One-cell Li-ion/Li-polymer battery protection IC

MM3511 series

Outline

The MM3511 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, charging overcurrent, and short protection 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	3.6V to 5.0V, 5mV steps	Accuracy±20mV
・Overcharge release voltage	3.6V 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 voltage	+50mV to +300mV, 5mV steps	Accuracy±10mV
・Charging overcurrent detection voltage	-300mV to -50mV, 5mV steps	Accuracy±20mV
・Short detection voltage	0.5V fixed	Accuracy±100mV

2) Range of detection delay time

・Overcharge detection delay time	Selection from 143ms, 573ms, 1.2s
・Overdischarge detection delay time	Selection from 38ms, 150ms, 300ms
・Discharging overcurrent detection delay time	Selection from 4.5ms, 9ms, 18ms
・Charging overcurrent detection delay time	Selection from 4.5ms, 9ms, 18ms
・Short detection delay time	Selection from 300us, 400us

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

4) Low current consumption

・Normal mode	Typ. 3.0uA, Max. 5.5uA
・Stand-by mode	Max. 0.1uA

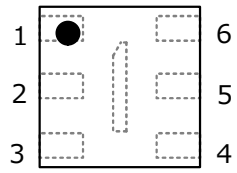
5) Package type

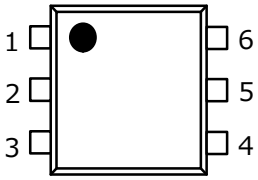
・SSON-6A	1.80 × 2.00 × 0.75 [mm]
・SSON-6J	1.40 × 1.40 × 0.55 [mm]
・SON-6C	1.60 × 2.00 × 0.55 [mm]

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Pin explanations

SSON-6A/6J	Pin No.	Symbol	Function
	1	DS	Delay shorten terminal.
	2	COUT	Output of overcharge detection.
	3	DOUT	Output of overdischarge detection.
	4	VSS	VSS terminal. Connected to ground.
	5	VDD	VDD terminal. Connected to IC substrate.
	6	V-	Input terminal connected to charger negative voltage

SON-6C	Pin No.	Symbol	Function
	1	DS	Delay shorten terminal.
	2	COUT	Output of overcharge detection.
	3	DOUT	Output of overdischarge detection.
	4	VSS	VSS terminal. Connected to ground.
	5	VDD	VDD terminal. Connected to IC substrate.
	6	V-	Input terminal connected to charger negative voltage

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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	5.5	V

