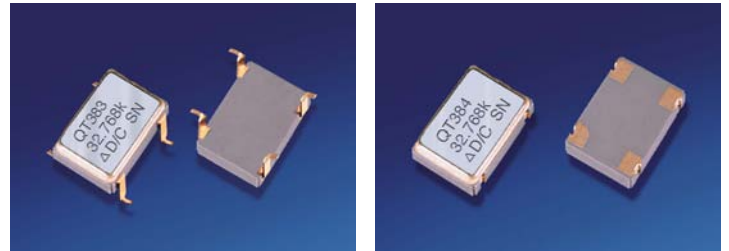
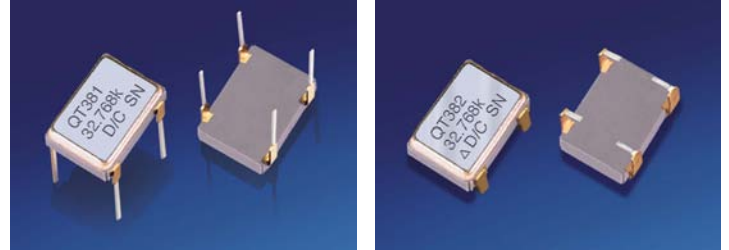


Description

Q-Tech's high temperature real time clock 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.

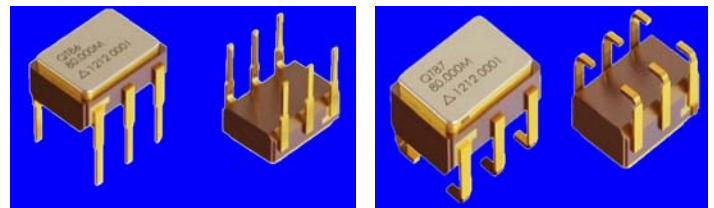
The device provides a precision clock for timekeeping for most down-hole electronic applications by using AT cut quartz crystals. The design and construction of the QT381 and QT386 series will make accuracy-improvement techniques over the traditional RTC with a 32.768kHz quartz tuning-fork crystal, which 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.



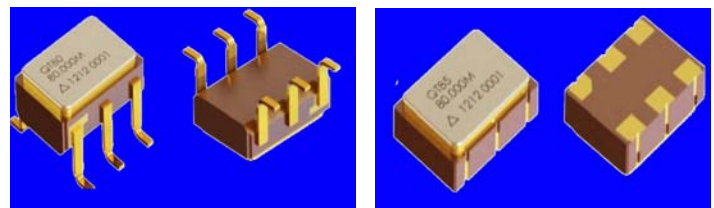
Features

- 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 ($\pm 150\text{ppm}$ to $\pm 250\text{ppm}$)
- Ultra-low current, 70 μA , suitable for battery operation
- Excellent AT cut crystal temperature characteristics
- Tristate output standard
- Fundamental design
- 4 or 6 leads
- Fast start-up time
- Hermetically sealed package
- 100% testing over temperature



