MITSUMI

IC for 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 when the power is turned on or interrupted.

It includes a watchdog timer which allows diagnosis of the system operation, so that it prevents system runaway by intermittently generating a reset pulse when system misoperation occurs.

Features

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

Packages

DIP-8A (MM1075XD)
SOP-8A (MM1075XF)

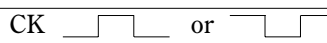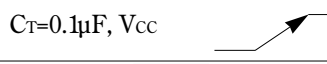## Application

Microcomputer system monitoring, etc.

Absolute Maximum Ratings (Ta=25℃)

Item	Symbol	Rating	Units
Storage temperature	T_{STG}	–40~+125	℃
Operating temperature	T_{OPR}	–20~+70	℃
Power supply voltage	V_{CC} max.	–0.3~+10	V
Voltage applied to VS & CK pins	$V_{VS} \& V_{CK}$	–0.3~+10	V
Voltage applied to RESET, $\overline{RESET}$ pin	V_{OH}	–0.3~+10	V
Allowable loss	Pd	400	mW

Electrical Characteristics (DC) (Except where noted otherwise, Ta=25℃, Vcc=5V)

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=OPEN, V_{CC} ⟍	4.05	4.20	4.35	V
	V_{SH}	1	V_S=OPEN, V_{CC} ⟋	4.15	4.30	4.45	
Detection voltage temperature coefficient	$V_S/\triangle T$	1			±0.01		%/℃
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}=5V		0	1	μA
	I_{IL}	1	V_{CK}=0V	−20	−10	−3	
Output voltage (High)	V_{OH1}	1	I $\overline{RESET}$ =−5μA, V_S=OPEN	4.5	4.8		V
	V_{OH2}	1	I $\overline{RESET}$ =−5μA, V_S=0V	4.5	4.8		
Output voltage (Low)	V_{OL1}	1	I $\overline{RESET}$ =3mA, V_S=0V		0.2	0.4	V
	V_{OL2}	1	I $\overline{RESET}$ =10mA, V_S=0V		0.3	0.5	
	V_{OL3}	1	I_{RESET}=0.5mA, V_S=OPEN		0.2	0.4	
	V_{OL4}	1	I_{RESET}=1mA, V_S=OPEN		0.3	0.5	
Output sink current	I_{OL1}	1	V $\overline{RESET}$ =1.0V, V_S=0V	10	16		mA
	I_{OL2}	1	V_{RESET}=1.0V, V_S=OPEN	1	2		
C_T charge current ∗1	I_{CT1}	1	V_{TC}=1.0V, R_{CT}=OPEN during watchdog timer operation	−0.8	−1.2	−2.4	μA
	I_{CT2}	1	V_{TV}=1.0V during power ON reset operation	−0.8	−1.2	−2.4	μA
Minimum operating power supply voltage to ensure $\overline{RESET}$	V_{CCL1}	1	V $\overline{RESET}$ =0.4V I $\overline{RESET}$ =0.2mA		0.8	1.0	V
Minimum operating power supply voltage to ensure RESET	V_{CCL2}	1	V_{RESET}=V_{CC}−0.1V R_L2 (between Pin 2 and GND)		0.8	1.0	V

Electrical Characteristics (AC)

(Except where noted otherwise, Ta=25℃, Vcc=5V)
(Except where noted otherwise, resistance unit is Ω)

Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
Vcc input pulse width	T_{P1}	2	Vcc 5V / 4V	8			µs
CK input pulse width	T_{CKW}	2	CK ⎍ or ⎍	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, Vcc	50	100	150	ms
Output delay time from Vcc *5	T_{PD1}	2	$\overline{RESET}$ pin R_{L1}=2.2k, C_{L1}=100pF		2	10	µs
	T_{PD2}	2	RESET pin R1, 2=10k, C_{L2}=20pF		3	10	
Output rise time *6	t_{R1}	2	$\overline{RESET}$ pin R_{L1}=2.2k, C_{L1}=100pF		1.0	1.5	µs
	t_{R2}	2	RESET pin R_{L2}=10k, C_{L2}=20pF		1.0	1.5	µs
Output fall time *6	t_{F1}	2	$\overline{RESET}$ pin R_{L1}=2.2k, C_{L1}=100pF		0.1	0.5	µs
	t_{F2}	2	RESET pin R_{L2}=10k, 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 Vcc 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 Vcc exceeds detection voltage (V_{SH}) during power ON reset until reset release ($\overline{RESET}$ 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 ($\overline{RESET}$ 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.

