

SN54290, SN54293, SN54LS290, SN54LS293 SN74290, SN74293, SN74LS290, SN74LS293 DECADE AND 4-BIT BINARY COUNTERS

SDLS097 – MARCH 1974 – REVISED MARCH 1988

'290, 'LS290 . . . DECADE COUNTERS
'293, 'LS293 . . . 4-BIT BINARY COUNTERS

- GND and V_{CC} on Corner Pins
(Pins 7 and 14 Respectively)

description

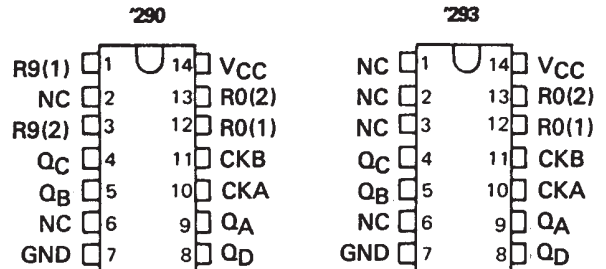
The SN54290/SN74290, SN54LS290/SN74LS290, SN54293/SN74293, and SN54LS293/SN74LS293 counters are electrically and functionally identical to the SN5490A/SN7490A, SN54LS90/SN74LS90, SN5493A/SN7493A, and SN54LS93/SN74LS93, respectively. Only the arrangement of the terminals has been changed for the '290, 'LS290, '293, and 'LS293.

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 '290 and 'LS290 and divide-by-eight for the '293 and 'LS293.

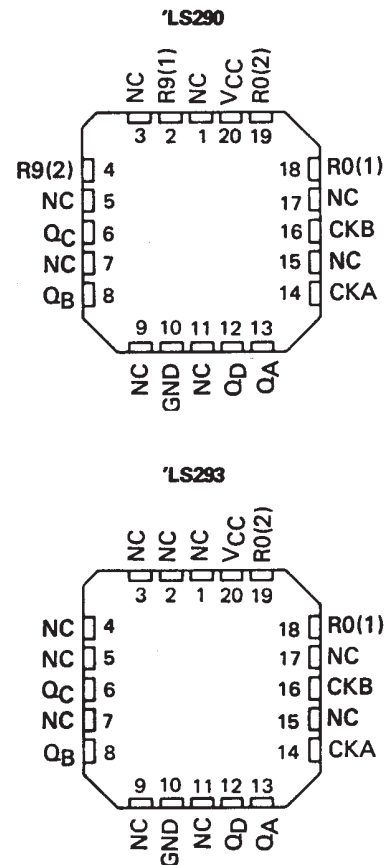
All of these counters have a gated zero reset and the '290 and 'LS290 also have gated set-to-nine inputs for use in BCD nine's complement applications.

To use the maximum count length (decade or four-bit binary) of these counters, the B input is connected to the Q_A output. The input count pulses are applied to input A and the outputs are as described in the appropriate function table. A symmetrical divide-by-ten count can be obtained from the '290 and 'LS290 counters by connecting the Q_D output to the A input and applying the input count to the B input which gives a divide-by-ten square wave at output Q_A.

SN54290, SN54LS290, SN54293,
SN54LS293 . . . J OR W PACKAGE
SN74290, SN74293 . . . N PACKAGE
SN74LS290, SN74LS293 . . . D OR N PACKAGE
(TOP VIEW)



SN54LS290, SN54LS293 . . . FK PACKAGE
(TOP VIEW)

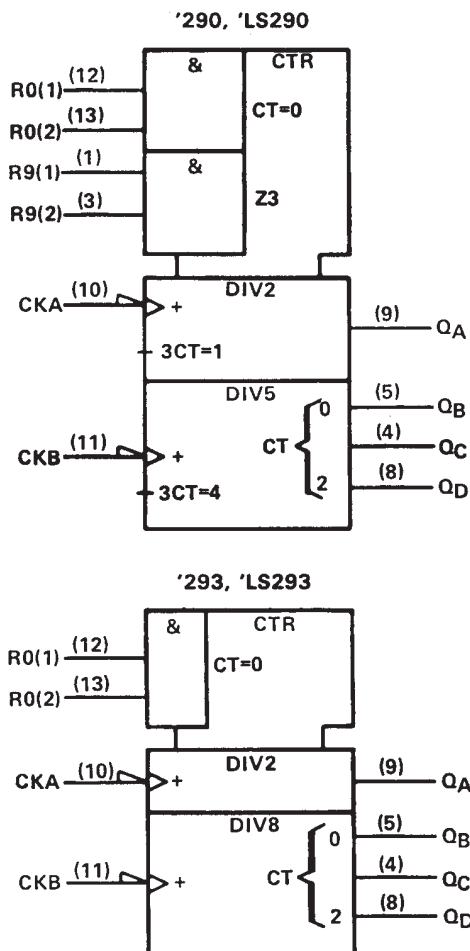


NC - No internal connection

SN54290, SN54293, SN54LS290, SN54LS293 SN74290, SN74293, SN74LS290, SN74LS293 DECADE AND 4-BIT BINARY COUNTERS

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logic symbols[†]



