TQM700013

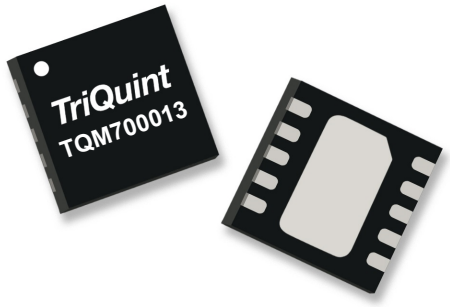
Band 13 LTE PA Module

Applications

- LTE Compatible Applications

Product Features

- Small 10-pin 3 x 3 mm Module
- Integrated High Performance Coupler
- Built-in Vreg Functionality Eliminates the Need For External Components
- Low Quiescent Current Provides Long Talk-Time
- High Linearity
- TriQuint's GaAs BiHEMT / CuFlip® PA Technology
- Optimized for 50 Ω system
- Lead-free 260 °C / RoHS / Halogen-free



10 Pin 3 x 3 mm Leadless SMT Package

Electrical Specifications

Parameter	Typ.	Units
Max P_{OUT}	27.5	dBm
E-UTRA ACLR	−40	dBc
UTRA ACLR1	−40	dBc
UTRA ACLR2	−60	dBc
LPM I_{CQ}	11	mA
Max. Power Current	430	mA
Rx Noise	−130	dBm/Hz

Note: Typical performance for LTE

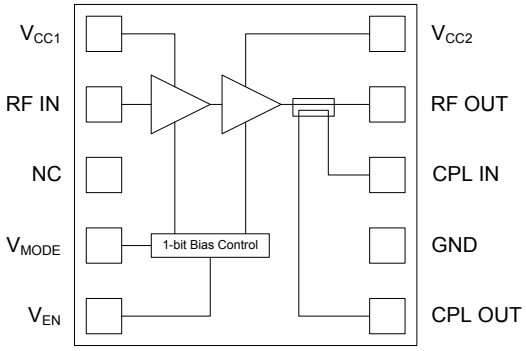
V_{CC1} = V_{CC2} = +3.4 VDC, V_{EN} = "High", T_C = 25 °C

General Description

The TQM700013 is fully matched Power Amplifier Module designed for use in LTE handsets. Its compact 3 x 3 mm package (including coupler) makes it ideal for today's extremely small data enabled phones. Its RF performance meets the stringent linearity requirements of LTE operation.

The TQM700013 is designed on TriQuint's GaAs BiHEMT technology with CuFlip® assembly offering state of the art reliability, temperature stability and ruggedness. The module includes built-in regulator functionality as well as a high performance coupler for maximum integration and space savings.

Functional Block Diagram



Pin Configuration

Pin No.	Label
1	V_{CC1}
2	RF IN
3	NC
4	V_{MODE}
5	V_{EN}
6	CPL OUT
7	GND
8	CPL IN
9	RF IN
10	V_{CC1}
Backside Pad	RF/DC Ground

Ordering Information

Part No.	Description
TQM700013	Band 13 LTE PAM

Standard T/R size = 2500 pieces on a 7" reel

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−30 to 150 °C
RF Input Power, CW, 50Ω, T=25°C	+10 dBm
Supply Voltage (V_{CC1}, V_{CC2})	+4.5 V
Control Voltage (V_{EN}, V_{MODE})	+4.2 V

Operation of this device outside the parameter ranges given above may cause permanent damage. Exposure exceeding absolute maximum rating conditions for extended periods may affect device reliability. Absolute maximum conditions are not guaranteed if multiple are applied at the same time.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Supply Voltage (V_{DD})	+3.2	-	+4.2	V
V_{EN} "Low"	0.0	-	+0.5	V
V_{EN} "High"	+1.35	+1.8	+3.1	V
V_{MODE} "Low"	0.0	-	+0.5	V
V_{MODE} "High"	+1.35	+1.8	+3.1	V
T_{CASE}	−20		+90	°C

