

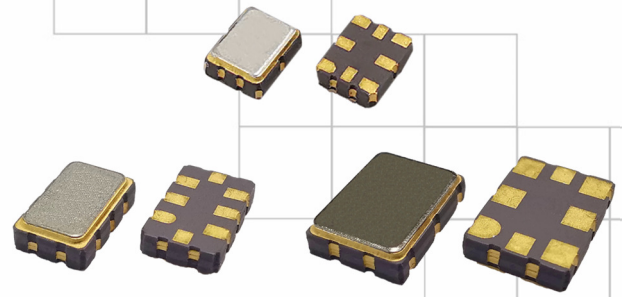


Model CC Series

Advanced PLL LVPECL or LVDS Clock

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



Part Dimensions:
3.2 × 2.5 × 1.2mm • 26.64mg
5.0 × 3.2 × 1.5mm • 61.8mg
7.0 × 5.0 × 1.9mm • 172.74mg

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 CC Series is a low cost, high performance clock oscillator supporting differential LVPECL or LVDS outputs. Employing the latest IC technology, CC 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	Packaging
CC	32	P	XXXX	3	I	L	R
↓		↓		↓		↓	
Code	Dimensions		Code	Frequency	Code	Temp. Range	Code
32	3.2mmx2.5mm		Product Frequency Code ¹		C	-20°C to +70°C	T
50	5.0mmx3.2mm				I	-40°C to +85°C	R
70	7.0mmx5.0mm						
		Code	Output	Code	Stability	Code	Voltage
		P	LVPECL	5	±25ppm	M	+1.8Vdc ²
		L	LVDS	3	±50ppm	N	+2.5Vdc
						L	+3.3Vdc

Notes:

- 1] Refer to document 016-1454-0, Frequency Code Tables. [4-digits for frequencies 100MHz or greater.]
- 2] LVDS output only.
- 3] Code T for package codes 50 and 70. Code R for package code 32 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.



Electrical Specifications

Operating Conditions

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Maximum Supply Voltage	V_{CC}	-	-0.5	-	3.8	V
Supply Voltage	V_{CC}	$\pm 5\%$, LVDS only	1.71	1.8	1.89	V
		$\pm 10\%$	2.25	2.5	2.75	
			2.97	3.3	3.63	
Supply Current						
LVPECL	I_{CC}	Maximum Load	-	100	120	mA
LVDS		Maximum Current Value @ +3.3V	-	75	90	
Operating Temperature	T_A	-	-20 -40	+25	+70 +85	$^{\circ}\text{C}$
Storage Temperature	T_{STG}	-	-55	-	+125	$^{\circ}\text{C}$

Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f_0	-		100 - 2,100		MHz
Frequency Stability [Note 1]	$\Delta f/f_0$	-		25 or 50		$\pm\text{ppm}$
Aging	$\Delta f/f_{25}$	First Year @ +25 $^{\circ}\text{C}$, 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	-	-		LVPECL		-
Output Load	R_L	Terminated to $V_{CC} - 2.0\text{V}$	-	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	@ $V_{CC} - 1.3\text{V}$	45	-	55	%
Differential Output Voltage	V_{OD}	$R_L = 50\text{ Ohms}$	595	-	930	mV
Rise and Fall Time	T_R, T_F	@ 20%/80% Levels, $R_L = 50\text{ Ohms}$	-	-	0.40	ns
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}	$R_L = 100\text{ Ohms}$	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, $R_L = 100\text{ Ohms}$	-	-	0.40	ns



Electrical Specifications

Output Parameters

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, LVPECL	-	99	-	mA
		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	t_{jrms}	Bandwidth 12 kHz - 20 MHz	-	150	300	fs

