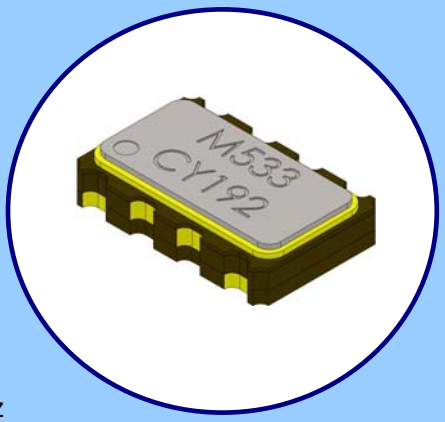
MODEL 533

TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR

FEATURES

- **HCMOS Output**
- **Optional Voltage Control for Frequency Tuning [VCTCXO]**
- 5.0mmx3.2mm Surface Mount Package
- Frequency Range 10 – 40 and 50 MHz [Standard Frequencies List Shown Below]
- Fundamental Crystal Design
- Frequency Stability, Standard Values from ±2.0ppm to ±5.0ppm
- Operating Voltage, +2.8Vdc, 3.0V and +3.3Vdc
- Operating Temperature to -40°C to +85°C
- Tape & Reel Packaging, EIA-418
- **RoHS/Green Compliant (6/6)**



APPLICATIONS

The Model 533 Temperature Compensated Crystal Oscillator (TCXO) is a quartz based, HCMOS output, digital temperature compensated oscillator with optional frequency tuning, in a hermetically sealed ceramic package. M533 is suitable for wireless communications, broadband access, WLAN/WiMax/WIFI, portable equipment, test and measurement and mobile phone applications.

ORDERING INFORMATION

533 □ □ □ □ □ □ □ M □ □ □ □

SUPPLY VOLTAGE
- T = +2.8Vdc
- R = +3.0Vdc
- L = +3.3Vdc

FREQUENCY STABILITY *
- 05 = ± 0.5 ppm [1]
- 10 = ± 1.0 ppm [1]
- 15 = ± 1.5 ppm [1]
- 20 = ± 2.0 ppm [2]
- 25 = ± 2.5 ppm
- 40 = ± 4.0 ppm
- 50 = ± 5.0 ppm

* Frequency vs. Temperature Only

FREQUENCY IN MHz
- M - indicates MHz and decimal point. [3]
- [See table below for standard frequencies available.]

FREQUENCY TUNING (AFC)
- A = ± 5 ppm
- T = TCXO (no AFC)
- {V_{CON}: 1.5Vdc ± 1.0Vdc}

OPERATING TEMPERATURE RANGE
- H = -10°C to +60°C
- C = -20°C to +70°C
- D = -30°C to +85°C
- I = -40°C to +85°C

1] Limited availability. Please consult factory.

2] Only available with temperature range codes "H" and "C".

3] Frequency is recorded with two leading digits before the 'M' and 4 significant digits after the 'M' (including zeros).
[Ex. XXMXXXX (10M0000), XXMXXXX (16M3840)]

