

**FEATURES**

- Max. shift frequency of 700MHz
- Clock to Q delay max. of 1100ps
- $S_n$  to  $\overline{TC}$  speed improved by 50%
- $S_n$  set-up and hold time reduced by more than 50%
- IEE min. of -170mA
- Industry standard 100K ECL levels
- Internal 75K $\Omega$  input pull-down resistors
- Extended supply voltage option:  
VEE = -4.2V to -5.5V
- Voltage and temperature compensation for improved noise immunity
- 50% faster than Fairchild 300K at lower power
- Function and pinout compatible with Fairchild F100K
- Available in 24-pin CERPAC and 28-pin PLCC packages

**DESCRIPTION**

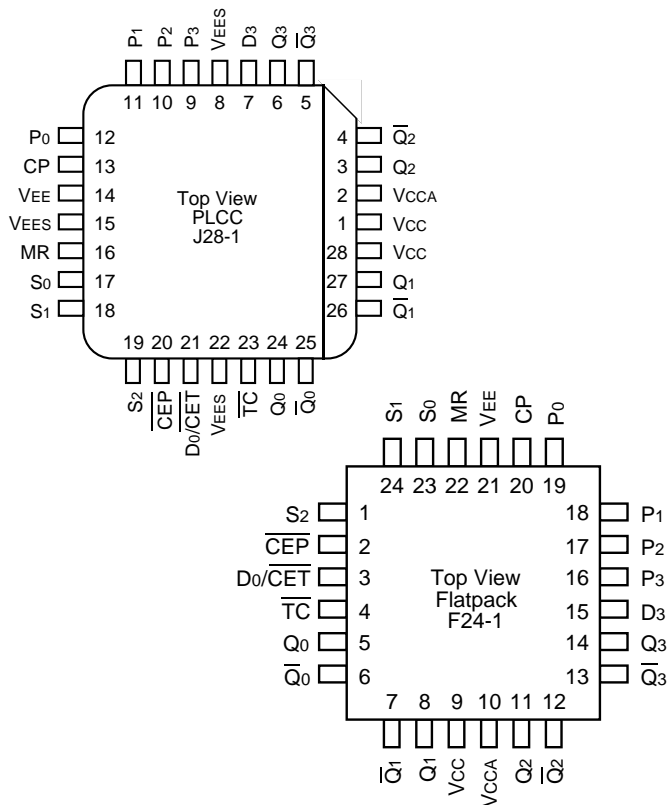
The SY100S336A is functionally the same as the SY100S336, but has  $S_n$  to  $\overline{TC}$  speed and  $S_n$  set-up and hold times significantly improved, allowing for higher clock frequency when used as a cascaded multi-stage counter.

The SY100S336A functions either as a modulo-16 up/down counter or as a 4-bit bidirectional shift register and is designed for use in high-performance ECL systems. Three Select inputs ( $S_n$ ) are provided for determining the mode of operation. The Function Table lists the available modes of operation. In order to allow cascading for multistage counters, two Count Enable controls ( $\overline{CEP}$ ,  $\overline{CET}$ ) are provided. The  $\overline{CET}$  input also functions as the Serial Data input ( $S_0$ ) for a shift-up operation, while the  $D_3$  input serves as the Serial Data input for the shift-down operation.

When the device is in the counting mode, the Terminal Count ( $\overline{TC}$ ) goes to a logical LOW when the count reaches 15 for count-up or reaches 0 for count-down. When in the shift mode, the  $\overline{TC}$  output simply repeats the  $Q_3$  output.

The flexibility provided by the  $\overline{TC}/Q_3$  output and the  $D_0/\overline{CET}$  input allows these signals to be interconnected from one stage to the next higher stage for multistage counting or shift-up operations. The individual Presets ( $P_n$ ) allow initialization of the counter by entering data in parallel to preset the counter. A logic HIGH on the Master Reset ( $\overline{MR}$ ) overrides all other inputs and asynchronously clears the flip-flops. An additional synchronous Clear is provided, as well as a complement function which synchronously inverts the contents of the flip-flops. All inputs have 75K $\Omega$  pull-down resistors.

