150mA Dual LDO REGULATOR

NO.EA-127-120404

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 (Limited) and DFN(PLP)1820-6 package, dual LDO regulators are included in each, high density mounting of the ICs on boards is possible.

FEATURES

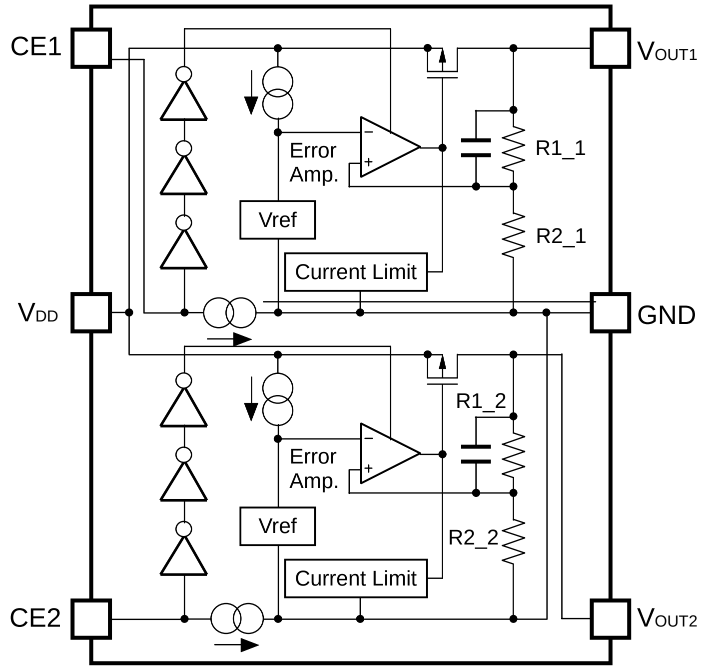
- Supply Current ....Typ. 3.0μA (VR1, VR2)
- Standby Current ....Typ. 0.1μA (VR1, VR2)
- Dropout Voltage ....Typ. 0.2V (I_{OUT}=150mA ,V_{OUT}=3.0V)
- Ripple Rejection ....Typ. 55dB (f=1kHz)
- Input Voltage ....1.5V to 6.0V
- Output Voltage Range..1.2V to 4.0V (0.1V steps)
  (For details, please refer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

APPLICATIONS

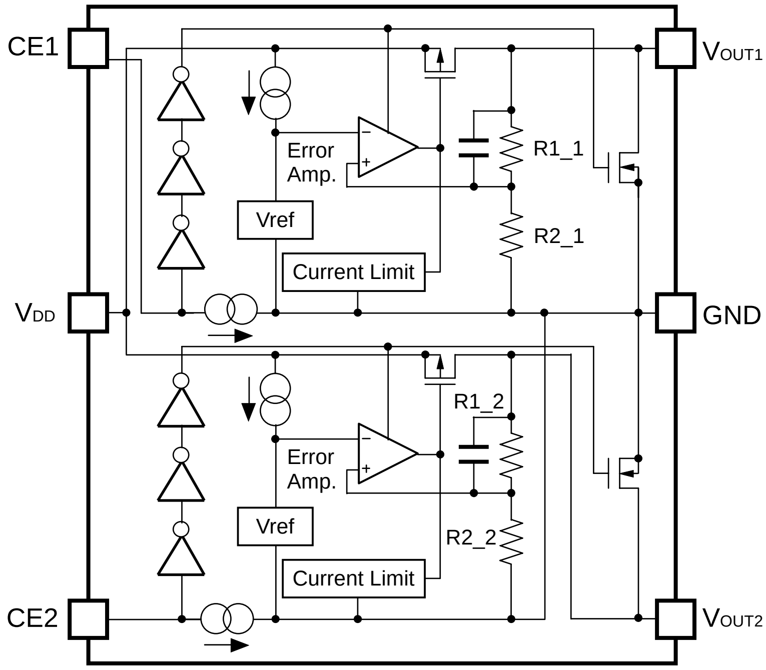
- Power source for handheld communication equipment.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

BLOCK DIAGRAMS

R5325xxxxA



R5325xxxxB



SELECTION GUIDE

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

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R5325Kxxx∗-TR	DFN(PLP)1820-6	3,000 pcs	Yes	Yes
R5325Nxxx∗-TR-FE	SOT-23-6 (Limited)	3,000 pcs	Yes	Yes

xxx : The combination of output voltage for each channel can be designated by serial numbers. (from 001)
The output voltage for each channel can be set in the range from 1.2V to 4.0V in 0.1V steps.
(For details, please refer to MARK INFORMATIONS.)

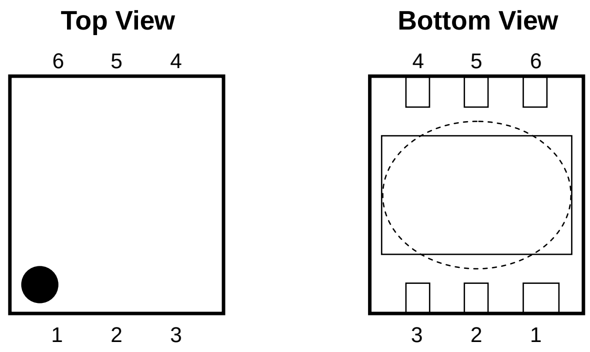
∗ : The auto discharge function at off state are options as follows.
(A) without auto discharge function at off state
(B) with auto discharge function at off state

The products scheduled to be discontinued (be sold to limited customer) : "Limited"

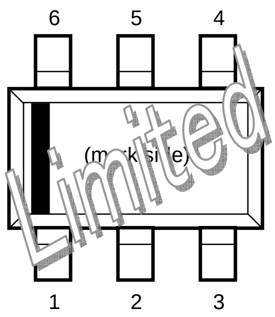
These products will be discontinued in the future. You can not select these products newly.
We will provide these products to the customer who has been using or has ordered them before.
But we recommend changing to other products as soon as possible.

PIN CONFIGURATION

● DFN（PLP）1820-6



● SOT-23-6



PIN DESCRIPTIONS

● **DFN(PLP)1820-6**

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

∗) Tab is GND level. (They are connected to the reverse side of this IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.

● **SOT-23-6 (Limited)**

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

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 (DFN(PLP)1820-6) *	880	mW
	Power Dissipation (SOT-23-6) (Limited)*	420	
Topt	Operating Temperature Range	–40 to 85	°C
Tstg	Storage Temperature Range	–55 to 125	°C

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

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.
The functional operation at or over these absolute maximum ratings is not assured.

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.

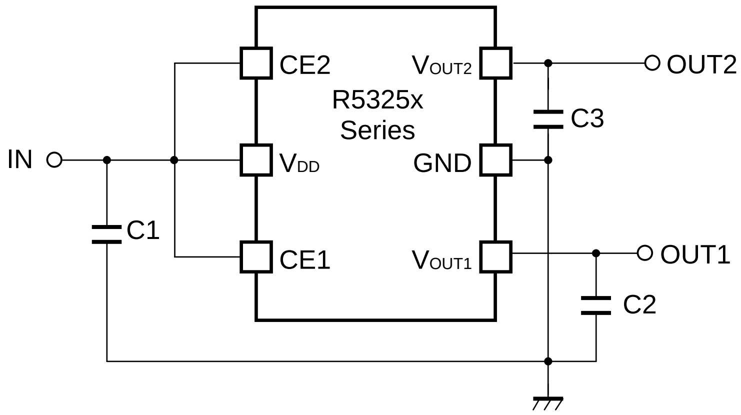
ELECTRICAL CHARACTERISTICS

- **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
$\Delta V_{OUT}/\Delta Topt$	Output Voltage Temperature Coefficient	I_{OUT}=30mA –40°C $\leqq$ Topt $\leqq$ 85°C			±100		ppm/°C
I_{SC}	Short Current Limit	V_{OUT}=0V			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.

