

150mA LDO REGULATOR

NO.EA-147-111026

OUTLINE

The R1183Z Series are CMOS-based voltage regulator ICs with extremely low supply current, and low dropout voltage realized with the built-in low ON-resistance $r_{DS(on)}$.

150mA output current is guaranteed, and the supply current of IC itself is Typ. 1 μ A at no load.

The R1183Z series have almost same characteristics as R1180x Series. Only difference is ultra small chip size package (WLCSP4-P2: 0.79mm $\times$ 0.79mm) and built-in auto discharge function is available with D version, and output voltage accuracy improved to $\pm 1.2\%$.

Since the package for these ICs is WLCSP-4-P2, the mount area size is less than 1/4 of R1180D Series (SON1612-6).

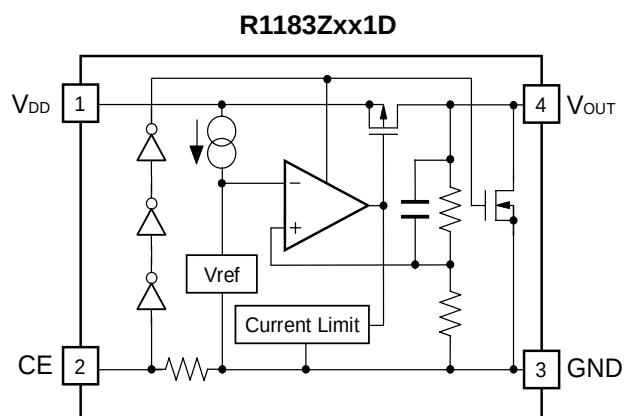
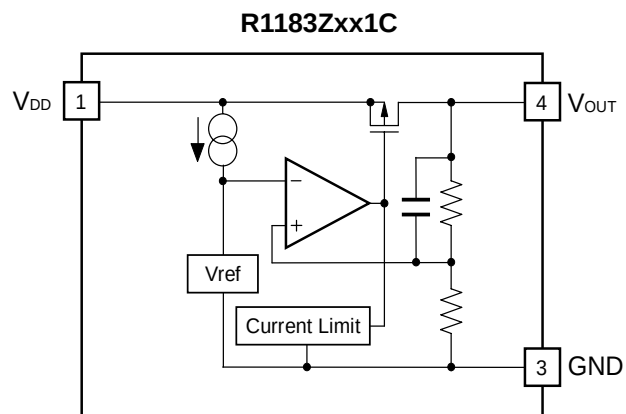
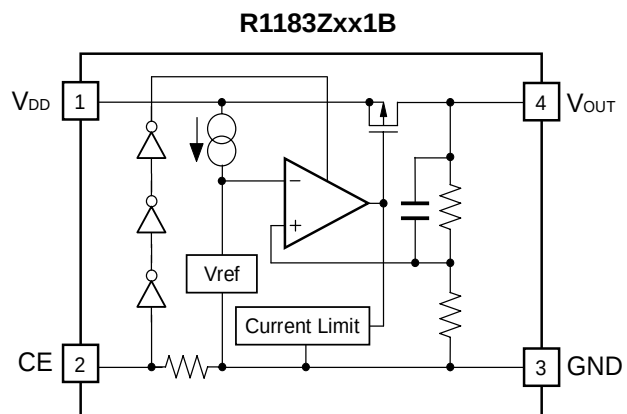
FEATURES

- Supply Current Typ. 1 μ A (Except the current through CE pull-down circuit)
- Standby Mode Typ. 0.1 μ A
- Dropout Voltage Typ. 0.25V ($I_{OUT}=150\text{mA}$, $V_{OUT}=3.0\text{V}$)
- Temperature-Drift Coefficient of Output Voltage .. Typ. $\pm 100\text{ppm}/^\circ\text{C}$
- Line Regulation Typ. 0.05%/V
- Output Voltage Accuracy..... $\pm 1.2\%$
- Output Voltage Range..... 1.2V to 3.6V (0.1V steps)
(For other voltages, please refer to MARK INFORMATION.)
- Input Voltage Range 1.7V to 6.0V
- Package WLCSP-4-P2
- Built-in Fold Back Protection Circuit Typ. 40mA
- Built-in Auto Discharge Function..... D Version
- Ceramic capacitors are recommended to be used with this IC 0.1 μ F or more

APPLICATIONS

- Stable voltage reference.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

BLOCK DIAGRAMS

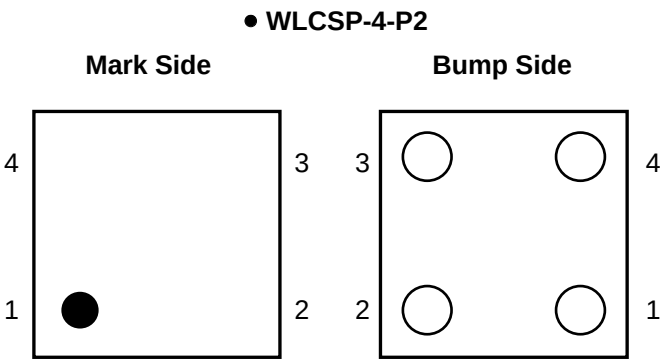


SELECTION GUIDE

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

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1183Zxx1*-TR-F	WLCSP-4-P2	5,000 pcs	Yes	Yes
xx: The output voltage can be designated in the range from 1.2V(12) to 3.6V(36) in 0.1V steps. (For other voltages, please refer to MARK INFORMATION.) * : The auto discharge function at off state are options as follows. (B) without auto discharge function at off state (C) without CE pin (D) with auto discharge function at off state				

PIN CONFIGURATION



PIN DESCRIPTIONS

• R1183Zxx1B/D

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

• R1183Zxx1C

Pin No	Symbol	Pin Description
1	V _{DD}	Input Pin
2	NC	No Connection
3	GND	Ground Pin
4	V _{OUT}	Output Pin

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	6.5	V
V_{CE}	Input Voltage(CE Pin)	−0.3 to 6.5	V
V_{OUT}	Output Voltage	−0.3 to $V_{IN}+0.3$	V
I_{OUT}	Output Current	200	mA
P_D	Power Dissipation (WLCSP-4-P2) *	530	mW
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

• R1183Zxx1B/D

T_{opt}=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V _{OUT}	Output Voltage	V _{IN} -V _{OUT} =1.0V I _{OUT} =1mA	V _{OUT} >1.5V	×0.988	×1.012	V
			V _{OUT} ≤ 1.5V	-18	+18	mV
I _{OUT}	Output Current	V _{IN} -V _{OUT} =1.0V (V _{OUT} ≥ 1.5V) If V _{OUT} <1.5V, V _{IN} =2.4V	150			mA
ΔV _{OUT} /ΔI _{OUT}	Load Regulation	V _{IN} -V _{OUT} =1.0V (V _{OUT} ≥ 1.5V) If V _{OUT} <1.5V, V _{IN} =2.4V 1μA ≤ I _{OUT} ≤ 150mA		20	40	mV
V _{DIF}	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I _{SS}	Supply Current*	V _{IN} -V _{OUT} =1.0V, I _{OUT} =0mA		1.0	1.5	μA
I _{standby}	Standby Current	V _{IN} -V _{OUT} =1.0V, V _{CE} =GND		0.1	1.0	μA
ΔV _{OUT} /ΔV _{IN}	Line Regulation	I _{OUT} =30mA V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V (V _{OUT} ≥ 1.5V) If V _{OUT} <1.5V, 2.0V ≤ V _{IN} ≤ 6.0V		0.05	0.20	%/V
V _{IN}	Input Voltage		1.7		6.0	V
ΔV _{OUT} /ΔT _{opt}	Output Voltage Temperature Coefficient	I _{OUT} =30mA -40°C ≤ T _{opt} ≤ 85°C		±100		ppm/°C
I _{SC}	Short Current Limit	V _{OUT} =0V		40		mA
I _{PD}	CE Pull-down Constant Current			0.35	0.80	μA
V _{CEH}	CE Input Voltage "H"		1.2		6.0	V
V _{CEL}	CE Input Voltage "L"		0		0.3	V
R _{LOW}	ON Resistance of Nch.Tr. for Auto discharge (of D version)	V _{CE} =0V		90		Ω

*) Except the pull-down constant current through CE pin.

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.

● R1183Zxx1C

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V _{OUT}	Output Voltage	V _{IN} -V _{OUT} =1.0V I _{OUT} =1mA	V _{OUT} >1.5V ×0.988		×1.012	V
			V _{OUT} ≤ 1.5V -18		+18	mV
I _{OUT}	Output Current	V _{IN} -V _{OUT} =1.0V (V _{OUT} ≥ 1.5V) If V _{OUT} <1.5V, V _{IN} =2.4V	150			mA
ΔV _{OUT} /ΔI _{OUT}	Load Regulation	V _{IN} -V _{OUT} =1.0V (V _{OUT} ≥ 1.5V) If V _{OUT} <1.5V, V _{IN} =2.4V 1μA ≤ I _{OUT} ≤ 150mA		20	40	mV
V _{DIF}	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I _{SS}	Supply Current	V _{IN} -V _{OUT} =1.0V, I _{OUT} =0mA		1.0	1.5	μA
ΔV _{OUT} /ΔV _{IN}	Line Regulation	I _{OUT} =30mA V _{OUT} +0.5V ≤ V _{IN} ≤ 6.0V (V _{OUT} ≥ 1.5V) If V _{OUT} <1.5V, 2.0V ≤ V _{IN} ≤ 6.0V		0.05	0.20	%/V
V _{IN}	Input Voltage		1.7		6.0	V
ΔV _{OUT} /ΔT _{opt}	Output Voltage Temperature Coefficient	I _{OUT} =30mA -40°C ≤ T _{opt} ≤ 85°C		±100		ppm/°C
I _{SC}	Short Current Limit	V _{OUT} =0V		40		mA

