



Features

- Wide range of operating supply voltage:
 - 1.62~5.50V(40~135MHz)
 - 2.25~3.63V(120~160MHz)
- Operating temperature range
 - XO5054Cy-C-Q: -40 to 125°C
- High Performance (Low Phase Noise/Low Jitter)
- High Frequency Stability <+/-1.5ppm
- Ultra-Low Drive Level
- Standby function
- High impedance in standby mode, oscillator stops
- CMOS output duty level(1/2VDD)
- 50±10% output duty
- 15/30pF output drive capability
- Die form or Wafer form
- AEC-Q 100 qualified. PPAP capable, and manufactured in IATF 16949 certified facilities.

Description

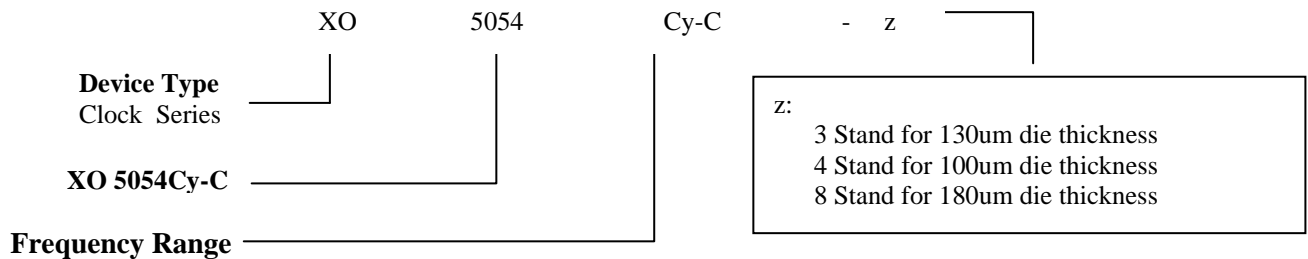
The XO5054Cy-C-Q series are miniature crystal oscillator module ICs. The oscillator circuit stage has Voltage regulator, significantly reducing current consumption and crystal current, compared with existing devices, and significantly reducing the oscillator characteristics supply voltage dependency.

Ordering Information

Part no.	Package type
XO5054Cy-zWF-C-Q	Wafer form
XO5054Cy-zDE-C-Q	Die form

Application

- Used for crystal oscillator
- 7050, 5032 Crystal Oscillator (XO5054Cy-3/8)
- 3225, 2520, Crystal Oscillator (XO5054Cy-3)
- 2016 crystal Oscillator (XO5054Cy-4)



Oscillation frequency range

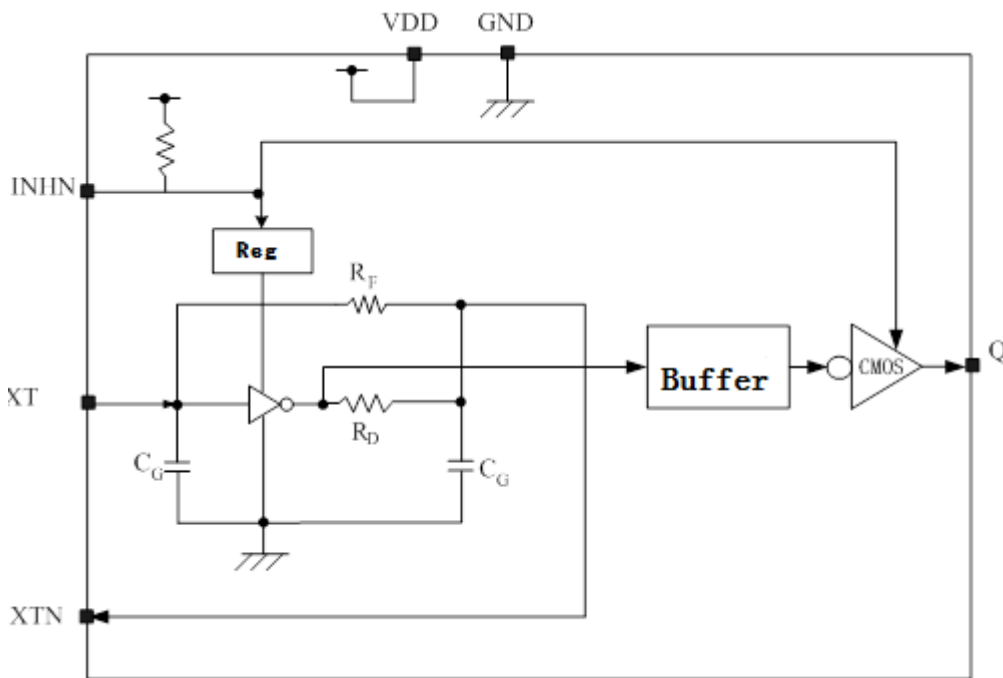
Suffix	Foutput	Frequency range
5054CZ-C-Q	40~50 MHz	40 to 160MHz
5054CX-C-Q	50-65 MHz	
5054CC-C-Q	65~80 MHz	
5054CF-C-Q	70~100 MHz	
5054CH-C-Q	90~135 MHz	
5054CE-C-Q	120~160 MHz	