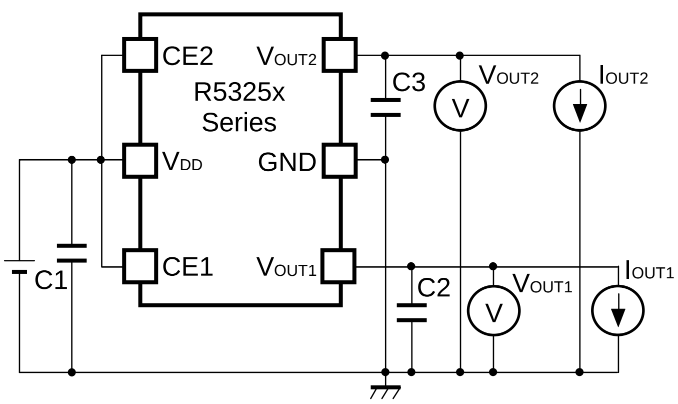
2.Phase Compensation

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.)

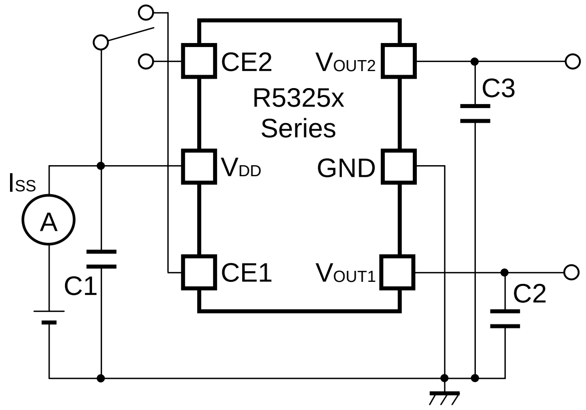
If you use a tantalum type capacitor and ESR value of the capacitor is large, output might be unstable. Evaluate your circuit with considering frequency characteristics.
Depending on the capacitor size, manufacturer, and part number, the bias characteristics and temperature characteristics are different.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

TEST CIRCUIT



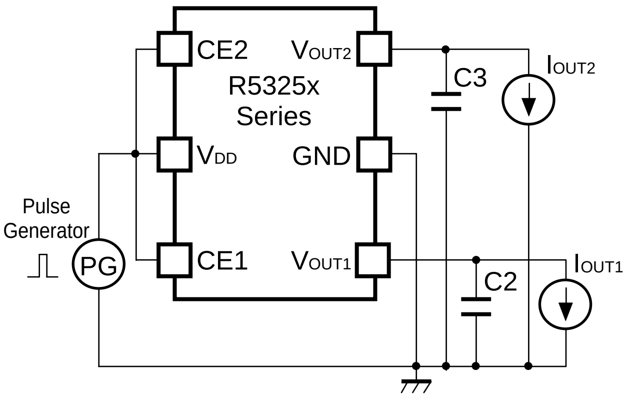
∗ C1=C2=C3=Ceramic 0.1μF

Fig.1 Standard test Circuit



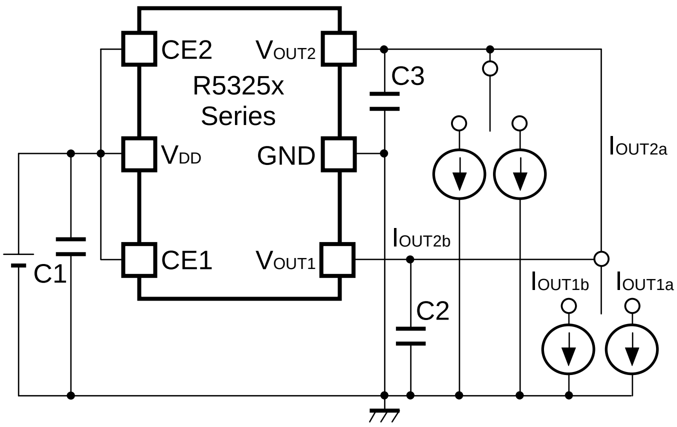
∗ C1=C2=C3=Ceramic 0.1μF

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

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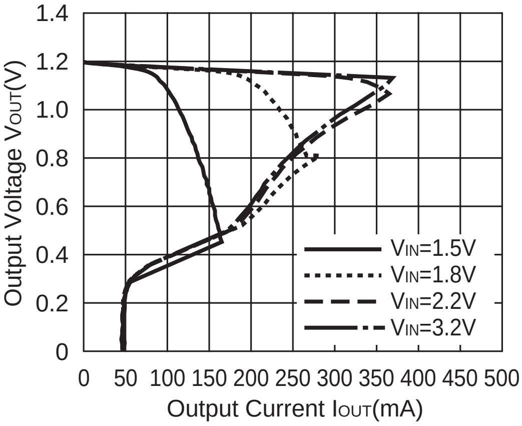
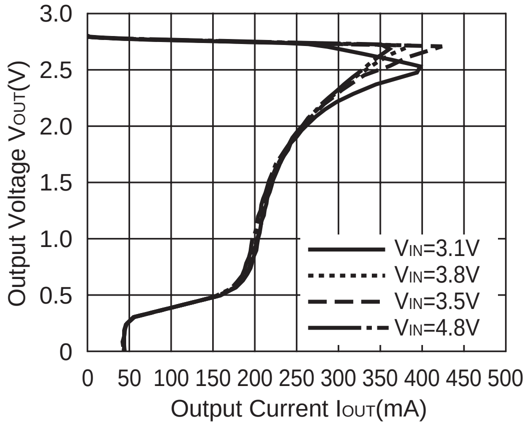
TYPICAL CHARACTERISTICS

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

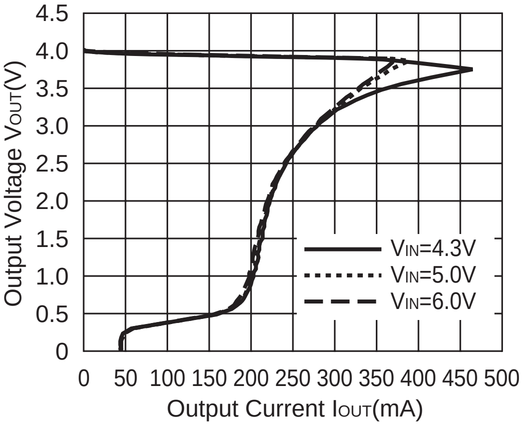
1.2V (VR1/VR2)



2.8V (VR1/VR2)

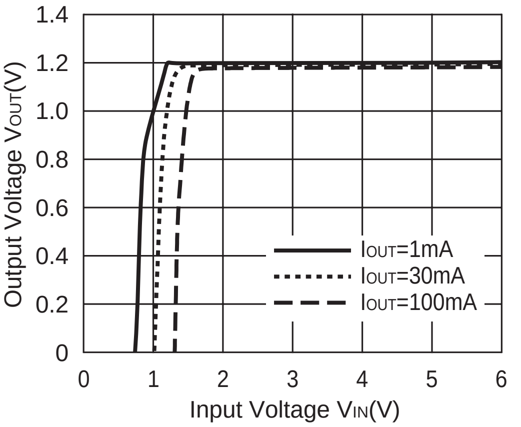


4.0V (VR1/VR2)

