

HT7L4091 LED Driver Buck Topology Applications

D/N : HA0295E

Abstract

The HT7L4091 converter device is particularly suitable for modified Buck LED driver topologies. It provides flexible power solutions for low cost and high performance LED lighting applications. This document provides two example application circuits to assist users with system design. The provided circuits will satisfy the requirements of low-cost, high efficiency, high power factor and EMI regulation within a minimum area. .

High Power Factor, Low Cost, Optimised Solution not Requiring an Electrolytic Capacitor

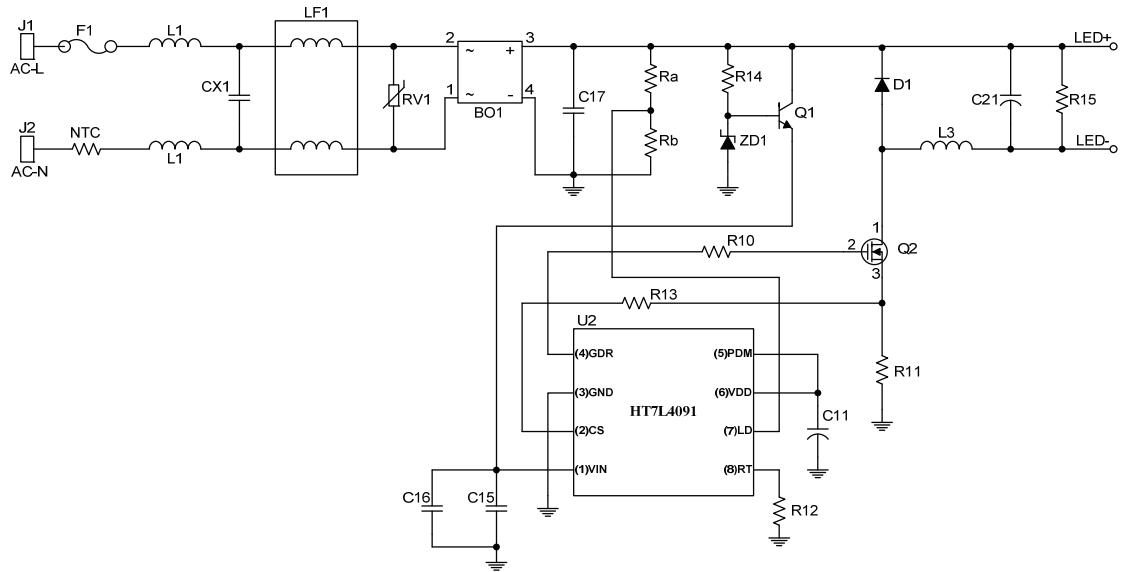
General Description

The HT7L4091 is an excellent choice as a simple solution to meet the demands of higher power factor applications. This optimised solution requires only two resistors connected to the LD pin which provides a method of allowing the LED current to be proportional to the AC input voltage to achieve higher PF values. The achieved PF values can be as high as 0.95. This application circuit which does not require an electrolytic capacitor, provides a low-cost and space saving solution. The power efficiency can be up to 83% at 220V. The Evaluation Board uses a Buck topology and includes input EMI filtering with inductors and common mode choke to provide filtering for EMI reduction. The device has a wide temperature operating range of -40°C to 105°C.

Operating Conditions

Parameter	Value
Input Voltage Range	180~264 Vac
Operating Temperature	-40~105°C
Performance	
Output Ripple Voltage proportion @ 49.4V	20%
Average power efficiency@ 220V	83%
Average power factor value	> 0.95

