

Low on Resistance / Low Voltage 1A LDO

NO.EA-265-120308

OUTLINE

The RP132x Series are voltage-regulators with a built-in low ON-resistance transistor and output current is 1A capability. These ICs have two versions: fixed output voltage type and externally adjustable output voltage type. The minimum output voltage can be set from 1.4V. Otherwise, the load regulation of RP132x has much improved when compared with conventional regulators. It's Typ.5mV at $I_{OUT}=0.1\text{mA}$ to 1A.

Each of these ICs consists of a voltage reference unit, an error amplifier, a resistor net for setting output voltage, current limit circuits to prevent over-current and a thermal-shutdown circuit. A standby mode with ultra low supply current can be realized with the chip enable function. Additionally, E/F Version with delay pin for inrush current limit time setting are also available.

The packages for these ICs are DFN(PLP)1820-6, SOT-89-5, HSOP-6J and TO-252-5-P2. DFN(PLP)1820-6 is suitable for high density mounting of the ICs on boards. SOT-89-5, HSOP-6J and TO-252-5-P2 are supporting high wattage.

FEATURES

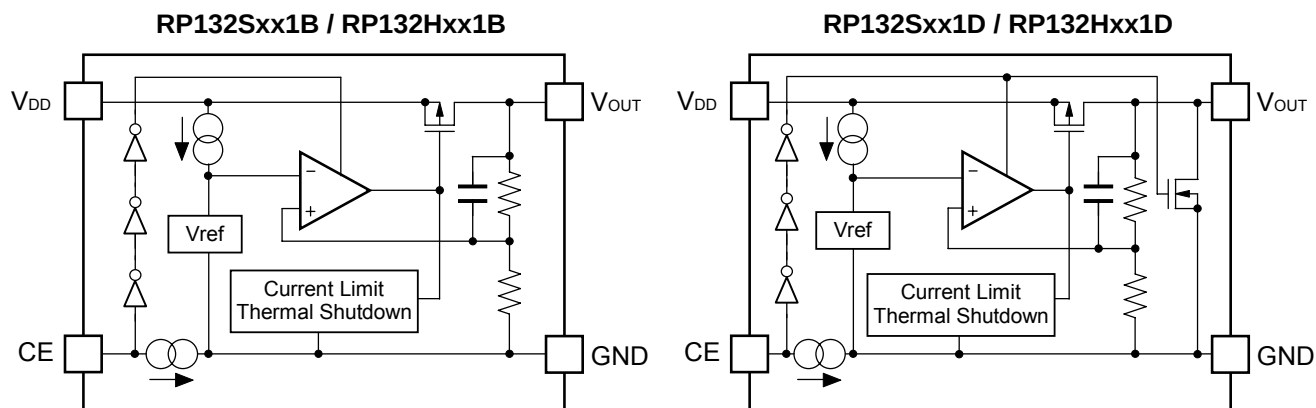
- Output Current Min. 1A
- Supply Current Typ. 65 μA
- Standby Current Typ. 0.15 μA
- Input Voltage Range 1.4V to 6.5V
- Output Voltage Range Fixed Output Voltage Type: 0.8V to 5.5V (0.1V steps)
Adjustable Output Voltage Type: 0.8V to 5.5V
(For other voltages, please refer to MARK INFORMATION.)
- Dropout Voltage..... Typ. 0.52V ($V_{OUT}=2.8\text{V}$, $I_{OUT}=1\text{A}$)
- Ripple Rejection Typ. 70dB ($f=1\text{kHz}$, $V_{OUT}=2.8\text{V}$)
- Output Voltage Accuracy $\pm 1.0\%$
- Output Voltage Temperature-Drift Coefficient Typ. $\pm 60\text{ppm}/^\circ\text{C}$
- Line Regulation Typ. 0.052%/V
- Load Regulation Typ. 3mV at $I_{OUT}=300\text{mA}$, Typ. 5mV at $I_{OUT}=1\text{A}$
- Packages DFN(PLP)1820-6, SOT-89-5, HSOP-6J, TO-252-5-P2
- Inrush Current Limit Circuit Typ. 500mA
B/D version: Inrush current limit time is 500 μs .
E/F version: Inrush current limit time is adjustable.
- Fold-Back Protection Circuit Typ. 250mA (Current at short mode)
- Thermal Shutdown Circuit Thermal Shutdown Temperature: Typ. 165 $^\circ\text{C}$
Released Temperature: Typ. 95 $^\circ\text{C}$
- Auto Discharge Function D, F version
- Ceramic capacitors are recommended to be used with this IC 2.2 μF or more ($V_{OUT} \leq 3.6\text{V}$)
4.7 μF or more ($V_{OUT} > 3.6\text{V}$)

APPLICATIONS

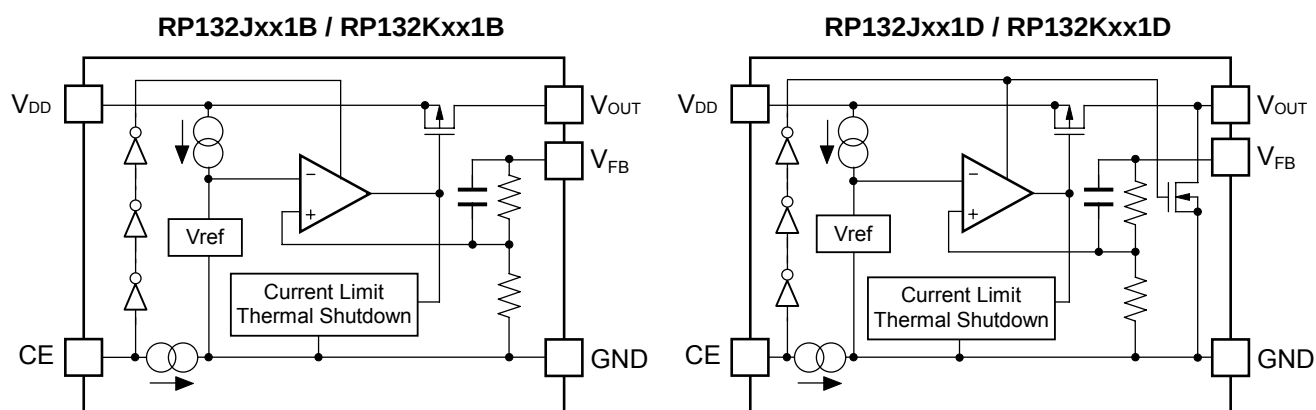
- Power source for battery-powered equipment.
- Power source for portable communication equipment
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for home appliances and Notebook PC.

BLOCK DIAGRAMS

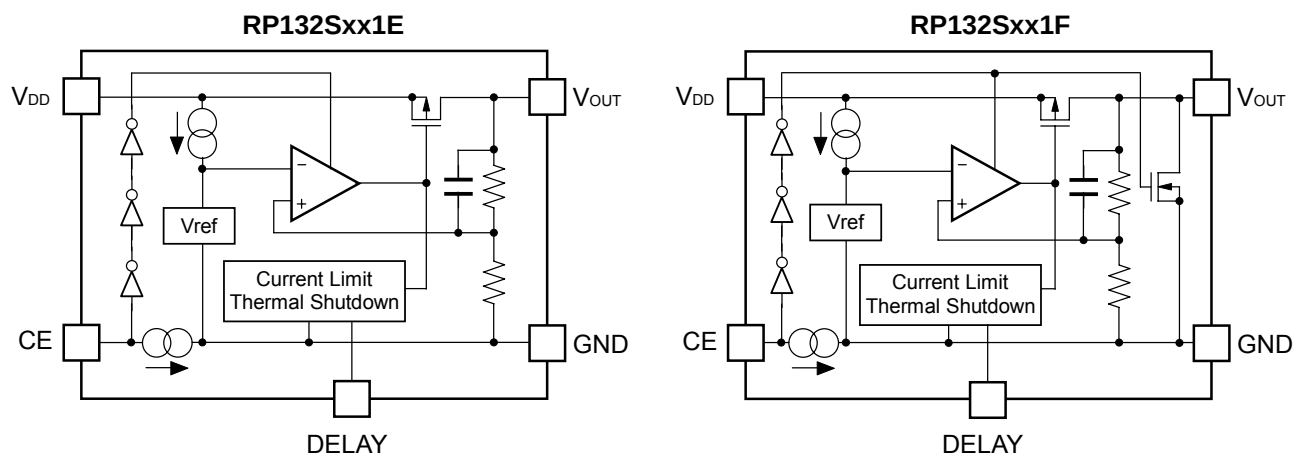
- Fixed Output Voltage Type (HSOP-6J / SOT89-5)



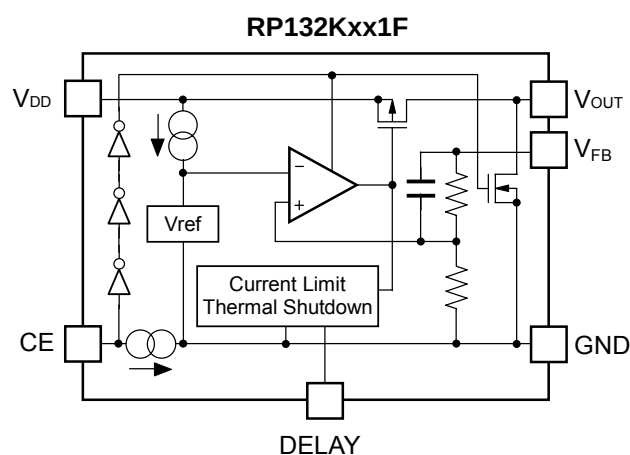
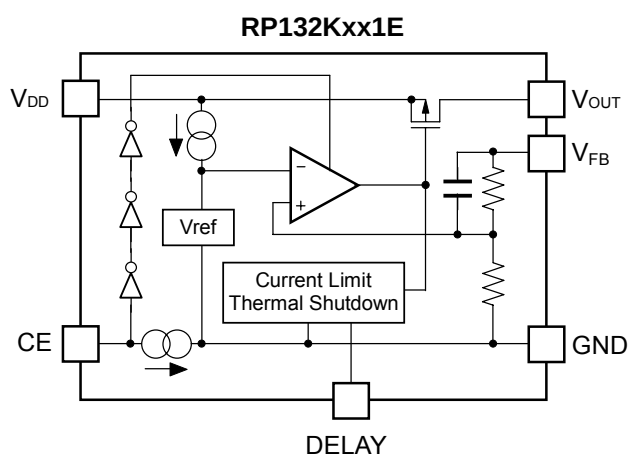
- Fixed Output Voltage Type (TO-252-5-P2 / DFN(PLP)1820-6)



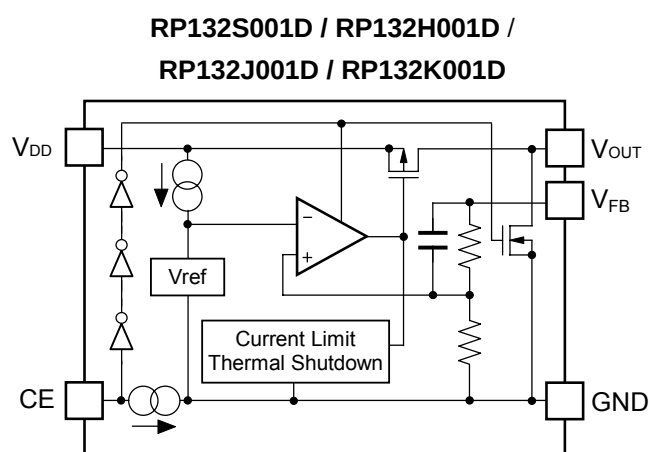
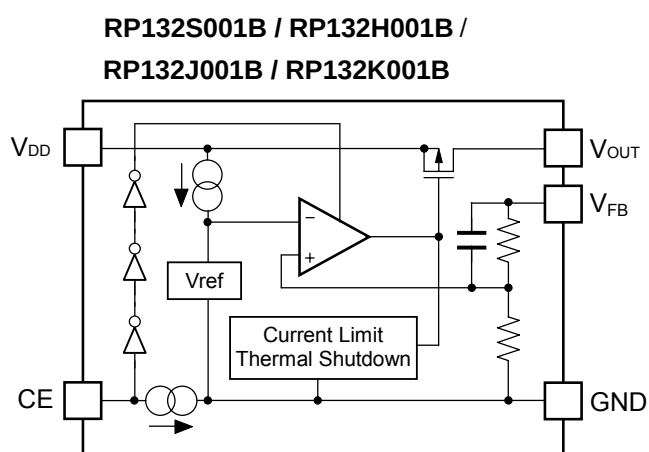
- Fixed Output Voltage Type with DELAY pin (HSOP-6J)



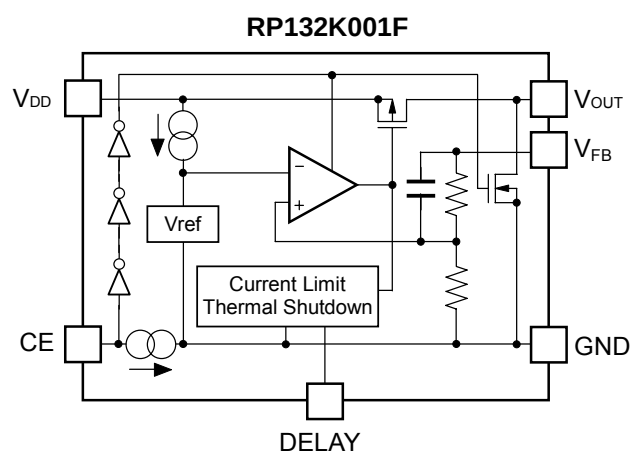
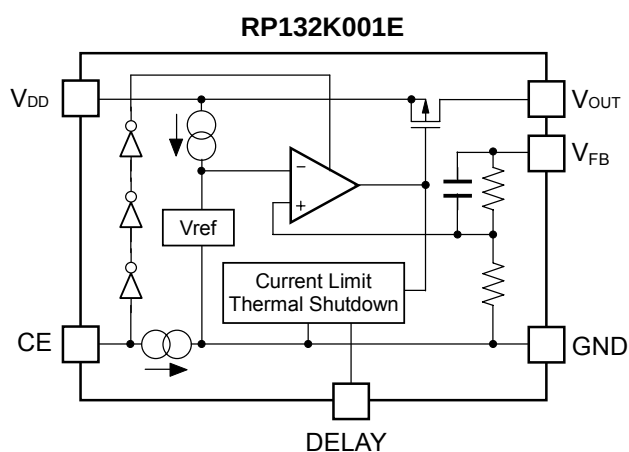
• Fixed Output Voltage Type with DELAY pin (DFN(PLP)1820-6)



• Adjustable Output Voltage Type (HSOP-6J / SOT-89-5 / TO-252-5-P2 /DFN(PLP)1820-6)



• Adjustable Output Voltage Type with DELAY pin (DFN(PLP)1820-6)



SELECTION GUIDE

The output voltage, the auto discharge function, and the package type for the ICs can be selected at the user's request.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP132Kxx1*-TR	DFN(PLP)1820-6	5,000 pcs	Yes	Yes
RP132Hxx1#-T1-FE	SOT-89-5	1,000 pcs	Yes	Yes
RP132Sxx1*-E2-FE	HSOP-6J	1,000 pcs	Yes	Yes
RP132Jxx1#-T1-FE	TO-252-5-P2	3,000 pcs	Yes	Yes

xx: The output voltage can be designated in the range from 0.8V(08) to 5.5V(55) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATION.)
RP132S001E/F doesn't exist.

