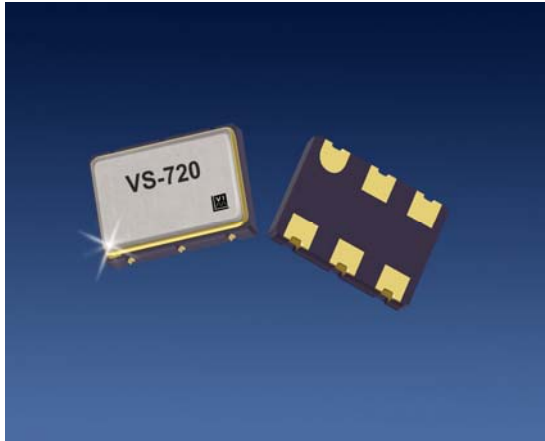


# VS-720 Voltage Controlled SAW Oscillator



## VS-720

### Voltage Controlled SAW Oscillator



#### Features

- Industry Standard Package, 5.0 x 7.5 x 2.0 mm
- ASIC Technology For Ultra Low Jitter
  - 0.100 ps-rms typical across 12 kHz to 20 MHz BW
  - 0.120 ps-rms typical across 50 kHz to 80 MHz BW
- Output Frequencies from 150 MHz to 1 GHz
- 3.3 V Operation
- LV-PECL or LVDS Configuration with Fast Transition Times
- Up to  $\pm 100$  ppm APR
- Complementary Outputs
- Output Disable Feature
- Improved Temperature Stability over Standard VCISO



Product is free of lead and compliant to EC RoHS Directive

#### Applications

PLL circuits for Clock Smoothing and Frequency Translation

<u>Description</u>	<u>Standard</u>
• 1-2-4 Gigabit Fibre Channel	INCITS 352-2002
• 10 Gigabit Fibre Channel	INCITS 364-2003
• 10GbE LAN / WAN	IEEE 802.3ae
• OC-192	ITU-T G.709
• SONET / SDH	GR-253-CORE Issue3

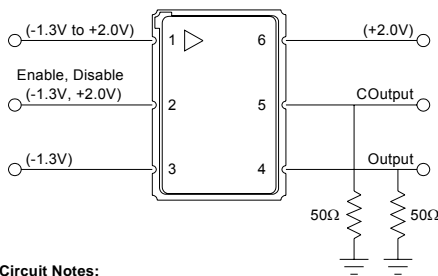
#### Description

The VS-720 is a Voltage Controlled SAW Oscillator that achieves low phase noise and very low jitter performance. The VS-720 is housed in an industry standard 6-Pad leadless ceramic package that is hermetically sealed. Packaging options include bulk or tape and reel.

# VS-720 Voltage Controlled SAW Oscillator

Electrical Performance						
Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
<b>Frequency</b>						
Nominal Frequency	$f_N$	150		1000	MHz	1,2,3
Absolute Pull Range (Ordering Option)	APR		$\pm 100$		ppm	1,2,8
Linearity	Lin			$\pm 10$	%	2,4,8,10
Gain Transfer (See Pg 5)	$K_V$		+90		ppm/V	2,8
Temperature Stability	$f_{STAB}$		$\pm 20$		ppm	1
<b>Supply</b>						
Voltage	$V_{CC}$	2.97	3.3	3.63	V	2,3
Current (No Load)	$I_{CC}$		55	70	mA	3
<b>Outputs</b>						
Mid Level - LVPECL		$V_{CC}-1.4$	$V_{CC}-1.25$	$V_{CC}-1.0$	V	2,3
Swing – LVPECL		450	600	750	mV-pp	2,3
Mid Level - LVDS		$V_{CC}-2.4$	$V_{CC}-2.3$	$V_{CC}-2.5$	V	2,3
Swing – LVDS		250	350	450	mV-pp	2,3
Current	$I_{OUT}$			20	mA	6
Rise Time	$t_R$			500	ps	5,6
Fall Time	$t_F$			500	ps	5,6
Symmetry	SYM	45	50	55	%	2,3
Jitter (12 kHz – 20 MHz BW) 622.08 MHz	$\phi_J$		0.100	0.250	ps-rms	6,7
Jitter (50 kHz – 80 MHz BW) 622.08 MHz	$\phi_J$		0.120	0.300	ps-rms	6,7
Period Jitter, RMS (622.08 MHz)	$\phi_J$		3.0	4.0	ps-rms	9
Period Jitter, Peak - Peak (622.08 MHz)	$\phi_J$		20	30	ps pk-pk	9
Sub-harmonic Suppression			-55		dBc	2
<b>Control Voltage</b>						
Control Voltage Range for APR	$V_C$	0.3		3.0	V	2,8
Control Voltage Input Impedance	$Z_{IN}$	75			K $\Omega$	6
Control Voltage Modulation BW	BW	50			KHz	6
<b>Operating Temp. (Ordering Option)</b>	$T_{OP}$	0/70,-20/70 or -40/85			$^{\circ}C$	1,3
<b>Package Size</b>		5.0 x 7.5 x 2.0			mm	

