

## SM77D Series 2.5 V CMOS Clock Oscillators

January 2011

**Lead Free** 

- Pletronics' SM77D Series is a quartz crystal controlled precision square wave generator with a CMOS output.
- The SM77D series will directly interface TTL devices also.
- 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.
- 70 to 135 MHz
- 5 x 7 mm LCC Ceramic Package
- Enable/Disable Function
- Disable function includes low standby power mode
- 3<sup>rd</sup> Overtone Crystals used
- Improved circuit to minimize oscillator issues such as multi-mode output signal.
- Low Jitter
- Capable of driving up to 30pF capacitive loads

**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: 0.17 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 |

### 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.

## Part Number:

|      |    |   |   |   |         |     |                                                                                                                                                       |
|------|----|---|---|---|---------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| SM77 | 45 | D | E | W | -125.0M | -XX |                                                                                                                                                       |
|      |    |   |   |   |         |     | <b>Packaging code or blank</b><br><b>T250</b> = 250 per Tape and Reel<br><b>T500</b> = 500 per Tape and Reel<br><b>T1K</b> = 1,000 per Tape and Reel  |
|      |    |   |   |   |         |     | <b>Frequency in MHz</b>                                                                                                                               |
|      |    |   |   |   |         |     | <b>Supply Voltage V<sub>CC</sub></b><br><b>W</b> = 2.5V ± 10%                                                                                         |
|      |    |   |   |   |         |     | <b>Optional Enhanced OTR</b><br><b>Blank</b> = Temp. range -10 to +70°C<br><b>C</b> = Temp. range -20 to +70°C<br><b>E</b> = Temp. range -40 to +85°C |
|      |    |   |   |   |         |     | <b>Series Model</b>                                                                                                                                   |
|      |    |   |   |   |         |     | <b>Frequency Stability</b><br><b>45</b> = ± 50 ppm<br><b>44</b> = ± 25 ppm<br><b>20</b> = ± 20 ppm                                                    |
|      |    |   |   |   |         |     | <b>Series Model</b>                                                                                                                                   |

## Part Marking and Marking Legend:

|                                               |                                                |                                                |
|-----------------------------------------------|------------------------------------------------|------------------------------------------------|
| <b>PLE SM77</b><br><b>FF.FFF M</b><br>• YMDxx | <b>PLE SM77</b><br><b>FF.FFF M</b><br>• YYWWxx | <b>7xYWWxx</b><br><b>FF.FFF M</b><br>• PLE xxx |
|-----------------------------------------------|------------------------------------------------|------------------------------------------------|

PLE = Pletronics  
 FF.FFF M = Frequency in MHz  
 YYWW or YWW or 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