*: The combination of the auto discharge function and delay pin (for setting inrush current limit time) are follows.

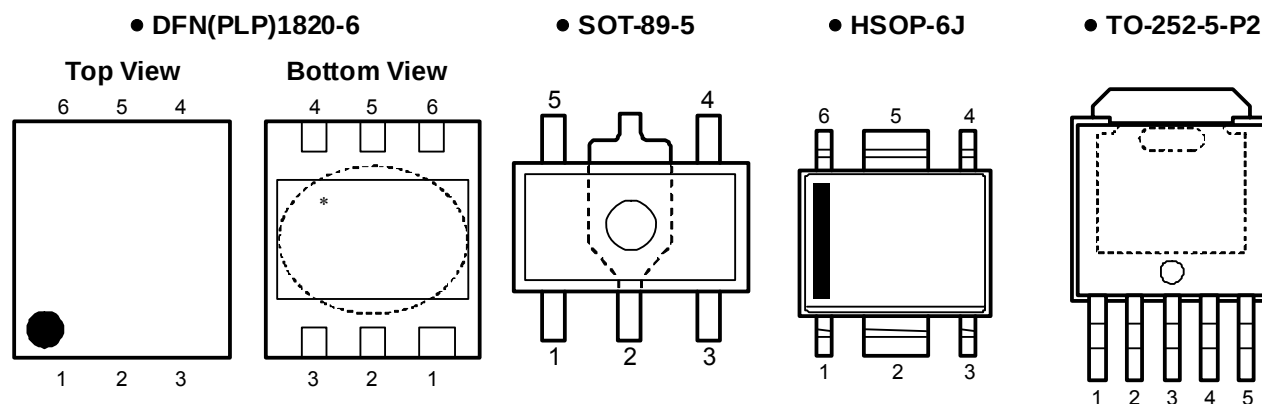
- (B) without auto discharge function
- (D) with auto discharge function
- (E) without auto discharge function, with delay pin (for setting inrush current limit time)
- (F) with auto discharge function and delay pin (for setting inrush current limit time)

#: The auto discharge function at off state are options as follows.

- (B) without auto discharge function at off state
- (D) with auto discharge function at off state

Auto-discharge function quickly lowers the output voltage to 0V, when the chip enable signal is switched from the active mode to the standby mode, by releasing the electrical charge accumulated in the external capacitor.

PIN CONFIGURATIONS



PIN DESCRIPTIONS

• DFN(PLP)1820-6

Pin No.	Symbol	Pin Description
1	V_{OUT}	Output Pin
2	V_{FB}	Feed Back Pin
3	GND	Ground Pin
4	CE	Chip Enable Pin ("H" Active)
5	NC	No Connection (RP132K001B/D, RP132Kxx1B/D)
	DELAY	Delay Pin (for setting inrush current limit time) (RP132K001E/F, RP132Kxx1E/F)
6	V_{DD}	Input Pin

* Tab is GND level. (They are connected to the reverse side of this IC.) The tab is better to be connected to the GND, but leaving it open is also acceptable.

- When using Fixed Output Voltage Type(RP132Kxx1x), the V_{OUT} pin and the V_{FB} pin should be connected.
- When using Adjustable Output Voltage Type (RP132K001x), please follow "Notes on the Adjustable Output Voltage Type Settings".

RP132x

• SOT-89-5

Pin No.	Symbol	Pin Description
1	CE	Chip Enable Pin ("H" Active) (RP132Hxx1B/D)
	V _{FB}	Feed Back Pin (RP132H001B/D)
2	GND	Ground Pin
3	NC	No Connection (RP132Hxx1B/D)
	CE	Chip Enable Pin ("H" Active) (RP132H001B/D)
4	V _{DD}	Input Pin
5	V _{OUT}	Output Pin

- When using Adjustable Output Voltage Type (RP132H001x), please follow "Notes on Adjustable Output Voltage Type Settings".

• HSOP-6J

Pin No.	Symbol	Pin Description
1	V _{OUT}	Output Pin
2	GND	Ground Pin ^{*1}
3	NC	No Connection (RP132Sxx1B/D)
	V _{FB}	Feed Back Pin (RP132S001B/D)
	DELAY	Delay Pin (for setting inrush current limit time)(RP132Sxx1E/F)
4	CE	Chip Enable Pin ("H" Active)
5	GND	Ground Pin ^{*1}
6	V _{DD}	Input Pin

^{*1} No.2 pin and No.5 pin must be wired each other when mounted on boards.

- When using Adjustable Output Voltage Type (RP132S001x), please follow "Notes on Adjustable Output Voltage Type Settings".

• TO-252-5-P2

Pin No.	Symbol	Pin Description
1	CE	Chip Enable Pin ("H" Active)
2	V _{DD}	Input Pin
3	GND	Ground Pin
4	V _{OUT}	Output Pin
5	V _{FB}	Feed Back Pin

* Tab is GND level. (They are connected to the reverse side of this IC.) The tab is better to be connected to the GND, but leaving it open is also acceptable.

- when using Fixed Output Voltage Type(RP132Jxx1x),V_{OUT} pin and V_{FB} pin should be connected.
- When using Adjustable Output Voltage Type (RP132J001x), please follow "Notes on the Adjustable Output Voltage Type Settings".

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	7.0	V
V_{CE}	Input Voltage (CE Pin)	−0.3 to 7.0	V
V_{FB}	Input Voltage (V_{FB} Pin)	−0.3 to 7.0	V
V_{OUT}	Output Voltage	−0.3 to $V_{IN}+0.3$	V
P_D	Power Dissipation (DFN(PLP)1820-6)*	880	mW
	Power Dissipation (SOT-89-5)*	900	
	Power Dissipation (HSOP-6J)*	1700	
	Power Dissipation (TO-252-5-P2)*	1900	
T_{opt}	Operating Temperature Range	−40 to 85	°C
T_{stg}	Storage Temperature Range	−55 to 125	°C

*) For Power Dissipation, please refer to PACKAGE INFORMATION.

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.

ELECTRICAL CHARACTERISTICS

$V_{IN} = \text{Set } V_{OUT} + 1.0V$, $I_{OUT} = 1mA$, $C_{IN} = 2.2\mu F$, $C_{OUT} = 2.2\mu F (V_{OUT} \leq 3.6V)$, $4.7\mu F (V_{OUT} > 3.6V)$.

The specification in is checked and guaranteed by design engineering at $-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$, unless otherwise noted.

● **RP132xxx1B/D(Fixed Output Voltage Type)**

● **RP132S/Kxx1E/F(Fixed Output Voltage Type with DELAY pin)**

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

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V _{OUT}	Output Voltage	T _{opt} =25°C	V _{OUT} > 1.5V	×0.99		×1.01	V
			V _{OUT} ≤ 1.5V	−15		15	mV
		−40°C ≤ T _{opt} ≤ 85°C	V _{OUT} > 1.5V	×0.981		×1.019	V
			V _{OUT} ≤ 1.5V	−29		29	mV
I _{LIM}	Output Current Limit			1			A
ΔV _{OUT} /ΔI _{OUT}	Load Regulation	0.1mA ≤ I _{OUT} ≤ 300mA			3	20	mV
		0.1mA ≤ I _{OUT} ≤ 1A			5	60	
V _{DIF}	Dropout Voltage	Refer to the following "Dropout Voltage"					
I _{SS}	Supply Current	I _{OUT} =0mA (V _{IN} =6.5V)			65	85	μA
I _{standby}	Standby Current	V _{CE} =0V, V _{IN} =6.5V			0.15	0.60	μA
ΔV _{OUT} /ΔV _{IN}	Line Regulation	Set V _{OUT} +0.5V ≤ V _{IN} ≤ 6.5V * However, V _{IN} ≥ 1.6V			0.05	0.10	%/V
RR	Ripple Rejection	f=1kHz Ripple 0.2Vp-p I _{OUT} =100mA	V _{OUT} ≤ 3.3V		70		dB
			V _{OUT} > 3.3V		60		
V _{IN}	Input Voltage			1.4		6.5	V
ΔV _{OUT} /ΔT _{opt}	Output Voltage Temperature Coefficient	−40°C ≤ T _{opt} ≤ 85°C			±60		ppm /°C
I _{SC}	Short Current Limit	V _{OUT} =0V			250		mA
I _{PD}	CE Pull-down Current				0.3	0.7	μA
V _{CEH}	CE Input Voltage "H"			1.0			V
V _{CEL}	CE Input Voltage "L"					0.4	V
en	Output Noise	BW=10Hz to 100kHz			70		μVrms
T _{TSD}	Thermal Shutdown Temperature	Junction Temperature			165		°C
T _{TSR}	Thermal Shutdown Released Temperature	Junction Temperature			95		°C
R _{LOW}	Low Output Nch Tr. ON Resistance (D/F version)	V _{IN} =4.0V, V _{CE} =0V			50		Ω
I _{DELAY}	DELAY pin Current (DELAY pin version)	V _{IN} =4.0V		0.7	1.2	1.7	μA

All test items listed under Electrical Characteristics are done under the pulse load condition ($T_j \approx T_a = 25^{\circ}C$) except Output Noise, Ripple Rejection, Output Voltage Temperature Coefficient, Dropout Voltage at 1A Output Current and Load Regulation and Thermal Shutdown.

• Dropout Voltage

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

Output Voltage V_{OUT} (V)	Dropout Voltage V_{DIF} (V)					
	Condition	Typ.	Max.	Condition	Typ.	Max.
$0.8 \leq V_{OUT} < 0.9$	$I_{OUT}=300\text{mA}$	0.67	0.89	$I_{OUT}=1\text{A}$	1.20	1.54
$0.9 \leq V_{OUT} < 1.0$		0.59	0.82		1.10	1.46
$1.0 \leq V_{OUT} < 1.1$		0.51	0.73		1.05	1.39
$1.1 \leq V_{OUT} < 1.2$		0.42	0.63		0.96	1.31
$1.2 \leq V_{OUT} < 1.5$		0.36	0.54		0.90	1.23
$1.5 \leq V_{OUT} < 2.6$		0.24	0.33		0.78	1.05
$2.6 \leq V_{OUT} < 3.3$		0.15	0.21		0.52	0.72
$3.3 \leq V_{OUT} \leq 5.5$		0.13	0.18		0.46	0.68

The specification in is checked and guaranteed by design engineering at $-40^{\circ}\text{C} \leq T_{opt} \leq 85^{\circ}\text{C}$, unless otherwise noted.

All test items listed under Electrical Characteristics are done under the pulse load condition ($T_j \approx T_a = 25^{\circ}\text{C}$) except Output Noise, Ripple Rejection, Output Voltage Temperature Coefficient, Dropout Voltage at 1A Output Current and Load Regulation and Thermal Shutdown.

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.

ELECTRICAL CHARACTERISTICS

$V_{IN} = \text{Set } V_{OUT} + 1.0V$, $I_{OUT} = 1mA$, $C_{IN} = 2.2\mu F$, $C_{OUT} = 2.2\mu F$ ($V_{OUT} \leq 3.6V$), $4.7\mu F$ ($V_{OUT} > 3.6V$).

The specification in is checked and guaranteed by design engineering at $-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$, unless otherwise noted.

