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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832


Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



Specifications

Parameter	Min	Typ	Max	Unit
Input Voltage				
AC	-	-	265	V_{rms}
DC	15	-	375	V_{DC}
Load Current	-	-	350	mA
Efficiency	-	90	-	%



WARNING!

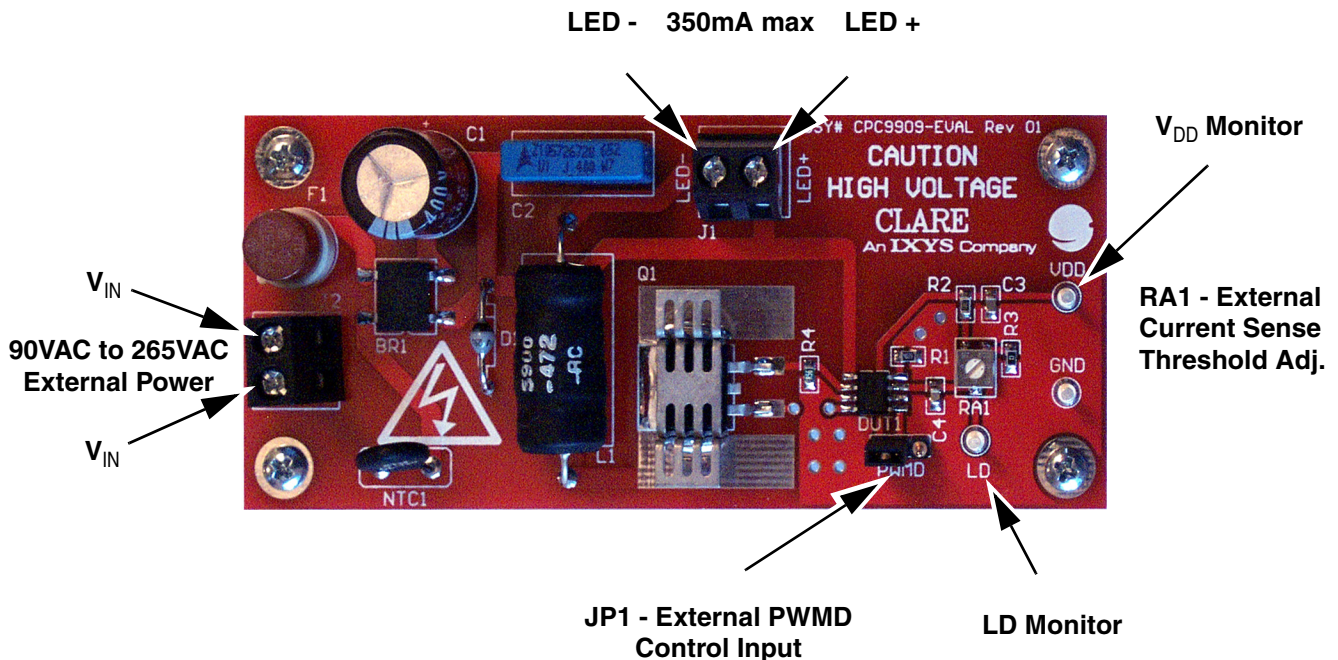
This demonstration board must be powered through an isolation transformer before connecting any external AC instrumentation

Introduction

Clare's CPC9909 Evaluation Board contains all the necessary circuitry to demonstrate all the features of CPC9909 High Brightness (HB), Off-Line LED driver. The CPC9909 IC architecture includes pulse frequency modulation (PFM) with a constant peak-current control scheme. This regulation scheme is inherently stable, allowing the driver to operate above 50% duty cycle without open-loop instability or sub-harmonic oscillations. This greatly increases the number of LEDs in series that can be driven by the CPC9909 and by this Evaluation Board.

Linear LED dimming can be achieved either by adjusting the on-board potentiometer, RA1, or by adjusting the voltage at the LD pin. In addition, PWM dimming can be achieved with a user-applied TTL-level, low frequency, pulse-width-modulated square wave signal between JP1-1 (GND) and JP1-2 (connected to the PWMD pin of the CPC9909).

