

74AC08, Alternative LED Transmitter Driver Chip for DC-10 MBd

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Application Note 5374

Introduction

Avago Technologies manufactures fiber optic components for industrial, medical, transportation, power generation and gaming markets. Its products have been adopted in various applications for years since it started producing fiber optic components. Avago Technologies offers both discrete and integrated fiber optic components that can be easily designed with. Discrete component solutions require a transmitter drive circuit be designed, while an integrated component incorporates the driving circuit in the product. However, the advantage of using a discrete component is the flexibility in designing an optical link solution that suits a specific application.

We have recommended the transmitter driving circuit in our datasheets and application notes to help design fiber optic discrete components. Nevertheless, the challenge is to ensure supply continuity of the recommended electronic components from the manufacturers. Over the years, some electronic component manufacturers have obsoleted their parts that are recommended in our datasheet and application notes.

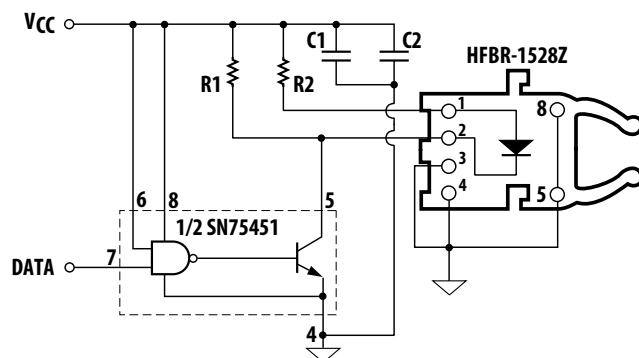


Figure 1. SN75451 as a HFBR-1528Z DC-10 MBd Driver

Objective

This application note discusses an alternative line driver, the 74AC08, besides the existing SN75451, which is recommended as an LED driver by Avago Technologies in the existing datasheets and application notes. This gives more choices for users to select their preferred component supplier.

Existing SN75451 Driver

The SN75451 has been recommended in our product datasheets and application notes as the LED transmitter driver in many parts from DC to 10 MBd optical link.

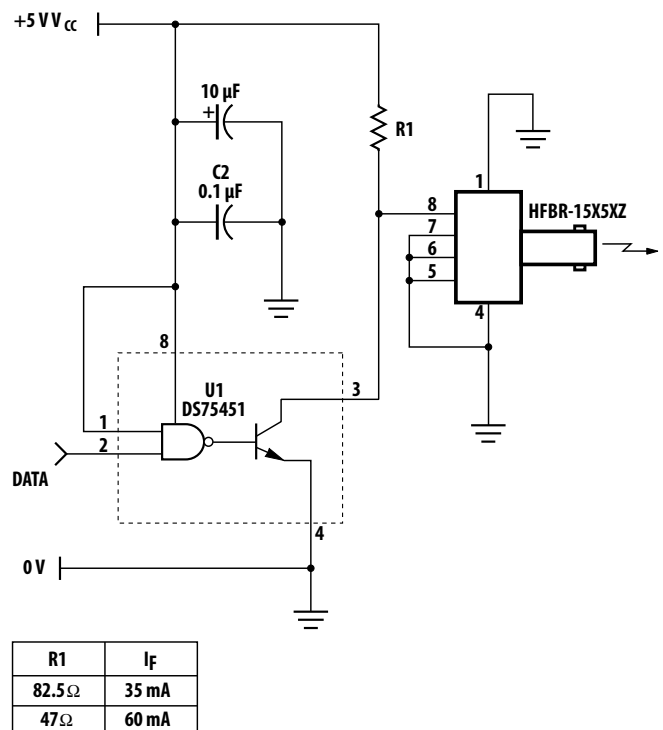


Figure 2. SN75451 as a HFBR-15X5XZ DC-10 MBd Driver

New 74AC08 Driver

The 74AC08 from Fairchild Semiconductor is recommended as the alternative driver because of its performance similarity to the existing driver, the SN75451. In this investigation, optical T_r , T_f and Pulse Width Distortion are measured.

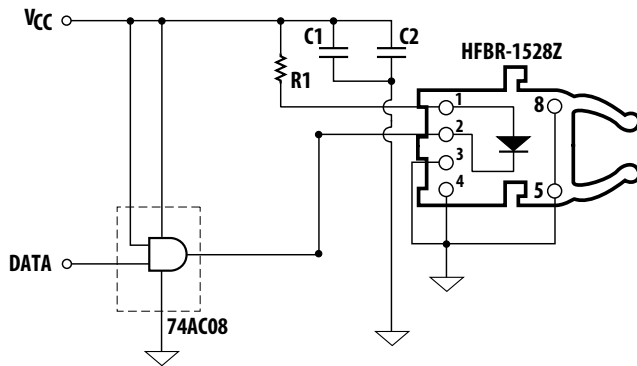


Figure 3. 74AC08 as an HFBR-1528Z DC-10 MBd Driver

Test Methodology

In order to measure the characteristics of the optical transmitter performance, an O/E converter is used to convert the optical signal to an electrical signal. The output of the O/E converter is measured using an oscilloscope. The LED driving circuit is set to supply 60 mA at 25 °C temperature.

