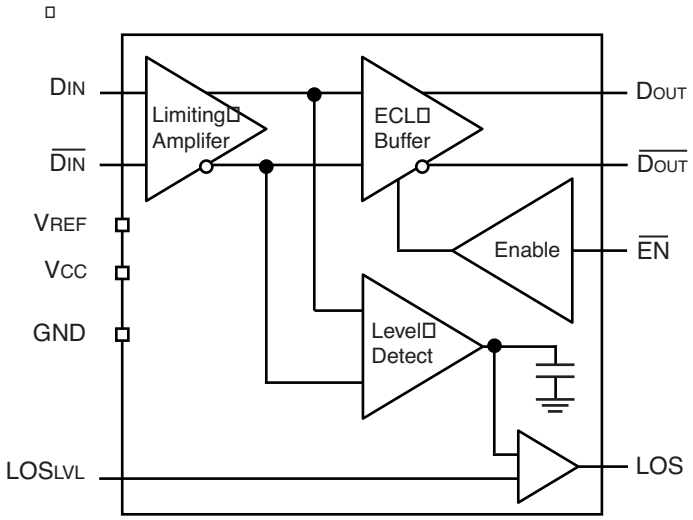
## FEATURES

- 3.3V and 5V power supply option
- Up to 1.25Gbps operation
- Low noise
- Chatter-free LOS generation
- Open collector TTL LOS output
- TTL /EN Input
- Differential PECL inputs for data
- Single power supply
- Designed for use with laser diode driver and controller
- Available in a tiny 10-pin (3mm × 3mm) MSOP

## APPLICATIONS

- 1.25Gbps Gigabit Ethernet
- 531Mbps and 1062Mbps Fibre Channel
- 622Mbps SONET
- Gigabit Interface Converter

## BLOCK DIAGRAM




## DESCRIPTION

The SY88903V limiting post amplifier with its high gain and wide bandwidth is ideal for use as a post amplifier in fiber optic receivers with data rates up to 1.25Gbps. Signals as small as $5mV_{pp}$ can be amplified to drive devices with PECL inputs. The SY88903V generates a chatter-free, Loss--of-Signal (LOS), open-collector TTL output.

The SY88903V is an integrated limiting amplifier intended for high-frequency fiber optic applications. The circuit connects to typical transimpedance amplifiers found within a fiber optics link. The linear signal output from a transimpedance amplifier can contain significant amounts of noise, and may vary in amplitude over time. The SY88903V limiting amplifier quantizes the signal and outputs a voltage-limited waveform.

The /EN pin allows the user to disable the output signal without removing the input signal.

The SY88903V incorporates a programmable level detect function to identify when the input signal has been lost. This information can be fed back to the /EN input of the device to maintain stability under loss of signal condition. The sensitivity of the level detection can be adjusted using $LOS_{LVL}$. The $LOS_{LVL}$ voltage can be set by connecting a resistor divider between $V_{CC}$ and $V_{REF}$ as shown in Figure 3. "Typical Characteristics" show the relationship between input level sensitivity and the voltage set on $LOS_{LVL}$.

The LOS output is a TTL open-collector output that requires a pull-up resistor for proper operation, Figure 1.

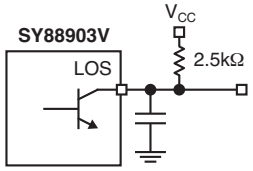
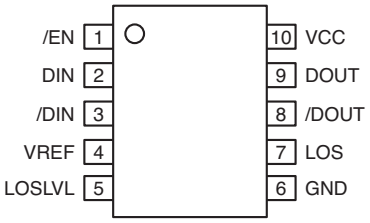



