

System Reset (with built-in watchdog timer) Monolithic IC MM1075

Outline

This IC functions in a variety of CPU systems and other logic systems to generate a reset signal and reset the system accurately during momentary interruption or lowering of power supply voltage.

It also has a built-in watchdog timer for operation diagnosis. This prevents the system from running wild by generating an intermittent reset pulse during system mis-operation.

Features

1. Built-in watchdog timer
2. Low minimum operating voltage $V_{CC}=0.8V$ typ.
3. Both positive and negative logic reset output can be extracted
4. Accurate detection of drop in power supply voltage
5. Detection voltage has hysteresis
6. Few external parts 1 capacitor
7. Timer monitoring time can be varied by using an external resistor

Package

DIP-8A (MM1075XD)

SOP-8A (MM1075XF)



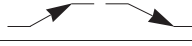
Applications

Microcomputer system monitoring, etc.




Absolute Maximum Ratings (Ta=25°C)

| Item | Symbol | Rating | Units |
|-------------------------------------|---------------------------|----------|-------|
| Storage temperature | T _{STG} | -40~+125 | °C |
| Operating temperature | T _{OPR} | -20~+70 | °C |
| Power supply voltage | V _{CC max.} | -0.3~+10 | V |
| Voltage applied to VS & CK pins | V _{VS & VCK} | -0.3~+10 | V |
| Voltage applied to RESET, RESET pin | V _{OH} | -0.3~+10 | V |
| Allowable loss | P _d | 400 | mW |

Electrical Characteristics (DC) (Except where noted otherwise, $T_a=25^\circ\text{C}$, $V_{CC}=5\text{V}$)

| Item | Symbol | Measurement circuit | Measurement conditions | Min. | Typ. | Max. | Units |
|--|----------------|---------------------|---|------|------------|------|---------------------|
| Consumption current | I_{CC} | 1 | During watchdog timer operation | | 0.7 | 1.0 | mA |
| Detection voltage | V_{SL} | 1 | $V_S=\text{OPEN}$, V_{CC}  | 4.05 | 4.20 | 4.35 | V |
| | V_{SH} | 1 | $V_S=\text{OPEN}$, V_{CC}  | 4.15 | 4.30 | 4.45 | |
| Detection voltage temperature coefficient | $V_S/\Delta T$ | 1 | | | ± 0.01 | | %/ $^\circ\text{C}$ |
| Hysteresis voltage | V_{HYS} | 1 | $V_{SH}-V_{SL}$, V_{CC}  | 50 | 100 | 150 | mV |
| CK input threshold | V_{TH} | 1 | | 0.8 | 1.2 | 2 | V |
| CK input current | I_{IH} | 1 | $V_{CK}=5\text{V}$ | | 0 | 1 | μA |
| | I_{IL} | 1 | $V_{CK}=0\text{V}$ | -20 | -10 | -3 | |
| Output voltage (High) | V_{OH1} | 1 | $I_{\overline{\text{RESET}}}=-5\mu\text{A}$, $V_S=\text{OPEN}$ | 4.5 | 4.8 | | V |
| | V_{OH2} | 1 | $I_{\overline{\text{RESET}}}=-5\mu\text{A}$, $V_S=0\text{V}$ | 4.5 | 4.8 | | |
| Output voltage (Low) | V_{OL1} | 1 | $I_{\overline{\text{RESET}}}=3\text{mA}$, $V_S=0\text{V}$ | | 0.2 | 0.4 | V |
| | V_{OL2} | 1 | $I_{\overline{\text{RESET}}}=10\text{mA}$, $V_S=0\text{V}$ | | 0.3 | 0.5 | |
| | V_{OL3} | 1 | $I_{\overline{\text{RESET}}}=0.5\text{mA}$, $V_S=\text{OPEN}$ | | 0.2 | 0.4 | |
| | V_{OL4} | 1 | $I_{\overline{\text{RESET}}}=1\text{mA}$, $V_S=\text{OPEN}$ | | 0.3 | 0.5 | |
| Output sink current | I_{OL1} | 1 | $V_{\overline{\text{RESET}}}=1.0\text{V}$, $V_S=0\text{V}$ | 10 | 16 | | mA |
| | I_{OL2} | 1 | $V_{\overline{\text{RESET}}}=1.0\text{V}$, $V_S=\text{OPEN}$ | 1 | 2 | | |
| C_T charge current *1 | I_{CT1} | 1 | $V_{TC}=1.0\text{V}$, $R_{CT}=\text{OPEN}$ during watchdog timer operation | -0.8 | -1.2 | -2.4 | μA |
| | I_{CT2} | 1 | $V_{TV}=1.0\text{V}$ during power ON reset operation | -0.8 | -1.2 | -2.4 | μA |
| Minimum operating power supply voltage to ensure $\overline{\text{RESET}}$ | V_{CCL1} | 1 | $V_{\overline{\text{RESET}}}=0.4\text{V}$ $I_{\overline{\text{RESET}}}=0.2\text{mA}$ | | 0.8 | 1.0 | V |
| Minimum operating power supply voltage to ensure RESET | V_{CCL2} | 1 | $V_{\overline{\text{RESET}}}=V_{CC}-0.1\text{V}$ R_{L2} (between Pin 2 and GND) | | 0.8 | 1.0 | V |

