

## SM10T Series Miniature SMD Crystal

March 2015



- Pletronics' SM10T Series is a miniature surface mount crystal.
- Package is ideal for automated surface mount assembly and reflow practices.
- Tape and Reel packaging
- 12 MHz to 67.5 MHz
- 2.5 x 3.2 mm 4 pad
- AT Cut Fundamental and 3<sup>rd</sup> Overtone Crystals
- Ideal for use in hand held consumer products

**Pletronics Inc. certifies this device is in accordance with the  
RoHS 6/6 (2011/65/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: 0.03 grams

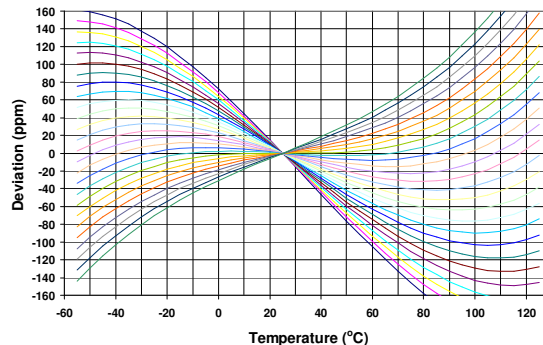
Moisture Sensitivity Level: 1 As defined in J-STD-020D.1

Second Level Interconnect code: e4

### Electrical Specification:

| Item                               | Min | Max  | Unit    | Condition                                       |
|------------------------------------|-----|------|---------|-------------------------------------------------|
| Frequency Range                    | 12  | 60   | MHz     |                                                 |
| Calibration Frequency Tolerance    | 10  | 50   | ppm     | at +25°C $\pm$ 3°C, see part number for options |
| Frequency Stability                | 3   | 150  | ppm     | see part number for available options           |
| Equivalent Series Resistance (ESR) | -   | 120  | Ohms    | 12 MHz to 14.318 MHz                            |
|                                    | -   | 100  | Ohms    | 14.318 MHz to 16 MHz                            |
|                                    | -   | 80   | Ohms    | 16 MHz to 20 MHz                                |
|                                    | -   | 70   | Ohms    | 20 MHz to 30 MHz                                |
|                                    | -   | 50   | Ohms    | 30 MHz to 50 MHz                                |
|                                    | -   | 80   | Ohms    | above 50 MHz                                    |
| Drive Level                        | -   | 100  | $\mu$ W | use 10 $\mu$ W for testing                      |
| Shunt Capacitance (C0)             | -   | 5    | pF      | Pad to Pad capacitance                          |
| Aging at 25°C $\pm$ 3°C            | -5  | +5   | ppm /Yr | for the first year                              |
|                                    | -2  | +2   | ppm /Yr | after the first year                            |
| Operating Temperature Range        | -40 | +125 | °C      | see part number for available options           |
| Storage Temperature Range          | -55 | +125 | °C      |                                                 |

### AT Cut Crystal Frequency versus Temperature Typical Performance:



Part Number:

SM10T -18 -16.384M -20 E 1 L K -XX

See chart below for available options

|  |                                                                                                                                                                                                                                                                                                                                                                        |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Internal code or blank                                                                                                                                                                                                                                                                                                                                                 |
|  | <b>Highest Specified Operating Temperature</b><br><b>A</b> = 40°C <b>G</b> = 70°C <b>N</b> = 100°C<br><b>B</b> = 45°C <b>H</b> = 75°C <b>P</b> = 105°C<br><b>C</b> = 50°C <b>J</b> = 80°C <b>R</b> = 110°C<br><b>D</b> = 55°C <b>K</b> = 85°C <b>S</b> = 115°C<br><b>E</b> = 60°C <b>L</b> = 90°C <b>T</b> = 120°C<br><b>F</b> = 65°C <b>M</b> = 95°C <b>U</b> = 125°C |
|  | <b>Lowest Specified Operating Temperature</b><br><b>A</b> = +10°C <b>F</b> = -15°C <b>L</b> = -40°C<br><b>B</b> = +5°C <b>G</b> = -20°C <b>M</b> = -45°C<br><b>C</b> = 0°C <b>H</b> = -25°C <b>N</b> = -50°C<br><b>D</b> = -5°C <b>J</b> = -30°C <b>P</b> = -55°C<br><b>E</b> = -10°C <b>K</b> = -35°C                                                                 |
|  | <b>Fundamental mode AT cut crystal</b><br><b>1</b> = Fundamental AT cut crystal<br><b>3</b> = 3 <sup>rd</sup> Overtone AT cut crystal                                                                                                                                                                                                                                  |
|  | Frequency Stability    See chart below                                                                                                                                                                                                                                                                                                                                 |
|  | <b>Calibration Frequency Tolerance (Typ. Values shown)</b><br><b>10</b> = ± 10 ppm at 25°C ± 3°C<br><b>20</b> = ± 20 ppm at 25°C ± 3°C<br><b>30</b> = ± 30 ppm at 25°C ± 3°C (Standard)<br><b>50</b> = ± 50 ppm at 25°C ± 3°C                                                                                                                                          |
|  | Frequency in MHZ                                                                                                                                                                                                                                                                                                                                                       |
|  | <b>Load in pF</b><br><b>Parallel Resonance</b> from <b>06</b> to <b>32</b> pF or<br><b>SR</b> = Series Resonance                                                                                                                                                                                                                                                       |
|  | Model Number                                                                                                                                                                                                                                                                                                                                                           |