**Figure 1. LOS Output with Desired Rise Time**

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

## PACKAGE/ORDERING INFORMATION




**10-Pin MSOP (K10-1)**

### Ordering Information[1]

| Part Number | Package Type | Operating Range | Package Marking | Lead Finish |
|---|---|---|---|---|
| SY88903VKC | K10-1 | Commercial | 903V with Pb-free bar-line indicator | Sn-Pb |
| SY88903VKCTR[2] | K10-1 | Commercial | 903V with Pb-free bar-line indicator | Sn-Pb |
| SY88903VKG | K10-1 | Industrial | 903V with Pb-free bar-line indicator | NiPdAu Pb-Free |
| SY88903VKGTR[2] | K10-1 | Industrial | 903V with Pb-free bar-line indicator | NiPdAu Pb-Free |

**Notes:**

1. Contact factory for die availability. Die is guaranteed at $T_A = 25°C$, DC electricals only.
2. Tape and Reel.

## PIN DESCRIPTION

| Pin Number | Pin Name | Type | Pin Function |
|---|---|---|---|
| 1 | EN | TTL Input | Output Enable (Active Low). |
| 2 | DIN | Data Input | Data Input. |
| 3 | /DIN | Data Input | Inverting Data Input. |
| 4 | VREF | Output | Reference Voltage Output for LOS Level Set (see Figure 3). |
| 5 | LOSLVL | Input | LOS Limit Set. |
| 6 | GND | Ground | Ground |
| 7 | LOS | TTL Output (Open Collector) | Loss-of-Signal Indicator (Active Low). |
| 8 | /DOUT | PECL Output | Inverting Data Output. |
| 9 | DOUT | PECL Output | Data Output. |
| 10 | VCC | Power Supply | Positive Power Supply. |

## Absolute Maximum Ratings[1]

Supply Voltage ($V_{CC}$) ..... 0V to +7.0V
Input Voltage ($D_{IN}$, /$D_{IN}$, /EN, $LOS_{LVL}$) ..... 0V to $V_{CC}$
Output Voltage
($D_{OUT}$, /$D_{OUT}$) with 50Ω Load ... $V_{CC}$ –2.5V to $V_{CC}$ +0.3V
(VREF) ..... $V_{CC}$ –2.0V to $V_{CC}$
Lead Temperature (soldering, 20 sec.) ..... 260°C
Maximum Operating Junction Temperature ($T_J$) ..... +125°C
Storage Temperature ($T_S$) ..... –55°C to +125°C

## Operating Ratings[2]

Supply Voltage ($V_{IN}$) ..... +2.97V to +5.5V
Ambient Temperature ($T_A$) ..... –40°C to +85°C
Package Thermal Resistance
MSOP ($\theta_{JA}$) Still-air ..... 113°C/W

## DC ELECTRICAL CHARACTERISTICS

$V_{CC}$ = +5V ±10% or +3.3V ±10%; $R_{LOAD}$ = 50Ω to $V_{CC}$ –2V; $T_A$ = –40°C to +85°C; unless noted.

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Power Supply Current | No output load | | 30 | 42 | mA |
| $I_{IL}$ | /EN Input LOW Current | $V_{IN}$ = 0.5V | –0.3 | | | mA |
| $I_{IH}$ | /EN Input HIGH Current | $V_{IN}$ = 2.7V<br>$V_{IN}$ = VCC | | | 20<br>100 | µA |
| $V_{CMR}$ | Common Mode Range | | GND +2.0 | | $V_{CC}$ | V |
| $V_{offset}$ | Differential Output Offset | | | | ±100 | mV |
| $LOS_{LVL}$ | LOSLVL Level | | $V_{REF}$ | | $V_{CC}$ | V |
| $V_{OL}$ | LOS Output Low Level | $I_{OL}$ = +2mA | | | 0.5 | V |
| $I_{OH}$ | LOS Output Leakage | $V_{OH}$ = 5.5V | | | 250 | µA |
| $V_{OH}$ | DOUT and /DOUT HIGH Output | | $V_{CC}$ –1085 | $V_{CC}$ –955 | $V_{CC}$ –880 | mV |
| $V_{OL}$ | DOUT and /DOUT LOW Output | | $V_{CC}$ –1830 | $V_{CC}$ –1705 | $V_{CC}$ –1620 | mV |
| $V_{REF}$ | Reference Supply | | $V_{CC}$ –1.38 | $V_{CC}$ –1.32 | $V_{CC}$ –1.26 | V |
| $I_{REF}$ | VREF Output Current | | –0.8 | | 0.5 | mA |
| $V_{IH}$ | /EN Input HIGH Voltage | | 2.0 | | | V |
| $V_{IL}$ | /EN Input LOW Voltage | | | | 0.8 | 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.

