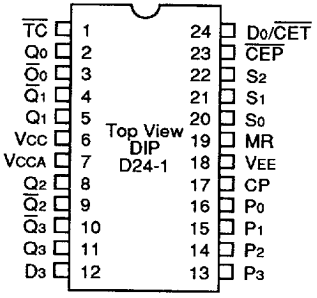
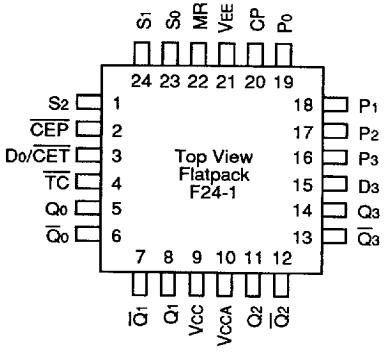
4-STAGE COUNTER/ SHIFT REGISTER

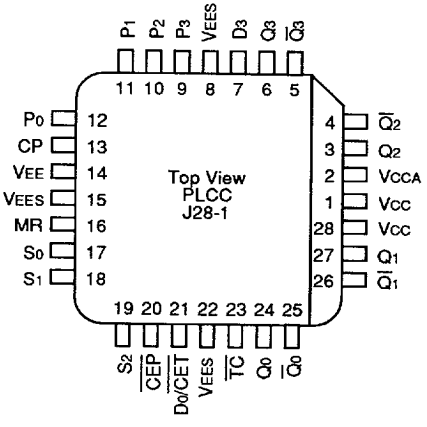
FEATURES

- Max. shift frequency of 700MHz
- Clock to Q delay max. of 1100ps
- IEE min. of –170mA
- ESD protection of 2000V
- Internal 75KΩ input pull-down resistors
- Industry standard 100K ECL levels
- Extended supply voltage option:
  — VEE = –4.2V to –5.46V
- Voltage and temperature compensation for improved noise immunity
- 50% faster than National 300K at lower power
- Function and pinout compatible with National and Signetics F100K
- Available in CERDIP, CERPACK and PLCC

PIN CONFIGURATIONS







DESCRIPTION

The SY100S336 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 (Sn) 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 (S0) for a shift-up operation, while the D3 input serves as the Serieal 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 Q3 output.

The flexiblity provided by the $\overline{TC}$/Q3 output and the D0/$\overline{CET}$ 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 (Pn) 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 75KΩ pull-down resistors.

6

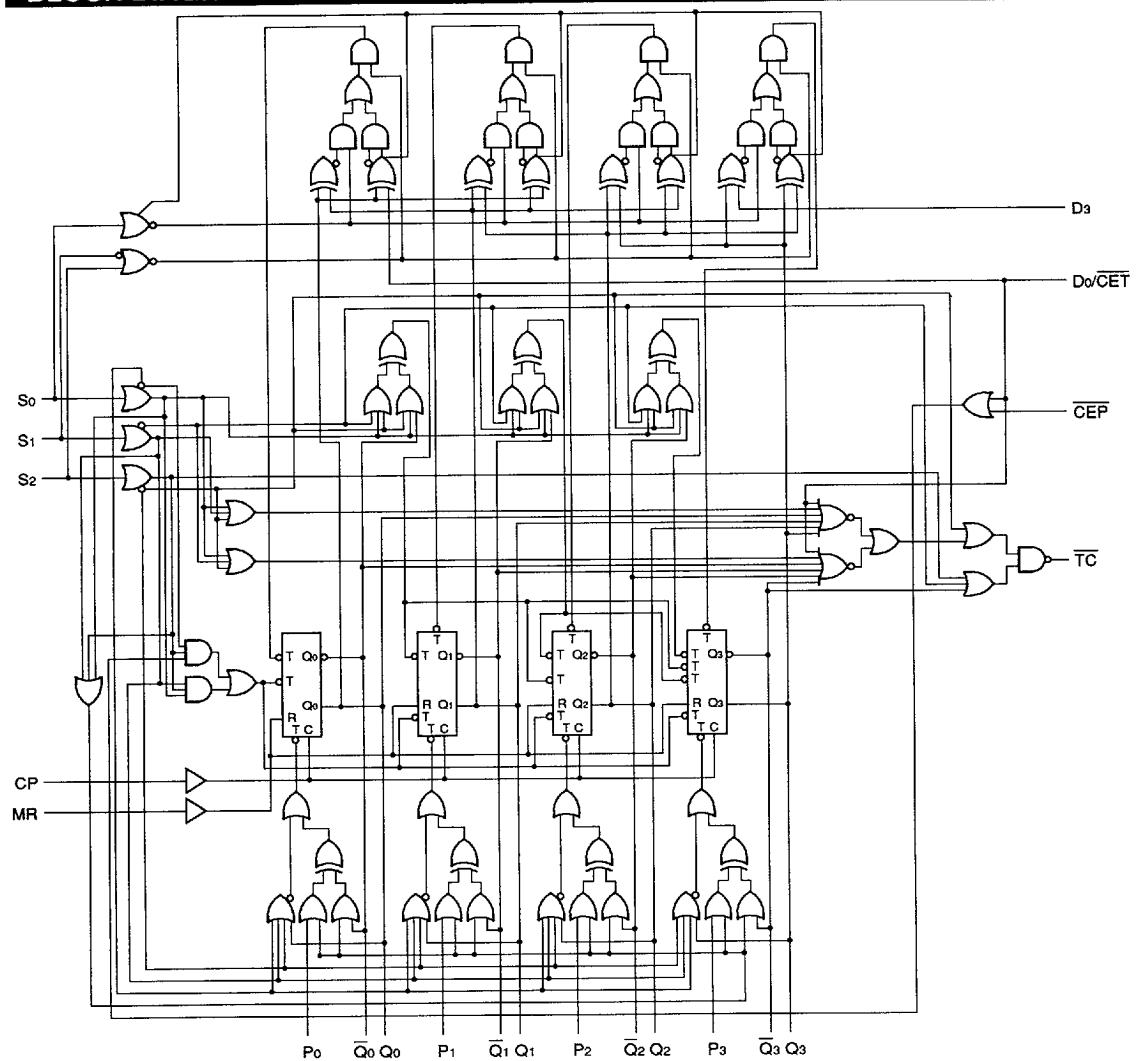
Rev.: B Amendment: /0
Issue Date: February, 1994

