



# 3.3V 1GHz DUAL 1:10 PRECISION LVDS FANOUT BUFFER/ TRANSLATOR WITH 2:1 INPUT MUX

Precision Edge®  
SY89828L



Precision Edge®

## FEATURES

- High-performance dual 1:10, 1GHz LVDS fanout buffer/translator
- Two banks of 10 differential LVDS outputs
- Guaranteed AC parameters over temperature and voltage:
  - > 1GHz  $f_{MAX}$
  - < 50ps within device skew
  - < 400ps  $t_r, t_f$  time
- Each bank includes a 2:1 input mux
- 2:1 mux input accepts LVDS and LVPECL
- Low jitter performance
  - < 1ps<sub>RMS</sub> cycle-to-cycle jitter
  - < 1ps<sub>pp</sub> total jitter
- 3.3V supply voltage
- Output enable function
- LVDS input includes internal 100Ω termination
- Available in a 64-Pin EPAD-TQFP

## APPLICATIONS

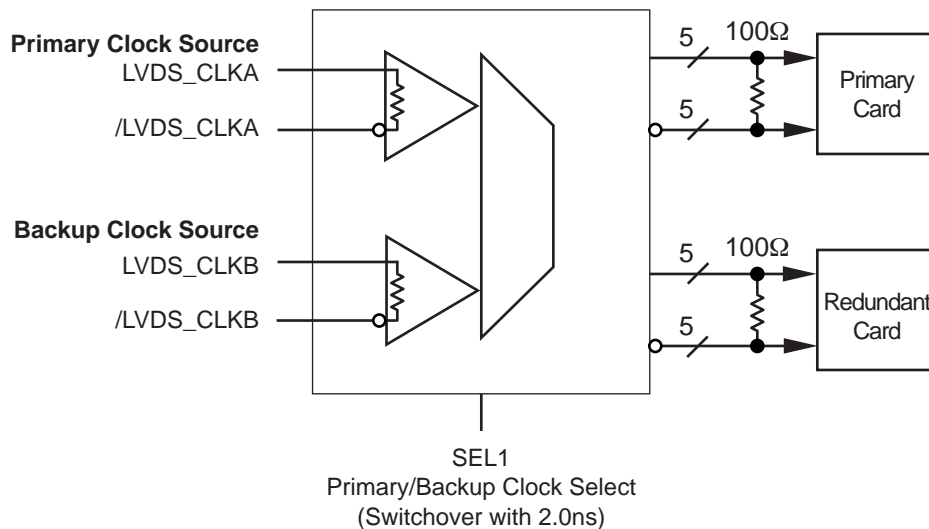
- Enterprise networking
- High-end servers
- Communications

## DESCRIPTION

The SY89828L is a precision fanout buffer with 20 differential LVDS (Low Voltage Differential Swing) output pairs. The part is designed for use in low voltage 3.3V applications that require a large number of outputs to drive precisely aligned, ultra low-skew signals to their destination. The input is multiplexed from either LVDS or LVPECL (Low Voltage Positive Emitter Coupled Logic) by the CLK\_SEL1 and CLK\_SEL2 pins. The Output Enables (OE1 and OE2) are synchronous so that the outputs will only be enabled/disabled when they are already in the LOW state. This avoids any chance of generating a runt clock pulse when the device is enabled/disabled as can happen with an asynchronous control.

The SY89828L features a low pin-to-pin skew of less than 50ps—performance previously unachievable in a standard product having such a high number of outputs. The SY89828L is available in a single space saving package, enabling a lower overall cost solution.

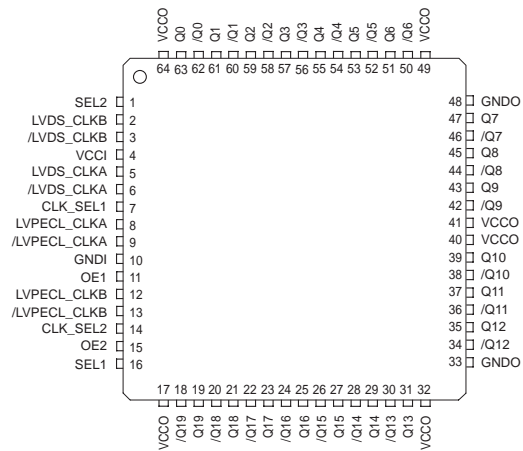
## TYPICAL APPLICATION CIRCUIT



System using SY89828L as a switchover circuit from a Primary Clock to a Redundant backup Clock in a fail-safe application. LVPECL inputs not shown in this application.

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**PACKAGE/ORDERING INFORMATION**