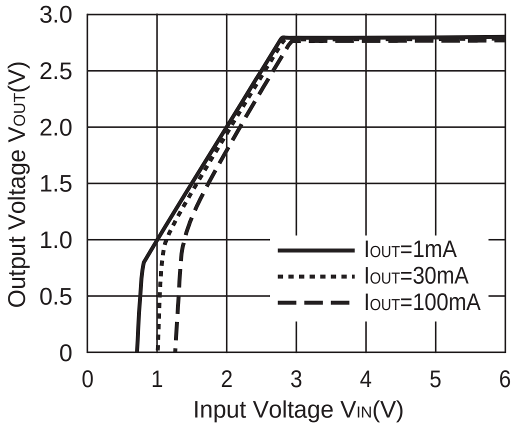


2) Output Voltage vs. Input Voltage (Topt=25°C)

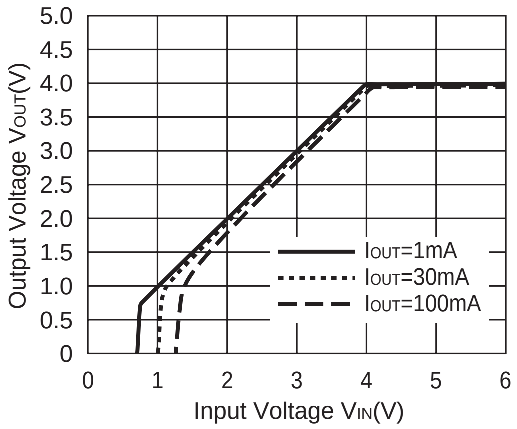
1.2V (VR1/VR2)



2.8V (VR1/VR2)

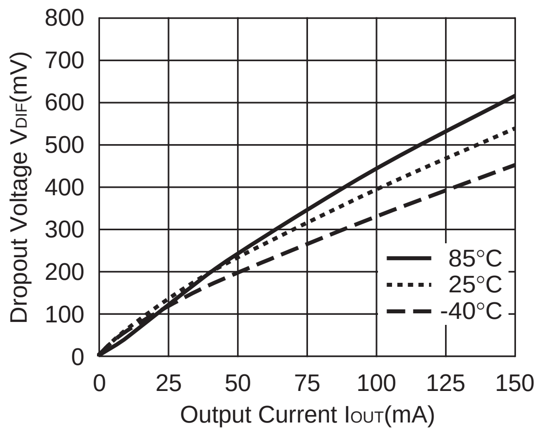


4.0V (VR1/VR2)

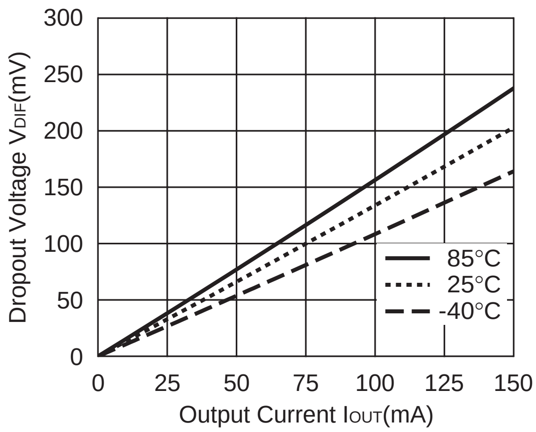


3) Dropout Voltage vs. Output Current

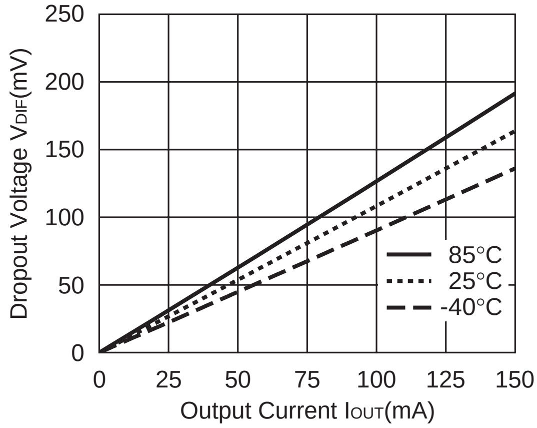
1.2V (VR1/VR2)



2.8V (VR1/VR2)

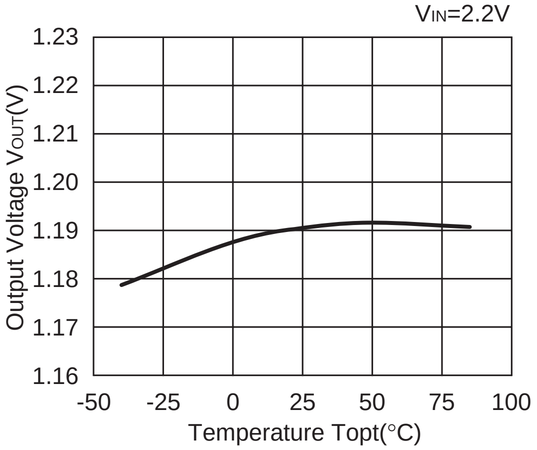


4.0V (VR1/VR2)

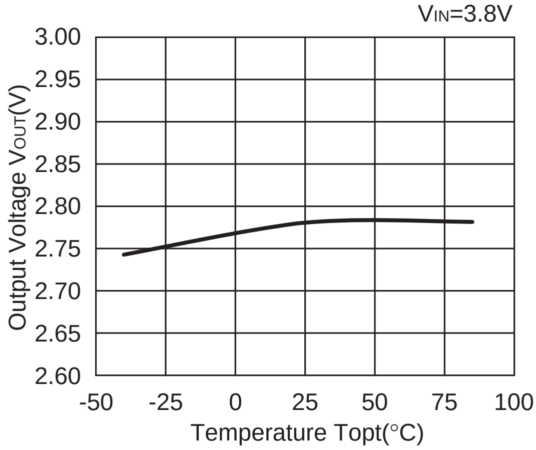


4) Output Voltage vs. Temperature (I_{OUT}=30mA)

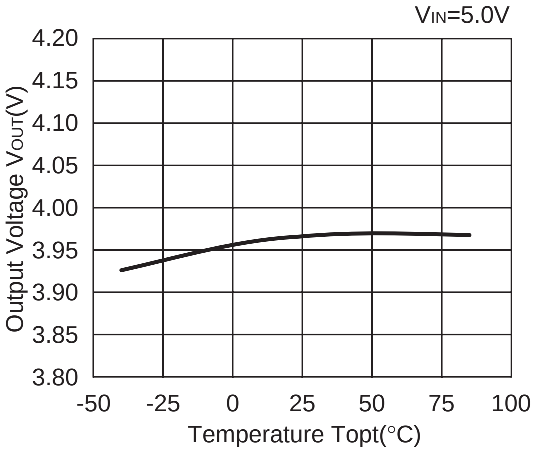
1.2V (VR1/VR2)



2.8V (VR1/VR2)

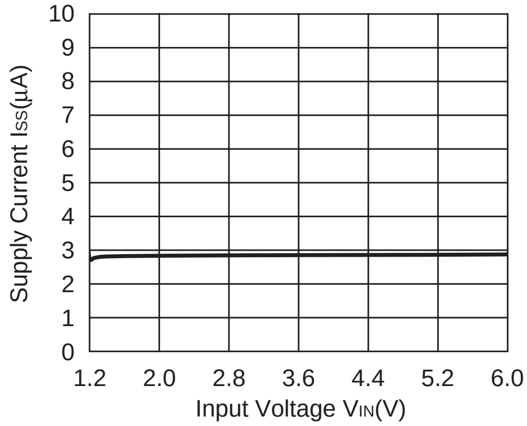


4.0V (VR1/VR2)

