

60V to 1000V Input, Triple Output 10W PSR Flyback



Description

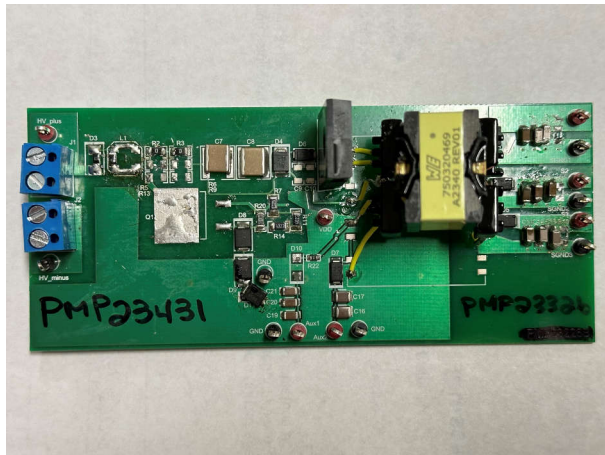
This reference design uses the [UCC28730-Q1](#) flyback controller to produce an isolated 33V output. The design is capable of three 100mA outputs from a 60V to 1000VDC input. This power system is designed to be a bias supply for a traction inverter with an automotive-qualified controller.

Features

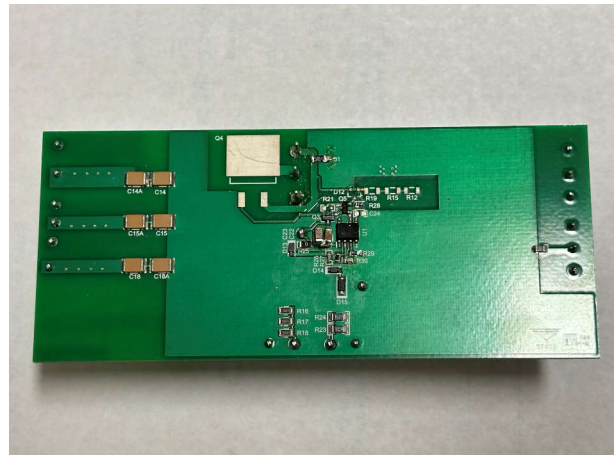
- Wide input voltage range
- Isolated outputs
- High efficiency
- Primary-side regulation for small size

Applications

- [Traction inverter motor control](#)
- Bias supply



Top of Board



Bottom of Board

1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1-1. Voltage and Current Requirements

Parameter	Specifications
V_{IN}	60VDC to 1000VDC
V_{OUT1} , V_{OUT2} , V_{OUT3}	33VDC each
I_{OUT1} , I_{OUT2} , I_{OUT3} ($< 400V_{IN}$)	10mA–70mA each
I_{OUT1} , I_{OUT2} , I_{OUT3} ($> 400V_{IN}$)	30mA–100mA each
P_{OUT} ($< 400V_{IN}$)	7W
P_{OUT} ($> 400V_{IN}$)	10W

1.2 Required Equipment

- Power supply (capable of up to 1000VDC output)
- 3 × Electronic loads or resistor decade boxes
- DMMs
- Oscilloscope

1.3 Dimensions

The size of the board is 4.9in × 2.1in.

2 Testing and Results

2.1 Efficiency Graphs

Efficiency is shown in the following figure.

