

# Model 588

## Stratum 3 Clipped Sine Wave TCXO/VC-TCXO



Part Dimensions:  
7.0 × 5.0 × 2.1mm • 177mg

### Features

- Ceramic Surface Mount Package
- Fundamental Crystal Design
- Frequency Range 5 – 52MHz \*
- Operating Voltage +2.5V, +3.0V and +3.3V
- Frequency Stability, Overall ±4.6ppm
- Operating Temperature Range to -40°C to +85°C
- Voltage Control Option for Frequency Tuning [VCTCXO]
- Tape and Reel Packaging, EIA-481

### Standard Frequencies

\* See Page 8 for common frequencies.  
Check with factory for frequency availability.

### Applications

- IEEE 1588 Timing
- Synchronous Ethernet
- Base Stations
- Femtocells and Microcells
- Wireless Communication
- Test and Measurement

### Description

CTS Model 588 is a high performance Temperature Compensated Crystal Oscillator [TCXO] suitable for applications requiring Stratum 3 performance. Employing IC technology with clipped sine output and analog temperature compensation engine; coupled with a fundamental quartz crystal M588 has excellent stability and low jitter/phase noise performance.

### Ordering Information

Model	Supply Voltage	Frequency Code [MHz]	Frequency Stability <sup>2</sup>	Temperature Range	Frequency Tuning	Packaging																				
588	L	XXX	X2	C	T	T																				
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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] Only available with operating temperature range code "C".

**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 <sub>CC</sub>	-	-0.6	-	6.0	V
Maximum Control Voltage	V <sub>C</sub>	-	-0.5	-	V <sub>CC</sub>	V
Supply Voltage	V <sub>CC</sub>	±5%	2.36	2.5	2.63	V
			2.85	3.0	3.15	
			3.14	3.3	3.47	
Supply Current	I <sub>CC</sub>	-	-	-	3.5	mA
Output Load	R <sub>L</sub> //C <sub>L</sub>	-	10k Ohm//10pF		-	-
Operating Temperature	T <sub>A</sub>	-	-20	+25	+70	°C
			-40		+85	
Storage Temperature	T <sub>STG</sub>	-	-55	-	+125	°C

### Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f <sub>0</sub>	-		5 - 52		MHz
Frequency Stability						
Overall Frequency Stability	Δf/f <sub>0</sub>	Reference to f <sub>0</sub> , Including 20 Years Aging	-4.6	-	4.6	ppm
Initial Calibration		Calibration @ +25°C, At Time of Shipment	-1.0	-	1.0	ppm
Temperature Only	Δf/f <sub>25</sub>	[Fmax - Fmin]/2, Over -40°C to +85°C	-0.28	-	0.28	ppm
		[Fmax - Fmin]/2, Over -20°C to +70°C	-0.14	-	0.14	
Voltage Coefficient	Δf/f <sub>25</sub>	Supply Voltage, ±5%	-0.4	-	0.4	ppm
Load Coefficient		Load, ±10%	-0.1	-	0.1	ppm
Aging	Δf/f <sub>25</sub>	20 Years @ +40°C, Nominal V <sub>CC</sub> and V <sub>C</sub>	-2.8	-	2.8	ppm
Holdover	Δf/f <sub>0</sub>	[Fmax - Fmin]/2, Over 24 Hours	-0.37	-	0.37	ppm

### Output Parameters

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Type	-	DC Coupled		Clipped Sine		-
Output Voltage Levels	V <sub>O</sub>	-	0.8	-	-	V <sub>P-P</sub>
Output Duty Cycle	SYM	@ 50% Level	45	-	55	%
Start Up Time	T <sub>S</sub>	-	-	-	5	ms
Phase Noise	-	See Typical Plots	-	-	-	-

