RICOH

R1183Z SERIES

150mA LDO REGULATOR

NO.EA-147-070315

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

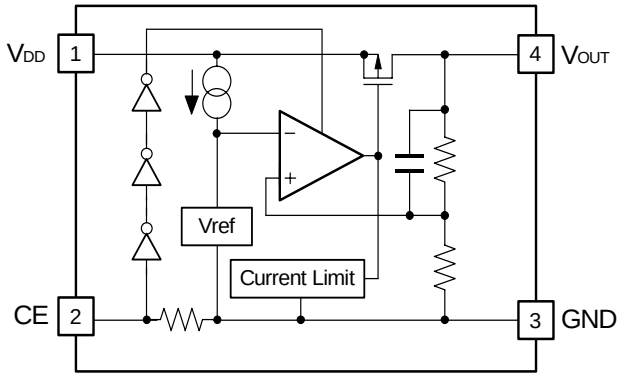
- Supply Current .....Typ. 1μA(Except the current through CE pull-down circuit)
- Standby Mode .....Typ. 0.1μA
- Dropout Voltage .....Typ. 0.25V (I_{OUT}=150mA,V_{OUT}=3.0V)
- Temperature-Drift Coefficient of Output Voltage Typ. ±100ppm/°C
- Line Regulation .....Typ. 0.05%/V
- Output Voltage Accuracy.....±1.2%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

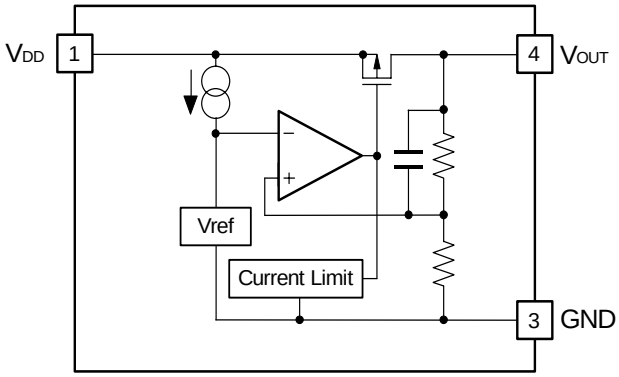
- Stable voltage reference.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

BLOCK DIAGRAMS

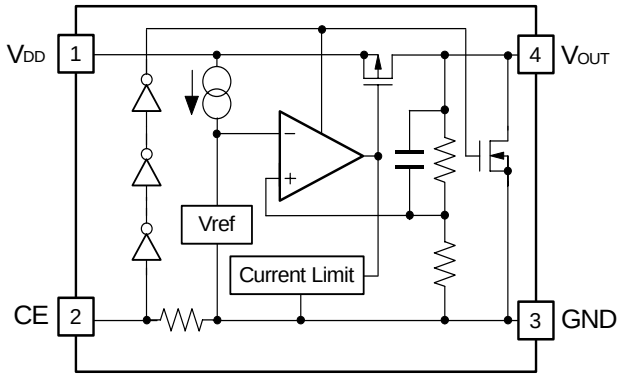
R1183Zxx1B



R1183Zxx1C



R1183Zxx1D



SELECTION GUIDE

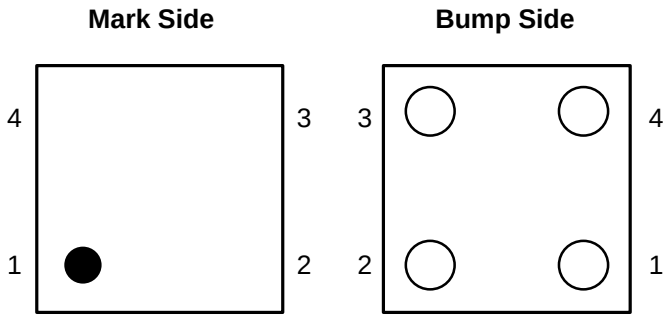
The output voltage, version, and the taping type for the ICs can be selected at the user's request.
The selection can be made with designating the part number as shown below:

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 plating

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

● **R1183Zxx1D**

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
Topt	Operating Temperature Range	−40 to +85	°C
Tstg	Storage Temperature Range	−55 to +125	°C

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

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are threshold limit values that must not be exceeded ever for an instant under any conditions. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

ELECTRICAL CHARACTERISTICS

- **R1183Zxx1B/D**

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage*1	V_{IN}=Set V_{OUT}+1V I_{OUT}=1mA	×0.988		×1.012	V
			−18mV		+18mV	
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
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN}=Set V_{OUT}+1V 1μA ≦ I_{OUT} ≦ 150mA		20	40	mV
V_{DIF}	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I_{SS}	Supply Current*2	V_{IN}=Set V_{OUT}+1V, I_{OUT}=0mA		1.0	1.5	μA
Istandby	Supply Current (Standby)	V_{IN}=Set V_{OUT}+1V V_{CE}=GND (B/D Version)		0.1	1.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	Set V_{OUT}+0.5V ≦ V_{IN} ≦ 6.0V (V_{OUT} ≧ 1.5V) If V_{OUT}<1.5V, 2.0V ≦ V_{IN} ≦ 6.0V I_{OUT}=30mA		0.05	0.20	%/V
V_{IN}	Input Voltage		1.7		6.0	V
ΔV_{OUT}/ ΔTopt	Output Voltage Temperature Coefficient	I_{OUT}=30mA −40°C ≦ Topt ≦ 85°C		±100		ppm /°C
Ilim	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		0.3	V
R_{LOW}	ON Resistance of Nch.Tr. for Auto discharge (of D version)	V_{CE}=0V		90		Ω

*1 If V_{OUT} ≦ 1.5V, then tolerance is ±18mV

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

- **R1183Zxx1C**

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage*1	V_{IN}=Set V_{OUT}+1V I_{OUT}=1mA	×0.988		×1.012	V
			−18mV		+18mV	
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
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN}=Set V_{OUT}+1V 1μA ≦ I_{OUT} ≦ 150mA		20	40	mV
V_{DIF}	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I_{SS}	Supply Current*2	V_{IN}=Set V_{OUT}+1V, I_{OUT}=0mA		1.0	1.5	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	Set V_{OUT}+0.5V ≦ V_{IN} ≦ 6.0V (V_{OUT} ≧ 1.5V) If V_{OUT}<1.5V, 2.0V ≦ V_{IN} ≦ 6.0V I_{OUT}=30mA		0.05	0.20	%/V
V_{IN}	Input Voltage		1.7		6.0	V
ΔV_{OUT}/ ΔTopt	Output Voltage Temperature Coefficient	I_{OUT}=30mA −40°C ≦ Topt ≦ 85°C		±100		ppm /°C
Ilim	Short Current Limit	V_{OUT}=0V		40		mA

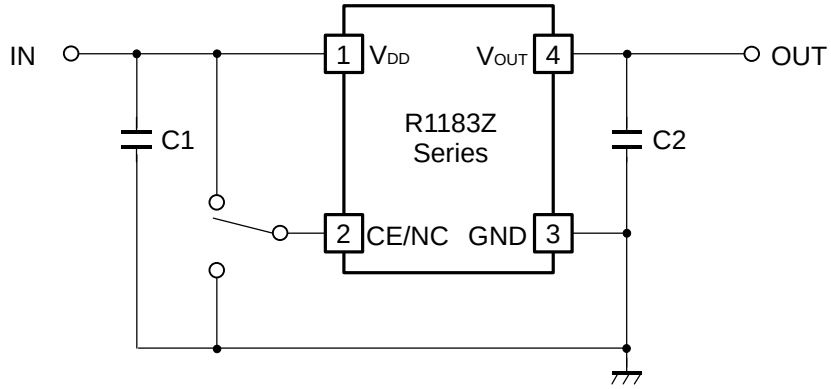
*1 If V_{OUT} ≦ 1.5V, then tolerance is ±18mV
*2 Except the pull-down constant current through CE pin.

- **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	0.1μF	murata	GRM155B31C104KA87B
		kyocera	CM05X5R104K16AB

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

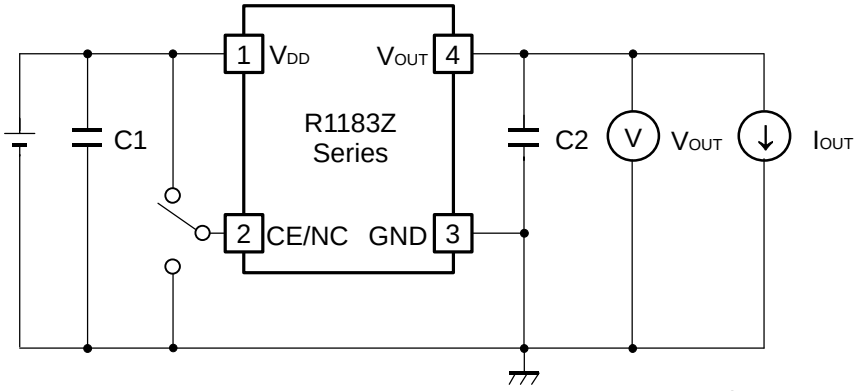
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C_2 with good frequency characteristics and ESR (Equivalent Series Resistance). (Note: If additional ceramic capacitors are connected with parallel to the output 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 1.0μF or more between V_{DD} and GND pin, and as close as possible to the pins.

