

# SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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'90A, 'LS90 . . . Decade Counters

'92A, 'LS92 . . . Divide By-Twelve Counters

'93A, 'LS93 . . . 4-Bit Binary Counters

TYPES	TYPICAL POWER DISSIPATION
'90A	145 mW
'92A, '93A	130 mW
'LS90, 'LS92, 'LS93	45 mW

## description

Each of these monolithic counters contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and a three-stage binary counter for which the count cycle length is divide-by-five for the '90A and 'LS90, divide-by-six for the '92A and 'LS92, and the divide-by-eight for the '93A and 'LS93.

All of these counters have a gated zero reset and the '90A and 'LS90 also have gated set-to-nine inputs for use in BCD nine's complement applications.

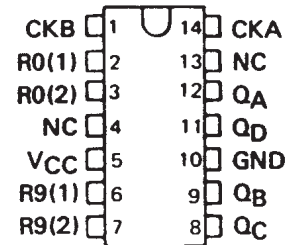
To use their maximum count length (decade, divide-by-twelve, or four-bit binary) of these counters, the CKB input is connected to the  $Q_A$  output. The input count pulses are applied to CKA input and the outputs are as described in the appropriate function table. A symmetrical divide-by-ten count can be obtained from the '90A or 'LS90 counters by connecting the  $Q_D$  output to the CKA input and applying the input count to the CKB input which gives a divide-by-ten square wave at output  $Q_A$ .

SN5490A, SN54LS90 . . . J OR W PACKAGE

SN7490A . . . N PACKAGE

SN74LS90 . . . D OR N PACKAGE

(TOP VIEW)

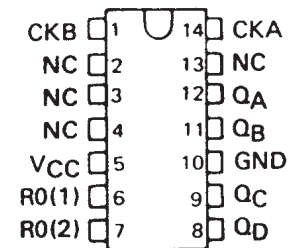


SN5492A, SN54LS92 . . . J OR W PACKAGE

SN7492A . . . N PACKAGE

SN74LS92 . . . D OR N PACKAGE

(TOP VIEW)

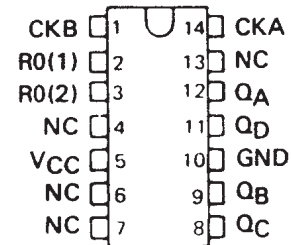


SN5493A, SN54LS93 . . . J OR W PACKAGE

SN7493 . . . N PACKAGE

SN74LS93 . . . D OR N PACKAGE

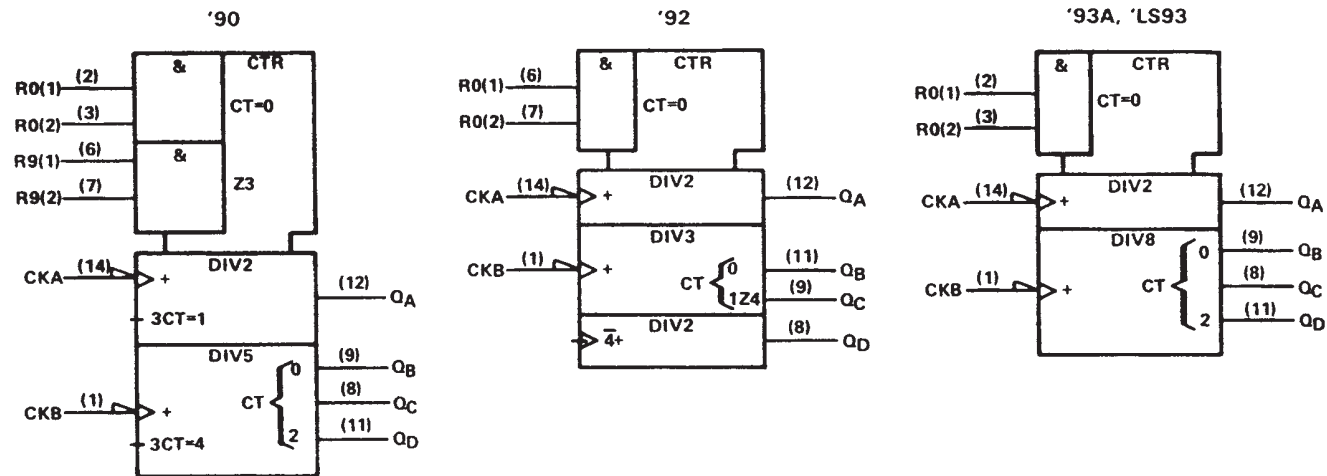
(TOP VIEW)



SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
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logic symbols†



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
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'90A, 'LS90  
 BCD COUNT SEQUENCE  
 (See Note A)

COUNT	OUTPUT			
	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>	Q <sub>A</sub>
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

'90A, 'LS90  
 BI-QUINARY (5-2)  
 (See Note B)

COUNT	OUTPUT			
	Q <sub>A</sub>	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	H	L	L	L
6	H	L	L	H
7	H	L	H	L
8	H	L	H	H
9	H	H	L	L

'92A, 'LS92  
 COUNT SEQUENCE  
 (See Note C)

COUNT	OUTPUT			
	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>	Q <sub>A</sub>
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	H	L	L	L
7	H	L	L	H
8	H	L	H	L
9	H	L	H	H
10	H	H	L	L
11	H	H	L	H

'90A, 'LS90  
 RESET/COUNT FUNCTION TABLE

RESET INPUTS				OUTPUT			
R <sub>0</sub> (1)	R <sub>0</sub> (2)	R <sub>9</sub> (1)	R <sub>9</sub> (2)	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>	Q <sub>A</sub>
H	H	L	X	L	L	L	L
H	H	X	L	L	L	L	L
X	X	H	H	H	L	L	H
X	L	X	L	COUNT			
L	X	L	X	COUNT			
L	X	X	L	COUNT			
X	L	L	X	COUNT			

'93A, 'LS93  
 COUNT SEQUENCE  
 (See Note C)

COUNT	OUTPUT			
	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>	Q <sub>A</sub>
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

'92A, 'LS92, '93A, 'LS93  
 RESET/COUNT FUNCTION TABLE

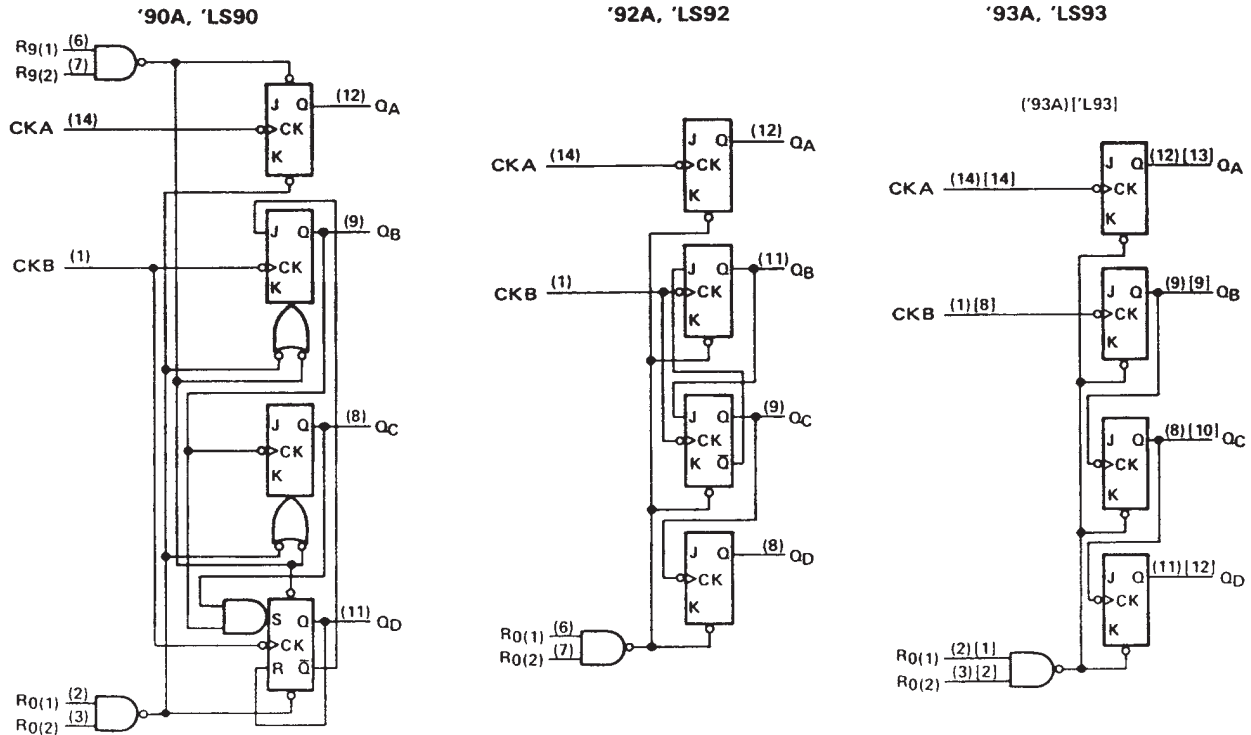
RESET INPUTS		OUTPUT			
R <sub>0</sub> (1)	R <sub>0</sub> (2)	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>	Q <sub>A</sub>
H	H	L	L	L	L
L	X	COUNT			
X	L	COUNT			

