

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

August 19, 2003

Outline

This IC functions in a variety of CPU systems and other logic systems to generate a reset signal and 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

Packages

- DIP-8A (MM1035XD)
- SOP-8A (MM1035XF)

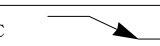


Applications

Microcomputers

Absolute Maximum Ratings (Ta=25°C)

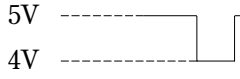
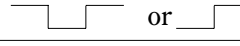
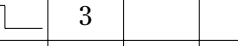

Item	Symbol	Rating	Units
Storage temperature	T _{STG}	-40~+125	°C
Operating temperature	T _{OPR}	-20~+70	°C
Power supply voltage	V _{CC max.}	-0.3~+10	V
Voltage applied to VS & CK pins	V _{VS} & V _{CK}	-0.3~+10	V
Voltage applied to RESET, RESET pin	V _{OH}	-0.3~+10	V
Allowable loss	Pd	400 (DIP-8)	mW
		340 (SOP-8)	

Electrical Characteristics 1 (DC) (Except where noted otherwise, Ta=25°C, Vcc=5V, measurement circuit 1)
 (Except where noted otherwise, resistance unit is Ω)

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 /ΔT	1			±0.01		%/°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} =5V		0	1	μA
	I _{IL}	1	V _{CK} =0V	-20	-10	-3	
Output voltage (High)	V _{OH1}	1	I _{RESET} = -5μA, V _S =OPEN	4.5	4.8		V
	V _{OH2}	1	I _{RESET} = -5μA, V _S =0V	4.5	4.8		
Output voltage (Low)	V _{OL1}	1	I _{RESET} = 3mA, V _S =0V		0.2	0.4	V
	V _{OL2}	1	I _{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 _{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	I _{CT1}	1	V _{TC} = 1.0V during watchdog timer operation	-8	-12	-24	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 RESET	V _{CCL1}	1	V _{RESET} = 0.4V I _{RESET} = 0.2mA		0.8	1.0	V
Minimum operating power supply voltage to ensure RESET	V _{CCL2}	1	I _{RESET} = V _{CC} - 0.1V R _{L2} (between Pin 2 and GND) = 1M		0.8	1.0	V

Products to be discontinued

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 _{PI}	2	V _{CC} 	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 *1	T _{WD}	2	C _T =0.1μF	5	10	15	ms
Reset time for watchdog timer *2	T _{WR}	2	C _T =0.1μF	1	2	3	ms
Reset hold time for power supply rise *3	T _{PR}	2	C _T =0.1μF, V _{CC} 	50	100	150	ms
Output delay time from V _{CC} *4	T _{PD1}	2	RESET pin R _{L1} =2.2k, C _{L1} =100pF		2	10	μs
	T _{PD2}	2	RESET pin R _{L2} =10k, C _{L2} =20pF		3	10	
Output rise time *5	tr1	2	RESET pin R _{L1} =2.2k, C _{L1} =100pF		1.0	1.5	μs
	tr2	2	RESET pin R _{L2} =10k, C _{L2} =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_{CC} exceeds detection voltage (V_{SH}) 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_{SL}), 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_{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} (ms) ≒ 1000 × C_T (μF)

T_{WD} (ms) ≒ 100 × C_T (μF)

T_{WR} (ms) ≒ 20 × C_T (μF)

