Test Report: PMP31338

Ultra-Wide Input Non-Isolated High-Side Buck Converter Reference Design

Description

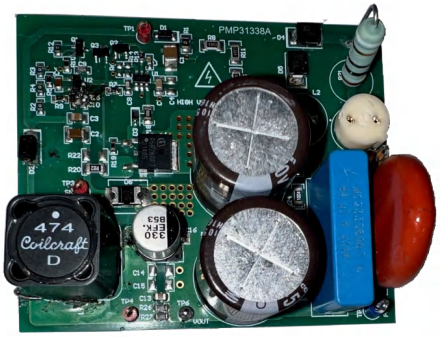
This reference design is an ultra-wide input, offline, high-side buck reference design that provides a 13V output at a maximum of 0.6A. The input voltage range is between $85V_{AC}$ to $485V_{AC}$. The reference design uses the UCC28750 current-mode flyback controller without opto-coupler feedback. There is no isolation, the design uses a low cost current mirror to regulate the output. The design is developed to be resistant to magnetic fields up to 200mT near the inductor.

Features

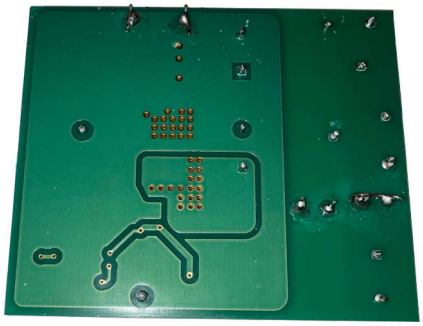
- Wide input range: $100V_{DC}$ to $630V_{DC}$
- Resistant to external magnetic fields
- Output short-circuit (OSC) protection
- Frequency dithering for improved electromagnetic interference (EMI)
- Frequency foldback and burst mode for improved light load efficiency
- UCC28750 controller with low cost current mirror

Applications

- Electricity meter
- DC-input BLDC motor drive
- String inverter
- Refrigerator and freezer
- Washer and dryer



Top Photo



Bottom Photo

Angled Board Photo

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1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1-1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
Maximum DC input voltage	$100V_{DC}$ to $630V_{DC}$
Output Voltage	13V
Output Current	0.6A

1.2 Dimensions

The reference design is built on board PMP31338RevA. The outline of the two-layer board is 69.9mm × 59.2mm.

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2 Testing and Results

2.1 Efficiency Graph

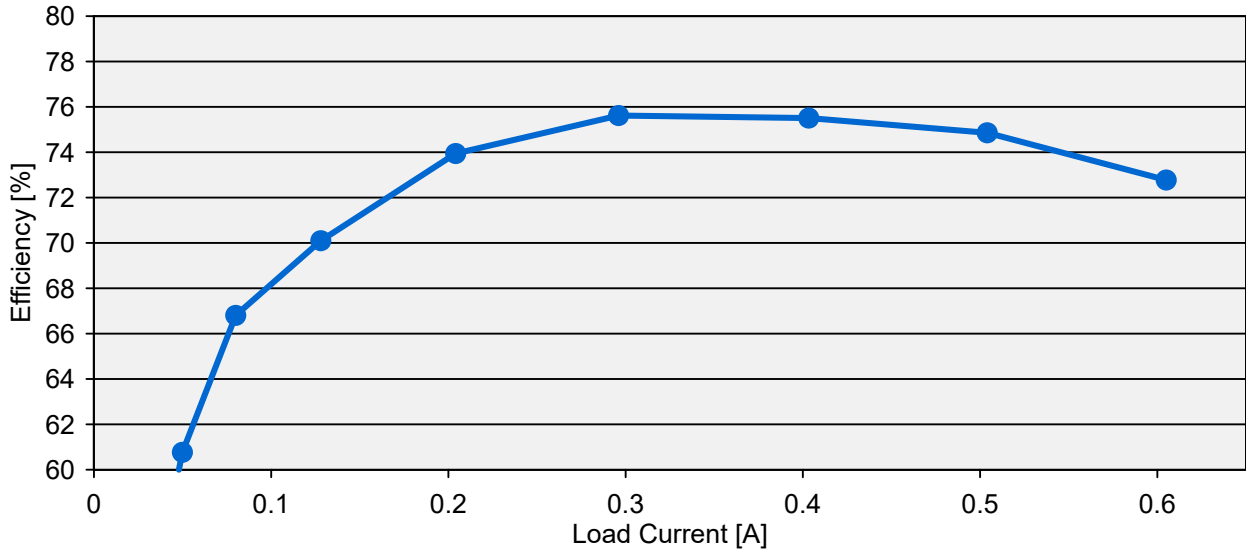

Figure 2-1. Efficiency versus Load Current (at 230V_{AC} Input Voltage)

2.2 Load Regulation

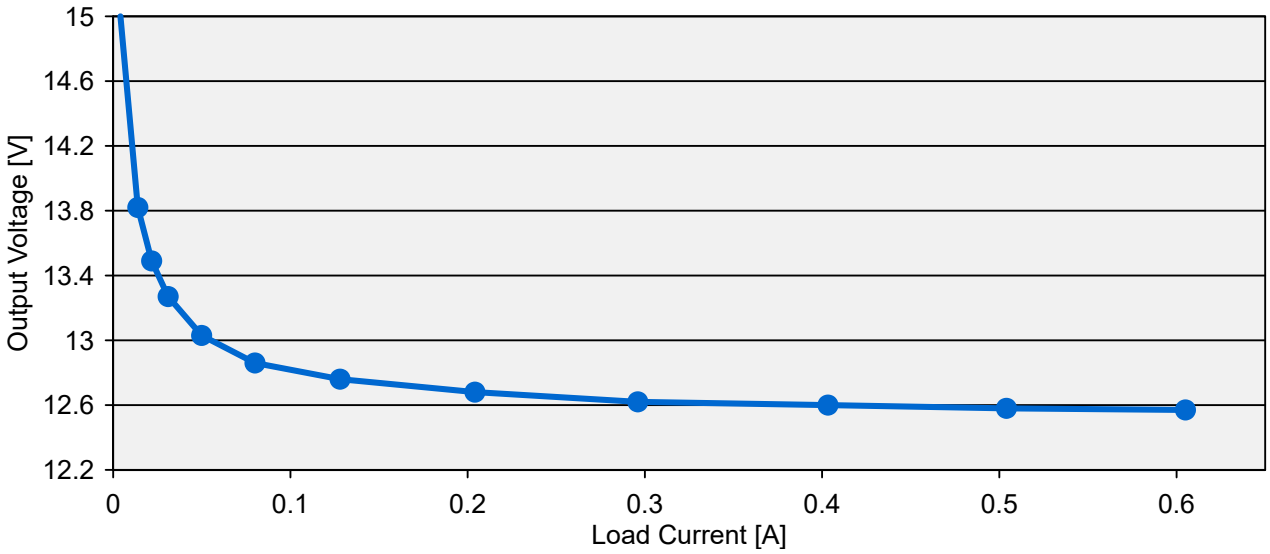

Figure 2-2. Output Voltage versus Load Current (at 230V_{AC} Input Voltage)

