

# System Reset (with built-in watchdog timer) Monolithic IC MM1035

## 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

## Package

DIP-8A (MM1035XD)

SOP-8A (MM1035XF)

## Applications

Microcomputers

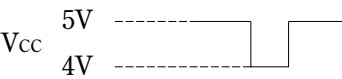
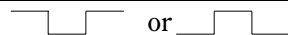

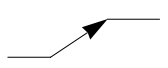
## Absolute Maximum Ratings (Ta=25°C)

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

**Electrical Characteristics 1 (DC)** (Except where noted otherwise,  $T_a=25^\circ\text{C}$ ,  $V_{CC}=5\text{V}$ , measurement circuit 1)  
 (Except where noted otherwise, resistance unit is  $\Omega$ )

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			$\pm 0.01$		$\%/^\circ\text{C}$
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	$\mu\text{A}$
	$I_{IL}$	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	$I_{\overline{RESET}}=0.5\text{mA}, V_S=OPEN$		0.2	0.4	
	$V_{OL4}$	1	$I_{\overline{RESET}}=1\text{mA}, V_S=OPEN$		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	$V_{\overline{RESET}}=1.0\text{V}, V_S=OPEN$	1	2		
$C_T$ charge current	$I_{CT1}$	1	$V_{TC} = 1.0\text{V}$ during watchdog timer operation	-8	-12	-24	$\mu\text{A}$
	$I_{CT2}$	1	$V_{TV} = 1.0\text{V}$ during power on reset operation	-0.8	-1.2	-2.4	$\mu\text{A}$
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 $\overline{RESET}$	$V_{CCL2}$	1	$I_{\overline{RESET}}=V_{CC}-0.1\text{V}$ $R_{i2}$ (between Pin 2 and GND) =1M		0.8	1.0	V

**Electrical Characteristics 2 (AC)** (Except where noted otherwise, Ta=25°C, Vcc=5V, measurement circuit 2)  
 (Except where noted otherwise, resistance unit is Ω)

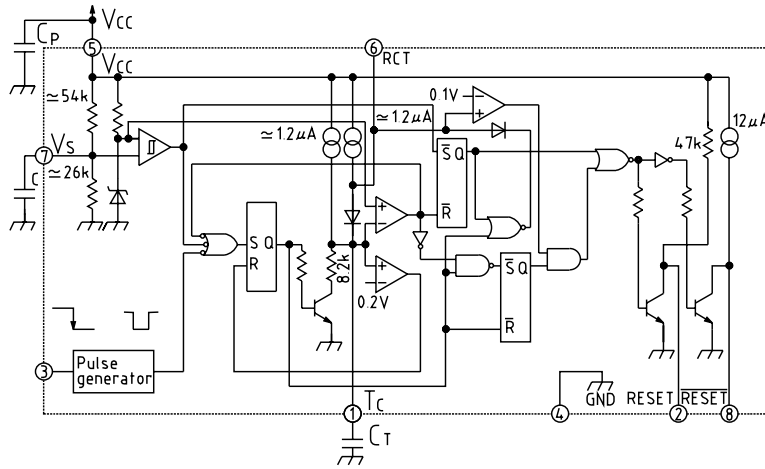
Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
Vcc input pulse width	T <sub>PI</sub>	2	V <sub>CC</sub> 	8			μs
CK input pulse width	T <sub>CKW</sub>	2	CK  or 	3			μs
CK input cycle	T <sub>CK</sub>	2		20			μs
Watchdog timer monitoring time *1	T <sub>WD</sub>	2	C <sub>T</sub> =0.1μF	5	10	15	ms
Reset time for watchdog timer *2	T <sub>WR</sub>	2	C <sub>T</sub> =0.1μF	1	2	3	ms
Reset hold time for power supply rise *3	T <sub>PR</sub>	2	C <sub>T</sub> =0.1μF, V <sub>CC</sub> 	50	100	150	ms
Output delay time from Vcc *4	T <sub>PD1</sub>	2	RESET pin R <sub>L1</sub> =2.2k, C <sub>L1</sub> =100pF		2	10	μs
	T <sub>PD2</sub>	2	RESET pin R <sub>L2</sub> =10k, C <sub>L2</sub> =20pF		3	10	
Output rise time *5	tr1	2	RESET pin R <sub>L1</sub> =2.2k, C <sub>L1</sub> =100pF		1.0	1.5	μs
	tr2	2	RESET pin R <sub>L2</sub> =10k, C <sub>L2</sub> =20pF		1.0	1.5	μs