Series Configuration

Part No.	Output frequency	Operating supply voltage range(V)	Oscillation mode	Recommended oscillation frequency range(MHz)	Output drive capability(mA)	Standby mode	
						Oscillator stop function	Output state
XO5054CZ-C-Q	40~50MHz	1.62~ 5.50	3 rd Overtone	40-160	16	Yes	Hi-Z
XO5054CX-C-Q	50~65MHz	1.62~ 5.50					
XO5054CC-C-Q	65~80MHz	1.62~ 5.50					
XO5054CF-C-Q	70~100MHz	1.62~ 5.50					
XO5054CH-C-Q	90~135MHz	1.62~ 5.50					
XO5054CE-C-Q	120~160MHz	2.25~ 3.63					

Block Diagram





Function Description

Standby Function

When INHN goes LOW, the oscillator stops and the output on Q becomes high impedance.

INHN	Q	Oscillator
HIGH (or open)	Output frequency	Normal operation
Low	High impedance	Stopped

Power-saving Pull-up Resistor

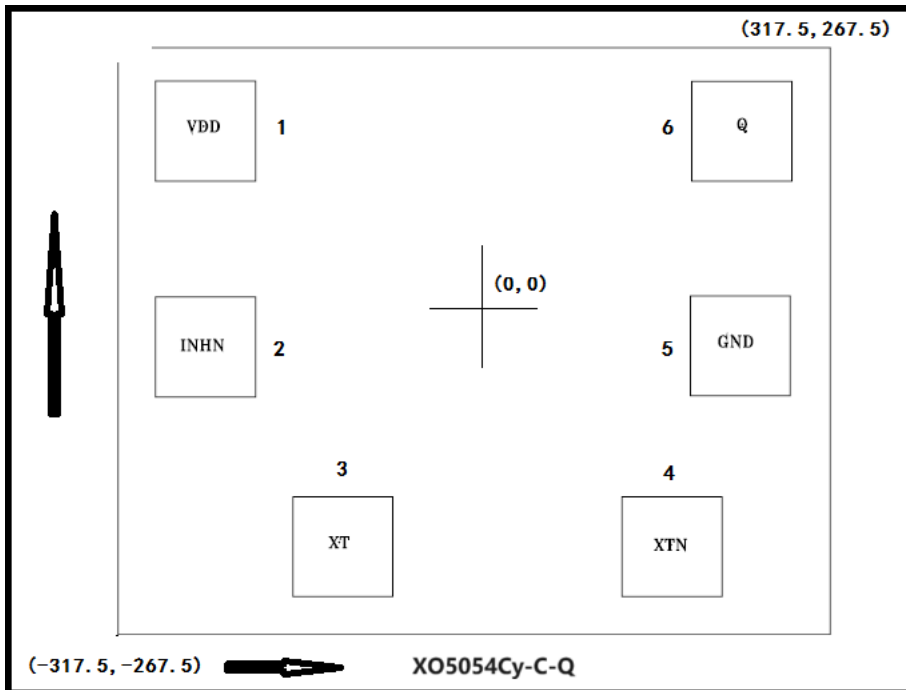
The INHN pin pull-up resistance RUP1 or RUP2 changes in response to the input level (HIGH or LOW). When INHN is tied LOW level, the pull-up resistance is large (RUP1), reducing the current consumed by the resistance. When INHN is left open circuit, the pull-up resistance is small (RUP2), which increases the input susceptibility to external noise. However, the pull-up resistance ties the INHN pin HIGH level to prevent external noise from unexpectedly stopping the output.

