



# Model TC20

## HCMOS Clock @ 32.768kHz

### Features

- Low Power Consumption, 240µA Maximum
- Ceramic Surface Mount Package
- Fundamental Crystal Design
- Frequency 32.768kHz
- +1.8V, +2.5V or +3.3V Operating Voltage
- Operating Temperature Range to -40°C to +85°C
- Output Enable Standard
- Tape and Reel Packaging, EIA-481



Part Dimensions:  
2.0 × 1.6 × 0.8mm • 8.29998mg

### Applications

- Real Time Clock Reference
- IoT
- Portable Electronics
- Smart Metering
- Wireless Communications
- Telematics
- Data Loggers
- Timing Synchronization
- Battery Powered Applications

### Description

CTS Model TC20 is a low cost, small size, HCMOS Clock Oscillator [XO] operating at 32.768kHz. Employing IC technology that provides low current consumption, TC20 provides a Real Time Clock reference with excellent stability and low phase jitter performance.

### Ordering Information

Model	Supply Voltage	Frequency Stability	Temperature Range	Frequency Code
TC20	L	3	I	32K7680

Code	Voltage
M	+1.8Vdc
N	+2.5Vdc
L	+3.3Vdc

Code	Temp. Range
C	-20°C to +70°C
D	-30°C to +85°C
I	-40°C to +85°C

Code	Stability	Code	Stability
6	±20ppm <sup>1</sup>	4	±30ppm
5	±25ppm	3	±50ppm

Code	Frequency
Product Frequency Code	

Notes:

1] Consult factory for availability of 6I Stability/Temperature combination.

**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
Maximum Supply Voltage	$V_{CC}$	-	-0.5	-	5.0	V
Supply Voltage	$V_{CC}$	$\pm 5\%$	1.710 2.375 3.135	1.8 2.5 3.3	1.890 2.625 3.465	V
Supply Current	$I_{CC}$	No Load	-	-	240	$\mu A$
Operating Temperature	$T_A$	-	-20 -30 -40	+25	+70 +85 +85	$^{\circ}C$
Storage Temperature	$T_{STG}$	-	-55	-	+125	$^{\circ}C$

### Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	$f_0$	-		32.768		kHz
Frequency Stability [Note 1]	$\Delta f/f_0$	-		20, 25, 30 or 50		$\pm ppm$
Aging	$\Delta f/f_{25}$	First Year @ +25 $^{\circ}C$ , nominal $V_{CC}$	-3	-	3	ppm

1.] Inclusive of initial tolerance at time of shipment, changes in supply voltage, load, temperature and 1st year aging.

### Output Parameters

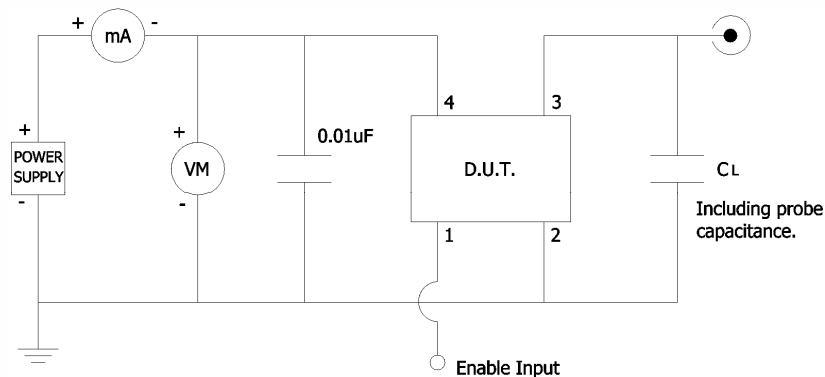
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Type	-	-		HCMOS		-
Output Load	$C_L$	-	-	-	15	pF
Output Voltage Levels	$V_{OH}$ $V_{OL}$	CMOS Load	0.9 $V_{CC}$ -	- -	- 0.1 $V_{CC}$	V
Output Duty Cycle	SYM	@ 50% Level	45	-	55	%
Rise and Fall Time	$T_R, T_F$	@ 10%/90% Levels, $C_L = 15pF$	-	-	200	ns
Start Up Time	$T_S$	Application of $V_{CC}$	-	-	10	ms
Enable Function		Standby				
Enable Input Voltage	$V_{IH}$	Pin 1 Logic '1', Output Enabled	0.7 $V_{CC}$	-	-	V
Disable Input Voltage	$V_{IL}$	Pin 1 Logic '0', Output Disabled	-	-	0.3 $V_{CC}$	V
Disable Current	$I_{IL}$	Pin 1 Logic '0', Output Disabled	-	-	3	$\mu A$
Enable Time	$T_{PLZ}$	Pin 1 Logic '1', Output Enabled	-	-	10	ms

