32.768 kHz QT381 AND QT388 SERIES

ULTRA-LOW CURRENT, HIGH-TEMPERATURE REAL TIME CLOCK DRIVER OSCILLATORS

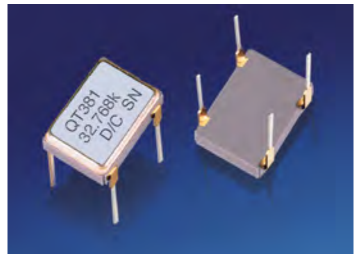
2.5Vdc and 3.3Vdc - 32.768kHz

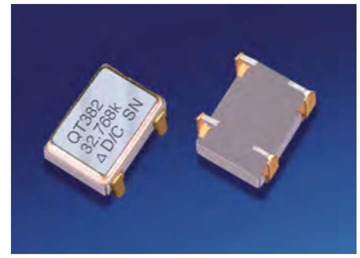
Description

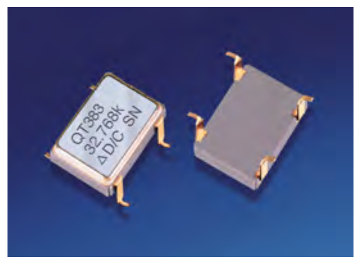
Q-Tech's high temperature real time clock driver oscillators consist of a source clock square wave generator and a miniature strip quartz crystal built in a low profile hermetically ceramic package with gold plated contact terminals.

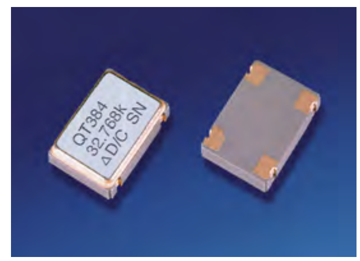
The device provides a precision clock for timekeeping for most down-hole electronic applications by using AT and IT cut quartz crystals. The design and construction of the QT381 and QT388 series will make accuracy-improvement techniques over the traditional RTC with a 32.768kHz quartz tuning-fork crystal, which due to its parabolic characteristics that do not provide much accuracy over a wide temperature range. As a result, there is a gaining or losing up to seconds per day and tens of minutes per year.

The device is built using high temperature materials and processes suitable for long life and highest reliability.



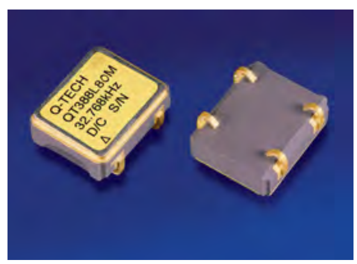
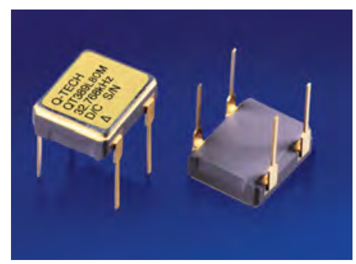






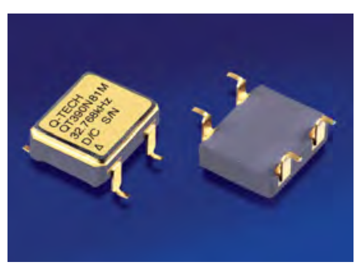
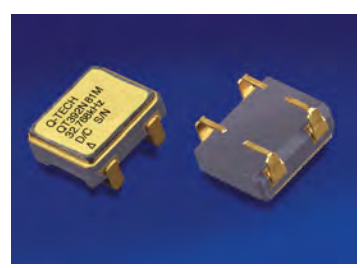
Features

- Made in the USA
- ECCN: EAR99
- +3.3Vdc and +2.5Vdc operation
- 32.768kHz square wave CMOS output
- Wide operating temperature -55°C to +185°C
- Frequency stability (±150ppm to ±250ppm)
- Ultra-low current, 70 µA, suitable for battery operation
- Excellent AT and IT cut crystal temperature characteristics
- Tristate output standard
- Fundamental design
- Fast start-up time
- Hermetically sealed package
- 100% testing over temperature

