

OO-U Type Ultra Low Phase Noise

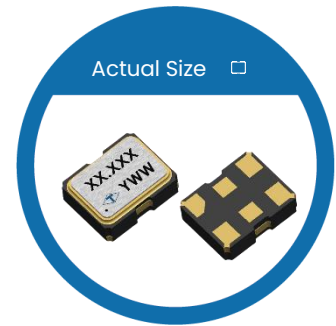
2.0 x 1.6 mm SMD Differential Output Crystal Oscillator

FEATURES

- Industry Standard 2.0 x 1.6 x 0.7mm Hermetically Sealed Ceramic Package
- Ultra Low Jitter Performance: Typical 40fs RMS from 12kHz - 20MHz
- Differential Output Level: LVPECL, LVDS and HCSL
- Operation Supply Voltage: 1.8V, 2.5V and 3.3V

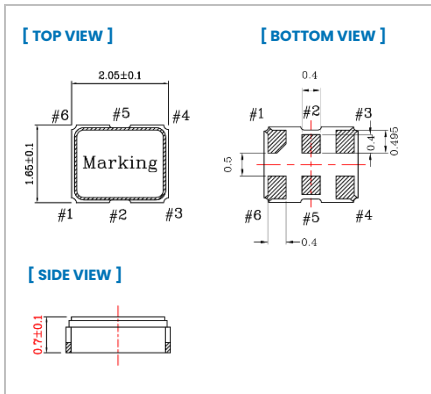
TYPICAL APPLICATION

- 400Gbit/800Gbit/1.6Tbit Optical Module, Fiber Channel
- Network Equipment: Router, Switch..etc
- Ethernet, MAN, SONET, Data Center
- Test Instrumentation

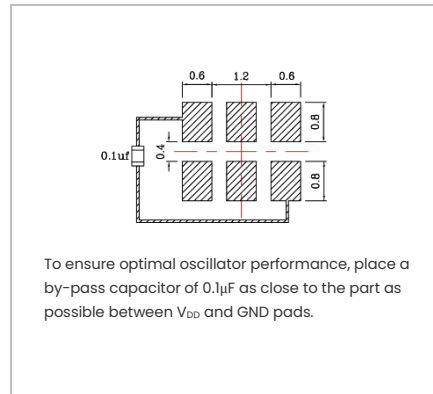


RoHS Compliant

DIMENSION (mm)



SOLDER PAD LAYOUT (mm)



PIN FUNCTION

PIN#	FUNCTION
1	Tri-State
2	NC
3	GND
4	Output
5	Comp. Output
6	V _{DD}

ELECTRICAL SPECIFICATION

Parameter	Symbol	LVPECL						Unit	Conditions / Remarks	
		3.3V			2.5V					
		Min.	Typ.	Max.	Min.	Typ.	Max.			
Supply Voltage Variation	V _{DD}	V _{DD} - 10%	V _{DD}	V _{DD} + 10%	V _{DD} - 5%	V _{DD}	V _{DD} + 5%	V		
Frequency Range	F _O	100	-	160	100	-	160	MHz	(*)	
Standard Frequency		100, 156.25						MHz	(*)	
Power Current Consumption	I _{DD}	-	38	60	-	38	60	mA	OE=V _{DD} Terminated to V _{DD} -2V	
Output Voltage	High-Level	V _{OH}	V _{DD} -1.105	V _{DD} -0.95	V _{DD} -0.88	V _{DD} -1.105	V _{DD} -0.95	V _{DD} -0.88	V	
	Low-Level	V _{OL}	V _{DD} -1.81	V _{DD} -1.7	V _{DD} -1.59	V _{DD} -1.81	V _{DD} -1.7	V _{DD} -1.59	V	
Differential Output Swing	V _{SW}	0.8	-	2	0.8	-	2	V		
Output Amplitude (Single-ended output signal)	V _{OPP}	0.4	0.75	0.95	0.4	0.75	0.95	V		
Transition Time 20%~80%, V _{OPP}	Rise Time	T _r	-	0.2	0.4	-	0.2	0.4	nSec	
	Fall Time	T _f	-	0.2	0.4	-	0.2	0.4	nSec	
Duty Cycle	Duty	45	-	55	45	-	55	%		
Start-up Time	T _{start}	-	-	2	-	-	2	mSec	Start from t=0 to 90% V _{DD}	
OE (Tri-State)	Enable Voltage	V _H	0.7 x V _{DD}	-	-	0.7 x V _{DD}	-	-	V	
	Disable Voltage	V _L	-	-	0.3 x V _{DD}	-	-	0.3 x V _{DD}	V	
Stand by Current	I _{DD}	-	8	10	-	8	10	µA	OE=GND	
Output Loading		50						Ω	Terminated to V _{DD} -2V	
Phase Noise	Offset 10kHz	-	-151	-	-	-151	-	dBc/Hz	F _O =156.25MHz	
	Offset 100kHz	-	-158	-	-	-158	-	dBc/Hz		
	Offset 1MHz	-	-159	-	-	-159	-	dBc/Hz		
RMS Phase Jitter	Phj	-	40	80	-	40	80	fSec	Integrated 12kHz - 20MHz Offset Frequency F _O =156.25MHz	
Aging	Ag	-	-	±3	-	-	±3	ppm	T=25°C, First Year	
Junction Temperature	T _j	-40	-	125	-40	-	125	°C		
Storage Temp. Range	T _{stg}	-55	-	150	-55	-	150	°C		