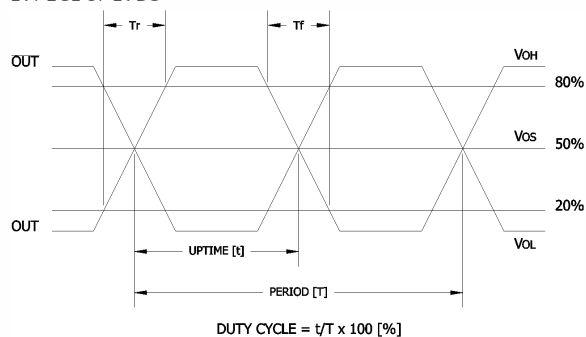
Enable Truth Table

LVPECL or LVDS

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

Output Waveform

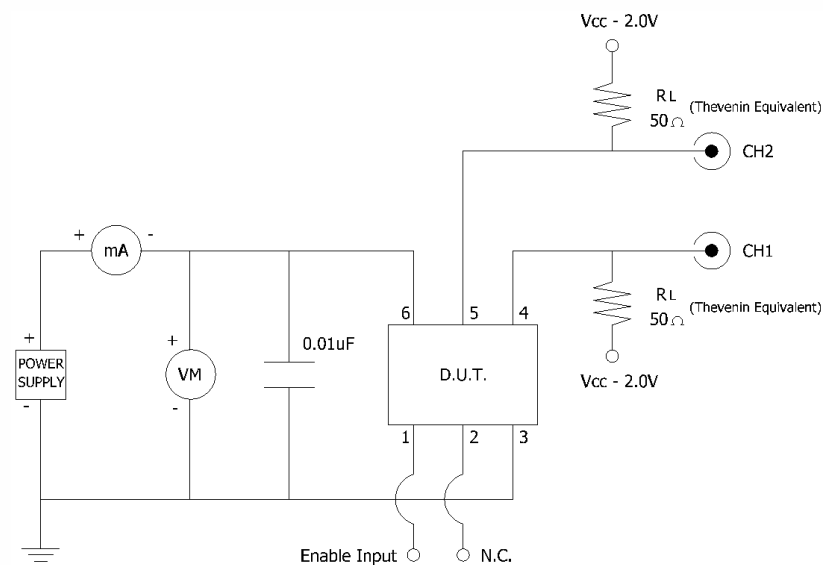
LVPECL or LVDS



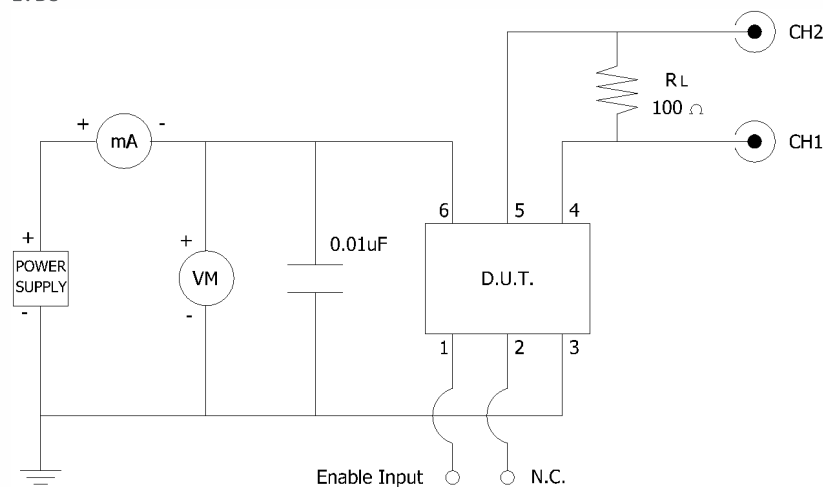
Electrical Specifications

Test Circuit

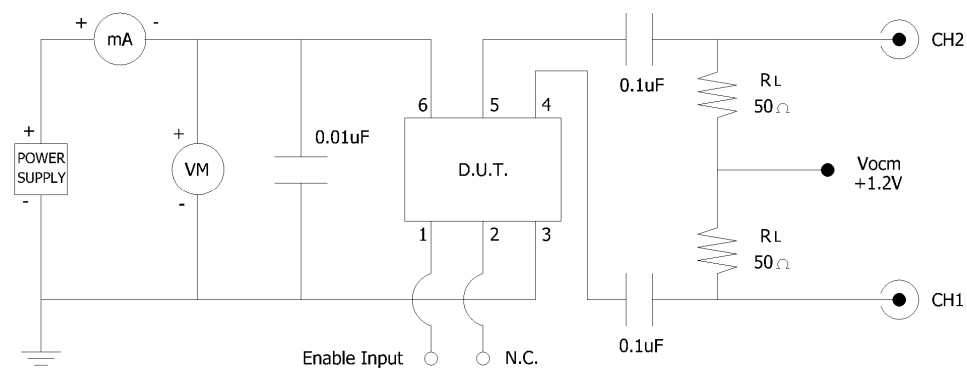
LVPECL



LVDS



LVDS @ +1.8V





Model CC Series

