

Helping Customers Innovate, Improve & Grow



### Description

The VS-401 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 coherent optical receivers. The VS-401 provides 12fs rms jitter in the 12kHz to 20MHz integration bandwidth and is available from 1.3GHz to 2.5GHz.

### Features

### Applications

- Frequency Range 1.3 to 2.5 GHz
- Ultra low jitter performance
- Typical Jitter: 12fsec rms, 12kHz to 20MHz
- 3.3 & 5V supply voltage
- Output sinewave + balanced sinewave
- 13x20 mm SMD package
- See table on Page 5 for standard frequencies

- High Speed ADCs
- 40G & 100G Coherent Receivers
- Test & Measurement

### Performance Specifications

Pulling Characteristics					
Parameter	Min	Typ	Max	Units	Notes
Absolute Pull Range (APR)	±20				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	10			kΩ	
Supply Voltage ( $V_s$ )					
Supply voltage (standard)	4.75	5.00	5.25	V DC	
Current consumption			75	mA	@ Sinewave / Balanced Sinewave
Supply voltage	3.135	3.3	3.465	VDC	
Current consumption			100	mA	@ Sinewave / Balanced Sinewave

## Performance Specifications (Continued)

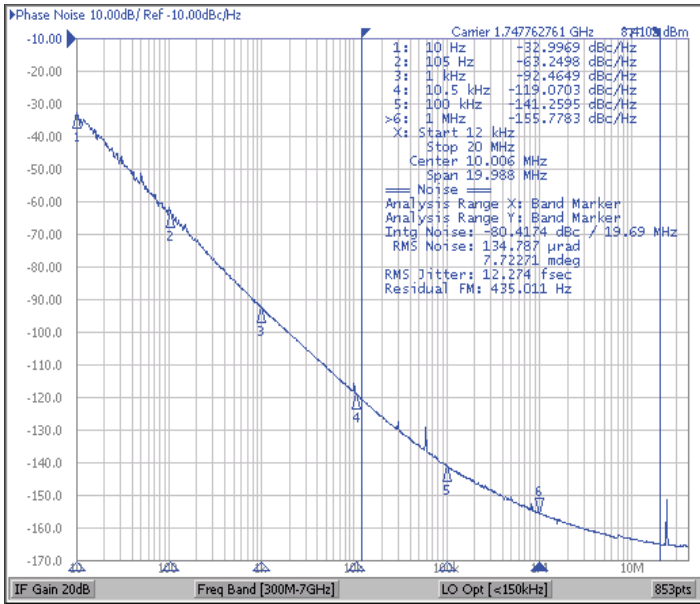
RF Output					
Parameter	Min	Typ	Max	Units	Notes
Signal	Sinewave				
Load	45	50	55	$\Omega$	
Output Power	7	8.5	12	dBm	
Signal	Balanced Sinewave				
Load	45	50	55	$\Omega$	
Output Power	0	3	6	dBm	
Phase difference between output signal pairs			$\pm 10$	$^{\circ}$	
Subharmonics			-30	dBc	
Phase Noise: 100Hz offset		-63		dBc/Hz	@ 1.75GHz Sinewave 5V
Phase Noise: 1kHz offset		-92		dBc/Hz	
Phase Noise: 10kHz offset		-119		dBc/Hz	
Phase Noise: 100kHz offset		-141		dBc/Hz	
Phase Noise: 1MHz offset		-155		dBc/Hz	
Phase Noise: 10MHz offset		-163		dBc/Hz	
Jitter: 12kHz to 20MHz offset		12		fs rms	
Phase Noise: 100Hz offset		-62		dBc/Hz	@ 1.98GHz Balanced Sinewave 5V
Phase Noise: 1kHz offset		-92		dBc/Hz	
Phase Noise: 10kHz offset		-118		dBc/Hz	
Phase Noise: 100kHz offset		-140		dBc/Hz	
Phase Noise: 1MHz offset		-155		dBc/Hz	
Phase Noise: 10MHz offset		-161		dBc/Hz	
Jitter: 12kHz to 20MHz offset		13		fs rms	
Phase Noise: 100Hz offset		-64		dBc/Hz	@ 2.46GHz Balanced Sinewave 3.3V
Phase Noise: 1kHz offset		-94		dBc/Hz	
Phase Noise: 10kHz offset		-118		dBc/Hz	
Phase Noise: 100kHz offset		-138		dBc/Hz	
Phase Noise: 1MHz offset		-151		dBc/Hz	
Phase Noise: 10MHz offset		-160		dBc/Hz	
Jitter: 12kHz to 20MHz offset		11		fs rms	