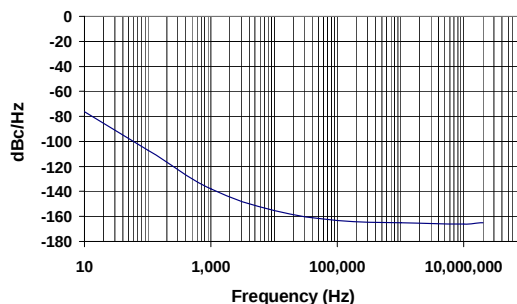
| Code | 0    | 1    | 2    | 3    | 4    | Code  | A   | B   | C   | D   | E   | F   | G   | H   | J   | K   | L   | M   |
|------|------|------|------|------|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year | 2010 | 2011 | 2012 | 2013 | 2014 | Month | JAN | 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                                      | 70   | 135  | MHz    |                                                                                            |
| Frequency Accuracy <b>"45"</b>                       | -50  | +50  | ppm    | For all supply voltages, load changes, aging for 1 year, shock, vibration and temperatures |
| <b>"44"</b>                                          | -25  | +25  |        |                                                                                            |
| <b>"20"</b>                                          | -20  | +20  |        |                                                                                            |
| Output Waveform                                      | CMOS |      |        |                                                                                            |
| Output High Level                                    | 90   | -    | %      | of V <sub>CC</sub> (See load circuit)                                                      |
| Output Low Level                                     | -    | 10   | %      | of V <sub>CC</sub> (See load circuit)                                                      |
| Output Symmetry                                      | 45   | 55   | %      | at 50% point of V <sub>CC</sub> (See load circuit)                                         |
| 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 <sub>CC</sub>                                                                         |
| V disable                                            | -    | 30   | %      | of V <sub>CC</sub> applied to pad 1                                                        |
| V enable                                             | 70   | -    | %      | of V <sub>CC</sub> applied to pad 1                                                        |
| Output leakage    V <sub>OUT</sub> = V <sub>CC</sub> | -10  | +10  | uA     | Pad 1 low, device disabled                                                                 |
| V <sub>OUT</sub> = 0V                                | -10  | +10  | uA     |                                                                                            |
| Standby Current I <sub>CC</sub>                      | -    | 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                                        | -    | 10   | mS     | Time for output to reach specified frequency                                               |
| Operating Temperature Range                          | -10  | +70  | °C     | Standard Temperature Range                                                                 |
|                                                      | -20  | +70  | °C     | Extended Temperature Range <b>"C"</b> Option                                               |
|                                                      | -40  | +85  | °C     | Extended Temperature Range <b>"E"</b> Option                                               |
| Storage Temperature Range                            | -55  | +125 | °C     |                                                                                            |

