

**LX7180A**  
**User Guide**  
**LX7180A 4 Amp Step-Down Converter Evaluation Board**



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# 1 Revision History

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The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

## 1.1 Revision 1.0

This document was published in November 2017. It was the first publication of this document.

## 2 Product Description

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The LX7180A is a 4 A step-down regulator with integrated MOSFETs packaged in a space-saving QFN12 2 mm × 2 mm for today's mobile devices. It uses an ultra-fast, constant frequency hysteretic control method to minimize external filter components while maintaining excellent regulation. The LX7180A reference voltage is programmable from 0.6 V to 1.195 V through a high speed (up to 3.4 MHz), bi-directional I<sup>2</sup>C bus.

The LX7180A operates from 3 V to 5.5 V rails and outputs 0.6 V to 100% of the input voltage.

Cycle-by-cycle current limiting protects against over-current conditions. Hiccup mode provides protection for heavy over-load or short-circuit faults. Thermal protection shuts down the regulator under over-temperature conditions. Over voltage conditions will immediately shut off the output to protect against permanent damage. The LX7180A automatically restarts when all fault conditions are cleared.

### 2.1 Applications

- High-performance HDDs
- LCD TVs
- Notebooks/netbooks
- Servers and workstations
- Video cards
- PoE-powered devices
- Smartphones

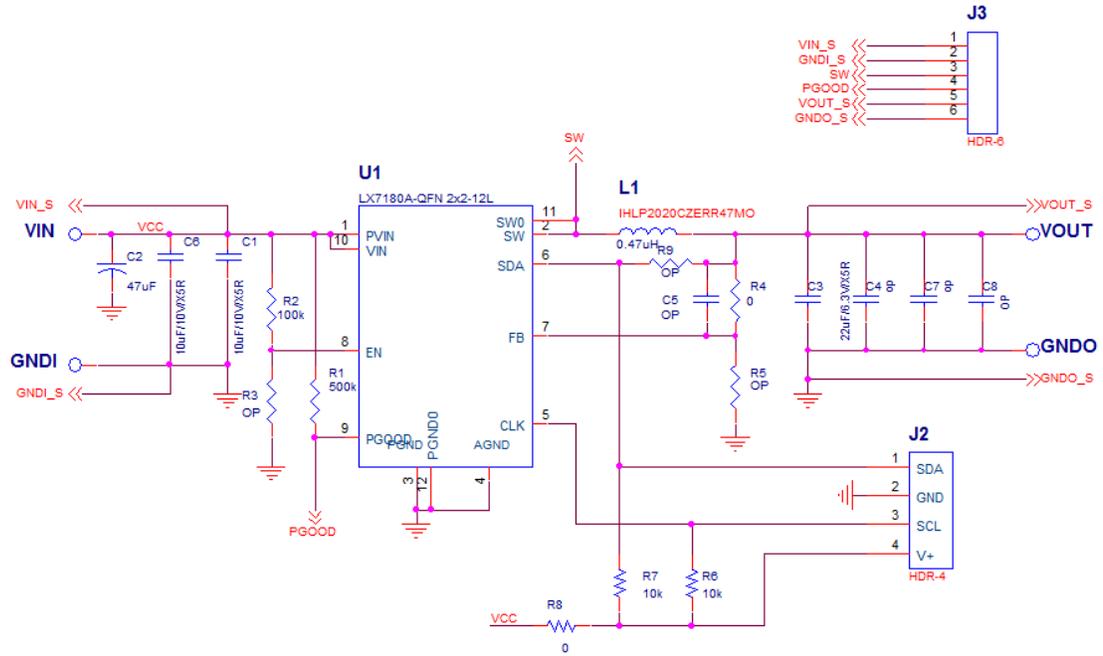
### 2.2 Key Features

- 0 A–4 A step-down regulator
- Operational input supply voltage range: 3.0 V–5.5 V (short durations to 6.5 V)
- Hysteretic control offers best transient response
- PWM switching at a constant 1.65 MHz
- Power save mode (PSM) can be selected to improve light load efficiency
- 100% duty ratio operation
- Input under-voltage and over-voltage protection
- Enable and Power Good function
- I<sup>2</sup>C serial interface at 3.4 Mbps
- Internal soft-start
- Cycle-by-cycle over current protection
- Hiccup mode protects against short circuit faults
- Seven-bit adjustable reference voltage through I<sup>2</sup>C bus
- RoHS-compliant

### 3 Evaluation Board Schematic

The following illustration shows the evaluation board schematic.

