

R5531V002

PCMCIA Power Controller

■DESCRIPTION

The R5531V002 switches between the three VCC voltages (0V/3.3V/5.0V) and the VPP voltages (off/0V/3.3V/5.0V). If VCC pin or VPP pin may be clamped to the GND, short current limit works at 1A(Min.) for VCC and 0.2A(Min.) for VPP. The R5531V002 is suitable for standard PCMCIA power controllers.

FEATURES

- Low on resistance P-channel MOSFET Switch
- Over- Current Limit Protection
- Thermal Shutdown Protection
- Built-in Open-drain Flag Pin
- Low Consumption Current
- Break-Before-Make Switching
- SSOP-16 pin Package

APPLICATIONS

- PC card Power Supply Pin Voltage Switch
- Card-bus Slot Power Supply Control
- PC Card Reader/Writer

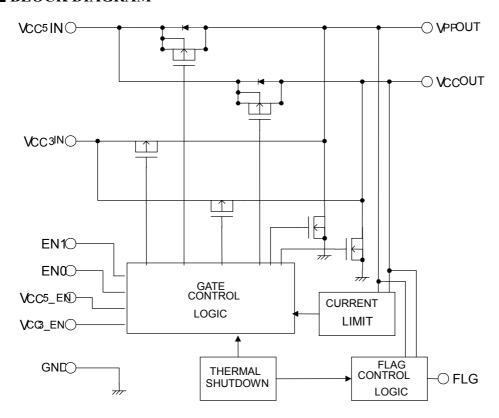
■ PIN CONFIGURATION (Top view)

VCC 5_EN	10	16	GND
VCC 3_EN	2	15	☐ VCC5 IN
EN0 🗆	3	14	□□ VCC OUT
EN1 🔲	4	13	UCC5 IN
FLG 🗀	5	12	₩ VCCOUT
NC 🗆	6	11	☐ Acc3 IM
NC 🗆	7	10	□ NC
VPPOUT	8	9	₩ VCCOUT

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■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

Topt=25°C

Item	Symbol	Rating	Unit		
Input Voltage(5V)	V_{cc5}	-0.3 to 6.0	V		
Input Voltage(3V)	V_{cc3}	-0.3 to 6.0	V		
Flag Voltage	VFLG	-0.3 to 6.0	V		
Logic Input Voltage	VIN	-0.3 to 6.0	V		
On the A Command	Io(vcc)	>1A Internal Limited			
Output Current	Io(vpp)		>200mA Internal Limited		
Power Dissipation	P_{D}				
Operating Temperature Range	Topt	-40 to 85	°C		
Storage Temperature Range	Tstg	-55 to 125	°C		

[Note] Absolute maximum ratings are threshold limit values that must not be exceeded even for any moment under any conditions. More over, such values for any two or more items of the ratings must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or fatal damage to the device. These mean stress ratings and do not necessarily imply functional operation below these limits.

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■ ELECTRICAL CHARACTERISTICS