Oscillation Detector Function

The XO5054Cy-C-Q series also feature an oscillation detector circuit. This circuit functions make the outputs disable until the oscillator circuit starts and oscillation becomes stable. This alleviates the danger of abnormal oscillator output at oscillator start-up when power is applied or when INHN is switched.



Pad Configuration



Pad Coordinate File					
Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
1	-214.85	168	4	158.35	-164.6
2	-214.85	-4.65	5	213.15	-3.85
3	-105.1	-164.6	6	214.2	167.9

Note: Substrate is connected to GND or floating.
Die Size: 630 μ m*530 μ m (Including scribe line, Scribe Line Width 60 μ m)
Die Thickness: 180 μ m \pm 20 μ m (-8), 130 μ m \pm 15 μ m (-3) or 100 μ m \pm 15 μ m (-4)
Pad Size: 80 μ m*80 μ m **Substrate Level:** GND or Floating

Pad Description

Sym.	Type	Description	
XTN	O	Amplifier output.	Crystal oscillator connected between XT and XTN
XT	I	Amplifier input.	
INH	I	Output state control input. High impedance when LOW. Power-saving pull-up resistor built in.	
V _{DD}	P	Supply voltage	
GND	P	Ground	
Q	O	Output. Output frequency determined by external crystal	



Maximum Ratings

Storage Temperature.....	-65°C to +150°C
Supply Voltage to Ground Potential (V _{DD} to GND).....	-0.5V to +7.0V
DC Input (All Other Inputs except V _{DD} & GND) ...	-0.5V to V _{DD} +0.5V
DC Output.....	-0.5V to V _{DD} +0.5V
DC Output Current (all outputs)	16mA

Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Operating Conditions

(GND=0V, unless otherwise noted.)

Sym.	Parameter	Series	Conditions	Min	Typ	Max	Unit
V _{DD}	Supply voltage	XO5054Cy-C-Q	Except XO5054CE-C-Q	1.62	-	5.50	V
		XO5054CE-C-Q		2.25		3.63	V
V _{IN}	Input voltage	All series		GND	-	VDD	V
T _A	Operating temperature	All series		-40	-	+125	°C
f _{OUT}	Output frequency	XO5054Cy-C-Q		40	-	160	MHz

Reliability Data

Sym.	Parameter	Series	Conditions	Min	Typ	Max	Unit
ESD	Human Body Model	All series	MIL-STD-883H Method 3015.8	+/-3000	+/-5500		V

Note: Industrial Standard ESD: HBM Model +/-2000V



DC Electrical Characteristics

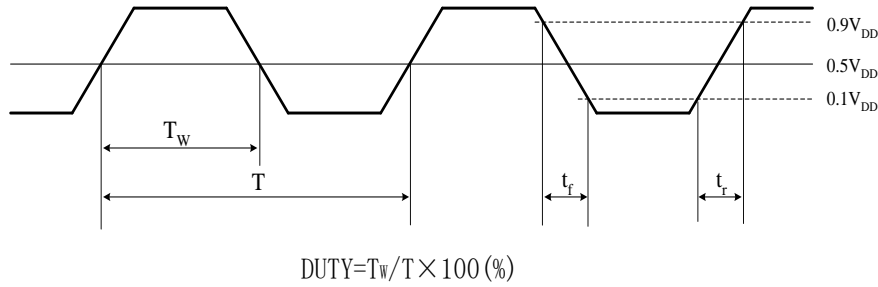
XO5054Cy-C-Q ($V_{DD} = 1.62$ to $5.50V$, $T_A = -40$ to $125^\circ C$, unless otherwise noted.)

