

FEATURES

Single Buck-Boosted Output: 5 V
Output Current: 600 mA
Input voltage: 3.0-4.2 V
Low Ripple
Accurate constant current limit

DESCRIPTION

This ADP2504 Reference Design uses 3.0 V to 4.2 V for the input voltage. Design criteria are for small size and low cost. The ripple is less than 10mV. Transient response varies over the load range and is not considered high priority. The switching frequency is fixed at 2.5 MHz. The output is current limited to 600mA +/-10% and remains in constant current for Vout down to 2.5 V

Table 1. User Target Specs, Vout1

<i>Spec</i>	<i>Target Value</i>	<i>Actual Value</i>	<i>Units</i>
Vout	5	5	Volts
Iout	0.6	0.6	Amps
Tamb	50	50	degC
Vinmin	3.0	3.0	Volts
Vinmax	4.2	4.2	Volts

Table 2. Default Design Target Specs, Vout1

<i>Spec</i>	<i>Target Value</i>	<i>Actual Value</i>	<i>Units</i>
Vout ripple max	N/A	<0.010	Volts
Ioutstep	N/A	0.6	Apk
Vout step error	N/A	N/A	Volts
MaxHeight	N/A	1.25	mm

Rev. 1

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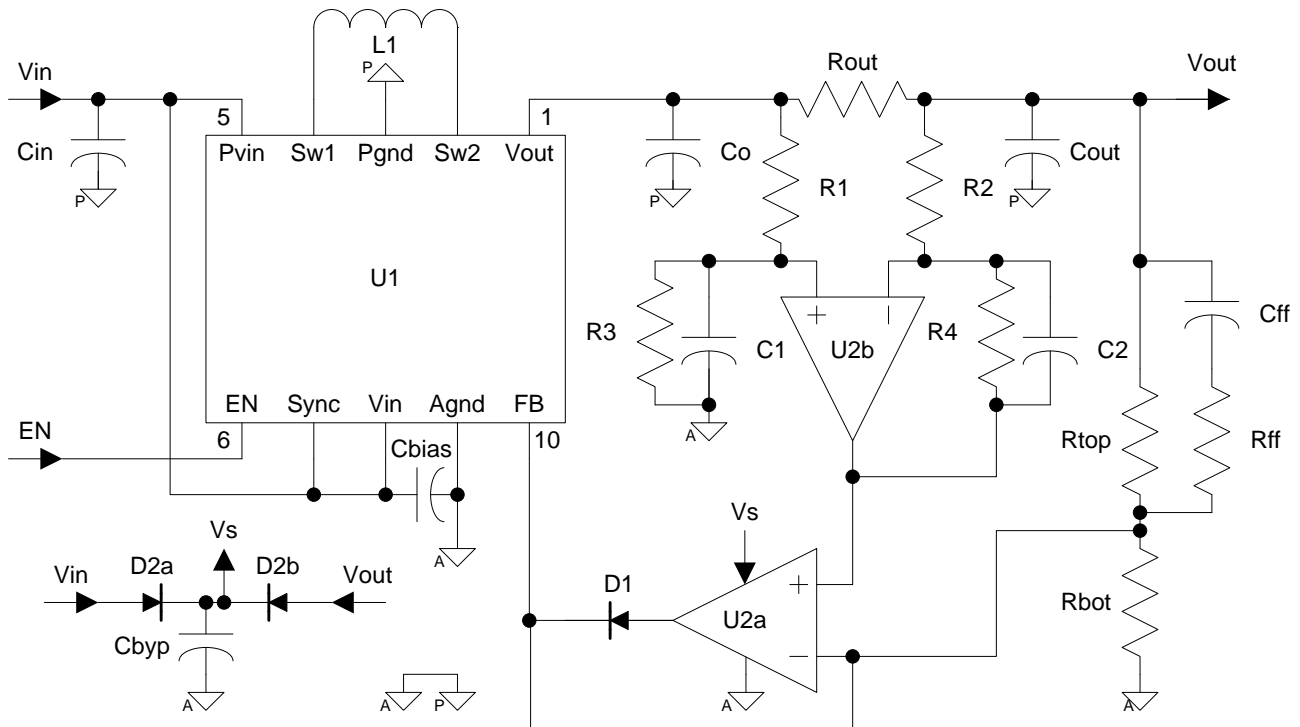
REVISION HISTORY

