

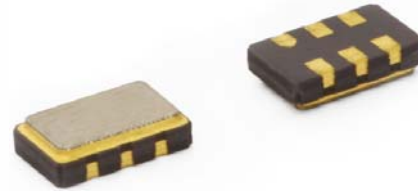


Model 654C

Advanced PLL HCMOS Clock

Features

- Ceramic Surface Mount Package
- Low Phase Jitter Performance, 600fs Typical
- Advanced PLL Design w/ Low Fundamental Crystal
- Frequency Range 10 – 250MHz *
- +2.5V or +3.3V Operation
- Output Enable Standard
- Tape and Reel Packaging, EIA-418



Part Dimensions:
5.0 × 3.2 × 1.2mm • 62.00mg

Applications

- Broadcast Video Systems
- Storage Area Networking
- Broadband Access
- PCI Express
- Networking Equipment
- Ethernet/GbE/SyncE
- Fiber Channel
- Test and Measurement

Standard Frequencies

- 77.76MHz
- 100.00MHz
- 106.25MHz
- 125.00MHz

* Check with factory for availability.

Description

CTS Model 654C is a low cost, high performance PLL clock oscillator supporting HCMOS output. Employing the latest IC technology, M654C has excellent stability and low phase jitter performance.

Ordering Information

Model	Output Type	Frequency Code [MHz]	Frequency Stability	Temperature Range	Supply Voltage	Packaging																	
654	C	XXX or XXXX	3	I	3	T																	
		<table><tr><th>Code</th><th>Frequency</th></tr><tr><td colspan="2">Product Frequency Code ¹</td></tr></table>	Code	Frequency	Product Frequency Code ¹			<table><tr><th>Code</th><th>Temp. Range</th></tr><tr><td>C</td><td>-20°C to +70°C</td></tr><tr><td>I</td><td>-40°C to +85°C</td></tr></table>	Code	Temp. Range	C	-20°C to +70°C	I	-40°C to +85°C		<table><tr><th>Code</th><th>Packing</th></tr><tr><td>T</td><td>1k pcs./reel</td></tr></table>	Code	Packing	T	1k pcs./reel			
Code	Frequency																						
Product Frequency Code ¹																							
Code	Temp. Range																						
C	-20°C to +70°C																						
I	-40°C to +85°C																						
Code	Packing																						
T	1k pcs./reel																						
	<table><tr><th>Code</th><th>Output</th></tr><tr><td>C</td><td>HCMOS</td></tr></table>	Code	Output	C	HCMOS		<table><tr><th>Code</th><th>Stability</th></tr><tr><td>6</td><td>±20ppm ²</td></tr><tr><td>5</td><td>±25ppm</td></tr><tr><td>3</td><td>±50ppm</td></tr></table>	Code	Stability	6	±20ppm ²	5	±25ppm	3	±50ppm		<table><tr><th>Code</th><th>Voltage</th></tr><tr><td>2</td><td>+2.5Vdc</td></tr><tr><td>3</td><td>+3.3Vdc</td></tr></table>	Code	Voltage	2	+2.5Vdc	3	+3.3Vdc
Code	Output																						
C	HCMOS																						
Code	Stability																						
6	±20ppm ²																						
5	±25ppm																						
3	±50ppm																						
Code	Voltage																						
2	+2.5Vdc																						
3	+3.3Vdc																						

Notes:

- 1] Refer to document 016-1454-0, Frequency Code Tables.
3-digits for frequencies <100MHz, 4-digits for frequencies 100MHz or greater.
- 2] Consult factory for availability of 6I Stability/Temperature combination.

