1. DESCRIPTION

Each of these monolithic counters contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and a there-stage binary counter for which the count cycle length is divide-by-five for the **74**LS90, and the divide-by-eight for the **74**LS93.

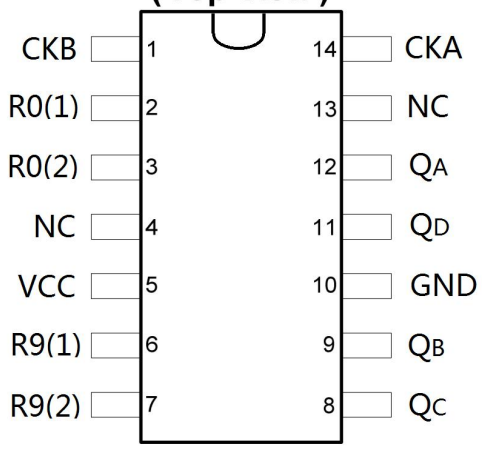
All of these counters have a gated zero reset and the ’LS90 also have gated set-to-nine inputs for use in BCD nine’s complement applications.

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 ’LS90 counters by connecting the QD 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.

2. PIN CONFIGURATIONS

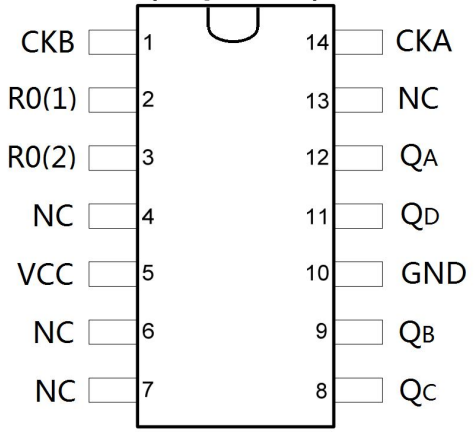
XD74LS90

(Top View)



XD74LS93

(Top View)



XD74LS90
BCD COUNT SEQUENCE

COUNT	OUTPUT			
	Q_D	Q_C	Q_B	Q_A
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

XD74LS90
BI-QUINARY

COUNT	OUTPUT			
	Q_D	Q_C	Q_B	Q_A
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

XD74LS90
RESET/COUNT FUNCTION TABLE

RESET INPUTS				OUTPUT			
$R_{0(1)}$	$R_{0(2)}$	$R_{9(1)}$	$R_{9(2)}$	Q_D	Q_C	Q_B	Q_A
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			

XD74LS93

RESET/COUNT FUNCTION TABLE

RESET INPUTS		OUTPUT			
$R_{0(1)}$	$R_{0(2)}$	Q_D	Q_C	Q_B	Q_A
H	H	L	L	L	L
L	X	COUNT			
X	L	COUNT			

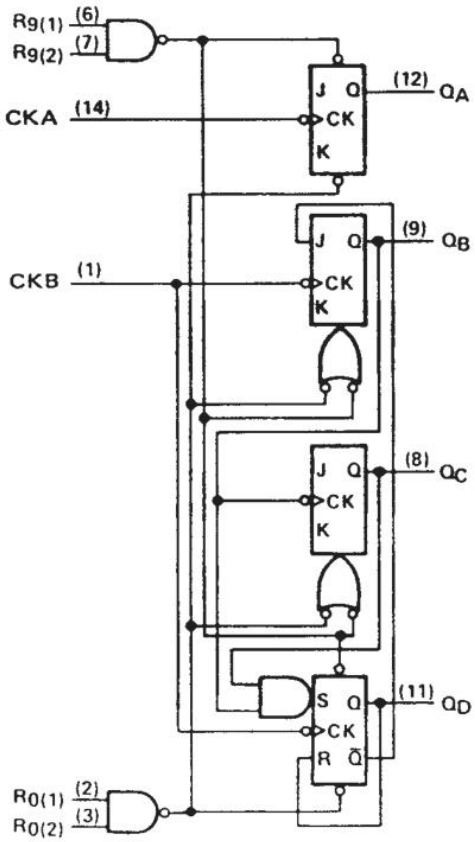
XD74LS93

COUNT SEQUENCE

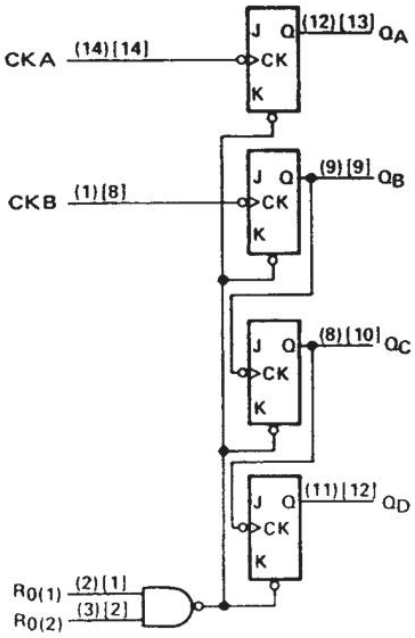
COUNT	OUTPUT			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