Typical phase-noise characteristics at 106.25MHz

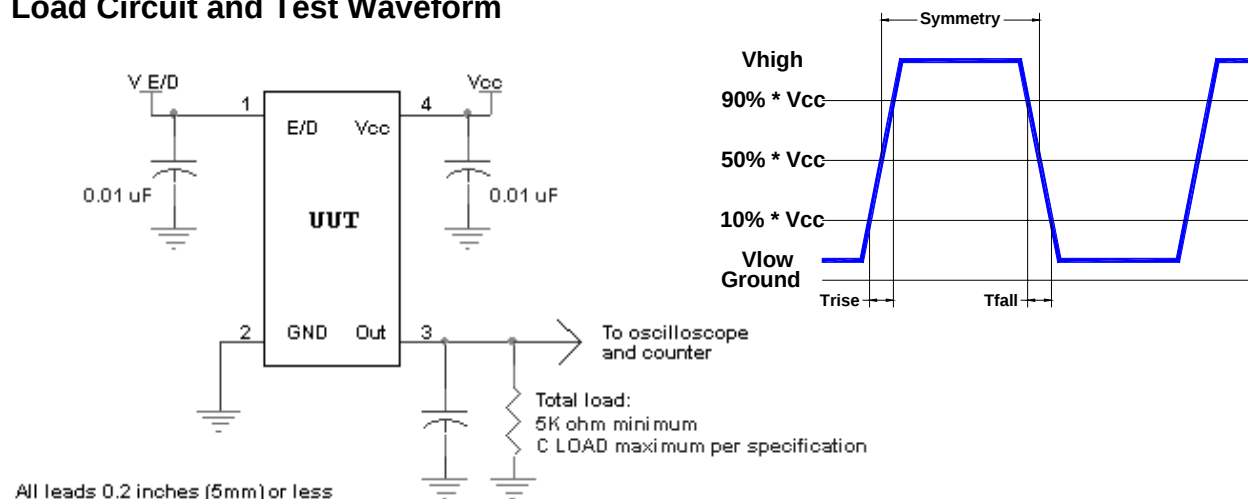


## Electrical Specification for 2.50V $\pm 10\%$ over the specified temperature range

| Item                                    | Min  | Typ  | Max | Unit | Condition                           |                                                                  |
|-----------------------------------------|------|------|-----|------|-------------------------------------|------------------------------------------------------------------|
| $V_{OUT}$ High ( $V_{OH}$ )             | 1.75 | 1.95 | -   | V    | $V_{CC} = 2.25V$ , $I_{OH} = +8$ mA |                                                                  |
| $V_{OUT}$ Low ( $V_{OL}$ )              | -    | 0.3  | 0.4 | V    | $V_{CC} = 2.25V$ , $I_{OL} = -8$ mA |                                                                  |
| Output $T_{RISE}$ and $T_{FALL}$        | -    | 1.0  | 3.0 | nS   | >110 MHz                            | $C_{LOAD} = 15$ pF<br>10% to 90% of $V_{CC}$<br>See Load Circuit |
|                                         | -    | 1.0  | 3.0 | nS   | >80 MHz and $\leq 110$ MHz          |                                                                  |
|                                         | -    | 2.0  | 4.0 | nS   | $\leq 80$ MHz                       |                                                                  |
|                                         | -    | 2.5  | 4.0 | nS   | >110 MHz                            | $C_{LOAD} = 30$ pF<br>10% to 90% of $V_{CC}$<br>See Load Circuit |
|                                         | -    | 2.5  | 4.0 | nS   | >80 MHz and $\leq 110$ MHz          |                                                                  |
|                                         | -    | 3.5  | 6.0 | nS   | $\leq 80$ MHz                       |                                                                  |
| $V_{CC}$ Supply Current<br>( $I_{CC}$ ) | -    | 25   | 60  | mA   | >110 MHz                            | $C_{LOAD} = 15$ pF                                               |
|                                         | -    | 20   | 50  | mA   | >80 MHz and $\leq 110$ MHz          |                                                                  |
|                                         | -    | 15   | 40  | mA   | $\leq 80$ MHz                       |                                                                  |
|                                         | -    | 38   | 70  | mA   | >110 MHz                            | $C_{LOAD} = 30$ pF                                               |
|                                         | -    | 31   | 60  | mA   | >80 MHz and $\leq 110$ MHz          |                                                                  |
|                                         | -    | 20   | 45  | mA   | $\leq 80$ MHz                       |                                                                  |

Specifications with Pad 1 E/D open circuit

## 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

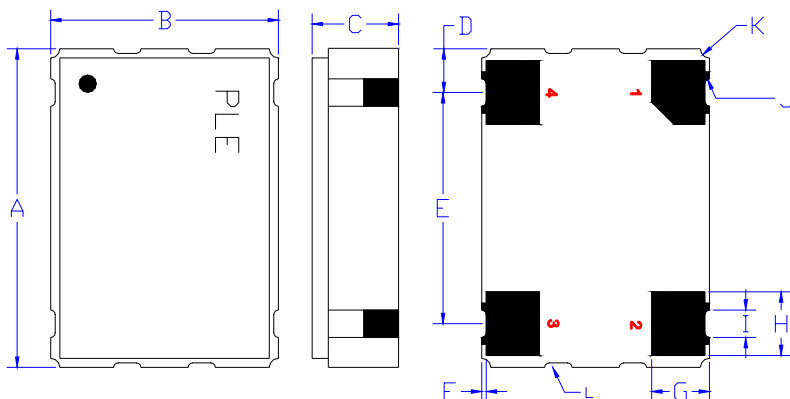
Label is 1" x 2.6" (25.4mm x 66.7mm)  
Font is Courier New  
Bar code is 39-Full ASCII

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

|               |  |     |
|---------------|--|-----|
| P/N:          |  |     |
| Customer P/N: |  |     |
| Qty:          |  | D/C |

|                                   |
|-----------------------------------|
| RoHS Compliant                    |
| 2nd LVL Interconnect              |
| Category=e4                       |
| Max Safe Temp=260C for 10s 2X Max |

**Mechanical:**



The detents marked "L" on the package ends are optional

Not to Scale

<sup>1</sup> Typical dimensions

|                | Inches            | mm              |
|----------------|-------------------|-----------------|
| A              | 0.276 $\pm$ 0.006 | 7.00 $\pm$ 0.15 |
| B              | 0.197 $\pm$ 0.006 | 5.00 $\pm$ 0.15 |
| C              | 0.068 $\pm$ 0.018 | 1.73 $\pm$ 0.44 |
| D <sup>1</sup> | 0.038             | 0.96            |
| E <sup>1</sup> | 0.200             | 5.08            |
| F <sup>1</sup> | 0.004             | 0.10            |
| G <sup>1</sup> | 0.050             | 1.27            |
| H <sup>1</sup> | 0.055             | 1.40            |
| I <sup>1</sup> | 0.024             | 0.60            |
| J <sup>1</sup> | 0.004             | 0.10R           |
| K <sup>1</sup> | 0.008             | 0.020R          |