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2.3 Line Regulation

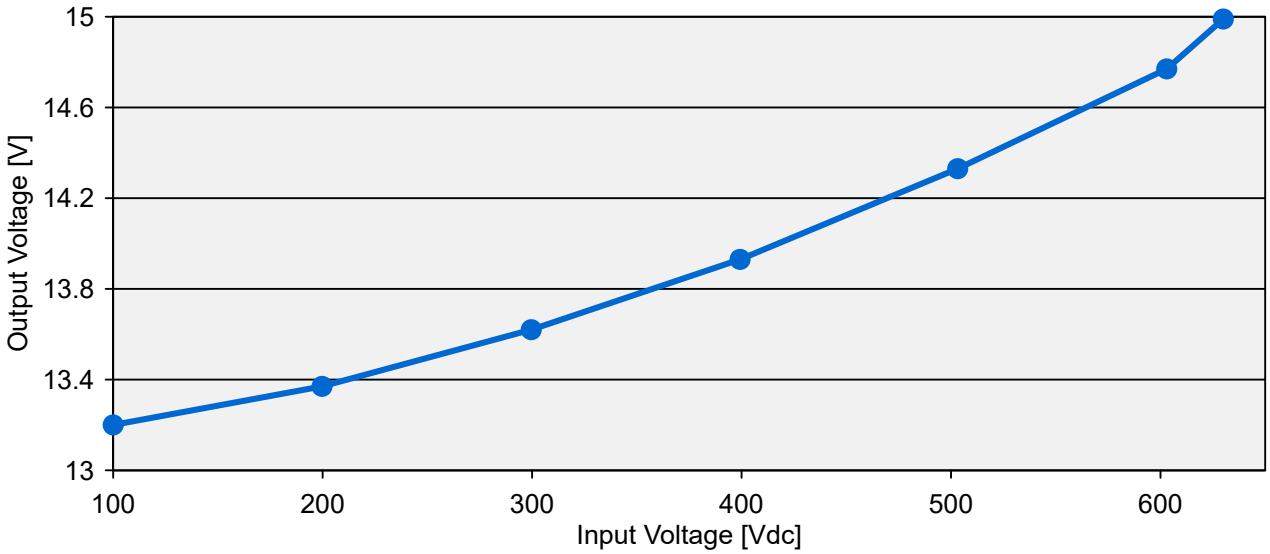

Figure 2-3. Output Voltage versus Input Voltage

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3 Waveforms

3.1 Switching

3.1.1 325V_{DC} Input Voltage

3.1.1.1 0A Load Current

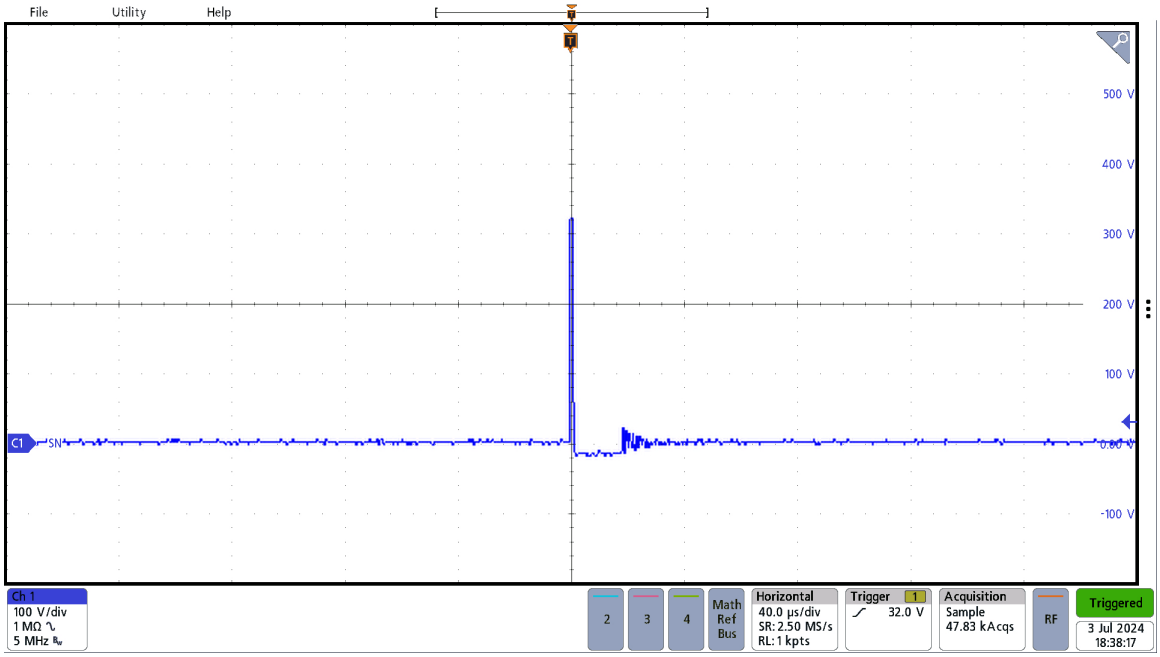