[†] These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

SN54290, SN54293, SN54LS290, SN54LS293 SN74290, SN74293, SN74LS290, SN74LS293 DECADE AND 4-BIT BINARY COUNTERS

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**'290, 'LS290
BCD COUNT SEQUENCE**
(See Note A)

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

**'290, 'LS290
BI-QUINARY (5-2)**
(See Note B)

COUNT	OUTPUT			
	Q _A	Q _D	Q _C	Q _B
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

**'290, 'LS290
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			

**'293, 'LS293
COUNT SEQUENCE**
(See Note C)

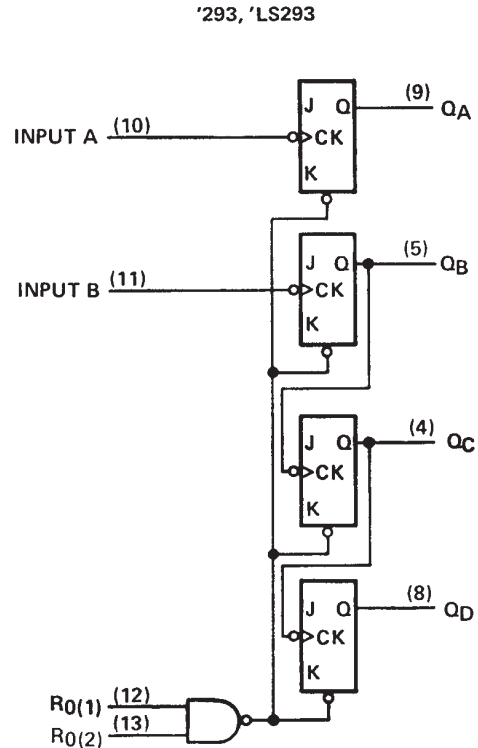
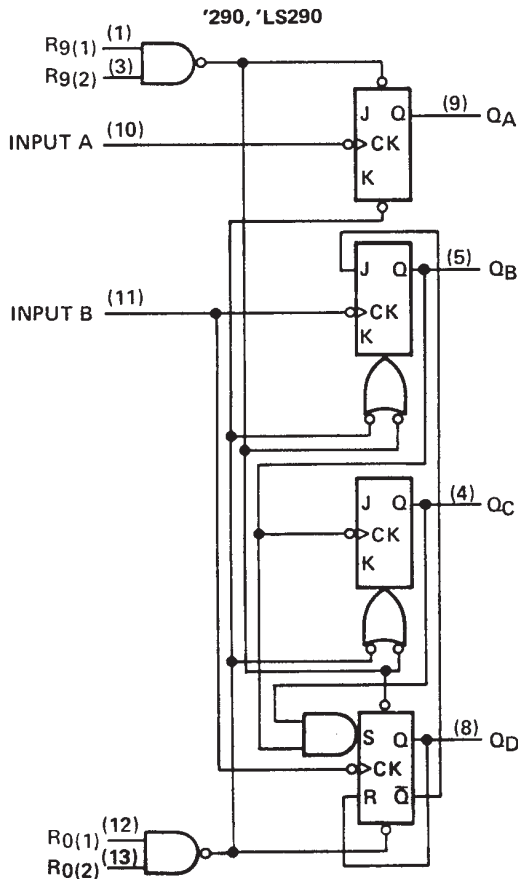
COUNT	OUTPUT			
	Q _D	Q _C	Q _B	Q _A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

NOTES: A. Output Q_A is connected to input B for BCD count.
B. Output Q_D is connected to input A for bi-quinary count.
C. Output Q_A is connected to input B.
D. H = high level, L = low level, X = irrelevant

**'293, 'LS293
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			

logic diagrams (positive logic)



