



## SM44T Series 2.5 V CMOS Clock Oscillators

April 2010

**Lead Free** 

- Pletronics' SM44 Series is a quartz crystal controlled precision square wave generator with a CMOS output.
- The package is designed for high density surface mount designs.
- This is a low cost mass produced oscillator.
- Tape and Reel or cut tape packaging is available.
- 0.8 to 180 MHz
- 2.5 x 3.2 mm LCC Ceramic Package
- Enable/Disable Function
- Disable function includes low standby power mode
- Low Jitter

**Pletronics Inc. certifies this device is in accordance with the  
RoHS 6/6 (2002/95/EC) 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: 0.041 grams  
Moisture Sensitivity Level: 1 As defined in J-STD-020C  
Second Level Interconnect code: e4

### Absolute Maximum Ratings:

| Parameter                      | Unit                            |
|--------------------------------|---------------------------------|
| V <sub>CC</sub> Supply Voltage | -0.5V to +7.0V                  |
| V <sub>i</sub> Input Voltage   | -0.5V to V <sub>CC</sub> + 0.5V |
| V <sub>o</sub> Output Voltage  | -0.5V to V <sub>CC</sub> + 0.5V |
| I <sub>o</sub> Output Current  | +25 mA to -25 mA                |

### Thermal Characteristics

The maximum die or junction temperature is 155°C  
The thermal resistance junction to board is 40 to 60°C/Watt depending on the solder pads, ground plane and construction of the PCB.

**Part Number:**

SM44 45 T E W - 75.0M -XX

**Part Marking:**

PFF.FFF  
• YMDxx

|  |
|--|
| <b>Packaging code or blank</b><br>T250 = 250 per Tape and Reel<br>T500 = 500 per Tape and Reel<br>T1K = 1000 per Tape and Reel |
| <b>Frequency in MHZ</b>  |
| <b>Supply Voltage V<sub>CC</sub></b><br>W = 2.5V ± 10%   |
| <b>Temperature Range</b><br>Blank = Temp. range -10 to +70°C<br>C = Temp. range -10 to +70°C<br>E = Temp. range -40 to +85°C   |
| <b>Series Model</b>  |
| <b>Frequency Stability</b><br>45 = ± 50 ppm<br>44 = ± 25 ppm<br>20 = ± 20 ppm  |
| <b>Series Model</b>  |

**Marking Legend:**

- P = Pletronics
- FF.FFF = Frequency in MHZ
- YMD = Date of Manufacture (year and week, or year-month-day)
- All other marking is internal factory codes

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

**Codes for Date Code YMD**

| Code | 10   | 1    | 2    | 3    | 4    | Code  | A   | B   | C   | D   | E   | F   | G   | H   | J   | K   | L   | M   |
|------|------|------|------|------|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year | 2010 | 2011 | 2012 | 2013 | 2014 | Month | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |

| Code | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | A  | B  | C  | D  | E  | F  | G  |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Day  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Code | H  | J  | K  | L  | M  | N  | P  | R  | T  | U  | V  | W  | X  | Y  | Z  |    |
| Day  | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |

## Electrical Specification for 2.50V $\pm 10\%$ over the specified temperature range

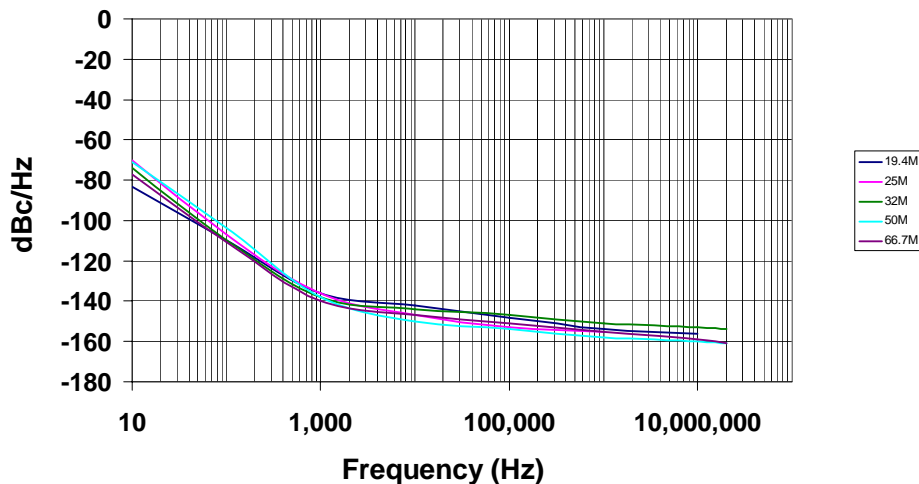
| Item                            | Min                  | Max               | Unit              | Condition                                    |  |
|---------------------------------|----------------------|-------------------|-------------------|--|--|
| Frequency Range                 | 0.8                  | 180               | MHZ               |  |  |
| Frequency Accuracy              | "45"<br>"44"<br>"20" | -50<br>-25<br>-20 | +50<br>+25<br>+20 | ppm  | For all supply voltages, load changes, aging for 1 year, shock, vibration and temperatures |
| Output Waveform                 | CMOS                 |                   |                   |  |  |
| Output High Level               | 90                   | -                 | %                 | of $V_{CC}$ (See load circuit)               |  |
| Output Low Level                | -                    | 10                | %                 |  |  |
| Output Symmetry                 | 45                   | 55                | %                 | at 50% point of $V_{CC}$                     |  |
| Jitter                          | -                    | 0.6               | pS RMS            | 12 KHz to 20 MHZ from the output frequency   |  |
|                                 | -                    | 2.5               | pS RMS            | 10 Hz to 1 MHZ from the output frequency     |  |
| Enable/Disable Internal Pull-up | 50                   | -                 | Kohm              | to $V_{CC}$                                  |  |
| V disable                       | -                    | 30                | %                 | of $V_{CC}$ applied to pad 1                 |  |
| V enable                        | 70                   | -                 | %                 |  |  |
| Output leakage                  | $V_{OUT} = V_{CC}$   | -10               | +10               | uA   | Pad 1 low, device disabled   |
|                                 | $V_{OUT} = 0V$       | -10               | +10               |  |  |
| Standby Current $I_{CC}$        | -                    | 3                 | uA                |  |  |
| Enable time                     | -                    | 100               | nS                | Time for output to reach a logic state       |  |
| Disable time                    | -                    | 100               | nS                | Time for output to reach a high Z state      |  |
| Start up time                   | -                    | 3                 | mS                | Time for output to reach specified frequency |  |
| Operating Temperature Range     | -10                  | +70               | °C                | Standard Temperature Range                   |  |
|                                 | -20                  | +70               | °C                | Extended Temperature Range "C" Option        |  |
|                                 | -40                  | +85               | °C                | Extended Temperature Range "E" Option        |  |
| Storage Temperature Range       | -55                  | +125              | °C                |  |  |