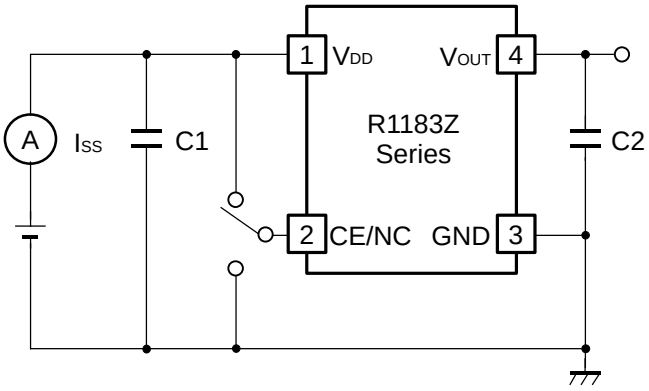
Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

TEST CIRCUITS



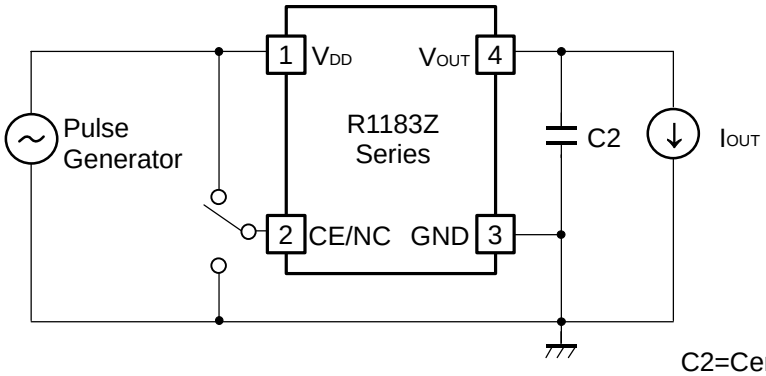
C1=Ceramic 1.0μF
C2=Ceramic 1.0μF

Standard test Circuit



C1=Ceramic 1.0μF
C2=Ceramic 1.0μF

Supply Current Test Circuit



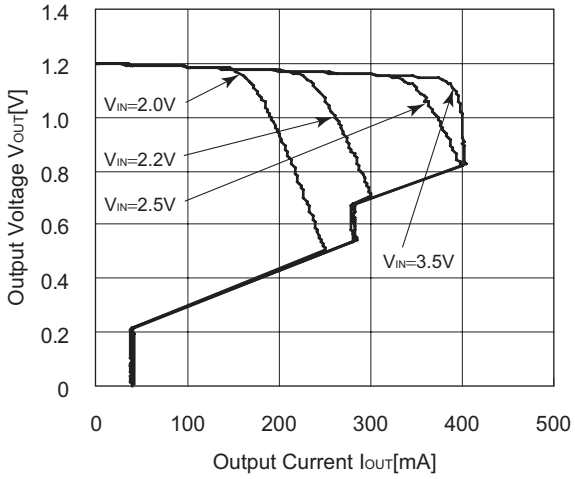
C2=Ceramic 1.0μF

Ripple Rejection, Line Transient Response Test Circuit

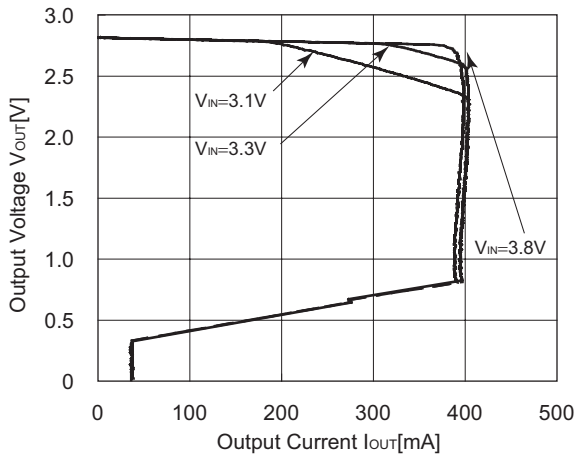
TYPICAL CHARACTERISTICS

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

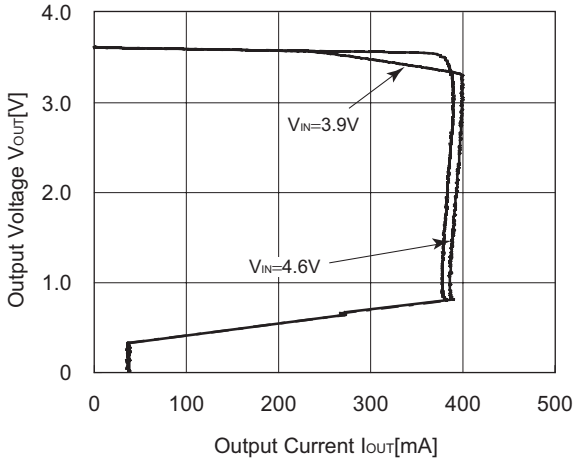
R1183Z121x



R1183Z281x

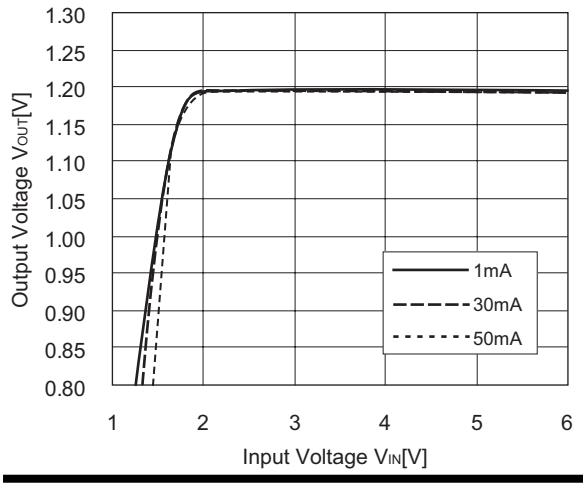


R1183Z361x

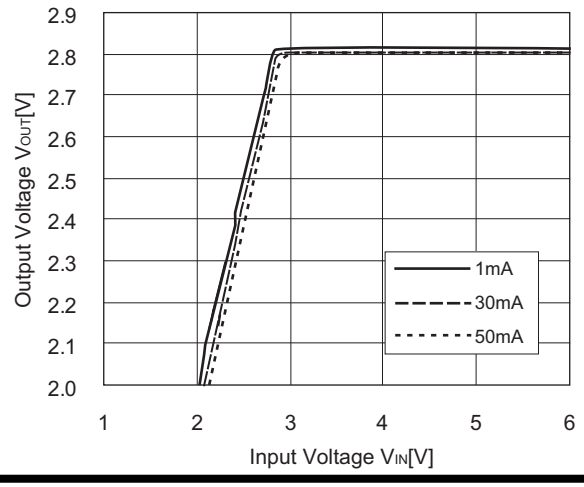


2) Output Voltage vs. Input Voltage (Topt=25°C)

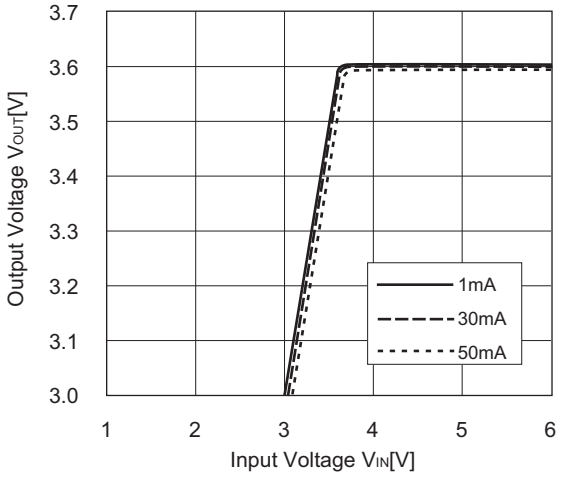
R1183Z121x



R1183Z281x

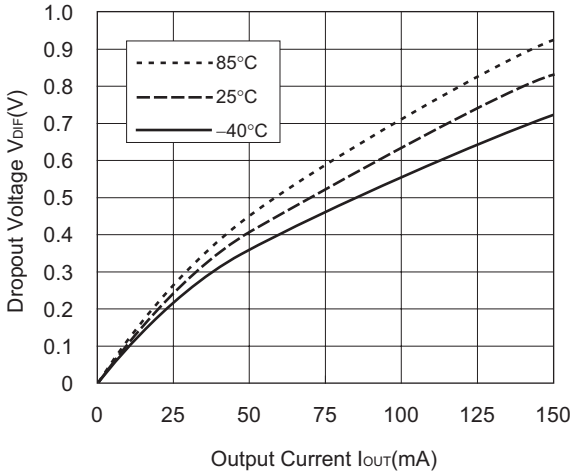


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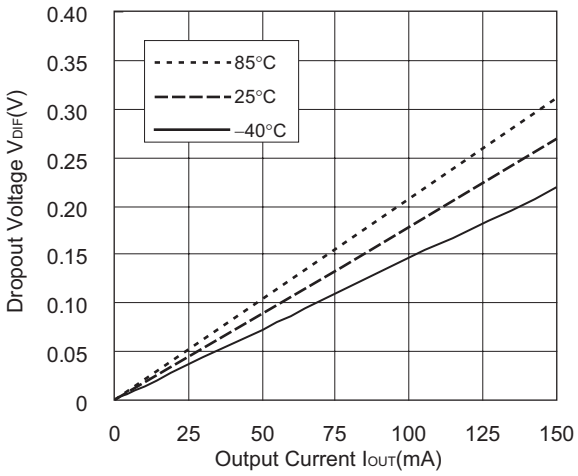


3) Dropout Voltage vs. Output Current

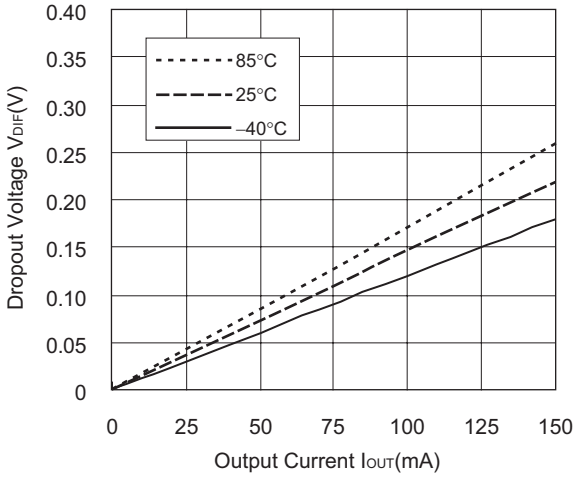
R1183Z121x



R1183Z281x

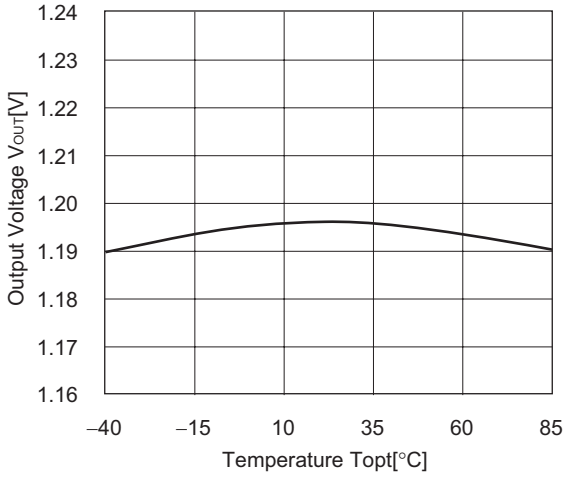


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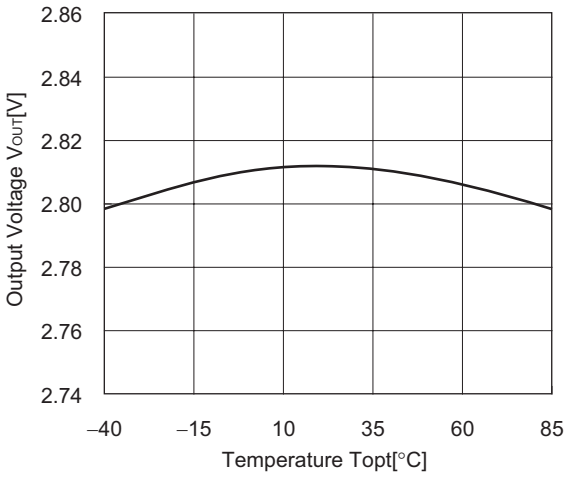