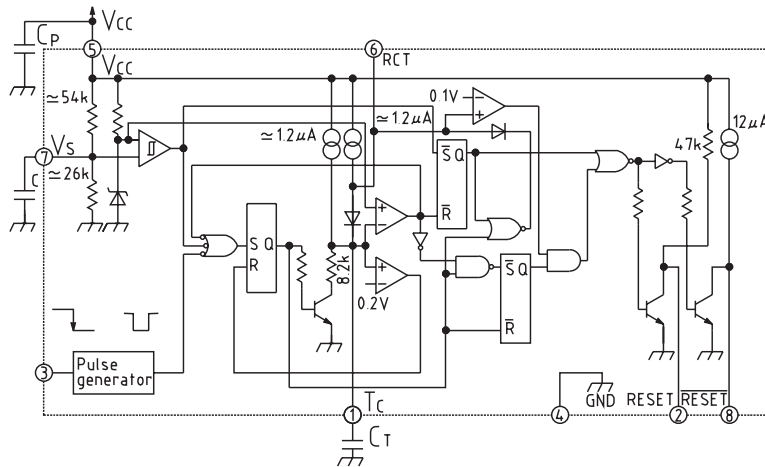
Example : When C_T=0.1μF

T_{PR} ≒ 100ms

T_{WD} ≒ 10ms

T_{WR} ≒ 2ms

Block Diagram

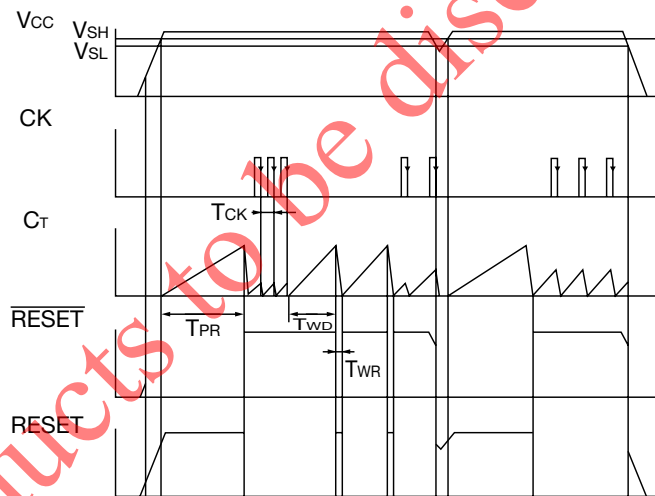


Note 1: $C_P = 0.1\mu F$ approx.

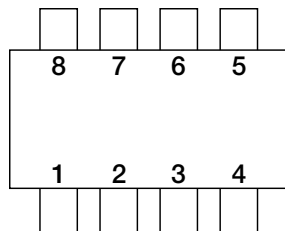
Note 2: $C \geq 1000pF$.

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



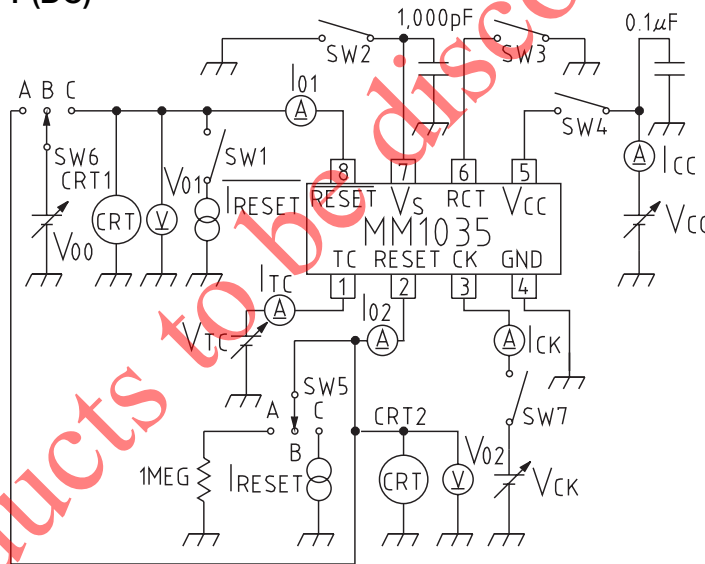
1	Tc
2	RESET
3	CK
4	GND
5	Vcc
6	RCT
7	Vs
8	RESET

Pin Description

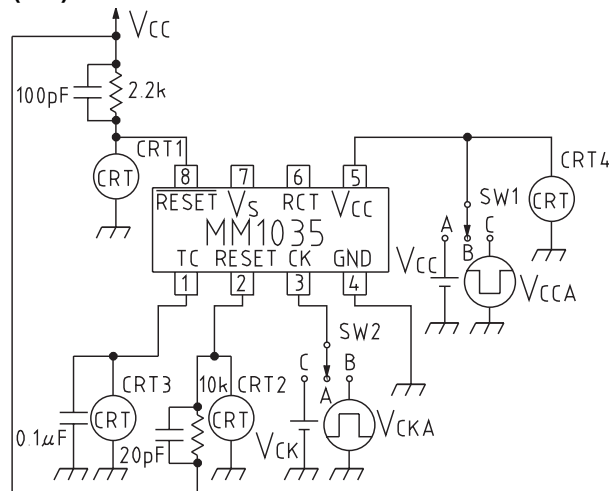
Pin No.	Pin Name	Function
1	Tc	T _{WD} , T _{WR} , T _{PR} variable pins. (T _{WD} , T _{WR} and T _{PR} times are determined by the external capacitor.)
2	RESET	Reset output pin (High output)
3	CK	Clock input pin (inputs clock from logic system)
4	GND	GND pin
5	Vcc	4.2V detection voltage
6	RCT	Watchdog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




