

### FEATURES

**Data Rates from 9.952 Gbps to 10.709 Gbps**  
**Typical Rise/Fall Time 25 ps/23 ps**  
**Bias Current Range 3 mA to 80 mA**  
**Modulation Current Range 5 mA to 80 mA**  
**Automatic Laser Shutdown, ALS**  
**CML Data Inputs**  
**50 Ω Internal Data Terminations**  
**3.3 V Single-Supply Operation**  
**Driver Supplied in Die Format Only**

### APPLICATIONS

**SONET OC-192, SDH STM-64**  
**Supports 10.667 Gbps and 10.709 Gbps FEC Rates**  
**10 Gb Ethernet IEEE802.3ae**

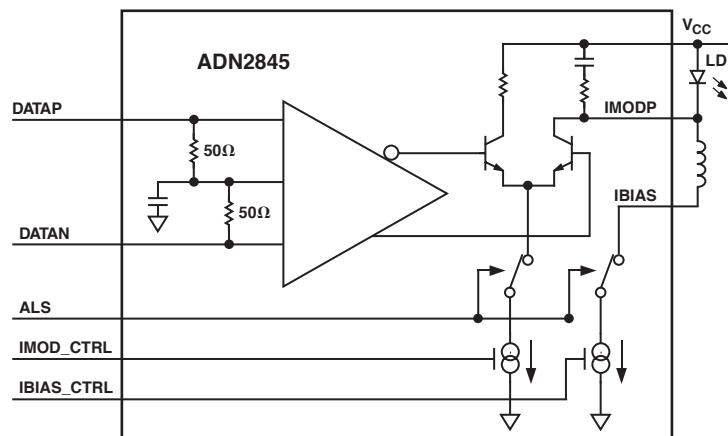
### GENERAL DESCRIPTION

The ADN2845 is a 10.709 Gbps laser diode driver. The ADN2845 eliminates the need to ac-couple since it can deliver 80 mA of modulation while dc-coupled to the laser diode. It is intended to be copackaged with the laser to minimize bond lengths, which improves performance of the optical transmitter.

The ADN2845 may be used in conjunction with the ADN2844 control chip. This chipset (ADN2843) offers a unique control algorithm to control both average power and extinction ratio of the laser diode.

For transmission line applications, contact the HSN Applications Group at [fiberoptic.ic@analog.com](mailto:fiberoptic.ic@analog.com)

### FUNCTIONAL BLOCK DIAGRAM



REV. 0

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# ADN2845-SPECIFICATIONS

## ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 3.0 V to 3.6 V. All specifications T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values as specified at 25°C.)

Parameter	Min	Typ	Max	Unit	Conditions
LASER BIAS (BIAS)					
Output Current I <sub>BIAS</sub>	3		80	mA	See Note 1
Compliance Voltage	1.2		V <sub>CC</sub> - 1.0	V	
I <sub>BIAS</sub> during ALS			10	μA	
ALS Shutdown Response Time			10	μs	
MODULATION CURRENT (LMODP, IMODN)					See Note 2
Output Current I <sub>MOD</sub>	5		80	mA	See Note 3 See Note 4
Compliance Voltage	1.2		V <sub>CC</sub>	V	
I <sub>MOD</sub> during ALS			10	μA	
Rise Time		25		ps	
Fall Time		23		ps	
Random Jitter		170		fs rms	
Total Jitter		7.41		ps p-p	
DATA INPUTS (DATAP, DATAN)					
V p-p(Single-Ended Peak-to-Peak)	300		800	mV	
Input Impedance		50		Ω	
LOGIC INPUTS (ALS)					
V <sub>IH</sub>	2.4			V	
V <sub>IL</sub>			0.8	V	
IMOD_CTRL Input					See Note 5
Gain (IMOD_CTRL to I <sub>MOD</sub> )	10		15.5	A/A	
Input Voltage	1.5			V	
IBIAS_CTRL Input					See Note 5
Gain (IBIAS_CTRL to I <sub>BIAS</sub> )	9		12	A/A	
Input Voltage	1.5			V	
SUPPLY					
V <sub>CC</sub>	3.0	3.3	3.6	V	See Note 6
I <sub>CC</sub>		75		mA	

### NOTES

<sup>1</sup>In ALS mode, approximately 15 mA is sourced to the laser from the IBIAS pin, which reverse biases the laser.