**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	-	5.0	V
Supply Voltage	V_{CC}	$\pm 5\%$	2.375 3.135	2.5 3.3	2.625 3.465	V
Supply Current	I_{CC}	Maximum Load	-	20	-	mA
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	-		10 - 250		MHz
Frequency Stability [Note 1]	$\Delta f/f_0$	-		20, 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	-	-		HCMOS		-
Output Load	C_L	-	-	-	15	pF
Output Voltage Levels	V_{OH} V_{OL}	CMOS Load	0.9 V_{CC} -	- -	- 0.1 V_{CC}	V
Output Duty Cycle	SYM	@ 50% Level	45	-	55	%
Rise and Fall Time	T_R, T_F	@ 20%/80% Levels, $C_L = 15\text{pF}$	-	5	10	ns
Start Up Time	T_S	Application of V_{CC}	-	3	5	ms
Enable Function [Standby]						
Enable Input Voltage	V_{IH}	Pin 1 Logic '1', Output Enabled	0.7 V_{CC}	-	-	V
Disable Input Voltage	V_{IL}	Pin 1 Logic '0', Output Disabled	-	-	0.3 V_{CC}	V
Disable Current	I_{IL}	Pin 1 Logic '0', Output Disabled	-	-	20	μA
Enable Time	T_{PLZ}	Pin 1 Logic '1', Output Enabled	-	-	5	ns
Phase Jitter, RMS	t_{jrms}	Bandwidth 12 kHz - 20 MHz	-	600	<1000	fs
Period Jitter, pk-pk	p_{jpk-pk}	-	-	3.0	-	ps
Period Jitter, RMS	p_{jrms}	-	-	30	-	ps

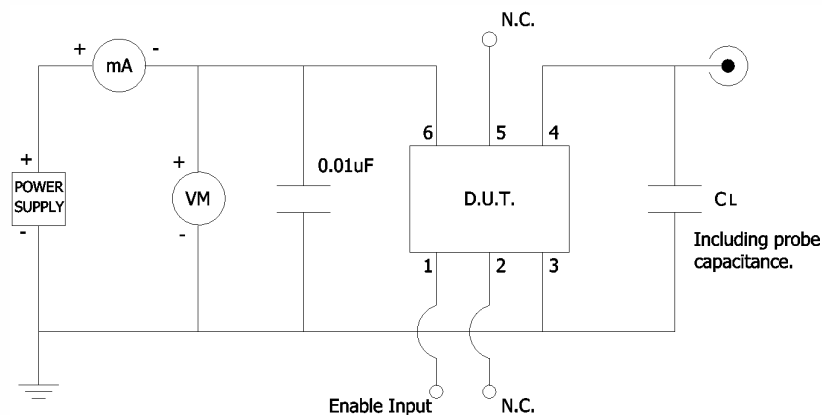
Electrical Specifications

Enable Truth Table

Pin 1	Pin 4
Logic '1'	Output
Open	Output
Logic '0'	High Imp.

