


Helping Customers Innovate, Improve & Grow



Description

The VS-703 is a Voltage Controlled SAW Oscillator that operates at the fundamental frequency of the internal SAW filter. The SAW filter is a high-Q Quartz device that enables the circuit to achieve low phase jitter performance over a wide operating temperature range. An internal multiplier circuit is deployed for output frequencies greater than 1.48 GHz. The oscillator is housed in a hermetically sealed leadless surface mount package and offered on tape and reel. It has a tri-state Output Enable function that provides one of three conditions: Outputs Enabled, Outputs Set, or Outputs Disabled.

Features

- Industry Standard Package, 5.0 x 7.0 x 1.8 mm³
- Output Frequencies from 700 MHz to 3 GHz
- 5th Generation ASIC Technology for Low Jitter
 - 135 fs-rms (fN = 2.457 GHz, 10 kHz to 100 MHz)
 - 105 fs-rms (fN = 2.457 GHz, 12 kHz to 20 MHz)
 - 90 fs-rms (fN = 2.457 GHz, 50 kHz to 80 MHz)
- 3.3 V Supply Voltage
- CML Compatible Outputs (fN < 1.2 GHz)
- Differential Sinewave Outputs (fN > 1.2 GHz)
- Tri-State Output Enable (OE / OS / OD)
- Compliant to EU RoHS 6 Directive 

Applications

- High Speed Data Converters (ADC / DAC)
- Optical Transport Networks (40G / 100G / 400G)
- Base Stations (LTE, Multicarrier GSM)
- Small Cells / Remote Radio Heads
- Cable Modem Termination Systems (DOCSIS)

Block Diagram

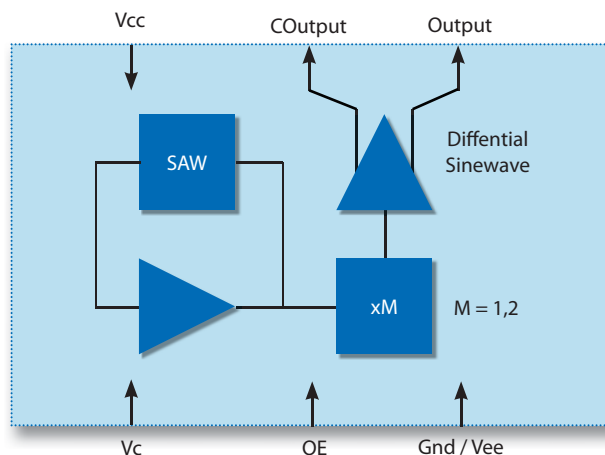


Figure 1. Functional block diagram

Performance Specifications

Electrical Performance						
Parameter	Symbol	Min	Typical	Maximum	Units	Notes
Frequency						
Nominal Frequency	f_N	700		3000	MHz	1,2,3
Absolute Pull Range	APR	± 50			ppm	1,2,3,9
Linearity	Lin		± 9		%	2,4,9
Gain Transfer	K_V		+220 to +300		ppm/V	2,9
Temperature Stability	f_{STAB}		± 100		ppm	1,6
Supply						
Voltage ($\pm 10\%$)	V_{CC}	2.97	3.3	3.63	V	3
Current (Typical 50 Ω Load)	I_{EE}		80		mA	2,3
Outputs ($f_N < 1.2$ GHz)						
Single Ended CML Output Power (0.7 GHz to 0.9 GHz) Output Power (0.9 GHz to 1.2 GHz)			-1.5 -2		dBm dBm	2,3,7 2,3,7
Mid Level			$V_{CC}-200$		mV-pp	6
Single Ended Swing			400		mV-pp	6
Differential Swing			800		mV-pp	6
Outputs ($f_N > 1.2$ GHz)						
Single Ended Sinewave Output Power (>1.20 GHz to <1.90 GHz) Output Power (>1.91 GHz to <2.50 GHz) Output Power (>2.51 GHz to <3.00 GHz)			-4 -6 -8		dBm dBm dBm	2,3,7 2,3,7 2,3,7
Sub-Harmonic (no Sub-H <1.48 GHz) 0.5*f _N (>1.48 GHz to <2.10 GHz) 0.5*f _N (>2.11 GHz to <2.35 GHz) 0.5*f _N (>2.36 GHz to <2.70 GHz) 0.5*f _N (>2.71 GHz to <3.00 GHz)			<-30 <-25 <-20 <-15		dBc dBc dBc dBc	2,7 2,7 2,7 2,7
2nd Harmonic 2*f _N (>1.20 GHz to <2.00 GHz) 2*f _N (>2.01 GHz to <2.20 GHz) 2*f _N (>2.21 GHz to <3.00 GHz)			<-15 <-20 <-25		dBc dBc dBc	6,7 6,7 6,7
3rd Harmonic 3*f _N (>1.20 GHz to <1.60 GHz) 3*f _N (>1.61 GHz to <1.70 GHz) 3*f _N (>1.71 GHz to <3.00 GHz)			<-15 <-20 <-25		dBc dBc dBc	6,7 6,7 6,7
Outputs (700 MHz < f_N < 3.0 GHz)						
Spurious Suppression (Non-Harmonic)		85	90		dBc	6
Symmetry	SYM	45	50	55	%	2,3
Jitter (10 kHz to 100 MHz) (12 kHz to 20 MHz) (50 kHz to 80 MHz)	Φ_J Φ_J Φ_J		175 125 100		fs-rms fs-rms fs-rms	6,8 6,8 6,8
Control Voltage						
Control Voltage	V_C	0.3		3.0	V	3
Input Impedance (Outputs Enabled)	Z_C		138		k Ω	6
Input Impedance (Outputs Disabled)	Z_C		450		k Ω	6
Modulation Bandwidth	BW		200		kHz	6
Operating Temperature	T_{OP}	-40		+85	$^{\circ}\text{C}$	1,3
Package Size		5.0 x 7.0 x 1.8	mm ³			