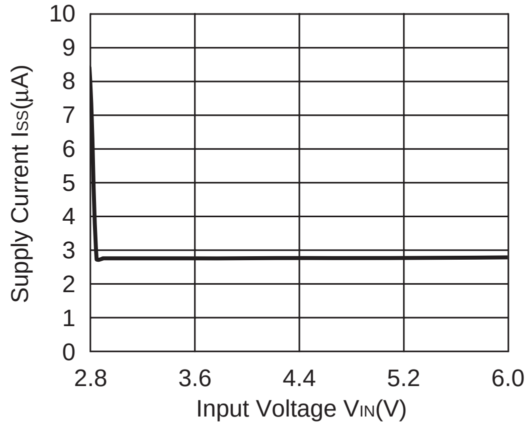


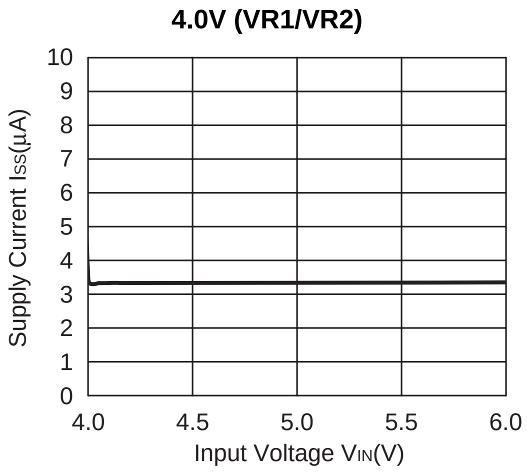
5) Supply Current vs. Input Voltage (Topt=25°C)

1.2V (VR1/VR2)

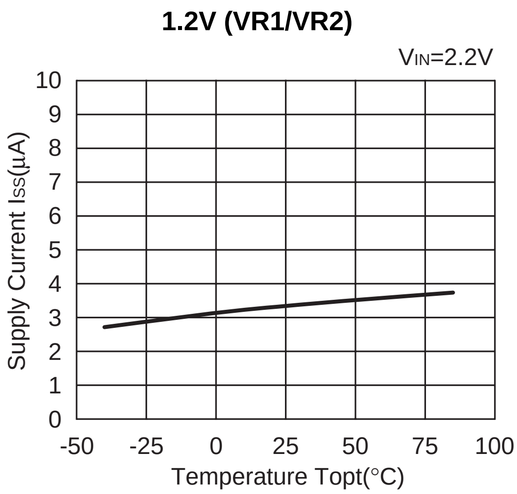


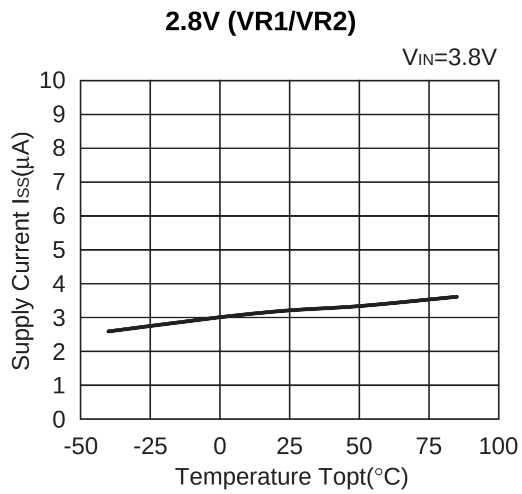
2.8V (VR1/VR2)

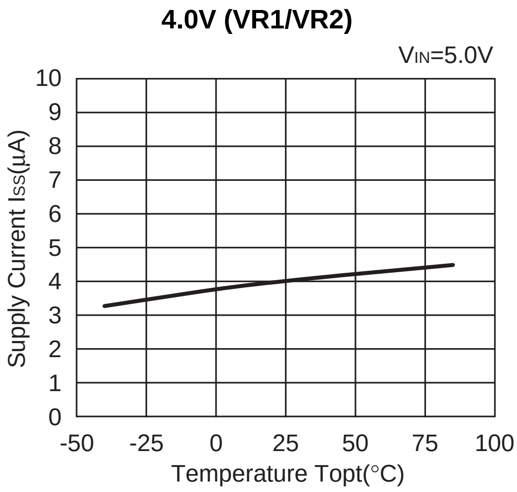




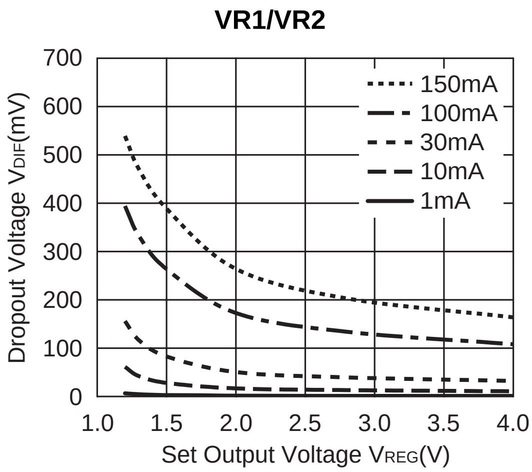
6) Supply Current vs. Temperature



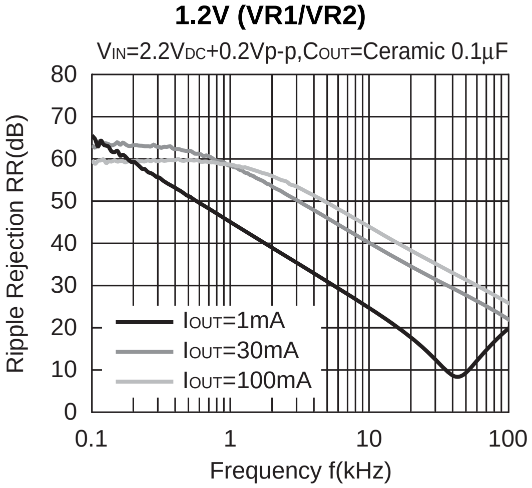


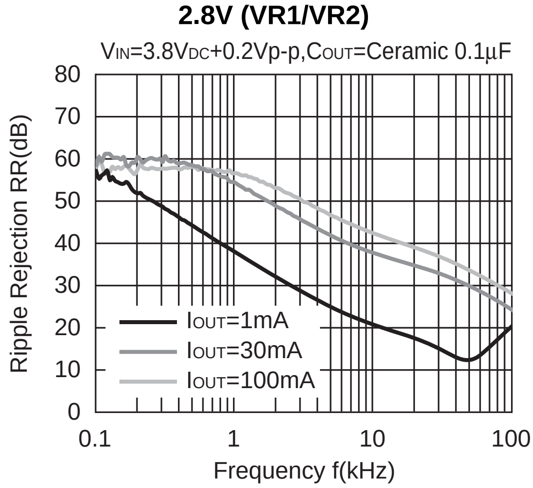


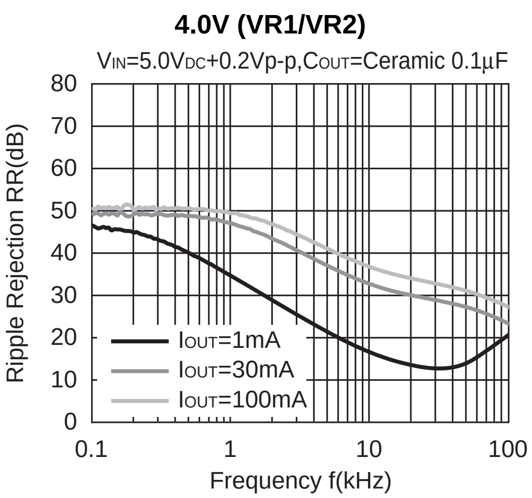
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)



