150mA Dual LDO REGULATOR

NO.EA-127-071112

OUTLINE

The R5325x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current (Typ. 3.0μA), low dropout, and fast transient response. Each of these voltage regulator ICs consists of a voltage reference unit, an error amplifier, resistors for setting output voltage, a current limit circuit, and a chip enable circuit.

These ICs perform with low dropout voltage due to built-in transistor with low ON resistance, and a chip enable function prolongs the battery life of each system. The line transient response and load transient response of the R5325x Series are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment.

The supply current at no load of R5325x Series is remarkably reduced compared with R5323x Series. The mode change signal to reduce the supply current is not necessary.

The output voltage of these ICs is internally fixed with high accuracy (±1.0%). Since the packages for these ICs are SOT-23-6 and DFN(PLP)1820-6 package, dual LDO regulators are included in each, high density mounting of the ICs on boards is possible.

FEATURES

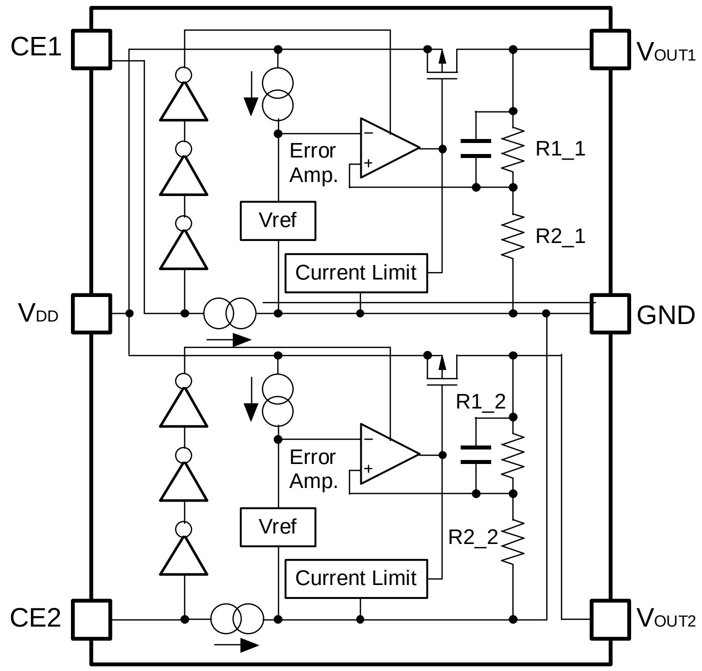
- Input Voltage .... 1.5V to 6.0V
- Output Voltage .... 1.2V to 4.0V
- Output Voltage Accuracy... ±1.0%
- Supply Current .... Typ. 3.0μA (VR1, VR2)
- Standby Current .... Typ. 0.1μA (VR1, VR2)
- Dropout Voltage .... Typ. 0.2V (I_{OUT}=150mA ,V_{OUT}=3.0V)
- Ripple Rejection.. Typ. 55dB (f=1kHz)
- Built-in fold-back protection circuit .... Typ. 50mA (Current at short mode)
- Temperature-Drift Coefficient of Output Voltage .... Typ. ±100ppm/°C
- Line Regulation Typ.0.1%/V
- Built-in chip enable circuit (active “H”)
- Fast Transient Response Time from large load current to small load current. (50% less than R5323x)
- Packages .... SOT-23-6, DFN(PLP)1820-6
- Ceramic Capacitor is recommended. (0.1μF or more)

APPLICATIONS

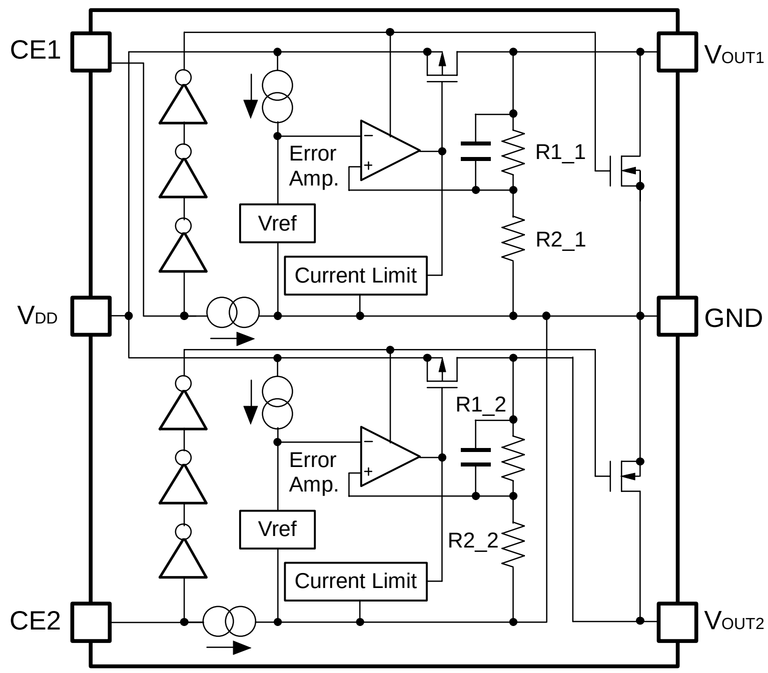
- Power source for handheld communication equipment.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

BLOCK DIAGRAMS

R5325xxxxA



R5325xxxxB



SELECTION GUIDE

The output voltage, auto discharge function*, 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;

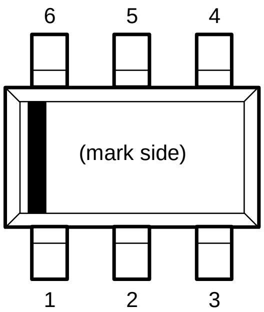
R5325xxxxx-xx-x ←Part Number
↑ ↑ ↑ ↑ ↑
a b c d e

Code	Contents
a	Designation of Package Type: N: SOT-23-6 K: DFN(PLP)1820-6
b	Setting combination of 2ch Output Voltage (V_{OUT}) : Serial Number for Voltage Setting, Stepwise setting with a step of 0.1V in the range of 1.2V to 4.0V is possible for each channel.
c	Designation of Mask Option: A version: without auto discharge function* at OFF state. B version: with auto discharge function* at OFF state.
d	Designation of Taping Type: Ex. TR (refer to Taping Specifications; TR type is the standard direction.)
e	Designation of composition of plating: –F : Lead free plating (SOT-23-6) None : Au plating (DFN(PLP)1820-6)

*) 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.

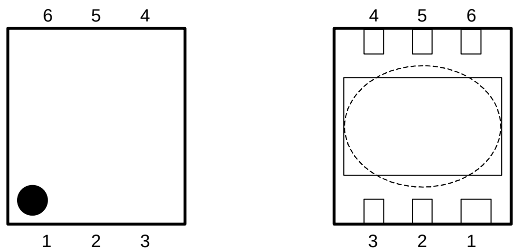
PIN CONFIGURATION

● SOT-23-6



● DFN(PLP)1820-6

Top View Bottom View



PIN DESCRIPTIONS

● **SOT-23-6**

Pin No.	Symbol	Description
1	V_{OUT1}	Output Pin 1
2	V_{DD}	Input Pin
3	V_{OUT2}	Output Pin 2
4	CE2	Chip Enable Pin 2
5	GND	Ground Pin
6	CE1	Chip Enable Pin 1

● **DFN(PLP)1820-6**

Pin No.	Symbol	Description
1	V_{OUT2}	Output Pin 2
2	V_{DD}	Input Pin
3	V_{OUT1}	Output Pin 1
4	CE1	Chip Enable Pin 1
5	GND	Ground Pin
6	CE2	Chip Enable Pin 2

∗ Tab in the ( ) parts have GND level.
(They are connected to the back side of this IC.)
Do not connect to other wires or land patterns.

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_{OUT1}, I_{OUT2}	Output Current	200	mA
P_D	Power Dissipation (SOT-23-6) *	420	mW
	Power Dissipation (DFN(PLP)1820-6) *	880	
Topt	Operating Temperature Range	–40 to 85	°C
Tstg	Storage Temperature Range	–55 to 125	°C

*) 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.

