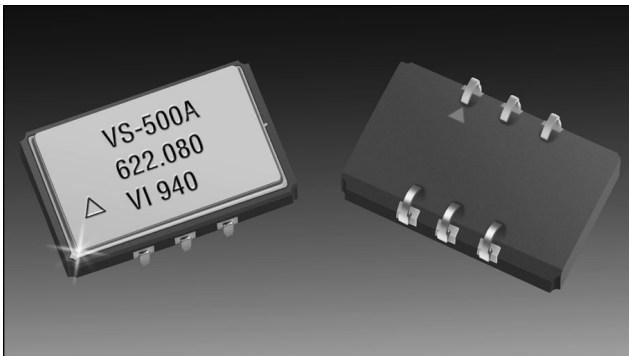


## VS-500A

### Voltage Controlled Saw Oscillator



#### Features

- Output Frequencies from 155 MHz to 800 MHz
- Low Jitter < 1 ps rms in the 12kHz to 20MHz range
- < 1ps rms jitter in 50kHz to 80MHz range
- 3.3V (see VS-500) or 5.0V operation
- Ideal for clock smoothing, frequency translation, clock and data retiming applications
- 10K ECL, PECL logic levels with fast transition times
- Complementary outputs
- Low profile, surface mount package
- Output disable feature

#### Applications

- 2.5, 10 Gbit/s FEC and standard SONET/SDH Clock Smoothing and Frequency Translation
- 10 Gigabit Ethernet Clock Smoothing
- Frequency Translation

#### Description

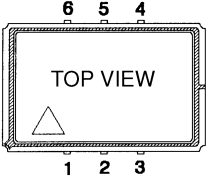
The VS-500A is a SAW based voltage controlled oscillator that operates at the fundamental frequency of the internal SAW filter. This resonator is a high-Q quartz device that enables the circuit to achieve low phase jitter performance over a wide operating temperature range. The oscillator is housed in a hermetically sealed J-lead surface mount package offered on tape and reel. It has an output disable to facilitate on-board testing.

# VS-500A Voltage Controlled SAW Oscillator

## Pin Information

**Table 1. Pin Function**

Pin	Symbol	Function
1	V <sub>c</sub>	VCSO Control Voltage
2	OD	Output Disable
3	GND	Case and electrical ground
4	Output	VCSO Output
5	COutput	VCSO Complimentary Output
6	V <sub>cc</sub>	Power Supply Voltage (5.0 V ±10%)



1. By setting OD low, the outputs are disabled and OUT is held high while Complementary OUT is held low. The threshold for Output Disable is 1.4V above pin 3. Output Disable should not be driven above mid supply and during normal operation, should be left floating (use with an open collector or 3-State gate for interfacing with standard logic).

