Evaluation Board User Guide

# MAX77845 Evaluation Kit

Evaluates: MAX77845

## General Description

The MAX77845 Evaluation Kit (EV kit) is a fully assembled and tested printed circuit board (PCB) designed to demonstrate the capabilities of the MAX77845, a high-efficiency, high-performance buck-boost regulator with a 5A switching current. The integrated circuit (IC) supports an input voltage range of 2.5V to 16V and provides a dynamically adjustable output voltage between 3V and 15V.

By default, the EV kit is configured with internal feedback and a start-up output voltage of 5V. Alternative start-up voltages can be achieved by using external feedback resistors or by enabling the $I^2C$ block using the BIASEN pin to adjust the output voltage before activation. The output voltage can also be modified dynamically through the $I^2C$ serial interface.

The kit includes I/O pins for the $I^2C$ interface, enable function, SYNC, and interrupt/power-OK indicators. Key parameters such as the $I^2C$ subordinate address, switching current limit, switching frequency, and feedback configuration can be adjusted by changing the $R_{SEL}$ resistor (R9) or the variable resistor (R8). The MAXUSB_INTERFACE# enables communication with Microsoft Windows®-based software, offering both a user-friendly graphical interface (ACE) and a detailed register-level interface to access all features of the IC. The EV kit is compatible with all versions of the MAX77845 WLP IC.

## Features

- Proven PCB reference design and layout for optimal performance
- Fully assembled and factory-tested evaluation board
- Dedicated sense points for high-accuracy voltage measurements
- Easily accessible test point pins for EN, POKB/INTB, $V_{IO}$, SEL, SYNC, and $I^2C$ serial interface (SCL, SDA)
- MAXUSB_INTERFACE# enables seamless communication with a Microsoft Windows PC
- ACE software provides intuitive $I^2C$ control through a graphical user interface
- Start-up output voltage configurable using external feedback resistors or using the $I^2C$ interface
- Output voltage can be dynamically adjusted through the $I^2C$ serial interface
- Synchronization frequency range is programmable using $I^2C$
- $I^2C$ subordinate address, switching current limit, and feedback configuration are adjustable using $R_{SEL}$ (R9) or a variable resistor (R8)

***Ordering Information* appears at end of data sheet.**



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## Check List

- MAX77845 IC Evaluation Board
- MAXUSB_INTERFACE# (USB to I2C Serial Interface)
- USB Type-A to Micro-USB Cable
- Microsoft Windows-Based Graphical User Interface (ACE) Software

## EV Kit Specifications

| SPECIFICATION | TEST CONDITION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Input voltage | | 2.5 | | 16 | V |
| Output voltage | | 3 | | 15 | V |
| Default output voltage | Internal feedback | | 5 | | V |
| Switching current limit | | | 5 | | A |

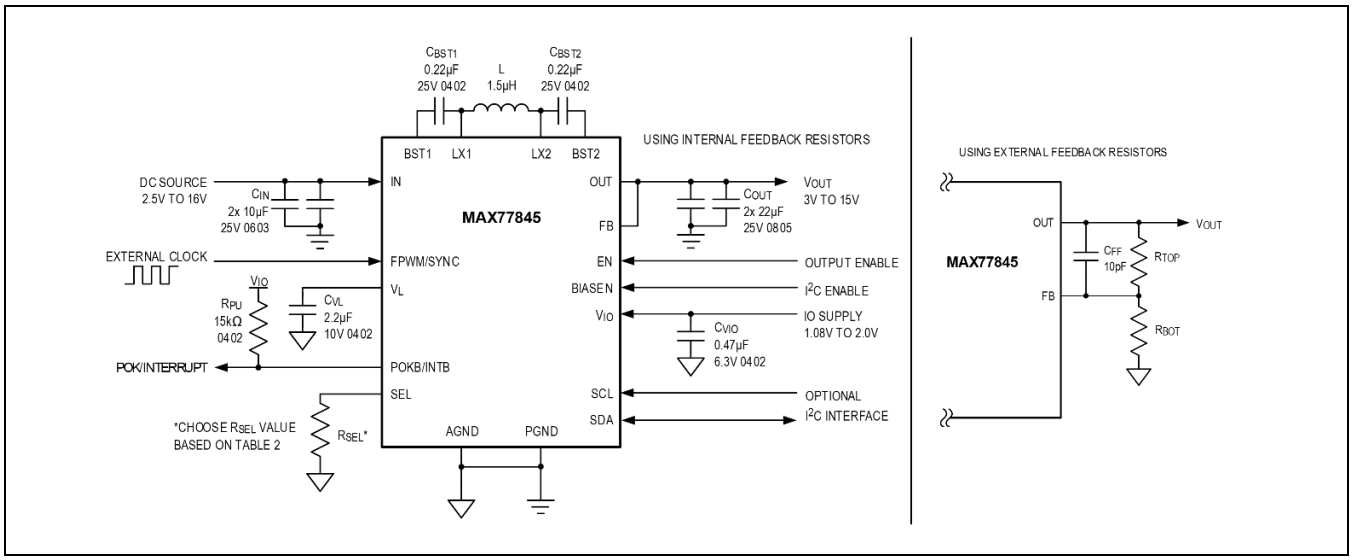



*Figure 1. MAX77845 Typical Application Circuit*

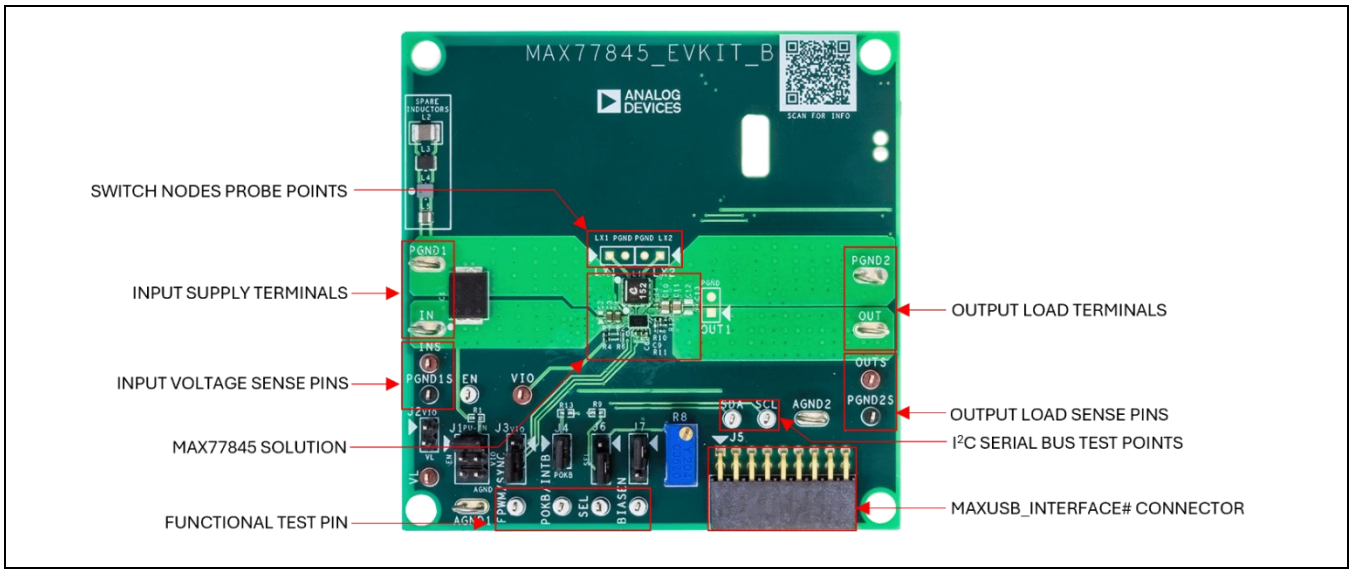



*Figure 2. MAX77845 Evaluation Board*

## EV Kit Default Configuration

With the default jumper configuration specified in *Table 1* and the following component values on the EV kit, $R_{SEL}$ (R9) = 3.9KΩ, $R_{TOP}$ (R10) = 0Ω, and $R_{BOT}$ (R11) = OPEN, the MAX77845 evaluation kit is set up with the corresponding default operating parameters.

- Internal feedback
- Switching Current Limit = 5A
- $I^2C$ subordinate address (7-bit) = 0x66
- Switching frequency = 2.1MHz (1.2MHz and 1.8MHzM are only adjustable through $I^2C$)
- $V_{IO}$ disconnected from $V_L$
- EN connected to $V_{IN}$

See the *EV Kit Hardware* section to change the EV kit configuration.

## Table 1. Default Shunt Positions and Jumper Descriptions

| JUMPER | NODE | SHUNT POSITION | FUNCTION |
|---|---|---|---|
| J1 | EN | 1 to 2* | Connect the EN pin to $V_{IN}$ through a 510 kΩ pull-up resistor to enable standalone operation. For additional details, see the *Standalone Operation* section. |
| | | 3 to 4 | Connecting the EN pin to $V_{IO}$ enables the converter when both $V_{IN}$ and $V_{IO}$ are valid. |
| | | 5 to 6 | Connecting the EN pin to GND enables the converter when BIASEN is valid and the BB_EN bit is set to 1 using $I^2C$. |
| | | Not installed | The EN pin is floating by default and can be used to control the converter using an external logic signal. If no external signal is connected to EN, the converter remains disabled when either BIASEN is invalid or the BB_EN bit is set to 0. |
| J2 | $V_{IO}$ | 1 to 2 | Connect $V_{IO}$ to $V_L$ to allow $V_{IO}$ to be powered directly from $V_L$, eliminating the need for a separate $V_{IO}$ supply. For further details, see the *Standalone Operation* section. |
| | | Not installed* | Disconnects $V_{IO}$ from $V_L$. $V_{IO}$ needs to be powered from either MAXUSB_INTERFACE# or an external $V_{IO}$ supply. |
| J3 | FPWM | 1 to 2 | Connect this pin to $V_{IO}$ to enable FPWM mode. |
| | | 2 to 3* | Connect this pin to AGND to activate SKIP mode. |
| J4 | POKB | 1 to 2* | Active-Low Open Drain Status/Interrupts Output. Connect a 15kΩ pull-up resistor to a logic HIGH level to enable proper signalling. |
| | | Not installed | Leave this pin unconnected if not used. |
| J6 | SEL | 1 to 2 | Connect SEL to R8, and place a resistor between SEL and AGND to configure internal/external feedback, switching current limit, and the $I^2C$ serial interface address. |
| | | 2 to 3* | Connect SEL to R9, and place a resistor between SEL and AGND to configure internal/external feedback, switching current limit, and the $I^2C$ serial interface address. |
| J7 | BIASEN | 1 to 2* | Connect $V_{IO}$ to BIASEN and set it to logic HIGH to enable the $I^2C$ interface and power up $V_L$ before enabling the Buck-Boost output. |
| | | 2 to 3 | Connect to AGND if not in use. |

**Default position*

## Quick Start

### Required Equipment

- MAX77845 EV kit
- Adjustable DC power supply
- Digital multimeters
- Electronic load
- MAXUSB_INTERFACE# (optional, for I2C serial interface)
- USB Type-A to Micro-USB cable (optional)
- Microsoft Windows-based PC with MAX77845 EV kit ACE software (optional)

### Setup Overview

Typical bench setups for the MAX77845 EV kit are illustrated in *Figure 3*, *Figure 4*, *Figure 5*, and *Figure 6*, showcasing various configurations.