$$T_{PR} \text{ (ms)} \simeq 1000 \times C_T \text{ (µF)}$$
$$T_{WD} \text{ (ms)} \simeq 1000 \times C_T \text{ (µF)}$$
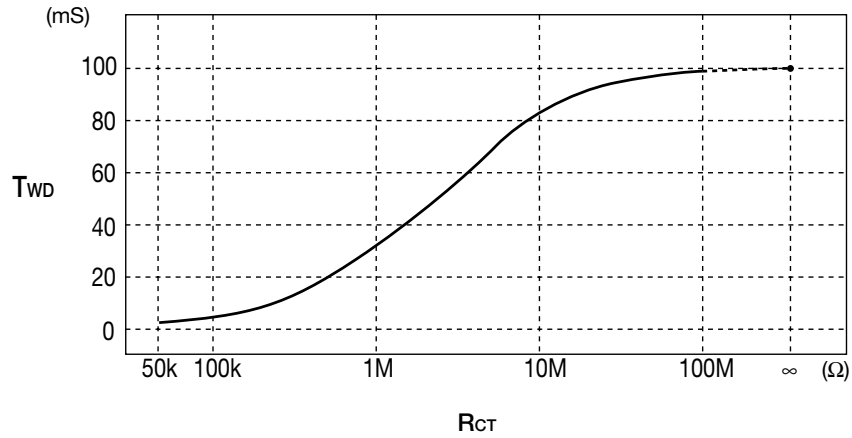$$T_{WR} \text{ (ms)} \simeq 20 \times C_T \text{ (µF)}$$

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

$$T_{PR} \simeq 100\text{ms}$$
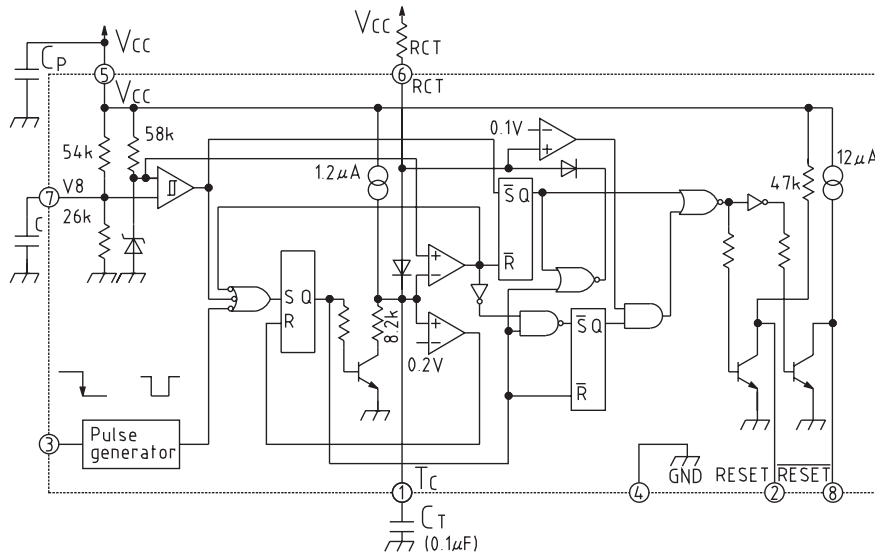$$T_{WD} \simeq 100\text{ms}$$
$$T_{WR} \simeq 2\text{ms}$$

Graph 1 R_{CT} & Monitoring Time

Note : The above graph shows data for when C_T=0.1μF.
T_{WD} is proportionate to C_T. Refer to the calculation formula for T_{WD} above.