12/24/2009—Revision 0: Initial Version

1/8/2010—Revision 1: Added bode plots for constant current operation

SCHEMATIC

Figure 1. Constant Current Limit Buck-Boost Schematic



BILL OF MATERIALS

Table 3. Bill of Materials

Item #	Des	Mfg	Part Number	Component Specs	Package	Qty	Area (mm ²)	Height (mm)	*Cost
1	U1	ADI	ADP2504ACPZ-R7	Current Mode Buck-Boost DC/DC Regulator	LFCSP-10	1	9	.8	1.40
2	U2	ADI	AD8542ARMZ-REEL	1MHz RtoR dual Opamp	MSOP-8	1	16.5	1.1	0.38
3	L1	Coilcraft	LPS4012-152	1.5H, 70 mOhm 4.0x4.0 inductor	4x4	1	16.0	1.2	0.43
4	D1	Diodes Inc.	1N4448HWT-7	Single 125mA, 100V Signal Diode	SOD-523	1	1.5	0.8	0.056
5	D2	Fairchild	BAT54CWT1G	Dual Common Cathode, 200mA, 30V Schottkey Diode	SOT-323	1	5.3	1.1	0.041
6	Cin	Taiyo-Yuden	JMK212 BJ106MG-T	10uF, 6.3V, X5R	0805	1	2.5	1.25	0.025

Item #	Des	Mfg	Part Number	Component Specs	Package	Qty	Area (mm^2)	Height (mm)	*Cost
7	Co	Taiyo-Yuden	JMK212 BJ106MG-T	10uF, 6.3V, X5R	0805	1	2.5	1.25	0.025
8	Cout	Taiyo-Yuden	JMK212BJ226MG-T	22uF, 6.3V, X5R	0805	2	5.0	1.25	0.154
9	Cbias	Vishay	10% tolerance	100nF, X7R	0402	1	0.5	0.5	0.010
10	Cbyp	Vishay	10% tolerance	100nF, X7R	0402	1	0.5	0.5	0.010
11	C1	Vishay	10% tolerance	1.0nF, 50V, X7R	0402	1	0.5	0.5	0.010
12	C2	Vishay	10% tolerance	1.0nF, 50V, X7R	0402	1	0.5	0.5	0.010
13	Cff	Vishay	10% tolerance	330pF,50V,C0G	0402	1	0.5	0.5	0.010
14	Rout	Susumu	RL1220S-0R1-G	0.1 Ohm, 2% tol, 0.25W	0805	1	3.2	0.4	0.100
15	Rtop	Vishay	1% tolerance	102 kohm	0402	1	0.5	0.4	0.005
16	Rbot	Vishay	1% tolerance	11.3 kohm	0402	1	0.5	0.4	0.005
17	Rff	Vishay	1% tolerance	30.1 kohm	0402	1	0.5	0.4	0.005
18	R1	Vishay	1% tolerance	10.0 kohm	0402	1	0.5	0.4	0.005
19	R2	Vishay	1% tolerance	10.0 kohm	0402	1	0.5	0.4	0.005
20	R3	Vishay	1% tolerance	82.5 kohm	0402	1	0.5	0.4	0.005
21	R4	Vishay	1% tolerance	82.5 kohm	0402	1	0.5	0.4	0.005
Total:						22	67.5	1.25	2.70

*BOM prices shown are 1000 piece estimates in US Dollars that should be used for comparison purposes only.