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

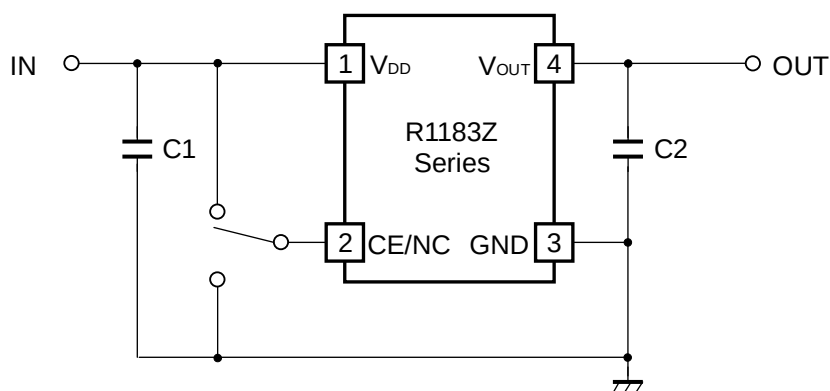
All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic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

● ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

Topt=25°C

Output Voltage V _{OUT} (V)	Dropout Voltage V _{DIF} (V)		
	Condition	Typ.	Max.
1.2 ≤ V _{OUT} < 1.3	I _{OUT} =150mA	0.85	1.20
1.3 ≤ V _{OUT} < 1.4		0.75	1.10
1.4 ≤ V _{OUT} < 1.5		0.65	1.00
1.5 ≤ V _{OUT} < 1.7		0.60	0.90
1.7 ≤ V _{OUT} < 1.9		0.50	0.75
1.9 ≤ V _{OUT} < 2.1		0.40	0.65
2.1 ≤ V _{OUT} < 2.8		0.35	0.55
2.8 ≤ V _{OUT} ≤ 3.6		0.25	0.40

TYPICAL APPLICATION



(External Components)

Output Capacitor

Ceramic Capacitor	0.1 μ F	murata	GRM155B31C104KA87B
		kyocera	CM05X5R104K16AB

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

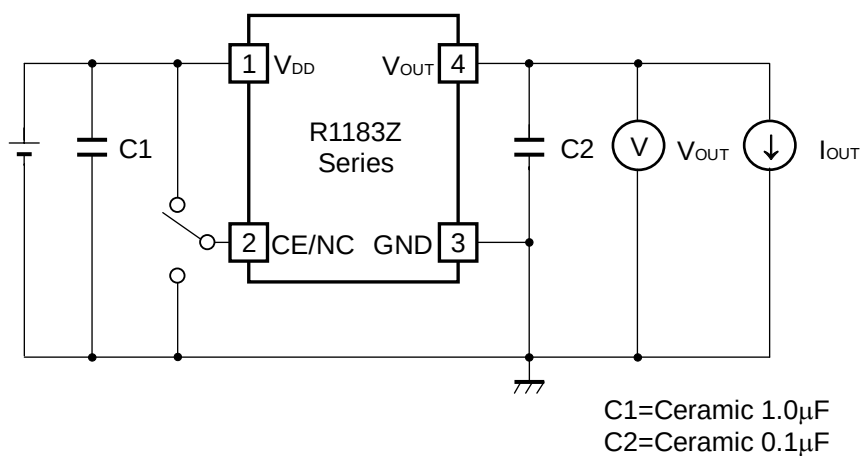
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance). (Note: If additional ceramic capacitors are connected with parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

PCB Layout

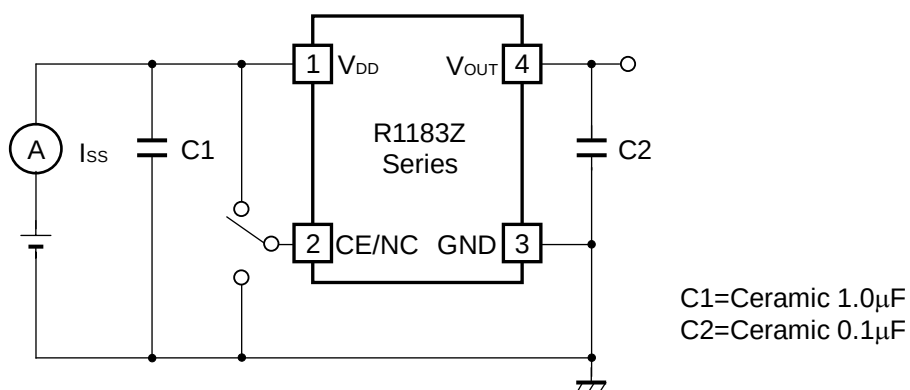
Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 0.1 μ F or more between V_{DD} and GND pin, and as close as possible to the pins.

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

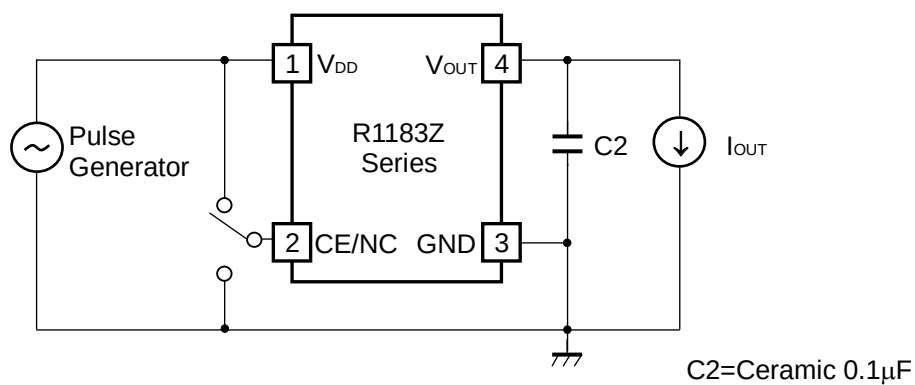
TEST CIRCUITS



Standard test Circuit



Supply Current Test Circuit

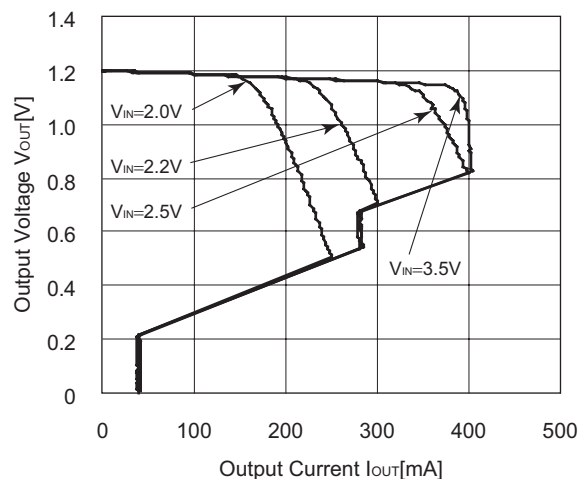


Ripple Rejection, Line Transient Response Test Circuit

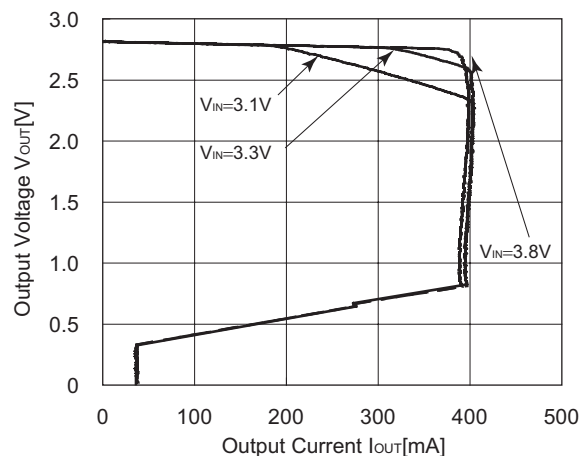
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (T_{opt}=25°C)

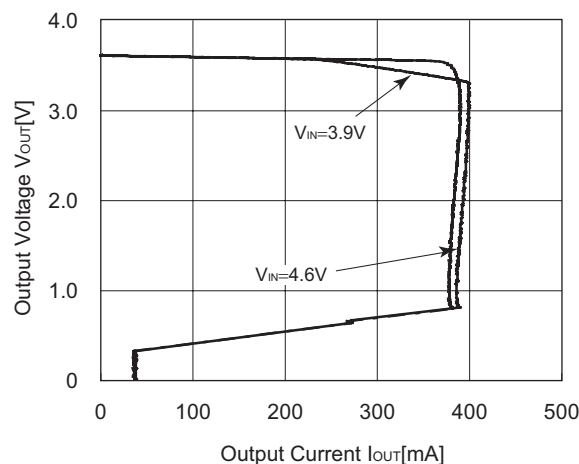
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R1183Z281x

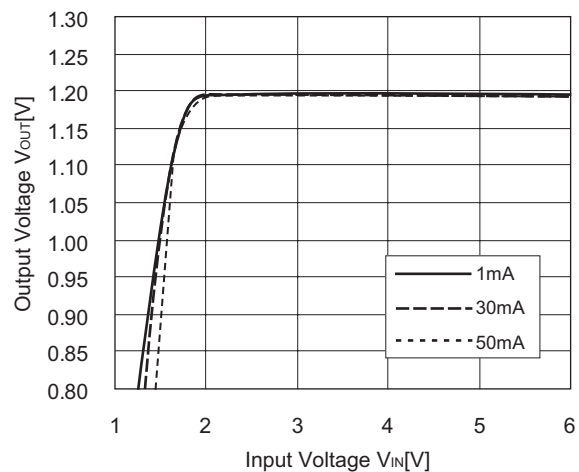


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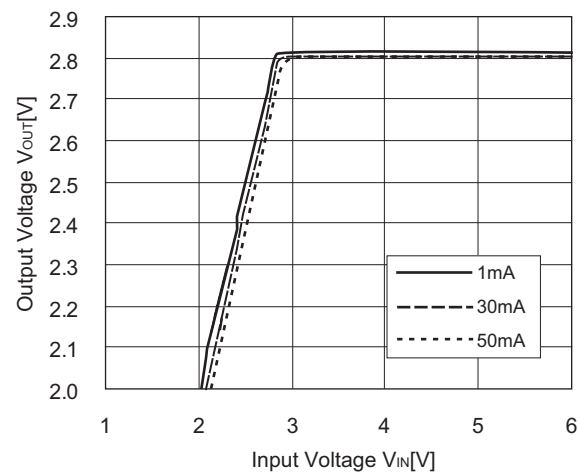