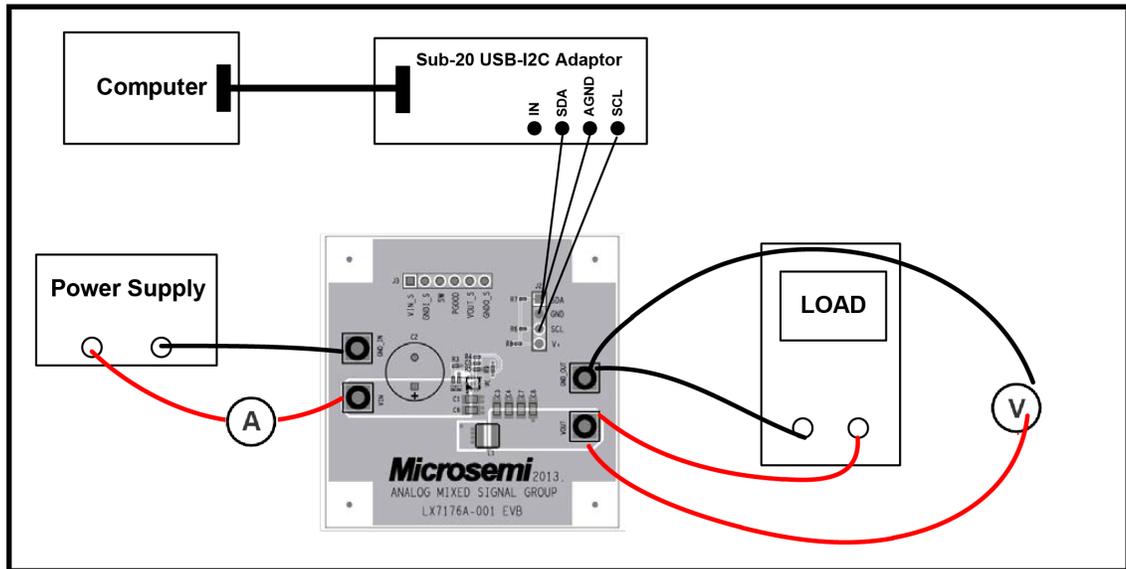
Figure 1 • Evaluation Board Schematic



## 4 Basic Connection Instructions

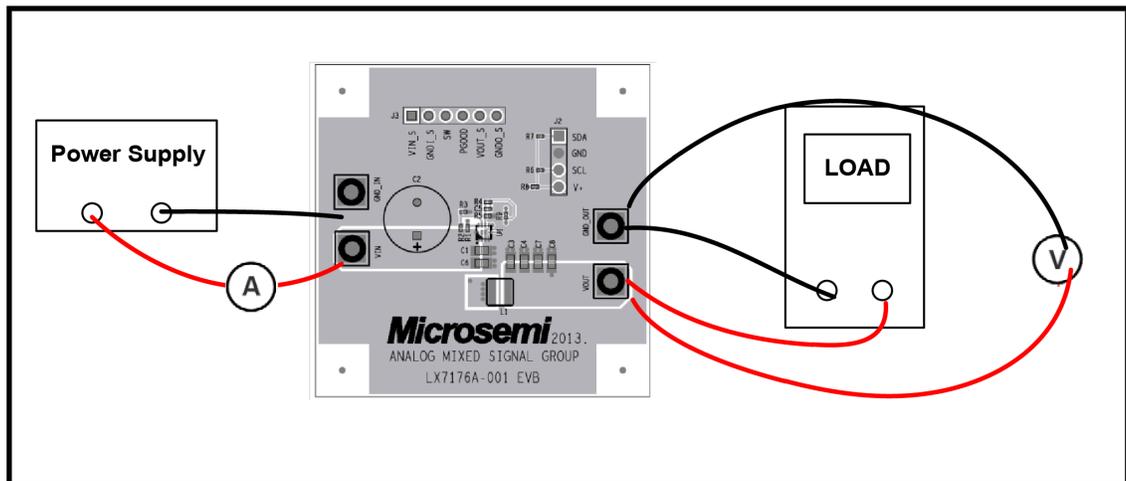
The following illustration shows how to connect the evaluation board to the power supply while I<sup>2</sup>C is implemented.

**Figure 2 • Power Supply and Load Connection with I<sup>2</sup>C Implemented**



The following illustration shows how to connect the board to the power supply without I<sup>2</sup>C.

**Figure 3 • Power Supply and Load Connection Without I<sup>2</sup>C Implemented**



## 5 Recommended Operating Conditions

The following table lists the recommended operating characteristics for the LX7180A evaluation board.

**Table 1 • Operating Conditions**

Description	Symbol	Minimum	Maximum	Unit
Input voltage	V <sub>IN</sub>	3.0	5.5	V
Output voltage	V <sub>OUT</sub>	0.6	5.5	V
Output current (V <sub>IN</sub> = 3 V to 5 V)	I <sub>OUT</sub>	0	4	A
Operating ambient temperature	T <sub>A</sub>	0	85	°C
Enable chip	EN	V <sub>IN</sub>		
Shut down chip	EN		Pull to GND	

### 5.1 Enabling Regulator from I<sup>2</sup>C Bus

In addition to the EN pin, the regulator can be enabled and disabled through the I<sup>2</sup>C bus by programming the control register. During disable, the regulator and most of the support circuitry is turned off. However, the I<sup>2</sup>C bus circuitry is still active and may be programmed.

### 5.2 Setting the Output Voltage

Using the I<sup>2</sup>C interface, you can adjust V<sub>OUT</sub> from 0.6 V to 1.2 V. When the I<sup>2</sup>C interface is implemented, the reference voltage is programmed with the I<sup>2</sup>C bus VSEL register value.

$$V_{REF} = 0.6V + V_{SEL} \times 0.0047V$$

Where V<sub>SEL</sub> is the decimal value of the 7 VSEL bits.

In case a higher output voltage is needed, it must be programmed through an external resistor divider connected from software to V<sub>OUT</sub> then to GND.

The following formula calculates the value of V<sub>OUT</sub> based on the resistor divider R1 and R2.

