

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

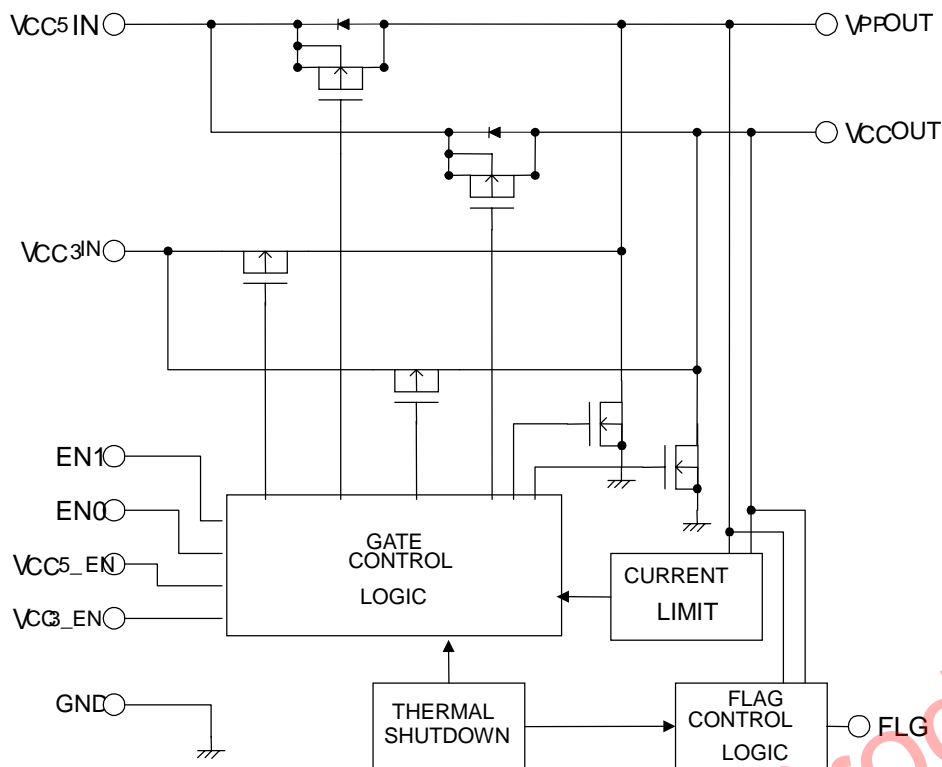
- PC card Power Supply Pin Voltage Switch
- Card-bus Slot Power Supply Control
- PC Card Reader/Writer

PIN CONFIGURATION (Top view)

VCC 5_EN	1	16	GND
VCC 3_EN	2	15	VCC5 IN
EN0	3	14	VCC OUT
EN1	4	13	VCC5 IN
FLG	5	12	VCCOUT
NC	6	11	VCC3 IN
NC	7	10	NC
VPPOUT	8	9	VCCOUT

Discontinued Product

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

$T_{opt}=25^{\circ}\text{C}$

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	V_{FLG}	-0.3 to 6.0	V
Logic Input Voltage	V_{IN}	-0.3 to 6.0	V
Output Current	$I_{O(VCC)}$	>1A Internal Limited	
	$I_{O(VPP)}$	>200mA Internal Limited	
Power Dissipation	P_D		
Operating Temperature Range	T_{opt}	-40 to 85	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	-55 to 125	$^{\circ}\text{C}$

[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.

