

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.


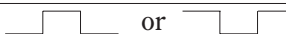

Absolute Maximum Ratings (Ta=25°C)

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} & V_{CK}	-0.3~+10	V
Voltage applied to RESET, \overline{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	$V_S=OPEN, V_{CC}$ 	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	$V_S/\Delta T$	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	$I_{\overline{RESET}}=-5\mu\text{A}, V_S=OPEN$	4.5	4.8		V
	V_{OH2}	1	$I_{\overline{RESET}}=-5\mu\text{A}, V_S=0\text{V}$	4.5	4.8		
Output voltage (Low)	V_{OL1}	1	$I_{\overline{RESET}}=3\text{mA}, V_S=0\text{V}$		0.2	0.4	V
	V_{OL2}	1	$I_{\overline{RESET}}=10\text{mA}, V_S=0\text{V}$		0.3	0.5	
	V_{OL3}	1	$I_{RESET}=0.5\text{mA}, V_S=OPEN$		0.2	0.4	
	V_{OL4}	1	$I_{RESET}=1\text{mA}, V_S=OPEN$		0.3	0.5	
Output sink current	I_{OL1}	1	$V_{\overline{RESET}}=1.0\text{V}, V_S=0\text{V}$	10	16		mA
	I_{OL2}	1	$V_{RESET}=1.0\text{V}, V_S=OPEN$	1	2		
C_T charge current *1	I_{CT1}	1	$V_{TC}=1.0\text{V}, R_{CT}=OPEN$ 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{RESET}	V_{CCL1}	1	$V_{\overline{RESET}}=0.4\text{V}$ $I_{\overline{RESET}}=0.2\text{mA}$		0.8	1.0	V
Minimum operating power supply voltage to ensure RESET	V_{CCL2}	1	$V_{RESET}=V_{CC}-0.1\text{V}$ 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 _{PI}	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	RESE _T pin R _{L1} =2.2kΩ, C _{L1} =100pF		2	10	μS
	T _{PD2}	2	RESE _T pin R _{L2} =10kΩ, C _{L2} =20pF		3	10	
Output rise time *6	tr ₁	2	RESE _T pin R _{L1} =2.2kΩ, C _{L1} =100pF		1.0	1.5	μS
	tr ₂	2	RESE _T pin R _{L2} =10kΩ, C _{L2} =20pF		1.0	1.5	μS
Output fall time *6	tf ₁	2	RESE _T pin R _{L1} =2.2kΩ, C _{L1} =100pF		0.1	0.5	μS
	tf ₂	2	RESE _T 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 (RESE_T output high, RESE_T output low).
- *5 Output delay time is the time from when power supply voltage drops below detection voltage (V_{SI}) until reset (RESE_T output low, RESE_T 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.

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

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

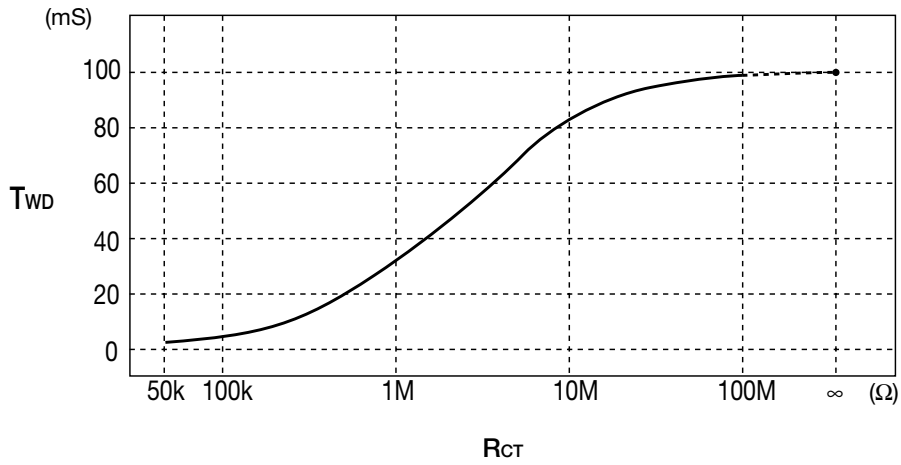
$$T_{WR} \text{ (mS)} \approx 20 \times C_T \text{ (}\mu\text{F)}$$

