RICOH

R5533V-E2-F

PCMCIA Power Controller

NO.EA-176-130204

OUTLINE

The R5533V Series switch the V_{CC} voltage among 0V, 3.3V or 5.0V. And the V_{PP} voltage is outputted in between either OFF, 0V, 3.3V or 5.0V conditions.

When the V_{CC} or V_{PP} pin are short-circuited to the GND, the minimum current limit protection values are V_{CC} pin=1A and V_{PP} pin=0.2A. R5533V is suitable for standard type of PCMCIA power controllers.

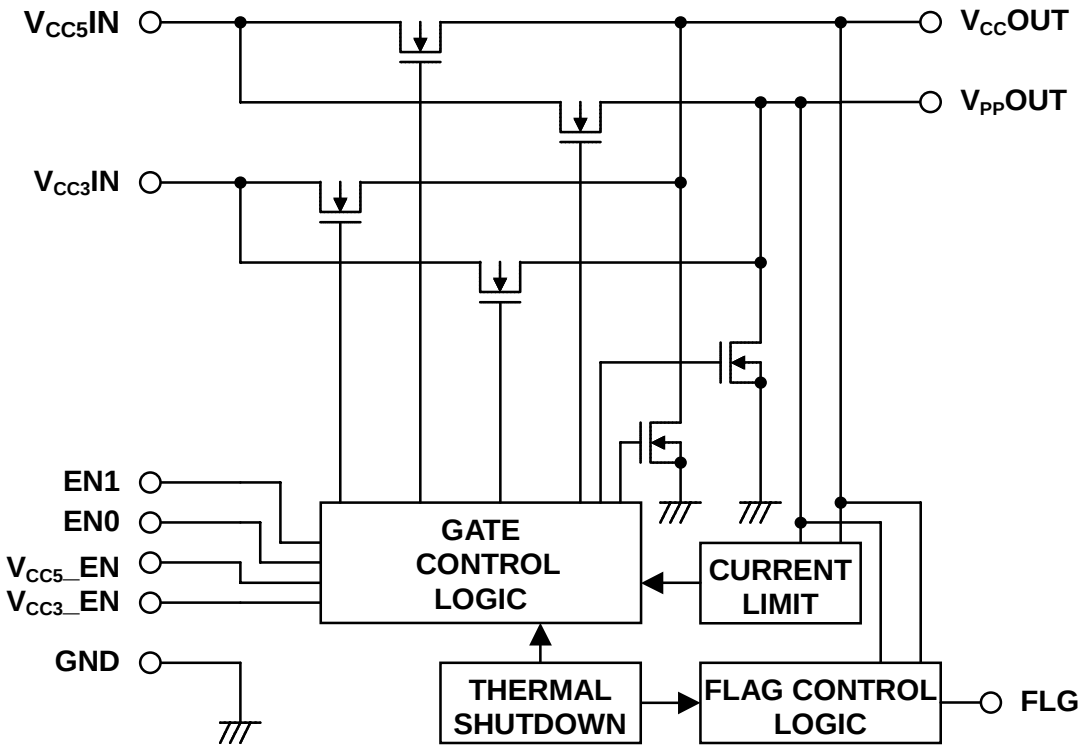
FEATURES

- Low ON resistance Nch MOSFET switch
- Built-in Over Current Limit Protection Function
- Built-in Thermal Shutdown Protection
- Open Drain Flag Pin
- Break-Before-Make Switching
- Package: SSOP-16

APPLICATIONS

- Power Supply Switch for PC Card
- Power Supply Control for a card-bus slot
- PC Card Reader / Writer

