
150mA LDO REGULATOR

NO.EA-147-081017

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. 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).

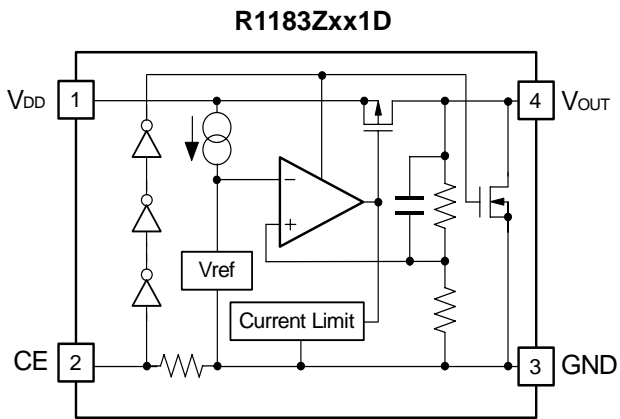
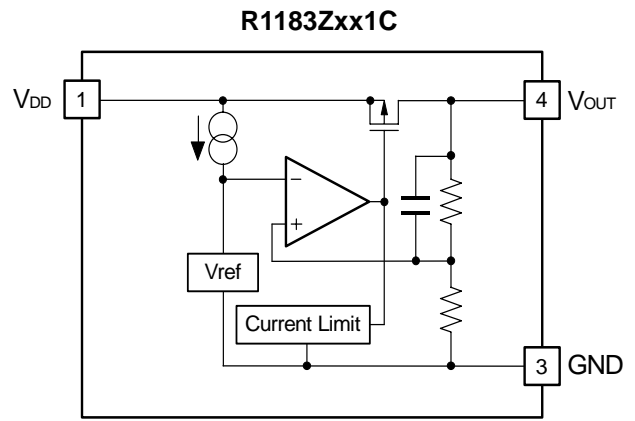
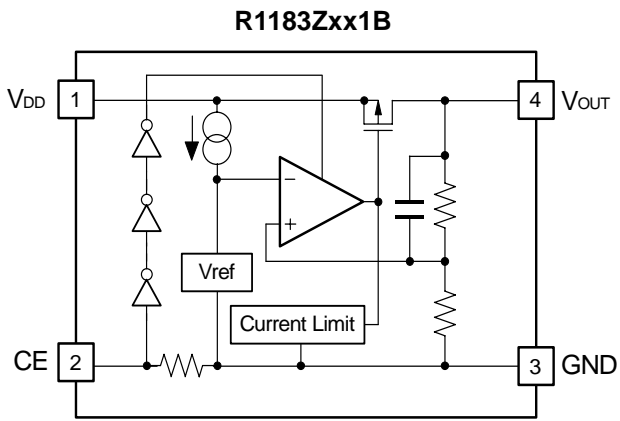
FEATURES

- 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
- 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, version, and the taping type for the ICs can be selected at the user's request.
The selection can be made with designating the part number as shown below:

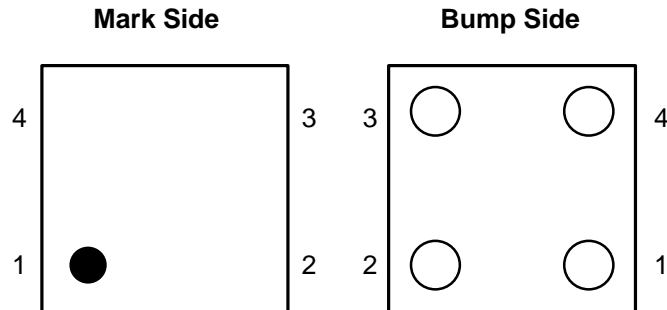
R1183Zxx1x-TR-x ← Part Number
 ↑ ↑ ↑ ↑ ↑
 a b c d e

Code	Contents
a	Designation of Package Type : Z: WLCSP-4-P2
b	Setting Output Voltage (V_{OUT}) : Stepwise setting with a step of 0.1V in the range of 1.2V to 3.6V is possible. Exceptions: 1.25V=R1183Z121x5, 1.85V=R1183Z181x5, 2.85V=R1183Z281x5
c	Designation of Function and with/without chip enable: B: active "H" type, without the auto discharge function* C: without chip enable circuit and auto discharge D: active "H" type, with the auto discharge function*
d	Designation of Taping Type : Ex. TR (refer to Taping Specifications; TR type is the standard direction.)
e	Designation of composition of pin plating: -F: Lead free solder plating

*) When the mode is into standby with CE signal, auto discharge transistor turns on, and it makes the turn-off speed faster than normal type.

PIN CONFIGURATION

• WLCSP-4-P2



PIN DESCRIPTIONS

• R1183Zxx1B/D

Pin No.	Symbol	Description
1	V _{DD}	Input Pin
2	CE	Chip Enable Pin
3	GND	Ground Pin
4	V _{OUT}	Output Pin

• R1183Zxx1C

Pin No.	Symbol	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) *1	530	mW
T _{opt}	Operating Temperature Range	-40 to +85	°C
T _{stg}	Storage Temperature Range	-55 to +125	°C

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

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 _{lim}	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

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
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 _{lim}	Short Current Limit	V _{OUT} =0V		40		mA

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

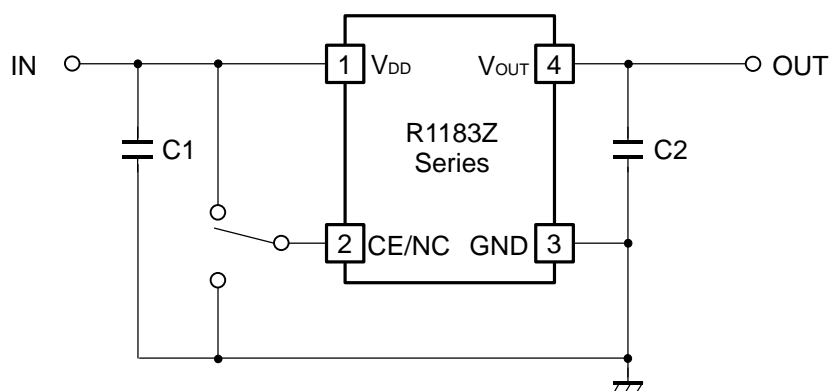
All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic 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

T_{opt}=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

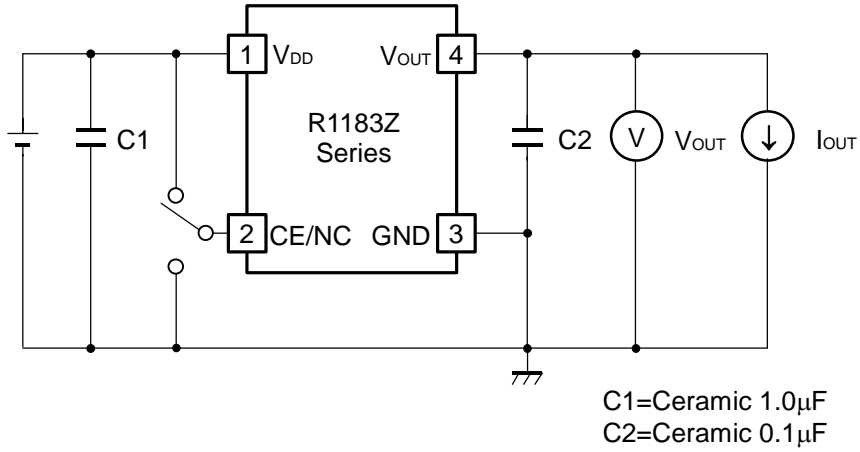
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance). (Note: If additional ceramic capacitors are connected with parallel to the output 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

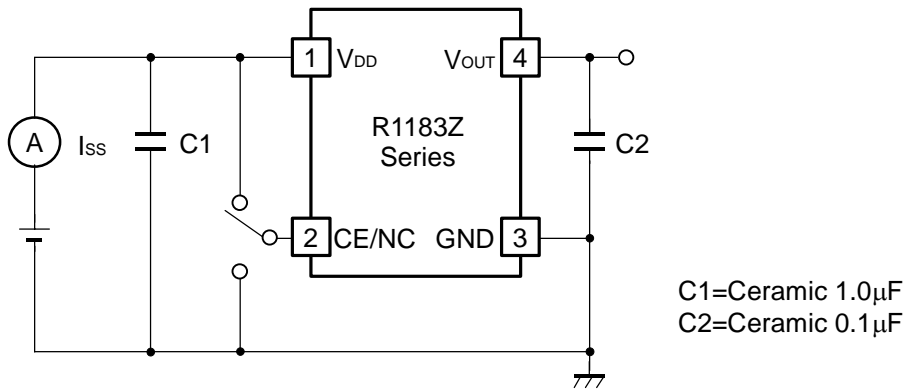
Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 0.1 μ F or more between V_{DD} and GND pin, and as close as possible to the pins.

