General Description

The MAX77816 evaluation kit (EV kit) is a fully assembled and tested printed circuit board (PCB) for evaluating the IC. The IC is a high-current, high-efficiency buck-boost regulator targeting single-cell Li-ion battery-powered applications. It supports a wide output voltage range from 2.60V to 5.14V. The IC allows 5A (typ) maximum switch current. In buck mode, the output current can go as high as 4A, and in boost mode, the maximum output current can be 3A. A unique control algorithm allows high-efficiency, outstanding line/load transient response, and seamless transition between buck and boost modes.

The IC features I^2C-compatible serial interface. The I^2C interface allows the output voltage to be dynamically adjusted thus enabling finer control of system power consumption. The I^2C interface also provides features such as enable control and device status monitoring.

The multifunction GPIO pin is register settable to five different options such as FPWM mode enable and inductor peak current-limit selection. These options provide design flexibility that allows the IC to cover a wide range of applications and use cases.

The Maxim Command Module (MINIQUSB) can be used to enable USB-to-I^2C communication between a Windows®-compatible PC and the EV kit. The EV kit software provides a Windows-based graphical user interface (GUI) to exercise the various features of the IC.

Ordering Information appears at end of data sheet.

Windows is a registered trademark and registered service mark of Microsoft Corporation.

True Shutdown is a trademark of Maxim Integrated Products, Inc.
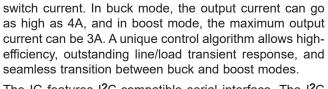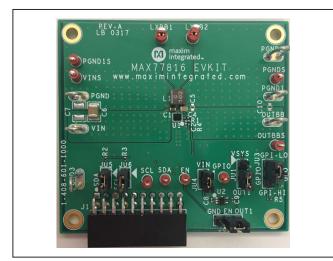
Benefits and Features

- Buck and Boost Operation Including Seamless Transition between Buck and Boost Modes
  - 2.3V to 5.5V V_{IN} Range
  - 2.60V to 5.14V V_{OUT} with 20mV Step
  - 3A Minimum Continuous Output Current ($V_{INBB} \geq 3.0V$, $V_{OUTBB} = 3.3V$)
  - Burst Current: 3.6A Minimum Output Current for 800µs ($V_{INBB} \geq 3.0V$, $V_{OUTBB} = 3.3V$)
- I^2C Serial Interface Allows Dynamic V_{OUT} Adjustment and Provides Design Flexibility
- 97.5% Peak Efficiency
- 40µA Quiescent Current
- Safety Features Enhance Device and System Reliability
  - Soft-Start
  - True Shutdown™
  - Thermal Shutdown and Short-Circuit Protection
- Multifunction GPIO Pin
  - MAX77816A: FPWM Mode Enable
  - MAX77816B: Inductor Peak Current-Limit Selection
  - MAX77816C: Output Voltage Selection
  - MAX77816D: Power-OK Indicator
  - MAX77816E: Interrupt Indicator
- Small Size: 1.827mm x 2.127mm, 20-Bump WLP, 0.4mm Pitch

Figure 1. MAX77816 EV Kit Photo

Quick Start

Required Equipment

- MAX77816 EV kit
- MAX77816 EV kit software (GUI)
- Maxim's MINIQUSB (optional, USB cable included)
- Adjustable DC power supply capable of supplying 6V 9A
- Digital multimeters
- Electronic load capable of sinking 4A
- Oscilloscope (optional)

Note: In the following sections, software-related items are identified by bolding. Text in **bold** only refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows OS.

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. Use twisted wires of appropriate gauge (20AWG) that are as short as possible to connect the load and power sources.

