RICOH

Low Voltage 150mA LDO REGULATOR

R1182x SERIES

OUTLINE

The R1182x Series are CMOS-based positive voltage regulator ICs with high output voltage accuracy and low supply current. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit which prevents the destruction by excess current, and so on.
The output voltage of these ICs is fixed with high accuracy. The R1182 Series has low dropout voltage caused by built in low on resistance transistor. Further, the consumption current of IC itself is Typ. 3.0μA at no load, at the same time, compared with the conventional low supply current regulator, transient response is improved.

Since the packages for these ICs are SOT-23-5 (R1182N Series) and ultra small PLP1616-6 (R1182K Series), high density mounting of the ICs on boards is possible.

FEATURES

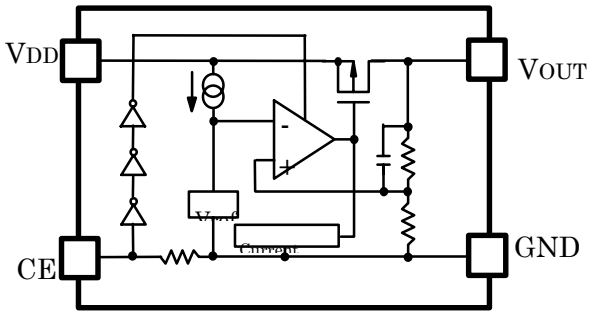
- Low Supply Current ..... Typ. 3μA(Except the current through CE pull-down circuit)
- Standby Mode ..... Typ. 0.1μA
- Low Dropout Voltage ..... Typ. 0.22V (I_{OUT}=150mA 3.0V Output type)
- Input Voltage Range ..... 1.5V to 6.0V
- High Output Voltage Accuracy..... ±1.0% (V_{OUT}≥ 1.5V)
- Small Packages ..... SOT-23-5 (R1182N) /PLP1616-6(R1182K)
- Output Voltage..... Stepwise setting with a step of 0.1V in the range of 1.2V to 4.0V is possible
- Built-in Fold Back Protection Circuit..... Typ. 50mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC 0.1μF or more
- Ripple Rejection ..... Typ. 55dB at 1kHz (V_{OUT}=1.5V, I_{OUT}=30mA)
  ..... Typ. 40dB at 10kHz (V_{OUT}=1.5V, I_{OUT}=30mA)

APPLICATIONS

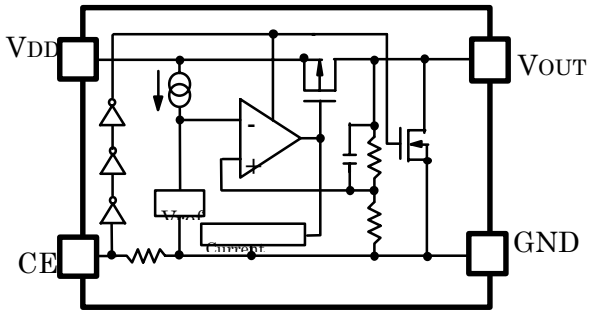
- Stable voltage reference.
- Power source for electrical appliances such as cameras, camcorders, mobile communication equipment.
- Power source for battery-powered equipment.

BLOCK DIAGRAMS

R1182xxx1B



R1182xxx1D



SELECTION GUIDE

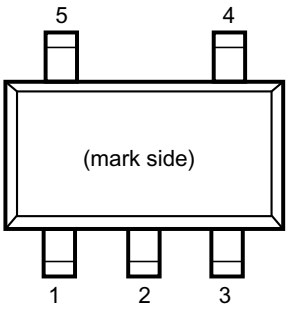
The output voltage, version, and the package type for the ICs can be selected at the user's request.
The selection can be made with designating the part number as shown below:

R1182x<u>xx</u>1x-<u>TR</u> ←Part Number
↑ ↑ ↑ ↑
a b c d

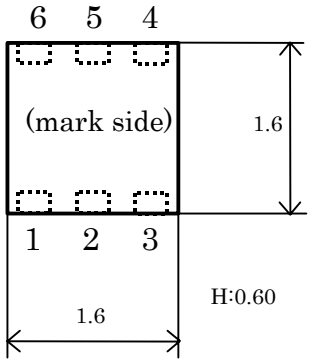
Code	Contents
a	Designation of Package Type : N: SOT-23-5 (Mini mold) K: PLP1616-6
b	Setting Output Voltage (V_{OUT}) : Stepwise setting with a step of 0.1V in the range of 1.2V to 4.0V is possible. Exceptions 2.85V output type: R1182X281X5, 1.85V output type: R1182X181X5, 1.25V output type: R1182X121X5
c	Designation of Active Type : B : active high type D : active high with auto discharge function at off mode
d	Designation of Taping Type : Ex. TR (refer to Taping Specifications; TR type is the standard direction.)

PIN CONFIGURATION

● **SOT-23-5**



● **PLP1616-6**



PIN DESCRIPTIONS

- **SOT-23-5 (R1182Nxx1B/D)**

Pin No	Symbol	Pin Description
1	GND	Ground Pin
2	V_{DD}	Input Pin
3	V_{OUT}	Output pin
4	NC	No Connection
5	CE	Chip Enable Pin

- **PLP1616**-6 **(R1180Kxx1B/D)**

Pin No	Symbol	Pin Description
1	V_{DD}	Input Pin
2	GND	Ground Pin
3	CE	Chip Enable Pin
4	NC	No Connection
5	NC	No Connection
6	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 ~ V_{IN}+0.3	V
I_{OUT}	Output Current	200	mA
P_D	Power Dissipation (SOT23-5)	250	mW
	Power Dissipation(PLP1616-6)	T.B.D.	
Topt	Operating Temperature Range	–40 ~ 85	°C
Tstg	Storage Temperature Range	–55 ~ 125	°C

ELECTRICAL CHARACTERISTICS

- **R1182xxx1B/R1182xxx1D**

Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	V_{IN} = Set V_{OUT}+1V I_{OUT}=1mA	V_{OUT} ×0.99 (-15mV)*1)		V_{OUT} ×1.01 (+15mV)*1)	V
I_{OUT}	Output Current	V_{IN} - V_{OUT} = 1.0V	150			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	V_{IN} = Set V_{OUT}+1V 1mA ≦ I_{OUT} ≦ 150mA		30	80	mV
V_{DIF}	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I_{SS}	Supply Current	V_{IN} = Set V_{OUT}+1V, I_{OUT}=0mA		3.0	7.0	µA
Istandby	Supply Current (Standby)	V_{IN} = Set V_{OUT}+1V V_{CE} = GND		0.1	1.0	µA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	Set V_{OUT}+0.5V ≦ V_{IN} ≦ 6.0V I_{OUT} = 30mA		0.1	0.3	%/V
V_{IN}	Input Voltage		1.5		6.0	V
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	I_{OUT} = 30mA –40°C ≦ Topt ≦ 85°C		±100		ppm /°C
I_{LIM}	Short Current Limit	V_{OUT} = 0V		50		mA
I_{PD}	CE Pull-down Constant Current		0.05	0.30	0.55	µA
V_{CEH}	CE Input Voltage “H”		1.0		6.0	V
V_{CEL}	CE Input Voltage “L”		0.0		0.4	V
en	Output Noise	BW=10Hz to 100kHz		30		µVrms
Rn	Nch Tr. On resistance for auto discharge function*2)	CE=”L”		50		Ω

*1) V_{OUT}≤1.5V, the tolerance is ±15mV.
*2) Only applied to D version.