<sup>2</sup>The ADN2845 high speed specifications are measured into a 5 Ω load.

<sup>3</sup>RMS jitter measured with a 0000 0000 1111 1111 repeating pattern at 10.7 Gbps rate.

<sup>4</sup>Peak-to-peak total jitter measured with a 2<sup>13</sup> - 1 PRBS pattern with 80 CIDs input pattern at 10.7 Gbps rate.

<sup>5</sup>It is recommended to decouple these pins to V<sub>CC</sub> rather than GND.

<sup>6</sup>IBIAS = 0, IMOD = 0 (when ALS is asserted). See Power Dissipation section on page 4 for calculation of complete power dissipation.

Specifications subject to change without notice.

### ABSOLUTE MAXIMUM RATINGS\*

(T<sub>A</sub> = 25°C, unless otherwise noted.)

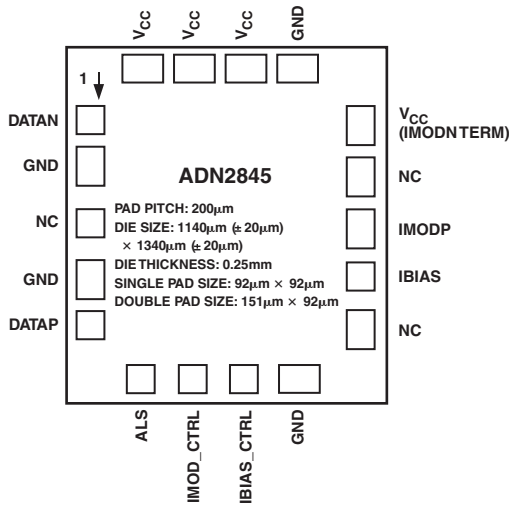
V <sub>CC</sub> to GND	5 V
DATAP to GND	-0.5 V to 4.2 V
DATAN to GND	-0.5 V to 4.2 V
ALS to GND	-0.5 V to 4.2 V
IMOD_CONTROL to GND	-0.5 V to 4.2 V
IBIAS_CONTROL to GND	-0.5 V to 4.2 V
IMODN, IMODP	V <sub>CC</sub> +1.2 V
Operating Temperature Range	
Industrial	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature (T <sub>J</sub> max)	150°C

\*Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### ORDERING GUIDE

Model	Temperature Range	Package Description	Qty. Min.
ADN2845ACHIPS	-40°C to +85°C	Die Form	100