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

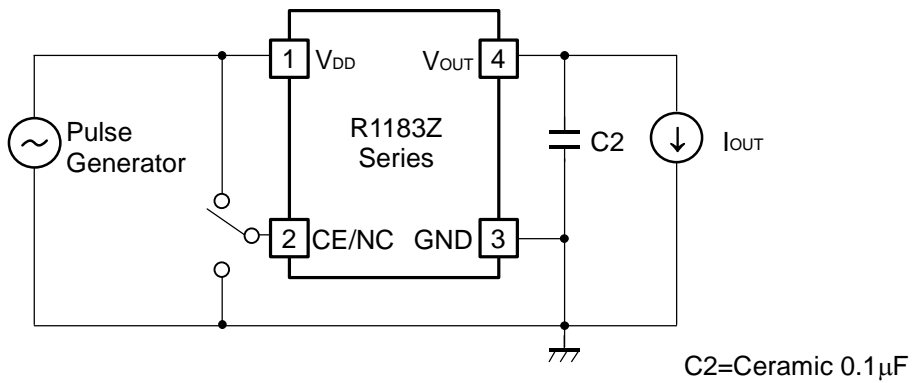
TEST CIRCUITS



Standard test Circuit



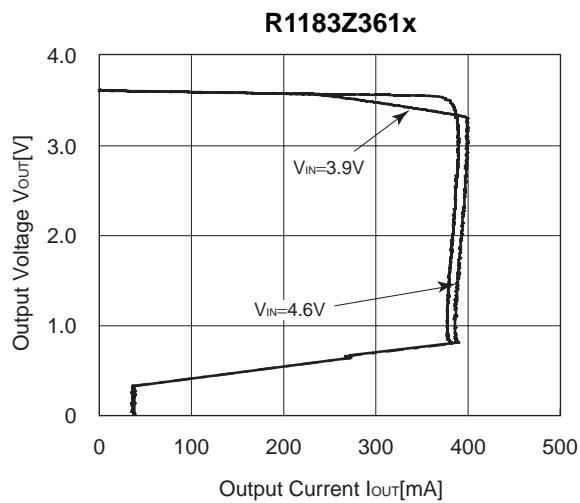
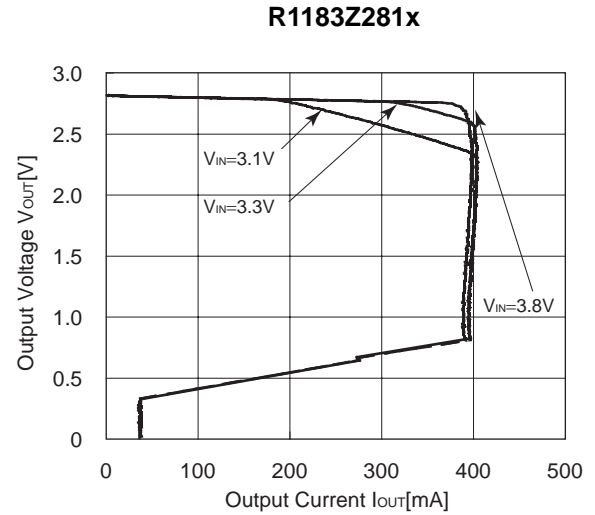
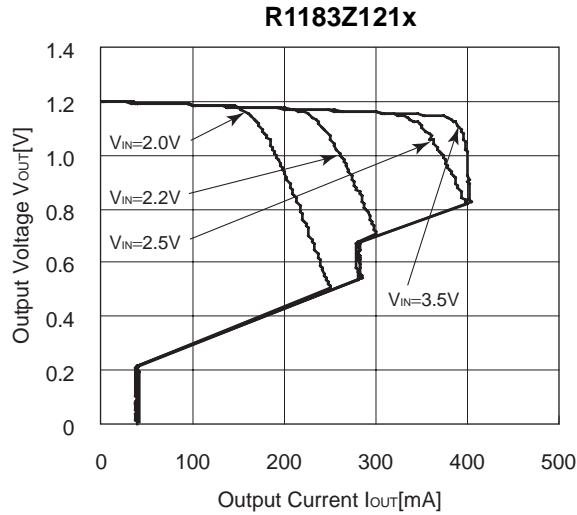
Supply Current Test Circuit



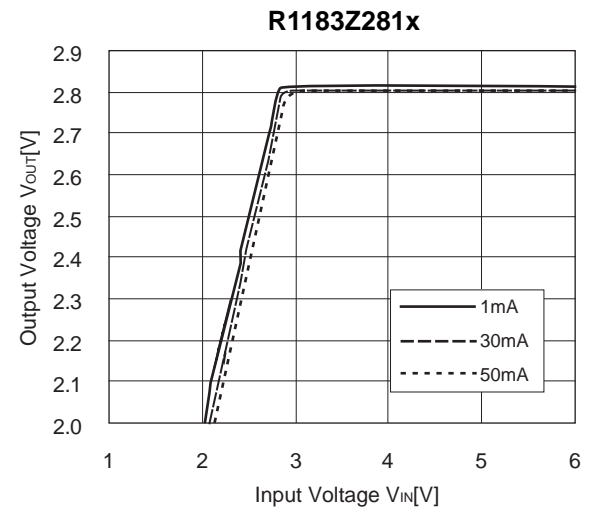
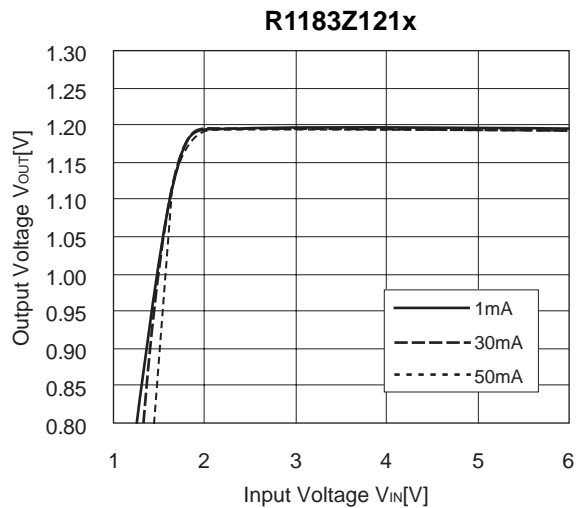
Ripple Rejection, Line Transient Response Test Circuit

TYPICAL CHARACTERISTICS

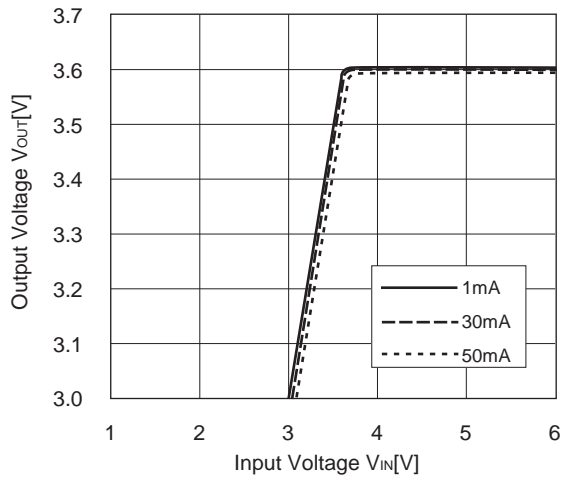
1) Output Voltage vs. Output Current (Topt=25°C)