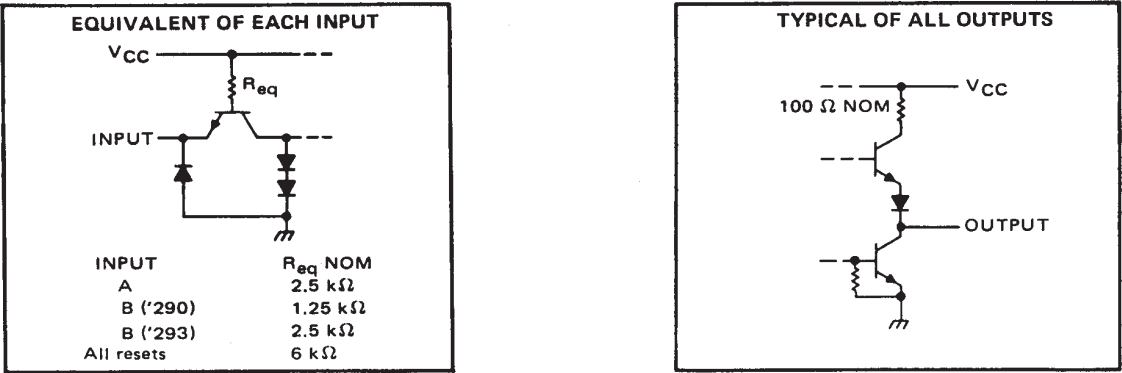
Pin numbers shown are for D, J, N, and W packages.

The J and K inputs shown without connection are for reference only and are functionally at a high level.

SN54290, SN54293, SN54LS290, SN54LS293
SN74290, SN74293, SN74LS290, SN74LS293
DECADE AND 4-BIT BINARY COUNTERS

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schematics of inputs and outputs



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: SN54' Circuits	−55°C to 125°C
SN74' Circuits	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 '290 circuit, it also applies between the two R_9 inputs.

recommended operating conditions

		SN54'			SN74'			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			μ A
Low-level output current, I_{OL}		16			16			mA
Count frequency, f_{count}	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

SN54290, SN54293, SN54LS290, SN54LS293
SN74290, SN74293, SN74LS290, SN74LS293
DECADE AND 4-BIT BINARY COUNTERS

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

PARAMETER		TEST CONDITIONS†	'290			'293			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IH}	High-level input voltage		2			2			V
V _{IL}	Low-level input voltage				0.8			0.8	V
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = -12 mA			-1.5			-1.5	V
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -800 µA	2.4	3.4		2.4	3.4		V
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OL} = 16 mA¶		0.2	0.4		0.2	0.4	V
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 5.5 V			1			1	mA
I _{IH}	High-level input current	Any reset			40			40	µA
		A input			80			80	
		B input			120			80	
I _{IL}	Low-level input current	Any reset			-1.6			-1.6	mA
		A input			-3.2			-3.2	
		B input			-4.8			-3.2	
I _{OS}	Short-circuit output current§	V _{CC} = MAX	SN54'	-20	-57	-20	-57		mA
			SN74'	-18	-57	-18	-57		
I _{CC}	Supply current	V _{CC} = MAX, See Note 3		29	42		26	39	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 V, T_A = 25°C.

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

¶ Q_A outputs are tested at I_{OL} = 16 mA plus the limit value of I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability.

NOTE 3: I_{CC} is measured with all outputs open, both R₀ inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER#	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'290			'293			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
f _{max}	A	Q _A	C _L = 15 pF, R _L = 400 Ω, See Note 4	32	42		32	42		MHz
	B	Q _B		16			16			
t _{PLH}	A	Q _A			10	16		10	16	ns
t _{PHL}					12	18		12	18	
t _{PLH}	A	Q _D			32	48		46	70	ns
t _{PHL}					34	50		46	70	
t _{PLH}	B	Q _B			10	16		10	16	ns
t _{PHL}					14	21		14	21	
t _{PLH}	B	Q _C			21	32		21	32	ns
t _{PHL}					23	35		23	35	
t _{PLH}	B	Q _D			21	32		34	51	ns
t _{PHL}					23	35		34	51	
t _{PHL}	Set-to-0	Any			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

