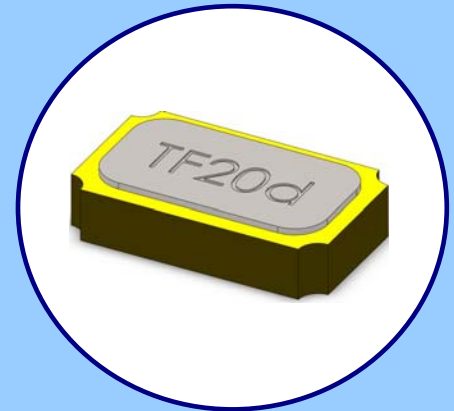




**FEATURES**

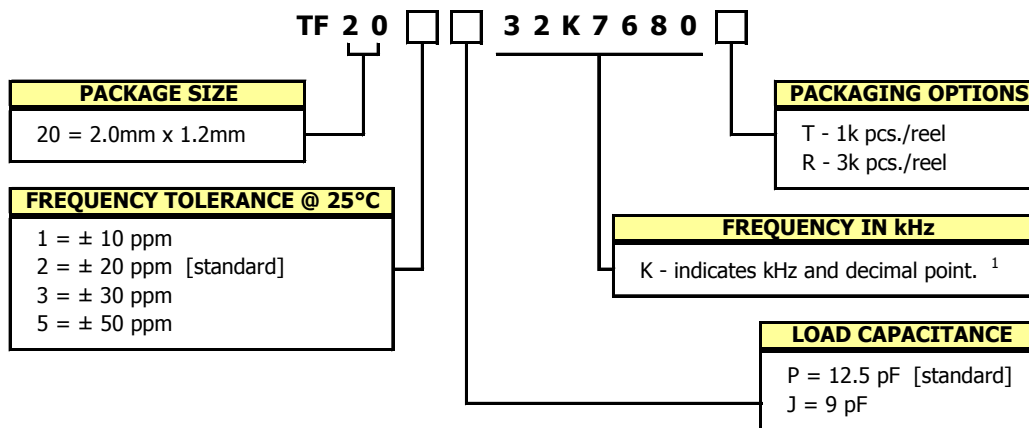
- **32.7680 kHz Frequency Reference**
- **Package Size 2.0mm x 1.2mm**
- **Tuning Fork Crystal Design**
- **Hermetic Ceramic Package**
- Frequency Tolerance,  $\pm 20$  ppm Standard  
[ $\pm 10$  ppm,  $\pm 30$  ppm and  $\pm 50$  ppm available]
- Frequency Temperature Coefficient,  $-0.030$  ppm/ $^{\circ}\text{C}^2$
- Operating Temperature,  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  Standard
- Tape & Reel Packaging, EAI-481-2
- **RoHS/Green Compliant (6/6)**



**APPLICATIONS**

The TF20 crystal series is ideal for use in a wide range of communication equipment, notebooks, computer peripherals, audio visual, Bluetooth and other wireless applications, USB interfaces, PDAs and automotive electronics.

**ORDERING INFORMATION**



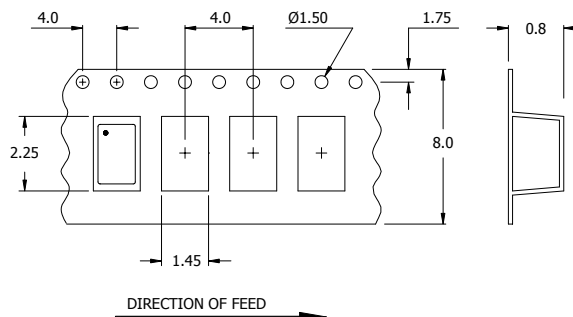
1] Frequency is recorded with two leading digits before the 'K' and 4 significant digits after the 'K' (including zeros).

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

**PACKAGING INFORMATION [reference]**

Factory may package reels in quantities of 1k pcs. or 3k pcs. Reel size is 180mm.

