



# TFNC Series

## Tuning Fork Crystal

### Features

- 32.7680kHz Frequency Reference
- Tuning Fork Crystal Design
- Cylindrical Thru-Hole Package
- Compatible to Citizen CFS Series and Epson C-Type
- Frequency Tolerance,  $\pm 20$ ppm Standard
- Parabolic Temperature Coefficient
- Packaging Bulk in Bag



Part Dimensions:  
 8.3 × 3.1mm • 153.950mg  
 6.2 × 2.1mm • 59.14778mg  
 5.1 × 1.5mm • 29.496mg

**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 TFNC 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]																
TFNC 38	2	P	32K7680																
<table border="1"> <thead> <tr> <th>Code</th> <th>Package</th> </tr> </thead> <tbody> <tr> <td>38</td> <td>8.3x3.1mm</td> </tr> <tr> <td>26</td> <td>6.2x2.1mm</td> </tr> <tr> <td>15</td> <td>5.1x1.5mm</td> </tr> </tbody> </table>		Code	Package	38	8.3x3.1mm	26	6.2x2.1mm	15	5.1x1.5mm	<table border="1"> <thead> <tr> <th>Code</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td>P</td> <td>12.5pF</td> </tr> <tr> <td>T</td> <td>6pF</td> </tr> <tr> <td>K</td> <td>8pF [TFNC15 Only]</td> </tr> </tbody> </table>		Code	Capacitance	P	12.5pF	T	6pF	K	8pF [TFNC15 Only]
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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 tolerances provided in its specification.

## 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

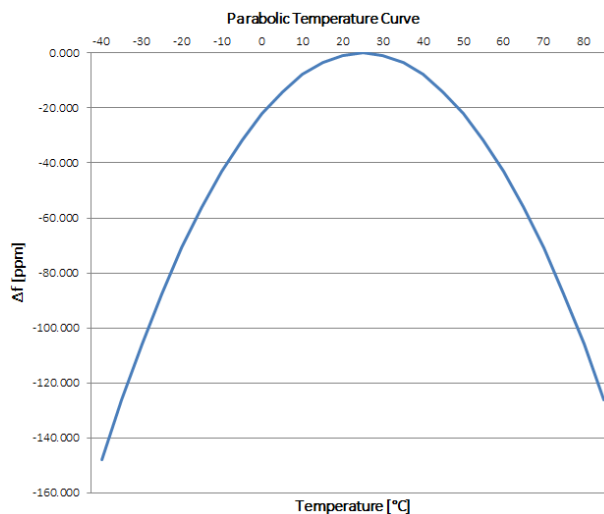
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency	$f_0$	-		32.7680		kHz
Frequency Tolerance [Note 1]	$\Delta f/f_0$	Standard @ +25°C	-20	-	20	ppm
Parabolic Coefficient	$\beta$	See Figure 1		-0.035 ±0.006		ppm/°C <sup>2</sup>
Aging	$\Delta f/f_0$	First Year @ +25°C	-3	-	3	ppm

### Crystal Parameters

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Mode	-	-		Flexural Mode [Tuning Fork]		-
Load Capacitance [Note 1]	$C_L$	TFNC38, TFNC26 TFNC15	-	12.5 8.0	-	pF
Shunt Capacitance	$C_0$	TFNC38, TFNC26, TFNC15		1.6, 1.35, 1.0		pF
Motional Capacitance	$C_1$	-	-	3.0	-	fF
Series Resistance	$R_1$	-	-	-	50	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  $[\Delta f]$  at a given temperature,

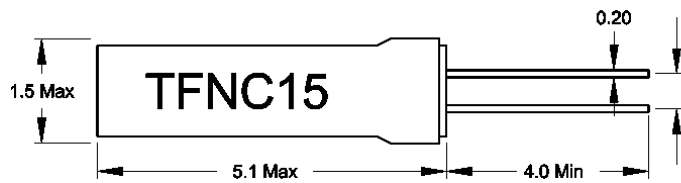
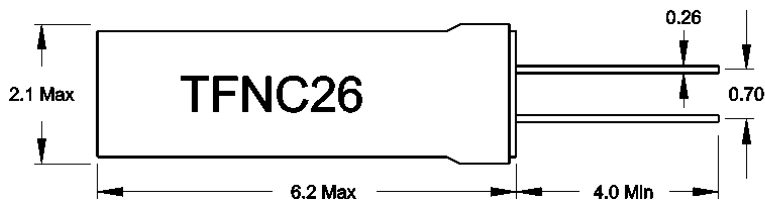
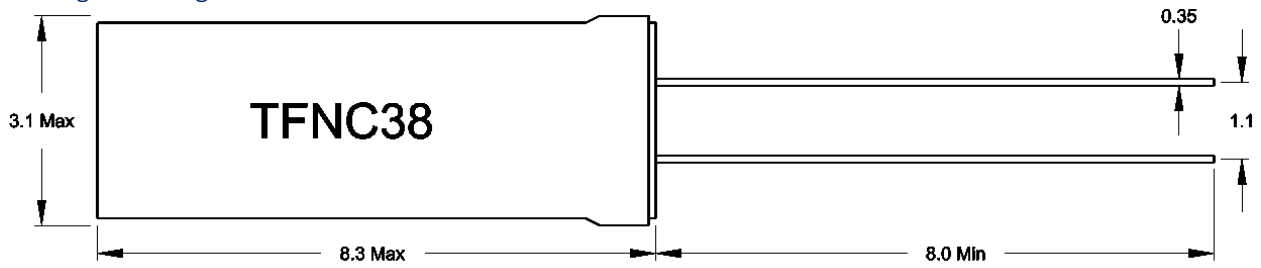
$$\Delta f = \beta [T_A - T_M]^2$$

$\beta$  = Parabolic Coefficient  
 $T_A$  = Ambient Temperature  
 $T_M$  = Turnover Temperature

Ex. Find frequency stability at  $T_A = +45^\circ\text{C}$   
 $\Delta f = -0.035[45-25]^2$   
 $\Delta f = -0.035[20]^2$   
 $\Delta f = -14.0 \text{ ppm}$

## Mechanical Specifications

### Package Drawing



Key: mm

### Marking Information

Refer to document 016-0071-0, TF Marking Guide, for marking formats by product family.

### Notes

1. JEDEC termination code (e2). Barrier-plating is nickel [Ni] with tin [Sn] copper [Cu] finish.
2. Soldering iron attach; +300°C maximum, 5 seconds.
3. MSL = 1.

### Packaging - Bulk in Bag

#### Notes

1. Packaging is bulk in plastic bag.
2. Complete CTS part number, frequency value, date code and manufacturing site code information must appear on reel and carton labels.