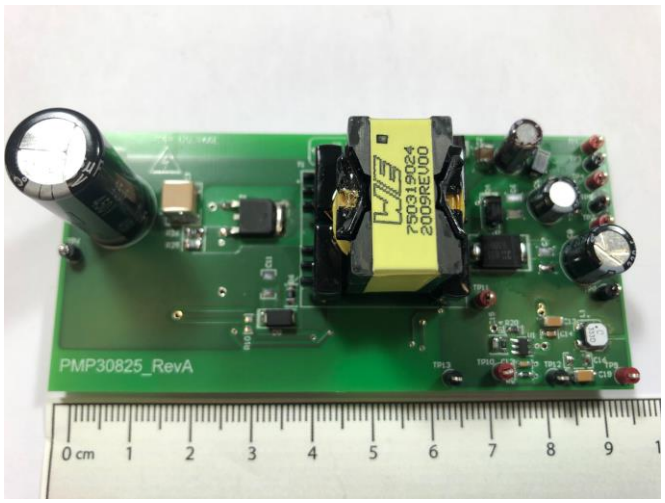
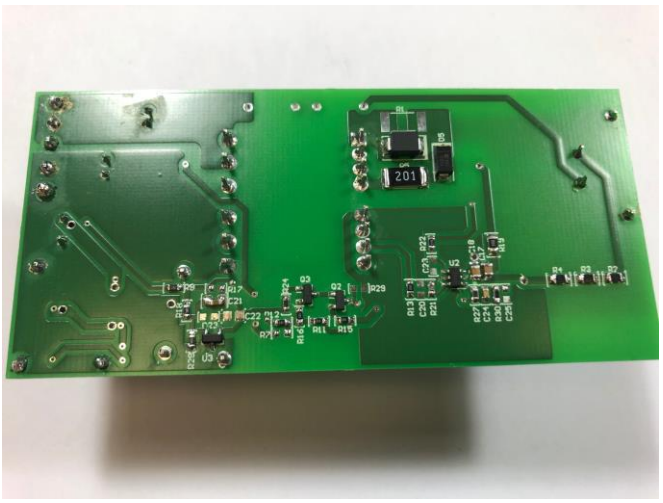
Test Report: PMP30825

150-VDC - 430-VDC Input, Multiple-Output Valley-Switching Flyback Reference Design





Description

This 10-W non-isolated flyback reference design uses the UCC28742 controller to generate four outputs (5 V at 150 mA, 12 V at 690 mA, 15 V at 80 mA, 18 V at 20 mA). The controller provides constant-voltage and constant-current regulation. Transistors are used in place of an optocoupler feedback circuit to reduce the overall BOM cost.

1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1. Voltage and Current Requirements

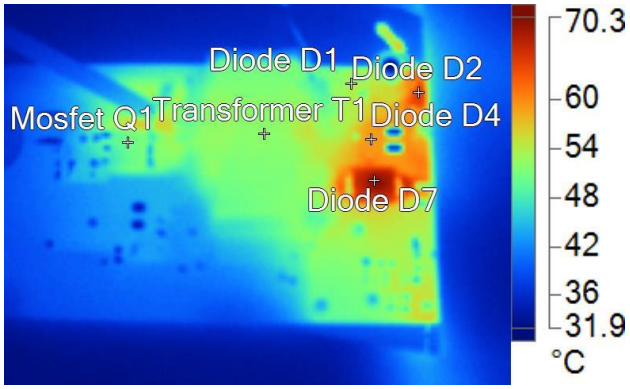
PARAMETER	SPECIFICATIONS
Input Voltage	150VDC – 430VDC
Output 1	5V@150mA
Output 2	12V@690mA
Output 3	15V@80mA
Output 4	18V@20mA

2 Testing and Results

2.1 Thermal Images

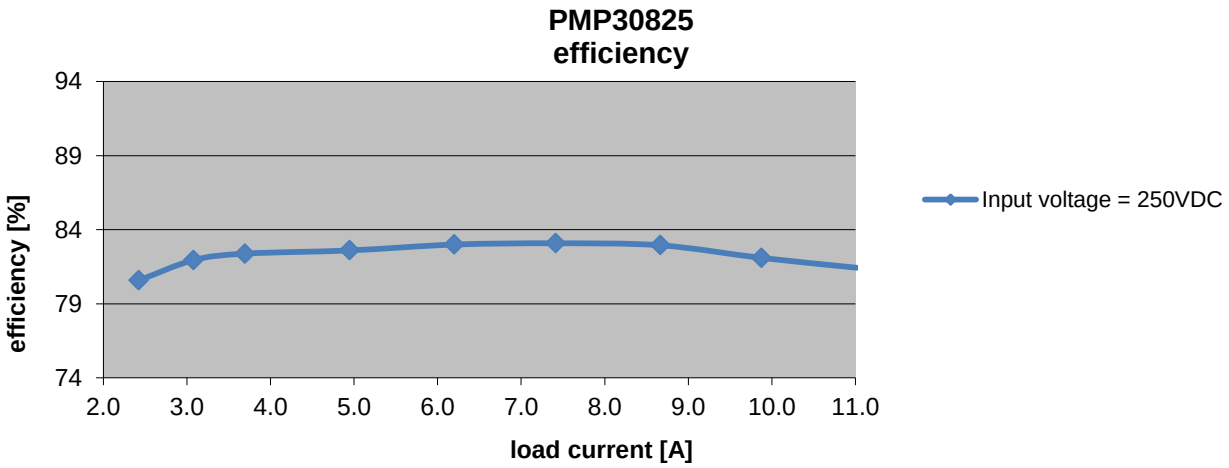
The images below show the infrared images taken from the FlexCam after 10min at full output load.

Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA
No airflow



Name	Temperature	
Diode D7	70.3°C	
Diode D4	59.1°C	
Diode D2	64.7°C	
Transformer T1	52.1°C	
Mosfet Q1	50.6°C	
Diode D1	53.8°C	

2.2 Efficiency Data

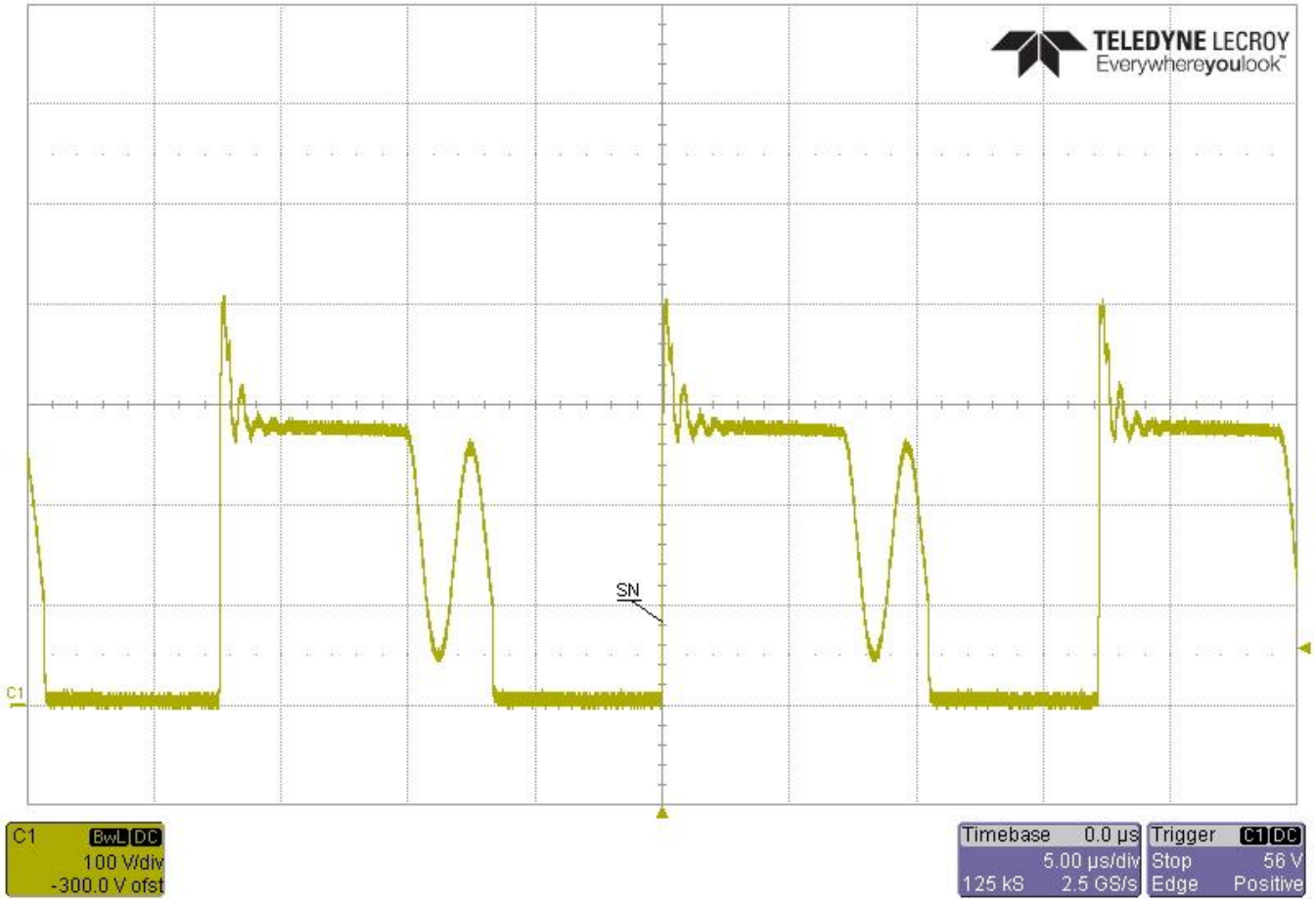


input voltage [VDC]	input current [A]	5Vout [V] Load=33ohm	output 12Vout[V]	I_12Vout[A]	15Vout[V] load=186.5ohm	18Vout[V] load=998ohm	Output power [W]
150.0	0.089	4.952	11.99	0.697	15.40	24.59	10.98
200.0	0.066	4.952	11.99	0.697	15.40	24.70	10.98
249.8	0.053	4.952	11.99	0.697	15.40	24.79	10.99
300.4	0.045	4.952	11.99	0.697	15.40	24.85	10.99
350.3	0.039	4.952	11.99	0.697	15.41	24.91	10.99
430.4	0.032	4.952	11.99	0.697	15.41	25.00	11.00
250.6	0.012	4.952	12.00	0.006	14.89	20.51	2.42
250.6	0.015	4.952	12.00	0.057	15.00	21.09	3.08
250.6	0.018	4.952	12.00	0.106	15.07	21.57	3.70
250.6	0.024	4.952	12.00	0.206	15.17	22.43	4.95
250.6	0.030	4.952	12.00	0.306	15.24	23.29	6.20
250.6	0.036	4.952	12.00	0.403	15.30	24.01	7.41
250.6	0.042	4.952	12.00	0.505	15.34	24.48	8.67
250.6	0.048	4.952	11.99	0.605	15.37	24.65	9.87
250.6	0.054	4.952	11.99	0.700	15.40	24.80	11.02

