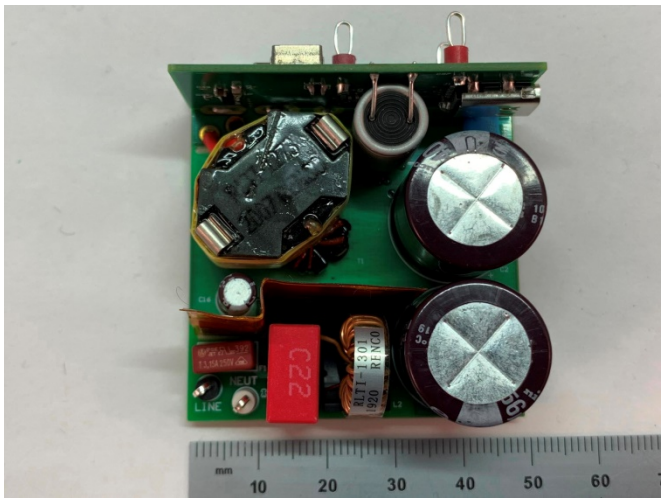
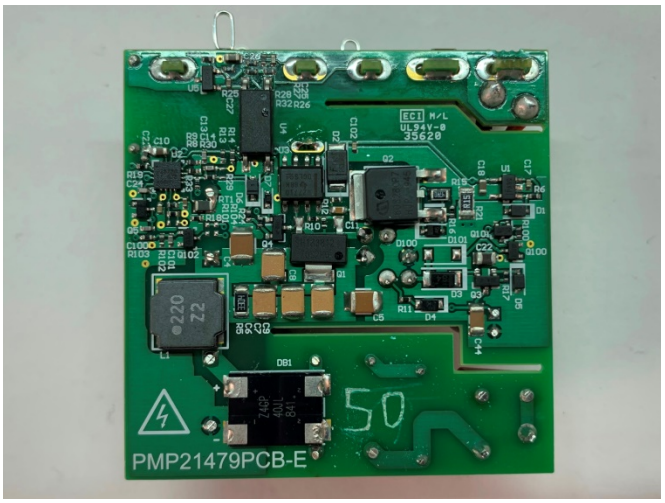
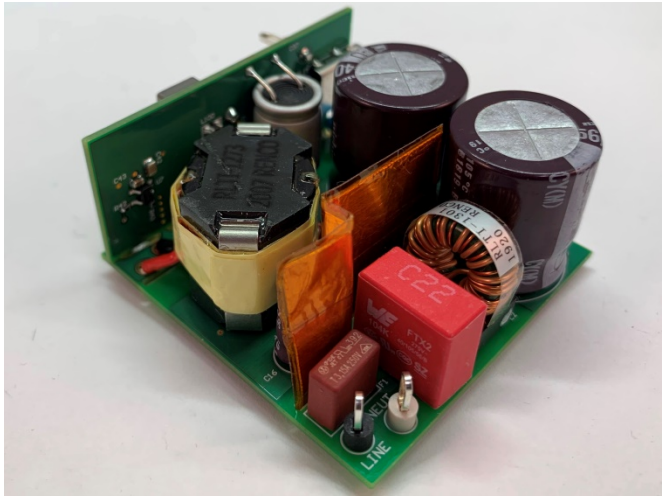
Test Report: PMP21479
65W Active Clamp Flyback With Si FETs Reference Design for a High Power Density 5-20V AC/DC Adapter

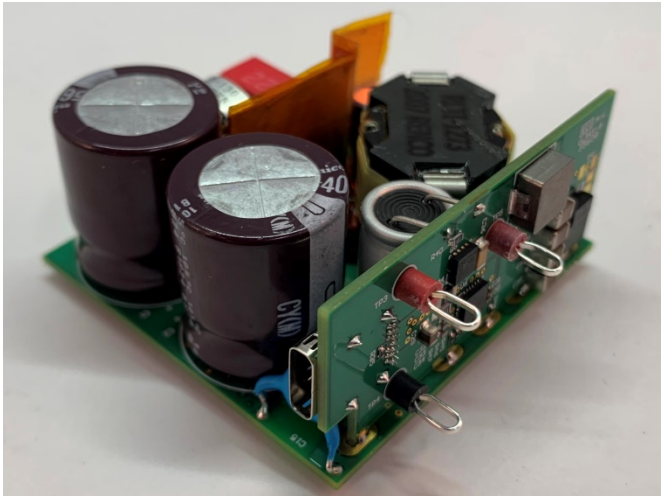
Description

PMP21479 uses the UCC28780 active clamp flyback controller to generate a 20V/15V/9V/5V adjustable output voltage. The maximum power rating is 65W at 20V output, and up to 3A at all other output voltage settings. This design reaches a peak efficiency of over 93% using silicon MOSFETs. The average efficiency and standby power levels are designed to meet DoE level VI and CoC Tier 2 limits. Board dimensions are 1.9” x 1.9” x 1” (49mm x 49mm x 25mm).









CONTENTS

1 Test Prerequisites

1.1 Voltage and Current Requirements

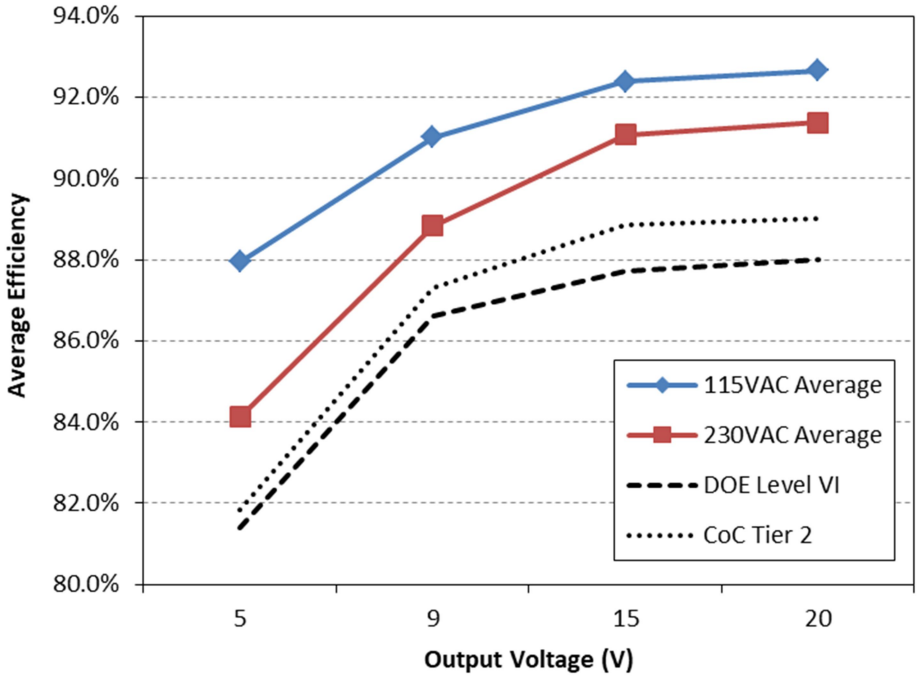
Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
Line Input Voltage Range	90VACrms – 265VACrms
Line Input Frequency	50Hz/60Hz
Output Voltage/Current	5V/3A, 9V/3A, 15V/3A, 20V/3.25A

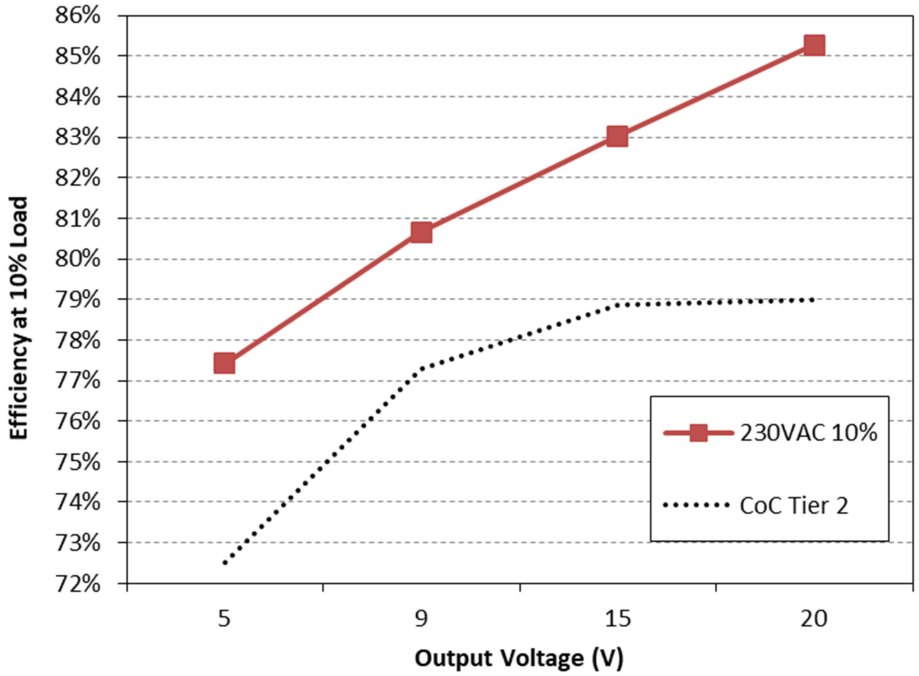
2 Testing and Results

2.1 Efficiency

2.1.1 Average Efficiency



2.1.2 Efficiency at 10% Load



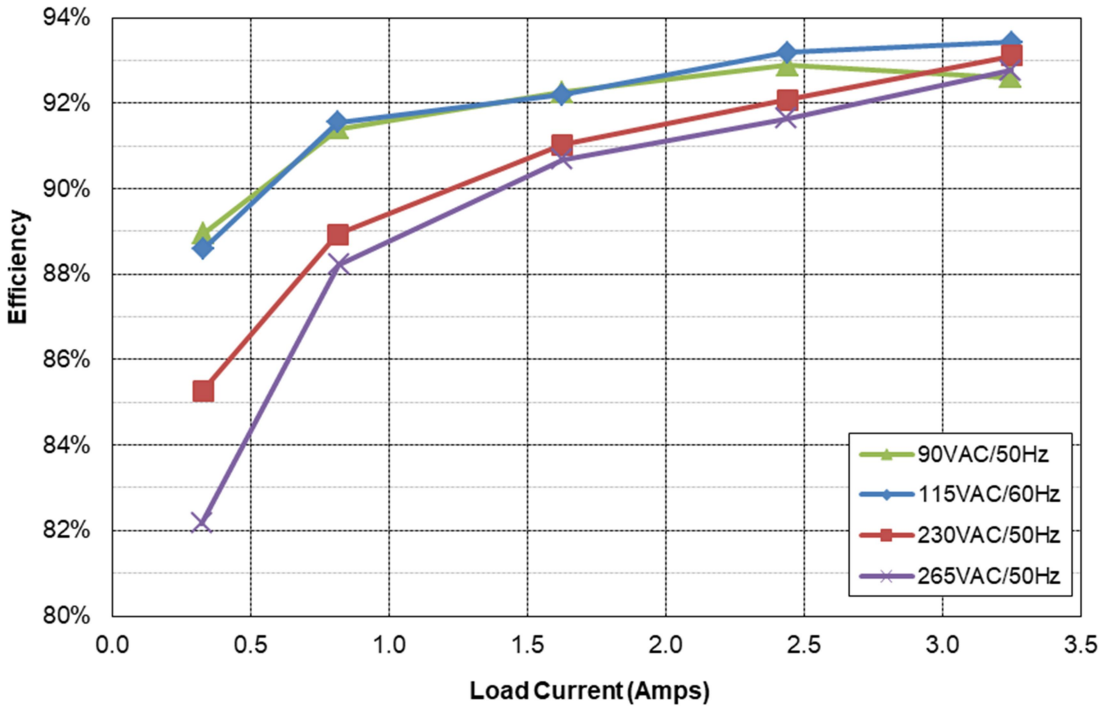
2.1.3 Standby (Output Cable Unplugged)

Vin RMS	Line Frequency	Input Power
115 V	60	24.6 mW
230 V	50	33.0 mW

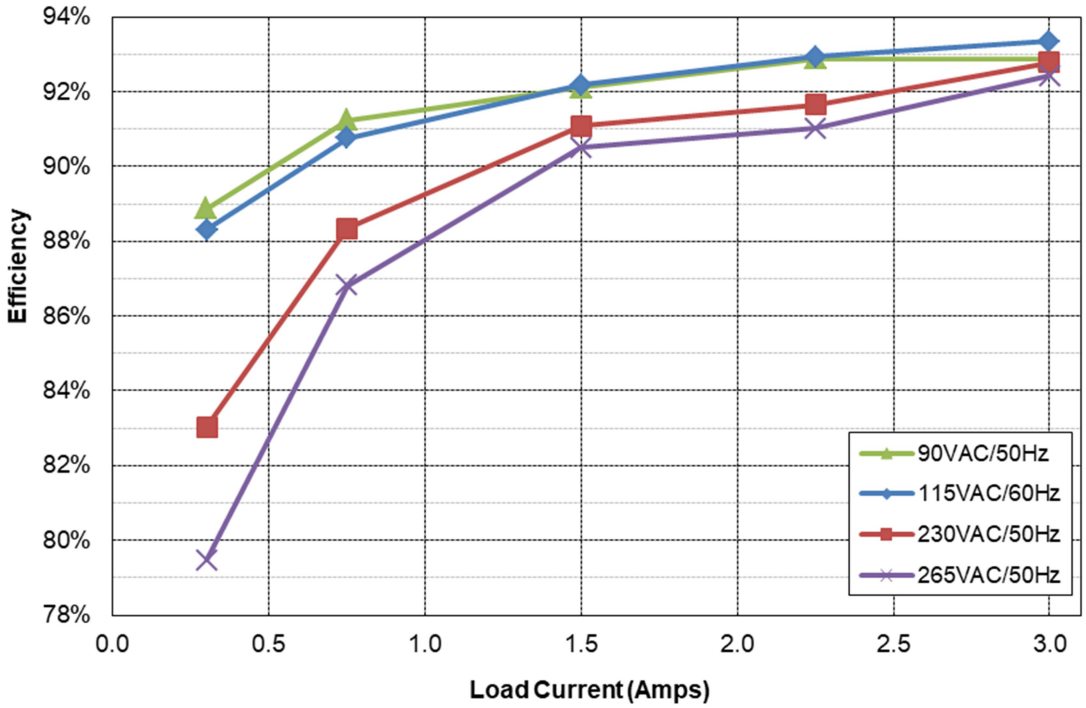
2.1.4 Tiny Load (20V Output at 250mw Load)

Vin RMS	Line Frequency	Input Power	Efficiency
115 V	60	393 mW	63.5%
230 V	50	414 mW	60.1%

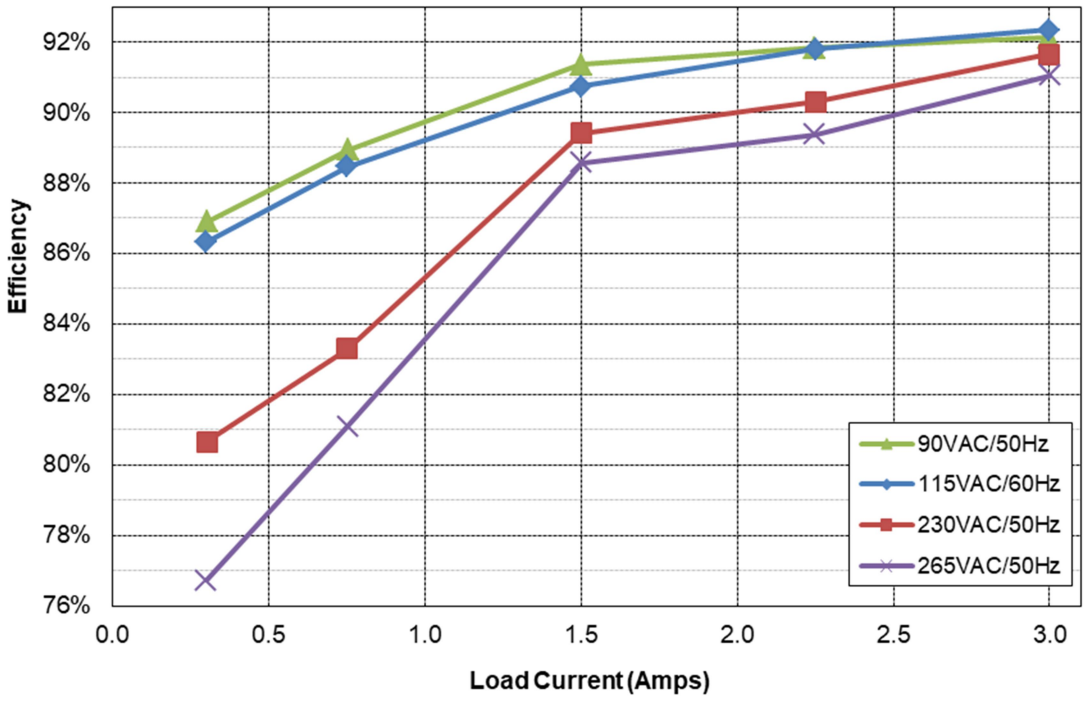
2.1.5 20V Output



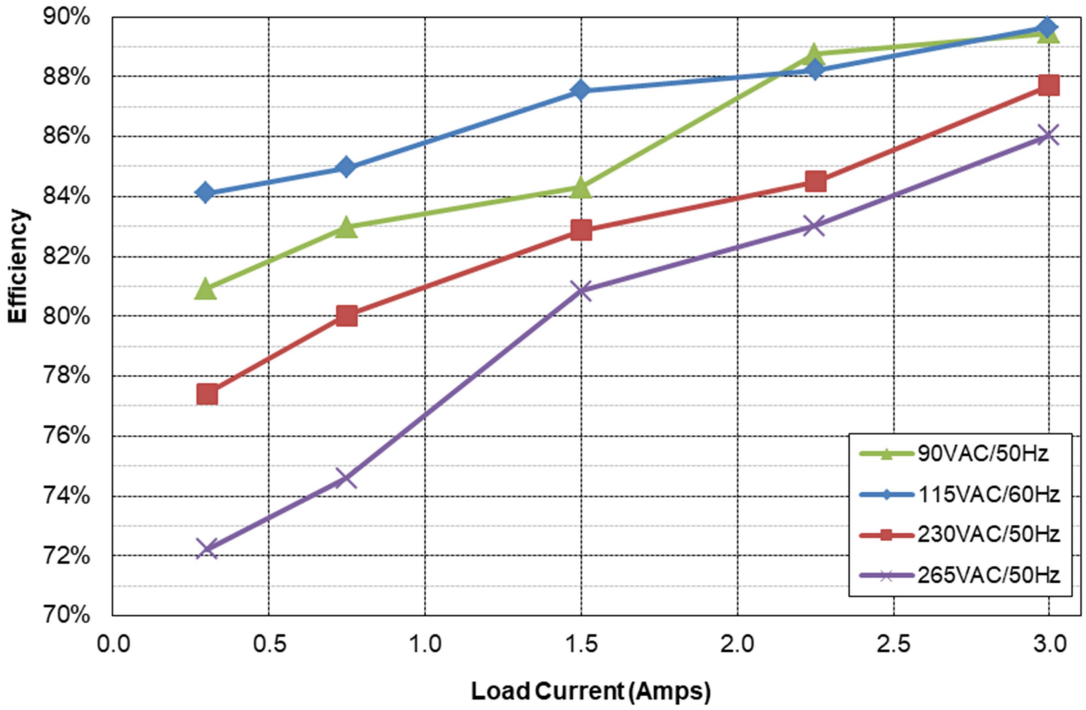
2.1.6 15V Output



2.1.7 9V Output



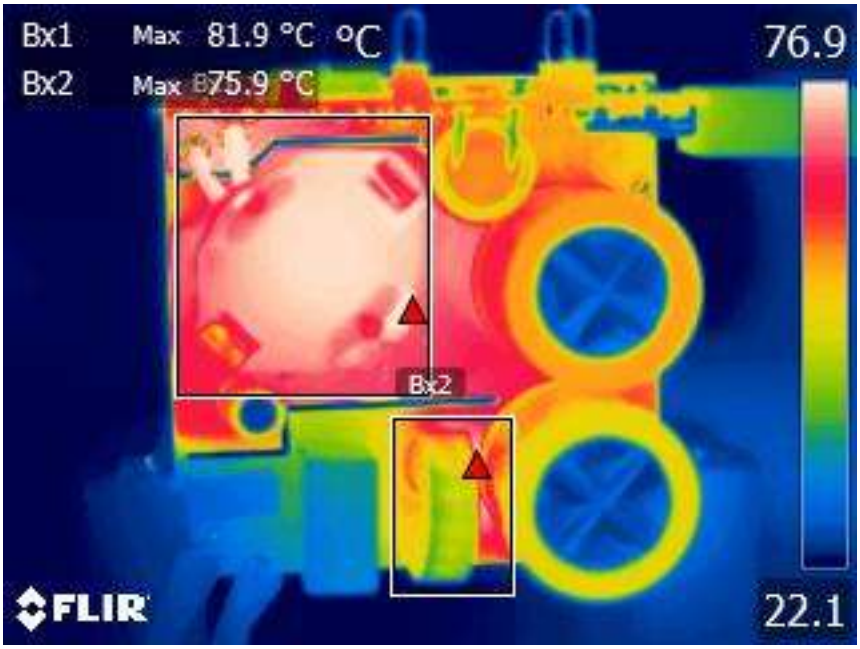
2.1.8 5V Output

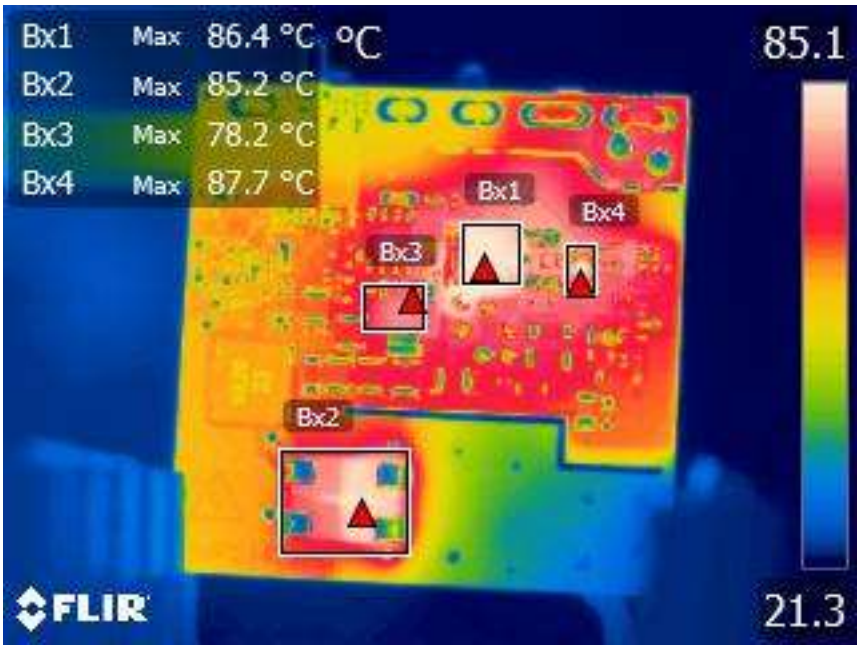


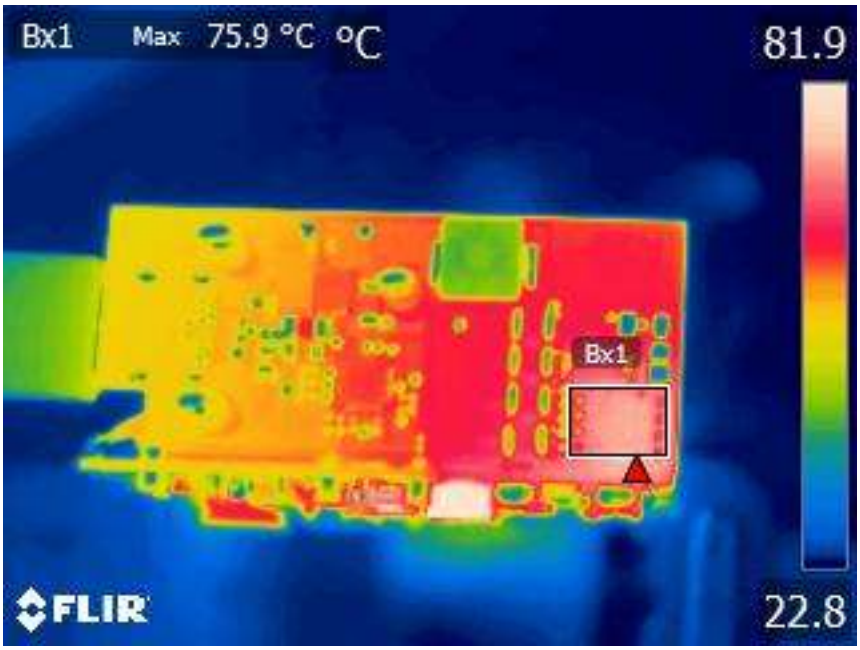
2.2 *Thermal Images*

All images captured open frame, 25ºC ambient, after a 30-minute warm up period.

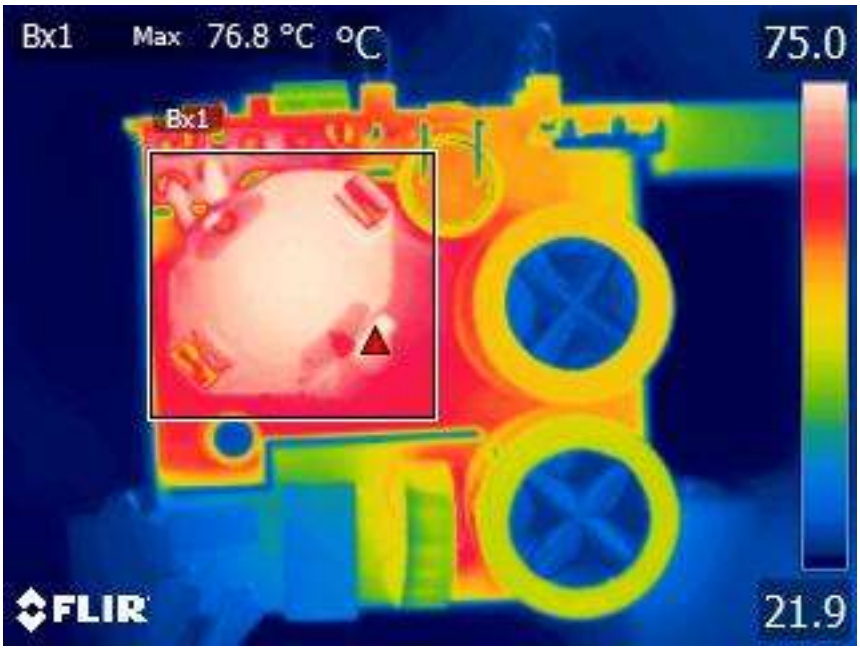
2.2.1 90VAC/50Hz Input, 20V/3.25A Output

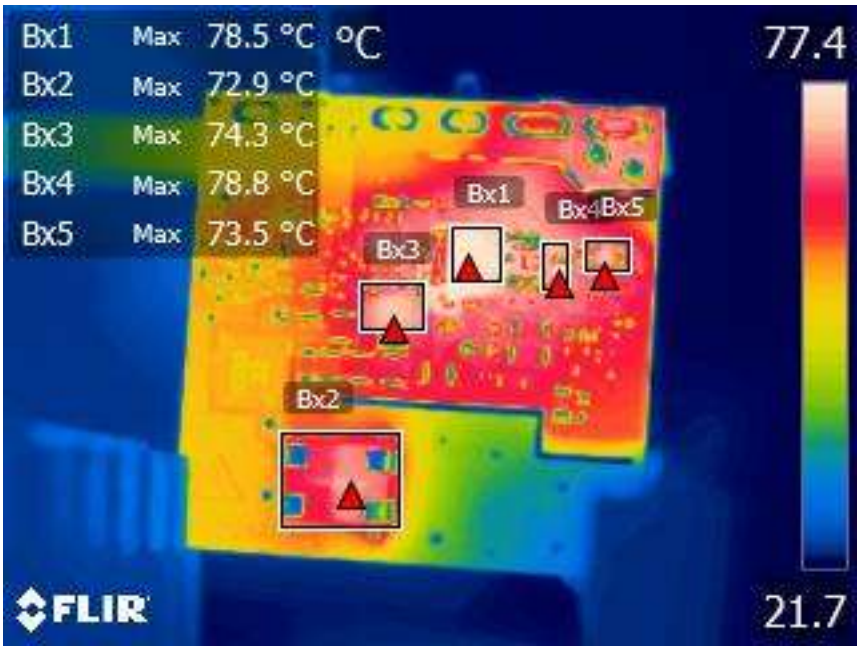


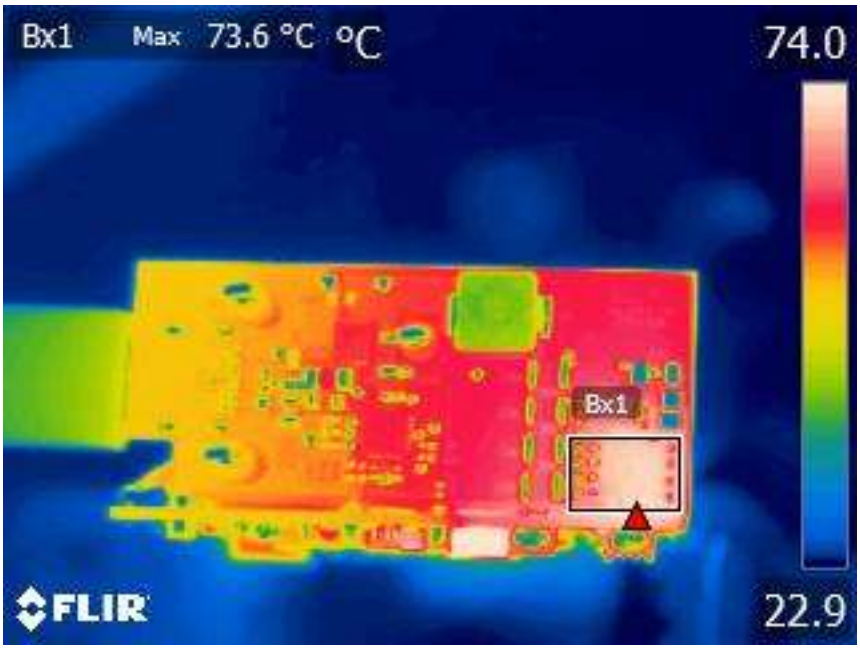




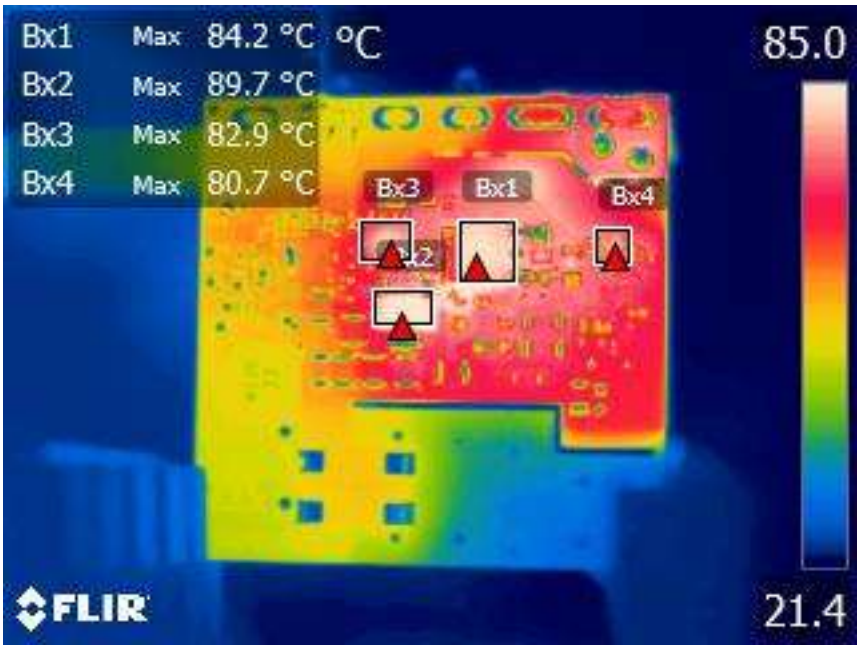
2.2.2 115VAC/60Hz Input, 20V/3.25A Output

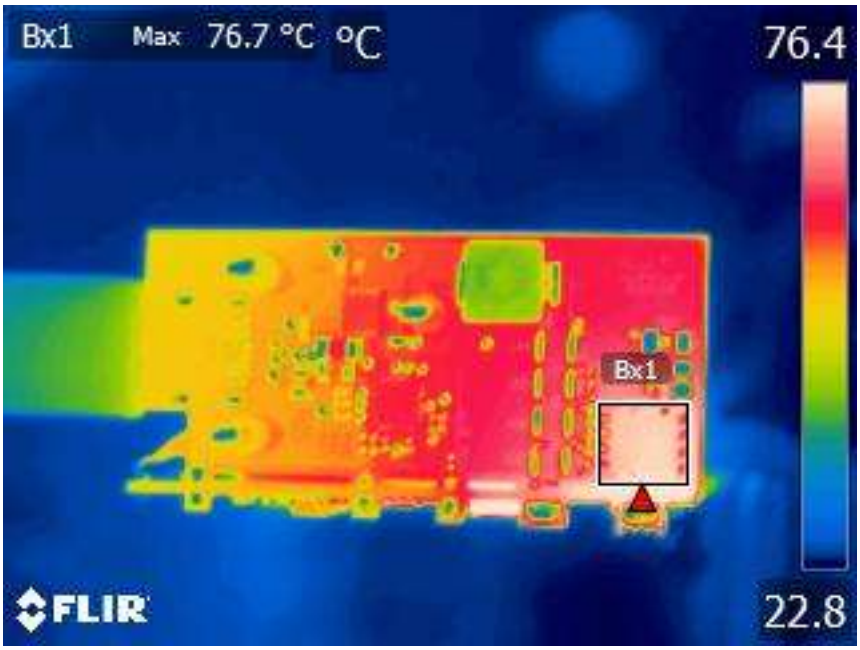




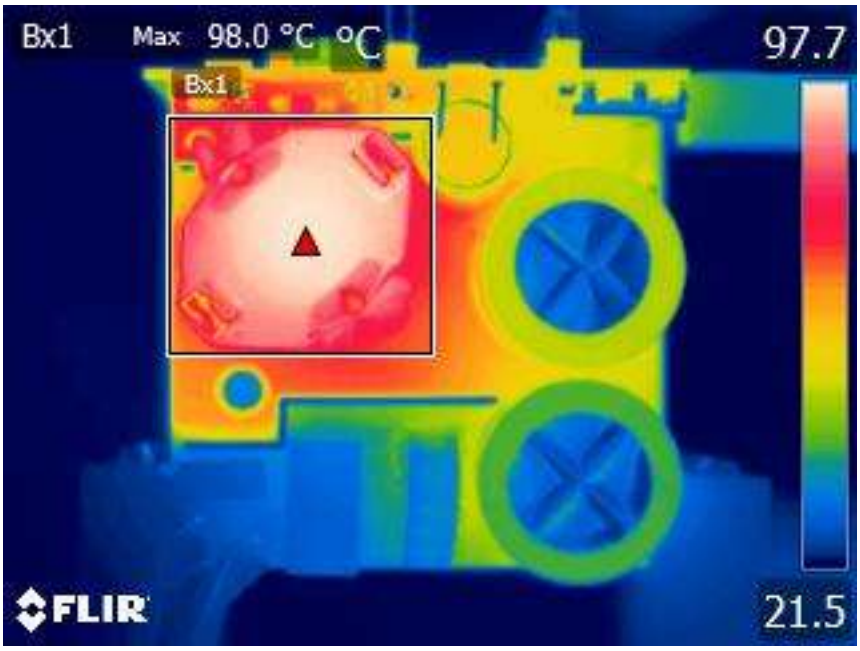


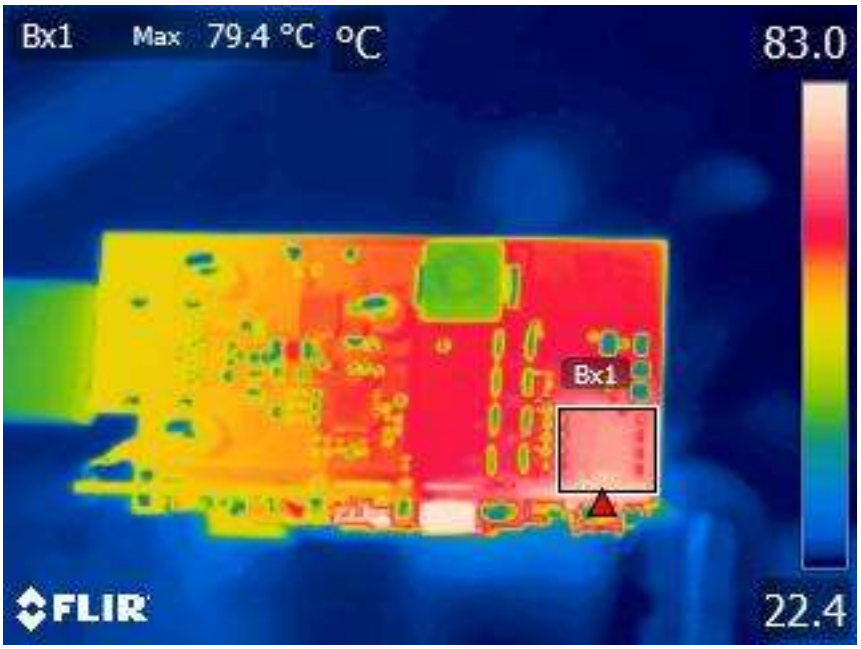
2.2.3 230VAC/50Hz Input, 20V/3.25A Output





