RICOH

R1183Z SERIES

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 Tr.

150mA output current is guaranteed, and the supply current of IC itself is Typ. 1μA 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×0.79mm) and built-in auto discharge function is available with D version, and output voltage accuracy improved to ±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

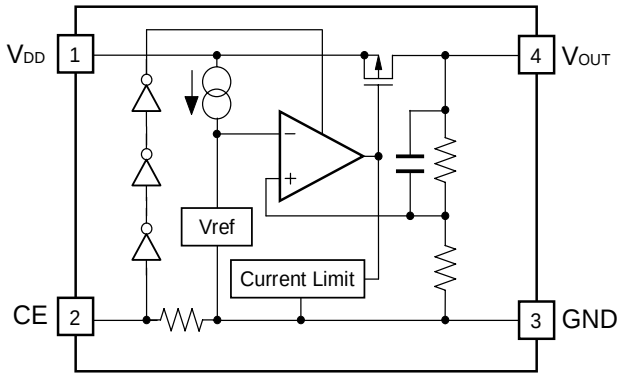
- Supply Current ..... Typ. 1μA (Except the current through CE pull-down circuit)
- Standby Mode ..... Typ. 0.1μA
- Dropout Voltage ..... Typ. 0.25V (I_{OUT}=150mA,V_{OUT}=3.0V)
- Temperature-Drift Coefficient of Output Voltage .. Typ. ±100ppm/°C
- Line Regulation ..... Typ. 0.05%/V
- Output Voltage Accuracy..... ±1.2%
- Output Voltage Range..... 1.2V to 3.6V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- 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 ····· 0.1μF or more

APPLICATIONS

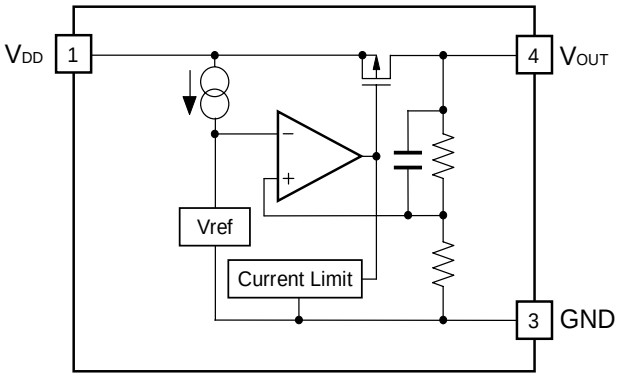
- Stable voltage reference.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

BLOCK DIAGRAMS

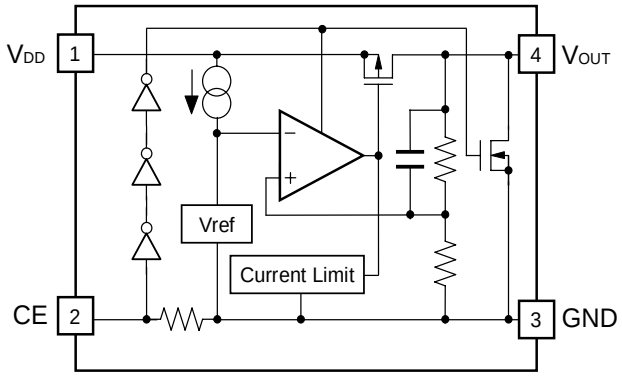
R1183Zxx1B



R1183Zxx1C



R1183Zxx1D



SELECTION GUIDE

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

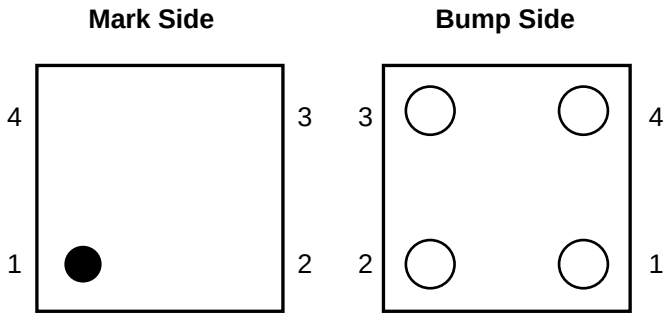
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1183Zxx1∗-TR-F	WLCSP-4-P2	5,000 pcs	Yes	Yes

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 INFORMATIONS.)

∗ : 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

● **WLCSP-4-P2**



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
Topt	Operating Temperature Range	−40 to +85	°C
Tstg	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**

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
			$V_{OUT} \leqq$ 1.5V	−18		+18	mV
I_{OUT}	Output Current	$V_{IN}-V_{OUT}$=1.0V ($V_{OUT} \geqq$ 1.5V) If V_{OUT}<1.5V, V_{IN}=2.4V		150			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	$V_{IN}-V_{OUT}$=1.0V ($V_{OUT} \geqq$ 1.5V) If V_{OUT}<1.5V, V_{IN}=2.4V 1μA $\leqq I_{OUT} \leqq$ 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
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	I_{OUT}=30mA V_{OUT}+0.5V $\leqq V_{IN} \leqq$ 6.0V ($V_{OUT} \geqq$ 1.5V) If V_{OUT}<1.5V, 2.0V $\leqq V_{IN} \leqq$ 6.0V			0.05	0.20	%/V
V_{IN}	Input Voltage			1.7		6.0	V
$\Delta V_{OUT}/\Delta Topt$	Output Voltage Temperature Coefficient	I_{OUT}=30mA −40°C $\leqq$ Topt $\leqq$ 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
			$V_{OUT} \leqq$ 1.5V	−18		+18	mV
I_{OUT}	Output Current	$V_{IN}-V_{OUT}$=1.0V ($V_{OUT} \geqq$ 1.5V) If V_{OUT}<1.5V, V_{IN}=2.4V		150			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	$V_{IN}-V_{OUT}$=1.0V ($V_{OUT} \geqq$ 1.5V) If V_{OUT}<1.5V, V_{IN}=2.4V 1μA $\leqq I_{OUT} \leqq$ 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
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	I_{OUT}=30mA V_{OUT}+0.5V $\leqq V_{IN} \leqq$ 6.0V ($V_{OUT} \geqq$ 1.5V) If V_{OUT}<1.5V, 2.0V $\leqq V_{IN} \leqq$ 6.0V			0.05	0.20	%/V
V_{IN}	Input Voltage			1.7		6.0	V
$\Delta V_{OUT}/\Delta Topt$	Output Voltage Temperature Coefficient	I_{OUT}=30mA −40°C $\leqq$ Topt $\leqq$ 85°C			±100		ppm /°C
I_{SC}	Short Current Limit	V_{OUT}=0V			40		mA

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

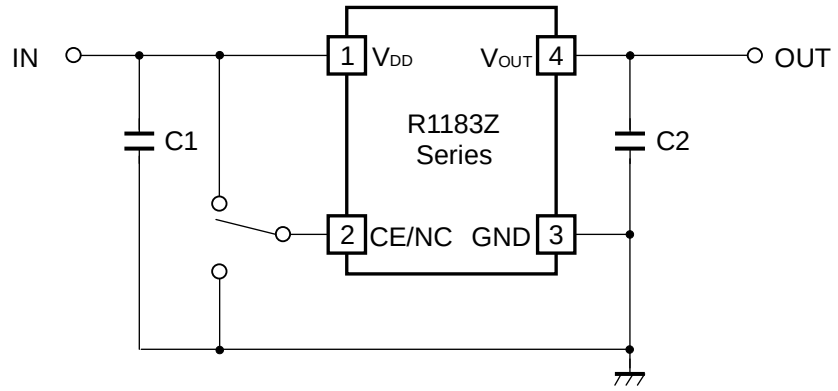
All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic 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 $\leqq V_{OUT}$ < 1.3	I_{OUT}=150mA	0.85	1.20
1.3 $\leqq V_{OUT}$ < 1.4		0.75	1.10
1.4 $\leqq V_{OUT}$ < 1.5		0.65	1.00
1.5 $\leqq V_{OUT}$ < 1.7		0.60	0.90
1.7 $\leqq V_{OUT}$ < 1.9		0.50	0.75
1.9 $\leqq V_{OUT}$ < 2.1		0.40	0.65
2.1 $\leqq V_{OUT}$ < 2.8		0.35	0.55
2.8 $\leqq V_{OUT} \leqq$ 3.6		0.25	0.40

TYPICAL APPLICATION



(External Components)
Output Capacitor

Ceramic Capacitor	0.1μF	murata	GRM155B31C104KA87B
		kyocera	CM05X5R104K16AB

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

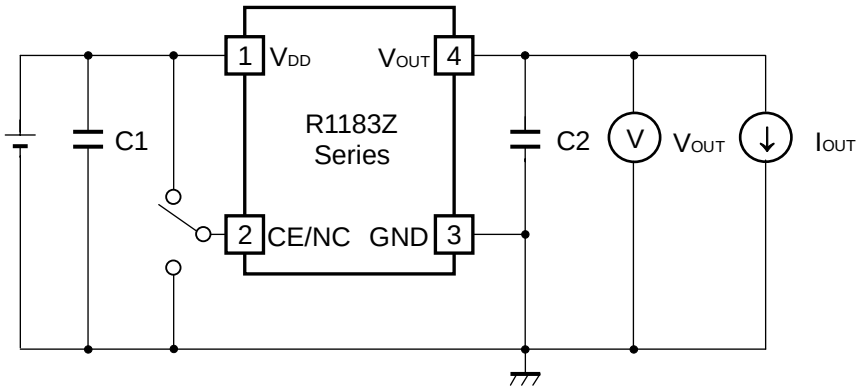
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance). (Note: If additional ceramic capacitors are connected with parallel to the output 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 0.1μF or more between V_{DD} and GND pin, and as close as possible to the pins.