Application Circuit

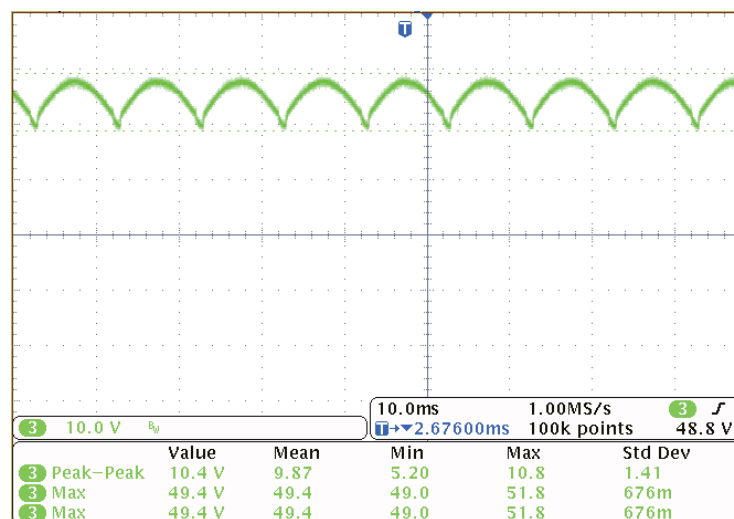
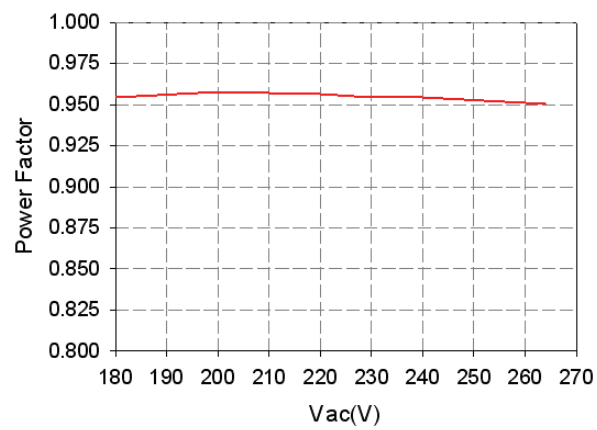
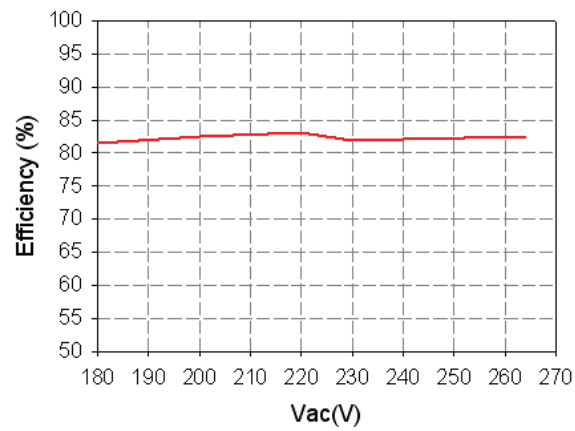


BOM

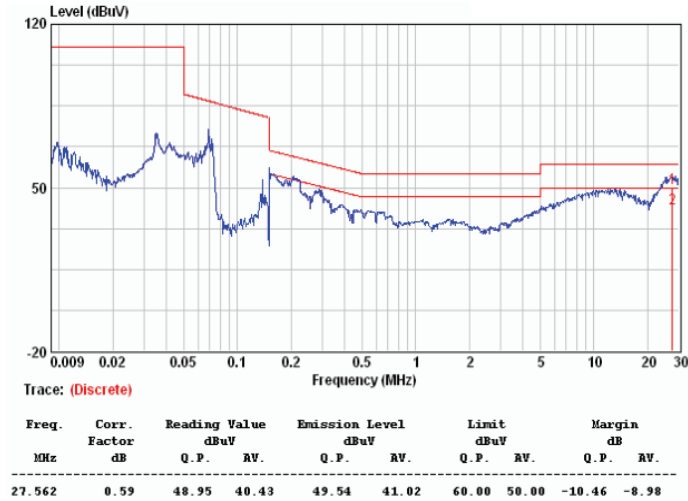
Ref. Des.	BOM			
	Quantity	Value	Package	Part Number
RT (R12)	1	304(300kΩ)	SMD 0603	
R11	1	1R(1.0Ω)	SMD 1206	
R10	1	10R (10Ω)	SMD 1206	
R13	1	10R (10Ω)	SMD 0603	
Ra	1	4.3M 1/4W	DIP	
Rb	1	2.4K 1/4W	DIP	
R14	1	1MΩ (1/4W)	AXIAL	
R15	1	1kΩ (1/4W)	AXIAL	
C11	1	10uF/50V	Radial	
C15	1	1uF/50V	Radial	Z18V/1W
C16	1	0.1uF/50V	SMD 0805	
Qa (Q1)	1	BJT FZT458		300mA/400V
Cf (C17)	1	0.1uF/400V	Radial	104K 400JS
Co (C21)	1	F105J 100MEF	Radial	1uF/100V
MOSFET	1	AOD3N60	NIKO-SEM DPAK	2A/600V
ZD1	1	18V ZENER	Radial	
C6	1	0.1uF/50V	SMD 0805	
BD1	1	BRIDGE DF04S	DF-S	1A/400V
D4	1	STTH2R06U (R6U)	SMB	2A/600V
U1	1	HT7L4091	NSOP8	HOLTEK
L-Tr	1	3.3mH/650mA	Radial	
NTC	1	STM CL-130	GE Sensing Radial	1.6A/50Ω
F1	1	FUSE 1A/250V		
VR1	1	CNR-10D471KD20	DIP	470V
LF1	1	COMMON MODE CHOKES FETC130	SHING GA, LTD	39mH
L1, L2	2	ICON CHOKES	SHING GA, LTD	500uH
CX1	1	X-CAP 0.1uF/250V	Radial	

