

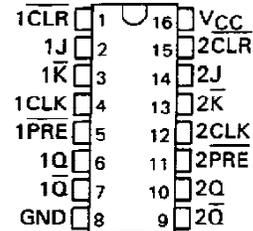
# DUAL J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

DECEMBER 1983 — REVISED MARCH 1988

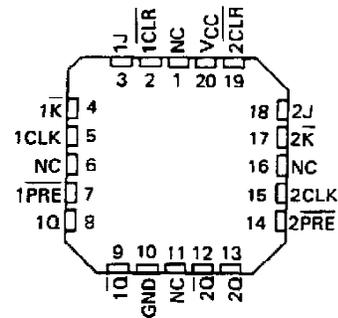
**SN54109, SN54LS109A,  
SN74109, SN74LS109A**

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

SN54109, SN54LS109A . . . J OR W PACKAGE  
SN74109 . . . N PACKAGE  
SN74LS109A . . . D OR N PACKAGE  
(TOP VIEW)



SN54LS109A . . . FK PACKAGE  
(TOP VIEW)



### description

These devices contain two independent J-K positive-edge-triggered flip-flops. A low level at the preset or clear inputs sets or resets the outputs regardless of the levels of the other inputs. When preset and clear are inactive (high), data at the J and K inputs meeting the setup time requirements are transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold time interval, data at the J and K inputs may be changed without affecting the levels at the outputs. These versatile flip-flops can perform as toggle flip-flops by grounding K and tying J high. They also can perform as D-type flip-flops if J and K are tied together.

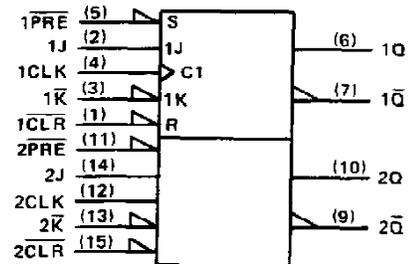
The SN54109 and SN54LS109A are characterized for operation over the full military temperature range of -55°C to 125°C. The SN74109 and SN74LS109A are characterized for operation from 0°C to 70°C.

FUNCTION TABLE (each flip-flop)

INPUTS					OUTPUTS	
PRE	CLR	CLK	J	K	Q	Q-bar
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H <sup>†</sup>	H <sup>†</sup>
H	H	↑	L	L	L	H
H	H	↑	H	L	TOGGLE	
H	H	↑	L	H	Q <sub>0</sub>	Q <sub>0</sub> -bar
H	H	↑	H	H	H	L
H	H	L	X	X	Q <sub>0</sub>	Q <sub>0</sub> -bar

<sup>†</sup> The output levels in this configuration are not guaranteed to meet the minimum levels for V<sub>OH</sub> if the lows at preset and clear are near V<sub>IL</sub> maximum. Furthermore, this configuration is nonstable; that is, it will not persist when preset or clear return to their inactive (high) level.

### logic symbol<sup>‡</sup>



<sup>‡</sup>This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

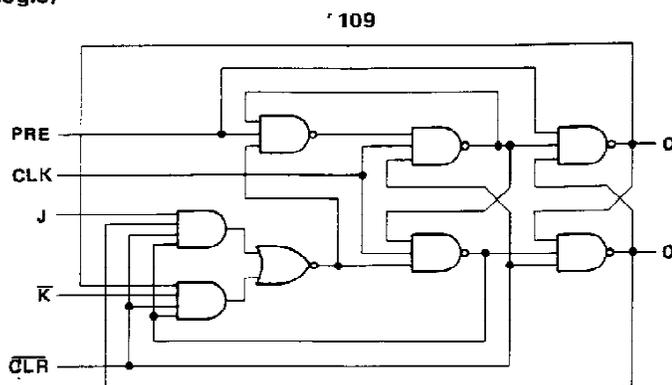
PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