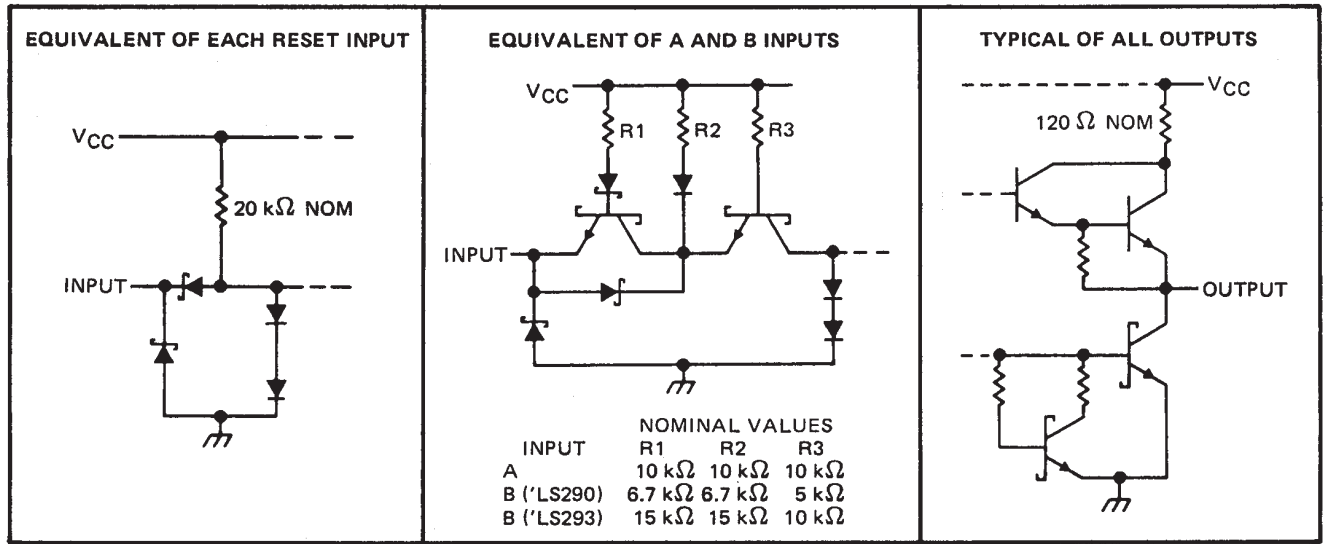
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.



SN54290, SN54293, SN54LS290, SN54LS293
SN74290, SN74293, SN74LS290, SN74LS293
DECADE AND 4-BIT BINARY COUNTERS

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schematics of inputs and outputs



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

Supply voltage, V_{CC} (see Note 5)	7 V
Input voltage: R inputs	7 V
A and B inputs	5.5 V
Operating free-air temperature range: SN54LS290, SN54LS293	−55°C to 125°C
SN74LS290, SN74LS293	0°C to 70°C
Storage temperature range	−65°C to 150°C

NOTE 5: Voltage values are with respect to network ground terminal.

recommended operating conditions

		SN54LS'			SN74LS'			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			μA
Low-level output current, I_{OL}		4			8			mA
Count frequency, f_{count}	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

SN54290, SN54293, SN54LS290, SN54LS293
SN74290, SN74293, SN74LS290, SN74LS293
DECADE AND 4-BIT BINARY COUNTERS

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

PARAMETER			TEST CONDITIONS†	SN54LS*			SN74LS*			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} = MIN, I _I = -18 mA				-1.5		-1.5	V	
V _{OH}	High-level output voltage		V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} max, I _{OH} = -400 µA			2.5	3.4	2.7	3.4	V	
V _{OL}	Low-level output voltage		V _{CC} = MIN, V _{IH} = 2 V,		I _{OL} = 4 mA¶	0.25	0.4	0.25	0.4	V	
			V _{IL} = V _{IL} max		I _{OL} = 8 mA¶			0.35	0.5		
I _I	Input current at maximum input voltage	Any reset	V _{CC} = MAX, V _I = 7 V				0.1		0.1	mA	
		A input					0.2		0.2		
		B of 'LS290	V _{CC} = MAX, V _I = 5.5 V				0.4		0.4		
		B of 'LS293					0.2		0.2		
I _{IH}	High-level input current	Any reset					20		20	µA	
		A input	V _{CC} = MAX, V _I = 2.7 V				40		40		
		B of 'LS290					80		80		
		B of 'LS293					40		40		
I _{IL}	Low-level input current	Any reset					-0.4		-0.4	mA	
		A input	V _{CC} = MAX, V _I = 0.4 V				-2.4		-2.4		
		B of 'LS290					-3.2		-3.2		
		B of 'LS293					-1.6		-1.6		
I _{OS}	Short-circuit output current§		V _{CC} = MAX			-20		-100		-100	mA
I _{CC}	Supply current		V _{CC} = MAX, See Note 3		'LS290	9	15	9	15	mA	
					'LS293	9	15	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 V, T_A = 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_A outputs are tested at specified I_{OL} plus the limit value of I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability.

