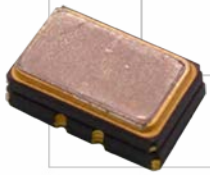
Model 535

High Stability Clipped Sine TCXO



Part Dimensions:
5.0 × 3.2 × 1.45mm

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

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

Code	Frequency
	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.

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.

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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 -40 -40	+25	+70 +85 +105	°C
Storage Temperature	T_{STG}	-	-55	-	+125	°C

Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f_O	Frequency stability ±0.10ppm Frequency stability ±0.28ppm or ±0.50ppm		10 - 40 10 - 54		MHz
Frequency Stability		**-10°C to +70°C & -40°C to +85°C**				
Overall Frequency Stability		Reference to f_O, 20 Years Aging, -40°C to +85°C	-4.6	-	4.6	ppm
Initial Calibration	$\Delta f/f_O$	Initial Calibration @ +25°C, At Time of Shipment	-1.0	-	1.0	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%	-0.1	-	0.1	ppm
Load Coefficient		Load, ±10%	-0.1	-	0.1	
Aging	$\Delta f/f_{25}$	First Year @ +25°C, nominal V_{CC} and V_C 20 Years @ +25°C, nominal V_{CC} and V_C	-1.0 -3.0	- -	1.0 3.0	ppm
Frequency Stability		**-40°C to +105°C**				
Overall Frequency Stability		Reference to f_O, 20 Years Aging, -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%	-0.1	-	0.1	ppm
Load Coefficient		Load, ±10%	-0.2	-	0.2	
Aging	$\Delta f/f_{25}$	First Year @ +25°C, nominal V_{CC} and V_C 20 Years @ +25°C, nominal V_{CC} and V_C	-1.0 -3.0	- -	1.0 3.0	ppm

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Electrical Specifications

Output Parameters

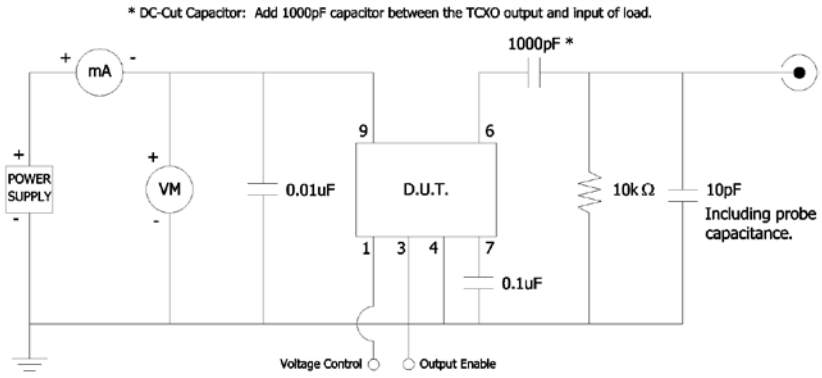
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Type	-	DC Coupled		Clipped Sine		-
Output Voltage Levels	V_O	-	0.8	-	-	V_{p-p}
Start Up Time	T_S	Application of V_{CC}	-	2	5	ms
Enable Function						
Enable Input Voltage	V_{IH}	Pin 3Logic '1', Output Enabled	$0.8V_{CC}$	-	-	V
Disable Input Voltage	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



