

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 (V _{cell} =3.8V) | 3µA typ. |
| 3. Consumption current (V _{cell} =2.3V) | 0.3µA typ. |
| 4. Pin I/O current between cells (V _{cell} =3.8V) | 0.3µA max. |
| 5. Delay time on overcharge voltage detection (C _t =0.22µF) | 1.5S typ. |
| 6. Output current (V _{cell} =V _{CC} =4.5 V) | 500µA typ. |

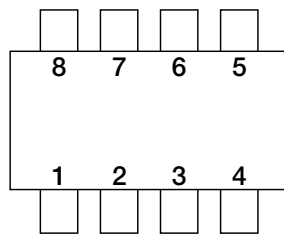
Package

VSOP-8B

Applications

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

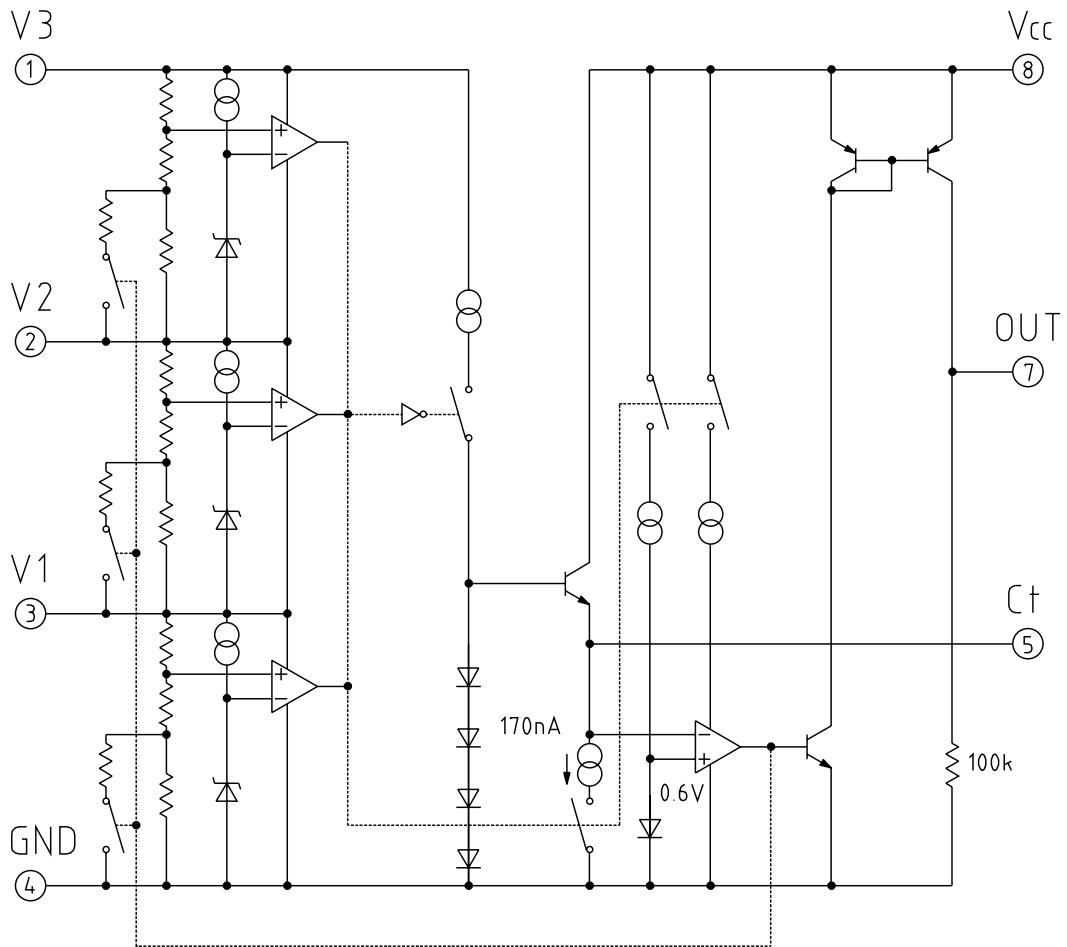
Pin Assignment



VSOP-8B

1	V3
2	V2
3	V1
4	GND
5	C _t
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 Maximum Ratings (Ta=25°C)

Item	Symbol	Ratings	Unit
Operating temperature	T _{OPR}	-20~+80	°C
Storage temperature	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	P _d	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

