LX7180A

User Guide

LX7180A 4 Amp Step-Down Converter Evaluation Board

Contents

1 Revision History

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

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 I²C 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

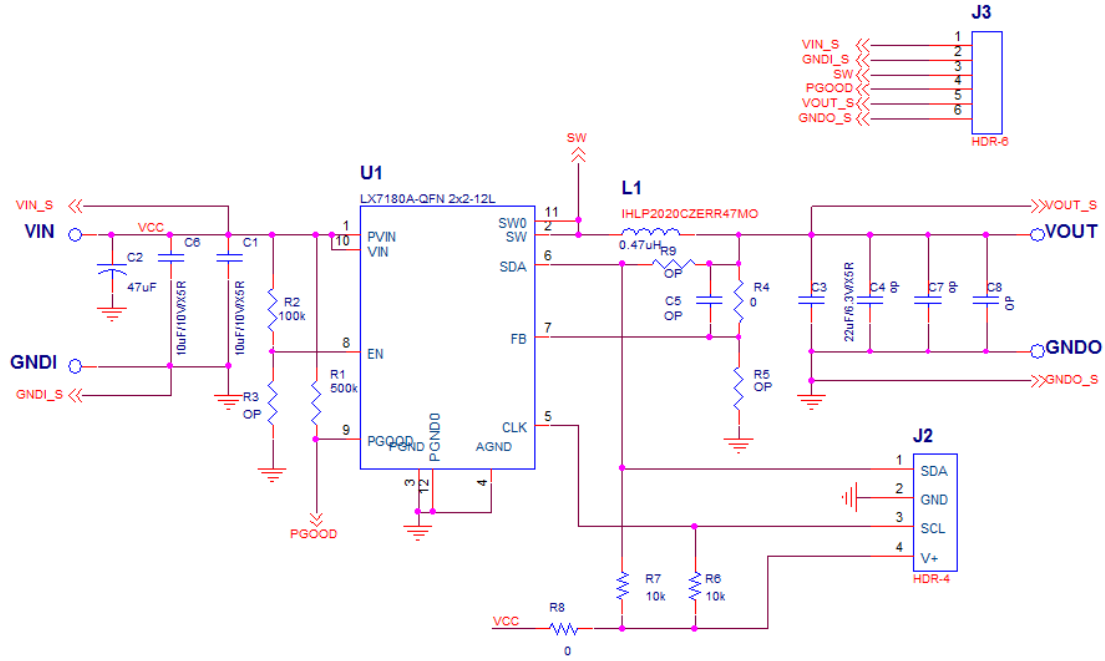
2.2 Key Features

- 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
- I²C 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 I²C bus
- RoHS-compliant

3 Evaluation Board Schematic

The following illustration shows the evaluation board schematic.