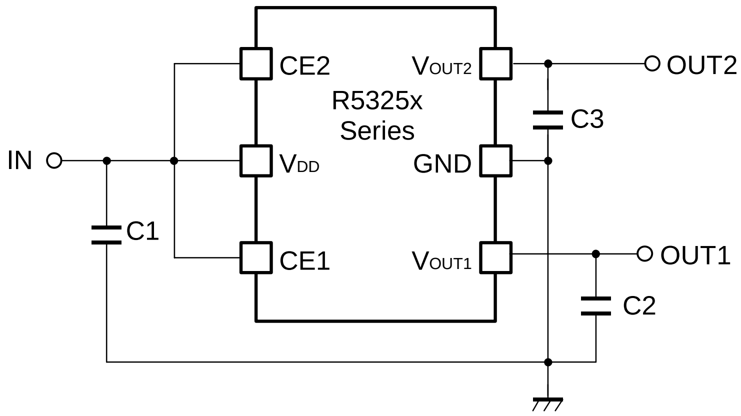
ELECTRICAL CHARACTERISTICS

- **R5325xxxxA/B**

Topt=25°C

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output voltage	V_{IN}=Set V_{OUT}+1V I_{OUT}=1mA	$V_{OUT} \geqq 1.5V$	×0.99		×1.01	V
			$V_{OUT} < 1.5V$	−15mV		+15mV	
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 $1mA \leqq I_{OUT} \leqq 150mA$			30	80	mV
V_{DIF}	Dropout Voltage	I_{OUT}=150mA	$1.2V \leqq V_{OUT} < 1.3V$		0.55	0.85	V
			$1.3V \leqq V_{OUT} < 1.4V$		0.48	0.74	
			$1.4V \leqq V_{OUT} < 1.5V$		0.43	0.68	
			$1.5V \leqq V_{OUT} < 2.0V$		0.40	0.59	
			$2.0V \leqq V_{OUT} < 2.8V$		0.27	0.39	
			$2.8V \leqq V_{OUT} < 4.0V$		0.21	0.28	
			$V_{OUT} = 4.0V$		0.17	0.23	
I_{SS}	Supply Current	V_{IN}=Set V_{OUT}+1V, I_{OUT}=0mA			3	7	μA
$I_{standby}$	Standby Current	V_{IN}=6V V_{CE}=GND			0.1	1.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line regulation	Set $V_{OUT}+0.5V \leqq V_{IN} \leqq 6.0V$ I_{OUT}=30mA			0.1	0.3	%/V
RR	Ripple Rejection	f=1kHz Ripple 0.5Vp-p $V_{IN}-V_{OUT}$=1.0V, I_{OUT}=30mA (In case that $V_{OUT} \leqq 1.7V$, V_{IN}=Set V_{OUT}+1.2V)			55		dB
V_{IN}	Input Voltage			1.5		6.0	V
$\Delta V_{OUT}/\Delta T_{opt}$	Output Voltage Temperature Coefficient	I_{OUT}=30mA $-40°C \leqq T_{opt} \leqq 85°C$			±100		ppm /°C
I_{lim}	Short Current Limit	V_{OUT}=0V			50		mA
I_{PD}	CE Pull-down Constant Current			0.15	0.30	0.55	μA
V_{CEH}	CE Input Voltage "H"			1.0		6.0	V
V_{CEL}	CE Input Voltage "L"			0		0.4	V
en	Output Noise	BW=10Hz to 100kHz			30		μVrms
R_{LOW}	Low Output Nch Tr. ON Resistance (of B version)	V_{CE}=0V			50		Ω

TYPICAL APPLIATION



(External Components)
Output Capacitor; Ceramic Type

0.1µF	Kyocera	CM05B104K06AB
	Murata	GRM155B31C104KA87B
1.0µF	Kyocera	CM05X5R105K06AB
	TDK	C1005JB0J105K
	Murata	GRM155B30J105KE18B

1.Mounting on PCB

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

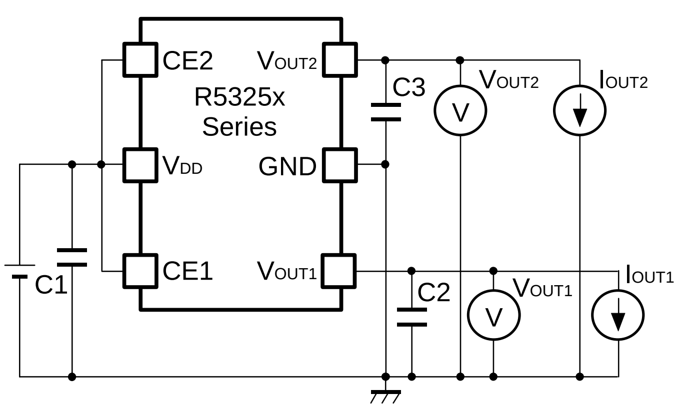
Set external components, especially the output capacitor, as close as possible to the ICs, and make wiring as short as possible.

2.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 and C3 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.)

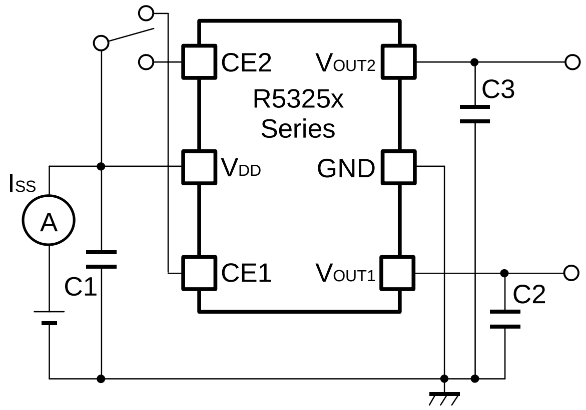
> If you use a tantalum type capacitor and ESR value of the capacitor is large, output might be unstable. Evaluate your circuit with considering frequency characteristics.
> Depending on the capacitor size, manufacturer, and part number, the bias characteristics and temperature characteristics are different. Evaluate the circuit with actual using capacitors.