- NOTES: A. Output Q<sub>A</sub> is connected to input CKB for BCD count.  
 B. Output Q<sub>D</sub> is connected to input CKA for bi-quinary count.  
 C. Output Q<sub>A</sub> is connected to input CKB.  
 D. H = high level, L = low level, X = irrelevant

# SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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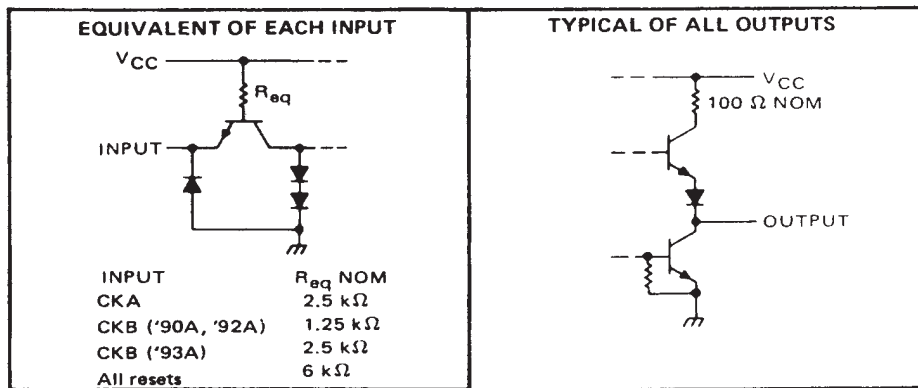
## logic diagrams (positive logic)



The J and K inputs shown without connection are for reference only and are functionally at a high level. Pin numbers shown in ( ) are for the 'LS93 and '93A and pin numbers shown in [ ] are for the 54L93.

## schematics of inputs and outputs

'90A, '92A, '93A

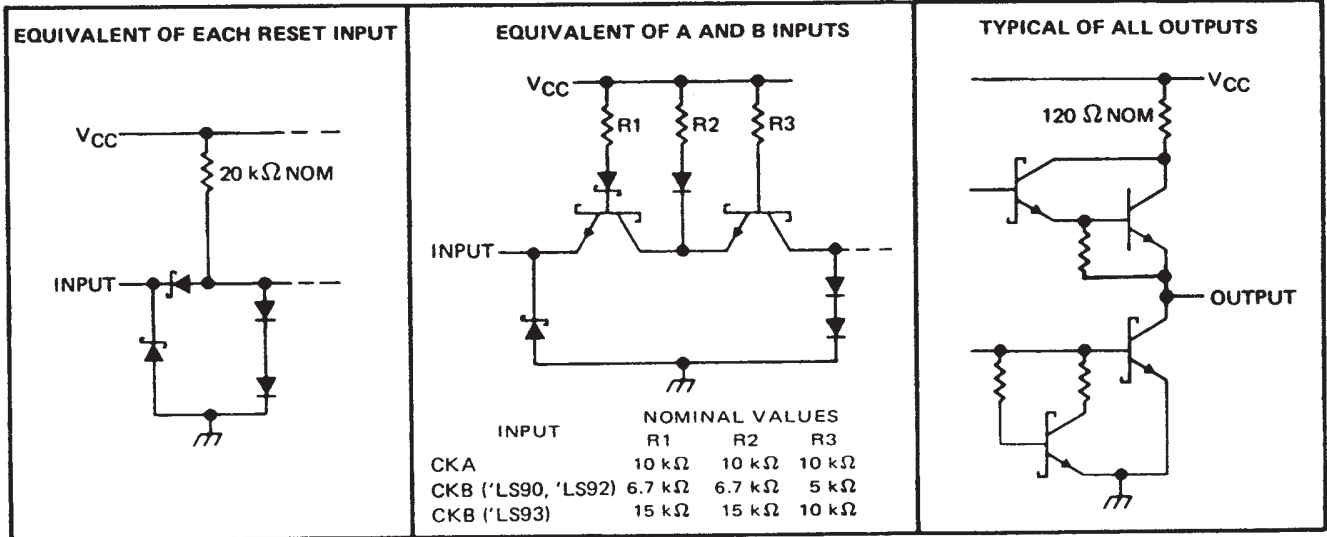


SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
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schematics of inputs and outputs (continued)

'LS90, 'LS92, 'LS93



# SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	5.5 V
Interemitter voltage (see Note 2)	5.5 V
Operating free-air temperature range: SN5490A, SN5492A, SN5493A	-55°C to 125°C
SN7490A, SN7492A, SN7493A	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTES: 1. Voltage values, except interemitter voltage, are with respect to network ground terminal.