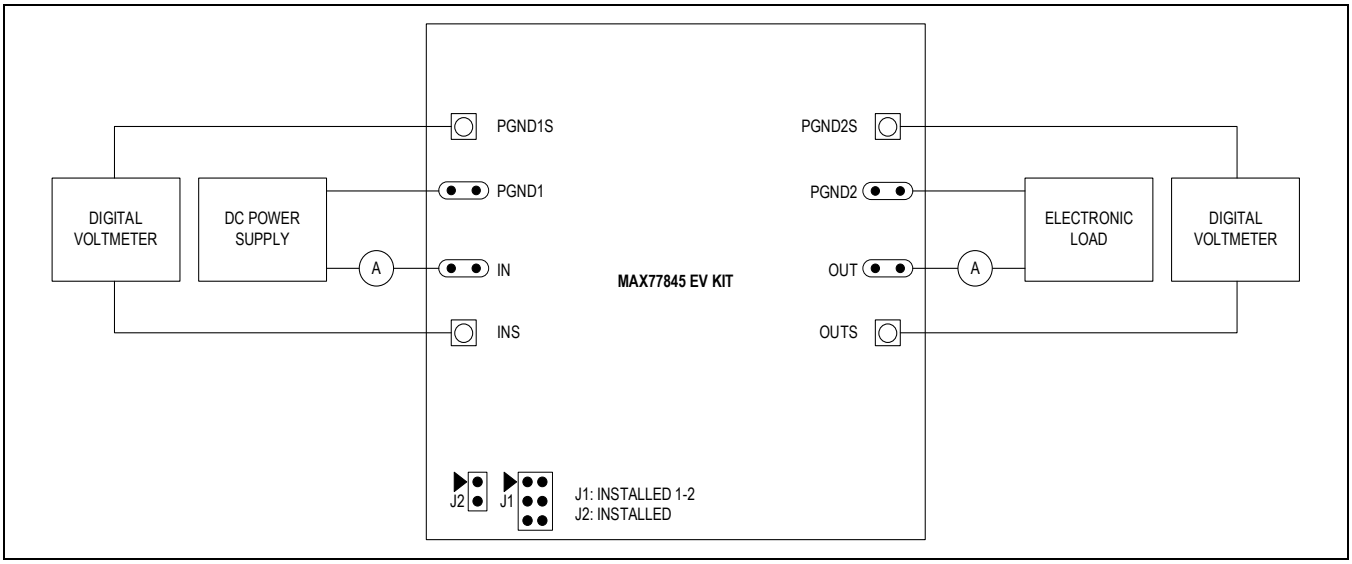



*Figure 3. EV Kit Connection Block Diagram—Standalone Operation*

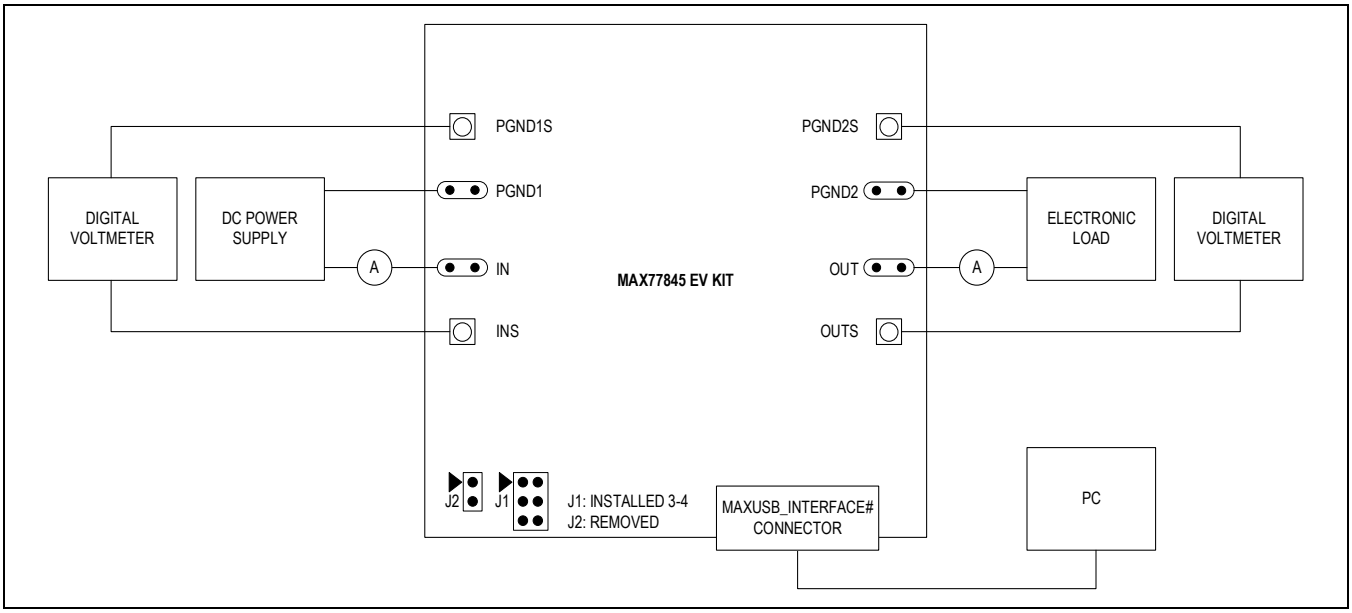



*Figure 4. EV Kit Connection Block Diagram—with MAXUSB_INTERFACE#*

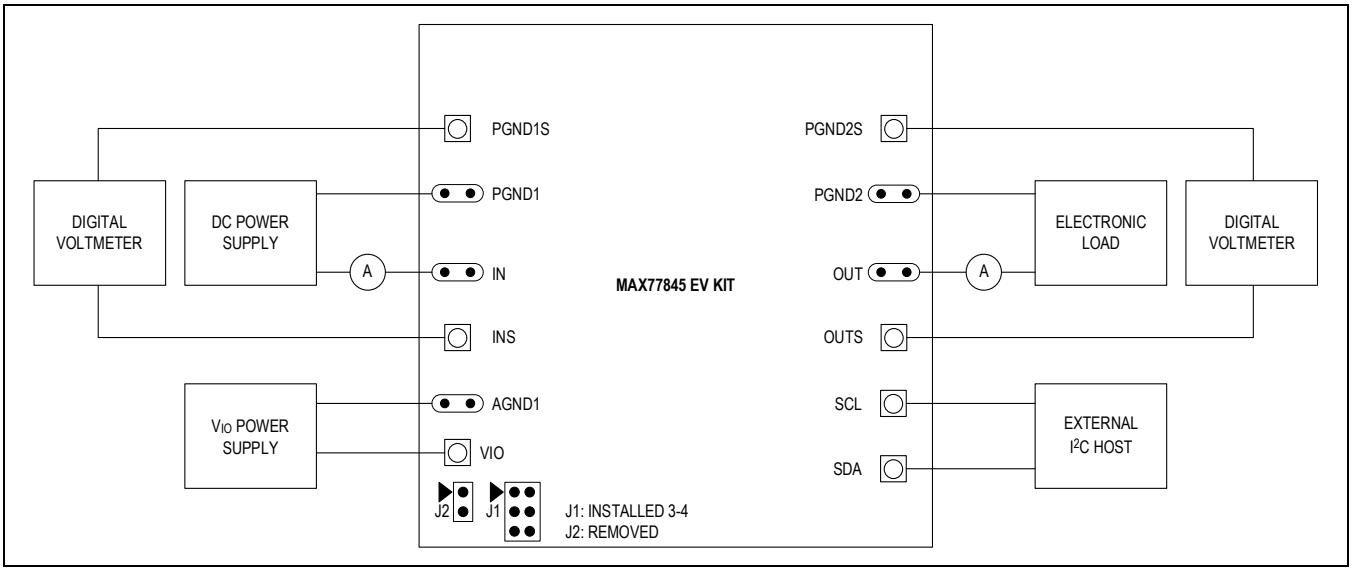



*Figure 5. EV Kit Connection Block Diagram—with External I²C Bus*

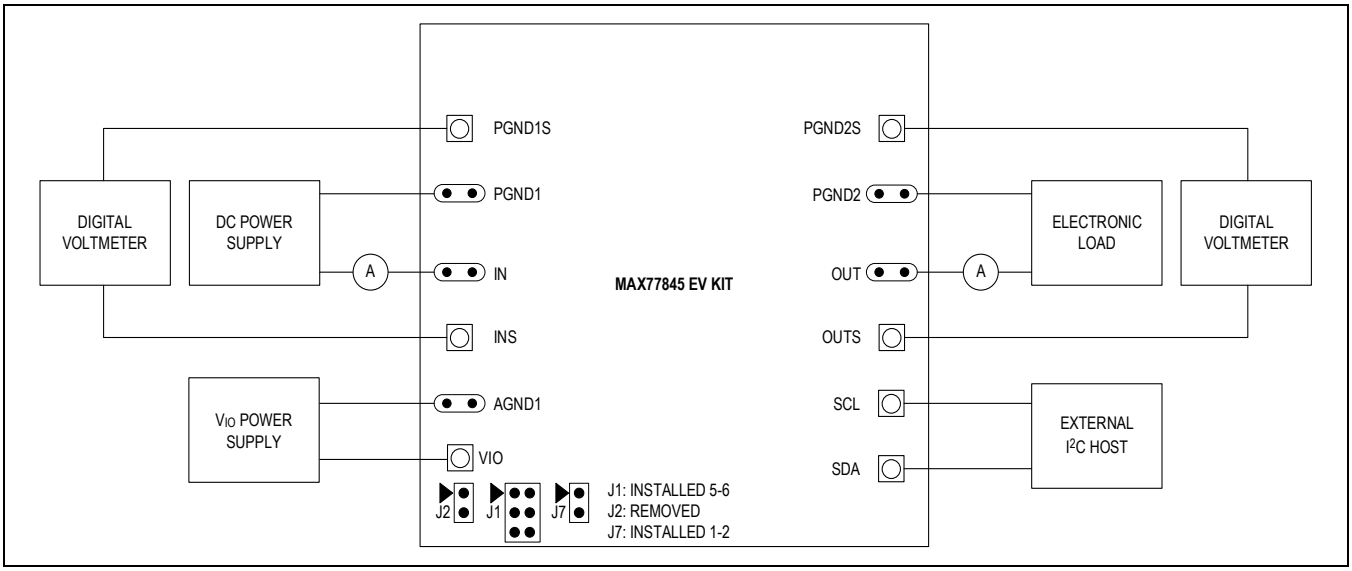



*Figure 6. EV Kit Connection Block Diagram—Software Enable Using BIASEN and I²C*

## Procedure

The EV kit is fully assembled and tested. To verify board operation, follow the steps below and use short, twisted 20 AWG wires to connect the load and power sources.

