MB39C011AEVB-01 2CH Buck DC/DC Converter IC

Evaluation Kit User Guide

Doc. No. 002-18196 Rev. **

Copyrights

Contents

Safety Information

Regulatory Compliance

This Evaluation Kit is intended for use as a development platform for hardware in a laboratory environment. The board is an open system design, which does not include a shielded enclosure. This may cause interference to other electrical or electronic devices in close proximity.

In a domestic environment, this product may cause radio interference. The user may then be required to take adequate prevention measures. Also, the board should not be used near any medical equipment or RF devices.

Attaching additional wiring to this product or modifying the product operation from the factory default may affect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

	This Evaluation Kit contains electrostatic discharge (ESD) sensitive devices. Electrostatic charges readily accumulate on the human body and any equipment, and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused this board in the protective shipping package.

General Safety Instructions

ESD Protection

ESD can damage boards and associated components. Cypress recommends that you perform procedures only at an ESD workstation. If an ESD workstation is not available, use appropriate ESD protection by wearing an antistatic wrist strap attached to chassis ground (any unpainted metal surface) on your board when handling parts.

Handling Boards

This board is sensitive to ESD. Hold the board only by its edges. After removing the board from its box, place it on a grounded, static-free surface. Use a conductive foam pad if available. Do not slide board over any surface.

1.   Introduction

Thank you for your interest in the MB39C011AEVB-01 2CH Buck DC/DC Converter IC Evaluation Kit (EVK). The kit is designed as an easy-to-use evaluation kit, showcasing the features of the Cypress MB39C011AEVB-01 2CH Buck DC/DC Converter IC that has synchronous rectification. For more information, see the MB39C011A datasheet.

1.1   Kit Contents

This evaluation kit includes the following items as shown in Figure 1-1:

- MB39C011AEVB-01 evaluation board
- Quick start guide (www.cypress.com/MB39C011AEVB-01)

Figure 1-1. MB39C011AEVB-01 Evaluation Kit Contents
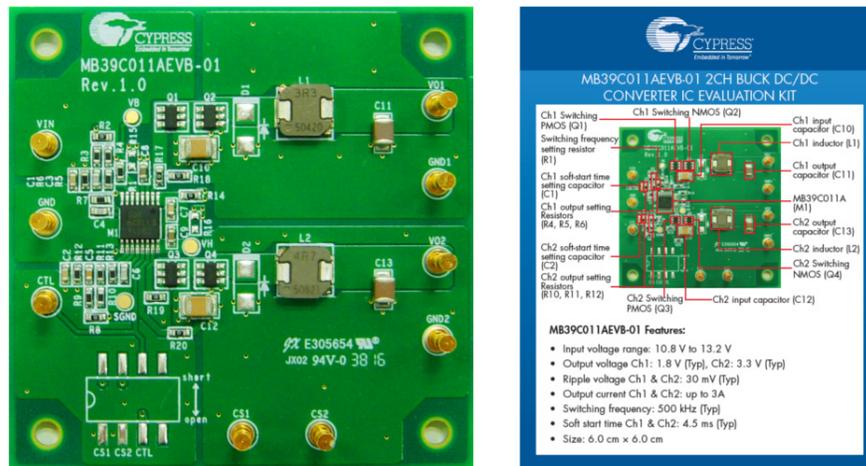
2. Kit Overview

2.1 Terminal Information

Terminal Name	I/O	Descriptions
VIN	I	Input power supply terminal
CTL	I	IC control terminal CTL = 0 V to 0.8 V: Standby mode CTL = 2.0 V to VIN: Operation mode
CS1	I	Ch1 control terminal CS1 = Open: VO1 output on CS1 = Ground: VO1 output off
CS2	I	Ch2 control terminal CS2 = Open: VO2 output on CS2 = Ground: VO2 output off
VO1	O	Ch1 DC/DC converter output terminal
VO2	O	Ch2 DC/DC converter output terminal
GND	–	Ground terminal
GND1	–	Ground terminal
GND2	–	Ground terminal

