



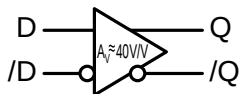
**3.3V/5V 2.5GHz**  
**PECL/ECL DIFFERENTIAL**  
**RECEIVER/BUFFER**

**Precision Edge®**  
**SY89306/316V**

## FEATURES

- $f_{MAX} > 2.5\text{GHz}$
- Inputs (D, /D) include 75k $\Omega$  pull-down resistors
- SY89306V: 100k EP compatible
- SY89316V: 10k EP compatible
- Industrial temperature range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Available in an ultra-small 8-pin (2mm x 2mm) MLF® package

## BLOCK DIAGRAM



Precision Edge®

## DESCRIPTION

The SY89306V and SY89316V are a high-speed buffer/receivers. The devices are functionally equivalent to the 10/100EP16 buffers, but feature a 70% smaller footprint.

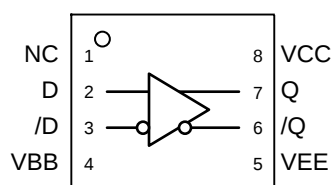
The SY89306/316V includes a  $V_{BB}$  reference for single-ended AC-coupling applications. Whenever used, the  $V_{BB}$  pin should be bypassed to ground via a 0.01 $\mu\text{F}$  capacitor.  $V_{BB}$  reference can only sink/source 0.5mA.

Under open input conditions (pulled to  $V_{EE}$ ), internal input clamps will force the Q output LOW.

## FUNCTIONAL CROSS REFERENCE

| Micrel Part Number | Logic  | Functional Cross |
|--------------------|--------|------------------|
| SY89306V           | 100KEP | 100EP16V         |
| SY89316V           | 10KEP  | 10EP16V          |

## PACKAGE/ORDERING INFORMATION



**8-Pin MLF®  
Ultra-Small Outline**

## Ordering Information

| Part Number                 | Package Type | Operating Range | Package Marking                     | Lead Finish    |
|-----------------------------|--------------|-----------------|-------------------------------------|----------------|
| SY89306VMITR                | MLF-8        | Industrial      | 306                                 | Sn-Pb          |
| SY89316VMITR                | MLF-8        | Industrial      | 316                                 | Sn-Pb          |
| SY89306VMGTR <sup>(1)</sup> | MLF-8        | Industrial      | 306 with Pb-Free bar-line indicator | Pb-Free NiPdAu |
| SY89316VMGTR <sup>(1)</sup> | MLF-8        | Industrial      | 316 with Pb-Free bar-line indicator | Pb-Free NiPdAu |

Note:

1. Pb-Free package is recommended for new designs.

## PIN DESCRIPTION

## SY89306V

| Pin Number | Pin Name           | Type                     | Pin Function                                                                                                                                                                                                         |
|------------|--------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2, 3       | D, /D              | 100k ECL Input           | Differential PECL/ECL Input: The signal inputs include internal 75kΩ pull-down resistors. If inputs are left open, Q output will default to LOW. See "Input Interface Applications" section for single-ended inputs. |
| 7, 6       | Q, /Q              | 100k ECL Output          | Differential PECL/ECL Output: Defaults to LOW if D inputs left open. See "Output Interface Applications" section for recommendations on terminations.                                                                |
| 8          | VCC                | Positive Power Supply    | Positive Power Supply: Bypass with 0.1μF//0.01μF low ESR capacitors.                                                                                                                                                 |
| 5          | VEE<br>Exposed Pad | Negative Power Supply    | Negative Power Supply: V <sub>EE</sub> and exposed pad must be tied to most negative supply. For PECL/LVPECL connect to ground.                                                                                      |
| 4          | VBB                | Reference Voltage Output | Bias Voltage: V <sub>CC</sub> -1.4V. Used as reference voltage when AC coupling to the D, /D inputs. Max sink/source is ±0.5mA.                                                                                      |
| 1          | NC                 |                          | No connection.                                                                                                                                                                                                       |