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}	Supply Current(each slot)	V _{cc} OUT = 5V or 3.3V		30	60	μA
I _{SLP5}		V _{cc} OUT = 0V (sleep mode)		0.2	10.0	μA
I _{CC3}		V _{cc} OUT = 5V or 3.3V		10	30	μA
I _{SLP3}		V _{cc} OUT = 0V (sleep mode)		0.1	10	μA
RoV _{cc}	V _{cc} OUT switch resistance	Select V _{cc} OUT=5V		85	140	mΩ
		Select V _{cc} OUT=3.3V		100	150	mΩ
		Select V _{cc} OUT=0V		500	3900	Ω
RoV _{pp}	V _{pp} OUT switch resistance	Select V _{pp} OUT=5V		1.8	2.5	Ω
		Select V _{pp} OUT=3.3V		3.3	5.0	Ω
		Select V _{pp} OUT=0V		2500	3900	Ω
IPPL	V _{pp} OUT Leakage Current	Select V _{pp} OUT=Hi-Z		1	10	μA
ICCSC	Short Current Limit	V _{cc} OUT=0V	1	1.4		A
IPPSC		V _{pp} OUT=0V	0.2	0.3		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
TSD	Thermal Shutdown Temperature			135		°C
VOOK	Flag Threshold Voltage	FLG is pulled up to V _{CC3IN} with 10kΩ		V _{cc} -1 V _{pp} -1		V
t ₁	V _{cc} Turn-on Delay Time (*Note 2)	V _{cc} OUT=0V to 10% of 3.3V		300	1500	μs
t ₂		V _{cc} OUT=0V to 10% of 5.0V		500	3000	μs
t ₃	V _{cc} Rising Time (*Note 2)	V _{cc} OUT=10% to 90% of 3.3V	200	800	2500	μs
t ₄		V _{cc} OUT=10% to 90% of 5.0V	200	1800	6000	μs
t ₇	V _{cc} Turn-off Delay Time (*Note1,2,4)	V _{cc} OUT=3.3V to Hi-Z		2.3	8.0	ms
t ₈		V _{cc} OUT=5V to Hi-Z		2.8	8.0	ms
t ₅	V _{cc} Falling Time (*Note 3)	V _{cc} OUT=90% to 10% of 3.3V	100	700	1500	μs
t ₆		V _{cc} OUT=90% to 10% of 5.0V	100	600	2000	μs
t ₉	V _{pp} Turn-on Delay Time (*Note 3)	V _{pp} OUT=0V to 10% of 3.3V		15	50	μs
t ₁₀		V _{pp} OUT=0V to 10% of 5.0V		25	50	μs
t ₁₁	V _{pp} Rising Time (*Note 3)	V _{pp} OUT=10% to 90% of 3.3V	100	200	800	μs
t ₁₂		V _{pp} OUT=10% to 90% of 5.0V	100	280	1000	μs
t ₁₅	V _{pp} Turn-off Delay Time (*Note 1,3)	V _{pp} OUT=3.3V to Hi-Z		0.1	1.0	μs
t ₁₆		V _{pp} OUT=5V to Hi-Z		0.1	1.0	μs
t ₁₃	V _{pp} Falling Time (*Note 3)	V _{pp} OUT=90% to 10% of 3.3V		0.05	1.00	μs
t ₁₄		V _{pp} OUT=90% to 10% of 5.0V		0.05	1.00	μs

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

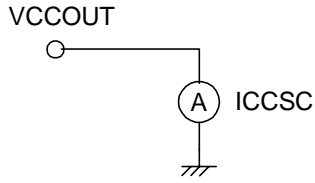
(*Note2) t₁ to t₈ Test Condition: R_L=10Ω

(*Note3) t₉ to t₁₅ Test Condition: R_L=100Ω

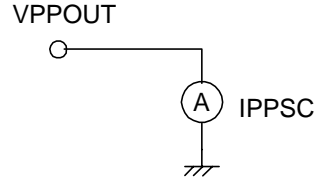
(*Note4) Do not apply to current limit or thermal shutdown conditions during these terms