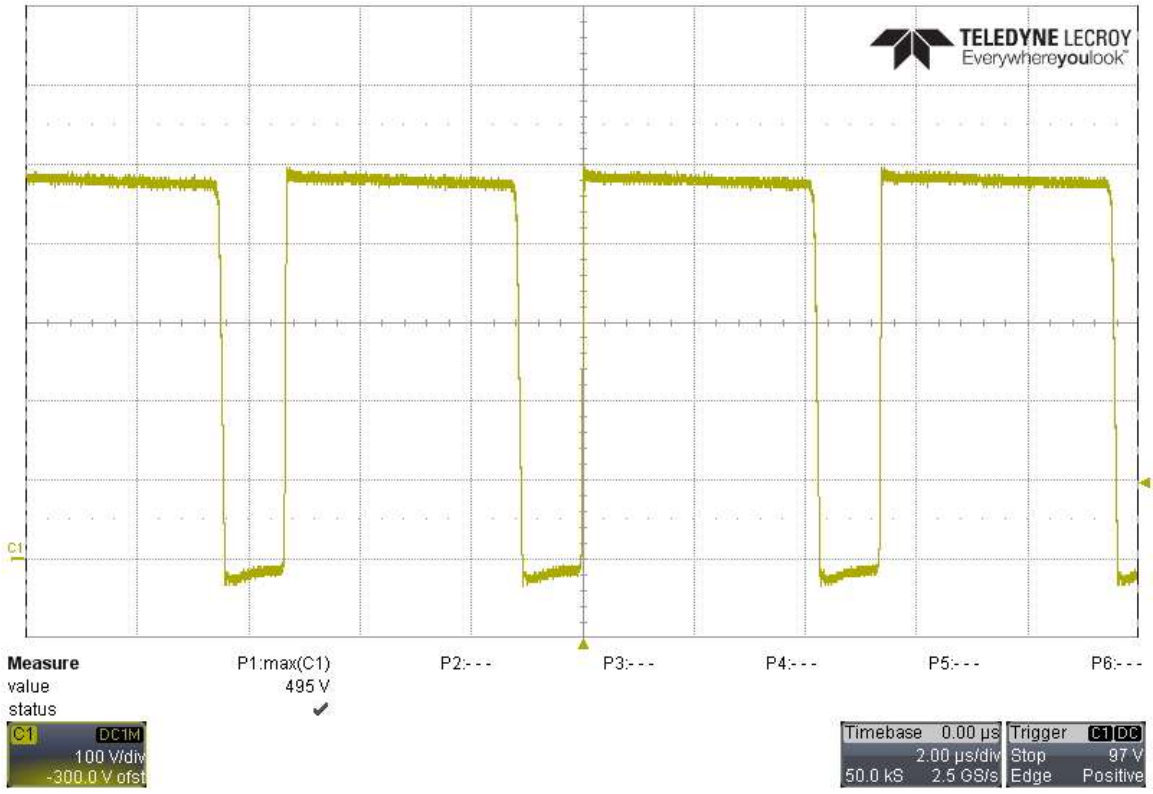
2.2.4 265VAC/50Hz Input, 20V/3.25A Output



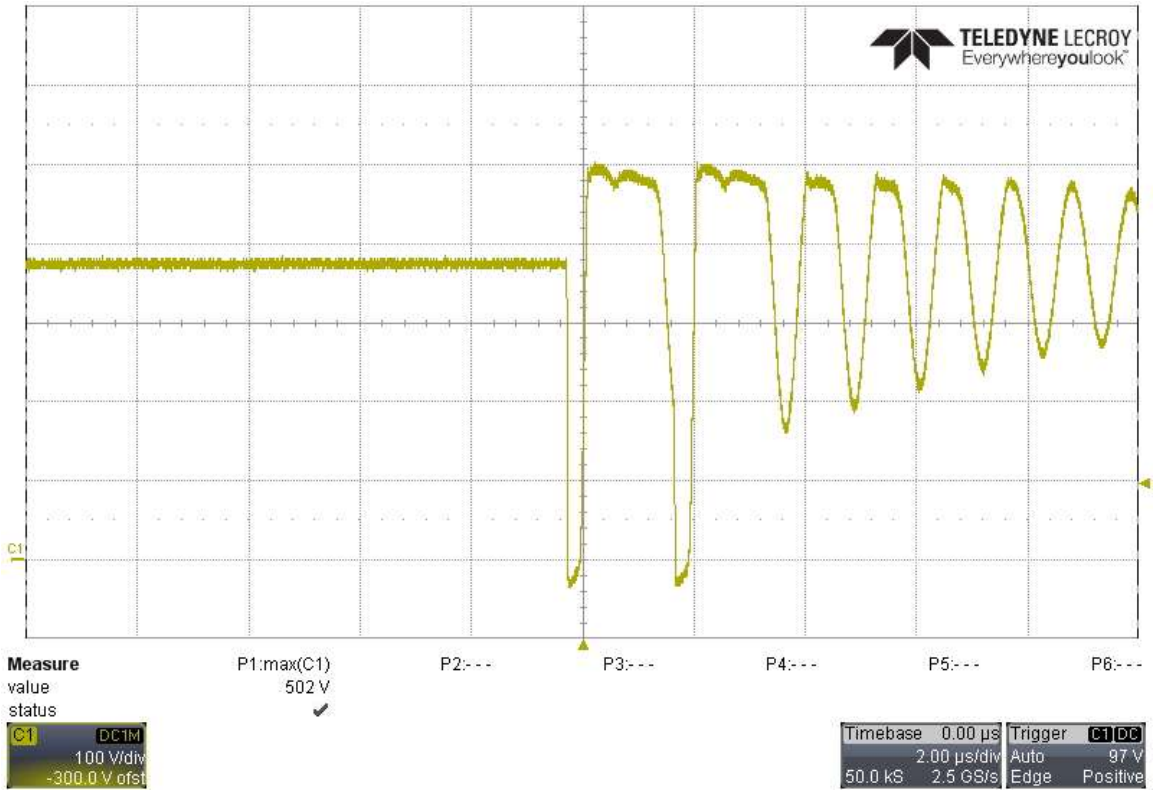


2.3 Switching Waveforms

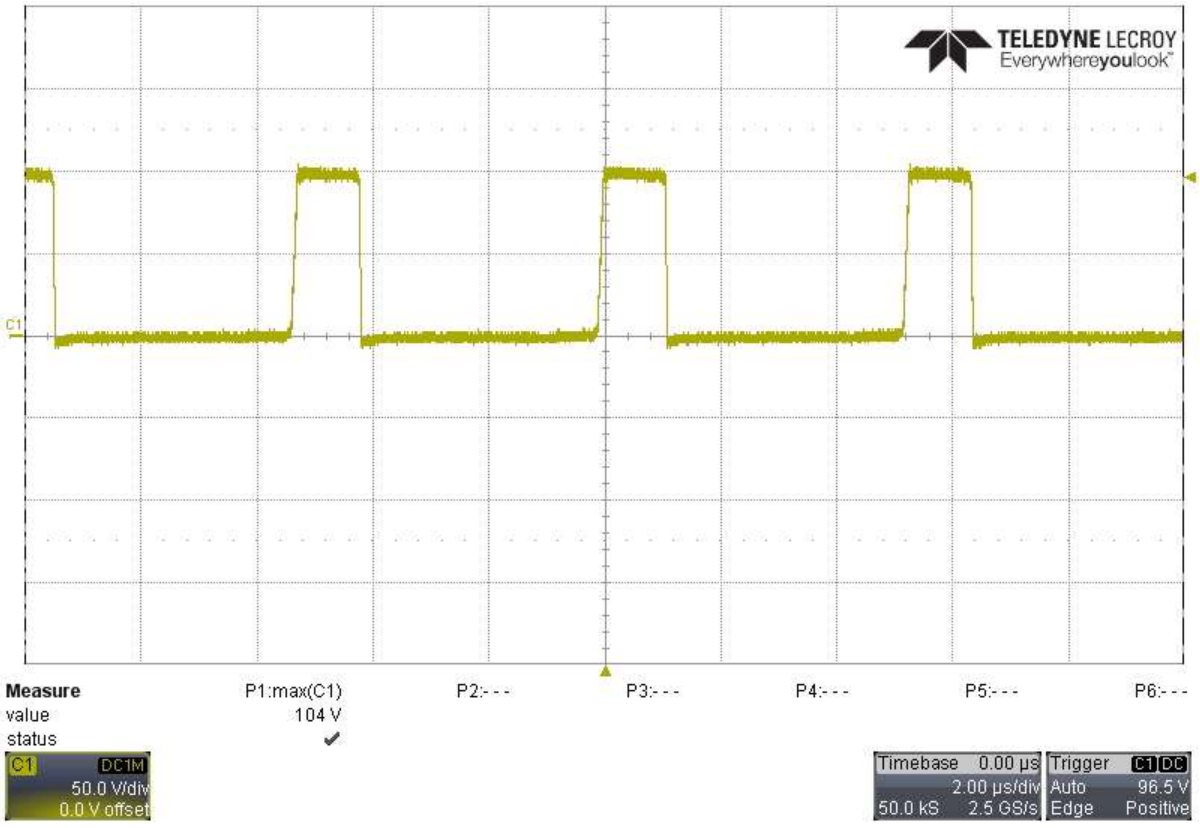
2.3.1 Primary Switch Node, 265VAC/50Hz Input, 20V/3.25A Output



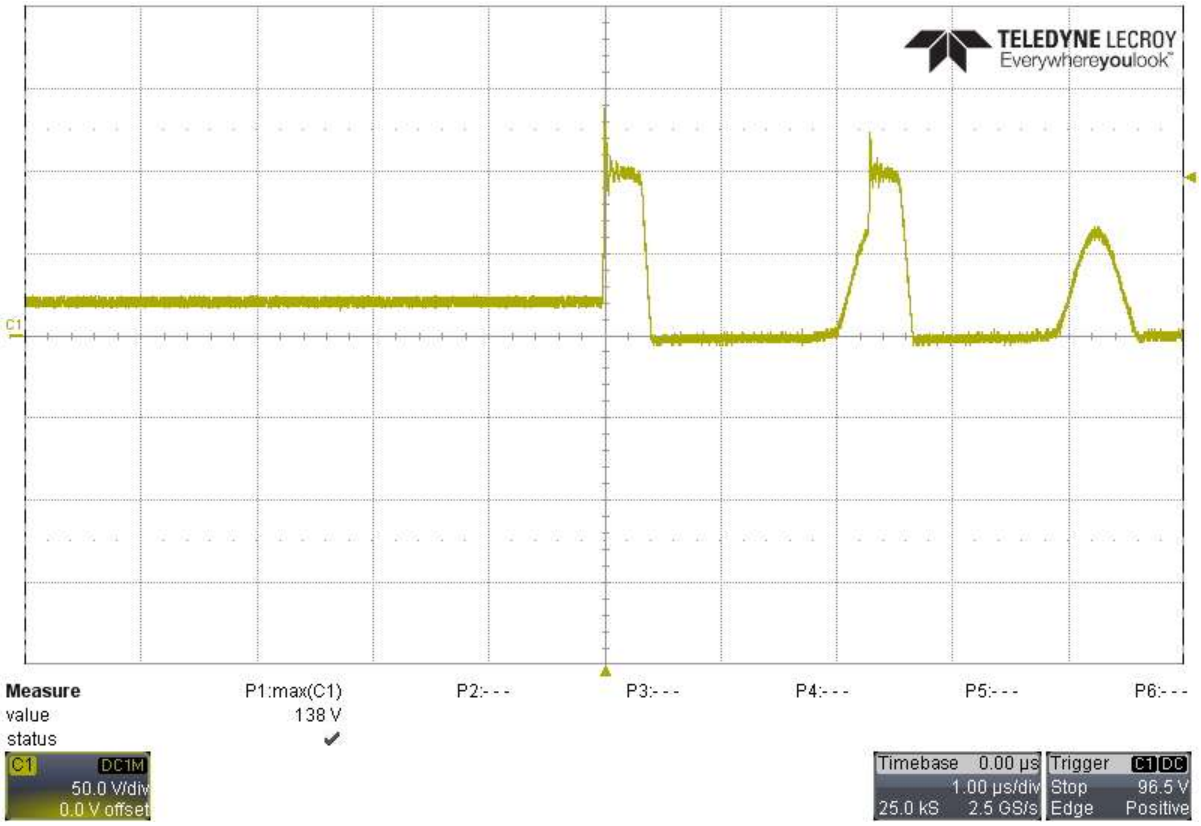
2.3.2 Primary Switch Node, 265VAC/50Hz Input, 20V/0A Output