## Performance Characteristics

**Table 2. Electrical Performance @ 25°C**

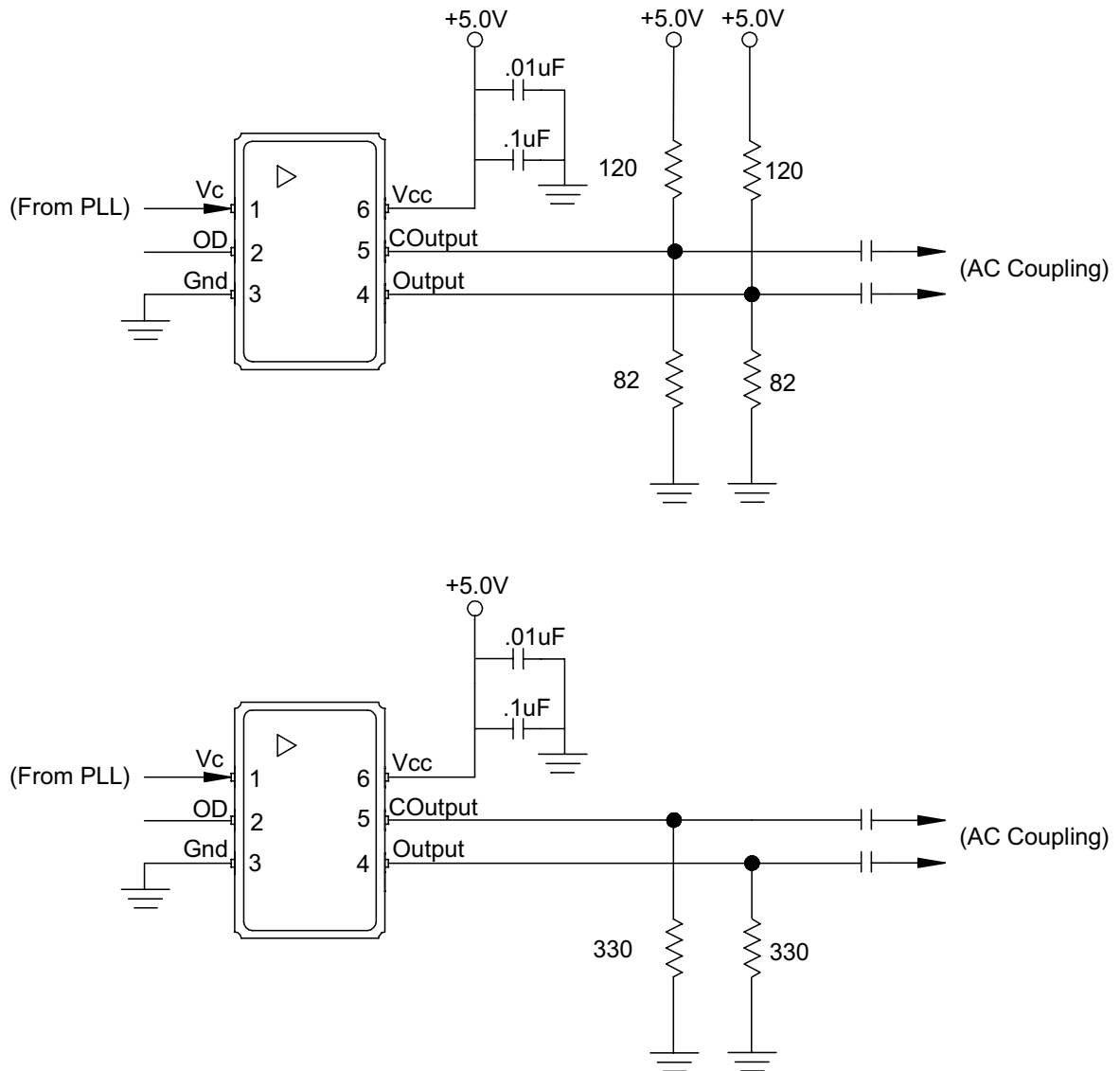
Parameter	Symbol	Minimum	Typical	Maximum	Units
Center Frequency, <i>see ordering information</i>	F <sub>N</sub>	155		800	MHz
Operating Temperature	T <sub>OP</sub>	-40	25	+85	°C
Supply Current (no load)	I <sub>CC</sub>		55	70	mA
Supply Voltage	V <sub>CC</sub>	4.5	5	5.5	V
Absolute Pull Range over -40 to 85°C (V <sub>c</sub> = 0.5 to 4.5)	APR	±50	-	-	ppm
Positive Gain Transfer @ 155.52MHz (Frequency vs Control voltage)	K <sub>v</sub>	-	350	-	ppm/V
Positive Gain Transfer @ 622.080MHz (Frequency vs Control voltage)	K <sub>v</sub>	-	200	-	ppm/V
Linearity	L <sub>in</sub>		±3		%
Frequency Stability, -40 to 85 wrt 25°C	F <sub>STAB</sub>		±150		ppm
Output Level Low <sup>1</sup>	V <sub>OL</sub>	V <sub>CC</sub> -1.95	-	V <sub>CC</sub> -1.63	V
Output Level High <sup>1</sup>	V <sub>OH</sub>	V <sub>CC</sub> -0.98	-	V <sub>CC</sub> -0.75	V
Output Rise Time <sup>2</sup>	t <sub>R</sub>		250	400	ps
Output Fall Time <sup>2</sup>	t <sub>F</sub>		250	400	ps
Jitter @ 155.520 MHz, 12 KHz to 20 MHz			0.439		ps, rms
Jitter @ 622.080 MHz, 12 KHz to 20 MHz			0.276		ps, rms
Jitter @ 622.080 MHz, 50 KHz to 80 MHz			0.293		ps, rms
Spurious Suppression		-50	-60		dB
Data Symmetry	SYM	45	49/51	55	%
Control Voltage Input Impedance	Z <sub>c</sub>	8	10	12	KΩ
Control Voltage Modulation Bandwidth	BW	-	500	-	kHz
Output Current	I <sub>out</sub>	-	-	20	mA

1. Output Levels are standard 10K ECL and are fully 100K ECL compatible.  
 2. Transition times are measured from 20% to 80% of a full 10K ECL level swing.

