Application Note:

High Voltage Implementation of AP3156 for Backlighting LED Driver Applications

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Introduction

In recent years, there has been a trend in the market with usage of the high DC input voltage in application systems. It now becomes important to not only select a suitable device for the applications but also to accommodate the overall given set-ups in the systems to adapt to the selectable device. This application note presents a typical design scenario using the high voltage implementation to our charge-pump DC/DC converter device for Backlighting LED Driver Applications.

Key Benefit

One of the key benefits from the AP3156 is its capability of using a high input voltage implementation (V_{CC} = up to 200V_{DC}) to the output of the device in many different ways for backlighting LED driver applications. In addition to constant current dimming control and maximum current setting features, the AP3156 also allows the PWM dimming control by applying external PWM signal directly to the gate of an external MOSFET switch, which is also connected to the SDI pin of the AP3156.

Figure 1 below is a general circuit configuration in system application flexibilities:

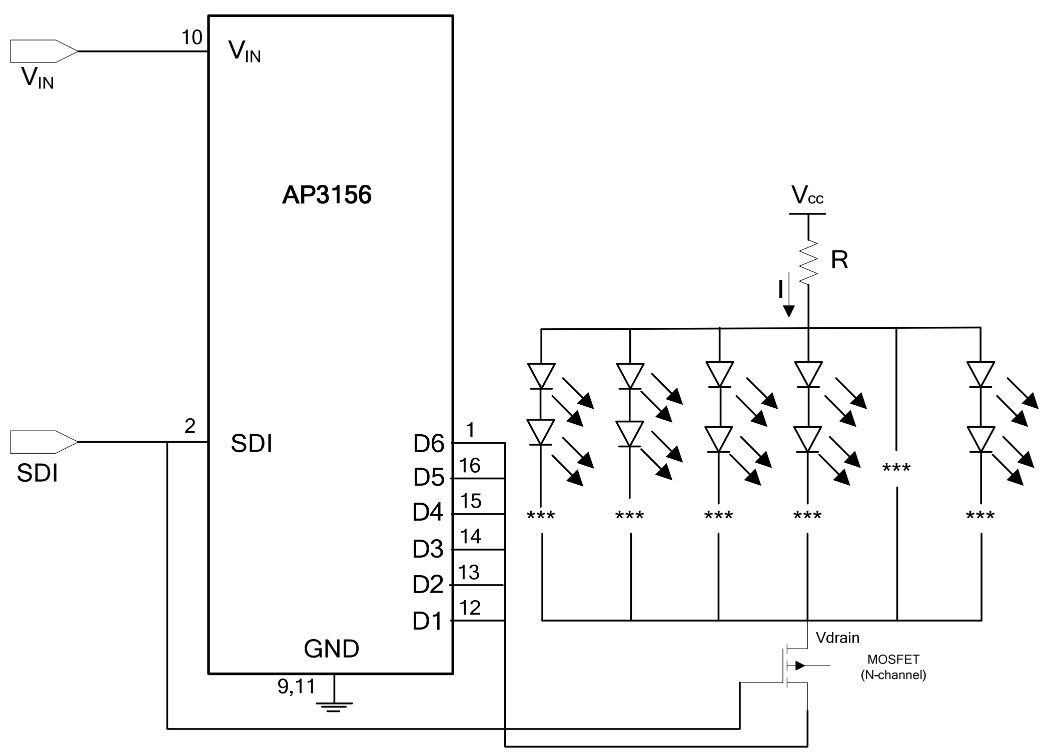

Figure 1 General circuit configuration of high voltage implementation

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Typical Example in Applications

Figure 2 below shows a typical example from which the AP3156 device can be configured to accommodate the high voltage usage.

