

## FEATURES

- Pin-for-pin, plug-in compatible to the ON Semiconductor MC100EP195
- Maximum frequency > 2.5GHz
- Programmable range: 2.2ns to 12.2ns
- 10ps increments
- PECL mode operating range:  $V_{CC} = 3.0V$  to  $5.5V$  with  $V_{EE} = 0V$
- NECL mode operating range:  $V_{CC} = 0V$  with  $V_{EE} = -3.0V$  to  $-5.5V$
- Open input default state
- Safety clamp on inputs
- A logic high on the /EN pin will force Q to logic low
- D[0:10] can accept either ECL, CMOS, or TTL inputs
- $V_{BB}$  output reference voltage
- Available in a 32-pin TQFP package



ECL Pro™

## DESCRIPTION

The SY100EP195V is a programmable delay line, varying the time a logic signal takes to traverse from IN to Q. This delay can vary from about 2.2ns to about 12.2ns. The input can be PECL, LVPECL, NECL, or LVNECL.

The delay varies in discrete steps based on a control word presented to SY100EP195V. The 10-bit width of this latched control register allows for delay increments of approximately 10ps.

An eleventh control bit allows the cascading of multiple SY100EP195V devices, for a wider delay range. Each additional SY100EP195V effectively doubles the delay range available.

For maximum flexibility, the control register interface accepts CMOS or TTL level signals, as well as the input level at the IN± pins.

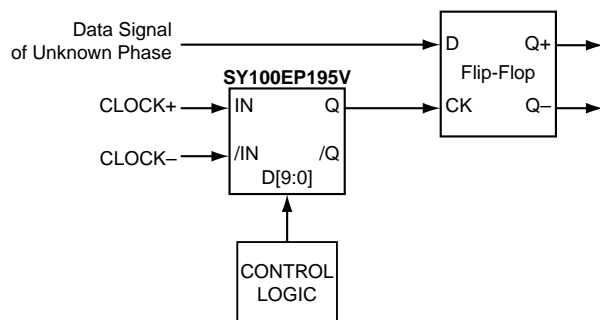
## APPLICATIONS

- Clock de-skewing
- Timing adjustment
- Aperture centering

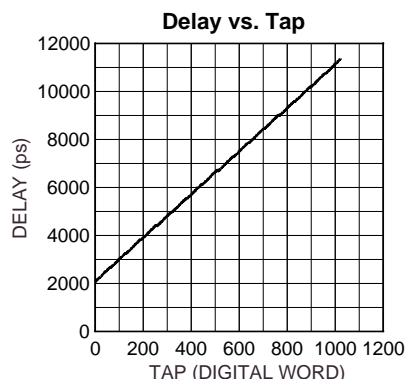
## CROSS REFERENCE TABLE

Micrel Semiconductor	ON Semiconductor
SY100EP195VTI	MC100EP195FA

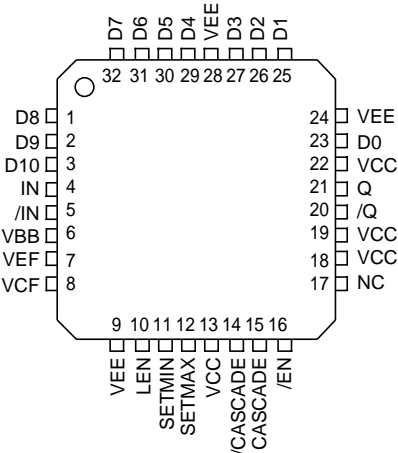
## TYPICAL APPLICATIONS CIRCUIT



## TYPICAL PERFORMANCE



PACKAGE/ORDERING INFORMATION



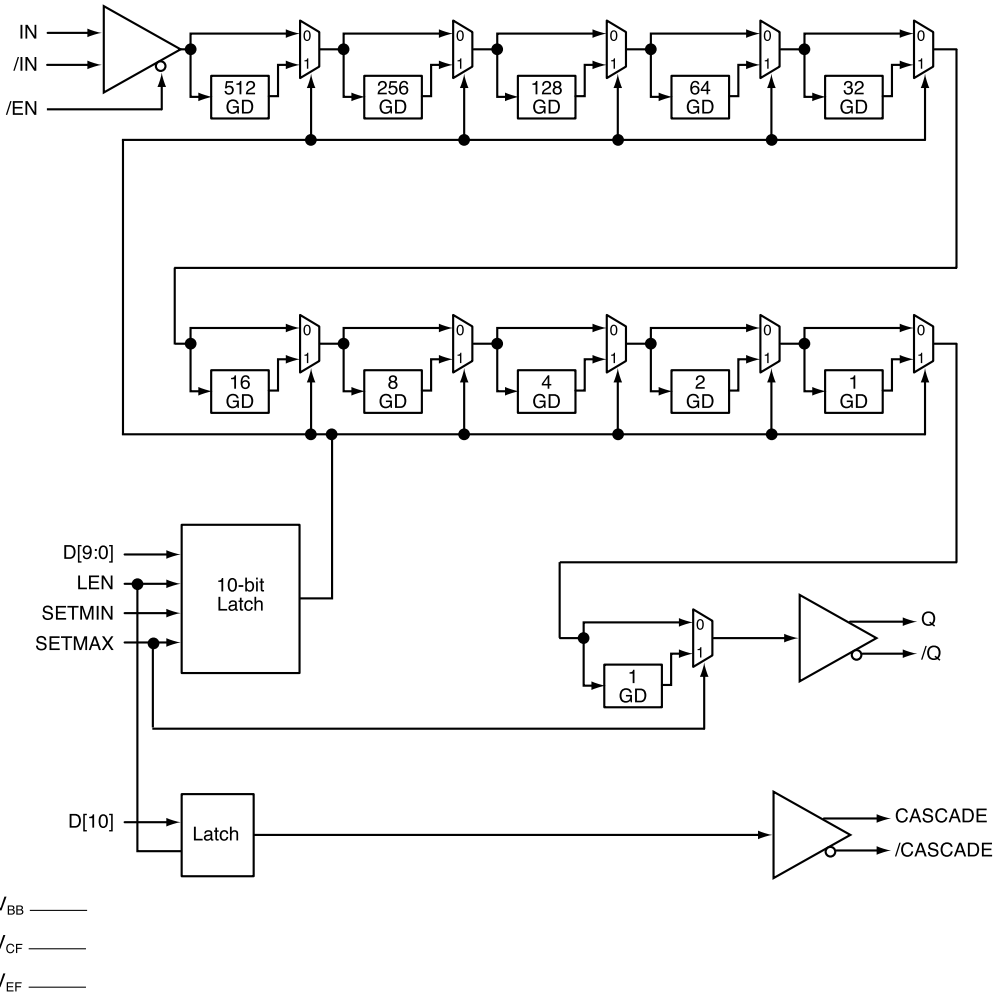
32-Pin TQFP (T32-1)