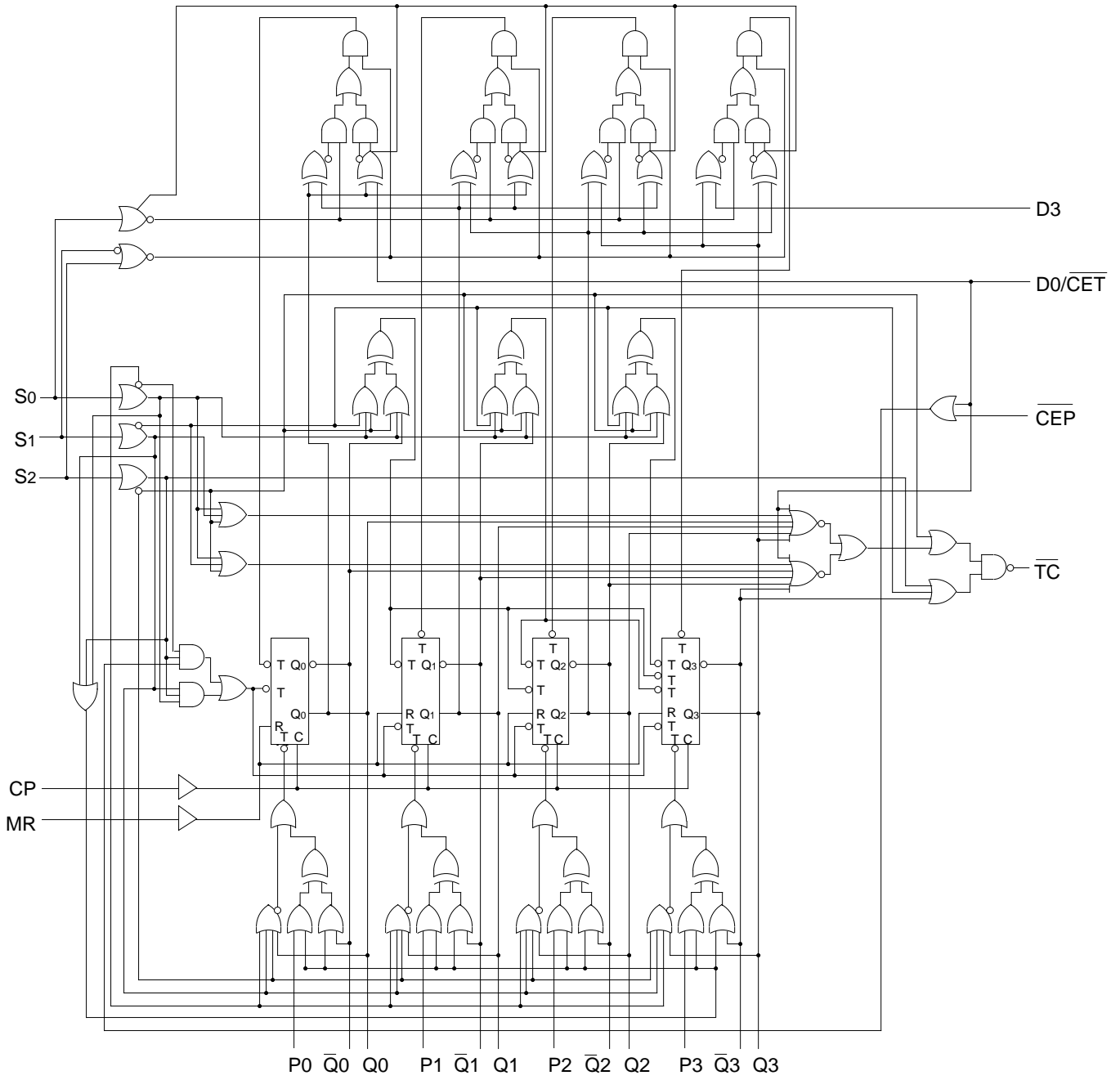
**PIN CONFIGURATIONS**



**PIN NAMES**

Pin	Function
CP	Clock Pulse Input
CEP	Count Enable Parallel Input (Active LOW)
$D_0/\overline{CET}$	Serial Data Input/Count Enable Trickle Input (Active LOW)
$S_0 - S_2$	Select Inputs
MR	Master Reset Input
VEES	VEE Substrate
VCCA	VCCO for ECL Outputs
$P_0 - P_3$	Preset Inputs
$D_3$	Serial Data Input
$\overline{TC}$	Terminal Count Output
$Q_0 - Q_3$	Data Outputs
$\overline{Q_0} - \overline{Q_3}$	Complementary Data Outputs

**BLOCK DIAGRAM**



**TRUTH TABLE<sup>(1)</sup>**

Inputs								Outputs					Mode
MR	S <sub>2</sub>	S <sub>1</sub>	S <sub>0</sub>	$\overline{\text{CEP}}$	D <sub>0</sub> / $\overline{\text{CET}}$	D <sub>3</sub>	CP	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	$\overline{\text{TC}}$	
L	L	L	L	X	X	X	u	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	L	Preset (Parallel Load)
L	L	L	H	X	X	X	u	$\overline{\text{Q}}_0$	$\overline{\text{Q}}_1$	$\overline{\text{Q}}_2$	$\overline{\text{Q}}_3$	L	Invert
L	L	H	L	X	X	X	u	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	D <sub>3</sub>	D <sub>3</sub>	Shift Left
L	L	H	H	X	X	X	u	D <sub>0</sub>	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub> *	Shift Right
L	H	L	L	L	L	X	u	(Q <sub>0-3</sub> ) minus 1				①	Count Down
L	H	L	L	H	L	X	X	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	①	Count Down with $\overline{\text{CEP}}$ Not Active
L	H	L	L	X	H	X	X	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	H	Count Down with $\overline{\text{CET}}$ Not Active