**Note:** In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the evaluation software. Text in **bold and underlined** refers to items from the Microsoft Windows operating system.

1. Visit ACE-Software | Analog Devices to download the latest version of the **ACE GUI**.
2. Install the EV kit software on the computer by running the **ACEInstall_version.exe** installer.
3. Ensure the EV kit is fully assembled and has the correct jumper settings for standalone operation (see *Table 1*).
4. Connect a voltmeter (DVM1) to the INS and PGND1S sense pins to measure input voltage.
5. Connect another voltmeter (DVM2) to the OUTS and PGND2S sense pins to measure output voltage.
6. Apply 0V from a power supply (with a 1.5A current limit) across the IN and PGND1 terminals. Gradually increase the voltage to 7.6V.
7. Confirm that DVM2 reads the default output voltage of 5V and the input current is approximately 200µA.

8. Once verified, bypass the series ammeter and increase the current limit. Connect an electronic load across the OUT and PGND2 terminals to evaluate the regulator's performance.
9. The next steps in the procedure use the EV kit ACE and MAXUSB_INTERFACE# to evaluate the MAX77845's I²C serial interface. If such an evaluation is not required, skip the following steps. The EV kit includes on-board 2.2kΩ pull-up resistors (R4 and R7) to $V_{IO}$ for I²C serial interface signals SDA and SCL.
10. Turn off the input power supply connected in step 4.
11. Remove jumper J2 to disconnect $V_{IO}$ from $V_L$. Move jumper J1 to position 3 to 4.
12. Set switches SW1 and SW2 on the MAXUSB_INTERFACE# to the **ON** position to enable I²C mode.
13. Set the $V_L$ jumper (J5) on the MAXUSB_INTERFACE# to 1.8V. **Important:** Setting this to 3.3V may damage the MAX77845 IC.
14. Connect the MAXUSB_INTERFACE# to the EV kit and to the PC using a USB Type-A to Micro-USB cable.
15. Turn on the input power supply.
16. Launch the **ACE GUI** on the PC. Select **MDXX Board**, then choose *MAX77845*. A successful connection displays *Status = Good*.
17. Use the slider in the *Output Voltage Configuration* section and click **DVS Start**, then **Apply Changes** to adjust the output voltage.
18. Verify the change on DVM2 to confirm successful I²C communication.

This concludes the *Quick Start* procedure. Users are now encouraged to explore further the device and its register settings with the **ACE GUI** software. For more information about the **ACE GUI**, see the *EV Kit Software* section.

## EV Kit Hardware

The MAX77845 EV kit demonstrates the MAX77845 buck-boost regulator. It regulates output from an input voltage range of 2.5V to 16V. The programmable output range is from 3V to 15V. The EV kit is suited for a general DC input. *Table 1* lists jumpers and associated functions available on the EV kit.

### Standalone Operation

The MAX77845 is capable of standalone operation, starting up whenever $V_{IN}$ and EN are valid, without requiring a separate supply for the $V_{IO}$ pin. This is useful for systems without a host controller or if the MAX77845 is the only power supply in the system. To configure the MAX778545 EV kit for standalone operation, install header jumper J1 to position 1 to 2. This connects EN to $V_{IN}$ through a 510kΩ pull-up resistor, allowing $V_{IN}$ to control EN. Also, install the header jumper J2. This connects $V_{IO}$ to $V_L$, allowing $V_{IO}$ to be powered by $V_L$, thus eliminating the need for an external $V_{IO}$ power supply.

### MAXUSB_INTERFACE#

The MAXUSB_INTERFACE#, along with the companion EV kit GUI software, allows users to easily change the MAX77845's register settings with a Microsoft Windows PC. Before connecting the MAXUSB_INTERFACE# to the EV kit's MAXUSB_INTERFACE# connector (J5), make sure the MAXUSB_INTERFACE# is configured with the following settings:

- SW1, SW2 to ON Position (this enables I²C mode on the MAXUSB_INTERFACE#.)
- $V_L$ Jumper (J5) to 1.8V (this sets the MAXUSB_INTERFACE#'s $V_{IO}$ voltage.)
  - **Warning:** Setting this incorrectly to 3.3V could potentially damage the MAX77845 IC.

The MAXUSB_INTERFACE# also includes an on-board LDO that can supply the necessary voltage to $V_{IO}$. If using the MAXUS_INTERFACE#, disconnect any external $V_{IO}$ supply from the EV kit, and make sure header jumper J2 is removed from the EV kit.

### External I²C Bus

To connect to the external I²C serial bus and not use the MAXUSB_INTERFACE#, unplug the MAXUSB_INTERFACE# from the EV kit's MAXUSB_INTERFACE# connector (J5). Apply an external I/O supply to the $V_{IO}$ pin or power the $V_{IO}$ pin from the $V_L$ pin by connecting header jumper J2. Make sure the external I²C serial bus's logic voltage level is compatible with the MAX77845's I/O logic voltage level. Refer to the *MAX77845* IC data sheet for the appropriate I/O logic voltage level.

### $R_{SEL}$ Configuration Resistor

The MAX77845 includes an SEL pin to set the I²C subordinate address, switching current limit, and feedback configuration. A resistor with 1% tolerance (or better) should be chosen for $R_{SEL}$ (R9). The default $R_{SEL}$ value installed on the EV kit is 3.9KΩ. See *Table 2* for nominal $R_{SEL}$ values and their corresponding settings. The switching current limit is also adjustable dynamically through the I²C serial interface when the IC is enabled. See the *EV Kit Software* section for more information.

## Table 2. MAX77845 $R_{SEL}$ Selection Table

| $R_{SEL}$ (Ω) | I²C ADDRESS (7-BIT) | TYPICAL $I_{LIM}$ (A) | SWITCHING FREQUENCY (MHz) | $R_{FB}$ SELECTION |
|---|---|---|---|---|
| GND | 110 0110 (0x66) | 5.0 | 2.1 | External feedback resistors |
| 200 | 110 0111 (0x67) | | | |
| 309 | 110 1110 (0x6E) | | | |
| 422 | 110 1111 (0x6F) | | | |
| 536 | 110 0110 (0x66) | 1.8 | | |
| 649 | 110 0111 (0x67) | | | |
| 768 | 110 1110 (0x6E) | | | |
| 909 | 110 1111 (0x6F) | | | |
| 1050 | 110 0110 (0x66) | 5.0 | 1.5 | |
| 1210 | 110 0111 (0x67) | | | |
| 1400 | 110 1110 (0x6E) | | | |
| 1620 | 110 1111 (0x6F) | | | |
| 1870 | 110 0110 (0x66) | 1.8 | | |
| 2150 | 110 0111 (0x67) | | | |
| 2490 | 110 1110 (0x6E) | | | |
| 2870 | 110 1111 (0x6F) | | | |
| 3740* | 110 0110 (0x66) | 5.0 | 2.1 | Internal feedback resistors |
| 8060 | 110 0111 (0x67) | | | |
| 12400 | 110 1110 (0x6E) | | | |
| 16900 | 110 1111 (0x6F) | | | |
| 21500 | 110 0110 (0x66) | 1.8 | | |
| 26100 | 110 0111 (0x67) | | | |
| 30900 | 110 1110 (0x6E) | | | |
| 36500 | 110 1111 (0x6F) | | | |
| 42200 | 110 0110 (0x66) | 5.0 | 1.5 | |
| 48700 | 110 0111 (0x67) | | | |
| 56200 | 110 1110 (0x6E) | | | |
| 64900 | 110 1111 (0x6F) | | | |
| 75000 | 110 0110 (0x66) | 1.8 | | |
| 86600 | 110 0111 (0x67) | | | |
| 100000 | 110 1110 (0x6E) | | | |
| OPEN | 110 1111 (0x6F) | | | |

**Default value installed on the EV kit*

## Output Voltage Configuration

By default, the EV kit is configured to use internal feedback resistors, with a 5V default start-up output voltage and an output voltage range from 3V to 15V. To achieve a different default start-up output voltage other than 5V, external feedback resistors are required. To change the EV kit to an external feedback configuration, replace the feedback resistors $R_{TOP}$ (R10) and $R_{BOT}$ (R11) with resistors of appropriate values (use resistors with 1% tolerance or better) and adjust $R_{SEL}$ (R9) accordingly to select the external feedback option. It is also recommended to install a 10pF feed-forward capacitor on C9 when using external feedback.

To select appropriate external feedback resistor values, first choose $R_{TOP}$ (R10) to be between 150kΩ and 330kΩ. Then, calculate the value of $R_{BOT}$ (R11) for a desired start-up output voltage with the following equation:

$$R_{BOT} = \frac{R_{TOP} \times V_{REF}}{V_{OUT} - V_{REF}}, V_{OUT} \leq V_{OVP}$$

where $V_{REF}$ is 0.30518V and $V_{OUT}$ is the desired start-up output voltage. Note that the output voltage cannot exceed the maximum output voltage of 15V. The recommended external feedback resistor values for standard output voltages are listed in *Table 3*.

After start-up, the output voltage can be adjusted dynamically using the I²C serial interface. See the *EV Kit Software* section for more information. When using internal feedback, output voltage ranges are between 3V and 15V in 20mV steps. When using external feedback, the output voltage range and step size vary based on the external feedback resistor values. To calculate the output voltage range, use the following equation and plug in the minimum $V_{REF}$ of 0.18311V and the maximum $V_{REF}$ of 0.91431V:

$$V_{OUT} = \frac{V_{REF}}{R_{BOT}} \times (R_{BOT} + R_{TOP})$$

Output voltage step size can be calculated with the following equation:

$$V_{OUT\_STEP} = \frac{1.22mV}{R_{BOT}} \times (R_{BOT} + R_{TOP})$$

Programmable output voltage ranges and output voltage step sizes for each recommended feedback resistor pair are listed in *Table 3*.