NOTE 3: I_{CC} is measured with all outputs open, both R₀ inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER#	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS290			'LS293			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
f _{max}	A	Q _A	C _L = 15 pF, R _L = 2 kΩ, See Note 4	32	42		32	42		MHz
	B	Q _B		16			16			
t _{PLH}	A	Q _A		10	16		10	16		ns
t _{PHL}	A	Q _A		12	18		12	18		
t _{PLH}	A	Q _D		32	48		46	70		ns
t _{PHL}	A	Q _D		34	50		46	70		
t _{PLH}	B	Q _B		10	16		10	16		ns
t _{PHL}	B	Q _B		14	21		14	21		
t _{PLH}	B	Q _C		21	32		21	32		ns
t _{PHL}	B	Q _C		23	35		23	35		
t _{PLH}	B	Q _D		21	32		34	51		ns
t _{PHL}	B	Q _D		23	35		34	51		
t _{PHL}	Set-to-0	Any		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

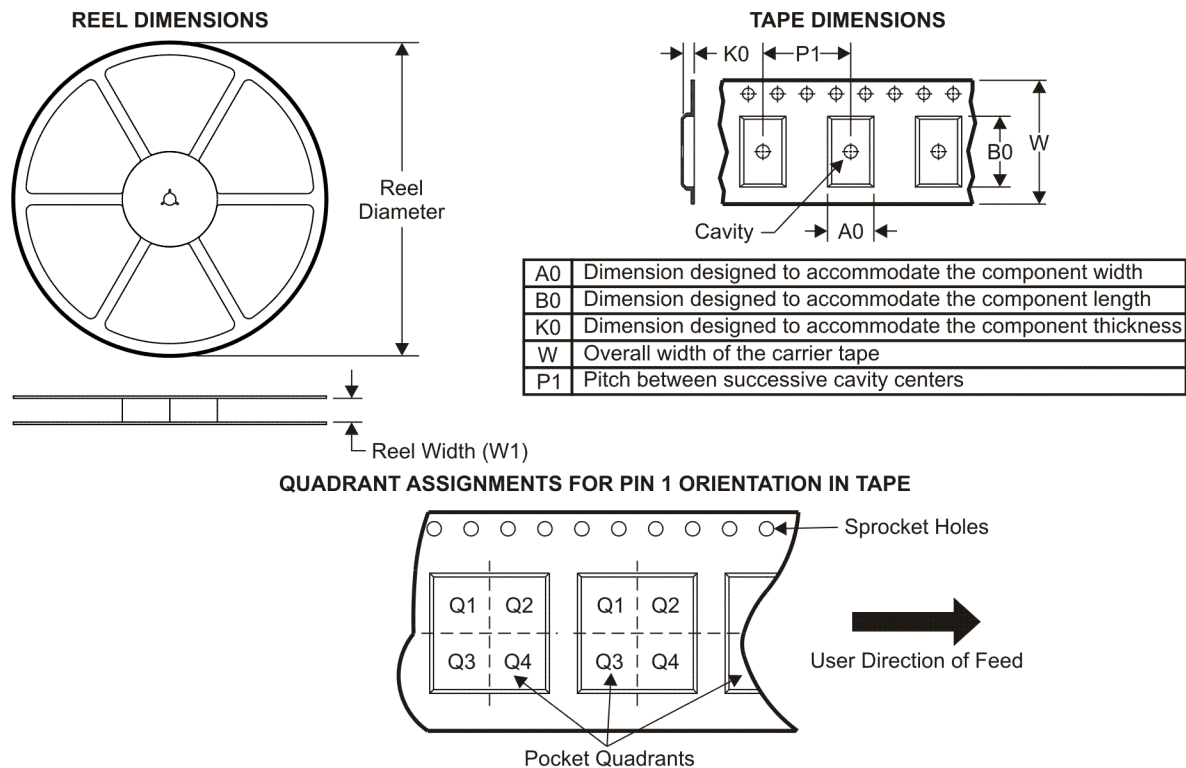
t_{PHL} = propagation delay time, high-to-low-level output

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.