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

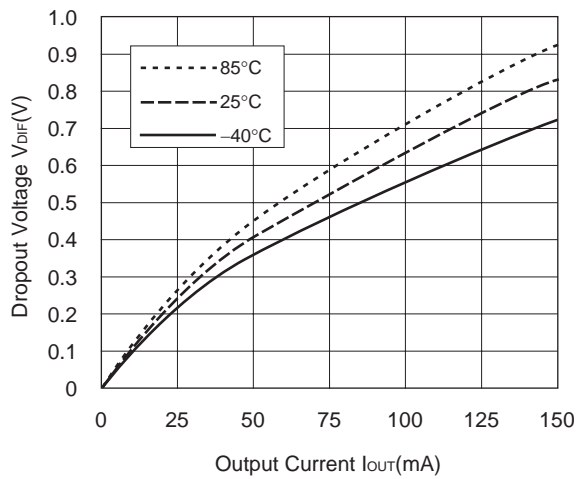


R1183Z361x

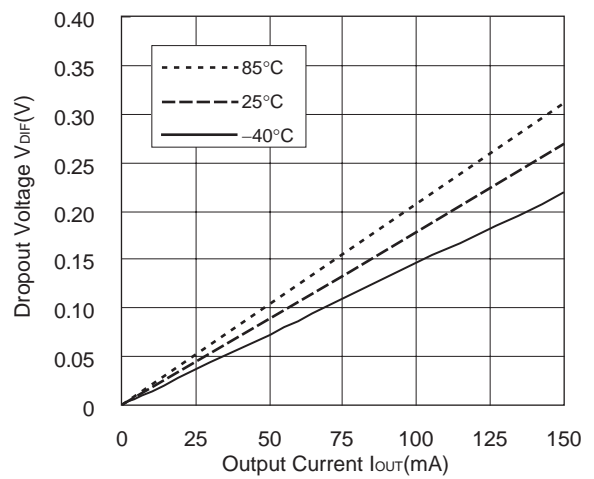


3) Dropout Voltage vs. Output Current

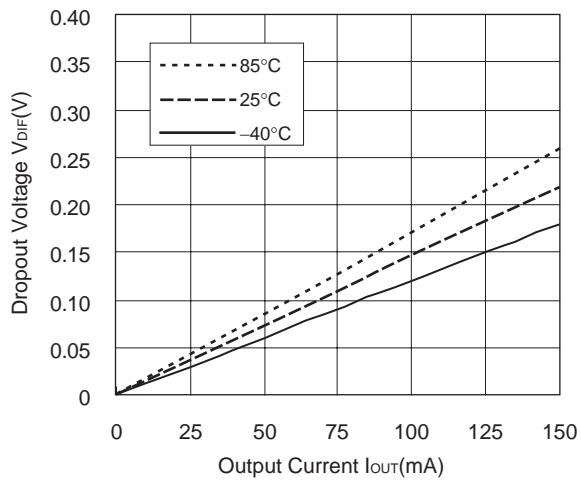
R1183Z121x



R1183Z281x

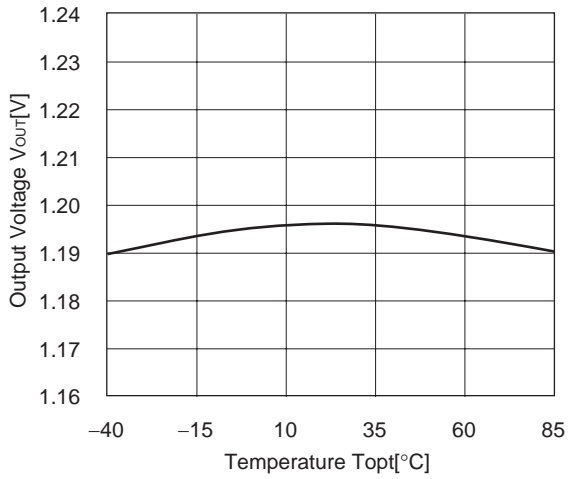


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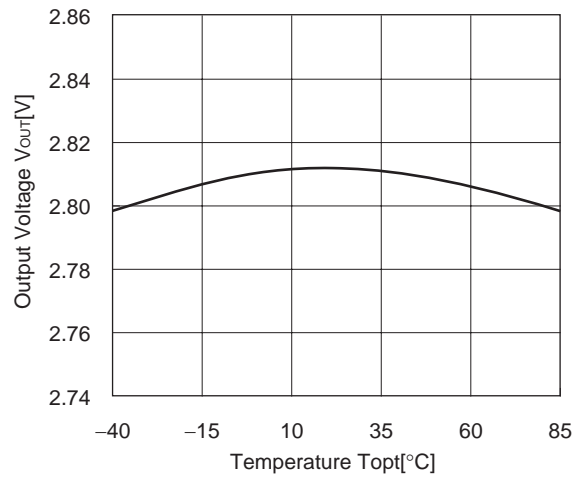


4) Output Voltage vs. Temperature ($I_{OUT}=30mA$)

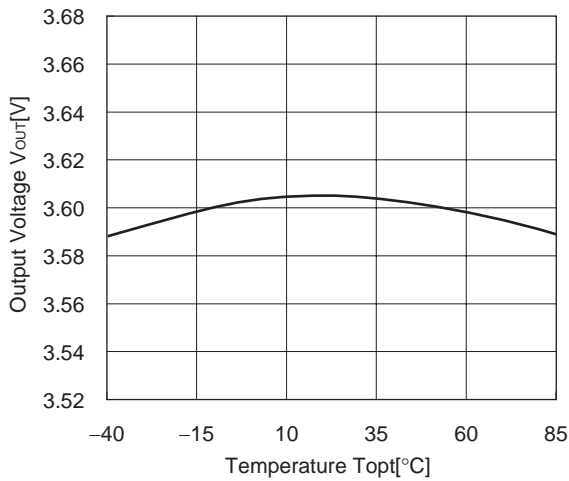
R1183Z121x ($V_{IN}=2.2V$)



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

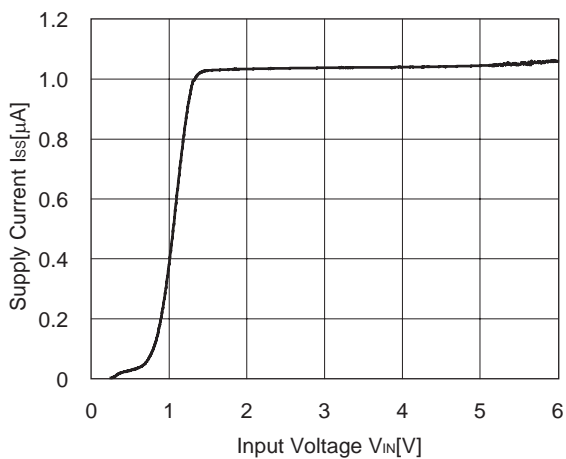


R1183Z361x ($V_{IN}=4.6V$)

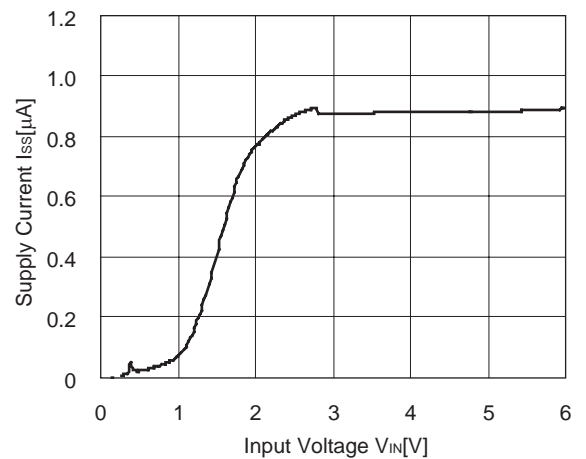


5) Supply Current vs. Input Voltage ($T_{opt}=25^{\circ}C$)

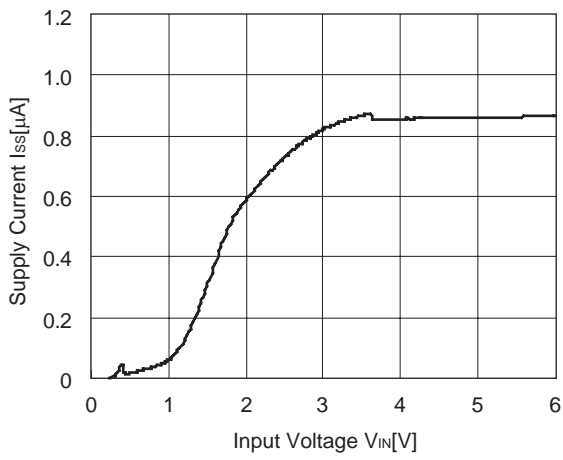
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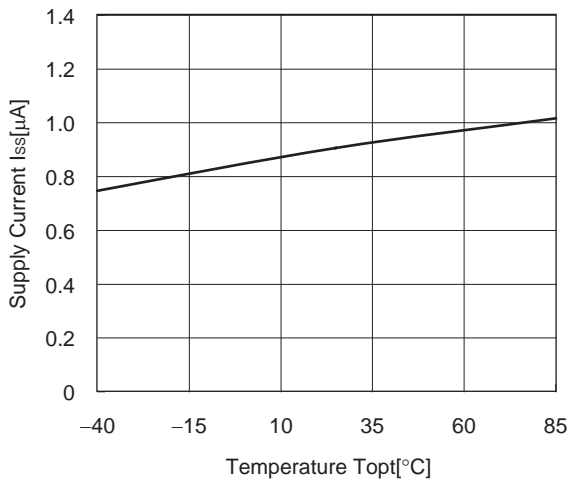


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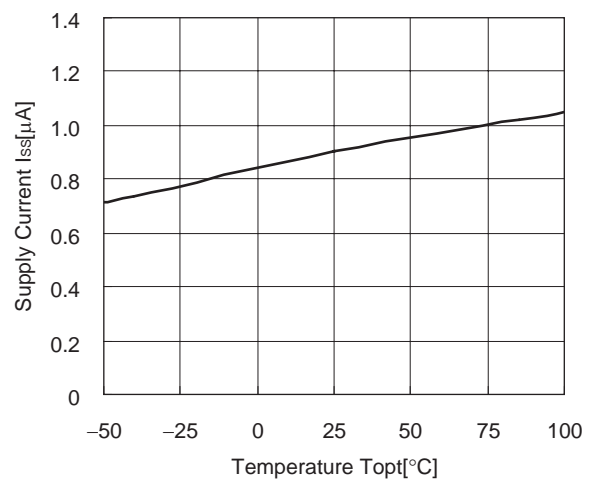


6) Supply Current vs. Temperature

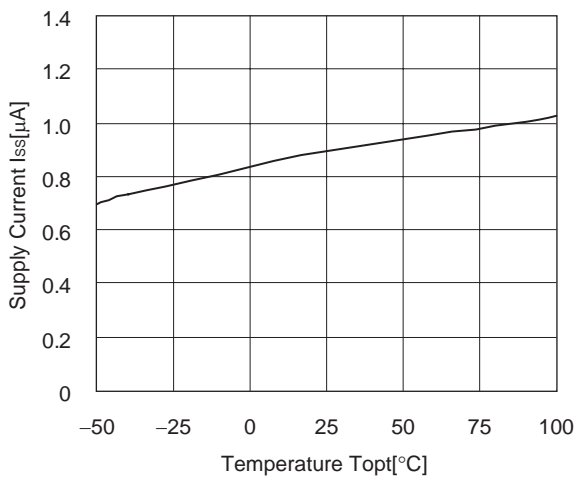
R1183Z121x (V_{IN}=2.2V)