■ TEST CIRCUITS

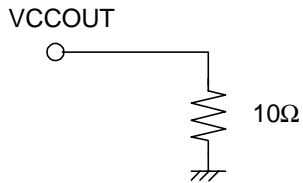
(1) ICCSC



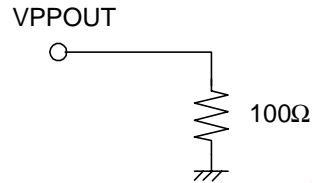
(2) IPPSC



(3) t1 to t8



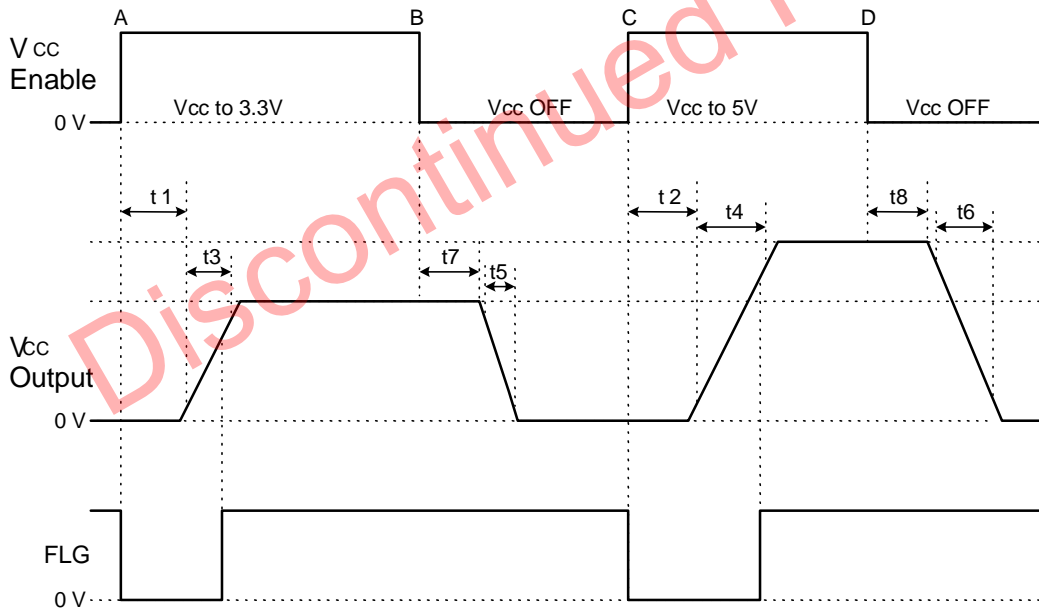
(4) t9 to t16



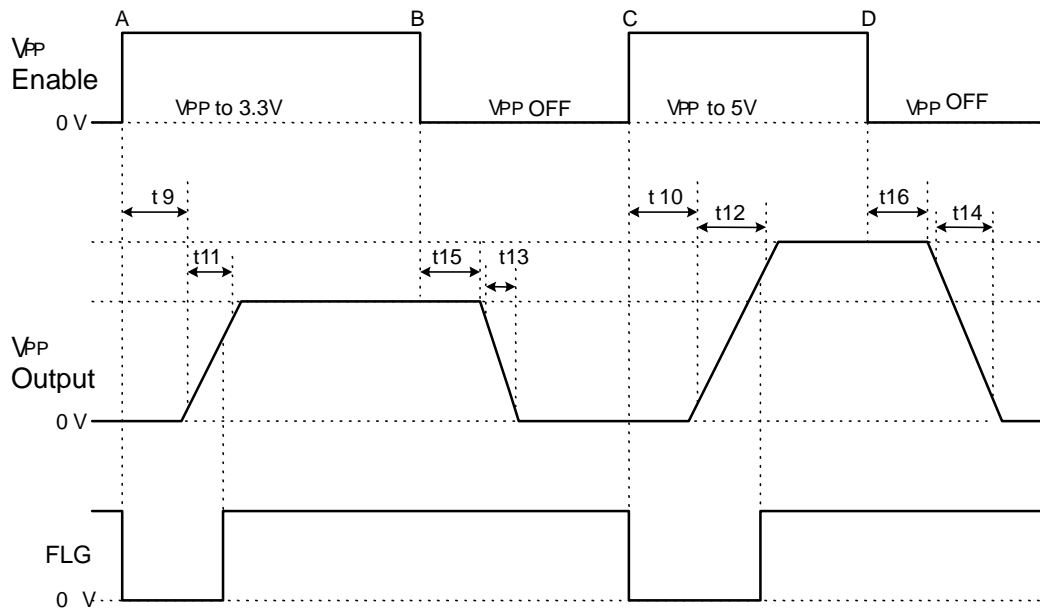
(Note 1) Except VCCOUT pin and VPPOUT pin, test circuits are same as typical application circuit.

(Note 2) At the measurement of Flag threshold voltage, add 10kΩ between FLG pin and Vcc3IN pin.