**64-Pin TQFP (H64-1)**

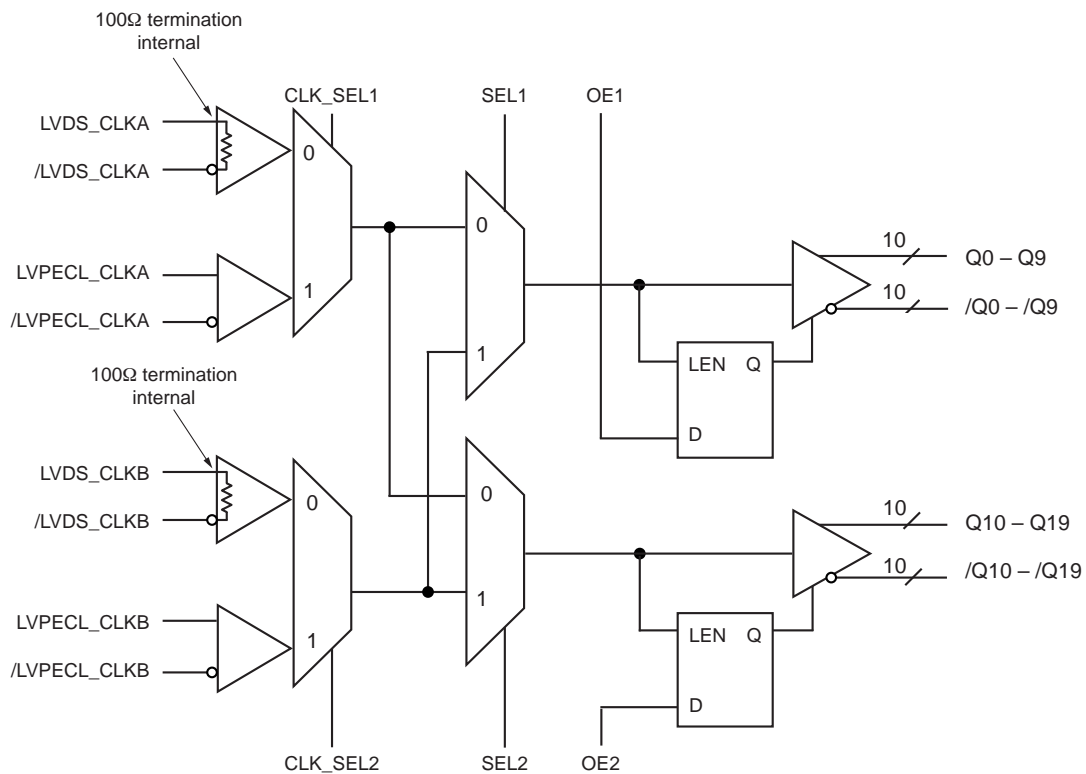
**Ordering Information<sup>(1)</sup>**

| Part Number                 | Package Type | Operating Range | Package Marking                            | Lead Finish      |
|-----------------------------|--------------|-----------------|--------------------------------------------|------------------|
| SY89828LHI <sup>(2)</sup>   | H64-1        | Industrial      | SY89828LHI                                 | Sn-Pb            |
| SY89828LHITR <sup>(2)</sup> | H64-1        | Industrial      | SY89828LHI                                 | Sn-Pb            |
| SY89828LHY <sup>(2)</sup>   | H64-1        | Industrial      | SY89828LHY with Pb-Free bar-line indicator | Pb-Free Matte-Sn |
| SY89828LHYTR <sup>(2)</sup> | H64-1        | Industrial      | SY89828LHY with Pb-Free bar-line indicator | Pb-Free Matte-Sn |

**Notes:**

1. Contact factory for die availability. Dice are guaranteed at T<sub>A</sub> = 25°C, DC electricals only.
2. Pb-Free package recommended for new designs.

**FUNCTIONAL BLOCK DIAGRAM**



## PIN DESCRIPTIONS

| Pin Number                               | Pin Name                    | I/O    | Type            | Internal P/U                    | Pin Function                                                                                                                                                                                                                              |
|------------------------------------------|-----------------------------|--------|-----------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5, 6                                     | LVDS_CLKA<br>/LVDS_CLKA     | Input  | LVDS            | 3.5kΩ<br>Pull-up<br>See Fig. 2  | Differential clock input selected by CLK_SEL1, SEL1 and SEL2. Can be left floating if not selected. Floating input, if selected produces an indeterminate output. Has internal 100Ω termination.                                          |
| 2, 3                                     | LVDS_CLKB<br>/LVDS_CLKB     | Input  | LVDS            | 3.5kΩ<br>Pull-up<br>See Fig. 2  | Differential clock input selected by CLK_SEL1, SEL1 and SEL2. Can be left floating if not selected. Floating input, if selected produces an indeterminate output. Has internal 100Ω termination.                                          |
| 8, 9                                     | LVPECL_CLKA<br>/LVPECL_CLKA | Input  | LVPECL          | 75kΩ<br>pull-down<br>See Fig. 1 | Differential clock input selected by CLK_SEL1, SEL1 and SEL2. Can be left floating. Floating input, if selected produces a LOW at output. Requires external termination.                                                                  |
| 12, 13                                   | LVPECL_CLKB<br>/LVPECL_CLKB | Input  | LVPECL          | 75kΩ<br>pull-down<br>See Fig. 1 | Differential clock input selected by CLK_SEL2, SEL1 and SEL2. Requires external termination.                                                                                                                                              |
| 7                                        | CLK_SEL1                    | Input  | LVTTTL/<br>CMOS | 11kΩ<br>Pull-up                 | Selects LVDS_CLKA input when LOW and LVPECL_CLKA input when HIGH.                                                                                                                                                                         |
| 14                                       | CLK_SEL2                    | Input  | LVTTTL/<br>CMOS | 11kΩ<br>Pull-up                 | Selects LVDS_CLKB input when LOW and LVPECL_CLKB input when HIGH.                                                                                                                                                                         |
| 16                                       | SEL1                        | Input  | LVTTTL/<br>CMOS | 11kΩ<br>Pull-up                 | Selects input source CLKA when LOW and CLKB when HIGH for outputs Q0 – Q9 and /Q0 – /Q9.                                                                                                                                                  |
| 1                                        | SEL2                        | Input  | LVTTTL/<br>CMOS | 11kΩ<br>Pull-up                 | Selects input source CLKA when LOW and CLKB when HIGH for outputs Q10 – Q19 and /Q10 – /Q19.                                                                                                                                              |
| 11                                       | OE1                         | Input  | LVTTTL/<br>CMOS | 11kΩ<br>Pull-up                 | Enable input synchronized internally to prevent output glitches or runt pulses.                                                                                                                                                           |
| 15                                       | OE2                         | Input  | LVTTTL/<br>CMOS | 11kΩ<br>Pull-up                 | Enable input synchronized internally to prevent output glitches or runt pulses.                                                                                                                                                           |
| 4                                        | VCCI                        | Power  |                 |                                 | Core VCC connected to 3.3V supply. Not connected to VCCO internally. Connected to VCCO on PCB. Bypass with 0.1μF in parallel with 0.01μF low ESR capacitors as close to VCC pins as possible.                                             |
| 17, 32, 40,<br>41, 49, 64                | VCCO                        | Power  |                 |                                 | Output buffer VCC connected to 3.3V supply. Not connected to VCCI internally. Connected to VCCI on PCB. Bypass with 0.1μF in parallel with 0.01μF low ESR capacitors as close to VCC pins as possible.                                    |
| 10                                       | GNDI                        | Power  |                 |                                 | Core ground not connected to GNDO internally. To be connected to GNDO on PCB.                                                                                                                                                             |
| 33, 48                                   | GNDO                        | Power  |                 |                                 | Output buffer ground not connected to GNDI internally. To be connected to GNDI on PCB.                                                                                                                                                    |
| 63, 61, 59, 57, 55<br>53, 51, 47, 45, 43 | Q0 – Q9                     | Output | LVDS            |                                 | Differential clock outputs from CLKA when SEL1 = LOW and from CLKB when SEL1 = HIGH. Q outputs are static when OE1 = LOW. Unused output pair must be terminated with 100Ω to maintain low jitter and skew.                                |
| 62, 60, 58, 56, 54<br>52, 50, 46, 44, 42 | /Q0 – /Q9                   | Output | LVDS            |                                 | Differential clock outputs (complement) from CLKA when SEL1 = LOW and from CLKB when SEL1 = HIGH. /Q outputs are static HIGH when OE1 = LOW. Unused output pairs must be externally terminated with 100Ω to maintain low jitter and skew. |
| 39, 37, 35, 31, 29<br>27, 25, 23, 21, 19 | Q10 – Q19                   | Output | LVDS            |                                 | Differential outputs from CLKA when SEL2 = LOW and from CLKB when SEL2 = HIGH. Q outputs are static LOW when OE2 = LOW. Unused output pairs must be externally terminated with 100Ω to maintain low jitter and skew.                      |