Figure 1. CPC9909 Evaluation Board, Top View



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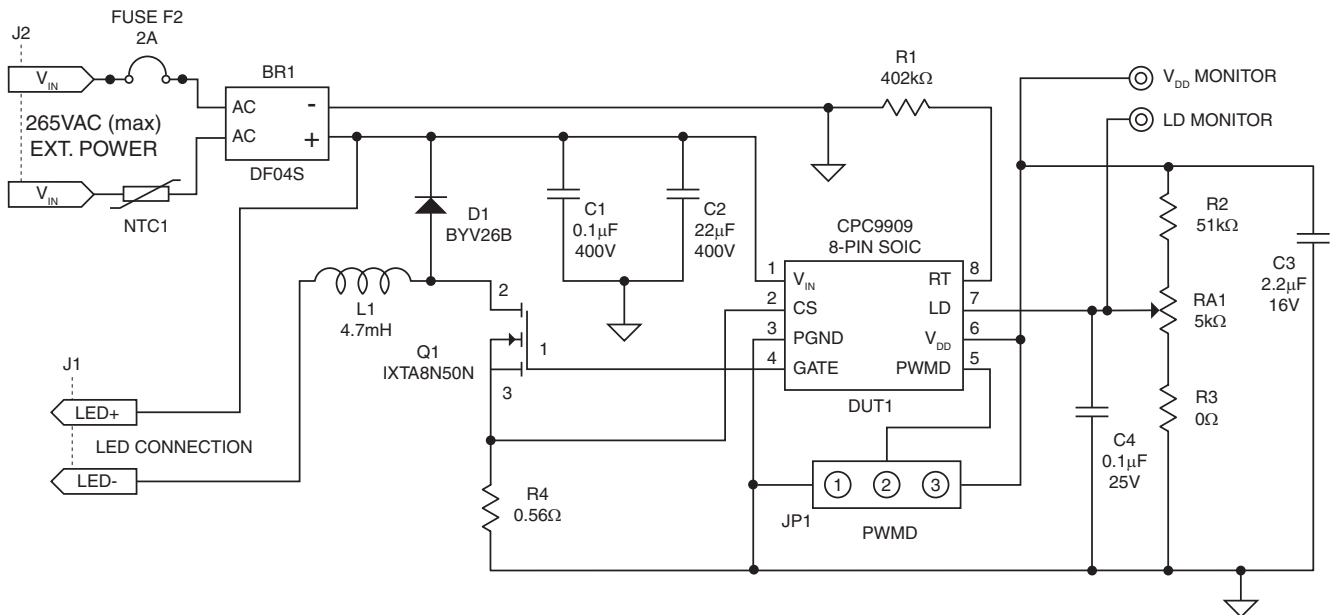
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1. Setup

1.1 CPC9909 Evaluation Board Schematic



1.2 Demo Board Connection Descriptions

Name	Description
J1	
LED+	LED+ is connected to the anode end of the LED string
LED-	LED- is connected to the cathode end of the LED string
J2 *	
V _{IN}	AC input: 265V _{rms} (max) - or - DC input: 15V _{DC} to 375V _{DC} (not DC polarity sensitive)
V _{IN}	AC input: 265V _{rms} (max) - or - DC input: 15V _{DC} to 375V _{DC} (not DC polarity sensitive)
V _{DD} Monitor	This pin is connected to the V _{DD} pin of the CPC9909. The typical voltage regulator output is set at 7.8V, and can be used to provide bias voltage to external circuits.
LD Monitor	The LD monitor pin is connected to the wiper of the potentiometer, RA1. The CPC9909 has a preset voltage level V _{CS(high)} which is typically set at 250mV. The LED drive current can be reduced in a linear fashion by adjusting RA1, thus pulling the LD pin down to below 250mV.
JP1	External PWMD Control Input: <ul style="list-style-type: none"> Jumper pins 1&2 to disable the CPC9909 and place it into a low-current, standby state. Jumper pins 2&3 to enable the CPC9909; dimming is accomplished with the potentiometer, RA1. No Jumper. Apply a TTL-level PWM signal in the 500Hz range to pin 2 to enable dimming under PWM control. The PWM signal's duty cycle determines LED brightness.
GND	This pin is connected to the ground of buck LED driver.