Applications

- Real-time clock driver
- 32.768kHz output crystal modules

ABSOLUTE MAXIMUM RATIMGS

Parameter	Symbol	Condition	Rating	Unit
Supply Voltage	Vdd	Between Vdd and Vss	-0.3 to +5.0	V
Output Current	Iout	Output pin	± 3	mA
Junction Temperature	Tj		+150	ºC
Storage Temperature	Tstg.		-62 to -150	ºC

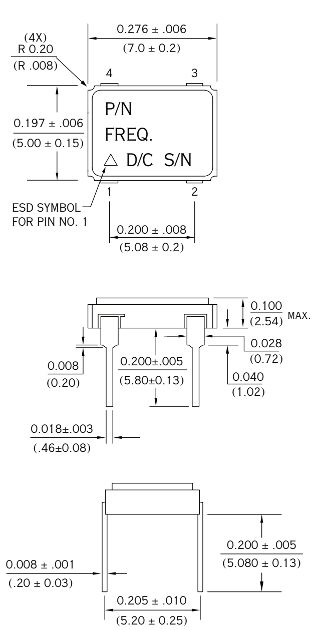
ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Rating			Unit
			Min.	Typ.	Max.	
Output frequency	Fo			32.768		kHz
Supply Voltage	Vdd		2.5 ± 10%		3.3 ± 10%	Vdc
Operating Temperature	Top		See Ordering information			ºC
Frequency Stability	DF/DT		See Ordering information			Ppm
Supply Current	Idd			70	120	µA /1
Symmetry	DC	At 1/2 Vdd	45	50	55	%
Output load	CL			15		pF
Risr and Fall times	Tr/Tf	10% to 90%		50	200	ns
Output disable delay	Tod	25ºC, 15pF			1	µs
Output voltage High	Voh		Vdd -0.4		Vdd	V
Output Voltage Low	Vol		0		0.4	V
Tristate input voltage H	Vih		0.7 Vdd			V
Tristate input voltage L	Vil				0.3 Vdd	V
Stand-by current	Ist	INHN=Low			20	µA
Start-up time	Tstup				10	ms

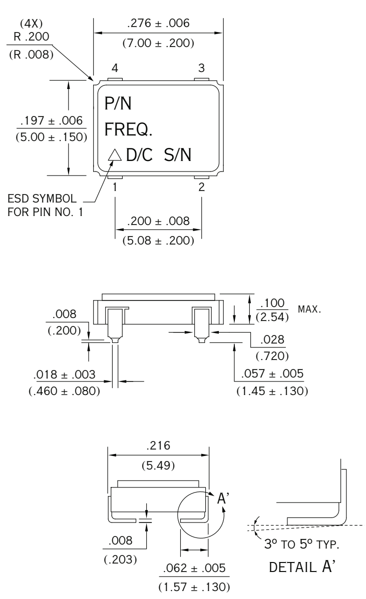
/1 160 µA max. at +185ºC

Package Outline and Pin Connections - Dimensions are in inches (mm)

