AN48
Getting more out of the ZXLD1350 - high output current

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Introduction

The ZXLD1350 is a continuous mode inductive step-down converter, designed for driving single or multiple series connected LEDs efficiently from a voltage source higher than the LED voltage. The device operates from an input supply between 7V and 30V and provides an externally adjustable output current of up to 350mA. In order to obtain higher output current to drive LEDs with higher power, a high current externally connected output stage is required.

700mA driver for multiple 3W LEDs in series

This driver is designed to drive up to six 3W LEDs in series which could deliver total output power of 15W with an overall efficiency of around 90%.

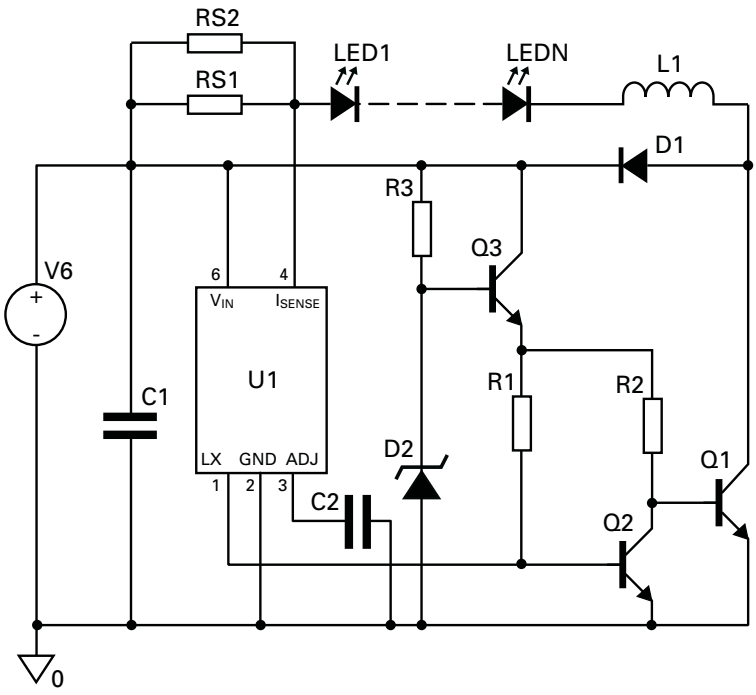


Figure 1 Schematic of 700mA driver

Part list

Table 1

Part ref.	Part no.	Remark
U1	ZXLD1350	
Q1	FCX619	
Q2	FMMT619	
Q3	FMMT619	
D1	ZLLS1000	
D	25.6V Zener diode	
L1	68μH 1A	
RS1	150mΩ	
RS2	2.2Ω	
R1	2.2KΩ	
R2	470Ω	
R3	15KΩ	
C1	3.3μF 50V	X5/7R or other low ESR cap
C2	0.1μF	Optional

Circuit description

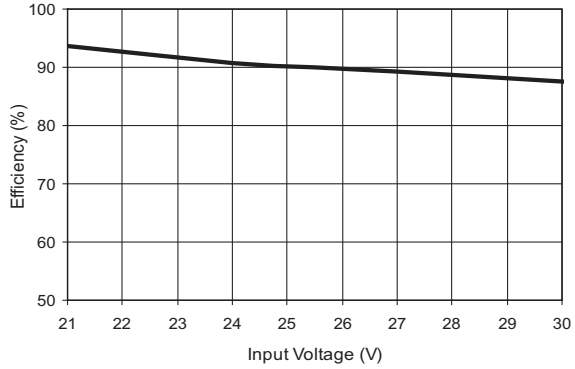
The output driver consists of two NPN transistors (Q1 and Q2). Transistor Q2 acts as a small signal inverter which inverts the original LX switch signal. The collector of Q2 is connected to the base of transistor Q1 which acts as the power output switch.

Transistor Q3 and Zener diode D2 form a simple regulator to supply a constant voltage to the driver stage. The voltage at emitter of Q3 is around 5V. This helps to provide a stable driving current to both Q1 and Q2. The driving currents are around 2mA and 9mA respectively.