2. This is the voltage between two emitters of a multiple-emitter transistor. For these circuits, this rating applies between the two  $R_0$  inputs, and for the '90A circuit, it also applies between the two  $R_0$  inputs.

## recommended operating conditions

	SN5490A, SN5492A SN5493A			SN7490A, SN7492A SN7493A			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$	4.5	5	5.5	4.75	5	5.25	V
High-level output current, $I_{OH}$			-800			-800	$\mu$ A
Low-level output current, $I_{OL}$			16			16	mA
Count frequency, $f_{count}$ (see Figure 1)	A input	0	32	0	32		MHz
	B input	0	16	0	16		
Pulse width, $t_w$	A input	15		15			ns
	B input	30		30			
	Reset inputs	15		15			
Reset inactive-state setup time, $t_{su}$		25			25		ns
Operating free-air temperature, $T_A$		-55	125		0	70	°C

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

PARAMETER <sup>¶</sup>	TEST CONDITIONS <sup>†</sup>	'90A			'92A			'93A			UNIT
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	
$V_{IH}$ High-level input voltage		2			2			2			V
$V_{IL}$ Low-level input voltage				0.8			0.8			0.8	V
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$			-1.5			-1.5			-1.5	V
$V_{OH}$ High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -800 \mu\text{A}$	2.4	3.4		2.4	3.4		2.4	3.4		V
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}^{\parallel}$		0.2	0.4		0.2	0.4		0.2	0.4	V
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1			1			1	mA
$I_{IH}$ High-level input current	Any reset			40			40			40	$\mu$ A
	CKA	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$		80	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$		80	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$		80	
	CKB	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$		120	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$		120	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$		80	
$I_{IL}$ Low-level input current	Any reset			-1.6			-1.6			-1.6	mA
	CKA	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-3.2	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-3.2	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-3.2	
	CKB	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-4.8	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-4.8	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-3.2	
$I_{OS}$ Short-circuit output current <sup>§</sup>	$V_{CC} = \text{MAX}$	SN54'	-20	-57	-20	-57	-20	-57			mA
		SN74'	-18	-57	-18	-57	-18	-57			
$I_{CC}$ Supply current	$V_{CC} = \text{MAX}, \text{ See Note 3}$		29	42		26	39		26	39	mA

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

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

<sup>§</sup> Not more than one output should be shorted at a time.

<sup>¶</sup> '90A outputs are tested at  $I_{OL} = 16 \text{ mA}$  plus the limit value for  $I_{IL}$  for the CKB input. This permits driving the CKB input while maintaining full fan-out capability.

NOTE 3:  $I_{CC}$  is measured with all outputs open, both  $R_0$  inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.



SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'90A			'92A			'93A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$f_{max}$	CKA	$Q_A$	$C_L = 15\text{ pF}$ , $R_L = 400\ \Omega$ , See Figure 1	32	42		32	42		32	42		MHz
	CKB	$Q_B$		16			16			16			
$t_{PLH}$	CKA	$Q_A$		10	16		10	16		10	16		ns
$t_{PHL}$				12	18		12	18		12	18		
$t_{PLH}$	CKA	$Q_D$		32	48		32	48		46	70		ns
$t_{PHL}$				34	50		34	50		46	70		
$t_{PLH}$	CKB	$Q_B$		10	16		10	16		10	16		ns
$t_{PHL}$				14	21		14	21		14	21		
$t_{PLH}$	CKB	$Q_C$		21	32		10	16		21	32		ns
$t_{PHL}$				23	35		14	21		23	35		
$t_{PLH}$	CKB	$Q_D$		21	32		21	32		34	51		ns
$t_{PHL}$				23	35		23	35		34	51		
$t_{PHL}$	Set-to-0	Any		26	40		26	40		26	40		ns
$t_{PLH}$	Set-to-9	$Q_A, Q_D$		20	30								ns
$t_{PHL}$		$Q_B, Q_C$		26	40								

†  $f_{max}$  = maximum count frequency  
 $t_{PLH}$  = propagation delay time, low-to-high-level output  
 $t_{PHL}$  = propagation delay time, high-to-low-level output



# SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage: R inputs	7 V
A and B inputs	5.5 V
Operating free-air temperature range: SN54LS' Circuits	-55°C to 125°C
SN74LS' Circuits	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

## recommended operating conditions

		SN54LS90 SN54LS92 SN54LS93			SN74LS90 SN74LS92 SN74LS93			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$		4.5	5	5.5	4.75	5	5.25	V
High-level output current, $I_{OH}$				-400			-400	$\mu$ A
Low-level output current, $I_{OL}$				4			8	mA
Count frequency, $f_{count}$ (see Figure 1)	A input	0		32	0		32	MHz
	B input	0		16	0		16	
Pulse width, $t_w$	A input	15			15			ns
	B input	30			30			
	Reset inputs	30			30			
Reset inactive-state setup time, $t_{SU}$		25			25			ns
Operating free-air temperature, $T_A$		-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS90 SN54LS92			SN74LS90 SN74LS92			UNIT	
		MIN	TYP‡	MAX	MIN	TYP‡	MAX		
$V_{IH}$ High-level input voltage		2			2			V	
$V_{IL}$ Low-level input voltage				0.7			0.8	V	
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$			-1.5			-1.5	V	
$V_{OH}$ High-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = V_{IL \text{ max}}$ , $I_{OH} = -400 \mu\text{A}$	2.5	3.4		2.7	3.4		V	
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = V_{IL \text{ max}}$	$I_{OL} = 4 \text{ mA} \parallel$		0.25	0.4	$I_{OL} = 4 \text{ mA} \parallel$		0.25	0.4
		$I_{OL} = 8 \text{ mA} \parallel$				$I_{OL} = 8 \text{ mA} \parallel$		0.35	
$I_I$ Input current at maximum input voltage	Any reset	$V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$			0.1			0.1	mA
	CKA	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			0.2			0.2	
	CKB				0.4			0.4	
$I_{IH}$ High-level input current	Any reset	$V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$			20			20	$\mu$ A
	CKA				40			40	
	CKB				80			80	
$I_{IL}$ Low-level input current	Any reset	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$			-0.4			-0.4	mA
	CKA				-2.4			-2.4	
	CKB				-3.2			-3.2	
$I_{OS}$ Short-circuit output current§	$V_{CC} = \text{MAX}$	-20		-100	-20		-100	mA	
$I_{CC}$ Supply current	$V_{CC} = \text{MAX}$ , See Note 3	'LS90		9	15	'LS92		9	15
		'LS92		9	15	'LS92		9	15

† 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 duration of the short-circuit should not exceed one second.

¶  $I_{QA}$  outputs are tested at specified  $I_{OL}$  plus the limit value of  $I_{IL}$  for the CKB input. This permits driving the CKB input while maintaining full fan-out capability.

NOTE 3:  $I_{CC}$  is measured with all outputs open, both  $R_0$  inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.



SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

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

PARAMETER	TEST CONDITIONS†	SN54LS93			SN74LS93			UNIT	
		MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V <sub>IH</sub> High-level input voltage		2			2			V	
V <sub>IL</sub> Low-level input voltage				0.7			0.8	V	
V <sub>IK</sub> Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.5			-1.5	V	
V <sub>OH</sub> High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL</sub> max, I <sub>OH</sub> = -400 μA	2.5	3.4		2.7	3.4		V	
V <sub>OL</sub> Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL</sub> max	I <sub>OL</sub> = 4 mA¶			0.25	0.4	0.25	0.4	V
		I <sub>OL</sub> = 8 mA¶					0.35	0.5	
I <sub>I</sub> Input current at maximum input voltage	Any reset	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V			0.1			mA	
	CKA or CKB	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			0.2				
I <sub>IH</sub> High-level input current	Any reset	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			20			μA	
	CKA or CKB				40				
I <sub>IL</sub> Low-level input current	Any reset	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-0.4			mA	
	CKA				-2.4				
	CKB				-1.6				
I <sub>OS</sub> Short-circuit output current §	V <sub>CC</sub> = MAX	-20		-100	-20		-100	mA	
I <sub>CC</sub> Supply current	V <sub>CC</sub> = MAX, See Note 3		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, and duration of the short-circuit should not exceed one second.

¶ Q<sub>A</sub> outputs are tested at specified I<sub>OL</sub> plus the limit value for I<sub>IL</sub> for the CKB input. This permits driving the CKB input while maintaining full fan-out capability.