TEST CIRCUIT



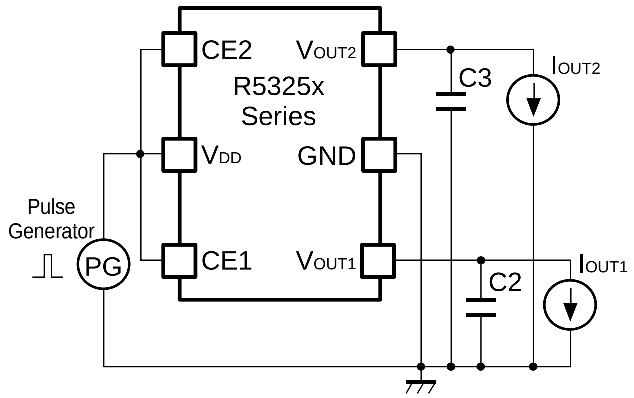
* C1=C2=C3=Ceramic 0.1µF

Fig.1 Standard test Circuit



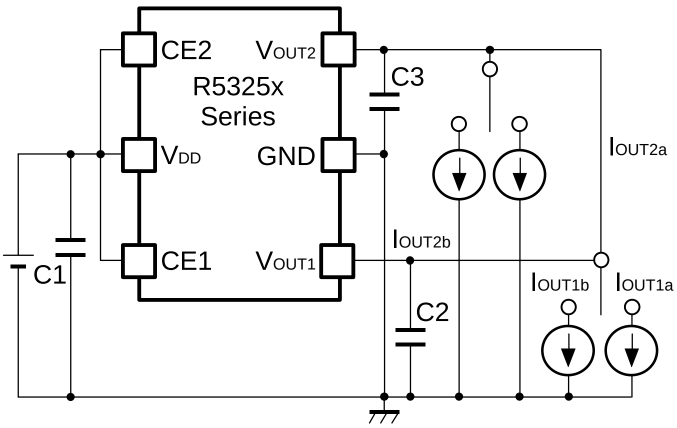
* C1=C2=C3=Ceramic 0.1µF

Fig.2 Supply Current Test Circuit



* C2=C3=Ceramic 0.1µF

Fig.3 Ripple Rejection, Line Transient Response Test Circuit



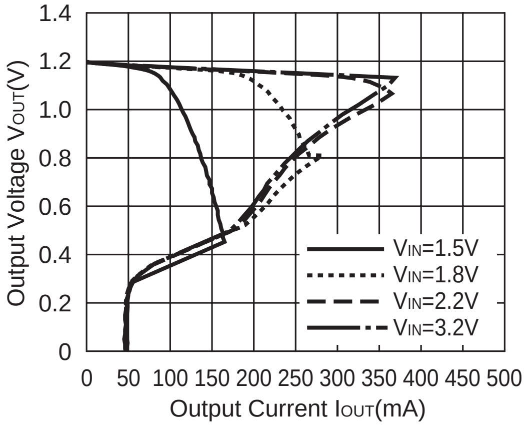
* C1=C2=C3=Ceramic 0.1µF

Fig.4 Load Transient Response Test Circuit

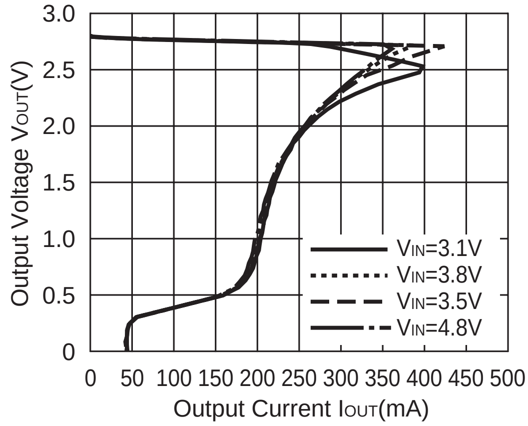
TYPICAL CHARACTERISTICS

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

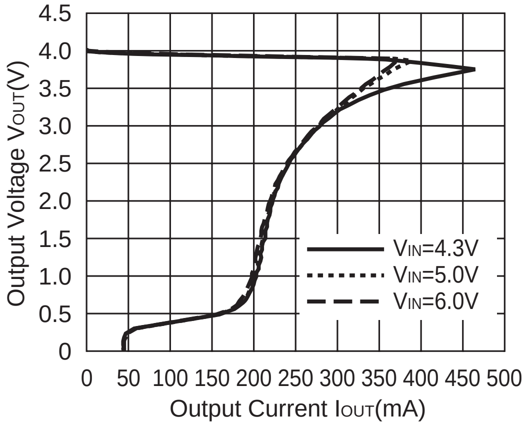
1.2V (VR1/VR2)



2.8V (VR1/VR2)

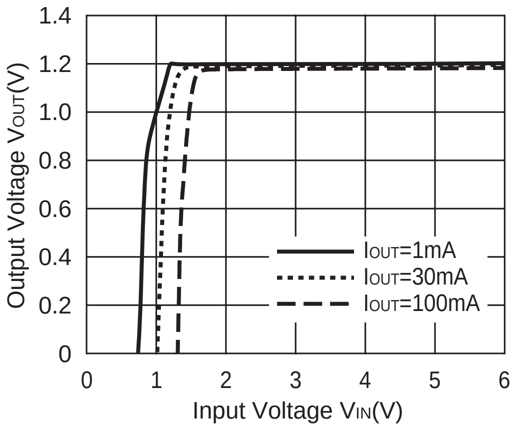


4.0V (VR1/VR2)

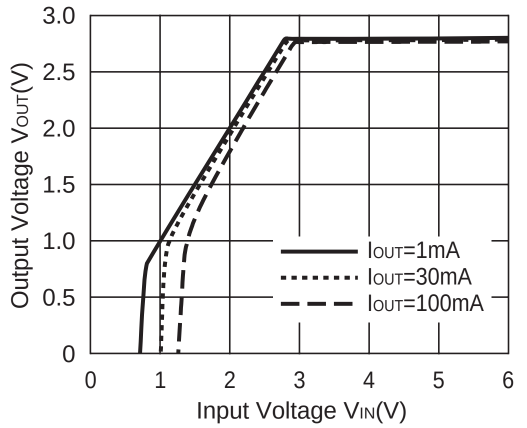


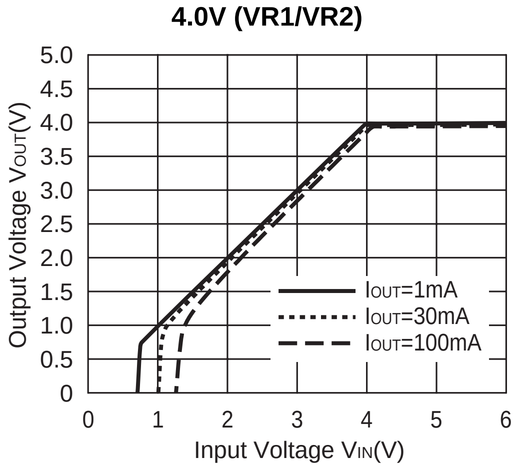
2) Output Voltage vs. Input Voltage (Topt=25°C)

1.2V (VR1/VR2)

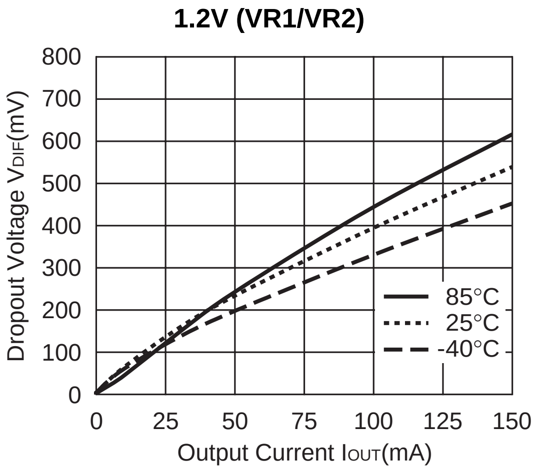


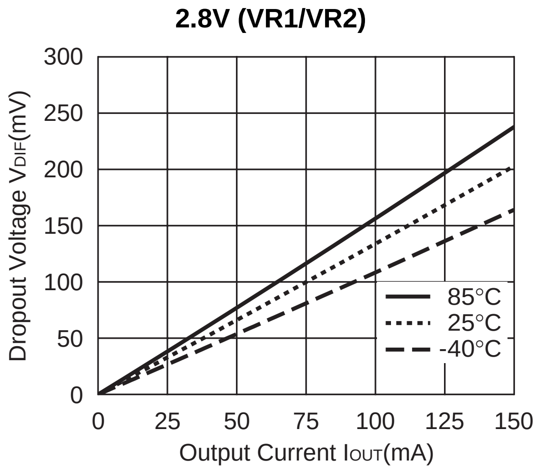
2.8V (VR1/VR2)

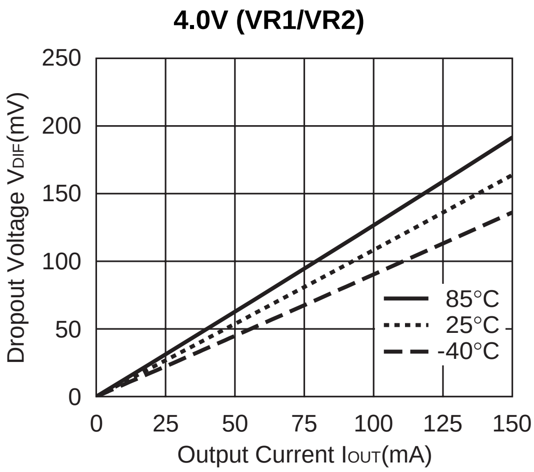




3) Dropout Voltage vs. Output Current

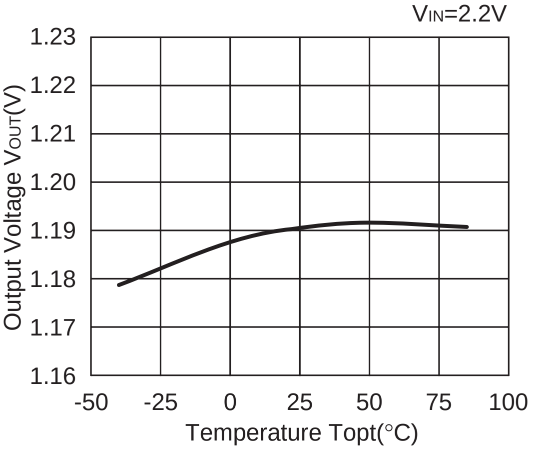




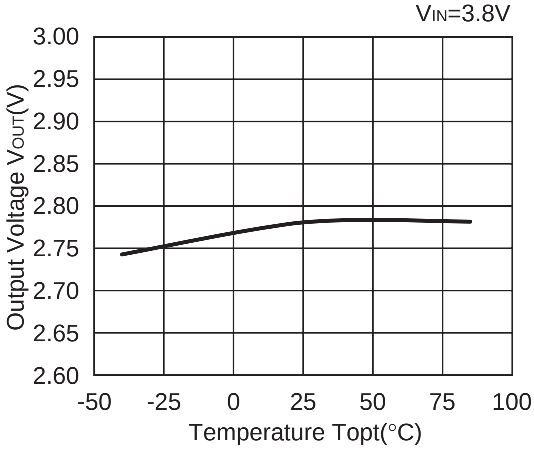


4) Output Voltage vs. Temperature (I_{OUT}=30mA)