PIN NAMES

Label	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

Label	Function
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[1]

Inputs								Outputs					
MR	S_2	S_1	S_0	$\overline{CEP}$	$D_0/\overline{CET}$	D_3	CP	Q_0	Q_1	Q_2	Q_3	$\overline{TC}$	Mode
L	L	L	L	X	X	X	↑	P_0	P_1	P_2	P_3	L	Preset (Parallel Load)
L	L	L	H	X	X	X	↑	$\overline{Q_0}$	$\overline{Q_1}$	$\overline{Q_2}$	$\overline{Q_3}$	L	Invert
L	L	H	L	X	X	X	↑	Q_1	Q_2	Q_3	D_3	D_3	Shift Left
L	L	H	H	X	X	X	↑	D_0	Q_0	Q_1	Q_2	Q_3*	Shift Right
L	H	L	L	L	L	X	↑	(Q_{0-3}) minus 1				①	Count Down
L	H	L	L	H	L	X	X	Q_0	Q_1	Q_2	Q_3	①	Count Down with $\overline{CEP}$ Not Active
L	H	L	L	X	H	X	X	Q_0	Q_1	Q_2	Q_3	H	Count Down with $\overline{CET}$ Not Active
L	H	L	H	X	X	X	↑	L	L	L	L	H	Clear
L	H	H	L	L	L	X	↑	(Q_{0-3}) plus 1				②	Count Up
L	H	H	L	H	L	X	X	Q_0	Q_1	Q_2	Q_3	②	Count Up with $\overline{CEP}$ Not Active
L	H	H	L	X	H	X	X	Q_0	Q_1	Q_2	Q_3	H	Count Up with $\overline{CET}$ Not Active
L	H	H	H	X	X	X	X	Q_0	Q_1	Q_2	Q_3	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
   ↑ = LOW-to-HIGH Transition
   ① = L if $Q_0 - Q_3$ = LLLL
   H if $Q_0 - Q_3 \neq$ LLLL
   ② = L if $Q_0 - Q_3$ = HHHH
   H if $Q_0 - Q_3 \neq$ HHHH
   * Before the clock, $\overline{TC}$ is Q_3; after the clock, $\overline{TC}$ is Q_2

DC ELECTRICAL CHARACTERISTICS

V_{EE} = –4.2V to –5.46V unless otherwise specified, V_{CC} = V_{CCA} = GND, T_A = 0°C to +85°C

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
I_{IH}	Input HIGH Current, All Inputs	—	—	200	µA	V_{IN} = V_{IH} (Max.)
I_{EE}	Power Supply Current	–170	–145	–90	mA	Inputs Open

AC ELECTRICAL CHARACTERISTICS

CERDIP

V_{EE} = –4.2V to –5.46V unless otherwise specified, V_{CC} = V_{CCA} = GND, T_A = 0°C to +85°C