BLOCK DIAGRAMS

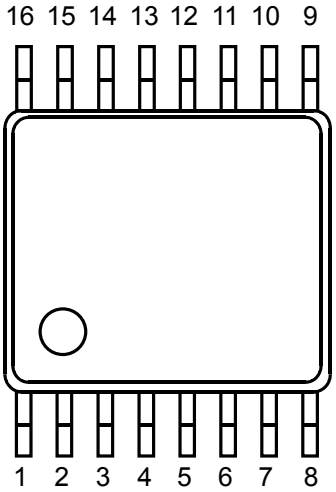


SELECTION GUIDE

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R5533V-E2-F	SSOP-16	2,000pcs	Yes	Yes

PIN CONFIGURATIONS

• **SSOP-16**



PIN DESCRIPTIONS

Pin No.	Symbol	Description
1	V_{CC5}_EN	Logic Input Pin
2	V_{CC3}_EN	Logic Input Pin
3	EN0	Logic Input Pin
4	EN1	Logic Input Pin
5	FLG	Flag Output Pin
6	TST	Test Pin
7	NC	No Connection
8	V_{PP}OUT	V_{PP} Output Pin
9	V_{CC}OUT	V_{CC} Output Pin
10	NC	No Connection
11	V_{CC3}IN	3V Input Pin
12	V_{CC}OUT	V_{CC} Output Pin
13	V_{CC5}IN	5V Input Pin
14	V_{CC}OUT	V_{CC} Output Pin
15	V_{CC5}IN	5V Input Pin
16	GND	Ground Pin

ABSOLUTE MAXIMUM RATINGS

(GND=0V)

Symbol	Item	Rating	Unit
$V_{CC5}IN$	Input Voltage (5V)	- 0.3 to 6.0	V
$V_{CC3}IN$	Input Voltage (3V)	- 0.3 to 6.0	V
V_{FLG}	Flag Voltage	- 0.3 to 6.0	V
V_{IN}	Logic Input Voltage	- 0.3 to 6.0	V
V_{TST}	Test Pin Voltage	- 0.3 to 6.0	V
P_D	Power Dissipation *	TBD	mW
Ta	Ambient Temperature Range	- 40 to 85	°C
Tstg	Storage Temperature Range	- 55 to 125	°C

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

RECOMMENDATION OF OPERATING CONDITION

(Ta=25°C)

Item	Symbol	Rating
Input Voltage (5V)	$V_{CC5}IN$	4.5V to 5.5V
Input Voltage (3V)	$V_{CC3}IN$	3.0V to 3.6V
Output Current	$I_O(V_{CC})$	$I_O(V_{CC})$<1A
	$I_O(V_{PP})$	$I_O(V_{PP})$<100mA

ELECTRICAL CHARACTERISTICS

V_{CC5}IN = 5V, V_{CC3}IN = 3.3V, unless otherwise noted.
The specification is guaranteed by design engineering at -40°C ≦ Ta ≦ 85°C. The typical value is at Ta = 25°C.

Ta=25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Current	I_{CC5}	V_{CC}OUT = 5V or 3.3V		180	340	µA
Supply Current	I_{SLP5}	V_{CC}OUT = 0V (Sleep Mode)		0.2	10	µA
Supply Current	I_{CC3}	V_{CC}OUT = 5V or 3.3V		7	20	µA
Supply Current	I_{SLP3}	V_{CC}OUT = 0V (Sleep Mode)		0.2	10	µA
V_{CC}OUT Switch Resistance	R_{OVCC}	Select V_{CC}OUT = 5V		90	140	mΩ
		Select V_{CC}OUT = 3.3V		85	140	mΩ
		Select V_{CC}OUT = 0V	300	500	1100	Ω
V_{PP}OUT Switch Resistance	R_{OVPP}	Select V_{PP}OUT = 5V		1	1.5	Ω
		Select V_{PP}OUT = 3.3V		1	1.5	Ω
		Select V_{PP}OUT = 0V	1500	2500	3900	Ω
V_{PP}OUT Leakage Current	I_{PPL}	Select V_{PP}OUT = Hi-Z		1	10	µA
Reverse Leakage Current	I_{CC}	V_{CC5}IN = V_{CC3}IN = 0V		3	50	µA
	I_{PP}	V_{CC5}IN = V_{CC3}IN = 0V		3	50	µA
Short Current Limit	I_{CCSC}	V_{CC}OUT = 0V	1	1.7	2.5	A
	I_{PPSC}	V_{PP}OUT = 0V	0.2	0.4	0.7	A
Short Current Limit Response Time *1	$t_{RES}(I_{CCSC})$	V_{CC}OUT = 0V		50		µs
	$t_{RES}(I_{PPSC})$	V_{PP}OUT = 0V		20		µs
Logic Input “H” Voltage	V_{IH}		2.0		6.0	V
Logic Input “L” Voltage	V_{IL}		- 0.3		0.8	V
Logic Input Current	I_{IN}				±1	µA
Thermal Shutdown Temperature	T_{SD}			140		°C
Hysterisis *2				10		°C
Flag Threshold Voltage	V_OOK	FLG is pulled up to V_{CC3}IN with 10kΩ		V_{CC}-1 V_{PP}-1		V
Flag Voltage “L”	V_{FLG}	I_{OL} = 2mA		0.3		V
Flag OFF Leakage Current	I_{FLGOFF}	V_{IN} = V_{FLG} = 5.5V			1	µA