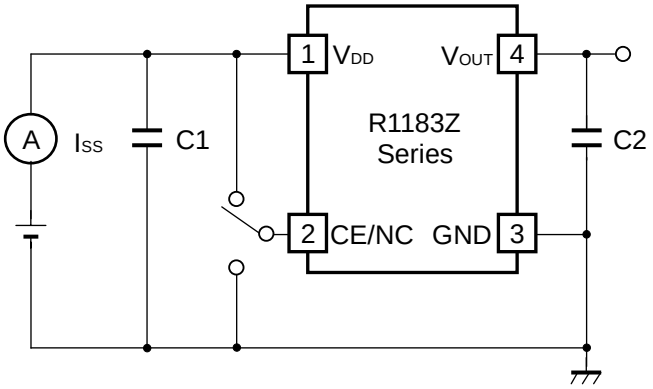
Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

TEST CIRCUITS



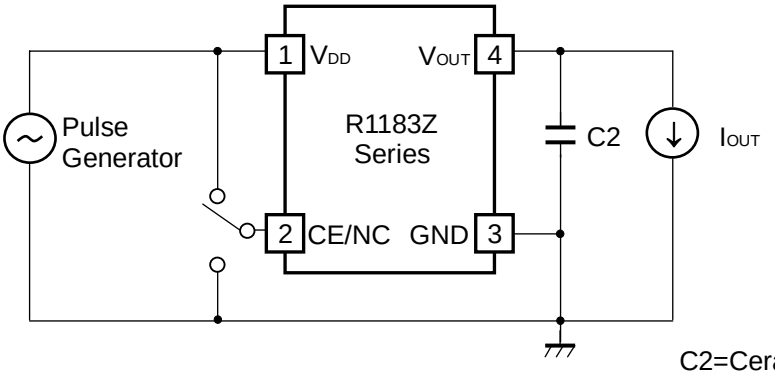
C1=Ceramic 1.0μF
C2=Ceramic 0.1μF

Standard test Circuit



C1=Ceramic 1.0μF
C2=Ceramic 0.1μF

Supply Current Test Circuit



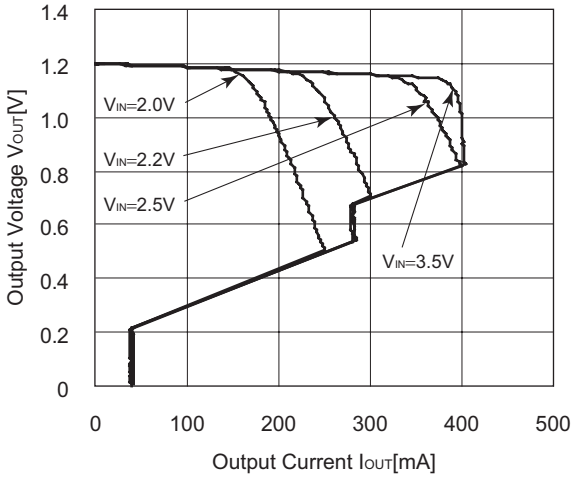
C2=Ceramic 0.1μF

Ripple Rejection, Line Transient Response Test Circuit

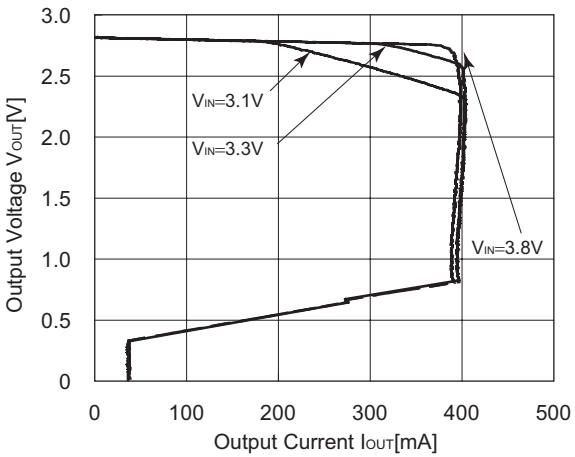
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (Topt=25°C)

R1183Z121x



R1183Z281x



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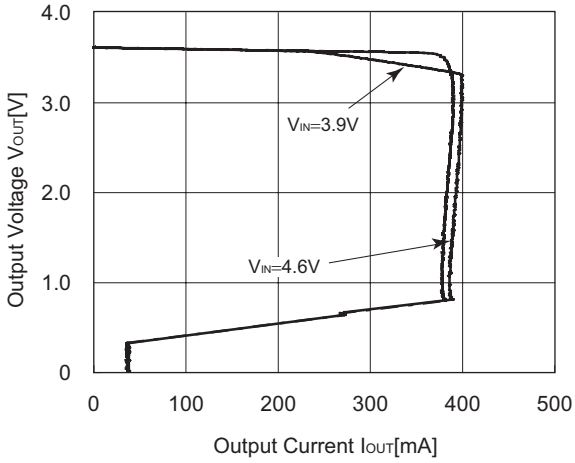
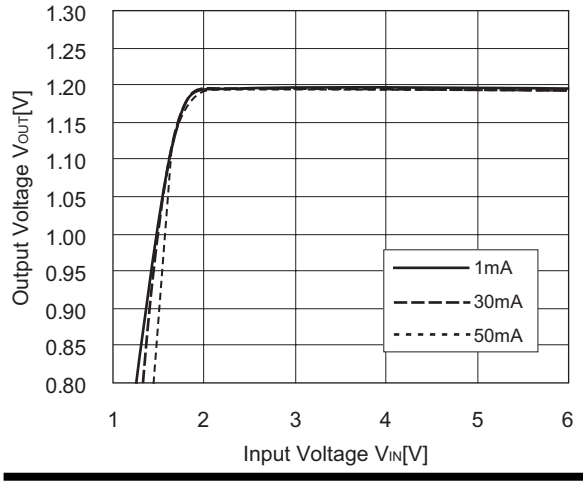


2) Output Voltage vs. Input Voltage (Topt=25°C)

R1183Z121x



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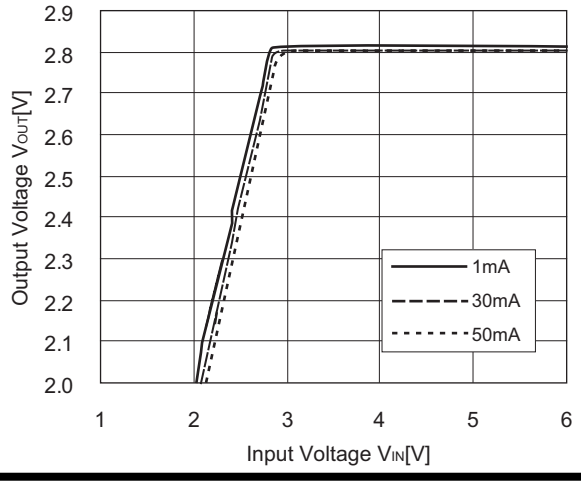

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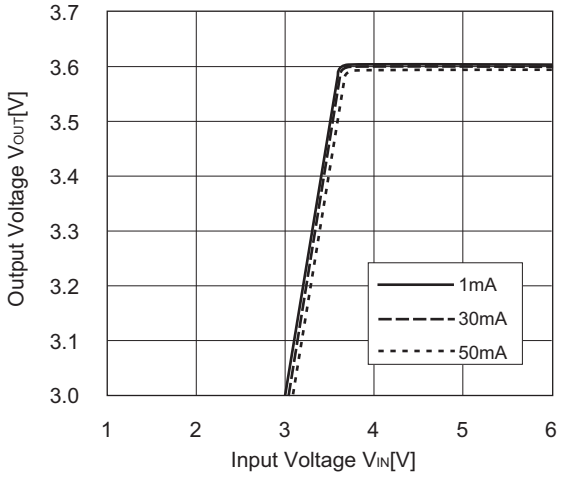
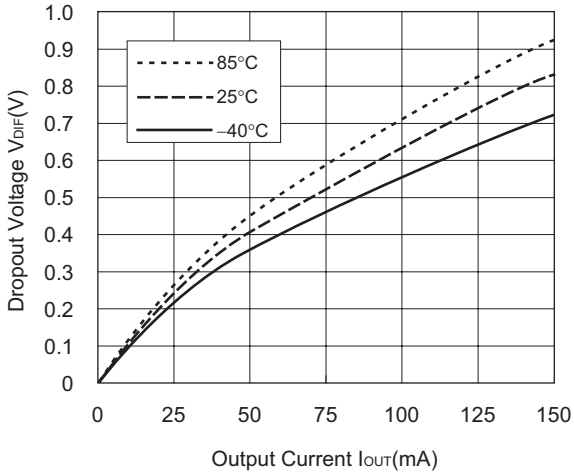