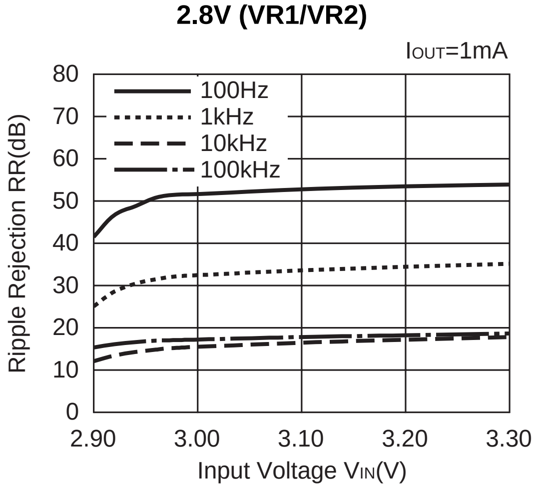
8) Ripple Rejection vs. Frequency (Topt=25°C, C_{OUT}=0.1µF)

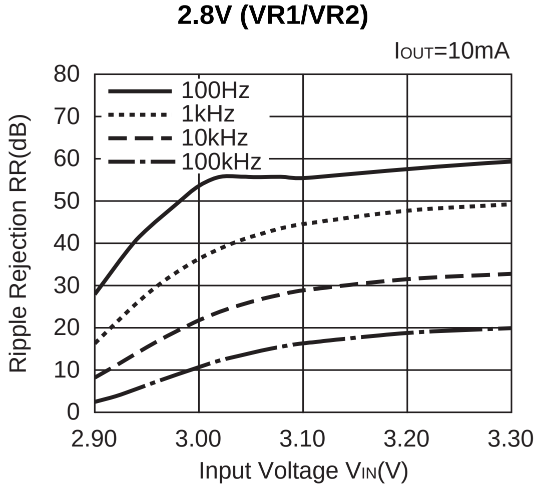


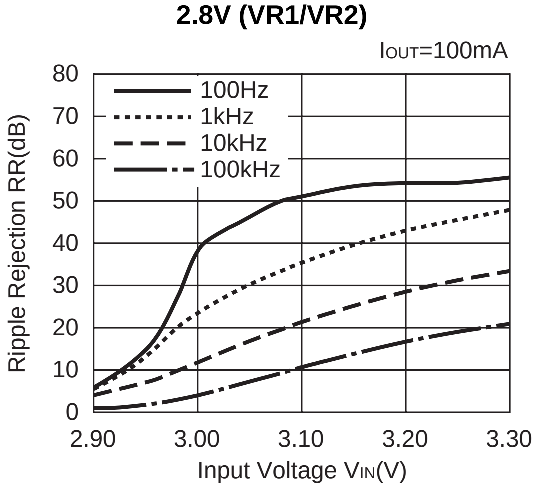




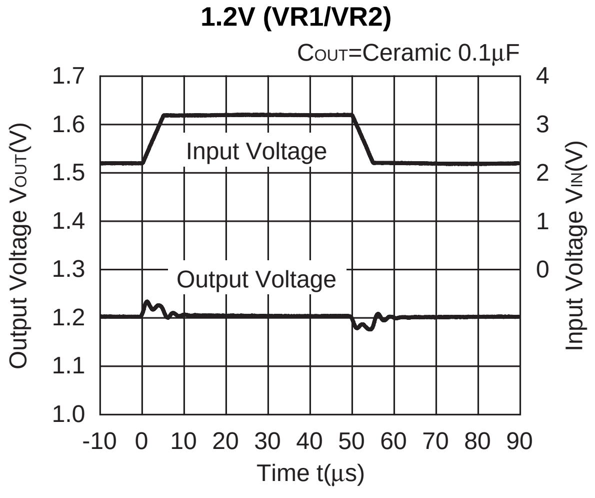
9) Ripple Rejection vs. Input Voltage (DC bias) (Topt=25°C, Ripple 0.2Vp-p)

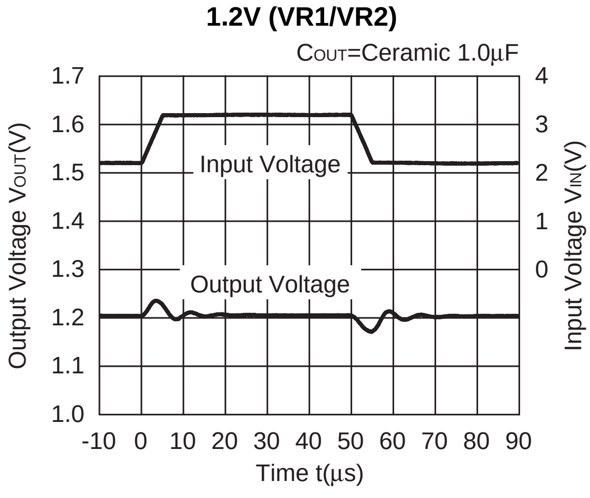




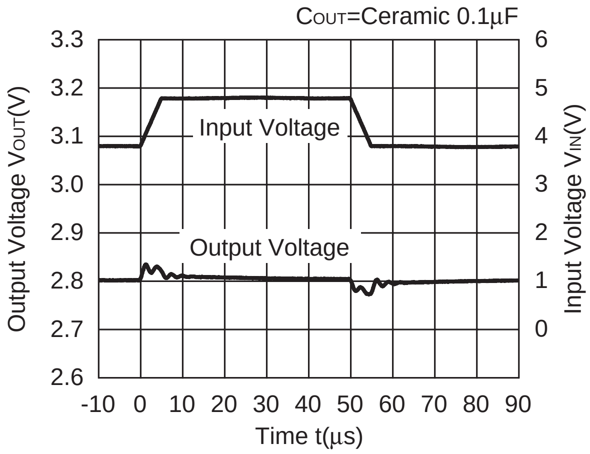


10) Input Transient Response(C_{IN}=none, tr=tf=5μs, I_{OUT}=30mA)

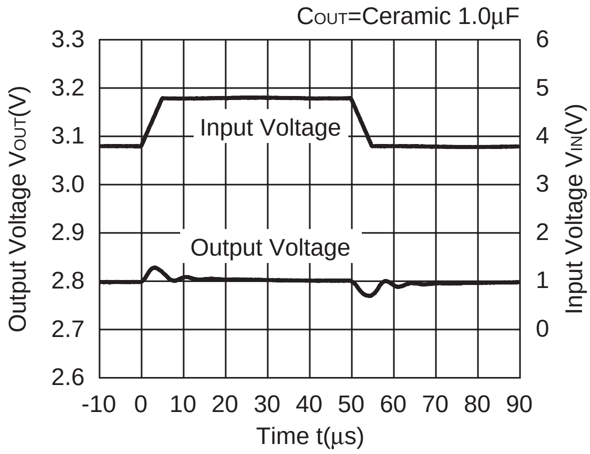




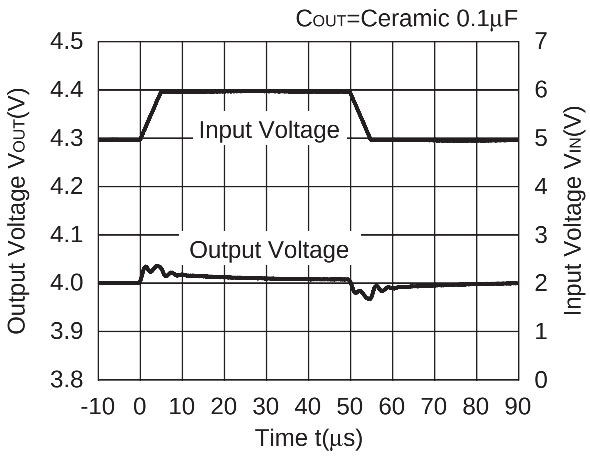
2.8V (VR1/VR2)



