

# LM3445 Off-Line TRIAC Dimmer LED Driver Reference Design

National Semiconductor  
RD-172  
LED Application Lab  
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## 1.0 Design Specifications

Inputs	Output #1
VinMin=80V	Vout1=LED dependant, up to 32V
VinMax=135V	Iout1=0.6A

## 2.0 Design Description

This reference design converts 90 V<sub>AC</sub> to 135 V<sub>AC</sub> input, and drives seven, or eight series connected LED's from 300 to 600 mA average current.. The LM3445 switching frequency is set at a nominal 225 kHz. This is a four layer board using the bottom and top layer for component placement. The reference design can be modified to adjust the LED forward current, the number of series connected LEDs and switching frequency. Refer to the LM3445 datasheet for detailed instructions.

A bill of materials below describes the parts used on this demonstration board. A schematic and layout have also been included below along with measured performance characteristics. The above restrictions for the input voltage are valid only for this reference design as shipped with the schematic below. Please refer to the LM3445 data sheet for detailed information regarding the LM3445 device, and the application circuit

## 3.0 Features

- No flicker even a very low dim ratios

## 4.0 Schematic

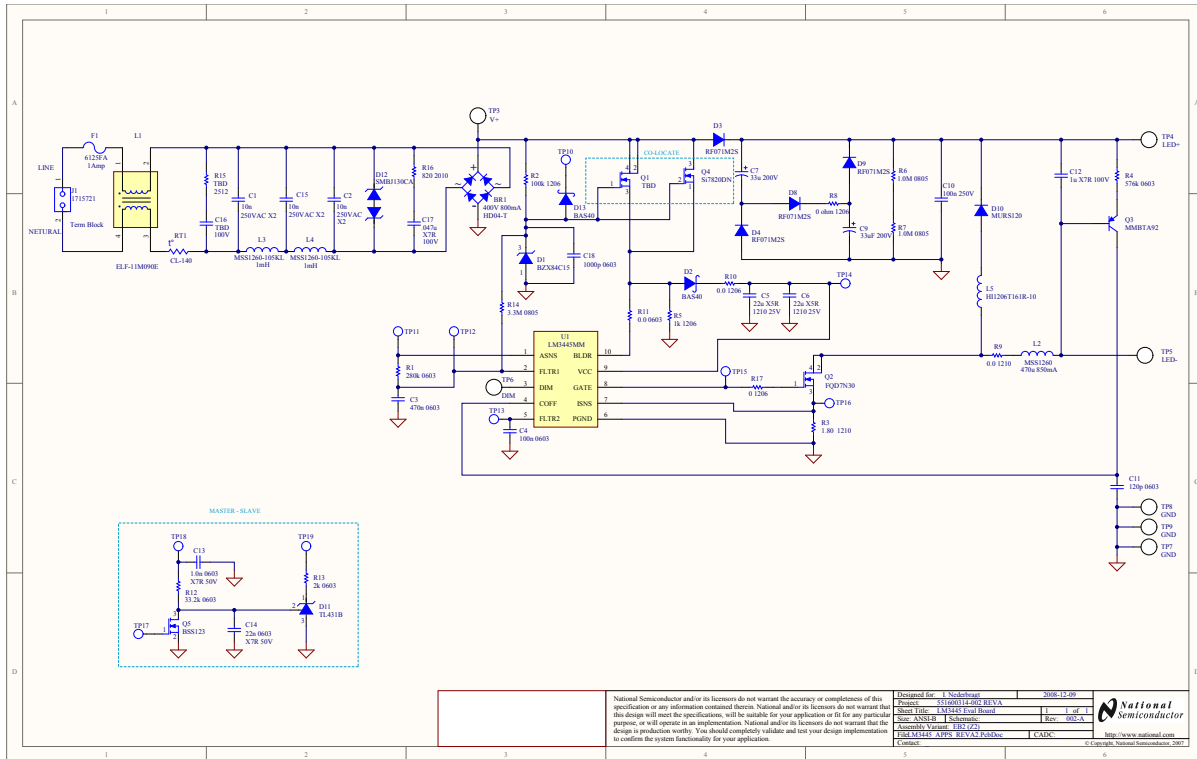


FIGURE 1. LM3445 EVB 120V schematic

schematic

