

NC7SZ175 TinyLogic™ UHS D-Type Flip-Flop with Asynchronous Clear

General Description

The NC7SZ175 is a single positive edge-triggered D-type CMOS Flip-Flop with Asynchronous Clear from Fairchild's Ultra High Speed Series of TinyLogic™ in the space saving SC70 6-lead package. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad V_{CC} operating range. The device is specified to operate over the 1.65V to 5.5V V_{CC} range. The inputs and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 7V independent of V_{CC} operating voltage. This single flip-flop will store the state of the D input that meets the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. A LOW input to Clear sets the Q output to LOW level. The Clear input is independent of clock.

Features

- Space saving SC70 6-lead package
- Ultra High Speed; t_{PD} 2.6 ns Typ into 50 pF at 5V V_{CC}
- High Output Drive; ± 24 mA at 3V V_{CC}
- Broad V_{CC} Operating Range; 1.65V to 5.5V
- Matches the performance of LCX when operated at 3.3V V_{CC}
- Power down high impedance inputs/output
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SZ175P6	MAA06A	Z75	6-Lead SC70, EIAJ SC88, 1.25mm Wide	250 Units on Tape and Reel
NC7SZ175P6X	MAA06A	Z75	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel

Function Table

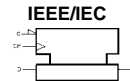
Inputs			Output
CP	D	\bar{C}	Q
—	L	H	L
—	H	H	H
—	X	H	Qn
X	X	L	L

H = HIGH Logic Level Qn = No change in data
L = LOW Logic Level X = Immaterial Z = HIGH Impedance

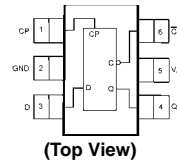
Pin Descriptions

Pin Names	Description
D	Data Input
CP	Clock Pulse Input
\bar{C}	Clear Input
Q	Flip-Flop Output

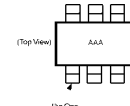
Logic Symbol



Connection Diagrams



Pin One Orientation Diagram



AAA represents Product Code Top Mark - see ordering code

Note: Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

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Absolute Maximum Ratings (Note 1)		Recommended Operating Conditions (Note 2)	
Supply Voltage (V_{CC})	-0.5V to +7.0V	Power Supply	
DC Input Voltage (V_{IN})	-0.5V to +7.0V	Operating (V_{CC})	1.65V to 5.5V
DC Output Voltage (V_{OUT})	-0.5V to +7.0V	Data Retention	1.5V to 5.5V
DC Input Diode Current (I_{IK})		Input Voltage (V_{IN})	0V to 5.5V
$V_{IN} < 0V$	-50 mA	Output Voltage (V_{OUT})	0V to V_{CC}
DC Output Diode Current (I_{OK})		Input Rise and Fall Time (t_r, t_f)	
$V_{OUT} < 0V$	-50 mA	$V_{CC} = 1.8V, 2.5V \pm 0.2V$	0 to 20 ns/V
DC Output (I_{OUT}) Source/Sink Current	± 50 mA	$V_{CC} = 3.3V \pm 0.3V$	0 to 10 ns/V
DC V_{CC}/GND Current (I_{CC}/I_{GND})	± 50 mA	$V_{CC} = 5.5V \pm 0.5V$	0 to 5 ns/V
Storage Temperature Range (T_{STG})	-65°C to +150°C	Operating Temperature (T_A)	-40°C to +85°C
Junction Temperature under Bias (T_J)	150°C	Thermal Resistance (θ_{JA})	350° C/W
Junction Lead Temperature (T_L)		Note 1: The "Absolute Maximum Ratings": are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.	
(Soldering, 10 seconds)	260°C	Note 2: Unused inputs must be held HIGH or LOW. They may not float.	
Power Dissipation (P_D) @+85°C	180 mW		

