



Integrated
Circuit
Systems, Inc.

Preliminary Information

M660-02

DUAL SAW, SELECTABLE FREQUENCY VCSO

GENERAL DESCRIPTION

The M660-02 is a dual SAW, selectable frequency VCSO frequency source for low-jitter clock generation. An integrated SAW (surface acoustic wave) delay line implements the high-Q VCO (voltage controlled oscillator) function, which results in low output phase noise and very low jitter. The M660-02 is available in a range of center frequencies from 500 to 700MHz. Minimum pull-range is ± 50 ppm (wider pull-range is available). The M660-02 is well suited for phase-locked loop implementations, clock and data recovery circuits, and other timing applications in telecom and optical fiber networking systems (e.g., OC-48, OC-192).



PIN ASSIGNMENT (9 x 14mm SMT)

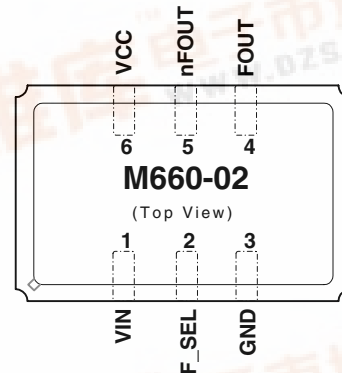


Figure 1: Pin Assignment

FEATURES

- ◆ Two integrated SAW devices
- ◆ Selectable output frequency
- ◆ Supports multi-rate optical interface requirements
- ◆ VCSO center frequencies from 500 to 700 MHz (Specify center frequency at time of order)
- ◆ Low phase jitter 0.19ps rms typical (50kHz-80MHz)
- ◆ Low phase noise -70dBc/Hz @ 1kHz offset
- ◆ Differential 3.3V LVPECL output
- ◆ Single 3.3V power supply
- ◆ Small 9 x 14mm SMT (surface mount) package

Sample of Available Output Frequencies

VCSO Center Frequency ¹ (MHz)	Applications
622.0800	SONET/SDH
625.0000	Gigabit Ethernet
644.5313	Gigabit Ethernet FEC
669.3265	SONET/SDH FEC

Table 1: Sample of Available Output Frequencies

Note 1: Specify VCSO center frequency at time of order

BLOCK DIAGRAM

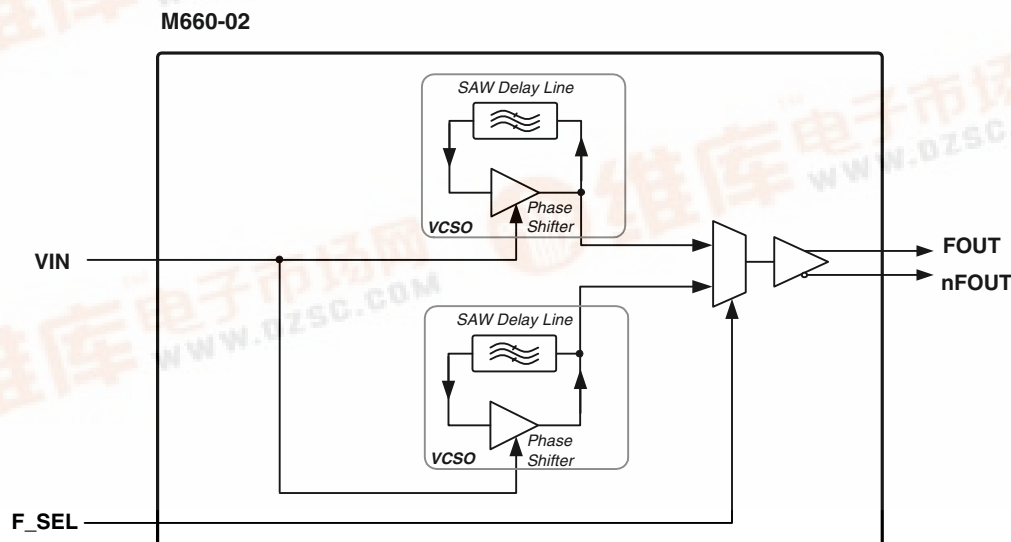


Figure 2: Block Diagram



PIN DESCRIPTIONS

Number	Name	I/O	Configuration	Description
1	VIN	Input		Tuning control voltage.
2	F_SEL	Input	Internal pull-down resistor ¹	Frequency select: Logic 1 selects Frequency 2. Logic 0 selects Frequency 1.
3	GND	Ground		Power supply ground connections.
4	FOUT	Output	No internal terminator	Clock output pair. Differential LVPECL.
5	nFOUT	Output		
6	VCC	Power		Power supply connection, connect to +3.3V.

