One-cell Lithium-ion/Lithium-polymer battery protection IC with integrated MOS-FET

MJ3542 series

Outline

MJ3542 series are protection IC with integrated MOS-FET for protection of the rechargeable Lithium-ion or Lithium-polymer battery.The overcharge, overdischarge and discharging and charging overcurrent protection of the rechargeable one-cell Lithium-ion or Lithium-polymer battery can be detected.

Features

（Unless otherwise specified, Ta=+25℃）

(1) Range and accuracy of detection/release voltage

Prameter	Symbol	Setting Range	Accuracy	Accuracy(Ta=-40 to +85℃)
・Overcharge detection voltage	Vdet1	4.10V to 4.60V, 5mV step	±10mV	-40mV/+17mV
・Overcharge release voltage	Vrel1	Vdet1 - CHYS *1	-	
・Overdischarge detection voltage	Vdet2	2.00V to 2.80V, 100mV step	±35mV	
・Overdischarge release voltage	Vrel2	Vdet2 + DHYS *2	-	
・Discharge current limit	Idch	3.0A to 12.0A, 0.1A step	*3	
・Charge overcurrent limit	Ichg	3.0A to 12.0A, 0.1A step	*3	
・Short detection voltage	Vshort	90mV to 180mV, 5mV step	±10mV	

*1 "CHYS" is selectable from "None(0V)","CHYS1","CHYS2" "CHYS1", "CHYS2" depend on setting value of Vdet1

*2 "DHYS" is selectable from "None(0V)","DHYS1","DHYS2","DHYS3"   "DHYS1", "DHYS2", "DHYS3" depend on setting value of Vdet2
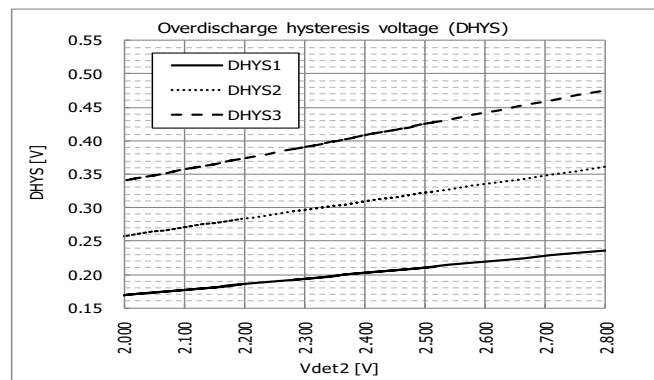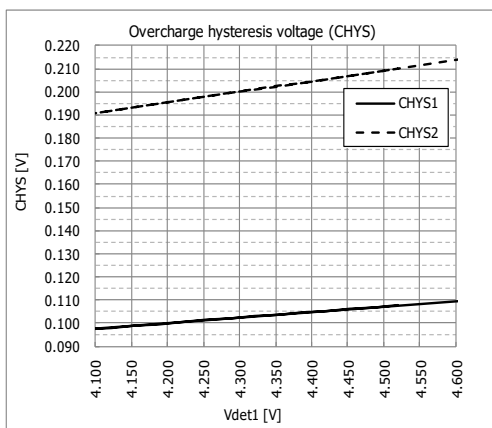
*3 Please inquire to us about details of the accuracy of Overcurrent detection current,which is varies depending on the setting value.

(2) Range of detection/release delay time
- ・ Overcharge detection delay time   tVdet1   Selection from 1.024s, 4.6s
- ・ Overcharge release delay time   tVrel1   Selection from 8ms, 16ms
- ・ Overdischarge detection delay time   tVdet2   Selection from 20ms, 96ms, 144ms
- ・ Discharging overcurrent detection delay time   tVdet3   Selection from 6ms, 8ms, 12ms, 16ms, 20ms, 32ms, 128ms, 256ms
- ・ Charging overcurrent detection delay time   tVdet4   Selection from 8ms, 16ms, 32ms
- ・ Short detection delay time   tshort   300us to 600us, 50us step

(3) 0V battery charge function   Selection from "Inhibition" or "Permission"
In the case of "Inhibition", the setting voltage is 0.90V or 1.25V.