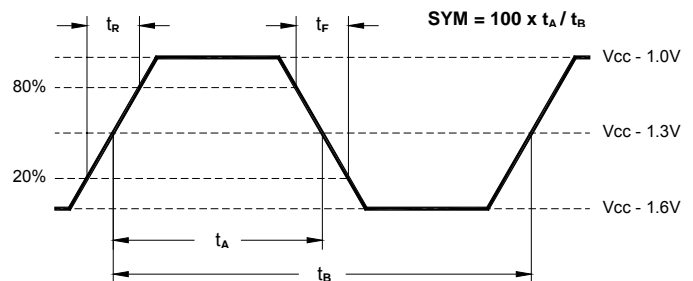
1. See Standard Frequencies and Ordering Information tables (Pg 7) for more specific information
2. Parameters are tested with production test circuit below (Fig 1).
3. Parameters are tested at ambient temperature with test limits guard-banded for specified operating temperature.
4. Measured as the maximum deviation from the best straight-line fit, per MIL-0-55310.
5. Measured from 20% to 80% of a full output swing (Fig 2).
6. Not tested in production, guaranteed by design, verified at qualification.
7. Integrated across stated bandwidth per GR-253-CORE Issue3.
8. Tested with  $V_C = 0.3V$  to  $3.0V$  unless otherwise stated in part description
9. Broadband Period Jitter measured using Lecroy Wavemaster 8600A 6 GHz Oscilloscope, 250K samples taken
10.  $\pm 100$  ppm APR parts will have linearity of  $>10\%$



**Test Circuit Notes:**

- 1) To Permit 50 $\Omega$  Measurement of Outputs, all DC Inputs are Biased Down 1.3V.
- 2) All Voltage Sources Contain Bypass Capacitors to Minimize Supply Noise.
- 3) 50 $\Omega$  Terminations are Within Test Equipment.

