

RECHARGEABLE LITHIUM-ION CELL PROTECTORS

RV5VG1~~XXX~~SERIES

EK-080-9803

OUTLINE

The RV5VG1 series Li-ion cell protectors are circuits designed for detecting overcharging and excessive discharging of rechargeable single-cell lithium-ion batteries (based on the CMOS process). Besides detecting overcharging or excessive discharging of single cell Li-ion battery, the RV5VG1 series Li-ion cell protectors include a short-circuit protector to prevent excessive current due to an external short-circuit.

Each of these protectors comprise two voltage detectors, a hysteresis circuit, a reference voltage source, a logic circuit, a short-circuit protector and a charger connection detection-circuit. Of the two voltage detectors, VD1 detects overcharging (rising edge of waveform) while VD2 detects excessive discharging (falling edge of waveform). Voltage output switches to a low (“L”) state if either a rising or falling voltage level is detected. When a short protection circuit is activated while DOUT output is at “H” level, DOUT output switches to “L” level after internally set delay time, which, in turn, switches to “H” level when short is cleared. Required current after detection of over-discharge is suppressed to minimum by stopping the internal circuit.

Using an external capacitor, the output delay time of the voltage detector for excessive discharge/overcharge can be set.

The series employ CMOS output type.

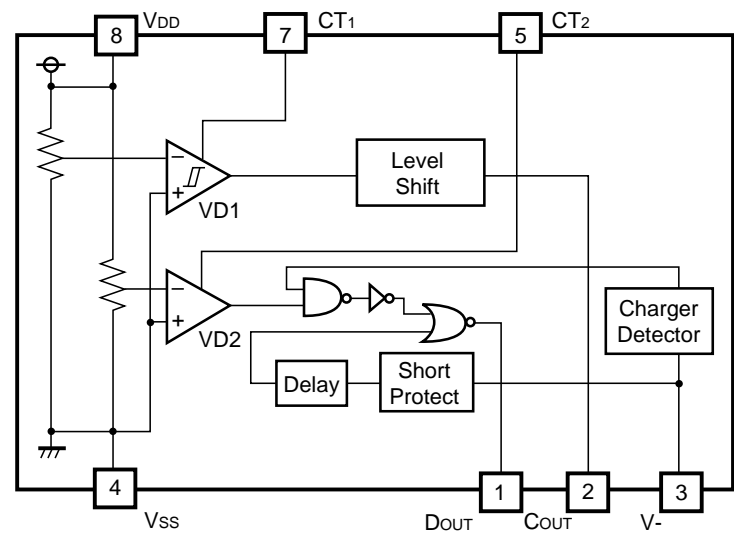
FEATURES

- | | | |
|---|---|--------------------------|
| • Low Supply Current | TYP. 2.3μA (for normal operations) | |
| • High Accuracy Detector Threshold..... | over-charge | ±50mV |
| | over-discharge | ±2.5% |
| • Variety of Detector Threshold | over-charge | 4.0 to 4.5 V(0.05V step) |
| | over-discharge | 2.0 to 3.0V(0.05V step) |
| • Built-in Protection Circuit | | |
| • Short protection voltage may be set insteps 0.05V within the range of 0.1V to 0.4V (accuracy±15%) | | |
| • Adustable sensing delay for overcharging | delay of 43ms when external 1000pF is installed
(VDD=4.3V) | |
| • Adjustable sensing delay for excessive discharging..... | delay of 24ms when external 1000pF is installed
(VDD=2.4V) | |
| • Output Type | CMOS | |
| • Small Package | 8pin SSOP | |

APPLICATIONS

- Li-ion single cell protectors for power pack.
- High precision protectors for cellular phones, camcorders and any other gadgets using Li-ion cell.

BLOCK DIAGRAM



SELECTION GUIDE

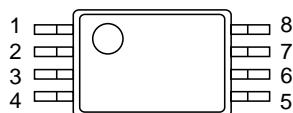
In the RV5VG1 series, the overcharge/excessive discharge detector threshold, respective hysteresis ranges, short-circuit detector threshold and taping type can be selected at the user's request. The selection can be made by designating the part number as shown belows.