(4) Current consumption
- ・ Normal mode   Idd   Typ. 4.5μA, Max. 7.0μA
- ・ Stand-by mode   Istb   Max. 0.1μA (In case Overdischarge latch function "Enable")
Max. 0.3μA (In case Overdischarge latch function "Disable")

(5) MOS-FET
- ・ Source to Source on state resistance   Rss(on) Typ. 4.7mΩ (@VDD=3.5V)

(6) Absolute maximum ratings
- ・ Supply voltage   VDD   -0.3V to +8.0V
- ・ V- terminal voltage   V-   VDD-15V to VDD+0.3V
- ・ Test terminal voltage   VPP   VSS-0.3V to VDD+0.3V
- ・ Source to source voltage VSSS   Max. 15.0V
- ・ Source current   IS   Max. 12.0A
- ・ Total power dissipation   Pt   Max. 1.0W

*4 These range and accuracy are the one of the standard setting.It may differ each product.
   Please refer to an individual specifications about detail parameters.
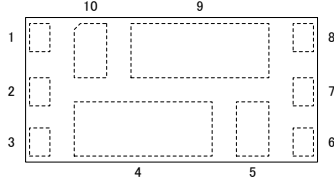*5 Please inquire to us, if you need another specifications.

Package type

- ・ SSON-6N   1.80 × 3.60 × 0.65max [mm]

Pin configuration

Package SSON-6N		Pin No.	Symbol	Function
TOP View 1.80 × 3.60mm typ. t=0.65mm max.		1	DOUT	Discharge MOS-FET control terminal (Connected to G1)
		2	VSS	Negative power supply voltage input terminal
		3	VPP	Test terminal (Connected to VSS)
		4	S2	Source terminal of charge MOS-FET
		5	G2	Gate terminal of charge MOS-FET (Connected to COUT)
		6	COUT	Charge MOS-FET control terminal (Connected to G2)
		7	V-	Charger negative voltage input terminal
		8	VDD	Positive power supply voltage input terminal
		9	S1	Source terminal of discharge MOS-FET
		10	G1	Gate terminal of discharge MOS-FET (Connected to DOUT)

Package dimension

UNIT: mm

裏面 (Bottom View)
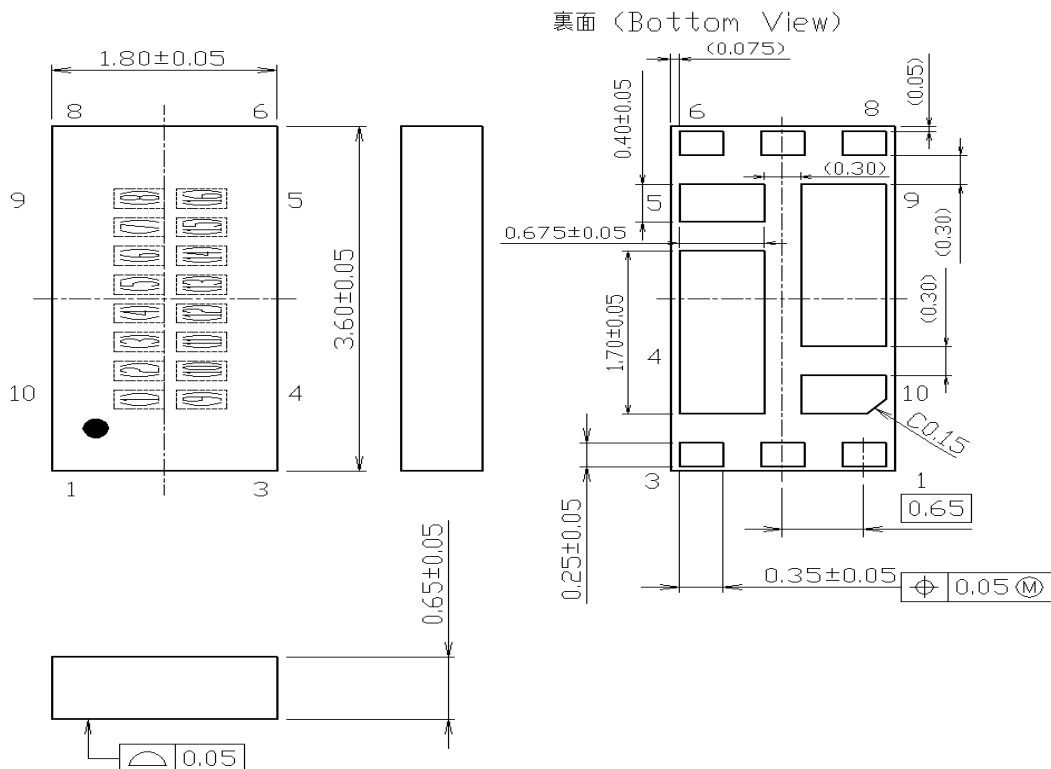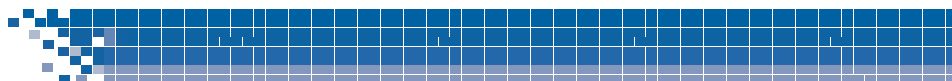
Recommend operation conditions