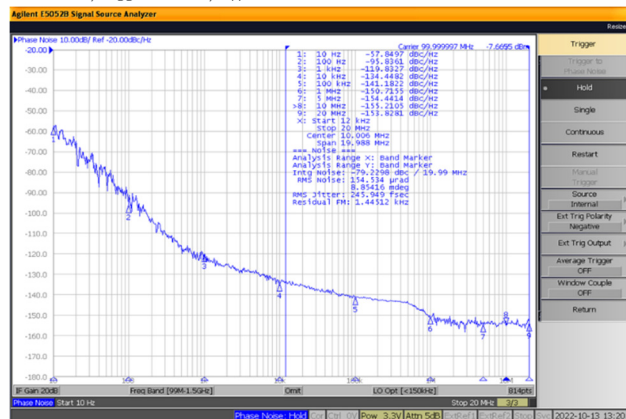
Advanced PLL LVPECL or LVDS Clock

Electrical Specifications

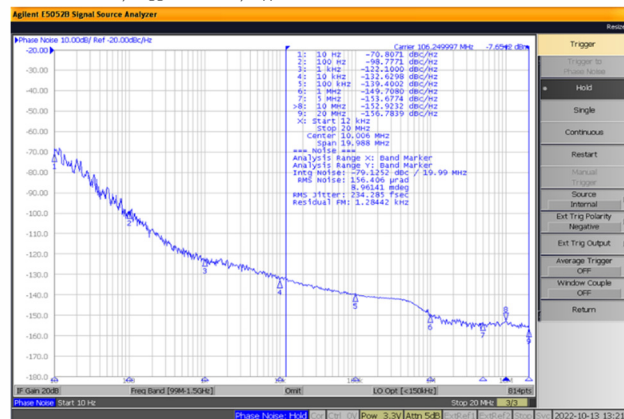
Performance Data

Phase Noise [typical]

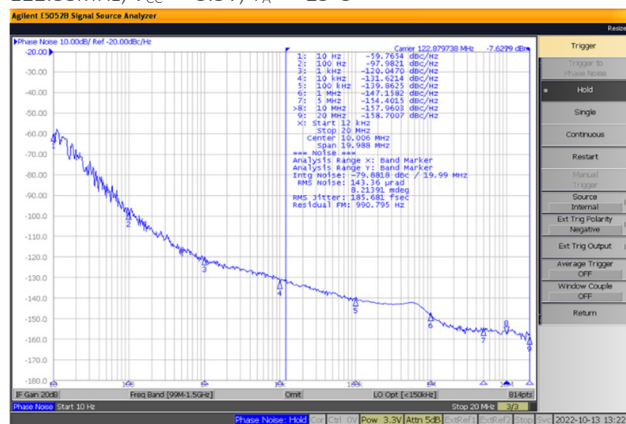
100MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



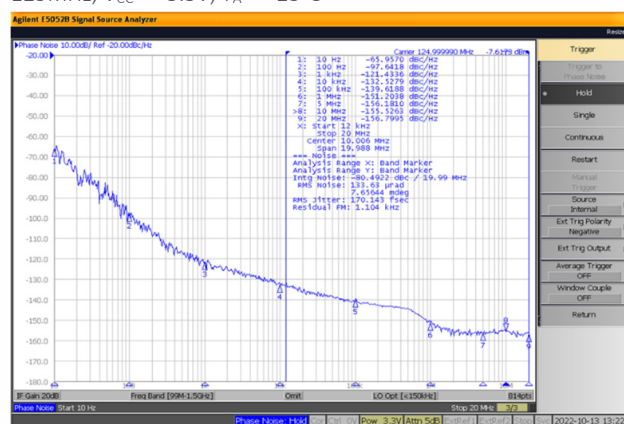
106.25MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