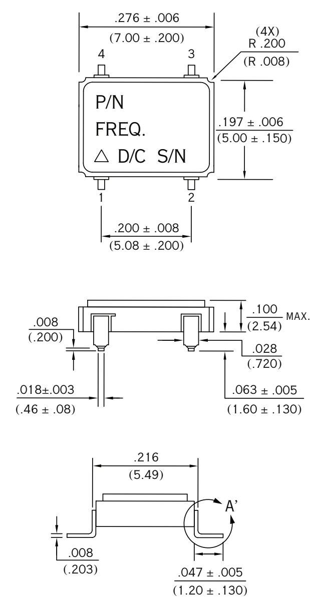
QT381



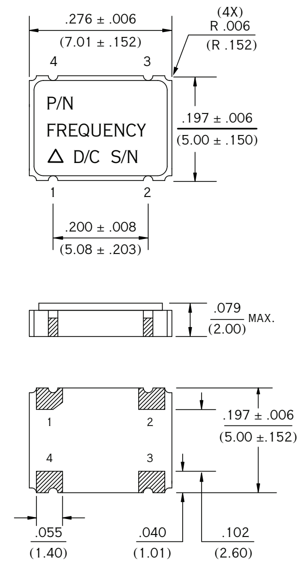
QT382



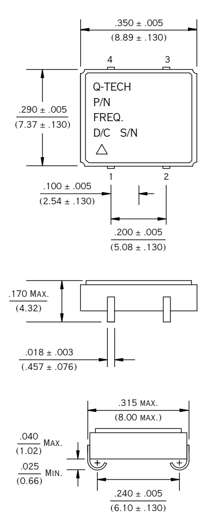
QT383



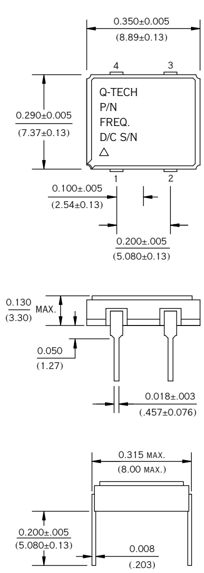
QT384



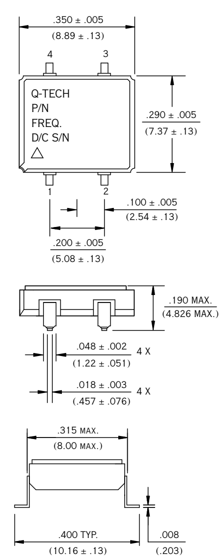
QT388



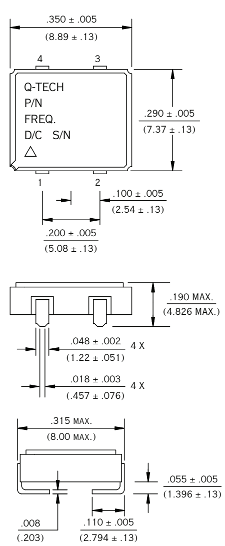
QT389



QT390



QT392



Package Information

- Package material: 91% AL_2O_3
- Lead material: Kovar
- Lead finish: Gold Plated: 50µ ~ 80µ inches
  Nickel Underplate: 100µ ~ 250µ inches
- Weight: 0.6g typ., 3.0g max.

Pin No.	Function
1	TRISTATE
2	GND/CASE
3	OUTPUT
4	VDD

Ordering Information

(Sample part number)

QT381L83M-32.768kHz

Q	T	3	81	L	83	M	-	32.768kHz

Solder Dip Option:
- T = Standard
- S = Solder Dip (*)
- G = Solder Dip (*)

High Temperature Real Time Clock Oscillator (3)

Package: (See page 3)

Logic & Supply Voltage:
- L = LVHCMOS +3.3V
- N = LVHCMOS +2.5V

Output Frequency

Screening Option:
- Blank = No Screening
- M = Per MIL-PRF-55310, Level B

Operating Temperature Option:

80 =	±40ppm	@ 0ºC to +175ºC	(Operable up to + 185ºC)
81 =	±75ppm	@ 0ºC to +175ºC	(Operable up to + 185ºC)
82 =	±40ppm	@ -20ºC to +175ºC	(Operable up to + 185ºC)
83 =	±75ppm	@ -20ºC to +175ºC	(Operable up to + 185ºC)
84 =	±75ppm	@ 0ºC to +185ºC	
85 =	±75ppm	@ -20ºC to +185ºC	
86 =	±100ppm	@ -20ºC to +185ºC	
87 =	±150ppm	@ -20ºC to +185ºC	
88 =	±200ppm	@ -20ºC to +175ºC	(Operable up to + 185ºC)
89 =	±250ppm	@ -40ºC to +175ºC	(Operable up to + 185ºC)
90 =	±200ppm	@ -40ºC to +185ºC	
91 =	±250ppm	@ -40ºC to +185ºC	
92 =	±250ppm	@ -55ºC to +185ºC	