• **RP132x001B/D(Adjustable Output Voltage Type)**

• **RP132K001E/F(Adjustable Output Voltage Type with DELAY pin)**

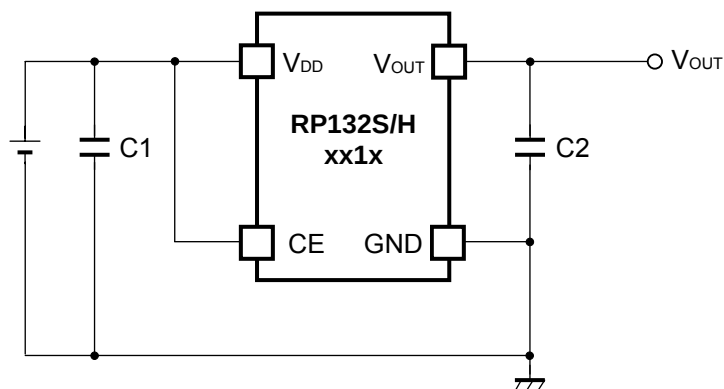
$T_{opt} = 25^{\circ}C$

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V _{FB}	Feedback Voltage	T _{opt} =25°C	V _{OUT} =V _{FB}	0.785	0.800	0.815	V
		−40°C ≤ T _{opt} ≤ 85°C		0.771		0.829	
V _{OUT}	Output Voltage Adjusting Range			0.8		5.5	V
I _{LIM}	Output Current Limit	V _{OUT} =V _{FB}		1			A
ΔV _{OUT} / ΔI _{OUT}	Load Regulation	0.1mA ≤ I _{OUT} ≤ 300mA			3	20	mV
		0.1mA ≤ I _{OUT} ≤ 1A			5	60	
V _{DIF}	Dropout Voltage	V _{OUT} =V _{FB}	I _{OUT} =300mA		0.67	0.89	V
			I _{OUT} =1A		1.20	1.54	
I _{SS}	Supply Current	V _{OUT} =V _{FB} , I _{OUT} =0mA (V _{IN} =6.5V)			65	85	μA
I _{standby}	Standby Current	V _{CE} =0V, V _{IN} =6.5V			0.15	0.60	μA
ΔV _{OUT} / ΔV _{IN}	Line Regulation	V _{OUT} =V _{FB} , 1.6V ≤ V _{IN} ≤ 6.5V			0.05	0.10	%/V
RR	Ripple Rejection	f=1kHz, Ripple 0.2Vp-p, I _{OUT} =100mA	V _{OUT} =V _{FB}		70		dB
V _{IN}	Input Voltage			1.4		6.5	V
ΔV _{OUT} / ΔT _{opt}	Output Voltage Temperature Coefficient	−40°C ≤ T _{opt} ≤ 85°C			±60		ppm /°C
I _{SC}	Short Current Limit	V _{OUT} =V _{FB} =0V			250		mA
I _{PD}	CE Pull-down Current				0.3	0.7	μA
V _{CEH}	CE Input Voltage "H"			1.0			V
V _{CEL}	CE Input Voltage "L"					0.4	V
en	Output Noise	BW=10Hz to 100kHz			70		μVrms
T _{TSD}	Thermal Shutdown Temperature	Junction Temperature			165		°C
T _{TSR}	Thermal Shutdown Released Temperature	Junction Temperature			95		°C
R _{LOW}	Low Output Nch Tr. ON Resistance (D/F version)	V _{IN} =4.0V, V _{CE} =0V			50		Ω
I _{DELAY}	DELAY pin Current (DELAY pin version)	V _{IN} =4.0V		0.7	1.2	1.7	μA

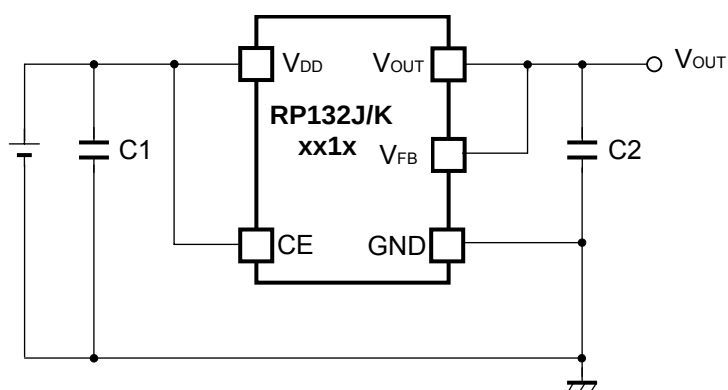
All of unit are tested and specified under load conditions such that $T_j \approx T_{opt} = 25^{\circ}C$ except for Output Noise, Ripple Rejection, Output Voltage Temperature Coefficient, Dropout Voltage at 1A Output Current and Load Regulation and Thermal Shutdown.

TYPICAL APPLICATION

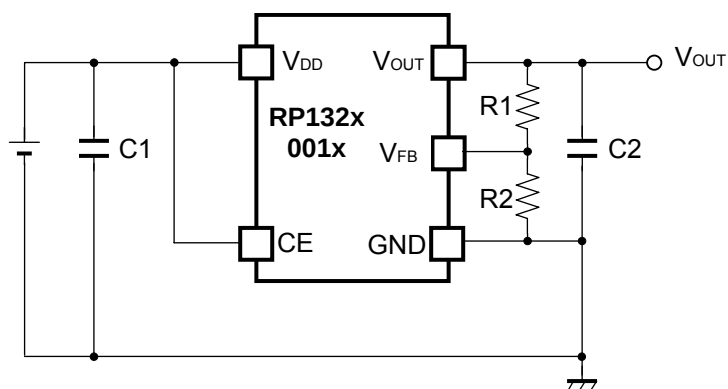
- Fixed Output Voltage Type (HSOP-6J/ SOT89-5)



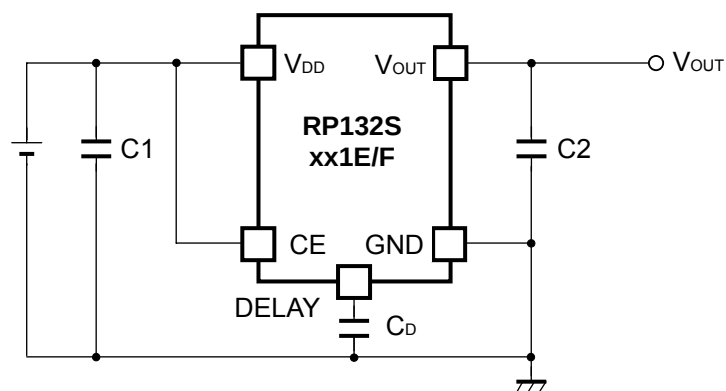
- Fixed Output Voltage Type (TO-252-5-P2/ DFN(PLP)1820-6)



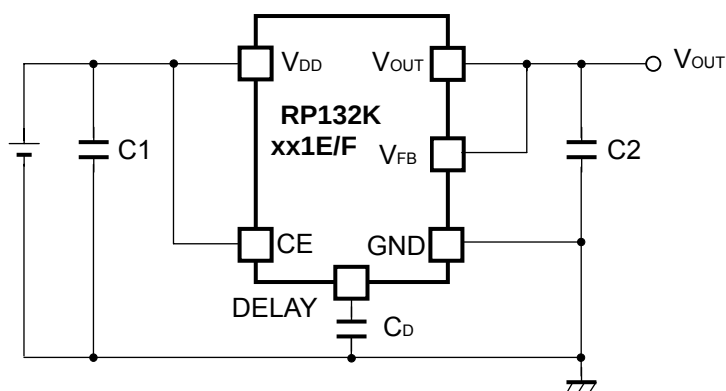
- Adjustable Output Voltage Type (HSOP-6J / SOT89-5/ TO-252-5-P2 / DFN(PLP)1820-6)



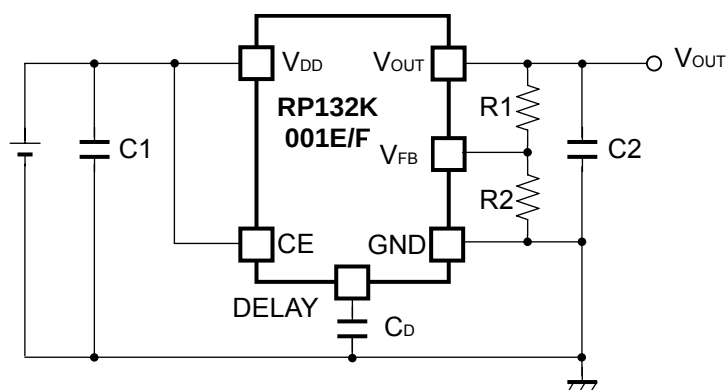
- Fixed Output Voltage Type with DELAY pin (HSOP-6J)



- Fixed Output Voltage Type with DELAY pin (DFN(PLP)1820-6)



- Adjustable Output Voltage Type with DELAY pin (DFN(PLP)1820-6)



Recommendation value of the external capacitors

V_{OUT}	Capacitors		
$V_{OUT} \leq 3.6V$	C1	Kyocera 2.2 μ F (size:1005)	[CM05X5R225M06A]
	C2	Kyocera 2.2 μ F (size:1608)	[CM105X5R225K06AB]
$V_{OUT} > 3.6V$	C1	Kyocera 2.2 μ F (size:1005)	[CM05X5R225K06A]
	C2	Kyocera 4.7 μ F (size:1608)	[CM105X5R475M06AB]

Please refer to "Technical Notes on Adjustable Output Voltage Type" when using R1 and R2 as output capacitors.

Also refer to "Inrush Current Limit Time Settings" concerning with C_D .

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance).

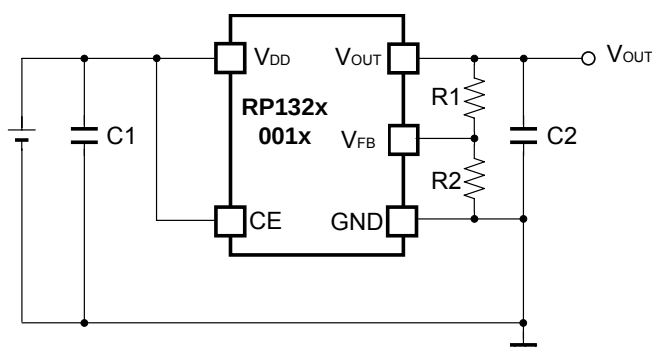
If a tantalum capacitor is used, and its ESR of C2 is large, the loop oscillation may result. Because of this, select C2 carefully considering its frequency characteristics.

PCB Layout

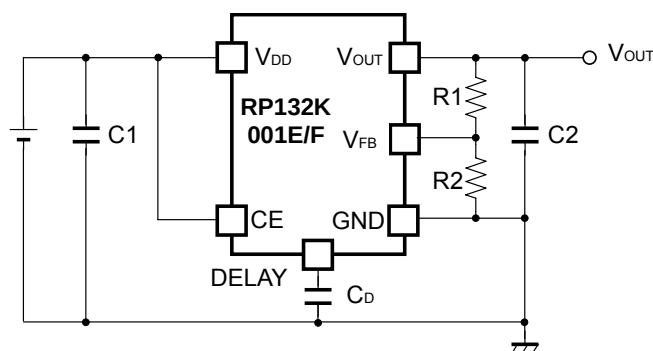
Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 between V_{DD} and GND pin with a capacitance value as "Recommendation value of the external capacitors" above or more, and as close as possible to the pins.

Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

TECHNICAL NOTES on Adjustable Output Voltage Type



Typical Application for Adjustable Output Voltage Type (HSOP-6J / SOT89-5/ TO-252-5-P2 / DFN(PLP)1820-6)



Typical Application for Adjustable Output Voltage Type with DELAY pin (DFN(PLP)1820-6)

Recommendation value of the external capacitors

V _{OUT}	Capacitors		
V _{OUT} ≤ 3.6V	C1	Kyocera 2.2μF (size:1005)	[CM05X5R225M06A]
	C2	Kyocera 2.2μF (size:1608)	[CM105X5R225K06AB]
V _{OUT} > 3.6V	C1	Kyocera 2.2μF (size:1005)	[CM05X5R225K06A]
	C2	Kyocera 4.7μF (size:1608)	[CM105X5R475M06AB]

Phase Compensation

Similar to the Fixed Output Voltage Type, Phase compensation is made for the Adjustable Output Voltage Type for securing stable operation even if the load current is varied. For this purpose, use a 4.7μF or more capacitor C2 between V_{OUT} pin and GND pin, and as close as possible to the pins.

PCB Layout

Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 2.2μF or more between V_{DD} and GND pin, and as close as possible to the pins.

When using the Adjustable Output Voltage Type, the transient response could be affected by the external resistors. Evaluate the circuit taking the actual conditions of use into account.

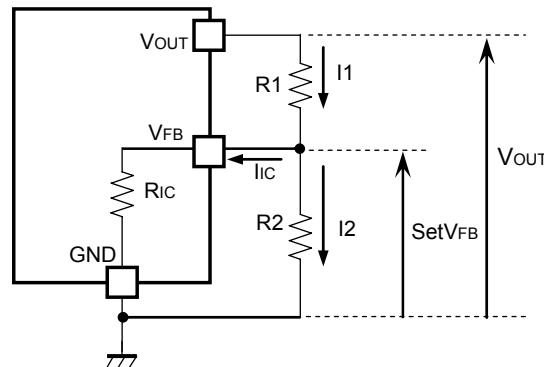
Adjustable Output Voltage Type Settings

• Output Voltage Setting Method

RP132x081x can be adjusted the output voltage up to 5.5V by using the external divider resistors.

Also, please use 16kΩ or less for R2 resistor.

If the V_{FB} voltage is described as $setV_{FB}$, the output voltage can be set by using the following equations
 $setV_{FB}$ is equal to 0.8V. The V_{OUT} pin of RP132x081x should be connected to the V_{FB} pin.



$$I1 = I_{IC} + I2 \dots\dots\dots (1)$$

$$I2 = setV_{FB} / R2 \dots\dots\dots (2)$$

Thus,

$$I1 = I_{IC} + setV_{FB} / R2 \dots\dots\dots (3)$$

Therefore,

$$V_{OUT} = setV_{FB} \times R1 \times I1 \dots\dots\dots (4)$$

Put Equation (3) into Equation (4), then

$$\begin{aligned} V_{OUT} &= setV_{FB} + R1(I_{IC} + setV_{FB} / R2) \\ &= setV_{FB} \times (1 + R1 / R2) + R1 \times I_{IC} \dots\dots\dots (5) \end{aligned}$$

In Equation (5), $R1 \times I_{IC}$ is the error-causing factor in V_{OUT} .

As for I_{IC} ,

$$I_{IC} = setV_{FB} / R_{IC} \dots\dots\dots (6)$$

Therefore, the error-causing factor $R1 \times I_{IC}$ can be described as follows.

$$\begin{aligned} R1 \times I_{IC} &= R1 \times setV_{FB} / R_{IC} \\ &= setV_{FB} \times R1 / R_{IC} \dots\dots\dots (7) \end{aligned}$$

For better accuracy, choosing $R1 (<< R_{IC})$ reduces this error.

Without the error-causing factor $R1 \times I_{IC}$, the output voltage can be calculated by the following equation

$$V_{OUT} = setV_{FB} \times ((R1 + R2) / R2) \dots\dots\dots (8)$$

R_{IC} of RP132x is approximately Typ.1.3MΩ ($T_{opt}=25^{\circ}C$, this value is guaranteed by design.).

The value could be affected by the temperature, therefore evaluate the circuit taking the actual conditions of use into account.

Inrush Current Limit Time Settings

The RP132xSeries include the circuit which can limit the inrush current at start-up to 500mA or less.

