

RECHARGEABLE LITHIUM-ION CELL PROTECTORS

RV5VG1XXSERIES

EK-080-9803

OUTLINE

The RV5VG***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.

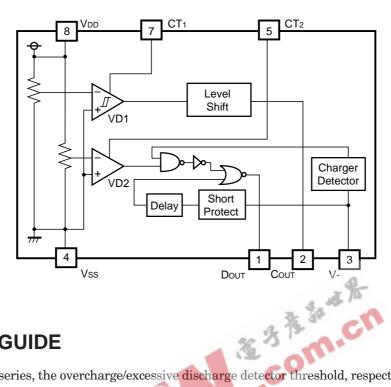
FEATURES

• Low Supply Current	·TYP. 2.3μA (for no	rmal operations)				
• High Accuracy Detector Threshold	··over-charge	$\pm 50 mV$				
	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 whe	n external 1000pF is installed				
	$(V_{DD}=4.3V)$					
• Adjustable sensing delay for excessive discharging	delay of 24ms whe	n external 1000pF is installed				
	$(V_{DD}=2.4V)$					
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

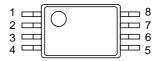
In the RV5VG1>>>> series, the overcharge/excessive discharge detector threshold, respective hysteresis ranges, short-circuit detector threshold and taping type can be selected at the user's request.

The selection can be made by designating the part number as shown belows.

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.
С	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	Соит	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	V_{DD}	Power supply Pin



ABSOLUTE MAXIMUM RATINGS

Topt=25°C, Vss=0V

Symbol	Item		Ratings	Unit
V_{DD}	Supply Voltage		-0.3 to +12	V
V-	T 4 \$7-14	V-pin	Vdd-12 to Vdd+0.3	V
VCT1, VCT2	Input Voltage	CT1, CT2 pin	Vss-0.3 to Vdd+0.3	V
VCOUT	Output Voltage	Cout pin	Vdd-12 to Vdd+0.3	V
VDOUT	- Output voltage	Dout pin	Vss-0.3 to Vdd+0.3	V
PD	Power Dissipation		300	mW
Topt	Operating Temperature Range		-30 to +80	$^{\circ}\mathrm{C}$
Tstg	Storage Temperature Range		–55 to +125	$^{\circ}\mathrm{C}$
Tsolder	Tsolder Lead Temperature (Soldering)		260°C, 10s	

ABSOLUTE MAXIMUM RATIN

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

 $Topt{=}25^{\circ}C$

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit.
V _{DD1}	0 1 1 1 1 1	V _{DD} to V _{SS}	1.2		5	V
V _{DD2}	Operating Input Voltage	V _{DD} to V-	1.2		10	V
VDET1	Over-charge Detector Threshold	Voltage rising edge detection	4.20	4.25	4.30	V
VHYS1	Over-charge Detector Hysteresis Range		0.15	0.20	0.25	V
tvdet1	VDET1 Output Delay Time	C1=1000pF, Vdd=3.6V-4.3V	22	43	86	ms
VDET2	Over-discharge Detector Threshold	Voltage falling edge detection	2.437	2.50	2.563	V
tvdet2	VDET2 Output Delay Time	C2=1000pF, VDD=3.6V-2.4V	12	24	48	ms
Vshort	Short protection Voltage	VDD=3.9V	0.17	0.2	0.23	V
tshort1		Vdd=3.0V, V-=0V- 3 V	2.4	4.8	9.6	
tshort2	Short protection Delay Time	VDD=2.0V, V-=0V-4V	1.4	2.8	5.6	ms
Vol1	Cout Nch Tr. ON Voltage	IoL=100μA, Vdd=4.4V		0.17	0.5	V
Vон1	Cour Pch Tr. ON Voltage	Ioh=-100µA, Vdd=3.9V	3.4	3.73		V
Vol2	Dout Nch Tr. ON Voltage	IoL=100μA, Vdd=2.4V		0.17	0.5	V
Vон2	Dout Pch Tr. ON Voltage	Ioh=-100μA, Vdd=3.9V	3.4	3.73		V
Idd	Supply Current	VDD=3.9V, V-=0V		2.3	5.0	μA
Istandby	Standby Current	Vdd=2.4V, V-=2.4V		0.2	2.5	μA
Vchg	Charger Sense Minimum Voltage	VDD=3.3V		0.13	0.2	V
Rshort	V- pin pull down resistance	Vdd=3.9V, V-=1.0V	65	130	260	kΩ