Absolute Maximum Ratings

Notes:

1. See Standard Frequencies and Ordering Information (Pg 11).
2. Parameters are tested with production test circuit (Fig 3).
3. Parameters are tested at ambient temperature with test limits guard-banded for specified operating temperature.
4. Measured as the maximum deviation from the best straight-line fit, per MIL-0-55310.
5. The Vc Model is described below (Fig 1).
6. Not tested in production, guaranteed by design, verified at qualification.
7. See Output Signal Levels (Pg 8).
8. Jitter is integrated across frequency range listed. See Phase Noise & Jitter (Pgs 7-8).
9. Tested with Vc = 0.3V to 3.0V.

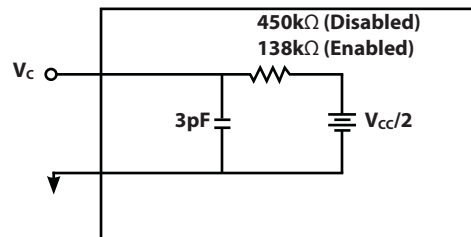


Figure 1. Vc Model - Outputs Enabled / Disabled

Absolute Maximum Ratings			
Parameter	Symbol	Ratings	Unit
Power Supply	V _{CC}	0 to 6	V
Voltage Control Range	V _C	0 to V _{CC}	V
Output Enable	OE	0 to V _{CC}	V
Storage Temperature	T _{STR}	-55 to 125	°C
Soldering Temperature/Duration	T _{PEAK} /t _P	260 / 40	°C/sec

Stresses in excess of the absolute maximum ratings can permanently damage the device. Also, exposure to these absolute maximum ratings for extended periods may adversely affect device reliability. Functional operation is not implied at these or any other conditions in excess of those represented in the operational sections of this datasheet. Permanent damage is also possible if any device input (Vc or OE) draws >100 mA.

