YA07

Laser Diode Driver with Mean Power Control

Data Sheet

Features

Mean power control

Highly integrated; Minimal external components needed

Bias current range:
5 mA to 100 mA

Modulation current range:
5 mA to 80 mA

Fully differential data input, PECL and CML compatible

On chip bias current limiting

Single 5 V power supply operation

Operating temperature range:
-40 °C to 85 °C

Industry standard 7 mm TQFP package

Applications

SONET/SDH-based transmission systems, test equipment and modules

OC–3 / OC–12 fiber optic modules and line termination

WDM for 622 Mb/s SONET applications

ATM over SONET/SDH

Section repeaters, muxes, terminators, broadband cross-connects

The Nortel Networks YA07 Laser Driver IC is a highly integrated, low cost laser diode driver with mean power control designed to run at data rates of up to 622 Mb/s. The YA07 has PECL/CML compatible differential inputs and requires a single + 5 V power supply.

The YA07 consists of a data input buffer, modulation switch and mean power control loop. It also features bias current limiting, laser shutdown and a means of externally monitoring the bias current.

An on-chip voltage reference ensures stable output currents over temperature and power supply ranges.

The YA07 is part of our family of 155 / 622 Mb/s components, which provides for power and chip-count savings that translate into better utilization of board real-estate and ultimately cost savings to the designer of fiber-based datacom or telecom solutions.

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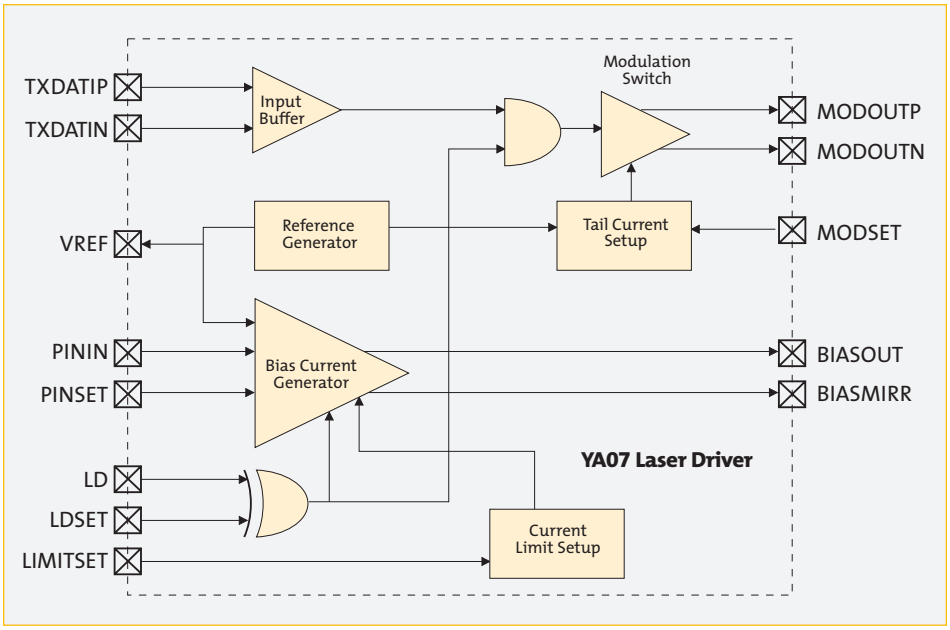

Figure 1: Functional Block Diagram

Functional description

Modulation Driver Circuit

The modulation input buffer accepts differential CML or PECL input voltages of nominal 400 mV amplitude from the data input pins, TXDATIP and TXDATIN. External termination resistors may be used, connected to the power supply for CML signals and the ECL bias voltage for PECL.

The modulation switch consists of a differential common emitter stage with outputs on the MODOUTP and MODOUTN pins and the tail current controlled by an external resistor connected between the MODSET pin and ground. The tail current is switched either to MODOUTP or MODOUTN depending on the state of the data at the TXDATIP/N inputs.

The laser diode cathode is connected to MODOUTN, with the anode connected to the power supply. A logic gate at the input to the switch allows current to be directed just to the MODOUTP pin, irrespective of the data input state, for laser shutdown.

The modulation current can be preset to any value between 5 mA and 80 mA by connecting an external resistor between the MODSET pin and ground.