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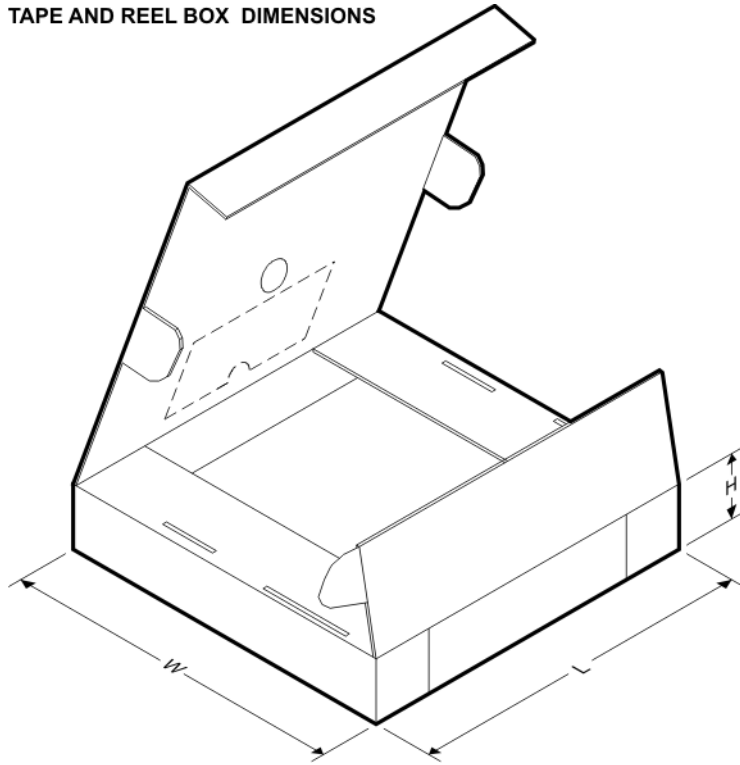
TAPE AND REEL INFORMATION



*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
SN74LS293DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	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)
SN74LS293DR	SOIC	D	14	2500	346.0	346.0	33.0

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)
SN74LS293D	Active	Production	SOIC (D) 14	50 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS293
SN74LS293D.A	Active	Production	SOIC (D) 14	50 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS293
SN74LS293N	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS293N
SN74LS293N.A	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS293N

⁽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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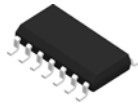
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TUBE