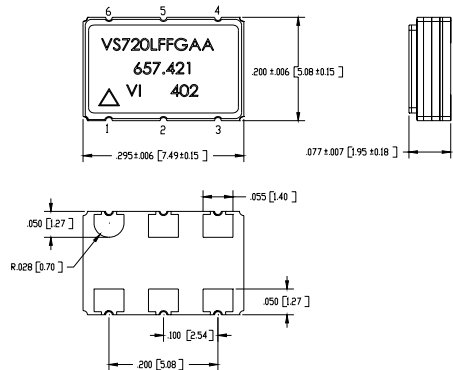
**Figure 1. Test Circuit**



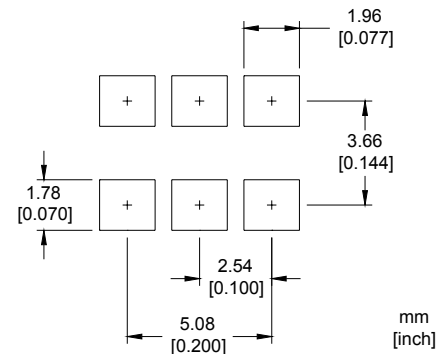
**Figure 2. 10K LV-PECL Waveform**

# VS-720 Voltage Controlled SAW Oscillator

## Outline Diagram



## Suggested Pad Layout

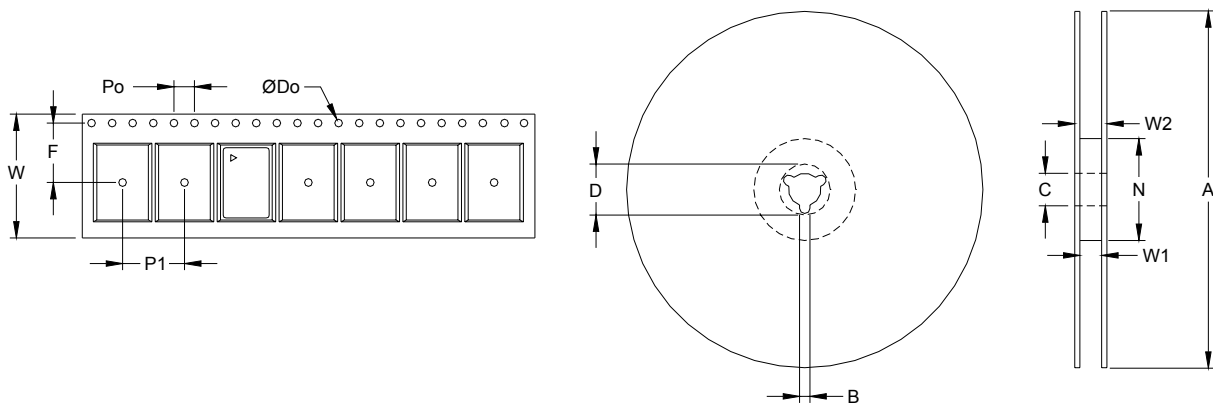


## Standard Pin Out

Pin	Symbol	Function
1	V <sub>C</sub>	VCXO control voltage
2	OE <sup>1</sup>	Enable = LV-CMOS logic 0 or Ground, Disable = LV-CMOS logic 1 <b>**see Note1 below**</b>
3	GND	Case and Electrical Ground
4	Output	Output
5	COutput	Complementary Output
6	V <sub>CC</sub>	Power Supply Voltage (3.3V ±10%)

Note 1: For proper operation disable pin can not be left floating. See page 7 for alternative input logic option

## 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-720	16	7.5	1.5	4	8	178	1.5	13	20.2	50	16.4	22.4	200

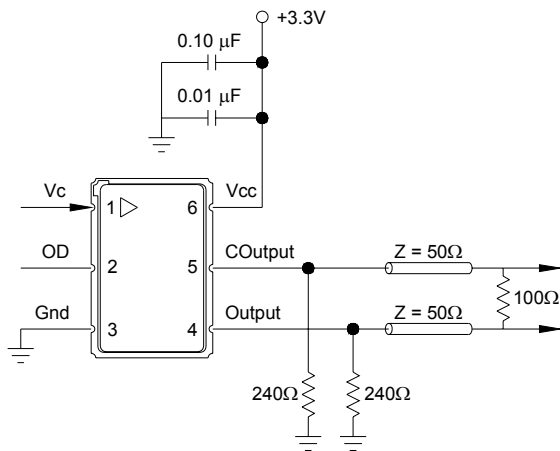
# VS-720 Voltage Controlled SAW Oscillator

## Absolute Maximum Ratings

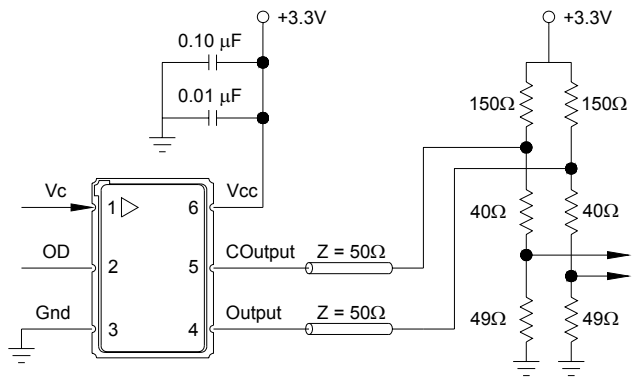
Parameter	Symbol	Ratings	Unit
Power Supply	$V_{CC}$	0 to 4	V
Output Current	$I_{out}$	25	mA
Voltage Control Range	$V_C$	0 to $V_{CC}$	V
Storage Temperature	TS	-55 to 125	°C
Soldering Temp/Time	$T_{LS}$	260/40	°C/sec

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 datasheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability. Permanent damage is also possible if OD or  $V_C$  is applied before  $V_{CC}$ .