SIMULATION RESULTS

Figure 2. Bode plot with 10 Ohm load

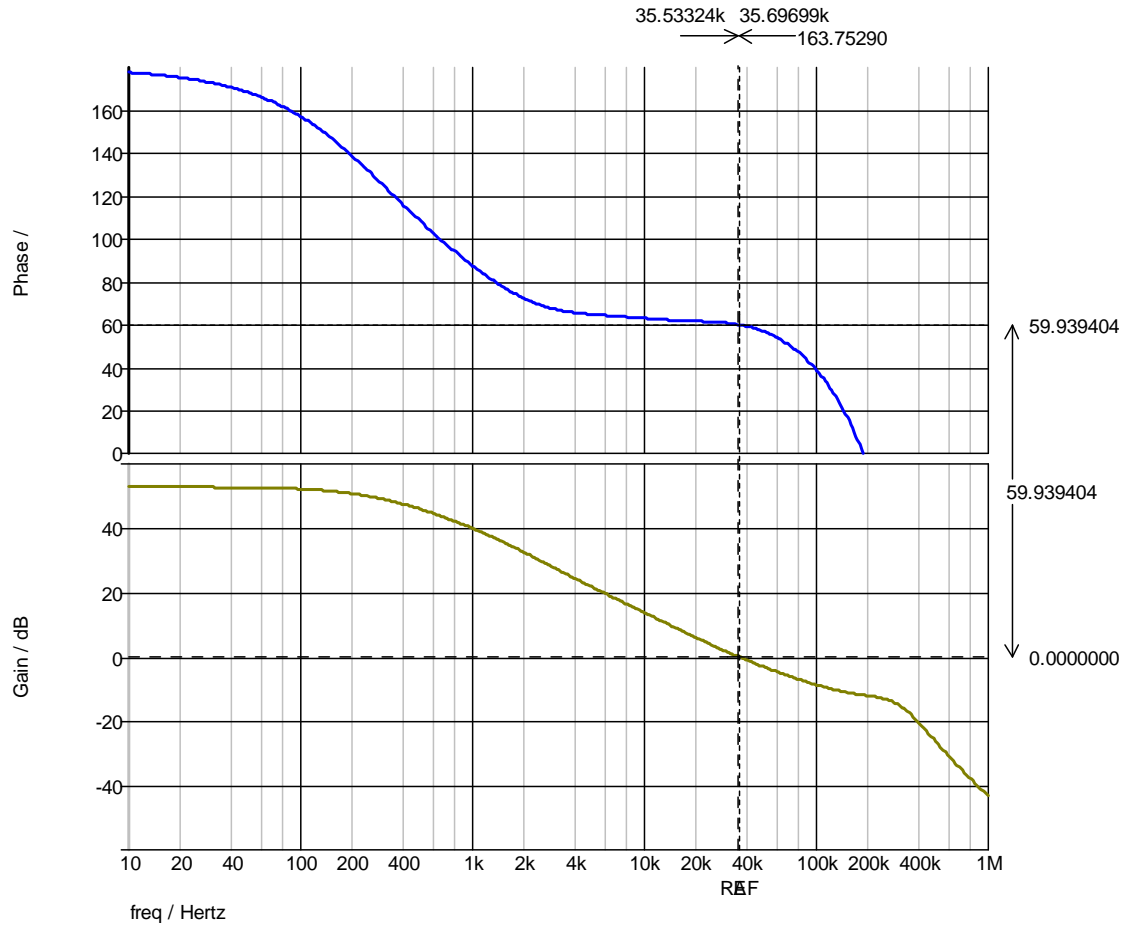


Figure 3. Bode plot with 10 Ohm load and 470 