



TCD4  
3.2 x 5 x 1.5 mm  
LCC Ceramic Package

### Features

- Pletronics' TCD4 Series Temperature Compensated Crystal Oscillator
- Optional Voltage Control Function
- Clipped Sine Wave Output
- 1.8V to 3.3V nominal Supply Voltage
- 10 - 40 MHz Frequency

### Applications

GPS  
WiMAX, Wi-Fi, Wi-LAN  
Handsets  
Broadband Access  
Point to point radios  
Seismic Exploration  
Wireless Communications  
Base Stations  
Test Equipment

### Electrical Characteristics

| Parameter                                        | Min                                  | Typ                          | Max          | Unit   | Condition (Consult factory for other options)                                                                                                               |
|--------------------------------------------------|--------------------------------------|------------------------------|--------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency Range <sup>2</sup>                     | 10                                   | -                            | 40           | MHz    | Specified by part number                                                                                                                                    |
| Frequency Stability vs. Temperature <sup>2</sup> | ±0.5                                 | -                            | ±2.5         | ppm    | Specified by part number $(f_{max} - f_{min}) / 2$                                                                                                          |
| Frequency Initial Calibration                    | -                                    | -                            | ±2.0         | ppm    | Vcontrol 1.50 volts at 25°C ± 2°C when V <sub>CC</sub> ≥ 2.5 volts<br>Vcontrol 0.9 volts at 25°C ± 2°C when V <sub>CC</sub> ≤ 2.4 volts<br>If Vcontrol used |
| Operating Temperature Range <sup>2</sup>         | -40                                  | -                            | +85          | °C     | Specified by part number, Consult factory for wider range                                                                                                   |
| Supply Voltage <sup>1,2</sup> V <sub>CC</sub>    | 1.8                                  | -                            | 3.3          | Volts  | ± 5%, Specified by part number                                                                                                                              |
| Supply Current I <sub>CC</sub>                   | -                                    | 2.0                          | 3.0          | mA     | Load: 10 Kohm    10 pF, V <sub>CC</sub> ± 5%                                                                                                                |
| Frequency Stability vs. Supply                   | -                                    | -                            | ±0.2         | ppm    | Load: 10 Kohm    10 pF, V <sub>CC</sub> ± 5%                                                                                                                |
| Frequency Stability vs. Load                     | -                                    | -                            | ±0.2         | ppm    | Load: 10 Kohm    10 pF ± 5%                                                                                                                                 |
| Vcontrol Range                                   | 0.50<br>0.30                         | 1.50<br>0.90                 | 2.50<br>1.50 | Volts  | 1.50 volts nominal for V <sub>CC</sub> nominal ≥ 2.5 volts<br>0.9 volts nominal for V <sub>CC</sub> nominal ≤ 2.4 volts                                     |
| Frequency Pullability <sup>2</sup>               | 0                                    | ±8.0                         | ±12.0        | ppm    | Specified by part number, Positive Slope                                                                                                                    |
| Output Waveform                                  | Clipped Sine Wave                    |                              |              |        | DC Coupled                                                                                                                                                  |
| Output Level                                     | 0.8                                  | -                            | -            | V p-p  | Load: 10 Kohm    10 pF ± 10%                                                                                                                                |
| Startup Time                                     | -                                    | -                            | 10.0         | mS     | Within ± 2.0 ppm of final frequency                                                                                                                         |
| Long Term Stability (Aging)                      | -                                    | -                            | ±1.0         | ppm    | Per year at 25°C ± 2°C                                                                                                                                      |
| Phase Noise                                      | 100 Hz<br>1 kHz<br>10 kHz<br>100 kHz | -110<br>-130<br>-145<br>-145 | -            | dBc/Hz | 25°C ± 2°C at 26.0 MHz                                                                                                                                      |
| Storage Temperature Range                        | -55                                  | -                            | +95          | °C     |                                                                                                                                                             |

#### Notes:

<sup>1</sup> Place an appropriate power supply bypass capacitor next to device for correct operation