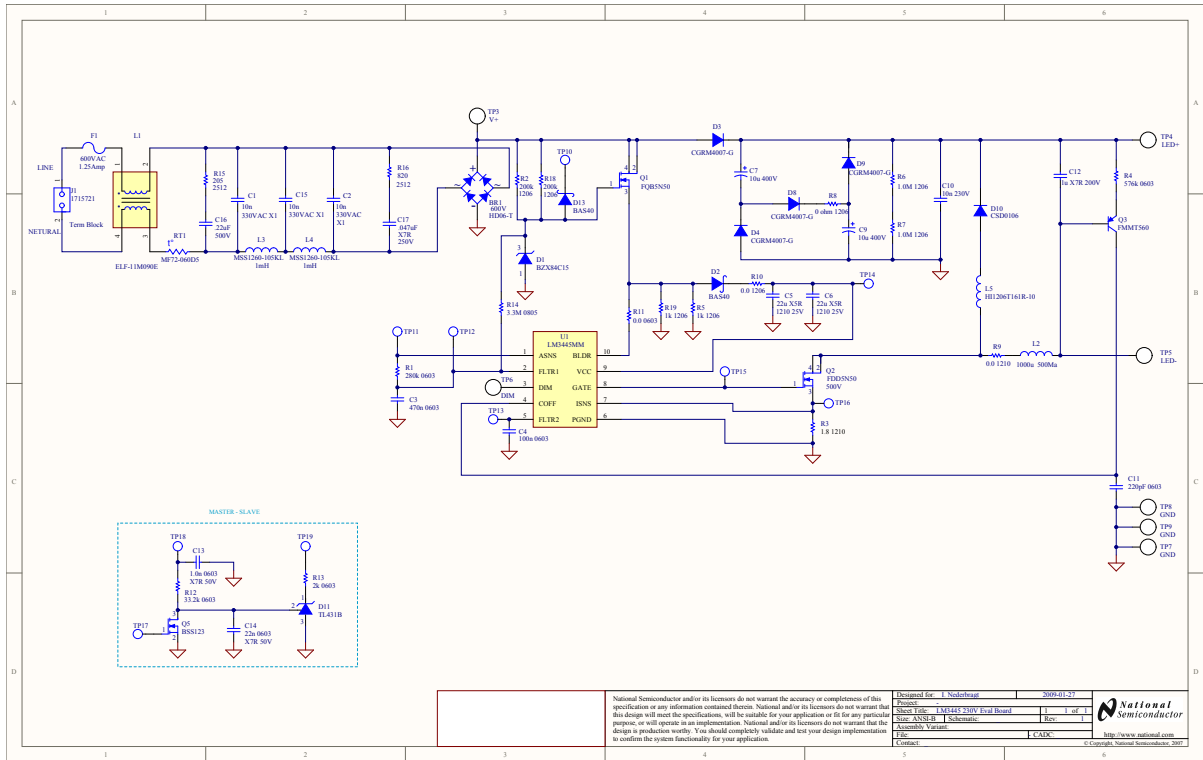


FIGURE 2. LM3445 230V reference schematic

## 5.0 Bill of Materials

schematic1

Item	Designator	CompType	Description	Manufacturer	PartNumber	Quantity
1	U1	IC	IC, CTRLR, DRV-LED, MSOP10	NSC	LM3445MM	1
2	BR1	Bridge Rectifier	Bridge Rectifier, SMT, 400V, 800mA	Diodes Inc	HD04-T	1
3	L1	Common mode filter DIP4NS	Common mode filter DIP4NS, 900mA, 700uH	Panasonic	ELF11M090E	1
4	L2	Inductor	Inductor, SHLD, SMT, 1A, 470uH	Coilcraft	MSS1260-474KLB	1
5	L3, L4	Diff mode inductor	Diff mode inductor, 500mA 1mH	Coilcraft	MSS1260-105KLB	2
6	L5	Bead Inductor	Bead Inductor, 160Ω, 6A	Steward	HI1206T161R-10	1
7	C1, C2, C10, C15	Cap	Cap, Film, X2Y2, 12.5MM, 250VAC, 20%, 10nF	Panasonic	B32921C3103M(K)	4
8	C3	Cap	Cap, X7R, 0603, 16V, 10%, 470nF	MuRata	GRM188R71C474KA88D	1
9	C4	Cap	Cap, X7R, 0603, 16V, 10%, 100nF	MuRata	GRM188R71C104KA01D	1
10	C5, C6	Cap	Cap, X5R, 1210, 25V, 10%, 22uF	MuRata	GRM32ER61E226KE15L	2
11	C7, C9	Cap	Cap, AL, 200V, 105C, 20%, 33uF	Panasonic	EEU-ED2D330	2
12	C12	Cap	Cap, X7R, 1206, 50V, 10%, 1.0uF	MuRata	GRM31CR72A105KA01	1
13	C11	Cap	Cap, COG, 0603, 100V, 5%, 120pF	MuRata	GRM1885C2A121JA01D	1
14	C13	Cap	Cap, X7R, 0603, 50V, 10%, 1.0nF	Kemet	C0603C102K5RACTU	1
15	C14	Cap	Cap, X7R, 0603, 50V, 10%, 22nF	Kemet	C0603C223K5RACTU	1
16	D1	Diode	Diode, ZNR, SOT23, 15V, 5%	On Semi	BZX84C15LT1G	1
17	D2, D13	Diode	Diode, SCH, SOD123, 40V, 120mA	NXP	BAS40H	2