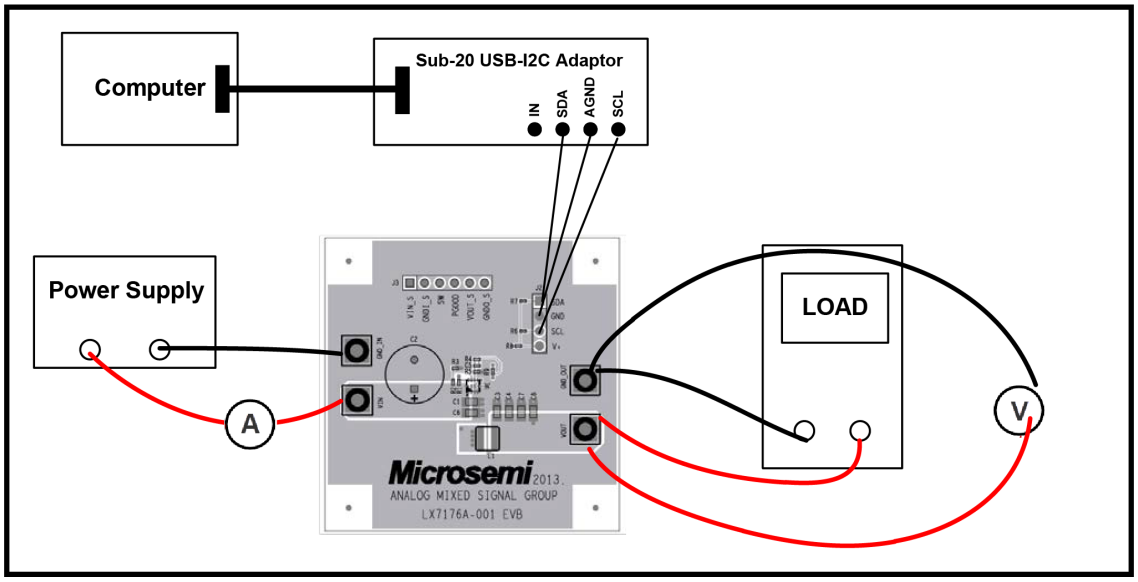
Figure 1 • Evaluation Board Schematic



4 Basic Connection Instructions

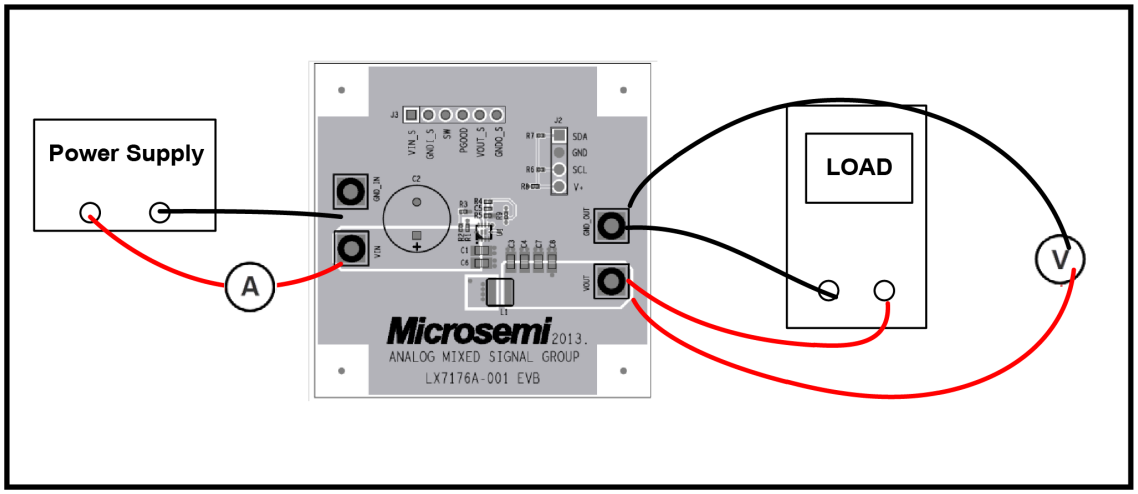
The following illustration shows how to connect the evaluation board to the power supply while I²C is implemented.

Figure 2 • Power Supply and Load Connection with I²C Implemented



The following illustration shows how to connect the board to the power supply without I²C.

Figure 3 • Power Supply and Load Connection Without I²C 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_{IN}	3.0	5.5	V
Output voltage	V_{OUT}	0.6	5.5	V
Output current (V_{IN}= 3 V to 5 V)	I_{OUT}	0	4	A
Operating ambient temperature	T_A	0	85	°C
Enable chip	EN	V_{IN}		
Shut down chip	EN		Pull to GND	

5.1 Enabling Regulator from I²C Bus

In addition to the EN pin, the regulator can be enabled and disabled through the I²C bus by programming the control register. During disable, the regulator and most of the support circuitry is turned off. However, the I²C bus circuitry is still active and may be programmed.

5.2 Setting the Output Voltage

Using the I²C interface, you can adjust V_{OUT} from 0.6 V to 1.2 V. When the I²C interface is implemented, the reference voltage is programmed with the I²C bus VSEL register value.

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

Where V_{SEL} 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_{OUT} then to GND.

The following formula calculates the value of V_{OUT} based on the resistor divider R1 and R2.

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

V_{REF} is determined by the chip. For example, to set the LX7180A to a VOUT= 1.8 V, given V_{REF}= 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