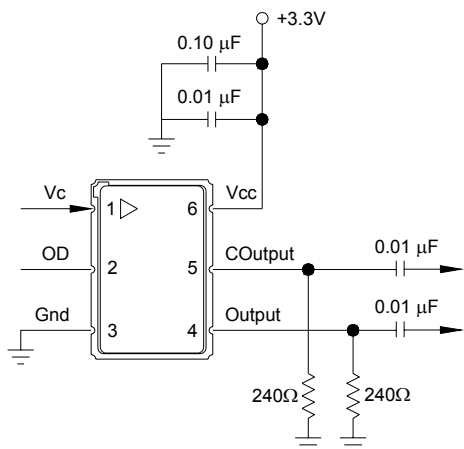
## Suggested Output Load Configurations



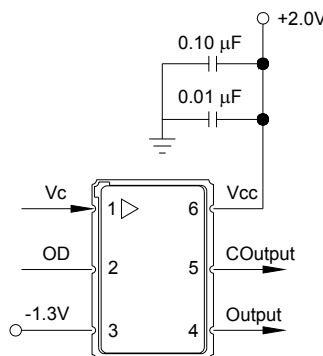
**LV-PECL to LV-PECL:** For short transmission lengths, the power consumption could be reduced by removing the 100Ω resistor and doubling the value of the pull down resistors.



**LV-PECL to LVDS:** Restricted for short transmission lengths. Configuration may require modification depending on LVDS receiver.



**Functional Test:** Allows standard power supply configuration. Since AC coupled, the LV-PECL levels cannot be measured.

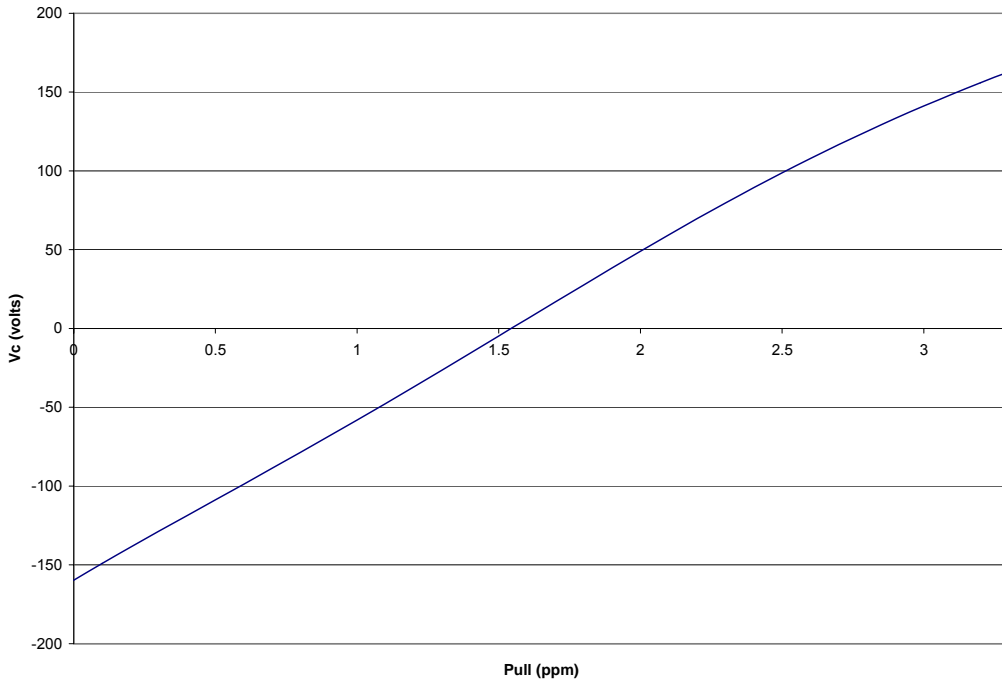


**Production Test:** Allows direct DC coupling into 50Ω measurement equipment. Must bias the power supplies as shown. Similar to Figure 1.