Measurement Results

Table 1. HFBR-1528Z at a Temperature of 0 °C, 10 MBd with a 1010 Data Pattern

HFBR-1528Z	V_{cc}	PWD (ns)			Optical t_r (ns)	Optical t_f (ns)
		40%	50%	60%		
DUT 1	4.75 V	4.2	4.1	4.3	11.3	5.3
	5.00 V	4.1	4	4.2	11.3	5.2
	5.25 V	3.8	3.8	4	10.7	5.1
DUT 2	4.75 V	4	4.3	4.1	11.5	5.3
	5.00 V	4.1	4.2	3.9	11.8	5.5
	5.25 V	3.9	4.1	3.7	11.6	5.4
DUT 3	4.75 V	4.3	4.2	4.3	12	5.7
	5.00 V	4	4.2	4.1	11.2	5.3
	5.25 V	4	4	3.9	11.7	5.5
DUT 4	4.75 V	4.8	4.7	4.5	11.7	8.8
	5.00 V	4.4	4.5	4.6	11.7	8.6
	5.25 V	4	4.3	3.9	10.9	5.7

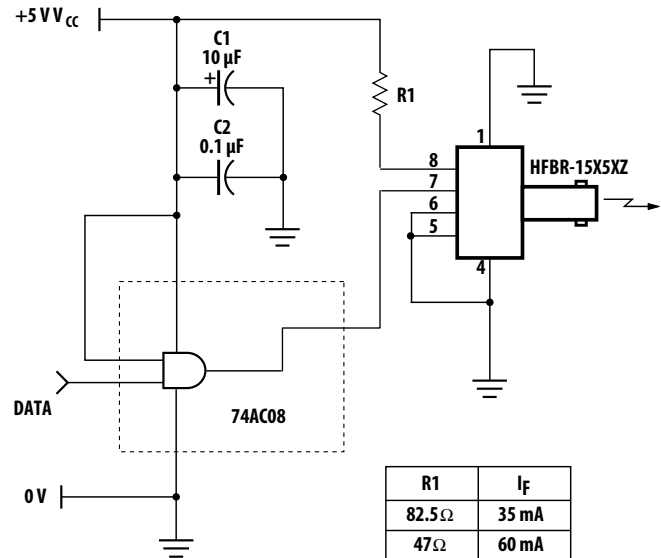


Figure 4. 74AC08 as an HFBR-15X5XZ DC-10 MBd Driver

Pulse Width Distortion (PWD)

PWD is measured by subtracting the pulse width of the 74AC08's electrical input (DATA) from the pulse width of O/E converter's output. A 40%, 50% and 60% duty cycle data pattern is applied at DATA to examine the transmitter light output performance due to duty cycle variance.

Optical Rise Time (t_r) and Fall Time (t_f)

Optical t_r and t_f are measured from 10% to 90% and 90% to 10%, respectively.

Table 2. HFBR-1528Z at a Temperature of 25 °C, 10 MBd with a 1010 Data Pattern

HFBR-1528Z	V _{cc}	PWD (ns)			Optical t _r (ns)	Optical t _f (ns)
		40%	50%	60%		
DUT 1	4.75 V	4.4	4.4	4.2	12.3	6.3
	5.00 V	4.1	4	4.1	11.3	5.7
	5.25 V	4	4.1	3.9	12.2	5.6
DUT 2	4.75 V	4.3	4.6	4.4	11.9	5.6
	5.00 V	4.2	4.4	4.2	12.4	5.6
	5.25 V	3.8	4.4	3.8	11.2	5.4
DUT 3	4.75 V	4.2	4.6	4.6	12.1	5.4
	5.00 V	4.1	4.4	4.3	11.5	5.4
	5.25 V	4.1	4.3	4.1	12	5.8
DUT 4	4.75 V	4.8	4.5	5	11.5	6.2
	5.00 V	4.6	4.6	4.6	10.9	6.1
	5.25 V	4	4.1	4.4	11.2	6.5