*1 The specification is checked and guaranteed by design engineering
*2 The value of Hysterisis is calculated by the thermal Shutdown Temperature. It does not test.

ELECTRICAL CHARACTERISTICS (cont.)

V_{CC5}IN = 5V, V_{CC3}IN = 3.3V, unless otherwise noted.
The specification is guaranteed by design engineering at -40°C ≦ Ta ≦ 85°C. The typical value is in Ta = 25°C.

Ta=25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
V_{CC} Turn-ON Delay Time *2	t1	V_{CC}=3.3V Time until 10% in 3.3V from EN.	0.1	0.4	0.8	ms
	t2	V_{CC}=5.0V Time until 10% in 5.0V from EN.	0.15	0.45	1.0	ms
V_{CC} Rising Time *2	t3	V_{CC}=3.3V Time until 90% from 10% in 3.3V.	0.3	0.6	1.2	ms
	t4	V_{CC}=5.0V Time until 90% from 10% in 5.0V.	0.5	1.1	1.7	ms
V_{CC} Turn-OFF Delay Time*1,*2,*4	t7	V_{CC}=3.3V Time until Hi-Z from EN.	0.7	2	8.0	ms
	t8	V_{CC}=5.0V Time until Hi-Z from EN	0.9	2.1	6.0	ms
V_{CC} Falling Time *2	t5	V_{CC}=3.3V Time until 10% from 90% in 3.3V.	0.2	0.7	1.8	ms
	t6	V_{CC}=5.0V Time until 10% from 90% in 5.0V.	0.2	0.7	2.0	ms
V_{PP} Turn-ON Deay Time *3	t9	V_{PP}=3.3V Time until 10% in 3.3V from EN.	30	100	210	µs
	t10	V_{PP}=5.0V Time until 10% in 5.0V from EN.	40	120	230	µs
V_{PP} Rising Time *3	t11	V_{PP}=3.3V Time until 90% from 10% in 3.3V.	80	180	350	µs
	t12	V_{PP}=5.0V Time until 90% from 10% in 5.0V.	120	280	650	µs
V_{PP} Turn-OFF Delay Time*1,*3	t15	V_{PP}=3.3V Time until Hi-Z from EN.	20	50	160	ns
	t16	V_{PP}=5.0V Time until Hi-Z from EN	30	50	150	ns
V_{PP} Falling Time *3	t13	V_{PP}=3.3V Time until 10% from 90% in 3.3V.	10	30	80	ns
	t14	V_{PP}=5.0V Time until 10% from 90% in 5.0V.	10	30	80	ns

*1 The time between the beginning of falling time of the output from the change of EN.
*2 The measurement condition of t1 ~ t8: RL = 10Ω
*3 The measurement condition of t9 ~ t16: RL = 100Ω
*4 Please avoid the status on current limit or thermal shutdown during t7 and t8.

