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RECHARGEABLE LITHIUM-ION CELL PROTECTORS

RV5VG1✕✕✕SERIES

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 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.
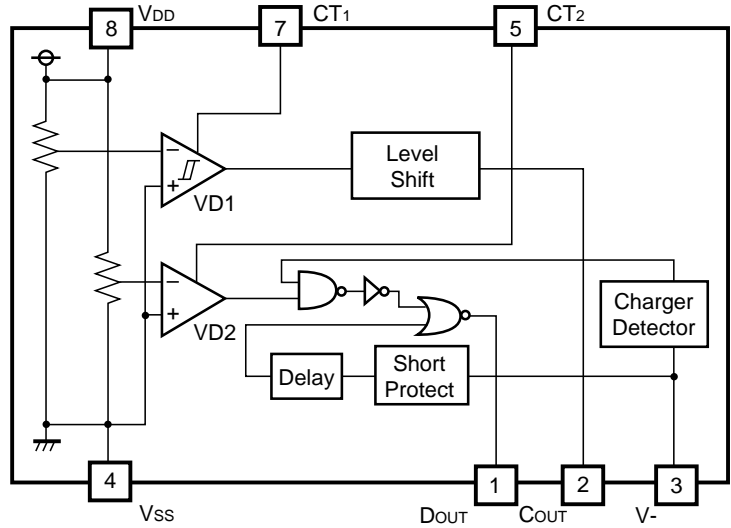
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BLOCK DIAGRAM

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 $V_{DET1}–V_{HYS1}$ 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 $V_{DET1}–V_{HYS1}$. VD2 (After excessive-discharge detection) ·····when battery voltage rises above $V_{DET2}+V_{HYS2}$ or a charger is connected.
c	Designation of Taping Type: EX. 8pin SSOP: E1, E2 (refer Taping Specifications) "E2" is prescribed as a standard.

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PIN CONFIGURATION

• **8pin SSOP (0.65mm pitch)**
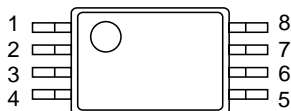
PIN DESCRIPTION

Pin No.	Symbol	Pin Description
1	D_{OUT}	Output Pin of over-discharge detection, CMOS output
2	C_{OUT}	Output Pin of over-charge detection, CMOS output
3	V-	Pin for charger negative input
4	V_{SS}	Ground Pin
5	CT_2	Pin for external capacitor for setting output delay of VD2
6	NC	No connection
7	CT_1	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-	Input Voltage	V-pin	V_{DD}−12 to V_{DD}+0.3	V
V_{CT1}, V_{CT2}		CT_1, CT_2 pin	V_{SS}−0.3 to V_{DD}+0.3	V
V_{COUT}	Output Voltage	C_{OUT} pin	V_{DD}−12 to V_{DD}+0.3	V
V_{DOUT}		D_{OUT} pin	V_{SS}−0.3 to V_{DD}+0.3	V
P_D	Power Dissipation		300	mW
Topt	Operating Temperature Range		−30 to +80	˚C
Tstg	Storage Temperature Range		−55 to +125	˚C
Tsolder	Lead Temperature (Soldering)		260˚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.

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ELECTRICAL CHARACTERISTICS

• RV5VG101C

Topt=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
Vshort	Short protection Voltage	V_{DD}=3.9V	0.17	0.2	0.23	V
tshort1	Short protection Delay Time	V_{DD}=3.0V, V-=0V→1V	2.4	4.8	9.6	ms
tshort2		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
Istandby	Standby Current	V_{DD}=2.4V, V-=2.4V		0.2	2.5	µA
Vchg	Charger Sense Minimum Voltage	V_{DD}=3.3V		0.13	0.2	V
Rshort	V- pin pull down resistance	V_{DD}=3.9V, V-=1.0V	65	130	260	kΩ

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• **RV5VG101D**

Topt=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
Vshort	Short protection Voltage	V_{DD}=3.9V	0.17	0.2	0.23	V
tshort1	Short protection Delay Time	V_{DD}=3.0V, V-=0V→1V	2.4	4.8	9.6	ms
tshort2		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
Istandby	Standby Current	V_{DD}=2.4V, V-=2.4V		1.0	2.5	μA
Vchg	Charger Sense MinimumVoltage	V_{DD}=2.9V		0.1	0.2	V
Rshort	V- pin pull down resistance	V_{DD}=3.9V, V-=1.0V	65	130	260	kΩ

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TYPICAL APPLICATION
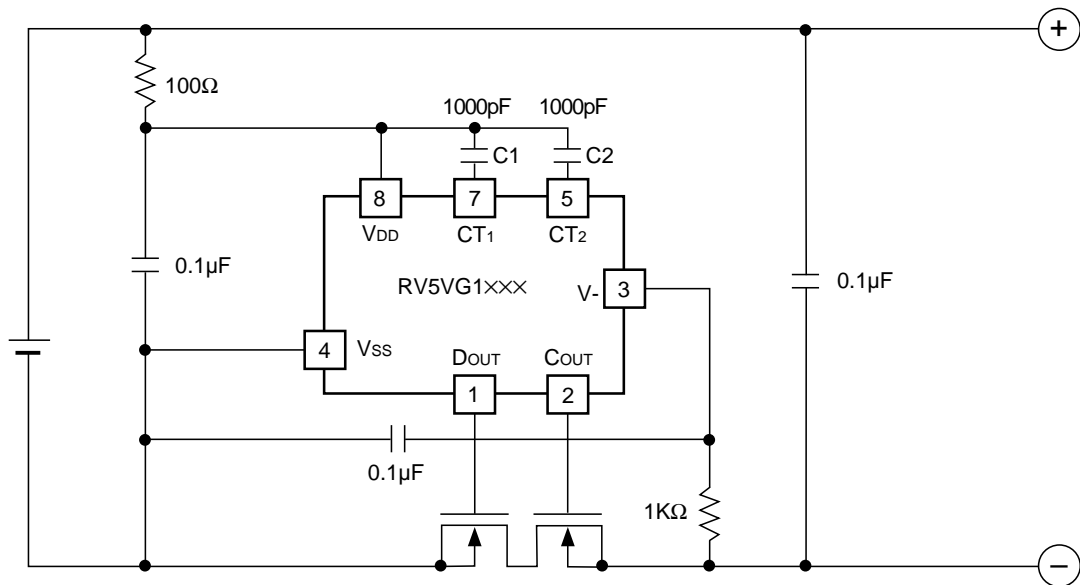
PACKAGE DIMENSIONS (Unit: mm)