4) Output Voltage vs. Temperature (I_{OUT}=30mA)

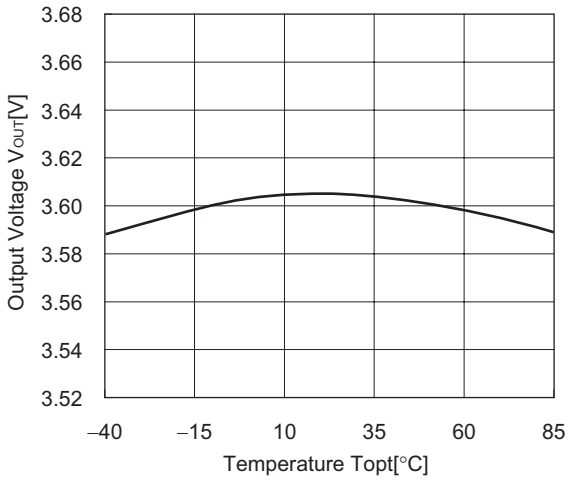
R1183Z121x (V_{IN}=2.2V)



R1183Z281x (V_{IN}=3.8V)

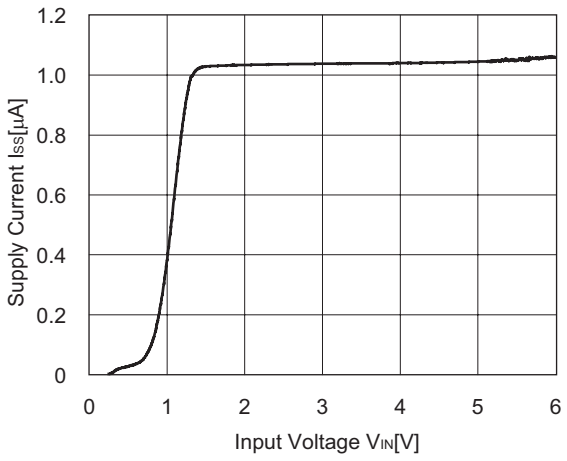


R1183Z361x (V_{IN}=4.6V)

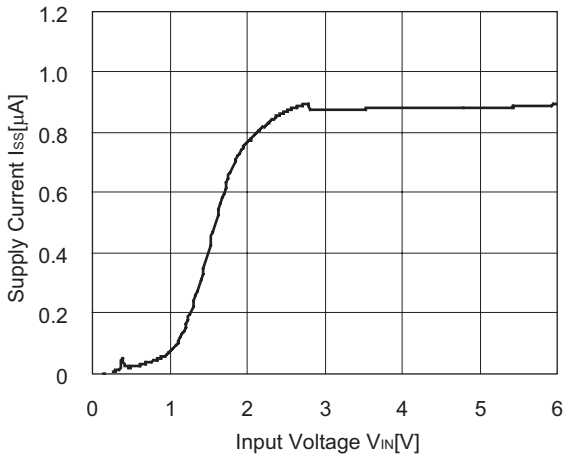


5) Supply Current vs. Input Voltage (Topt=25°C)

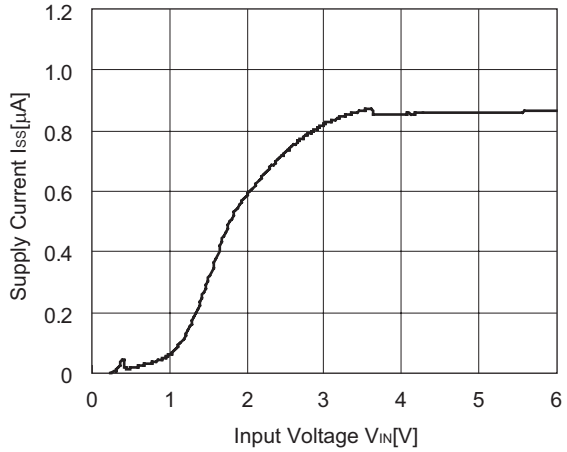
R1183Z121x



R1183Z281x

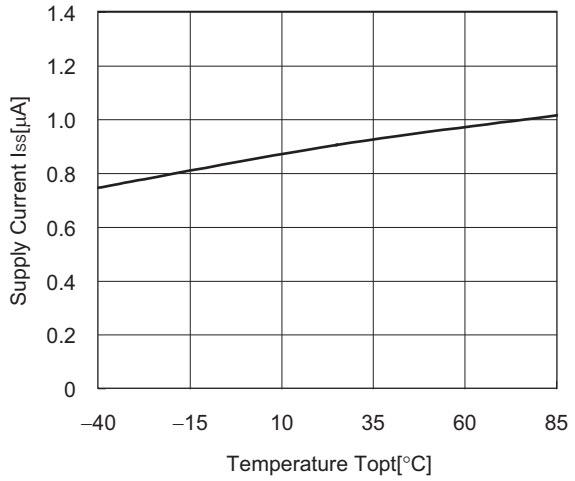


R1183Z361x

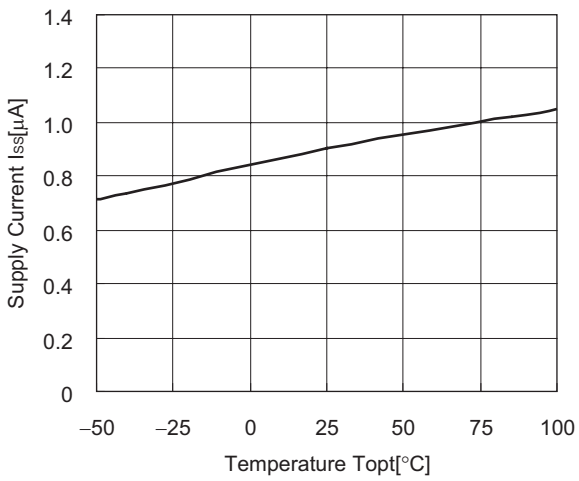


6) Supply Current vs. Temperature

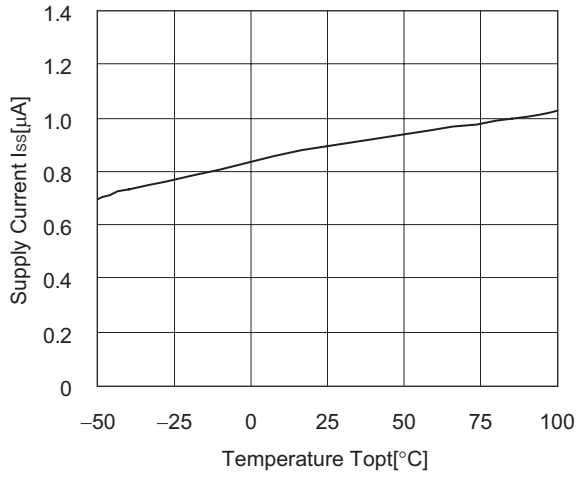
R1183Z121x (V_{IN}=2.2V)



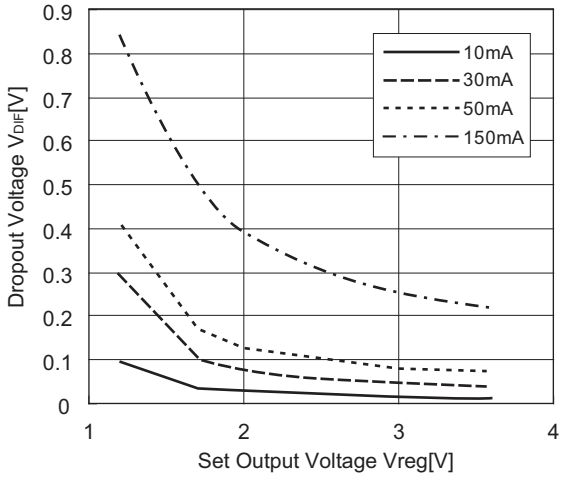
R1183Z281x (V_{IN}=3.8V)



R1183Z361x (V_{IN}=4.6V)

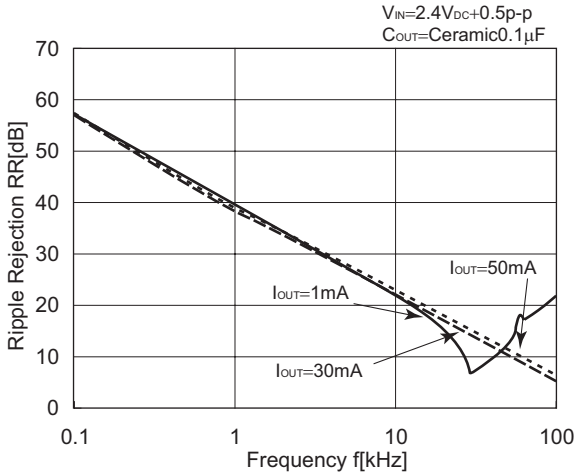


7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)

