

# SN74LS109A

## Dual JK Positive Edge-Triggered Flip-Flop

The SN74LS109A consists of two high speed completely independent transition clocked  $\overline{JK}$  flip-flops. The clocking operation is independent of rise and fall times of the clock waveform. The  $\overline{JK}$  design allows operation as a D flip-flop by simply connecting the J and  $\overline{K}$  pins together.

### MODE SELECT – TRUTH TABLE

OPERATING MODE	INPUTS				OUTPUTS	
	$\overline{S}_D$	$\overline{C}_D$	J	K	Q	$\overline{Q}$
Set	L	H	X	X	H	L
Reset (Clear)	H	L	X	X	L	H
*Undetermined	L	L	X	X	H	H
Load "1" (Set)	H	H	h	h	H	L
Hold	H	H	l	h	q	$\overline{q}$
Toggle	H	H	h	l	$\overline{q}$	q
Load "0" (Reset)	H	H	l	l	L	H

\* Both outputs will be HIGH while both  $\overline{S}_D$  and  $\overline{C}_D$  are LOW, but the output states are unpredictable if  $\overline{S}_D$  and  $\overline{C}_D$  go HIGH simultaneously.

H, h = HIGH Voltage Level

L, l = LOW Voltage Level

X = Don't Care

l, h (q) = Lower case letters indicate the state of the referenced input (or output) one set-up time prior to the LOW to HIGH clock transition.

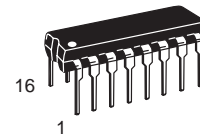
### GUARANTEED OPERATING RANGES

Symbol	Parameter	Min	Typ	Max	Unit
$V_{CC}$	Supply Voltage	4.75	5.0	5.25	V
$T_A$	Operating Ambient Temperature Range	0	25	70	°C
$I_{OH}$	Output Current – High			-0.4	mA
$I_{OL}$	Output Current – Low			8.0	mA

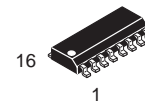


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### LOW POWER SCHOTTKY



PLASTIC  
N SUFFIX  
CASE 648



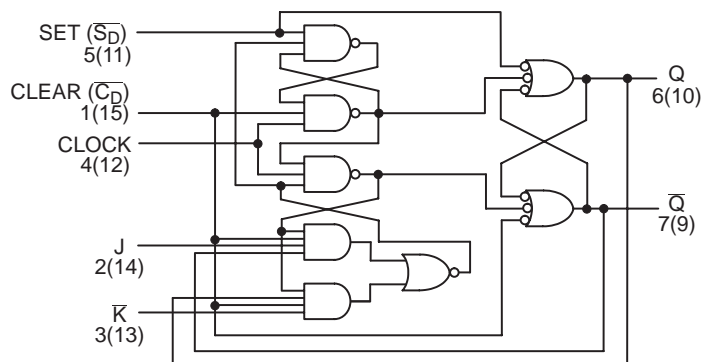
SOIC  
D SUFFIX  
CASE 751B

### ORDERING INFORMATION

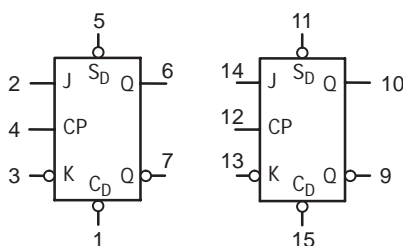
Device	Package	Shipping
SN74LS109AN	16 Pin DIP	2000 Units/Box
SN74LS109AD	16 Pin	2500/Tape & Reel

# SN74LS109A

## LOGIC DIAGRAM



## LOGIC SYMBOL



$V_{CC}$  = PIN 16  
GND = PIN 8

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
$V_{IH}$	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage for All Inputs
$V_{IL}$	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage for All Inputs
$V_{IK}$	Input Clamp Diode Voltage		-0.65	-1.5	V	$V_{CC} = \text{MIN}$ , $I_{IN} = -18 \text{ mA}$
$V_{OH}$	Output HIGH Voltage	2.7	3.5		V	$V_{CC} = \text{MIN}$ , $I_{OH} = \text{MAX}$ , $V_{IN} = V_{IH}$ or $V_{IL}$ per Truth Table
$V_{OL}$	Output LOW Voltage		0.25	0.4	V	$V_{CC} = V_{CC} \text{ MIN}$ , $V_{IN} = V_{IL}$ or $V_{IH}$ per Truth Table
			0.35	0.5	V	
$I_{IH}$	Input HIGH Current J, K, Clock Set, Clear			20 40	$\mu\text{A}$	$V_{CC} = \text{MAX}$ , $V_{IN} = 2.7 \text{ V}$
	J, K, Clock Set, Clear			0.1 0.2	mA	$V_{CC} = \text{MAX}$ , $V_{IN} = 7.0 \text{ V}$
$I_{IL}$	Input LOW Current J, K, Clock Set, Clear			-0.4 -0.8	mA	$V_{CC} = \text{MAX}$ , $V_{IN} = 0.4 \text{ V}$
$I_{OS}$	Output Short Circuit Current (Note 1)	-20		-100	mA	$V_{CC} = \text{MAX}$
$I_{CC}$	Power Supply Current			8.0	mA	$V_{CC} = \text{MAX}$

