PCMCIA Power Controller

■DESCRIPTION

The R5534V switches between the three V_{CC} voltages (0V/3.3V/5.0V) and the V_{PP} voltages (off/0V/3.3V/5.0V). The R5534V has two sets of V_{CC} output and V_{PP} output each, therefore it fits dual slot models. If V_{CC} pin or V_{PP} pin may be clamped to the GND, short current limit works at 1A(Min.) for VCC and 0.15A(Min.) for V_{PP}.

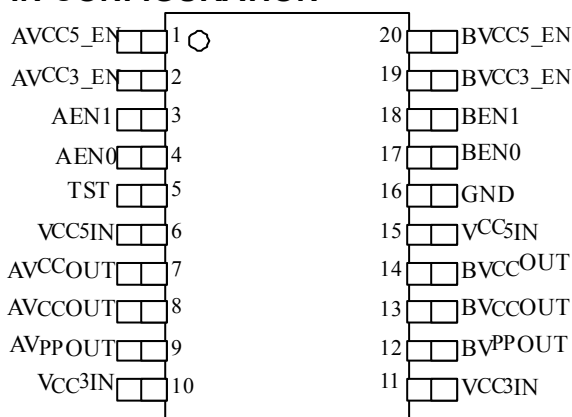The R5534V is suitable for standard PCMCIA power controllers.

■FEATURES

- Low on resistance P-channel MOSFET Switch
- Dual Slot Power Supply Control
- Over- Current Limit Protection
- Thermal Shutdown Protection
- Low Consumption Current
- Break-Before-Make Switching
- SSOP-20 pin Package

■APPLICATIONS

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

■ PIN CONFIGURATION

AVCC5_EN	1	20 BVCC5_EN
AVCC3_EN	2	19 BVCC3_EN
AEN1	3	18 BEN1
AEN0	4	17 BEN0
TST	5	16 GND
VCC5IN	6	15 VCC5IN
AVCCOUT	7	14 BVCCOUT
AVCCOUT	8	13 BVCCOUT
AVPPOUT	9	12 BVPPOUT
VCC3IN	10	11 VCC3IN

*Note: Same name pins should be connected one another.
Connect TST pin to $V_{CC}5IN$ pin.

