SDLS004 D2633, JANUARY 1981—REVISED MARCH 1988

- **Parallel Register Inputs ('LS592)**
- **Parallel 3-State I/O: Register Inputs/ Counter Outputs ('LS593)**
- **Counter has Direct Overriding Load and Clear**
- **Accurate Counter Frequency: DC to 20 MHz**

description

The 'LS592 comes in a 16-pin package and consists of a parallel input, 8-bit storage register feeding an 8-bit binary counter. Both the register and the counter have individual positive-edge-triggered clocks. In addition, the counter has direct load and clear functions. A low-going $\overline{RCO}$ pulse will be obtained when the counter reaches the hex word FF. Expansion is easily accomplished for two stages by connecting $\overline{RCO}$ of the first stage to $\overline{CCKEN}$ of the second stage. Cascading for larger count chains can be accomplished by connecting $\overline{RCO}$ of each stage to CCK of the following stage.

The 'LS593 comes in a 20-pin package and has all the features of the 'LS592 plus 3-state I/O, which provides parallel counter outputs. The tables below show the operation of the enable (CCKEN, $\overline{CCKEN}$) inputs. A register clock enable ($\overline{RCKEN}$) is also provided.

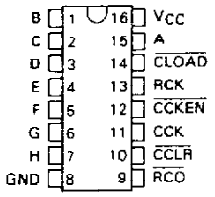
OUTPUT ENABLE CONTROL ('593 ONLY)

G	$\overline{G}$	A/Q_A thru H/Q_H
L	L	input mode
L	H	input mode
H	L	output mode
H	H	input mode

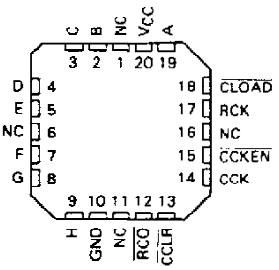
COUNTER CLOCK ENABLE CONTROL

CCKEN	$\overline{CCKEN}$	EFFECT ON CCK
L	L	Enable
L	H	Disable
H	L	Enable
H	H	Enable

SN54LS592 . . . J OR W PACKAGE
SN74LS592 . . . N PACKAGE
(TOP VIEW)

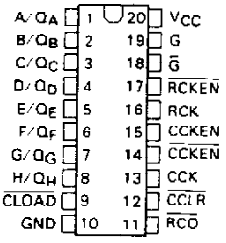


SN54LS592 . . . FK PACKAGE
(TOP VIEW)

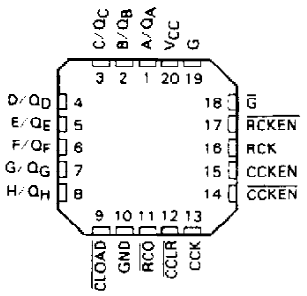


NC — No internal connection

SN54LS593 . . . J OR W PACKAGE
SN74LS593 . . . DW OR N PACKAGE
(TOP VIEW)

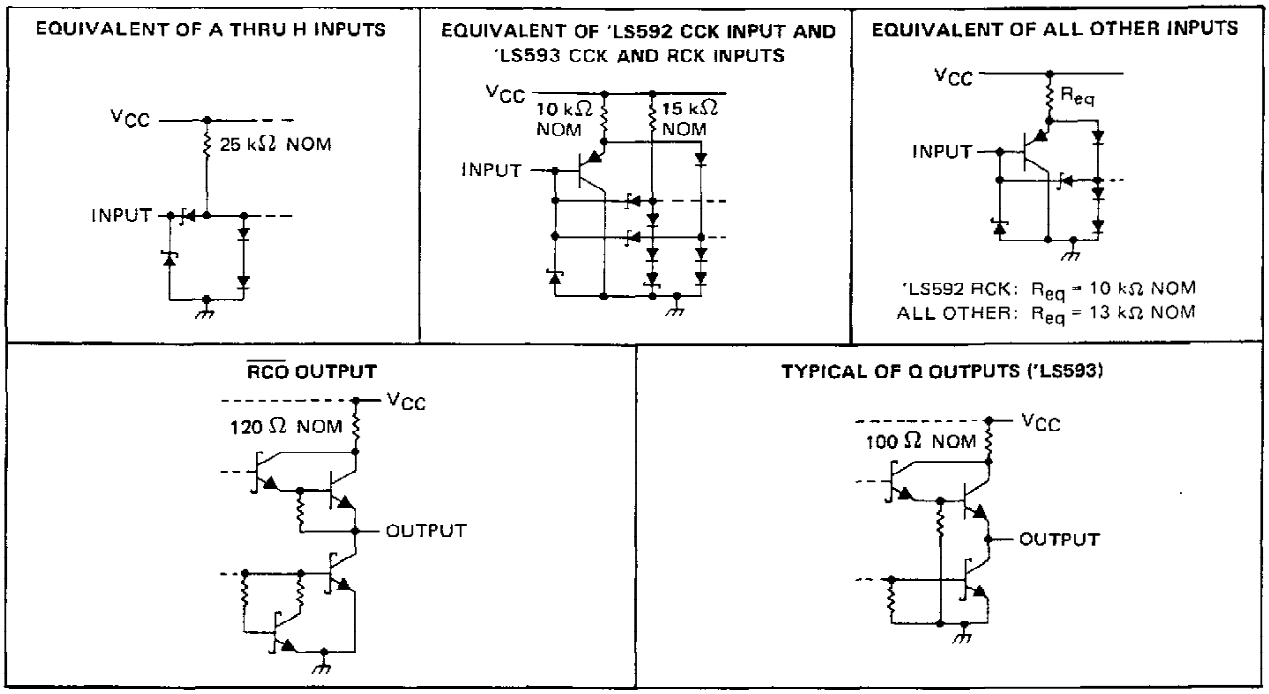


SN54LS593 . . . FK PACKAGE
(TOP VIEW)