Mean Power Control Circuit

The device incorporates a mean power control loop that senses the output from a back facet monitor diode to control the laser bias current. The control loop maintains a constant, temperature independent current in the monitor diode which is connected between PININ and the power supply. This current can be programmed with an external resistor connected to the PINSET pin. The bias current can be set to any value between 5 mA (start of life) and 100 mA (end of life).

A dominant pole is required in the open loop response of the controller in order to guarantee stability. This must be supplied by an external capacitor, connected across the monitor diode. Soft start for the bias current is provided by slowing the rise time of the reference voltage generator at switch on. A capacitor connected from the VREF pin to ground provides this function.

Bias Current Limiter

The bias current limiter circuit prevents the laser bias current from exceeding an externally programmable threshold. This threshold current can be preset to any value between 20 mA to 100 mA by connecting a resistor between the LIMITSET pin and ground.

Bias Mirror Output

The BIASMIRR pin provides an external means of monitoring the bias current. The device sinks a current into this pin that is proportional to the bias current. The ratio between bias current and BIASMIRR current is set internally to 11.

Laser Shutdown Input

The LD pin is a CMOS compatible laser shutdown input. The polarity of this input is set by the state of the LDSET pin. A logic '1' on LDESET configures the LD pin so that a logic '1' shuts down the laser.

Absolute Maximum Ratings

These are stress ratings only. Exposure to stresses beyond these maximum ratings may cause permanent damage to, or affect the reliability of, the device. Avoid operating the device outside the recommended operating conditions defined below.

Symbol	Parameter	Min	Max	Unit
VCC	Supply voltage – any VCC pin	-0.7	6.0	V
V_I	Single ended input voltage – CML/PECL & CMOS inputs	-0.7	6.0	V
$V_I$diff	Peak differential voltage – CML/PECL inputs	-1.3	1.3	V
$V_I$setm	MODSET/LIMITSET pins - maximum applied voltage	-0.7	2.2	V
$V_I$setb	PINSET/PININ pins - maximum applied voltage	-0.7	VCC + 0.7	V
Iomodout	Output current – MODOUTP/N outputs	-2	120	mA
$I_O$biasout	Output current - BIASOUT output	-2	130	mA
$I_I$setm	MODSET/LIMITSET - maximum source/sink current	-5	5	mA
$I_I$setb	PINSET PININ pins - maximum source/sink current	-7	7	mA
$I_O$vref	VREF output current	-15	15	mA
Tstg	Storage temperature	-65	135	°C

Note: by convention, positive current values flow into pins, negative values flow out.

Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VCC	Supply voltage – any V_{CC} pin	4.7	5.0	5.3	V
$V_I$cml	CML/PECL input voltage – single ended wrt GND	VCC-2.5		VCC +0.2	V
V_{ID}cml	CML/PECL input voltage – differential	0.4		1.0	V
V_{IH}cmos	CMOS compatible input $_{HIGH}$ voltage	2.0		VCC +0.5	V
V_{IL}cmos	CMOS compatible input $_{LOW}$ voltage	-0.5		0.8	V
$I_I$setm	MODSET/LIMITSET pins - source current			3	mA
I_{OVREF}	VREF pin - source current			10	mA
I_{PININ}	Current at pins PINSET and PININ	-5		5	mA
$V_{BIASOUT}$	Permissible voltage range at BIASOUT pin	1.2		4	V
Tamb	Operating ambient temperature	-40		85	°C

DC Electrical Characteristics

Over recommended operating conditions, output load 25 Ω.