Performance

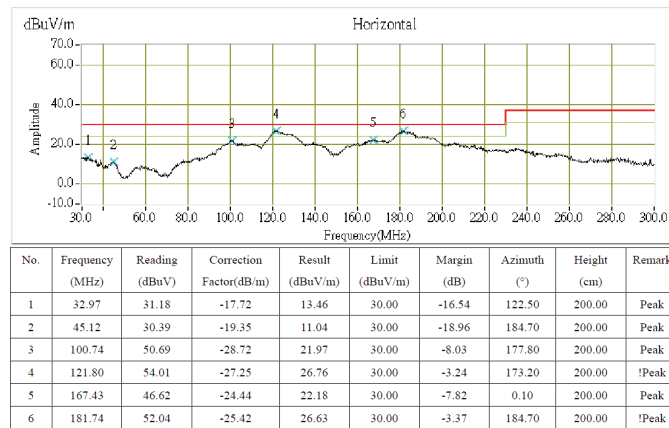
All measurements are performed at room temperature with a 16S series-10P parallel LED load at 10W power consumption.



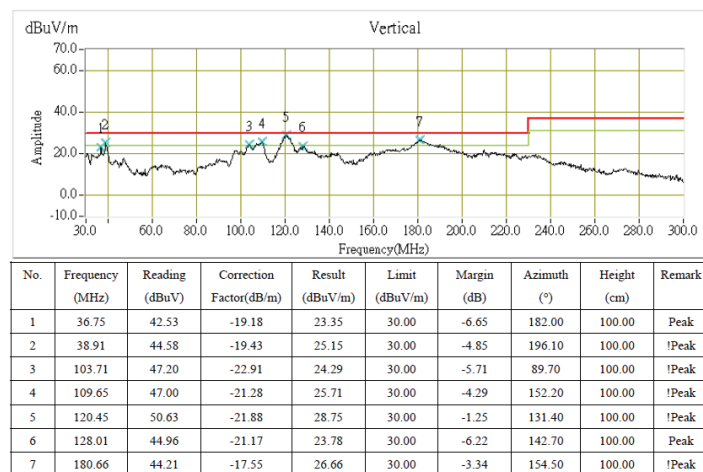
Output Voltage Ripple



Conducted, AC Input 230V



Radiated Horizontal, AC Input 230V



Radiated Vertical, AC Input 230V

Summary

This application note has provided an an electrolytic capacitor free optimised HT7L4091 application circuit to achieve a low-cost, high efficiency, high power factor and good EMI regulation within a small area.

