



TCE4  
2.5 x 3.2 x 1.0 mm  
LCC Ceramic Package

### Features

- Pletronics' TCE4 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 Vcontrol 0.9 volts at 25°C ± 2°C when V <sub>CC</sub> ≤ 2.4 volts 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 0.30	1.50 0.90	2.50 1.50	Volts	1.50 volts nominal for V <sub>CC</sub> nominal ≥ 2.5 volts 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 1 kHz 10 kHz 100 kHz	-110 -130 -145 -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)
TCE4	031	035	G	K	015	008	-19.44M
	<b>031</b> = 3.1 for 3.3 volts nominal <b>029</b> = 2.9 for 3.0 volts nominal <b>027</b> = 2.7 for 2.8 volts nominal <b>024</b> = 2.4 for 2.5 volts nominal <b>017</b> = 1.7 for 1.8 volts nominal	<b>035</b> = 3.5 for 3.3 volts nominal <b>031</b> = 3.1 for 3.0 volts nominal <b>029</b> = 2.9 for 2.8 volts nominal <b>026</b> = 2.6 for 2.5 volts nominal <b>019</b> = 1.9 for 1.8 volts nominal	<b>A</b> = +10°C <b>B</b> = +5°C <b>C</b> = +0°C <b>D</b> = -5°C <b>E</b> = -10°C <b>F</b> = -15°C <b>G</b> = -20°C <b>H</b> = -25°C <b>J</b> = -30°C <b>K</b> = -35°C <b>L</b> = -40°C	<b>A</b> = +40°C <b>B</b> = +45°C <b>C</b> = +50°C <b>D</b> = +55°C <b>E</b> = +60°C <b>F</b> = +65°C <b>G</b> = +70°C <b>H</b> = +75°C <b>J</b> = +80°C <b>K</b> = +85°C	<b>005</b> = ± 0.5 <b>010</b> = ± 1.0 <b>015</b> = ± 1.5 <b>020</b> = ± 2.0 <b>025</b> = ± 2.5	<b>000</b> = TCXO <b>005</b> = ± 5 <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> • PLE xx YWWx	<b>FFFF XXX</b> • PLE x YWWx	PLE = Pletronics FFF F = Frequency in MHz YWW = Date Code (year week) All other marking is internal codes
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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. 8mm tape, 4mm 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>  TCE4024026JK010008-10.0M <b>Customer P/N:</b>  12345678 <b>Qty:</b>  1000 <b>D/C</b>  MSL: 1 <span style="float: right;">2BN-M8U0</span>
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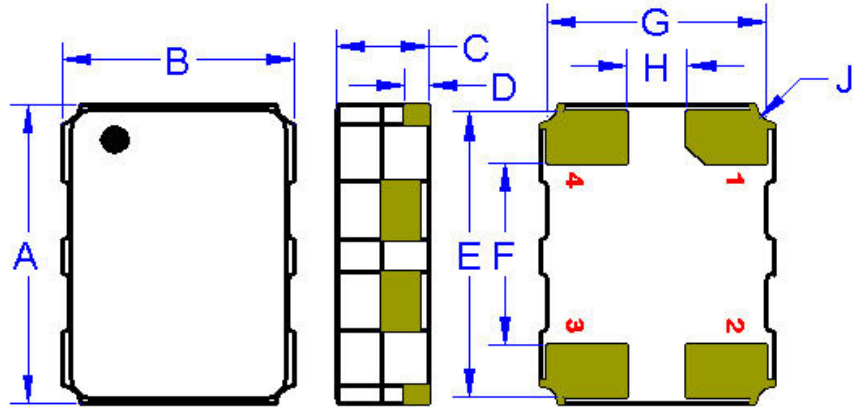
<b>RoHS Compliant</b> 2nd LvL Interconnect Category=e4 Max Safe Temp=260C for 10s 2X Max
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Pletronics Inc. certifies this device is in accordance with the RoHS 2 (2011/65/EU) and WEEE (2002/96/EC) directives.

Pletronics Inc. guarantees the device does not contain the following: Cadmium, Hexavalent Chromium, Lead, Mercury, PBB's, PBDE's  
 Weight of the Device: 0.04 grams  
 Moisture Sensitivity Level: 1 As defined in J-STD-020D  
 Second Level Interconnect code: e4

**Mechanical Dimensions**

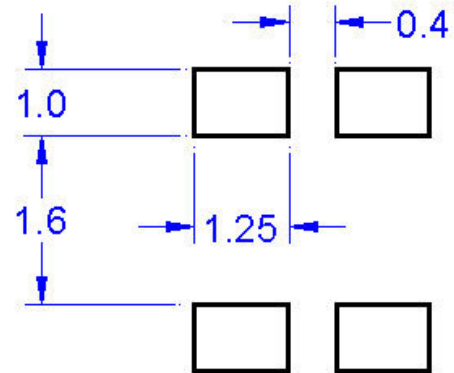
	Inches	mm
<b>A</b>	0.126 ± 0.008	3.20 ± 0.20
<b>B</b>	0.098 ± 0.008	2.50 ± 0.20
<b>C</b>	0.039 max	1.00 max
<b>D<sup>1</sup></b>	0.010	0.26
<b>E<sup>1</sup></b>	0.120	3.05
<b>F<sup>1</sup></b>	0.077	1.95
<b>G<sup>1</sup></b>	0.093	2.35
<b>H<sup>1</sup></b>	0.026	0.65
<b>J<sup>1</sup></b>	0.008	0.20R