## Table 3. Feedback Resistor Value Recommendations

| DEFAULT $V_{REF}$ (V) | $R_{TOP}$ (kΩ) | $R_{BOT}$ (kΩ) | START-UP $V_{OUT}$ (V) | PROGRAMMABLE $V_{OUT}$ RANGE (V) | $V_{OUT}$ STEP SIZE (mV) |
|---|---|---|---|---|---|
| 0.30518 | 205 | 23.2 | 3 | 3.0 to 9.0 | 12 |
| | 162 | 16.5 | 3.3 | 3.0 to 9.9 | 13.2 |
| | Internal Feedback Resistors* | | 5 | 3.0 to 15 | 20 |
| | 160 | 5.62 | 9 | 5.4 to 15 | 36 |
| | 182 | 4.75 | 12 | 7.2 to 15 | 48 |
| | 180 | 3.74 | 15 | 9.0 to 15 | 60 |

**Default EV kit configuration*

## High-Temperature Testing

The MAX77857 is rated for operation under junction temperatures up to +125°C. However, not all components on the EV kit are rated for operation at this temperature. Certain ceramic capacitors may exhibit increased leakage when exposed to temperatures beyond their specified range, which can result in higher-than-expected supply current readings for the IC. The MAXUSB_INTERFACE# is also not rated for +125°C. It is recommended to verify the temperature ratings of all components on the EV kit before conducting tests at +125°C ambient or junction temperatures. Components should be replaced if operation at +125°C is a critical requirement.

**Capacitors not rated for +125°C:** C10, C11 (OUT capacitors).

### Critical Node Measurement (OUT and LX)

The EV kit comes with probe points for measuring critical nodes OUT1, LX1, and LX2. See *Figure 2* for their locations on the EV kit. Use these probe points to minimize noise when measuring the critical nodes. To ensure the best results, use a very short ground wire from the ground sleeve of the scope probe to the GND side of the probe point, and use the bare tip of the probe directly to the signal side of the probe point (*Figure 7*). Following these guidelines gives the most accurate results when measuring parameters such as output voltage ripple, switching waveforms, and load transient response.

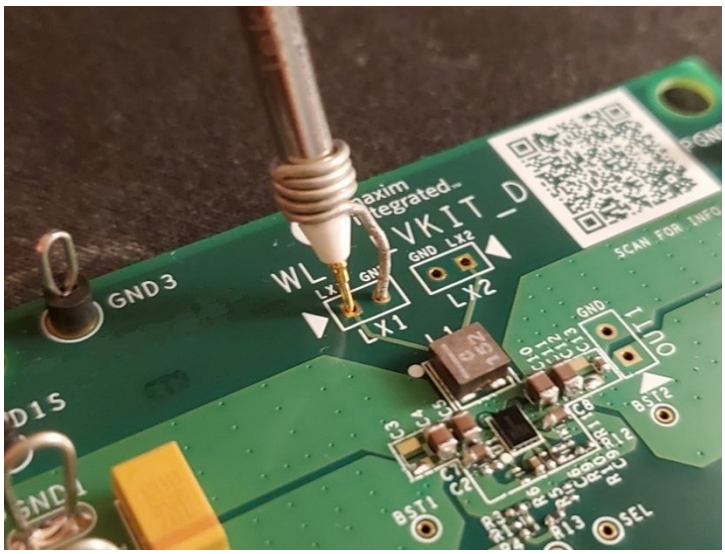



*Figure 7. Probing Critical Nodes*

### Efficiency Measurement (INS and OUTS)

The EV kit includes sense pins for accurate measurement of input voltage (**INS**, **PGND1S**) and output voltage (**OUTS**, **PGND2S**). See *Figure 2* for their locations on the EV kit. For precise efficiency, load regulation, and line regulation measurements, use these sense pins to measure input and output voltages.

**Warning:** These sense pins are intended only for voltage measurement. Do not connect the input supply to the input sense pins, or an electronic load to the output sense pins, as they are not designed to carry current. Doing so may damage the EV kit. Use the input supply terminals to connect the input supply and the output terminals to connect the electronic load, as shown in *Figure 2*.

## Table 4. Usage of Critical Test Points

| LOAD TRANSIENT, OUTPUT RIPPLE | LOAD REGULATION, LINE REGULATION, $V_{OUT}$ ACCURACY | EFFICIENCY | | SWITCHING NODE | |
|---|---|---|---|---|---|
| | | OUTPUT VOLTAGE | INPUT VOLTAGE | LX1 | LX2 |
| $V_{OUT}$ (OUT1) | $V_{OUT}$ (OUTS, PGND2S) | $V_{OUT}$ (OUTS, PGND2S) | $V_{IN}$ (INS, PGND1S) | LX1 (LX1) | LX2 (LX2) |

## EV Kit Software

The graphical user interface (ACE GUI) software allows for a quick, easy, and thorough evaluation of the MAX77845. The ACE GUI, along with the MAXUSB_INTERFACE# drives, provides I2C communication with the EV kit. Every control in the ACE GUI corresponds directly to a register within the MAX77845. Refer to the *Register Map* section of the MAX77845 IC data sheet for a complete description of the registers. See *Figure 8* for a screenshot of the ACE GUI upon first opening.

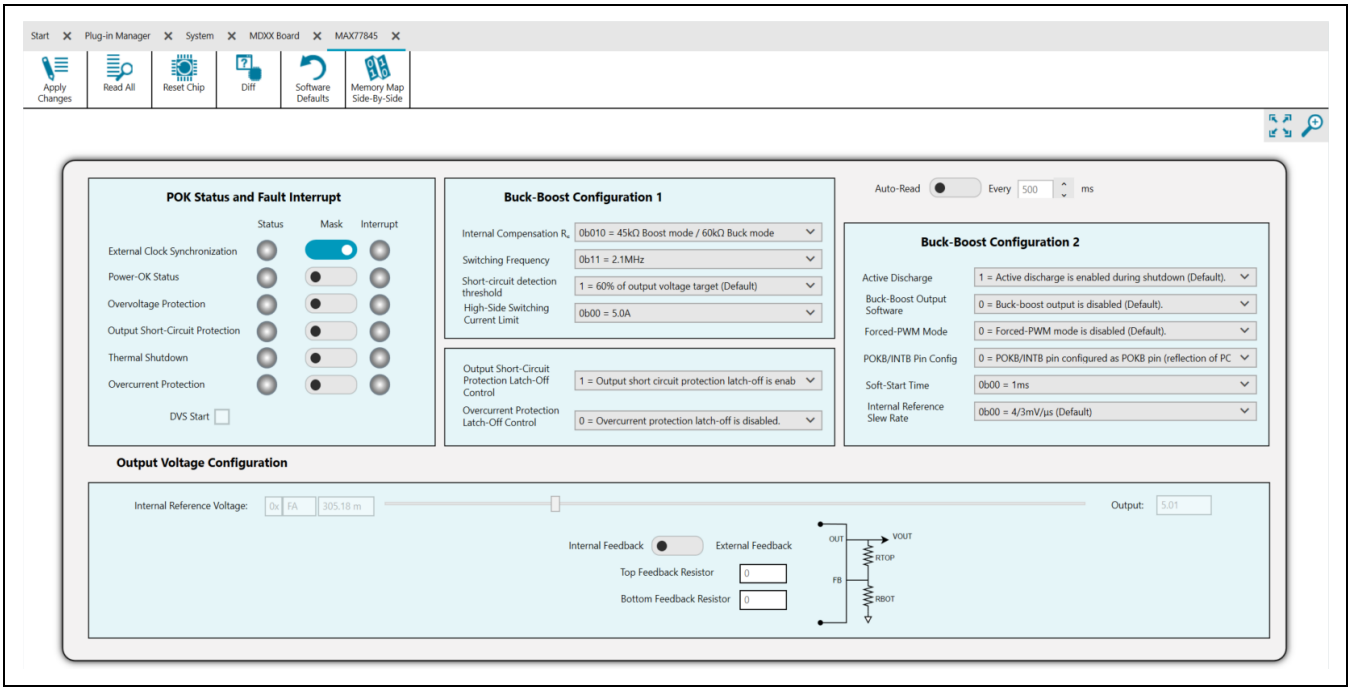



*Figure 8. MAX77845 EV Kit ACE GUI Software Configuration Tab*

### Microsoft Windows Driver

After plugging the MAXUSB_INTERFACE# into the PC with a Micro-USB cable for the first time, wait about 30 seconds for Microsoft Windows to install the necessary drivers automatically.

### Connecting the ACE GUI to MAXUSB_INTERFACE#

After opening the ACE GUI, the attached hardware should display the MDXX Board (*Figure 9*). Select the **MDXX Board** and choose MAX77845 from the dropdown menu, then click **Navigate to Chip** (*Figure 10*). If the connection is successful, the lower left corner displays **Status = Good**. Proceed to the **Configuration Tab** (*Figure 8*).