### Enable Truth Table

Pin 1	Pin 3
Logic '1'	Output Enabled
Open	Output Enabled
Logic '0'	Output Disabled, High Impedance

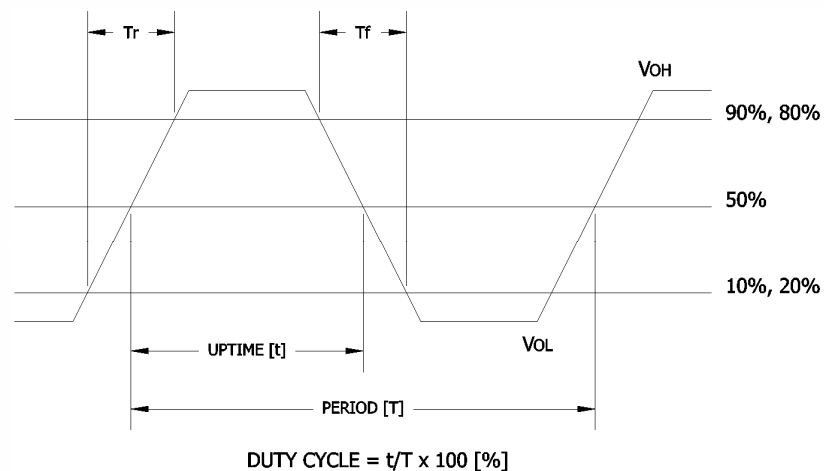
## Electrical Specifications

Test Circuit  
HCMOS



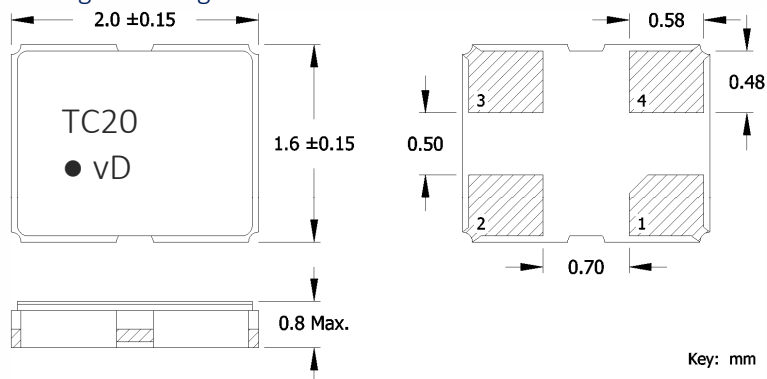
## Output Waveform

HCMOS



## Mechanical Specifications

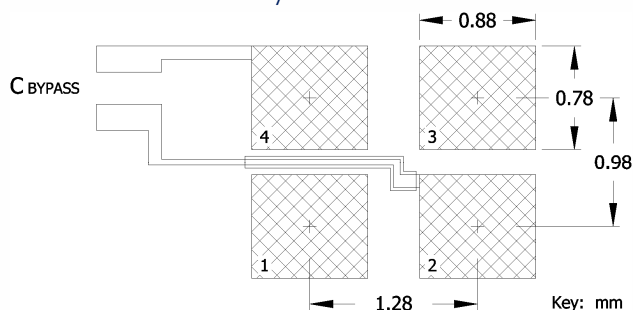
### Package Drawing



### Marking Information

1. TC25 – CTS Model.
2. v – Voltage Code  
[L = 3.3V, N = 2.5V, M = 1.8V, V = 1.5V]
3. D – Date Code. See Table I for codes.

