Microsemi

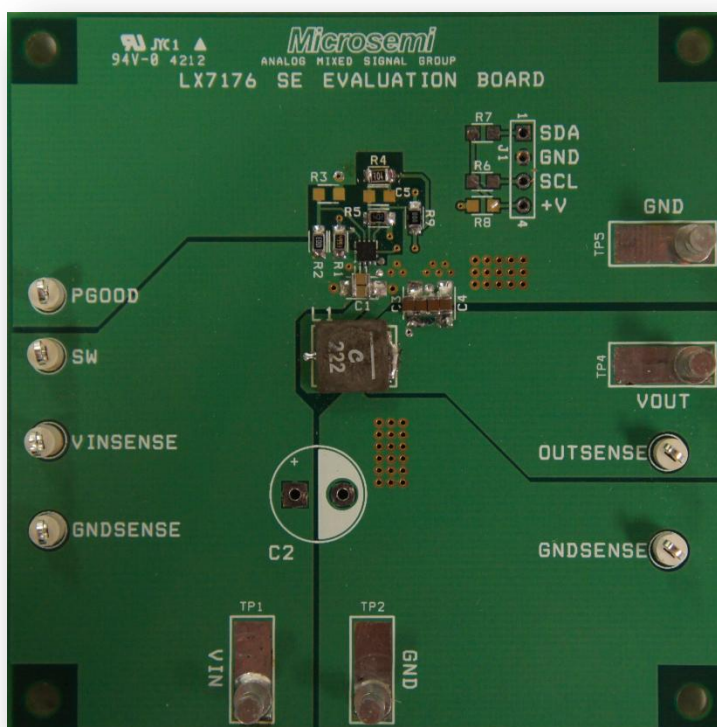# LX7176 EVALUATION BOARD USER GUIDE

1.65MHz 3A Synchronous Buck Converter

Table of Contents

Introduction to Product

The LX7176 is a 3A step-down regulator with integrated MOSFETs placed in a space saving QFN 2x2mm 12L package for today's mobile devices. It uses an ultra fast constant frequency hysteretic control method and a high switching frequency to minimize external filter components while maintaining excellent regulation. The LX7176 has a fixed 0.6V reference, Power Good, and Enable pins. The LX7176 operates from 4.0V to 5.5V rails.

Cycle-by-cycle current limiting protects against over-current conditions. The LX7176 operates in hiccup mode to further enhance the robustness of the converter for heavy over-load or short-circuit faults and it automatically recovers once the fault clears.

Thermal protection shuts down the regulator under over-temperature conditions. Over voltage conditions will immediately shut off the output to protect against permanent damage.

Key Features

♦ 0-3A Step-down Regulator

♦ Operational Input Supply Voltage Range: 4.0V-5.5V (short durations to 6.5V)

♦ Integrated PMOS and NMOS

♦ Hysteretic Control Offers Best Transient Response

♦ PWM Switching at a Constant 1.65MHz

♦ Input Under-voltage and Over-voltage Protection

♦ Enable and Power Good Function

♦ Internal Soft-start

♦ Cycle-by-Cycle Over Current Protection

♦ Hiccup Mode Protects Against Short Circuit Faults

♦ RoHS Compliant & Halogen Free

Applications

♦ High Performance HDD

♦ LCD TV

♦ Notebook/Netbook

♦ Server and Workstations

♦ Video Cards

Part Specific Information

IC Part Number	Description
LX7176CLQ	QFN 2x2mm 12L

Evaluation Board Part Number	Description
LX7176 SE Evaluation Board	Evaluation PCB for LX7176

Evaluation Board Schematic

Figure 1   Schematic of Evaluation Board

Basic Connection Instructions

Figure 2   Power Supply and Load Connection with I^{2}C Implemented

Recommended Operating Conditions

Description	Symbol	Min	Max	Unit
Input Voltage	VIN	4.0	5.5	V
Output Voltagae	VOUT	0.6	3.3	V
Output Current	I_{OUT}	0	3	A
Operating Ambient Temperature	T_A	0	85	°C
Enable Chip	EN	V_{IN}		
Shut Down Chip	EN		Pull to GND	

Setting the Output Voltage

The formula below gives the value of VOUT.

$$VOUT = V_{REF} \times \left(1 + \frac{R_4}{R_5}\right), \; V_{REF} \text{ is } 0.6V.$$