Symbol	Parameter	Min	Typ	Max	Unit
I_{IH}cmos	CMOS Compatible Input HIGH current			180	µA
I_{IL}cmos	CMOS Compatible Input LOW current			-30	µA
$I_{BIASOUT}$	Output current setting range – BIASOUT pin	5		100	mA
I_{BIAS}leak	BIASOUT pin - Output current in shutdown state			1	µA
V_{PINSET}	Bias voltage at PINSET pin	1.20		1.32	V
V_{PINSET}ppm	Temperature coefficient of voltage at PINSET pin	-200		200	ppm/°C
V_{LIMSET}	Bias voltage at LIMSET pin	1.20		1.33	V
V_{LIMSET}ppm	Temperature coefficient of voltage on LIMSET pin	-200		200	ppm/°C
I_{LIMIT}	Bias current limiter setting range	20		100	mA
	Ratio of BIASOUT current to BIASMIRR current.	10		12	
I_{MODOUT}	Output current setting range – MODOUTP/N pins	5		80	mA
V_{MODSET}	Bias voltage at MODSET pin	1.20		1.32	V
V_{MODSET}ppm	Temperature coefficient of voltage at MODSET pin	-200		200	ppm/°C
$V_{MODOUTN}$	Voltage compliance at MODOUTN pin	1.4		4.0	V
$V_{MODOUTP}$	Voltage compliance at MODOUTP pin	2.4		5.3	V
Ileakm25	MODOUTN Output leakage. (NOTE 1)			100	µA
Ileakm80	MODOUTN output leakage (NOTE 2)			330	µA
Pd0	Power dissipation (Ibiasout, Imodout = 0)			350	mW
Pdwkq	Power dissipation ($I_{BIASOUT}$ = 60 mA, I_{MODOUT} = 25 mA, Vbias = Vmod = 2.5 V)			700	mW
$P_D$max	Maximum power dissipation ($I_{BIASOUT}$ = max, I_{MODOUT} = max, Vbias = Vmod = 2.5 V)			1.2	W

NOTE 1 - Measured with 3.0 V source applied between MODOUTN and Ground, an input voltage differential (TXDATIP wrt TXDATIN) of 400 mV, and Imod set to 25 mA.

NOTE 2 - Measured with 3.0 V source applied between MODOUTN and Ground, an input voltage differential (TXDATIP wrt TXDATIN) of 400 mV, and Imod set to 80 mA.

AC Characteristics

Over recommended operating conditions, output load 25 Ω.

Symbol	Parameter	Min	Max	Unit
DRi	Input data rate		650	Mb/s
tr_{MODOUT}	Rise time MODOUTP/N output		250	ps
tf_{MODOUT}	Fall time MODOUTP/N output		250	ps
R_{MS}modout	Output data mark/space ration MODOUTP/N	48	52	%

Typical Application Circuit

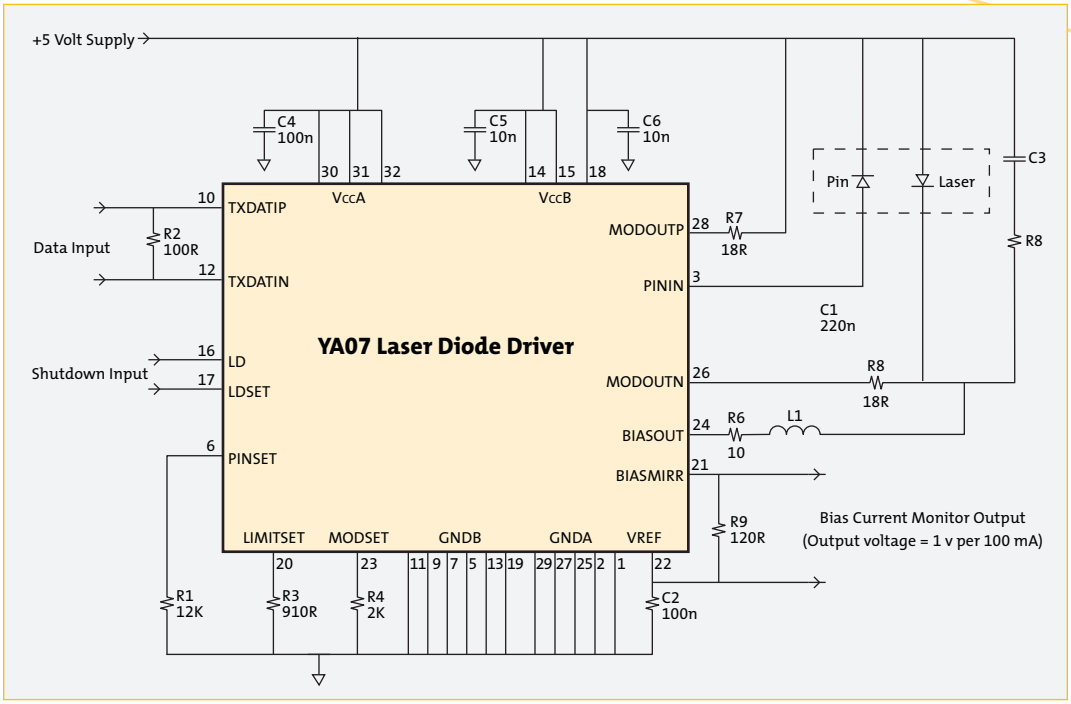

Figure 2: Typical Application Circuit

Notes: 1) The PIN current in this schematic is set at 104 uA by resistor R1. [Ipin = 1.25/R1]