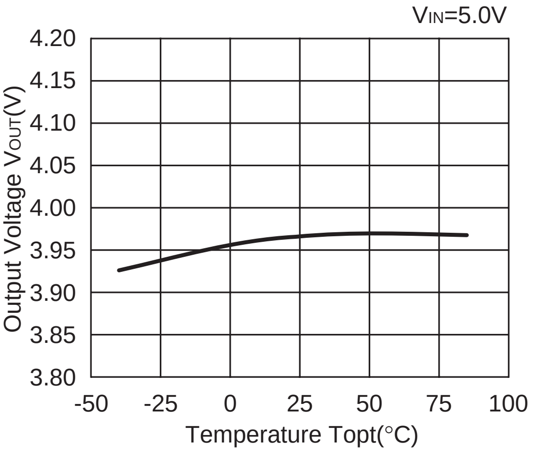
1.2V (VR1/VR2)



2.8V (VR1/VR2)

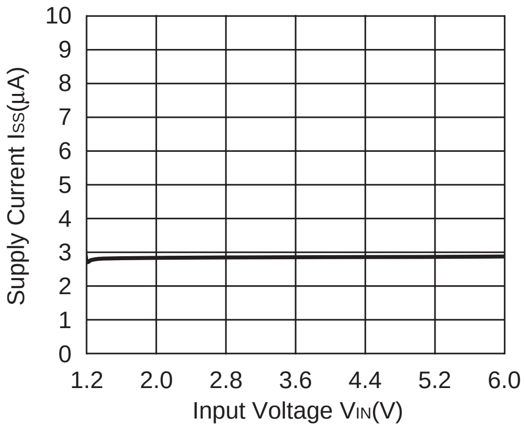


4.0V (VR1/VR2)

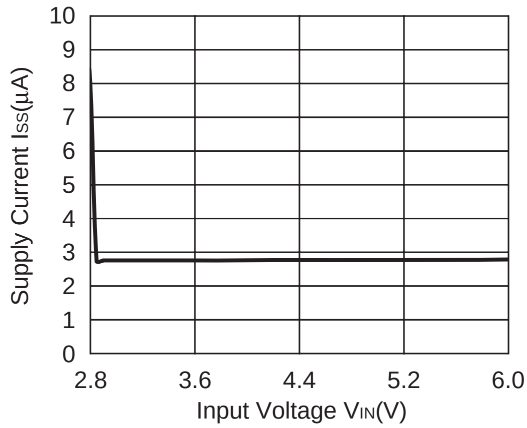


5) Supply Current vs. Input Voltage (Topt=25°C)

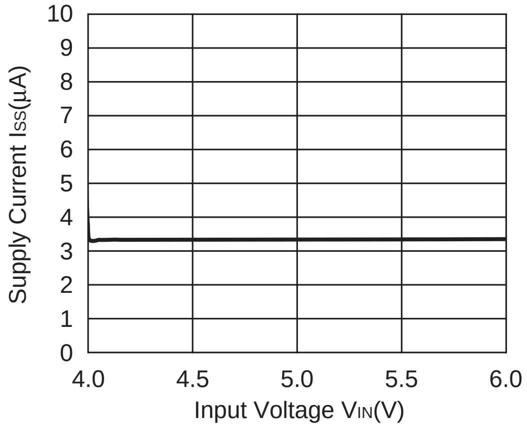
1.2V (VR1/VR2)



2.8V (VR1/VR2)

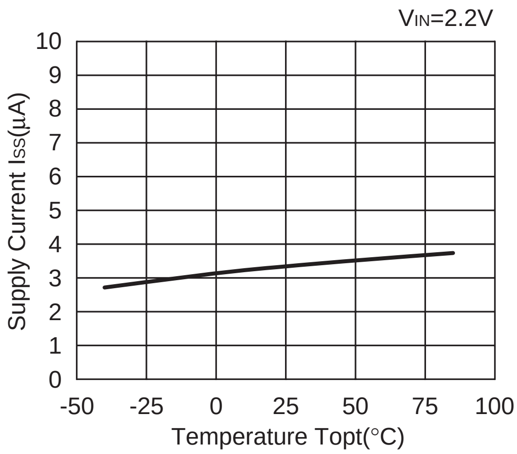


4.0V (VR1/VR2)

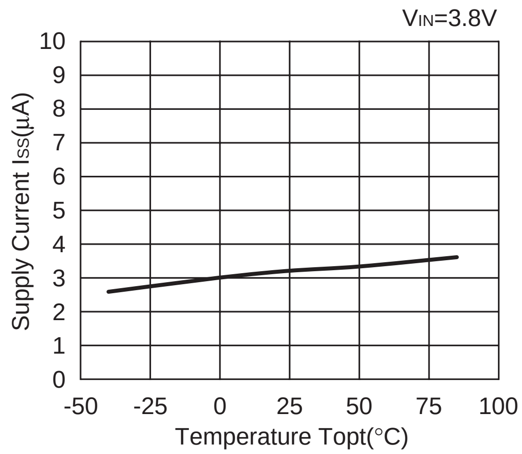


6) Supply Current vs. Temperature

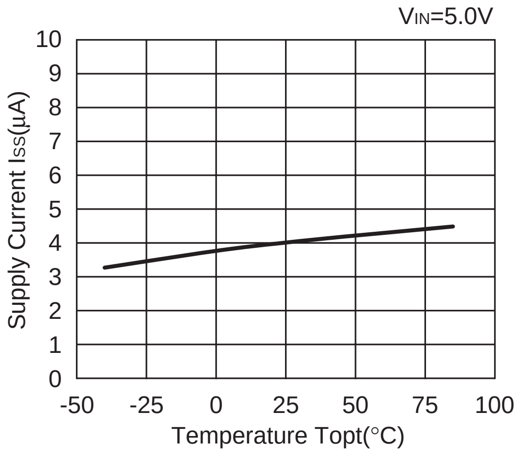
1.2V (VR1/VR2)



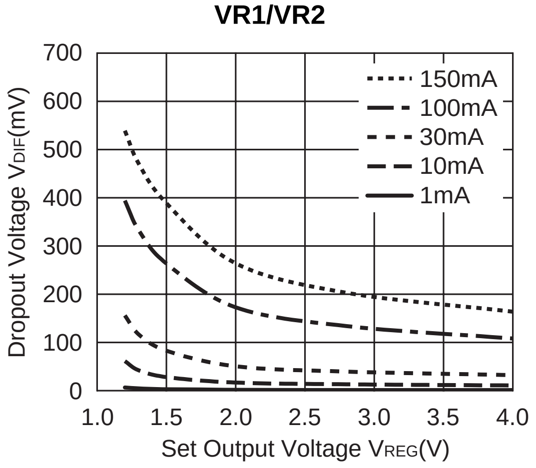
2.8V (VR1/VR2)