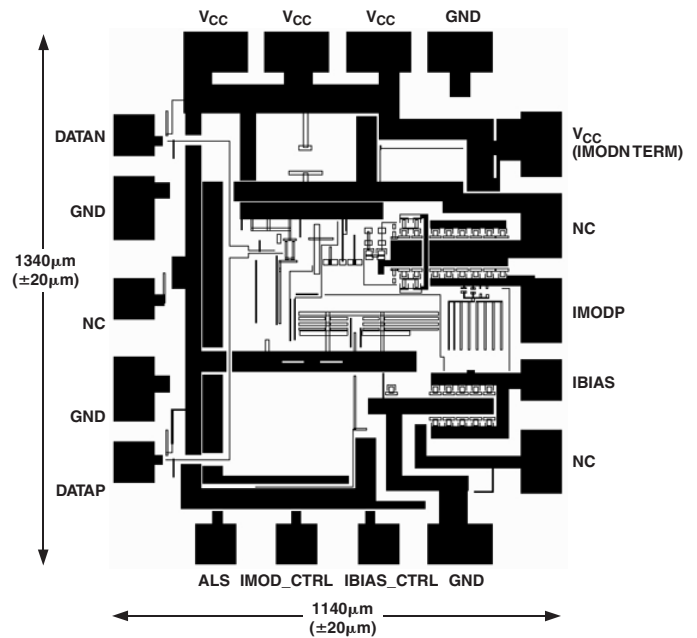
## PIN CONFIGURATION



## PIN FUNCTION DESCRIPTIONS

Pin No.	Mnemonic	Function
1	DATAN	AC-Coupled CML Data, Negative Differential Terminal
2	GND	Negative Supply
3	NC	No Connect. Leave floating.
4	GND	Negative Supply
5	DATAP	AC-Coupled CML Data, Positive Differential Terminal
6	ALS	Automatic Laser Shutdown Logic Input
7	IMOD_CTRL	Modulation Current Control Input (Control circuit sinks IMOD/10 from pin to GND.)
8	IBIAS_CTRL	BIAS Current Control Input (Control circuit sinks IBIAS/10 from pin to GND.)
9	GND	Negative Supply
10	NC	No Connect. Leave floating.
11	IBIAS	BIAS Current
12	IMODP	Modulation Current
13	NC	No Connect. Leave floating.
14	V <sub>CC</sub>	V <sub>CC</sub> Connection for IMODN Termination Resistor
15	GND	Negative Supply
16	V <sub>CC</sub>	Positive Supply
17	V <sub>CC</sub>	Positive Supply
18	V <sub>CC</sub>	Positive Supply

## METALLIZATION PHOTOGRAPH



## DIE PAD COORDINATES<sup>1</sup>

Pad No.	Pad Name	X ( $\mu$ m)	Y ( $\mu$ m)
1	DATAN	-500.00	400.00
2	GND <sup>2</sup>	-500.00	222.00
3	NC	-500.00	0.00
4	GND <sup>2</sup>	-500.00	-222.00
5	DATAP	-500.00	-400.00
6	ALS	-300.00	-600.00
7	IMOD_CTRL	-100.00	-600.00
8	IBIAS_CTRL	100.00	-600.00
9	GND <sup>2</sup>	300.00	-600.00
10	NC <sup>2</sup>	500.00	-400.00
11	IBIAS	500.00	-200.00
12	IMODP <sup>2</sup>	500.00	-30.00
13	NC <sup>2</sup>	500.00	178.00
14	V <sub>CC</sub> (IMODN TERM) <sup>2</sup>	500.00	378.00
15	GND <sup>2</sup>	300.00	600.00
16	V <sub>CC</sub> <sup>2</sup>	100.00	600.00
17	V <sub>CC</sub> <sup>2</sup>	-100.00	600.00
18	V <sub>CC</sub> <sup>2</sup>	-300.00	600.00

### NOTES

<sup>1</sup>The reference point with x = 0, y = 0 is the center of the die.

<sup>2</sup>Denotes double bond pad.

### CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the ADN2845 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



# ADN2845

## GENERAL

The ADN2845 is a 3.3 V high speed data switch that is intended to be dc-coupled with a copackaged laser diode. Achieving best performance requires using low inductance ribbon connections between the ADN2845 and the laser.

## IMOD\_CTRL, IBIAS\_CTRL

The operation of the ADN2845 is controlled by the two input pins called IBIAS\_CTRL and IMOD\_CTRL. The user should connect current sinks from each of these pins to GND.

These currents are internally mirrored and used to control the actual values for the bias and modulation currents used to drive the laser diode. It is recommended to decouple these pins to V<sub>CC</sub> instead of GND.

## DATA INPUTS

Figure 1 shows a simplified schematic of the ADN2845 data inputs. The data inputs are terminated via the equivalent of a 100 Ω internal resistor between DATAN and DATAP. This provides 50 Ω termination for single-ended signals. The actual signal on the switching devices is attenuated by a factor of 2

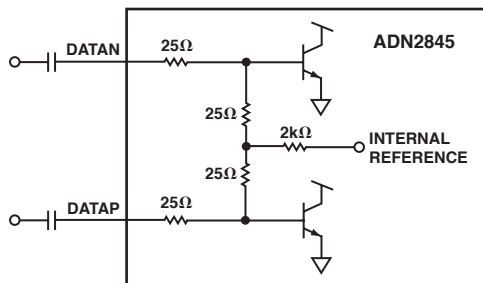


Figure 1. Simplified Schematic of the Data Inputs

internally. There is a high impedance circuit to set the common-mode voltage, which is designed to change over temperature. It is recommended that ac coupling be used to eliminate the need for matching between the common-mode voltages.