## Electrical Specification for 2.50V $\pm 10\%$ over the specified temperature range

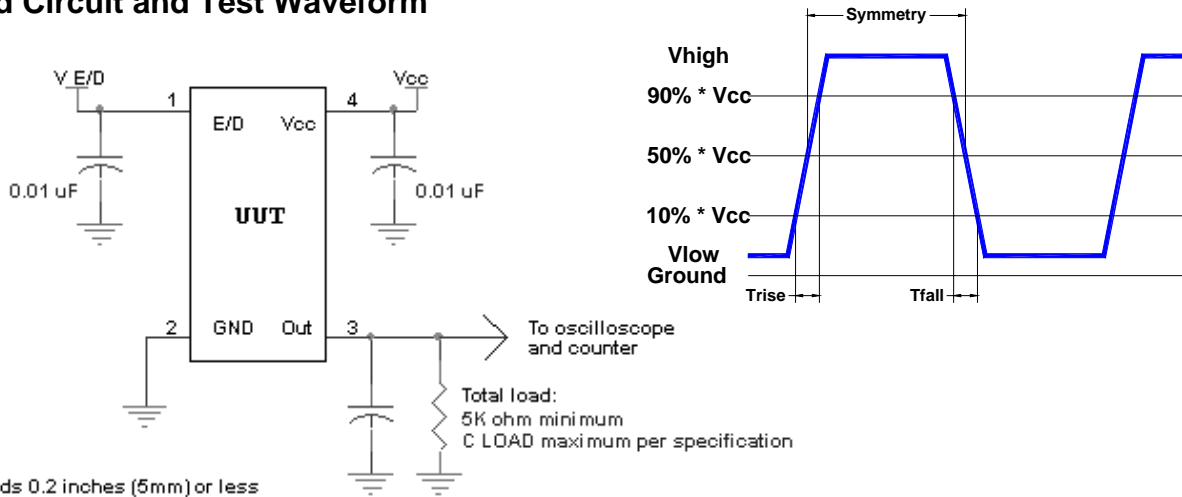
| Item                                 | Typ | Max | Unit | Condition                   |  |  |
|--------------------------------------|-----|-----|------|-----------------------------|--|--|
| Output $T_{RISE}$ and $T_{FALL}$     | 2.8 | 5.5 | nS   | < 35 MHZ                    | $C_{LOAD} = 15$ pF<br>10% to 90% of $V_{CC}$<br>See Load Circuit |  |
|                                      | 3   | 6   | nS   | $\geq 35$ MHZ and < 70 MHZ  |  |  |
|                                      | 1   | 2   | nS   | $\geq 70$ MHZ               |  |  |
|                                      |     | 4.5 | 9    | nS                          | < 35 MHZ   | $C_{LOAD} = 30$ pF<br>10% to 90% of $V_{CC}$<br>See Load Circuit |
|                                      |     | 6   | 12   | nS                          | $\geq 35$ MHZ and < 70 MHZ                                       |  |
|                                      |     | 2   | 3    | nS                          | $\geq 70$ MHZ and < 120 MHZ                                      |  |
| $V_{CC}$ Supply Current ( $I_{CC}$ ) | 1.5 | 2.5 | mA   | < 8 MHZ                     | $C_{LOAD} = 15$ pF   |  |
|                                      | 1.8 | 3   | mA   | $\geq 8$ MHZ and < 16 MHZ   |  |  |
|                                      | 2.4 | 4   | mA   | $\geq 16$ MHZ and < 35 MHZ  |  |  |
|                                      | 7   | 9   | mA   | $\geq 35$ MHZ and < 70 MHZ  |  |  |
|                                      |     | 36  | mA   | $\geq 70$ MHZ and < 120 MHZ |  |  |
|                                      |     | 55  | mA   | $\geq 120$ MHZ              |  |  |
|                                      |     | 2   | 3    | mA                          | < 8 MHZ  | $C_{LOAD} = 30$ pF   |
|                                      |     | 2.2 | 3.5  | mA                          | $\geq 8$ MHZ and < 16 MHZ  |  |
|                                      |     | 2.5 | 4.5  | mA                          | $\geq 16$ MHZ and < 35 MHZ                                       |  |
|                                      |     | 10  | 13   | mA                          | $\geq 35$ MHZ and < 70 MHZ                                       |  |
| 27                                   |     | 42  | ma   | $\geq 70$ MHZ and < 120 MHZ |  |  |

Specifications with Pad 1 E/D open circuit

Typical phase noise plot for 5 oscillators at different output frequencies.



## Load Circuit and Test Waveform



## Reliability: Environmental Compliance

| Parameter        | Condition                            |
|------------------|--------------------------------------|
| Mechanical Shock | MIL-STD-883 Method 2002, Condition B |
| Vibration        | MIL-STD-883 Method 2007, Condition A |
| Solderability    | MIL-STD-883 Method 2003              |
| Thermal Shock    | MIL-STD-883 Method 1011, Condition A |