18	D3, D4, D8, D9	Diode	Diode, FR, SOD123, 200V, 1A	Rohm	RF071M2S	4
19	D10	Diode	Diode, FR, SMB, 400V, 1A	On Semi	MURS140T3G	1
20	D11	IC	IC, SHNT, ADJ, SOT23, 2.5V, 0.5%	Ti	TL431BIDBZR	1
21	D12	TVS	TVS, VBR = 144V	Littelfuse	SMBJ130CA	1
22	R1	Resistor	Resistor, 0603, 1%, 280kΩ	Panasonic	ERJ-3EKF2803V	1
23	R2	Resistor	Resistor, 1206, 1%, 100kΩ	Panasonic	ERJ-8ENF1003V	1
24	R3	Resistor	Resistor, 1210, 5%, 1.8Ω	Panasonic	ERJ-14RQJ1R8U	1
25	R4	Resistor	Resistor, 0603, 1%, 576kΩ	Panasonic	ERJ-3EKF5763V	1
26	R5	Resistor	Resistor, 1206, 1%, 1.00kΩ	Panasonic	ERJ-8ENF1001V	1
27	R6, R7	Resistor	Resistor, 0805, 1%, 1.00 MΩ	Rohm	MCR10EZH1004	2
28	R8, R10	Resistor	Resistor, 1206, 0.0Ω	Yageo	RC1206JR-070RL	2
29	R9	Resistor	Resistor, 1210, 0.0Ω	Vishay	CRCW12100000Z0EA	1
30	R11	Resistor	Resistor, 0603, 0.0Ω	Yageo	RC0603JR-070RL	1
31	R12	Resistor	Resistor, 0603, 1%, 33.2kΩ	Panasonic	ERJ-3EKF3322V	1
32	R13	Resistor	Resistor, 0603, 1%, 2.0kΩ	Panasonic	ERJ-3EKF2001V	1
33	R14	Resistor	Resistor, 0805, 1%, 3.3 MΩ	Rohm	MCR10E2PJ335	1
34	RT1	Thermistor	Thermistor, 120V, 1.1A, 50Ω @ 25C	GE sensing	KC014L-ND	1
35	Q1, Q2	XSTR	XSTR, NFET, DPAK, 300V, 4A	Fairchild	FQD7N30TF	2
36	Q3	XSTR	XSTR, PNP, SOT23, 300V, 500mA	Fairchild	MMBTA92	1
37	Q5	XSTR	XSTR, NFET, SOT23, 100V, 170mA	Fairchild	BSS123	1
38	J1	Conn	Terminal Block 2 pos	Phoenix Contact	1715721	1
39	F1	Fuse	Fuse, 125V, 1,25A	cooper/bussman	6125FA1A	1

