To all our customers

Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

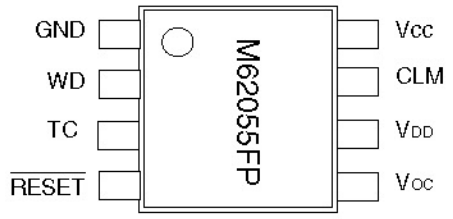
M62055FP

3V POWER SUPPLY with WATCHDOG TIMER

GENERAL DESCRIPTION

M62055FP is a 3V power supply featuring a watchdog timer function for a microcontroller system.
It can be a power source of 3V ± 5% by utilizing the reference voltage and amplifier.
It can also generate a reset pulse for the applied systems during power-on, moreover it includes the watchdog timer for a self diagnostics of the system, which can prevent system erroneous functions.

PIN CONFIGURATION(TOP VIEW)



Outline 8P2S

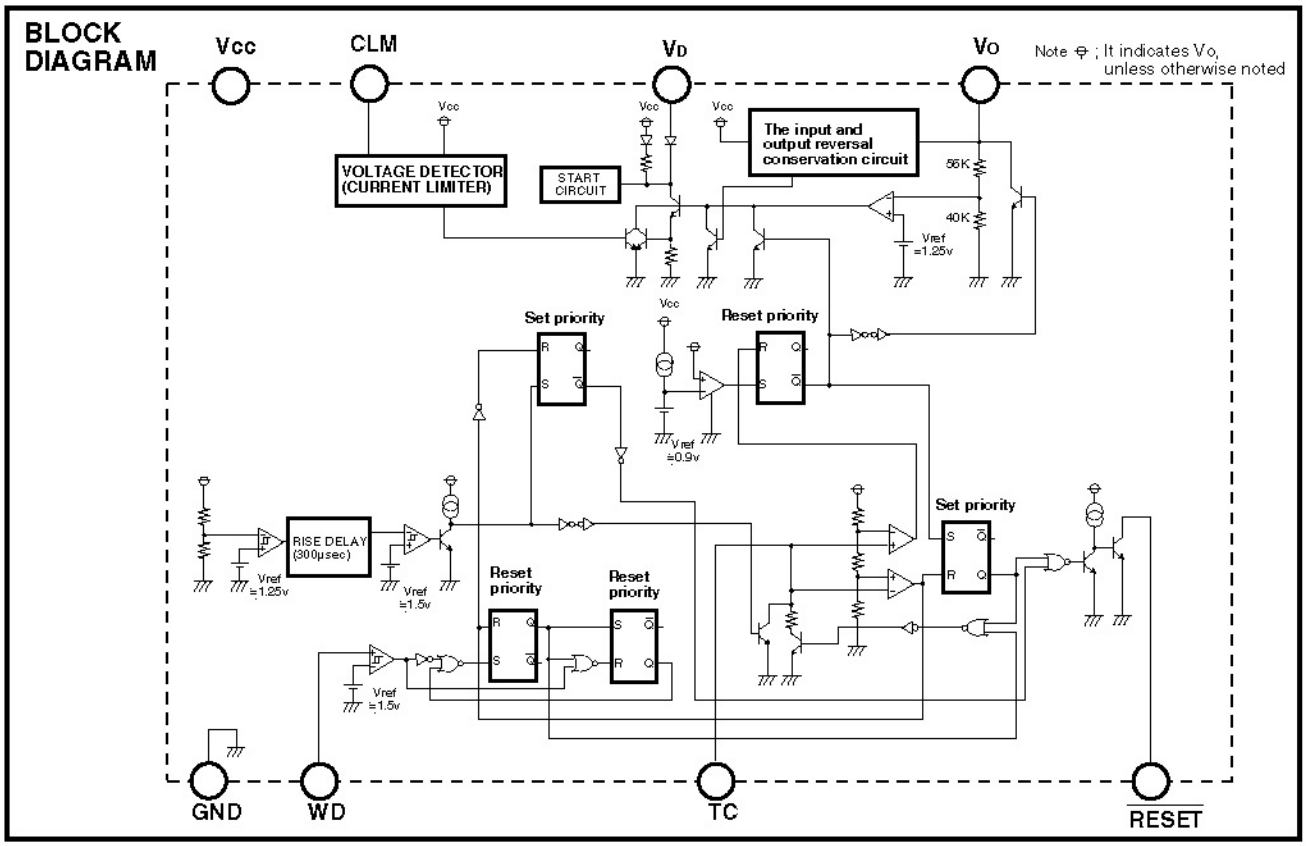
FEATURES

- Power-on reset
- Watchdock timer
- High accuracy voltage source of 3V ±5% (max)
- Overcurrent protection circuit
- The voltage detection accuracy of ±5% (max)
- Output power (Vo) cutoff function at erroneous conditions
- Backward voltage protection circuits for inputs and outputs

APPLICATION

Handy information terminal equipment, CD-ROM, Portable audio equipment.