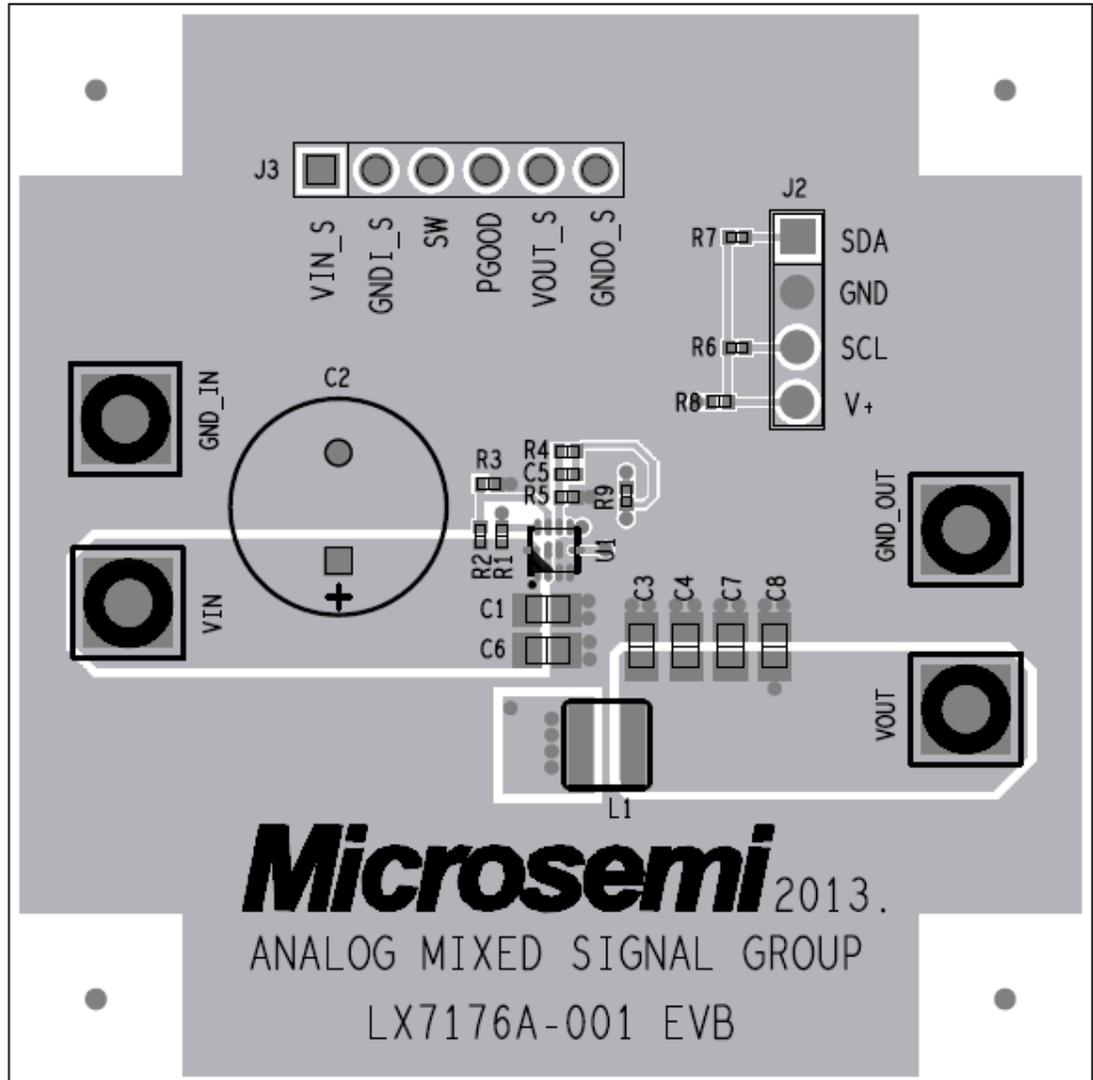
$$V_{OUT} = V_{REF} \times \left( 1 + \frac{R1}{R2} \right)$$

V<sub>REF</sub> is determined by the chip. For example, to set the LX7180A to a V<sub>OUT</sub>= 1.8 V, given V<sub>REF</sub>= 0.6 V, first pick the lower resistor R2= 120K, calculate the upper resistor R1= 240K.

