TQM7M5013

Quad-Band Input Power Controlled EDGE PAM

Applications

- Quad-Band GSM850 / GSM900 / DCS / PCS
- GSM / EDGE / WEDGE Handsets
- GSM / EDGE / WEDGE Wireless Cards

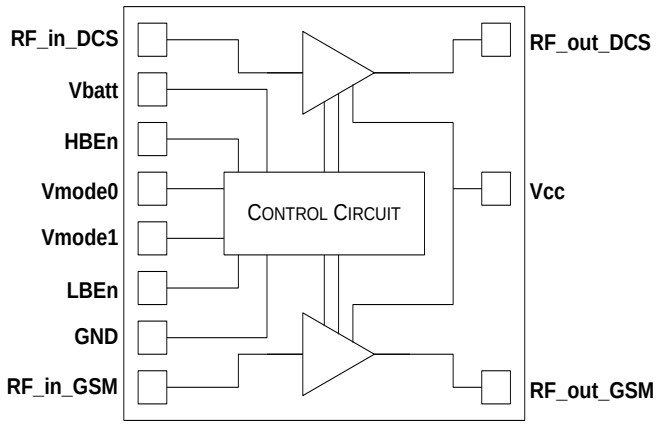
Product Features

- Digital Control Interface
- Low Current At Backed-Off Power Levels
- Input Power Controlled – GMSK & 8PSK
- LB Has 4 modes – HP, MP, LP, & ULP
- HB Has 3 modes – HP, LP, & ULP
- HBT/PHEMT High Efficiency Technology
- High–Power Linearity
- Standard LB & HB Paths
- 50 Ω Input & Output Impedance
- Halogen-Free
- 11 Pin Package

General Description

The TQM7M5013 is an input power controlled, multiple gain state, quad band, GSM/EDGE PAM designed for use with the Qualcomm QTR/RTR8600 WEDGE solutions. This highly efficient PAM significantly improves talk-time while still providing an easy to use solution in a small form factor. The PA output power is controlled by the input power coming from the transceiver in both GMSK and 8PSK modes and so does not require a Vramp input. Additionally, the small 5 mm x 5 mm package requires minimum board space and allows for high levels of phone integration.

Functional Block Diagram



Pin Configuration

Pin No.	Label	Pin No.	Label
1	RF_in_DCS	7	GND
2	Vbatt	8	RF_in_GSM
3	HBEn	9	RF_out_GSM
4	Vmode0	10	V_{CC}
5	Vmode1	11	RF_out_DCS
6	LBEn	Backside Pad	GND

GSMK Electrical Specifications

Parameter	Typical Value GSM850	GSM900	DCS	PCS	Units
HPM P_{out}	35.3	35	33.3	33	dBm
MPM P_{out}	31.8	32.2			
LPM P_{out}	22	22	22.8	22	
ULPM P_{out}	20.5	21	21.5	20	
HPM PAE	52	55	55	52	%
MPM PAE	43	45			
LPM PAE	27	31	25	19	
ULPM PAE	29	32	23	16	

8PSK Electrical Specifications

Parameter	Typical Value GSM850	GSM900	DCS	PCS	Units
RMS Power	29	29	28	28	dBm

Ordering Information

Part No.	Description
TQM7M5013	Quad-Band EDGE PAM

Standard T/R size = 2500 pieces on a 13” reel

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
Positive Supply Voltage	$V_{CC,}$ connects to 2nd stage collectors	−0.5 to +5.5	V
Storage Temperature	Tstorage	−40 to +150	°C
Operating Case Temperature (Ambient)	Tcase	−25 to +90	°C
Output Load		10:1	VSWR
Maximum Input Power	Pin	+15	dBm
Peak Reflow Temperature	Tmax	260	°C
Duty Cycle At Maximum Power	δ	50	%

Notes:
1. Stresses greater than the listed absolute maximum ratings may cause permanent and functional damage to the device.
2. Exposure exceeding absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Conditions	Min	Typ	Max	Units
Battery voltage (V_{BATT})		+3.0	+3.5	+4.8	V
V_{MODE0}, V_{MODE1} (digital control) LB_EN, HB_EN	Low	+0		+0.5	V
	High	+1.35		+3.1	V
	Logic Line Current			+0.1	mA
Rise Time	From Pout = −30 dBm to Pout = Pmax		0.5		µs
Fall Time	From Pout = −30 dBm to Pout = Pmax		0.5		µs
Operating Case Temperature		-25		+90	°C
LB TX Frequency Range GSM850		824		849	MHz
LB TX Frequency Range GSM900		880		915	MHz
HB TX Frequency Range GSM1800		1710		1785	MHz
HB TX Frequency Range GSM1900		1850		1910	MHz