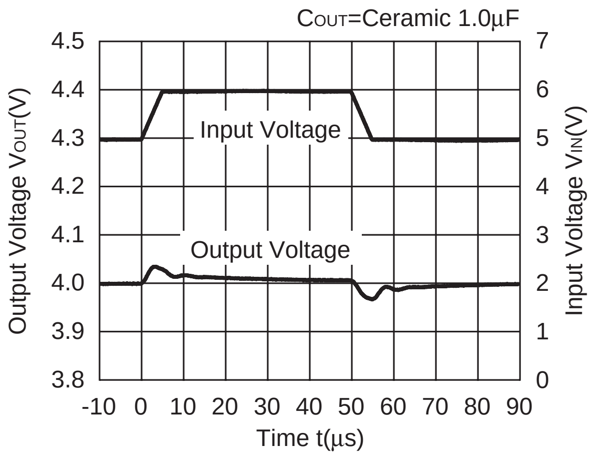
2.8V (VR1/VR2)



4.0V (VR1/VR2)

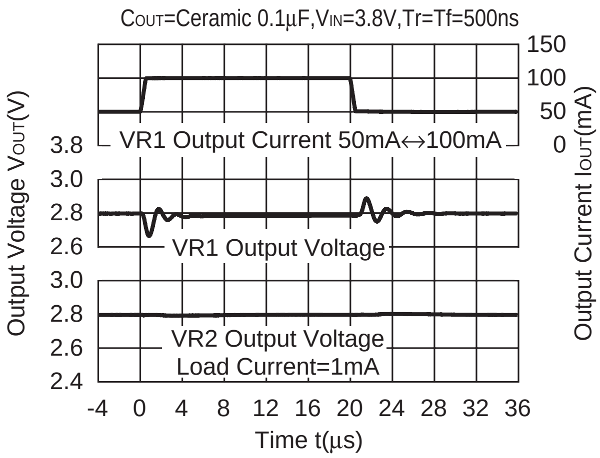


4.0V (VR1/VR2)

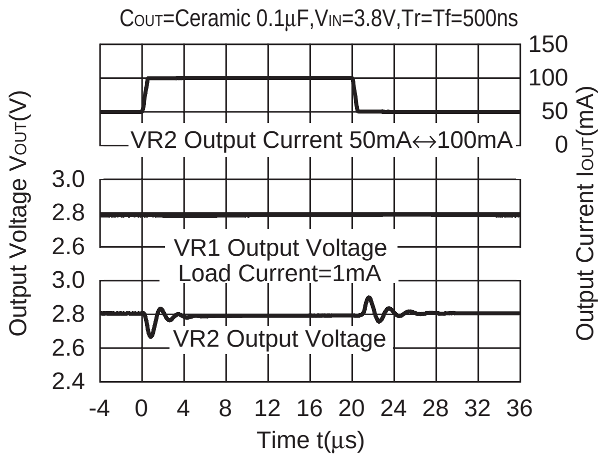


11) Load Transient Response (C_{IN}=Ceramic 0.1μF)

2.8V (VR1/VR2)

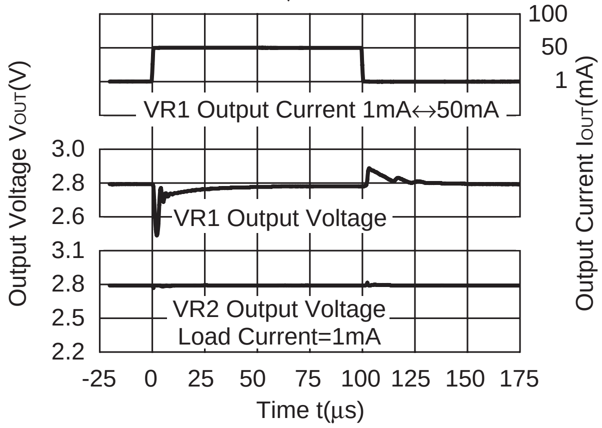


2.8V (VR1/VR2)



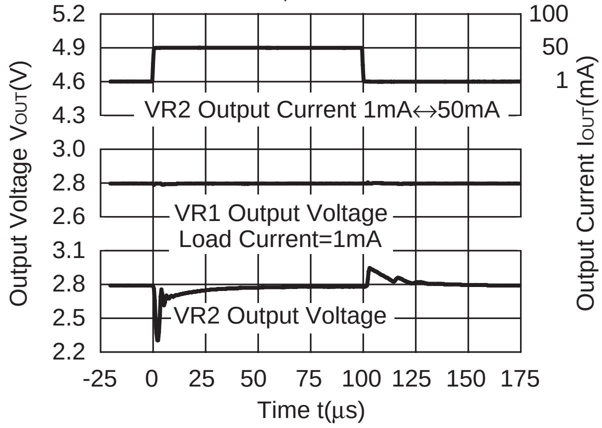
2.8V (VR1/VR2)

C_{OUT}=Ceramic 0.1µF,V_{IN}=3.8V,Tr=Tf=500ns



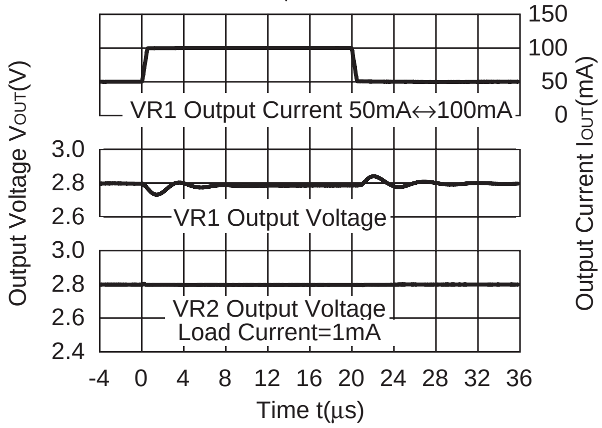
2.8V (VR1/VR2)

C_{OUT}=Ceramic 0.1µF,V_{IN}=3.8V,Tr=Tf=500ns



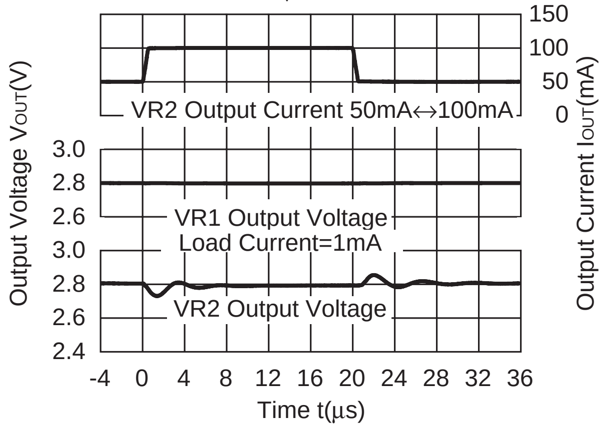
2.8V (VR1/VR2)

C_{OUT}=Ceramic 1.0µF,V_{IN}=3.8V,Tr=Tf=500ns



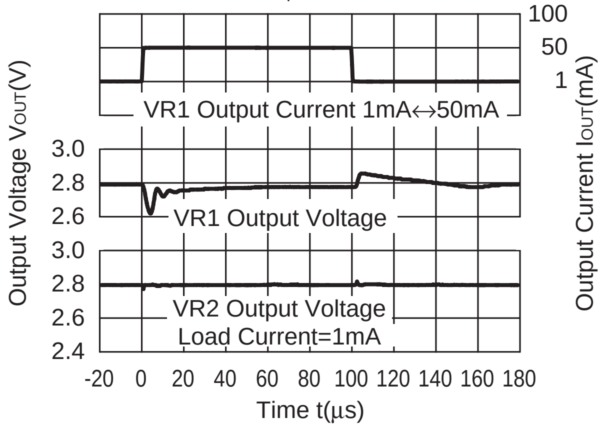
2.8V (VR1/VR2)