High-performance Solution with Valley Filled PFC

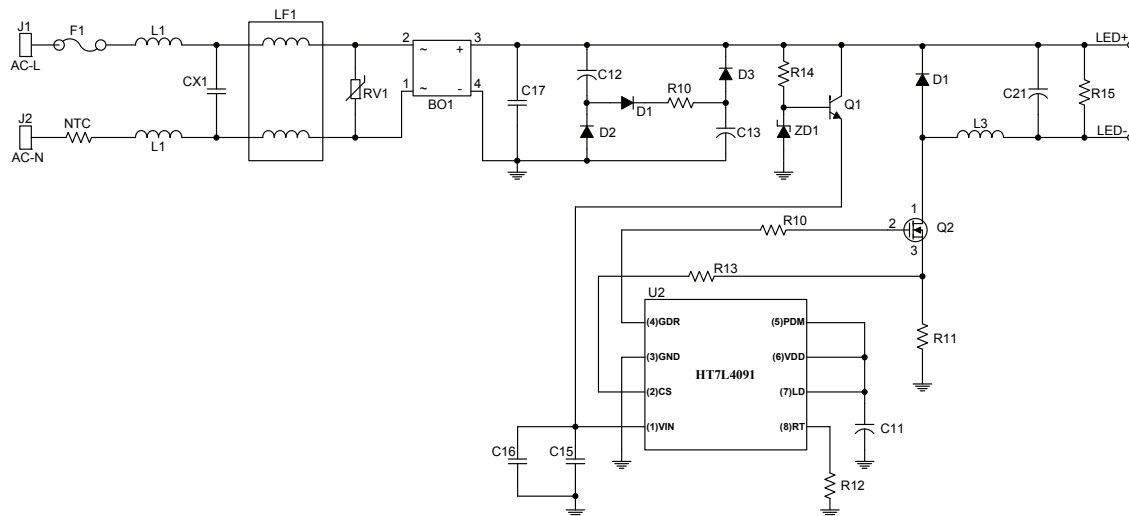
General Description

Here the HT7L4091 is used together with valley-filled PFC and an electrolytic capacitor to implement a high-performance solution, which can achieve PF values of up to 0.95 and non-120Hz harmonic disturbance. The device can achieve $\pm 5\%$ precision for a constant output current and can obtain power efficiencies of up to 84%. The Evaluation Board uses a Buck topology which includes input EMI filtering with inductors and common mode choke to provide filtering for EMI reduction. The device has a wide temperature operating range of -40°C to 105°C .

Operating Conditions

Parameter	Value
Input Voltage Range	100~240 Vac
Current precision	$\pm 5\%$
Operating Temperature	$-40\sim 105^{\circ}\text{C}$
Performance	
Output Voltage Ripple proportion @ 51.4v	10%
Average Efficiency @VAC=100~240V	84%
Average power factor value	> 0.9