Electrical performance is measured under conditions noted in the electrical specifications table. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Test conditions unless otherwise noted: LTE 10 MHz QPSK 12 RB, RBstart = 0, Temp.= +25 °C, V_{CC1} = V_{CC2} = +3.4 V

Parameter	Conditions		Min	Typ	Max	Units
Frequency Range			777		787	MHz
PA Enable Current			-	-	0.1	mA
Mode Control Current			-	-	0.1	mA
Leakage Current [2]			-	10	-	µA
Turn on/off time	DC: I_{CC} to within 90% of final value		-	-	20	µs
	RF: P_{OUT} within 1 dB of final value		-	-	6	
Quiescent Current	LPM		-	11	-	mA
Maximum P_{OUT}	HPM, Worst case LTE MPR=0dB		27.5	-	-	dBm
	LPM, Worse case LTE MPR=0dB		16.0	-	-	
Supply Current	HPM, P_{OUT} = P_{MAX}		-	430	-	mA
	LPM, P_{OUT} = +16 dBm		-	45	-	
Gain	HPM (P_{OUT} ≤ P_{MAX})		28	31	34	dB
	LPM (P_{OUT} ≤ +16 dBm)		16	19	21.5	
LTE Gain Variation	All modes		-	-	±0.25	dB
Gain Linearity	All modes		-	±1.0	-	dB
ACLR	LTE E-UTRA$_{ACLR}$, P_{OUT} ≤ (P_{MAX} – MPR)		-	-	−33	dBc
	LTE UTRA$_{ACLR1}$, ±5 MHz, P_{OUT} ≤ (P_{MAX} – MPR)		-	-	−36	
	LTE UTRA$_{ACLR2}$, ±10 MHz, P_{OUT} ≤ (P_{MAX} – MPR)		-	-	−39	
EVM	P_{OUT} ≤ (P_{MAX} – MPR)		-	-	5	% rms
Harmonic Suppression	P_{OUT} ≤ P_{MAX}, 1 MHz BW	H2	-	-	−42	dBc
		H3+	-	-	−42	
Rx Band Noise	10 MHz LTE, −31 MHz offset from Tx, ±4.5 MHz,	15 RB	-	-	−126	dBm / Hz
		20 RB	-	-	−122	
B13 NS_07 PS emissions	All modes, 763 – 775 MHz		-	-	−58	dBm / 6.25 kHz
ISM Noise	2400 – 2483.5 MHz		-	-	−143	dBm / Hz
GPS Noise	1574 – 1577 MHz		-	-	−140	dBm / Hz

Electrical Specifications (contd.)

Test conditions unless otherwise noted: LTE 10 MHz QPSK 12 RB, RBstart = 0, +25 °C, V_{CC1} = V_{CC2} = +3.4 V

