



# 5V/3.3V 1.25Gbps HIGH-SPEED LIMITING POST AMPLIFIER

SY88903V

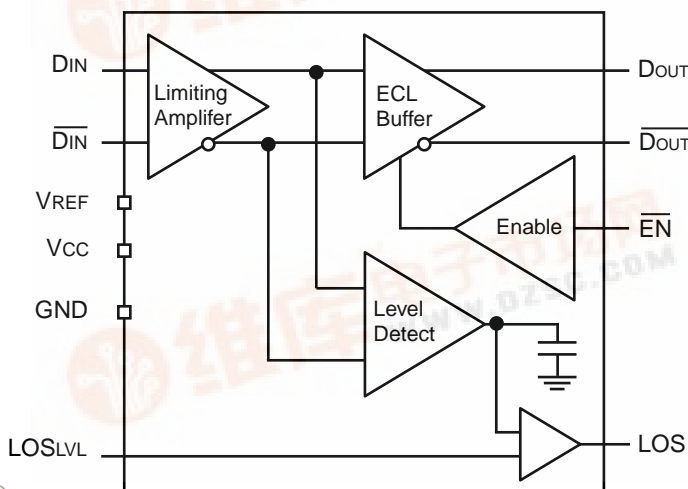
## FEATURES

- 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<sub>pp</sub> 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<sub>LVL</sub>. The LOS<sub>LVL</sub> voltage can be set by connecting a resistor divider between V<sub>CC</sub> and V<sub>REF</sub> as shown in Figure 3. "Typical Characteristics" show the relationship between input level sensitivity and the voltage set on LOS<sub>LVL</sub>.

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

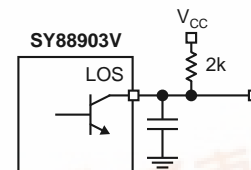
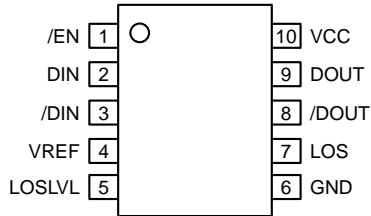


Figure 1. LOS Output with Desired Rise Time

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



## PACKAGE/ORDERING INFORMATION



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

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

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY88903VKC	K10-1	Commercial	903V with Pb-free bar-line indicator	Sn-Pb
SY88903VKCTR <sup>(2)</sup>	K10-1	Commercial	903V with Pb-free bar-line indicator	Sn-Pb
SY88903VKG	K10-1	Industrial	903V with Pb-free bar-line indicator	NiPdAu
SY88903VKGTR <sup>(2)</sup>	K10-1	Industrial	903V with Pb-free bar-line indicator	NiPdAu

**Notes:**

- Contact factory for die availability. Die is guaranteed at  $T_A = 25^\circ\text{C}$ , DC electricals only.
- 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<sup>(1)</sup>

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, 10 sec.) ..... 270°C  
 Storage Temperature ( $T_S$ ) ..... -55°C to +125°C

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

Supply Voltage ( $V_{IN}$ ) ..... +xxV to +xxV  
 Ambient Temperature ( $T_A$ ) ..... -40°C to +85°C  
 Package Thermal Resistance  
     MSOP ( $\theta_{JA}$ ) ..... xx°C/W

## DC ELECTRICAL CHARACTERISTICS

$V_{CC} = +5V \pm 10\%$  or  $+3.3V \pm 10\%$ ;  $R_{LOAD} = 50\Omega$  to  $V_{CC} - 2V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ ; 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	$V_{IN} = 2.7V$ $V_{IN} = V_{CC}$			20 100	$\mu A$
$V_{CMR}$	Common Mode Range		GND +2.0		$V_{CC}$	V
$V_{offset}$	Differential Output Offset				$\pm 100$	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	$\mu A$
$V_{OH}$	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

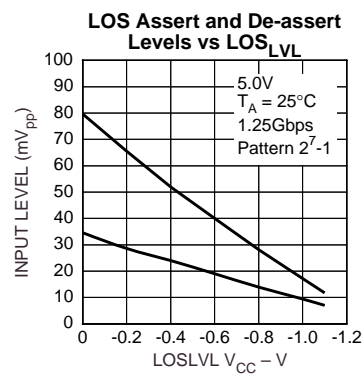
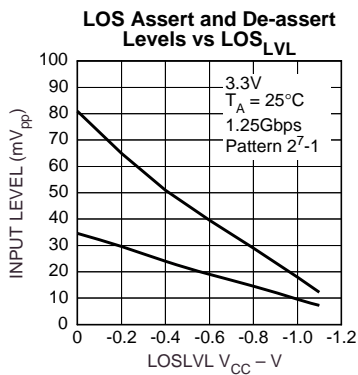
$V_{CC} = +5V \pm 10\%$  or  $+3.3V \pm 10\%$ ;  $R_{LOAD} = 50\Omega$  to  $V_{CC} - 2V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ ; unless noted.