*1: Standard frequencies are frequencies in which the crystal has been designed and does not imply a stock position.

Note: not all combination of options are available. Other specifications may be available upon request.
 Specifications subject to change with notice.

Parameter	Symbol	LVDS									Unit	Conditions / Remarks	
		3.3V			2.5V			1.8V					
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.			
Supply Voltage Variation	V _{DD}	V _{DD} - 10%	V _{DD}	V _{DD} + 10%	V _{DD} - 10%	V _{DD}	V _{DD} + 10%	V _{DD} - 5%	V _{DD}	V _{DD} + 5%	V		
Frequency Range	F ₀	100	-	160	100	-	160	100	-	160	MHz	(*)	
Standard Frequency		100, 156.25									MHz	(*)	
Power Current Consumption	I _{DD}	-	15	20	-	15	20	-	15	20	mA	OE= V _{DD}	
Output Voltage (Single-ended)	High-Level	V _{OH}	-	1.42	1.6	-	1.42	1.6	-	1.42	1.6	V	
	Low-Level	V _{OL}	0.9	1.07	-	0.9	1.07	-	0.9	1.07	-	V	
Differential Output Voltage (Out_H-Out_L)	V _{OD}	247	330	454	247	330	454	247	330	454	mV	V _{OD} =OUT(High)-OUTN(Low)	
Differential Output Voltage Error	ΔV _{OD}	-	-	50	-	-	50	-	-	50	mV	ΔV _{OD} = V _{OD1} -V _{OD2}	
Differential Output Amplitude	V _{SW}	0.494	-	0.9	0.494	-	0.9	0.494	-	0.9	V		
Offset Voltage	V _{OS}	1.125	1.25	1.375	1.125	1.25	1.375	1.125	1.25	1.375	V	Offset Voltage, V _{OS1} , V _{OS2}	
Offset Voltage Error	ΔV _{OS}	-	-	50	-	-	50	-	-	50	mV	ΔV _{OS} = V _{OS1} -V _{OS2}	
Transition Time 20%-80%, V _{OD}	Rise Time	Tr	-	0.2	0.5	-	0.2	0.5	-	0.2	0.5	nSec	
	Fall Time	Tf	-	0.2	0.5	-	0.2	0.5	-	0.2	0.5	nSec	
Duty Cycle	Duty	45	-	55	45	-	55	45	-	55	%		
Start-up Time	T _{start}	-	-	2	-	-	2	-	-	2	mSec	Start from t=0 to 90% V _{DD}	
Tri-State	Enable Voltage	V _H	0.7 x V _{DD}	-	-	0.7 x V _{DD}	-	-	0.7 x V _{DD}	-	-	V	
	Disable Voltage	V _L	-	-	0.3 x V _{DD}	-	-	0.3 x V _{DD}	-	-	0.3 x V _{DD}	V	
Stand by Current	I _{DD}	-	8	10	-	8	10	-	8	10	μA	OE=GND	
Output Loading		100									Ω	Connect between OUT and OUTn	
Phase Noise	Offset 10kHz	-	-147	-	-	-147	-	-	-146	-	dBc/Hz		
	Offset 100kHz	-	-156	-	-	-156	-	-	-155	-	dBc/Hz	F ₀ =156.25MHz	
	Offset 1MHz	-	-158	-	-	-158	-	-	-158	-	dBc/Hz		
RMS Phase Jitter	Phj	-	40	70	-	40	70	-	40	70	fSec	Integrated 12kHz - 20MHz Offset Frequency F ₀ =156.25MHz	
Aging	Ag	-	-	±3	-	-	±3	-	-	±3	ppm	T=25°C, First Year	
Junction Temperature	Tj	-40	-	125	-40	-	125	-40	-	125	°C		
Storage Temp. Range	Tstg	-55	-	150	-55	-	150	-55	-	150	°C		

