SY88232L/AL

2.5Gbps Laser Diode Driver with Integrated Limiting Amplifier

General Description

The SY88232L is a single supply 3.3V integrated laser driver and post amplifier for telecom/datacom applications with data rates from 155Mbps up to 2.5Gbps. The driver can deliver modulation current up to 85mA, and provides a high compliance voltage that makes it suitable for high-current operation with the laser DC-coupled to it. The post amplifier can detect signals with amplitude as low as $5mV_{PP}$.

The SY88232AL is a version of the SY88232L without 50Ω termination resistors at the inputs of the driver and the post amplifier. The SY88232AL is to be used specially in SFF modules mounted on mother boards which have preinstalled terminations. Removing post amplifier input terminations will allow for receiver gain control.

All support documentation can be found on Micrel's web site at: www.micrel.com.

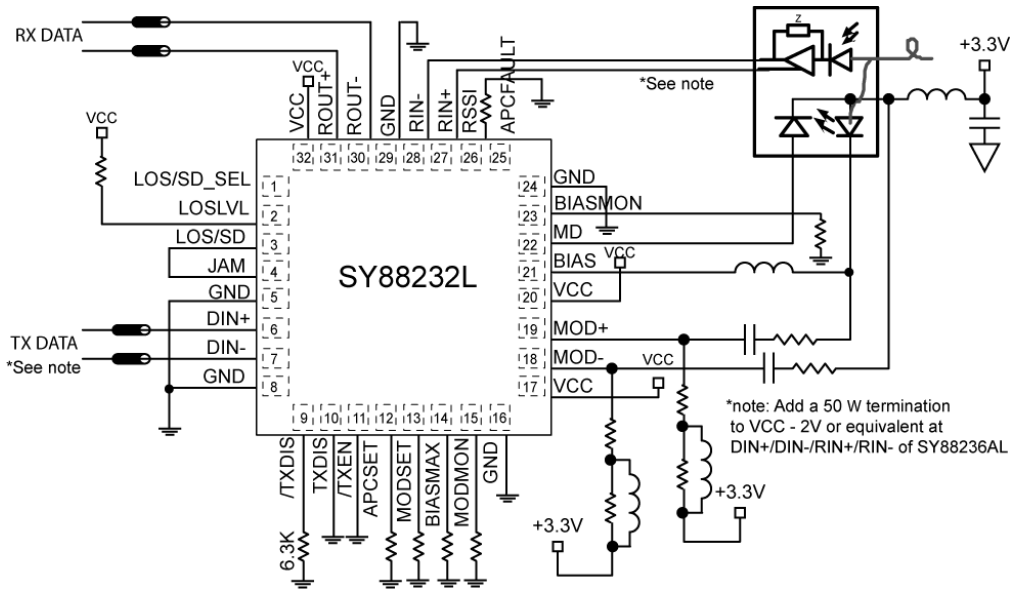
Features

- 2.4V minimum laser compliance voltage
- Operation up to 2.5Gbps
- Integrated APC circuit
- Modulation current up to 85mA
- Bias current up to 70mA
- Bias, Modulation, and power monitoring
- High input sensitivity post amplifier, $5mV_{PP}$
- Programmable LOS level
- Available in 32-pin (5mm x 5mm) QFN package

Applications

- Multi-rate burst mode applications: A-PON, B-PON, G-PON, E-PON, GE-PON

Typical Application



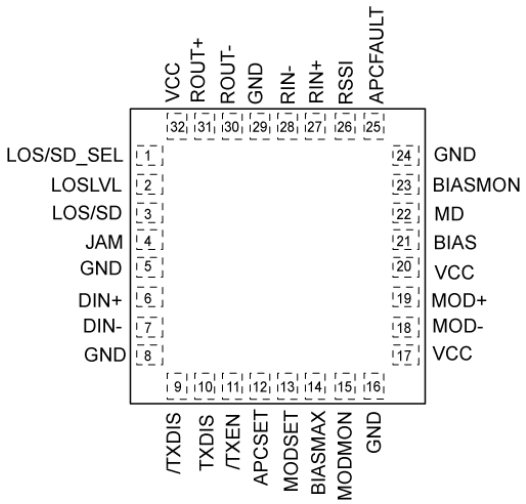
Ordering Information[1]

Part Number	Voltage	Temperature Range	Package Type	Package Marking	Lead Finish
SY88232LMG	3.3V	–40° to +85°C	QFN-32	SY88232L with Pb-Free bar-line indicator	NiPdAu Pb-Free
SY88232LMGTR[2]	3.3V	–40° to +85°C	QFN-32	SY88232L with Pb-Free bar-line indicator	NiPdAu Pb-Free
SY88232ALMG	3.3V	–40° to +85°C	QFN-32	SY88232A with Pb-Free bar-line indicator	NiPdAu Pb-Free
SY88232ALMGTR[2]	3.3V	–40° to +85°C	QFN-32	SY88232A with Pb-Free bar-line indicator	NiPdAu Pb-Free

Notes:

1. Contact factory for die availability. Dice are guaranteed at T_A = +25°C, DC Electricals only.
2. Tape and Reel.

Pin Configuration



32-Pin QFN

Pin Description

Pin Number	Pin Name	Pin Function
1	LOS/SD_SEL	LOS or SD selection, TTL input. Set high, connect to VCC, or leave open to select LOS. Set low or connect to GND to select SD.
2	LOSLVL	Loss-of-Signal Level Set. A resistor from this pin to V_{CC} sets the threshold for the data input amplitude at which LOS will be asserted.
3	LOS/SD	Loss-of-Signal (LOS selected): asserts high when the data input amplitude falls below the threshold set by LOS_{LVL}. Signal Detect (SD selected): asserts low when the data input amplitude falls below the threshold set by LOS_{LVL}.
4	JAM	Active low TTL/CMOS. Internally pulled-up with 75kΩ. Connect to GND or apply a low level signal (<0.8 V) to enable the post amp output. Can be shorted to LOS/SD (pin 3) to create a squelch function. The polarity of this input follows the polarity of LOS/SD.
6	DIN+	SY88232L: Driver Non-inverting input data. Internally terminated with 50 Ω to a reference voltage.
		SY88232AL: Driver Non-inverting input data. No internal termination.
7	DIN-	SY88232L: Driver inverting input data. Internally terminated with 50 Ω to a reference voltage.
		SY88232AL: Driver inverting input data. No internal termination.
9	/TXDIS	Transmitter Complementary Fast Disable. TTL input. The transmitter is enabled when this pin is asserted High or left open and disabled when this pin is asserted Low. A 6.3kΩ resistor must be installed between pin 10 and GND if /TXDIS is used as TTL input.
10	TXDIS	Transmitter Fast Disable. TTL Input. The transmitter is enabled when this pin is asserted Low and disabled when this pin is asserted High or left open. A 6.3kΩ resistor must be installed between pins 9 and GND if TXDIS is used as TTL input.
11	/TXEN	Active low TTL/CMOS. Internally pulled-up. Pull-down with a 22kΩ or lower resistance or apply a low level signal (<0.8V) to enable bias and modulation. Keep floating or apply a high level (>2V) to disable.

Pin Description (continued)

Pin Number	Pin Name	Pin Function
12	APCSET	Bias current setting and control. The bias current is set by installing an external resistor from this pin to ground or using a current source. Connect a 50kΩ resistor to GND for open loop operation.
13	MODSET	Modulation current setting and control. The modulation current is set by installing an external resistor from this pin to ground or using a current source.
14	BIASMAX	Install a resistor between this pin and GND to set the maximum bias current for the closed loop operation. The APC loop controls the bias current up to the level of BIASMAX. When the bias current reaches the maximum value set through this pin, the driver continues to sink a current equal to this maximum. For open loop operations, this pin sets the bias current.
15	MODMON	Modulation Current Monitor. Provides a current, which represents 1/100 of the modulation current. Install a resistor between this pin and GND to convert that current to a voltage proportional to the modulation current.
18	MOD-	Inverted modulation current output. Provides modulation current when input data is negative.
19	MOD+	Non-inverted modulation current output. Provides modulation current when input data is positive.
21	BIAS	Bias current output, sources current when /TXDIS is high. Connect to the cathode of the laser through a resistor.
22	MD	Input from the laser monitoring photodiode. Connect to the anode of the laser photodiode for APC operation.
23	BIASMON	Bias Monitor. Provides a current, which represents 1/50 of the bias current. Install a resistor between this pin and GND to convert that current to a voltage.
24	RSSI	Received Signal Strength Indicator. Install a resistor from this pin to GND to get a voltage proportional to the received signal.
25	APCFAULT	Indicates APC failure when High. Active High TTL/CMOS. Use a 10kΩ Pull up.
27	RIN+	**SY88232L:** Post amplifier Non-inverting input data. Internally terminated with 50Ω to a reference voltage.
		SY88232AL: Post amplifier Non-inverting input data. No internal termination.
28	RIN-	**SY88232L:** Driver inverting input data. Internally terminated with 50Ω to a reference voltage.
		SY88232AL: Driver inverting input data. No internal termination.
30	ROUT-	Post Amplifier Complementary CML data output.
31	ROUT+	Post Amplifier true CML data output.
5, 8, 16, 24, 29	GND	Ground. Ground and exposed pad must be connected to the plane of the most negative potential.
17, 20, 32		Supply Voltage. Bypass with a 0.1µF//0.01µF low ESR capacitor as close to VCC pin as possible.

Truth Tables

DIN+	DIN-	/TXEN	MOD+[2]	MOD-	Laser Output Power[3]
L	H	L	H	L	L
H	L	L	L	H	H
X	X	X	H	L	L

Table 1. Modulation Output Truth Table[1, 3]

/TXEN	BIAS
L	ON
L	OFF
H	OFF

Table 2. BIAS Output Truth Table[1]

Notes:

1. Assuming /TXDIS = H and a 6.3kΩ resistor installed between TXDIS and GND or TXDIS = L and a 6.3kΩ resistor installed between /TXDIS and GND
2. I_{MOD} = 0 when MOD+ = H.
3. Assuming that the cathode of the laser is connected to MOD+.

LOS/SD_SEL	Function Selected	JAM	Output
H	LOS	L	Enabled
H	LOS	H	Disabled
L	SD	L	Disabled
L	SD	H	Enabled

Table 3. Post Amp Output Truth Table

hbwhelp@micrel.com or (408) 955-1690

Absolute Maximum Ratings[1]

Supply Voltage (V_{IN}) ..... –0.5V to +4.0V
CML Input Voltage (V_{IN}) ..... V_{CC}–1.2V to V_{CC}+0.5V
TTL Control Input Voltage (V_{IN}) ..... 0V to V_{CC}
Lead Temperature (soldering, 20sec.) ..... +260°C
Storage Temperature (T_s) ..... –65°C to +150°C

Operating Ratings[2]

Supply Voltage (V_{CC}) ..... +3.0V to +3.6V
Ambient Temperature (T_A) ..... –40°C to +85°C
Package Thermal Resistance[3]
QFN
(θ_{JA}) Still-air ..... 60°C/W
(ψ_{JB}) ..... 33°C/W

DC Electrical Characteristics

T_A = –40°C to +85°C and V_{CC} = +3.0V to +3.6V, unless otherwise noted. Typical values are V_{CC} = +3.3V, T_A = 25°C, I_{MOD} = 30mA, I_{BIAS} = 30mA.

