



SY88782L

3.3V, 1.25Gbps High Current, Low Power Laser Driver for Datacom Telecom Applications

General Description

The SY88782L is a single supply 3.3V low power consumption, small form factor, driver for telecom/datacom applications using FP/DFB lasers at data rates up to 1.25Gbps. The driver can deliver modulation current up to 90mA, and the high compliance voltage it offers makes the part suitable for high-current operation (with the laser AC- or DC-coupled to it.) This device is intended to be used with Micrel MIC3000/1 Optical Transceiver Management IC which allows for modulation and bias currents control and monitoring, automatic power Control, and temperature compensation.

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

Features

- 2.3V minimum laser compliance voltage
- 44mA power supply current typical
- Operation up to 1.25Gbps
- Modulation current up to 90mA
- Designed for use with the MIC3000/1
- Small form factor 3mm x 3mm MLF™ package

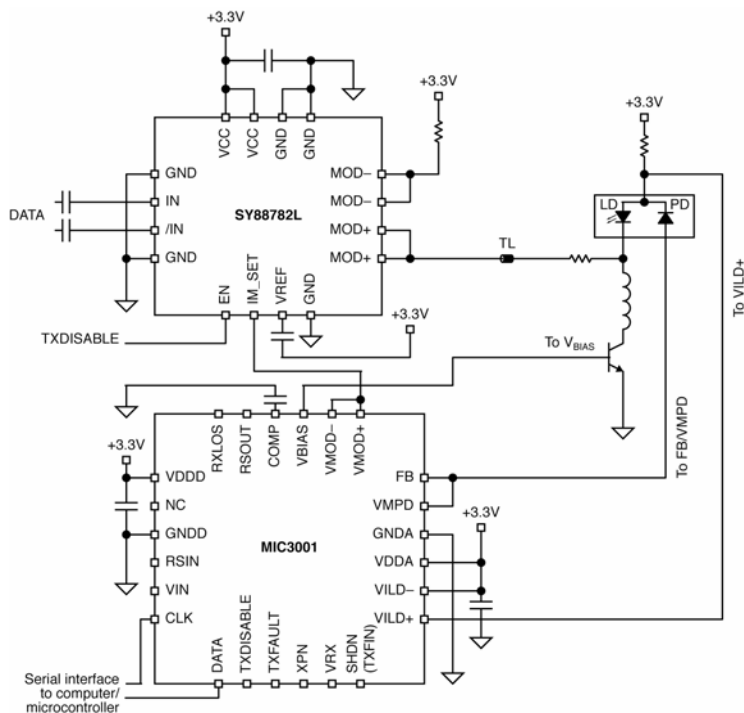
Applications

- Multi-rate LAN, MAN applications up to 1.25Gbps: Ethernet, SONET OC3/12/24 and SDH STM1/4/8
- SFF, SFP Modules

