Q-TECH CORPORATION

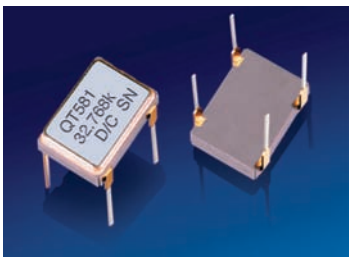
# 32.768 kHz QT58X AND QT59X SERIES

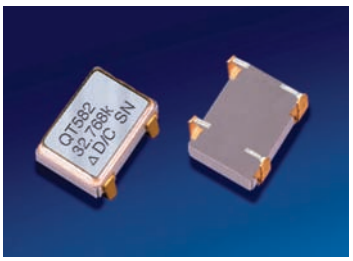
## ULTRA-LOW CURRENT, HIGH-TEMPERATURE REAL TIME CLOCK DRIVER OSCILLATORS

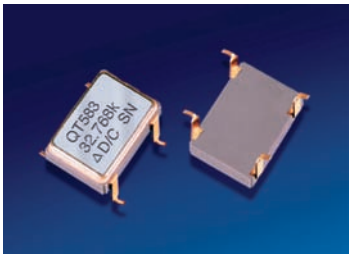
### 2.5Vdc and 3.3Vdc - 32.768kHz

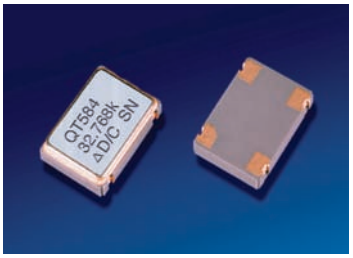
## Description

Q-Tech's high temperature real time clock oscillators consist of a source clock square wave generator and a miniature round or 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 or IT cut quartz crystals. The design and construction of the QT58X and QT59X 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.



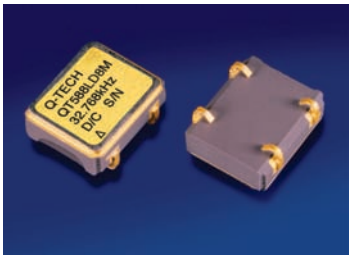



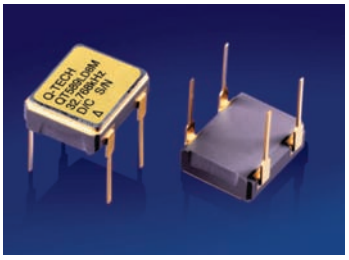



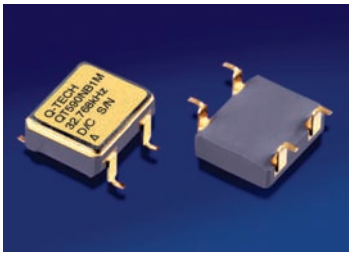



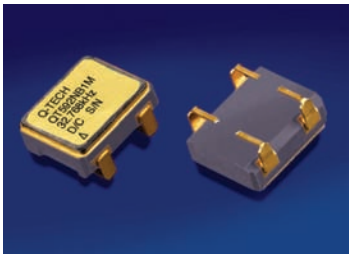

## Features

- Made in the USA
- ECCN: EAR99
- +3.3Vdc and +2.5Vdc operation
- 32.768kHz square wave CMOS output
- Wide operating temperature -55°C to +200°C
- Tight frequency stability (±40ppm to ±250ppm)
- Ultra-low current 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
- RoHS compliant




## Applications

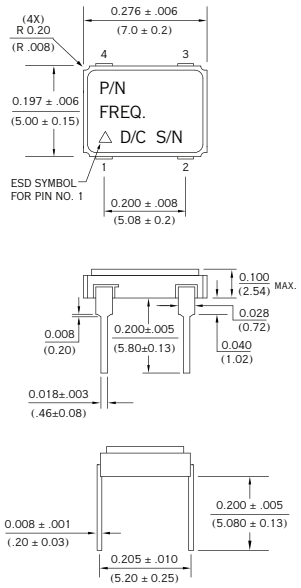
- Real-time clock driver
- 32.768kHz output crystal modules