**Table 3. Typical Single Side-Band Phase Noise (dBc/Hz)**

Offset from Carrier	100 Hz	1kHz	10kHz	100kHz
VS-500A 622.080	-62	-85	-109	-127

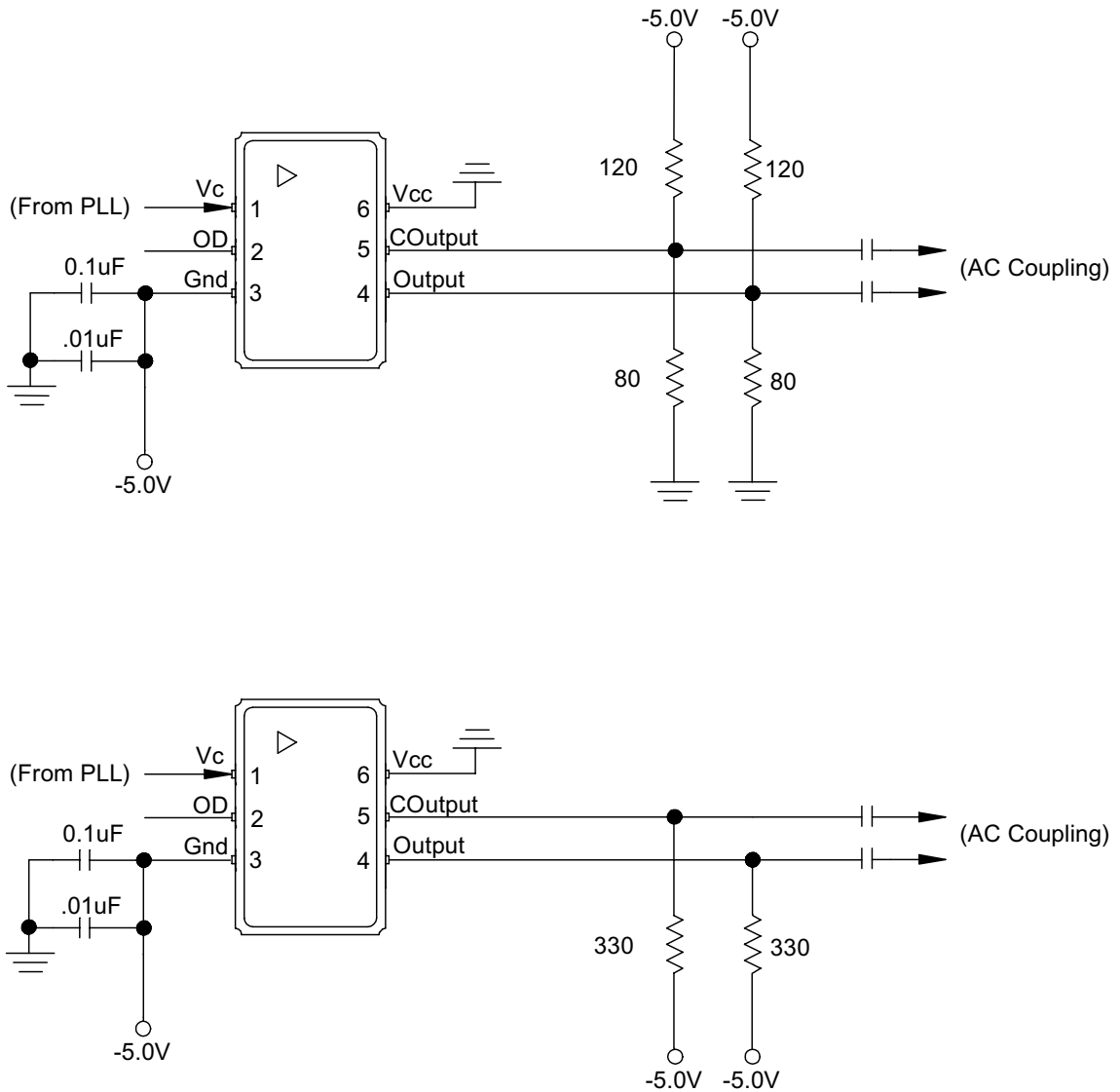
# VS-500A Voltage Controlled SAW Oscillator



Note 2: To disable output, connect Output Disable to ground. To enable output, leave pin 2 floating or open.

