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 ±100 ppm meets GbE requirements. (It also fully satisfies ±50 ppm minimum pull-range specification commonly required.) Industry-standard Kvco (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 Kvco 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**

PIN ASSIGNMENT (5 x 7.5mm SMT)

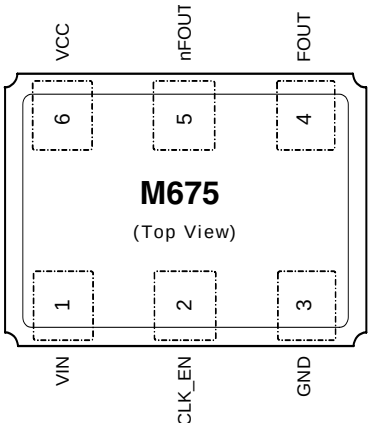


Figure 1: Pin Assignment

Sample of Available Output Frequencies

VCSO Center Frequencies[1] (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

BLOCK DIAGRAM

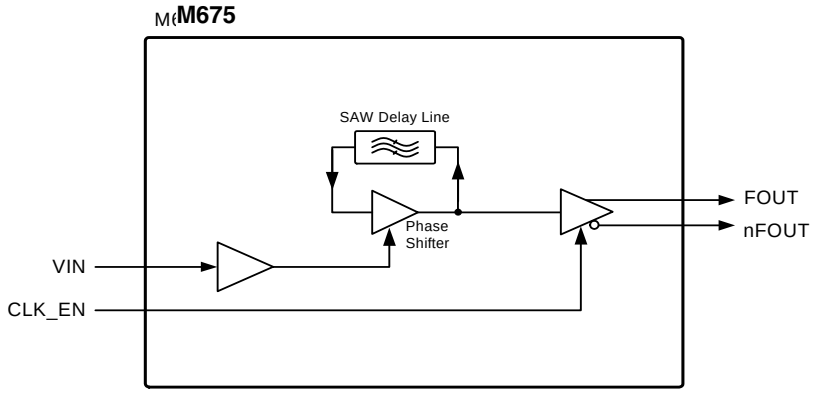


Figure 2: Block Diagram

PIN DESCRIPTIONS

Number	Name	I/O	Configuration	Description
1	VIN	Input		Frequency control input.
2	CLK_EN	Input	Internal pull-up resistor[1]	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 5	FOUT nFOUT	Output	No internal terminator	Clock output pair. Differential LVPECL.
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[1]

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	4.6	V
T_S	Storage Temperature	-55 to +125	^oC

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	^oC

Table 4: Recommended Conditions of Operation

ELECTRICAL SPECIFICATIONS FOR M675-01

DC Characteristics for M675-01

Unless stated otherwise, V_{CC} = 3.3 Volts ± 10%, T_A = 0 to 85 °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[1]	V_{IH}	Input High Voltage	CLK_EN	2		V_{cc} + 0.3	V
	V_{IL}	Input Low Voltage		-0.3		0.8	V
	I_{IH}	Input High Current				5	µA
	I_{IL}	Input Low Current		-150			µA
	R_{pullup}	Internal Pull-up Resistor			51		kΩ
Differential Outputs	V_{OH}	Output High Voltage	FOUT, nFOUT	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[2]		0.450	0.625	0.85	V_{P-P}
	I_{OUT}	Output Current				20	mA

Table 5: DC Characteristics for M675-01

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.

AC Characteristics for M675-01

Unless stated otherwise, V_{CC} = 3.3 Volts ± 10%, T_A = 0 to 85 °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	VIN		500		kHz	
Output	F_{OUT}	Output Center Frequency Range **M675-01**		125		175	MHz	
	APR	Absolute (Guaranteed) Pull-Range [1]		±100			ppm	
	f_{STAB}	Frequency Stability			100		ppm p-p	At any givin V_{IN}
	L_{IN}	Tuning Linearity			6		%	V_{IN} = 0.3 to 3.0V Best fit straight line
	K_{VCO}	VCO Gain			400		ppm/V	V_{IN} = 0.3 to 3.0V
		Non-harmonic Spurious		-50	-77		dBc	
	Φ 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 [2]		45		55	%	
	t_R	Output Rise Time [2] for FOUT, nFOUT			275	425	ps	20% to 80%
	t_F	Output Fall Time [2] for FOUT, nFOUT			275	425	ps	20% to 80%

Table 6: AC Characteristics for M675-01

Note 1: Also fully meets ±50 ppm minimum pull-range specification that is commonly required.
Note 2: See Parameter Measurement Information on pg. 5.

ELECTRICAL SPECIFICATIONS FOR M675-02

DC Characteristics for M675-02

Unless stated otherwise, V_{CC} = 3.3 Volts ± 10%, T_A = 0 to 85 °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 Impedence			100		kΩ
Clock Enable Pull-up[1]	V_{IH}	Input High Voltage	CLK_EN	2		V_{CC} + 0.3	V
	V_{IL}	Input Low Voltage		-0.3		0.8	V
	I_{IH}	Input High Current				5	µA
	I_{IL}	Input Low Current		-150			µA
	R_{pullup}	Internal Pull-up Resistor			51		kΩ
Differential Outputs	V_{OH}	Output High Voltage	FOUT, nFOUT	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[2]		0.450	0.625	0.85	V_{P-P}
	I_{OUT}	Output Current				20	mA

Table 7: DC Characteristics for M675-02

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.

