# MIC4574 Evaluation Board

## 200kHz Switching Regulator

## General Description

Designed for distributed power systems, the MIC4574 is a monolithic, step-down switching regulator capable of 0.5A output current and can operate from input voltages ranging from 4V to 24V. It has a logic-compatible enable that provides 200µA of quiescent current in shutdown mode.

The Micrel MIC4574 is an enhanced version of the popular LM2574, a 52kHz step-down (buck) switching regulator. The MIC4574 features a 200kHz switching frequency that reduces the inductor size by a factor of four, freeing up precious board space.

The MIC4574 evaluation board is designed for applications up to 0.5A. MIC4575 and MIC4576 evaluation boards, for 1A and 3A applications respectively, are also available.

### Requirements

The MIC4574 evaluation board requires a power supply capable of at least 0.8A at up to 24V. The load may be up to 0.5A maximum, respectively.

## Operation

Figure 1 shows the schematic of the evaluation board circuit. When the internal high-side switch turns on, one side of the inductor is fed from the input voltage. During this period, current flows from the input, through the internal output switch, output inductor, and load. When the output switch turns off, the SW pin voltage drops until the clamp diode is forward biased. During this portion of the cycle, current flows through the diode, inductor, and load. Figures 2a through 2c show the efficiency for 5V, 2.5V, and 3.3V outputs versus input voltage and output current.

### Precautions

The MIC4574 has no protection from reversed polarity being applied to its input. Any momentary reversal of the dc power supply connections can cause permanent damage to the circuit. Use extreme care with these connections.

The safest way to power up the MIC4574 evaluation board is to set the power supply to zero volts and then gradually increase the supply voltage. Monitor the input supply current while increasing the input voltage. If the circuit draws excessive current, immediately shut off the main supply and check for proper power supply connections. This simple procedure can avoid most catastrophic failures.

### Output Voltage Configuration

The MIC4574 is available in 3.3V fixed, 5.0V fixed, and adjustable output-voltage versions. The evaluation board uses the adjustable output version to provide industry standard output voltages of 2.5V, 3.3V, 5V, or 6V, by jumper selection.

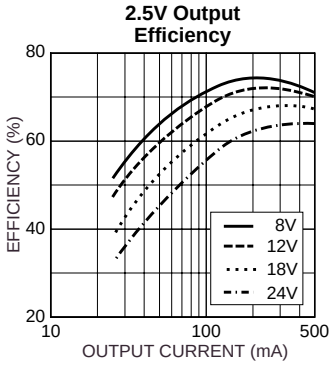



**Figure 2a. 5V Output Efficiency**

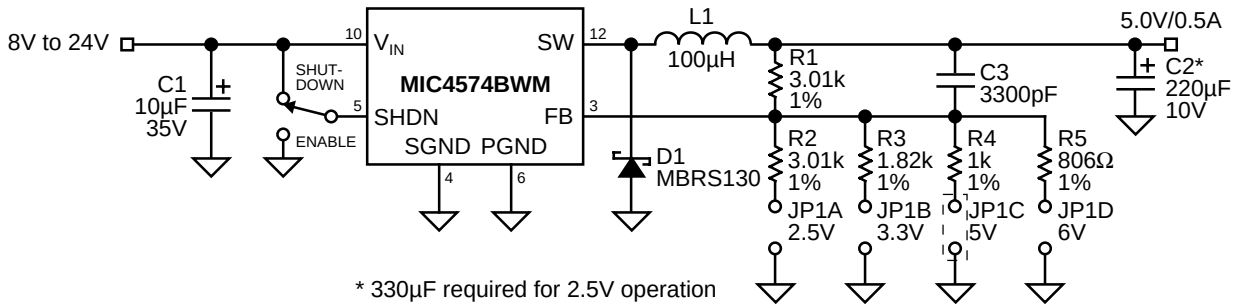



**Figure 1. Buck Converter (8V–24V to 5V/0.5A)**

Table 1 shows standard 1% resistor values for jumper selectable output voltages.