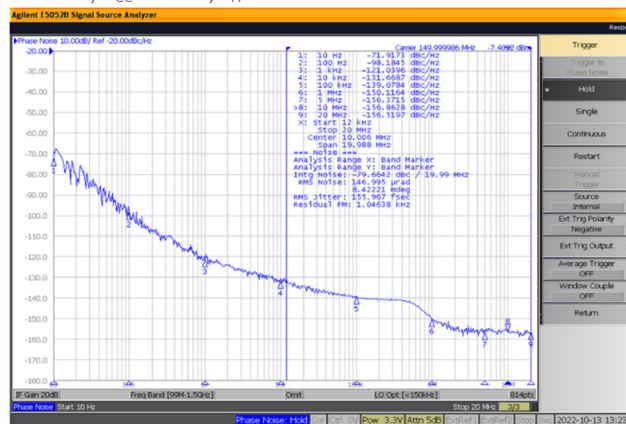
122.88MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



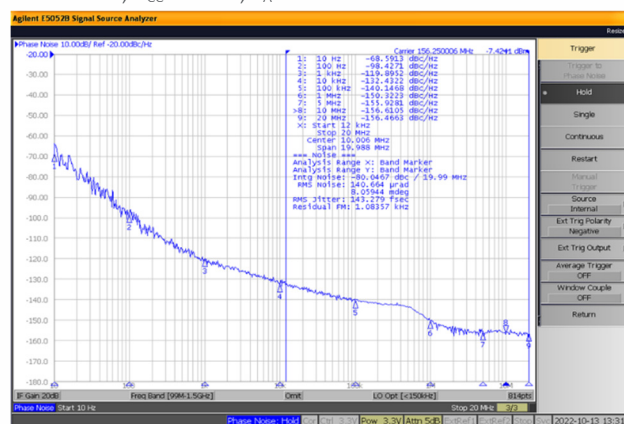
125MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



150MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



156.25MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$





Model CC Series

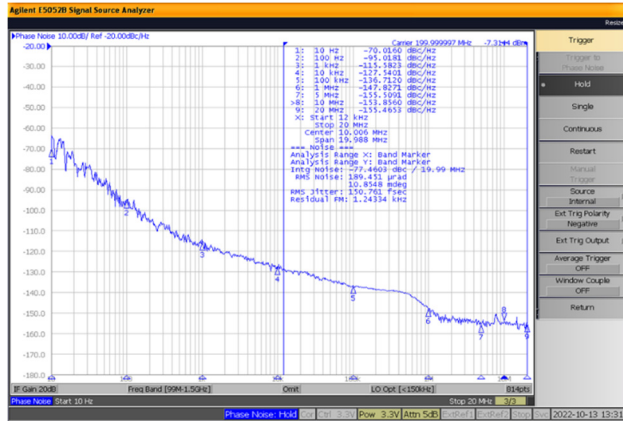
Advanced PLL LVPECL or LVDS Clock

Electrical Specifications

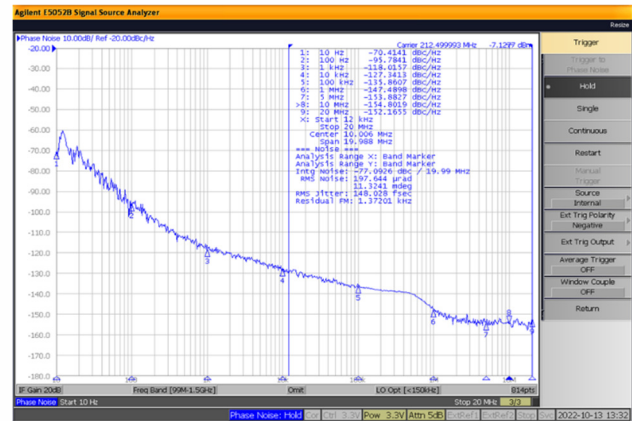
Performance Data

Phase Noise [typical]

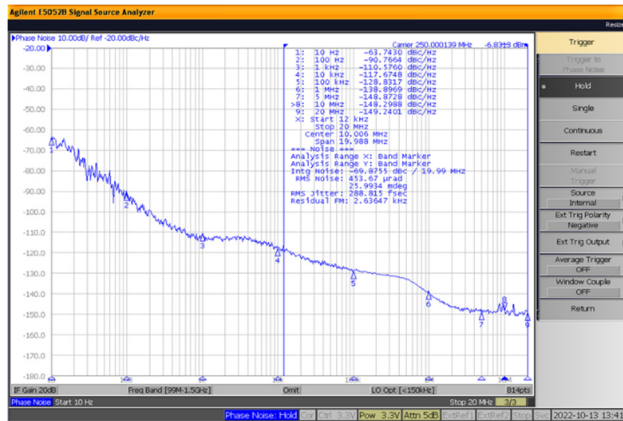
200MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