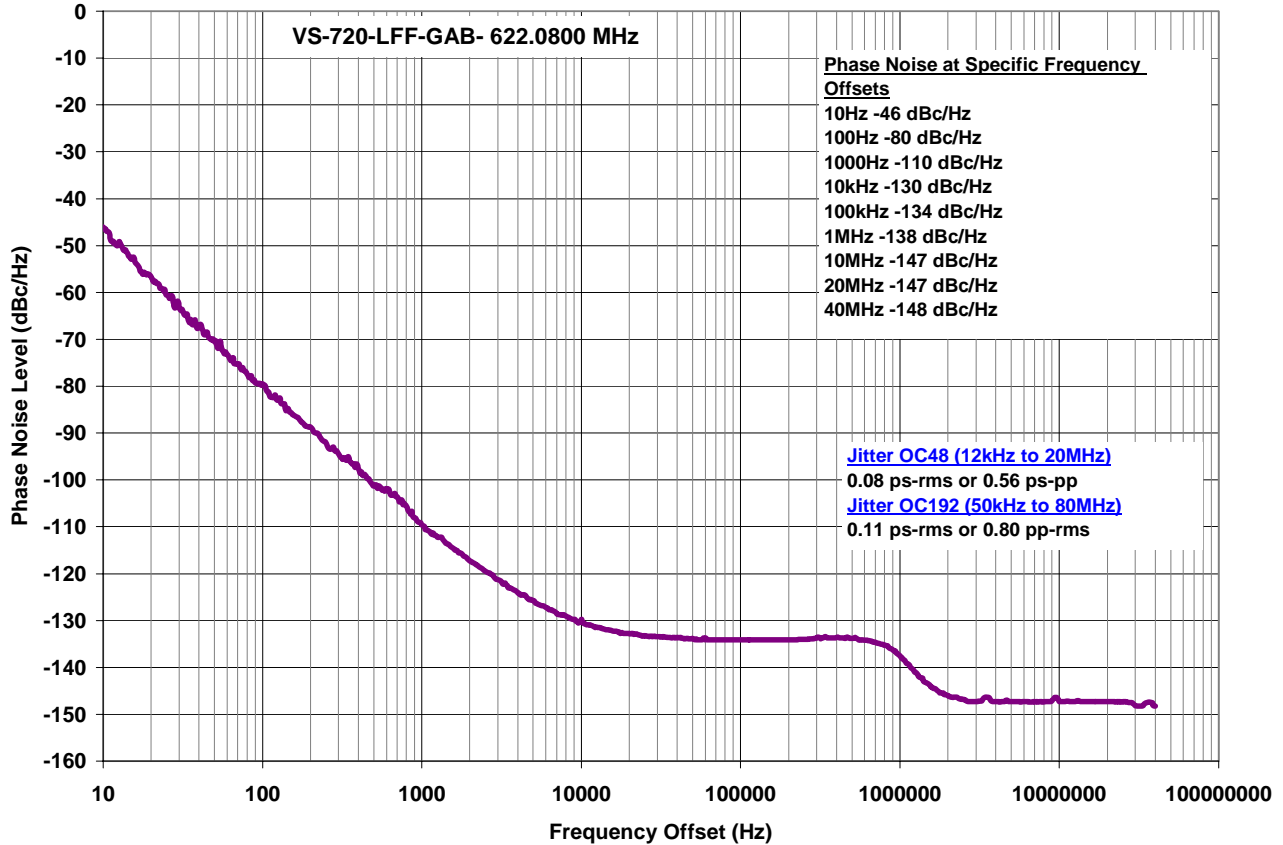
# VS-720 Voltage Controlled SAW Oscillator

## Typical Gain Transfer

VS-720-LFF-GAB-622M08



## Typical Phase Noise



# VS-720 Voltage Controlled SAW Oscillator

## Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VS-720 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 2015

## Handling Precautions

Although ESD protection circuitry has been designed into the VS-720 proper precautions should be taken when handling and mounting. VI employs a human body model (HBM) and a charged device model (CDM) for ESD susceptibility testing and design protection evaluation.