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = +25^\circ C$			$T_A = -40^\circ C$ to $+85^\circ C$		Unit	Conditions	
			Min	Typ	Max	Min	Max			
V_{IH}	HIGH Level Control Input Voltage	1.65 to 1.95	0.75 V_{CC}			0.75 V_{CC}		V		
		2.3 to 5.5	0.7 V_{CC}			0.7 V_{CC}				
V_{IL}	LOW Level Control Input Voltage	1.65 to 1.95	0.25 V_{CC}			0.25 V_{CC}		V		
		2.3 to 5.5	0.3 V_{CC}			0.3 V_{CC}				
V_{OH}	HIGH Level Control Output Voltage	1.65	1.55	1.65	1.55		V	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -100 \mu A$	
		1.8	1.7	1.8	1.7					
		2.3	2.2	2.3	2.2					
		3.0	2.9	3.0	2.9					
		4.5	4.4	4.5	4.4					
		1.65	1.24	1.52	1.29				$I_{OH} = -4$ mA $I_{OH} = -8$ mA $I_{OH} = -16$ mA $I_{OH} = -24$ mA $I_{OH} = -32$ mA	
		2.3	1.9	2.15	1.9					
		3.0	2.4	2.8	2.4					
		3.0	2.3	2.68	2.3					
		4.5	3.8	4.2	3.8					
V_{OL}	LOW Level Control Output Voltage	1.65	0.0			0.1		V	$V_{IN} = V_{IL}$ or V_{IH}	$I_{OL} = 100 \mu A$
		1.8	0.0			0.1				
		2.3	0.0			0.1				
		3.0	0.0			0.1				
		4.5	0.0			0.1				
		1.65	0.08			0.24				$I_{OL} = 4$ mA $I_{OL} = 8$ mA $I_{OL} = 16$ mA $I_{OL} = 24$ mA $I_{OL} = 32$ mA
		2.3	0.10			0.3				
		3.0	0.15			0.4				
3.0	0.22			0.55						
4.5	0.22			0.55						
I_{IN}	Input Leakage Current	0 to 5.5	± 0.1			± 1.0		μA	$0 \leq V_{IN} \leq 5.5V$	
I_{OFF}	Power Off Leakage Current	0.0	1.0			10		μA	V_{IN} or $V_{OUT} = 5.5V$	
I_{CC}	Quiescent Supply Current	1.65 to 5.5	1.0			10.0		μA	$V_{IN} = 5.5V, GND$	

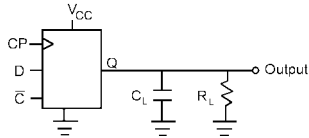
AC Electrical Characteristics										
Symbol	Parameter	V _{CC} (V)	T _A = +25°C			T _A = -40°C to +85°C		Units	Conditions	Fig. No.
			Min	Typ	Max	Min	Max			
f _{MAX}	Maximum Clock Frequency	1.65					100	MHz	C _L = 50 pF R _L = 500 Ω	Figures 1, 4
		1.8					100			
		2.5 ± 0.2					125			
		3.3 ± 0.3					150			
		5.0 ± 0.5					175			
t _{PLH} t _{PHL}	Propagation Delay CP to Q	1.65	2.5	9.8	15.0	2.5	16.5	ns	C _L = 15 pF R _L = 1 MΩ	Figures 1, 3
		1.8	2.5	6.5	10.0	2.5	11.0			
		2.5 ± 0.2	2.0	3.8	6.5	2.0	7.0			
		3.3 ± 0.3	1.5	2.8	4.5	1.4	5.0			
		5.0 ± 0.5	1.0	2.2	3.5	1.0	3.8			
		3.3 ± 0.3	2.0	3.4	5.5	1.6	6.2			
t _{PHL}	Propagation Delay \bar{C} to Q	1.65	2.5	9.8	13.5	2.5	15.0	ns	C _L = 15 pF R _L = 1 MΩ	Figures 1, 3
		1.8	2.5	6.5	9.0	2.5	10.0			
		2.5 ± 0.2	2.0	3.8	6.0	2.0	6.4			
		3.3 ± 0.3	1.5	2.8	4.3	1.2	4.6			
		5.0 ± 0.5	1.5	2.2	3.2	1.0	3.5			
		3.3 ± 0.3	1.5	3.4	5.3	1.5	5.8			
t _S	Setup Time CP to D	2.5 ± 0.2				2.5	ns	C _L = 50 pF R _L = 500 Ω	Figures 1, 4	
		3.3 ± 0.3				2.0				
		5.0 ± 0.5				1.5				
t _H	Hold Time, CP to D	2.5 ± 0.2				1.5	ns	C _L = 50 pF R _L = 500 Ω	Figures 1, 4	
		3.3 ± 0.3				1.5				
		5.0 ± 0.5				1.5				
t _W	Pulse Width, CP	2.5 ± 0.2				3.0	ns	C _L = 50 pF R _L = 500 Ω	Figures 1, 4	
		3.3 ± 0.3				2.8				
		5.0 ± 0.5				2.5				
	Pulse Width, \bar{C}	2.5 ± 0.2				3.0	ns	Clock HIGH or LOW C _L = 50 pF R _L = 500 Ω	Figures 1, 4	
		3.3 ± 0.3				2.8				
		5.0 ± 0.5				2.5				
t _{rec}	Recovery Time, \bar{C} to CP	2.5 ± 0.2				1.0	ns	C _L = 50 pF R _L = 500 Ω	Figures 1, 4	
		3.3 ± 0.3				1.0				
		5.0 ± 0.5				1.0				