Topt=25°C

Symbol	Item	Conditions	Min.	Тур.	Max.	Unit
Vcc5	Supply Voltage(5V)	Conditions	3.0	5.0	5.5	V
V _{cc3}	Supply Voltage(3V)		3.0	3.3	5.5	V
Icc5		Vcc OUT = 5V or 3.3V		30	60	μA
I _{SLP5}	Supply Current(each slot)	Vcc OUT = 0V (sleep mode)		0.2	10.0	μA
Icc3		Vcc OUT = 5V or 3.3V		10	30	μA
I _{SLP3}		Vcc OUT = 0V (sleep mode)		0.1	10	μΑ
		Select Vcc OUT=5V		85	140	mΩ
RoVcc	Vccout switch resistance	Select Vcc OUT=3.3V		100	150	mΩ
		Select Vcc OUT=0V		500	3900	Ω
		Select Vpp OUT=5V		1.8	2.5	Ω
RoV _{pp}	Vppout switch resistance	Select Vpp OUT=3.3V		3.3	5.0	Ω
		Select Vpp OUT=0V		2500	3900	Ω
IPPL	Vppout Leakage Current	Select Vpp OUT=Hi-Z		1	10	μΑ
ICCSC	Chart Commont Limit	Vcc out=0V	1	1.4		Α
IPPSC	Short Current Limit	VPP OUT=0V	0.2	0.3		A
VIH	Logic Input "H" Voltage		2.2		6.0	V
VIL	Logic Input "L" Voltage		-0.3		0.8	V
IIN	Logic Input Current		-1		1	μΑ
TSD	Thermal Shutdown Temperature			135		°C
Vook	Flag Threshold Voltage	FLG is pulled up to VCC3IN with 10kΩ		Vcc-1		V
VOOK	riag Tilleshold Voltage			VPP-1		v
t1	Vcc Turn-on Delay Time	Vcc OUT=0V to 10% of 3.3V		300	1500	μs
t ₂	(*Note 2)	Vcc OUT=0V to 10% of 5.0V		500	3000	μs
t ₃	Vcc Rising Time (*Note 2)	Vcc OUT=10% to 90% of 3.3V	200	800	2500	μs
t ₄	vec kising time (Note 2)	Vcc OUT=10% to 90% of 5.0V	200	1800	6000	μs
t 7	Vcc Turn-off Delay Time	Vcc OUT=3.3V to Hi-Z		2.3	8.0	ms
t8	(*Note1,2,4)	Vcc OUT=5V to Hi-Z		2.8	8.0	ms
t5	V D 11' (D' (457 - 5)	Vcc OUT=90% to 10% of 3.3V	100	700	1500	μs
t6	Vcc Falling Time (*Note 3)	Vcc OUT=90% to 10% of 5.0V	100	600	2000	μs
t9	Vpp Turn-on Delay Time	Vpp OUT=0V to 10% of 3.3V		15	50	μs
t10	(*Note 3)	Vpp OUT=0V to 10% of 5.0V		25	50	μs
t11	Vpp Rising Time (*Note 3)	Vpp OUT=10% to 90% of 3.3V	100	200	800	μs
t12	v pp Kising Time (Trote 3)	Vpp OUT=10% to 90% of 5.0V	100	280	1000	μs
t15	Vpp Turn-off Delay Time	Vpp OUT=3.3V to Hi-Z		0.1	1.0	μs
t16	(*Note 1,3)	Vpp OUT=5V to Hi-Z		0.1	1.0	μs
t13	Vpp Falling Time (*Note 3)	Vpp OUT=90% to 10% of 3.3V		0.05	1.00	μs
t14	lay from commanding Hi-Z or (Vpp OUT=90% to 10% of 5.0V		0.05	1.00	μs

^{(*}Note1) Delay from commanding Hi-Z or 0V to beginning slope

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^{(*}Note2) t1 to t8 Test Condition: RL= 10Ω

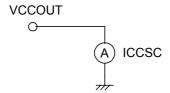
^{(*}Note3) t9 to t15 Test Condition: RL=100 Ω

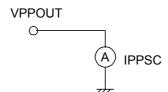
^{(*}Note4) Do not apply to current limit or thermal shutdown conditions during these terms

■ TEST CIRCUITS

(1) ICCSC

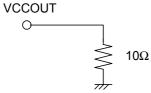
(2) IPPSC

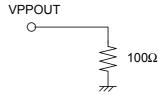




(3) t1 to t8

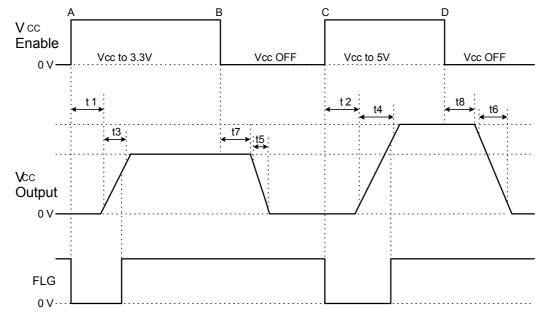
(4) t9 to t16





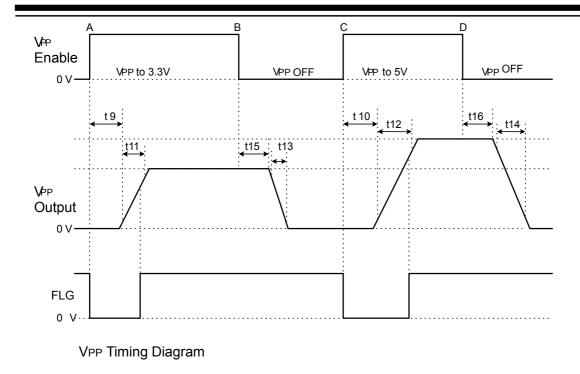
(Note 1) Except VCCOUT pin and VPPOUT pin, test circuits are same as typical application circuit. (Note 2) At the measurement of Flag threshold voltage, add $10k\Omega$ between FLG pin and Vcc3IN pin.