3) Dropout Voltage vs. Output Current

R1183Z121x



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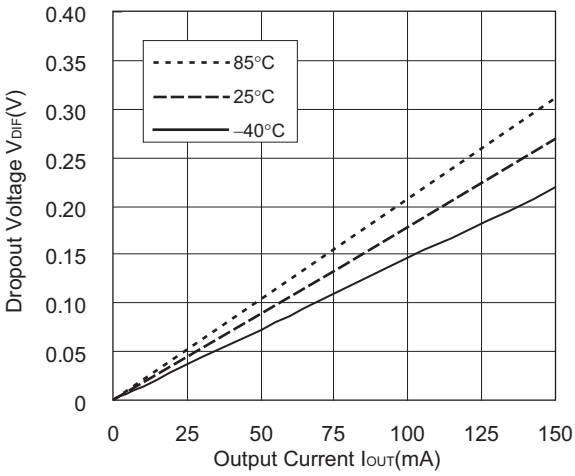

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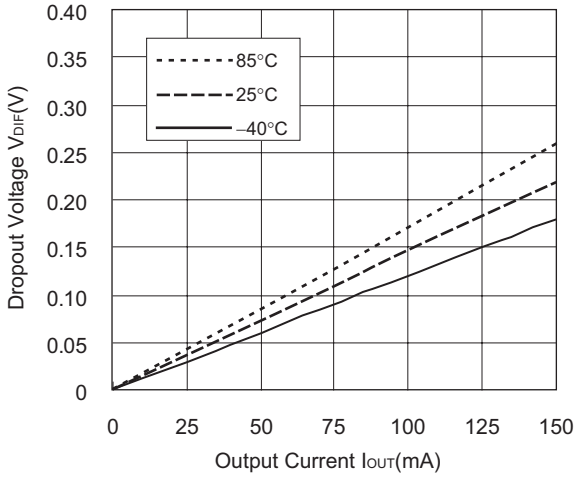
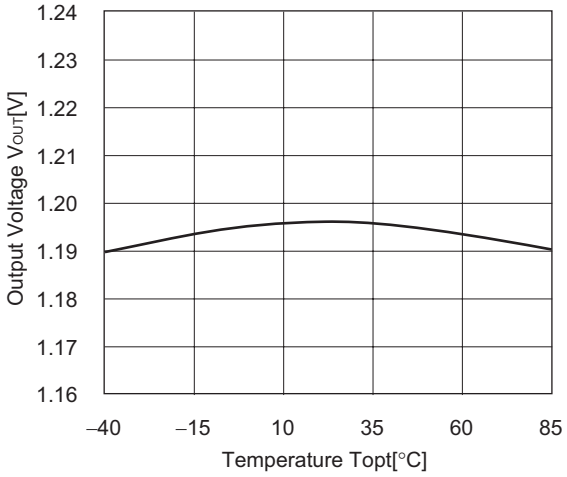
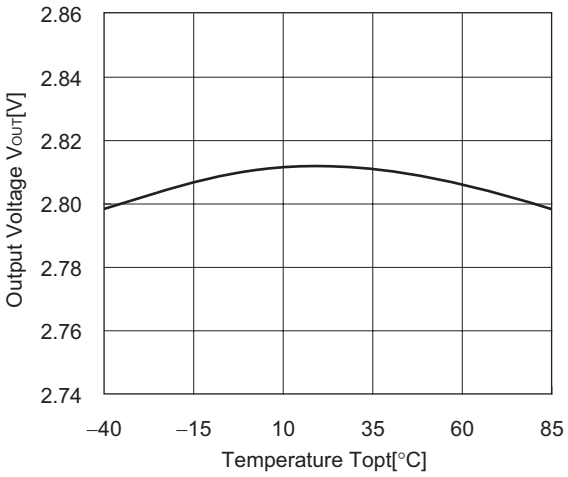


4) Output Voltage vs. Temperature (I_{OUT}=30mA)

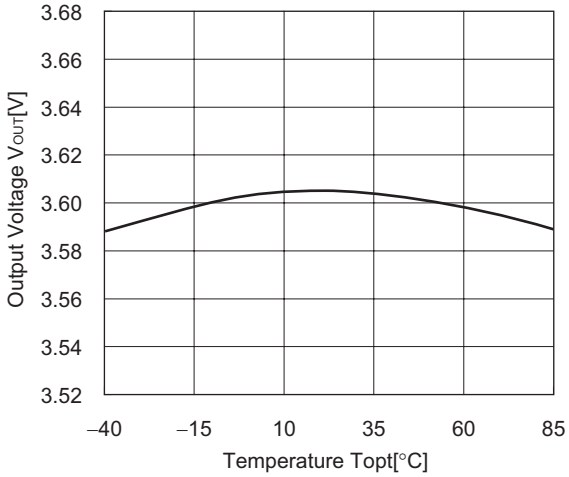
R1183Z121x (V_{IN}=2.2V)



R1183Z281x (V_{IN}=3.8V)

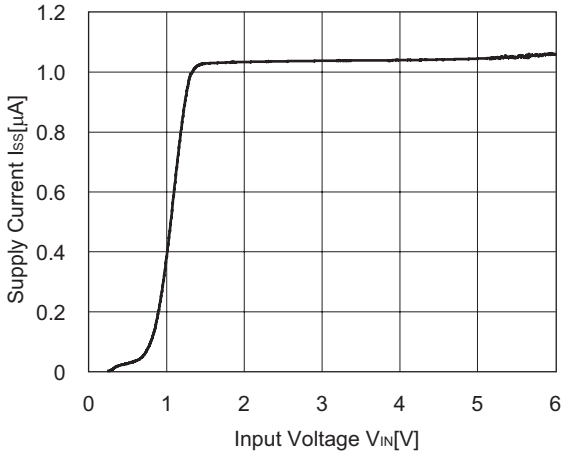


R1183Z361x (V_{IN}=4.6V)



5) Supply Current vs. Input Voltage (Topt=25°C)

R1183Z121x



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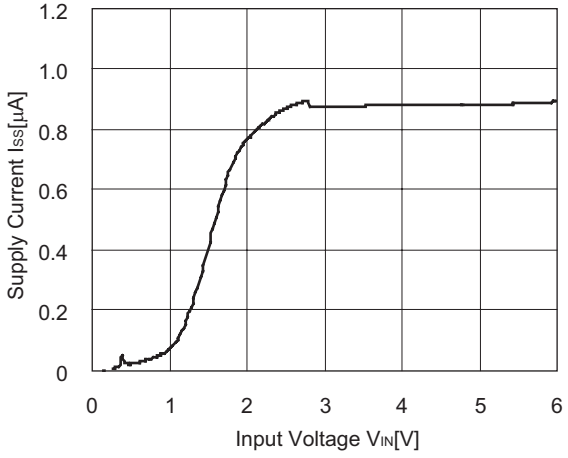

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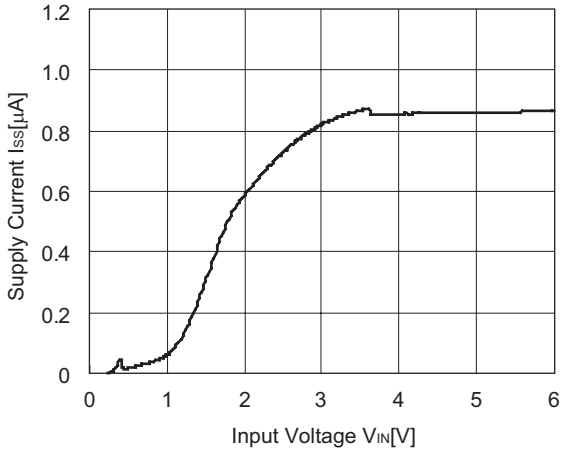
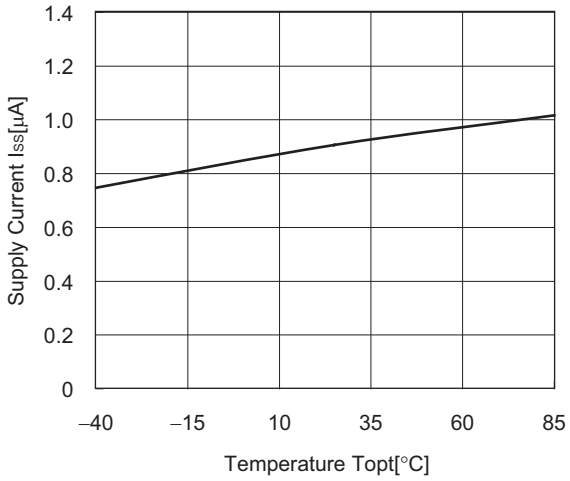
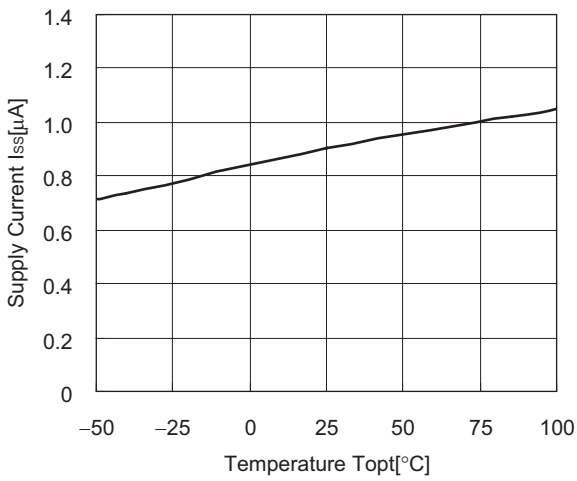