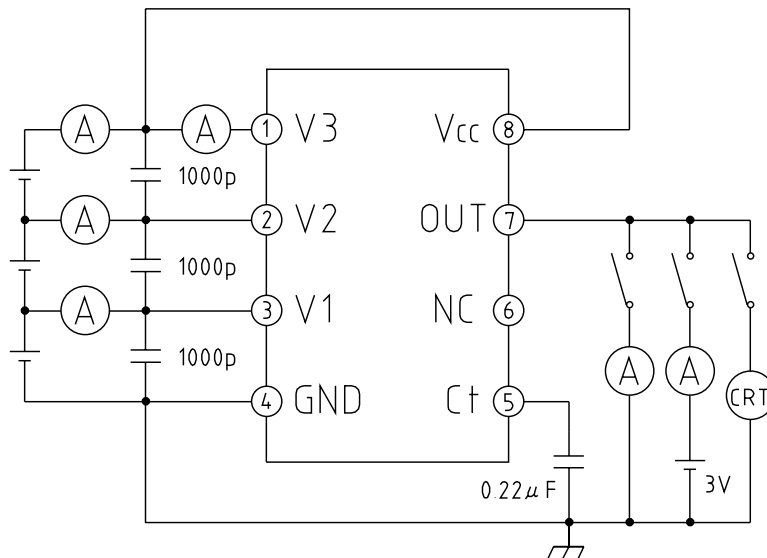
Electrical Characteristics 2 (Except where noted otherwise, Ta=25°C, V_{CEL}=V3-V2=V2-V1=V1-GND, V_{CC}=3×V_{CEL})

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

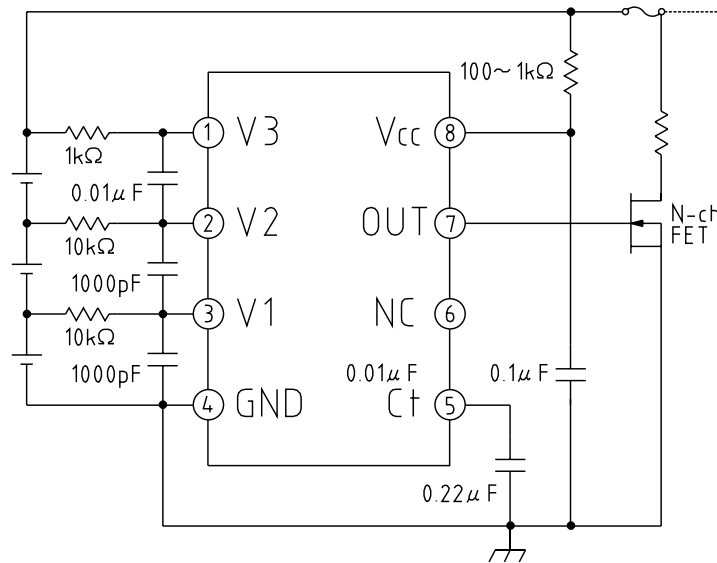
Electrical Characteristics 3 (Except where noted otherwise, $T_a=25^\circ\text{C}$, $V_{\text{CEL}}=V_3-V_2=V_2-V_1=V_1-\text{GND}$, $V_{\text{CC}}=3 \times V_{\text{CEL}}$)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Current consumption 1	I_1	$V_{\text{CEL}}=3.8\text{V}$, $V_{\text{CC}}=V_{\text{CEL}} \times 3$		2.5	3.5	μA
Current consumption 2	I_2	$V_{\text{CEL}}=3.8\text{V}$, $V_{\text{CC}}=V_{\text{CEL}} \times 3$		1.5	2.5	μA
Current consumption 3	I_3	$V_{\text{CEL}}=2.3\text{V}$, $V_{\text{CC}}=V_{\text{CEL}} \times 3$		0.15	0.3	μA
Current consumption 4	I_4	$V_{\text{CEL}}=2.3\text{V}$, $V_{\text{CC}}=V_{\text{CEL}} \times 3$		0.1	0.2	μA
Pin I/O current between cells	I_3	$V_{\text{CEL}}=3.8\text{V}$ (between V3, V2, V1)		± 0.0	± 0.3	μA
Overcharge detection voltage	V_s	$V_{\text{CEL}}=\text{L} \rightarrow \text{H}$ $T_a=-20 \sim +70^\circ\text{C}$	4.400	4.450	4.500	V
Hysteresis voltage	Hys	$V_{\text{CEL}}=\text{L} \rightarrow \text{H} \rightarrow \text{L}$	35	50	65	mV
Overcharge detection delay time	T_{PLH}	$C_t=0.22\mu\text{F}$	1.0	1.5	2.0	S
Output current	I_{OH}	$V_{\text{CEL}}=V_{\text{CC}}=4.6\text{V}$ $V_0=3\text{V}$	100	500		μA
Output leakage current	I_{LEAK}	$V_{\text{CEL}}=3.8\text{V}$, $V_{\text{CC}}=18\text{V}$			0.1	μA

