



# SY88422L

## 4.25Gbps Laser Driver with Integrated Bias

### General Description

The SY88422L is a single 3.3V supply, small form factor laser driver for telecom/datacom applications up to 4.25Gbps. The driver can deliver modulation current up to 90mA and a bias current up to 100mA.

Datasheets and support documentation can be found on Micrel's web site at: [www.micrel.com](http://www.micrel.com).

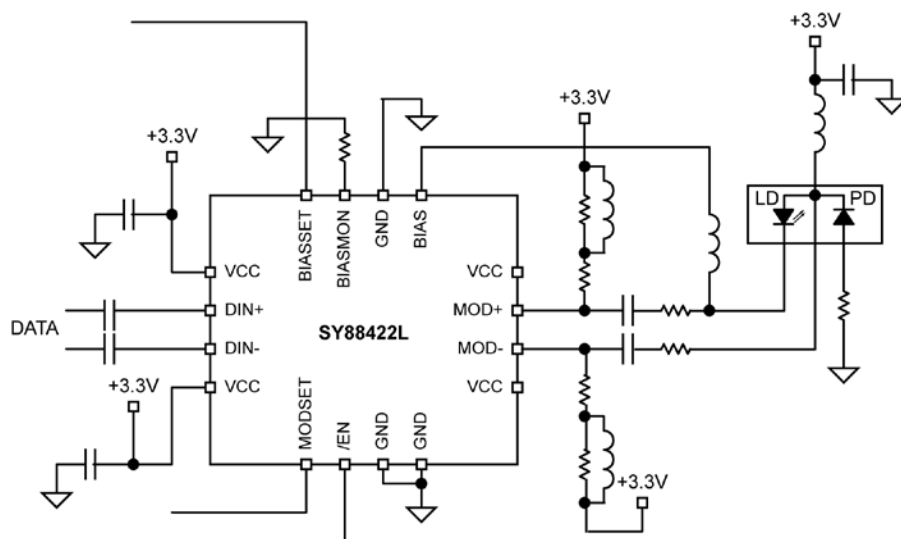
### Features

- 35mA power supply current typical
- Operation up to 4.25Gbps
- Modulation current up to 90mA
- Bias current up to 100mA
- Available in 16-pin small form factor (3mm x 3mm) QFN package

### Applications

- Multi-rate LAN, MAN applications up to 4.25Gbps: FC, GbE, SONET/SDH
- SFF, SFP, LX-4 Modules

### Typical Application



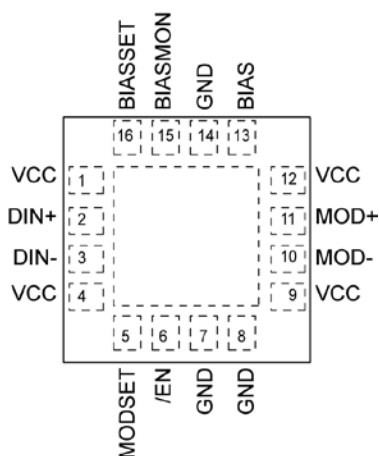
## Ordering Information<sup>(1)</sup>

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY88422LMG	QFN-16	Industrial	422L with Pb-Free bar-line indicator	NiPdAu Pb-Free
SY88422LMGTR <sup>(2)</sup>	QFN-16	Industrial	422L with Pb-Free bar-line indicator	NiPdAu Pb-Free

**Notes:**

1. Contact factory for die availability. Dice are guaranteed at  $T_A = +25^{\circ}\text{C}$ , DC Electricals only.
2. Tape and Reel.

## Pin Configuration



16-Pin QFN

## Pin Description

Pin Name	Pin Number	Pin Function
1, 4, 9, 12	VCC	Supply Voltage. Bypass with a 0.1 $\mu$ F//0.01 $\mu$ F low ESR capacitor as close to VCC pin as possible.
7, 8, 14	GND	Ground. Ground and exposed pad must be connected to the plane of the most negative potential.
2	DIN+	Non-inverting input data. Internally terminated with 50 $\Omega$ to a reference voltage.
3	DIN-	Inverting input data. Internally terminated with 50 $\Omega$ to a reference voltage.
5	MODSET	Modulation current setting and control. The voltage applied to this pin will set the modulation current. Input impedance 25k $\Omega$ .
6	/EN	Active Low TTL. The driver is disabled when this pin is unconnected or /EN asserted high. The driver is enabled when /EN is asserted low.
10	MOD-	Inverted modulation current output. Outputs modulation current when input data is negative.
11	MOD+	Non-inverted modulation current output. Outputs modulation current when input data is positive.
13	BIAS	BIAS Current Output
15	BIASMON	Bias monitor. Install an external resistor from this pin to GND to convert the output current to a voltage proportional to the bias current
16	BIASSET	Bias current setting. The voltage applied to this pin will set the bias current. Input impedance 25k $\Omega$ .