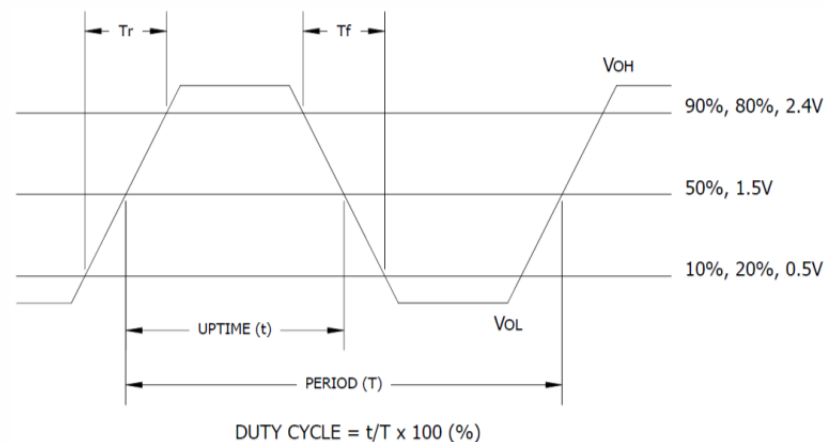
Test Circuit

HCMOS



Output Waveform

HCMOS

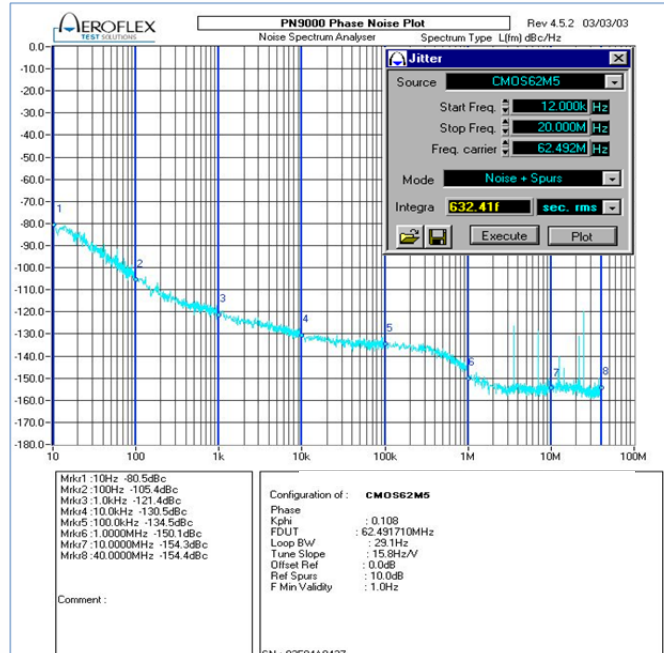


Electrical Specifications

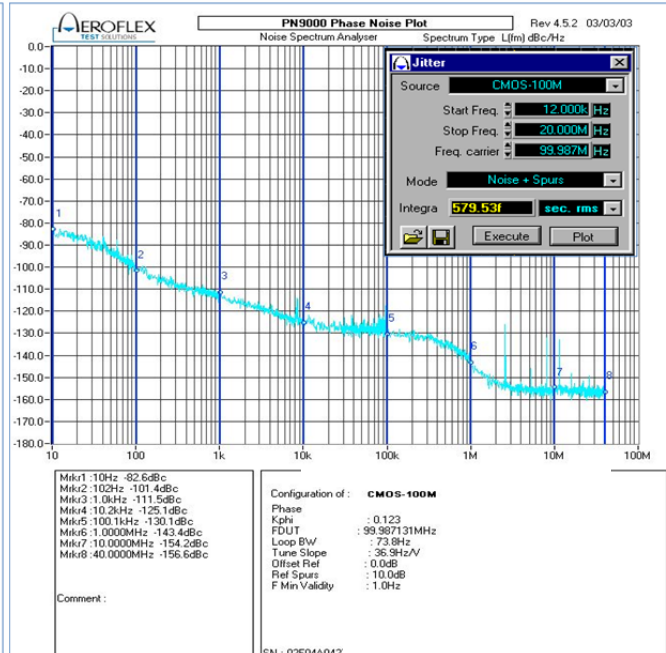
Performance Data

Phase Noise [typical]

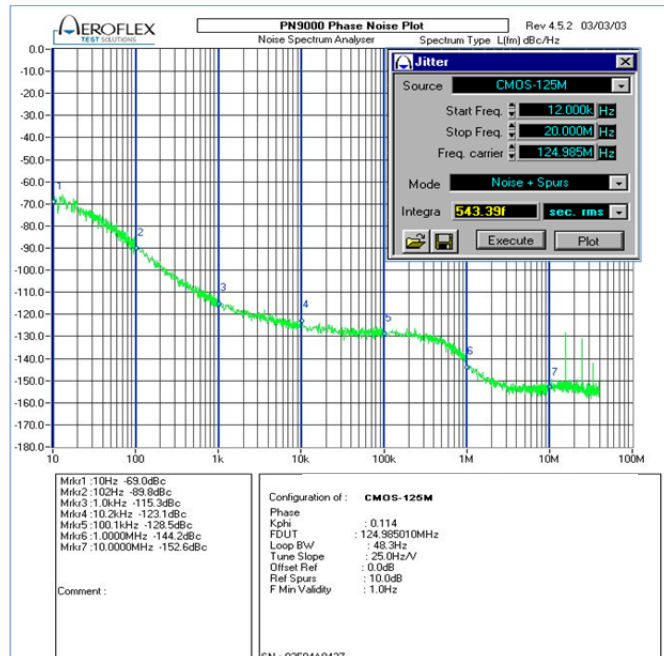
62.50MHz, HCMOS, $V_{CC} = 3.3V$, $T_A = +25^\circ C$



