (ACLR)	All modes ⁴	± 5 MHz, P _{OUT} ≤ (maximum power - MPR)			-36	dBc
		± 10 MHz, P _{OUT} ≤ (maximum power - MPR)			-46	dBc
LTE Adjacent Channel Leakage Power Ratio (ACLR)	All modes	E-UTRA _{ACLR} ; P _{OUT} ≤ (27dBm – MPR)			-33	dBc
		UTRA _{ACLR1} ; P _{OUT} ≤ (27dBm – MPR)			-36	dBc
		UTRA _{ACLR2} ; P _{OUT} ≤ (27dBm – MPR)			-39	dBc
Harmonic Suppression	H2	P _{out} ≤ maximum power			-35	dBc
Harmonic Suppression	H3 and higher	P _{out} ≤ maximum power			-42	dBc
GPS Noise	All modes	1574 – 1577 MHz		-140		dBm/Hz
GPS Band Gain		Where G is gain in Tx band			G-25	dB
ISM Noise	All modes	2400 – 2483.5 MHz		-143		dBm/Hz
ISM Band Gain		Where G is gain in Tx band			G-30	dB
Input Impedance VSWR	All modes	No external matching		2.0:1		
Stability (all spurious)	All modes	Load VSWR ≤ 5:1 in band, all phases			-70	dBc
Coupling Factor	All modes			20		dB

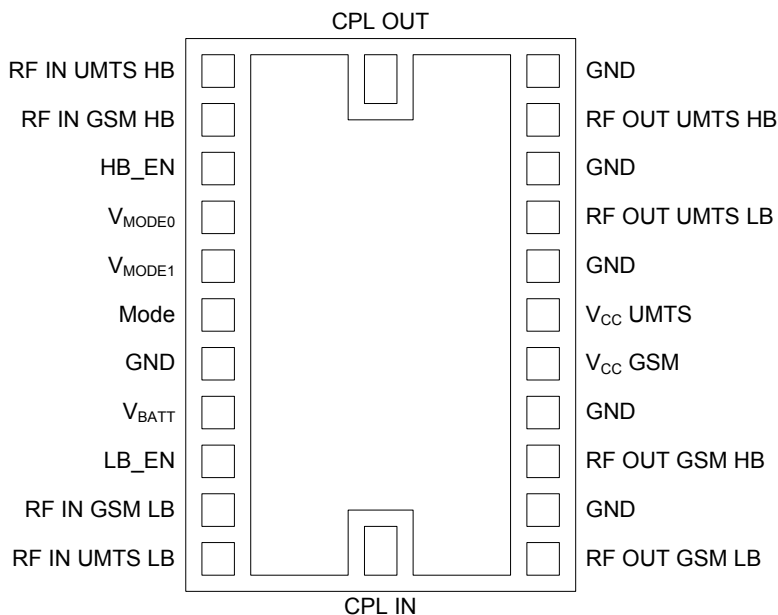
Note 1: RF measurements under the following conditions unless otherwise specified: VCC=3.4V, T=25°C, Z_{in}/Z_{out}=50ohm, Rel99 waveform. All measurements are based upon tuning optimized for Band 8 performance. Please see application note for more information.

Note 2: RF measurements shall be made with 3GPP (UTRAN/FDD UE) TS25.101 specification compliant waveforms. (a) Rel99 waveform (all beta_c, beta_d combinations) has very low peak-to-average power ratio and has its own requirement. MPR is the maximum power reduction, worse case MPR = 0dB waveforms across UMTS technologies are required to meet a 1 dB lower maximum power than Rel99. Signal Configuration: 3GPP (DPCCH + 1DPDCH) Up-Link unless specified otherwise.

Note 3: For VCC < 3.4V operation, up to a 0.5dB back-off is allowed for maximum power output. For VCC=3.4V, T=85°C, up to a 0.5dB back-off is allowed for maximum power output.