| Pin Number                               | Pin Name    | I/O    | Type | Internal P/U | Pin Function                                                                                                                                                                                                                        |
|------------------------------------------|-------------|--------|------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 38, 36, 34, 30, 28<br>26, 24, 22, 20, 18 | /Q10 – /Q19 | Output | LVDS |              | Differential outputs (complement) from CLKA when SEL2 = LOW and from CLKB when SEL2 = HIGH. /Q outputs are static HIGH when OE2 = LOW. Unused output pairs must be externally terminated with 100Ω to maintain low jitter and skew. |

**TRUTH TABLE**

| OE1 <sup>(1)</sup> | OE2 <sup>(1)</sup> | SEL1 <sup>(1)</sup> | SEL2 <sup>(1)</sup> | CLK_SEL1 <sup>(1)</sup> | CLK_SEL2 <sup>(1)</sup> | Q0 – Q9     | /Q0 – /Q9    | Q10 – Q19   | /Q10 – /Q19  |
|--------------------|--------------------|---------------------|---------------------|-------------------------|-------------------------|-------------|--------------|-------------|--------------|
| 1                  | 1                  | 0                   | 0                   | 0                       | X                       | LVDS_CLKA   | /LVDS_CLKA   | LVDS_CLKA   | /LVDS_CLKA   |
| 1                  | 1                  | 0                   | 0                   | 1                       | X                       | LVPECL_CLKA | /LVPECL_CLKA | LVPECL_CLKA | /LVPECL_CLKA |
| 1                  | 1                  | 0                   | 1                   | 0                       | 0                       | LVDS_CLKA   | /LVDS_CLKA   | LVDS_CLKB   | /LVDS_CLKB   |
| 1                  | 1                  | 0                   | 1                   | 0                       | 1                       | LVDS_CLKA   | /LVDS_CLKA   | LVPECL_CLKB | /LVPECL_CLKB |
| 1                  | 1                  | 0                   | 1                   | 1                       | 0                       | LVPECL_CLKA | /LVPECL_CLKA | LVDS_CLKB   | /LVDS_CLKB   |
| 1                  | 1                  | 0                   | 1                   | 1                       | 1                       | LVPECL_CLKA | /LVPECL_CLKA | LVPECL_CLKB | /LVPECL_CLKB |
| 1                  | 1                  | 1                   | 0                   | 0                       | 0                       | LVDS_CLKB   | /LVDS_CLKB   | LVDS_CLKA   | /LVDS_CLKA   |
| 1                  | 1                  | 1                   | 0                   | 0                       | 1                       | LVPECL_CLKB | /LVPECL_CLKB | LVDS_CLKA   | /LVDS_CLKA   |
| 1                  | 1                  | 1                   | 0                   | 1                       | 0                       | LVDS_CLKB   | /LVDS_CLKB   | LVPECL_CLKA | /LVPECL_CLKA |
| 1                  | 1                  | 1                   | 0                   | 1                       | 1                       | LVPECL_CLKB | /LVPECL_CLKB | LVPECL_CLKA | /LVPECL_CLKA |
| 1                  | 1                  | 1                   | 1                   | X                       | 0                       | LVDS_CLKB   | /LVDS_CLKB   | LVDS_CLKB   | /LVDS_CLKB   |
| 1                  | 1                  | 1                   | 1                   | X                       | 1                       | LVPECL_CLKB | /LVPECL_CLKB | LVPECL_CLKB | /LVPECL_CLKB |
| 0                  | 1                  | X                   | 0                   | 0                       | X                       | LOW         | HIGH         | LVDS_CLKA   | /LVDS_CLKA   |
| 0                  | 1                  | X                   | 0                   | 1                       | X                       | LOW         | HIGH         | LVPECL_CLKA | /LVPECL_CLKA |
| 0                  | 1                  | X                   | 1                   | X                       | 0                       | LOW         | HIGH         | LVDS_CLKB   | /LVDS_CLKB   |
| 0                  | 1                  | X                   | 1                   | X                       | 1                       | LOW         | HIGH         | LVPECL_CLKB | /LVPECL_CLKB |
| 1                  | 0                  | 0                   | X                   | 0                       | X                       | LVDS_CLKA   | /LVDS_CLKA   | LOW         | HIGH         |
| 1                  | 0                  | 0                   | X                   | 1                       | X                       | LVPECL_CLKA | /LVPECL_CLKA | LOW         | HIGH         |
| 1                  | 0                  | 1                   | X                   | X                       | 0                       | LVDS_CLKB   | /LVDS_CLKB   | LOW         | HIGH         |
| 1                  | 0                  | 1                   | X                   | X                       | 1                       | LVPECL_CLKB | /LVPECL_CLKB | LOW         | HIGH         |
| 0                  | 0                  | X                   | X                   | X                       | X                       | LOW         | HIGH         | LOW         | HIGH         |

