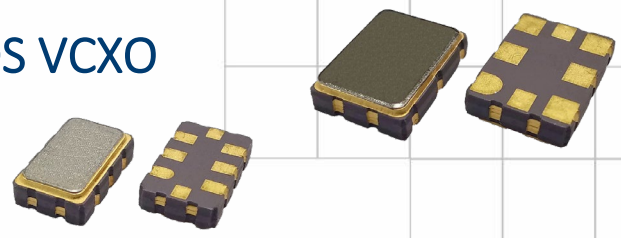
Model CV Series

Advanced PLL HCMOS, LVPECL or LVDS VCXO



Part Dimensions:
5.0 × 3.2 × 1.5mm • 61.8mg
7.0 × 5.0 × 1.9mm • 172.74mg

Features

- Ceramic Surface Mount Package
- Very Low Phase Jitter Performance, 150fs Typical
- Quartz Crystal Based Design
- Frequency Range to 2.1GHz *
- +1.8V, +2.5V or +3.3V Operation
- Output Enable Standard
- Tape and Reel Packaging, EIA-481

Standard Frequencies

* See Page 12 for common frequencies.
Check with factory for availability of frequencies not listed.

Applications

- SerDes
- Storage Area Networking
- Broadband Access
- SONET/SDH/DWDM
- PON
- Ethernet/Gbe/SyncE
- Fiber Channel
- Medical Electronics
- Test and Measurement

Description

CTS Model CV Series is a low cost, high performance clock oscillator supporting HCMOS and differential LVPECL or LVDS outputs. Employing the latest IC technology, CV Series has excellent stability and low jitter/phase noise performance.

Ordering Information

Model	Package Size	Output Type	Frequency Code	Frequency Stability	Temperature Range	Supply Voltage	Pullability Minimum	Packaging
CV	50	C	XXX or XXXX	3	I	L	6	T

Code	Dimensions
50	5.0mmx3.2mm
70	7.0mmx5.0mm

Code	Frequency
	Product Frequency Code [1]

Code	Temp. Range
C	-20°C to +70°C
I	-40°C to +85°C

Code	Voltage
6	±100ppm
7	±150ppm

Code	Output
C	HCMOS
P	LVPECL
L	LVDS

Code	Stability
5	±25ppm
3	±50ppm

Code	Voltage
M	+1.8Vdc [2]
N	+2.5Vdc
L	+3.3Vdc

Code	Packing
T	1k pcs./reel

Notes:
1] Refer to document 016-1454-0, Frequency Code Tables. [3-digits for frequencies <100MHz, 4-digits for frequencies 100MHz or greater.]
2] HCMOS and LVDS outputs 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	-	3.8	V
Maximum Control Voltage	V_C	V_{CC} = nominal	-0.5	-	3.8	V
Supply Voltage	V_{CC}	±5%, HCMOS & LVDS only	1.71	1.8	1.89	V
		±10%	2.25	2.5	2.75	
			2.97	3.3	3.63	
Supply Current	I_{CC}	Maximum Load Maximum Current Value @ +3.3V				mA
HCMOS			-	80	-	
LVPECL			-	100	120	
LVDS			-	75	90	
Operating Temperature	T_A	-	-20	+25	+70	°C
			-40		+85	
Storage Temperature	T_{STG}	-	-55	-	+125	°C

Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f_O	-		15 - 250		MHz
				15 - 2,100		
Frequency Stability [Note 1]	$\Delta f/f_O$	-		25 or 50		±ppm
Aging	$\Delta f/f_{25}$	First Year @ +25°C, nominal V_{CC}	-3	-	3	ppm

1.] Inclusive of initial tolerance at time of shipment, changes in supply voltage, load, temperature and 1st year aging.

Output Parameters

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Type	-	-		HCMOS		-
Output Load	C_L	-	-	-	15	pF
Output Voltage Levels	V_{OH}	CMOS Load	V_{CC} - 0.4V	-	-	V
	V_{OL}	CMOS Load	-	-	$0.1V_{CC}$	
		CMOS Load @ +1.8V	-	-	0.3	
Output Duty Cycle	SYM	@ 50% Level, +2.5V and +3.3V	45	-	55	%
		@ 50% Level, +1.8V	40	-	60	
Rise and Fall Time	T_R, T_F	@ 10%/90% Levels, C_L = 15pF	-	-	5	ns
Output Type	-	-		LVPECL		-
Output Load	R_L	Terminated to V_{CC} - 2.0V	-	50	-	Ohms
Output Voltage Levels	V_{OH}	PECL Load	V_{CC} - 1.165	-	V_{CC} - 0.80	V
	V_{OL}		V_{CC} - 2.0	-	V_{CC} - 1.55	
Output Duty Cycle	SYM	@ V_{CC} - 1.3V	45	-	55	%
Differential Output Voltage	V_{OD}	R_L = 50 Ohms	595	-	930	mV
Rise and Fall Time	T_R, T_F	@ 20%/80% Levels, R_L = 50 Ohms	-	-	0.40	ns

