Protection of Lithium-Ion Batteries (for Double-Protect)
Monolithic IC MM1451

Outline

This IC is used for double-protection of lithium-ion batteries with from one to three cells, and has an ultra-compact package. Short-circuits between cells accommodate series connections of one to three cells.

Features

1. Overcharge detection voltage accuracy (0°C to 50°C)	±50 mV/cell.
2. Consumption current (Vcell=3.8V)	3μA typ.
3. Consumption current (Vcell=2.3V)	0.3μA typ.
4. Pin I/O current between cells (Vcell=3.8V)	0.3μA max.
5. Delay time on overcharge voltage detection (Ct=0.22μF)	1.5S typ.
6. Output current (Vcell=V_{CC}=4.5 V)	500μA typ.

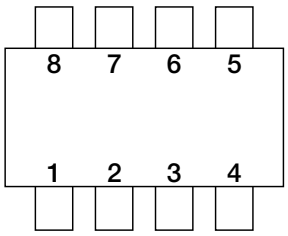
Package

VSOP-8B

Applications

IC for double-protection of lithium-ion batteries with one to three cells.

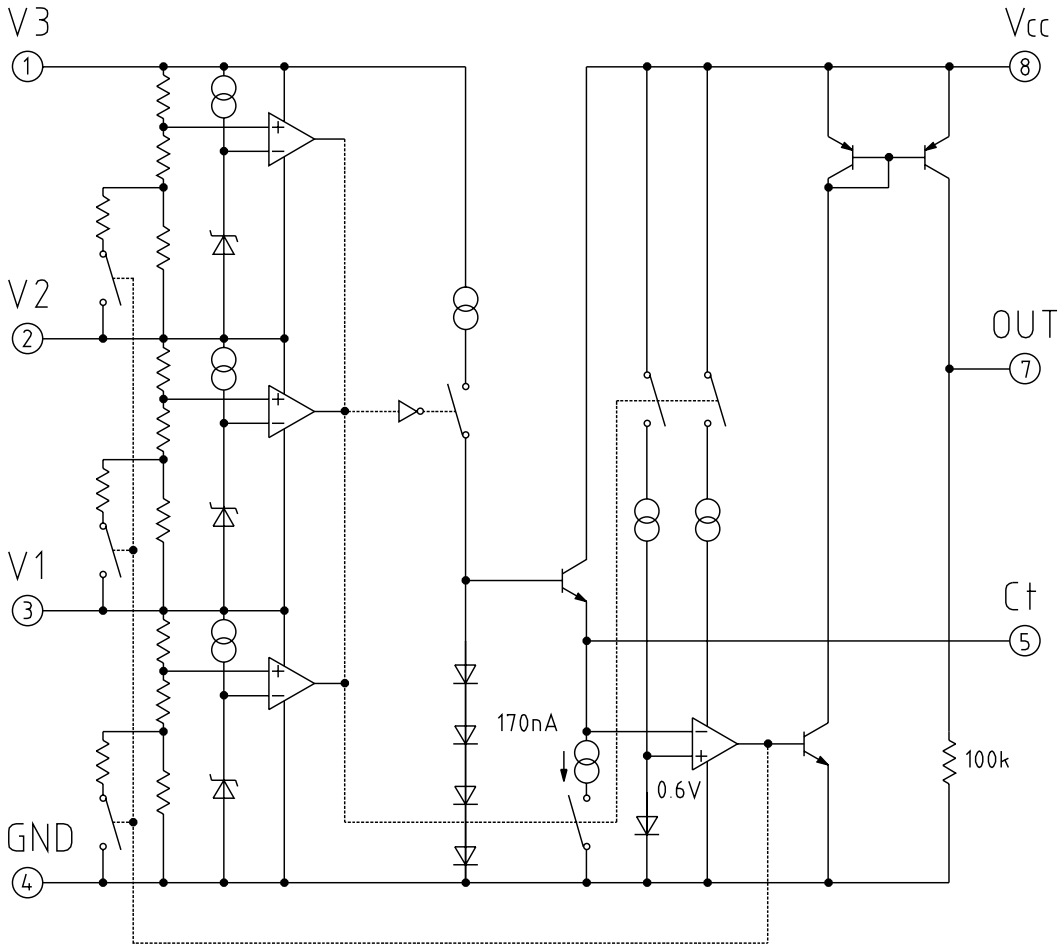
Pin Assignment



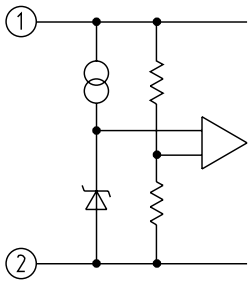
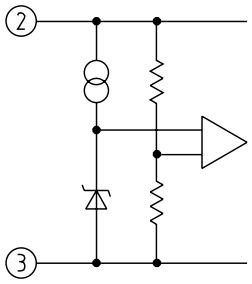
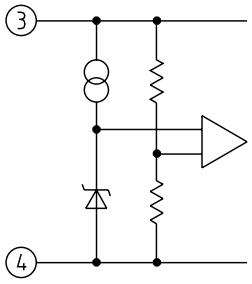
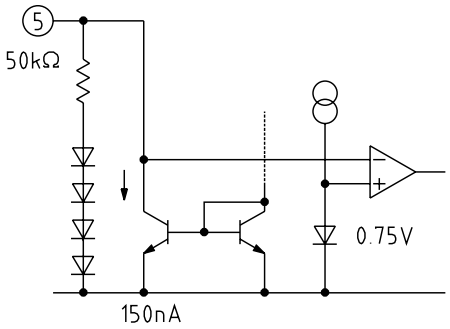
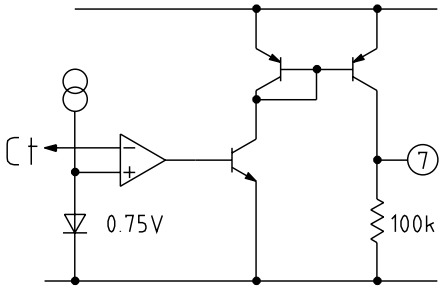
VSOP-8B

1	V3
2	V2
3	V1
4	GND
5	Ct
6	N.C
7	OUT
8	V_{CC}

Block Diagram



Pin Description

Pin No.	Pin name	Functions	Equivalent circuit diagram