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Parameter	Symbol	HCSL									Unit	Conditions / Remarks	
		3.3V			2.5V			1.8V					
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.			
Supply Voltage Variation	V _{DD}	V _{DD} - 10%	V _{DD}	V _{DD} + 10%	V _{DD} - 10%	V _{DD}	V _{DD} + 0%	V _{DD} - 5%	V _{DD}	V _{DD} + 5%	V		
Frequency Range	F ₀	100	-	160	100	-	160	100	-	160	MHz	(*)	
Standard Frequency		100, 156.25									MHz	(*)	
Power Current Consumption	I _{DD}	-	24	38	-	24	38	-	20	32	mA	OE= V _{DD}	
Output Voltage (Single-ended)	High-Level	V _{OH}	0.55	-	0.9	0.55	-	0.9	0.5	-	1.0	V	
	Low-Level	V _{OL}	-0.15	-	0.15	-0.15	-	0.15	-0.15	-	0.15	V	
Output Swing (Single-ended output signal)	V _{OPP}	0.55	-	-	0.55	-	-	0.5	-	-	V		
Transition Time 20%-80%, V _{OD}	Rise Time	Tr	-	0.3	0.6	-	0.3	0.6	-	0.3	0.6	nSec	
	Fall Time	Tf	-	0.3	0.6	-	0.3	0.6	-	0.3	0.6	nSec	
Duty Cycle	Duty	45	-	55	45	-	55	45	-	55	%		
Start-up Time	T _{start}	-	-	2	-	-	2	-	-	2	mSec	Start from t=0 to 90% V _{DD}	
Tri-State	Enable Voltage	V _H	0.7 x V _{DD}	-	-	0.7 x V _{DD}	-	-	0.7 x V _{DD}	-	-	V	
	Disable Voltage	V _L	-	-	0.3 x V _{DD}	-	-	0.3 x V _{DD}	-	-	0.3 x V _{DD}	V	
Stand by Current	I _{DD}	-	-	10	-	-	10	-	-	10	μA	OE=GND	
Output Loading		50 (to GND)									Ω	Terminated to GND	
Phase Noise	Offset 10kHz	-	-152	-	-	-152	-	-	-152	-	dBc/Hz		
	Offset 100kHz	-	-157	-	-	-157	-	-	-157	-	dBc/Hz	F ₀ =156.25MHz	
	Offset 1MHz	-	-160	-	-	-160	-	-	-160	-	dBc/Hz		
RMS Phase Jitter	Phj	-	40	70	-	40	70	-	50	80	fSec	Integrated 12kHz - 20MHz Offset Frequency F ₀ =156.25MHz	
Aging	Ag	-	-	±3	-	-	±3	-	-	±3	ppm	T=25°C, First Year	
Junction Temperature	Tj	-40	-	125	-40	-	125	-40	-	125	°C		
Storage Temp. Range	Tstg	-55	-	150	-55	-	150	-55	-	150	°C		

*1: Standard frequencies are frequencies in which the crystal has been designed and does not imply a stock position.

