



## GENERAL DESCRIPTION

The M675 is a VCSO (Voltage Controlled SAW Oscillator) 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 M675-01 is available in a range of center frequencies from 125 to 175 MHz. The M675-02 provides 500 to 700 MHz. Guaranteed minimum pull-range of  $\pm 100$  ppm meets GbE requirements. (It also fully satisfies  $\pm 50$  ppm minimum pull-range specification commonly required.) Industry-standard  $K_{vco}$  (VCO Gain) provides full replacement compatibility. The M675 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., SONET/SDH).

## FEATURES

- ◆ Integrated SAW device
- ◆ M675-01 output frequencies from 125 to 175 MHz  
M675-02 output frequencies from 500 to 700 MHz  
(Specify center frequency at time of order)
- ◆ Industry-standard  $K_{vco}$  for full compatibility
- ◆ Low phase jitter 0.2ps rms typical for the M675-02  
(50kHz to 80MHz)
- ◆ Differential 3.3V LVPECL output
- ◆ Single 3.3V power supply
- ◆ Small 5 x 7.5mm SMT (surface mount) package

## BLOCK DIAGRAM

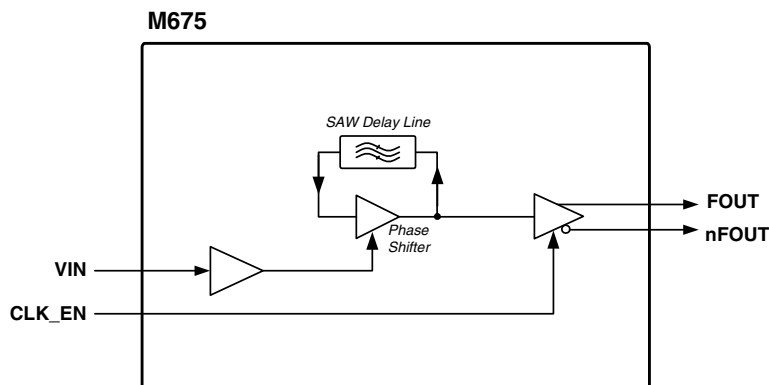


Figure 2: Block Diagram

## PIN ASSIGNMENT (5 x 7.5mm SMT)

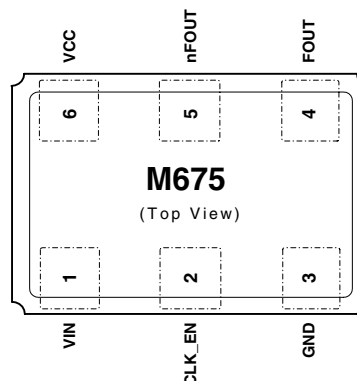


Figure 1: Pin Assignment

## Sample of Available Output Frequencies

VCSO Center Frequencies <sup>1</sup> (MHz)		Applications
M675-01	M675-02	
155.5200	622.0800	SONET/SDH
156.2500	625.0000	Gigabit Ethernet
161.1328	644.5313	Gigabit Ethernet FEC
167.3316	669.3266	SONET/SDH FEC

Table 1: Sample of Available Output Frequencies

Note 1: Specify VCSO center frequencies at time of order



## PIN DESCRIPTIONS

Number	Name	I/O	Configuration	Description
1	VIN	Input		Frequency control input.
2	CLK_EN	Input	Internal pull-up resistor <sup>1</sup>	Clock enable: Logic 1 enables normal operation. Logic 0 stops the output clock; nFOUT is held high, FOUT is held low.
3	GND	Ground		Power supply ground connection.
4	FOUT	Output	No internal terminator	Clock output pair. Differential LVPECL.
5	nFOUT			
6	VCC	Power		Power supply connection, connect to +3.3V.

Table 2: Pin Descriptions

Note 1: See "Clock Enable Pull-up" in Table 5 (DC Characteristics for M675-01 on pg. 3) and Table 7 (DC Characteristics for M675-02 on pg. 4).