Ordering Information

Part Number	Package Type	Operating Range	Package Marking
SY100EP195VTI	T32-1	Commercial	SY100EP195V
SY100EP195VTCTR <sup>(1)</sup>	T32-1	Commercial	SY100EP195V
SY100EP195VTI <sup>(2)</sup>	T32-1	Industrial	SY100EP195V
SY100EP195VTITR <sup>(1,2)</sup>	T32-1	Industrial	SY100EP195V

**Note 1.** Tape and Reel.  
**Note 2.** Recommended for new designs.

FUNCTIONAL BLOCK DIAGRAM



**PIN DESCRIPTION**

Pin Number	Pin Name	Pin Function
23, 25, 26, 27, 29, 30, 31, 32, 1, 2	D[0:9]	CMOS, ECL, or TTL Select Inputs: These digital control signals adjust the amount of delay from IN to Q. Please refer to the delay selection Table 1 for delay values. Figure 9 shows how to interface these inputs to various logic family standards. These inputs default to logic low when left unconnected. Bit 0 is the least significant bit, and bit 9 is the most significant bit.
3	D[10]	CMOS, ECL, or TTL Select Input: This input latches just like D[0:9] does. It drives the CASCADE, /CASCADE differential pair. Use only when cascading two or more SY100EP195V to extend the range of delays required.
4, 5	IN, /IN	ECL Input: This is the signal to be delayed. If this input pair is left unconnected, this is equivalent to a logic low input.
6	VBB	Voltage Output: When using a single-ended logic source for IN and /IN, connect the unused input of the differential pair to this pin. This pin can also re-bias AC coupled inputs to IN and /IN. When used, de-couple this pin to V <sub>CC</sub> through an 0.01μF capacitor. Limit current sinking or sourcing to 0.5mA or less.
7	VEF	Voltage Output: Connect this pin to VCF when the D inputs are ECL. Refer to the digital control logic standard section of the Functional Description to interface the D inputs to CMOS or TTL.
8	VCF	Voltage Input: The voltage at this pin sets the logic transition threshold for the D inputs.
9, 24, 28	VEE	Most negative supply. Supply ground for PECL systems.
10	LEN	ECL Control Input: When logic low, the D inputs flow through. Any changes to the D inputs reflect in the delay between IN, /IN and Q, /Q. When logic high, the logic values at D are latched, and these latched bits determine the delay.
11	SETMIN	ECL Control Input: When logic high, the contents of the D register are reset. This sets the delay to the minimum possible, equivalent to D[0:9] being set to 0000000000. When logic low, the value of the D register, or the logic value of SETMAX determines the delay from IN, /IN to Q, /Q. This input defaults to logic low when left unconnected.
12	SETMAX	ECL Control Input: When logic high and SETMIN is logic low, the contents of the D register are set high, and the delay is set to one step greater than the maximum possible with D[0:9] set to 1111111111. When logic low, the value of the D register, or the logic value of SETMIN determines the delay from IN, /IN to Q, /Q. This input defaults to logic low when left unconnected.
13, 18, 19, 22	VCC	Most positive supply: Supply ground for NECL systems. Bypass to V <sub>EE</sub> with 0.1μF and 0.01μF low ESR capacitors.
14, 15	CASCADE, /CASCADE	ECL Outputs: These outputs are used when cascading two or more SY100EP195V to extend the delay range required.
16	/EN	ECL Control Input: When set active low, Q, /Q are a delayed version of IN, /IN. When set inactive high, IN, /IN are gated such that Q, /Q become a differential logic low. This input defaults to logic low when left unconnected.
20, 21	Q, /Q	ECL Outputs: This signal pair is the delayed version of IN, /IN.
17	NC	No Connect: Leave this pin unconnected.

**Absolute Maximum Ratings**(Note 1)

Supply Voltage ( $V_{CC}$ )	
PECL Mode ( $V_{EE}=0V$ )	–0.5V to +6.0V
Supply Voltage ( $V_{EE}$ )	
NECL Mode ( $V_{CC}=0V$ )	+0.5V to –6.0V
Any Input Voltage ( $V_{IN}$ )	
PECL Mode	–0.5V to $V_{CC}+0.5V$
NECL Mode	+0.5V to $V_{EE}-0.5V$
ECL Output Current ( $I_{OUT}$ )	
Continuous	50mA
Surge	100mA
$I_{BB}$ Sink/Source Current	$\pm 0.5mA$
Lead Temperature (soldering, 10 sec.)	+300°C
Storage Temperature ( $T_S$ )	–65°C to +150°C
ESD Rating, <b>Note 3</b>	>1.5kV

**Operating Ratings**(Note 2)

Supply Voltage ( $V_{CC}$ )	
PECL Mode ( $V_{EE}=0V$ )	+3.0V to +5.5V
Supply Voltage ( $V_{EE}$ )	
NECL Mode ( $V_{CC}=0V$ )	–3.0V to –5.5V
Ambient Temperature ( $T_A$ )	–40°C to +85°C
Package Thermal Resistance	
TQFP-32 ( $\theta_{JA}$ )	
Still-air	50°C/W
500lfpm	42°C/W
TQFP-32 ( $\theta_{JC}$ )	20°C/W