Symbol	Parameter	T_A = 0°C		T_A = +25°C		T_A = +85°C		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
f_{shift}	Shift Frequency	700	—	700	—	700	—	MHz
t_{PLH} t_{PHL}	Propagation Delay CP to Q_n, $\overline{Q}_n$	450	1300	450	1300	450	1300	ps
t_{PLH} t_{PHL}	Propagation Delay CP to $\overline{TC}$	600	2000	600	2000	600	2000	ps
t_{PLH} t_{PHL}	Propagation Delay MR to Q_n, $\overline{Q}_n$	500	1500	500	1500	500	1500	ps
t_{PLH} t_{PHL}	Propagation Delay MR to $\overline{TC}$	600	2000	600	2000	600	2000	ps
t_{PLH} t_{PHL}	Propagation Delay $D_0/\overline{CET}$ to $\overline{TC}$	400	1300	400	1300	400	1300	ps
t_{PLH} t_{PHL}	Propagation Delay S_n to $\overline{TC}$	1500	2700	1500	2700	1500	2700	ps
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	300	900	300	900	300	900	ps
t_s	Set-up Time							ps
	D_3	800	—	800	—	800	—	
	P_n	800	—	800	—	800	—	
	$D_0/\overline{CET}$, $\overline{CEP}$	700	—	700	—	700	—	
	S_n	2000	—	2000	—	2000	—	
	MR (Release Time)	900	—	900	—	900	—	
t_h	Hold Time							ps
	D_3	200	—	200	—	200	—	
	P_n	200	—	200	—	200	—	
	$D_0/\overline{CET}$, $\overline{CEP}$	200	—	200	—	200	—	
	S_n	–600	—	–600	—	–600	—	
t_{pw} (H)	Pulse Width HIGH, CP, MR	—	800	—	800	—	800	ps

AC ELECTRICAL CHARACTERISTICS (CONT'D.)

CERPACK

V_{EE} = −4.2V to −5.46V unless otherwise specified, V_{CC} = V_{CCA} = GND, T_A = 0°C to +85°C

Symbol	Parameter	T_A = 0°C		T_A = +25°C		T_A = +85°C		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
f_{shift}	Shift Frequency	700	—	700	—	700	—	MHz
t_{PLH} t_{PHL}	Propagation Delay CP to Q_n, $\overline{Q_n}$	450	1200	450	1200	450	1200	ps
t_{PLH} t_{PHL}	Propagation Delay CP to $\overline{TC}$	600	1900	600	1900	600	1900	ps
t_{PLH} t_{PHL}	Propagation Delay MR to Q_n, $\overline{Q_n}$	500	1400	500	1400	500	1400	ps
t_{PLH} t_{PHL}	Propagation Delay MR to $\overline{TC}$	600	1900	600	1900	600	1900	ps
t_{PLH} t_{PHL}	Propagation Delay $D_0/\overline{CET}$ to $\overline{TC}$	400	1200	400	1200	400	1200	ps
t_{PLH} t_{PHL}	Propagation Delay S_n to $\overline{TC}$	1500	2600	1500	2600	1500	2600	ps
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	300	900	300	900	300	900	ps
t_s	Set-up Time							ps
	D_3	800	—	800	—	800	—	
	P_n	800	—	800	—	800	—	
	$D_0/\overline{CET}$, $\overline{CEP}$	700	—	700	—	700	—	
	S_n	2000	—	2000	—	2000	—	
	MR (Release Time)	900	—	900	—	900	—	
t_h	Hold Time							ps
	D_3	200	—	200	—	200	—	
	P_n	200	—	200	—	200	—	
	$D_0/\overline{CET}$, $\overline{CEP}$	200	—	200	—	200	—	
	S_n	−600	—	−600	—	−600	—	
t_{pw} (H)	Pulse Width HIGH, CP, MR	—	800	—	800	—	800	ps

6

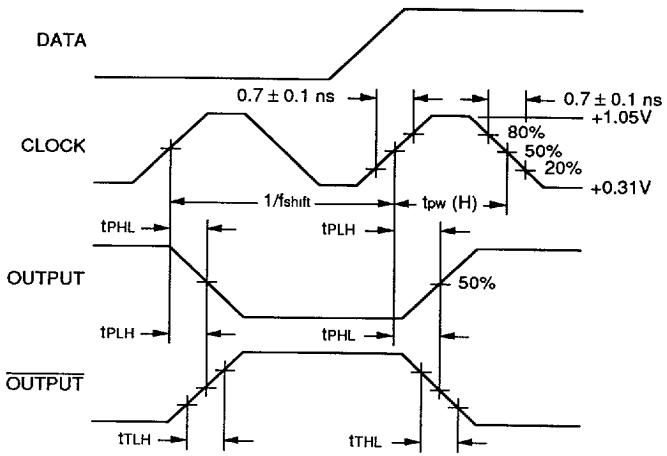
AC ELECTRICAL CHARACTERISTICS (CONT'D.)

