

# IC for System Reset (with built-in watchdog timer) Monolithic IC MM1142

August 26, 2004

## Outline

This IC was developed to drive low voltage batteries, and has a watchdog timer with built-in microcomputer reset voltage detection circuit and low battery detection circuit.

A single reference voltage is used for low battery voltage detection and microcomputer reset voltage detection, so detection voltage difference is uniform ( $\approx 0.2V$ ). Further, there is a built-in watchdog timer for operation diagnosis, which prevents the system from running wild by generating an intermittent reset pulse during system mis-operation.

## Features

1. Accurate voltage drop detection voltage
  1. Low battery detection 2.2V $\pm$ 3%
  2. Power supply voltage detection 2.0V $\pm$ 3%
  3. Detection voltage error 0.2V $\pm$ 20mV 1-2
  4. Hysteresis both 50mV typ.
2. Watchdog function stop pin (can be made to function only as reset IC during V<sub>CC</sub> rise)
3. Low current consumption 150 $\mu$ A typ.

## Package

SOP-8C (MM1142XF)

## Applications

1. 2V cordless telephones
2. Portable communication equipment
3. Various types of small, handy equipment

## Series Table

Model	V <sub>SLB</sub>	V <sub>SLR</sub>	T <sub>PR</sub>	T <sub>WD</sub>	T <sub>WR</sub>
MM1142	2.2V	2.0V	100ms	100ms	2ms