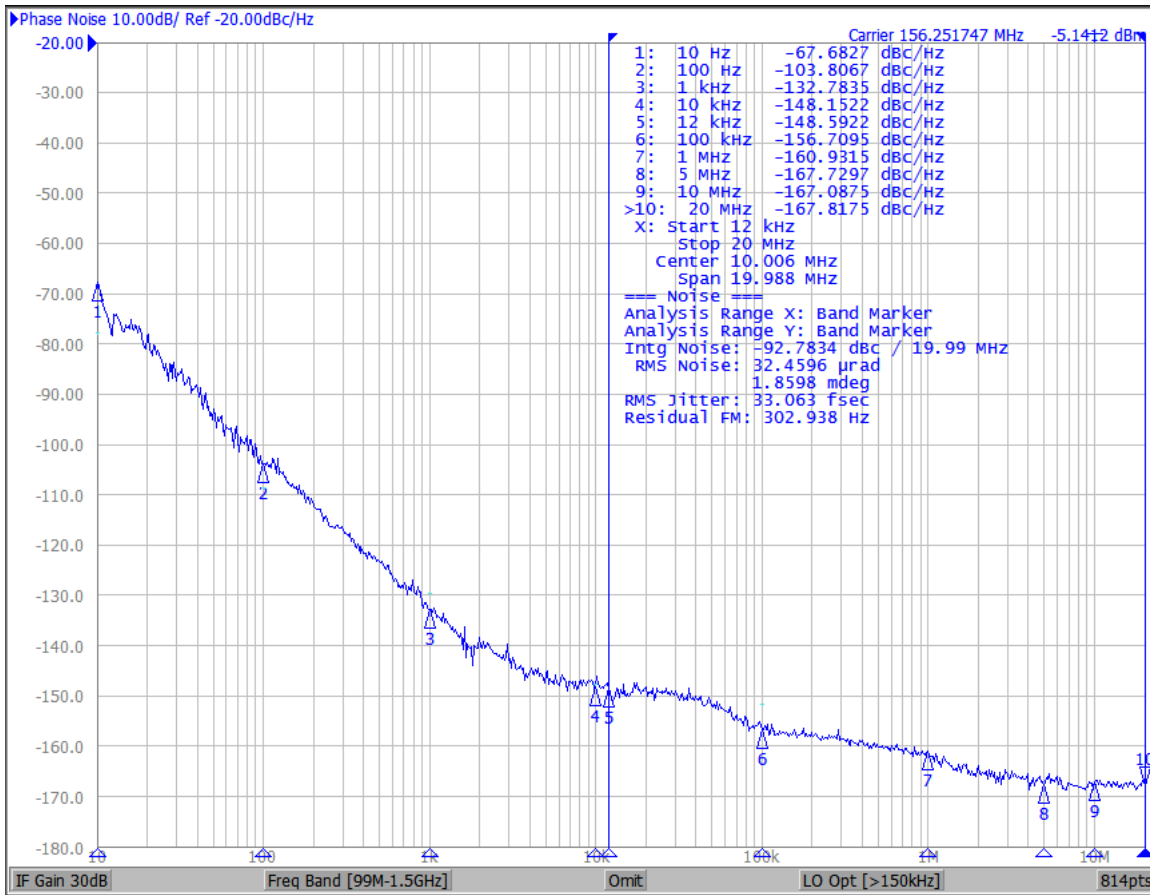
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FREQ. STABILITY vs. TEMP. RANGE

Temp.(°C)	ppm	±20	±25	±50	±100
-20 ~ +70		○	○	○	○
-40 ~ +85		△	○	○	○
-40 ~ +105		X	X	○	○
-40 ~ +125		X	X	△	○

○ : Available △ : Conditional X : Not Available
 Inclusive of Calibration @ 25°C, Operating Temperature Range, Input Voltage Variation, Load Variation, Aging (1st year), Shock, and Vibration

Phase Noise Data: Typical 33fs @offset 12k-20M, OO Type LVDS output, 3.3V, 156.25MHz



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