2.3.3 Vds of SR FET (Q7), 265VAC/50Hz Input, 20V/3.25A Output

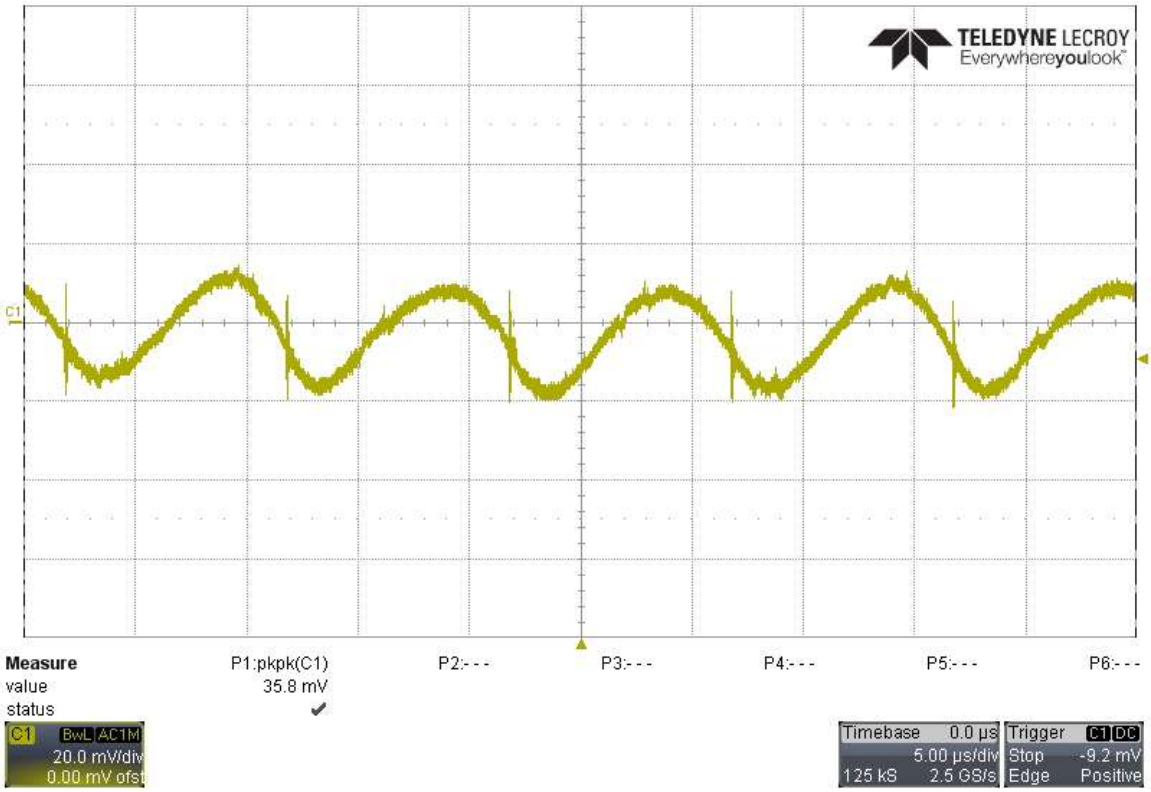


2.3.4 Vds of SR FET (Q7), 265VAC/50Hz Input, 20V/0A Output

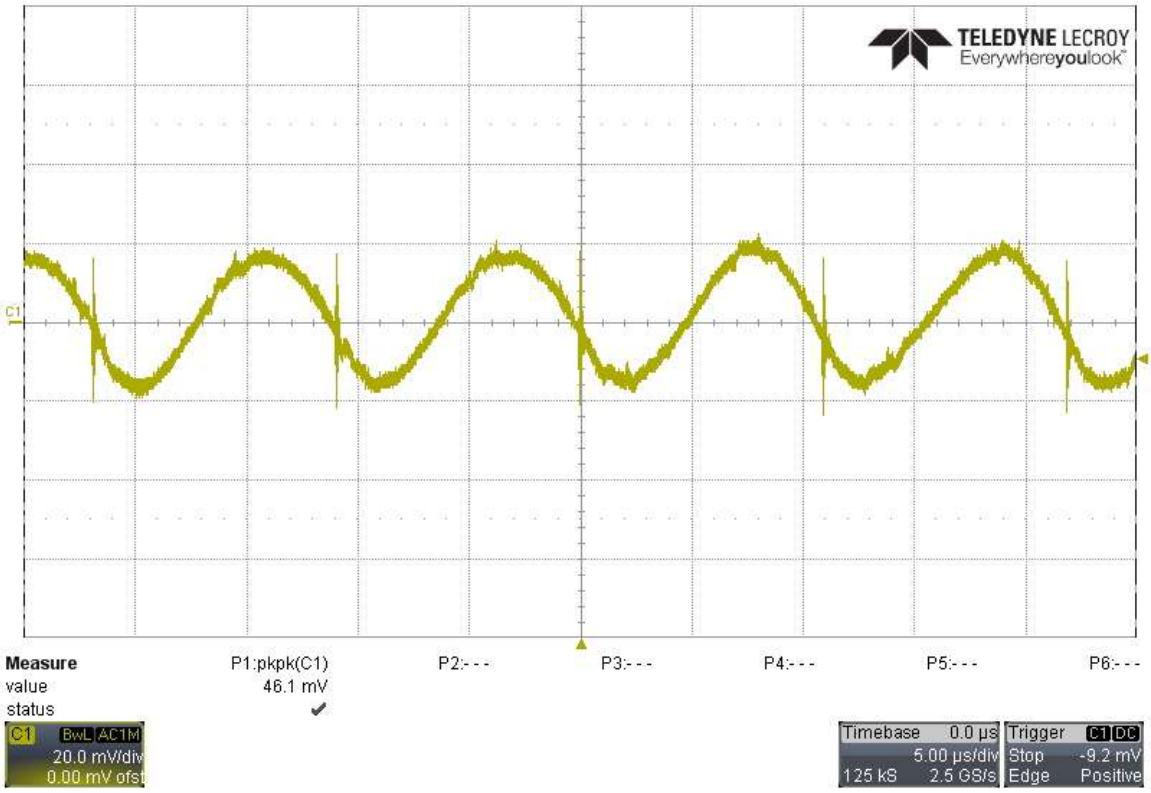


2.4 Output Voltage Ripple at Maximum Load Current

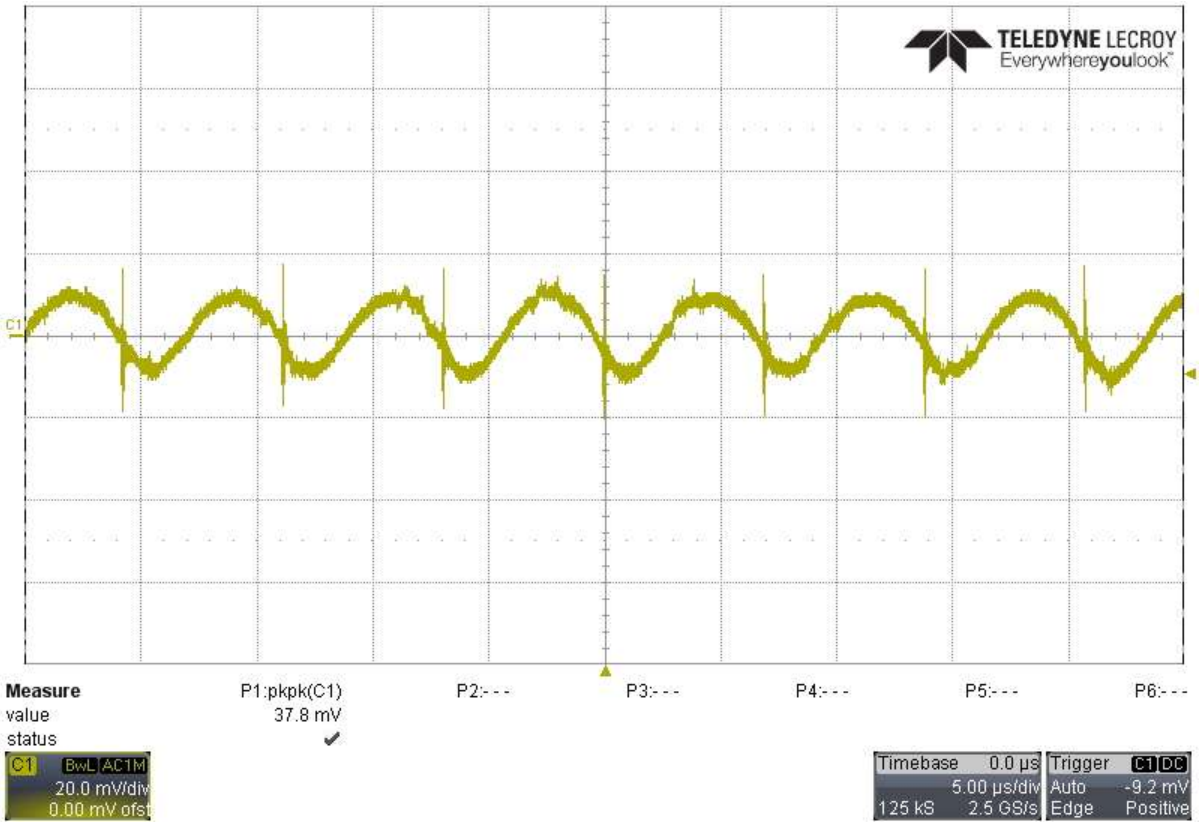
2.4.1 5V/3A Output, 120VAC/60Hz Input



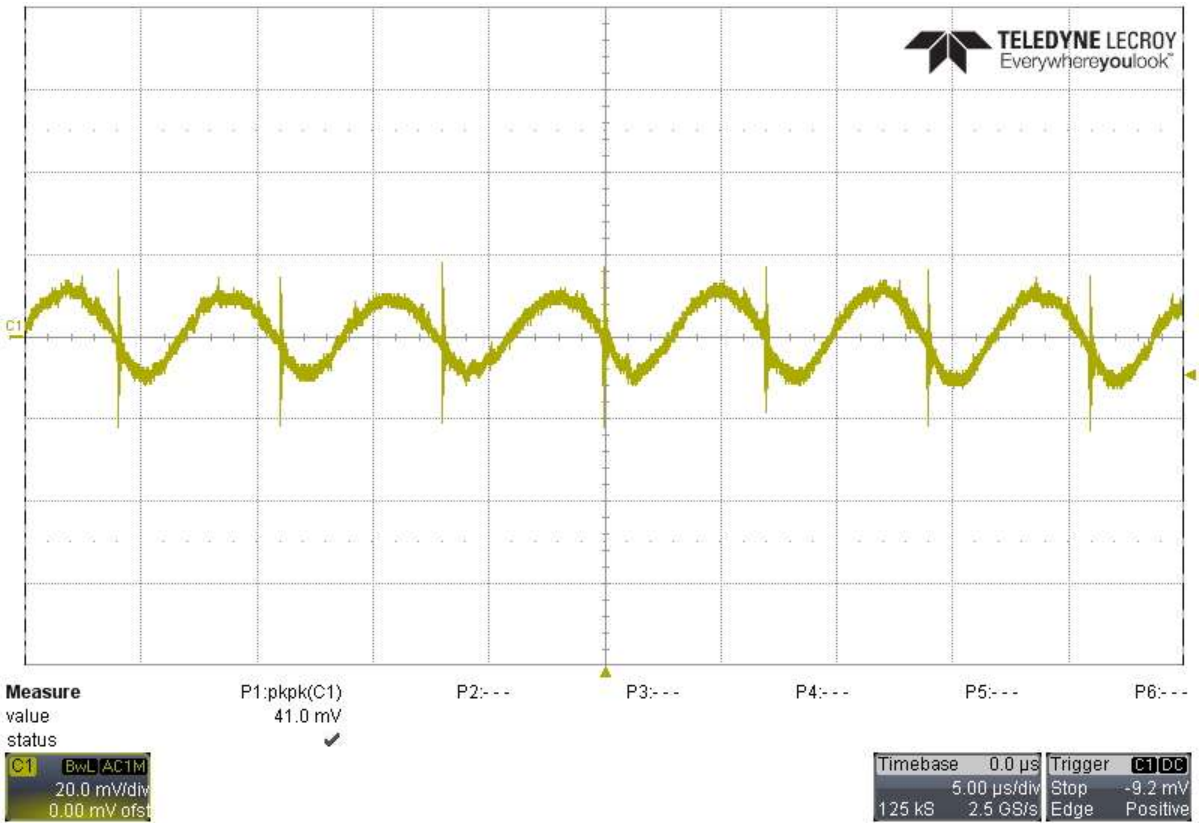
2.4.2 5V/3A Output, 230VAC/50Hz Input



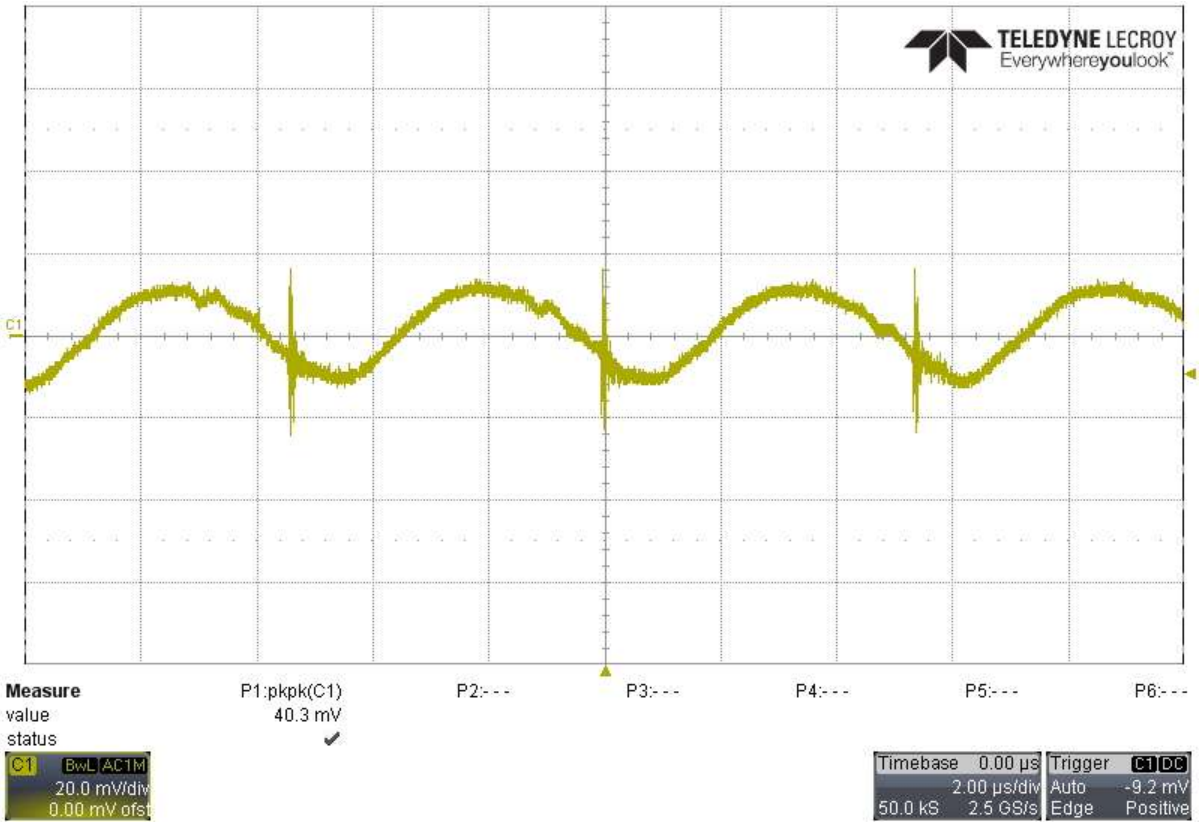
2.4.3 9V/3A Output, 120VAC/60Hz Input



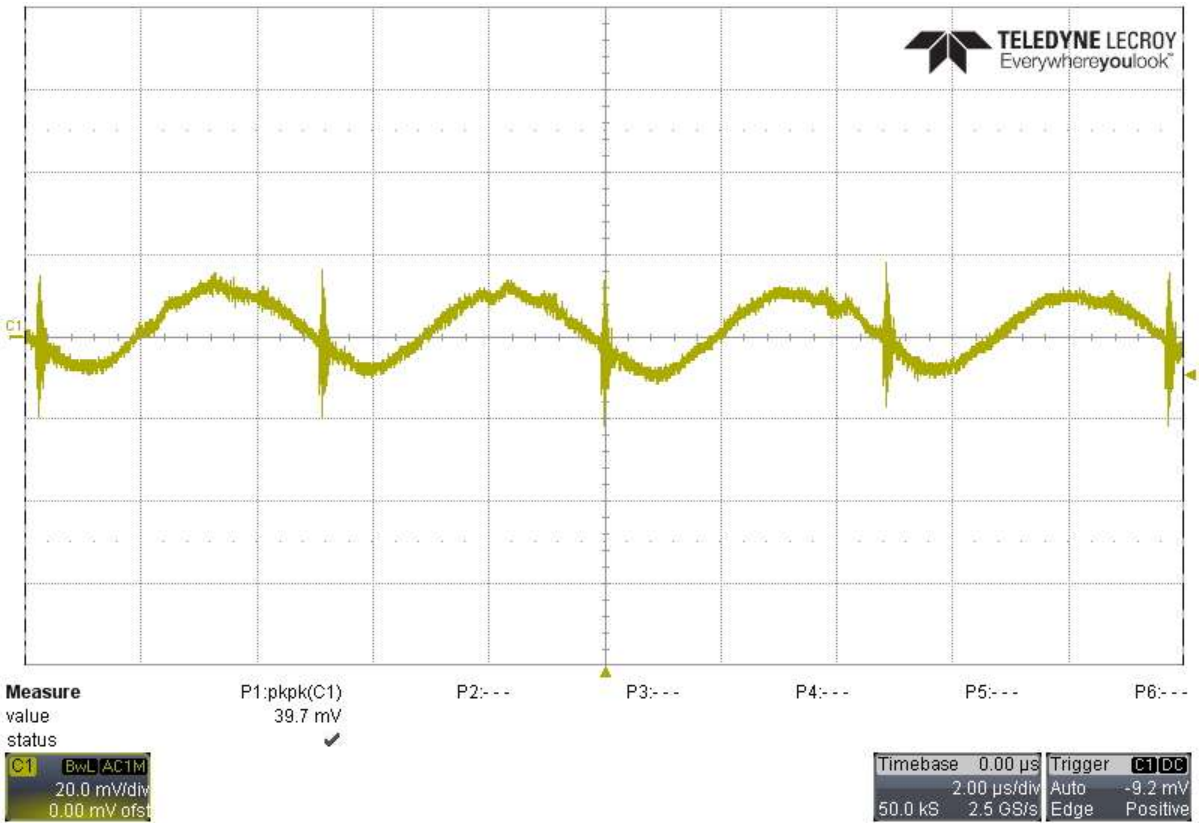
2.4.4 9V/3A Output, 230VAC/50Hz Input



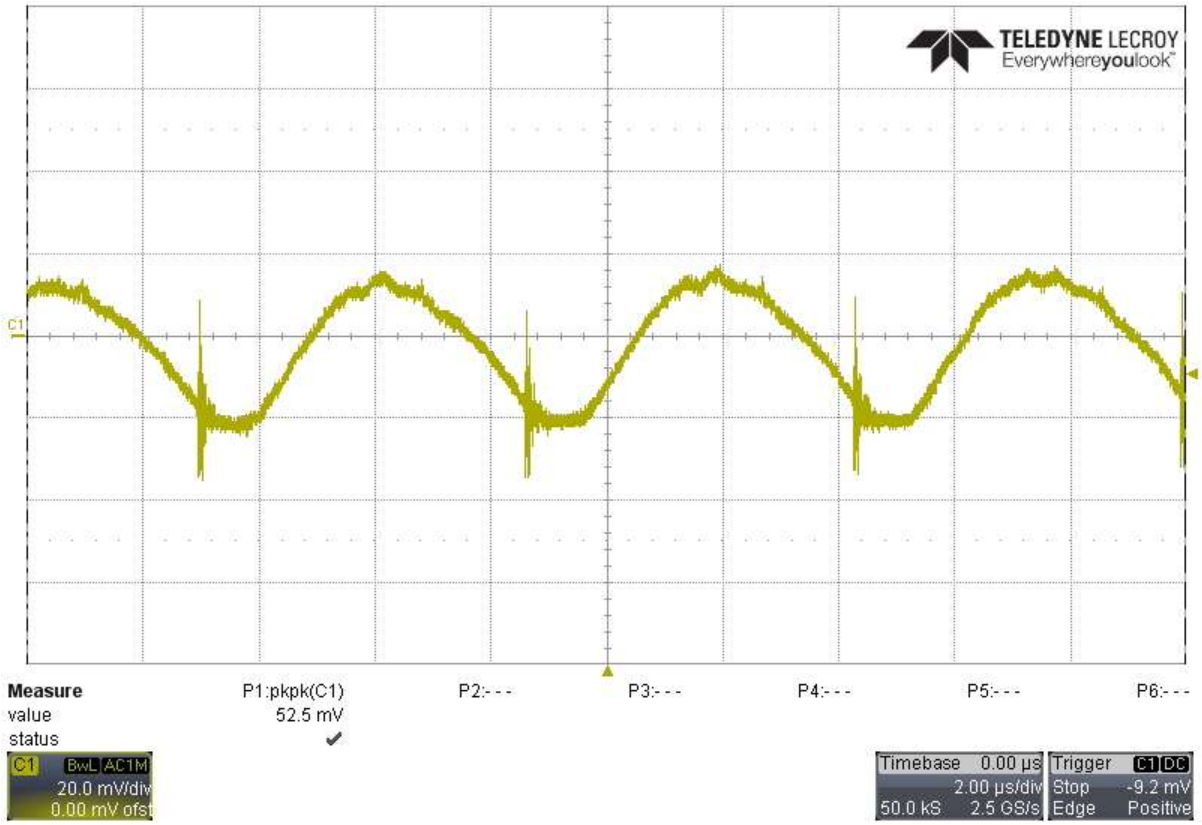
2.4.5 15V/3A Output, 120VAC/60Hz Input



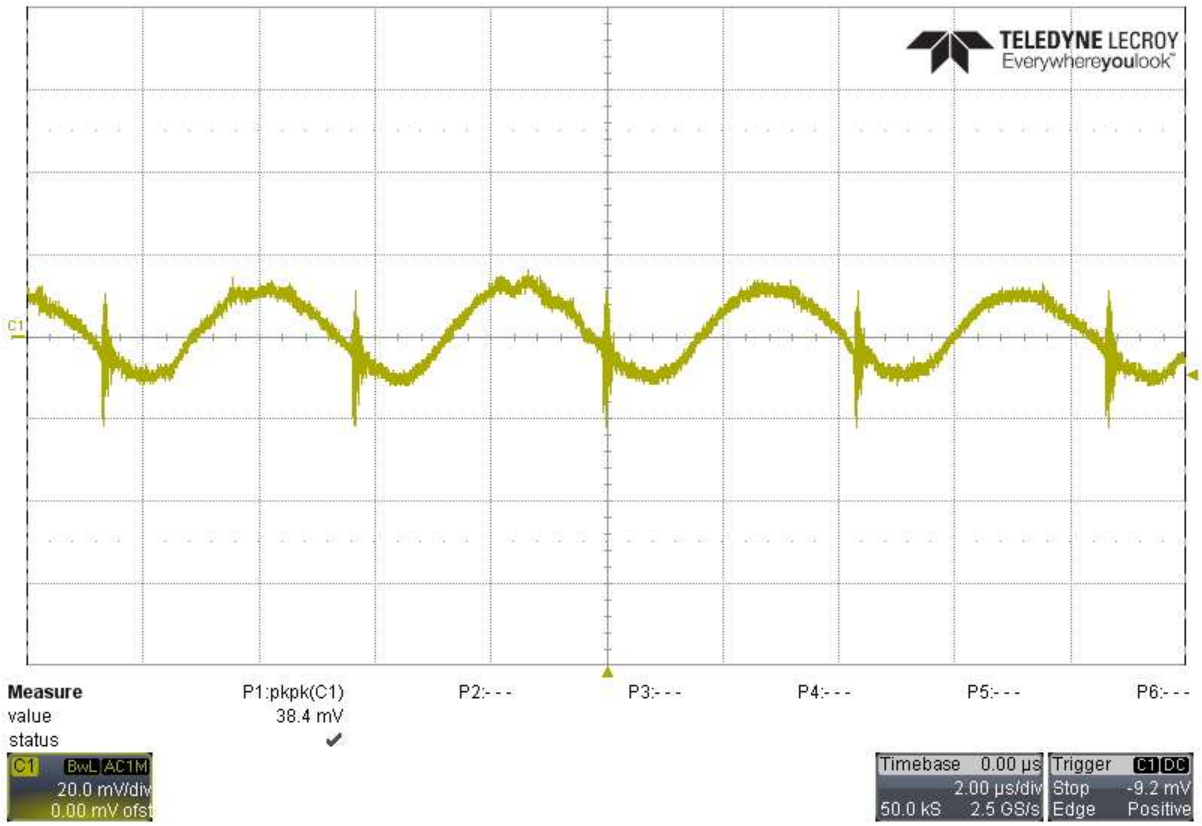
2.4.6 15V/3A Output, 230VAC/50Hz Input



2.4.7 20V/3.25A Output, 120VAC/60Hz Input

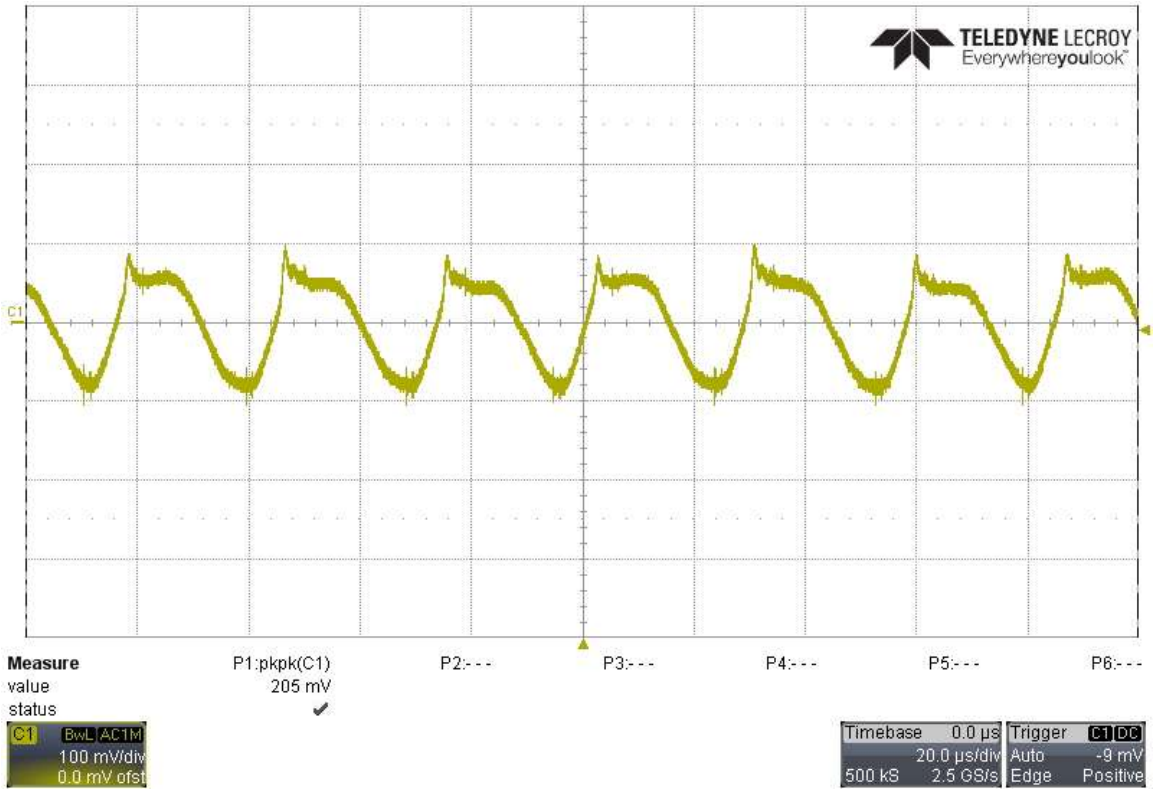


2.4.8 20V/3.25A Output, 230VAC/50Hz Input

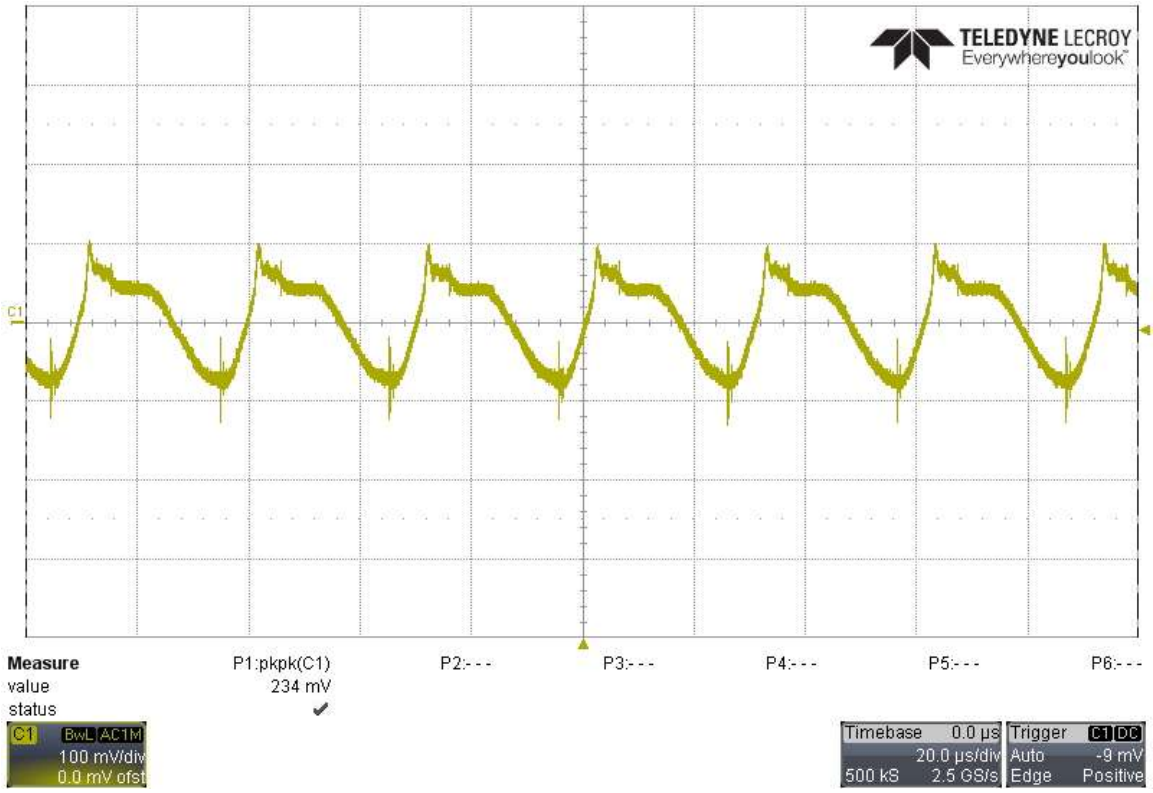


2.5 Output Voltage Ripple during Burst Mode

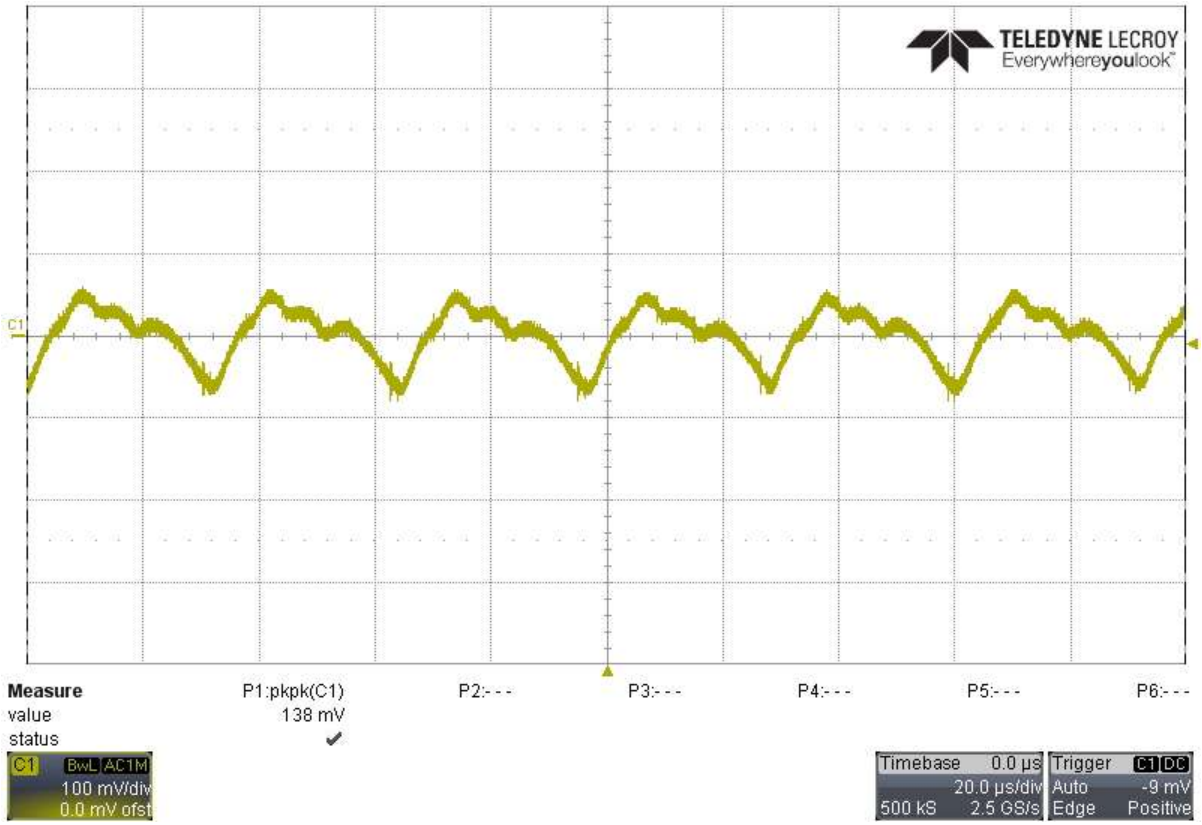
2.5.1 5V/2A Output, 120VAC/60Hz Input



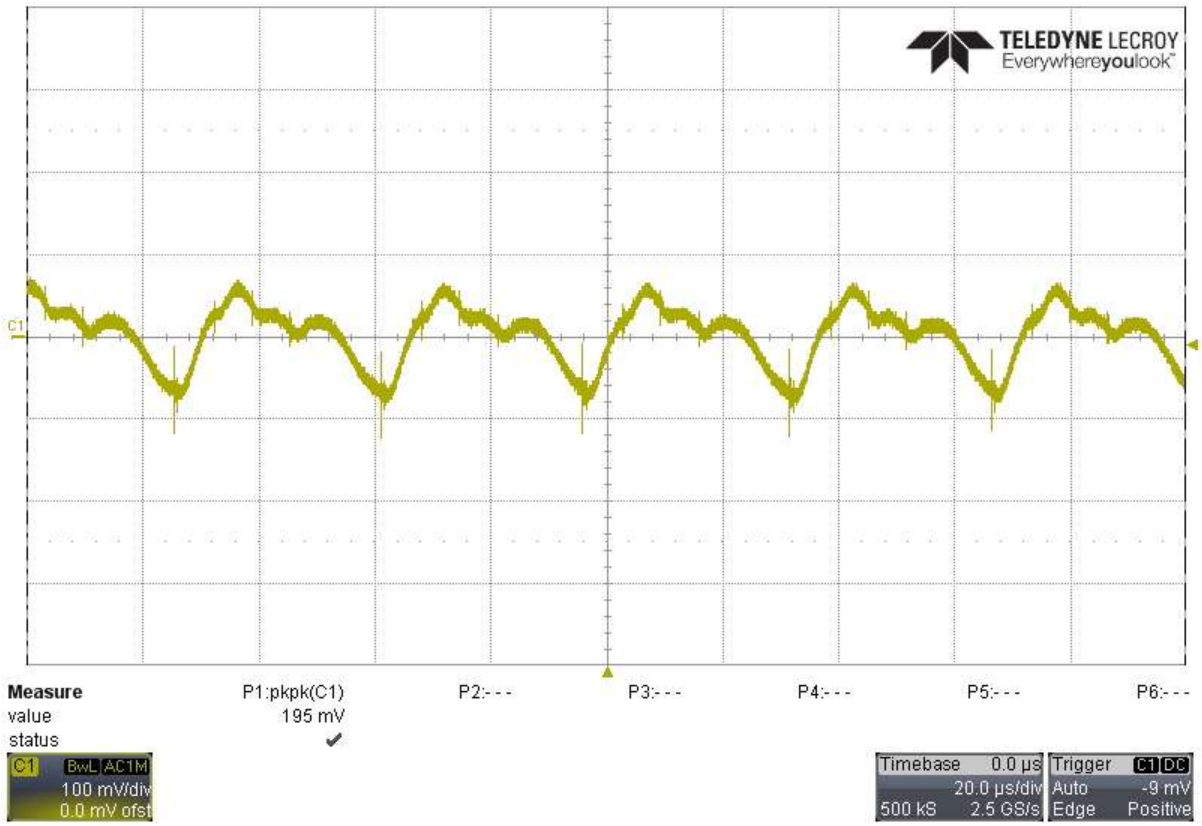
2.5.2 5V/2A Output, 230VAC/50Hz Input



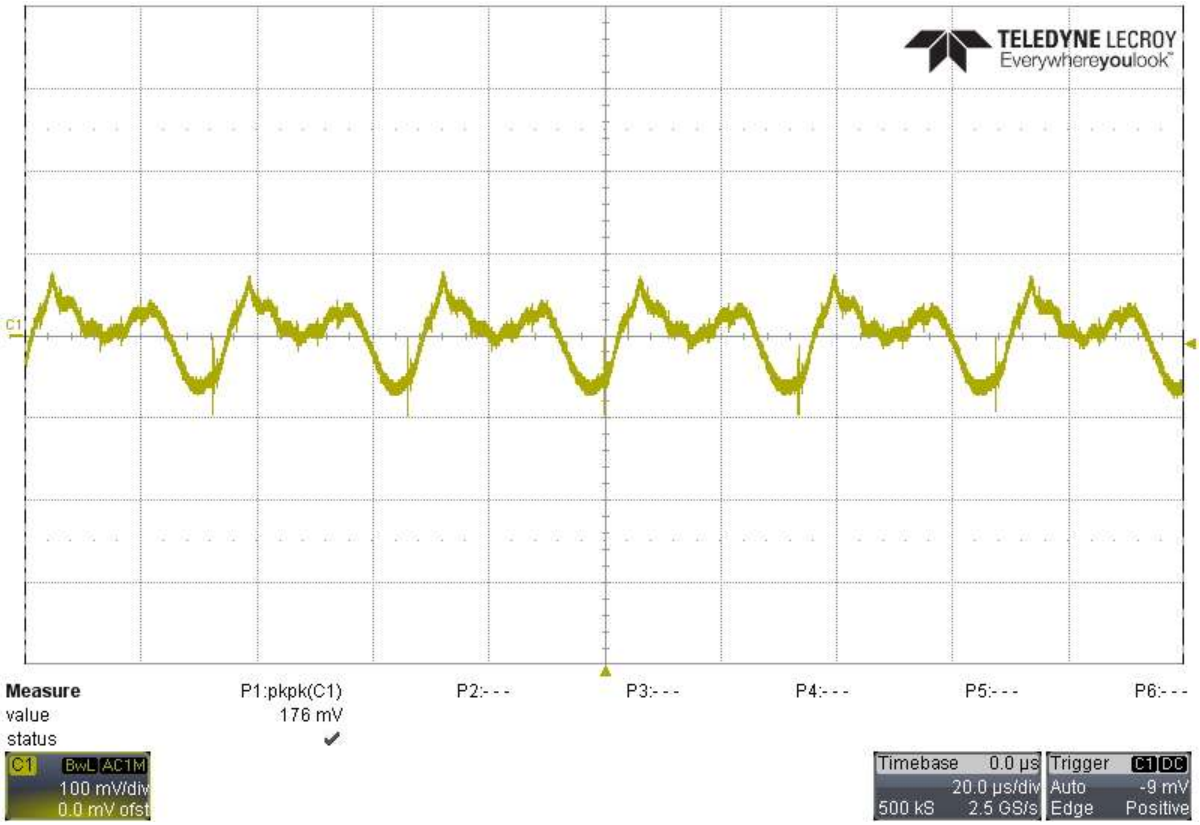
2.5.3 9V/2A Output, 120VAC/60Hz Input



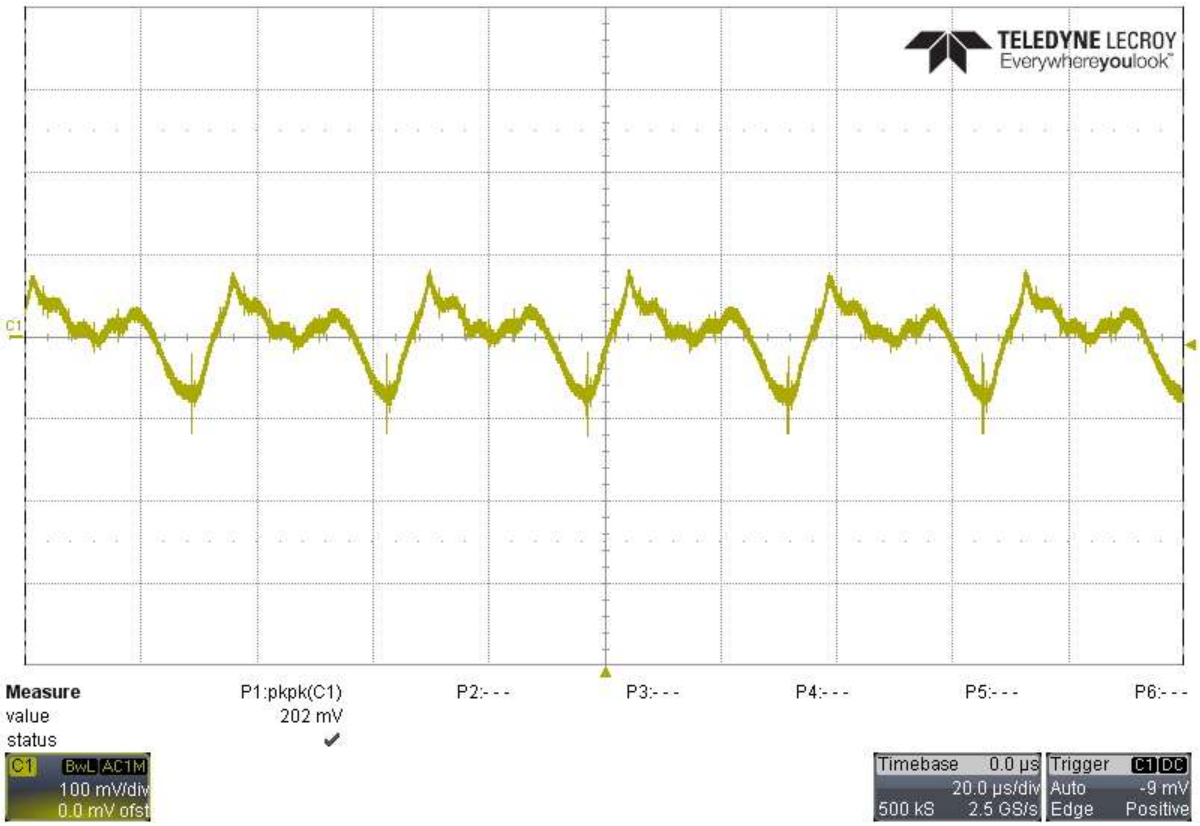
2.5.4 9V/2A Output, 230VAC/50Hz Input



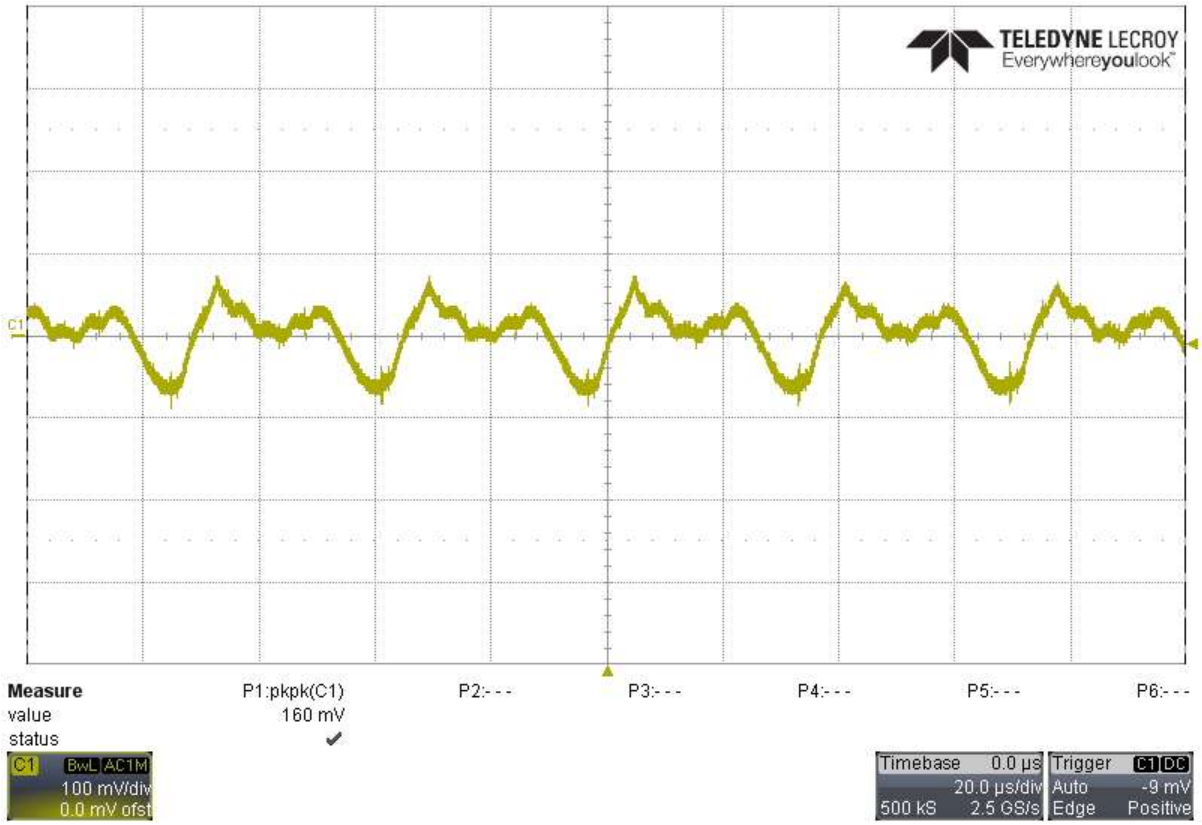
2.5.5 15V/1.6A Output, 120VAC/60Hz Input



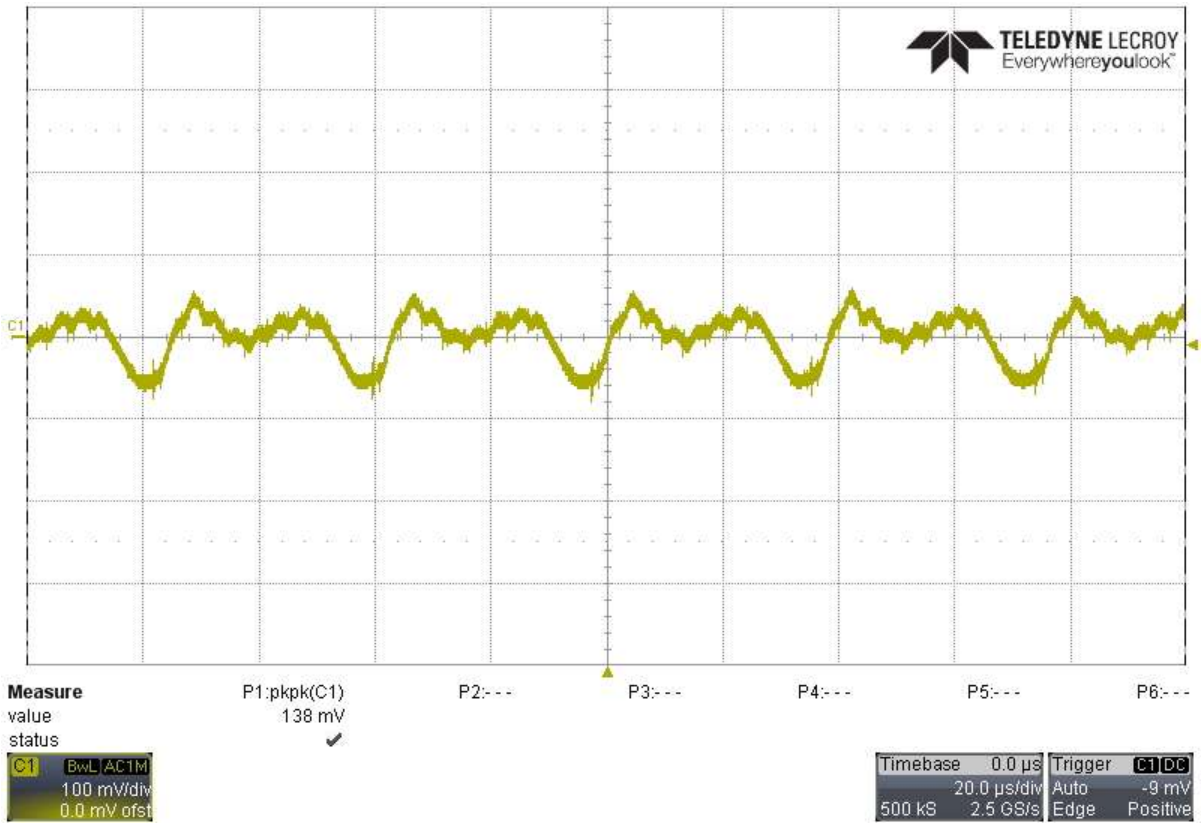
2.5.6 15V/1.8A Output, 230VAC/50Hz Input