Notes :

- \*1: 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.
- \*2: Reset time means reset pulse width. However, this does not apply to power on reset.
- \*3: Reset hold time is the time from when V<sub>CC</sub> exceeds detection voltage (V<sub>SH</sub>) during power on reset, until RESET output goes high (reset release).
- \*4: Output delay time is the time from when power supply voltage drops below detection voltage (V<sub>SL</sub>), until RESET output goes low (reset status).
- \*5: Voltage range when measuring output rise and fall is 10~90%.
- \*6: Watchdog timer monitoring time (T<sub>WD</sub>), watchdog timer reset time (T<sub>WR</sub>) and reset hold time (T<sub>PR</sub>) during power supply rise can be changed by varying C<sub>T</sub> capacitance. The times are expressed by the following formulae. The recommended range for C<sub>T</sub> is 0.001~10μF.

$T_{PR} (ms) \cong 1000 \times C_T (\mu F)$	$T_{PR} \cong 100ms$	Example : When C <sub>T</sub> =0.1μF
$T_{WD} (ms) \cong 100 \times C_T (\mu F)$	$T_{WD} \cong 10ms$	
$T_{WR} (ms) \cong 20 \times C_T (\mu F)$	$T_{WR} \cong 2ms$	

Block Diagram

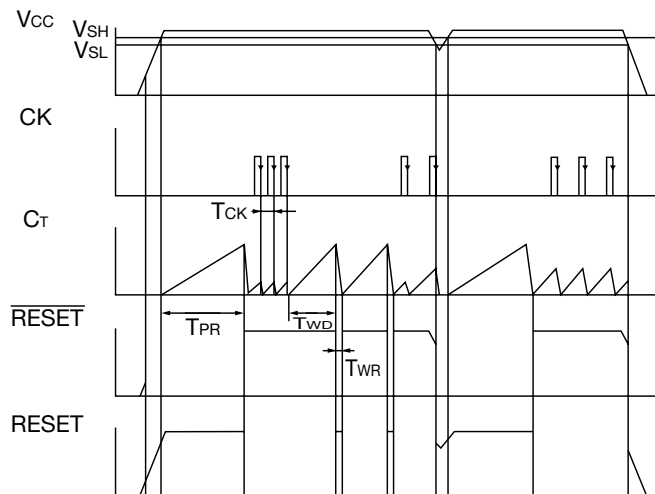


Note 1: CP = 0.1µF approx.

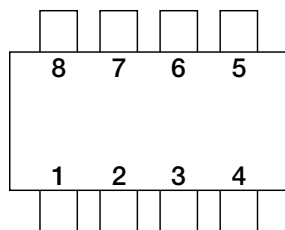
Note 2: C ≥ 1000pF.

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

Timing Chart



Pin Assignment



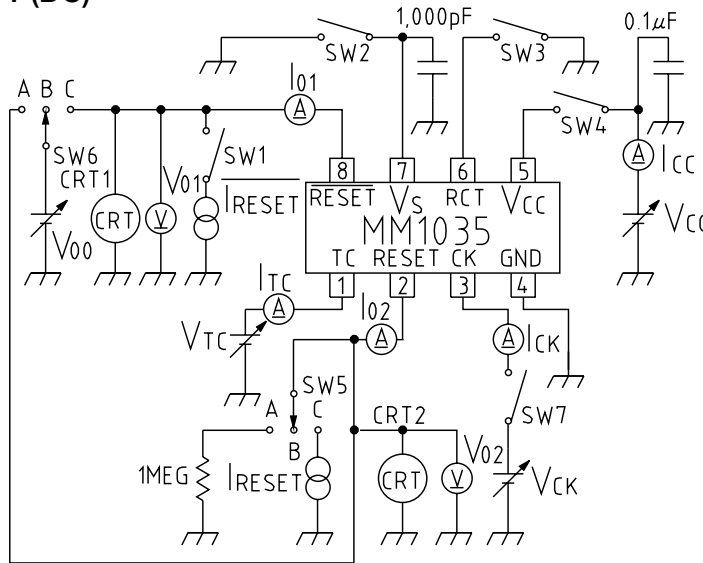
1	Tc
2	RESET
3	CK
4	GND
5	Vcc
6	RCT
7	Vs
8	RESET