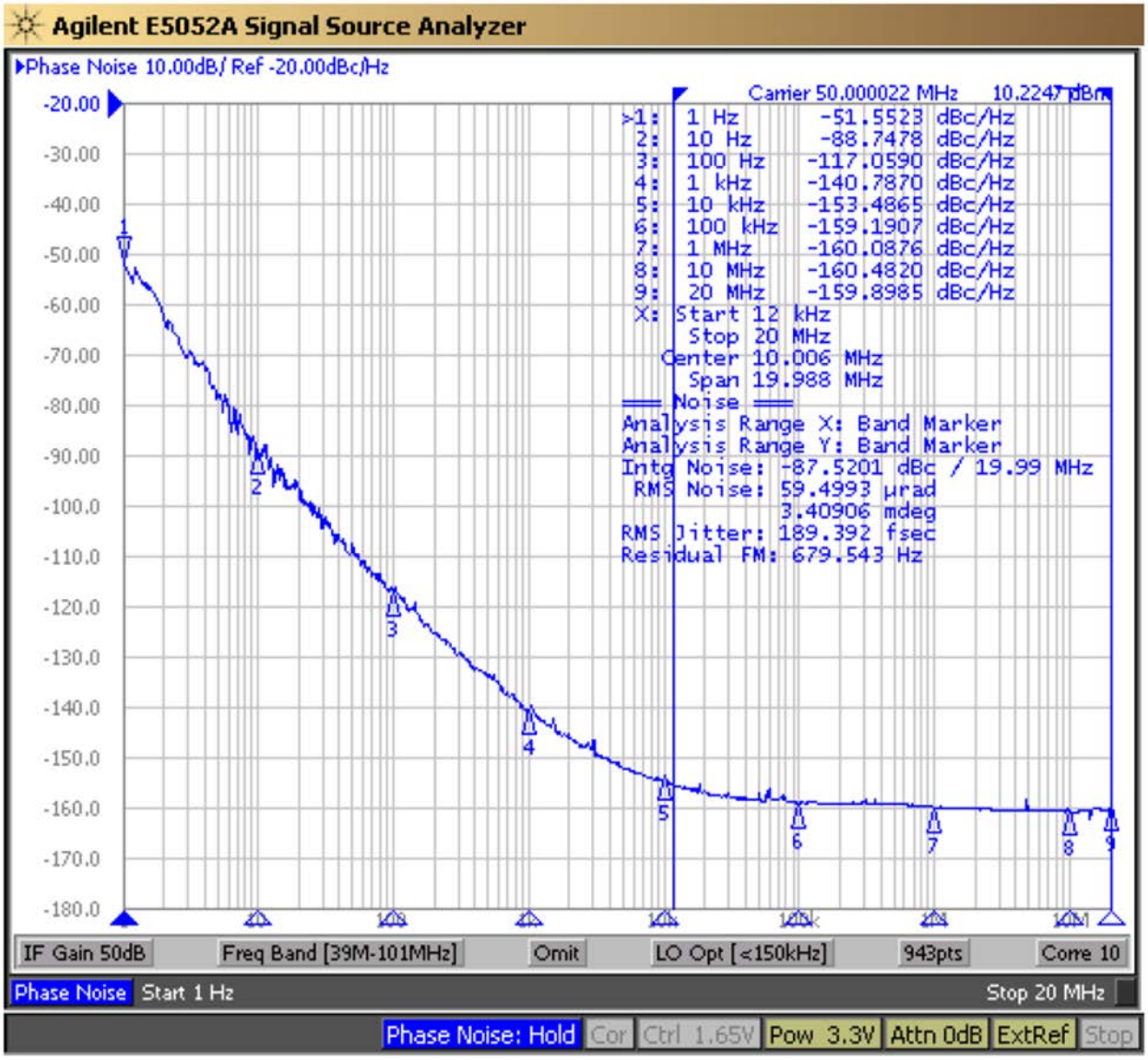
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Electrical Specifications

Performance Data

Phase Noise [typical]

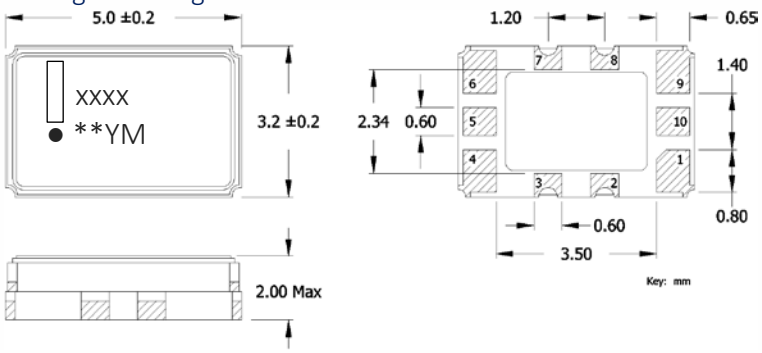
50MHz, V_{CC} = 3.3V, T_A = +25°C



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Mechanical Specifications

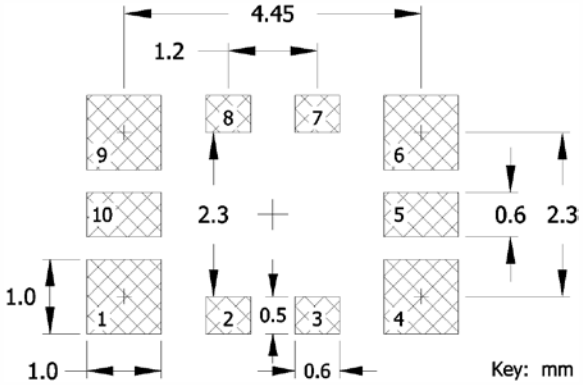
Package Drawing



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.