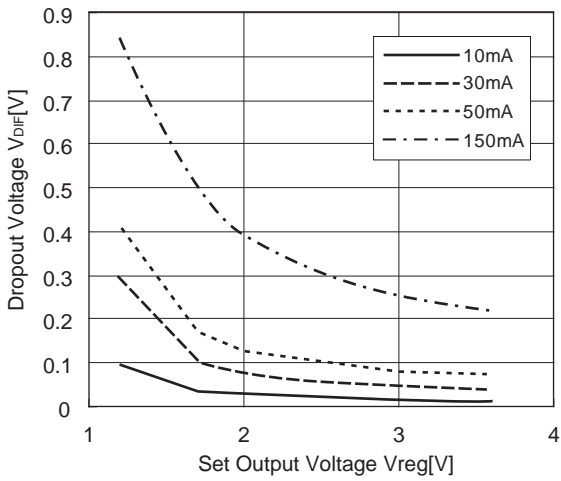
R1183Z281x (V_{IN}=3.8V)



R1183Z361x (V_{IN}=4.6V)

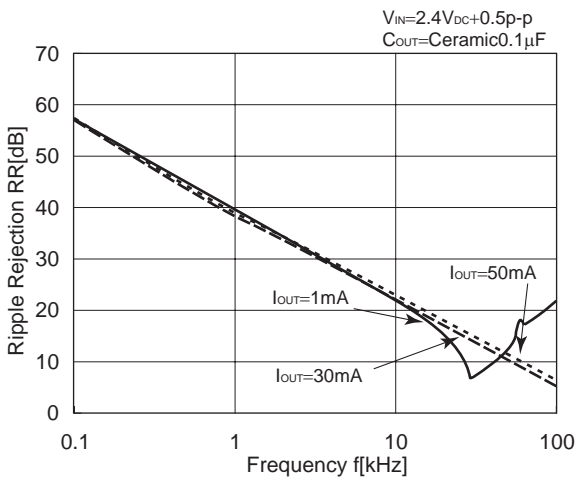


7) Dropout Voltage vs. Set Output Voltage ($T_{opt}=25^{\circ}C$)

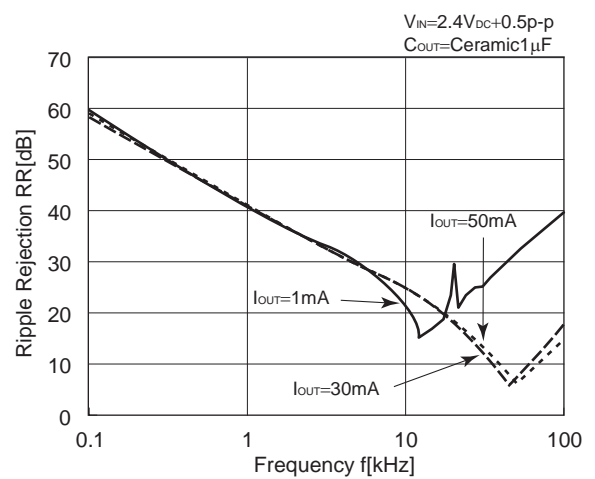


8) Ripple Rejection vs. Frequency ($C_{IN}=none$)

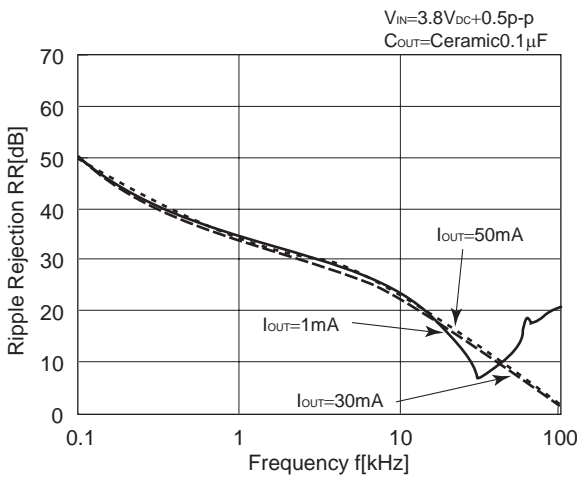
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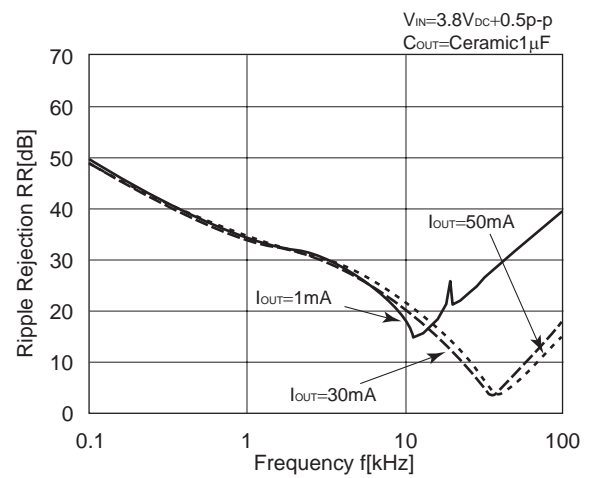
R1183Z121x



R1183Z281x

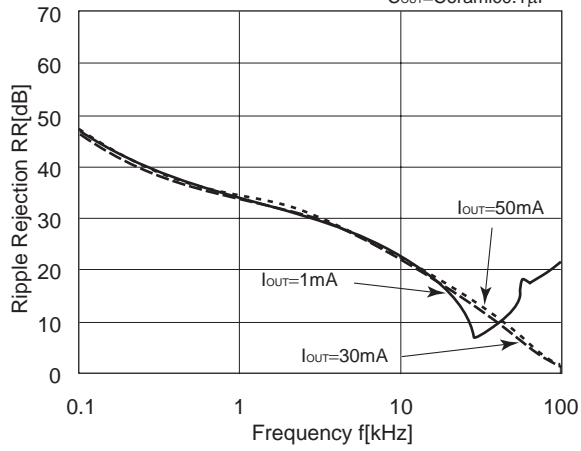


R1183Z281x



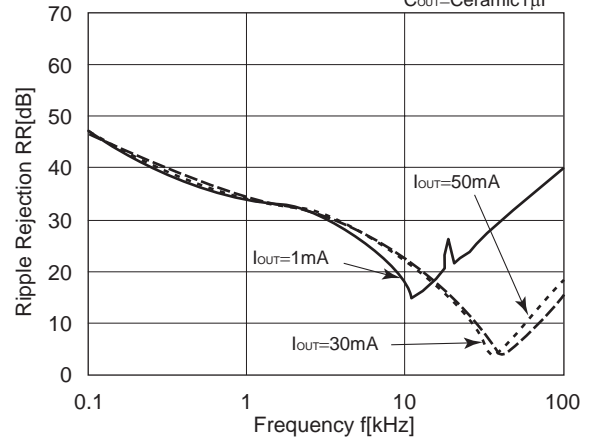
R1183Z361x

$V_{IN}=4.6V_{DC}+0.5p-p$
 $C_{OUT}=\text{Ceramic}0.1\mu F$



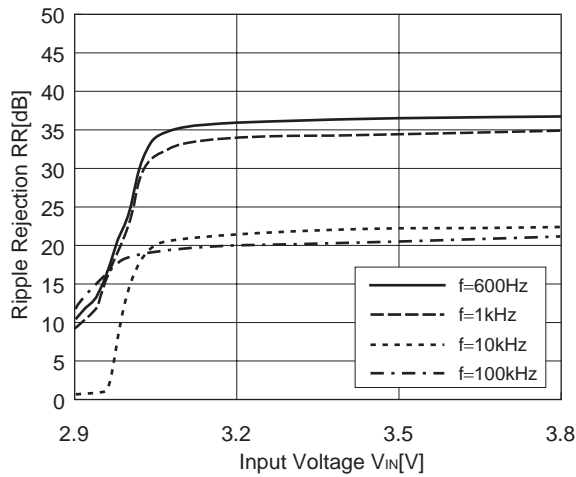
R1183Z361x

$V_{IN}=4.6V_{DC}+0.5p-p$
 $C_{OUT}=\text{Ceramic}1\mu F$

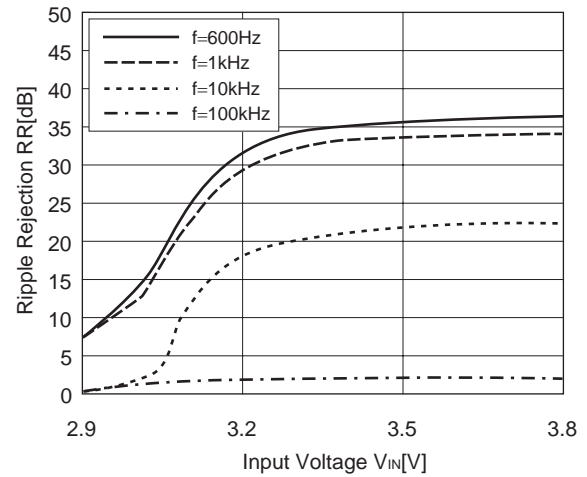


9) Ripple Rejection vs. Input Bias Voltage ($T_{opt}=25^{\circ}C$, $C_{IN}=\text{none}$, $C_{OUT}=\text{ceramic}0.1\mu F$)