- **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	0.60	0.82
1.3 ≦ V_{OUT} < 1.4		0.53	0.75
1.4 ≦ V_{OUT} < 1.5		0.46	0.67
1.5 ≦ V_{OUT} < 2.0		0.43	0.60
2.0 ≦ V_{OUT} < 2.8		0.31	0.40
2.8 ≦ V_{OUT} < 4.0		0.23	0.29
2.1 ≦ V_{OUT} < 2.8		0.19	0.23
V_{OUT}=4.0		0.25	0.40

External Components and Technical Notes

Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, be sure to use a 0.1μF or more capacitor CL (Ceramic type).

If a tantalum capacitor is used, and its ESR (Equivalent Series Resistance) of CL is large, the loop oscillation may result. Because of this, select CL carefully considering its frequency characteristics.

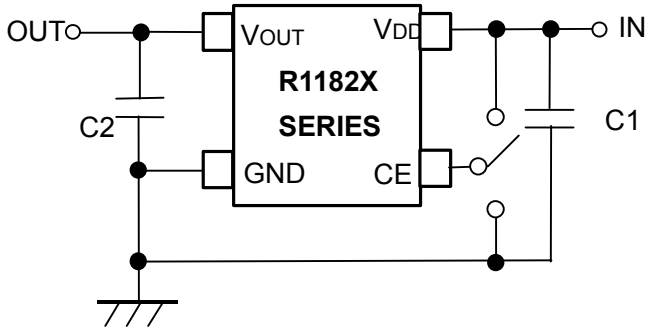
Mounting on Board

Make V_{DD} and GND lines sufficient. If their impedance is high, pick-up the noise or unstable operation may result.

Connect the capacitor with a 0.1μF or more between V_{DD} and GND as close as possible.

Set external components, especially the output capacitor, as close as possible to the ICs and make wiring as short as possible. (Refer to the typical application)

TYPICAL APPLICATION



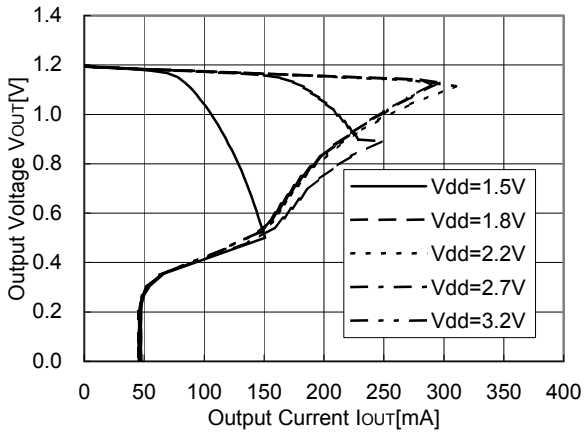
(External components example; Output capacitor: Ceramic type
Input capacitor: Ceramic type
Output Capacitor: 0.1μF: Kyocera CM05B104K06AB
Murata GRM155B31C104KA87B
1.0μF: Kyocera CM05X5R105K06AB

: TDK C1005JB0J105K
: Murata GRM155B30J105KE18B

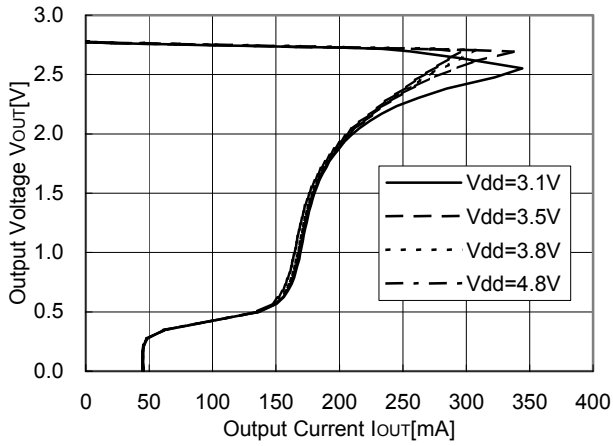
TYPICAL CHARACTERISTICS

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

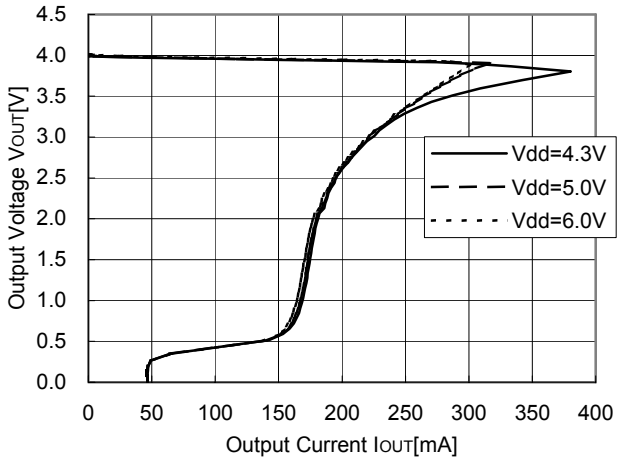
R1182x121x



R1182x281x

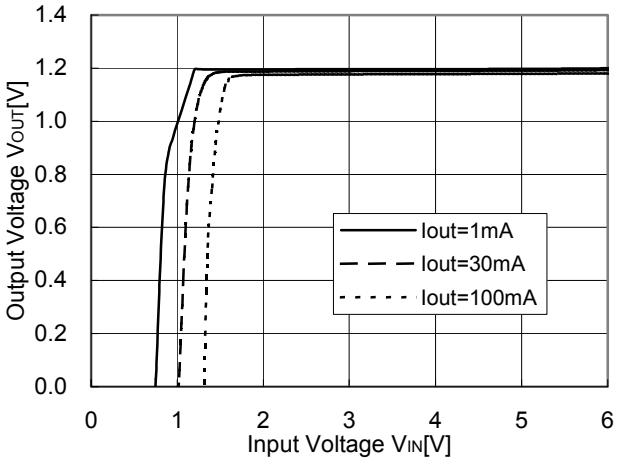


R1182x401x

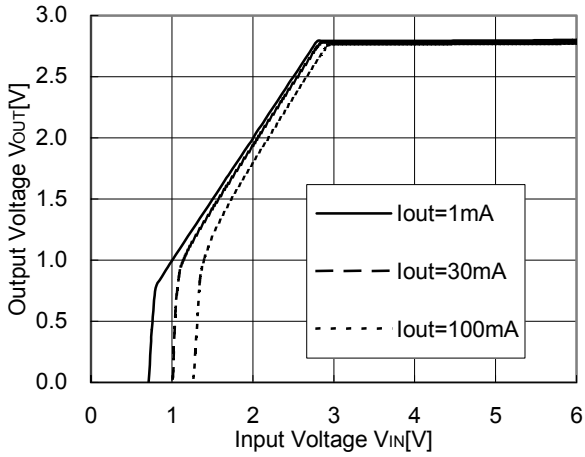


2) Output Voltage vs. Input Voltage (Topt=25°C)