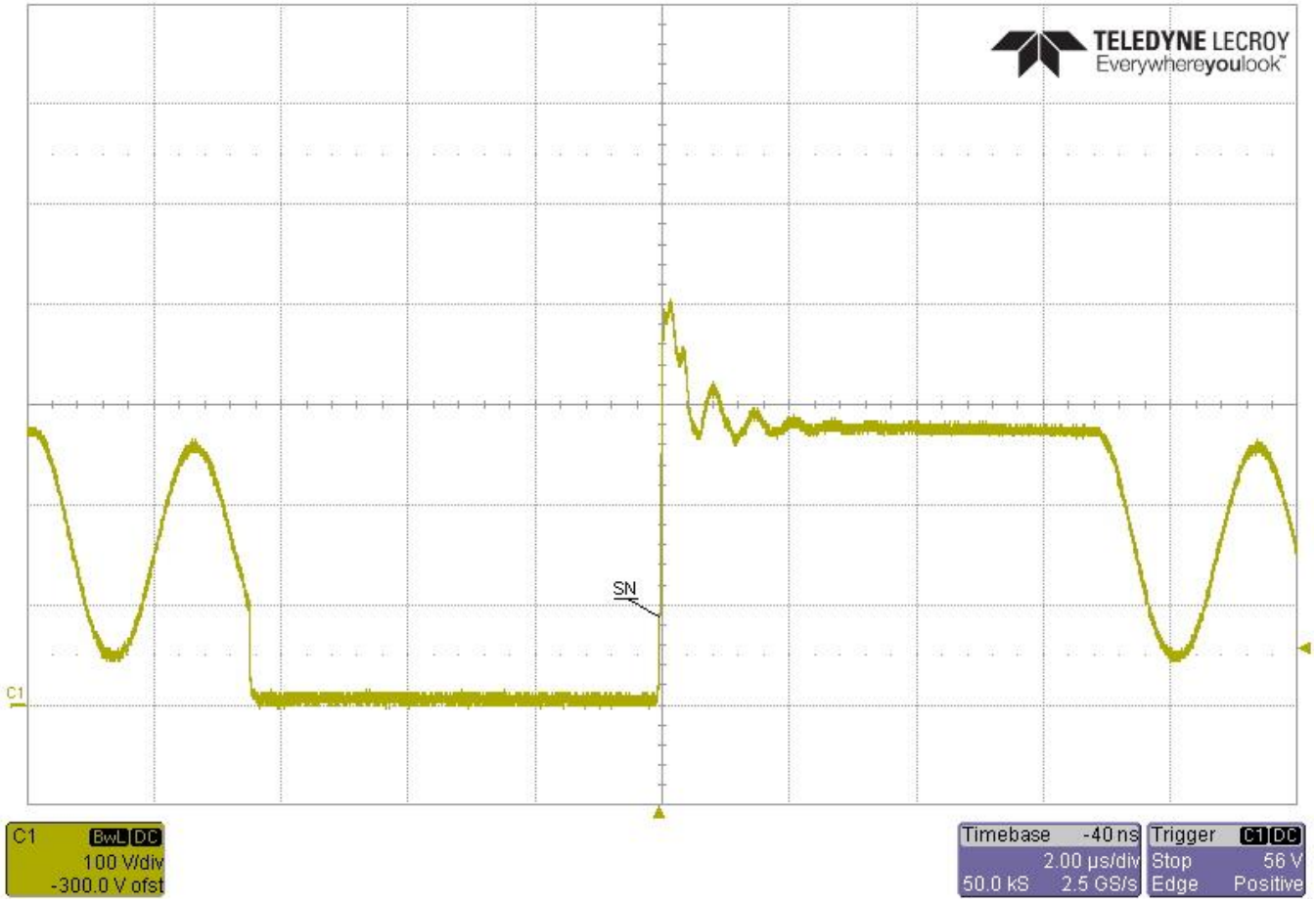
3 Waveforms

3.1 Switchnode

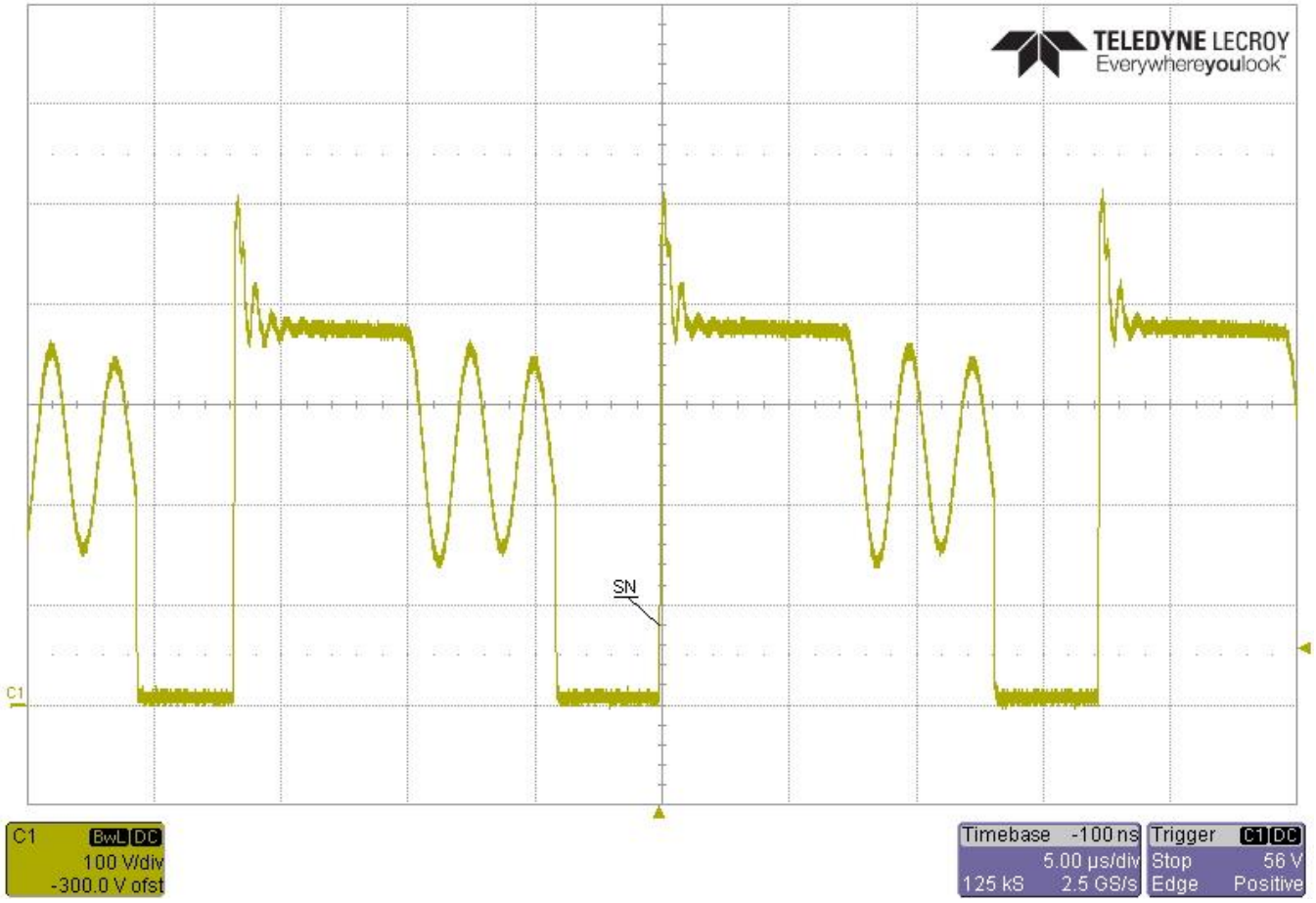
Input voltage = 150VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