6) Supply Current vs. Temperature

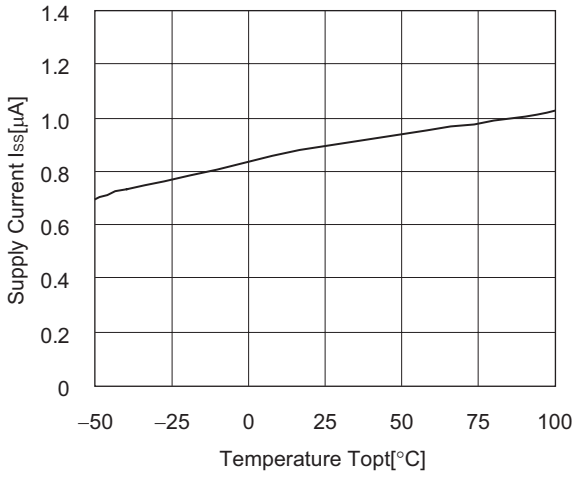
R1183Z121x (V_{IN}=2.2V)



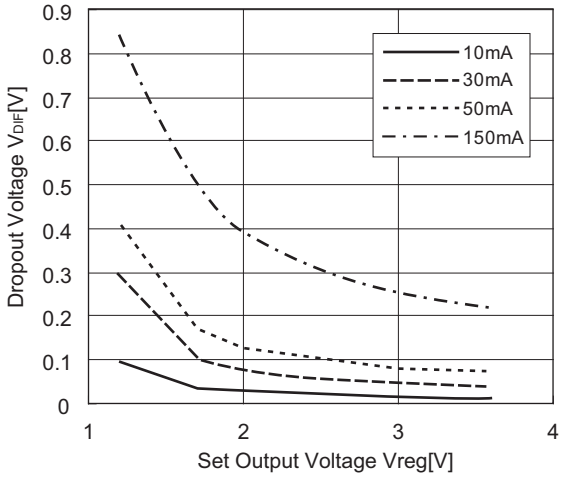
R1183Z281x (V_{IN}=3.8V)



R1183Z361x (V_{IN}=4.6V)

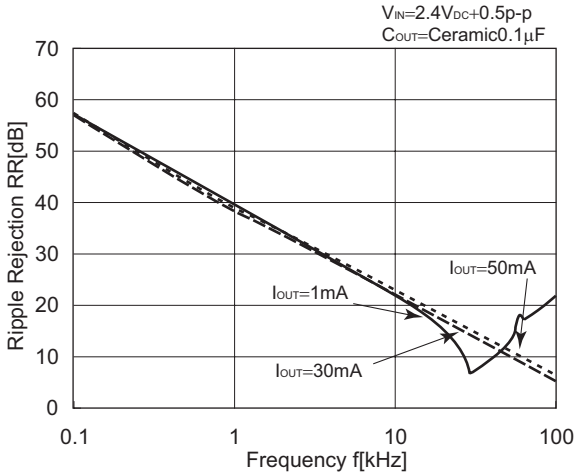


7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)



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

R1183Z121x



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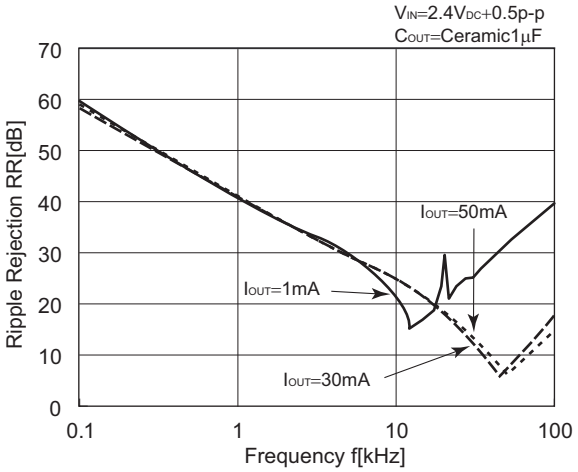

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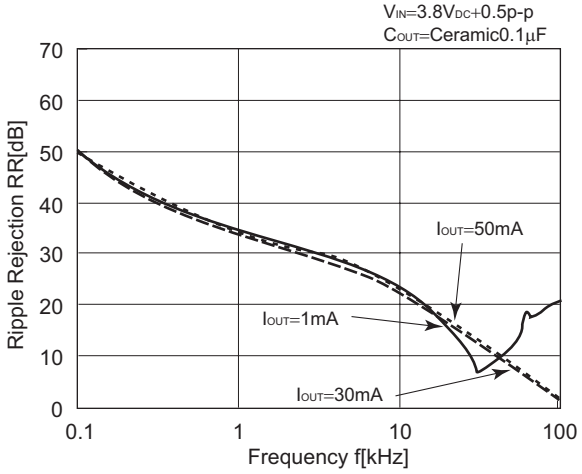
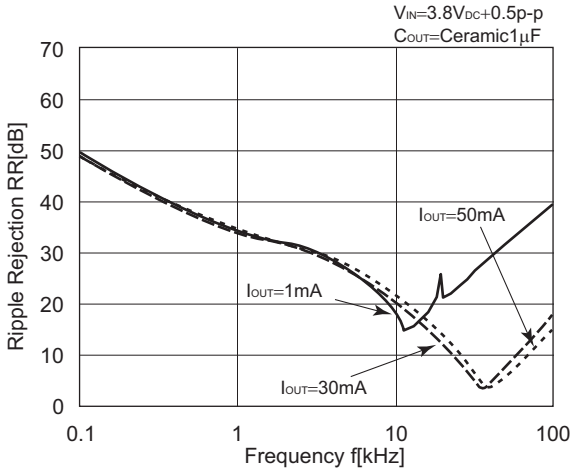


R1183Z281x



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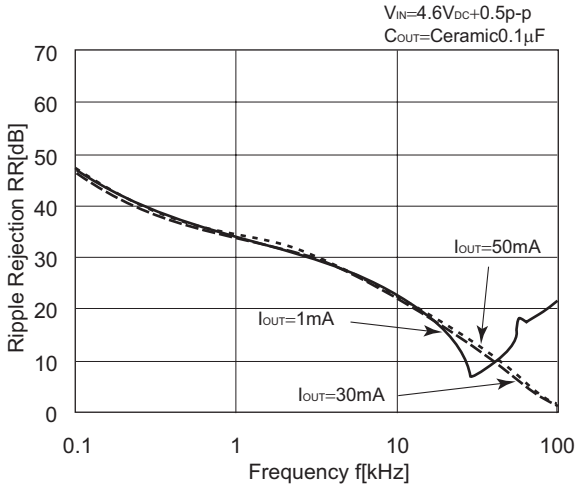

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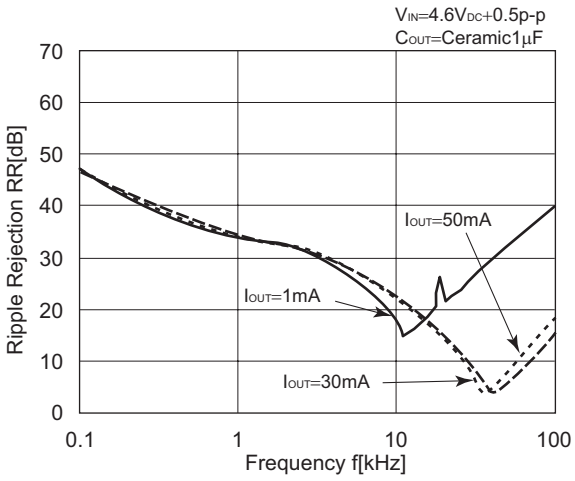
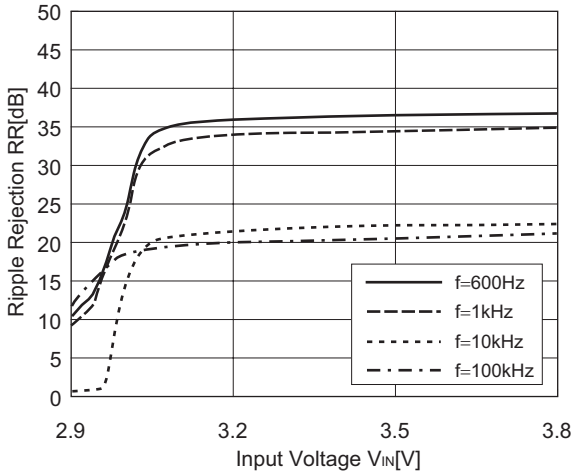
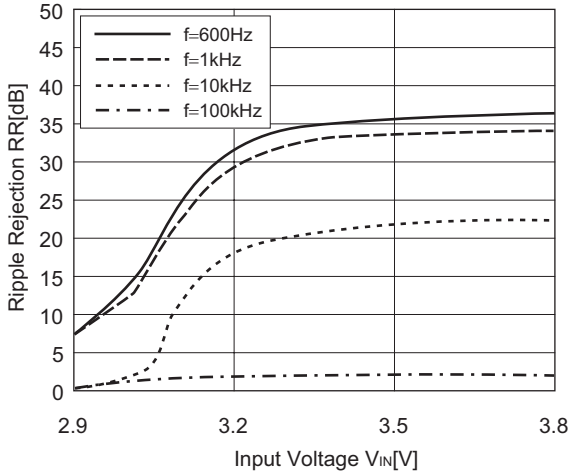


9) Ripple Rejection vs. Input Bias Voltage (Topt=25°C, CIN=none, COUT=ceramic0.1μF)