**NOTE:**

1. Input has internal pull-up so floating input = 1.

### Absolute Maximum Ratings<sup>(Note 1)</sup>

|                                                |                   |
|------------------------------------------------|-------------------|
| Power Supply Voltage ( $V_{CCI}$ , $V_{CCO}$ ) | -0.5 to +4.0V     |
| Input Voltage ( $V_{IN}$ )                     | -0.5 to $V_{CCI}$ |
| Output Current ( $I_{OUT}$ )                   | ±10mA             |
| Storage Temperature ( $T_S$ )                  | -65 to +150°C     |
| ESD Rating, <b>Note 3</b>                      | 1kV               |

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

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Supply Voltage                                                  | +3V to +3.6V   |
| Ambient Temperature ( $T_A$ )                                   | -40°C to +85°C |
| Package Thermal Resistance                                      |                |
| TQFP ( $\theta_{JA}$ )                                          |                |
| <i>Exposed pad soldered to GND</i>                              |                |
| Still-Air (multi-layer PCB)                                     | 23°C/W         |
| -200lfpm (multi-layer PCB)                                      | 18°C/W         |
| -500lfpm (multi-layer PCB)                                      | 15°C/W         |
| <i>Exposed pad <u>NOT</u> soldered to GND (not recommended)</i> |                |
| Still-Air (multi-layer PCB)                                     | 44°C/W         |
| -200lfpm (multi-layer PCB)                                      | 36°C/W         |
| -500lfpm (multi-layer PCB)                                      | 30°C/W         |
| TQFP ( $\theta_{JC}$ )                                          | 4.4°C/W        |

## DC ELECTRICAL CHARACTERISTICS

**Power Supply:**  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$

| Symbol                | Parameter                      | Condition              | Min | Typ | Max | Units |
|-----------------------|--------------------------------|------------------------|-----|-----|-----|-------|
| $V_{CCI}$ , $V_{CCO}$ | $V_{CC}$ Core, $V_{CC}$ Output | <b>Note 4</b>          | 3.0 | 3.3 | 3.6 | V     |
| $I_{CCI}$             | $I_{CC}$ Core                  | Max. $V_{CC}$          |     | 45  | 70  | mA    |
| $I_{CCO}$             | $I_{CC}$ Output                | No Load, Max. $V_{CC}$ |     | 160 | 260 | mA    |

**LVDS Input:**  $V_{CC} = 3.3\text{V} \pm 10\%$ ,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$

| Symbol   | Parameter                                                     | Condition | Min   | Typ | Max | Units    |
|----------|---------------------------------------------------------------|-----------|-------|-----|-----|----------|
| $V_{IN}$ | Input Voltage Range                                           |           | 0     |     | 2.4 | V        |
| $V_{ID}$ | Differential Input Swing                                      |           | 100   |     |     | mV       |
| $I_{IL}$ | Input LOW Current                                             |           | -1.25 |     |     | mA       |
| $R_{IN}$ | LVDS Differential Input Resistance<br>(LVDS_CLK to /LVDS_CLK) |           | 80    | 100 | 120 | $\Omega$ |

- Note 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 RATING conditions for extended periods may affect device reliability.
- Note 2.** The data sheet limits are not guaranteed if the device is operated beyond the operating ratings.
- Note 3.** Devices are ESD sensitive. Handling precautions recommended.
- Note 4.**  $V_{CCI}$  and  $V_{CCO}$  must be connected together on the PCB such that they remain at the same potential.  $V_{CCI}$  and  $V_{CCO}$  are not internally connected on the die.

**DC ELECTRICAL CHARACTERISTICS****LVPECL Input:**  $V_{CC} = 3.3V \pm 10\%$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ 

| Symbol    | Parameter                         | Condition     | Min              | Typ | Max              | Units   |
|-----------|-----------------------------------|---------------|------------------|-----|------------------|---------|
| $V_{IH}$  | Input HIGH Voltage (Single-Ended) |               | $V_{CC} - 1.165$ |     | $V_{CC} - 0.880$ | V       |
| $V_{IL}$  | Input LOW Voltage                 |               | $V_{CC} - 1.945$ |     | $V_{CC} - 1.625$ | V       |
| $V_{PP}$  | Minimum Input Swing (LVPECL_CLK)  | <b>Note 5</b> | 300              |     |                  | mV      |
| $V_{CMR}$ | Common Mode Range (LVPECL_CLK)    | <b>Note 6</b> | GNDI + 1.8       |     | $V_{CCI} - 0.4$  | V       |
| $I_{IH}$  | Input HIGH Current                |               |                  |     | 150              | $\mu A$ |
| $I_{IL}$  | Input LOW Current                 |               | 0.5              |     |                  | $\mu A$ |

