

# For lithium ion battery protection (for double protection) Monolithic IC MM1373

## Outline

This IC detects overcharging of lithium ion batteries. It is designed for use with three or four battery cells, and detects battery voltages for each cell. An overcharge detection delay time can be set using an external capacitor. The overcharge detection signal output is NPN open-collector, and goes low when overcharging is detected. MM1451 is available for 1 ~ 3 cells. Overcharge detection signal output is PNP output, and output goes high during detection.

## Features

- |   |                 |                     |
|---|-----------------|---------------------|
| 1. Consumption current  | $V_{CEL}=3.8V$  | 3.0 $\mu$ A typ.    |
| 2. Consumption current  | $V_{CEL}=2.3V$  | 0.3 $\mu$ A typ.    |
| 3. Input current between cell pins                                | $V_{CEL}=3.8V$  | $\pm 0.3\mu$ A max. |
| 4. Overcharge detection voltage                                   | A type          | 4.35V $\pm$ 50mV    |
| 5. Overcharge detection delay time                                | $C_T=0.22\mu$ F | 1.5S typ.           |
| 6. Detection voltage can be changed to accommodate customer needs |                 |                     |

## Package

SOP-8C  
SOP-8E

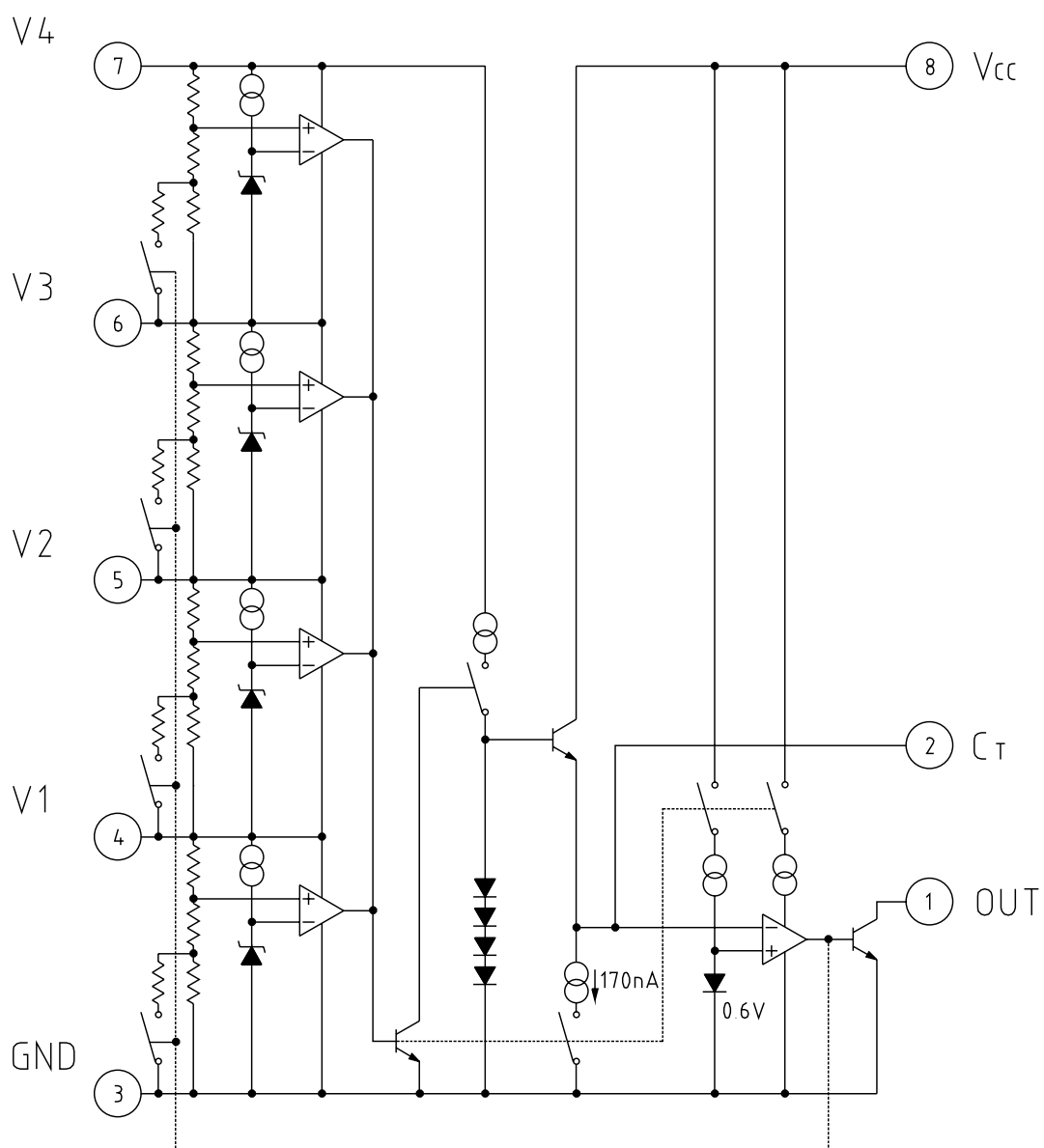
## Applications

- For 3 ~ 4 cell lithium ion batteries, for double protection.