<sup>2</sup> Specified by part number

### Part Number

| Series Model | V <sub>CC</sub> Supply Voltage <sup>1</sup>                                                                                                                                                                    |                                                                                                                                                                                                                | Operating Temperature                                                                                                                                                                                                 |                                                                                                                                                                                                      | Stability <sup>1, 2</sup>                                                                                  | Pullability <sup>1</sup>                                  | Frequency      |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|----------------|
|              | Lowest                                                                                                                                                                                                         | Highest                                                                                                                                                                                                        | Lowest                                                                                                                                                                                                                | Highest                                                                                                                                                                                              | (ppm)                                                                                                      | (ppm)                                                     | (MHz)          |
| <b>TCD4</b>  | <b>031</b>                                                                                                                                                                                                     | <b>035</b>                                                                                                                                                                                                     | <b>G</b>                                                                                                                                                                                                              | <b>H</b>                                                                                                                                                                                             | <b>015</b>                                                                                                 | <b>008</b>                                                | <b>-19.44M</b> |
|              | <b>031</b> = 3.1 for 3.3 volts nominal<br><b>029</b> = 2.9 for 3.0 volts nominal<br><b>027</b> = 2.7 for 2.8 volts nominal<br><b>024</b> = 2.4 for 2.5 volts nominal<br><b>017</b> = 1.7 for 1.8 volts nominal | <b>035</b> = 3.5 for 3.3 volts nominal<br><b>031</b> = 3.1 for 3.0 volts nominal<br><b>029</b> = 2.9 for 2.8 volts nominal<br><b>026</b> = 2.6 for 2.5 volts nominal<br><b>019</b> = 1.9 for 1.8 volts nominal | <b>A</b> = +10°C<br><b>B</b> = +5°C<br><b>C</b> = +0°C<br><b>D</b> = -5°C<br><b>E</b> = -10°C<br><b>F</b> = -15°C<br><b>G</b> = -20°C<br><b>H</b> = -25°C<br><b>J</b> = -30°C<br><b>K</b> = -35°C<br><b>L</b> = -40°C | <b>A</b> = +40°C<br><b>B</b> = +45°C<br><b>C</b> = +50°C<br><b>D</b> = +55°C<br><b>E</b> = +60°C<br><b>F</b> = +65°C<br><b>G</b> = +70°C<br><b>H</b> = +75°C<br><b>J</b> = +80°C<br><b>K</b> = +85°C | <b>005</b> = ± 0.5<br><b>010</b> = ± 1.0<br><b>015</b> = ± 1.5<br><b>020</b> = ± 2.0<br><b>025</b> = ± 2.5 | <b>000</b> = TCXO<br><b>005</b> = ± 5<br><b>008</b> = ± 8 | 10 - 40 MHz    |

<sup>1</sup> Contact Factory for non-standard specifications

<sup>2</sup> Not all stabilities are available with all operating temperature ranges. Contact Factory for exact combinations available.

### Device Marking

|                                             |                                                      |                                                                                                                   |
|---------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>FFFF . xxx</b><br>• <b>PLE xx . YWWx</b> | <b>FFFF . xxx</b><br>• <b>PLE</b><br><b>x . YWWx</b> | PLE = Pletronics<br>FFFF = Frequency in MHz<br>YWW = Date Code (year week)<br>All other marking is internal codes |
|---------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|

Note: Specifications such as frequency stability, supply voltage and operating temperature range, etc. are not identified from marking. External packaging labels and packing list will correctly identify the ordered Pletronics part number.

### Package Labeling

Tape and Reel available for quantities of 250 to 1000 per reel, cut tape for < 250. 16mm tape, 8mm pitch.