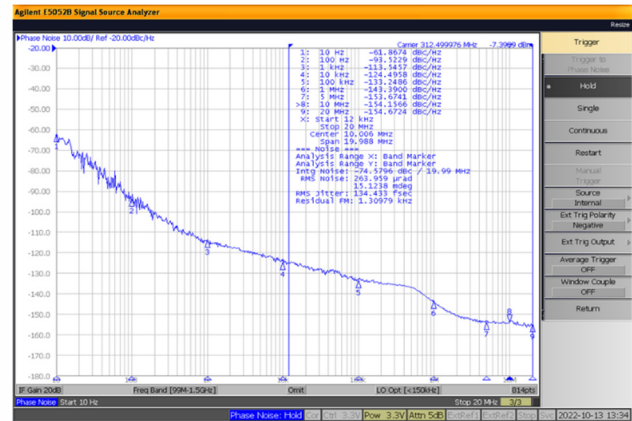
212.5MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



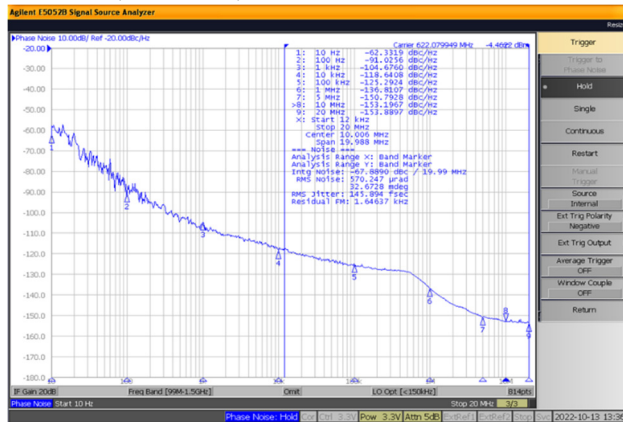
250MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



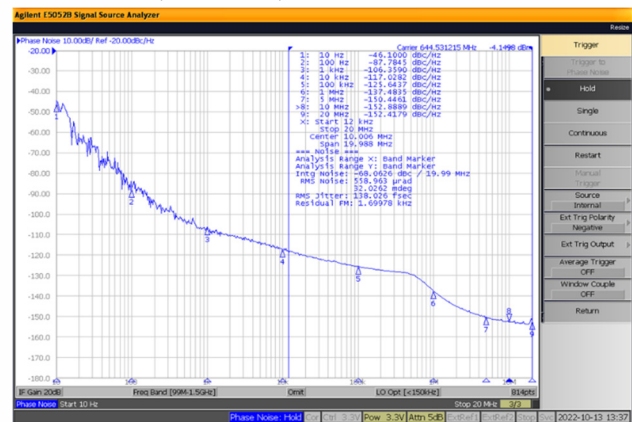
312.5MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



622.08MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



644.53125MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$





Electrical Specifications

Performance Data

Phase Noise Tabulated

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

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
100.0000MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-57.8497	
		@ 100Hz	-95.8361	
		@ 1kHz	-119.8327	
		@ 10kHz	-134.4482	
		@ 100kHz	-141.1822	
		@ 1MHz	-150.7155	
		@ 5MHz	-154.4414	
		@ 10MHz	-155.2105	
		@ 20MHz	-153.8281	
				dBc/Hz
Phase jitter, RMS	tj_rms	Integration Bandwidth 12kHz - 20MHz	245.9490	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	
		@ 100kHz	-139.8625	
		@ 1MHz	-147.1582	
		@ 5MHz	-154.4015	
		@ 10MHz	-157.9603	
		@ 20MHz	-158.7007	
				dBc/Hz
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	185.6810	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	
		@ 100kHz	-139.0784	
		@ 1MHz	-150.1164	
		@ 5MHz	-156.3715	
		@ 10MHz	-156.8628	
		@ 20MHz	-156.5197	
				dBc/Hz
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	155.9670	fs

