LTC3245 Buck Boost Voltage Regulator Breakout Board

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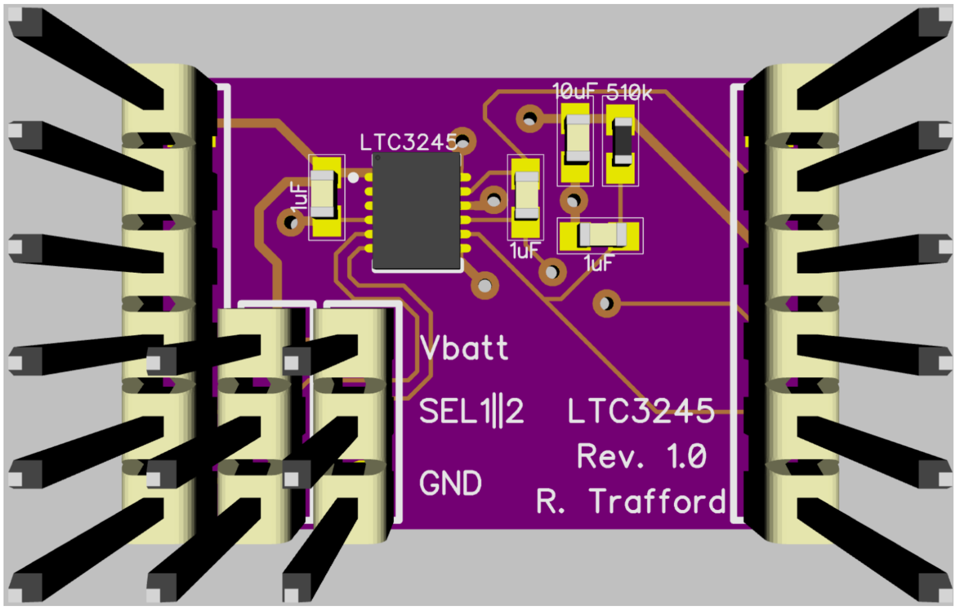
1 Overview

This breakout board for the LTC3245 is built to be an economical equivalent to the DC1802A Evaluation Board. The board can be utilized on its own or placed within a prototyping board for easy access to the pins on the device. The circuit on-board is pulled directly from the LTC3245 Data sheet and is meant for typical 3.3V operation. This board can operate in 5V mode, however, the BURST mode pin is tied to ground, meaning it will not be the most efficient configuration. See Section 4.2 for more information regarding 5V mode.



2 LTC3245 Specifications

2.1 Maximum Ratings

ABSOLUTE MAXIMUM RATINGS

(Note 1)

V_{IN}, SEL1, SEL2, $\overline{BURST}$ .... –0.3V to 38V
V_{OUT}, OUTS/ADJ, PGOOD .... –0.3V to 6V
I_{PGOOD} 2mA
V_{OUT} Short-Circuit Duration .... Indefinite

Operating Junction Temperature Range (Notes 2, 3)
(E-/I-Grade) .... –40°C to 125°C
(H-Grade) .... –40°C to 150°C
(MP-Grade) .... –55°C to 150°C
Storage Temperature Range .... –65°C to 150°C
Lead Temperature (Soldering, 10 sec)
(MSE Only) .... 300°C

2.2 Electrical Characteristics

ELECTRICAL CHARACTERISTICS **The ● denotes the specifications which apply over the specified operating junction temperature range, otherwise specifications are at T_A = 25°C, (Note 2). V_{IN} = 12V, V_{OUT} = 5V, C_{FLY} = 1µF unless otherwise noted.**