Application Circuit

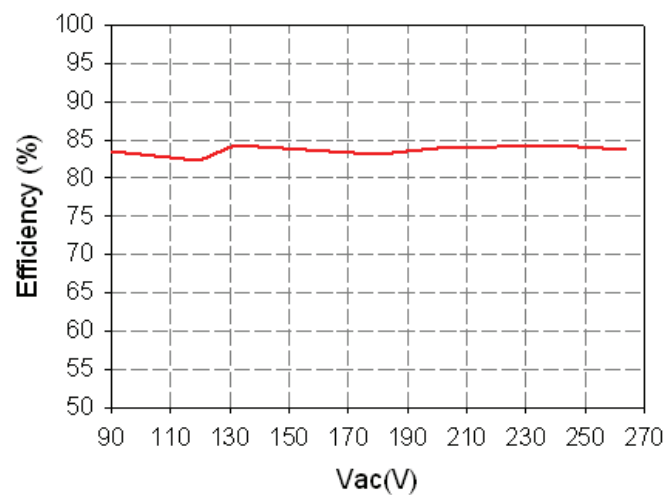


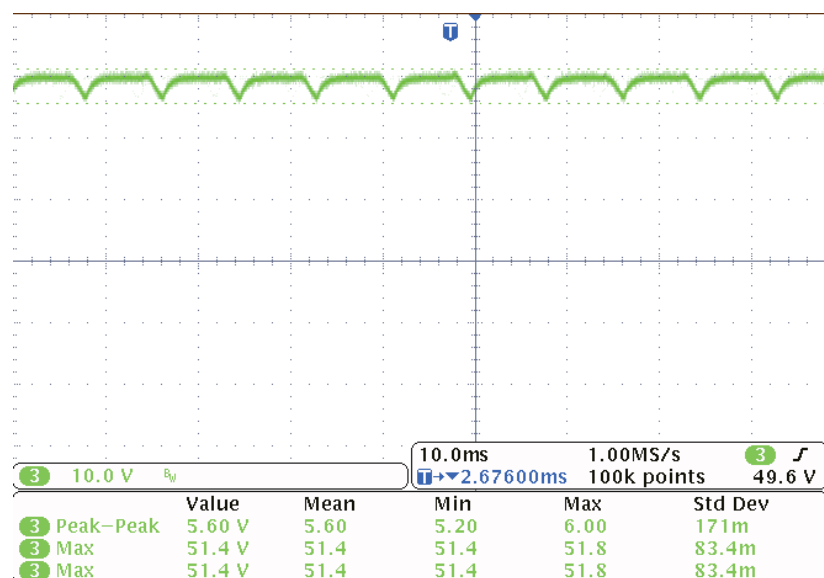
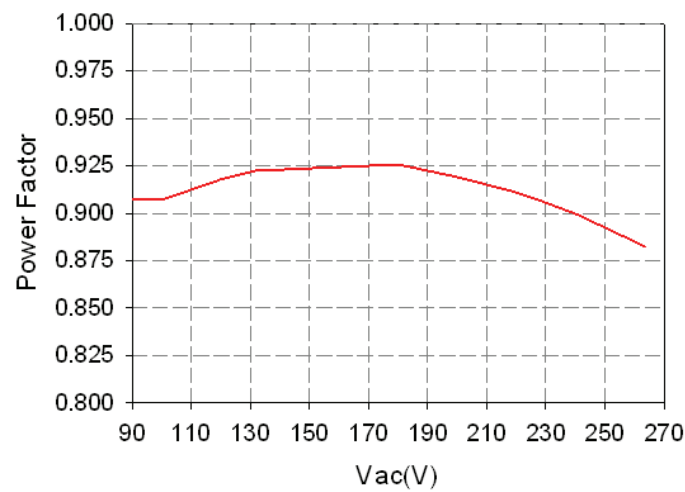
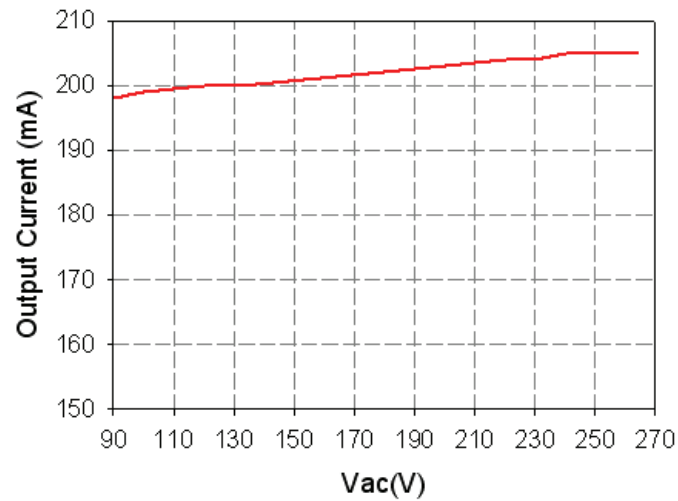
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R10	1	10R (10 Ω)	SMD 1206	
R13	1	10R (10 Ω)	SMD 0603	
C12,C13	2	22uF/250V	Radial	
D1,D2,D3	3	DIODE 1N4007	SMB	
R10	1	100 Ω 2W	DIP	
R14	1	1M Ω (1/4W)	AXIAL	
R15	1	1k Ω (1/4W)	AXIAL	
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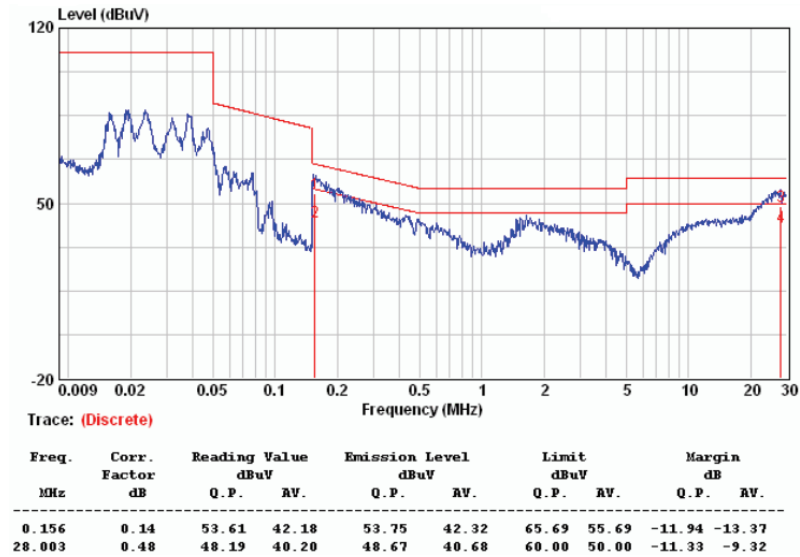
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All measurements are performed at room temperature, using a 16S series-10P parallel LED load at 10W power consumption.