**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.

**DC ELECTRICAL CHARACTERISTICS**

$T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{CC}$	Power Supply Voltage (PECL)		3.0	3.3	3.6	V
			4.5	5.0	5.5	V
$V_{EE}$	Power Supply Voltage (NECL)		–3.6	–3.3	–3.0	V
			–5.5	–5.0	–4.5	V
$I_{EE}$	Power Supply Current, <b>Note 1</b>	No Load, Over Supply Voltage		150	180	mA

**Note 1.** Required 500lfpm air flow when using +5V or –5V power supply.

**(100KEP) LVPECL DC ELECTRICAL CHARACTERISTICS** $V_{CC} = 3.3V$ ,  $V_{EE} = 0V$ ;  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , **Note 1, 2**

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{OH}$	Output HIGH Voltage	Figures 2, 3, 6	2155	2280	2405	mV
$V_{OL}$	Output LOW Voltage	Figures 2, 3, 6	1355	1480	1605	mV
$V_{IH}$	Input HIGH Voltage PECL CMOS TTL	Figures 1, 4	2075 1815 2000		2420	mV mV mV
$V_{IL}$	Input LOW Voltage PECL CMOS TTL	Figures 1, 4	1355		1675 1485 800	mV mV mV
$V_{BB}$	Output Voltage Reference		1775	1875	1975	mV
$V_{CF}$	Input Select Voltage		1610	1720	1825	mV
$V_{EF}$	Mode Connection		1900	2000	2100	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range, <b>Note 3</b>	Figure 5	2.0		3.3	V
$I_{IH}$	Input HIGH Current				150	$\mu A$
$I_{IL}$	Input LOW Current IN /IN		0.5 -150			$\mu A$ $\mu A$

**Note 1.** Device is guaranteed to meet the DC specifications, shown in the table above, after thermal equilibrium has been established. The device is tested in a socket such that transverse airflow of  $\geq 500$ lpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.3V to -2.2V.

**Note 3.**  $V_{IHCMR}$  maximum varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

**(100KEP) PECL DC ELECTRICAL CHARACTERISTICS** $V_{CC} = 5.0V$ ,  $V_{EE} = 0V$ ;  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , **Note 1, 2**

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{OH}$	Output HIGH Voltage	Figures 2, 3, 6	3855	3980	4105	mV
$V_{OL}$	Output LOW Voltage	Figures 2, 3, 6	3055	3180	3305	mV
$V_{IH}$	Input HIGH Voltage PECL CMOS TTL	Figures 1, 4	3775 2750 2000		4120	mV mV mV
$V_{IL}$	Input LOW Voltage PECL CMOS TTL	Figures 1, 4	3055		3375 2250 800	mV mV mV
$V_{BB}$	Output Voltage Reference		3475	3575	3675	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range, <b>Note 3</b>	Figure 5	2.0		5.0	V
$I_{IH}$	Input HIGH Current				150	$\mu A$
$I_{IL}$	Input LOW Current IN /IN		0.5 -150			$\mu A$ $\mu A$

**Note 1.** Device is guaranteed to meet the DC specifications, shown in the table above, after thermal equilibrium has been established. The device is tested in a socket such that transverse airflow of  $\geq 500$ lfpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +2.0V to -0.5V.

**Note 3.**  $V_{IHCMR}$  maximum varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

**(100KEP) NECL DC ELECTRICAL CHARACTERISTICS** $V_{CC} = 0V$ ,  $V_{EE} = -5.5V$  to  $-3.0V$ ;  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , **Note 1**

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{OH}$	Output HIGH Voltage	Figures 2, 3	-1145	-1020	-895	mV
$V_{OL}$	Output LOW Voltage	Figures 2, 3	-1945	-1820	-1695	mV
$V_{IH}$	Input HIGH Voltage NECL	Figures 1, 4	-1225		-880	mV
$V_{IL}$	Input LOW Voltage NECL	Figures 1, 4	-1945		-1625	mV
$V_{BB}$	Output Voltage Reference		-1525	-1425	-1325	mV
$V_{IHCMR}$	Input HIGH Voltage Common Mode Range, <b>Note 2</b>	Figure 5	$V_{EE}+2.0$		0.0	V
$I_{IH}$	Input HIGH Current				150	$\mu A$
$I_{IL}$	Input LOW Current IN /IN		0.5 -150			$\mu A$ $\mu A$

**Note 1.** Device is guaranteed to meet the DC specifications, shown in the table above, after thermal equilibrium has been established. The device is tested in a socket such that transverse airflow of  $\geq 500$ lfpm is maintained.

**Note 2.**  $V_{IHCMR}$  minimum varies 1:1 with  $V_{EE}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

**AC ELECTRICAL CHARACTERISTICS**
 $V_{CC} = 3.0$  to  $5.5V$ ,  $V_{EE} = 0V$  or  $V_{CC} = 0V$ ,  $V_{EE} = -3.0$  to  $-5.5V$ ;  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , **Notes 1, 2, 3**

Symbol	Parameter	$T_A = -40^{\circ}C$			$T_A = +25^{\circ}C$			$T_A = +85^{\circ}C$			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{MAX}$	Maximum Frequency, <b>Note 4</b>		2.5			2.5			2.5		GHz
$t_{PLH}$ $t_{PHL}$	Propagation Delay IN to Q; D[0-10]=0 IN to Q; D[0-10]=1023 /EN to Q; D[0-10]=0 D10 to CASCADE	1650 9500 1600 300	2000 11500 2150 420	2450 13500 2600 500	1800 9800 1800 325	2050 12200 2300 450	2600 14000 2800 550	1950 10600 2000 325	2250 13300 2500 525	2750 15800 3000 625	ps ps ps ps
$t_{RANGE}$	Programmable Range $t_{PD(max)} - t_{PD(min)}$	7850	9450		8200	10000		8850	10950		ps
$\Delta t$	Step Delay, <b>Note 5</b> D0 High D1 High D2 High D3 High D4 High D5 High D6 High D7 High D8 High D9 High		9 25 42 75 142 296 532 1080 2100 4250			10 26 42 80 143 300 540 1095 2150 4300			10 27 43 81 150 310 565 1140 2250 4500		ps ps ps ps ps ps ps ps ps ps
Lin	Linearity					25					
$t_{SKEW}$	Duty Cycle Skew, <b>Note 6</b> $t_{PHL} - t_{PLH}$					25					ps
$t_S$	Setup Time D to LEN D to IN, <b>Note 7</b> /EN to IN, <b>Note 8</b>	200 300 300	0 140 150		200 300 300	0 160 170		200 300 300	0 180 180		ps ps ps
$t_H$	Hold Time LEN to D IN to /EN, <b>Note 9</b>	200 400	60 250		200 400	100 280		200 400	80 300		ps ps
$t_R$	Release Time /EN to IN, <b>Note 10</b> SETMAX to LEN SETMIN to LEN					500 250 200					ps ps ps
$t_{JIT}$	Cycle-to-Cycle Jitter, <b>Note 11</b>		0.2	< 1		0.2	< 1		0.2	< 1	ps rms
$V_{PP}$	Input Voltage Swing (Differential)	150	800	1200	150	800	1200	150	800	1200	mV
$t_r$ $t_f$	Output Rise/Fall Time 20% to 80% (Q) 20% to 80% (CASCADE)		180 180	250 250		210 210	300 300		230 230	325 325	ps ps