## Truth Table

DIN+	DIN-	/EN	MOD+ <sup>(1)</sup>	MOD-	Laser Output <sup>(2)</sup>
L	H	L	H	L	L
H	L	L	L	H	H
X	X	H or NC	H	L	L

### Notes:

1.  $I_{MOD} = 0$  when MOD+ = H.
2. Assuming that the laser cathode is tied to MOD+.

**Absolute Maximum Ratings<sup>(1)</sup>**

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

**Operating Ratings<sup>(2)</sup>**

Supply Voltage ( $V_{CC}$ )	+3.0V to +3.6V
Ambient Temperature ( $T_A$ )	-40°C to +85°C
Package Thermal Resistance <sup>(3)</sup>	
QFN	
( $\theta_{JA}$ ) Still-air	60°C/W
( $\psi_{JB}$ )	33°C/W

**DC Electrical Characteristics**

$T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$  and  $V_{CC} = +3.0V$  to  $+3.6V$ , unless otherwise noted. Typical values are  $V_{CC} = +3.3V$ ,  $T_A = 25^\circ\text{C}$ ,  $I_{MOD} = 30\text{mA}$ ,  $I_{BIAS} = 20\text{mA}$ .

Symbol	Parameter	Condition	Min	Typ	Max	Units
$I_{CC}$	Power Supply Current	Modulation currents excluded		35	56 <sup>(4)</sup>	mA
$V_{MOD\_C}$	Compliance Voltage		$V_{CC}-1.5$		$V_{CC}$	V
$V_{BIAS\_C}$	Compliance Voltage		$V_{CC}-2.3$		$V_{CC}$	V
$R_{IN(DATA)}$	Input Resistance at DIN+, DIN-, Single Ended		45	50	55	$\Omega$
$V_{DIFF\_IN(DIN)}$	Differential Input Voltage Swing		100		2400	mV <sub>pp</sub>
$V_{IL(/EN)}$	Input Low Voltage				0.8	V
$V_{IH(/EN)}$	Input High Voltage		2			V
$R_{IN(MODSET)}$	MODSET Input Resistance			25		k $\Omega$
$V_{MODSET}$	Voltage Range on MODSET Pin	$I_{MOD}$ range 10mA to 90mA			1.2	V
$R_{IN(BIASSET)}$	BIASSET Input Resistance			25		k $\Omega$
$V_{BIASSET}$	Voltage Range on BIASSET Pin	$I_{BIAS}$ range 10mA to 100mA			1.2	V

**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.  $\psi_{JB}$  uses a 4-layer and  $\theta_{JA}$  in still air unless otherwise stated.
4.  $I_{CC} = 56\text{mA}$  for worst-case conditions with  $I_{MOD} = 90\text{mA}$  and  $BIAS=100\text{mA}$ ,  $T_A = +85^\circ\text{C}$ ,  $V_{CC} = 3.6V$ .

## AC Electrical Characteristics

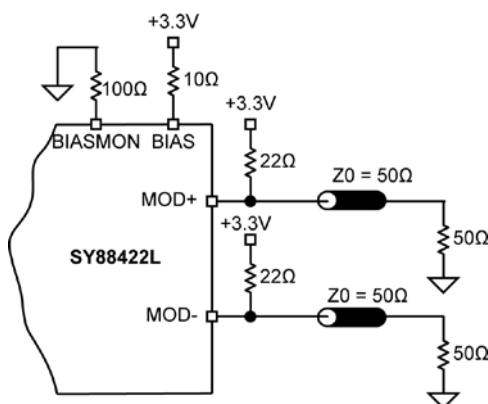
$T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and  $V_{CC} = +3.0\text{V}$  to  $+3.6\text{V}$ , unless otherwise noted. Typical values are  $V_{CC} = +3.3\text{V}$ ,  $T_A = 25^{\circ}\text{C}$ ,  $I_{MOD} = 30\text{mA}$ ,  $I_{BIAS} = 20\text{mA}$ .