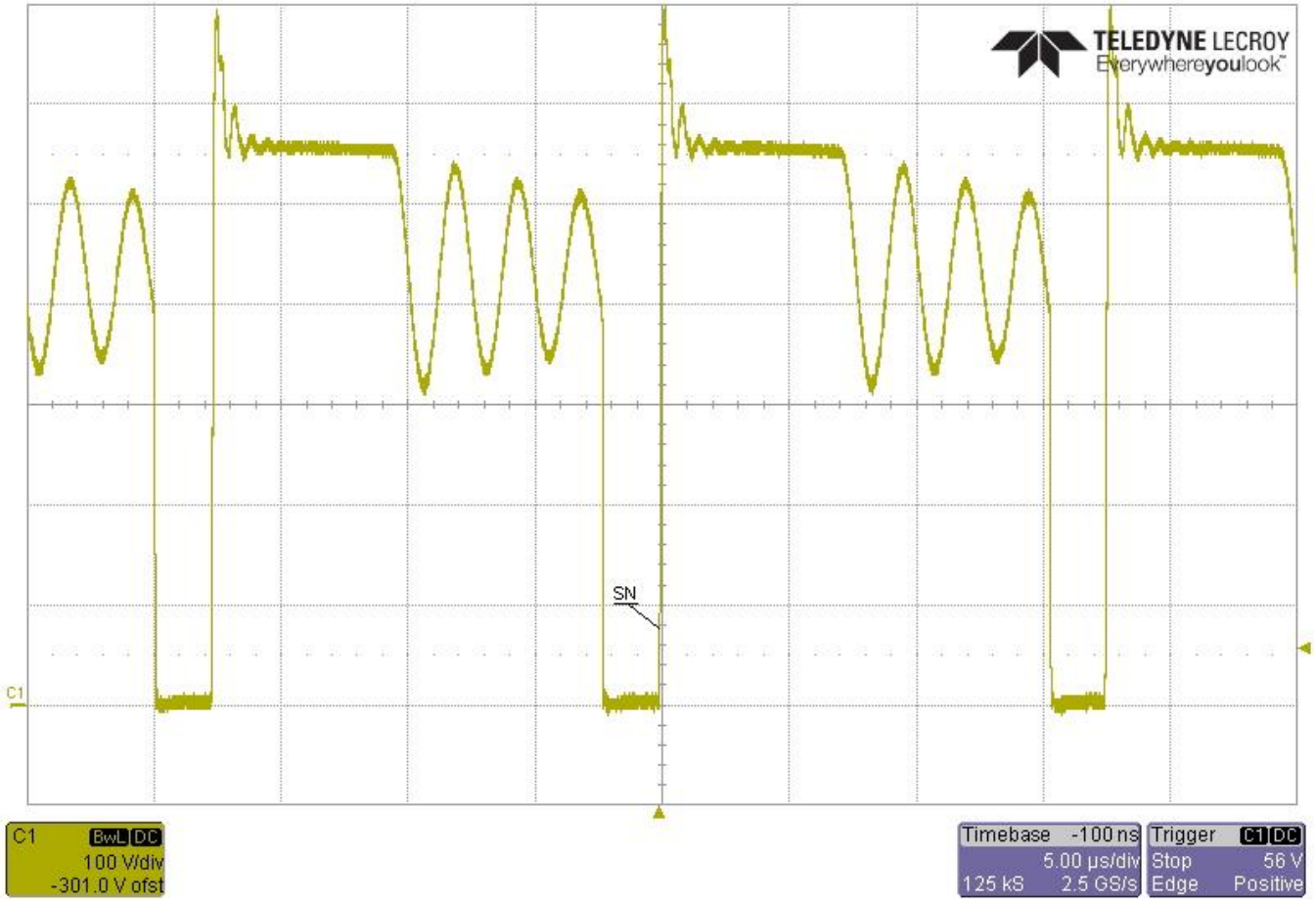
Input voltage = 150VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



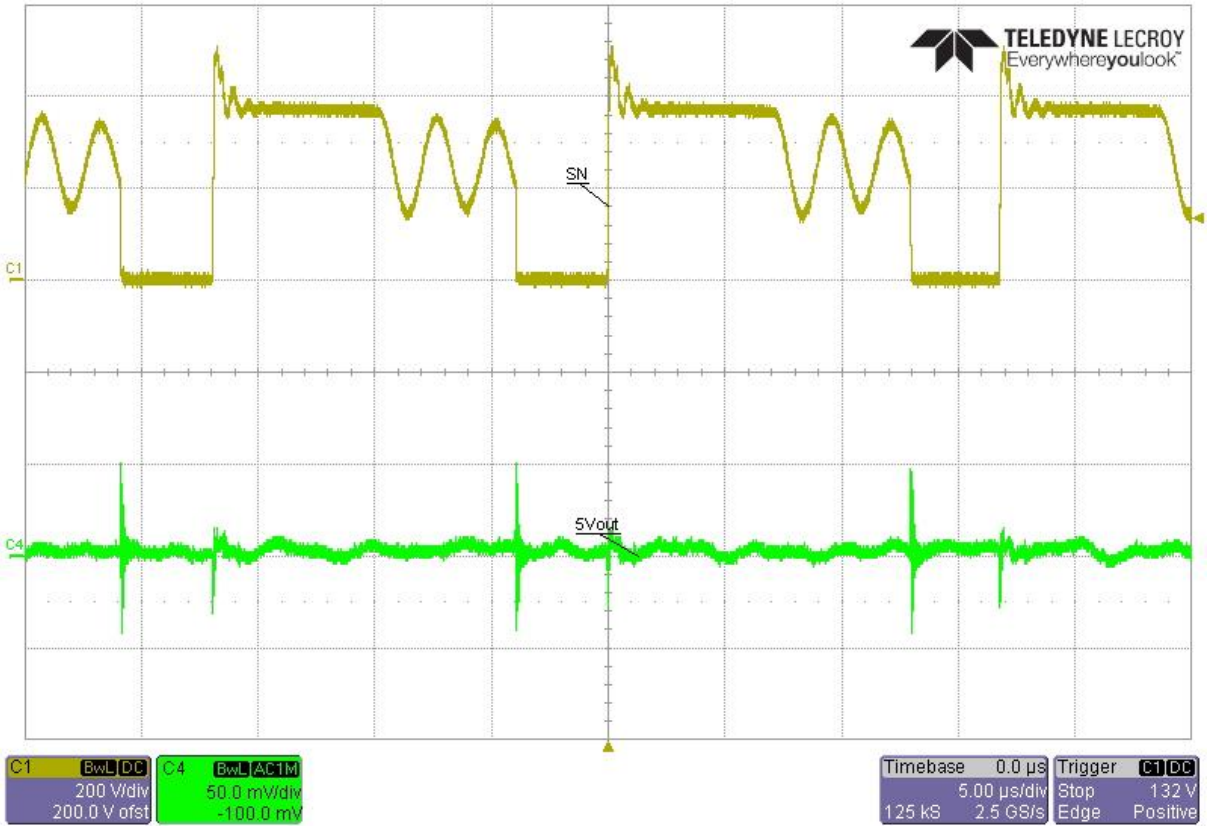
Input voltage = 430VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