## LASER SHUTDOWN

The ADN2845 ALS allows compliance to ITU-T-G958 (11/94), section 9.7. When ALS is asserted, both bias and modulation currents are turned off. In ALS mode, approximately 15 mA is sourced to the laser from the IBIAS pin, which reverse biases the laser and ensures that it is turned off. ALS should have a 10 kΩ pull-down resistor connected and should be driven with correct logic levels (see Specifications section). The ALS pin should never be left floating.

## POWER DISSIPATION

The power dissipation of the ADN2845 can be calculated using the following expressions:

$$I_{CC} = 75 \text{ mA} + 1.75 \times I_{MOD} (\text{mA}) + 0.3 \times I_{BIAS} (\text{mA})$$

$$P = V_{CC} \times I_{CC} (\text{A}) + V_{IMOD} \times \frac{I_{MOD} (\text{A})}{2} + V_{IBIAS} \times I_{BIAS} (\text{A})$$

where  $V_{IMOD}$  is the average voltage on the IMOD pin, and  $V_{IBIAS}$  is the average voltage on the IBIAS pin.

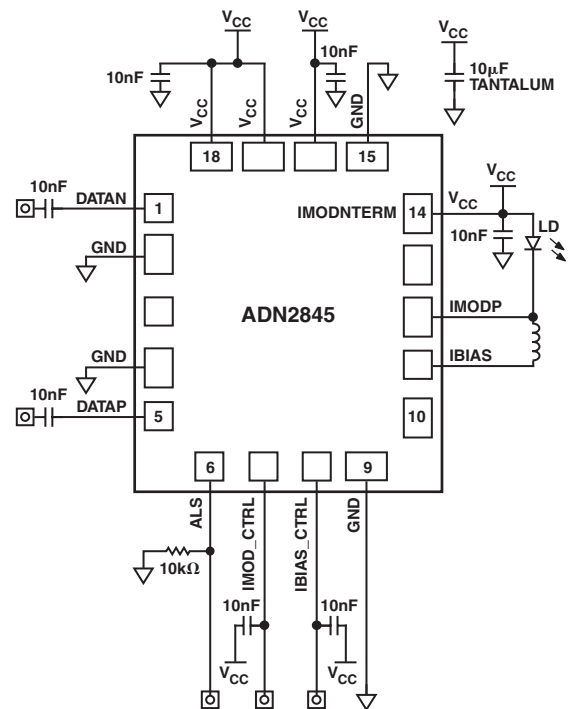
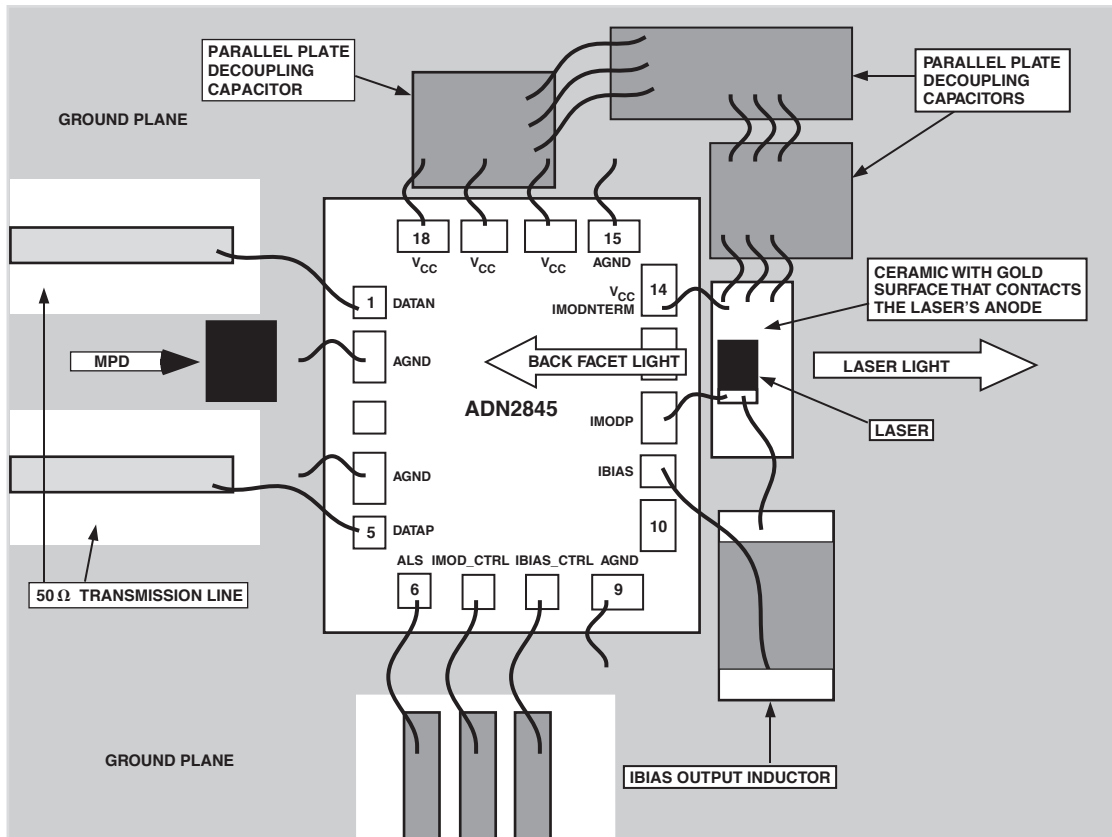