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
I_{VIN}	V_{IN} Quiescent Current SEL1 = SEL2 = 0V V_{OUT} Enabled, $\overline{BURST}$ = 0V V_{OUT} Enabled, $\overline{BURST}$ = V_{IN}	Shutdown, V_{OUT} = 0V CP Enabled, Output in Regulation CP Enabled, Output in Regulation			4 18 20	8 35 40	µA µA µA
V_{OUT5_BM}	Fixed 5V Burst Mode Output Regulation (OUTS/ADJ Connected to V_{OUT}, $\overline{BURST}$ = 0V, SEL2 = V_{IN}, SEL1 = 0V) (Note 5)	5V ≤ V_{IN} < 38V, I_{OUT} ≤ 250mA 4V ≤ V_{IN} < 5V, I_{OUT} ≤ 150mA 3.3V ≤ V_{IN} < 4V, I_{OUT} ≤ 75mA 3V ≤ V_{IN} < 3.3V, I_{OUT} ≤ 45mA	● ● ● ●	4.8 4.8 4.8 4.8		5.2 5.2 5.2 5.2	V V V V
V_{OUT5_LN}	Fixed 5V Low Noise Output Regulation (OUTS/ADJ Connected to V_{OUT}, $\overline{BURST}$ = V_{IN}, SEL2 = V_{IN}, SEL1 = 0V) (Note 5)	5V ≤ V_{IN} < 38V, I_{OUT} ≤ 200mA 4V ≤ V_{IN} < 5V, I_{OUT} ≤ 120mA 3.3V ≤ V_{IN} < 4V, I_{OUT} ≤ 60mA 3V ≤ V_{IN} < 3.3V, I_{OUT} ≤ 35mA	● ● ● ●	4.8 4.8 4.8 4.8		5.2 5.2 5.2 5.2	V V V V
V_{OUT33_BM}	Fixed 3.3V Burst Mode Output Regulation (OUTS/ADJ Connected to V_{OUT}, $\overline{BURST}$ = 0V, SEL2 = V_{IN}, SEL1 = V_{IN}) (Note 5)	5V ≤ V_{IN} < 38V, I_{OUT} ≤ 250mA 4V ≤ V_{IN} < 5V, I_{OUT} ≤ 175mA 3.3V ≤ V_{IN} < 4V, I_{OUT} ≤ 110mA 2.7V ≤ V_{IN} < 3.3V, I_{OUT} ≤ 60mA	● ● ● ●	3.17 3.17 3.17 3.17		3.43 3.43 3.43 3.43	V V V V
V_{OUT33_LN}	Fixed 3.3V Low Noise Output Regulation (OUTS/ADJ Connected to V_{OUT}, $\overline{BURST}$ = V_{IN}, SEL2 = V_{IN}, SEL1 = V_{IN}) (Note 5)	5V ≤ V_{IN} < 38V, I_{OUT} ≤ 220mA 4V ≤ V_{IN} < 5V, I_{OUT} ≤ 140mA 3.3V ≤ V_{IN} < 4V, I_{OUT} ≤ 90mA 2.7V ≤ V_{IN} < 3.3V, I_{OUT} ≤ 50mA	● ● ● ●	3.17 3.17 3.17 3.17		3.43 3.43 3.43 3.43	V V V V
V_{ADJ}	OUTS/ADJ Reference Voltage (Note 4)	SEL2 = 0V, SEL1 = V_{IN}, I_{OUT} = 0mA	●	1.176	1.200	1.224	V
R_{CL}	Load Regulation (Referred to ADJ)	SEL2 = 0V, SEL1 = V_{IN}			0.2		mV/mA
V_{PG_RISE}	PGOOD Rising Threshold	V_{OUT}% of Final Regulation Voltage			95	98	%
V_{PG_FALL}	PGOOD Falling Threshold	V_{OUT}% of Final Regulation Voltage		88	91		%
V_{PG_LOW}	PGOOD Output Low Voltage	I_{PGOOD} = 0.2mA	●		0.1	0.4	V
I_{PG_HIGH}	PGOOD Output High Leakage	V_{PGOOD} = 5V		–1	0	1	µA
V_{LOW}	$\overline{BURST}$, SEL1, SEL2 Input Voltage		●	0.4	0.9		V
V_{HIGH}	$\overline{BURST}$, SEL1, SEL2 input Voltage		●		1.2	2	V
I_{LOW}	$\overline{BURST}$, SEL1, SEL2 Input Current	V_{PIN} = 0V		–1	0	1	µA
I_{HIGH}	$\overline{BURST}$, SEL1, SEL2 Input Current	V_{PIN} = 38V		0.5	1	3	µA
I_{SHORT_CKT}	I_{VOUT} Short-Circuit Current	V_{OUT} = GND			900		mA
R_{OUT}	Charge Pump Output Impedance	2:1 Step-Down Mode 1:1 Step-Down Mode 1:2 Step-Up Mode (V_{IN} = 3.3V)			3 3.5 14		Ω Ω Ω
f_{OSC}	Oscillator Frequency		●		450	500	kHz

3 Board Design

3.1 Schematic

The design of this breakout board was directly imported from the LTC3245 datasheet. The schematic this datasheet provides can be seen in Figure 1. The schematic of the resulting breakout board can be seen in Figure 2. Schematic capture and PCB layout were all performed within the Diptrace® environment.