Capacitance (Note 3)					
Symbol	Parameter	Typ	Max	Units	Conditions
C _{IN}	Input Capacitance	3		pF	V _{CC} = Open, V _{IN} = 0V or V _{CC}
C _{OUT}	Output Capacitance	4		pF	V _{CC} = 3.3V, V _{IN} = 0V or V _{CC}
C _{PD}	Power Dissipation Capacitance (Note 4)	10		pF	V _{CC} = 3.3V
		12			V _{CC} = 5.0V

Note 3: T_A = +25C, f = 1MHz.

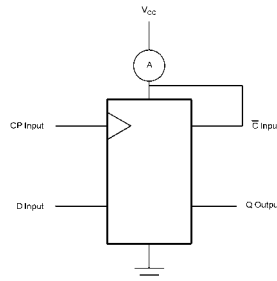
Note 4: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2)
C_{PD} is related to I_{CCD} dynamic operating current by the expression: I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}static).

AC Loading and Waveforms



C_L includes load and stray capacitance
 Input PRR = 1.0 MHz, $t_w = 500$ ns

FIGURE 1. AC Test Circuit



CP Input = AC Waveform; $t_r = t_f = 1.8$ ns;
 CP Input PRR = 10 MHz; Duty Cycle = 50%
 D Input PRR = 5MHz; Duty Cycle = 50%

