Test Report: PMP23296

118-V, 25-W Battery Backup Reference Design

Description

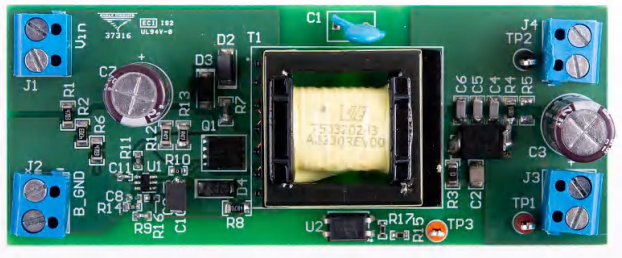
This reference design is for a flyback DC/DC converter with 42 components. This flyback converts a 45-V to 90-V input to an isolated 118-V, 210-mA output. Primary side regulation eliminates the need for a feedback network and optocoupler. An isolated enable and disable circuit is included to minimize power consumption when disabled.

Features

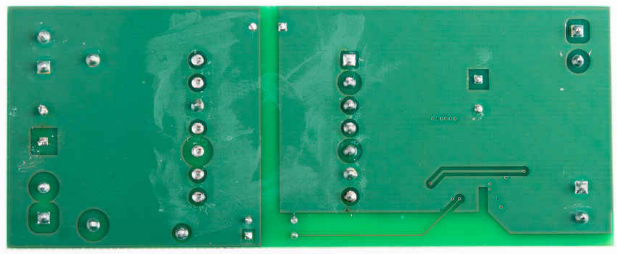
- Wide input range, 45 V – 90 V
- 93% Efficiency
- Isolation with secondary side enable and disable
- 118-V, 210-mA output
- Low cost

Applications

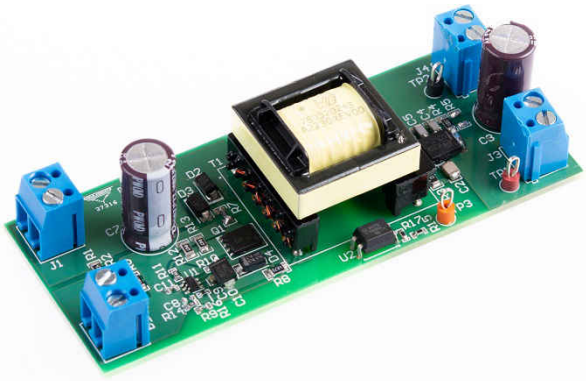
- Power distribution unit (PDU)
- Single phase online UPS
- Three phase UPS



Top Board Photo



Bottom Board Photo



Angle Board Photo

1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1-1. Voltage and Current Requirements

Parameter	Specifications
V_{IN}	45 V – 90 V
V_{OUT}	118 V
I_{OUT} MAX	210 mA

1.2 Dimensions

Board Dimensions: 40.64 mm (W) × 101.6 mm (L) × 25.4 mm (H)

2 Testing and Results

2.1 Efficiency Graphs

Efficiency is shown in the following graph.

