

### 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 CERPACK and 28-pin PLCC packages

### PIN NAMES

Pin	Function
CP	Clock Pulse Input
$\overline{CEP}$	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

### DESCRIPTION

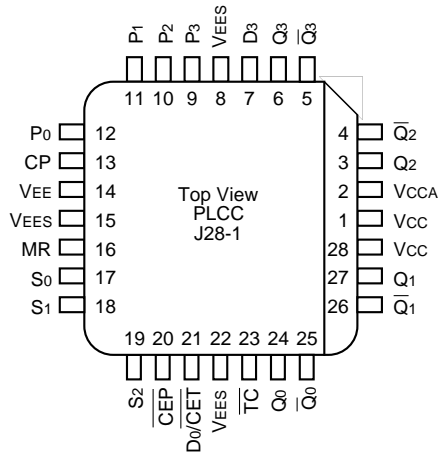
The SY100S336A is functionally the same as the SY100S336, but has  $S_n$  to  $\overline{TC}$  speed and  $S_n$  set-up and hold times significantly improved, allowing for higher clock frequency when used as a cascaded multi-stage counter.

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.

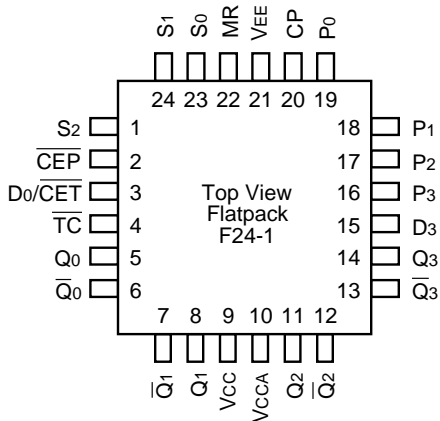
When the device is in the counting mode, the Terminal Count ( $\overline{TC}$ ) goes to a logical LOW when the count reaches 15 for count-up or reaches 0 for count-down. When in the shift mode, the  $\overline{TC}$  output simply repeats the  $Q_3$  output.

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 (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.

