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

MD1421ExxCPAL series

Outline

MD1421ExxCPAL series are protection IC with integrated MOSFET for protection of the rechargeable lithium-ion or lithiumpolymer 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
   - ・Overcharge detection voltage ... 4.1V to 4.45V, 5mV steps ... Accuracy±20mV
   - ・Overcharge release voltage ... 3.9V to 4.3V ※1 ... Accuracy±50mV
   - ・Overdischarge detection voltage ... 2.0V to 3.0V ※2 ... Accuracy±100mV
   - ・Overdischarge release voltage ... 2.0V to 3.2V ※2 ... Accuracy±100mV
   - ・Discharging overcurrent detection voltage ... +40mV to +180mV, 5mV steps ... Accuracy±5mV
   - ・Charging overcurrent detection voltage ... -180mV to -40mV, 5mV steps ... Accuracy±15mV
   - ・Short detection voltage ... Selection from 0.56V, 0.9V ... Accuracy±100mV
   - ・Over voltage charger detection voltage ... VDD-8.0V fixed ... Accuracy±2.0V
   - ・Over voltage charger release voltage ... VDD-7.3V fixed ... Accuracy±1.5V

   *1 Hysteresis voltagebetween Overcharge detection and release voltage is selectable from 0.10V/0.15V/0.20V/0.25V.
   *2 Please inquire to us about details of the setting of Overdischarge detection and release voltage.

2) Range of detection delay time
   - ・Overcharge detection delay time ... Selection from 1.0s, 4.5s, 6.25s
   - ・Overdischarge detection delay time ... Selection from 100ms, 256ms
   - ・Discharging overcurrent detection delay time ... Selection from 8ms, 12ms, 16ms, 20ms, 34ms
   - ・Charging overcurrent detection delay time ... Selection from 8.5ms, 25ms, 32.5ms
   - ・Short detection delay time ... Selection from 0.50ms, 0.75ms, 1.00ms

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

4) The overcharge detection delay timer reset time function (function for the pulse charge) is provided.

5) Low current consumption
   - ・Normal mode ... Typ. 3.0uA, Max. 5.2uA
   - ・Stand-by mode ... Max. 0.1uA （For "Charger connection release" the overdischarge release condition.）
   - Max. 0.5uA （For "Voltage release" the overdischarge release condition.）

6) MOS-FET
   - ・Source to Source on state resistance ... Typ. 38.0mΩ （ @VCC=3.7V）

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7) Package type
 ・PLP-4-1228   2.85 × 1.25 × 0.60 [mm]

Pin explanations

PLP-4-1228	Pin No.	Symbol	Function
	1	S1	Negative power supply and source of discharge MOS-FET terminal. Connect to the negative terminal of the battery.
	2	VCC	Positive power supply voltage input terminal. Connect to the positive terminal of the battery through R1.
	3	IDT	Charger negative voltage input terminal. Connect to S2 terminal through R2.
	4	S2	Source terminal of charge MOS-FET. Connect to a negative power supply terminal of charger.
	-	D	Drain terminal of discharge and charge MOS-FET. Drain terminal must be open electrically.

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Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage	VCC	-0.3	12	V
Pin voltage	VIDT	VCC-24	VCC+0.3	V
Drain-source voltage	VDSS	-	24	V
Drain current	ID	-	6.0	A
Storage temperature	TSTG	-40	125	℃

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Operating ambient temperature	TOPE	-40	85	℃
Operating voltage	VCCop1	1.5	5.5	V

Electrical characteristics

(Unless otherwise specified,Ta=25℃)

Parameter	Symbol	Note	Min	Typ	Max	Unit
Current consumption						
Current consumption	Icc1	VCC=3.6V, IDT=0V	-	3.0	5.2	uA
Current consumption at stand-by	Icc2	Vdet2＝Vrel2	-	-	0.1	uA
	Icc3	Vdet2≠Vrel2	-	-	0.5	uA
Detection/Release voltage						
Overcharge detection voltage	V1		Typ-0.020	V1	Typ+0.020	V
Overcharge release voltage	V2		Typ-0.050	V2	Typ+0.050	V
Overdischarge release voltage	V3		Typ-0.100	V3	Typ+0.100	V
Overdischarge detection voltage	V4		Typ-0.100	V4	Typ+0.100	V
Discharge Overcurrent detection voltage 1	V5_1	VCC=4.5V	Typ-0.008	V5_1	Typ+0.008	V
Discharge Overcurrent detection voltage 2	V5_2	VCC=3.5V	Typ-0.005	V5_2	Typ+0.005	V
Discharge Overcurrent detection voltage 3	V5_3	VCC=2.5V	Typ-0.008	V5_3	Typ+0.008	V
Short detection voltage	V6		Typ-0.100	V6	Typ+0.100	V
0V battery charge inhibition battery voltage	V7		0.40	0.65	1.10	V
			0.65	0.90	1.25	V
Overvoltage charger detection voltage	V8det		6.0	8.0	10.0	V
Overvoltage charger release voltage	V8rec		5.8	7.3	8.8	V
Charge Overcurrent detection voltage	V9		Typ-0.015	V9	Typ+0.015	V
Detection delay time						
Overdischarge detection delay time	Tsp1		Typ*0.75	Tsp1	Typ*1.25	ms
Discharging overcurrent detection delay time	Tsp2		Typ*0.75	Tsp2	Typ*1.25	ms
Overcharge detection delay time	Tsp3		Typ*0.75	Tsp3	Typ*1.25	s
Short detection delay time	Tsp4		Typ*0.75	Tsp4	Typ*1.25	us
Charging overcurrent detection delay time	Tsp5		Typ*0.75	Tsp5	Typ*1.25	ms
MOS-FET						
Drain current of cut off	IDSS	VDS=24V	-	-	1.0	uA
Source to source on state resistance 1	RSS(on)1	VCC=4.5V , Is=1.0A	27.0	36.0	45.0	mΩ
Source to source on state resistance 2	RSS(on)2	VCC=3.5V , Is=1.0A	30.0	39.0	48.0	mΩ
Source to source on state resistance 3	RSS(on)3	VCC=2.5V , Is=1.0A	33.0	48.0	65.0	mΩ
Body diode forward voltage	VSD	Is=1A	0.50	0.70	1.00	V