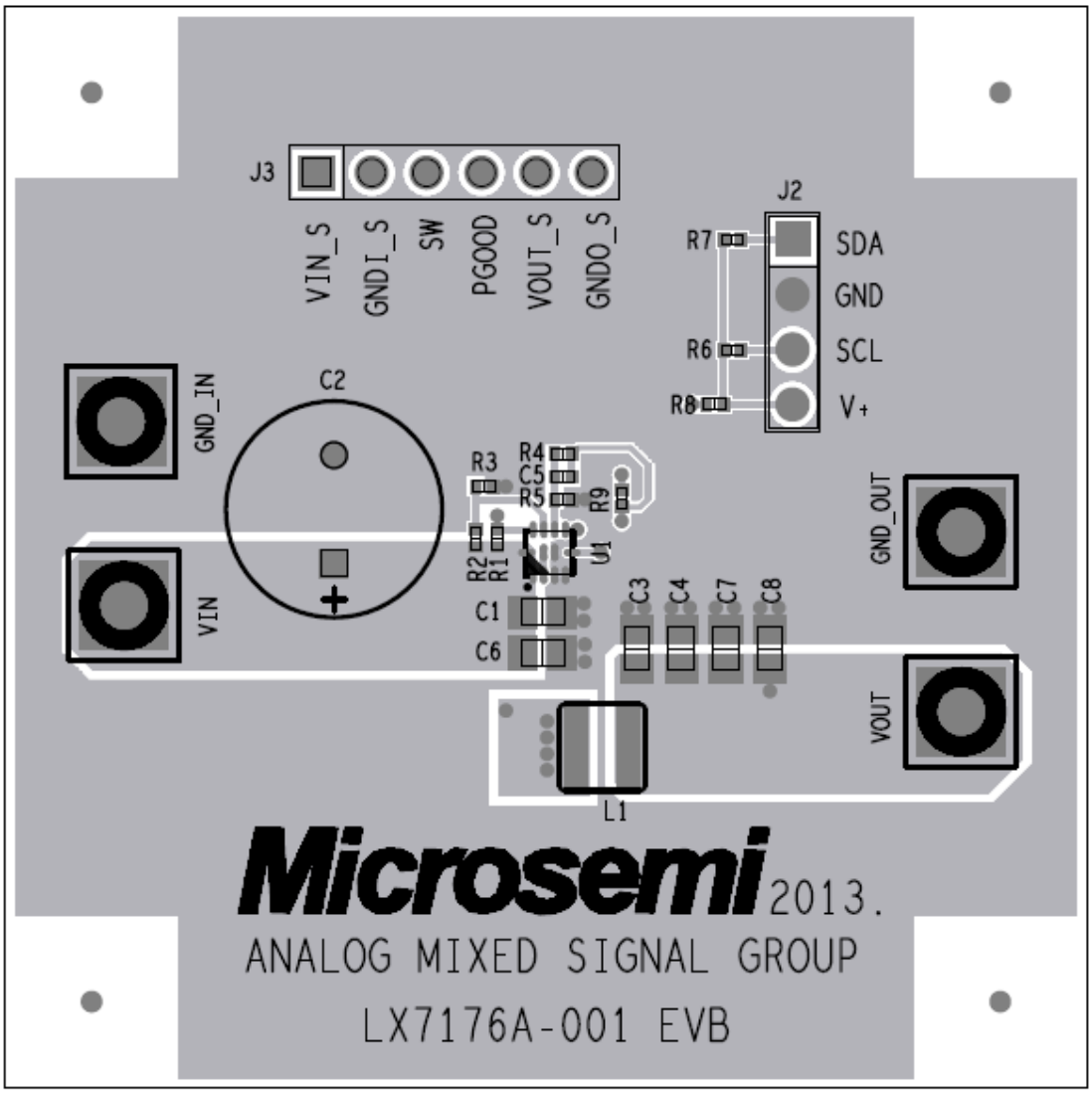


Figure 5 • Layer 2: Ground