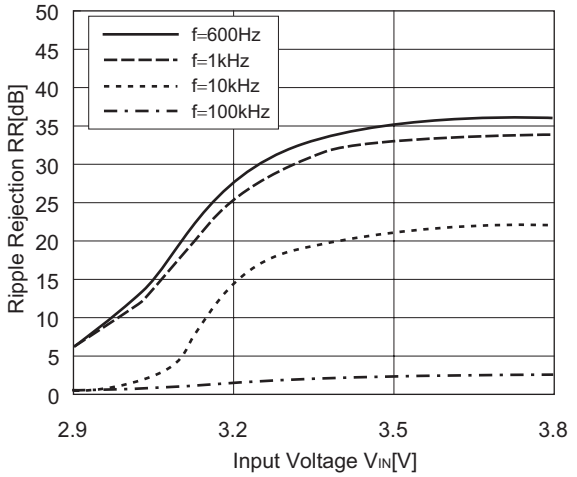
R1183Z281x (IOUT=1mA)



R1183Z281x (IOUT=30mA)

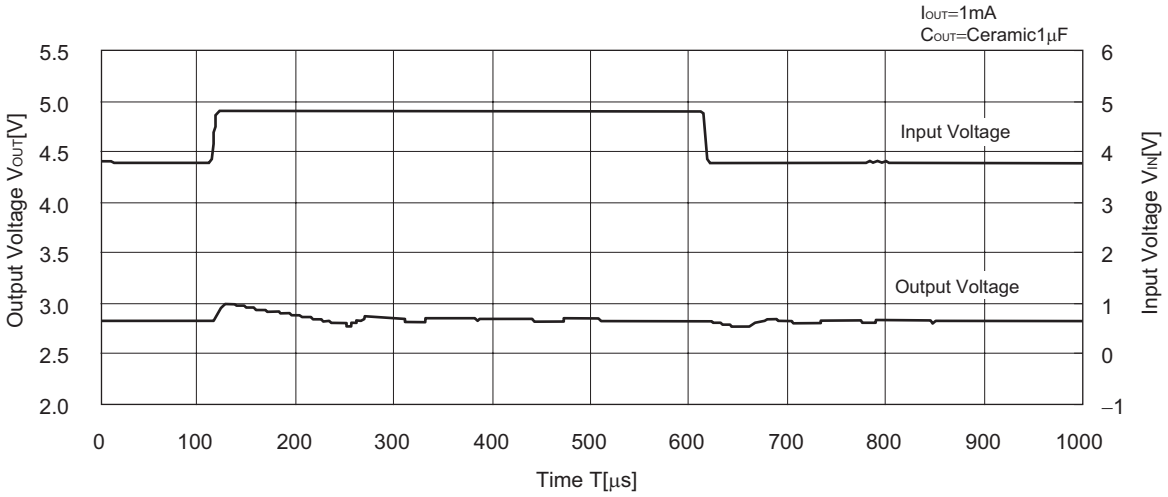


R1183Z281x (IOUT=50mA)



10) Input Transient Response (C_{IN}=none, tr=tf=5μs)

R1183Z281x



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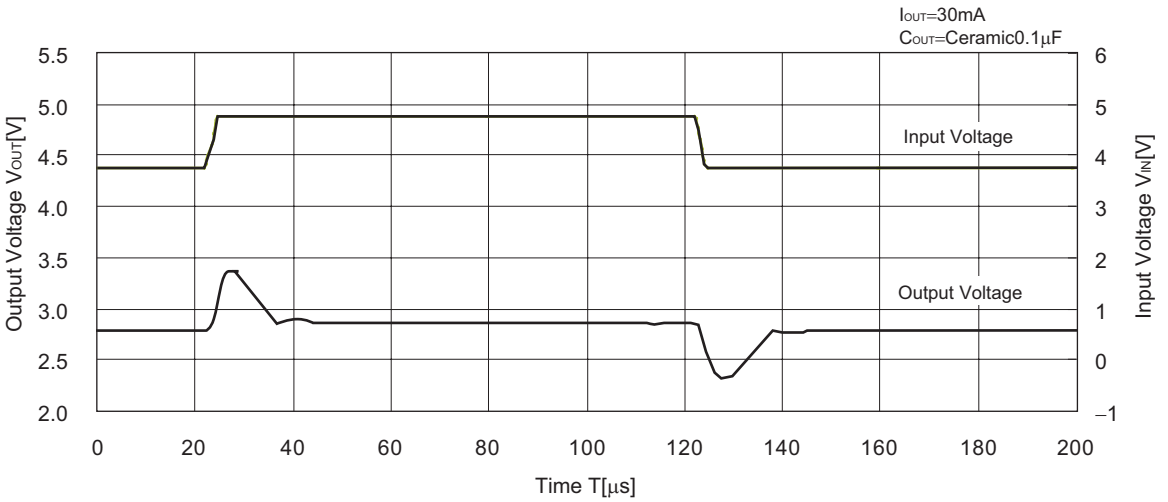

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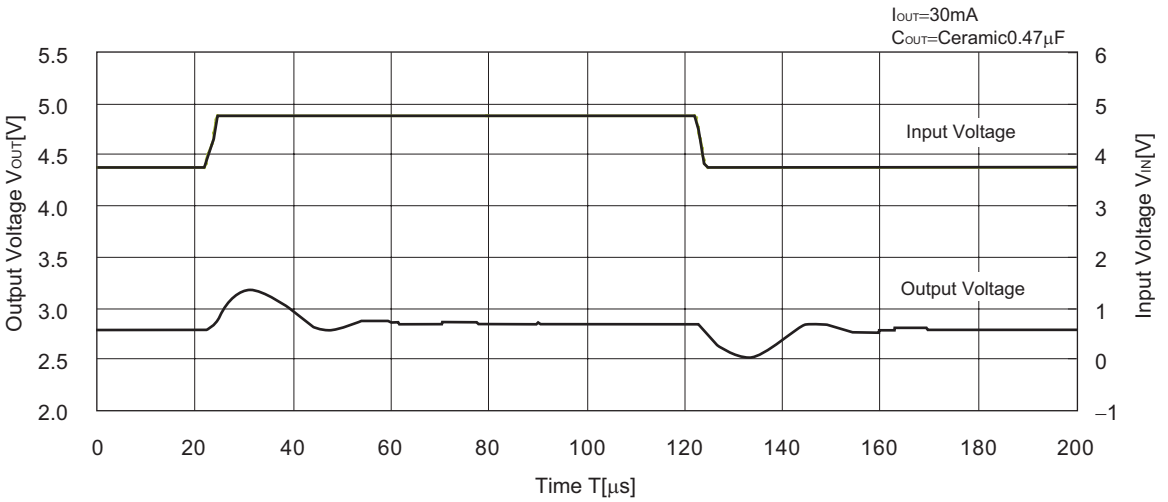

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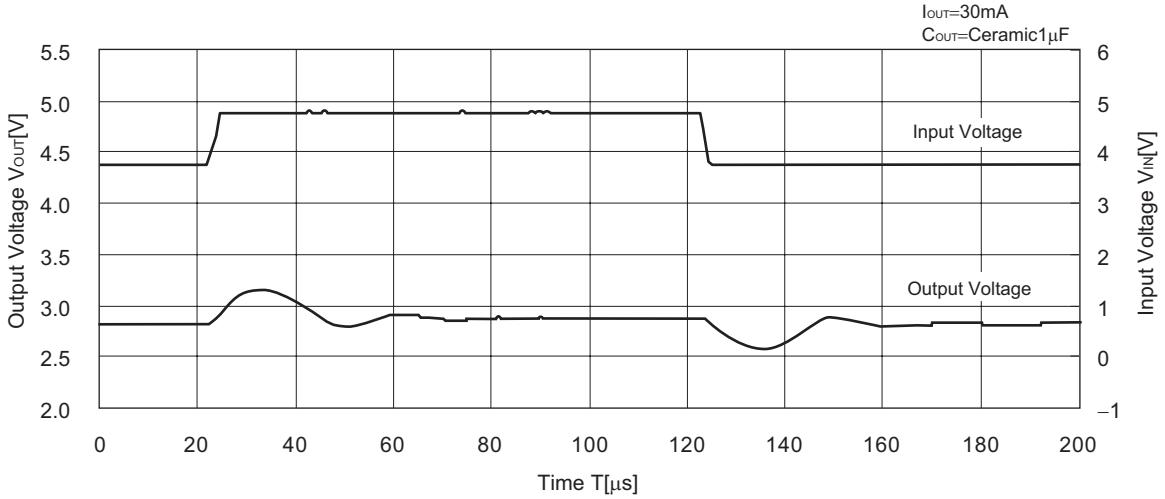
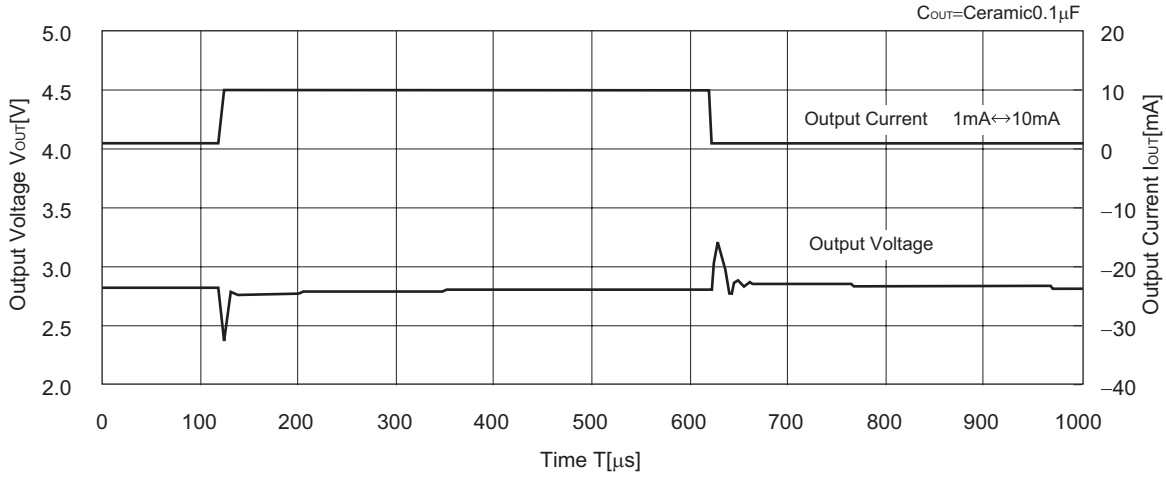