AC Characteristics for M675-02

Unless stated otherwise, V_{CC} = 3.3 Volts ± 10%, T_A = 0 to 85 °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	VIN		500		kHz	
Output	F_{OUT}	Output Center Frequency Range **M675-02**		500		700	MHz	
	APR	Absolute (Guaranteed) Pull-Range [1]		±100			ppm	
	f_{STAB}	Frequency Stability			100		ppm p-p	At any givin V_{IN}
	L_{IN}	Tuning Linearity			6		%	V_{IN} = 0.3 to 3.0V Best fit straight line
	K_{VCO}	VCO Gain			400		ppm/V	V_{IN} = 0.3 to 3.0V
		Non-harmonic Spurious		-50	-77		dBc	
	Φ 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 [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 8: AC Characteristics for M675-02

Note 1: Also fully meets ±50 ppm minimum pull-range specification that is commonly required.
Note 2: See Parameter Measurement Information on pg. 5.

PARAMETER MEASUREMENT INFORMATION

Output Rise and Fall Time

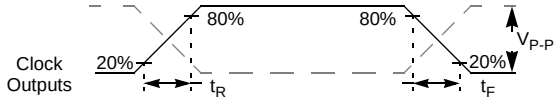


Figure 3: Output Rise and Fall Time

Output Duty Cycle

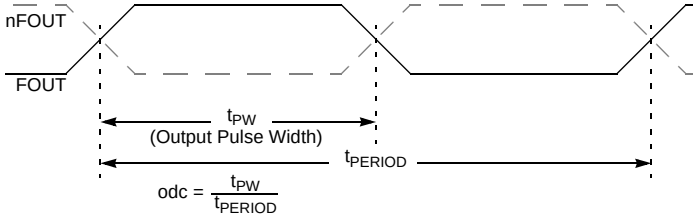
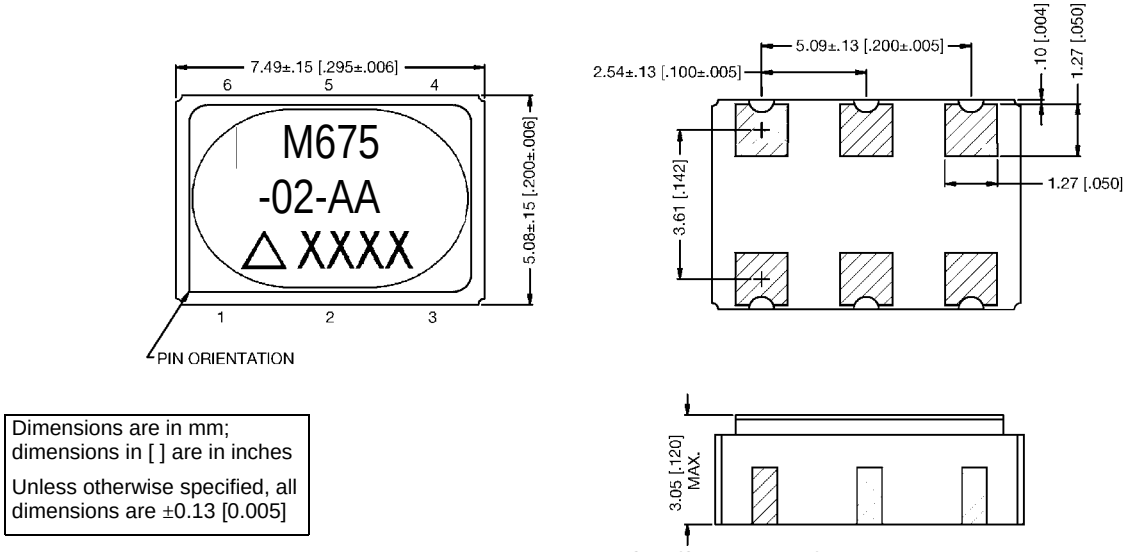


Figure 4: Output Duty Cycle

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

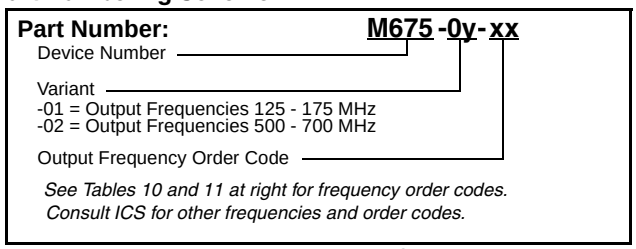


Figure 6: Part Numbering Scheme

Example Order Numbers

For Output Frequencies	Order Part # M675-01-B*x*	For Output Frequencies	Order Part # M675-02-A*x*
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

125.0000 **DA**	168.0407 **BJ**
155.5200 **BA**	172.6423 **BK**
156.2500 **BB**	173.3708 **BL**
156.8324 **BC**	164.3555 **BM**
161.1328 **BD**	153.6000 **BO**
166.6286 **BE**	118.7500 **BP**
167.2820 **BF**	176.8382 **BQ**
167.3280 **BG**	156.1762 **BR**
167.3316 **BH**	174.1537 **BU**
167.7097 **BI**	174.7031 **BV**

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

M675-02 Standard Output Frequencies & Order Codes

500.0000 **CA**	672.1627 **AJ**
622.0800 **AA**	690.5692 **AK**
625.0000 **AB**	693.4830 **AL**
627.3296 **AC**	657.4219 **AM**
644.5313 **AD**	614.4000 **AO**
666.5143 **AE**	475.0000 **AP**
669.1281 **AF**	707.3527 **AQ**
669.3120 **AG**	624.7048 **AR**
669.3266 **AH**	696.6149 **AU**
670.8386 **AI**	698.8123 **AV**

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

Consult IDT for the availability of other frequencies

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

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