NOTE 3: I<sub>CC</sub> is measured with all outputs open, both R<sub>Q</sub> inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.

switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

PARAMETER#	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS90			'LS92			'LS93			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
f <sub>max</sub>	CKA	Q <sub>A</sub>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 2 kΩ See Figure 1	32	42		32	42		32	42		MHz
	CKB	Q <sub>B</sub>		16			16			16			
t <sub>PLH</sub>	CKA	Q <sub>A</sub>		10	16		10	16		10	16		ns
				12	18		12	18		12	18		
t <sub>PLH</sub>	CKA	Q <sub>D</sub>		32	48		32	48		46	70		ns
				34	50		34	50		46	70		
t <sub>PLH</sub>	CKB	Q <sub>B</sub>		10	16		10	16		10	16		ns
				14	21		14	21		14	21		
t <sub>PLH</sub>	CKB	Q <sub>C</sub>		21	32		10	16		21	32		ns
				23	35		14	21		23	35		
t <sub>PLH</sub>	CKB	Q <sub>D</sub>		21	32		21	32		34	51		ns
				23	35		23	35		34	51		
t <sub>PHL</sub>	Set-to-0	Any		26	40		26	40		26	40		ns
t <sub>PLH</sub>	Set-to-9	Q <sub>A</sub> , Q <sub>D</sub>		20	30								ns
		Q <sub>B</sub> , Q <sub>C</sub>		26	40								

#f<sub>max</sub> = maximum count frequency

t<sub>PLH</sub> = propagation delay time, low-to-high-level output

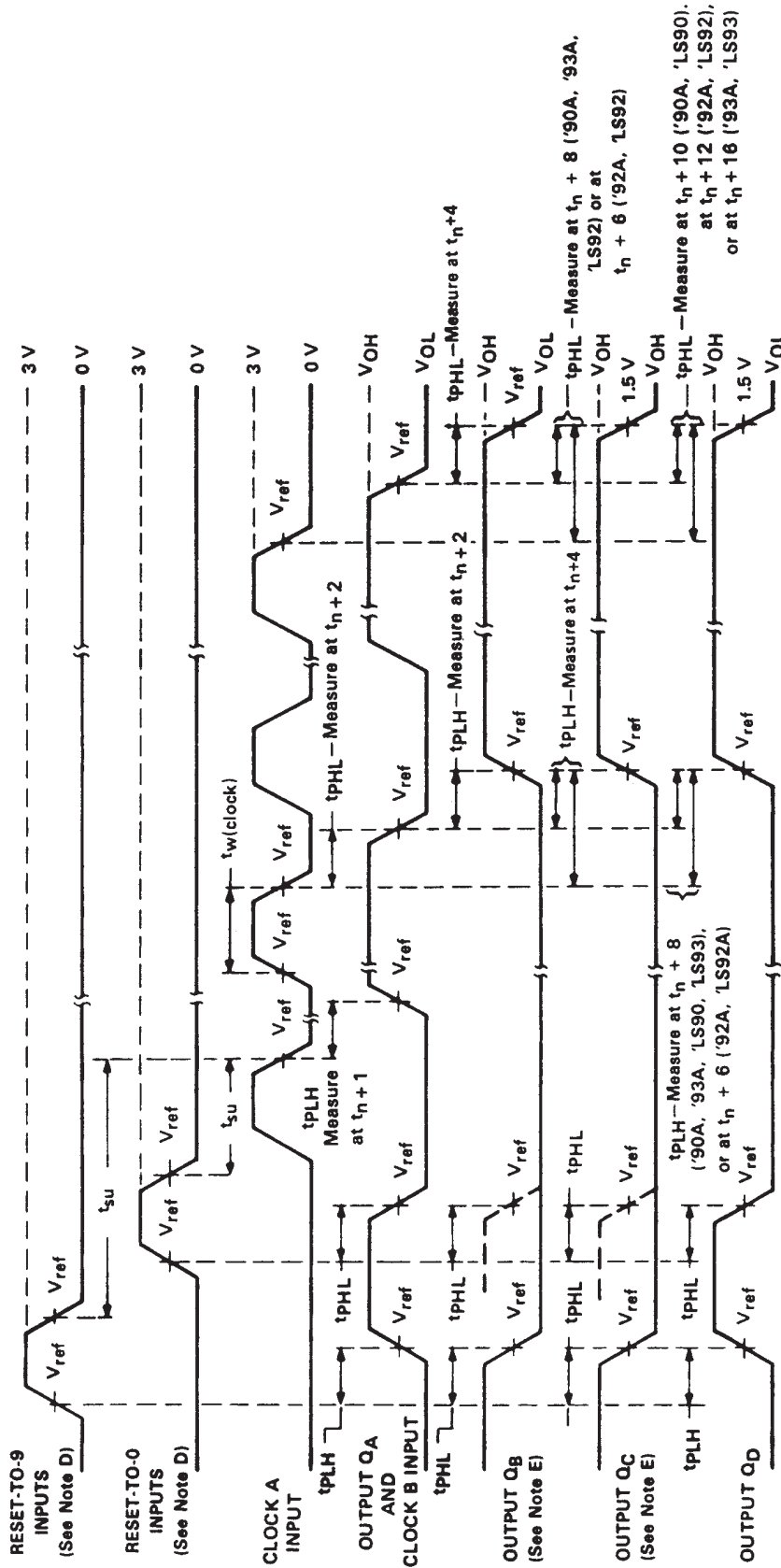
t<sub>PHL</sub> = propagation delay time, high-to-low-level output



