

Protection for Lithium-Ion Batteries (3-serial cells) Monolithic IC MM1309

Outline

This is a 3-cell series protection IC is for protecting a lithium ion battery from overcharging and excess discharging. If abnormalities occur during charging and excess voltage is applied, it has a function that turns off the external FET switch (overcharging detection). It also has a function that turns off the external FET switch when the voltage for each battery falls below a set voltage, to prevent excess discharge when discharging the battery (discharging detection). At that time, the IC is switched to low current consumption mode.

These functions comprise a protection circuit, with few external parts, for lithium ion batteries.

Series Table

Temperature conditions A: Ta=-25 ~ 75°C, B: Ta=-20 ~ 70°C, C: Ta=0 ~ 50°C,
D: Ta=0 ~ 40°C, E: Ta=-20 ~ 25°C

Model	Package	Overcharge prohibition voltage (V)	Overcharge detection voltage temperature conditions	Overcharge detection hysteresis voltage (V)	Overdischarge detection voltage (V)	Discharge resumption voltage (V)	Overcurrent detection voltage (mV)
	SOP-8C, 8E						
MM1309	BF	4.350±0.050	B	45±15	2.40±0.09	2.65±0.16	—
	CF	4.250±0.050	B	45±15	2.35±0.09	2.60±0.16	—

Features

- | | | |
|---|-------------------------|----------------------------------|
| 1. Current consumption (for V _{CC} pin) | V _{CELL} =4.4V | 700µA typ. |
| 2. Current consumption (for V _{CC} pin) | V _{CELL} =4.2V | 300µA typ. |
| 3. Current consumption (for V _{CC} pin) | V _{CELL} =3.8V | 25µA typ. |
| 4. Current consumption (for V _{CC} pin) | V _{CELL} =2.2V | 0.1µA max. |
| 5. Current consumption (for BATH pin) | V _{CELL} =4.4V | 12µA typ. |
| 6. Current consumption (for BATH pin) | V _{CELL} =3.8V | 8µA typ. |
| 7. Current consumption (for BATH pin) | V _{CELL} =2.3V | 1µA typ. |
| 8. Charge prohibit detection function operation voltage | | B : 4.20V typ.
C : 4.10V typ. |
| 9. Excess discharge detection hysteresis voltage | | 250±75mV |

Package

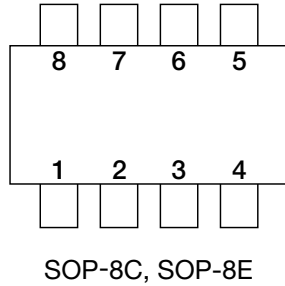
SOP-8C, SOP-8E (MM1309□F)

*The box represents the rank resulting from the combination of protection functions.