Electrical Specifications

Output Parameters

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Type	-	-		LVDS		-
Output Load	R_L	Between Outputs	-	100	-	Ohms
Output Voltage Levels	V_{OH}	LVDS Load	-	1.40	1.60	V
	V_{OL}		0.90	1.10	-	
Output Duty Cycle	SYM	@ 1.25V	45	-	55	%
Differential Output Voltage	V_{OD}	R_L = 100 Ohms	250	-	450	mV
Offset Voltage	V_{OS}	LVDS Load	1.20	1.25	1.30	V
Rise and Fall Time	T_R, T_F	@ 20%/80% Levels, R_L = 100 Ohms	-	-	0.40	ns

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Start Up Time	T_S	Application of V_{CC}	-	5	10	ms
Enable Function [Tri-State]						
Enable Input Voltage	V_{IH}	Pin 2 Logic '1', Output Enabled	$0.8V_{CC}$	-	-	V
Disable Input Voltage	V_{IL}	Pin 2 Logic '0', Output Disabled	-	-	$0.2V_{CC}$	V
Disable Current	I_{IL}	Pin 2 Logic '0', Output Disabled, HCMOS	-	63	-	mA
		Pin 2 Logic '0', Output Disabled, LVPECL	-	99	-	
		Pin 2 Logic '0', Output Disabled, LVDS	-	74	-	
Disable Time	T_{PLZ}	Pin 2 Logic '0', Output Disabled	-	-	10	µs
Enable Time	T_{PLZ}	Pin 2 Logic '1', Output Enabled	-	-	2.5	ms
Phase Jitter, RMS	tjrms	Bandwidth 12 kHz - 20 MHz	-	150	300	fs

Control Voltage

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Control Voltage	V_C	V_{CC} = +1.8V, LVDS only	0.0	0.90	1.8	V
		V_{CC} = +2.5V	0.25	1.25	2.25	
		V_{CC} = +3.3V	0.3	1.65	3.0	
Frequency Pulling Range	$\Delta f/f_O$	V_C range	±100 or ±150 minimum			ppm
Linearity	L	Best Straight Line Fit	-	-	±10	%
Gain Transfer	K_V	Pull Sensitivity; @ +1.25V, +25°C	-	80	260	ppm/V
		Pull Sensitivity; @ +1.65V, +25°C				
Input Impedance	Z_{Vc}	-	5	-	-	MOhms
Modulation Roll-off	-	@ -3dB	10	-	-	kHz
Transfer Function	-	-		Positive		-

Enable Truth Table

HCMOS

Pin 2	Pin 4
Logic '1'	Output Enabled
Open	Output Enabled
Logic '0'	Output Disabled, High Impedance

Enable Truth Table

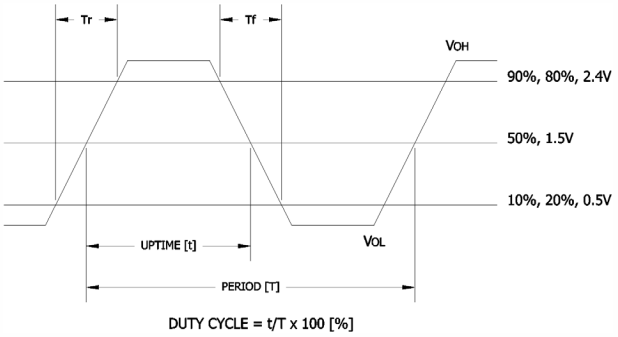
LVPECL or LVDS

Pin 2	Pin 4 & Pin 5
Logic '1'	Output Enabled
Open	Output Enabled
Logic '0'	Output Disabled, High Impedance