Sym.	Parameter	Condition	Datasheet			Unit	
			Min	Typ.	Max		
V_{OH}	HIGH-level output voltage	Q: Measurement cct3, $I_{OH}=8mA$	$V_{DD}-0.4$	-	-	V	
V_{OL}	LOW-level output voltage	Q: Measurement cct3, $I_{OL}=8mA$	-	-	0.4	V	
V_{IH}	HIGH-level input voltage	INH, Measurement cct4	$0.7V_{DD}$	-	-	V	
V_{IL}	LOW-level input voltage	INH, Measurement cct4	--	-	$0.3V_{DD}$	V	
I_Z	Output leakage current	Q: Measurement cct5, INH=LOW	$V_{OH}=V_{DD}$	-	-	10	μA
			$V_{OL}=GND$	-	-	10	μA
I_{DD}	Current consumption	Measurement cct 1, 5054CZ-C-Q $F_{out}=50MHz$ No load	$V_{DD}=1.8V$			10	mA
			$V_{DD}=3.3V$			12	mA
			$V_{DD}=5.0V$			20	mA
		Measurement cct 1, 5054CX-C-Q $F_{out}=60MHz$ No load	$V_{DD}=1.8V$			12	mA
			$V_{DD}=3.3V$			15	mA
			$V_{DD}=5.0V$			25	mA
		Measurement cct 1, 5054CC-C-Q $F_{out}=80MHz$ No load	$V_{DD}=1.8V$			15	mA
			$V_{DD}=3.3V$			18	mA
			$V_{DD}=5.0V$			30	mA
		Measurement cct 1, 5054CF-C-Q $F_{out}=100MHz$ No load	$V_{DD}=1.8V$			18	mA
			$V_{DD}=3.3V$			25	mA
			$V_{DD}=5.0V$			40	mA
		Measurement cct 1, 5054CH-C-Q $F_{out}=125MHz$ No load	$V_{DD}=1.8V$	-		20	mA
			$V_{DD}=3.3V$			30	mA
			$V_{DD}=5.0V$			45	mA
		Measurement cct 1, 5054CE-C-Q $F_{out}=156.25MHz$ No load	$V_{DD}=2.5V$			30	mA
$V_{DD}=3.3V$				40	mA		
I_{ST}	Standby current	Measurement cct1, INH=LOW	-	-	10	μA	
R_{UP1}	INH pull-up resistance	Measurement cct6	0.4	1.5	8	$M\Omega$	
R_{UP2}			30	70	150	$K\Omega$	

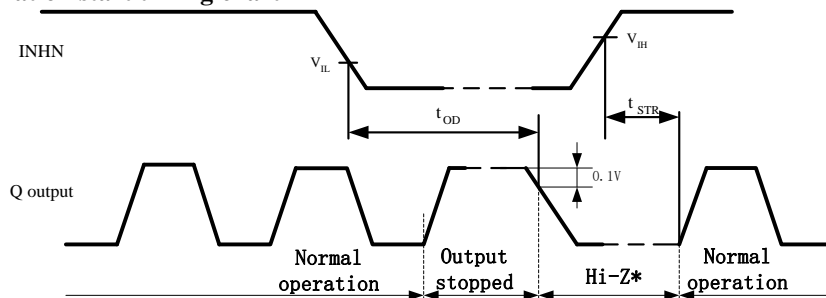


AC Electrical Characteristics

Output switching waveform



Output disable and oscillation start timing chart



When INHN goes HIGH to LOW, the Q output goes HIGH once and then becomes high impedance.

When INHN goes LOW to HIGH, the Q output from high impedance to normal output operation when the oscillation starts (oscillation is detected)

*: the high impedance interval in the figure is shown as a LOW level due to the 1K Ω pull-down resistor connected to the Q pin (see “Measurement circuit 2” in the “Measurement circuits” section)

XO5054Cy-C Series (VDD=1.62 to 5.5V, Ta=-40 to 125°C unless otherwise noted)

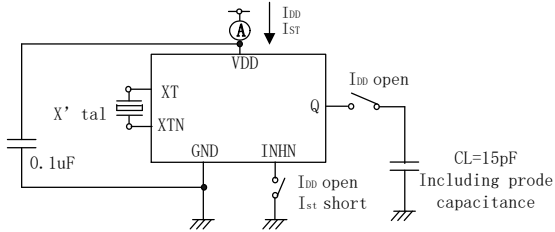
Parameter	Symbol	Condition		Min	Typ.	Max	Unit
Output rise time Output fall time (XO5054CZ-C-Q XO5054CX-C-Q XO5054CC-C-Q)	t_{r1}/t_{f1}	CL=15pF, 0.2V _{DD} ~0.8V _{DD}	V _{DD} =1.62 to 1.98V	-	2.5	3.5	ns
	t_{r2}/t_{f2}	CL=15pF, 0.1V _{DD} ~0.9V _{DD}	V _{DD} = 2.97 to 3.63V	-	1.5	2.5	
	t_{r3}/t_{f3}	CL=15pF, 0.1V _{DD} ~0.9V _{DD}	V _{DD} = 4.5 to 5.50V		1.2	2	
Output rise time Output fall time (XO5054CF-C-Q XO5054CH-C-Q) (XO5054CE-C-Q: 3.3V)	t_{r1}/t_{f1}	CL=15pF, 0.2V _{DD} ~0.8V _{DD}	V _{DD} =1.62 to 1.98V	-	2.0	3.0	ns
	t_{r2}/t_{f2}	CL=15pF, 0.1V _{DD} ~0.9V _D	V _{DD} =2.97 to 3.63V	-	1.0	2.0	
	t_{r3}/t_{f3}	CL=15pF, 0.1V _{DD} ~0.9V _{DD}	V _{DD} =4.5 to 5.50V		0.7	1.5	
Output duty cycle	Duty	Measurement cct 1, T _A =25°C, C _L =15pF		40	50	60	%
Output disable delay time	t _{OD}	Measurement cct 1, T _A =25°C, C _L ≤15pF		-	-	50	us