Block Diagram

Note 1 : CP=0.1μF approx.
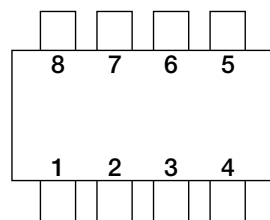Note 2 : C ≃ 1000pF
Note 3 : The watchdog timer can be stopped by connecting the RCT pin to GND. (Then it functions as a voltage detection circuit.)
Note 4 : T_{PR} and T_{WD} can be varied by pulling up the R_{CT} pin to V_{CC} with a resistor. The recommended range for RCT is 100kΩ~RCT pin OPEN.

Timing Chart
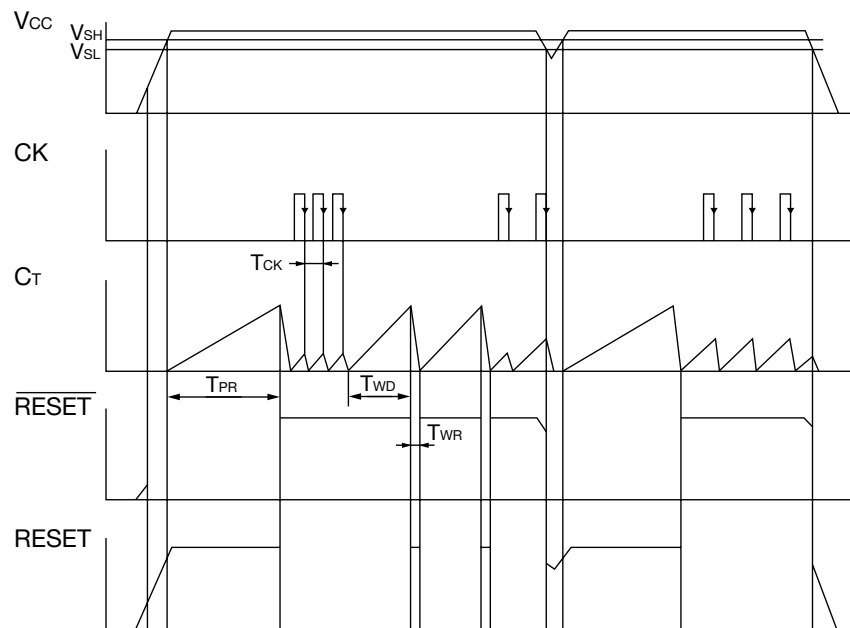
Pin Assignment

1	TC
2	RESET
3	CK
4	GND
5	V_{CC}
6	RCT
7	V_S
8	$\overline{RESET}$

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	GND pin
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	$\overline{RESET}$	Reset output pin (Low output)

Measuring Circuits

■ Measuring Circuit 1
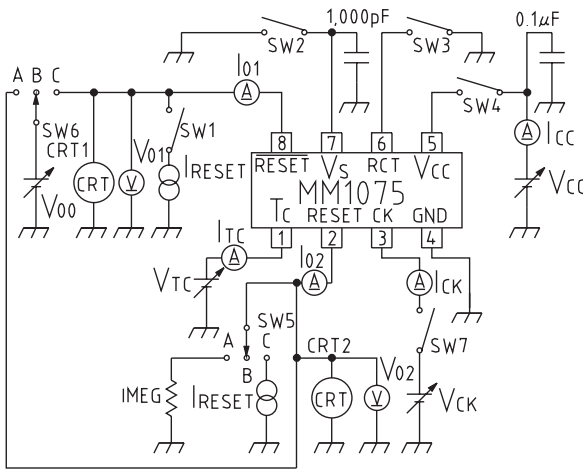
■ Measuring Circuit 2
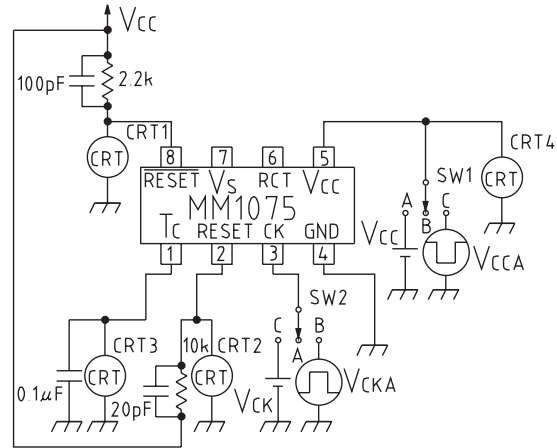
Measuring Circuit 2-1 SW & Power Supply Table