**Figure 1**  
**PECL Operation**

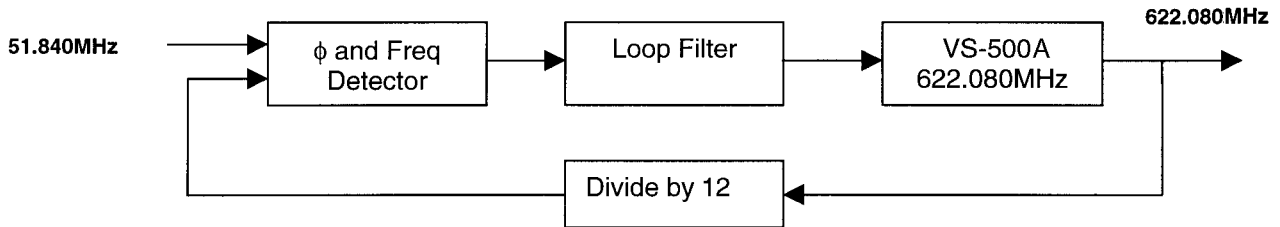
# VS-500A Voltage Controlled SAW Oscillator



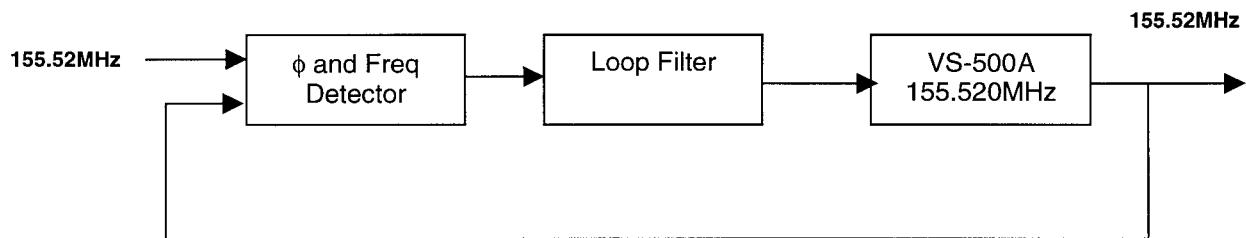
Note 1: Conductive lid will be @ -5V for ECL configuration  
 Note 2: To disable output, connect Output Disable to -5V. To enable output, leave pin 2 floating or open.

**Figure 2. ECL Operation**

# VS-500A Voltage Controlled SAW Oscillator



**Figure 3. Typical Frequency Translation Diagram**



**Figure 4. Typical Clock Smoothing Diagram**

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can permanently damage the device. Functional operation is not implied at these or any other conditions in excess of conditions represented in the operational sections of this data sheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability.

**Table 4. Absolute Maximum Ratings**

Parameter	Symbol	Ratings	Unit
Power Supply	Vcc	0 to 8	V
Output Current <sup>1</sup>	Iout	20	mA
Output Current <sup>2</sup>	Iout	50	mA
Voltage Control Range <sup>1</sup>	Vc	0 to Vcc	V
Voltage Control Range <sup>2</sup>	Vc	-0.5 to Vcc+0.5	V
Storage Temperature	Ts	-55 to 125	°C
Soldering Temp./Time	Tls	220/10	°C/Seconds

1 Limits beyond which performance can not be guaranteed.

2 Limits beyond which device life may be impaired.

## Qualification Conformance

The VS-500A family passes the following Mil-Std qualification.