Electrical Characteristics (AC) (Except where noted otherwise, Ta=25°C, Vcc=5V)

| Item | Symbol | Measurement circuit | Measurement conditions | Min. | Typ. | Max. | Units |
|---|------------------|---------------------|---|------|------|------|-------|
| V _{CC} input pulse width | T _{P1} | 2 | V _{CC}  | 8 | | | μS |
| CK input pulse width | T _{CKW} | 2 | CK  | 3 | | | μS |
| CK input cycle | T _{CK} | 2 | | 20 | | | μS |
| Watchdog timer monitoring time *2 | T _{WD} | 2 | C _T =0.1μF R _{CT} =OPEN | 50 | 100 | 150 | mS |
| Reset time for watchdog timer *3 | T _{WR} | 2 | C _T =0.1μF | 1 | 2 | 3 | mS |
| Reset hold time for power supply rise *4 | T _{PR} | 2 | C _T =0.1μF, V _{CC}  | 50 | 100 | 150 | mS |
| Output delay time from V _{CC} *5 | T _{PD1} | 2 | RESET pin R _{L1} =2.2kΩ, C _{L1} =100pF | | 2 | 10 | μS |
| | T _{PD2} | 2 | RESET pin R ₁ , 2=10kΩ, C _{L2} =20pF | | 3 | 10 | |
| Output rise time *6 | t _{r1} | 2 | RESET pin R _{L1} =2.2kΩ, C _{L1} =100pF | | 1.0 | 1.5 | μS |
| | t _{r2} | 2 | RESET pin R _{L2} =10kΩ, C _{L2} =20pF | | 1.0 | 1.5 | μS |
| Output fall time *6 | t _{f1} | 2 | RESET pin R _{L1} =2.2kΩ, C _{L1} =100pF | | 0.1 | 0.5 | μS |
| | t _{f2} | 2 | RESET pin R _{L2} =10kΩ, C _{L2} =20pF | | 0.5 | 1.0 | μS |

Notes:

- *1 I_{CT1} changes according to R_{CT} pin (Pin 6) pull up resistance.
- *2 Monitoring time is the time from the last pulse (negative edge) of the timer clear clock pulse until reset pulse output. In other words, reset output is output if a clock pulse is not input during this time. Also, monitoring time can be varied by pulling up the R_{CT} pin to V_{CC} with a resistor (R_{CT}). Monitoring time adjustments are shown in Graph 1.
- *3 Reset time means reset pulse width. However, this does not apply to power ON reset.
- *4 Reset hold time is the time from when V_{CC} exceeds detection voltage (V_{SH}) during power ON reset until reset release (RESET output high, RESET output low).
- *5 Output delay time is the time from when power supply voltage drops below detection voltage (V_{SI}) until reset (RESET output low, RESET output high).
- *6 Voltage range when measuring output rise and fall is 10~90%.
- *7 Watchdog timer monitoring time (T_{WD}), watchdog timer reset time (T_{WR}) and reset hold time (T_{PR}) during power supply rise can be changed by varying C_T capacitance. The times are expressed by the following formulae. The recommended range for C_T is 0.001~10μF.

