

FEATURES

- **Guaranteed AC performance over temperature and voltage**
 - > 4GHz f_{MAX} input frequency
 - < 240ps t_r/t_f
 - < 500ps T_{PD}
- **3.3V and 5V power supply operation**
- **100k ECL/PECL compatible I/O**
- **Wide operating temperature range: -40°C to +85°C**
- **Available in ultra-small 8-pin MLF® (2mm x 2mm) package**



Precision Edge®

DESCRIPTION

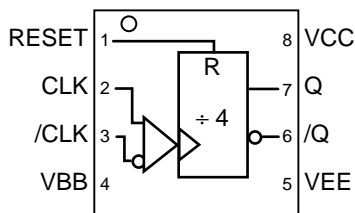
The SY89313V is a differential ECL/PECL integrated ÷4 divider clock generator. It is functionally equivalent to the SY100EP33V but in an ultra-small 8-lead MLF® package that features a 70% smaller footprint.

The V_{BB} pin, an internally generated voltage supply, is available for this device only. For single-ended input conditions, the unused differential input is connected to V_{BB} as a switching reference voltage. V_{BB} may also re-bias AC-coupled inputs. When used, decouple V_{BB} and V_{CC} via a 0.01µF capacitor and limit current sourcing or sinking to 0.5mA. When not used, V_{BB} should be left open.

The reset pin is asynchronous and is asserted on the rising edge. Upon power-up, the internal flip-flops will be in a random state; the reset allows for the synchronous use of multiple SY89313V's in a system.

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PIN CONFIGURATION/BLOCK DIAGRAM



**TOP VIEW
8-Pin MLF®**

Ultra-Small Outline (2mm x 2mm)

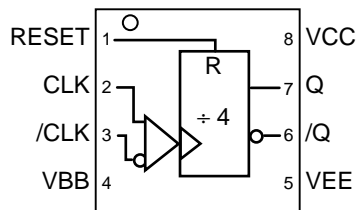
TRUTH TABLE(1)

| CLK | /CLK | RESET | Q | /Q |
|------------|--------------|-------|---|----|
| X | X | Z | L | H |
| \uparrow | \downarrow | L | F | F |

Note:

1. \uparrow = LOW-to-HIGH transition
 \downarrow = HIGH-to-LOW transition
 F = Divide by 4 function

PACKAGE/ORDERING INFORMATION



TOP VIEW
8-Pin MLF®

Ultra-Small Outline
(2mm x 2mm)

Ordering Information

| Part Number | Package Type | Operating Range | Package Marking | Lead Finish |
|-----------------------------|--------------|-----------------|-------------------------------------|----------------|
| SY89313VMITR | MLF-8 | Industrial | 313 | Sn-Pb |
| SY89313VMGTR ⁽¹⁾ | MLF-8 | Industrial | 313 with Pb-Free bar-line indicator | Pb-Free NiPdAu |

Note:

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

PIN DESCRIPTION

| Pin Number | Pin Name | Type | Pin Function |
|------------|------------------|--------------------------|--|
| 2, 3 | CLK, /CLK | 100K ECL/PECL Input | Differential PECL/ECL Input: Internal 75kΩ pull-down resistor. If left open, pin defaults LOW. See "Input Interface Applications" section for single-ended inputs. |
| 7, 6 | Q, /Q | 100K Output | Differential PECL/ECL Output: Output CLK input divided by 4. 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, Exposed Pad | Negative Power Supply | Negative Power Supply: V _{EE} and Exposed pad must be tied to most negative supply. For PECL/LVPECL connect to ground. |
| 4 | VBB | Reference Voltage Output | Bias Reference Voltage: V _{CC} -1.4V. Used as reference voltage for single-ended input or AC-coupling to the CLK, /CLK inputs. Max sink/source is ±0.5mA. See "Input Interface Applications" section. |
| 1 | Reset | 100EP Input | Single-ended Input: PECL/ECL Asynchronous reset. |

Absolute Maximum Ratings⁽¹⁾

| | |
|--|-------------------|
| Supply Voltage (V_{CC}) | -0.5V to +6.0V |
| Input Voltage (V_{IN}) | -0.5V to V_{CC} |
| LVPECL Output Current (I_{OUT}) | |
| Continuous | 50mA |
| Surge | 100mA |
| Current (V_{BB}) | |
| Source or sink current on V_{BB} , Note 3 | ± 1.5 mA |
| Lead Temperature (soldering, 20 sec.) | +260°C |
| Storage Temperature (T_S) | -65°C to +150°C |

Operating Ratings⁽²⁾

| | |
|---|----------------|
| Supply Voltage (V_{CC}) | 3.0V to 3.6V |
| | 4.5V to 5.5V |
| Ambient Temperature (T_A) | -40°C to +85°C |
| Package Thermal Resistance ⁽⁴⁾ | |
| MLF® (θ_{JA}) | |
| Still-Air | 93°C/W |
| 500lfpm | ~87°C/W |
| MLF® (Ψ_{JB}) | |
| Junction-to-Board | 60°C/W |

PECL/ECL (100K) 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 $-5V \pm 10\%$; $R_L = 50\Omega$ to $V_{CC}-2V$; $T_A = -40^\circ C$ to $+85^\circ C$ unless otherwise noted.