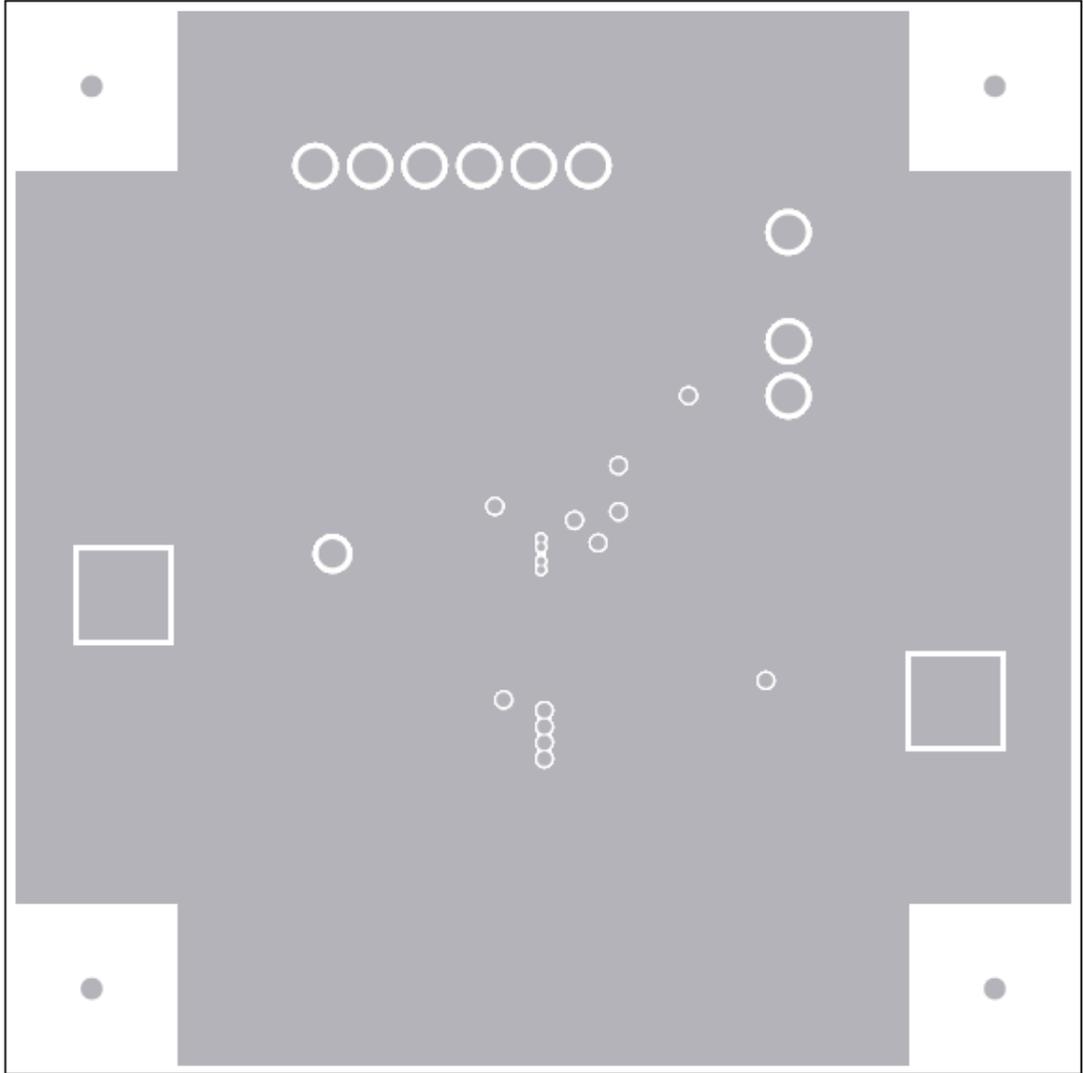
## 6 PCB Layout of Evaluation Board

The LX7180A evaluation board is a four-layer board. The recommended distance between ground layer and the top layer is 6 mil. The following illustrations depict each of the board's four layers.