$$T_{PR} \text{ (mS)} \approx 1000 \times C_T \text{ (}\mu\text{F)}$$

$$T_{WD} \text{ (mS)} \approx 1000 \times C_T \text{ (}\mu\text{F)}$$

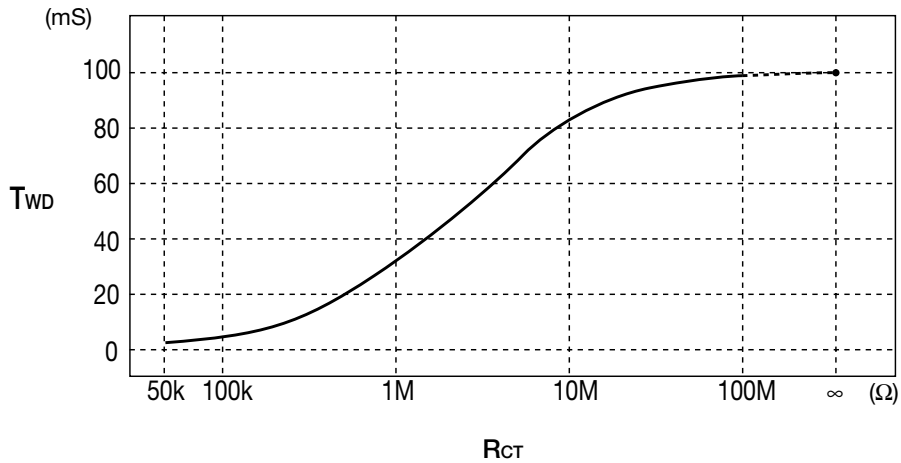
$$T_{WR} \text{ (mS)} \approx 20 \times C_T \text{ (}\mu\text{F)}$$

Example : When C_T=0.1μF (R_{CT} pin OPEN)

$$T_{PR} \approx 100\text{mS}$$

$$T_{WD} \approx 100\text{mS}$$

$$T_{WR} \approx 2\text{mS}$$

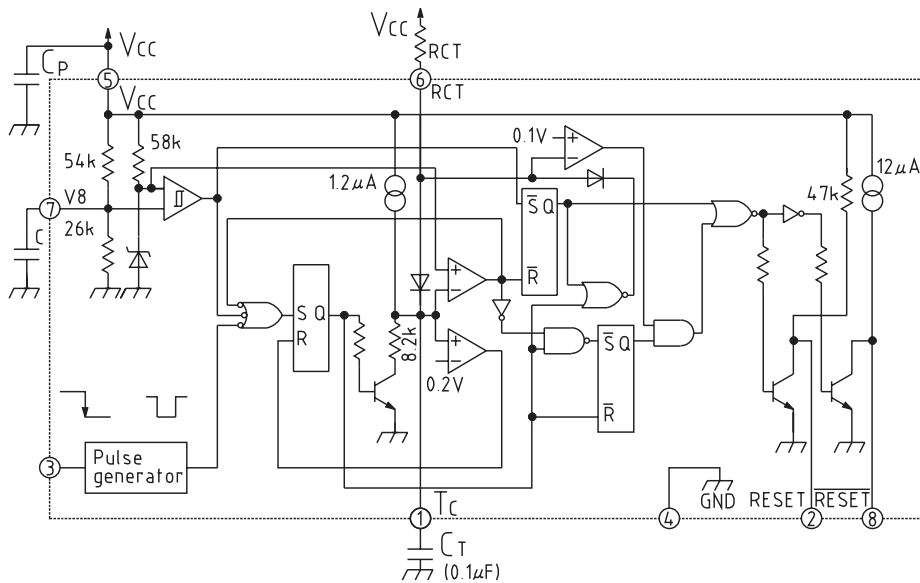


Graph 1 RCT & Monitoring Time

Note : The above graph shows data for when $C_T=0.1\mu F$.

T_{WD} is proportionate to C_T . Refer to the calculation formula for T_{WD} above.

Block Diagram



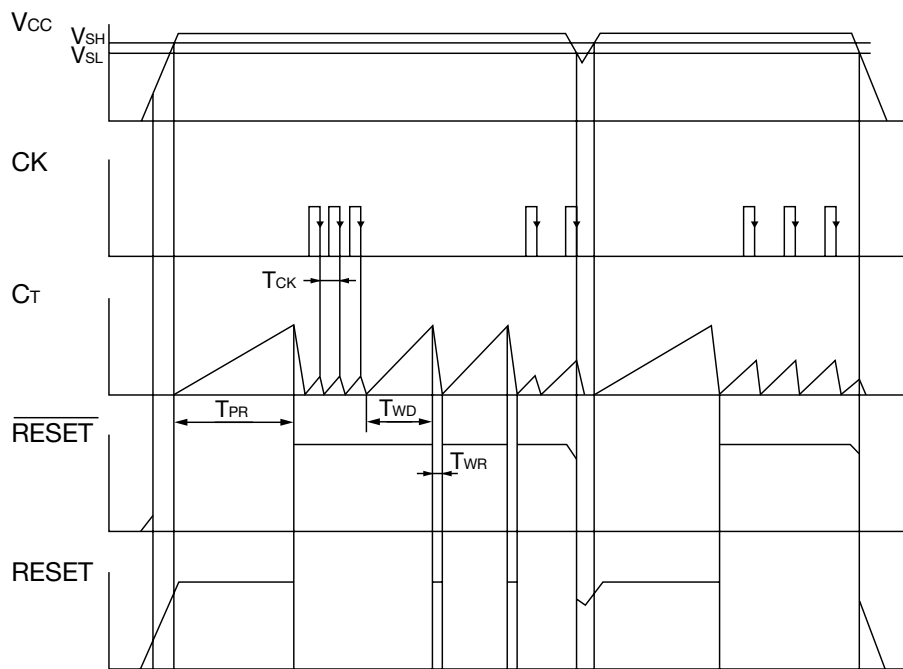
Note 1 : $C_P=0.1\mu F$ approx.

