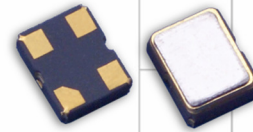




Model 521

HCMOS TCXO



Part Dimensions:
2.5 x 2.0 x 1.0mm • 14.25851mg

Features

- Ceramic Surface Mount Package
- Low Phase Jitter Performance
- Fundamental Crystal Design
- Frequency Range 9.5 – 60MHz *
- +1.8V, +2.5V, +2.8V, +3.0V and +3.3V Operation
- Output Enable Standard
- Tape and Reel Packaging, EIA-481

Standard Frequencies

* See Page 7 for common frequencies.
Check with factory for frequency availability.

Applications

- GPS
- IoT and IIoT
- Wireless Connectivity
- Synchronous Ethernet
- Base Stations/Femto Cells
- Mobile Communication
- WiMax/Wi-Fi/WLAN
- Phase Locked Loop
- Test Equipment

Description

CTS Model 521 is a low cost, small size, high performance Temperature Compensated Crystal Oscillator [TCXO]. Employing analog IC technology that provides a HCMOS output, high order temperature compensation engine; coupled with a fundamental quartz crystal M521 has excellent stability and low jitter/phase noise performance.

Ordering Information

Model	Supply Voltage	Frequency Code [MHz]	Frequency Stability ²	Temperature Range	Frequency Tuning	Packaging																						
521	L	XXX	25	D	T	R																						
	<table border="1"> <thead> <tr> <th>Code</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>M</td> <td>+1.8Vdc</td> </tr> <tr> <td>N</td> <td>+2.5Vdc</td> </tr> <tr> <td>T</td> <td>+2.8Vdc</td> </tr> <tr> <td>R</td> <td>+3.0Vdc</td> </tr> <tr> <td>L</td> <td>+3.3Vdc</td> </tr> </tbody> </table>	Code	Voltage	M	+1.8Vdc	N	+2.5Vdc	T	+2.8Vdc	R	+3.0Vdc	L	+3.3Vdc		<table border="1"> <thead> <tr> <th>Code</th> <th>Stability</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>±2.0ppm³</td> </tr> <tr> <td>25</td> <td>±2.5ppm</td> </tr> </tbody> </table>	Code	Stability	20	±2.0ppm ³	25	±2.5ppm		<table border="1"> <thead> <tr> <th>Code</th> <th>Frequency Deviation</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>TCXO [No Voltage Control]</td> </tr> </tbody> </table>	Code	Frequency Deviation	T	TCXO [No Voltage Control]	
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Notes:

- 1] Refer to document 016-1454-0, Frequency Code Tables. 3-digits for frequencies <100MHz, 4-digits for frequencies 100MHz or greater.
- 2] Frequency vs. Temperature only.
- 3] Contact factory for availability with Temperature Range codes "D" and "I".

**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	-	4.6	V
			1.71	1.8	1.89	
			2.38	2.5	2.63	
Supply Voltage	V _{CC}	±5%	2.66	2.8	2.94	V
			2.85	3.0	3.15	
			3.14	3.3	3.47	
Supply Current	I _{CC}	9.50MHz - 60.00MHz	-	-	10	mA
Output Load	C _L	-	-	-	15	pF
			-20		+70	
Operating Temperature	T _A	-	-30	+25	+85	°C
			-40		+85	
Storage Temperature	T _{STG}	-	-40	-	+85	°C

Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f ₀	-		9.5 - 60		MHz
Frequency Stability						
Initial Calibration	Δf/f ₀	Calibration @ +25°C, After 2 Reflows	-2.0	-	2.0	ppm
Temperature Only	Δf/f ₂₅	Referenced to +25°C Reading		2.0, 2.5		±ppm
Voltage Coefficient		Supply Voltage, ±5%	-0.2	-	0.2	ppm
Load Coefficient		Load, ±10%	-0.2	-	0.2	ppm
Aging	Δf/f ₂₅	First Year @ +25°C, nominal V _{CC} and V _C	-1.0	-	1.0	ppm
		10 Years @ +25°C, nominal V _{CC} and V _C	-10	-	10	