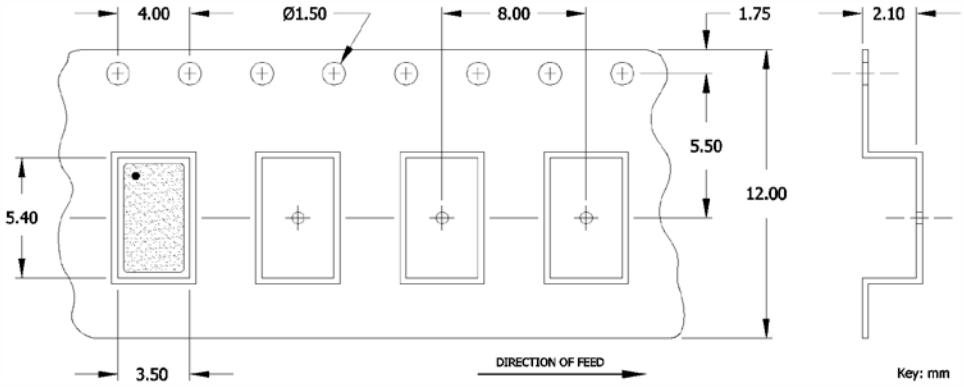
Table I - Month Code

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

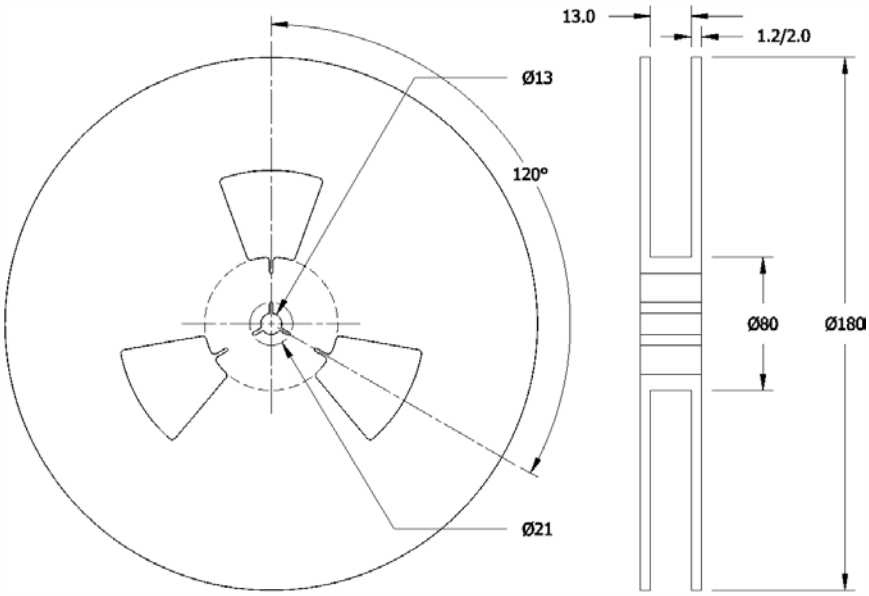
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Packaging - Tape and Reel

Tape Drawing



Reel Drawing



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.

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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	24.576000	24C	2457	38.880000	388	3888
12.800000	128	1280	25.000000	250	2500	40.000000	400	4000
13.000000	130	1300	26.000000	260	2600	50.000000	500	5000
19.200000	192	1920	30.720000	307	3072	54.000000	540	5400
20.000000	200	2000	32.000000	320	3200			

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	24.576000	24C	2457	38.880000	388	3888
12.800000	128	1280	25.000000	250	2500	40.000000	400	4000
13.000000	130	1300	26.000000	260	2600			
19.200000	192	1920	30.720000	307	3072			
20.000000	200	2000	32.000000	320	3200			

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						
24.576000	24C	2457						
25.000000	250	2500						
30.720000	307	3072						

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