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

Symbol	Parameter	Rating	Unit
V <sub>I</sub>	Inputs	-0.5 to V <sub>CC</sub> +0.5	V
V <sub>O</sub>	Outputs	-0.5 to V <sub>CC</sub> +0.5	V
V <sub>CC</sub>	Power Supply Voltage	4.6	V
T <sub>S</sub>	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 <sub>CC</sub>	Positive Supply Voltage	2.97	3.3	3.63	V
T <sub>A</sub>	Ambient Operating Temperature	-40	25	+85	°C

Table 4: Recommended Conditions of Operation



## ELECTRICAL SPECIFICATIONS FOR M675-01

### DC Characteristics for M675-01

Unless stated otherwise,  $V_{CC} = 3.3 \text{ Volts} \pm 10\%$ ,  $T_A = 0 \text{ to } 85^\circ\text{C}$ , VCSO Freq.s = 155.52 MHz, 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			85	125	mA
Control Voltage	$V_{IN}$	Input Control Voltage Range	VIN	0		3.3	V
		$V_{IN}$ Input Impedence			100		kΩ
Clock Enable Pull-up <sup>1</sup>	$V_{IH}$	Input High Voltage		2		$V_{CC} + 0.3$	V
	$V_{IL}$	Input Low Voltage		-0.3		0.8	V
	$I_{IH}$	Input High Current	CLK_EN			5	μA
	$I_{IL}$	Input Low Current		-150			μA
	$R_{pullup}$	Internal Pull-up Resistor			51		kΩ
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 <sup>2</sup>	FOUT, nFOUT	0.450	0.625	0.85	$V_{P-P}$
	$I_{OUT}$	Output Current				20	mA

Note 1: Internally pulled up to Logic 1 (normal operation) if left unselected.

Note 2: Single-ended measurement. See Figure 3, Output Rise and Fall Time, on pg. 5.

Table 5: DC Characteristics for M675-01

### AC Characteristics for M675-01

Unless stated otherwise,  $V_{CC} = 3.3 \text{ Volts} \pm 10\%$ ,  $T_A = 0 \text{ to } 85^\circ\text{C}$ , VCSO Freq. = 155.52 MHz, Outputs terminated into 180Ω to ground

	Symbol	Parameter	Min	Typ	Max	Unit	Notes
Control Voltage	$V_{IN}$	Modulation Bandwidth		500		kHz	
Output	$F_{OUT}$	Output Center Frequency Range M675-01	125		175	MHz	
	APR	Absolute (Guaranteed) Pull-Range <sup>1</sup>	±100			ppm	
	$f_{STAB}$	Frequency Stability		100		ppm p-p	At any given $V_{IN}$
	$L_{IN}$	Tuning Linearity		6		%	$V_{IN} = 0.3 \text{ to } 3.0\text{V}$ Best fit straight line
	$K_{VCO}$	VCO Gain		400		ppm/V	$V_{IN} = 0.3 \text{ to } 3.0\text{V}$
		Non-harmonic Spurious		-50	-77		dBc
	$\Phi_n$	SSB (single sideband) Phase Noise, offset from carrier	100Hz Offset		-52		dBc/Hz
			1kHz Offset		-80		dBc/Hz
			10kHz Offset		-112		dBc/Hz
			100kHz Offset		-136		dBc/Hz
			1MHz Offset		-146		dBc/Hz
	J(t)	Jitter (rms)	12kHz to 20MHz		0.36		ps rms
			50kHz to 80MHz		0.50		ps rms
	odc	Output Duty Cycle <sup>2</sup>		45		55	%
$t_R$	Output Rise Time <sup>2</sup> for FOUT, nFOUT			275	425	ps	20% to 80%
$t_F$	Output Fall Time <sup>2</sup> for FOUT, nFOUT			275	425	ps	20% to 80%

Note 1: Also fully meets ±50 ppm minimum pull-range specification that is commonly required.

Note 2: See Parameter Measurement Information on pg. 5.

