

TI 公司的 UCC28810 和 UCC28811 是中小功率通用 led 照明电源控制器,具有功率因素修正(PFC)和 EMC 兼容特性.设计用于工作在临界导通模式的反激,降压或升压转换器. UCC28810/1 集成了用于反馈误差处理的跨导电压放大器,用来产生正比于输入电压的电流指令的电流基准发生器,电流检测(PWM)比较器,PWM 逻辑和用来驱动外接 FET 的图腾柱驱动器.此外,控制器还提供峰值电流限制,重起定时器,过压保护(OVP)以及使能等. UCC28810 和 UCC28811 广泛用在交流输入 HB LED 照明,工业,商业和住宅区照明以及户外照明如路灯,停车场,建筑物和装饰性 LED 照明等.本文介绍了 UCC28810 和 UCC28811 的主要特性,方框图,简化应用电路图, 25W PFC 反激转换器参考设计以及 PR788 100W AC/DC LED 电流驱动器参考设计和元件列表.

The UCC28810 and UCC28811 are general lighting power controllers for low to medium power lumens applications requiring power factor correction and EMC compliance. It is designed for controlling a flyback, buck or boost converter operating in critical conduction mode. It features a transconductance voltage amplifier for feedback error processing, a simple current reference generator for generating a current command proportional to the input voltage, a current-sense (PWM) comparator, PWM logic and a totem-pole driver for driving an external FET.

In the critical conduction mode operation, the PWM circuit is sELF-oscillating with the turn-on being governed by a transformer zero energy detector (TZE pin) and the turn-off being governed by the current sense comparator. Additionally, the controller provides features such as peak current limit, restart timer, overvoltage protection (OVP), and enable.

The efficient system performance is attained by incorporation of zero power detect function which allows the controller output to shut down at light load conditions without running into overvoltage. The device also features an innovative slew rate enhancement circuit which improves the large signal transient performance of the voltage error amplifier. The low start-up and operating currents of the device result in low power consumption and ease of start-up. The highly-accurate internal bandgap reference leads to tight regulation of the output voltage in normal and OVP conditions, resulting in higher system reliability. The enable comparator ensures that the controller is off if the feedback sense path is broken or if the input voltage is very low.

There are two key parametric differences between UCC28810 and UCC28811, the UVLO turn-on threshold and the gM amplifier source current. The UVLO turn-on threshold of the UCC28810 is 15.8 V and for the UCC28811 it is 12.5 V. The gM amplifier source current for UCC28810 is typically 1.3 mA, and for the UCC28811 it is 300µA. The higher UVLO turn-on threshold of the UCC28810 allows quicker and easier start-up with a smaller VDD capacitance while the lower UVLO turn-on threshold of UCC28811 allows operation of the critical conduction mode controller to be easily controlled by the downstream

PWM controller in two-stage power converters. The UCC28810 gM amplifier also provides a full 1.3-mA typical source current for faster start-up and improved transient response when the output is low either at start-up or during transient conditions. The UCC28811 is suitable for applications such as street lights and larger area luminaires where a two-stage power conversion is needed. The UCC28810 is suitable for applications such as commercial or residential retrofit luminaires where there is no down-stream PWM conversion and the advantages of smaller VDD capacitor and improved transient response can be realized.

Devices are available in the industrial temperature range of -40°C to 105°C . Package offering is an 8-pin SOIC (D) package.

UCC28810/1 主要特性:

Transition Mode Controller for Low Implementation Cost of AC Input LED Lighting Applications

Implements Single Stage Power Factor Corrected LED Driver

Enhanced Transient Response With Slew-Rate Comparator

Interfaces with Traditional Wall Dimmers

Accurate Internal VREF for Tight Output Regulation

Two UVLO Options

Overvoltage Protection (OVP), Open-Feedback Protection and Enable Circuits

$\pm 750\text{-mA}$ Peak Gate Drive Current

Low Start-Up and Operating Currents

Lead (Pb)-Free Packages

UCC28810/1 应用:

AC Input General Lighting Applications Using HB LEDs

Industrial, Commercial and Residential Lighting Fixtures

Outdoor Lighting: Street, Roadway, Parking, Construction and Ornamental LED Lighting Fixtures