uF aluminum output cap

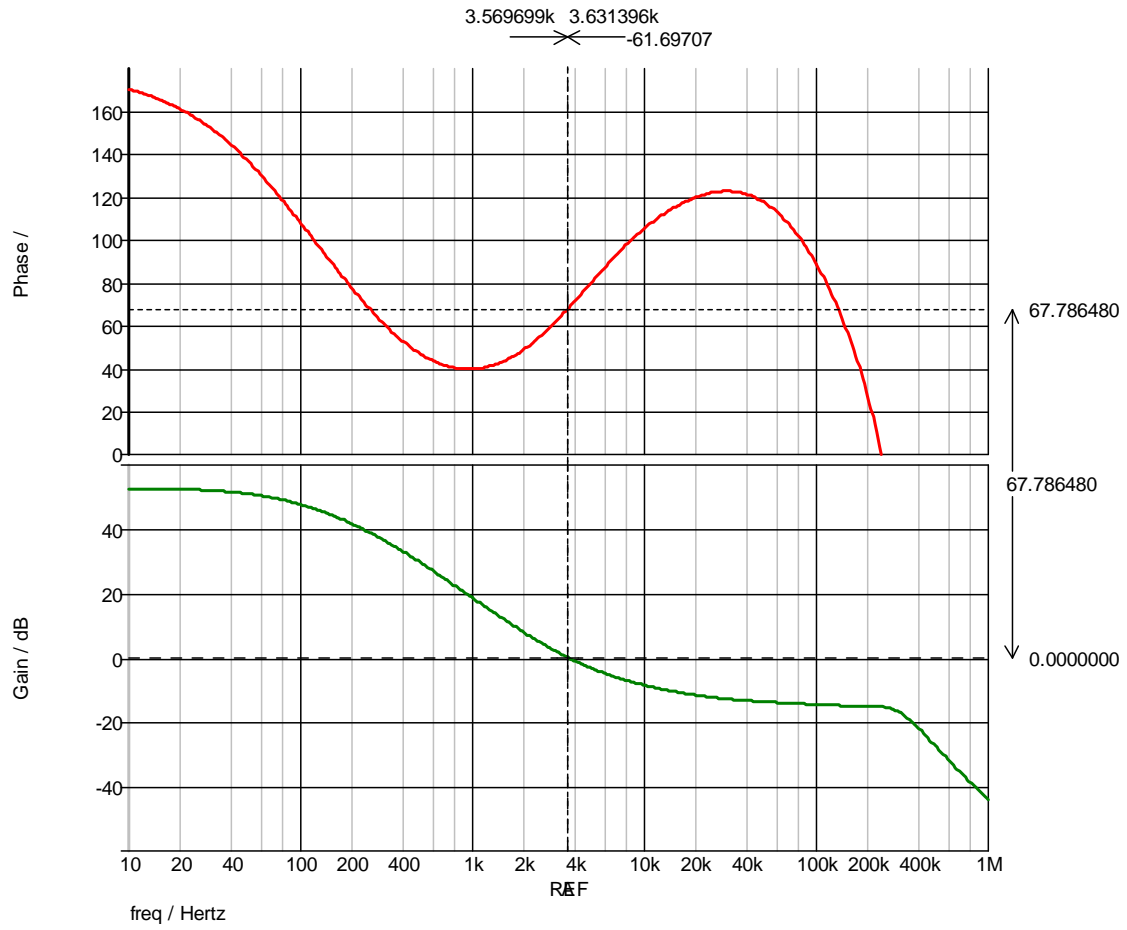


Figure 4. Bode plot with 7 Ohm load ($V_{out} = 4.2\text{ V}$, constant current)