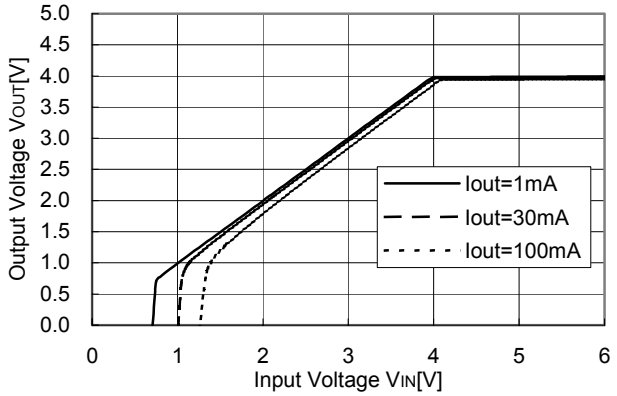
R1182x121x



R1182x281x

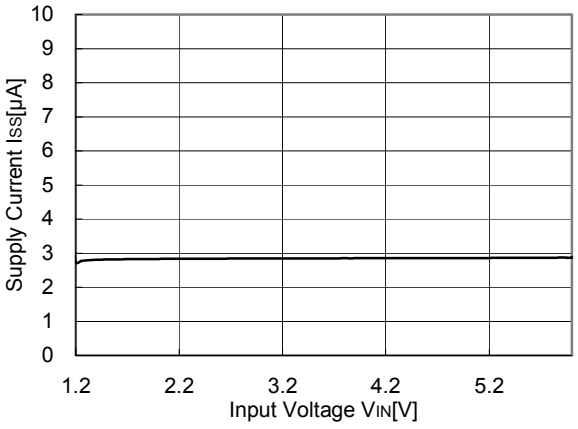


R1182x401x

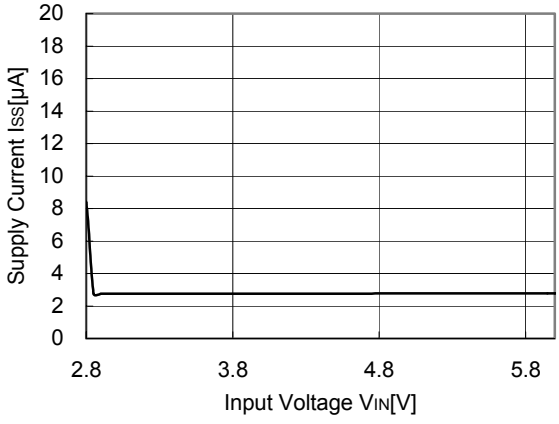


3) Supply Current vs. Input Voltage

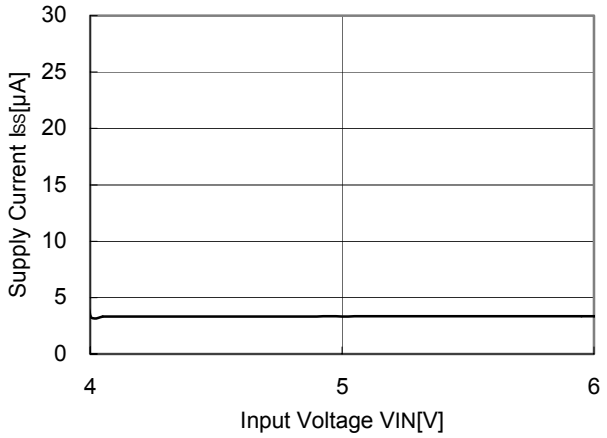
R1182x121x



R1182x281x

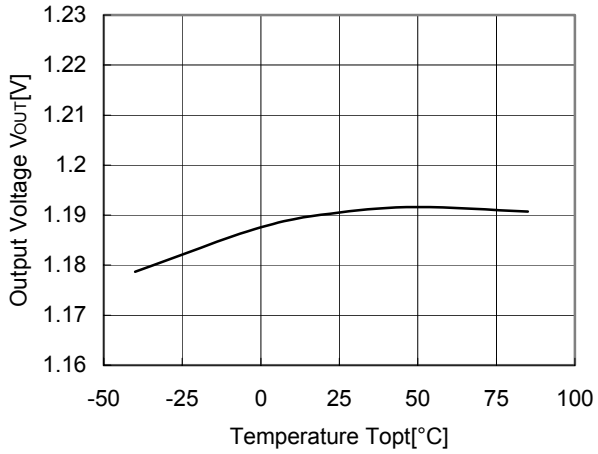


R1182x401x

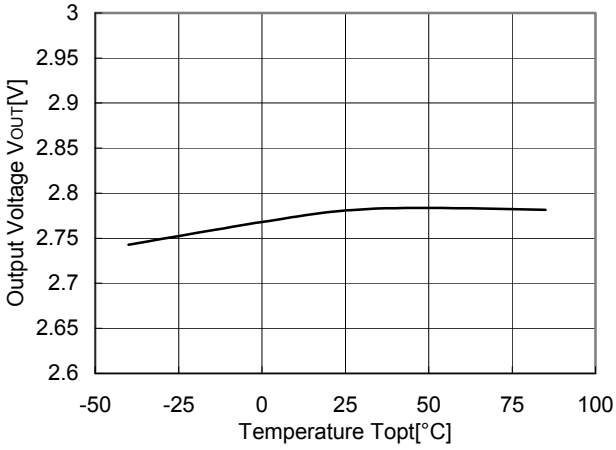


4) Output Voltage vs. Temperature (I_{OUT}=30mA)

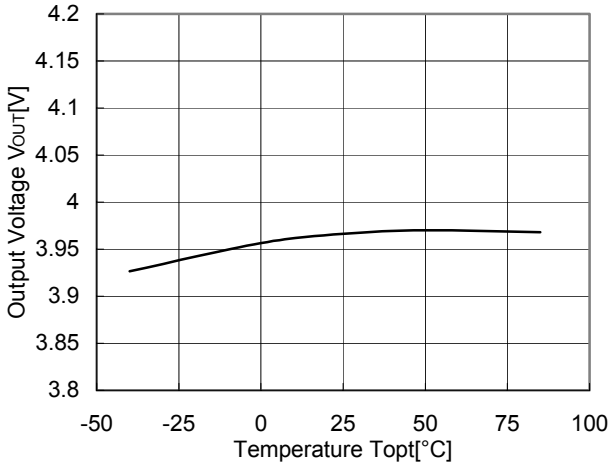
R1182x121x (V_{IN}=2.2V)



R1182x281x (V_{IN}=3.8V)

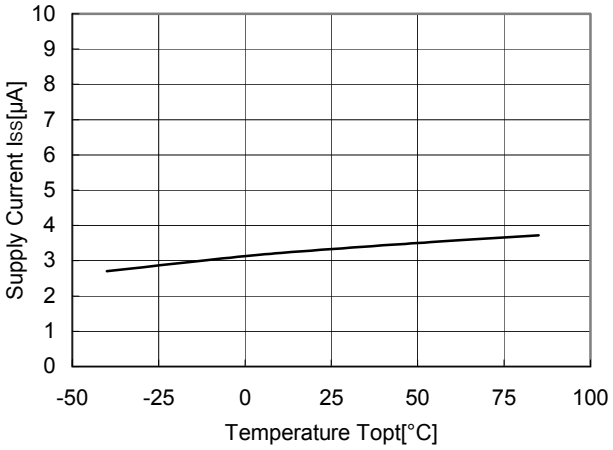


R1182x401x (V_{IN}=5V)

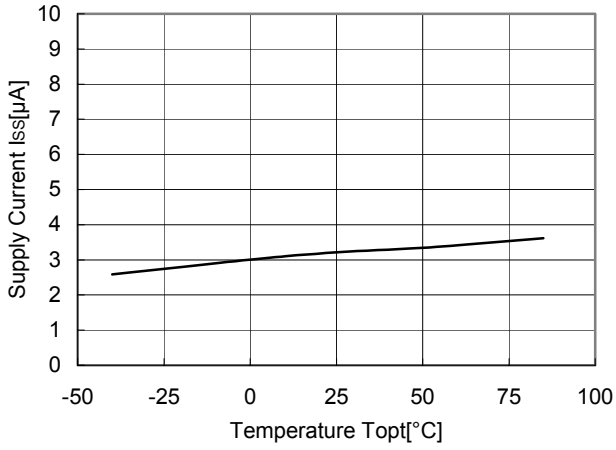


5) Supply Current vs. Temperature (Topt=25°C)