ITEM	SYMBOL	MIN.	MAX.	UNIT
Operating Ambient temperature	Topr	-40	85	℃
Operating voltage	Vop	1.5	4.8	V

Electrical characteristics (Main item)

(Unless otherwise specified, Ta=+25℃)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Discharge overcurrent release resistance	Rshort	VDD=3.6V, VM=3.6V	5.0	10.0	20.0	kΩ
VM terminal pull-up resistances	Rpu	VDD=2.0V, VM=0V	150	300	600	kΩ
Current consumption	Idd	VDD=4.0V, VM=0V	-	4.5	7.0	uA
Current consumption at stand-by	Istb	Overdischarge latch function "Enable" VDD=2.0V, VM=VDD	-	0.150	0.300	uA
		Overdischarge latch function "Disable" VDD=1.5V, VM=VDD	-	-	0.100	

(Unless otherwise specified, Ta=+25℃)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Overcharge detection voltage	Vdet1		Vdet1-0.010	Vdet1	Vdet1+0.010	V
Overcharge release voltage	Vrel1	Overcharge latch function "Enable" Vdet1=Vrel1	Vrel1-0.030	Vrel1	Vrel1+0.010	V
		Overcharge latch function "Disable" Vdet1≠Vrel1	Vrel1-0.030		Vrel1+0.030	
Overdischarge detection voltage	Vdet2		Vdet2-0.035	Vdet2	Vdet2+0.035	V
Overdischarge release voltage	Vrel2	Overdischarge latch function "Enable" Vdet2=Vrel2	Vrel2-0.035	Vrel2	Vrel2+0.045	V
		Overdischarge latch function "Disable" Vdet2≠Vrel2	Vrel2-0.090		Vrel2+0.090	
Discharging overcurrent detection voltage	Vdet3	VDD=3.6V	-	Idch36*Rsson36	-	mV
Discharge current limit	Idch		*6	Idch	*6	A
Discharging overcurrent release voltage	Vrel3	VDD=3.6V, R2=1kΩ	1.00	1.40	1.90	V
Charging overcurrent detection voltage	Vdet4	VDD=3.6V	-	-Ichg36*Rsson36	-	mV
Charging current limit	Ichg		*6	Ichg	*6	A
Short detection voltage	Vshort		Vshort-10	Vshort	Vshort+10	mV
0V battery charge inhibition battery voltage	Vst	When "Inhibition" is selected	0.600	0.900	1.200	V
		Vst = VDD - VSS	1.100	1.250	1.400	V
Minimum operating voltage for 0V charging	Vst	When "Permission" is selected Vst = VDD - V-	-	-	1.60	V
Overcharge detection delay time	tVdet1	*11	tVdet1*0.8	tVdet1	tVdet1*1.2	s
Overdischarge detection delay time	tVdet2	*11	tVdet2*0.8	tVdet2	tVdet2*1.2	ms
Discharging overcurrent detection delay time	tVdet3	*11	tVdet3*0.8	tVdet3	tVdet3*1.2	ms
Charging overcurrent detection delay time	tVdet4	*11	tVdet4*0.8	tVdet4	tVdet4*1.2	ms
Short detection delay time	tshort	*11	*6	tshort	*6	us

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ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Source current of cut off	ISSS	VDS=24V	-	-	1.0	uA
Source to source on state	RSS(on)45	VDD=4.5V , IS=3.0A	3.5	4.7	6.1	mΩ
Source to source on state	RSS(on)40	VDD=4.0V , IS=3.0A	3.5	4.7	6.1	mΩ
Source to source on state	RSS(on)37	VDD=3.7V , IS=3.0A	3.5	4.7	6.1	mΩ
Source to source on state	RSS(on)36	VDD=3.6V , IS=3.0A	3.5	4.7	6.1	mΩ
Source to source on state	RSS(on)35	VDD=3.5V , IS=3.0A	3.5	4.7	6.1	mΩ
Source to source on state	RSS(on)33	VDD=3.3V , IS=3.0A	3.5	4.7	6.1	mΩ
Source to source on state	RSS(on)30	VDD=3.0V , IS=3.0A	3.6	5.0	6.6	mΩ
Source to source on state	RSS(on)25	VDD=2.5V , IS=3.0A	4.0	5.7	7.7	mΩ
Body diode forward voltage	VF	Is=1A	0.40	0.60	0.80	V