L	H	L	H	X	X	X	u	L	L	L	L	H	Clear
L	H	H	L	L	L	X	u	(Q <sub>0-3</sub> ) plus 1				≠	Count Up
L	H	H	L	H	L	X	X	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	≠	Count Up with $\overline{\text{CEP}}$ Not Active
L	H	H	L	X	H	X	X	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	H	Count Up with $\overline{\text{CET}}$ Not Active
L	H	H	H	X	X	X	X	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	H	Hold
H	L	L	L	X	X	X	X	L	L	L	L	L	Asynchronous Master Reset
H	L	L	H	X	X	X	X	L	L	L	L	L	
H	L	H	L	X	X	X	X	L	L	L	L	L	
H	L	H	H	X	X	X	X	L	L	L	L	L	
H	H	L	L	X	L	X	X	L	L	L	L	L	
H	H	L	L	X	H	X	X	L	L	L	L	H	
H	H	L	H	X	X	X	X	L	L	L	L	H	
H	H	H	L	X	X	X	X	L	L	L	L	H	
H	H	H	H	X	X	X	X	L	L	L	L	H	

**NOTE:**

1. H = High Voltage Level

L = Low Voltage Level

X = Don't Care

u = LOW-to-HIGH Transition

① = L if Q<sub>0</sub> – Q<sub>3</sub> = LLLLH if Q<sub>0</sub> – Q<sub>3</sub> ≠ LLLL≠ = L if Q<sub>0</sub> – Q<sub>3</sub> = HHHHH if Q<sub>0</sub> – Q<sub>3</sub> ≠ HHHH\* Before the clock,  $\overline{\text{TC}}$  is Q<sub>3</sub>; after the clock,  $\overline{\text{TC}}$  is Q<sub>2</sub>**DC ELECTRICAL CHARACTERISTICS**V<sub>EE</sub> = –4.2V to –5.5V unless otherwise specified, V<sub>CC</sub> = V<sub>CCA</sub> = GND

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
I <sub>IH</sub>	Input HIGH Current, All Inputs	—	—	200	μA	V <sub>IN</sub> = V <sub>IH</sub> (Max.)
I <sub>EE</sub>	Power Supply Current	–170	–120	–60	mA	Inputs Open

