



## SY897132L

1.5Gbps Link Replicator for Fibre Channel,  
Gigabit Ethernet, HDTV and SATA

### General Description

The SY897132L is a Link Replicator which provides both serial loop replication as well as serial loopback control functions. It is high performance and works up to 1.5Gbps on 3.3V power supplies. The SY897132L is ideal for Fibre Channel, Gigabit Ethernet, HDTV and SATA applications. Other applications include internal/external connection routing in Host Bus Adaptors as well as hot-pluggable links between switch cards.

The IN input is sent to both OUT0 and OUT1, which are enabled when OE0 and OE1 are HIGH and disabled when they are LOW. When the outputs are disabled, both differential outputs go HIGH and the buffers are turned off to save power.

MUX0 controls whether IN or IN1 is sent to OUT0. Similarly, MUX1 controls whether IN or IN1 is sent to OUT1. MUX selects whether IN0 or IN1 is sent to OUT.

The SY897132L operates on 3.3V  $\pm 5\%$  power supplies and is guaranteed over the full industrial temperature range ( $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ). The SY897132L is part of Micrel's high-speed, Precision Edge<sup>®</sup> product line.

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



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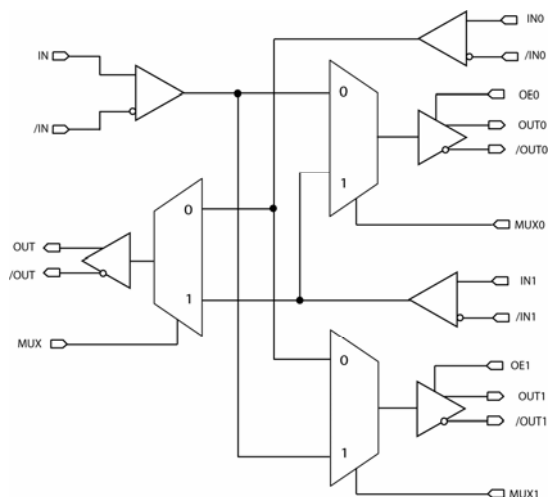
### Features

- Serial loop replication
- No external components required
- T11 Fibre Channel compliant at 1.0625Gbps
- IEEE802.3z Gigabit Ethernet compliant at 1.25Gbps
- SMPTE-292M compliant at 1.485Gbps
- Operates with 3.3V  $\pm 5\%$
- Industrial temperature range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Available in 28-pin TSSOP package

### Applications

- Link Replicator for: Fibre Channel, Gigabit Ethernet, HDTV and SATA
- For line cards to provide redundant, hot-swappable links to redundant switch fabric cards
- For host bus adapter boards for routing between internal and external connectors

### Functional Block Diagram



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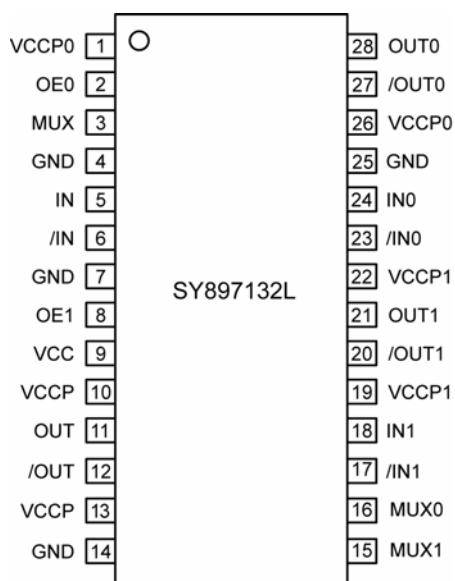
## Ordering Information<sup>(1)</sup>

| Part Number                  | Package Type | Operating Range | Package Marking                       | Lead Finish    |
|------------------------------|--------------|-----------------|---------------------------------------|----------------|
| SY897132LKG                  | K-28         | Industrial      | 7132L with Pb-Free bar-line indicator | NiPdAu Pb-Free |
| SY897132LKGTR <sup>(2)</sup> | K-28         | Industrial      | 7132L 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



28-Pin TSSOP (K-28)