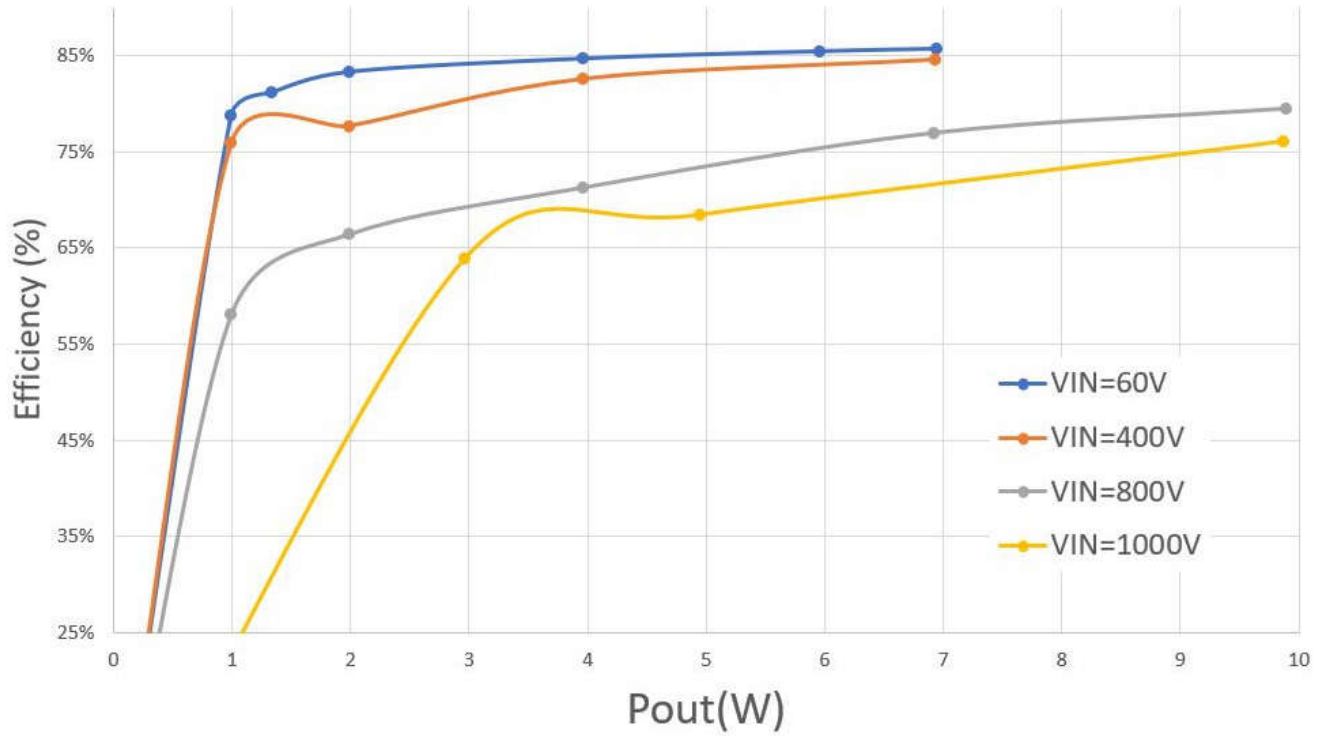


Figure 2-1. Efficiency Graph

2.2 Efficiency Data

Efficiency data is shown in the following table.

V _{IN} (V)	I _{IN} (A)	V _{OUT} (V)	I _{OUT} (A)	P _{IN} (W)	P _{OUT} (W)	P _{LOSS} (W)	Efficiency (%)
60	0.05367	33.15	0.08	3.2202	2.652	0.5682	82.36
60	0.0779	33.007	0.12	4.674	3.9608	0.7132	84.74
60	0.135	33.08	0.21	8.1	6.9468	1.1532	85.76
400	0.00638	33.05	0.06	2.552	1.9832	0.5688	77.71
400	0.01198	32.99	0.12	4.792	3.9592	0.8328	82.62
400	0.02047	32.99	0.21	8.188	6.9293	1.2587	84.63
800	0.00373	33.02	0.06	2.984	1.9814	1.0026	66.40
800	0.00694	32.99	0.12	5.552	3.9588	1.5932	71.30
800	0.01123	32.94	0.21	8.984	6.9181	2.0659	77.00
800	0.01555	32.98	0.30	12.44	9.895	2.545	79.54
1000	0.00464	32.95	0.09	4.64	2.9652	1.6748	63.91
1000	0.00722	32.93	0.14	7.22	4.9405	2.2795	68.43
1000	0.01297	32.89	0.3	12.97	9.868	3.102	76.08

2.3 Thermal Images

Figure 2-2 and Figure 2-3 show the top and bottom thermal images with *no airflow* after running for 10 minutes.

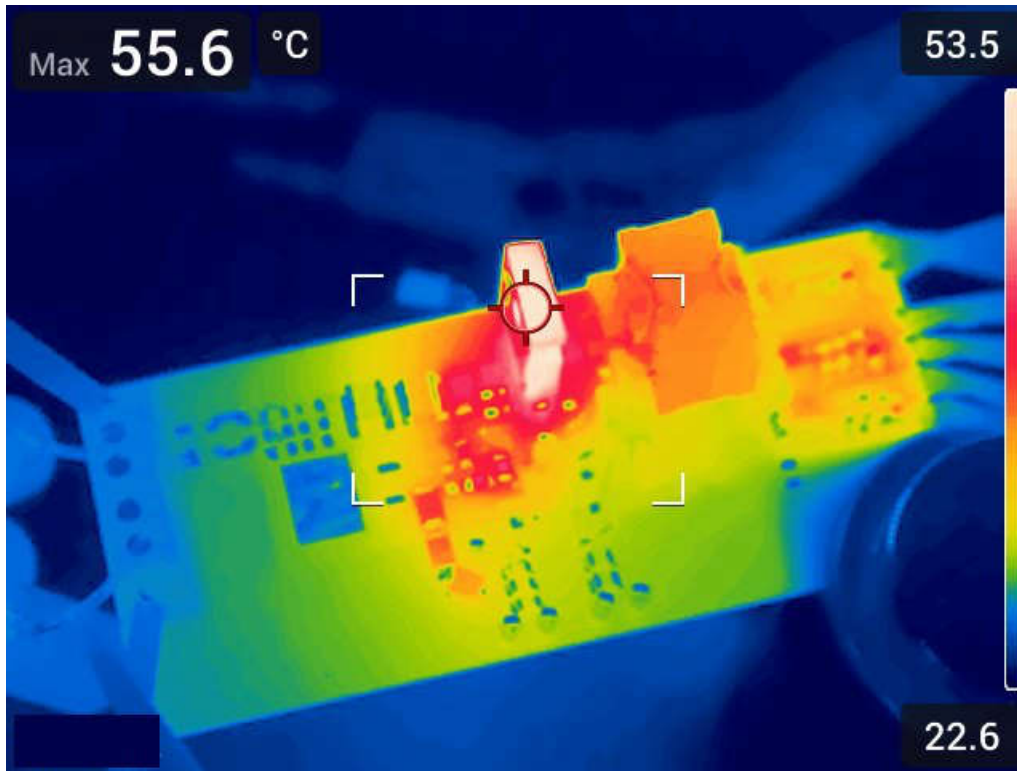


Figure 2-2. Top View, 60V_{4.125}_{IN}, 10W



Figure 2-3. Bottom View, 60V_{IN}, 10W

3 Waveforms

3.1 Switching

Switching behavior is shown in the following figures.