BLOCK DIAGRAM



Pin Functional description

pin number	symbol	Functional description
1	GND	Ground
2	WD	Input for watchdock timer.
3	TC	Setting up reset timer and watchdock timer.
4	$\overline{\text{RESET}}$	Reset signal output
5	VO	Feedback to a power supply for a MCU.
6	VD	Controlling the stability of an output voltage with a PNP transistor connected externally.
7	CLM	Current limiting
8	Vcc	Power supply voltage

ABSOLUTE MAXIMUM RATINGS (Ta=25°C, Unless otherwise noted)

symbol	Parameter		conditions	Ratings	Unit
Vcc	supply voltage			13	V
VRM	Reset pin	Output voltage		10	V
IRM		Output current		10	mA
V_{WDM}	Watchdock pin input voltage			3	V
Kθ	Thermal derating		Ta ≥ 25°C	4.0	mW/°C
Topr	Operating temperature			- 20 ~ + 75	°C
Tstg	Storage temperature			- 55 ~ + 150	°C

ELECTRICAL CHARACTERISTICS (Vcc=5.0V,Ta=25°C, Unless otherwise noted)

(1) DC CHARACTERISTICS

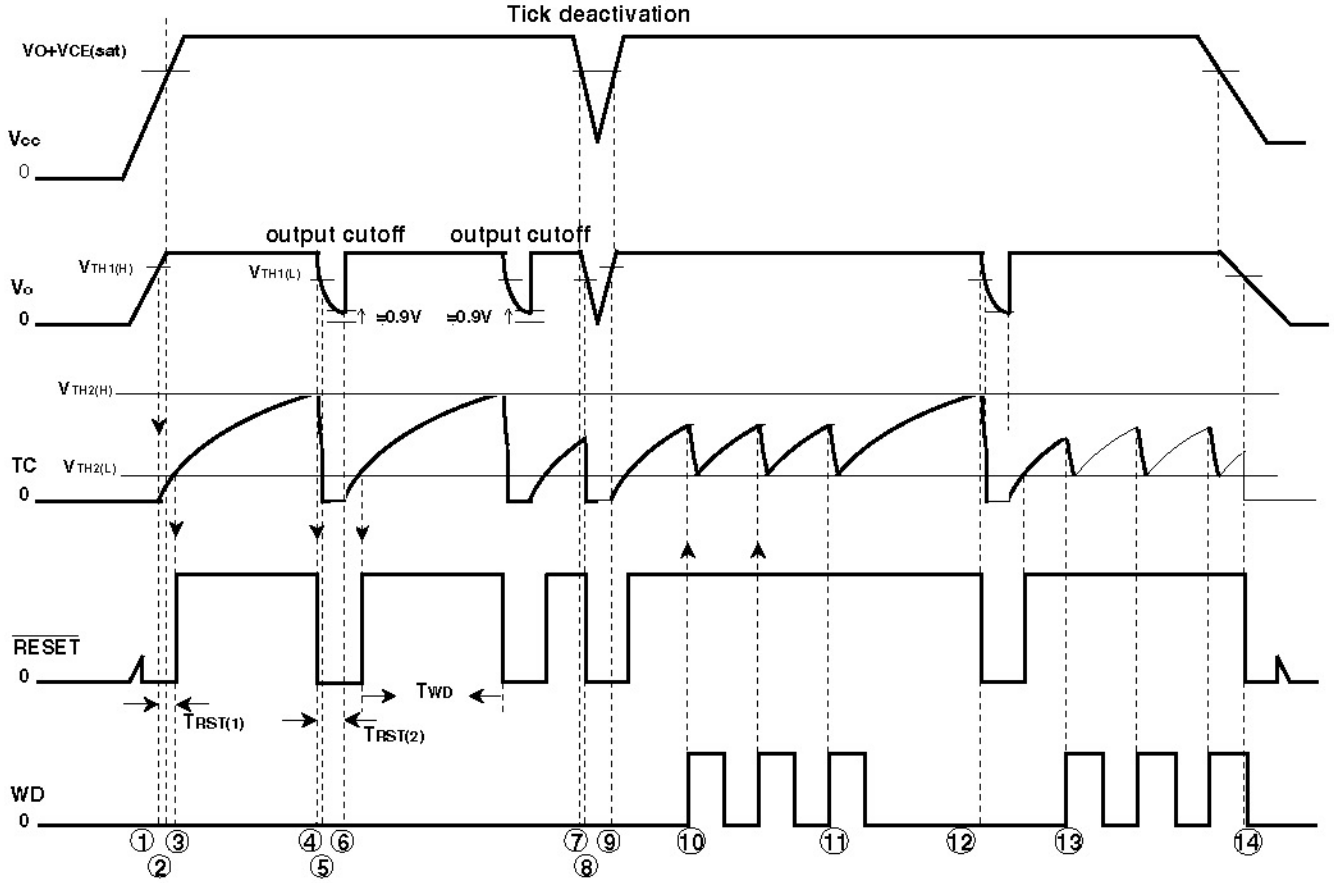
symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ	Max	
	Battery• back up• regulator						
Vcc	supply voltage			3.5		13	V
Icc	Circuitry current				650	950	µA
Vo	Output voltage			2.85	3.0	3.15	V
IBmax	Bias current				10		mA
I BSC	Listing short-circuit bias current				1.5		mA
Reg-in	Input voltage regulation		Vcc=3.5V~13V		0.02	0.25	%/V
Reg-lo	Loading voltage regulation		Io=10mA~100mA		1	25	mV
ΔVo/ΔT	Output voltage thermal coefficient				0.02		%/T
VTHCLM	CLM threshold voltage			180	200	220	mV
	Reset, watch dock timer						
VTH1(H)	Vo detection voltage			2.68	2.82	2.96	V
VTH1(L)				2.58	2.72	2.86	V
ΔVTH1					0.1		V
VOL(RST)	Output voltage	Reset pin	Isink=4mA		0.2	0.4	V
Ileak	Output leakage current					5	µA
VTH2(H)	Watchdock timer threshold voltage			2.28	2.4	2.52	V
VTH2(L)				0.95	1.0	1.05	V
IWD	WD input current		VIN=3V			1	µA
VTH(WD)	WD input threshold voltage				1.5		V
Itco	TC output current		VIN=0.8V			1	µA
Itc1	TC input current		VIN=2.4V		2.0		mA
Itc2			In the output cutoff transmission mode	8.0			mA
VCCMIN	Vcc min operating voltage		*1			2.0	V