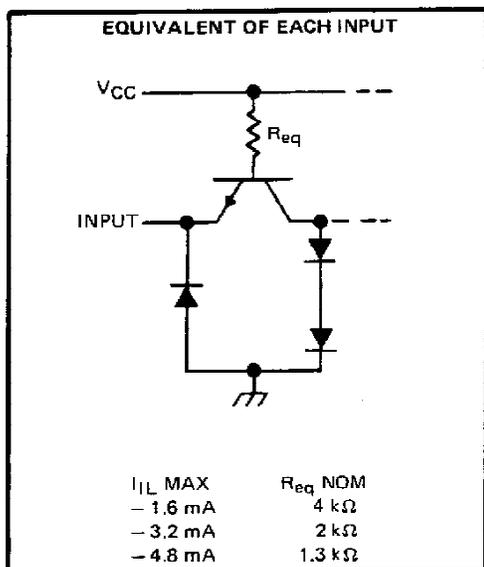
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**SN54109, SN74109**  
**DUAL J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR**

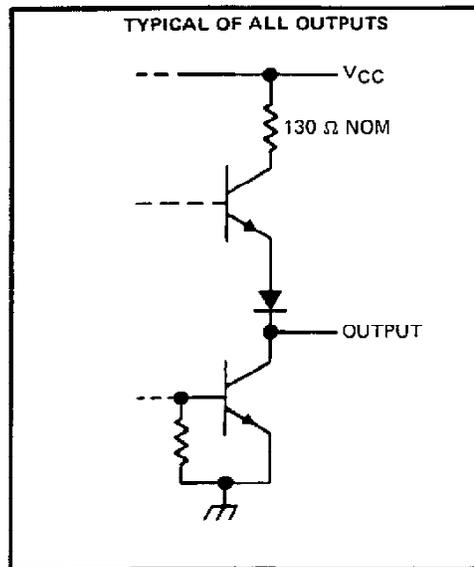
logic diagram (positive logic)