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

**Notes:**

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

## TYPICAL CHARACTERISTICS



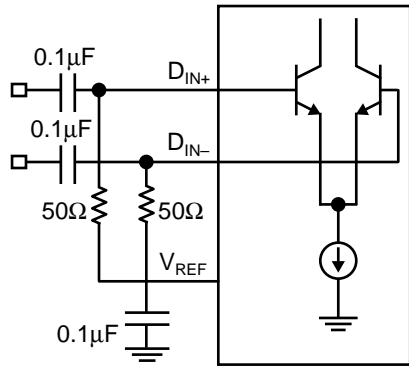
**DESIGN PROCEDURE**

**Output Termination**

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

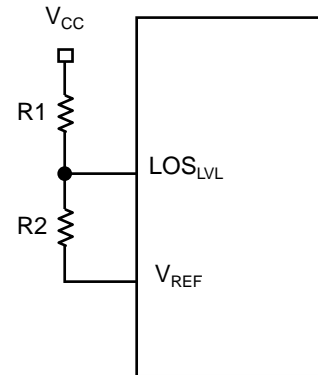
**Layout and PCB Design**

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.



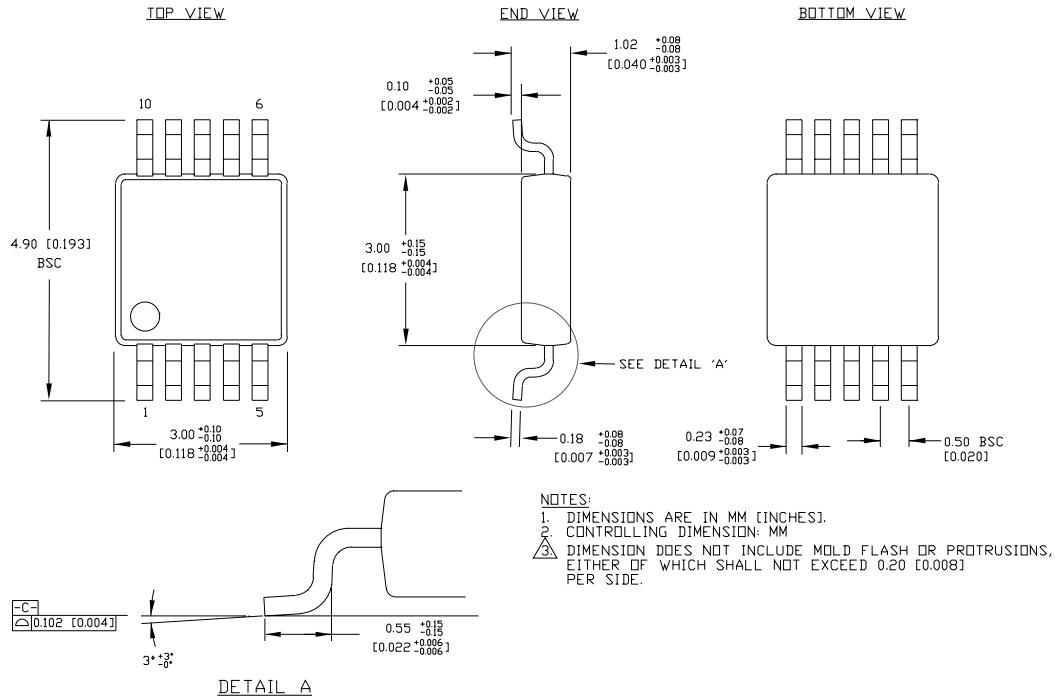
**Notes:**  

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

$$R1 + R2 \geq 2.6k\Omega$$

**Figure 3. LOSLVL Circuit**

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



Rev. 00

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