PCB Layout of Evaluation Board

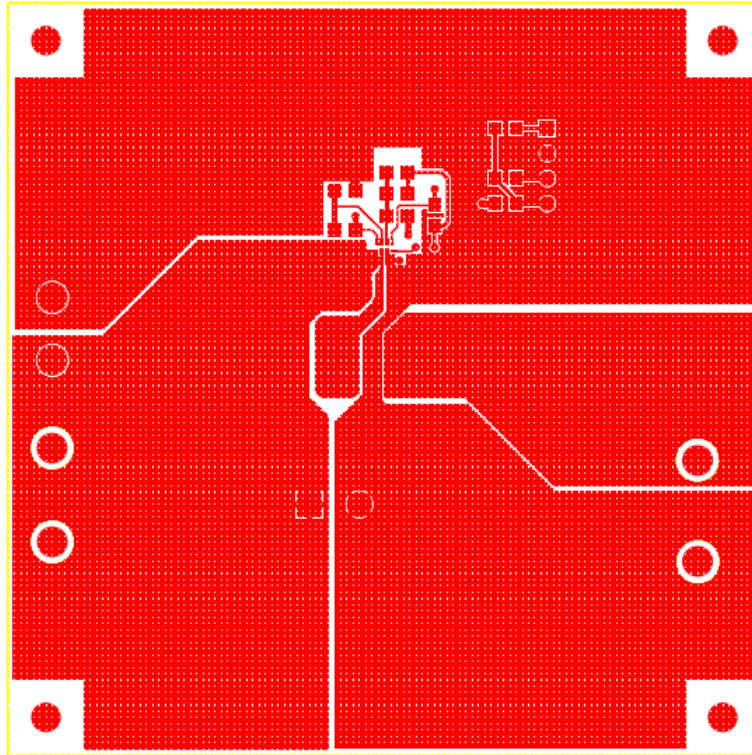The LX7176 EVAL Board is a 4-layer board.