Note 2 : $C \approx 1000pF$

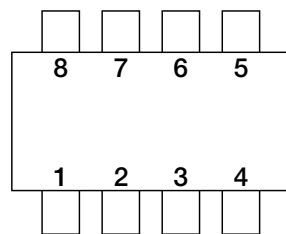
Note 3 : The watchdog timer can be stopped by connecting the RCT pin to GND. (Then it functions as a voltage detection circuit.)

Note 4 : T_{PR} and T_{WD} can be varied by pulling up the RCT pin to V_{CC} with a resistor. The recommended range for RCT is $100k\Omega \sim R_{CT}$ pin OPEN.

Timing Chart



Pin Assignment



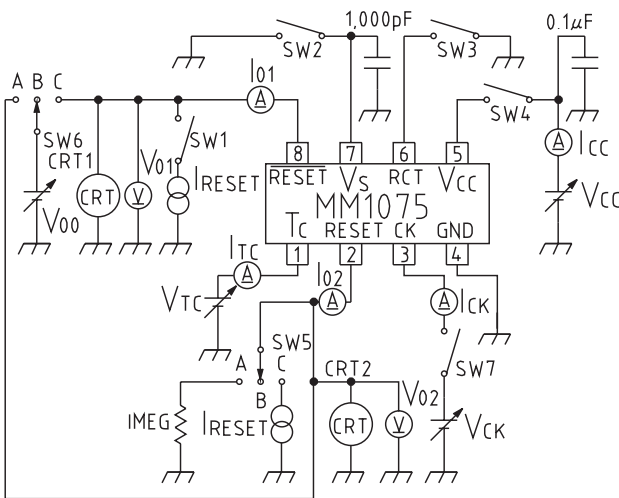
| | |
|---|-----------------|
| 1 | TC |
| 2 | RESET |
| 3 | CK |
| 4 | GND |
| 5 | V _{CC} |
| 6 | RCT |
| 7 | V _S |
| 8 | RESET |

Pin Description

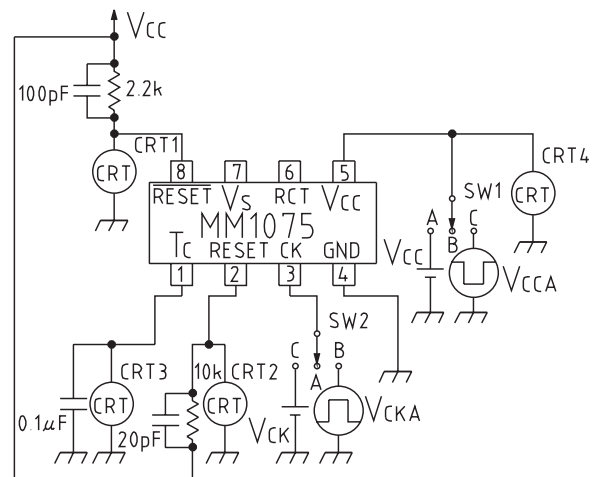
| Pin No. | Pin Name | Function |
|---------|-----------------|--|
| 1 | TC | T _{WD} , T _{WR} , T _{PR} variable pins. (T _{WD} , T _{WR} and T _{PR} times are determined by the external capacitor.) |
| 2 | RESET | Reset output pin (High output) |
| 3 | CK | Clock input pin (inputs clock from logic system) |
| 4 | GND | |
| 5 | V _{CC} | 4.2V detection voltage |
| 6 | RCT | Watchdog timer stop pin Operation modes : Operation → OPEN, Stop → connect to GND |
| 7 | V _S | Detection voltage variable pin Adjustment modes : Lower → pull up resistance, Raise → pull down |
| 8 | RESET | Reset output pin (Low output) |