Control Truth Table

Mode of Operation	LB_EN	HB_EN	VMode0	Vmode1
Powerdown	Low	Low	Low	Low
Low Band – High-power mode (HPM)	High	Low	Low	Low
Low Band – Medium Power mode (MPM)	High	Low	Low	High
Low Band – Low-power mode (LPM)	High	Low	High	Low
Low Band – Ultra-Low-power mode (ULPM)	High	Low	High	High
High Band – High-power mode (HPM)	Low	High	Low	Low
High Band – Low-power mode (LPM)	Low	High	High	Low
High Band – Ultra-Low-power mode (ULPM)	Low	High	High	High

Notes:
1. RF functionality will be disabled for LB or HB when the respective EN pin is low. This is true regardless of the voltages applied to Vmode0 and Vmode1. However, leakage current will be minimized when Vmode voltages are low.

Recommended GSM Power Levels for Each Mode of Operation (1)

GMSK Mode	PCL	Output Power Range
Low Band – High-power mode (HPM)	5 – 6	30.5 dBm <Pout ≤ Psat
Low Band – Medium Power mode (MPM)	7 – 13	18.5 dBm < Pout ≤ 30.5 dBm
Low Band – Low-power mode (LPM)	14 – 15	12.5 dBm < Pout ≤ 18.5 dBm
Low Band – Ultra-Low-power mode (ULPM)	16 – 19	Pout ≤ 12.5 dBm
High Band – High-power mode (HPM)	0 – 6	18.5 dBm ≤ Pout ≤ Psat
High Band – Low-power mode (LPM)	7 – 9	12.5 dBm ≤ Pout ≤ 18.5 dBm
High Band – Ultra-Low-power mode (ULPM)	10 – 15	Pout ≤ 12.5 dBm

Notes:
1. Use of ULPM mode is optional. LPM can support the ULPM PCLs.

Recommended EDGE Power Levels for Each Mode of Operation (1)

8PSK Mode	PCL	Output Power Range
Low Band – High-power mode (HPM)	8 – 9	23 dBm < Pout ≤ 29 dBm
Low Band – Medium Power mode (MPM)	10 – 14	13 dBm < Pout ≤ 23 dBm
Low Band – Low-power mode (LPM)	15 – 19	Pout ≤ 13 dBm
High Band – High-power mode (HPM)	2 – 8	14 dBm ≤ Pout ≤ 28 dBm
High Band – Low-power mode (LPM)	9 – 15	Pout ≤ 14 dBm

Notes:
1. Battery voltage operating range for EDGE operation is +3.2 V to +4.2 V.

Electrical Specifications: GSM 850 / GSM 900 Low–Band

Test conditions unless otherwise noted: Temp.=+25 °C, V_{CC}=V_{BATT}= +3.8 V, Pulse Width= 1145 µs, Duty Cycle= 25 %, LB_EN= High & Zin/Zout= 50 Ω