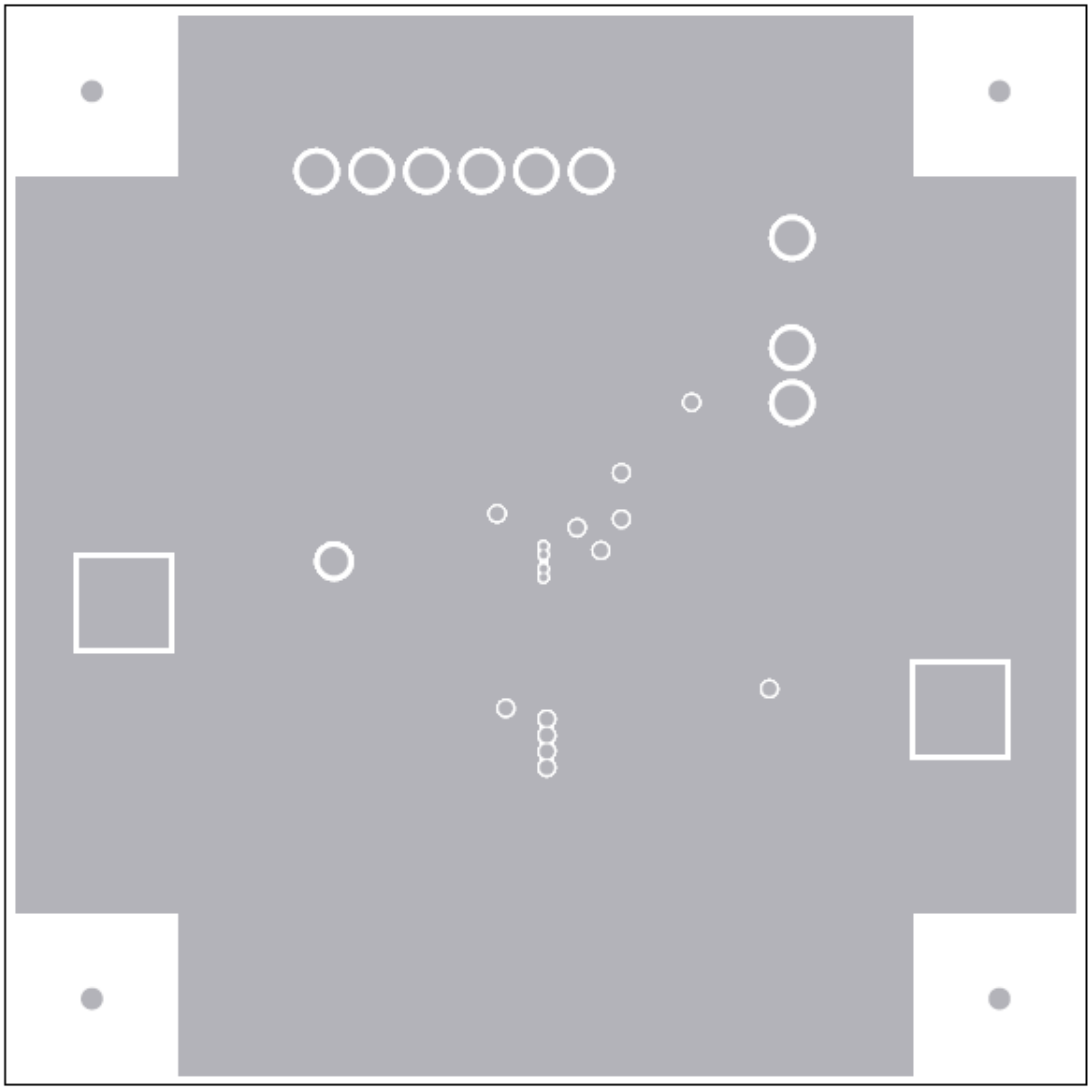


Figure 6 • Layer 3: Sense