## AC ELECTRICAL CHARACTERISTICS

### CERPACK

VEE = -4.2V to -5.5V unless otherwise specified, VCC = VCCA = GND

Symbol	Parameter	TA = 0°C		TA = +25°C		TA = +85°C		Unit	Condition
		Min.	Max.	Min.	Max.	Min.	Max.		
fshift	Shift Frequency	700	—	700	—	700	—	MHz	
tPLH tPHL	Propagation Delay CP to Qn, Qn	450	1200	450	1200	450	1200	ps	
tPLH tPHL	Propagation Delay CP to TC	600	1900	600	1900	600	1900	ps	
tPLH tPHL	Propagation Delay MR to Qn, Qn	500	1400	500	1400	500	1400	ps	
tPLH tPHL	Propagation Delay MR to TC	600	1900	600	1900	600	1900	ps	
tPLH tPHL	Propagation Delay D0/CET to TC	400	1200	400	1200	400	1200	ps	
tPLH tPHL	Propagation Delay Sn to TC	400	1500	400	1500	400	1500	ps	
tTLH tTHL	Transition Time 20% to 80%, 80% to 20%	300	900	300	900	300	900	ps	
ts	Set-up Time D3 Pn D0/CET to CEP Sn MR (Release Time)	800 800 700 1000 900	— — — — —	800 800 700 1000 900	— — — — —	800 800 700 1000 900	— — — — —	ps	
tH	Hold Time D3 Pn D0/CET to CEP Sn	200 200 200 -200	— — — —	200 200 200 -200	— — — —	200 200 200 -200	— — — —	ps	
tpw (H)	Pulse Width HIGH, CP, MR	—	800	—	800	—	800	ps	

