General Description

The EC9526 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, Topr=+25℃）

1) Range and accuracy of detection/release voltage

・Overcharge detection voltage	4.0V to 4.5V, 5mV steps	Accuracy±20mV Accuracy±25mV（Topr=-5 to +60℃）
・Overcharge release voltage	3.9V 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	-50mV to -300mV, 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) Absolute maximum ratings

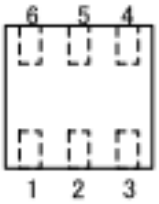
・VDD pin	VSS-0.3V to 12V
・COUT pin and V- pin	VDD-28V to VDD+0.3V
・DOUT pin	VSS-0.3V to VDD+0.3V
・Storage temperature	-55 to +125℃
・Operation temperature	-40 to +85℃

6) Package type

・SSON-6J	1.40 × 1.40 × 0.55（mm）
・SON-6C	1.60 × 2.00 × 0.60（mm）

Pin Assignments

(SSON-6J)



(SON-6C)

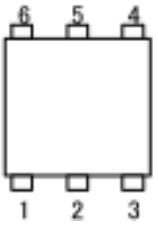


Figure 1. Pin Assignment Diagram (DFN and SON Package)

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.

Ordering Information

EC9526VVV XX X

R=Tape & Reel

Package Type

FS：SON-6C

FX：SSON-6J

※ VVV：Please check the following table 1.

