

Helping Customers Innovate, Improve & Grow



### Description

The VS-501 VCSO (Voltage Controlled Saw Oscillator) from Vectron is a high frequency, ultra low phase noise oscillator designed to support high speed data converters and 100G / 400G coherent optical receivers. The VS-501 provides 12fs rms jitter in a 12kHz to 20MHz integration bandwidth and is available from 0.6 to 3.0GHz.

### Features

- Frequency Range 0.6 to 3.0 GHz
- Ultra low jitter performance
- Typical Jitter: 12fsec rms, 12kHz to 20MHz
- 3.3 + 5V supply voltage
- Output: Sinewave, balanced Sinewave, LVPECL
- 9x14 mm SMD package
- See table on Page 5 for standard frequencies

### Applications

- High Speed ADCs
- 100G & 400G Coherent Receivers
- Test & Measurement

### Performance Specifications

Pulling Characteristics					
Parameter	Min	Typ	Max	Units	Notes
Absolute Pull Range (APR)	±20			ppm	Includes df vs: •Operating temperature range +10 .. 85°C •Aging 10 years •Supply Voltage Change 5% •Load change 10%
Tuning Slope					Positive
Control Voltage Range	0.5	2.5	4.5	V DC	with $V_s = 5V$
	0	1.65	3.3	VDC	with $V_s = 3.3V$
Frequency control input impedance	100			k $\Omega$	
Modulation bandwidth	20			kHz	@ -3dB
Supply Voltage ( $V_s$ )					
Supply voltage (standard)	4.75	5.00	5.25	V DC	
Current consumption			100	mA	
Supply voltage (standard)	3.135	3.3	3.465	V DC	
Current consumption			150	mA	

