MIC2245 Evaluation Board

High Efficiency 4MHz Step-Down Converter with LOWQ™ Mode

General Description

The Micrel MIC2245 is a high efficiency 4MHz PWM synchronous step-down switching regulator that features a *LOWQ*™ LDO standby mode that draws only 20μA of quiescent current. The MIC2245 features an ultra-low noise, small size, and high efficiency solution for portable power applications.

In PWM mode, the MIC2245 operates at a constant frequency of 4MHz. Under light load conditions, such as in system sleep or standby modes, the PWM switching operation can be disabled to reduce switching losses. In this light load *LOWQ*™ mode, the LDO maintains the output voltage and draws only 20μA of quiescent current. The LDO mode of operation saves battery life while not introducing spurious noise and high ripple as experienced with pulse skipping or bursting mode regulators.

The MIC2245 operates from a 2.7V to 5.5V input and features internal power MOSFETs that can supply up to 500mA of output current in PWM mode. It can operate with a maximum duty cycle of 100% for use in low-dropout conditions

Requirements

The MIC2245 evaluation board requires an input power source that is able to deliver greater than 500mA at 2.7V. The output load can either be an active or passive source.

Precautions

The evaluation board does not have reverse polarity protection. Applying a negative voltage to the V_{IN} terminal may damage the device.

In addition, the maximum operating voltage of the MIC2245 evaluation board is 5.5V. Exceeding 6V on the input could damage the device.

Getting Started

1. **Connect an external supply to V_{IN} terminal**. Apply desired input voltage to the V_{IN} (J1)and ground (J2 and J5) terminals of the evaluation board, paying careful attention to polarity and supply voltage ($2.7V \le V_{IN} \le 5.5V$). An ammeter may be placed between the input supply and the V_{IN} terminal to the evaluation board. Be sure to monitor the supply voltage at the V_{IN} terminal. The ammeter and/or power lead resistance can reduce the voltage supplied to the input.

2. **Connect the load to the V_{OUT} (J4) and ground terminals**. The load can be either passive (resistor) or active (electronic load). An ammeter can be placed between the load and the V_{OUT} terminal. Be sure to monitor the output voltage at the V_{OUT} terminal. The default output voltage is set to 1.8V. This can be adjusted by changing the feedback resistors. *(see **Output Voltage**)*.

3. **Disable the MIC2245**. Apply ground, or 0V, to the enable (EN) terminal.

Output Voltage

The output voltage on the MIC2245 evaluation board is adjustable. The output voltage is controlled by the feedback resistors (R1 and R2) and can be calculated as follows:

$$V_{OUT} = 1.0V \times \left(\frac{R1}{R2} + 1\right)$$

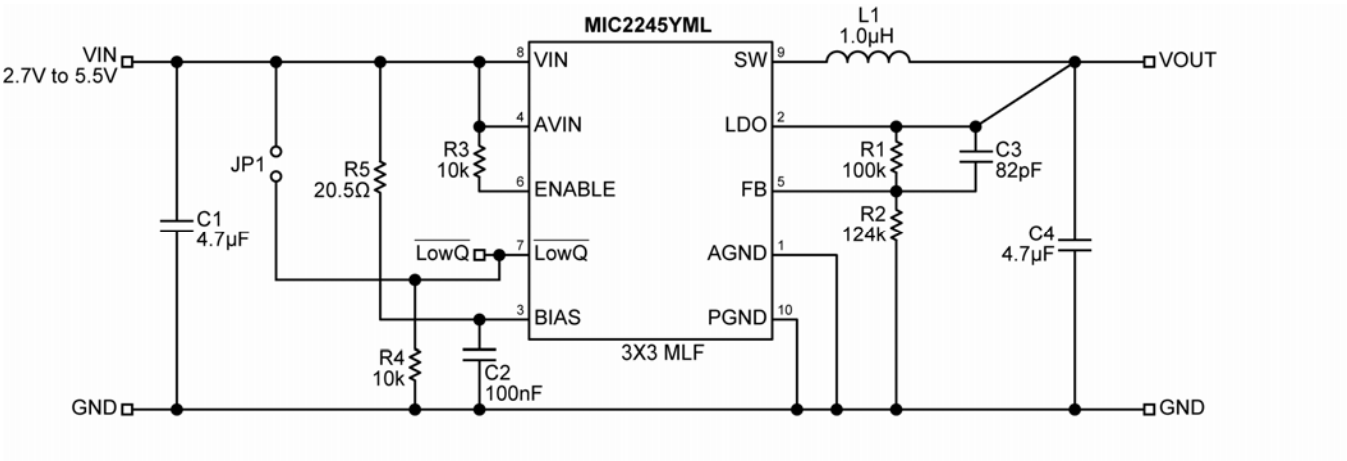
The evaluation board is initially adjusted to 1.8V, but can easily be modified by removing R2 and replacing it with the value that yields the desired output voltage. (Removing R2 sets the output to 1.0V).