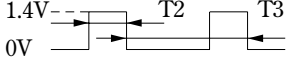
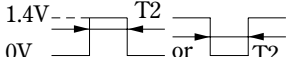
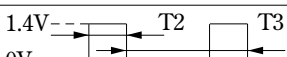
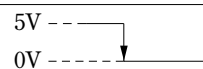
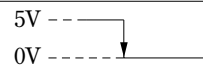
Measuring Circuit 2 (AC)



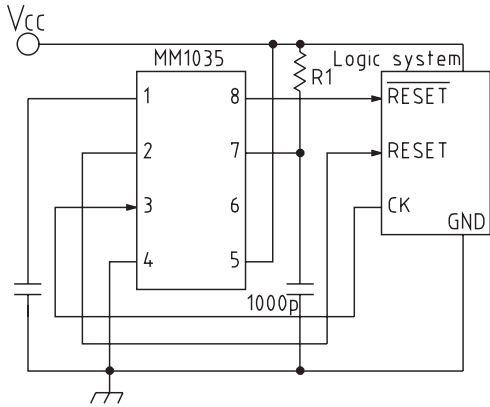
Measuring Circuit 1 SW Table 6-1-2. SW&Power Supply Table 1

Item	Symbol	SW1	SW2	SW3	SW4	SW5	SW6	SW7	V _{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→0V	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 _{o1}	OFF	ON	ON	ON	B	C	ON	5V	5V	3V	-	-	I _{o1}	V _{oo} =1V
	I _{o2}	OFF	OFF	ON	ON	B	A	ON	5V	5V	3V	-	-	I _{o2}	V _{oo} =1V
Ct charge current 1	I _{TC1}	OFF	OFF	OFF	ON	B	B	OFF	5V	-	1V	-	-	I _{TC}	
Ct 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 SW Table 6-2-2. SW&Power Supply Table 2

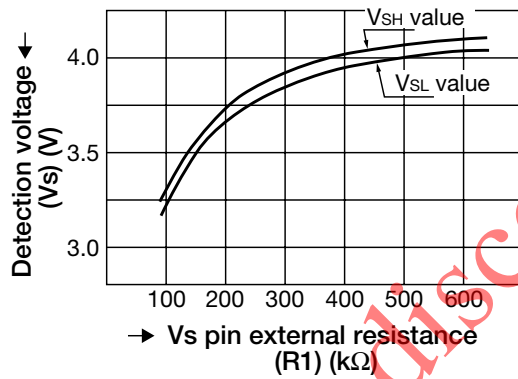
Item	Symbol	SW1	SW2	V _{CCA}	V _{CC}	V _{CKA}	V _{CK}	CRT	Notes
V _{CC} input pulse width	T _{PI}	C	B		-		-	CRT1,2,3	T1=8μs
CK input pulse width	T _{CKW}	A	B		5V		-	CRT1,2,3	T2=3μs
CK input cycle	T _{CK}	A	B		5V		-	CRT1,2,3	T3=20μs
Watchdog timer monitoring time	T _{WD}	A	A		5V		5V	CRT1,2,3	
Reset time 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 V _{CC}	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 _{P1}	A	A		5V		5V	CRT1	
	T _{P2}	A	A		5V		5V	CRT2	

Detection Voltage Variation 1 (lowering detection voltage)

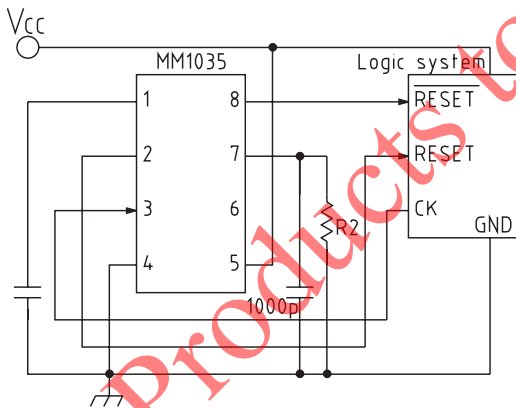


Detection voltage can be changed by connecting resistor R1 externally to MM1035 Vs pin. Determine R1 according to graph 1 when changing Vs.