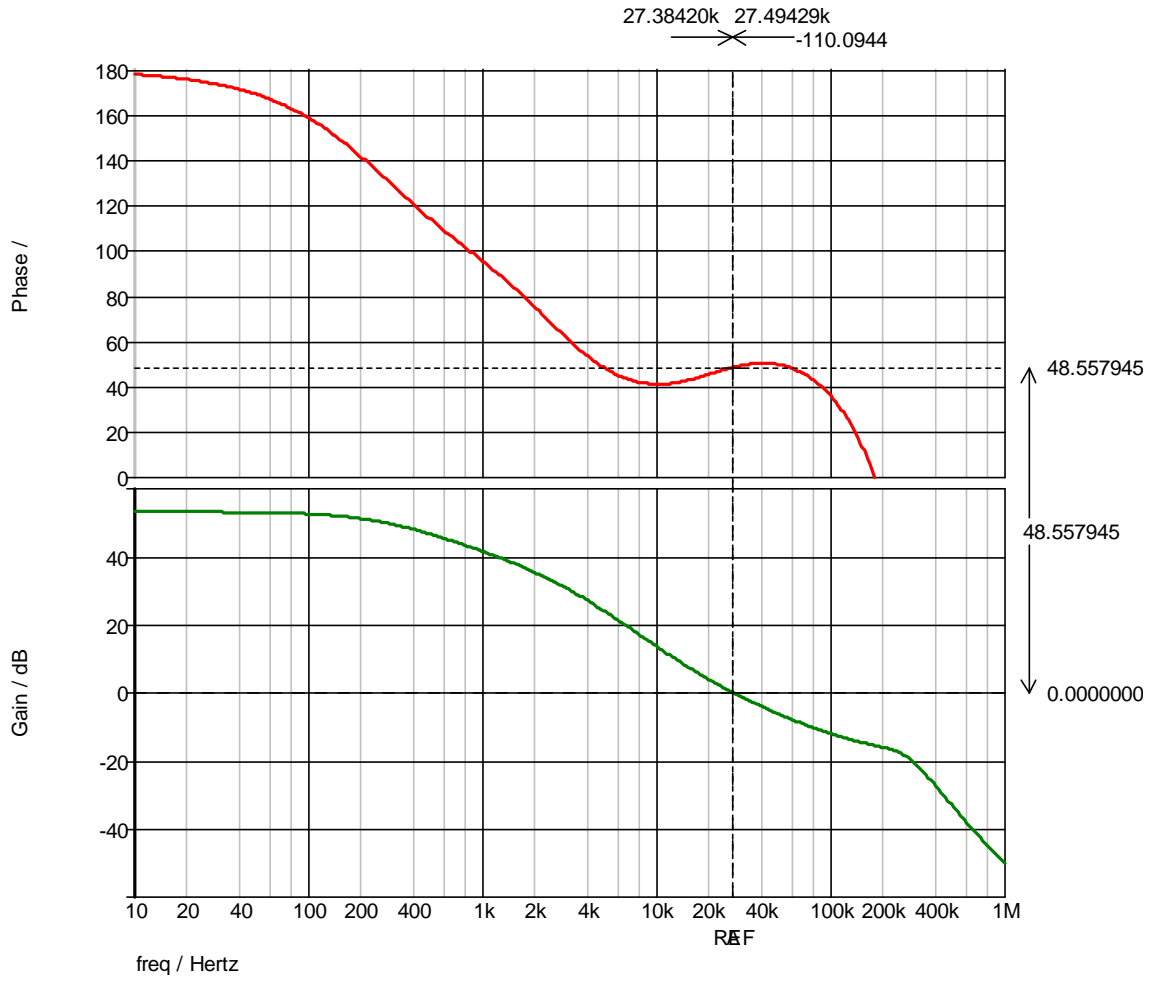


Figure 5. Bode plot with 5 Ohm load ($V_{out} = 3\text{ V}$, constant current)