Figure 3-1. Load Current = 0mA

3.1.1.2 30mA Load Current

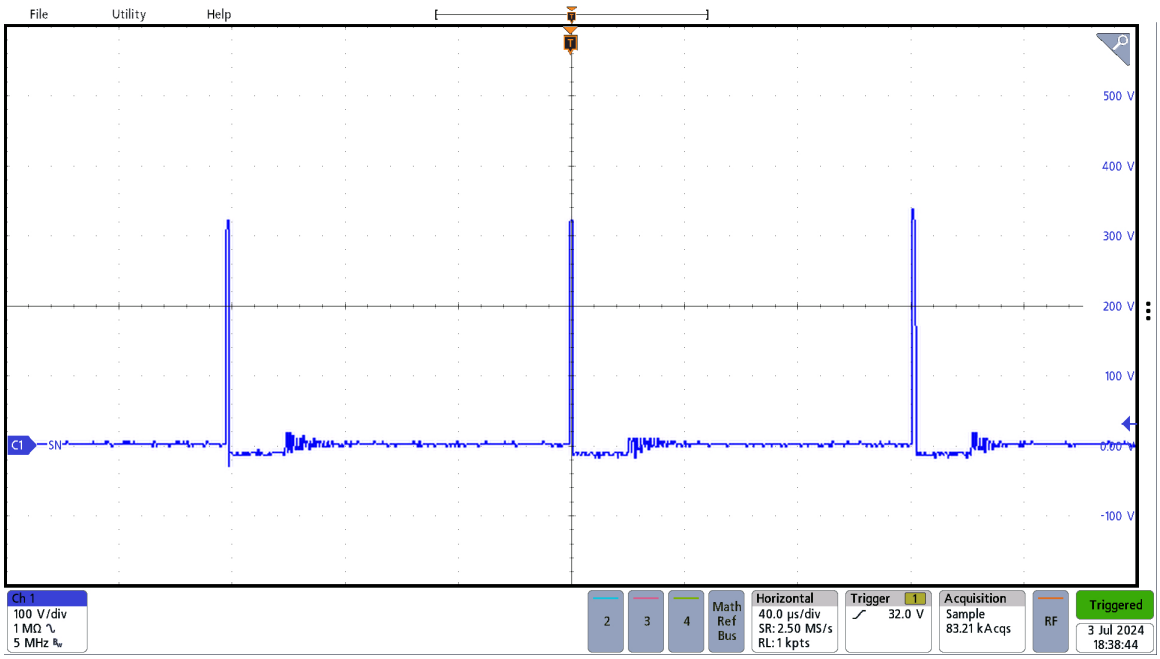

Figure 3-2. Load Current = 30mA

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3.1.1.3 130mA Load Current

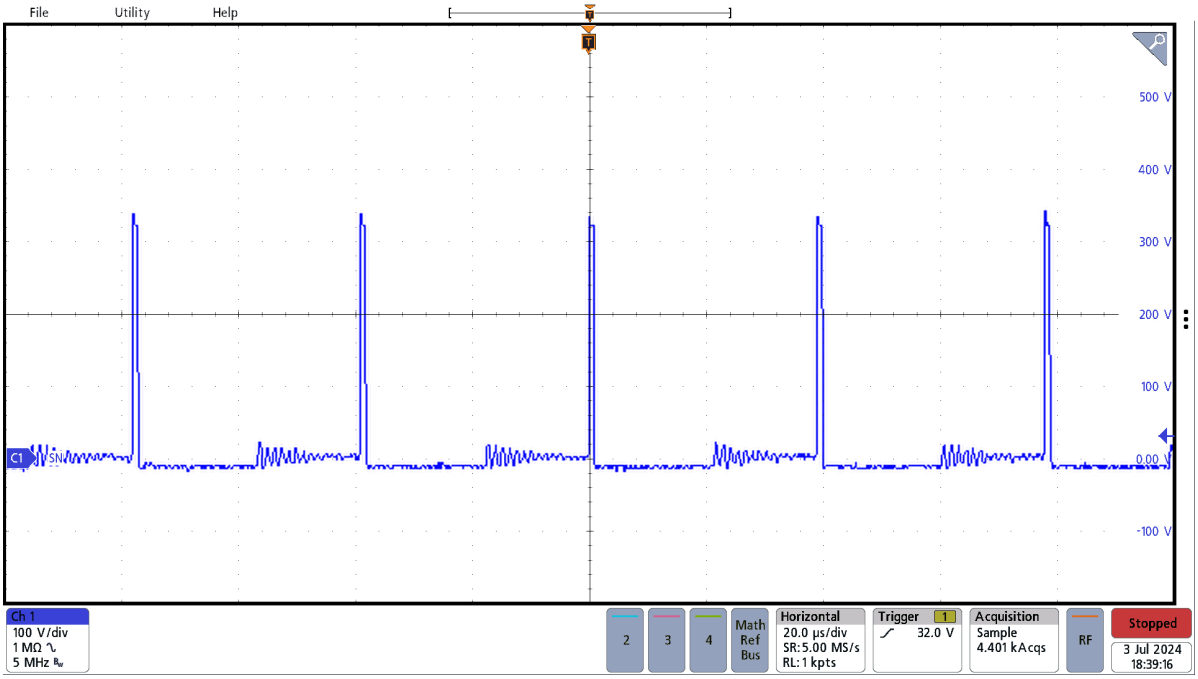

Figure 3-3. Load Current = 130mA

3.1.1.4 340mA Load Current