P/N Label is 1" x 2.6" (25.4mm x 66.7mm)  
 Font is Courier New  
 Bar code is 39-Full ASCII

RoHS Label is 1" x 2.6" (25.4mm x 66.7mm)  
 Font is Arial

|                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P/N:</b><br>TCD4029036JK005008-12.80M<br><b>Customer P/N:</b><br>12345678<br><b>Qty:</b><br>1000<br><b>D/C</b><br>921-M8S07<br>MSL: 1 |
|------------------------------------------------------------------------------------------------------------------------------------------|

#### RoHS Compliant

2nd Lvl Interconnect  
 Category=e4  
 Max Safe Temp=260C for 10s 2X Max

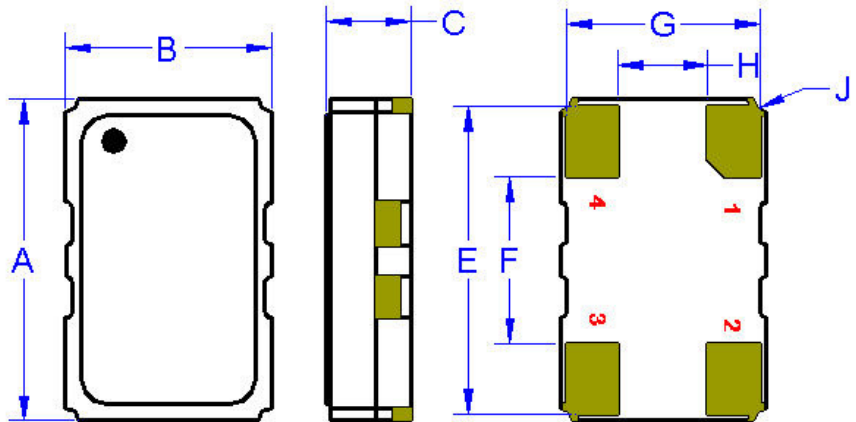
Pletronics Inc. certifies this device is in accordance with the RoHS 2 (2011/65/EU) and WEEE (2002/96/EC) directives.

Pletronics Inc. guarantees the device does not contain the following: Cadmium, Hexavalent Chromium, Lead, Mercury, PBB's, PBDE's  
 Weight of the Device: 0.10 grams  
 Moisture Sensitivity Level: 1 As defined in J-STD-020D  
 Second Level Interconnect code: e4

## Mechanical Dimensions

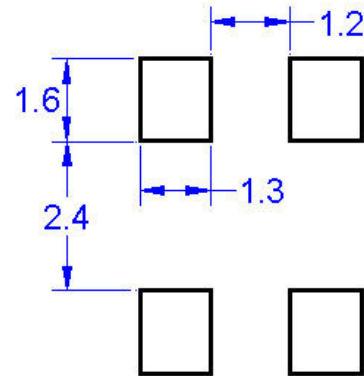
|                      | Inches        | mm          |
|----------------------|---------------|-------------|
| <b>A</b>             | 0.197 ± 0.006 | 5.00 ± 0.15 |
| <b>B</b>             | 0.126 ± 0.006 | 3.20 ± 0.15 |
| <b>C</b>             | 0.059 max     | 1.50 max    |
| <b>E<sup>1</sup></b> | 0.189         | 4.80        |
| <b>F<sup>1</sup></b> | 0.102         | 2.60        |
| <b>G<sup>1</sup></b> | 0.118         | 3.00        |
| <b>H<sup>1</sup></b> | 0.055         | 1.40        |
| <b>J<sup>1</sup></b> | 0.008R        | 0.20R       |

<sup>1</sup> Typical dimensions



**Pad Layout** mm shown

Disclaimer: Recommended layout shown.  
Adjust layout as needed for individual  
process requirements.