DIMENSIONS IN MILLIMETERS

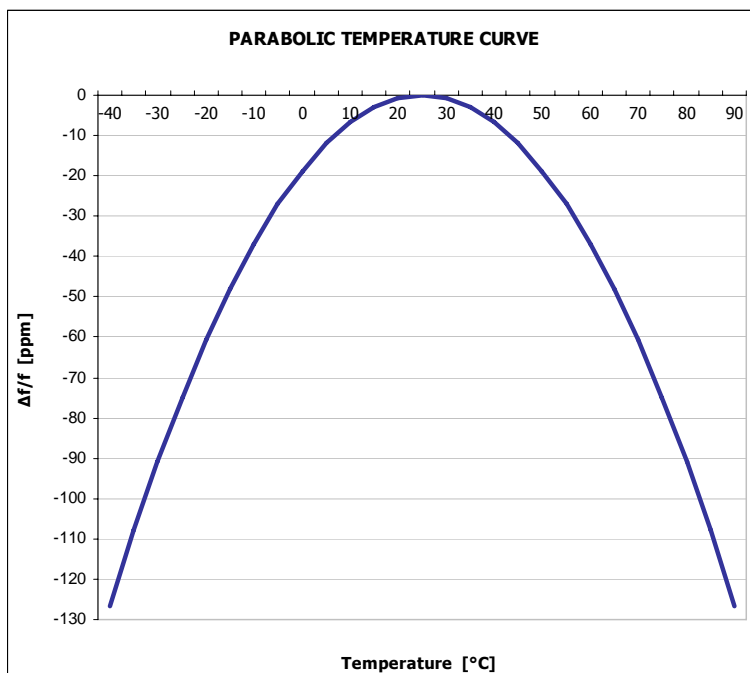


**ELECTRICAL CHARACTERISTICS**

	PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
<b>ELECTRICAL PARAMETERS</b>	Frequency	$f_0$			32.7680		kHz
	Operating Mode	-		Flexural Mode [Tuning Fork]			-
	Frequency Tolerance *	$\Delta f/f_0$	@+25°C	-	20	-	± ppm
	Frequency Temperature Coefficient	$\Delta f/f_M$		-0.030 ±0.01ppm/°C <sup>2</sup>			-
	Frequency Stability			See Figure 1			
	Operating Temperature Range	$T_A$		-40	-	+85	°C
	Turnover Temperature	$T_M$	±5°C	-	+25	-	°C
	Load Capacitance *	$C_L$	Standard	-	12.5	-	pF
	Aging	$\Delta f/f_0$	@+25°C, 1st year	-	-	3.0	± ppm
	Drive Level	DL		-	0.1	0.5	µW
	Shunt Capacitance	$C_0$	@1 MHz	-	-	7.0	pF
	Motional Capacitance	$C_1$		-	7.0	-	fF
	Series Resistance	$R_1$		-	-	90	k Ohms
	Insulation Resistance	$R_i$	+100Vdc ±15Vdc	500	-	-	M Ohms
	Storage Temperature Range	$T_{STR}$		-55	-	+125	°C

\* See Ordering Information for available options.

**FIGURE 1**

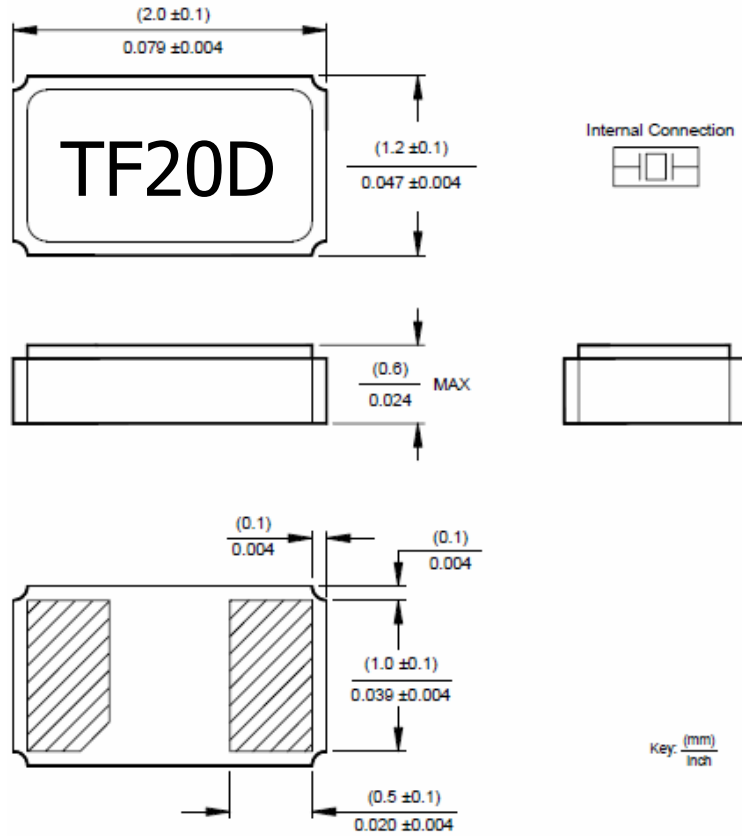


Frequency stability [ppm] is determined using parabolic curve,  $\Delta f = \text{Temperature Coefficient}(T_A - T_M)^2$ .

Ex. Find frequency stability at  $T_A = 45^\circ\text{C}$   
 $\Delta f = -0.030(45-25)^2$   
 $\Delta f = -0.030(20)^2$   
 $\Delta f = -12.0 \text{ ppm}$

**MECHANICAL SPECIFICATIONS**

**TF20 PACKAGE DRAWING**



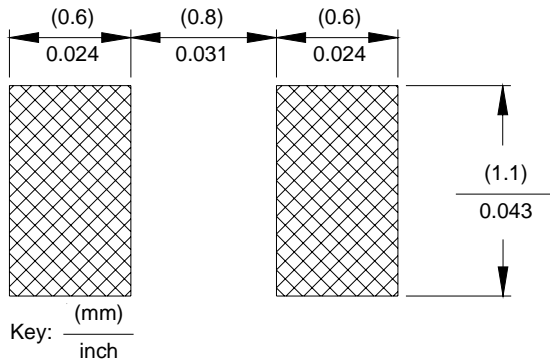
**MARKING INFORMATION**

1. TF20 - CTS Model Series.
2. D - Date code. See Table I for codes.

**TABLE I - DATE CODE**

YEAR		MONTH					JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
		2001	2005	2009	2013	2017	A	B	C	D	E	F	G	H	J	K	L	M
2002	2006	2010	2014	2018	N	P	Q	R	S	T	U	V	W	X	Y	Z		
2003	2007	2011	2015	2019	a	b	c	d	e	f	g	h	j	k	l	m		
2004	2008	2012	2016	2020	n	p	q	r	s	t	u	v	w	x	y	z		

**SUGGESTED SOLDER PAD GEOMETRY**



**NOTES**

1. Complete CTS part number, frequency value, date code and manufacturing site code information must appear on reel and carton labels.
2. Termination pads (e4); barrier plating is nickel [Ni] with gold [Au] flash plate.
3. Reflow conditions per JEDEC J-STD-020; 260°C maximum, 20 seconds.
4. MSL = 1.