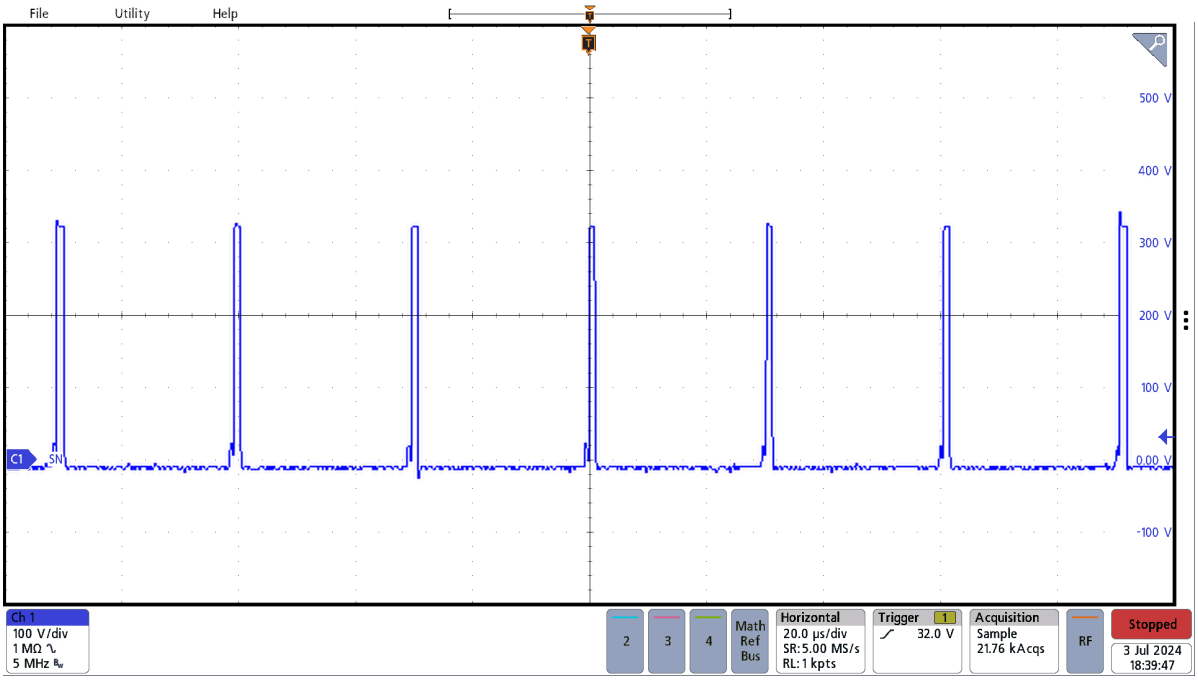

Figure 3-4. Load Current = 340mA

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3.1.1.5 600mA Load Current

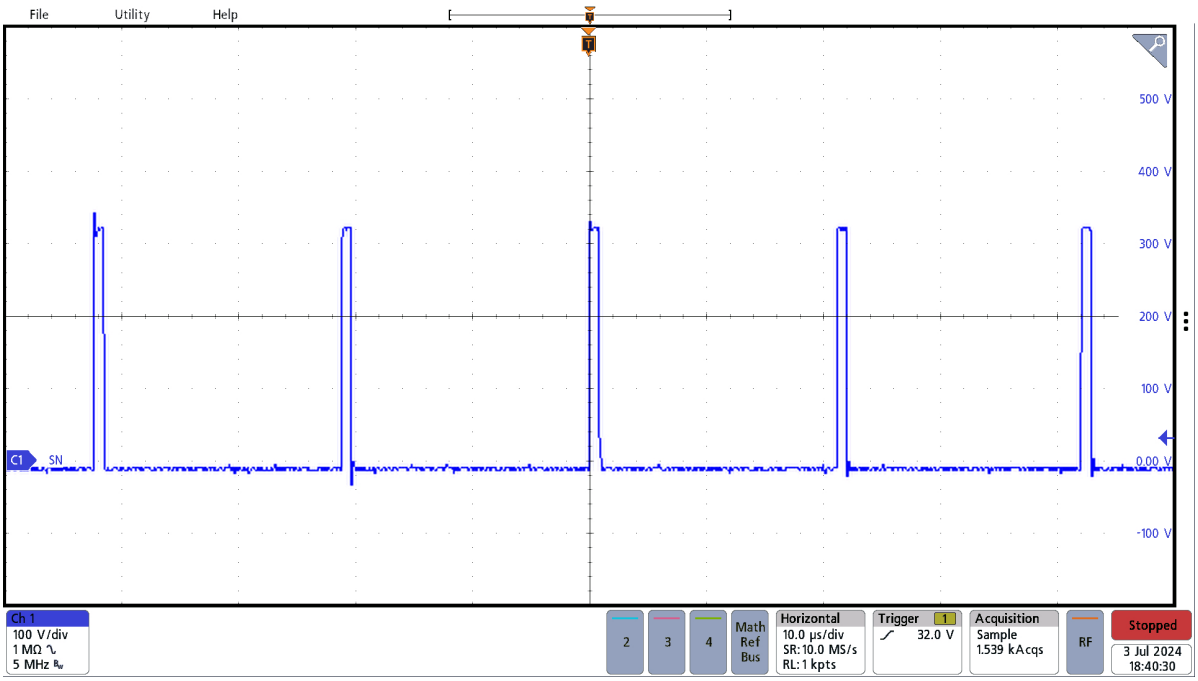

Figure 3-5. Load Current = 600mA

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3.1.2 630V_{DC} Input Voltage