For Non-Standard requirements, contact Q-Tech Corporation at Sales@Q-Tech.com

Packaging Options

- Standard packaging in black foam
- Standard packaging in anti-static plastic tube (60 pcs/tube)
- Tape and Reel (800 pcs/reel) is available for an additional charge.

Other Options Available For An Additional Charge

- P. I. N. D. test (MIL-STD 883, Method 2020, Condition B)

(*) Hot Solder Dip options for an additional cost:
S = Sn60/Pb40 per MIL-PRF 55310
G = Lead free Alloy SAC305 (96.5% Sn, 3% Ag, 0.5% Cu)

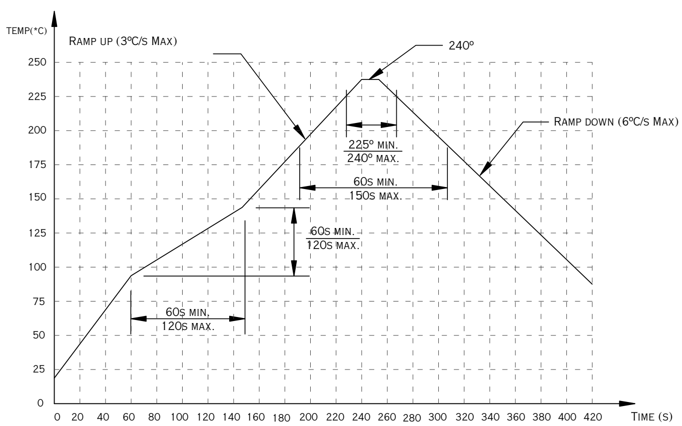
Specifications subject to change without prior notice.

Reflow Profile

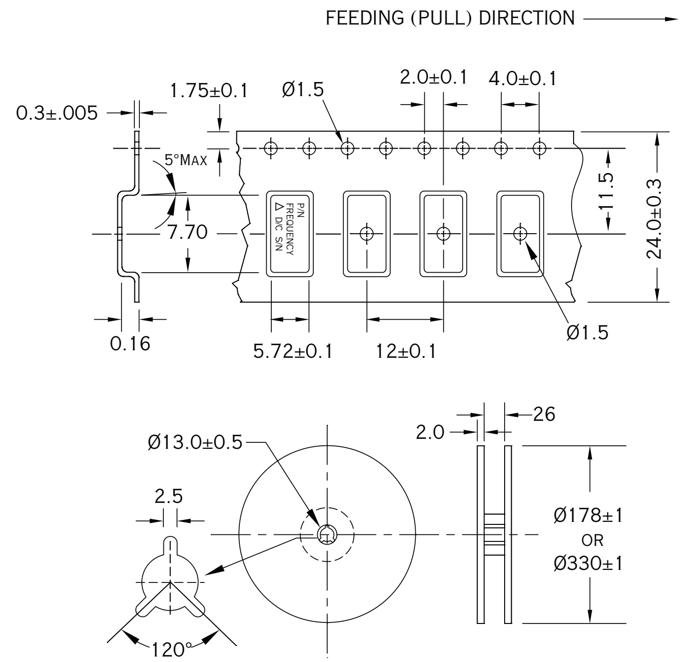
The five transition periods for the typical reflow process are:

- Preheat
- Flux activation
- Thermal equalization
- Reflow
- Cool down

TYPICAL REFLOW PROFILE FOR SN-PB ASSEMBLY



Embossed Tape and Reel Information For QT384



Dimensions are in mm. Tape is compliant to EIA-481-A.

