Connect

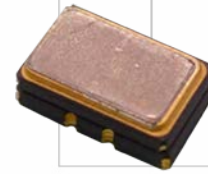# Model 535
High Stability Clipped Sine TCXO

Features

- Fundamental Crystal Design
- Frequency Range 10 – 54MHz *
- Operating Voltage +3.3V
- Frequency Stability, Overall ±4.6ppm [-40°C to +85°C]
- Operating Temperature Range to -40°C to +105°C
- Voltage Control Option for Frequency Tuning [VCTCXO]
- Enable Function Option Available
- Tape and Reel Packaging, EIA-418

Part Dimensions:
5.0 × 3.2 × 2.0mm

Standard Frequencies – see Page 7 for common frequencies.
* Check with factory for availability of frequencies not listed.

Applications

- 5G, 4G, LTE
- Femtocells, RRU, BBU
- Military Radio [Manpack]
- Inflight Entertainment

- Autonomous Technologies
- Synchronous Ethernet
- IP Networking
- Medical Imaging

- Stratum 3
- IEEE 1588 Timing
- Wireless Communication
- Test and Measurement

Description

CTS Model 535 is a high performance Temperature Compensated Crystal Oscillator [TCXO] suitable for applications requiring tight stability, Stratum 3 performance and more. Employing IC technology with Clipped Sine output and analog temperature compensation engine; coupled with a fundamental quartz crystal M535 has excellent stability and low jitter/phase noise performance.

Ordering Information

Model	Output Enable	Supply Voltage	Frequency Code [MHz]	Frequency Stability [2]	Temperature Range	Frequency Tuning	Packaging
535		L	XXX	X2	I	T	5

Code	Function
Blank	No Enable
E	Enable, Pin 3

Product Frequency Code [1]

Code	Temp. Range
C	-10°C to +70°C
I	-40°C to +85°C
G	-40°C to +105°C [3]

Code	Packing
5	500 pcs./reel

Code	Voltage
L	+3.3Vdc

Code	Stability
01	±0.10ppm
X2	±0.28ppm
05	±0.50ppm

Code	Frequency Deviation
T	TCXO [No Voltage Control]
A	±5ppm - ±10ppm [VCTCXO]

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] Available with stability code X2 and 05 only.

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

Electrical Specifications

Operating Conditions

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Maximum Supply Voltage	V_{CC}	-	-0.5	-	4.6	V
Maximum Control Voltage	V_C	-	-0.3	-	V_{CC}	V
Supply Voltage	V_{CC}	±5%	3.14	3.3	3.47	V
Supply Current	I_{CC}	-	-	-	10	mA
Output Load	$R_L//C_L$	-	10k Ohm//10pF			-
Operating Temperature	T_A	-	-10		+70	°C
			-40	+25	+85	
			-40		+105	
Storage Temperature	T_{STG}	-	-55	-	+125	°C

Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f_O	Frequency stability ±0.10ppm		10 - 40		MHz
		Frequency stability ±0.28ppm or ±0.50ppm		10 - 54		
Frequency Stability		**-10°C to +70°C & -40°C to +85°C**				
Overall Frequency Stability		Ref. f_O, 20 Years Aging, ±0.28ppm over -40 to +85°C	-4.6	-	4.6	ppm
Initial Calibration	$\Delta f/f_O$	Initial Calibration @ +25°C, At Time of Shipment	-0.9	-	0.9	ppm
Temperature Only		[fmax - fmin]/2, Over Temperature Range		0.10, 0.28, 0.50		±ppm
Voltage Coefficient	$\Delta f/f_{25}$	Supply Voltage, ±5%	-0.2	-	0.2	ppm
Load Coefficient		Load, ±10%	-0.2	-	0.2	
Aging	$\Delta f/f_{25}$	First Year @ +25°C, nominal V_{CC} and V_C	-1.0	-	1.0	ppm
		20 Years @ +25°C, nominal V_{CC} and V_C	-3.0	-	3.0	
Frequency Stability		**-40°C to +105°C**				
Overall Frequency Stability		Ref. f_O, 20 Years Aging, ±0.28ppm over -40°C to +105°C	-4.7	-	4.7	ppm
Initial Calibration	$\Delta f/f_O$	Initial Calibration @ +25°C, At Time of Shipment	-0.9	-	0.9	ppm
Temperature Only		[fmax - fmin]/2, Over Temperature Range		0.28, 0.5		±ppm
Voltage Coefficient	$\Delta f/f_{25}$	Supply Voltage, ±5%	-0.2	-	0.2	ppm
Load Coefficient		Load, ±10%	-0.2	-	0.2	
Aging	$\Delta f/f_{25}$	First Year @ +25°C, nominal V_{CC} and V_C	-1.0	-	1.0	ppm
		20 Years @ +25°C, nominal V_{CC} and V_C	-3.0	-	3.0	