## Pin Description

| Pin Number                | Pin Name                                | Pin Function                                                                                                                                                           |
|---------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5, 6<br>24, 23<br>18, 17  | IN, /IN<br>IN0, /IN0<br>IN1, /IN1       | Differential Input Pairs: The inputs are internally biased to 1.2V.                                                                                                    |
| 11,12<br>28,27<br>21,20   | OUT, /OUT<br>OUT0, /OUT0<br>OUT1, /OUT1 | LVPECL Differential Output Pairs.                                                                                                                                      |
| 2<br>8                    | OE0<br>OE1                              | Output Enable (TTL Inputs): OEx pins enable OUTx pins when HIGH. When OEx is LOW, OUTx are powered down and both OUT and /OUT go HIGH.                                 |
| 3                         | MUX                                     | Source Select for OUT (TTL Input): Selects either IN0 (LOW) or IN1 (HIGH); defaults HIGH when left open.                                                               |
| 16                        | MUX0                                    | Source Select for OUT0 (TTL Input): Selects either IN (LOW) or IN1 (HIGH); defaults HIGH when left open.                                                               |
| 15                        | MUX1                                    | Source Select for OUT1 (TTL Input): Selects either IN (HIGH) or IN0 (LOW); defaults HIGH when left open.                                                               |
| 9                         | VCC                                     | Positive Power Supply: Bypass with 0.1 $\mu$ F//0.01 $\mu$ F low ESR capacitors as close to the V <sub>CC</sub> pin as possible. Supplies input and core circuitry.    |
| 10, 13<br>1, 26<br>19, 22 | VCCP<br>VCCP0<br>VCCP1                  | Positive Output Power Supply: Bypass with 0.1 $\mu$ F//0.01 $\mu$ F low ESR capacitors as close to the VCCPx pins as possible. Supplies the respective output buffers. |
| 4, 7, 14, 25              | GND,<br>Exposed pad                     | Ground: Exposed pad must be connected to a ground plane that is the same potential as the ground pins.                                                                 |

## Input/Output Truth Table

| MUX Setting |      | OUT & /OUT | OUT0 & /OUT0 | OUT1 & /OUT1 |
|-------------|------|------------|--------------|--------------|
| MUX         | Low  | IN0 & /IN0 | -            | -            |
|             | High | IN1 & /IN1 | -            | -            |
| MUX0        | Low  | -          | IN & /IN     | -            |
|             | High | -          | IN1 & /IN1   | -            |
| MUX1        | Low  | -          | -            | IN0 & /IN0   |
|             | High | -          | -            | IN & /IN     |

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

Supply Voltage ( $V_{CC}$ ) ..... 0.5V to +4.0V  
 Input Voltage ( $V_{INPECL}$ ) ..... -0.5V to  $V_{CC} + 0.5V$   
 Input Voltage ( $V_{INTTL}$ ) ..... -0.5V to  $V_{CC} + 0.5V$   
 LVPECL Output Current ( $I_{OUT}$ ) ..... -50mA  
 Lead Temperature (soldering, 20sec.) ..... 260°C  
 Maximum Case Temperature ..... -55°C to +125°C  
 Storage Temperature ( $T_s$ ) ..... -65°C to +150°C

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

Supply Voltage ( $V_{CC}$ ) ..... 3.135V to 3.465V  
 Ambient Temperature ( $T_A$ ) ..... -40°C to +85°C  
 Package Thermal Resistance<sup>(3)</sup>  
     TSSOP  
         Still-air ( $\theta_{JA}$ ) ..... 76°C/W  
         Junction-to-Case ( $\theta_{JC}$ )<sup>(4)</sup> ..... 25°C/W

**DC Electrical Characteristics<sup>(5)</sup>**

$V_{CC} = 3.135V$  to  $3.465V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ , unless otherwise stated.

| Symbol         | Parameter                                     | Condition                             | Min   | Typ | Max          | Units |
|----------------|-----------------------------------------------|---------------------------------------|-------|-----|--------------|-------|
| $V_{CC}$       | Power Supply Voltage Range                    |                                       | 3.135 | 3.3 | 3.465        | V     |
| $I_{CC}$       | Power Supply Current                          | Max. $V_{CC}$                         |       | 105 | 125          | mA    |
| $V_{IH}$       | Input HIGH Voltage                            | INx, /INx                             | 1.2   |     | $V_{CC}$     | V     |
| $V_{IL}$       | Input LOW Voltage                             | INx, /INx                             | 0     |     | $V_{IH}-0.1$ | V     |
| $V_{IN}$       | Input Voltage Swing                           | INx, /INx, see Figure 2a              | 0.15  |     | 1.3          | V     |
| $V_{DIFF\_IN}$ | Differential Input Voltage Swing ( IN - /IN ) | AC-coupled, Internally Biased to 1.2V | 0.3   |     | 2.6          | V     |
| $P_D$          | Power Dissipation                             | Outputs Open, Max $V_{CC}$            |       |     | 450          | mW    |