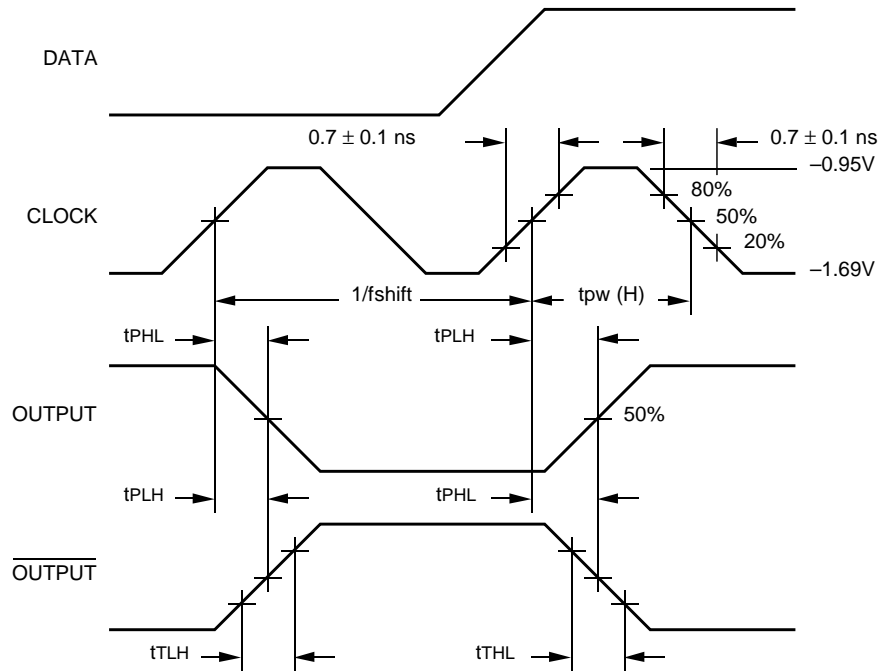
## AC ELECTRICAL CHARACTERISTICS

### PLCC

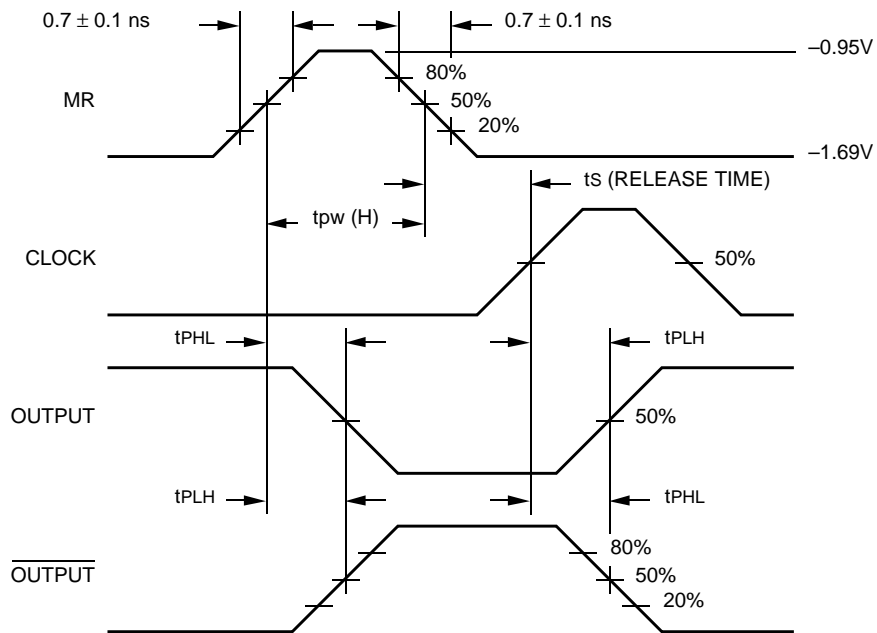
$V_{EE} = -4.2V$  to  $-5.5V$  unless otherwise specified,  $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	TA = 0°C		TA = +25°C		TA = +85°C		Unit	Condition
		Min.	Max.	Min.	Max.	Min.	Max.		
f <sub>shift</sub>	Shift Frequency	700	—	700	—	700	—	MHz	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub> , $\bar{Q}_n$	450	1100	450	1100	450	1100	ps	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to $\bar{TC}$	600	1800	600	1800	600	1800	ps	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay MR to Q <sub>n</sub> , $\bar{Q}_n$	500	1300	500	1300	500	1300	ps	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay MR to $\bar{TC}$	600	1800	600	1800	600	1800	ps	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay D <sub>0</sub> / $\bar{CET}$ to $\bar{TC}$	400	1100	400	1100	400	1100	ps	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay S <sub>n</sub> to $\bar{TC}$	400	1500	400	1500	400	1500	ps	
t <sub>TLH</sub> t <sub>THL</sub>	Transition Time <sup>300</sup> 20% to 80%, 80% to 20%	900	300	900	300	900	300	ps	
ts	Set-up Time D <sub>3</sub> P <sub>n</sub> D <sub>0</sub> / $\bar{CET}$ to $\bar{CEP}$ S <sub>n</sub> MR (Release Time)	800 800 700 1000 900	— — — — —	800 800 700 1000 900	— — — — —	800 800 700 1000 900	— — — — —	ps	
t <sub>H</sub>	Hold Time D <sub>3</sub> P <sub>n</sub> D <sub>0</sub> / $\bar{CET}$ to $\bar{CEP}$ S <sub>n</sub>	200 200 200 -200	— — — —	200 200 200 -200	— — — —	200 200 200 -200	— — — —	ps	
t <sub>pw</sub> (H)	Pulse Width HIGH, CP, MR	—	800	—	800	—	800	ps	

