

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

MC3761 series

Outline

MC3761 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.

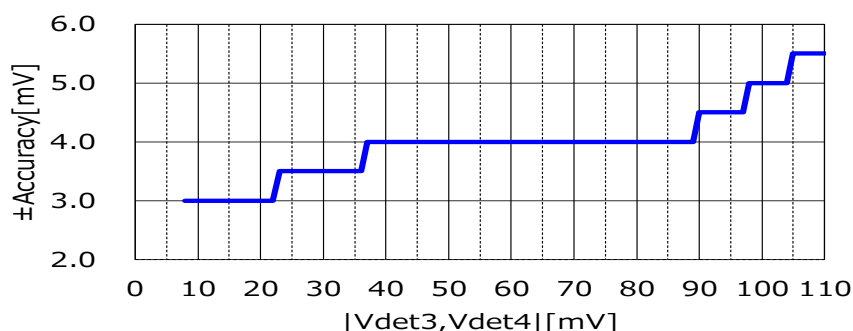
Features

(Unless otherwise specified, Ta=+25°C)

(1) Range and accuracy of detection/release voltage

- | | | |
|--|---|--|
| Overcharge detection voltage | 4.20V to 4.70V, 5mV step | Accuracy ±20mV
Accuracy -50/+25mV (Ta=-40 to +85°C) |
| Overcharge release voltage | Vdet1-0.4V to Vdet1, 100mV step | Accuracy -30/+20mV (Vdet1=Vrel1)
Accuracy ±30mV (Vdet1≠Vrel1) |
| Overdischarge detection voltage | 2.00V to 3.30V, 50mV step | Accuracy ±30mV |
| Overdischarge release voltage | Vdet2+0.4V to Vdet2, 100mV step | Accuracy -30/+40mV (Vdet2=Vrel2)
Accuracy ±90mV (Vdet2≠Vrel2) |
| Discharging overcurrent detection voltage
(Discharging overcurrent detection current) | +8mV to +110mV, 1mV step
(0.140A to 1.95A) | Accuracy *1 |
| Discharging overcurrent release volt Selection from | VDD-0.7V, 1.6V, Vdet3 | |
| Charging overcurrent detection voltage
(Charging overcurrent detection current) | -100mV to -8mV, 1mV step
(-0.140A to -1.75A) | Accuracy *1 |
| Short detection voltage | 0.040V to 0.700V, 5mV step | Accuracy ±20 to 50mV |

*1



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.



(2) Range of detection delay time

- Overcharge detection delay time 1.0s fixed
- Overdischarge detection delay time Selection from 20ms, 96ms, 144ms
- Discharging overcurrent detection delay time Selection from 6ms, 8ms, 12ms, 16ms, 20ms, 32ms, 128ms, 256ms, 512ms
- Charging overcurrent detection delay time Selection from 8ms, 16ms, 32ms
- Short detection delay time 150us to 550us, 50us step

(3) 0V battery charge function

Selection from "Inhibition" or "Permissi *2"

(4) Low current consumption

- Normal mode Typ. 1.0μA, Max. 1.4μA
- Stand-by mode Max. 0.025μA (In case Overdischarge latch function "Enable")
Max. 0.550μA (In case Overdischarge latch function "Disable")

(5) MOS-FET

- Source to Source on state resistance Typ. 56.5mΩ (@VDD=3.5V)

(6) Absolute maximum ratings

- VDD pin -0.3V to +12V
- V- pin VDD-24V to VDD+0.3V
- Drain-source voltage Max. 24V
- Source current 2.0A
- Total Power Dssipation 0.3W
- Storage temperature -55 to +125°C
- Operation temperature -40 to +85°C

Package type

- PLP-6J 1.40 × 2.00 × 0.50max [mm]