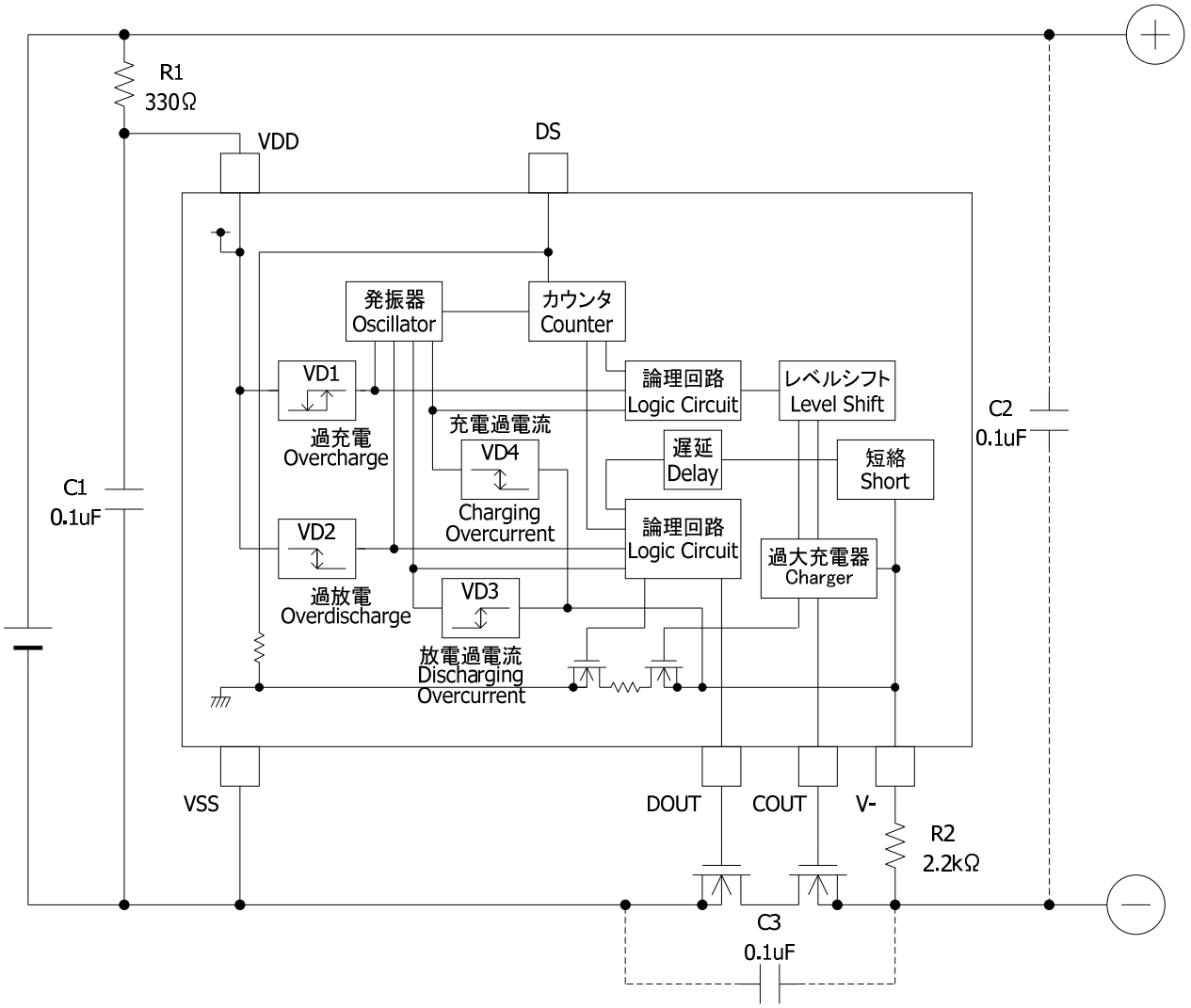
Electrical characteristics

(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=4.5V	-	0.4	0.5	V
COUT pin Pch ON voltage	Voh1	Ioh=-30uA, VDD=3.9V	3.4	3.7	-	V
DOUT pin Nch ON voltage	Vol2	Iol=30uA, VDD=2.0V	-	0.2	0.5	V
DOUT pin Pch ON voltage	Voh2	Ioh=-30uA, VDD=3.9V	3.4	3.7	-	V
Current consumption						
Current consumption	Idd	VDD=3.9V, V-=0V	-	3.0	5.5	uA
Current consumption at stand-by	Is	Vdet2＝Vrel2	-	-	0.1	uA
		Vdet2≠Vrel2	-	0.2	0.5	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 voltage	Vdet3		Typ-0.010	Vdet3	Typ+0.010	V
Charging overcurrent detection voltage	Vdet4		Typ-0.020	Vdet4	Typ+0.020	V
Short detection voltage	Vshort		0.4	0.5	0.6	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 time	tVdet3		Typ*0.8	tVdet3	Typ*1.2	ms
Charging overcurrent detection delay time	tVdet4		Typ*0.8	tVdet4	Typ*1.2	ms
Short detection delay time	tVshort		Typ*0.8	tVshort	Typ*1.2	us

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Block diagram / Typical application circuit



R1 and C1 stabilize a supply voltage ripple. However, the detection voltage rises by the current of penetration in IC of the voltage detection when R1 is enlarged, and the value of R1 is adjusted to 1kohm or less. Moreover, adjust the value of C1 to 0.01u

R1 and R2 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 R2 may cause a power consumption will be over rating of power dissipation, theref

C2 and C3 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.

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