## ESD Ratings

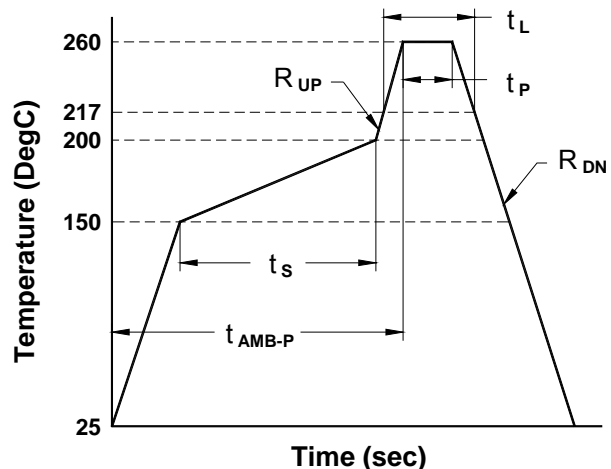
Model	Minimum	Conditions
Human Body Model	1500 V	MIL-STD 883, Method 3015
Charge Device Model	500 V	JESD22-C101

## Reflow Profile (IPC/JEDEC J-STD-020C)

Parameter	Symbol	Value
PreHeat Time	$t_S$	60 sec Min, 180 sec Max
Ramp Up	$R_{UP}$	3 °C/sec Max
Time Above 217 °C	$t_L$	60 sec Min, 150 sec Max
Time To Peak Temperature	$t_{AMB-P}$	480 sec Max
Time At 260 °C	$t_P$	20 sec Min, 40 sec Max
Ramp Down	$R_{DN}$	6 °C/sec Max

The device is 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 VS-720 device is hermetically sealed so an aqueous wash is not an issue.

Termination Plating: Electroless Gold Plate over Nickel Plate



# VS-720 Voltage Controlled SAW Oscillator

Standard Output Frequencies (MHz)							
*155.5200	*156.2500	*160.0000	*162.0000	*175.0000	*187.5000	*200.0000	212.5000
240.0000	245.7600	250.0000	260.0000	268.8000	300.0000	311.0400	312.5000
320.0000	324.0000	350.0000	375.0000	384.0000	389.6000	400.0000	480.0000
491.5200	500.0000	531.2500	532.0000	533.0000	537.6000	622.0800	625.0000
635.0400	637.5000	640.0000	644.5313	657.4219	666.5143	669.3266	672.1627
690.5692	693.4830	704.3806	707.3527	720.0000	742.4347	768.0000	796.8750
800.0000	901.1200	1000.0000					

Frequencies not shown are available upon request. \*VC-710 is preferred VCXO for frequencies  $\leq$  200 MHz

## Ordering Information

### VS - 720 - L F F - G A A - xxx.xxx

**Product Family**

VS = VCXO

**Package**

720 = 5.0 x 7.5 x 2.0 mm  
6 Pad Ceramic SMD

**Input**

L = 3.3 Vdc  $\pm$  10%

**Output**

F = LVPECL (45/55% Symmetry)  
P = LVDS (45/55% Symmetry)

**Operating Temperature**

C = 0°C to 70°C  
D = -20°C to 70°C  
F = -40°C to 85°C

**Frequency**

150 - 1000 MHz

**Performance Options\***

A = Default Option  
B = Lowest Phase Noise  
C =  $\pm$ 5% maximum Linearity  
D =  $\pm$  20 ppm maximum Temperature Stability

**Enable/Disable Input Logic (LV-CMOS)**

A = Pin 2: Enable Low (or Gnd)/Disable High  
B = Pin 2: Enable High (or Vcc)/Disable Low

**Absolute Pull Range Options**

C =  $\pm$  20 ppm minimum  
F =  $\pm$  32 ppm minimum  
G =  $\pm$  50 ppm minimum (default value)  
N =  $\pm$  80 ppm minimum  
H\*\* =  $\pm$  100 ppm minimum

\*Not all combinations are possible

\*\*Linearity >10% for  $\pm$ 100 ppm APR option

## For Additional Information, Please Contact:



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