Table 2: Pin Descriptions

Note 1: See "Frequency Select" in Table 5, [DC Characteristics](#) on [pg. 3](#).

ABSOLUTE MAXIMUM RATINGS¹

Symbol	Parameter	Rating	Unit
V_I	Inputs	-0.5 to $V_{CC} + 0.5$	V
V_O	Outputs	-0.5 to $V_{CC} + 0.5$	V
V_{CC}	Power Supply Voltage	3.63	V
T_S	Storage Temperature	-55 to +125	°C

Table 3: Absolute Maximum Ratings

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These ratings are stress specifications only. Functional operation of product at these conditions or any conditions beyond those listed in [Recommended Conditions of Operation](#), [DC Characteristics](#), or [AC Characteristics](#) is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

RECOMMENDED CONDITIONS OF OPERATION

Symbol	Parameter	Min	Typ	Max	Unit
V_{CC}	Positive Supply Voltage	2.97	3.3	3.63	V
T_A	Ambient Operating Temperature	-40	25	+85	°C

Table 4: Recommended Conditions of Operation



ELECTRICAL SPECIFICATIONS

DC Characteristics

Unless stated otherwise, $V_{CC} = 3.3 \text{ Volts} \pm 10\%$, $T_A = 0 \text{ to } 85^\circ\text{C}$, VCSO Frequency = 500-700MHz, Outputs terminated into 180Ω to ground

	Symbol	Parameter	Pin	Min	Typ	Max	Unit
Power Supply	V_{CC}	Positive Supply Voltage	VCC	2.97	3.3	3.63	V
	I_{CC}	Power Supply Current			90	125	mA
Control Voltage	V_{IN}	Input Control Voltage Range		0		V_{CC}	V
		V_{IN} Input Impedence	VIN		100		k Ω
		V_{IN} Modulation Bandwidth			1000		kHz
Frequency Select ¹	V_{IH}	Input High Voltage		2		$V_{CC} + 0.3$	V
	V_{IL}	Input Low Voltage		-0.3		0.8	V
	I_{IH}	Input High Current	F_SEL			5	μA
	I_{IL}	Input Low Current		-150			μA
	$R_{pulldown}$	Internal Pull-down Resistor			51		k Ω
Differential Outputs	V_{OH}	Output High Voltage		$V_{CC} - 0.98$		$V_{CC} - 0.75$	V
	V_{OL}	Output Low Voltage		$V_{CC} - 1.95$		$V_{CC} - 1.63$	V
	V_{P-P}	Peak to Peak Output Voltage	FOUT, nFOUT	0.475	0.625	0.85	V_{P-P}
	I_{OUT}	Output Current				20	mA

Table 5: DC Characteristics

Note 1: Internally pulled down to Logic 0 (Frequency 1) if left unselected.

AC Characteristics

Unless stated otherwise, $V_{CC} = 3.3 \text{ Volts} \pm 10\%$, $T_A = 0 \text{ to } 85^\circ\text{C}$, VCSO Frequency = 500-700MHz, Outputs terminated into 180Ω to ground

	Symbol	Parameter	Min	Typ	Max	Unit	Notes
Frequency	F_{OUT}	Output Center Frequency Range	500		700	MHz	
	APR	Absolute Pull-Range ¹	± 50			ppm	
	f_{STAB}	Frequency Stability		110		ppm p-p	
	L_{IN}	Tuning Linearity		6		%	
	K_{VCO}	VCO Gain	@622.08MHz	230		ppm/V	$V_{IN} = 0.3 \text{ to } 3.0\text{V}$ Best fit straight line
Outputs		Non-harmonic Spurious	-50	-77		dBc	
	Φ_n	SSB (single sideband)	100Hz Offset	-41		dBc/Hz	
		Phase Noise, offset from carrier	1kHz Offset	-68		dBc/Hz	
			10kHz Offset	-97		dBc/Hz	
			100kHz Offset	-122		dBc/Hz	
	J(t)	Jitter (rms)	12kHz to 20MHz	0.37		ps rms	
			50kHz to 80MHz	0.19		ps rms	
	odc	Output Duty Cycle ²	45		55	%	
	t_R	Output Rise Time ² for FOUT, nFOUT		275	400	ps	20% to 80%
	t_F	Output Fall Time ² for FOUT, nFOUT		275	400	ps	20% to 80%