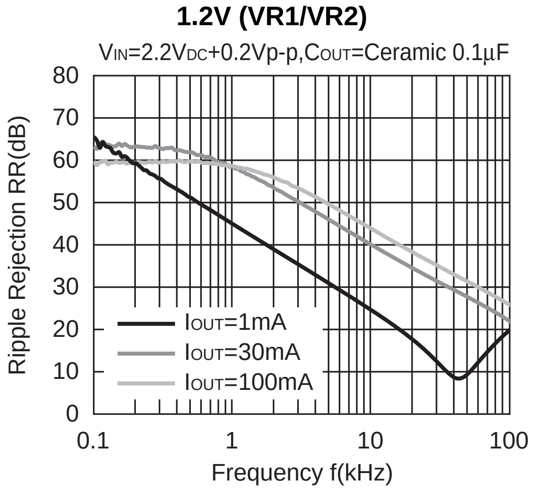
4.0V (VR1/VR2)

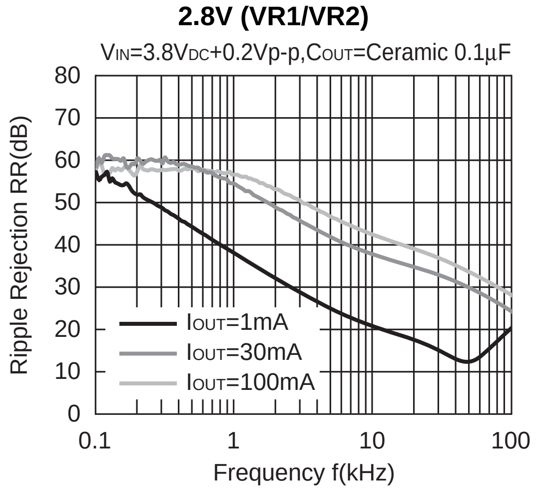


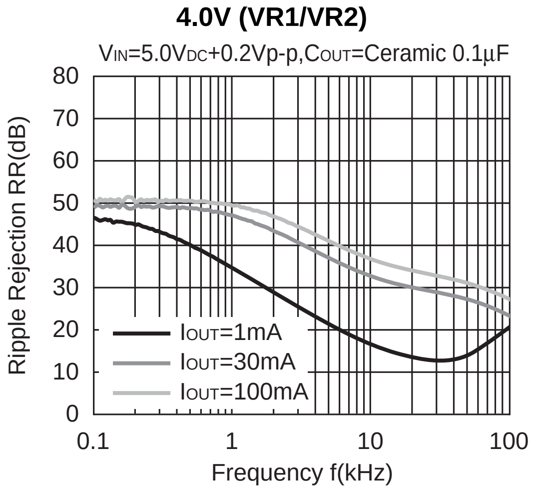
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)



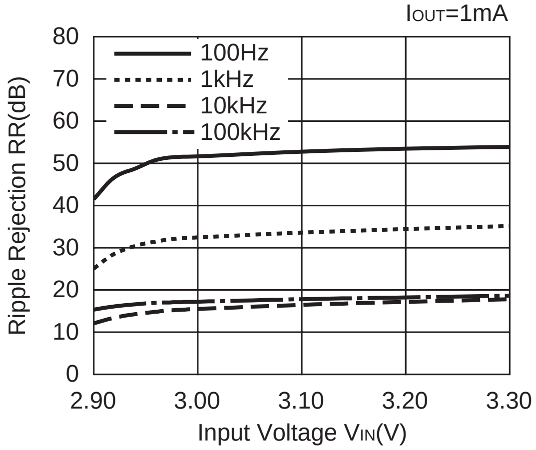
8) Ripple Rejection vs. Frequency (Topt=25°C, C_{OUT}=0.1µF)

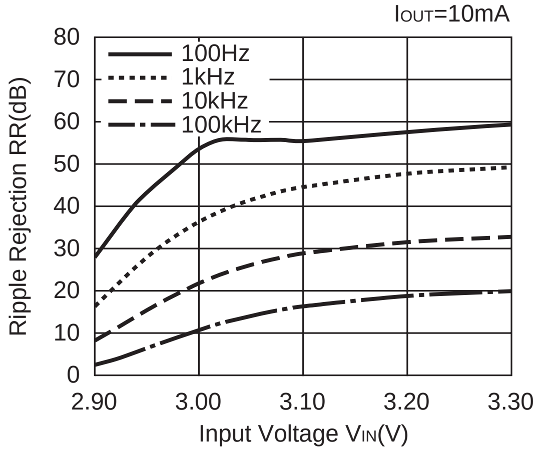


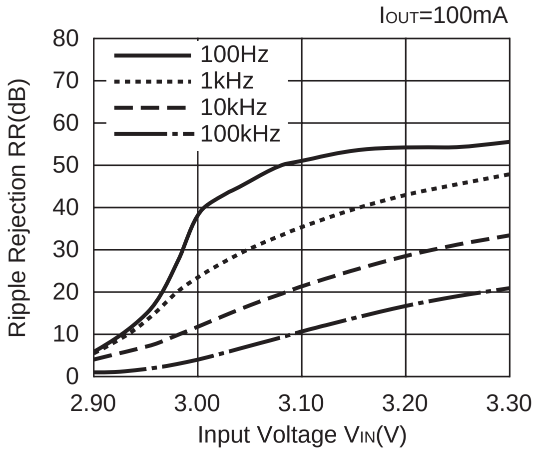




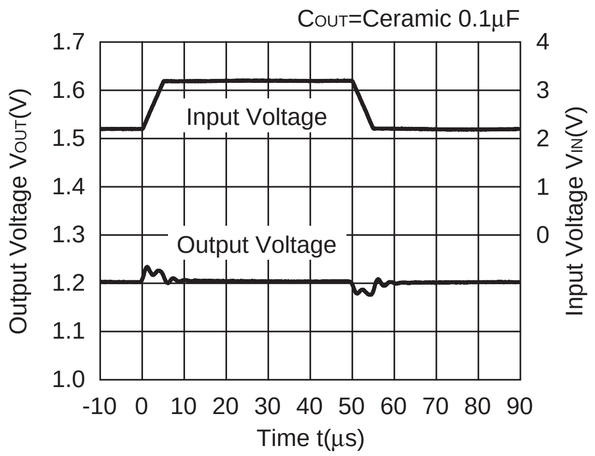
9) Ripple Rejection vs. Input Voltage (DC bias) (Topt=25°C, Ripple 0.2Vp-p)

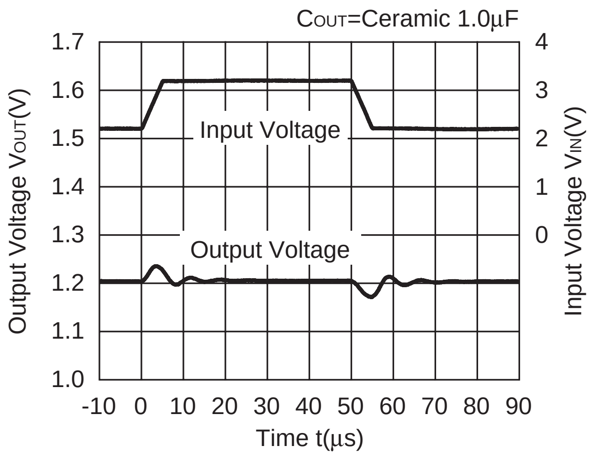






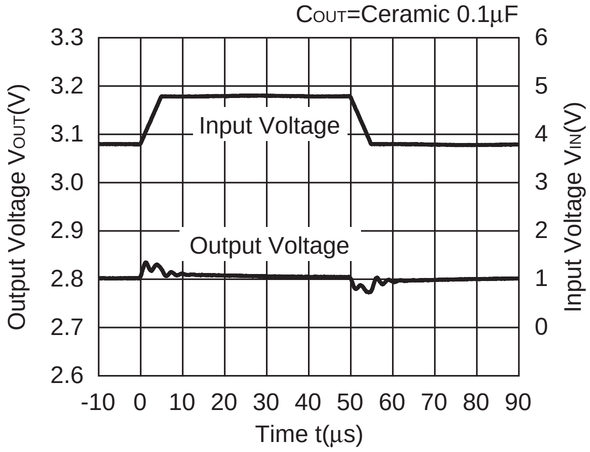
10) Input Transient Response(C_{IN}=none, tr=tf=5µs, I_{OUT}=30mA)