Measuring Circuit



Application Circuit



Delay time $T_d(S) = 7 \times C_{ct} (\mu F)$

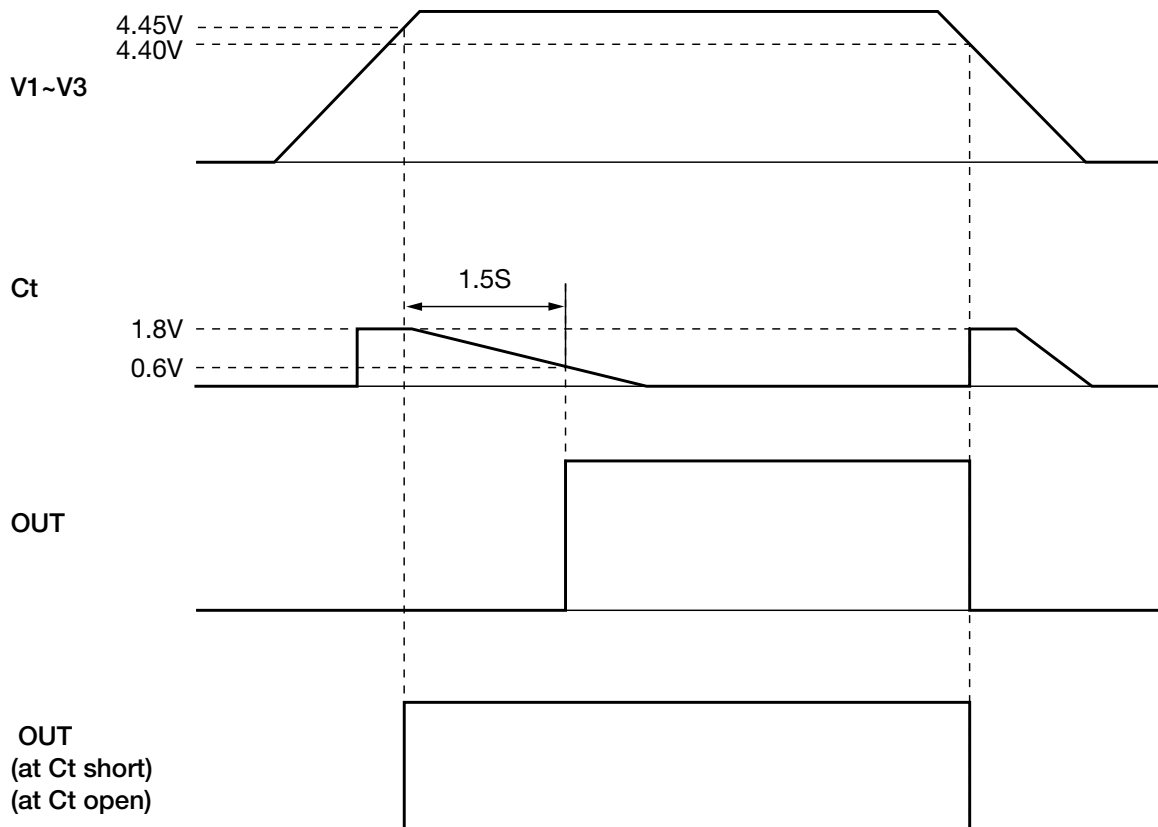
Note 1: Can support 1, 2 or 3 cells by shorting each cell. However, be sure to connect a battery for V3 cell. V3 cell may not operate correctly when shorted.