Applications

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



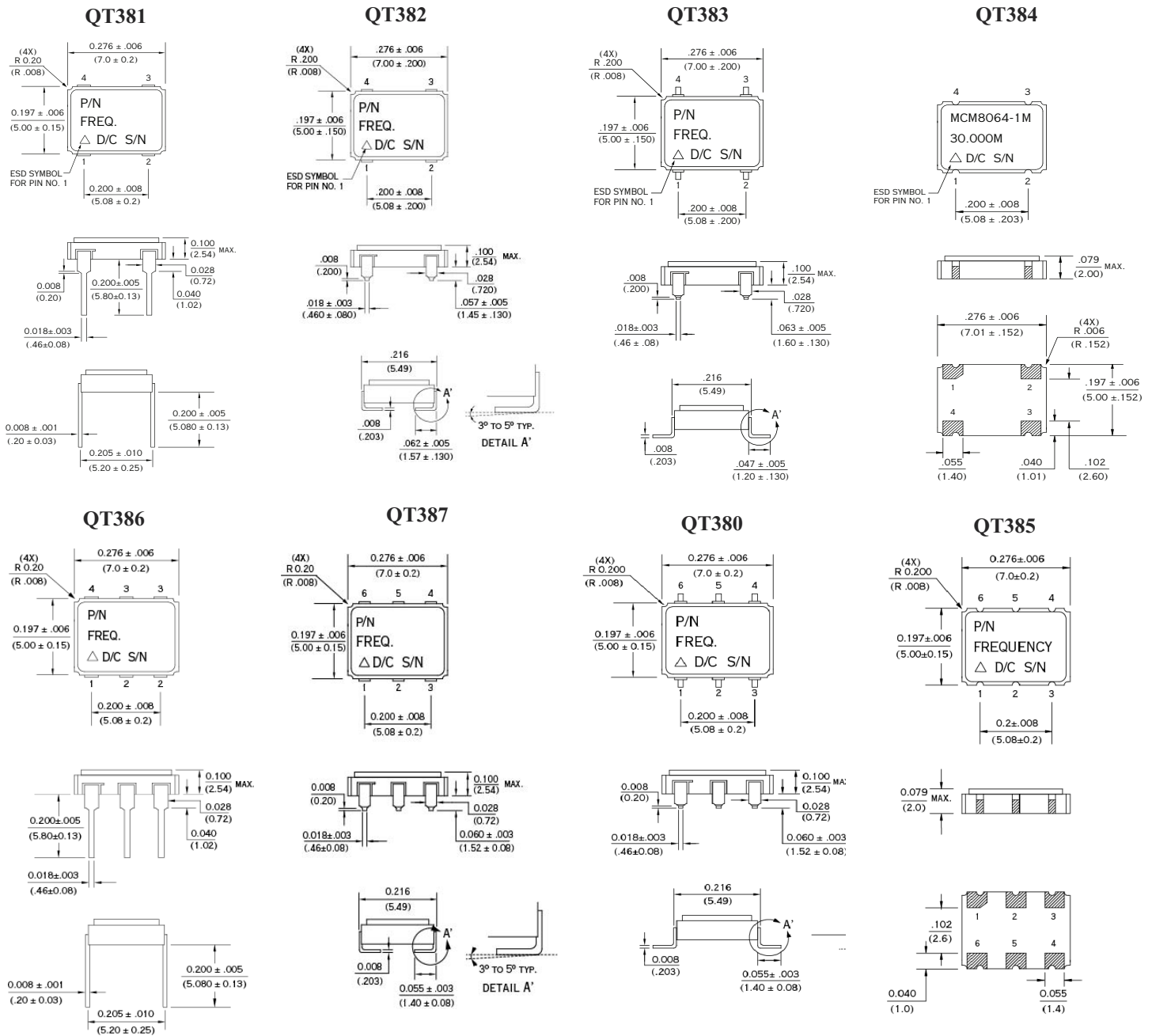
ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Condition | Rating | Unit |
|----------------------|--------|---------------------|--------------|------|
| Supply Voltage | Vdd | Between Vdd and Vss | -0.3 to +7.0 | V |
| Output Current | Iout | Output pin | ± 3 | mA |
| Junction Temperature | Tj | | +150 | °C |
| Storage Temperature | Tstg. | | -62 to -150 | °C |

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 | | | °C |
| Frequency Stability | DF/DT | | See Ordering information | | | Ppm |
| Supply Current | Idd | | | 70 | 120 | µA |
| 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 | 25°C, 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 | INH=Low | | | 20 | µA |
| Start-up time | Tstup | | | | 10 | ms |