3.1.2.1 600mA Load Current

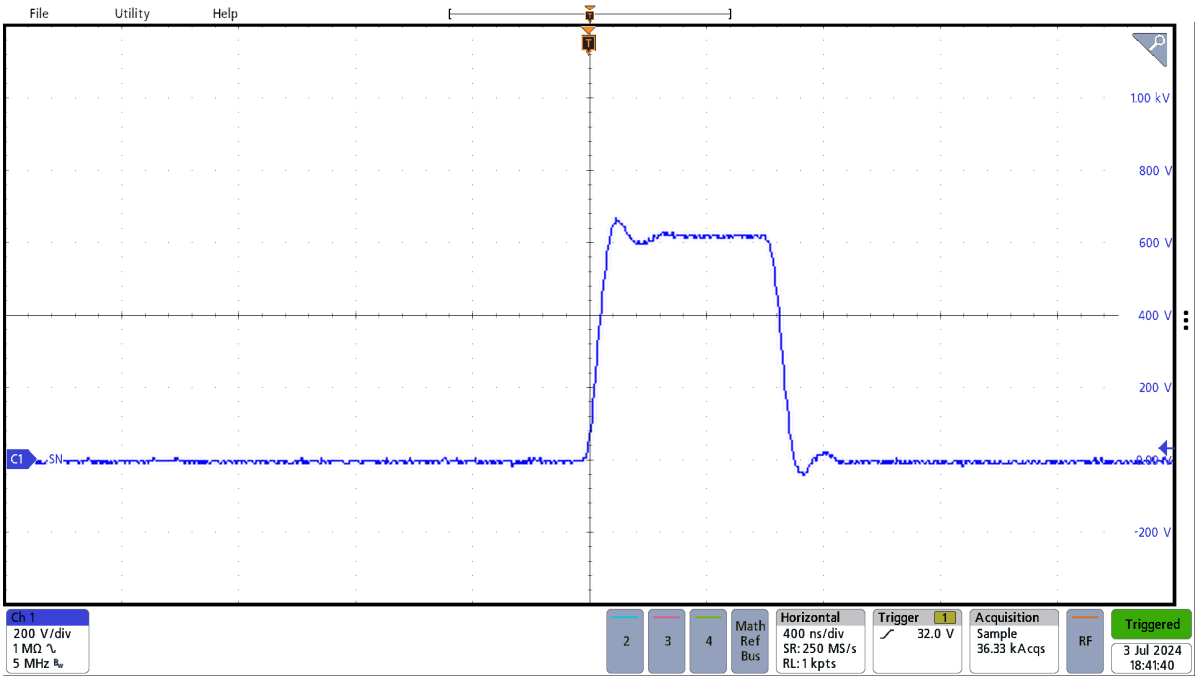

Figure 3-6. Load Current = 600mA

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3.2 Output Voltage Ripple

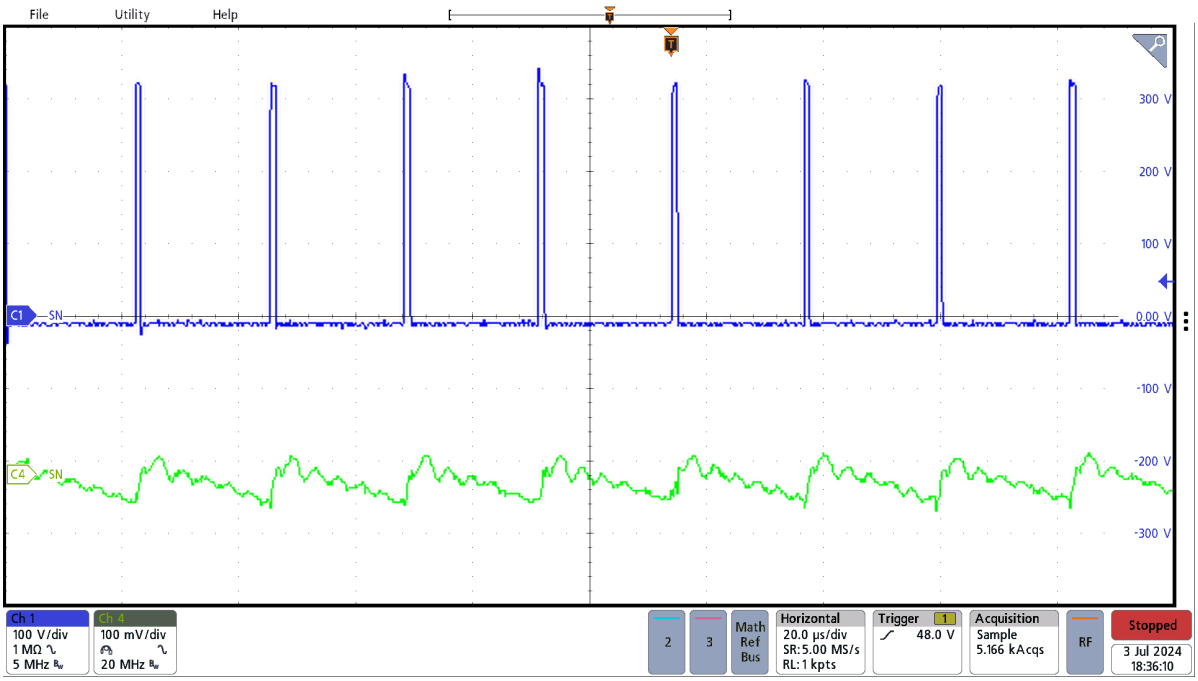

Figure 3-7. 325V_{DC} Input Voltage, Full Load

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3.3 Load Transients