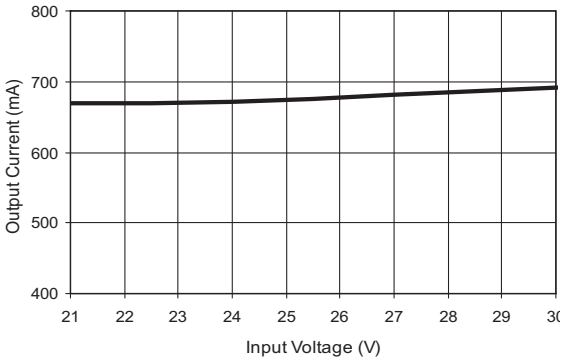
Total propagation delay is less than 200ns against the LX pin. Both the rise time and the fall time of the output switch are less than 70ns when input supply voltage is 30V.

Typical performance graphs

5 LEDs in series with total V_F = 17.9V

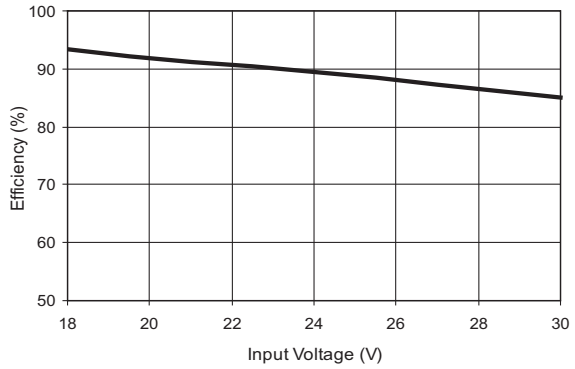


Efficiency vs Input Voltage (5 LEDs)

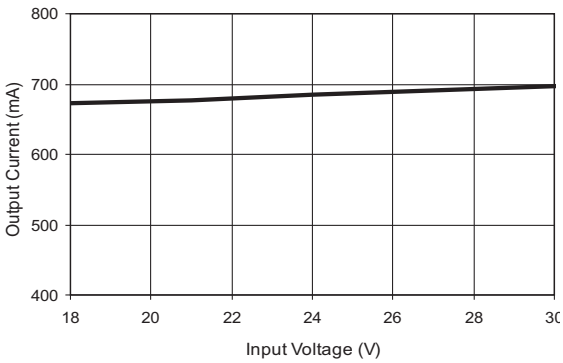


Output Current vs Input Voltage (5 LEDs)

4 LEDs in series with total V_F = 14.9V

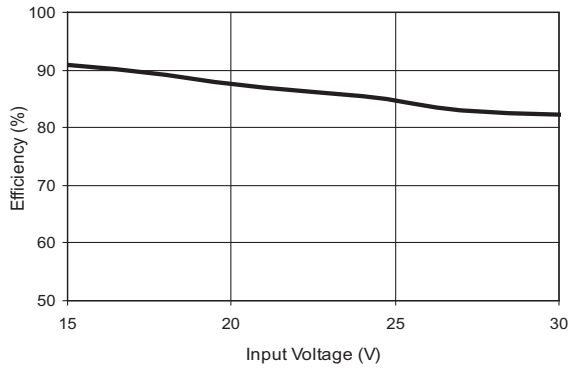


Efficiency vs Input Voltage (4 LEDs)

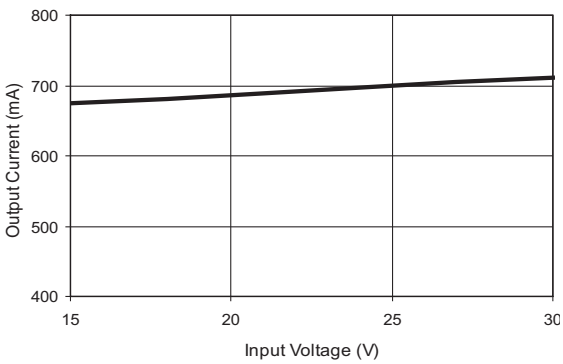


Output Current vs Input Voltage (4 LEDs)

3 LEDs in series with total V_F = 11.1V



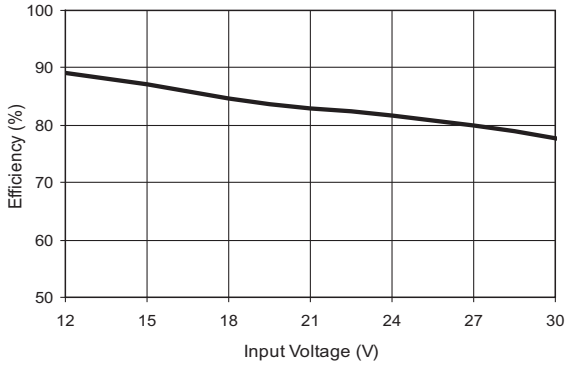
Efficiency vs Input Voltage (3 LEDs)