Applications

1. Notebook PCs
2. Portable terminals
3. Others

Pin Assignment

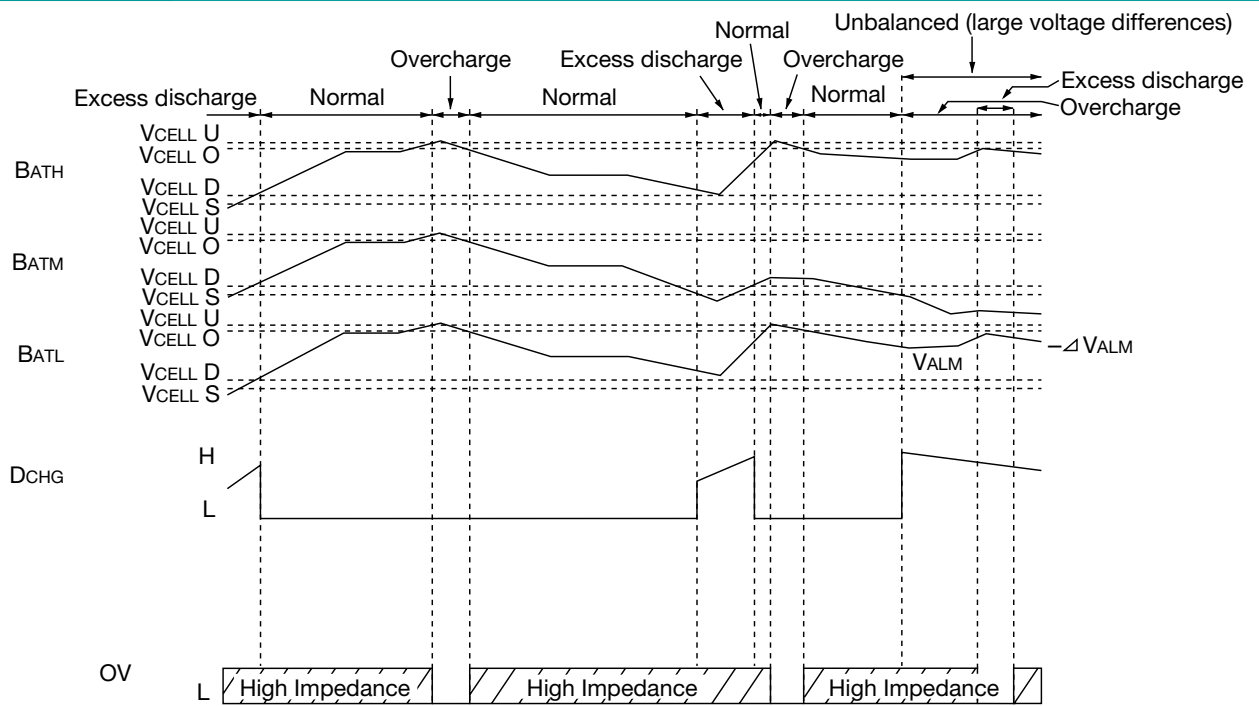


1	DCHG
2	N. C
3	OV
4	GND
5	BATL
6	BATM
7	BATH
8	VCC

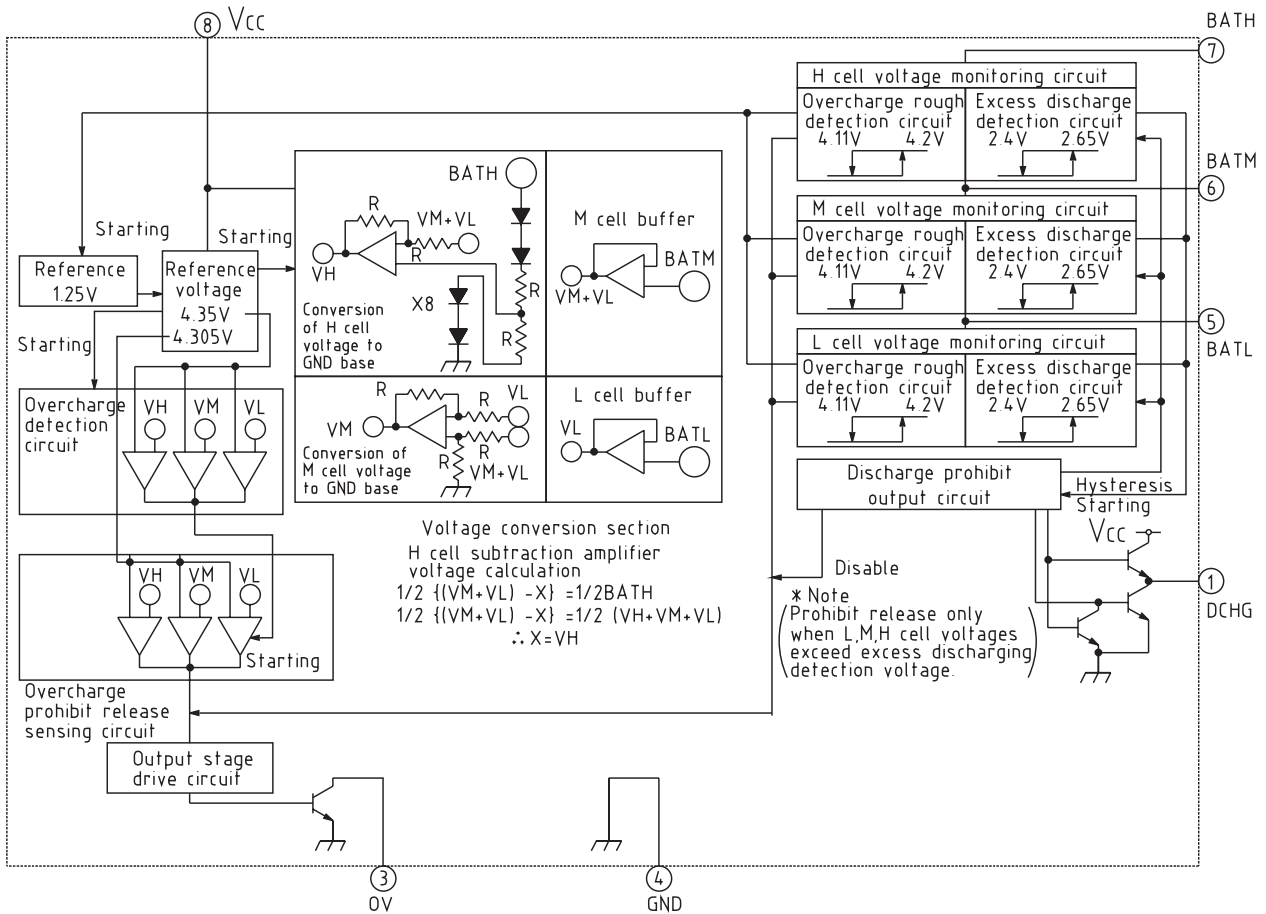
Pin Description

No.	Pin	Output	Function
1	DCHG	Output	FET drive pin for excess discharge control
2	N. C		Non connect
3	OV	Output	FET drive pin for overcharge control
4	GND		Negative connection pin for the low side battery. Also, IC ground pin. (IC reference power supply pin)
5	BATL	Input	Positive connection pin for the low side battery, and negative connection pin for the middle side battery.
6	BATM	Input	Positive connection pin for the middle side battery, and negative connection pin for the high side battery.
7	BATM	Input	Positive connection pin for the high side battery.
8	VCC		IC positive power supply input pin.

Timing Chart



Block Diagram



Output Pin Conditions

Pin	Voltage	Excess discharge 2.4V/CELL	Normal 4.35V/CELL	Overcharging prohibited status
DCHG	H	L	L	L
OV	High Impedance	L	L	L

Absolute Maximum Ratings

Item	Symbol	Rating	Units
Storage temperature	T _{STG}	-40~+125	°C
Operating temperature	T _{OPR}	-20~+70	°C
Charging voltage	V _{BAT max.}	15	V
Power supply voltage	V _{CC max.}	15	V
OV2 pin applied voltage	V _{O max.}	18	V
Allowable power dissipation	P _d	300	mW

Electrical Characteristics (Unless otherwise specified Ta=25°C, VIN=15V, VCELL=VBATH=VBATM=VBATL)

Item	Symbol	Measurement Conditions	Min	Typ.	Max.	Units
Current consumption (Vcc pin) 1	Icc1	VCELL=4.4V		0.7	1.1	mA
Current consumption (Vcc pin) 2	Icc2	VCELL=4.2V		300	450	µA