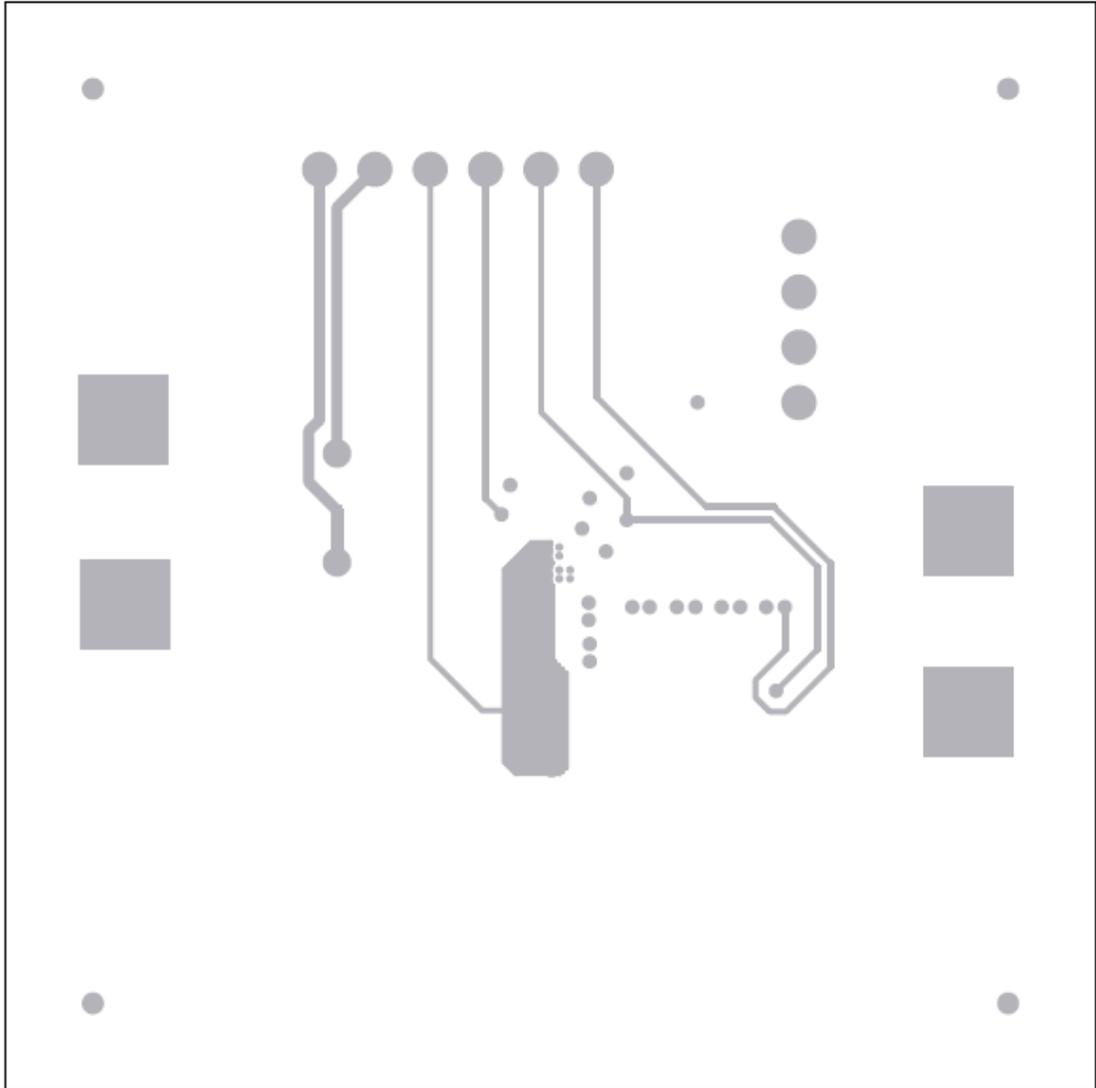
Figure 4 • Layer 1: Top



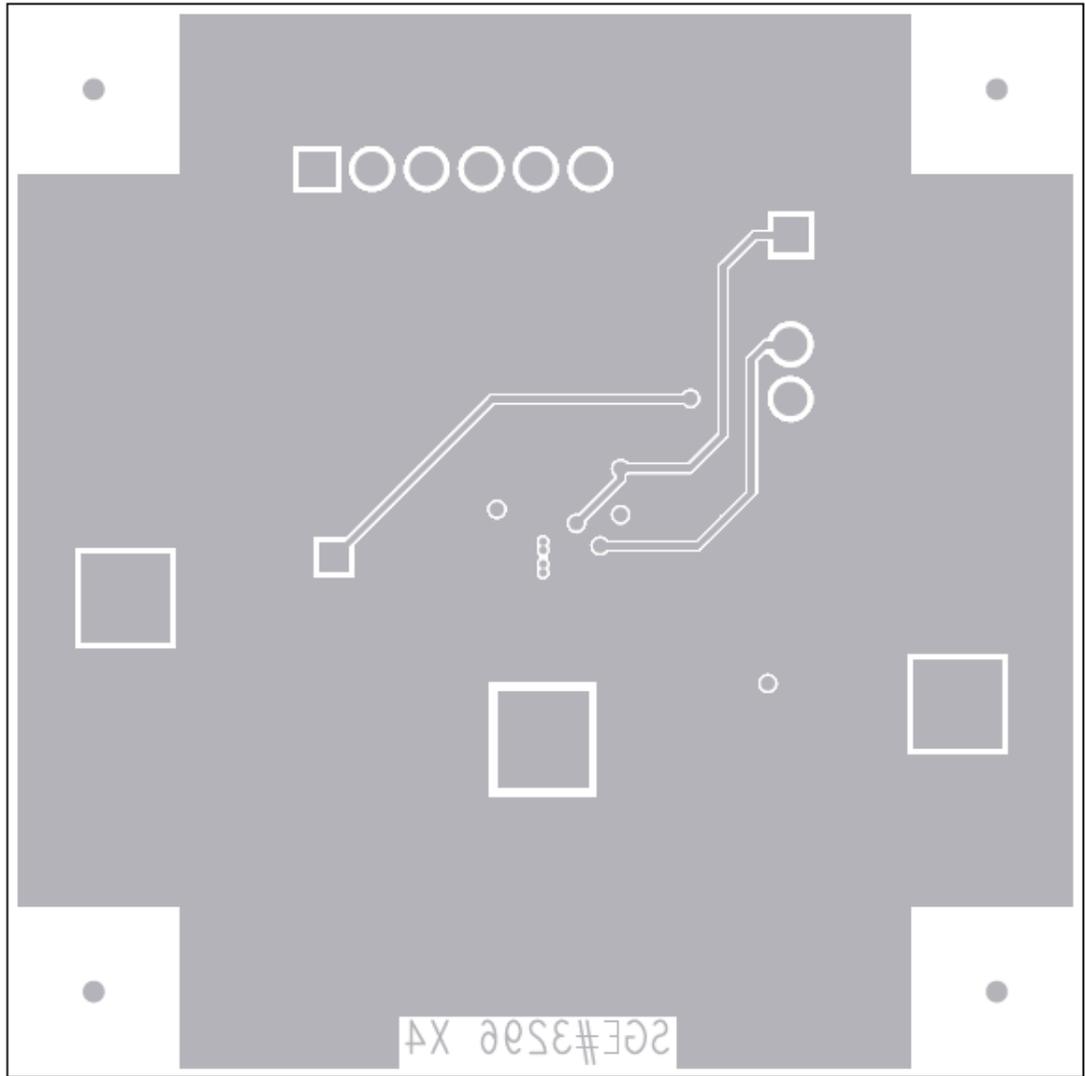
**Figure 5 • Layer 2: Ground**



**Figure 6 • Layer 3: Sense**



**Figure 7 • Layer 4: Bottom**



## 7 Bill of Materials

The following table lists the bill of materials (BOM) for the LX7175 evaluation board.