FIGURE 2. I_{CCD} Test Circuit

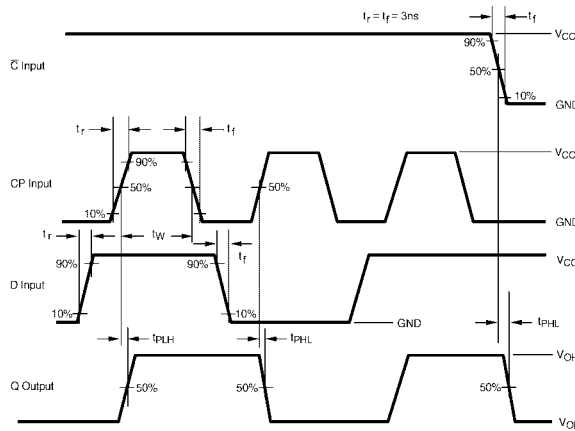


FIGURE 3. AC Waveforms

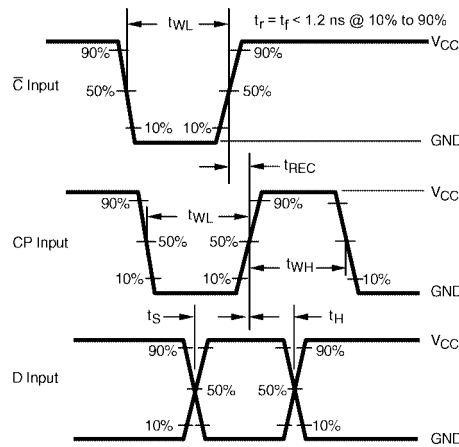


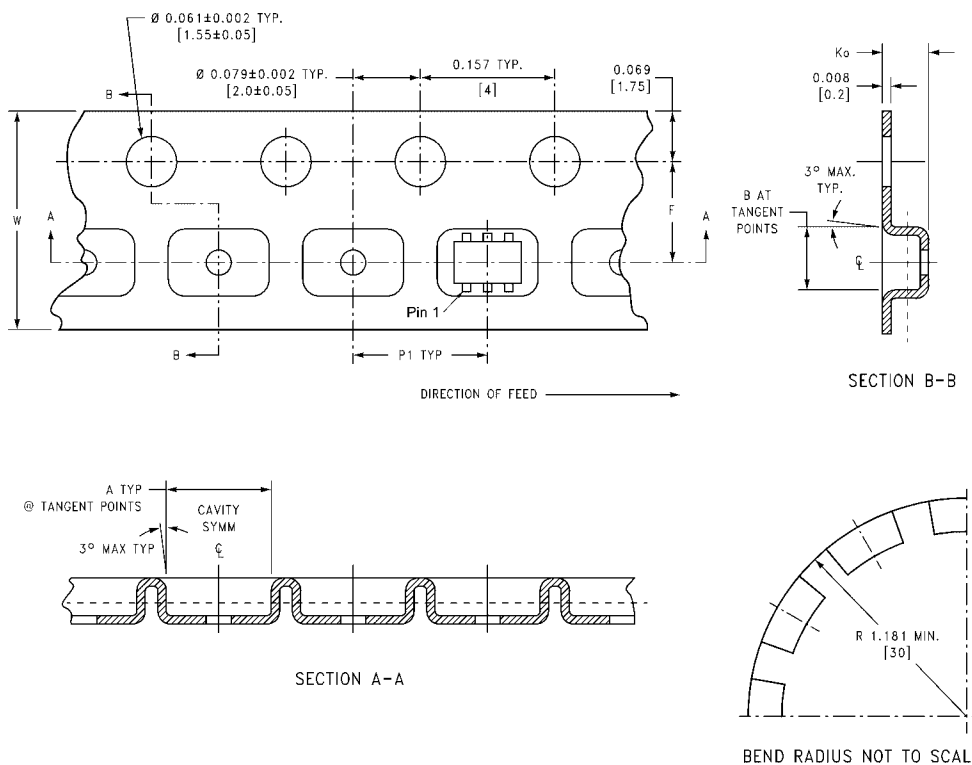
FIGURE 4. AC Waveforms

Tape and Reel Specification

TAPE FORMAT

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
P6	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	250	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed
P6X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