SN5490A, SN5492A, SN5493A, SN54LS90, SN54LS92, SN54LS93  
 SN7490A, SN7492A, SN7493A, SN74LS90, SN74LS92, SN74LS93  
 DECADE, DIVIDE-BY-TWELVE AND BINARY COUNTERS

SDLS940A - MARCH 1974 - REVISED MARCH 1988

PARAMETER MEASUREMENT INFORMATION

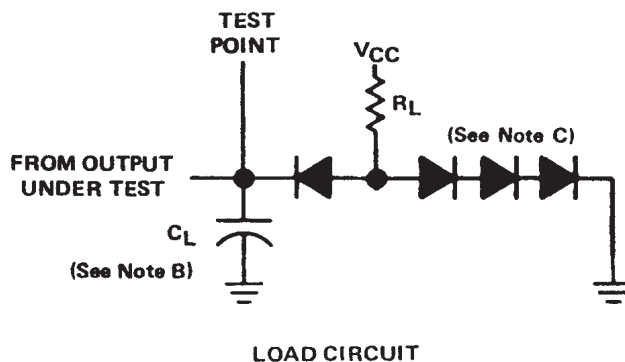


NOTES: A. Input pulses are supplied by a generator having the following characteristics:

- for '90A, '92A, '93A,  $t_r \leq 5$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms;
- for 'LS90, 'LS92, 'LS93,  $t_r \leq 15$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms.
- B.  $C_L$  includes probe and jig capacitance.
- C. All diodes are 1N3064 or equivalent.
- D. Each reset input is tested separately with the other reset at 4.5 V.
- E. Reference waveforms are shown with dashed lines.
- F. For '90A, '92A, and '93A;  $V_{ref} = 1.5$  V. For 'LS90, 'LS92, and 'LS93;  $V_{ref} = 1.3$  V.

FIGURE 1A

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. Input pulses are supplied by a generator having the following characteristics:  
for '90A, '92A, '93A,  $t_r \leq 5$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms;  
for 'LS90, 'LS92, 'LS93,  $t_r \leq 15$  ns,  $t_f \leq 5$  ns, PRR = 1 MHz, duty cycle = 50%,  $Z_{out} \approx 50$  ohms.
- B.  $C_L$  includes probe and jig capacitance.
- C. All diodes are 1N3064 or equivalent.
- D. Each reset input is tested separately with the other reset at 4.5 V.
- E. Reference waveforms are shown with dashed lines.
- F. For '90A, '92A, and '93A;  $V_{ref} = 1.5$  V. For 'LS90, 'LS92, and 'LS93;  $V_{ref} = 1.3$  V.

FIGURE 1B

**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="#">7603201CA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7603201CA SNJ54LS90J
<a href="#">7700101CA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7700101CA SNJ54LS93J
<a href="#">7700101DA</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7700101DA SNJ54LS93W
<a href="#">JM38510/31501BCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31501BCA
JM38510/31501BCA.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31501BCA
<a href="#">JM38510/31502BCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31502BCA
JM38510/31502BCA.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31502BCA
<a href="#">JM38510/31502BDA</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31502BDA
JM38510/31502BDA.A	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31502BDA
<a href="#">M38510/31501BCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31501BCA
<a href="#">M38510/31502BCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31502BCA
<a href="#">M38510/31502BDA</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31502BDA
<a href="#">SN54LS90J</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS90J
SN54LS90J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS90J
<a href="#">SN54LS93J</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS93J
SN54LS93J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS93J
<a href="#">SN74LS90D</a>	Obsolete	Production	SOIC (D)   14	-	-	Call TI	Call TI	0 to 70	LS90
<a href="#">SN74LS90DR</a>	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS90
SN74LS90DR.A	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS90
<a href="#">SN74LS90N</a>	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS90N