Reel size vs. quantity:

Reel size (Diameter in mm)	Qty per reel (pcs)
178	150
330	800

Environmental Specifications

Q-Tech Standard Screening/QCI (MIL-PRF55310) is available for all of our QT381 and QT388 series. Q-Tech can also customize screening and test procedures to meet your specific requirements. The QT381 and QT388 series are designed and processed to exceed the following test conditions:

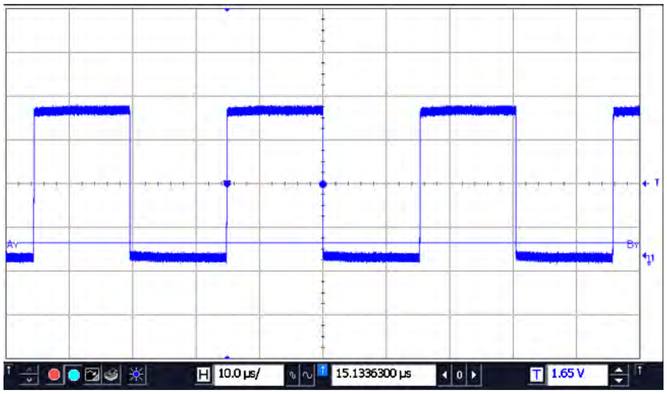
Environmental Test	Test Conditions
Temperature cycling	MIL-STD-883, Method 1010, Cond. B
Constant acceleration	MIL-STD-883, Method 2001, Cond. A, Y1
Seal: Fine and Gross Leak	MIL-STD-883, Method 1014, Cond. A and C
Burn-in	160 hours, 125°C with load
Aging	30 days, 70°C, ±1.5ppm max
Vibration sinusoidal	MIL-STD-202, Method 204, Cond. D
Shock, non operating	MIL-STD-202, Method 213, Cond. I (See Note 1)
Thermal shock, non operating	MIL-STD-202, Method 107, Cond. B
Ambient pressure, non operating	MIL-STD-202, 105, Cond. C, 5 minutes dwell time minimum
Resistance to solder heat	MIL-STD-202, Method 210, Cond. B
Moisture resistance	MIL-STD-202, Method 106
Terminal strength	MIL-STD-202, Method 211, Cond. C
Resistance to solvents	MIL-STD-202, Method 215
Solderability	MIL-STD-202, Method 208
ESD Classification	MIL-STD-883, Method 3015, Class 1 HBM 0 to 1,999V
Moisture Sensitivity Level	J-STD-020, MSL=1

Note 1: Additional shock results successfully passed on 16MHz, 20MHz, 24MHz, 40MHz, and 80MHz

- Shock 1,500g peak, half-sine, 0.5ms duration (MIL-STD-883, Method 2002, Cond. B)
- Random Vibration, 3 minuets per axis, (MIL-STD-202, Method 214, Cond. Ik, 46.32 g RMS)

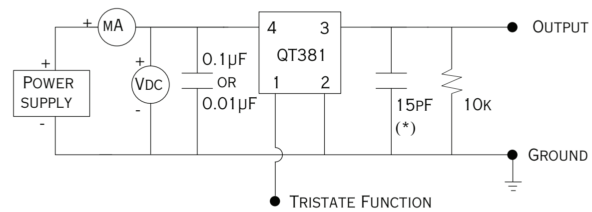
Please contact Q-Tech for higher shock requirements

Output Waveform (Typical)