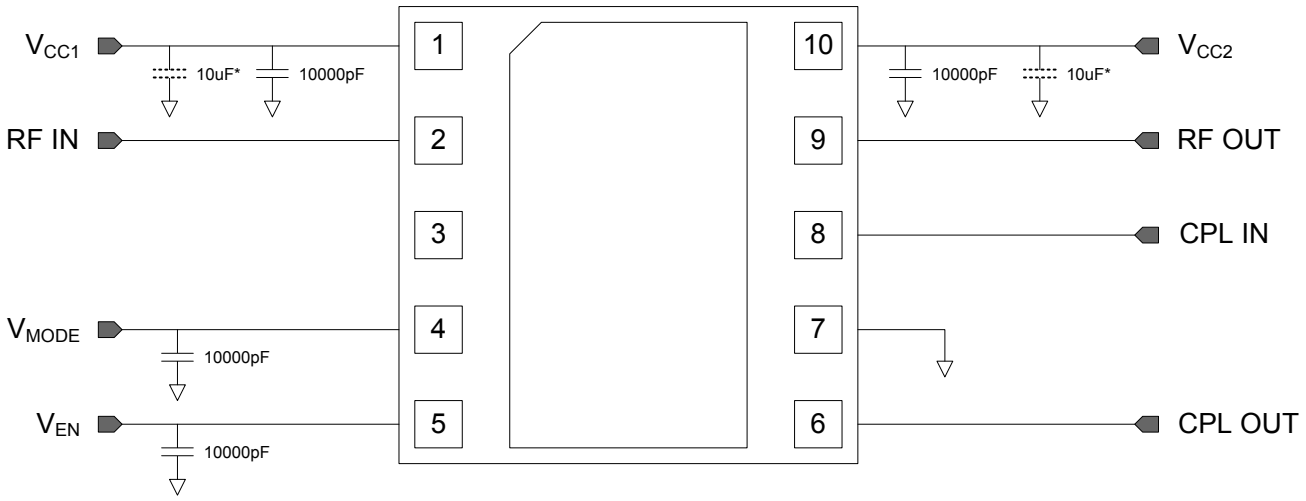
Parameter	Conditions		Min	Typ	Max	Units
Stability (all spurious)	Load VSWR = 6:1 at all angles		-	-	-70	dBc
Ruggedness	Load VSWR = 10:1 at all angles, No Damage	HPM	27.5	-	20	dBm
		LPM	16.0	-	6	
Phase Discontinuity Variation			-	±10	-	Deg
Intermodulation	All modes, −40 dBc CW Interferer	Channel BW	27.5	-	-	dBc
		2x Channel BW	16.0	-	-	
Coupling Factor	All modes, RF OUT to CPLR OUT		-	20	-	dB
Daisy-chain Insertion Loss	CPL IN to CPL OUT, 698 – 2620 MHz, V_{EN}=Low		-	-	0.5	dB

Notes:
1. RF measurements are made with 3GPP TS36.101 LTE specification compliant waveforms.
2. For Vcc1>+4.2V, maximum leakage current is degraded to 25 uA. To guarantee leakage current as specified, it is required to keep both V_{CC1} and V_{CC2} on the same level or leave V_{CC2} in a high impedance state.

Truth Table

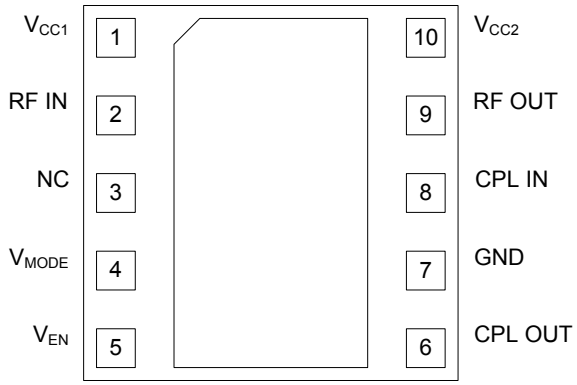
Condition	V_{CC1}	V_{CC2}	V_{EN}	V_{MODE}
Power Down / PA Off	On	On	Low	Low
LPM (P_{OUT} ≤ 16 dBm)	On	On	High	High
HPM (P_{OUT} ≤ P_{MAX})	On	On	High	Low