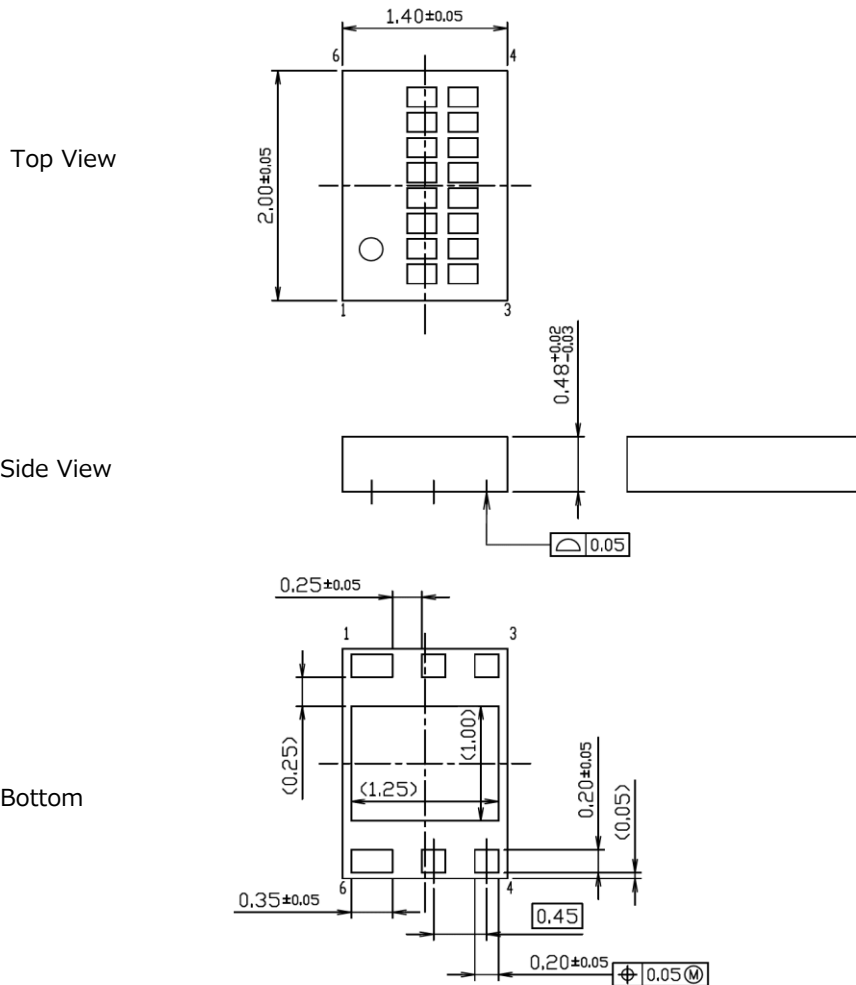


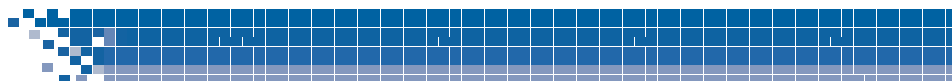
Pin configuration

Package	Pin No.	Symbol	Function
PLP-6J			
<p>TOP View</p> <p>1.40 × 2.00mm typ. , t=0.50mm max.</p>	1	S1	Source terminal of discharge FET
	2	VSS	Negative power supply voltage input terminal
	3	VDD	Positive power supply voltage input terminal
	4	NC	No connection
	5	VM	Charger negative voltage input terminal
	6	S2	Source terminal of charge FET
	-	D	Drain terminal of discharge FET and charge FET

Package dimension

UNIT: mm





Recommend operation conditions

ITEM	SYMBOL	MIN.	MAX.	UNIT
Operating Ambient temperature	Topr	-40	85	°C
Operating voltage	Vop	1.5	5.5	V

Electrical characteristics (Main item)

Ta=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Discharge overcurrent release resistance	Rshort	VDD=3.6V, VM=3.6V	10.0	20.0	40.0	kΩ
VM terminal pull-up resistances	Rpu	VDD=2.0V, VM=0V	150	300	600	kΩ
Current consumption	Idd	VDD=4.0V, VM=0V	#REF!	1.0	1.4	μA
Current consumption at stand-by	Istb	VDD=2.0V, VM=VDD, *4	-	-	0.025	μA
		VDD=1.5V, VM=VDD, *5	-	-	0.550	

