



## SY89312V

3.3V/5V, 4GHz PECL/ECL  
÷2 Clock Generator

Precision Edge®

### General Description

The SY89312V is an integrated ÷2 divider with differential clock inputs. It is functionally equivalent to the SY100EP32V but in an ultra-small 8-pin QFN 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.  $V_{BB}$  can also 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 in use,  $V_{BB}$  should be left open.

The reset pin is asynchronous and is asserted when it is high. Upon power-up, the internal flip-flops will be in a random state; the reset allows for the synchronous use of multiple SY89312Vs in a system.

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



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### Features

- Guaranteed AC performance over temperature and voltage:
- >4GHz  $f_{MAX}$  input
- <160ps  $t_r/t_f$
- <440ps  $t_{pd}$
- 3.3V and 5V power supply operation
- 100k ECL/PECL-compatible I/O
- Internal 75KΩ input pull-down resistors
- Wide operating temperature range: -40°C to +85°C
- Available in ultra-small 8-pin 2mm x 2mm QFN package

### Truth Table<sup>(1)</sup>

CLK	/CLK	RESET	Q	/Q
X	X	H	L	H
⌋	⌋	L	F	F

**Note:**

1. F = Divide by 2 function.

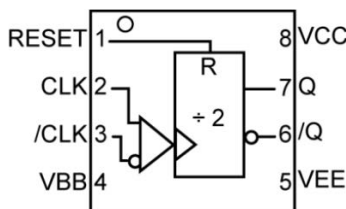
## Ordering Information

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY89312VMGTR <sup>(2)</sup>	8-pin 2mm × 2mm QFN	Industrial	312 with Pb-Free Bar Line Indicator	Pb-Free NiPdAu

**Note:**

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

## Pin Configuration



8-Pin 2mm × 2mm QFN

## 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 ECL/PECL Output	Differential PECL/ECL Output: Output CLK input divided by 2 (see Output Interface Applications section for recommendations on terminations).
8	VCC	Positive Power Supply	Positive Power Supply: Bypass with 0.1 $\mu$ F low ESR capacitor.
5	VEE, ePad	Negative Power Supply	Negative Power Supply: VEE and exposed pad (ePad) must be tied to most negative supply. For PECL/LVPECL connect to ground.
4	VBB	Reference Voltage Output	Bias Reference Voltage: VCC–1.4V. Used as reference voltage for single-ended inputs or AC-coupling to the CLK, /CLK inputs. Maximum sink/source is $\pm 0.5$ mA (see Input Interface Applications section).
1	Reset	100k ECL/PECL Input	Single-Ended Input: PECL/ECL asynchronous reset.

**Absolute Maximum Ratings<sup>(3)</sup>**

Supply Voltage ( $ V_{CC} - V_{EE} $ )	+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 on $V_{BB}$ <sup>(6)</sup>	$\pm 1.5$ mA
Lead Temperature (soldering, 20s)	260°C
Storage Temperature ( $T_s$ )	-65°C to +150°C

**Operating Ratings<sup>(4)</sup>**

Supply Voltage ( $ V_{CC} - V_{EE} $ )	+3.0 to +3.6V
Ambient Temperature ( $T_A$ )	-40°C to +85°C
Package Thermal Resistance <sup>(5)</sup>	
QFN ( $\theta_{JA}$ )	
Still Air	93°C/W
500lfpm	87°C/W
QFN ( $\psi_{JB}$ )	
Junction-to-Board	56°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  $V_{CC} - 2V$ ;  
 $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$  unless otherwise stated.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
$I_{EE}$	Power Supply Current	Maximum $V_{CC}$ , no load	—	30	42	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 <sup>(7)</sup>		$V_{EE} + 2.0$	—	$V_{CC}$	V
$V_{BB}$	Bias Voltage		$V_{CC} - 1.525$	$V_{CC} - 1.425$	$V_{CC} - 1.325$	V
$I_{IH}$	Input HIGH Current		—	—	150	$\mu\text{A}$
$I_{IL}$	Input LOW Current CLK		0.5	—	—	$\mu\text{A}$
	Input LOW Current /CLK		-150	—	—	

**Notes:**

- 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.
- The data sheet limits are not guaranteed if the device is operated beyond the operating ratings.
- Package thermal resistance assumes exposed pad is soldered (or equivalent) to the devices most negative potential on the PCB.
- Due to the limited drive capability use for input of the same package only.
- $V_{IHCMR}$  (minimum) varies 1:1 with  $V_{EE}$ , (maximum) varies 1:1 with  $V_{CC}$ .