MB39C011AEVB-01
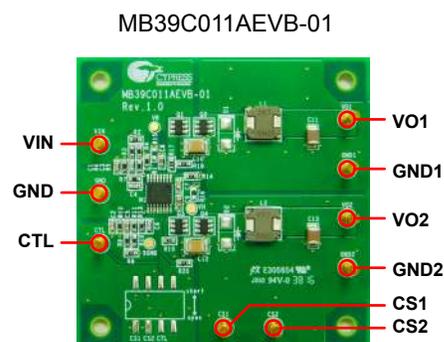
2.2 Specification

Parameter			Value			Unit
			Min	Typ	Max	
Input voltage	Ch1, Ch2	VIN	10.8	12	13.2	V
Output voltage	Ch1	VO1	1.76	1.8	1.83	V
	Ch2	VO2	3.23	3.3	3.36	V
Ripple voltage	Ch1	VO1	–	30	60	mV
	Ch2	VO2	–	30	60	mV
Output current	Ch1	I_{O1}	0	–	3	A
	Ch2	I_{O2}	0	–	3	A
Oscillation frequency	Ch1, Ch2	–	–	500	–	kHz
Soft-start time	Ch1	VO1	–	4.5	–	ms
	Ch2	VO2	–	4.5	–	ms

2.3   Hardware

The kit consists of the following components as shown in Figure 2-1:

Figure 2-1. Kit Components
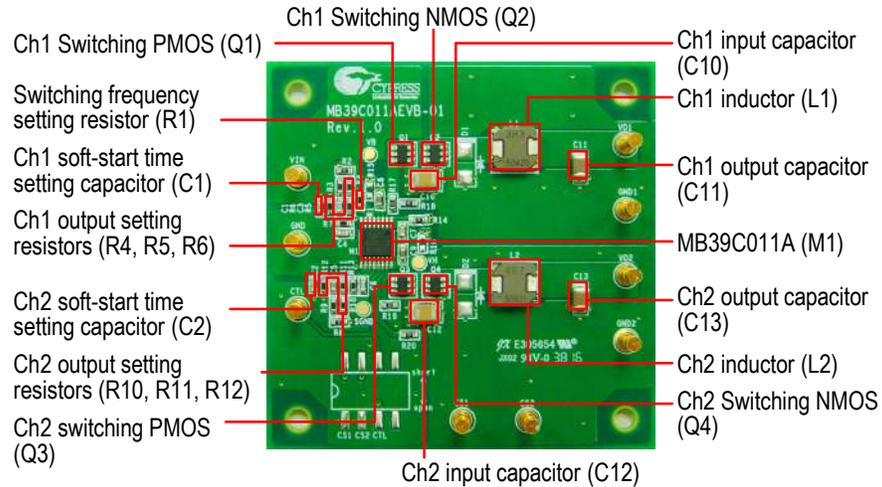
2.4   Default Settings

1. Output voltage

$$VO1 \ = \ \frac{(R4 + R5) + R6}{R6} \times 1.0 \ = \ \frac{(5.1k + 75k) + 100k}{100k} \times 1.0 \ \approx 1.8 \ [V]$$

$$VO2 \ = \ \frac{(R10 + R11) + R12}{R12} \times 1.0 \ = \ \frac{(1.5k + 33k) + 15k}{15k} \times 1.0 \ = 3.3 \ [V]$$

2. Oscillation frequency

$$f_{OSC} \ = \ \frac{1.00}{R1 \times (122.4 \times 10^{-12}) + (96 \times 10^{-9})} \ = \ \frac{1.00}{16k \times (122.4 \times 10^{-12}) + (96 \times 10^{-9})} = 486760 \ [Hz] \approx 500 \ [kHz]$$

3. Soft-start time

$$t_{S1} \ = \ 19.0 \times C1 \times R1 = \ 19.0 \times (0.015 \ \mu) \times (16k) = \ 0.00456 \ [s] \ \approx \ 4.5 \ [ms]$$

$$t_{S2} \ = \ 19.0 \times C2 \times R1 = \ 19.0 \times (0.015 \ \mu) \times (16k) = \ 0.00456 \ [s] \ \approx \ 4.5 \ [ms]$$

3. Set Up and Check

3.1 Setup and Check

Figure 3-1. Terminals for Setup and Check
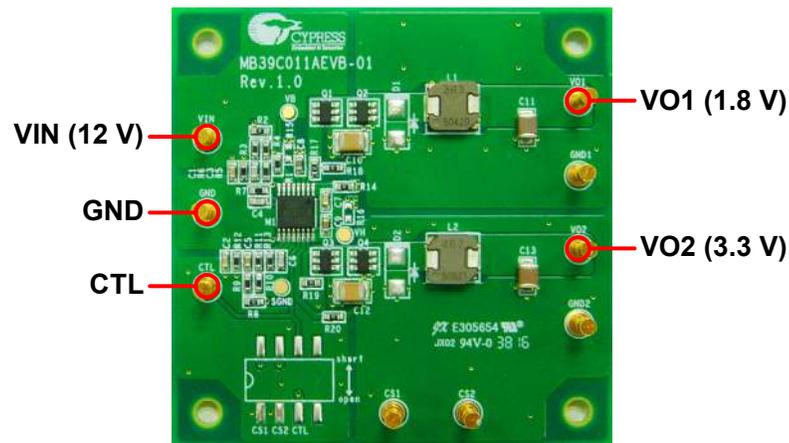
Setup*