PRODUCT LINEUP

			Detection / Release voltage						
Product name	Package	0V battery charge function	Overcharge detection voltage	Overcharge release voltage	Overdischarge detection voltage	Overdischarge release voltage	Discharging overcurrent detection voltage	Charging overcurrent detection voltage	Detections delay time combination ※ (Table 2)
			Vdet1	Vrel1	Vdet2	Vrel2	Vdet3	Vdet4	
EC9526A16FSR	SON6C	Permission	4.275	4.175	2.300	2.400	0.100	-0.100	1
EC9526A26FSR	SON6C	Permission	4.280	4.080	2.300	2.300	0.080	-0.100	1
EC9526A36FSR	SON6C	Permission	4.280	4.080	2.300	2.300	0.100	-0.100	1
EC9526A46FSR	SON6C	Permission	4.275	4.075	2.300	2.300	0.150	-0.100	1
EC9526A56FSR	SON6C	Permission	4.280	4.280	2.800	2.800	0.050	-0.100	1
EC9526A66FSR	SON6C	Permission	4.280	4.280	3.000	3.000	0.075	-0.100	1
EC9526A76FSR	SON6C	Permission	4.275	4.175	2.300	2.400	0.050	-0.100	1
EC9526A86FSR	SON6C	Permission	4.300	4.100	2.300	2.300	0.130	-0.100	1
EC9526B16FSR	SON6C	Permission	3.900	3.800	2.300	2.400	0.100	-0.100	1
EC9526B26FSR	SON6C	Permission	3.950	3.850	2.300	2.400	0.100	-0.100	1
EC9526B36FSR	SON6C	Permission	4.000	3.900	2.300	2.400	0.100	-0.100	1
EC9526B46FSR	SON6C	Permission	4.050	3.950	2.300	2.400	0.100	-0.100	1
EC9526B56FSR	SON6C	Permission	4.100	4.000	2.300	2.400	0.100	-0.100	1
EC9526C16FSR	SON6C	**Prohibition**	4.280	4.080	2.300	2.300	0.100	-0.100	1
EC9526C26FSR	SON6C	**Prohibition**	4.280	4.080	2.300	2.300	0.130	-0.100	1
EC9526C36FSR	SON6C	**Prohibition**	4.280	4.130	2.600	3.100	0.150	-0.100	1
EC9526C46FSR	SON6C	**Prohibition**	4.280	4.130	2.800	3.100	0.150	-0.100	1
EC9526C56FSR	SON6C	**Prohibition**	4.200	4.100	2.800	2.900	0.150	-0.100	1
EC9526C66FSR	SON6C	**Prohibition**	4.280	4.130	2.800	3.100	0.100	-0.100	1
EC9526C76FSR	SON6C	**Prohibition**	4.280	4.130	2.800	3.100	0.050	-0.100	1
EC9526E16FSR	SON6C	Permission	4.325	4.075	2.500	2.900	0.150	-0.100	2
EC9526F16FSR	SON6C	**Prohibition**	4.325	4.075	2.500	2.900	0.150	-0.100	2
EC9526G16FSR	SON6C	Permission	4.350	4.150	2.300	3.000	0.200	-0.100	3
EC9526H16FSR	SON6C	Permission	4.280	4.180	2.300	2.300	0.120	-0.100	4
EC9526H26FSR	SON6C	Permission	4.275	4.075	2.800	3.100	0.100	-0.100	4
EC9526H36FSR	SON6C	Permission	4.275	4.175	2.300	2.300	0.120	-0.100	4
EC9526H46FSR	SON6C	Permission	4.275	4.175	2.400	2.400	0.100	-0.100	4
EC9526J16FSR	SON6C	**Prohibition**	4.280	4.180	2.300	2.300	0.120	-0.100	4
EC9526K16FSR	SON6C	Permission	4.275	4.275	2.300	2.300	0.100	-0.100	5
EC9526K26FXR	SSON6J	Permission	4.275	4.075	2.300	2.300	0.120	-0.100	5
EC9526K26FSR	SON6C	Permission	4.275	4.075	2.300	2.300	0.120	-0.100	5
EC9526K36FXR	SSON6J	Permission	4.275	4.075	2.300	2.300	0.130	-0.100	5
EC9526K36FSR	SON6C	Permission	4.275	4.075	2.300	2.300	0.130	-0.100	5
EC9526K46FXR	SSON6J	Permission	4.275	4.075	2.300	2.300	0.150	-0.100	5
EC9526K46FSR	SON6C	Permission	4.275	4.075	2.300	2.300	0.150	-0.100	5
EC9526K56FSR	SON6C	Permission	4.275	4.275	2.300	2.300	0.050	-0.100	5
EC9526K66FXR	SSON6J	Permission	4.270	4.070	2.300	2.300	0.100	-0.100	5
EC9526K66FSR	SON6C	Permission	4.270	4.270	2.300	2.300	0.100	-0.100	5
EC9526K76FSR	SON6C	Permission	4.275	4.075	2.300	2.300	0.130	-0.130	5
EC9526K86FXR	SSON6J	Permission	4.275	4.075	2.600	2.600	0.110	-0.085	5
EC9526K86FSR	SON6C	Permission	4.275	4.075	2.600	2.600	0.110	-0.085	5
EC9526K96FSR	SON6C	Permission	4.275	4.075	2.600	2.600	0.190	-0.085	5
EC9526L16FXR	SSON6J	Permission	4.275	4.075	2.600	2.600	0.100	-0.085	5
EC9526L16FSR	SON6C	Permission	4.275	4.075	2.600	2.600	0.100	-0.085	5
EC9526L26FSR	SON6C	Permission	4.275	4.075	3.400	3.400	0.100	-0.085	5
EC9526L36FXR	SSON6J	Permission	4.275	4.075	2.600	2.600	0.180	-0.120	5
EC9526L36FSR	SON6C	Permission	4.275	4.075	2.600	2.600	0.180	-0.120	5
EC9526L56FSR	SON6C	Permission	4.350	4.150	2.300	2.300	0.130	-0.100	5

			Detection / Release voltage						
Product name	Package	0V battery charge function	Overcharge detection voltage	Overcharge release voltage	Overdischarge detection voltage	Overdischarge release voltage	Discharging overcurrent detection voltage	Charging overcurrent detection voltage	Detections delay time combination ※ (Table 2)
			Vdet1	Vrel1	Vdet2	Vrel2	Vdet3	Vdet4	
EC9526N16FSR	SON6C	**Prohibition**	4.280	4.080	2.400	2.400	0.050	-0.100	6
EC9526P16FSR	SON6C	**Prohibition**	4.225	4.125	2.000	2.000	0.200	-0.100	7
EC9526T16FSR	SON6C	Permission	4.225	4.225	2.500	2.900	0.150	-0.150	8
EC9526W16FSR	SON6C	Permission	4.225	4.025	2.500	2.900	0.150	-0.150	8
EC9526W26FSR	SON6C	Permission	4.375	4.175	2.400	2.800	0.145	-0.145	8

(Table 1)