3.2 Output Ripple Voltage

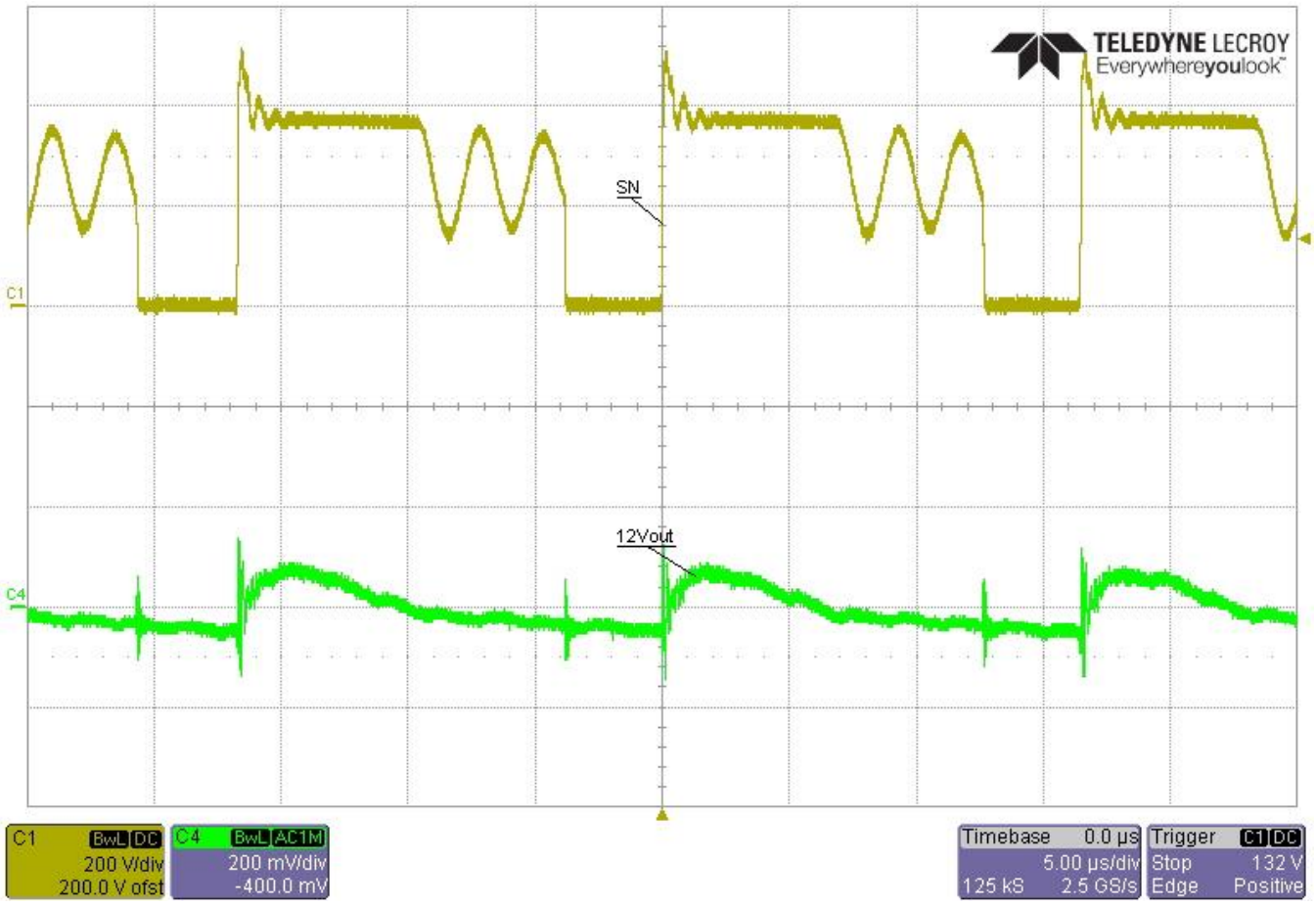
3.2.1 5Vout

Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



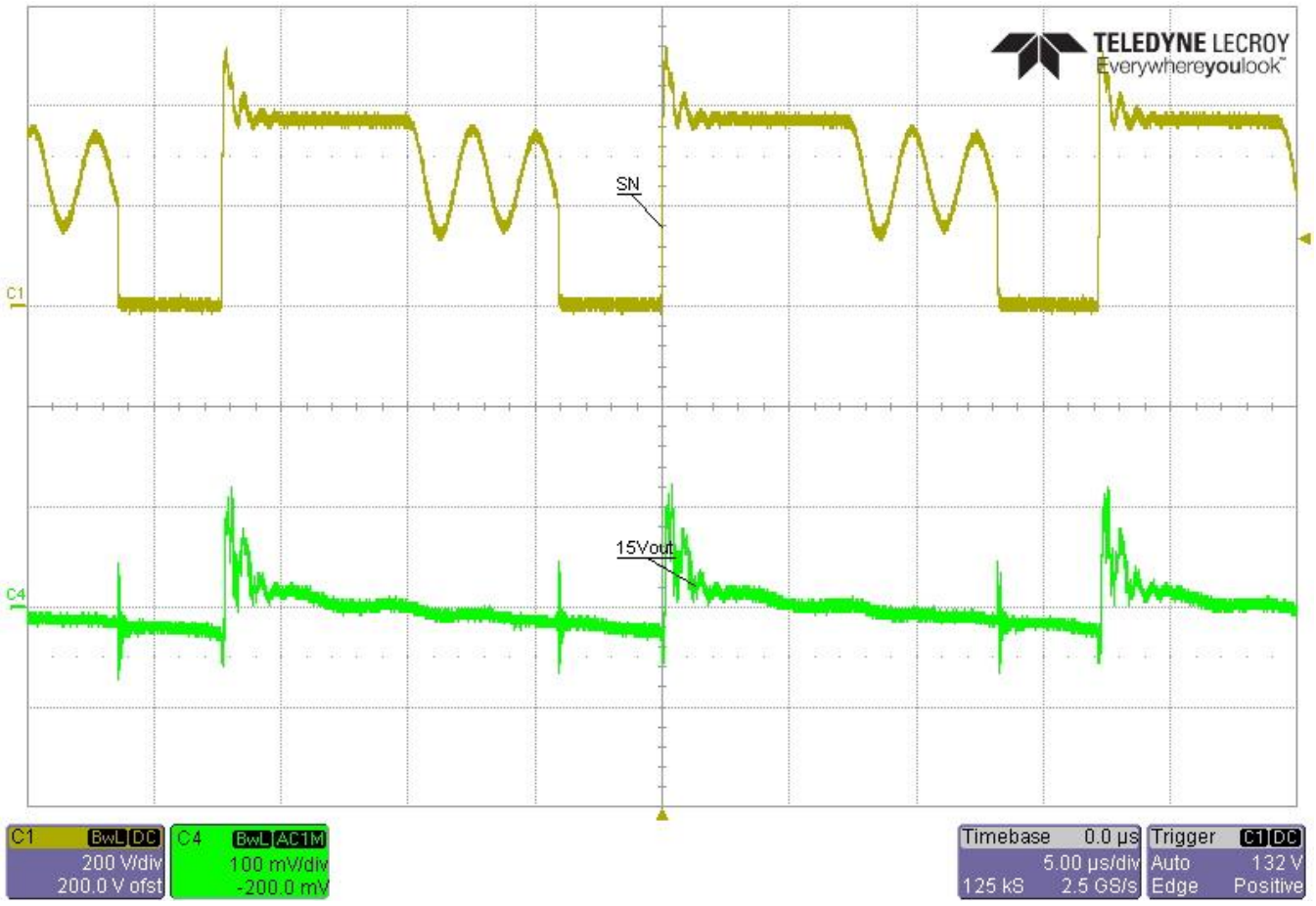
3.2.2 12Vout

Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



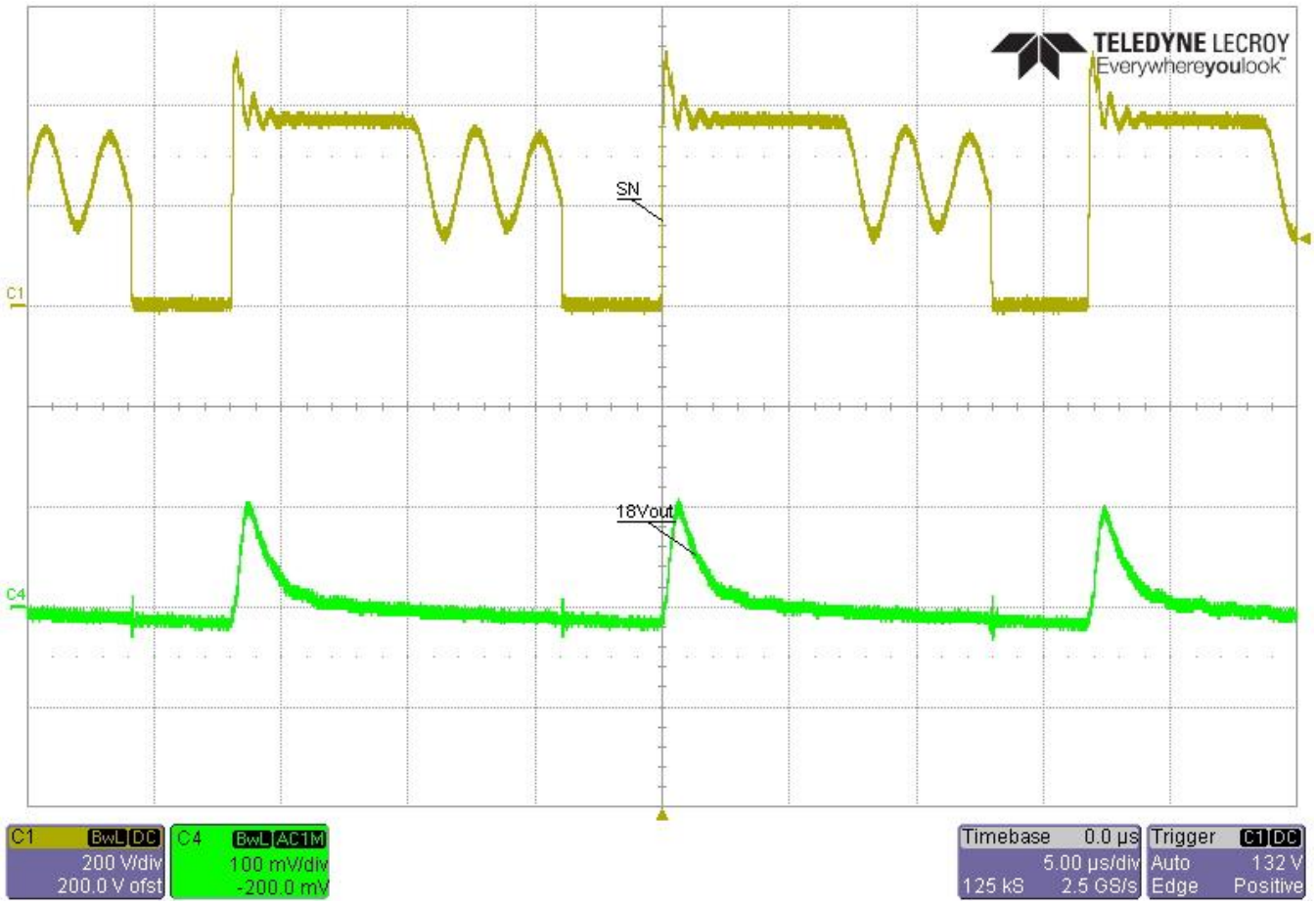
3.2.3 15Vout

Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



3.2.4 18Vout

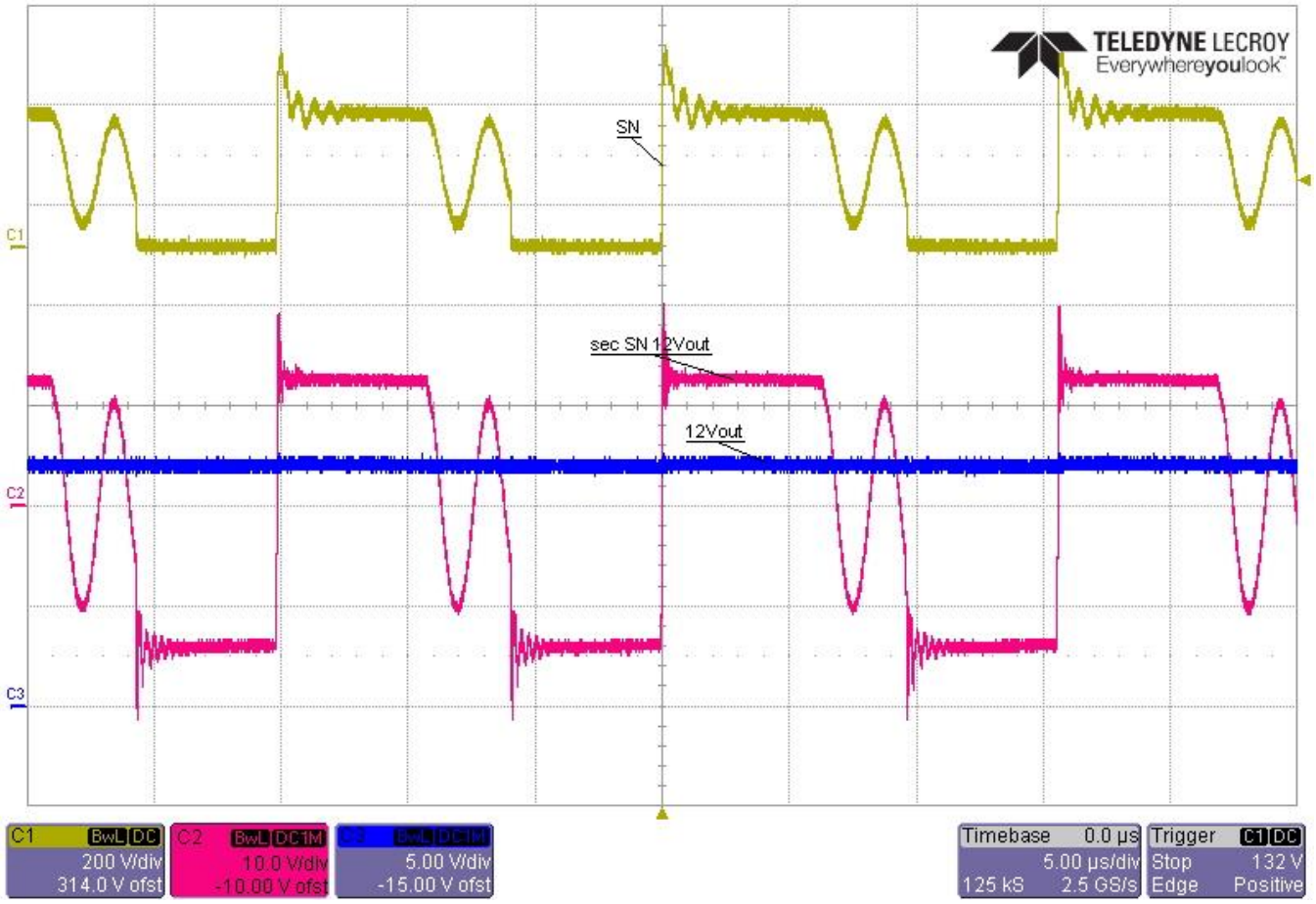
Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