Item	Symbol	SW1	SW2	SW3	SW4	SW5	SW6	SW7	V_{CC}	V_{CK}	V_{CT}	$I_{\overline{RESET}}$	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)	$V_{OH}1$	ON	OFF	ON	ON	B	B	ON	5V	5V	3V	–5µA	–	V_{o1}	
	$V_{OH}2$	OFF	ON	ON	ON	C	B	ON	5V	5V	3V	–	–5µA	V_{o2}	
Output voltage (Low)	$V_{OL}1$	ON	ON	ON	ON	B	B	ON	5V	5V	3V	3mA	–	V_{o1}	
	$V_{OL}2$	ON	ON	ON	ON	B	B	ON	5V	5V	3V	10mA	–	V_{o1}	
	$V_{OL}3$	OFF	OFF	ON	ON	C	B	ON	5V	5V	3V	–	0.5mA	V_{o2}	
	$V_{OL}4$	OFF	OFF	ON	ON	C	B	ON	5V	5V	3V	–	1mA	V_{o2}	
Output sink current	$I_{OL}1$	OFF	ON	ON	ON	B	C	ON	5V	5V	3V	–	–	I_{o1}	V_{oo}=1V
	$I_{OL}2$	OFF	OFF	ON	ON	B	A	ON	5V	5V	3V	–	–	I_{o2}	V_{oo}=1V
C_T charge current 1	$I_{TC}1$	OFF	OFF	OFF	ON	B	B	OFF	5V	–	1V	–	–	I_{TC}	
C_T charge current 2	$I_{TC}2$	OFF	OFF	ON	ON	B	B	OFF	5V	–	1V	–	–	I_{TC}	
Minimum operating power supply voltage to ensure $\overline{RESET}$	$V_{CCL}1$	ON	OFF	ON	ON	B	B	ON	0V→2V	0V	0V		–	V_{o1}, V_{cc}	
Minimum operating power supply voltage to ensure RESET	$V_{CCL}2$	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	5V / 4V T1	–	1.4V / 0V T2 T3	–	CRT1, 2, 3	T1=8µs
CK input pulse width	T$_{CKW}$	A	B	–	5V	1.4V / 0V T2 or T2	–	CRT1, 2, 3	T2=3µs
CK input cycle	T$_{CK}$	A	B	–	5V	1.4V / 0V T2 T3	–	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$_{PD}$1	C	A	5V / 0V	–	–	0V	CRT1, 3	
	T$_{PD}$2	C	A	5V / 0V	–	–	0V	CRT2, 3	
Output rise time	T$_{R}$1	A	A	–	5V	–	5V	CRT1	
	T$_{R}$2	A	A	–	5V	–	5V	CRT2	
Output fall time	T$_{F}$1	A	A	–	5V	–	5V	CRT1	
	T$_{F}$2	A	A	–	5V	–	5V	CRT2	

Detection Voltage Adjustment 1 (lowering detection voltage)