Pin Description

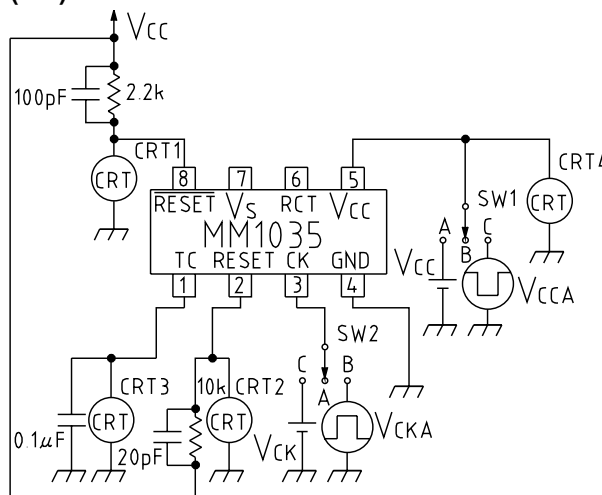
Pin No.	Pin Name	Function
1	Tc	T <sub>WD</sub> , T <sub>WR</sub> , T <sub>PR</sub> variable pins. (T <sub>WD</sub> , T <sub>WR</sub> and T <sub>PR</sub> times are determined by the external capacitor.)
2	RESET	Reset output pin (High output)
3	CK	Clock input pin (inputs clock from logic system)
4	GND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

Measuring Circuit

Measuring Circuit 1 (DC)



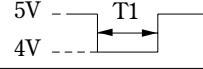
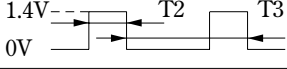
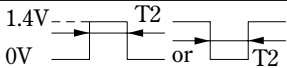
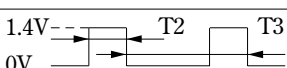
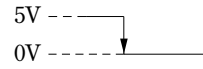
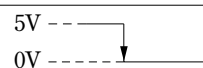
Measuring Circuit 2 (AC)



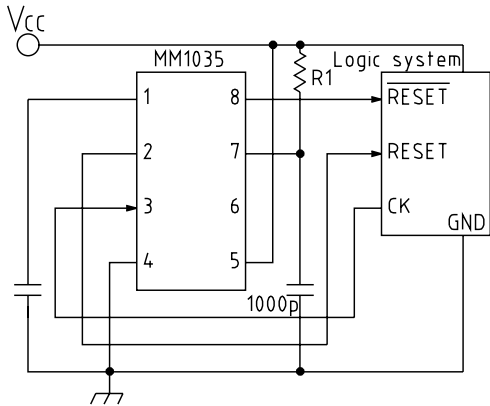
**Measuring Circuit 1** SW Table 6-1-2. SW&Power Supply Table 1