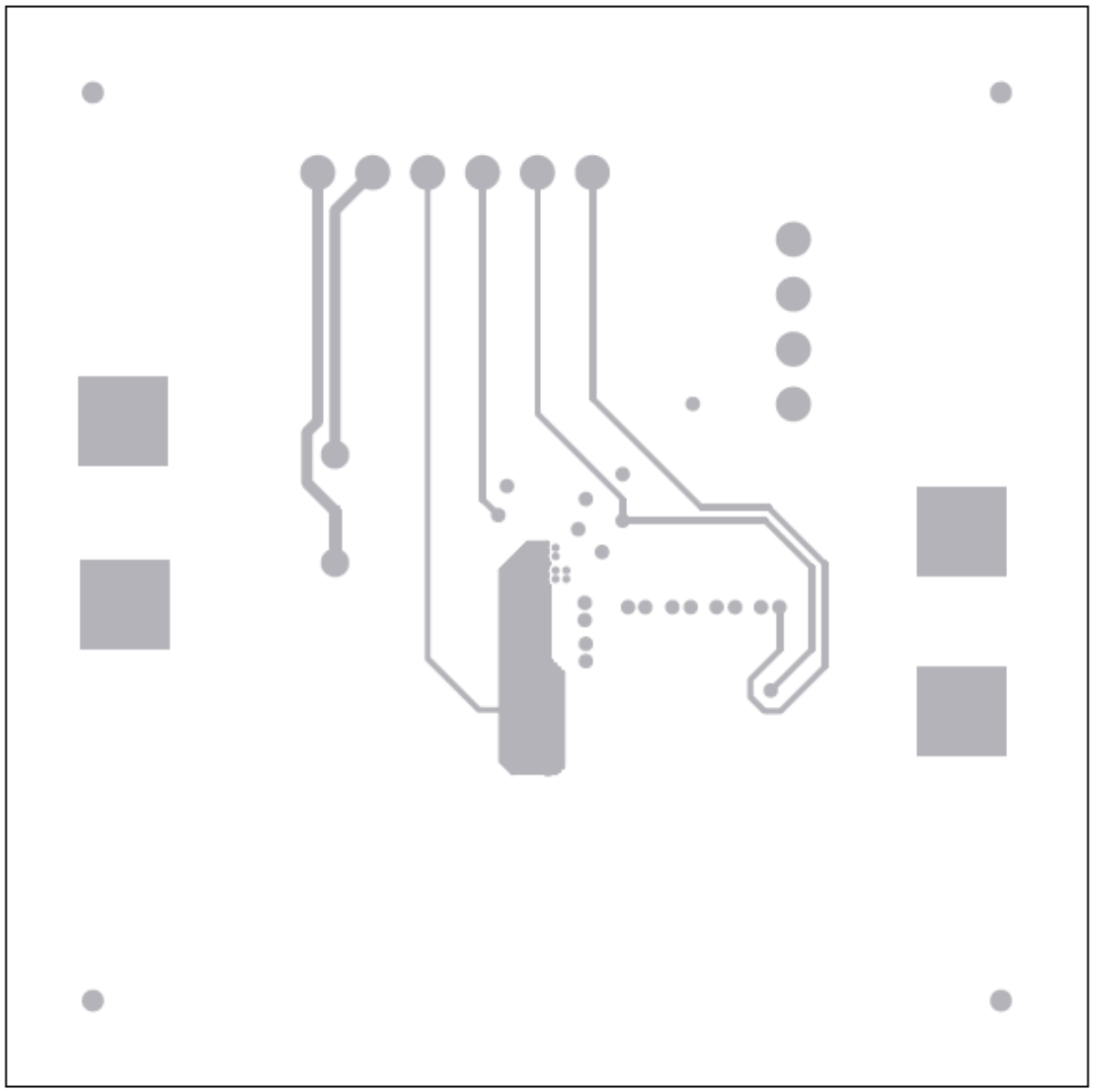
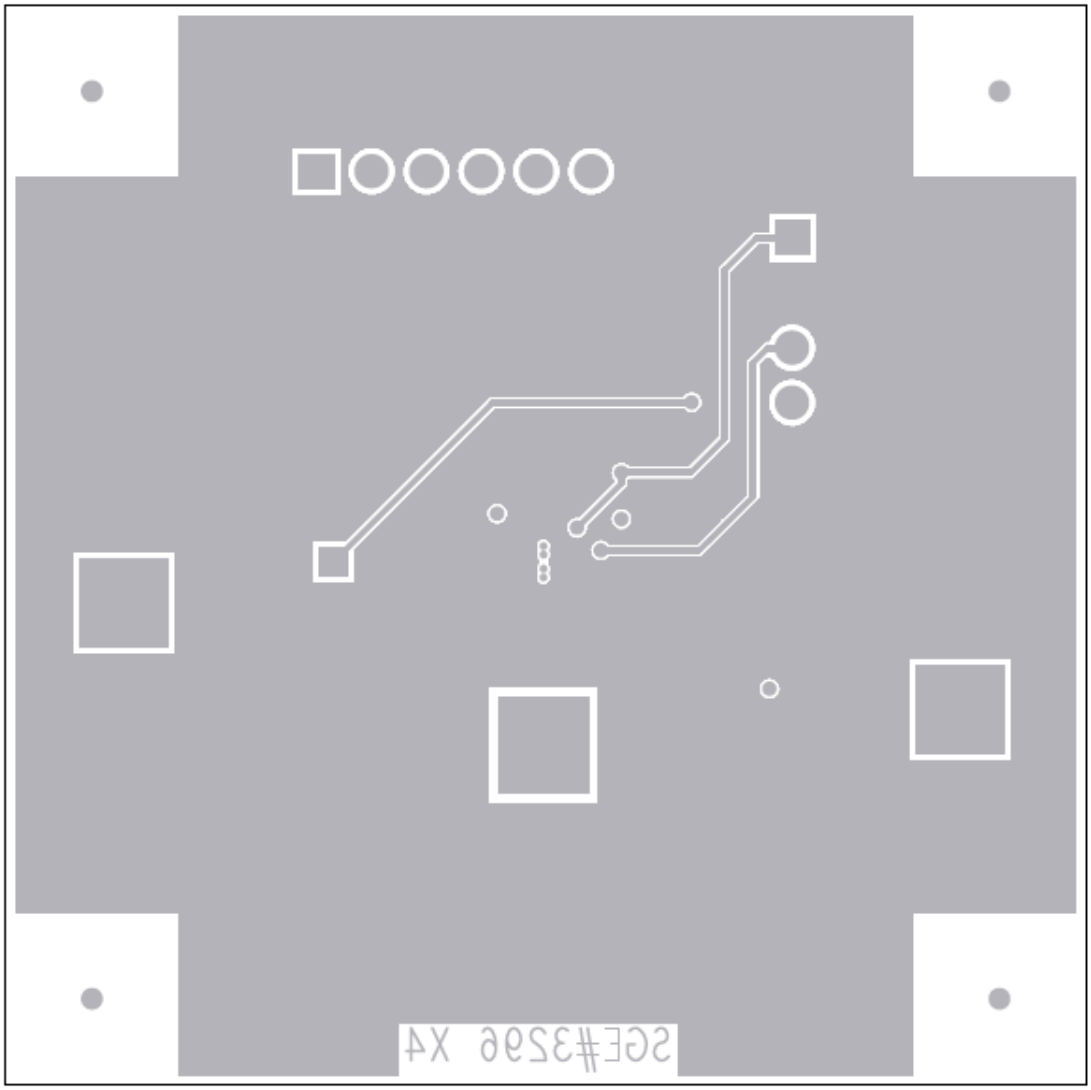