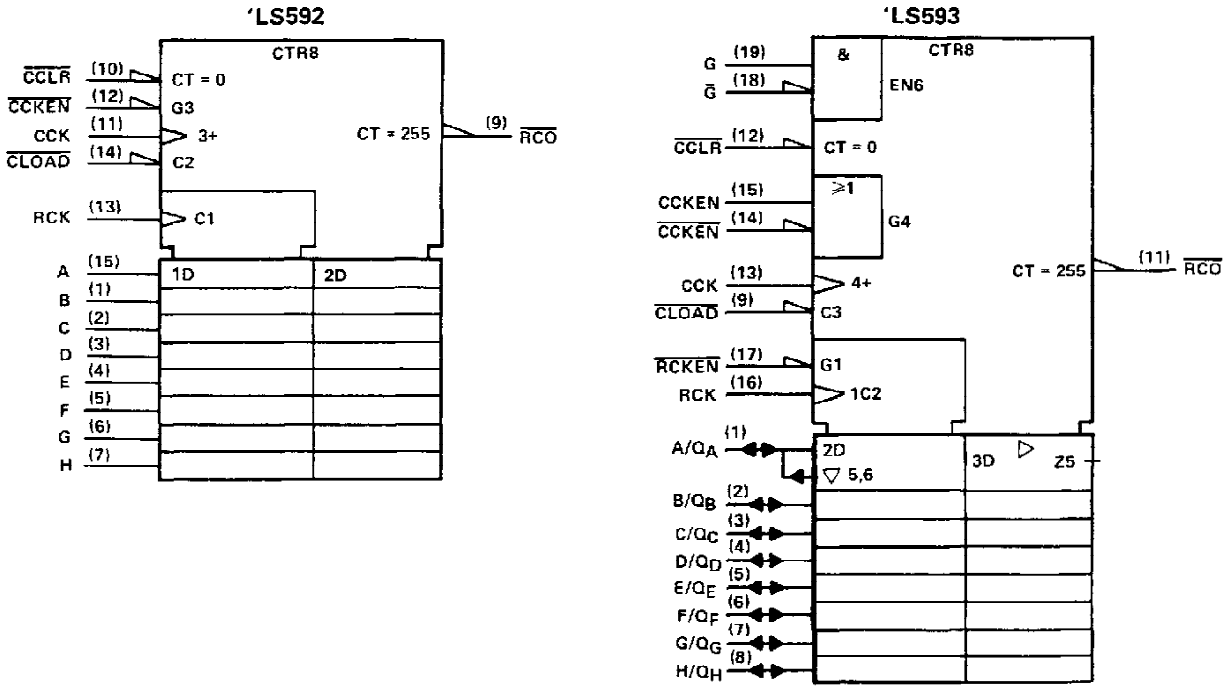


PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

schematics of inputs and outputs

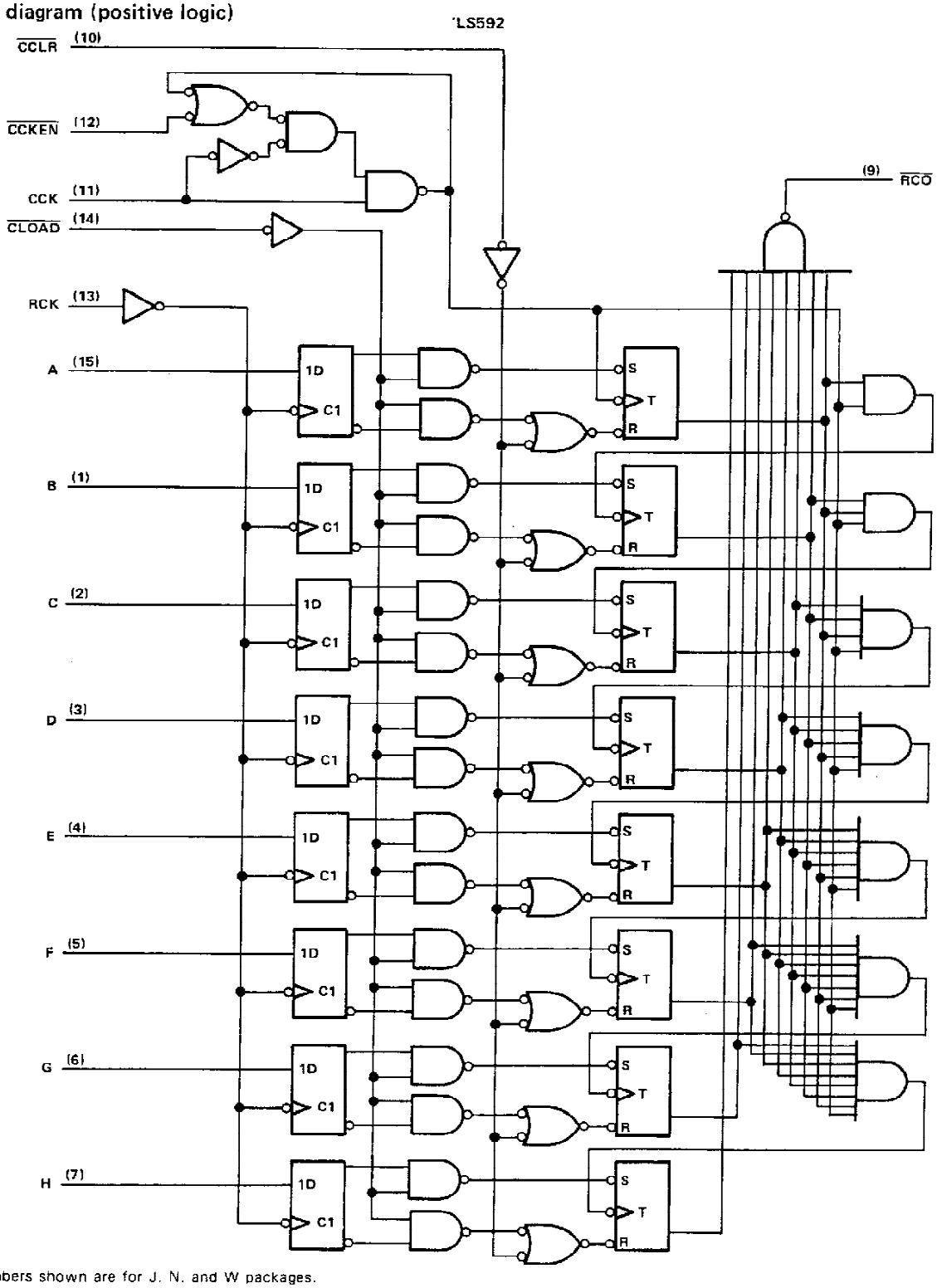


logic symbols†



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

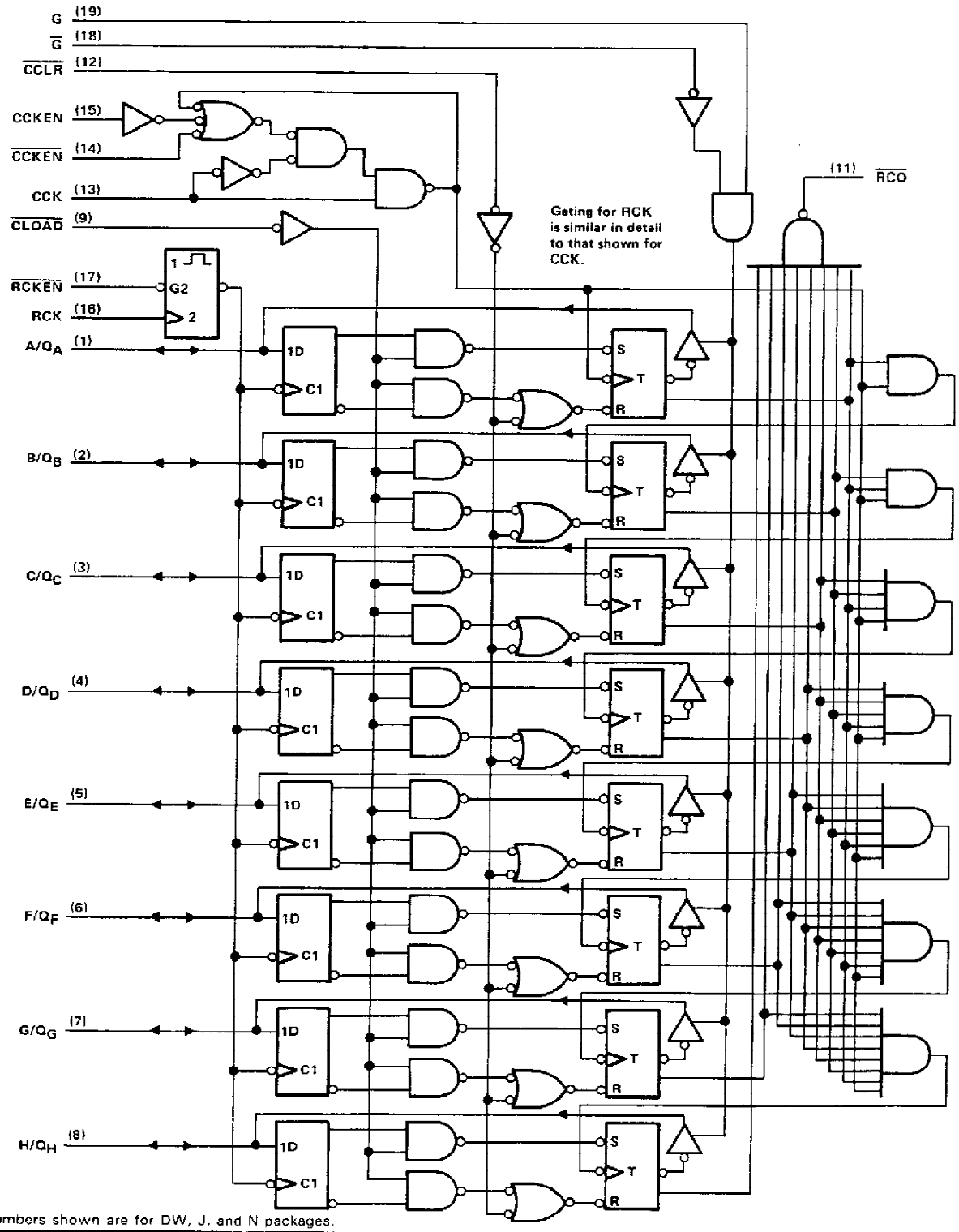
logic diagram (positive logic)



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

logic diagram (positive logic)

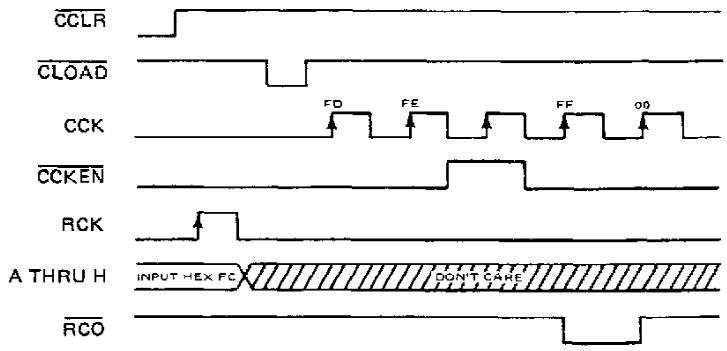
'LS593



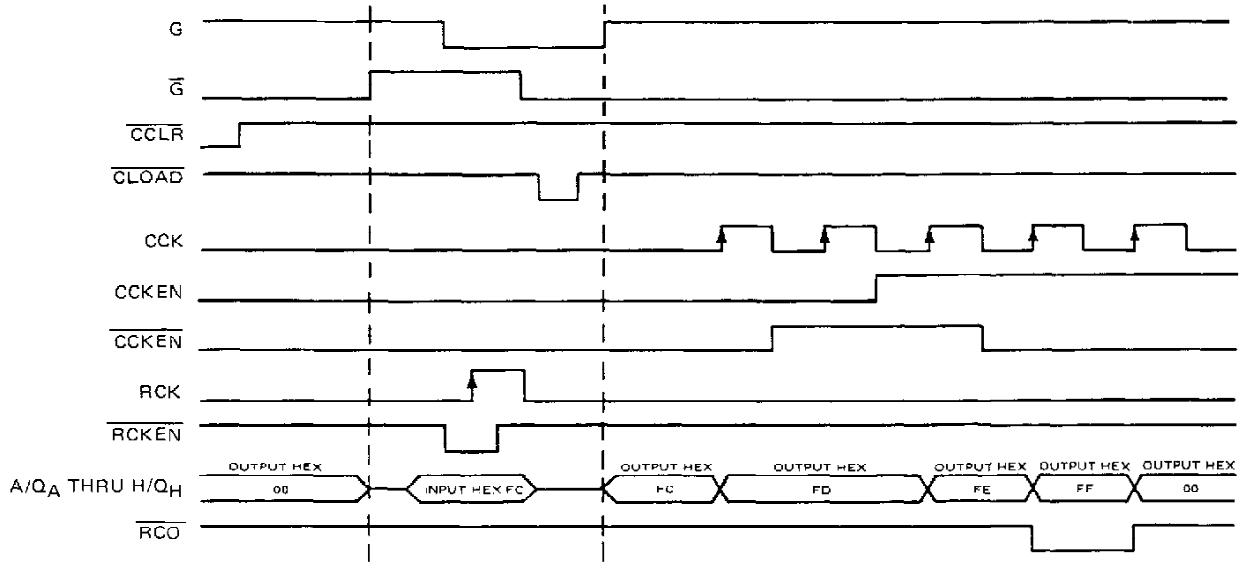
Pin numbers shown are for DW, J, and N packages.

typical operating sequences

'LS592



'LS593



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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage (excluding I/O ports) . . . . . 7 V
Off-state output voltage (including I/O ports) . . . . . 5.5 V
Operating free-air temperature range: SN54LS592, SN54LS593 . . . . . −55°C to 125°C
SN74LS592, SN74LS593 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