■ BLOCK DIAGRAM
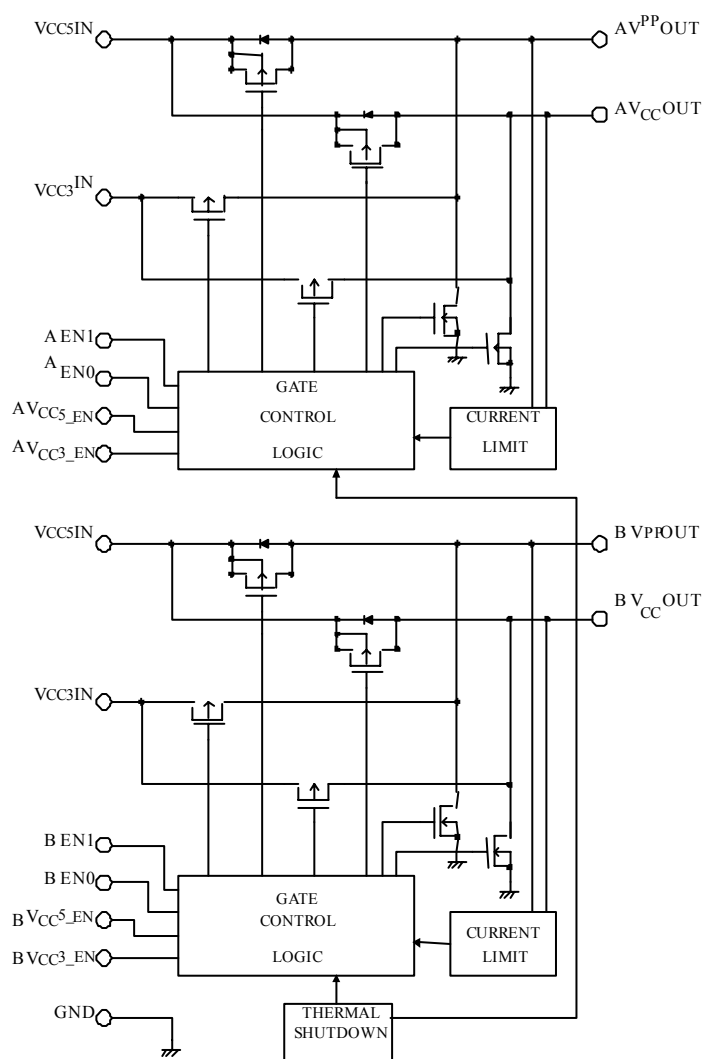
■ PIN DESCRIPTION

Symbol	Pin description
V_{CC5IN}	5V Input Pin
V_{CC3IN}	3V Input Pin
GND	Ground Pin
V_{CC5_EN}	Logic Input Pin
V_{CC3_EN}	Logic Input Pin
EN1	Logic Input Pin
EN0	Logic Input Pin
V_{CCOUT}	V_{CC} Output Pin
V_{PPOUT}	V_{PP} Output Pin
TST	Test Pin

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■ ABSOLUTE MAXIMUM RATINGS

Topt=25°C

Item	Symbol	Conditions	Ratings	Unit
Input Voltage (5V)	V_{cc5IN}		-0.3 to 6.0	V
Input Voltage (3V)	V_{cc3IN}		-0.3 to 6.0	V
Logic Input Voltage	V_{IN}		-0.3 to 6.0	V
TST Input Voltage	V_{TST}		-0.3 to 6.0	V
Output Current	$I_{O\,(VCC)}$	Each Slot	>1A, Internal Limited	
	$I_{O\,(VPP)}$	Each Slot	>150mA, Internal Limited	
Power Dissipation	P_D		Internal Limited	
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.	Typ.	Max.	Unit
V_{cc5}	Supply Voltage (5V)		3.0	5.0	5.5	V
V_{cc3}	Supply Voltage (3V)		3.0	3.3	5.5	V
I_{cc5}		Vcc OUT = 5V or 3.3V		60	120	μA
I_{SLP5}	Supply Current	Vcc OUT = 0V (sleep mode)		0.2	10.0	μA
I_{CC3}		Vcc OUT = 5V or 3.3V		20	60	μA
I_{SLP3}		Vcc OUT = 0V (sleep mode)		0.1	10	μA
RoV_{cc}	Vcc OUT switch resistance	Select Vcc OUT=5V, Vcc5IN=5.0V		110	170	mΩ
		Select Vcc OUT=3.3V, Vcc3IN=3.3V		130	180	mΩ
		Select Vcc OUT=0V, Vcc5IN=5.0V		500	3900	Ω
RoV_{pp}	Vpp OUT switch resistance	Select Vpp OUT=5V, Vcc5IN=5.0V		2.1	3.5	Ω
		Select Vpp OUT=3.3V, Vcc3IN=3.3V		3.3	5.5	Ω
		Select Vpp OUT=0V, Vcc5IN=5.0V		2500	3900	Ω
I_{PPL}	Vpp OUT Leakage Current	Select Vpp OUT=Hi-Z		1	10	μA
I_{CCSC}	Short Current Limit	Vcc OUT=0V	1	1.5		A
I_{PPSC}		$V_{PP\ OUT}$=0V	0.15	0.40		A
V_{IH}	Logic Input "H" Voltage		2.2		6.0	V
V_{IL}	Logic Input "L" Voltage		-0.3		0.8	V
I_{IN}	Logic Input Current		-1		1	μA
T_{SD}	Thermal Shutdown Temperature			135		°C
t1	Vcc Turn-on Delay Time (*Note 2)	Vcc OUT=0V to 10% of 3.3V(Select 3.3V)		200		μs
t2		Vcc OUT=0V to 10% of 5.0V(Select 5V)		400		μs
t3	Vcc Rising Time (*Note 2)	Vcc OUT=10% to 90% of 3.3V(Select 3.3V)		800		μs
t4		Vcc OUT=10% to 90% of 5.0V(Select 5V)		2300		μs
t7	Vcc Turn-off Delay Time (*Note1,2,4)	Vcc OUT=3.3V to Hi-Z		2.3		ms
t8		Vcc OUT=5V to Hi-Z		2.8		ms
t5	Vcc Falling Time (*Note 3)	Vcc OUT=90% to 10% of 3.3V(Select 3.3V)		800		μs
t6		Vcc OUT=90% to 10% of 5.0V(Select 5V)		700		μs
t9	Vpp Turn-on Delay Time (*Note 3)	Vpp OUT=0V to 10% of 3.3V(Select 3.3V)		5		μs
t10		Vpp OUT=0V to 10% of 5.0V(Select 5V)		12		μs
t11	Vpp Rising Time (*Note 3)	Vpp OUT=10% to 90% of 3.3V(Select 3.3V)		300		μs
t12		Vpp OUT=10% to 90% of 5.0V(Select 5V)		360		μs
t15	Vpp Turn-off Delay Time (*Note 1,3)	Vpp OUT=3.3V to Hi-Z		0.1		μs
t16		Vpp OUT=5V to Hi-Z		0.1		μs
t13	Vpp Falling Time (*Note 3)	Vpp OUT=90% to 10% of 3.3V(Select 3.3V)		0.05		μs
t14		Vpp OUT=90% to 10% of 5.0V(Select 5V)		0.05		μs