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



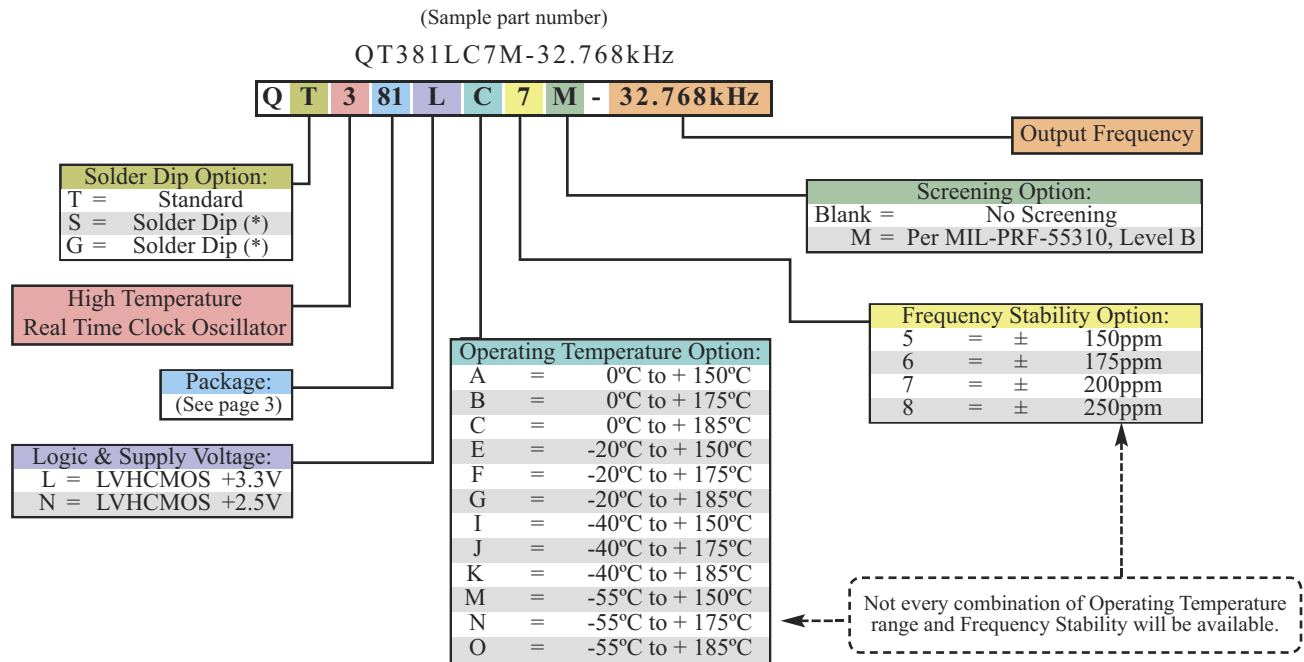
Package Information

- Package material: 91% AL₂O₃
- 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 |

| Pin No. | Function |
|---------|----------|
| 1 | TRISTATE |
| 2 | N/C |
| 3 | GND/CASE |
| 4 | OUTPUT |
| 5 | N/C |
| 6 | VDD |

Ordering Information



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

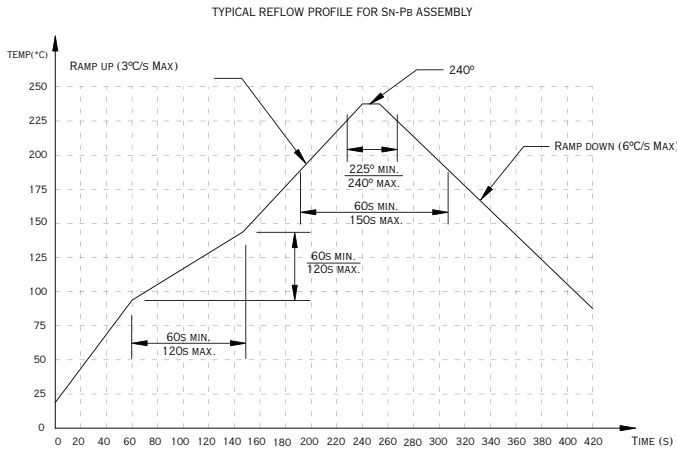
- P. I. N. D. test (MIL-STD 883, Method 2020, Condition B)
- (*) Hot Solder Dip options for an additional cost:
S = Sn60/Pb40 per MIL-PRF 55310
G = Lead free Alloy SAC305 (96.5% Sn, 3% Ag, 0.5% Cu)

Specifications subject to change without prior notice.

