2 cells lithium–ion/lithium–polymer battery protection IC

MM3220 series

Outline

The MM3220 series are protection IC using high voltage CMOS process for overcharge, overdischarge and overcurrent protection of the rechargeable Lithium-ion or Lithium-polymer battery. The overcharge, overdischarge, discharging overcurrent, short, charging , and overcurrent(optional) of the rechargeable one-cell Lithium-ion or Lithium-polymer battery can be detected. Each of these IC composed of four voltage detectors, short detection circuit, reference voltage sources, oscillator, counter circuit and logical circuits.

Features

(Unless otherwise specified,Ta=25℃)

1) Range and accuracy of detection/release voltage

・Overcharge detection voltage	4.0V to 4.5V, 5mV steps	Accuracy±20mV
・Overcharge release voltage	3.9V to 4.5V, 50mV steps	Accuracy±30mV
・Overdischarge detection voltage	2.0V to 3.0V, 50mV steps	Accuracy±35mV
・Overdischarge release voltage	2.0V to 3.5V, 50mV steps	Accuracy±100mV
・Discharging overcurrent detection voltage1	+50mV to +300mV, 5mV steps	Accuracy±10mV
・Discharging overcurrent detection voltage2	+50mV to +700mV, 50mV steps	Accuracy±20%
・Charging overcurrent detection voltage	-300mV to -50mV, 5mV steps	Accuracy±20mV
・Short detection voltage	0.9V fixed	Accuracy±100mV

2) Range of detection delay time

・Overcharge detection delay time	Selection from 0.25s, 1.0s, 1.2s, 4.5s
・Overdischarge detection delay time	Selection from 20ms, 24ms, 96ms, 125ms, 144ms
・Discharging overcurrent detection delay time1	Selection from 8ms, 12ms, 16ms, 20ms, 48ms
・Discharging overcurrent detection delay time2	Selection from 0.5ms, 1ms , 1.5ms , 2ms , 4ms
・Charging overcurrent detection delay time	Selection from 4ms, 6ms, 8ms, 16ms
・Short detection delay time	400us fixed

3) 0V battery charge function — Selection from "Prohibition" or "Permission"

4) Low current consumption

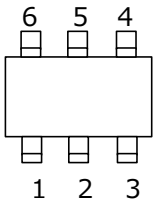
・Normal mode	Typ. 4.0uA, Max. 8.0uA
・Stand-by mode	Max. 0.1uA

5) Package type

・SOT-26A	2.90 × 2.80 × 1.15 [mm]

Mitsumi Electric CO.,LTD.
Semiconductor Business Division
Strategy Engineering Department
tel:+81-46-230-3470

Pin explanations

SOT-26A	Pin No.	Symbol	Function
	1	DOUT	Output of overdischarge detection.
	2	COUT	Output of overcharge detection.
	3	V-	Input terminal connected to charger negative voltage
	4	VBL	Input terminal of the low side cell.
	5	VDD	Input terminal of the high side cell. Supply terminal.
	6	VSS	VSS terminal. Connected to ground.

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage	VDD	-0.3	12	V
V- terminal	V-	VDD-28	VDD+0.3	V
COUT terminal	VCOUT	VDD-28	VDD+0.3	V
DOUT terminal	VDOUT	VSS-0.3	VDD+0.3	V
Storage temperature	Tstg	-55	125	℃

Recommended Operating Conditions

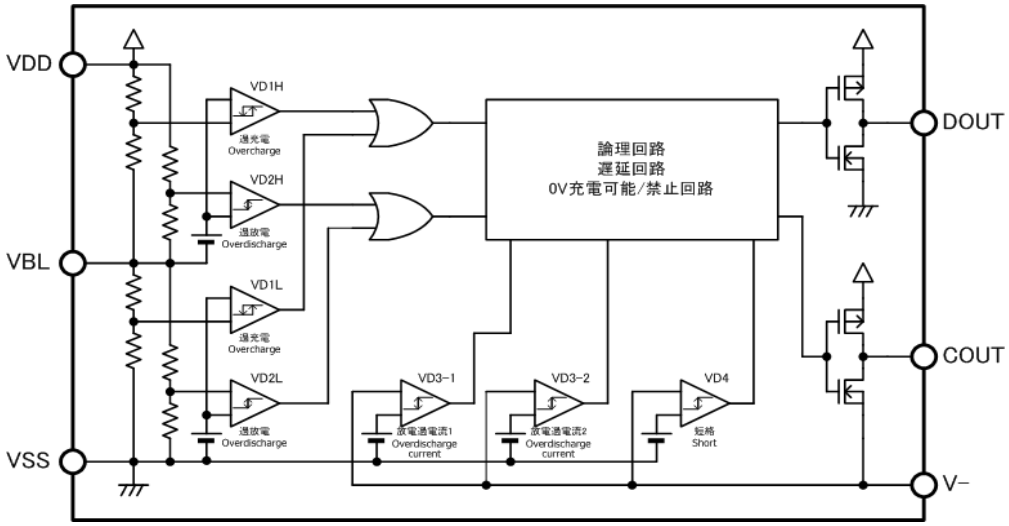
Parameter	Symbol	Min	Max	Unit
Operating ambient temperature	Topr	-40	85	℃
Operating voltage	Vop	1.5	12.0	V

