

# NC7SZ175

## TinyLogic UHS D-Type Flip-Flop with Asynchronous Clear

### Description

The NC7SZ175 is a single positive edge-triggered D-type CMOS Flip-Flop with Asynchronous Clear from ON Semiconductor'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 1.65 V to 5.5 V  $V_{CC}$  range. The inputs and output are high impedance when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 5.5 V 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 Small MicroPak™ Leadless Package
- Ultra High Speed:  $t_{PD}$  2.6 ns Typ into 50 pF at 5 V  $V_{CC}$
- High Output Drive:  $\pm 24$  mA at 3 V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Matches the Performance of LCX when Operated at 3.3 V  $V_{CC}$
- Power Down High Impedance Inputs / Output
- Overvoltage Tolerant Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

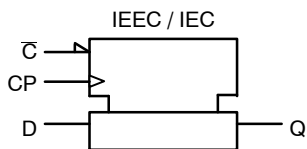


Figure 1. Logic Symbol



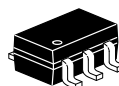
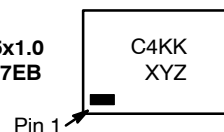
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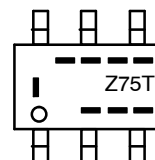
### MARKING DIAGRAMS



SIP6 1.45x1.0  
CASE 127EB



SC-88  
(SC-70 6 Lead)  
1.25x2  
CASE 419AD-01



C4, Z75	= Specific Device Code
KK	= 2-Digit Lot Run Traceability Code
XY	= 2-Digit Date Code Format
Z	= Assembly Plant Code
----	= Year Coding Scheme
-	= Plant Code Identifier
T	= Die Run Code
----	= Eight-Week Datacoding Scheme

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

Connection Diagrams

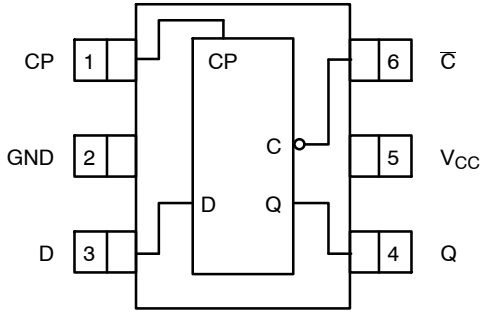


Figure 2. SC70 (Top View)

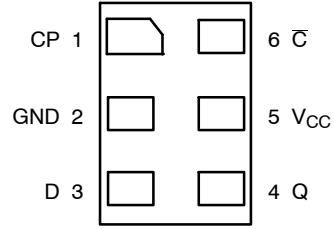
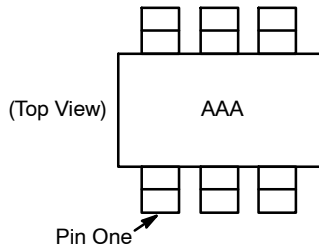


Figure 4. MicroPak (Top Through View)



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).

Figure 3. Pin 1 Orientation

PIN DESCRIPTIONS

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

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  
 L = LOW Logic Level

Qn = No Change in Data  
 X = Immaterial

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## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Unit
V <sub>CC</sub>	Supply Voltage		-0.5	+6.5	V
V <sub>IN</sub>	DC Input Voltage		-0.5	+6.5	V
V <sub>OUT</sub>	DC Output Voltage		-0.5	+6.5	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0 V	-	-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0 V	-	-50	mA
I <sub>OUT</sub>	DC Output Source / Sink Current		-	±50	mA
I <sub>CC</sub> / I <sub>GND</sub>	DC V <sub>CC</sub> / GND Current		-	±50	mA
T <sub>STG</sub>	Storage Temperature Range		-65	+150	°C
T <sub>J</sub>	Junction Temperature under Bias		-	150	°C
T <sub>L</sub>	Junction Lead Temperature (Soldering, 10 Seconds)		-	260	°C
P <sub>D</sub>	Power Dissipation @ +85°C	SC70	-	190	mW
		MicroPak	-	327	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage Operating		1.65	5.5	V
	Supply Voltage Data Retention		1.5	5.5	
V <sub>IN</sub>	Input Voltage		0	5.5	V
V <sub>OUT</sub>	Output Voltage		0	V <sub>CC</sub>	V
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time	V <sub>CC</sub> = 1.8 V, 2.5 V ±0.2 V	0	20	ns/V
		V <sub>CC</sub> = 3.3 V ±0.3 V	0	10	
		V <sub>CC</sub> = 5.5 V ±0.5 V	0	5	
T <sub>A</sub>	Operating Temperature		-40	+85	°C
θ <sub>JA</sub>	Thermal Resistance	SC70-5	-	659	°C/W
		MicroPak	-	382	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