$$R2 = \frac{100k\Omega}{\left(\frac{V_{OUT}}{1.0V} - 1\right)}$$

LOWQ™

The MIC2245 is a 500mA PWM power device that utilizes a LOWQ™ light load mode to maximize battery efficiency in light load conditions. This is achieved with a LOWQ™ control pin that when pulled low, (Remove JP1), shuts down all the biasing and drive current for the PWM regulator, drawing only 20μA of operating current. This allows the output to be regulated through the LDO output that is capable of providing 60mA of output current. This method has the advantage of producing a clean, low current, ultra low noise output in LOWQ™ mode. During LOWQ™ mode, the SW node becomes high impedance, blocking current flow. Other methods of reducing quiescent current, such as pulse frequency modulation (PFM) or bursting techniques, create large amplitude, low frequency ripple voltages that can be detrimental to system operation.

When more than 60mA is required, the LOWQ pin can be forced high, (Connect JP1), causing the MIC2245 to enter PWM mode. In this case, the LDO output makes a "hand-off" to the PWM regulator virtually without any variation in output voltage. The LDO output then turns off allowing up to 500mA of current to be efficiently supplied through the PWM output to the load.



Bill of Material

MIC2245 Evaluation Board

Ref Des	Part Number	Description	Manufacturer
C1, C4	C1608X5R0J475M	4.7µF 6.3V X5R 0603 Ceramic Capacitor	TDK
	GRM188R60J475KE19D		MuRata
	VJ0603Y475KXQCW1BC		Vishay
	06036D475MAT2A		AVX
C2	C1005X5R0J104M	0.1µF 6.3V X5R 0402 Ceramic Capacitor	TDK
	04026D104MAT2A		AVX
	GRM155R60J104K	0.1µF 6.3V X7R 0402 Ceramic Capacitor	MuRata
C3	VJ0402A820KXQCW1BC	82pF X7R 0402 Ceramic Capacitor	Vishay
	C1005COG1H820J	82pF COG 0402 Ceramic Capacitor	TDK
L1	DO2010-102ML	1µH Inductor	Coilcraft
	GLF2518T1R0M	1µH Inductor	TDK
R1	CRCW04021003F	100kΩ 1% 0402 Resistor	Vishay
R2	CRCW04021243F	124kΩ 1% 0402 Resistor	Vishay
R3	CRCW04021002F	10kΩ 1% 0402 Resistor	Vishay
R4	CRCW04021002F	10kΩ 1% 0402 Resistor	Vishay
R5	CRCW040220R5F	20.5Ω 1% 0402 Resistor	Vishay
U1	MIC2245YML	4MHz PWM Step-Down Converter/LDO	Micrel

Notes:

1. AVX: www.avx.com
2. Murata: www.murata.com
3. TDK: www.tdk.com
4. Vishay: www.vishay.com
5. Coilcraft: www.coilcraft.com
6. Micrel Semiconductor: www.micrel.com

Printed Circuit Board Layouts

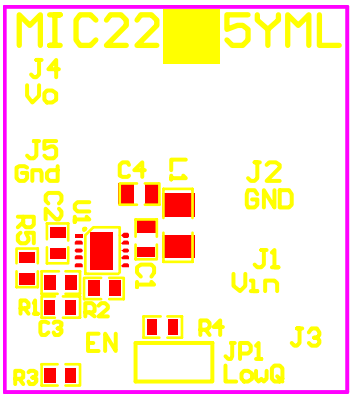


Figure 1a. Top Silkscreen

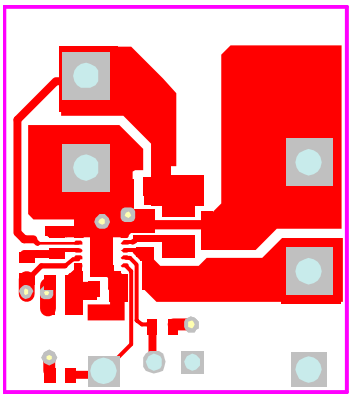


Figure 1b. Top Layer

Figure 1c. Bottom Silkscreen

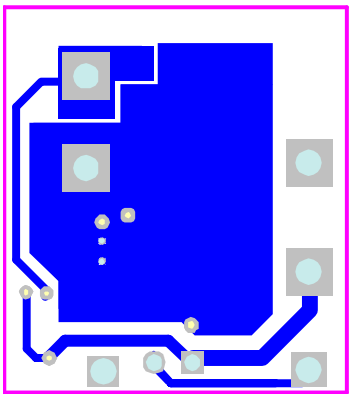


Figure 1d. Bottom Layer