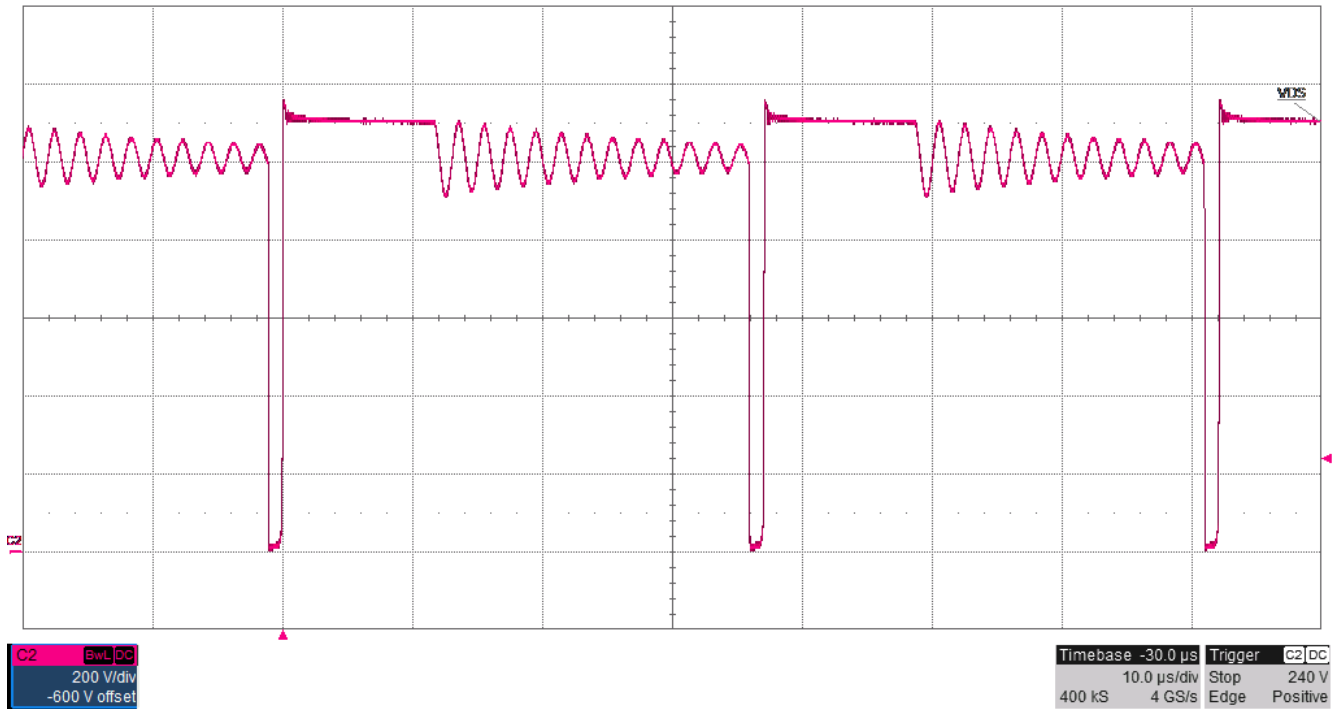
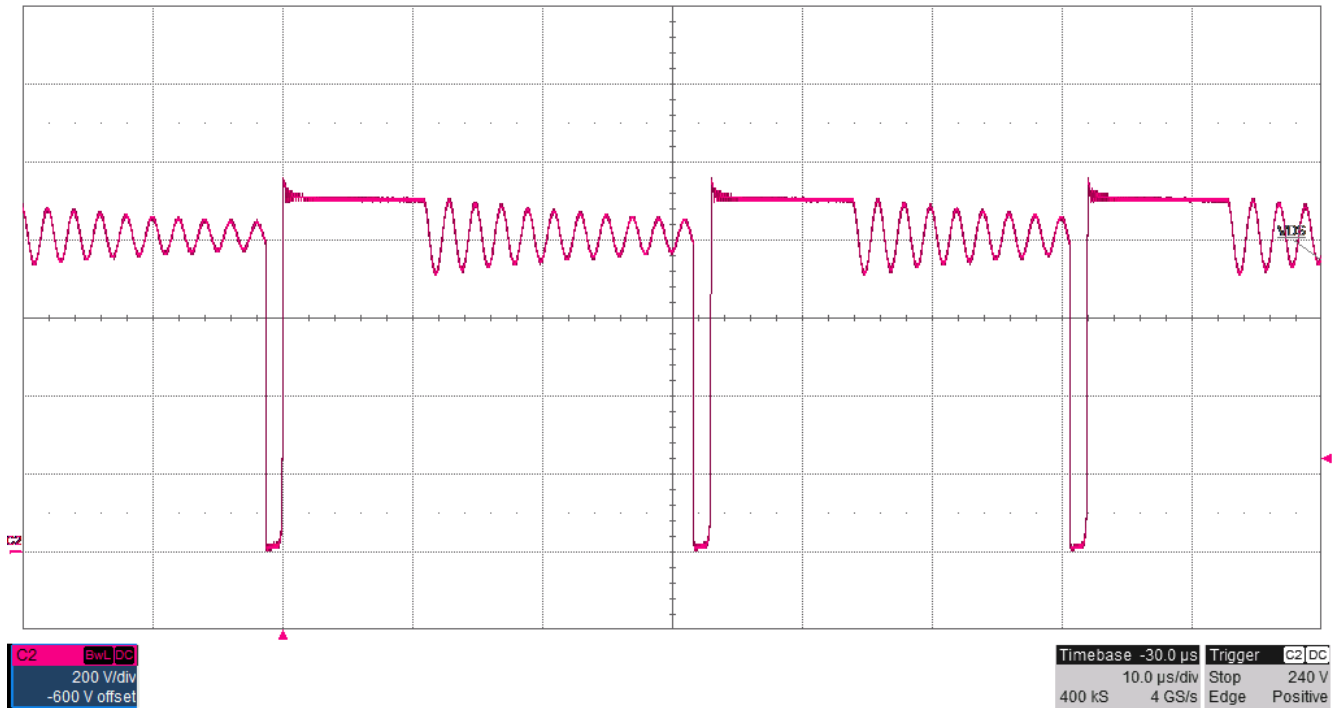