## SY89316V

| Pin Number | Pin Name           | Type                     | Pin Function                                                                                                                                                                                                         |
|------------|--------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2, 3       | D, /D              | 10k ECL Input            | Differential PECL/ECL Input: The signal inputs include internal 75kΩ pull-down resistors. If inputs are left open, Q output will default to LOW. See "Input Interface Applications" section for single-ended inputs. |
| 7, 6       | Q, /Q              | 10k ECL Output           | Differential PECL/ECL Output: Defaults to LOW if D inputs left open. See "Output Interface Applications" section for recommendations on terminations.                                                                |
| 8          | VCC                | Positive Power Supply    | Positive Power Supply: Bypass with 0.1μF//0.01μF low ESR capacitors.                                                                                                                                                 |
| 5          | VEE<br>Exposed Pad | Negative Power Supply    | Negative Power Supply: V <sub>EE</sub> and exposed pad must be tied to most negative supply. For PECL/LVPECL connect to ground.                                                                                      |
| 4          | VBB                | Reference Voltage Output | Bias Voltage: V <sub>CC</sub> -1.4V. Used as reference voltage when AC coupling to the D, /D inputs. Max sink/source is ±0.5mA.                                                                                      |
| 1          | NC                 |                          | No connection.                                                                                                                                                                                                       |

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

|                                                              |                 |
|--------------------------------------------------------------|-----------------|
| Power Supply Voltage ( $V_{EE}$ ) ( $V_{CC} = 0V$ ) .....    | –6.0V to 0V     |
| Power Supply Voltage ( $V_{CC}$ ) ( $V_{EE} = 0V$ ) .....    | +6.0V to 0V     |
| Input Voltage ( $V_{IN}$ )                                   |                 |
| ( $V_{CC} = 0V$ , $V_{IN}$ not more negative than $V_{EE}$ ) | –6.0V to 0V     |
| ( $V_{EE} = 0V$ , $V_{IN}$ not more negative than $V_{CC}$ ) | +6.0V to 0V     |
| Output Current ( $I_{OUT}$ )                                 |                 |
| Continuous .....                                             | 50mA            |
| Surge .....                                                  | 100mA           |
| $V_{BB}$ Sink/Source Current ( $I_{BB}$ ) .....              | $\pm 0.5mA$     |
| Lead Temperature (soldering, 20 sec.) .....                  | 260°C           |
| Storage Temperature ( $T_S$ ) .....                          | –65°C to +150°C |

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

|                                                  |                |
|--------------------------------------------------|----------------|
| Power Supply Voltage ( $ V_{CC}-V_{EE} $ ) ..... | 3.0V to 3.6V   |
| .....                                            | 4.5V to 5.5V   |
| Ambient Temperature ( $T_A$ ) .....              | –40°C to +85°C |
| Package Thermal Resistance <sup>(3)</sup>        |                |
| MLF® ( $\theta_{JA}$ )                           |                |
| Still-Air .....                                  | 93°C/W         |
| 500lfpm .....                                    | 87°C/W         |
| MLF® ( $\psi_{JB}$ ) .....                       | 60°C/W         |

**SY89306V (100K ECL) DC ELECTRICAL CHARACTERISTICS**

$V_{CC} = +3.3V \pm 10\%$  or  $+5V \pm 10\%$  and  $V_{EE} = 0V$ ;  $V_{CC} = 0V$  and  $V_{EE} = -3.3V \pm 10\%$  or  $-5V \pm 10\%$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ , unless otherwise noted.