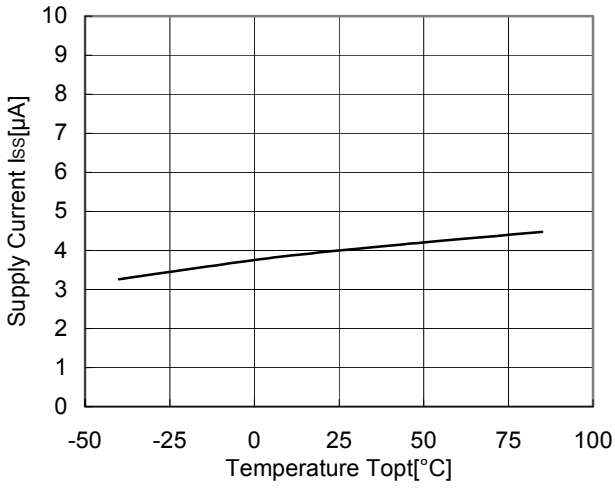
R1182x121x(V_{IN}=2.2V)



R1182x281x(V_{IN}=3.8V)

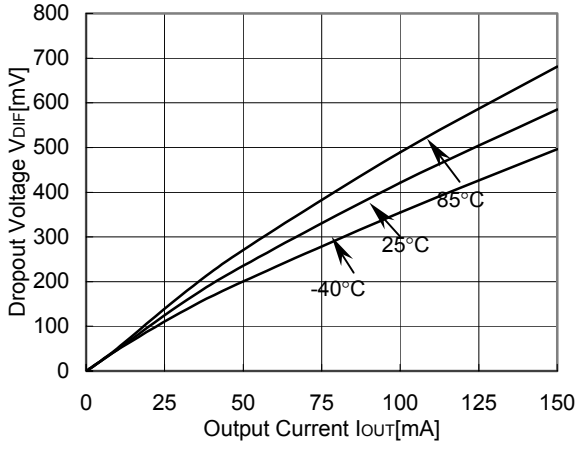


R1182x401x(V_{IN}=5V)

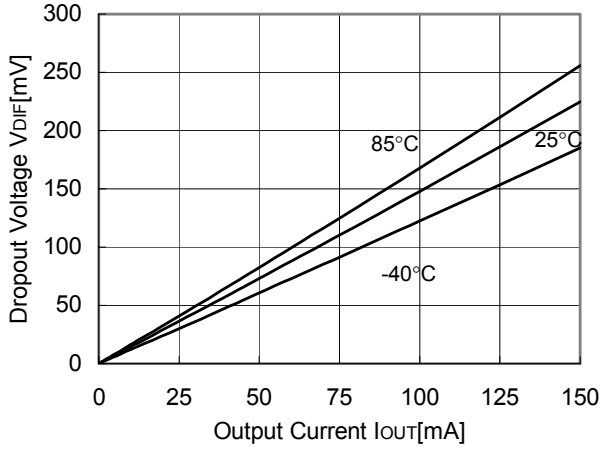


6) Dropout Voltage vs. Output Current

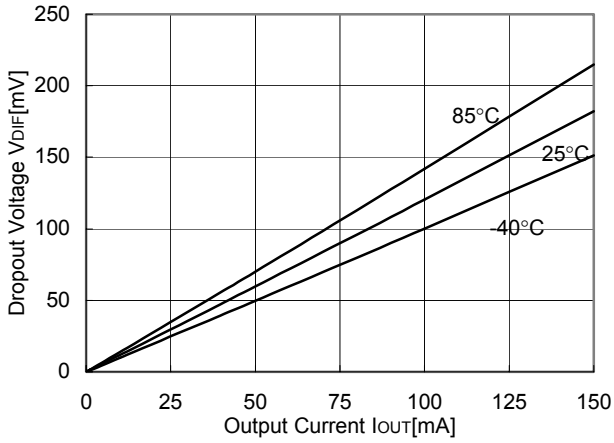
R1182x121x



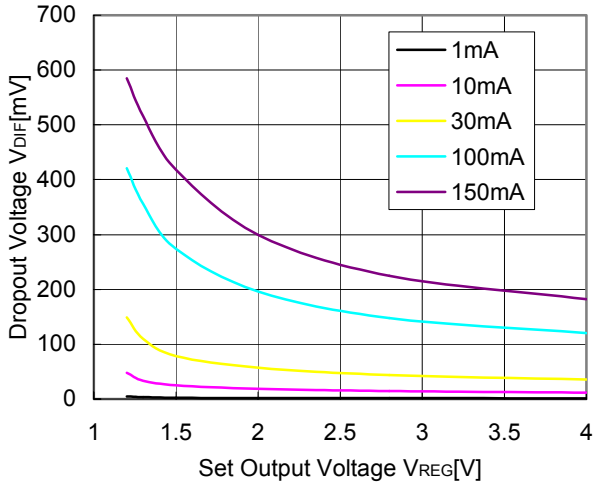
R1182x281x



R1182x401x

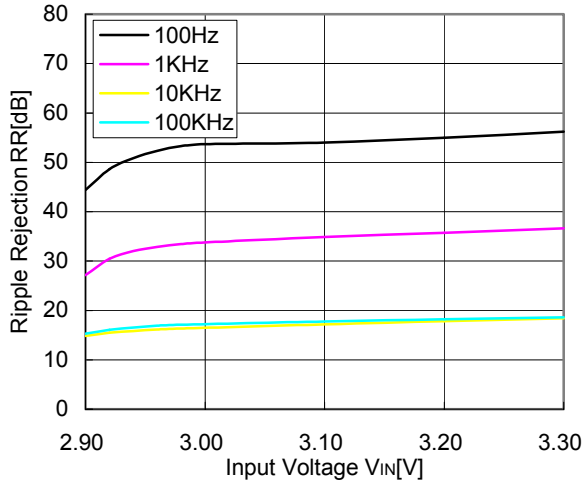


7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)

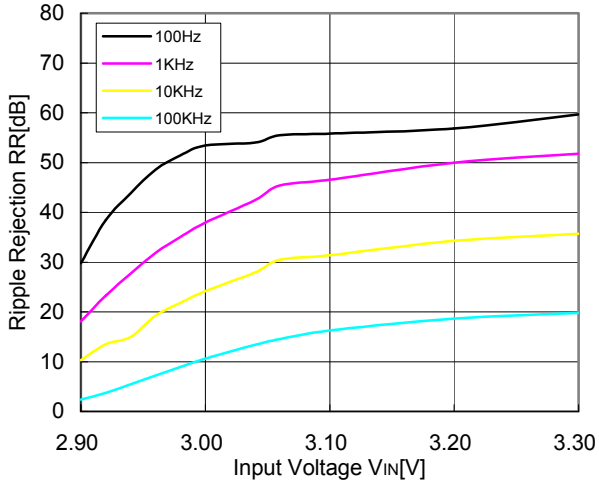


8) Ripple Rejection vs. Input Bias Voltage (C_{IN}=none, R1182x281x Vripple=0.2Vp-p