## AC ELECTRICAL CHARACTERISTICS

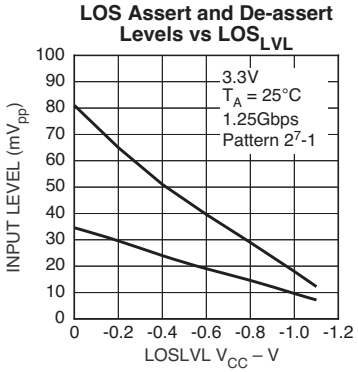
$V_{CC}$ = +5V ±10% or +3.3V ±10%; $R_{LOAD}$ = 50Ω to $V_{CC}$ –2V; $T_A$ = –40°C to +85°C; unless noted.

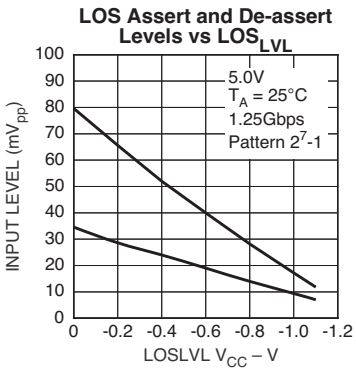
| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| PSRR | Power Supply[3] Rejection Ratio | Input referred, 55MHz | | 35 | | dB |
| $V_{ID}$ | Input Voltage Range | | 5 | | 1800 | $mV_{pp}$ |
| $t_r$, $t_f$ | Output Rise/Fall Time | $V_{ID} > 100mV_{pp}$<br>$V_{ID} < 100mV_{pp}$ | | <br>trin,tfin | 260 | ps |
| $V_{OD}$ | Differential Output Voltage Swing[4] | $V_{ID} = 15mV_{pp}$<br>$V_{ID} = 5mV_{pp}$ | | 600<br>200 | | mV<br>mV |
| $t_{OFFL}$ | LOS Release Time[5] Minimum Input | | | 0.1 | 0.5 | µs |
| $t_{OFFH}$ | LOS Release Time[6] Maximum Input | | | 0.1 | 0.5 | µs |
| $t_{ONL}$ | LOS Assert Time[5] | | | 0.2 | 0.5 | µs |
| VSR | LOS Sensitivity Range | $2^{23}$–1 pattern | 5 | | 50 | $mV_{pp}$ |
| HYS | LOS Hysteresis | $2^{23}$–1 pattern | 2 | 4.6 | 8 | dB |

**Notes:**

3. Input referred noise = RMS output noise/low frequency gain.
4. Input is a 622MHz square wave.
5. Input is a 200MHz square wave, $t_r$ < 300ps, $8mV_{pp}$.
6. Input is a 200MHz square wave, $t_r$ < 300ps, $1.8V_{pp}$.

## TYPICAL CHARACTERISTICS



## DESIGN PROCEDURE

### Output Termination

The SY88903V outputs must be terminated with a 50Ω load to $V_{CC}$ –2V (or Thevenin equivalent).

### Layout and PCB Design

Since the SY88903V is a high-frequency component, performance can largely be determined by board layout and design. A common problem with high-gain amplifiers is feedback from the large swing outputs to the input via the power supply.