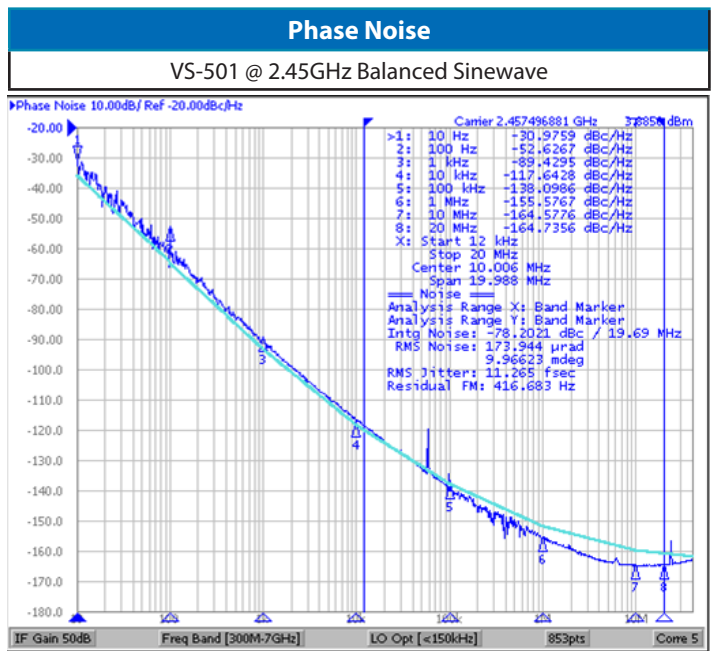
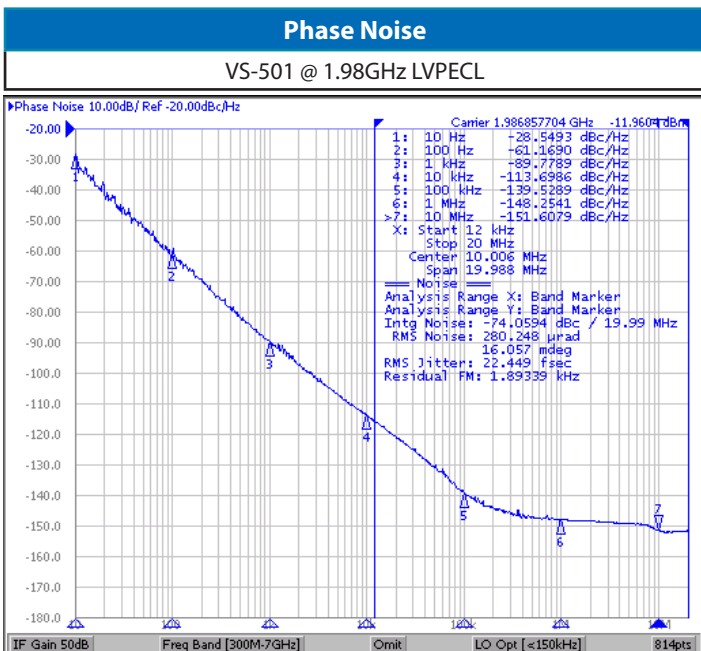
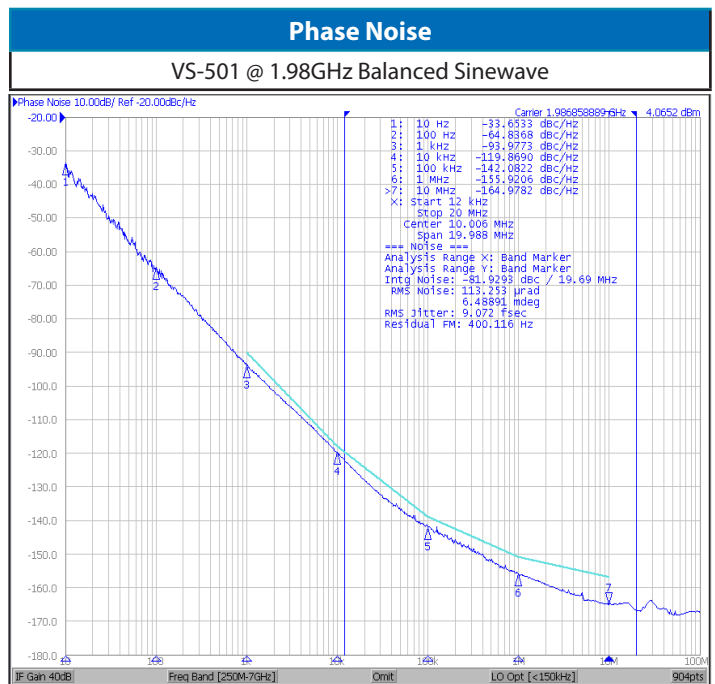
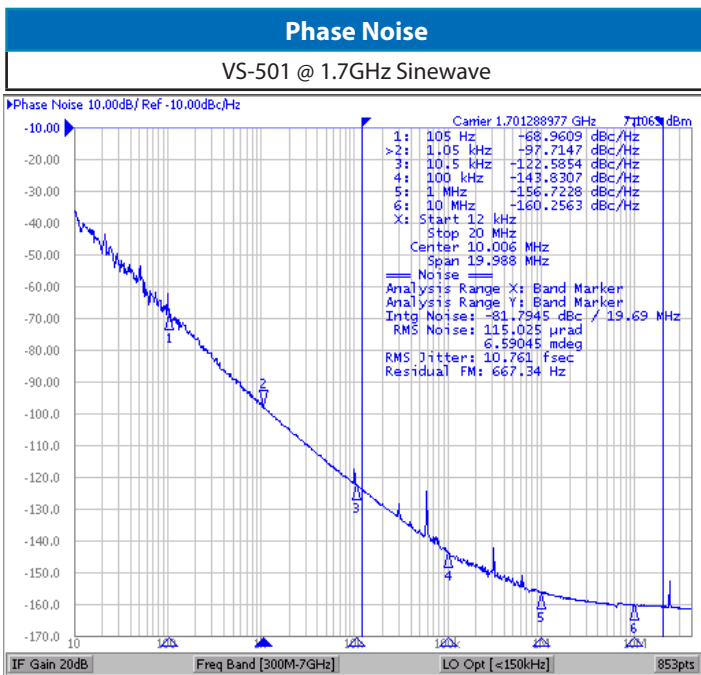
## Performance Specifications (Continued)