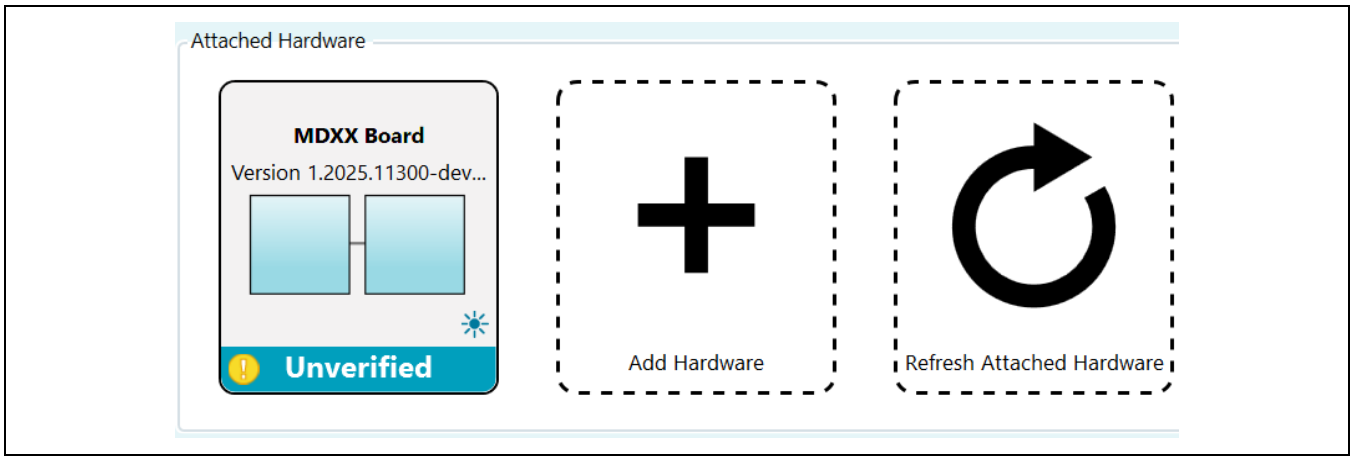



*Figure 9. ACE GUI showing Attached Hardware*

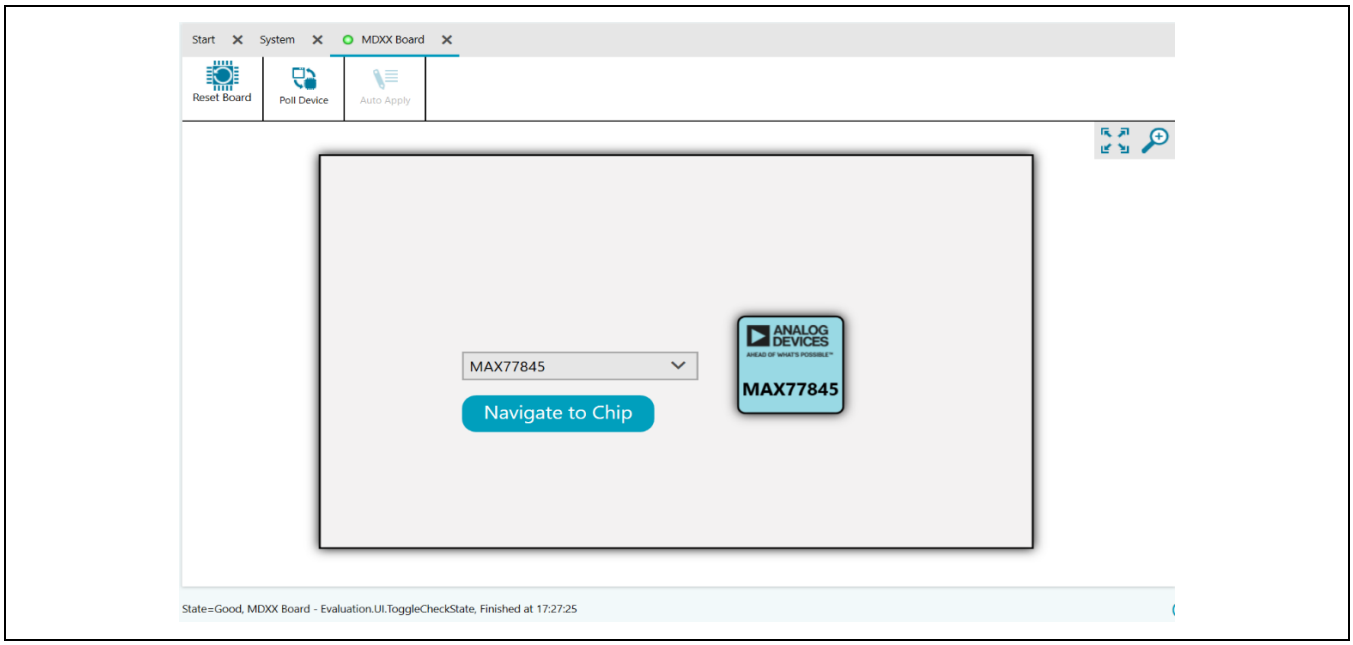



*Figure 10. ACE GUI Dropdown Menu*

### Configuration

The **Configuration** tab (*Figure 8*) displays the information and status of the IC on the EV kit as well as all available register settings. It is divided into different sections: **POK Status** and **Fault Interrupts**, **Buck-Boost Configuration 1 and 2**, and **Output Voltage Configuration**.

Click **Read All** at the top of the ACE GUI window to obtain all the setting values currently stored in all the MAX77845 registers. After changing the setting values in the ACE GUI software, click **Apply Changes** at the top of the ACE GUI window to apply all settings to the MAX77845 registers.

The **POK Status** and **Fault Interrupt** section (*Figure 11*) configures the reflection of the bits in INT_SRC to the POKB/INTB pin. If a bit is masked, its status in the INT_SRC register is not shown on the POKB/INTB pin. Refer to the **Power-OK Monitor** and **Fault Interrupts** section in the IC data sheet for more information about the operation of the POKB/INTB pin. Click **Read All** to obtain the settings stored on the IC, and click **Apply Changes** to apply new settings to the IC.

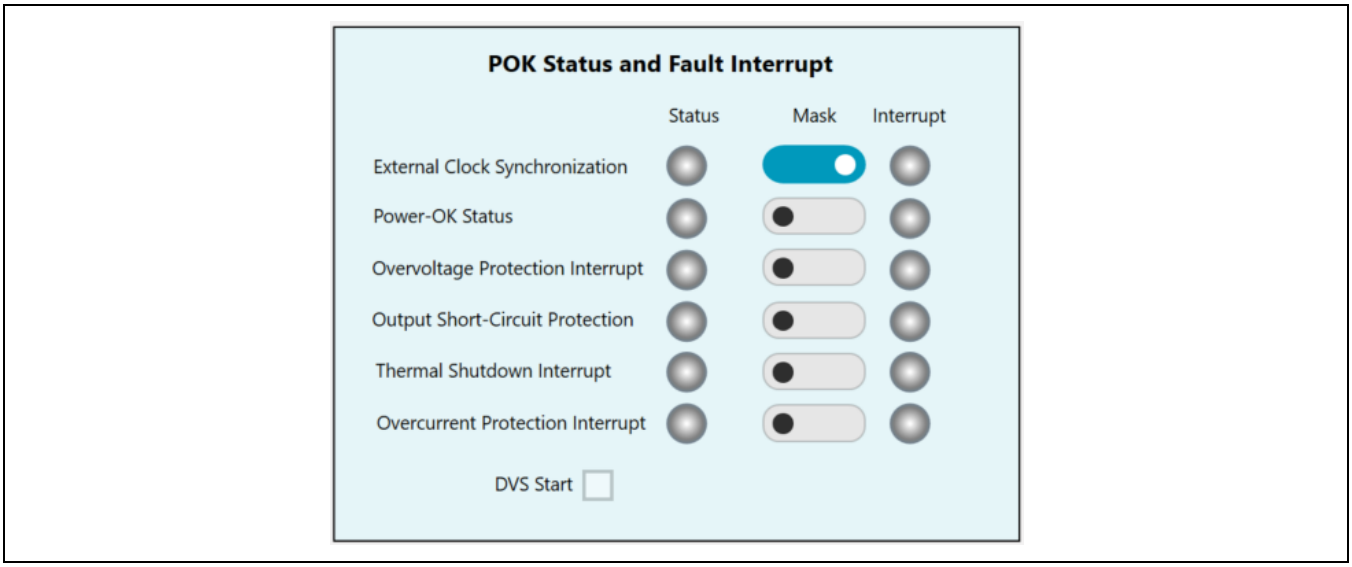



*Figure 11. Configuration Tab—POK Status and Fault Interrupt Section*

The *Output Voltage Configuration* section (*Figure 12*) configures the EV kit ICs' output voltage. The output voltage is changed by adjusting the internal reference voltage. Drag the slider to the desired internal reference voltage (or output voltage) and click **Apply Changes** to change the output voltage. Clicking **Read All** returns the programmed internal reference voltage (or output voltage) to the ACE GUI.

To simplify evaluation, the GUI software displays the corresponding output voltage value in the **Output Voltage** text box based on the **Internal Reference Voltage** slider. To obtain the correct value, check the **Internal Feedback** or **External Feedback** checkbox corresponding to the EV kit configuration. For external feedback configuration, enter the chosen feedback resistor values in the **Top Feedback Resistor** and **Bottom Feedback Resistor** text boxes to ensure the correct calculation of the corresponding output voltage is displayed on the ACE GUI software.

**Note:** Changing the **Internal Feedback** or **External Feedback** checkboxes (*Figure 12*) does NOT change the feedback configuration on the EV kit. It is only for calculating and displaying the correct output voltage value on the GUI software. To change the EV kit's feedback configuration, see the *EV Kit Hardware* and *Output Voltage Configuration* section for details.

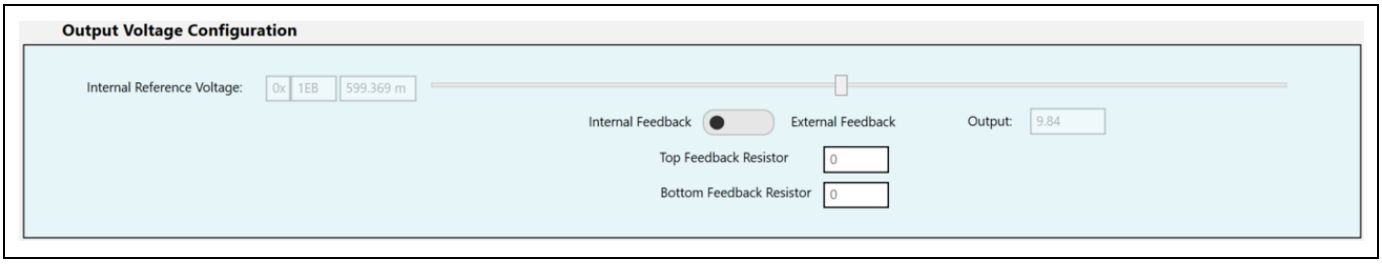



*Figure 12. Configuration Tab—Output Voltage Configuration Section*

The **Buck-Boost 1 and 2 Configuration** (*Figure 13*) show the remaining register settings of the MAX77845. Use these sections to control internal compensation resistance, switching frequency, switching current limit, forced-PWM mode, and output voltage change slew rate (using the internal reference voltage DVS slew rate) and other functions. See *Figure 13* for more information on each available setting. Click **Read All** to obtain the settings stored on the IC, and click **Apply Changes** to apply new settings to the IC.

