
Temperature Compensated Crystal Oscillator

Features

- 10.000 MHz to 52.000 MHz Output
- ± 0.5 ppm to ± 2.5 ppm Temperature Stability
- Optional Frequency Tuning
- Fundamental Crystal Design
- Clipped Sine Wave Output
- -20°C to $+70^{\circ}\text{C}$, -30°C to $+85^{\circ}\text{C}$, or -40°C to $+85^{\circ}\text{C}$ Temperature Ranges
- Hermetically Sealed Ceramic SMD Package
- Product is Compliant to RoHS Directive and Fully Compatible with Lead-Free Assembly (excluding solder dipped, _SNPB option)

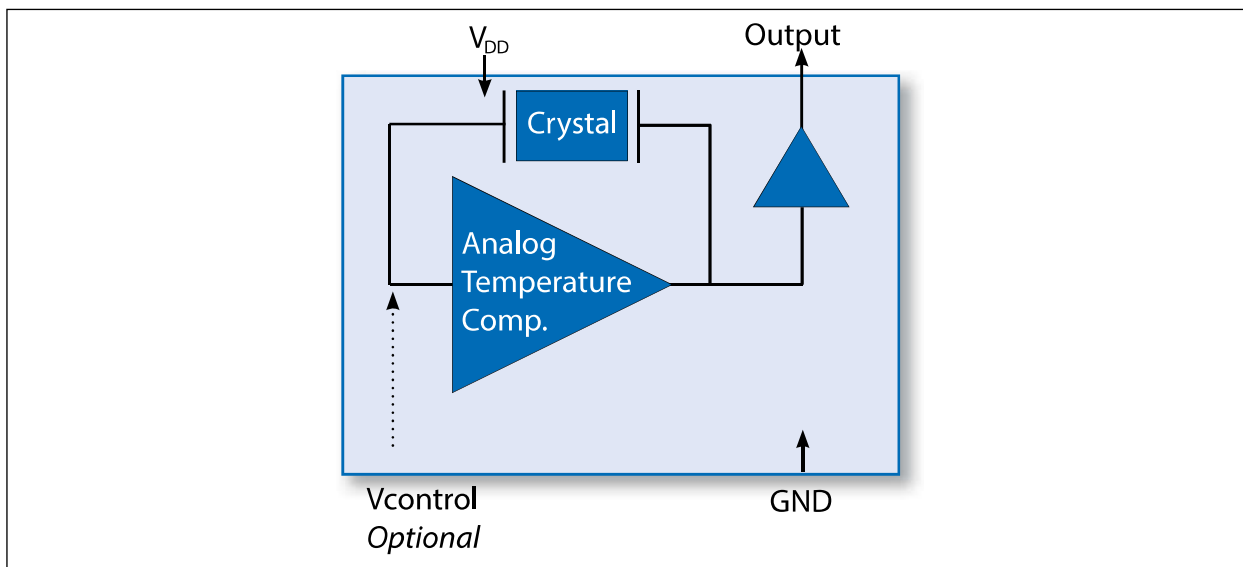
General Description

Microchip's VT-860B Temperature Compensated Crystal Oscillator (TCXO) is a quartz-stabilized, clipped sine wave output, analog temperature compensated oscillator that operates off a 1.8V to 3.3V supply in a hermetically sealed 2.0 mm x 1.6 mm ceramic package.

Applications

- GPS
- WiMax, WLAN
- IoT, Wearables

Block Diagram



VT-860B

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

ESD Rating, Human Body Model (Note 1, Note 2)	2 kV
ESD Rating, Machine Model (Note 3)	200V
ESD Rating, Charged Device Model (Note 3)	750V
Storage Temperature (T _S)	-55°C to +125°C
Maximum Junction Temperature (T _{J(MAX)})	+90°C

† **Notice:** 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.

Note 1: Although ESD protection circuitry has been designed into the VT-860B, proper precautions should be taken when handling and mounting. Microchip employs a Human Body Model (HBM) and a Charged Device Model (CDM) for ESD susceptibility testing and design evaluation. ESD thresholds are dependent on the circuit parameters used to define the model. Although no industry standard has been adopted for the CDM, a standard resistance of 1.5 kΩ and capacitance of 100 pF is widely used and therefore can be used for comparison purposes.

2: MIL-STD-883, Method 3115.

3: JESD22-C101.