1) Confirm all jumpers are in their default positions as indicated in Table 1.
2) Preset the DC power supply to 3.8V. Do not turn on the power supply until all connections are completed.
3) Set up the test circuit as shown in Figure 2. Adjust the ammeters to their largest current range to minimize their series impedance. Do not allow the ammeters to operate in their auto-range mode. If current readings are not required, short across the ammeters.
4) Turn on the power supply.
5) Switch JU2 to OUT1(1-2) to enable the IC. Verify that the voltage at OUTBBS is 3.4V (default output voltage setting).
6) Enable the electronic load and apply load current as required.
7) The EV kit software can be downloaded from **www.maximintegrated.com/evalkitsoftware**. If I^{2}C control is required, install the EV kit software on to your computer by running the installation file (MAX77816GUISetup1.70605.0A.EXE). The program files are copied and a shortcut icon is created in Windows **Start | Programs**.
8) Connect the MINIQUSB to J1. Connect a USB cable from the PC to the MINIQUSB.
9) Start the EV kit software by opening its icon in the **Start | Programs**. The EV kit software main window appears. Click on **Device** then **Connect**. If connection is successful, a window displaying the message **Currently connected to CMOD "MINIQUSB" and device "MAX77816"** appears as shown in Figure 3. Click **Read and Close**.
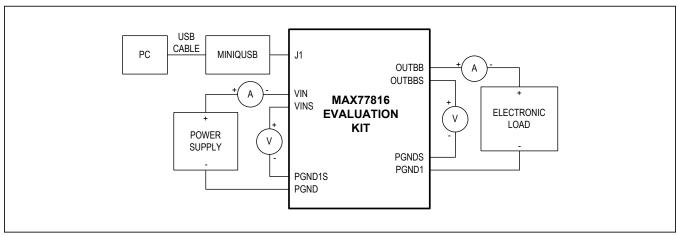10) The EV kit and GUI are now ready for use.
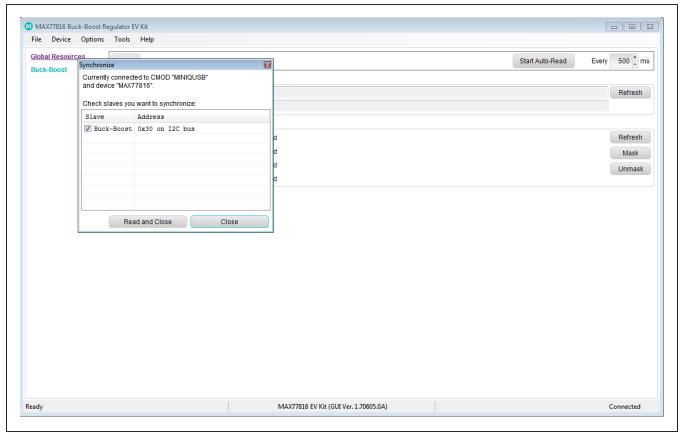

Figure 2. Quick Start Connection Diagram

Figure 3. MAX77816 EV Kit Software Window (Connect)

Detailed Description of Software

The EV kit software main window consists of two tabs: **Global Resources** (Figure 4) and **Buck-Boost** (Figure 5).

Global Resources shows the chip identification information as well as the status of Power-OK, OCP, OVP, and thermal shutdown.

Buck-Boost provides a convenient means to control the IC, including configuring the output voltage, FPWM mode enable, output active discharge, output OVP threshold, ramp up/down slew rate, inductor peak current-limit threshold, buck-boost enable and others.

Refer to the register description section in the MAX77816 data sheet for details.
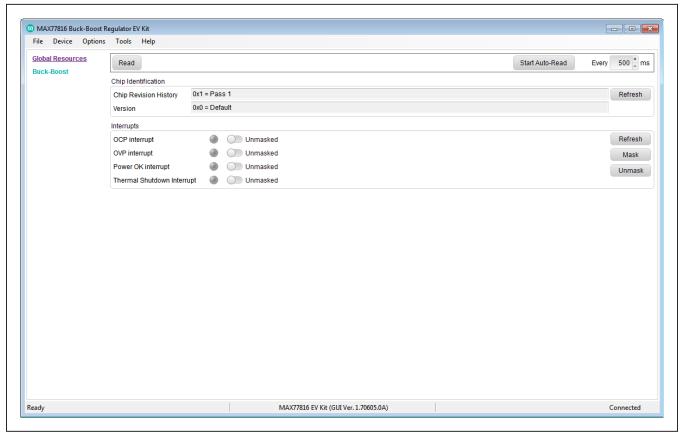

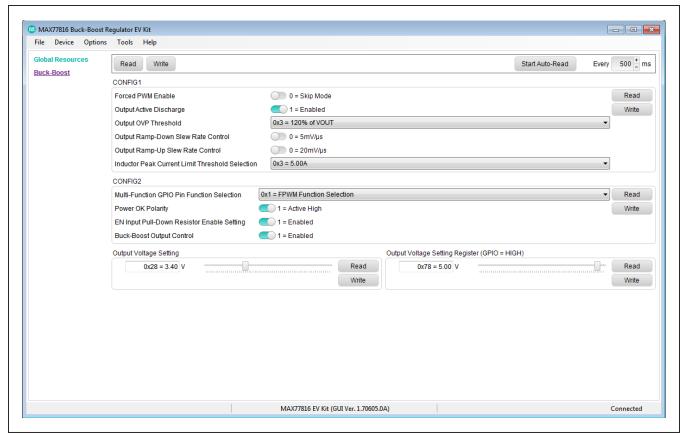Figure 4. MAX77816 EV Kit Software Window (Global Resources Tab)

Figure 5. MAX77816 EV Kit Software Window (Buck-Boost Tab)

Detailed Description of Hardware

Table 1 lists the MAX77816 EV kit jumpers and its associated functions.