TIMING CHART

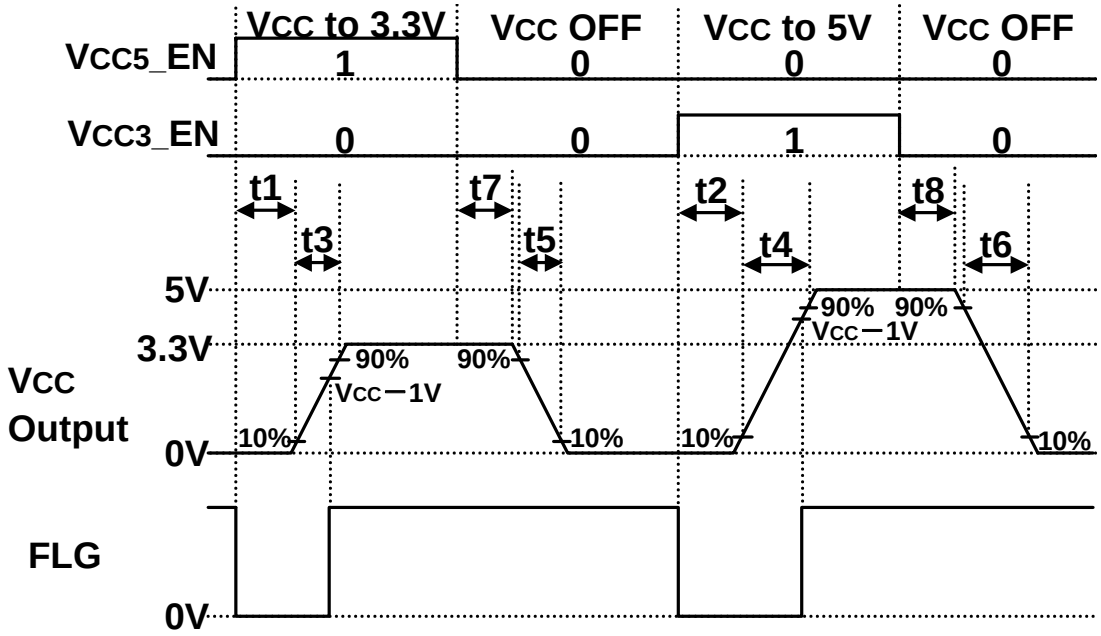


Fig1 Timing Diagram of V_{CC}

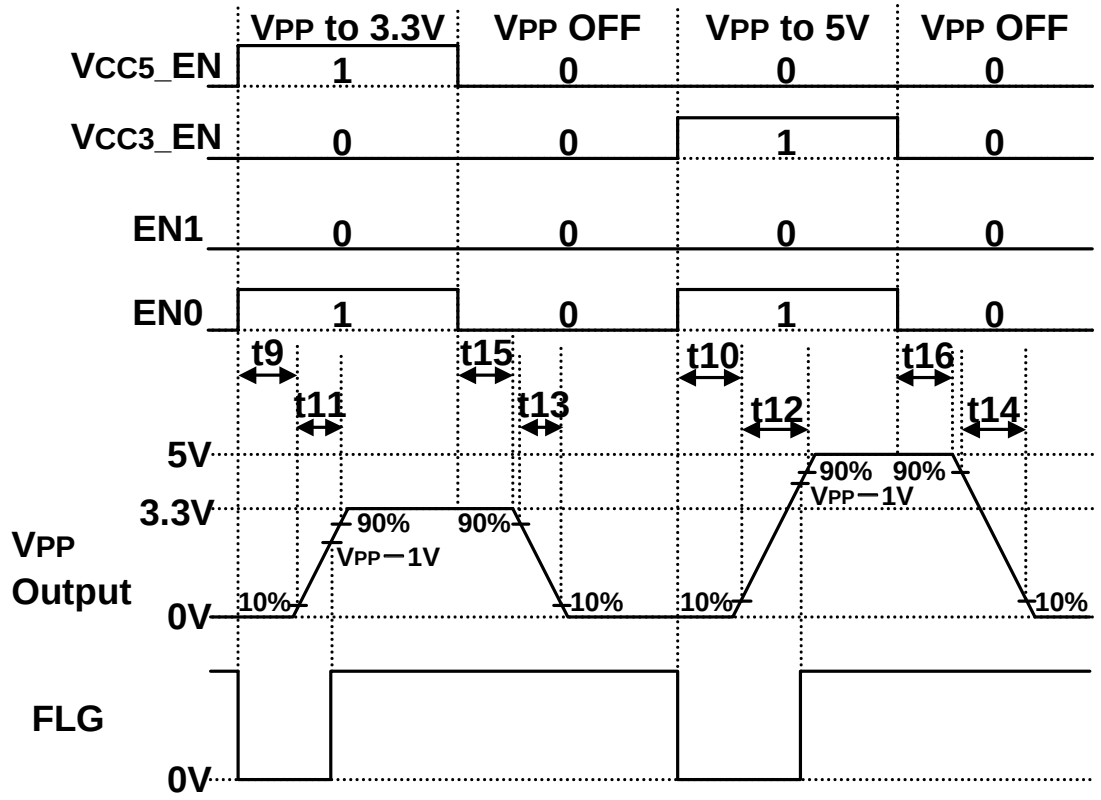


Fig 2 Timing Diagram of V_{PP}

OPERATION