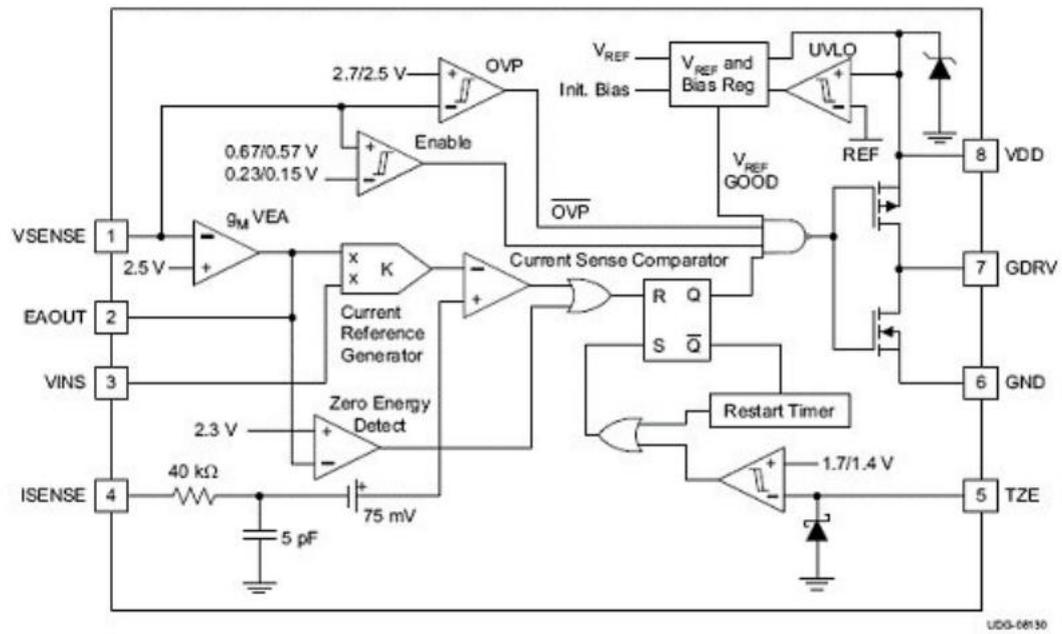


图 1.UCC28810 方框图

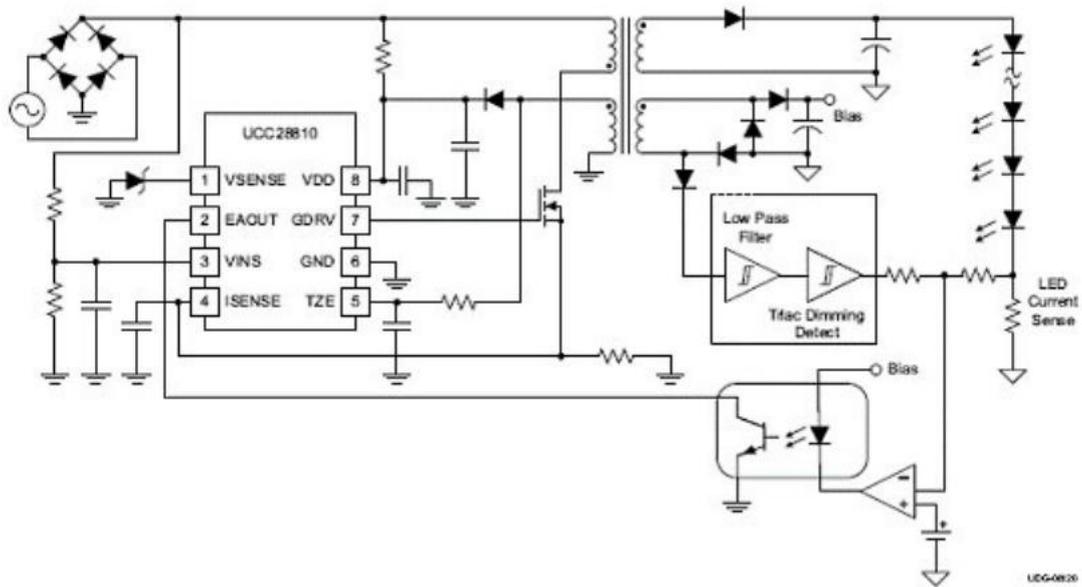


图 2.UCC28810 简化应用电路图

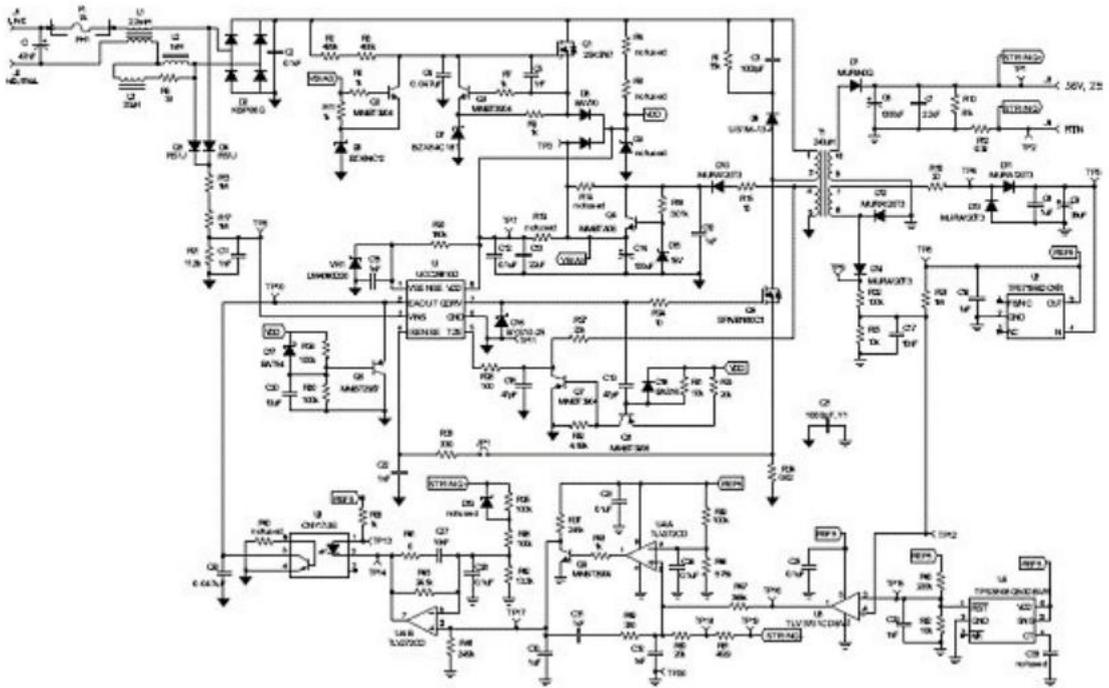


图 3.25W PFC 反激转换器参考设计

The PR788 is a 100-W offline AC-to-DC LED current driver with power factor correction.

This design is a two stage converter design with a universal input boost follower PFC stage providing a 240-V to 400-V DC output and a low-side buck stage providing the current source to power the LEDs. This converter was designed to support up to 30 high-brightness LEDs in series with up to 900-mA average current. The design incorporates an interface for microprocessor control to allow for shutdown into a low power mode ($< 0.5\text{ W}$) and PWM dimming of the LEDs.