**Note 5.** The  $V_{PP}$  (min.) is defined as the minimum input differential voltage which will cause no increase in the propagation delay.**Note 6.**  $V_{CMR}$  is defined as the range within which the  $V_{IH}$  level may vary, with the device still meeting the propagation delay specification. The numbers in the table are referenced to  $V_{CCI}$ . The  $V_{IL}$  level must be such that the peak-to-peak voltage is less than 1.0V and greater than or equal to  $V_{PP}$  (min.). CMR range varies 1:1 with  $V_{CCI}$ .  $V_{CMR}$  (min) is fixed at GNDI + 1.8V.**CMOS/LVTTL:**  $V_{CC} = 3.3V \pm 10\%$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ 

| Symbol   | Parameter          | Condition         | Min  | Typ | Max | Units   |
|----------|--------------------|-------------------|------|-----|-----|---------|
| $V_{IH}$ | Input HIGH Voltage |                   | 2.0  |     |     | V       |
| $V_{IL}$ | Input LOW Voltage  |                   |      |     | 0.8 | V       |
| $I_{IH}$ | Input HIGH Current | $V_{IN} = V_{CC}$ |      |     | 150 | $\mu A$ |
| $I_{IL}$ | Input LOW Current  | $V_{IN} = 0.5V$   | -600 |     |     | $\mu A$ |

**LVDS Output:**  $V_{CC} = 3.3V \pm 10\%$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ 

| Symbol           | Parameter                     | Condition        | Min   | Typ | Max   | Units |
|------------------|-------------------------------|------------------|-------|-----|-------|-------|
| $V_{OD}$         | Differential Output Voltage   | <b>Note 7, 8</b> | 250   | 350 | 400   | mV    |
| $V_{OH}$         | Output HIGH Voltage           | <b>Note 7</b>    |       |     | 1.474 | V     |
| $V_{OL}$         | Output LOW Voltage            | <b>Note 7</b>    | 0.925 |     |       | V     |
| $V_{OCM}$        | Output Common Mode Voltage    | <b>Note 8</b>    | 1.125 |     | 1.375 | V     |
| $\Delta V_{OCM}$ | Change in Commom Mode Voltage |                  | -50   |     | 50    | mV    |

**Note 7.** Measured as per Figure 3,  $100\Omega$  across Q and /Q outputs.**Note 8.** Measured as per Figure 4.

**AC ELECTRICAL CHARACTERISTICS(NOTE 1)**

$V_{CC} = 3.3V \pm 10\%$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ , unless noted.

| Symbol                 | Parameter                                       | Condition                                                   | Min           | Typ          | Max           | Units                   |
|------------------------|-------------------------------------------------|-------------------------------------------------------------|---------------|--------------|---------------|-------------------------|
| $f_{MAX}$              | Maximum Toggle Frequency                        | <b>Note 2</b>                                               | 1.0           |              |               | GHz                     |
| $t_{PHL}$<br>$t_{PLH}$ | Differential Propagation Delay<br><b>Note 3</b> | LVPECL Input: 150mV<br>LVPECL Input: 800mV                  | 0.950<br>0.80 | 1.15<br>1.0  | 1.45<br>1.3   | ns<br>ns                |
|                        |                                                 | LVDS Input: 100mV<br>LVDS Input: 400mV                      | 1.10<br>0.950 | 1.35<br>1.20 | 1.60<br>1.450 | ns<br>ns                |
| $t_{SWITCHOVER}$       | Clock Input Switchover                          | CLK_SEL to Valid Output                                     |               | 1.55         | 1.85          | ns                      |
| $t_{S(OE)}$            | Output Enable Set-Up Time                       | <b>Note 4</b>                                               | 1.0           |              |               | ns                      |
| $t_{H(OE)}$            | Output Enable Hold Time                         | <b>Note 4</b>                                               | 0.5           |              |               | ns                      |
| $t_{SKEW}$             | Within Device Skew                              | <b>Note 5</b> $0^\circ C$ to $+85^\circ C$<br>$-40^\circ C$ |               | 25<br>35     | 50<br>75      | ps<br>ps                |
|                        | Part-to-Part Skew                               | <b>Note 6</b>                                               |               |              | 400           | ps                      |
| $t_{JITTER}$           | Cycle-to-Cycle<br>Total Jitter                  | <b>Note 7</b><br><b>Note 8</b>                              |               | <1           | <1<br>2       | $ps_{RMS}$<br>$ps_{PP}$ |
| $t_r, t_f$             | Output Rise/Fall Times<br>(20% to 80%)          |                                                             | 200           | 290          | 400           | ps                      |

**Note 1.** 100 $\Omega$  termination between Q and /Q outputs. Airflow  $\geq 300$ lfpm, or exposed pad soldered to ground plane.

**Note 2.**  $f_{MAX}$  is defined as the maximum toggle frequency, measured with a 750mV LVPECL input or 350mV LVDS input. Outut swing is  $> 200$ mV.

**Note 3.** Differential propagation delay is defined as the delay from the crossing point of the differential input signals to the crossing point of the differential output signals.

**Note 4.** Set-up and hold time applies to synchronous applications that intend to enable/disable before the next clock cycle. For asynchronous applications, set-up and hold time does not apply. OE set-up time is defined with respect to the rising edge of the clock. OE HIGH to LOW transition ensures outputs remain disabled during the next clock cycle. OE LOW to HIGH transition enables normal operation of the next input clock.

**Note 5.** The within-device skew is defined as the worst case difference between any two similar delay paths within a single device identical input transition, operating at the same voltage and temperature.

**Note 6.** The part-to-part skew is defined as the absolute worst case difference between any two delay paths on any two devices operating at the same voltage and temperature. Part-to-part skew is the total skew difference; pin-to-pin skew + part-to-part skew.