Output Load Configuration - DC Coupled

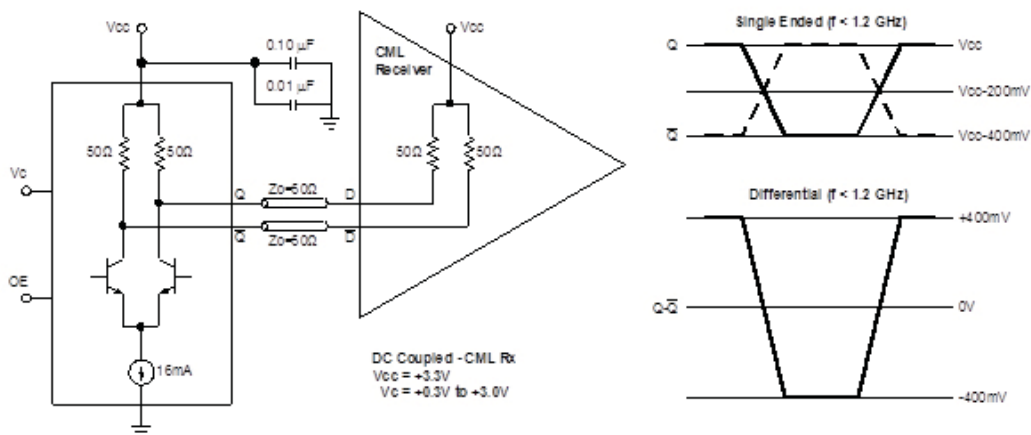


Figure 2. DC Coupled CML

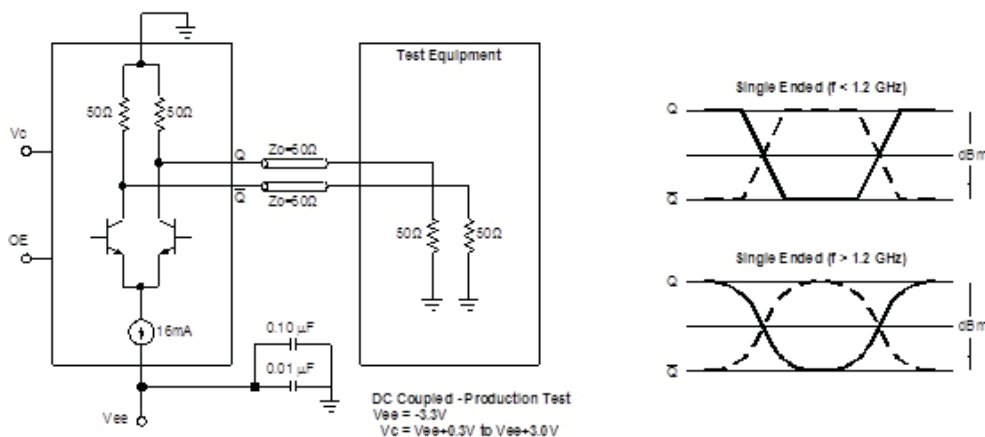