ELECTRICAL CHARACTERISTICS

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions
Output Frequency	f _O	10	—	52	MHz	—
Supply Voltage (Note 1)	V _{DD}	—	1.8	—	V	Ordering Option
		—	2.5	—		
		—	2.8	—		
		—	3.0	—		
		—	3.3	—		
Maximum Supply Voltage Range	V _{IN(MAX)}	-0.3	—	4.5	V	Non-operating
Supply Current	I _{DD}	—	—	1.5	mA	10 MHz ≤ f _O ≤ 26 MHz
		—	—	2.0	mA	26 MHz < f _O ≤ 52 MHz
Operating Temperature	T _{OP}	-20	—	+70	°C	Ordering Option
		-30	—	+85	°C	
		-40	—	+85	°C	
Frequency Stability						
Stability over Operating Temperature	T _{STAB}	—	—	±0.5	ppm	—
		—	—	±1.0		
		—	—	±1.5		
		—	—	±2.0		
		—	—	±2.5		

Note 1: It's recommended that a 0.01 μF and a 0.1 μF capacitor be located as close to the supply as possible (to ground).

2: Duty cycle is defined as On-time divided by period.

3: Measured using an E5052B or equivalent at room temperature.

ELECTRICAL CHARACTERISTICS (CONTINUED)

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions
Frequency Tolerance	f_{TOL}	—	—	±2.0	ppm	—
		—	—	±3.0		P code, 1.71V to 3.465V
Power Supply Tolerance	—	—	—	±0.2	ppm	—
Load Stability	—	—	—	±0.2	ppm	—
Aging	—	—	—	±1.0	ppm	—
Output						
Amplitude	—	0.8	—	—	V	—
Load	—	10K 10 pF			—	—
Duty Cycle	—	40	—	60	%	Note 2
Optional Frequency Tuning						
Frequency Adjust Voltage	V_C	0.5	—	2.5	V	3.3V, 3.0V, 2.8V option
		0.4	—	2.4	V	2.5V option
		0.3	—	1.5	V	1.8V option
Maximum Control Voltage	—	-0.3	—	$V_{DD} + 0.3$	V	—
Pull Range	—	±5	—	—	ppm	Ordering Option
		±8	—	—		
		±10	—	—		
Gain Transfer	—	Positive			ppm/V	—
Input Impedance	—	500	—	—	kΩ	—
Control Voltage Bandwidth (-3 dB)	BW	10	—	—	kHz	—
Phase Noise (Note 3)	—	—	-115	—	dBc/Hz	100 Hz
		—	-135	—		1 kHz
		—	-148	—		10 kHz
Start-Up Time	t_{SU}	—	—	2	ms	—

Note 1: It's recommended that a 0.01 μF and a 0.1 μF capacitor be located as close to the supply as possible (to ground).

2: Duty cycle is defined as On-time divided by period.

3: Measured using an E5052B or equivalent at room temperature.

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2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 2-1](#).

TABLE 2-1: PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	V _C or NC	VCXO Control Voltage or No connection.
2	GND	Ground.
3	f _O	Frequency output.
4	V _{DD}	Supply voltage.

3.0 RELIABILITY

Microchip qualification will include aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VT-860B is capable of meeting the following qualification tests.

TABLE 3-1: ENVIRONMENTAL COMPLIANCE

Parameter	Conditions
Mechanical Shock	1500g, half sine, 0.5 ms, 3 times each axis
Mechanical Vibration	10 Hz - 2000 Hz, 1.52 mm, 2.0g, 4 hours each axis
IR Reflow	260°C ±5°C, 3 Reflows
Thermal Shock	-55°C to +125°C, dwell 10 minutes, 200 cycles
Damp Heat	85°C/85% RH for 500 hours
Gross and Fine Leak	100% Tested in production
Moisture Sensitivity Level	MSL1
Contact Pads	Gold (40 µm max.) over nickel
Contact Pads _SNPB option	Tinned using SN63PB37 solder alloy in accordance with J-STD-006
Weight	7.5 mg

4.0 IR REFLOW

The VT-860B 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 and parameters are listed in the table below. The contact pads are gold over nickel so lower IR reflow temperatures such as 220°C can be used (device is backwards compatible with a lead solder assembly). The VT-860B is hermetically sealed so an aqueous wash is not an issue.

Note: Devices that have been solder dipped, `_SNPB`, are not Pb-free.