**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

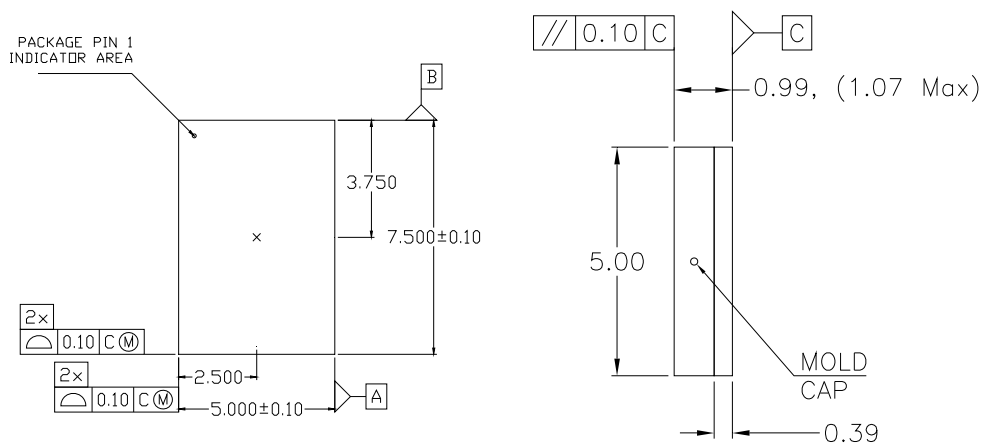
Pin Out and Assignments



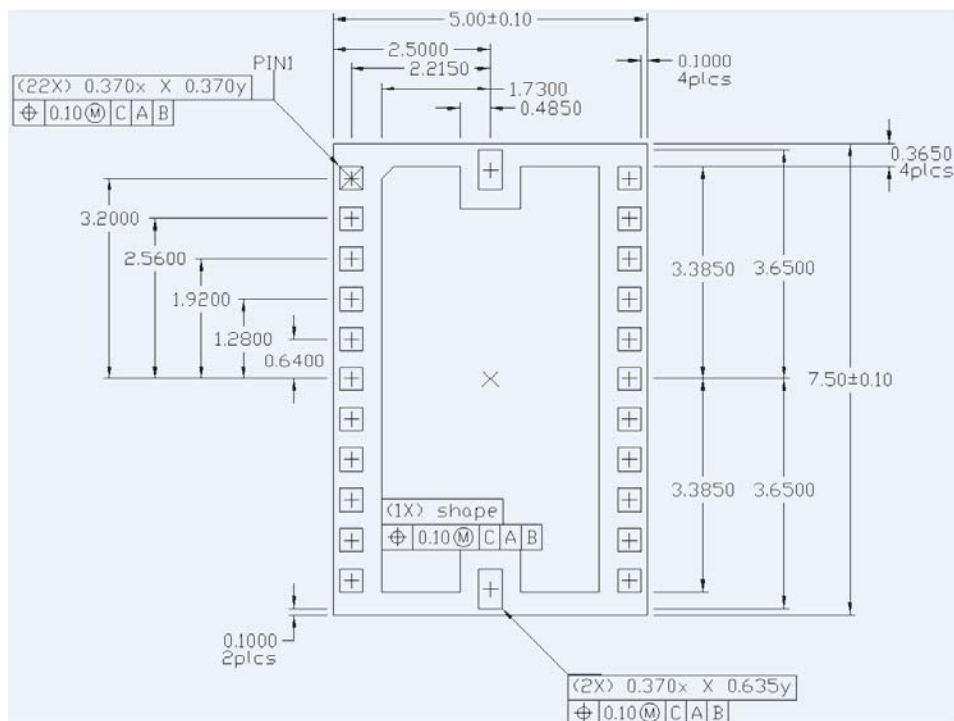
PIN	SYMBOL	DESCRIPTION
1	RF IN UMTS HB	RF input for High Band WCDMA amplifier (Band 1)
2	RF IN GSM HB	RF input for DCS/PCS amplifier
3	HB_EN	Enables HB (DCS/PCS) amplifier
4	V _{MODE0}	Logic input to set amplifier mode
5	V _{MODE1}	Logic input to set amplifier mode
6	Mode	Logic input to set amplifier mode – WCDMA or GSM
8	V _{BATT}	Battery voltage
9	LB_EN	Enables LB (GSM) amplifier
7,14,16,19,21,23	GND	GND pin
10	RF IN GSM LB	RF input for GSM850/900 amplifier
11	RF IN UMTS LB	RF input for Low Band WCDMA amplifier (Band 5/8)
12	CPL IN	Coupler Input
13	RF OUT GSM LB	RF output for GSM850/900 amplifier
15	RF OUT GSM HB	RF output for DCS/PCS amplifier
17	V _{CC} GSM	Voltage supply to Vcc GSM
18	V _{CC} UMTS	Voltage supply to Vcc WCDMA
20	RF OUT UMTS LB	RF output for Low Band WCDMA amplifier (Band 5/8)
22	RF OUT UMTS HB	RF output for High Band WCDMA amplifier (Band 1)
24	CPL OUT	Coupler Output