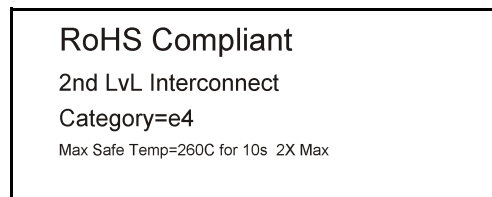
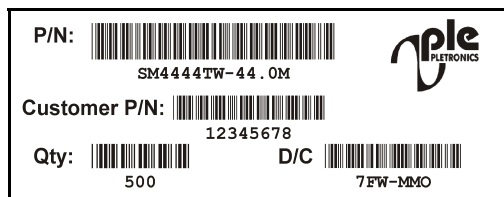
## ESD Rating

| Model                | Minimum Voltage | Conditions              |
|----------------------|-----------------|-------------------------|
| Human Body Model     | 1500            | MIL-STD-883 Method 3115 |
| Charged Device Model | 1000            | JESD 22-C101            |

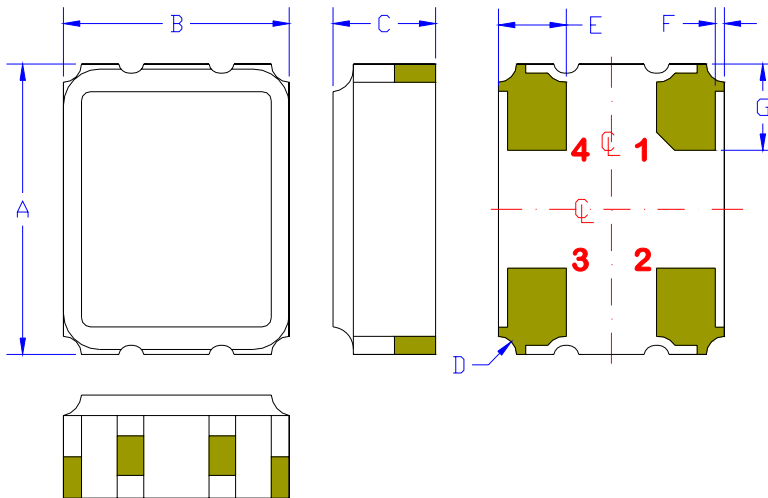
## Package Labeling

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

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



## Mechanical:



|                | Inches       | mm         |
|----------------|--------------|------------|
| A              | 0.125 ±0.006 | 3.20 ±0.15 |
| B              | 0.098 ±0.006 | 2.50 ±0.15 |
| C              | 0.041 ±0.004 | 1.05 ±0.10 |
| D <sup>1</sup> | 0.008        | 0.20R      |
| E <sup>1</sup> | 0.030        | 0.75       |
| F <sup>1</sup> | 0.004        | 0.10       |
| G <sup>1</sup> | 0.037        | 0.95       |

Not to Scale

<sup>1</sup> Typical dimensions

### Contacts :

Gold 11.8 to 29.4 μinches (0.3 to 1.0μm) over Nickel 50 to 350 μinches (1.27 to 8.89 μm)

| Pad | Function                          | Note  |
|-----|-----------------------------------|---|
| 1   | Output Enable/Disable             | When this pad is not connected the oscillator shall operate.<br>When this pad is logic low the output will be inhibited (high impedance state.)<br>Recommend connecting this pad to V <sub>CC</sub> if the oscillator is to be always on. |
| 2   | Ground (GND)                      |   |
| 3   | Output                            |   |
| 4   | Supply Voltage (V <sub>CC</sub> ) | Recommend connecting appropriate power supply bypass capacitors as close as possible.   |

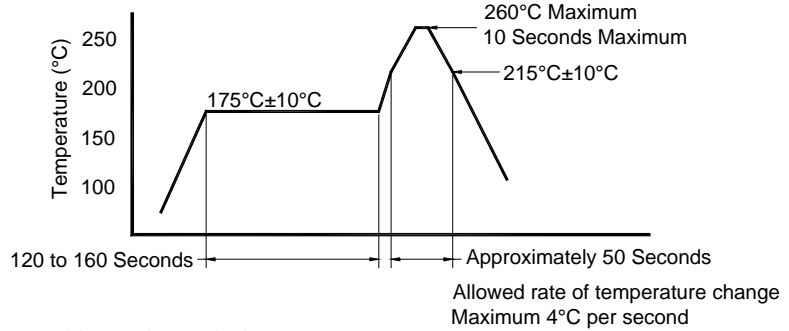
## Layout and application information



For Optimum Jitter Performance, Pletronics recommends:

- a ground plane under the device
- no large transient signals (both current and voltage) should be routed under the device
- do not layout near a large magnetic field such as a high frequency switching power supply
- do not place near piezoelectric buzzers or mechanical fans.