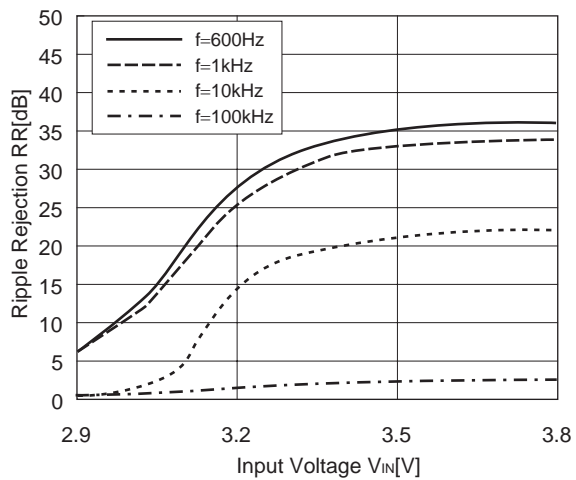
R1183Z281x ($I_{OUT}=1mA$)



R1183Z281x ($I_{OUT}=30mA$)

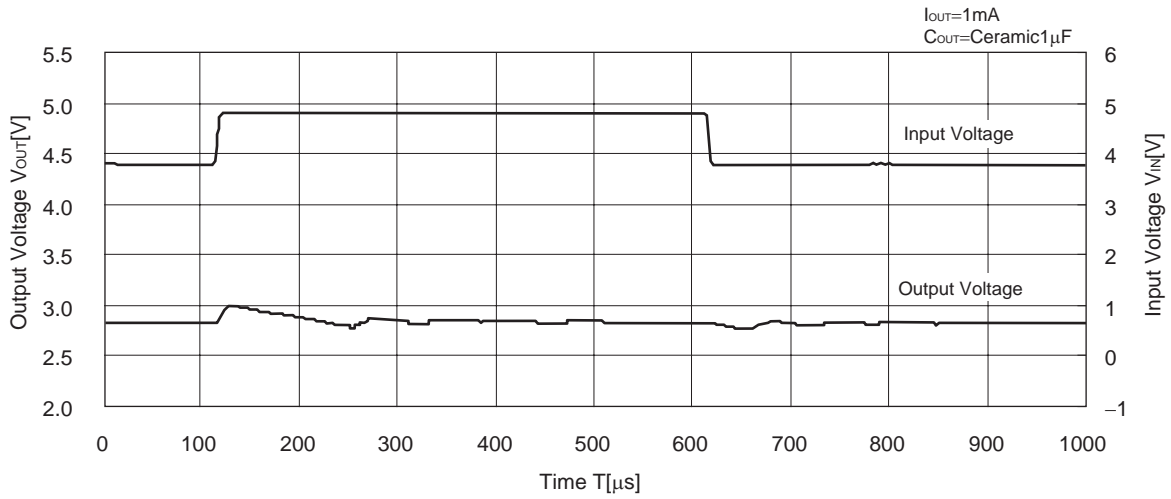


R1183Z281x ($I_{OUT}=50mA$)

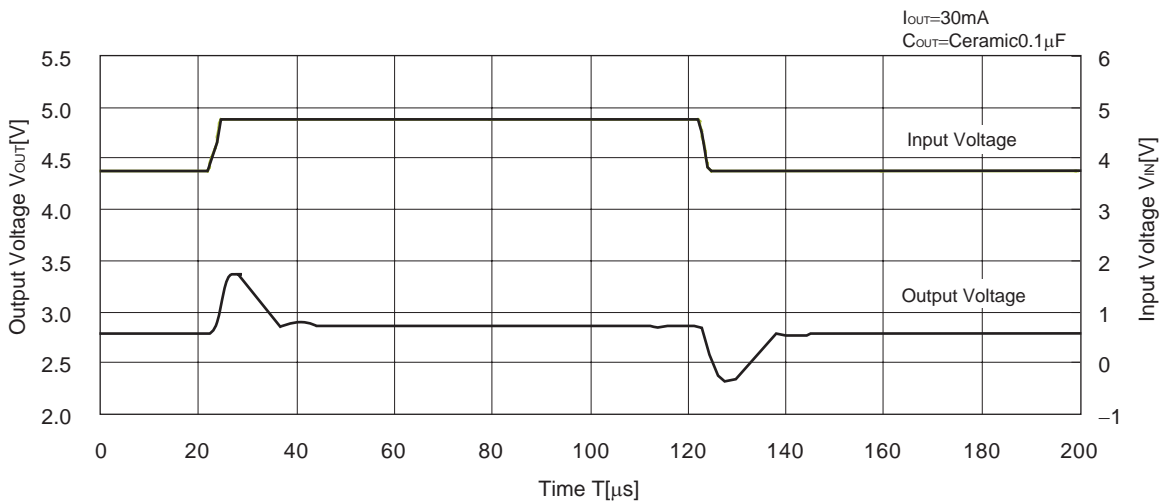


10) Input Transient Response ($C_{IN}=none, tr=tf=5\mu s$)

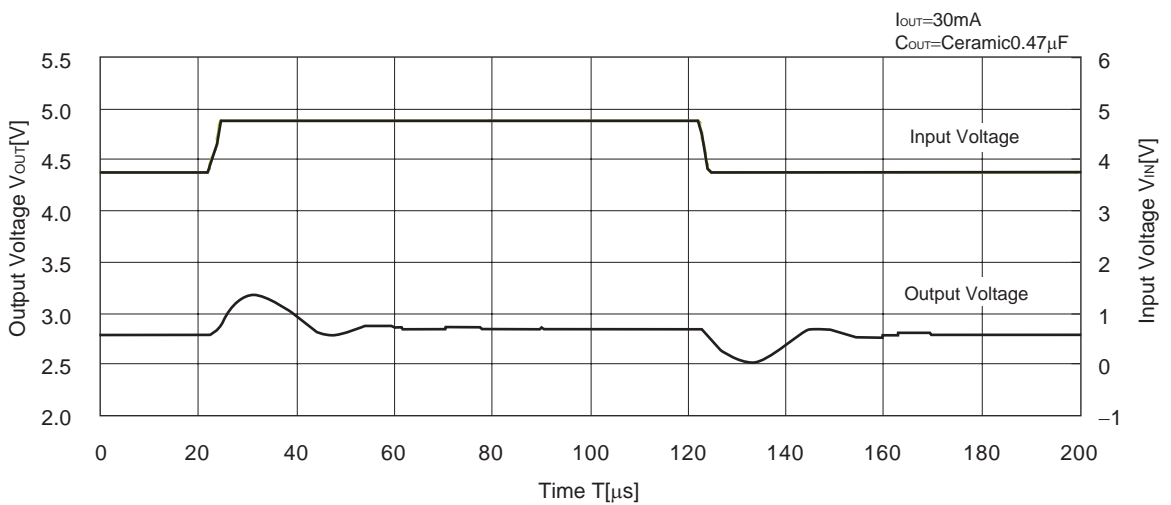
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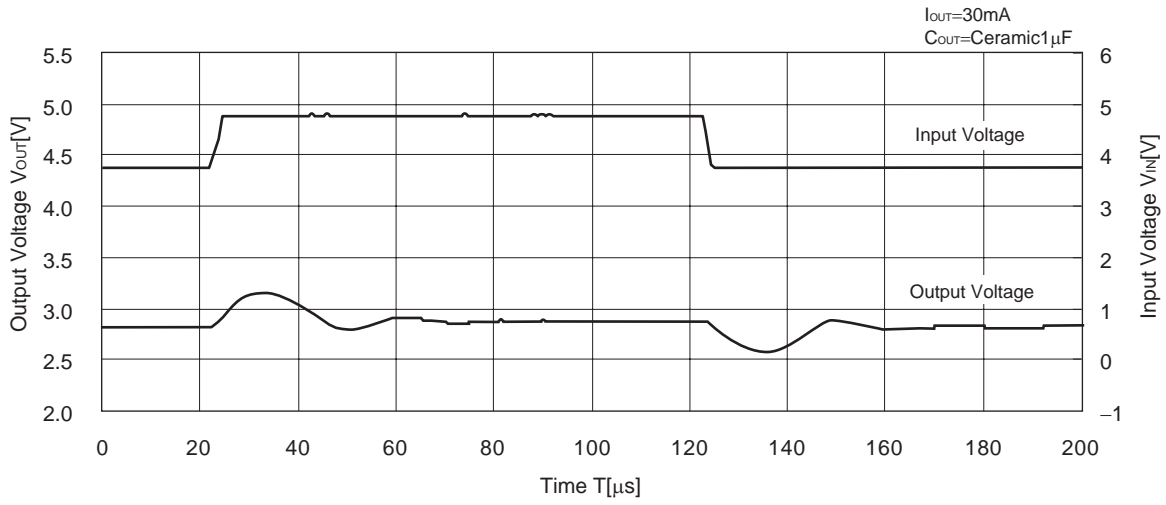
R1183Z281x