Figure 5.   Top Silkscreen

Figure 6.   Top Layer
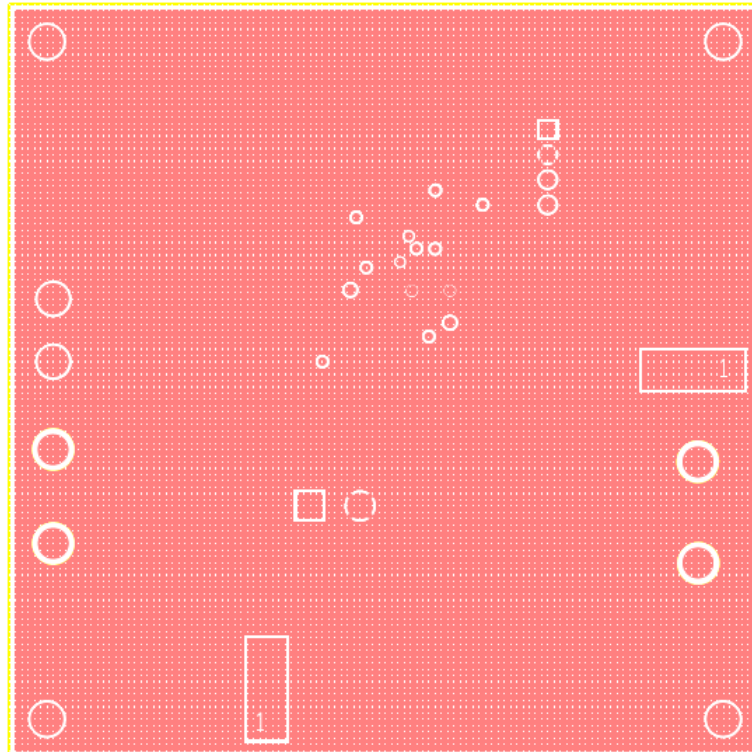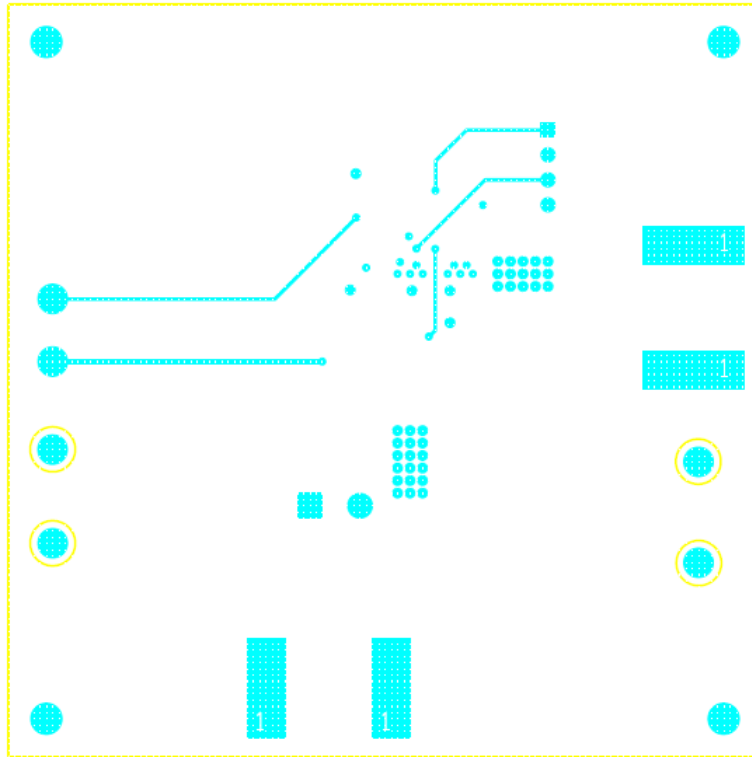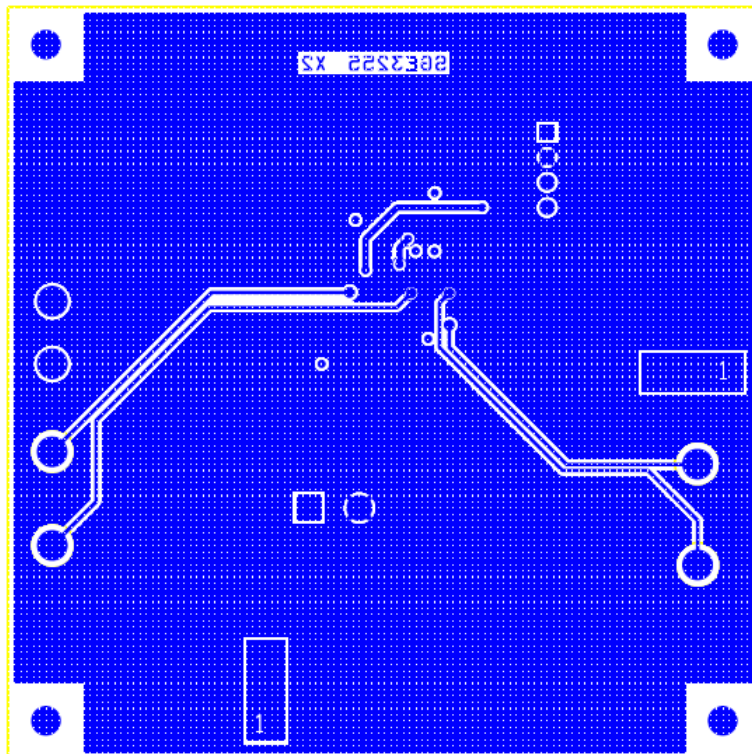

Figure 7.   Inner Layer 1

Figure 8.   Inner Layer 2

Figure 9.   Bottom Layer

Bill of Material

MISCELLANEOUS COMPONENTS			
Item	Part Description	Reference	Qty
1	Microsemi IC – LX7176	U1	1
2	Test Point	SW, PGOOD, VINSENSE, OUTSENSE, GNDSENSE, GNDSENSE	6
3	Terminal	VIN, VOUT, GND, GND	4
4	Jumper/4pin	J2	1

CAPACITORS			
Item	Part Description	Reference	Qty
5	10µF/10V/X5R	C1	2
6	47µF Electronic (Optional)	C2	1
7	22µF/6.3V/X5R	C3, C4	4

RESISTORS			
Item	Part Description	Reference	Qty
8	500kΩ	R1	1
9	100kΩ	R2, R4	2
10	200kΩ	R5	1
11	10kΩ	R6, R7	2
12	0	R9	1