OPERATING EXPLANATION

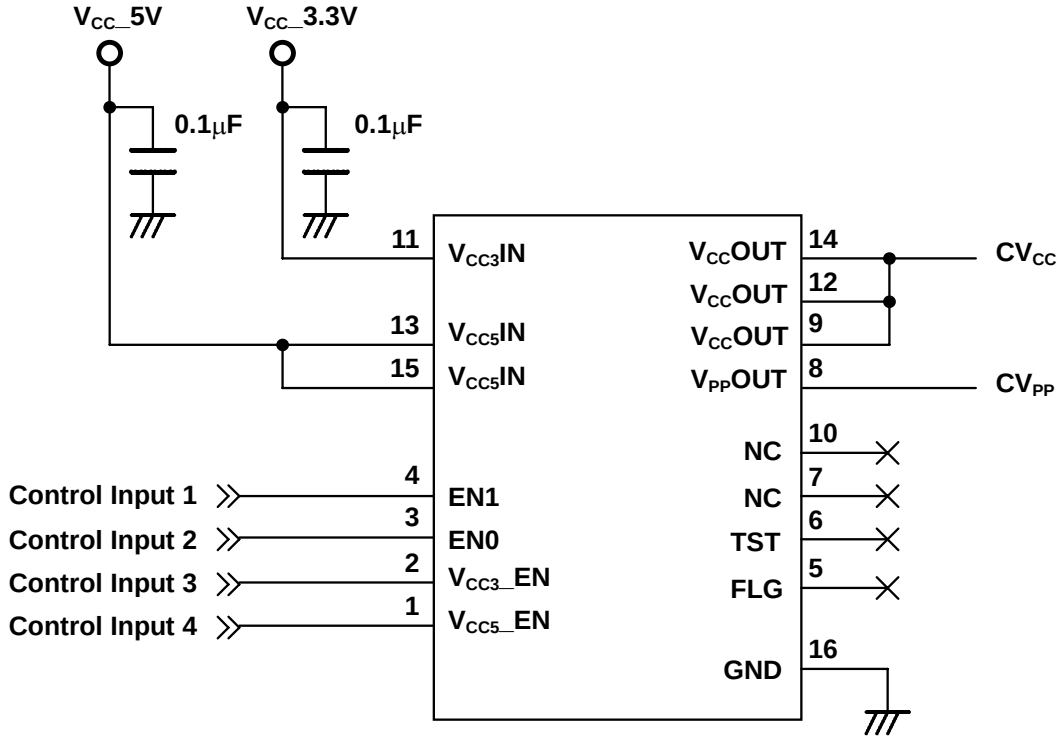
When the V_{CC}OUT=0V is selected, the IC switches into the sleep mode, the supply current decreases to nano-amperes.