R1183Z281x

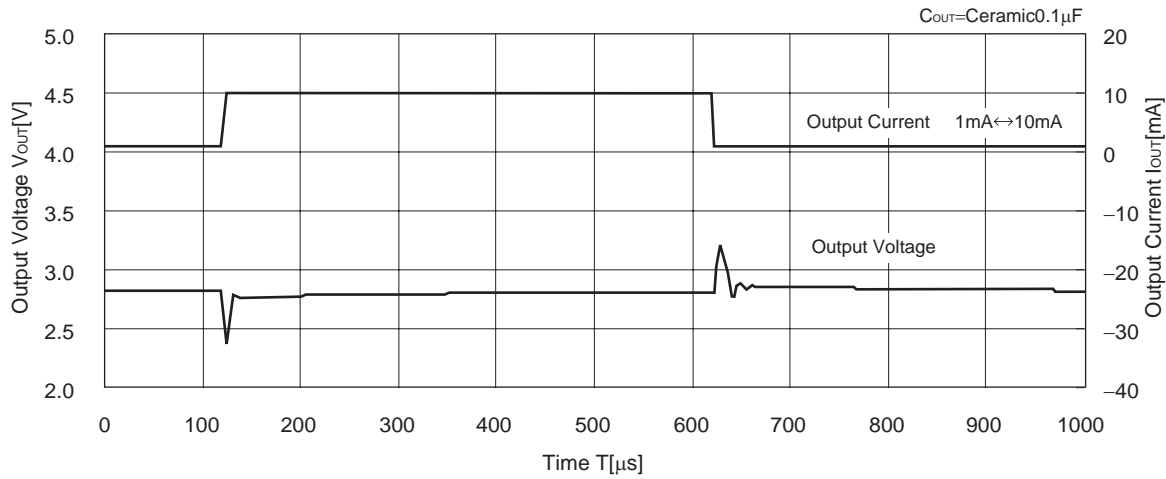


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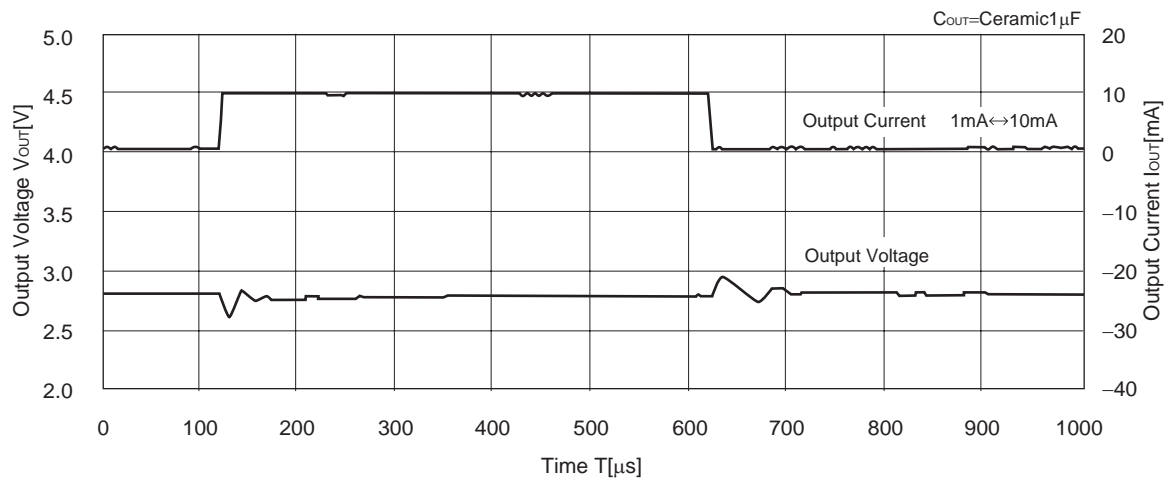


11) Load Transient Response ($t_r=t_f=0.5\mu s$ $V_{IN}=3.8V$)

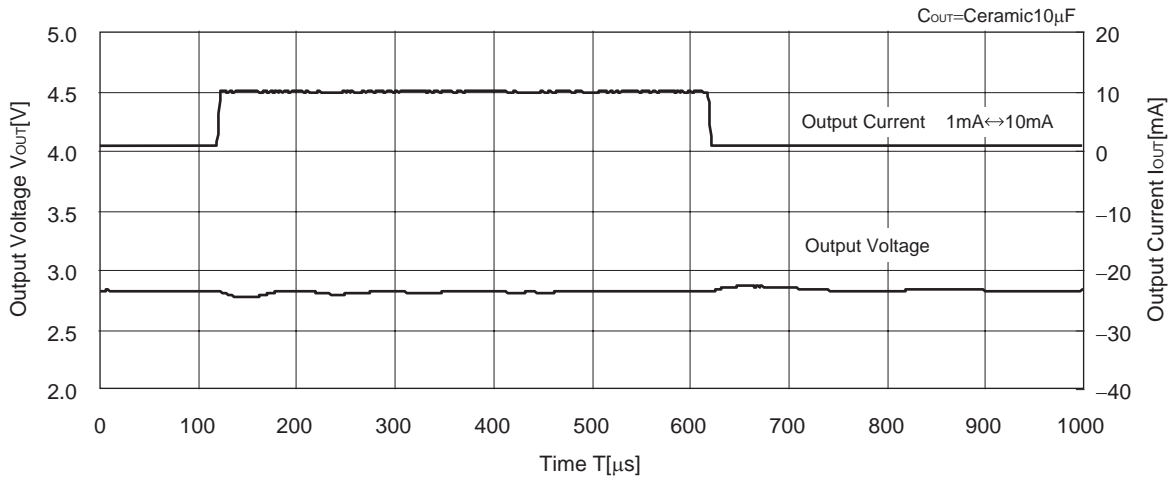
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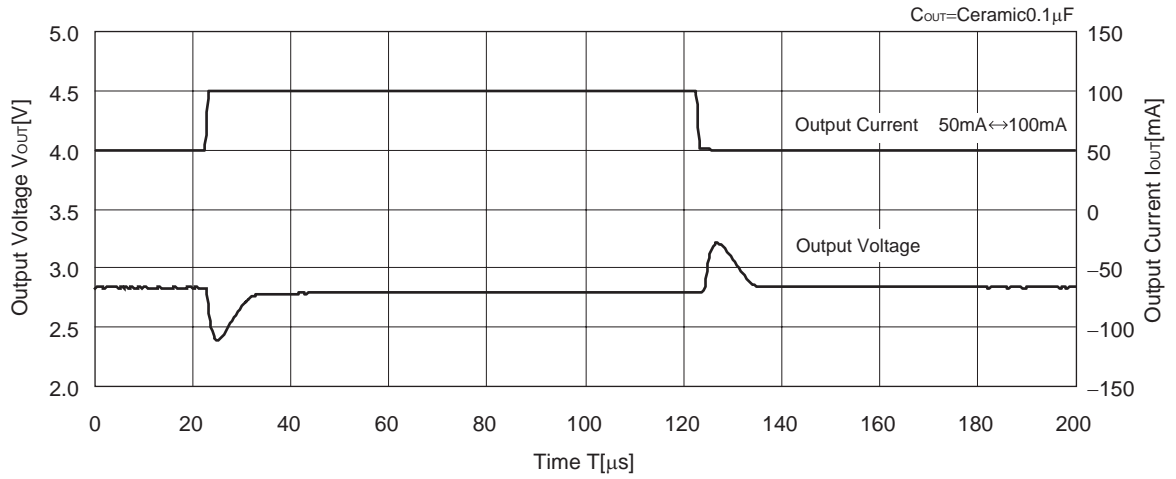
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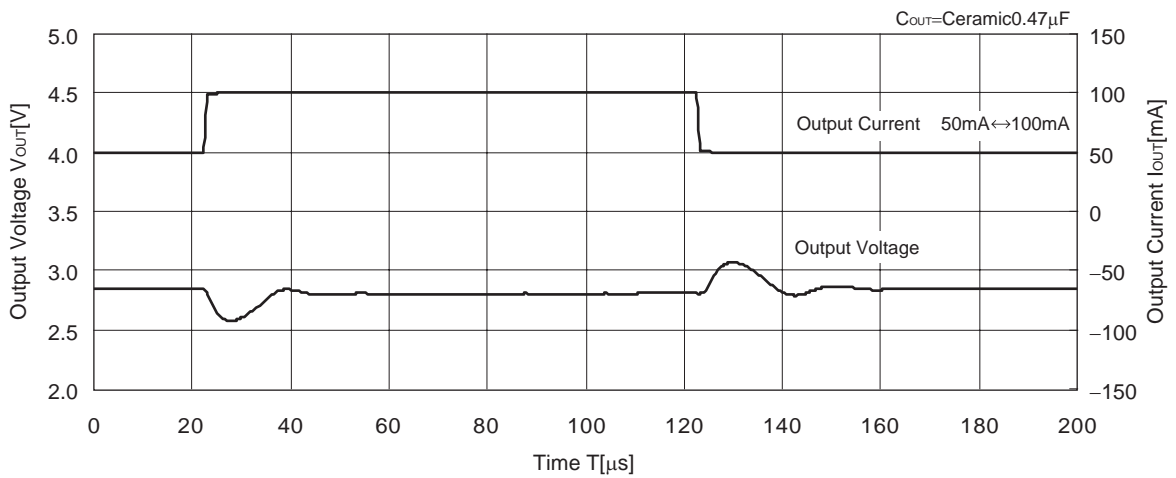
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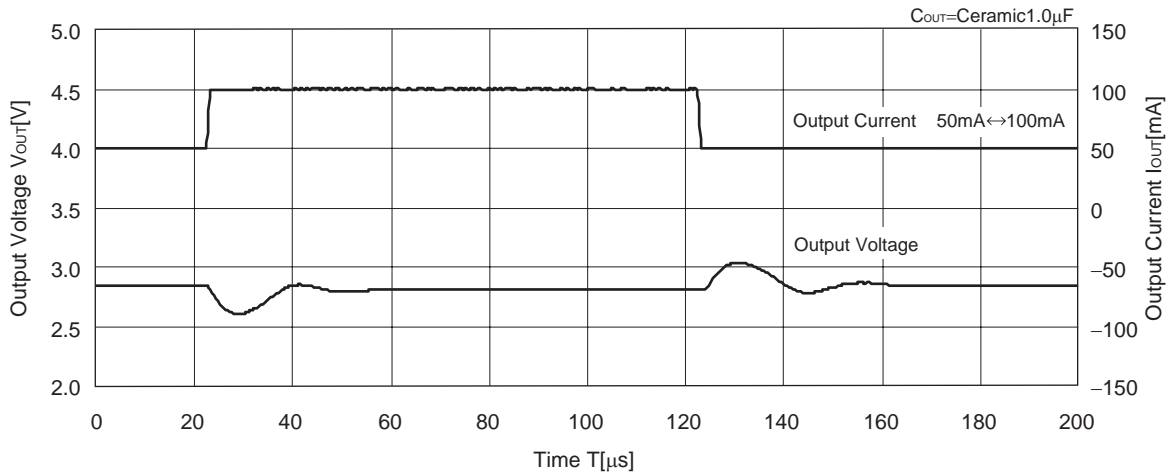
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R1183Z281x