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

Graph 1. Detection voltage change using MM1075 external resistor

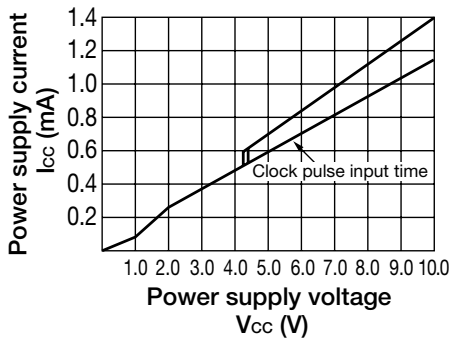## Detection Voltage Adjustment 2 (raising detection voltage)
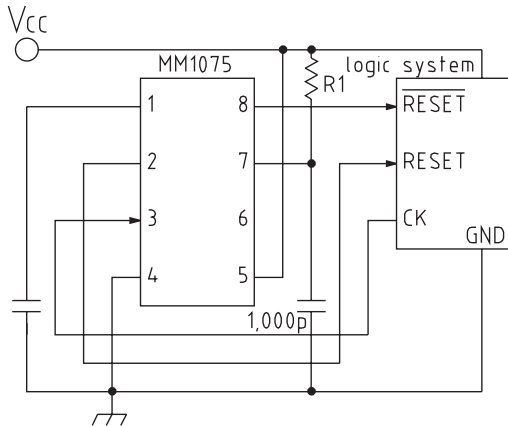
Detection voltage can be changed by connecting resistor R1 externally to MM1075 Vs pin. Determine R1 according to graph 2 when changing Vs.

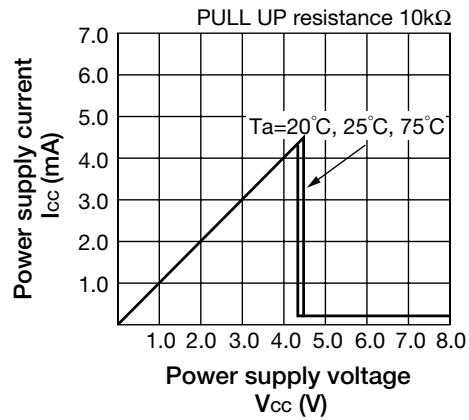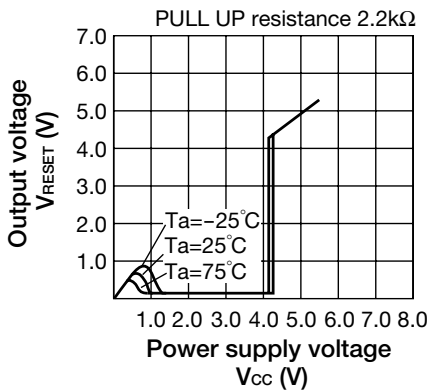Graph 2. Detection voltage change using MM1075 external resistor
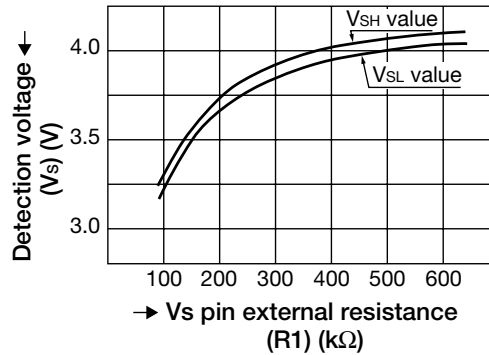
Characteristics
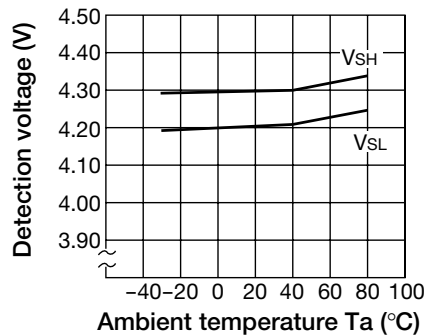
■Power supply current-Power supply voltage

■Output voltage-Power supply voltage (RESET pin)
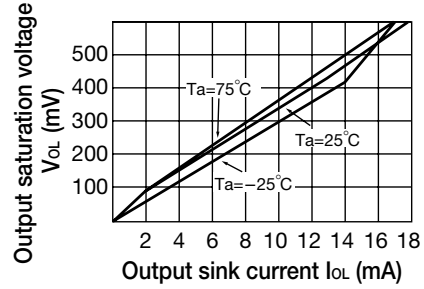

■Output voltage-Power supply voltage (RESET pin)