PLCC

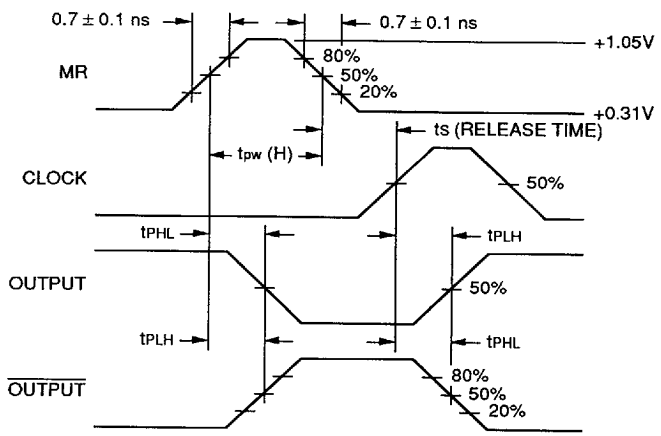
V_{EE} = –4.2V to –5.46V unless otherwise specified, V_{CC} = V_{CCA} = GND, T_A = 0°C to +85°C

Symbol	Parameter	T_A = 0°C		T_A = +25°C		T_A = +85°C		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
f_{shift}	Shift Frequency	700	—	700	—	700	—	MHz
t_{PLH} t_{PHL}	Propagation Delay CP to Q_n, $\overline{Q_n}$	450	1100	450	1100	450	1100	ps
t_{PLH} t_{PHL}	Propagation Delay CP to $\overline{TC}$	600	1800	600	1800	600	1800	ps
t_{PLH} t_{PHL}	Propagation Delay MR to Q_n, $\overline{Q_n}$	500	1300	500	1300	500	1300	ps
t_{PLH} t_{PHL}	Propagation Delay MR to $\overline{TC}$	600	1800	600	1800	600	1800	ps
t_{PLH} t_{PHL}	Propagation Delay $D_0/\overline{CET}$ to $\overline{TC}$	400	1100	400	1100	400	1100	ps
t_{PLH} t_{PHL}	Propagation Delay S_n to $\overline{TC}$	1500	2500	1500	2500	1500	2500	ps
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	300	900	300	900	300	900	ps
t_s	Set-up Time							ps
	D_3	800	—	800	—	800	—	
	P_n	800	—	800	—	800	—	
	$D_0/\overline{CET}$, $\overline{CEP}$	700	—	700	—	700	—	
	S_n	2000	—	2000	—	2000	—	
	MR (Release Time)	900	—	900	—	900	—	
t_h	Hold Time							ps
	D_3	200	—	200	—	200	—	
	P_n	200	—	200	—	200	—	
	$D_0/\overline{CET}$, $\overline{CEP}$	200	—	200	—	200	—	
	S_n	–600	—	–600	—	–600	—	
t_{pw} (H)	Pulse Width HIGH, CP, MR	—	800	—	800	—	800	ps

TIMING DIAGRAMS

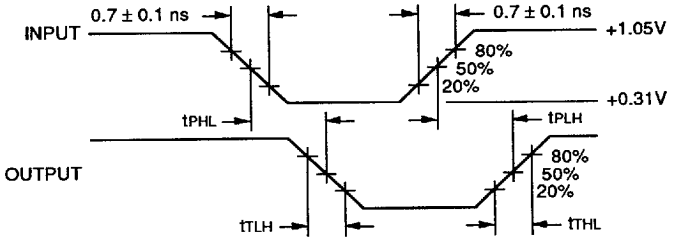


Propagation Delay (Clock) and Transition Times

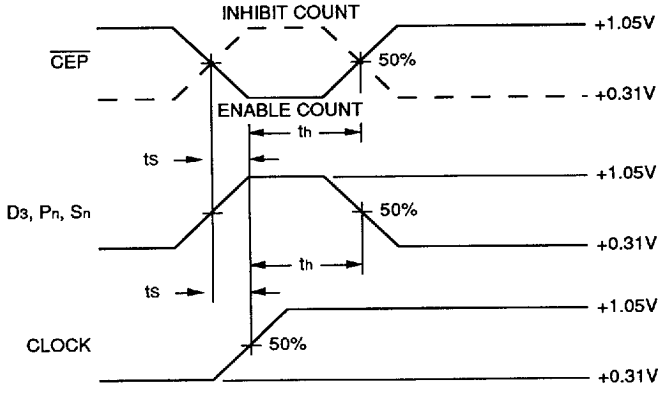


Propagation Delay (Reset)

TIMING DIAGRAMS (CONT'D.)



Propagation Delay (Serial Data, Selects)



Set-up and Hold Time

NOTES:

t_s is the minimum time before the transition of the clock that information must be present at the data input.

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
SY100S336DC	D24-1	Commercial
SY100S336FC	F24-1	Commercial
SY100S336JC	J28-1	Commercial