



Battery Protection IC for 2-Serial-Cell Pack

Features

- ◆ High-accuracy voltage detection function for each cell
 - Overcharge detection voltage n (n = 1, 2) 3.550 V to 4.600 V (5 mV steps) Accuracy ± 20 mV (Ta = +25°C) Accuracy ± 25 mV (Ta = -10°C to +60°C)
 - Overcharge release voltage n (n = 1, 2) 3.150 V to 4.600 V ^{Note 1} Accuracy ± 30 mV
 - Overdischarge detection voltage n (n = 1, 2) 2.000 V to 3.000 V (10 mV steps) Accuracy ± 50 mV
 - Overdischarge release voltage n (n = 1, 2) 2.000 V to 3.400 V ^{Note 2} Accuracy ± 100 mV
 - Discharge overcurrent detection voltage 0.050 V to 0.400 V (10 mV steps) Accuracy ± 10 mV
 - Load short-circuiting detection voltage 0.500 V to 0.900 V (50 mV steps) Accuracy ± 100 mV
 - Charge overcurrent detection voltage -0.400 V to -0.050 V (25 mV steps) Accuracy ± 20 mV
- ◆ Charge overcurrent detection function "available" / "unavailable" is selectable.
- ◆ Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
 - Accuracy $\pm 20\%$
- ◆ High-withstand voltage (VM pin and CO pin: Absolute maximum rating = 28 V)

- ◆ 0 V battery charge function "available" / "unavailable" is selectable.
- ◆ Wide operation temperature range Ta = -40°C to +85°C
- ◆ Low current consumption
 - During operation 8.0 μ A max. (Ta = +25°C)
 - During power-down 0.1 μ A max. (Ta = +25°C)
- ◆ Lead-free (Sn 100%), halogen-free
- ◆ 6-Pin SOT23-6 Package

Applications

- ◆ Lithium-ion rechargeable battery pack
- ◆ Lithium polymer rechargeable battery pack

Note:

- (1) Overcharge release voltage = Overcharge detection voltage - Overcharge hysteresis voltage (Overcharge hysteresis voltage n (n = 1, 2) can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV steps.)
- (2) Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage (Overdischarge hysteresis voltage n (n = 1, 2) can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV steps.)



Order Information

Part Number	Over charge Detection Voltage	Over charge Release Voltage	Over discharge Detection Voltage	Over discharge Release Voltage	Discharge Over current Detection Voltage	LoadShort circuiting Detection Voltage	Charge Over current Detection Voltage	0 V Battery Charge Function	Power down Function	Delay Time ^{Note}
HL5100 SOAA	4.280	4.080	2.000	2.000	0.200	0.500	-0.100	Unavailable	Available	(1)
HL5100 SOAB	4.325	4.075	2.200	2.900	0.210	0.500	-0.200	Unavailable	Available	(1)
HL5100 SOAC	4.300	4.100	2.400	3.000	0.200	0.500	-0.200	Unavailable	Available	(1)
HL5100 SOAD	4.280	4.130	2.400	2.900	0.150	0.500	-0.150	Unavailable	Available	(1)
HL5100 SOAE	4.350	4.150	2.300	3.000	0.300	0.500	-0.300	Available	Available	(1)
HL5100 SOAF	4.350	4.100	2.400	3.000	0.150	0.500	-0.150	Available	Available	(1)
HL5100 SOAG	4.300	4.150	2.800	3.000	0.150	0.500	-0.150	Available	Available	(1)
HL5100 SOAH	4.250	4.100	3.000	3.000	0.200	0.500	-0.200	Available	Available	(1)
HL5100 SOAI	3.650	3.450	2.000	2.700	0.200	0.500	-0.200	Available	Unavailable	(1)
HL5100 SOAJ	3.900	3.500	2.000	2.500	0.200	0.500	-0.200	Available	Unavailable	(1)
HL5100 SOAK	4.350	4.150	2.300	3.000	0.200	0.500	-0.200	Available	Available	(1)
HL5100 SOAL	4.200	4.050	2.500	3.000	0.200	0.500	-0.200	Unavailable	Available	(1)
HL5100 SOAO	4.250	4.100	2.500	3.000	0.200	0.500	-0.100	Unavailable	Available	(1)
HL5100 SOAP	4.350	4.150	2.200	2.900	0.200	0.500	-0.400	Unavailable	Available	(1)
HL5100	4.300	4.100	2.600	3.000	0.400	0.500	-0.400	Unavailable	Available	(1)