RV5VG1- - Part Number
 ↑ ↑ ↑
 a b c

Code	Contents
a	Development serial number for overcharging/excessive discharge detector threshold, hysteresis ranges, and short-circuit detector threshold.
b	Designation of release conditions of voltage detector. C : VD1 (After over-charge detection).....when battery voltage falls below VDET1–VHYS1 or a load resistance is applied. VD2 (After excessive-discharge detection).....when a charger is connected. D : VD1 (After over-charge detection).....when battery voltage falls below VDET1–VHYS1. VD2 (After excessive-discharge detection)when battery voltage rises above VDET2+VHYS2 or a charger is connected.
c	Designation of Taping Type: EX. 8pin SSOP: E1, E2 (refer Taping Specifications) “E2” is prescribed as a standard.

PIN CONFIGURATION

• 8pin SSOP (0.65mm pitch)



PIN DESCRIPTION

Pin No.	Symbol	Pin Description
1	DOUT	Output Pin of over-discharge detection, CMOS output
2	COUT	Output Pin of over-charge detection, CMOS output
3	V-	Pin for charger negative input
4	VSS	Ground Pin
5	CT2	Pin for external capacitor for setting output delay of VD2
6	NC	No connection
7	CT1	Pin for external capacitor for setting output delay of VD1
8	VDD	Power supply Pin

ABSOLUTE MAXIMUM RATINGS

 $T_{opt}=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$

Symbol	Item		Ratings	Unit
V_{DD}	Supply Voltage		-0.3 to +12	V
V_{-}	Input Voltage	V-pin	$V_{DD}-12$ to $V_{DD}+0.3$	V
V_{CT1}, V_{CT2}		CT1, CT2 pin	$V_{SS}-0.3$ to $V_{DD}+0.3$	V
V_{COUT}	Output Voltage	COUT pin	$V_{DD}-12$ to $V_{DD}+0.3$	V
V_{DOUT}		DOUT pin	$V_{SS}-0.3$ to $V_{DD}+0.3$	V
P_D	Power Dissipation		300	mW
T_{opt}	Operating Temperature Range		-30 to +80	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range		-55 to +125	$^{\circ}\text{C}$
T_{solder}	Lead Temperature (Soldering)		260 $^{\circ}\text{C}$, 10s	

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are threshold limit values that must not be exceeded even for an instant under any conditions. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

ELECTRICAL CHARACTERISTICS

• RV5VG101C

T_{opt}=25°C

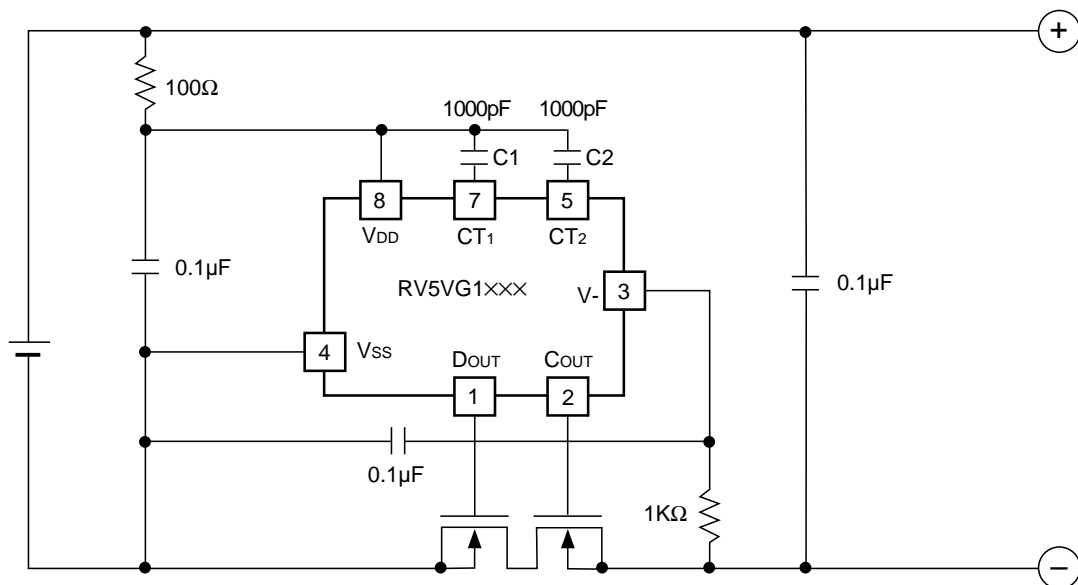
Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit.
V _{DD1}	Operating Input Voltage	V _{DD} to V _{SS}	1.2		5	V
V _{DD2}		V _{DD} to V ₋	1.2		10	V
V _{DET1}	Over-charge Detector Threshold	Voltage rising edge detection	4.20	4.25	4.30	V
V _{HYS1}	Over-charge Detector Hysteresis Range		0.15	0.20	0.25	V
t _{VDET1}	V _{DET1} Output Delay Time	C1=1000pF, V _{DD} =3.6V-4.3V	22	43	86	ms
V _{DET2}	Over-discharge Detector Threshold	Voltage falling edge detection	2.437	2.50	2.563	V
t _{VDET2}	V _{DET2} Output Delay Time	C2=1000pF, V _{DD} =3.6V-2.4V	12	24	48	ms
V _{short}	Short protection Voltage	V _{DD} =3.9V	0.17	0.2	0.23	V
t _{short1}	Short protection Delay Time	V _{DD} =3.0V, V ₋ =0V-1V	2.4	4.8	9.6	ms
t _{short2}		V _{DD} =2.0V, V ₋ =0V-1V	1.4	2.8	5.6	
V _{OL1}	C _{OUT} Nch Tr. ON Voltage	I _{OL} =100μA, V _{DD} =4.4V		0.17	0.5	V
V _{OH1}	C _{OUT} Pch Tr. ON Voltage	I _{OH} =-100μA, V _{DD} =3.9V	3.4	3.73		V
V _{OL2}	D _{OUT} Nch Tr. ON Voltage	I _{OL} =100μA, V _{DD} =2.4V		0.17	0.5	V
V _{OH2}	D _{OUT} Pch Tr. ON Voltage	I _{OH} =-100μA, V _{DD} =3.9V	3.4	3.73		V
I _{DD}	Supply Current	V _{DD} =3.9V, V ₋ =0V		2.3	5.0	μA
I _{standby}	Standby Current	V _{DD} =2.4V, V ₋ =2.4V		0.2	2.5	μA
V _{chg}	Charger Sense Minimum Voltage	V _{DD} =3.3V		0.13	0.2	V
R _{short}	V ₋ pin pull down resistance	V _{DD} =3.9V, V ₋ =1.0V	65	130	260	kΩ