Figure 3. Production Test

Output Load Configuration - AC Coupled

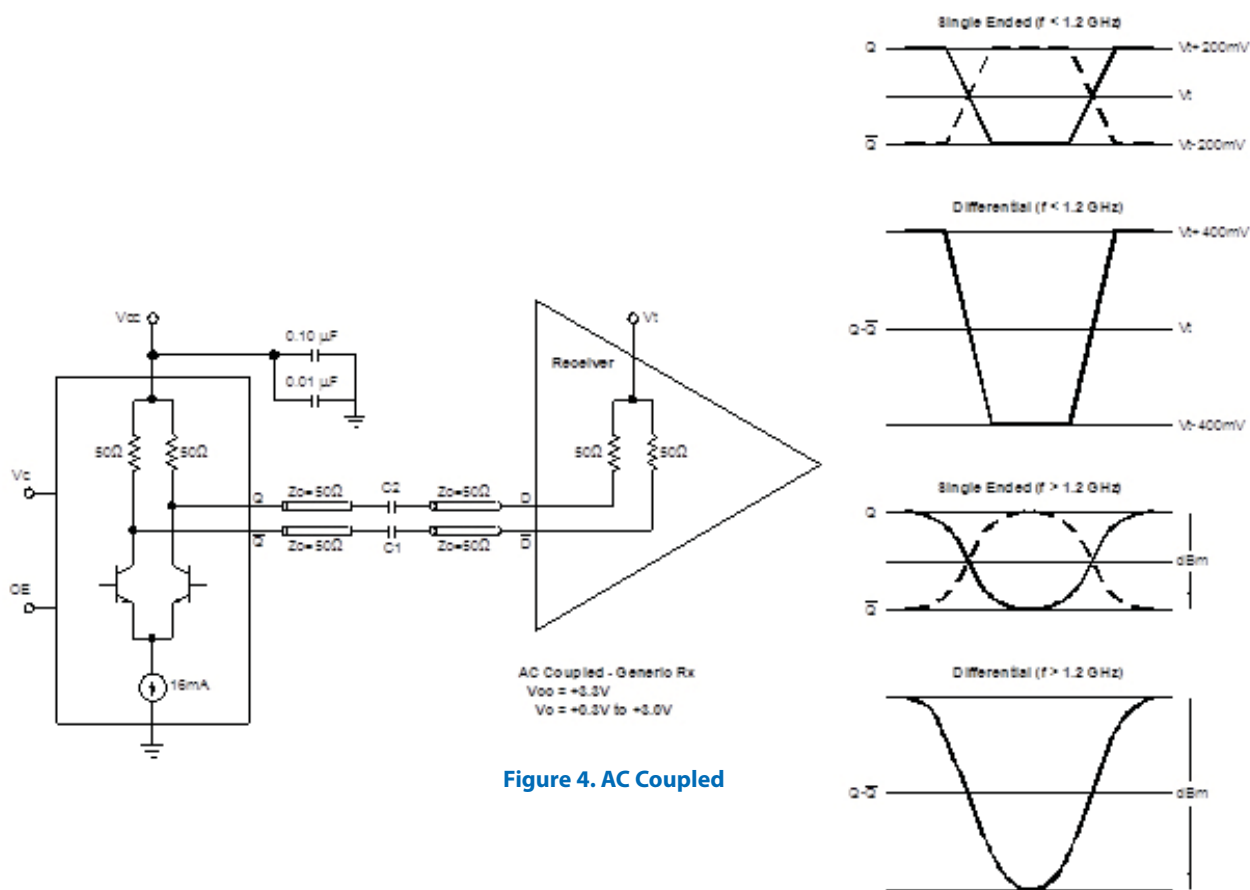
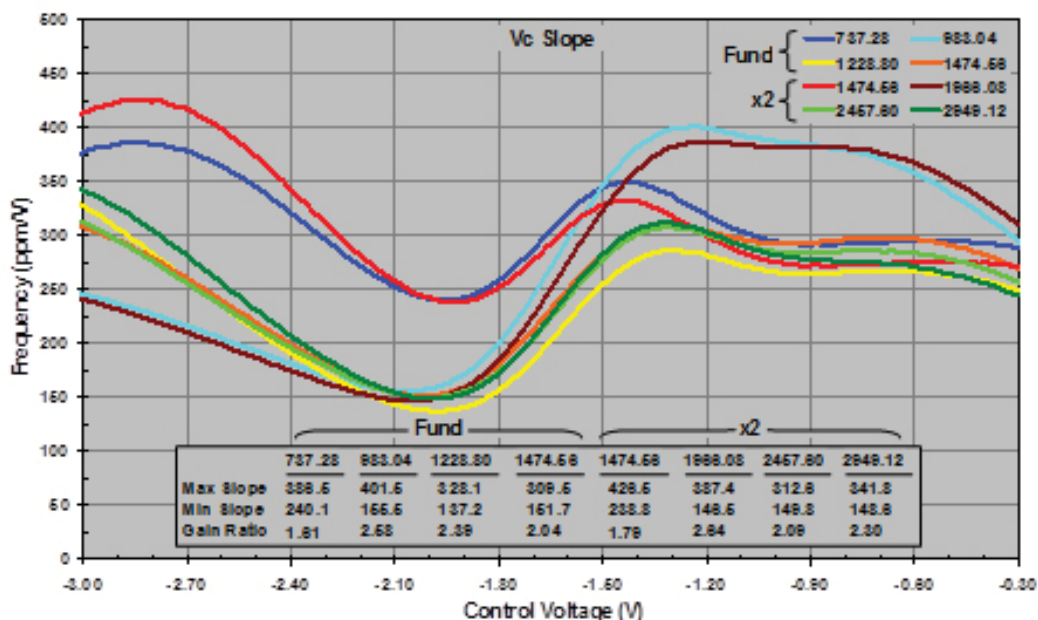