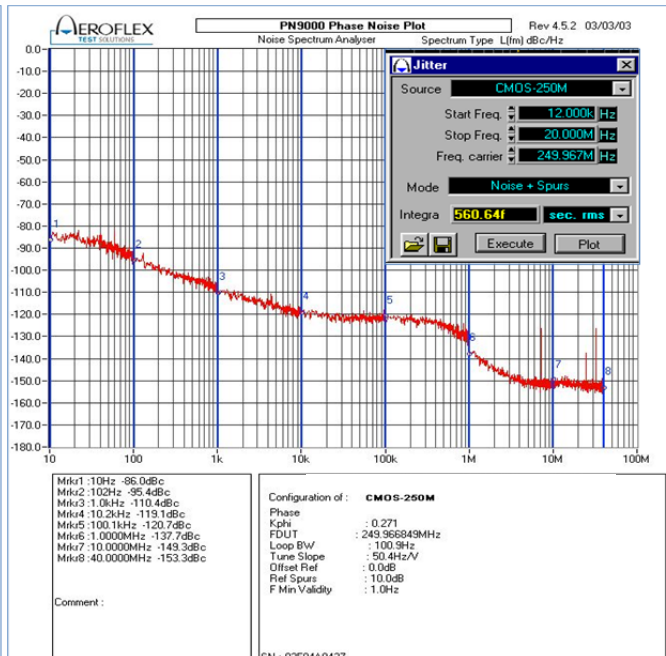
100.00MHz, HCMOS, $V_{CC} = 3.3V$, $T_A = +25^\circ C$



125.00MHz, HCMOS, $V_{CC} = 3.3V$, $T_A = +25^\circ C$



250.00MHz, HCMOS, $V_{CC} = 3.3V$, $T_A = +25^\circ C$





Electrical Specifications

Performance Data

Phase Noise Tabulated

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

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
HCMOS @ 62.5MHz				
Phase Noise	Single Side Band			
	@ 10Hz		-80.50	
	@ 100Hz		-105.40	
	@ 1kHz		-121.40	
	- @ 10kHz		-130.50	dBc/Hz
	@ 100kHz		-134.50	
	@ 1MHz		-150.10	
	@ 10MHz		-154.30	
	@ 40MHz		-154.40	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	632.41	fs