Electrical Specifications

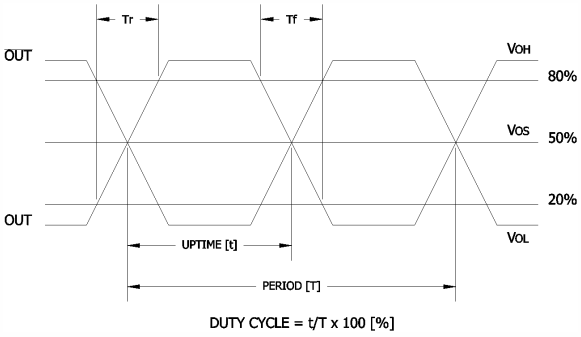
Output Waveform

HCMOS



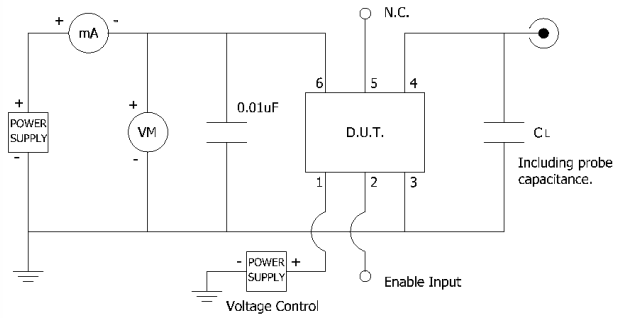
Output Waveform

LVPECL or LVDS

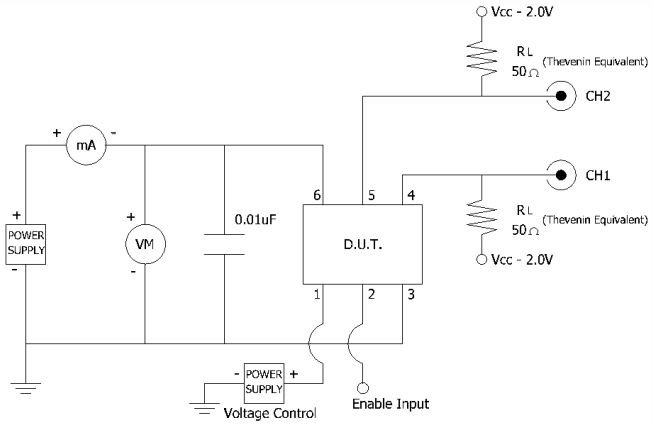


Test Circuits

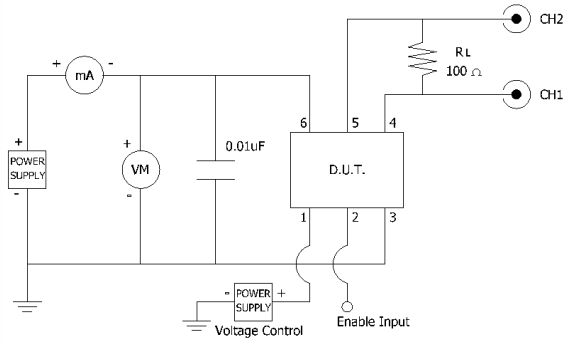
HCMOS



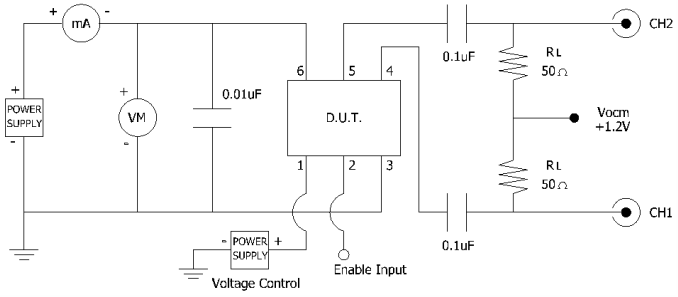
LVPECL



LVDS



LVDS @ +1.8V

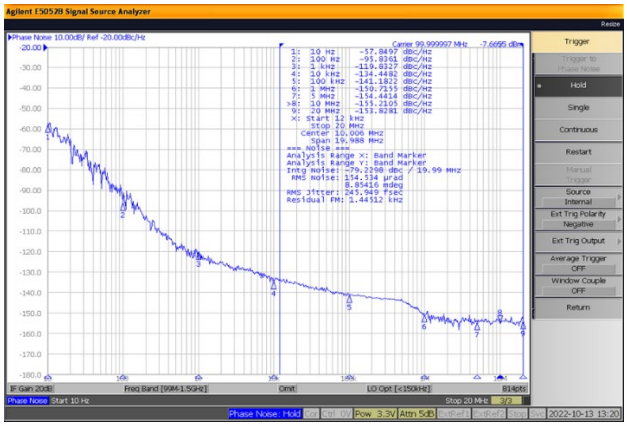


Electrical Specifications

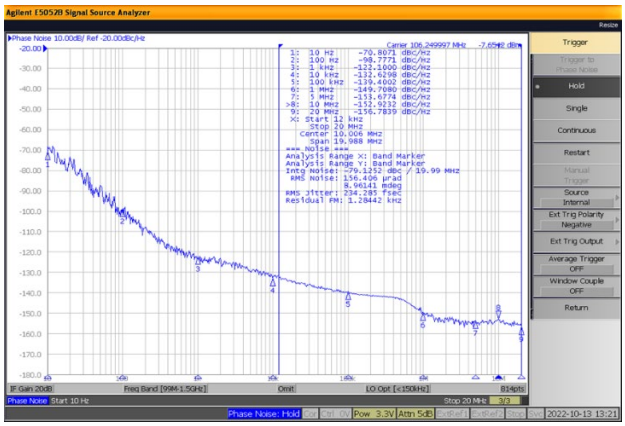
Performance Data

Phase Noise [typical]

