High Voltage Switching Regulator

Non-Isolation Controller

FEATURES

_ Operate from a rectified 85~265 VAC line source.

_ Typical oscillation frequency: 90 kHz

_ Unnecessary external DC Power supply

_ Output voltage external setting (FB) type available.

_ FB terminal voltage (VFB) 1.0 V.

_ Duty ratio: 0% to 5% typ.- PFM control, 5% to 85% typ. - PWM control

_ Built-in current limiting circuit: Assigned by external resistor.

_ Soft-start function: Built-in Soft-start circuit.

_ Built-in HV regulator.

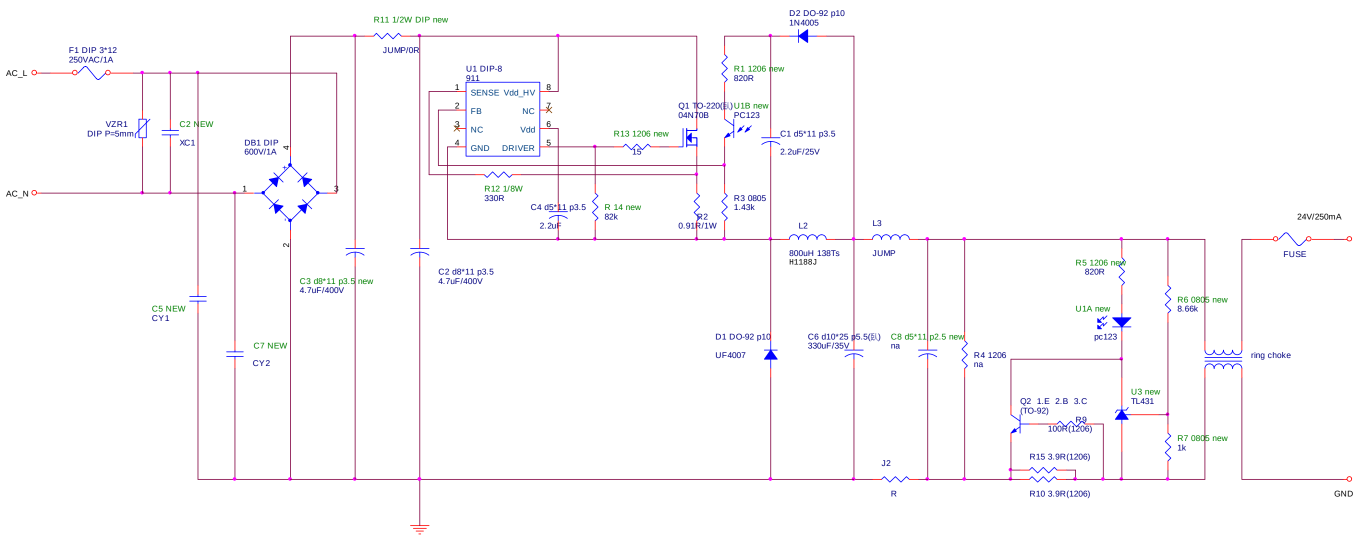
APPLICATIONS

_ LED Drivers

_ Back Lighting

_ Energy Saving Illumination

1. Demo board circuit:

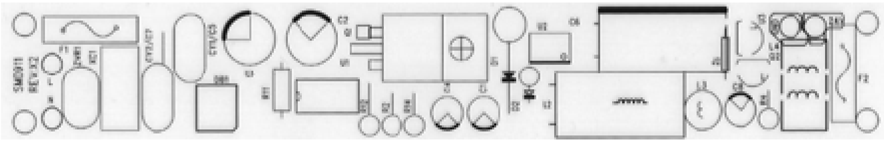


2. BOM:

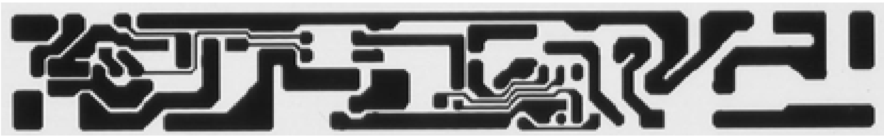
Item	Quantity	Reference	Part
1	1	C2	XC1
2	1	C5	CY1
3	1	C7	CY2
4	1	C1	2.2uF/25V
5	2	C2,C3	4.7uF/400V
6	1	C4	2.2uF
7	2	R4,C8	na
8	1	C6	330uF/35V
9	1	DB1	600V/1A
10	1	D1	UF4007
11	1	D2	1N4005
12	1	F1	250VAC/1A
13	1	F2	FUSE
14	1	J2	R
15	1	L2	800uH 138Ts
16	1	L3	JUMP
17	1	L4	ring choke
18	1	Q1	04N70B
19	1	Q2	2N3904
20	1	R14	82k
21	1	R2	0.91R/1W
22	1	R9	100R
23	2	R1,R5	820R
24	2	R15,R10	3.9R
25	1	R11	JUMP/0R
26	1	R12	330R
27	1	R3	1.43k
28	1	R6	8.66k
29	1	R7	1k
30	1	R13	15R
31	1	U1A/B	pc123
32	1	U3	TL431
33	1	U1	SMD911
34	1	VZR1	VARISTOR

3. PCB Layout:

Top-Silkscreen



Bottom-side



4. Critical Inductance:

The buck power stage have been for continuous and discontinuous conduction modes of steady-state operation. The conduction mode of a power stage is a function of input voltage, output voltage, output current, and the value of the inductor. A buck power stage can be designed to operate in continuous mode for load currents above a certain level usually 5% to 10% of full load. Usually, the input voltage range, the output voltage and load current are defined by the power stage specification. This leaves the inductor value as the design parameter to maintain continuous conduction mode.

The minimum value of inductor to maintain continuous conduction mode can be determined by the following procedure.

First, define $Io(\min)$ as the minimum current to maintain continuous conduction Mode.

Equation:

$$Io(\min) = \frac{\Delta I_L}{2}$$

$$L(\min) = \frac{Vin - Vo}{2Io(\min)} \times t_{on}(\max)$$

$$= \frac{Vo\frac{Ts}{t_{on}(\max)} - Vo}{2Io(\min)} \times t_{on}(\max)$$

$$= \frac{Vo(\frac{Ts}{t_{on}(\max)} - 1)}{2Io(\min)} \times t_{on}(\max)$$

5. Output Capacitance:

In switching power supply power stages, the function of output capacitance is to store energy. The energy is stored in the capacitor's electric field due to the voltage applied. Thus, qualitatively, the function of a capacitor is to attempt to maintain a constant voltage.

The value of output capacitance of a Buck power stage is generally selected to limit output voltage ripple to the level required by the specification. Since the ripple current in the output inductor is usually already determined, the series impedance of the capacitor primarily determines the output voltage ripple. The three elements of the capacitor that contribute to its impedance (and output voltage ripple) are equivalent series resistance (ESR), equivalent series inductance (ESL), and capacitance (C). The following gives guidelines for output capacitor selection.

For continuous inductor current mode operation, to determine the amount of capacitance needed as a function of inductor current ripple, ΔI_L, switching frequency, fS, and desired output voltage ripple, ΔVo, the following equation is used assuming all the output voltage ripple is due to the capacitor's capacitance.

Equation:

$$C = \frac{65 \times 10^{-6}}{ESR}$$

$$= 65 \times 10^{-6} \bullet \frac{\Delta I_L}{\Delta Vo}$$

$$\Delta Vo = \frac{ESR}{\Delta I_L}$$