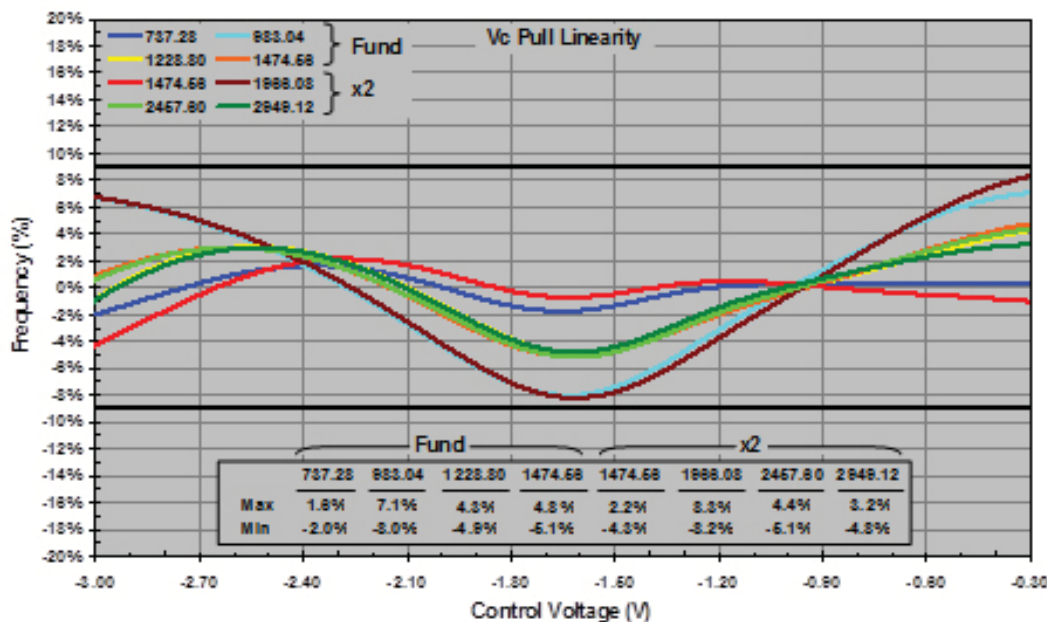
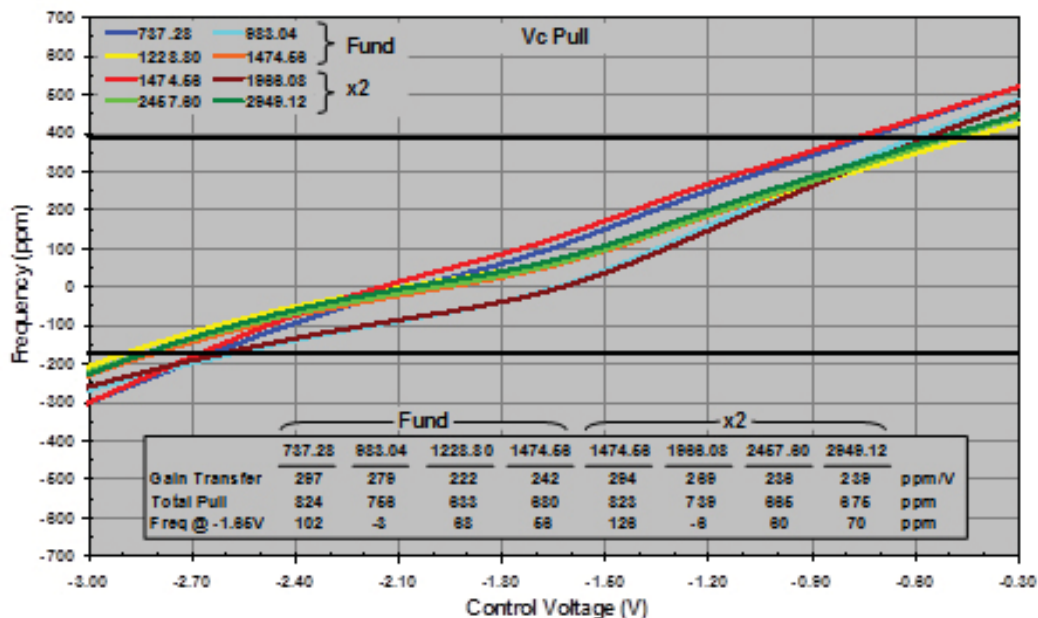
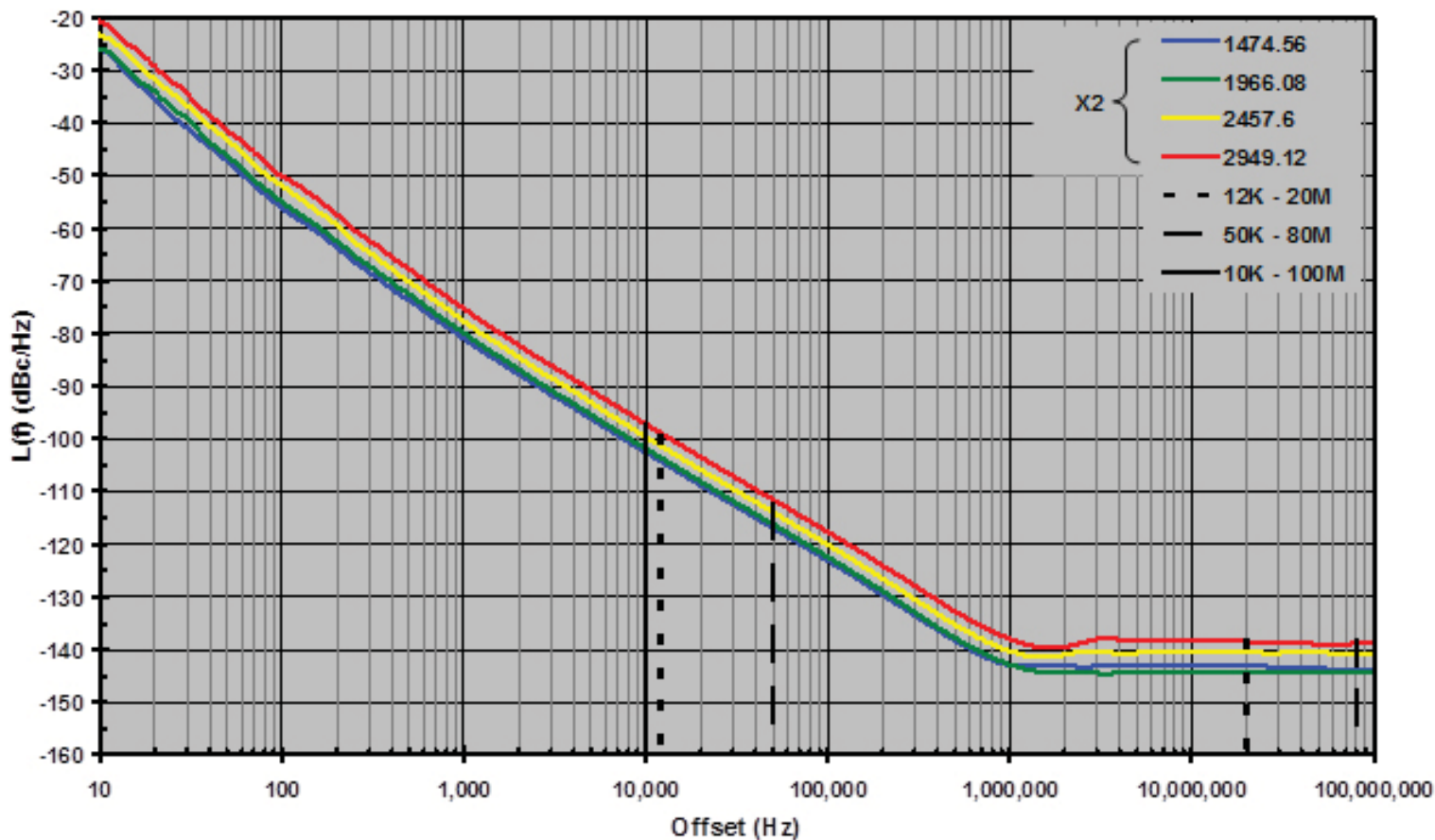
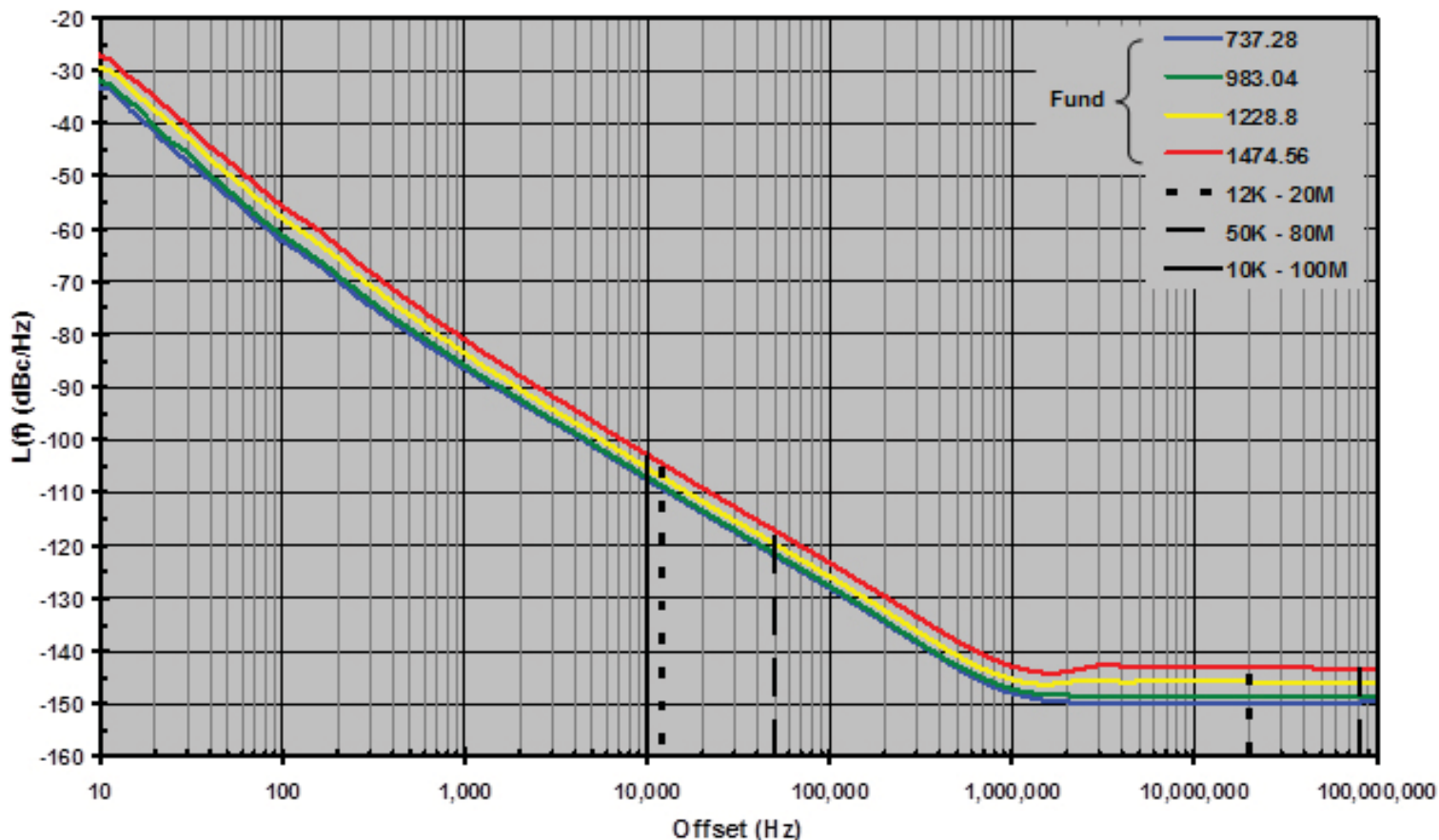