■ TIMING DIAGRAMS



Vcc Timing Diagram



VPP Timing Diagram

■ OPERATION

(1) Operation Description

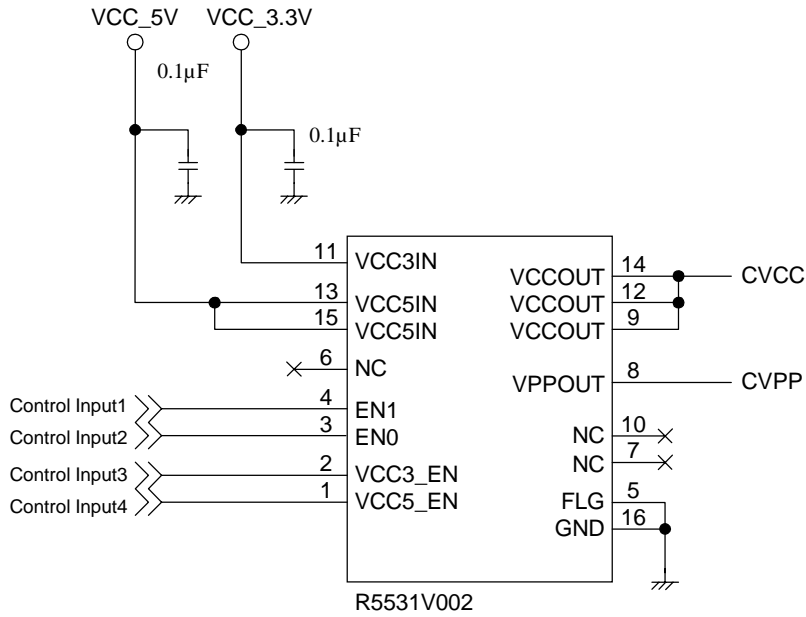
When the $V_{CCOUT}=0V$ is selected, the IC switches into the sleep mode, and draws only nano-amperes of leakage current.

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".

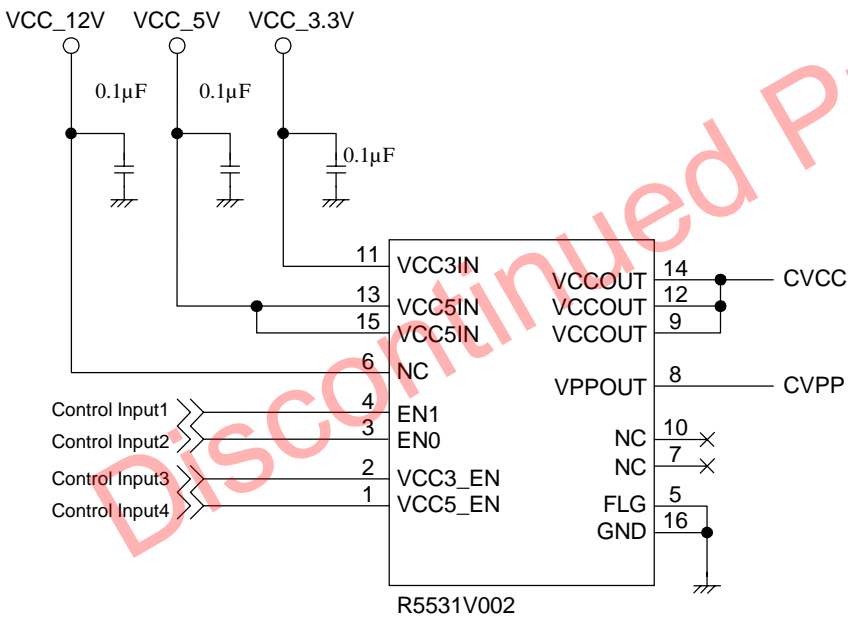
In case that an OUT pin may be clamped to the GND, if over-current would continue, the temperature of the IC would increase drastically. If the temperature of the IC is beyond Typ. 135°C, the switch transistor turns off. Then, when the temperature of the IC decreases by approximately 10°C, the switch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