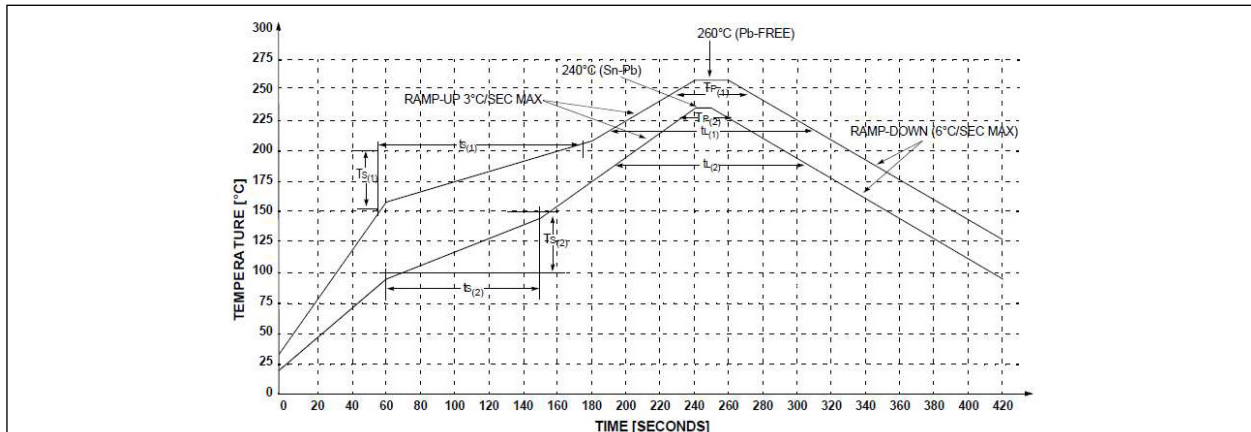


FIGURE 4-1: Solder Profile.

TABLE 4-1: REFLOW PROFILE, (IPC/JEDEC J-STD-020)

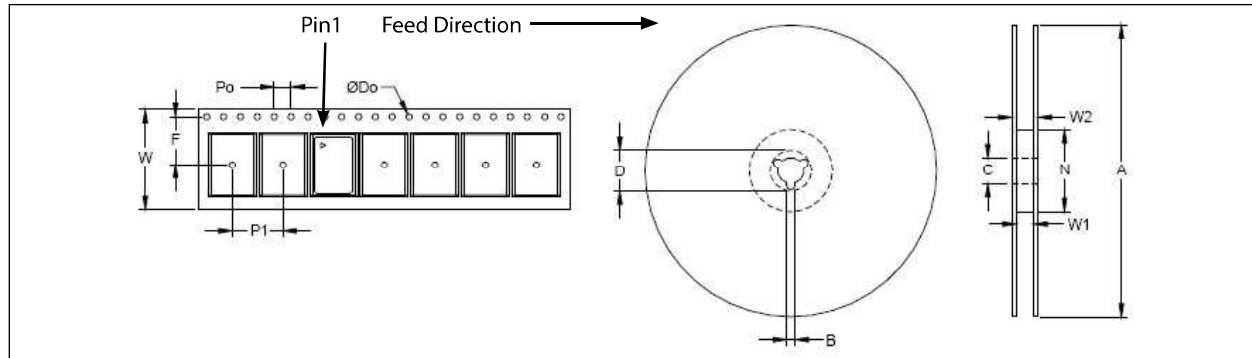
Symbol	Min ~ Max	Conditions
$T_{S(1)}$	150°C ~ 200°C	Pb-free Option
$T_{S(2)}$	100°C ~ 150°C	<code>_SNPB</code> Option
$t_{s(1)}$	60°C ~ 180°C	Pb-free Option
$t_{s(2)}$	60°C ~ 120°C	<code>_SNPB</code> Option
$t_{l(1)}$	60°C ~ 150°C	Pb-free Option
$t_{l(2)}$	60°C ~ 150°C	<code>_SNPB</code> Option
$T_{p(1)}$	245°C ~ 260°C	Pb-free Option
$T_{p(2)}$	225°C ~ 240°C	<code>_SNPB</code> Option