Contacts (pads) :

Gold 11.8 to 39.4  $\mu$ inches (0.3 to 1.0  $\mu$ m) over Nickel 50 to 350  $\mu$ inches (1.27 to 8.89  $\mu$ m)

| 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.                                                                                                                                                     |

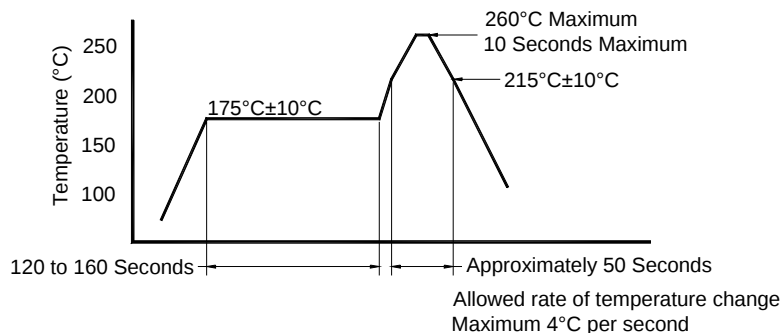
**Layout and application information**



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 (< 250 = cut tape)

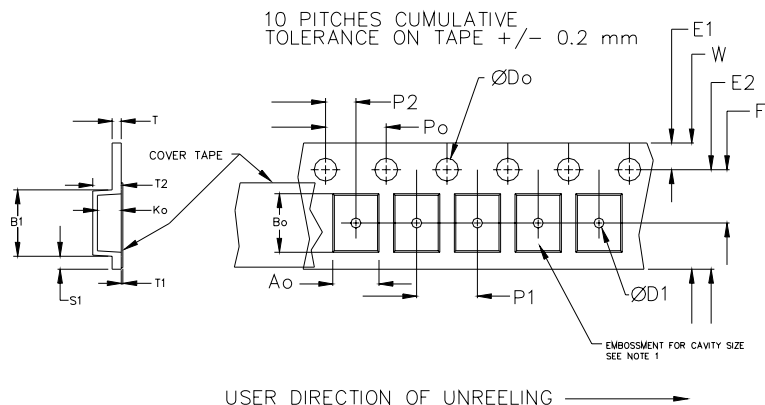
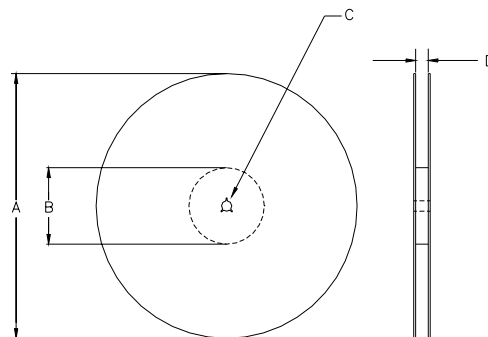
| Constant Dimensions Table 1 |                         |        |      |     |              |        |       |        |
|-----------------------------|-------------------------|--------|------|-----|--------------|--------|-------|--------|
| Tape Size                   | D0                      | D1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

| 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         |
|                 | mm     | 177.8            | 254.0        | 330.2        |
| B               | inches | 2.50             | 4.00         | 3.75         |
|                 | mm     | 63.5             | 101.6        | 95.3         |
| C               | mm     | 13.0 +0.5 / -0.2 |              |              |
| D               | mm     | 16.4             | 16.4         | 16.4         |
|                 |        | +2.0<br>-0.0     | +2.0<br>-0.0 | +2.0<br>-0.0 |

Reel dimensions may vary from the above

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