| Jumper Position | Output Voltage | R1 | R2–R5 (nearest 1%) |
|---|---|---|---|
| JP1A | 2.5V | 3.01k | 3.01k |
| JP1B | 3.3V | 3.01k | 1.82k |
| JP1C | 5V | 3.01k | 1.00k |
| JP1D | 6V | 3.01k | 806Ω |

**Table 1. Programming Resistor Values**

Programming resistors R2, R3, R4, and R5 are used to set the output voltage according to the equation:

$$V_{OUT} = 1.25V\left(1 + \frac{R1}{R2}\right)$$

The adjustable regulator can be replaced with MIC4574-3.3 or MIC4574-5.0 fixed output voltage devices for evaluation. To configure the board for fixed devices, connect the feedback pin (pin 4) directly to the output voltage by removing the voltage adjustment jumper and placing a zero-ohm jumper across R1.

**Input Voltage**

The minimum input voltage rating varies with output voltage. Table 2 lists the lowest input voltage the MIC4574 can operate from.

| Output Voltage | $V_{IN}$ (Minimum) |
|---|---|
| 2.5V | 5V |
| 3.3V | 6V |
| 5V | 8V |
| 6V | 9V |
| 12V | 15V |

**Table 2. Minimum Input Voltages**

**Enable/Shutdown Mode**

To activate the MIC4574, set the enable switch to the ON position. To put the MIC4574 into its micropower (200µA) shutdown state, set the enable switch to the OFF position.

**2.5V Output Option**

Although the evaluation board will operate normally at 2.5V output, the phase margin falls below 20°. A 330µF output capacitor (C2†) is recommended to increase the phase margin above 20°.

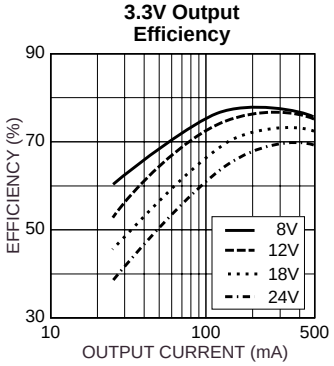



**Figure 2b. 2.5V Output Efficiency**

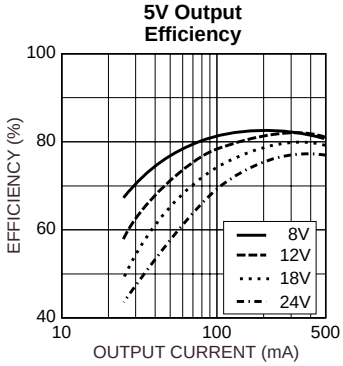
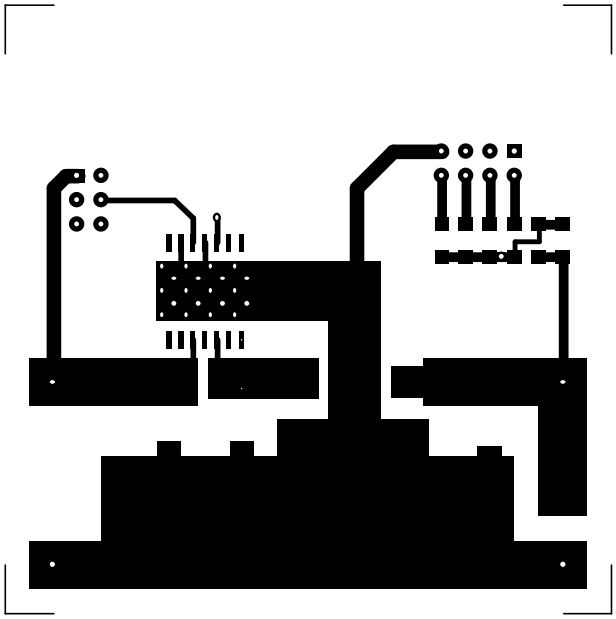