**Note 1.** AC characteristics are guaranteed by design and characterization.

**Note 2.** Measured using 750mV source, 50% duty cycle clock source.

**Note 3.** Tested using environment of Figure 6.

**Note 4.** Refer to "Typical Operating Characteristics" for output swing performance.

**Note 5.** The delays of the individual bits are cumulative.

**Note 6.** Duty cycle skew guaranteed only for differential operation measured from the crosspoint of the input edge to the crosspoint of the corresponding output edge.

**Note 7.** Setup time defines the amount of time prior to an edge on IN, /IN that the D[0:9] bits must be set to guarantee the new delay will occur for that edge.

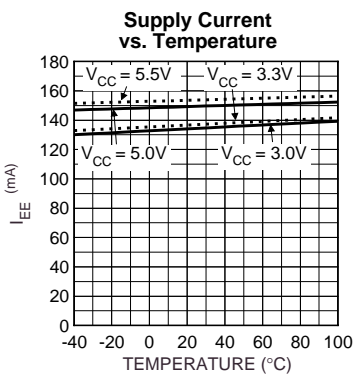
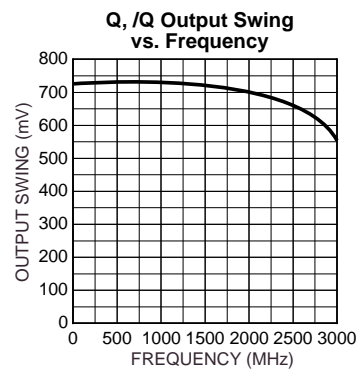
**Note 8.** Setup time is the minimum that /EN must be asserted prior to the next transition of IN, /IN to prevent an output response greater than  $\pm 75mV$  to that IN, /IN transition.

**Note 9.** Hold time is the minimum time that /EN must remain asserted after a negative going IN or a positive going /IN to prevent an output response greater than  $\pm 75mV$  to that IN, /IN transition.

**Note 10.** Release time is the minimum time that /EN must be deasserted prior to the next IN, /IN transition to ensure an output response that meets the specified IN to Q propagation delay and transition times.

**Note 11.** This is the amount of generated jitter added to an otherwise jitter free clock signal, going from IN, /IN to Q, /Q, where the clock may be any frequency between 0.0 and 2.5GHz.