※ Detection delay time combination

		1	2	3	4	5	6	7	8
Overcharge detection delay time	tVdet1	1.2s	1.2s	143ms	1.2s	1.2s	1.2s	573ms	1.0s
Overdischarge detection delay time	tVdet2	150ms	150ms	38ms	150ms	38ms	150ms	150ms	96ms
Discharging overcurrent detection delay time	tVdet3	9ms	9ms	18ms	18ms	9ms	4.5ms	4.5ms	12ms
Charging overcurrent detection delay time	tVdet4	9ms	9ms	9ms	9ms	9ms	9ms	4.5ms	6ms
Short detection delay time	tshort	300us	400us	300us	300us	300us	300us	300us	400us

(Table 2)

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, Topr=+25℃

Parameter	Symbol	Conditions	Min.	Typ.	Max.	unit
INPUT/OUTPUT VOLTAGE						
Operating input voltage	VDD1	VDD-VSS	1.5	-	5.5	V
Maximum forbidden voltage for 0V charging※	Vst	"Prohibition" function	0.6	0.9	1.2	V
Minimum operating voltage for 0V charging※	Vst	"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,	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,	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		-	-	0.1	uA
DETECTION/RELEASE VOLTAGE						
Overcharge detection voltage	Vdet1	Ta=+25℃	Typ-0.020	Vdet1	Typ+0.020	V
Overcharge detection voltage	Vdet1	Ta=-5～+60℃	Typ-0.025	Vdet1	Typ+0.025	V
Overcharge release voltage※2	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※3	Vrel2	Vdet2≠Vrel2	Typ-0.10	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	tshort		Typ*0.8	tshort	Typ*1.2	us

※1 0V battery charge function is selected from "Prohibition" or "Permission".

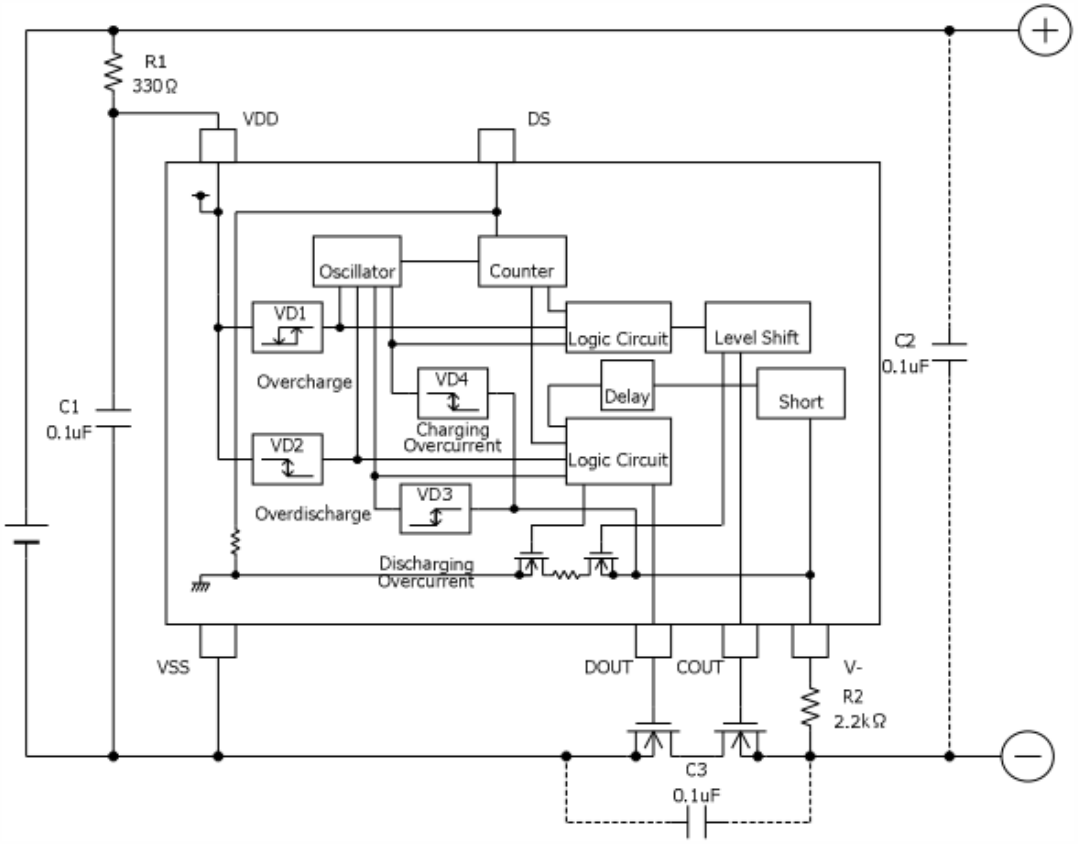
※2 There is occasion as follows of two kinds of release condition from the overcharge status.