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

recommended operating conditions

			SN54LS'			SN74LS'			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	$\overline{RCO}$			−1			−1	mA
		Q 'LS593 only			−1			−2.6	
I_{OL}	Low-level output current	$\overline{RCO}$			8			16	mA
		Q 'LS593 only			12			24	
f_{CCK}	Counter clock frequency		0		20	0		20	MHz
t_{w} (CCK)	Duration of counter clock pulse		25			25			ns
t_{w} ($\overline{CCLR}$)	Duration of counter clear pulse		20			20			ns
t_{w} (RCK)	Duration of register clock pulse		20			20			ns
t_{w} ($\overline{CLOAD}$)	Duration of counter load pulse		40			40			ns
t_{su}	Register enable setup time	$\overline{RCKEN}$ low to RCK ↑, 'LS593	20			20			ns
t_{su}	Counter enable setup time before CCK ↑	$\overline{CCKEN}$ low, 'LS592	30			30			ns
		$\overline{CCKEN}$ low or CCKEN high, 'LS593	30			30			
t_{su}	Setup time	$\overline{CCLR}$ inactive before CCK ↑	20			20			ns
		$\overline{CLOAD}$ inactive before CCK ↑	20			20			
		RCK ↑ before $\overline{CLOAD}$ ↑ (see Note 2)	30			30			
		Data A thru H before RCK ↑	20			20			
t_{h}	Hold time	Data A thru H after RCK ↑	0			0			ns
		All others	0			0			
T_{A}	Operating free-air temperature		−55		125	0		70	°C

NOTE 2: This time insures the data saved by RCK ↑ will also be loaded into the counter.

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

PARAMETER			TEST CONDITIONS†		SN54LS' MIN	SN54LS' TYP‡	SN54LS' MAX	SN74LS' MIN	SN74LS' TYP‡	SN74LS' MAX	UNIT
V_{IK}			V_{CC} = MIN, I_I = −18 mA				−1.5			−1.5	V
V_{OH}	'LS593 Q		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	I_{OH} = −1 mA	2.4	3.2					V
				I_{OH} = −2.6 mA				2.4	3.1		
	$\overline{RCO}$			I_{OH} = −1 mA	2.4	3.2		2.4	3.2		
V_{OL}	'LS593 Q		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
				I_{OL} = 24 mA					0.35	0.5	
	$\overline{RCO}$			I_{OL} = 8 mA		0.25	0.4		0.25	0.4	
				I_{OL} = 16 mA					0.35	0.5	
I_{OZH}	'LS593 Q		V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = MAX, V_O = 2.7 V				20			20	μA
I_{OZL}	'LS593 Q		V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = MAX, V_O = 0.4 V				−0.4			−0.4	mA
I_I	'LS593 Q		V_{CC} = MAX	V_I = 5.5 V			0.1			0.1	mA
	Others			V_I = 7 V			0.1			0.1	
I_{IH}			V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	CCK		V_{CC} = MAX, V_I = 0.4 V				−0.8			−0.8	mA
	RCK	'LS592					−0.2			−0.2	
		'LS593					−0.8			−0.8	
	A thru H						−0.4			−0.4	
	Others						−0.2			−0.2	
I_{OS}§	'LS593 Q		V_{CC} = MAX, V_O = 0 V		−30		−130	−30		−130	mA
	$\overline{RCO}$				−20		−100	−20		−100	
I_{CC}	'LS592	I_{CCH}	V_{CC} = MAX, All possible inputs grounded, All outputs open			40	60		40	60	mA
		I_{CCL}				40	60		40	60	
	'LS593	I_{CCH}				47	70		47	70	
		I_{CCL}				53	80		53	80	
		I_{CCZ}				57	85		57	85	

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

switching characteristics, V_{CC} = 5 V, T_A = 25°C, (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS592			'LS593			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
f_{max}	CCK	$\overline{RCO}$	R_L = 1 kΩ, C_L = 30 pF	20	35		20	35		MHz
t_{PLH}	CCK ↑	Q	R_L = 667 Ω, C_L = 45 pF					14	21	ns
t_{PHL}	CCK ↑	Q						26	39	ns
t_{PLH}	$\overline{CLOAD}$ ↓	Q						34	51	ns
t_{PHL}	$\overline{CLOAD}$ ↓	Q						28	42	ns
t_{PHL}	$\overline{CCLR}$ ↓	Q						25	38	ns
t_{PZH}	G ↑	Q						31	47	ns
t_{PZL}	G ↑	Q						27	40	ns
t_{PZH}	$\overline{G}$ ↓	Q						29	45	ns
t_{PZL}	$\overline{G}$ ↓	Q						31	47	ns
t_{PHZ}	G ↓	Q	R_L = 667 Ω, C_L = 5 pF					33	50	ns
t_{PLZ}	G ↓	Q						35	52	ns
t_{PHZ}	$\overline{G}$ ↑	Q						26	39	ns
t_{PLZ}	$\overline{G}$ ↑	Q						28	42	ns
t_{PLH}	CCK ↑	$\overline{RCO}$	R_L = 1 kΩ, C_L = 30 pF		15	23		14	21	ns
t_{PHL}	CCK ↑	$\overline{RCO}$			20	30		20	30	ns
t_{PLH}	$\overline{CLOAD}$ ↓	$\overline{RCO}$			31	47		31	47	ns
t_{PHL}	$\overline{CLOAD}$ ↓	$\overline{RCO}$			27	41		27	41	ns
t_{PLH}	$\overline{CCLR}$ ↓	$\overline{RCO}$			30	45		30	45	ns
t_{PLH}	RCK ↑	$\overline{RCO}$	R_L = 1 kΩ; C_L = 30 pF $\overline{CLOAD}$ = L		35	53		42	63	ns
t_{PHL}	RCK ↑	$\overline{RCO}$			30	45		33	50	ns

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

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)
5962-8762101EA	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101EA SNJ54LS592J
5962-8762101FA	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101FA SNJ54LS592W
5962-8762101FA	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101FA SNJ54LS592W
SN54LS592J	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS592J
SN54LS592J	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS592J
SN54LS592J.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS592J
SN54LS592J.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS592J
SN54LS593J	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS593J
SN54LS593J	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS593J
SN54LS593J.A	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS593J
SN54LS593J.A	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS593J
SN74LS592D	Active	Production	SOIC (D) | 16	40 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS592
SN74LS592D	Active	Production	SOIC (D) | 16	40 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS592
SN74LS592D.A	Active	Production	SOIC (D) | 16	40 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS592
SN74LS592D.A	Active	Production	SOIC (D) | 16	40 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS592
SN74LS592N	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS592N
SN74LS592N	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS592N
SN74LS592N.A	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS592N
SN74LS592N.A	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS592N
SN74LS592NSR	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS592
SN74LS592NSR	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS592
SN74LS592NSR.A	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS592
SN74LS592NSR.A	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS592
SN74LS593DW	Obsolete	Production	SOIC (DW) | 20	-	-	Call TI	Call TI	0 to 70	LS593
SN74LS593DW	Obsolete	Production	SOIC (DW) | 20	-	-	Call TI	Call TI	0 to 70	LS593
SN74LS593DWR	Last Time Buy	Production	SOIC (DW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS593