Table 6: AC Characteristics for M675-01



## ELECTRICAL SPECIFICATIONS FOR M675-02

### DC Characteristics for M675-02

Unless stated otherwise,  $V_{CC} = 3.3 \text{ Volts} \pm 10\%$ ,  $T_A = 0 \text{ to } 85^\circ\text{C}$ , VCSO Freq. = 622.08 MHz, 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			85	125	mA
Control Voltage	$V_{IN}$	Input Control Voltage Range	VIN	0		3.3	V
		$V_{IN}$ Input Impedance			100		kΩ
Clock Enable Pull-up <sup>1</sup>	$V_{IH}$	Input High Voltage		2		$V_{CC} + 0.3$	V
	$V_{IL}$	Input Low Voltage		-0.3		0.8	V
	$I_{IH}$	Input High Current	CLK_EN			5	μA
	$I_{IL}$	Input Low Current		-150			μA
	$R_{pullup}$	Internal Pull-up Resistor			51		kΩ
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 <sup>2</sup>	FOUT, nFOUT	0.450	0.625	0.85	$V_{P-P}$
	$I_{OUT}$	Output Current				20	mA

Note 1: Internally pulled up to Logic 1 (normal operation) if left unselected.

Note 2: Single-ended measurement. See Figure 3, Output Rise and Fall Time, on pg. 5.

Table 7: DC Characteristics for M675-02

### AC Characteristics for M675-02

Unless stated otherwise,  $V_{CC} = 3.3 \text{ Volts} \pm 10\%$ ,  $T_A = 0 \text{ to } 85^\circ\text{C}$ , VCSO Freq. = 622.08 MHz, Outputs terminated into 180Ω to ground

	Symbol	Parameter	Min	Typ	Max	Unit	Notes
Control Voltage	$V_{IN}$	Modulation Bandwidth		500		kHz	
Output	$F_{OUT}$	Output Center Frequency Range M675-02	500		700	MHz	
	APR	Absolute (Guaranteed) Pull-Range <sup>1</sup>	±100			ppm	
	$f_{STAB}$	Frequency Stability		100		ppm p-p	At any given $V_{IN}$
	$L_{IN}$	Tuning Linearity		6		%	$V_{IN} = 0.3 \text{ to } 3.0\text{V}$ Best fit straight line
	$K_{VCO}$	VCO Gain		400		ppm/V	$V_{IN} = 0.3 \text{ to } 3.0\text{V}$
		Non-harmonic Spurious		-50	-77		dBc
	$\Phi_n$	SSB (single sideband) Phase Noise, offset from carrier	100Hz Offset		-48		dBc/Hz
			1kHz Offset		-75		dBc/Hz
			10kHz Offset		-99		dBc/Hz
			100kHz Offset		-124		dBc/Hz
			1MHz Offset		-142		dBc/Hz
	J(t)	Jitter (rms)	12kHz to 20MHz		0.30		ps rms
			50kHz to 80MHz		0.18		ps rms
odc	Output Duty Cycle <sup>2</sup>		45		55	%	
$t_R$	Output Rise Time <sup>2</sup> for FOUT, nFOUT			275	400	ps	20% to 80%
$t_F$	Output Fall Time <sup>2</sup> for FOUT, nFOUT			275	400	ps	20% to 80%

Note 1: Also fully meets ±50 ppm minimum pull-range specification that is commonly required.

Note 2: See Parameter Measurement Information on pg. 5.