## AC Electrical Characteristics<sup>(8)</sup>

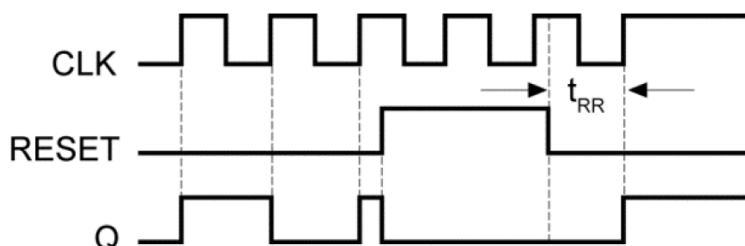
PECL:  $V_{CC} = +3.3V \pm 10\%$  or  $+5V \pm 10\%$  and  $V_{EE} = GND$ ; ECL:  $V_{EE} = -3.3V \pm 10\%$  or  $-5V \pm 10\%$  and  $V_{CC} = GND$ ;  $R_L = 50\Omega$  to  $V_{CC} - 2V$ ;  $T_A = -40^\circ C$  to  $+85^\circ C$  unless otherwise stated.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
$f_{MAX}$	Maximum Input Frequency		4	—	—	GHz
$t_{pd}$	Propagation Delay to Output Differential RESET, CLK $\rightarrow$ Q, /Q		250	275	440	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	psRMS
$V_{PP}$	Input Voltage Swing (Differential)		150	800	1200	mV
$t_r, t_f$	Output Rise/Fall Times Q, /Q (20% to 80%)		50	100	160	ps

### Note:

8. Measured using a 750mV source, 50% duty cycle clock source

## Timing Diagram



## Input Interface Applications

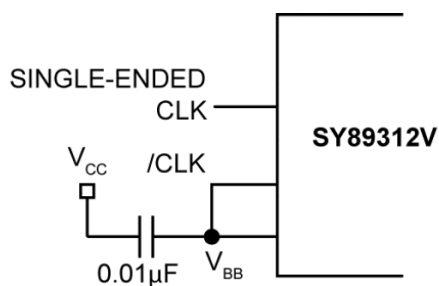


Figure 1. Single-Ended LVPECL Input (Terminating Unused Input)

## LVPECL Output Interface Applications

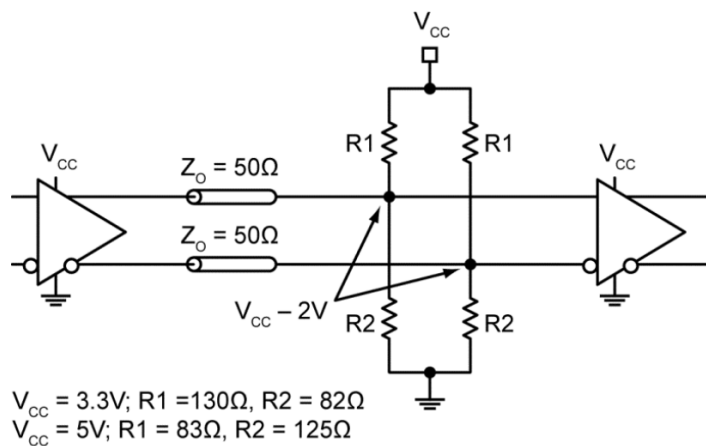


Figure 2. Parallel Thevenin-Equivalent Termination

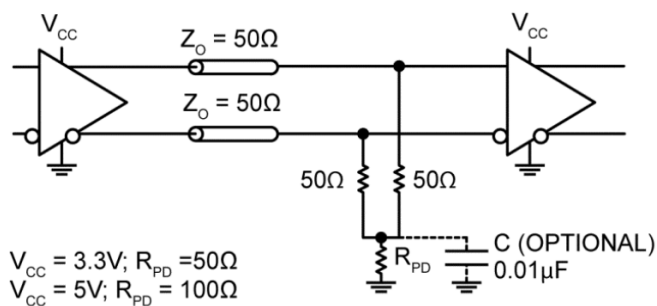


Figure 3. Three Resistor "Y Termination"