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

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

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

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

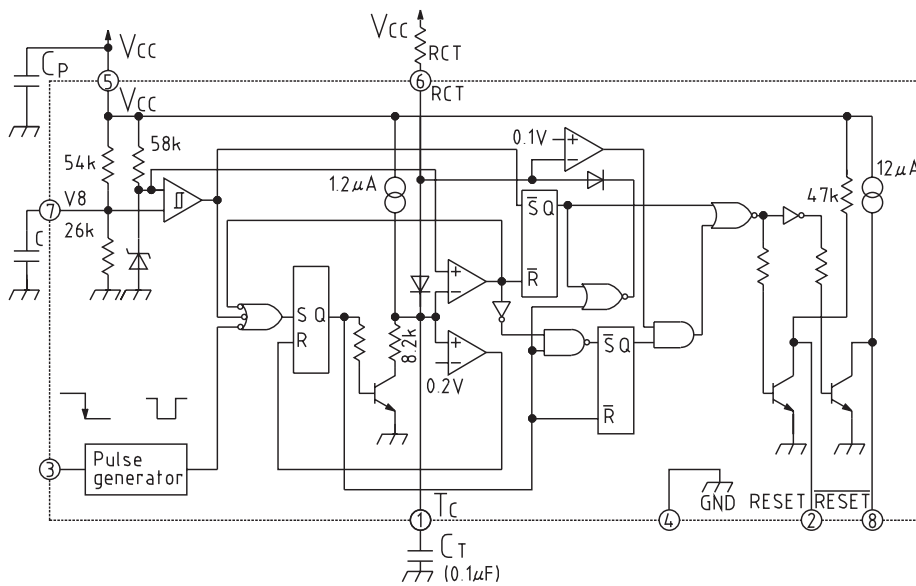


Graph 1 RCT & Monitoring Time

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



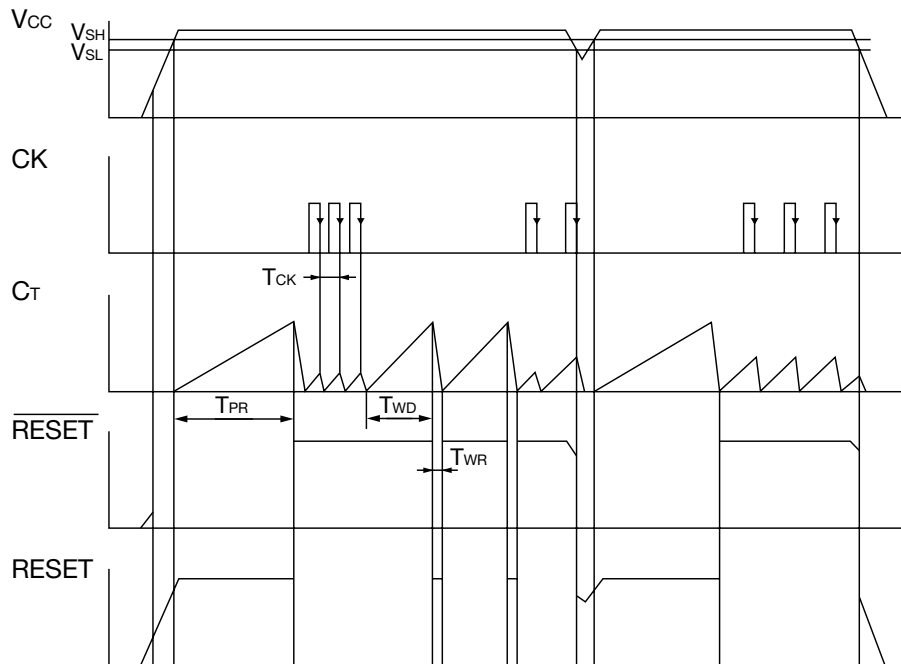
Note 1 : $C_P=0.1\mu F$ approx.

Note 2 : $C \approx 1000pF$

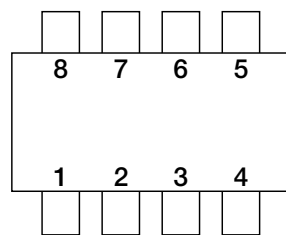
Note 3 : The watchdog timer can be stopped by connecting the RCT pin to GND. (Then it functions as a voltage detection circuit.)