## Electrical Characteristics

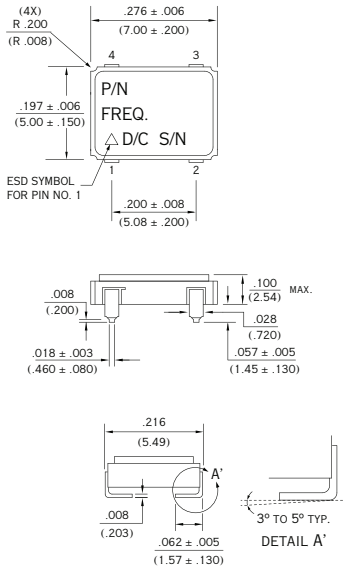
| Parameters | +3.3Vdc | +2.5Vdc |
|---|---|---|
| Output frequency range (Fo) | **32.768kHz** | |
| Supply voltage (Vdd) | +3.3Vdc ± 10% | +2.5Vdc ± 10% |
| Maximum Applied Voltage (Vdd max.) | +5Vdc | |
| Frequency stability (ΔF/ΔT) | See Ordering Information | |
| Operating temperature (Topr) | See Ordering Information | |
| Storage temperature (Tsto) | -55ºC to + 125ºC | |
| Operating supply current (Idd) (No Load) | 0.42 mA typ., 0.7mA max. | 0.24 mA typ., 0.5mA max. |
| Symmetry (50% of ouput waveform) | 50/50% typ., 45/55% max. | |
| Rise and Fall times (Tr, Tf between 10% and 90% of output waveform) | 0.2µs typ., 1µs max. | |
| Output Load | 15pF | |
| Start-up time (Tstup) | 10ms max. | |
| Output voltage (Voh/Vol) | 0.9 x Vdd min.; 0.1 x Vdd max. | |
| Output Current (Ioh/Iol) | ± 2mA min. | |
| Enable/Disable function Pin 1 | VIH ≥ 0.7Vdd: Active<br>VIL ≤ 0.3Vdd: High Impedance<br>Stand-by current: 10µA max. | |
| Aging | ± 5ppm max. first year / ± 2ppm max. per year thereafter | |