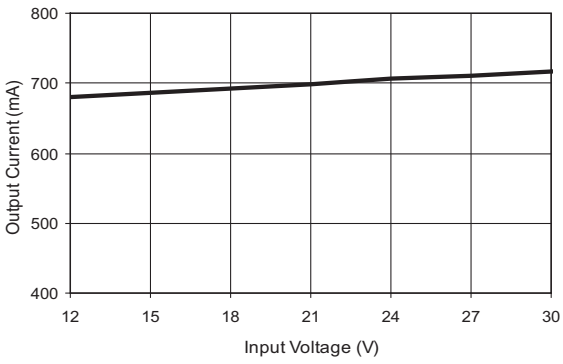
Output Current vs Input Voltage (3 LEDs)

Typical performance graphs (cont.)

2 LEDs in series with total V_F = 7.7V

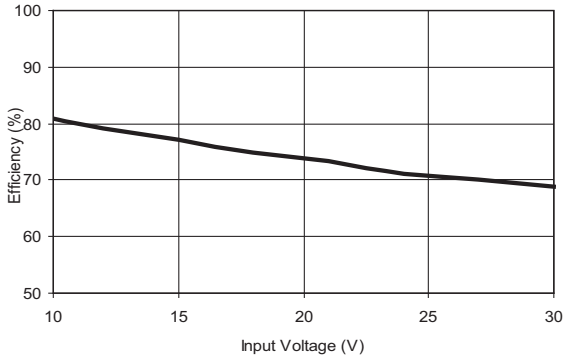


Efficiency vs Input Voltage (2 LEDs)

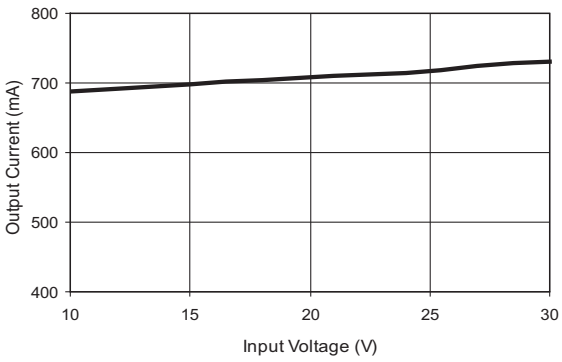


Output Current vs Input Voltage (2 LEDs)

1 LED in series with V_F = 3.8V



Efficiency vs Input Voltage (1 LED)



Output Current vs Input Voltage (1 LED)

A driver for supply voltage up to 16V

This driver is a simplified version to the 700mA driver described above. The driver is designed to drive up to 3 Luxeon® K2 LEDs in series which could deliver a total output power of 10W with a maximum input supply voltage of 16V.

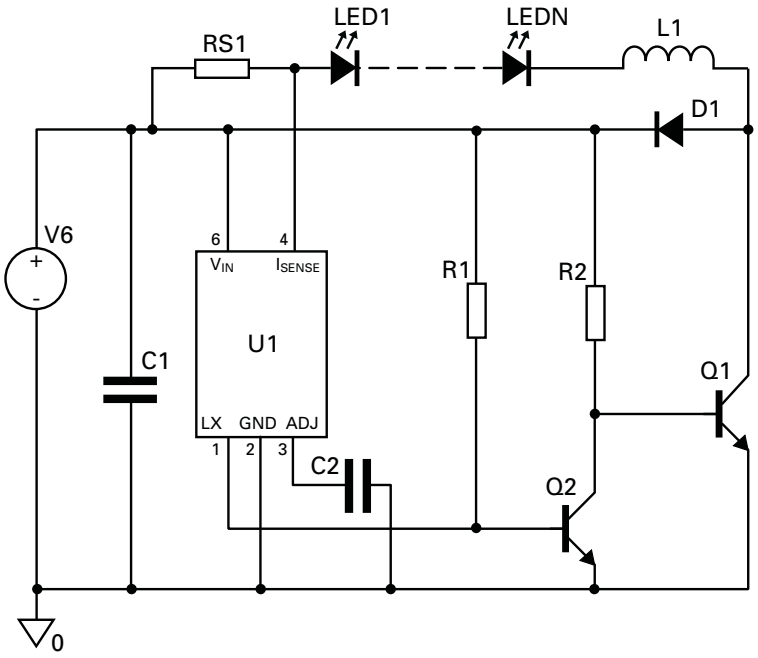


Figure 2 Schematic of 1A driver

Part List

Table 2

Part ref.	Part no.	Remark
U1	ZXLD1350	
Q1	ZXTN25020DFH	
Q2	ZXTN25020DFH	
D1	ZLLS2000	
L1	47μH 1.5A	
RS	100mΩ	
R1	4.7KΩ	
R2	1.5KΩ	
C1	4.7μF 25V	X5/7R or other low ESR cap
C2	0.1μF	Optional