(*Note1) Delay from commanding Hi-Z or 0V to beginning slope
(*Note2) t1 to t8 Test Condition: RL=10Ω
(*Note3) t9 to t15 Test Condition: RL=100Ω
(*Note4) Do not apply to current limit or thermal shutdown conditions during these terms

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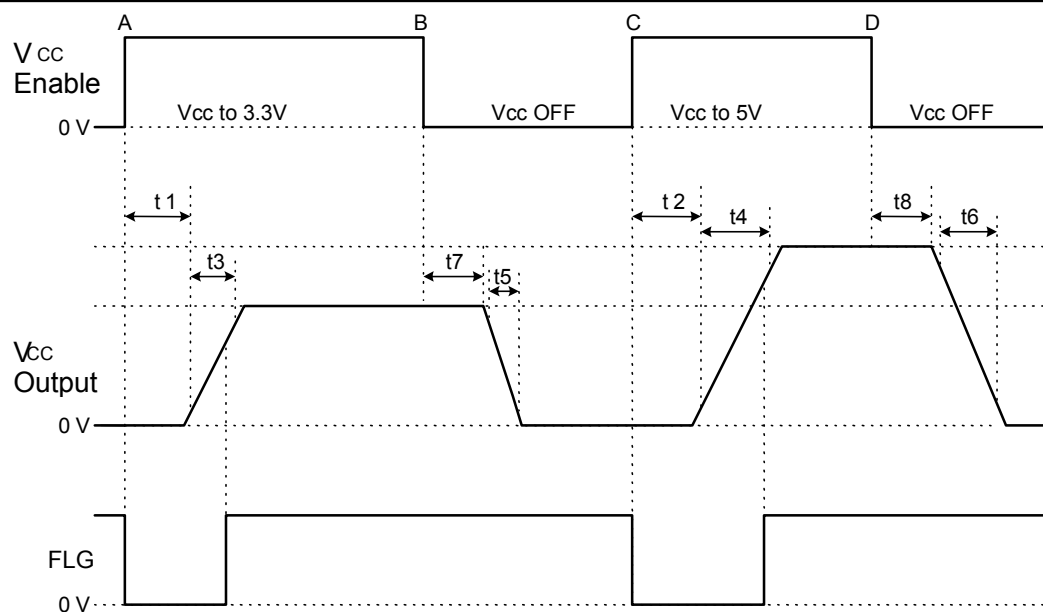
Fig.1 R5534V Vcc Timing Diagram
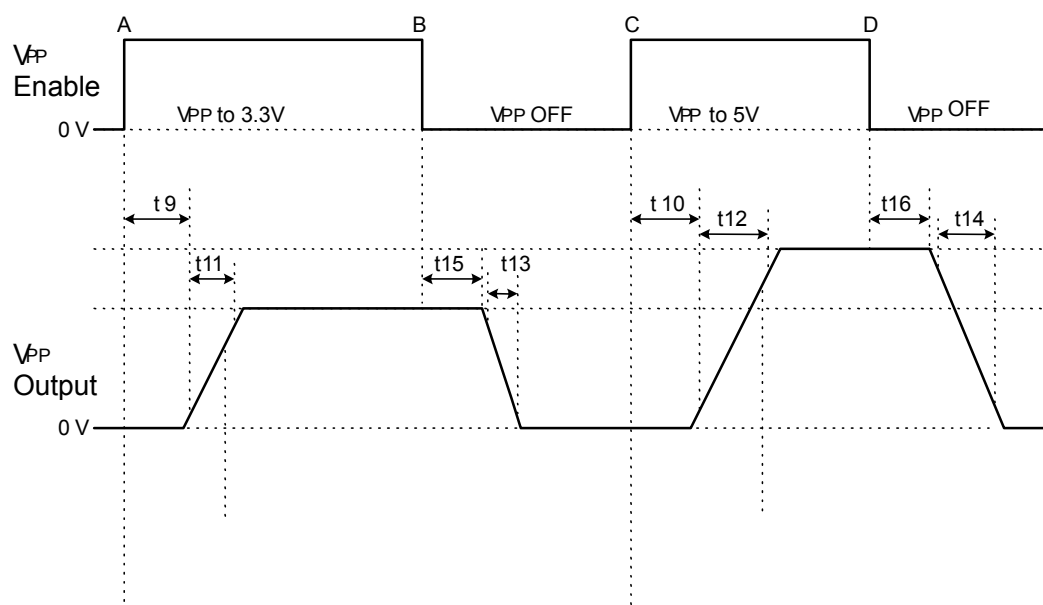
Fig. 2 R5534V Vpp Timing Diagram