### Recommended Pad Layout



### Notes

1. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
3. MSL = 1.

### Pin Assignments

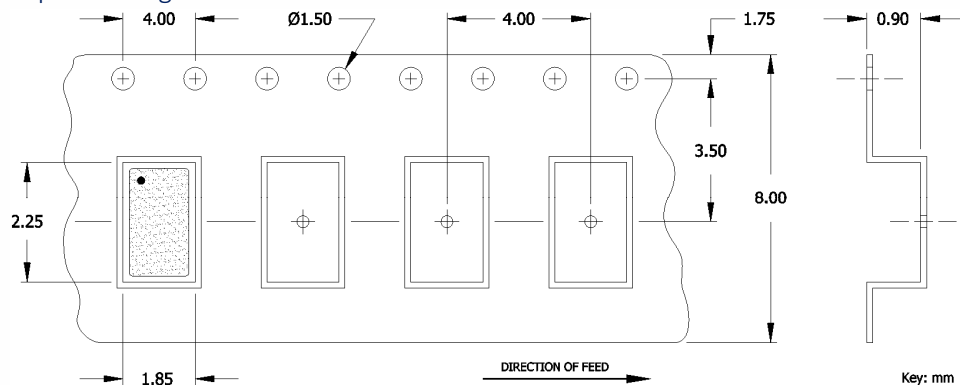
Pin	Symbol	Function
1	EOH	Enable
2	GND	Circuit & Package Ground
3	Output	RF Output
4	V <sub>CC</sub>	Supply Voltage

Table I - Date Code, Beginning year 2021

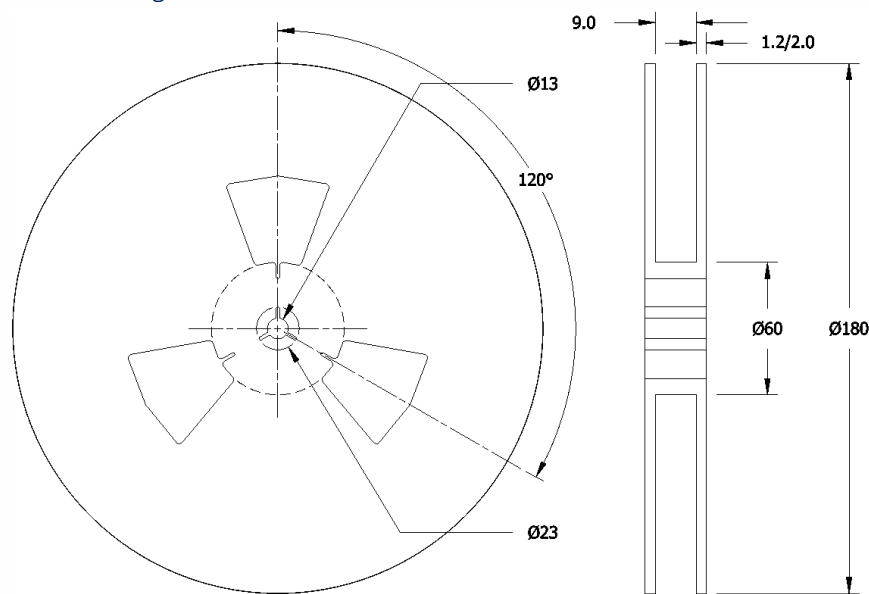
YEAR \ MONTH					JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
					2021	2025	2029	2033	2037	A	B	C	D	E	F	G
2022	2026	2030	2034	2038	N	P	Q	R	S	T	U	V	W	X	Y	Z
2023	2027	2031	2035	2039	a	b	c	d	e	f	g	h	j	k	l	m
2024	2028	2032	2036	2040	n	p	q	r	s	t	u	v	w	x	y	z

### Packaging - Tape and Reel

#### Tape Drawing



#### Reel Drawing



#### Notes

1. Device quantity is 1k pieces minimum to 3k pieces maximum per 180mm reel.
2. Complete CTS part number, frequency value and date code information must appear on reel and carton labels.