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)
SN74LS593DWR	Last Time Buy	Production	SOIC (DW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS593
SN74LS593DWR.A	Last Time Buy	Production	SOIC (DW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS593
SN74LS593DWR.A	Last Time Buy	Production	SOIC (DW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS593
SN74LS593N	Active	Production	PDIP (N) | 20	20 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS593N
SN74LS593N	Active	Production	PDIP (N) | 20	20 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS593N
SN74LS593N.A	Active	Production	PDIP (N) | 20	20 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS593N
SN74LS593N.A	Active	Production	PDIP (N) | 20	20 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS593N
SNJ54LS592J	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101EA SNJ54LS592J
SNJ54LS592J	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101EA SNJ54LS592J
SNJ54LS592J.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101EA SNJ54LS592J
SNJ54LS592J.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101EA SNJ54LS592J
SNJ54LS592W	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101FA SNJ54LS592W
SNJ54LS592W	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101FA SNJ54LS592W
SNJ54LS592W.A	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101FA SNJ54LS592W
SNJ54LS592W.A	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8762101FA SNJ54LS592W
SNJ54LS593J	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS593J
SNJ54LS593J	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS593J
SNJ54LS593J.A	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS593J
SNJ54LS593J.A	Active	Production	CDIP (J) | 20	20 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS593J

(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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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54LS592, SN54LS593, SN74LS592, SN74LS593 :

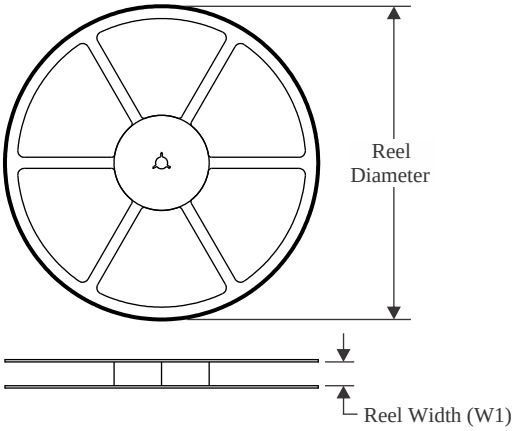
- Catalog : SN74LS592, SN74LS593
- Military : SN54LS592, SN54LS593

NOTE: Qualified Version Definitions:

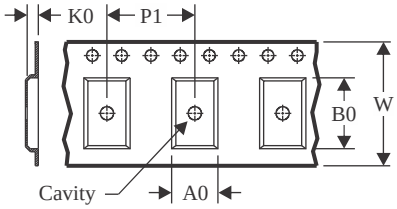
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

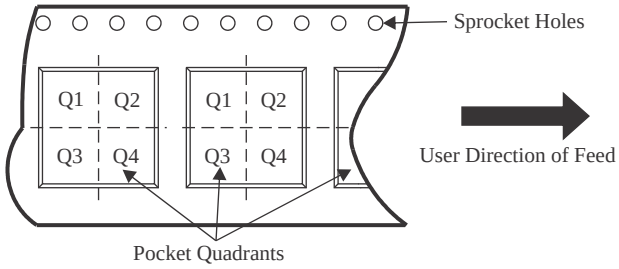


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

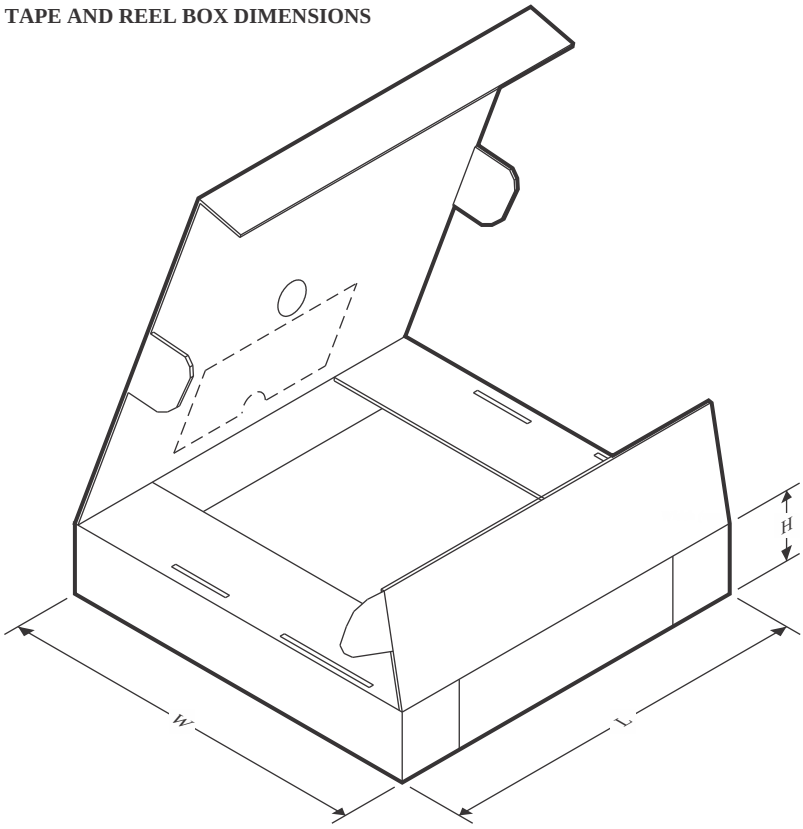
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74LS592NSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
SN74LS593DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1

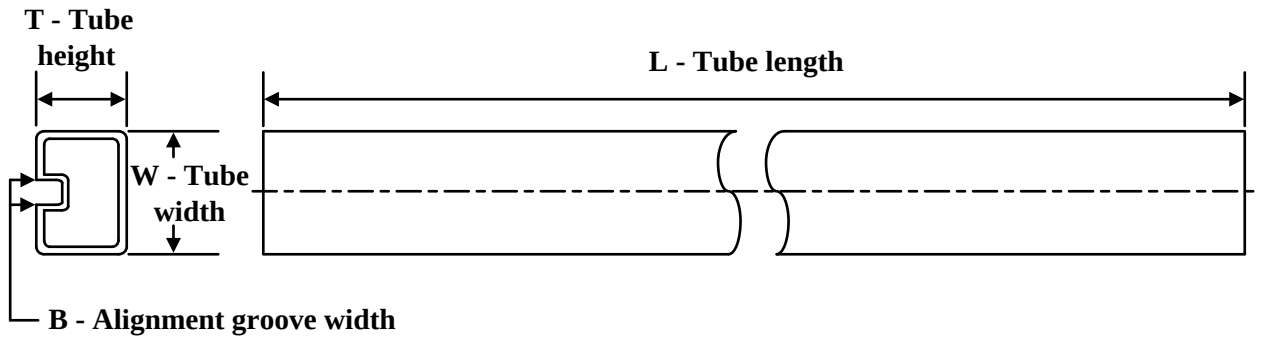
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS592NSR	SOP	NS	16	2000	353.0	353.0	32.0
SN74LS593DWR	SOIC	DW	20	2000	356.0	356.0	45.0