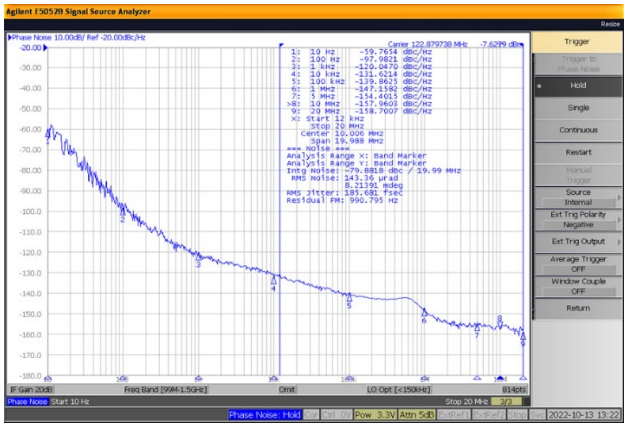
100MHz, V_{CC} = +3.3V, T_A = +25°C



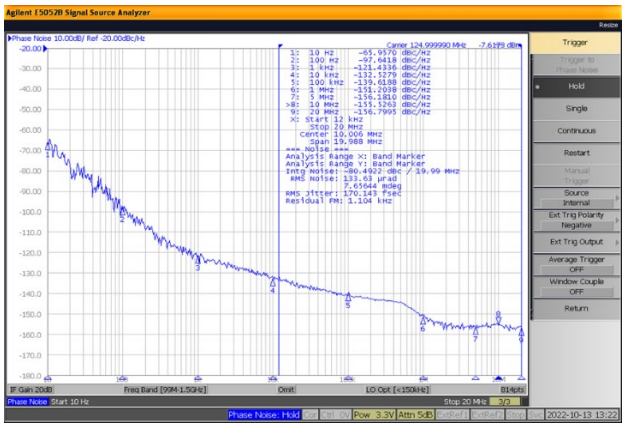
106.25MHz, V_{CC} = +3.3V, T_A = +25°C



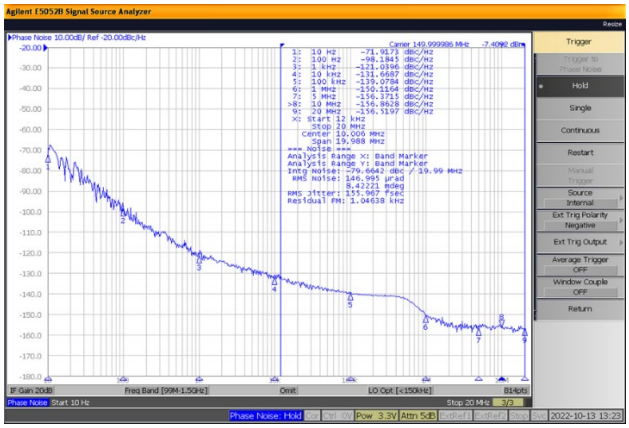
122.88MHz, V_{CC} = +3.3V, T_A = +25°C



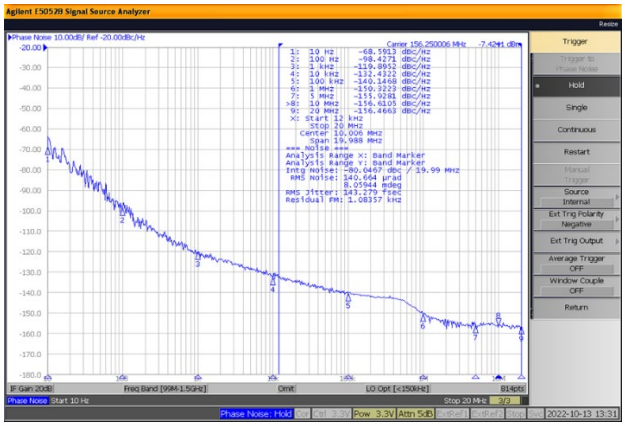
125MHz, V_{CC} = +3.3V, T_A = +25°C



150MHz, V_{CC} = +3.3V, T_A = +25°C



156.25MHz, V_{CC} = +3.3V, T_A = +25°C

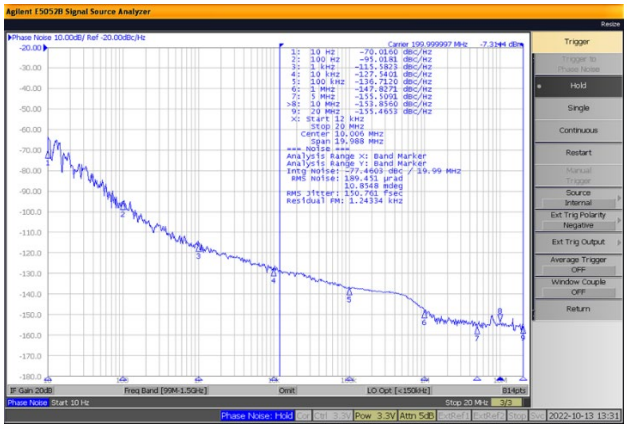


Electrical Specifications

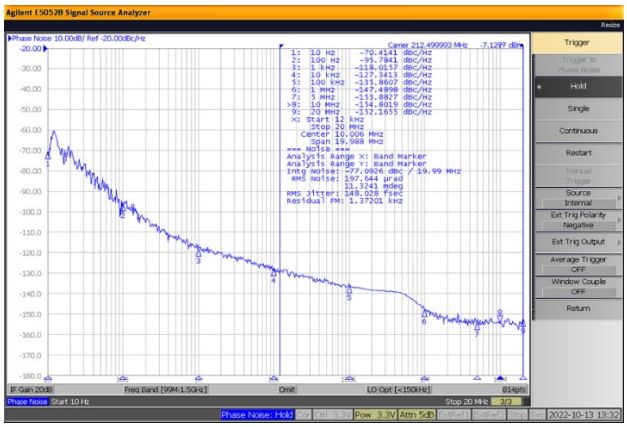
Performance Data

Phase Noise [typical]

