

# Control of Lithium Ion Battery Charging and Discharging Monolithic IC MM1214

## Outline

This IC controls constant current charging and excess discharge for lithium-ion batteries (sub-batteries). It performs constant current charging, stops charging at set voltages, and prevents excess discharging. When the voltage falls below a set level, it prohibits discharges and reduces IC current consumption nearly to zero.

## Features

### During charging

1. Input voltage range		4.5V~15.0V
2. Current consumption (VIN pin)	$V_{BATT}<4.1V$	9mA typ.
3. Current consumption (VCC pin)	$I_{BATC}=0mA$	500 $\mu$ A typ.
4. Charging current switching voltage		2.7V $\pm$ 0.1V
5. Charging current (normal conditions)		105mA typ.
6. Charging current (low voltages)		5.0mA typ.
7. Charging control voltage (Ta = -20~+70°C)		4.200V $\pm$ 0.063V
8. Overvoltage detection voltage (Ta = -20~+70°C)		4.335V $\pm$ 0.065V
9. Overvoltage reset voltage		3.50V $\pm$ 0.13V
10. Overvoltage detection non-induction time	$C_{CC}=2.22\mu F$	0.80S typ.
11. Overvoltage reset non-induction time	$C_{CC}=0.22\mu F$	0.80S typ.

### During discharging

12. Current consumption (Vbat pin)	$I_L=10mA$	450 $\mu$ A typ.
13. Current consumption (Vbat pin)	$I_L=0mA$	15 $\mu$ A typ.
14. Current consumption (Vbat pin) discharging off,	$: V_{BAT}<2.4V$	0.1 $\mu$ A max.
15. Excess discharging detection voltage		2.30V $\pm$ 0.19V
16. Discharge resumption voltage		2.70V $\pm$ 0.1V
17. Voltage drop between battery and output ( $V_{BATT}=3.0V, I_L=-10mA$ )		70mV typ.
18. Voltage drop between battery and output ( $I_L=100\mu A, V_{BATT}=3V$ )		2.92V typ.

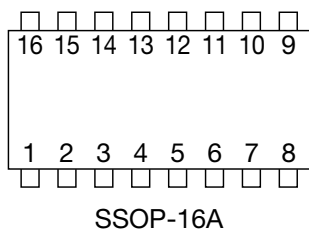
## Package

SSOP-16A (MM1214XF)

## Application

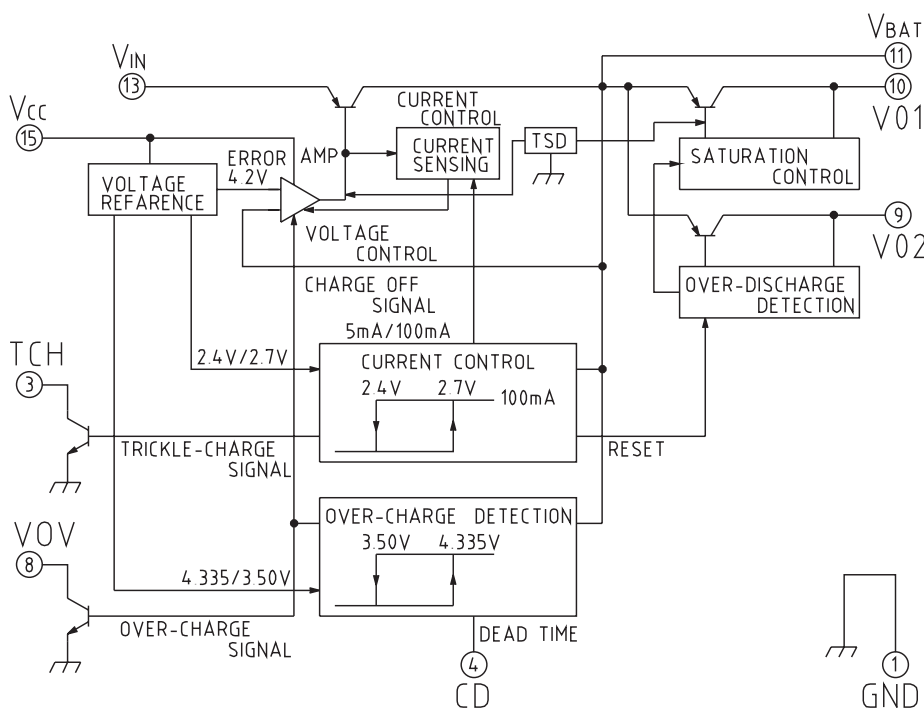
For overnight charging

Pin Assignment



1	GND	9	Vo2
2	N.C	10	Vo1
3	TCH	11	V <sub>BAT</sub>
4	CD	12	N.C
5	N.C	13	V <sub>IN</sub>
6	N.C	14	N.C
7	N.C	15	V <sub>CC</sub>
8	V <sub>OV</sub>	16	N.C