Ta=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Overcharge detection voltage	Vdet1		Vdet1-0.02	Vdet1	Vdet1+0.02	V
Overcharge release voltage	Vrel1	Vdet1=Vrel1	Vrel1-0.03	Vrel1	Vrel1+0.02	V
		Vdet1≠Vrel1	Vrel1-0.03		Vrel1+0.03	
Overdischarge detection voltage	Vdet2		Vdet2-0.03	Vdet2	Vdet2+0.03	V
Overdischarge release voltage1	Vrel2	Vdet2=Vrel2	Vrel2-0.03	Vrel2	Vrel2+0.04	V
		Vdet2≠Vrel2	Vrel2-0.09		Vrel2+0.09	
Discharging overcurrent detection voltage	Vdet3	*6	Vdet3-3.00	Vdet3	Vdet3+3.0	mV
Discharging overcurrent release voltage	Vrel3		VDD-1.0	VDD-0.7	VDD-0.4	V
			*6	1.60	*6	
			*6	Vdet3	*6	
Charging overcurrent detection voltage	Vdet4	*6	Vdet4-3.00	Vdet4	Vdet4+3.00	mV
Short detection voltage	Vshort		Vshort-0.02	Vshort	Vshort+0.02	V
0V battery charge inhibition battery voltage	Vst	When "Inhibition" is selected	0.60	0.90	1.20	V
Overcharge detection delay time	tVdet1	*6	tVdet1*0.8	tVdet1	tVdet1*1.2	s
Overcharge release delay time	tVrel1	*6	tVrel1*0.8	tVrel1	tVrel1*1.2	ms
Overdischarge detection delay time	tVdet2	*6	tVdet2*0.8	tVdet2	tVdet2*1.2	ms
Overdischarge release delay time	tVrel2	*6	tVrel2*0.8	tVrel2	tVrel2*1.2	ms
Discharging overcurrent detection delay time	tVdet3	*6	tVdet3*0.8	tVdet3	tVdet3*1.2	ms
Discharging overcurrent release delay time	tVrel3	*6	tVrel3*0.8	tVrel3	tVrel3*1.2	ms
Charging overcurrent detection delay time	tVdet4	*6	tVdet4*0.8	tVdet4	tVdet4*1.2	ms
Charging overcurrent release delay time	tVrel4	*6	tVrel4*0.8	tVrel4	tVrel4*1.2	ms
Short detection delay time	tshort	*6	tshort*0.7	tshort	tshort*1.3	us





Ta=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Drain current of cut off	IDSS	VDS=24V	-	-	1.0	uA
Source to source on state resistance	RSS(on)45	VDD=4.5V , Is=1.0A	46.0	52.5	61.0	mΩ
	RSS(on)42	VDD=4.2V , Is=1.0A	46.0	53.0	62.0	mΩ
	RSS(on)39	VDD=3.9V , Is=1.0A	47.0	54.5	64.0	mΩ
	RSS(on)37	VDD=3.7V , Is=1.0A	47.5	55.5	65.0	mΩ
	RSS(on)35	VDD=3.5V , Is=1.0A	48.0	56.5	67.0	mΩ
	RSS(on)33	VDD=3.3V , Is=1.0A	48.5	58.0	69.0	mΩ
	RSS(on)30	VDD=3.0V , Is=1.0A	49.5	60.5	73.5	mΩ
	RSS(on)25	VDD=2.5V , Is=1.0A	50.0	68.0	87.0	mΩ
Body diode forward voltage	VF	Is=1A	0.55	0.70	0.85	V

*4 In case Overdischarge latch function "Enable"

*5 In case Overdischarge latch function "Disable"

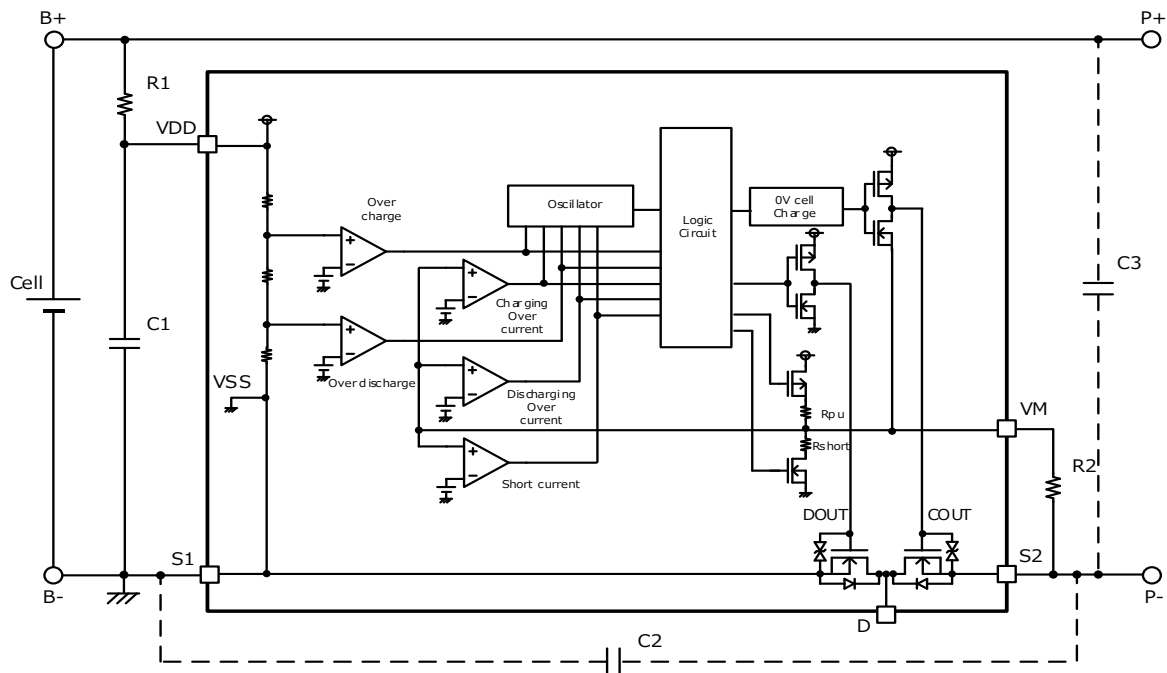
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Typical applicaton circuit



