MIC2176 5A Evaluation Board

High Input Voltage, Synchronous Buck Controllers Featuring Adaptive On-Time Control

Hyper Speed Control™ Family

General Description

The Micrel MIC2176-1/-2/-3 is a family of constant-frequency, synchronous buck controllers featuring a unique digitally modified adaptive ON-time control architecture. The MIC2176 family operates over an input supply range of 4.5V to 75V. The output voltage is adjustable down to 0.8V with a guaranteed accuracy of ±1%, and the device operates at a switching frequency of 100kHz, 200kHz, and 300kHz.

Data sheets and other support documents can be found on Micrel's web site at: www.micrel.com.

Requirements

The MIC2176 evaluation board requires only a single power supply with at least 10A current capability. A linear regulator, which includes a Zener and an NPN transistor, has been installed on the board to provide housekeeping for the MIC2176 controller. The output load can either be a passive or an active load.

Precautions

The MIC2176 evaluation board does not have reverse polarity protection. Applying a negative voltage to the VIN and GND terminals may damage the device. The maximum V_{IN} of the board is rated at 75V. Exceeding 75V on the VIN terminal could damage the device.

Getting Started

1. **Connect a supply to the VIN and GND terminals**. Apply desired input voltage to the VIN and GND terminals of the evaluation board, paying careful attention to polarity and supply voltage ($4.5V < V_{IN} < 75V$). A current meter may be placed between the input supply and the VIN terminal of the evaluation board. Ensure the supply voltage is monitored at the VIN terminal. At heavy loads, the current meter, wires, and power lead could have voltage drops that reduce the voltage applied to the input.

2. **Connect a load to the VOUT and GND terminals**. The load can be either a passive (resistive) or an active (as in an electronic load) type. A current meter can be placed between the VOUT terminal and the load. Ensure the output voltage is monitored at the VOUT terminal.

3. **Enable the MIC2176**. An EN connector is provided on the MIC2176 evaluation board for the users to easily access the enable feature of the MIC2176 controller. The EN pin has an internal 100k pull-up resistor to VDD, which allows the output to be turned on when VDD exceeds its UVLO threshold. Applying an external logic signal on the EN pin to pull it low or using a jumper to short the EN pin to GND will shut off the output of the MIC2176 evaluation board.

Output Voltage

The output voltage on the MIC2176 evaluation board is preset to 3.3V. The final output voltage is determined by the feedback divider as calculated as follows:

$$V_{OUT} = V_{REF} \times (1 + \frac{R1}{R_{BOTTOM}})$$

where V_{REF} = 0.8V, and R_{BOTTOM} is one of R4, R5, R6, R7, R8, R9, R10, R11, which corresponds to 0.9V, 1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, or 5V output voltage.

Leaving the R_{BOTTOM} open gives a 0.8V output voltage. All other voltages not listed above can be set by modifying R_{BOTTOM} value according to:

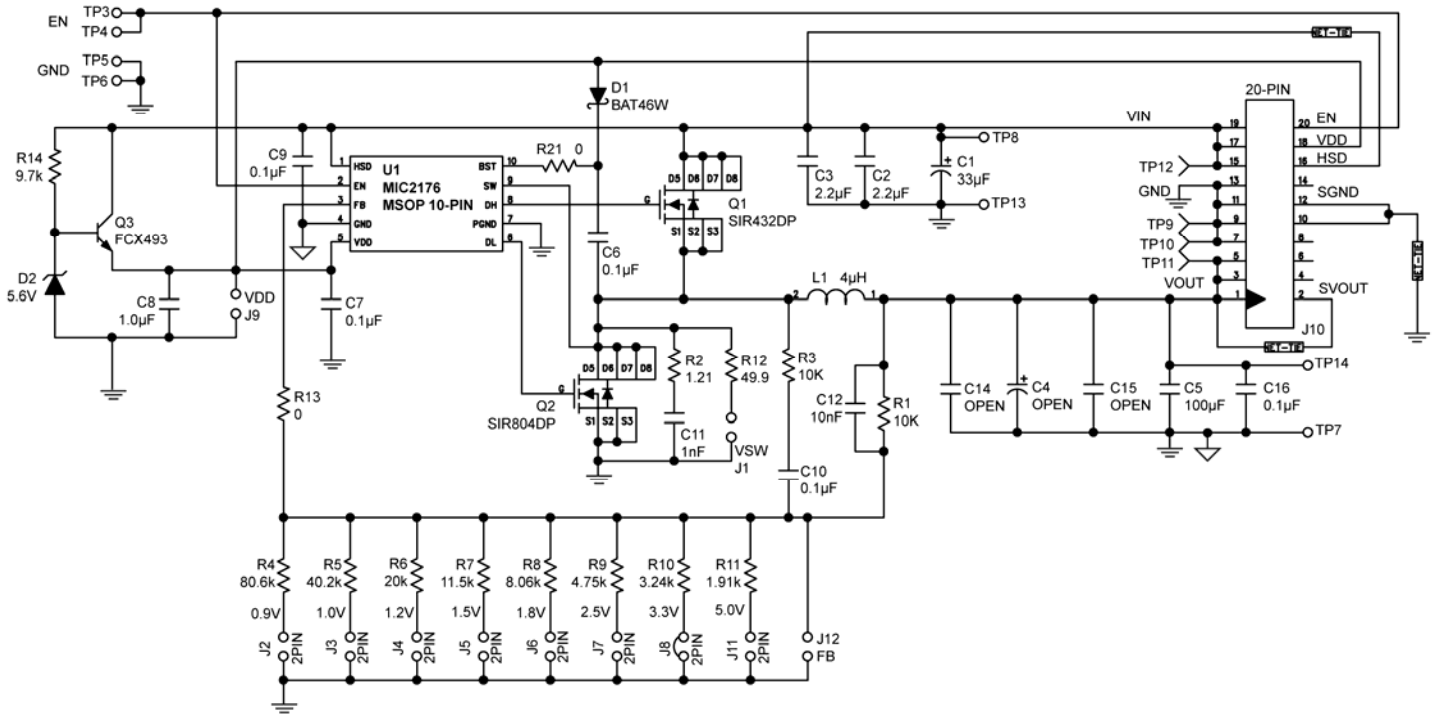
$$R_{BOTTOM} = \frac{R1 \times V_{REF}}{V_{OUT} - V_{REF}}$$

Note that the output voltage should not be set to exceed 5V due to the 6.3V voltage rating on the output capacitors. If a higher than 5V output voltage is desired, those output capacitors have to be replaced with higher rating ones.

Ordering Information

Part Number	Description	Package
MIC2176-1YMM	IC, 100kHz	10-Pin MSOP
MIC2176-2YMM	IC, 200kHz	10-Pin MSOP
MIC2176-3YMM	IC, 300kHz	10-Pin MSOP
MIC2176-2YMM 5A EV	Evaluation Board	

Evaluation Board Schematic



Schematic of MIC2176 Evaluation Board
(J1, J9, J12, R12, and R13 are for testing purposes)