Output Parameters

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Type	-	-		HCMOS		-
Output Voltage Levels	V _{OH}	Logic '1' Level, CMOS Load	0.9V _{CC}	-	-	V
	V _{OL}	Logic '0' Level, CMOS Load	-	-	0.1V _{CC}	
Output Duty Cycle	SYM	@ 50% Level	45	-	55	%
Rise and Fall Time	T _R , T _F	@ 20%/80% Levels	-	-	5	ns
Start Up Time	T _S	Application of V _{CC}	-	-	5	ms
Phase Noise	-	See Typical Plots	-	-	-	-

Output Enable/Disable

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Enable Function		Standby				
Enable Input Voltage	V _{IH}	Pin 1 Logic '1', Output Enabled	0.7V _{CC}	-	-	V
Disable Input Voltage	V _{IL}	Pin 1 Logic '0', Output Standby	-	-	0.3V _{CC}	V
Standby Current	I _{STB}	Pin 1 Logic '0', Output Standby	-	-	10	μA
Enable Time	T _{PLZ}	Pin 1 Logic '1'	-	-	5	ms

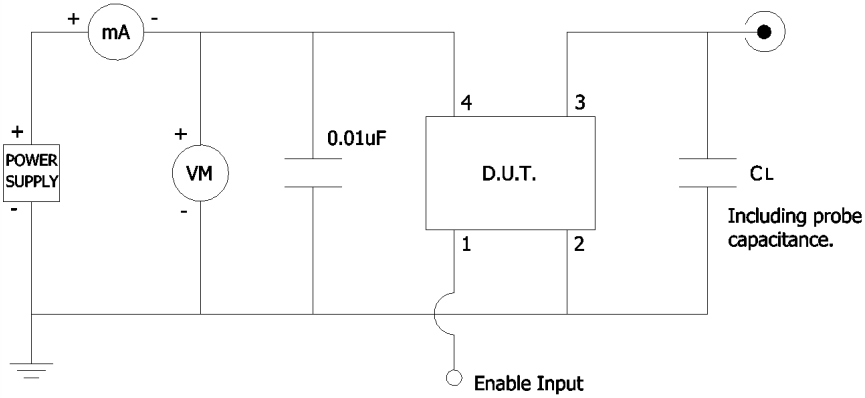
Electrical Specifications

Enable Truth Table

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

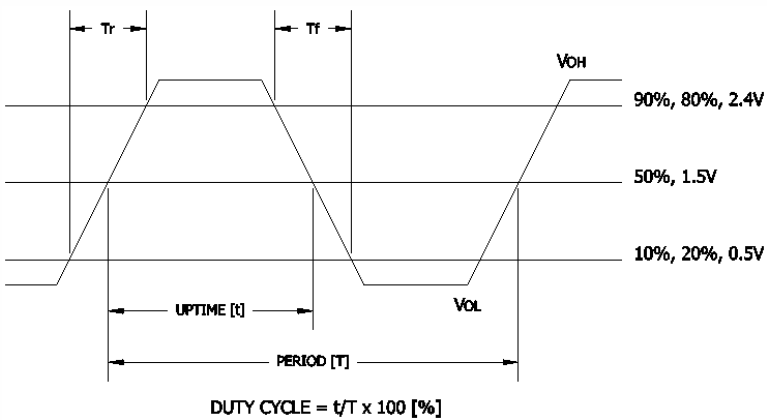
Test Circuit

HCMOS



Output Waveform

HCMOS

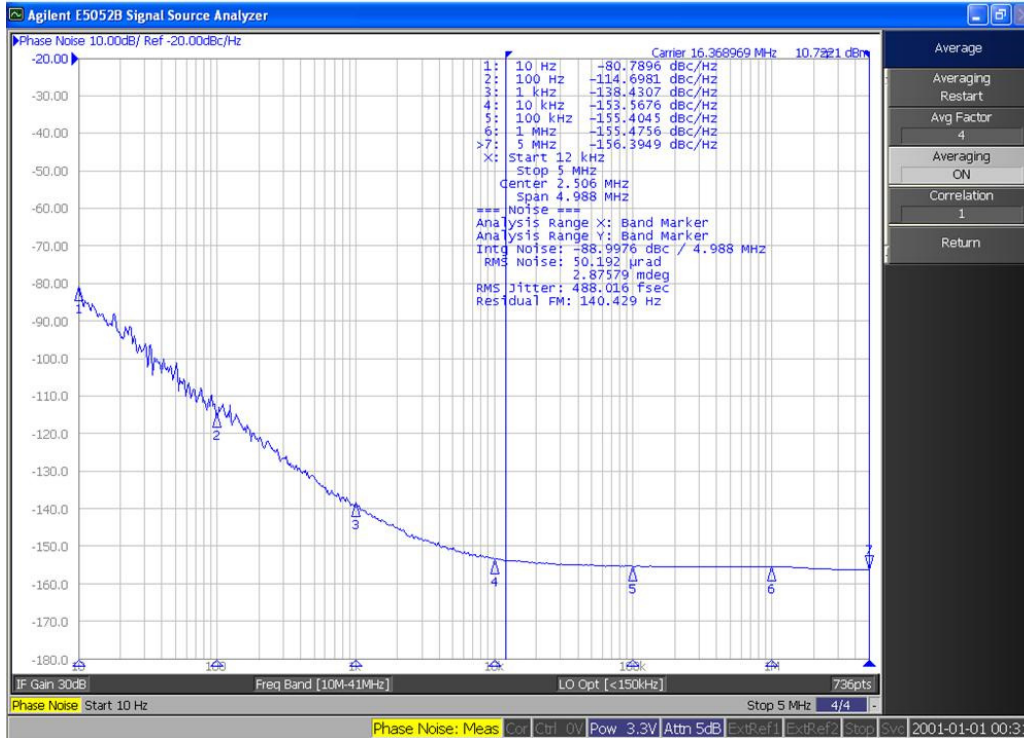


Electrical Specifications

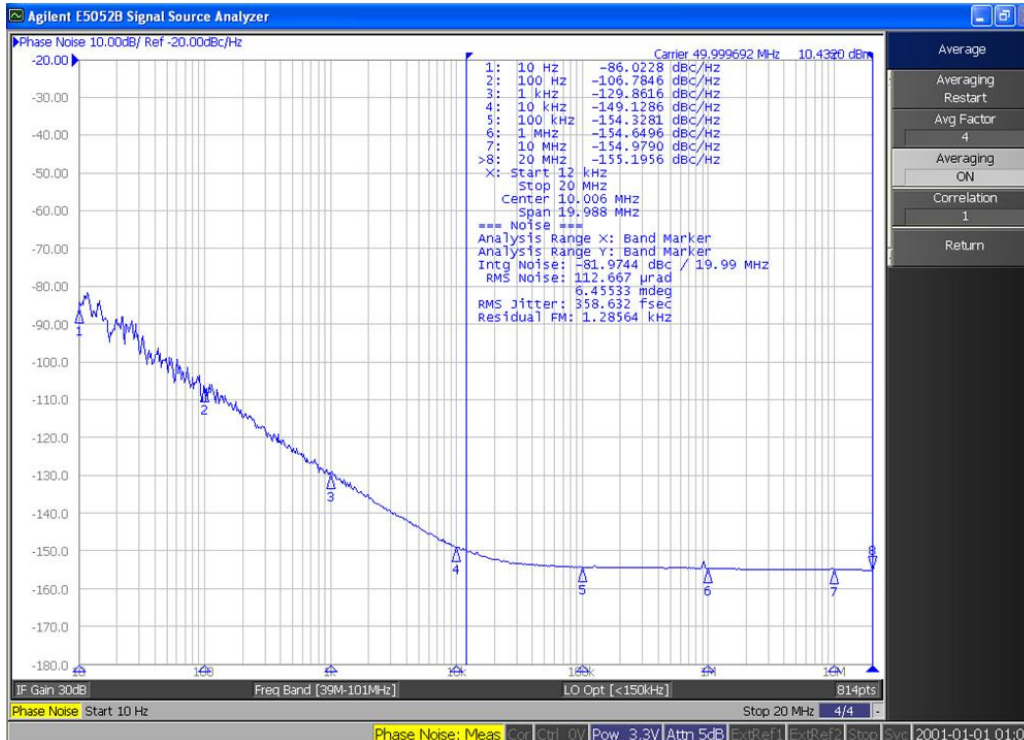
Performance Data

Phase Noise [typical]

16.368MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$

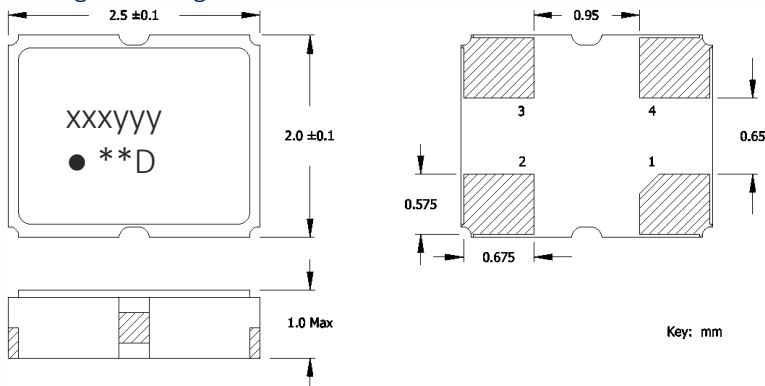


50MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



Mechanical Specifications

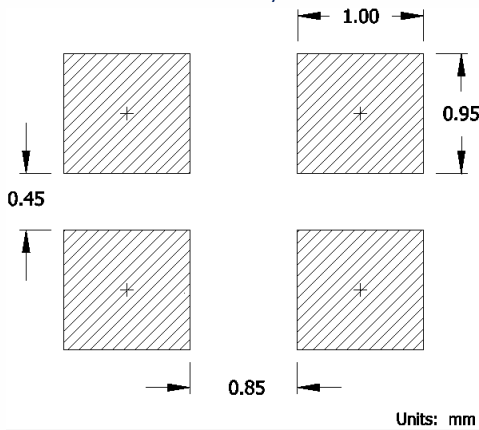
Package Drawing



Marking Information

- xxx – Frequency Code.
3-digits for frequencies <100MHz
[See document 016-1454-0, Frequency Code Tables.]
- yyy – Crystal Lot Code or Date Code [Optional].
- – Pin 1 identifier.
- ** – Manufacturing Site Code.
- D – Date Code. See Table I for codes.

Recommended Pad Layout



Notes

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

Pin Assignments

Pin	Symbol	Function
1	EOH	Output Enable/Disable [Note 1]
2	GND	Circuit & Package
3	Output	RF Output
4	V _{CC}	Supply Voltage