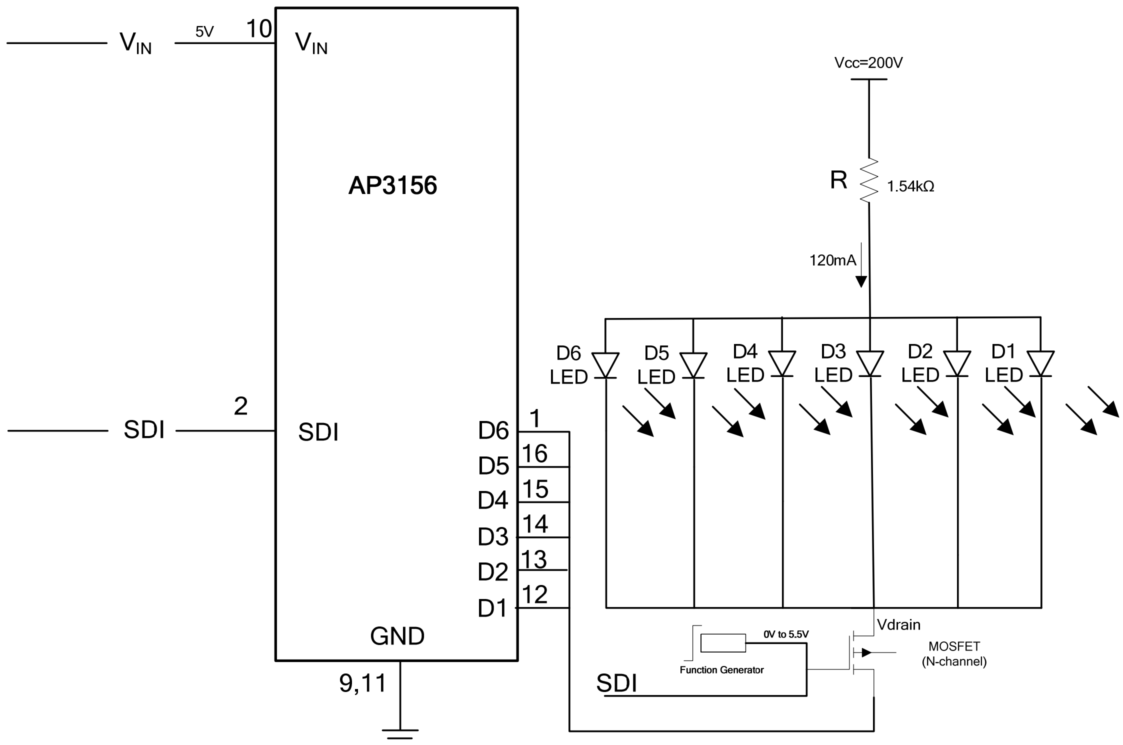

Figure 2 High voltage implementation to the output of the AP3156

When V_{IN} (AP3156) is 5V, the AP3156 device is in 1x mode providing load current of 120mA at the output. For high voltage operation, the external 200V input voltage can be applied across a 1.54kΩ resistor that is configured in series with six individual LEDs each in parallel and the N-channel MOSFET switch (ZXMN20B28K). The source terminal of the N-channel MOSFET switch is fed into six sink inputs (D1 to D6) of the AP3156. For the MOSFET switch operation, a 1Hz square signal from a Function Generator, providing 0V to 5.5V, can be applied to the SDI input of the AP3156 and the gate terminal of the switch which, in turn, is used to turn ON and OFF.

Following are actual test conditions:

V_{IN} (AP3156) = 5V

V_{CC} (external power supply) = 200V

SDI = 0 to 5.5V (1Hz Square Signal; Duty Cycle=50% from Functional Generator)

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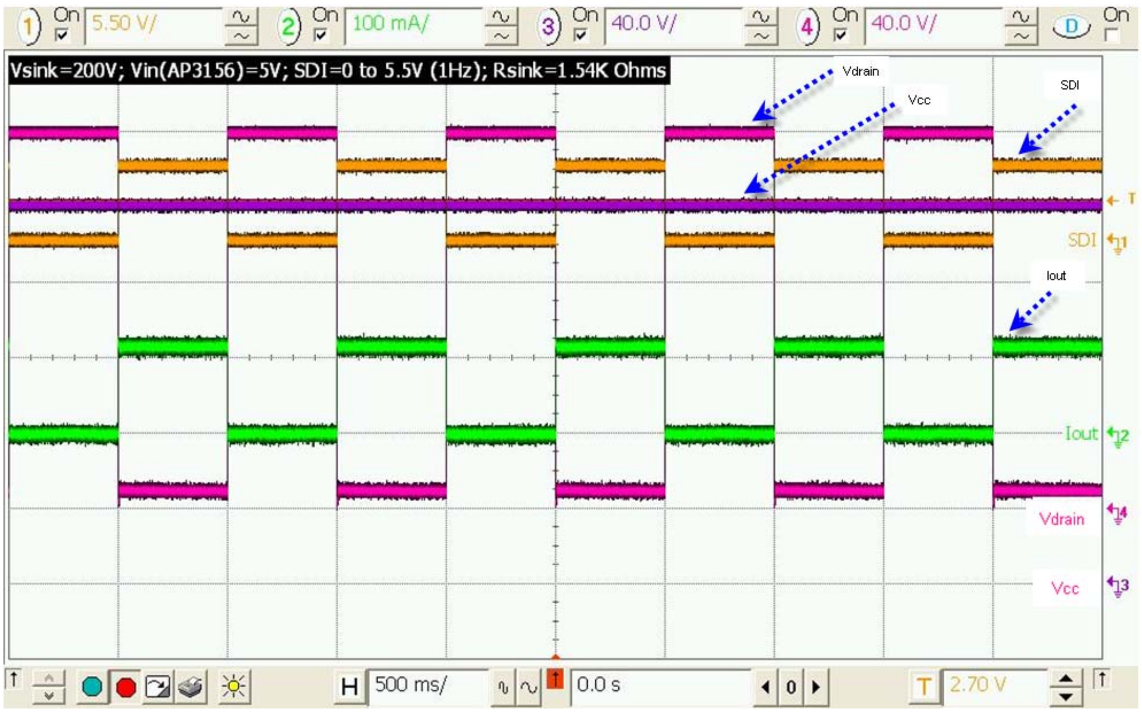
Bill of Material

Ref	Count	Mfr	Part Number	Description
D1 to D6	6	Everlight	172W1D-ANPHY35	White LEDs
MOSFET	1	Diodes Inc	ZXMN20B28K	200V N-channel Enhancement Mode MOSFET
R	1	Any	Any	1.54kΩ resistor
U1	1	Diodes Inc	AP3156	Charge Pump Device

Functional waveform for Figure 2



Waveform #1

According to waveform #1, V_{DRAIN} is monitored at the drain terminal of the MOSFET switch, which results that it is working well with the output current when the SDI signal is turning ON and OFF.

This high voltage circuit implementation is one of many other examples, which is suitable for backlighting LED driver applications.

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Conclusion

The above circuit implementations are only representative of what could be done with the AP3156 as demonstrated by practical use in the lab. They provide basic examples of testing considerations that may be needed by the designer. On the whole, the performance goals have been met. These circuits can be applied to or adapted for use in similar designs with flexibility in backlighting LED driver applications where the external high input voltage up to 200V is implemented.

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