(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

(4) Control Logic Table

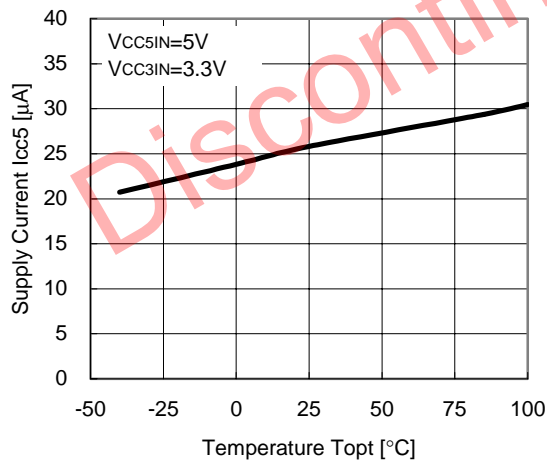
Vcc5_EN	Vcc3_EN	EN1	EN0	Vcc OUT	Vpp OUT
0	0	0	0	0V	0V
0	0	0	1	0V	Hi-Z
0	0	1	0	0V	Hi-Z
0	0	1	1	0V	Hi-Z
0	1	0	0	5V	0V
0	1	0	1	5V	5V
0	1	1	0	5V	Hi-Z
0	1	1	1	5V	Hi-Z
1	0	0	0	3.3V	0V
1	0	0	1	3.3V	3.3V
1	0	1	0	3.3V	Hi-Z
1	0	1	1	3.3V	Hi-Z
1	1	0	0	0V	0V
1	1	0	1	0V	Hi-Z
1	1	1	0	0V	Hi-Z
1	1	1	1	0V	Hi-Z

■ APPLICATION NOTES

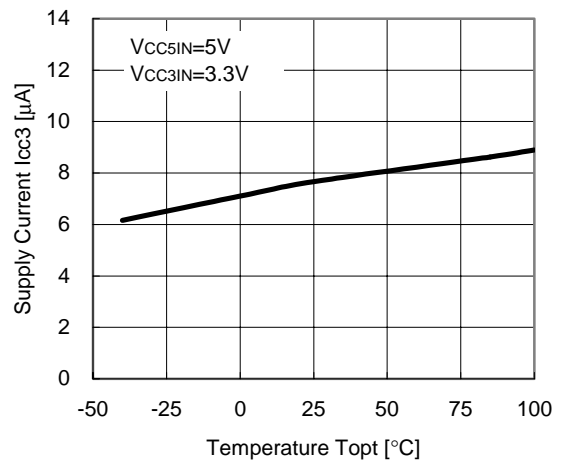
- * Set a bypass capacitor with a capacity range from 0.1μF to 1μF between VCC5IN pin and GND pin, and between VCC3IN and GND pin, each.
- * VCC5IN voltage should be equal or more than VCC3IN.
- * Same name pins should be connected one another.
- * There is a parasitic diode between source and drain 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