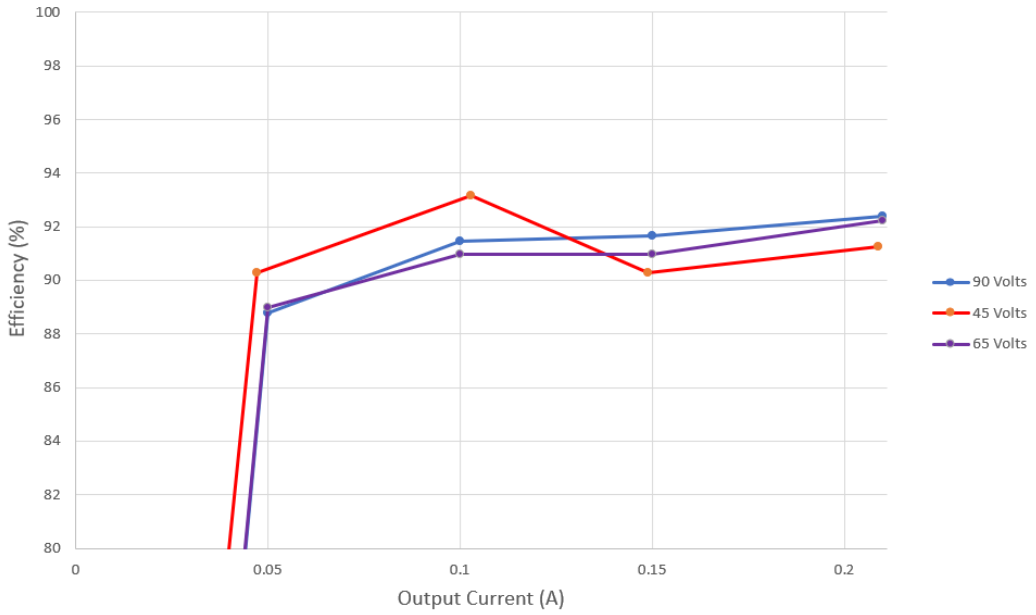


Figure 2-1. Efficiency Graph

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 (%)
45	0.00403	115.4	0.00038	0.18135	0.043852	0.137498	0.241809
45	0.1348	115.8	0.0473	6.066	5.47734	0.58866	0.902957
45	0.2867	116.7	0.103	12.9015	12.0201	0.8814	0.931682
45	0.4310	117.5	0.149	19.395	17.5075	1.8875	0.902681
45	0.6030	118.5	0.209	27.135	24.7665	2.3685	0.912714
65	0.00281	115.3	0.00022	0.18265	0.025366	0.157284	0.138878
65	0.100	115.7	0.05	6.5	5.785	0.715	0.89
65	0.197	116.5	0.1	12.805	11.65	1.155	0.909801
65	0.298	117.5	0.15	19.37	17.625	1.745	0.909912
65	0.415	118.5	0.21	26.975	24.885	2.09	0.922521
90	0.00209	115.3	0.00022	0.1881	0.025366	0.162734	0.134854
90	0.0724	115.7	0.05	6.516	5.785	0.731	0.887815
90	0.1418	116.7	0.1	12.762	11.67	1.092	0.914433
90	0.2136	117.5	0.15	19.224	17.625	1.599	0.916823
90	0.2992	118.5	0.21	26.928	24.885	2.043	0.924131

2.3 Thermal Images

Thermal images are shown in the following figures.

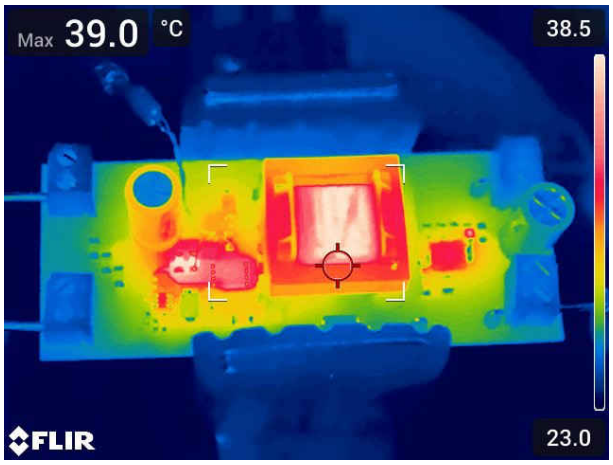


Figure 2-2. 45-V Input at Full Load, 15 Minute Soak

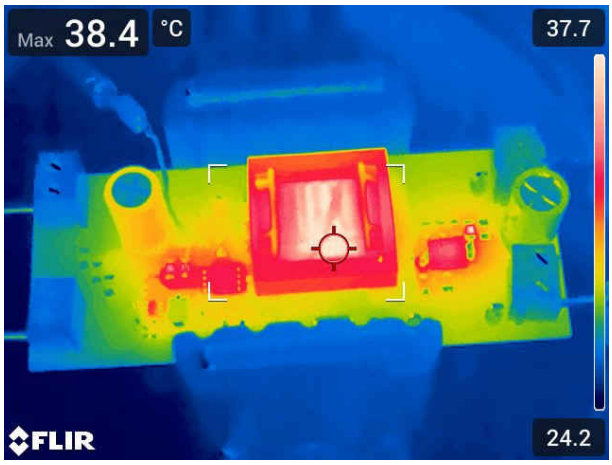


Figure 2-3. 90-V Input at Full Load, 15 Minute Soak

3 Waveforms

3.1 Switching

Switching behavior is shown in the following figures.