1	V3	3-cell power supply	
2	V2	2-cell power supply	
3	V1	1-cell power supply	
5	Ct	Delay capacity pin	
7	OUT	OUT pin	

Absolute Maximun Ratings (Ta=25°C)

Item	Symbol	Ratings	Unit
Operating temparature	T_{OPR}	−20~+80	°C
Storage temparature	T_{STG}	−40~+125	°C
V_{CC} Input voltage	V_{CC}	−0.3~18	V
V1 Input voltage *1	V1		
V2 Input voltage *1	V2		
V3 Input voltage *1	V3		
Ct pin voltage *2	V_{CT}	−0.3~18	V
V_{OUT} pin voltage	V_{OUT}	−0.3~18	V
Allowable loss	Pd	170	mW

Note 1 : *1 18V ≧ V3 ≧ V2 ≧ V1 ≧ −0.3

Note 2 : *2 Do not impress current of 300μA or more on the Ct pin.

Electrical Characteristics 1 (Except where noted otherwise, Ta=25°C, V_{CEL}=V3−V2=V2−V1=V1−GND, V_{CC}=3×V_{CEL})

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Current consumption 1	I_1	V_{CEL}=3.8V		3.0	6.0	μA
Current consumption 2	I_2	V_{CEL}=2.3V		0.3	0.5	μA
Pin I/O current between cells	I_3	V_{CEL}=3.8V (between V3, V2, V1)		±0.0	±0.3	μA
Overcharge detection voltage	V_S	V_{CEL}=L→H Ta=−20~+70°C	4.400	4.450	4.500	V
Hysterisis voltage	Hys	V_{CEL}=L→H→L	35	50	65	mV
Overcharge detection delay time	T_{PLH}	Ct=0.22μF	1.0	1.5	2.0	S
Output current	I_{OH}	V_{CEL}=V_{CC}=4.5V V_O=3V	100	500		μA