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



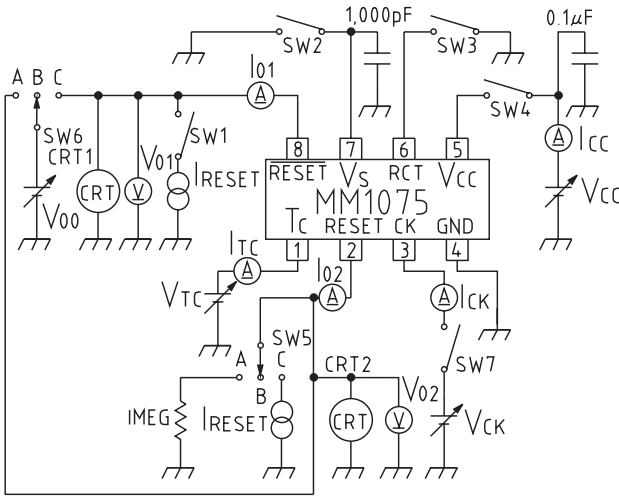
1	TC
2	RESET
3	CK
4	GND
5	V _{CC}
6	RCT
7	V _S
8	$\overline{\text{RESET}}$

Pin Description

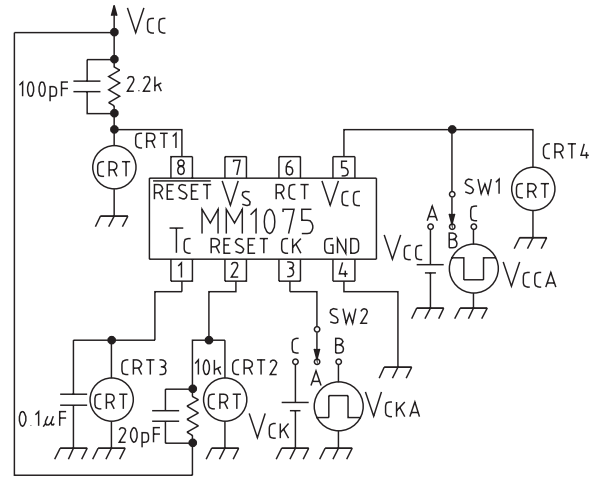
Pin No.	Pin Name	Function
1	TC	T _{WD} , T _{WR} , T _{PR} variable pins. (T _{WD} , T _{WR} and T _{PR} times are determined by the external capacitor.)
2	RESET	Reset output pin (High output)
3	CK	Clock input pin (inputs clock from logic system)
4	GND	
5	V _{CC}	4.2V detection voltage
6	RCT	Watchdog 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	$\overline{\text{RESET}}$	Reset output pin (Low output)

Measuring Circuits

Measuring Circuit 1



Measuring Circuit 2



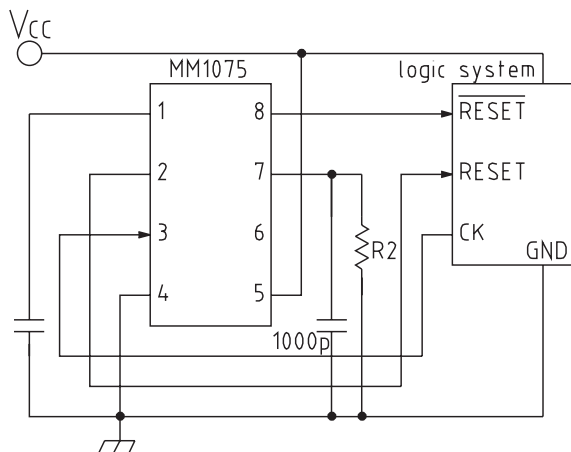
Measuring Circuit 2-1 SW & Power Supply Table

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 _{TC1}	OFF	OFF	OFF	ON	B	B	OFF	5V	-	1V	-	-	I _{TC}	
C _T charge current 2	I _{TC2}	OFF	OFF	ON	ON	B	B	OFF	5V	-	1V	-	-	I _{TC}	
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}	

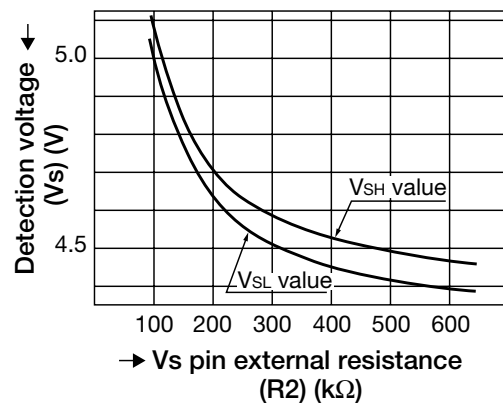
Measuring Circuit 2-2 SW & Power Supply Table