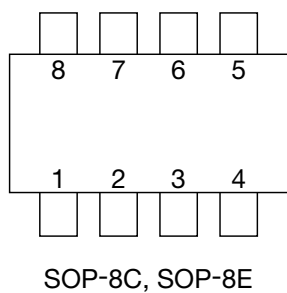
## Overcharge Detection ICs

MM1373	Detection voltage	Hysteresis
Rank A	4.350V	250mV
Rank C	4.225V	None
Rank D	4.130V	None
Rank E	4.450V	100mV

## Block Diagram

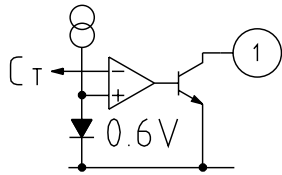
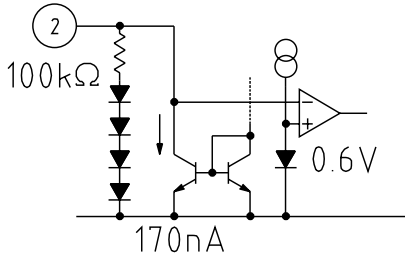
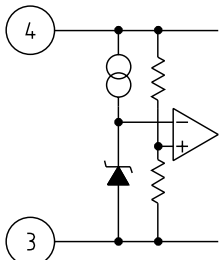
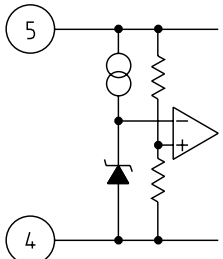
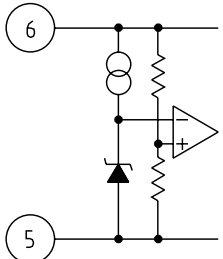
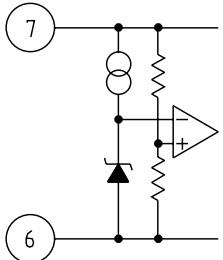


## Pin Assignment



1	OUT
2	C <sub>T</sub>
3	GND
4	V1
5	V2
6	V3
7	V4
8	V <sub>CC</sub>

## Pin Description

Pin no.	Pin name	Function	Internal equivalent circuit diagram
1	OUT	Reset output pin	
2	C <sub>T</sub>	Delay capacitance pin	
3	GND	Ground pin	
4	V1	Cell 1 power supply	
5	V2	Cell 2 power supply	
6	V3	Cell 3 power supply	
7	V4	Cell 4 power supply	
8	V <sub>CC</sub>		

## Absolute Maximun Ratings

Item	Symbol	Ratings	Units
V <sub>CC</sub> input voltage	V <sub>CC</sub>	-0.3~24	V
V4 input voltage *1	V4		
V3 input voltage *1	V3		
V2 input voltage *1	V2		
V1 input voltage *1	V1		
C <sub>T</sub> pin voltage *2	V <sub>CT</sub>	-0.3~24	V
V <sub>OUT</sub> pin voltage	V <sub>OUT</sub>	-0.3~24	V
Allowable loss	Pd	300	mW
Operating temperature	T <sub>OPR</sub>	-20~+80	°C
Storage temperature	T <sub>STG</sub>	-40~+125	°C

\*1 V<sub>CC</sub> ≥ V4 ≥ V3 ≥ V2 ≥ V1 ≥ -0.3

\*2: A current no greater than 100μA should be passed through pin Ct.