Note *1; The Vcc minimum operating voltage at which the $\overline{\text{RESET}}$ output is Low

(2) AC CHARACTERISTICS (Vcc=5.0V,Ta=25°C, Unless otherwise noted)

symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
tWD	Watch dock timer	C=0.1µF,R1=10KΩ	0.5	1.2	1.7	mS
tRST(1)	Reset timer (1)	C=0.1µF,R1=10KΩ		0.7		mS
tRST(2)	Reset timer (2)	CO=10µF, R1=10KΩ, IL=0	0.1		2.0	mS

FUNCTIONAL DESCRIPTION



① : When Vo rises to 0.5 V, $\overline{\text{RESET}}$ becomes low. Then, charging to a capacitor C connected to TC will be started at the Vo of 2.82V($V_{TH1(H)}$).

② : When V_{CC} rises to 3V+V_{CE}(sat), Vo becomes stable.

③④: When TC voltage rises to 1V($V_{TH2(L)}$) , $\overline{\text{RESET}}$ becomes high. When it rises to 2.4V ($V_{TH2(H)}$) further, the capacitor C is switched to discharge and $\overline{\text{RESET}}$ becomes low.

⑤ : At the same time of a change-over to the discharge from the capacitor C, Vo is intercepted.
Then,TC will be discharged completely at Vo of 2.72V($V_{TH1\ (L)}$).

⑥ : Vo returns to 3V right after it has fallen down to 0.9 V.
$\overline{\text{RESET}}$ repeats above operation till a normal clock signal is input to WD pin.

⑦⑧⑨ : In the case of a sudden power interruption, Vo falls down according to a decrease of V_{CC}. When it falls down to 2.72V, the capacitor C is discharged and $\overline{\text{RESET}}$ will be low.
In the case of a reversion from the power interruption, Vo rises according to a increase of V_{CC}. When it rises to 2.82V, the charging to the capacitor C is started and $\overline{\text{RESET}}$ will be high right after TC voltage reaches 1V.