**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

Package Dimensional Drawings:

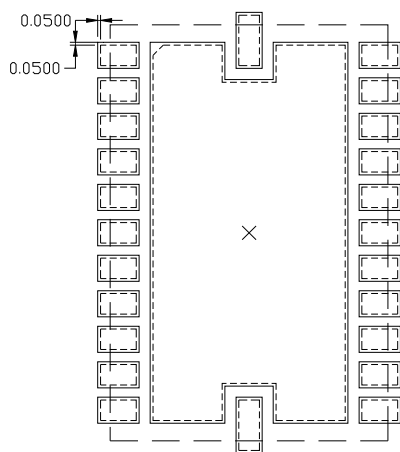
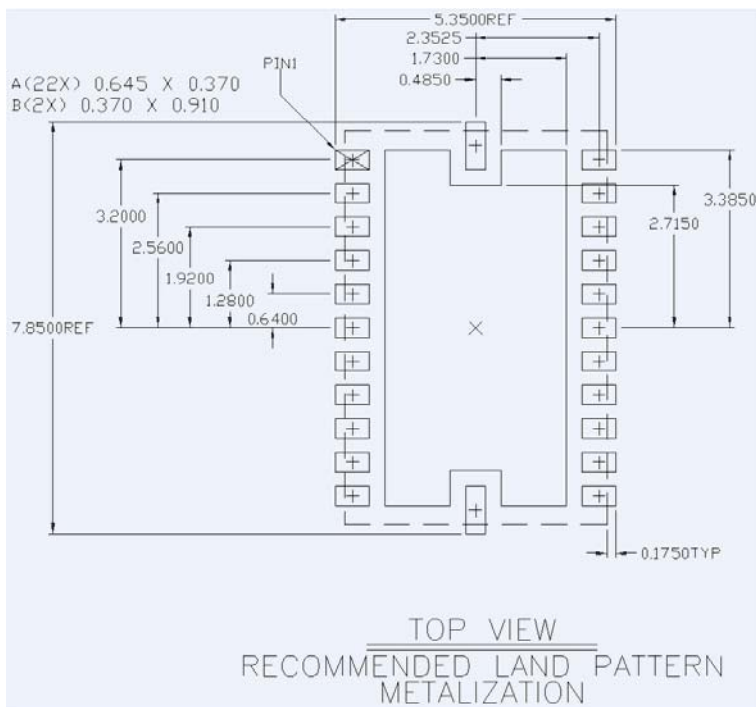


TOP VIEW




**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

Package Land Pattern:

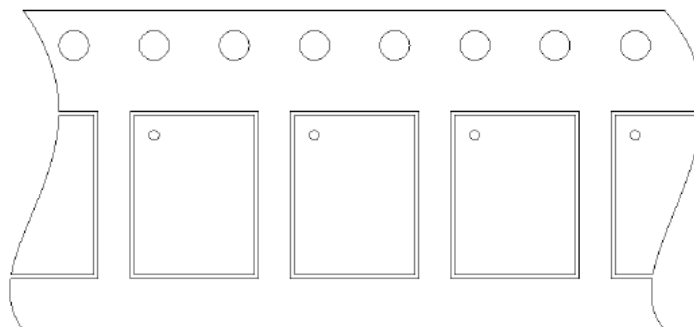


**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

Package Marking

 TQM7M9023 YYWW CCCC AaXXXX	TriQuint: Product name: Year, Work week, Country code: Vendor Code and Assembly #	TQM7M9023 YY= year, WW= work week, CCCC= country code Aa= Vendor, XXXX= TriQuint assembly number
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Tape and Reel Specification:



**MODULE 4x7, 5X7.5, 5x8, 6x8,
and 7x7.5** →

Carrier tape - 3M part # 3M053091,
Cavity: Length=5.40mm, Width=7.90mm, Depth=1.40mm, Pitch = 8mm
Carrier Tape: Width = 16mm
Cover tape - 3M part # 2678 13.3mm wide

Note: Packaged quantity is 2,500 per reel

Data Sheet

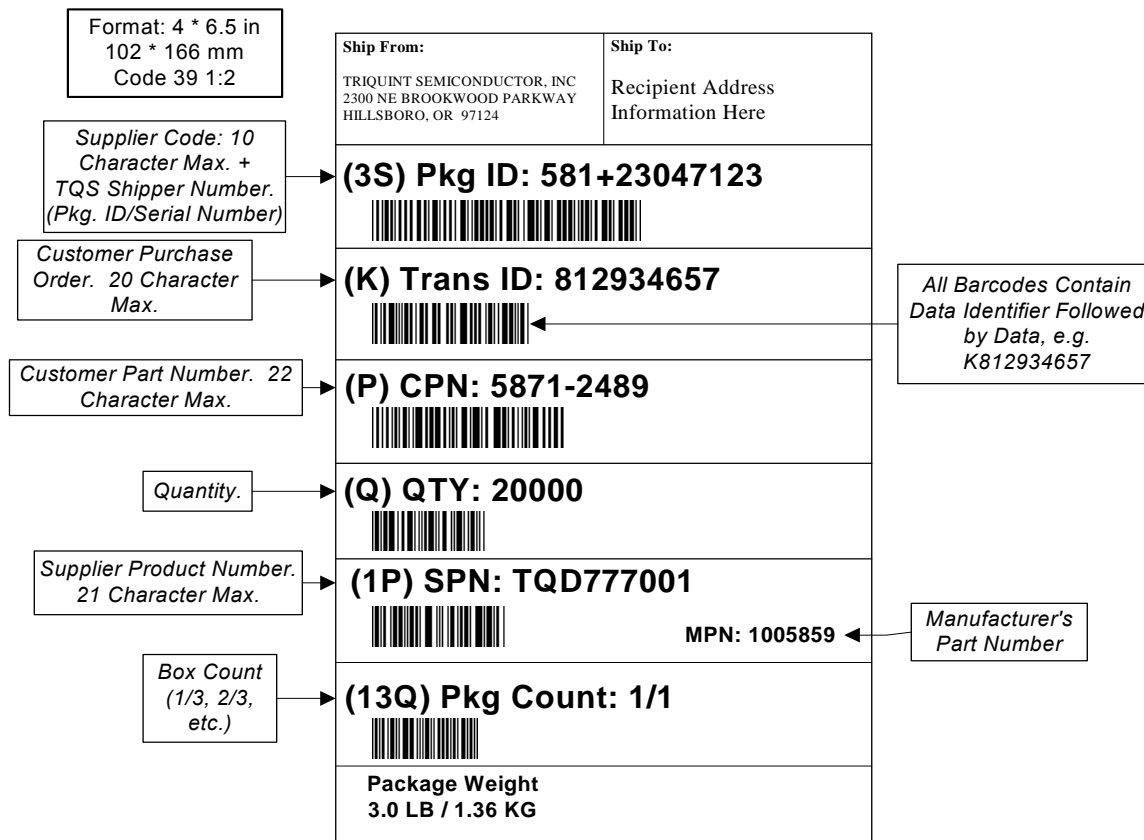
For additional information and the latest specifications, see our website: www.triquint.com
Revision F, September, 2011

**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

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



**5.0x7.5mm Multimode Multiband Power Amplifier (MMPA)
(Quad-Band GSM / EDGE and Tri-band W/CDMA/HSPA+/LTE)**

Additional Information¹

This part is compliant with RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) and compliant to IPC/JEDEC J-STD-033B.1. The part is rated Moisture Sensitivity Level 3 at 260 degrees 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

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Data Sheet

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Revision F, September, 2011