1. Connect VIN to a power supply and GND to the ground.

2. Connect CTL to VIN.

3. Connect VO1 to a voltmeter.

4. Connect VO2 to a voltmeter.

Check*

1. Apply 12 V to VIN.

2. VO1 voltage should be 1.8 V (typ) and
   VO2 voltage should be 3.3 V (typ)

*Do not supply power to VIN until settings are completed.

4.   Reference Data

4.1   Reference Data

Figure 4-1. Reference Data

Ch1: Efficiency

VIN = 12V, VO1 setting = 1.8 V, F_{OSC} = 500 kHz, T_A = +25 °C

[Graph: Ch1: Efficiency (?) [%] vs VO1 Load Current (I_{O1}) [A], y-axis 60 to 100, x-axis 0 to 3]

MB39C011AEVB-01Graph001

Ch2: Efficiency

VIN = 12V, VO2 setting = 3.3 V, F_{OSC} = 500 kHz, T_A = +25 °C

[Graph: Ch2: Efficiency (?) [%] vs VO2 Load Current (I_{O2}) [A], y-axis 60 to 100, x-axis 0 to 3]

MB39C011AEVB-01Graph002

Ch1: VO1 Load Regulation

VIN = 12V, VO1 setting = 1.8 V, F_{OSC} = 500 kHz, T_A = +25 °C

[Graph: VO1 [V] vs VO1 Load Current (I_{O1}) [A], y-axis 1.76 to 1.84, x-axis 0 to 3]

MB39C011AEVB-01Graph003

Ch2: VO2 Load Regulation

VIN = 12V, VO2 setting = 3.3 V, F_{OSC} = 500 kHz, T_A = +25 °C

[Graph: VO2 [V] vs VO2 Load Current (I_{O2}) [A], y-axis 3.26 to 3.34, x-axis 0 to 3]

MB39C011AEVB-01Graph004

Ch1: VO1 Ripple Voltage Waveform
VIN = 12 V, VO1 setting = 1.8 V, F_{OSC} = 500 kHz,
VO1 Load Current (I_{O1}) = 3 A, T_A = +25 ^{o}C

VO1
10 mV/div
AC Coup.
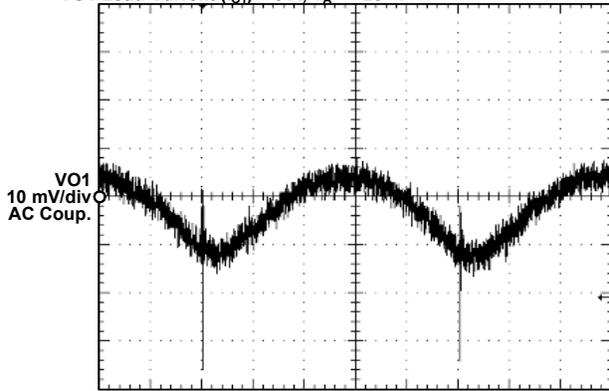
400 ns/div

MB39C011AEVB-01Graph005

Ch2: VO2 Ripple Voltage Waveform
VIN = 12 V, VO2 setting = 3.3 V, F_{OSC} = 500 kHz,
VO2 Load Current (I_{O2}) = 3 A, T_A = +25 ^{o}C

VO2
10 mV/div
AC Coup.
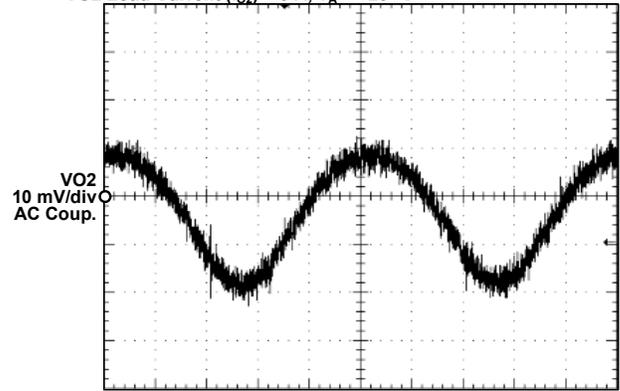
400 ns/div

MB39C011AEVB-01Graph006

Ch1 and Ch2: Turn On Responses
VIN = 12 V, VO1 setting = 1.8 V, VO2 setting = 3.3 V, F_{OSC} = 500 kHz,
VO1 Load Current (I_{O1}) = 3 A, VO2 Load Current (I_{O2}) = 3 A, T_A = +25 ^{o}C