• RV5VG101D

T_{opt}=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit.
V _{DD1}	Operating Input Voltage	V _{DD} to V _{SS}	1.2		5	V
V _{DD2}		V _{DD} to V-	1.2		10	V
V _{DET1}	Over-charge Detector Threshold	Voltage rising edge detection	4.20	4.25	4.30	V
V _{HYS1}	Over-charge Detector Hysteresis Range		0.15	0.2	0.25	V
t _{VDET1}	V _{DET1} Output Delay Time	C1=1000pF, V _{DD} =3.6V-4.3V	22	43	86	ms
V _{DET2}	Over-discharge Detector Threshold	Voltage falling edge detection	2.437	2.50	2.563	V
V _{HYS2}	Over-discharge Detector Hysteresis Range		0.50	0.60	0.70	V
t _{VDET2}	V _{DET2} Output Delay Time	C2=1000pF, V _{DD} =3.6V-2.4V	12	24	48	ms
V _{short}	Short protection Voltage	V _{DD} =3.9V	0.17	0.2	0.23	V
t _{short1}	Short protection Delay Time	V _{DD} =3.0V, V-=0V-4V	2.4	4.8	9.6	ms
t _{short2}		V _{DD} =2.0V, V-=0V-4V	1.4	2.8	5.6	
V _{OL1}	C _{OUT} Nch Tr. ON Voltage	I _{OL} =100μA, V _{DD} =4.4V		0.17	0.5	V
V _{OH1}	C _{OUT} Pch Tr. ON Voltage	I _{OH} =-100μA, V _{DD} =3.9V	3.4	3.73		V
V _{OL2}	D _{OUT} Nch Tr. ON Voltage	I _{OL} =100μA, V _{DD} =2.4V		0.17	0.5	V
V _{OH2}	D _{OUT} Pch Tr. ON Voltage	I _{OH} =-100μA, V _{DD} =3.9V	3.4	3.73		V
I _{DD}	Supply Current	V _{DD} =3.9V, V-=0V		2.3	5.0	μA
I _{standby}	Standby Current	V _{DD} =2.4V, V-=2.4V		1.0	2.5	μA
V _{chg}	Charger Sense Minimum Voltage	V _{DD} =2.9V		0.1	0.2	V
R _{short}	V- pin pull down resistance	V _{DD} =3.9V, V-=1.0V	65	130	260	kΩ

TYPICAL APPLICATION



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1995 June

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