

# Temperature Switch with Latch Function Monolithic IC MM3188 Series

## Outline

This IC is a temperature switch IC that senses the IC ambient temperature and switches the IC output from the Low to the High level when there is a detected temperature. In addition, the latch function maintains the output at the High level even when the ambient temperature after detection falls below the detected temperature. The detection temperature can be selected in the range of  $80^{\circ}\text{C} \leq T_{\text{DET}} \leq 100^{\circ}\text{C}$  at  $1.0^{\circ}\text{C}$  steps using rank expansion, and the detection temperature accuracy error is a maximum of  $\pm 2.5^{\circ}\text{C}$ .

Envisioned applications for this IC includes as a shutdown function to prevent damage from device abnormal heating. It is also suitable for applications in mobile devices, compact packages, and when low power consumption is required.

## Features

- |   |  |
|---|--|
| 1. Temperature detection can be selected using rank expansion | $(80^{\circ}\text{C} \leq T_{\text{DET}} \leq 100^{\circ}\text{C}$ at $1.0^{\circ}\text{C}$ steps) |
| 2. Low power consumption                                      | $(V_{\text{CC}}=3\text{V}, I_{\text{DD}}=12\mu\text{A})$   |
| 3. With a latch function                                      |  |
| 4. With malfunction prevention delay circuit                  |  |
| 5. Broad operation power voltage range                        | $(+2.2\text{V} \sim +10.0\text{V})$  |