schematics of inputs and outputs



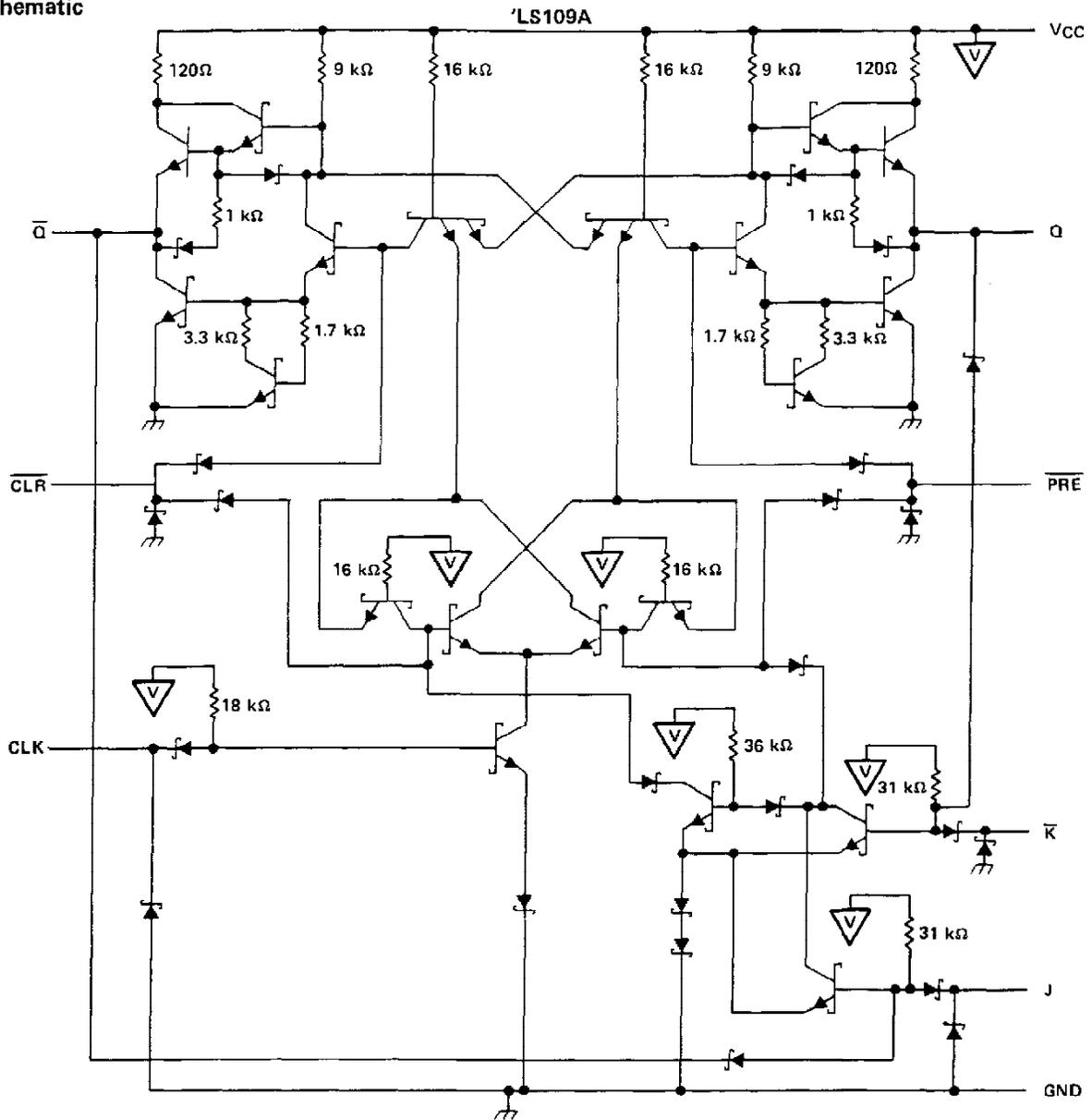
'109



**SN54109, SN54LS109A,  
SN74109, SN74LS109A**

**DUAL J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR**

schematic



**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

Supply voltage, $V_{CC}$ (see Note 1) .....	7 V
Input voltage: '109 .....	5.5 V
'LS109A .....	7 V
Operating free-air temperature range: SN54' .....	-55°C to 125°C
SN74' .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

**TEXAS  
INSTRUMENTS**

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# SN54109, SN74109

## DUAL J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

### recommended operating conditions

	SN54109			SN74109			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.8			0.8	V
I <sub>OH</sub> High-level output current			-0.8			-0.8	mA
I <sub>OL</sub> Low-level output current			16			16	mA
t <sub>w</sub> Pulse duration	CLK high or low		20	20			ns
	PRE or CLR low		20	20			
t <sub>su</sub> Input setup time before CLK †	10			10			ns
t <sub>h</sub> Input hold time-data after CLK †	6			6			ns
T <sub>A</sub> Operating free-air temperature	-55		125	0		70	°C

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54109			SN74109			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA			-1.5			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -0.8 mA	2.4	3.4		2.4	3.4		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 16 mA		0.2	0.4		0.2	0.4	V
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V		1			1		mA
I <sub>IH</sub>	J or K		40			40		μA
	CLR		160			160		
	PRE or CLK	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V		80			80	
I <sub>IL</sub>	J or K		-1.6			-1.6		mA
	CLR †		-4.8			-4.8		
	PRE †		-3.2			-3.2		
	CLK	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V		-3.2			-3.2	
I <sub>OS</sub> §	V <sub>CC</sub> = MAX	-30		-85	-30		-85	mA
I <sub>CC</sub> #	V <sub>CC</sub> = MAX, See Note 2		9	15		9	15	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

§ Not more than one output should be shorted at a time.

† Clear is tested with preset high and preset is tested with clear high.

# Average per flip-flop.

NOTE 2: With all outputs open, I<sub>CC</sub> is measured with the Q and Q̄ outputs high in turn. At the time of measurement, the clock input is grounded.

### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f <sub>max</sub>				25	33		MHz
t <sub>PLH</sub>	PRE	Q	R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 15 pF		10	15	ns
t <sub>PHL</sub>		Q̄			23	35	ns
t <sub>PLH</sub>	CLR	Q̄			10	15	ns
t <sub>PHL</sub>		Q			17	25	ns
t <sub>PLH</sub>	CLK	Q or Q̄			10	16	ns
t <sub>PHL</sub>						18	28

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



# SN54LS109A, SN74LS109A DUAL J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

## recommended operating conditions

		SN54LS109A			SN74LS109A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.7			0.8	V
$I_{OH}$	High-level output current			-0.4			-0.4	mA
$I_{OL}$	Low-level output current			4			8	mA
$f_{clock}$	Clock frequency	0		25	0		25	MHz
$t_w$	Pulse duration	CLK high		25			25	ns
		PRE or CLR low		25			25	
$t_{su}$	Setup time before CLK †	High-level data		35			35	ns
		Low-level data		25			25	
$t_h$	Hold time-data after CLK †			5			5	ns
$T_A$	Operating free-air temperature	-55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54LS109A		SN74LS109A		UNIT		
		MIN	TYP‡	MAX	MIN		TYP‡	MAX
$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$			-1.5		-1.5	V	
$V_{OH}$	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = \text{MAX}, I_{OH} = -0.4 \text{ mA}$	2.5	3.4		2.7	3.4	V	
$V_{OL}$	$V_{CC} = \text{MIN}, I_{OL} = 4 \text{ mA}, V_{IL} = \text{MAX}, V_{IH} = 2 \text{ V}$		0.25	0.4		0.25	0.4	V
	$V_{CC} = \text{MIN}, I_{OL} = 8 \text{ mA}, V_{IL} = \text{MAX}, V_{IH} = 2 \text{ V}$					0.35	0.5	
$I_I$	J, K or CLK			0.1		0.1	mA	
	CLR or PRE			0.2		0.2		
$I_{IH}$	J, K or CLK			20		20	$\mu\text{A}$	
	CLR or PRE			40		40		
$I_{IL}$	J, K or CLK			-0.4		-0.4	mA	
	CLR or PRE			-0.8		-0.8		
$I_{OS}\S$	$V_{CC} = \text{MAX},$ See Note 4	-20		-100	-20		-100	mA
$I_{CC}$ (Total)	$V_{CC} = \text{MAX},$ See Note 2		4	8		4	8	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

NOTE 2: With all outputs open,  $I_{CC}$  is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement, the clock input is grounded.

NOTE 4: For certain devices where state commutation can be caused by shorting an output to ground, an equivalent test may be performed with  $V_O = 2.25 \text{ V}$  and  $2.125 \text{ V}$  for the 54 family and the 74 family, respectively with the minimum and maximum limits reduced to one half of their stated values.

## switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$f_{max}$				25	33		MHz
$t_{PLH}$	CLR, PRE	Q or $\bar{Q}$	$R_L = 2 \text{ k}\Omega, C_L = 15 \text{ pF}$		13	25	ns
$t_{PHL}$	or CLK				25	40	

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

  
**TEXAS**  
**INSTRUMENTS**

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**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">JM38510/30109BEA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BEA
JM38510/30109BEA.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BEA
JM38510/30109BEA.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BEA
<a href="#">JM38510/30109BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BFA
<a href="#">JM38510/30109BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BFA
JM38510/30109BFA.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BFA
JM38510/30109BFA.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BFA
<a href="#">M38510/30109BEA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BEA
<a href="#">M38510/30109BEA</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BEA
<a href="#">M38510/30109BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BFA
<a href="#">M38510/30109BFA</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 30109BFA
<a href="#">SN54LS109AJ</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS109AJ
<a href="#">SN54LS109AJ</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS109AJ
SN54LS109AJ.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS109AJ
SN54LS109AJ.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS109AJ
<a href="#">SN74LS109AD</a>	Obsolete	Production	SOIC (D)   16	-	-	Call TI	Call TI	0 to 70	LS109A
<a href="#">SN74LS109AD</a>	Obsolete	Production	SOIC (D)   16	-	-	Call TI	Call TI	0 to 70	LS109A
<a href="#">SN74LS109ADR</a>	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS109A
<a href="#">SN74LS109ADR</a>	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS109A
SN74LS109ADR.A	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS109A
SN74LS109ADR.A	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS109A