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

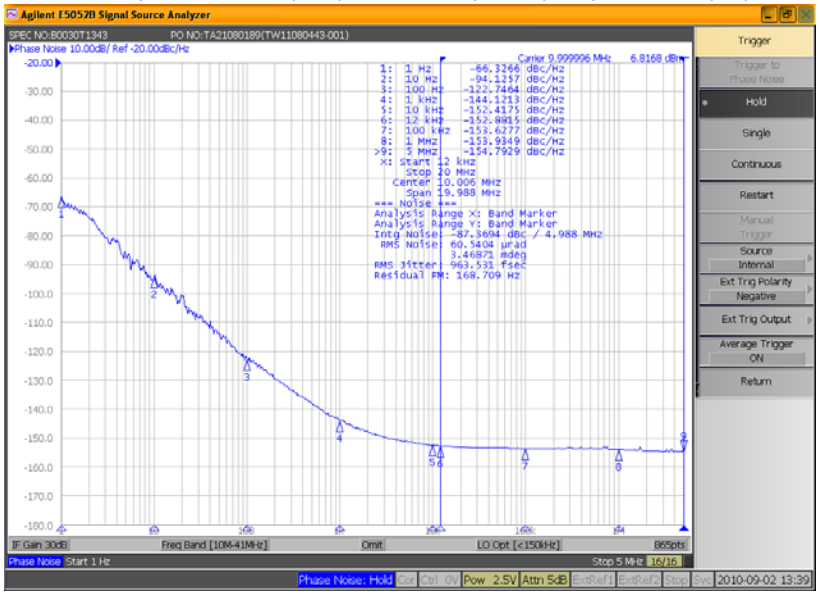
M533 Standard Frequencies					
10.000 MHz	14.7456 MHz	19.440 MHz	25.000 MHz	40.000 MHz	
12.288 MHz	16.000 MHz	19.680 MHz	26.000 MHz	50.000 MHz	
12.800 MHz	16.384 MHz	20.000 MHz	27.000 MHz		
13.000 MHz	19.200 MHz	24.576 MHz	32.000 MHz		

ELECTRICAL CHARACTERISTICS

	PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
ELECTRICAL PARAMETERS	Maximum Supply Voltage	V_{CC}	-	-0.5	-	6.0	V
	Maximum Control Voltage	V_C	-	-0.5	-	V_{CC}	V
	Storage Temperature	T_{STG}	-	-40	-	85	°C
	Frequency Range	f_O	Std frequencies listed in Ordering Information	10	-	50	MHz
	Frequency Stability	$\Delta f/f_O$	Frequency vs. Temperature Only	Reference Ordering Information			± ppm
	Frequency Stability vs. Initial Calibration vs. Supply Voltage vs. Load vs. Reflow Shift vs. Aging	-	 @25°C ±5% change ±10% change After 2 reflows 1st year 10 year	 - - - - - -	 - 0.3 - - - -	 3.0 0.5 0.2 2.0 1.0 10.0	± ppm
	Operating Temperature Order Code 'H' Order Code 'C' Order Code 'D' Order Code 'I'	T_A	-	 -10 -20 -30 -40	 25 	 60 70 85 85	°C
	Supply Voltage Order Code 'T' Order Code 'R' Order Code 'L'	V_{CC}	±5%	 2.66 2.85 3.14	 2.8 3.0 3.3	 2.94 3.15 3.47	V
	Supply Current	I_{CC}	10 - 40 MHz 50 MHz	- -	- -	5.0 8.0	mA
	Control Voltage	V_C	-	0.5	1.5	2.5	V
	Frequency Tuning [VCTCXO Only]	-	V_C = 1.5V ±1.0V	5.0	-	-	± ppm
	V_C Input Impedance	ZV_C	-	500	-	-	kOhm
	Output Waveform		DC coupled CMOS				
	Output Voltage Levels Logic '1' Level Logic '0' Level	 V_{OH} V_{OL}	 CMOS Load CMOS Load	 0.9*V_{CC} -	 - -	 - 0.1*V_{CC}	V
	Output Load	C_L	-	-	-	15	pF
	Rise and Fall Time	T_R, T_F	@ 20% - 80% Levels	-	3.0	6.0	ns
	Output Duty Cycle	SYM	@ 50% Level	45	-	55	%
	Start Up Time	T_S	-	-	-	2	ms
	Phase Noise [1]	-	-				dBc/Hz

Notes:

1. Phase Noise performance may vary based on output frequency. See example plot at 10 MHz below.

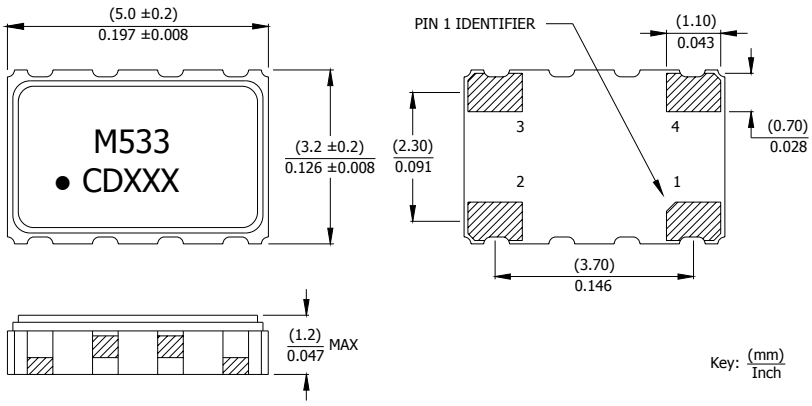


SINGLE SIDE BAND PHASE NOISE
(typical maximums @ 10 MHz)

Frequency Offset	Phase Noise (dBc/Hz)
10 Hz	-90
100 Hz	-115
1k Hz	-135
10k Hz	-148

MECHANICAL SPECIFICATIONS

PACKAGE DRAWING



MARKING INFORMATION

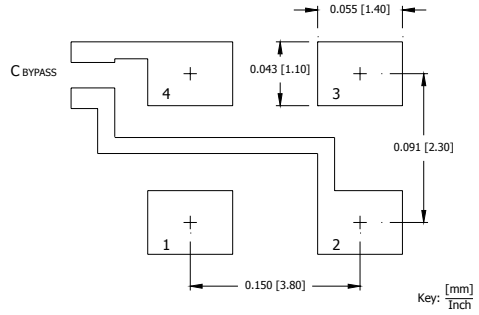
1. M533 - CTS Model Series.
2. ● – Pin 1 identifier.
3. C – CTS identifier.
4. D – Date code. See Table II for codes.
5. XXX – Frequency code. See Table I for codes.

Complete CTS part number, frequency value and date code information must appear on reel and carton labels.

NOTES

1. DO NOT make connections to non-labeled pins. Castellation pins may have internal connections used in the manufacturing process.
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.

SUGGESTED SOLDER PAD GEOMETRY



C_{BYPASS} should be ≥ 0.01 uF.

TABLE I – FREQUENCY CODING

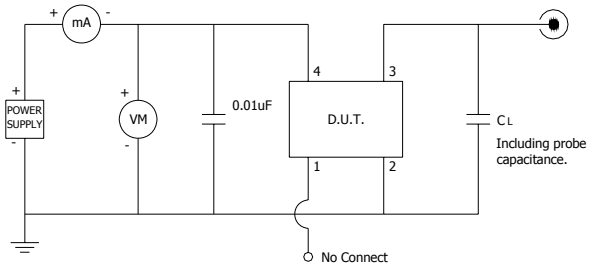
FREQUENCY	MARKING CODE	FREQUENCY	MARKING CODE	FREQUENCY	MARKING CODE	FREQUENCY	MARKING CODE
10.000 MHz	100	16.367 MHz	16A	19.800 MHz	198	30.720 MHz	307
10.240 MHz	102	16.3676 MHz	16E	19.998 MHz	199	32.000 MHz	320
12.000 MHz	120	16.367667 MHz	16B	20.000 MHz	200	32.512 MHz	325
12.288 MHz	122	16.368 MHz	16C	20.480 MHz	204	32.768 MHz	327
12.800 MHz	128	16.369 MHZ	16D	21.000 MHz	210	33.600 MHz	336
13.000 MHz	130	16.384 MHz	163	24.000 MHz	240	36.000 MHz	360
13.500 MHz	135	16.800 MHz	168	24.5535 MHz	24B	38.400 MHz	384
14.000 MHz	140	18.000 MHz	180	24.576 MHz	24C	38.880 MHz	388
14.400 MHz	144	18.432 MHz	184	25.000 MHz	250	40.000 MHz	400
14.7456 MHz	147	19.200 MHz	192	26.000 MHz	260	50.000 MHz	500
15.360 MHz	153	19.440 MHz	194	27.000 MHz	270		
16.000 MHz	160	19.680 MHz	196	30.000 MHz	300		

Not all frequencies listed may be available for this design.