Symbol	Parameter	Condition	Min	Typ	Max	Units
I_{CC}	Power Supply Current	Modulation and Bias currents excluded		90	150[4]	mA
V_{IL}	TXDIS, /TXDIS, /TXEN, JAM, and LOS/SD_SEL Input Low		-0.3		0.8	V
V_{IH}	TXDIS, /TXDIS, /TXEN, JAM, and LOS/SD_SEL Input High		2		V_{CC} + 0.3	V
Laser Driver						
V_{MOD_MIN}	Minimum Voltage Required at the Driver Output, MOD+ and MOD-, for Proper Operation		0.6			V
V_{BIAS_MIN}	Minimum Voltage Required at the Driver Output, BIAS pin, for Proper Operation		0.8			V
I_{BIAS}	Bias-ON Current	Voltage at Bias pin ≥ 0.8V	1		70	mA
I_{BIAS_OFF}	Bias-OFF Current	Current at BIAS pin when /EN is high or TXDIS is low and a 6.3kΩ installed between /TXDIS and GND			150	µA
R_{IN} (SY88232L only)	Input Resistance at DIN+ and DIN-	Single ended	42.5	50	57.5	Ω
V_{OL}	APCFAULT Output Low	I_{OL} = 2mA			0.5	V
I_{OH}	APCFAULT Output Leakage	V_{OH} = V_{CC}			100	µA
I_{MD}	Current range at MD pin		50		1500	µA

Notes:

1. Permanent device damage may occur if absolute maximum ratings are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to absolute maximum ratings conditions for extended periods may affect device reliability.
2. The data sheet limits are not guaranteed if the device is operated beyond the operating ratings.
3. Package Thermal Resistance assumes exposed pad is soldered (or equivalent) to the devices most negative potential on the PCB. θ_{JB} uses a 4-layer and θ_{JA} in still air unless otherwise stated.
4. I_{CC} = 150mA for worst-case conditions with I_{MOD} = 85mA, I_{Bias} = 70mA, T_A = +85°C, V_{CC} = 3.6V.

Post Amplifier

Symbol	Parameter	Condition	Min	Typ	Max	Units
LOS_{LVL}	LOS_{LVL} Voltage		V_{CC} -1.3		V_{CC}	V
V_{OH}	ROUT+, ROUT- HIGH Voltage		V_{CC}-0.020	V_{CC}-0.005	V_{CC}	V
V_{OL}	ROUT+, ROUT- LOW Voltage		V_{CC}-0.475	V_{CC}-0.400	V_{CC}-0.350	V
V_{RSSI}	Maximum voltage at RSSI pin				1.2	V
V_{OFFSET}	Differential Output Offset				±80	mV
Z_0 (ROUT)	Single-Ended Output Impedance		42.5	50	57.5	Ω
Z_I (RIN) (SY88232L only)	Single-Ended Input Impedance		42.5	50	57.5	Ω
V_{OL}(LOS/SD)	LOS/SD Output Low	I_{OL} = 2mA			0.5	V
I_{OH}(LOS/SD)	LOS/SD Output Leakage	$V_{OH} = V_{CC}$			100	µA

AC Electrical Characteristics

T_A = –40°C to +85°C and V_{CC} = +3.0V to +3.6V, unless otherwise noted. Typical values are V_{CC} = +3.3V, T_A = 25°C, I_{MOD} = 30mA, I_{BIAS} = 30mA.

Symbol	Parameter	Condition	Min	Typ	Max	Units
Laser Driver						
	Data Rate	NRZ	0.155		2.5	Gbps
$V_{DIFF-IN}$ (DIN)	Differential Input Voltage Swing		100		2400	mV_{PP}
I_{MOD}	Modulation Current(5)	AC-coupled	10		85	mA
		DC-coupled, Voltage at MOD pin ≥0.6V	10		70(6)	mA
I_{MOD_OFF}	Modulation OFF Current	Current at MOD+ when /TXEN is high or TXDIS is low and a 6.3kΩ installed between /TXDIS and GND			150	µA
		Current at MOD- when /TXEN is high or TXDIS is low and a 6.3kΩ installed between /TXDIS and GND			150	µA
t_r	Output Current Rise Time	20% to 80%, I_{MOD} = 60mA		60	85	ps
t_f	Output Current Fall Time	20% to 80%, I_{MOD} = 60mA		60	85	ps
Jitter	Total Jitter(7)	155Mbps data rate			30	ps_{PP}
		622Mbps data rate			30	ps_{PP}
		1.25Gbps data rate			30	ps_{PP}
		2.5Gbps data rate			30	ps_{PP}
t_{INIT}	APC Loop Initialization Time	Power up with /TXEN low, TXDIS high, and a 6.3kΩ installed between /TXDIS and GND			12	µs
		/TXEN changes from high to low with power ON, TXDIS high, and a 6.3kΩ installed between /TXDIS and GND			10	µs
		TXDIS changes from low to high with power ON, /TXEN low, and a 6.3kΩ installed between /TXDIS and GND			2.5	ns
		622Mbps	720			ns
		1.25Gbps	576			ns
		2.5Gbps	576			ns

Notes:

5. Load = 15Ω.
6. Assuming V_{CC} = 3.0V, Laser bandgap voltage = 1V, laser package inductance = 1nH, laser equivalent series resistor = 5 Ω, and damping resistor = 10Ω.
7. Total jitter is measured using 2^7 – 1 PRBS pattern.