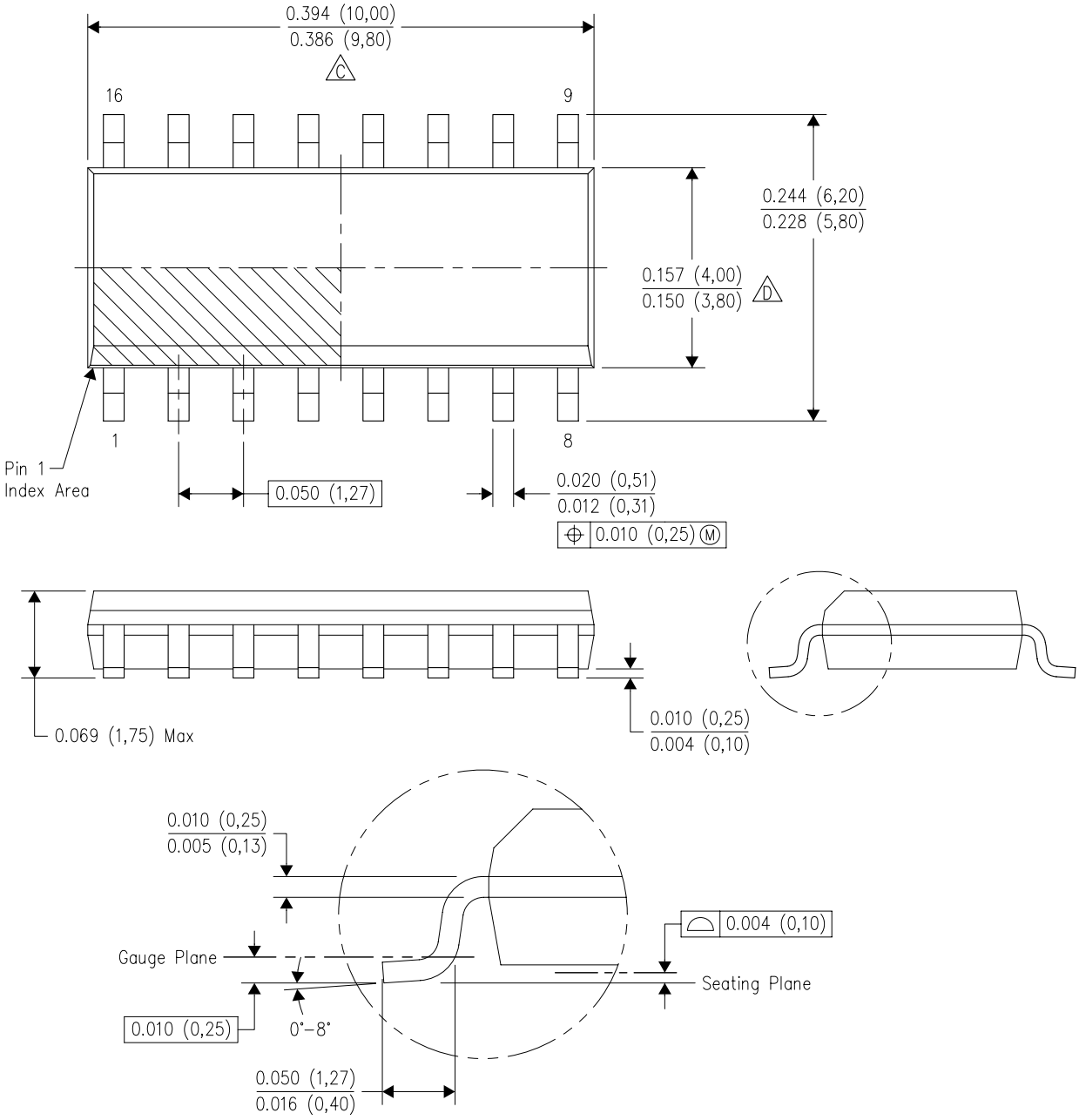
TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-8762101FA	W	CFP	16	25	506.98	26.16	6220	NA
SN74LS592D	D	SOIC	16	40	507	8	3940	4.32
SN74LS592D.A	D	SOIC	16	40	507	8	3940	4.32
SN74LS592N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS592N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS592N.A	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS592N.A	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS593N	N	PDIP	20	20	506	13.97	11230	4.32
SN74LS593N.A	N	PDIP	20	20	506	13.97	11230	4.32
SNJ54LS592W	W	CFP	16	25	506.98	26.16	6220	NA
SNJ54LS592W.A	W	CFP	16	25	506.98	26.16	6220	NA

D (R–PDSO–G16) PLASTIC SMALL OUTLINE

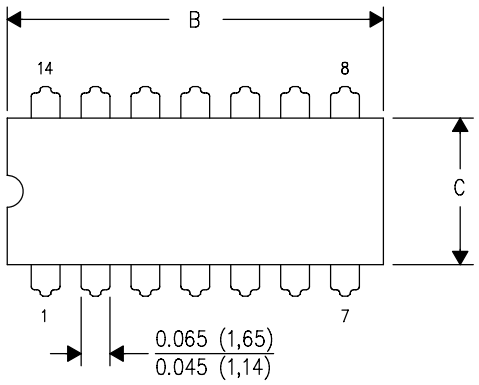


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AC.

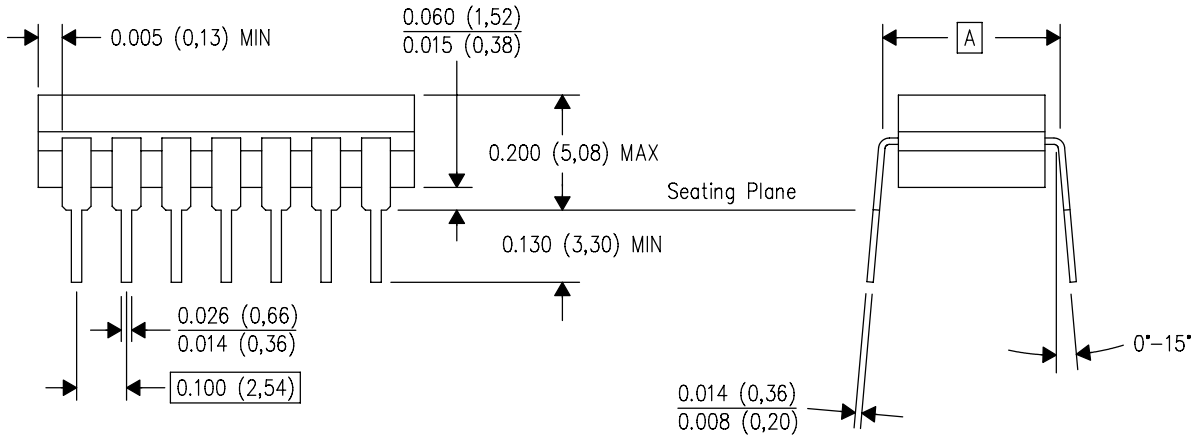
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