2) The bias current limit in this schematic is set at 80 mA by resistor R3. [Ilimit = 72/R3]

3) The modulation current in this schematic is set at 25 mA by resistor R4. [Imod = 50/R4]

Typical Eye Diagram

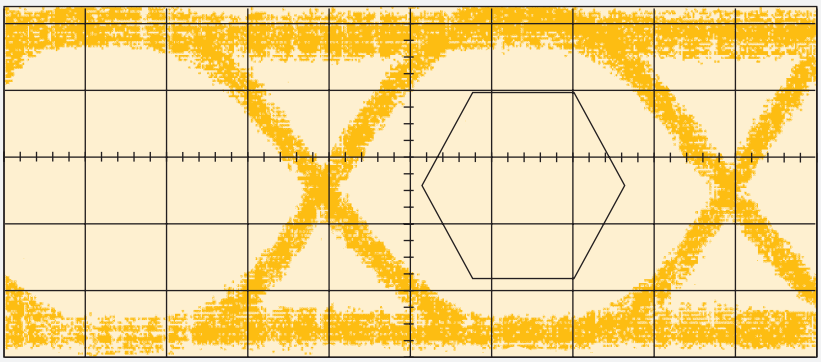

Figure 3: Typical Eye Diagram (622 Mb/s)
After fourth order 0.75 x bit-rate Bessel-Thomson filtering.

Pin Assignment

Pin No	Symbol	Type	Description	Function
1, 2	GNDA	P		High current ground
3	PININ	I	Analog	Connection for monitor diode anode
4,8	NC			No connection
5, 7	GNDB	P		'Quiet' ground
6	PINSET	I	Analog	Connection for monitor diode current setting resistor
9	GNDB	P		'Quiet' ground
10	TXDATIP	I	CML	Data input +ve
11	GNDB	P		'Quiet' ground
12	TXDATIN	I	CML	Data input –ve
13	GNDB	P		'Quiet' ground
14, 15	VCCB	P		'Quiet' power supply
16	SD	I	CMOS	Shutdown input. CMOS compatible
17	SDSET	I	CMOS	Shutdown configure input. CMOS compatible
18	VCCB	P		'Quiet' power supply
19	GNDB	P		'Quiet' ground
20	LIMITSET	I	Analog	Connection for bias current limit setting resistor
21	BIASMIRR	O	Analog	Bias current mirror output
22	VREF	O	Analog	2.4 V bandgap reference output
23	MODSET	I	Analog	Connection for modulation current setting resistor
24	BIASOUT	O	Analog	Bias current output pin
25, 27, 29	GNDA	P		High current Ground
26	MODOUTN	O	Analog	Modulation output -ve pin. connection for laser diode cathode
28	MODOUTP	O	Analog	Modulation output +ve pin.
30, 31, 32	VCCA	P		High current power supply