CTL
5 V/div

VO2

VO1

← 3.3 V

← 1.8 V

VO1
VO2
1 V/div
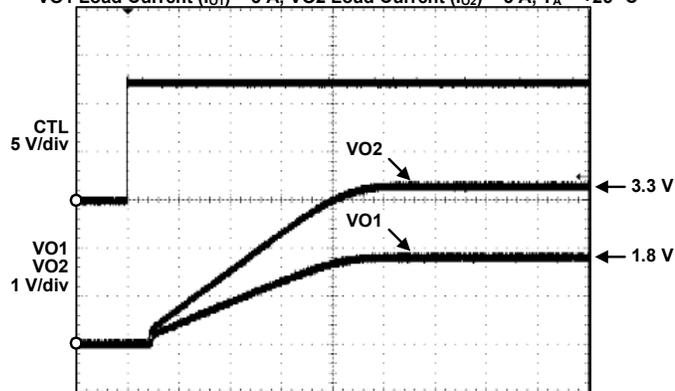
1 ms/div

MB39C011AEVB-01Graph007

Ch1: VO1 Load Transient Response
VIN = 12 V, VO1 setting = 1.8 V, F_{OSC} = 500 kHz, T_A = +25 ^{o}C

3 A →

← 0 A

VO1 Load
Current (I_{O1})
2 A/div

VO1
500 mV/div
1.8 V offset
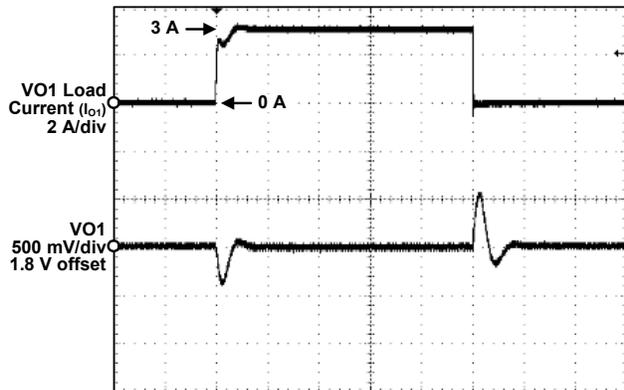
40 µs/div

MB39C011AEVB-01Graph008

Ch2: VO2 Load Transient Response
VIN = 12 V, VO2 setting = 3.3 V, F_{OSC} = 500 kHz, T_A = +25 ^{o}C

3 A →

← 0 A

VO2 Load
Current (I_{O2})
2 A/div

VO2
500 mV/div
3.3 V offset

40 µs/div

MB39C011AEVB-01Graph009

Ch1: Gain and Phase Characteristics
VIN = 12 V, VO1 setting = 1.8 V, F_{OSC} = 500 kHz,
VO1 Load Current (I_{O1}) = 3 A, T_A = +25 ^oC