Measuring Circuits

Measuring Circuit 1



Measuring Circuit 2



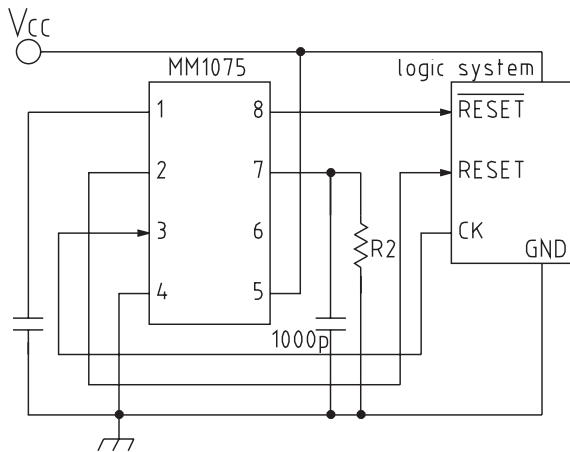
Measuring Circuit 2-1 SW & Power Supply Table

| Item | Symbol | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | V _{CC} | V _{CK} | V _{CT} | I _{RESET} | I _{RESET} | VM, IM | Notes |
|--|------------------|-----|-----|-----|-----|-----|-----|-----|-----------------|-----------------|-----------------|--------------------|--------------------|-----------------------------------|---------------------|
| Consumption current | I _{CC} | OFF | OFF | OFF | ON | B | B | ON | 5V | 5V | 0V | - | - | I _{CC} | |
| Detection voltage | V _{SL} | OFF | OFF | ON | ON | B | B | ON | 5V→4V | 3V | 3V | - | - | V _{o1} , CRT1 | |
| | V _{SH} | OFF | OFF | ON | ON | B | B | ON | 4V→5V | 3V | 3V | - | - | V _{o1} , CRT1 | |
| CK input threshold | V _{TH} | OFF | OFF | OFF | ON | B | B | ON | 5V | 0V→3V | 1V | - | - | I _{CK} | |
| CK input current | I _{IH} | OFF | OFF | OFF | ON | B | B | ON | 5V | 5V | 0V | - | - | I _{CK} | |
| | I _{IL} | OFF | OFF | OFF | ON | B | B | ON | 5V | 0V | 0V | - | - | I _{CK} | |
| Output voltage (High) | V _{OH1} | ON | OFF | ON | ON | B | B | ON | 5V | 5V | 3V | -5μA | - | V _{o1} | |
| | V _{OH2} | OFF | ON | ON | ON | C | B | ON | 5V | 5V | 3V | - | -5μA | V _{o2} | |
| Output voltage (Low) | V _{OL1} | ON | ON | ON | ON | B | B | ON | 5V | 5V | 3V | 3mA | - | V _{o1} | |
| | V _{OL2} | ON | ON | ON | ON | B | B | ON | 5V | 5V | 3V | 10mA | - | V _{o1} | |
| | V _{OL3} | OFF | OFF | ON | ON | C | B | ON | 5V | 5V | 3V | - | 0.5mA | V _{o2} | |
| | V _{OL4} | OFF | OFF | ON | ON | C | B | ON | 5V | 5V | 3V | - | 1mA | V _{o2} | |
| Output sink current | I _{OL1} | OFF | ON | ON | ON | B | C | ON | 5V | 5V | 3V | - | - | I _{o1} | V _{oo} =1V |
| | I _{OL2} | OFF | OFF | ON | ON | B | A | ON | 5V | 5V | 3V | - | - | I _{o2} | V _{oo} =1V |
| C _T charge current 1 | I _{rc1} | OFF | OFF | OFF | ON | B | B | OFF | 5V | - | 1V | - | - | I _{rc} | |
| C _T charge current 2 | I _{rc2} | OFF | OFF | ON | ON | B | B | OFF | 5V | - | 1V | - | - | I _{rc} | |
| Minimum operating power supply voltage to ensure RESET | V _{cc1} | ON | OFF | ON | ON | B | B | ON | 0V→2V | 0V | 0V | - | - | V _{o1} , V _{CC} | |
| Minimum operating power supply voltage to ensure RESET | V _{cc2} | OFF | ON | ON | ON | A | B | ON | 0V→2V | 0V | 0V | - | - | V _{o2} , V _{CC} | |

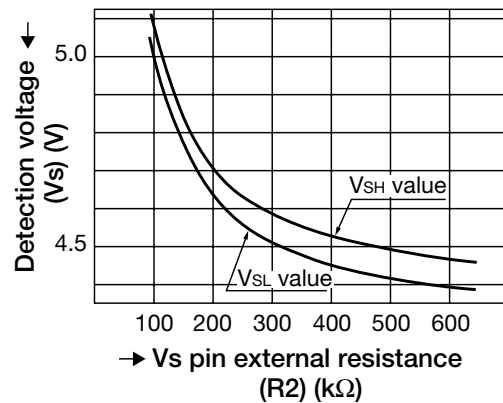
Measuring Circuit 2-2 SW & Power Supply Table