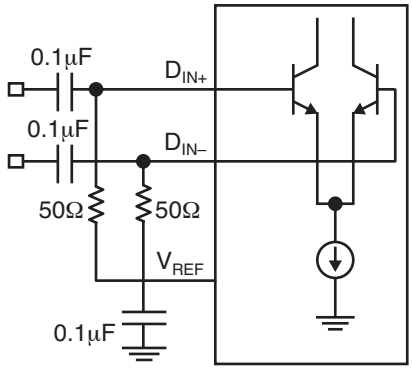
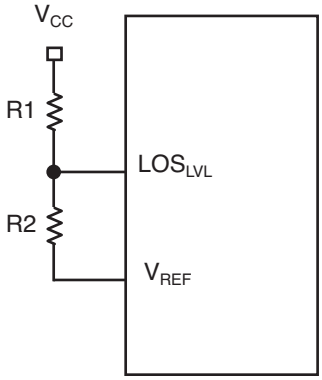



**Figure 2. Differential Input Configuration**

The SY88903V ground pin should be connected to the circuit board ground. Use multiple PCB vias close to the part to connect to ground. Avoid long, inductive runs which can degrade performance.



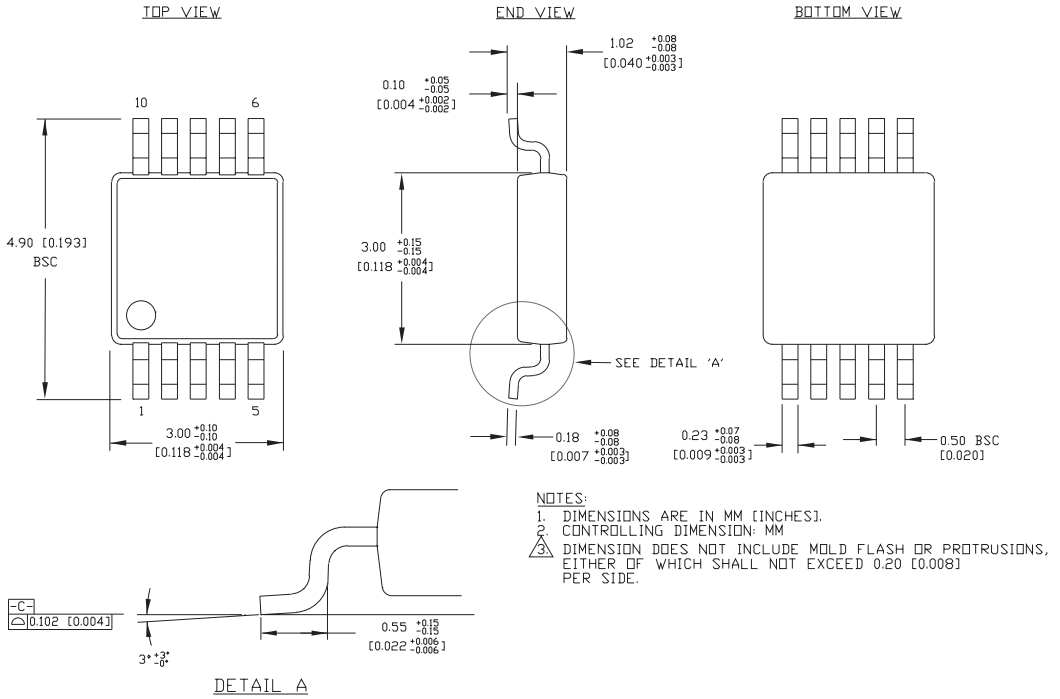

**Notes:**

$LOS_{LVS} = V_{CC} - 1.32V + \frac{R2 \times 1.32V}{R1 + R2}$

$R1 + R2 \geq 2.6k\Omega$

**Figure 3. LOSLVL Circut**

## 10-PIN MSOP (K10-1)




Rev. 00

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