Symbol	Parameter	Condition	Min	Typ	Max	Units
	Data Rate	NRZ	0.1		4.25	Gbps
$I_{MOD}$	Modulation Current <sup>(5)</sup>	Laser or equivalent load AC-coupled to the driver	10		90	mA
$I_{MOD\_OFF}$	Modulation OFF Current	Current at MOD+ and MOD- when the device is disabled			150	$\mu\text{A}$
$t_r$	Output Current Rise Time	20% to 80%, 15 $\Omega$ load		50	70	ps
$t_f$	Output Current Fall Time	20% to 80%, 15 $\Omega$ load		50	70	ps
	Total Jitter				20	ps <sub>PP</sub>
$I_{BIAS}$	Bias Current <sup>(5)</sup>		5		100	mA
$I_{Bias\_OFF}$	Bias OFF Current	Current at BIAS when the device is disabled			150	$\mu\text{A}$

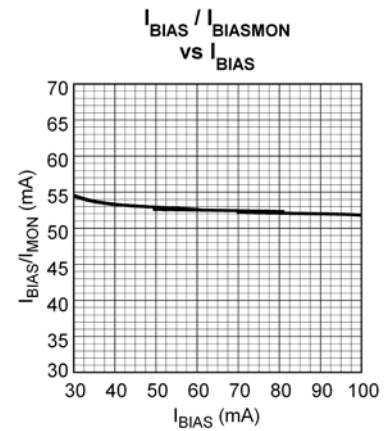
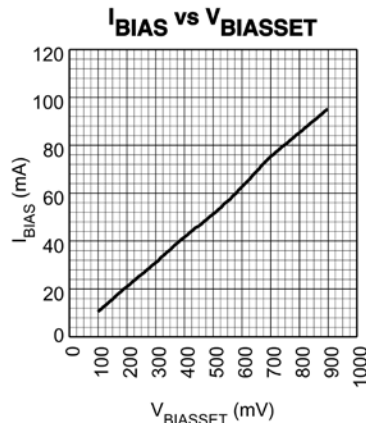
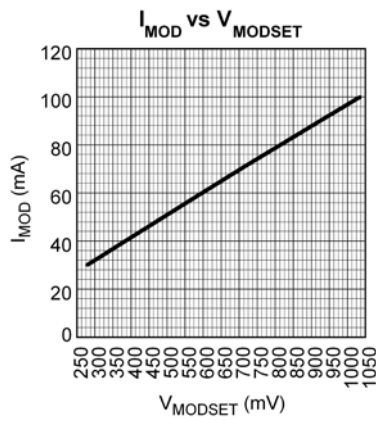
**Notes:**

5. Load = 15  $\Omega$ .

## Test Circuit

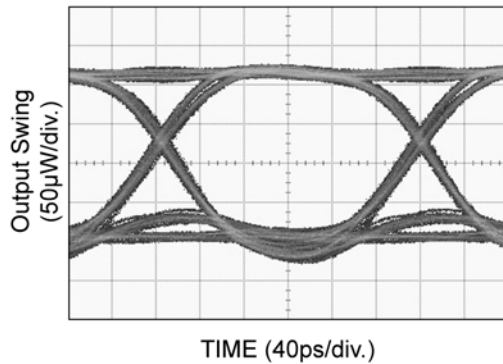


## Typical Characteristics

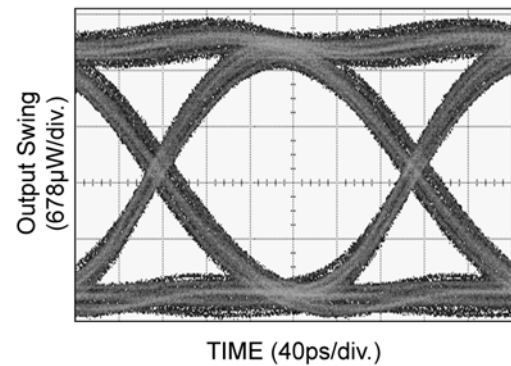


## Functional Characteristics

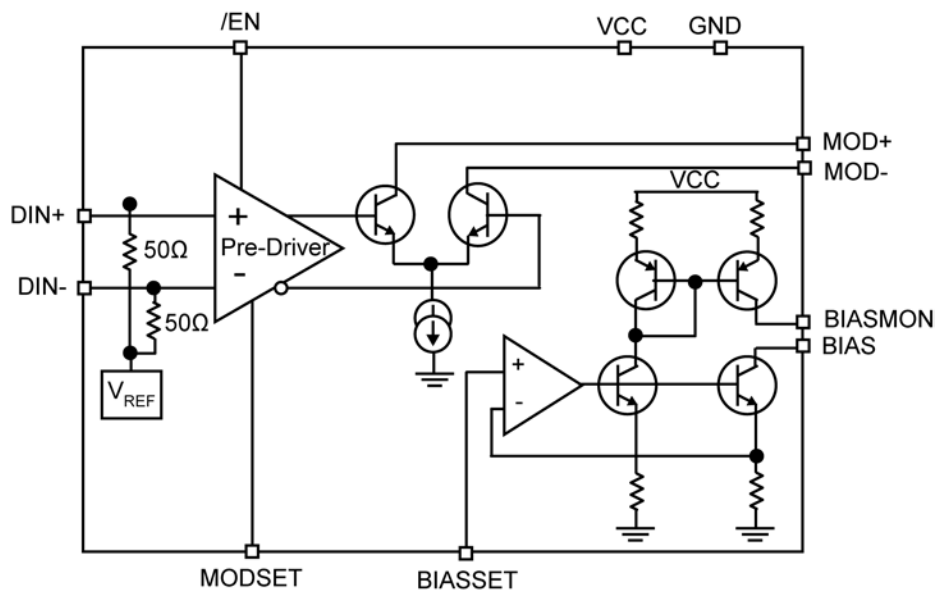
**Electrical Eye Diagram**  
4.25Gbps, PRBS 2<sup>23</sup>-1, 25Ω load,  
60mA Modulation