Figure 7 • Layer 4: Bottom



7 Bill of Materials

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

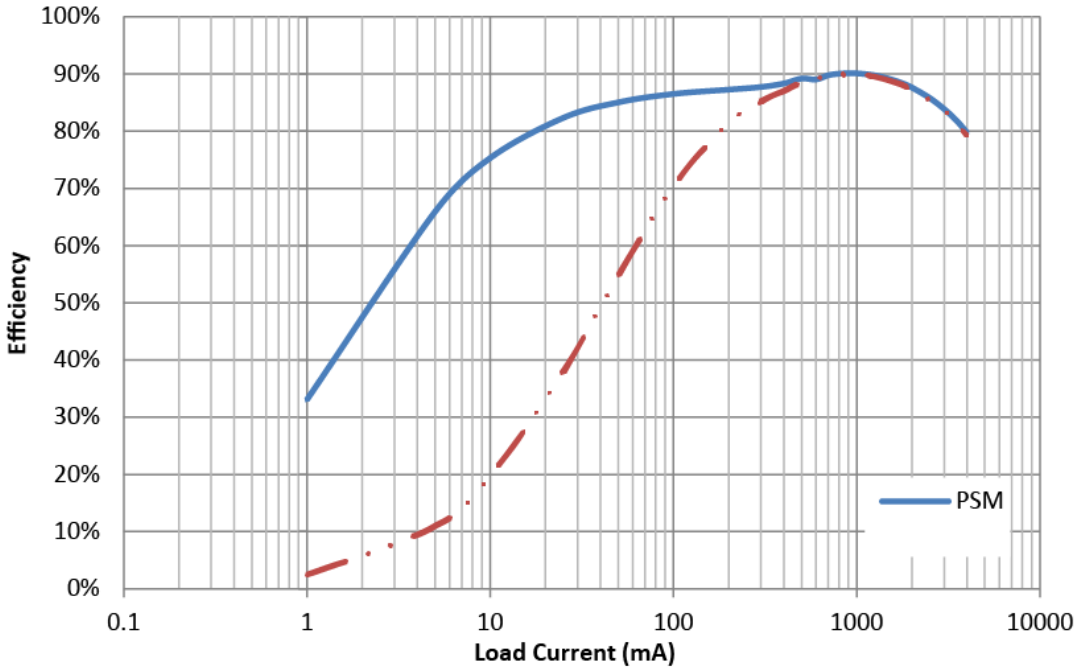
Table 2 • BOM

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 µF/10 V/10%/0805/X5R	C1, C6	2
6	47 µF Electronic/35V	C2	1
7	22 µF/6.3 V/10%/0805/X5R	C3	1
8	500 kΩ/1%/0402	R1	1
9	100 kΩ/1%/0402	R2	1
10	0 Ω/1%/0402	R4, R8	2
11	10 kΩ/1%/0402	R6, R7	1
12	0.47 µH – IHLP2020CZERR47MO	L1	1