MB39C011AEVB-01Graph010

Ch2: Gain and Phase Characteristics
VIN = 12 V, VO2 setting = 3.3 V, F_{OSC} = 500 kHz,
VO2 Load Current (I_{O2}) = 3 A, T_A = +25 ^oC
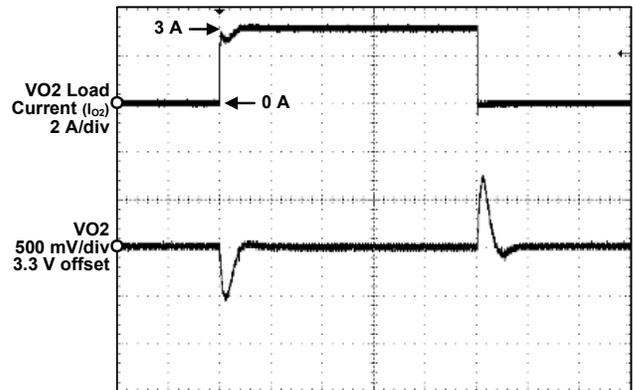
MB39C011AEVB-01Graph010
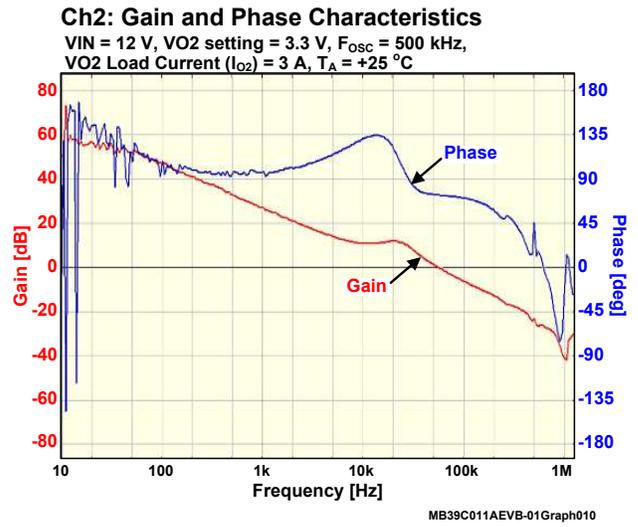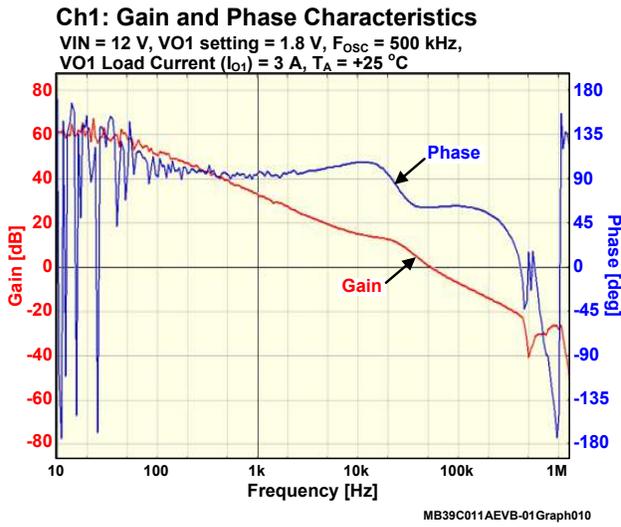
Appendix

A.1 Schematic

[ ] : Non-mounted component
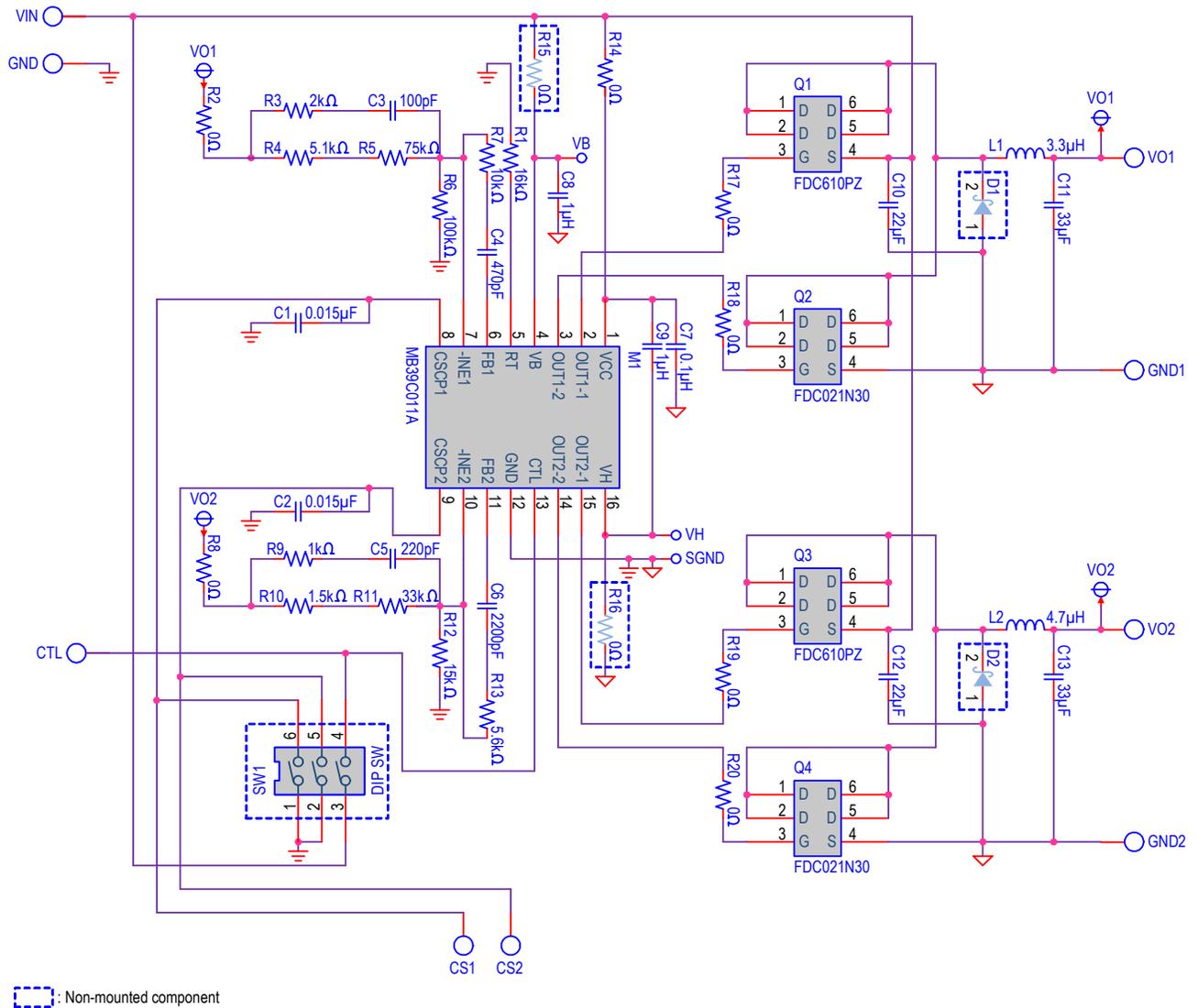
A.2. Bill of Materials (BOM)