\*C<sub>T</sub>=0.02 $\mu$ F

T<sub>PR</sub> : Reset hold time during V<sub>CC</sub> rise

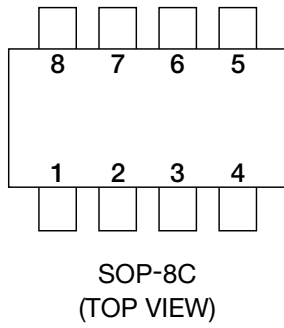
T<sub>WD</sub> : Timer monitoring time

T<sub>WR</sub> : Reset time

V<sub>SLB</sub>: Battery check detection voltage

V<sub>SLR</sub>: Reset detection voltage

Pin Assignment

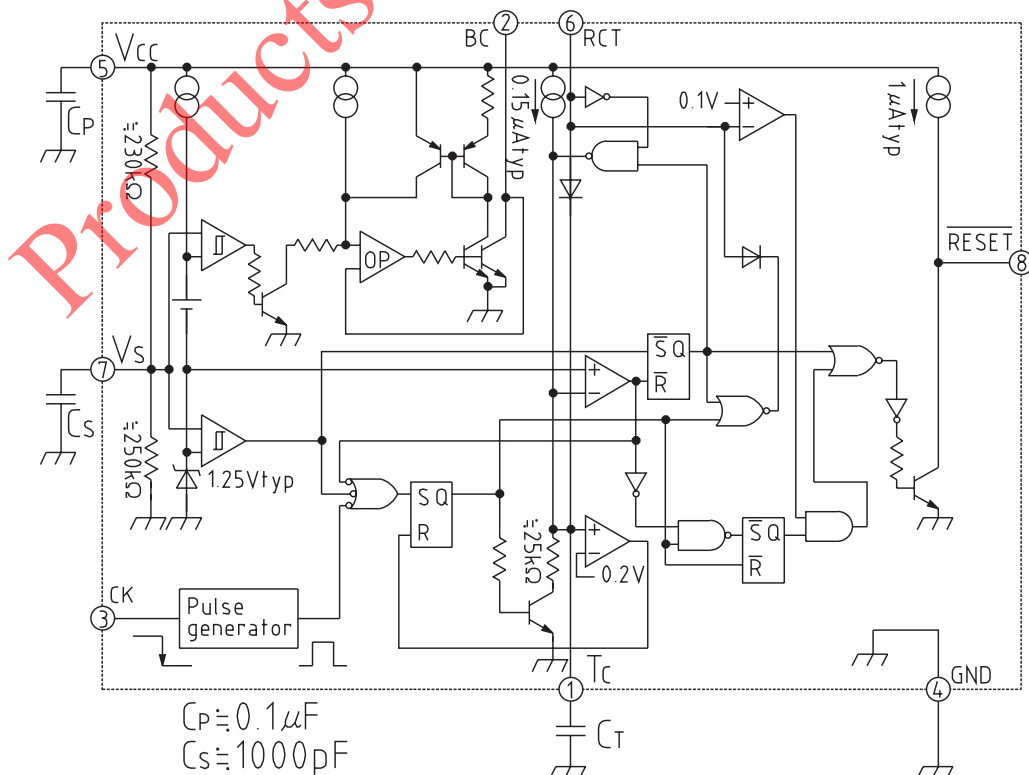


1	TC
2	BC(RESET)
3	CK
4	GND
5	V <sub>CC</sub>
6	RCT
7	V <sub>S</sub>
8	RESET

Pin Description

Pin No.	Pin name	Function
1	TC	T <sub>WD</sub> , T <sub>WR</sub> , T <sub>PR</sub> time setting pins.
2	BC(RESET)	Battery check output pin (RESET low level output) for 3.4V
3	CK	Clock input pin
4	GND	GND pin
5	V <sub>CC</sub>	Power supply voltage input pin
6	RCT	Watchdog timer stop pin Operation modes Operation → OPEN, Stop → connect to GND
7	V <sub>S</sub>	Detection voltage fine adjustment pin
8	RESET	Reset output pin (low output)

Block Diagram



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

Item	Symbol	Rating	Units
Power supply voltage	V <sub>CC</sub> max.	-0.3~+7	V
Voltage applied to input pin	V <sub>IN</sub>	-0.3~V <sub>CC</sub> +0.3 (≦+7)	V
Voltage applied to output pin	V <sub>OUT</sub>	-0.3~V <sub>CC</sub> +0.3 (≦+7)	V
Allowable loss	P <sub>d</sub>	300	mW
Storage temperature	T <sub>STG</sub>	-40~+125	°C


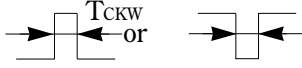
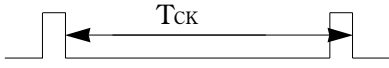
**Recommended Operating Conditions**

Item	Symbol	Rating	Units
Power supply voltage	V <sub>CC</sub>	+1.9~+6.5	V
RESET sync current	I <sub>OLR</sub>	0~500	μA
BC sync current	I <sub>OLC</sub>	0~5.0	mA
Clock input high level voltage	V <sub>CKH</sub>	1.0<	V
Clock input low level voltage	V <sub>CKL</sub>	<0.2	V
Clock monitoring time setting	T <sub>WD</sub>	1~10000	ms
Clock rise and fall times	t <sub>TRCK</sub> , t <sub>TFCK</sub>	<100	μs
Power supply voltage rise times	t <sub>RVCC</sub>	100<	μs
Power supply voltage fall times	t <sub>FVCC</sub>	50<	μs
TC pin capacitance	C <sub>T</sub>	0.0022~2.2	μF
Operating temperature	T <sub>OP</sub>	-20~+70	°C