Figure 4. AC Coupled

Typical Characteristics: VC Pull, VC Pull Linearity, VC Pull Slope



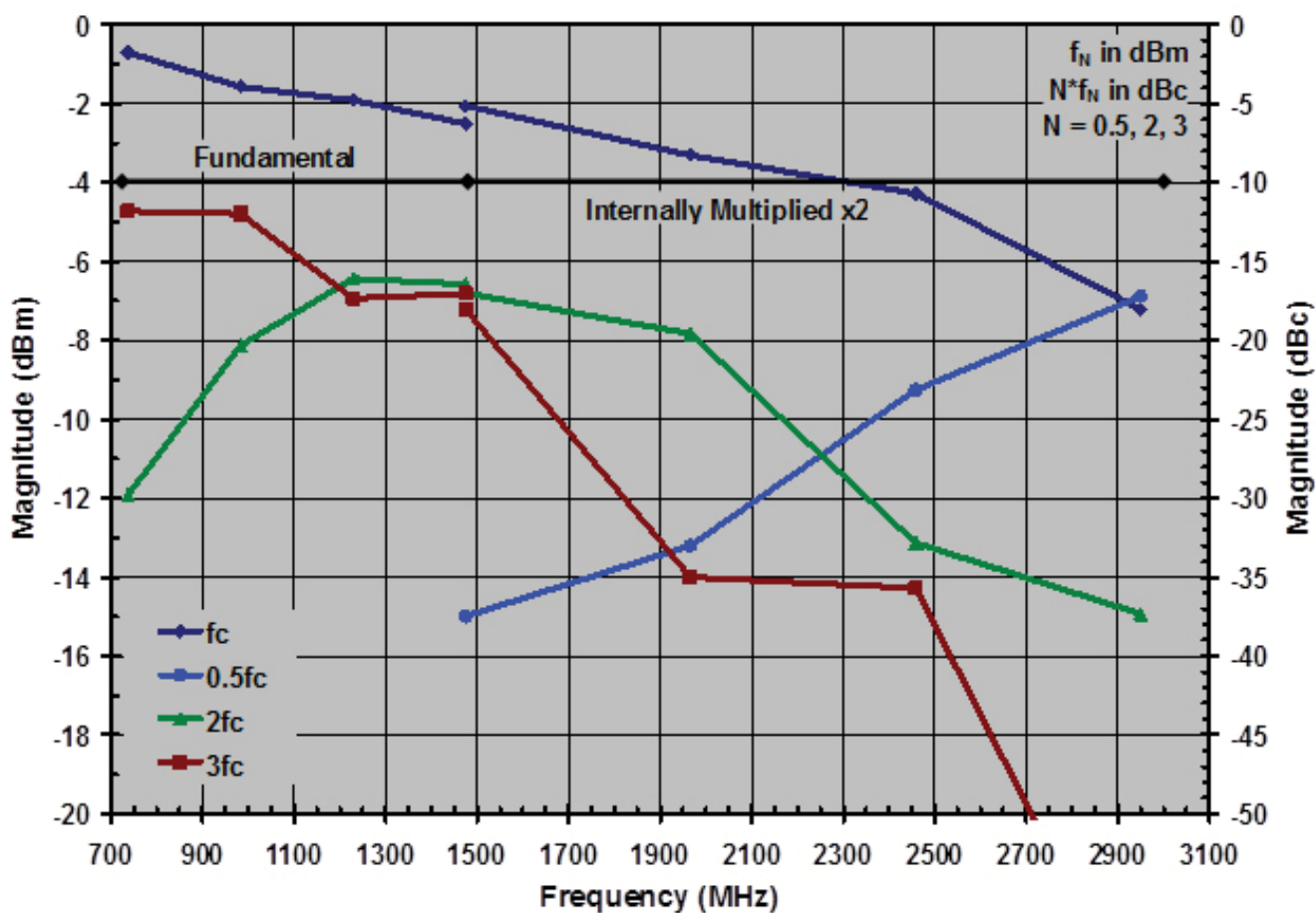
Typical Characteristics: Phase Noise



Typical Characteristics: Phase Noise & Jitter

Parameter	Fundamental				Internal X2 Multiplier					Units
	737.28	983.04	1228.80	1474.56	1474.56	1966.08	2457.60	2949.12		
L (f) @ 10	-33.2	-31.8	-29.3	-27.1	-25.9	-25.9	-23.2	-20.7	dBc/Hz	
L (f) @ 100	-62.4	-61.2	-57.9	-55.7	-56.2	-55.0	-52.0	-50.0	dBc/Hz	
L (f) @ 1K	-86.6	-85.8	-83.6	-81.0	-81.0	-79.8	-77.6	-75.3	dBc/Hz	
L (f) @ 10K	-107.5	-107.1	-105.3	-102.8	-102.5	-101.8	-99.6	-97.2	dBc/Hz	
L (f) @ 100K	-128.1	-127.7	-125.9	-123.3	-123.1	-122.4	-120.1	-117.7	dBc/Hz	
L (f) @ 1M	-147.9	-147.1	-145.3	-142.9	-142.9	-142.8	-140.3	-138.0	dBc/Hz	
L (f) @ 10M	-149.9	-148.7	-145.7	-142.9	-143.0	-144.4	-140.5	-138.2	dBc/Hz	
L (f) @ 100M	-149.3	-148.5	-146.2	-143.3	-143.8	-144.1	-140.9	-138.7	dBc/Hz	
10 - 100M	168.9	137.0	139.4	158.1	158.8	121.1	133.0	143.1	fs-rms	
12K - 20M	133.5	106.4	105.9	118.8	121.8	96.4	101.9	111.7	fs-rms	
50K - 80M	104.1	86.9	92.4	105.9	104.4	74.0	86.9	91.4	fs-rms	

Typical Characteristics: Output Signal Levels



Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VS-703 family is capable of meeting the following qualification tests:

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