The current limit time of B/D version is fixed internally as approximately Typ.500μs.

On the other hand, the current limit times of E/F versions are adjustable by controlling the DELAY pin value, which is the capacitance value connected between DLEAY pin and GND pin.

The relation between Inrush Current Limit Time (t_D [s]) and the DELAY pin capacitance (C_D [F]) can be described in the following equation.

$$t_D = (C_D + 70 \times 10^{-12}) \times 0.525 \times 10^6$$

When not using C_D on E/F versions, DELAY pin should be open.

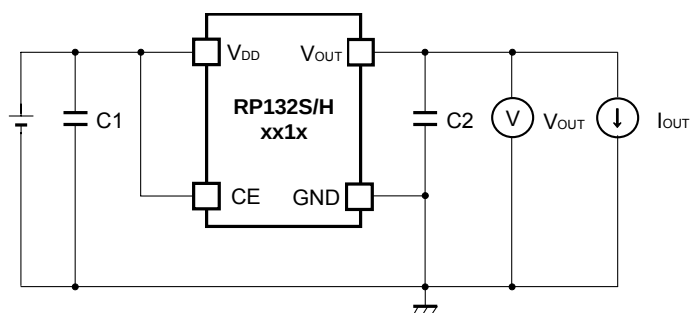
In this case, $C_D=0$ is applied to the above equation and as a result, 37μs can be obtained.

That means, when using C_D on E/F versions, the inrush current limit time will be more than 37μs.

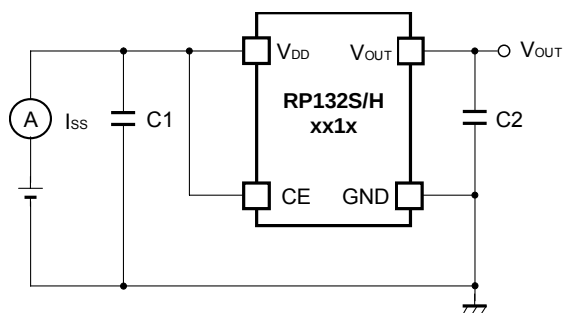
Please note that during the inrush current limit time, the load current cannot be more than the limited current.

TEST CIRCUITS

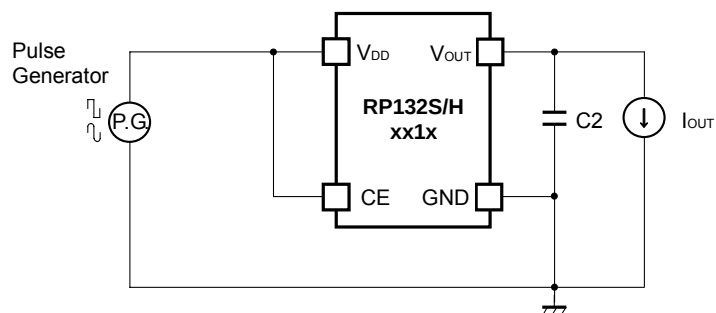
• Fixed Output Voltage Type (HSOP-6J / SOT89-5)



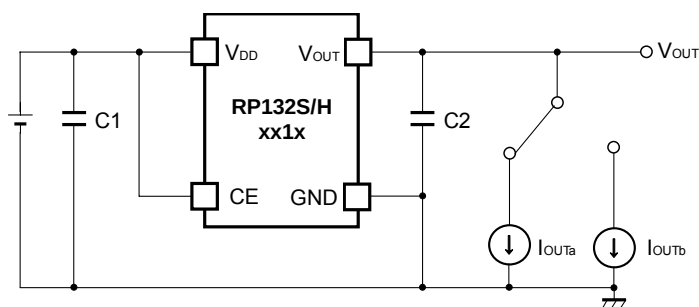
Basic Test Circuit



Test Circuit for Supply Current

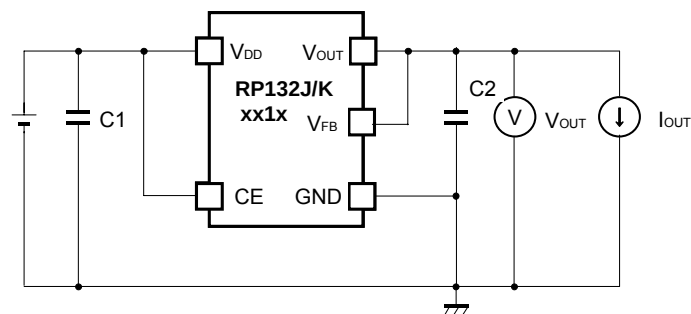


Test Circuit for Ripple Rejection

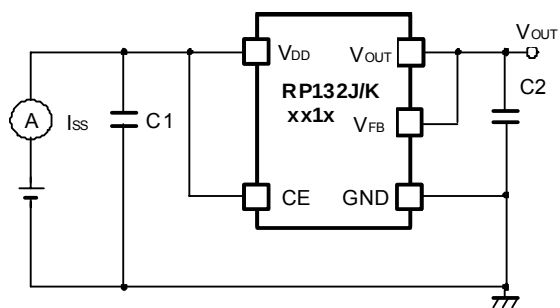


Test Circuit for Load Transient Response

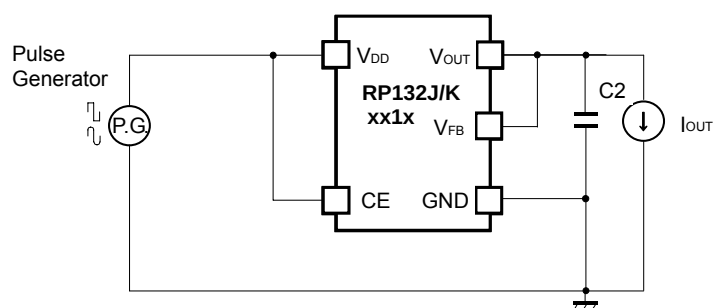
• **Fixed Output Voltage Type (TO-252-5-P2 / DFN(PLP)1820-6)**



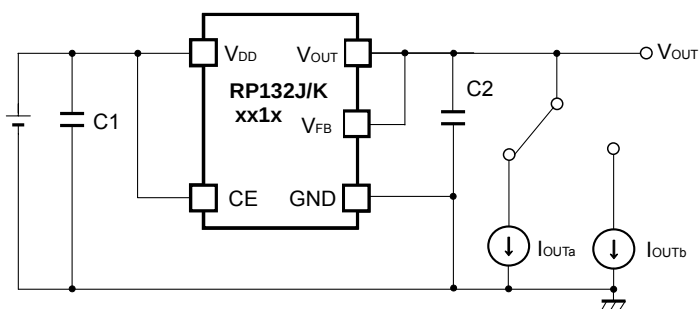
Basic Test Circuit



Test Circuit for Supply Current

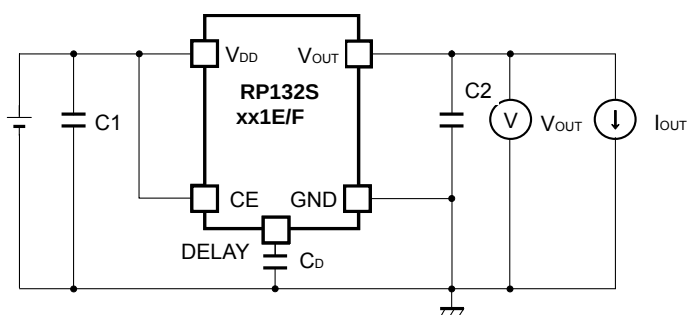


Test Circuit for Ripple Rejection

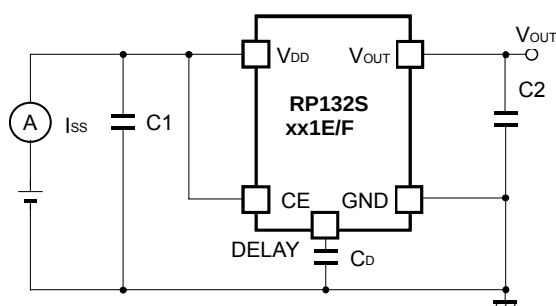


Test Circuit for Load Transient Response

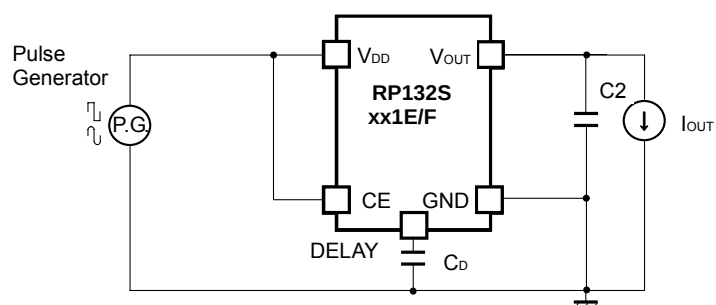
• Fixed Output Voltage Type with DELAY pin (HSOP-6J)



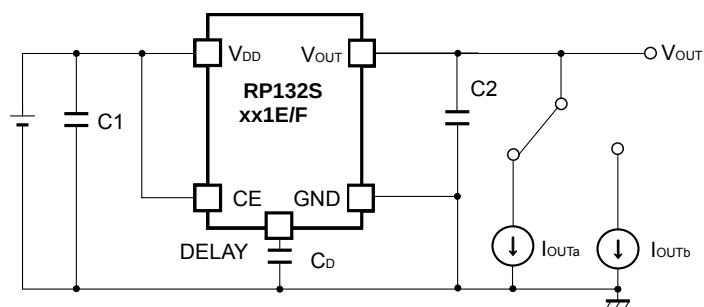
Basic Test Circuit



Test Circuit for Supply Current



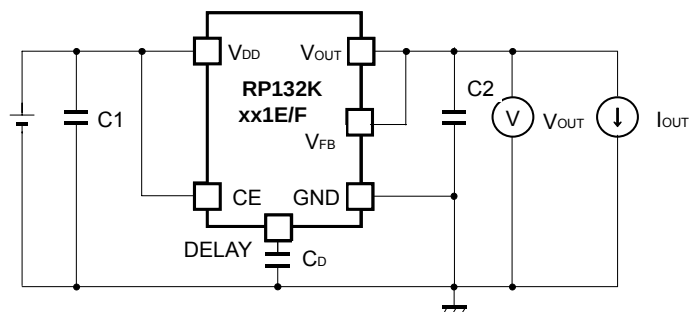
Test Circuit for Ripple Rejection



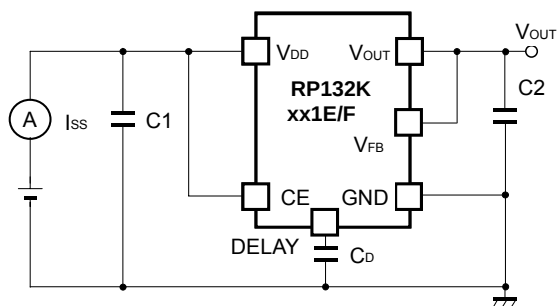
Test Circuit for Load Transient Response

Please refer to "Inrush Current Limit Time Settings" concerning with C_D .

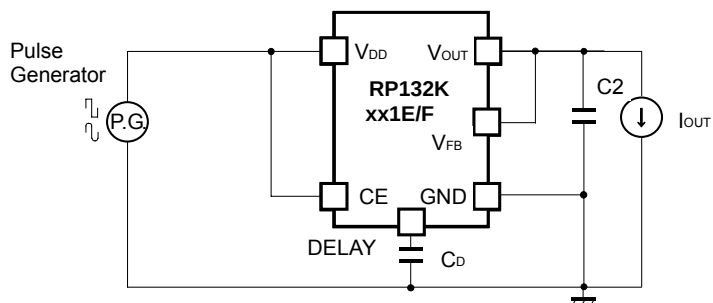
• Fixed Output Voltage Type with DELAY pin (DFN(PLP)1820-6)



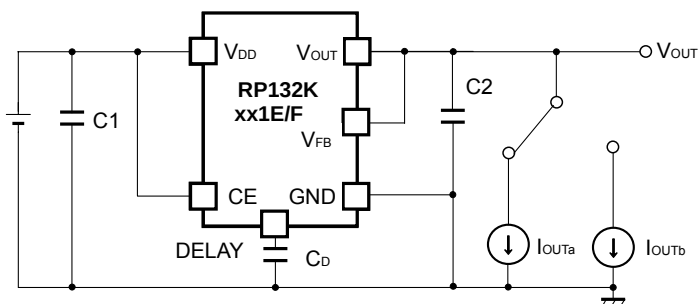
Basic Test Circuit



Test Circuit for Supply Current



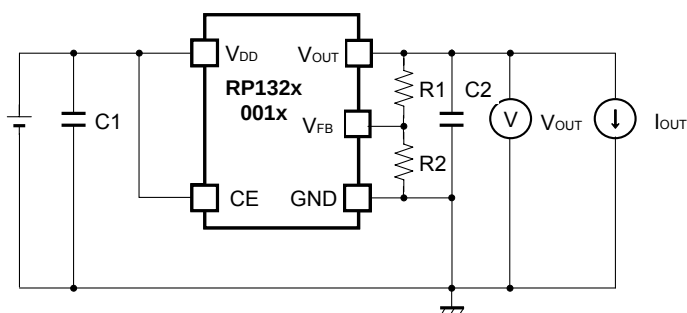
Test Circuit for Ripple Rejection



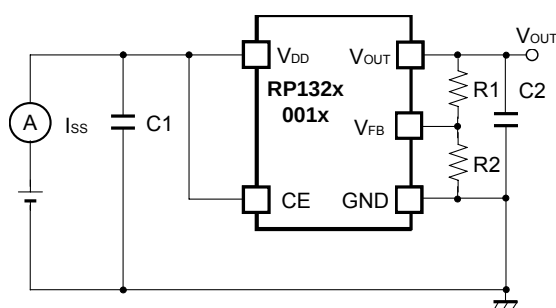
Test Circuit for Load Transient Response

Please refer to "Inrush Current Limit Time Settings" concerning with C_D .