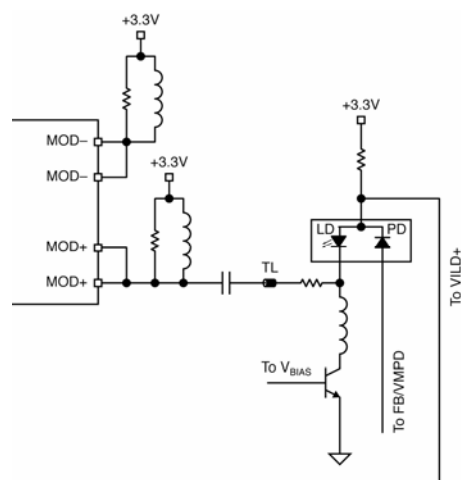
Markets

- Telecom, Datacom

Typical Application



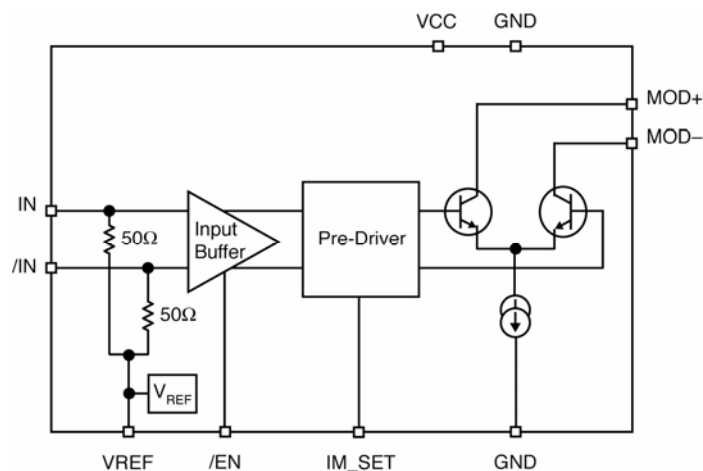
Laser DC-Coupled to the Driver



Laser AC-Coupled to the Driver

MicroLeadFrame is a trademark of Amkor Technology, Inc.

Functional Block Diagram



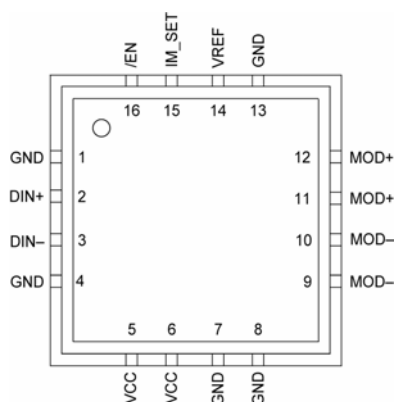
Ordering Information⁽¹⁾

| Part Number | Package Type | Operating Range | Package Marking | Lead Finish |
|-----------------------------|--------------|-----------------|--------------------------------------|----------------|
| SY88782LMG | MLF-16 | Industrial | 782L with Pb-Free bar-line indicator | NiPdAu Pb-Free |
| SY88782LMGTR ⁽²⁾ | MLF-16 | Industrial | 782L 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 MLFTM (MLF-16)

Pin Description

| Pin Name | Pin Number | Pin Function |
|----------------|------------|---|
| 1, 4, 7, 8, 13 | 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 50Ω to a reference voltage. |
| 3 | DIN- | Inverting input data. Internally terminated with 50Ω to a reference voltage. |
| 5, 6 | VCC | Supply Voltage. Bypass with a 0.1μF//0.01μF low ESR capacitor as close to VCC pin as possible. |
| 9, 10 | MOD- | Inverted modulation current output. Outputs modulation current when input data is negative. |
| 11, 12 | MOD+ | Non-inverted modulation current output. Outputs modulation current when input data is positive. |
| 14 | VREF | Reference Voltage. Install a 0.1μF capacitor between VREF and VCC. |
| 15 | IM_SET | Modulation current setting and control. The voltage applied to this pin will set the modulation current. To be connected to the MIC3000/1 pin 24 (VMOD+). Input impedance 25KΩ. |
| 16 | /EN | A low level signal on this pin will enable the output stage of the driver. Internally pulled down with 75KΩ. |

Truth Table

| DIN+ | DIN- | /EN | MOD+ ⁽¹⁾ | MOD- | Laser Output ⁽²⁾ |
|------|------|-----|---------------------|------|-----------------------------|
| L | H | L | H | L | L |
| H | L | L | L | H | H |
| X | X | H | H | L | L |

Notes:

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

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⁾
 MLF™
 (θ_{JA}) Still-air 60°C/W
 (ψ_{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 $V_{CC} = +3.3V$, $T_A = 25^\circ\text{C}$, $I_{MOD} = 60\text{mA}$.