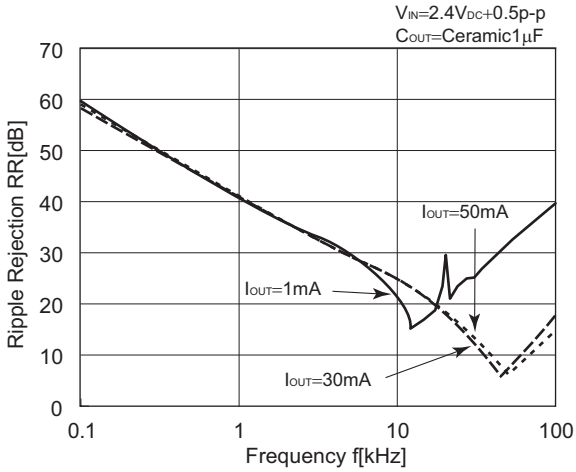


8) Ripple Rejection vs. Frequency (C_{IN}=none)

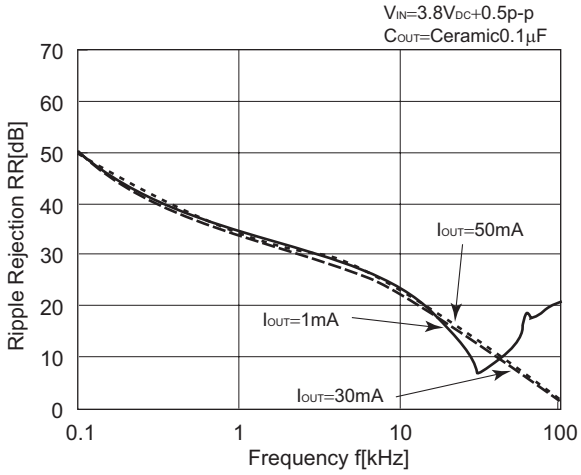
R1183Z121x



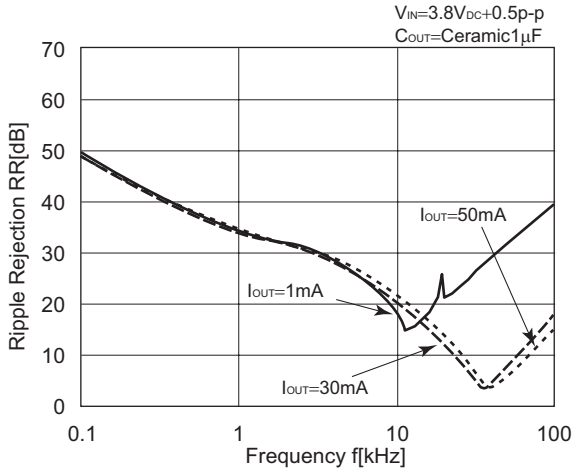
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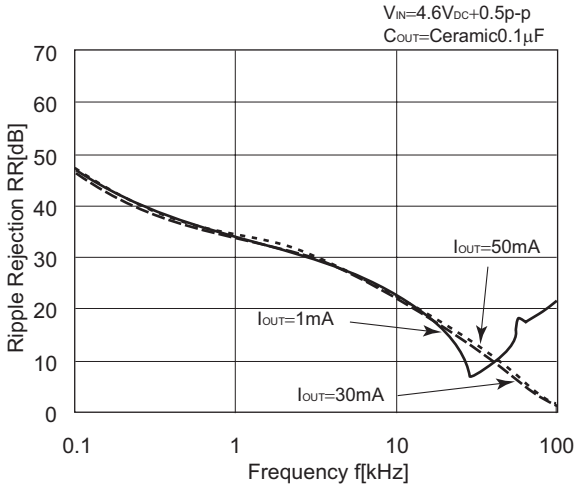
R1183Z281x



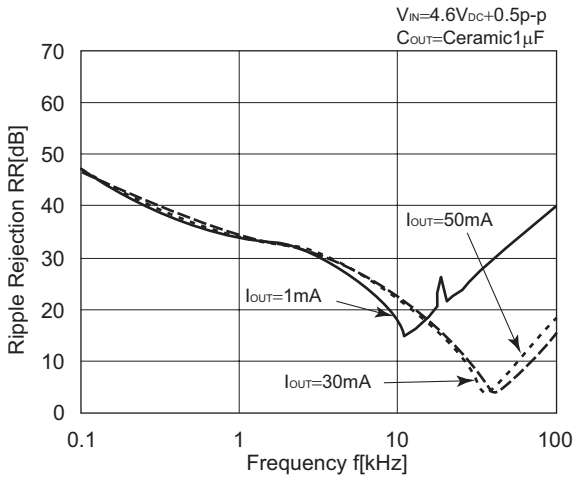
R1183Z281x



R1183Z361x

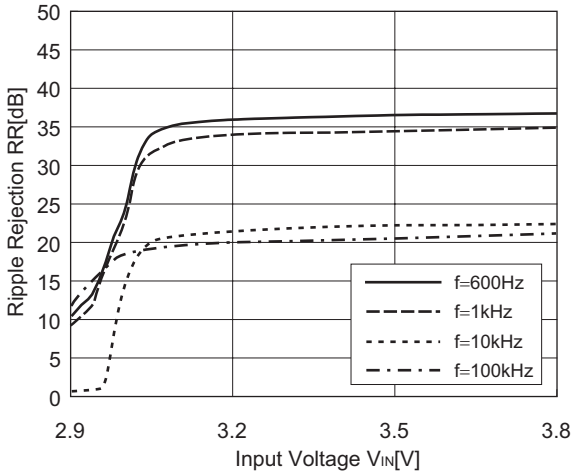


R1183Z361x

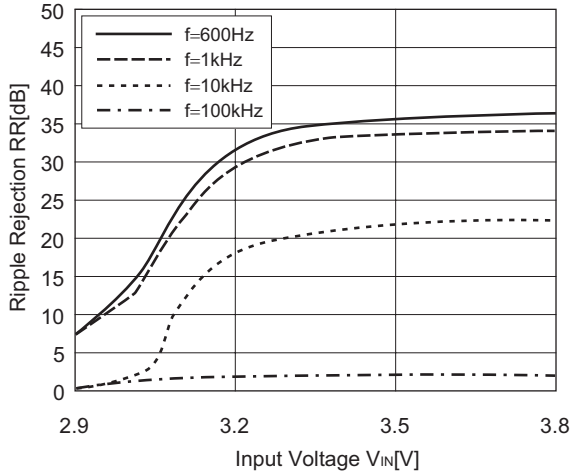


9) Ripple Rejection vs. Input Bias Voltage (Topt=25°C, CIN=none, COUT=ceramic0.1μF)

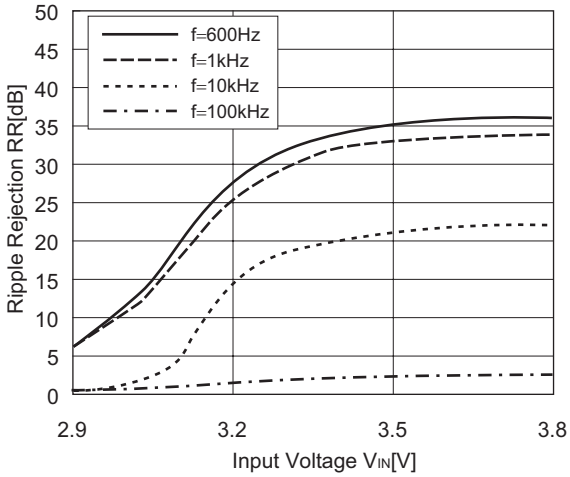
R1183Z281x (IOUT=1mA)



R1183Z281x (IOUT=30mA)

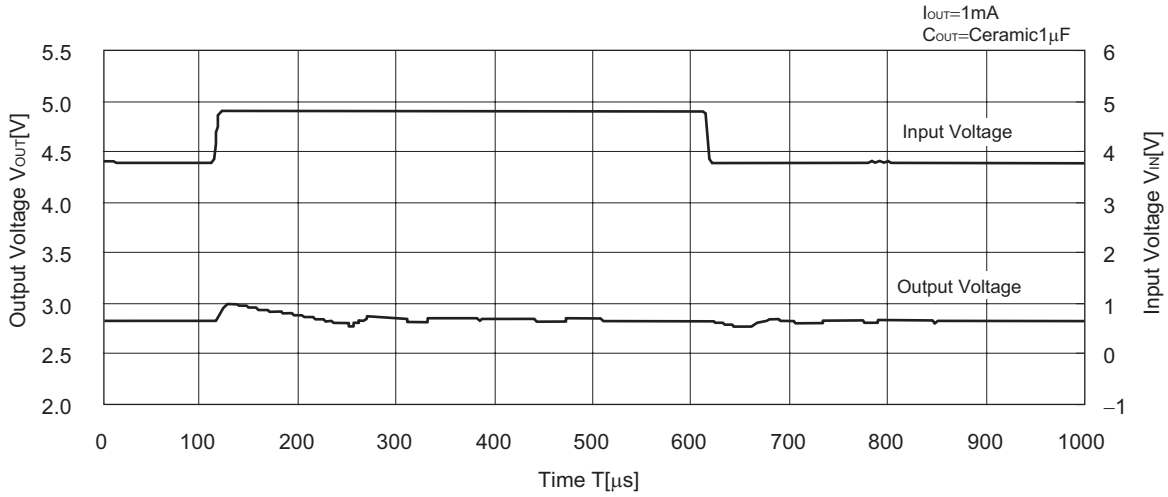


R1183Z281x (IOUT=50mA)