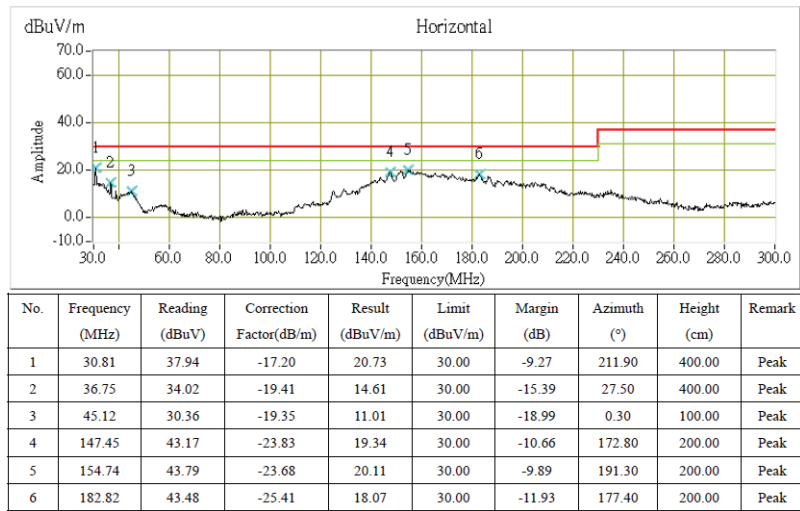




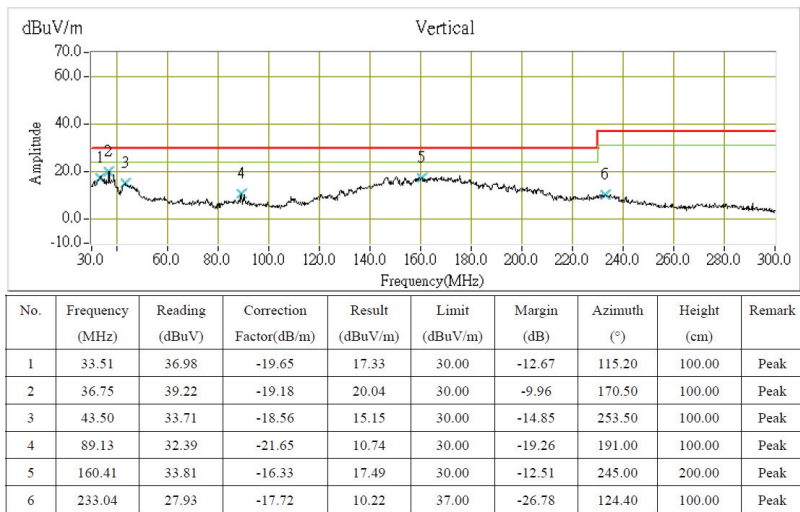
Output Voltage Ripple



Conducted, AC Input 230V



Radiated Horizontal, AC Input 230V



Radiated Vertical, AC Input 230V

Summary

This application has provided a solution using valley filled PFC. Under typical conditions, it operates at a current of 200mA and has a power consumption of around 10w. With low-cost, high efficiency, high power factor, good EMI regulation, the HT7L4091 can be used to implement high performance application solutions in a limited space.