If commanded to switch from 5.0V to 3.3V, or vise versa from 3.3V to 5.0V, without selecting V_{CC}OUT=0V between switching. In this case, enhancement of the second switch begins after the first is OFF, that is called as "the break-before-make switching".

If the condition of the over-current limit caused by the OUT pin clamped to the GND were continue the temperature of the ICs would increase drastically. The switch-transistor is turned OFF if the temperature of the ICs becomes over 140°C (Typ.). And after this, the switch-transistor is turned ON again when the temperature of ICs decreased approximately 10°C. The switch-transistor keeps continual ON and OFF until either the switch is turned OFF or the OUT pin is removed from GND.

The Short Current Limit is fixed internal ICs. The response at the over-current is the following two types. (1) The ICs become constant current state immediately if the ICs are turned ON under the condition that the OUT pin is shorted or the large capacity is loaded. The current value in the state of constant current is the short current limit. (2) The large transient current flows until the current limit circuit responds, if the OUT pin is shorted or the large capacity is loaded under the condition that the switch-transistor is turned ON. The transient current is depending on the impedance from the power supply circuit of V_{CC5}IN / V_{CC3}IN to the output load. It means that the transient current depends upon the transient response characteristics of the power supply circuits of V_{CC5}IN / V_{CC3}IN, PCB layout or the card connecter. After the current limit circuit is responded, the short current limit flows as the condition of constant current.

TYPICAL APPLICATION



Note: The signal from Control Input1~4 provided by PCMCIA control.

CONTROL LOGIC TABLE

V_{CC5}_EN	V_{CC3}_EN	EN1	EN0	V_{CC}OUT	V_{PP}OUT
0	0	0	0	0 V	0 V
0	0	0	1	0 V	Hi-Z
0	0	1	0	0 V	Hi-Z
0	0	1	1	0 V	Hi-Z
0	1	0	0	5 V	0 V
0	1	0	1	5 V	5 V
0	1	1	0	5 V	Hi-Z
0	1	1	1	5 V	Hi-Z
1	0	0	0	3.3 V	0 V
1	0	0	1	3.3 V	3.3 V
1	0	1	0	3.3 V	Hi-Z
1	0	1	1	3.3 V	Hi-Z
1	1	0	0	0 V	0 V
1	1	0	1	0 V	Hi-Z
1	1	1	0	0 V	Hi-Z
1	1	1	1	0 V	Hi-Z

APPLICATION NOTES

Connect a by-pass capacitor value from 0.1μF to 1.0μF between V_{CC5}IN and GND pin, V_{CC3}IN and GND pin.
Please connect the same function pins to one another.
TST pin (Pin 6) should be OPEN.