Graph 1. Detection voltage change using MM1035 external resistor

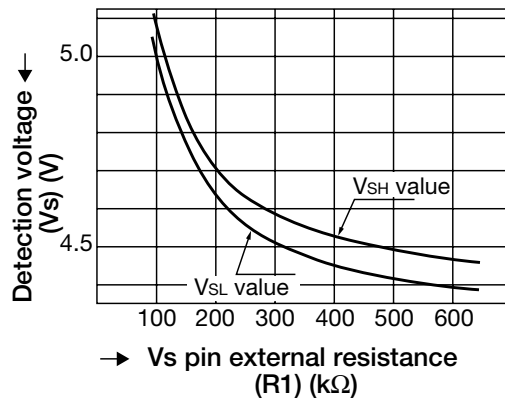


Detection Voltage Variation 2 (raising detection voltage)



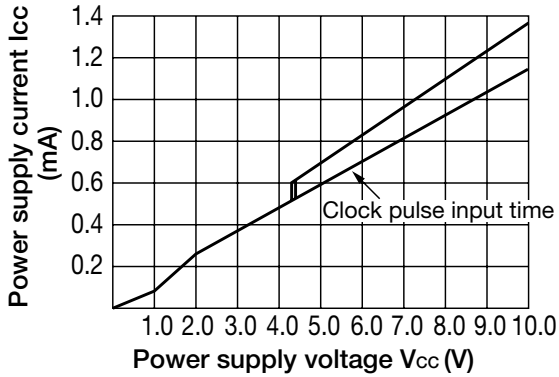
Detection voltage can be changed by connecting resistor R2 externally to MM1035 Vs pin. Determine R2 according to graph 2 when changing Vs.

Graph 2. Detection voltage change using MM1035 external resistor

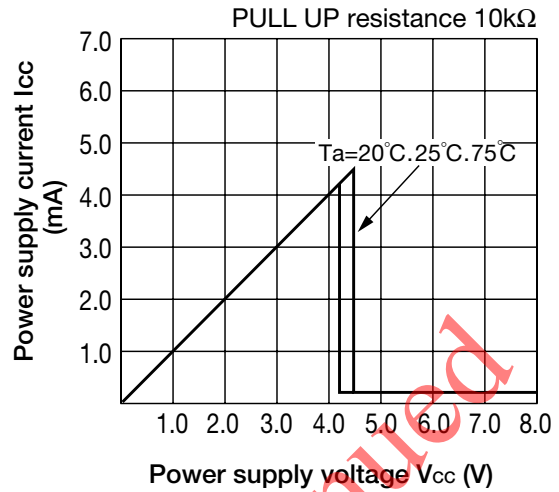


Characteristics

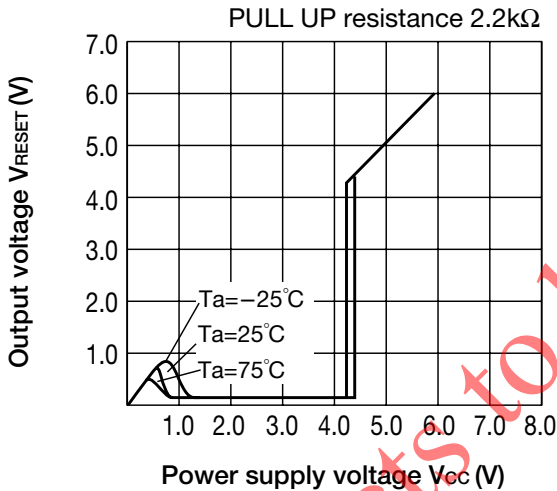
Power supply current-Power supply voltage



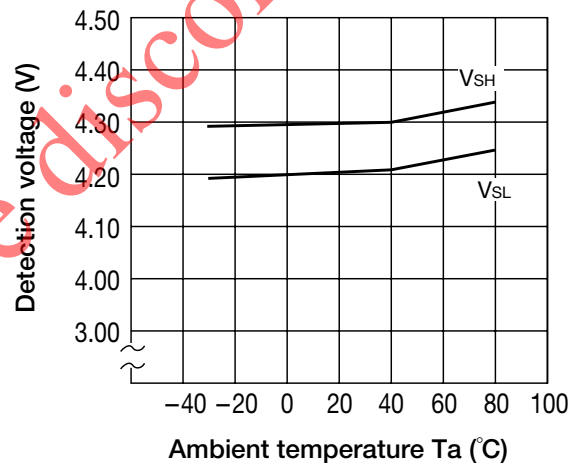
Output voltage-Power supply voltage (RESET pin)