| Operating Temperature Range | CODE | Available Frequency Stability versus Temperature in ppm |       |       |      |      |      |      |      |       |       |
|-----------------------------|------|---------------------------------------------------------|-------|-------|------|------|------|------|------|-------|-------|
|                             |      | A                                                       | B     | C     | D    | E    | F    | G    | H    | J     | K     |
| 0 to +45°C                  | CB   | ± 3.0                                                   | ± 5.0 | ± 8.0 | ± 10 | ± 15 | ± 20 | ± 30 | ± 50 | ± 100 | ± 150 |
| 0 to +50°C                  | CC   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| 0 to +60°C                  | CE   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| 0 to +70°C                  | CG   | •                                                       | •     | •     | •    | •    | •    | •    | STD  | •     | •     |
| -10 to +50°C                | EC   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -10 to +60°C                | EE   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -10 to +75°C                | EH   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -20 to +70°C                | GG   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -20 to +75°C                | GH   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -30 to +75°C                | JH   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -30 to +80°C                | JJ   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -30 to +85°C                | JK   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -35 to +80°C                | KJ   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -40 to +85°C                | LK   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -40 to +90°C                | LL   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -40 to +105°C               | LP   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |
| -40 to +125°C               | LU   | •                                                       | •     | •     | •    | •    | •    | •    | •    | •     | •     |

### Legacy Part Number (not for new designs):

| SM10T | B | E | -18 | -23.45M | -XX |                                                                                        |
|-------|---|---|-----|---------|-----|----------------------------------------------------------------------------------------|
|       |   |   |     |         |     | Internal code or blank                                                                 |
|       |   |   |     |         |     | Frequency in MHz                                                                       |
|       |   |   |     |         |     | Load in pF<br>Parallel Resonance from 6 to 32 pF or<br><b>SR</b> = Series Resonance    |
|       |   |   |     |         |     | Operating Temperature Range<br>Blank = 0 to + 70°C (STD)<br><b>E</b> = -40 to +85°C    |
|       |   |   |     |         |     | Calibration Tolerance / Frequency Stability<br>Blank = 30/50 (STD)<br><b>B</b> = 30/30 |
|       |   |   |     |         |     | Series Model                                                                           |

### 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 |

### Package Labeling

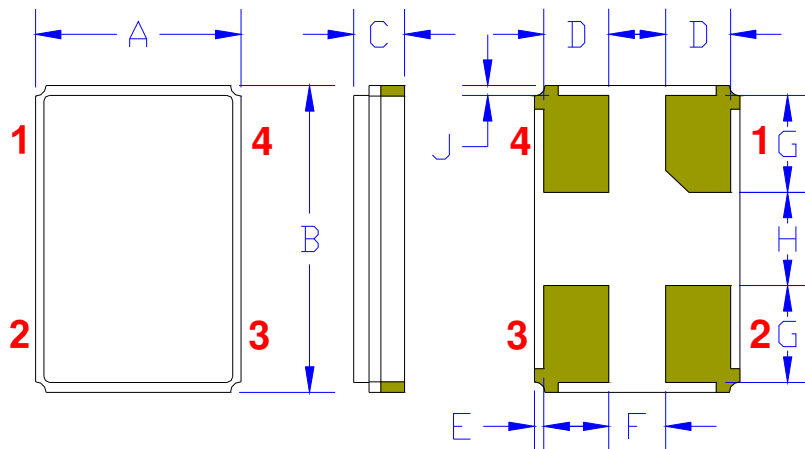
Label is 1" x 2.6" (25.4mm x 66.7mm)  
Font is Courier New  
Bar code is 39-Full ASCII

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

|               |                                                                                     |
|---------------|-------------------------------------------------------------------------------------|
| P/N:          |  |
|               | SM10T-16-23.45M-10F1CG                                                              |
| Customer P/N: |  |
|               | 12345678                                                                            |
| Qty:          |  |
|               | 1000                                                                                |
| D/C           |  |
|               | 0526                                                                                |