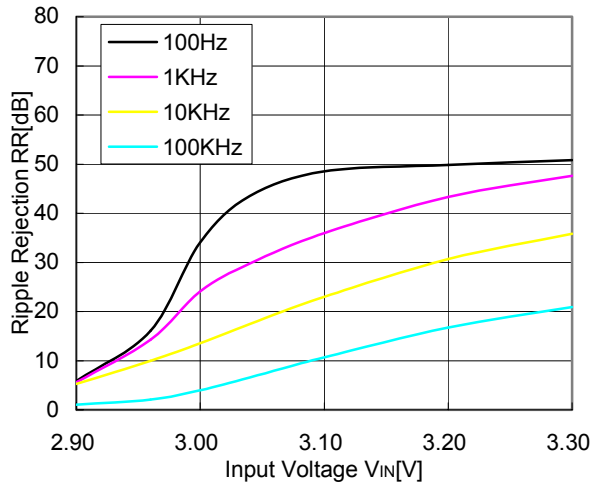
I_{OUT}=1mA



I_{OUT}=10mA

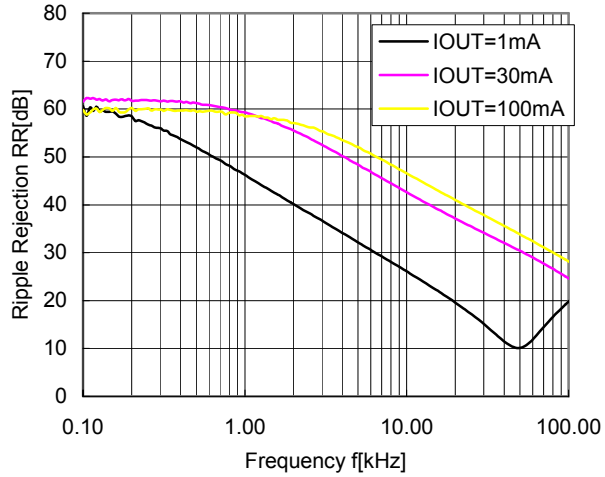


I_{OUT}=100mA

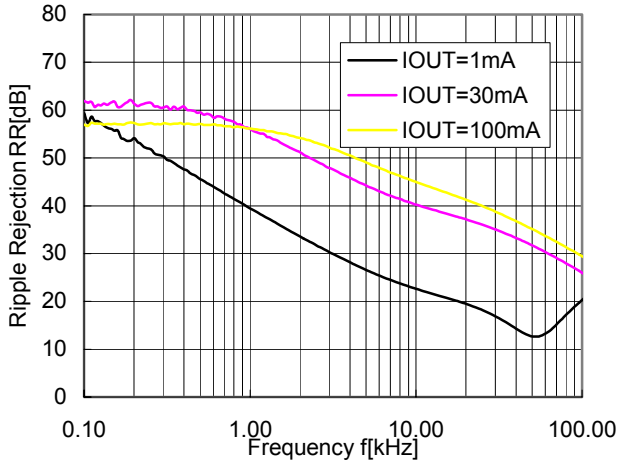


9) Ripple Rejection vs. Frequency (Topt=25°C, C_{IN}=none, C_{OUT}=ceramic0.1µF)

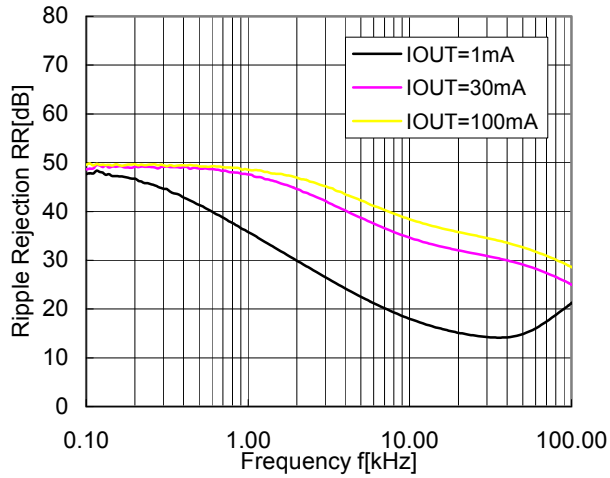
R1182X121X V_{IN}=2.2V_{DC}+0.2Vp-p



R1182X281X V_{IN}=3.8V_{DC}+0.2Vp-p

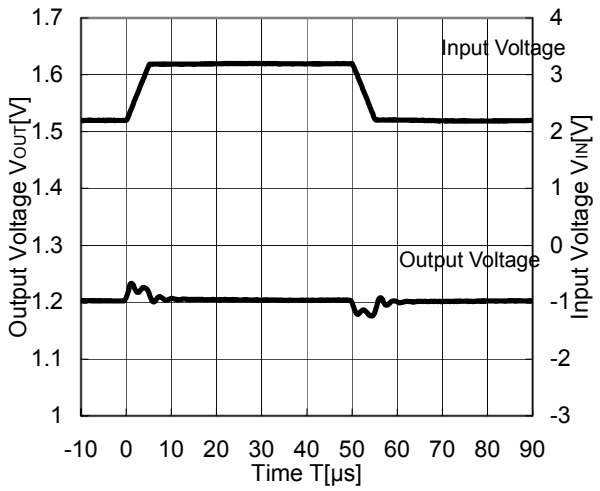


R1182X401X V_{IN}=5.0V_{DC}+0.2Vp-p

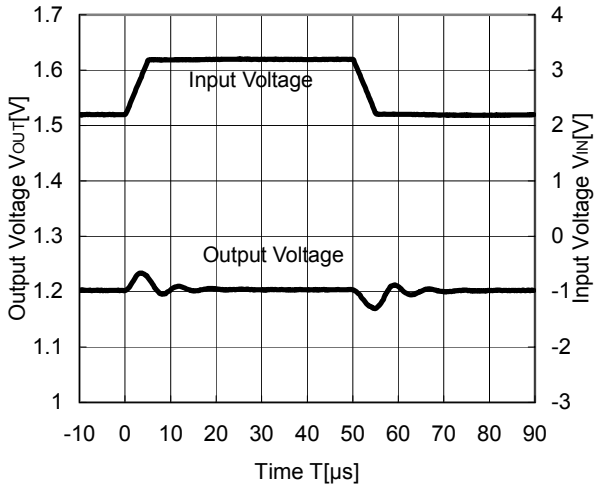


10) Input Transient Response (C_{IN}=none, tr=tf=5µs, I_{OUT}=30mA)