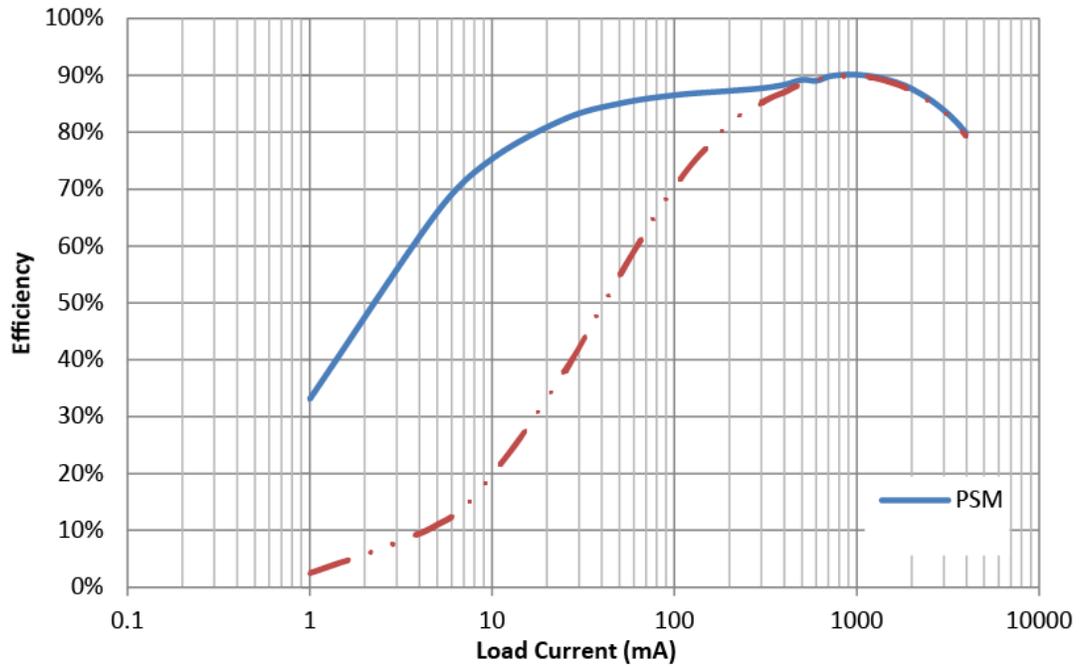
**Table 2 • BOM**

Item	Part Description	Reference	Quantity
1	Microsemi IC—LX7180A-xy	U1	1
2	Test Point (J3)	SW, PGOOD, VIN_S, VO_S, GND_S, GND_S	6
3	Terminal	VIN, VOUT, GND, GND	4
4	Jumper/4 pin	J2	1
5	10 $\mu$ F/10 V/10%/0805/X5R	C1, C6	2
6	47 $\mu$ F Electronic/35V	C2	1
7	22 $\mu$ F/6.3 V/10%/0805/X5R	C3	1
8	500 k $\Omega$ /1%/0402	R1	1
9	100 k $\Omega$ /1%/0402	R2	1
10	0 $\Omega$ /1%/0402	R4, R8	2
11	10 k $\Omega$ /1%/0402	R6, R7	1
12	0.47 $\mu$ H – IHLP2020CZERR47MO	L1	1

## 8 Efficiency Plot

The following graph shows the efficiency of the LX7180A at a voltage output of 1 V.