**PACKAGE/ORDERING INFORMATION**



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



**24-Pin Cerpack (F24-1)**

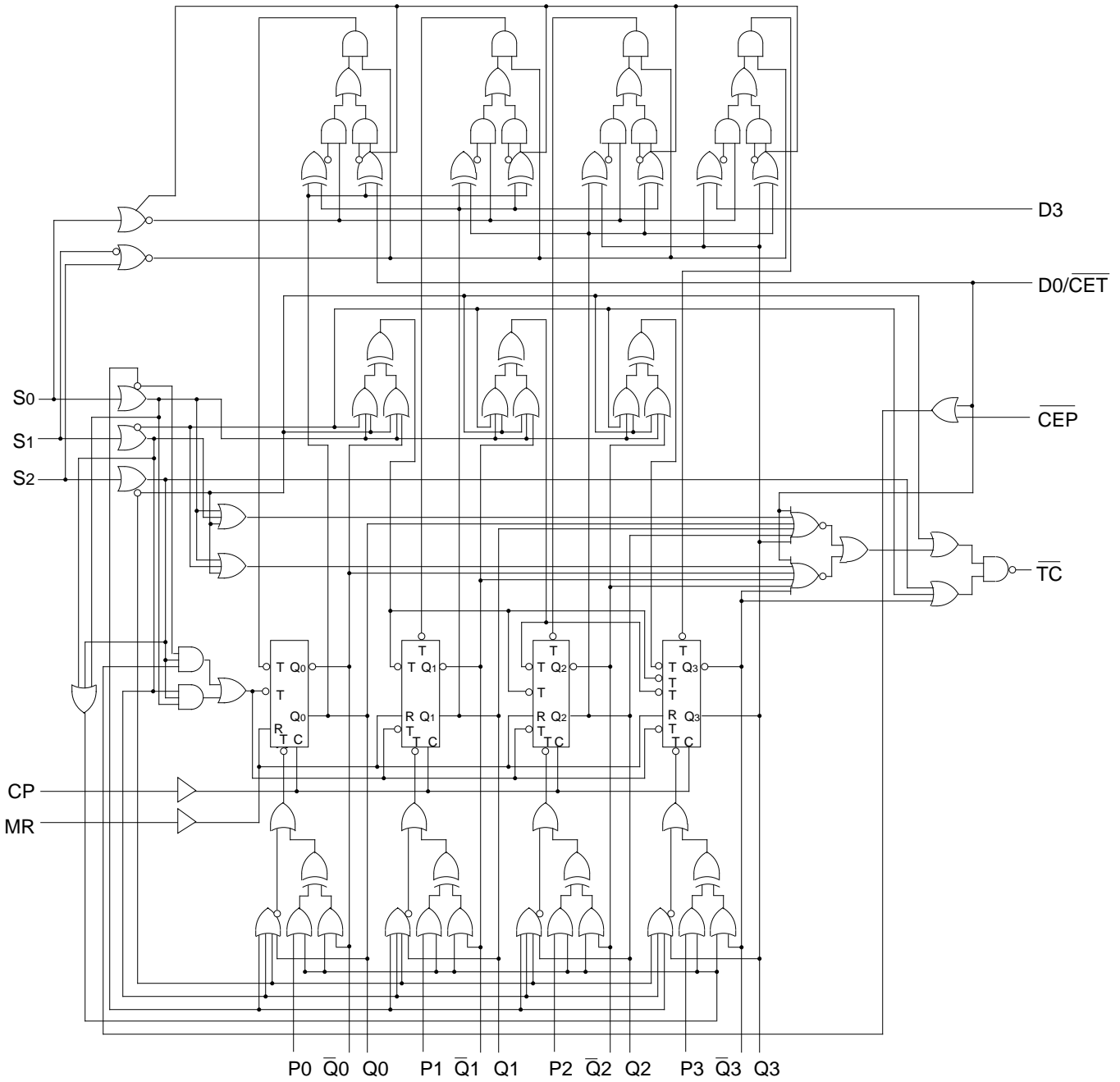
**Ordering Information**

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY100S336AFC	F24-1	Commercial	SY100S336AFC	Sn-Pb
SY100S336AFCTR <sup>(1)</sup>	F24-1	Commercial	SY100S336AFC	Sn-Pb
SY100S336AJC	J28-1	Commercial	SY100S336AJC	Sn-Pb
SY100S336AJCTR <sup>(1)</sup>	J28-1	Commercial	SY100S336AJC	Sn-Pb
SY100S336AJZ <sup>(2)</sup>	J28-1	Commercial	SY100S336AJZ with Pb-Free bar-line indicator	Matte-Sn
SY100S336AJZTR <sup>(1, 2)</sup>	J28-1	Commercial	SY100S336AJZ with Pb-Free bar-line indicator	Matte-Sn

**Notes:**

1. Tape and Reel.
2. Pb-Free package is recommended for new designs.

**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, $\overline{Q}_n$	450	1200	450	1200	450	1200	ps	
tPLH tPHL	Propagation Delay CP to $\overline{TC}$	600	1900	600	1900	600	1900	ps	
tPLH tPHL	Propagation Delay MR to Qn, $\overline{Q}_n$	500	1400	500	1400	500	1400	ps	
tPLH tPHL	Propagation Delay MR to $\overline{TC}$	600	1900	600	1900	600	1900	ps	
tPLH tPHL	Propagation Delay D0/ $\overline{CET}$ to $\overline{TC}$	400	1200	400	1200	400	1200	ps	
tPLH tPHL	Propagation Delay Sn to $\overline{TC}$	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							ps	
	D3	800	—	800	—	800	—		
	Pn	800	—	800	—	800	—		
	D0/ $\overline{CET}$ to $\overline{CEP}$	700	—	700	—	700	—		
	Sn	1000	—	1000	—	1000	—		
MR (Release Time)	900	—	900	—	900	—			
tH	Hold Time							ps	
	D3	200	—	200	—	200	—		
	Pn	200	—	200	—	200	—		
	D0/ $\overline{CET}$ to $\overline{CEP}$	200	—	200	—	200	—		
	Sn	-200	—	-200	—	-200	—		
t <sub>pw</sub> (H)	Pulse Width HIGH, CP, MR	—	800	—	800	—	800	ps	