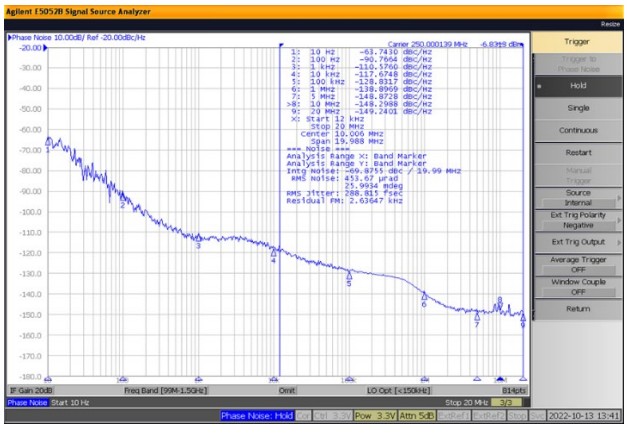
200MHz, V_{CC} = +3.3V, T_A = +25°C



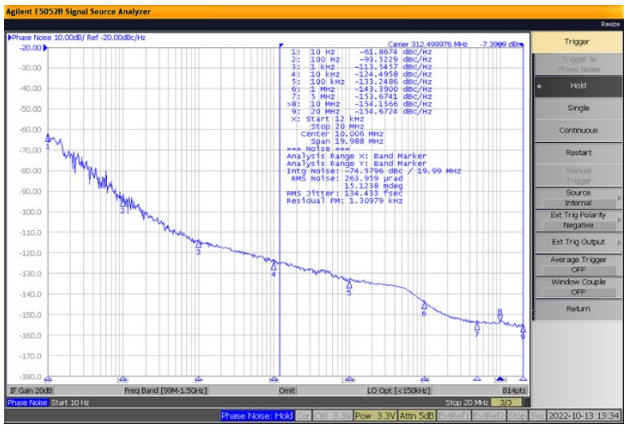
212.5MHz, V_{CC} = +3.3V, T_A = +25°C



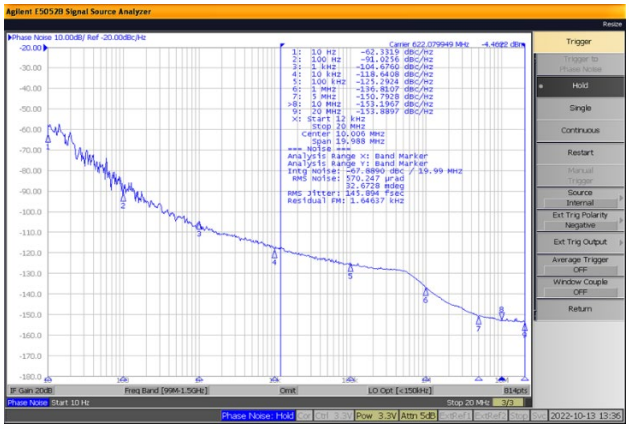
250MHz, V_{CC} = +3.3V, T_A = +25°C



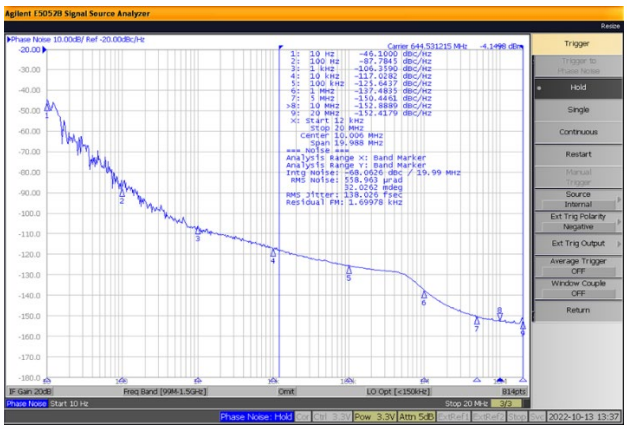
312.5MHz, V_{CC} = +3.3V, T_A = +25°C



622.08MHz, V_{CC} = +3.3V, T_A = +25°C



644.53125MHz, V_{CC} = +3.3V, T_A = +25°C



Electrical Specifications

Performance Data

Phase Noise Tabulated

Typical, V_{CC} = +3.3V, T_A = +25°C

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
100.0000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-57.8497	
		@ 100Hz	-95.8361	
		@ 1kHz	-119.8327	
	-	@ 10kHz	-134.4482	dBc/Hz
		@ 100kHz	-141.1822	
		@ 1MHz	-150.7155	
		@ 5MHz	-154.4414	
		@ 10MHz	-155.2105	
		@ 20MHz	-153.8281	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	245.9490	fs