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

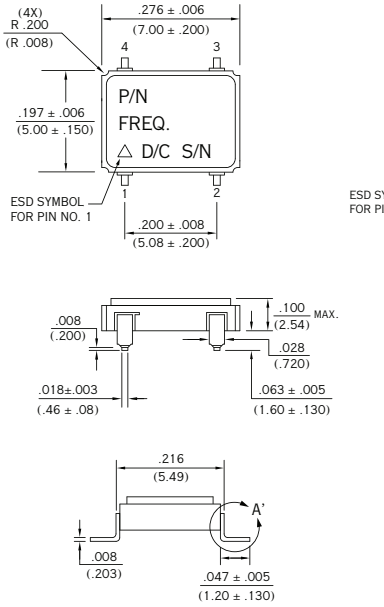
### QT581



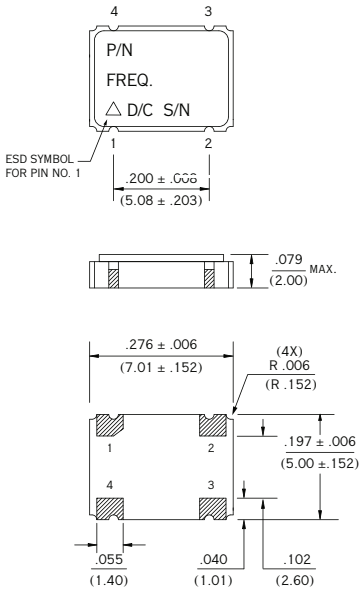

### QT582



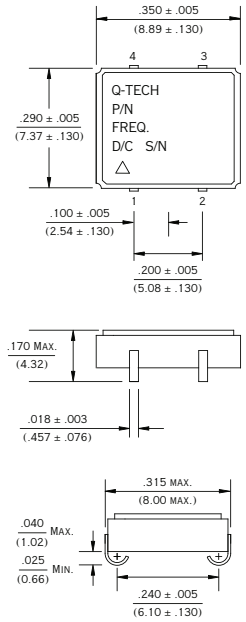

### QT583



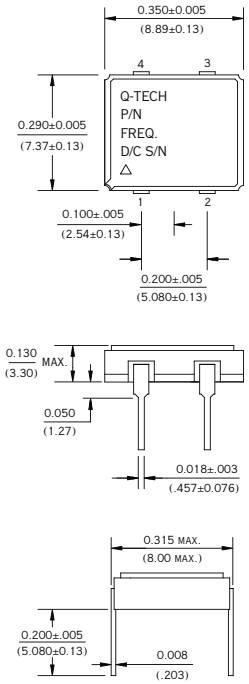

### QT584



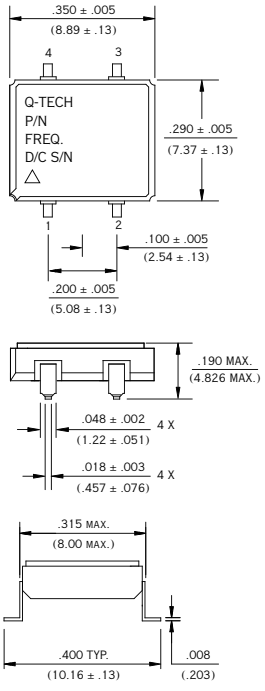

### QT588



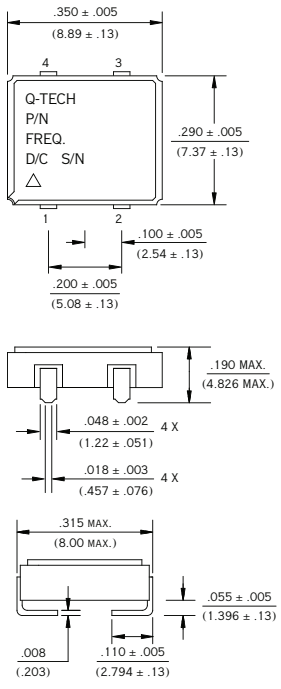

### QT589




### QT590




### QT592




## 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)

QT581L80M-32.768kHz

| Q | T | 5 | 81 | L | 80 | M | - | 32.768kHz |
|---|---|---|---|---|---|---|---|---|

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

**High Temperature Real Time Clock Oscillator**

**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 | @ 0°C to +175°C | (Operable up to +185°C) |
| 81 | = ± 75ppm | @ 0°C to +175°C | (Operable up to +185°C) |
| 82 | = ± 40ppm | @ -20°C to +175°C | (Operable up to +185°C) |
| 83 | = ± 75ppm | @ -20°C to +175°C | (Operable up to +185°C) |
| 84 | = ± 75ppm | @ 0°C to +185°C | |
| 85 | = ± 75ppm | @ -20°C to +185°C | |
| 86 | = ±100ppm | @ -20°C to +185°C | |
| 87 | = ± 150ppm | @ -20°C to +185°C | |
| 88 | = ± 200ppm | @ -20°C to +175°C | (Operable up to +185°C) |
| 89 | = ± 250ppm | @ -40°C to +175°C | (Operable up to +185°C) |
| 90 | = ± 200ppm | @ -40°C to +185°C | |
| 91 | = ± 250ppm | @ -40°C to +185°C | |
| 92 | = ± 250ppm | @ -55°C to +185°C | |
| 93 | = ± 200ppm | @ 0°C to +200°C | |
| 94 | = ± 250ppm | @ 0°C to +200°C | |
| 95 | = ± 250ppm | @ -20°C to +200°C | |
| 96 | = ± 250ppm | @ -40°C to +200°C | |
| 97 | = ± 250ppm | @ -55°C to +200°C | |
| 98 | = ± 250ppm | @ 0°C to +185°C | |