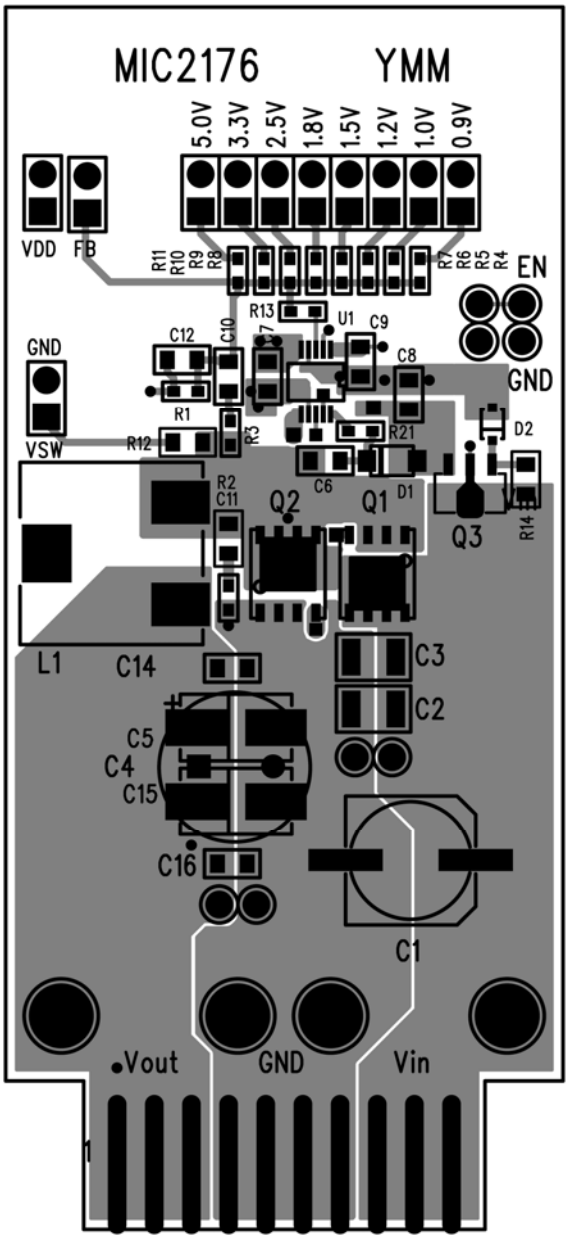
Bill of Materials

Item	Part Number	Manufacturer	Description	Qty
C1	B41125A9336M	EPCOS[1]	33µF Aluminum Capacitor, SMD, 100V	1
C2, C3	GRM32ER72A225K	Murata[2]	2.2µF/100V Ceramic Capacitor, X7R, Size 1210	2
C4	6SEPC470M	Sanyo[3]	470µF/6.3V OSCON Capacitor	1
C5, C15	GRM32ER60J104KA94D	Murata[2]	100µF/6.3V Ceramic Capacitor, X7R, Size 1210	2
C6, C7, C16	GRM188R71H104KA94L	Murata[2]	0.1µF/6.3V Ceramic Capacitor, X7R, Size 0603	3
C8	GRM188R70J105KA01D	Murata[2]	1µF/6.3V Ceramic Capacitor, X7R, Size 0603	1
C9, C10	GRM188R72A104KA35D	Murata[2]	0.1µF/100V Ceramic Capacitor, X7R, Size 0603	2
C11	GRM188R72A102KA01D	Murata[2]	1nF/100V Cermiac Capacitor, X7R, Size 0603	1
C12	GRM188R71H103K	Murata[2]	10nF/50V Ceramic Capacitor, X7R, Size 0603	1
C14	GRM31CR60J475KA01L	Murata[2]	4.7µF/6.3V Ceramic Capacitor, X5R, Size 1206	1
D1	BAT46W	Diodes, Inc.[4]	100V Small Signal Schottky Diode, SOD123	1
D2	CMDZ5L6	Central Semi[5]	5.6V Zener Diode, SOD323	1
L1	HCL1305-4R0-R	Cooper Bussmann[6]	4.0µH Inductor, 10A RMS Current	1
Q1	SIR432DP	Vishay[7]	MOSFET, N-CH, Power SO-8	1
Q2	SIR804DP	Vishay[7]	MOSFET, N-CH, Power SO-8	1
Q3	FCX493	ZETEX[4]	100V NPN Transistor, SOT89	1
R1, R3	CRCW060310K0FKEA	Vishay Dale[7]	10kΩ Resistor, Size 0603, 1%	2
R2	CRCW08051R21FKEA	Vishay Dale[7]	1.21Ω Resistor, Size 0805, 5%	1
R4	CRCW060380K6FKEA	Vishay Dale[7]	80.6kΩ Resistor, Size 0603, 1%	1
R5	CRCW060340K2FKEA	Vishay Dale[7]	40.2kΩ Resistor, Size 0603, 1%	1
R6	CRCW060320K0FKEA	Vishay Dale[7]	20kΩ Resistor, Size 0603, 1%	1
R7	CRCW060311K5FKEA	Vishay Dale[7]	11.5kΩ Resistor, Size 0603, 1%	1
R8	CRCW06038K06FKEA	Vishay Dale[7]	8.06kΩ Resistor, Size 0603, 1%	1
R9	CRCW06034K75FKEA	Vishay Dale[7]	4.75kΩ Resistor, Size 0603, 1%	1
R10	CRCW06033K24FKEA	Vishay Dale[7]	3.24kΩ Resistor, Size 0603, 1%	1
R11	CRCW06031K91FKEA	Vishay Dale[7]	1.91kΩ Resistor, Size 0603, 1%	1
R12	CRCW060349K24FKEA	Vishay Dale[7]	49.9Ω Resistor, Size 0603, 1%	1
R13, R21	CRCW06030000FKEA	Vishay Dale[7]	0Ω Resistor, Size 0603, 5%	2
R14	CRCW08059K7FKEA	Vishay Dale[7]	9.7kΩ Resistor, Size 0805, 5%	1
U1	**MIC2176-2YMM**	**Micrel. Inc.[8]**	**75V Synchronous Buck DC-DC Regulator**	**1**