Post Amplifier

Symbol	Parameter	Condition	Min	Typ	Max	Units
t_r, t_f	Output Rise/Fall Time (20% to 80%)	Note 8		60	120	ps
t_{JITTER}	Deterministic Random	Note 9 Note 10		15 5		ps_{PP} ps_{RMS}
V_{Diff_IN} (RIN)	Differential Input Voltage Swing		5		1800	mV_{PP}
V_{Diff_OUT} (ROUT)	Differential Output Voltage Swing	Note 8	700	800	950	mV_{PP}
G_{RSSI}	RSSI Gain = I_{RSSI} / V_{Diff_IN} (RIN)	$5mV_{PP} \le V_{Diff_IN}$ (RIN) $\le 200mV_{PP}$		5		µA/ mV_{PP}
RSSI Linearity		$5mV_{PP} \le V_{Diff_IN}$ (RIN) $\le 200mV_{PP}$		± 2.5		%
LOS_{AL}	Low LOS Assert Level	R_{LOSLVL} = 15kΩ	2	8		mV_{PP}
LOS_{DL}	Low LOS De-assert Level	R_{LOSLVL} = 15kΩ		10	20	mV_{PP}
HSY_L	Low LOS Hysteresis	R_{LOSLVL} = 15kΩ, Note 11	1.5	2.6	6	dB
LOS_{AM}	Medium LOS Assert Level	R_{LOSLVL} = 5kΩ	4	12		mV_{PP}
LOS_{DM}	Medium LOS De-assert Level	R_{LOSLVL} = 5kΩ		16	30	mV_{PP}
HSY_M	Medium LOS Hysteresis	R_{LOSLVL} = 5kΩ, Note 11	1.5	2.8	6	dB
LOS_{AH}	High LOS Assert Level	R_{LOSLVL} = 100Ω	15	25		mV_{PP}
LOS_{DH}	High LOS De-assert Level	R_{LOSLVL} = 100Ω		36	50	mV_{PP}
HSY_H	High LOS Hysteresis	R_{LOSLVL} = 100Ω	1.5	3.2	6	dB
T_{OFF}	LOS Release Time	Note 12		2	10	µs
T_{ON}	LOS Assert Time	Note 12		2	10	µs
B_{-3dB}	3dB Bandwidth			2.0		GHz
$A_{V(Diff)}$	Differential Voltage Gain			38		dB
S_{21}	Single-Ended Small-Signal Gain		26	32		dB

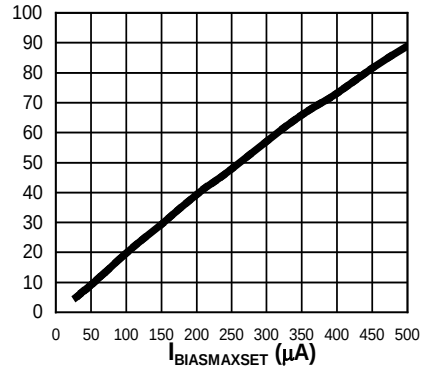
Notes:

8. Amplifier in limiting mode. Input is a 200MHz square wave.
9. Deterministic jitter measured using 2.5Gbps K28.5 pattern, V_{ID} = $10mV_{PP}$.
10. Random jitter measured using 2.5Gbps K28.7 pattern, V_{ID} = $10mV_{PP}$.
11. This specification defines electrical hysteresis as 20log (LOS De-Assert/LOS Assert). The ratio between optical hysteresis and electrical hysteresis is found to vary between 1.5 and 2 depending upon the level of received optical power and ROSA characteristics. Based on that ratio, the optical hysteresis corresponding to the electrical hysteresis range 1dB-4.5 dB, shown in the AC characteristics table, will be 0.5dB-3dB Optical Hysteresis.
12. In real world applications, the LOS Release/Assert time can be strongly influenced by the RC time constant of the AC-coupling cap and the 50Ω input termination. To keep this time low, use a decoupling cap with the lowest value that is allowed by the data rate and the number of consecutive identical bits in the application (typical values are in the range of 0.001µF to 1.0µF).