## Electrical Specifications

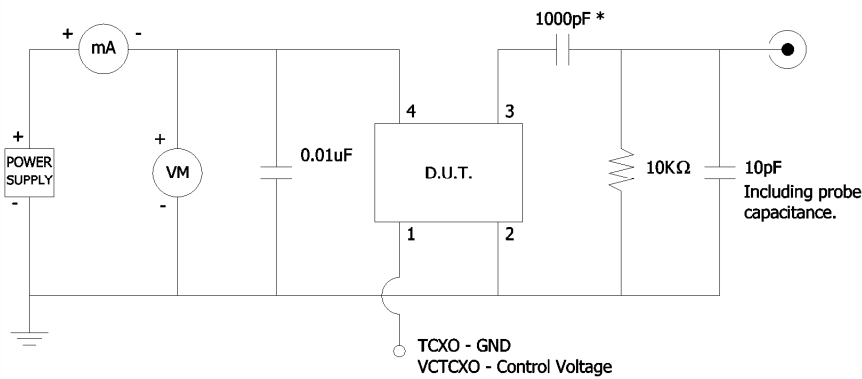
### Control Voltage

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Control Voltage	$V_c$	$V_{CC} = \text{Selected Value}$	0.5	1.5	2.5	V
Frequency Tuning [VCTCXO Only]	$\Delta f/f_0$	Specified $V_c$ Range	$\pm 5$	-	-	ppm
Linearity	L	Best Straight Line Fit	-	-	$\pm 10$	%
Input Impedance	$Z_{Vc}$	-	100	-	-	kOhms
Transfer Function	-	-		Positive		-

### Test Circuit

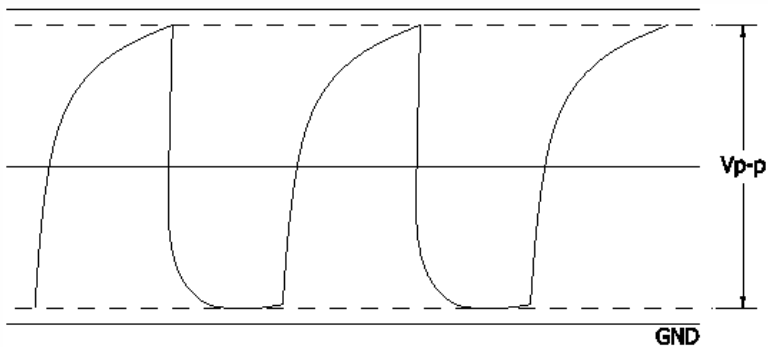
#### Clipped Sine

\* DC-Cut Capacitor: Add 1000pF capacitor between the TCXO output and input of load.



