

SM77H Series 1.8V CMOS Clock Oscillators

May 2008



- Pletronics' SM77H 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 70 MHz
- 5 x 7 mm LCC Ceramic Package
- Enable/Disable
- 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: 0.17 grams

Moisture Sensitivity Level: 1 As defined in J-STD-020C

Second Level Interconnect code: e4

Absolute Maximum Ratings:

| Parameter | Unit |
|--------------------------------|---------------------------------|
| V _{CC} Supply Voltage | -0.5V to +7.0V |
| V _i Input Voltage | -0.5V to V _{CC} + 0.5V |
| V _o Output Voltage | -0.5V to V _{CC} + 0.5V |
| I _o 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 30 to 50°C/Watt depending on the solder pads, ground plane and construction of the PCB.

PART NUMBER:

| | | | | | | | |
|------|----|---|---|---|--------|-----|--|
| SM77 | 45 | H | E | X | -50.0M | -XX | |
| | | | | | | | Packaging code or blank T250 = 250 per Tape and Reel T500 = 500 per Tape and Reel T1K = 1000 per Tape and Reel |
| | | | | | | | Frequency in MHz |
| | | | | | | | Supply Voltage V_{CC} X = 1.8V ± 10% |
| | | | | | | | Optional Enhanced OTR Blank = Temp. range -10 to +70°C E = Temp. range -40 to +85°C |
| | | | | | | | Series Model |
| | | | | | | | Frequency Stability 45 = ± 50 ppm 44 = ± 25 ppm 20 = ± 20 ppm |
| | | | | | | | Series Model |

Part Marking:

PLE SM77
FF.FFF M
• YMDXX

or

PLE SM77
FF.FFF M
• YYWWXX

or

7XYWWXX
FF.FFF M
• PLE XXX

Marking Legend:

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 | 6 | 7 | 8 | 9 | 0 | 1 | 2 |
|------|------|------|------|------|------|------|------|
| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

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

Legacy Part Numbers:

- 'S' Denoted Symmetry of 45%/55% at 50% of V_{CC}. This is now the standard Duty Cycle and is no longer needed in the part number. We will still support part numbers with the 'S'. For example: SM7745HX and SM7745HSX describe the same specifications and can be used interchangeably by the customer.
- 30 Denoted Output Load other than the standard 15 pF. Data sheets now reflect the specifications at all available loads so this load designation is no longer needed. We'll still support part numbers with this load designation.

Electrical Specification for 1.80V $\pm 10\%$ over the specified temperature range

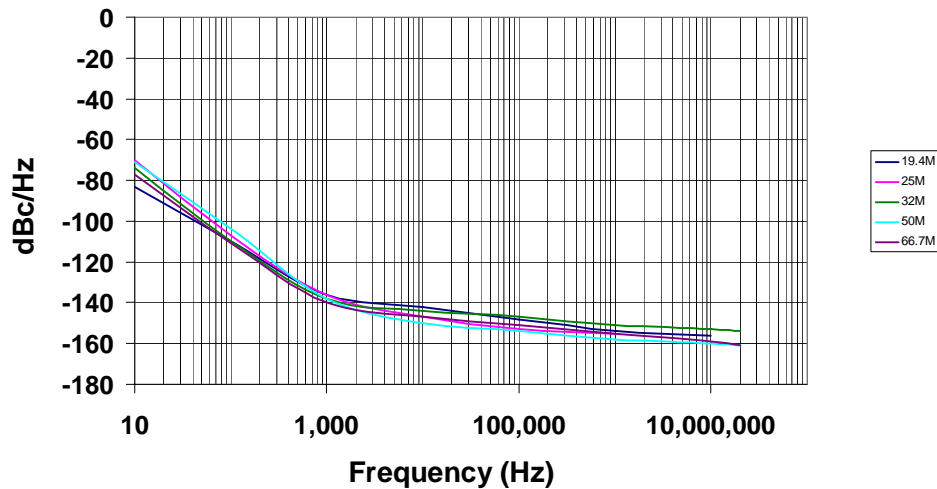
| Item | Min | Max | Unit | Condition |
|-----------------------------------|------|--------|--------------|--|
| Frequency Range | 0.8 | 69.999 | MHz | |
| Frequency Accuracy "45" | -50 | +50 | ppm | For all supply voltages, load changes, aging for 1 year, shock, vibration and temperatures |
| "44" | -25 | +25 | | |
| "20" | -20 | +20 | | |
| Output Waveform | CMOS | | | |
| Output High Level | 90 | - | % | of V_{CC} for $I_{OH} = +2$ mA <35 MHz |
| | 70 | - | | of V_{CC} for $I_{OH} = +8$ mA ≥ 35 MHz |
| Output Low Level | - | 10 | % | of V_{CC} for $I_{OL} = -2$ mA <35 MHz |
| | - | 30 | | of V_{CC} for $I_{OL} = -8$ mA ≥ 35 MHz |
| Output Symmetry | 45 | 55 | % | at 50% point of V_{CC} (See load circuit) |
| Jitter Output: 1 to 15MHz | - | 6.0 | pS RMS | 10 Hz to 1 MHz from the output frequency |
| Output: 15 to 35MHz | - | 5.0 | pS RMS | |
| Output: 35 to 50MHz | - | 4.0 | pS RMS | |
| Output: 50 to 70MHz | - | 3.0 | pS RMS | |
| Output: 25 to 70MHz | - | 0.7 | pS RMS | 12 KHz to 20 MHz from the output frequency |
| E/D Internal Pull-up | 50 | 500 | Kohm | to V_{CC} |
| V disable | - | 30 | % | of V_{CC} applied to pin 1 |
| V enable | 70 | - | % | |
| Output leakage $V_{OUT} = V_{CC}$ | -10 | +10 | μ A | Pin 1 low, device disabled |
| $V_{OUT} = 0V$ | -10 | +10 | μ A | |
| Standby Current I_{CC} | - | 4 | μ A | <35 MHz |
| | - | 100 | μ A | ≥ 35 MHz |
| Enable time | - | 250 | nS | Time for output to reach a logic state |
| Disable time | - | 250 | 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 | $^{\circ}$ C | Standard Temperature Range |
| | -40 | +85 | $^{\circ}$ C | Extended Temperature Range "E" Option |
| Storage Temperature Range | -55 | +125 | $^{\circ}$ C | |