Item	Symbol	SW1	SW2	V _{CCA}	V _{CC}	V _{CKA}	V _{CK}	CRT	Notes
V _{CC} input pulse width	T _{PI}	C	B	5V 4V	-	1.4V 0V	-	CRT1, 2, 3	T1=8μS
CK input pulse width	T _{CKW}	A	B	-	5V	1.4V 0V	-	CRT1, 2, 3	T2=3μS
CK input cycle	T _{CK}	A	B	-	5V	1.4V 0V	-	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 V _{CC}	T _{PD1}	C	A	5V 0V	-	-	0V	CRT1, 3	
	T _{PD2}	C	A	5V 0V	-	-	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)

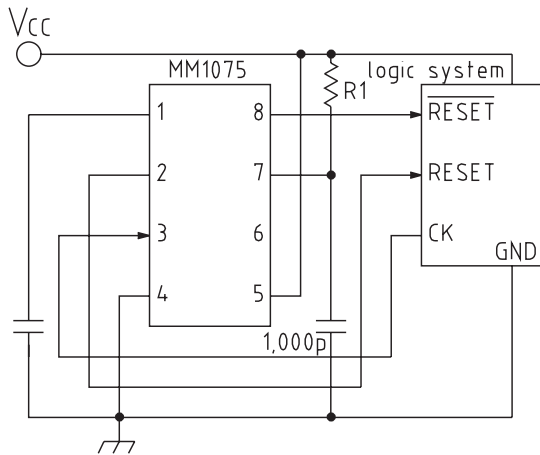


Graph 1. Detection voltage change using MM1075 external resistor



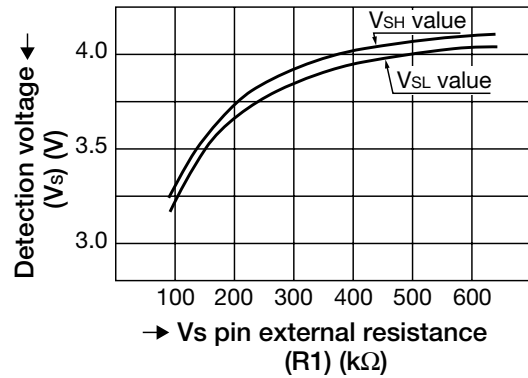
Detection voltage can be changed by connecting resistor R₂ externally to MM1075 V_s pin. Determine R₂ according to graph 1 when changing V_s.

Detection Voltage Adjustment 2 (raising detection voltage)



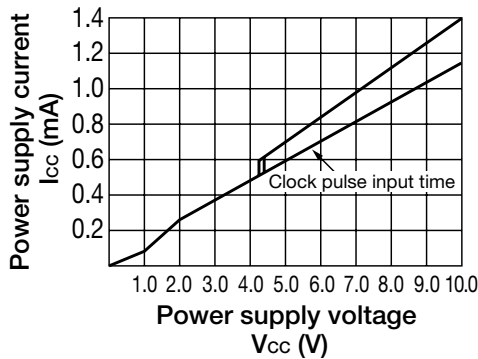
Detection voltage can be changed by connecting resistor R1 externally to MM1075 Vs pin. Determine R1 according to graph 2 when changing Vs.

Graph 2. Detection voltage change using MM1075 external resistor

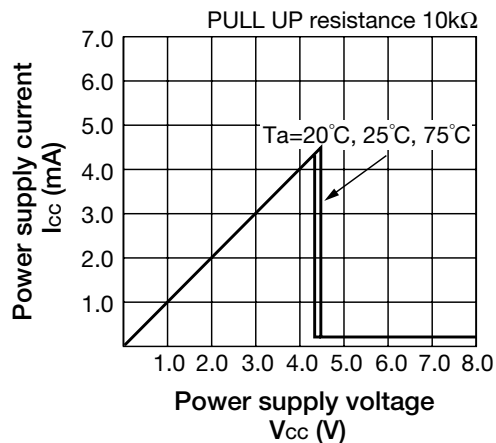


Characteristics

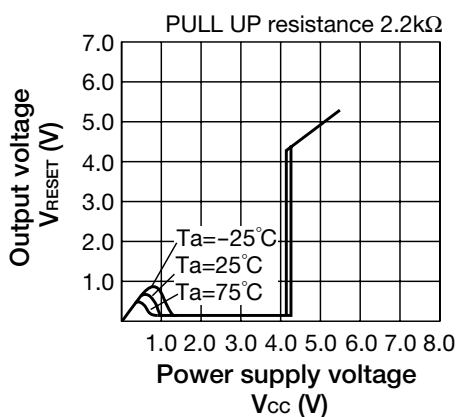
■ Power supply current-Power supply voltage