TYPICAL OPERATING CHARACTERISTICS





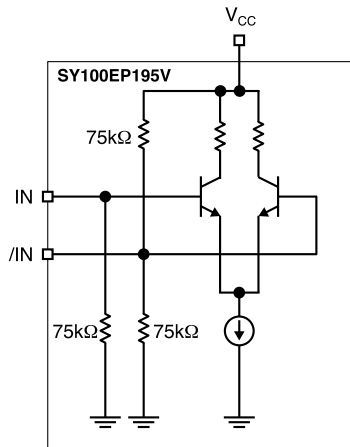


Figure 1a. Differential Input Structure

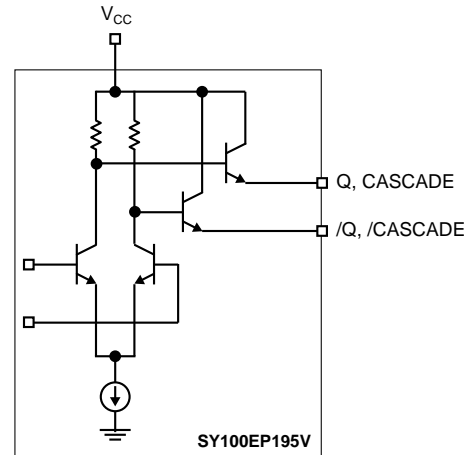


Figure 2. Emitter Output Structure

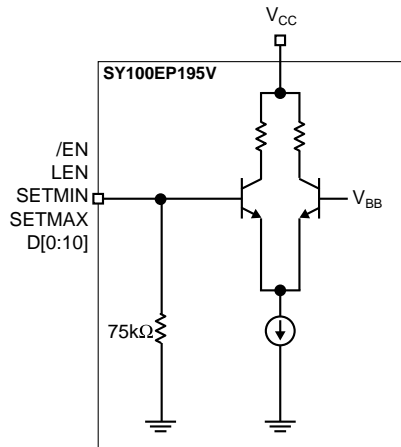


Figure 1b. Single-Ended Input Structure

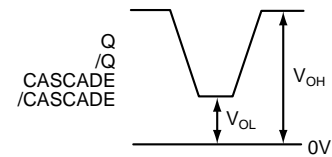


Figure 3a. Output Levels, PECL, LVPECL

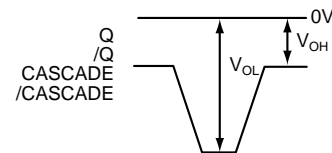


Figure 3b. Output Levels NECL

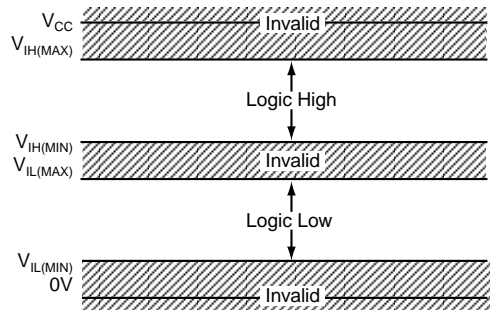


Figure 4a. Input Levels, PECL

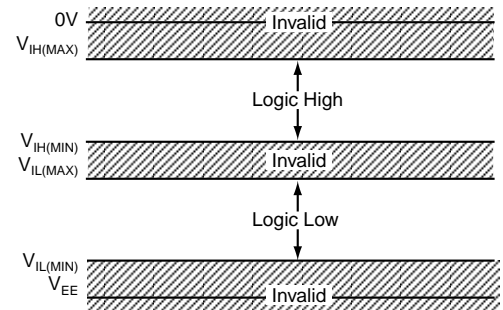


Figure 4c. Input Levels, NECL

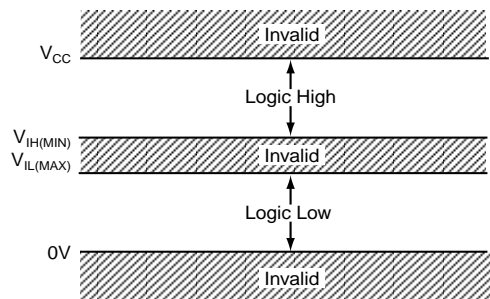


Figure 4b. Input Levels, CMOS, TTL

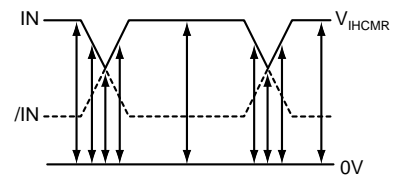


Figure 5a. Input Common Mode, PECL, LVPECL

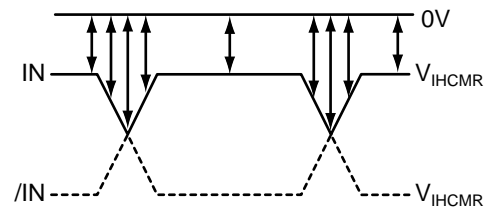
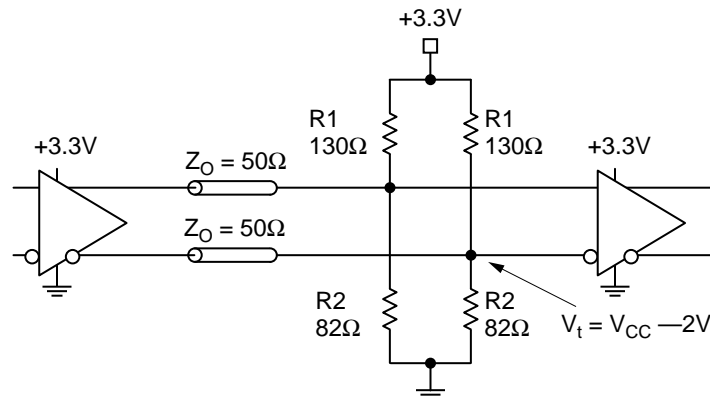


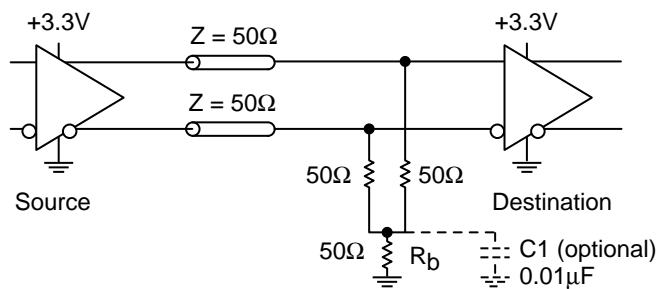
Figure 5b. Input Common Mode, NECL

## TERMINATING PECL



**Figure 6a. Parallel Termination–Thevenin Equivalent**

**Note 1.** For +5.0V systems:  $R1 = 82\Omega$ ,  $R2 = 130\Omega$ .

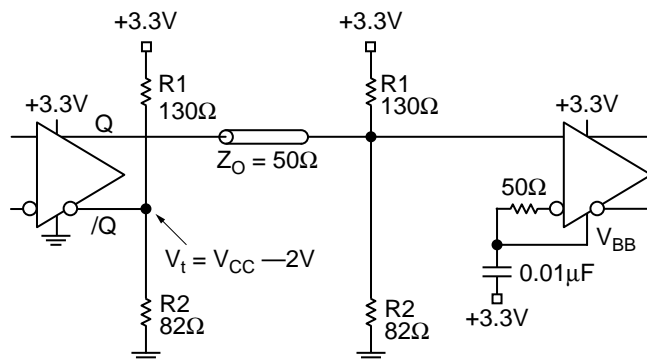


**Figure 6b. Three-Resistor ‘Y–Termination’**

**Note 1.** Power-saving alternative to Thevenin termination.

**Note 2.** Place termination resistors as close to destination inputs as possible.

**Note 3.**  $R_b$  resistor sets the DC bias voltage, equal to  $V_t$ . For +3.3V systems  $R_b = 46\Omega$  to  $50\Omega$ . For +5V systems,  $R_b = 110\Omega$ .

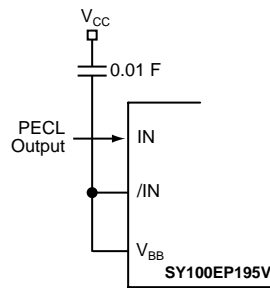


**Figure 6c. Terminating Unused I/O**

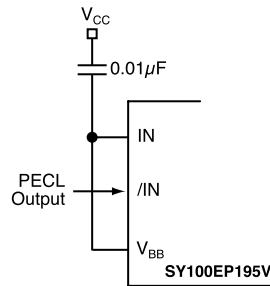
**Note 1.** Unused output (/Q) must be terminated to balance the output.