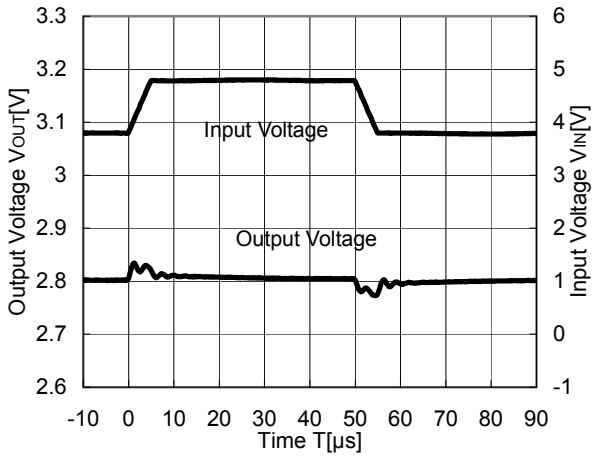
R1182X121X C_{OUT}=0.1µF



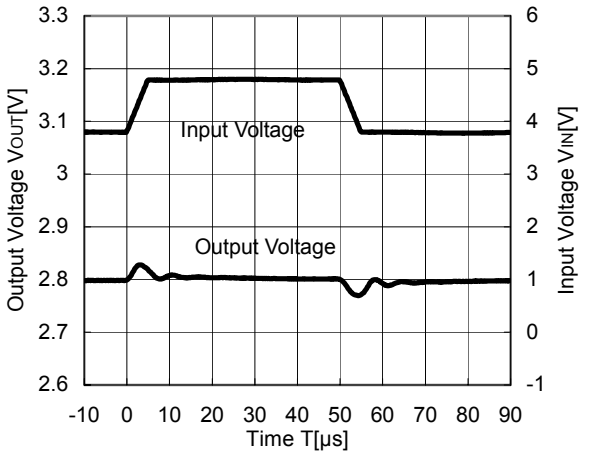
R1182X121X C_{OUT}=1µF



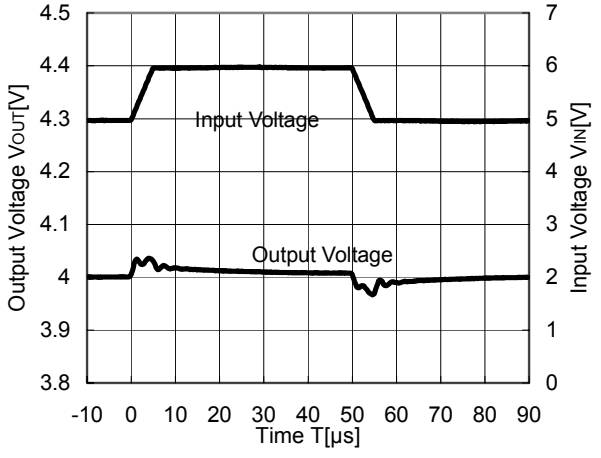
R1182X281x C_{OUT}=Ceramic 0.1µF



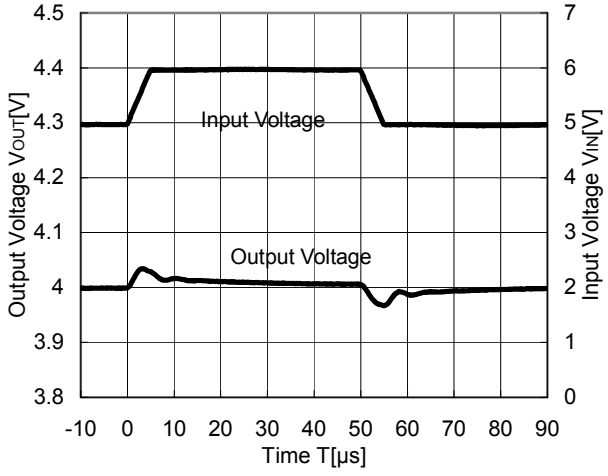
R1182X281X C_{OUT}=Ceramic 1.0µF



R1182X401x C_{OUT}=Ceramic 0.1µF

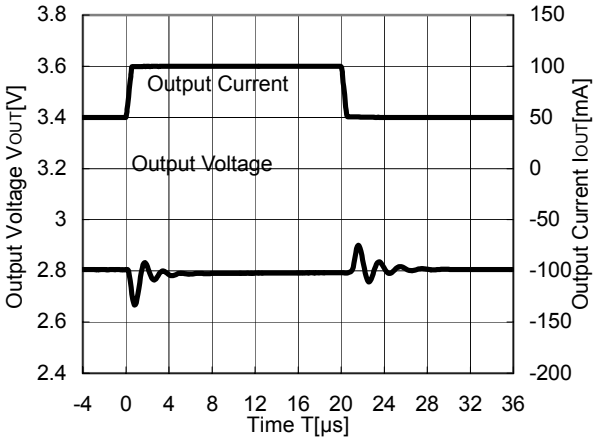


R1182X401x C_{OUT}=Ceramic 1.0µF

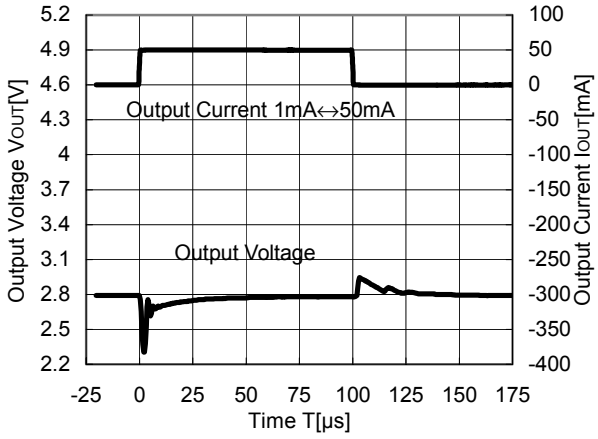


11) Load Transient Response (tr=tf=0.5µs, CIN=Ceramic 0.1µF)