Typical, V_{CC} = +3.3V, T_A = +25°C

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
106.250MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-70.8071	
		@ 100Hz	-98.7771	
		@ 1kHz	-122.1000	
	-	@ 10kHz	-132.6298	dBc/Hz
		@ 100kHz	-139.4002	
		@ 1MHz	-149.7080	
		@ 5MHz	-153.6774	
		@ 10MHz	-152.9232	
		@ 20MHz	-156.7839	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	234.2850	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
122.8800MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-59.7654	
		@ 100Hz	-97.9821	
		@ 1kHz	-120.0470	
	-	@ 10kHz	-131.6214	dBc/Hz
		@ 100kHz	-139.8625	
		@ 1MHz	-147.1582	
		@ 5MHz	-154.4015	
		@ 10MHz	-157.9603	
		@ 20MHz	-158.7007	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	185.6810	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
125.0000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-65.9570	
		@ 100Hz	-97.6418	
		@ 1kHz	-121.4336	
	-	@ 10kHz	-132.5279	dBc/Hz
		@ 100kHz	-139.6188	
		@ 1MHz	-151.2038	
		@ 5MHz	-156.1810	
		@ 10MHz	-155.5263	
		@ 20MHz	-156.7995	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	170.1430	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
150.0000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-71.9173	
		@ 100Hz	-98.1845	
		@ 1kHz	-121.0396	
	-	@ 10kHz	-131.6687	dBc/Hz
		@ 100kHz	-139.0784	
		@ 1MHz	-150.1164	
		@ 5MHz	-156.3715	
		@ 10MHz	-156.8628	
		@ 20MHz	-156.5197	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	155.9670	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
156.2500MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-68.5913	
		@ 100Hz	-98.4271	
		@ 1kHz	-119.8952	
	-	@ 10kHz	-132.4322	dBc/Hz
		@ 100kHz	-140.1468	
		@ 1MHz	-150.3223	
		@ 5MHz	-155.9281	
		@ 10MHz	-156.6105	
		@ 20MHz	-156.4663	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	143.2790	fs

Electrical Specifications

Performance Data

Phase Noise Tabulated

Typical, V_{CC} = +3.3V, T_A = +25°C

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
200.0000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-70.0160	
		@ 100Hz	-95.0181	
		@ 1kHz	-115.5823	
	-	@ 10kHz	-127.5401	dBc/Hz
		@ 100kHz	-136.7120	
		@ 1MHz	-147.8271	
		@ 5MHz	-155.5091	
		@ 10MHz	-153.8560	
		@ 20MHz	-155.4653	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	150.7610	fs

Typical, V_{CC} = +3.3V, T_A = +25°C

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
212.5000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-70.4141	
		@ 100Hz	-95.7841	
		@ 1kHz	-118.0157	
	-	@ 10kHz	-127.3413	dBc/Hz
		@ 100kHz	-135.8607	
		@ 1MHz	-147.4898	
		@ 5MHz	-153.8827	
		@ 10MHz	-154.8019	
		@ 20MHz	-152.1655	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	148.0280	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
250.0000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-63.7430	
		@ 100Hz	-90.7664	
		@ 1kHz	-110.5760	
	-	@ 10kHz	-117.6748	dBc/Hz
		@ 100kHz	-128.8317	
		@ 1MHz	-138.8969	
		@ 5MHz	-148.8728	
		@ 10MHz	-148.2933	
		@ 20MHz	-149.2401	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	288.8150	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
312.5000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-61.8674	
		@ 100Hz	-93.5229	
		@ 1kHz	-113.5457	
	-	@ 10kHz	-124.4958	dBc/Hz
		@ 100kHz	-133.2486	
		@ 1MHz	-143.3900	
		@ 5MHz	-153.6741	
		@ 10MHz	-154.1566	
		@ 20MHz	-154.6724	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	134.4330	fs

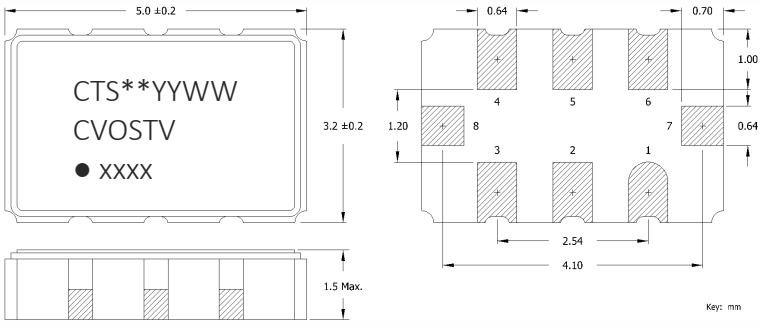
PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
622.0800MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-62.3319	
		@ 100Hz	-91.0256	
		@ 1kHz	-104.6760	
	-	@ 10kHz	-118.6408	dBc/Hz
		@ 100kHz	-125.2924	
		@ 1MHz	-136.8107	
		@ 5MHz	-150.7928	
		@ 10MHz	-153.1967	
		@ 20MHz	-153.8897	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	145.8940	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
644.53125MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-46.1000	
		@ 100Hz	-87.7845	
		@ 1kHz	-106.3590	
	-	@ 10kHz	-117.0282	dBc/Hz
		@ 100kHz	-125.6437	
		@ 1MHz	-137.4835	
		@ 5MHz	-150.4461	
		@ 10MHz	-152.8889	
		@ 20MHz	-152.4179	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	138.0260	fs