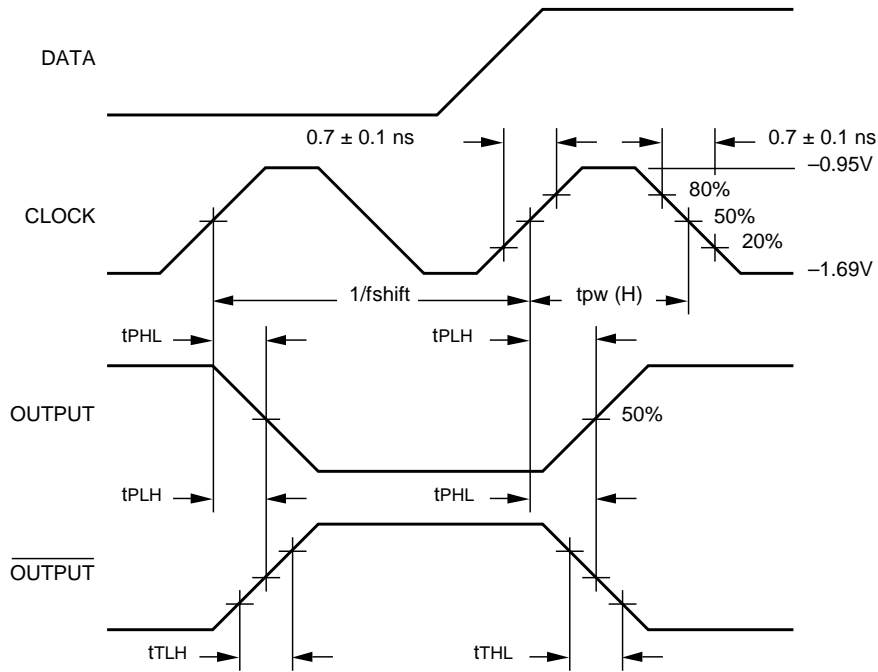
## AC ELECTRICAL CHARACTERISTICS

### PLCC

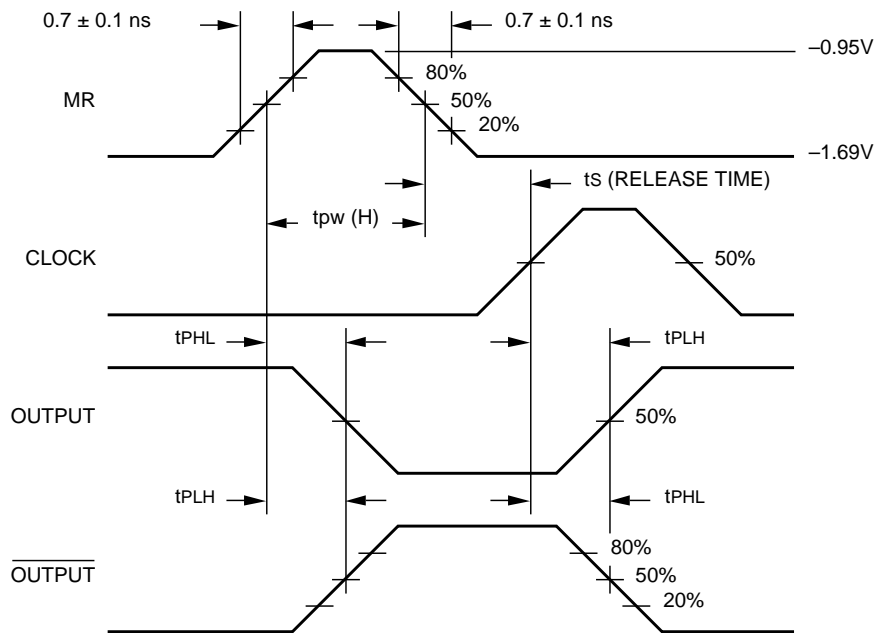
$V_{EE} = -4.2V$  to  $-5.5V$  unless otherwise specified,  $V_{CC} = V_{CCA} = GND$