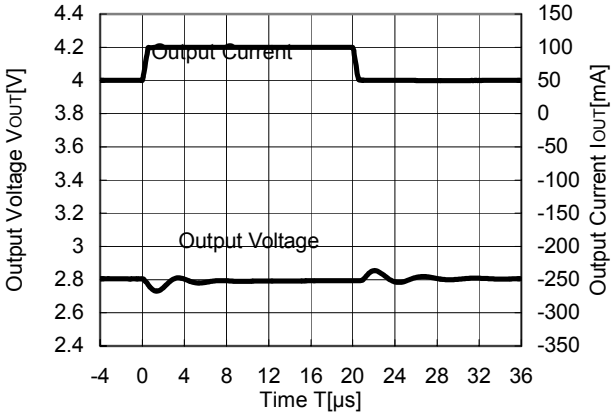
R1182X281X VIN=3.8V COUT=0.1µF



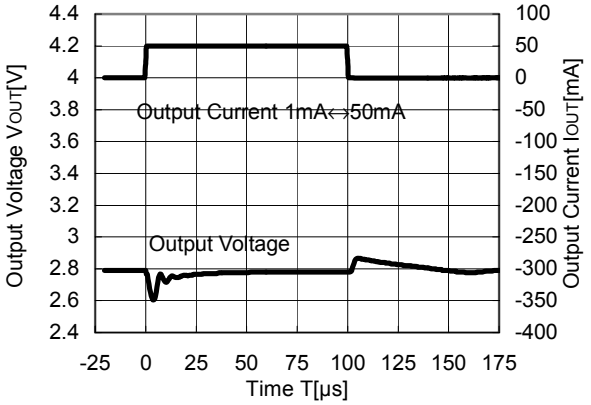
R1182X281X VIN=3.8V COUT=0.1µF



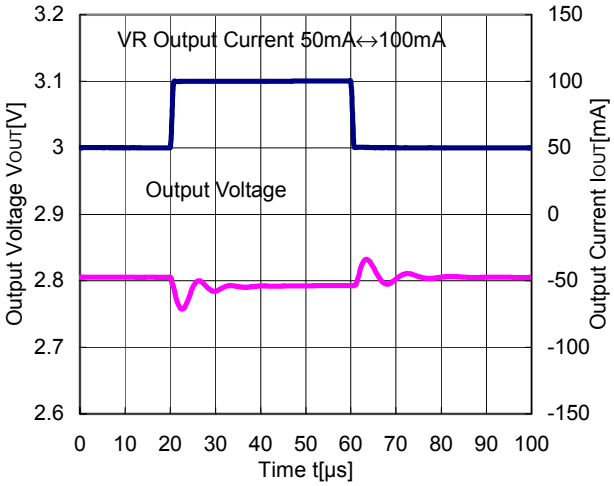
R1182X281X VIN=3.8V COUT=1µF



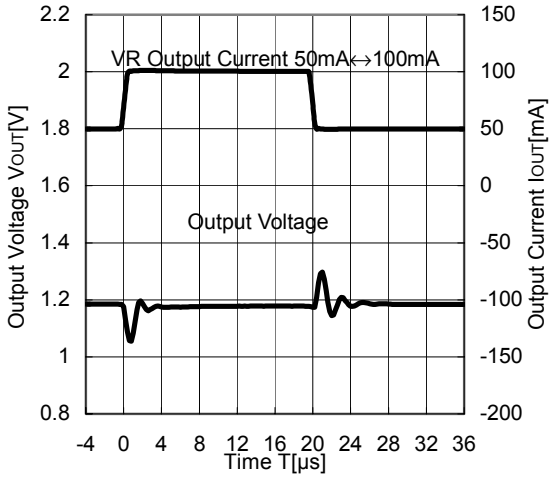
R1182X281X VIN=3.8V COUT=1µF



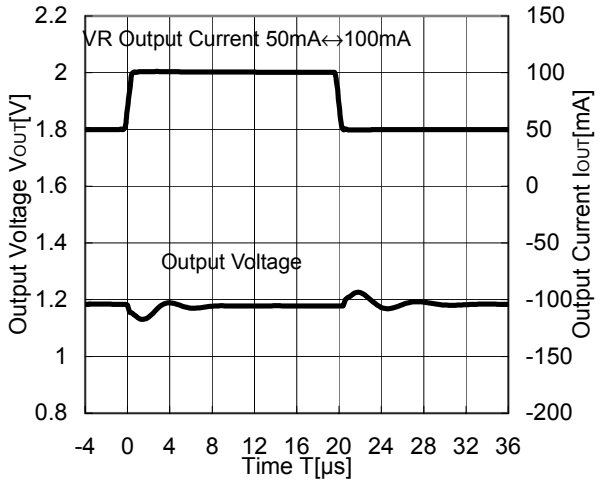
R1182X281X VIN=3.8V COUT=2.2µF



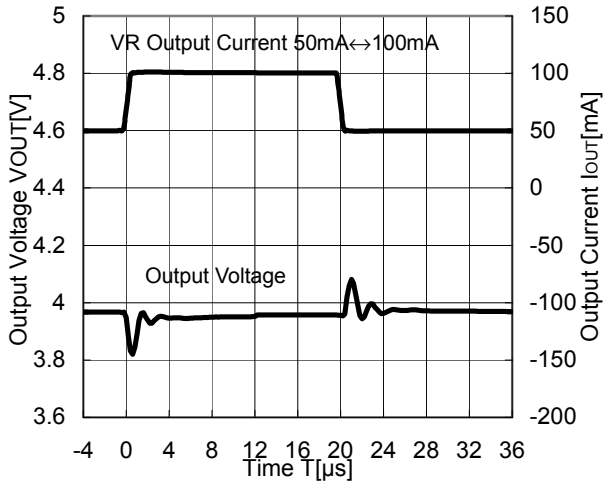
R1182X121X VIN=2.2V, COUT=0.1µF



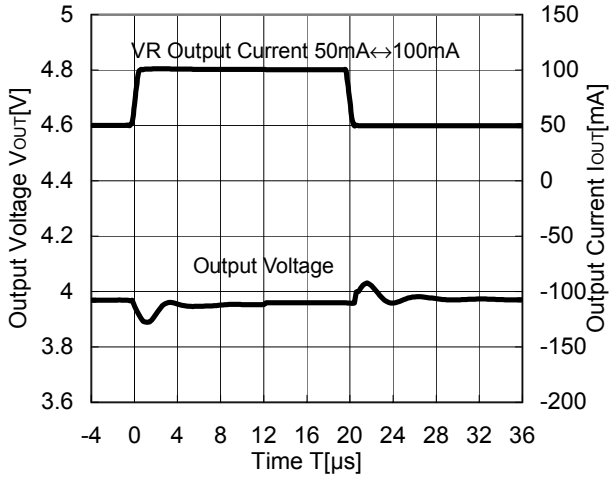
R1182X121X V_{IN}=2.2V, C_{OUT}=1µF



R1182X401X V_{IN}=5.0V, C_{OUT}=0.1µF

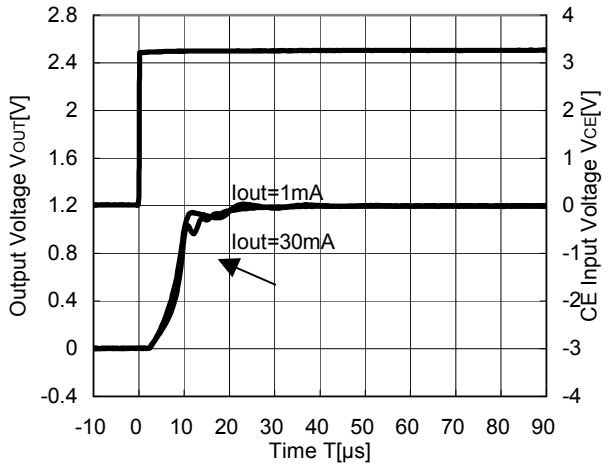


R1182X401X V_{IN}=5.0V, C_{OUT}=1µF

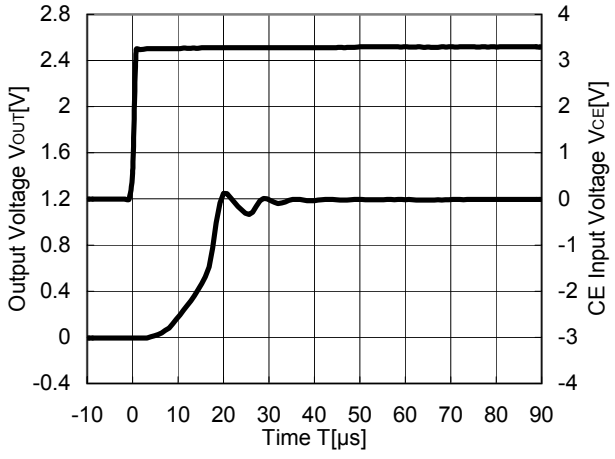


12) Turn on speed by CE pin

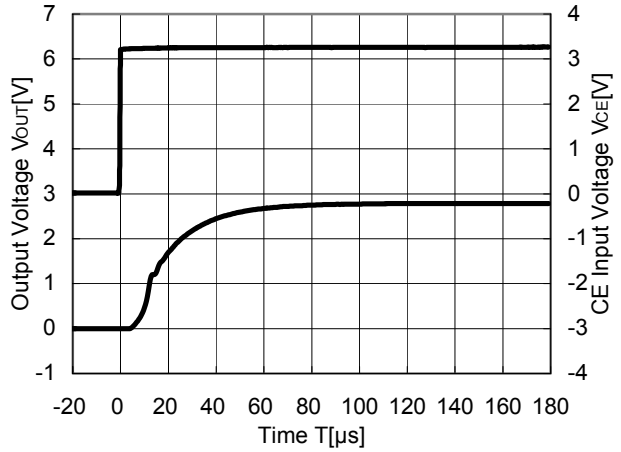
V_{OUT}=1.2V C_{OUT}=0.1µF V_{IN}=3.3V



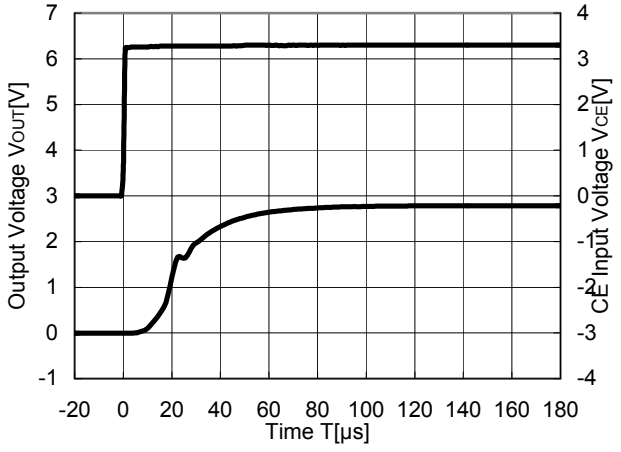
V_{OUT}=1.2V C_{OUT}=1µF V_{IN}=3.3V I_{OUT}=30mA