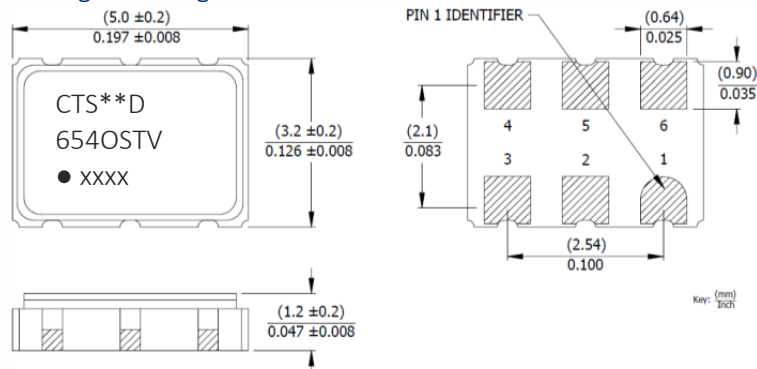
PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
HCMOS @ 125.00MHz				
Phase Noise	Single Side Band			
	@ 10Hz		-69.00	
	@ 100Hz		-89.80	
	@ 1kHz		-115.30	
	- @ 10kHz		-123.10	dBc/Hz
	@ 100kHz		-128.50	
	@ 1MHz		-144.20	
	@ 10MHz		-152.60	
	@ 40MHz		-153.00	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	543.39	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
HCMOS @ 100.00MHz				
Phase Noise	Single Side Band			
	@ 10Hz		-82.60	
	@ 100Hz		-101.40	
	@ 1kHz		-111.50	
	- @ 10kHz		-125.10	dBc/Hz
	@ 100kHz		-130.10	
	@ 1MHz		-143.40	
	@ 10MHz		-154.20	
	@ 40MHz		-156.60	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	579.53	fs

PARAMETER	SYMBOL	CONDITIONS	TYP	UNIT
HCMOS @ 250.00MHz				
Phase Noise	Single Side Band			
	@ 10Hz		-86.00	
	@ 100Hz		-95.40	
	@ 1kHz		-110.40	
	- @ 10kHz		-119.10	dBc/Hz
	@ 100kHz		-120.70	
	@ 1MHz		-137.70	
	@ 10MHz		-149.30	
	@ 40MHz		-153.30	
Phase Jitter, RMS	tjrms	Integration Bandwidth 12kHz - 20MHz	560.64	fs

Mechanical Specifications

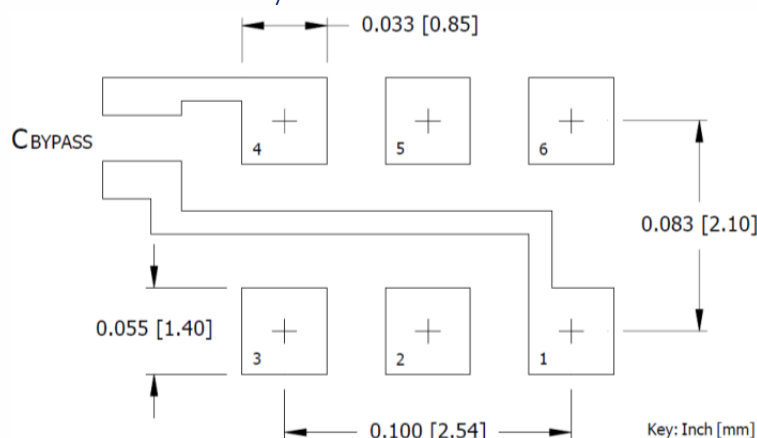
Package Drawing



Marking Information

1. ** - Manufacturing Site Code.
2. D - Date Code. See Table I for codes.
3. O - Output Type; C = HCMOS.
3. ST - Frequency Stability/Temperature Code. [Refer to Ordering Information]
4. V - Voltage Code; 3 = 3.3V, 2 = 2.5V.
5. xxxx - Frequency Code.
3-digits, frequencies below 100MHz
4-digits, frequencies 100MHz or greater
[See document 016-1454-0, Frequency Code Tables.]

Recommended Pad Layout



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.