TEST CIRCUITS

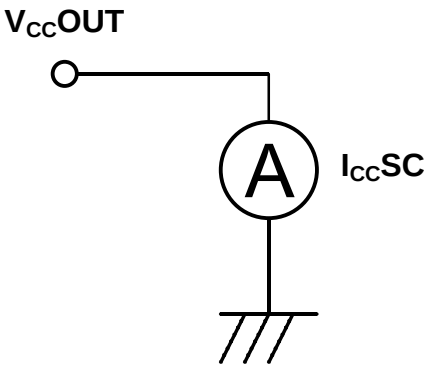


Fig.1 I_{CC}SC

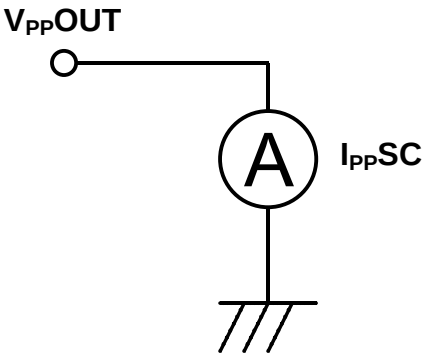


Fig.2 I_{PP}SC

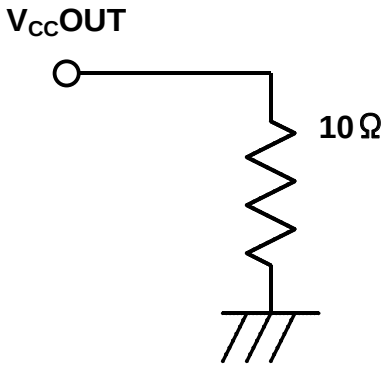


Fig.3 t1~t8

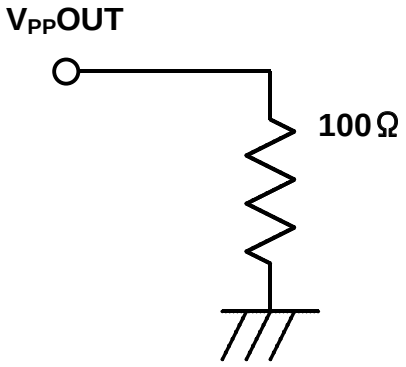


Fig.3 t9~t16

Note 1: The test circuits of all other pins, except V_{CC}OUT pin and V_{PP}OUT pins refer to the TYPICAL APPLITCATIONS (p.8).
Note 2: Please connect a 10kΩ resistance with between FLG pin and V_{CC3}IN pin when the threshold of FLG pin voltage is testing.

TYPICAL CHARACTERISTICS

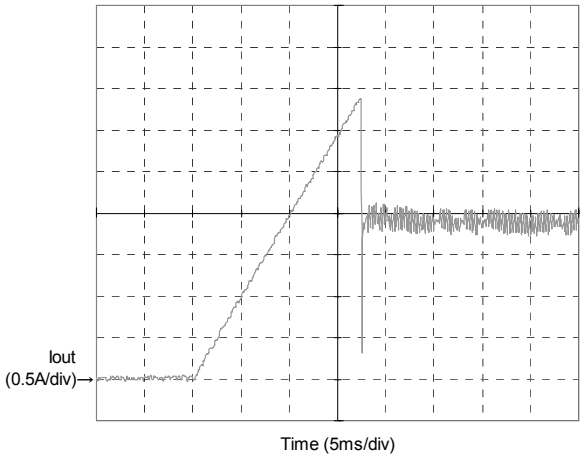


Fig.1 Ramped Load Connected to an Enabled Device

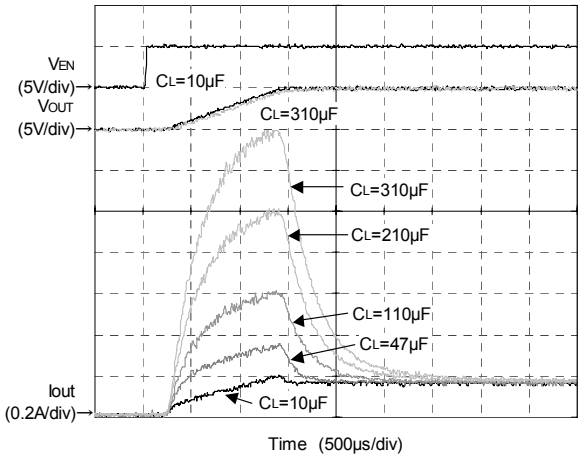


Fig.2 Rush Current

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For the conservation of the global environment, Ricoh is advancing the decrease of the negative environmental impact material.
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