Figure 3-1. Switching 1: 800V_{IN}, 33V_{OUT}, 100mA_{OUT}



At 1000V_{IN}, voltage stress on Q2 is 1150V, the absolute maximum VDS of Q2 is 1200V.

Figure 3-2. Switching 2: 1000V_{IN}, 33V_{OUT}, 100mA_{OUT}

3.2 Output Voltage Ripple

Output voltage ripple is shown in the following figures.

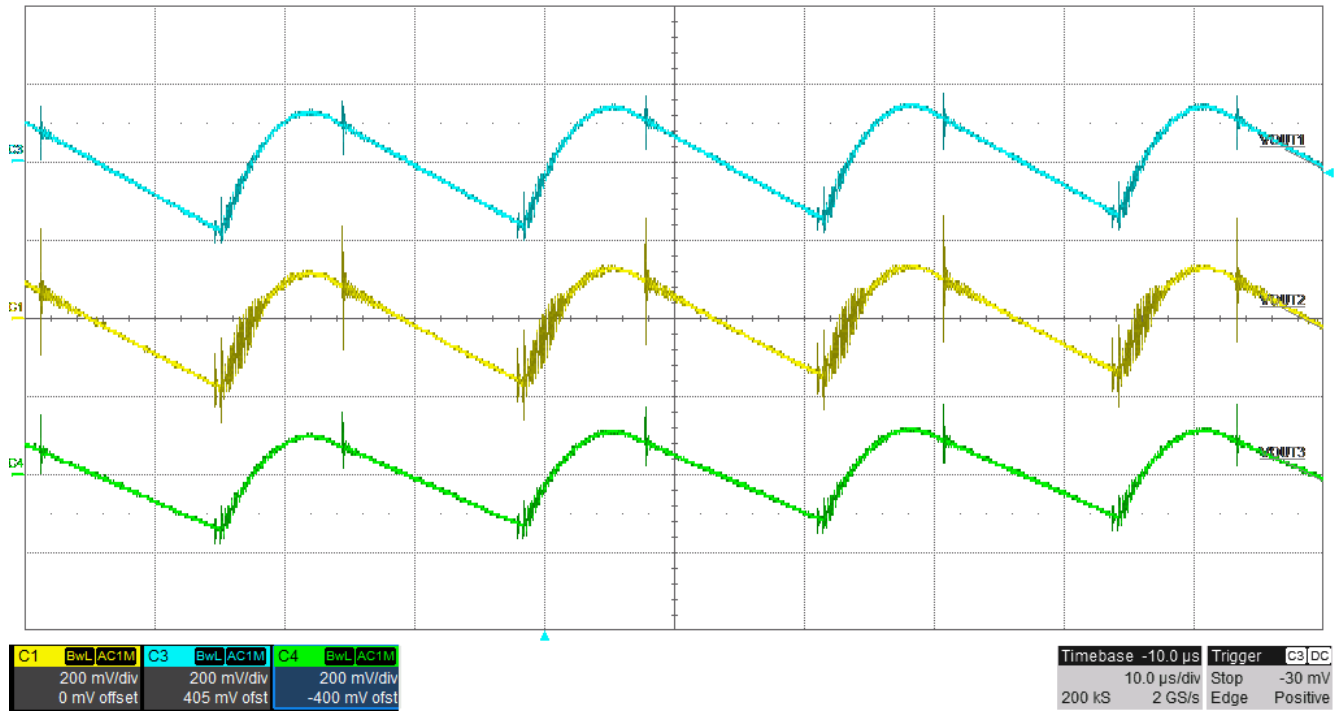


Figure 3-3. Output Voltage Ripple 1: 60V_{IN}, 33V_{OUT}, 80mA_{OUT}

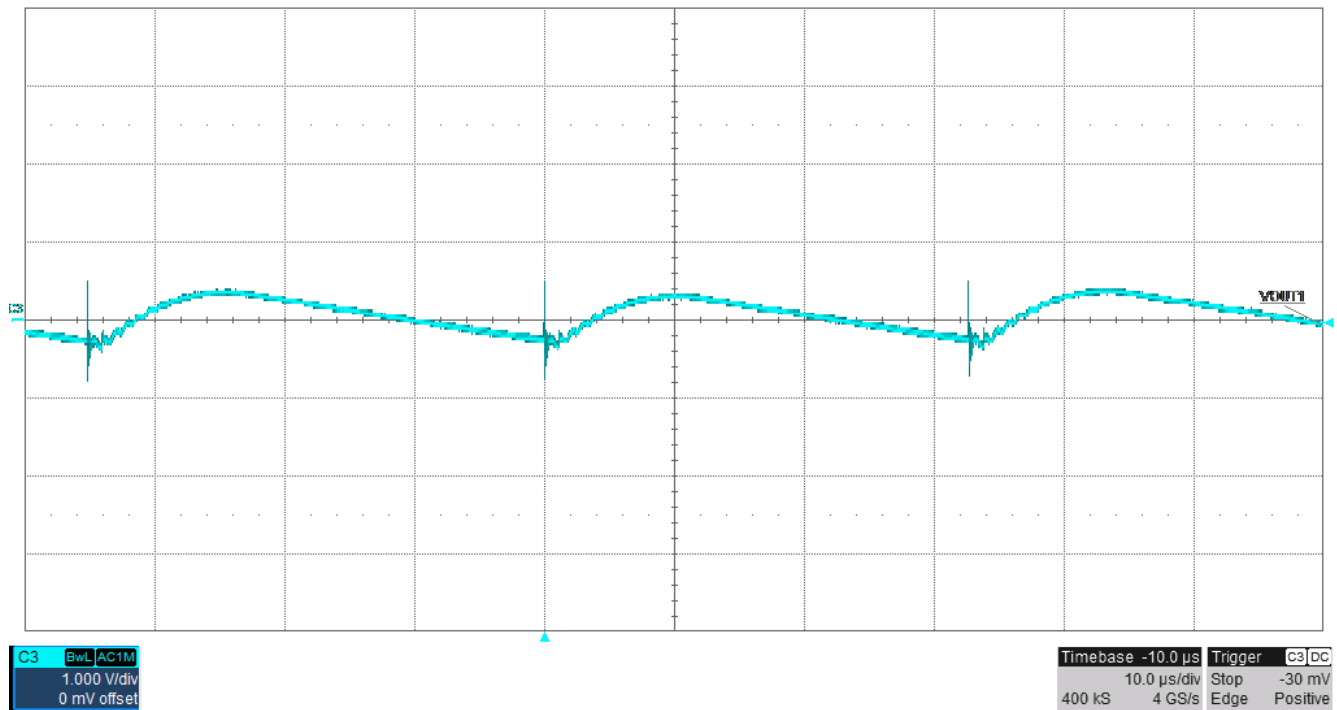


Figure 3-4. Output Voltage Ripple 2: 1000V_{IN}, 33V_{OUT}, 100mA_{OUT}

3.3 Load Transients

Load transient response is shown in the following figures.