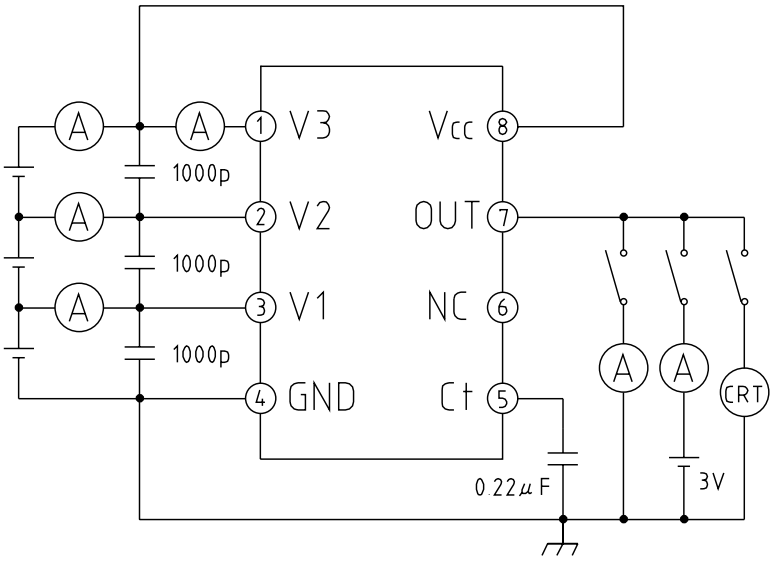
Electrical Characteristics 2 (Except where noted otherwise, Ta=25°C, V_{CEL}=V3-V2=V2-V1=V1-GND, V_{CC}=3×V_{CEL})

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Current consumption 1	I_1	V_{CEL}=3.8V, V_{CC}=V_{CEL}×3		3.0	6.0	μA
Current consumption 2	I_2	V_{CEL}=2.3V, V_{CC}=V_{CEL}×3		0.3	0.5	μA
Pin I/O current between cells	I_3	V_{CEL}=3.8V (between V3, V2, V1)		±0.0	±0.3	μA
Overcharge detection voltage	V_S	V_{CEL}=L→H Ta=−20~+70°C	4.400	4.450	4.500	V
Hysterisis voltage	Hys	V_{CEL}=L→H→L	35	50	65	mV
Overcharge detection delay time	T_{PLH}	Ct=0.22μF	1.0	1.5	2.0	S
Output current	I_{OH}	V_{CEL}=V_{CC}=4.6V V_O=3V	100	500		μA
Output leakage current	I_{LEAK}	V_{CEL}=3.8V, V_{CC}=18V			0.1	μA

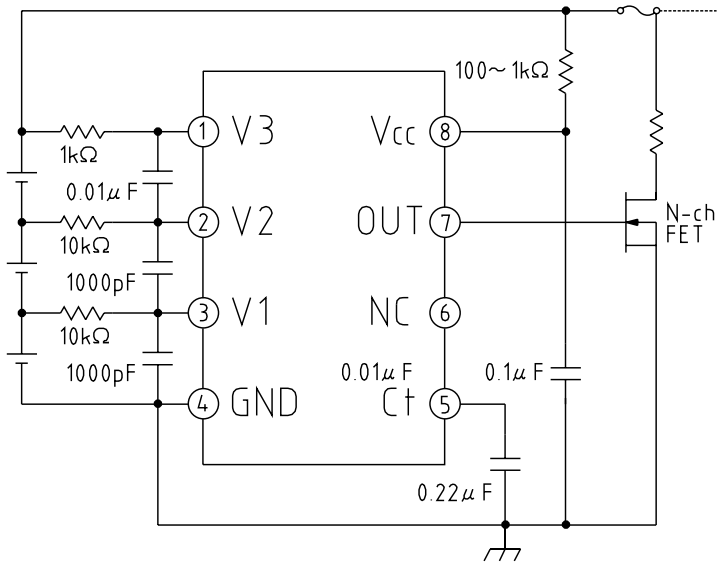
Electrical Characteristics 3 (Except where noted otherwise, Ta=25°C, V_{CEL}=V3-V2=V2-V1=V1-GND, V_{CC}=3×V_{CEL})