No	Symbol	Item	Value / Description	Part Number	Vendor	PKG / Size	Remark
1	M1	IC	2ch Buck controllers	MB39C011APFT-G-BND-ERE1	Cypress	STB016	–
2	Q1, Q3	PMOS FET	V_{DS}= -30 V, I_D= -4.9 A, R_{ON} = 42 mΩ	FDC610PZ	Fairchild	SO8	–
3	Q2, Q4	NMOS FET	V_{DS}= 30 V, I_D= 6.1 A, R_{ON} = 26 mΩ	FDC021N30	Fairchild	SO8	–
4	D1	Schottky	–	–	–	–	No mount
5	D2	Schottky	–	–	–	–	No mount
6	L1	Inductor	3.3 µH (27 mΩ, 6.8A, ±20 %)	SPM6530T-3R3M	TDK	7.1×6.5×3 (mm)	–
7	L2	Inductor	4.7 µH (35.8 mΩ, 5.6 A, ±20 %)	SPM6530T-4R7M	TDK	7.1×6.5×3 (mm)	–
8	C1, C2	Capacitor	0.015 µF (50 V, JB)	C1608JB1H153K080AA	TDK	0603	–
9	C3	Capacitor	100 pF (50 V, CH)	C1608CH1H101J080AA	TDK	0603	–
10	C4	Capacitor	470 pF (50 V, CH)	C1608CH1H471J080AA	TDK	0603	–
11	C5	Capacitor	220 pF (50 V, CH)	C1608CH1H221J080AA	TDK	0603	–
12	C6	Capacitor	2200 pF (50 V, CH)	C1608CH1H222J080AA	TDK	0603	–
13	C7	Capacitor	0.1 µF (50 V, JB)	C1608JB1H104K080AA	TDK	0603	–
14	C8, C9	Capacitor	1 µF (16 V, JB)	C1608JB1C105K080AA	TDK	0603	–
15	C10, C12	Capacitor	22 µF (25 V, X5R)	GRM32ER61E226KE15K	Murata	1210	–
16	C11, C13	Capacitor	33 µF (6.3 V, JB)	C3216JB0J336M130AC	TDK	1210	–
17	R1	Resistor	1.6 kΩ (1/16 W, 0.5 %)	RR0816P-163-D	SSM	0603	–
18	R2, R8, R14, R17, R18, R19, R20	Resistor	0 Ω	RK73Z1JTTD	KOA	0603	–
19	R3	Resistor	2 kΩ (1/16 W, 0.5 %)	RR0816P-202-D	SSM	0603	–
20	R4	Resistor	5.1 kΩ (1/16 W, 0.5 %)	RR0816P-512-D	SSM	0603	–
21	R5	Resistor	75 kΩ (1/16 W, 0.5 %)	RR0816P-753-D	SSM	0603	–
22	R6	Resistor	100 kΩ (1/16 W, 0.5 %)	RR0816P-104-D	SSM	0603	–
23	R7	Resistor	10 kΩ (1/16 W, 0.5 %)	RR0816P-103-D	SSM	0603	–
24	R9	Resistor	1 kΩ (1/16 W, 0.5 %)	RR0816P-102-D	SSM	0603	–
25	R10	Resistor	1.5 kΩ (1/16 W, 0.5 %)	RR0816P-152-D	SSM	0603	–
26	R11	Resistor	33 kΩ (1/16 W, 0.5 %)	RR0816P-333-D	SSM	0603	–
27	R12	Resistor	15 kΩ (1/16 W, 0.5 %)	RR0816P-153-D	SSM	0603	–
28	R13	Resistor	5.6 kΩ (1/16 W, 0.5 %)	RR0816P-562-D	SSM	0603	–
29	R15, R16	Resistor	0 Ω	–	–	0603	No mount
30	SW1	Dip switch	–	–	–	–	No mount
31	PIN	Terminal	Wire wrap	WT-2-1	Mac-Eight	–	–