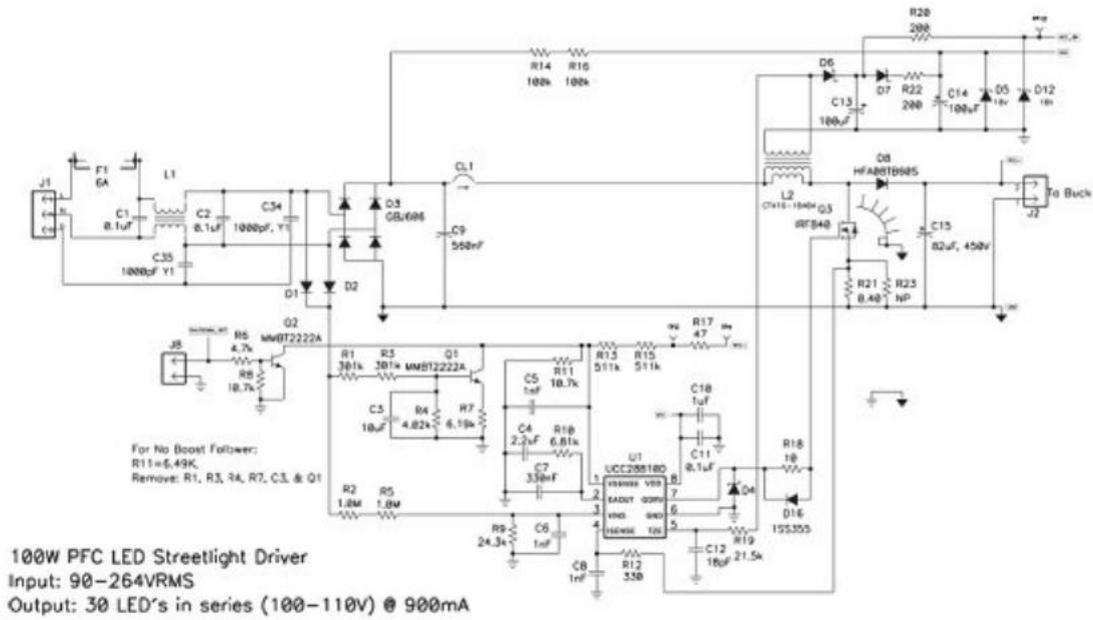


图 4. PR788 100W AC/DC LED 电流驱动器参考设计

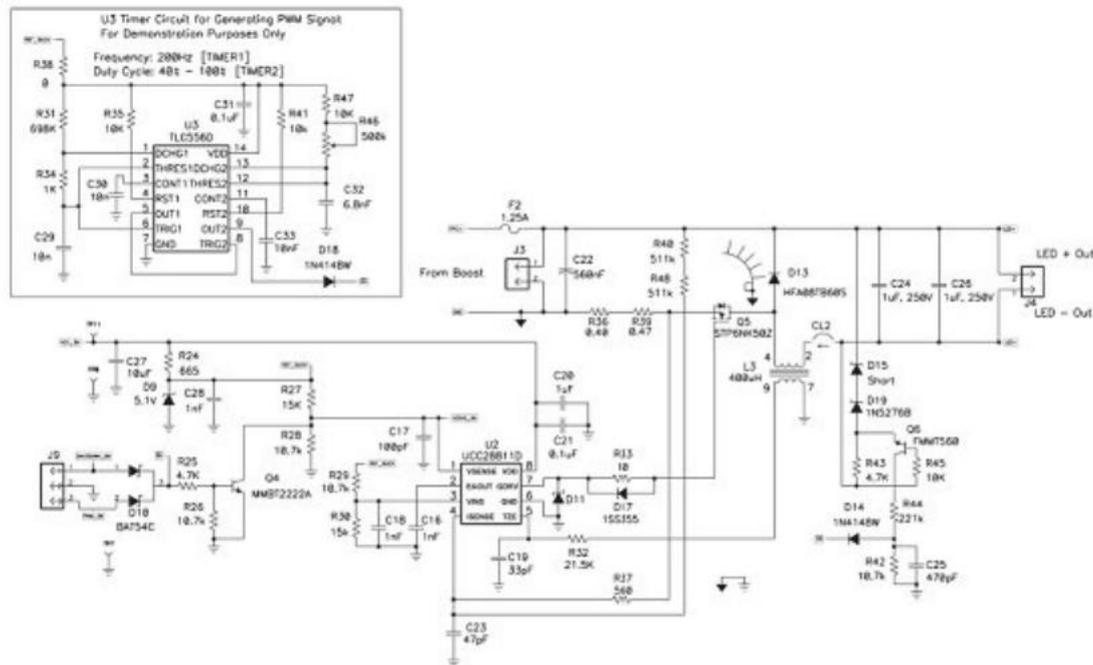


图 5.工作在 CCM 的低边降压转换器电路图

100W LED 照明应用电路

A 0.9-A Constant Current Supply with PFC for 100-W LED Lighting Applications

The UCC28810EVM-002 is a constant current non-isolated power supply for LED lighting applications. It will convert universal mains (90 VRMS to 264 VRMS) to a 0.9-A constant current into a 100-W load. This evaluation module will allow the customer evaluate the UCC28810/11 in a typical LED lighting application.

The evaluation module uses a two stage approach to controlling the output current.

The first stage is a transition mode PFC circuit. This ensures the design meets the harmonic current or power factor requirements set out by various standards, such as EN61000-3-2. The PFC circuit converts the AC input to a regulated DC voltage. This DC voltage can be configured in one of two ways. The default configuration of the module is that of a boost follower type PFC. The boost follower PFC is where the PFC regulated output DC voltage tracks the AC input peak voltage. The second configuration requires removing some components and changing a resistor value see below for more details. This second

configuration removes the tracking element of the PFC circuit. The PFC DC output voltage will then be regulated to a fixed value in the region of 396 VDC.