**Note 2.** Micrel's differential I/O logic devices include a  $V_{BB}$  reference pin.

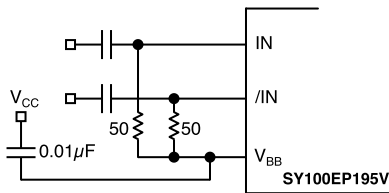
**Note 3.** Connect unused input through  $50\Omega$  to  $V_{BB}$ . Bypass with a  $0.01\mu F$  capacitor to  $V_{CC}$ , not GND, as PECL is referenced to  $V_{CC}$ .



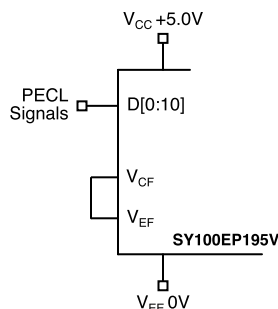
**Figure 7a. Interfacing to a Single-Ended PECL Signal**



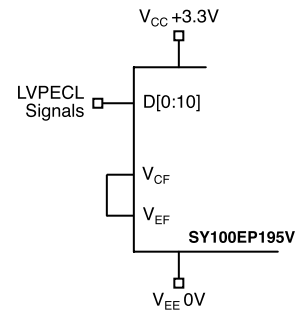
**Figure 7b. Interfacing to and Inverting a Single-Ended PECL Signal**



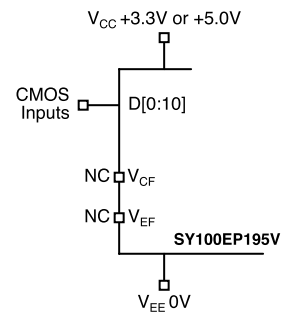
**Figure 8. Re-Biasing an AC-Coupled Signal**



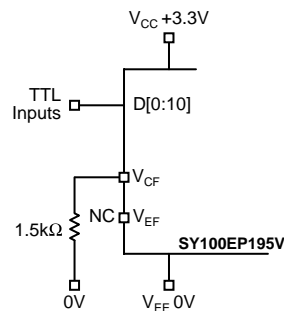
**Figure 9a. Connecting PECL Signals to the D Inputs**



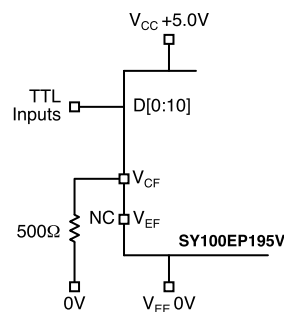
**Figure 9b. Connecting LVPECL Signals to the D Inputs**



**Figure 9c. Connecting CMOS Signals to the D Inputs**  
*Note:  $V_{CF}$  and  $V_{EF}$  are not connected*



**Figure 9d. Connecting TTL Signals to the D Inputs, with  $V_{CC} = 3.3V$**



**Figure 9e. Connecting TTL Signals to the D Inputs, with  $V_{CC} = 5.0V$**

## FUNCTIONAL DESCRIPTION

SY100EP195V is a programmable delay line, varying the delay of a PECL or NECL input signal by any amount between about 2.2ns and 12.2ns. A 10-bit digital control register affords delay steps of approximately 10ps.

SY100EP195V implements the delay using a multiplexer chain and a set of fixed delay elements. Under digital control, various subsets of the delay elements are included in the signal chain. To simplify interfacing, the 10-bit digital delay control word interfaces to PECL, CMOS, or TTL interface standards.

Since multiplexers must appear in the delay path, SY100EP195V has a minimum delay of about 2.2ns. Delays below this value are not possible. In addition, when cascading multiple SY100EP195V to extend the delay range, the minimum delay is about 2.2ns times the number of SY100EP195V in cascade. An eleventh control bit, D[10], along with the CASCADE and /CASCADE outputs and the SETMIN and SETMAX inputs, simplifies the task of cascading.

### Signal Path Logic Standard

The signal path, from IN, /IN to Q, /Q, interfaces to PECL, LVPECL, or NECL signals, as shown in Table 6. The choice of signal path logic standard may limit possible choices for the delay control inputs, D.

### Input Enable

The /EN input gates the signal at IN, /IN. When disabled, the input is effectively gated out, just as if a logic low was being provided to SY100EP195V.

/EN	Value at Q, /Q
L	IN, /IN Delayed
H	Logic Low Delayed

**Table 1. /EN Truth Table**

### Digital Control Latch

SY100EP195V can capture the digital delay control word into its internal 11-bit latch, 10 bits for D[0:9], and an extra bit for the D[10] cascade control. The LEN input controls the action of this latch, as per Table 2.

Note that the LEN input is always PECL, LVPECL, or NECL, the same as the IN, /IN signal pair. The 11-bit delay control word, however, may also be CMOS or TTL.

LEN	Latch Action
L	Pass Through D[0:10]
H	Latch D[0:10]

**Table 2. LEN Truth Table**

The nominal delay value is based on the binary value in D[0:9], where D[0] is the least significant bit, and D[9] is the most significant bit. This delay from IN, /IN to Q, /Q is about:

$$\Delta t = 2200 + 10 \times \text{value}(D[9:0]), \text{ ps}$$

### Digital Control Logic Standard

When used in systems where  $V_{EE}$  connects to ground, SY100EP195V may interface either to PECL, CMOS, or TTL on its D[0:10] inputs. To this end, the  $V_{CF}$  pin sets the threshold at which the D inputs switch between logic low and logic high.

As shown in Table 3, connecting  $V_{CF}$  to  $V_{EF}$  sets the threshold to PECL (if  $V_{CC}$  is 5V) or LVPECL (if  $V_{CC}$  is 3.3V). Leaving  $V_{CF}$  and  $V_{EF}$  open yields a threshold suitable for detecting CMOS output logic levels. Leaving  $V_{EF}$  open and connecting  $V_{CF}$  to a 1.5V source allows the D inputs to accept TTL signals.

Logic Standard	$V_{CF}$ Connects To
ECL, PECL	$V_{EF}$
CMOS	No Connect
TTL	1.5V Source

**Table 3. Digital Control Standard Truth Table**

If a 1.5V source is not available, connecting  $V_{CF}$  to  $V_{EE}$  through an appropriate resistor will bias  $V_{CF}$  at about 1.5V. The value of this resistor depends on the  $V_{CC}$  supply, as indicated in Table 4.