Item	Symbol	SW1	SW2	SW3	SW4	SW5	SW6	SW7	V <sub>CC</sub>	V <sub>CK</sub>	V <sub>CT</sub>	I <sub>RESET</sub>	I <sub>RESET</sub>	VM, IM	Notes
Consumption current	I <sub>CC</sub>	OFF	OFF	OFF	ON	B	B	ON	5V	5V	0V	-	-	I <sub>CC</sub>	
Detection voltage	V <sub>SL</sub>	OFF	OFF	ON	ON	B	B	ON	5V→0V	3V	3V	-	-	V <sub>o1</sub> , CRT1	
	V <sub>SH</sub>	OFF	OFF	ON	ON	B	B	ON	4V→5V	3V	3V	-	-	V <sub>o1</sub> , CRT1	
CK input threshold	V <sub>TH</sub>	OFF	OFF	OFF	ON	B	B	ON	5V	0V→3V	1V	-	-	I <sub>CK</sub>	
CK input current	I <sub>IH</sub>	OFF	OFF	OFF	ON	B	B	ON	5V	5V	0V	-	-	I <sub>CK</sub>	
	I <sub>IL</sub>	OFF	OFF	OFF	ON	B	B	ON	5V	0V	0V	-	-	I <sub>CK</sub>	
Output voltage (High)	V <sub>OH1</sub>	ON	OFF	ON	ON	B	B	ON	5V	5V	3V	-5μA	-	V <sub>o1</sub>	
	V <sub>OH2</sub>	OFF	ON	ON	ON	C	B	ON	5V	5V	3V	-	-5μA	V <sub>o2</sub>	
Output voltage (Low)	V <sub>OL1</sub>	ON	ON	ON	ON	B	B	ON	5V	5V	3V	3mA	-	V <sub>o1</sub>	
	V <sub>OL2</sub>	ON	ON	ON	ON	B	B	ON	5V	5V	3V	10mA	-	V <sub>o1</sub>	
	V <sub>OL3</sub>	OFF	OFF	ON	ON	C	B	ON	5V	5V	3V	-	0.5mA	V <sub>o2</sub>	
	V <sub>OL4</sub>	OFF	OFF	ON	ON	C	B	ON	5V	5V	3V	-	1mA	V <sub>o2</sub>	
Output sink current	I <sub>o1</sub>	OFF	ON	ON	ON	B	C	ON	5V	5V	3V	-	-	I <sub>o1</sub>	V <sub>o0</sub> =1V
	I <sub>o2</sub>	OFF	OFF	ON	ON	B	A	ON	5V	5V	3V	-	-	I <sub>o2</sub>	V <sub>o0</sub> =1V
C <sub>T</sub> charge current 1	I <sub>TC1</sub>	OFF	OFF	OFF	ON	B	B	OFF	5V	-	1V	-	-	I <sub>TC</sub>	
C <sub>T</sub> charge current 2	I <sub>TC2</sub>	OFF	OFF	ON	ON	B	B	OFF	5V	-	1V	-	-	I <sub>TC</sub>	
Minimum operating power supply voltage to ensure reset	V <sub>CC1</sub>	ON	OFF	ON	ON	B	B	ON	0V→2V	0V	0V		-	V <sub>o1</sub> , V <sub>CC</sub>	
Minimum operating power supply voltage to ensure reset	V <sub>CC2</sub>	OFF	ON	ON	ON	A	B	ON	0V→2V	0V	0V	-	-	V <sub>o2</sub> , V <sub>CC</sub>	

**Measuring Circuit 2** SW Table 6-2-2. SW&Power Supply Table 2

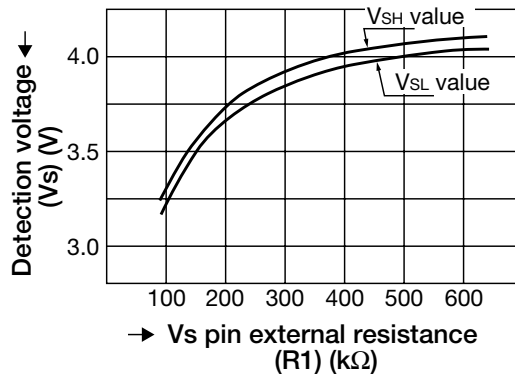
Item	Symbol	SW1	SW2	V <sub>CCA</sub>	V <sub>CC</sub>	V <sub>CKA</sub>	V <sub>CK</sub>	CRT	Notes
V <sub>CC</sub> input pulse width	T <sub>PI</sub>	C	B		-		-	CRT1,2,3	T1=8μs
CK input pulse width	T <sub>CKW</sub>	A	B		5V		-	CRT1,2,3	T2=3μs
CK input cycle	T <sub>CK</sub>	A	B		5V		-	CRT1,2,3	T3=20μs
Watchdog timer monitoring time	T <sub>WD</sub>	A	A		5V		5V	CRT1,2,3	
Reset time for watchdog timer	T <sub>WR</sub>	A	A		5V		5V	CRT1,2,3	
Reset hold time for power supply rise	T <sub>PR</sub>	B→A	A		5V		5V	CRT1,2,3	
Output delay time from V <sub>CC</sub>	T <sub>PD1</sub>	C	A		-		0V	CRT1,3	
	T <sub>PD2</sub>	C	A		-		0V	CRT2,3	
Output rise time	T <sub>R1</sub>	A	A		5V		5V	CRT1	
	T <sub>R2</sub>	A	A		5V		5V	CRT2	
Output fall time	T <sub>F1</sub>	A	A		5V		5V	CRT1	
	T <sub>F2</sub>	A	A		5V		5V	CRT2	