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|------------------------|---|------------------------------|-----|-----|-------------------|------------------|
| I_{CC} | Power Supply Current | Modulation currents excluded | | 44 | 60 ⁽⁴⁾ | mA |
| V_{MOD_MIN} | Minimum Voltage Required at the Driver Output (headroom) for Proper Operation | | 0.7 | | | V |
| $R_{IN(DATA)}$ | Input Resistance (DIN+, DIN-) | | 45 | 50 | 55 | Ω |
| V_{ID} | Differential Input Voltage Swing | | 200 | | 2400 | mV _{pp} |
| /EN Low | | | | | 0.8 | V |
| /EN High | | | 2 | | | V |
| $R_{IN(I_{MOD_SET})}$ | I_{MOD_SET} Input Resistance | | | 25 | | k Ω |
| V_{IM_SET} | Voltage Range on I_{MOD_SET} Pin | I_{MOD} range 10mA to 90mA | | | 1.2 | V |

AC Electrical Characteristics

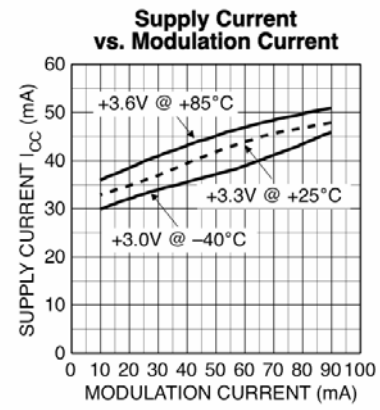
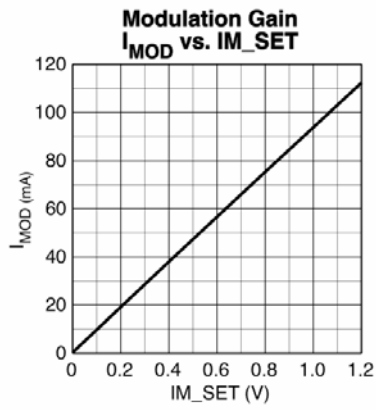
$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ and $V_{CC} = +3.0V$ to $+3.6V$, unless otherwise noted. Typical values are $V_{CC} = +3.3V$, $T_A = 25^\circ\text{C}$, $I_{MOD} = 60\text{mA}$.

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|----------------|-----------------------------------|---|------|-----|-------------------|------------------|
| | Data Rate | NRZ | 0.05 | | 1.25 | Gbps |
| I_{MOD} | Modulation Current ⁽⁵⁾ | AC-coupled | 10 | | 90 | mA |
| | | DC-coupled | 10 | | 70 ⁽⁶⁾ | mA |
| I_{MOD_OFF} | Modulation OFF Current | Current at MOD+ when the device is disabled | | | 750 | μA |
| t_r | Output Current Rise Time | 20% to 80%, $I_{MOD} = 60\text{mA}$ | | 80 | | ps |
| t_f | Output Current Fall Time | 20% to 80%, $I_{MOD} = 60\text{mA}$ | | 80 | | ps |
| | Total Jitter | @1.25Gbps data rate | | | 20 | ps _{pp} |
| | Pulse-Width Distortion | | | | 20 | ps |

Notes:

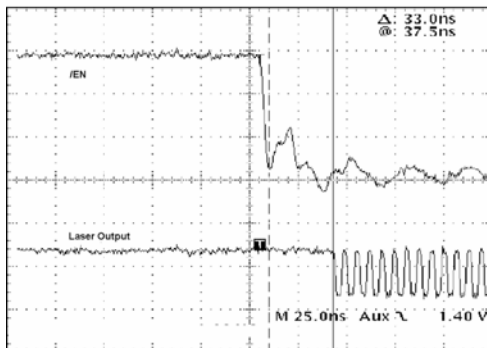
1. Permanent device damage may occur if absolute maximum ratings are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to absolute maximum ratings conditions for extended periods 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. ψ_{JB} uses a 4-layer and θ_{JA} in still air unless otherwise stated.
4. $I_{CC} = 60\text{mA}$ for worst-case conditions with $I_{MOD} = 90\text{mA}$, $T_A = +85^\circ\text{C}$, $V_{CC} = 3.6V$.
5. Load = 15 Ω .
6. Assuming $V_{CC} = 3.0V$, Laser bandgap voltage = 1V, laser package inductance = 1nH, laser equivalent series resistor = 5 Ω , and damping resistor = 10 Ω .