2.5.7 20V/1.5A Output, 120VAC/60Hz Input

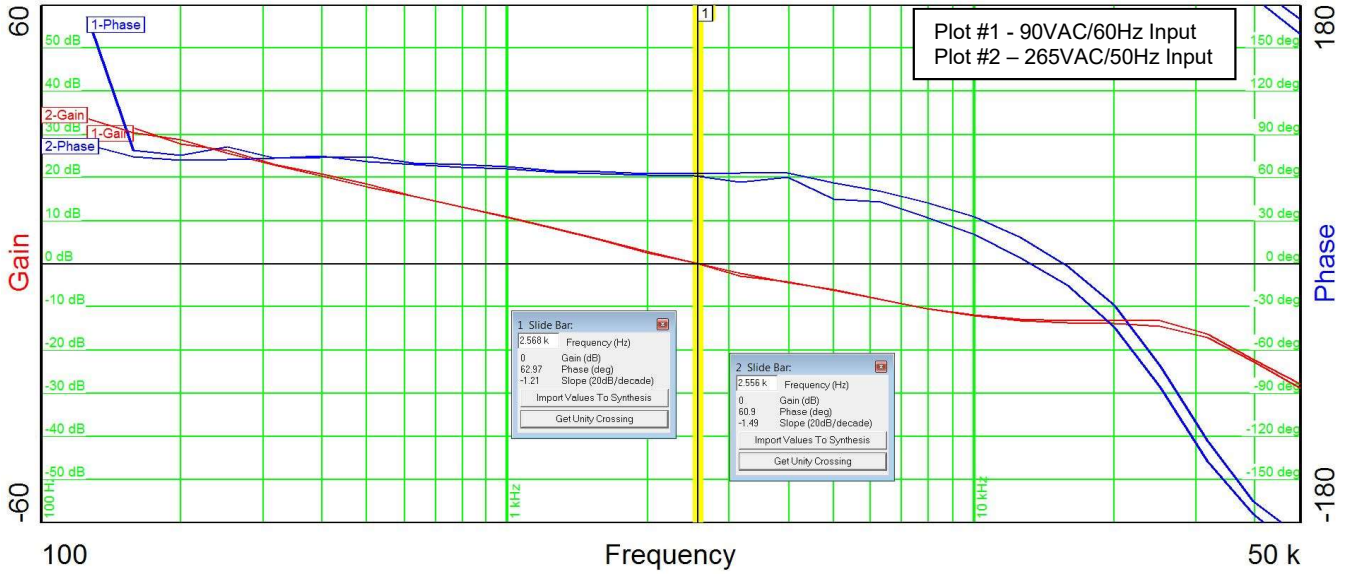


2.5.8 20V/1.5A Output, 230VAC/50Hz Input

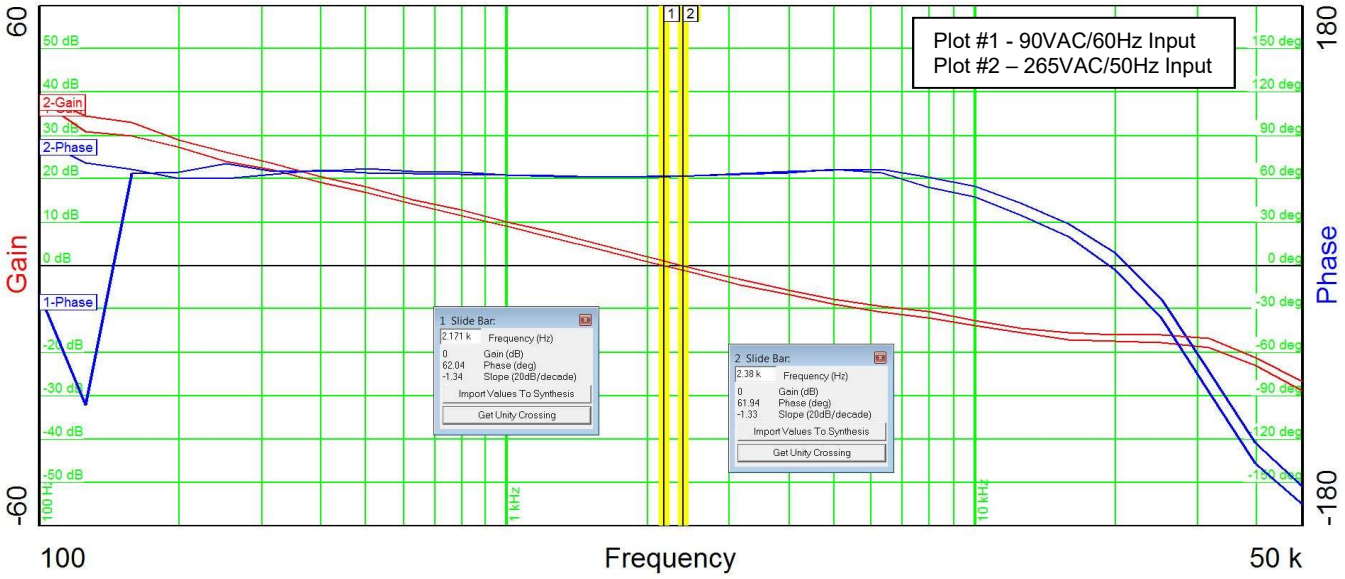


2.6 Bode Plot

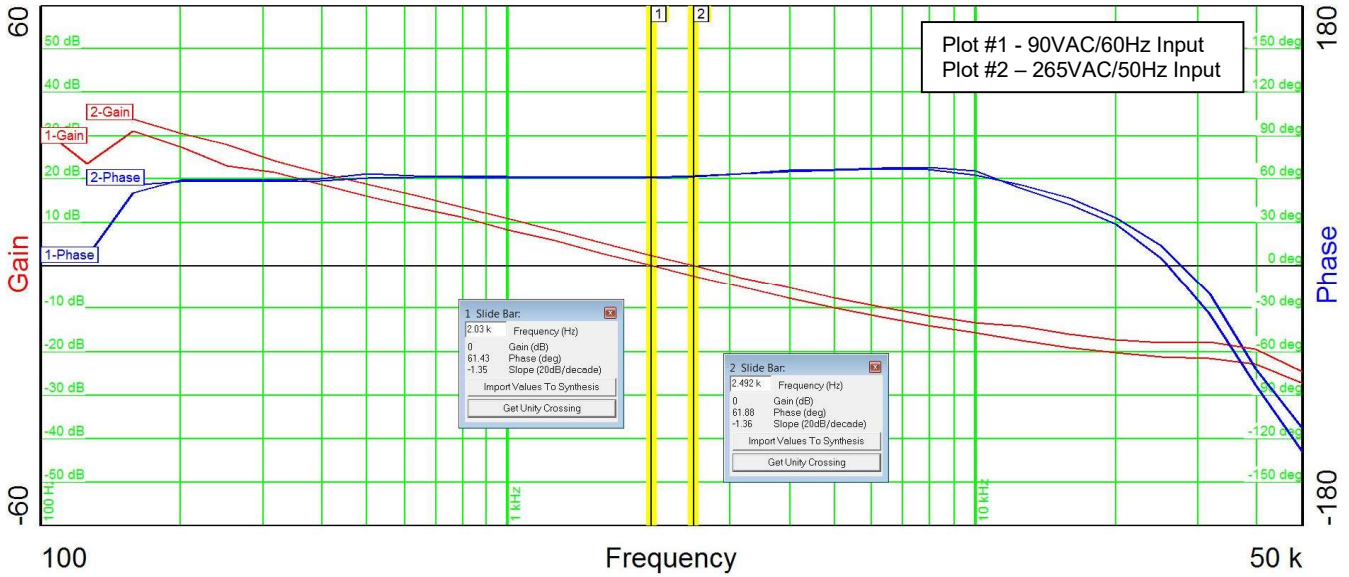
2.6.1 5V/3A Output



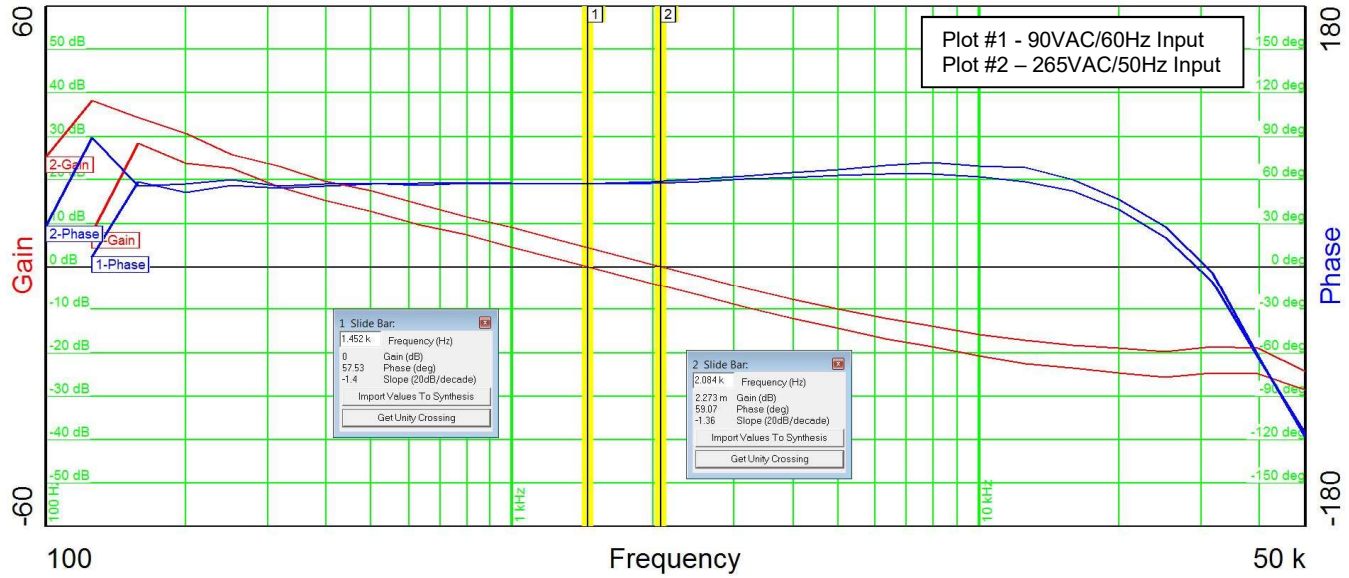
2.6.2 9V/3A Output



2.6.3 15V/3A Output

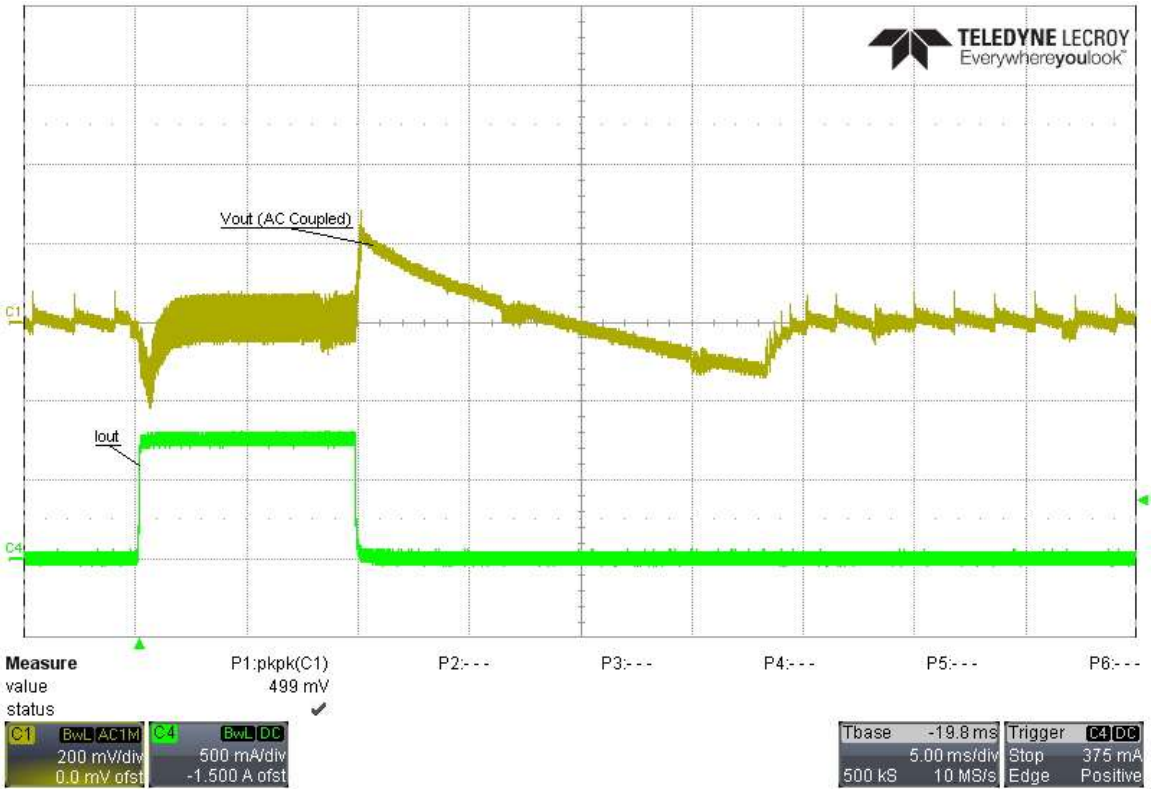


2.6.4 20V/3.25A Output

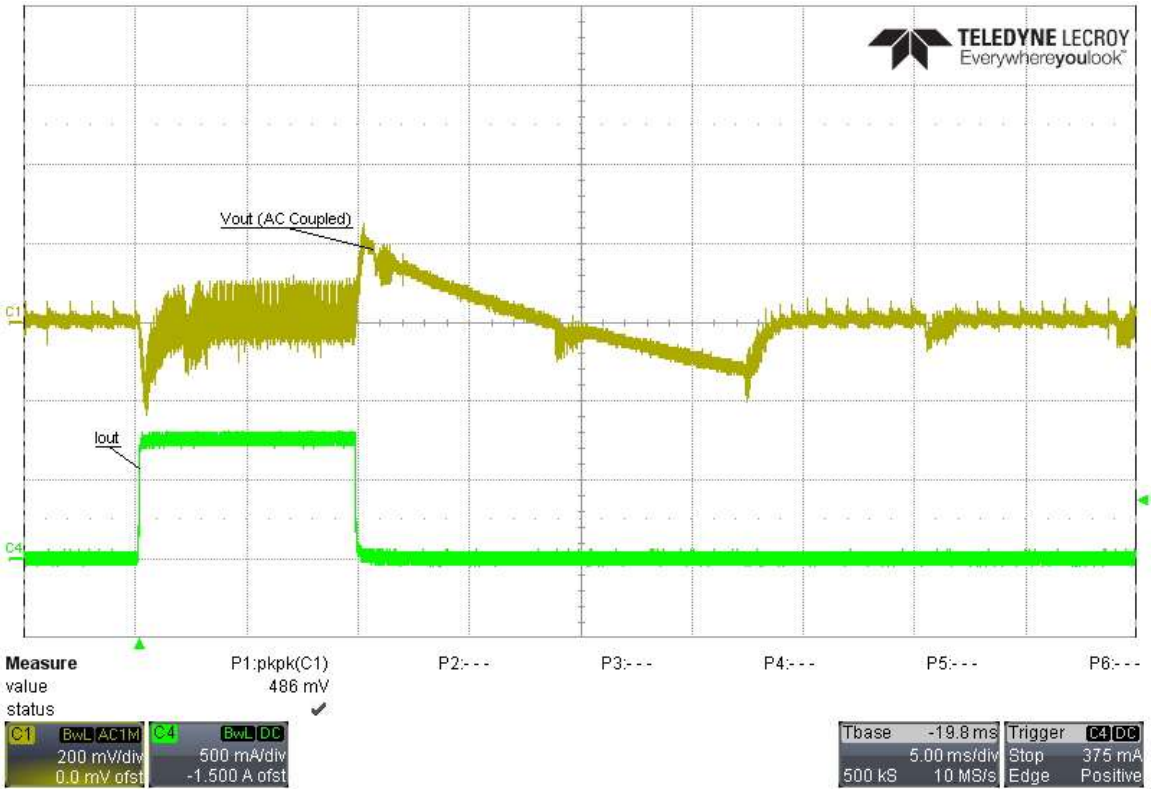


2.7 5V Output Load Transients

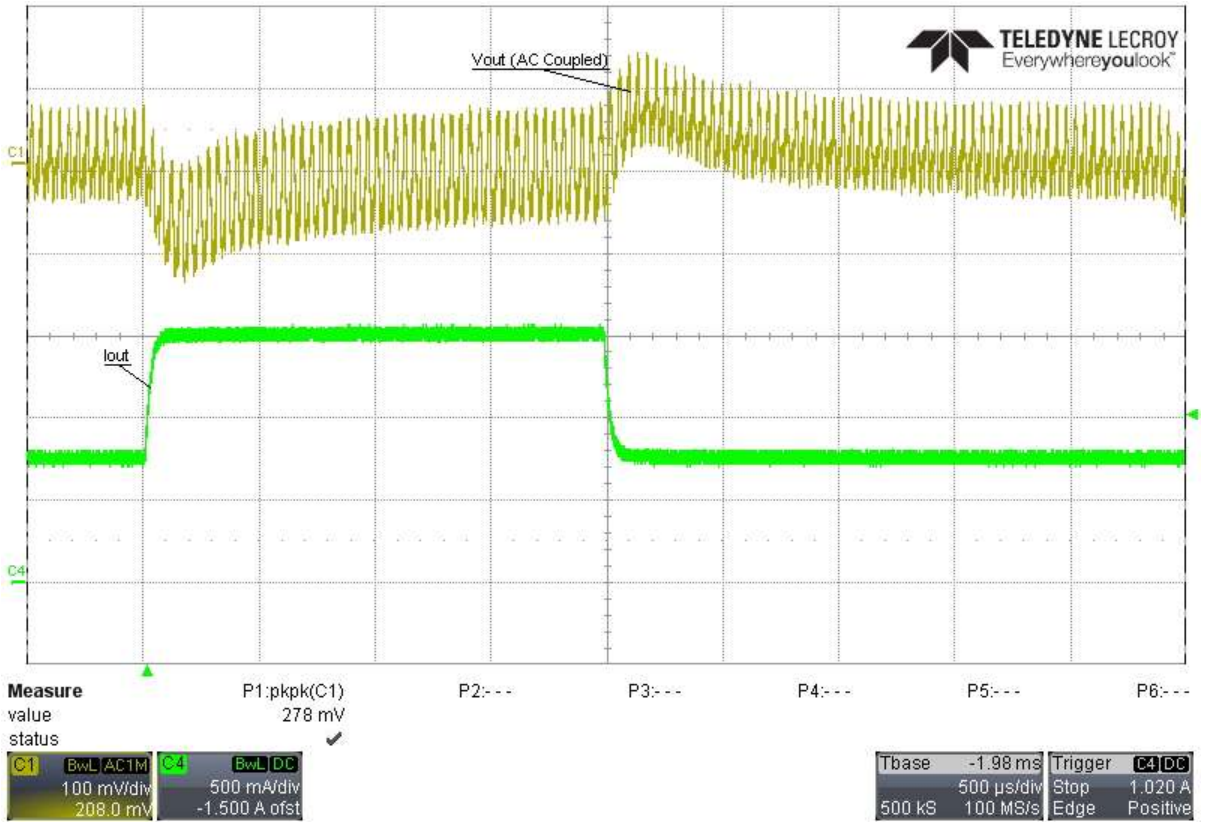
2.7.1 5V Output, 0A to 750mA Load Step, 120VAC/60Hz Input



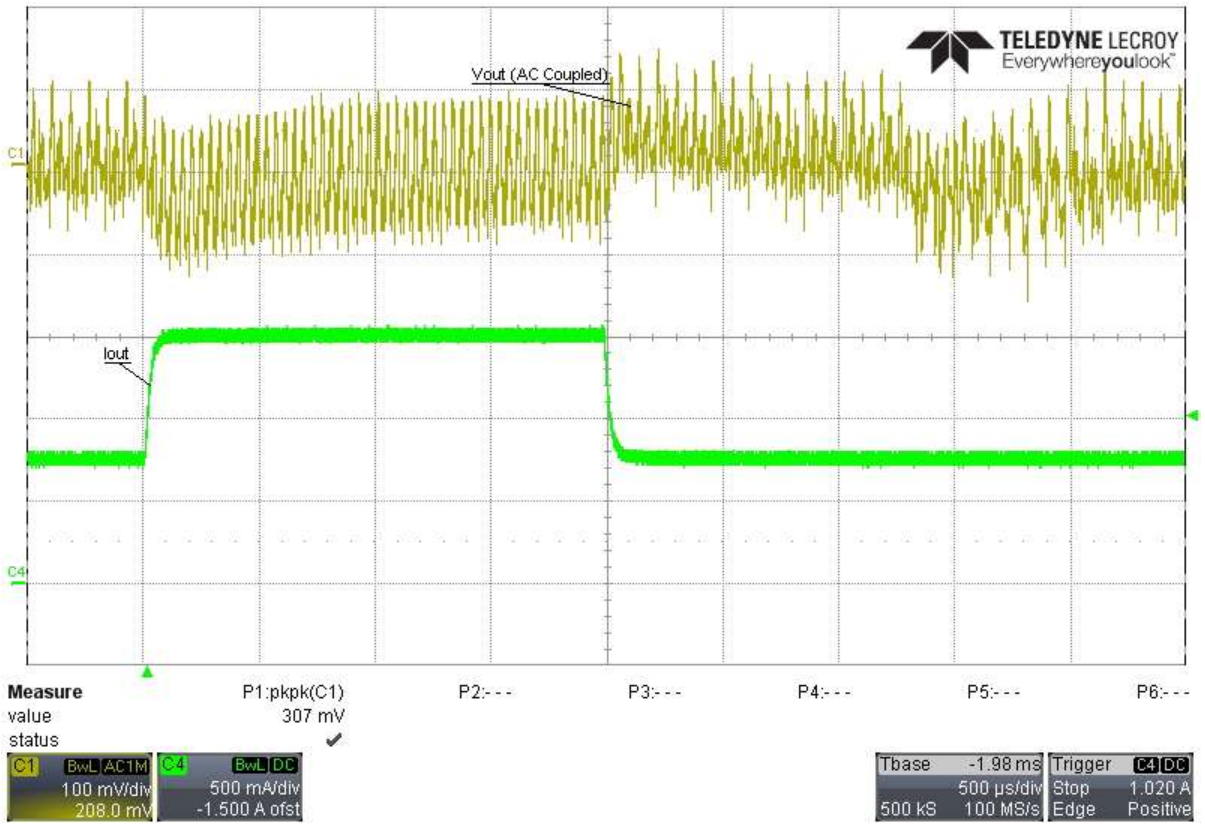
2.7.2 5V Output, 0A to 750mA Load Step, 230VAC/50Hz Input



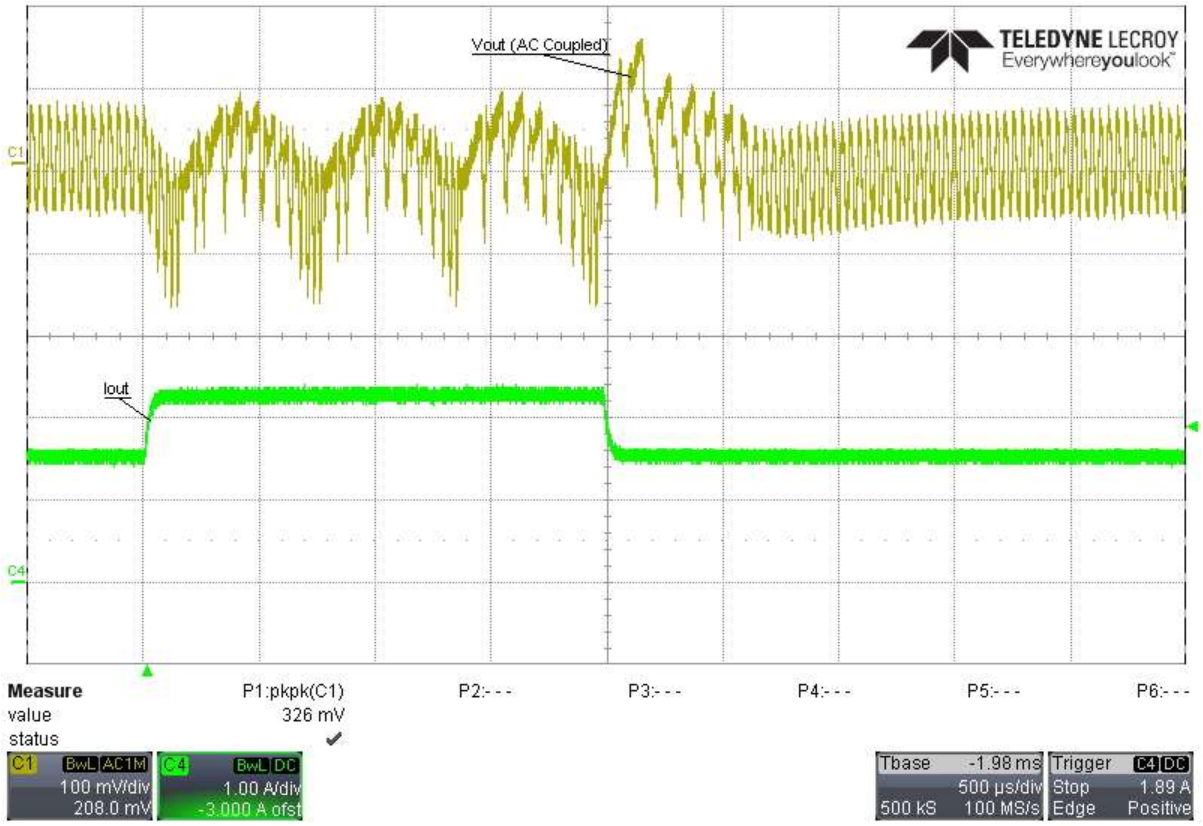
2.7.3 5V Output, 750mA to 1.5A Load Step, 120VAC/60Hz Input



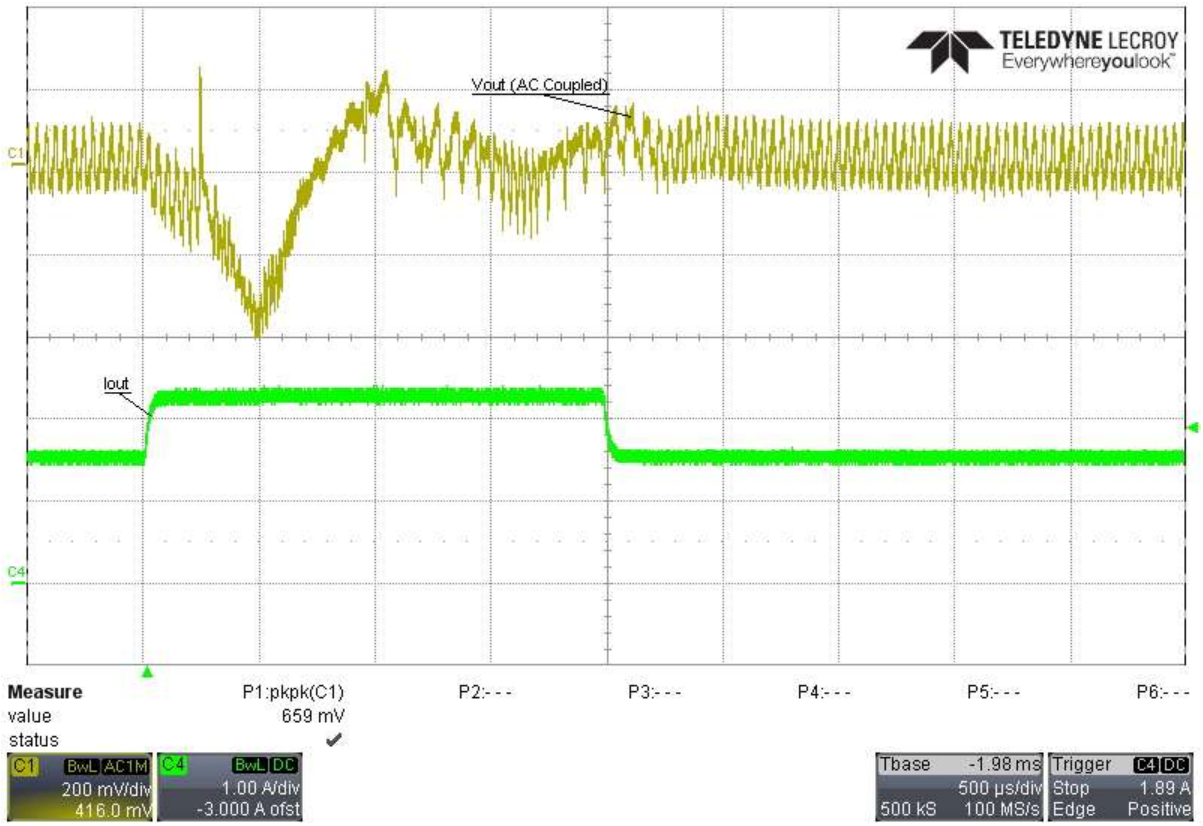
2.7.4 5V Output, 750mA to 1.5A Load Step, 230VAC/50Hz Input



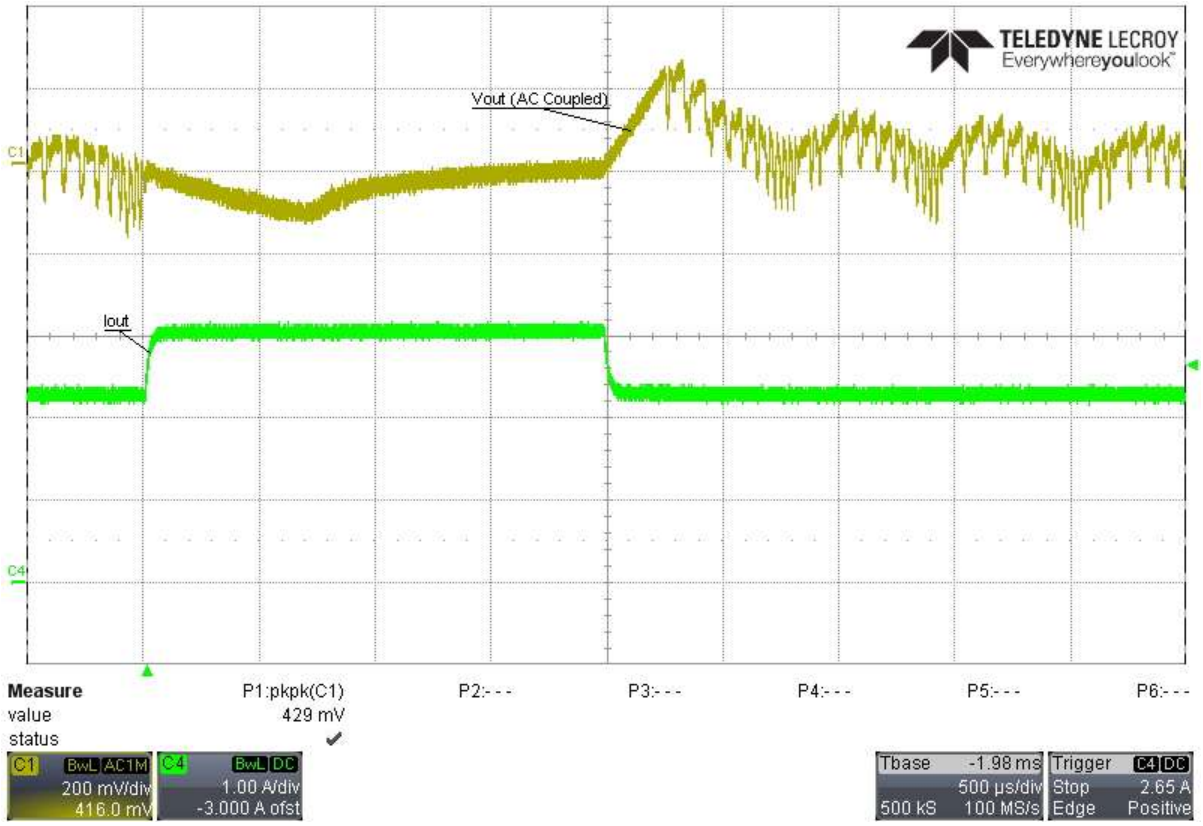
2.7.5 5V Output, 1.5A to 2.25A Load Step, 120VAC/60Hz Input



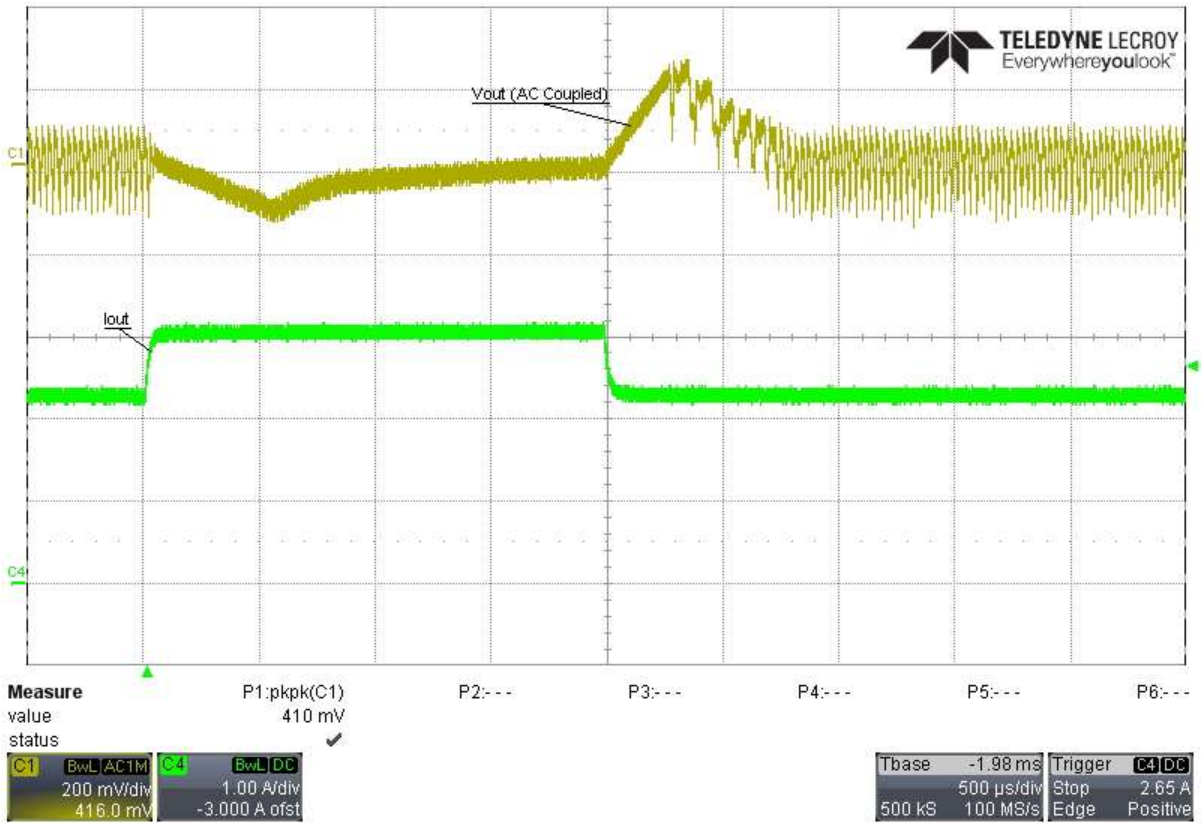
2.7.6 5V Output, 1.5A to 2.25A Load Step, 230VAC/50Hz Input



2.7.7 5V Output, 2.25A to 3.0A Load Step, 120VAC/60Hz Input

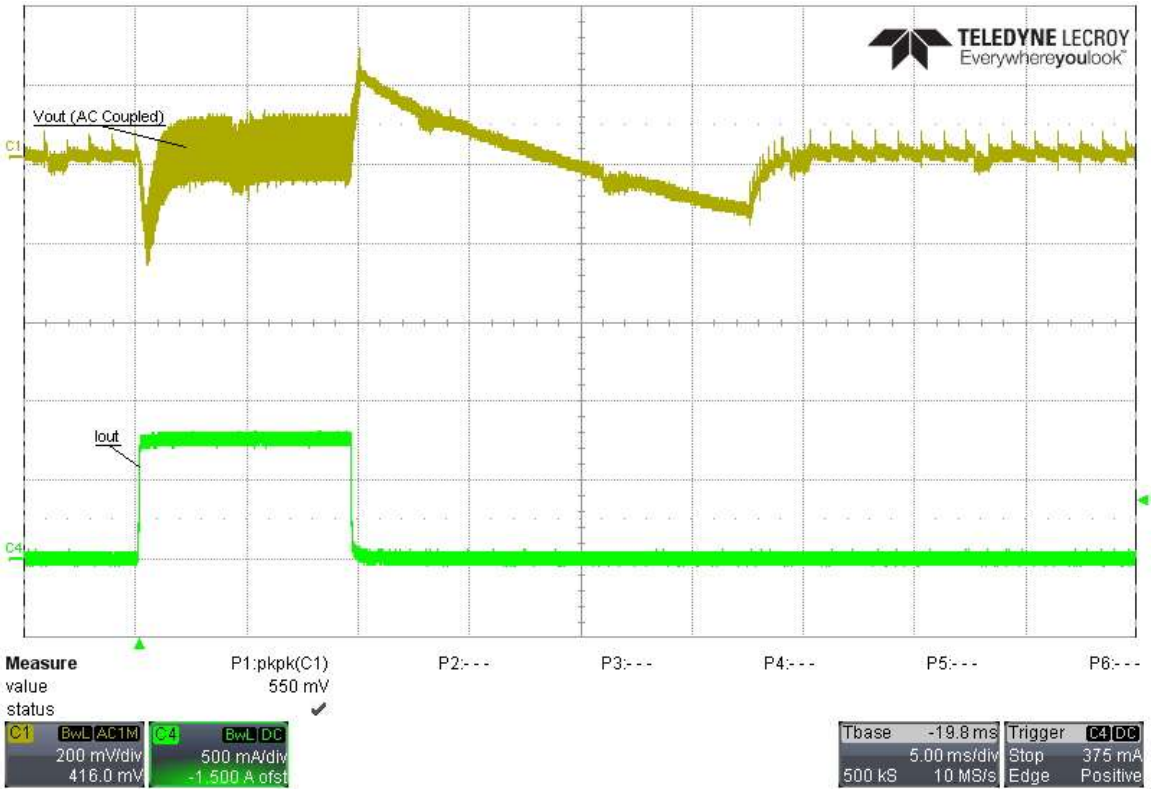


2.7.8 5V Output, 2.25A to 3.0A Load Step, 230VAC/50Hz Input

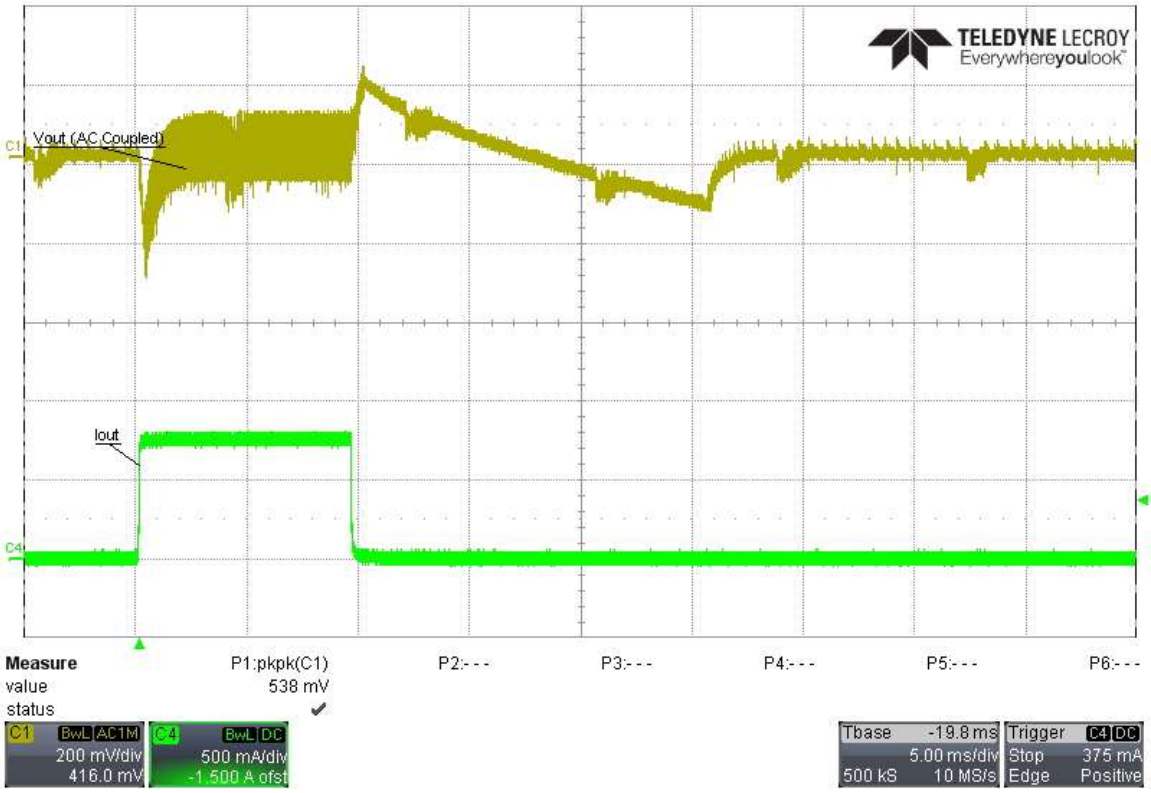


2.8 9V Output Load Transients

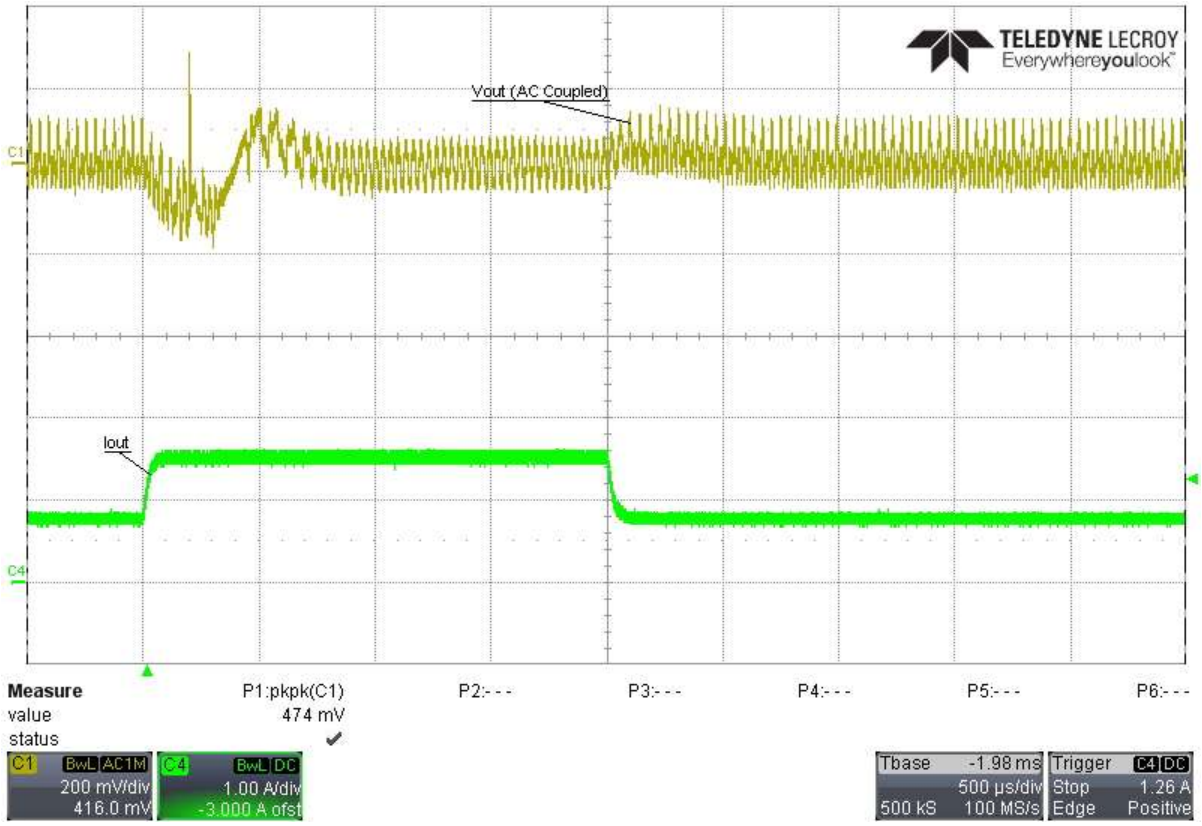
2.8.1 9V Output, 0A to 750mA Load Step, 120VAC/60Hz Input



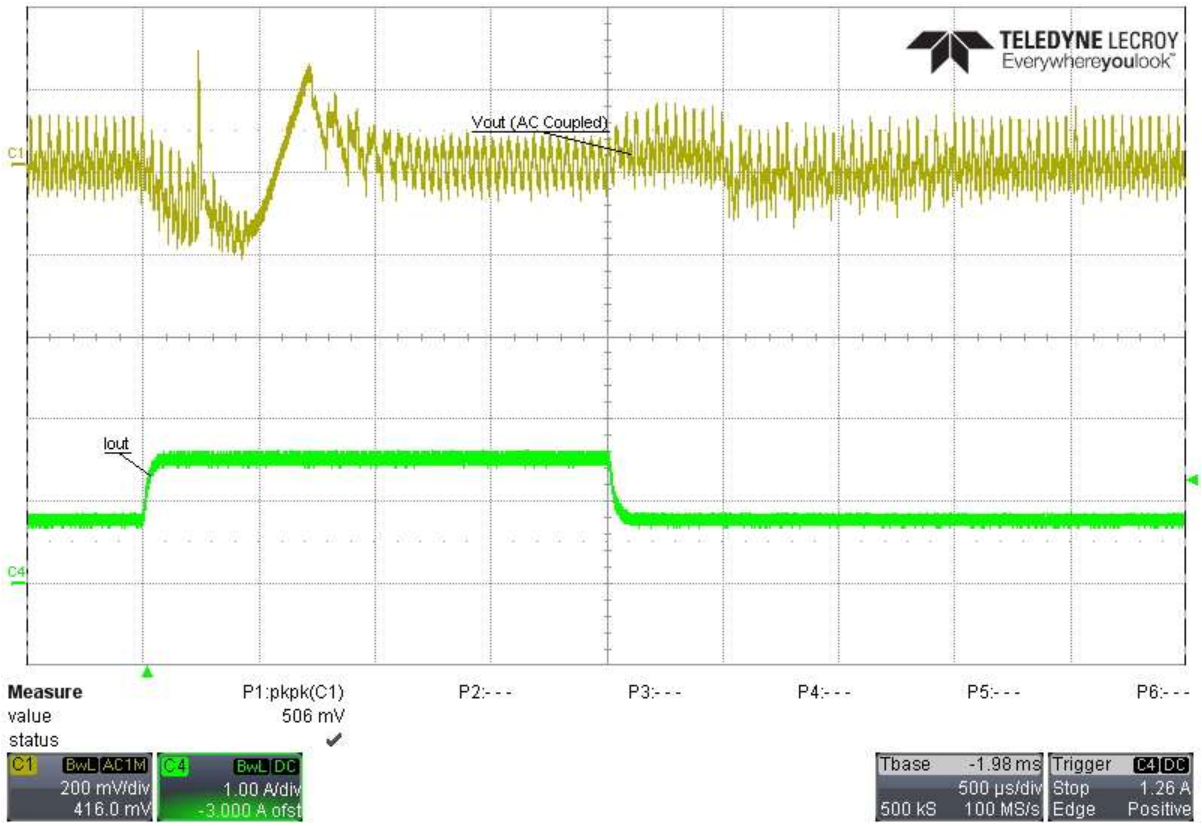
2.8.2 9V Output, 0A to 750mA Load Step, 230VAC/50Hz Input