Test Circuit

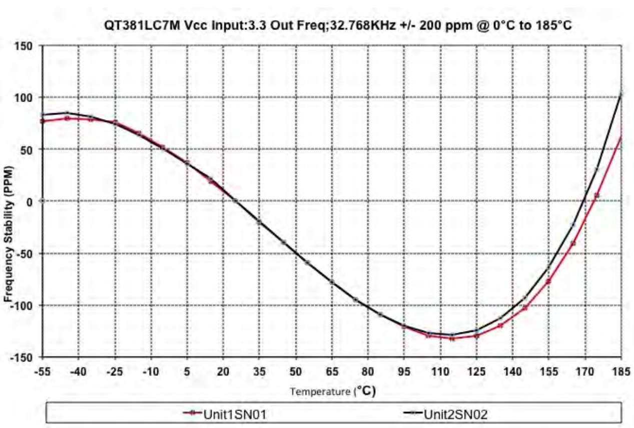
TYPICAL TEST CIRCUIT FOR CMOS LOGIC



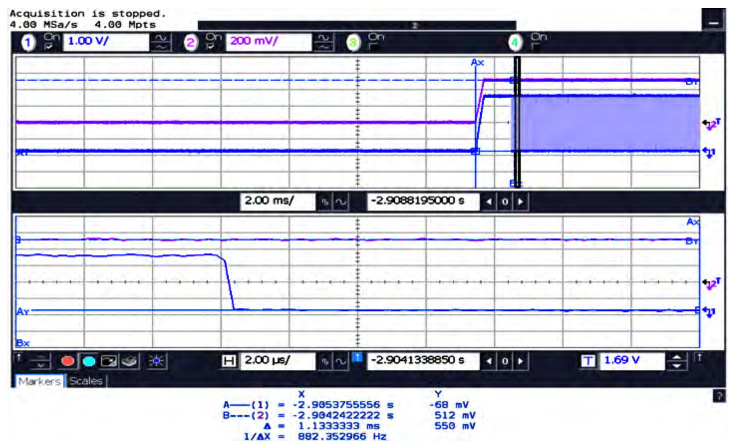
(*) CL INCLUDES PROBE AND JIG CAPACITANCE

The Tristate function on pin 1 has a built-in pull-up resistor typical 50kΩ, so it can be left floating or tied to Vdd without deteriorating the electrical performance.

Frequency vs. Temperature Curve



Start up Time at 185°C



Thermal Characteristics

The heat transfer model in a hybrid package is described in figure 1.

Heat spreading occurs when heat flows into a material layer of increased cross-sectional area. It is adequate to assume that spreading occurs at a 45° angle.

The total thermal resistance is calculated by summing the thermal resistances of each material in the thermal path between the device and hybrid case.

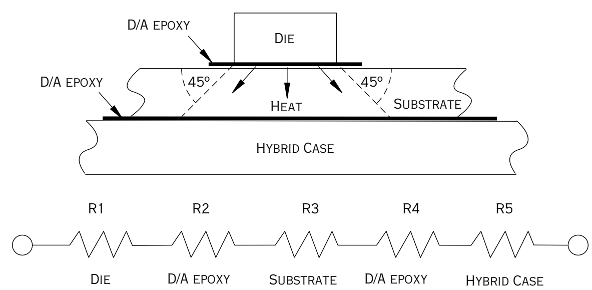
$$RT = R1 + R2 + R3 + R4 + R5$$

The total thermal resistance RT (see figure 2) between the heat source (die) to the hybrid case is the Theta Junction to Case (Theta JC) in°C/W.

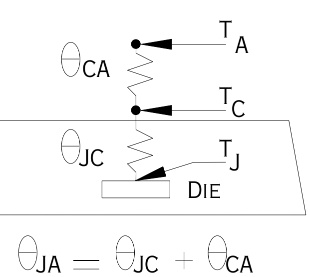
- Theta junction to case (Theta JC) for this product is 30°C/W.
- Theta case to ambient (Theta CA) for this part is 100°C/W.
- Theta Junction to ambient (Theta JA) is 130°C/W.

Maximum power dissipation PD for this package at 25°C is:

- PD(max) = (TJ (max) – TA)/Theta JA
- With TJ = 175°C (Maximum junction temperature of die)
- PD(max) = (175 – 25)/130 = 1.15W



(Figure 1)



(Figure 2)

Revision History

ECO	REV	REVISION SUMMARY	Page
.	_	Initial Release	