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	
t <sub>s</sub>	Set-up Time							ps	
	D <sub>3</sub>	800	—	800	—	800	—		
	P <sub>n</sub>	800	—	800	—	800	—		
	D <sub>0</sub> / $\bar{CET}$ to $\bar{CEP}$	700	—	700	—	700	—		
	S <sub>n</sub>	1000	—	1000	—	1000	—		
	MR (Release Time)	900	—	900	—	900	—		
t <sub>H</sub>	Hold Time							ps	
	D <sub>3</sub>	200	—	200	—	200	—		
	P <sub>n</sub>	200	—	200	—	200	—		
	D <sub>0</sub> / $\bar{CET}$ to $\bar{CEP}$	200	—	200	—	200	—		
	S <sub>n</sub>	-200	—	-200	—	-200	—		
t <sub>pw</sub> (H)	Pulse Width HIGH, CP, MR	—	800	—	800	—	800	ps	

**TIMING DIAGRAMS**

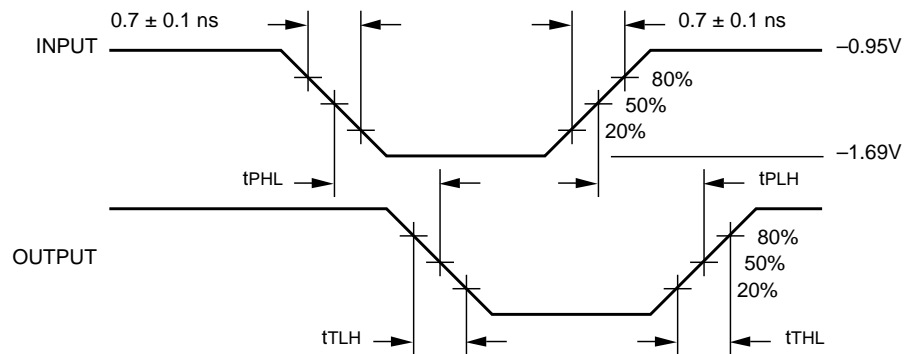


**Propagation Delay (Clock) and Transition Times**

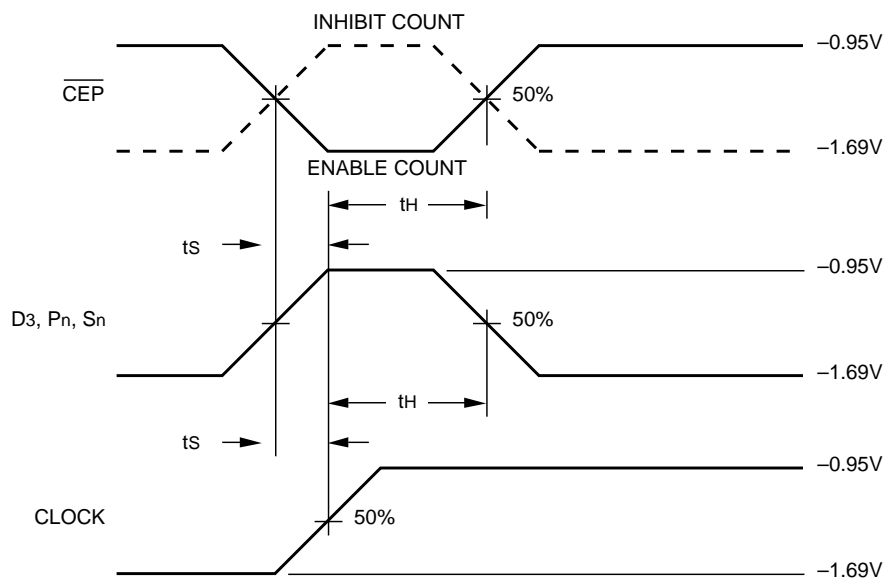


**Propagation Delay (Reset)**

**TIMING DIAGRAMS**



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



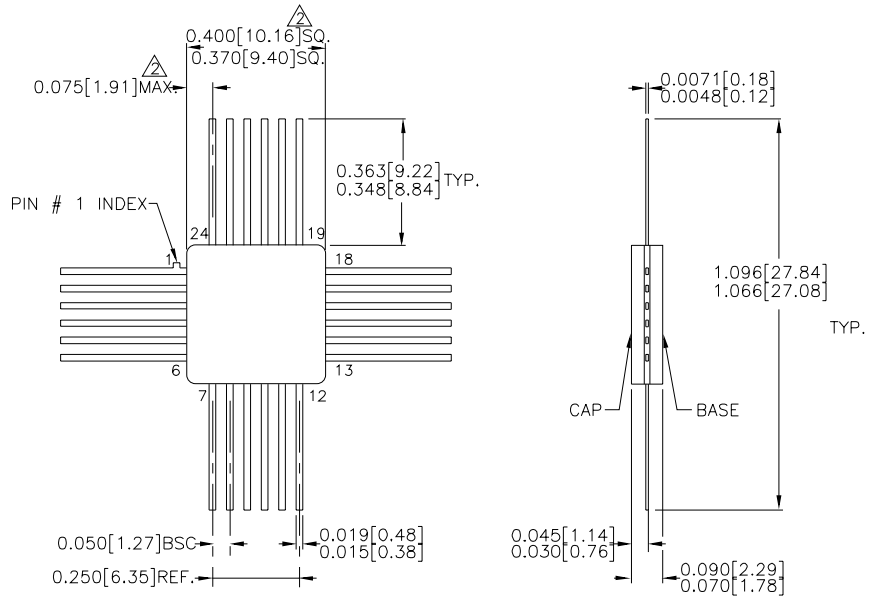
**Set-up and Hold Time**

**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.



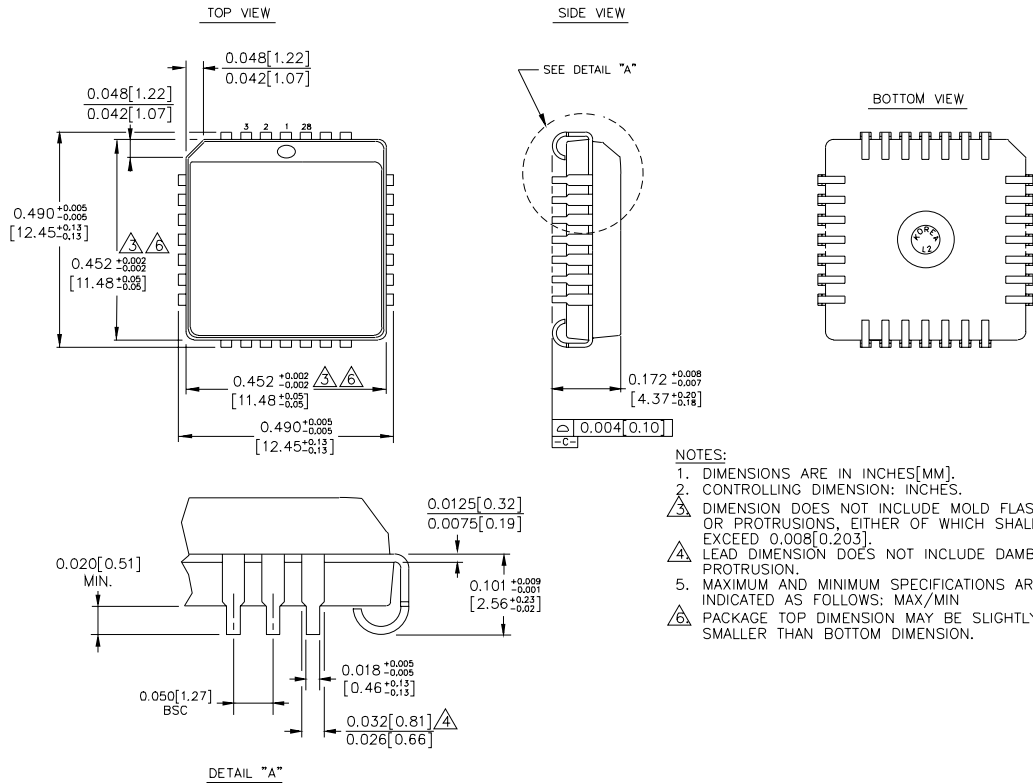
**24-PIN CERPACK (F24-1)**



- 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-PIN PLCC (J28-1)**



Rev. 03

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