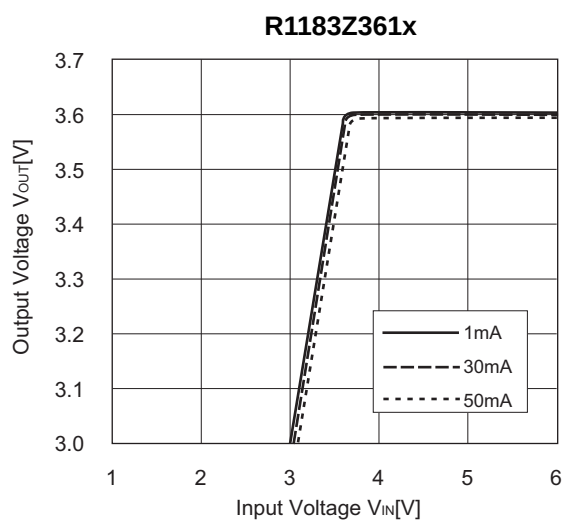
2) Output Voltage vs. Input Voltage (T_{opt}=25°C)

R1183Z121x

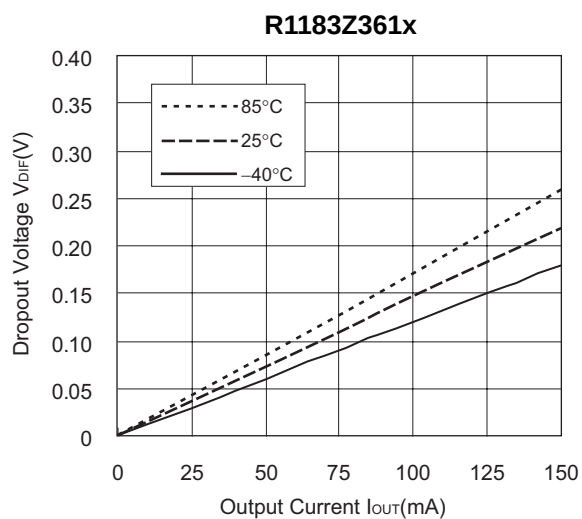
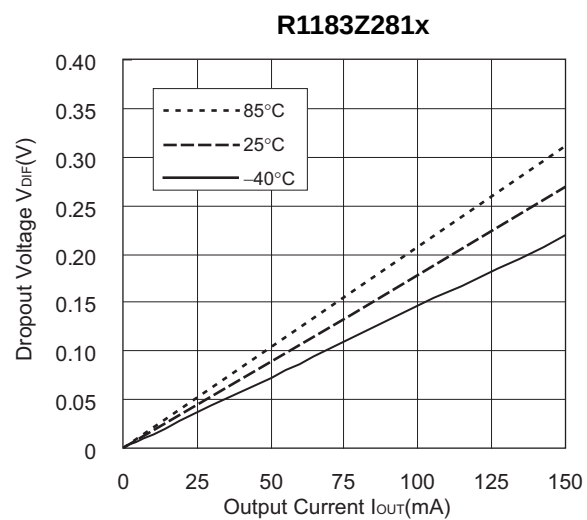
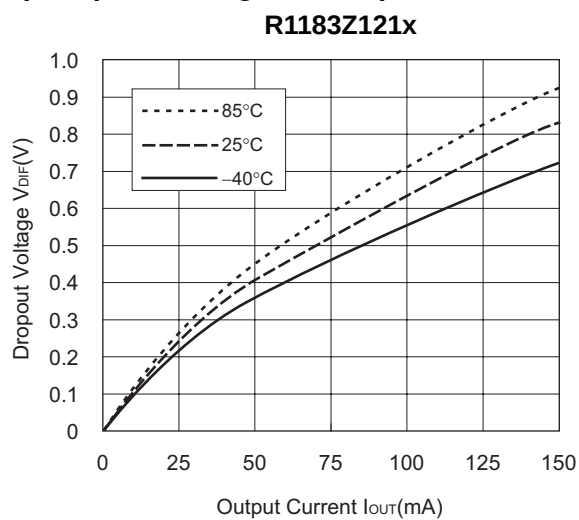


R1183Z281x



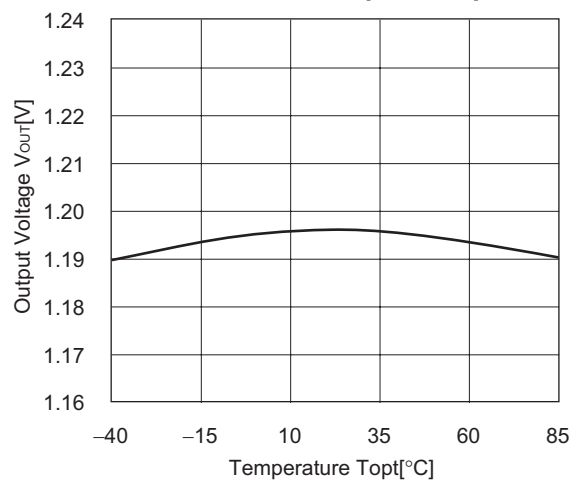


3) Dropout Voltage vs. Output Current

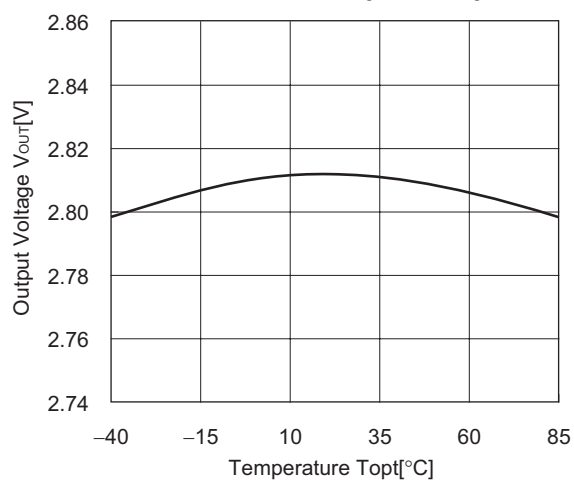


4) Output Voltage vs. Temperature ($I_{OUT}=30mA$)

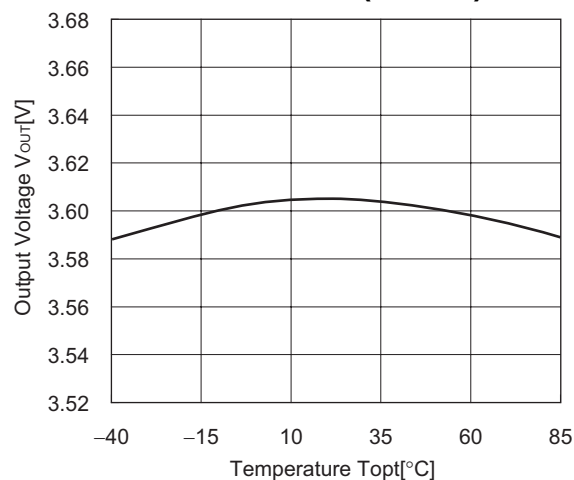
R1183Z121x ($V_{IN}=2.2V$)



R1183Z281x ($V_{IN}=3.8V$)

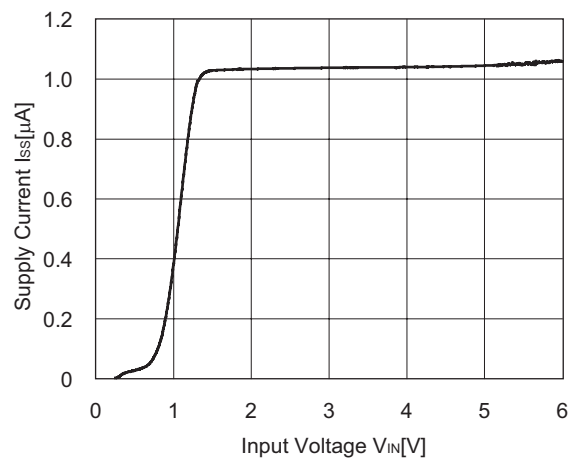


R1183Z361x ($V_{IN}=4.6V$)

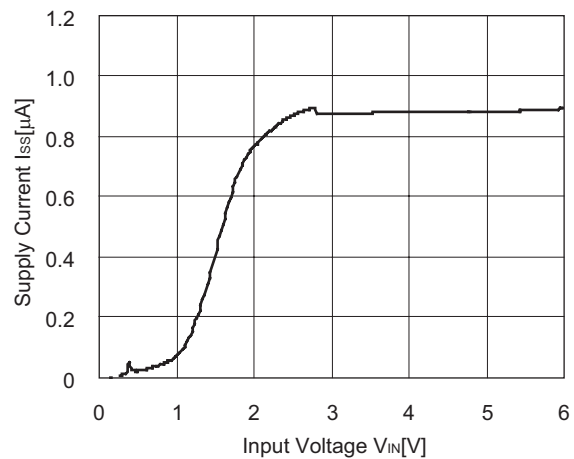


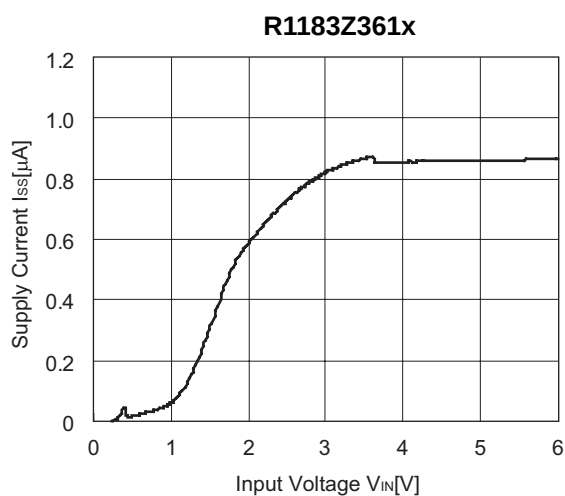
5) Supply Current vs. Input Voltage ($T_{opt}=25^{\circ}C$)

