

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. Consumption current ($V_{cell}=3.8V$) | 3 μ A typ. |
| 2. Consumption current ($V_{cell}=2.3V$) | 0.3 μ A typ. |
| 3. Overcharge detection voltage accuracy ($-20^{\circ}C$ to $70^{\circ}C$) | ± 50 mV/cell. |
| 4. Pin I/O current between cells ($V_{cell}=3.8V$) | 0.3 μ A max. |
| 5. Delay time on overcharge voltage detection ($C_t=0.22\mu F$) | 1.5S typ. |
| 6. Output current ($V_{cell}=V_{CC}=4.5$ V) | 500 μ A typ. |

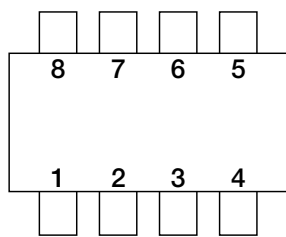
Package

VSOP-8B

Applications

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

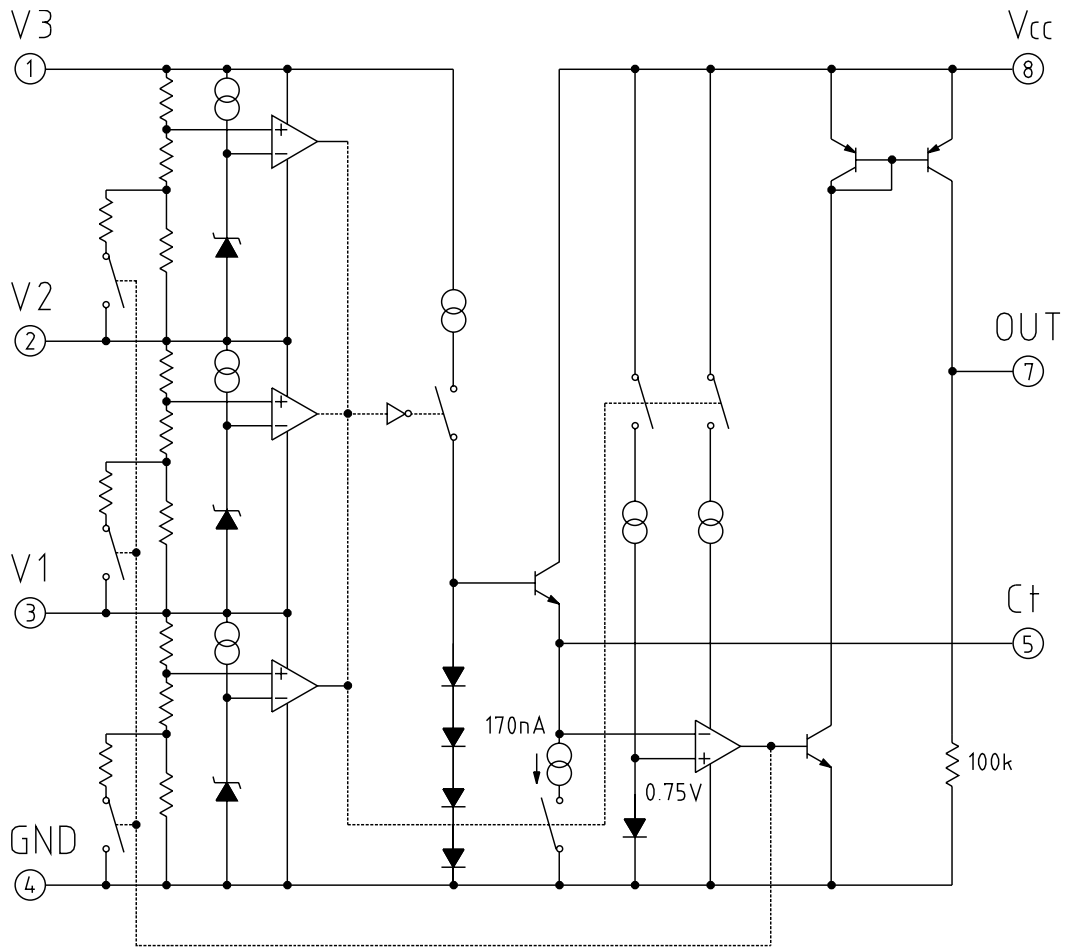
Pin Assignment



VSOP-8B

| | |
|---|-----|
| 1 | V3 |
| 2 | V2 |
| 3 | V1 |
| 4 | GND |
| 5 | Ct |
| 6 | N.C |
| 7 | OUT |
| 8 | Vcc |

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 |

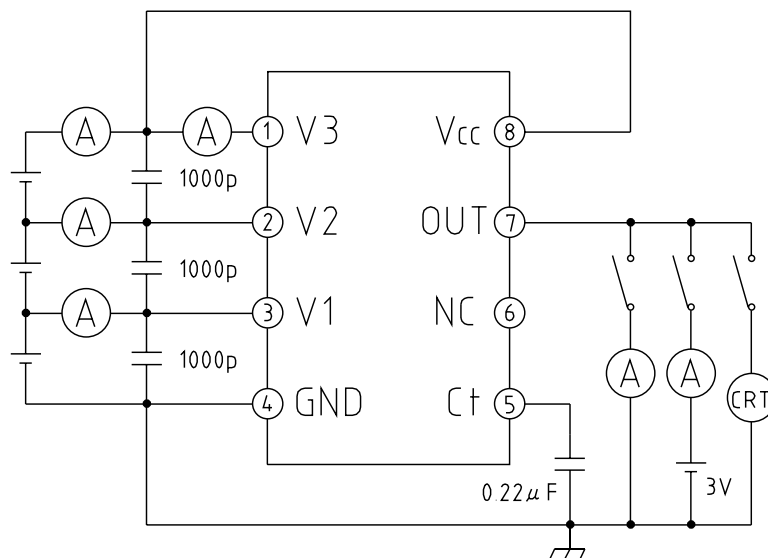
Note 1 : *1 18V ≥ V3 ≥ V2 ≥ V1 ≥ -0.3

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

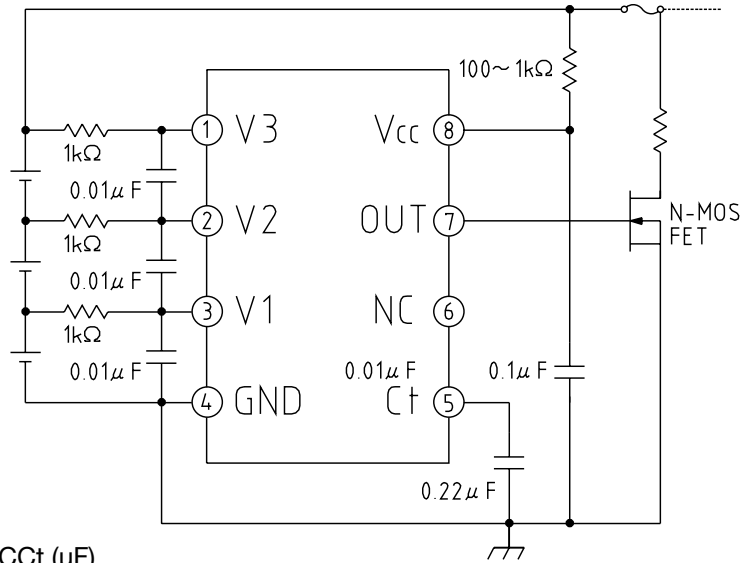
Electrical Characteristics (Except where noted otherwise, Ta=25°C, V_{CEL}=V3-V2=V2-V1=V1-GND, V_{CC}=3×V_{CEL})