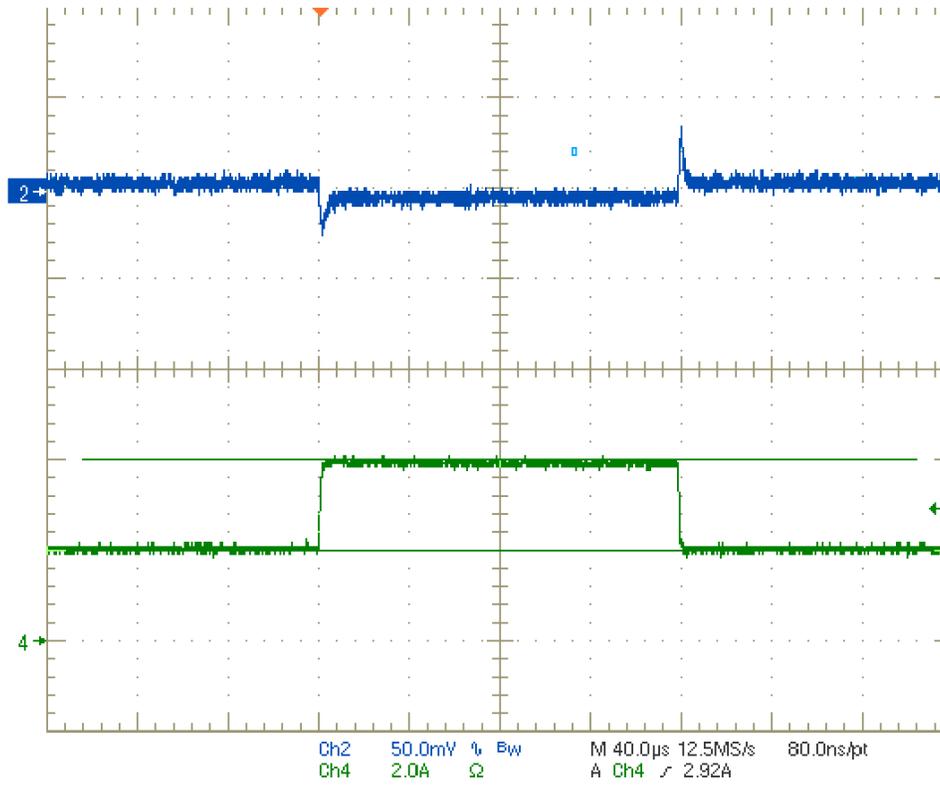
Figure 8 • Efficiency Plot



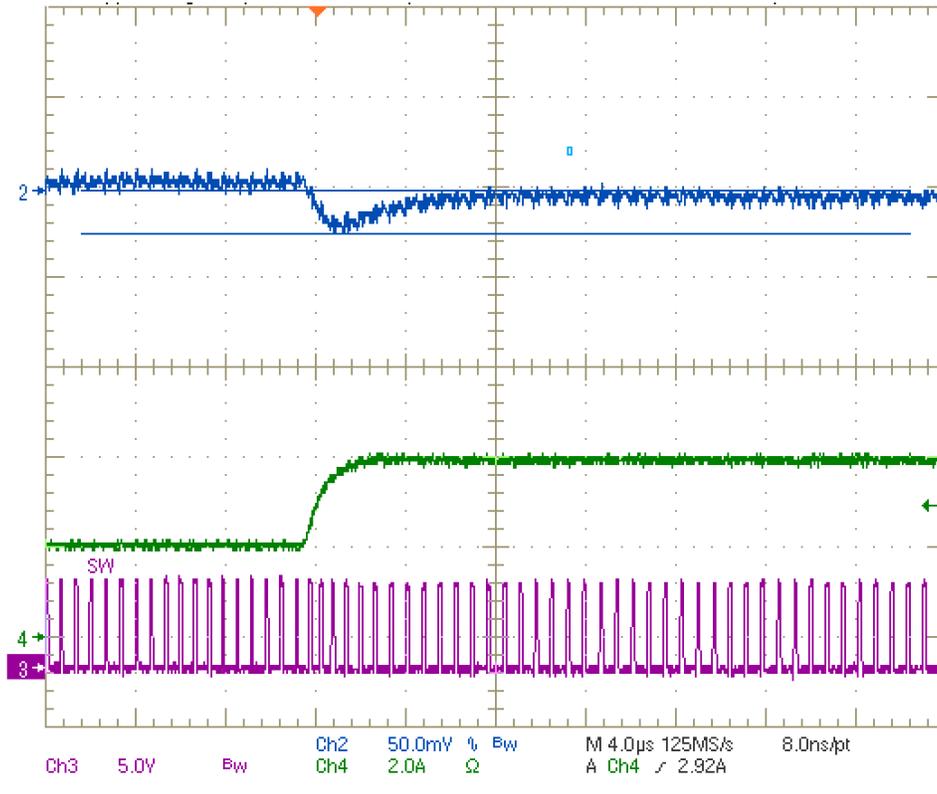
## 9 Dynamic Load Response Scope Shots

The following illustrations show the dynamic load response for the evaluation board.