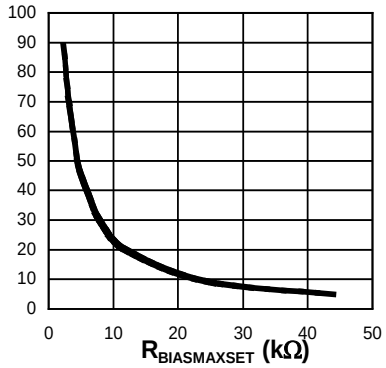
Typical Characteristics

Laser Driver

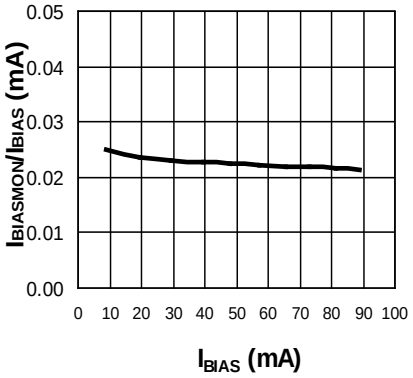
I_{BIAS} vs. $I_{BIASMAXSET}$



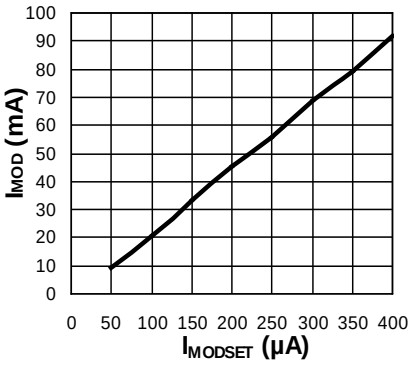
I_{BIAS} vs. $R_{BIASMAXSET}$



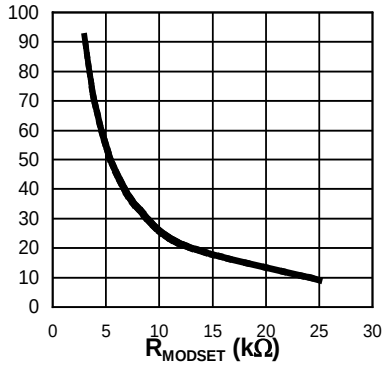
$I_{BIASMON}$ Gain



Modulation Gain

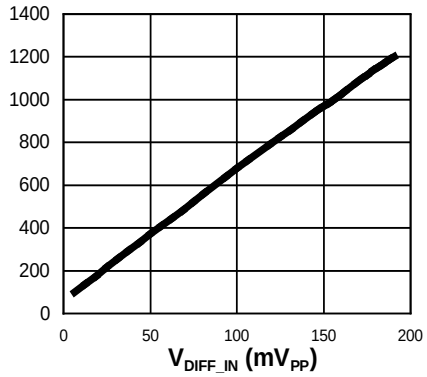


I_{MOD} vs. R_{MODSET}

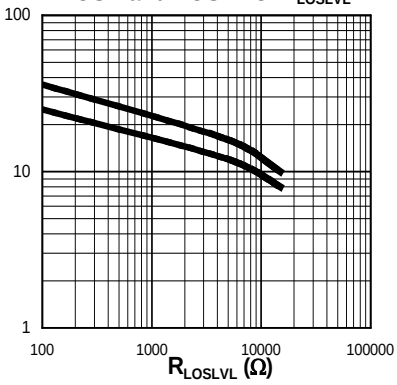


Post Amplifier

I_{RSSI} vs. RIN



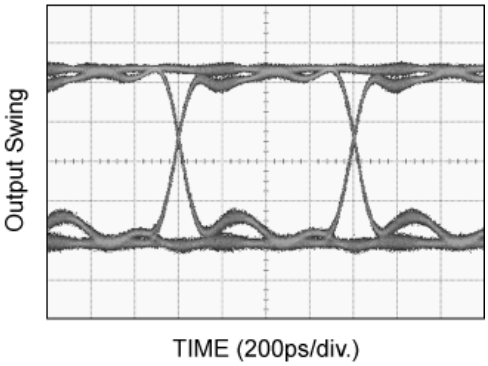
LOSA and LOSD vs. R_{LOSLVL}



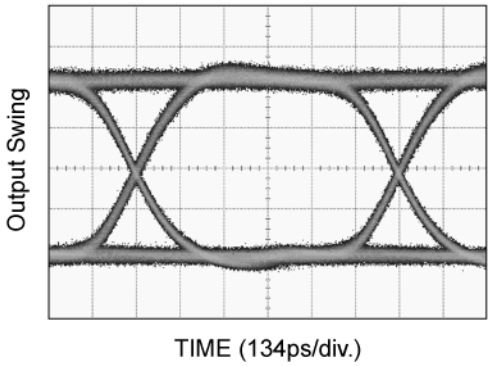
Functional Characteristics

Laser Driver

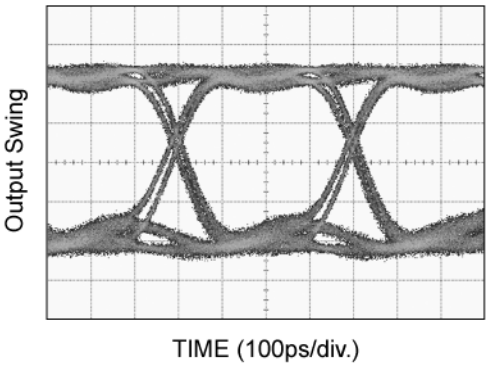
Electrical Eye Diagram @1.25Gbps



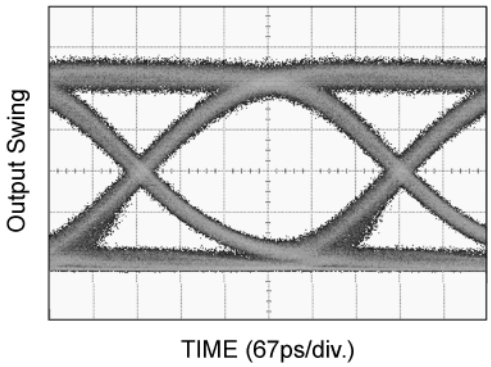
Optical Eye Diagram @1.25Gbps with 2.3G Filter Laser DC-Coupled to the Driver



Electrical Eye Diagram @2.5Gbps



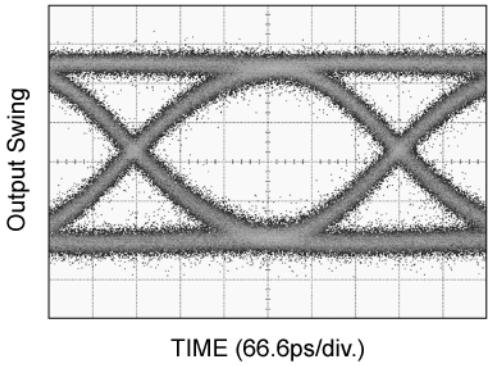
Optical Eye Diagram @2.5Gbps with 2.3G Filter Laser DC-Coupled to the Driver



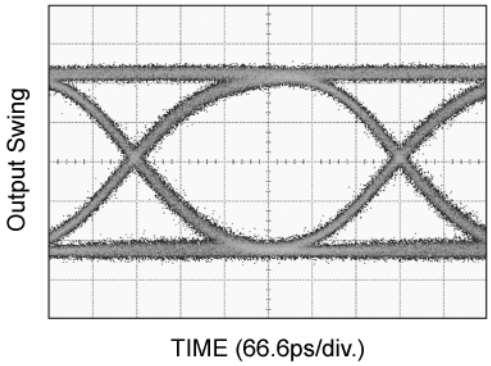
Functional Characteristics (continued)

Post Amplifier

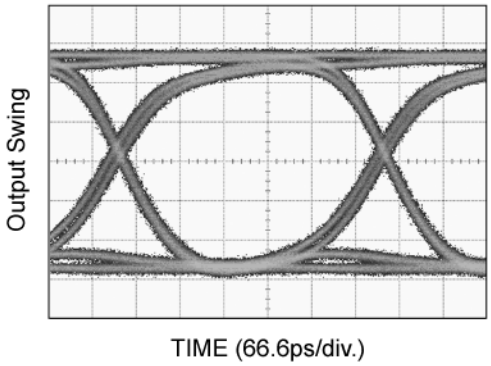
Electrical Eye Diagram @2.5Gbps
V_{DIFF_IN} = 2.5mV_{PP}