| 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



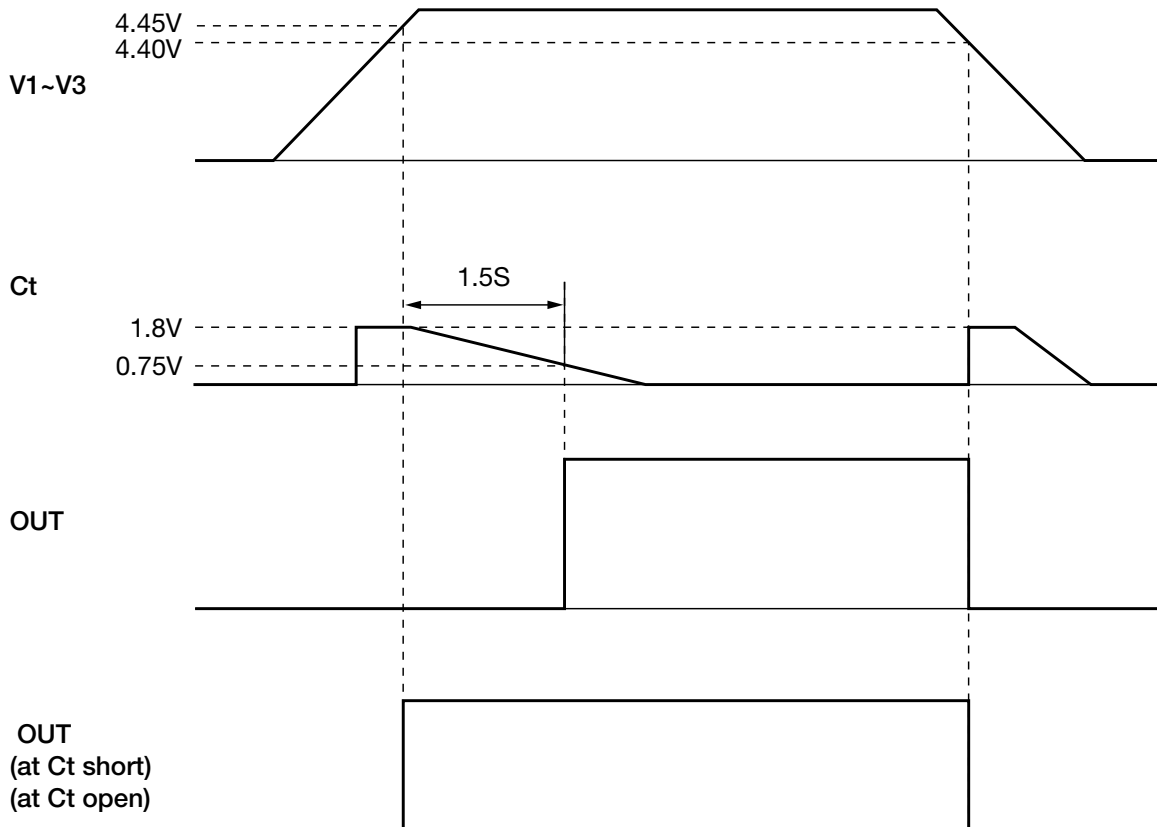
Application Circuit



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

- 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 → 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.
- Note 5: 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.

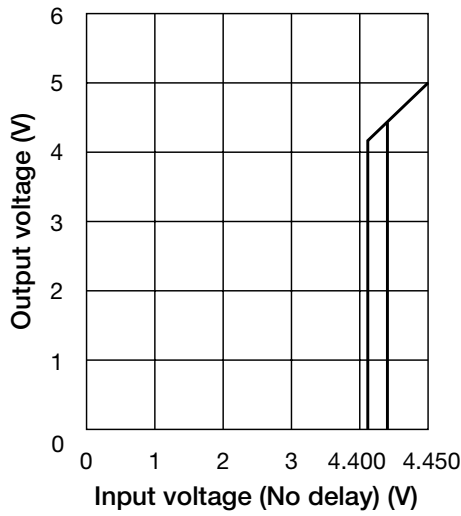
Timing Chart



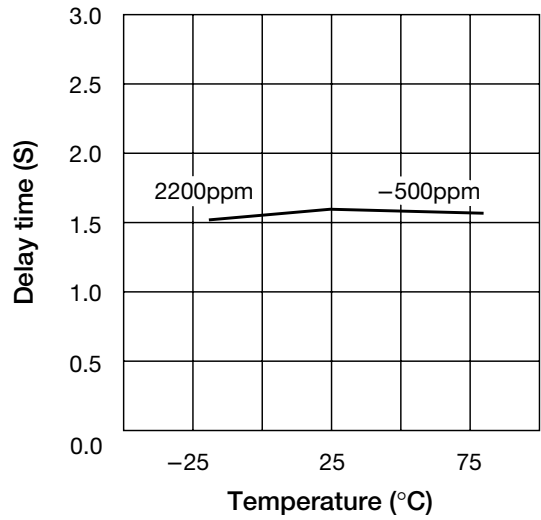
Note: Output goes high simultaneously with overcharge detection at Ct pin short and open.

Characteristics

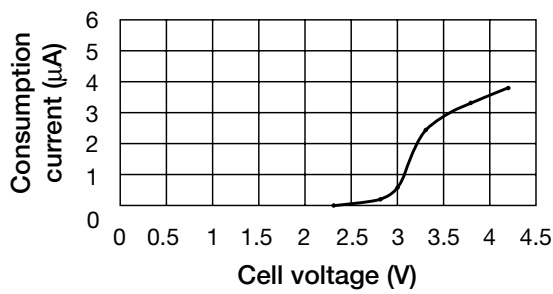
■ Detection voltage



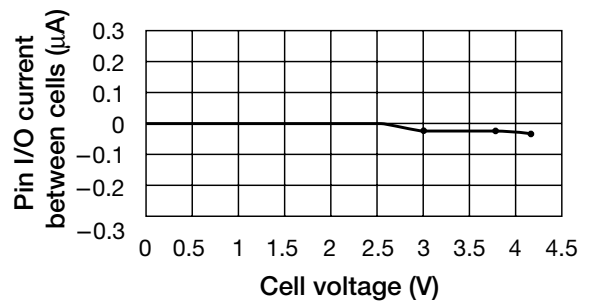
■ Output delay time



■ Consumption current



■ Pin I/O current between cells



■ Output current