11) Load Transient Response (tr=tf=0.5μs V_{IN}=3.8V)

R1183Z281x



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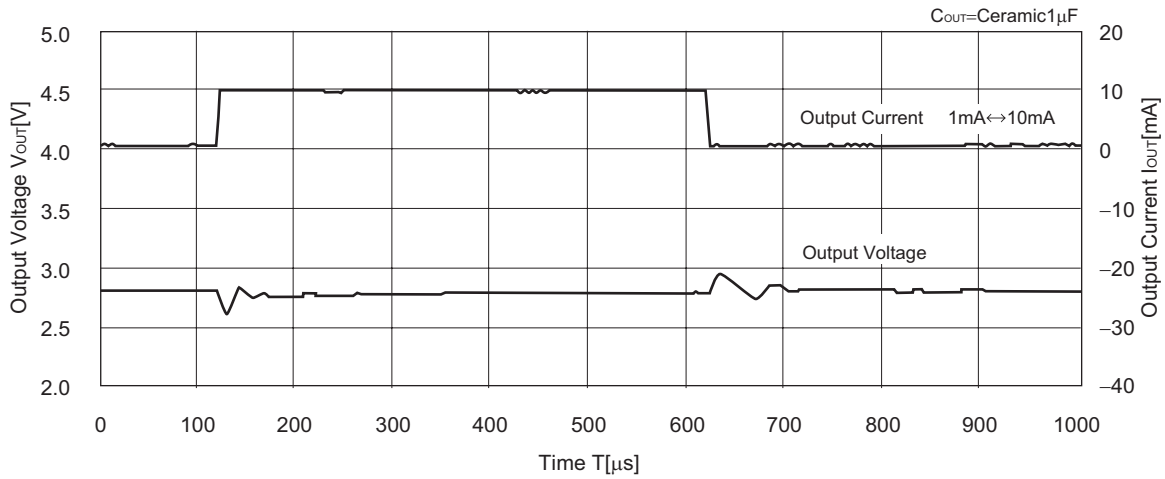

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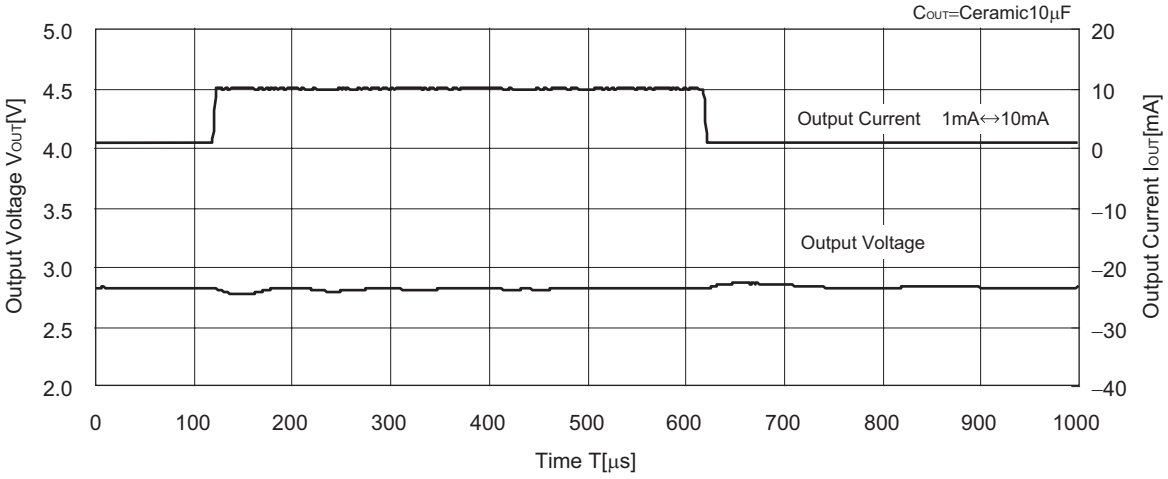

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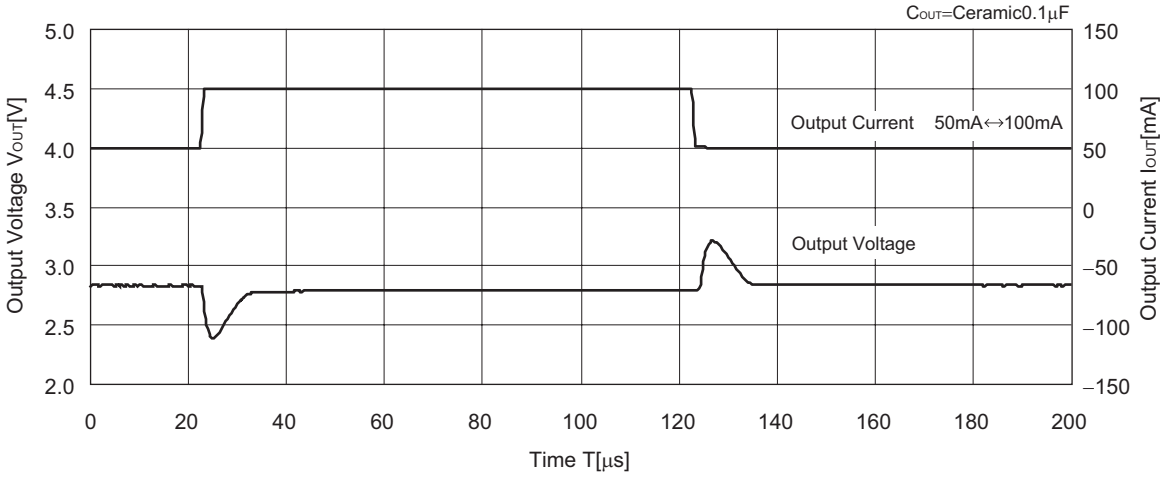

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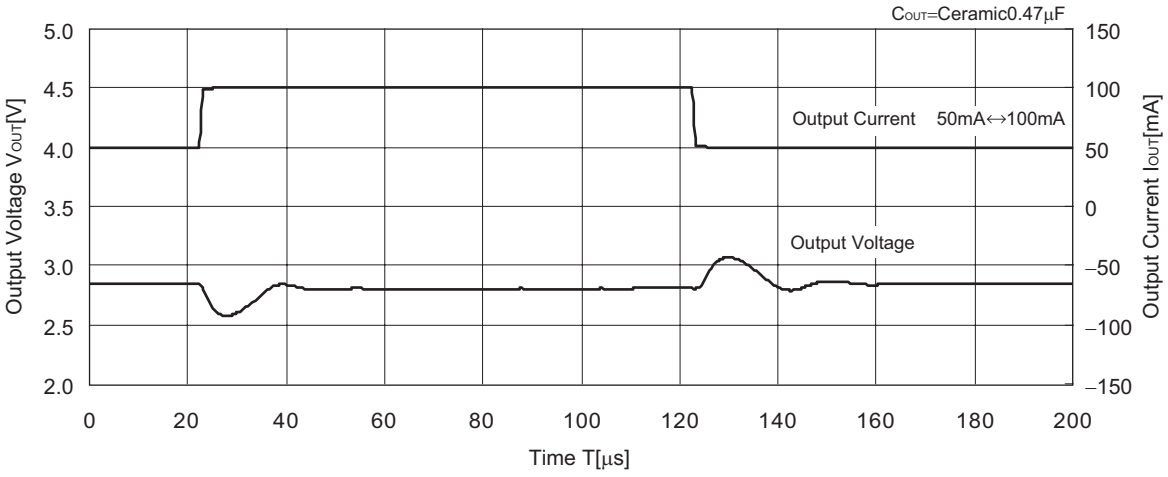