| Symbol       | Parameter                               | Condition | Min            | Typ | Max            | Units   |
|--------------|-----------------------------------------|-----------|----------------|-----|----------------|---------|
| $I_{EE}$     | Power Supply Current                    |           |                |     | 48             | mA      |
| $V_{OH}$     | Output HIGH Voltage                     | Note 4, 5 | $V_{CC}-1.085$ | —   | $V_{CC}-0.880$ | V       |
| $V_{OL}$     | Output LOW Voltage                      | Note 4, 5 | $V_{CC}-1.830$ | —   | $V_{CC}-1.555$ | V       |
| $V_{IH}$     | Input HIGH Voltage                      |           | $V_{CC}-1.165$ | —   | $V_{CC}-0.880$ | V       |
| $V_{IL}$     | Input LOW Voltage                       |           | $V_{CC}-1.810$ | —   | $V_{CC}-1.475$ | V       |
| $V_{IHC MR}$ | Input HIGH Voltage<br>Common Mode Range | Note 6    | $V_{EE}+2.0$   | —   | $V_{CC}-0.4$   | V       |
| $V_{BB}$     | Bias Voltage                            |           | $V_{CC}-1.38$  | —   | $V_{CC}-1.26$  | V       |
| $I_{IH}$     | Input HIGH Current                      |           | —              | —   | 150            | $\mu A$ |
| $I_{IL}$     | Input LOW Current                       |           | 0.5            | —   | —              | $\mu A$ |

**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 rating 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 values assumes exposed pad is soldered (or equivalent) to the device's most negative potential on the PCB.
4. Output loaded with  $50\Omega$  to  $V_{CC}-2V$ .
5.  $V_{IN} = V_{IL}(\text{min})$  or  $V_{IH}(\text{max})$
6.  $V_{IHC MR}(\text{Min})$  varies 1:1 with  $V_{EE}$ , (max) varies 1:1 with  $V_{CC}$ .

**SY89316V (10K ECL) DC ELECTRICAL CHARACTERISTICS**

$V_{CC} = +3.3V \pm 10\%$  or  $+5V \pm 10\%$  and  $V_{EE} = 0V$ ;  $V_{CC} = 0V$  and  $V_{EE} = -3.3V \pm 10\%$  or  $-5V \pm 10\%$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ , unless otherwise noted.

| Symbol       | Parameter                            | Condition        | Min             | Typ | Max              | Units   |
|--------------|--------------------------------------|------------------|-----------------|-----|------------------|---------|
| $I_{EE}$     | Power Supply Current                 |                  |                 |     | 48               | mA      |
| $V_{OH}$     | Output HIGH Voltage                  | <b>Note 4, 5</b> | $V_{CC} - 1.08$ | —   | $V_{CC} - 0.72$  | V       |
| $V_{OL}$     | Output LOW Voltage                   | <b>Note 4, 5</b> | $V_{CC} - 1.95$ | —   | $V_{CC} - 1.595$ | V       |
| $V_{IH}$     | Input HIGH Voltage                   |                  | $V_{CC} - 1.23$ | —   | $V_{CC} - 0.72$  | V       |
| $V_{IL}$     | Input LOW Voltage                    |                  | $V_{CC} - 1.95$ | —   | $V_{CC} - 1.445$ | V       |
| $V_{IHC MR}$ | Input HIGH Voltage Common Mode Range | <b>Note 6</b>    | $V_{EE} + 2.0$  | —   | $V_{CC} - 0.4$   | V       |
| $V_{BB}$     | Bias Voltage                         |                  | $V_{CC} - 1.43$ | —   | $V_{CC} - 1.19$  | V       |
| $I_{IH}$     | Input HIGH Current                   |                  | —               | —   | 150              | $\mu A$ |
| $I_{IL}$     | Input LOW Current                    |                  | 0.5             | —   | —                | $\mu A$ |

**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 rating 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 values assumes exposed pad is soldered (or equivalent) to the device's most negative potential on the PCB.
4. Output loaded with  $50\Omega$  to  $V_{CC} - 2V$ .
5.  $V_{IN} = V_{IL}(\text{min})$  or  $V_{IH}(\text{max})$
6.  $V_{IHC MR}(\text{Min})$  varies 1:1 with  $V_{EE}$ , (max) varies 1:1 with  $V_{CC}$ .