HL5100

SOAQ								able	ble	
HL5100 SOAR	4.300	4.100	2.600	3.000	0.400	0.500	-	Unavail able	Availa ble	(3)
HL5100 SOAS	4.250	4.050	2.500	3.000	0.200	0.500	-0.200	Availabl e	Unavai lable	(1)
HL5100 SOAT	4.250	4.100	2.700	3.000	0.120	0.500	-0.050	Availabl e	Availa ble	(1)
HL5100 SOAU	4.275	4.075	2.500	2.900	0.300	0.500	-0.100	Availabl e	Availa ble	(1)
HL5100 SOAV	4.400	4.250	2.500	2.900	0.150	0.500	-0.100	Availabl e	Availa ble	(1)
HL5100 SOAW	4.350	4.150	2.300	3.000	0.200	0.500	-0.400	Unavail able	Availa ble	(1)
HL5100 SOAX	4.230	4.030	2.750	3.050	0.150	0.500	-0.100	Unavail able	Availa ble	(1)
HL5100 SOAY	4.250	4.050	3.000	3.200	0.150	0.500	-0.050	Unavail able	Availa ble	(2)
HL5100 SOAZ	4.225	4.075	2.400	2.900	0.150	0.500	-0.150	Unavail able	Availa ble	(1)
HL5100 SOBA	4.300	4.150	3.000	3.100	0.100	0.500	-0.150	Availabl e	Availa ble	(1)
HL5100 SOBB	4.300	4.100	2.000	2.000	0.120	0.500	-	Availabl e	Availa ble	(3)
HL5100 SOBC	4.300	4.100	2.000	2.000	0.055	0.500	-	Availabl e	Availa ble	(3)
HL5100 SOBD	4.300	4.100	2.400	3.000	0.200	0.500	-0.200	Unavail able	Availa ble	(4)
HL5100 SOBE	4.225	4.075	2.400	2.900	0.100	0.500	-0.100	Unavail able	Availa ble	(1)
HL5100 SOBF	4.300	4.100	2.400	2.400	0.100	0.500	-0.100	Availabl e	Availa ble	(1)
HL5100 SOBG	4.280	4.130	2.400	2.900	0.150	0.500	-0.150	Unavail able	Unavai lable	(1)
HL5100 SOBH	4.300	4.100	2.400	2.400	0.150	0.500	-	Availabl e	Availa ble	(1)
HL5100 SOBI	4.425	4.225	2.500	2.800	0.150	0.500	-0.100	Unavail able	Unavai lable	(1)



HL5100

HL5100 SOBQ	4.300	4.100	2.370	2.970	0.210	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOBR	4.300	4.100	2.300	2.700	0.280	0.500	-0.250	Unavail able	Availa ble	(1)
HL5100 SOBS	4.350	4.150	2.000	2.400	0.250	0.500	-0.400	Unavail able	Availa ble	(1)
HL5100 SOBT	4.450	4.250	2.300	2.700	0.280	0.500	-0.250	Unavail able	Availa ble	(1)
HL5100 SOBU	4.500	4.300	2.000	2.400	0.250	0.500	-0.400	Unavail able	Availa ble	(1)
HL5100 SOBV	4.300	4.100	2.370	2.570	0.210	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOBW	4.300	4.100	2.370	2.570	0.400	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOBX	4.350	4.150	2.100	2.400	0.250	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOBY	4.450	4.250	2.300	2.700	0.370	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOBZ	4.500	4.300	2.000	2.400	0.200	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOCA	4.300	4.150	2.800	3.000	0.150	0.500	-	Availabl e	Availa ble	(5)
HL5100 SOCB	4.300	4.100	2.270	2.370	0.210	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOCC	4.300	4.100	2.280	2.380	0.250	0.500	-	Unavail able	Unavai lable	(3)
HL5100 SOCE	4.300	4.100	2.230	2.930	0.080	0.500	-0.075	Unavail able	Availa ble	(1)
HL5100 SOCF	4.225	4.075	2.400	2.900	0.190	0.500	-0.100	Unavail able	Availa ble	(5)
HL5100 SOCI	4.440	4.250	2.750	3.050	0.150	0.500	-0.100	Unavail able	Availa ble	(1)
HL5100 SOCM	4.375	4.225	2.800	3.000	0.130	0.500	-0.075	Unavail able	Availa ble	(6)
HL5100 SOCN	4.280	4.180	2.500	3.000	0.250	0.500	-0.200	Availabl e	Unavai lab	(7)



HL5100 SOCO	4.300	4.100	2.300	2.700	0.280	0.500	-0.125	Unavail able	Availa ble	(5)
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Note:

Refer to Table 1 about the details of the delay time combinations.



Delay Time Combination	Overcharge Detection Delay Time [t _{cu}]	Overdischarge Detection Delay Time [t _{dL}]	Discharge Overcurrent Detection Delay Time [t _{dIOV}]	Load Short-circuiting Detection Delay Time [t _{SHORT}]	Charge Overcurrent Detection Delay Time [t _{cIOV}]
(1)	1.0 s	128 ms	8 ms	280 us	
(2)	1.0 s	512 ms	8 ms	280 us	
(3)	1.0 s	128 ms	8 ms	280 us	
(4)	1.0 s	128 ms	8 ms	1ms	
(5)	1.0 s	128 ms	16 ms	280 us	
(6)	1.0 s	128 ms	32 ms	280 us	
(7)	1.0 s	512 ms	8 ms	1ms	

Table1 Delay Time

Remark The delay times can be changed within the range listed Table 5. For details, please contact our sales office.