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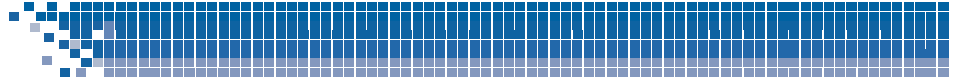
Block diagram / Typical application circuit
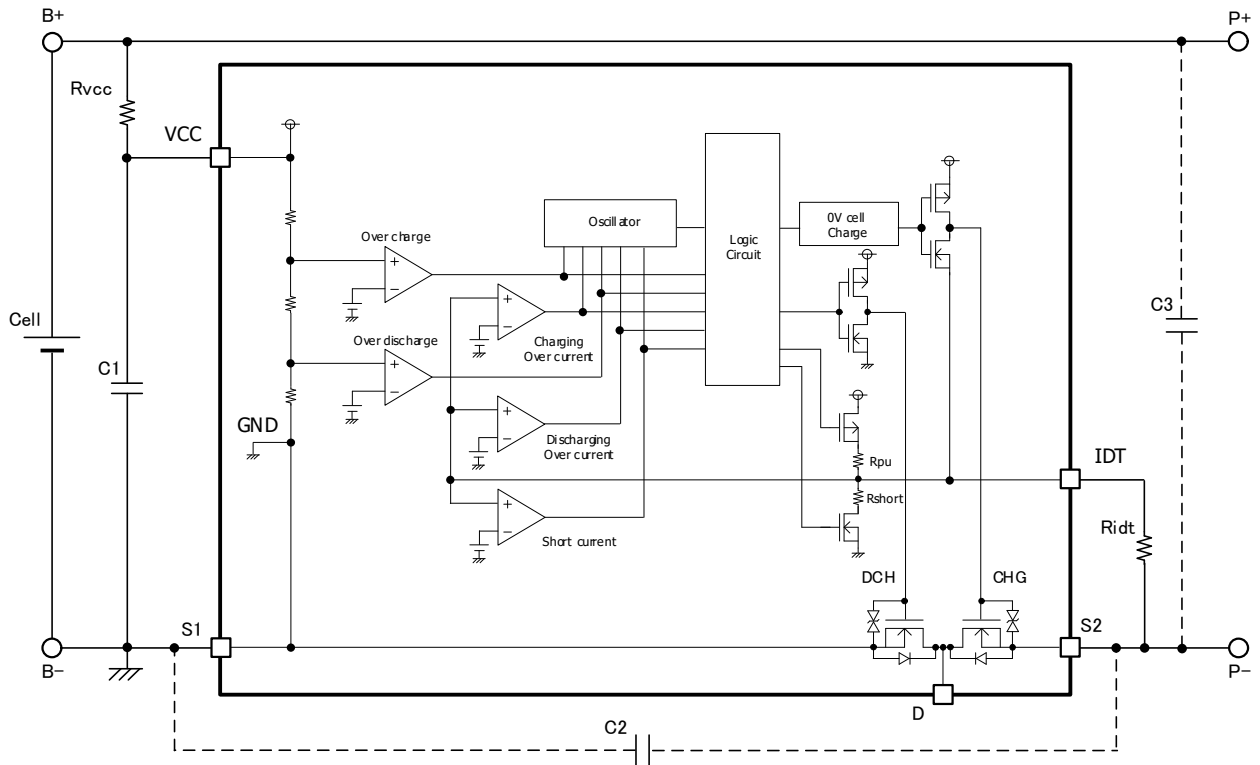
Symbol	Part	Min.	Typ.	Max.	Unit
Rvcc	Resistor	-	33	470	Ω
C1/C2/C3	Capacitor	0.01	0.1	1.0	uF
Ridt	Resistor	-	2.7k	-	Ω

※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.