(Not to Scale)

**Contacts (pads):** Gold 11.8 to 39.4 μm (0.3 to 1.0 μm) over Nickel 50 to 350 μm (1.27 to 8.89 μm)

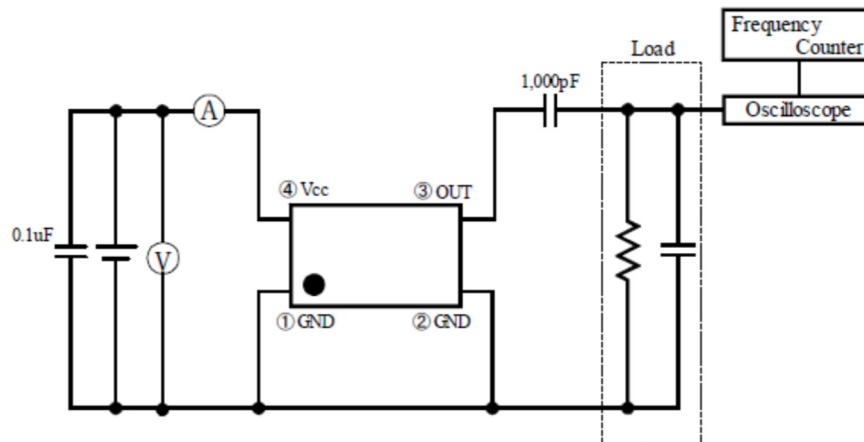
## Layout

| Pad | Function                       | Note                                                                                                        |
|-----|--------------------------------|-------------------------------------------------------------------------------------------------------------|
| 1   | Vcontrol Input                 | If this function is not specified, recommend connecting this pad to ground.                                 |
| 2   | Ground (GND)                   |                                                                                                             |
| 3   | Output                         | The output is DC coupled. Most commonly used with external coupling capacitor. 0.001 to 0.01μF recommended. |
| 4   | V <sub>CC</sub> Supply Voltage | Connect an appropriate power supply bypass capacitor as close as possible                                   |

For Optimum Jitter Performance, Pletronics recommends:

- A ground plane under the device
- Do not route large transient signals (both current and voltage) under the device
- Do not place near a large magnetic field such as a high frequency switching power supply
- Do not place near piezoelectric buzzers or mechanical fans

**Electrical Test / Load Circuit**



**Environmental / ESD Ratings**

Reliability: Environmental Compliance

| Parameter        | Condition                            |
|------------------|--------------------------------------|
| Mechanical Shock | JESD22-B104                          |
| Vibration        | JESD22-B103                          |
| Solderability    | IPC J-STD-002                        |
| Thermal Shock    | MIL-STD-883 Method 1011, Condition A |

ESD Rating

| Model                | Min. Voltage | Condition    |
|----------------------|--------------|--------------|
| Human Body Model     | 2000V        | JESD22-A114  |
| Charged Device Model | 500V         | JESD 22-C101 |
| Machine Model        | 200V         | JESD22-A115  |

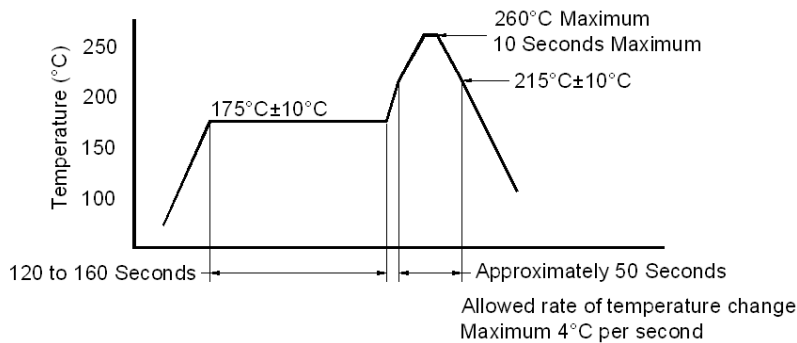
Absolute Maximum Ratings

| Parameter                      | Unit                            |
|--------------------------------|---------------------------------|
| V <sub>CC</sub> Supply Voltage | -0.6V to +6V                    |
| V <sub>i</sub> Input Voltage   | -0.6V to V <sub>CC</sub> + 0.6V |
| I <sub>o</sub> Output Current  | -10mA to +10mA                  |