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

### Mechanical:



|                | Inches            | mm         |
|----------------|-------------------|------------|
| A              | 0.098 ± 0.004     | 2.5 ± 0.15 |
| B              | 0.126 ± 0.004     | 3.2 ± 0.15 |
| C              | 0.028 max         | 0.7 max    |
| D <sup>1</sup> | 0.028 to 0.031    | 0.7 to 0.8 |
| E <sup>1</sup> | 0.004             | 0.1        |
| F <sup>1</sup> | A - (2 * (D + E)) |            |
| G <sup>1</sup> | 0.035             | 0.9        |
| H <sup>1</sup> | 0.047             | 1.2        |
| J <sup>1</sup> | 0.004             | 0.1        |

The chamfered pad may or may not be present and may be on any pad

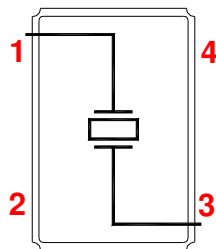
#### Contacts :

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

Not to Scale

<sup>1</sup> Typical dimensions

### Connection (top view):



Pad 2 and Pad 4 are common and connected to the metal cover. They are not connected to the crystal. Connected to ground is recommended

The crystal is symmetrical, there is no Pad 1 preference. The part can be rotated 180° when being assembled on the PCB and will still perform correctly.

### Marking:

- P = Pletronics
- ff.ffM or ff.f = Frequency
- ymd or ym = Year Month Day or Year Month, see code below
- z = Internal information
- Orientation of marking may be mixed on the tape
- Traceability of part is lost once removed from reel

**Pff.ffM  
ymdz**

OR

**ff.ffM  
Pymdz**

OR

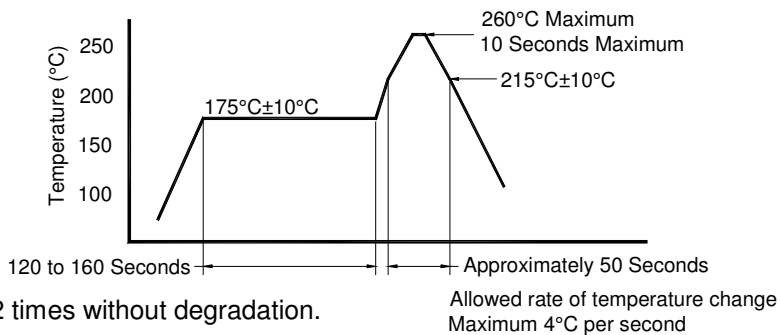
**ff.fym**

### Codes for Date Code YMD

| Code | 3    | 4    | 5    | 6    | 7    | Code  | A   | B   | C   | D   | E   | F   | G   | H   | J   | K   | L   | M   |
|------|------|------|------|------|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 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 |    |

### Reflow Cycle (typical for lead free processing)



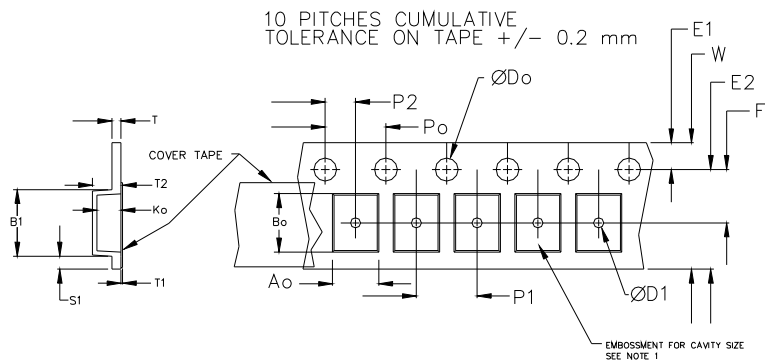
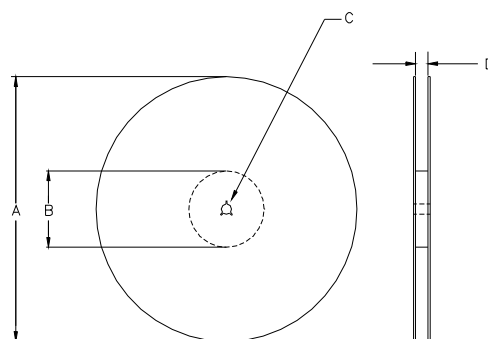
The part may be reflowed 2 times without degradation.

### Tape and Reel: available for quantities of 250 to 3000 per reel (<1000 will be 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<br><br>±0.1 | 4.0<br><br>±0.1 | 2.0<br>±0.05 | 0.6    | 0.25  | 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 |
| 8 mm                        | 3.5    | 6.4    | 1.7 ±0.1 | 4.0 ±0.1 | 1.0    | 8.9   | Note 1      |

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



| REEL DIMENSIONS |        |                     |                     |                     | Tape Width |
|-----------------|--------|---------------------|---------------------|---------------------|------------|
| A               | inches | 7.0                 | 10.0                | 13.0                |            |
|                 | 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     | 8.4<br>+2.0<br>-0.0 | 8.4<br>+2.0<br>-0.0 | 8.4<br>+2.0<br>-0.0 |            |

USER DIRECTION OF UNREELING →

Reel dimensions may vary from the above

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