Table 6: AC Characteristics

Note 1: Consult ICS for availability of other APRs.

Note 2: See [Parameter Measurement Information](#) on pg. 4.



PARAMETER MEASUREMENT INFORMATION

Output Rise and Fall Time

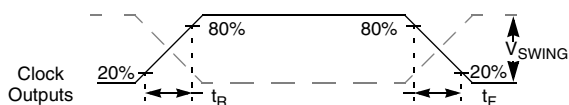


Figure 3: Output Rise and Fall Time

Output Duty Cycle

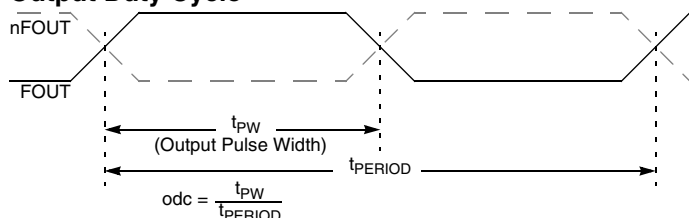


Figure 4: Output Duty Cycle

DEVICE PACKAGE - 9 x 14mm SMT (Surface Mount) Package

Mechanical Dimensions:

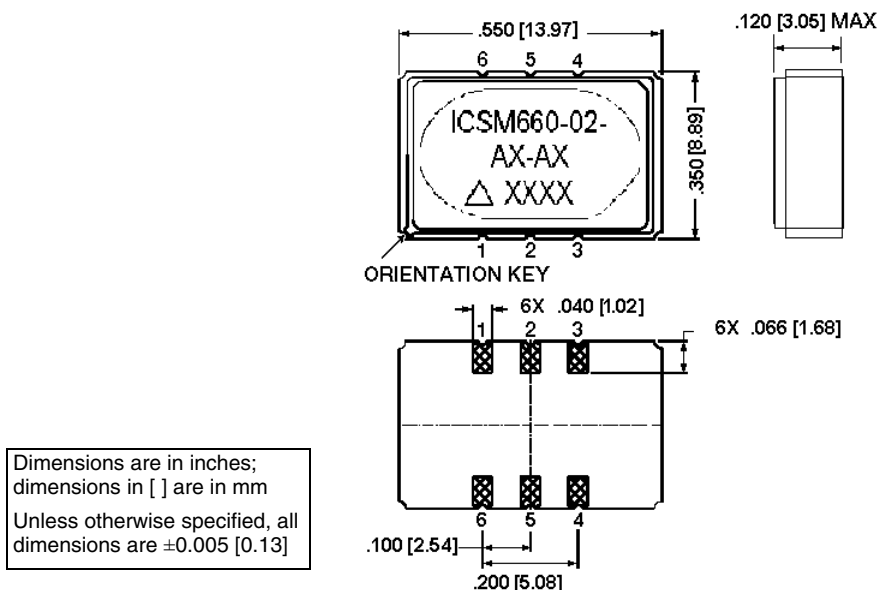


Figure 5: Device Package - 9 x 14mm SMT (Surface Mount) Package

ORDERING INFORMATION

For Output Frequencies (MHz)	Order Part Number
Frequency 1, Frequency 2	M660-02-Ax-Ax
e.g., 622.0800, 669.3265	M660-02-AA-AH

Table 7: Ordering Information

Standard Output Frequencies

AA	622.0800	AG	669.3120
AB	625.0000	AH	669.3265
AC	627.3296	AI	670.8386
AD	644.5313	AJ	672.1600
AE	666.5143	AK	690.5692
AF	669.1281	AL	693.4830

Table 8: Standard Output Frequencies

Consult ICS for the availability of other VCSO frequencies.

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