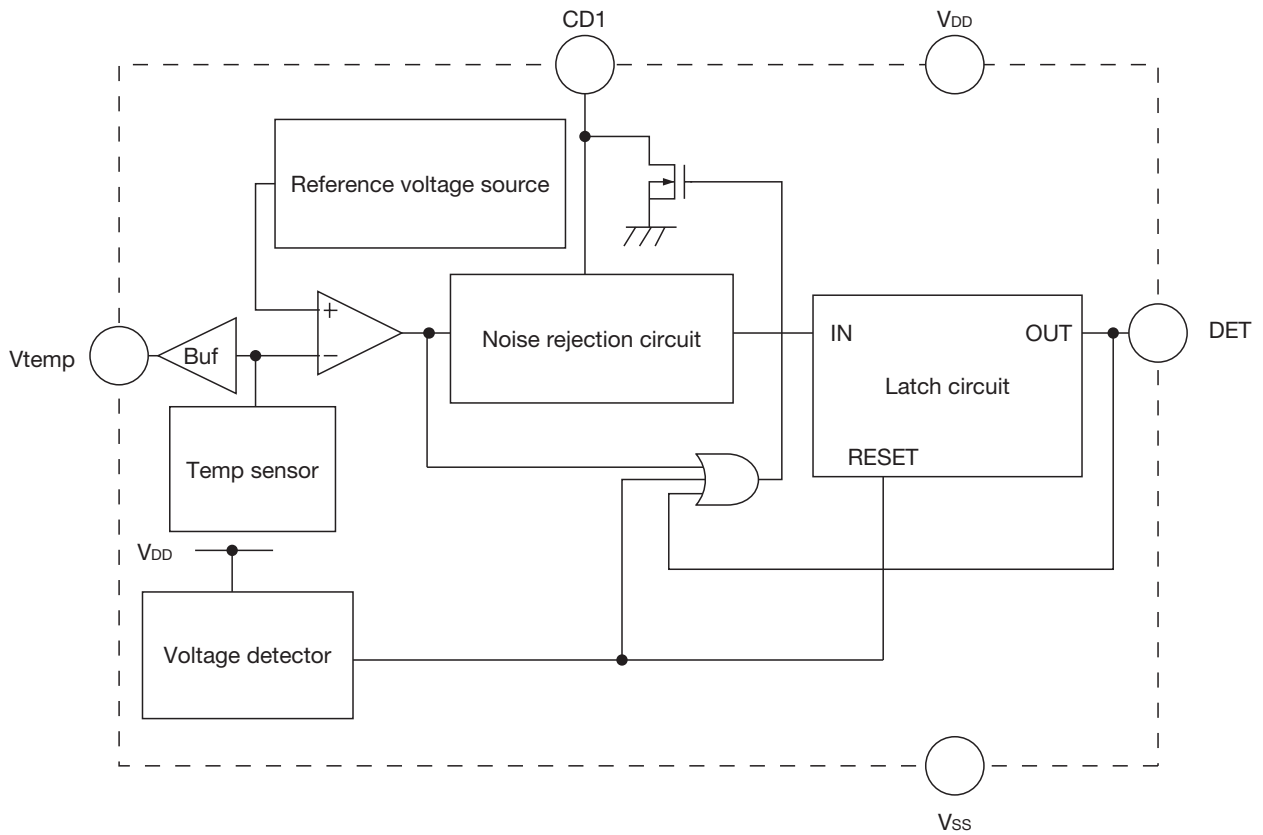
## Package

SOT-25A

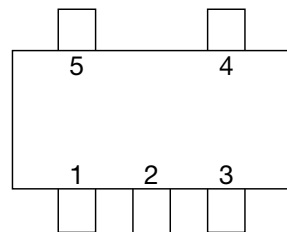
## Applications

1. Cell phones / PHS
2. LCD TV
3. Computer game machines
4. PC
5. System temperature monitoring
6. OA equipment

Block Diagram



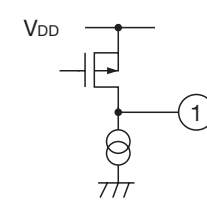
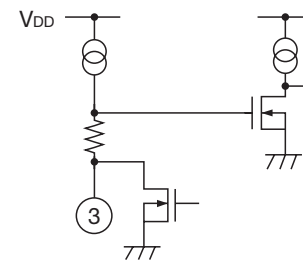
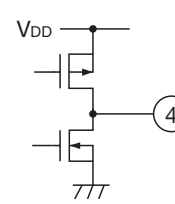
Pin Assignment



SOT-25A  
(TOP VIEW)

1	Vtemp
2	V <sub>SS</sub>
3	CD1
4	DET
5	V <sub>DD</sub>

**Pin Description**

Pin No.	Pin name	Functions	Equivalent circuit diagram
1	Vtemp	Temp. sensor voltage output pin	
2	Vss	GND	
3	CD1	Capacitor connect pin with temp detect delay	
4	DET	Temp. detect output pin	
5	VDD	Power supply pin	

## Absolute Maximum Ratings

Item	Symbol	Ratings	Units
Storage temperature	T <sub>STG</sub>	-55~+125	°C
Operating temperature	T <sub>OPR</sub>	-40~+100	°C
Supply voltage (V <sub>SS</sub> =0.0V)	V <sub>DD</sub> max.	10	V
Terminal voltage	V <sub>temp</sub> max., CD1 max., DET max.	V <sub>SS</sub> -0.3~V <sub>DD</sub> +0.3	V
Allowable loss *2	P <sub>d</sub>	350 *1	mW

Note : \*1 With PC Board of glass epoxy. (25×25×1.6mm, Copper foil area 60%)

Note : \*2 The Absolute Maximum power dissipation depends on the PC board and temperature.

## Recommended Operating Conditions

Item	Symbol	Ratings	Units
Operating temperature	T <sub>OPR</sub>	-40~+100	°C
Supply voltage (V <sub>SS</sub> =0.0V)	V <sub>DD</sub>	+2.2~+10	V
Terminal voltage	V <sub>temp</sub> , CD1, DET	V <sub>SS</sub> -0.3~V <sub>DD</sub> +0.3	V