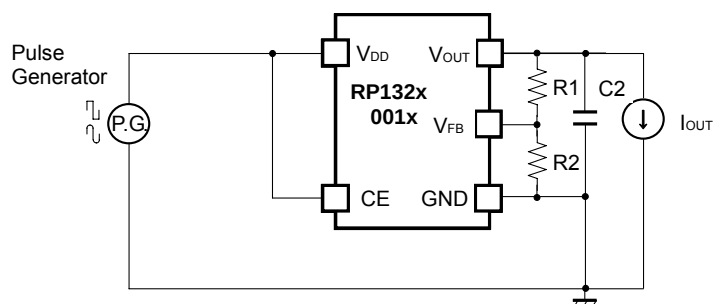
- Adjustable Output Voltage Type (HSOP-6J / SOT89-5/ TO-252-5-P2 / DFN(PLP)1820-6)



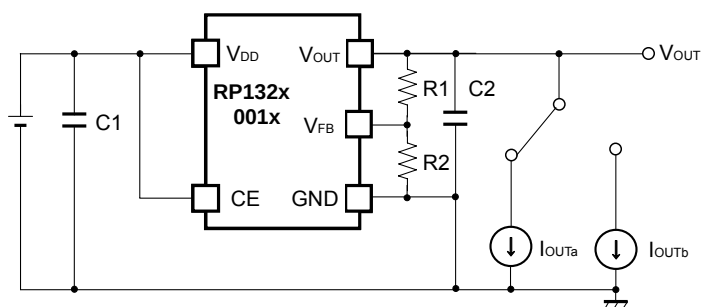
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection

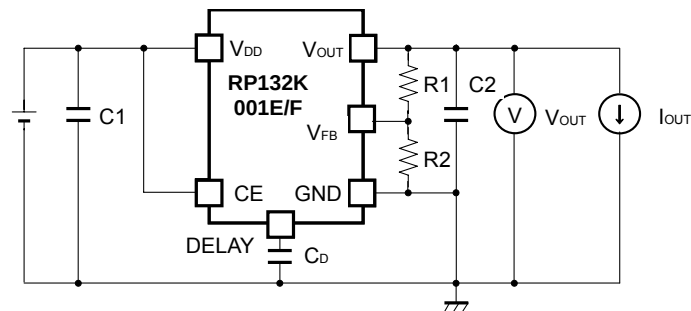


Test Circuit for Load Transient Response

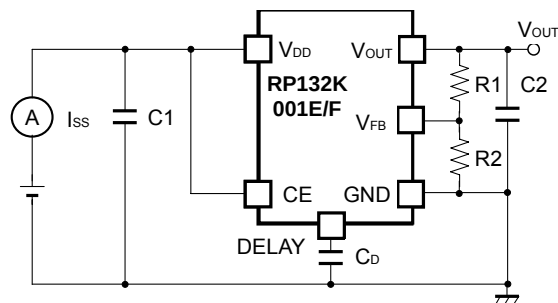
Please refer to "Technical Notes on Adjustable Output Voltage Type" when using R1 and R2 as output

capacitors.

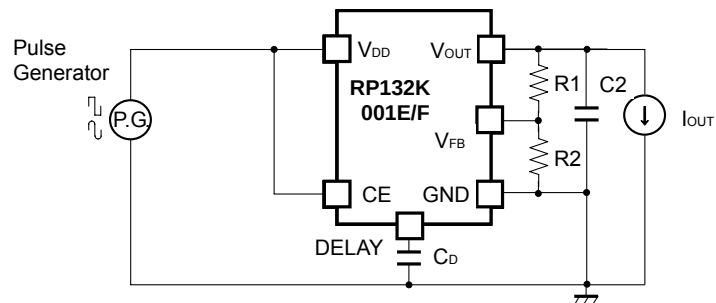
• Adjustable Output Voltage Type with DELAY pin (DFN(PLP)1820-6)



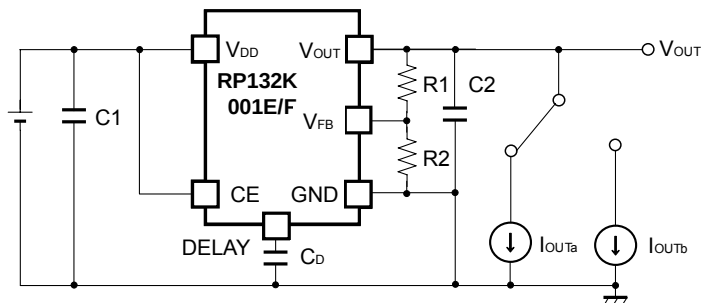
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection

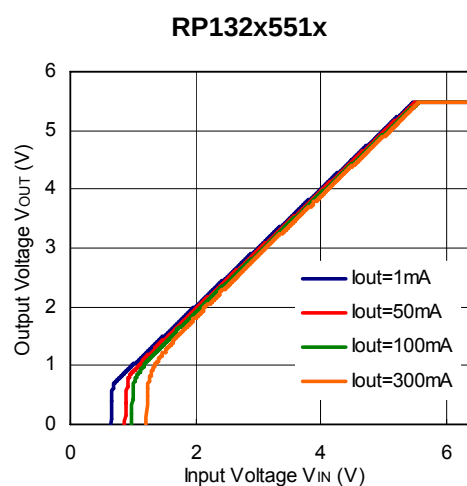
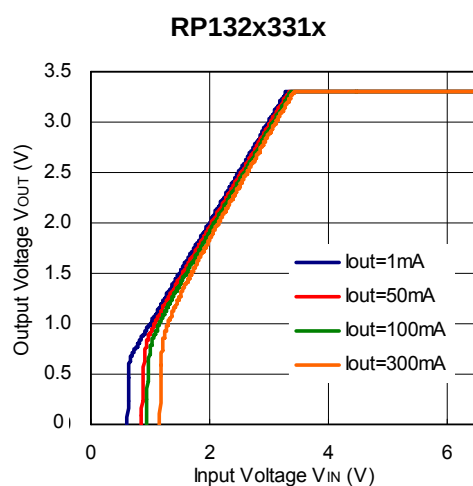
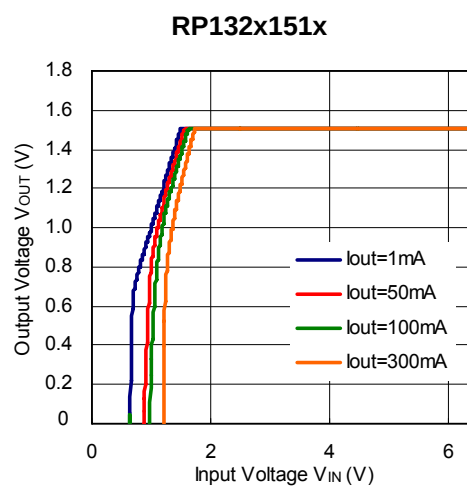
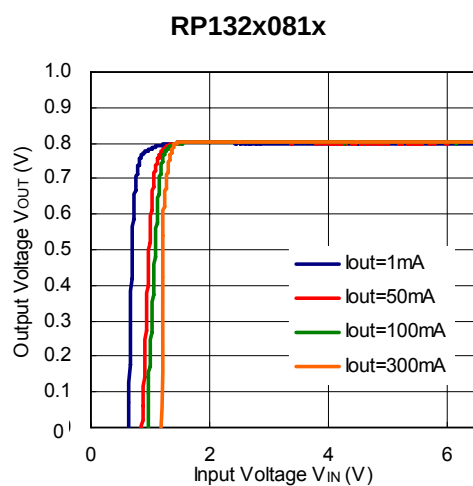


Test Circuit for Load Transient Response

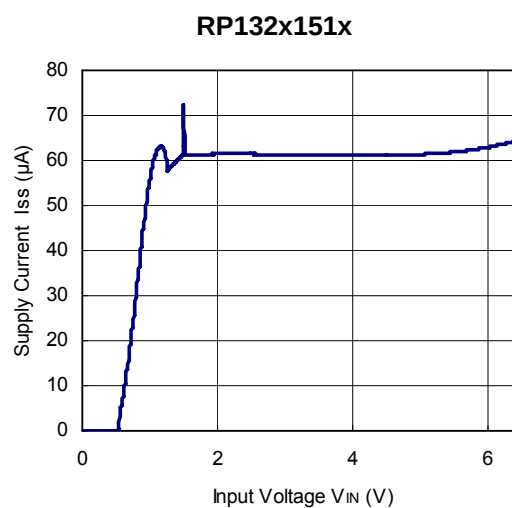
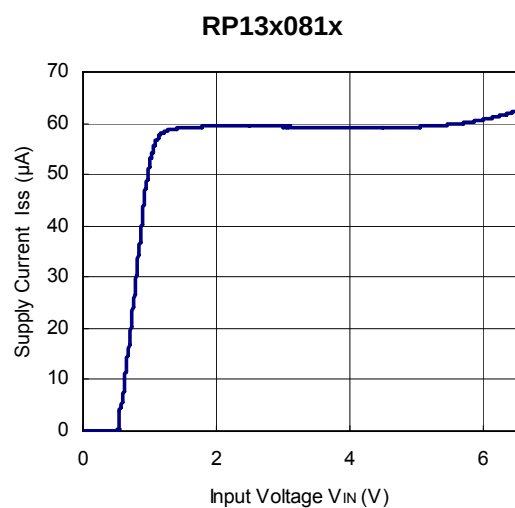
Please refer to "Technical Notes on Adjustable Output Voltage Type" when using R1 and R2 as output capacitors. Also refer to "Inrush Current Limit Time Settings" concerning with CD.

TYPICAL CHARACTERISTICS

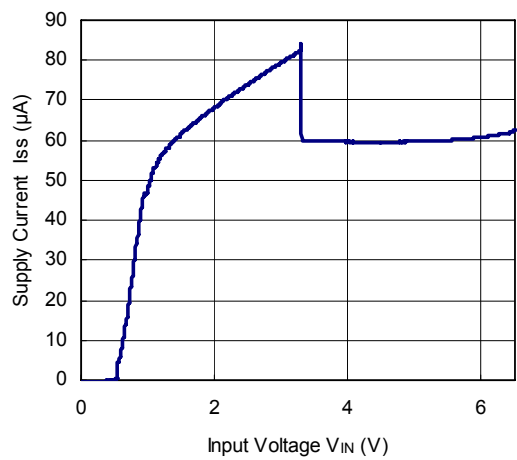
1) Output Voltage vs. Input Voltage ($T_{opt}=25^{\circ}\text{C}$)



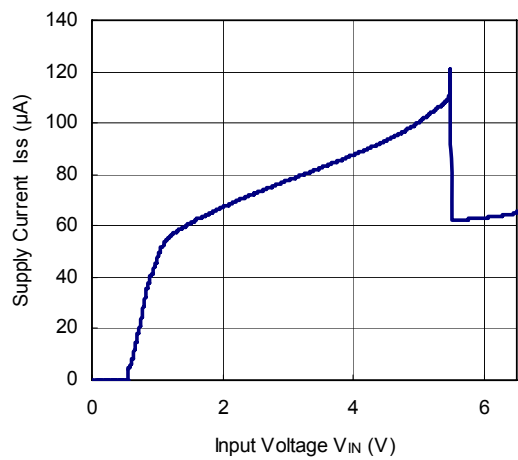
2) Supply Current vs. Input Voltage ($T_{opt}=25^{\circ}\text{C}$)