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

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
106.250MHz				
Phase Noise		Single Side Band		
		@ 10Hz	-70.8071	
		@ 100Hz	-98.7771	
		@ 1kHz	-122.1000	
		@ 10kHz	-132.6298	
		@ 100kHz	-139.4002	
		@ 1MHz	-149.7080	
		@ 5MHz	-153.6774	
		@ 10MHz	-152.9232	
		@ 20MHz	-156.7839	
				dBc/Hz
Phase Jitter, RMS	tj _{rms}	Integration Bandwidth 12kHz - 20MHz	234.2850	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	
		@ 100kHz	-139.6188	
		@ 1MHz	-151.2038	
		@ 5MHz	-156.1810	
		@ 10MHz	-155.5263	
		@ 20MHz	-156.7995	
				dBc/Hz
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	170.1430	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	
		@ 100kHz	-140.1468	
		@ 1MHz	-150.3223	
		@ 5MHz	-155.9281	
		@ 10MHz	-156.6105	
		@ 20MHz	-156.4663	
				dBc/Hz
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	143.2790	fs



Electrical Specifications

Performance Data

Phase Noise Tabulated

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

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
200.0000MHz				
Phase Noise	-	Single Side Band		
		@ 10Hz	-70.0160	
		@ 100Hz	-95.0181	
		@ 1kHz	-115.5823	
		@ 10kHz	-127.5401	
		@ 100kHz	-136.7120	dBc/Hz
		@ 1MHz	-147.8271	
		@ 5MHz	-155.5091	
		@ 10MHz	-153.8560	
		@ 20MHz	-155.4653	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	150.7610	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	
		@ 100kHz	-128.8317	dBc/Hz
		@ 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
622.0800MHz				
Phase Noise	-	Single Side Band		
		@ 10Hz	-62.3319	
		@ 100Hz	-91.0256	
		@ 1kHz	-104.6760	
		@ 10kHz	-118.6408	
		@ 100kHz	-125.2924	dBc/Hz
		@ 1MHz	-136.8107	
		@ 5MHz	-150.7928	
		@ 10MHz	-153.1967	
		@ 20MHz	-153.8897	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	145.8940	fs

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

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

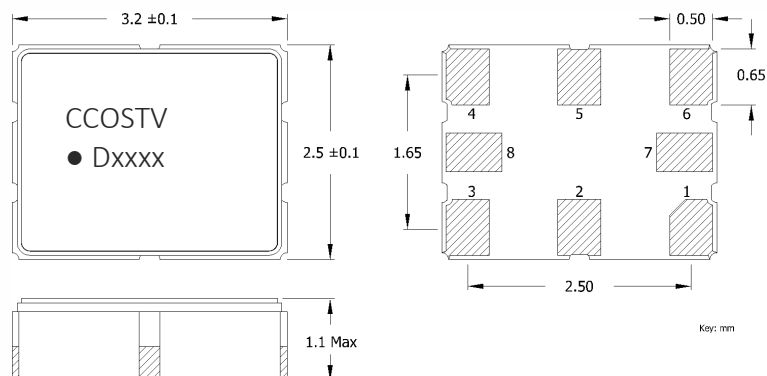
PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
312.5000MHz				
Phase Noise	-	Single Side Band		
		@ 10Hz	-61.8674	
		@ 100Hz	-93.5229	
		@ 1kHz	-113.5457	
		@ 10kHz	-124.4958	
		@ 100kHz	-133.2486	dBc/Hz
		@ 1MHz	-143.3900	
		@ 5MHz	-153.6741	
		@ 10MHz	-154.1566	
		@ 20MHz	-154.6724	
Phase Jitter, RMS	tjrms	Integration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