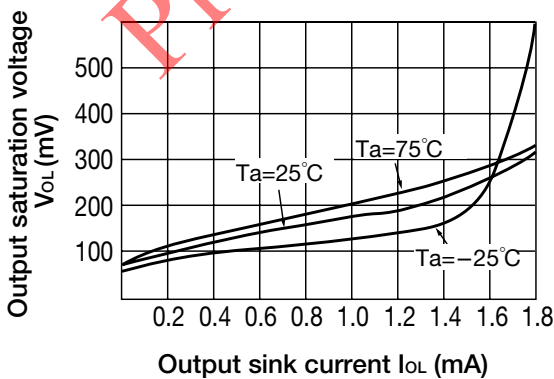
Output voltage-Power supply voltage (RESET pin)



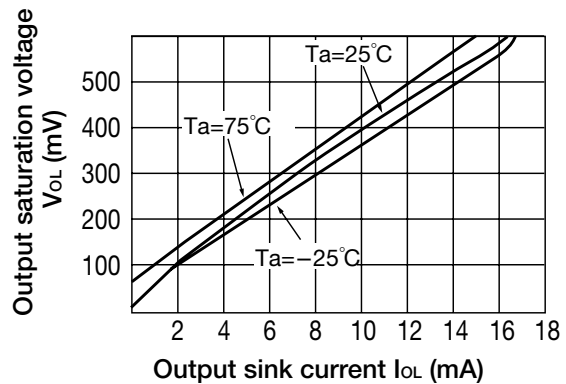
Detection voltage (V_{SL}, V_{SH}) temperature (RESET, RESET pins)



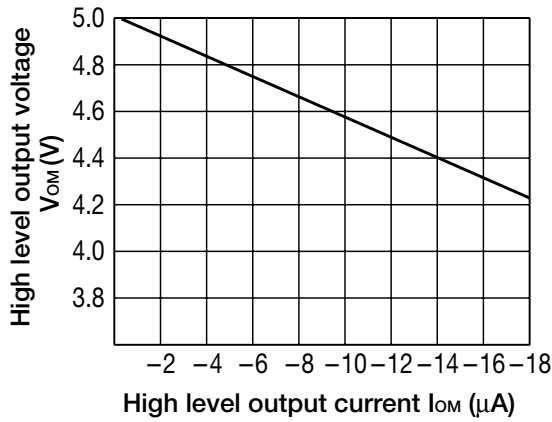
Output saturation voltage-Output sink current (RESET pin)



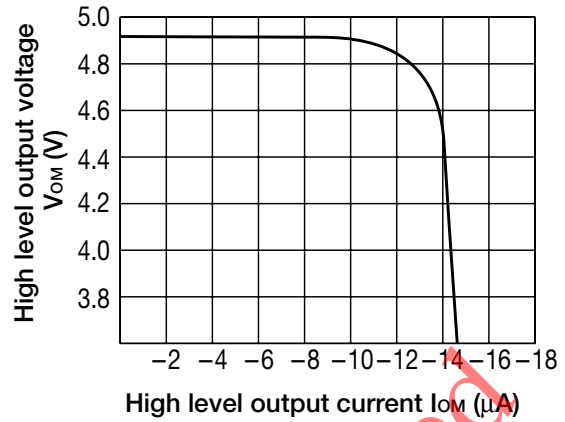
Output saturation voltage-Output sink current (RESET pin)



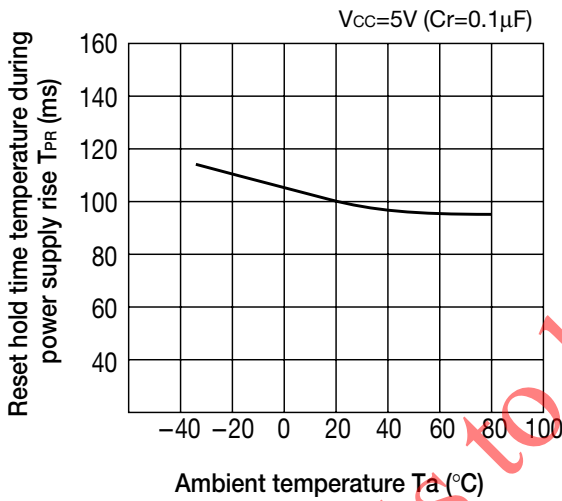
■ High level output voltage-High level output current (RESET pin)