8 Efficiency Plot

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

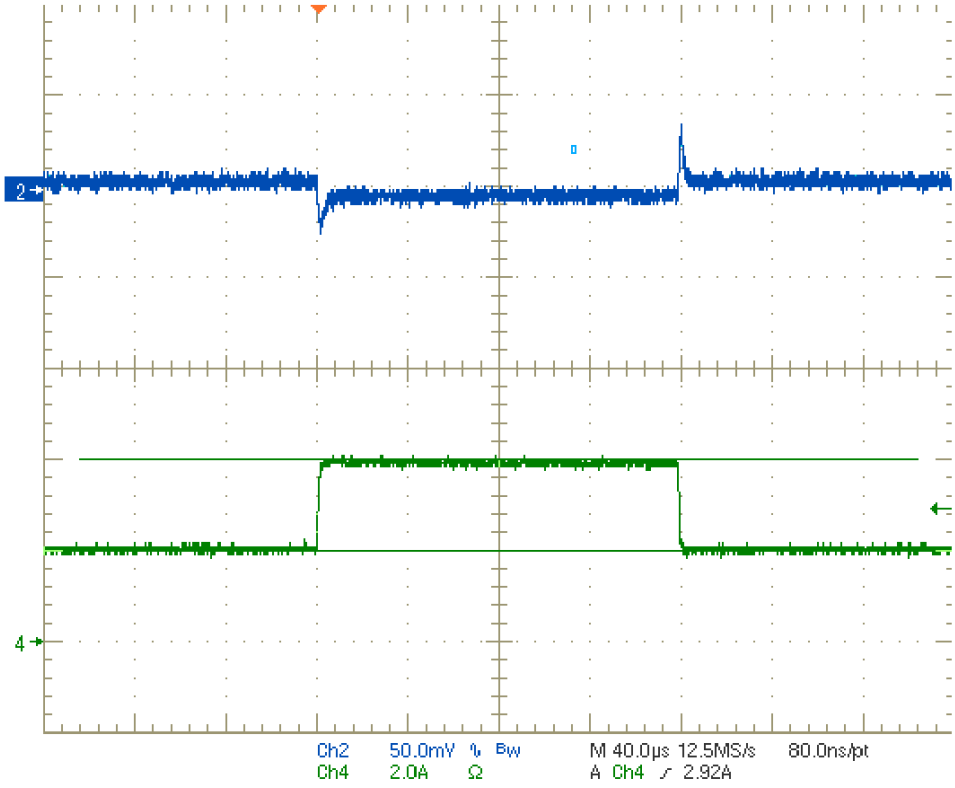
Figure 8 • Efficiency Plot



9 Dynamic Load Response Scope Shots

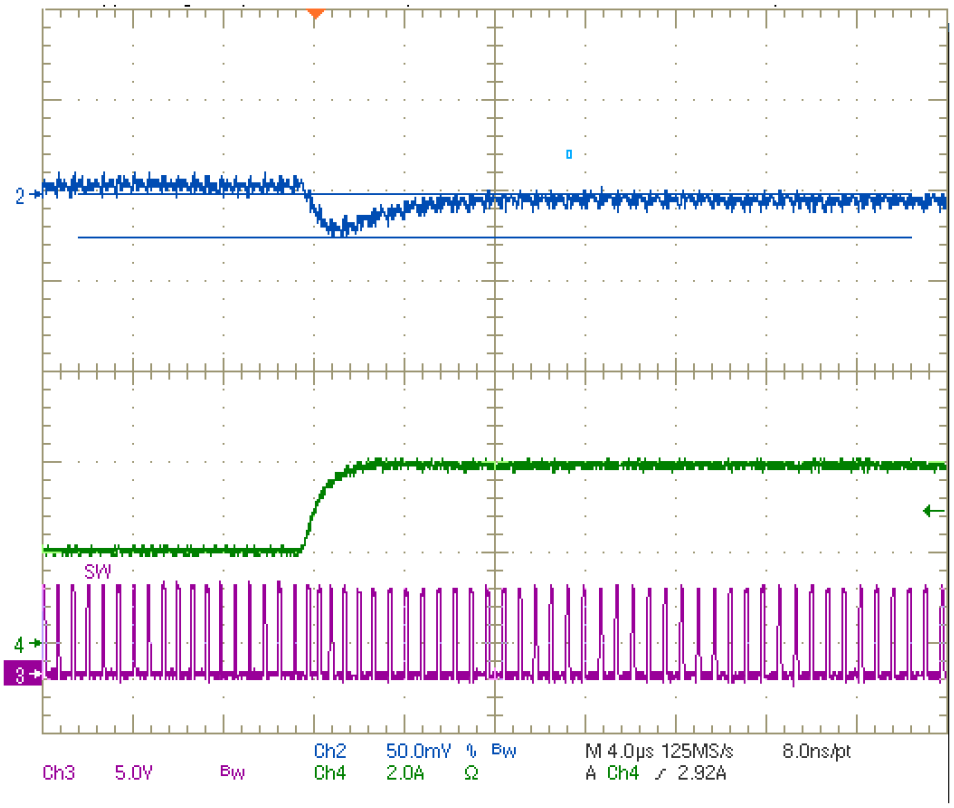
The following illustrations show the dynamic load response for the evaluation board.

Figure 9 • Step Response



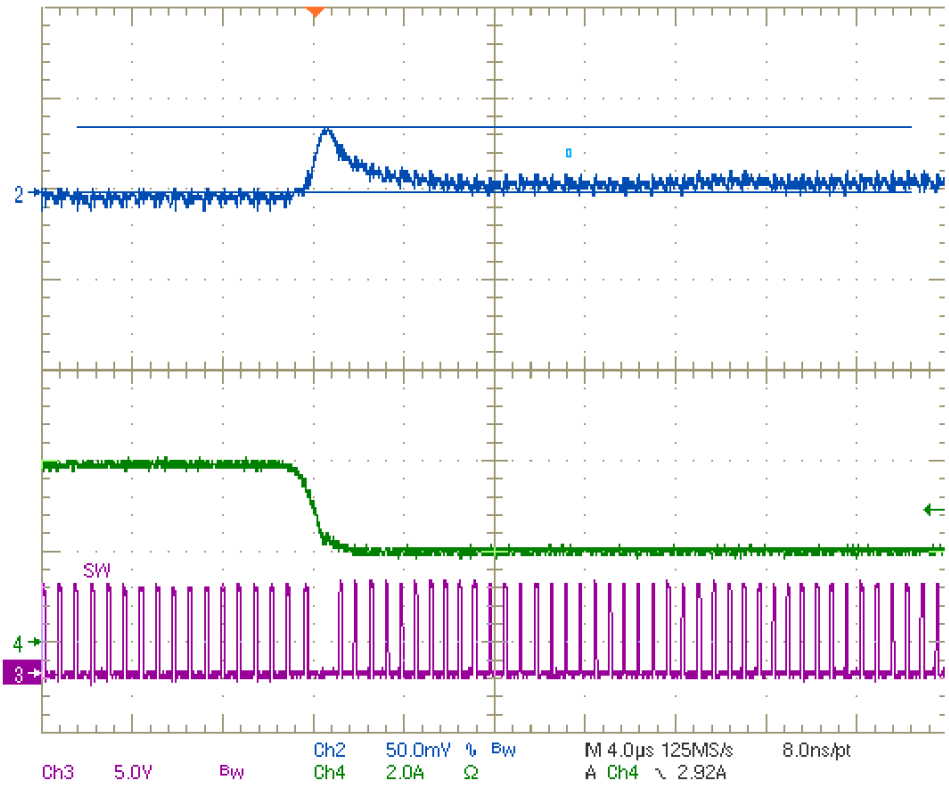
Note: CH2: VOUT, CH4: I_{LOAD}.

Figure 10 • Step Response Rising Edge



Note: CH2: VOUT, CH3: SW Node, CH4: I_{LOAD}.