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

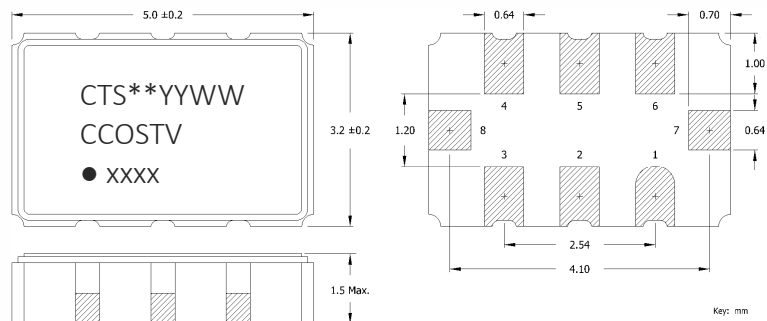
Mechanical Specifications

Package Drawing

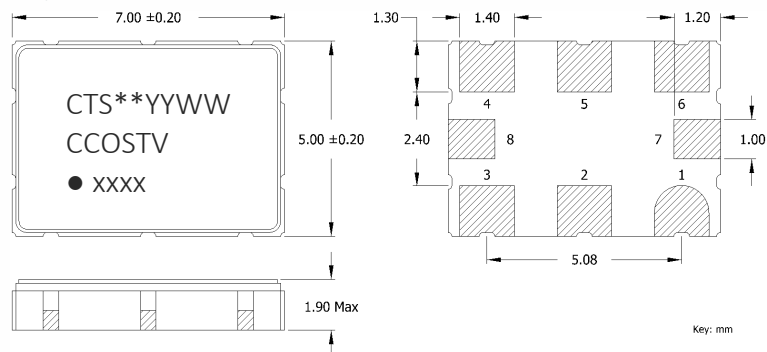
CC32



CC50



CC70



Marking Information

CC32

1. CC – Model series.
2. O – Output Type; P = LVPECL, L = LVDS.
3. ST – Frequency Stability/Temperature Code.
[Refer to Ordering Information]
4. V – Voltage Code; M = 1.8V, N = 2.5V, L = 3.3V.
5. D – Date Code. See Table I for codes.
6. xxxx – Frequency Code.
3-digits, frequencies below 100MHz
4-digits, frequencies 100MHz or greater
[See document 016-1454-0, Frequency Code Tables.]

CC50 and CC70

1. ** - Manufacturing Site Code.
2. YYWW – Date Code; YY – year, WW – week.
3. CC – Model series.
4. O – Output Type; 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.]

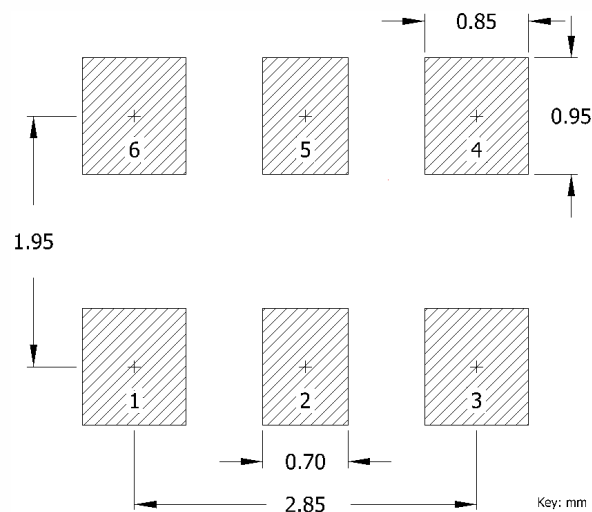
Notes

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.