The second stage also uses transition mode but is configured as a buck converter. It converts the PFC output voltage to a fixed constant current. This circuit is capable of supplying 0.9 A into a 100-W load. It also accepts PWM dimming inputs. Alternatively the user can use the PWM circuit on the module to see the dimming function.

This module will work with most high brightness LED's (HB-LED) that operate with 0.9 A and a total string voltage drop of between 55 V and 110 V.

主要特性:

90 VRMS to 264 VRMS operation

Boost Follower or Fixed Output PFC Stage

PFC Disable

Output Current Disable

External or Internal PWM Dimming

典型应用:

AC Input General Lighting Applications Using HB-LED's

Industrial, Commercial and Residential Lighting Fixtures

Outdoor Lighting: Street, Roadway, Parking, Construction and Ornamental LED Lighting Fixtures

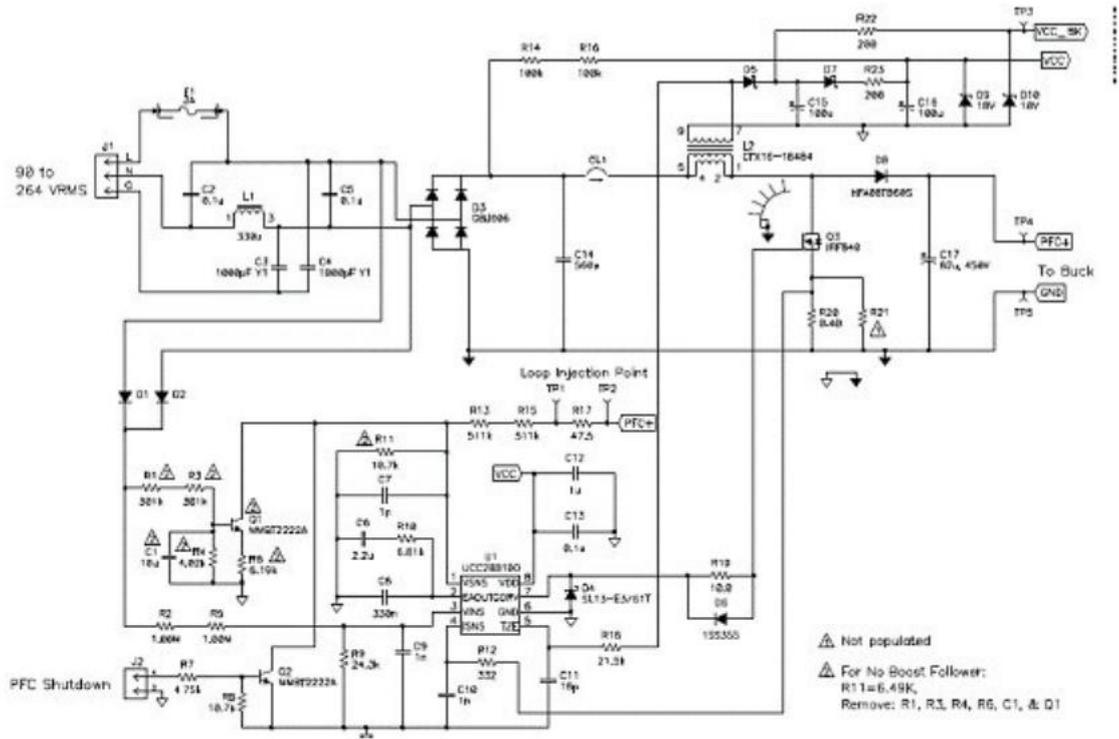


图 6. 100W LED 照明应用电路图(1)