⑩⑪ : In the case a clock signal for discharging the capacitor C is applied to pin WD before TC voltage reaches to 2.4V, a reset signal to $\overline{\text{RESET}}$ is canceled.

⑫⑬ : In the case an abnormal clock signal is input, TC repeats charging / discharging alternately between 1 V and 2.4 V, so that $\overline{\text{RESET}}$ also repeats high / low till a normal clock signal is input.

⑭ : When Vo falls down to 2.72 V, $\overline{\text{RESET}}$ becomes Low.

DESCRIPTION of TERMS

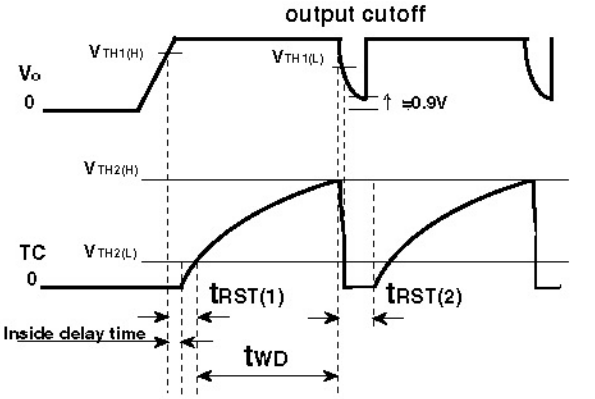
$t_{RST(1)}$ Time from when TC begins to charge until it reaches to $V_{TH2(L)}$.

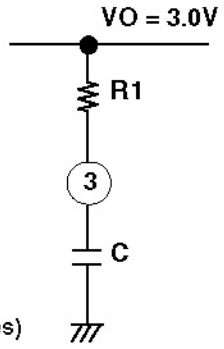
t_{WD} Time from when TC is $V_{TH2(L)}$ until it reaches to $V_{TH2(H)}$.

$t_{RST(2)}$ Time from when TC is $V_{TH2(H)}$ until TC starts charging.

1. Pin③ (TC pin) Charging and discharging time .

When an error is occurred in WD input, TC waveform is as shown below.





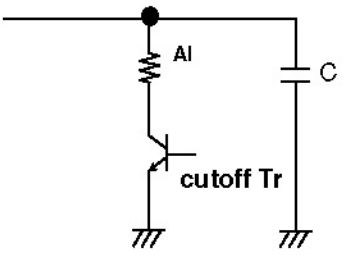
$t_{RST(1)} = 0.406 \cdot C \cdot R_1 + 300\mu s$ *1

$t_{WD} = 1.2 \cdot C \cdot R_1$
(Charging time)

*1 : Inside delay time (Typical values)

The following formula can be obtained because $t_{RST(2)}$ is equal to the duration of Vo cutoff.

$$t_{RST(2)} = C \cdot R^{*3} \cdot \ln\left(\frac{3}{0.9}\right) + 300\mu s^{*2} = 40 \cdot C + 300\mu s^{*2}$$

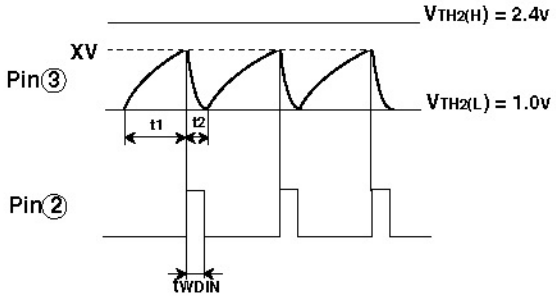


*2 : Inside delay time (Typical values)

*3 : R = Internal resistance

2. Pin② (WD pin) Input frequency, input pulse width, charge/discharge time .

When input of② WD is normal, TC waveform ③ is as shown below.



$$t1 = C \cdot R_1 \cdot \ln\frac{2}{3-X}$$

$$t2 = 1000 \cdot C \cdot R1 \cdot \ln\frac{X\left(\frac{R_1}{1000} + 1\right) - 3}{\frac{R_1}{1000} - 2}$$

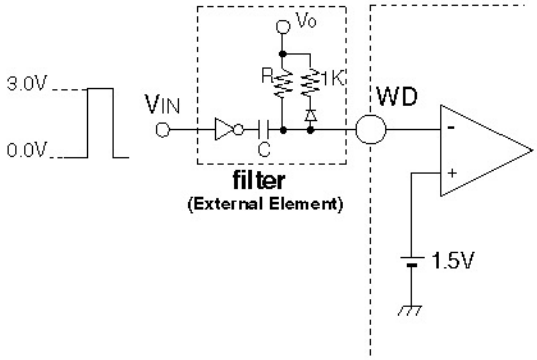
Conditions of an input to pin② (WD pin)