Block Diagram



Absolute Maximum Ratings

Item	Symbol	Rating	Units
Storage temperature	T <sub>STG</sub>	-40~+125	°C
Operating temperature	T <sub>OPR</sub>	-20~+70	°C
input voltage	V <sub>INN max.</sub>	18	V
Power supply voltage	V <sub>CC max.</sub>	18	V
Battery voltage	V <sub>BAT max.</sub>	4.4	V
VOV pin applied voltage	V <sub>VOV max.</sub>	10	V
TCH pin applied voltage	V <sub>TCH max.</sub>	10	V
Charging current	I <sub>CHG max.</sub>	-150	mA
Output current	I <sub>BAT max.</sub>	-30	mA
Allowable power dissipation 1	P <sub>d1</sub>	500	mW
Allowable power dissipation 2 (Note 1)	P <sub>d2</sub>	1000	mW

Note 1 : When mounted on glass epoxy board (10 × 25 × 0.8) Plated area 80% (Refer to Fig.1)

**Electrical Characteristics** (Unless otherwise specified Ta=25°C, V<sub>CC</sub>, V<sub>IN</sub>=6.5V)

Item	Symbol	Measurement Conditions	Min.	Typ.	Max.	Units
Charging input operation range 1	V <sub>INOPR1</sub>	During low-current charging (Note 2)	4.50		(15.0)	V
Charging input operation range 2	V <sub>INOPR2</sub>	During rapid charge	4.50		5.5	V
Power supply input operation range	V <sub>CCOPR</sub>	Charging OFF	4.50		15.0	V
Current consumption (V <sub>IN</sub> pin)	I <sub>IN</sub>	V <sub>BAT</sub> < 4.1V		9	12	mA
Current consumption (V <sub>CC</sub> pin)	I <sub>CC</sub>	I <sub>BATC</sub> =0mA		500	750	μA
Current consumption (V <sub>BAT</sub> pin) 1	I <sub>BAT1</sub>	I <sub>L</sub> =10mA, V <sub>CC</sub> =0V, V <sub>BATT</sub> =3V		450	550	μA
Current consumption (V <sub>BAT</sub> pin) 2	I <sub>BAT2</sub>	I <sub>L</sub> =0mA, V <sub>CC</sub> =0V, V <sub>BATT</sub> =3V		15	30	μA
Current consumption (V <sub>BAT</sub> pin) 3	I <sub>BAT3</sub>	V <sub>BAT</sub> < 2.4V (Discharging OFF), V <sub>CC</sub> =0V			0.1	μA
Charge control voltage	V <sub>BATC</sub>	Ta=-20~+70°C	4.137	4.200	4.263	V
Overcharge detection voltage	V <sub>BATU</sub>	Ta=-20~+70°C	4.270	4.335	4.400	V
Overcharge reset voltage	V <sub>BATO</sub>	V <sub>BATT</sub> =4.5V→3.0V	3.37	3.50	3.63	V
Detection voltage margin 1	ΔV <sub>UC</sub>	V <sub>BATU</sub> -V <sub>BATC</sub> , Ta=-20~+70°C	100	135		mV
Charge current conversion voltage	V <sub>CH</sub>	V <sub>BATT</sub> =2.0V→3.0V	2.60	2.70	2.80	V
Charge hysteresis voltage	ΔV <sub>CH</sub>	V <sub>BATT</sub> =3.0V→2.0V	300	400	500	mV