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Current consumption 1	I_1	V_{CEL}=3.8V, V_{CC}=V_{CEL}×3		2.5	3.5	µA
Current consumption 2	I_2	V_{CEL}=3.8V, V_{CC}=V_{CEL}×3		1.5	2.5	µA
Current consumption 3	I_3	V_{CEL}=2.3V, V_{CC}=V_{CEL}×3		0.15	0.3	µA
Current consumption 4	I_4	V_{CEL}=2.3V, V_{CC}=V_{CEL}×3		0.1	0.2	µA
Pin I/O current between cells	I_3	V_{CEL}=3.8V (between V3, V2, V1)		±0.0	±0.3	µA
Overcharge detection voltage	V_S	V_{CEL}=L→H Ta=–20~+70°C	4.400	4.450	4.500	V
Hysterisis voltage	Hys	V_{CEL}=L→H→L	35	50	65	mV
Overcharge detection delay time	T_{PLH}	Ct=0.22µF	1.0	1.5	2.0	S
Output current	I_{OH}	V_{CEL}=V_{CC}=4.6V V_O=3V	100	500		µA
Output leakage current	I_{LEAK}	V_{CEL}=3.8V, V_{CC}=18V			0.1	µA

Measuring Circuit



Application Circuit



Delay time Td(S) = 7× CCt (μF)

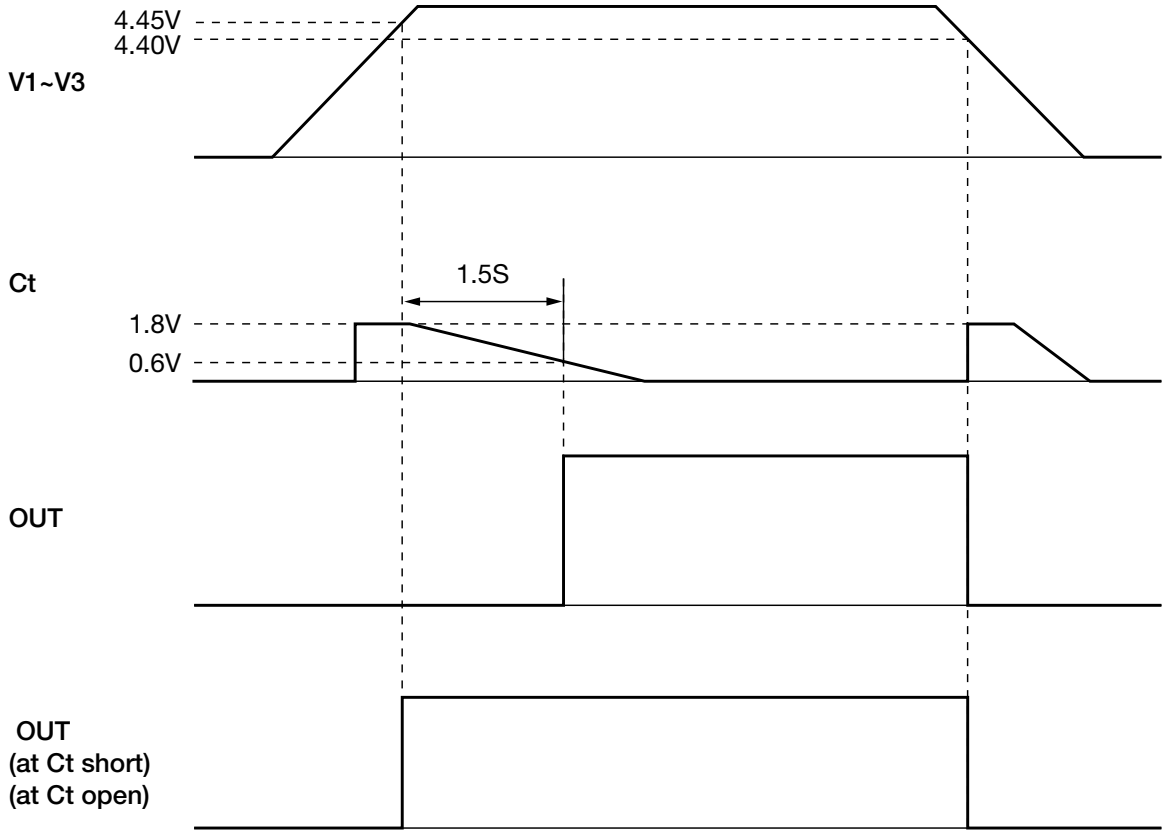
Note 1: Can support 1, 2 or 3 cells by shorting each cell. However, be sure to connect a battery for V3 cell. V3 cell may not operate correctly when shorted.