| Item | Symbol | SW1 | SW2 | V _{CCA} | V _{CC} | V _{CKA} | V _{CK} | CRT | Notes |
|---------------------------------------|------------------|-----|-----|------------------|-----------------|------------------|-----------------|------------|---------|
| Vcc input pulse width | T _{PI} | C | B | | - | | - | CRT1, 2, 3 | T1=8μS |
| CK input pulse width | T _{CKW} | A | B | - | 5V | | - | CRT1, 2, 3 | T2=3μS |
| CK input cycle | T _{CK} | A | B | - | 5V | | - | CRT1, 2, 3 | T3=20μS |
| Watchdog timer monitoring time | T _{WD} | A | A | - | 5V | - | 5V | CRT1, 2, 3 | |
| Reset time for watchdog timer | T _{WR} | A | A | - | 5V | - | 5V | CRT1, 2, 3 | |
| Reset hold time for power supply rise | T _{PR} | B→A | A | - | 5V | - | 5V | CRT1, 2, 3 | |
| Output delay time from Vcc | T _{PD1} | C | A | | - | - | 0V | CRT1, 3 | |
| | T _{PD2} | C | A | | - | - | 0V | CRT2, 3 | |
| Output rise time | T _{r1} | A | A | - | 5V | - | 5V | CRT1 | |
| | T _{r2} | A | A | - | 5V | - | 5V | CRT2 | |
| Output fall time | T _{f1} | A | A | - | 5V | - | 5V | CRT1 | |
| | T _{f2} | A | A | - | 5V | - | 5V | CRT2 | |

Detection Voltage Adjustment 1 (lowering detection voltage)

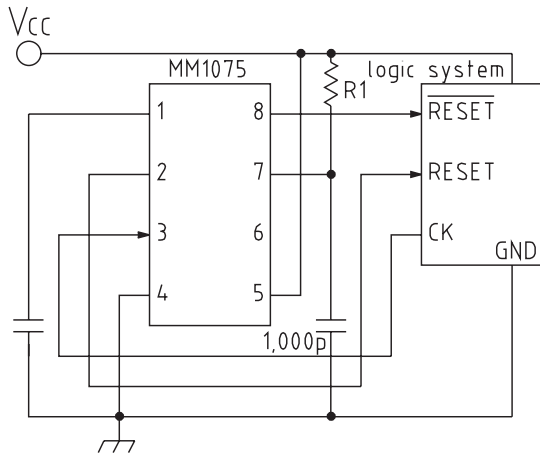


Graph 1. Detection voltage change using MM1075 external resistor



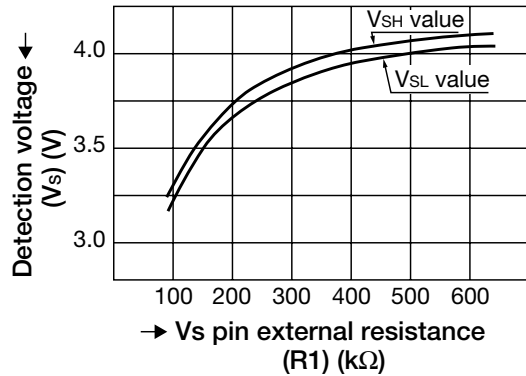
Detection voltage can be changed by connecting resistor R2 externally to MM1075 Vs pin. Determine R2 according to graph 1 when changing Vs.

Detection Voltage Adjustment 2 (raising detection voltage)



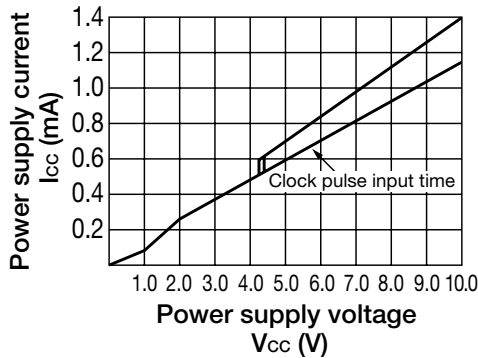
Detection voltage can be changed by connecting resistor R1 externally to MM1075 Vs pin. Determine R1 according to graph 2 when changing Vs.

Graph 2. Detection voltage change using MM1075 external resistor

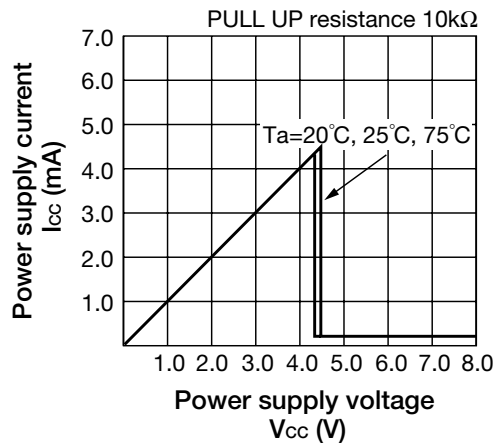


Characteristics

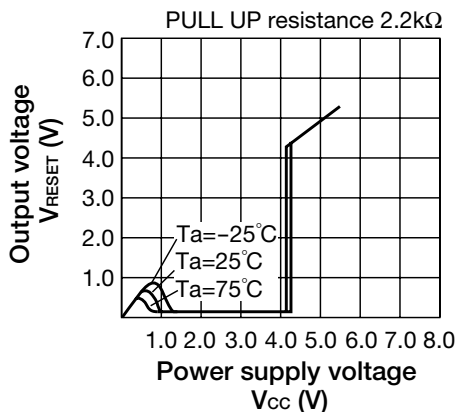
■ Power supply current-Power supply voltage