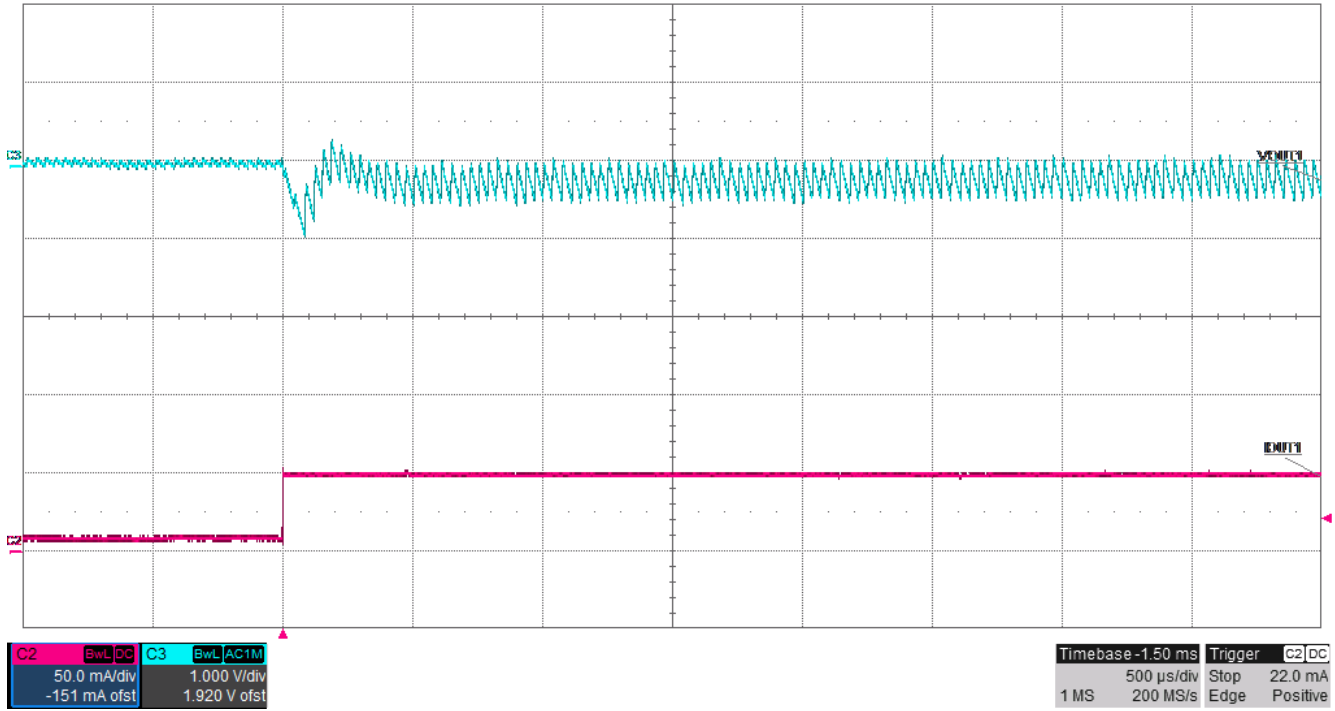


Figure 3-5. Load Transient 1: 60V_{IN}, 33V_{OUT}, 10mA_{OUT}

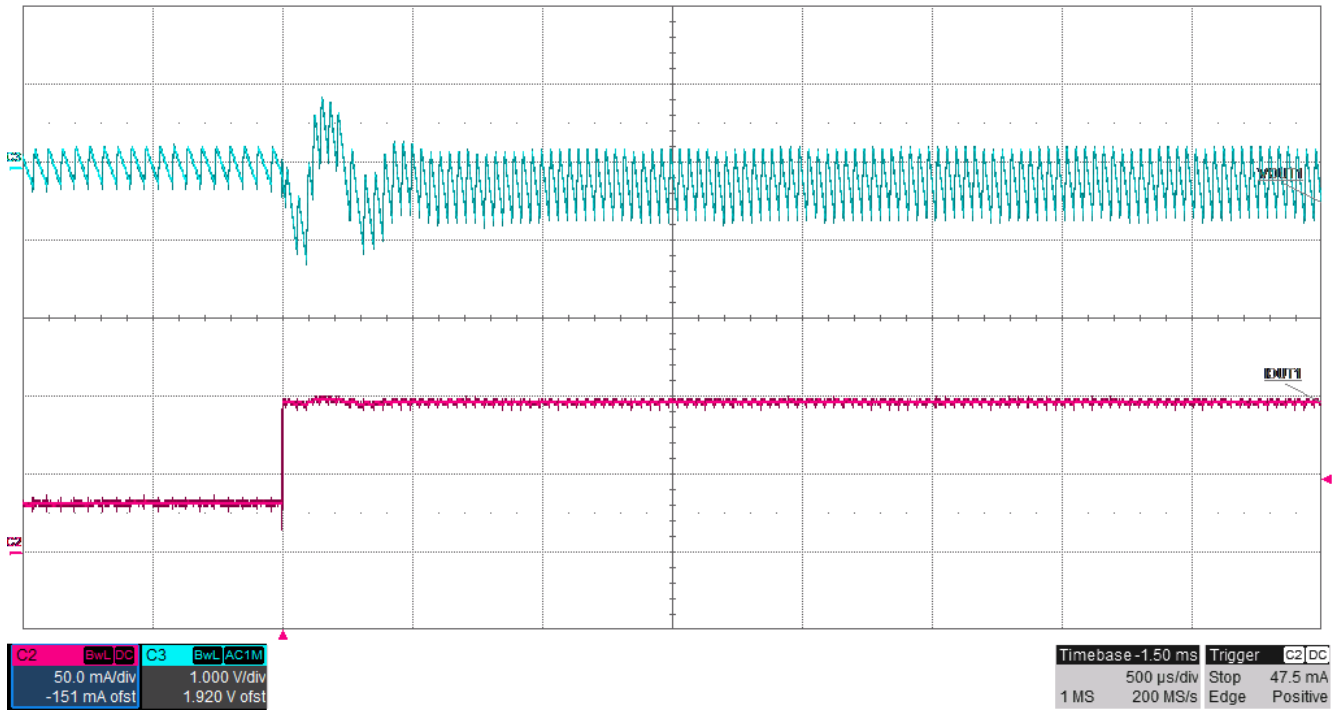


Figure 3-6. Load Transient 2: 800V_{IN}, 33V_{OUT}, 30mA_{OUT} to 100mA_{OUT}