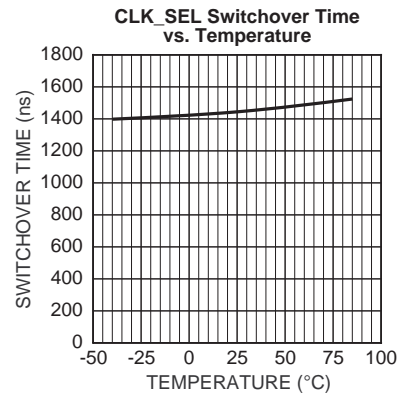
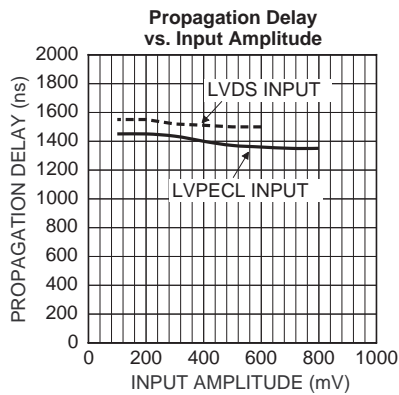
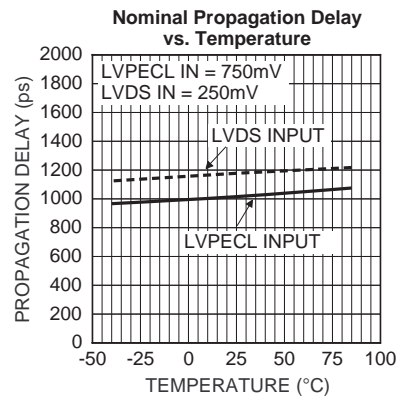
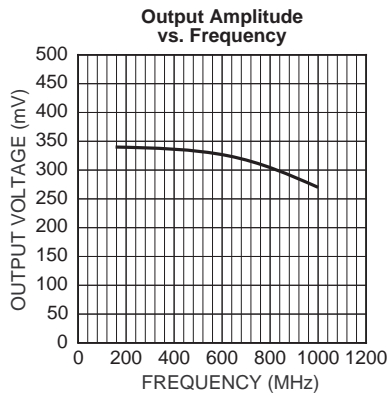
**Note 7.** Cycle-to-cycle jitter definition: The variation period between adjacent cycles over a random sample of adjacent cycle pairs.  $T_{JITTER\_CC} = T_n - T_{n+1}$  where T is the time between rising edges of the output signal.

**Note 8.** Total jitter definition: with an ideal clock input, no more than one output edge in  $10^{12}$  output edges will deviate by more than the specified peak-to-peak jitter value.



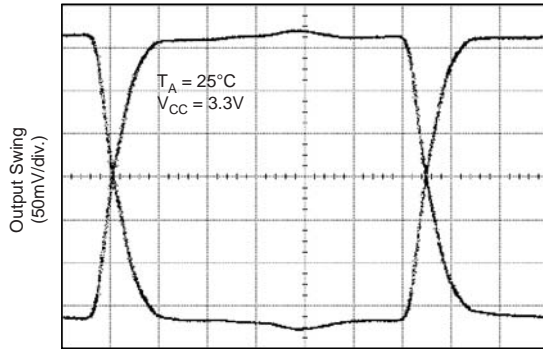
**TYPICAL OPERATING CHARACTERISTICS**

(Conditions:  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ , unless otherwise stated)



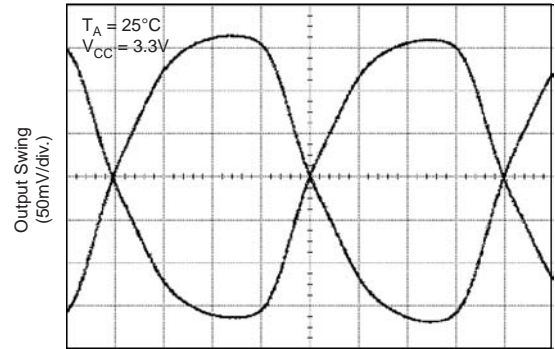
# FUNCTIONAL CHARACTERISTICS

155MHz Output



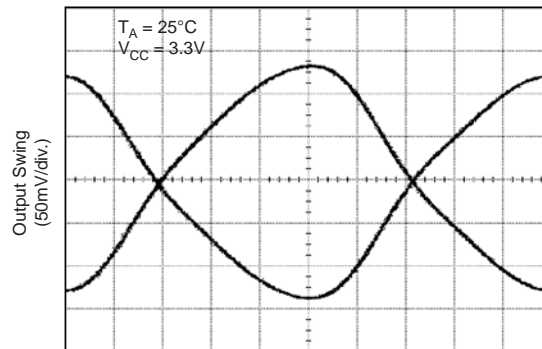
TIME (500ps/div.)

622MHz Output



TIME (200ps/div.)

1GHz Output



TIME (100ps/div.)

## LVPECL/LVDS INPUTS

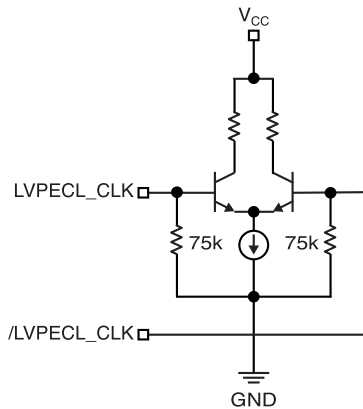


Figure 1. Simplified LVPECL Input Stage

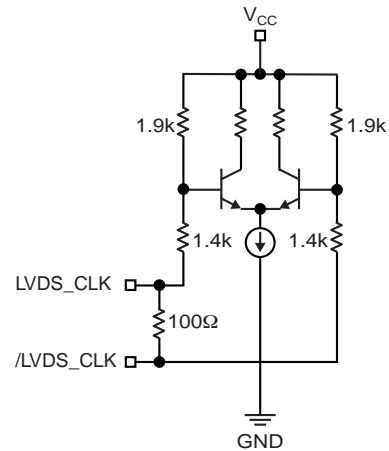


Figure 2. Simplified LVDS Input Stage

## LVDS OUTPUTS

LVDS stands for Low Voltage Differential Swing. LVDS specifies a small swing of 350mV typical, on a nominal 1.25V common mode above ground. The common mode voltage has tight limits to permit large variations in ground

between an LVDS driver and receiver. Also, change in common mode voltage, as a function of data input, is also kept tight, to keep EMI low.