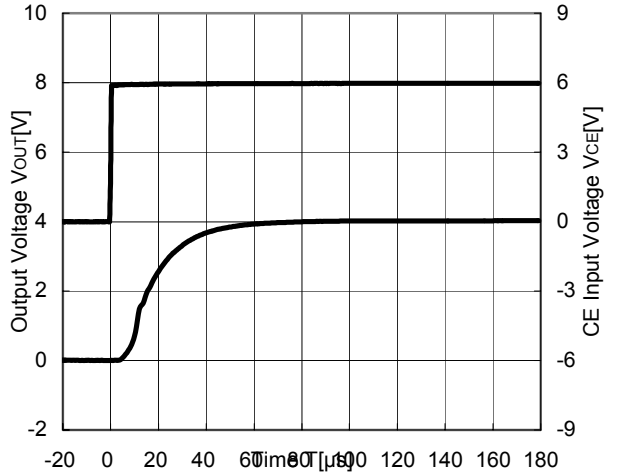
VOUT=2.8V COUT=0.1µF VIN=3.3V IOUT=30mA



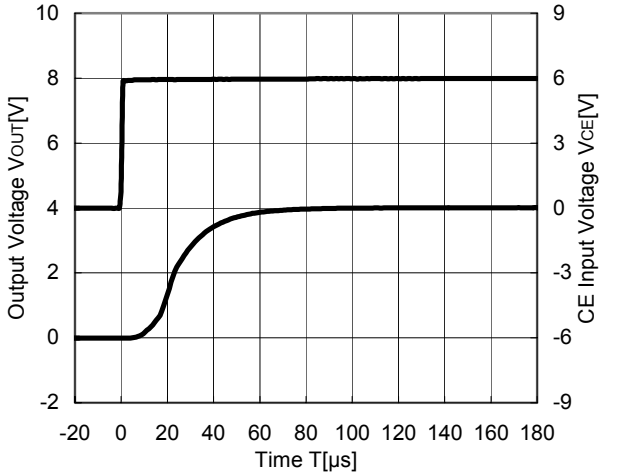
VOUT=2.8V COUT=1µF VIN=3.3V IOUT=30mA



VOUT=4.0V COUT=0.1µF VIN=6.0V IOUT=30mA

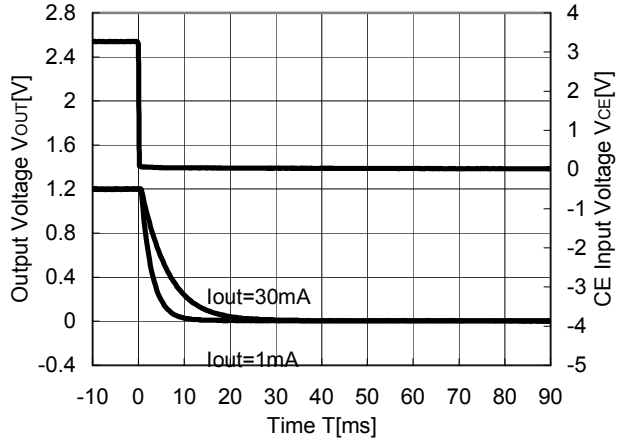


VOUT=4.0V COUT=1µF VIN=6.0V IOUT=30mA

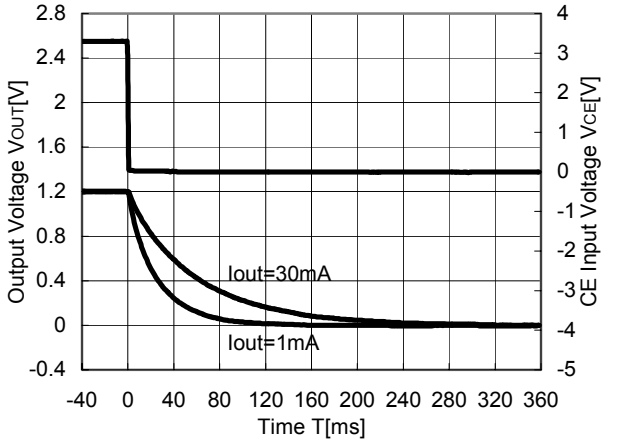


13) Turn-off Speed by CE pin (D version)

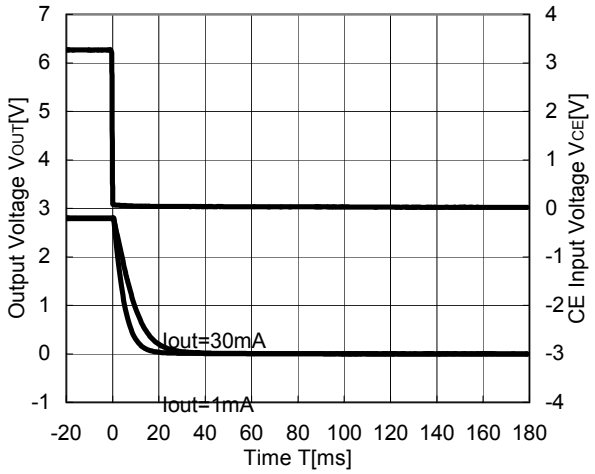
VOUT=1.2V COUT=0.1µF VIN=3.3V



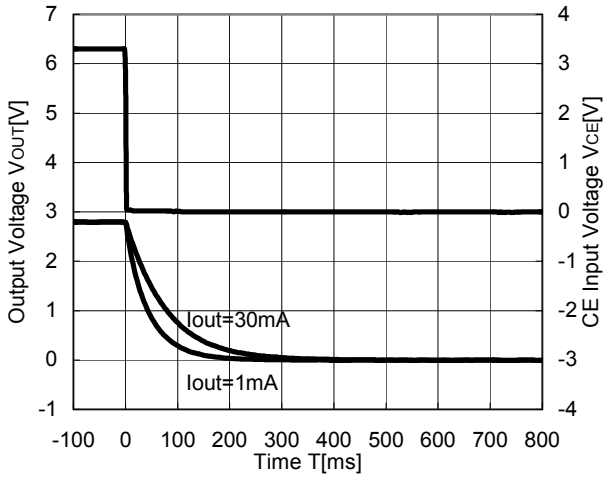
VOUT=1.2V COUT=1µF VIN=3.3V



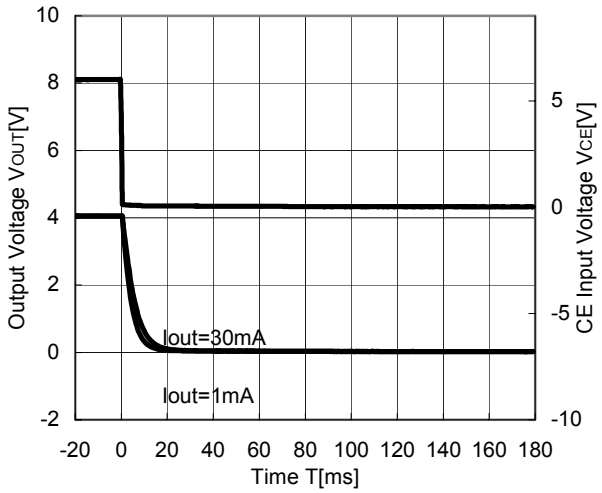
VOUT=2.8V COUT=0.1µF VIN=3.3V



VOUT=2.8V COUT=1µF VIN=3.3V



VOUT=4.0V COUT=0.1µF VIN=6.0V



VOUT=4.0V COUT=1µF VIN=6.0V