**Table 5. Environmental Compliance**

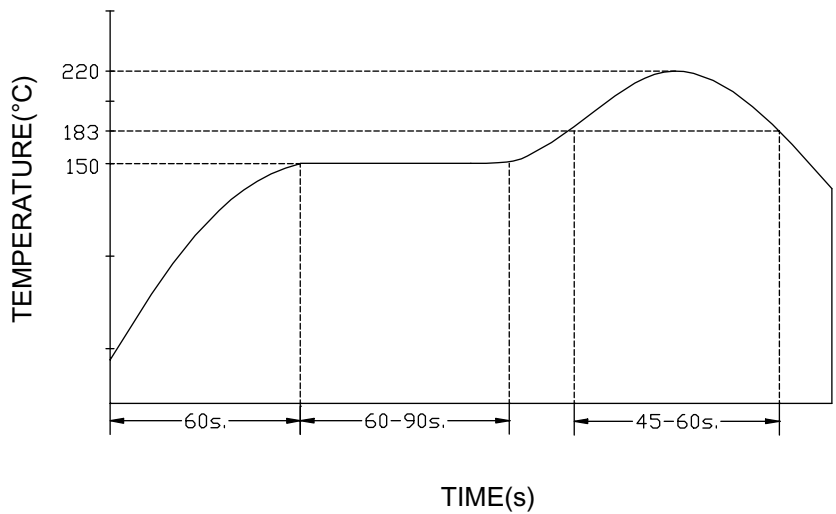
Parameter	Conditions
Mechanical Shock	MIL-STD-883, Method 2002
Mechanical Vibration	MIL-STD-883, Method 2007
Solderability	MIL-STD-883, Method 2003
Gross and Fine Leak	MIL-STD-883, Method 1014
Resistance to Solvents	MIL-STD-883, Method 2016

# VS-500A Voltage Controlled SAW Oscillator

## Handling Precautions

Although ESD protection circuitry has been designed into the the VS-500A proper precautions should be taken when handling and mounting. VI employs a human body model and a charged-device model (CDM) for ESD susceptibility testing and design protection evaluation. ESD thresholds are dependent on the circuit parameters used to define the model. Although no industry wide standard has been adopted for the CDM, a standard HBM of resistance = 1.5Kohms and capacitance = 100pF is widely used and therefore can be used for comparison purposes.

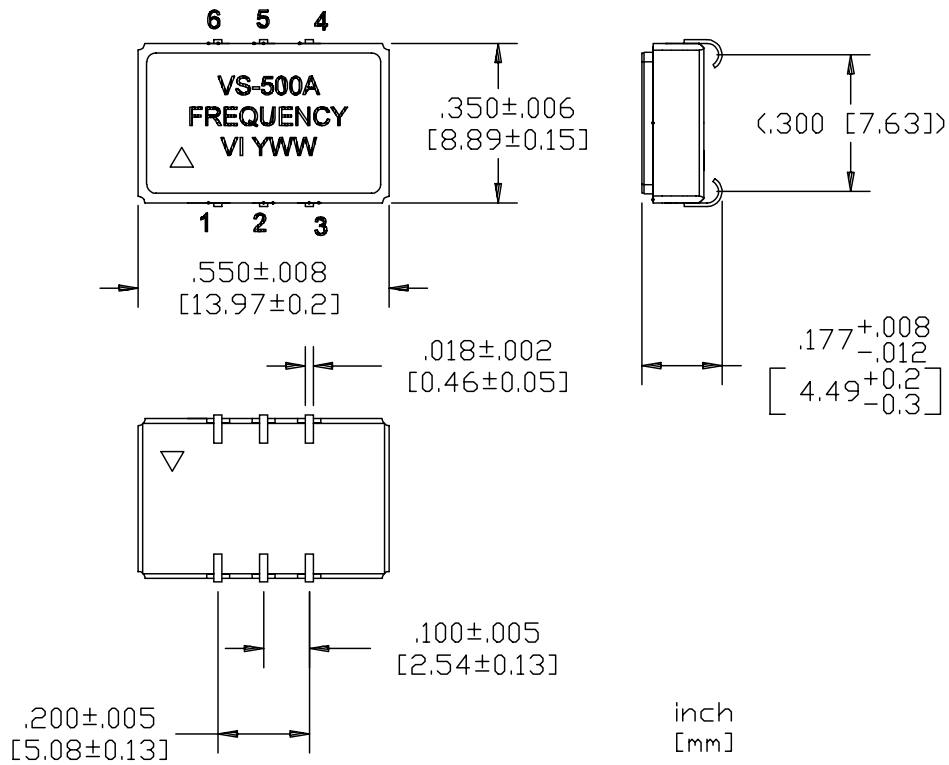
Table 6. ESD Ratings	
Model	Minimum
Human Body Model	1500V
Charged Device Model	1000V