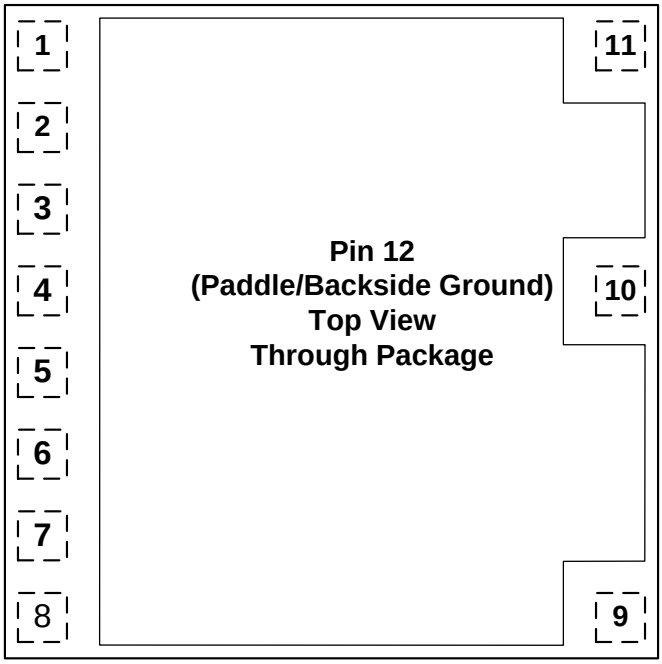
Parameter	Conditions		Min	Typ	Max	Units
Operating Frequency Range	GSM 850		824		849	MHz
	GSM 900		880		915	
Maximum Output Power	GMSK HPM		+34.2	+35		dBm
	GMSK HPM (degraded power)		+32.2			
	GMSK MPM		+30.5	+32		
	8PSK (RMS power)		+29			
	GMSK LPM		+20	+22		
	GMSK ULPM		+16	+21		
Power Added Efficiency (PAE)	GMSK HPM, Po = Psat_HPM		44	53		%
	GMSK MPM, Po = Psat_MPM		36	44		
	GMSK LPM, Po = Psat_LPM		19	29		
	GMSK ULPM, Po = Psat_ULPM		21	29		
	8PSK HPM, Po = +29dBm		20	28		
Gain	High-power mode Po = +34.2 dBm		25.5	29	33	dB
	Medium Power mode Po = +30.5 dBm		22.5	26	30	
	Low-power mode Po = +16 dBm		13	17	20	
	Ultra Low Power mode Po = +8 dBm		10	13	17	
Gain Variations – Tc	−25 ≤ Tc ≤ 90 °C (all modes)			±1.5		dB
Gain Variations – Vbatt	+3.2 ≤ Vbatt ≤ +4.2 V (all modes)			±1		dB
EDGE ACPR	MPM; Po ≤ +23 dBm LPM; Po ≤ +16 dBm	±400 kHz		−60	−58	dBc/ 30 kHz
		±600 kHz		−70	−65	
		±400 kHz		−45	−40	dBm/ 30 kHz
		±600 kHz		−60	−55	
EDGE EVM	All modes			1.7	3	%
Rx Band noise	Rx=869-894 MHz			−90	−86	dBm/ 100 kHz
	Rx=925-935 MHz			−89	−79	
	Rx=935-960 MHz			−-90	−86	
Harmonics	Po ≤ +34.2 dBm	2fo		−23	−10	dBm
		3fo-5fo		−30	−15	
Forward Isolation	LB_EN = low, pin = −10 dBm			−34	−30	dBm
Cross Isolation	LB_EN = high	Spurious at HB output		−27	−20	dBm
		LB fundamental on HB output		−10	+2	
Stability	Load VSWR ≤ 8:1 in band, all phases				−36	dBm
Ruggedness	Pout ≤ +32.0 dBm, +3.0 V ≤ Vbatt ≤ +4.8 V, all phases		10:1			VSWR
Input Impedance				1.5:1	2.5:1	VSWR

Electrical Specifications: GSM 1800/GSM 1900 High – Band

Test conditions unless otherwise noted: Temp.=+25 °C, V_{CC}=V_{BATT}= +3.8 V, Pulse Width= 1145 µs, Duty Cycle= 25 %, HB_EN= High & Zin/Zout= 50 Ω

Parameter	Conditions		Min	Typ	Max	Units
Operating Frequency Range	DCS 1800		1710		1785	MHz
	PCS 1900		1850		1910	
Maximum Output Power	GMSK High Power Mode		+32.2	+33		dBm
	GMSK HPM (degraded power)		+30.0			
	8PSK (RMS power)		+28			
	Low Power Mode		+19	+22.5		
	Ultra Low Power Mode		+16	+20		
Power Added Efficiency (PAE)	GMSK HPM, Po = Psat_HPM		44	53		%
	GMSK LPM, Po = Psat_LPM		8	23		
	GMSK ULPM, Po = Psat_ULPM		5	20		
	8PSK HPM, Po = 28 dBm		22	28		
Gain	High Power Mode Po =+32.0 dBm		26.5	29	32	dB
	Low Power Mode Po = +16 dBm		13	17	21	
	Ultra Low Power mode, Po = +8 dBm		10	13	18	
Gain variations – Tc	−25 ≤ Tc ≤ 90 °C			±1.5		dB
Gain variations – Vbatt	+3.2 ≤ Vbatt ≤ +4.2 V			±1		dB
EDGE ACPR	MPM; Po ≤ +22 dBm LPM; Po ≤ +16 dBm	±400 kHz		−60	−58	dBc/ 30 kHz
		±600 kHz		−73	−65	
		±400 kHz		−45	−40	dBm/ 30 kHz
		±600 kHz		−65	−60	
EDGE EVM	All modes			1.7	3	%
Rx band Noise	Rx=1805 – 1880 MHz			−85	−83	dBm/ 100 kHz
	Rx=1930 – 1990 MHz			−85	−83	
Harmonics	Po ≤ 32.0 dBm	2fo		−30	−10	dBm
		3fo – 5fo		−30	−15	
Forward Isolation	HB_EN = low, pin = −10 dBm			−43	−30	dBm
Cross Isolation	HB_EN = high	Spurious at HB output		−36	−20	dBm
		HB fundamental on LB output		−12	+5	
Stability	Load VSWR ≤ 8:1 in band, all phases				−36	dBm
Ruggedness	Pout ≤ +32.0 dBm, +3.0 V ≤ Vbatt ≤ +4.8 V, all phases		10:1			VSWR
Input Impedance				1.5:1	2.5:1	VSWR