R1183Z121x

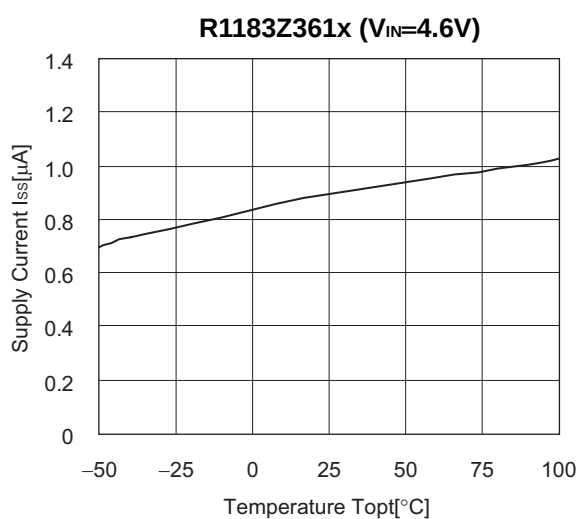
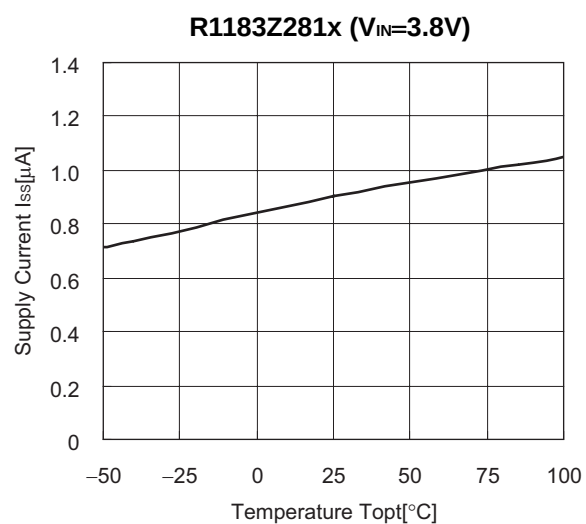
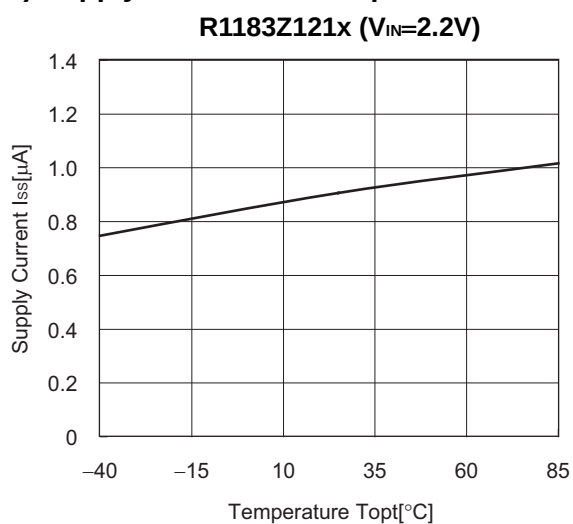


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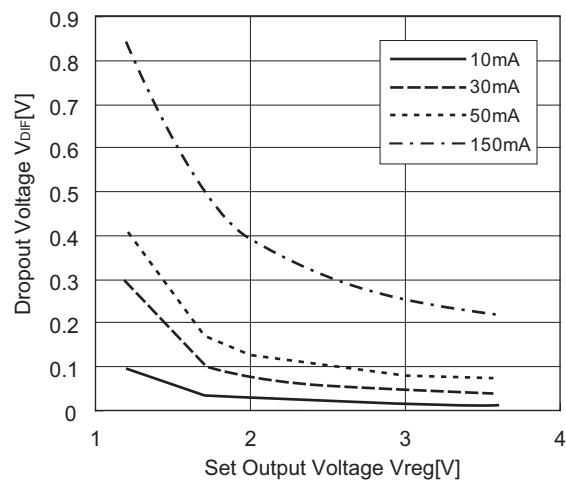




6) Supply Current vs. Temperature



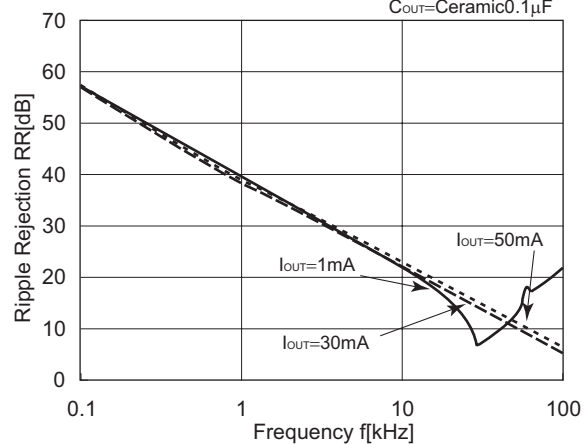
7) Dropout Voltage vs. Set Output Voltage (T_{opt}=25°C)



8) Ripple Rejection vs. Frequency (C_{IN}=none)

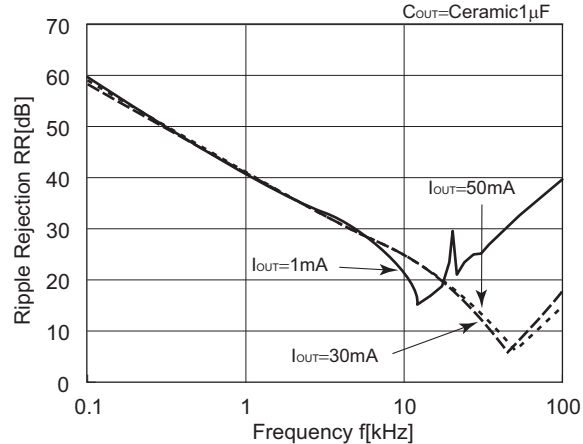
R1183Z121x

$V_{IN}=2.4V_{DC}+0.5p-p$
C_{OUT}=Ceramic0.1 μ F



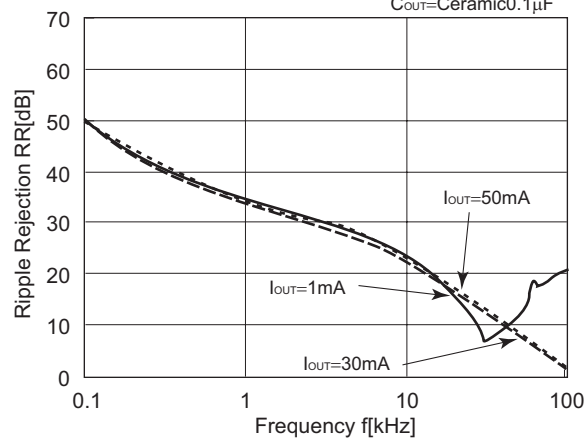
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$V_{IN}=2.4V_{DC}+0.5p-p$
C_{OUT}=Ceramic1 μ F



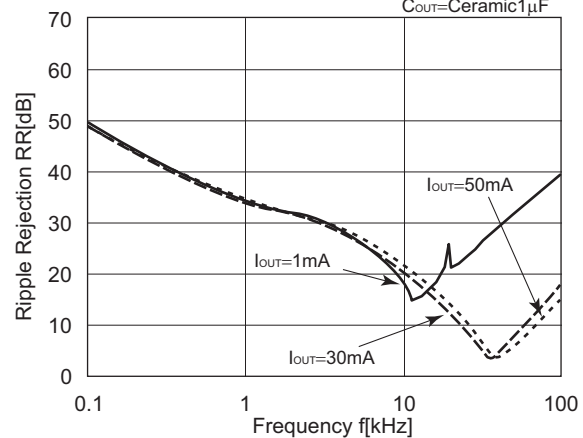
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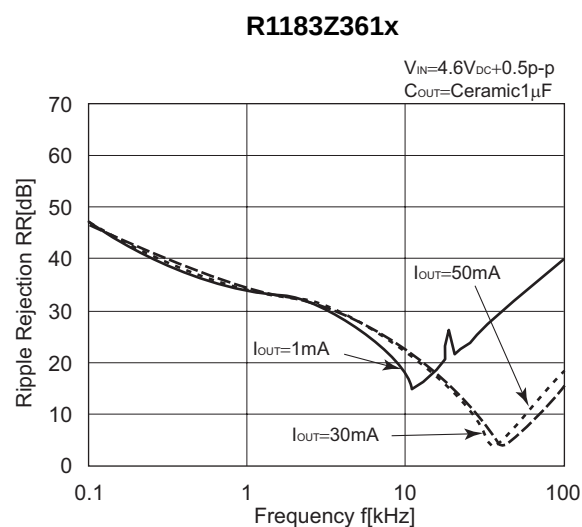
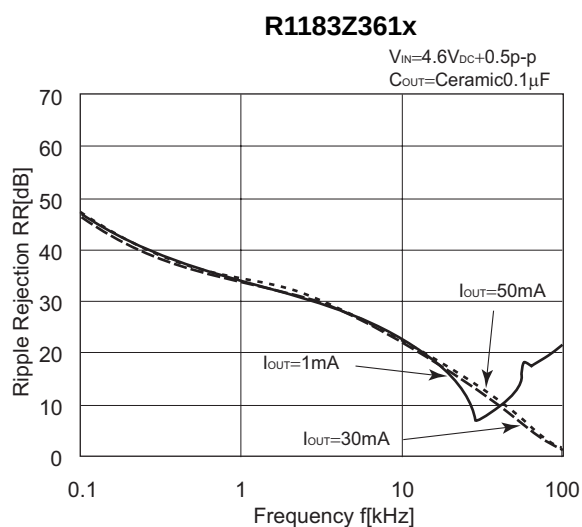
$V_{IN}=3.8V_{DC}+0.5p-p$
C_{OUT}=Ceramic0.1 μ F