RF Output					
Parameter	Min	Typ	Max	Units	Notes
Signal	Sinewave				
Load	45	50	55	$\Omega$	
Output Power	7	8.5	12	dBm	
Phase Noise: 100Hz offset		-68		dBc/Hz	@ 1.7GHz Sinewave 5V
Phase Noise: 1kHz offset		-96		dBc/Hz	
Phase Noise: 10kHz offset		-122		dBc/Hz	
Phase Noise: 100kHz offset		-145		dBc/Hz	
Phase Noise: 1MHz offset		-156		dBc/Hz	
Phase Noise: 10MHz offset		-160		dBc/Hz	
Jitter: 12kHz to 20MHz offset		12		fs rms	
Signal	Balanced Sinewave				
Load	45	50	55	$\Omega$	
Output Power	0	3	6	dBm	
Phase Noise: 100Hz offset		-64		dBc/Hz	@ 1.98GHz Balanced Sinewave 3.3V
Phase Noise: 1kHz offset		-93		dBc/Hz	
Phase Noise: 10kHz offset		-119		dBc/Hz	
Phase Noise: 100kHz offset		-142		dBc/Hz	
Phase Noise: 1MHz offset		-155		dBc/Hz	
Phase Noise: 10MHz offset		-164		dBc/Hz	
Jitter: 12kHz to 20MHz offset		9		fs rms	
Signal	LVPECL				
Load	45	50	55	$\Omega$	
Duty Cycle	45		55	%	
Phase Noise: 100Hz offset		-61		dBc/Hz	@ 1.98GHz LVPECL 3.3V
Phase Noise: 1kHz offset		-89		dBc/Hz	
Phase Noise: 10kHz offset		-113		dBc/Hz	
Phase Noise: 100kHz offset		-139		dBc/Hz	
Phase Noise: 1MHz offset		-148		dBc/Hz	
Phase Noise: 10MHz offset		-151		dBc/Hz	
Jitter: 12kHz to 20MHz offset		22		fs rms	
Signal	Balanced Sinewave				
Load	45	50	55	$\Omega$	
Output Power	0	3	6	dBm	
Phase Noise: 100Hz offset		-52		dBc/Hz	@ 2.45GHz Balanced Sinewave 3.3V
Phase Noise: 1kHz offset		-89		dBc/Hz	
Phase Noise: 10kHz offset		-117		dBc/Hz	
Phase Noise: 100kHz offset		-138		dBc/Hz	
Phase Noise: 1MHz offset		-155		dBc/Hz	
Phase Noise: 10MHz offset		-164		dBc/Hz	
Jitter: 12kHz to 20MHz offset		11		fs rms	

# Performance Specifications (Continued)

Additional Parameters					
Parameter	Min	Max	Units	Notes	
Weight	2.0g				
Subharmonics		-30 -25	dBc dBc	< 2 GHz > 2 GHz	
Processing and Packing	Handling and Processing Note				
Absolute Maximum Ratings					
Parameter	Min	Max	Units	Notes	
Supply Voltage (V <sub>s</sub> )		6.0	V		
Operable Temperature Range	-40	+85	°C		
Storage Temperature Range	-40	+95	°C		

## Typical Performance



## Outline Drawing / Enclosure

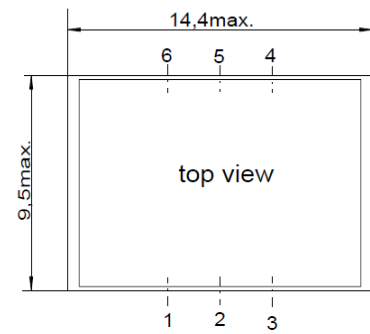
Package Codes		
Code	Height "H"	Pin Length "L"
G218C	2.8	N/A
G218H	4.9	N/A
G218L	2.3	N/A

Dimensions in mm

Pin Assignment Sinewave	
1	Control Voltage ( $V_c$ )
2	GND
3	GND
4	RF Out
5	GND
6	Supply Voltage Input ( $V_s$ )