**AC ELECTRICAL CHARACTERISTICS**

$V_{CC} = +3.3V \pm 10\%$  or  $+5V \pm 10\%$  and  $V_{EE} = 0V$ ;  $V_{CC} = 0V$  and  $V_{EE} = -3.3V \pm 10\%$  or  $-5V \pm 10\%$ ;  $R_L = 50\Omega$  to  $V_{CC} - 2V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$ , unless noted.

| Symbol                 | Parameter                           | Condition                 | Min | Typ | Max | Units |
|------------------------|-------------------------------------|---------------------------|-----|-----|-----|-------|
| $f_{MAX}$              | Maximum Input Frequency             | <b>Note 7</b>             | 2.5 |     |     | GHz   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay (Differential)    | D to Q, /Q; <b>Note 8</b> | 100 |     | 300 | ps    |
| $t_{SKEW}$             | Duty-Cycle Skew                     | <b>Note 9</b>             |     | 8   | 30  | ps    |
| $t_r, t_f$             | Output Rise/Fall Times (20% to 80%) | Q, /Q                     | 60  | 110 | 180 | ps    |

**Notes:**

7.  $f_{MAX}$  guaranteed for functionality only,  $V_{OUT} \geq 400mV$ .  $V_{OL}$  and  $V_{OH}$  levels are guaranteed at DC only.
8.  $V_{IN} = 800mV$ .
9. Duty-cycle skew is the difference between the  $t_{PLH}$  and  $t_{PHL}$  propagation delay.

## INPUT INTERFACE APPLICATIONS

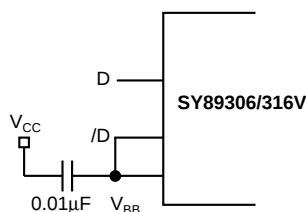


Figure 1. Single-Ended LVPECL Input  
(Terminating Unused Input)

## LVPECL OUTPUT INTERFACE APPLICATIONS

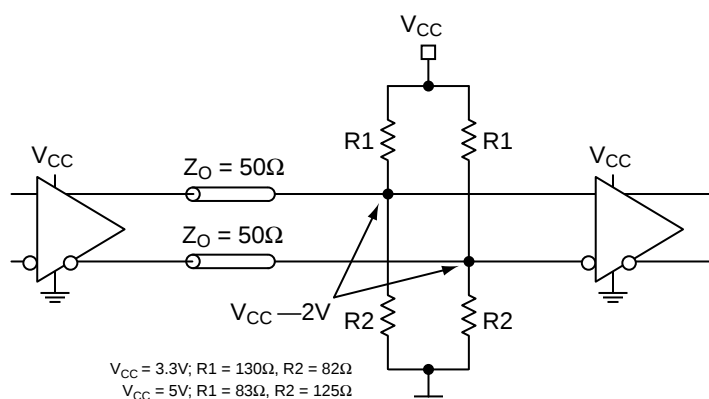


Figure 2a. Parallel Thevenin-Equivalent  
Termination

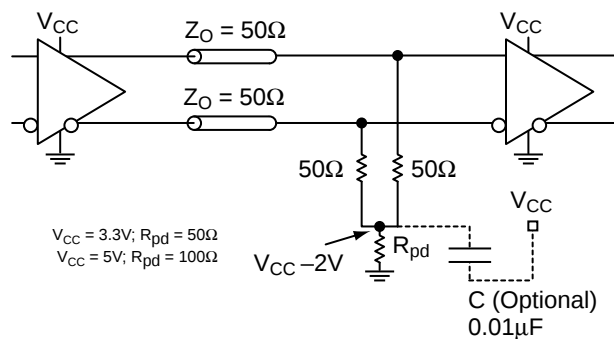


Figure 2b. Three Resistor  
"Y Termination"