QTY	REF DES	DESCRIPTION	MFR	PART NUMBER
1	C1	Capacitor, ceramic, 10 μ F, 25 V, X5R, 20%, 1206	Std	Std
2	C2, C5	Capacitor, metallized polyester film, 0.1 μ F, 275 VAC, 10%, X2, 17.5 mm x 5.5 mm	Std	Std
2	C3, C4	Capacitor, ceramic disc, 1 nF, 250 V, Y1/X1	Panasonic	ECK-ANA102MB
1	C6	Capacitor, ceramic, 2.2 μ F, 25 V, X7R, 10%, 0805	Std	Std
6	C7, C9, C10, C21, C23, C25	Capacitor, ceramic, 1 nF, 50 V, NPO, 5%, 0805	Std	Std
1	C8	Capacitor, ceramic, 330 nF, 16 V, X7R, 10%, 0805	Std	Std
1	C11	Capacitor, ceramic, 18 pF, 50 V, NPO, 5%, 1206	Std	Std
3	C12, C28, C34	Capacitor, ceramic, 1 μ F, 25 V, X5R, 10%, 0805	Std	Std
3	C13, C20, C29	Capacitor, ceramic, 0.1 μ F, 25 V, X7R, 10%, 0805	Std	Std
1	C14	Capacitor, polypropylene film, 0.56 μ F, 400 V, 5%	Panasonic	ECW-F4564JL
2	C15, C16	Capacitor, aluminum electrolytic, 100 μ F, 35 V, 20%, 6.3 mm x 11.5 mm	Std	Std
1	C17	Capacitor, aluminum electrolytic, 82 μ F, 450 V, TS-HB	Panasonic	ECO-S2WB820BA
1	C18	Capacitor, ceramic, 10 μ F, 25 V, X7R, 10%, 1210	Std	Std
2	C19, C22	Capacitor, ceramic, 10 nF, 50 V, X7R, 10%, 0805	Std	Std
1	C24	Capacitor, ceramic, 100 pF, 200 V, NPO, 5%, 0805	Std	Std
1	C26	Capacitor, ceramic, 47 pF, 50 V, NPO, 5%, 0805	Std	Std
1	C27	Capacitor, ceramic, 33 pF, 50 V, NPO, 5%, 1206	Std	Std
1	C30	Capacitor, polypropylene film, 0.56 μ F, 630 V, 5%	Panasonic	ECW-F6564JL
2	C31, C32	Capacitor, metallized polyester film, 1.0 μ F, 250 V, 10%	Panasonic	ECQ-E2105KF
1	C33	Capacitor, ceramic, 470 pF, 50 V, NPO, 5%, 0805	Std	Std
2	CL1, CL2	Current loop, wire, 20 AWG., stranded, 3.0 in.	Std	NA
2	D1, D2	Diode, 1.5 A, 600 V	Std	BYG10J
1	D3	Diode, bridge rectifier, 6 A, 600 V	Std	GBJ606
2	D4, D16	Diode, Schottky, 1.5 A, 30 V	Std	SL13-E3/61T
2	D5, D7	Diode, Schottky, 1 A, 90 V	Std	BYS11-90-E3/TR
2	D6, D17	Diode, switching, 90 V, 225 mA Ifm, high speed	Rohm	1SS355
2	D8, D18	Diode, ultra fast, 8 A, 600 V	IR	HFA08TB60S
2	D9, D10	Diode, Zener, 18 V, 1 W	Std	SMAZ18-13
3	D11, D13, D15	Diode, signal, 300 mA, 75 V, 35 mW	Std	1N4148W
2	D12, D21	Diode, dual Schottky, 200 mA, 30 V	Std	BAT54C
1	D14	Diode, Zener, 5.1 V, 1 W	Std	SMAZ5V1-13-F
4	D19, D20, D22, D23	Diode, Zener, 500 mW, 75 V	Std	MMS25267BT1