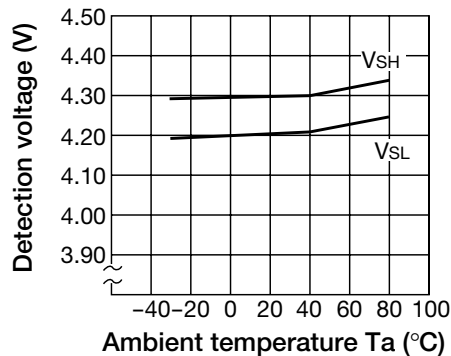
■ Output voltage-Power supply voltage (RESET pin)



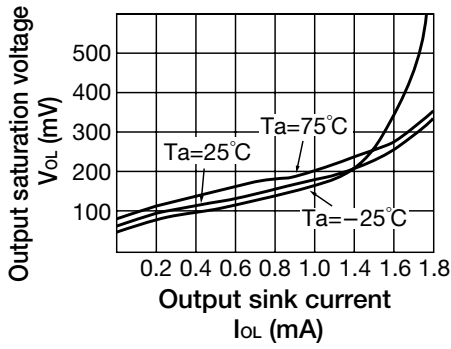
■ Output voltage-Power supply voltage (RESET pin)



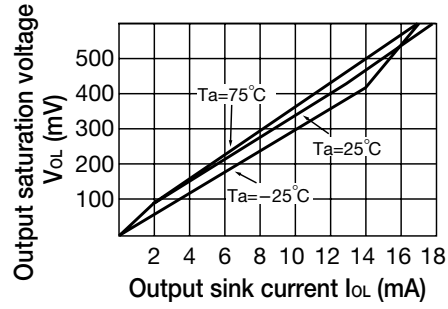
■ Detection voltage (VSL, VSH) temperature (RESET, RESET pins)



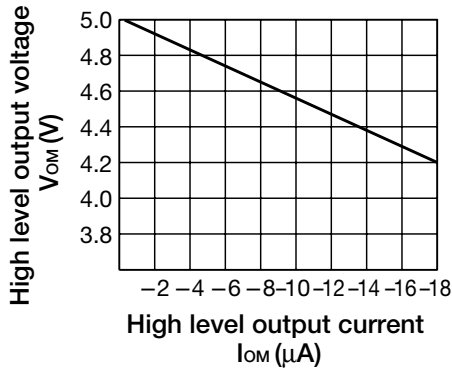
■ Output saturation voltage-Output sink current (RESET pin)



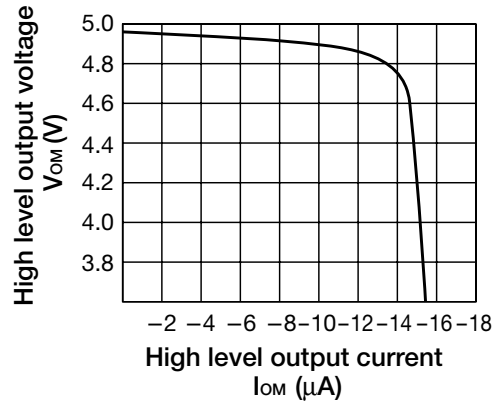
■ Output saturation voltage-Output sink current (RESET pin)



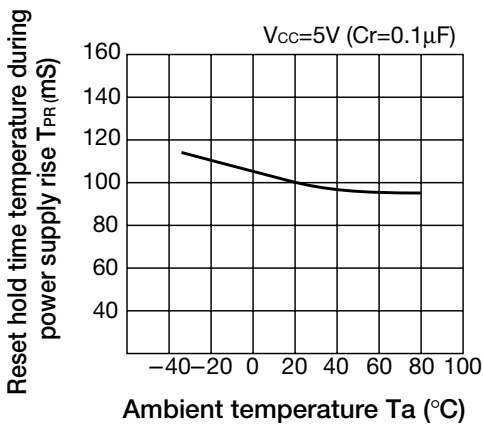
■ High level output voltage-High level output current (RESET pin)