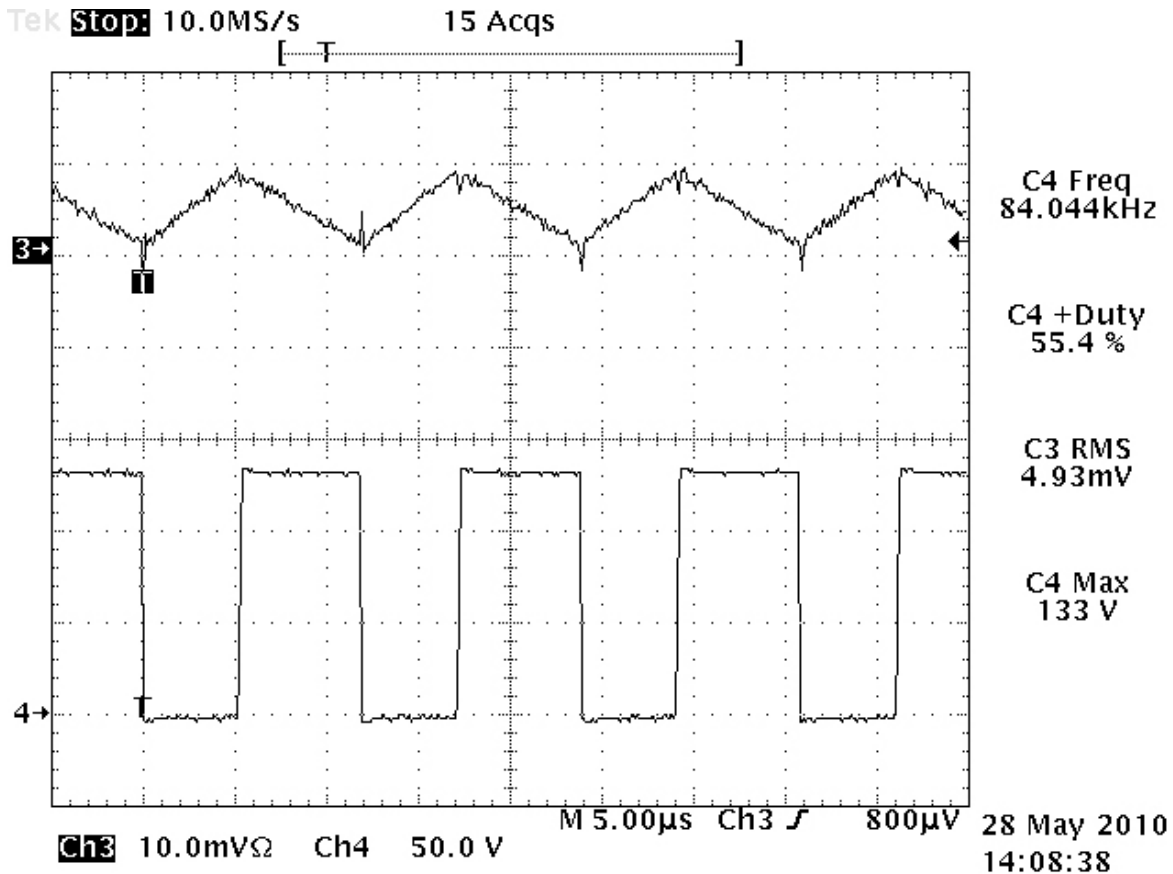
* Note that the demo board and the connected LED's are not isolated from line voltage, therefore an isolation transformer should be used to protect the user and all measuring instruments such as oscilloscope and multi-meters.

1.3 CPC9909 Evaluation Board Bill of Materials

Designator	Qty.	Description	Part Number
BR1	1	IC, Rectifier Bridge, 400V, 1.5A	DF04S
C1	1	Capacitor, Polarized, 0.5 WD, 22 μ F, 400V	EXXG401ELL22CMK20S
C2	1	Capacitor, Axial, 0.6 x 0.35, 0.1 μ F, 400V	B32652A4104J
C3	1	Capacitor, 2.2 μ F, 16V	GRM21BR61C225KA88L
C4	1	Capacitor, 0.1 μ F, 25V	GRM216F51E104ZA01D
D1	1	BYV26B, 1A, 400V	BYV26B-TR
DUT1	1	Clare CPC9909	CPC9909
F1	1	Fuse Holder, Thru-Hole, PC Mount	5600000100
F2	1	Fuse, 2A, 250V	37312000410
J1	1	2-Position Terminal Block	39544-3002
J2	1	2-Position Terminal Block	39544-3002
JP1	1	3-Position Jumper	800-10-064-10-001000 w/shunt 929950-00
JP2	1	Wire Jumper, 0.3	(Included)
L1	1	Inductor, Axial, 4.7mH, 0.4A	5900-472-RC
NTC1	1	Thermistor, Inrush Current Limiter	CL-130
Q1	1	IXYS FET, With Aavid Thermalloy Heat Sink	IXTA8N50P w/heatsink 573100D00000
R1	1	Resistor, Surface Mount, 402k	RC0805FR-07402KL
R2	1	Resistor, Surface Mount, 51k	RC0805FR-0751K1L
R3	1	Resistor, Surface Mount, 0 Ohms	RC0805JR-070RL
R4	1	Resistor, Surface Mount, 0.56	RL1220S-R56-F
RA1	1	Variable Resistor, 5k	3314G-1-502E
TP2	1	Test Point	10-138-2-01
TP3	1	Test Point	10-138-2-01
TP4	1	Test Point	10-138-2-01