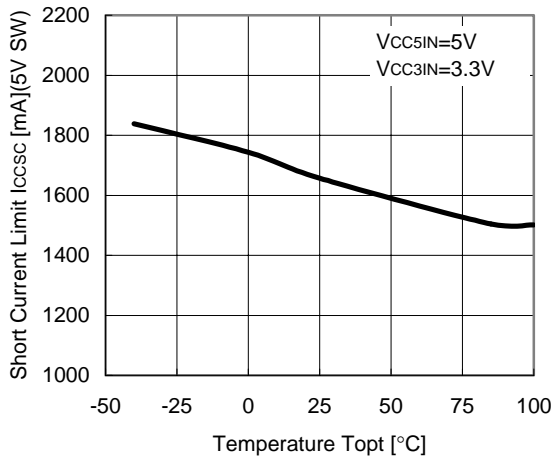
1) Supply Current Icc5 vs. Temperature



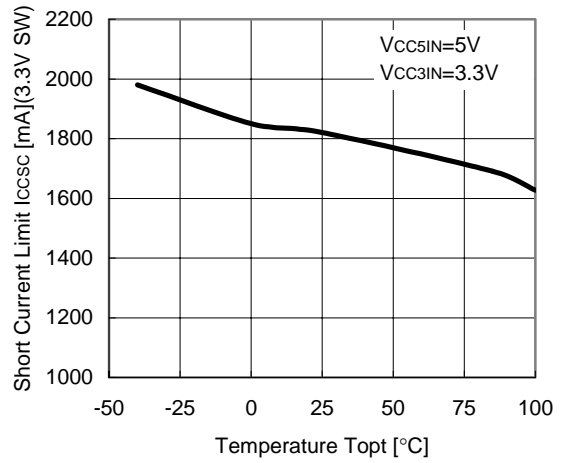
2) Supply Current Icc3 vs. Temperature



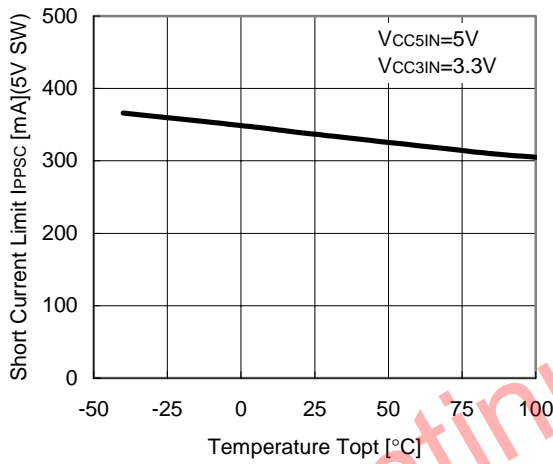
3) Short Current Limit vs. Temperature (Select VCCOUT=5V)



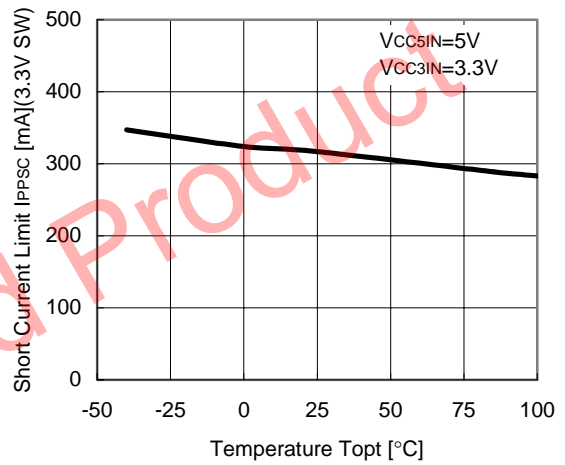
4) Short Current Limit vs. Temperature (Select VCCOUT=3.3V)



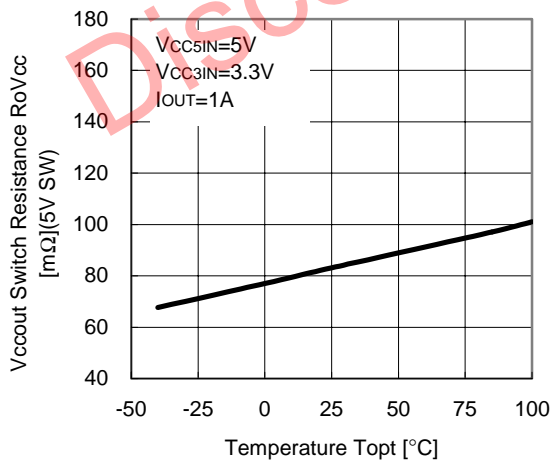
5) Short Current Limit vs. Temperature (Select VPPOUT=5V)



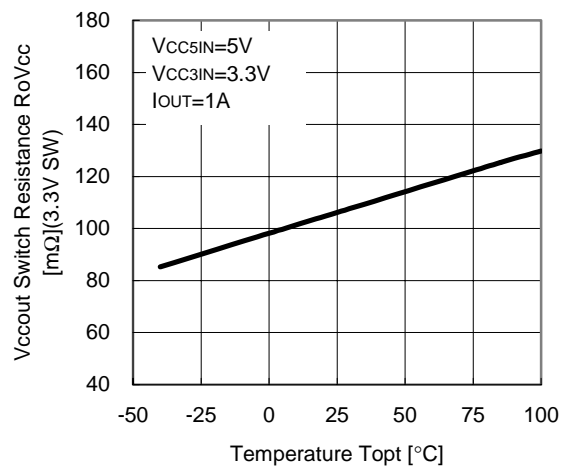
6) Short Current Limit vs. Temperature (Select VCCOUT=3.3V)