**TIMING DIAGRAMS**

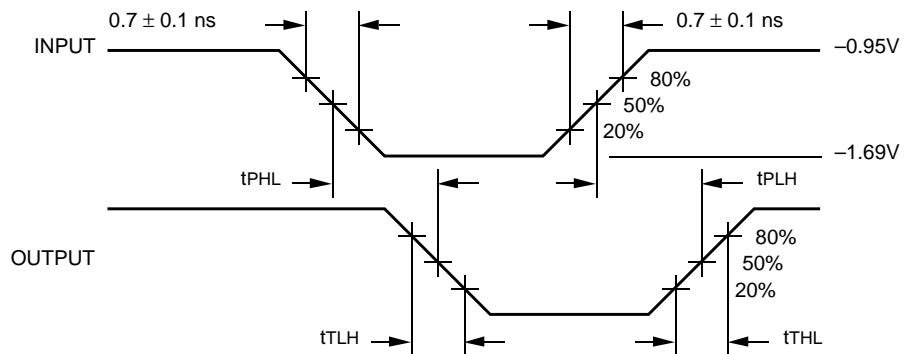


**Propagation Delay (Clock) and Transition Times**

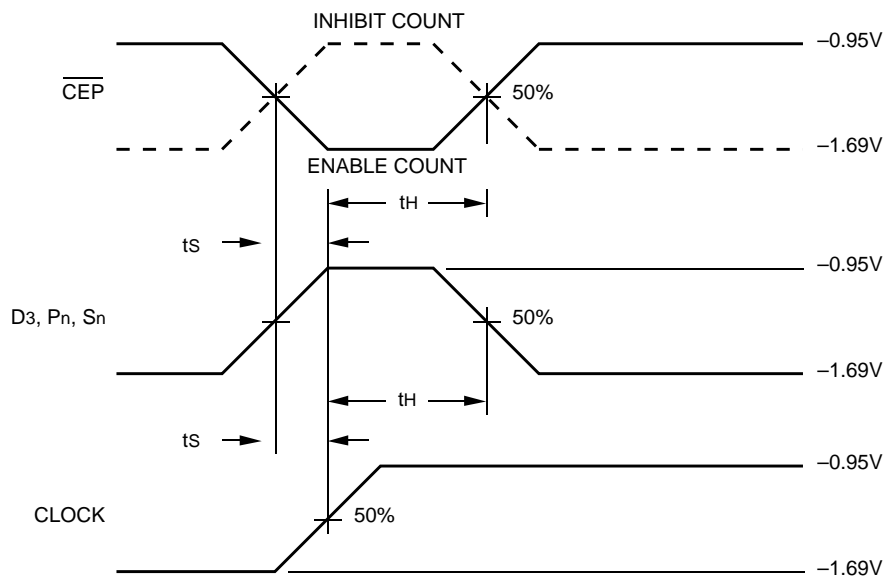


**Propagation Delay (Reset)**

**TIMING DIAGRAMS**



**Propagation Delay (Serial Data, Selects)**



**Set-up and Hold Time**

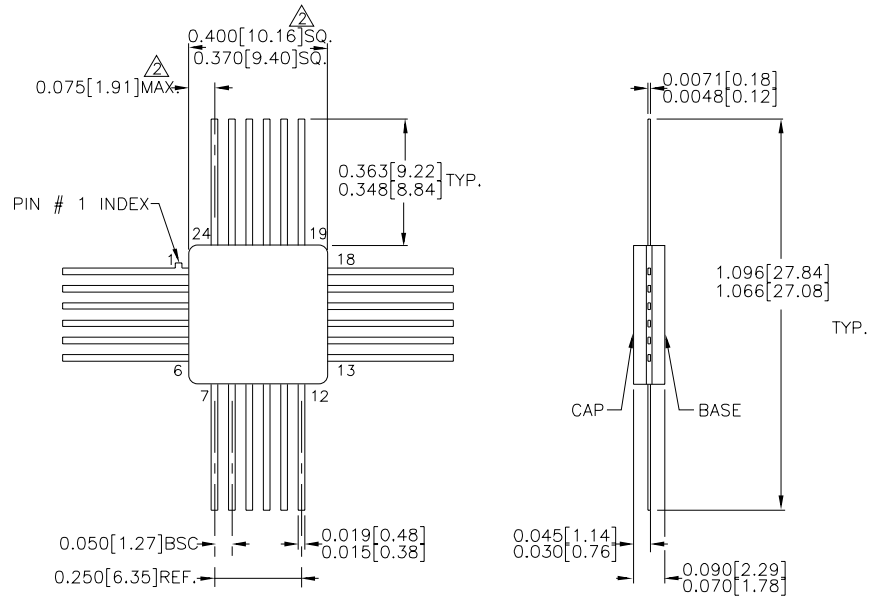
**NOTES:**

1.  $V_{EE} = -4.2V$  to  $-5.5V$  unless otherwise specified,  $V_{CC} = V_{CCA} = GND$ .
2.  $t_s$  is the minimum time before the transition of the clock that information must be present at the data input.
3.  $t_H$  is the minimum time after the transition of the clock that information must remain unchanged at the data input.