## Reflow Cycle (typical for lead free processing)



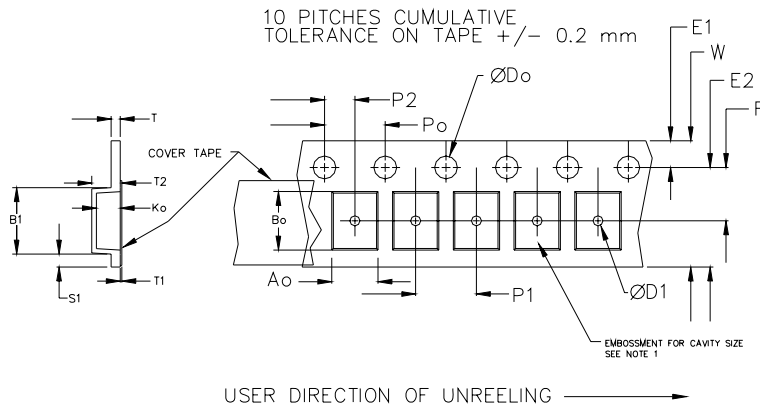
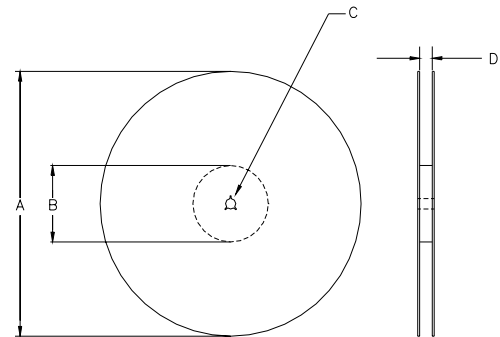
The part may be reflowed 3 times without degradation.

## Tape and Reel: available for quantities of 250 to 1000 per reel, cut tape for < 250

| Constant Dimensions Table 1 |     |           |      |     |            |        |       |        |
|-----------------------------|-----|-----------|------|-----|------------|--------|-------|--------|
| Tape Size                   | D0  | D1 Min    | E1   | P0  | P2         | S1 Min | T Max | T1 Max |
| 8mm                         | 1.5 | 1.0       | 1.75 | 4.0 | 2.0 ± 0.05 | 0.6    | 0.6   | 0.1    |
| 12mm                        |     | 1.5       |      |     | 2.0 ± 0.1  |        |       |        |
| 16mm                        |     | +0.1 -0.0 |      |     | ± 0.1      |        |       |        |
| 24mm                        |     | 1.5       |      |     | ± 0.1      |        |       |        |

| Variable Dimensions Table 2 |        |        |           |           |        |       |             |
|-----------------------------|--------|--------|-----------|-----------|--------|-------|-------------|
| Tape Size                   | B1 Max | E2 Min | F         | P1        | T2 Max | W Max | Ao, Bo & Ko |
| 16 mm                       | 12.1   | 14.25  | 7.5 ± 0.1 | 8.0 ± 0.1 | 8.0    | 16.3  | Note 1      |

Note 1: Embossed cavity to conform to EIA-481-B      Dimensions in mm      Not to scale



| REEL DIMENSIONS |        |                  |                |                |            |
|-----------------|--------|------------------|----------------|----------------|------------|
| A               | inches | 7.0              | 10.0           | 13.0           | Tape Width |
|                 | mm     | 177.8            | 254.0          | 330.2          |            |
| B               | inches | 2.50             | 4.00           | 3.75           | Tape Width |
|                 | mm     | 63.5             | 101.6          | 95.3           |            |
| C               | mm     | 13.0 +0.5 / -0.2 |                |                | Tape Width |
| D               | mm     | 16.4 +2.0 -0.0   | 16.4 +2.0 -0.0 | 16.4 +2.0 -0.0 |            |

Reel dimensions may vary from the above

## IMPORTANT NOTICE

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