1. Unused inputs must be held HIGH or LOW. They may not float.

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## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions		T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
					Min	Typ	Max	Min	Max	
V <sub>IH</sub>	HIGH Level Input Control Voltage	1.65 to 1.95			0.65 V <sub>CC</sub>	-	-	0.65 V <sub>CC</sub>	-	V
		2.3 to 5.5			0.7 V <sub>CC</sub>	-	-	0.7 V <sub>CC</sub>	-	
V <sub>IL</sub>	LOW Level Input Control Voltage	1.65 to 1.95			-	-	0.35 V <sub>CC</sub>	-	0.35 V <sub>CC</sub>	V
		2.3 to 5.5			-	-	0.3 V <sub>CC</sub>	-	0.3 V <sub>CC</sub>	
V <sub>OH</sub>	HIGH Level Control Output Voltage	1.65	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	1.55	1.65	-	1.55	-	V
		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		I <sub>OH</sub> = -4 mA	1.24	1.52	-	1.29	-	
		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 <sub>OL</sub>	LOW Level Control Output Voltage	1.65	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>	I <sub>OL</sub> = 100 μA	-	0.0	0.1	-	0.1	V
		1.8			-	0.0	0.1	-	0.1	
		2.3			-	0.0	0.1	-	0.1	
		3.0			-	0.0	0.1	-	0.1	
		4.5			-	0.0	0.1	-	0.1	
		1.65		I <sub>OL</sub> = 4 mA	-	0.08	0.24	-	0.24	
		2.3			-	0.10	0.3	-	0.3	
		3.0			-	0.15	0.4	-	0.4	
		3.0			-	0.22	0.55	-	0.55	
		4.5			-	0.22	0.55	-	0.55	
I <sub>IN</sub>	Input Leakage Current	1.65 to 5.5	0 ≤ V <sub>IN</sub> ≤ 5.5 V		-	-	±0.1	-	±1.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	0.0	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V		-	-	1.0	-	10	μA
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.5	V <sub>IN</sub> = 5.5 V, GND		-	-	1.0	-	10.0	μA

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## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Clock Frequency (Figures 5, 8)	1.65	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	-	-	100	-	MHz
		1.8		-	-	-	100	-	
		2.5 ±0.2		-	-	-	125	-	
		3.3 ±0.3		-	-	-	150	-	
		5.0 ±0.5		-	-	-	175	-	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay CP to Q (Figures 5, 7)	1.65	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	-	9.8	15.0	-	16.5	ns
		1.8		-	6.5	10.0	-	11.0	
		2.5 ±0.2		-	3.8	6.5	-	7.0	
		3.3 ±0.3		-	2.8	4.5	-	5.0	
		5.0 ±0.5		-	2.2	3.5	-	3.8	
		3.3 ±0.3	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	3.4	5.5	-	6.2	
		5.0 ±0.5		-	2.6	4.0	-	4.7	
t <sub>PHL</sub>	Propagation Delay $\bar{C}$ to Q (Figures 5, 7)	1.65	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	-	9.8	13.5	-	15.0	ns
		1.8		-	6.5	9.0	-	10.0	
		2.5 ±0.2		-	3.8	6.0	-	6.4	
		3.3 ±0.3		-	2.8	4.3	-	4.6	
		5.0 ±0.5		-	2.2	3.2	-	3.5	
		3.3 ±0.3	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	3.4	5.3	-	5.8	
		5.0 ±0.5		-	2.7	4.0	-	4.5	
t <sub>S</sub>	Setup Time, CP to D (Figures 5, 8)	2.5 ±0.2	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	-	-	2.5	-	ns
		3.3 ±0.3		-	-	-	2.0	-	
		5.0 ±0.5		-	-	-	1.5	-	
t <sub>H</sub>	Hold Time, CP to D (Figures 5, 8)	2.5 ±0.2	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	-	-	1.5	-	ns
		3.3 ±0.3		-	-	-	1.5	-	
		5.0 ±0.5		-	-	-	1.5	-	
t <sub>W</sub>	Pulse Width, CP (Figures 5, 8)	2.5 ±0.2	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	-	-	3.0	-	ns
		3.3 ±0.3		-	-	-	2.8	-	
		5.0 ±0.5		-	-	-	2.5	-	
	Pulse Width, $\bar{C}$ (Figures 5, 8)	2.5 ±0.2	Clock HIGH or LOW C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	-	-	3.0	-	ns
		3.3 ±0.3		-	-	-	2.8	-	
		5.0 ±0.5		-	-	-	2.5	-	
t <sub>rec</sub>	Recovery Time, $\bar{C}$ to CP (Figures 5, 8)	2.5 ±0.2	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	-	-	-	1.0	-	ns
		3.3 ±0.3		-	-	-	1.0	-	
		5.0 ±0.5		-	-	-	1.0	-	

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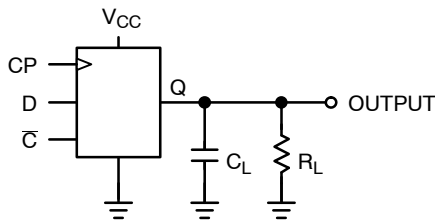
## CAPACITANCE ( $T_A = +25^\circ\text{C}$ , $f = 1\text{ MHz}$ )