**Optical Eye Diagram**  
4.25Gbps, PRBS 2<sup>23</sup>-1



### Functional Block Diagram



## Input and Output Stages

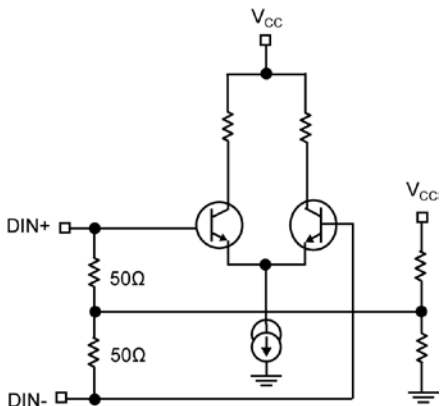


Figure 1a. Simplified Input Stage

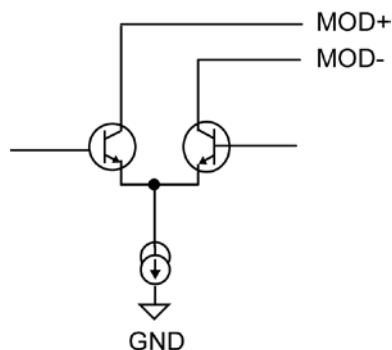


Figure 1b. Simplified Output Stage

## Interfacing the Input to Differential Logic Drivers

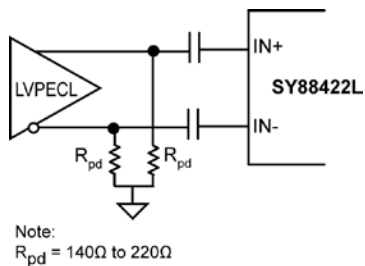


Figure 2a. AC-Coupling to LVPECL Driver

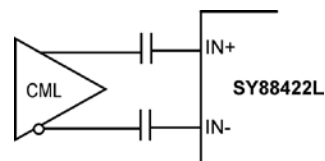
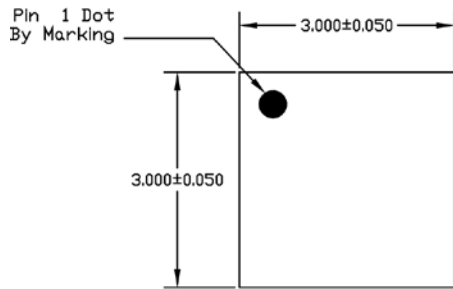


Figure 2b. AC-Coupling to CML Driver

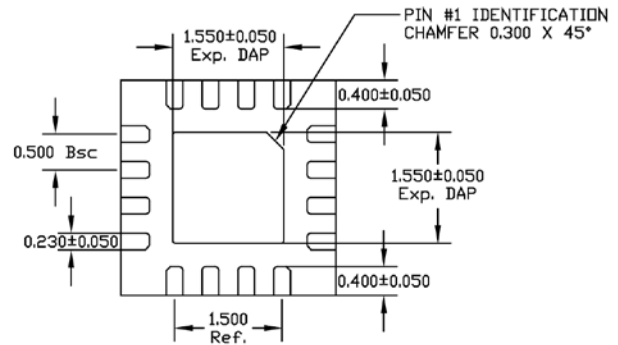




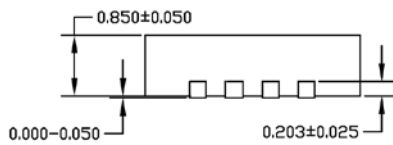
**Package Information**



TOP VIEW



BOTTOM VIEW



SIDE VIEW

**NOTE:**

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. MAX. PACKAGE WARPAGE IS 0.05 mm.
3. MAXIMUM ALLOWABLE BURRS IS 0.076 mm IN ALL DIRECTIONS.
4. PIN #1 ID ON TOP WILL BE LASER/INK MARKED.

**16-Pin QFN**

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