<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 μinches (0.3 to 1.0 μm) over Nickel 50 to 350 μinches (1.27 to 8.89 μm)

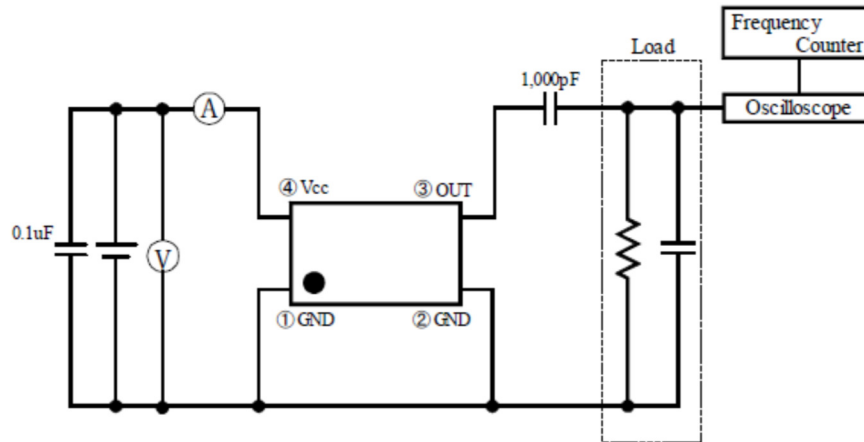
**Layout**

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 0.01 μF 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

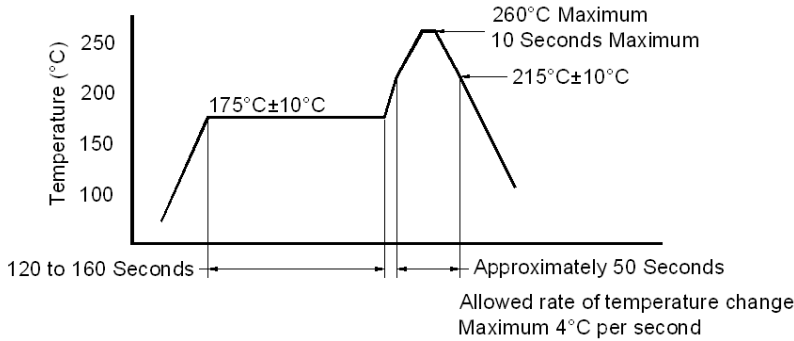
Absolute Maximum Ratings

Parameter	Unit
V <sub>CC</sub> Supply Voltage	-0.6V to +4.6V
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:**

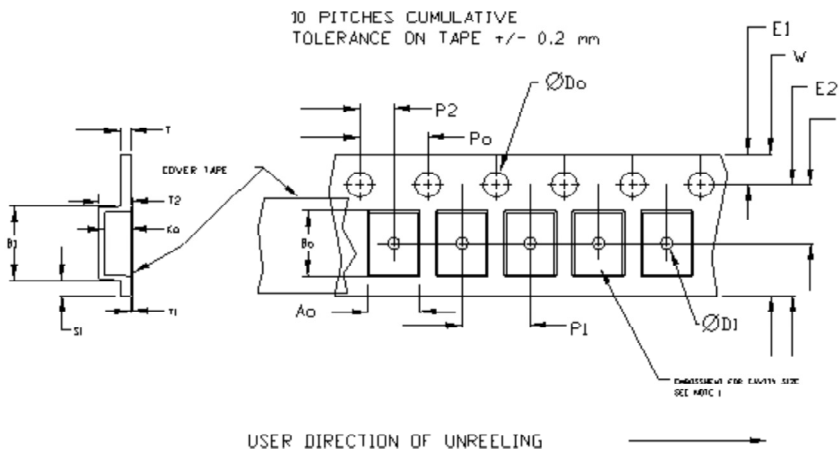
The maximum die or junction temperature is 155°C  
The thermal resistance junction to board is 25 to 40°C/Watt  
depending on the solder pads, ground plane and construction of the PCB.

**Reflow Cycle**



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

**Tape and Reel**



Tape Size	Do	D1 min	E1	Po	P2	S1 min	T max	T1 max
8mm	1.5	1.0	1.75	4.0	±0.05	0.6	0.6	0.1
12mm		1.5						
16mm		1.5			±0.1			
24mm	+0.1 -0.0	1.5			±0.1			

Tape Size	B1 max	E2 min	F	P1	T2 max	W max	Ao, Bo & Ko
8mm	4.2	6.25	3.5 ± 0.05	4.0 ± 0.1	2.0	8.3	Note 1

Dimensions in mm Drawing Not to scale

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



Reel Size	A		B		C	D
	Inches	mm	Inches	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		
13	13.0	330.2	3.75	95.3		

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