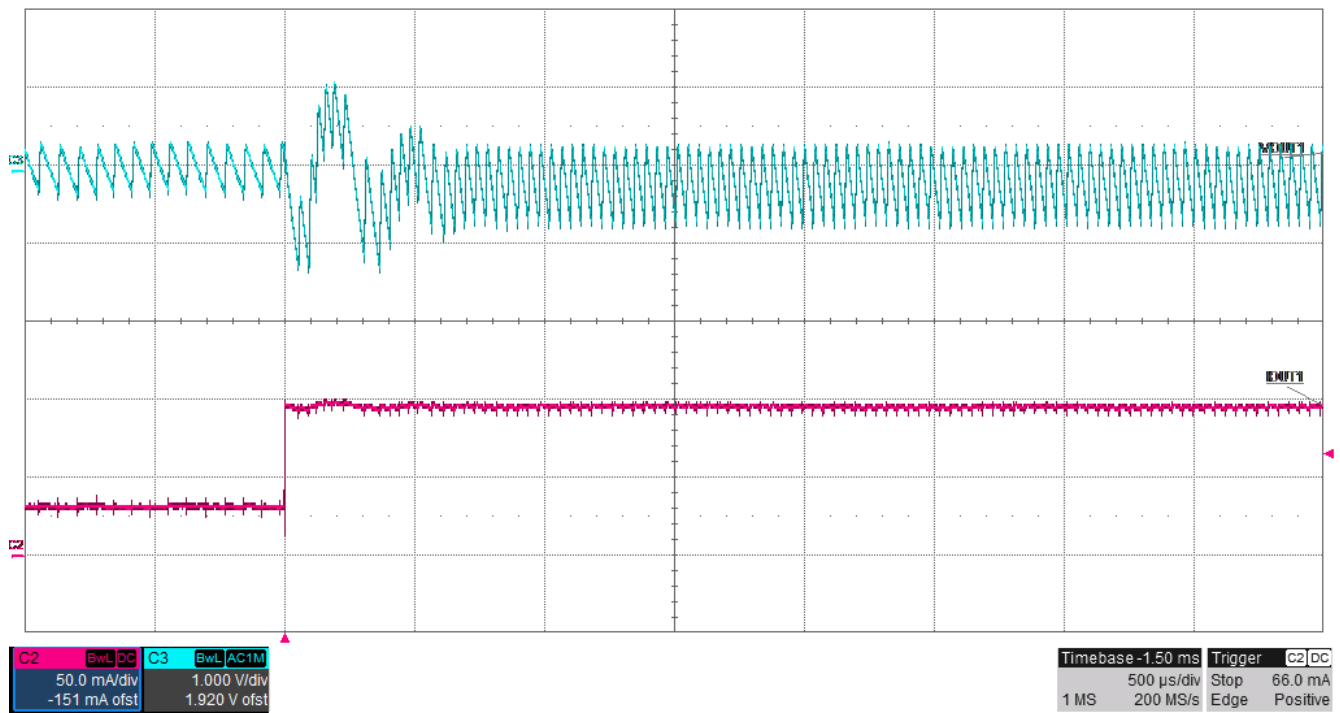


Figure 3-7. Load Transient 3: 1000V_{IN}, 33V_{OUT}, 30mA_{OUT} to 100mA_{OUT}

3.4 Start-Up Sequence

Start-up behavior is shown in the following figures.