**Detection Voltage Variation 1** (lowering detection voltage)

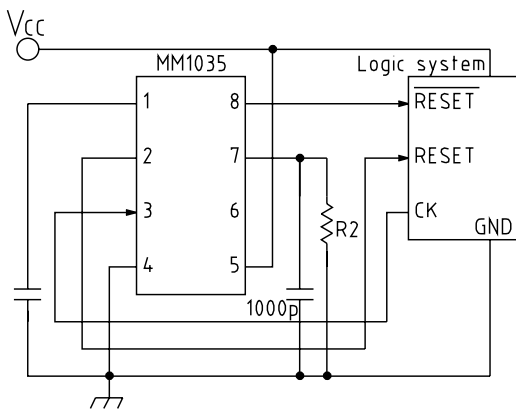


Detection voltage can be changed by connecting resistor R1 externally to MM1035 Vs pin. Determine R1 according to graph 1 when changing Vs.

Graph 1. Detection voltage change using MM1035 external resistor

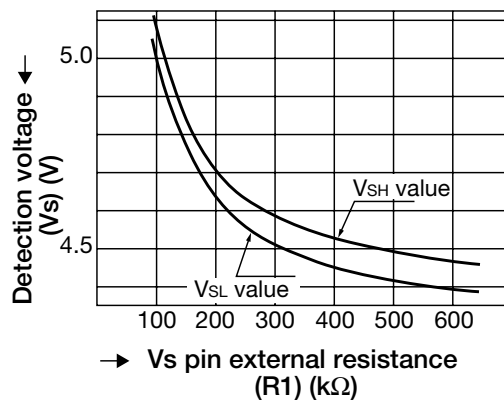


**Detection Voltage Variation 2** (raising detection voltage)



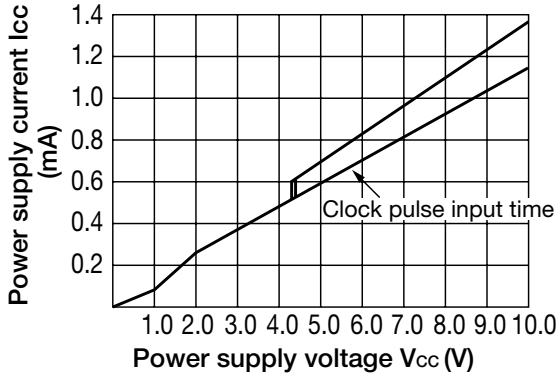
Detection voltage can be changed by connecting resistor R2 externally to MM1035 Vs pin. Determine R2 according to graph 2 when changing Vs.

Graph 2. Detection voltage change using MM1035 external resistor

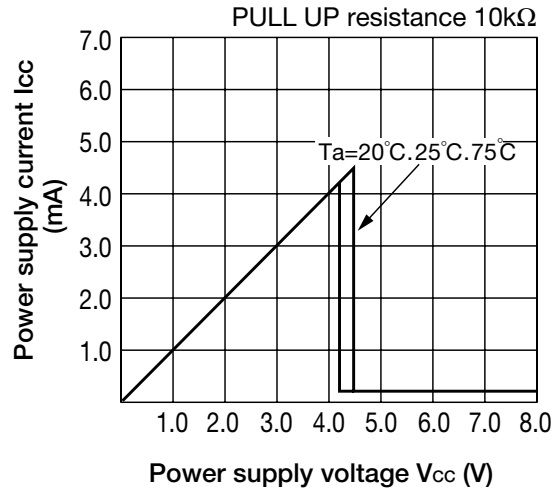


Characteristics

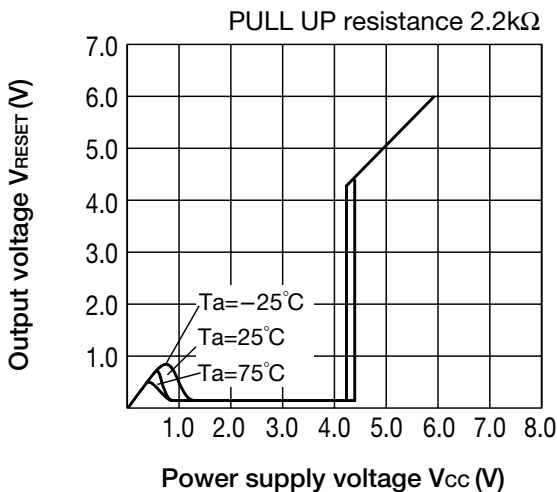
Power supply current-Power supply voltage