Electrical Specifications

Output Parameters

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Type	-	DC Coupled		Clipped Sine		-
Output Voltage Levels	V_O	-	0.8	-	-	$V_{p\text{-}p}$
Start Up Time	T_S	Application of V_{CC}	-	2	5	ms
Enable Function						
Enable Input Voltage	V_{IH}	Pin 3 Logic '1', Output Enabled	$0.8V_{CC}$	-	-	V
Disable Input Voltage	V_{IL}	Pin 3 Logic '0', Output Disabled	-	-	$0.2V_{CC}$	V
Disabled Current	I_{STB}	Pin 3 Logic '0', Output Disabled	-	-	3.5	mA
Enable Time	T_{PLZ}	Pin 3 Logic '1'	-	-	5	ms
Phase Noise	-	See Typical Plots	-	-	-	-

Control Voltage

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Control Voltage	V_C	V_{CC} = +3.3V	0.0	1.65	3.3	V
Frequency Tuning [VCTCXO Only]	$\Delta f/f_O$	Specified V_C Range		±5 to ±10		ppm
Input Impedance	Z_{Vc}	-	100	-	-	kOhms
Linearity	L	Best Straight Line Fit	-	±5	±10	%
Transfer Function	-	-		Positive		-

Test Circuit

Clipped Sine

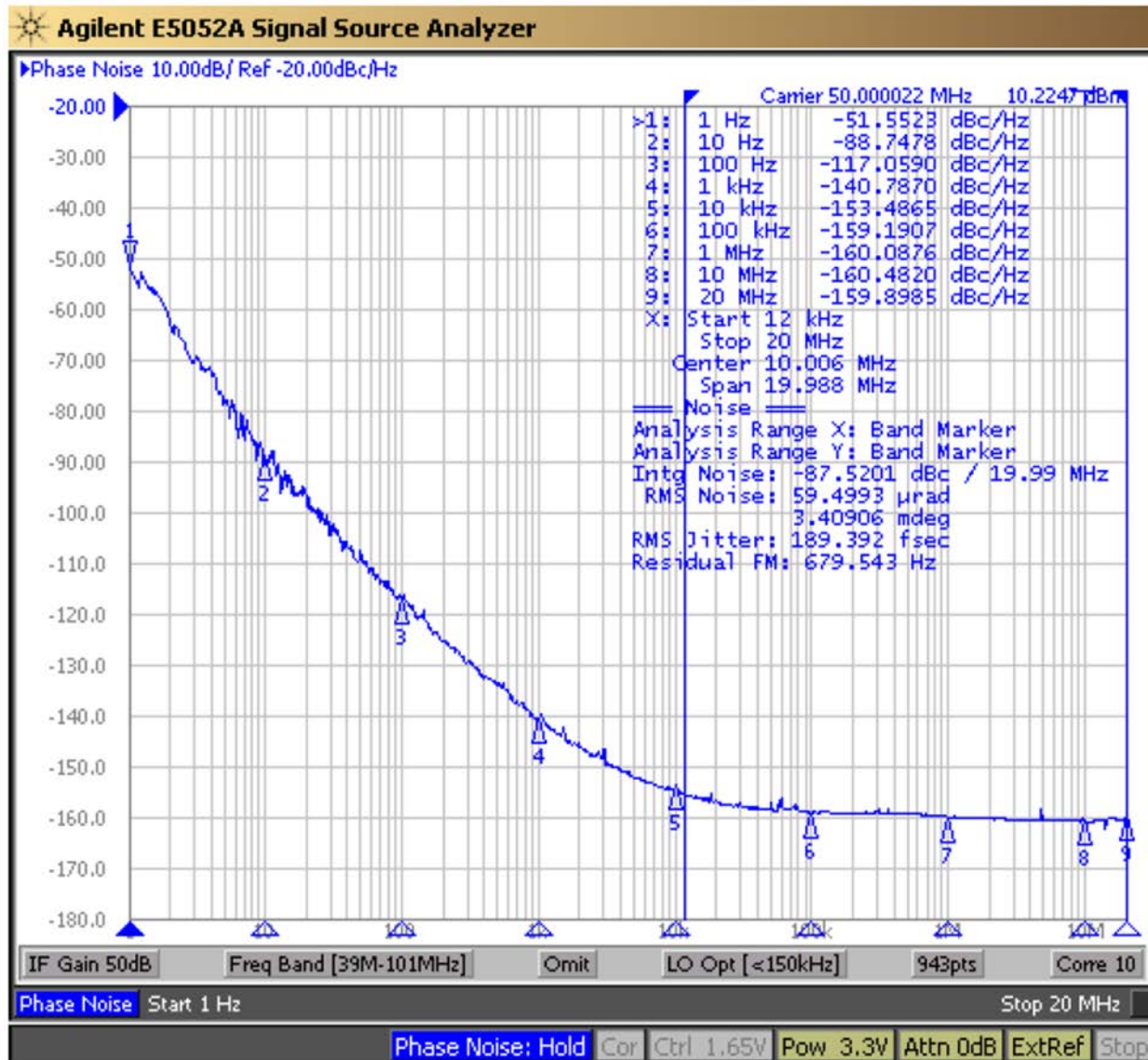* DC-Cut Capacitor: Add 1000pF capacitor between the TCXO output and input of load.
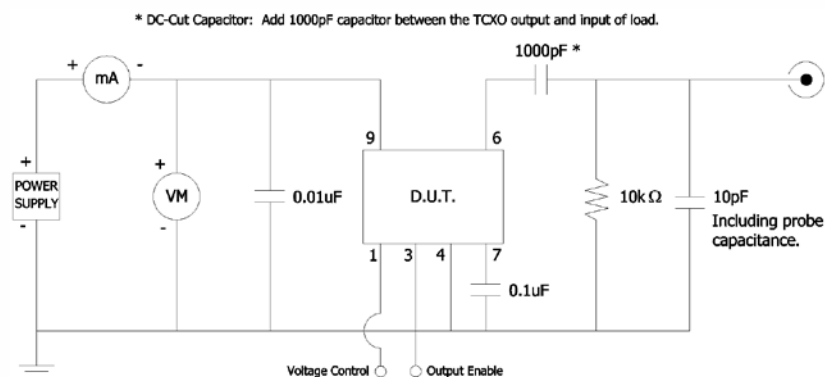
Electrical Specifications
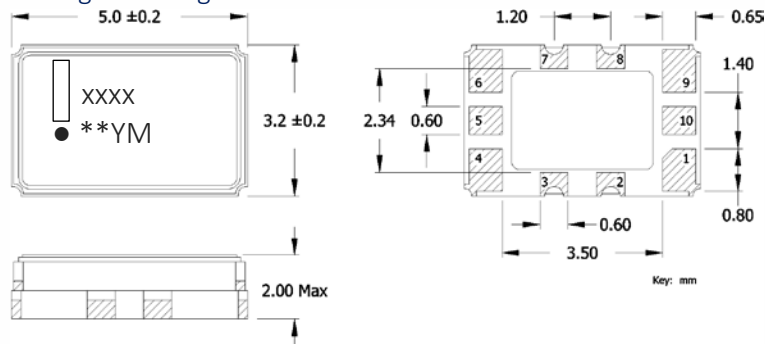
Performance Data

Phase Noise [typical]

50MHz, V_{CC} = +3.3V, T_A = +25°C
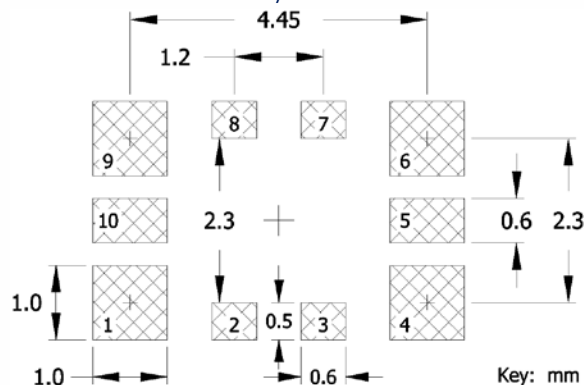
Mechanical Specifications

Package Drawing

Marking Information

1. xxxx – Frequency Code, 4-digits. See Page 7.
2. ● – Pin 1 Identifier.
3. ** – Manufacturing Site Code.
4. YM – Date Code; Y – year [last digit], M – month. [See Table I for month codes.]
5. ▯ – Area for Crystal Lot Code or Date Code.