Table 3. HFBR-1528Z at a Temperature of 70 °C, 10 MBd with a 1010 Data Pattern

HFBR-1528Z	V _{cc}	PWD (ns)			Optical t _r (ns)	Optical t _f (ns)
		40%	50%	60%		
DUT 1	4.75 V	4.5	4.6	4.5	13.1	6
	5.00 V	4.4	4.2	4.3	13.8	5.9
	5.25 V	4	4.4	4.4	12.4	6
DUT 2	4.75 V	4.6	4.9	4.5	13.1	5.7
	5.00 V	4.4	4.8	4.4	13.6	6.1
	5.25 V	4	4.3	4.2	12	5.7
DUT 3	4.75 V	4.5	4.8	4.7	13.4	5.8
	5.00 V	4.2	4.5	4.5	12.6	5.7
	5.25 V	4.4	4.4	4.3	12.8	6
DUT 4	4.75 V	5.3	5.1	4.9	11.3	8.4
	5.00 V	4.4	5	4.8	12.8	8.4
	5.25 V	4.6	4.4	4.1	12.2	8.7

Table 4. HFBR-1505AZ at a Temperature of 0 °C, 10MBd with a 1010 Data Pattern

HFBR_1505AZ	V _{cc}	PWD (ns)			Optical t _r (ns)	Optical t _f (ns)
		40%	50%	60%		
DUT 1	4.75 V	-4	-4.1	-3.9	11.9	8.4
	5.00 V	-3.8	-4.1	-4	12	8.3
	5.25 V	-3.7	-3.9	-3.8	11.6	8.7
DUT 2	4.75 V	-3.8	-4	-3.8	11.8	9.4
	5.00 V	-4	-4	-3.7	11.6	10
	5.25 V	-3.5	-3.7	-3.8	11.7	10.2
DUT 3	4.75 V	-4.1	-4.3	-4.1	12.1	8.3
	5.00 V	-4	-4.3	-4	11.7	8.8
	5.25 V	-3.8	-4	-3.9	11.5	8.3

Table 5. HFBR-1505AZ at a Temperature of 25 °C, 10 MBd with a 1010 Data Pattern

HFBR_1505AZ	V _{cc}	PWD (ns)			Optical t _r (ns)	Optical t _f (ns)
		40%	50%	60%		
DUT 1	4.75 V	-4.8	-4.7	-5	12.9	8.2
	5.00 V	-4.7	-4.5	-4.2	13.2	8.6
	5.25 V	-4.3	-4.6	-4.7	12.3	8.4
DUT 2	4.75 V	-4.9	-4.7	-4.7	13.4	9.7
	5.00 V	-4.6	-4.7	-4.9	13.2	9
	5.25 V	-4.5	-4.6	-4.3	13.5	8.7
DUT 3	4.75 V	-4.7	-4.8	-4.7	12.9	8.2
	5.00 V	-4.5	-4.9	-4.6	13.7	9
	5.25 V	-4.3	-4.6	-4.4	12.4	8.4

Table 6. HFBR-1505AZ at a Temperature of 70 °C, 10 MBd with a 1010 Data Pattern

HFBR_1505AZ	V _{cc}	PWD (ns)			Optical t _r (ns)	Optical t _f (ns)
		40%	50%	60%		
DUT 1	4.75 V	-5.8	-5.5	-5.6	15.7	8.6
	5.00 V	-5.5	-5.5	-5	15.4	8.6
	5.25 V	-5.1	-5	-4.9	14.7	8.3
DUT 2	4.75 V	-5.8	-5.4	-5.7	15.8	9.4
	5.00 V	-5.6	-5.4	-5.5	15.2	9
	5.25 V	-5.2	-5.2	-5.3	14.2	10
DUT 3	4.75 V	-5.3	-5.2	-5.5	14.8	8.4
	5.00 V	-5	-5.5	-5.2	15	9.1
	5.25 V	-4.8	-5.4	-5	15.5	8.7

Summary

The SN75451 is recommended as the driver for our LED transmitters for DC to 10 MBd data rates. An alternative driver is the 74AC08. It has similar performance to the SN75451. To ensure the performance of the 74AC08, PWD, optical tr and tf were measured.

Optical tr and tf for the HFBR-1528Z with a 74AC08 are within the HFBR-1528Z datasheet limits, which is based on the SN75451 driver. On the other hand, optical tr for

the HFBR-1505AZ with the 74AC08 is slower as compared to the SN75451 driver. Nevertheless, the optical tr for the HFBR-1505AZ and 74AC08 combination is still good enough to run at 10 MBd. In addition, both the HFBR-1528Z and the HFBR-1505AZ with the 74AC08 driver show small PWD results.

Therefore, we conclude that the 74AC08 driver can be used with our LED transmitter for DC to 10 MBd applications.

For product information and a complete list of distributors, please go to our web site: www.avagotech.com

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