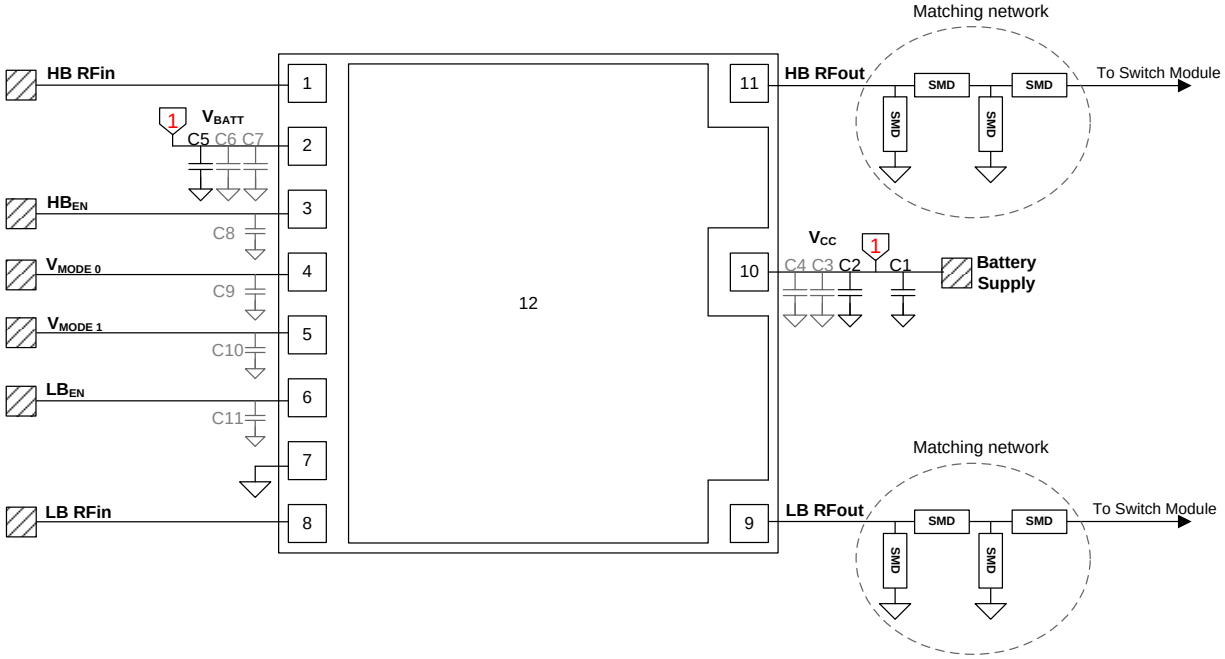
Pin Configuration and Description



TOP VIEW

Pin No.	Label	Description
1	RF_IN_DCS	RF input for DCS/PCS amplifier
2	Vbatt	Battery Voltage supply to module and Vcc1
3	HB_EN	Enables HB (DCS/PCS) amplifier
4	Vmode0	Logic input to set amplifier mode
5	Vmode1	Logic input to set amplifier mode
6	LB_EN	Enables LB (GSM) amplifier
7	GND	GND pin
8	RF_IN_GSM	RF input for GSM850/900 amplifier
9	RF_OUT_GSM	RF output for GSM850/900 amplifier
10	VCC	Voltage supply to Vcc2 (QCOM refers to this as pin 13)
11	RF_OUT_DCS	RF output for DCS/PCS amplifier (QCOM refers to this as pin 16)
12	GND	Ground Paddle (See application note pages 7-10)