SDA/SCL Pullup

Pullup resistors on SDA and SCL can be provided on-board by EV kit or externally.

- When using the MINIQUSB, the on-board pullup should be disabled by open JU5 and JU6. SCL and SDA is pulled up to 3.3V by the MINIQUSB.

- When using other communication modules, the on-board 1.8V LDO can be used as power rail. JU5 and JU6 can be short.

Test Points

Accurate Voltage Measurement

The EV kit provides test points for accurate measurements of the input and output voltages. VINS/PGND1S

and OUTBBS/PGNDS should be used for efficiency, regulation, and any measurements that require a higher degree of accuracy.

Multifunction GPIO Pin

The GPIO pin can be configured to one of five different functions using the GUI (see Figure 5):

- Input for FPWM mode enable
- Input for inductor peak current-limit selection
- Input for output voltage selection
- Output for Power-OK (POK) indication
- Output for interrupts indication

JU3 can be used to bias the GPIO pin as shown in Table 1 and test point GPIO can be used to monitor the pin status.

Table 1. Jumper Functions

REFERENCE DESIGNATOR	NODE	SHUNT POSITION	FUNCTION
JU1	I^{2}C Pullup Voltage	1-2	I^{2}C pullup voltage is supplied from VSYS
		2-3*	I^{2}C pullup voltage is supplied from on-board 1.8V LDO (U2)
JU2	EN	1-2*	Connects EN to OUT1: IC is enabled
		2-3	Connects EN to GND: IC is disabled
JU3	GPIO	1-2*	Connects GPIO to GND: GPIO input is logic low
		1-3	Connects a 100KΩ pullup resistor to GPIO: GPIO status output
		1-4	Connects GPIO to OUT1: GPIO input is logic high
JU4	LDO Input	OPEN	Disconnects on-board LDO input
		1-2*	On-board LDO is supplied from VIN
JU5	SDA Pullup	OPEN*	No pullup on SDA on EV kit (see SDA/SCL Pullup section)
		1-2	SDA pin is pulled up to OUT1/VSYS through 2.2kΩ
JU6	SCL Pullup	OPEN*	No pullup on SCL on EV kit (see SDA/SCL Pullup section)
		1-2	SCL pin is pulled up to OUT1/VSYS through 2.2kΩ

*Default position.

Component List

PART	QTY	DESCRIPTION
C1	1	10µF ±5%, 6.3V X5R ceramic capacitor (0603), TDK CGB3C1X5R0J106M065AC
C2, C8, C9	3	1µF ±10%, 6.3V X5R ceramic capacitor (0402), MURATA GRM155R60J105KE19
C4	1	47µF ±20%, 6.3V X5R ceramic capacitor (0805), TDK C2012X5R0J476M125AC
C6	1	100µF ±20%, 6.3V X5R ceramic capacitor (1210), TDK C3225X5R0J107M250AC
J1	1	Right angle connector, 20 pins, SULLINS ELECTRONICS CORP. PPTC102LJBN-RC
JU1, JU2	2	Straight connector, 3 pins, SAMTEC TSW-103-07-L-S
JU3	1	Straight connector, 4 pins, SAMTEC TSW-104-07-L-S
JU4, JU5, JU6	3	Straight connector, 2 pins, SAMTEC TSW-102-07-T-S
L1	1	1µH ±20%, ISAT=8.7A, DCR=13.25mΩ, COILCRAFT XAL4020-102ME
R1, R4	2	0kΩ, resistor (0402)
R2, R3	2	2.2kΩ ±1%, resistor (0402)
R5	1	100kΩ ±1%, resistor (0402)
U1	1	BUCK-BOOST (20 WLP), MAX77816AEWP+
U2	1	Voltage regulator, MAX8511EXK18+
—	1	PCB: MAX77816 EVALUATION KIT