Current consumption (Vcc pin) 3	Icc3	VCELL=3.8V		25.0	40.0	µA
Current consumption (Vcc pin) 4	Icc4	VCELL=2.3V			0.1	µA
Current consumption (BATH pin) 1	IBATH1	VCELL=4.4V		12.0	20.0	µA
Current consumption (BATH pin) 2	IBATH2	VCELL=3.8V		8.0	12.0	µA
Current consumption (BATH pin) 3	IBATH3	VCELL=2.3V		1.0	2.0	µA
Overcharge prohibit voltage	MM1309BF	VCELLU Ta=-20~70°C VCELL=4.0V→4.5V	4.30	4.35	4.40	V
	MM1309CF		4.20	4.25	4.30	
Charge prohibit release voltage	VCELL0	VCELL=4.5V→4.0V	VCELLU -60mV	VCELLU -45mV	VCELLU -30mV	V
Overcharge detection function operation voltage	MM1309BF	VALM VCELL=3.8V→4.4V	4.05	4.20	4.35	V
	MM1309CF		3.95	4.10	4.25	
Overcharge detection function operation voltage Hysteresis voltage	ΔVALM	VCELL=4.4V→3.8V	50	90	130	mV
Excess discharging detection voltage	MM1309BF	VCELLS VCELL=3.0V→2.0V	2.31	2.40	2.49	V
	MM1309CF		2.26	2.35	2.44	
Discharge resumption voltage	MM1309BF	VCELLD VCELL=2.0V→3.0V	2.49	2.65	2.81	V
	MM1309CF		2.44	2.60	2.76	
Excess discharge detection hysteresis voltage	ΔVcsD	VCELLD-VCELLS	175	250	325	mV
BATL pin input voltage 1	IBATL	VCELL=3.8V			±300	nA
BATL pin input voltage 2	IBATLA	VCELL=4.4V	0.7	1.0	1.3	µA
BATM pin input voltage 1	IBATM	VCELL=3.8V			±300	nA
BATM pin input voltage 2	IBATMA	VCELL=4.4V	0.7	1.0	1.3	µA
DCHG pin source voltage	IsoDCH	VCELL < VCELLS SW1: A	20			µA
DCHG sink voltage	IsoDCH	VCELL > VCELLS SW1: A	20			µA
DCHG output voltage L	VTHDcL	BATH-DCHG IS=20uA SW1: B			1.16	V
DCHG output voltage M	VTHDcH	DCHG-GND IS=-20uA SW1: B			0.8	V
OV pin sink current	IsoOv	VOv=0.4, Ta=-20~70°C	200			µA

Application Circuits