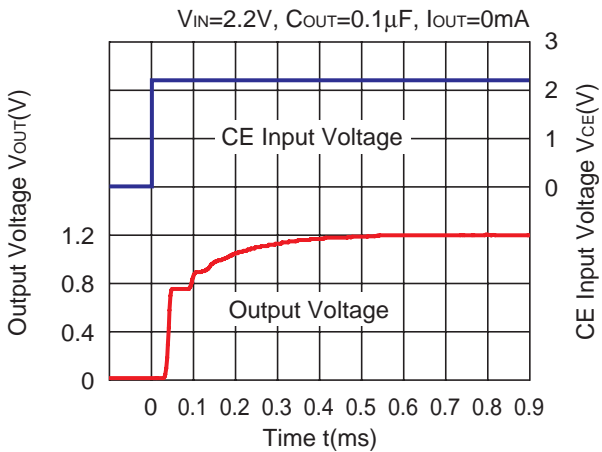


R1183Z281x

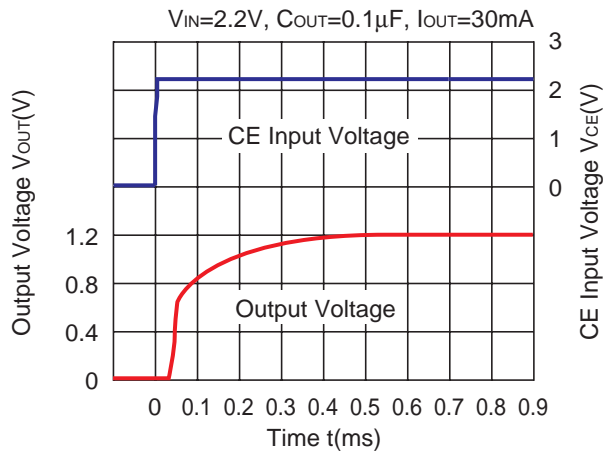


12) Turn-on speed with CE pin signal

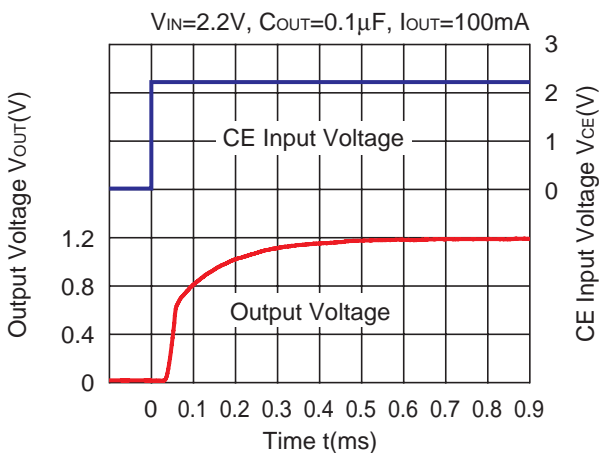
R1183Z121x



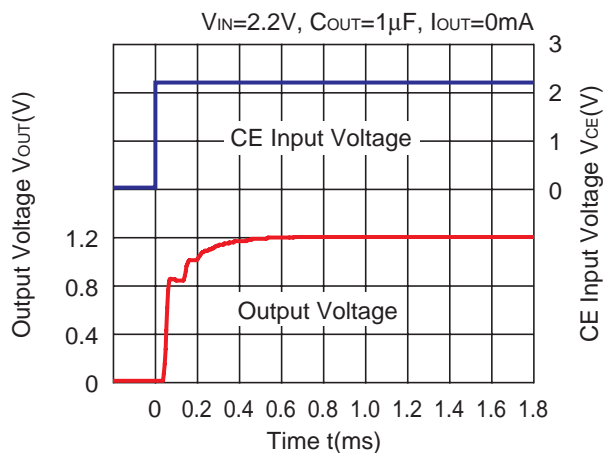
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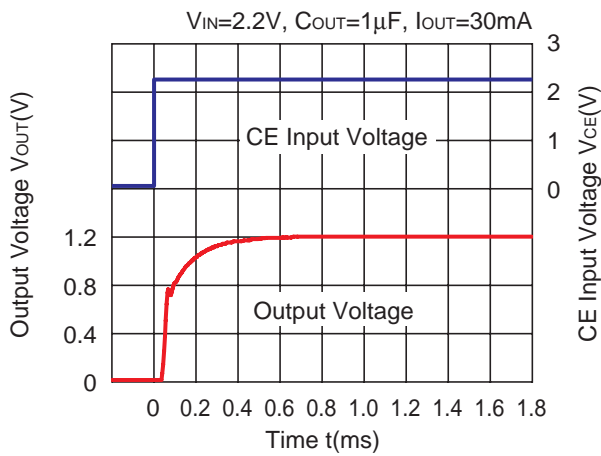
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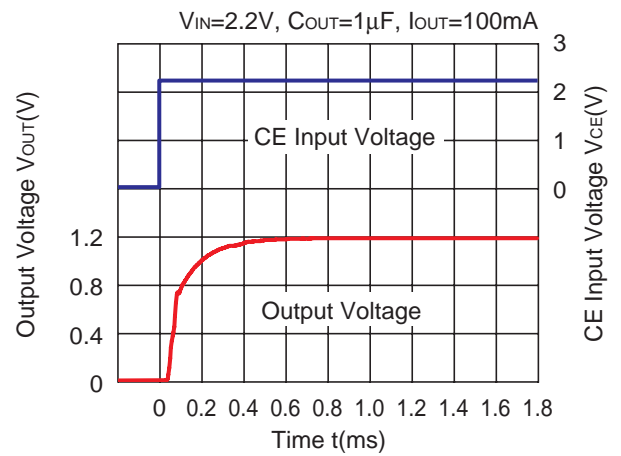
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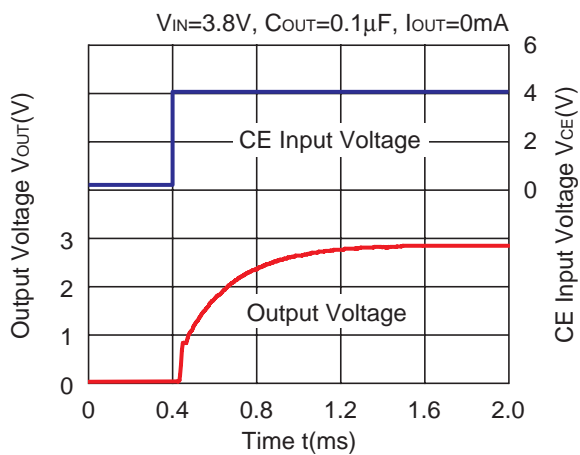
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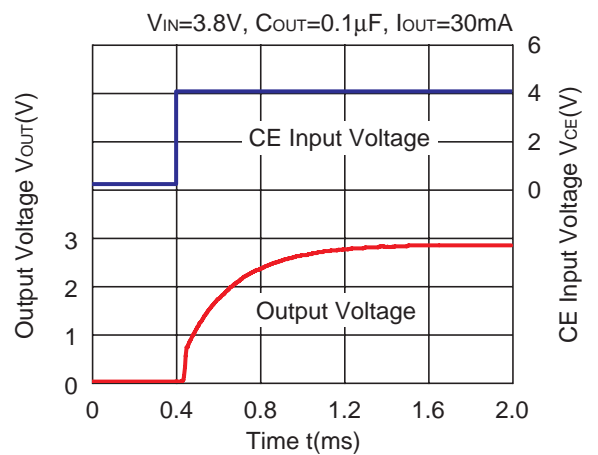
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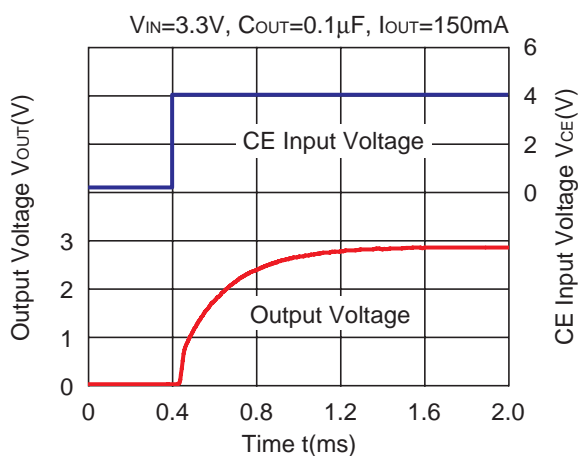
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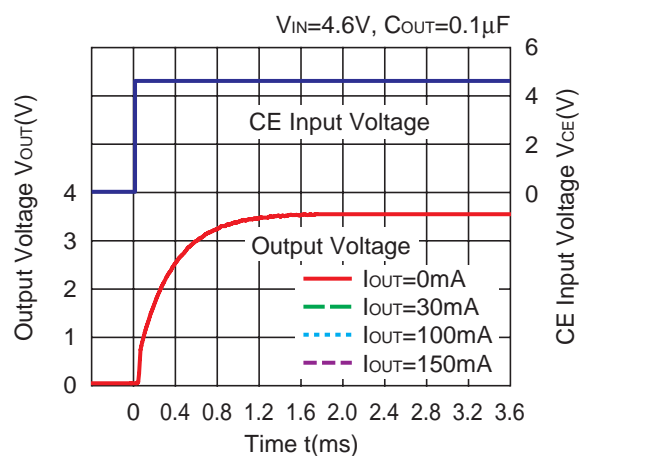
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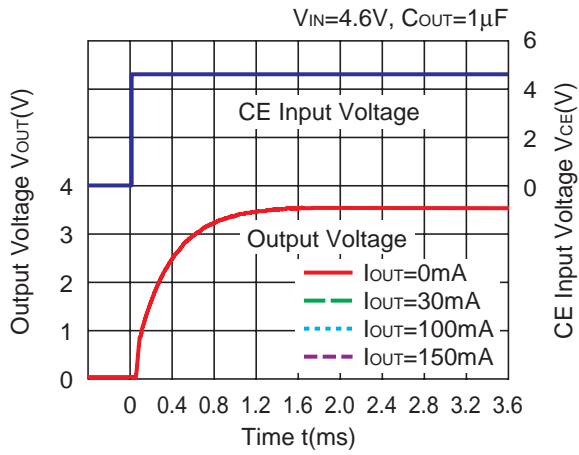
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R1183Z361x