INDUCTOR			
Item	Part Description	Reference	Qty
13	2.2µH	L1	1

Output Component Selection Table

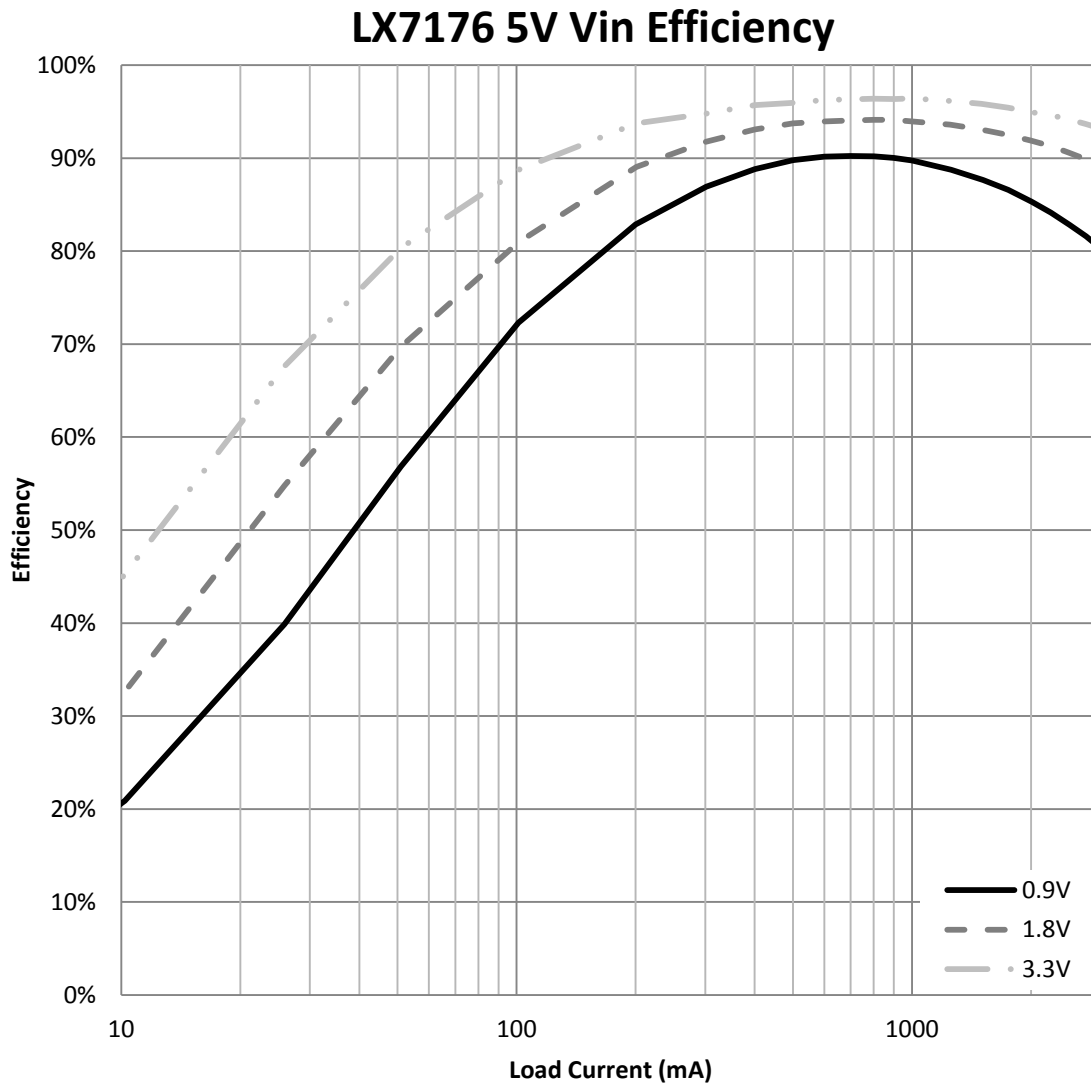| VOUT	Inductor (L1)	Upper Feedback Resistor (R4)	Lower Feedback Resistor (R5)	Output Capacitor (C3 & C4)
0.9V	2.2µH	100kΩ	200kΩ	4x22µF
1.8V	4.9µH	200kΩ	100kΩ	4x22µF
3.3V	1.0µH	453kΩ	100kΩ	4x22µF