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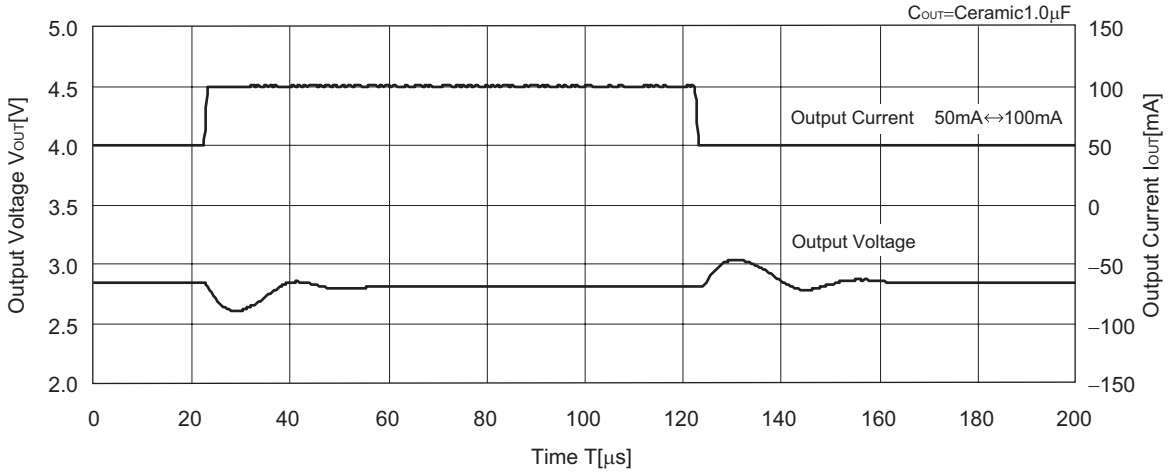
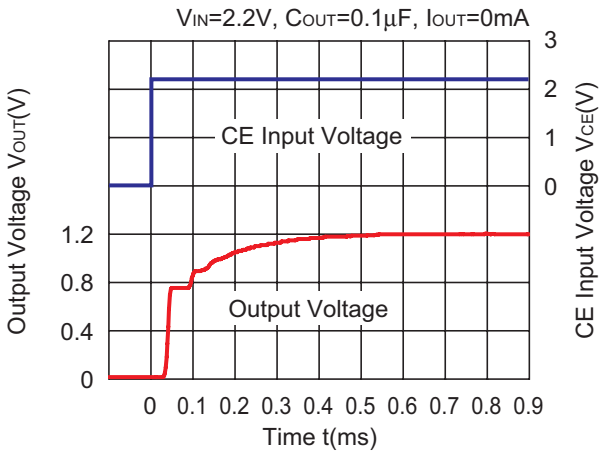


12) Turn-on speed with CE pin signal

R1183Z121x



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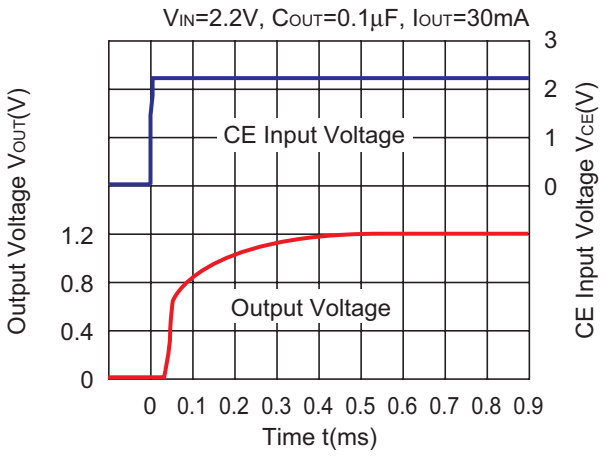

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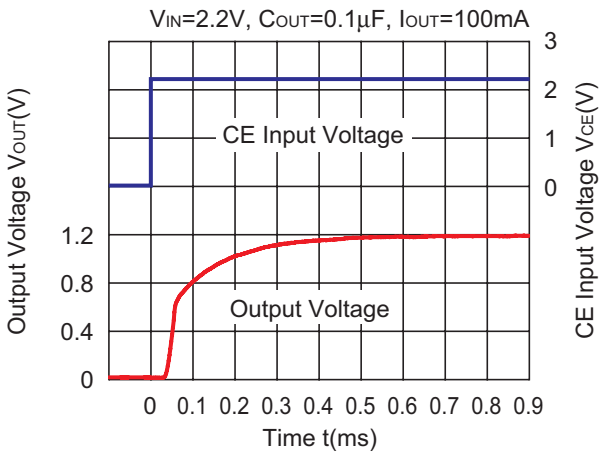

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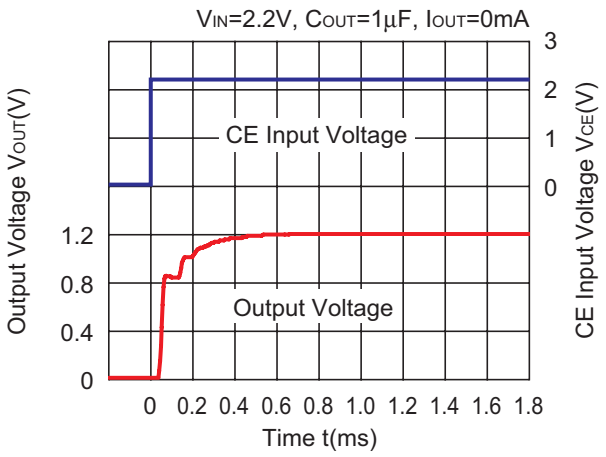

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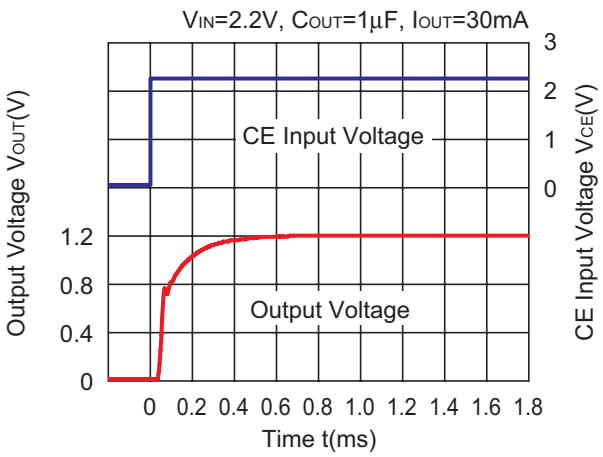

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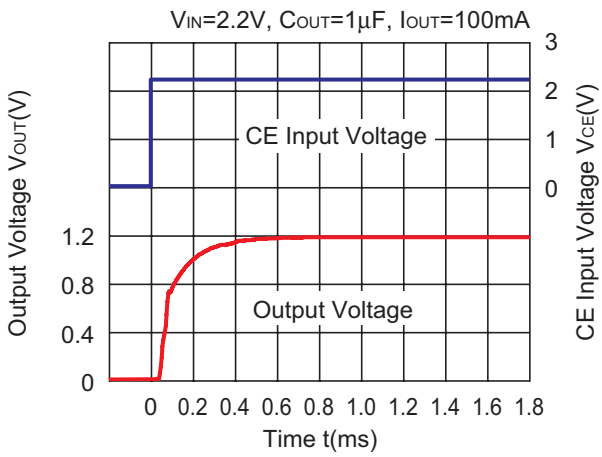

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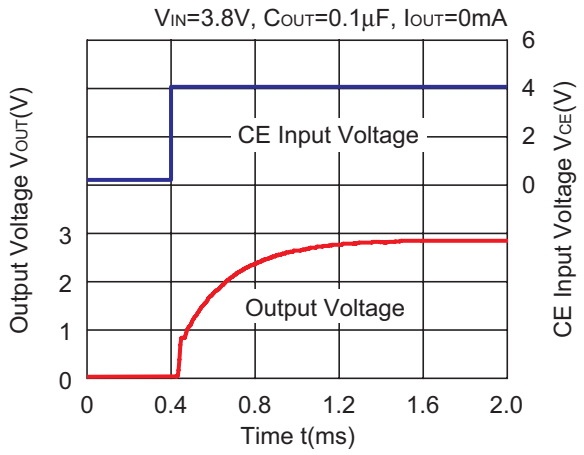

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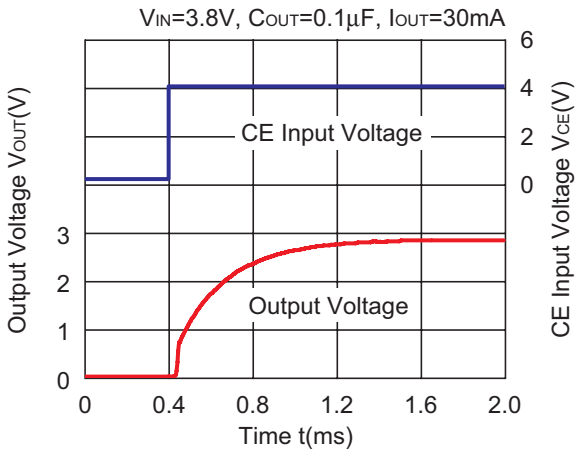

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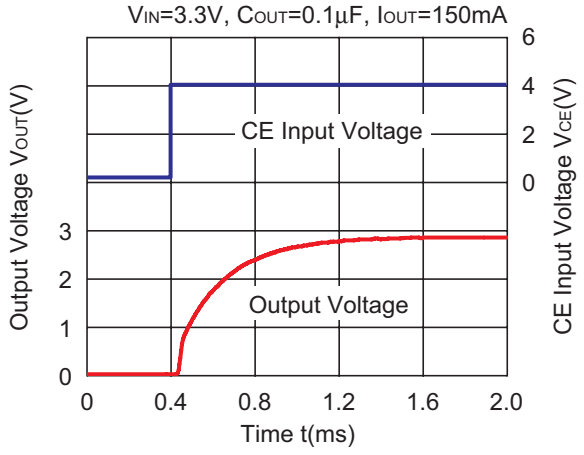