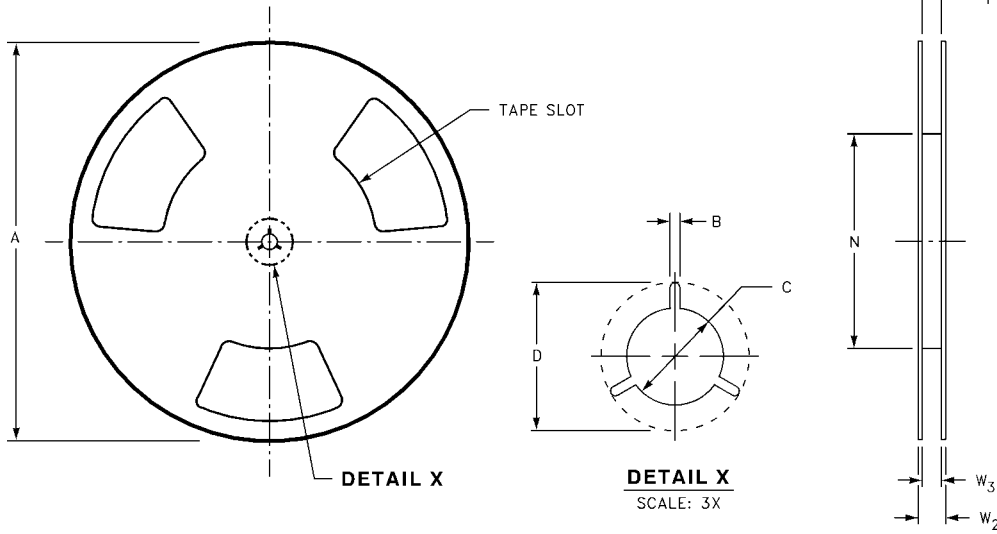
TAPE DIMENSIONS inches (millimeters)



Package	Tape Size	DIM A	DIM B	DIM F	DIM K_0	DIM P1	DIM W
SC70-6	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)

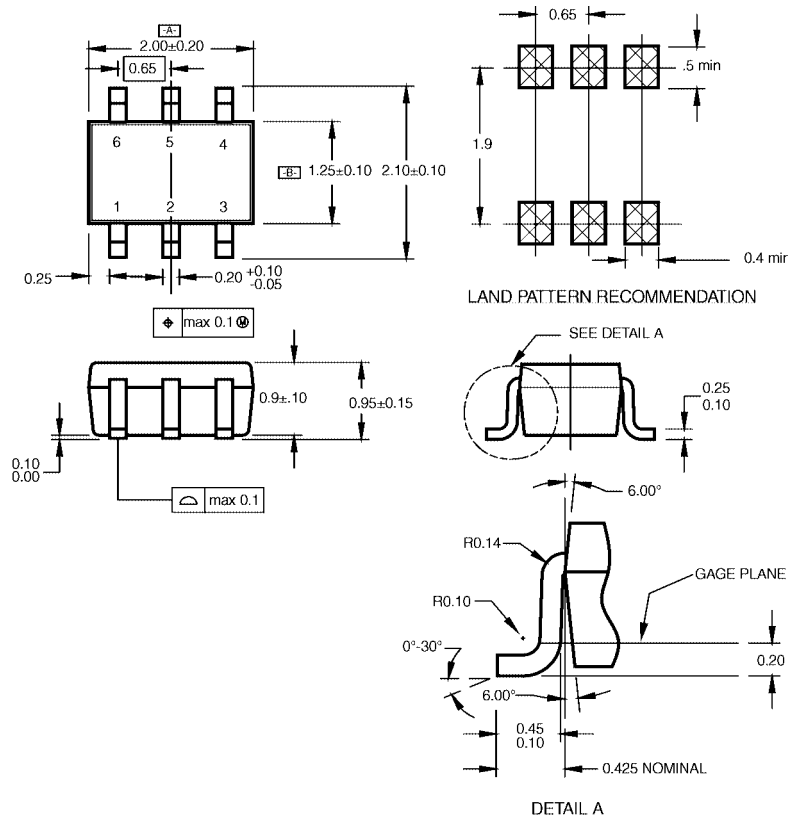
NC7SZ175

Tape and Reel Specification (Continued)
REEL DIMENSIONS inches (millimeters)



Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)	0.567 (14.40)	W1 + 0.078/-0.039 (W1 + 2.00/-1.00)

Physical Dimensions inches (millimeters) unless otherwise noted



NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA06ARevC

**6-Lead SC70, EIAJ SC88, 1.25mm Wide
Package Number MAA06A**

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