A.3 Image

Figure 5-1. Image

Top   Bottom

A.4 Silk Screen

Top   Bottom
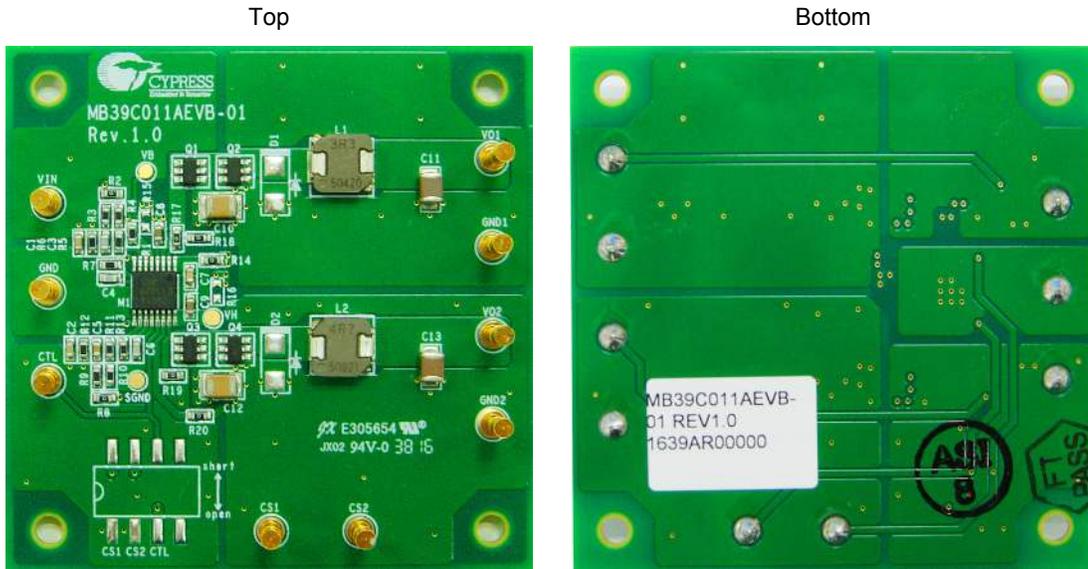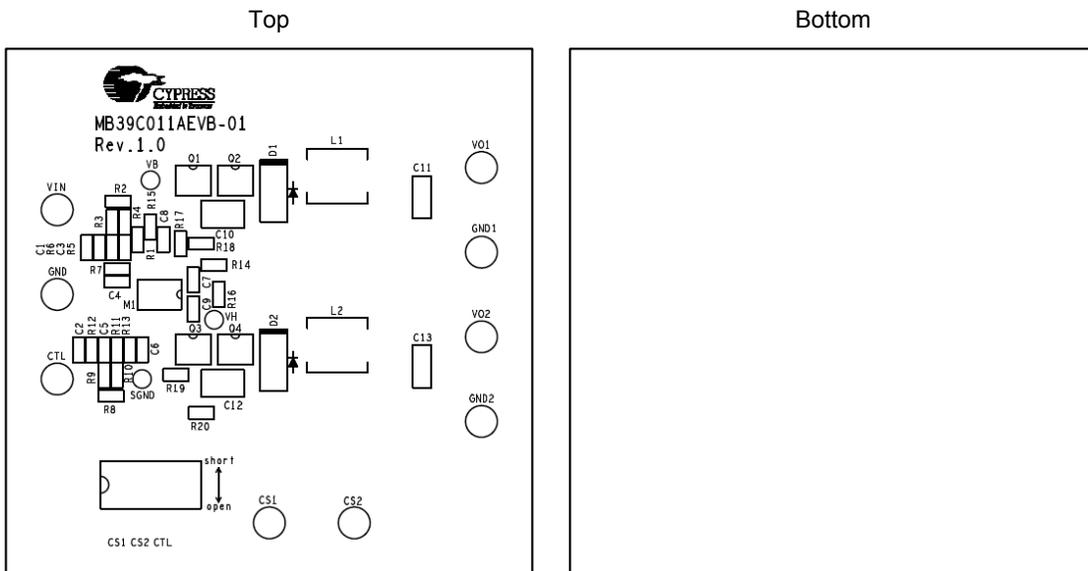
There is no silk screen on the bottom.