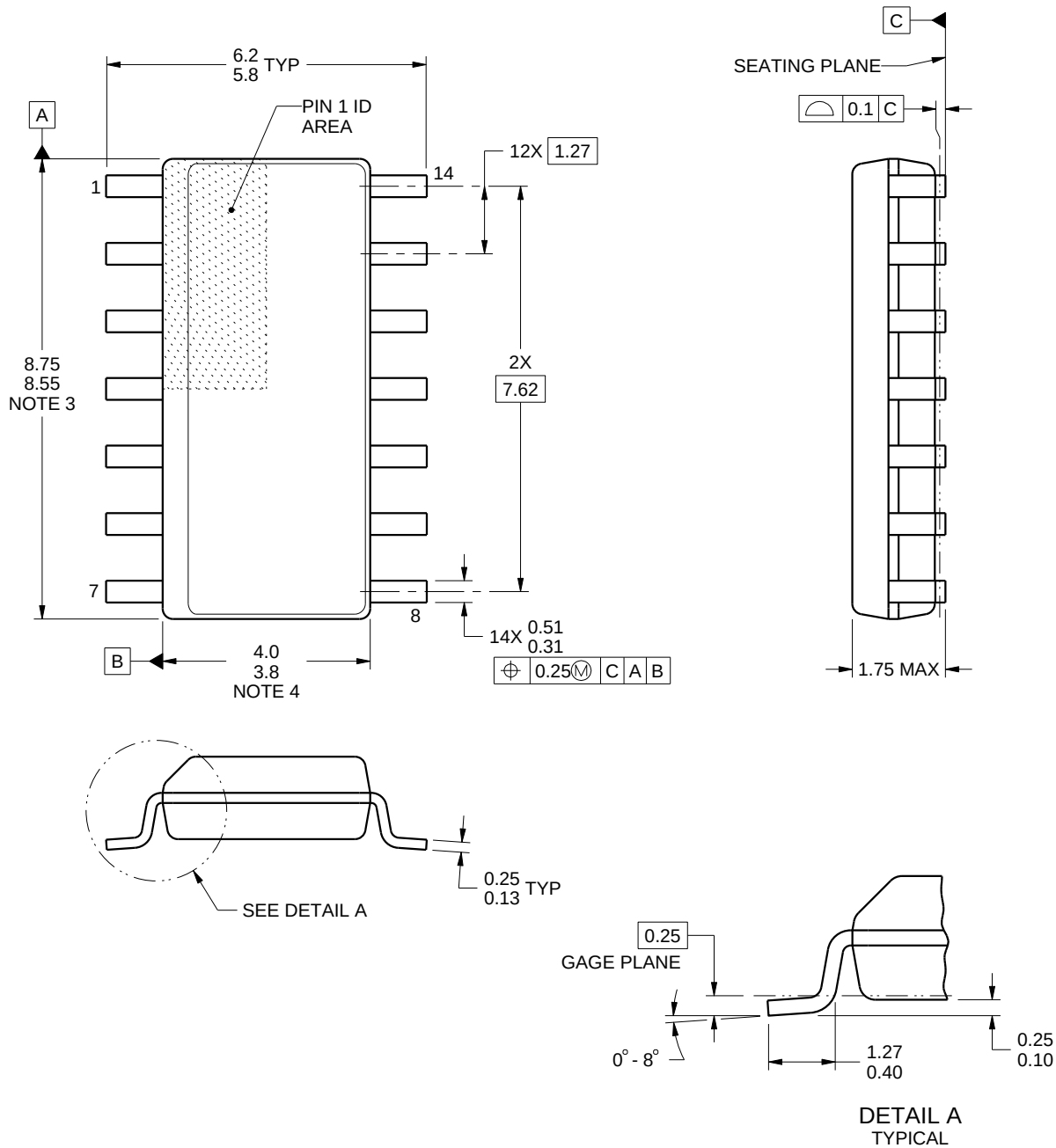


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74LS293D	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS293D.A	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS293N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS293N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS293N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS293N.A	N	PDIP	14	25	506	13.97	11230	4.32

D0014A**PACKAGE OUTLINE****SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

NOTES:

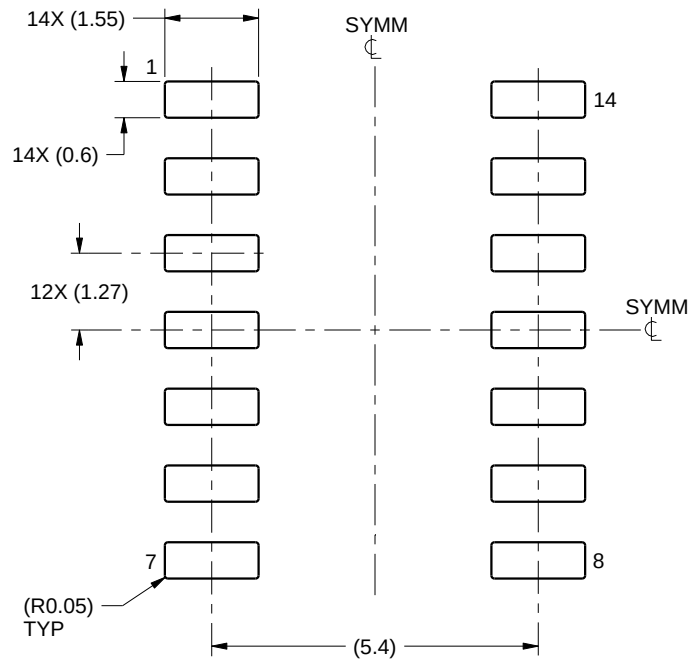
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

EXAMPLE BOARD LAYOUT

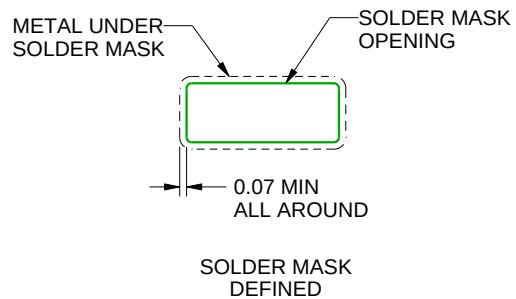
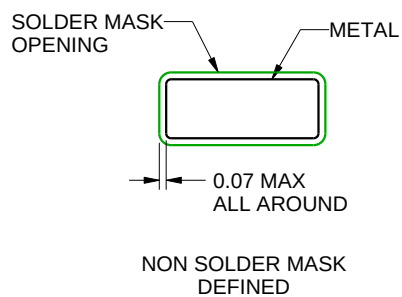
D0014A

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.