**LVPECL Outputs DC Electrical Characteristics<sup>(5)</sup>**

$V_{CC} = 3.135V$  to  $3.465V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ ,  $R_L = 50\Omega$  to  $V_{CC}-2.0V$  unless otherwise stated.

| Symbol              | Parameter                         | Condition                         | Min  | Typ           | Max  | Units |
|---------------------|-----------------------------------|-----------------------------------|------|---------------|------|-------|
| $V_{OH}$            | Output HIGH Voltage               |                                   |      | $V_{CC}-1V$   |      | V     |
| $V_{OL}$            | Output LOW Voltage                |                                   |      | $V_{CC}-1.8V$ |      | V     |
| $V_{DIFF\_OUT\_50}$ | Differential Output Voltage Swing |                                   | 1000 |               | 2200 | mV    |
| $V_{DIFF\_OUT\_75}$ | Differential Output Voltage Swing | $R_L = 75\Omega$ to $V_{CC}-2.0V$ | 1200 |               | 2200 | mV    |

**LVTTTL/CMOS DC Electrical Characteristics<sup>(5)</sup>**

$V_{CC} = 3.135V$  to  $3.465V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ , unless otherwise stated.

| Symbol   | Parameter          | Condition | Min  | Typ | Max          | Units   |
|----------|--------------------|-----------|------|-----|--------------|---------|
| $V_{IH}$ | Input HIGH Voltage |           | 2.0  |     | $V_{CC}+0.5$ | V       |
| $V_{IL}$ | Input LOW Voltage  |           | 0    |     | 0.8          | V       |
| $I_{IH}$ | Input HIGH Current |           |      |     | 100          | $\mu A$ |
| $I_{IL}$ | Input LOW Current  |           | -100 |     |              | $\mu A$ |

**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 device's most negative potential on the PCB.  $\psi_{JB}$  and  $\theta_{JA}$  values are determined for a four-layer board in still-air number, unless otherwise stated. The circuit is designed to meet the DC specifications shown in the above table after thermal equilibrium has been established.
4. JEDEC standard multilayer board -2S2P (2 signal, 2 power)
5. The circuit is designed to meet the DC specifications shown in the above table after thermal equilibrium has been established.

## AC Electrical Characteristics

$V_{CC} = 3.135V$  to  $3.465V$ ;  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise stated.

| Symbol        | Parameter                               | Condition             | Min | Typ | Max | Units            |
|---------------|-----------------------------------------|-----------------------|-----|-----|-----|------------------|
| $f_{MAX}$     | Maximum Frequency                       | NRZ Data              | 1.5 |     |     | Gbps             |
| $t_{PD}$      | Propagation Delay                       | Figure 1a             |     | 0.4 | 4   | ns               |
| $t_{Jitter}$  | Deterministic Jitter                    | Note 8                |     |     | 40  | ps <sub>pp</sub> |
| $t_R, t_F$    | Output Rise/Fall Times<br>(20% to 80%)  | At full output swing. |     | 140 | 175 | ps               |
|               | Duty Cycle                              |                       | 47  |     | 53  | %                |
| $T_{ENABLE}$  | Output Enable Time<br>(OE LOW to HIGH)  | See Figure 1b         |     | 8   | 20  | ns               |
| $T_{DISABLE}$ | Output Disable Time<br>(OE HIGH to LOW) | See Figure 1b         |     | 3   | 10  | ns               |

### Notes:

6. Output-to-Output skew is the difference in time between both outputs, receiving data from the same input, for the same temperature, voltage and transition.
7. Part-to-part skew is defined for two parts with identical power supply voltages at the same temperature and no skew at the edges at the respective inputs.
8. Deterministic jitter is measured at 1.5Gbps with both K28.5 and  $2^{23}-1$  PRBS pattern.