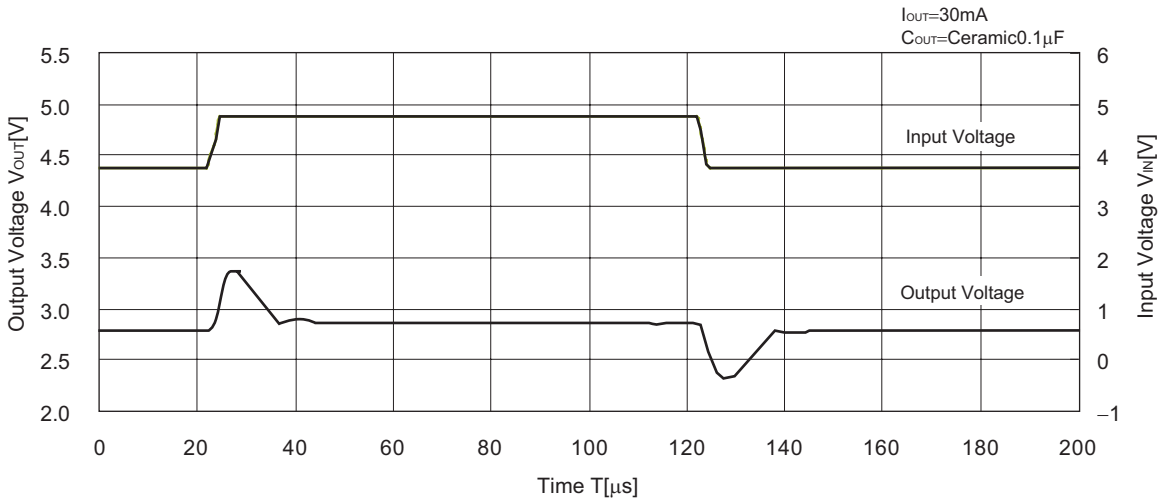


10) Input Transient Response (C_{IN}=none, tr=tf=5μs)

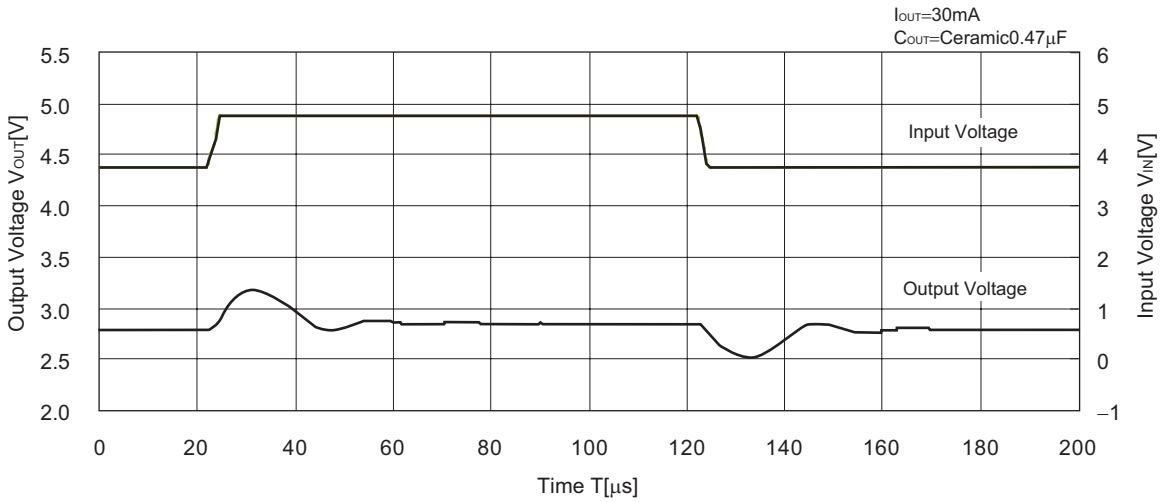
R1183Z281x



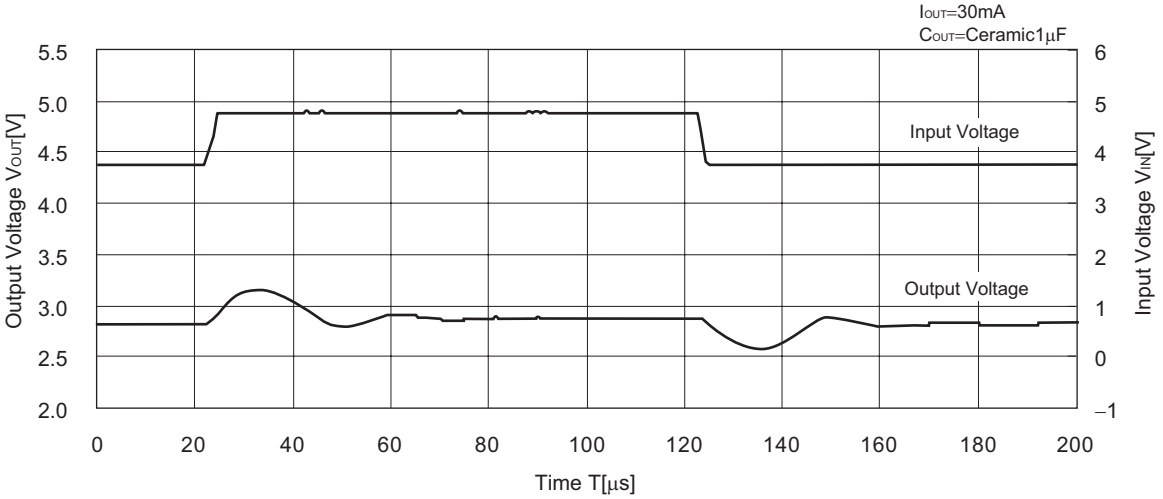
R1183Z281x



R1183Z281x

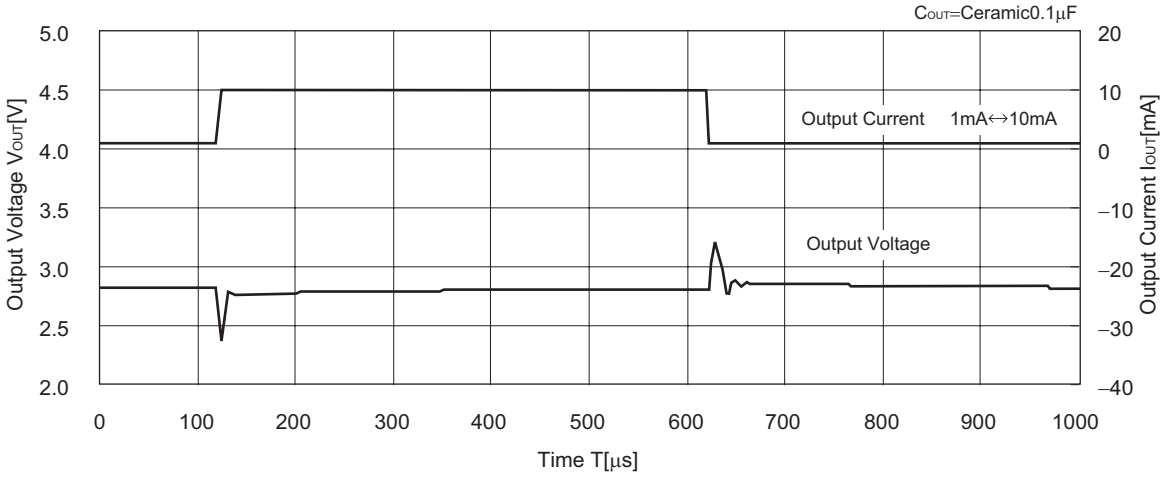


R1183Z281x

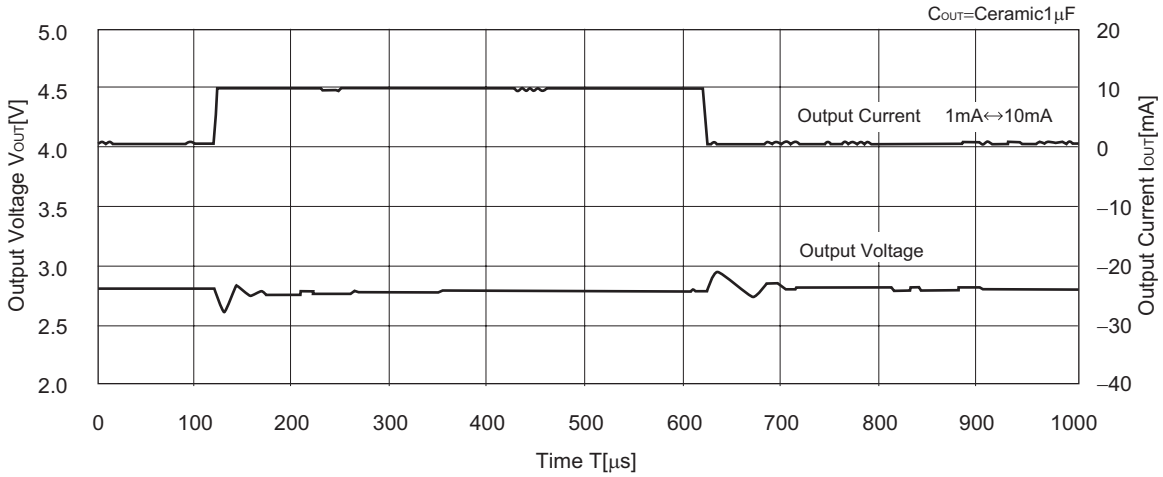


11) Load Transient Response (tr=tf=0.5μs V_{IN}=3.8V)