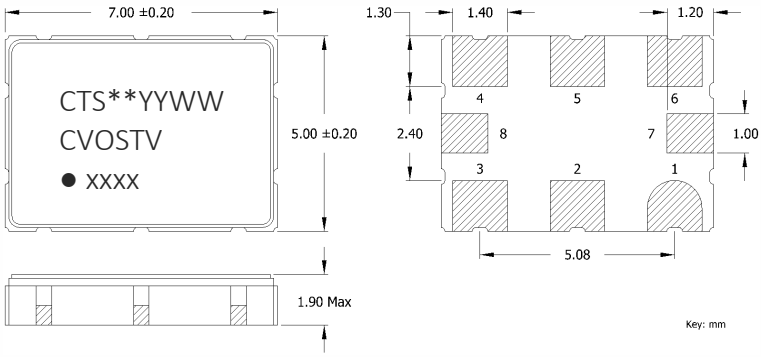
Mechanical Specifications

Package Drawing

CV50



CV70



Marking Information

CV50 and CV70

1. ** - Manufacturing Site Code.
2. YYWW – Date Code; YY – year, WW – week.
3. CV – Model series.
4. O – Output Type; C = HCMOS, P = LVPECL, L = LVDS.
5. ST – Frequency Stability/Temperature Code.
   [Refer to Ordering Information]
6. V – Voltage Code; M = 1.8V, N = 2.5V, L = 3.3V.
7. xxxx – Frequency Code.
   3-digits, frequencies below 100MHz
   4-digits, frequencies 100MHz or greater

[See document 016-1454-0, Frequency Code Tables.]

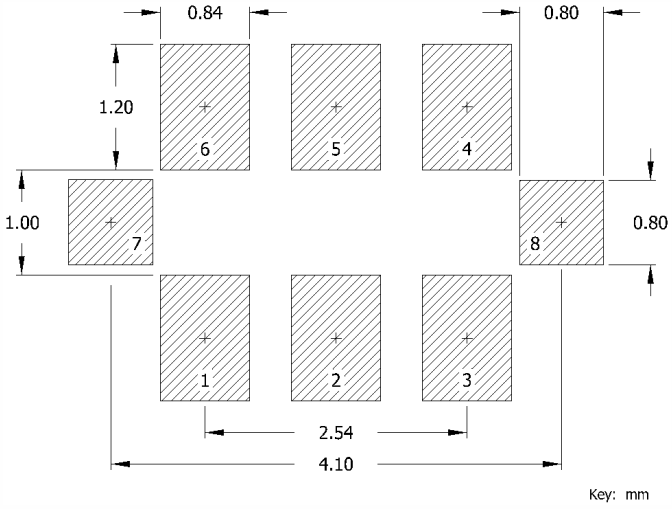
Notes

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

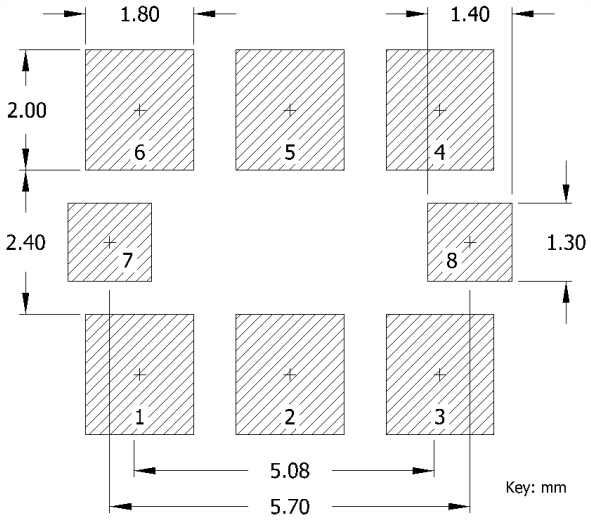
Mechanical Specifications

Recommended Pad Layout

CV50



CV70



Pin Assignments

HCMOS

Pin	Symbol	Function
1	Vc	Voltage Control
2	EOH	Enable
3	GND	Circuit & Package Ground
4	Output	RF Output
5	N.C.	No Connect
6	V_{CC}	Supply Voltage
7	N.C.	Do Not Connect
8	N.C.	Do Not Connect