Notes:

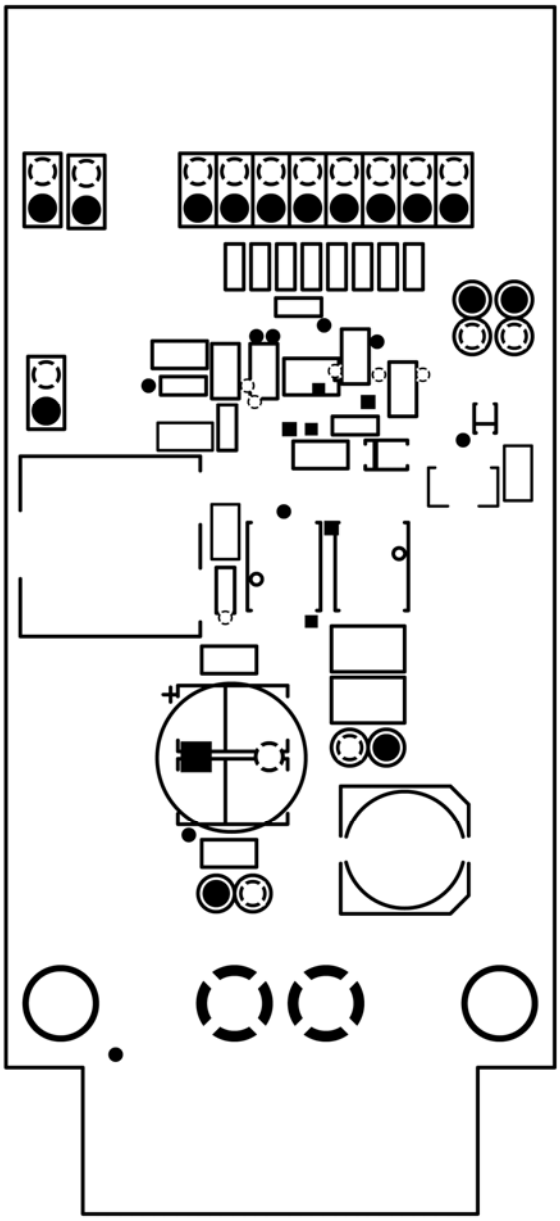
1. EPCOS: www.epcos.com.
2. Murata: www.murata.com.
3. Sanyo: www.sanyo.com.
4. Diodes Inc.: www.diodes.com.
5. Central Semi: www.centralsemi.com.
6. Cooper Bussmann: www.cooperbussmann.com.
7. Vishay: www.vishay.com.
8. **Micrel, Inc.: www.micrel.com.**