Measurement Circuit

Measurement cct1

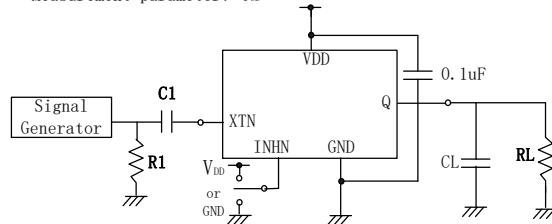
Measurement parameter: I_{DD} , I_{ST} , Duty, t_r , t_f



Note: The AC characteristics are observed using an oscilloscope on pin Q

Measurement cct2

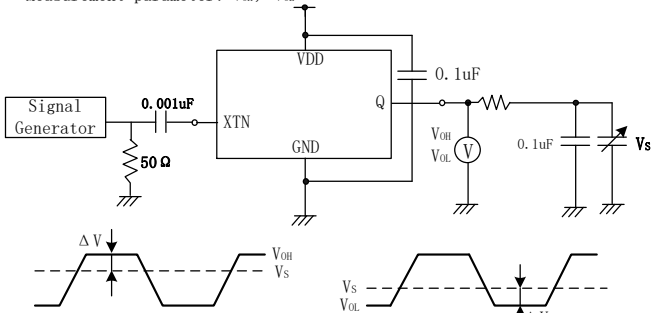
Measurement parameter: t_{DD}



XTN input signal: 1Vp-p, sina wave
C1: 0.001uF CL: 15pF
R1: 50Ω RL: 1KΩ

Measurement cct3

Measurement parameter: V_{OH} , V_{OL}



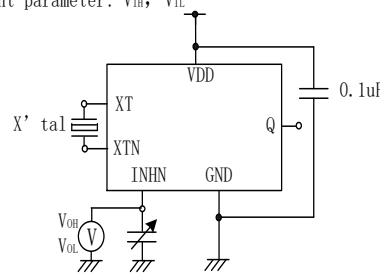
V_s adjusted such that $\Delta V = 50 \times I_{OH}$

V_s adjusted such that $\Delta V = 50 \times I_{OL}$

XTN input signal: 1Vp-p, sina wave

Measurement cct4

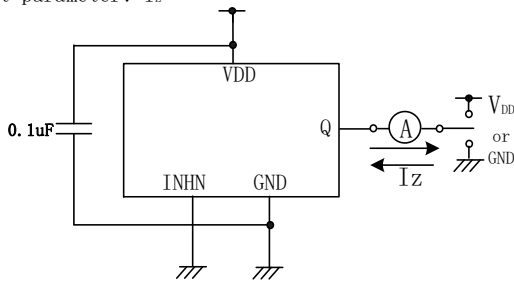
Measurement parameter: V_{IH} , V_{IL}



V_{IH} : Voltage is 0V to V_{DD} transition that changes the output state.
 V_{IL} : Voltage is V_{DD} to 0V transition that changes the output state.
INHN has an oscillation stop function