■ TIMING DIAGRAMS



Vcc Timing Diagram

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OPERATION

(1) Operation Description

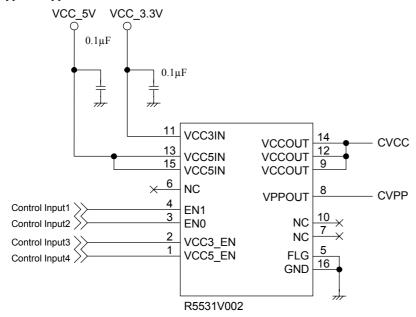
When the VCCOUT =0V is selected, the IC switches into the sleep mode, and draws only nano-amperes of leakage current. Without being V_{CCOUT} =0V, if commanded to immediately switch from 5V to 3.3V or vice versa, enhancement of the second switch begins after the first is OFF, realizing "break-before-make switching".

In case that an OUT pin may be clamped to the GND, if over-current would continue, the temperature of the IC would increase drastically. If the temperature of the IC is beyond Typ. 135°C, the switch transistor turns off. Then, when the temperature of the IC decreases by approximately 10°C, the switch transistor turns on. Unless the abnormal situation of OUT pin is removed or turned off, the switch transistor repeats on and off.

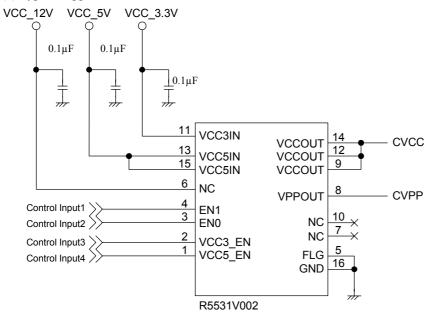
Short over-current level is set internally in the IC. There are two types of response against over-current: (1) Under the condition that OUT pin is short or large capacity is loaded, if the IC is enabled, the IC becomes constant current state immediately. Current level of constant current is short current limit. (2) While the switch transistor is on, if OUT pin is short or large capacity is loaded, until the current limit circuit responds, large transient current flows. The transient current depends on the impedance between the power supply circuit, VCC5IN/VCC3IN and load capacitance. In other words, the transient current depends on the transient response characteristics of the power supply circuit, VCC5IN/VCC3IN, PCB layout, and the connector of the card. After the transient current is beyond the current limit threshold and current limit circuit responds, the IC becomes into the constant current mode, and the current level is equal to short current limit.

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(2) Typical Application 1



(3) Typical Application 2



(Note1) Control Input 1 through 4 means a signal from PCMCIA controller. (Note2) 12V through 15V voltage can be forced to VCC_12V

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(4) Control Logic Table

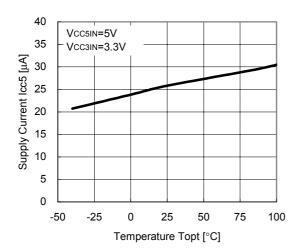
Vcc5_EN	Vcc3_EN	EN1	EN0	Vcc out	Vpp OUT
0	0	0	0	0V	0V
0	0	0	1	0V	Hi-Z
0	0	1	0	0V	Hi-Z
0	0	1	1	0V	Hi-Z
0	1	0	0	5V	0V
0	1	0	1	5V	5V
0	1	1	0	5V	Hi-Z
0	1	1	1	5V	Hi-Z
1	0	0	0	3.3V	0V
1	0	0	1	3.3V	3.3V
1	0	1	0	3.3V	Hi-Z
1	0	1	1	3.3V	Hi-Z
1	1	0	0	0V	0V
1	1	0	1	0V	Hi-Z
1	1	1	0	0V	Hi-Z
1	1	1	1	0V	Hi-Z