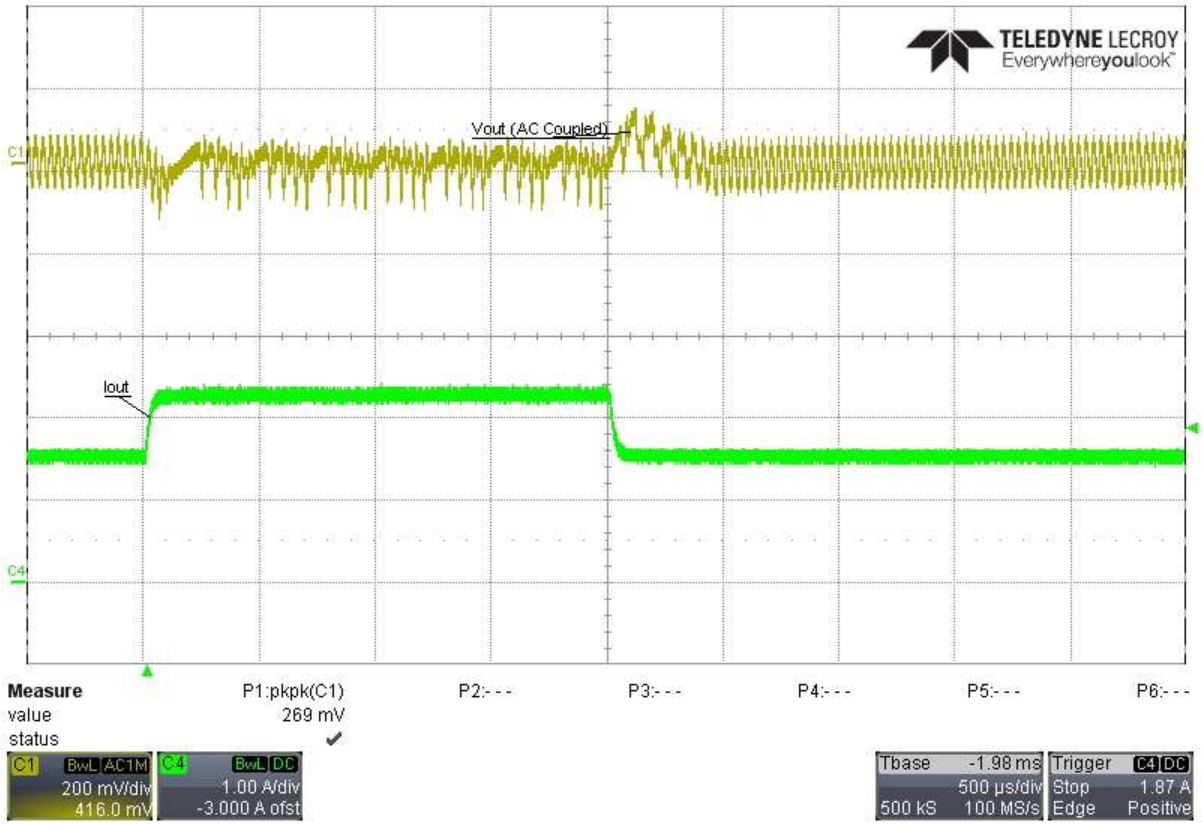
2.8.3 9V Output, 750mA to 1.5A Load Step, 120VAC/60Hz Input



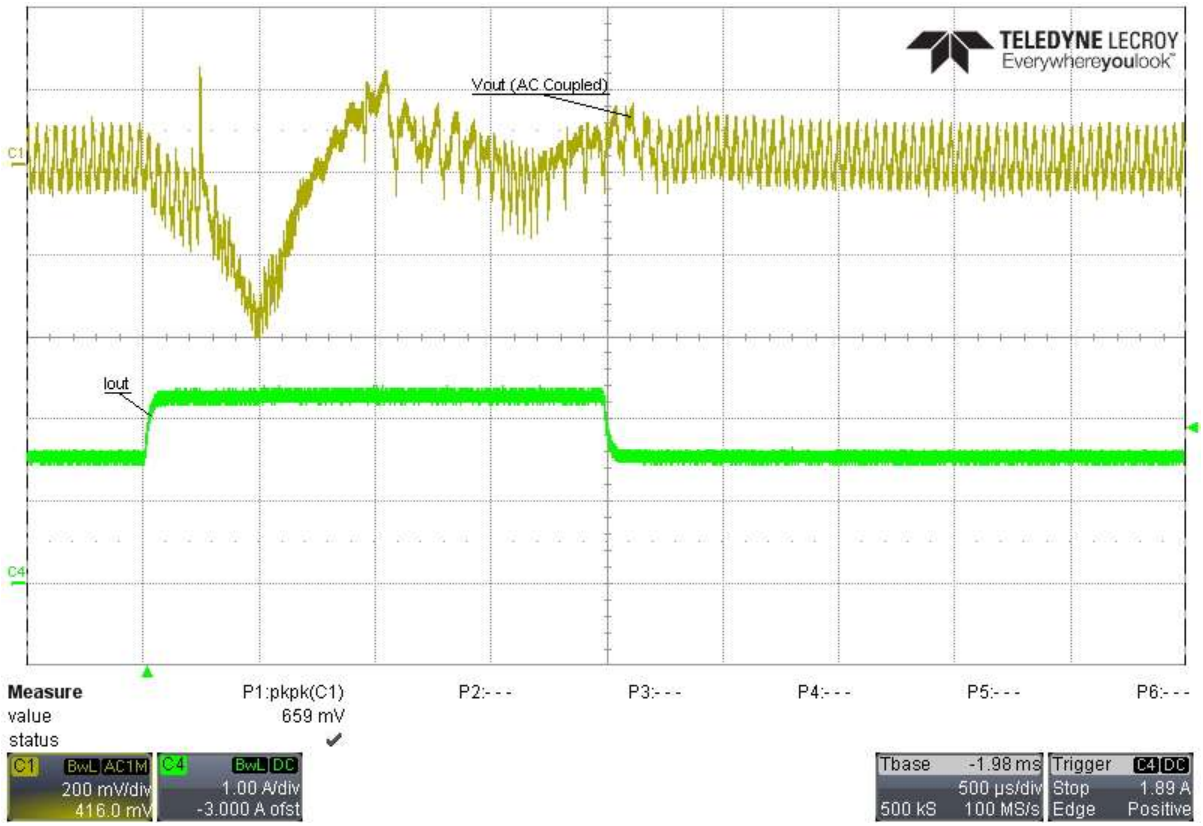
2.8.4 9V Output, 750mA to 1.5A Load Step, 230VAC/50Hz Input



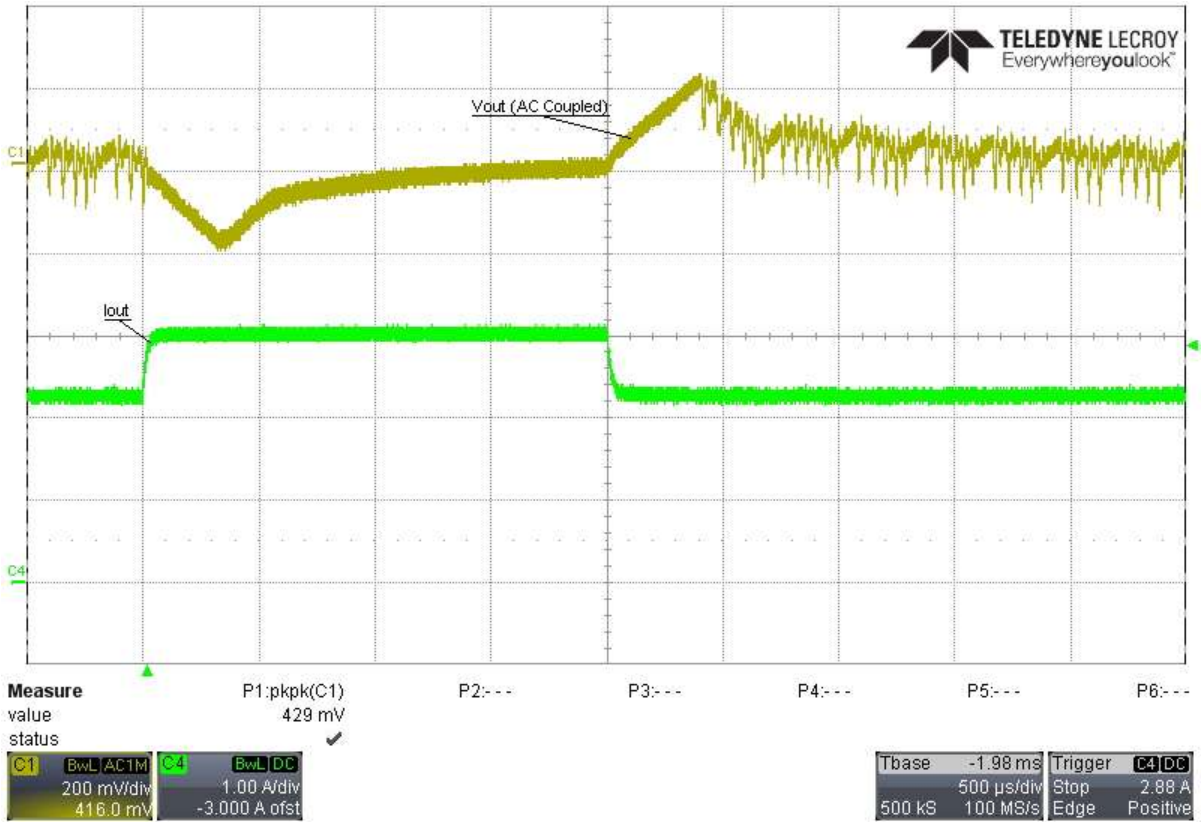
2.8.5 9V Output, 1.5A to 2.25A Load Step, 120VAC/60Hz Input



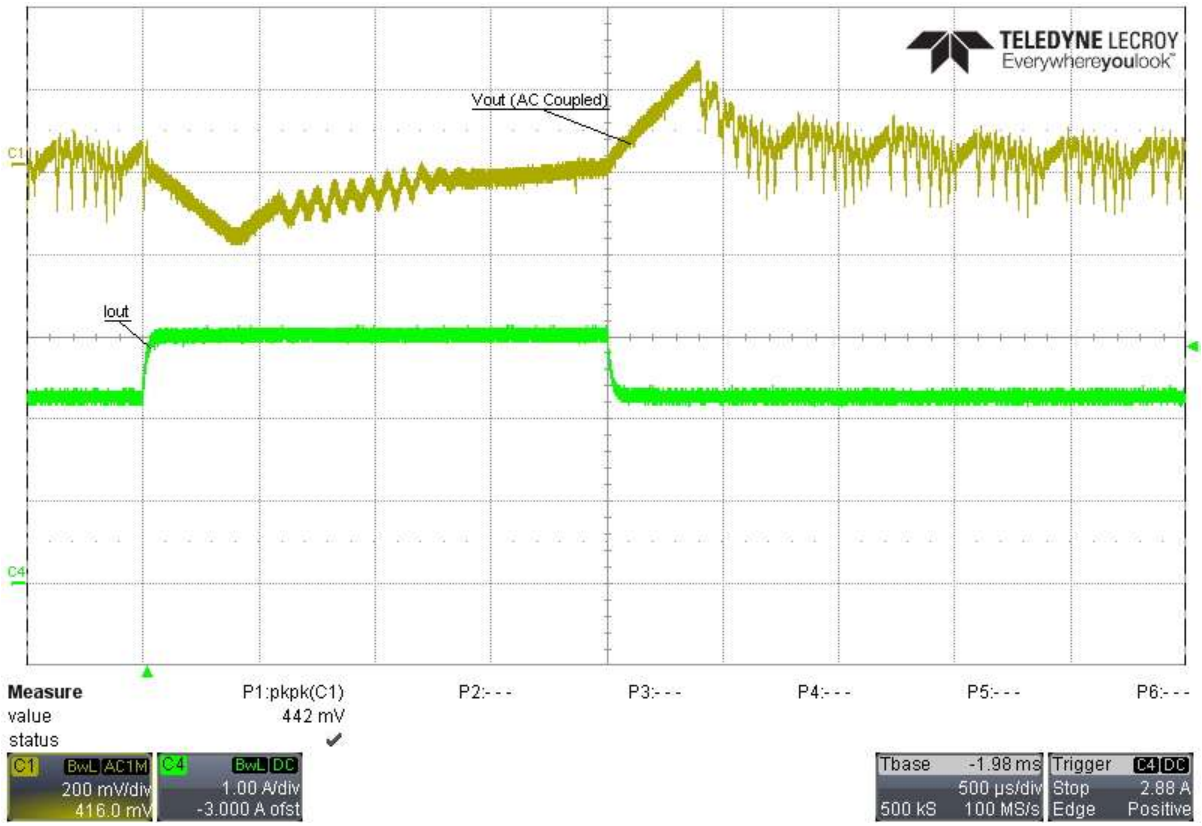
2.8.6 9V Output, 1.5A to 2.25A Load Step, 230VAC/50Hz Input



2.8.7 9V Output, 2.25A to 3.0A Load Step, 120VAC/60Hz Input

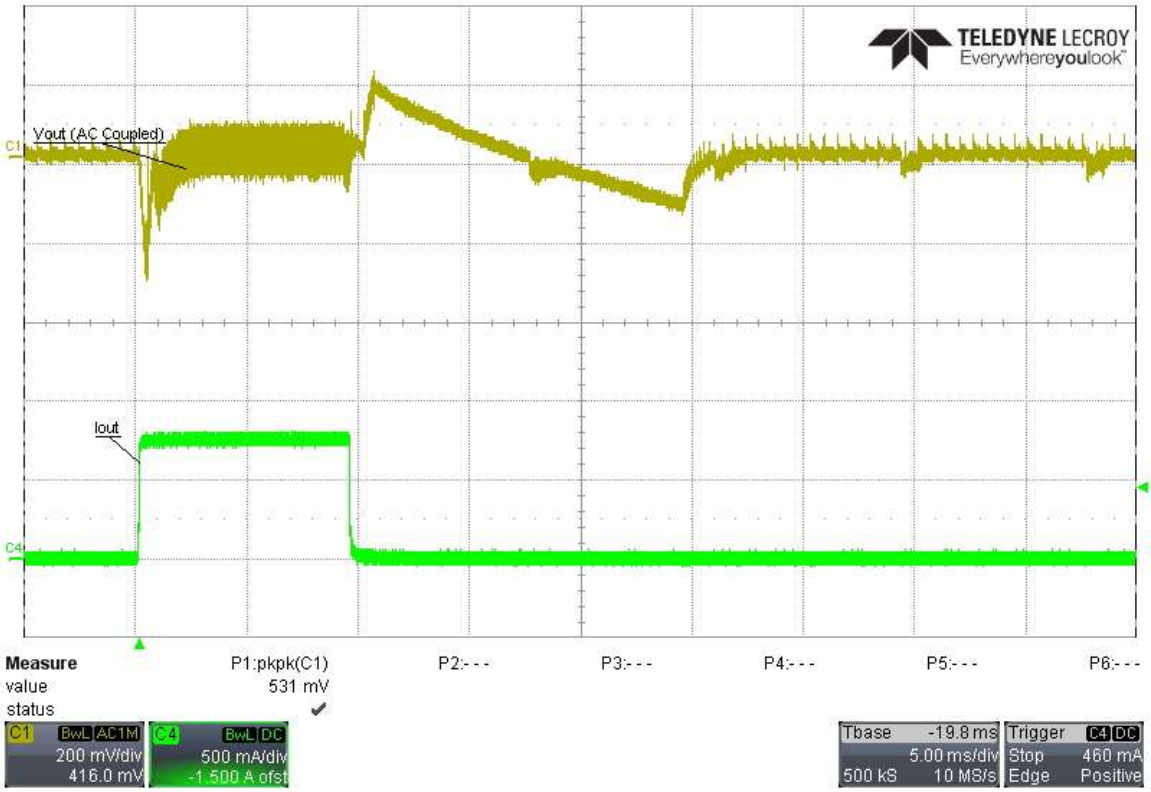


2.8.8 9V Output, 2.25A to 3.0A Load Step, 230VAC/50Hz Input

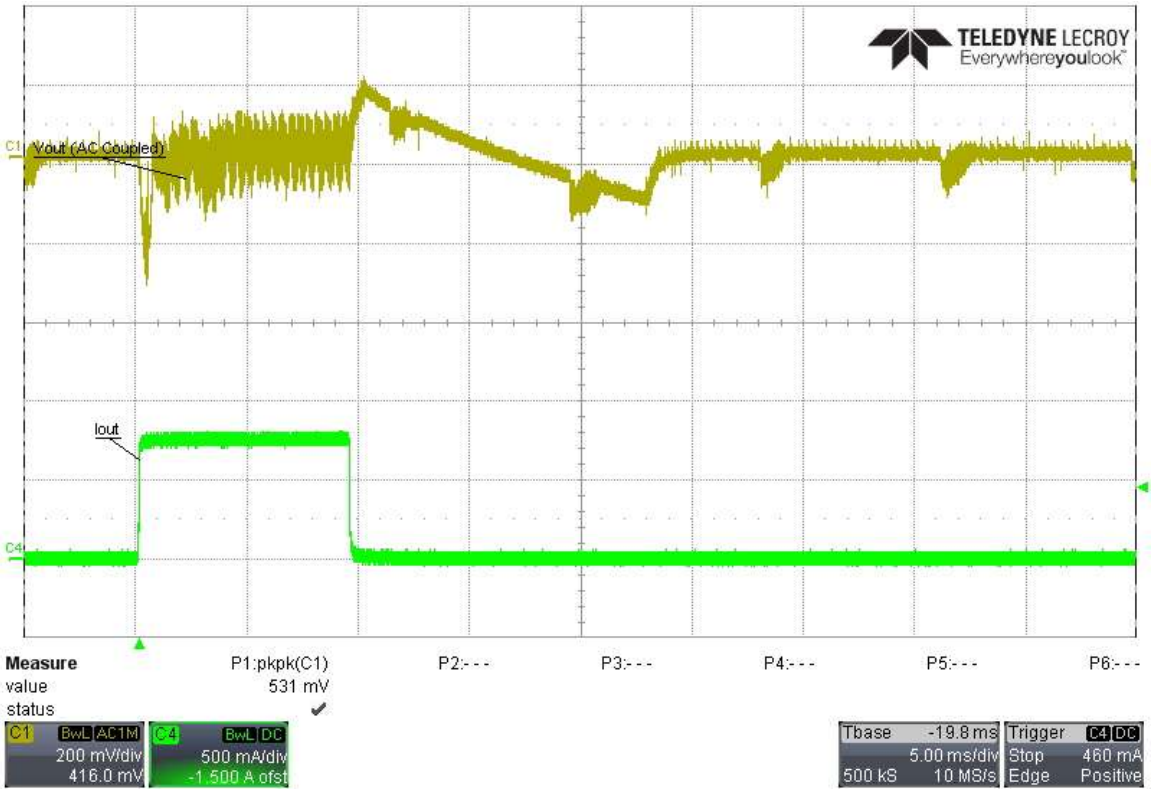


2.9 15V Output Load Transients

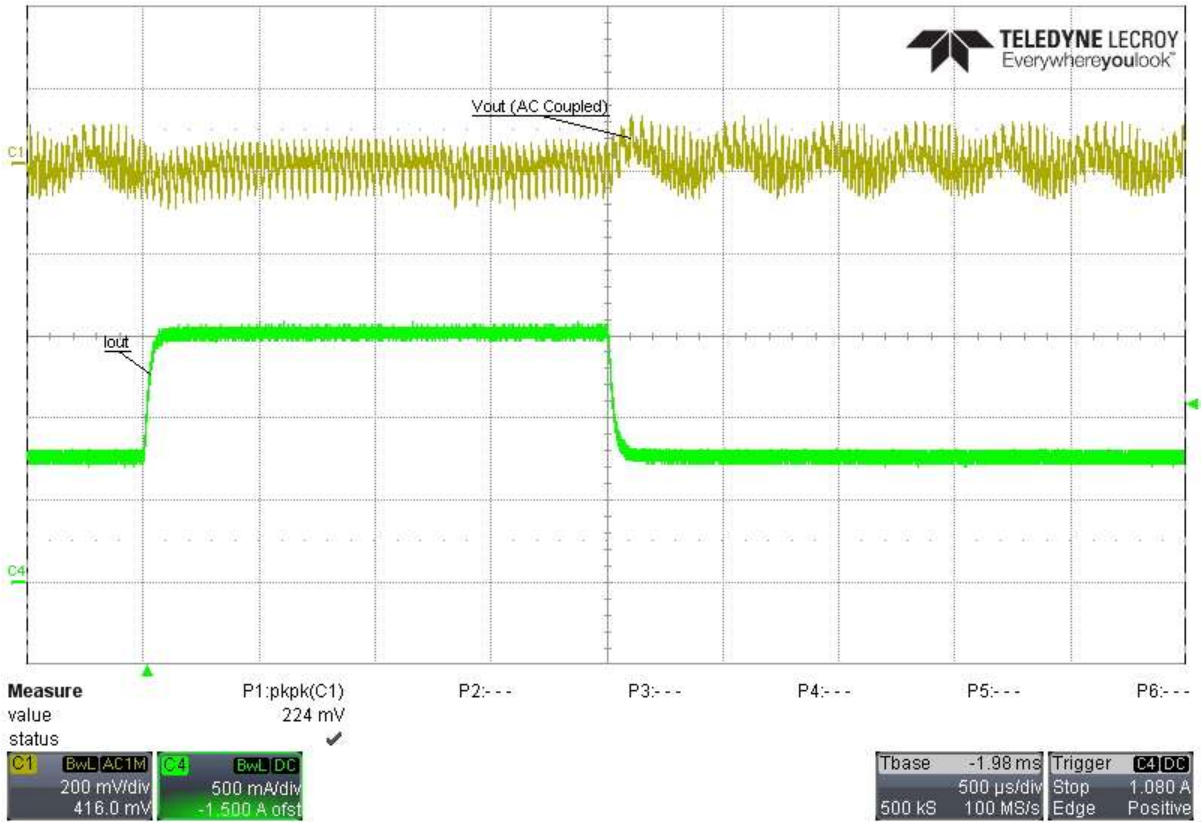
2.9.1 15V Output, 0A to 750mA Load Step, 120VAC/60Hz Input



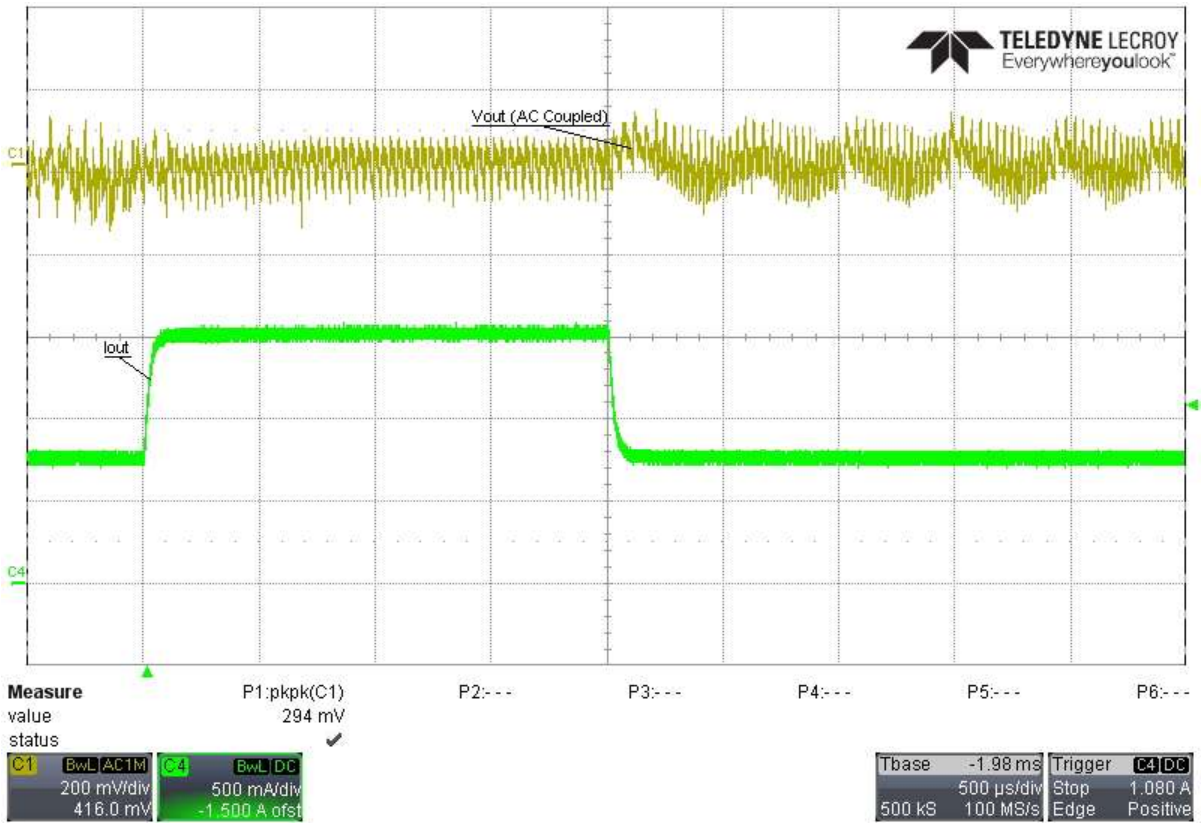
2.9.2 15V Output, 0A to 750mA Load Step, 230VAC/50Hz Input



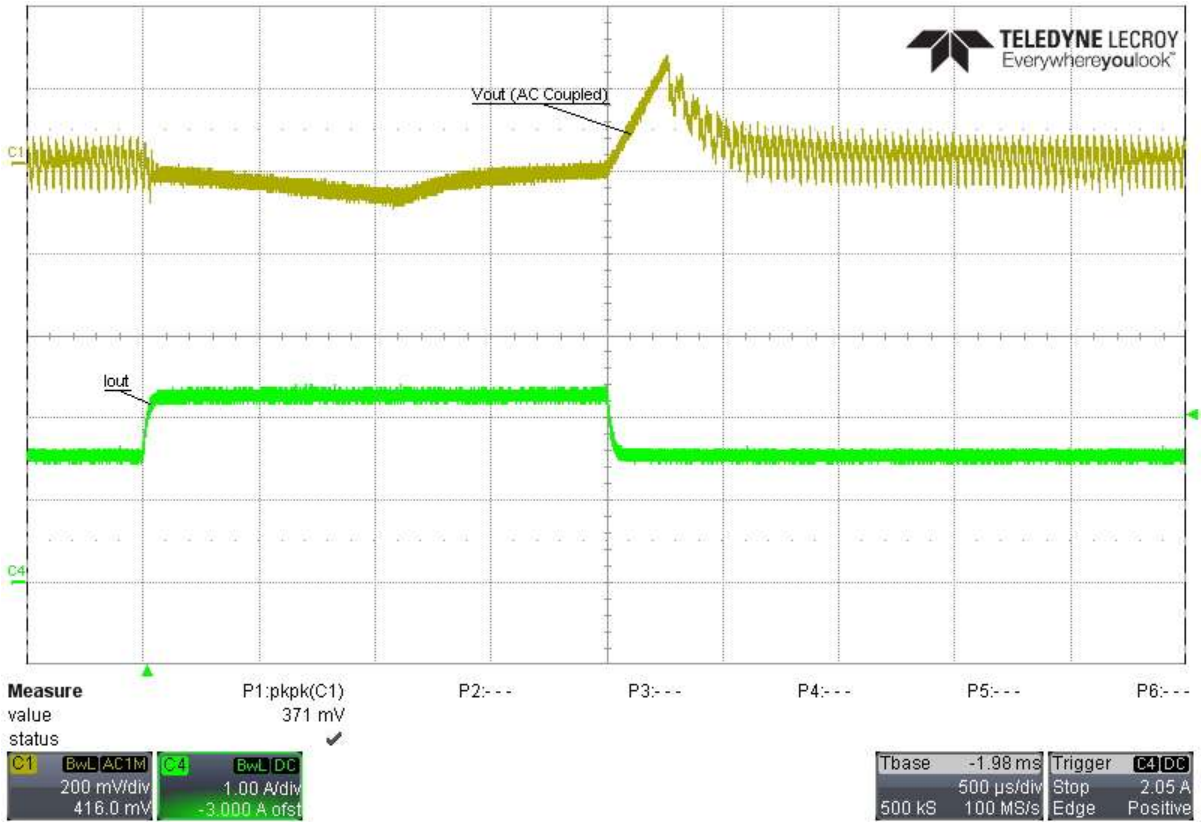
2.9.3 15V Output, 750mA to 1.5A Load Step, 120VAC/60Hz Input



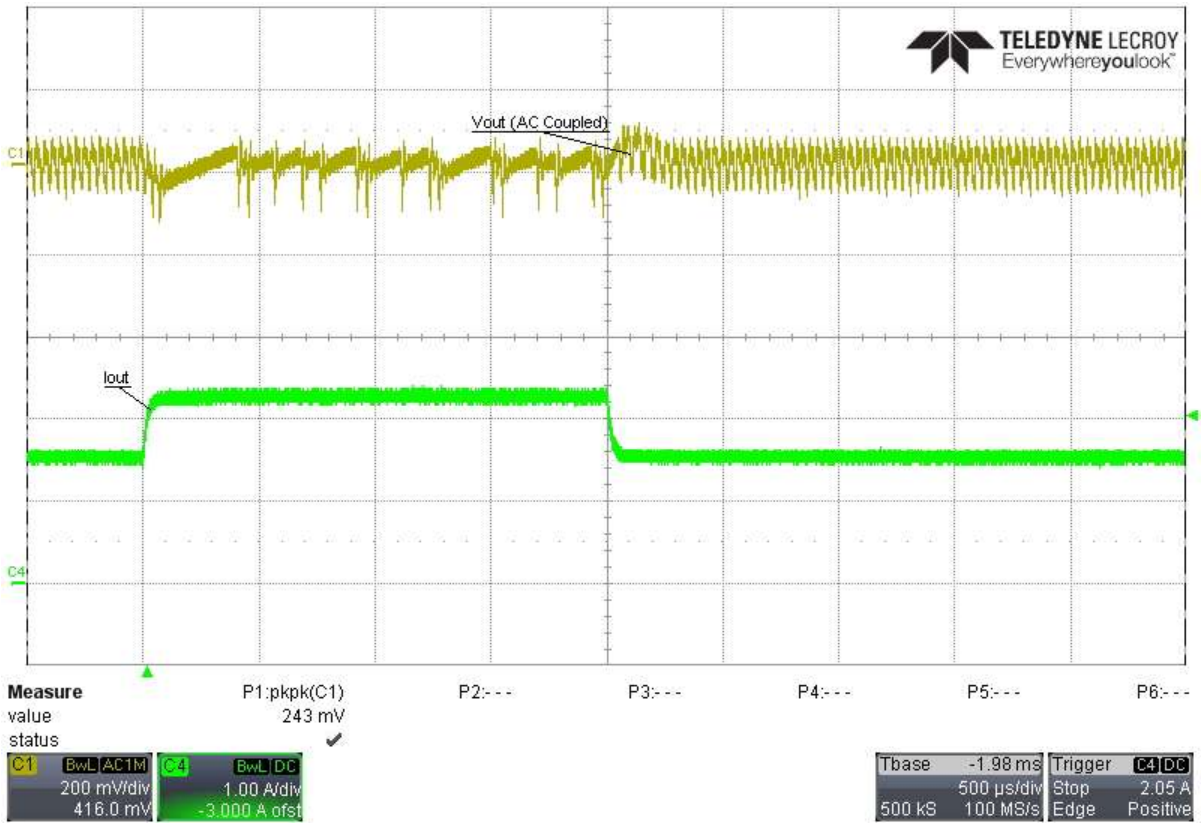
2.9.4 15V Output, 750mA to 1.5A Load Step, 230VAC/50Hz Input



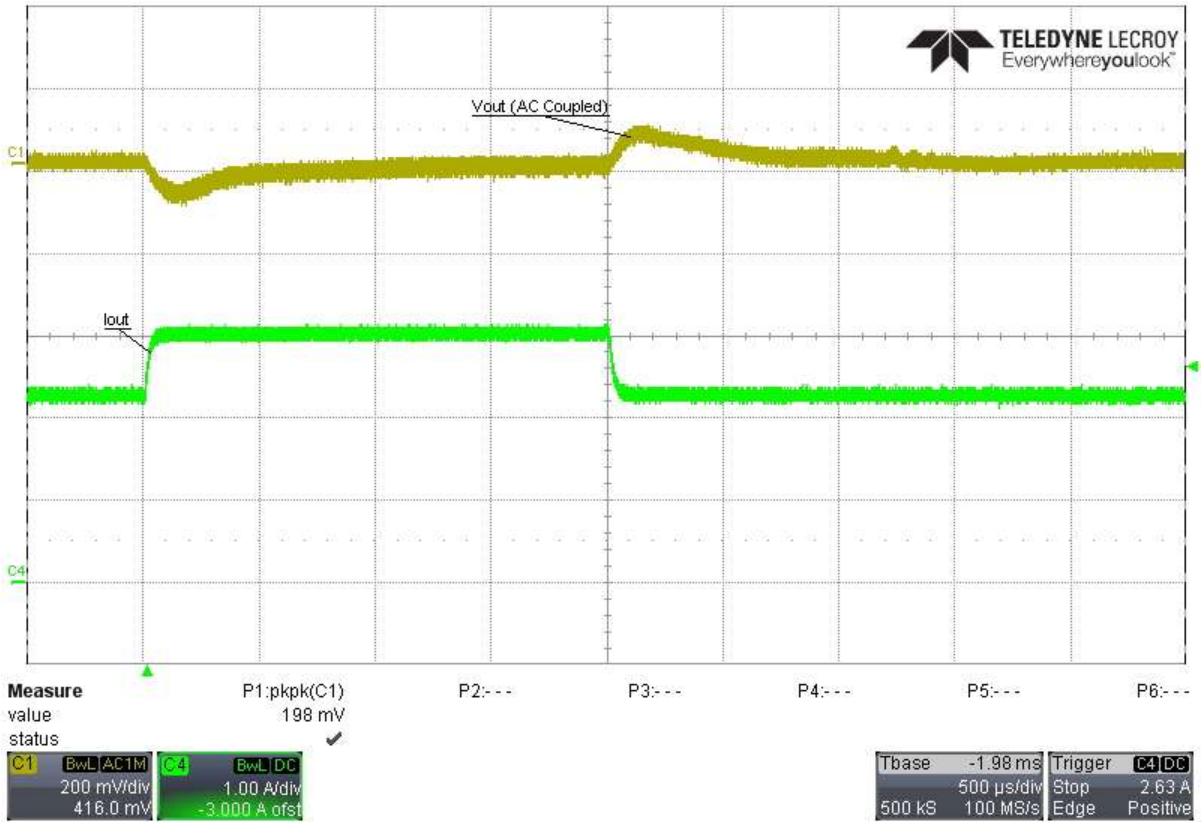
2.9.5 15V Output, 1.5A to 2.25A Load Step, 120VAC/60Hz Input