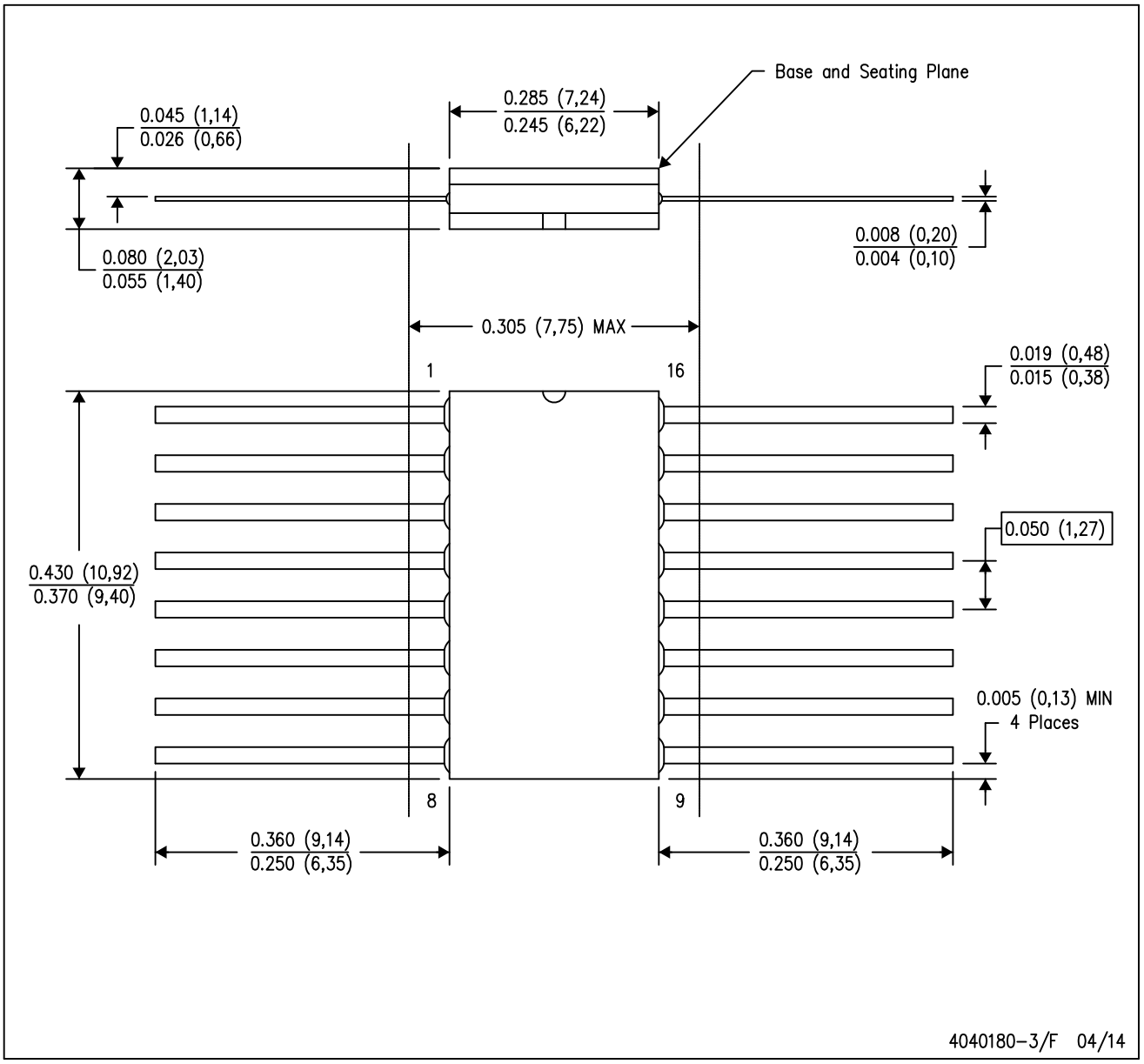
DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

W (R–GDFP–F16) CERAMIC DUAL FLATPACK

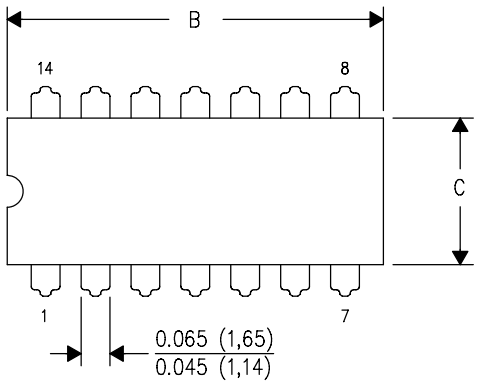


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP2–F16

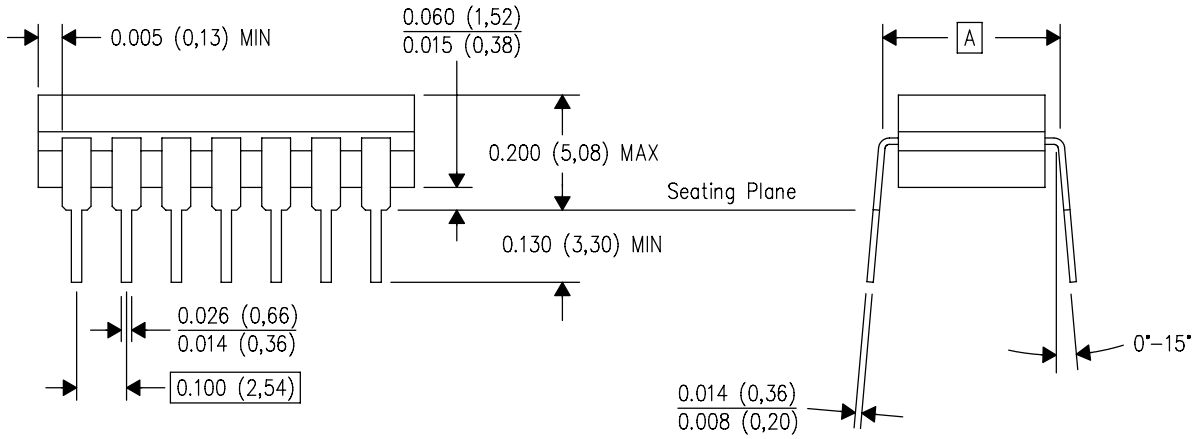
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