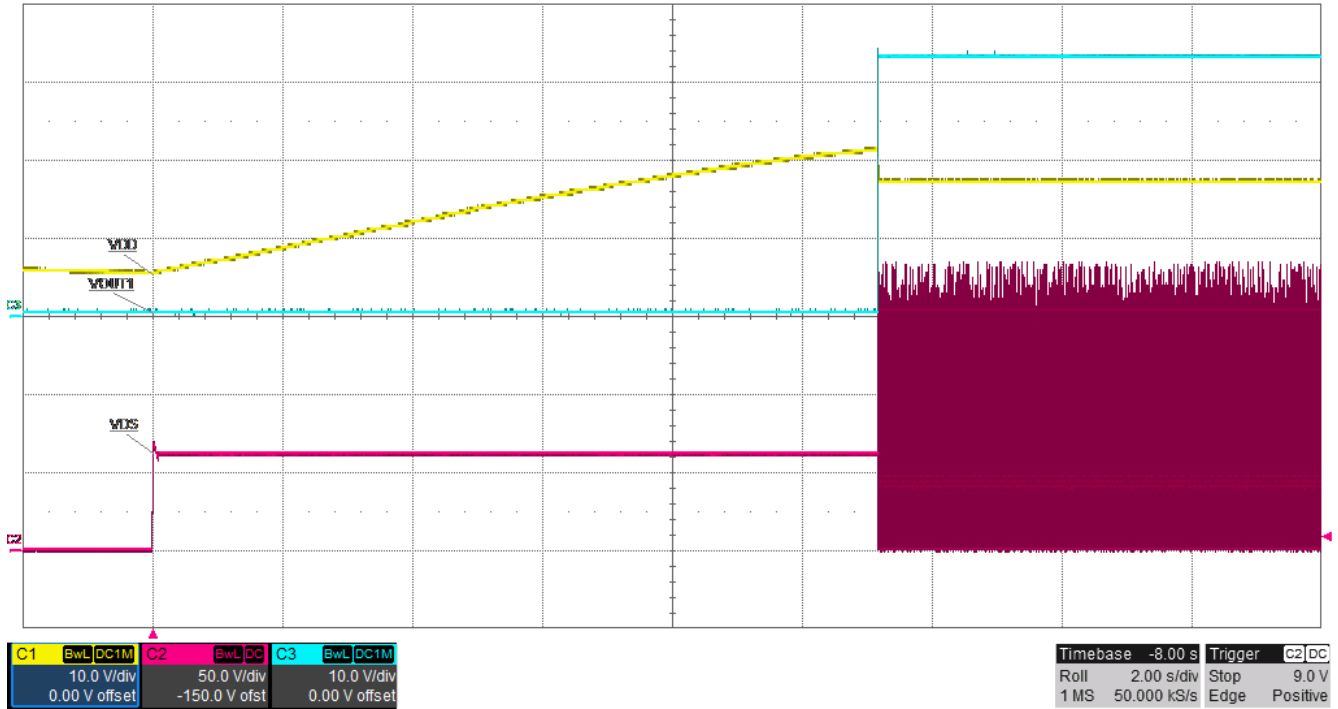


Figure 3-8. Start-Up 1: 60V_{IN}, 33V_{OUT}, 10mA_{OUT}

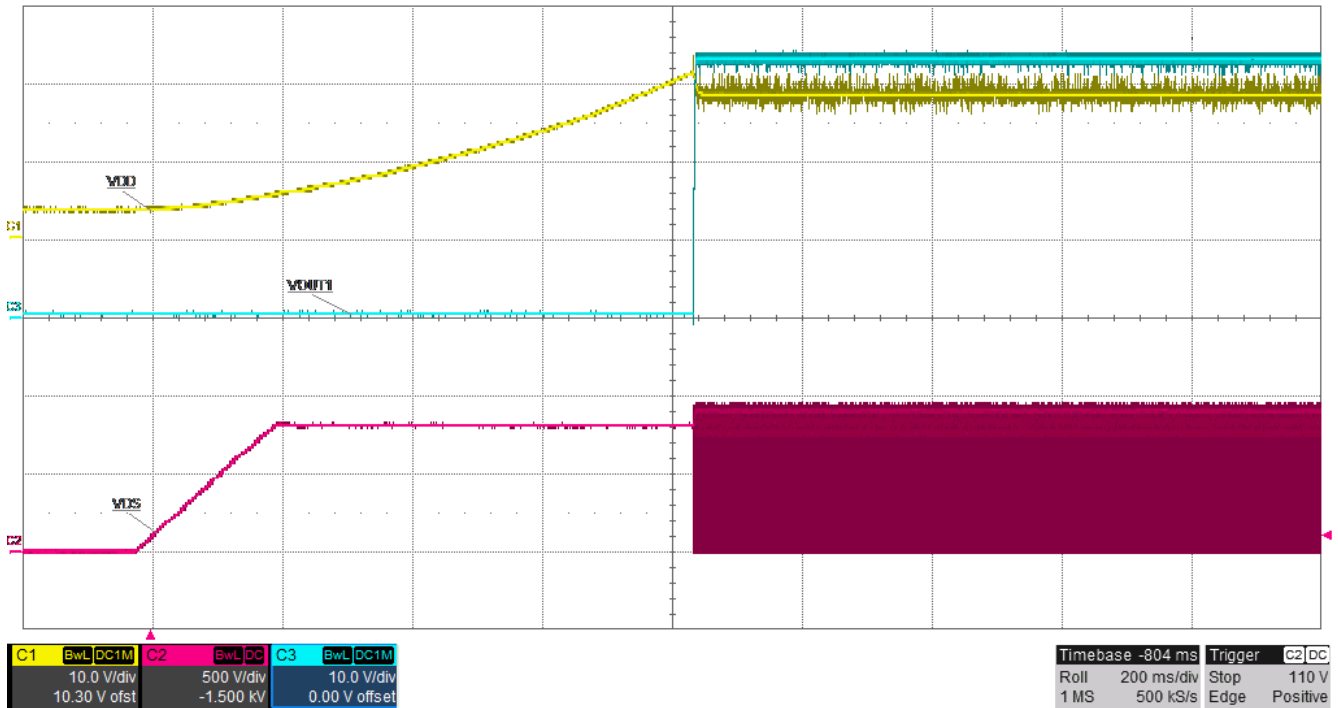


Figure 3-9. Start-Up 2: 800V_{IN}, 33V_{OUT}, 100mA_{OUT}