Efficiency Plot

Figure 10   Efficiency Plot of LX7176

Dynamic Load Response Scope Shots

Dynamic load response with 1.0↔2.5A load, 4x22µF C$_{OUT}$
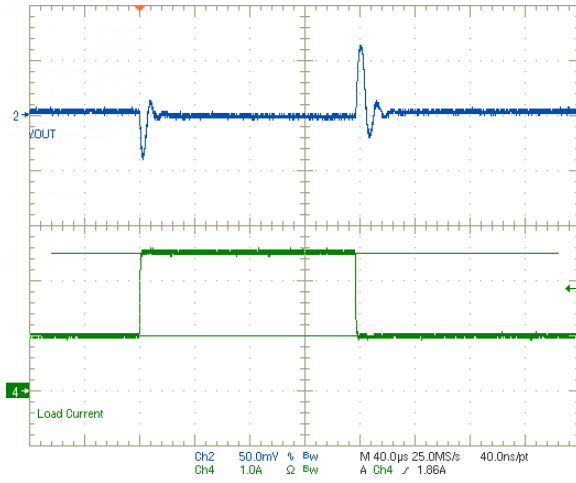

Figure 11 VOUT = 0.9V, L = 2.2 µH
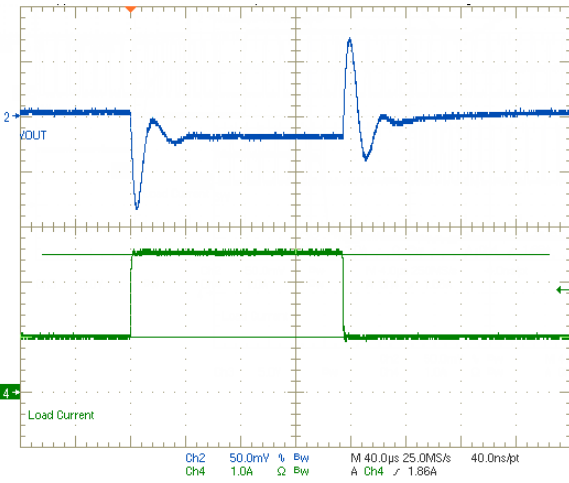CH2: VOUT, CH4: Load Current

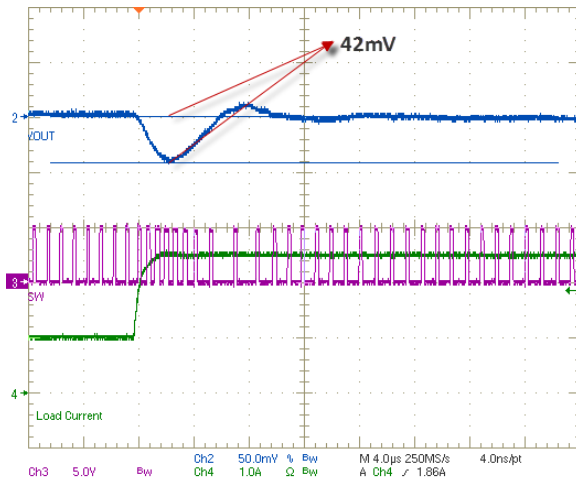Figure 11 VOUT = 1.8V, L = 4.9µH
CH2: VOUT, CH4: Load Current

Figure 11 Rising Edge
VOUT = 0.9V, L = 2.2µH
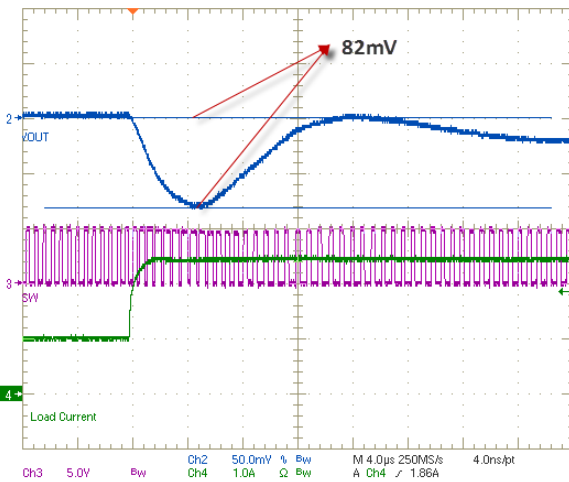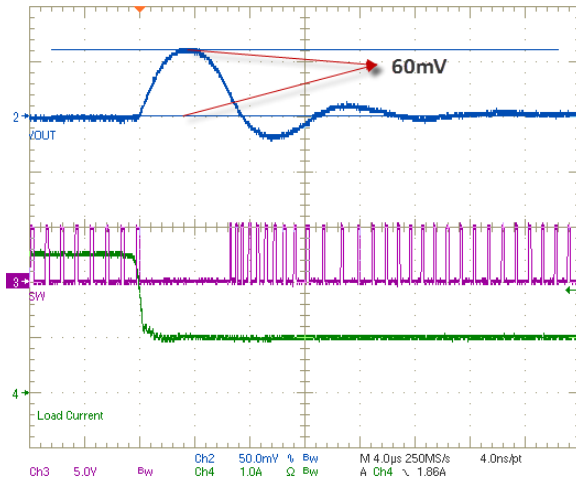CH2: VOUT, CH3: SW, CH4: Load Current