FIGURE 3. LM3445 BOM 120V version

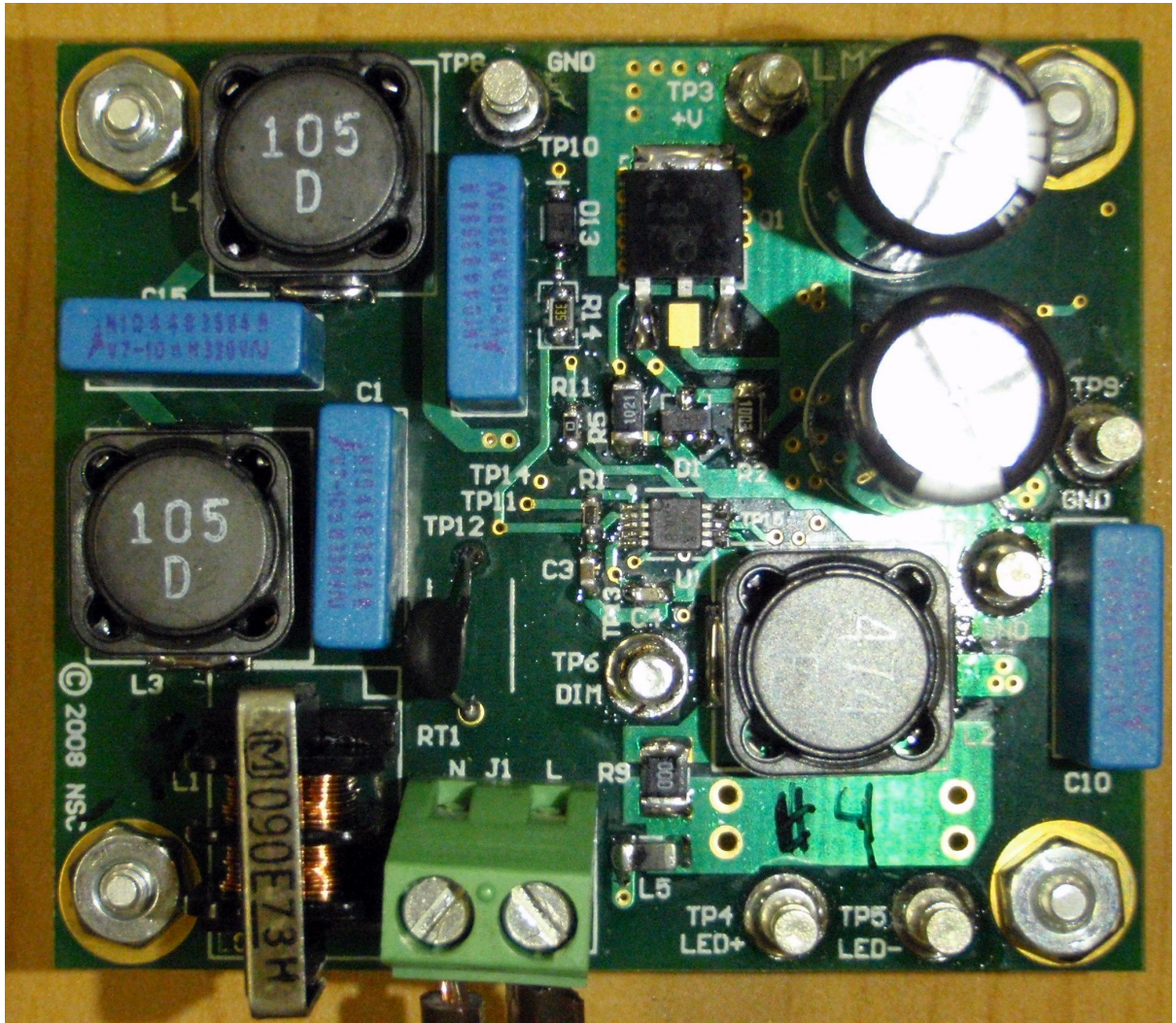
## 6.0 Other Operating Values

### Operating Values

Description	Parameter	Value	Unit
Modulation Frequency	Frequency	225	KHz

## 7.0 Board Photos

bom1



boardphoto3

FIGURE 4. LM3445TRIACEVAL Board Photo (120V)

## 8.0 Hardware Description

This reference design is based on the LM3445 evaluation board. More details about the hardware design is contained in the LM3445 datasheet