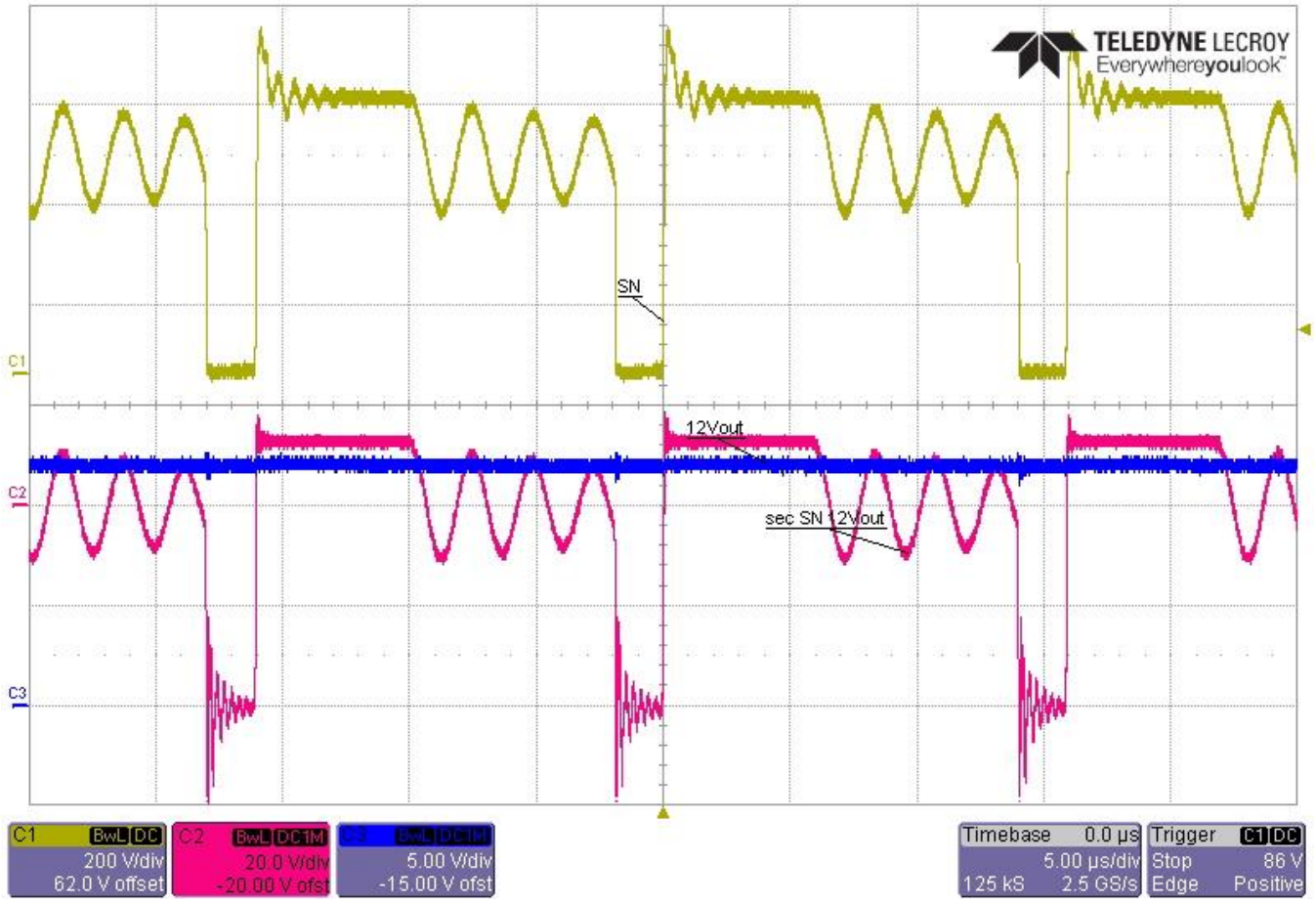
3.3 Secondary side Switchnode

3.3.1 12Vout

Input voltage = 150VDC
12V Output = 690mA

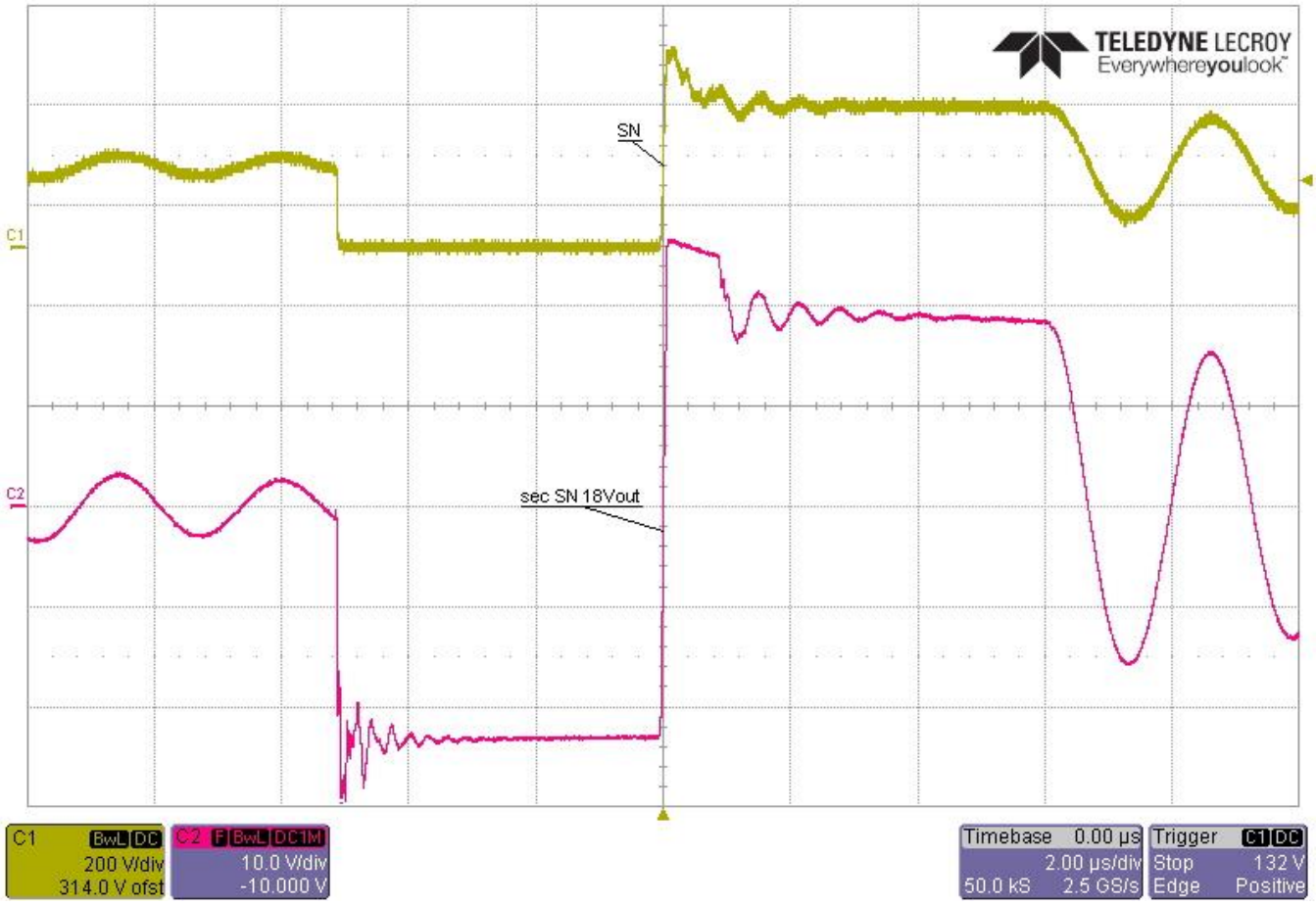


Input voltage = 430VDC
12V Output = 690mA



3.3.2 18Vout

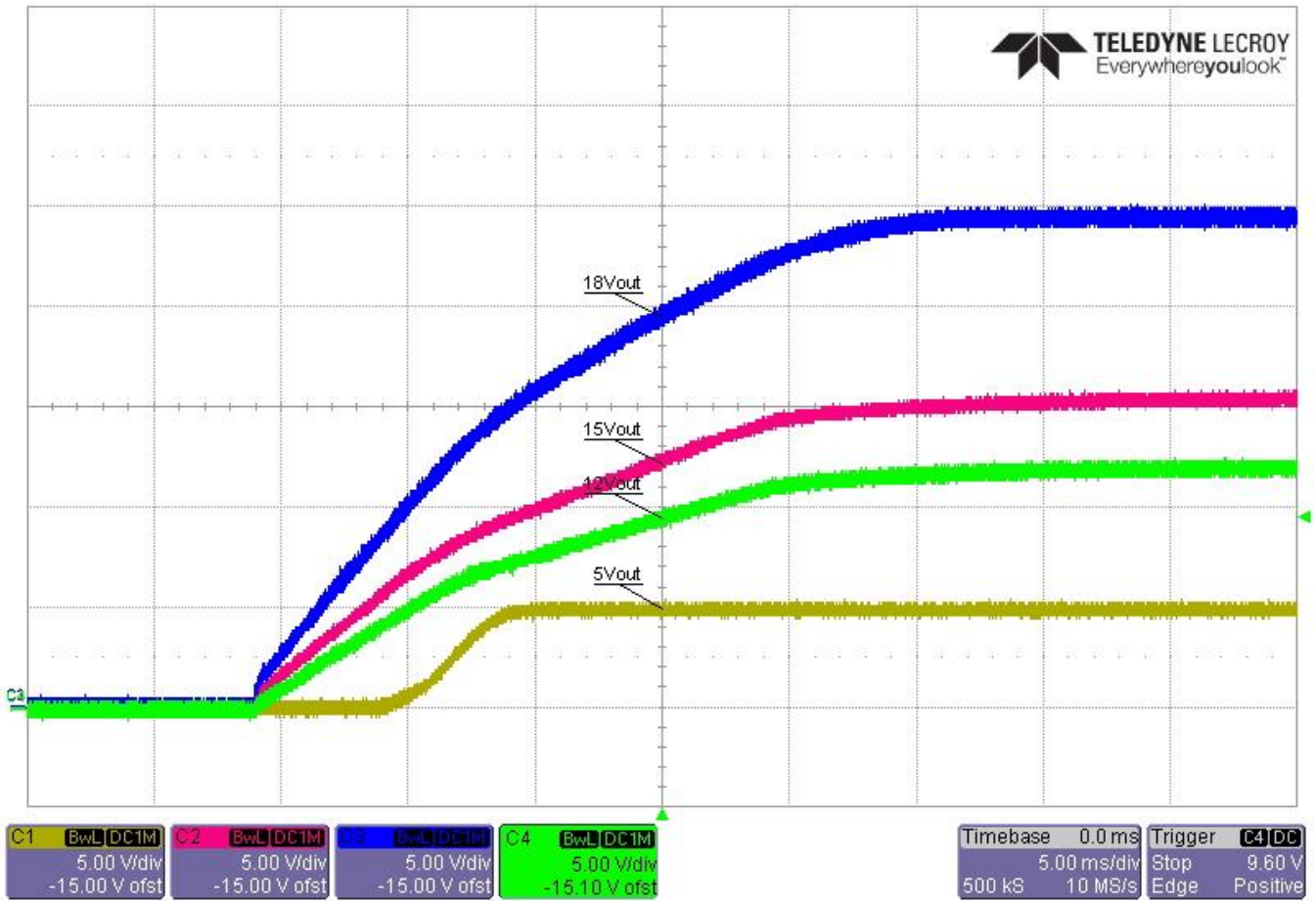
