# TFSM Series

## Tuning Fork Crystal



Part Dimensions:
6.2 × 2.1mm • 56.56mg

### Features

- 32.7680kHz Frequency Reference
- Tuning Fork Crystal Design
- Cylindrical Thru-Hole Package w/ SM Lead-Form
- Compatible to Citizen CMR200T and Micro Crystal MS1V-T1K
- Frequency Tolerance, ±20ppm Standard
- Parabolic Temperature Coefficient
- Tape and Reel Packaging, EIA-418

RoHS Compliant in Accordance with EU Directive 2011/65/EU
- Lead-Free Termination Finish
- Exemption 7(a), Lead [Pb] in high melting temperature type solders

### Applications

- Real Time Clock Reference
- FPGAs & Microcontrollers
- Wireless Communications
- Consumer Electronics
- Computer Peripherals
- IoT Applications
- Instrumentation
- Industrial Electronics

### Description

CTS TFSM Series is ideal for supporting wide range of electronic designs requiring a Real Time Clock reference. This series will support general commercial applications.

### Ordering Information

| Model | Frequency Tolerance | Load Capacitance | Frequency Code [kHz] |
|---|---|---|---|
| TFSM 26 | 2 | P | 32K7680 |

| Code | Package |
|---|---|
| 26 | 6.2x2.1mm |

| Code | Capacitance |
|---|---|
| P | 12.5pF |
| T | 6pF |

| Code | @ +25°C |
|---|---|
| 2 | ±20ppm |
| 1 | ±10ppm [1] |

| Code | Frequency |
|---|---|
| | Product Frequency Code [2] |

Notes:

1] Check factory for availability.

2] Frequency is recorded with two leading digits before the 'K' and 4 significant digits after the 'K' [including zeros].

**Not all performance combinations and frequencies may be available.**
**Contact your local CTS Representative or CTS Customer Service for availability.**

This product is specified for use only in standard commercial applications. Supplier disclaims all express and implied warranties and liability in connection with any use of this product in any non-commercial applications or in any application that may expose the product to conditions that are outside of the lerances provided in its specification.



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# Electrical Specifications

## Operating Conditions

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Operating Temperature | $T_A$ | - | -10 | +25 | +60 | °C |
| Turnover Temperature | $T_M$ | - | +20 | +25 | +30 | °C |
| Storage Temperature | $T_{STG}$ | - | -40 | - | +85 | °C |

## Frequency Stability

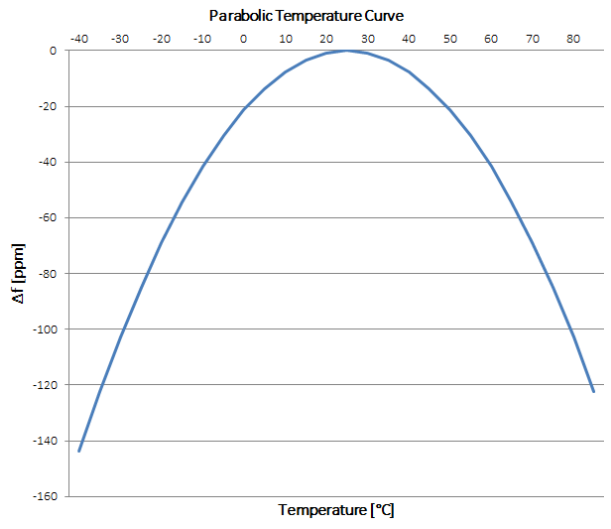
| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Frequency | $f_O$ | - | | 32.7680 | | kHz |
| Frequency Tolerance [Note 1] | $\Delta f/f_O$ | Standard @ +25°C | -20 | - | 20 | ppm |
| Parabolic Coefficient | ß | See Figure 1 | | -0.034 ±0.006 | | ppm/°C$^2$ |
| Aging | $\Delta f/f_0$ | First Year @ +25°C | -3 | - | 3 | ppm |

## Crystal Parameters

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Operating Mode | - | - | | Flexural Mode [Tuning Fork] | | - |
| Load Capacitance [Note 1] | $C_L$ | Standard | - | 12.5 | - | pF |
| Shunt Capacitance | $C_0$ | - | - | 1.0 | - | pF |
| Motional Capacitance | $C_1$ | - | - | 3.0 | - | fF |
| Series Resistance | $R_1$ | - | - | - | 40 | kΩ |
| Drive Level | DL | - | - | - | 1.0 | µW |
| Insulation Resistance | $R_i$ | +100Vdc ±15Vdc | 500 | - | - | MΩ |

1.] See Ordering Information for available options.

Figure 1




Frequency Stability [Δf] at a given temperature,

$$\Delta f = ß[T_A - T_M]^2$$

ß = Parabolic Coefficient
$T_A$ = Ambient Temperature
$T_M$ = Turnover Temperature