### Output Waveform

#### Clipped Sine

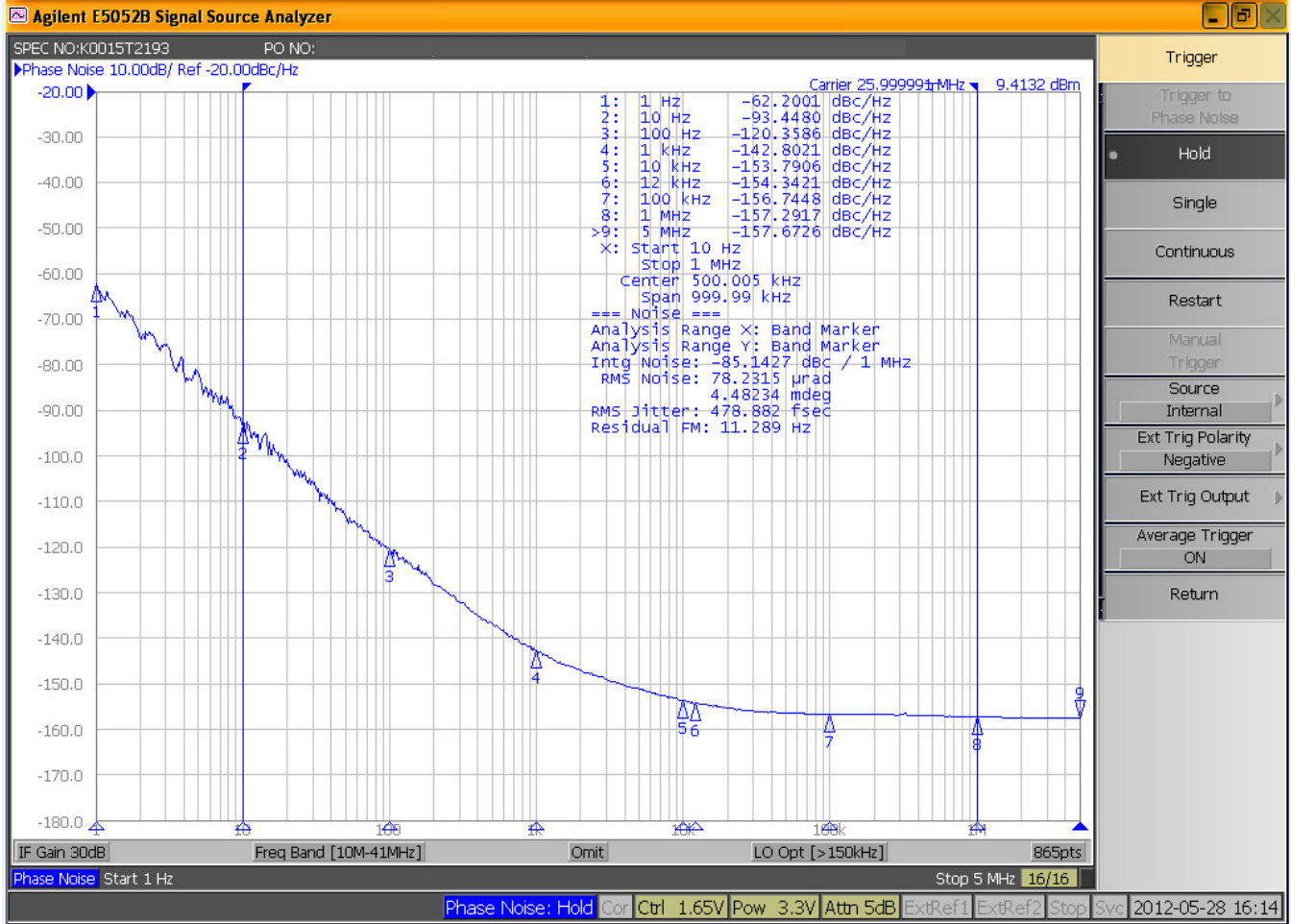


### Electrical Specifications

#### Performance Data

#### Phase Noise [typical]

26MHz,  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$

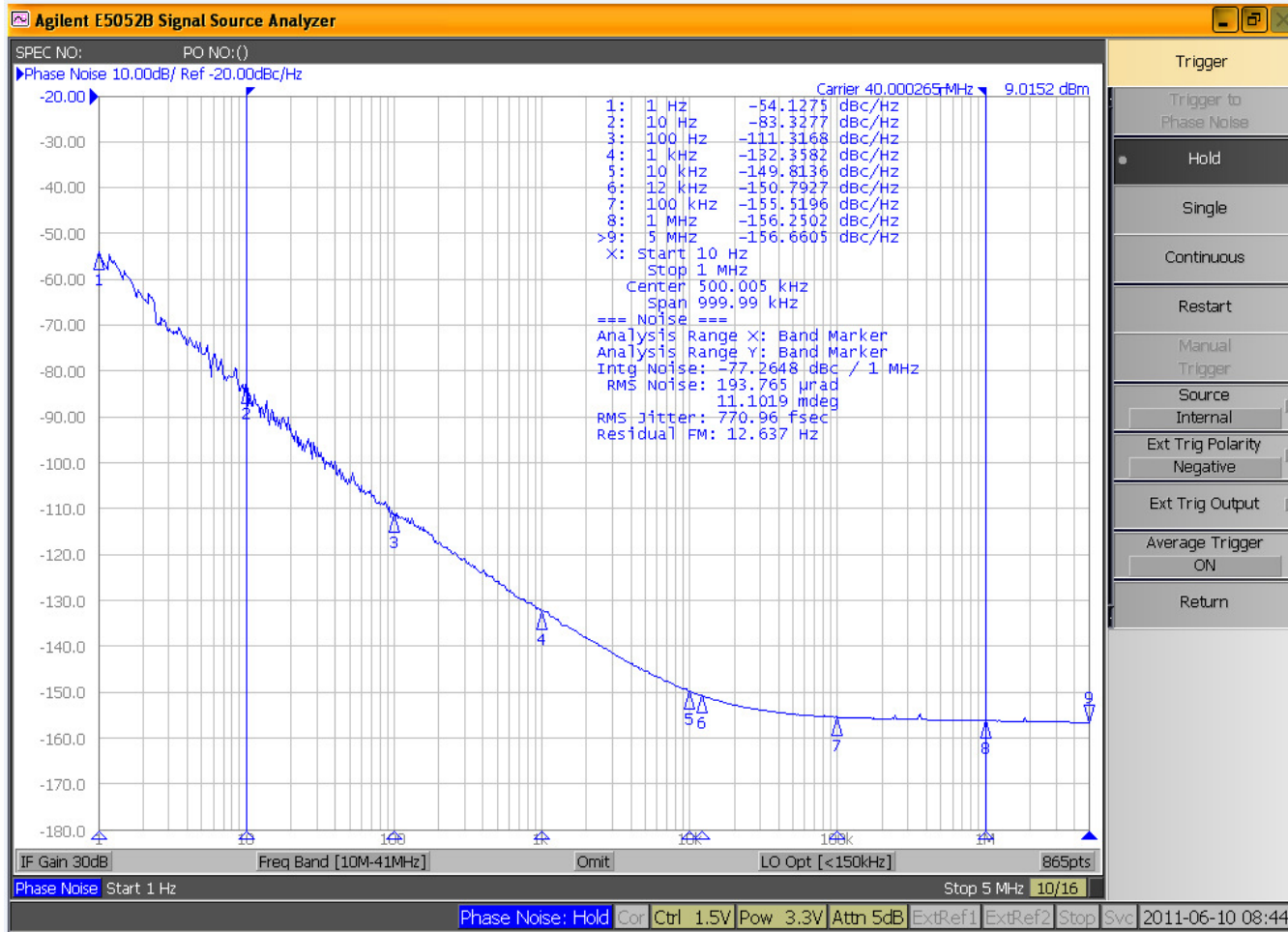


### Electrical Specifications

#### Performance Data

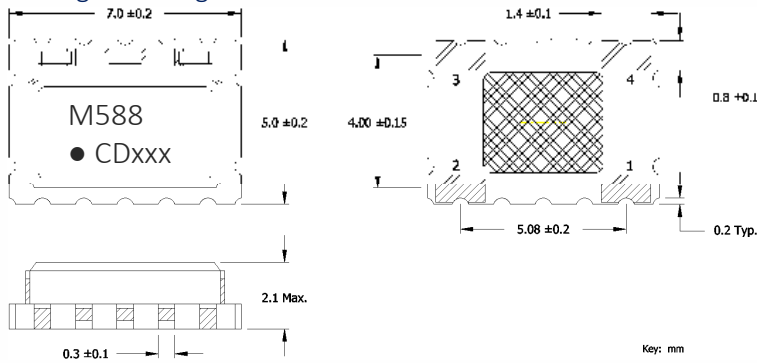
#### Phase Noise [typical]

40MHz,  $V_{CC} = +3.3V$ ,  $T_A = +25^{\circ}C$



### Mechanical Specifications

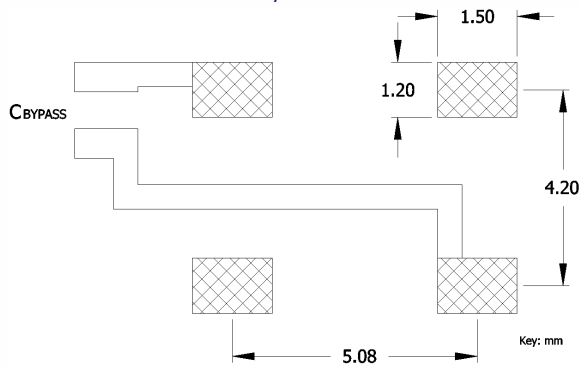
#### Package Drawing



#### Marking Information

1. M588 – CTS Model Series.
  2. ● – Pin 1 Identifier.
  3. C – CTS
  4. D – Date Code. See Table I for codes.
  5. xxx – Frequency Code, 3-digits.
- [See document 016-1454-0, Frequency Code Tables.]

#### Recommended Pad Layout



#### Notes

1. DO NOT make connections to non-labeled pins or castellations as they may have internal connections used in the manufacturing process.
2. JEDEC termination code (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.