**Thermal Characteristics:**

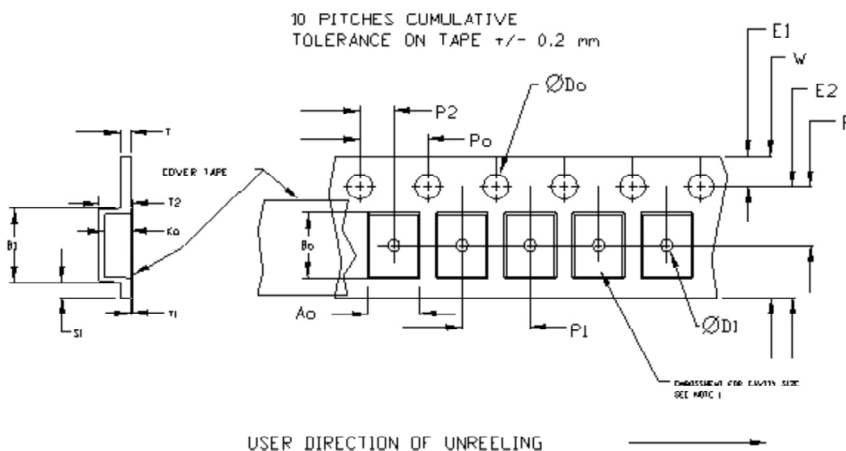
The maximum die or junction temperature is 155°C  
The thermal resistance junction to board is 30 to 50°C/Watt depending on the solder pads, ground plane and construction of the PCB.

## Reflow Cycle



The part may be reflowed 2 times without degradation (typical for lead free processing).

## Tape and Reel



Tape Constant Dimensions Table 1

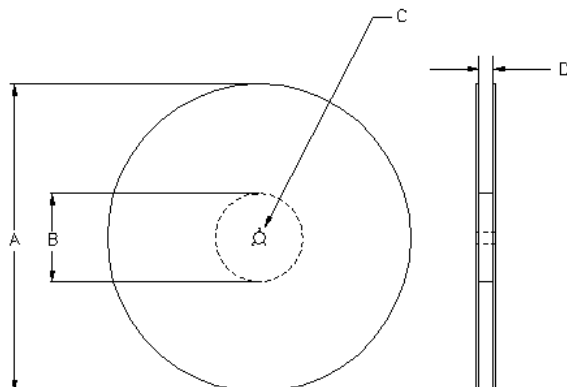
| Tape Size | Do                  | D1 min | E1                    | Po                   | P2         | S1 min | T max | T1 max |
|-----------|---------------------|--------|-----------------------|----------------------|------------|--------|-------|--------|
| 8mm       | 1.5<br>+0.1<br>-0.0 | 1.0    | 1.75<br><br>$\pm 0.1$ | 4.0<br><br>$\pm 0.1$ | 2.0        | 0.6    | 0.6   | 0.1    |
| 12mm      |                     | 1.5    |                       |                      | $\pm 0.05$ |        |       |        |
| 16mm      |                     | 1.5    |                       |                      | 2.0        |        |       |        |
| 24mm      |                     | 1.5    |                       |                      | $\pm 0.1$  |        |       |        |

Tape Variable Dimensions Table 2

| Tape Size | B1 max | E2 min | F             | P1            | T2 max | W max | Ao, Bo & Ko |
|-----------|--------|--------|---------------|---------------|--------|-------|-------------|
| 16mm      | 12.1   | 14.25  | $7.5 \pm 0.1$ | $8.0 \pm 0.1$ | 8.0    | 16.3  | Note 1      |

Dimensions in mm Drawing Not to scale

Note 1: Embossed cavity to conform to EIA-481-B



Reel Dimensions (may vary) Table 3

| Reel Size | A      |       | B      |       | C            | D              |
|-----------|--------|-------|--------|-------|--------------|----------------|
|           | Inches | mm    | Inches | mm    | mm           | mm             |
| 7         | 7.0    | 177.8 | 2.50   | 63.5  | 13.0         | Tape size +0.4 |
| 10        | 10.0   | 254.0 | 4.00   | 101.6 | +0.5<br>-0.2 | +2.0<br>-0.0   |
| 13        | 13.0   | 330.2 | 3.75   | 95.3  |              |                |

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