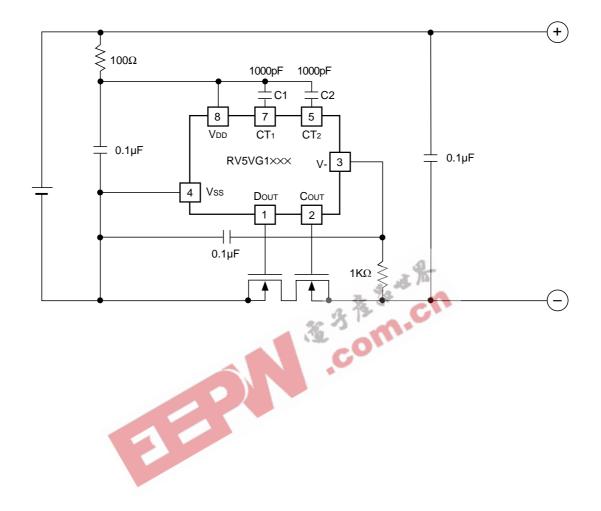
RV5VG1 ***

• RV5VG101D

 $Topt{=}25^{\circ}C$

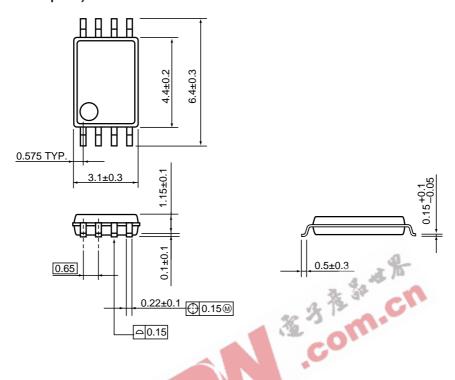
Cumbal						
Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit.
V _{DD1}	0 4 1 4 17 14	V _{DD} to V _{SS}	1.2		5	V
V _{DD2}	Operating Input Voltage	Vdd to V-	1.2		10	V
VDET1	Over-charge Detector Threshold	Voltage rising edge detection	4.20	4.25	4.30	V
VHYS1	Over-charge Detector Hysteresis Range		0.15	0.2	0.25	V
tvdet1	VDET1 Output Delay Time	C1=1000pF, Vdd=3.6V-4.3V	22	43	86	ms
VDET2	Over-discharge Detector Threshold	Voltage falling edge detection	2.437	2.50	2.563	V
VHYS2	Over-discharge Detector Hysteresis Range	3 13	0.50	0.60	0.70	V
tvdet2	VDET2 Output Delay Time	C2=1000pF, VDD=3.6V-2.4V	12	24	48	ms
Vshort	Short protection Voltage	V DD=3.9V	0.17	0.2	0.23	V
tshort1	Cl d d . d D . l Th'	VDD=3.0V, V-=0V-1V	2.4	4.8	9.6	
tshort2	Short protection Delay Time	Vdd=2.0V, V-=0V- 3 V	1.4	2.8	5.6	ms
Vol1	Cout Nch Tr. ON Voltage	IoL=100μA, Vdd=4.4V		0.17	0.5	V
Vон1	Cout Pch Tr. ON Voltage	IOH=-100μA, VDD=3.9V	3.4	3.73		V
Vol2	Dout Nch Tr. ON Voltage	IoL=100μA, Vdd=2.4V		0.17	0.5	V
Voh2	Dout Pch Tr. ON Voltage	Ioh=-100µA, Vdd=3.9V	3.4	3.73		V
Idd	Supply Current	Vdd=3.9V, V-=0V		2.3	5.0	μА
Istandby	Standby Current	Vdd=2.4V, V-=2.4V		1.0	2.5	μA
Vchg	Charger Sense MinimumVoltage	Vdd=2.9V		0.1	0.2	V
Rshort	V- pin pull down resistance	Vdd=3.9V, V-=1.0V	65	130	260	kΩ

TYPICAL APPLICATION



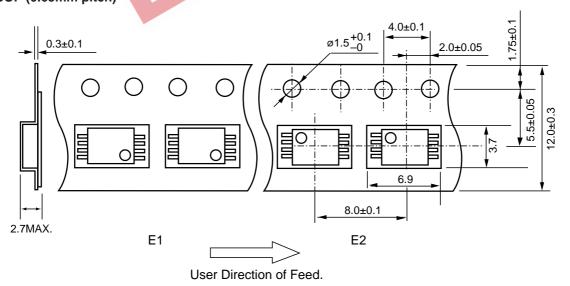
PACKAGE DIMENSIONS (Unit: mm)

• 8pin SSOP (0.65mm pitch)



TAPING SPECIFICATION (Unit: mm)

• 8pin SSOP (0.65mm pitch)



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