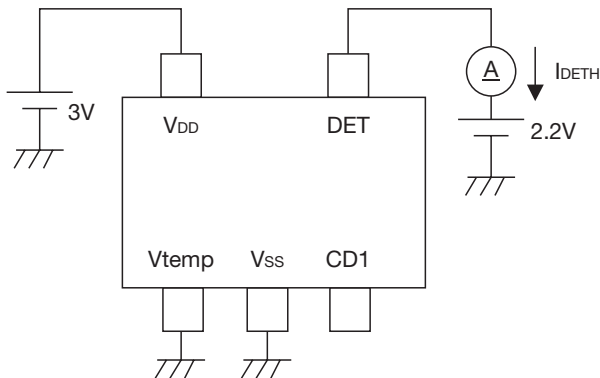
## Electrical Characteristics (Except where noted otherwise Ta=25°C, V<sub>DD</sub>=3V)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Detecting temperature	T <sub>DET</sub>		typ.-2.5	80-100	typ.+2.5	°C
DET source current	I <sub>DETH</sub>	V <sub>DET</sub> =2.2V	2	4		mA
DET sink current	I <sub>DETL</sub>	V <sub>DET</sub> =0.4V	0.5	1		mA
Reset detecting voltage *1	V <sub>RET</sub>	V <sub>DD</sub> =L→H	1.2	1.6	2	V
Reset hysteresis voltage *1	V <sub>HYS</sub>			0.08		V
Reset temperature coefficient *1	$\frac{\Delta V_{RET}}{\Delta T \cdot V_{RET}}$	Ta=-40~100°C		±100		ppm/°C
Supply current	I <sub>DD</sub>			12	24	μA
Noise rejection time	t <sub>noise</sub>	CD1=4700pF	10	30	50	ms
Temperature sensor voltage	V <sub>TEMP</sub>			1.8		V
Temperature sensor voltage temp. coefficient *1	$\Delta V_{TEMP}/\Delta T$			-10		mV/°C

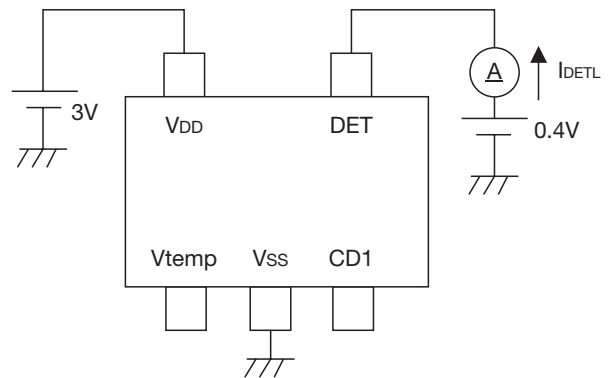
Note : \*1 The parameter is guaranteed by design.

**Measuring Circuit**

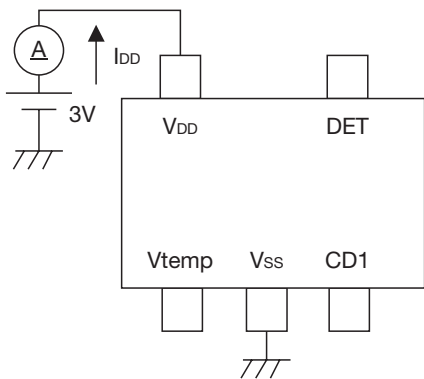
**1. DET terminal source current  
DET power High level state**



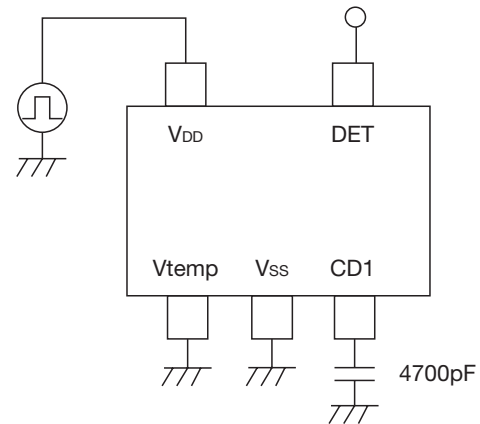
**2. DET terminal sink current  
DET power Low level state**



**3. Power consumption**

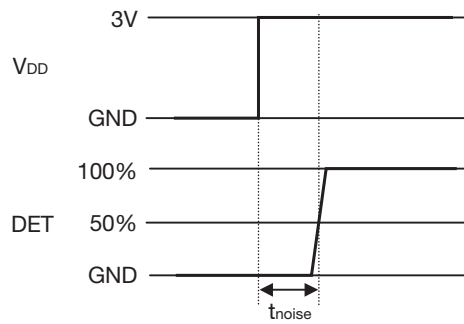
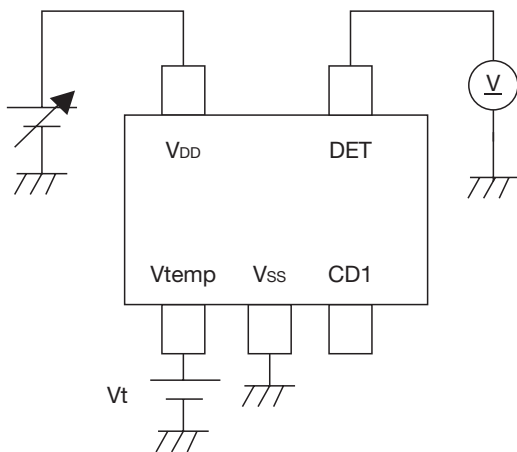