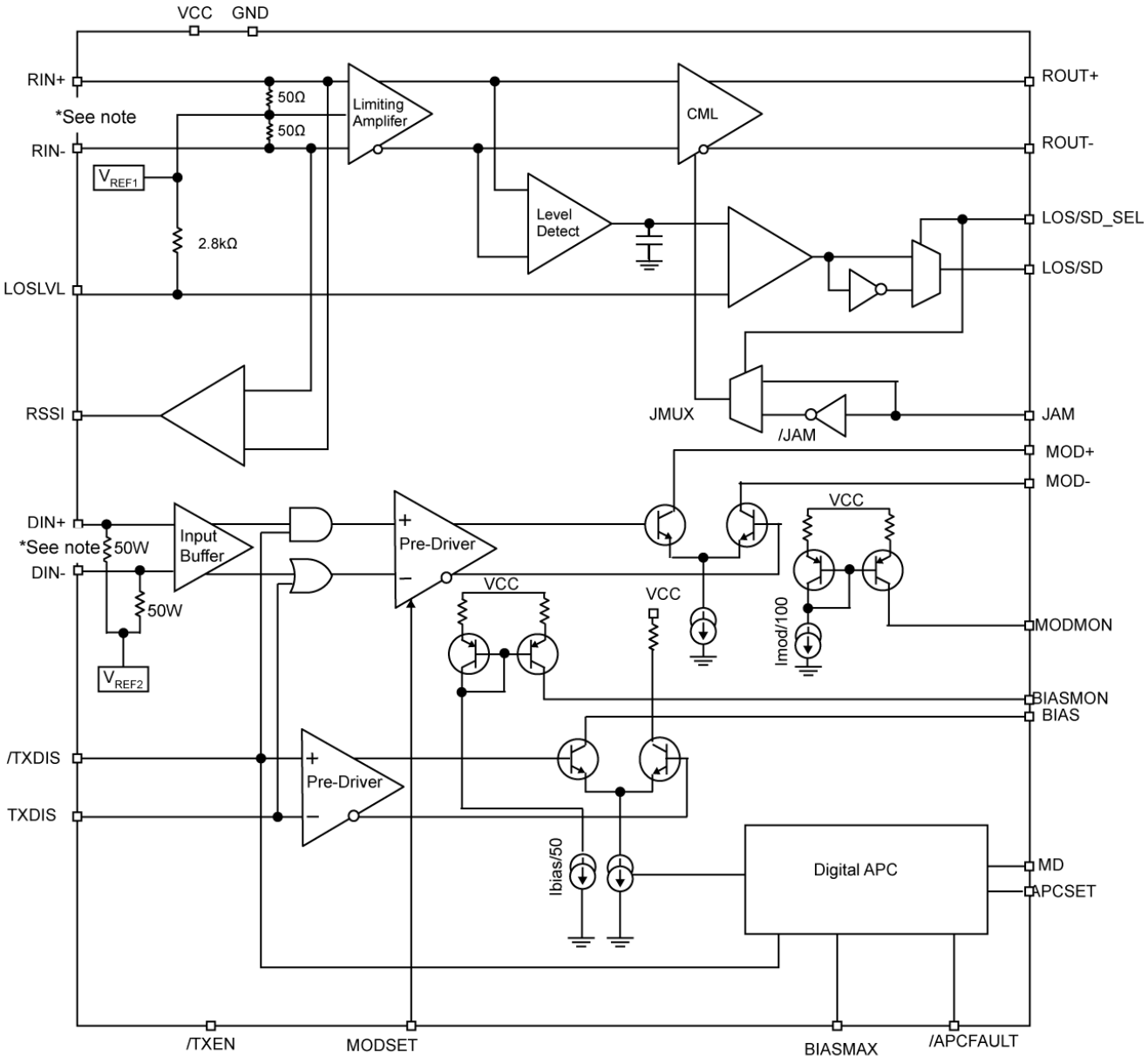
Electrical Eye Diagram @2.5Gbps
V_{DIFF_IN} = 5mV_{PP}



Electrical Eye Diagram @2.5Gbps
V_{DIFF_IN} = 10mV_{PP}



Functional Diagram



*note: The internal terminations at DIN+, DIN-, RIN+, RIN- apply for SY88232L only.
SY88232AL doesn't have internal terminations at those inputs

The SY88232L is shown. For the SY88232AL, 50Ω terminations should be removed from DIN± and RIN±.

Functional Description

Laser Driver

The laser driver is comprised from a modulator, a bias circuit, and a digital APC loop.

The driver features bias and modulation current monitoring functions, which can be configured for optical power monitoring.

BIAS and Modulation Setting

Bias and modulation currents are set by installing resistors from APCSET to ground and from MODSET to ground respectively or by applying a negative current at those pins. I_{BIAS} variation versus $R_{BIASMAXSET}$ resistor and $I_{BIASMAXSET}$, and I_{MOD} variation versus R_{MODSET} resistor and I_{MODSET} are shown on page 10.

BIASMAX

A resistor between BIASMAX pin and ground sets the maximum bias the driver can sink. At normal operation, the bias current tracks the laser optical power through the laser monitoring photodiode and the APC loop to compensate for any power deviation from the nominal value set at the start of operation using APCSET. If for any failure (laser or photodiode degradation, open feedback circuit etc…) the APC loop keeps increasing the bias current to compensate for the low power indication, the bias current will stop increasing when it reaches BIASMAX value and continues to operate at that maximum value and APCFAULT is asserted.

BIASMAX also sets the bias current when the circuit is operating in the open loop mode.

APC Loop Function

At start up, with the driver enabled, TXDIS low and /TXEN low, the laser turns ON within a few microseconds and its back facet monitoring photodiode starts to generate a photocurrent proportional to the optical power. The photocurrent is fed back to the MD pin on the driver where it's converted to a voltage. The conversion voltage is compared to APCSET on the driver. At equilibrium, the feedback voltage equals the APCSET voltage and the laser optical power reaches its nominal value. If the laser power deviates from its nominal value, the APC loop brings it back to its nominal setting.