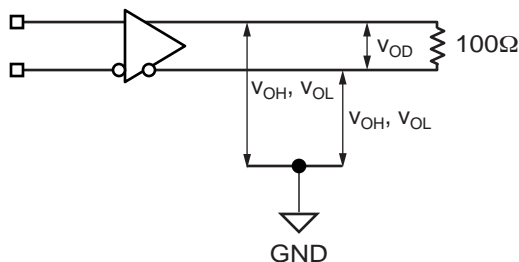


Figure 3. LVDS Differential Measurement

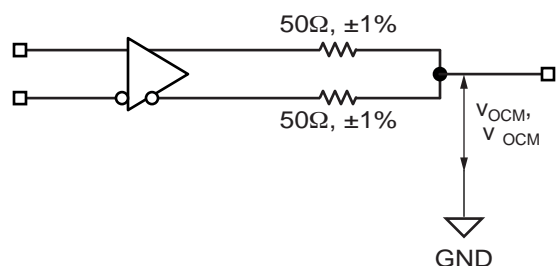


Figure 4. LVDS Common Mode Measurement

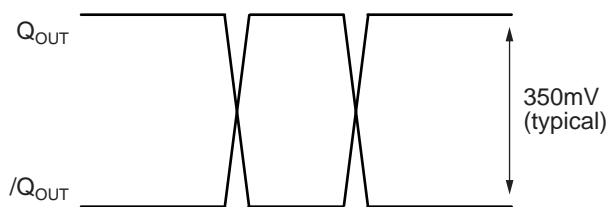


Figure 5. Output Driver Signal Levels (Single-Ended)

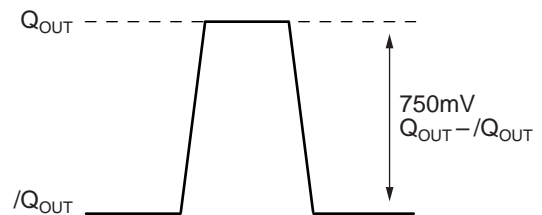


Figure 6. Output Driver Signal Levels (Differential)

## DETAILED DESCRIPTION

The SY89828L is a precision dual 1:10 fanout buffer. It allows either LVPECL or LVDS inputs, selectable by an input muxes, and outputs 2 sets of 10 LVDS output pairs. The device features 2 synchronous output enables. The SY89828L provides extremely low skew across its outputs.

### LVPECL\_CLKA, LVPECL\_CLKB

The SY89828L allows two inputs with standard LVPECL voltage swings. These inputs may be adjusted per the data sheet characteristics regarding the CMR and minimum input swing. As the SY89828L contains no appropriate internal termination, upstream devices need to be properly terminated to provide the proper LVPECL input swing. If not being used (CLK\_SEL1 and CLK\_SEL2 are LOW), these input pairs may be left floating, as they are internally terminated to ground via 75k $\Omega$  pull-down resistors.

### LVDS\_CLKA, LVDS\_CLKB

The SY89828L allows two inputs with standard LVDS voltage swings. The SY89828L provides an appropriate internal 100 $\Omega$  termination resistor. Hence, upstream LVDS devices do not require external termination to drive the SY89828L. If not being used (CLK\_SEL1 and CLK\_SEL2 are HIGH), these inputs pair may be left floating.

### SEL1, SEL2 TTL Inputs

The SEL1 Input is used to select either CLKA (SEL1 is LOW) or CLKB (SEL1 is HIGH) for the Q0-Q9 differential output pairs. In a similar manner, The SEL2 Input is used to select either CLKA (SEL2 is LOW) or CLKB (SEL2 is HIGH) for the Q10-Q19 differential output pairs.

### CLK\_SEL1, CLK\_SEL2 TTL Inputs

The CLK\_SEL1 Input is used to select either LVDS\_CLKA (CLK\_SEL1 is LOW) or LVPECL\_CLKA (CLK\_SEL1 is HIGH). In a similar manner, The CLK\_SEL2 Input is used to select either LVDS\_CLKB (CLK\_SEL2 is LOW) or LVPECL\_CLKB (CLK\_SEL2 is HIGH).

### OE1, OE2 TTL Inputs

The SY89828L's output enable functions are designed to disable the outputs only when the outputs are LOW. The OE1 TTL Input controls the Q0-Q9 outputs and OE2 controls the Q10-Q19 outputs. This avoids the possibility of generating runt pulses. The OE1 and OE2 inputs are asynchronous inputs, but operate as synchronous enables. For synchronous operation, please adhere to the specific setup and hold times. When disabled, the Q outputs are LOW and the /Q outputs are HIGH.