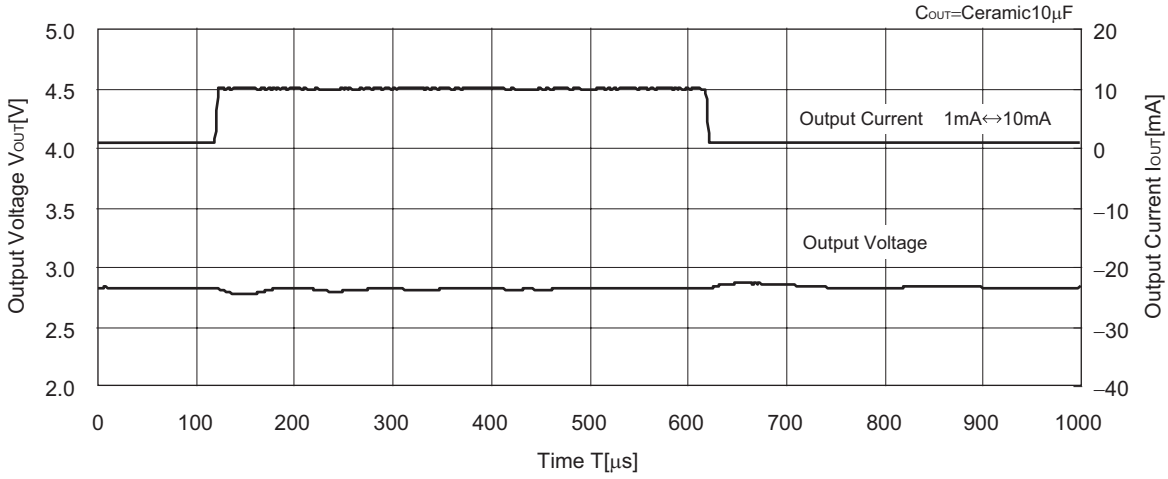
R1183Z281x



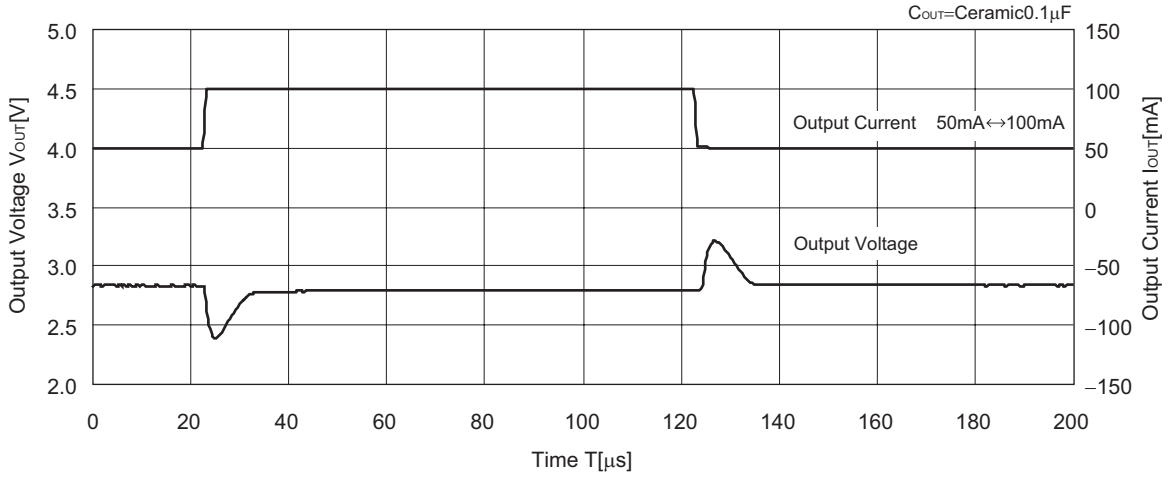
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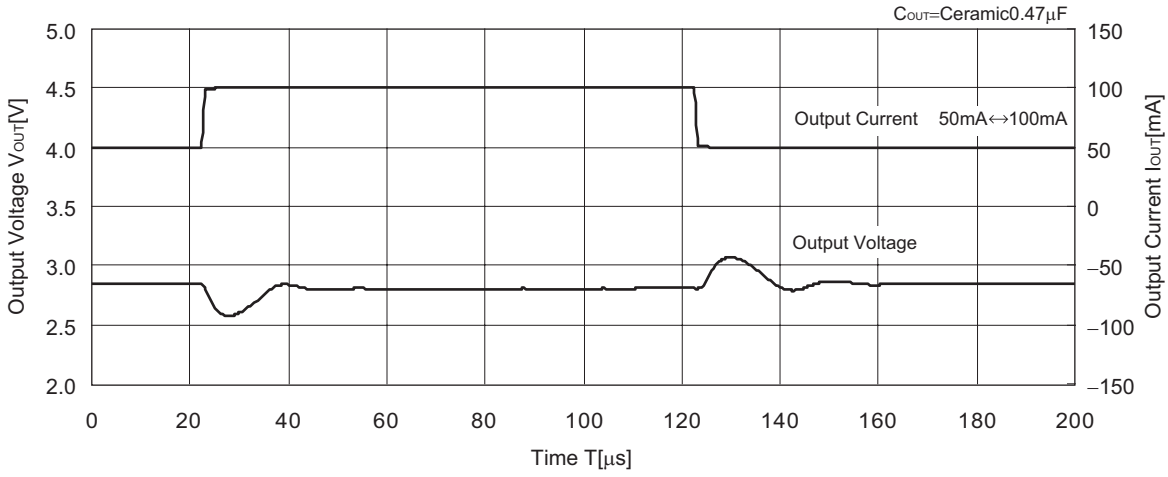
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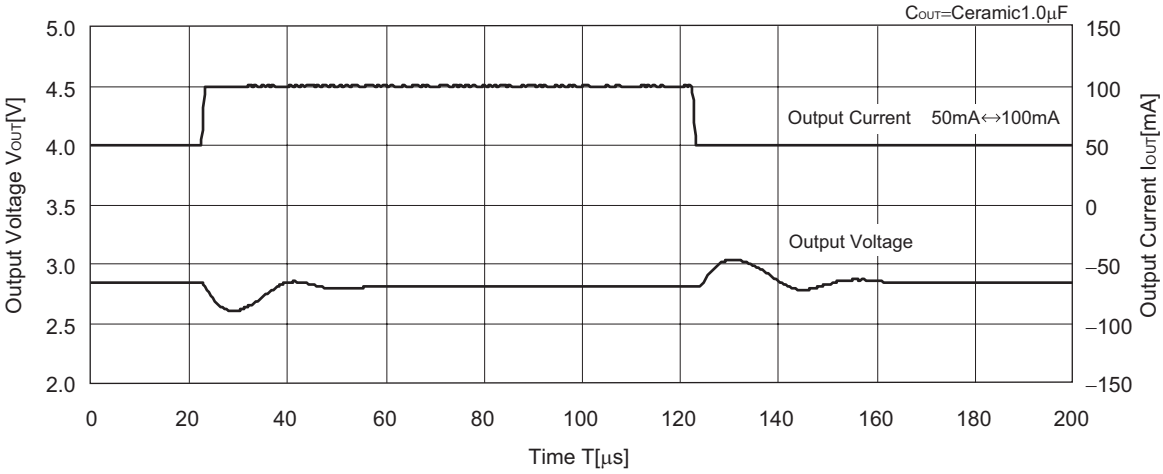
R1183Z281x



R1183Z281x

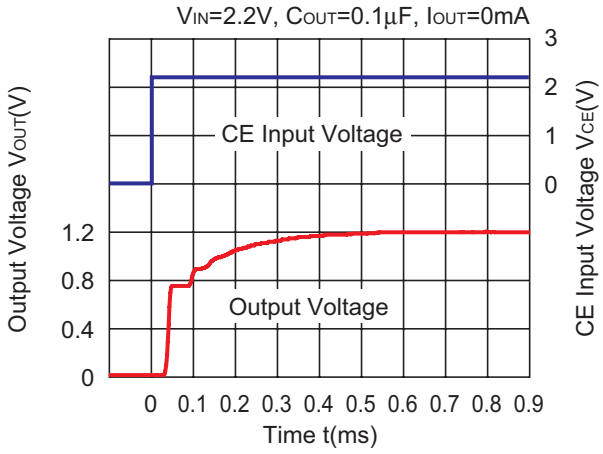


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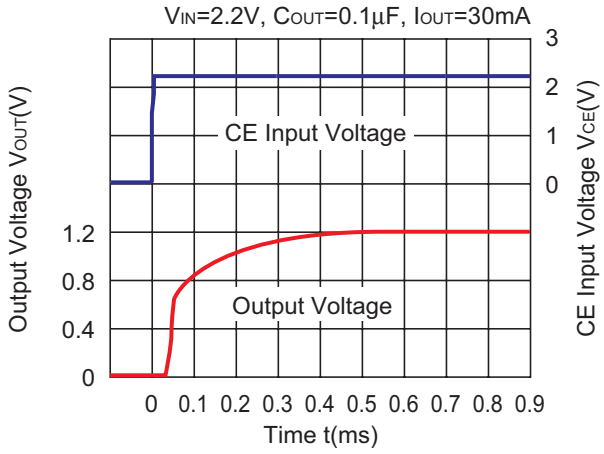