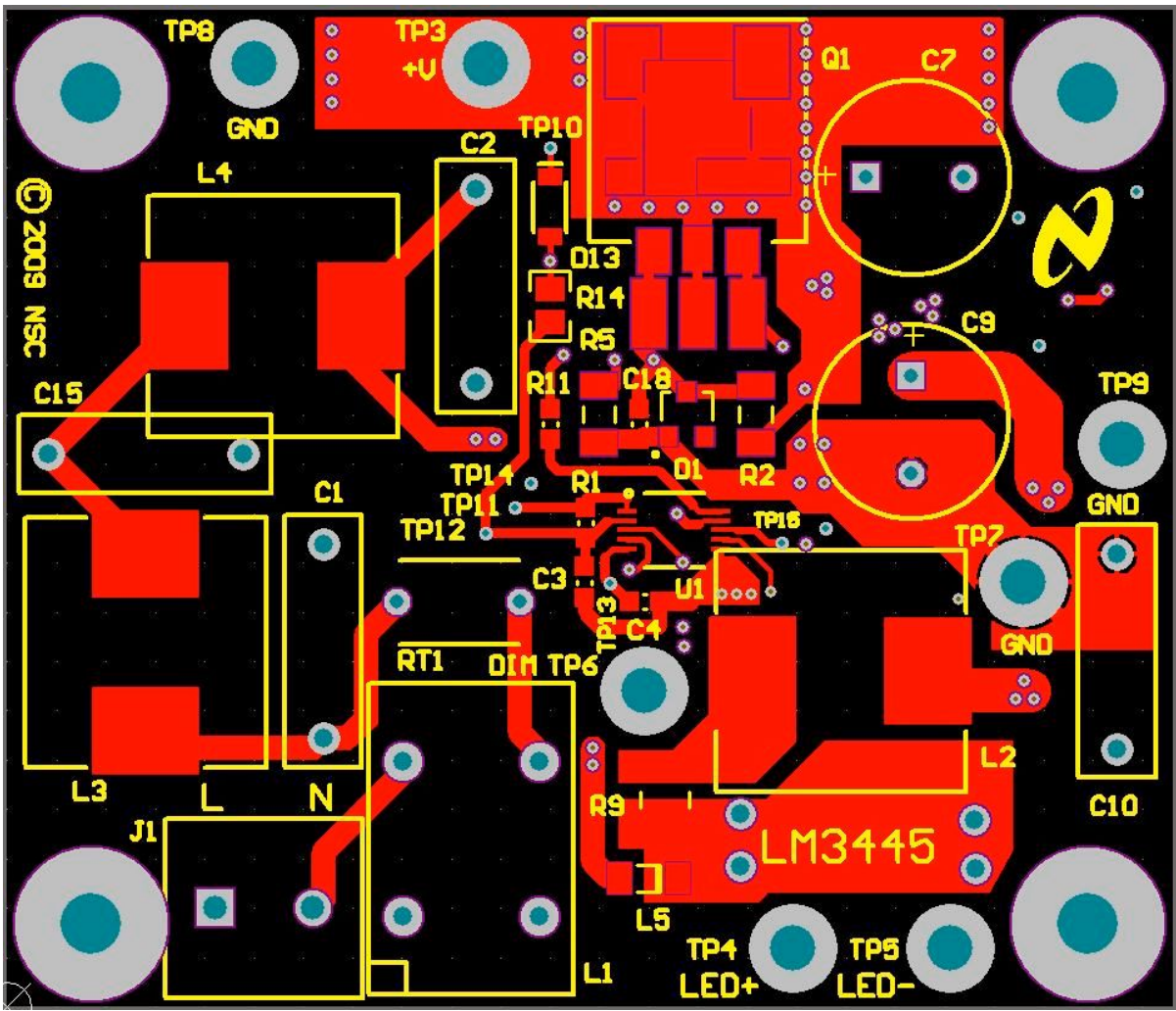
<http://www.national.com/pf/LM/LM3445.html>

This board has no isolation nor any type of protection from shock. Caution must be taken when handling evaluation