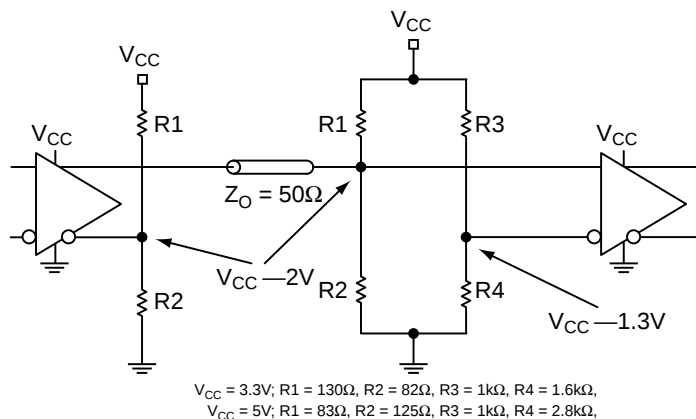
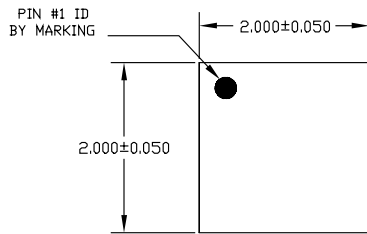


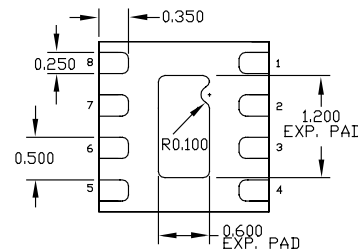
Figure 2c. Terminating Unused I/O

## RELATED PRODUCT AND SUPPORT DOCUMENTATION

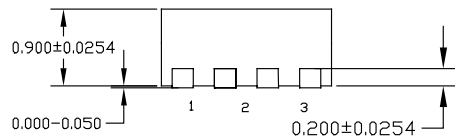
| Part Number   | Function                                           | Data Sheet Link                                                                                                                      |
|---------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| SY89206/216V  | 3.3V/5V 1GHz Differential PECL/ECL Receiver/Buffer | <a href="http://www.micrel.com/product-info/products/sy89206-216v.shtml">www.micrel.com/product-info/products/sy89206-216v.shtml</a> |
| SY89223L      | 3.3V Dual Differential LVPECL-to-LVTTL Translator  | <a href="http://www.micrel.com/product-info/products/sy89223l.shtml">www.micrel.com/product-info/products/sy89223l.shtml</a>         |
| HBW Solutions | New Products and Applications                      | <a href="http://www.micrel.com/product-info/products/solutions.shtml">www.micrel.com/product-info/products/solutions.shtml</a>       |

**8-PIN ULTRA-SMALL EPAD-MicroLeadFrame® (MLF-8)**

TOP VIEW

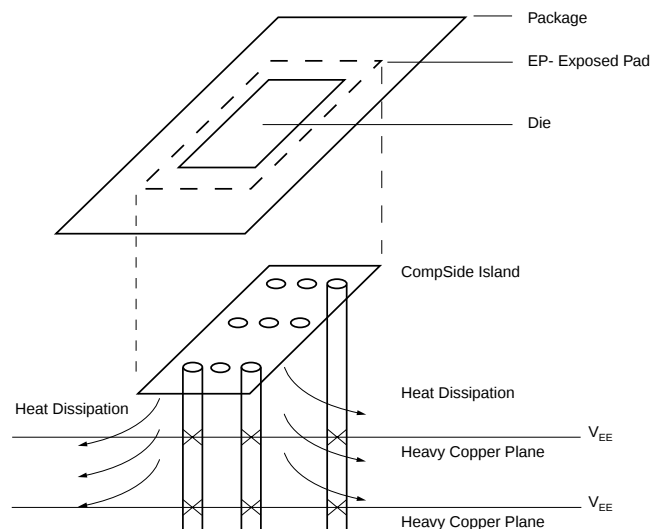


BOTTOM VIEW



SIDE 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.

**PCB Thermal Consideration for 8-Pin MLF® Package****Package Notes:**

1. Package meets Level 2 Moisture Sensitivity Classification and is shipped in Dry-pack form.
2. Exposed pads must be soldered to the most negative supply plane, equivalent to  $V_{EE}$ , for proper thermal management.

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