**4. Noise elimination time**

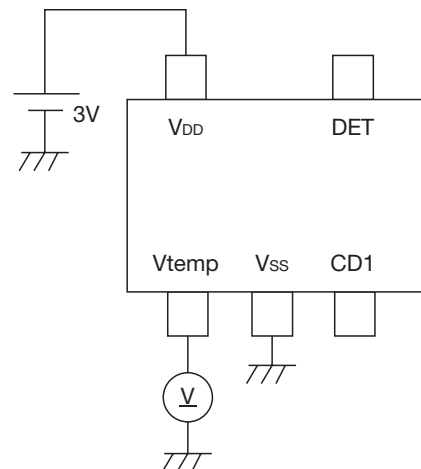


**5. Detection temperature**

Voltage detection circuit reset cancel voltage  
Voltage detection circuit hysteresis width



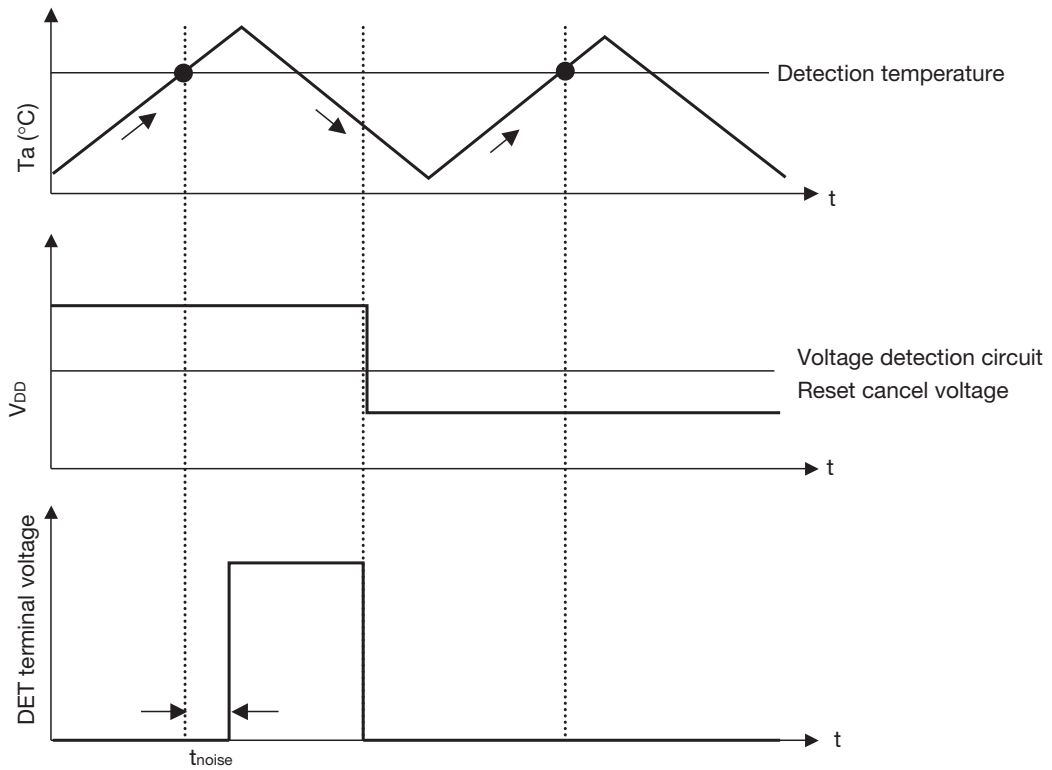
**6. Temperature sensor voltage**



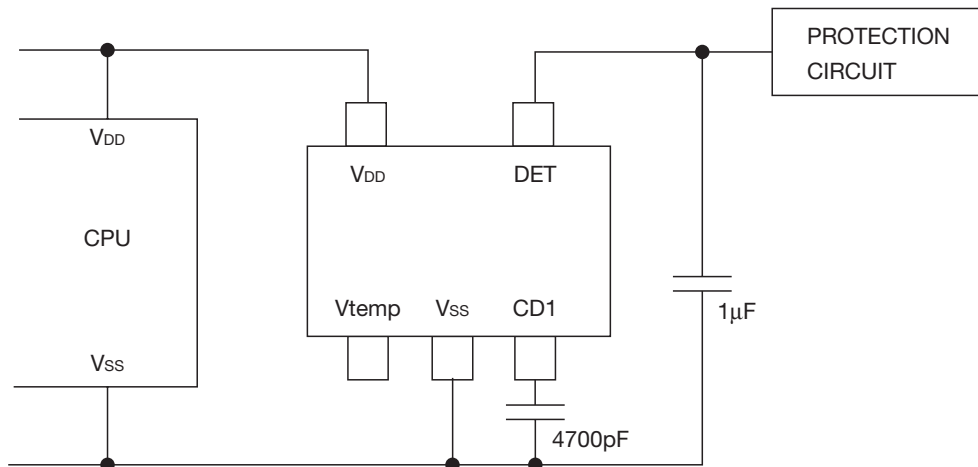
- Detection temperature  
Vtemp pin open, V<sub>DD</sub> = 3.0V, temperature sweep
- Reset cancel voltage, hysteresis width  
V<sub>t</sub> = 0V, V<sub>DD</sub> sweep (V<sub>DD</sub> = 1.2V → 2.0V)  
↓  
Vtemp pin open, V<sub>DD</sub> sweep (V<sub>DD</sub> = 2.0V → 1.0V)

Timing Chart

Temp. detect timing chart



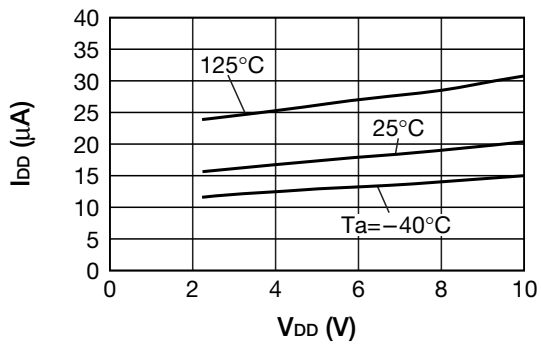