APC Loop Failure

The APCFAULT is asserted High if the bias current reaches BIASMAX or if the APC loop counter reaches its minimum or its maximum counts.

Interfacing the Driver with the Laser Diode

As shown on the "Typical Application" drawing, MOD+ pin is AC coupled to the laser diode cathode through a series resistor and MOD- is AC coupled to the laser diode anode through a series resistor. MOD+ and MOD- are terminated to VCC with a resistor in series with an other resistor in parallel with an inductor. To minimize the components count, MOD+ and MOD- can simply be DC coupled to the cathode and anode of the laser respectively with a single series resistor without capacitor and without termination network.

Post Amplifier

The post amplifier detects and amplifies signals with data rates from DC up to 3.2Gbps, and amplitude as small as $5mV_{PP}$. To reduce the noise at the output of the post amplifier when the input signal is absent or lower than the minimum detectable level set by LOS_{LVL}, a JAM pin is provided, which can be connected to LOS/SD output to turn off the output buffer when LOSS/SD is asserted.

Input Amplifier/Buffer

Figure 1-d shows a simplified schematic of the input stage. The high-sensitivity of the input amplifier allows signals as small as $5mV_{PP}$ to be detected and amplified. The input amplifier allows input signals as large as $1800mV_{PP}$. Small input signals below typically $12mV_{PP}$ are linearly amplified with a typically 38dB differential voltage gain. For input signals larger than $12mV_{PP}$, the output signal is limited to typically $800mV_{PP}$.

Output Buffer

The post amplifier CML output buffer is designed to drive 50Ω lines and is internally terminated with 50Ω to V_{CC}. Figure 1e shows a simplified schematic of the output stage.

Loss-of-Signal

The post amplifier generates a selectable chatter-free loss-of-signal (LOS) or signal detect (SD) open-collector TTL output as shown in Figure 2d. LOS/SD is used to determine that the input amplitude is too small to be considered as a valid input. When the LOSS function is selected (LOS/SD_SEL=1), LOS/SD asserts high if the input amplitude falls below the threshold set by LOSLVL and de-asserts low otherwise. IF SD function is selected (LOS/SD_SEL=0), LOS/SD asserts low if the input amplitude falls below the threshold set by LOSLVL and de-asserts high otherwise. LOS/SD can be fed back to the JAM input to maintain output stability under a loss of signal condition. Jam de-asserts low the true output signal without removing the input signals. Typically, 3dB LOS hysteresis is provided to prevent chattering.

Loss/Signal Detect Selection

A pin (LOS/SD_SEL) is provided to select between LOS (set to high) or SD (set to low) function. It also controls the internal circuitry of JAM input to follow LOS/SD selection.

Loss-of-Signal-Level Set

A programmable LOS/SD level set pin (LOS_{LVL}) sets the threshold of the input amplitude detection. Connecting an external resistor between V_{CC} and LOS_{LVL} sets the voltage at LOS_{LVL}. This voltage ranges from V_{CC} to V_{CC} -1.3V. The external resistor creates a voltage divider between V_{CC} and V_{CC}-1.3V, as shown in Figure 2c.

Hysteresis

The post amplifier provides typically 3dB LOS electrical hysteresis, which is defined as 20log ($VIN_{LOS\text{-}Assert}$ / $VIN_{LOS\text{-}De\text{-}Assert}$). Since the relationship between the voltage out of the ROSA to optical power at its input is linear, the optical hysteresis will be typically half of the electrical hysteresis reported in the datasheet, but in practice the ratio between electrical and optical hysteresis is found to be within the range 1.5 to 1.8. Thus, 3dB electrical hysteresis will correspond to an optical hysteresis within the range 1.6dB to 2dB.

RSSI Pin

The post amplifier has an RSSI (Received Signal Strength) pin, which provides a current proportional to the amplitude of the signal at the input of the post amplifier from the ROSA. Install a resistor between this pin and GND to convert the current into a monitoring voltage proportional to the amplitude of the signal at the input of the post amplifier. The value of the resistor should be selected to keep the voltage at the RSSI pin under its limit of 1.2V to maintain RSSI linearity.

Input and Output Stages (SY88232L)[1]

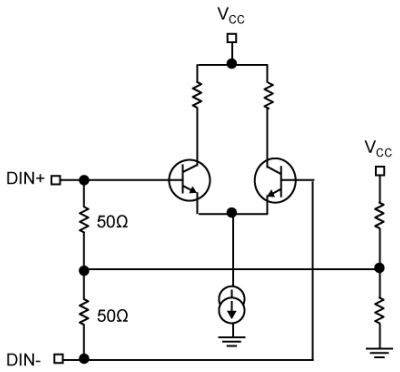


Figure 1a. Simplified Driver Input Stage[1]

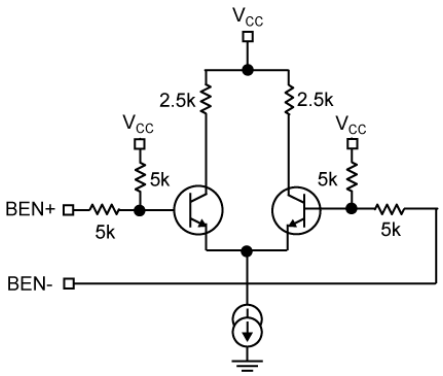


Figure 1b. Simplified TXDIS Input Stage

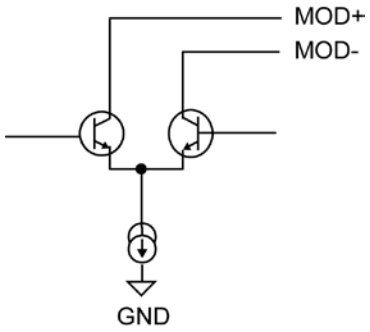


Figure 1c. Simplified Driver Output Stage

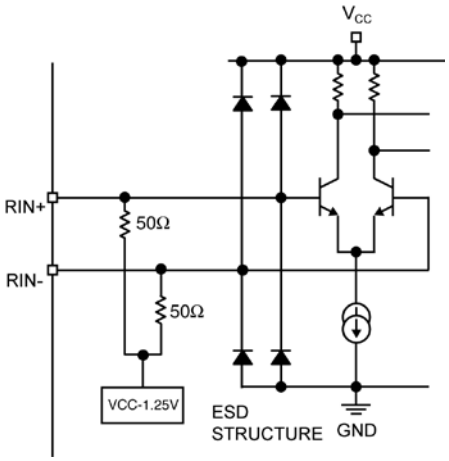


Figure 1d. Post Amplifier Input Stage[1]