Table 8: AC Characteristics for M675-02



**PARAMETER MEASUREMENT INFORMATION**

**Output Rise and Fall Time**

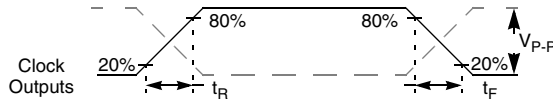


Figure 3: Output Rise and Fall Time

**Output Duty Cycle**

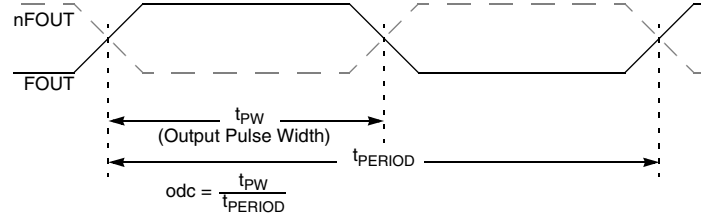
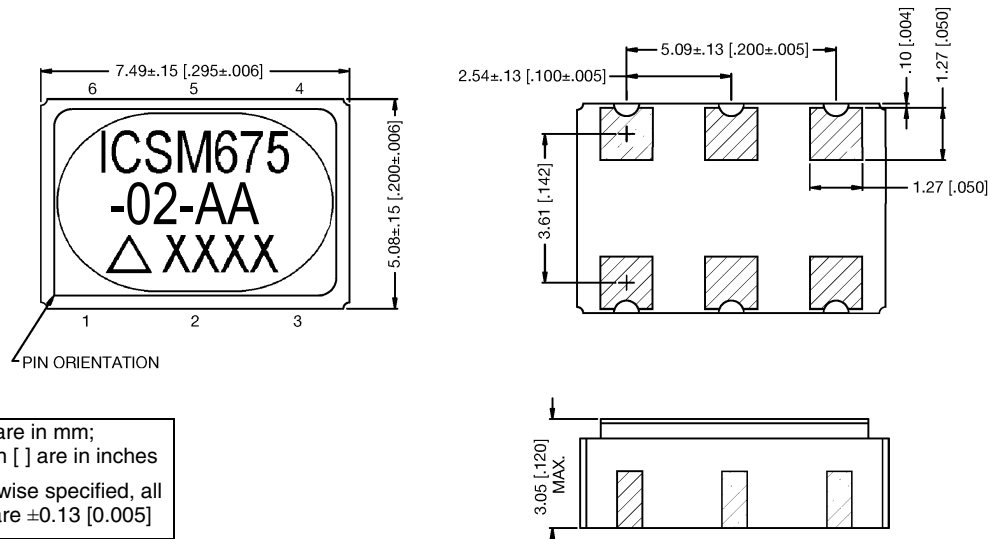


Figure 4: Output Duty Cycle

**DEVICE PACKAGE - 5 x 7.5mm SMT (Surface Mount) Package**

**Mechanical Dimensions:**



Dimensions are in mm;  
dimensions in [ ] are in inches  
Unless otherwise specified, all  
dimensions are ±0.13 [0.005]

Figure 5: Device Package - 5 x 7.5mm SMT (Surface Mount) Package



## ORDERING INFORMATION

### Part Numbering Scheme

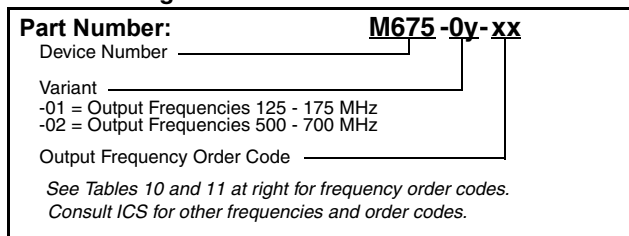


Figure 6: Part Numbering Scheme

### Example Order Numbers

For Output Frequencies	Order Part # M675-01-Bx	For Output Frequencies	Order Part # M675-02-Ax
155.5200	M675-01-BA	622.0800	M675-02-AA
156.2500	M675-01-BB	625.0000	M675-02-AB
161.1328	M675-01-BD	644.5313	M675-02-AD
167.3316	M675-01-BH	669.3266	M675-02-AH

Table 9: Example Order Numbers

### M675-01 Standard Output Frequencies & Order Codes

153.6000 BO	167.2820 BF
155.5200 BA	167.3280 BG
156.2500 BB	167.3316 BH
156.8324 BC	167.7097 BI
161.1328 BD	168.0400 BJ
164.3555 BM	172.6423 BK
166.6286 BE	173.3708 BL

Table 10: M675-01 Standard Output Frequencies & Order Codes

### M675-02 Standard Output Frequencies & Order Codes

614.4000 AO	669.1281 AF
622.0800 AA	669.3120 AG
625.0000 AB	669.3266 AH
627.3296 AC	670.8386 AI
644.5313 AD	672.1600 AJ
657.4219 AM	690.5692 AK
666.5143 AE	693.4830 AL

Table 11: M675-02 Standard Output Frequencies & Order Codes

Consult ICS for the availability of other frequencies

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