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, 10 seconds.
4. MSL = 1.

Pin Assignments

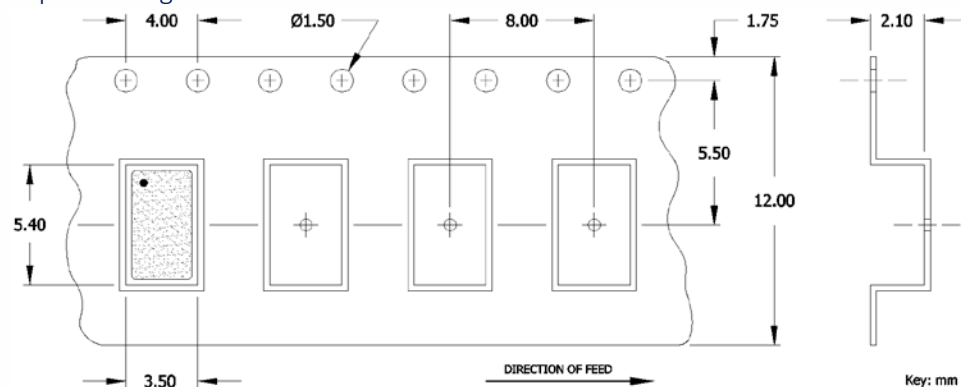| Pin	Symbol	Function
1	Vc	Voltage Control Note 1
2	-	Do Not Connect
3	EOH	Enable, Pin 3 [Optional] Note 2
4	GND	Circuit & Package
5	-	Do Not Connect
6	Output	Clipped Sine
7	-	Vcfilter
8	-	Do Not Connect
9	V$_{CC}$	Supply Voltage
10	-	Do Not Connect

Notes

1. Do not connect to Pin 1, if Voltage Control function is not used [TCXO].
2. Do not connect to Pin 3, if Output Enable function is not used.
3. Add 0.1µF capacitor between Pin 7 and ground.
4. DC-Cut Capacitor Required. Add 1000pF capacitor between TCXO output and input of load.