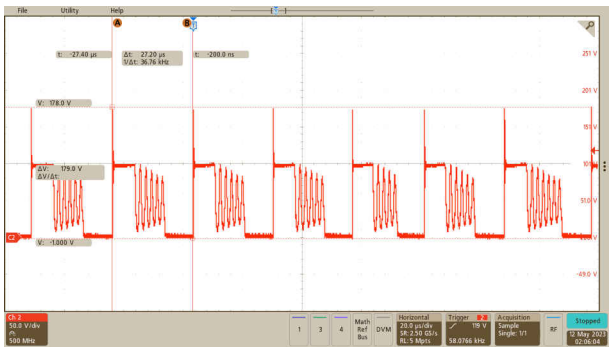


Figure 3-1. Switch Node at Full Load, 45-V Input

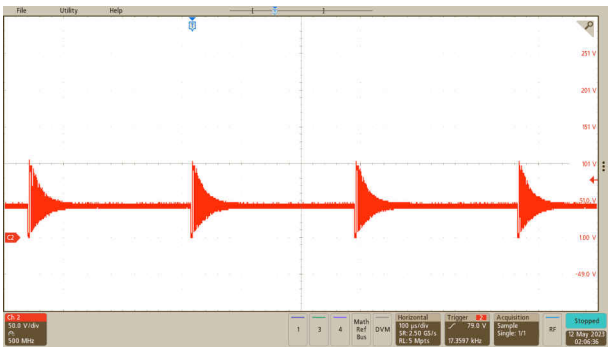


Figure 3-2. Switch Node at No Load, 45-V Input

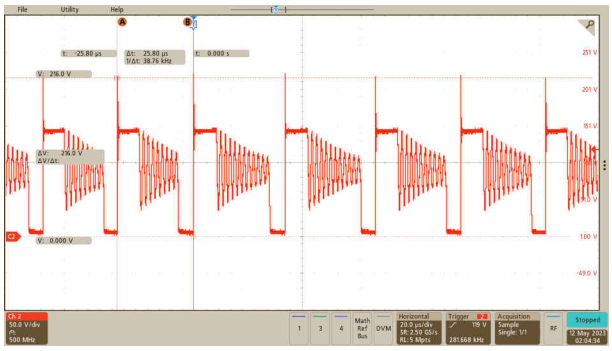


Figure 3-3. Switch Node at Full Load, 90-V Input

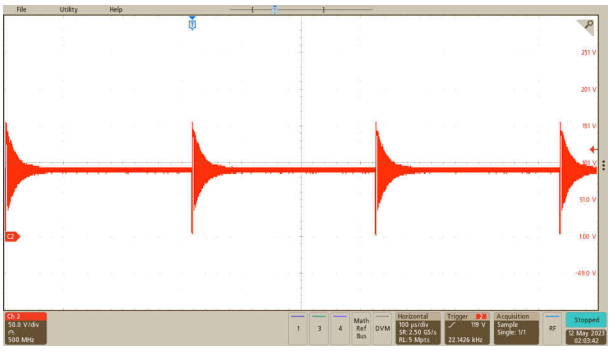


Figure 3-4. Switch Node at No Load, 90-V Input

3.2 Output Voltage Ripple

Output voltage ripple is shown in the following figures.