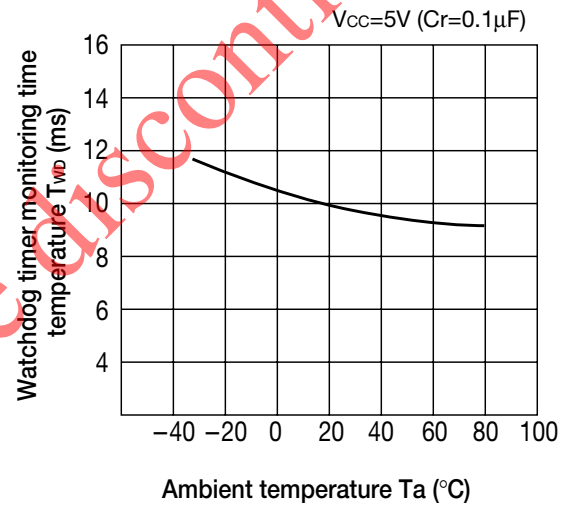
■ High level output voltage - High level output current (RESET pin)



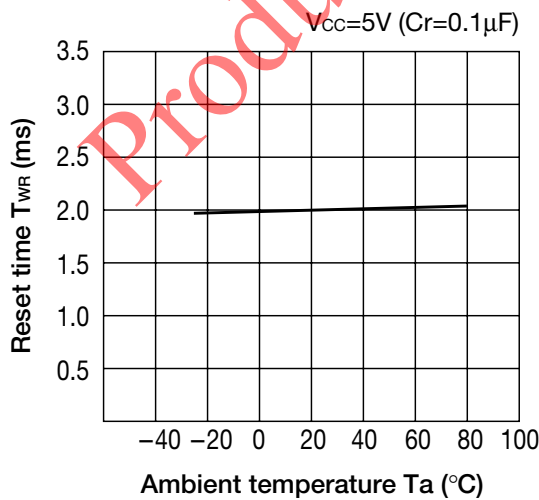
■ Reset hold time temperature during power supply rise



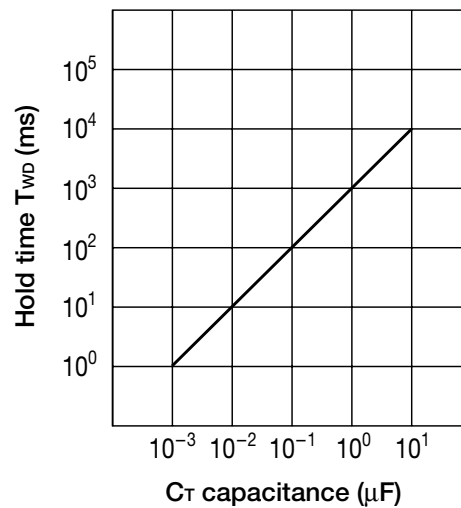
■ Watchdog timer monitoring time temperature



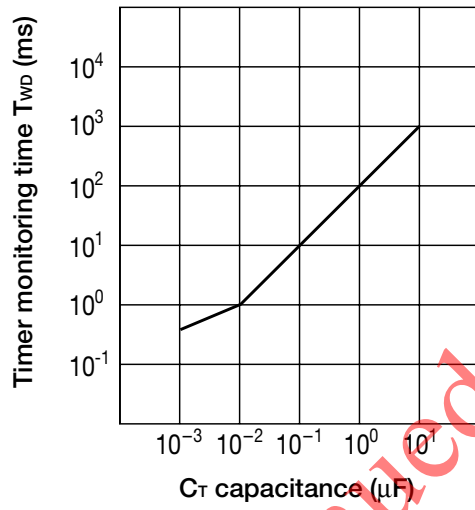
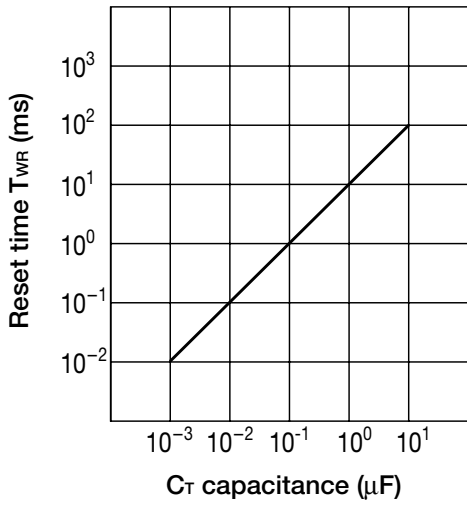
■ Reset time temperature (for watchdog timer)



■ 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



Products to be discontinued