

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 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).



PIN ASSIGNMENT (5 x 7.5mm SMT)

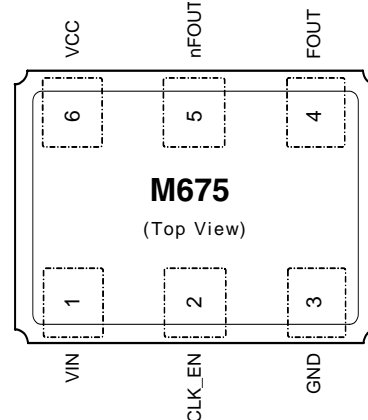


Figure 1: Pin Assignment

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

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

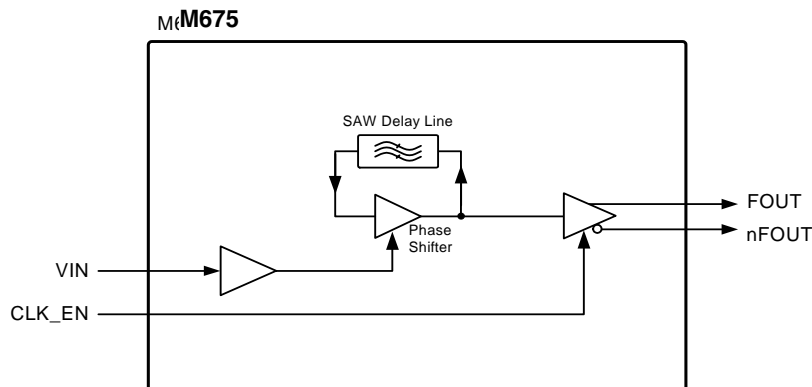


Figure 2: Block Diagram

PIN 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 | 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 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 | 4.6 | 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 FOR M675-01**DC Characteristics for M675-01**

Unless stated otherwise, $V_{CC} = 3.3 \text{ Volts} \pm 10\%$, $T_A = 0 \text{ to } 85^\circ\text{C}$, $V_{CSO} \text{ Freq.} = 155.52 \text{ MHz}$, 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 | | k Ω |
| ClockEnable Pull-up 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 | CLK_EN | | | 5 | μA |
| | I_{IL} | Input Low Current | | -150 | | | μA |
| | R_{pullup} | Internal Pull-up 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 ² | 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, $V_{CC} = 3.3 \text{ Volts} \pm 10\%$, $T_A = 0 \text{ to } 85^\circ\text{C}$, $V_{CSO} \text{ Freq.} = 155.52 \text{ MHz}$, 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 ¹ | ± 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 | |
| | 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% |

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 Impedence | | | 100 | | k Ω |
| Clock Enable Pull-up 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 | CLK_EN | | | 5 | μA |
| | I_{IL} | Input Low Current | | -150 | | | μA |
| | R_{pullup} | Internal Pull-up 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 ² | 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 ¹ | ± 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 | |
| | Φ_n | SSB (single sideband) | 100Hz Offset | -48 | | dBc/Hz | |
| | | Phase Noise, offset from carrier | 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% |

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

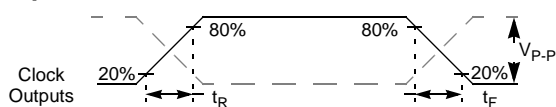


Figure 3: Output Rise and Fall Time

Output Duty Cycle

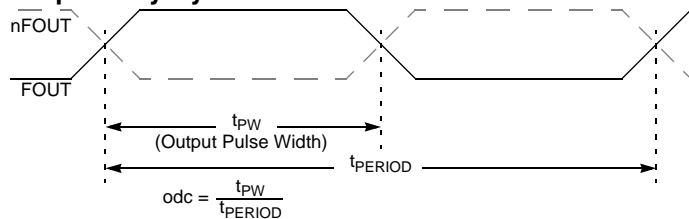
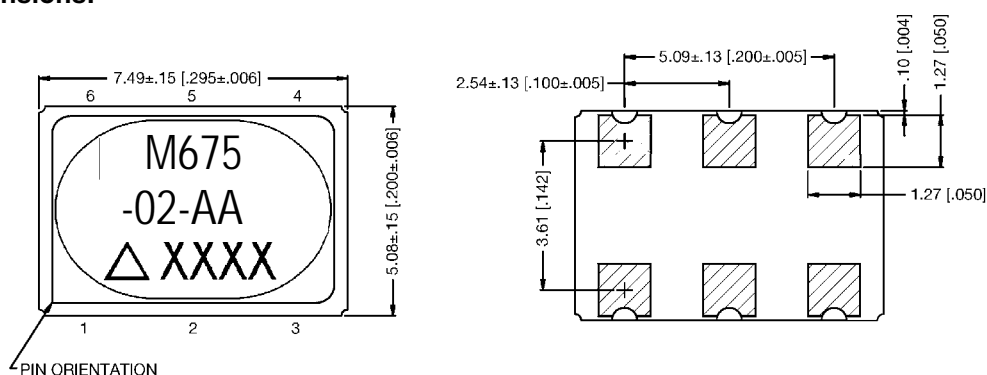


Figure 4: Output Duty Cycle

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

| | |
|--|-------------------|
| Part Number: | M675-0y-xx |
| Device Number _____ | |
| Variant _____ | |
| -01 = Output Frequencies 125 - 175 MHz -02 = Output Frequencies 500 - 700 MHz | |
| Output Frequency Order Code _____ | |
| See Tables 10 and 11 at right for frequency order codes. Consult ICS for other frequencies and order codes. | |

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

| | |
|-------------|-------------|
| 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

IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES ("RENESAS") PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Rev.1.0 Mar 2020)

Corporate Headquarters

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

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.