A.5 Layout

Top

Layer 2

Layer 3

Bottom
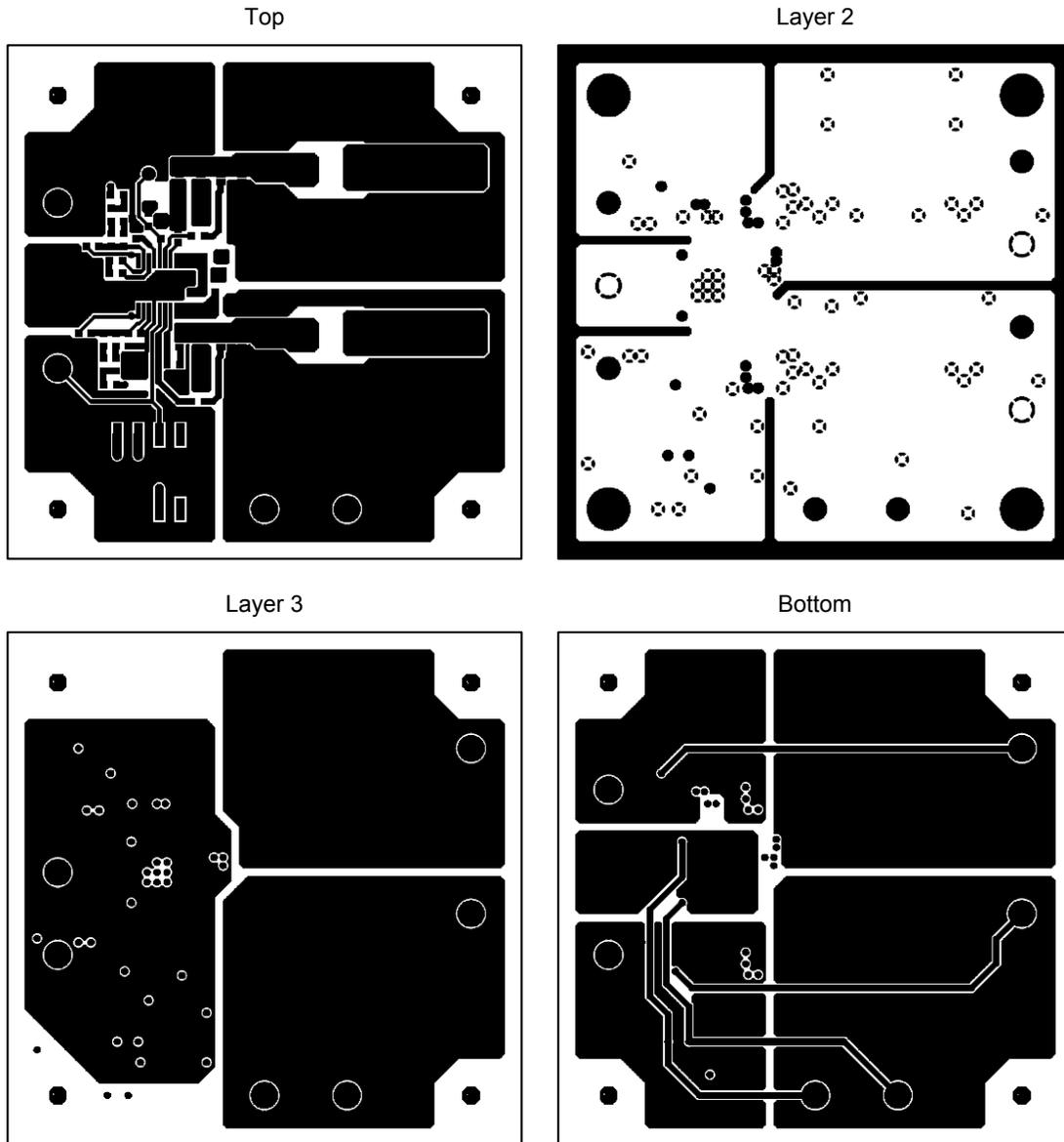
Revision History

Document Revision History

Document Title: MB39C011AEVB-01 2CH Buck DC/DC Converter IC Evaluation Kit User Guide				
Document Number: 002-18196				
Revision	ECN#	Issue Date	Origin of Change	Description of Change
**	5560142	12/28/2016	HIXT	New user guide