Table I - Month Code

MONTH	1 JAN	2 FEB	3 MAR	4 APR	5 MAY	6 JUN	7 JUL	8 AUG	9 SEP	10 OCT	11 NOV	12 DEC
MONTH CODE	1	2	3	4	5	6	7	8	9	X	Y	Z

Packaging - Tape and Reel

Tape Drawing

4.00   Ø1.50   8.00   1.75   2.10

5.50   12.00

5.40

3.50

DIRECTION OF FEED

Key: mm

Reel Drawing

13.0   1.2/2.0

Ø13

120°

Ø80   Ø180

Ø21
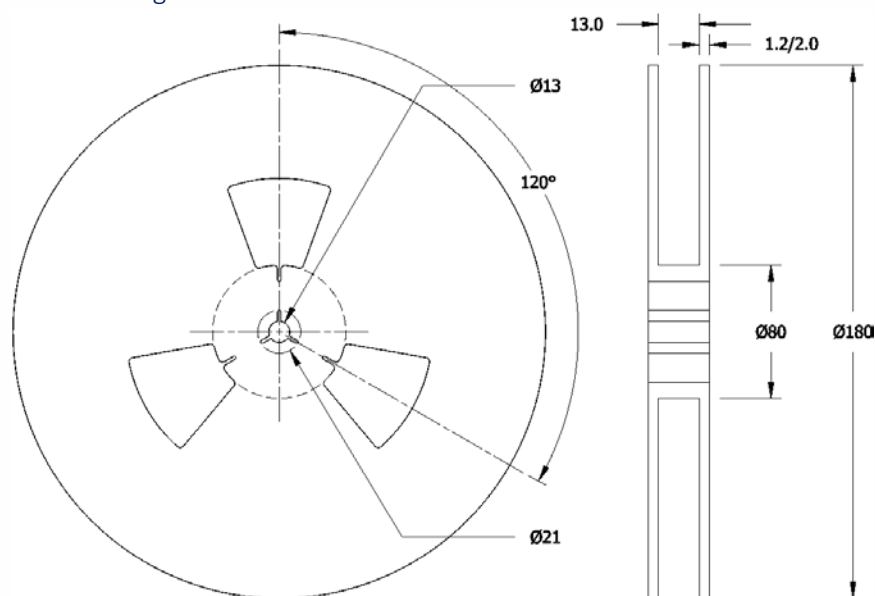
Notes

1. Device quantity is 500 pieces maximum per 180mm reel.
2. Complete CTS part number, frequency value and date code information must appear on reel and carton labels.

Addendum

Available Frequencies for Stability ±0.50ppm − MHz

FREQUENCY	ORDERING CODE	MARKING CODE	FREQUENCY	ORDERING CODE	MARKING CODE	FREQUENCY	ORDERING CODE	MARKING CODE
10.000000	100	1000	38.880000	388	3888			
19.200000	192	1920	40.000000	400	4000			
20.000000	200	2000						
25.000000	250	2500						
38.400000	384	3840						

Available Frequencies for Stability ±0.28ppm − MHz

FREQUENCY	ORDERING CODE	MARKING CODE	FREQUENCY	ORDERING CODE	MARKING CODE	FREQUENCY	ORDERING CODE	MARKING CODE
10.000000	100	1000	38.880000	388	3888			
19.200000	192	1920	40.000000	400	4000			
20.000000	200	2000						
25.000000	250	2500						
38.400000	384	3840						

Available Frequencies for Stability ±0.10ppm − MHz

FREQUENCY	ORDERING CODE	MARKING CODE	FREQUENCY	ORDERING CODE	MARKING CODE	FREQUENCY	ORDERING CODE	MARKING CODE
10.000000	100	1000						
20.000000	200	2000						
25.000000	250	2500						

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[CTS](#):
  535EL10001IA5 535EL10001IT5 535EL10005GA5 535EL10005GT5 535EL10005IA5 535EL10005IT5
535EL100X2GA5 535EL100X2GT5 535EL100X2IA5 535EL100X2IT5 535EL12805GA5 535EL12805GT5
535EL12805IA5 535EL12805IT5 535EL128X2GA5 535EL128X2GT5 535EL128X2IA5 535EL128X2IT5
535EL13005GA5 535EL13005GT5 535EL13005IA5 535EL13005IT5 535EL130X2GA5 535EL130X2GT5
535EL130X2IA5 535EL130X2IT5 535EL19205GA5 535EL19205GT5 535EL19205IA5 535EL19205IT5
535EL192X2GA5 535EL192X2GT5 535EL192X2IA5 535EL192X2IT5 535EL20001IA5 535EL20001IT5
535EL20005GA5 535EL20005GT5 535EL20005IA5 535EL20005IT5 535EL200X2GA5 535EL200X2GT5
535EL200X2IA5 535EL200X2IT5 535EL24C01IA5 535EL24C01IT5 535EL24C05GA5 535EL24C05GT5
535EL24C05IA5 535EL24C05IT5 535EL24CX2GA5 535EL24CX2GT5 535EL24CX2IA5 535EL24CX2IT5
535EL25001IA5 535EL25001IT5 535EL25005GA5 535EL25005GT5 535EL25005IA5 535EL25005IT5
535EL250X2GA5 535EL250X2GT5 535EL250X2IA5 535EL250X2IT5 535EL26005GA5 535EL26005GT5
535EL26005IA5 535EL26005IT5 535EL260X2GA5 535EL260X2GT5 535EL260X2IA5 535EL260X2IT5
535EL30701IA5 535EL30701IT5 535EL30705GA5 535EL30705GT5 535EL30705IA5 535EL30705IT5
535EL307X2GA5 535EL307X2GT5 535EL307X2IA5 535EL307X2IT5 535EL32005GA5 535EL32005GT5
535EL32005IA5 535EL32005IT5 535EL320X2GA5 535EL320X2GT5 535EL320X2IA5 535EL320X2IT5
535EL38401IA5 535EL38401IT5 535EL38805GA5 535EL38805GT5 535EL38805IA5 535EL38805IT5
535EL388X2GA5 535EL388X2GT5 535EL388X2IA5 535EL388X2IT5