**Electrical Characteristics** (Except where noted otherwise, Ta=25°C, V<sub>CC</sub>=2.6V)

(Except where noted otherwise, resistance unit is Ω)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Consumption current	I <sub>CC</sub>	No load		200	280	μA
RESET detection voltage	V <sub>S<sub>LR</sub></sub>	V <sub>CC</sub> : High→Low, R <sub>CT</sub> : GND, V <sub>TC</sub> =OPEN		2.00	±3%	V
Detection voltage temperature coefficient R	$\frac{\Delta V_{SR}}{\Delta T}$			±0.01	±0.05	%/°C
Hysteresis voltage R	V <sub>H<sub>YSR</sub></sub>	V <sub>CC</sub> : Low→High, R <sub>CT</sub> =GND, V <sub>TC</sub> =OPEN	25	50	100	mV
BC detection voltage	V <sub>S<sub>LB</sub></sub>	V <sub>CC</sub> : High→Low, R <sub>LB</sub> =10k		2.20	±3%	V
Detection voltage temperature coefficient B	$\frac{\Delta V_{SB}}{\Delta T}$			±0.01	±0.05	%/°C
Hysteresis voltage B	V <sub>H<sub>YSB</sub></sub>	V <sub>CC</sub> : Low→High, R <sub>LB</sub> =10k	25	50	100	mV
Detection voltage difference	ΔV <sub>S<sub>L</sub></sub>	ΔV <sub>S<sub>L</sub></sub> =V <sub>S<sub>LB</sub></sub> -V <sub>S<sub>LR</sub></sub>	0.175	0.200	0.225	V
CK input threshold	V <sub>TH</sub>		0.4	0.6	1.2	V
CK input current	I <sub>IH</sub>	V <sub>CK</sub> =2.6V		0	1	μA
	I <sub>IL</sub>	V <sub>CK</sub> =0.0V	-15	-6	-2	
Output voltage RH	V <sub>O<sub>HR</sub></sub>	I <sub>RESET</sub> =-1μA	2.0	2.2		V
Output voltage BH	V <sub>O<sub>HB</sub></sub>	R <sub>LB</sub> =10k	2.0	2.2		V
Output voltage RL	V <sub>O<sub>LR</sub></sub>	I <sub>RESET</sub> =500μA, V <sub>CC</sub> =1.8V		0.3	0.5	V
Output voltage BL	V <sub>O<sub>LB</sub></sub>	I <sub>BC</sub> =5mA, V <sub>CC</sub> =1.8V		0.3	0.5	V
Output sync current R	I <sub>OLR</sub>	V <sub>RESET</sub> =0.5V, V <sub>CC</sub> =1.8V	500	700		μA
Output sync current B	I <sub>OLB</sub>	V <sub>BC</sub> =0.5V, V <sub>CC</sub> =1.8V	5	7		mA
Output source current R	I <sub>O<sub>HR</sub></sub>	V <sub>RESET</sub> =2.0V	2	4		μA
C <sub>T</sub> charge current	I <sub>CT1</sub>	V <sub>TC</sub> =0.5V during watchdog timer operation	-0.300	-0.150	-0.075	μA
	I <sub>CT2</sub>	V <sub>TC</sub> =0.5V during power ON reset operation	-0.300	-0.150	-0.075	
Minimum operating power supply voltage to ensure RESET	V <sub>CCL</sub>	V <sub>RESET</sub> =0.4V, I <sub>RESET</sub> =0.05mA		0.8	1.0	V

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
V <sub>CC</sub> input pulse width	T <sub>PI</sub>	V <sub>CC</sub> 	20			μs
CK input pulse width	T <sub>CKW</sub>	CK 	10			μs
CK input cycle	T <sub>CK</sub>	CK 	50			μs
Watchdog timer monitoring time *1	T <sub>WD</sub>	C <sub>T</sub> =0.022μF	50	100	150	ms
Watchdog timer reset time *2	T <sub>WR</sub>	C <sub>T</sub> =0.022μF	1	2	3	ms
Reset hold time for power supply rise *3	T <sub>PR</sub>	C <sub>T</sub> =0.022μF	50	100	150	ms
RESET delay time	t <sub>PDR</sub>	V <sub>CC</sub> : High → Low, R <sub>LR</sub> =100k, C <sub>LR</sub> =15pF		10		μs
BC delay time	t <sub>PDB</sub>	V <sub>CC</sub> : High → Low, R <sub>LB</sub> =10k, C <sub>LB</sub> =15pF		10		μs
RESET rise time	t <sub>RR</sub>	R <sub>LR</sub> =100k, C <sub>LR</sub> =15pF		10		μs
RESET fall time	t <sub>FR</sub>	R <sub>LR</sub> =100k, C <sub>LR</sub> =15pF		2		μs
BC rise time	t <sub>RB</sub>	R <sub>LB</sub> =10k, C <sub>LB</sub> =15pF		10		μs
BC fall time	t <sub>FB</sub>	R <sub>LB</sub> =10k, C <sub>LB</sub> =15pF		2		μs