Moisture Sensitivity Level	IPC/JEDEC J-STD-020, MSL1

Handling Precautions

Although ESD protection circuitry has been designed into the VS-703 proper precautions should be taken when handling and mounting. VI employs a Human Body Model (HBM), a Charged Device Model (CDM), and a Machine Model (MM) for ESD susceptibility testing and design protection evaluation.

ESD Ratings		
Model	Minimum	Conditions
Human Body Model	2000 V	MIL-STD 883, Method 3015
Charged Device Model	1000 V	JEDEC, JESD22-C101
Machine Model	200 V	JEDEC, JESD22-A115-A

Reflow Profile (IPC/JEDEC J-STD-020)		
Parameter	Symbol	Value
PreHeat Time	t_s	60 s min., 180 s max.
Ramp Up	R_{UP}	3°C / s max.
Time Above 217°C	t_L	60 s min., 150 s max.
Time To Peak Temperature	t_{AMB-P}	480 s max.
Time At 260°C	t_P	20 s min., 40 s max.
Ramp Down	R_{DN}	6°C / s max.

The device has been qualified to meet the JEDEC standard for Pb-Free assembly. The temperatures and time intervals listed are based on the Pb-Free small body requirements. The temperatures refer to the topside of the package, measured on the package body surface. The VS-703 device is hermetically sealed so an aqueous wash is not an issue.

Terminal Plating: Electroless Au > 1.50 μm over
Electroless Ni > 1.90 μm

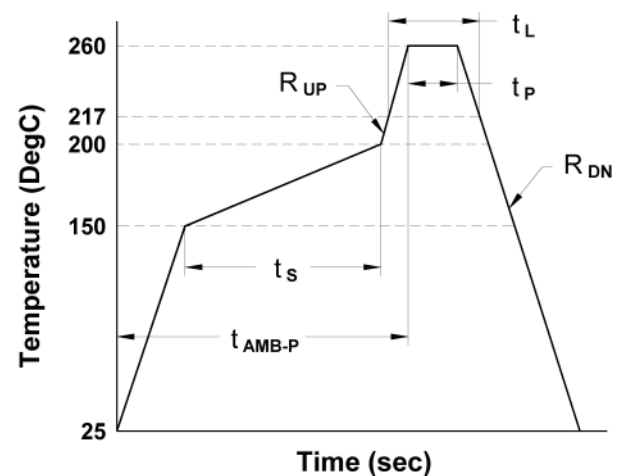
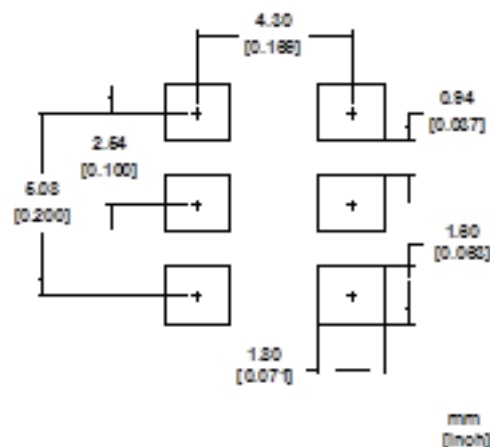
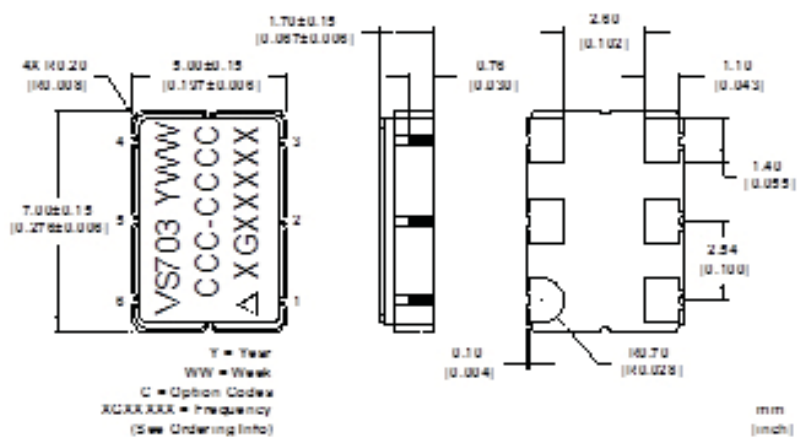