a) In the case that the V- pin voltage is lower than the discharging overcurrent detection voltage (Vdet4), EC9526 releases the overcharge status when the battery voltage falls below the overcharge release voltage(Vrel1).

b) In the case that the V- pin voltage is higher than or equal to the discharging overcurrent detection voltage (Vdet4), EC9526 releases the overcharge status when the battery voltage falls below the overcharge detection voltage (Vdet1).This is a hysteresis cancellation function.

※3 The release condition from the overdischarge status is that the charger is connected and the V- pin voltage is lower than the discharging overcurrent detection voltage (Vdet3), and the battery voltage rise more then the overdischarge release voltage(Vrel2).

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 0.01uF or more to do the stability operation, please.

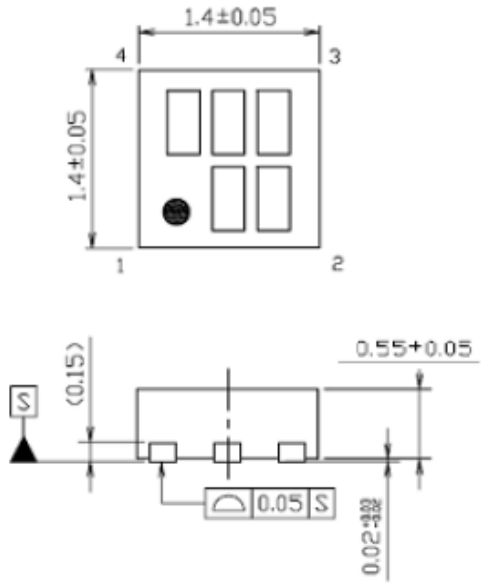
R1 and R2 resistors are current limit resistance if a charger is connected reversibly or a high-voltage charger that exceeds the absolute maximum rating is connected. R1 and R2 may cause a power consumption will be over rating of power dissipation, therefore the `R1+R2` should be more than 1kohm. Moreover, if R2 is too enlarged, the charger connection release cannot be occasionally done after the overdischarge is detected, so adjust the value of R2 to 10kohm or less, please.

C2 and C3 capacitors have effect that the system stability about voltage ripple or extraneous noise. After check characteristics, decide that these capacitors should be inserted or not, where should be inserted, and capacitance value, please.

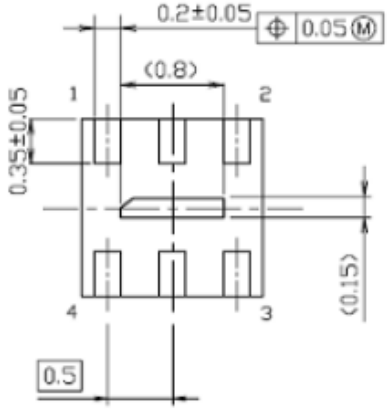
Package Information

SSON-6J

(Top View)

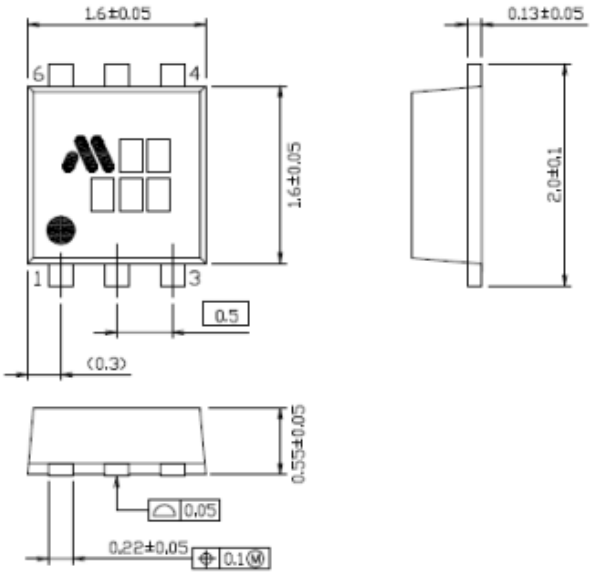


(Bottom View)



SON-6C

(Top View)



(Bottom View)