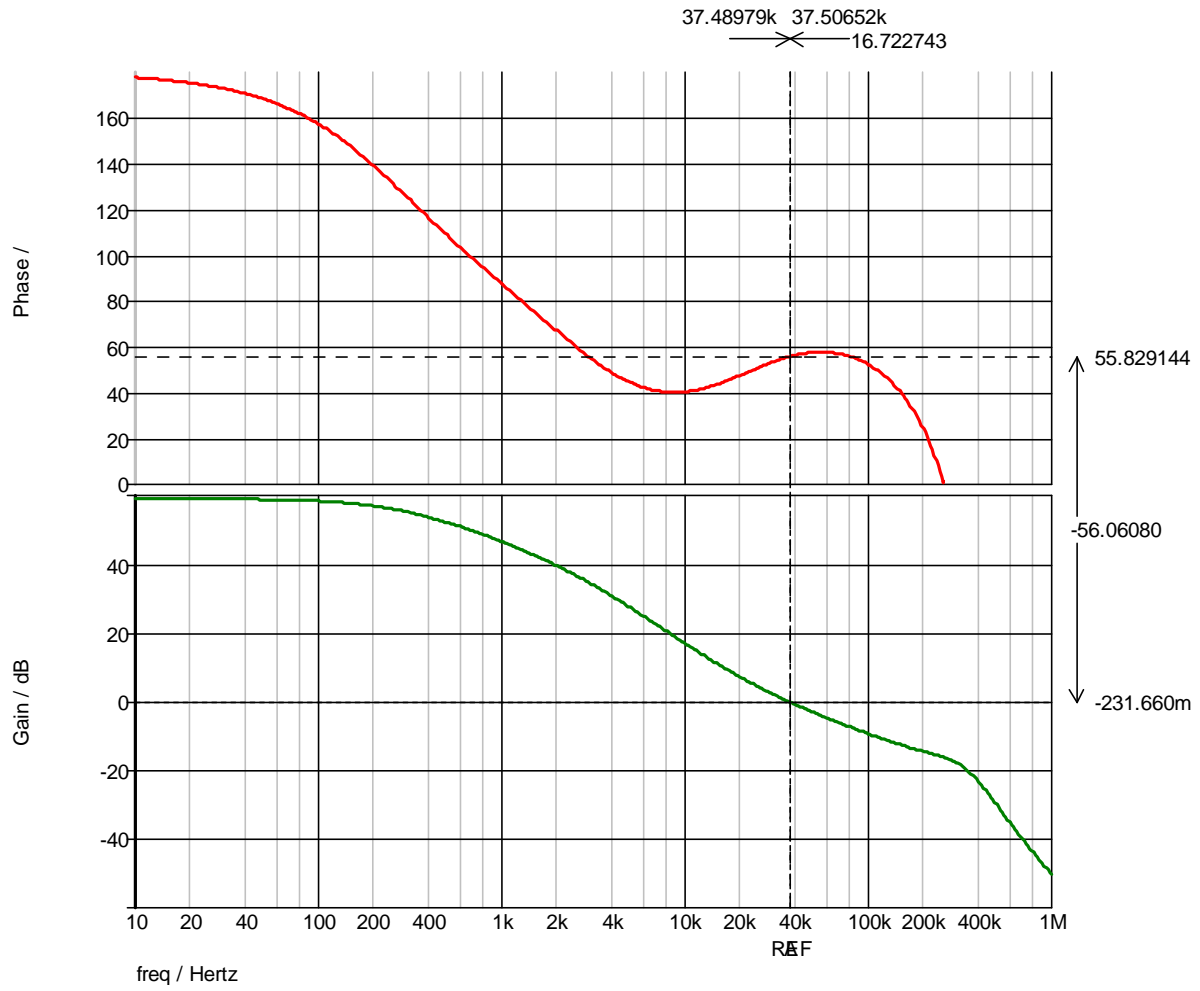


Figure 6. Transient with 10 Ohm load and 100 mA dynamic step

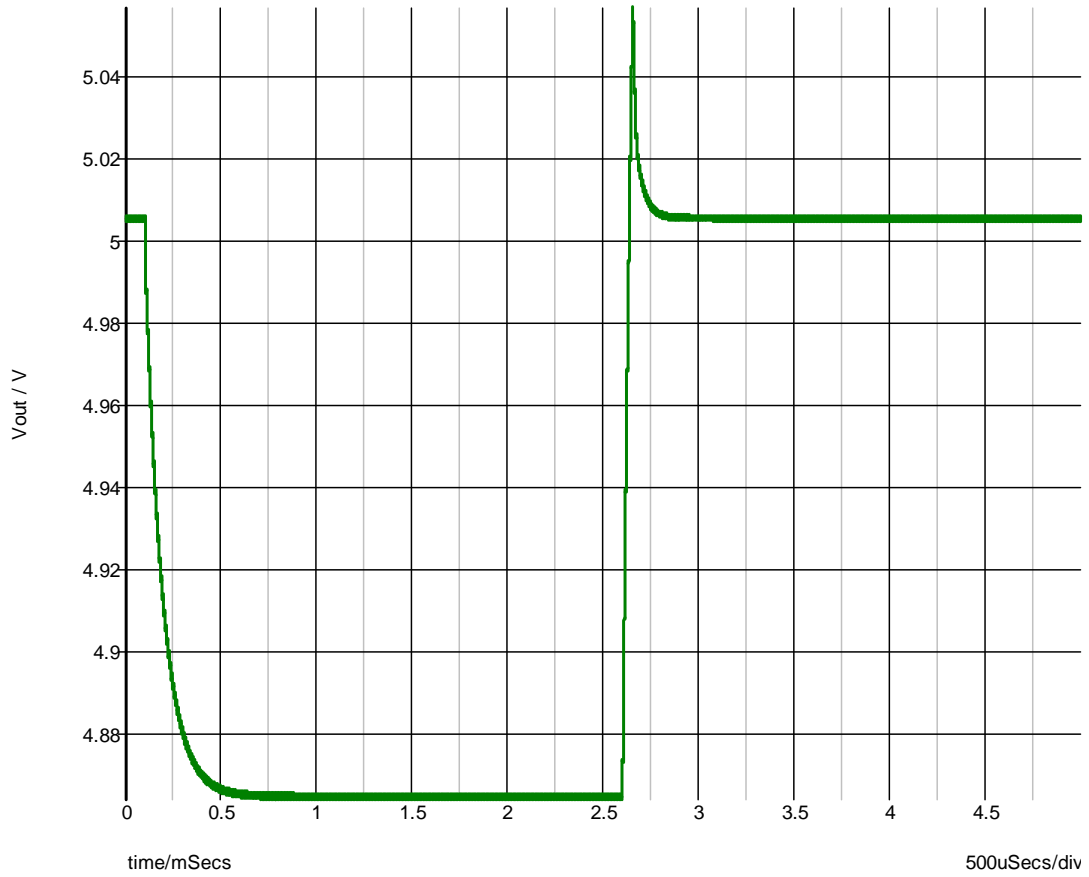
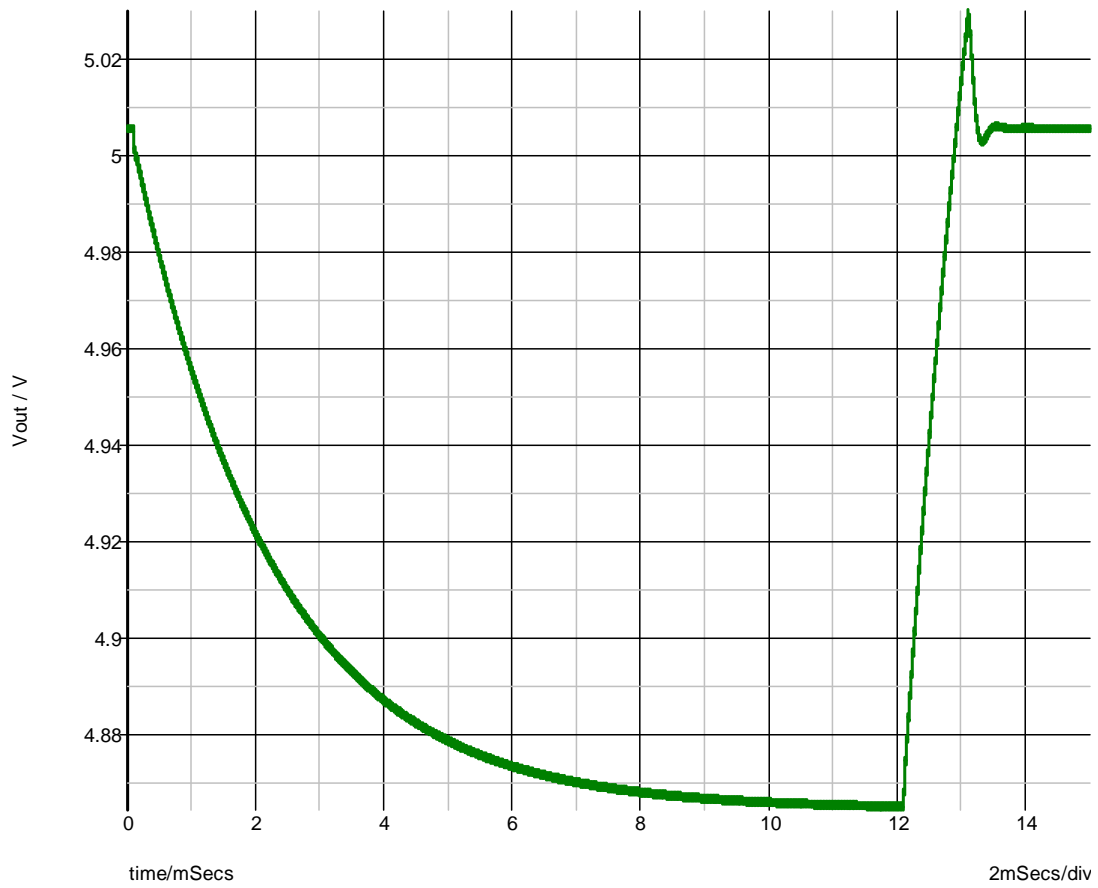


Figure 7. Transient with 10 Ohm load and 100 mA dynamic step and 470 uF aluminum output cap



NOTES

Simulations show the voltage loop is stable with the output caps listed in the BOM and with the addition of 470 uF of additional aluminum output cap. Transient response shows the constant current mode is stable with the output caps listed in the BOM and with the addition of 470 uF of additional aluminum output cap. The transient response also shows minimal overshoot when transitioning from one mode to the other.

Simulations also shows that the constant current loop is stable when loaded with 7 Ohms and with 5 Ohms.