TABLE II – 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

TEST CIRCUIT – RL//CL LOAD



D.U.T. PIN ASSIGNMENTS

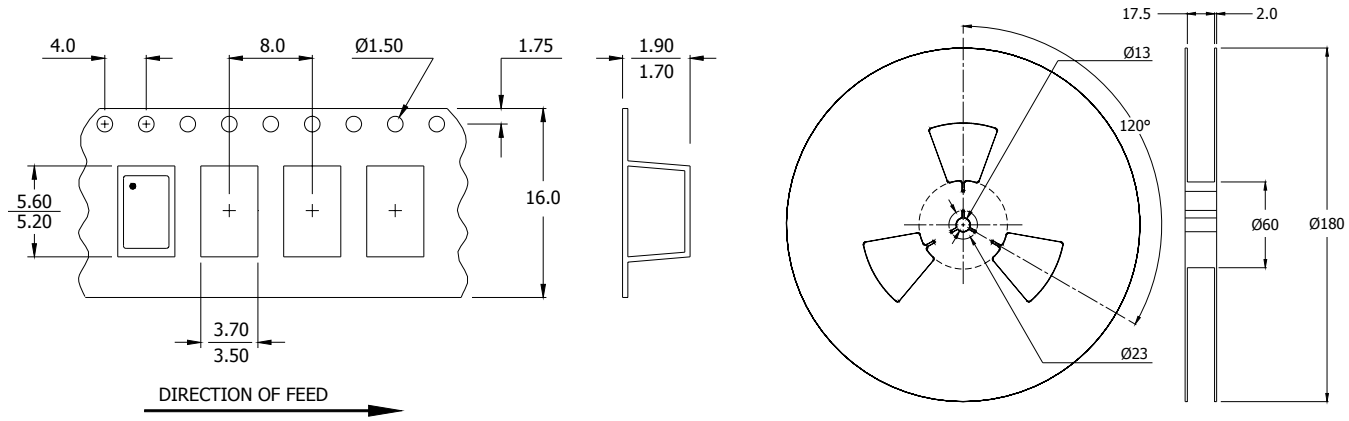
PIN	SYMBOL	DESCRIPTION
1	V_C	Control Voltage – VCTCXO (Note 1)
		GND - TCXO
2	GND	Circuit & Package Ground
3	Output	CMOS Output
4	V_{CC}	Supply Voltage

NOTES

1. Connect to ground for TCXO (no AFC) option.

PACKAGING INFORMATION

Device quantity is 1,000 pieces per 180mm reel.



Dimensions in Millimeters

ENVIRONMENTAL SPECIFICATIONS

Temperature Cycle:	400 cycles from –55°C to +125°C, 10 minute dwell at each temperature, 1 minute transfer time between temperatures.
Mechanical Shock:	1,500g's, 0.5mS duration, ½ sinewave, 3 shocks each direction along 3 mutually perpendicular planes (18 total shocks).
Sinusoidal Vibration:	0.06 inches double amplitude, 10 to 55 Hz and 20g's, 55 to 2,000 Hz, 3 cycles each in 3 mutually perpendicular planes (9 times total).
Gross Leak:	No leak shall appear while immersed in an FC40 or equivalent liquid at +125°C for 20 seconds.
Fine Leak:	Mass spectrometer leak rates less than $2x10^{-8}$ ATM cc/sec air equivalent.
Resistance to Solder Heat:	Product must survive 3 reflows of +250°C maximum, 10 seconds maximum.
High Temperature Operating Bias:	2,000 hours at +125°C, disregarding frequency shift.
Frequency Aging:	1,000 hours at +85°C.
Insulation Resistance:	500M Ohms @ $100V_{DC}$ $\pm15V_{DC}$.
Moisture Sensitivity Level:	Level 1 per JEDEC J-STD-020.