■Detection voltage (VSL, VSH) temperature (RESET, RESET pins)
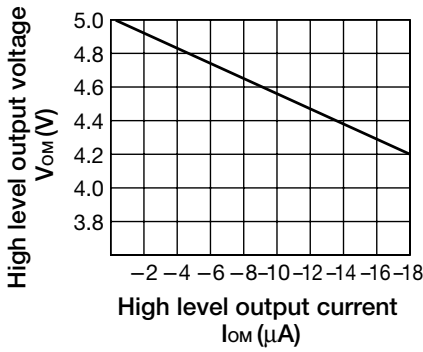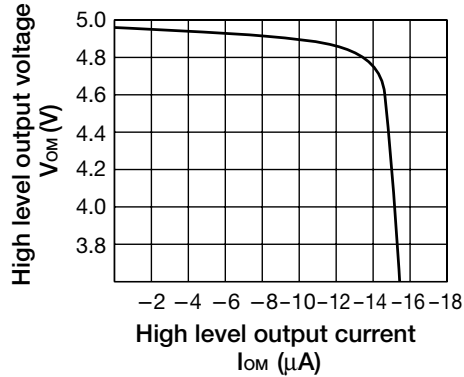
■Output saturation voltage-Output sink current (RESET pin)
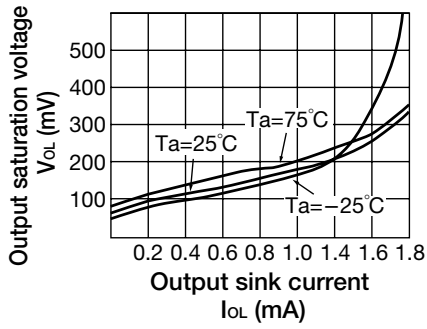
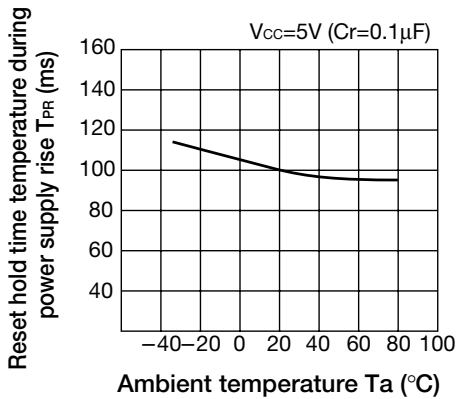Output saturation voltage V_OL (mV) vs Output sink current I_OL (mA)

Ta=75°C, Ta=25°C, Ta=−25°C

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

Output saturation voltage V_OL (mV) vs Output sink current I_OL (mA)

Ta=75°C, Ta=25°C, Ta=−25°C

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

High level output voltage V_OM (V) vs High level output current I_OM (μA)

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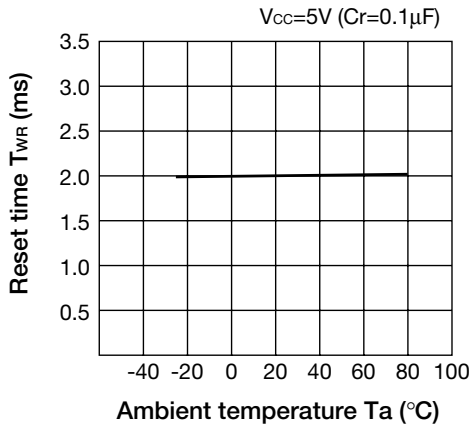

High level output voltage V_OM (V) vs High level output current I_OM (μA)

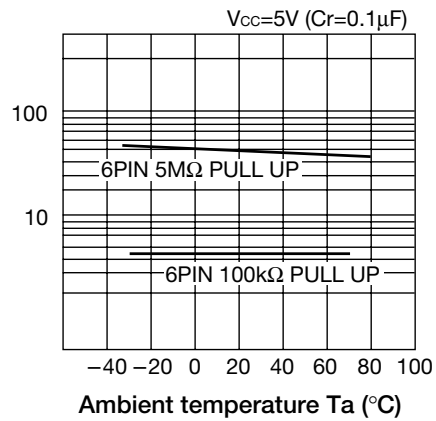■Reset hold time temperature during power supply rise