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)
SN74LS90N.A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS90N
SN74LS90NE4	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS90N
<a href="#">SN74LS92D</a>	Active	Production	SOIC (D)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS92
SN74LS92D.A	Active	Production	SOIC (D)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS92
<a href="#">SN74LS92N</a>	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS92N
SN74LS92N.A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS92N
<a href="#">SN74LS92NSR</a>	Active	Production	SOP (NS)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS92
SN74LS92NSR.A	Active	Production	SOP (NS)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS92
<a href="#">SN74LS93D</a>	Active	Production	SOIC (D)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS93
SN74LS93D.A	Active	Production	SOIC (D)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS93
<a href="#">SN74LS93N</a>	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS93N
SN74LS93N.A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS93N
<a href="#">SNJ54LS90J</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7603201CA SNJ54LS90J
SNJ54LS90J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7603201CA SNJ54LS90J
<a href="#">SNJ54LS93J</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7700101CA SNJ54LS93J
SNJ54LS93J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7700101CA SNJ54LS93J
<a href="#">SNJ54LS93W</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7700101DA SNJ54LS93W
SNJ54LS93W.A	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7700101DA SNJ54LS93W

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

<sup>(2)</sup> **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.

<sup>(3)</sup> **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 SN54LS90, SN54LS93, SN74LS90, SN74LS93 :**

- Catalog : [SN74LS90](#), [SN74LS93](#)
- Military : [SN54LS90](#), [SN54LS93](#)

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**

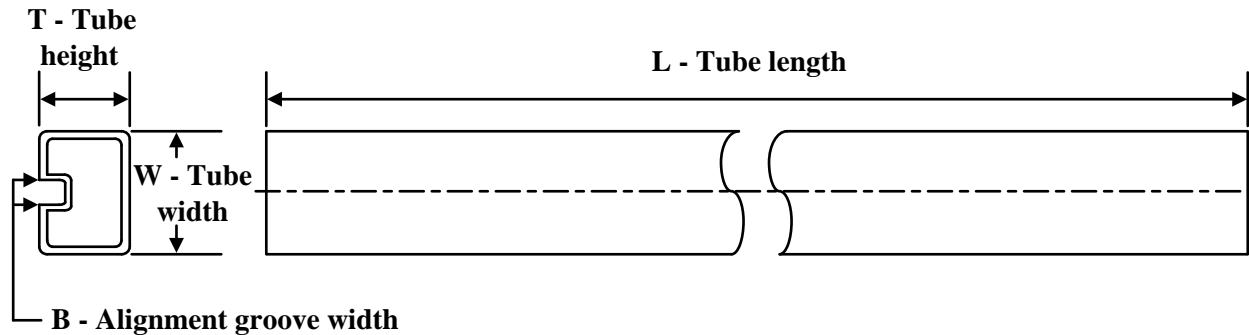

\*All dimensions are nominal

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
SN74LS90DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LS92NSR	SOP	NS	14	2000	330.0	16.4	8.1	10.4	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)
SN74LS90DR	SOIC	D	14	2500	353.0	353.0	32.0
SN74LS92NSR	SOP	NS	14	2000	353.0	353.0	32.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
7700101DA	W	CFP	14	25	506.98	26.16	6220	NA
JM38510/31502BDA	W	CFP	14	25	506.98	26.16	6220	NA
JM38510/31502BDA.A	W	CFP	14	25	506.98	26.16	6220	NA
M38510/31502BDA	W	CFP	14	25	506.98	26.16	6220	NA
SN74LS90N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS90N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS90N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS90N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS90NE4	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS90NE4	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS92D	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS92D.A	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS92N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS92N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS92N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS92N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS93D	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS93D.A	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS93N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS93N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS93N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS93N.A	N	PDIP	14	25	506	13.97	11230	4.32
SNJ54LS93W	W	CFP	14	25	506.98	26.16	6220	NA
SNJ54LS93W.A	W	CFP	14	25	506.98	26.16	6220	NA

D0014A



# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



NOTES:

- All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
- This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
- Reference JEDEC registration MS-012, variation AB.

# EXAMPLE BOARD LAYOUT

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP1-F14

J 14

**GENERIC PACKAGE VIEW**  
**CDIP - 5.08 mm max height**  
CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4040083-5/G

J0014A



# PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

# EXAMPLE BOARD LAYOUT

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE  
NON-SOLDER MASK DEFINED  
SCALE: 5X



4214771/A 05/2017

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

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