Figure 5. Recommended Reflow Profile

Outline Drawing & Pad Layout



Pin Out		
Pin	Symbol	Function
1	V _c	Control Voltage
2	OE	Output Enable
3	GND	Case and Electrical Ground
	V _{ee}	For Production Test Only
4	Output	Output
5	COutput	Complementary Output
6	V _{cc}	Power Supply Voltage

Floating OE Always Results In Outputs Enabled

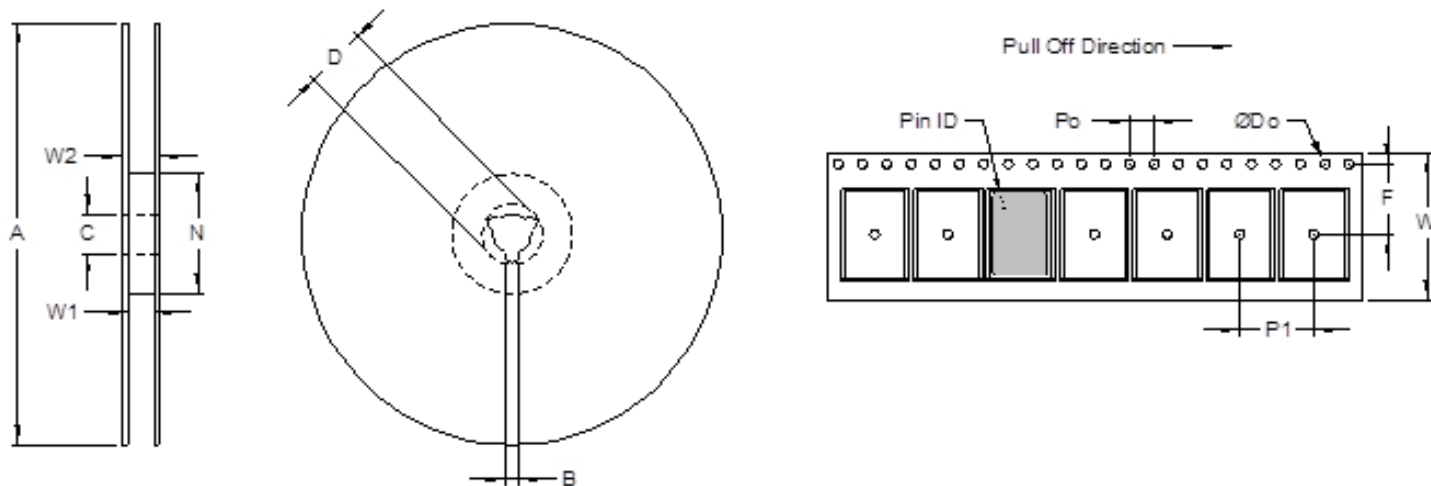
Pin Out			
Option	OE	Voltage Range	Result
A	H	(5V _{cc} / 6) to V _{cc}	OE
	M	(V _{cc} / 2) ± 15%(V _{cc} / 2)	OS
	L	Gnd to (V _{cc} / 6)	OD
B	H	(5V _{cc} / 6) to V _{cc}	OD
	M	(V _{cc} / 2) ± 15%(V _{cc} / 2)	OS
	L	Gnd to (V _{cc} / 6)	OE

OE = Outputs Enabled

OS = Outputs Set (Output = H, COutput = L)

OD = Outputs Disabled

Tape and Reel (EIA-481-2-A)



Tape Dimensions (mm)						Reel Dimensions (mm)							
Dimension	W	F	Do	Po	P1	A	B	C	D	N	W1	W2	#Per Reel
Tolerance	Typ.	Typ.	Typ.	Typ.	Typ.	Typ.	Min.	Typ.	Min.	Min.	Typ.	Max.	
VS-703	16	7.5	1.5	4	8	178	1.5	13	20.2	50	16.4	22.4	200

Ordering Information

Standard Frequencies (MHz)						
983.040000						

Standard Frequencies (GHz)						
1.22880000	1.47456000	1.74703084	1.96608000	1.98681938	2.45760000	2.94912000

Other Frequencies Available Upon Request

Ordering Information

VS-703-EGE-KAAN-xGxxxxxxxx

Product Family

VS: VCSO

Package

703: 5.0 x 7.0 x 1.8mm

Input

E: 3.3 V

Output

G: Differential Sinewave

Operating Temperature

E: -40 to 85°C

Absolute Pull Range

K: ± 50 ppm
S: ± 100 ppm

Frequency (See Above)

700M000000 - 3G00000000

Factory Use

N: N/A

Oscillator Gain

A: Standard

Enable Logic (Float Condition)

A: H=OE, M=OS, L=OD (OE)
B: H=OD, M=OS, L=OE (OE)

Revision History		
Date	Approved	Description
11Dec2013	JM	Preliminary Release.
24Mar2014	JM	Added New Vectron Logo.
23Apr2014	JM	Added Frequencies: 1G74703084 & 1G98681938.

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