Additional Parameters					
Weight	2.0g				
Processing and Packing	Handling and Processing Note				
Absolute Maximum Ratings					
Parameter	Min		Max	Units	Notes
Supply Voltage ( $V_s$ )			6.0	V	
Operable Temperature Range	-40		+85	$^{\circ}\text{C}$	
Storage Temperature Range	-55		+125	$^{\circ}\text{C}$	

# Typical Performance

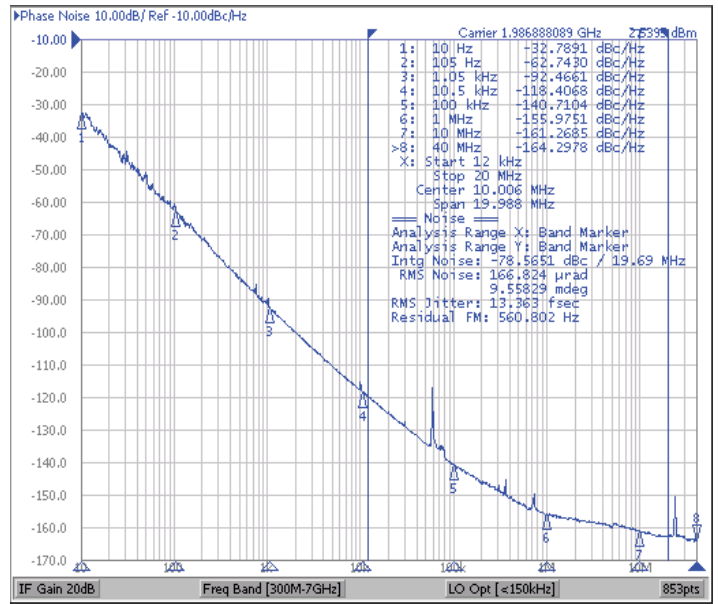
## Phase Noise

VS-401 @ 1.75GHz Sinewave



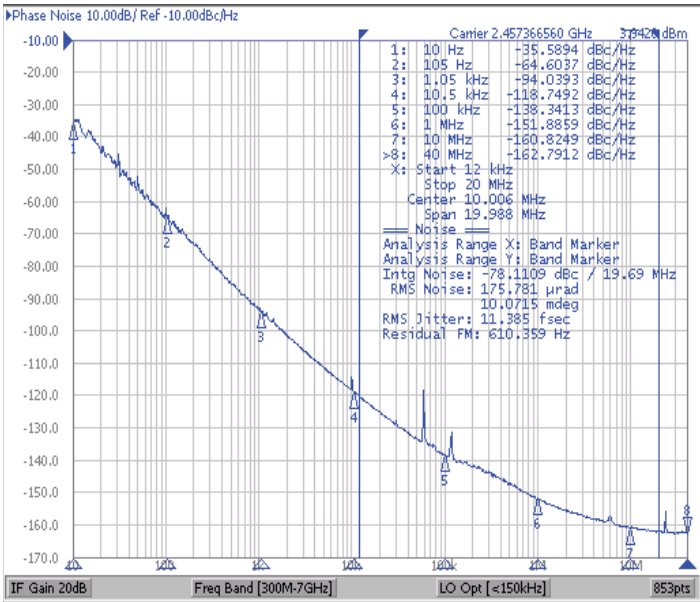