QTY	REF DES	DESCRIPTION	MFR	PART NUMBER
1	F1	Fuse, SMP, 1.25 A	Bel	SMP 1.25
1	F1	Fuse 250 V UL fast 5 X 20 MM	Std	Std
2	FH1	Fuse clip, 5 x 20 mm, PC mount	Wickmann	01000056H
2	HS1, HS2	Heatsink, TO-220, vertical mount, 15°C/W	Aavid	593002
1	J1	Connector, AC receptacle, board mount, R/A, 9 mm	Qualtek Electronics	703W-00/54
2	J2, J3	Header, male 2 pin, 100-mil spacing, (36-pin strip)	Sullins	PTC36SAAN
1	J4	Header, male 3 pin, 100-mil spacing, (36-pin strip)	Sullins	PTC36SAAN
1	J5	Terminal block, 2 pin 9.52-mm spacing	OST	OSTT7022150
1	L1	Inductor, thru hole, 1.3 A, 126 mΩ	muRata	33331C
1	L2	Transformer, 1 prim, 1 sec, 1 mH, 3.1 A	Coiltronics	CTX16-18484
1	L3	Transformer, 1 prim, 1 sec, 400 μH, 2 A	Coiltronics	CTX33-18428
4	Q1, Q2, Q4, Q7	Transistor, NPN, 75 V, 500 mA	Std	MMBT2222A
1	Q3	MOSFET, N-channel, 400 V, 10 A	IR	IRF840
1	Q5	MOSFET, N-channel, 500 V, 6 A	ST	STP6NK50Z
1	Q6	Bipolar, PNP, -500 V, -500 mA	Zetex	FMMT560
2	R1, R3	Resistor, chip, 301 kΩ, 1/4 W, 1%, 1206	Std	Std
2	R2, R5	Resistor, chip, 1.00 MΩ, 1/4 W, 1%, 1206	Std	Std
1	R4	Resistor, chip, 4.02 kΩ, 1/8 W, 1%, 0805	Std	Std
1	R6	Resistor, chip, 6.19 kΩ, 1/8 W, 1%, 0805	Std	Std
2	R7, R28	Resistor, chip, 4.75 kΩ, 1/8 W, 1%, 0805	Std	Std
6	R8, R11, R29, R30, R33, R44	Resistor, chip, 10.7 kΩ, 1/8 W, 1%, 0805	Std	Std
1	R9	Resistor, chip, 24.3 kΩ, 1/8 W, 1%, 0805	Std	Std
1	R10	Resistor, chip, 6.81 kΩ, 1/8 W, 1%, 0805	Std	Std
1	R12	Resistor, chip, 332 Ω, 1/8 W, 1%, 0805	Std	Std
4	R13, R15, R39, R40	Resistor, chip, 511 kΩ, 1/4 W, 1%, 1206	Std	Std
2	R14, R16	Resistor, chip, 100 kΩ, 1/4 W, 1%, 1206	Std	Std
1	R17	Resistor, chip, 47.5 Ω, 1/8 W, 1%, 0805	Std	Std
2	R18, R37	Resistor, chip, 21.5 kΩ, 1/8 W, 1%, 0805	Std	Std
2	R19, R36	Resistor, chip, 10.0 Ω, 1/8 W, 1%, 0805	Std	Std
2	R20, R35	Resistor, chip, 0.40 Ω, 1 W, 1%, 2512	Std	Std
2	R22, R23	Resistor, chip, 200Ω, 1/2 W, 1%, 1812	Std	Std
2	R24, R42	Resistor, chip, 10.0 kΩ, 1/8 W, 1%, 0805	Std	Std
2	R25, R46	Resistor, chip, 100 kΩ, 1/8 W, 1%, 0805	Std	Std
1	R26	Potentiometer, 3/8 cermet, single turn, flat	Bourns	3362P-504
1	R27	Resistor, chip, 665 Ω, 1/4 W, 1%, 1206	Std	Std

QTY	REF DES	DESCRIPTION	MFR	PART NUMBER
3	R31, R32, R45	Resistor, chip, 15.0 kΩ, 1/8 W, 1%, 0805	Std	Std
1	R34	Resistor, chip, 560 Ω, 1/8 W, 1%, 0805	Std	Std
1	R38	Resistor, chip, 0.47 Ω, 1 W, 1%, 2512	Std	Std
1	R41	Resistor, chip, 4.75 kΩ, 1/4 W, 1%, 1206	Std	Std
1	R43	Resistor, chip, 221 kΩ, 1/8 W, 1%, 0805	Std	Std
2	R47, R48	Resistor, chip, 221 kΩ, 1/4 W, 1%, 1206	Std	Std
1	U1	LED Lighting Power Controller	TI	UCC28810D
1	U2	Timer, Low-Power CMOS	TI	TLC555D
1	U3	LED Lighting Power Controller	TI	UCC28811D
1	--	PCB, 10.4 in x 2 in x 0.062 in	Any	HPA439 REVA
2		Washer, #4, shoulder, nylon	Keystone	
2		Heatpad TO-220 0.009" SP900	Bergquist	SP900S-90
2		Washer, #4 split, ss	Std	Std
2		Nut, #4-40, ss	Std	Std
2		Screw, #4 - 40, SS, 0.5 in.	Std	Std
1	JP1	Connector, jumper, shorting, gold, 0.100"	Sullens	