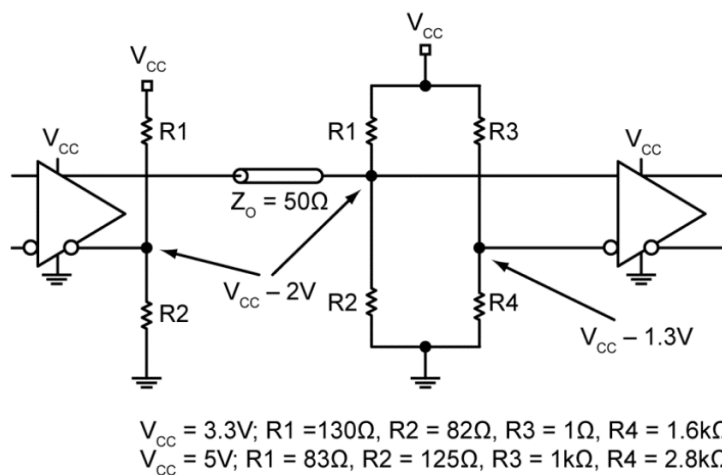
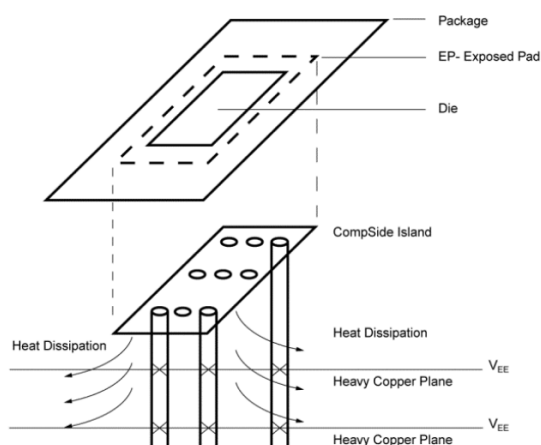
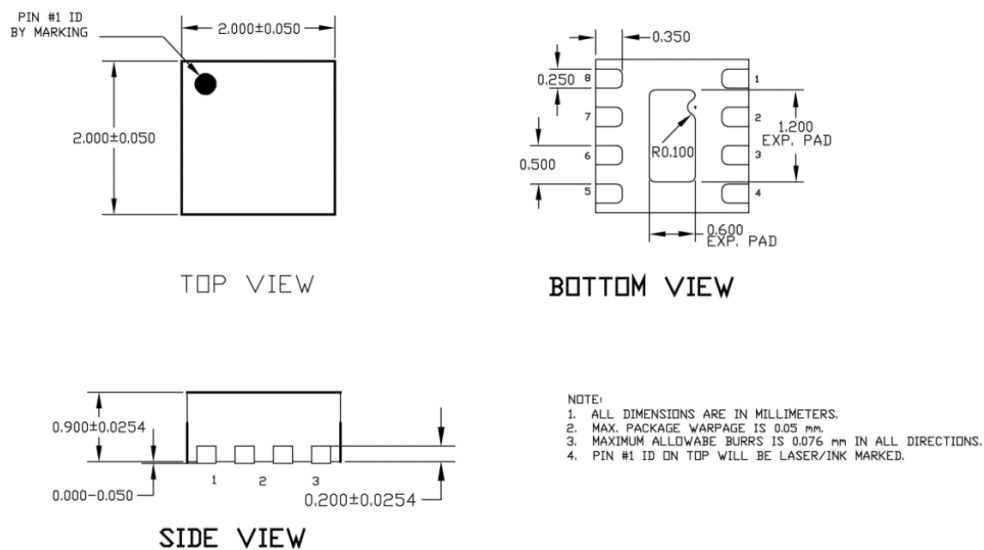


Figure 4. Terminating Unused I/O

## Package Information<sup>(9, 10, 11, 12)</sup>



### 8-Pin 2mm x 2mm QFN Package

**Note:**

9. Package information is correct as of the publication date. For updates and most current information, go to [www.micrel.com](http://www.micrel.com).
10. Package meets Level 1 qualifications.
11. All parts are dry packaged before shipment.
12. Exposed pads must be soldered to the most negative plane, equivalent to device  $V_{BB}$ , for proper thermal management.

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