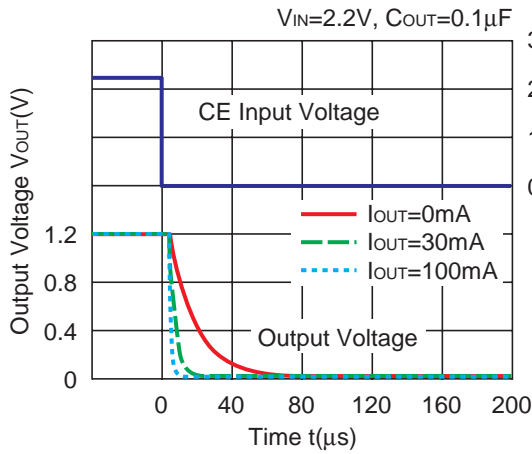


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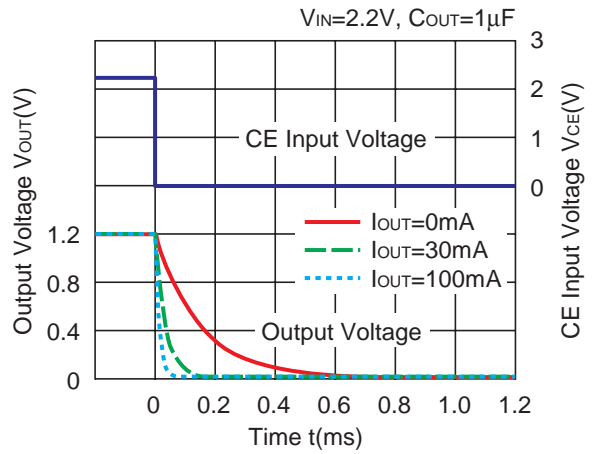


13) Turn off speed with CE pin signal

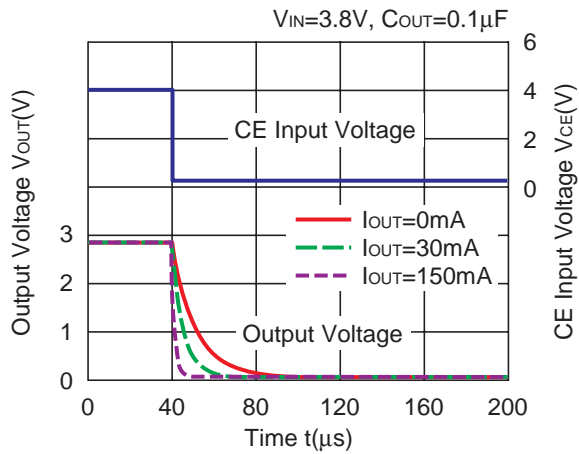
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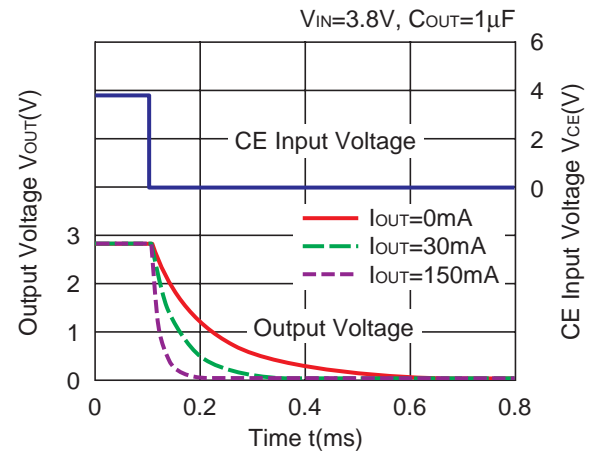
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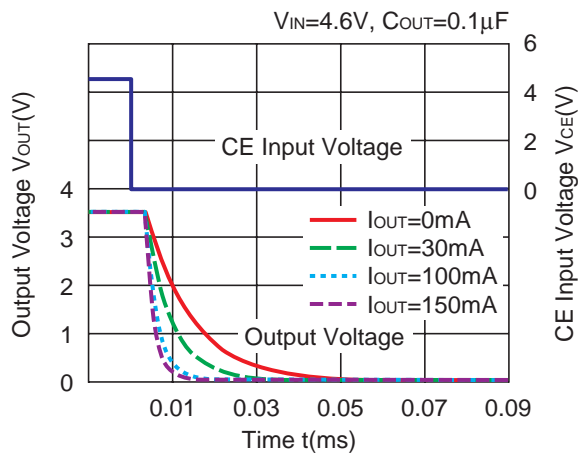
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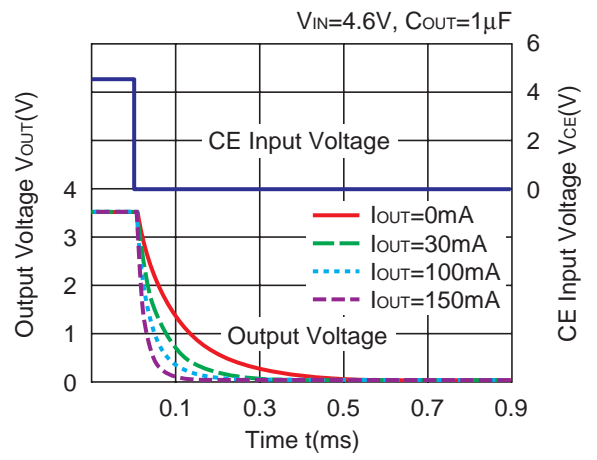
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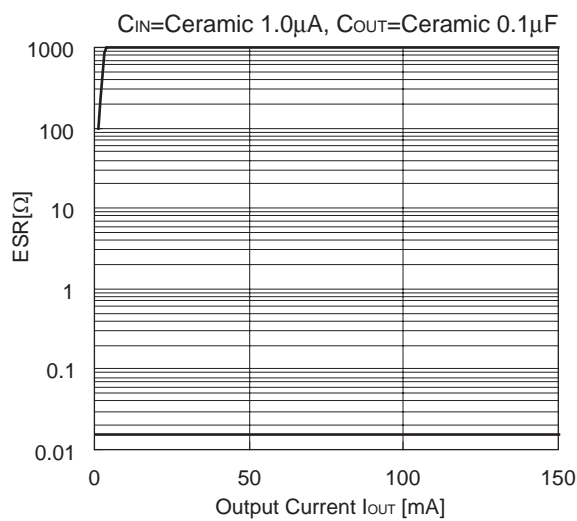
ESR vs. Output Current

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 $40\mu V$ (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 $85^{\circ}C$

R1183Z121x



R1183Z281x