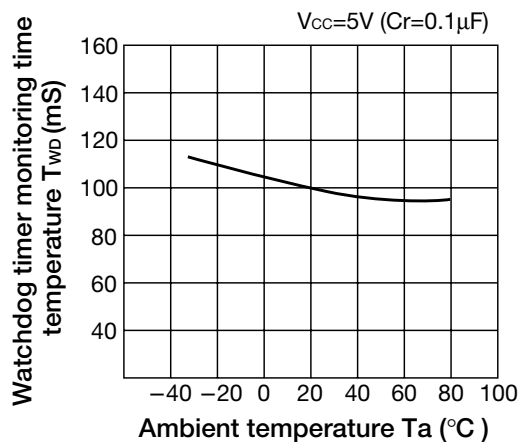
■ High level output voltage-High level output current (RESET pin)



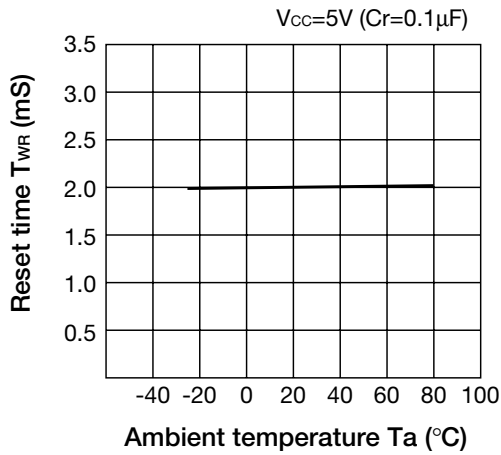
■ Reset hold time temperature during power supply rise



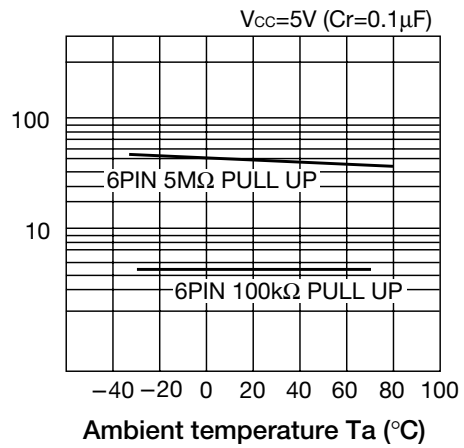
■ Watchdog timer monitoring time temperature



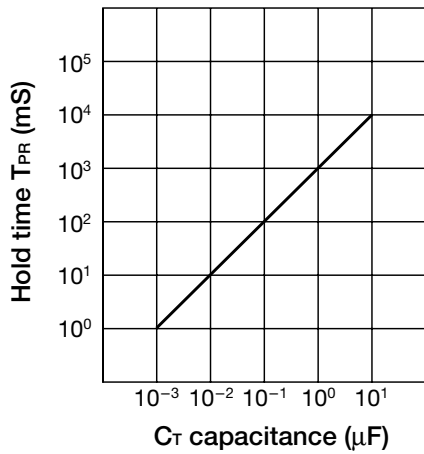
Reset time temperature (for watchdog timer)



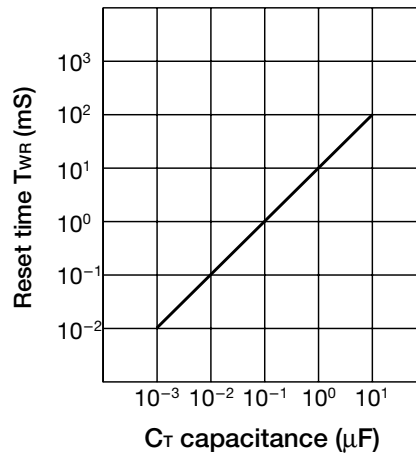
Watchdog timer monitoring time temperature



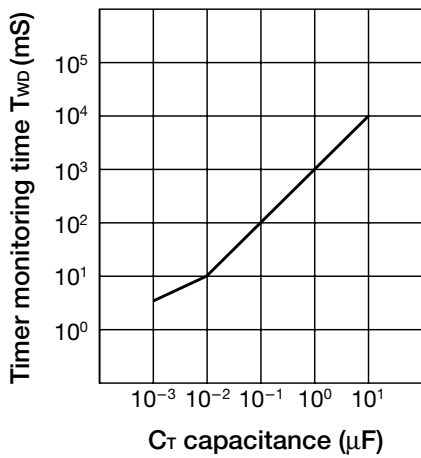
C_T value for reset hold time during power supply rise



C_T value for reset time (for watchdog timer)



C_T value for watchdog timer monitoring time



Type of timer time adjustment C_T value for watchdog timer monitoring time