Typical Operating Characteristics

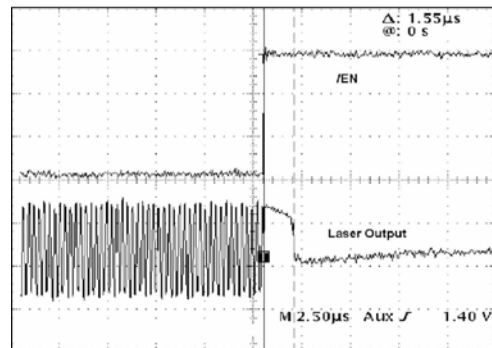


Functional Characteristics

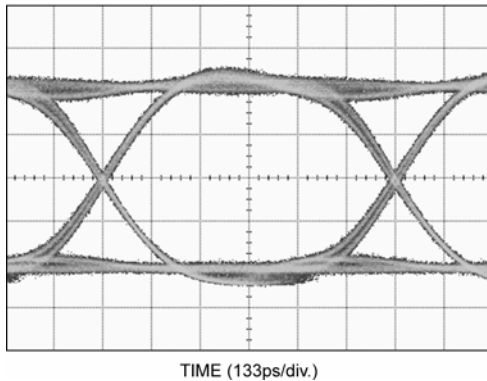
Transmitter Enable Time



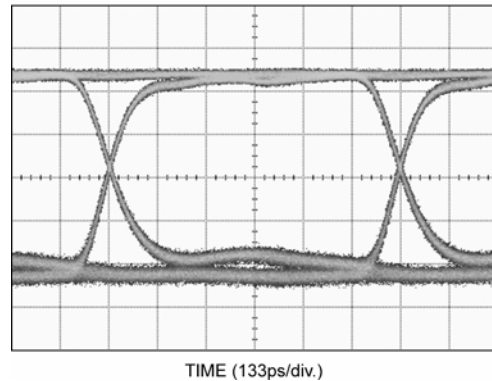
Transmitter Disable Time



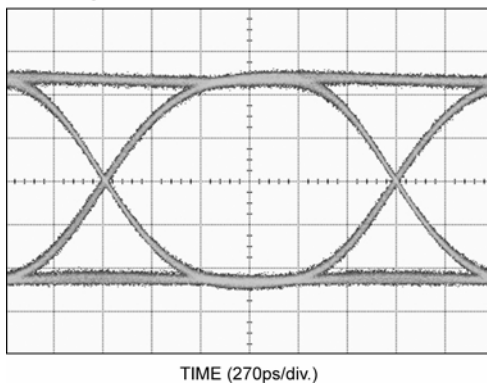
Optical Eye Diagram
1.25Gbps PRBS $2^{23}-1$, ER = 14dB, OC-48 Filter



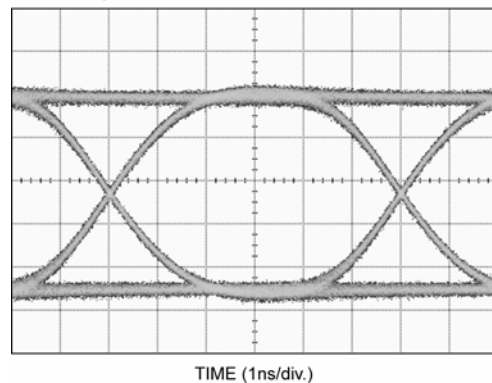
Electrical Eye Diagram
1.25Gbps PRBS $2^{23}-1$, Load = 15Ω