Figure 11 • Step Response Falling Edge

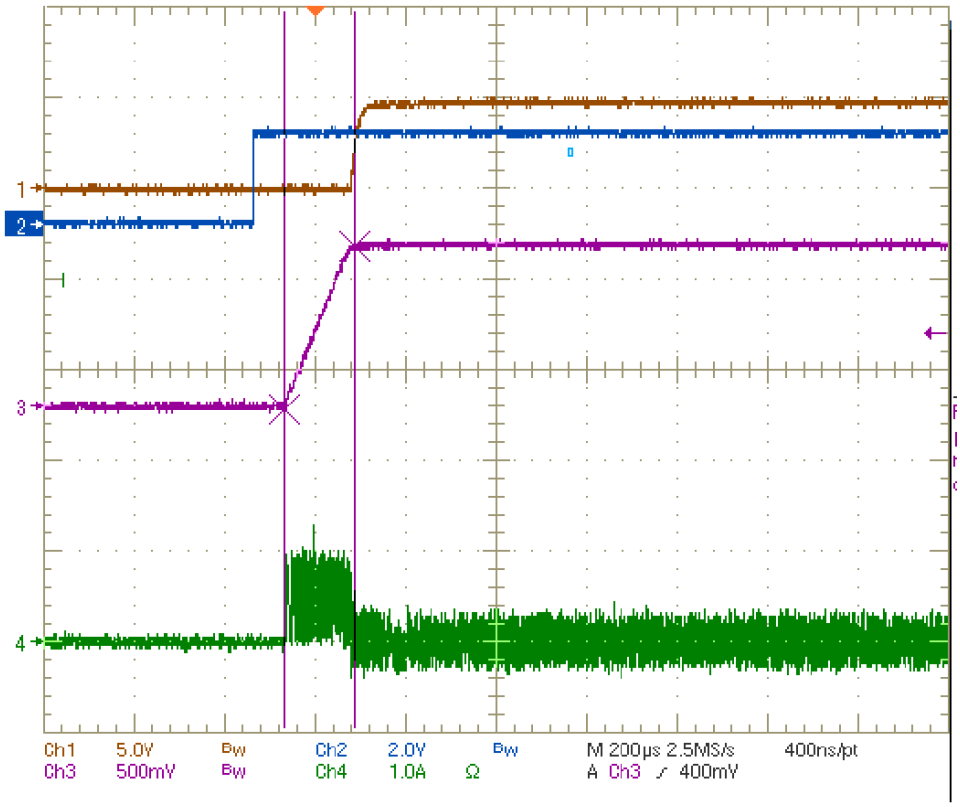


Note: CH2: VOUT, CH3: SW Node, CH4: I_{LOAD}.

10 Start-up and Short Condition Scope Shots

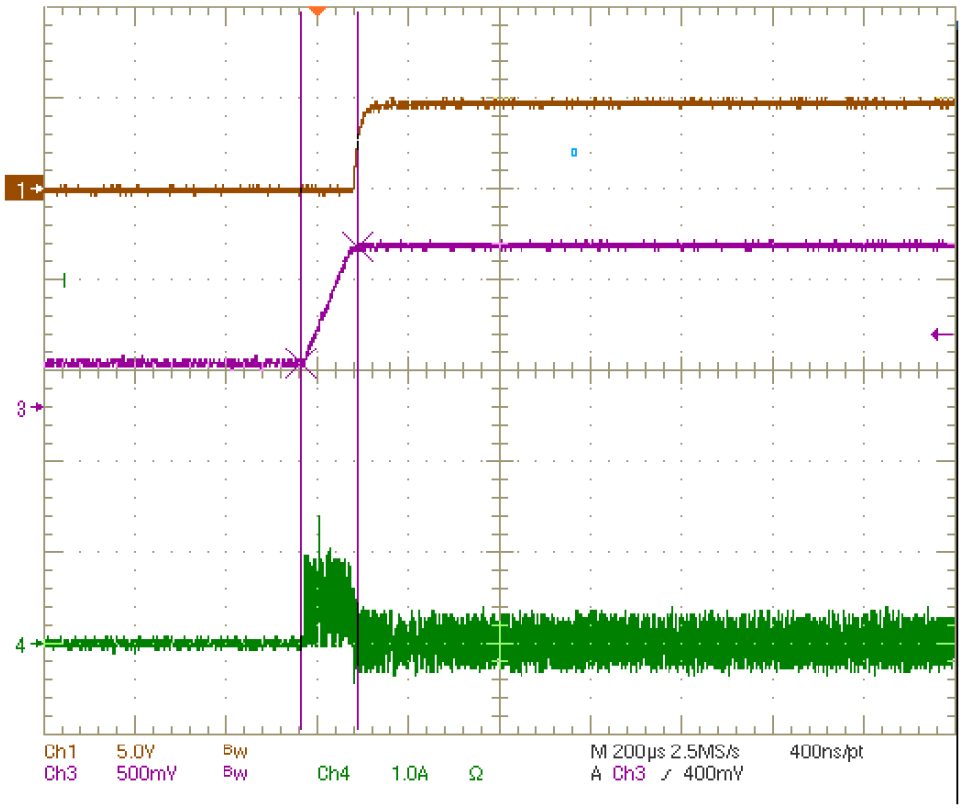
The following illustrations show the scope shots for the LX7180A.

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

Table 3 • Ordering Information

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

[1]Consult factory for other I²C slave address and set output voltage options.

"x" stands for the 2 LSB bits of the binary I²C 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).

Microsemi Corporate Headquarters
One Enterprise, Aliso Viejo,
CA 92656 USA
Within the USA: +1 (800) 713-4113
Outside the USA: +1 (949) 380-6100
Fax: +1 (949) 215-4996
Email: sales.support@microsemi.com
www.microsemi.com

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions; security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, California, and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

MSCC-0102-UG-01005-1.0-0717