**PRODUCT ORDERING CODE**

Ordering Code	Package Type	Operating Range
SY100S336AFC	F24-1	Commercial
SY100S336AJC	J28-1	Commercial
SY100S336AJCTR	J28-1	Commercial

**24 LEAD CERPACK (F24-1)**

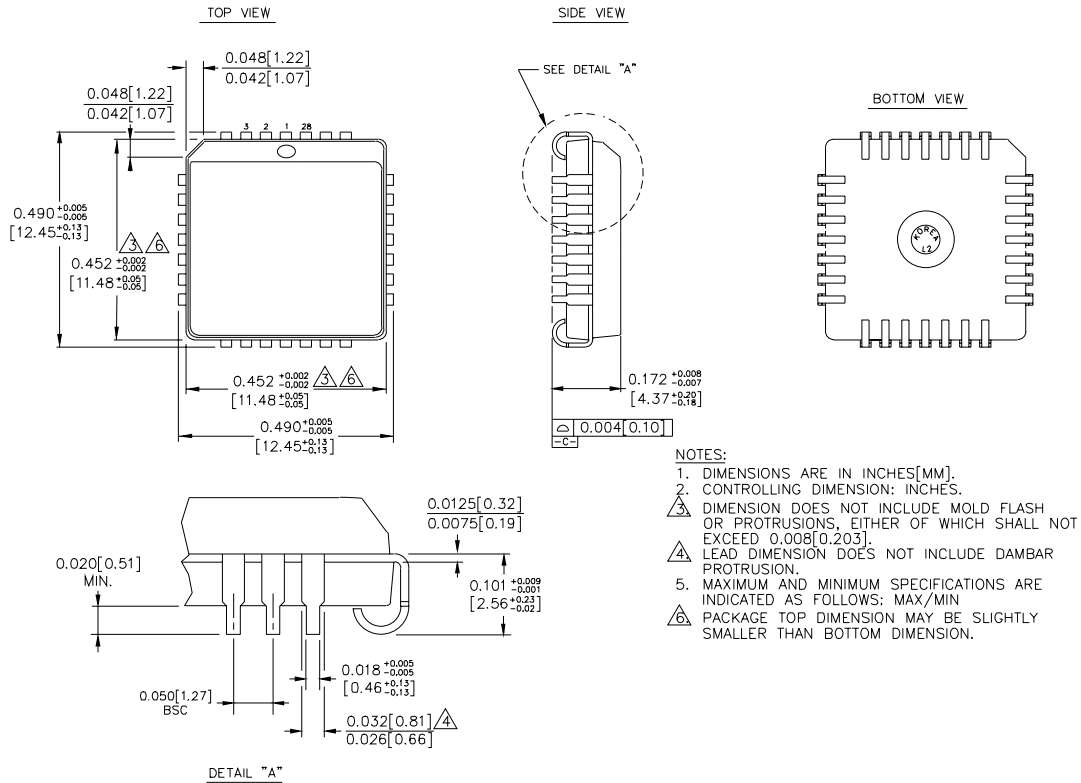


- NOTES:
1. DIMENSIONS ARE IN INCHES[MM].
  2. THIS DIMENSION INCLUDES GLASS PROTRUSION AND CAP TO BASE ALIGNMENT TOLERANCES.
  3. DIMENSIONS SHOWN ARE MAX/MIN, WHERE NOTED.

Rev. 03



**28 LEAD PLCC (J28-1)**



Rev. 03

**MICREL-SYNERGY 3250 SCOTT BOULEVARD SANTA CLARA CA 95054 USA**

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