PCB Layout Recommendations



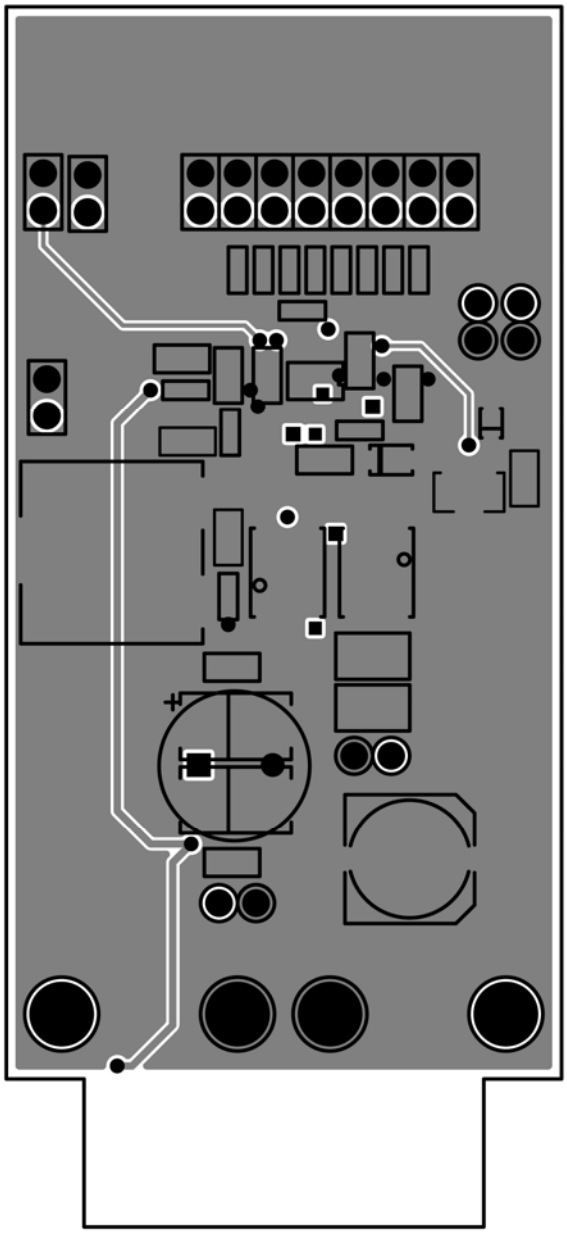
MIC2176 Evaluation Board Top Layer

PCB Layout Recommendations (Continued)



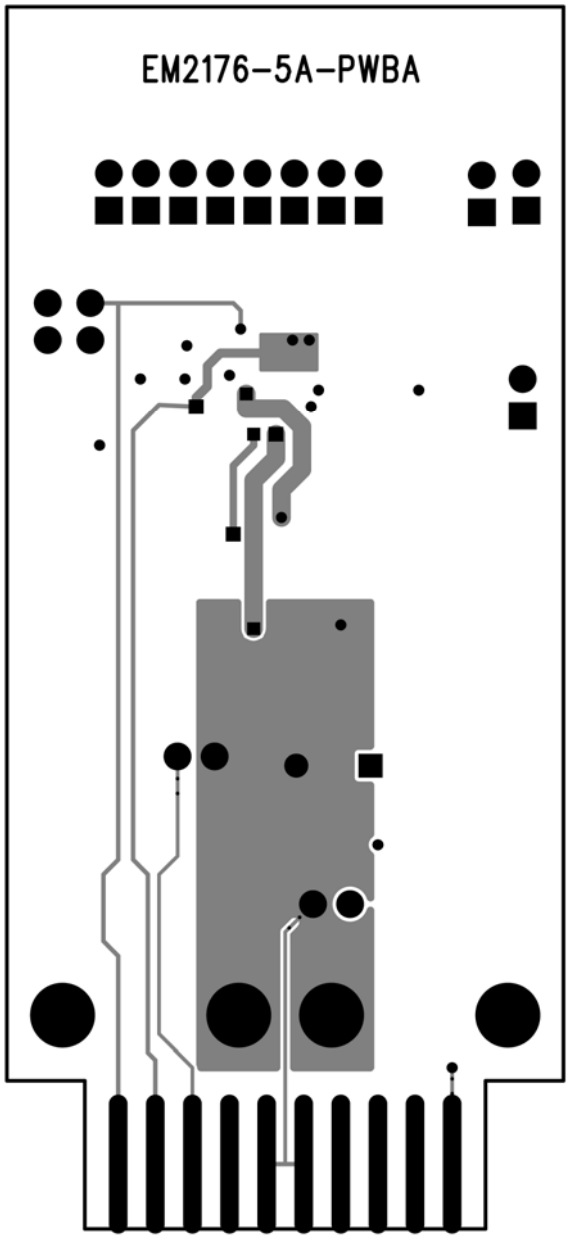
MIC2176 Evaluation Board Mid-Layer 1 (Ground Plane)

PCB Layout Recommendations (Continued)



MIC2176 Evaluation Board Mid-Layer 2

PCB Layout Recommendations (Continued)



MIC2176 Evaluation Board Bottom Layer

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- Поставка образцов и прототипов;
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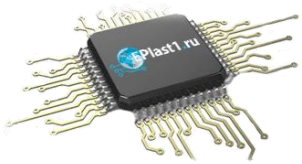

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