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5.0 TAPE AND REEL

TABLE 5-1: TAPE AND REEL DIMENSIONS

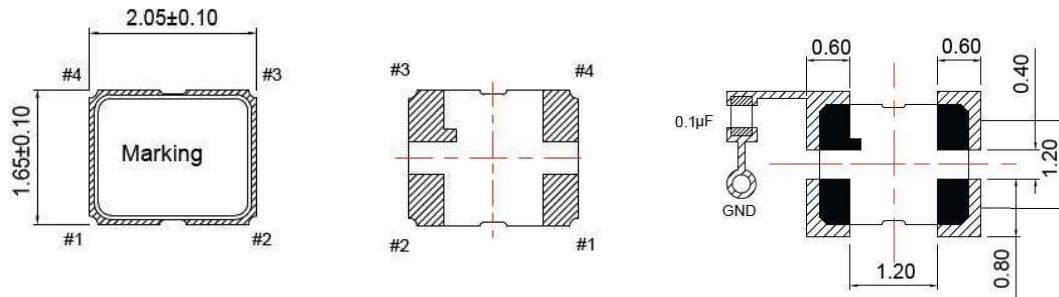
Tape Dimensions (mm)						Reel Dimensions (mm)							# per Reel
Dimension	A	B	C	D	E	F	G	H	I	J	K	L	
Tolerance	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Max	
VT-860B	8	3.5	1.5	4	4	2	—	20	60	1.2	9	180	3000



6.0 PACKAGING INFORMATION

4-Lead 2.0 mm x 1.6 mm Ceramic Leadless Chip Carrier Package Outline (FWC) and Recommended Land Pattern

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Dimensions in mm

Marking
VXXMXX
. YYWWT

where
XXMXX = Frequency, eg 26M00 = 26.00 MHz
YY = Year
WW = Week
T = Manufacturing Location

. = Pin 1

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NOTES:

APPENDIX A: REVISION HISTORY

Revision A (March 2025)

- Initial release of VT-860B as Microchip data sheet DS20006988A.

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NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

<u>Device</u>	<u>-X</u>	<u>X</u>	<u>X</u>	<u>-XXX</u>	<u>X</u>	<u>-XXXXXXXXXX</u>	<u>XX</u>
Part No.	Power Supply	Output	Temp. Range	Stability	Tuning	Frequency	Packaging
Device:	VT-860B: Temperature Compensated Crystal Oscillator in a 2.0 mm x 1.6 mm CLCC						
Power Supply:	E = 3.3V ±5%						
	F = 3.0V ±5%						
	G = 2.8V ±5%						
	H = 2.5V ±5%						
	J = 1.8V ±5%						
	P = 1.71V to 3.465V						
Output:	F = Clipped Sine Wave						
Temperature Range:	J = -20°C to +70°C						
	H = -30°C to +85°C						
	E = -40°C to +85°C						
Stability:	507 = ±0.5 ppm						
	106 = ±1.0 ppm						
	156 = ±1.5 ppm						
	206 = ±2.0 ppm						
	256 = ±2.5 ppm						
Tuning:	0 = Fixed, No Tuning						
	A = ±5 ppm						
	B = ±8 ppm						
	C = ±10 ppm						
Frequency:	xxMxxxxxx=Frequency in MHz						
Packaging:	TR = 3,000/Reel						
	<blank>= Cut Tape/ non-TR quantities						
	_SNPB= Tin Lead Solder Dipped						
Examples:							
a) VT-860B-EFE-2560-26M000000TR				VT-860B, 3.3V, Clipped Sine Wave Output, -40°C to +85°C Temp. Range, ±2.5 ppm Stability, No Tuning, 26 MHz Frequency, 3000/Reel			
b) VT-860B-GFJ-507B-12M8000000				VT-860B, 2.8V, Clipped Sine Wave Output, -20°C to +70°C Temp. Range, ±0.5 ppm Stability, ±8 ppm Tuning, 12.8 MHz Frequency, Cut Tape			
c) VT-860B-FFE-106C-20M0000000_SNPB				VT-860B, 3.0V, Clipped Sine Wave Output, -40°C to +85°C Temp. Range, ±1.0 ppm Stability, ±10 ppm Tuning, 20 MHz Frequency, Tin Lead Solder Dipped			
d) VT-860B-HFH-156A-30M7200000				VT-860B, 2.5V, Clipped Sine Wave Output, -30°C to +85°C Temp. Range, ±1.5 ppm Stability, ±5 ppm Tuning, 30.720 MHz Frequency, Cut Tape			
Note 1:				Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.			

Note: Not all combinations of options are available. Other specifications may be available upon request.

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NOTES:

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