## Phase Noise

VS-401 @ 1.97GHz Balanced Sinewave



## Phase Noise

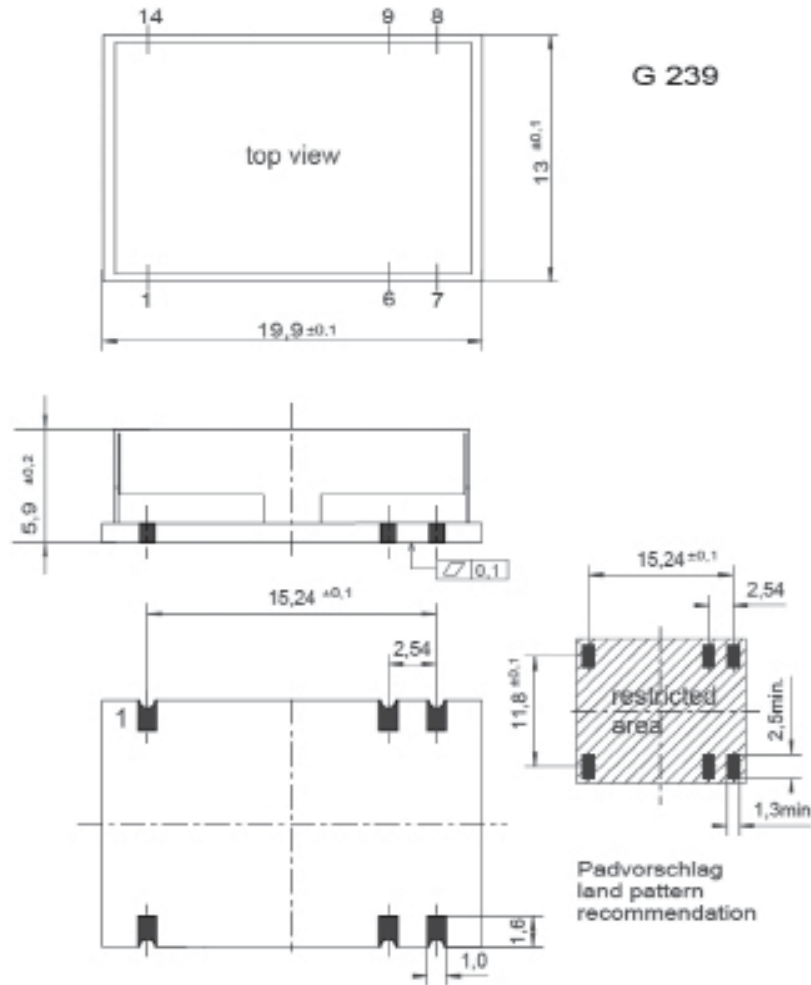
VS-401 @ 2.46GHz Balanced Sinewave



# Outline Drawing / Enclosure

Package Codes		
Code	Height "H"	Pin Length "L"
G239	5.9	NA

Dimensions in mm

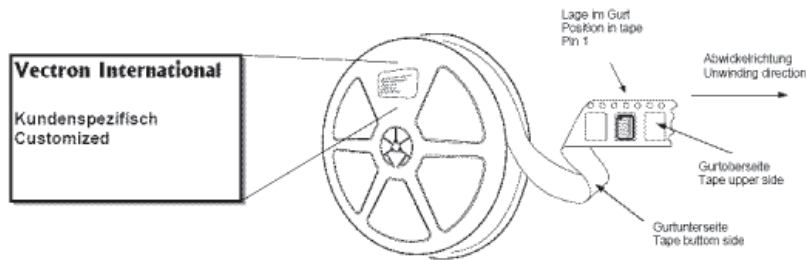
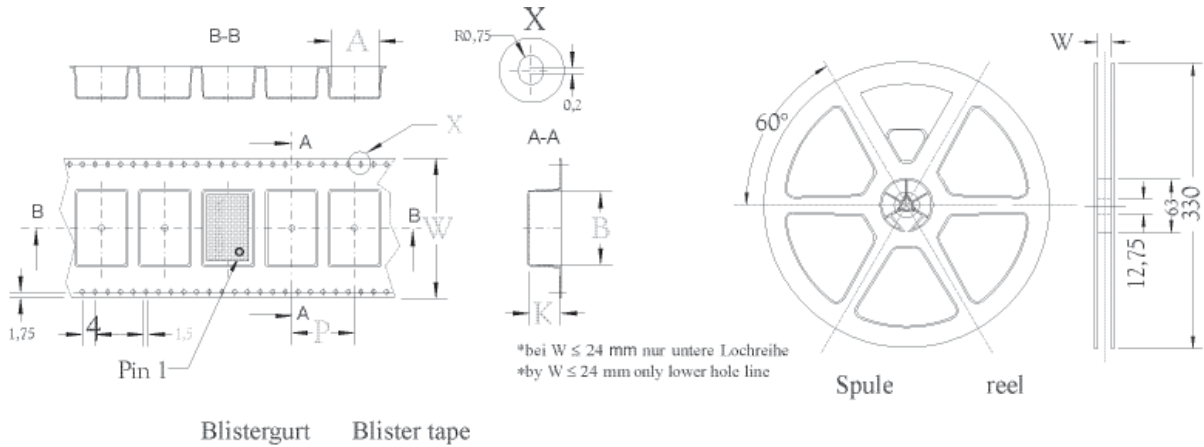


Pin Assignment (Sinewave)	
1	Control Voltage ( $V_c$ )
6	GND
7	GND
8	RF Out
9	GND (Sinewave)
14	Supply Voltage Input ( $V_s$ )