Component Suppliers

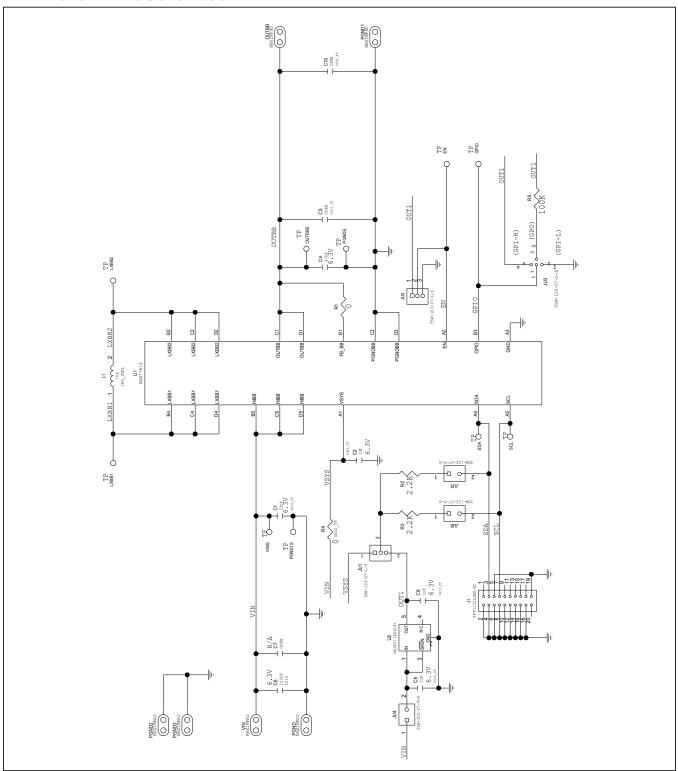| SUPPLIER	PHONE	WEBSITE
TDK	847-803-6100	www.comopnent.tdk.com
MURATA	770-436-1300	www.murata-northamerica.com
TAIYO-YUDEN	603-669-7587	www.t-yuden.com
SULLINS ELECTRONICS CORP.	760-774-0125	www.sullinselectronics.com
SAMTEC	800-726-8329	www.samtec.com
COILCRAFT	847-639-6400	www.coilcraft.com

Note: Indicate that you are using the MAX77816 when contacting these component suppliers.
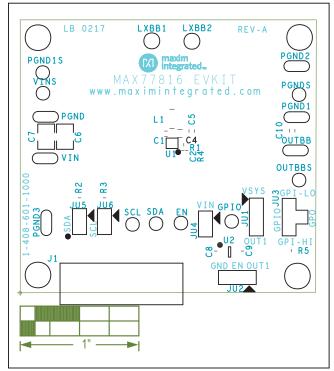
Ordering Information

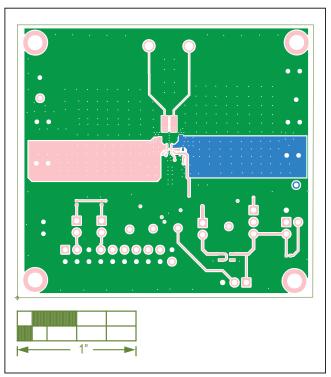| PART	TYPE
MAX77816EVKIT#	EV Kit
MINIQUSB+	Command Module

+Denotes lead(Pb)-free/RoHS-compliant package.

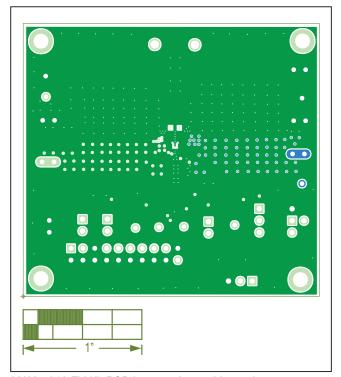## MAX77816 EV Kit Schematic

MAX77816 EV Kit PCB Layout Diagrams

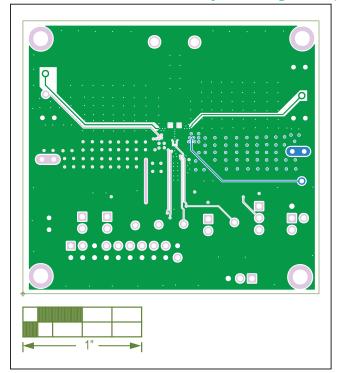*MAX77816 EV Kit Component Placement Guide—Top Silkscreen*
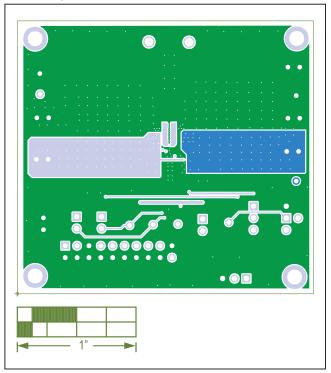

MAX77816 EV Kit PCB Layout—Top Layer

MAX77816 EV Kit PCB Layout—Internal Layer 2

MAX77816 EV Kit PCB Layout Diagrams (continued)

MAX77816 EV Kit PCB Layout—Internal Layer 3

MAX77816 EV Kit PCB Layout—Bottom Layer

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/17	Initial release	—
1	3/19	Updated U1 full part number in the *Component List* table	7