APPLICATION NOTES

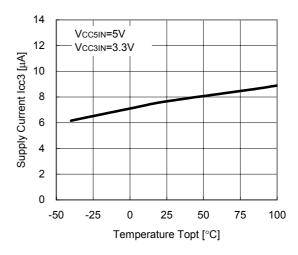
- * Set a bypass capacitor with a capacity range from $0.1\mu F$ to $1\mu F$ between VCC5IN pin and GND pin, and between VCC3IN and GND pin, each.
- * VCC5IN voltage should be equal or more than VCC3IN.
- * Same name pins should be connected one another.
- * There is a parasitic diode between source and drain of the switch transistors. (Refer to the block diagram.) Therefore, even If the switch may be disabled, in case the OUT voltage is higher than VCC5IN, some current flows from OUT to VCC5IN.

■ TYPICAL CHARACTERISTICS

1) Supply Current Iccs vs. Temperature

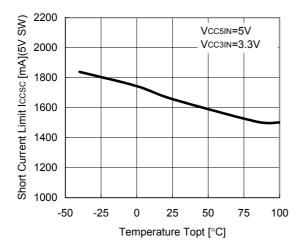


2) Supply Current Icc3 vs. Temperature

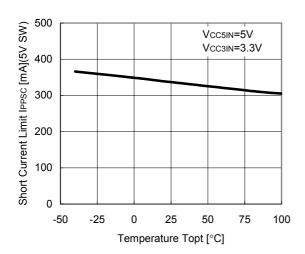


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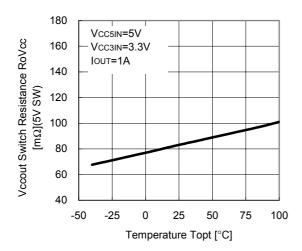
3) Short Current Limit vs. Temperature (Select VCCOUT=5V)



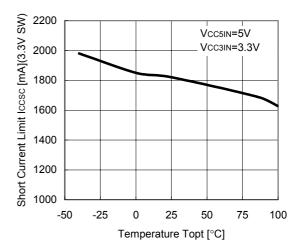
5) Short Current Limit vs. Temperature (Select VPPOUT=5V)



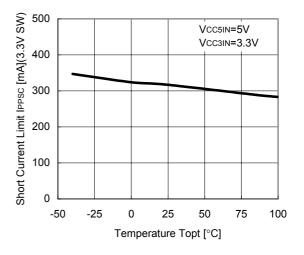
7) VCCOUT Switch Resistance vs. Temperature (Select VCCOUT=5V)



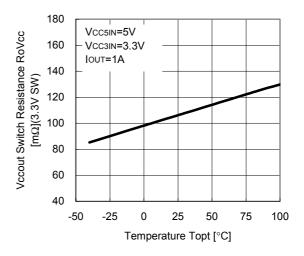
4) Short Current Limit vs. Temperature (Select VCCOUT=3.3V)



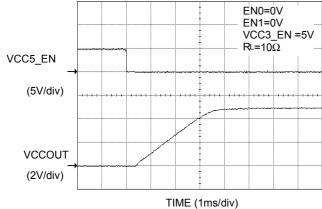
6) Short Current Limit vs. Temperature (Select VCCOUT=3.3V)



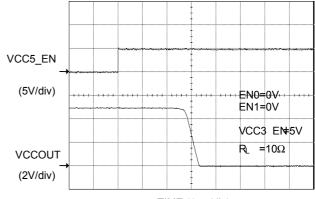
8) VCCOUT Switch Resistance vs. Temperature (Select VCCOUT=3.3V)



9)Vcc Turn on speed (Select VCCOUT=5V)

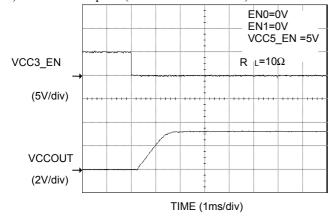


10) Vcc Turn off speed (Select Vccout=5V)

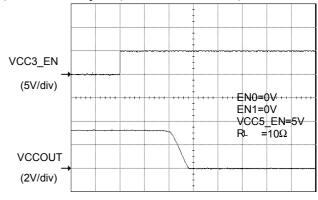


s/div) TIME (1ms/div)

11) Vcc Turn on speed (Select VCCOUT=3.3V)



12) Vcc Turn off speed (Select VCCOUT=3.3V)



TIME (1ms/div)