3.3.1 100V_{DC} Input Voltage

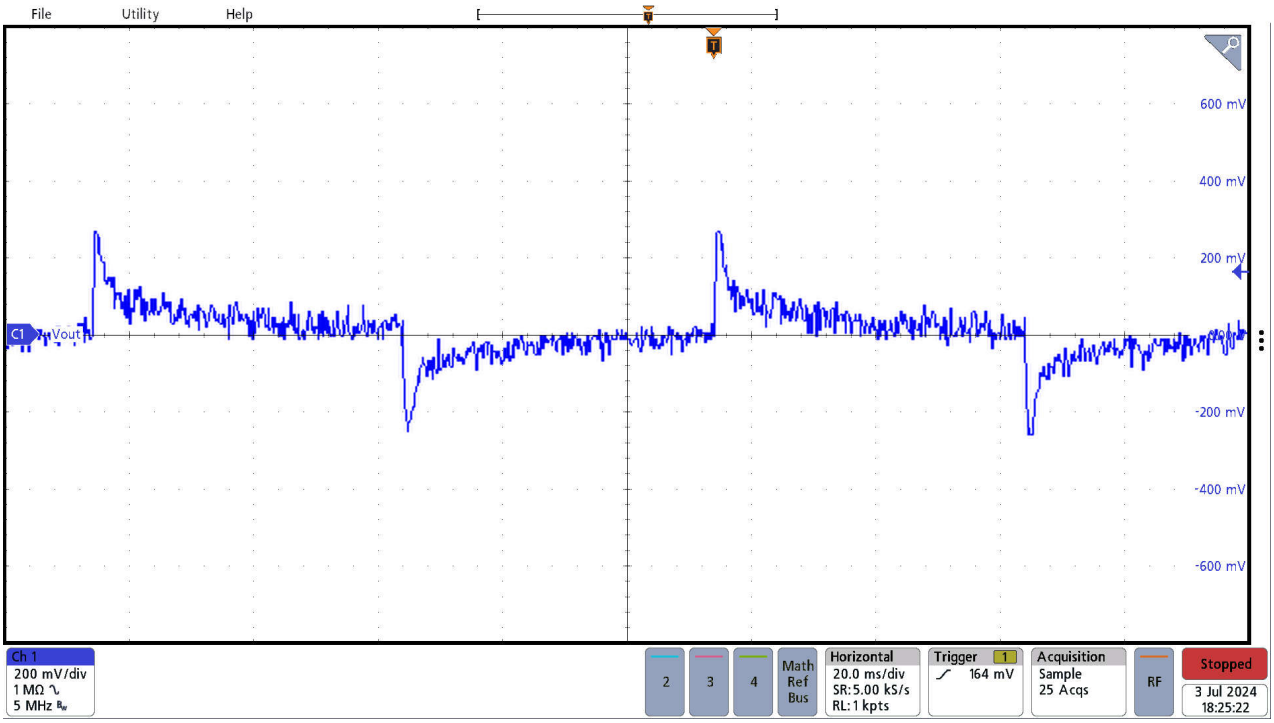

Figure 3-8. 100V_{DC} Input Voltage, Loadstep = 300mA to 600mA

3.3.2 250V_{DC} Input Voltage

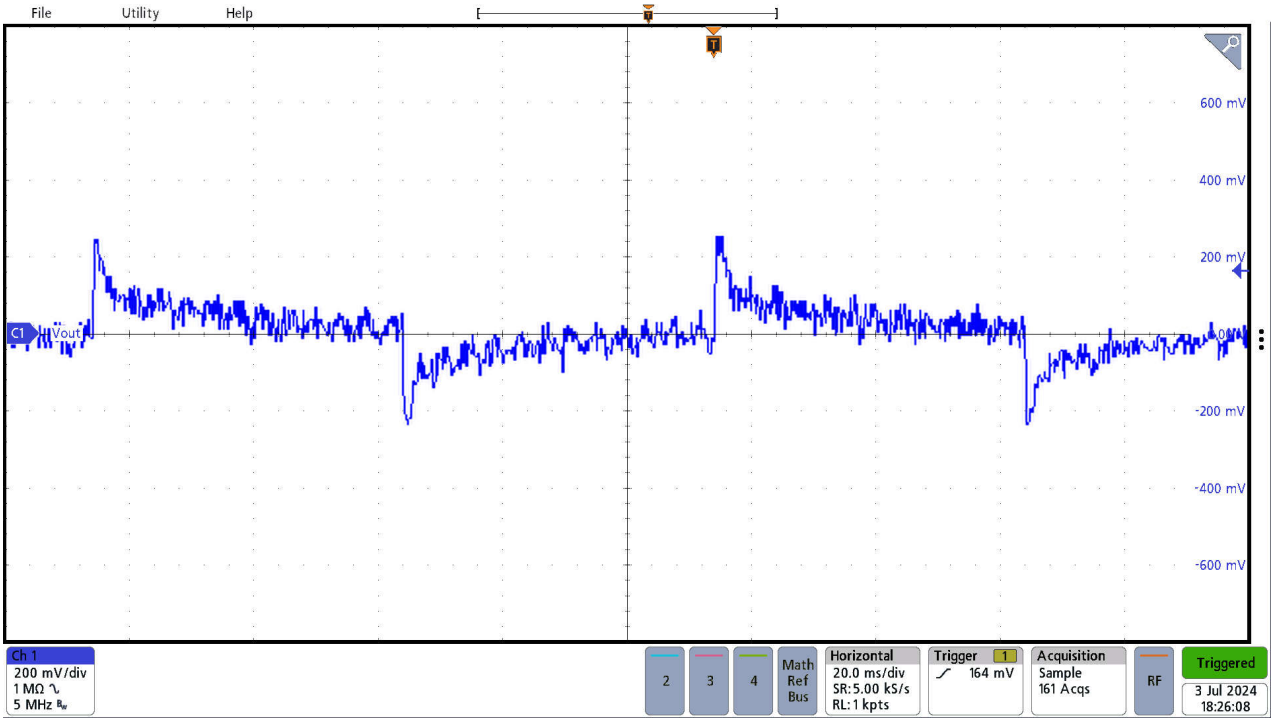

Figure 3-9. 250V_{DC} Input Voltage, Loadstep = 300mA to 600mA

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3.3.3 450V_{DC} Input Voltage