## Detailed Description

### Input Functionality

The inputs are typically AC-coupled and are terminated internally to 1.2V. SY897132L can accept AC-coupled and DC-coupled LVPECL, CML.

### Outputs Termination

The SY897132L are capable of driving differential transmission lines with either 50 $\Omega$  or 75 $\Omega$  impedance. The outputs are designed to operate with or without external termination resistors. However, differential transmission lines should be terminated at the destination to avoid reflections and noise. See Figure 3 for more details.

### OEx Output Enable

The Output Enable (OEx) pins on the SY897132L provide an option to turn on/off OUT0 and/or OUT1. If OEx is LOW, the entire output buffer is turned off and both differential outputs float HIGH. This would reduce overall  $I_{CC}$  by approximately 26mA for each disabled output pair.

### Power Supply Bypass

The SY897132L uses separate 3.3V power supplies for its core circuitry and output buffers. By separating the power supplies, SY897132L minimizes the impact of noise coupled onto the power supply by the various switching outputs. Placing a 0.1 $\mu$ F bypass capacitor on the VCC pins will provide additional noise isolation.

## Timing Diagrams

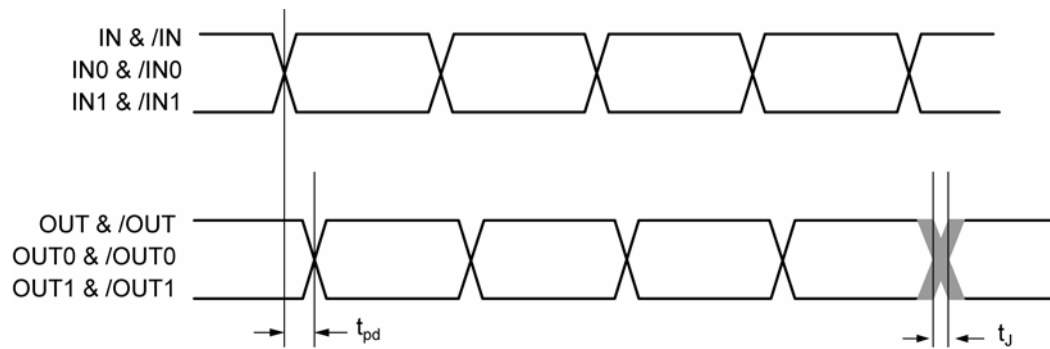


Figure 1a. Propagation Delay

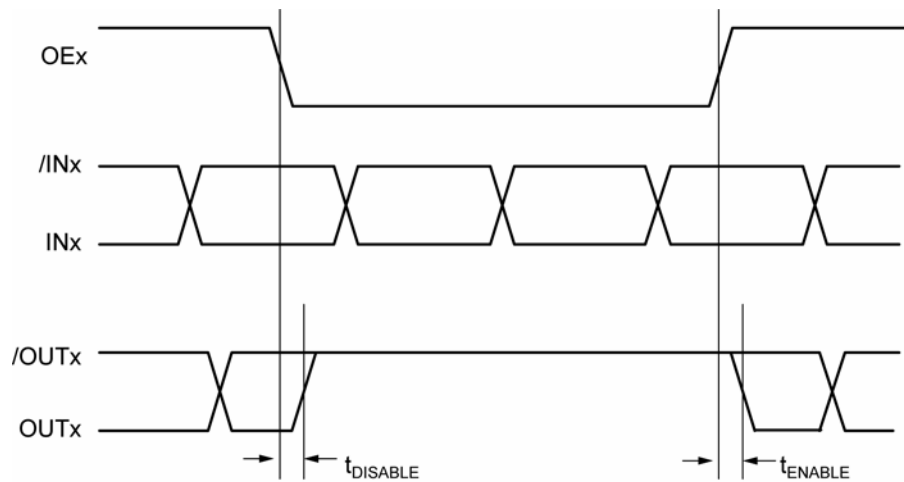
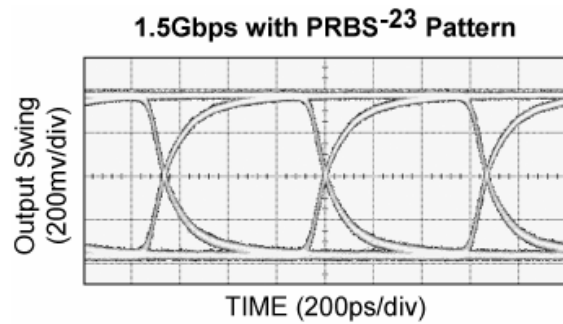
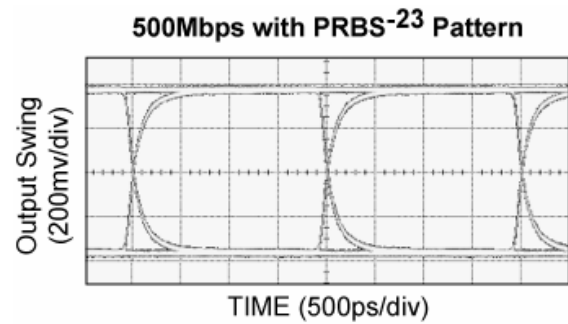