Electrical Specification for 1.80V $\pm 10\%$ over the specified temperature range

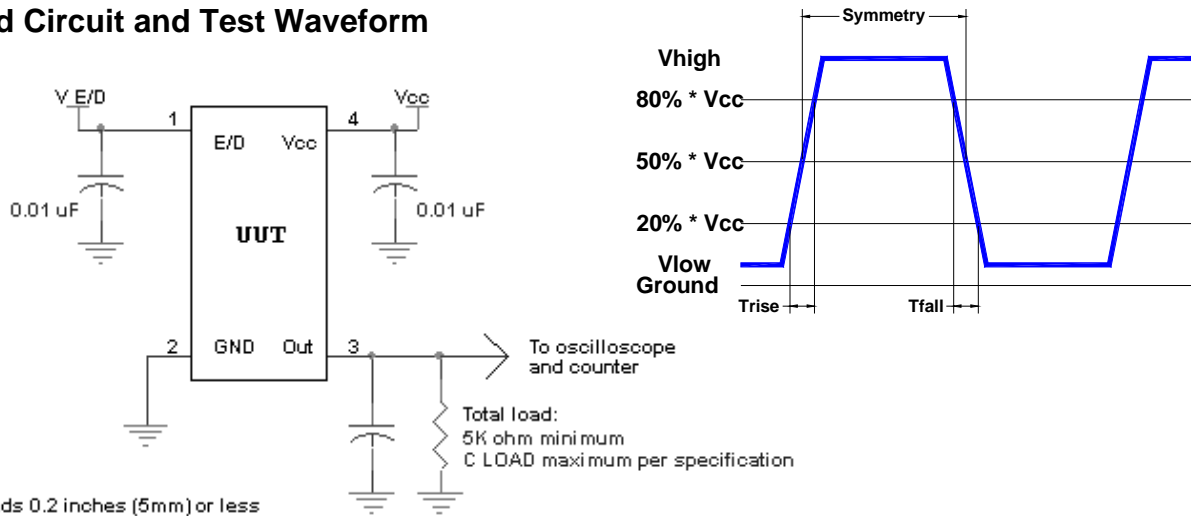
| Item | Typ | Max | Unit | Condition | |
|--------------------------------------|-----|------|------|----------------------------|--|
| Output T_{RISE} and T_{FALL} | 2.0 | 5.0 | nS | < 35 MHz | $C_{LOAD} = 15$ pF 20% to 80% of V_{CC} See Load Circuit |
| | 1.7 | 3.5 | nS | ≥ 35 MHz | |
| | 4.0 | 10.0 | nS | < 35 MHz | $C_{LOAD} = 30$ pF 20% to 80% of V_{CC} See Load Circuit |
| | 2.0 | 7.0 | nS | ≥ 35 MHz | |
| V_{CC} Supply Current (I_{CC}) | - | 4 | mA | < 8 MHz | $C_{LOAD} = 15$ pF |
| | - | 5 | mA | ≥ 8 MHz and < 16 MHz | |
| | - | 7 | mA | ≥ 16 MHz and < 35 MHz | |
| | - | 18 | mA | ≥ 35 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