Application Circuit



* 10uF cap is recommended when using a power supply for cleaning DC signal

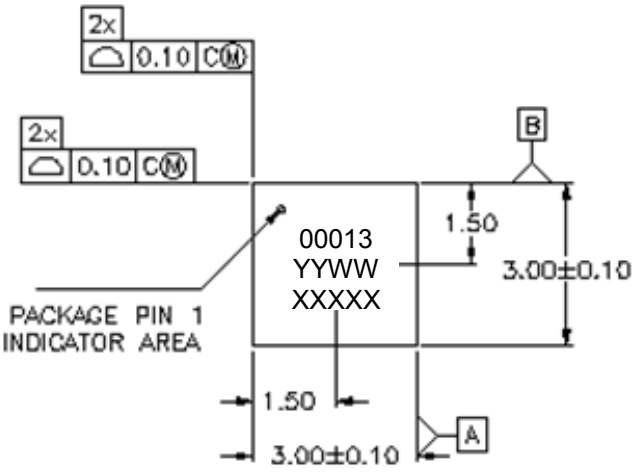
Pin Configuration and Description



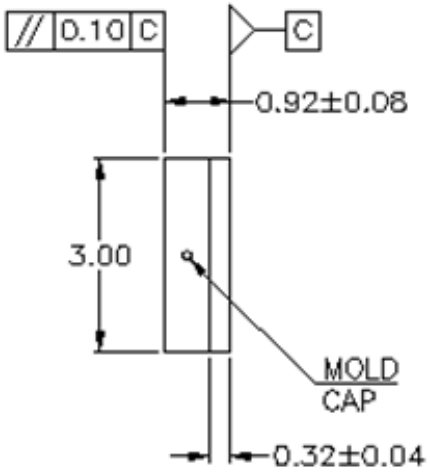
Pin No.	Label	Description
I	V_{CC1}	Battery Voltage for biasing (VCCB).
2	RF IN	RF Input. The RF circuit is DC grounded. 50 Ohm RF impedance.
3	NC	No connect
4	V_{MODE}	Mode control pin
5	V_{EN}	PA Enable Digital Control Voltage
6	CPL OUT	High directivity coupler output
7	GND	Ground
8	CPL IN	High directivity coupler input
9	RF OUT	RF Output. 50 Ohm RF impedance
10	V_{CC2}	Collector Voltage for all stages. Can be connected to DC-DC converter.

Package Marking and Dimensions

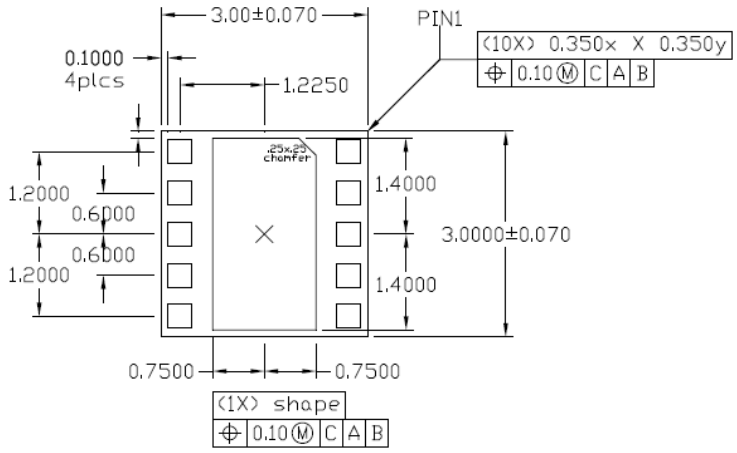
Marking: Part number –00013
Year/week code - YYWW
Lot code – XXXXX