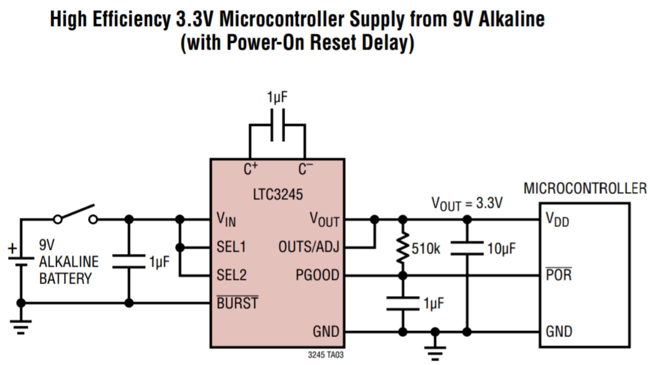


Figure 1: Schematic from the LTC3245 DataSheet

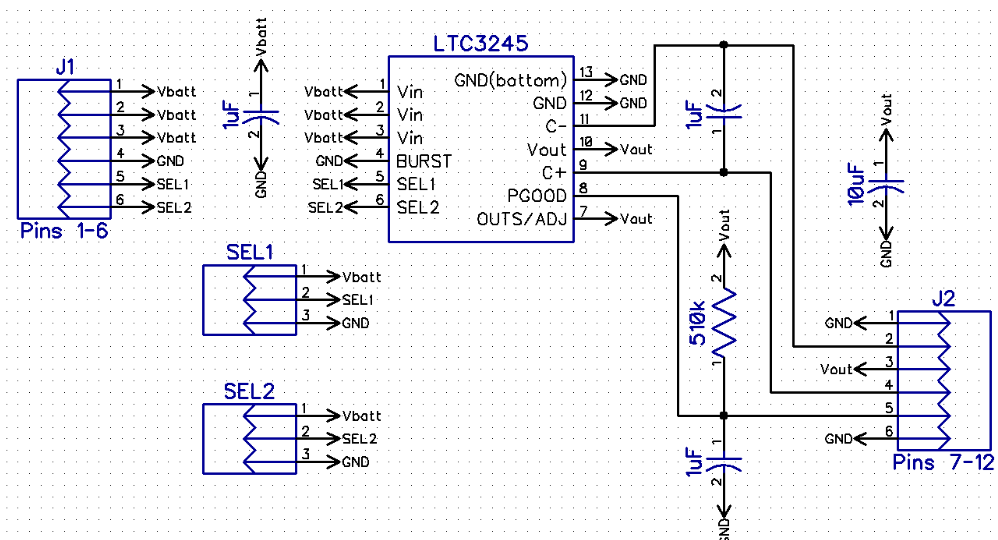
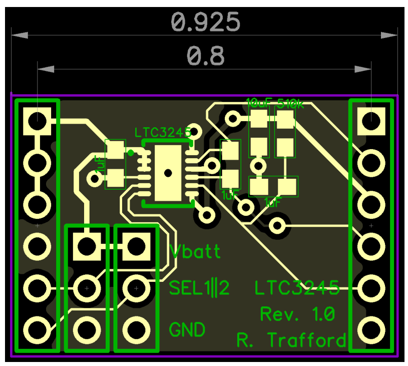


Figure 2: Schematic for the LTC3245 Breakout Board

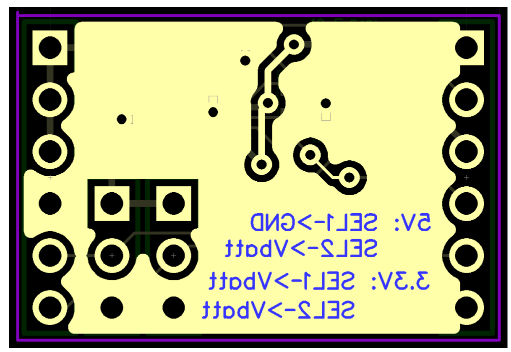
3.2 Physical Layout

The LTC3245 Breakout board is designed on a 2 layer 1.6mm thick PCB with 1oz copper pour. Trace width for the $\mathbf{V_{IN}}$, $\mathbf{V_{OUT}}$, and **GND** connections are all 13 mil, with all other connections being made with 6 mil traces. This can be seen in Figures 3a and 3b.

The left and right headers in Figure 3a are spaced to fit within a standard .1" pitch breadboard. The two set of jumper pins to the bottom left of the board allow the user to set **SEL1** and **SEL2** to determine the operating mode of the LTC3245, as explained in Section **??**.