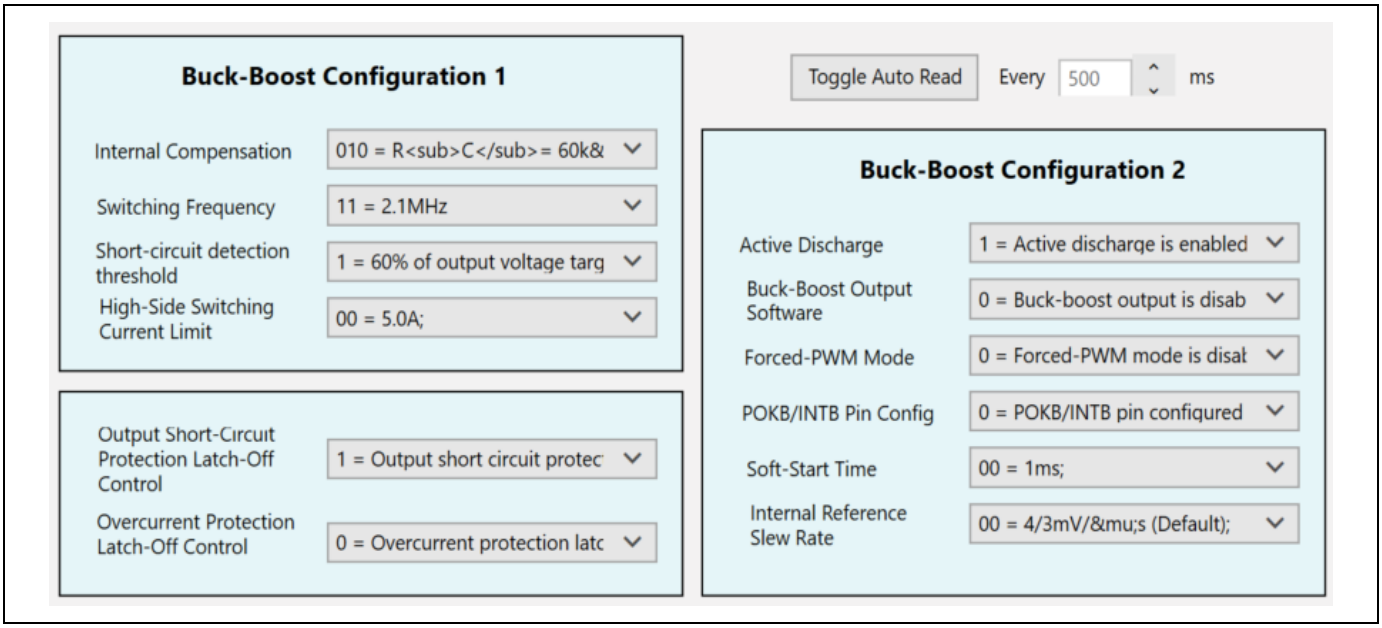



*Figure 13. Configuration Tab—Buck-Boost 1 and 2 Configuration Sections*

### Register Map

The **Register Map** tab provides an overview of all the MAX77845 registers and the values currently stored on them. Clicking an individual bit shows the name and description of the specific bitfield.

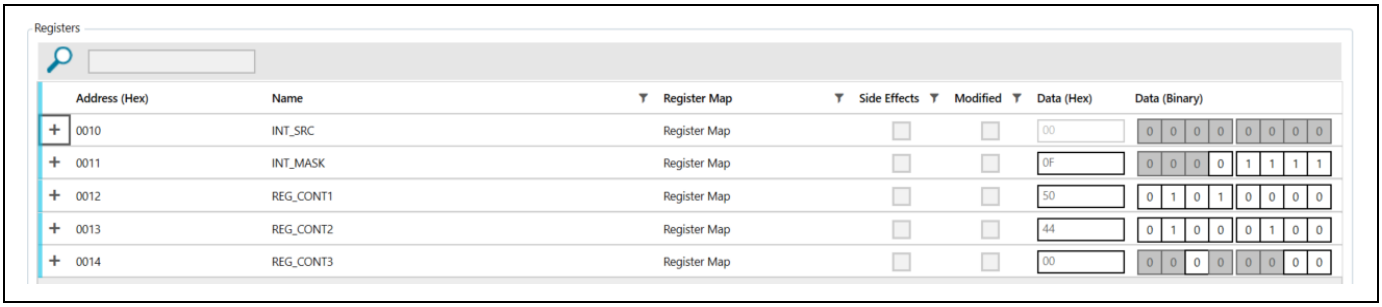



*Figure 14. EV Kit GUI Software Register Map Tab*

## Layout Guideline

- Careful circuit board layout is essential for achieving low switching power losses and stable operation. The EV kit also serves as Analog Devices' recommended layout for the MAX77845. If POK or fault interrupt functionality is required, a high-density interconnect (HDI) PCB is necessary to route to the I2C. Otherwise, an HDI PCB is recommended but not mandatory. When designing the IC, use the provided layout files and refer to the MAX77845 EV Kit PCB layouts for guidance. The IC data sheet includes a list of valuable layout tips and guidelines, summarized below for convenience.
- Place the **Input Capacitors ($C_{IN}$)** and **Output Capacitors ($C_{OUT}$)** as close as possible to the **IN** and **OUT** pins of the IC, respectively. Since the IC operates at a high switching frequency, this placement is critical to minimizing parasitic inductance in the input and output current loops, which can cause high voltage spikes and potentially damage the internal switching MOSFETs.
- Position the inductor close to the LX bumps, and ensure the traces between the LX bumps and the inductor are short and wide to minimize PCB trace impedance. Excessive impedance reduces converter efficiency. When routing LX traces on separate layers, include sufficient usings and consider multi-layer routing to reduce impedance further. Avoid excessive trace area, as fast switching at this node increases radiated emissions.
- Route LX nodes to their corresponding bootstrap capacitor (CBST) with minimal trace length. Prioritize CBST placement to reduce the distance to the IC.
- Connect the inner PGND bumps to a low-impedance ground plane using usings placed adjacent to the bumps. Avoid creating PGND islands, as they may interrupt the hot loops. Connect AGND and the AGND island to the same low-impedance ground plane as PGND.
- Keep power traces and load connections short and wide to ensure high converter efficiency.
- Do not overlook the ceramic capacitor DC voltage derating. Select capacitor values and case sizes carefully. Refer to the *Output Capacitor Selection* section in the MAX77845 IC data sheet and *Tutorial 5527* for further guidance.

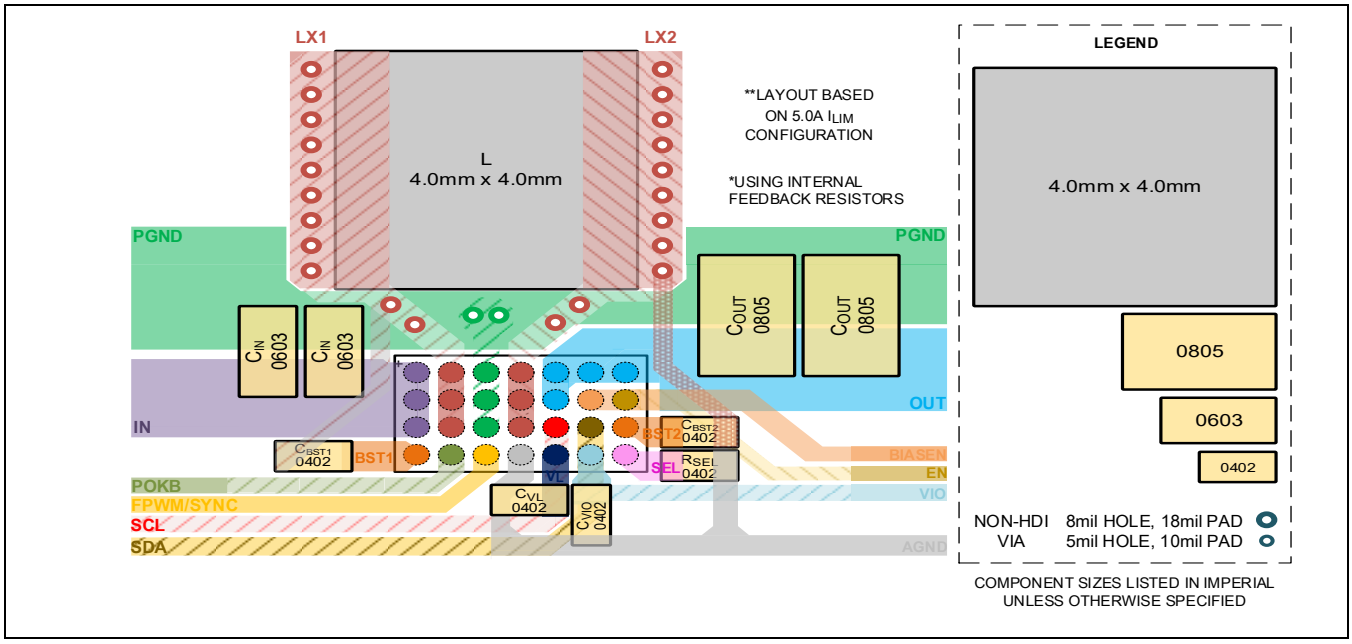



*Figure 15. Non-HDI PCB Layout Recommendation for 28 WLP Package with 4mm x 4mm Inductor*