Top View



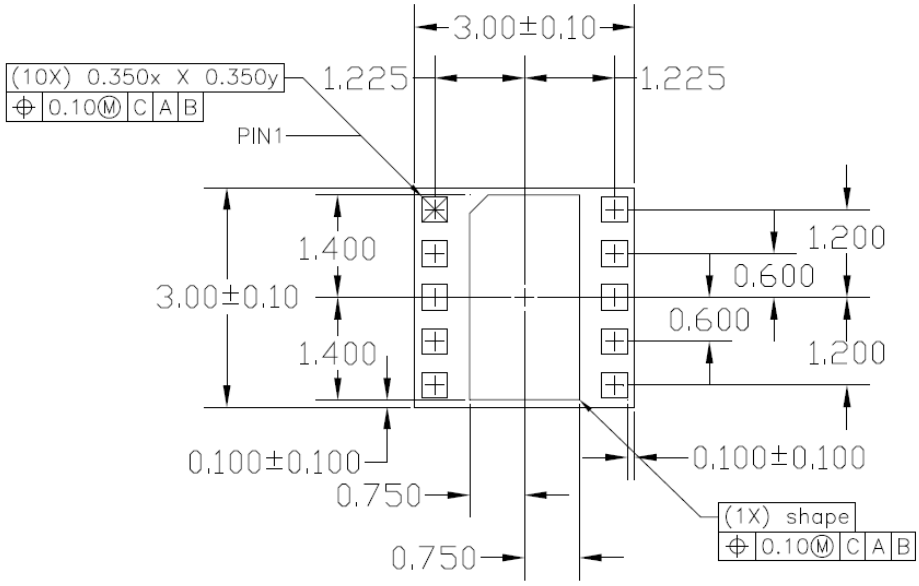
Side View



Bottom View

Notes:
1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

PCB Mounting Pattern

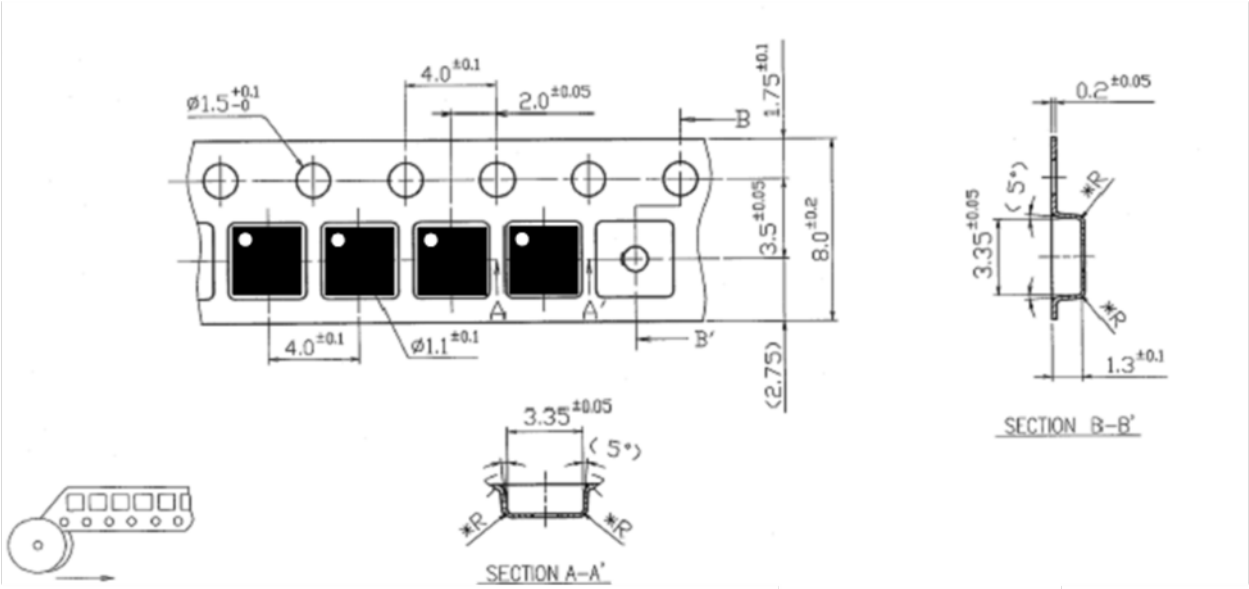


Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Only ground signal traces are allowed directly under the package.
3. Use 1 oz. copper minimum for top and bottom layer metal.
4. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation.
5. Do not remove or minimize via hole structure in the PCB. Thermal and RF grounding is critical.
6. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.10”).
7. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Tape and Reel Information

Tape and reel specifications for this part are also available on the TriQuint website.
Standard T/R size = 2,500 pieces on a 7” reel.