RP132x331x

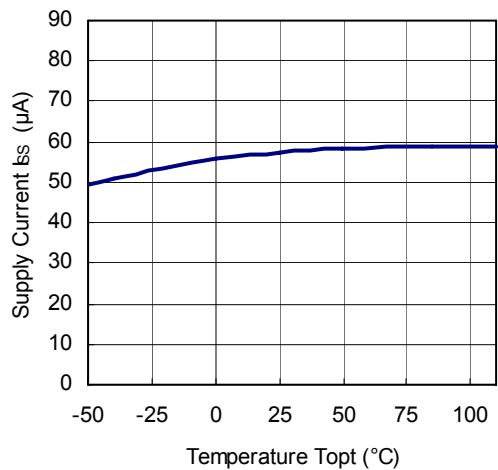


RP132x551x

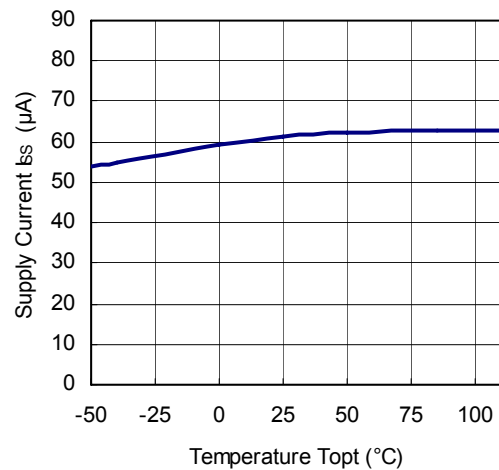


3) Supply Current vs. Temperature

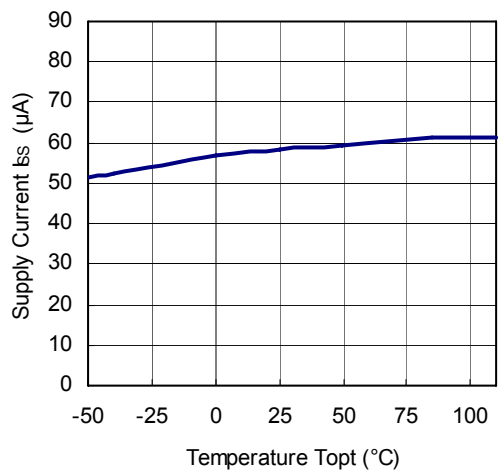
RP132x081x



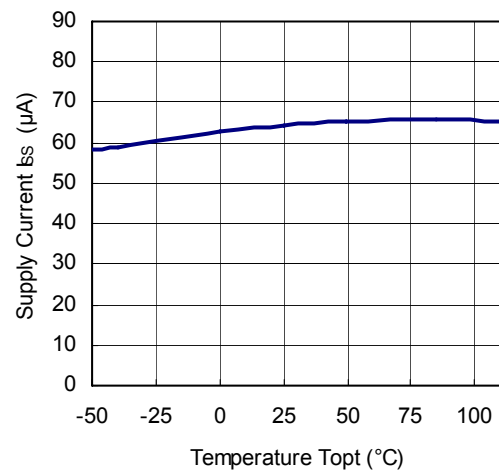
RP132x151x



RP132x331x

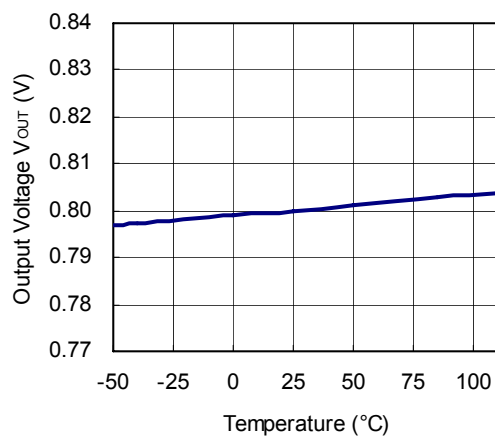


RP132x551x

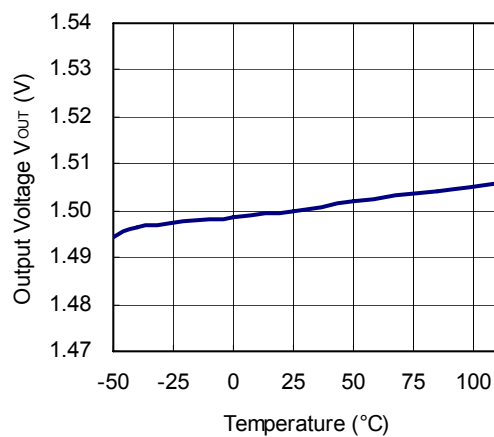


4) Output Voltage vs. Temperature

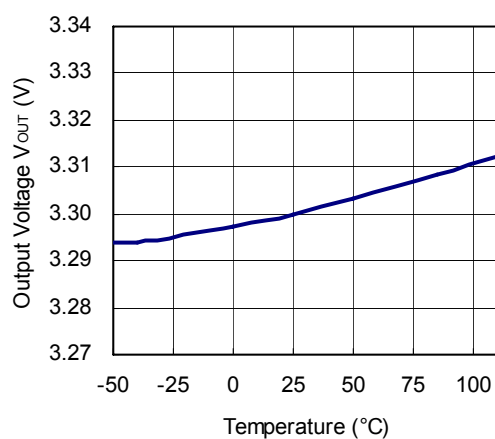
RP132x081x



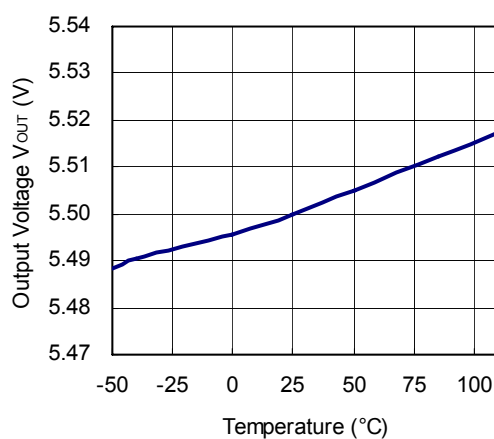
RP132x151x



RP132x331x

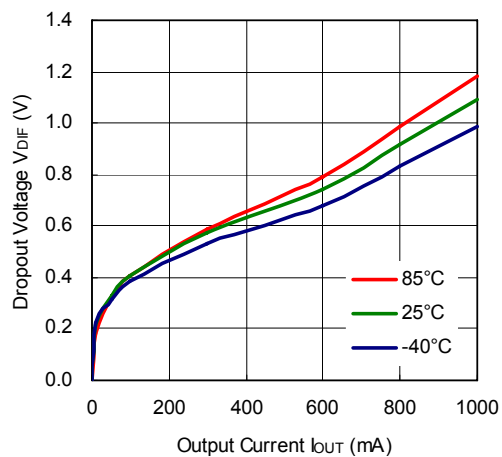


RP132x551x

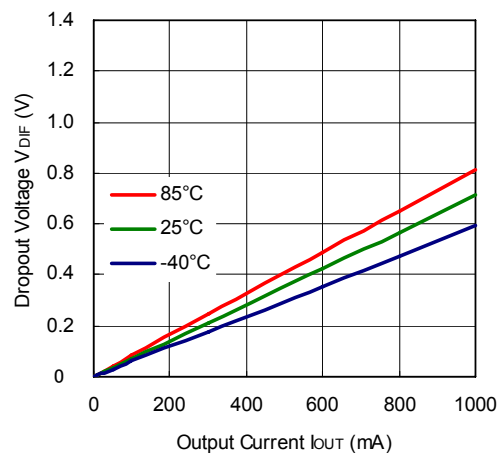


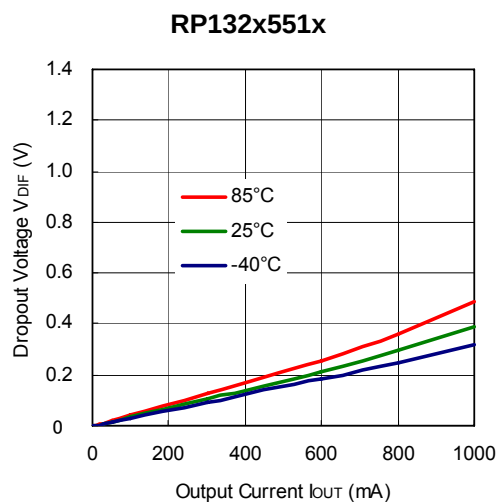
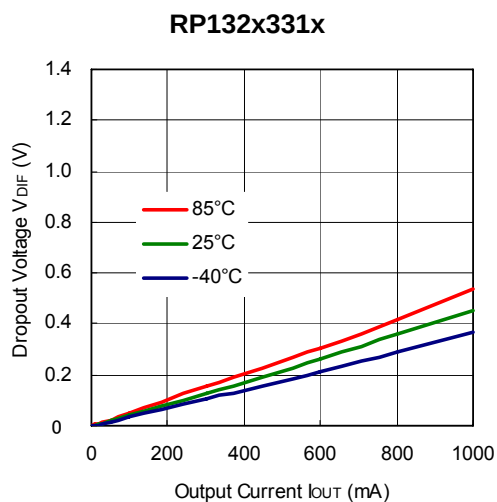
5) Dropout Voltage vs. Output Current

RP132x081x

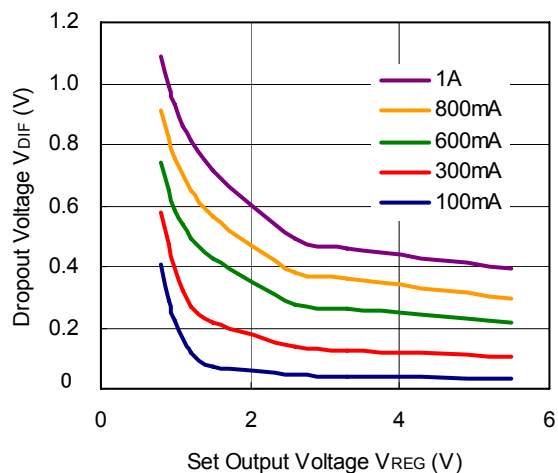


RP132x151x

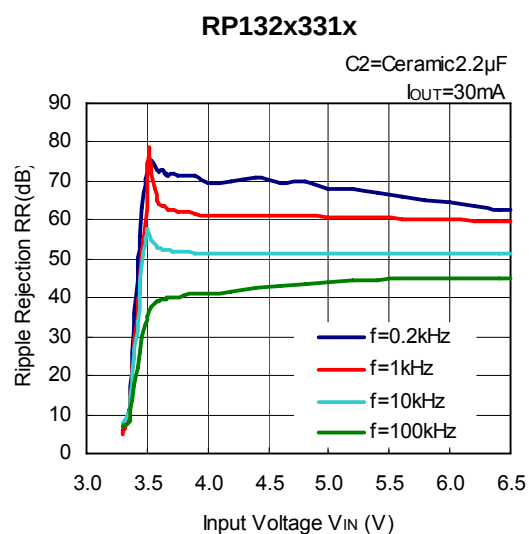
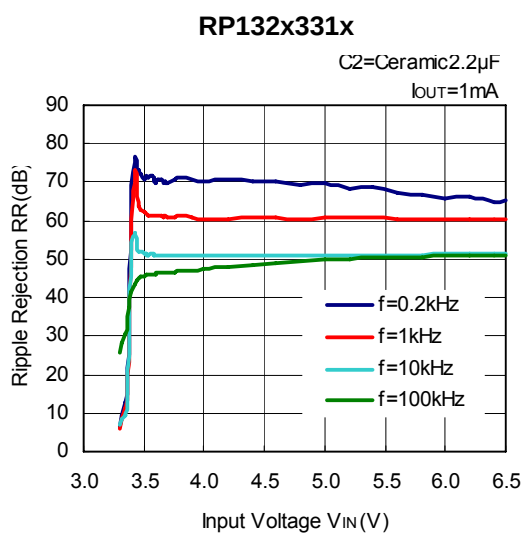


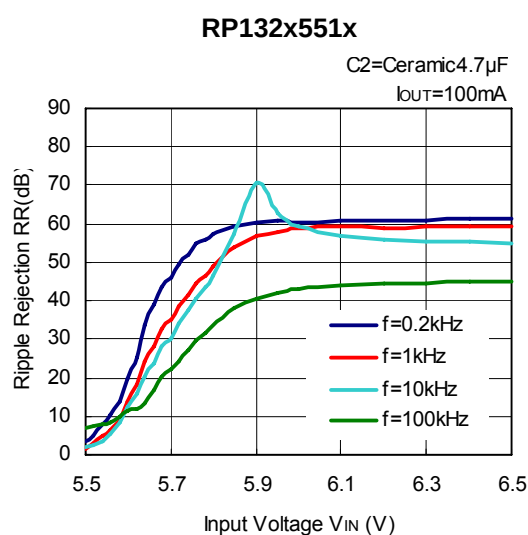
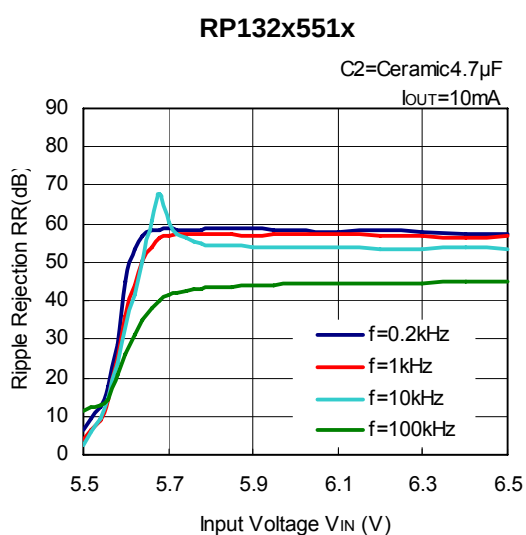
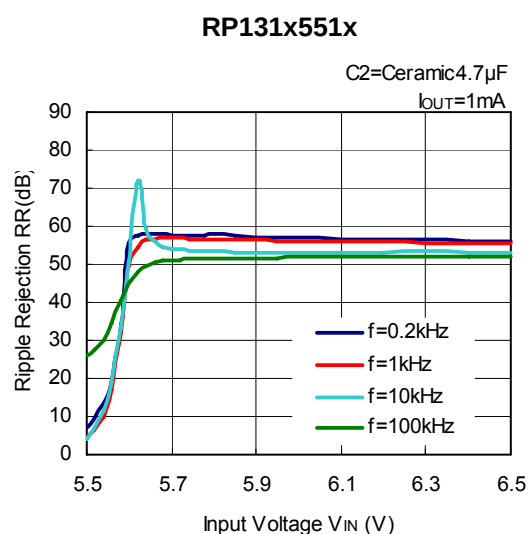
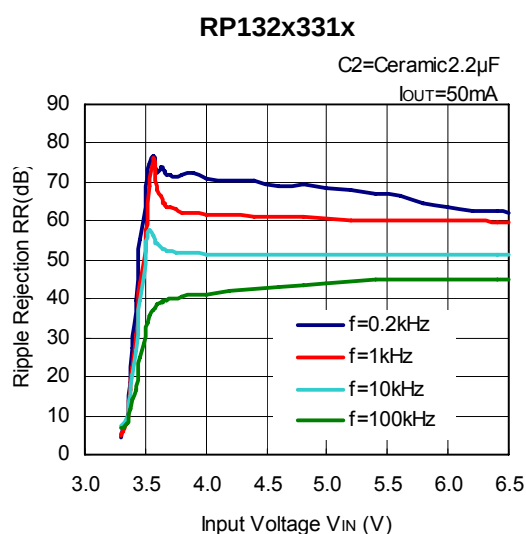


6) Dropout Voltage vs. Set Output Voltage

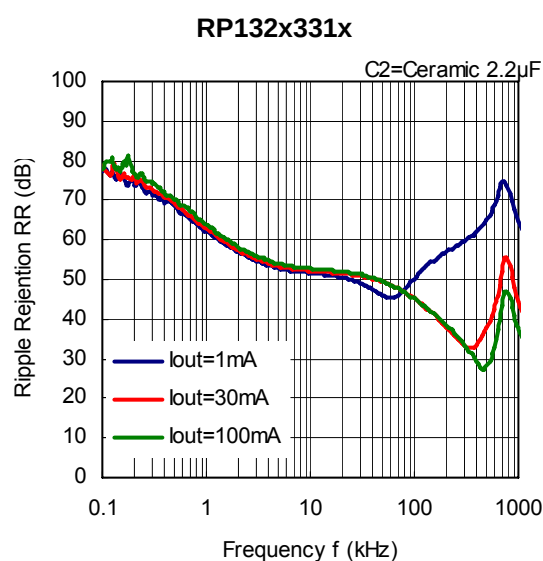
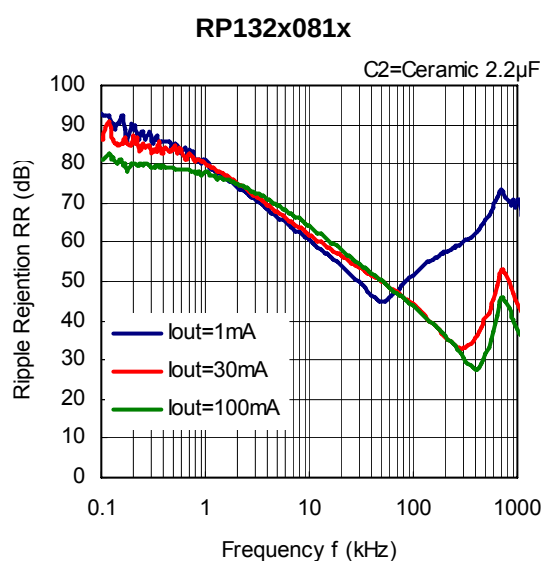