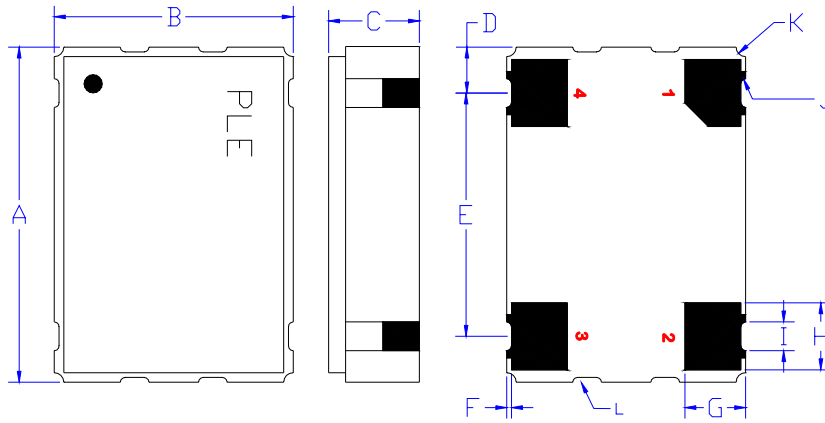
Label is 1" x 2.6" (25.4mm x 66.7mm)
 Font is Courier New
 Bar code is 39-Full ASCII

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

| | | |
|---------------|----------------|--------|
| P/N: | | |
| | SM7745HX-20.0M | |
| Customer P/N: | | |
| | 12345678 | |
| Qty: | | D/C |
| | 1000 | 75514B |

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

Mechanical:



The detents "L" 4 each on package end are optional

Not to Scale

¹ Typical dimensions

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

Contacts :

Gold 11.8 pinches 0.3 µm minimum over Nickel 50 to 350 pinches 1.27 to 8.89 µm

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

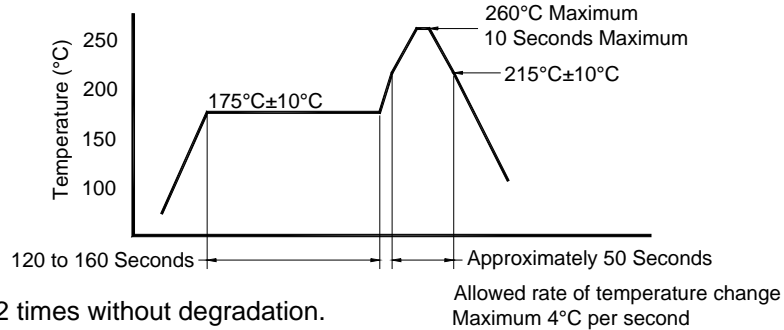


Layout and application information

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 2 times without degradation.

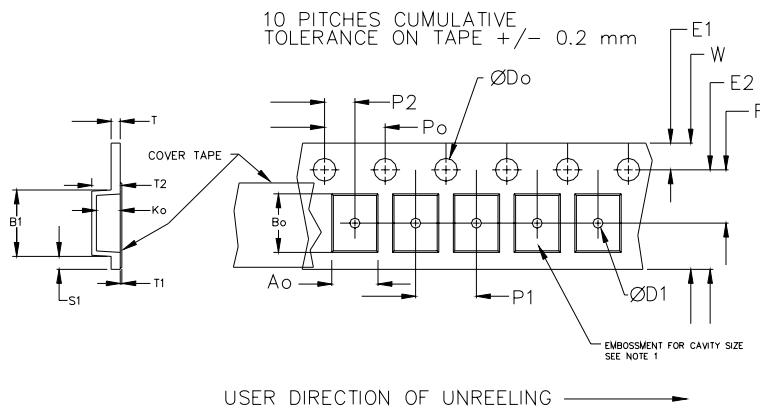
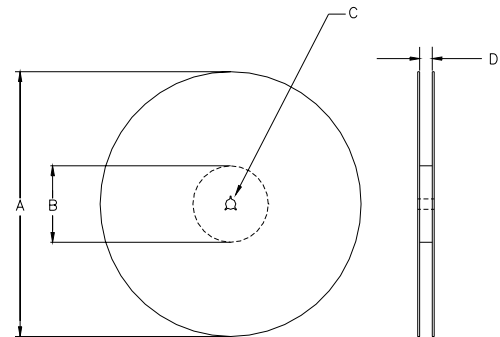
Tape and Reel: available for quantities of 250 to 1000 per reel, cut tape for < 250

| 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 | | | | ± 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

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

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