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|-------------|--------------------------------------|------------------------|----------------|----------------|----------------|---------|
| I_{EE} | Power Supply Current | Max V_{CC} , No Load | — | 30 | 40 | mA |
| V_{OH} | Output HIGH Voltage | | $V_{CC}-1.145$ | — | $V_{CC}-0.895$ | V |
| V_{OL} | Output LOW Voltage | | $V_{CC}-1.945$ | — | $V_{CC}-1.695$ | V |
| V_{IH} | Input HIGH Voltage | | $V_{CC}-1.225$ | — | $V_{CC}-0.88$ | V |
| V_{IL} | Input LOW Voltage | | $V_{CC}-1.945$ | — | $V_{CC}-1.625$ | V |
| V_{IHCMR} | Input HIGH Voltage Common Mode Range | Note 5 | $V_{EE}+2.0$ | — | V_{CC} | V |
| V_{BB} | Bias Voltage | | $V_{CC}-1.525$ | $V_{CC}-1.425$ | $V_{CC}-1.325$ | V |
| I_{IH} | Input HIGH Current | | — | — | 150 | μA |
| I_{IL} | Input LOW Current CLK, RESET | | 0.5 | — | — | μA |
| | Input LOW Current /CLK | | -150 | — | — | μA |

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. Due to the limited drive capability use for input of the same package only.
4. Package thermal resistance assumes exposed pad is soldered (or equivalent) to the devices most negative potential on the PCB.
5. V_{IHCMR} (min) varies 1:1 with V_{EE} , (max) varies 1:1 with V_{CC} .

AC ELECTRICAL CHARACTERISTICS⁽⁶⁾

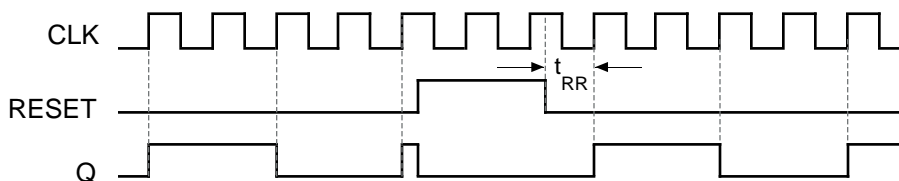
$V_{CC} = +3.3V \pm 10\%$ or $+5V \pm 10\%$ and $V_{EE} = 0V$; $V_{CC} = 0V$ and $V_{EE} = -3.3V \pm 10\%$ or $-5V \pm 10\%$; $R_L = 50\Omega$ to $V_{CC} - 2V$; $T_A = -40^\circ C$ to $+85^\circ C$ unless otherwise noted.

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|------------------------|---|-----------|-------------------|-------------------|-------------------|-------------------|
| f_{MAX} | Maximum Input Frequency | | 4 | — | — | GHz |
| t_{PLH} t_{PHL} | Propagation Delay to Output CLK → Q (SY10EP33V) RESET → Q (SY100EP33V) RESET → Q | | 300 300 310 | 380 420 420 | 460 500 500 | ps |
| t_{RR} | Set/Reset Recovery | | 200 | 100 | — | ps |
| t_{PW} | Minimum Pulse Width | RESET | 550 | 200 | — | ps |
| t_{JITTER} | Cycle-to-Cycle RMS Jitter | | — | — | 1 | ps _{RMS} |
| V_{PP} | Input Voltage Swing (Differential) | | 150 | 800 | 1200 | mV |
| t_r t_f | Output Rise/Fall Times (20% to 80%) | Q, /Q | 90 | 180 | 240 | ps |

Note:

6. Measured using a 750mV source, 50% duty cycle clock source. All loading with 50Ω to $V_{CC} - 2.0V$.

TIMING DIAGRAM



INPUT INTERFACE APPLICATIONS

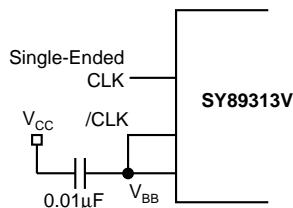


Figure 1. Single-Ended LVPECL Input (Terminating Unused Input)