**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)

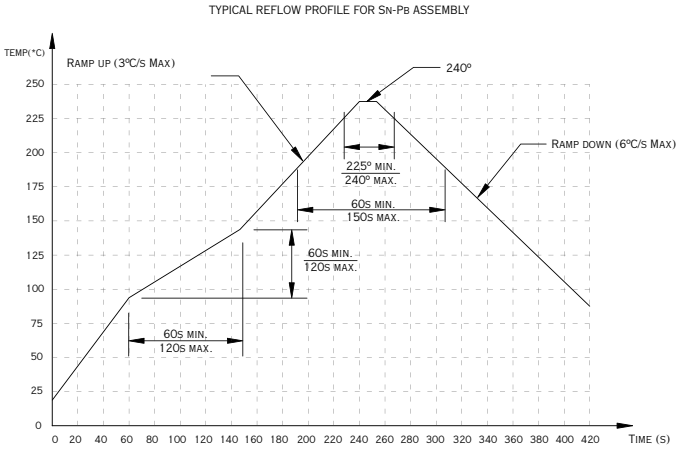
(*) Hot Solder Dip options for an additional cost:
S = Sn60/Pb40 per MIL-PRF 55310
G = Lead free Alloy SAC305 (96.5% Sn, 3% Ag, 0.5% Cu)

**Specifications subject to change without prior notice.**

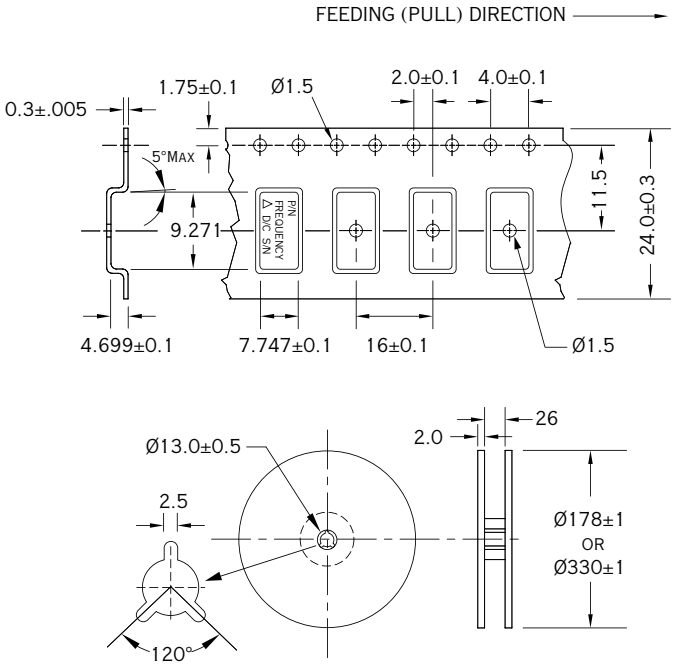
## Reflow Profile

The five transition periods for the typical reflow process are:

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




## Embossed Tape and Reel Information For QT588




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

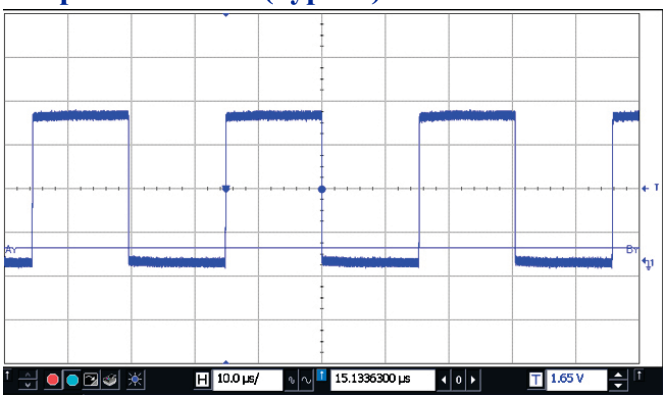
Q-Tech Standard Screening/QCI (MIL-PRF55310) is available for all of our QT581 and QT588 series. Q-Tech can also customize screening and test procedures to meet your specific requirements. The QT581 and QT588 series are designed and processed to exceed the following test conditions:

| 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 |

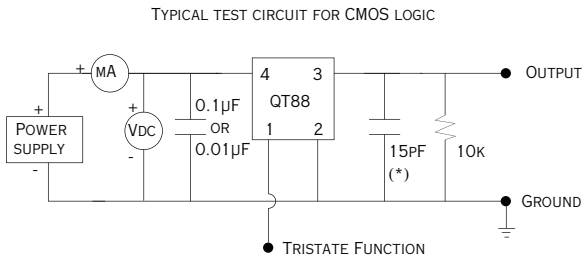
**Note 1:** Additional shock results successfully passed on 16MHz, 20MHz, 24MHz, 40MHz, and 80MHz
- Shock 850g peak, half-sine, 1 ms duration (MIL-STD-202, Method 213, Cond. D modified)
- Shock 1,500g peak, half-sine, 0.5ms duration (MIL-STD-883, Method 2002, Cond. B)
- Shock 36,000g peak, half-sine, 0.12 ms duration