*6 Please inquire to us about details of the accuracy of Overcurrent detection current and Short detction delay time, which is varies depending on the setting value.
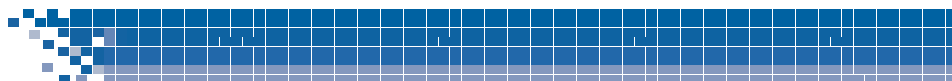
Typical applicaton circuit
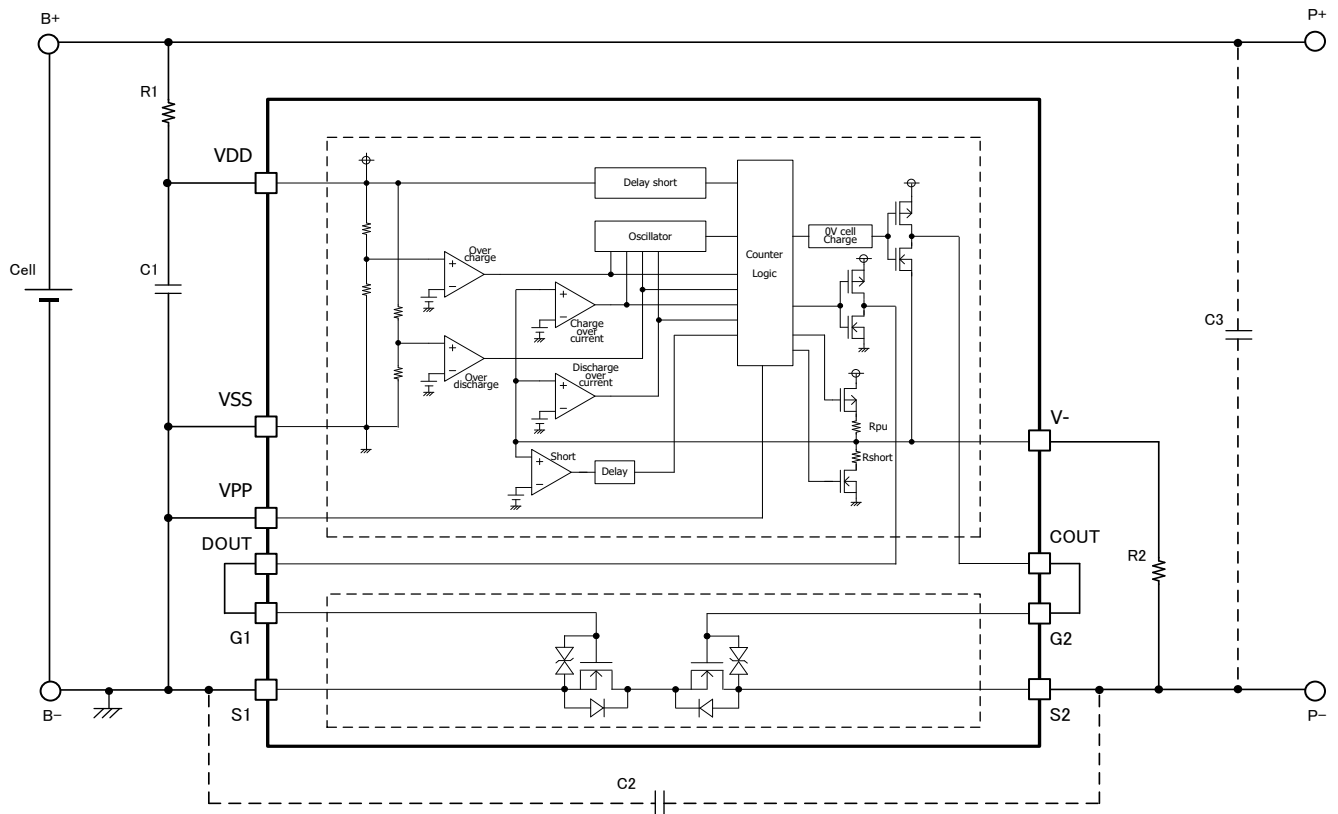
Symbol	Parts	Min.	Typ.	Max.	Purpose
R1	Resistor	-	330Ω	-	For voltage fluctuation, For ESD
C1	Capacitor	0.01uF	0.1uF	1.0uF	For voltage fluctuation
R2	Resistor	-	1.0kΩ	10kΩ	Current limit for charger reverse connection
C2	Capacitor	-	0.1uF	-	For exogenous noise
C3	Capacitor	-	0.1uF	-	For exogenous noise