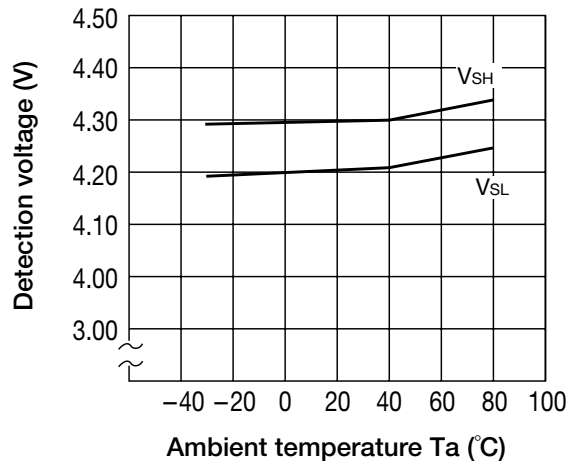
Output voltage-Power supply voltage (RESET pin)



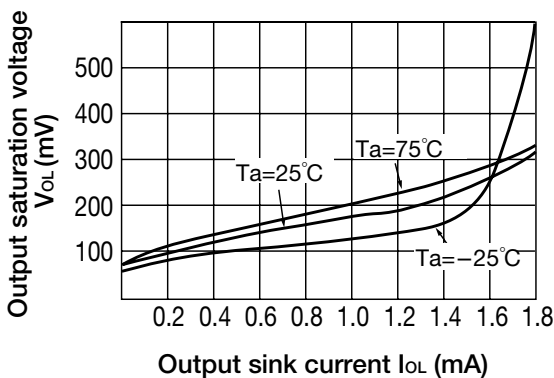
Output voltage-Power supply voltage (RESET pin)



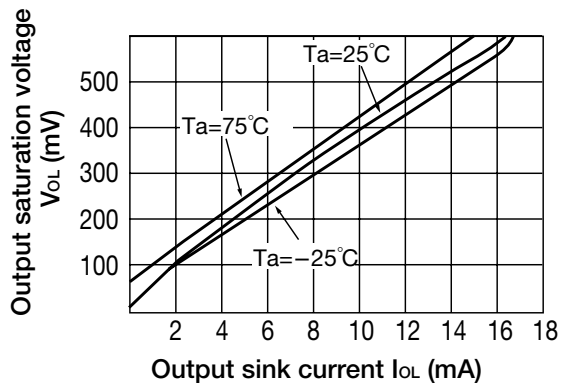
Detection voltage (VSL, VSH) temperature (RESET, RESET pins)



Output saturation voltage-Output sink current (RESET pin)

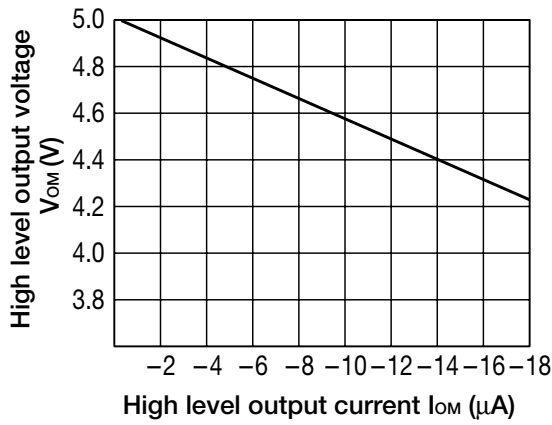


Output saturation voltage-Output sink current (RESET pin)