$V_{CC}$	Resistor Value
3.3V	1.5K $\Omega$
5.0V	500 $\Omega$

**Table 4. Resistor Values for TTL Input**

### Cascade Logic

SY100EP195V is designed to ease cascading multiple devices in order to achieve a greater delay range. The SETMIN and SETMAX pins accomplish this, as set out in the applications section below. SETMIN and SETMAX override the delay by changing the value in the D latch register. Table 5 lists the action of these pins.

SETMIN	SETMAX	Nominal Delay (ps)
L	L	As per D Latch
L	H	$2200 + 10 \times 1024$
H	L	2200
H	H	Not Allowed

**Table 5. SETMIN and SETMAX Action**

Signal Path Logic Standard	V <sub>CC</sub>	V <sub>EE</sub>	Delay Control Input Choices
PECL	+4.5V to +5.5V	0V	PECL, CMOS, TTL
LVPECL	+3.0V to +3.6V	0V	LVPECL, CMOS, TTL
NECL	0V	−3.0 to −5.5V	NECL

**Table 6. Signal Path Logic Standard**

## APPLICATIONS INFORMATION

For best performance, use good high frequency layout techniques, filter  $V_{CC}$  supplies, and keep ground connections short. Use multiple vias where possible. Also, use controlled impedance transmission lines to interface with the SY100EP195V data inputs and outputs.

### $V_{BB}$ Supply

The  $V_{BB}$  pin is an internally generated supply, and is available for use only by the SY100EP195V. When unused, this pin should be left unconnected. The two common uses for  $V_{BB}$  are to handle a single-ended PECL input, and to re-bias inputs for AC coupling applications.

If IN, /IN is driven by a single-ended output,  $V_{BB}$  is used to bias the unused input. Please refer to Figures 7. The PECL signal driving SY100EP195V may optionally be inverted in this case.

When the signal is AC coupled,  $V_{BB}$  is used, as shown in Figure 8, to re-bias IN, /IN. This ensures that SY100EP195V inputs are within its acceptable common mode range.

In all cases,  $V_{BB}$  current sinking or sourcing must be limited to 0.5mA or less.

### Setting D Input Logic Thresholds

As explained earlier, in all designs where the SY100EP195V  $V_{EE}$  supply is at zero volts, the D inputs may accommodate CMOS and TTL level signals, as well as PECL or LVPECL. Figures 9 show how to connect  $V_{CF}$  and  $V_{EF}$  for all possible cases.

### Cascading

Two or more SY100EP195V may be cascaded, in order to extend the range of delays permitted. Each additional SY100EP195V adds about 2200ps to the minimum delay, and adds another 10240ps to the delay range.

Internal cascade circuitry has been included in the SY100EP195V. Using this internal circuitry, SY100EP195V may be cascaded without any external gating.

Examples of cascading 2, 3, or 4 SY100EP195V appear in Figures 10. Table 7 lists the nominal delay for all the cases that appear in Figures 10.