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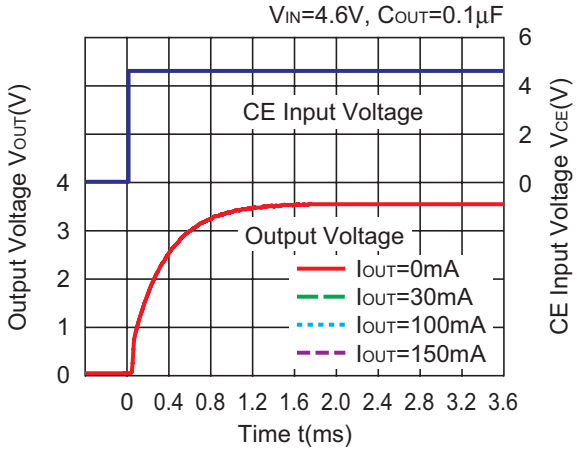

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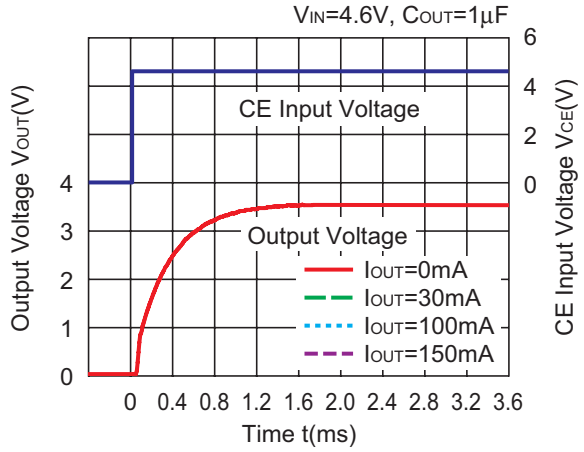
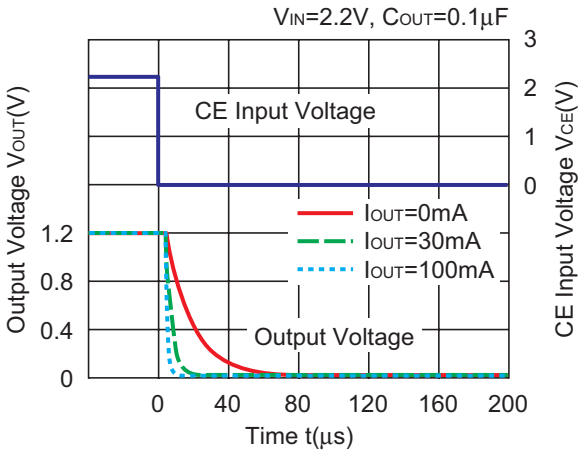


13) Turn off speed with CE pin signal

R1183Z121D



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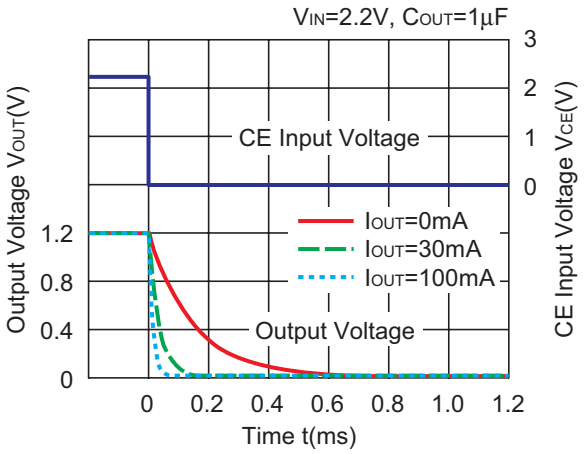

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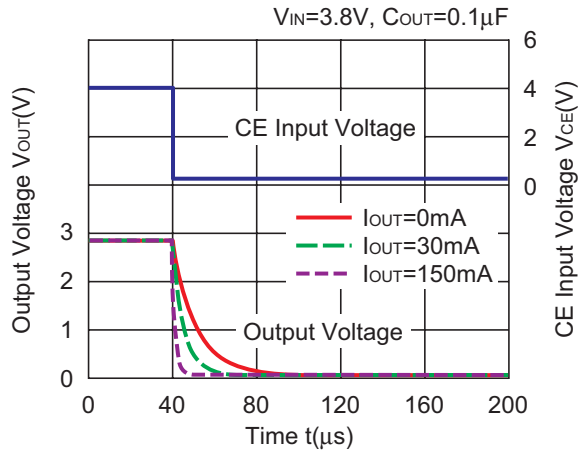

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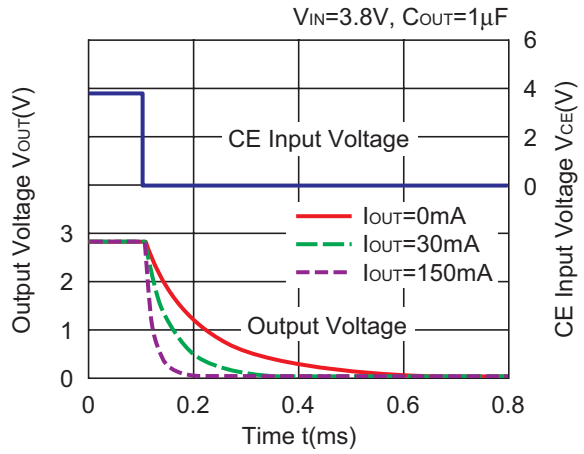

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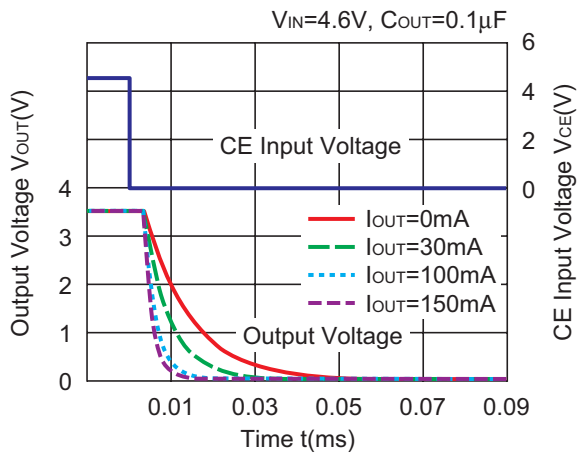

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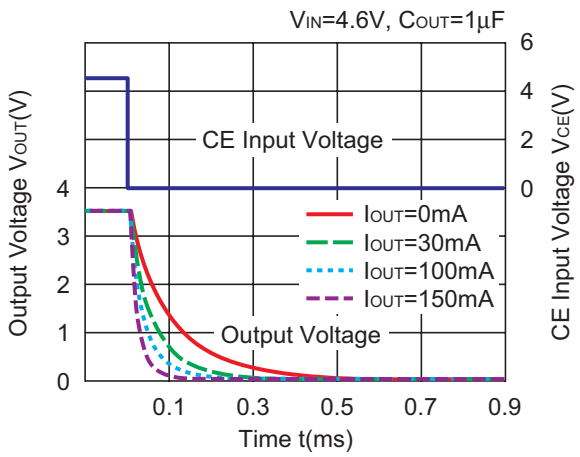

ESR vs. Output Current

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 40μV (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°C to 85°C

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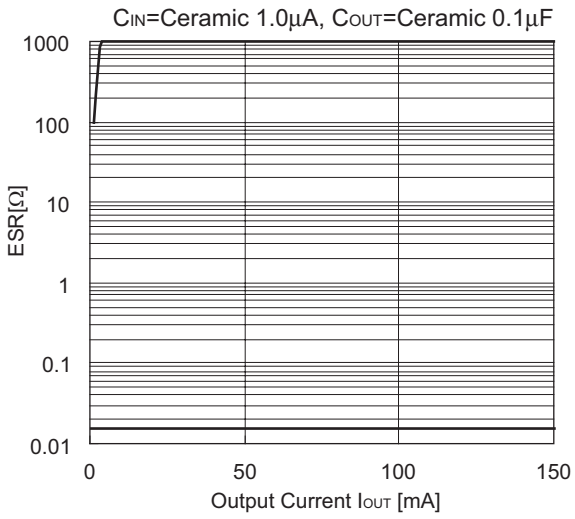

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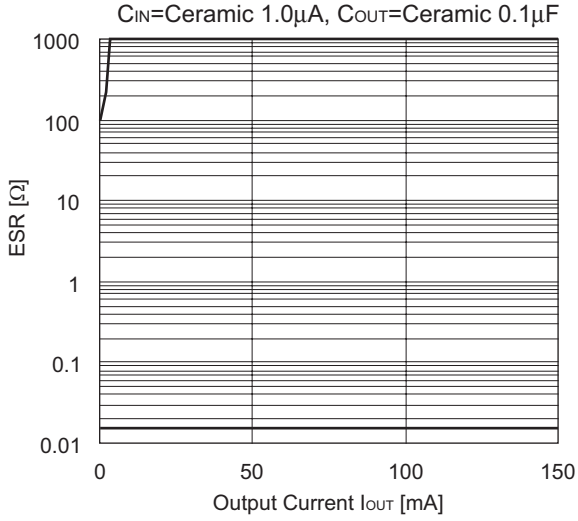

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■Ricoh awarded ISO 14001 certification.
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