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

# SN74LS109A

## AC CHARACTERISTICS (T<sub>A</sub> = 25°C, V<sub>CC</sub> = 5.0 V)

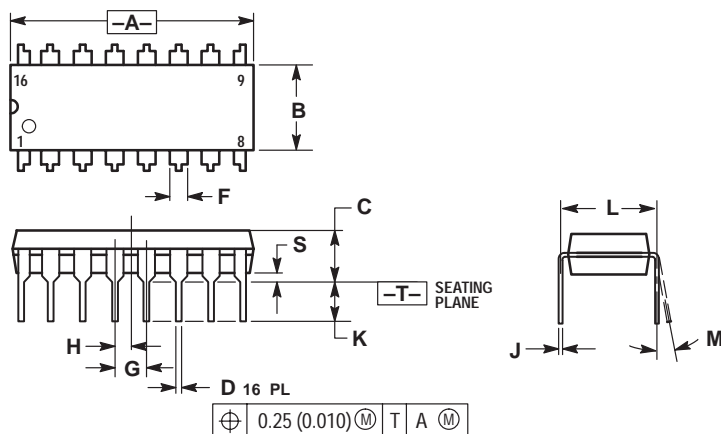
Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
f <sub>MAX</sub>	Maximum Clock Frequency	25	33		MHz	V <sub>CC</sub> = 5.0 V C <sub>L</sub> = 15 pF
t <sub>PLH</sub>	Clock, Clear, Set to Output		13	25	ns	
t <sub>PHL</sub>			25	40	ns	

## AC SETUP REQUIREMENTS (T<sub>A</sub> = 25°C, V<sub>CC</sub> = 5.0 V)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
t <sub>W</sub>	Clock High Clear, Set Pulse Width	25			ns	V <sub>CC</sub> = 5.0 V
t <sub>s</sub>	Data Setup Time — HIGH LOW	20			ns	
		20			ns	
t <sub>h</sub>	Hold time	5.0			ns	

## PACKAGE DIMENSIONS

### N SUFFIX PLASTIC PACKAGE CASE 648-08 ISSUE R



#### NOTES:

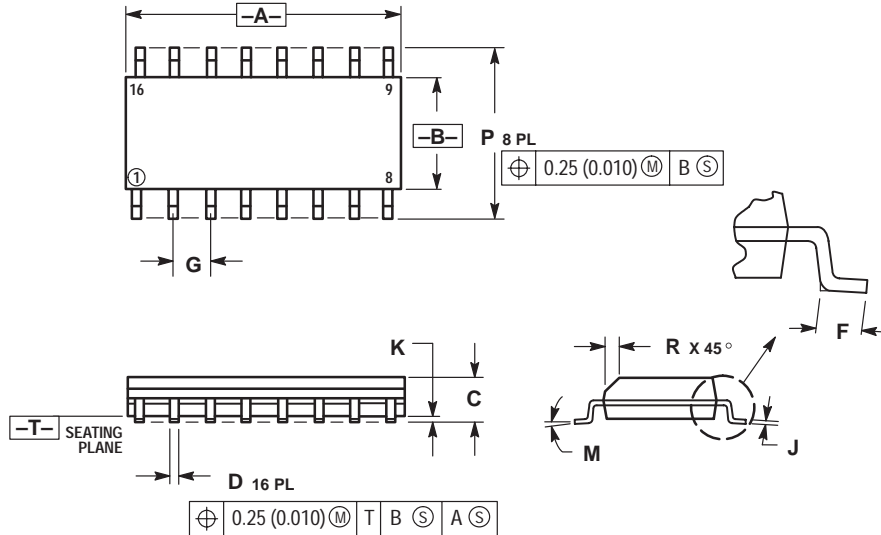
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.
- ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

# SN74LS109A

## PACKAGE DIMENSIONS


### D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0° 7°		0° 7°	
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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