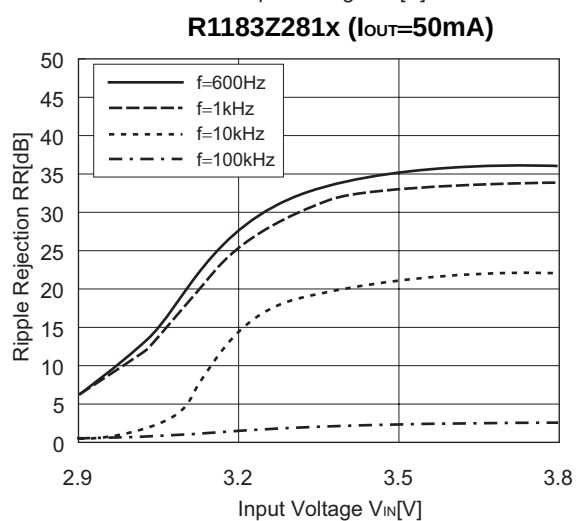
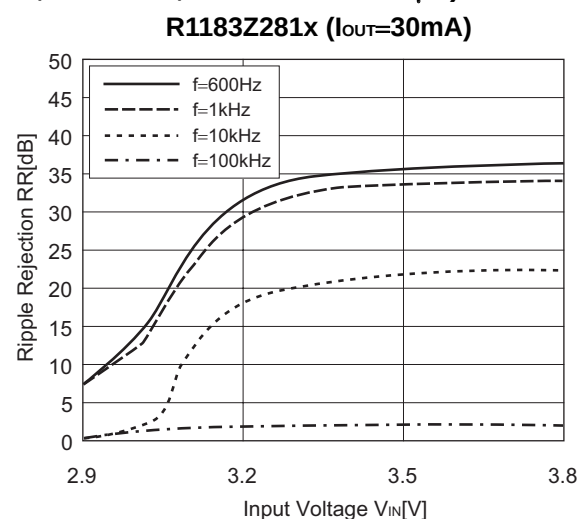
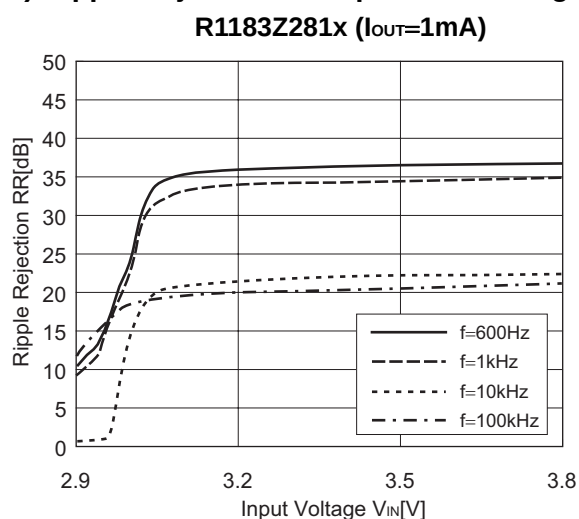
R1183Z281x

$V_{IN}=3.8V_{DC}+0.5p-p$
C_{OUT}=Ceramic1 μ F



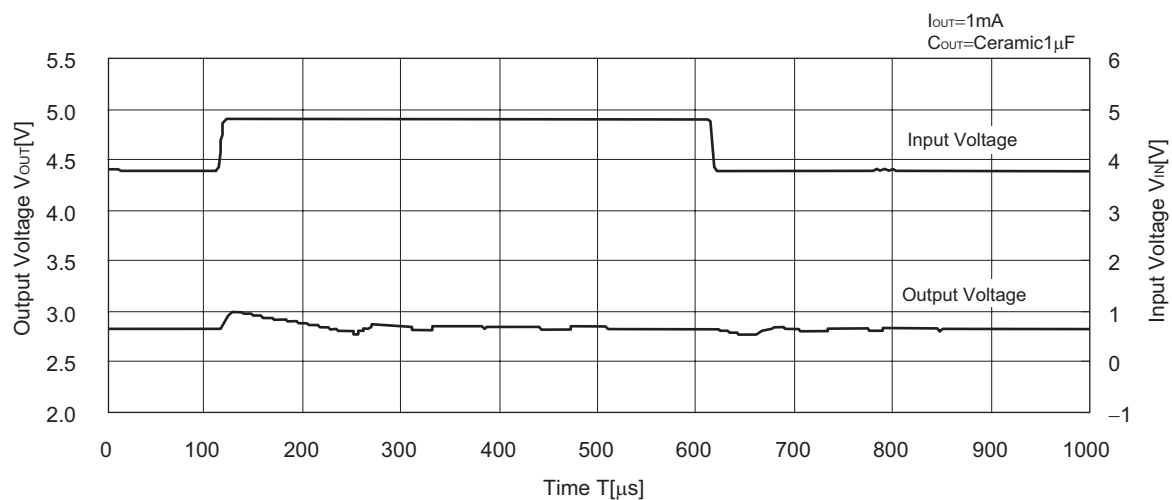


9) Ripple Rejection vs. Input Bias Voltage ($T_{opt}=25^{\circ}C$, $C_{IN}=\text{none}$, $C_{OUT}=\text{ceramic } 0.1\mu F$)

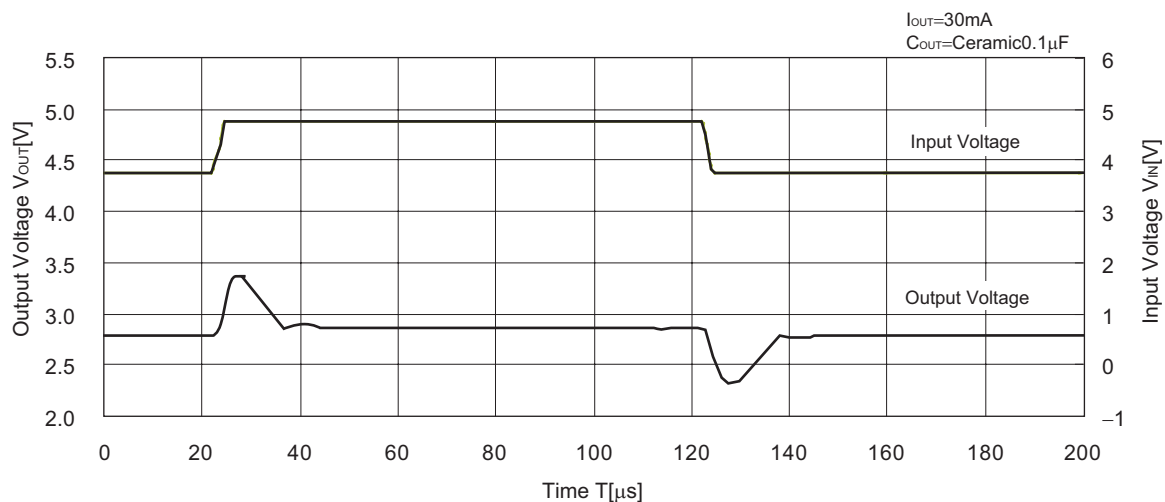


10) Input Transient Response ($C_{IN}=none$, $t_r=t_f=5\mu s$)

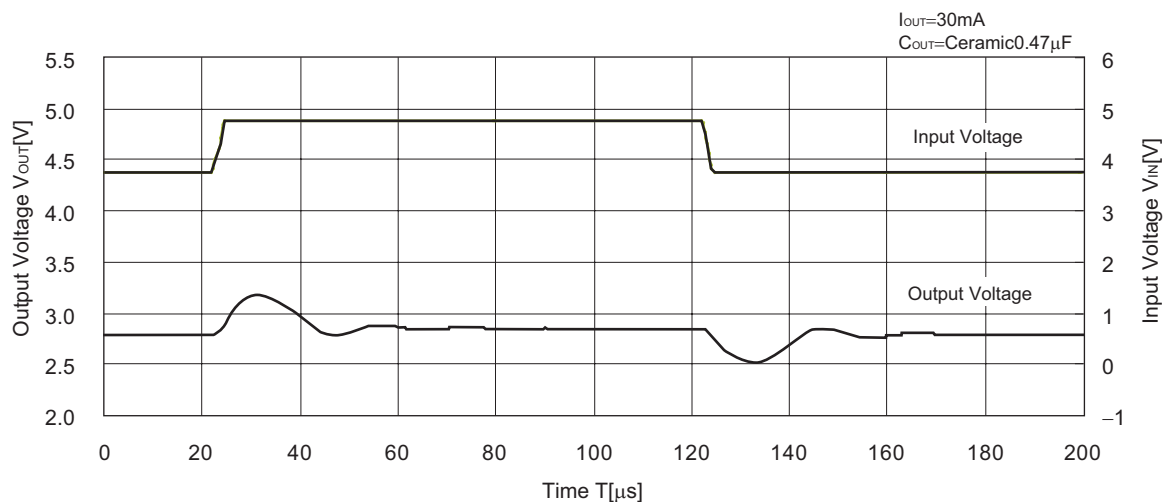
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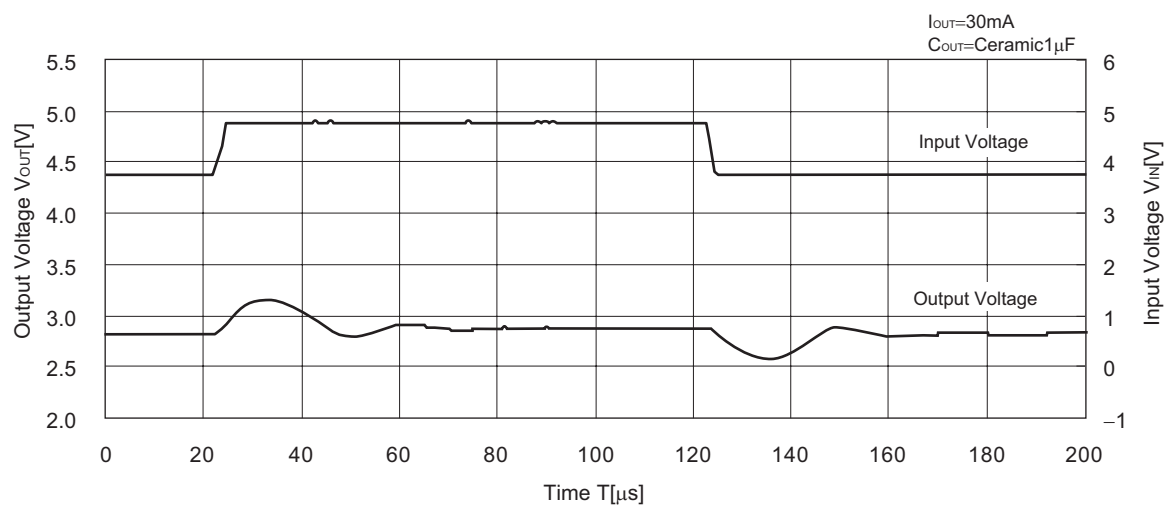
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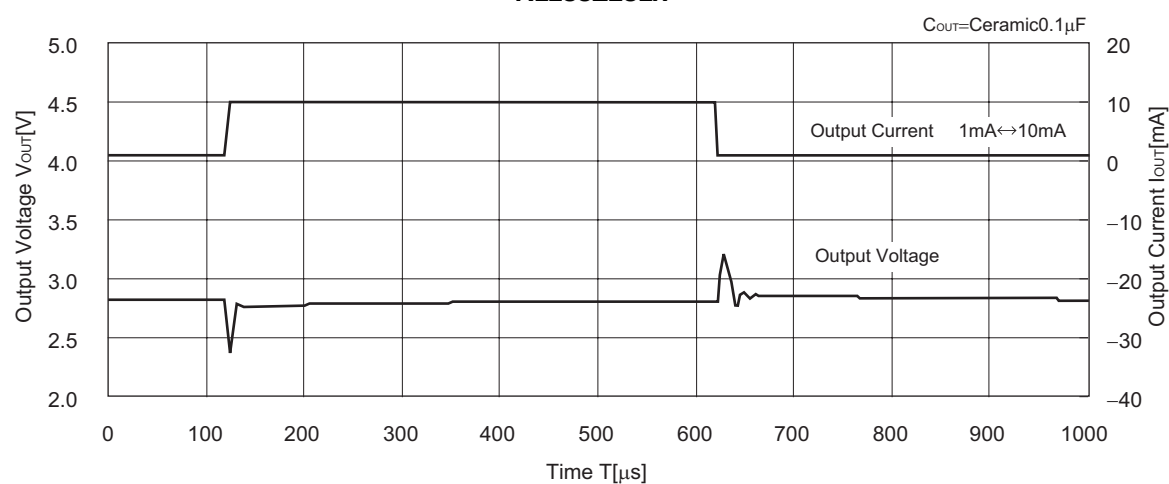