Application Circuit Diagram



TOP VIEW

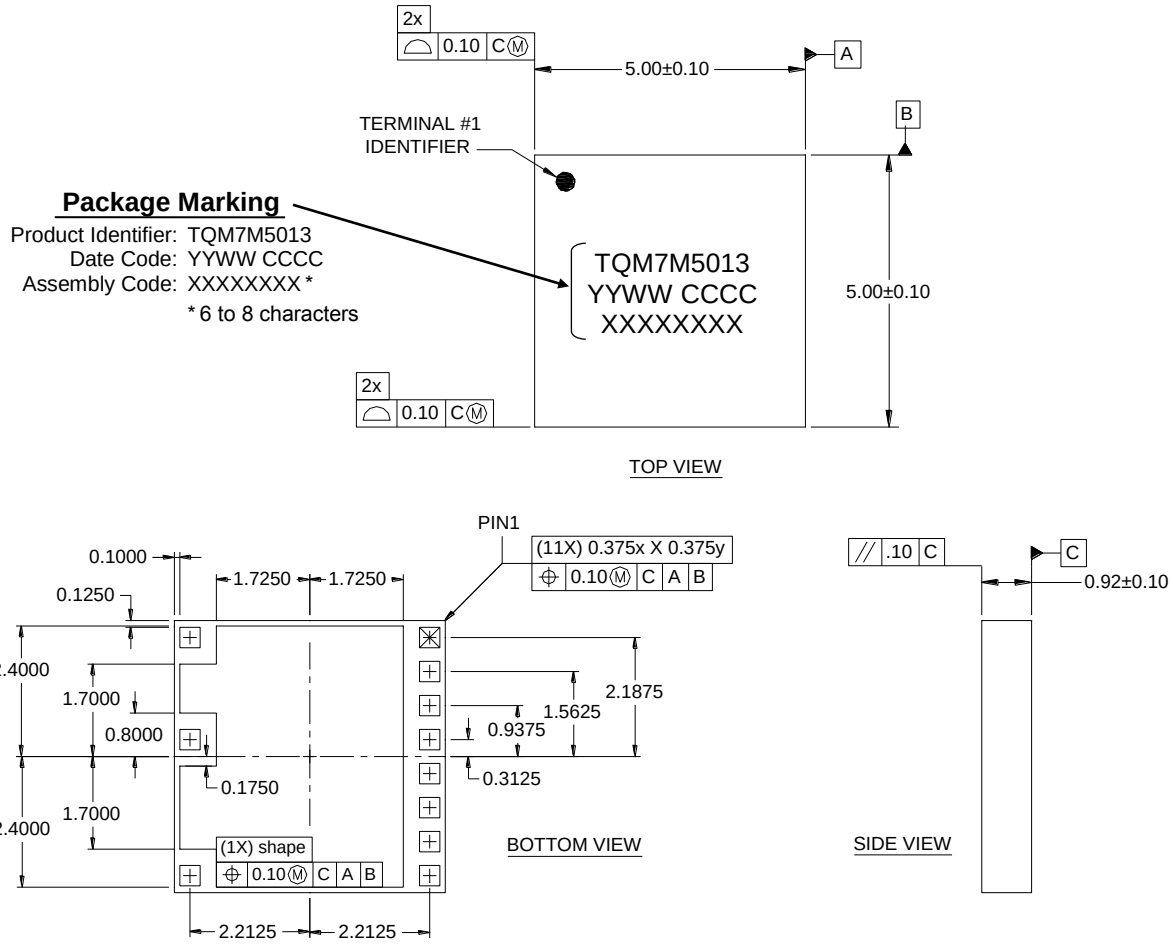
Bill of Material – TQM7M5013 Application Circuit

Component	Reference Designator	Value	Recommended Size	Notes
Capacitor	C1	22 uF (1, 4)	>= 0603	Vcc, V_{BATT} voltage drop regulation.
Capacitor	C2, C5	0.01 uF (2)	0402	Vcc, V_{BATT} bypass.
Capacitor	C3, C6	15 pF (2, 3)	0402	Vcc, V_{BATT} RF bypass for DCS/PCS
Capacitor	C4, C7	56 pF (2, 3)	0402	Vcc, V_{BATT} RF bypass for GSM850/900
Capacitor	C8-C11	1 nF (2, 3)	0402 or 0201	Logic line bypassing
Matching Network SMD	SMD	Application Specific (5)	0402 or 0201	Please make provisions for all four components as shown