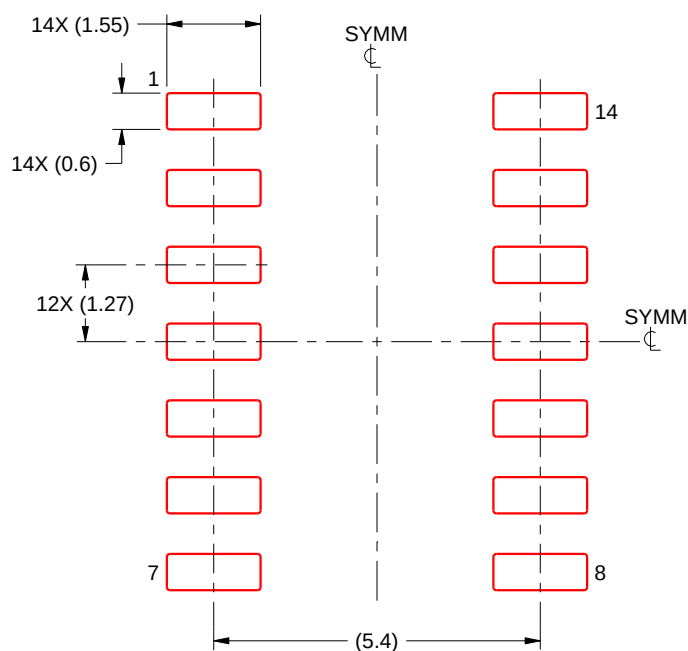
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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

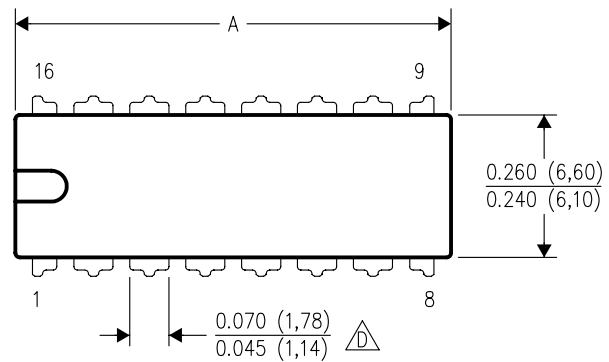
NOTES: (continued)

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.

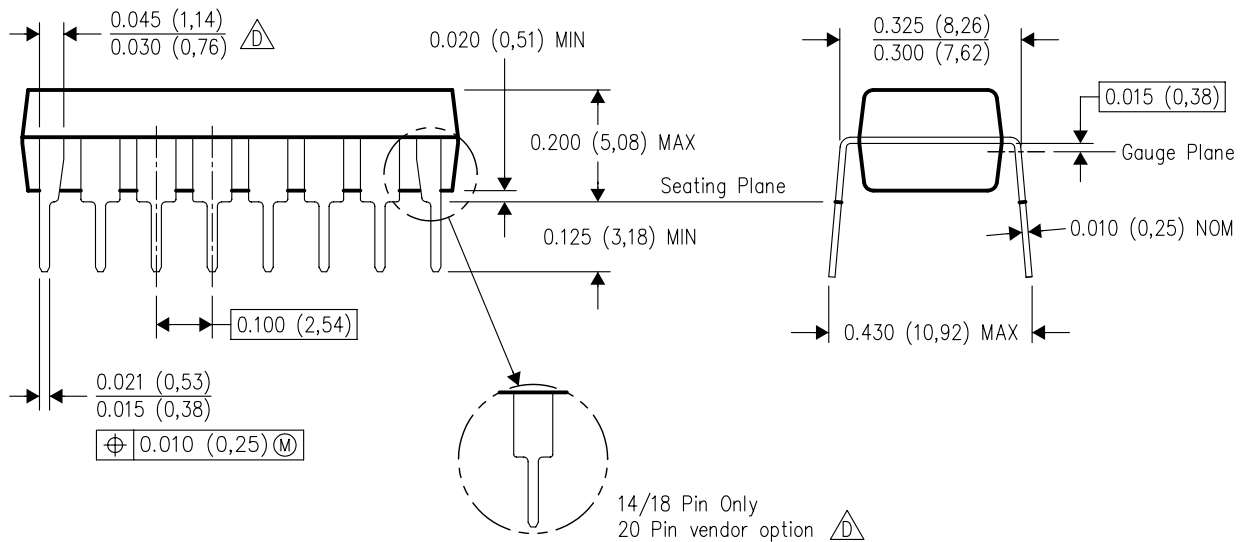
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

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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