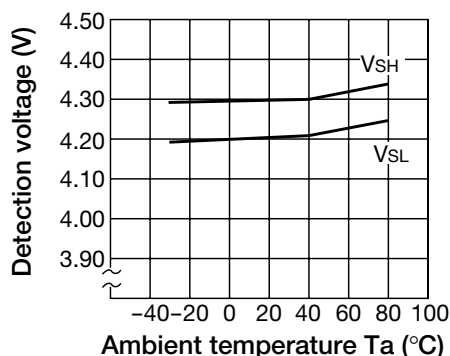
■ Output voltage-Power supply voltage (RESET pin)



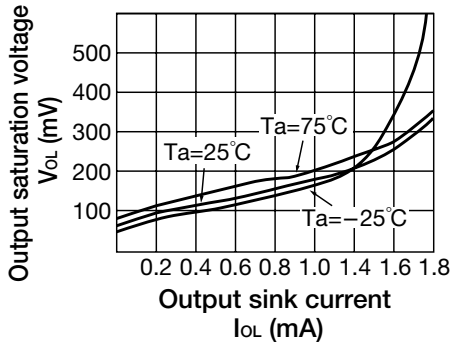
■ Output voltage-Power supply voltage (RESET pin)



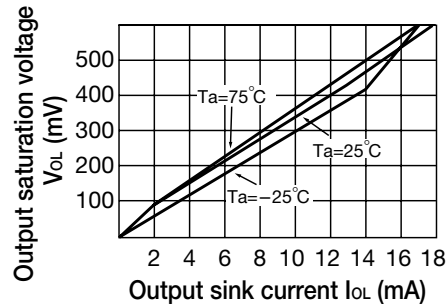
■ Detection voltage (V_{SL}, V_{SH}) temperature (RESET, RESET pins)



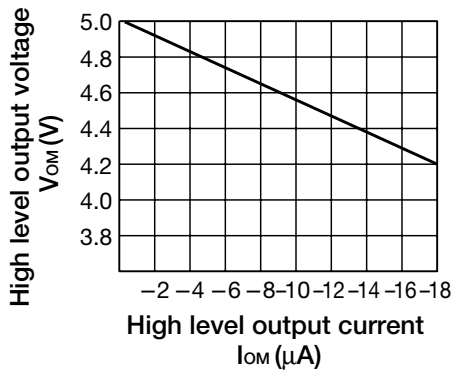
■ Output saturation voltage-Output sink current (RESET pin)



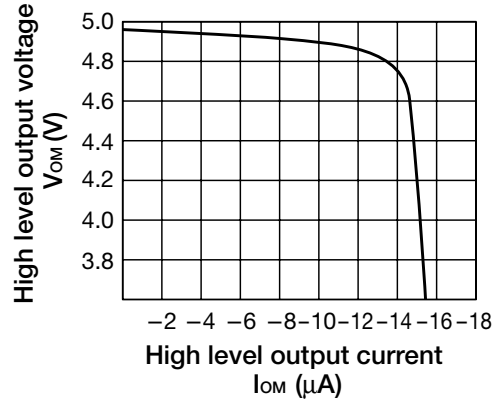
■ Output saturation voltage-Output sink current (RESET pin)



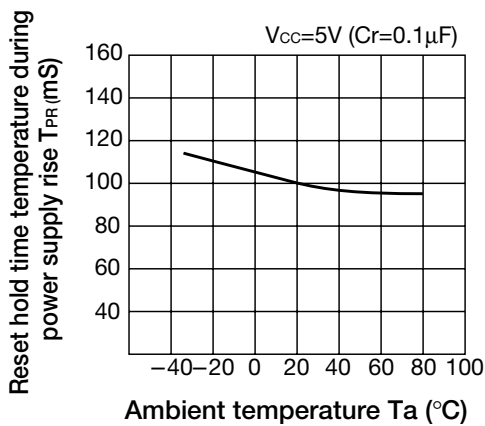
■ High level output voltage-High level output current (RESET pin)