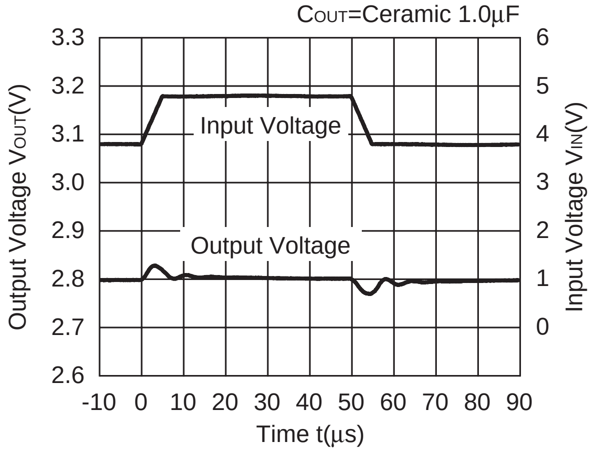
2.8V (VR1/VR2)

COUT=Ceramic 0.1µF



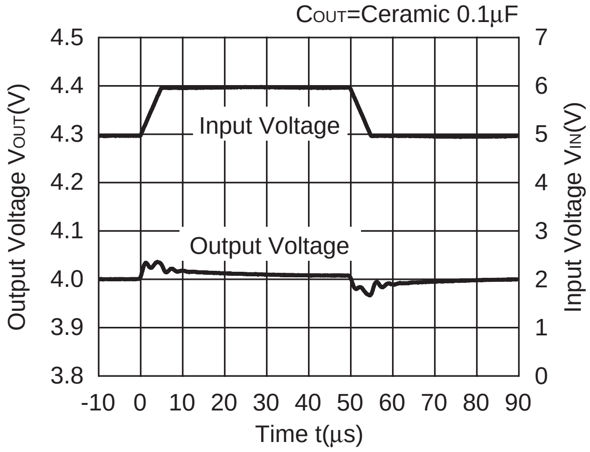
2.8V (VR1/VR2)

COUT=Ceramic 1.0µF



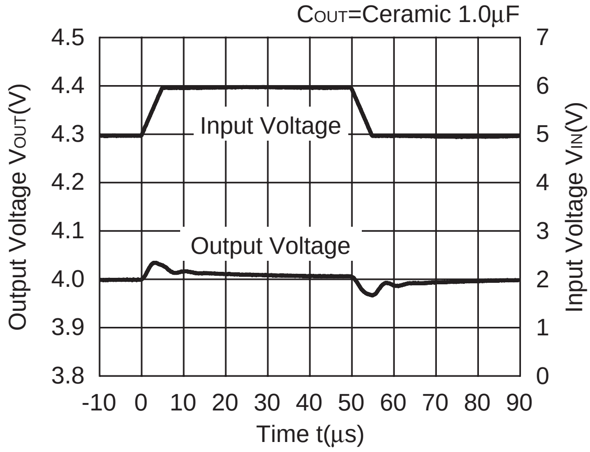
4.0V (VR1/VR2)

COUT=Ceramic 0.1µF



4.0V (VR1/VR2)

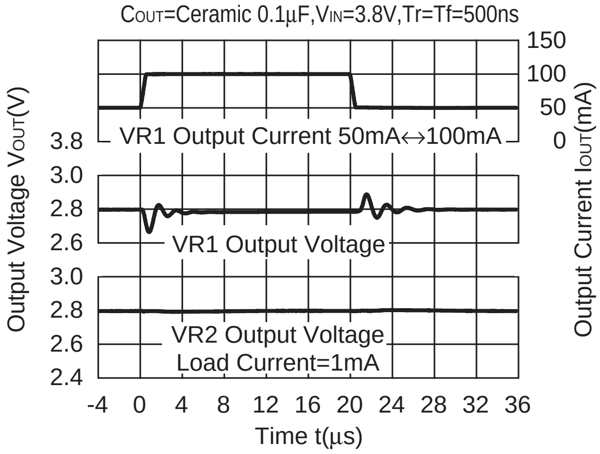
COUT=Ceramic 1.0µF



11) Load Transient Response (C_{IN}=Ceramic 0.1µF)

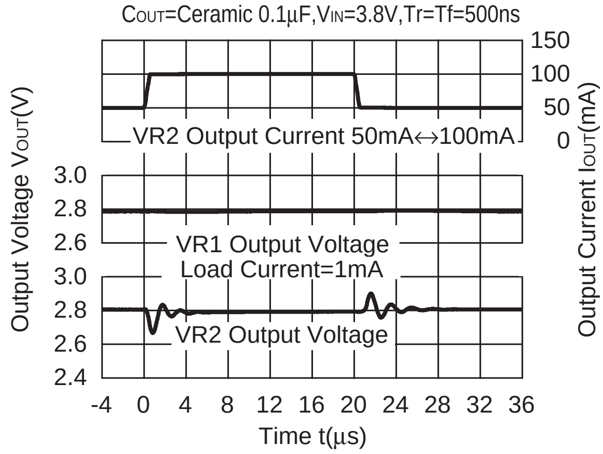
2.8V (VR1/VR2)

COUT=Ceramic 0.1µF,VIN=3.8V,Tr=Tf=500ns



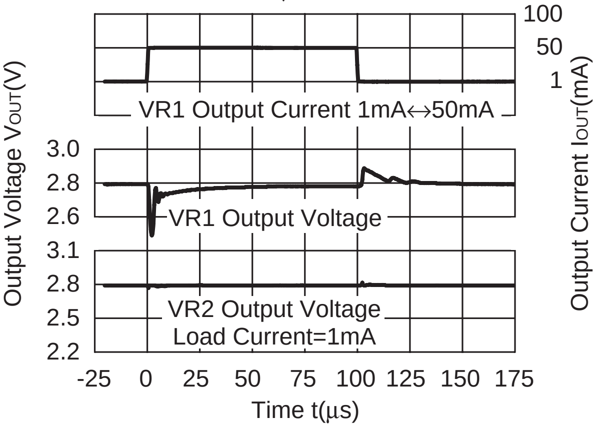
2.8V (VR1/VR2)

COUT=Ceramic 0.1µF,VIN=3.8V,Tr=Tf=500ns



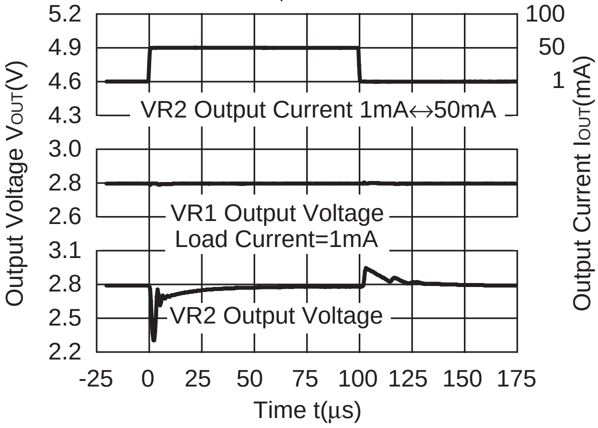
2.8V (VR1/VR2)

COUT=Ceramic 0.1µF,VIN=3.8V,Tr=Tf=500ns



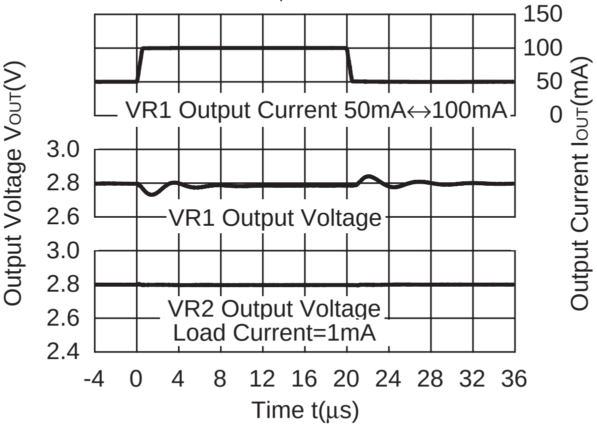
2.8V (VR1/VR2)