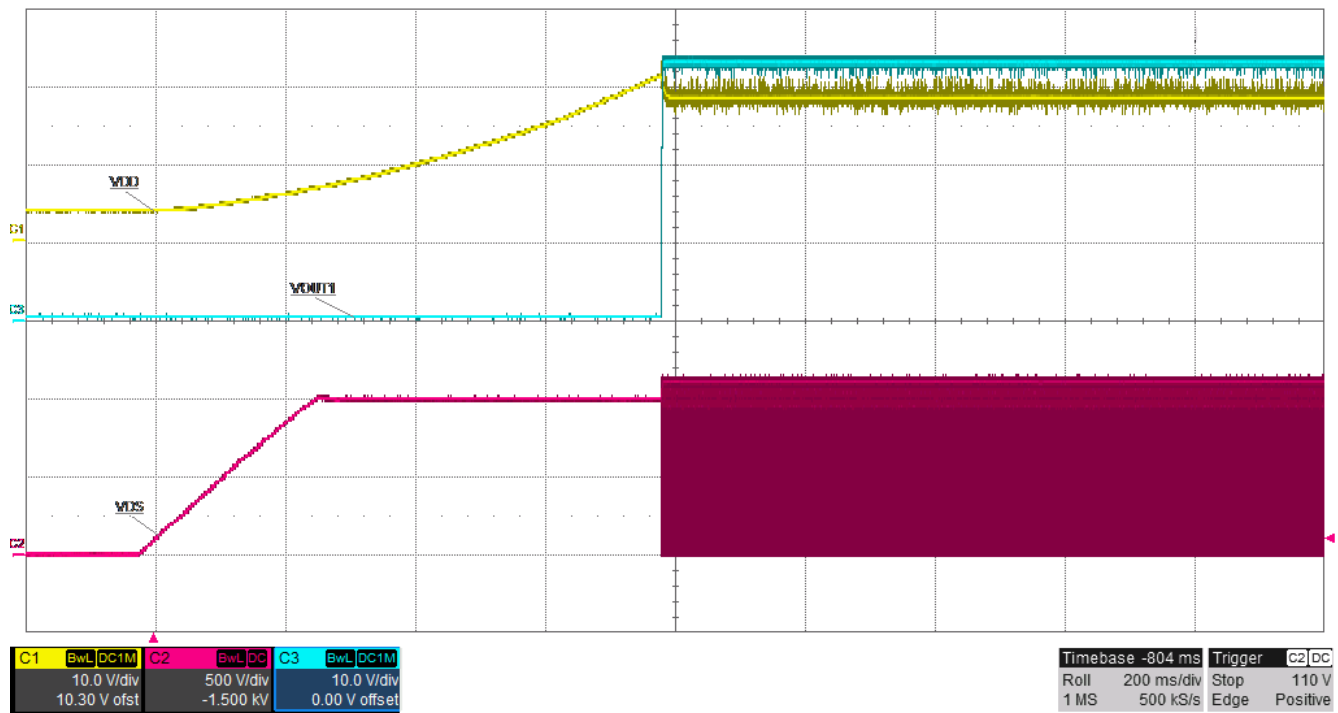


Figure 3-10. Start-Up 3: 1000V_{IN}, 33V_{OUT}, 100mA_{OUT}

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