12) Turn-on speed with CE pin signal

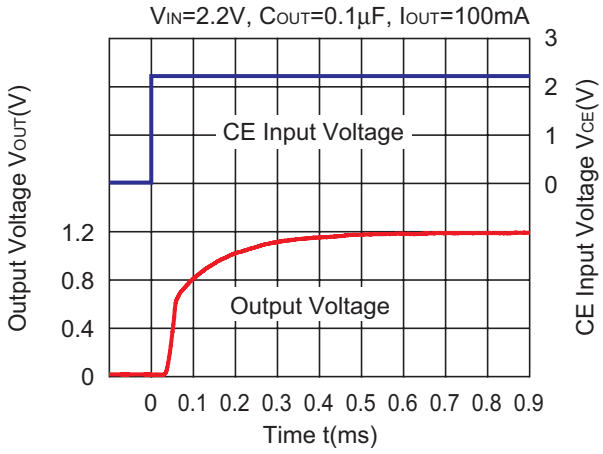
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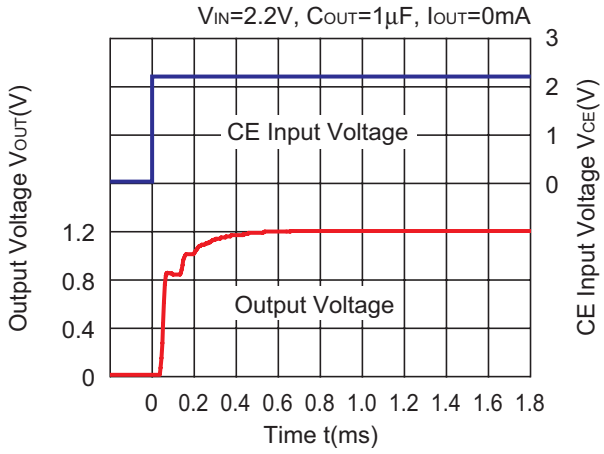
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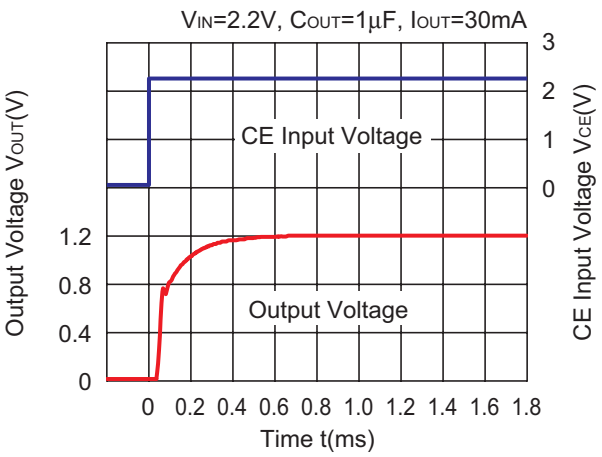
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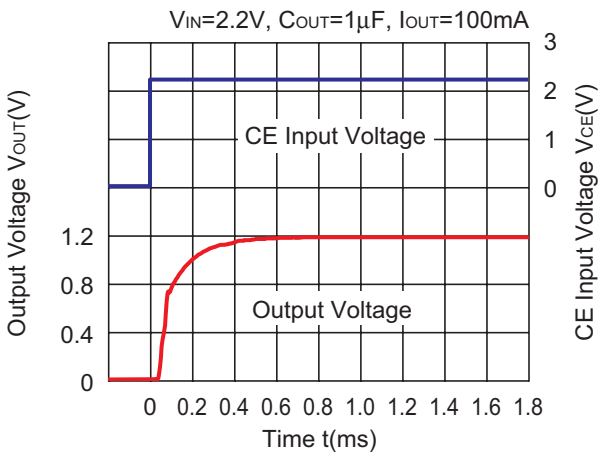
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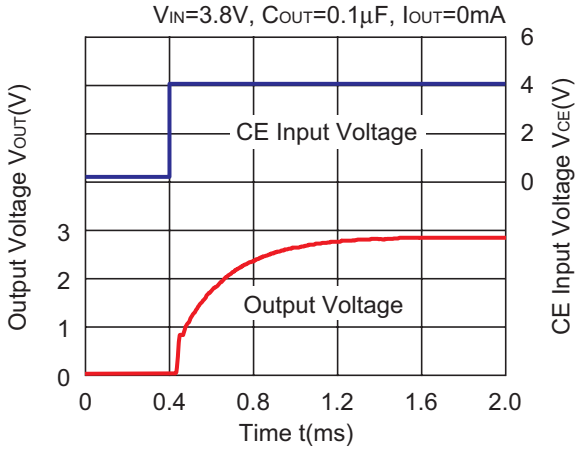
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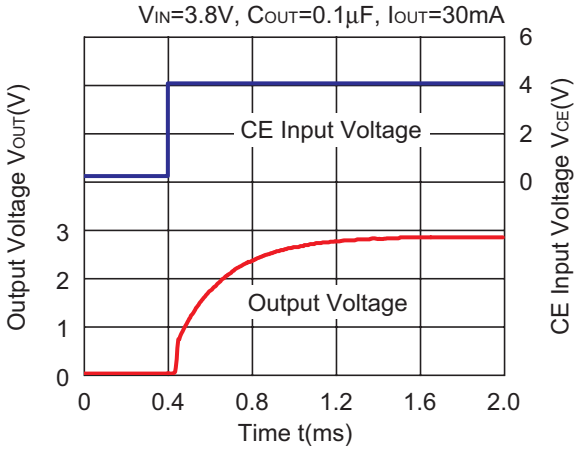
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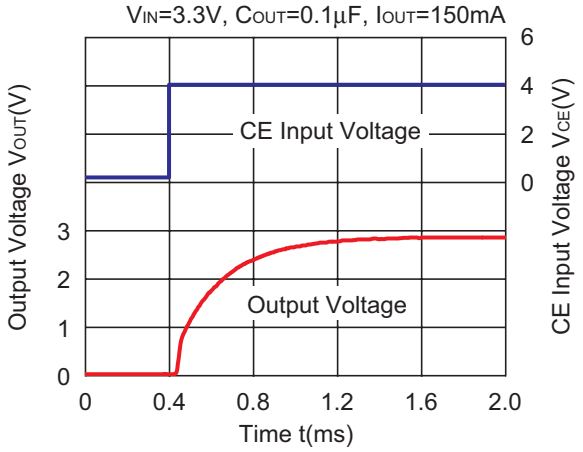
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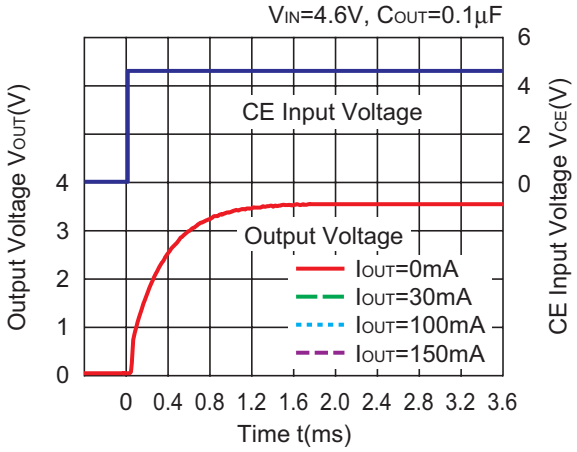
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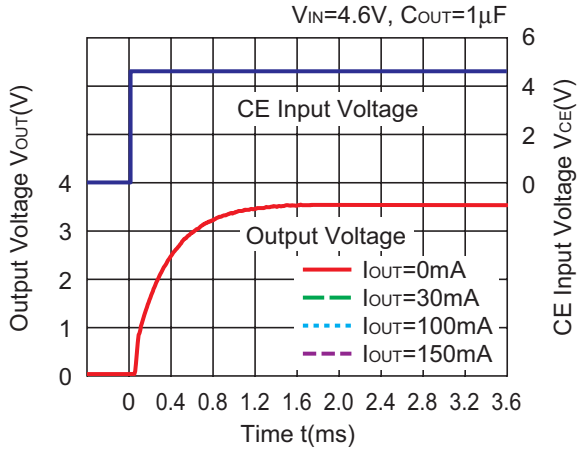
R1183Z281x



R1183Z361x

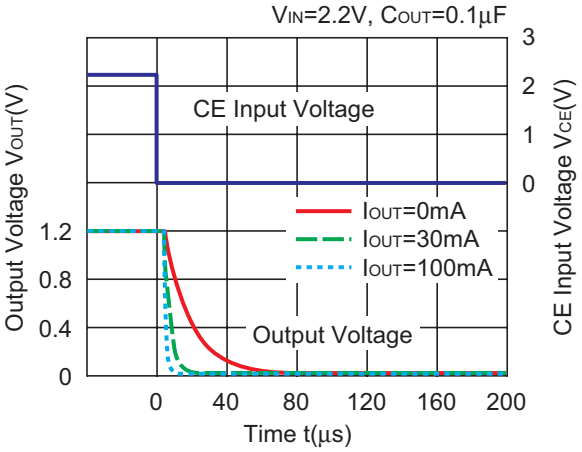


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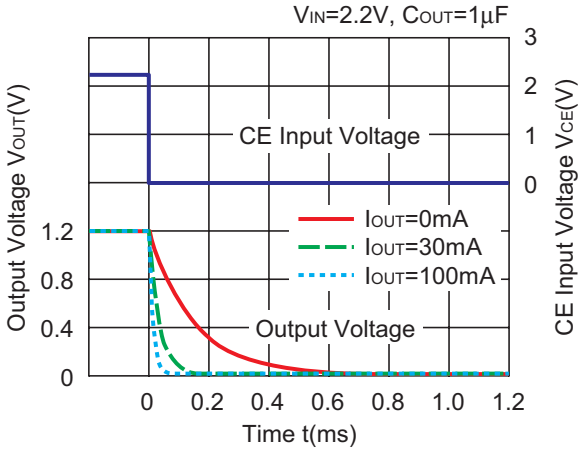


13) Turn off speed with CE pin signal

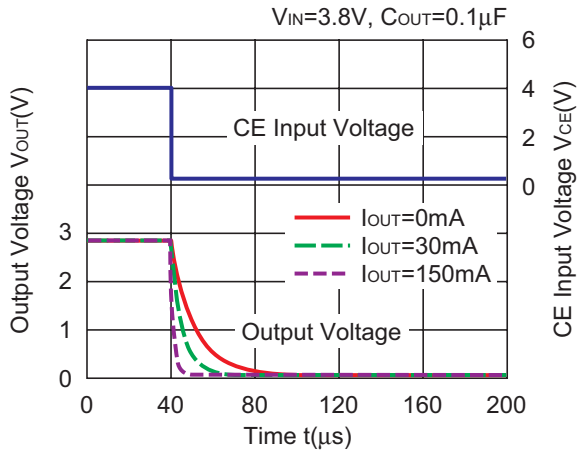
R1183Z121D



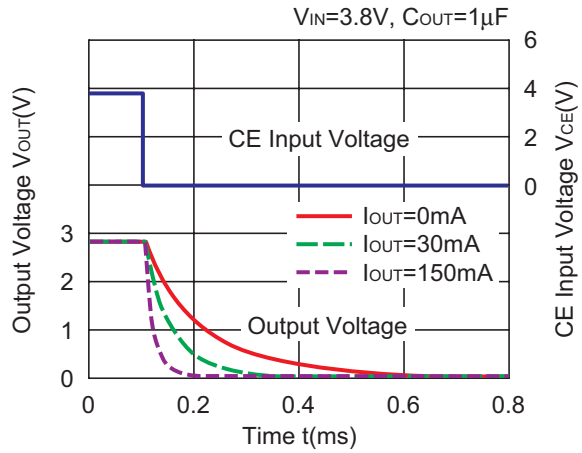
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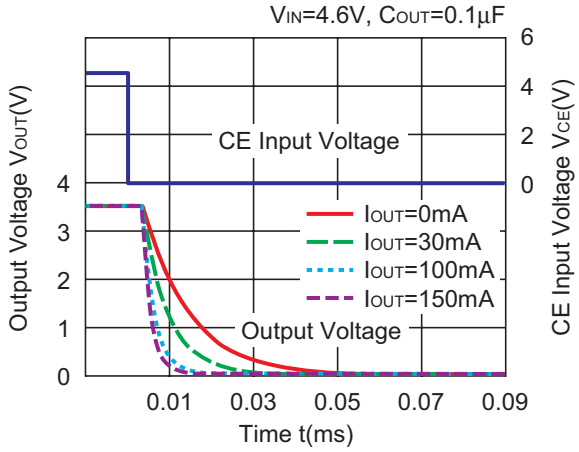
R1183Z281D