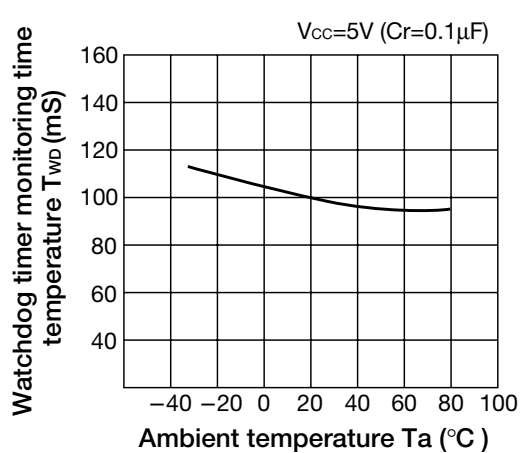
■ High level output voltage-High level output current (RESET pin)



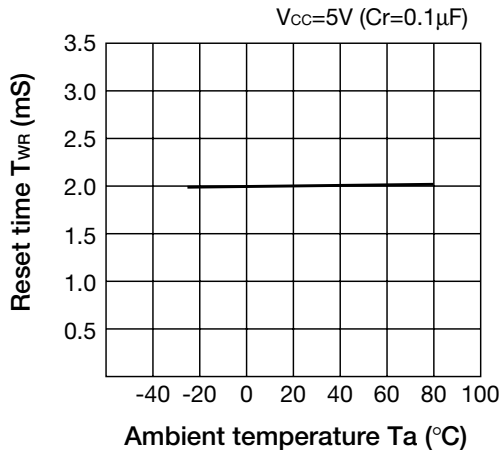
■ Reset hold time temperature during power supply rise



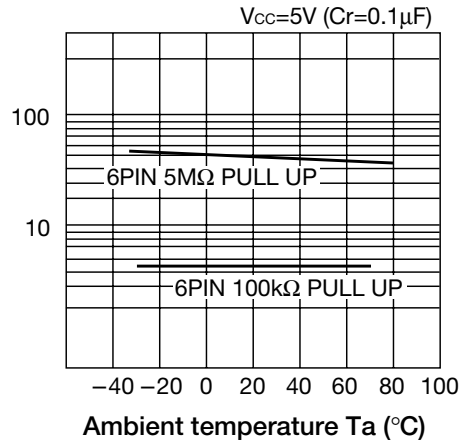
■ Watchdog timer monitoring time temperature



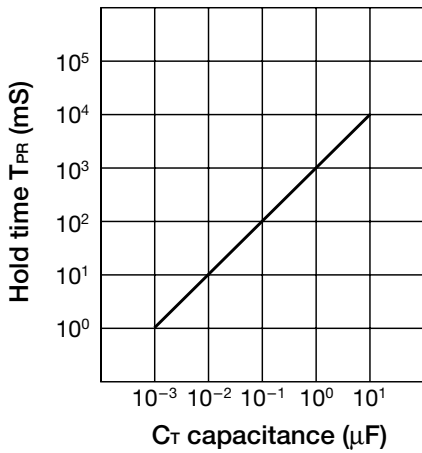
Reset time temperature (for watchdog timer)



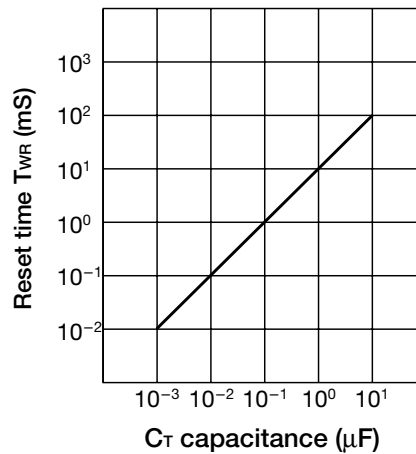
Watchdog timer monitoring time temperature



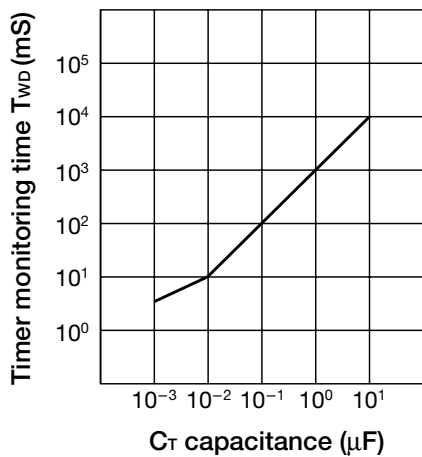
C_T value for reset hold time during power supply rise



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