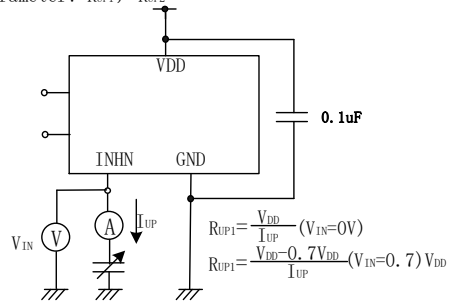
Measurement cct5

Measurement parameter: I_z



Measurement cct6

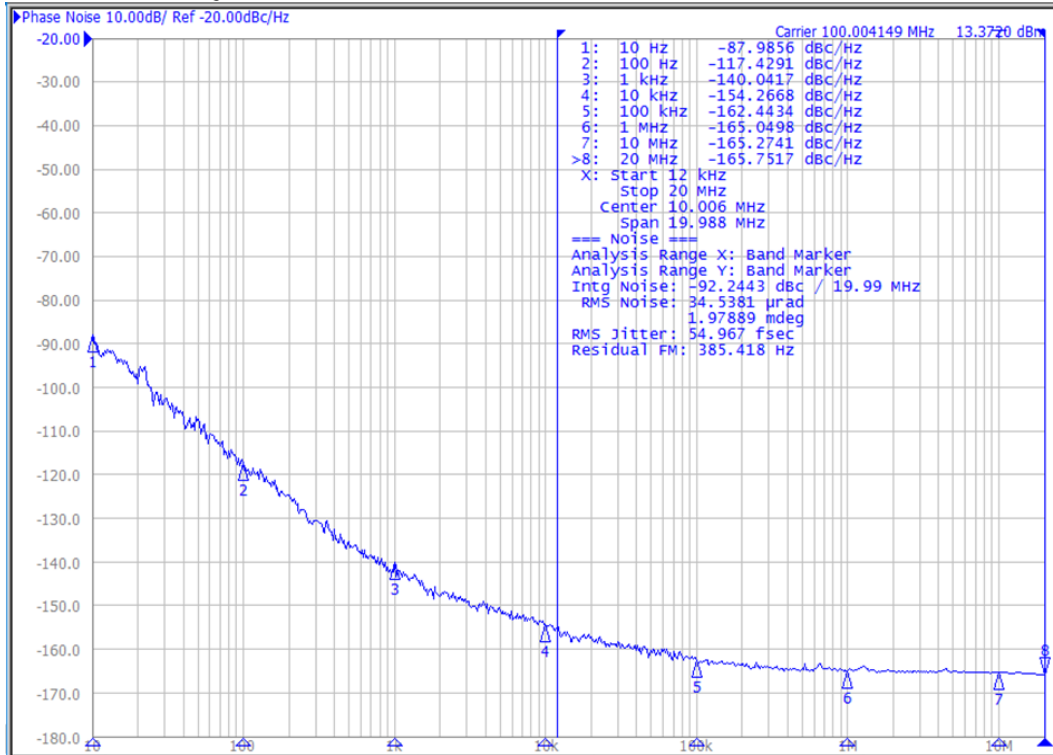
Measurement parameter: R_{UP1} , R_{UP2}



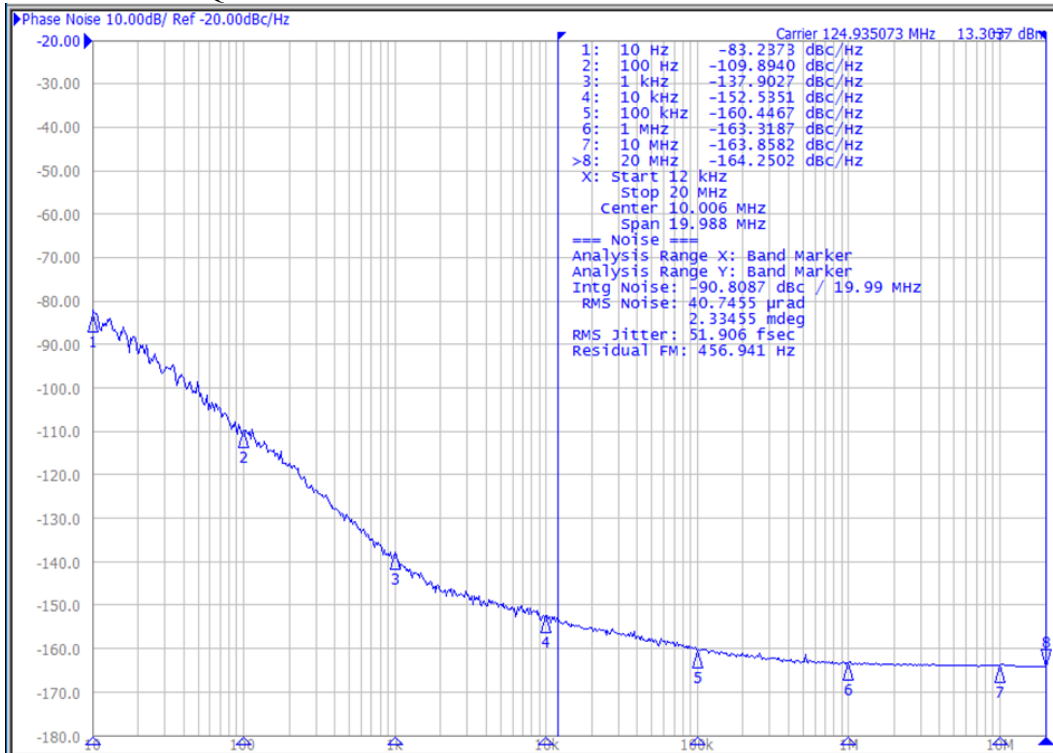


Phase noise:

XO5054CF-C-Q: 100MHz/3.3V



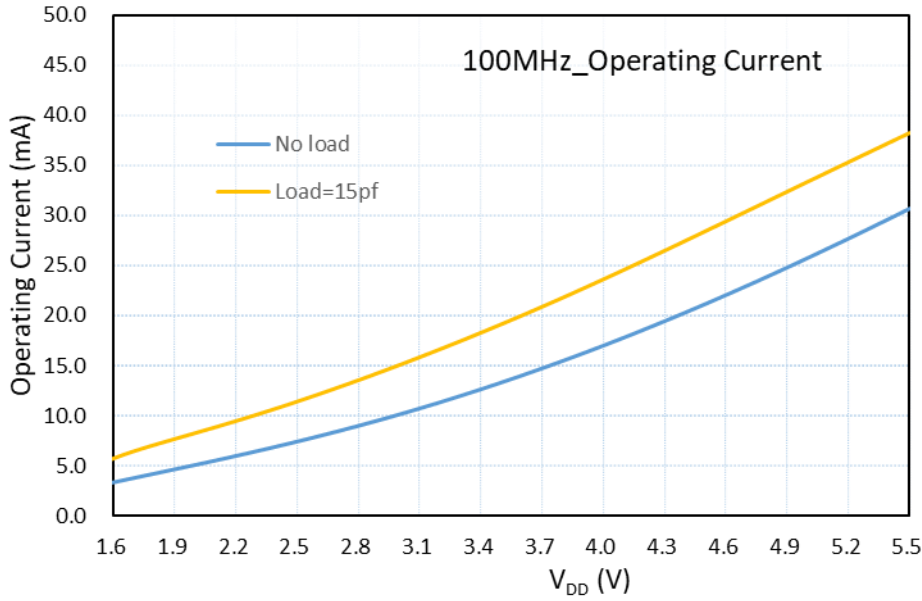
XO5054CH-C-Q: 125MHz/3.3V



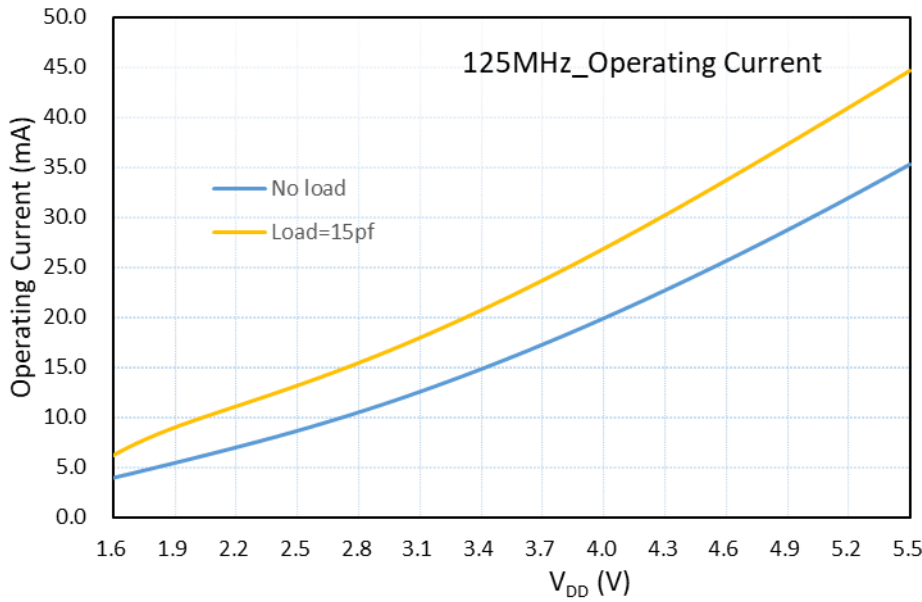


Operating current:

XO5054CF-C-Q: 100MHz



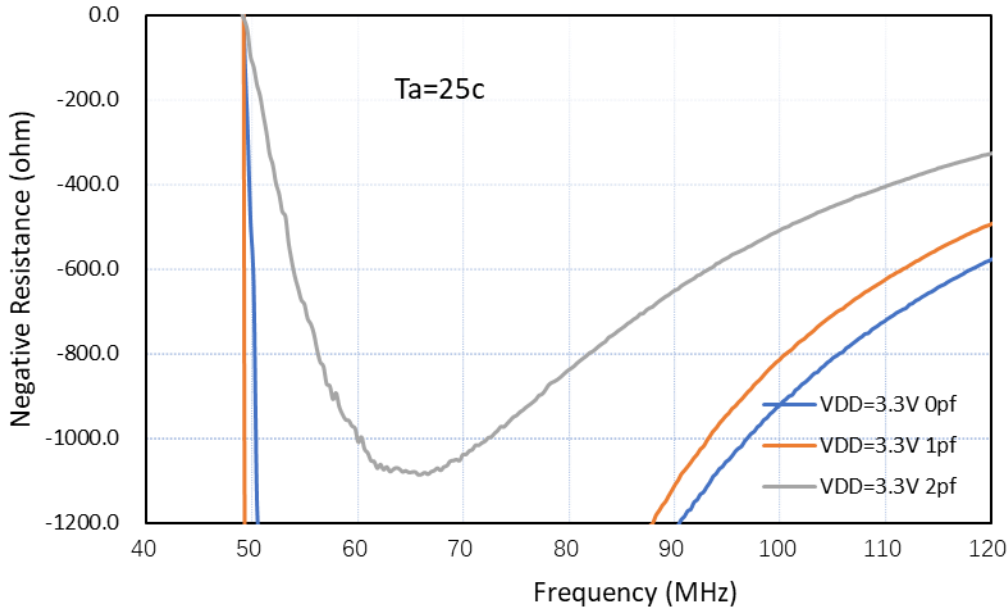
XO5054CH-C-Q: 125MHz



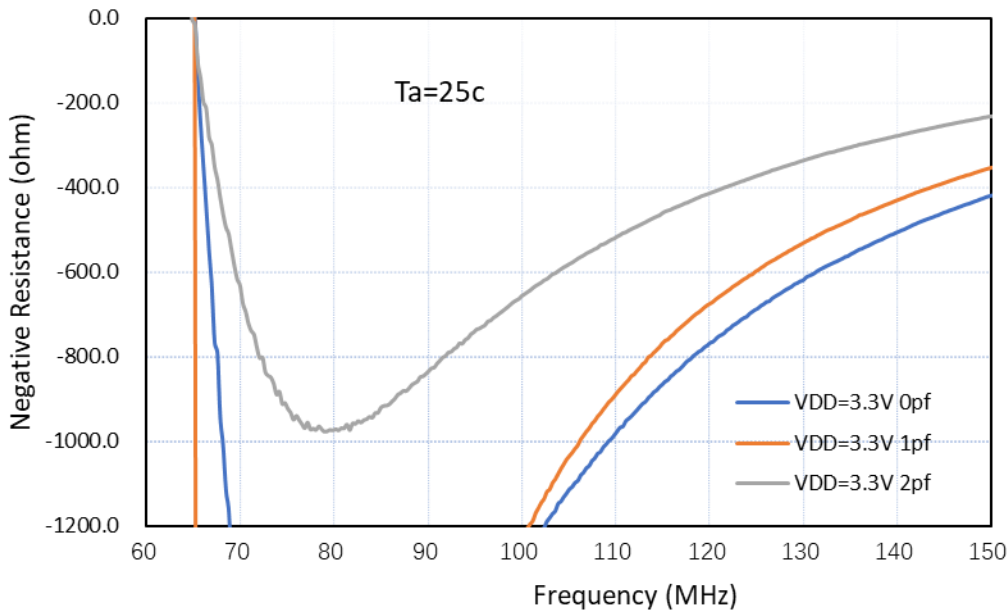


Negative resistance

XO5054CF-C-Q: VDD=3.3V(Operating Frequency range: 70MHz~100MHz)



XO5054CH-C-Q: VDD=3.3V (Operating Frequency range: 90MHz~135MHz)





Revision History

Revision	Description	Date
V0.9	Initiated	2023/11/9