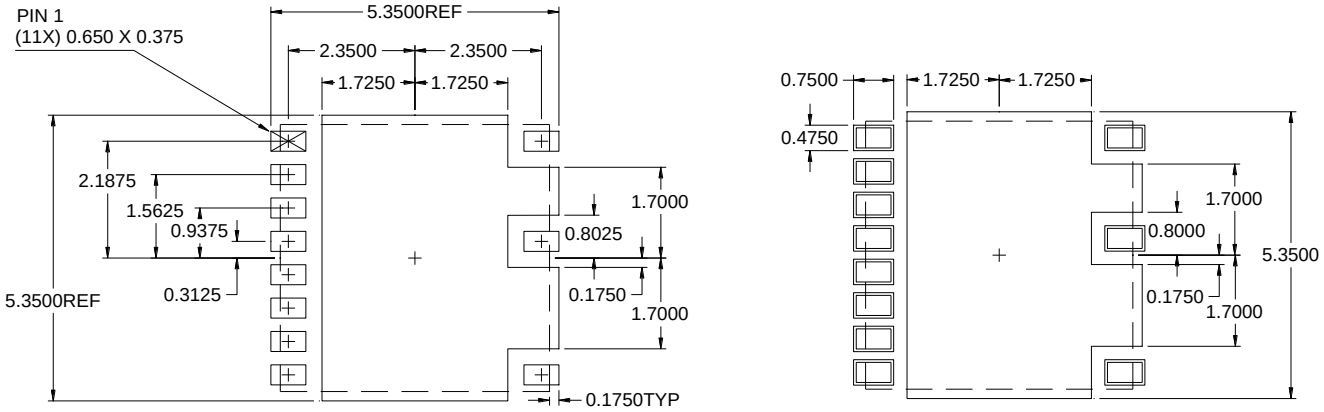
Notes:

1. Please refer to your transceiver vendor's documentation for additional phone level bypassing recommendations.
2. The effectiveness of an RF bypassing capacitor is determined by the frequency at which it is resonant. Because a component's resonance is a function of its size, value, location, and grounding, the recommended values may need to be adjusted. Please place bypass caps as close to their respective PA pins as possible.
3. Please place all bypass caps as shown for initial builds.
4. Vbatt line supplies driver amplifier stage. Vcc line supplies PA stage. Vcc current is ~ 10x Vbatt current. Please place 22uF cap close to Vcc.
5. Component values will vary depending on performance requirements, switch module, and layout. TriQuint Field and Factory Application Engineers are available to assist.
6. GND pin 7 should be a good RF ground. Use a via to ground under pin 7.

Package Marking and Dimensions



Recommended Land Pattern



Recommended Metallization

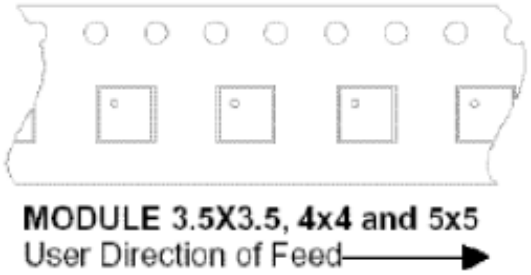
Recommended Solder Mask Opening

Tape and Reel Information – Carrier Tape

Tape and reel specifications for this part are also available on the TriQuint website.
Standard T/R size = 2500 pieces on a 13” reel.

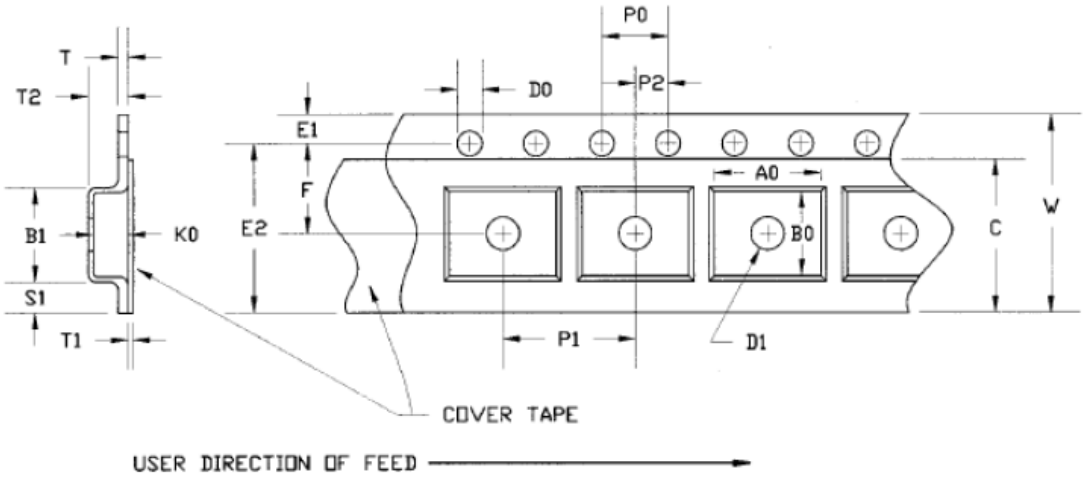
*Provided as informational only. Please request TriQuint PKG.075 for controlling documentation.