LVPECL OUTPUT INTERFACE APPLICATIONS

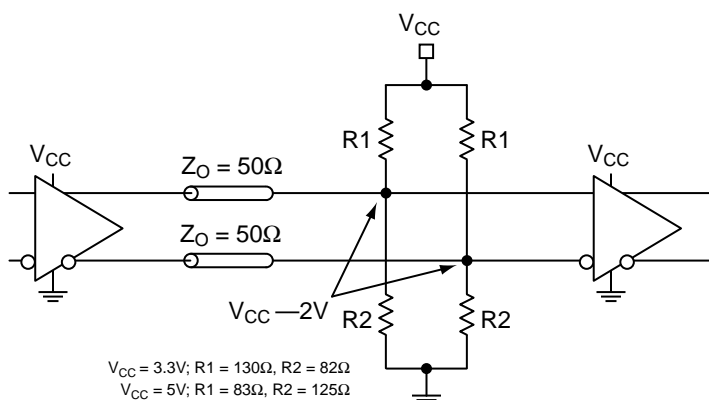


Figure 2a. Parallel Thevenin-Equivalent Termination

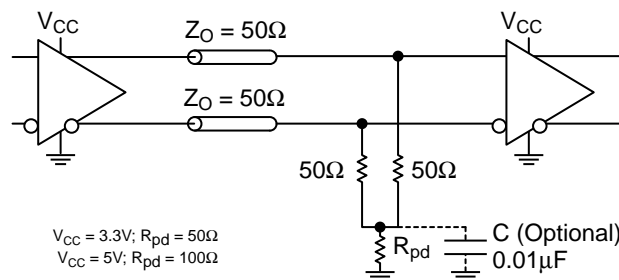


Figure 2b. Three Resistor "Y Termination"

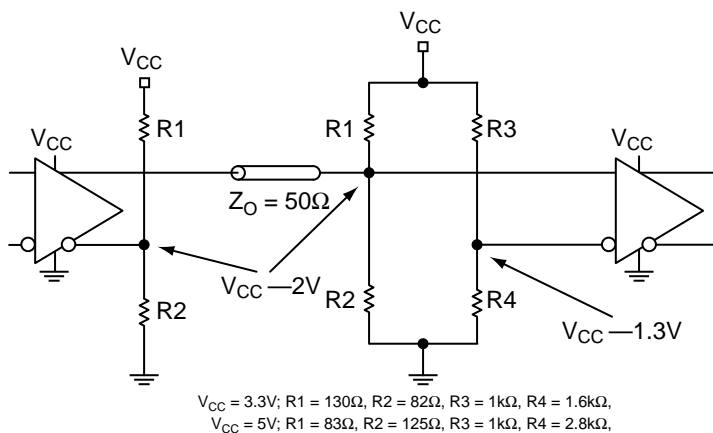
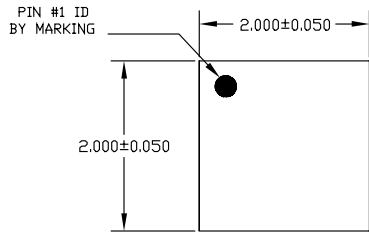
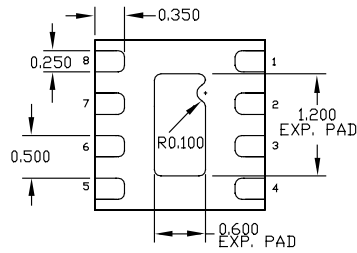


Figure 2c. Terminating Unused I/O

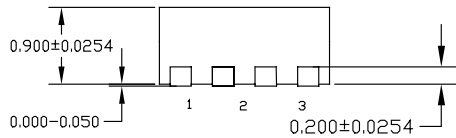
8 LEAD ULTRA-SMALL EPAD-MicroLeadFrame® (MLF-8)



TOP VIEW

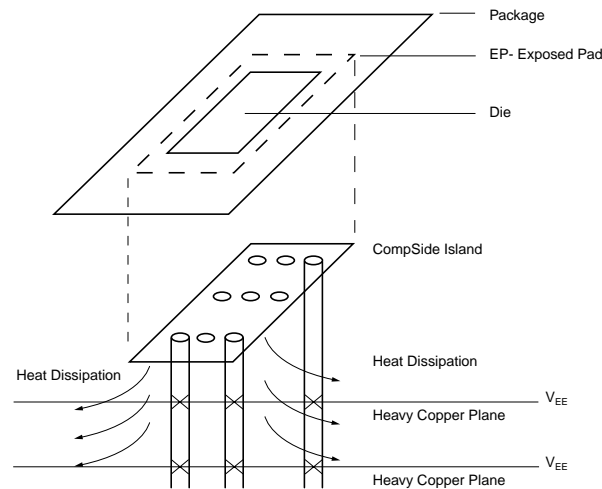


BOTTOM VIEW



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 plane equivalent to device V_{EE} pin's potential for proper thermal management.

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA

TEL + 1 (408) 944-0800 FAX + 1 (408) 944-0970 WEB <http://www.micrel.com>

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