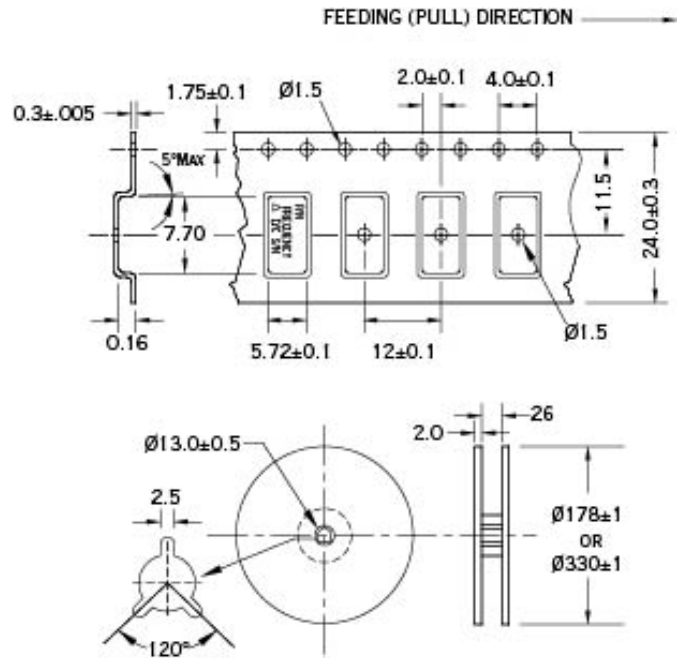
Reflow Profile

The five transition periods for the typical reflow process are:

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



Embossed Tape and Reel Information For 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 QT386 series. Q-Tech can also customize screening and test procedures to meet your specific requirements. The QT381 and QT386 series are designed and processed to exceed the following test conditions:

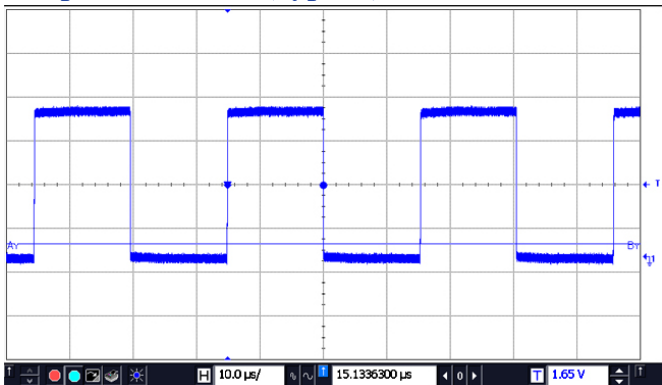
| Environmental Test | Test Conditions |
|---------------------------------|---|
| Temperature cycling | MIL-STD-883, Method 1010, Cond. B |
| Constant acceleration | MIL-STD-883, Method 2001, Cond. A, Y1 |
| Seal: Fine and Gross Leak | MIL-STD-883, Method 1014, Cond. A and C |
| Burn-in | 160 hours, 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

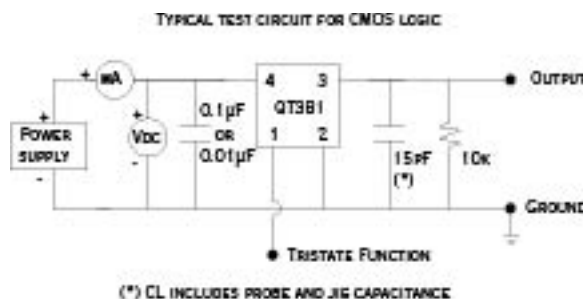
- Shock 1,500g peak, half-sine, 0.5ms duration (MIL-STD-883, Method 2002, Cond. B)
- Random Vibration, 3 minutes per axis, (MIL-STD-202, Method 214, Cond. Ik, 46.32 g RMS)