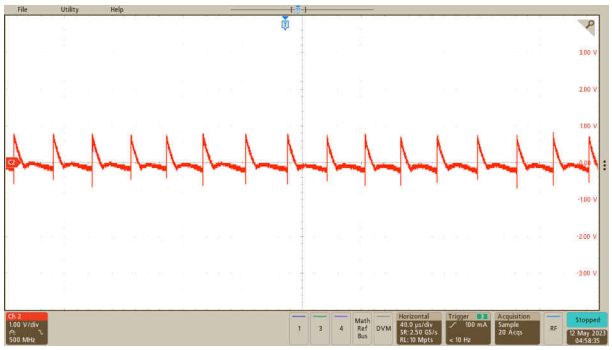


Figure 3-5. Output Voltage Ripple at Full Load, 45-V Input

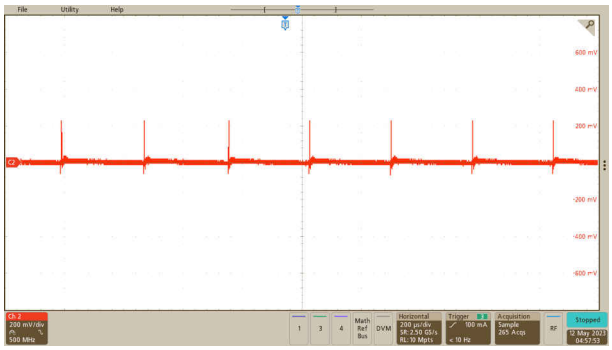


Figure 3-6. Output Voltage Ripple at No Load, 45-V Input

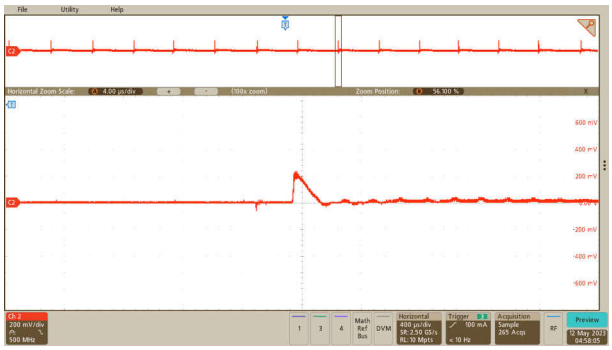


Figure 3-7. Output Voltage Ripple at No Load, Close Up, 45-V Input

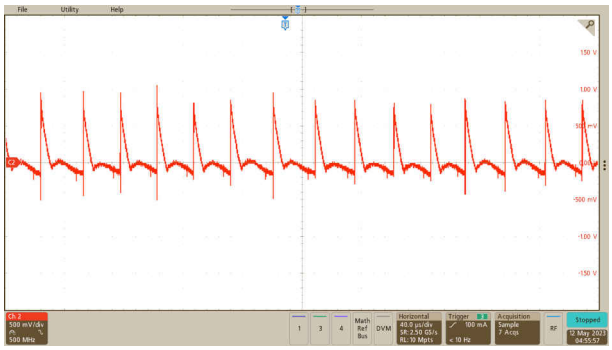


Figure 3-8. Output Voltage Ripple at Full Load, 90-V Input

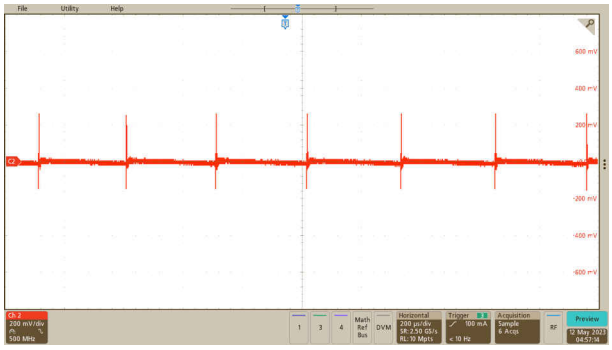


Figure 3-9. Output Voltage Ripple at No Load 90-V Input

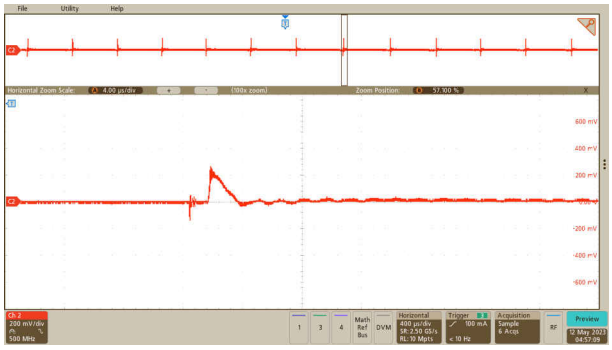
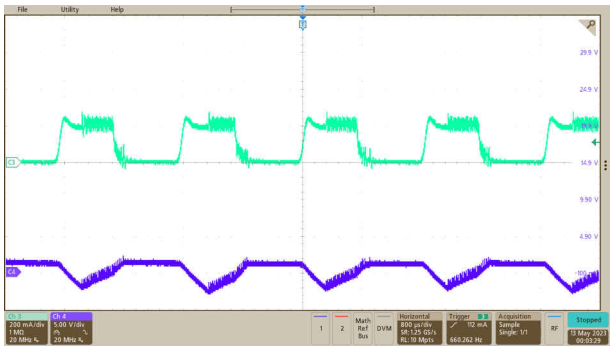


Figure 3-10. Output Voltage Ripple at No Load, Close Up 90-V Input

3.3 Load Transients

Load transient response is shown in the following figure.