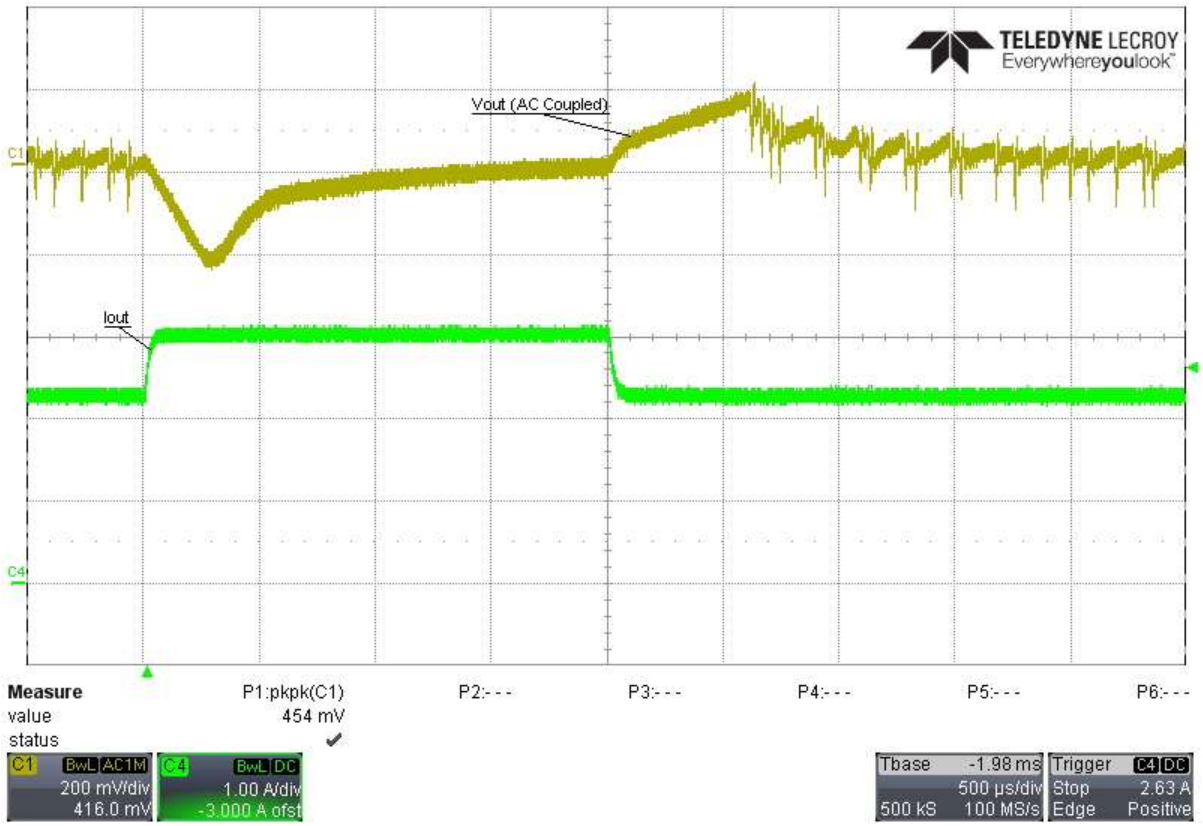
2.9.6 15V Output, 1.5A to 2.25A Load Step, 230VAC/50Hz Input



2.9.7 15V Output, 2.25A to 3.0A Load Step, 120VAC/60Hz Input

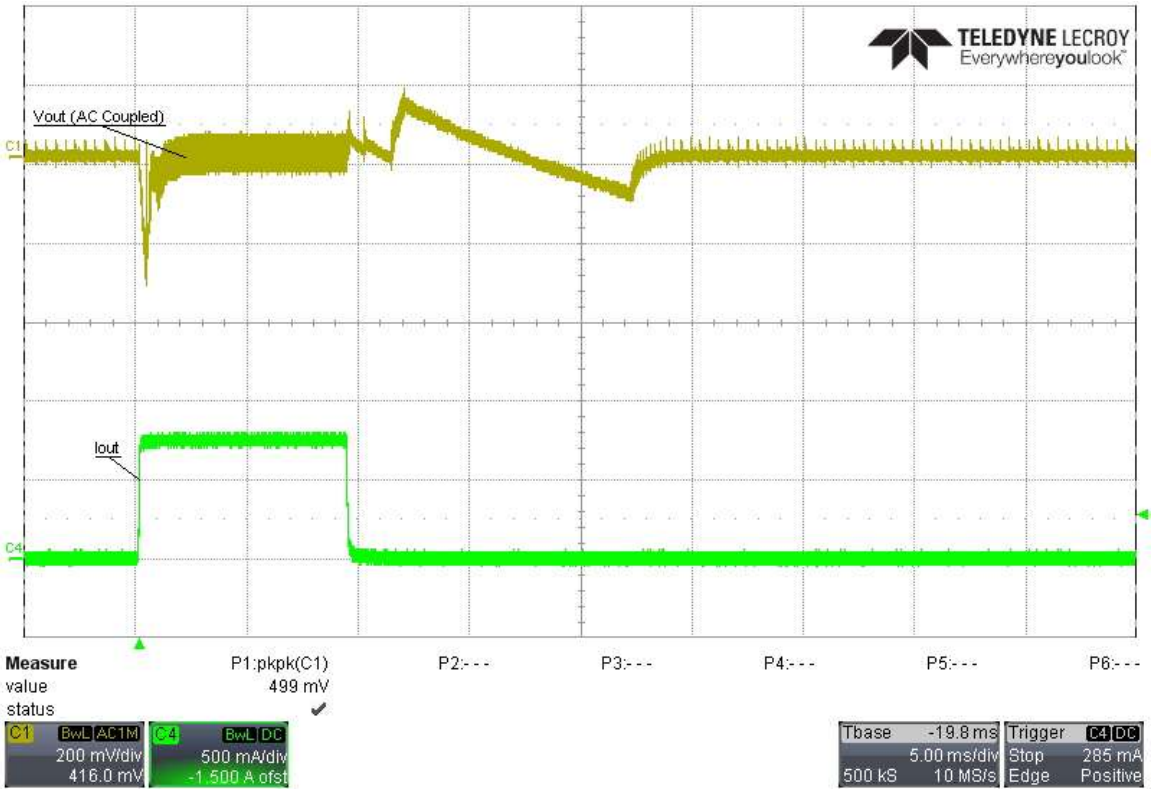


2.9.8 15V Output, 2.25A to 3.0A Load Step, 230VAC/50Hz Input

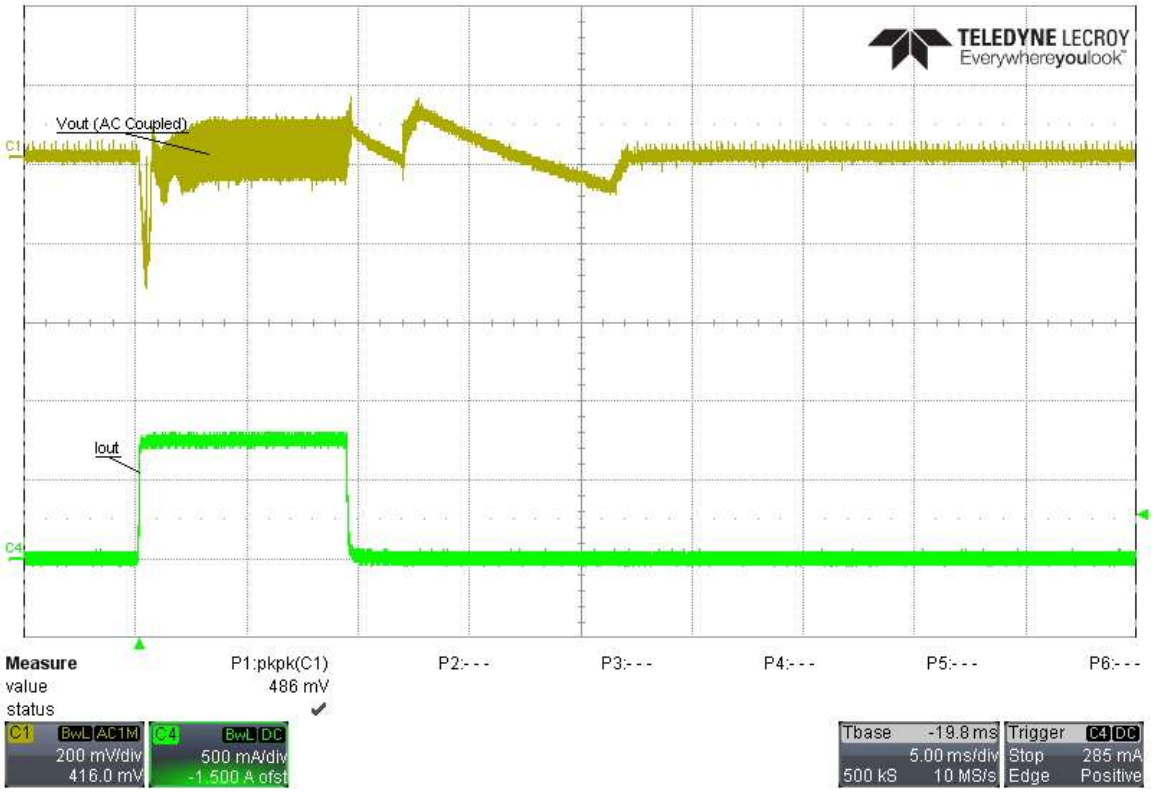


2.10 20V Output Load Transients

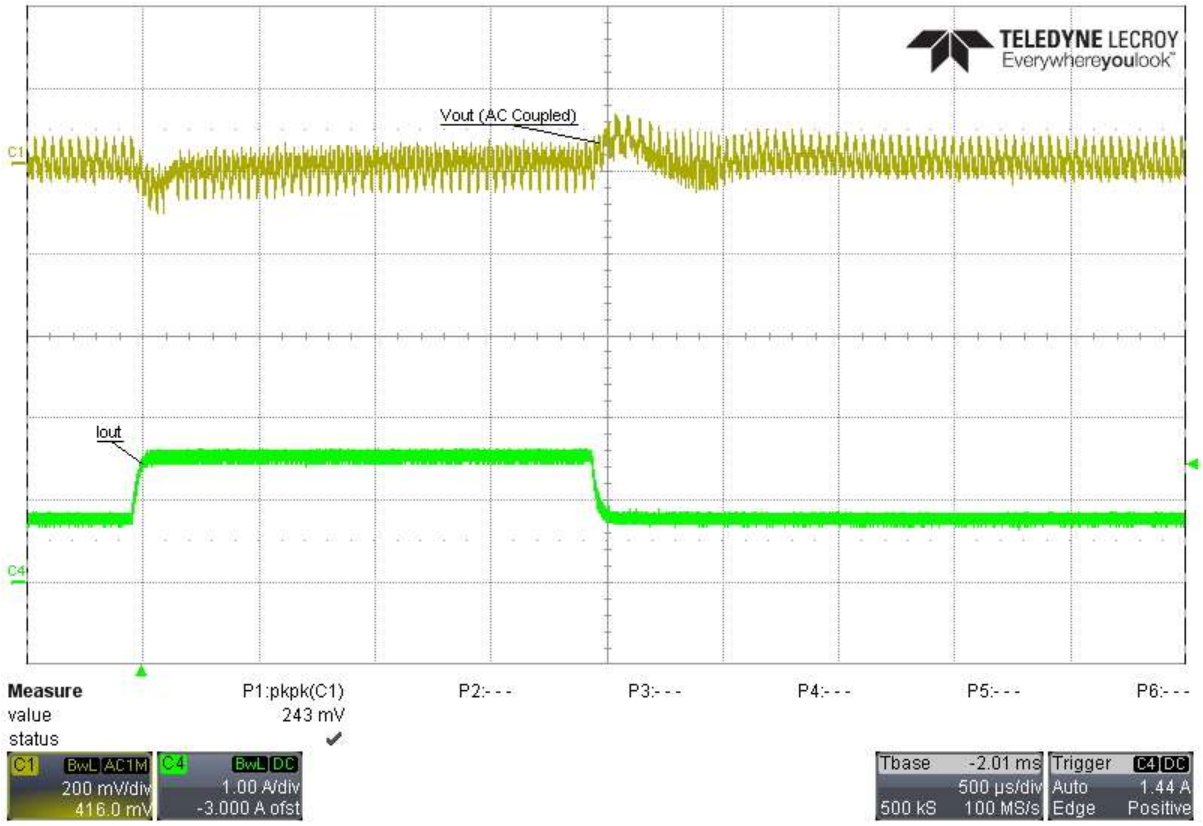
2.10.1 20V Output, 0A to 750mA Load Step, 120VAC/60Hz Input



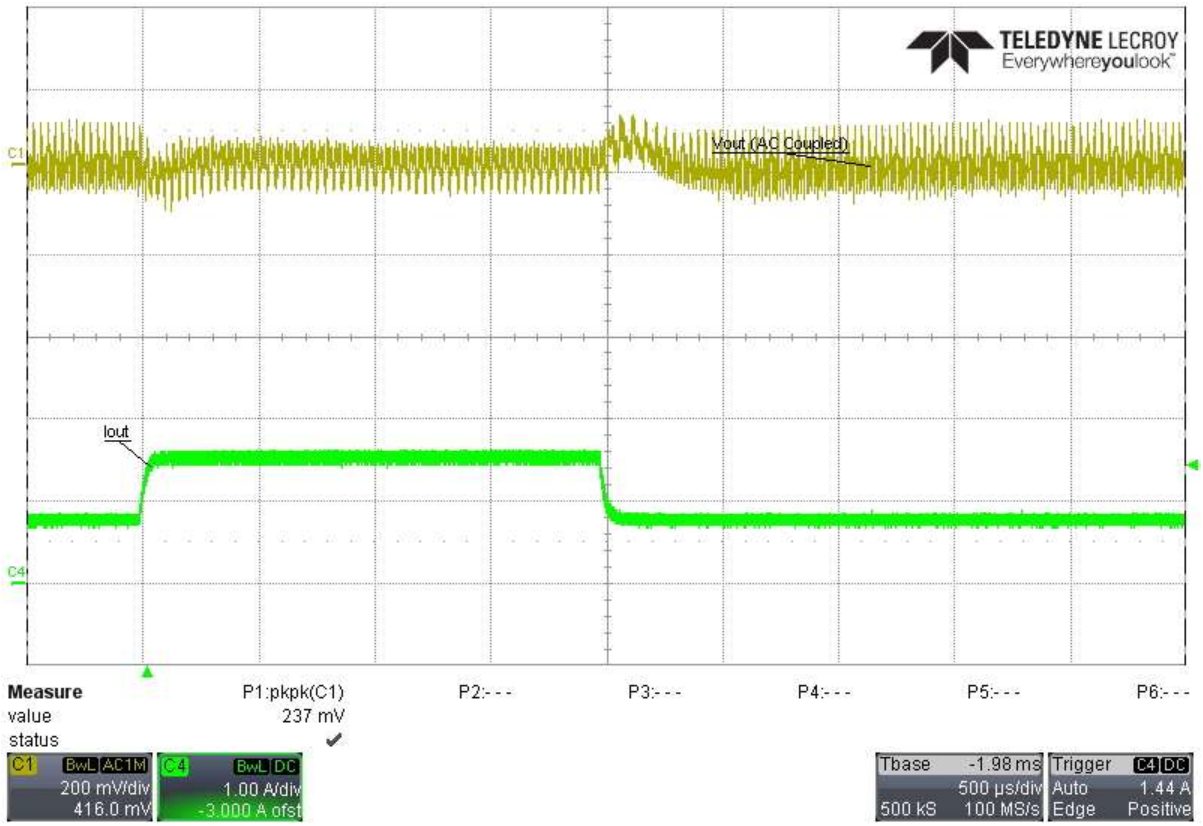
2.10.2 20V Output, 0A to 750mA Load Step, 230VAC/50Hz Input



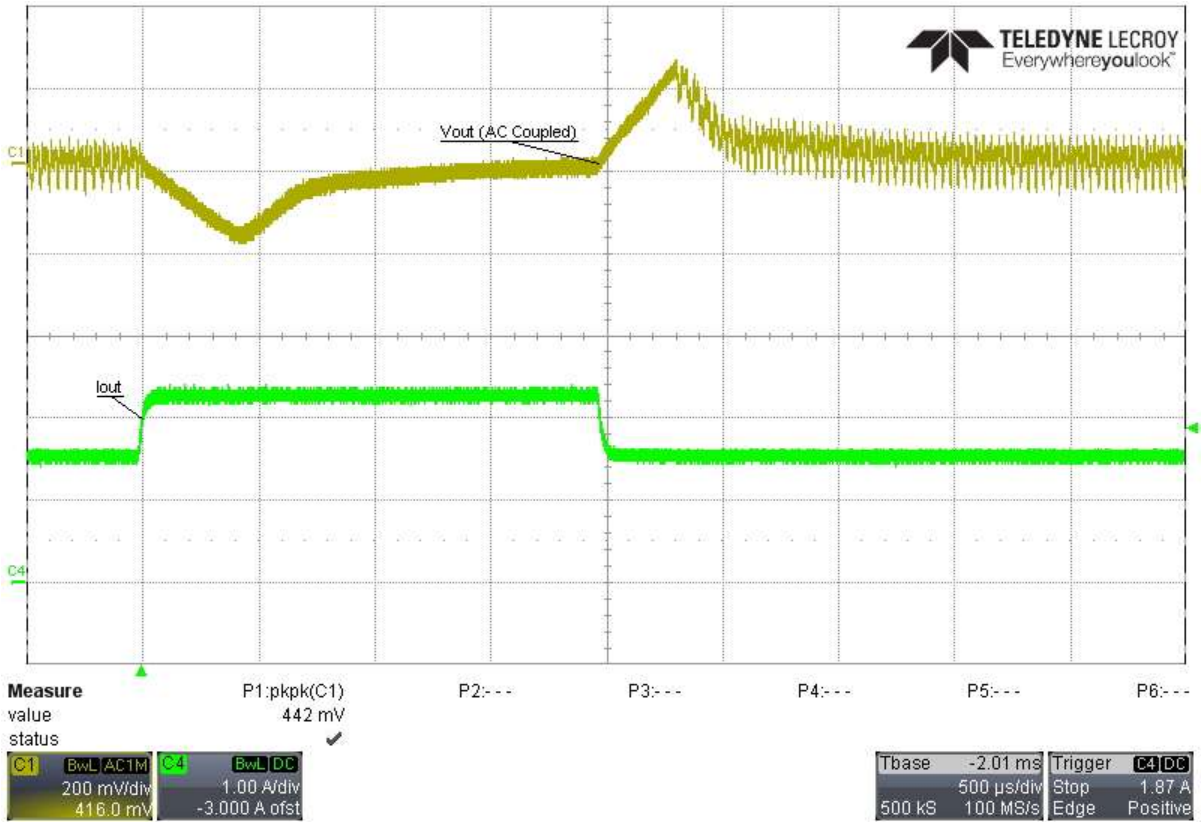
2.10.3 20V Output, 750mA to 1.5A Load Step, 120VAC/60Hz Input



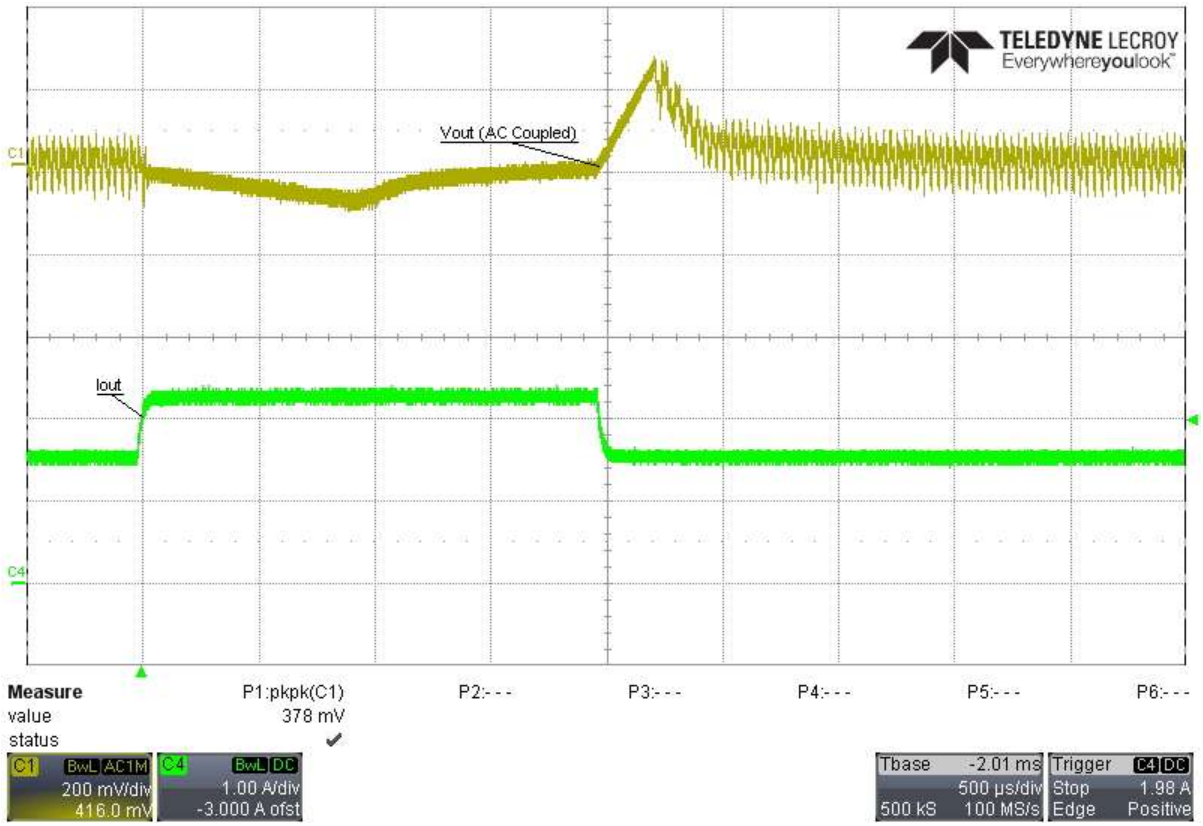
2.10.4 20V Output, 750mA to 1.5A Load Step, 230VAC/50Hz Input



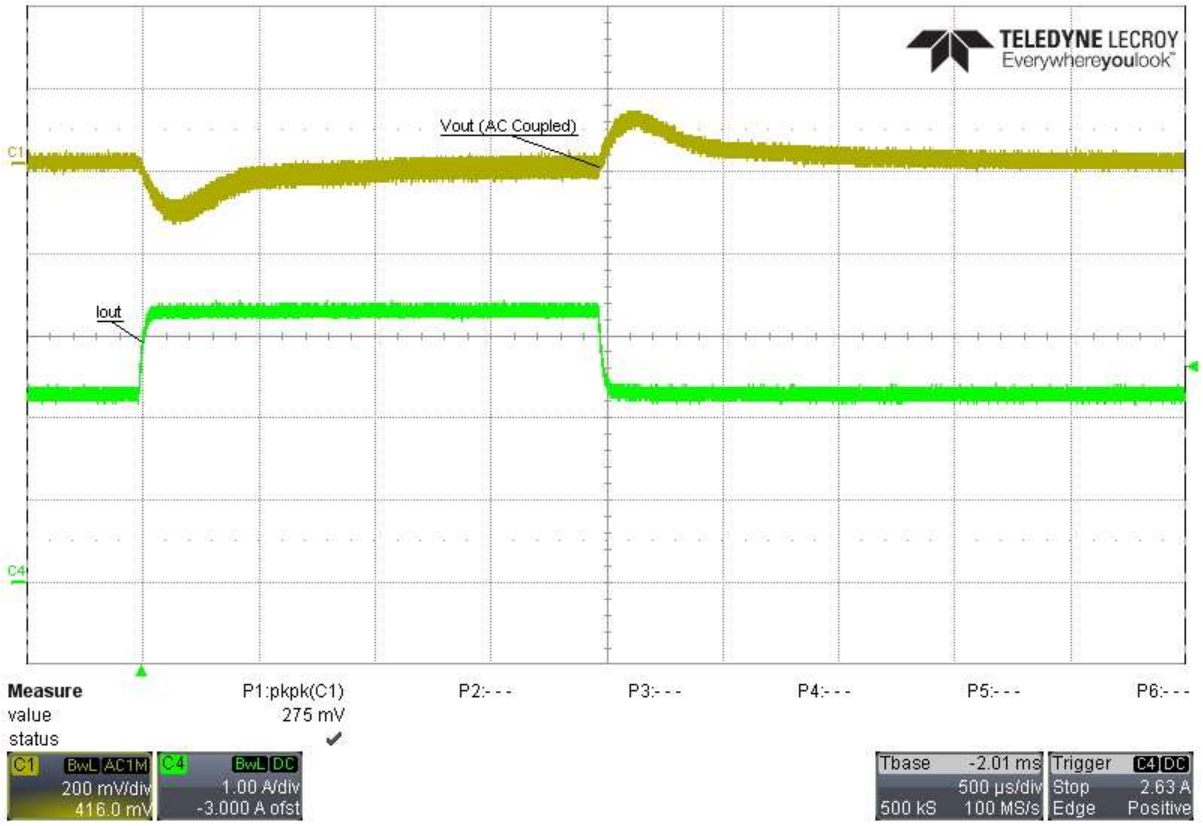
2.10.5 20V Output, 1.5A to 2.25A Load Step, 120VAC/60Hz Input



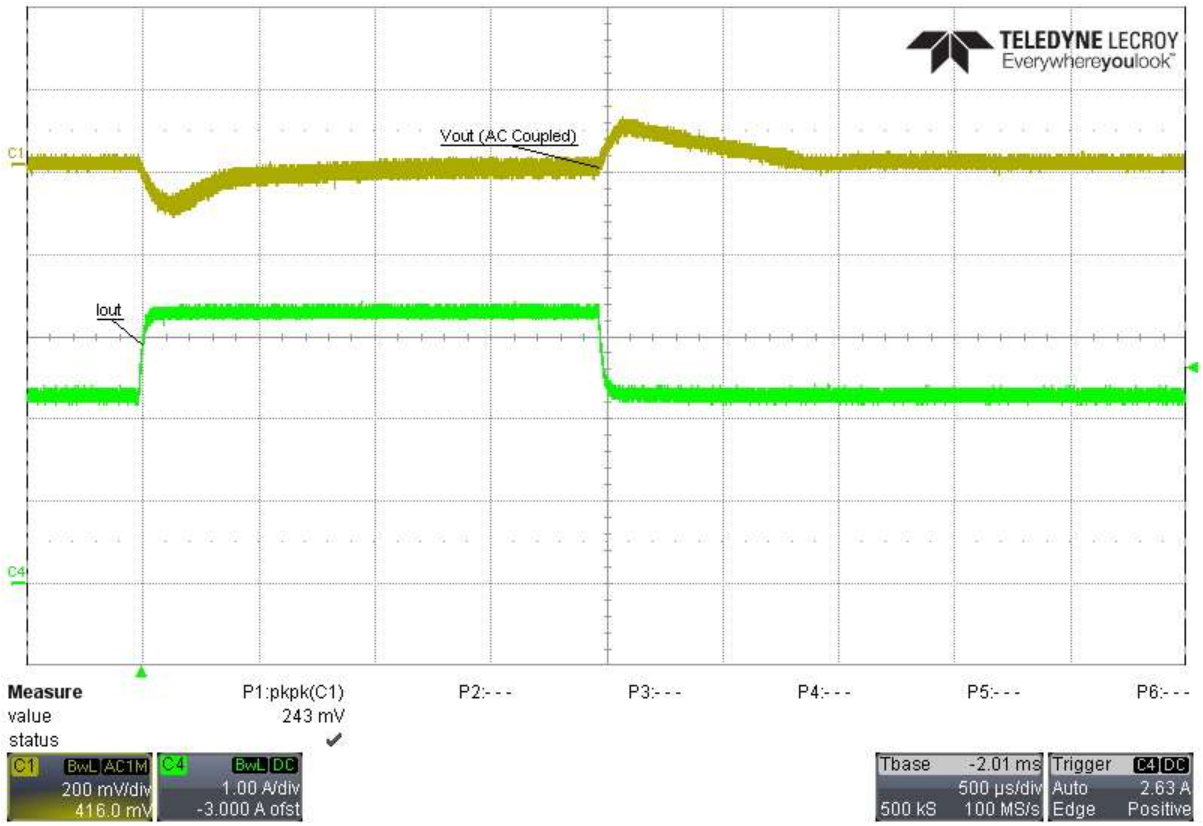
2.10.6 20V Output, 1.5A to 2.25A Load Step, 230VAC/50Hz Input



2.10.7 20V Output, 2.25A to 3.25A Load Step, 120VAC/60Hz Input

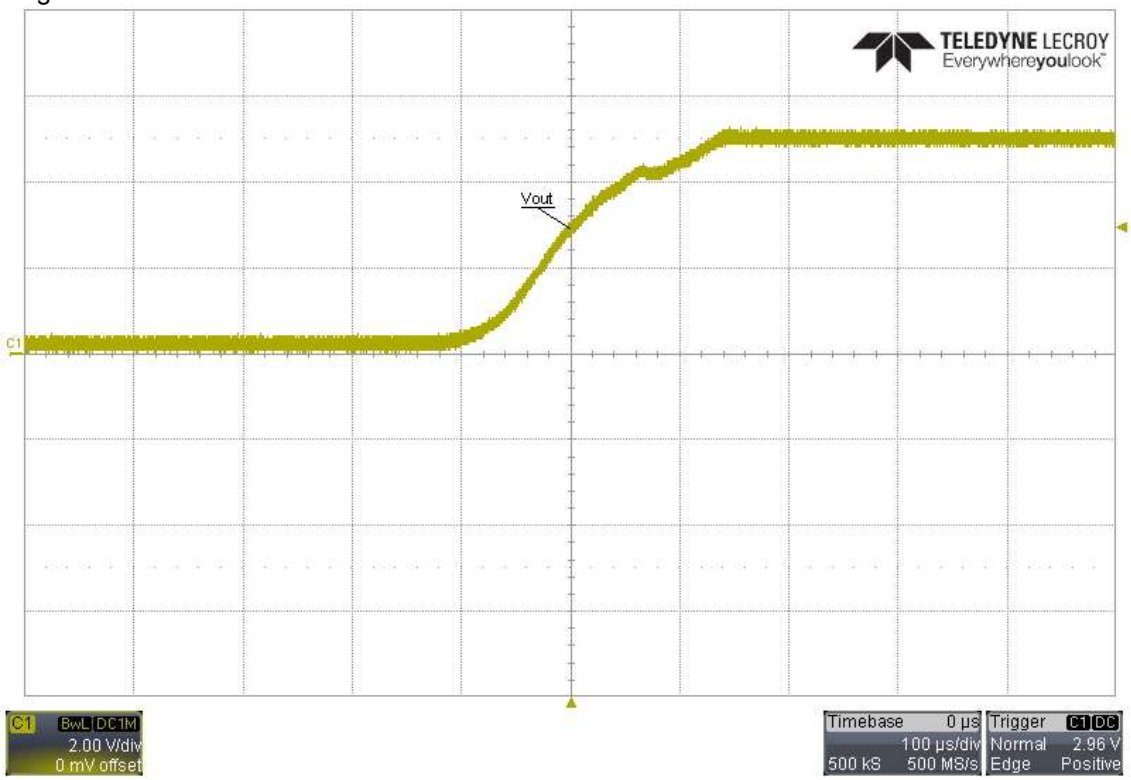


2.10.8 20V Output, 2.25A to 3.25A Load Step, 230VAC/50Hz Input



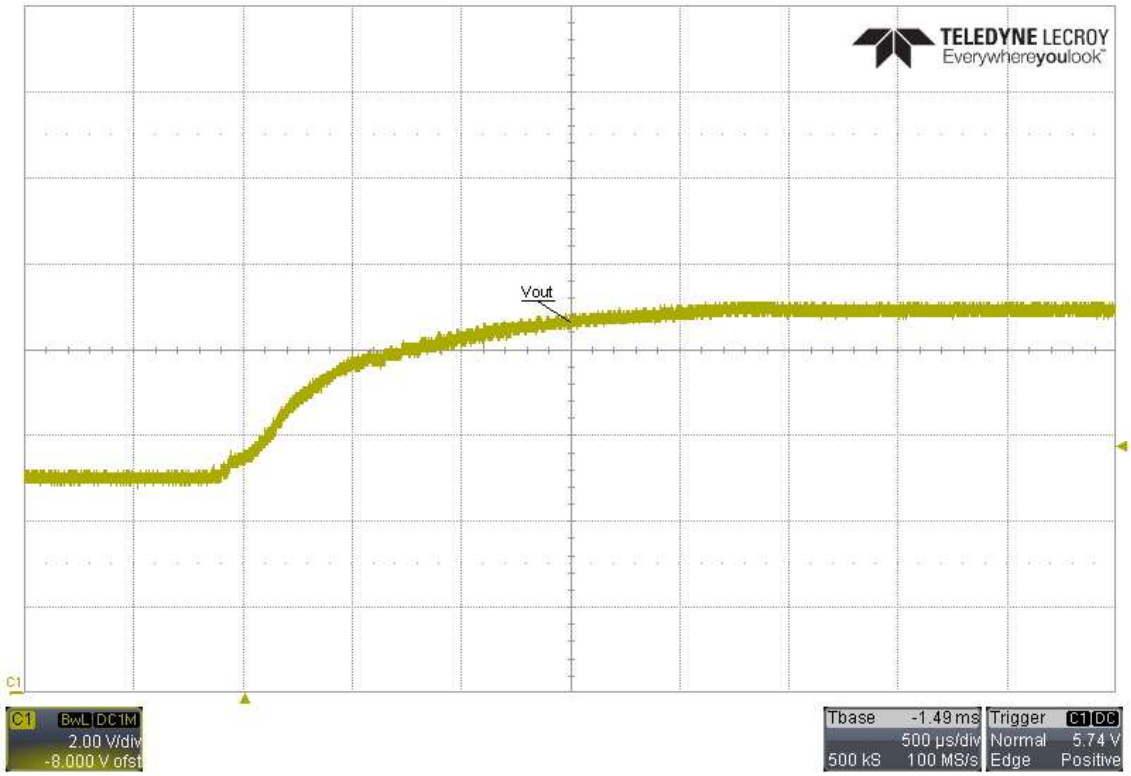
2.11 Startup

Output voltage measured at connector when USB-C cable inserted with no load.