Input voltage = 150VDC
12V Output = 300mA
18V Output = 0A



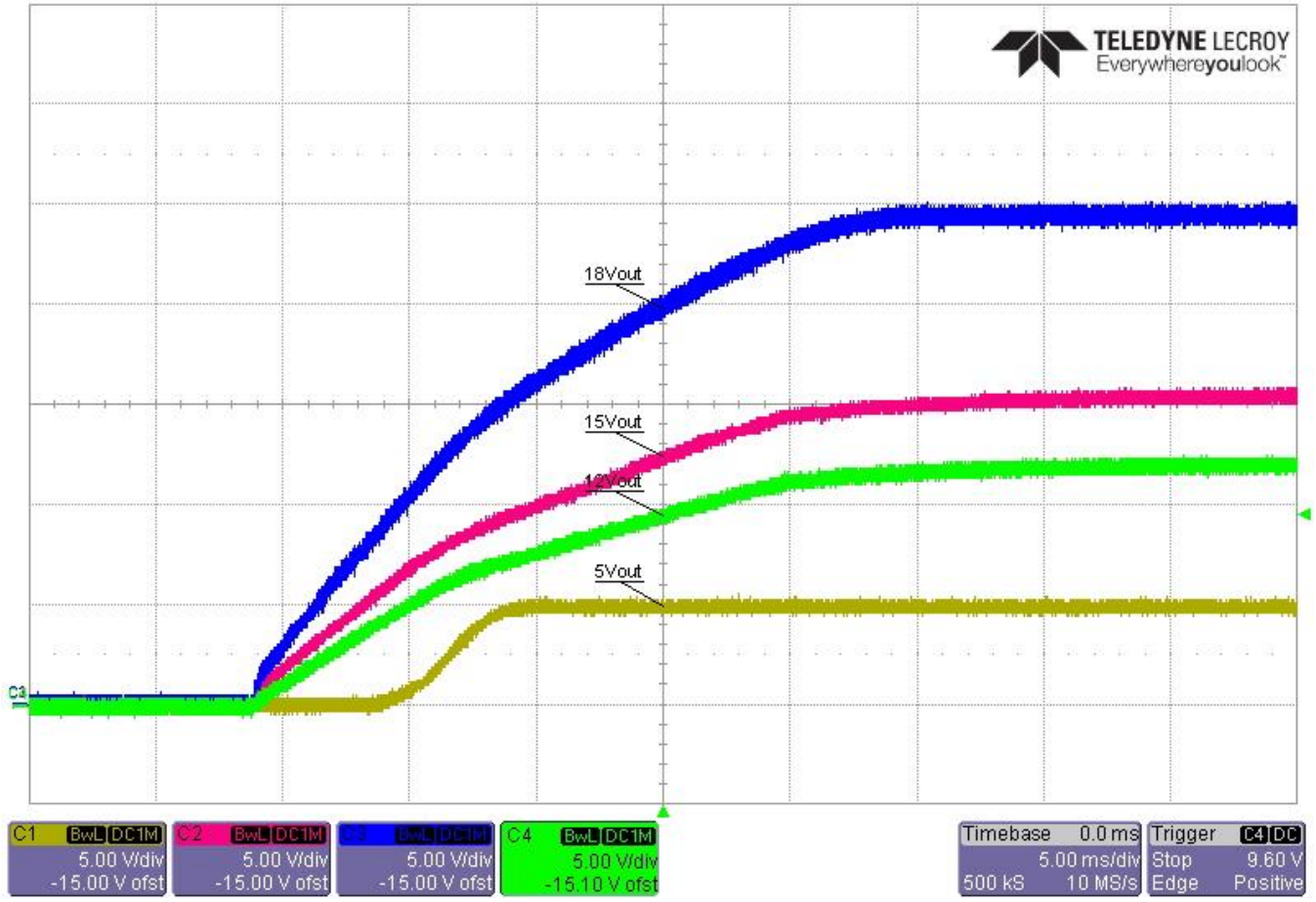
3.4 Startup/Shutdow

3.4.1 Startup Full Load

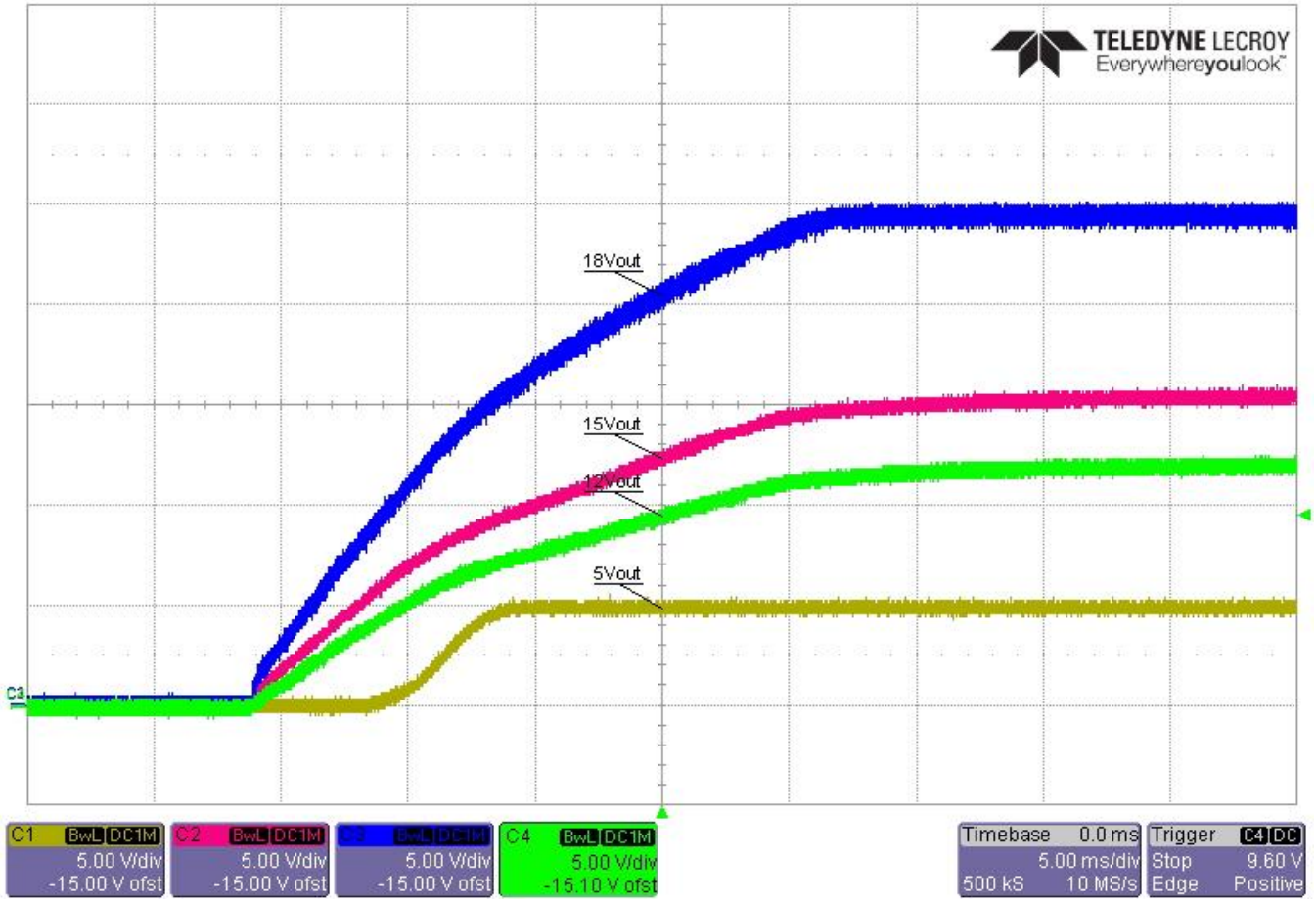
Input voltage = 150VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA

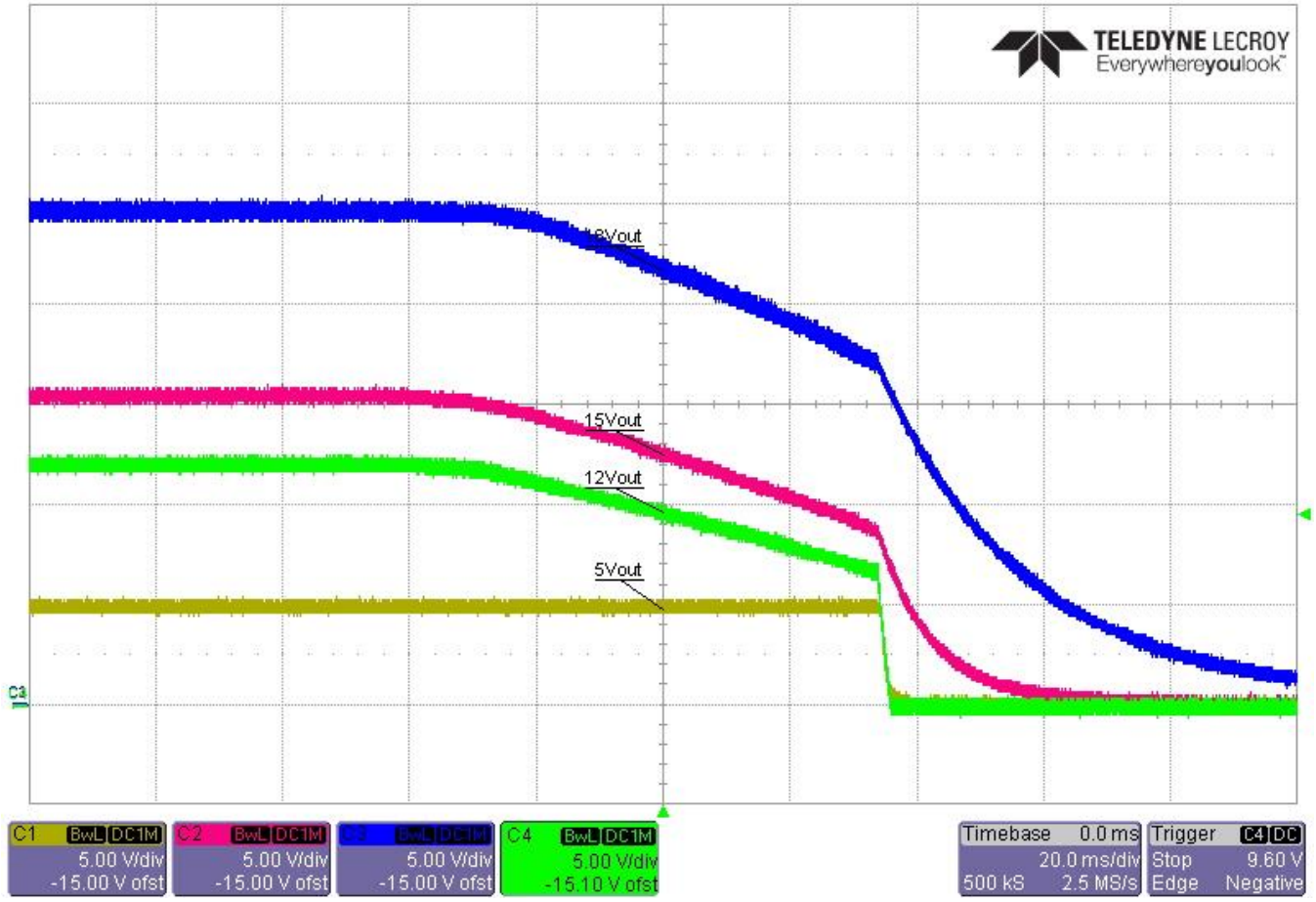


Input voltage = 430VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA

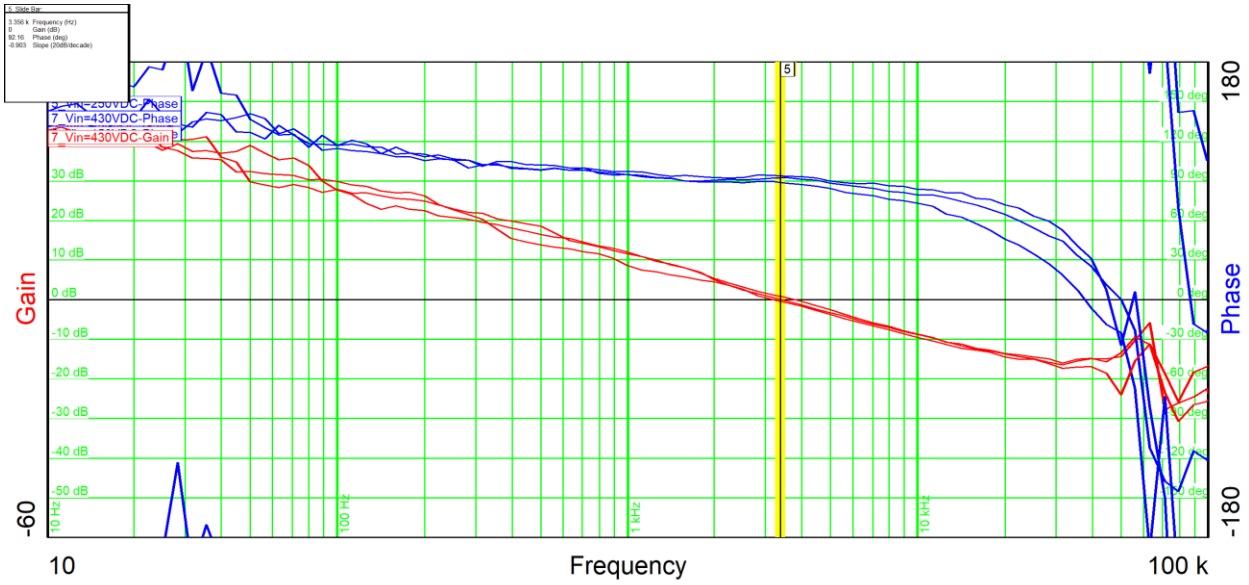


3.4.2 Shutdown

Input voltage = 250VDC
5V Output = 150mA
12V Output = 690mA
15V Output = 80mA
18V Output = 20mA