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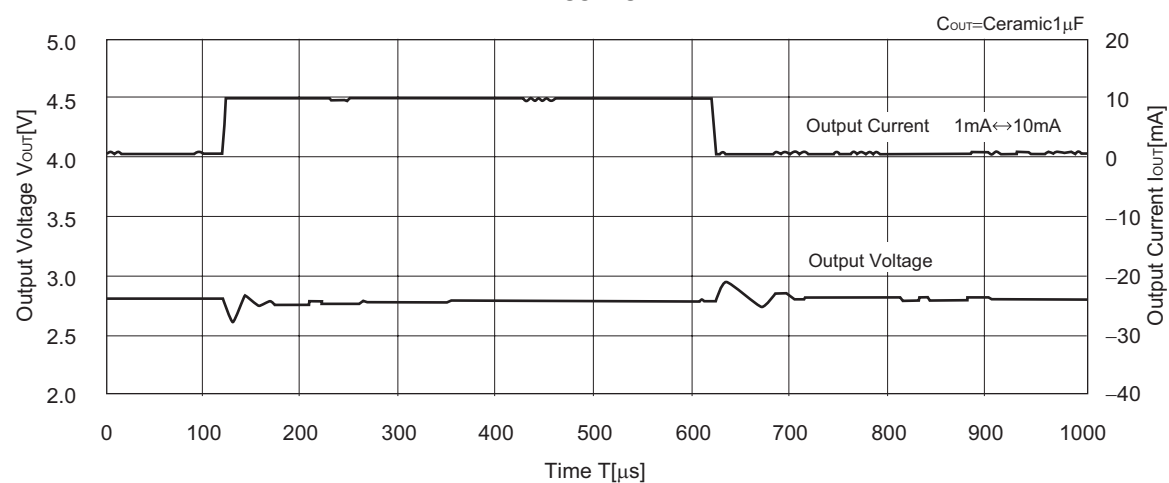


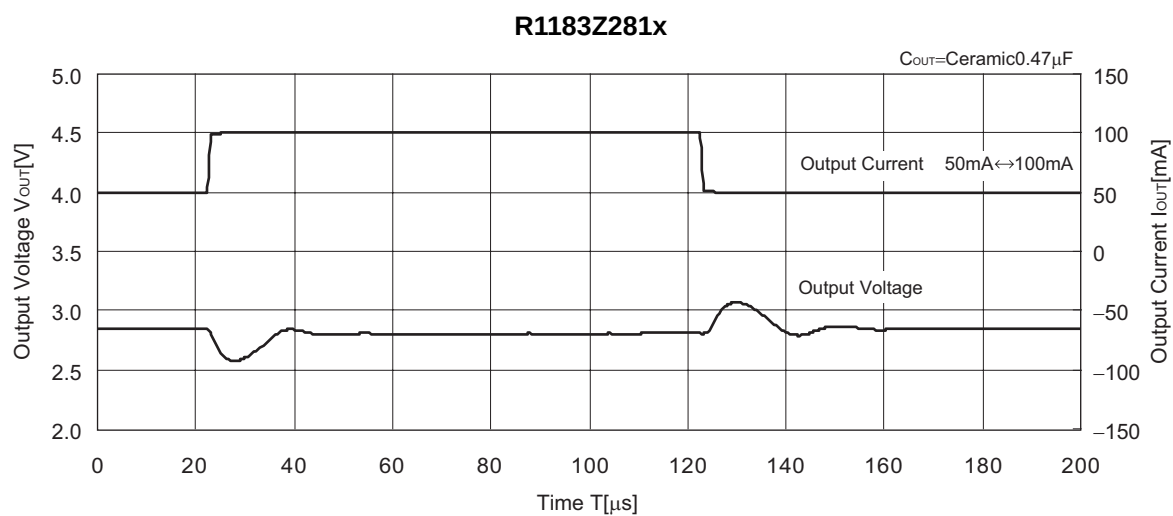
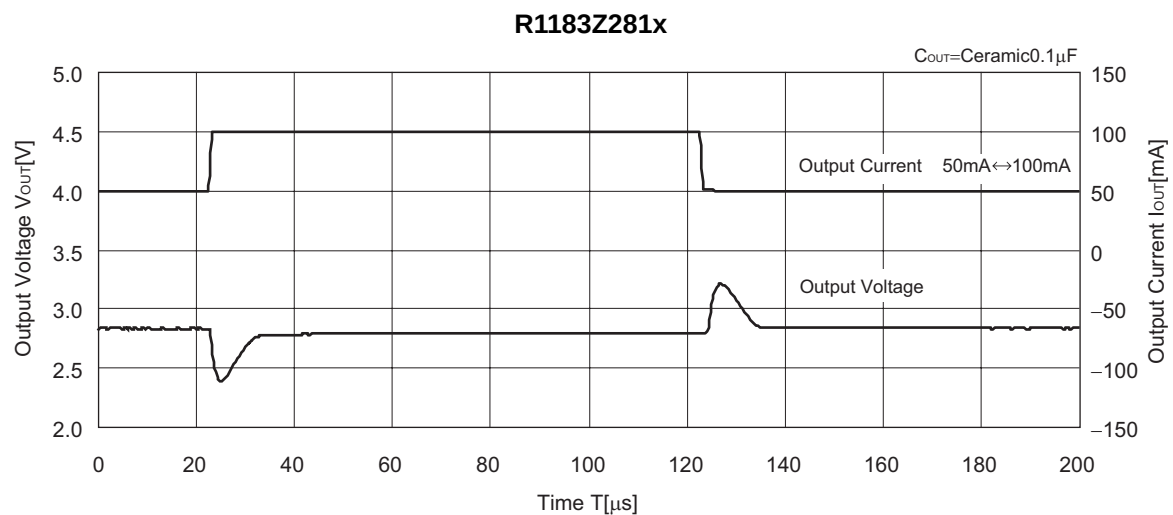
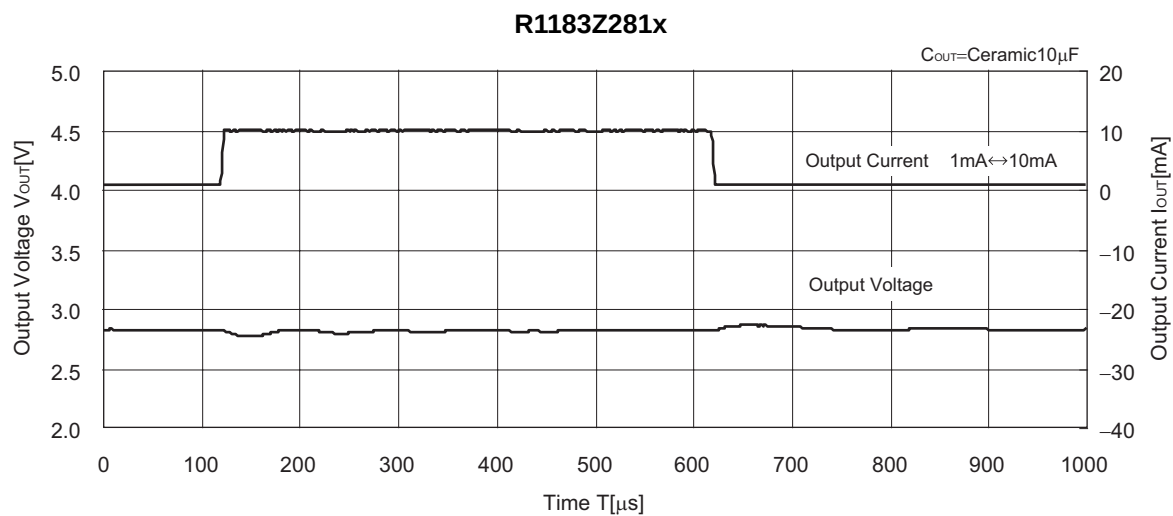
11) Load Transient Response ($t_r=t_f=0.5\mu\text{s}$ $V_{IN}=3.8\text{V}$)