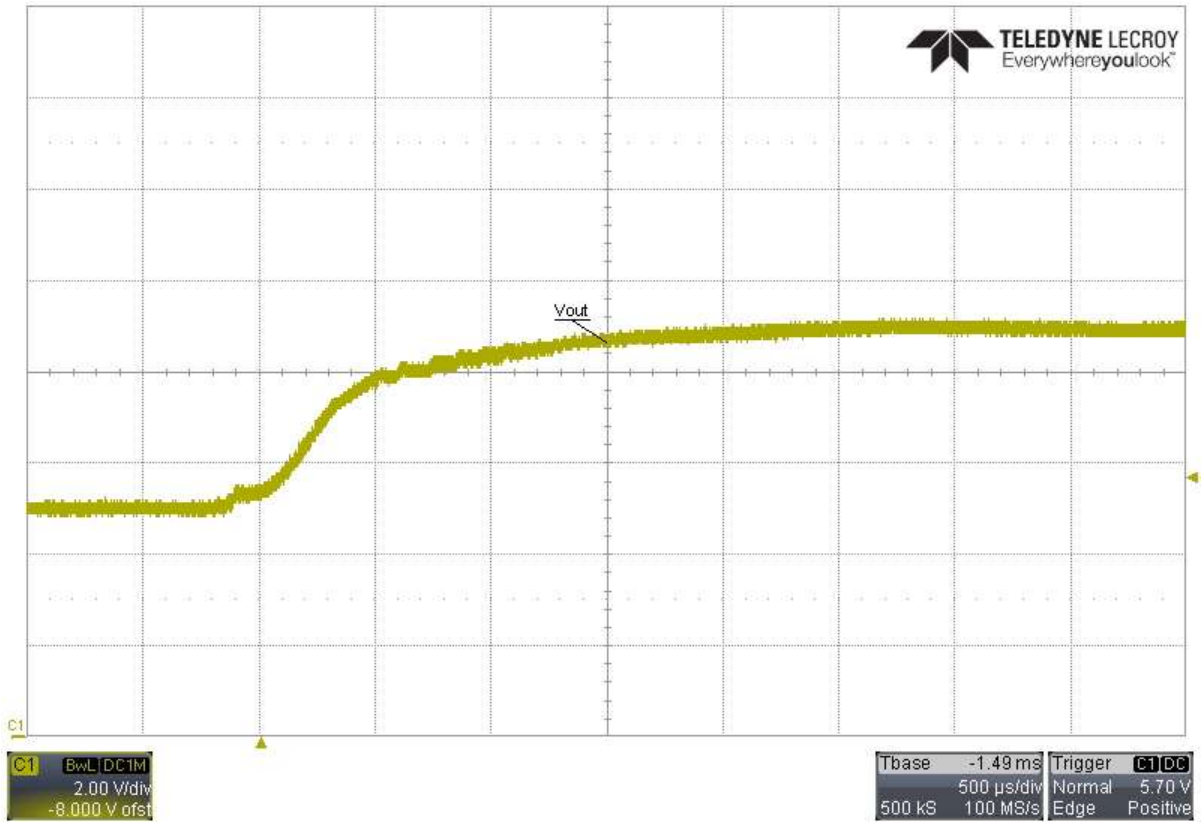


2.12 Voltage Transitions

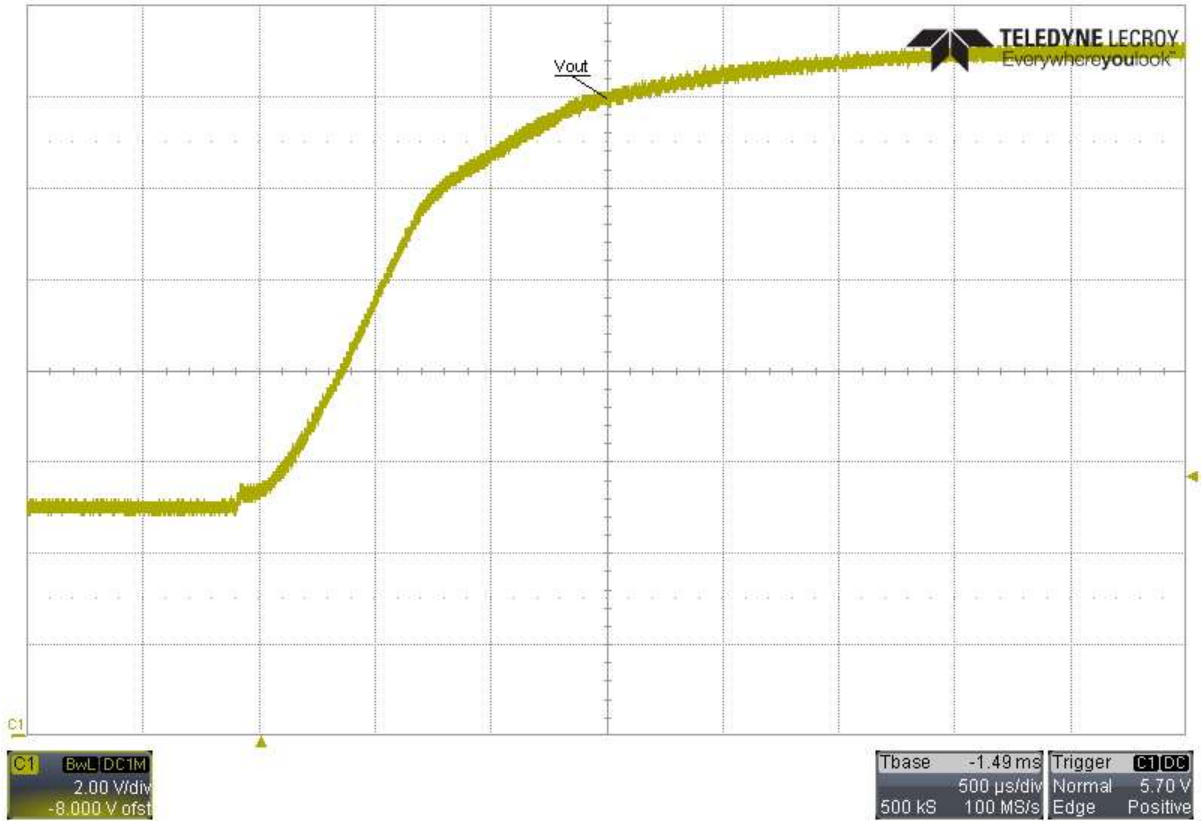
2.12.1 5V to 9V, 120VAC/60Hz Input, No Load



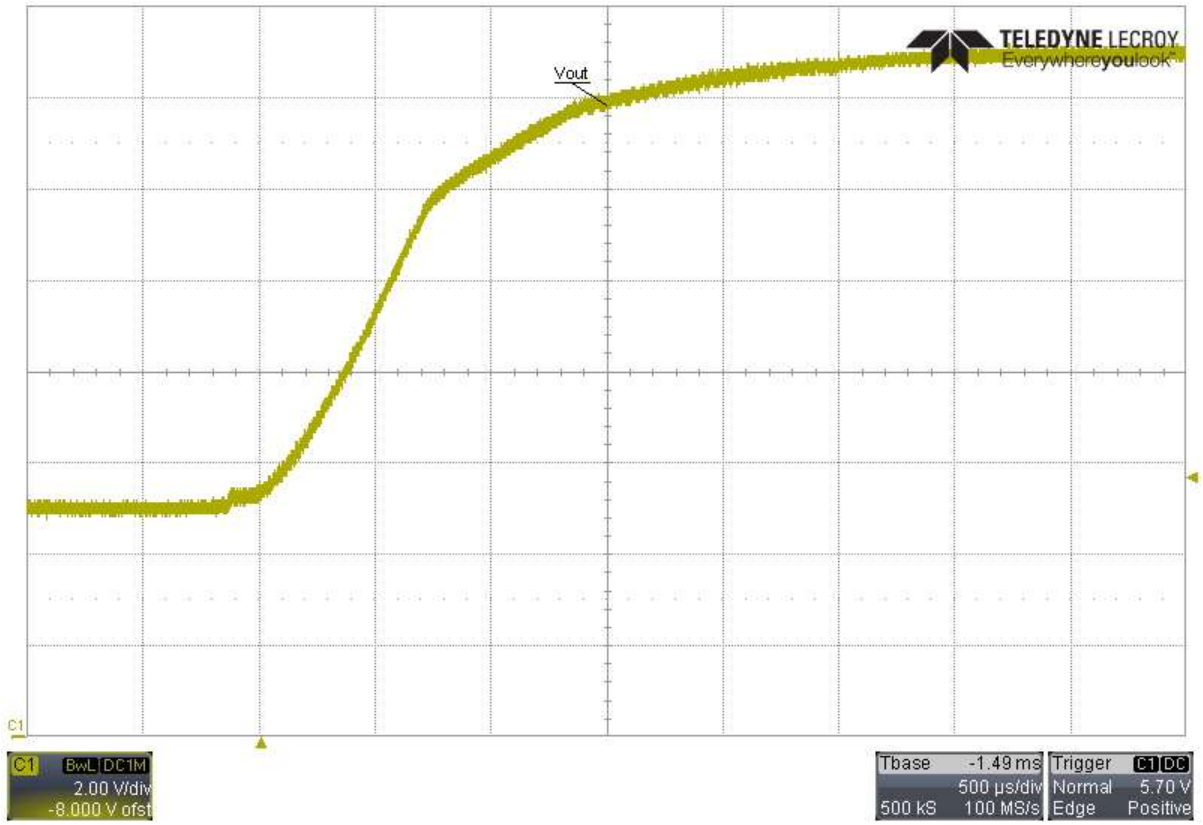
2.12.2 5V to 9V, 230VAC/50Hz Input, No Load



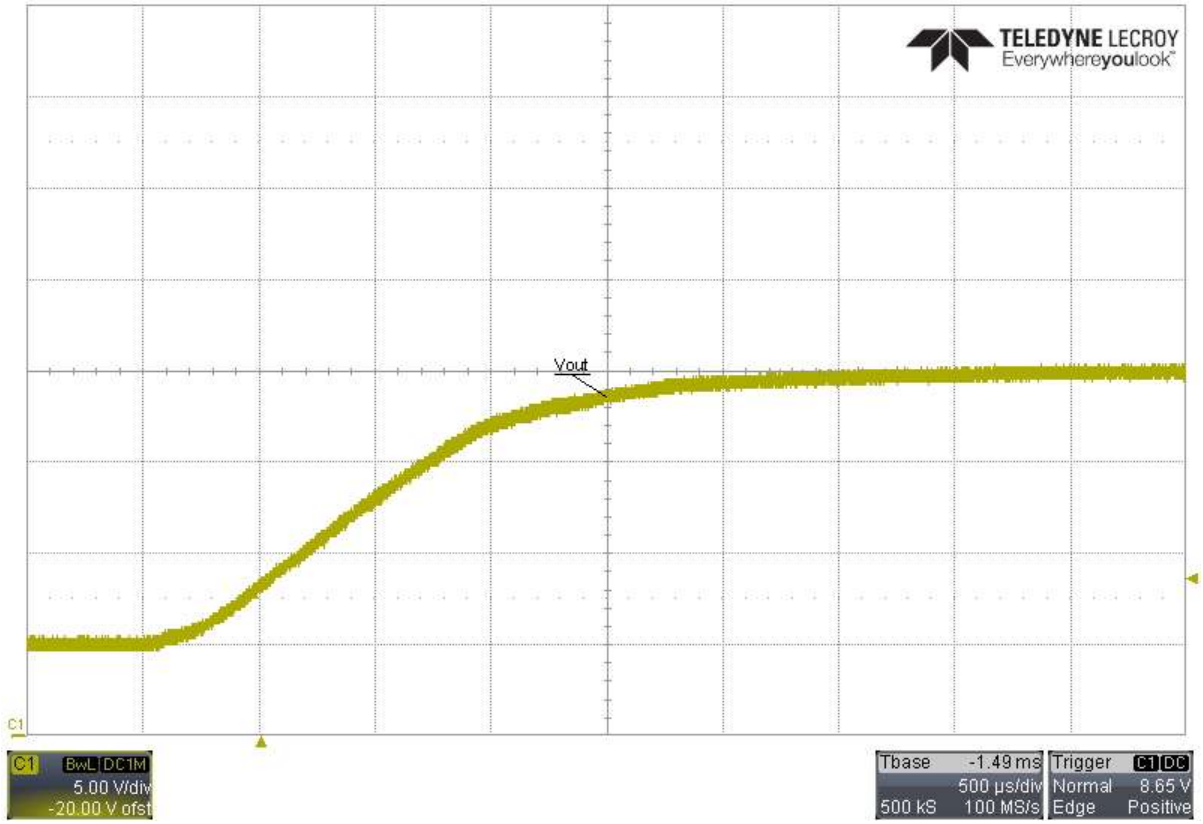
2.12.3 5V to 15V, 120VAC/60Hz Input, No Load



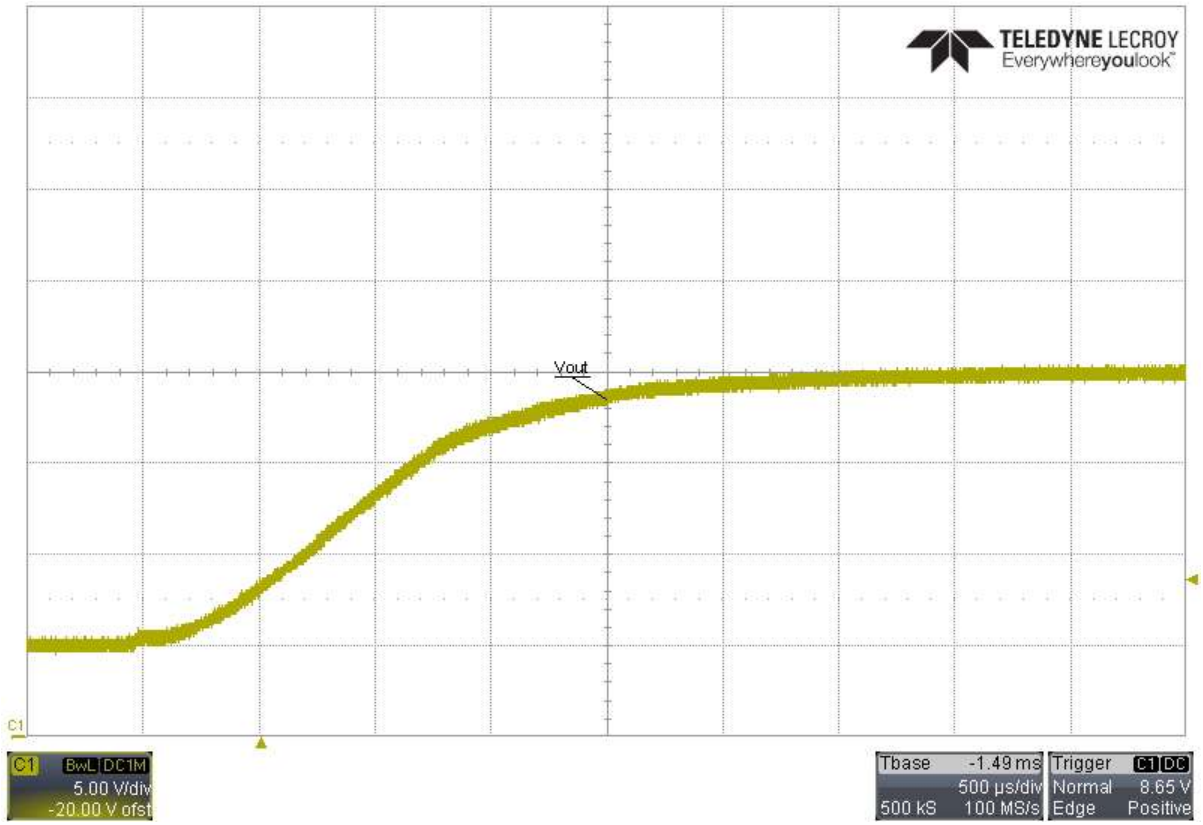
2.12.4 5V to 15V, 230VAC/50Hz Input, No Load



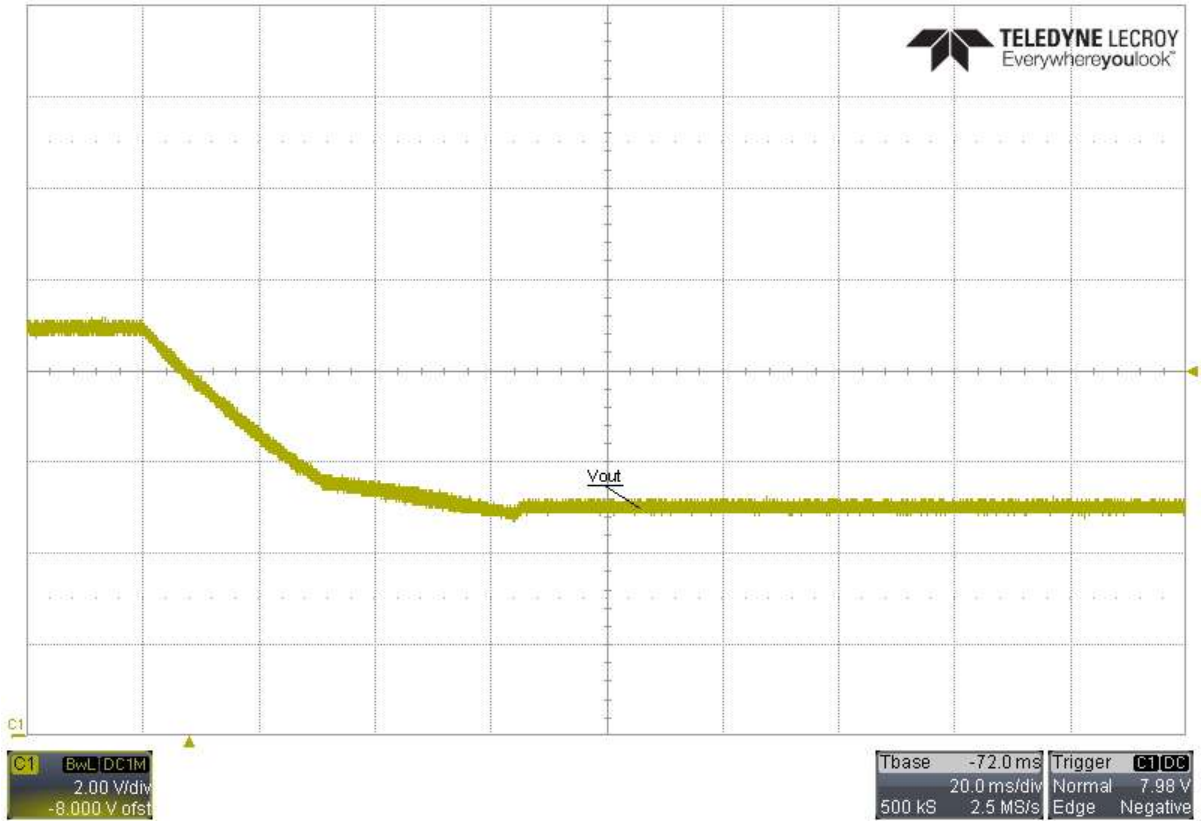
2.12.5 5V to 20V, 120VAC/60Hz Input, No Load



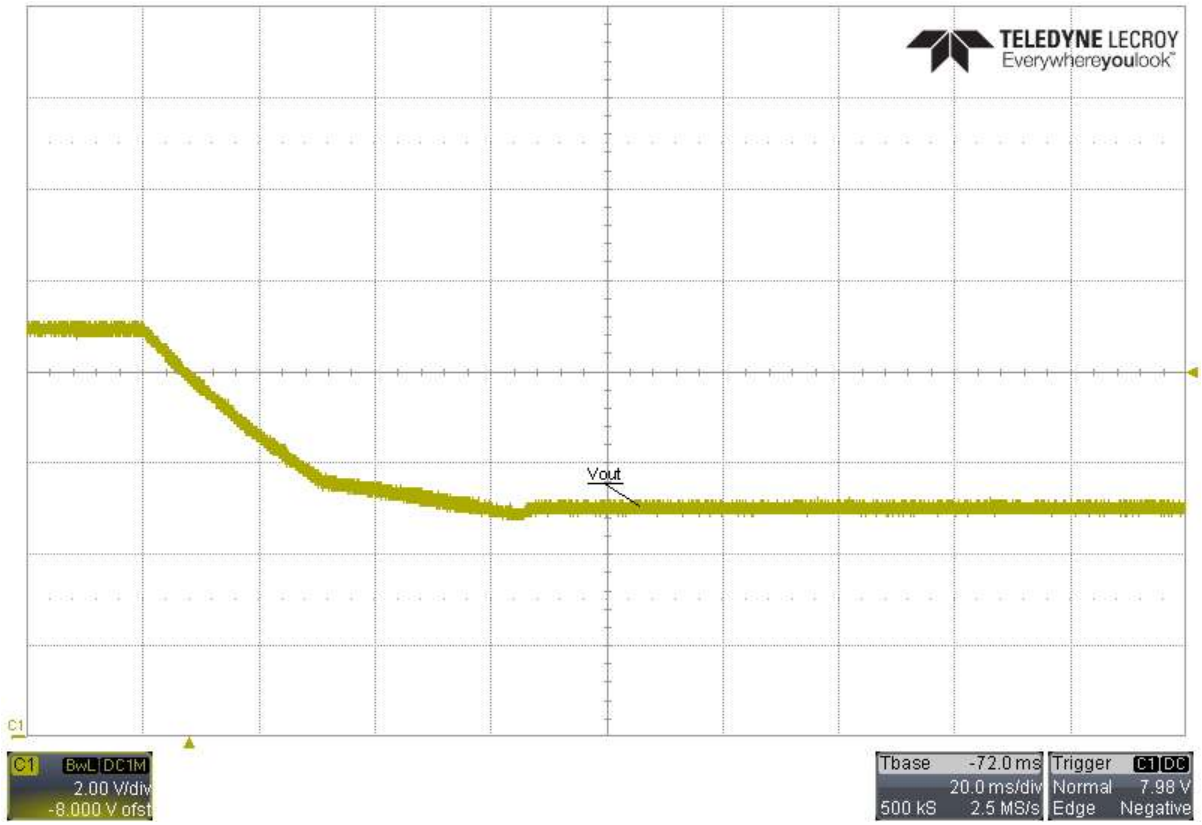
2.12.6 5V to 20V, 230VAC/50Hz Input, No Load



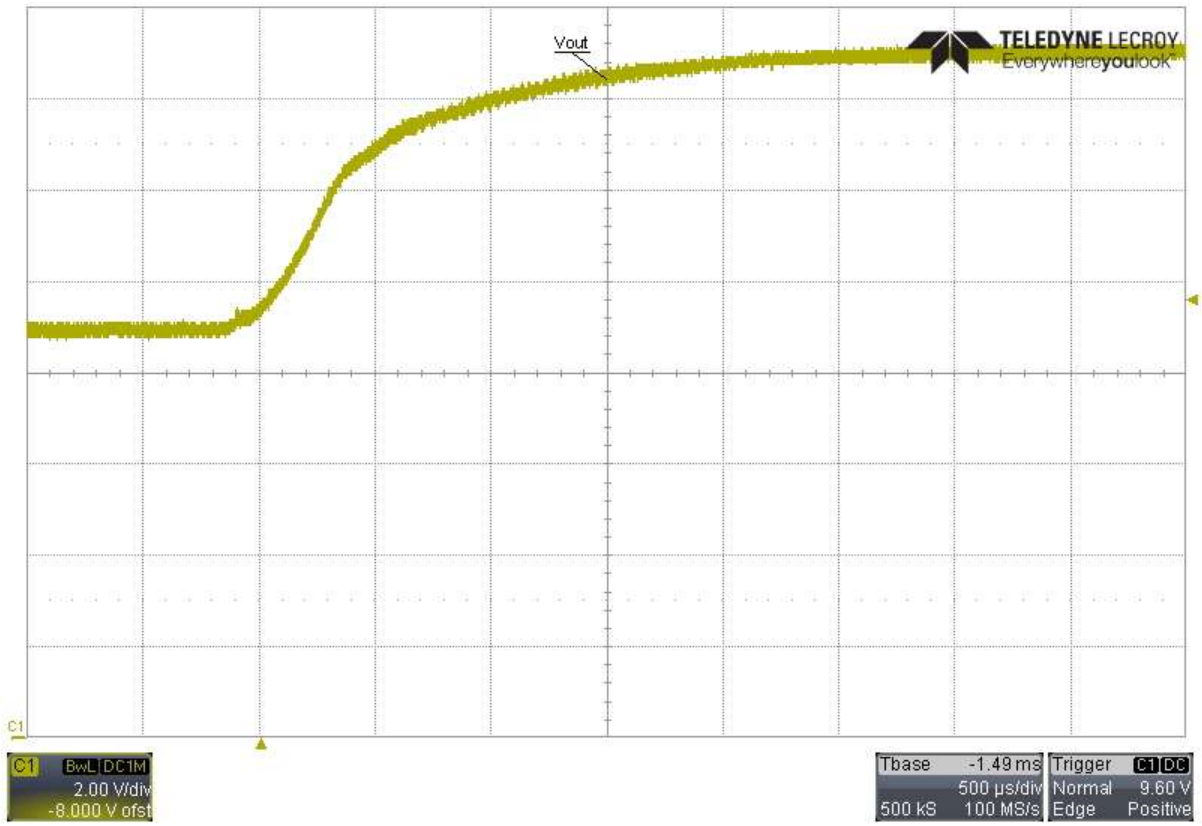
2.12.7 9V to 5V, 120VAC/60Hz Input, No Load



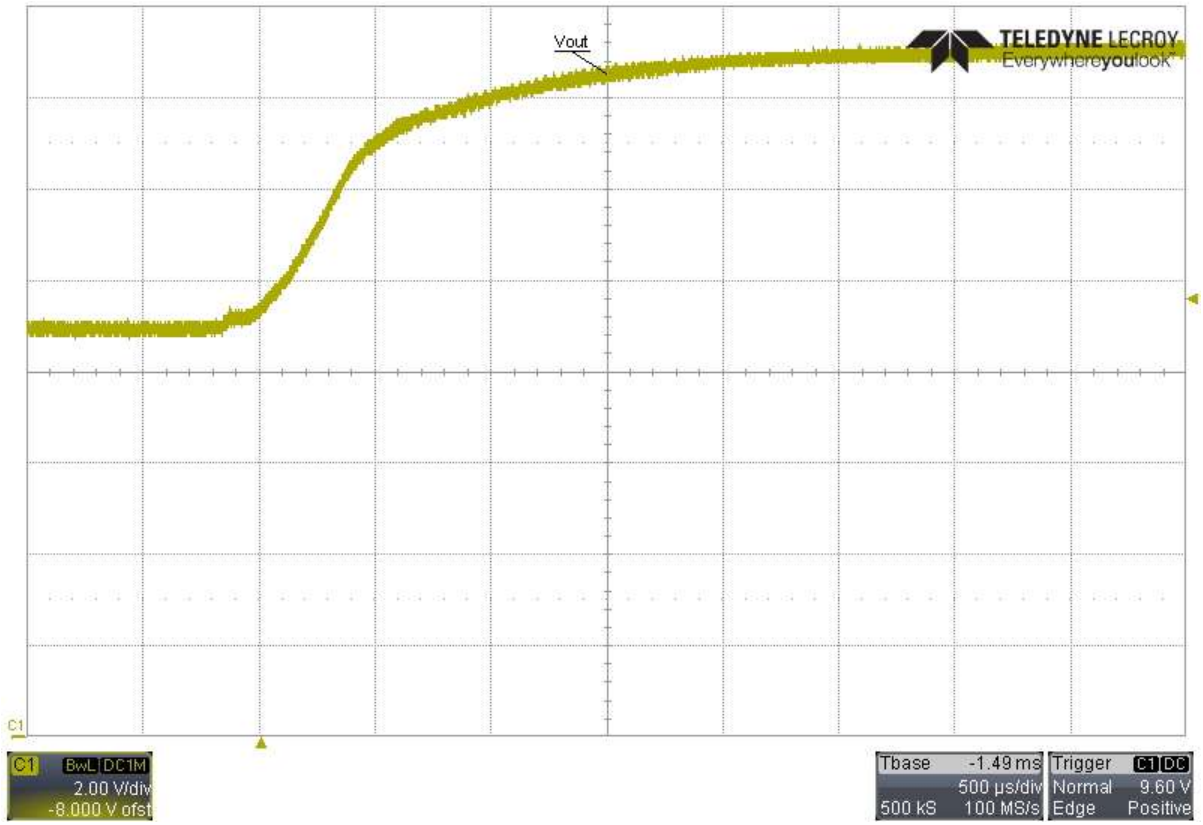
2.12.8 9V to 5V, 230VAC/50Hz Input, No Load



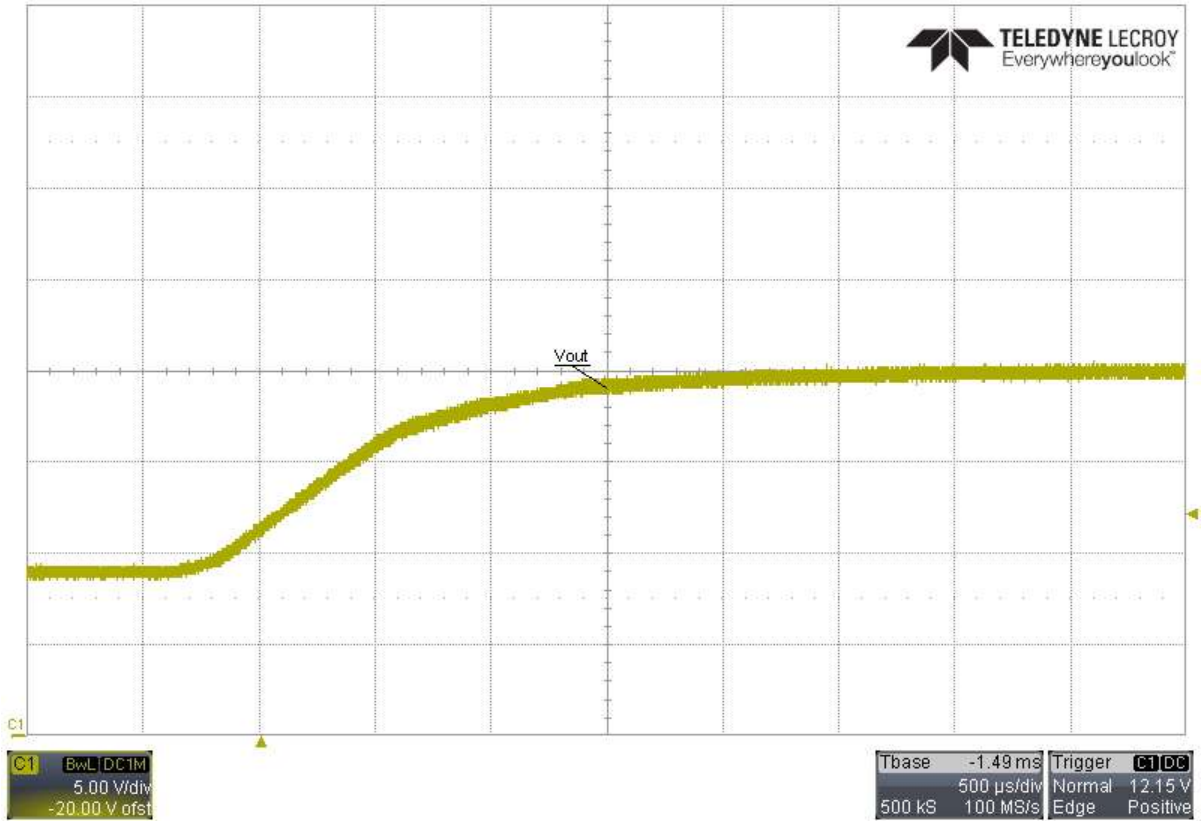
2.12.9 9V to 15V, 120VAC/60Hz Input, No Load



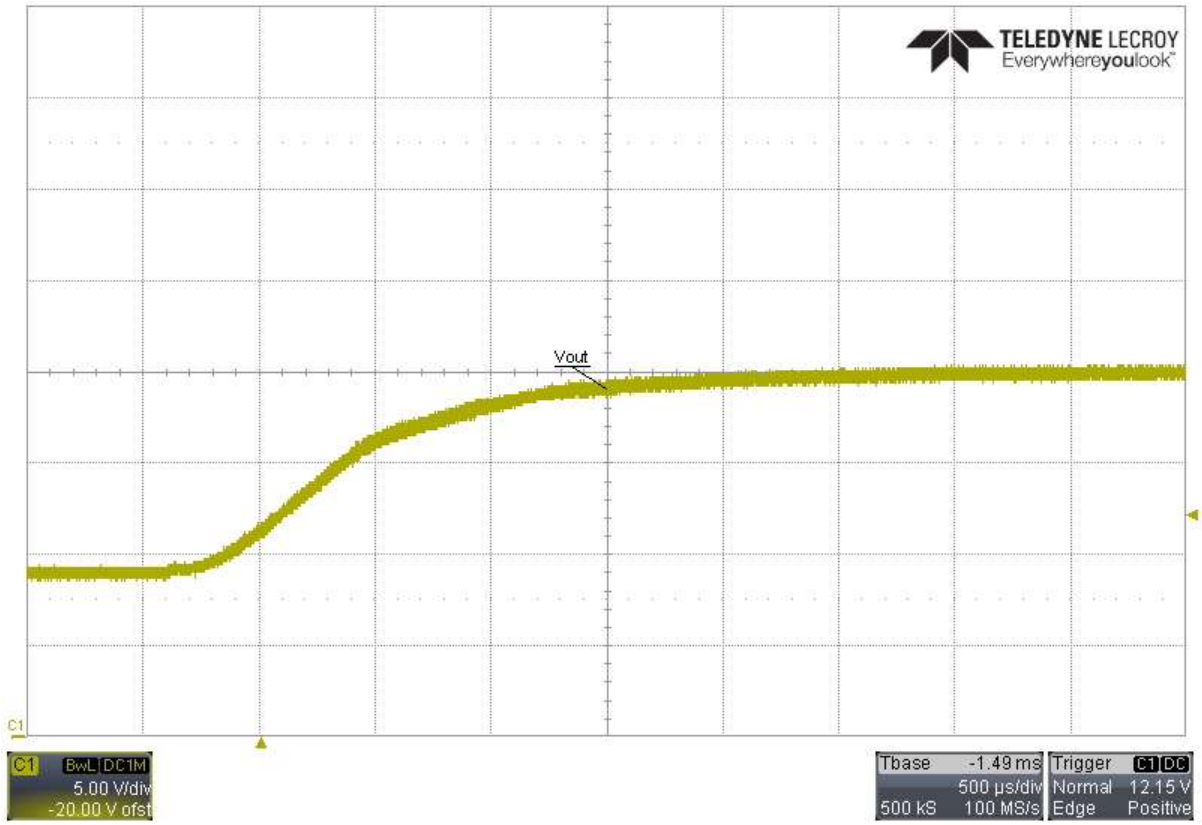
2.12.10 9V to 15V, 230VAC/50Hz Input, No Load



2.12.11 9V to 20V, 120VAC/60Hz Input, No Load

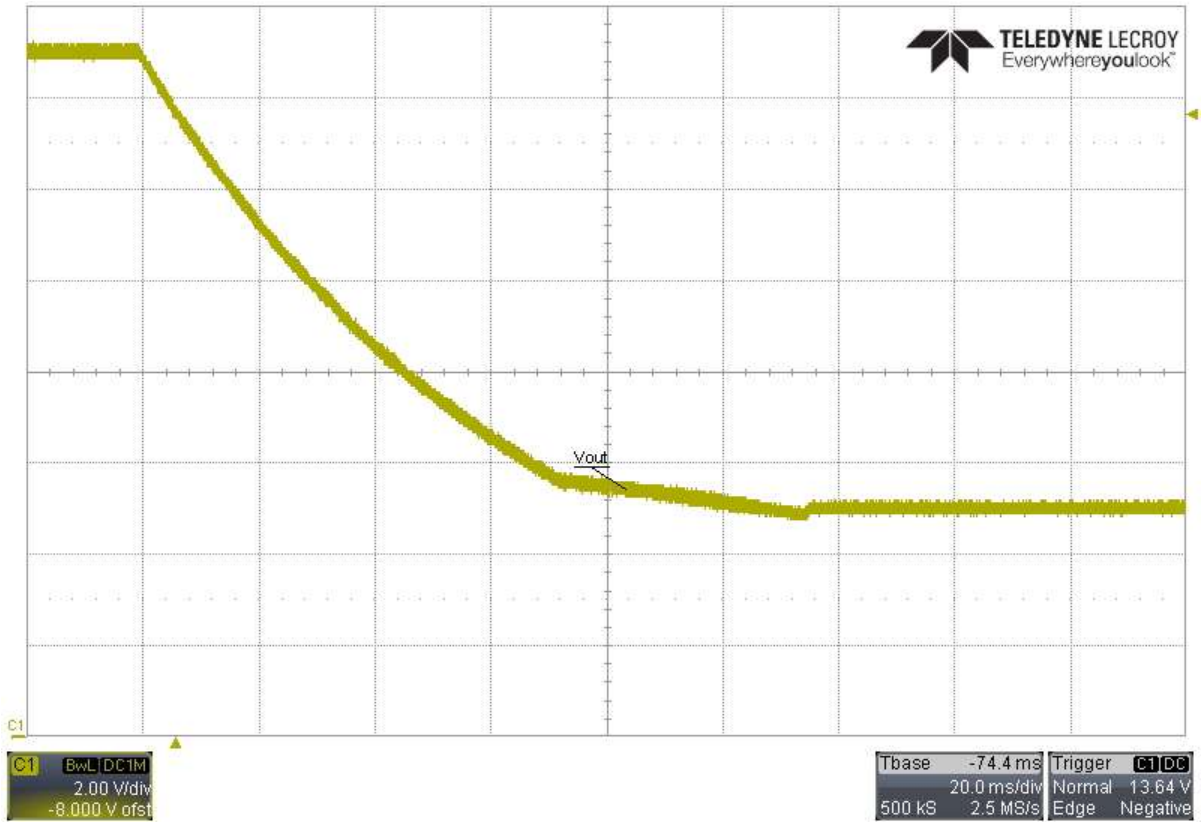


2.12.12 9V to 20V, 230VAC/50Hz Input, No Load

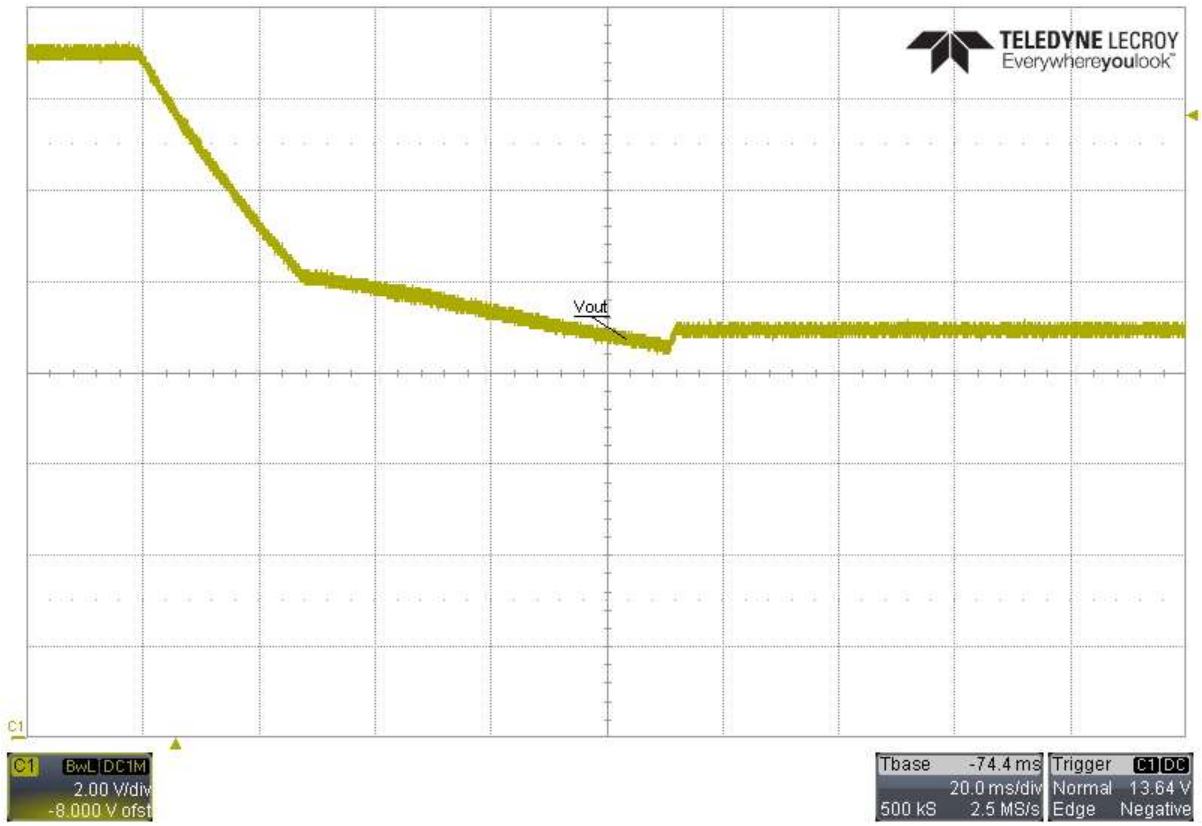


2.12.13 15V to 5V, 120VAC/60Hz Input, No Load

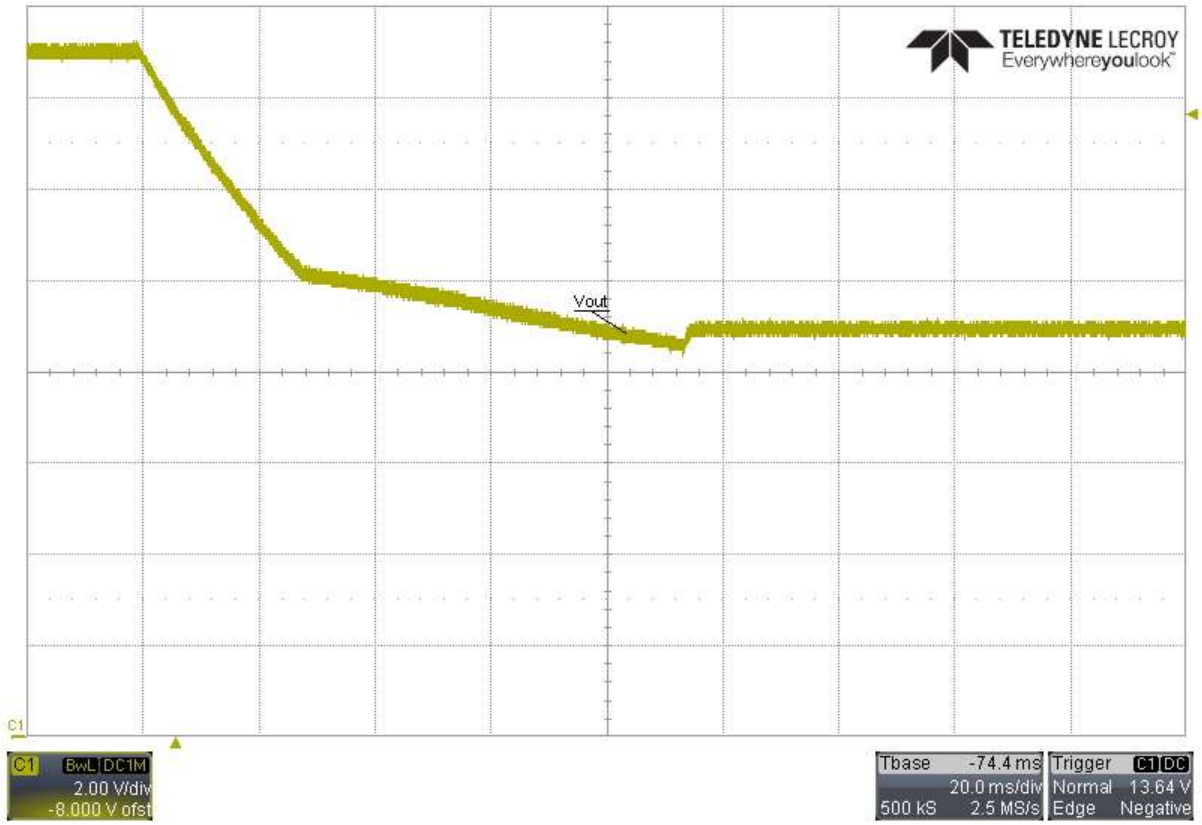
2.12.14 15V to 5V, 230VAC/50Hz Input, No Load