3.5 Control Loop Gain and Stability UCC28742

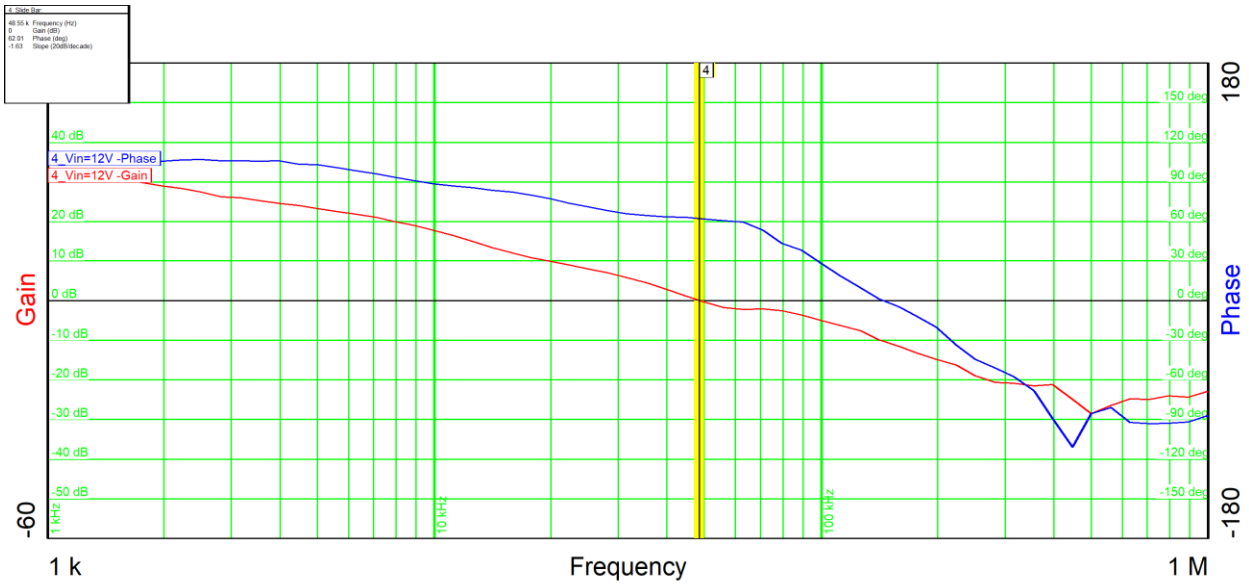


Input Voltage = 150VDC
Load = full load
Bandwidth = 3.7kHz
Phase Margin = 88°

Input Voltage = 250VDC
Load = full load
Bandwidth = 3.4kHz
Phase Margin = 92°

Input Voltage = 430VDC
Load = full load
Bandwidth = 3.2kHz
Phase Margin = 94°

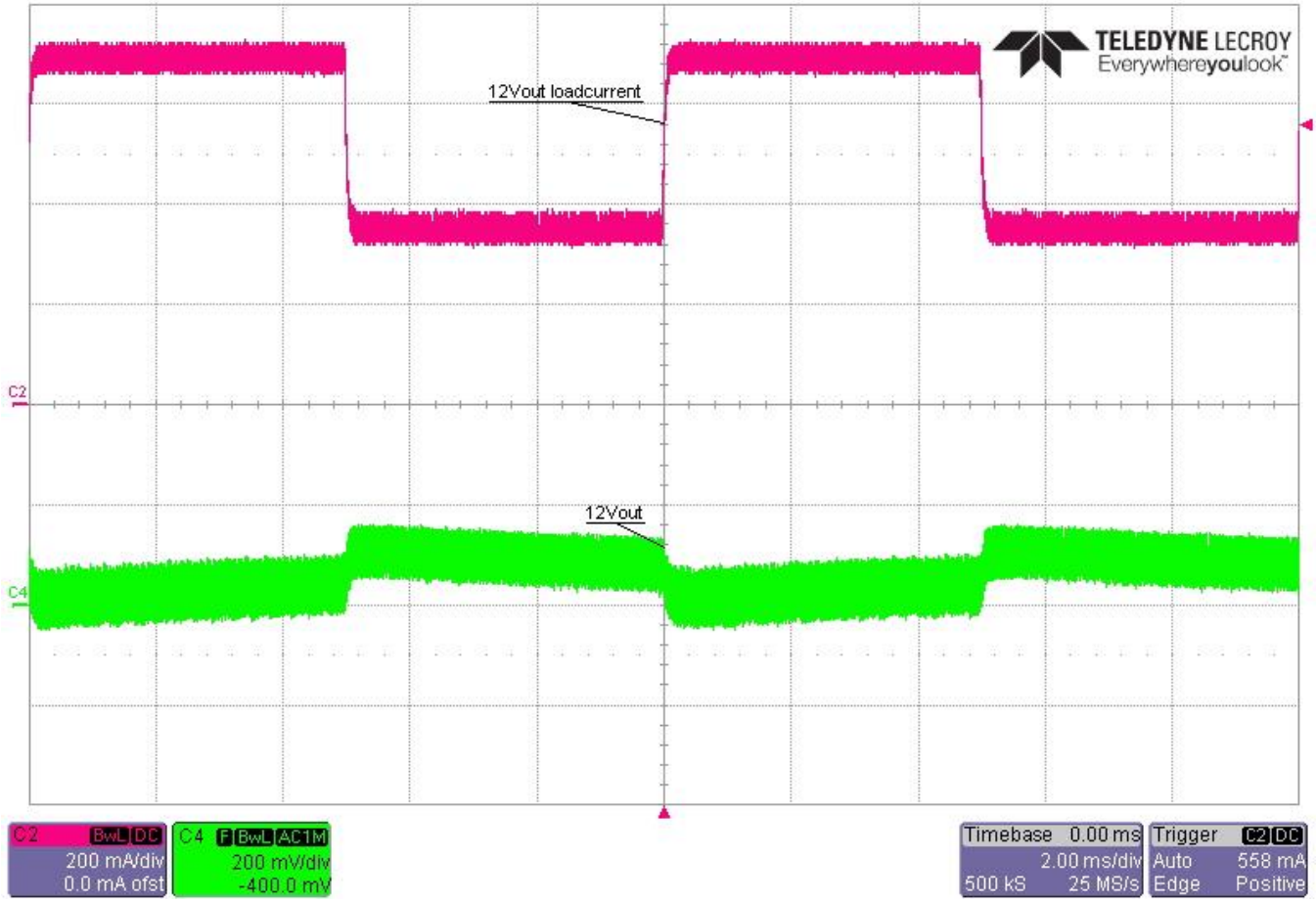
3.6 Control Loop Gain and Stability TPS54202



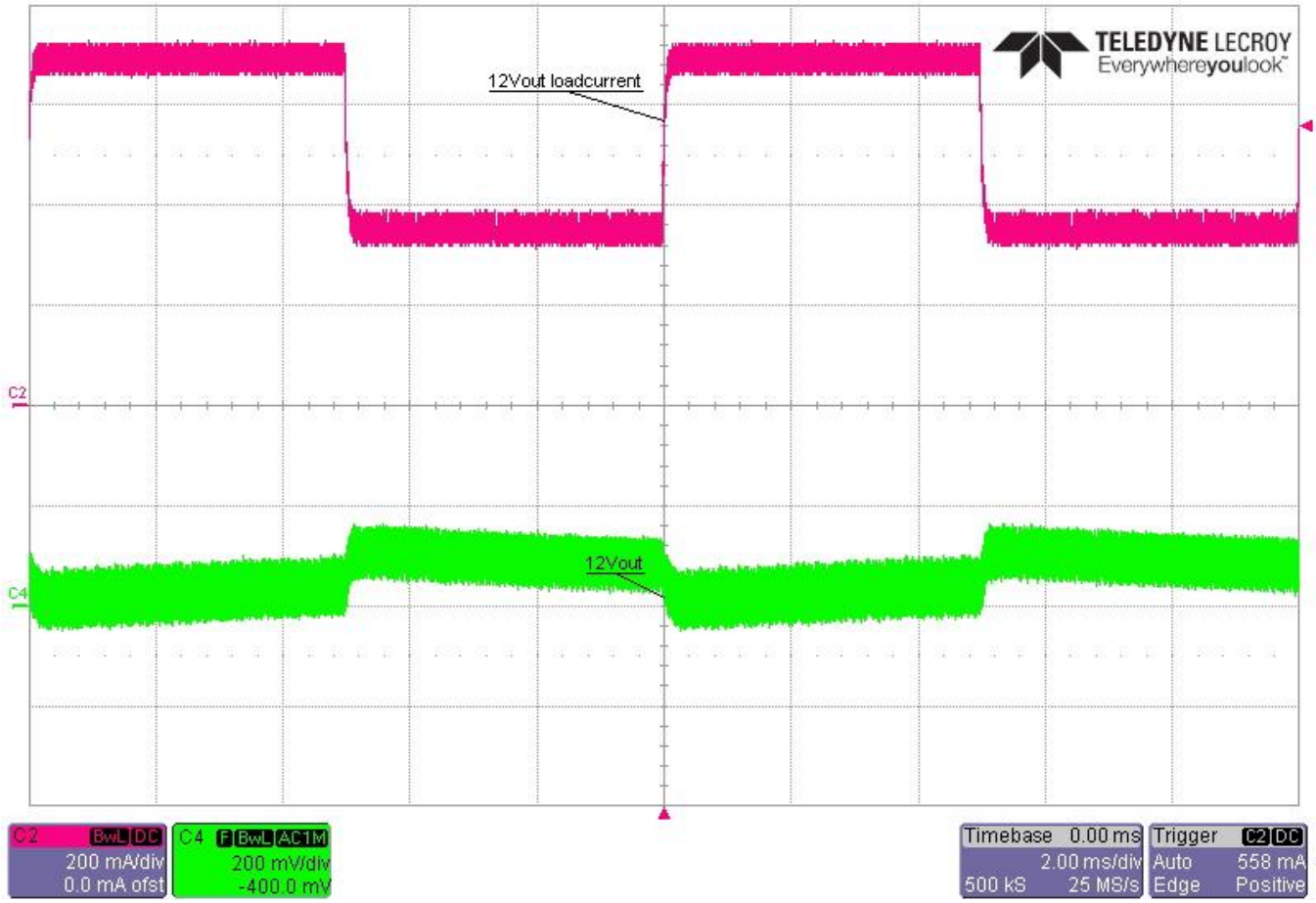
Input Voltage = 12VDC
Load = full load
Bandwidth = 49kHz
Phase Margin = 62°

3.7 Load Transients 12V Output

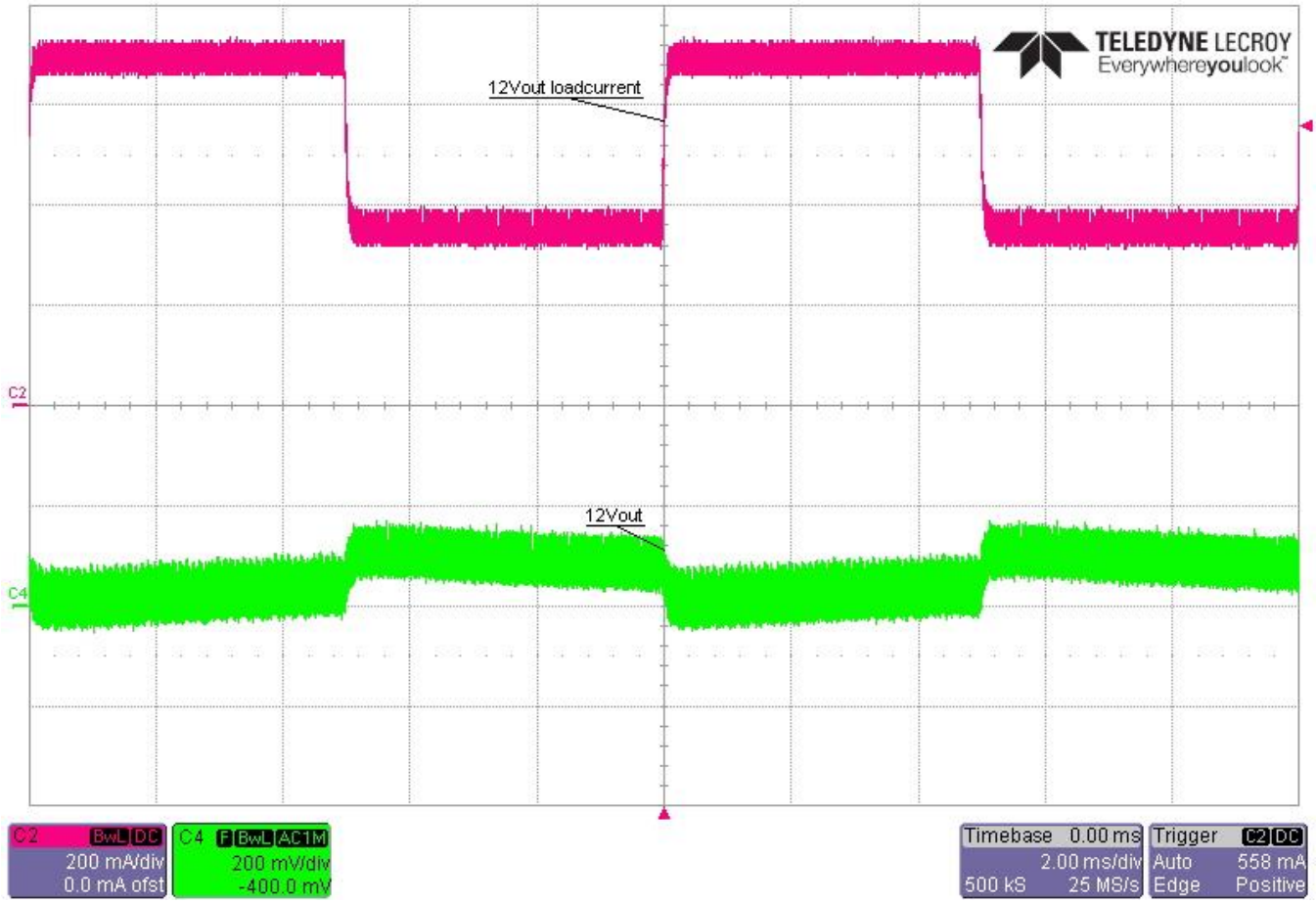
Input voltage = 150VDC
12V Output = 350mA to 690mA



Input voltage = 250VDC
12V Output = 350mA to 690mA



Input voltage = 430VDC
12V Output = 350mA to 690mA



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