Figure 1b. Output Enable/Disable Timing (Measured at 50%)

## Typical Characteristics

$V_{CC} = 3.3V$ ,  $V_{IN\_DIFF} = 1000mV$ ,  $T_A = 25^\circ C$ , unless otherwise stated.



## Single-Ended and Differential Swings



Figure 2a. Single-Ended Swing

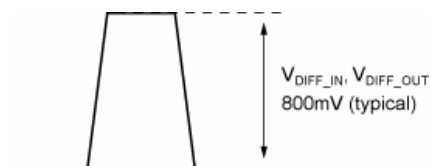


Figure 2b. Differential Swing

## Input Interface Applications

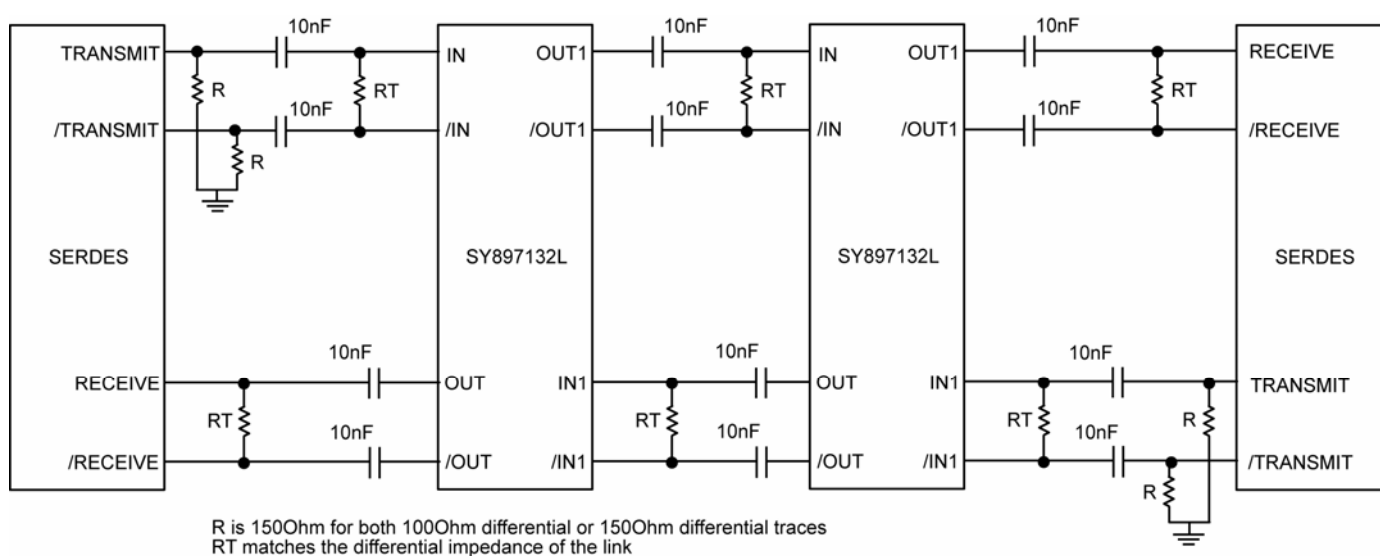
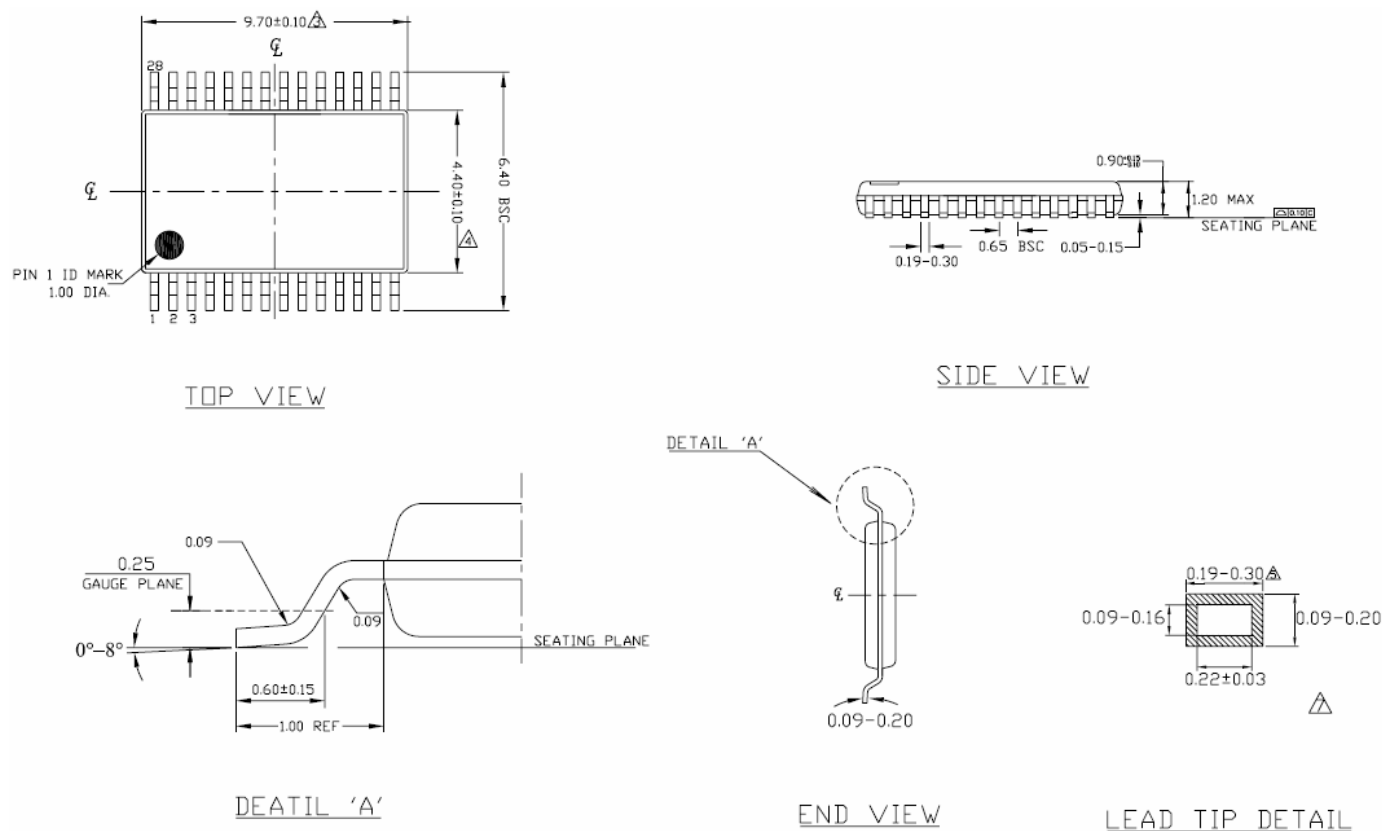


Figure 3. SY897132L Typical Application Interface Diagram

## Related Product and Support Documents

| Part Number   | Function                                       | Datasheet Link                                                                                                                                            |
|---------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| HBW Solutions | New Products and Termination Application Notes | <a href="http://www.micrel.com/page.do?page=/product-info/as/HBWolutions.shtml">http://www.micrel.com/page.do?page=/product-info/as/HBWolutions.shtml</a> |

## Package Information



### Notes

1. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
  2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
- △ DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
  - △ DIMENSION DOES NOT INCLUDE INTERNAL FLASH OR PROTRUSION.
  - △ DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION.
  - △ CROSS SECTION TO BE DETERMINED AT 0.10 TO 0.25MM FROM THE LEAD TIP.

### 28-Pin TSSOP (K-28)

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