Optical Eye Diagram
622Mbps PRBS $2^{23}-1$, ER = 13dB, OC-12 Filter



Electrical Eye Diagram
155Mbps PRBS $2^{23}-1$, ER = 14dB, OC-3 Filter



Input and Output Stages

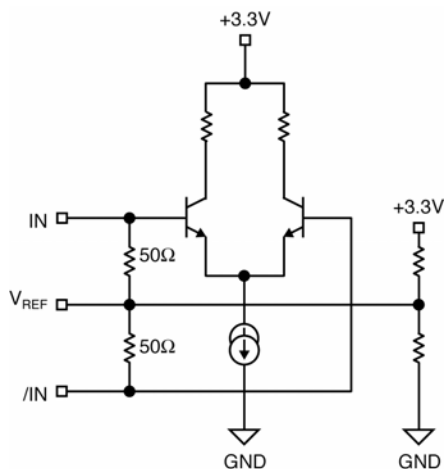


Figure 1a. Simplified Input Stage

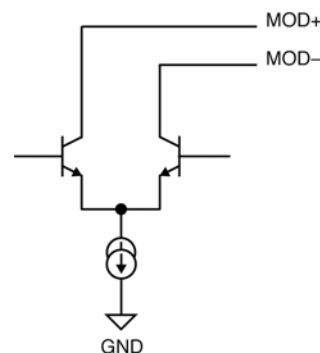


Figure 1b. Simplified Output Stage

Interface the Input to Different Logic Drivers

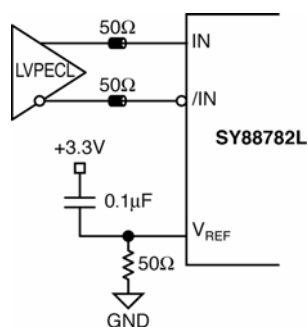


Figure 2a. DC-Coupling to LVPECL Driver

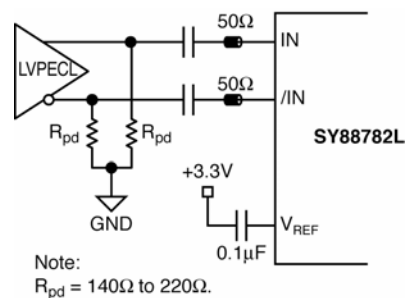


Figure 2b. AC-Coupling to LVPECL Driver

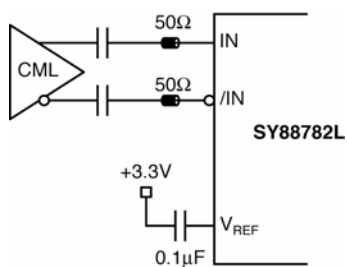


Figure 2c. AC-Coupling to CML Driver

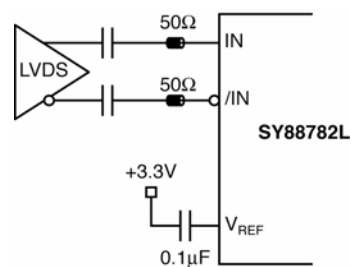
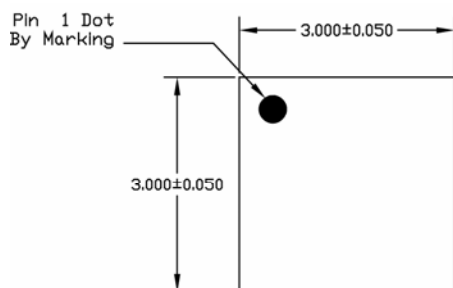
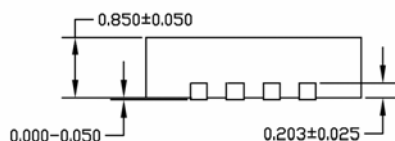


Figure 2d. AC-Coupling to LVDS Driver

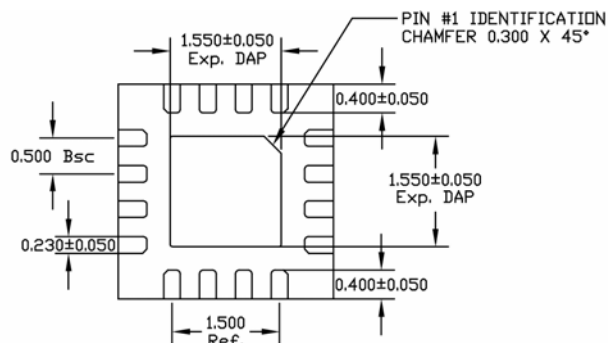
16 LEAD (3mmx3mm) *MicroLEADFRAME*[™] (MLF-16)



TOP VIEW



SIDE VIEW



BOTTOM 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.

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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