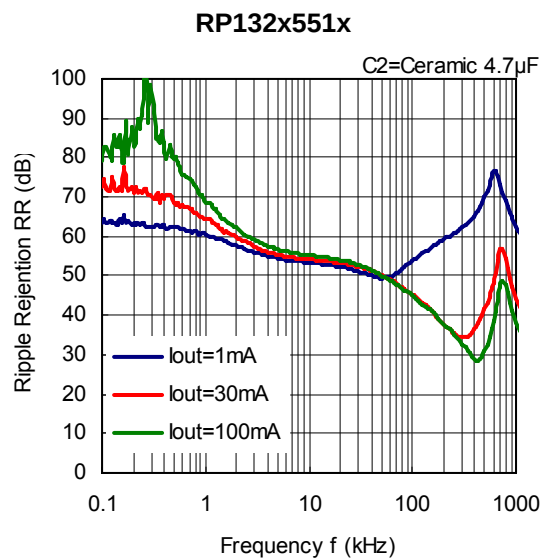
7) Ripple Rejection vs. Input Voltage (C1=none, Ripple=0.2Vp-p, $T_{opt}=25^\circ\text{C}$)



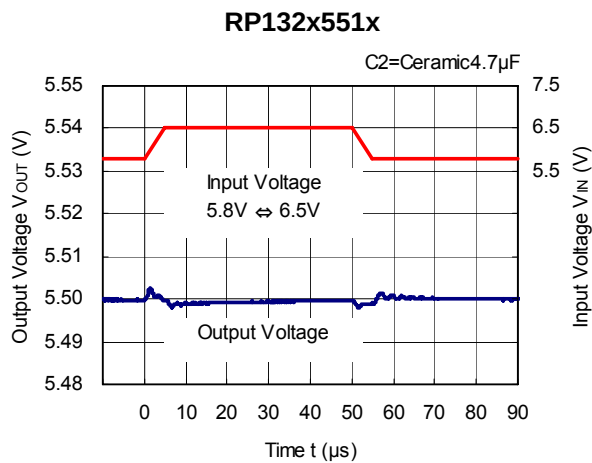
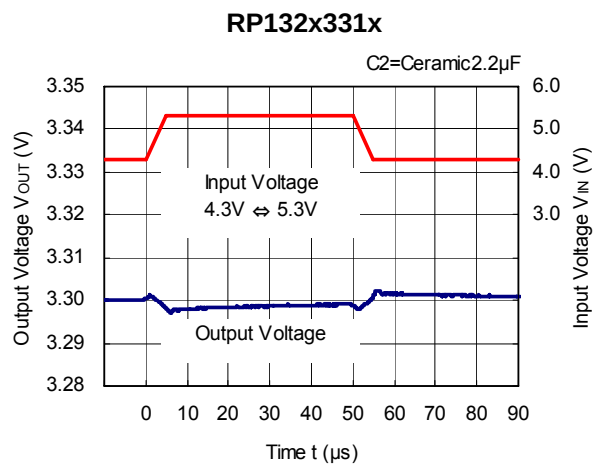
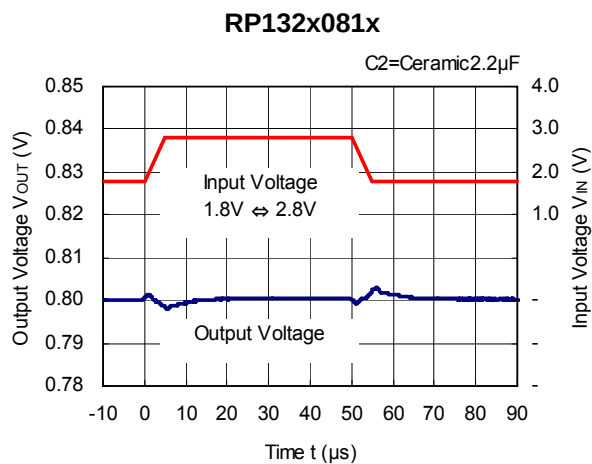


8) Ripple Rejection vs. Frequency (C1=none, T_{opt}=25°C)

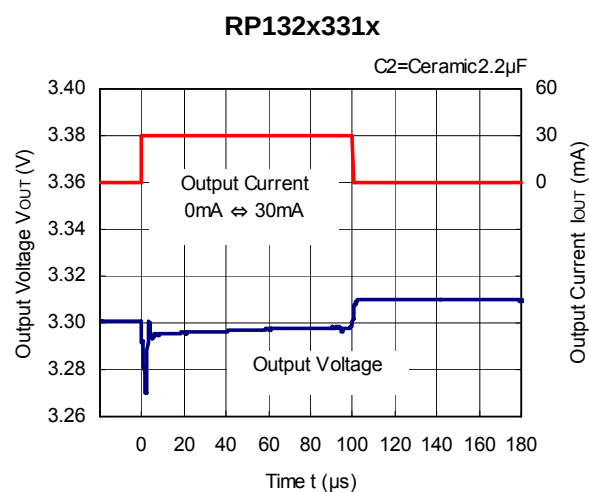
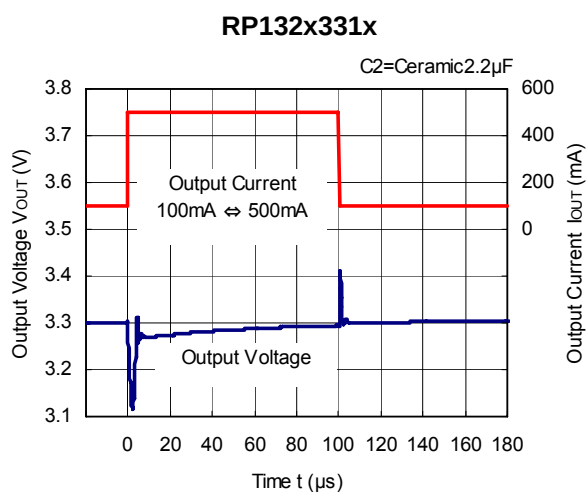
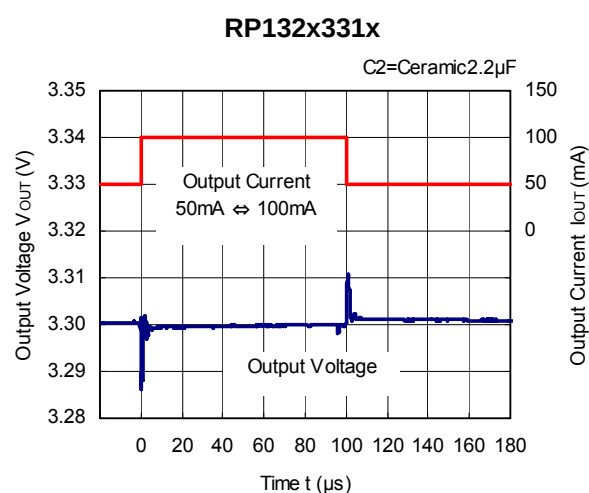
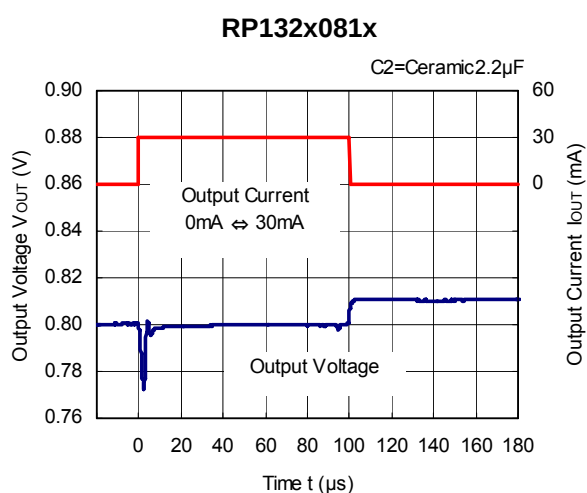
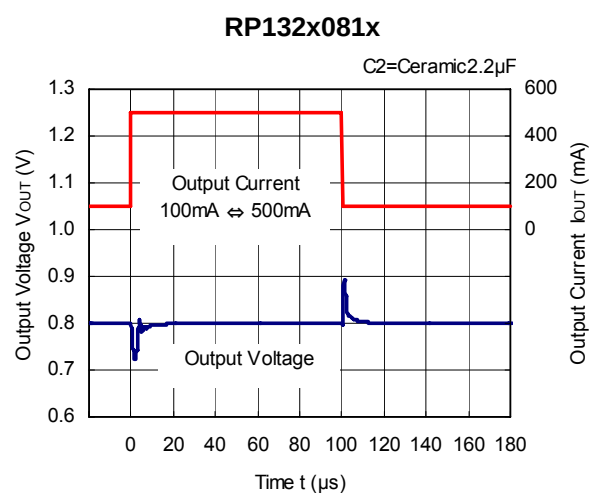
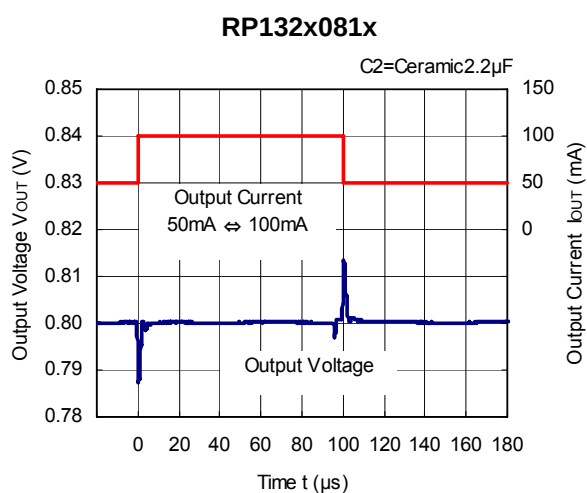


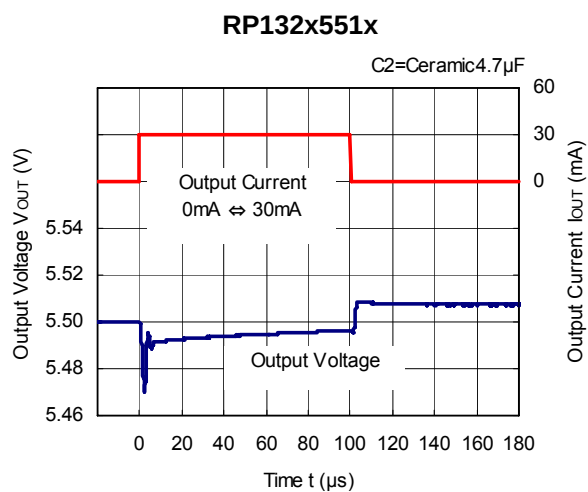
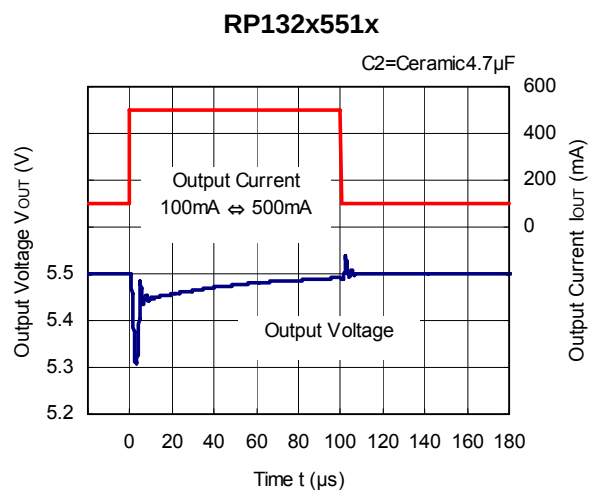
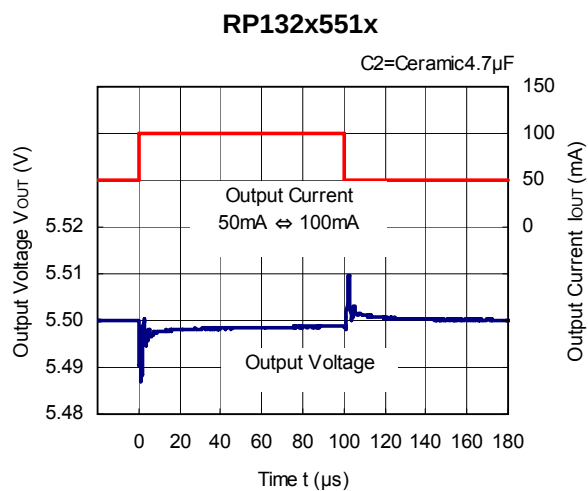


9) Input Transient Response ($C1=\text{none}$, $I_{out}=100\text{mA}$, $t_r=t_f=5\mu\text{s}$, $T_{opt}=25^\circ\text{C}$)