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN74LS109AN</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS109AN
<a href="#">SN74LS109AN</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS109AN
SN74LS109AN.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS109AN
SN74LS109AN.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS109AN
SN74LS109ANE4	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS109AN
SN74LS109ANE4	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS109AN
<a href="#">SN74LS109ANSR</a>	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS109A
<a href="#">SN74LS109ANSR</a>	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS109A
SN74LS109ANSR.A	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS109A
SN74LS109ANSR.A	Active	Production	SOP (NS)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS109A
<a href="#">SNJ54LS109AJ</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AJ
<a href="#">SNJ54LS109AJ</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AJ
SNJ54LS109AJ.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AJ
SNJ54LS109AJ.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AJ
<a href="#">SNJ54LS109AW</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AW
<a href="#">SNJ54LS109AW</a>	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AW
SNJ54LS109AW.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AW
SNJ54LS109AW.A	Active	Production	CFP (W)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS109AW

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

**(6) Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**OTHER QUALIFIED VERSIONS OF SN54LS109A, SN74LS109A :**

- Catalog : [SN74LS109A](#)
- Military : [SN54LS109A](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**

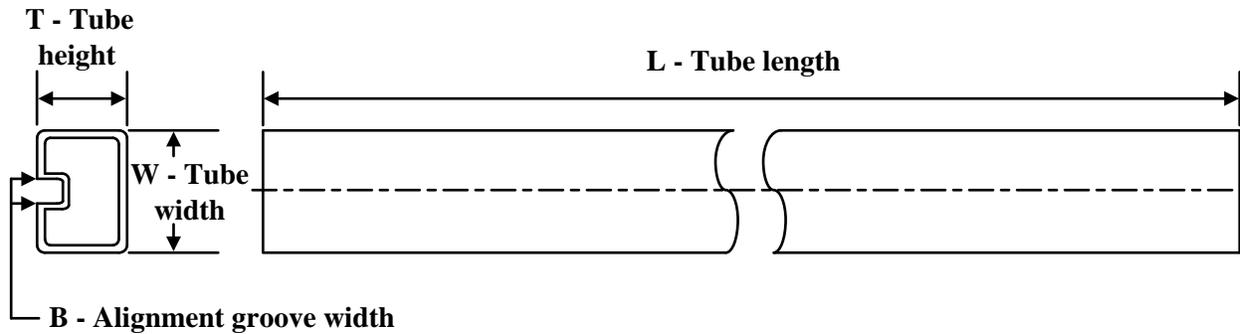

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS109ADR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74LS109ANSR	SOP	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS109ADR	SOIC	D	16	2500	340.5	336.1	32.0
SN74LS109ANSR	SOP	NS	16	2000	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
JM38510/30109BFA	W	CFP	16	25	506.98	26.16	6220	NA
JM38510/30109BFA.A	W	CFP	16	25	506.98	26.16	6220	NA
M38510/30109BFA	W	CFP	16	25	506.98	26.16	6220	NA
SN74LS109AN	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS109AN	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS109AN.A	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS109AN.A	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS109ANE4	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS109ANE4	N	PDIP	16	25	506	13.97	11230	4.32
SNJ54LS109AW	W	CFP	16	25	506.98	26.16	6220	NA
SNJ54LS109AW.A	W	CFP	16	25	506.98	26.16	6220	NA

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