C_{OUT}=Ceramic 1.0µF,V_{IN}=3.8V,Tr=Tf=500ns



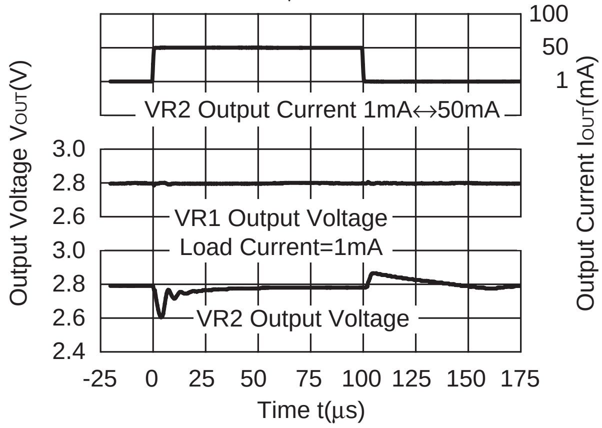
2.8V (VR1/VR2)

C_{OUT}=Ceramic 1.0µF,V_{IN}=3.8V,Tr=Tf=500ns



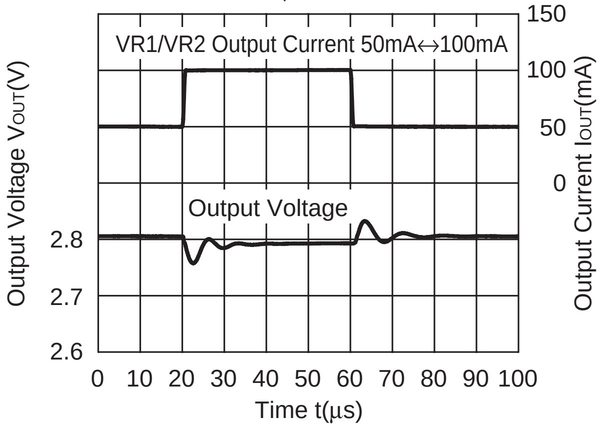
2.8V (VR1/VR2)

C_{OUT}=Ceramic 1.0µF,V_{IN}=3.8V,Tr=Tf=500ns



2.8V (VR1/VR2)

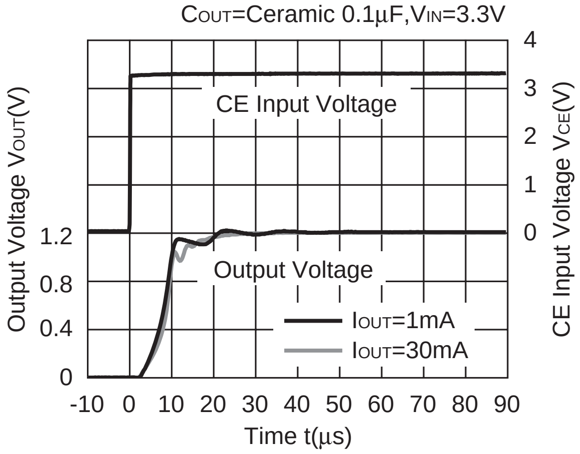
C_{OUT}=Ceramic 2.2μF,V_{IN}=3.8V,Tr=Tf=500ns



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

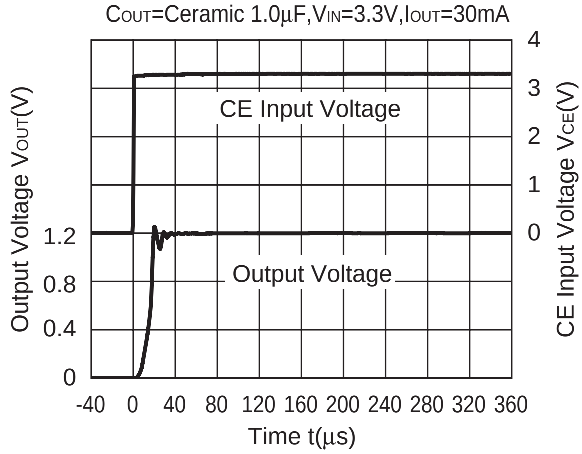
1.2V (VR1/VR2)

C_{OUT}=Ceramic 0.1μF,V_{IN}=3.3V



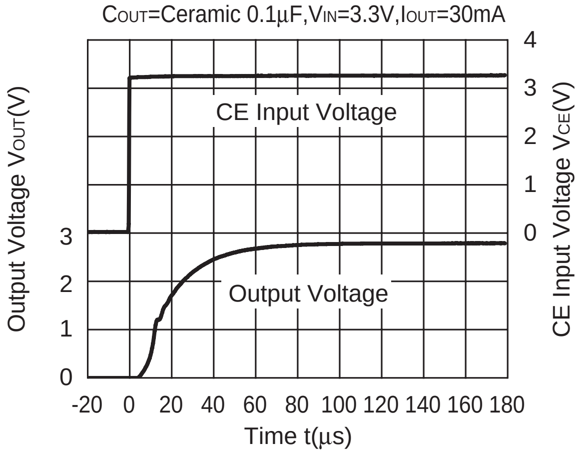
1.2V (VR1/VR2)

C_{OUT}=Ceramic 1.0μF,V_{IN}=3.3V,I_{OUT}=30mA



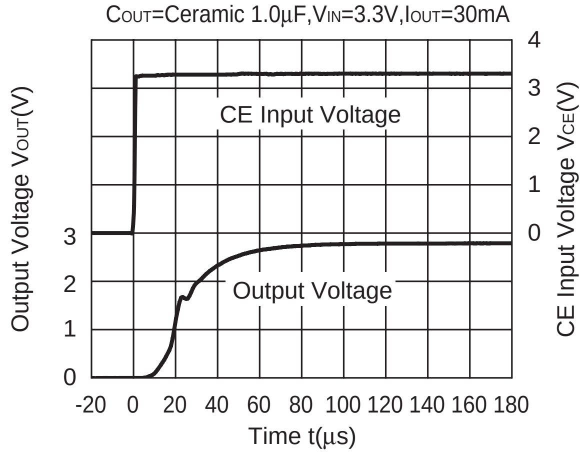
2.8V (VR1/VR2)

C_{OUT}=Ceramic 0.1μF,V_{IN}=3.3V,I_{OUT}=30mA



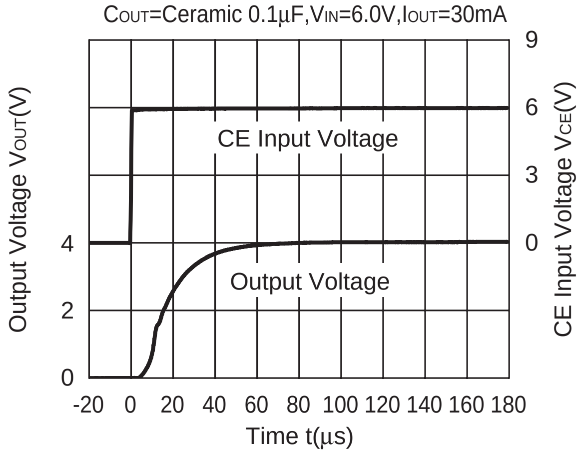
2.8V (VR1/VR2)