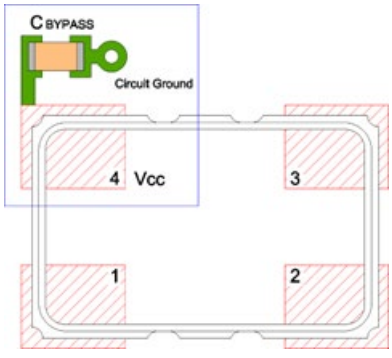
Pin Assignments

LVPECL or LVDS

Pin	Symbol	Function
1	Vc	Voltage Control
2	EOH	Enable
3	GND	Circuit & Package Ground
4	Output	RF Output
5	$\overline{\text{Output}}$	Complimentary RF Output
6	V_{CC}	Supply Voltage
7	N.C.	Do Not Connect
8	N.C.	Do Not Connect

VOLTAGE SUPPLY - BYPASS CAPACITOR

Proper filtering of high frequency noise riding on the voltage supply line is critical to eliminating the injecting of that noise into the oscillator and throughout the system. It is recommended that a 0.1µF [100nF] capacitor be inserted from the Vcc pin to circuit ground. The bypass capacitor placement should be as close to the Vcc pad as possible with a short trace routing to circuit ground.



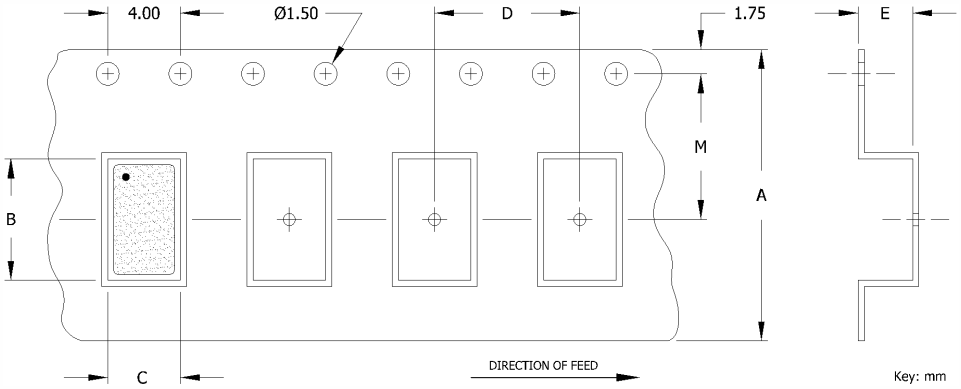
Mechanical Specifications

Table I - Date Code, Beginning year 2021

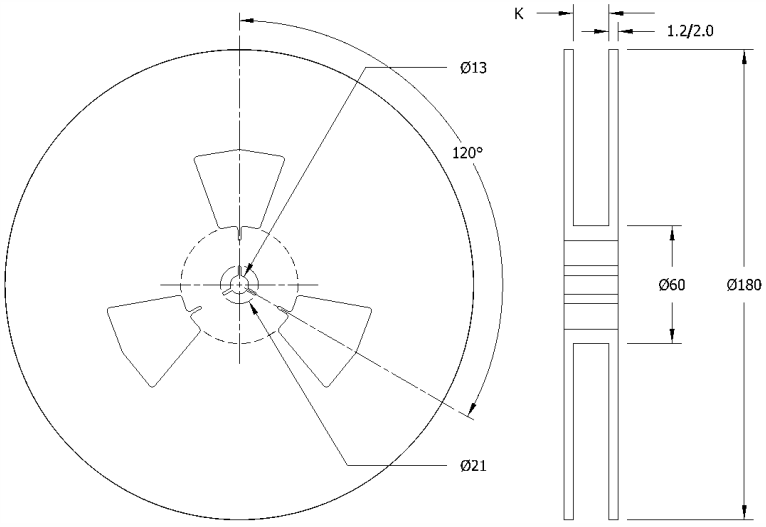
YEAR \ MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2021 2025 2029 2033 2037	A	B	C	D	E	F	G	H	J	K	L	M
2022 2026 2030 2034 2038	N	P	Q	R	S	T	U	V	W	X	Y	Z
2023 2027 2031 2035 2039	a	b	c	d	e	f	g	h	j	k	l	m
2024 2028 2032 2036 2040	n	p	q	r	s	t	u	v	w	x	y	z

Packaging - Tape and Reel

Tape Drawing



Reel Drawing



Tape Dimensions

PACKAGE	A	B	C	D	E	M	QUANTITY
CC50	12.00	5.30	3.60	8.00	1.40	5.50	1000
CC70	16.00	7.30	5.30	8.00	1.90	7.50	1000

Reel Dimensions

K
13.00
17.20

Notes

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

Addendum

Common Frequencies Available – MHz

FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE
100.000000	1000	155.520000	1555	250.000000	2500		
106.250000	1062	156.250000	1562	312.500000	3125		
122.880000	1228	160.000000	1600	622.080000	6220		
125.000000	1250	200.000000	2000	644.531250	6445		
150.000000	1500	212.500000	2125				