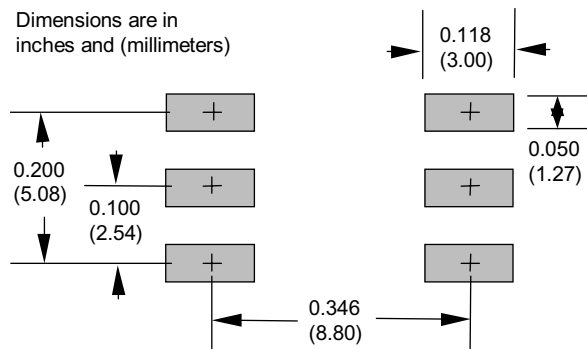
**Figure 5. Suggested IR profile**

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling and IR reflow simulation. The conditions a device can withstand are well understood and devices can be subjected to the profile in figure 5. This profile shows a ramp up condition to prevent thermal shock, a preheat period in which the flux is activated, a ramp up to 183°C which is the reflow temperature of Sn/Pb eutectic and a gradual cool down. The time above 183°C should not exceed 60 seconds and the peak temperature should be no more than 220°C for 10 seconds. The VS-500A's are 100% screened for hermiticity so an aqueous wash is not an issue.

# VS-500A Voltage Controlled SAW Oscillator



**Figure 6. Outline Diagram**



**Figure 7. Suggested Pad Layout**

# VS-500A Voltage Controlled SAW Oscillator

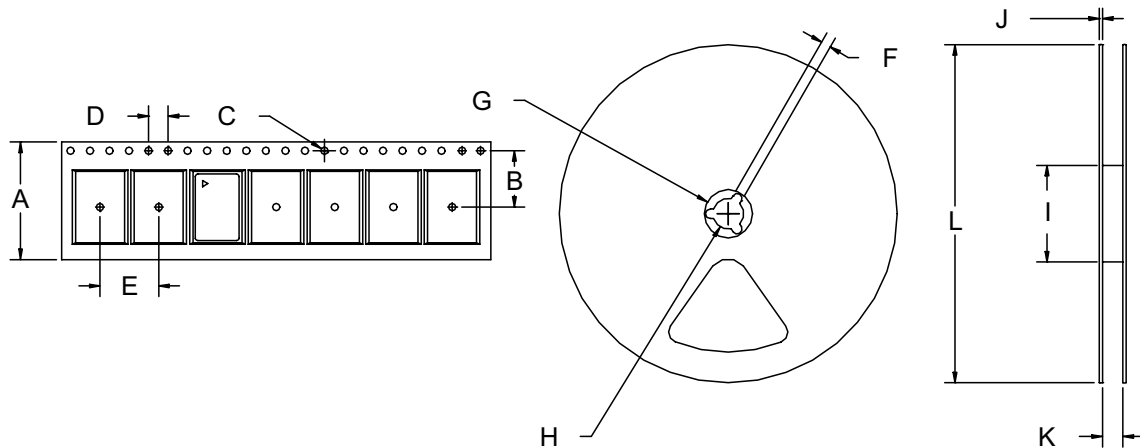


Figure 8. Tape Reel Drawing

Table 7. Tape and Reel Dimensions (mm)

Tape Dimensions						Reel Dimensions							# Per Reel
Product	A	B	C	D	E	F	G	H	I	J	K	L	
VS-500A	24	11.5	1.5	4	12	1.78	21	13	100	5	25	330	200

## Ordering Information

Table 8. Available Frequencies (MHz)

155.520	156.250	161.1328	166.6286
177.7371	311.040	622.080	624.7048
625.000	627.3296	644.5313	666.5143
669.1281	669.3265	690.5692	719.7344
759.410	765.5906	767.250	777.600

Other frequencies available upon request

For additional information please contact:



USA: Vectron International • 267 Lowell Road, Hudson, NH 03051 . . . . Tel: 1-888-VECTRON-1 • Fax: 1-888-FAX-VECTRON  
 EUROPE: . . . . . Tel: 49 (0) 3328 4784 17 ☒ Fax: 49 (0) 3328 4784 30

[www.vectron.com](http://www.vectron.com)

ASIA: . . . . . Tel: +86 21 28909740 / 41 / 42 ☒ Fax: +86 21 28909240 / 2890999

Vectron International reserves the right to make changes to the product(s) and/or information contained herein without notice.  
 No liability is assumed as a result of their use or application. No rights under any patent accompany the sale of any such product(s) or information.