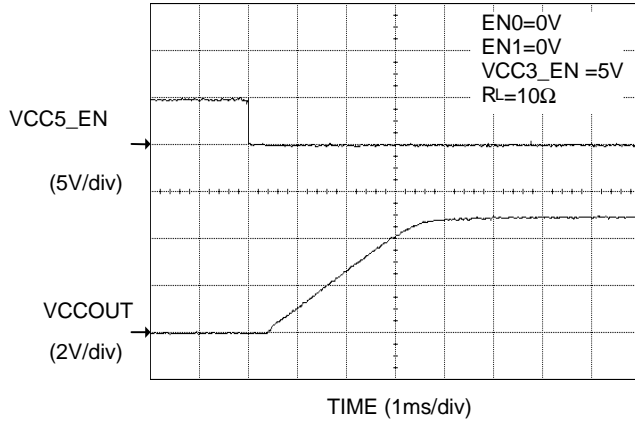
7) VCCOUT Switch Resistance vs. Temperature (Select VCCOUT=5V)



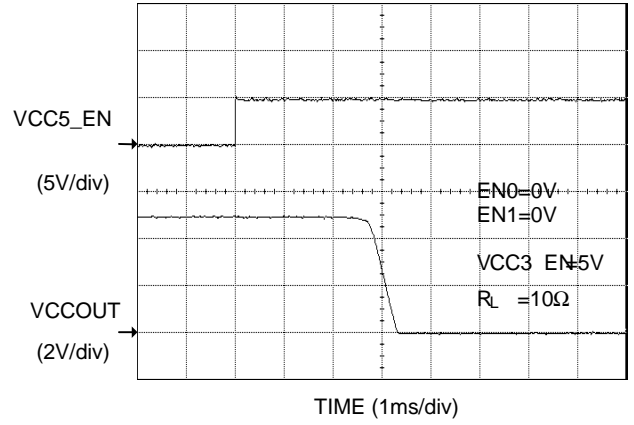
8) VCCOUT Switch Resistance vs. Temperature (Select VCCOUT=3.3V)



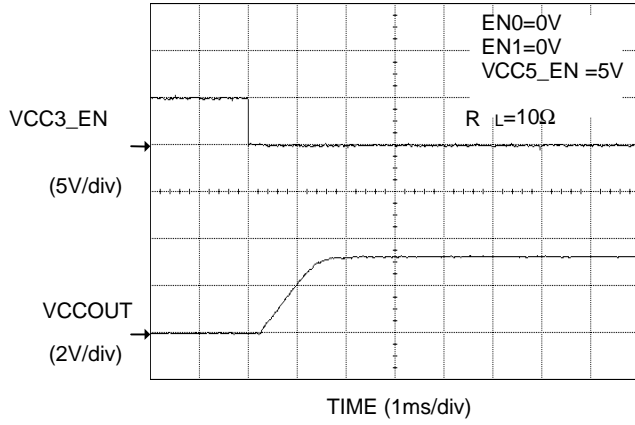
9) Vcc Turn on speed (Select VCCOUT=5V)



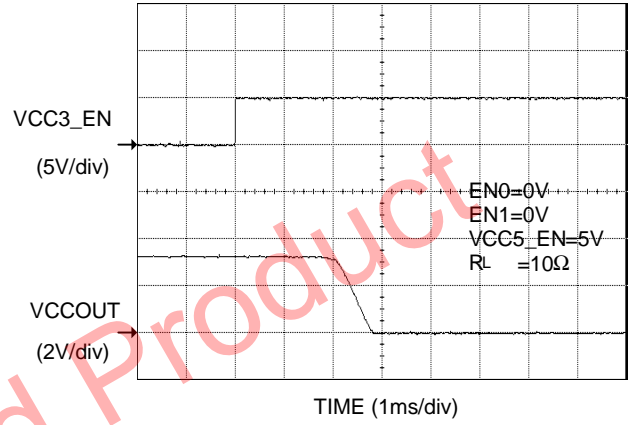
10) Vcc Turn off speed (Select VCCOUT=5V)



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



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



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