V_CC=5V (Cr=0.1μF)

Reset hold time temperature during power supply rise T_PR (ms) vs Ambient temperature Ta (°C)

■Watchdog timer monitoring time temperature

V_CC=5V (Cr=0.1μF)

Watchdog timer monitoring time temperature T_WD (ms) vs Ambient temperature Ta (°C)
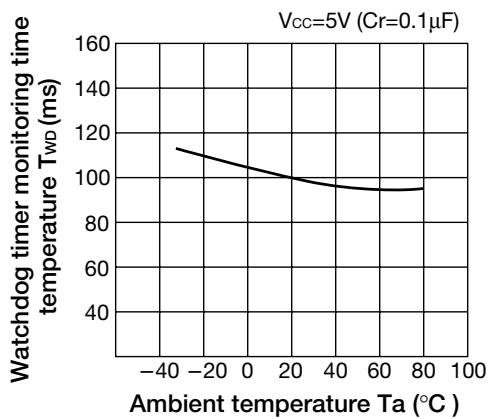
■ Reset time temperature
(for watchdog timer)

Vcc=5V (Cr=0.1μF)

Reset time T_WR (ms) vs Ambient temperature Ta (°C)

■ Watchdog timer monitoring time
temperature

Vcc=5V (Cr=0.1μF)

6PIN 5MΩ PULL UP

6PIN 100kΩ PULL UP

Ambient temperature Ta (°C)

■ C_T value for reset hold time during power
supply rise

Hold time T_PR (ms) vs C_T capacitance (μF)
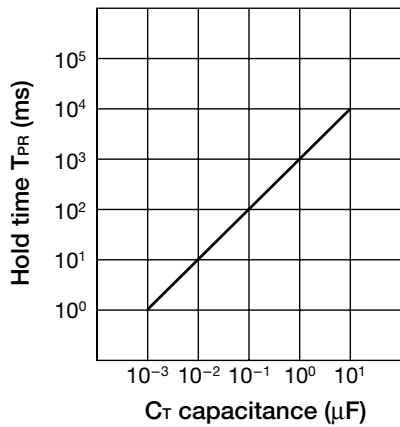
■ C_T value for reset time (for watchdog timer)

Reset time T_WR (ms) vs C_T capacitance (μF)

■ C_T value for watchdog timer monitoring
time

Timer monitoring time T_WD (ms) vs C_T capacitance (μF)
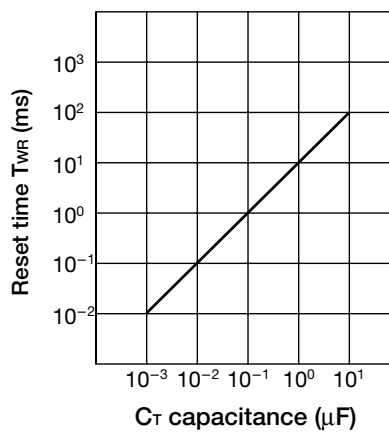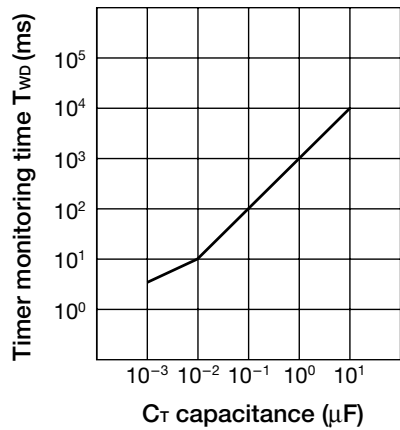
■ Type of timer time adjustment
C_T value for watchdog timer monitoring time

Connect R between Rct and Vcc

R=
OPEN
2.2MΩ
1kΩ
470kΩ
200kΩ

Timer monitoring time T_WD (ms) vs C_T capacitance (μF)