Delay Time	Symbol	Selection Range			Remark
Overcharge detection delay time	t _{cu}	256	512 ms	1.0	Select a value from the left.
Overdischarge detection delay time	t _{dL}	32	64	128	Select a value from the left.
Discharge overcurrent detection delay time	t _{dIOV}	4	8	16	Select a value from the left.
Load short-circuiting detection delay time	t _{SHORT}	280us	500us	1ms	Select a value from the left.
Charge overcurrent detection delay time	t _{cIOV}	4ms	8ms	16ms	Select a value from the left.

Table 2 Delay Time



Typical Application Diagram

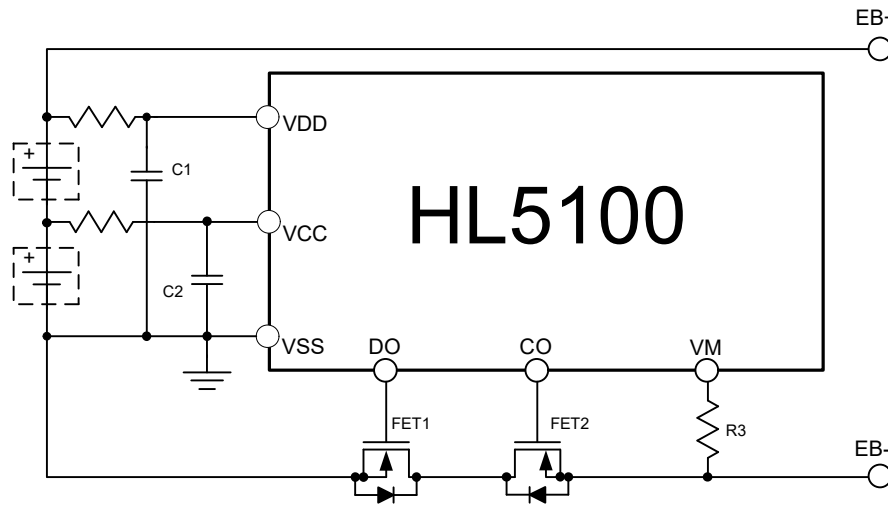


Figure 1 HL5100 Typical Application Diagram

Component	Part	Typ	Min	Max	Remark
FET1	N-channel MOS FET	-	-	-	Threshold voltage \leq Overdischarge detection voltage* ^{Note2} Gate to source withstand voltage \geq Charger voltage* ^{Note3}
FET2	N-channel MOS FET	-	-	-	Threshold voltage \leq Overdischarge detection voltage* ² Gate to source withstand voltage \geq Charger voltage* ^{Note3}
R1,R2	Resistor	470 Ω	150 Ω * ^{Note 1}	1k Ω * ^{Note 1}	Resistance should be as small as possible to avoid lowering the overcharge detection accuracy due to current consumption. * ^{Note4}
C1,C2	Capacitor	0.1 μ F	0.068 μ F* ^{Note1}	1.0 μ F* ^{Note1}	Connect a capacitor of 0.068 μ F or higher between VDD pin and VSS pin. * ^{Note5}
R3	Resistor	2k Ω	300 Ω * ^{Note 1}	4k Ω * ^{Note 1}	Select as large a resistance as possible to prevent current when a charger is connected in reverse. * ^{Note6}

Table 3 Recommended Component list

**Note:**

- (1) Please set up a filter constant to be $R1 \cdot C1 = R2 \cdot C2$.
- (2) If the threshold voltage of an FET is low, the FET may not cut the charge current. If an FET with a threshold voltage equal to or higher than the overdischarge detection voltage is used, discharging may be stopped before overdischarge is detected.
- (3) If the withstand voltage between the gate and source is equal to or lower than the charger voltage, the FET may be destroyed.
- (4) An accuracy of overcharge detection voltage is guaranteed by $R1 = 470\Omega$. Connecting resistors with other values worsen the accuracy. In case of connecting larger resistor to R1, the voltage between the VDD pin and VSS pin may exceed the absolute maximum rating because the current flows to the HL5100 Series from the charger due to reverse connection of charger. Connect a resistor of 150Ω or more to R1 for ESD protection.
- (5) When connecting a resistor of 150Ω or less to R1 or R2 or a capacitor of $0.068\mu\text{F}$ or less to C1 or C2, the HL5100 Series may malfunction when power dissipation is largely fluctuated.
- (6) When a resistor of $4\text{ k}\Omega$ or more is connected to R3, the charge current may not be cut.



Description

HL5100 Series is a protection IC for 2-serial-cell lithium-ion /lithium polymer rechargeable batteries and includes high accuracy voltage detection circuits and delay circuits.

The HL5100 Series is suitable for protecting 2-serial-cell rechargeable lithium-ion / lithium polymer battery packs from overcharge, overdischarge, and overcurrent.

HL5100 is available in a 6-pin SOT23 package.



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