Figure 9 • Step Response

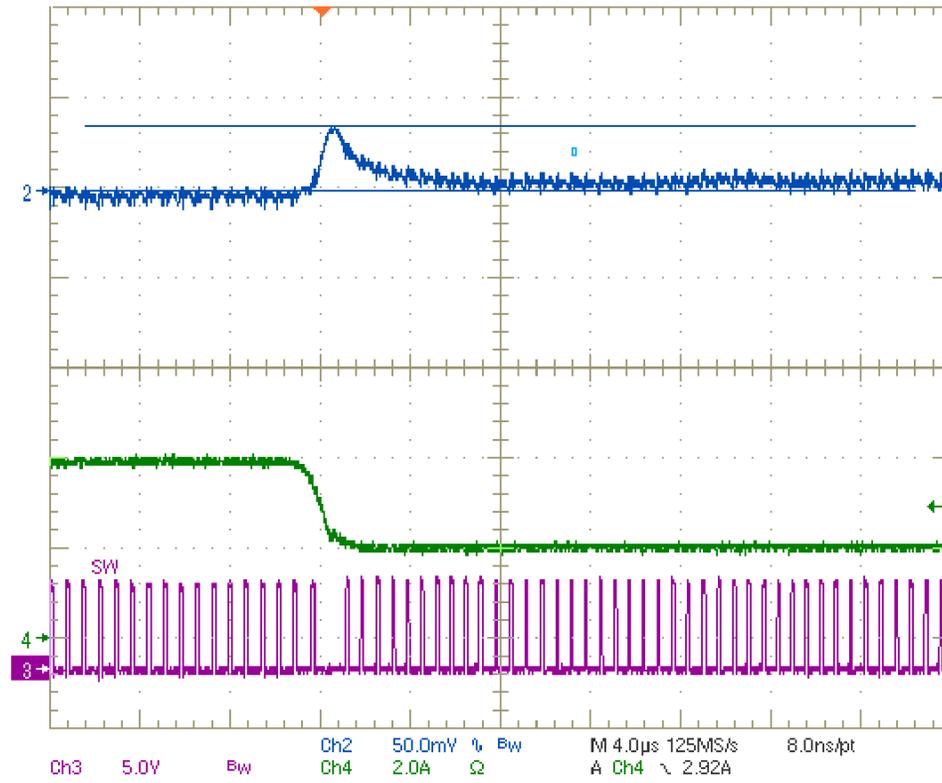


**Note:** CH2: VOUT, CH4: ILOAD.

**Figure 10 • Step Response Rising Edge**

**Note:** CH2: VOUT, CH3: SW Node, CH4: I<sub>LOAD</sub>.

Figure 11 • Step Response Falling Edge

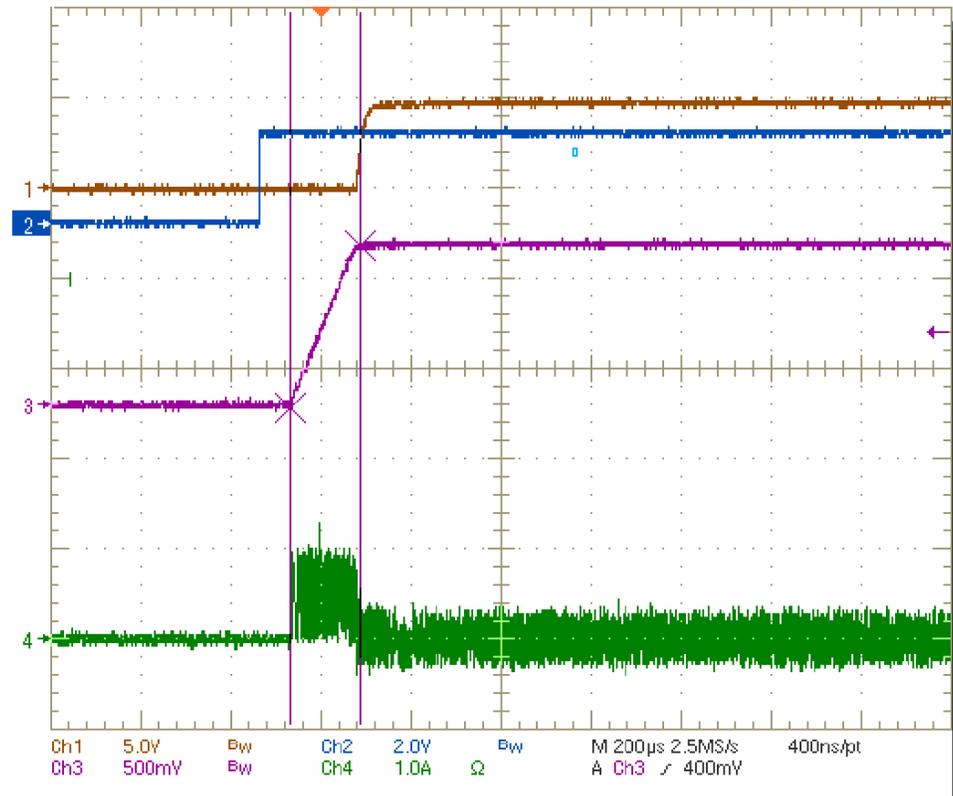


**Note:** CH2: VOUT, CH3: SW Node, CH4: ILOAD.

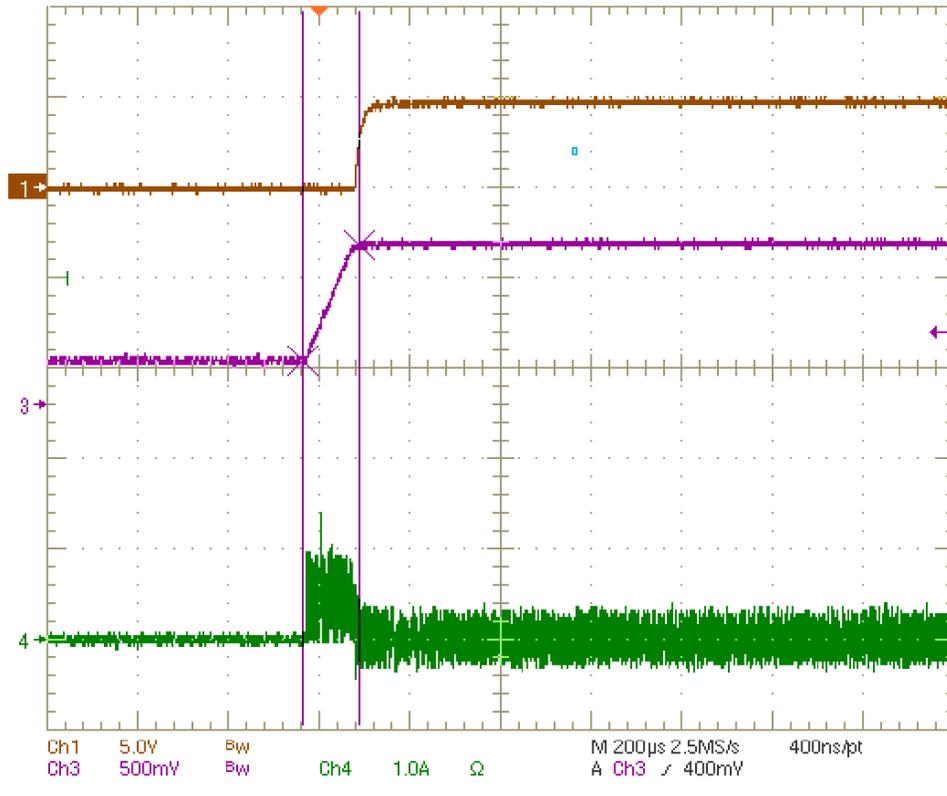
## 10 Start-up and Short Condition Scope Shots

The following illustrations show the scope shots for the LX7180A.

**Figure 12 • Start-up With ENABLE Toggled**



**Note:** CH1: PG, CH2: EN, CH3:  $V_{out}$ , CH4: inductor current.

**Figure 13 • Soft-Start VIN Tied to ENABLE**

**Note:** CH1: PG, CH3:  $V_{OUT}$ , CH4: inductor current.

## 11 Ordering Information

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**Table 3 • Ordering Information**

Part Number	Description
LX7180A-01CLQ	QFN 2 mm × 2 mm 12L IC
LX7180A-11CLQ	
LX7180A-21CLQ	
LX7180A-31CLQ	
LX7180A-xyCLQ <sup>1</sup>	
LX7176A EVAL BOARD	Evaluation PCB for LX7180A

<sup>1</sup>Consult factory for other I<sup>2</sup>C slave address and set output voltage options.

"x" stands for the 2 LSB bits of the binary I<sup>2</sup>C slave address (0 to 3), and "y" is the set output voltage (0 is 0.6 V, 1 is 0.9 V, 2 is 0.95 V, and 3 is 0.97 V).

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