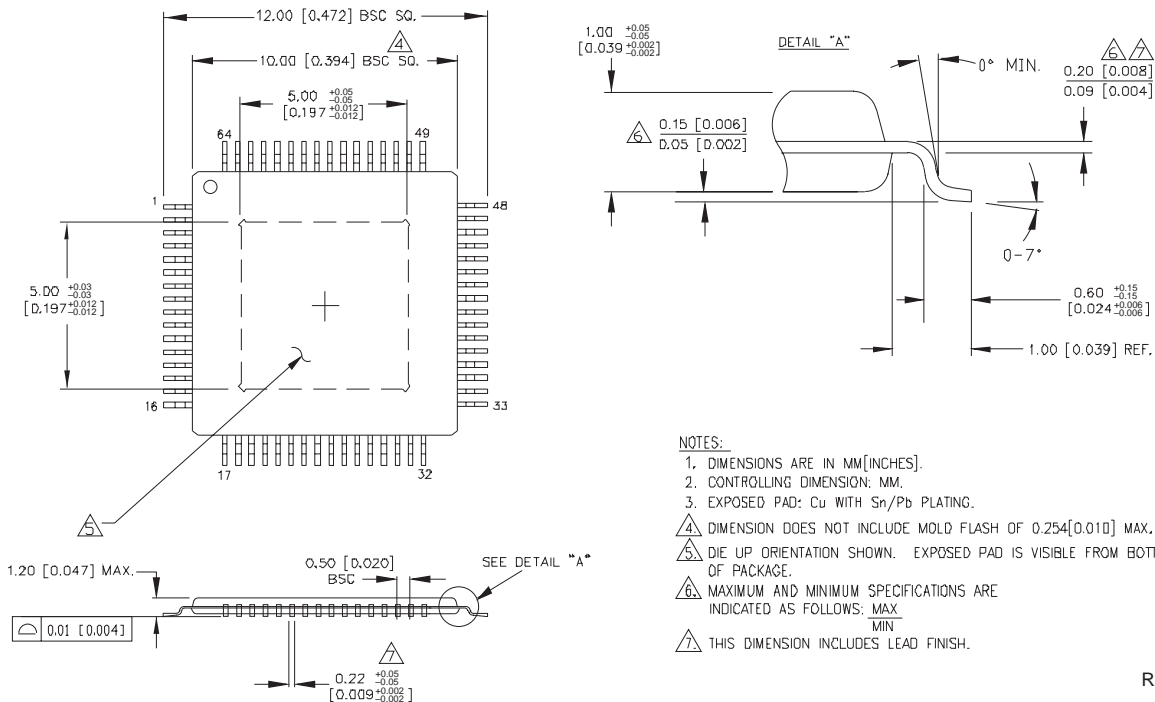
### Q0-Q9, Q10-Q19 LVDS Outputs

The SY89828L's LVDS outputs swing typically 350mV around a 1.25V common mode voltage above ground. The common mode voltage has tight limits to permit large variations in ground between an LVDS driver and receiver. Also, change in common mode voltage, as a function of data input is kept tight to keep EMI low. Each of the SY89828L's LVDS outputs should be terminated with a 100 $\Omega$  termination resistor including any unused output pairs. This ensures the best jitter and skew performance of the device. In a similar manner, The SEL2 Input is used to select either CLKA (SEL2 is LOW) or CLKB (SEL2 is HIGH) for the Q10-Q19 differential output pairs.

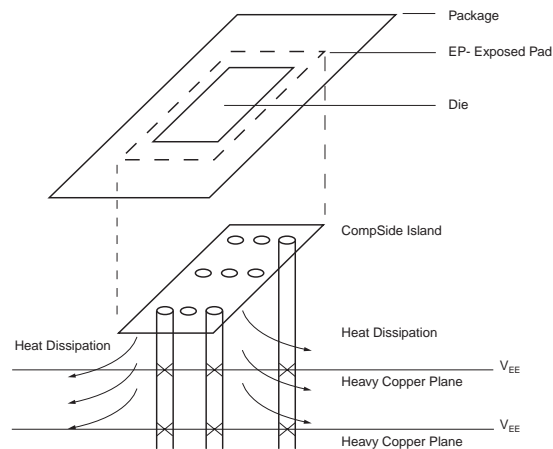
## RELATED MICREL PRODUCTS AND SUPPORT DOCUMENTATION

| Part Number | Function                                                                                               | Data Sheet Link                                                                                                                |
|-------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| SY55855V    | Dual CML/PECL/LVPECL-to-LVDS Translator                                                                | <a href="http://www.micrel.com/product-info/products/sy55855v.shtml">www.micrel.com/product-info/products/sy55855v.shtml</a>   |
| SY89825U    | 2.5/3.3V 1:22 High-Performance, Low-Voltage PECL Bus Clock Driver & Translator w/Internal Termination  | <a href="http://www.micrel.com/product-info/products/sy89825u.shtml">www.micrel.com/product-info/products/sy89825u.shtml</a>   |
| SY89826U    | 3.3V 1GHz Precision 1:22 LVDS Fanout Buffer with 2:1 Input Mux                                         | <a href="http://www.micrel.com/product-info/products/sy89826u.shtml">www.micrel.com/product-info/products/sy89826u.shtml</a>   |
| SY89829U    | 2.5/3.3V High-Performance, Dual 1:10 LVPECL Clock Driver w/Internal Termination & Redundant Switchover | <a href="http://www.micrel.com/product-info/products/sy89829u.shtml">www.micrel.com/product-info/products/sy89829u.shtml</a>   |
| M-0317      | HBW Solutions                                                                                          | <a href="http://www.micrel.com/product-info/products/solutions.shtml">www.micrel.com/product-info/products/solutions.shtml</a> |
| Exposed pad | Amkor Exposed Pad Application Note                                                                     | <a href="http://www.amkor.com/products/notes_papers/ePad.pdf">www.amkor.com/products/notes_papers/ePad.pdf</a>                 |

**64-PIN EPAD-TQFP (DIE UP) (H64-1)**



Rev. 02



**PCB Thermal Consideration for 64-Pin EPAD-TQFP Package**

**Package Notes:**

- Note 1.** Package meets Level 3 qualifications.
- Note 2.** All parts are 100% baked and dry-packed before shipment.
- Note 3.** Exposed pad must be soldered to a ground for proper thermal management.

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