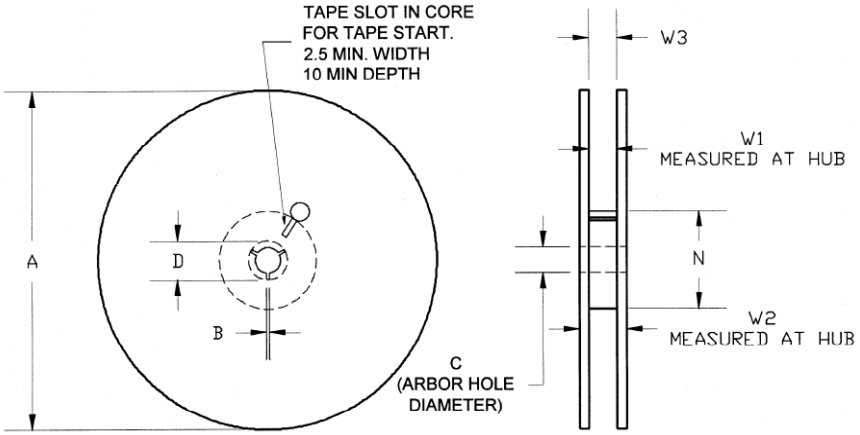


User Direction of Feed →

Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.132	3.35
	Width	B0	0.132	3.35
	Depth	K0	0.051	1.30
	Pitch	P1	0.157	4.00
Centerline Distance	Cavity to Perforation - Length Direction	P2	0.079	2.00
	Cavity to Perforation - Width Direction	F	0.138	3.50
Cover Tape	Width	C	0.213	5.40
Carrier Tape	Width	W	0.315	8.00

Tape and Reel Information – Reel Dimensions

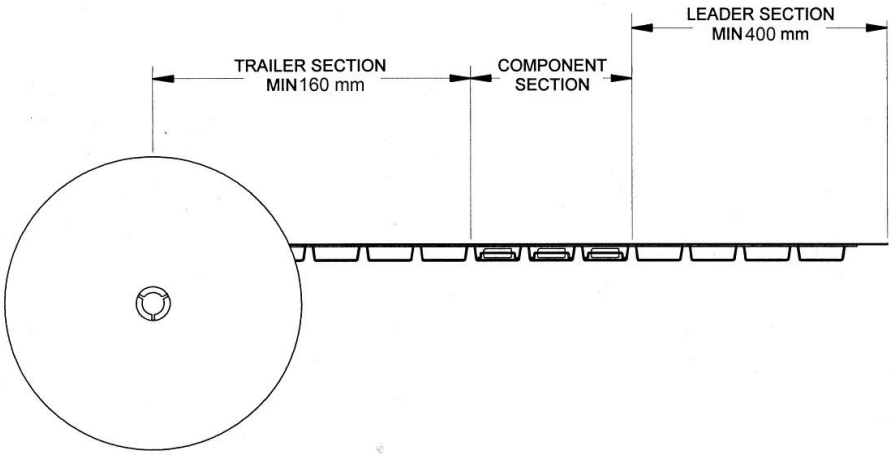
Packaging reels are used to prevent damage to devices during shipping and storage, loaded carrier tape is typically wound onto a plastic take-up reel. The reel size is 13" diameter. The reels are made from high-impact injection-molded polystyrene (HIPS), which offers mechanical and ESD protection to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

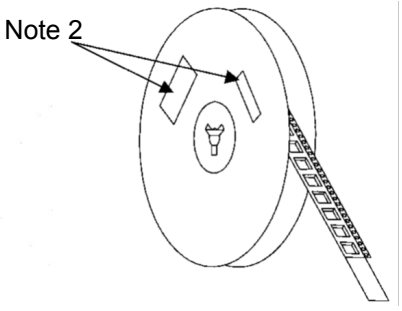


Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	6.969	177.0
	Thickness	W2	0.559	14.2
	Space Between Flange	W1	0.346	8.8
Hub	Outer Diameter	N	4.016	102.0
	Arbor Hole Diameter	C	0.512	13.0
	Key Slit Width	B	0.079	2.0
	Key Slit Diameter	D	0.787	20.0

Tape 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 = 7,000 pieces on a 7” reel.