Note 2: When connecting batteries, be sure to connect in the following order: GND → V3, and Vcc → V1OR V2.

Note 3: Output may go ON momentarily when starting up power supply. If this error output during startup becomes a problem, connect the Vcc pin last.

Note 4: Operation can not be guaranteed for connections other than the above.

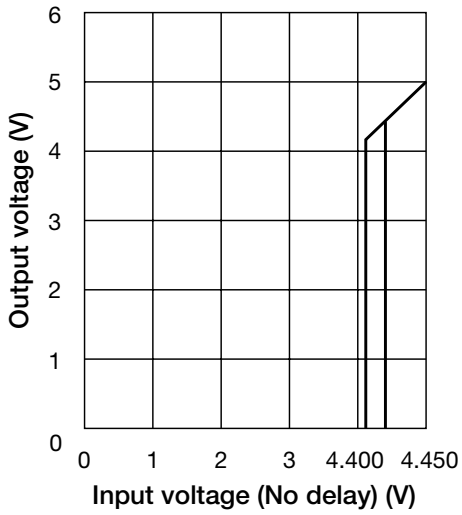
Timing Chart



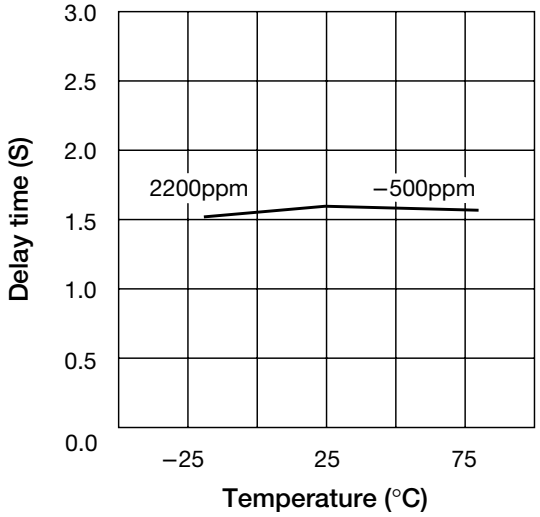
Note: Output goes low simultaneously with overcharge detection at Ct pin short and open.

Characteristics

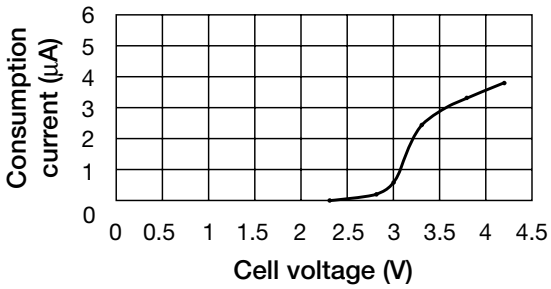
Detection voltage



Output delay time



Consumption current



Pin I/O current between cells