Symbol	Parameter	Condition	Typ	Max	Units
$C_{IN}$	Input Capacitance	$V_{CC} = \text{Open}$ , $V_{IN} = 0\text{ V or }V_{CC}$	3	-	pF
$C_{OUT}$	Output Capacitance	$V_{CC} = 3.3\text{ V}$ , $V_{IN} = 0\text{ V or }V_{CC}$	4	-	pF
$C_{PD}$	Power Dissipation Capacitance (Note 2)	$V_{CC} = 3.3\text{ V}$	10	-	pF
		$V_{CC} = 5.0\text{ V}$	12	-	

2.  $C_{PD}$  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 6)

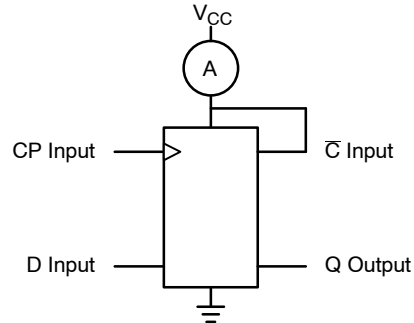
$C_{PD}$  is related to  $I_{CCD}$  dynamic operating current by the expression:  $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC\text{static}})$ .

## AC Loading and Waveforms



$C_L$  includes load and stray capacitance  
Input PRR = 1.0 MHz,  $t_W = 500\text{ ns}$ .

Figure 5. AC Test Circuit



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

Figure 6.  $I_{CCD}$  Test Circuit

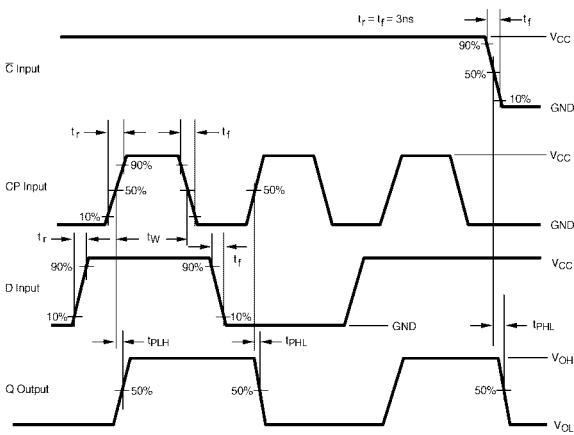


Figure 7. AC Waveforms

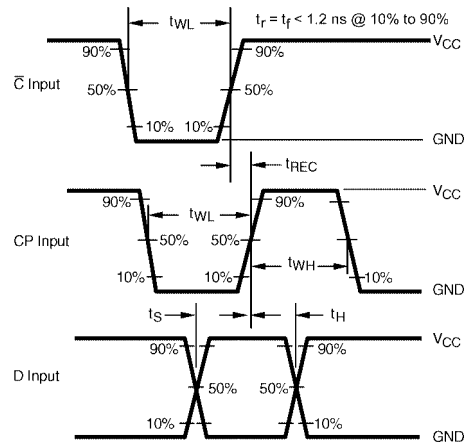


Figure 8. AC Waveforms

## DEVICE ORDERING INFORMATION

Device	Top Mark	Packages	Shipping <sup>†</sup>
NC7SZ175P6X	Z75	6-Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 / Tape & Reel
NC7SZ175L6X	C4	6-Lead MicroPak, 1.00 mm Wide	5000 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SIP6 1.45X1.0  
CASE 127EB  
ISSUE O

DATE 31 AUG 2016



NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

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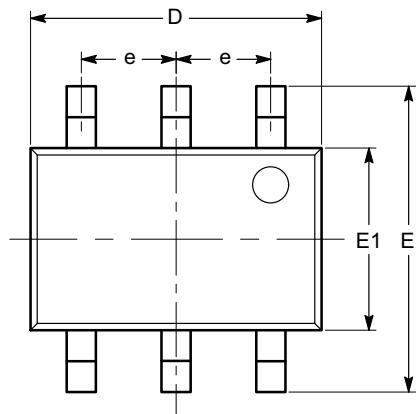
## PACKAGE DIMENSIONS

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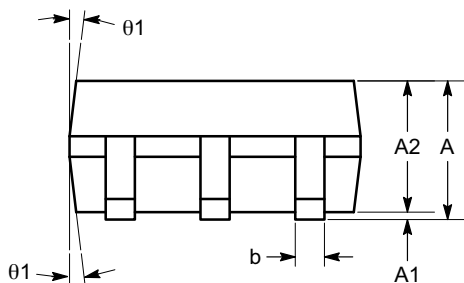
SC-88 (SC-70 6 Lead), 1.25x2  
CASE 419AD-01  
ISSUE A

DATE 07 JUL 2010

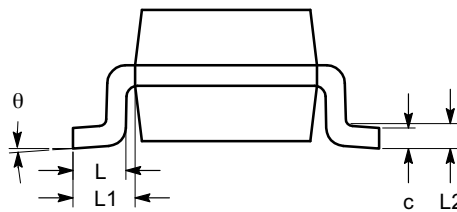


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	0.80		1.10
A1	0.00		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80	2.00	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.26	0.36	0.46
L1	0.42 REF		
L2	0.15 BSC		
$\theta$	0°		8°
$\theta_1$	4°		10°



SIDE VIEW



END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

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