Pin Assignments

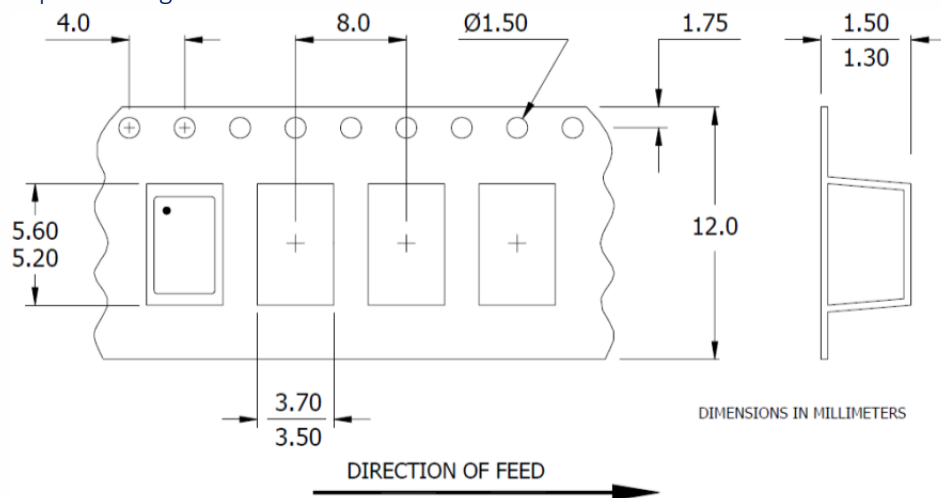
Pin	Symbol	Function
1	EOH	Enable
2	N.C.	No Connect
3	GND	Circuit & Package Ground
4	Output	RF Output
5	Output	Complimentary RF Output
6	V _{CC}	Supply Voltage

Table I - Date Code

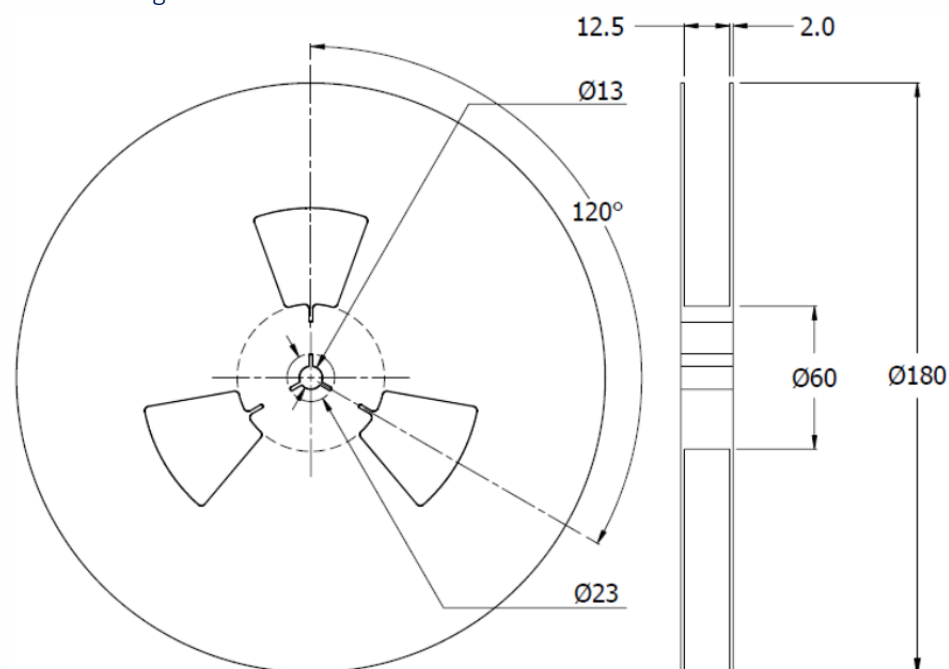
YEAR					MONTH											
2001	2002	2003	2004	2005	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2001	2002	2003	2004	2005	A	B	C	D	E	F	G	H	J	K	L	M
2002	2003	2004	2005	2006	N	P	Q	R	S	T	U	V	W	X	Y	Z
2003	2004	2005	2006	2007	a	b	c	d	e	f	g	h	j	k	l	m
2004	2005	2006	2007	2008	n	p	q	r	s	t	u	v	w	x	y	z

Packaging - Tape and Reel

Tape Drawing



Reel Drawing



Notes

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