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R5534V 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

■ OPERATION

When the V_{CCOUT} =0V is selected, the IC switches into the sleep mode, and draws only some 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 protection.

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 135°C, the switch transistor turns off. Then, when the temperature of the IC decreases equal or lower than 125°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.
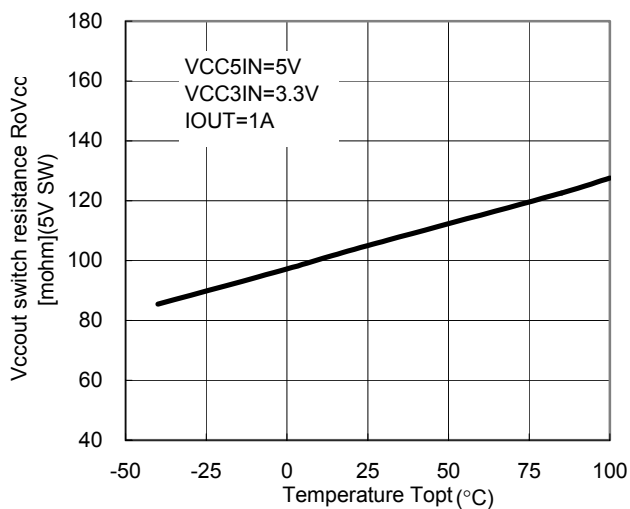
Short over-current level is set internally in the IC. There are two types of response against over-current: Under the condition that OUT pin is short or large capacity is loaded, if the IC is enabled, the IC becomes constant current state immediately. Current level of constant current is short current limit. 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, V_{CC5IN}/V_{CC3IN} and load capacitance. In other words, the transient current depends on the transient response characteristics of the power supply circuit, V_{CC5IN}/V_{CC3IN}, 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.
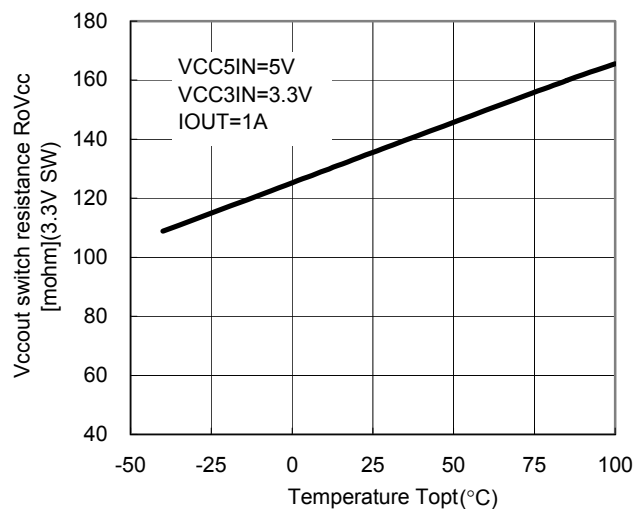
■APPLICATION NOTES