Notes:

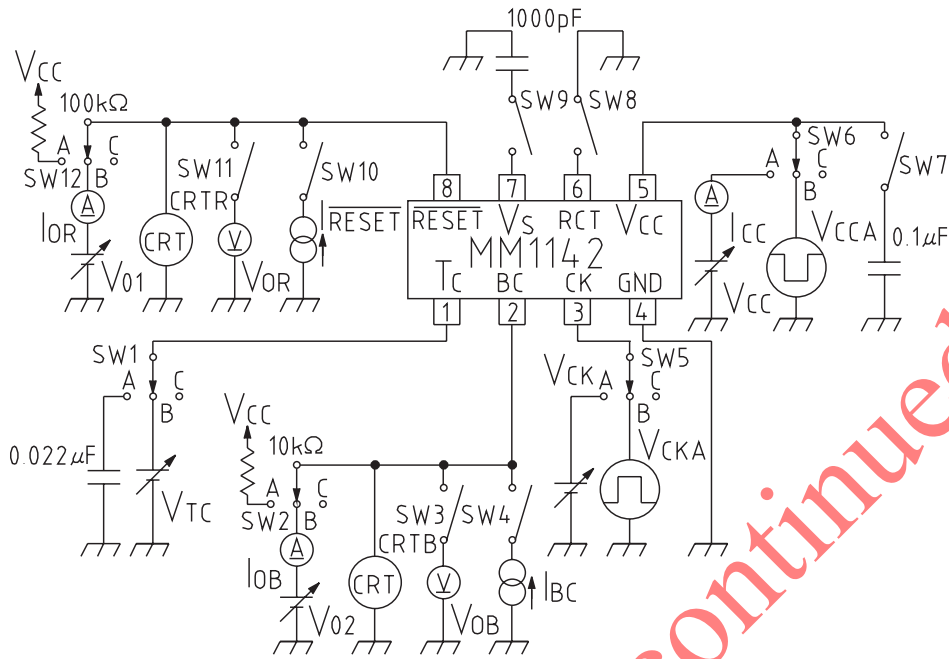
- \*1 Monitoring time is the time from the last pulse (negative edge) of the timer clear clock pulse until reset pulse output.  
In other words, reset output is output if a clock pulse is not input during this time.
- \*2 Reset time means reset pulse width. However, this does not apply to power ON reset.
- \*3 Reset hold time is the time from when V<sub>CC</sub> exceeds detection voltage (V<sub>SHR</sub>) during power ON reset until reset release (RESET output high).
- \*4 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.  
Example : When C<sub>T</sub>=0.22F  

$$T_{PR} \text{ (ms)} \approx 4500 \times C_T \text{ (}\mu\text{F)} \quad T_{PR} \approx 100\text{ms}$$

$$T_{WD} \text{ (ms)} \approx 4500 \times C_T \text{ (}\mu\text{F)} \quad T_{WD} \approx 100\text{ms}$$

$$T_{WR} \text{ (ms)} \approx 90 \times C_T \text{ (}\mu\text{F)} \quad T_{WR} \approx 2\text{ms}$$
- \*5 T<sub>WD</sub> can be varied by placing a resistor (1MΩ or more) between the RCT pin and V<sub>CC</sub>.
- \*6 The voltage range when measuring output rise and fall time is 10~90%.
- \*7 V<sub>CC</sub> rise time should be 100μs or more, and fall time should be 50μs or more.

Measuring Circuit



Timing Chart