Application Circuit



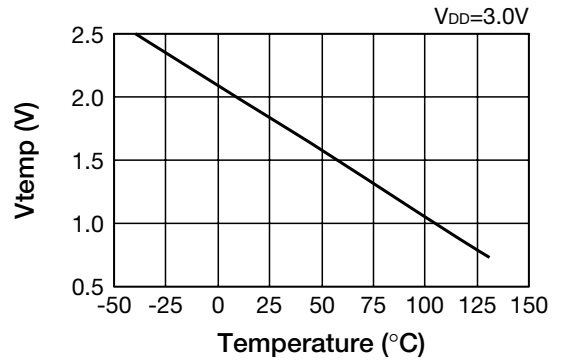
- We shall not be liable for any trouble or damage caused by using this circuit.
- In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, Mitsumi Electric Co., Ltd. shall not be liable for any such problem, nor grant a license therefore.
- Please put up the capacitor of about 1µF to the terminal DET for the prevention of the malfunction by the noise when the power supply is turned on.

Characteristics

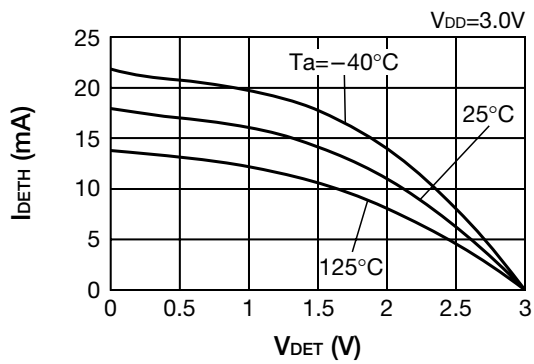
■ I<sub>DD</sub>-V<sub>DD</sub> characteristics



■ Temp. sensor voltage - Temperature characteristics



■ I<sub>DETH</sub> characteristics



■ I<sub>DETL</sub> characteristics