Package Pin Configuration

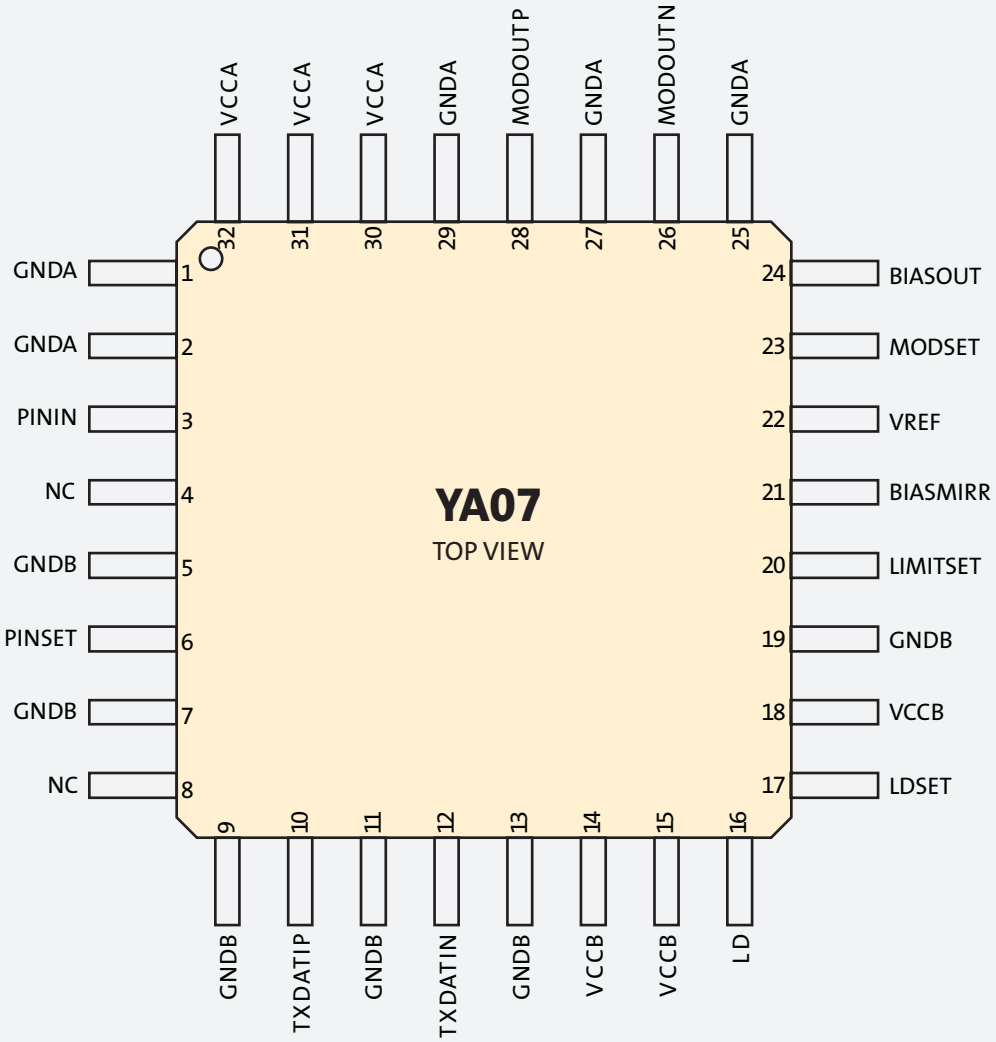

Figure 4: Package Pin Configuration

Package Outline Drawing and Dimensions

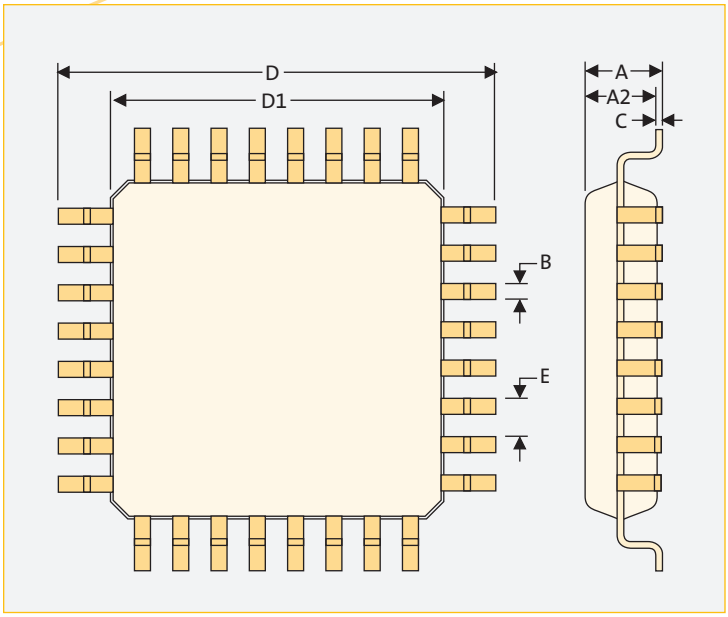

Figure 5: Package Outline

Dimension	Nominal	Tol	Units
D	9	±0.20	mm
D1	7	±0.10	mm
B	0.35	±0.05	mm
E	0.80		mm
A	1.6	MAX	mm
A2	1.4	±0.05	mm
C	0.05 (min)	0.15 (max)	mm

Notes:

Notes:

Ordering information

Please quote the Product Code from Table 1 below when ordering as this is the identification that appears on the part when shipped.

Table 1: Product ordering information

Product Code	Product Name
A0685475 (QMV695-1AF5)	YA07 Laser Diode Driver with Mean Power Control

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