Please contact Q-Tech for higher shock requirements

Output Waveform (Typical)

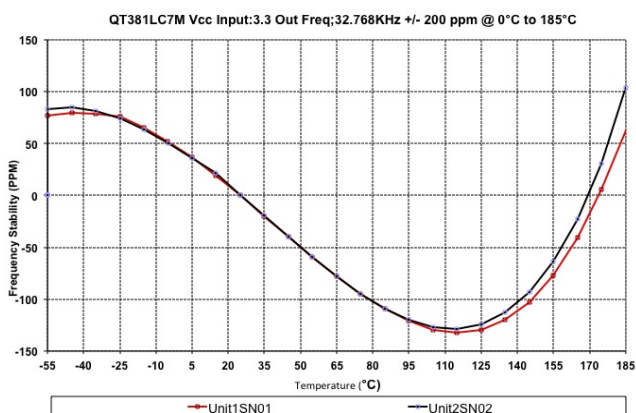


Test Circuit

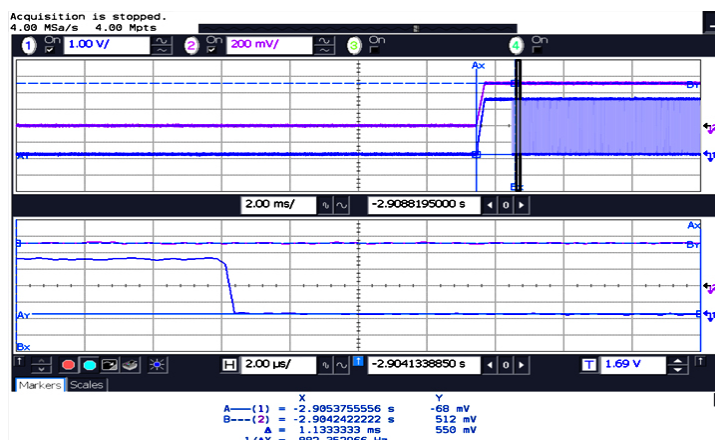


The Tristate function on pin 1 has a built-in pull-up resistor typical 50kΩ, so it can be left floating or tied to Vdd without deteriorating the electrical performance.

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.

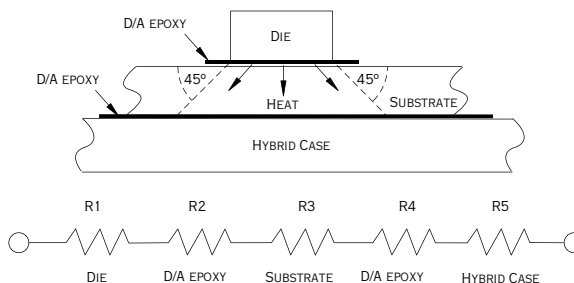
$$RT = R1 + R2 + R3 + R4 + R5$$

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.

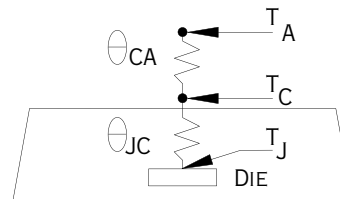
- Theta junction to case (Theta JC) for this product is 30°C/W.
- Theta case to ambient (Theta CA) for this part is 100°C/W.
- Theta Junction to ambient (Theta JA) is 130°C/W.

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)



$$\theta_{JA} = \theta_{JC} + \theta_{CA}$$

(Figure 2)



Revision History

| ECO | REV | REVISION SUMMARY | Page |
|-----|-----|------------------|-------|
| | | Initial Release | |
| | | ----- | ----- |
| | | ----- | ----- |