Figure 2. ADN2845 Application Circuit



- NOTES
- FOR OPTIMUM PERFORMANCE, RIBBON BONDS ARE RECOMMENDED ON PADS 1, 5, 12, AND 14. WIRES ARE 3 MIL OR 5 MIL RIBBONS <400 $\mu$ m LONG. ALL OTHER PINS CAN BE ROUND WIRE <1mm.
  - LASER'S ANODE IS CONNECTED TO V<sub>CC</sub> THROUGH GOLD LAYER ON TOP OF CERAMIC STANDOFF. STANDOFF MINIMIZES LENGTH OF PAD 12 AND PAD 14 RIBBONS.
  - PARALLEL PLATE DECOUPLING CAPACITORS SHOULD BE >100pF AND BE OF MICROWAVE AVX TYPE, PART NO. GB0159391KA6N (390pF).
  - THE RECOMMENDED SUBSTRATE CONNECTION IS TO GND. HOWEVER, PERFORMANCE IS NOT AFFECTED BY CONNECTING THE SUBSTRATE TO V<sub>CC</sub>.
  - AN INDUCTOR SHOULD BE USED IN THE BIAS CURRENT PATH. A MICROWAVE COMPONENTS COIL 30-1847-GCCAS-01 (48 MIL x 24 MIL) SHOULD BE USED.
  - THE EXTERNAL POWER SUPPLY IS CONNECTED AT THE PARALLEL PLATE DECOUPLING CAPACITOR.

Figure 3. Recommended Layout

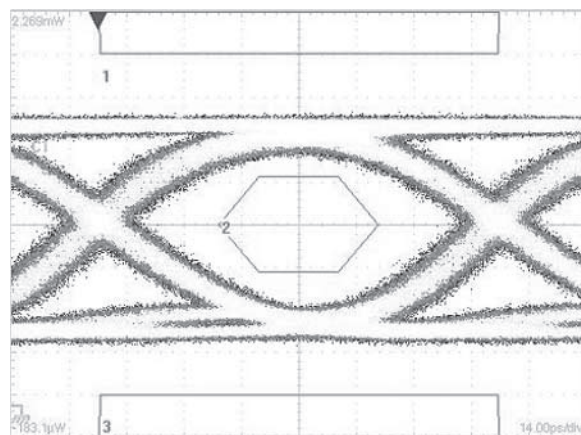


Figure 4. 10 Gbps Optical Diagram Provided Courtesy of NEL.  
 $P_{AV} = 0$  dBm, ER = 5 dB, PRBS 31 Pattern.

# ADN2845

## OUTLINE DIMENSIONS

### 18-Pad Bare Die

Dimensions shown in micrometers and millimeters