#### Pin Assignments

Pin	Symbol	Function
1	GND	Ground [Note 1]
	V <sub>C</sub>	Voltage Control [VC-TCXO]
2	GND	Circuit & Package
3	Output	RF Output [Note 2]
4	V <sub>CC</sub>	Supply Voltage

#### Notes

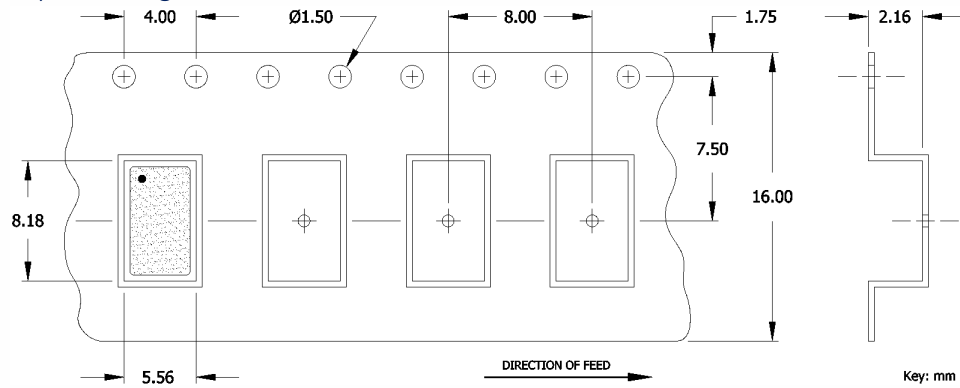
1. Connect to ground for TCXO, no frequency tuning.
2. DC-Cut capacitor required. Add 1000pF capacitor between TCXO output and input of load.

Table I - Date Code, Beginning year 2021

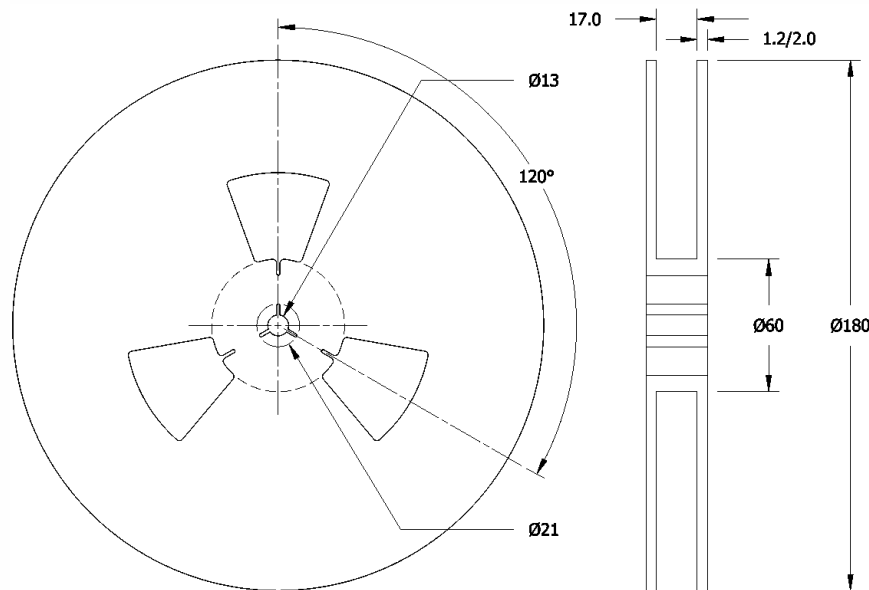
YEAR					MONTH											
					JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2021	2025	2029	2033	2037	A	B	C	D	E	F	G	H	J	K	L	M
2022	2026	2030	2034	2038	N	P	Q	R	S	T	U	V	W	X	Y	Z
2023	2027	2031	2035	2039	a	b	c	d	e	f	g	h	j	k	l	m
2024	2028	2032	2036	2040	n	p	q	r	s	t	u	v	w	x	y	z

### Packaging - Tape and Reel

#### Tape Drawing



#### Reel Drawing



#### Notes

1. Device quantity is 1k pieces 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	40.000000	400				
12.288000	122	50.000000	500				
12.800000	128						
16.000000	160						
16.384000	163						
19.200000	192						
19.440000	194						
20.000000	200						
25.000000	250						
26.000000	260						
27.000000	270						
30.720000	307						