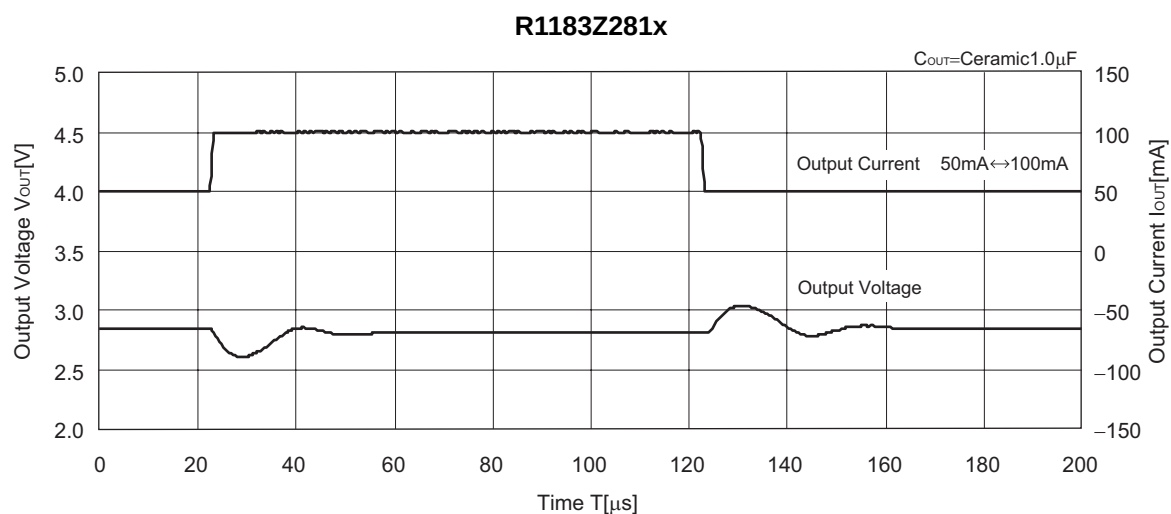
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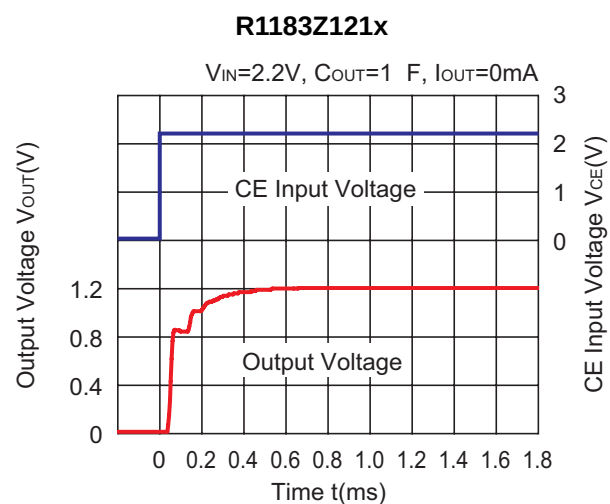
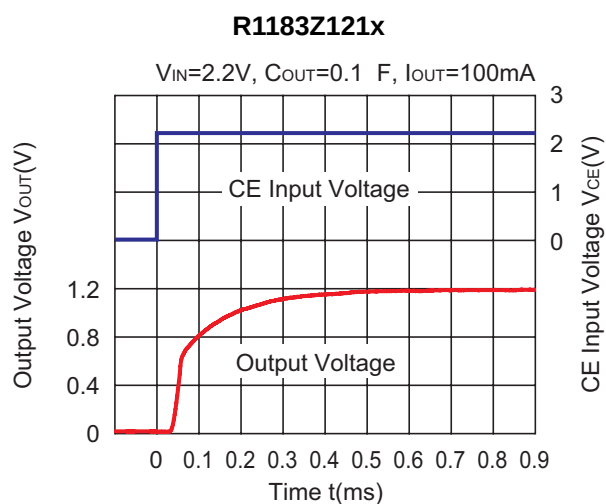
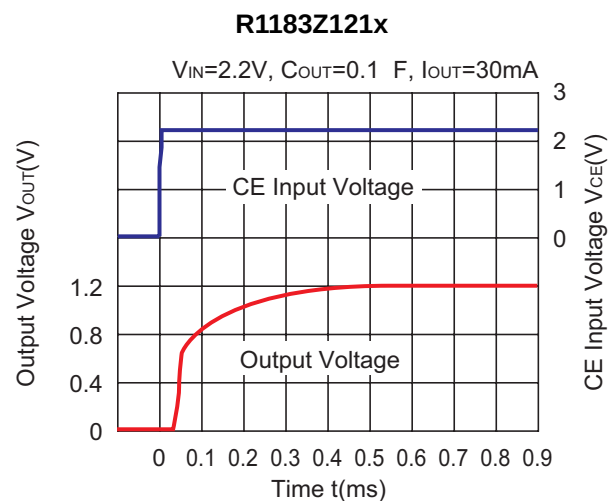
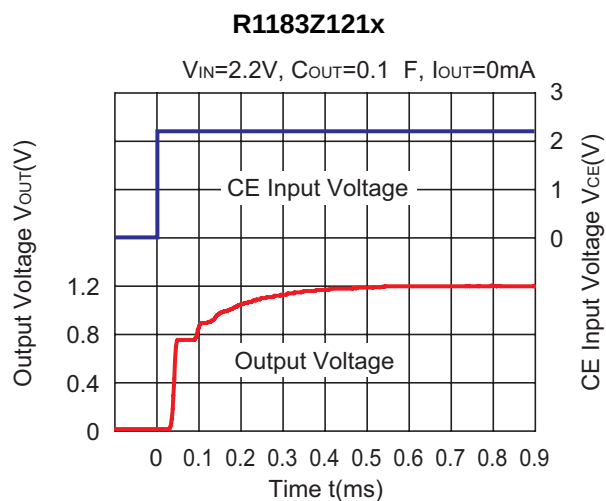
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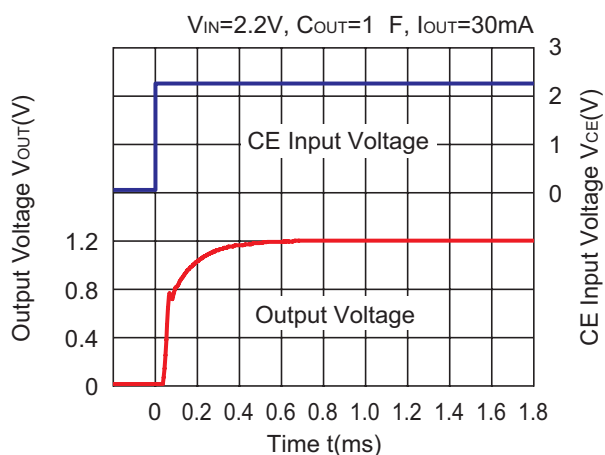