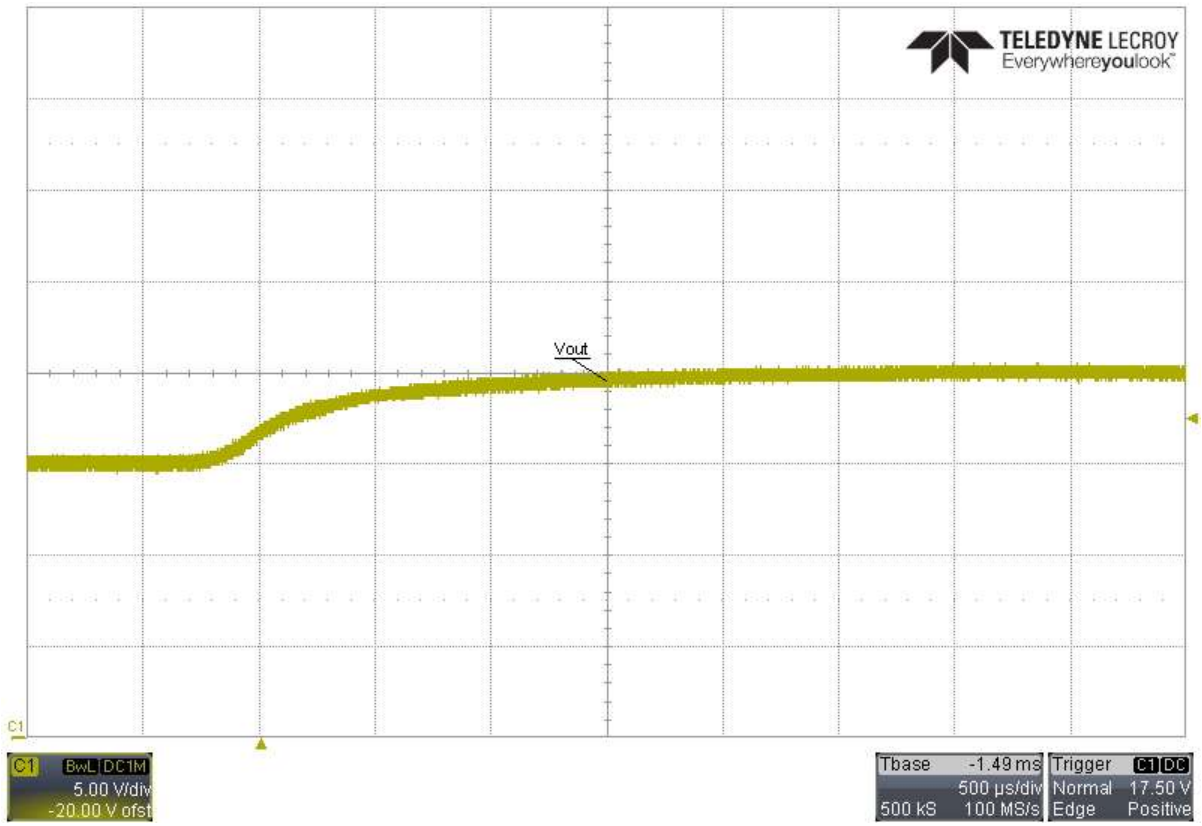
2.12.15 15V to 9V, 120VAC/60Hz Input, No Load



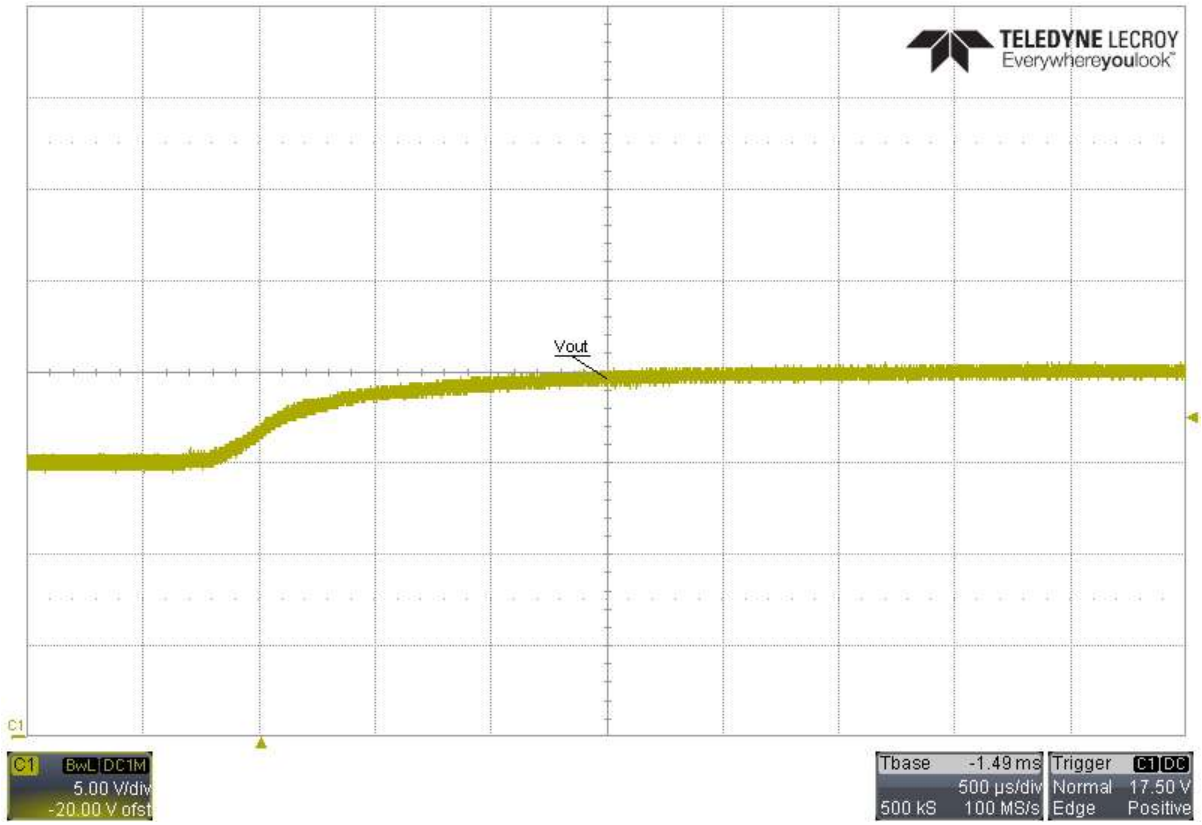
2.12.16 15V to 9V, 230VAC/50Hz Input, No Load



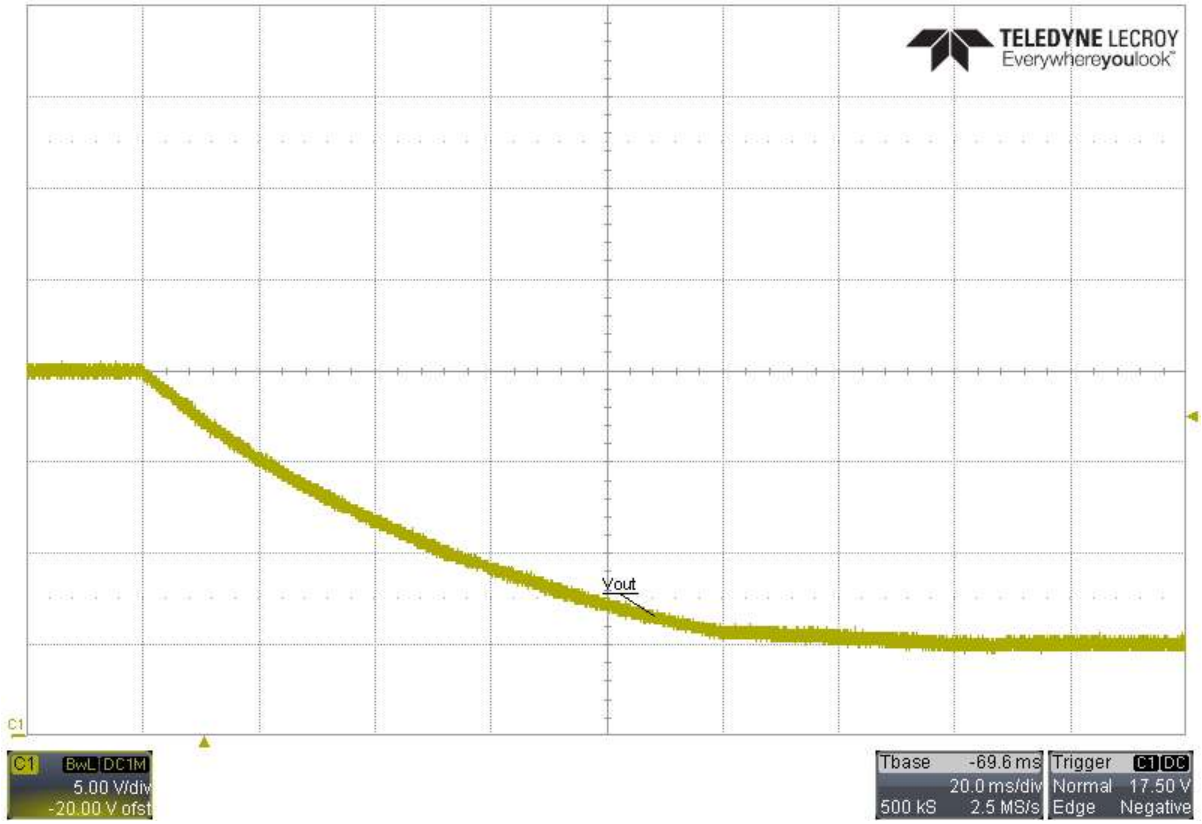
2.12.17 15V to 20V, 120VAC/60Hz Input, No Load



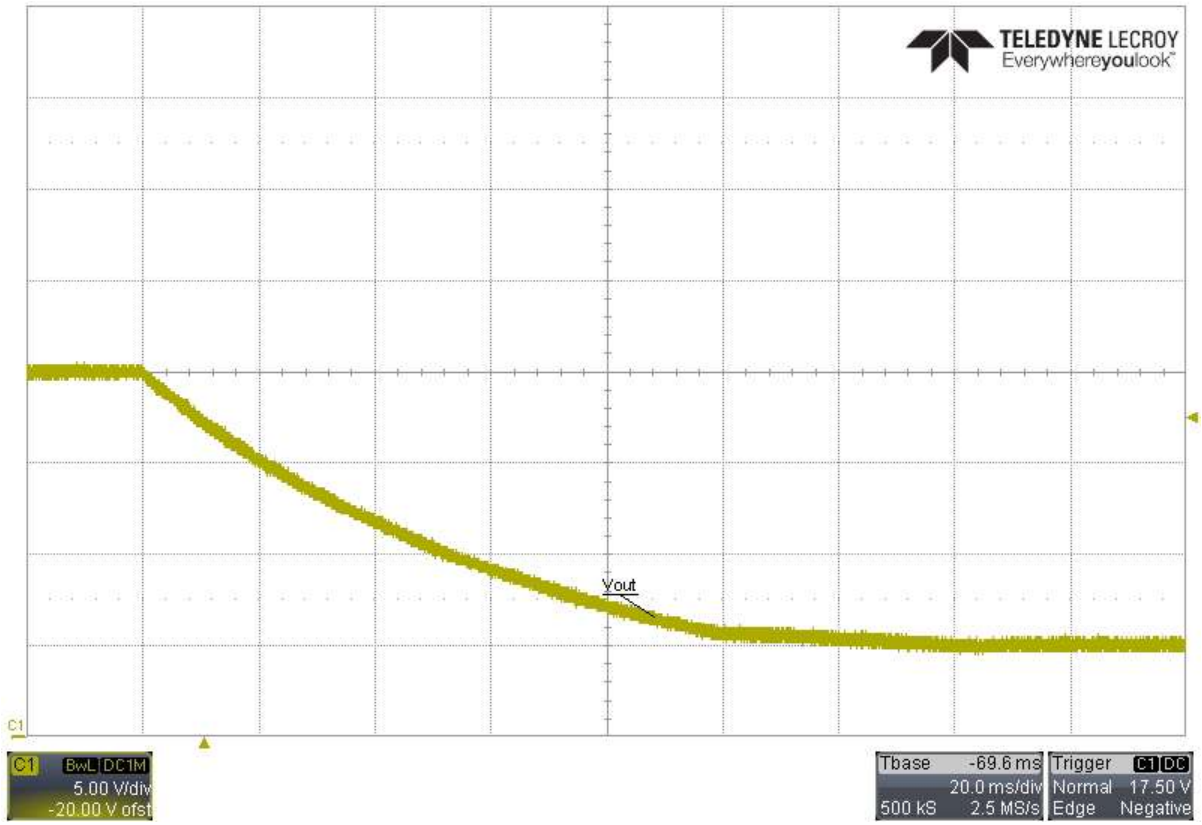
2.12.18 15V to 20V, 230VAC/50Hz Input, No Load



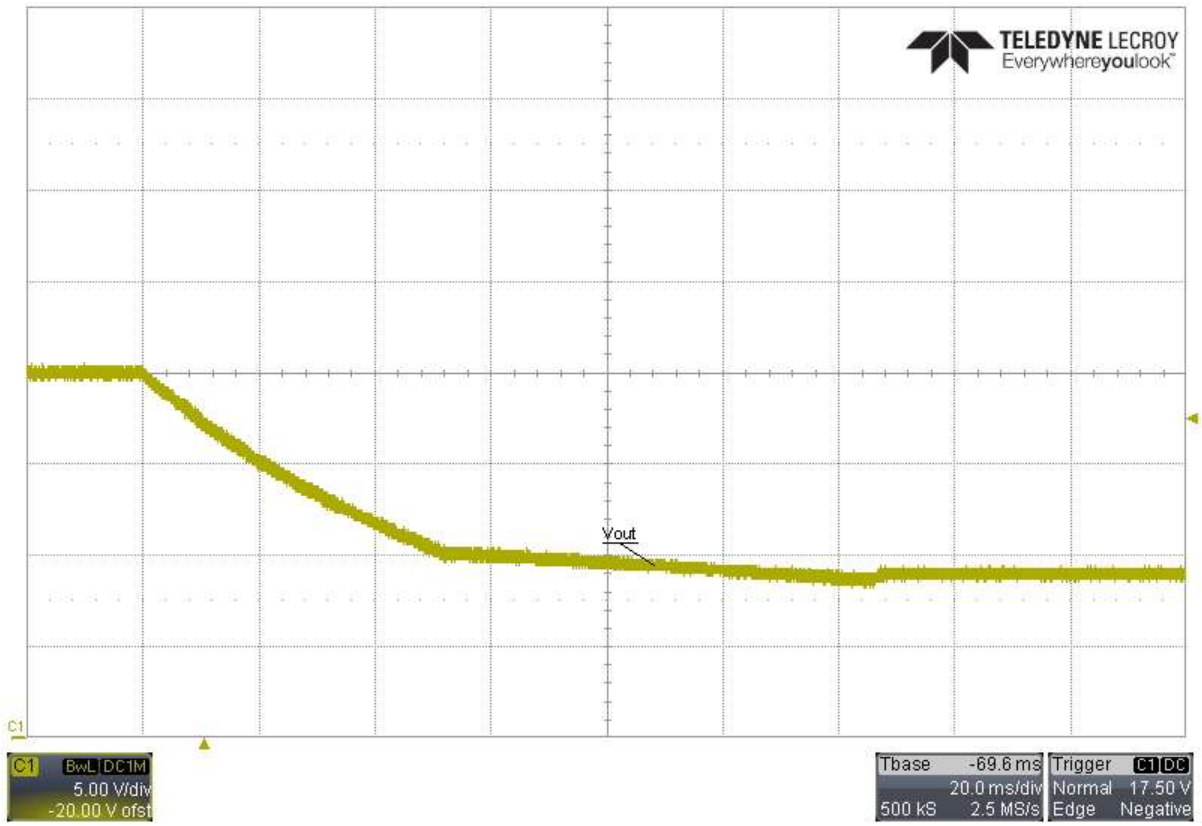
2.12.19 20V to 5V, 120VAC/60Hz Input, No Load



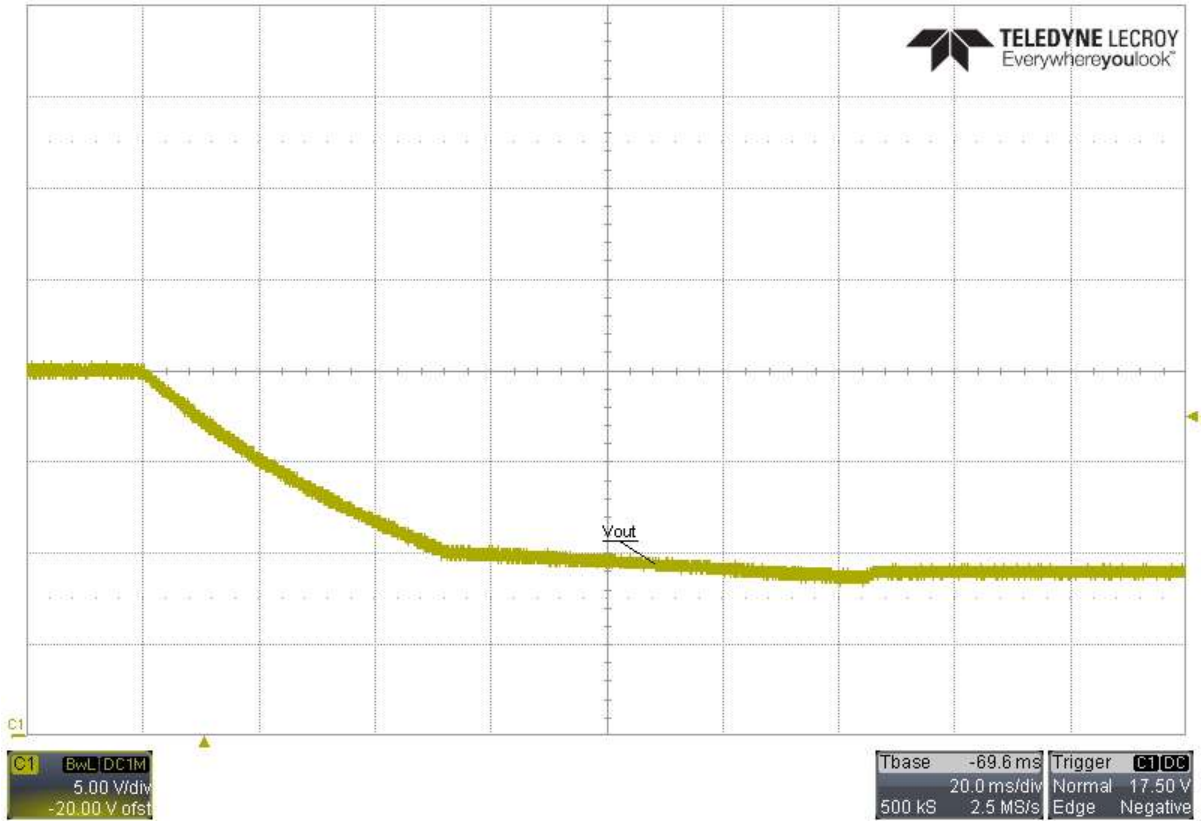
2.12.20 20V to 5V, 230VAC/50Hz Input, No Load



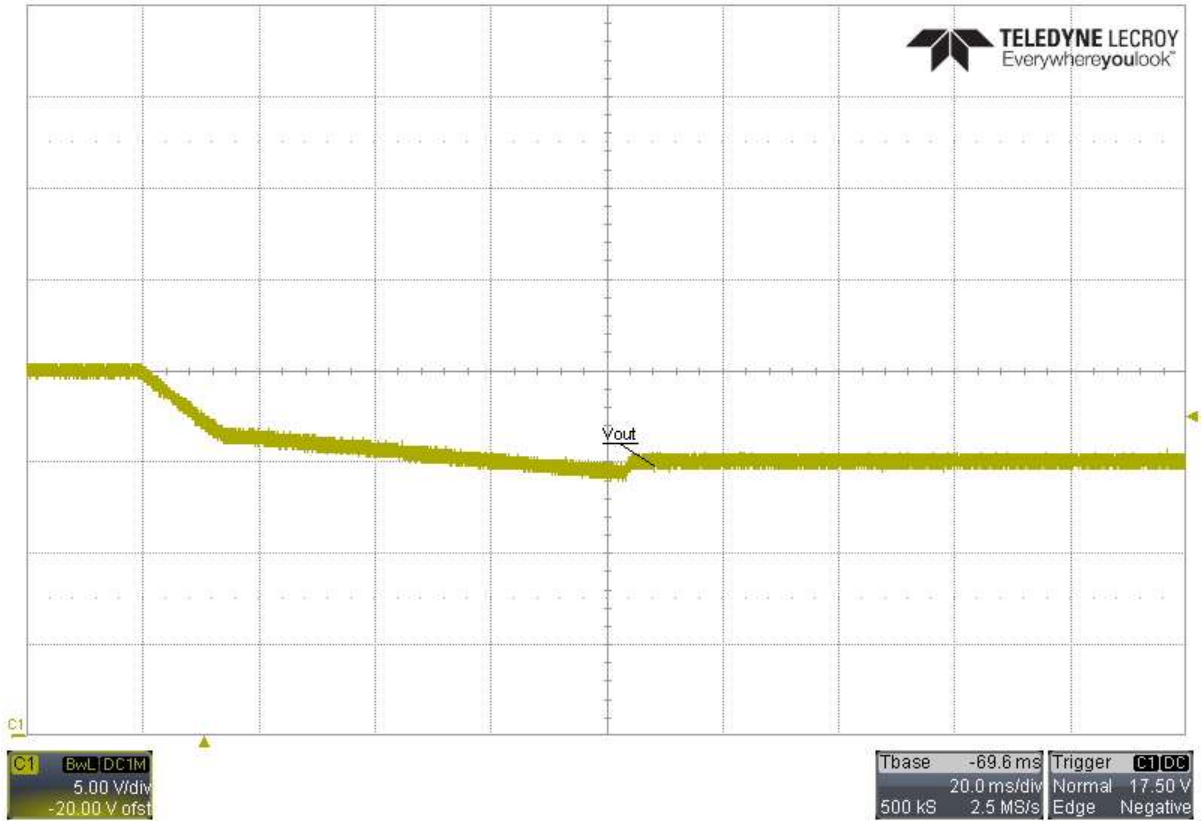
2.12.21 20V to 9V, 120VAC/60Hz Input, No Load



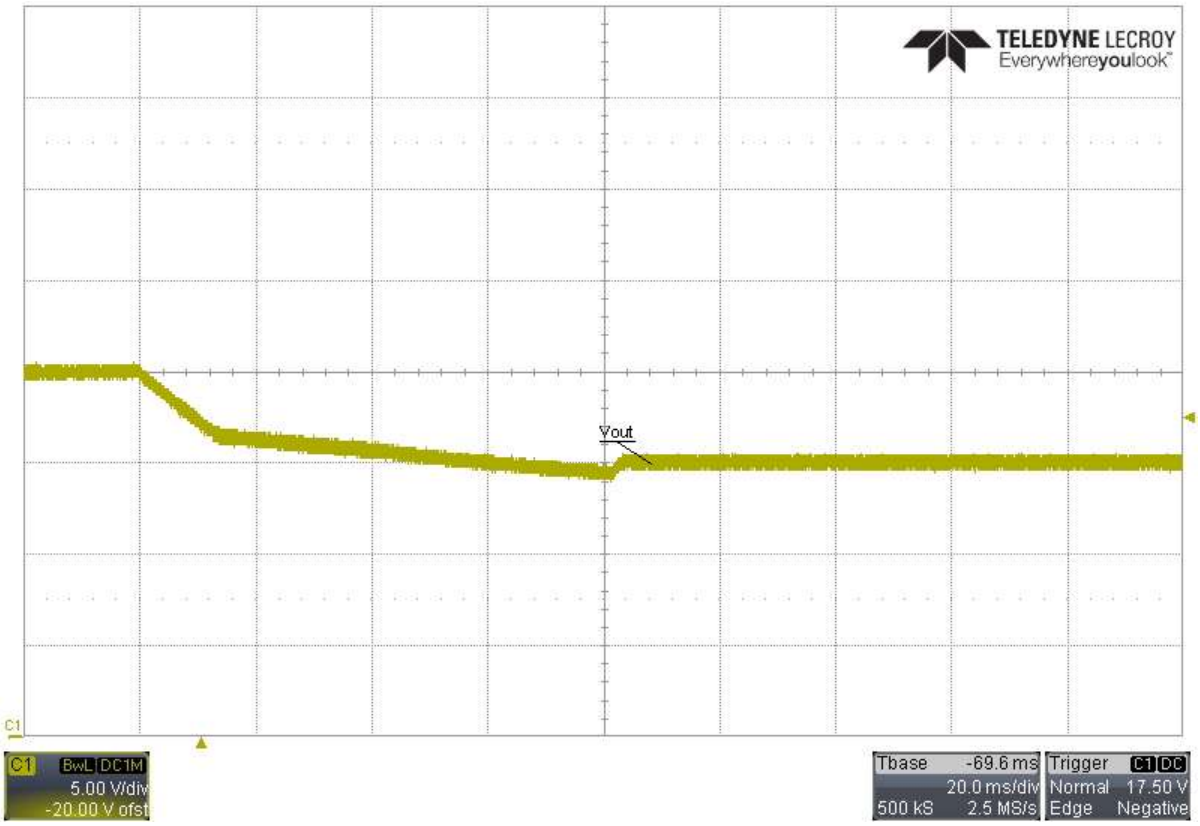
2.12.22 20V to 9V, 230VAC/50Hz Input, No Load



2.12.23 20V to 15V, 120VAC/60Hz Input, No Load

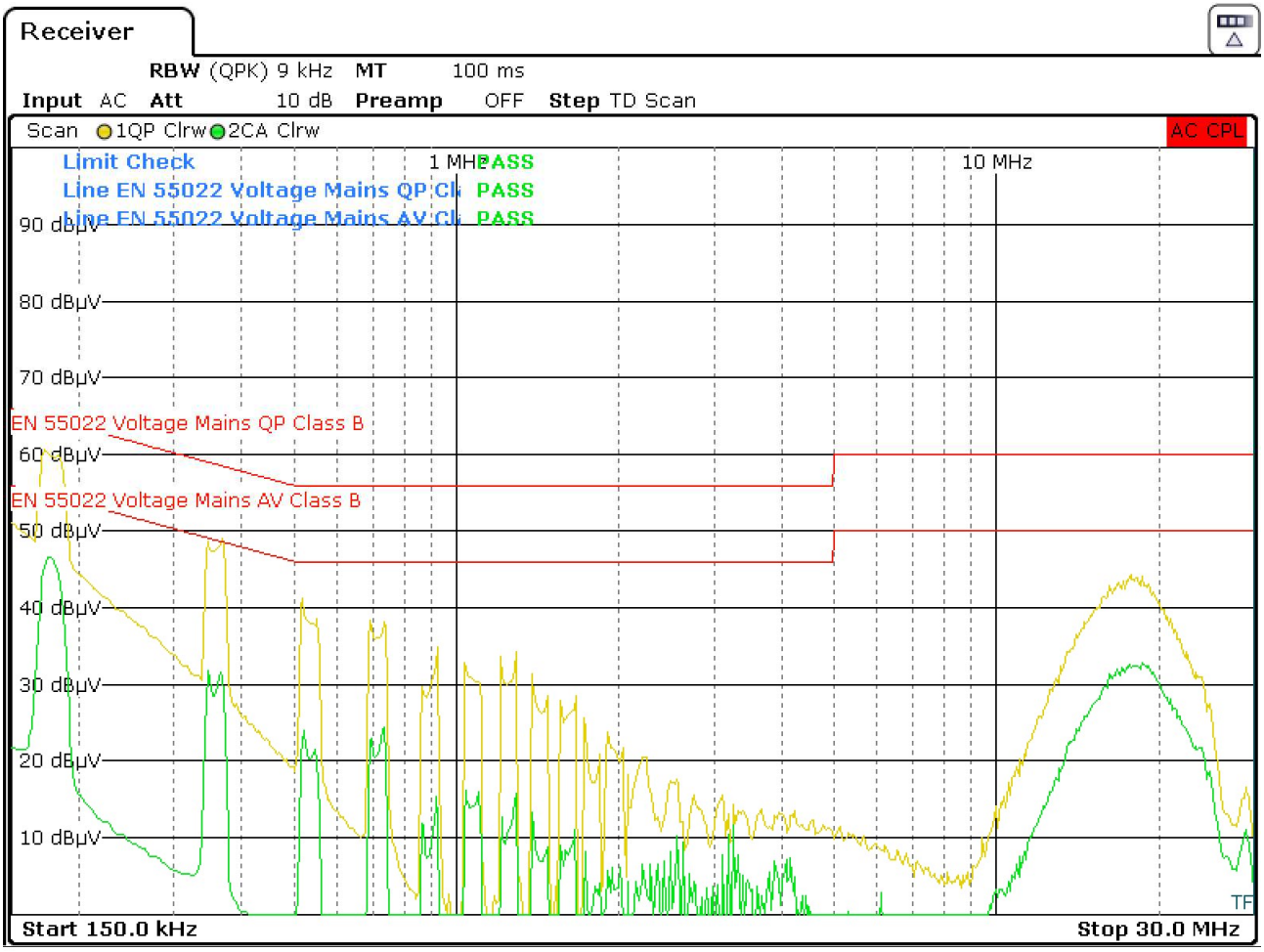


2.12.24 20V to 15V, 230VAC/50Hz Input, No Load



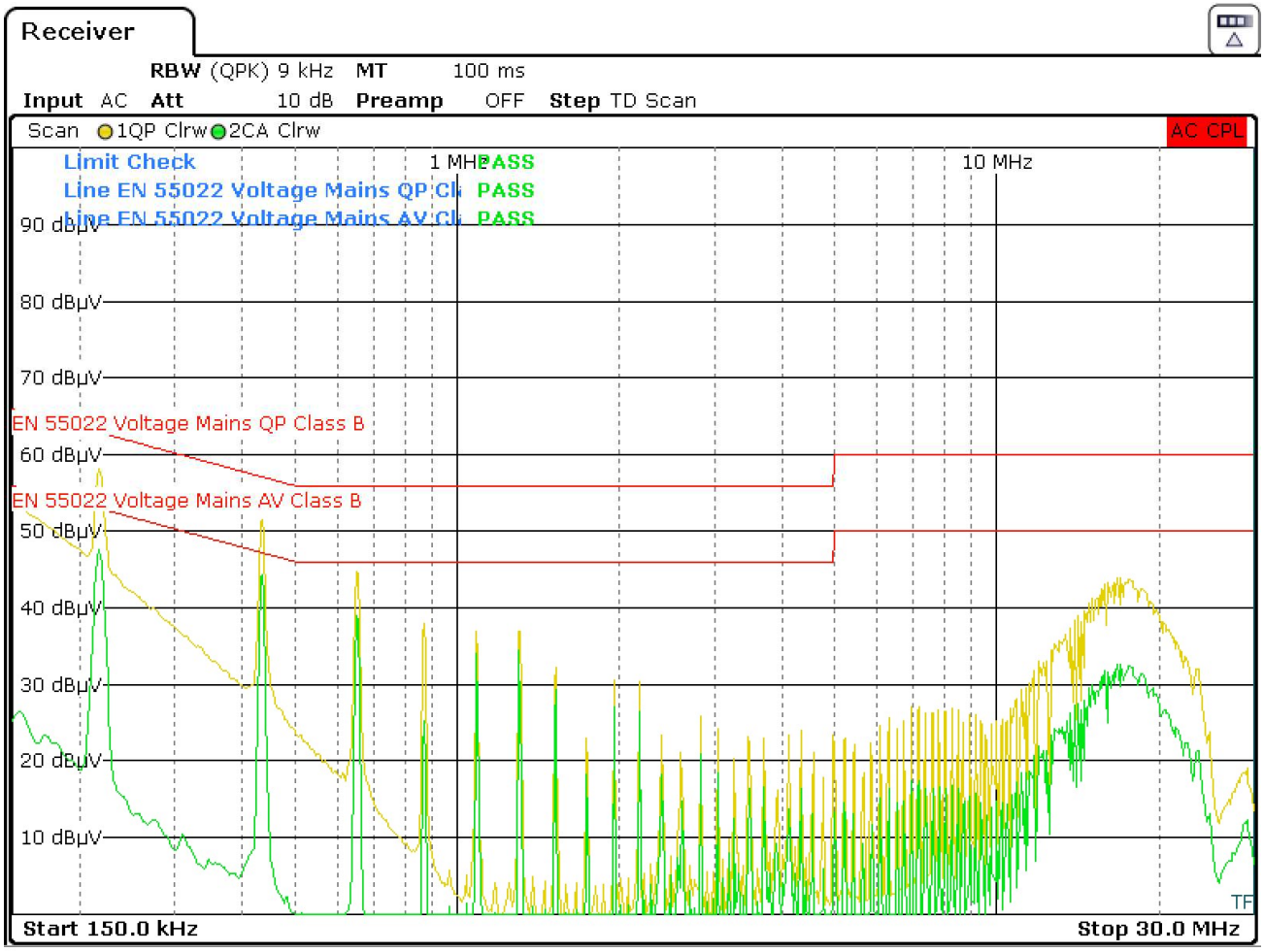
2.13 Conducted EMI

2.13.1 115VAC/60Hz Input, 20V/3.25A Output Tied to Earth Ground



Date: 13.JUN.2019 09:59:33

2.13.2 230VAC/50Hz Input, 20V/3.25A Output Tied to Earth Ground



Date: 13.JUN.2019 09:55:51

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