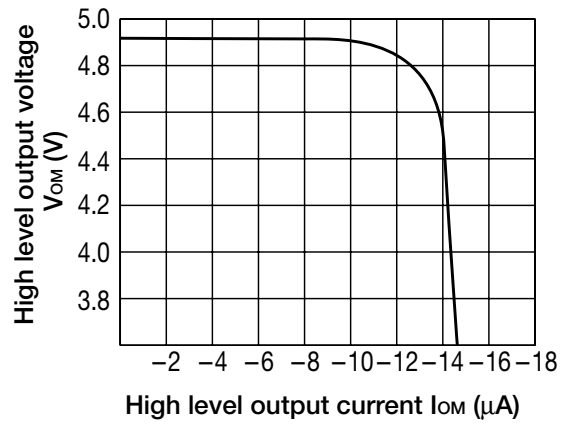




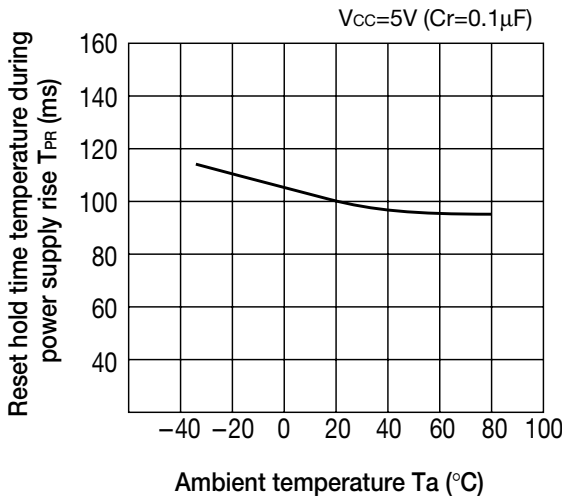
■ High level output voltage-High level output current (RESET pin)



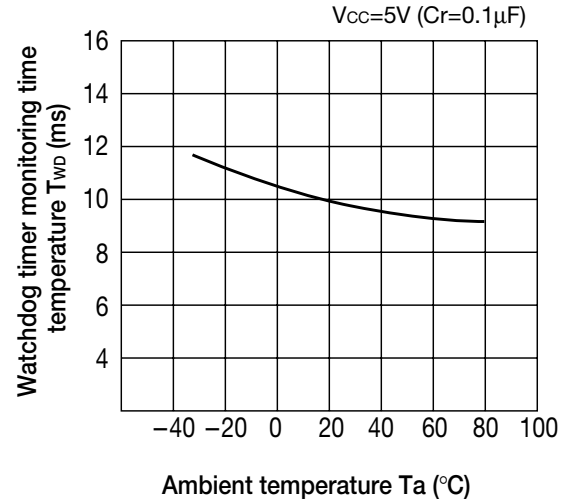
■ High level output voltage - High level output current (RESET pin)



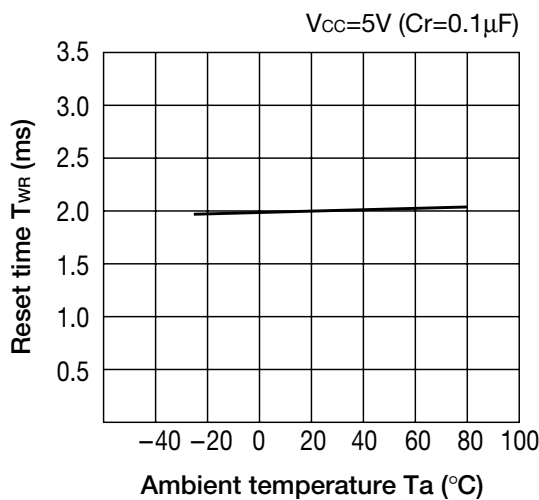
■ Reset hold time temperature during power supply rise



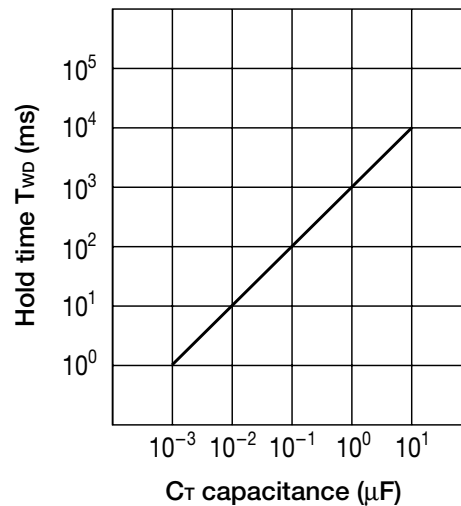
■ Watchdog timer monitoring time temperature



■ Reset time temperature (for watchdog timer)



■ 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