Figure 11 Rising Edge
VOUT = 1.8V, L = 4.9µH
CH2: VOUT, CH3: SW, CH4: Load Current

Dynamic Load Response Scope Shots (Continue)

Figure 11 Falling Edge
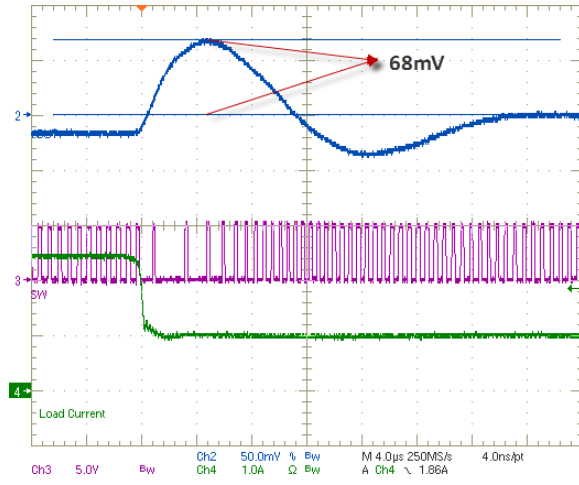VOUT = 0.9V, L = 2.2µH
CH2: VOUT, CH3: SW, CH4: Load Current

Figure 11 Falling Edge
VOUT = 1.8V, L = 4.9µH
CH2: VOUT, CH3: SW, CH4: Load Current
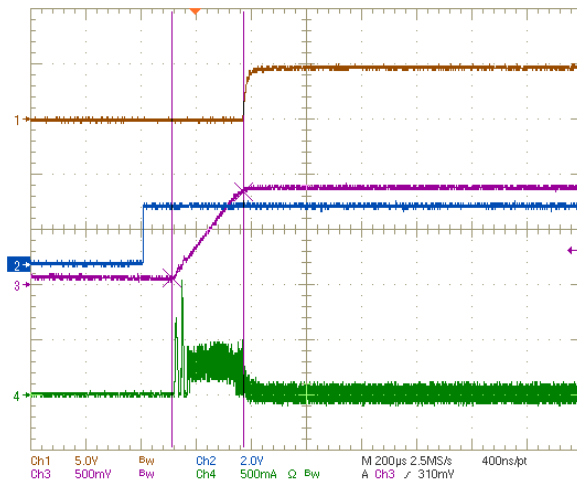
Start up and Short Condition

Figure 11 Startup with toggled EN
CH1: PGOOD, CH2: EN,
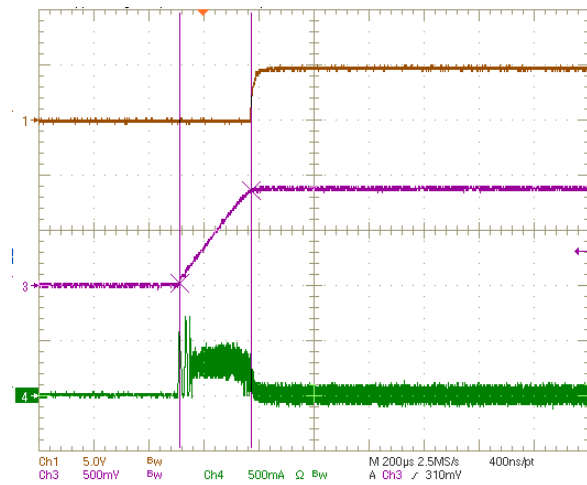CH3: VOUT, CH4: Inductor Current