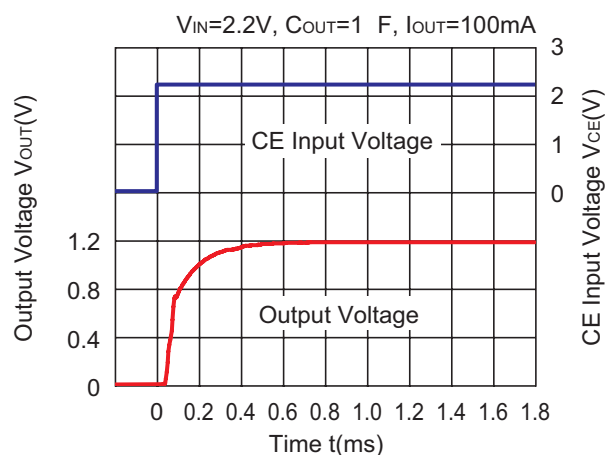
12) Turn-on speed with CE pin signal



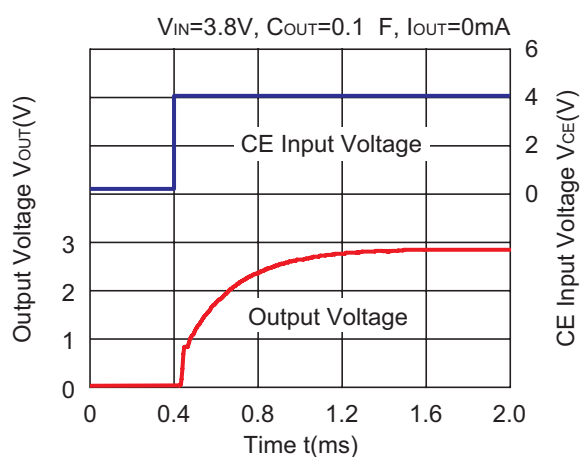
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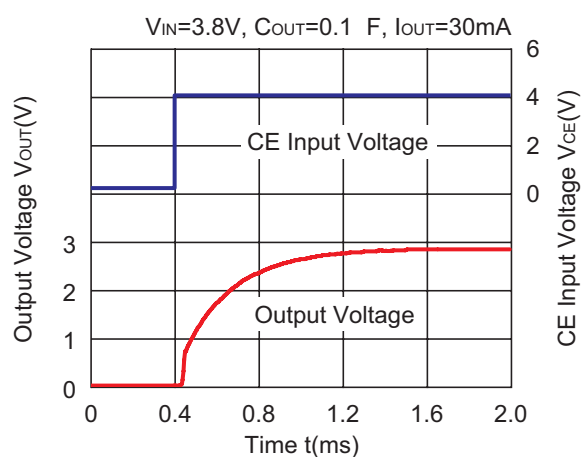
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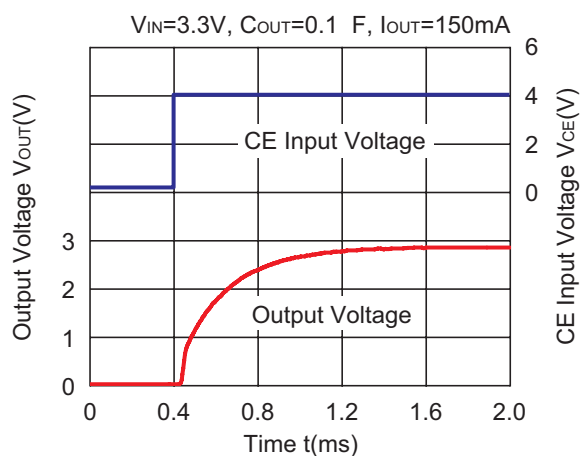
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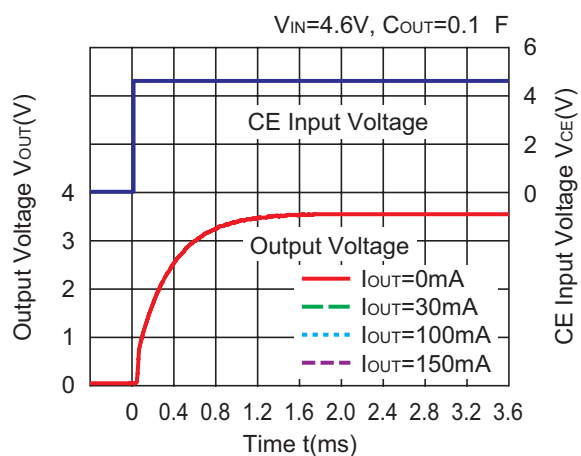
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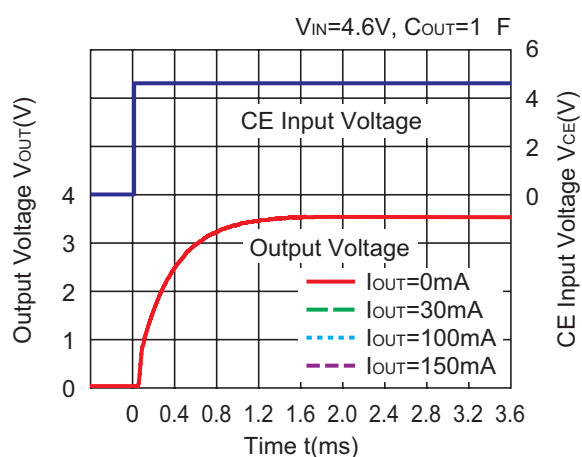
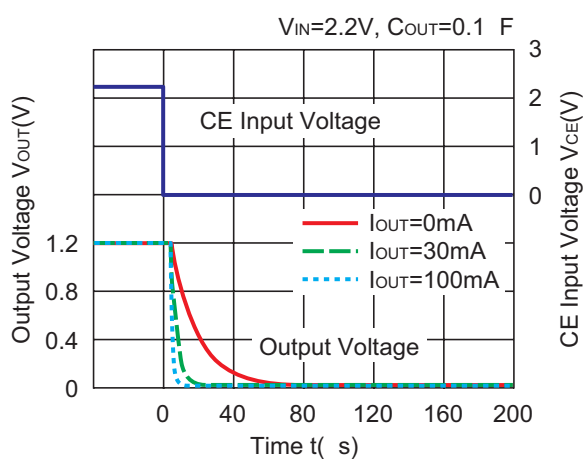
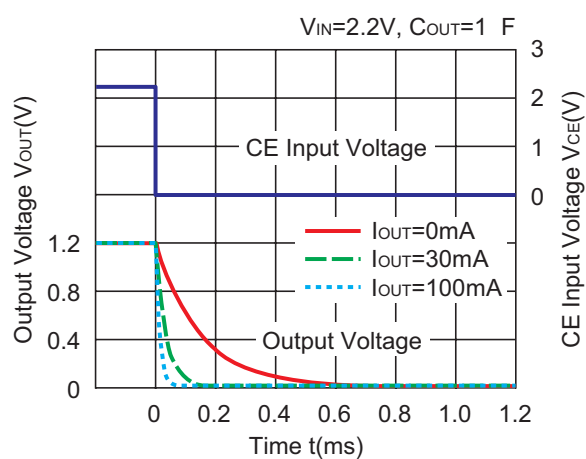
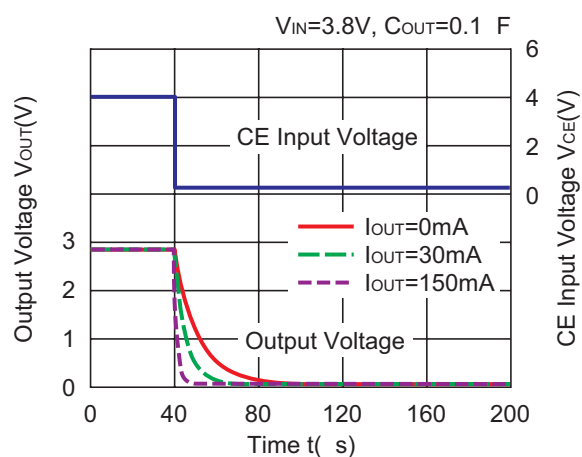
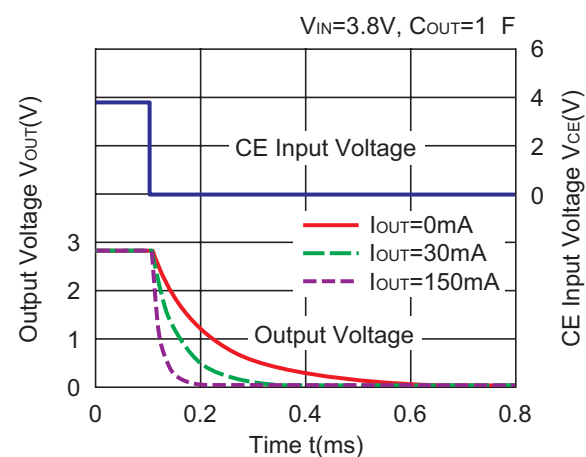


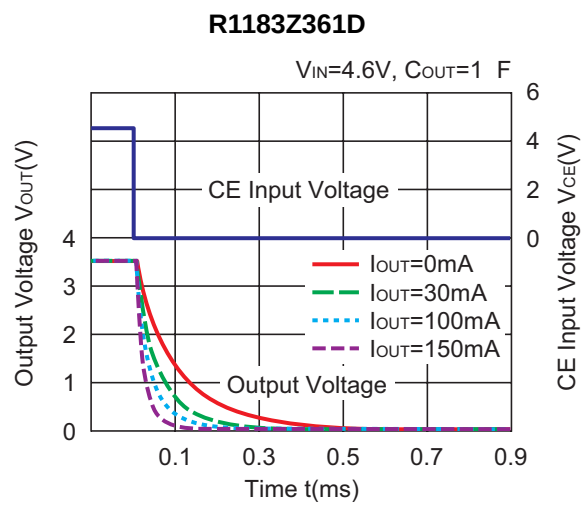
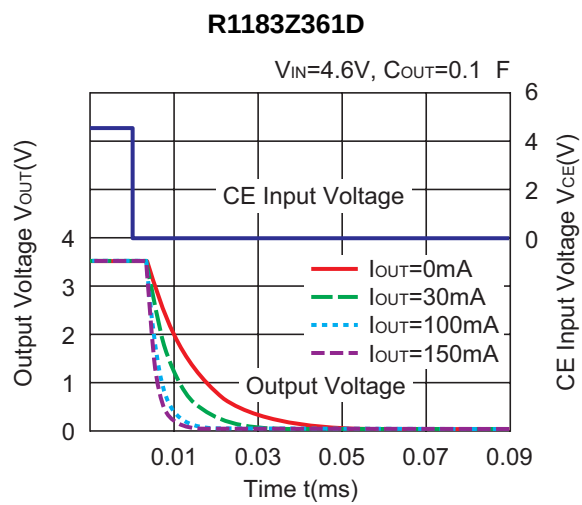
R1183Z281x



R1183Z361x



R1183Z361x**13) Turn off speed with CE pin signal****R1183Z121D****R1183Z121D****R1183Z281D****R1183Z281D**

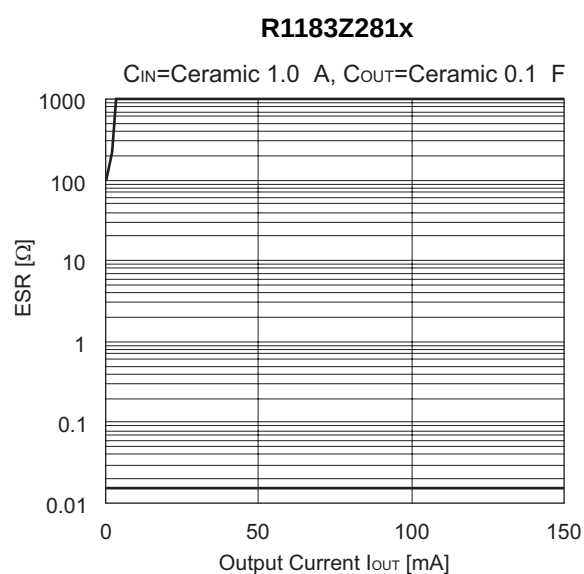
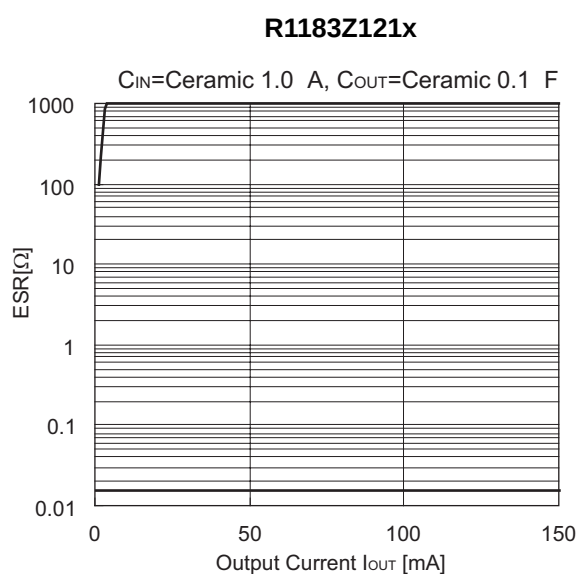


ESR vs. Output Current

The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown above. The conditions when the white noise level is under $40\mu V$ (Avg.) are marked as the hatched area in the graph.

<Measurement conditions>

- (1) $V_{IN}=V_{OUT}+1V$
- (2) Frequency Band: 10Hz to 2MHz (BW=30Hz)
- (3) Temperature: $-40^{\circ}C$ to $85^{\circ}C$





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■ Ricoh awarded ISO 14001 certification.

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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.