COUT=Ceramic 0.1µF,VIN=3.8V,Tr=Tf=500ns



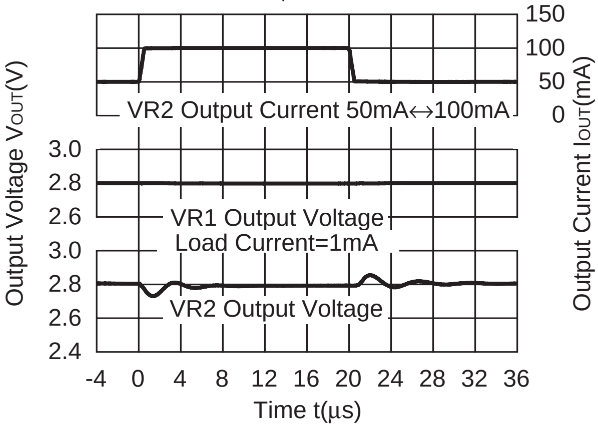
2.8V (VR1/VR2)

COUT=Ceramic 1.0µF,VIN=3.8V,Tr=Tf=500ns



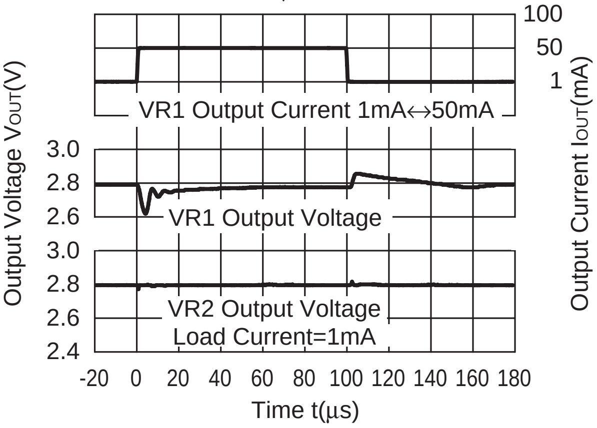
2.8V (VR1/VR2)

COUT=Ceramic 1.0µF,VIN=3.8V,Tr=Tf=500ns



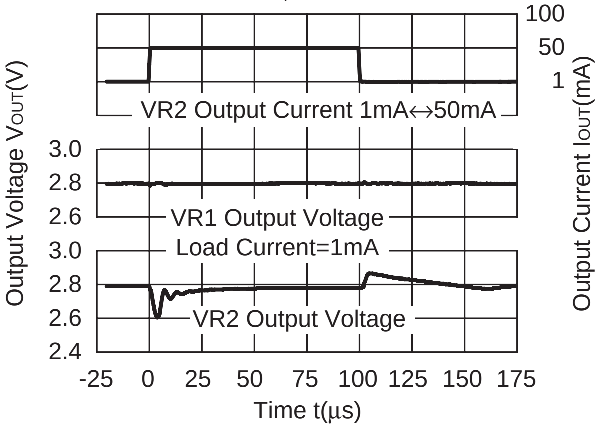
2.8V (VR1/VR2)

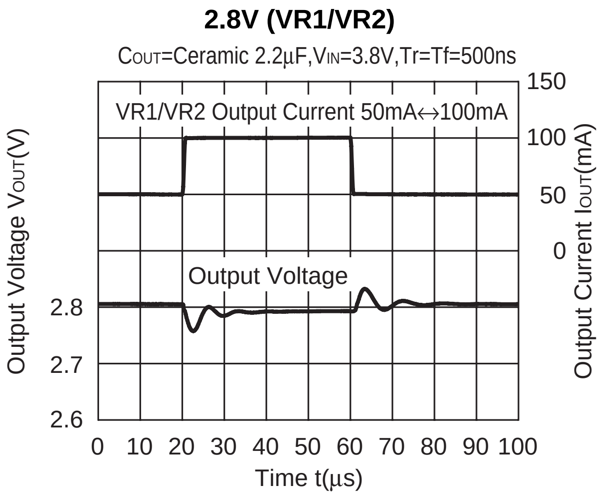
COUT=Ceramic 1.0µF,VIN=3.8V,Tr=Tf=500ns



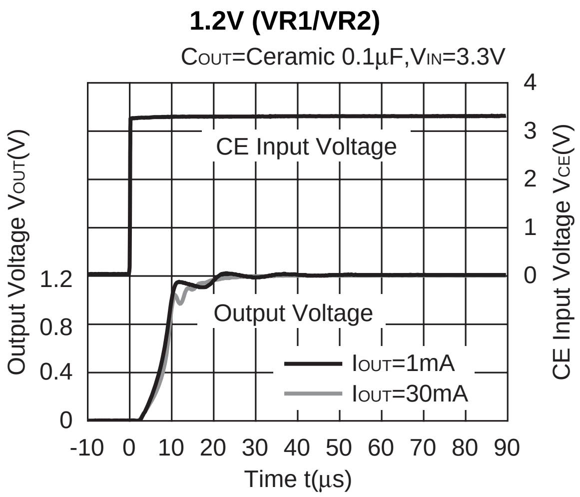
2.8V (VR1/VR2)

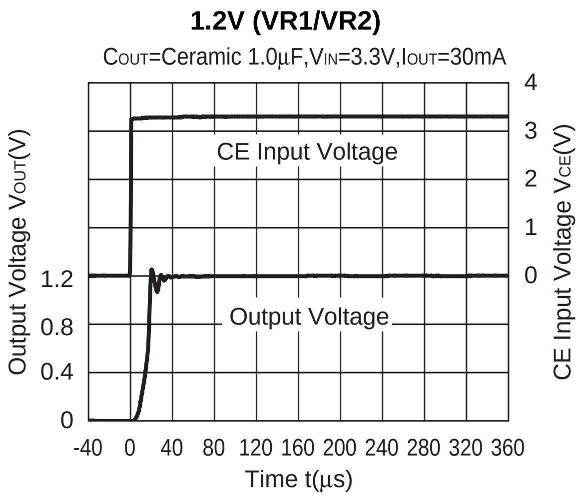
COUT=Ceramic 1.0µF,VIN=3.8V,Tr=Tf=500ns

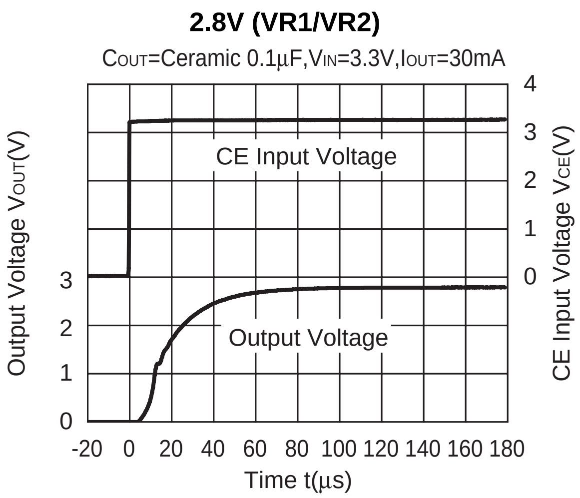


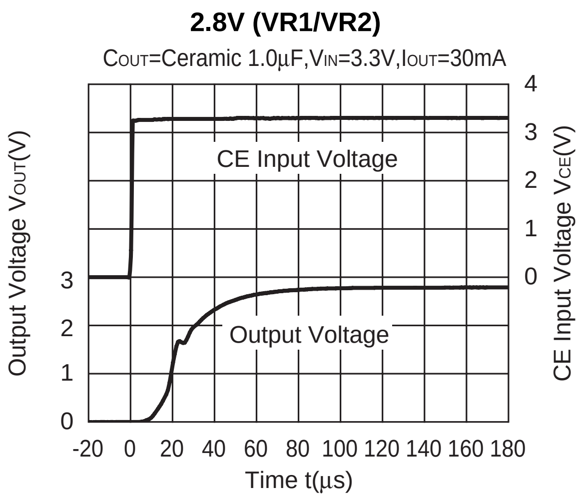


12) Turn on Speed by CE signal (C_{IN}=Ceramic 0.1µF)