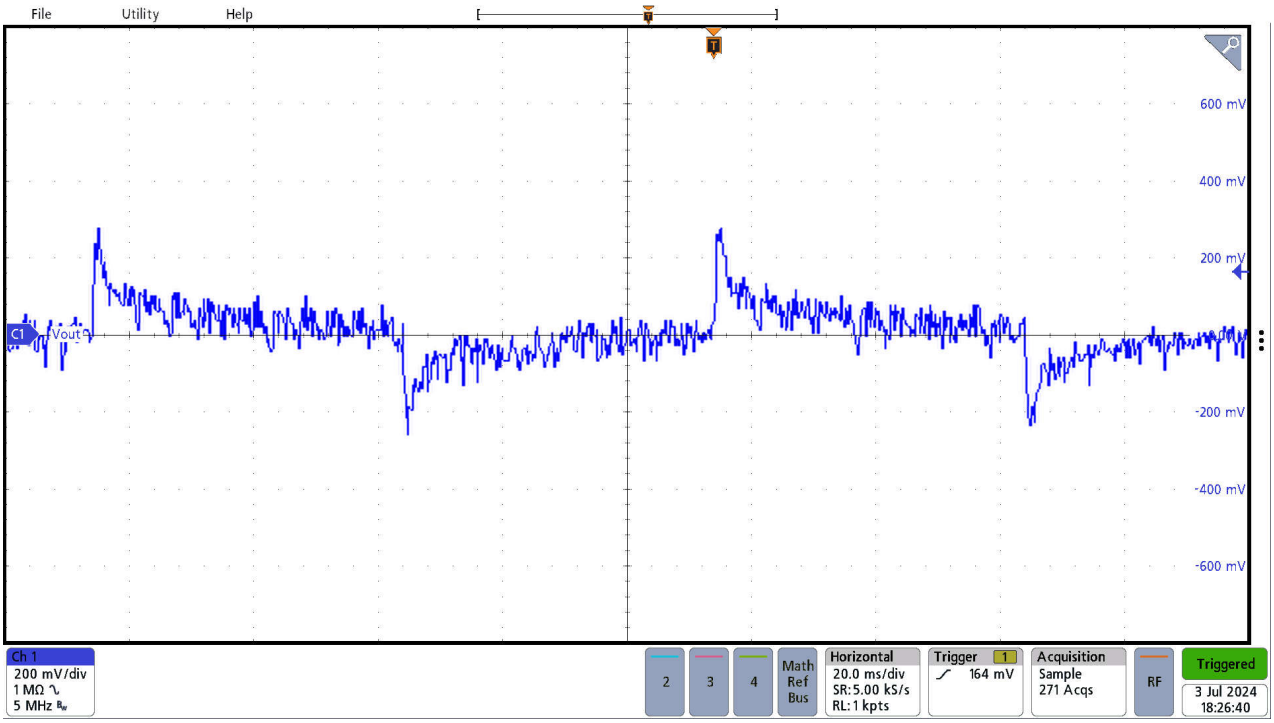

Figure 3-10. 450V_{DC} Input Voltage, Loadstep = 300mA to 600mA

3.3.4 630V_{DC} Input Voltage

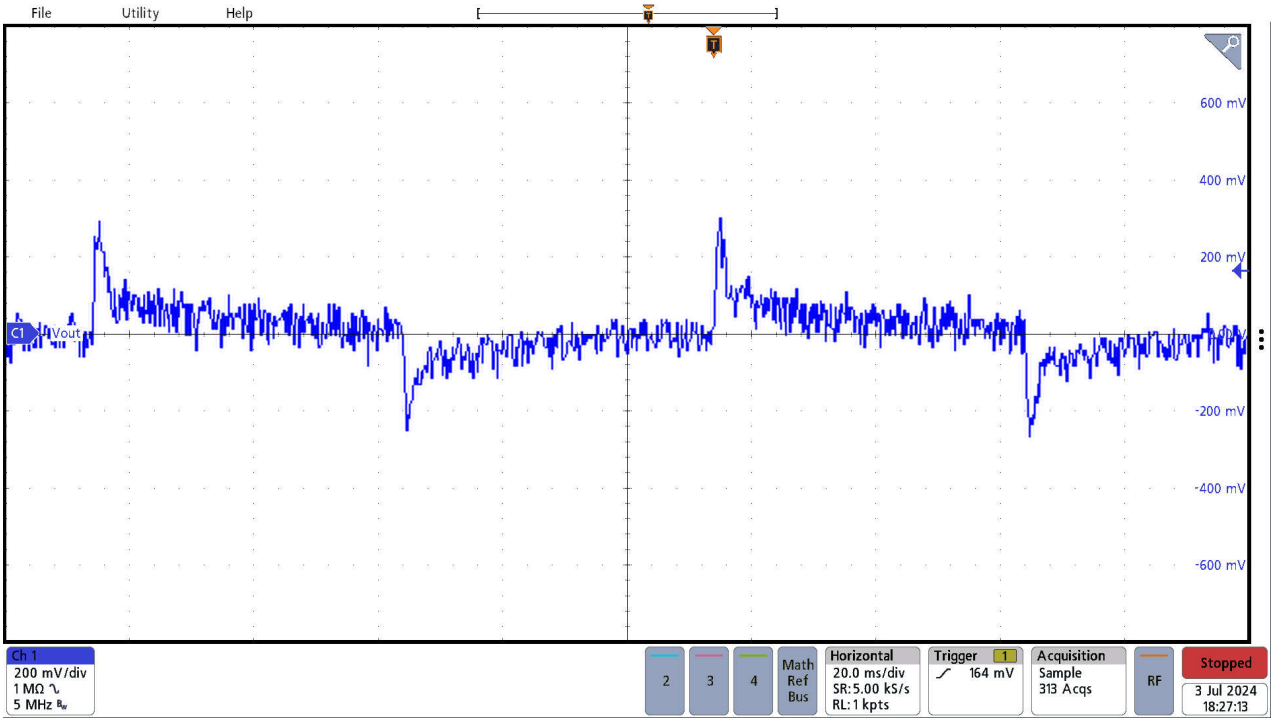

Figure 3-11. 630V_{DC} Input Voltage, Loadstep = 300mA to 600mA

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3.4 Start-up Sequence

3.4.1 150V_{DC} Input Voltage and 600mA Load Current

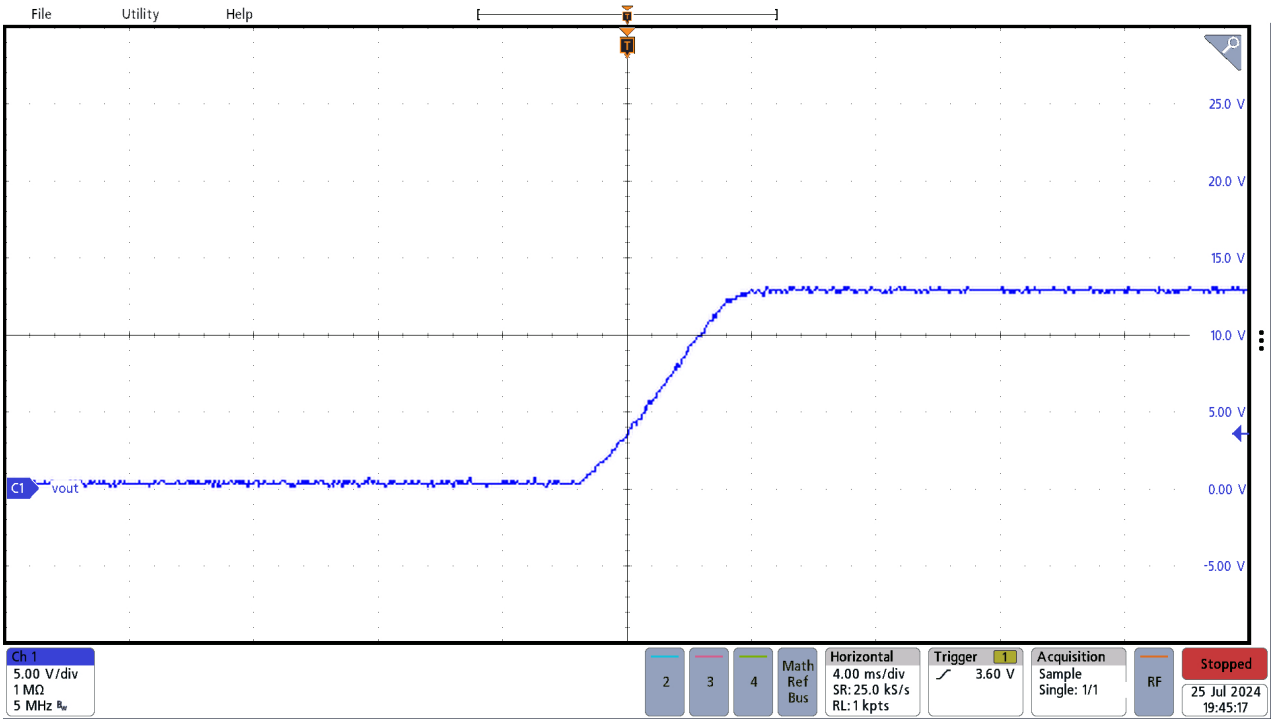