Pin Assignment (Balanced Sinewave)	
1	Control Voltage ( $V_c$ )
6	GND
7	GND
8	RF Out
9	RF Out compl. (180° phase shifted)
14	Supply Voltage Input ( $V_s$ )

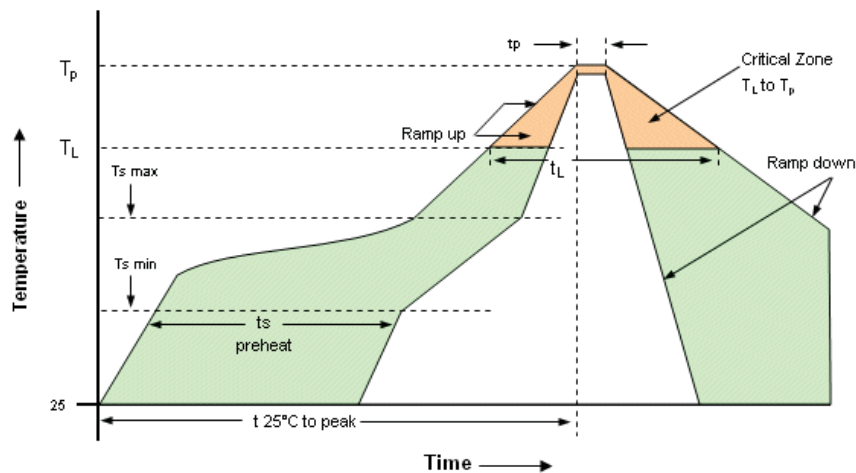
Marking
VS-401-xxxx
Frequency
•AYYWW

## Standard Shipping Method



Enclosure Type	Tape Width W (mm)	Quantity per meter	Quantity per reel	Dimension P
G239	24		500	12

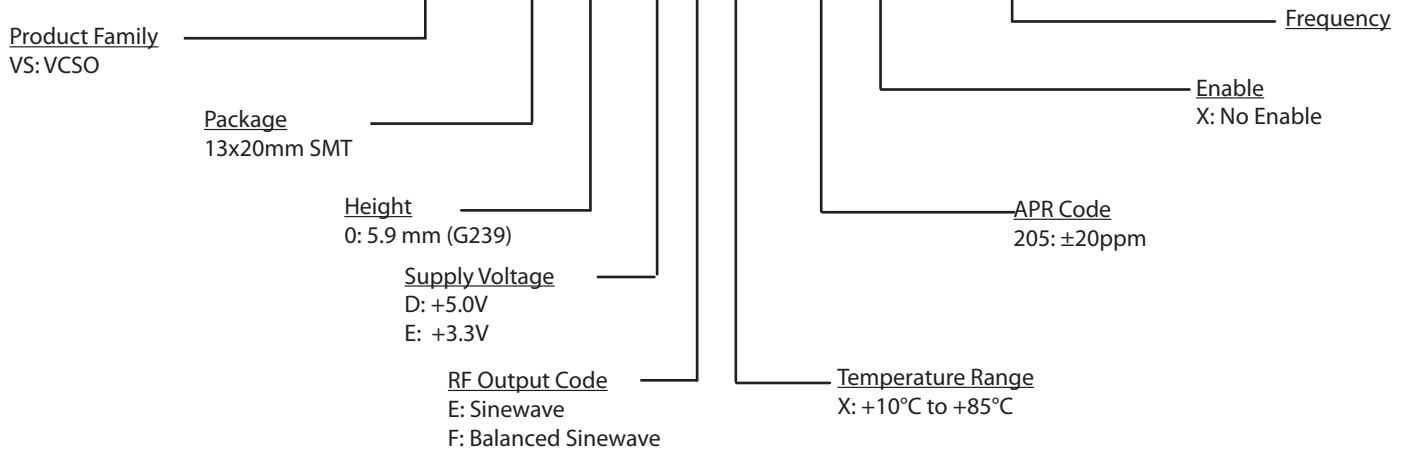
## Recommended Reflow Profile



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

## Ordering Information

### VS - 401 0 - D E X - 205 X - 1747M03083



Standard Frequencies (MHz)						
1687.5	1701.32	1707.08	1747.030837	1747.62305	1748.366885	1769.145
1959.55	1968.75	1986.819383	2457.6			

Other Frequencies Available Upon Request

**Notes:**

1. Contact factory for improved stabilities or additional product options. Not all options and codes are available at all frequencies.
2. 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).
3. Phase noise degrades with increasing output frequency.
4. Subject to technical modification.
5. Contact factory for availability.

## For Additional Information, Please Contact

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