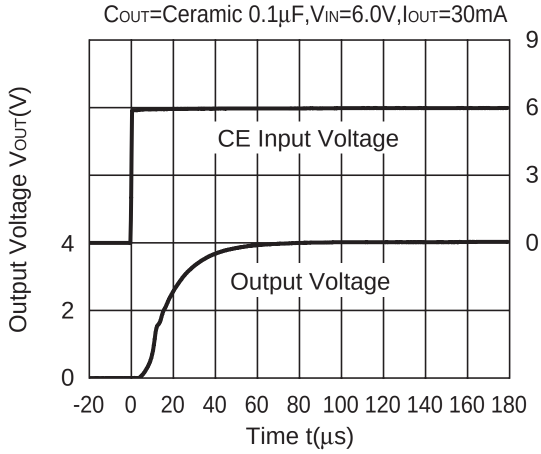






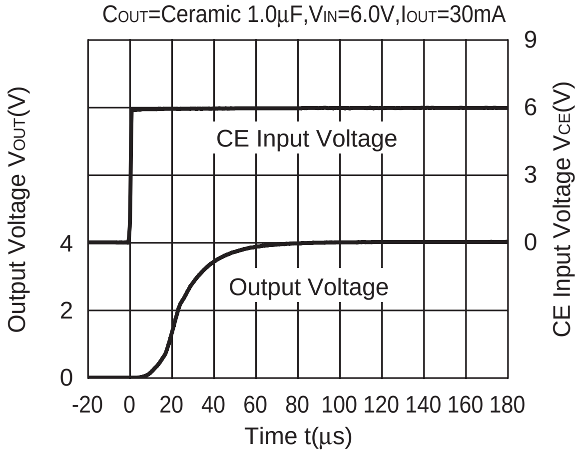
4.0V (VR1/VR2)

COUT=Ceramic 0.1µF,VIN=6.0V,IOUT=30mA



4.0V (VR1/VR2)

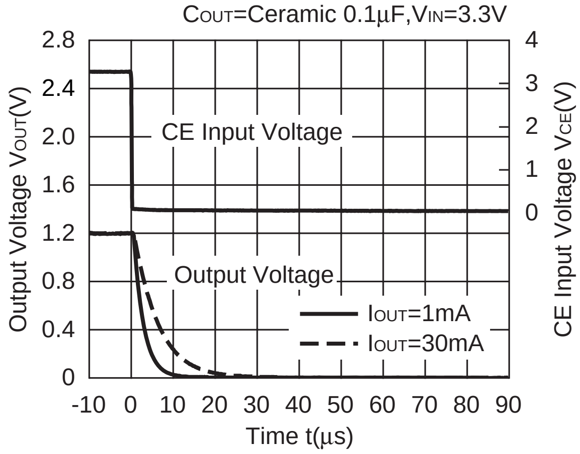
COUT=Ceramic 1.0µF,VIN=6.0V,IOUT=30mA



13) Turn-off Speed with CE Signal (B version) (CIN=Ceramic 0.1µF)

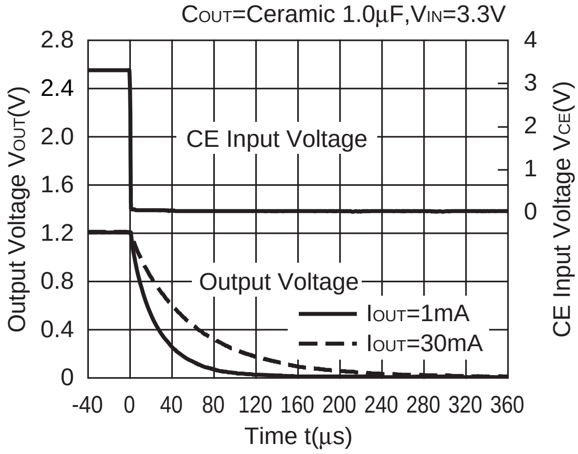
1.2V (VR1/VR2)

COUT=Ceramic 0.1µF,VIN=3.3V



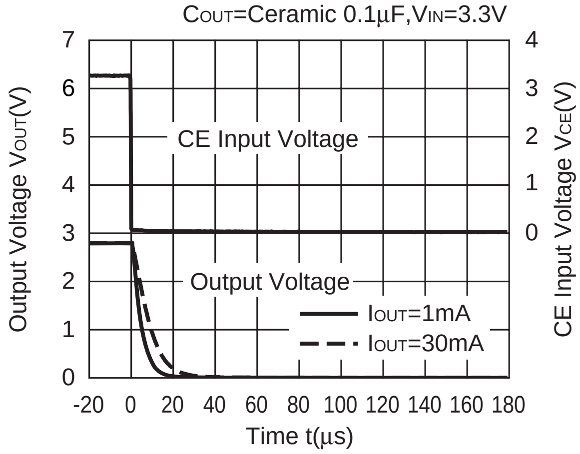
1.2V (VR1/VR2)

COUT=Ceramic 1.0µF,VIN=3.3V



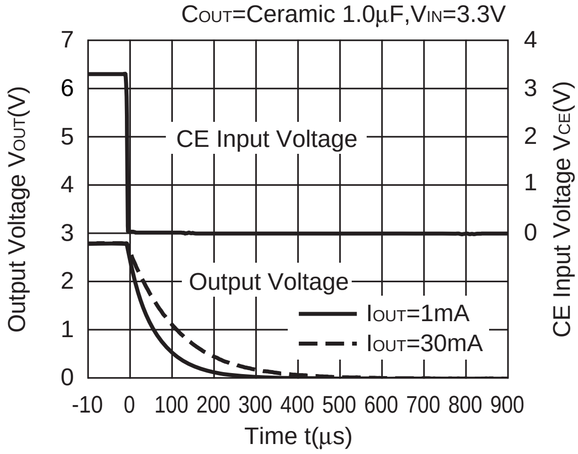
2.8V (VR1/VR2)

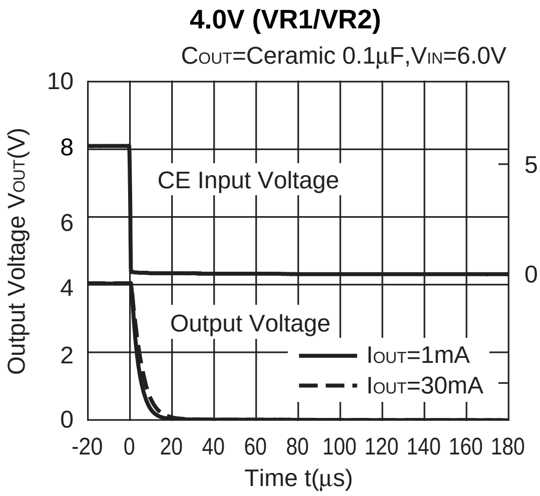
COUT=Ceramic 0.1µF,VIN=3.3V

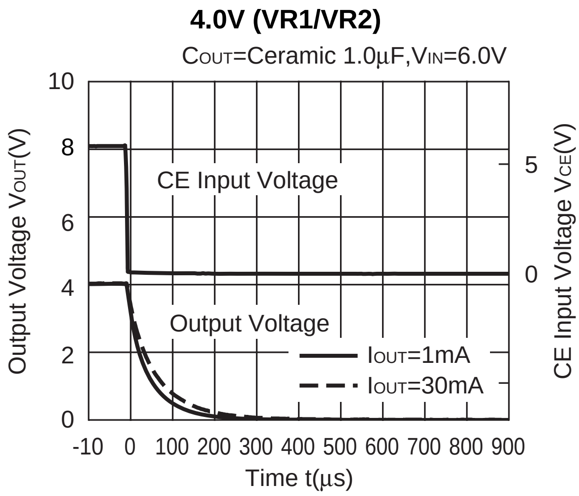


2.8V (VR1/VR2)

COUT=Ceramic 1.0µF,VIN=3.3V




4.0V (VR1/VR2)
COUT=Ceramic 0.1µF,VIN=6.0V
Output Voltage VOUT(V)
CE Input Voltage VCE(V)
CE Input Voltage
Output Voltage
IOUT=1mA
IOUT=30mA
10
8
6
4
2
0
5
0
-20 0 20 40 60 80 100 120 140 160 180
Time t(µs)


4.0V (VR1/VR2)
COUT=Ceramic 1.0µF,VIN=6.0V
Output Voltage VOUT(V)
CE Input Voltage VCE(V)
CE Input Voltage
Output Voltage
IOUT=1mA
IOUT=30mA
10
8
6
4
2
0
5
0
-10 0 100 200 300 400 500 600 700 800 900
Time t(µs)