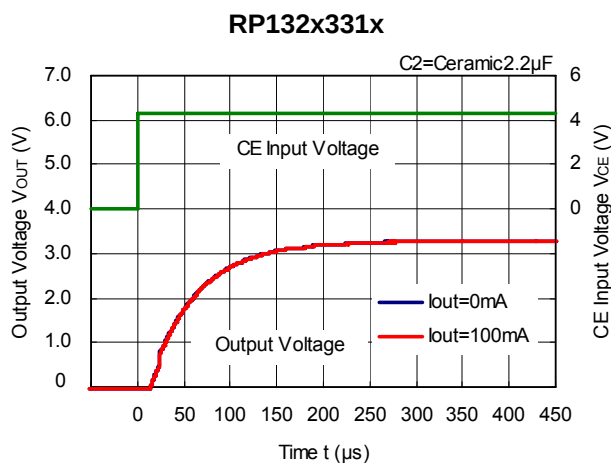
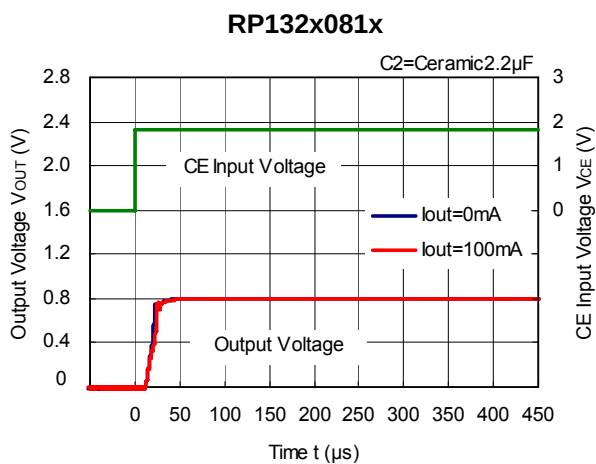


10) Load Transient Response ($V_{IN}=V_{OUT}+1.0V$, $C1=Ceramic\ 2.2\mu F$, $t_r=t_f=0.5\mu s$, $T_{opt}=25^{\circ}C$)

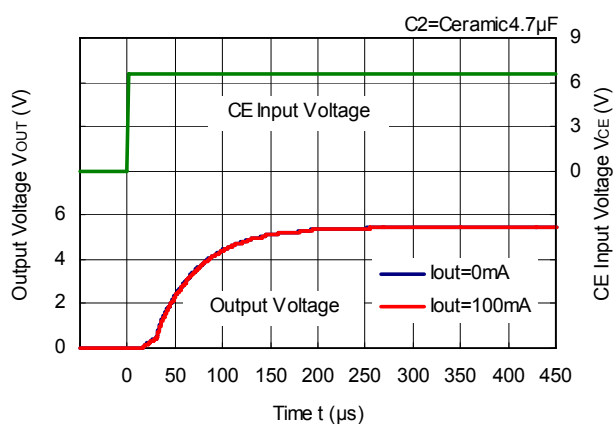




11) Turn on Speed with CE pin (C1=Ceramic 2.2 μ F, T_{opt}=25°C)

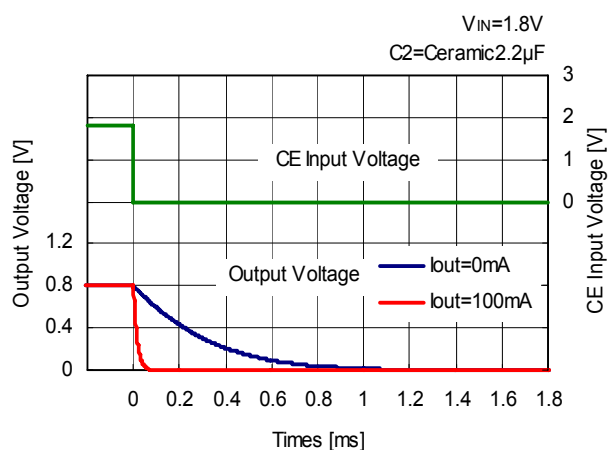


RP132x551x

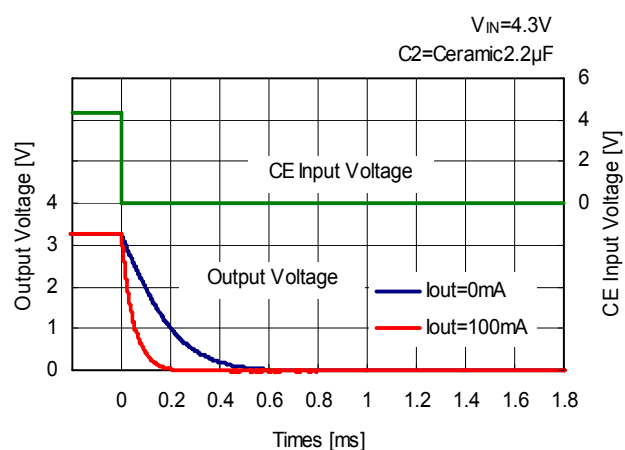


12) Turn off Speed with CE pin (D version) (C1=Ceramic 2.2 μ F, $T_{opt}=25^{\circ}C$)

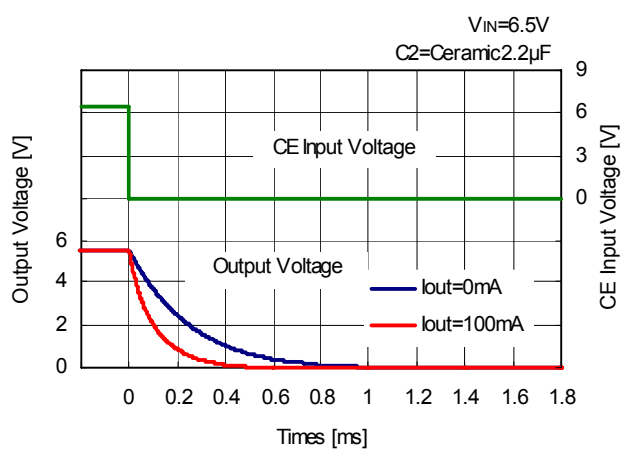
RP132x081D



RP132x331D

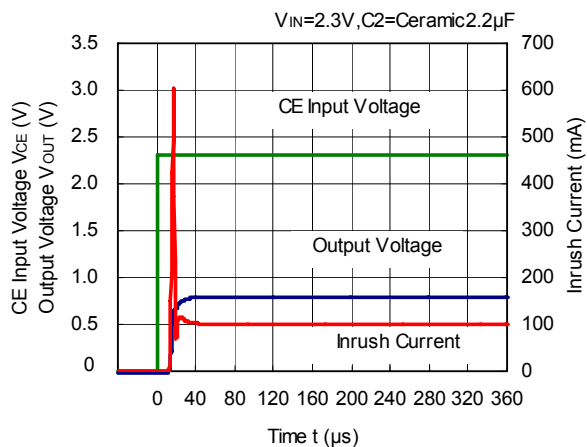


RP132x551D

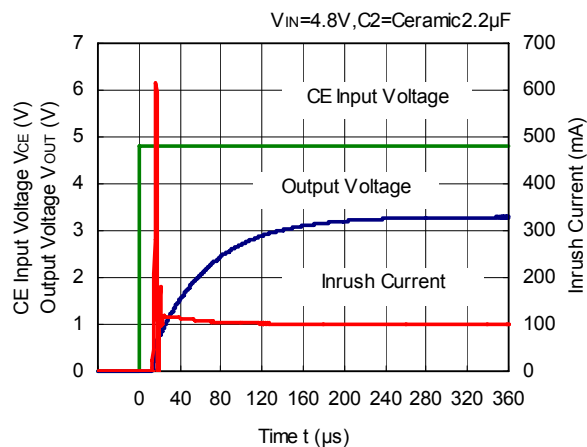


13) Inrush Current (C1=Ceramic 2.2 μ F, I_{OUT}=100mA, T_{opt}=25°C)

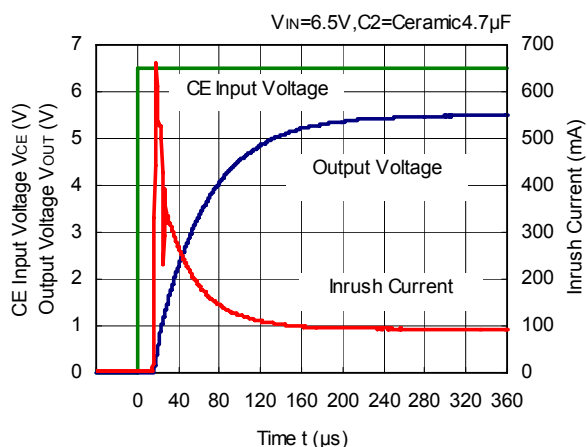
RP132x081x



RP132x331x

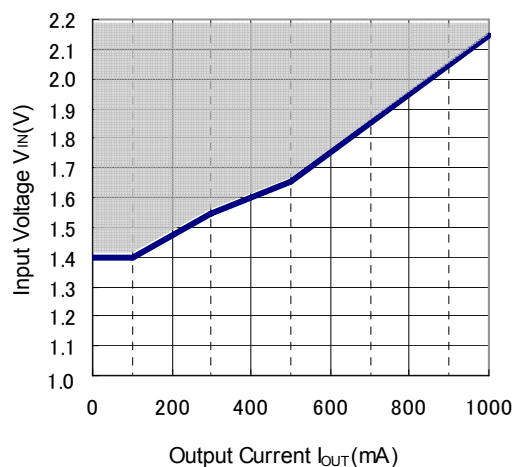


RP132x551x



14) Minimum Operating Voltage

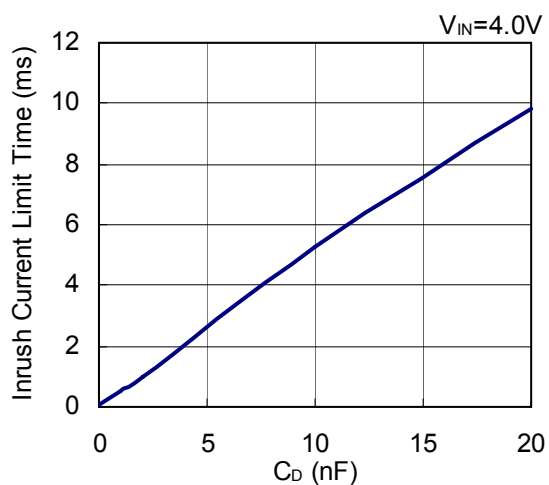
RP132x081x



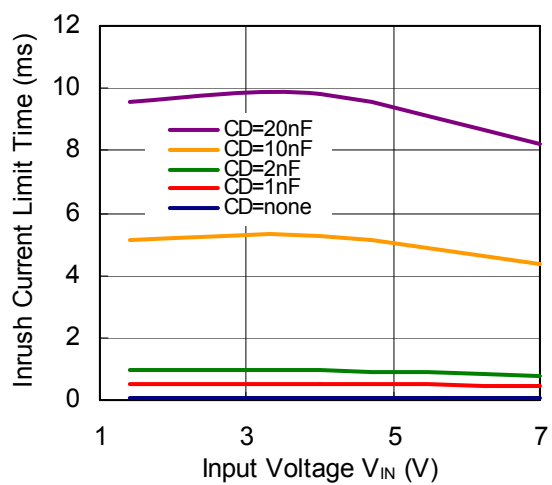
The operation rage that can output 0.8V is shown by the hatched area in the graph.

15) Inrush Current Limit Time vs. C_D Capacitance (E / F Version)

RP132x081x

**16) Inrush Current Limit Time vs. Input Voltage (E / F Version)**

RP132x081x



ESR vs. Output Current

When using these ICs, consider the following points:

The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below.

The conditions when the white noise level is under $40\mu V$ (Avg.) are marked as the hatched area in the graph.

Measurement conditions

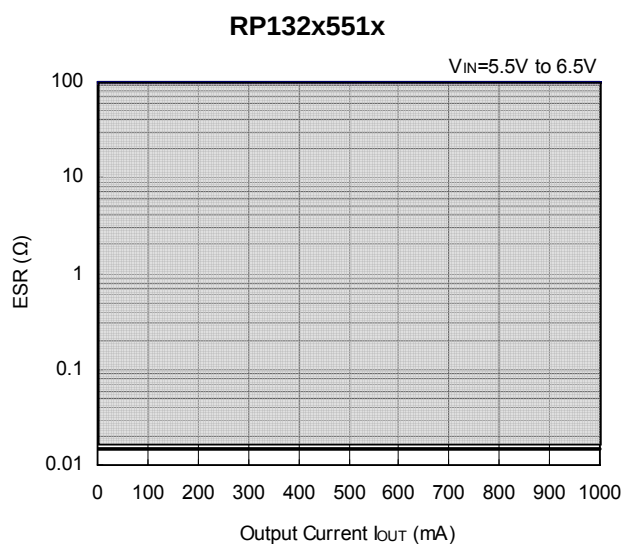
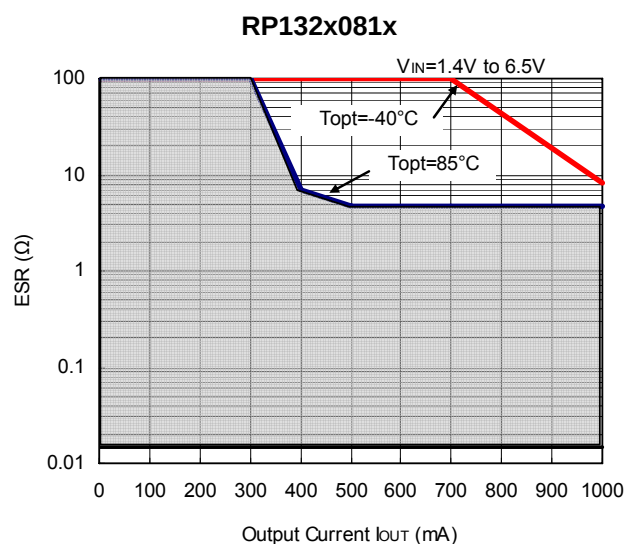
Frequency Band : 10Hz to 2MHz

Temperature : $-40^{\circ}C$ to $85^{\circ}C$

Hatched Area : Noise level is under $40\mu V_{rms}$ (Avg.)

C_{IN} : $2.2\mu F$ Kyocera (CM05X5R225M06A)

C_{OUT} : $4.7\mu F$ Kyocera (CM105X5R475M06AB)





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Ricoh completed the organization of the Lead-free production for all of our products. After Apr. 1, 2006, we will ship out the lead free products only. Thus, all products that will be shipped from now on comply with RoHS Directive.