* V_{CC5IN} voltage should be equal or more than V_{CC3IN}.
* 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 V_{CC5IN}, some current flows from OUT to V_{CC5IN}.
* Connect TST pin to V_{CC5IN}
* Set a bypass capacitor with capacitance ranging from 0.1μF to 1.0μF between V_{CC5IN} pin and GND pin, and between V_{CC3IN} and GND pin each.
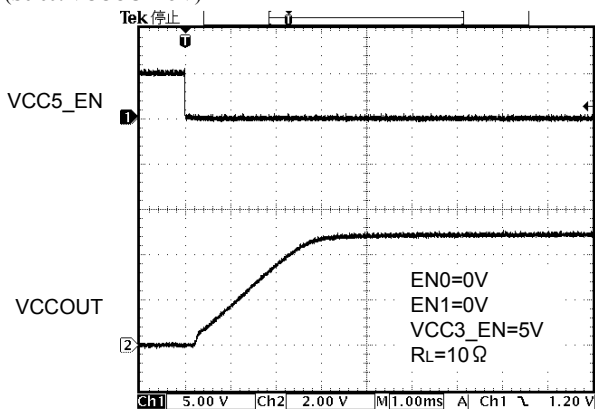
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■ TYPICAL CHARACTERISTICS

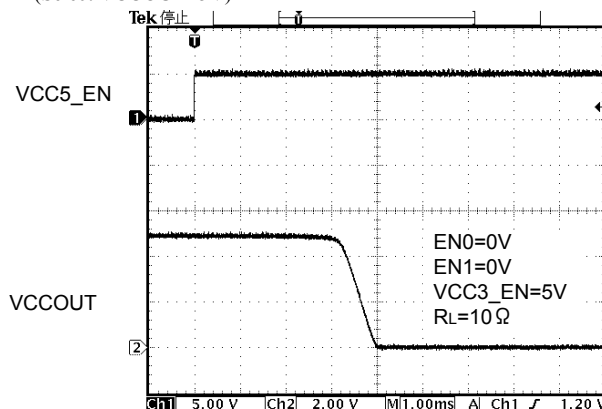1) V<small>CCOUT</small> Switch Resistance vs. Temperature
   (Select VCCOUT=5V)

VCC5IN=5V
VCC3IN=3.3V
IOUT=1A

Vccout switch resistance RoVcc [mohm](5V SW)

Temperature Topt(°C)

2) V<small>CCOUT</small> Switch Resistance vs. Temperature
   (Select VCCOUT=3.3V)

VCC5IN=5V
VCC3IN=3.3V
IOUT=1A

Vccout switch resistance RoVcc [mohm](3.3V SW)

Temperature Topt(°C)

3) Vcc Turn-on Delay Time, Vcc Rising Time
   (Select VCCOUT=5V)

Tek 停止

VCC5_EN

VCCOUT

EN0=0V
EN1=0V
VCC3_EN=5V
R<small>L</small>=10Ω

Ch1 5.00 V   Ch2 2.00 V   M1.00ms   A Ch1 ⅃ 1.20 V

4) Vcc Turn-off Delay Time, Vcc Falling Time
   (Select VCCOUT=5V)

Tek 停止

VCC5_EN

VCCOUT

EN0=0V
EN1=0V
VCC3_EN=5V
R<small>L</small>=10Ω

Ch1 5.00 V   Ch2 2.00 V   M1.00ms   A Ch1 ⌐ 1.20 V

5) Vcc Turn-on Delay Time, Vcc Rising Time
   (Select VCCOUT=3.3V)

Tek 停止

VCC3_EN

VCCOUT

EN0=0V
EN1=0V
VCC5_EN=5V
R<small>L</small>=10Ω

Ch1 5.00 V   Ch2 2.00 V   M1.00ms   A Ch1 ⅃ 1.20 V

6) Vcc Turn-off Delay Time, Vcc Falling Time
   (Select VCCOUT=3.3V)

Tek 停止

VCC3_EN

VCCOUT

EN0=0V
EN1=0V
VCC5_EN=5V
R<small>L</small>=10Ω

Ch1 5.00 V   Ch2 2.00 V   M1.00ms   A Ch1 ⌐ 1.20 V

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