Module Orientation



MODULE 3.5X3.5, 4x4 and 5x5
User Direction of Feed

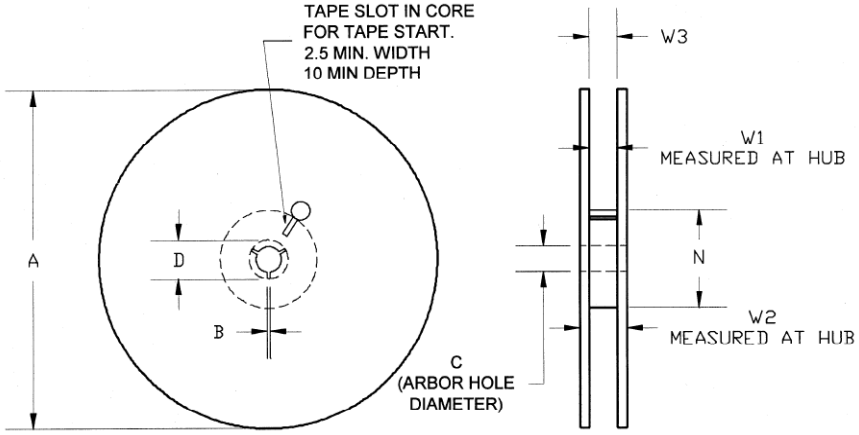
Carrier and Cover Tape Physical Dimensions



Feature	Feature	Symbol	Size (in)	Size (mm)
Cavity	Bottom Hole Diameter	D1	0.059	1.50
Perforation	Diameter	D0	0.059	1.50
	Pitch	P0	1.57	4.00
	Position	E1	0.069	1.75
Carrier Tape	Thickness	T	0.012	0.30
Cover Tape	Thickness	T1	0.002	0.056

Tape and Reel Information – Reel Dimensions

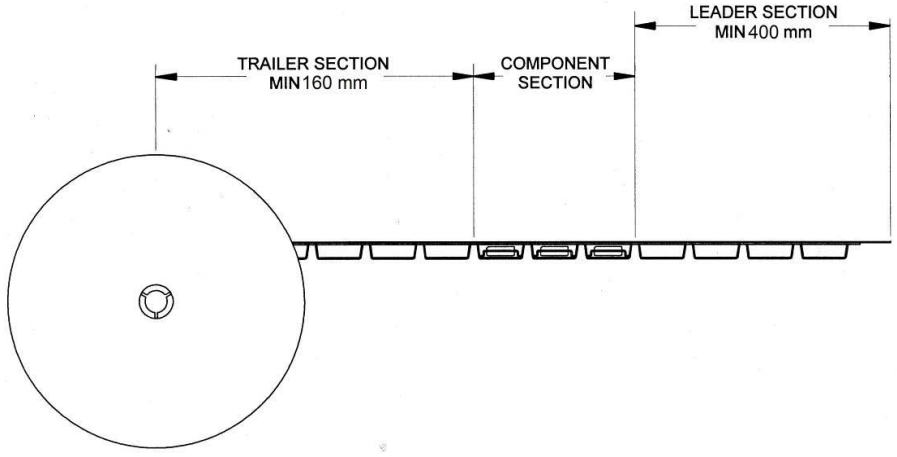
Packaging reels are used to prevent damage to devices during shipping and storage, loaded carrier tape is typically wound onto a plastic take-up reel. The reel size is 13" diameter. The reels are made from high-impact injection-molded polystyrene (HIPS), which offers mechanical and ESD protection to packaged devices.

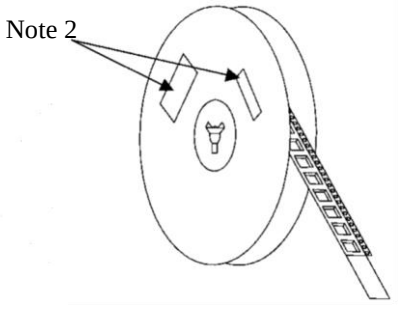


Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	12.992	330.0
	Thickness	W2	0.717	18.2
	Space Between Flange	W1	0.504	12.8
Hub	Outer Diameter	N	4.016	102.0
	Arbor Hole Diameter	C	0.512	13.0
	Key Slit Width	B	0.079	2.0
	Key Slit Diameter	D	0.795	20.2

Tape and Reel Information – Tape Length and Label Placement

Tape and reel specifications for this part are also available on the TriQuint website.
Standard T/R size = 2500 pieces on a 13” reel.