C_{OUT}=Ceramic 1.0μF,V_{IN}=3.3V,I_{OUT}=30mA



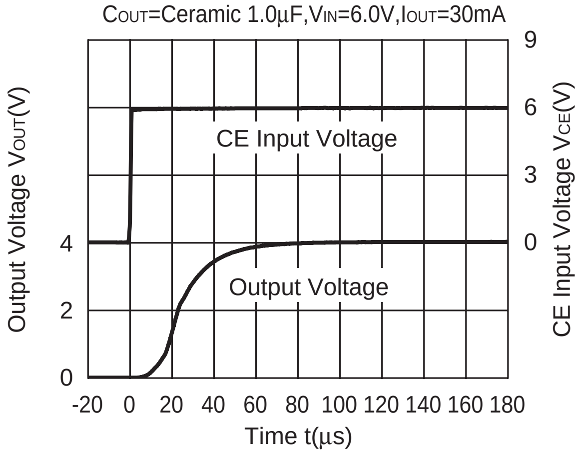
4.0V (VR1/VR2)

C_{OUT}=Ceramic 0.1µF,V_{IN}=6.0V,I_{OUT}=30mA



4.0V (VR1/VR2)

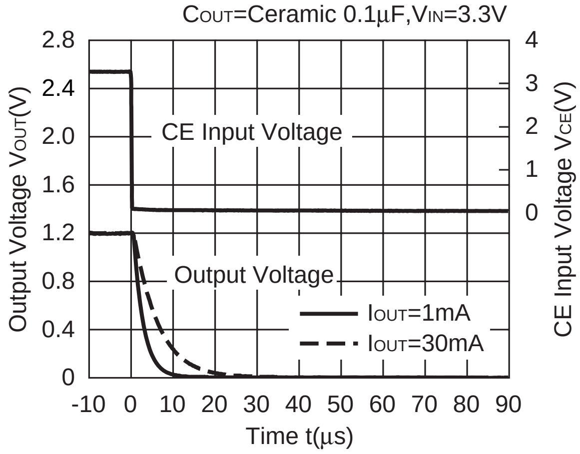
C_{OUT}=Ceramic 1.0µF,V_{IN}=6.0V,I_{OUT}=30mA



13) Turn-off Speed with CE Signal (B version) (C_{IN}=Ceramic 0.1µF)

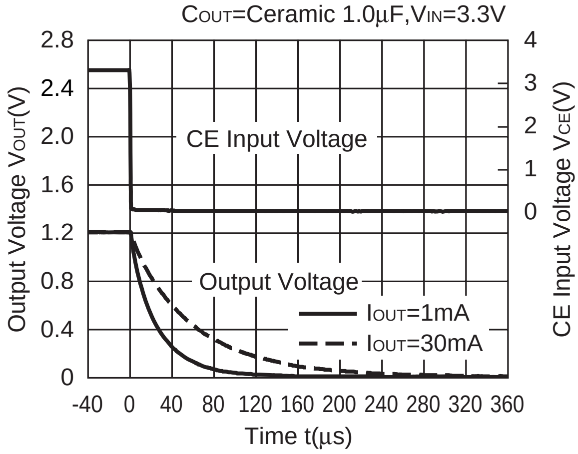
1.2V (VR1/VR2)

C_{OUT}=Ceramic 0.1µF,V_{IN}=3.3V



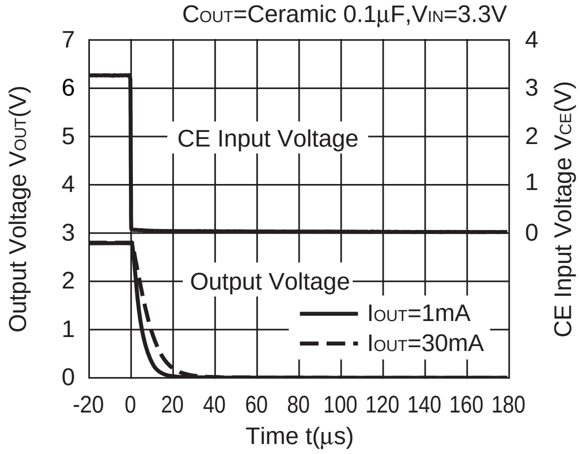
1.2V (VR1/VR2)

C_{OUT}=Ceramic 1.0µF,V_{IN}=3.3V



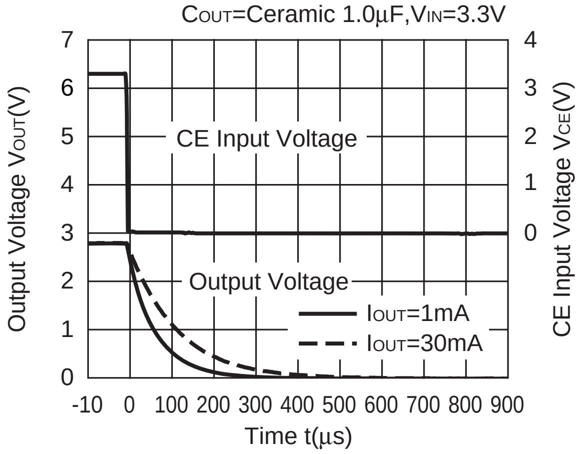
2.8V (VR1/VR2)

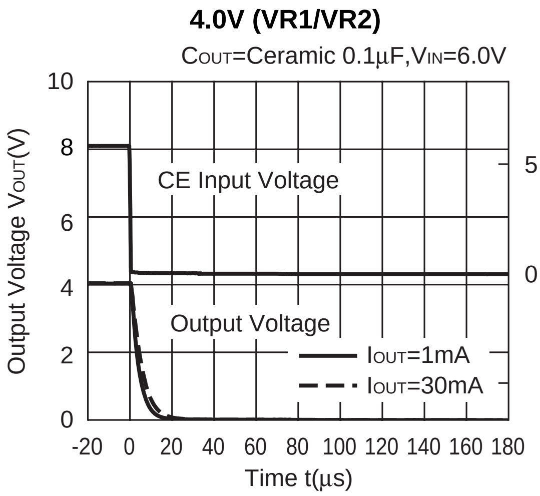
C_{OUT}=Ceramic 0.1µF,V_{IN}=3.3V

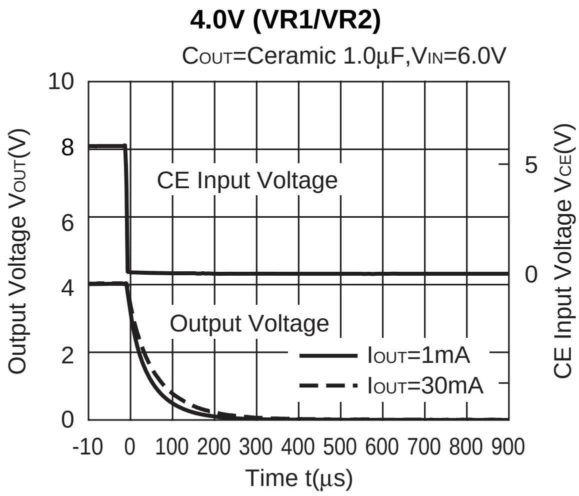


2.8V (VR1/VR2)

C_{OUT}=Ceramic 1.0µF,V_{IN}=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)

RICOH COMPANY, LTD. Electronic Devices Company

日本経営品質賞 1999年度受賞

■**Ricoh presented with the Japan Management Quality Award for 1999.**
Ricoh continually strives to promote customer satisfaction, and shares the achievements of its management quality improvement program with people and society.

■**Ricoh awarded ISO 14001 certification.**
The Ricoh Group was awarded ISO 14001 certification, which is an international standard for environmental management systems, at both its domestic and overseas production facilities. Our current aim is to obtain ISO 14001 certification for all of our business offices.

RoHS Compliant

Ricoh completed the organization of the Lead-free production for all of our products. After Apr. 1, 2006, we will ship out the lead free products only. Thus, all products that will be shipped from now on comply with RoHS Directive.

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