• **8pin SSOP (0.65mm pitch)**

4.4±0.2
6.4±0.3
0.575 TYP.
3.1±0.3
1.15±0.1
0.1±0.1
0.65
0.22±0.1   ⊕ 0.15Ⓜ
⬠ 0.15
0.15 +0.1 −0.05
0.5±0.3
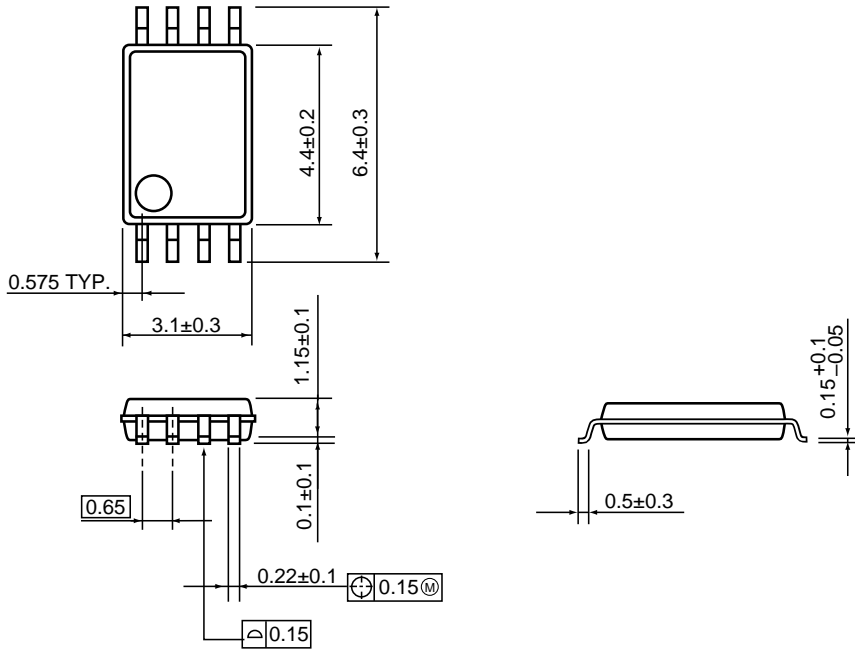
TAPING SPECIFICATION (Unit: mm)

• **8pin SSOP (0.65mm pitch)**

0.3±0.1
2.7MAX.
ø1.5 +0.1 −0
4.0±0.1
2.0±0.05
1.75±0.1
5.5±0.05
12.0±0.3
3.7
6.9
8.0±0.1
E1
E2
User Direction of Feed.

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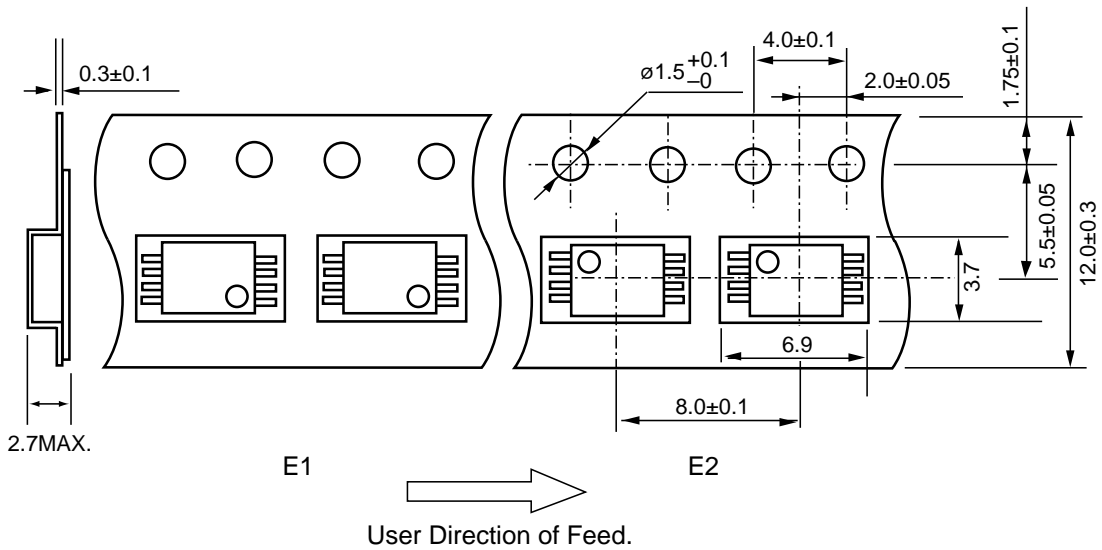
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