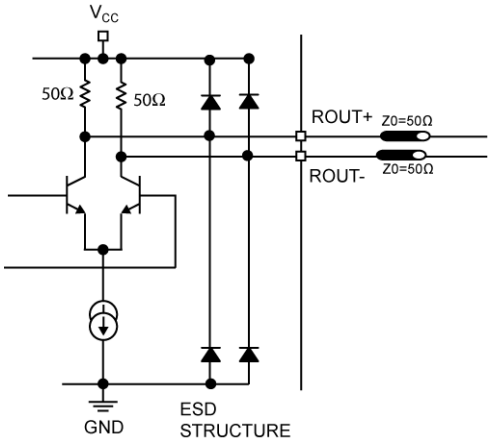


Figure 1e. Post Amplifier Output Stage

Note:

1. Applies for SY88232L only. For SY88232AL input terminations need to be removed.

Interfacing DIN to Different Logic Drivers (SY88232L) [1]

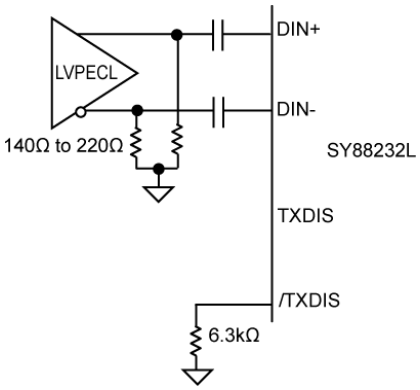


Figure 2a. Driving DIN with PECL Outputs[1]

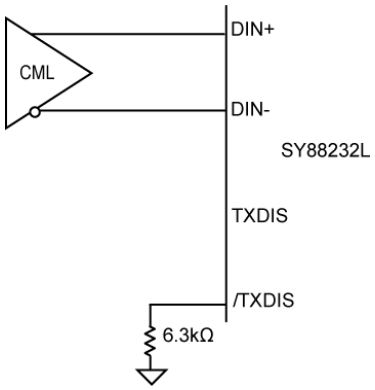


Figure 2b. Driving DIN with CML Outputs[1]

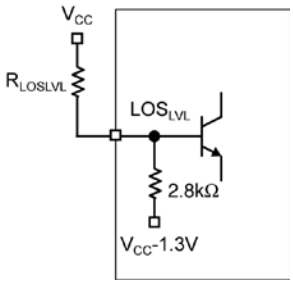


Figure 2c. LOSLVL Setting Circuit

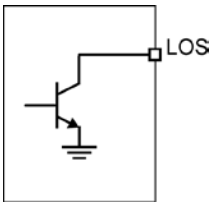
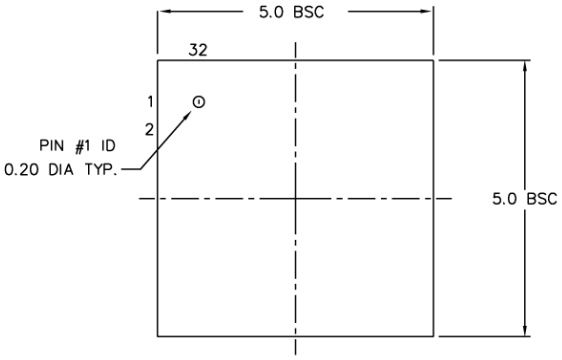


Figure 2d. LOS Output Structure

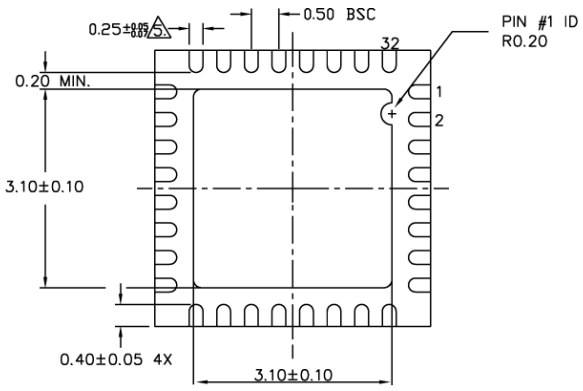
Note:

1. Applies for SY88232L only. For SY88232AL input terminations need to be added.

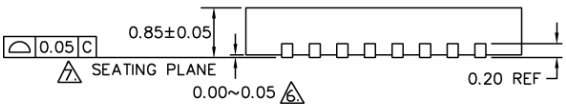
Package Information



TOP VIEW



BOTTOM VIEW



SIDE VIEW

NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. MAX. PACKAGE WARPAGE IS 0.05 mm.
3. MAXIMUM ALLOWABE BURRS IS 0.076 mm IN ALL DIRECTIONS.
4. PIN #1 ID ON TOP WILL BE LASER/INK MARKED.
5. DIMENSION APPLIES TO METALIZED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25 mm FROM TERMINAL TIP.
6. APPLIED ONLY FOR TERMINALS.
7. APPLIED FOR EXPOSED PAD AND TERMINALS.

32-Pin (5mm x 5mm) QFN

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA
TEL +1 (408) 944-0800 FAX +1 (408) 474-1000 WEB http://www.micrel.com

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