Circuit description

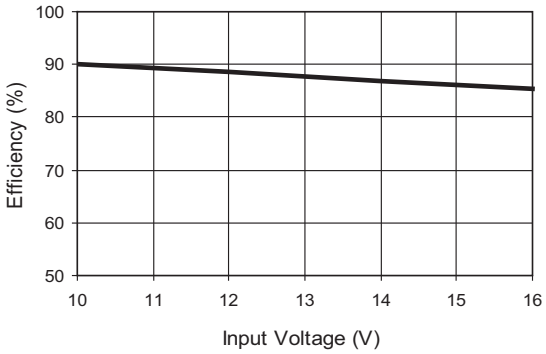
This circuit is similar to the 700mA driver described above. The output driver consists of two NPN transistors (Q1 and Q2). Transistor Q2 acts as a small signal inverter which inverts the original LX switch signal. The collector of Q2 is connected to the base of transistor Q1 which act as the power output switch.

Unlike the 700mA driver, the driving current to both Q1 and Q2 varies with the input supply voltage. Hence, the maximum input supply voltage is limited to 16V. The driving current to Q1 is between 5mA and 10mA with input supply voltage between 8V and 16V. Lowering the maximum supply voltage to 16V enables us to use a lower voltage BJT with better switching performance.

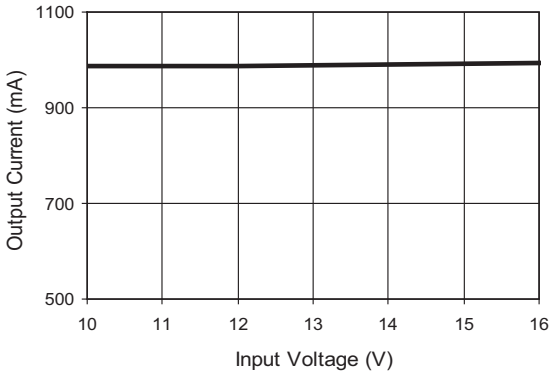
Total propagation delay is less than 200ns against the LX pin. Both the rise time and the fall time of the output switch are less than 60ns when input supply voltage is 16V.

Typical performance graphs

2 LEDs in series with total V_F = 7.1V

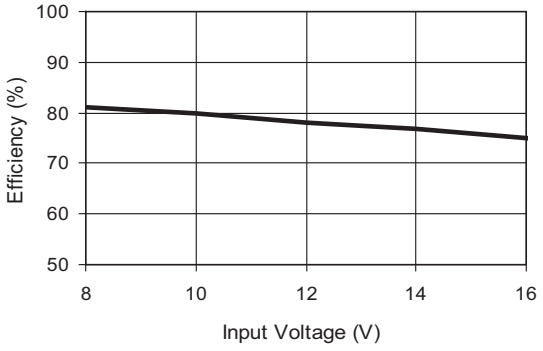


Efficiency vs Input Voltage (2 LEDs)

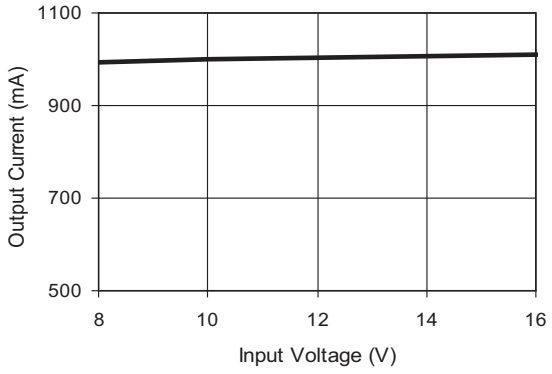


Output Current vs Input Voltage (2 LEDs)

1 LED in series with total V_F = 3.5V



Efficiency vs Input Voltage (1 LED)



Output Current vs Input Voltage (1 LED)

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