Figure 11 Soft start VIN tied to EN
CH1: PGOOD,
CH3: VOUT, CH4: Inductor Current

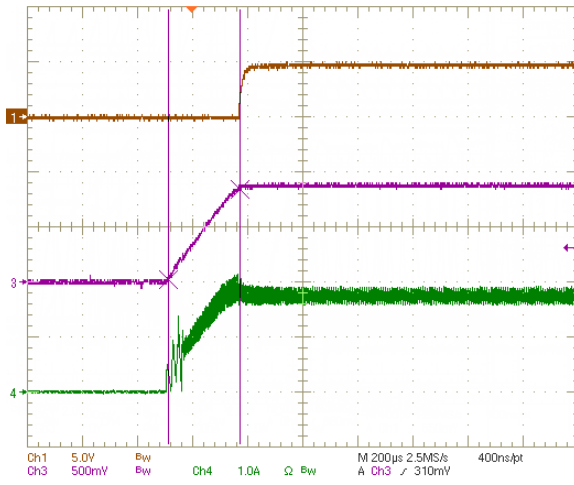# Start up and Short Condition (Continue)

Figure 11 Start up when Load=0.5ohm
CH1: PGOOD,
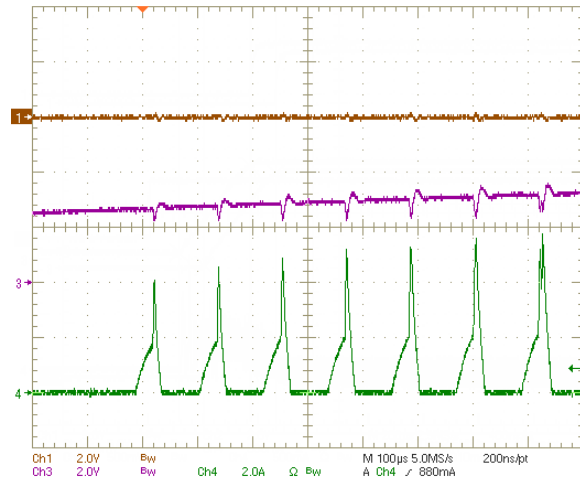CH3: VOUT, CH4: Inductor Current

Figure 11 Power into short
CH1: VOUT,
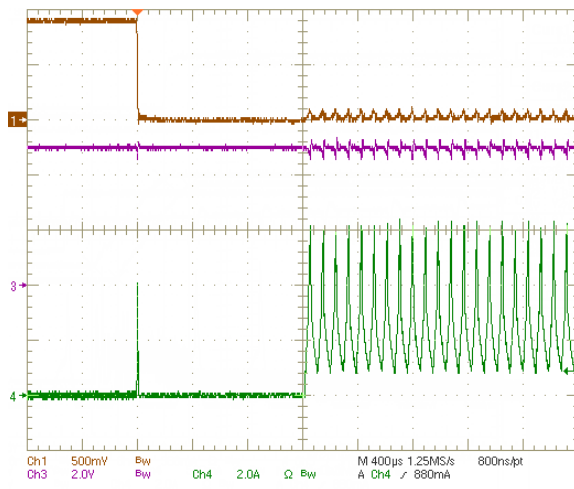CH3: VIN, CH4: Inductor Current

Figure 11 Short after power up
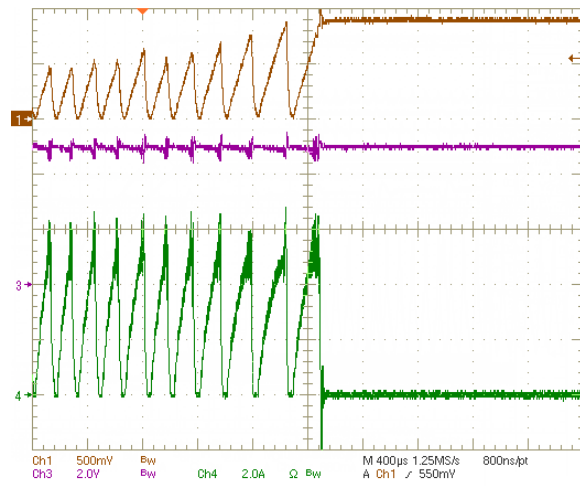CH1: VOUT,
CH3: VIN, CH4: Inductor Current

Figure 11 Recovery from short
CH1: VOUT,
CH3: PGOOD, CH4: Inductor Current