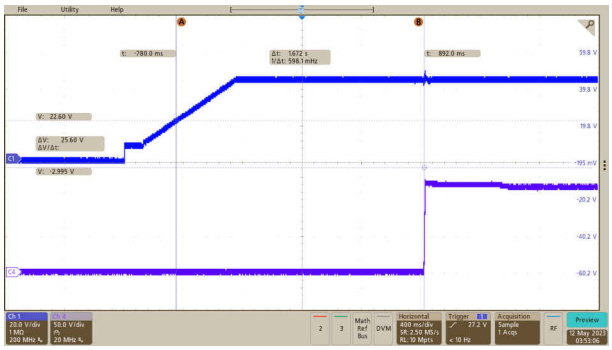


Ch 3: output current
Ch 4: AC coupled output voltage

Figure 3-11. Load Transient, 50 mA to 150 mA at 2.5 A/ms Slew Rate

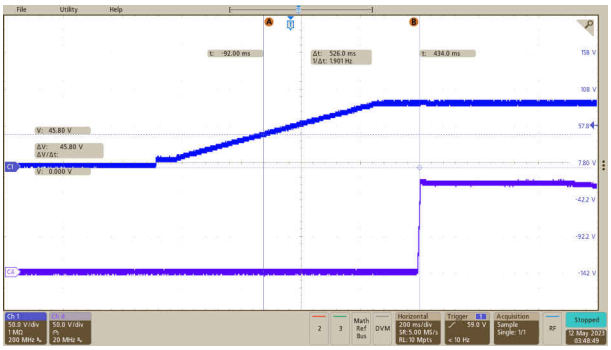
3.4 Start-Up Sequence

Start-up behavior is shown in the following figures.



Ch 1: Input voltage
Ch 4: Output voltage

Figure 3-12. No Load Start-Up, 45-V Input, 1.672 s Midpoint to Midpoint

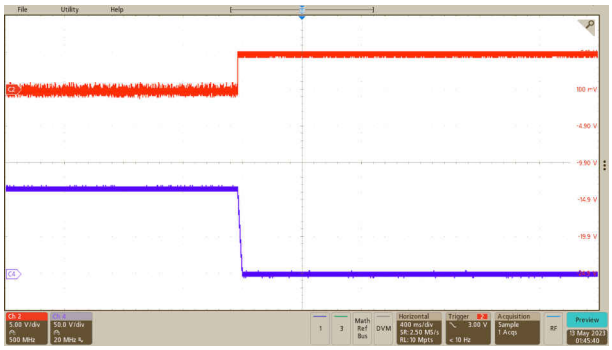


Ch 1: Input voltage
Ch 4: Output voltage

Figure 3-13. No Load Start-Up, 90-V Input, 526 ms Midpoint to Midpoint

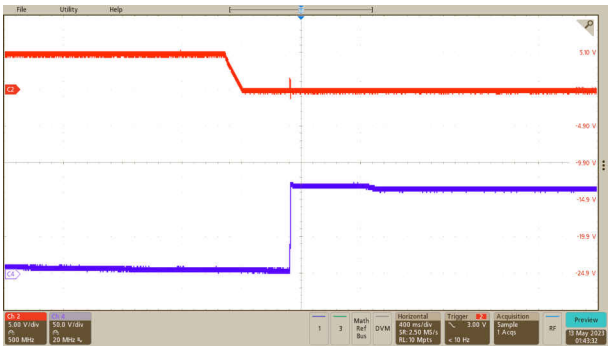
3.5 Enabled and Disabled

Figure 3-14 shows the enabled to disabled waveform and Figure 3-15 shows the disabled to enabled waveform.



Ch 2: Shutdown_PM signal
Ch 4: Output voltage

Figure 3-14. Enabled to Disabled



Ch 2: Shutdown_PM signal
Ch 4: Output voltage

Figure 3-15. Disabled to Enabled

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