3. LOGIC DIAGRAMS

XD74LS90

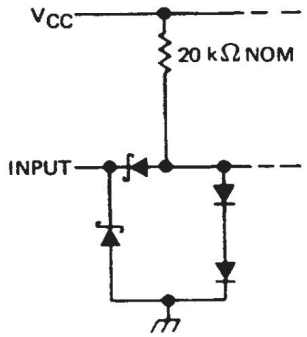
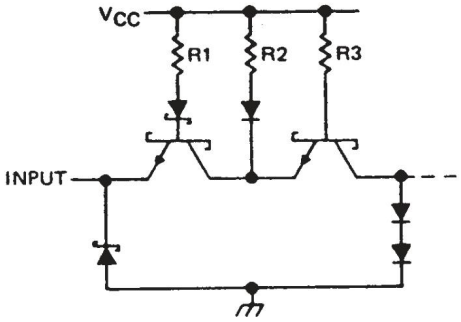
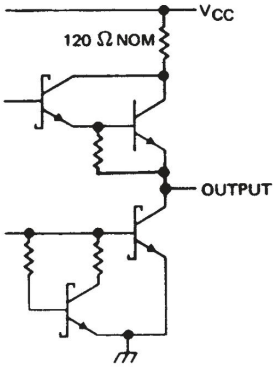


XD74LS93



4. SCHEMATICS OF INPUTS AND OUTPUTS

XD74LS90,XD74LS93

		
EQUIVALENT OF EACH RESET INPUT	EQUIVALENT OF A AND B INPUTS	TYPICAL OF ALL OUTPUTS

5. ABSOLUTE MAXIMUM RATINGS OVER OPERATING FREE-AIR TEMPERATURE RANGE (UNLESS OTHERWISE NOTES)

Supply voltage, V_{CC} (see Note 1)..... 7V

Input voltage, VI: 74LS90,74LS93..... 7V

Operating free-air temperature range: DIP package..... 0°C to 70°C

Storage temperature range, Tstg..... −65°C to 150°C

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

6. RECOMMENDED OPERATING CONDITIONS

			74LS90,74LS93			UNIT
			MIN	NOM	MAX	
V_{CC}	Supply voltage		4.75	5	5.25	V
I_{OH}	High-level output current				−400	μA
I_{OL}	Low-level output current				8	mA
f_{count}	Count frequency	A input	0		32	MHz
		B input	0		16	
t_w	Pulse duration	A input	15			ns
		B input	30			
		Reset inputs	30			
t_{su}	Reset inactive-state setup time		25			ns
T_A	Operating free-air temperature		0		70	°C

7. ELECTRICAL CHARACTERISTICS OVER RECOMMENDED OPERATING FREE-AIR RANGE (UNLESS OTHERWISE NOTED)

PARAMETER			TEST CONDITIONS†		74LS90			UNIT
					MIN	TYP‡	MAX	
V_{IH}	High-level input voltage				2			V
V_{IL}	Low-level input voltage						0.8	V
V_{IK}	Input clamp voltage		V_{CC} = MIN,	I_I = −18 mA			−1.5	V
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IL} = V_{IL} MAX	V_{IH} = 2 V, I_{OH} = −400 μA	2.7	3.4		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} MAX	I_{OL} = 1.6 mA		0.25	0.4	V
				I_{OL} =3.2mA		0.35	0.5	
I_I	Input current at maximum input voltage	Any reset	V_{CC} = MAX,	V_I = 7 V			0.1	mA
		CKA	V_{CC} = MAX,	V_I = 5.5V			0.2	
		CKB					0.4	
IIH	High-level input current	Any reset	V_{CC} = MAX,	V_I = 2.7 V			20	μA
		CKA					40	
		CKB					80	
I_{IL}	Low-level input current	Any reset	V_{CC} = MAX,	V_I = 0.4 V			−0.4	mA
		CKA					−2.4	
		CKB					−3.2	
I_{OS}	Short-circuit output current§		V_{CC} = MAX		−20		−100	mA
I_{CC}	Supply current		V_{CC} = MAX			9	15	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at VCC = 5 V, TA = 25 C.
§ Not more than one output should be shorted at a time.