Symbol	Parts	Min.	Typ.	Max.	Purpose
R1	Resistor	-	100Ω	1.0kΩ	For voltage fluctuation, For ESD
C1	Capacitor	0.01uF	0.1uF	1.0uF	For voltage fluctuation
R2	Resistor	-	1.0kΩ	-	Current limit for charger reverse connection
C2	Capacitor	-	0.1uF	-	For exogenous noise
C3	Capacitor	-	0.1uF	-	For exogenous noise

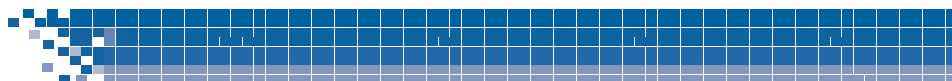
Application hints

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	Optional function			Detection/Release voltage							Detection delay time				Overcurrent		MOS-FET															
				0V battery charge function	Overcharge detection Latch function	Overdischarge detection Latch function	Overcharge detection voltage	Overcharge release voltage	Overcharge release voltage	Overdischarge release voltage	Discharging overcurrent detection voltage	Charging overcurrent detection voltage	Short detection voltage	Overcharge detection delay time	Overdischarge detection delay time	Discharging overcurrent detection delay time	Charging overcurrent detection delay time	Short detection delay time	Discharge current limit (@VDD=3.5V)		Charge current limit (@VDD=3.5V)														
																						Vdet1	Vrel1	Vdet2	Vrel2	Vdet3	Vdet4	Vshort	tVdet1	tVdet2	tVdet3	tVdet4	tshort	Idischg	Icharge
																						V	V	V	V	mV	mV	V	s	ms	ms	ms	us	A	A
MP	MC3761PK1HAU	PLP-6J	761PK1U	Inhibition	Disable	Enable	4.280	4.180	2.700	2.700	30.0	-30.0	0.060	1.0	96.0	20.0	8.0	300	0.530	0.535	56.5														
ES	MC3761AJ2HAU	PLP-6J	761AJ2U	Permission	Disable	Disable	4.455	4.255	2.800	3.200	110.0	-100.0	0.270	1.0	96.0	12.0	8.0	300	1.945	1.785	56.5														
ES	MC3761AJ3HAU	PLP-6J	761AJ3U	Permission	Disable	Disable	4.225	4.025	2.800	3.200	37.0	-36.0	0.080	1.0	96.0	12.0	8.0	300	0.655	0.645	56.5														
MP	MC3761PK2HAU	PLP-6J	761PK2U	Inhibition	Disable	Enable	4.430	4.130	3.000	3.000	19.0	-12.0	0.055	1.0	96.0	20.0	8.0	300	0.335	0.215	56.5														
MP	MC3761PJ2HAU	PLP-6J	761PJ2U	Permission	Disable	Enable	4.380	4.180	2.800	2.800	56.0	-56.0	0.140	1.0	20.0	12.0	16.0	400	0.990	1.000	56.5														
MP	MC3761E1HAU	PLP-6J	761E1U	Permission	Enable	Enable	4.525	4.525	2.700	2.700	20.0	-33.0	0.080	1.0	96.0	512.0	8.0	250	0.355	0.590	56.5														
ES	MC3761EK1HAU	PLP-6J	761EK1U	Inhibition	Enable	Enable	4.410	4.410	2.700	2.700	17.0	-17.0	0.047	1.0	20.0	128.0	8.0	200	0.300	0.305	56.5														
ES	MC3761PK4HAU	PLP-6J	761PK4U	Inhibition	Disable	Enable	4.475	4.375	2.700	2.700	17.0	-17.0	0.150	1.0	20.0	128.0	8.0	150	0.305	0.310	56.5														
ES	MC3761PJ4HAU	PLP-6J	761PJ4U	Permission	Disable	Enable	4.270	4.070	3.000	3.000	50.0	-53.0	0.120	1.0	96.0	12.0	8.0	500	0.900	0.965	56.5														

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