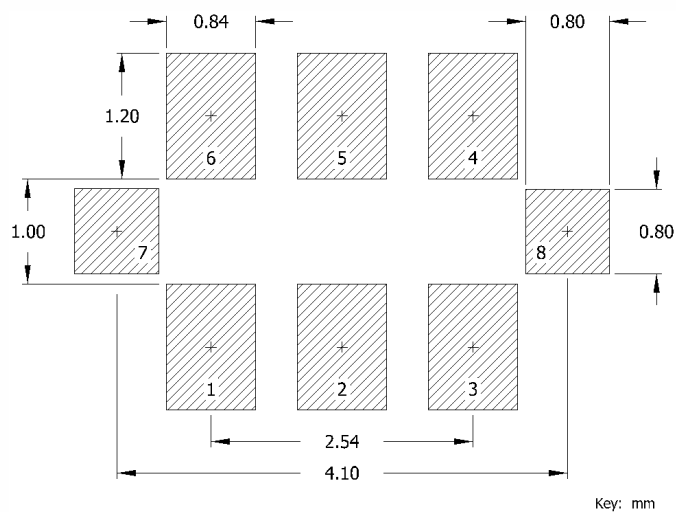
Mechanical Specifications

Recommended Pad Layout

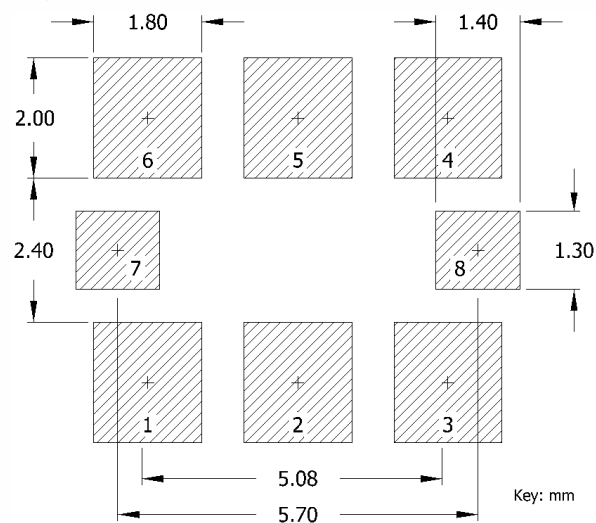
CC32



CC50



CC70



Pin Assignments

LVPECL or LVDS

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

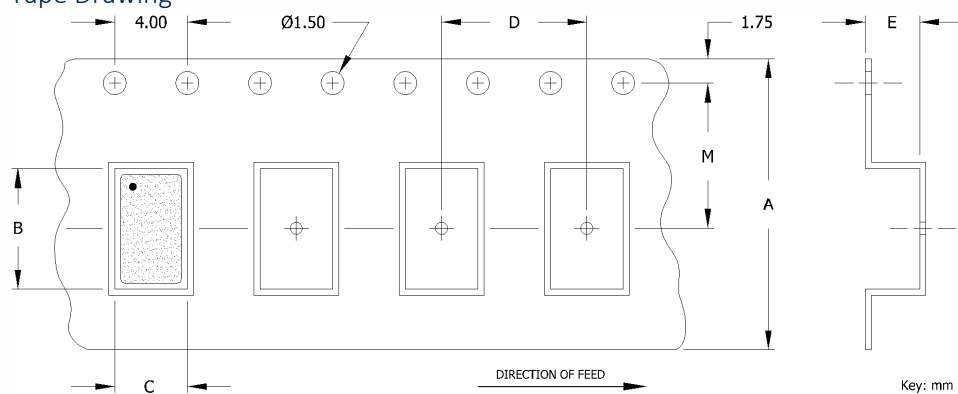
Mechanical Specifications

Table I - Date Code, Beginning year 2021

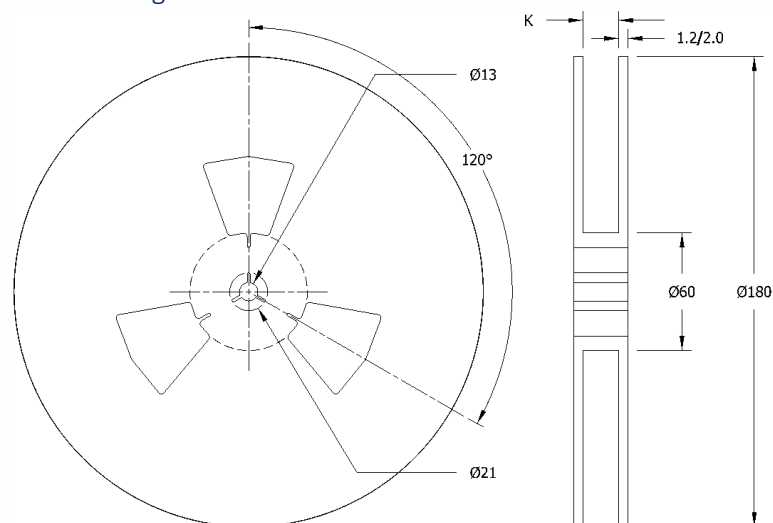
MONTH					JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
YEAR					A	B	C	D	E	F	G	H	J	K	L	M
2021	2025	2029	2033	2037	A	B	C	D	E	F	G	H	J	K	L	M
2022	2026	2030	2034	2038	N	P	Q	R	S	T	U	V	W	X	Y	Z
2023	2027	2031	2035	2039	a	b	c	d	e	f	g	h	j	k	l	m
2024	2028	2032	2036	2040	n	p	q	r	s	t	u	v	w	x	y	z

Packaging - Tape and Reel

Tape Drawing



Reel Drawing



Tape Dimensions

PACKAGE	A	B	C	D	E	M	QUANTITY
CC32	8.00	3.40	2.70	4.00	1.40	3.50	3000
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
8.00
13.00
17.20

Notes

- 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				