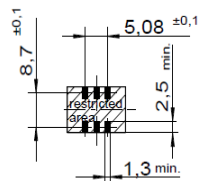
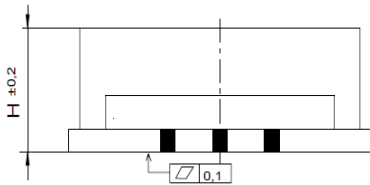
Pin Assignment Balanced Sinewave	
1	Control Voltage ( $V_c$ )
2	GND
3	GND
4	RF Out
5	RF-Out_Copl. 180° phase shifted
6	Supply Voltage Input ( $V_s$ )

Pin Assignment LVPECL	
1	Control Voltage ( $V_c$ )
2	GND
3	GND
4	RF Out
5	RF-Out_complementary
6	Supply Voltage Input ( $V_s$ )

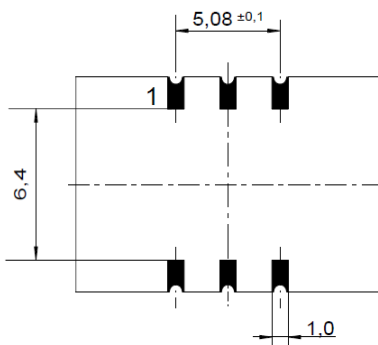


### G 218

- H = 5,9 ; G218 B
- H = 2,8 ; G218 C
- H = 2,6 ; G218 D
- H = 4,7 ; G218 E
- H = 5,7 ; G218 F
- H = 5,4 ; G218 G
- H = 4,9 ; G218 H

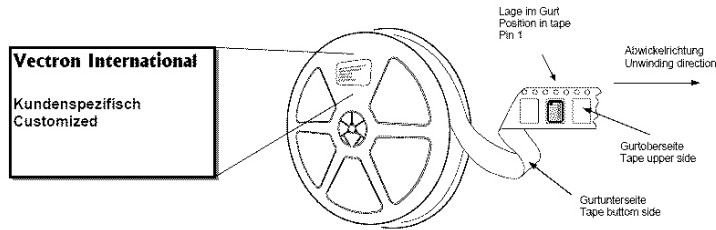
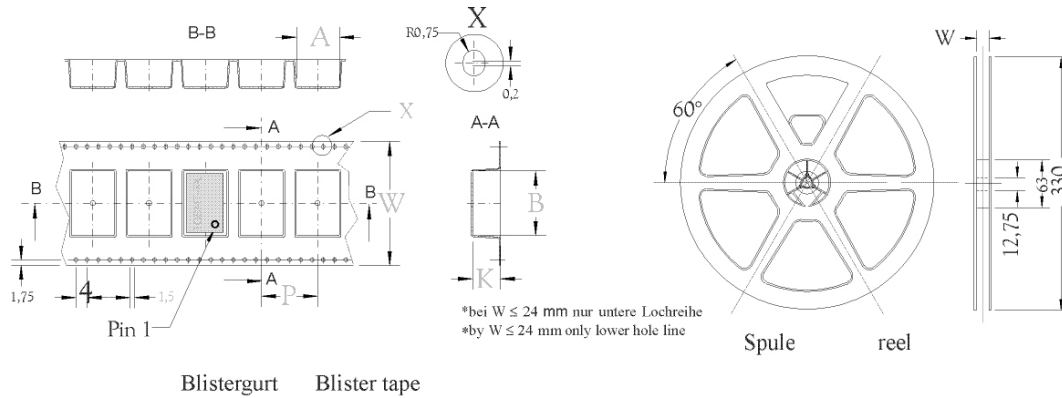