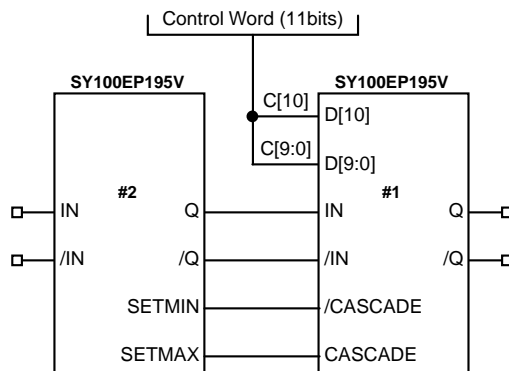


Figure 10a. Cascading Two SY100EP195V

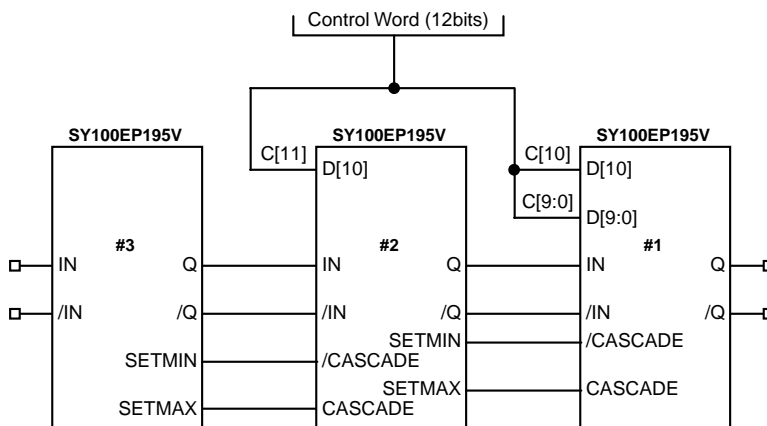


Figure 10b. Cascading Three SY100EP195V

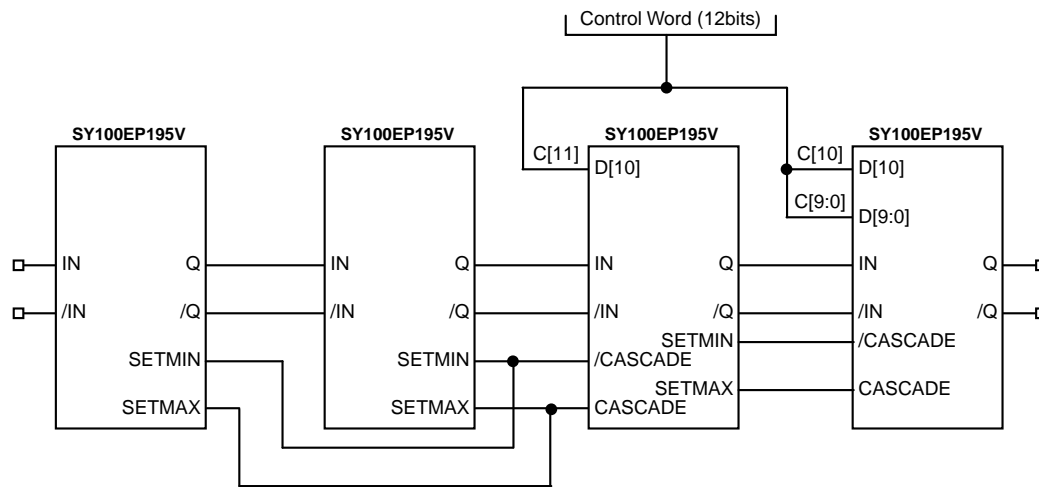


Figure 10c. Cascading Four SY100EP195V

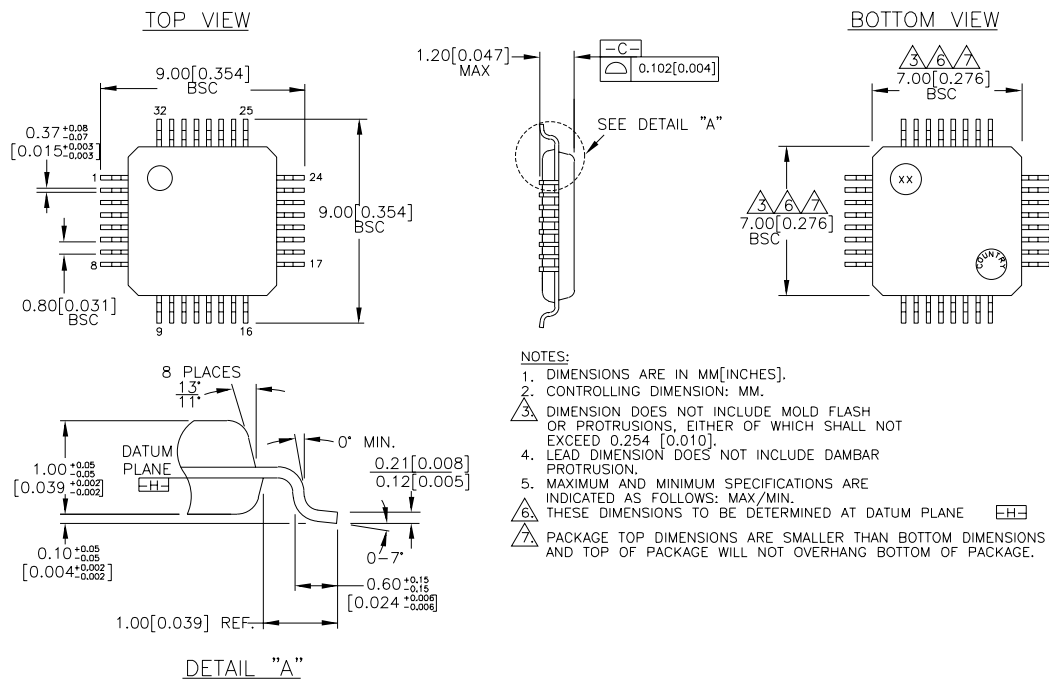
## RELATED PRODUCT AND SUPPORT DOCUMENTATION

Part Number	Function	Data Sheet Link
SY100EP196VTI	3.3V/5V Programmable Delay Chip with Fine Tune Control	<a href="http://www.micrel.com/product-info/products/sy100ep196v.shtml">http://www.micrel.com/product-info/products/sy100ep196v.shtml</a>
SY55856UHI	2.5V/3.3V 2.5GHz Differential 2-Channel Precision CML Delay Line	<a href="http://www.micrel.com/product-info/products/sy55856u.shtml">http://www.micrel.com/product-info/products/sy55856u.shtml</a>



Control Inputs			Nominal Delay (ps)			
D[11]	D[10]	D[9:0]	One Chip	Two Chips	Three Chips	Four Chips
0	0	0000000000	2,200	4,400	6,600	8,800
0	0	0000000001	2,210	4,410	6,610	8,810
0	0	0000000010	2,220	4,420	6,620	8,820
0	0	0000000100	2,240	4,440	6,640	8,840
0	0	0000001000	2,280	4,480	6,680	8,880
0	0	0000010000	2,360	4,560	6,760	8,960
0	0	0000100000	2,520	4,720	6,920	9,120
0	0	0001000000	2,840	5,040	7,240	9,440
0	0	0010000000	3,480	5,680	7,880	10,080
0	0	0100000000	4,760	6,960	9,160	11,360
0	0	1000000000	7,320	9,520	11,720	13,920
0	0	1111111111	12,430	14,630	16,830	19,030
0	1	0000000000		14,640	16,840	19,040
0	1	0000000001		14,650	16,850	19,050
0	1	0000000010		14,660	16,860	19,060
0	1	0000000100		14,680	16,880	19,080
0	1	0000001000		14,720	16,920	19,120
0	1	0000010000		14,800	17,000	19,200
0	1	0000100000		14,960	17,160	19,360
0	1	0001000000		15,280	17,480	19,680
0	1	0010000000		15,920	18,120	20,320
0	1	0100000000		17,200	19,400	21,600
0	1	1000000000		19,760	21,960	24,160
0	1	1111111111		24,870	27,070	29,270
1	0	0000000000			27,080	29,280
1	0	0000000001			27,090	29,290
1	0	0000000010			27,100	29,300
1	0	0000000100			27,120	29,320
1	0	0000001000			27,160	29,360
1	0	0000010000			27,240	29,440
1	0	0000100000			27,400	29,600
1	0	0001000000			27,720	29,920
1	0	0010000000			28,360	30,560
1	0	0100000000			29,640	31,840
1	0	1000000000			32,200	34,400
1	0	1111111111			37,310	39,510
1	1	0000000000			27,080	39,520
1	1	0000000001			27,090	39,530
1	1	0000000010			27,100	39,540
1	1	0000000100			27,120	39,560
1	1	0000001000			27,160	39,600
1	1	0000010000			27,240	39,680
1	1	0000100000			27,400	39,840
1	1	0001000000			27,720	40,160
1	1	0010000000			28,360	40,800
1	1	0100000000			29,640	42,080
1	1	1000000000			32,200	44,640
1	1	1111111111			37,310	49,750

Table 7. List of Nominal Delay Values for Cascaded SY100EP195V

**32 LEAD TQFP (T32-1)**

Rev. 01

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