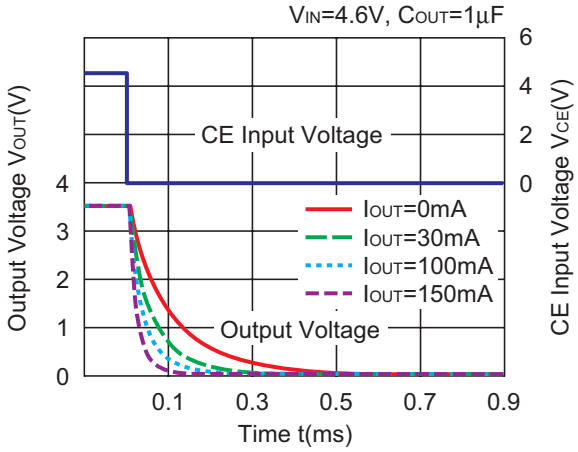
R1183Z281D



R1183Z361D



R1183Z361D

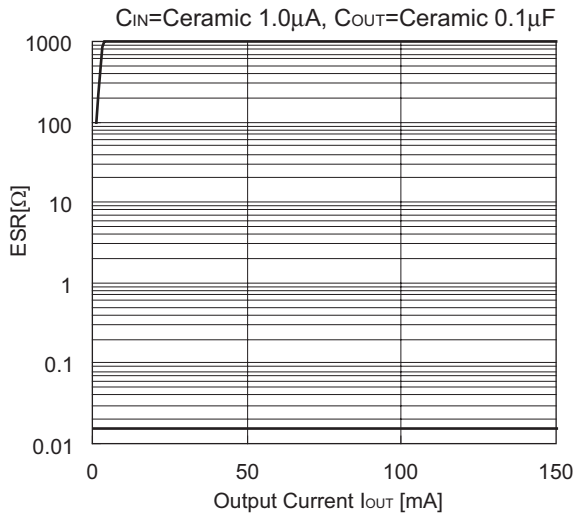


ESR vs. Output Current

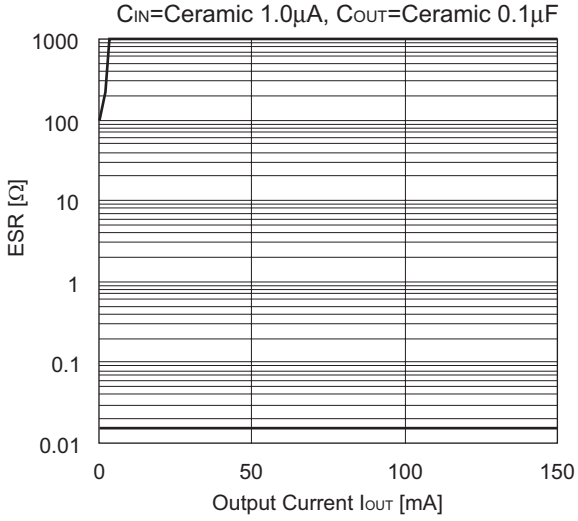
The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown above. The conditions when the white noise level is under 40μV (Avg.) are marked as the hatched area in the graph.

<Measurement conditions>
(1) V_{IN}=V_{OUT}+1V
(2) Frequency Band: 10Hz to 2MHz (BW=30Hz)
(3) Temperature: −40°C to 85°C

R1183Z121x



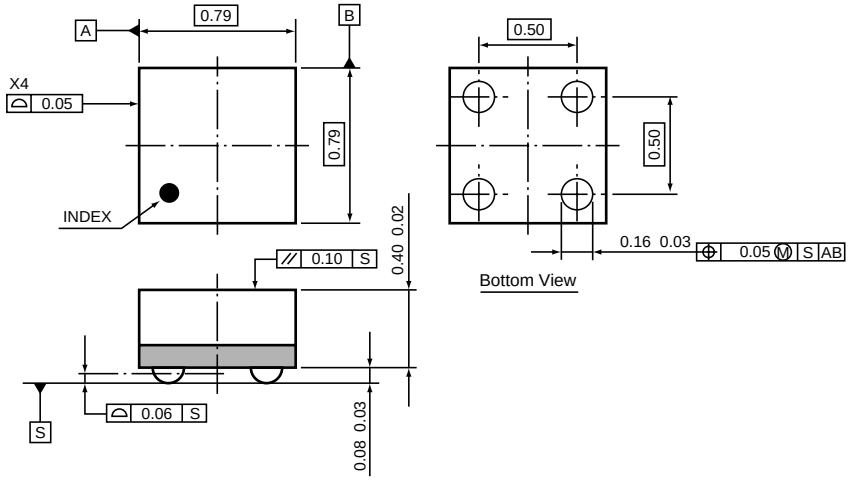
R1183Z281x



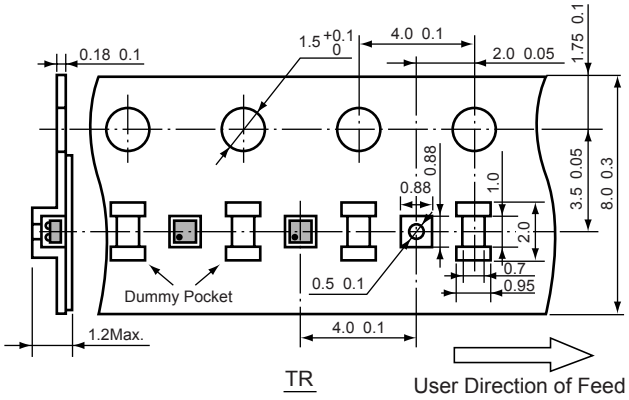
- **WLCSP-4-P2**

Unit: mm

PACKAGE DIMENSIONS

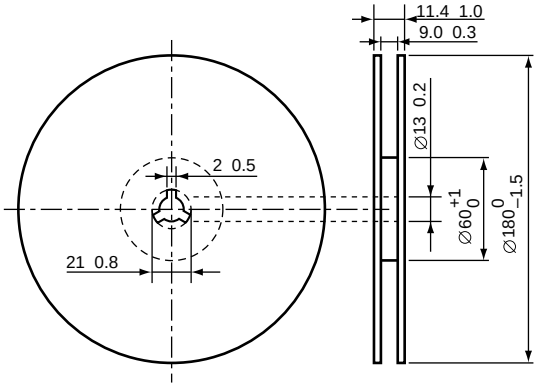


TAPING SPECIFICATION



TAPING REEL DIMENSIONS REUSE REEL (EIAJ-RRM-08Bc)

(1reel=5000pcs)
(R3115Z : 1reel=3000pcs)



POWER DISSIPATION (WLCSP-4-P2)

This specification is at mounted on board. Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

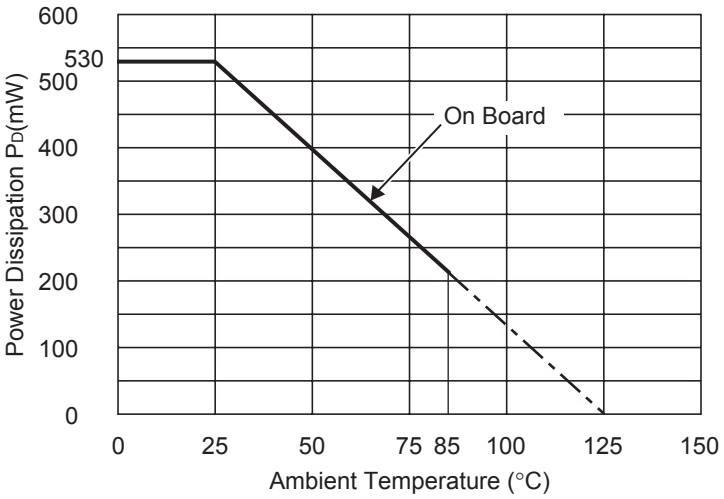
Measurement Conditions

	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plactic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side : Approx. 50% , Back side : Approx. 50%
Through-hole	–

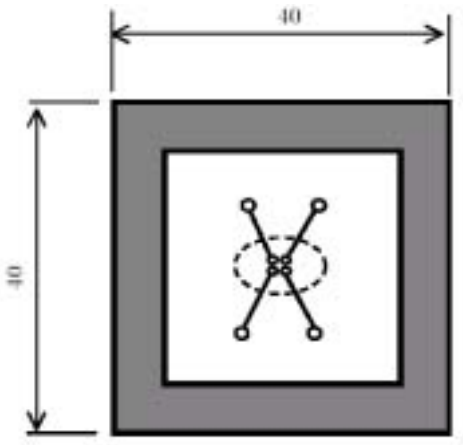
Measurement Result

(Topt=25°C,Tjmax=125°C)

	Standard Land Pattern
Power Dissipation	530mW
Thermal Resistance	θja=(125−25°C)/0.53W=189°C/W



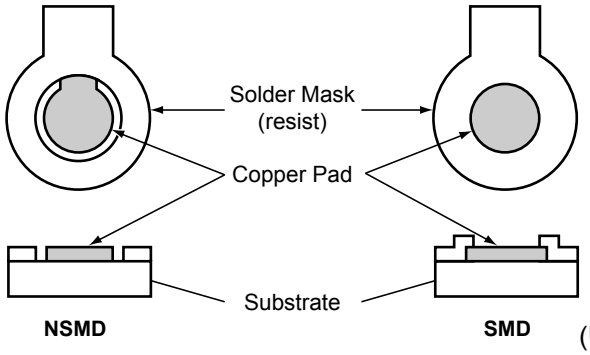
Power Dissipation



Measurement Board Pattern

IC Mount Area (Unit : mm)

RECOMMENDED LAND PATTERN



(Unit : mm)

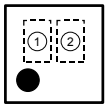
NSMD and SMD Pad Definition

Pad definition	Copper Pad	Solder Mask Opening
NSMD (Non-Solder Mask defined)	0.20mm	Min. 0.30mm
SMD (Solder Mask defined)	Min. 0.30mm	0.20mm

* Pad layout and size can be modified by customers material, equipment, method.
* Please adjust pad layout according to your conditions.
* Recommended Stencil Aperture Size....ø0.3mm
* Since lead free WL-CSP components are not compatible with the tin/lead solder process, you shall not mount lead free WL-CSP components using the tin/lead solder paste.

R1183Z SERIES MARK SPECIFICATION

- **WLCSP-4-P2**



①, ② : Lot Number

(A part number is discriminable from a lot number)