Application hints
The resistors that are inserted into each pin are to protect the IC. They help to remove ESD and latch-up damages. The capacitors help to reduce the effects of transient variations in voltage and electromagnetic waves,and to improve ESD tolerance of the IC.
Please use either C2 or C3, or both of them by request of your application.
These values in the above figure are for example. Please choose appropriate values.

Product lineup

Development state	Product name	Package	Model Code.	0V battery charge function	Overcharge detection Latch function	Overdischarge detection Latch function	Overcharge detection voltage Vdet1 V	Overcharge release voltage Vrel1 V	Overcharge release voltage Vdet2 V	Overdischarge release voltage Vrel2 V	Discharging overcurrent detection voltage (@VDD=3.6V) Vdet3 mV	Charging overcurrent detection voltage (@VDD=3.6V) Vdet4 mV	Short detection voltage Vshort mV	Overcharge detection delay time tVdet1 s	Overdischarge detection delay time tVdet2 ms	Discharging overcurrent detection delay time tVdet3 ms	Charging overcurrent detection delay time tVdet4 ms	Short detection delay time tshort us	Discharge current limit (@VDD=3.6V) Idch A	Charge current limit (@VDD=3.6V) Ichg A	Source to source on-state resistance (@VDD=3.6V) Rss(on) mΩ
ES	MJ3542CM1EBU	SSON-6N	542CM1U	Permission	Disable	Disable	4.425	4.220	2.500	2.925	*1	*2	90	1.0	96.0	12.0	8.0	270	6.10	6.10	4.7
MP	MJ3542CM2EBU	SSON-6N	542CM2U	Permission	Disable	Disable	4.475	4.265	2.300	2.690	*1	*2	120	1.0	96.0	20.0	32.0	460	6.80	6.80	4.7
ES	MJ3542CM5EBU	SSON-6N	542CM5U	Permission	Disable	Disable	4.450	4.245	2.000	2.340	*1	*2	90	1.0	96.0	12.0	8.0	350	6.10	6.10	4.7
ES	MJ3542CM6EBU	SSON-6N	542CM6U	Permission	Disable	Disable	4.425	4.220	2.500	2.925	*1	*2	90	1.0	96.0	12.0	8.0	500	9.10	6.45	4.7
ES	MJ3542CM7EBU	SSON-6N	542CM7U	Permission	Disable	Disable	4.475	4.265	2.300	2.690	*1	*2	150	1.0	96.0	20.0	32.0	500	10.00	7.30	4.7
ES	MJ3542KM2EBU	SSON-6N	542KM2U	Permission	Enable	Disable	4.475	4.475	2.300	2.690	*1	*2	120	1.0	96.0	20.0	32.0	460	6.80	6.80	4.7
ES	MJ3542KT1EBU	SSON-6N	542KT1U	Inhibition	Enable	Disable	4.475	4.475	2.300	2.690	*1	*2	120	1.0	96.0	32.0	32.0	460	6.80	6.80	4.7
ES	MJ3542LM1EBU	SSON-6N	542LM1U	Permission	Enable	Enable	4.435	4.435	2.300	2.300	*1	*2	90	1.0	144.0	16.0	8.0	460	8.10	6.40	4.7
ES	MJ3542LT1EBU	SSON-6N	542LT1U	Inhibition	Enable	Enable	4.435	4.435	2.300	2.300	*1	*2	90	1.0	144.0	16.0	8.0	460	8.10	6.40	4.7
MP	MJ3542LT2EBU	SSON-6N	542LT2U	Inhibition	Enable	Enable	4.435	4.435	2.300	2.300	*1	*2	90	1.0	144.0	16.0	8.0	460	7.60	6.40	4.7

*1 Discharging overcurrent detection voltage (Vdet3) = Idch36 * Rss(on)36

*2 Charging overcurrent detection voltage (Vdet4) = - Ichg36 * Rss(on)36

Please inquire to us, if you request a rank other than the above.