Charge current (During low voltage)	I <sub>TCH</sub>	V <sub>BATT</sub> < V <sub>CH</sub> -ΔV <sub>CH</sub>	-6.5	-5.0	-3.5	mA
Charge current (Normal)	I <sub>BATC1</sub>	4.0V > V <sub>BAT</sub> > V <sub>CH</sub>	-115	-105	-95	mA
Charge current 1 (Normal)	I <sub>BAT1CT</sub>	Ta=-20~+70°C, V <sub>IN</sub> =4.5V~5.5V	-120	-105	-90	mA
Charge current 2 (Normal)	I <sub>BAT2CT</sub>	Ta=-20~+70°C, V <sub>IN</sub> =4.5V~6.5V	-125	-105	-90	mA
Charge with constant current mode OFF	I <sub>BATC2</sub>	V <sub>BAT</sub> =4.0V	-115		-80	mA
Excess discharging detection voltage	V <sub>BATS</sub>	V <sub>BATT</sub> =3.0V→2.0V	2.11	2.30	2.49	V
Discharge resumption voltage	V <sub>BATD</sub>	V <sub>CC</sub> > 4.5V	2.60	2.70	2.80	V
Voltage drop between battery and output	V <sub>CE</sub>	V <sub>BAT</sub> =3.0V, I <sub>L</sub> =10mA		70	100	mV
VOV pin sink current	I <sub>SIVOV</sub>	V <sub>BATT</sub> =4.4V, V <sub>VOV</sub> =0.4V	1.00	4.00		mA
VOV pin leak current	I <sub>LVOV</sub>	V <sub>BAT</sub> =4.0V			0.1	μA
VOV pin output voltage	V <sub>VOV</sub>	I <sub>VOV</sub> =1mA		0.25	0.35	V
TCH pin sink current	I <sub>SITCH</sub>	V <sub>BAT</sub> =2.0V, V <sub>TCH</sub> =0.4V	1.00	4.00		mA
TCH pin leak current	I <sub>LTCH</sub>	V <sub>BAT</sub> =3.0V			0.1	μA
TCH pin output voltage	V <sub>TCH</sub>	I <sub>TCH</sub> =1mA		0.25	0.35	V
CD pin charge current	I <sub>CD</sub>	V <sub>CD</sub> =1.5V, V <sub>BAT</sub> =4.4V	-800	-600	-400	nA
CD pin discharge current	I <sub>CD</sub>	V <sub>CD</sub> =1.5V, V <sub>BAT</sub> =3.0V	500	680	860	nA
CD pin H voltage	V <sub>CDH</sub>	V <sub>BATT</sub> =4.5V	2.65	2.90	3.15	V
CD pin threshold voltage 1	V <sub>THC1</sub>	V <sub>CD</sub> =3V→0V	0.65	0.73	0.91	V
CD pin threshold voltage 2	V <sub>THC2</sub>	V <sub>CD</sub> =0V→3V	2.00	2.35	2.70	V
Overvoltage detection non-induction time	t <sub>dCD1</sub>	C <sub>CD</sub> =0.22μF	0.40	0.80	1.60	S
Overvoltage reset non-induction time	t <sub>dCD2</sub>	C <sub>CD</sub> =0.22μF	0.40	0.80	1.60	S

Note 2 : During rapid charging, use 5.5 V Vin power supply.

Note 3 : V<sub>O2</sub> has no current supply capacity, so do not connect load.

Characteristics

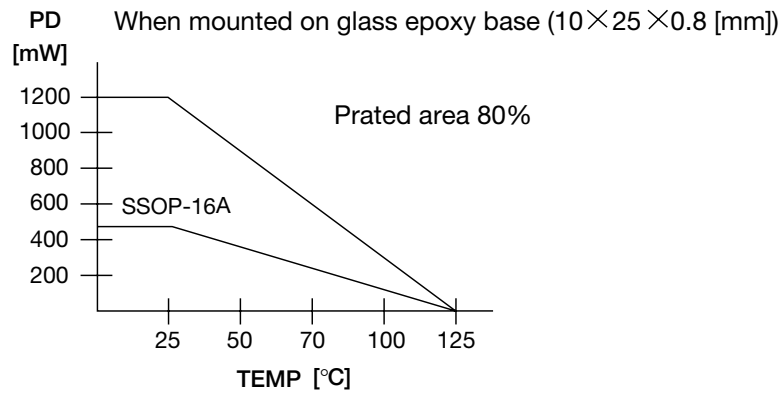


Fig.1

Application Circuits