Ex. Find frequency stability at $T_A$ = +45°C

$\Delta f = -0.034[45-25]^2$

$\Delta f = -0.034[20]^2$

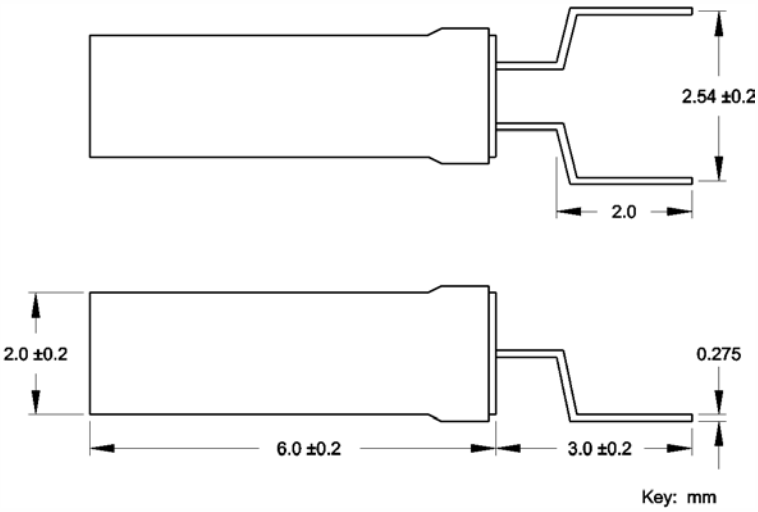
$\Delta f = -13.6$ppm



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# Mechanical Specifications

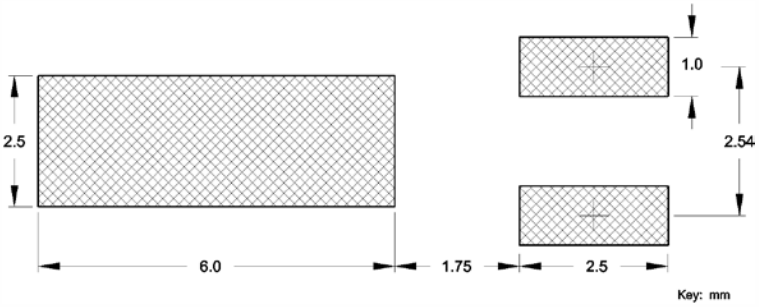
## Package Drawing




## Marking Information

Contact factory for marking formats that apply to this model series.

## Recommended Pad Layout




## Notes

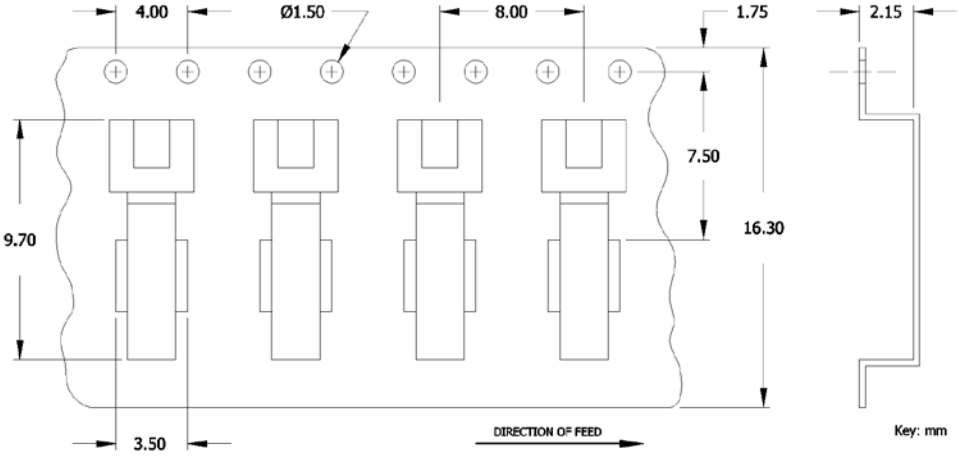
1. JEDEC termination code (e2). Barrier-plating is nickel [Ni] with tin [Sn] copper [Cu] finish.
2. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
3. MSL = 1.



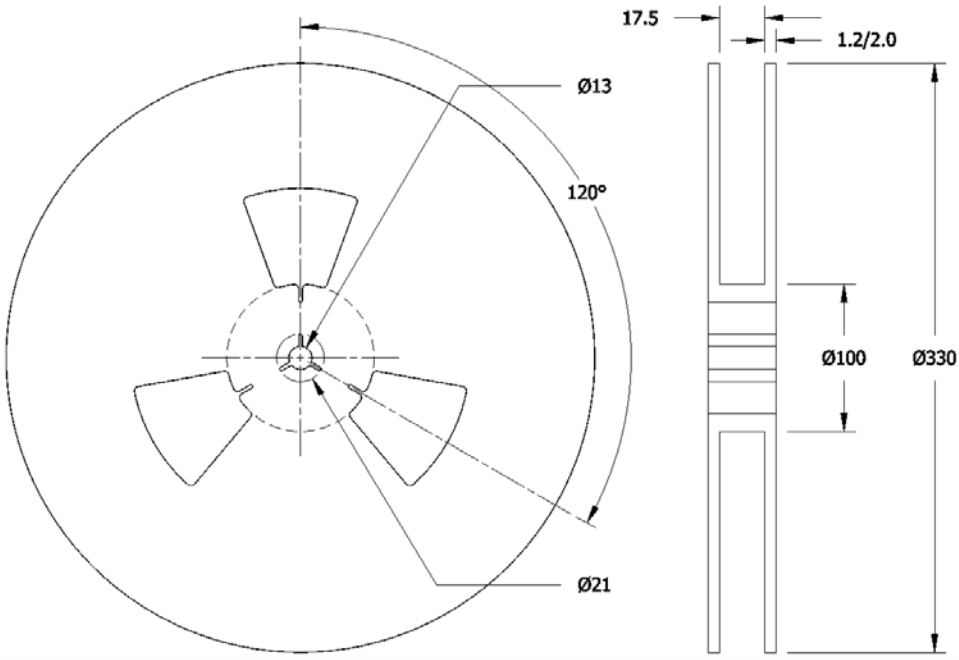
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## Packaging - Tape and Reel

### Tape Drawing




### Reel Drawing




### Notes

1. Device quantity is 3.4k pieces maximum per 330mm reel.
2. Complete CTS part number, frequency value, date code and manufacturing site code information must appear on reel and carton labels.



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