## Ordering Information

| PART | TYPE |
|---|---|
| MAX77845EVKIT# | EV Kit |

*#Denotes RoHS-compliance.*

## MAX77845 EV Kit Bill of Materials

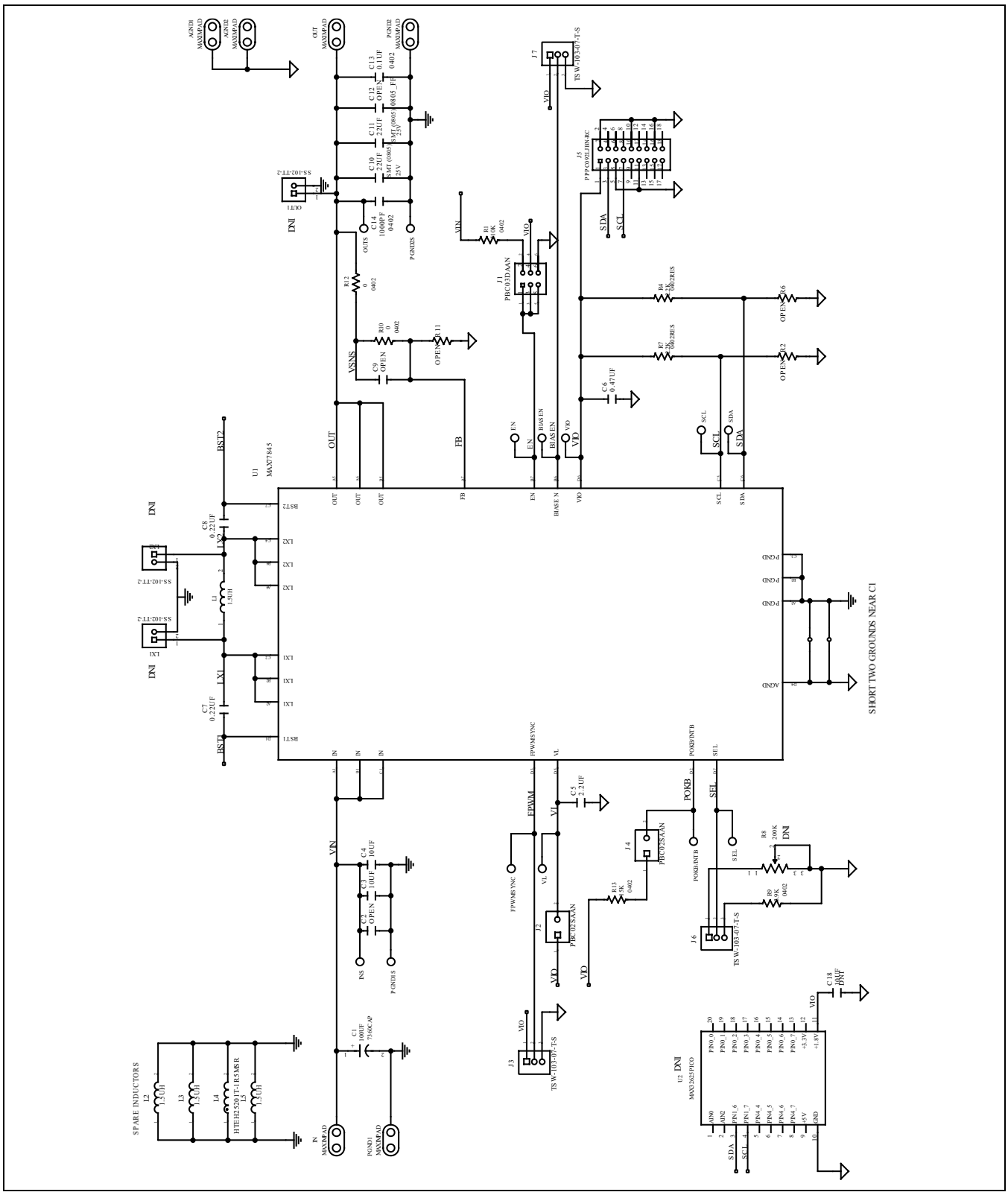
| PART | QTY | MFG PART # | MANUFACTURER | VALUE | DESCRIPTION |
|---|---|---|---|---|---|
| AGND1, AGND2, IN, OUT, PGND1, PGND2 | 6 | 9020 BUSS | WEICO WIRE | ANALOG PAD | EV KIT PARTS; ANALOG PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG |
| ASSY1 | 1 | MAXUSB_INTERFACE# | ANALOG DEVICES | MAXUSB_INTERFACE# | EV KIT PART-MODULE; KIT; MAXUSB INTERFACE; DUAL-PORT USB-TO-SERIAL INTERFACE BOARD |
| BIASEN, EN, FPWM/SYNC, POKB/INTB, SCL, SDA, SEL | 7 | 5002 | KEYSTONE | N/A | TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; WHITE; PHOSPOROUS BRONZE WIRE SILVER |
| C1 | 1 | T52M1107M035C0055 | VISHAY | 100µF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (7360); 100µF; 20%; 35V; TANTALUM |
| C3, C4 | 2 | C1608X5R1E106M080AC; CL10A106MA8NRNC; GRM188R61E106MA73; ZRB18AR61E106ME01; GRT188R61E106ME13 | TDK; SAMSUNG ELECTRONICS; MURATA; MURATA; MURATA | 10µF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0603); 10µF; 20%; 25V; X5R; CERAMIC |
| C5 | 1 | C1005X7S1A225K050BC | TDK | 2.2µF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0402); 2.2µF; 10%; 10V; X7S; CERAMIC |
| C6 | 1 | LMK105B7474KV; GRM155R71A474KE01 | PANASONIC; MURATA | 0.47µF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0402); 0.47µF; 10%; 10V; X7R; CERAMIC |
| C7, C8 | 2 | C1005X7R1E224K050BB | TDK | 0.22µF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0402); 0.22µF; 10%; 25V; X7R; CERAMIC |
| C10, C11 | 2 | C2012X5R1E226M125AC; CL21A226MAQNNN; GRM21BR61E226ME44 | TDK; SAMSUNG ELECTRO-MECHANICS; MURATA | 22µF | CAPACITOR; SMT (0805); 22µF; 20%; 25V; X5R; CERAMIC |
| C13 | 1 | GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB | MURATA; TDK; TAIYO YUDEN; TDK | 0.1µF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0402); 0.1µF; 10%; 25V; X7R; CERAMIC |
| C14 | 1 | GCM155R71H102KA37 | MURATA | 1000PF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0402); 1000PF; 10%; 50V; X7R; CERAMIC |

| | | | | | |
|---|---|---|---|---|---|
| INS, OUTS, VIO, VL | 4 | 5000 | KEYSTONE | N/A | TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH |
| J1 | 1 | PBC03DAAN | SULLINS ELECTRONICS CORP. | PBC03DAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 6 PINS; -65ºC TO +125ºC |
| J2, J4 | 2 | PBC02SAAN | SULLINS ELECTRONICS CORP. | PBC02SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2 PINS |
| J3, J6, J7 | 3 | TSW-103-07-T-S | SAMTEC | TSW-103-07-T-S | CONNECTOR; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 3 PINS |
| J5 | 1 | PPPC092LJBN-RC | SULLINS ELECTRONICS CORP | PPPC092LJBN-RC | CONNECTOR; FEMALE; THROUGH HOLE; PPP SERIES; RIGHT ANGLE; 18 PINS |
| L1 | 1 | XGL4020-152ME | COILCRAFT | 1.5µH | INDUCTOR; SURFACE MOUNT TECHNOLOGY; COMPOSITE; 1.5µH; 20%; 11.1A |
| L2 | 1 | DFE322520F-1R5M | MURATA | 1.5µH | INDUCTOR; SURFACE MOUNT TECHNOLOGY (2010); SHIELDED; 1.5µH; 20%; 4.0A |
| L3 | 1 | CIGW252012TM1R5ML | SAMSUNG | 1.5µH | INDUCTOR; SURFACE MOUNT TECHNOLOGY (1008); METAL; 1.5µH; 20%; 4.6A |
| L4 | 1 | HTEH25201T-1R5MSR | CYNTEC | HTEH25201T-1R5MSR | INDUCTOR; SURFACE MOUNT TECHNOLOGY; METAL DUST CORE; CHOKE; TOL=+/-20%; 3.6A |
| L5 | 1 | DFE201612E-1R5M | MURATA | 1.5µH | INDUCTOR; SURFACE MOUNT TECHNOLOGY (0806); METAL; 1.5µH; 20%; 2.30A |
| MH1-MH4 | 4 | 9032 | KEYSTONE | 9032 | MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON |
| PGND1S, PGND2S | 2 | 5001 | KEYSTONE | N/A | TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; BLACK; PHOSPOROUS BRONZE WIRE SILVER |
| R1 | 1 | CRCW0402510KFK | VISHAY DALE | 510K | RESISTOR; SURFACE MOUNT TECHNOLOGY (0402); 510K; 1%; +/-100PPM/DEGK; 0.0630W |

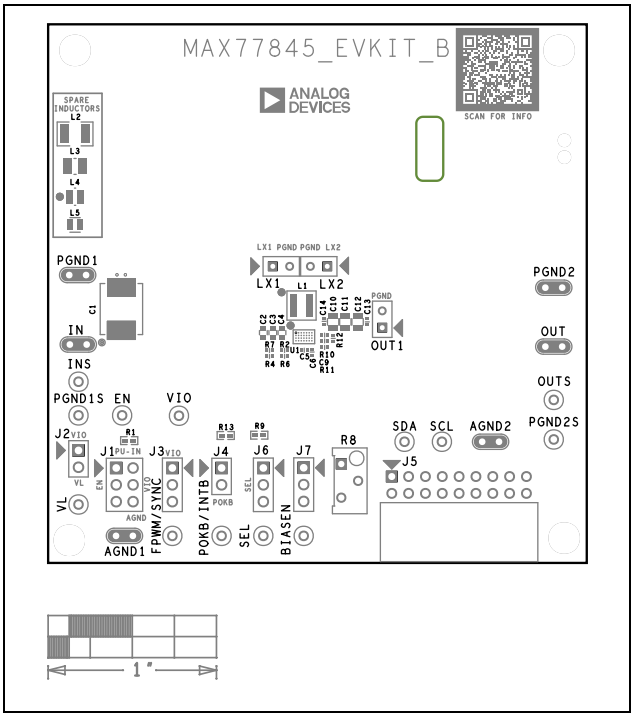
| | | | | | |
|---|---|---|---|---|---|
| R4, R7 | 2 | RC0402FR-072K2L | YAGEO | 2.2K | RESISTOR; SURFACE MOUNT TECHNOLOGY (0402); 2.2K; 1%; +/-100PPM/ºC; 0.0630W |
| R9 | 1 | CRCW04023K90FK | VISHAY | 3.9K | RESISTOR; SURFACE MOUNT TECHNOLOGY (0402); 3.9K; 1%; +/-100PPM/ºK; 0.0630W |
| R10, R12 | 2 | ERJ-2GE0R00 | PANASONIC | 0 | RESISTOR; SURFACE MOUNT TECHNOLOGY (0402); 0; JUMPER; JUMPER; 0.1000W |
| R13 | 1 | ERJ-2RKF1502 | PANASONIC | 15K | RESISTOR; SURFACE MOUNT TECHNOLOGY (0402); 15K; 1%; +/-100PPM/ºC; 0.1000W |
| U1 | 1 | MAX77845 | ANALOG DEVICES | MAX77845 | EVKIT PART-IC; 2.5V TO 16V INPUT; 5A SWITCHING CURRENT HIGH-EFFICIENCYT BUCK-BOOST CONVERTER WITH EXTERNAL CLOCK SYNCHRONIZATION; WLP28; PACKAGKE CODE: W281B2+1; 21-100763 |
| PCB | 1 | MAX77845 | ANALOG DEVICES | PCB | PCB: MAX77845 |
| EV_KIT_ BOX1 | 6 | NPC02SXON-RC | SULLINS ELECTRONICS CORP. | | CONNECTOR; FEMALE; MINI SHUNT; 0.100IN CC; OPEN TOP; JUMPER; STRAIGHT; 2 PINS |
| C18 | 0 | GRM155C80J106ME18 | MURATA | 10µF | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0402); 10µF; 10%; 6.3V; X6S; CERAMIC |
| LX1, LX2, OUT1 | 0 | SS-102-TT-2 | SAMTEC | SS-102-TT-2 | IC-SOCKET; SIP; STRAIGHT; PRECISION MACHINED SOCKET STRIP; OPEN FRAME; 2 PINS; 100MIL |
| R8 | 0 | 3296Y-1-204LF | BOURNS | 200K | RESISTOR; THROUGH HOLE-RADIAL LEAD; 3296 SERIES; 200KΩ; 10%; 100PPM; 0.5W |
| U2 | 0 | MAX32625PICO | ANALOG DEVICES | MAX32625PICO | MODULE; BOARD; MAX32625PICO BOARD DESIGN FOR MAX32625 ARM CORTEX-M4F; BOARD; LAMINATED PLASTIC WITH COPPER CLAD |

| | | | | | |
|---|---|---|---|---|---|
| C2 | 0 | N/A | N/A | OPEN | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0603); OPEN; FORM FACTOR |
| C9 | 0 | N/A | N/A | OPEN | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0402); OPEN; FORM FACTOR |
| C12 | 0 | N/A | N/A | OPEN | CAPACITOR; SURFACE MOUNT TECHNOLOGY (0805); OPEN; FORM FACTOR |
| R2, R6, R11 | 0 | N/A | N/A | OPEN | RESISTOR; 0402; OPEN; FORM FACTOR |
| TOTAL | 62 | | | | |