Padvorschlag  
land pattern  
recommendation



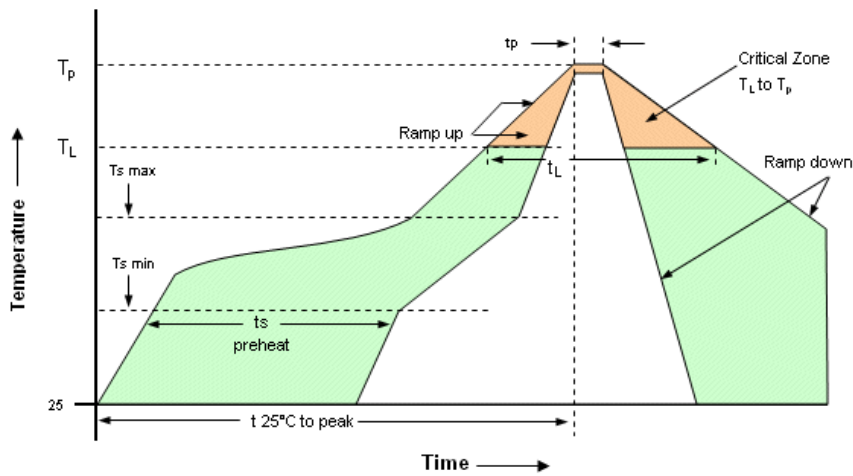
Marking
VS-501-xxxx
Frequency
•AYYWW

## Standard Shipping Method



Enclosure Type	Tape Width W (mm)	Quantity per meter	Quantity per reel	Dimension P (mm)
G218C	24		1700	12
G218H	24		850	12

## Recommended Reflow Profile



Profile Feature	Pb-Free Assembly/Sn-Pb Assembly	Profile Feature	Pb-Free Assembly/Sn-Pb Assembly
Average ramp-up rate ( $T_L$ to $T_p$ )	3°C/second max.	Time 25°C to Peak Temperature	8 minutes max.
Preheat - Temperature Min $T_{Smin}$ -Temperature Min $T_{Sma}$ -Time (min to max) $t_s$	150°C 200°C 60-180 seconds	Time maintained above -Temperature ( $T_L$ ) -Time ( $t_L$ )	217°C 60-150 seconds
$T_{Smax}$ to $T_L$ -Ramp-up Rate	3°C/second max		
Time maintained above -Temperature ( $T_L$ ) -Time ( $t_L$ )	217°C 60-150 seconds	Time within 5°C of actual Peak-Temperature ( $t_p$ )	20-40 seconds
Peak Temperature ( $T_p$ )	max 260°C	Ramp-down Rate	6°C/ second max

**Note:** All temperatures refer to topside of the package, measured on the package body surface. SMD oscillators must be on the top side of the PCB during the reflow process.

## Ordering Information

### VS - 501 0 - D E X - 205 X - 1747M030837

**Product Family**  
VS: VCISO

**Package**  
9x14mm SMT

**Height**  
0: 2.8mm (G218C)  
1: 4.9mm (G218H)  
2: 2.3mm (G218L)

**Supply Voltage**  
D: +5.0V  
E: +3.3V

**RF Output Code**  
C: LVPECL  
E: Sinewave  
F: Balanced Sinewave

**Temperature Range**  
X: +10°C to +85°C

**APR Code**  
205: ±20ppm

**Frequency**  
**Enable**  
X: No Enable

Standard Frequencies (MHz)						
632.8125	784.489605	832	867.1875	873.5154185	949.976022	980.604559
993.4096915	1000	1024.23965	1034.337568	1040	1067.686799	1200
1265.625	1280	1568.97921	1687.5	1701.32	1707.08	1734.375
1747.030837	1747.62305	1748.366885	1769.145	1875	1879.437686	1884.052863
1899.952044	1961.209118	1968.75	1986.819383	2000	2048.4793	2068.675135
2104.658326	2135.373597	2187.5	2400	2457.6	2560	2812.5
2949.12						

Other frequencies and temperature ranges available upon request

**Notes:**

- Contact factory for improved stabilities or additional product options. Not all options and codes are available at all frequencies.
- Unless other stated all values are valid after warm-up time and refer to typical conditions for supply voltage, frequency control voltage, load, temperature (25°C).
- Phase noise degrades with increasing output frequency.
- Subject to technical modification.
- Contact factory for availability.

## For Additional Information, Please Contact

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