## Recommended Operating Conditions

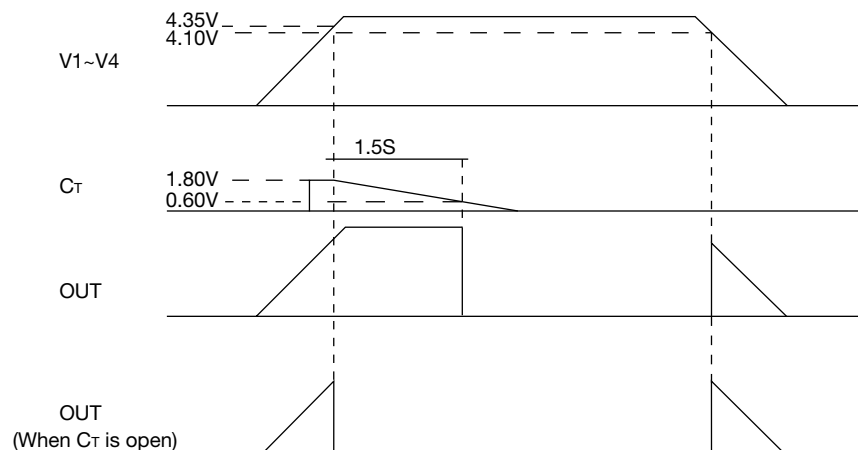
Item	Symbol	Ratings	Units
Input voltage between cells 1	V <sub>op1</sub>	2.0~4.35	V
V <sub>CC</sub> input voltage	V <sub>op2</sub>	4.0~18	V

## Electrical Characteristics

(Except where noted otherwise, Ta=25°C, V<sub>CEL</sub>=V4-V3=V3-V2=V2-V1=V1-GND, V<sub>CC</sub>=4 × V<sub>CEL</sub>) Models listed MM1373AF

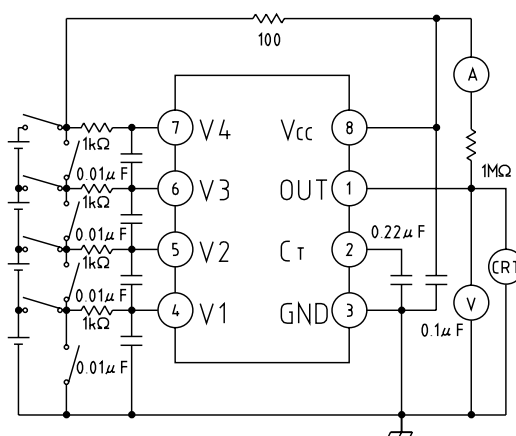
Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Consumption current 1	I1	V <sub>CEL</sub> =3.8V		3.0	6.0	μA
Consumption current 2	I2	V <sub>CEL</sub> =2.3V		0.3	0.5	μA
Pin I/O current between cells	I3	V <sub>CEL</sub> =3.8V (V4, V3, V2, V1 side)		±0.0	±0.3	μA
Overcharge detection voltage	V <sub>s</sub>	V <sub>CEL</sub> =L→H, Ta=-20~+70°C	4.30	4.35	4.40	V
Hysteresis voltage	HSY	V <sub>CEL</sub> =L→H→L	0.20	0.25	0.30	V
Overcharge detection delay time	T <sub>PLH</sub>	C <sub>T</sub> =0.22μF	1.0	1.5	2.0	S
Output voltage L	V <sub>OL</sub>	I <sub>L</sub> =100μA			0.4	V
Output leakage current	I <sub>LEAK</sub>	V <sub>CEL</sub> =3.8V, V <sub>OUT</sub> =24V			0.1	μA

## Timing Chart



Note : When pin Ct is shorted or left open, the output goes low when overcharging is detected.

## Application Circuits



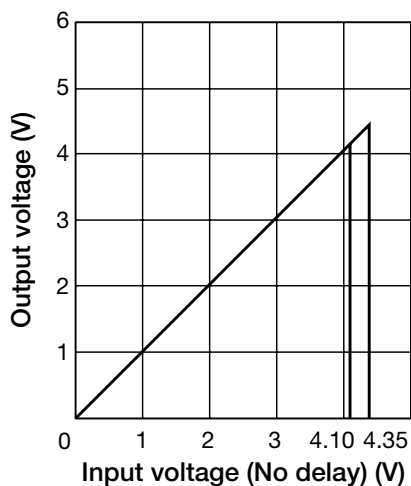
Note 1: By shorting each cell, two-, three- and four-cell series can be accommodated. A V4 cell should always be connected. If the V4 cell is shorted, the chip may not function correctly.

Note 2: The input resistance for each cell should be 1kΩ or lower. Also, please select the appropriate value for the external capacitor according to the usage environment.

Note 3: Connect in the following order when connecting the battery: GND → V4 and VCC → V2 → V1 or V3.

## Characteristics

### Detection voltage



### Output delay time