**Please contact Q-Tech for higher shock requirements**

## Output Waveform (Typical)



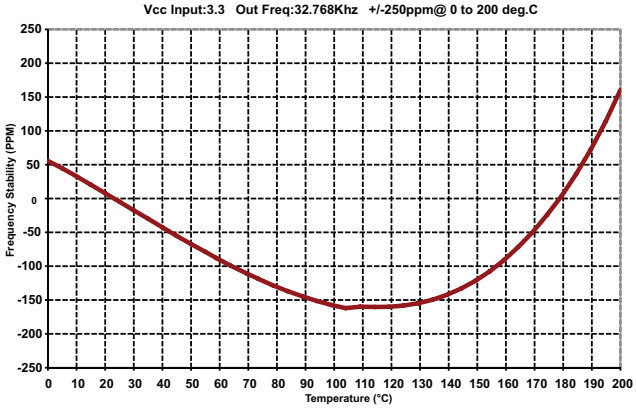

## Test Circuit



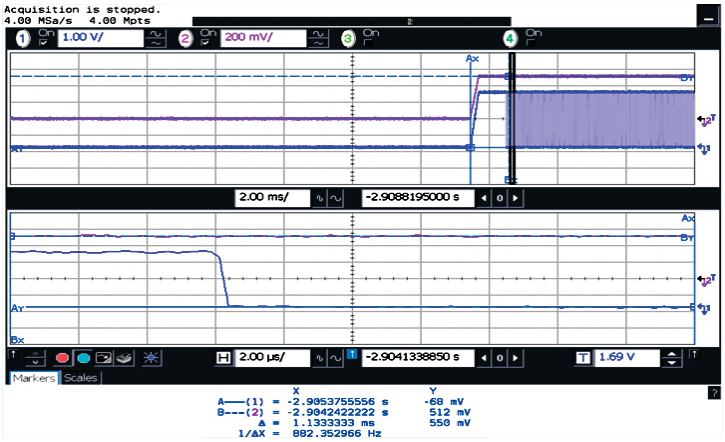

(*) CL INCLUDES PROBE AND JIG CAPACITANCE

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 200°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.

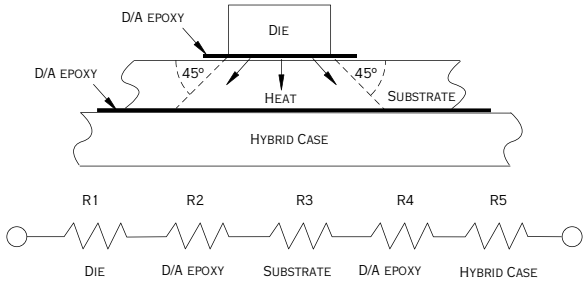
$$RT = R1 + R2 + R3 + R4 + R5$$

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.

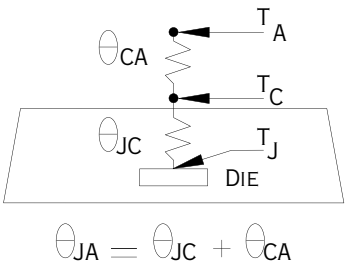
- Theta junction to case (Theta JC) for this product is 30°C/W.
- Theta case to ambient (Theta CA) for this part is 100°C/W.
- Theta Junction to ambient (Theta JA) is 130°C/W.

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 |
|---|---|---|---|
| 10336 | B | Added dimension tolerance to QT582 & QT583 outlines | 3 |
| | | Added Solder Dip option G | 3 |
| | | Modified ordering information table | 4 |
| | | Added “Revision History” table | 7 |
| | | Add document number on footer of all pages | All |
| | C | Changed document number from QPDS-0007 to QPDS-0117 to avoid conflict | All |
| | | Added temperature code 98 | 4 |