Note 2: When connecting batteries, be sure to connect in the following order: GND → V3, and Vcc → V1 OR 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.

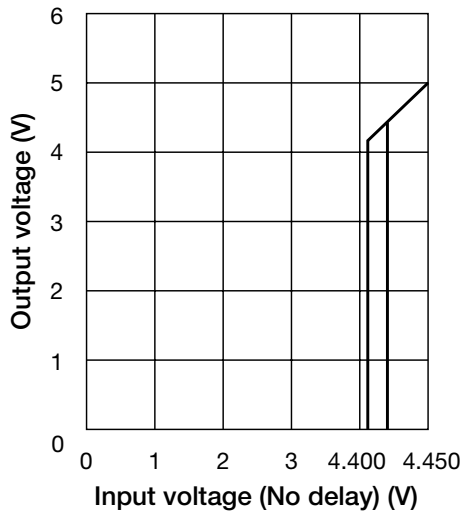
Timing Chart



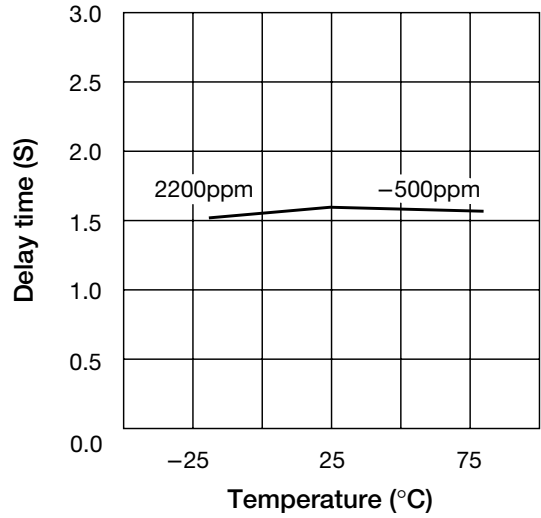
Note: Output goes low simultaneously with overcharge detection at Ct pin short and open.

Characteristics

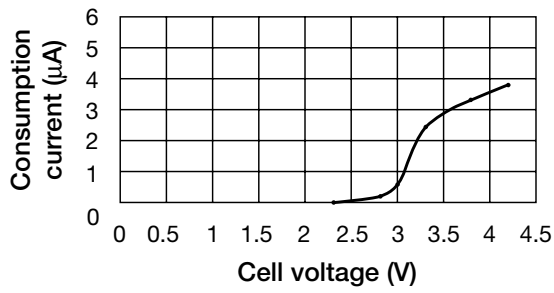
■ Detection voltage



■ Output delay time



■ Consumption current



■ Pin I/O current between cells