Electrical characteristics

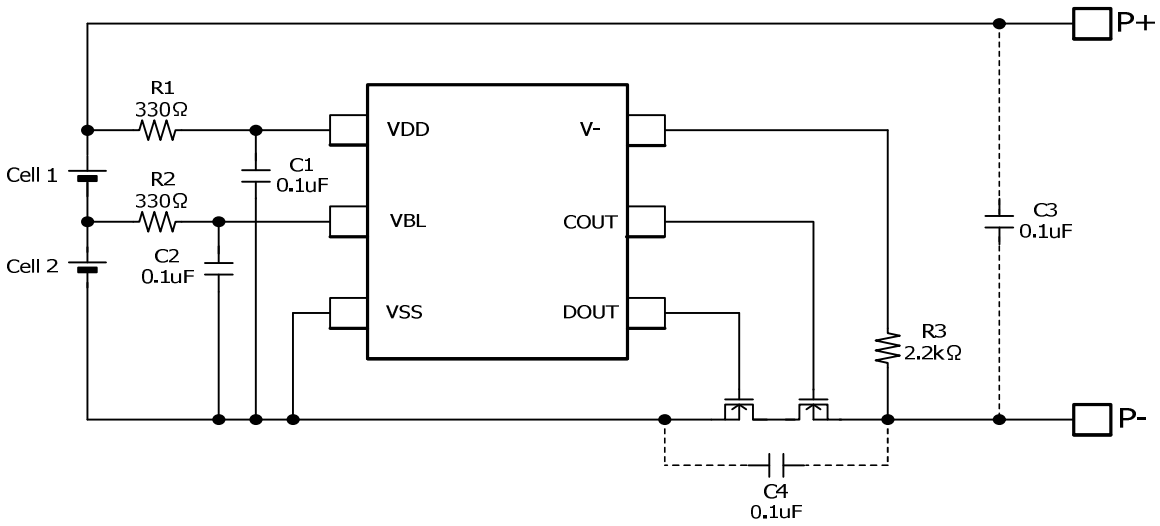
(Unless otherwise specified,Ta=25℃)

Parameter	Symbol	Note	Min	Typ	Max	Unit
Input/Output voltage						
Maximum forbidden voltage for 0V charging	Vst	"Prohibition" function	0.6	0.9	1.2	V
Minimum operating voltage for 0V charging		"Permission" function	-	-	1.2	V
COUT pin Nch ON voltage	Vol1	Iol=30uA, VDD=9.0V	-	0.4	0.5	V
COUT pin Pch ON voltage	Voh1	Ioh=-30uA, VDD=7.0V	6.5	6.8	-	V
DOUT pin Nch ON voltage	Vol2	Iol=30uA, VDD=3.8V	-	0.2	0.5	V
DOUT pin Pch ON voltage	Voh2	Ioh=-30uA, VDD=7.0V	6.5	6.8	-	V
Current consumption						
Current consumption	Idd	Vcell=3.5V, V-=0V	-	4.0	8.0	uA
Current consumption at stand-by	Is	Vcell=1.9V, V-=3.8V	-	-	0.1	uA
Detection/Release voltage						
Overcharge detection voltage	Vdet1	Ta=+25℃	Typ-0.020	Vdet1	Typ+0.020	V
		Ta=-5～+60℃	Typ-0.025		Typ+0.025	
Overcharge release voltage	Vrel1	Vdet1≠Vrel1	Typ-0.030	Vrel1	Typ+0.030	V
Overdischarge detection voltage	Vdet2		Typ-0.035	Vdet2	Typ+0.035	V
Overdischarge release voltage	Vrel2	Vdet2≠Vrel2	Typ-0.100	Vrel2	Typ+0.100	V
Discharging overcurrent detection voltage1	Vdet3-1		Typ-0.010	Vdet3	Typ+0.010	V
Discharging overcurrent detection voltage2	Vdet3-2		Typ*0.8	Vdet3	Typ*1.2	V
Charging overcurrent detection voltage	Vdet4		Typ-0.020	Vdet4	Typ+0.020	V
Short detection voltage	Vshort		0.8	0.9	1.0	V
Detection delay time						
Overcharge detection delay time	tVdet1		Typ*0.8	tVdet1	Typ*1.2	s
Overdischarge detection delay time	tVdet2		Typ*0.8	tVdet2	Typ*1.2	ms
Discharging overcurrent detection delay time1	tVdet3-1		Typ*0.8	tVdet3-1	Typ*1.2	ms
Discharging overcurrent detection delay time2	tVdet3-2		Typ*0.8	tVdet3-2	Typ*1.2	ms
Charging overcurrent detection delay time	tVdet4		Typ*0.8	tVdet4	Typ*1.2	ms
Short detection delay time	tVshort		280	400	560	us

Block diagram



Typical application circuit



R1 , C1 , R2 , C2 stabilize a supply voltage ripple. However, R1 is enlarged, the detection voltage shifts by voltage when c urrent consumption flows into R1. Please decide it after confirming the characteristic. Moreover, adjust the value of C1 , C2 to 0.01uF or more to do the stability operation, please.

R1 and R3 resistors are current limit resistance if a charger is connected reversibly or a high-voltage charger that exceeds the absolute maximum rating is connected. R1 and R3 may cause a power consumption will be over rating of power dissipation, therefore the `R1+R3` should be more than 1kohm. Moreover, if R3 is too enlarged, the charger connection release cannot be occasionally done after the overdischarge is detected, so adjust the value of R3 to 10kohm or less, please.

In the state of overdischarge, The current flows through overdischarge pull-up resistance built into between VDD terminal and V- terminal when the charger is connected. As a result, current that flows into VDD terminal increases. When current increases, the voltage is generated in R1. And hysteresis might be caused. Please use it after confirming the characteristic.

C3 and C4 capacitors have effect that the system stability about voltage ripple or imported noise. After check characteristics, decide that these capacitors should be inserted or not, where should be inserted, and capacitance value, please.