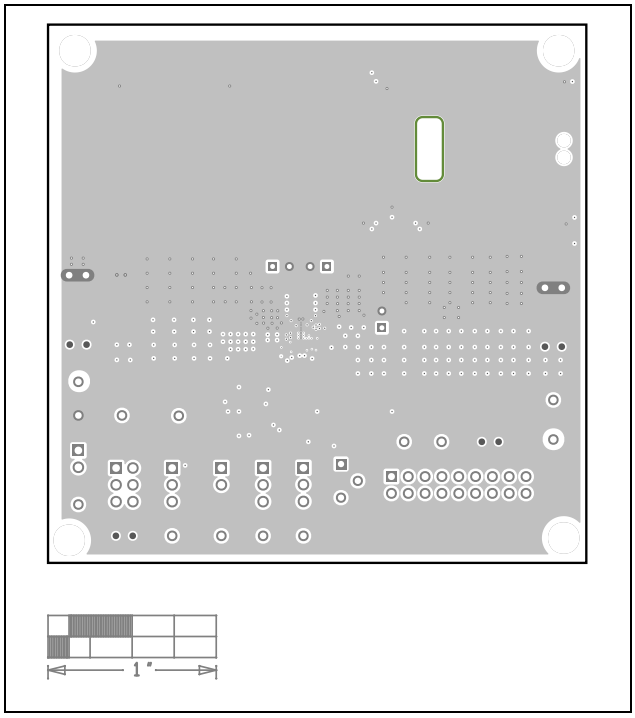
## MAX77845 EV Kit Schematic



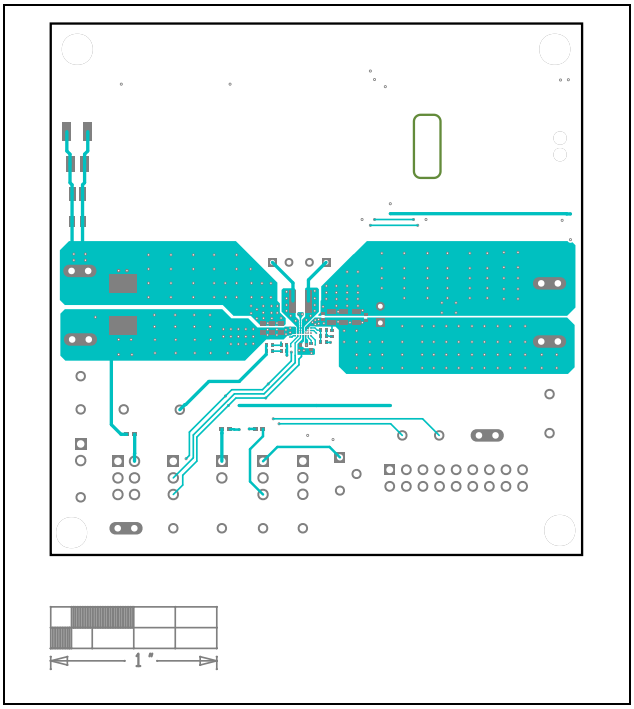
## MAX77845 EV Kit PCB Layouts



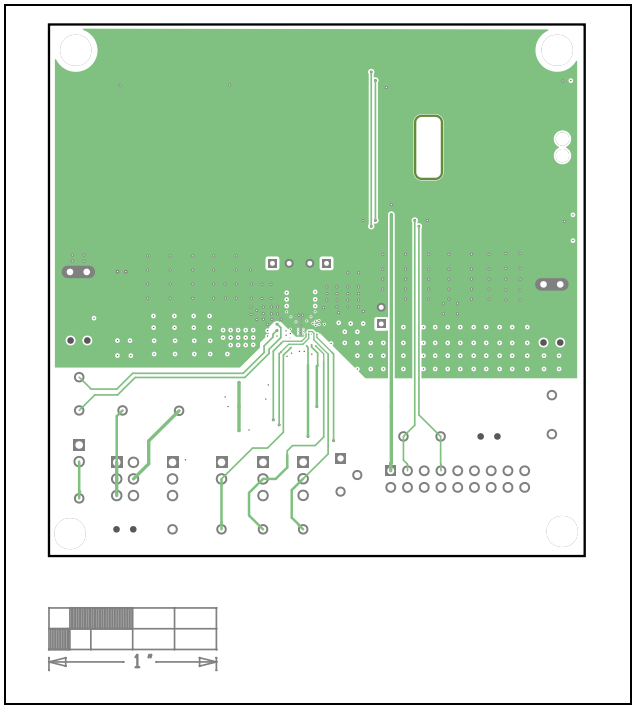

*MAX77845 EV Kit Component Placement Guide—Top Silkscreen*




*MAX77845 EV Kit PCB Layout—Internal 2*

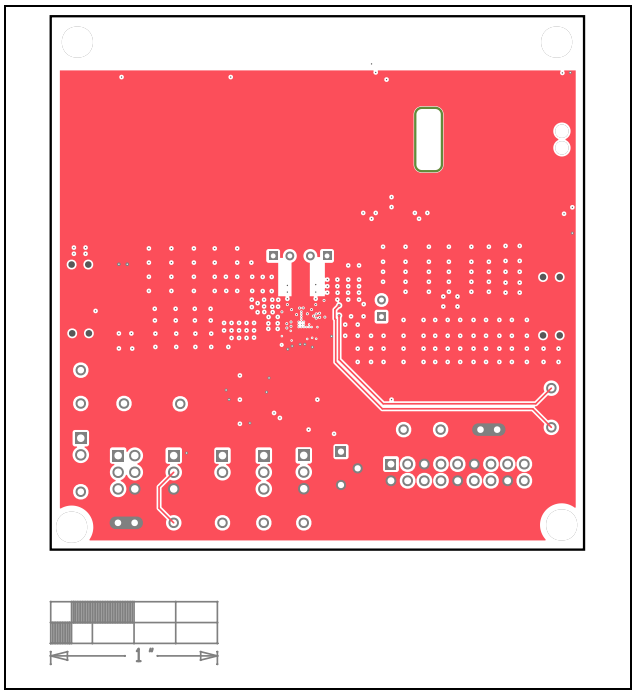



*MAX77845 EV Kit PCB Layout—Top View*

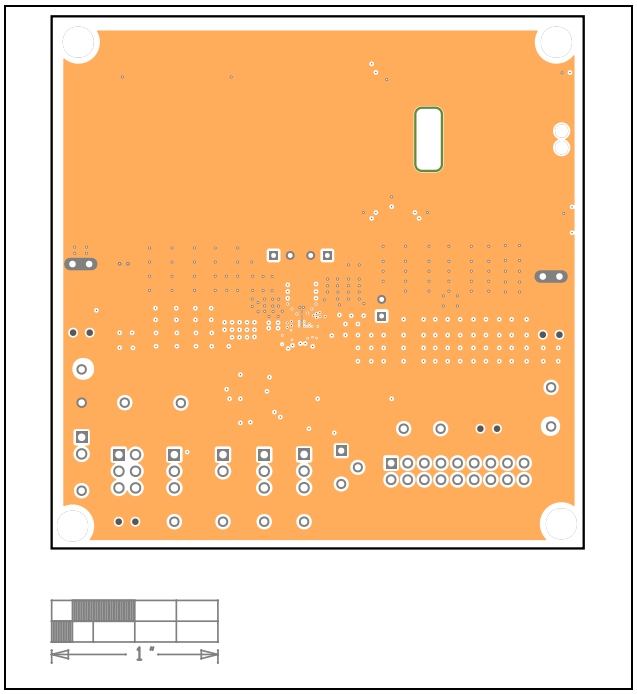



*MAX77845 EV Kit PCB Layout—Internal 3*

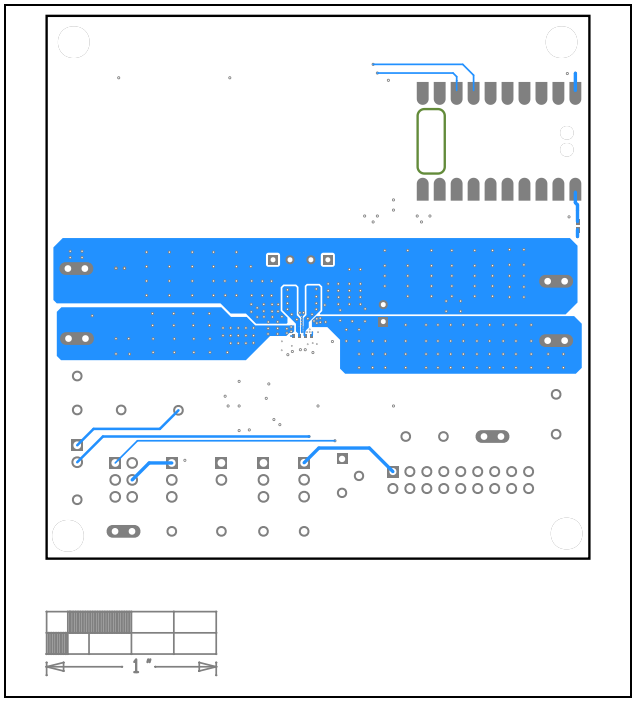
## MAX77857 EV Kit PCB Layouts (continued)



*MAX77845 EV Kit PCB Layout—Internal 4*



*MAX77845 EV Kit PCB Layout—Bottom View*



*MAX77845 EV Kit PCB Layout—Internal 5*

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|---|---|---|---|
| 0 | 10/25 | Initial release | — |
| 1 | 10/25 | Updated *Ordering Information* | 15 |
| 2 | 11/25 | The *MAX77845 Evaluation Kit Files* section has been removed | 1 |

## Notes