Notes

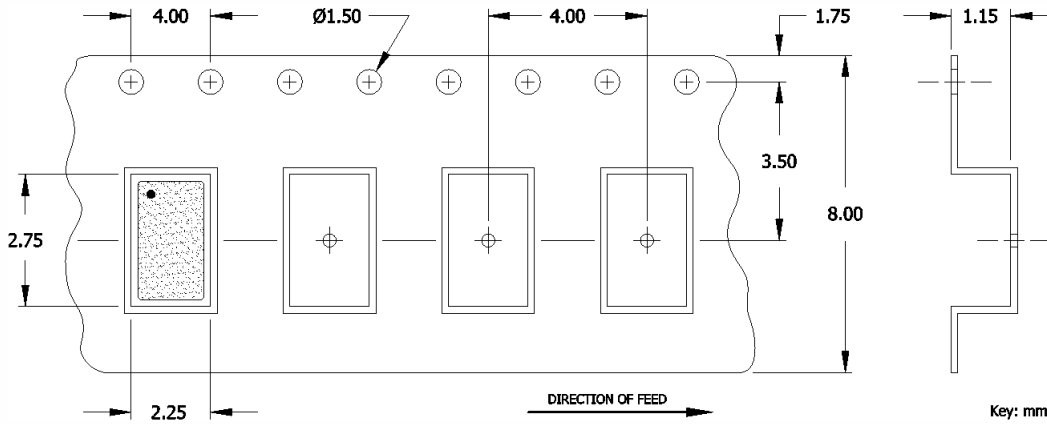
- Pin 1 can be left floating if enable function is not needed. Pin connected to V_{CC} through internal pull-up resistor. Do not connect to ground.

Table I - Date Code, Beginning year 2021

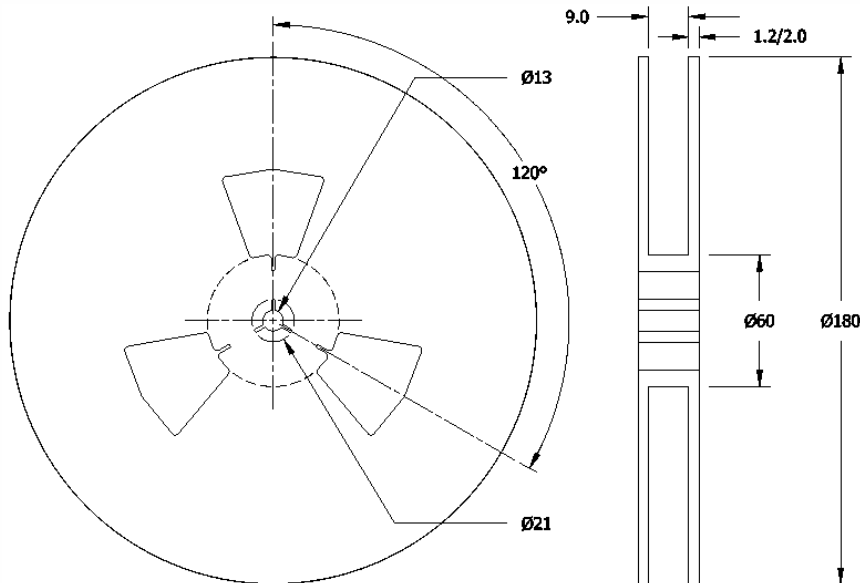
YEAR					MONTH											
					JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2021	2025	2029	2033	2037	A	B	C	D	E	F	G	H	J	K	L	M
2022	2026	2030	2034	2038	N	P	Q	R	S	T	U	V	W	X	Y	Z
2023	2027	2031	2035	2039	a	b	c	d	e	f	g	h	j	k	l	m
2024	2028	2032	2036	2040	n	p	q	r	s	t	u	v	w	x	y	z

Packaging - Tape and Reel

Tape Drawing



Reel Drawing



Notes

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



Addendum

Common Frequencies – MHz

FREQUENCY	ORDERING CODE	FREQUENCY	ORDERING CODE	FREQUENCY	ORDERING CODE	FREQUENCY	ORDERING CODE
10.000000	100	26.000000	260				
14.400000	144	27.000000	270				
14.745600	147	30.720000	307				
16.000000	160	32.000000	320				
16.384000	163	38.400000	384				
18.432000	184	40.000000	400				
19.200000	192	44.000000	440				
20.000000	200	48.000000	480				
24.000000	240	50.000000	500				
25.000000	250	52.000000	520				