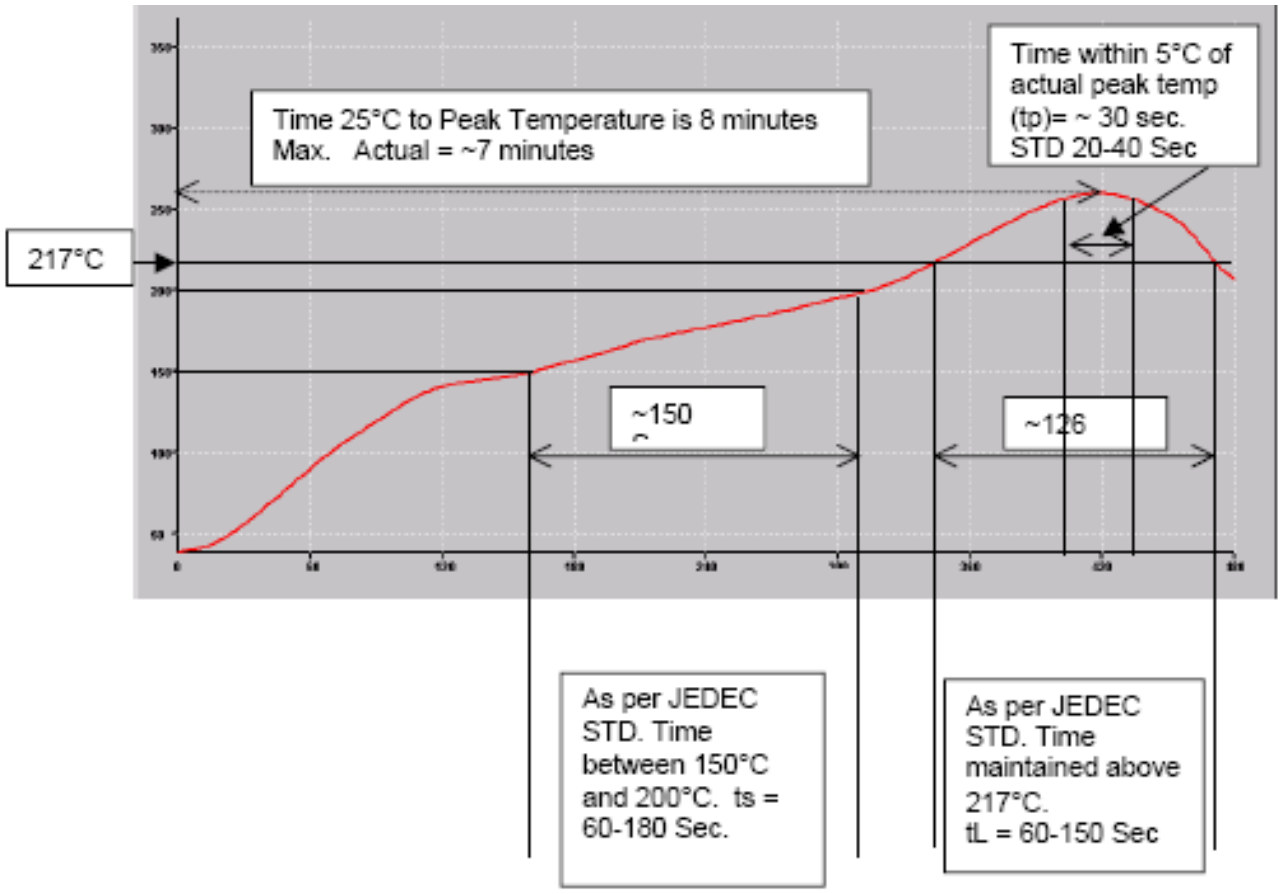




Notes:
1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481-1-A.
2. Labels are placed on the flange opposite the sprockets in the carrier tape.

Recommended Solder Reflow Profile

This part 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.



Product Compliance Information

ESD Sensitivity Rating

Caution! ESD-Sensitive Device

ESD Rating: Class 1B
Value: ≥ 500 V and < 1000 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 both lead-free (260°C maximum reflow temperature) and tin/lead (245°C maximum reflow temperature) soldering processes.

Contact plating: AU over NI

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:

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