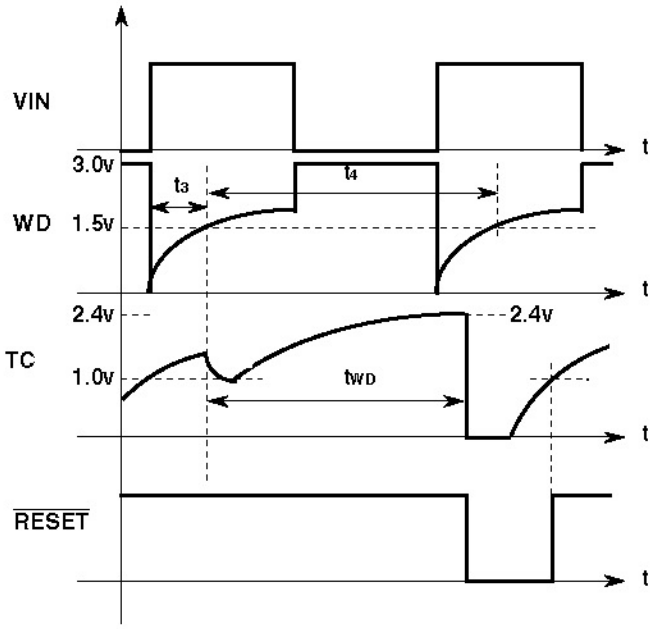
(1) Input period should be t_{WD} or less.
(Pin discharge is completed before the arrival of VTH2(H) = 2.4 V)

$$\frac{1}{1.2 \cdot C \cdot R_1} < f$$

(2) Input pulse width t_{WDIN} should be t_2 or less.

3. Relationship between the input pulse width and the low pass filter





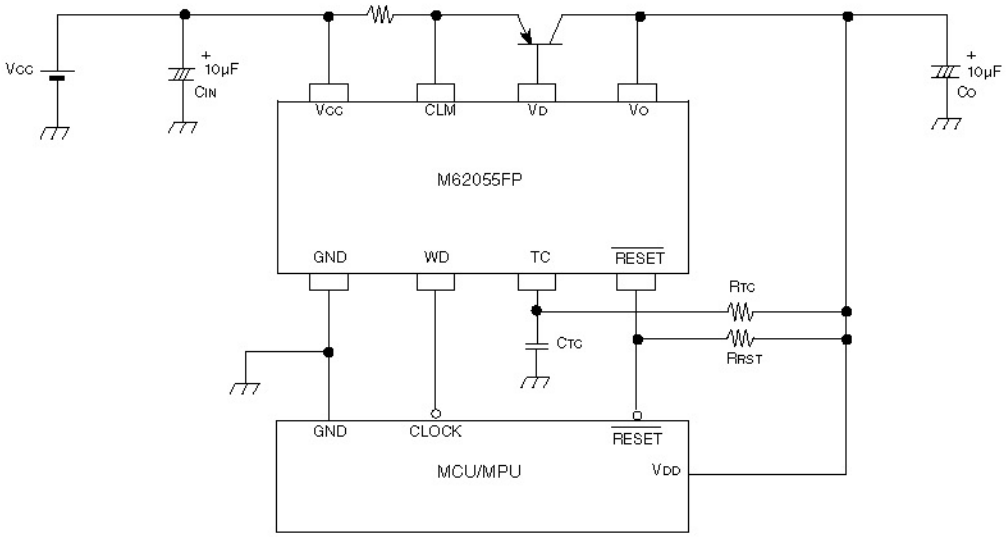
Addition of a low pass filter makes input waveform dull. An input pulse width and CR of a low pass filter is determined referring to the right figure.

$$t_3 = -C \cdot R \cdot \ln \frac{1.5v}{VIN}$$

$\overline{\text{RESET}}$ is output in the case of $t_4 > t_{WD}$.

If t3 is too long, the TC waveform changes as shown in the diagram above.
t3 is set as follows; t_{WDIN} (3 µs) or more and t_2 (charging time) or less.
(t2 is a discharge time while an input is normal)

APPLICATION



Note : h_{FE} of the external PNP transistor, 100 to 300 is recommended.