## 9.0 Layouts

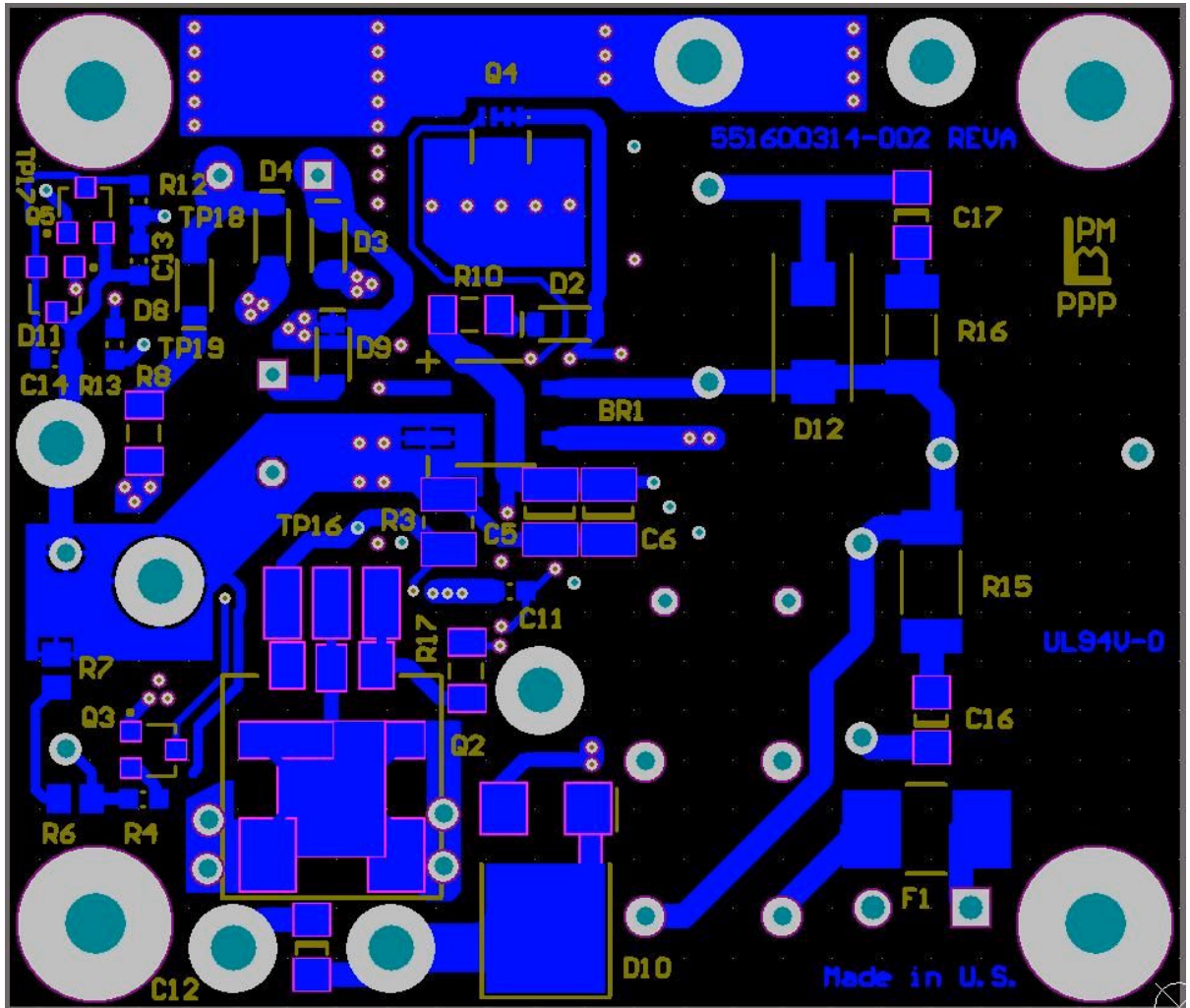
board. Avoid touching evaluation board, and removing any cables while the design is operating. Isolating the evaluation board rather than the oscilloscope is highly recommended.

It is up to the user of this material to take into account for the regulatory standards and requirements for their end product application of this design.



boardphoto

FIGURE 5. LM3445 top JPG EVB



boardphoto1

FIGURE 6. LM3445 bottom layer JPG EVB

# Notes

## Notes

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