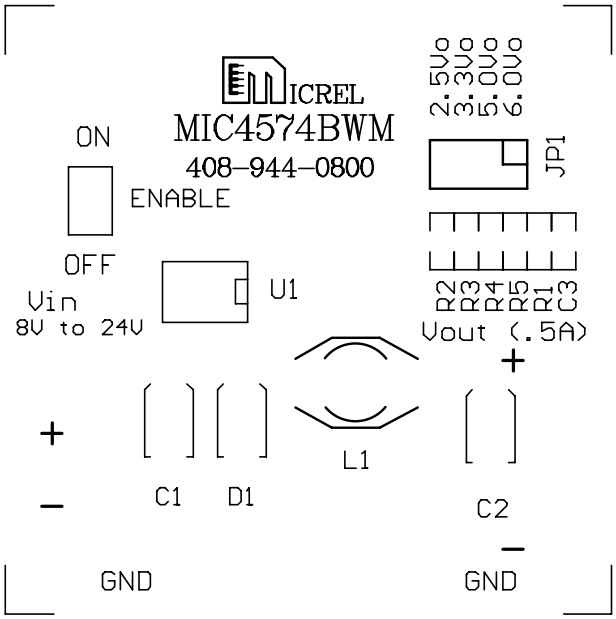

**Figure 2c. 3.3V Output Efficiency**

| Item | Part Number | Source |
|---|---|---|
| C1<br>C2<br>†C2<br>C3 | TPSD106M035R0300<br>TPSE227M010R0100<br>TPSE337M006R0100<br>3300pF ceramic X7R | AVX<br>(803) 448-9411 |
| D1 | MBRS130LT3 | Motorola<br>(800) 521-6274 |
| L1 | D03316P-683 | Coilcraft<br>(708) 639-2361 |
| U1 | MIC4574BWM | Micrel<br>(408) 944-0800 |

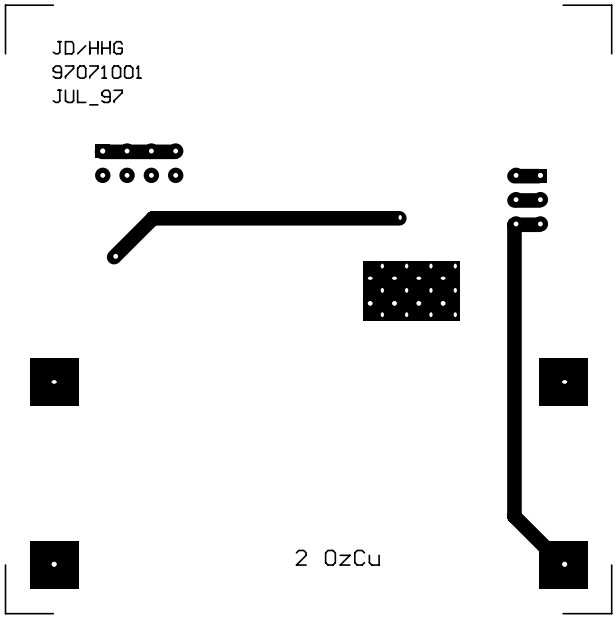
**Table 3. Bill of Materials**



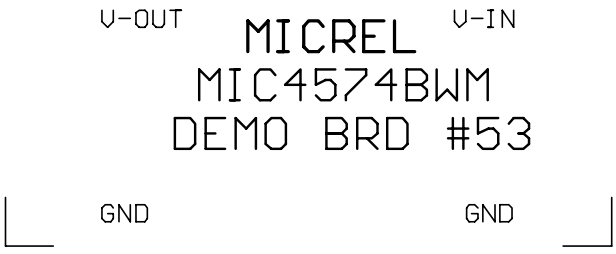
**Component Side**




**Silk Screen (Component Side)**




**Solder Side**




**Silk Screen (Solder Side)**

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