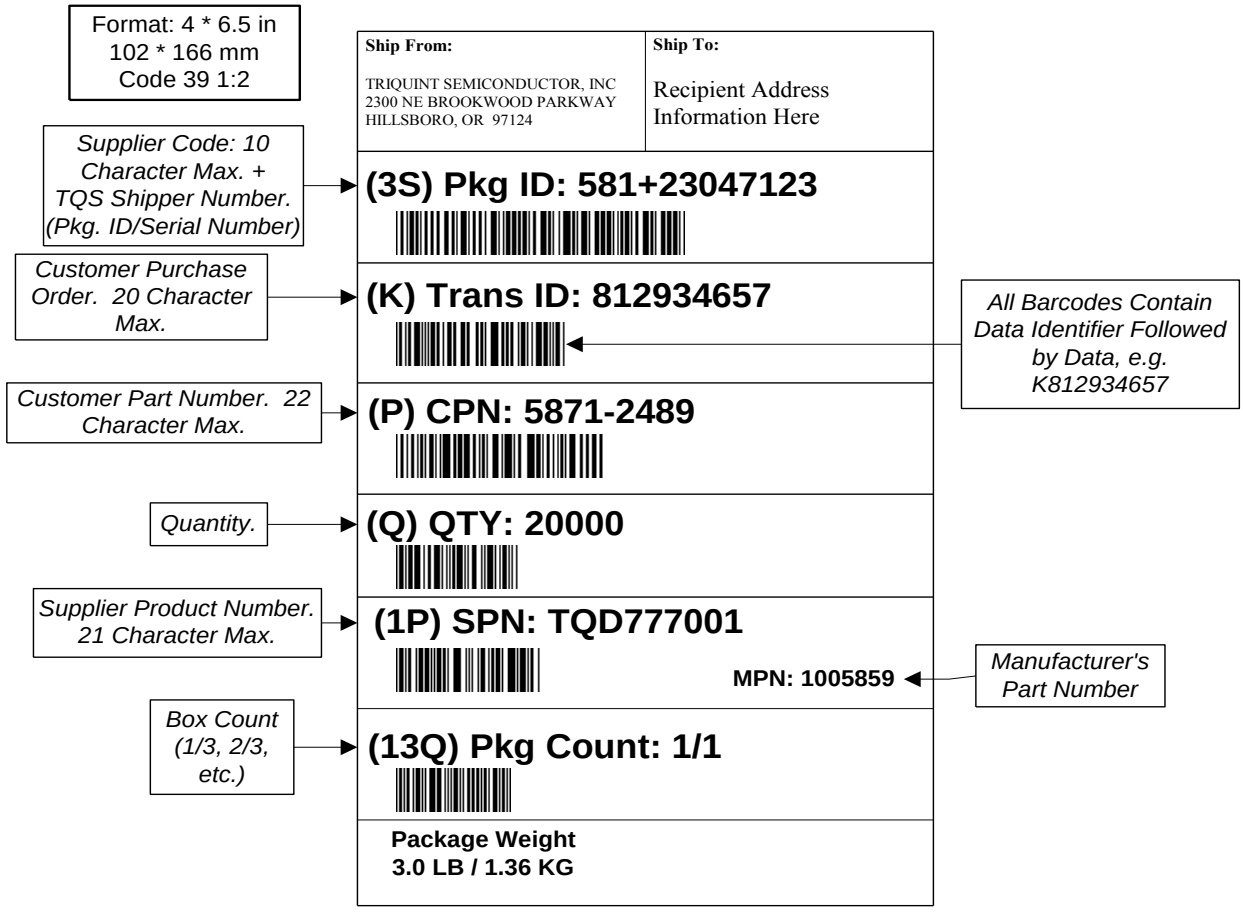


Notes:
1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481-1-A.
2. Labels are placed on the flange opposite the sprockets in the carrier tape.

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 x 16 mm – Drypack		
Box Size	**Reel Qty/Box**	**Empty Box Wt w/ Packing**
15 x 15 x 7	3	2
18 x 15 x 11	5	2.36
17 x 16 x 17	9	2.76



Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: Class 2
Value: ≥ 2000 V to < 4000 V
Test: Human Body Model (HBM)
Standard: ESDA/JEDEC Standard JS-001-2012

MSL Rating

MSL Rating: Level 3
Test: 260°C convection reflow
Standard: JEDEC Standard IPC/JEDEC J-STD-020

Solderability

Compatible with the latest version of J-STD-020, Lead free solder, 260°C.

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 ($C_{15}H_{12}Br_4O_2$) 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@triquint.com **Fax:** +1.503.615.8902

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- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
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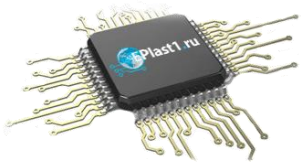
- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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