PARAMETER			TEST CONDITIONS†		74LS93 MIN	74LS93 TYP‡	74LS93 MAX	UNIT
V_{IH}	High-level input voltage				2			V
V_{IL}	Low-level input voltage						0.8	V
V_{IK}	Input clamp voltage		V_{CC} = MIN,	I_I = −18 mA			−1.5	V
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IL} = V_{IL} MAX	V_{IH} = 2 V, I_{OH} = −400 μA	2.7	3.4		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} MAX	I_{OL} =4 mA		0.25	0.4	V
				I_{OL} =8mA		0.35	0.5	
I_I	Input current at maximum input voltage	Any reset	V_{CC} = MAX,	V_I = 7 V			0.1	mA
		CKA or CKB	V_{CC} = MAX,	V_I = 5.5V			0.2	
IIH	High-level input current	Any reset	V_{CC} = MAX,	V_I = 2.7 V			20	μA
		CKA or CKB					80	
I_{IL}	Low-level input current	Any reset	V_{CC} = MAX,	V_I = 0.4 V			−0.4	mA
		CKA					−2.4	
		CKB					−1.6	
I_{OS}	Short-circuit output current§		V_{CC} = MAX		−20		−100	mA
I_{CC}	Supply current		V_{CC} = MAX			9	15	mA

8. SWITCHING CHARACTERISTICS,VCC = 5 V, TA = 25℃

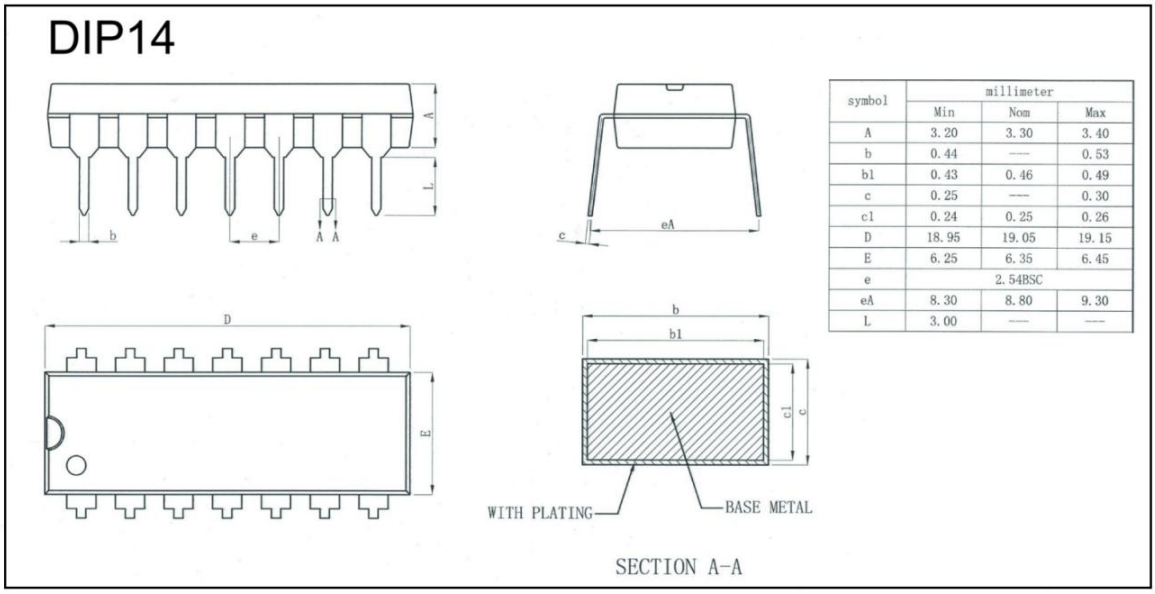
PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS90 MIN	'LS90 TYP	'LS90 MAX	'LS93 MIN	'LS93 TYP	'LS93 MAX	UNIT
f_{max}	CKA	QA	C_L=15 pF,R_L=2kΩ,	32	42		32	42		MHz
	CKB	QB		16			16			
t_{PLH}	CKA	QA			10	16		10	16	ns
t_{PHL}					12	18		12	18	
t_{PLH}	CKA	QD			32	48		46	70	ns
t_{PHL}					34	50		46	70	
t_{PLH}	CKB	QB			10	16		10	16	ns
t_{PHL}					14	21		14	21	
t_{PLH}	CKB	QC			21	32		21	32	ns
t_{PHL}					23	35		23	35	
t_{PLH}	CKB	QD			21	32		34	51	ns
t_{PHL}					23	35		34	51	ns
t_{PHL}	Set-to-0	Any			26	40		26	40	ns
t_{PLH}	Set-to-9	QA.QD			20	30				ns
t_{PHL}		QB.QC			26	40				

9. ORDERING INFORMATION

Ordering Information

Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
XD74LS90	XD74LS90	DIP14	19.05 * 6.35	-0 to 70	MSL3	Tube 25	1000
XD74LS93	XD74LS93	DIP14	19.05 * 6.35	-0 to 70	MSL3	Tube 25	1000

10. DIMENSIONAL DRAWINGS



symbol	millimeter		
	Min	Nom	Max
A	3.20	3.30	3.40
b	0.44	----	0.53
b1	0.43	0.46	0.49
c	0.25	----	0.30
c1	0.24	0.25	0.26
D	18.95	19.05	19.15
E	6.25	6.35	6.45
e	2.54BSC		
eA	8.30	8.80	9.30
L	3.00	----	----