(a) Top Layer Copper Pour



(b) Bottom Layer Copper Pour

3.3 Bill of Materials

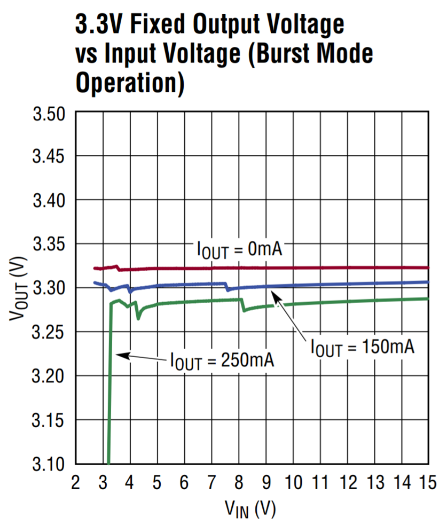
- 3 1μF 0603 Ceramic Capacitors
- 1 10μF 0603 Ceramic Capacitor
- 1 510$k\Omega$ 0603 Resistor
- 1 Linear Technology LTC3245EDE#PBF Voltage Regulator

4 Operation Modes

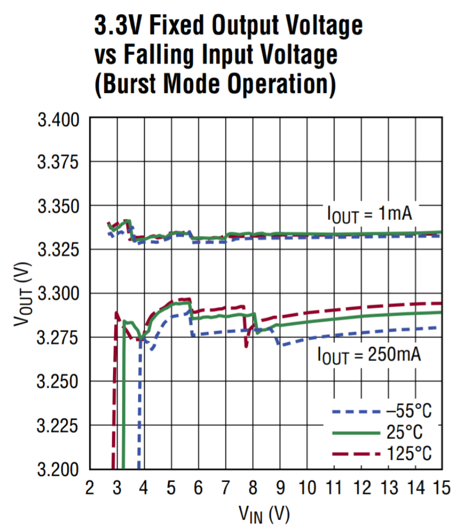
4.1 3.3V Fixed Output Mode

To turn the board into 3.3V Fixed Output mode, the jumpers for **SEL1** and **SEL2** should be set to the top position. This will connect them to **VIN** or **VBATT**. As can be seen in Figure 4a, at maximum load current, the minimum required **VIN** voltage ranges from roughly 3V to 3.9V depending on the temperature. Under a $1mA$ load, the regulator performs consistently as a function of input voltage, and requires a minimum of roughly 2.7V to output 3.3V.

Precautions should be taken when operating at maximum load to prevent the varying output voltage from causing brownout conditions in the rest of your circuit. Although at small loads this device appears to output a voltage higher than 3.3V, even the inclusion of a $\pm1\%$ 3.3V Zener Diode will not help bring the output voltage closer to 3.3V.



(a) 3.3V Mode Performance vs. Load Current

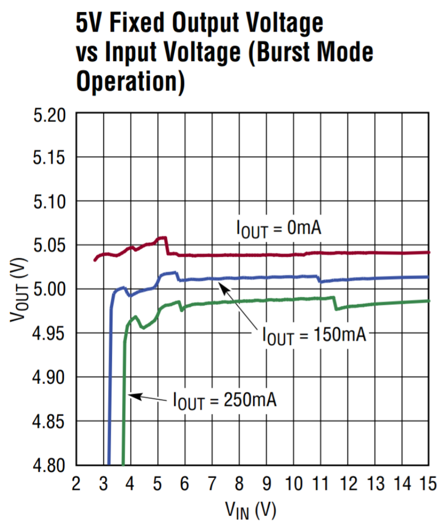


(b) 3.3V Mode Performance vs. Temperature

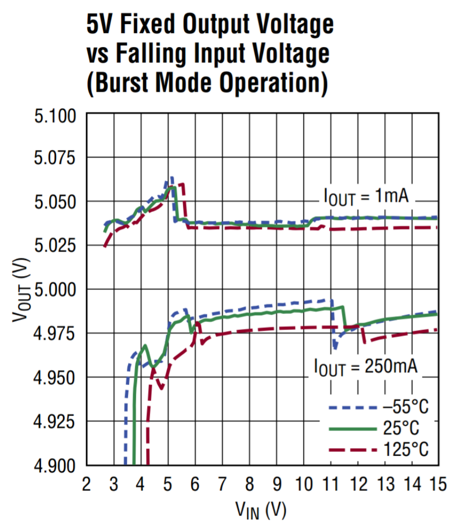
4.2 5V Fixed Output Mode

To turn the board into 5V Fixed Output mode, **SEL1** should be in the bottom position (tied to **GND**), and **SEL2** should be in the top position tied to **VBatt**. As can be seen in Figure 5a, under a load of $250mA$, the minimum required input voltage for regulation to begin is roughly 3.6 volts to 4.2 volts depending on the temperature. At a 1mA load, the regulator requires a minimum of roughly 2.8V to begin operating at 5V.

Precautions should be taken when operating at maximum load to prevent the varying output voltage from causing brownout conditions in the rest of your circuit. Although at small loads the output seems to be higher than the required output, this value is within 1% of 5V, meaning zener regulation would not be effective.



(a) 5V Mode Performance vs. Load Current



(b) 5V Mode Performance vs. Temperature

5 References

LTC3245 Data sheet: http://cds.linear.com/docs/en/datasheet/3245fa.pdf