2. Performance

2.1 Typical Output Waveforms



Input Voltage = 110VAC
 CH3: LED Current, 10mVΩ = 100mA/div
 CH4: MOSFET drain voltage, 50V/div
 Frequency = 84kHz, positive duty cycle = 55.4%

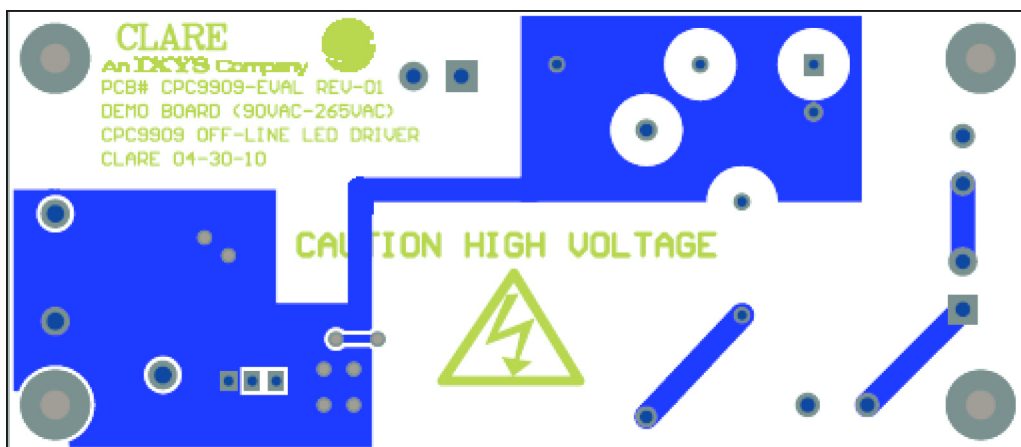
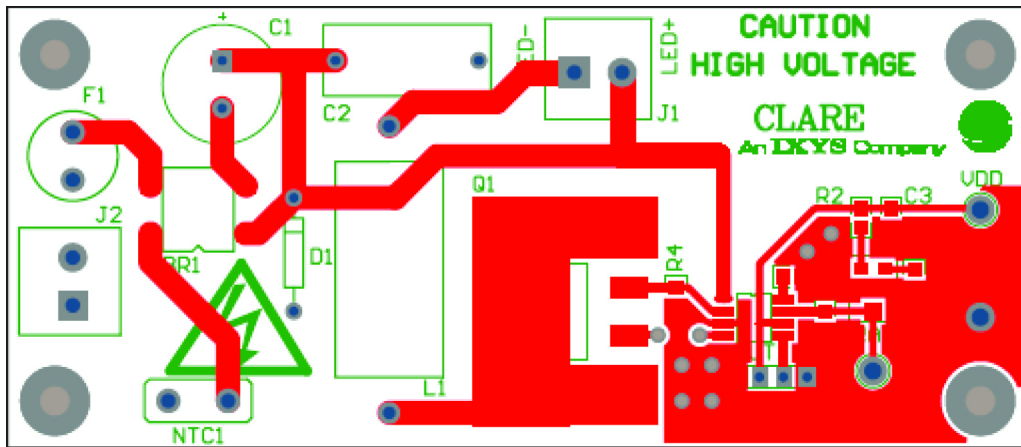
3. PC Board Layout Considerations

Proper PCB layout should include a short, thick trace from pin 4 of the CPC9909 internal gate driver to the gate of the external power MOSFET.

In addition, the current sense resistor, connected to pin 2, and the one-shot programming resistor, connected to pin 8, should be placed as close as possible to pin 2 and pin 8 respectively to minimize any noise coupling to the CS and RT pins.

Please note that in some cases, during turn-off transitions of the external power MOSFET, high current spikes from the external inductor can develop. In this case, the design may require placing a high voltage capacitor, 100nF or higher, between the LED+ and LED- terminals to filter these current spikes.

4. PC Board Layout



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