Figure 3-12. 150V_{DC} Input Voltage, Load Current = 600mA

3.4.2 325V_{DC} Input Voltage and No Load

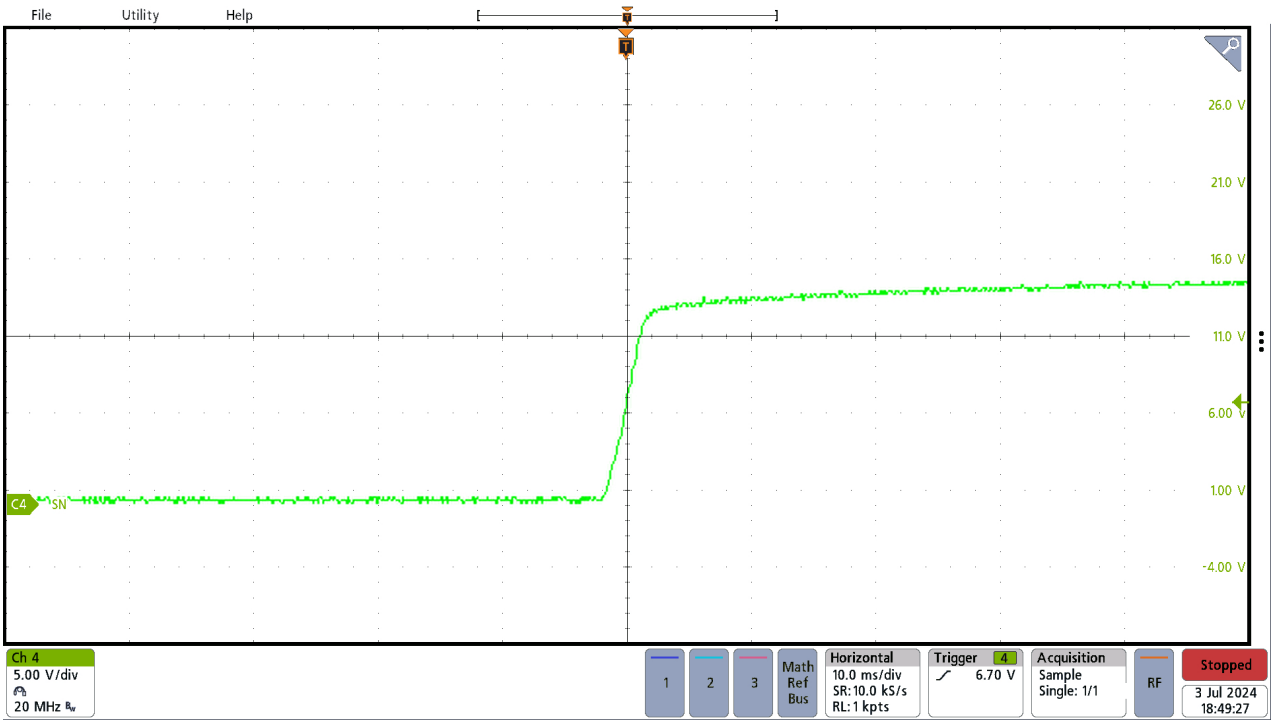

Figure 3-13. 325V_{DC} Input Voltage, Load Current = 0A

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3.4.3 630V_{DC} Input Voltage and 600mA Load Current

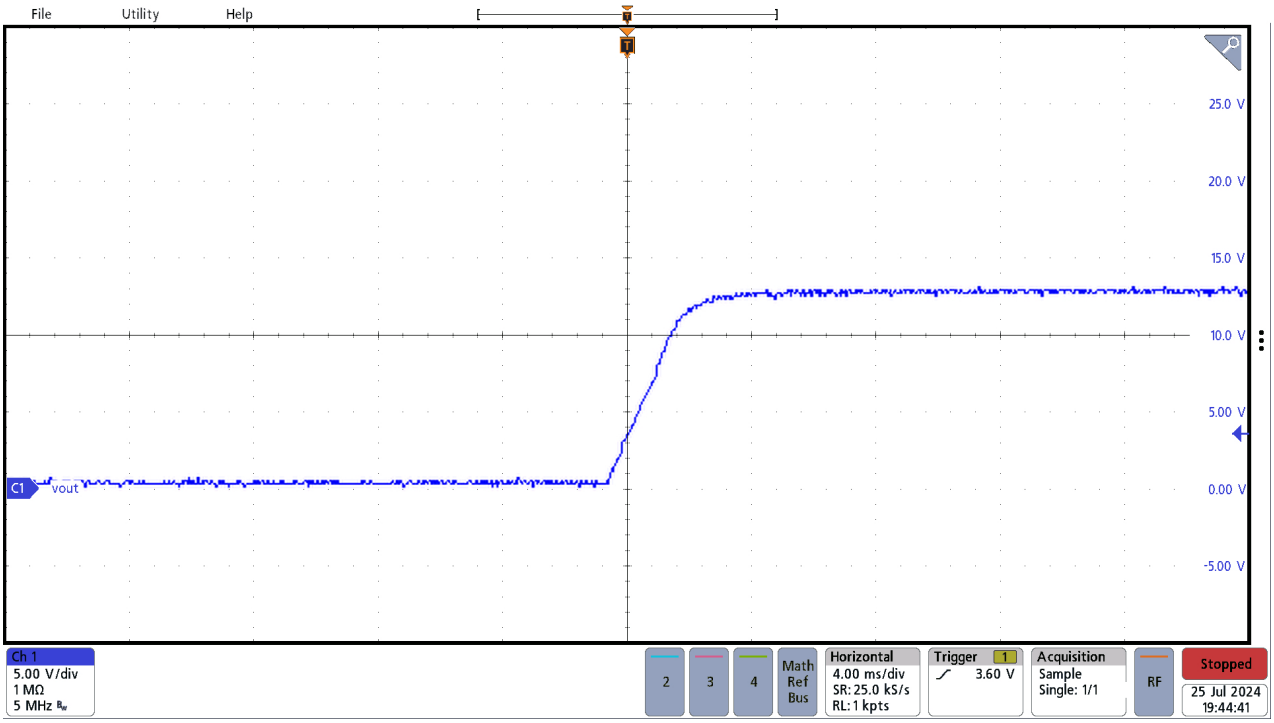

Figure 3-14. 630V_{DC} Input Voltage, Load Current = 600mA

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