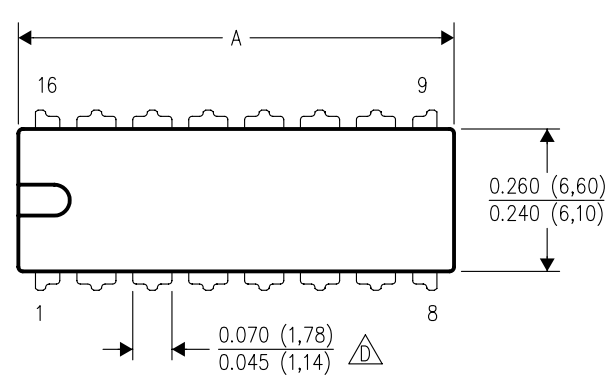
4040083/F 03/03

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

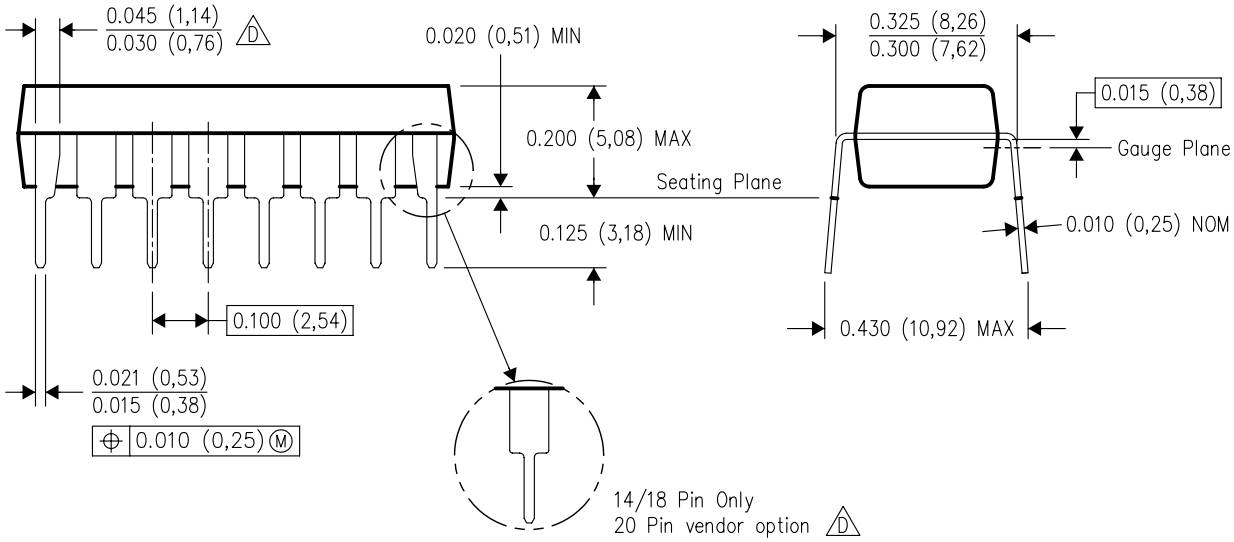
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN

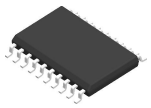


DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

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

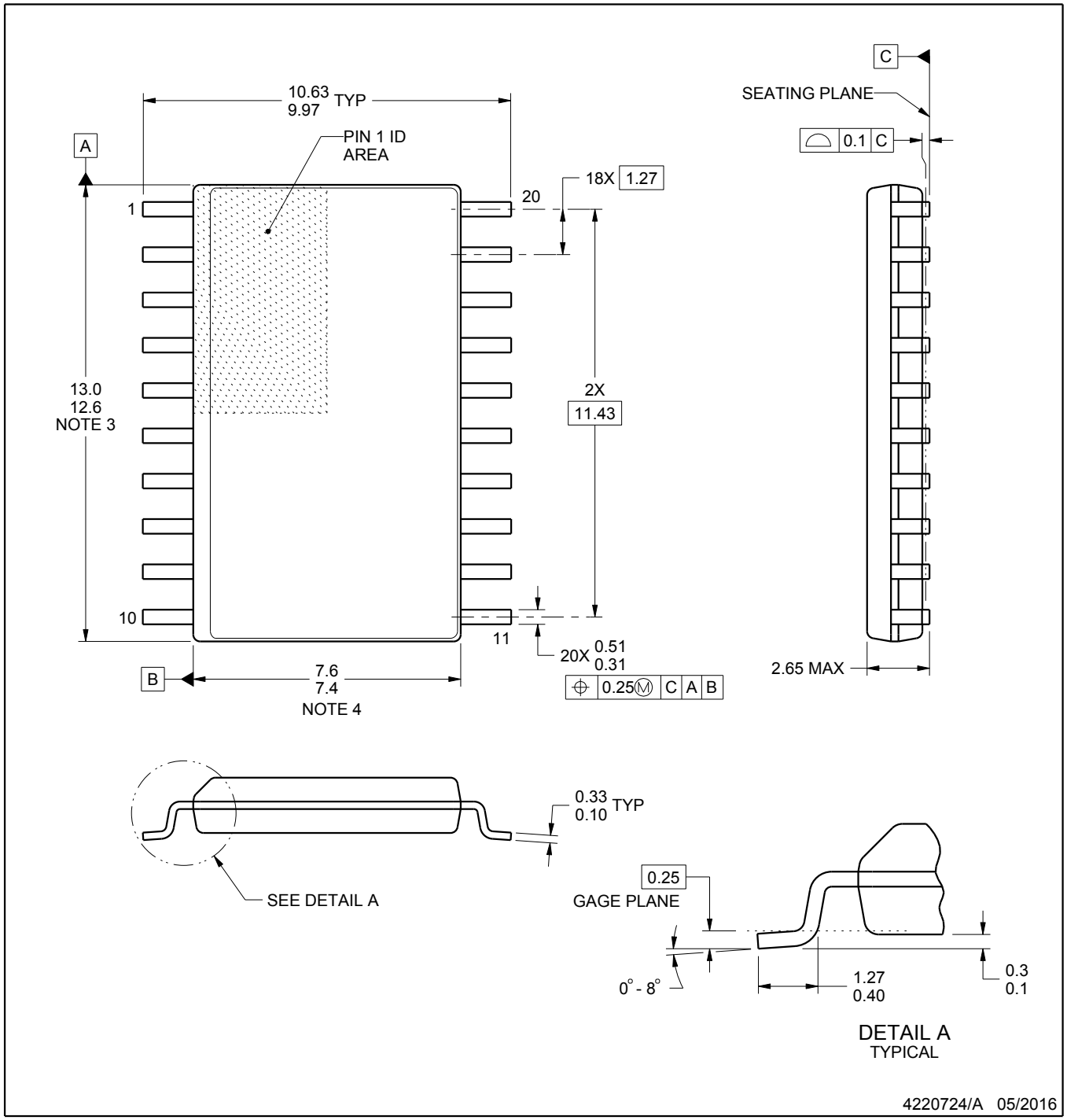


PACKAGE OUTLINE

DW0020A

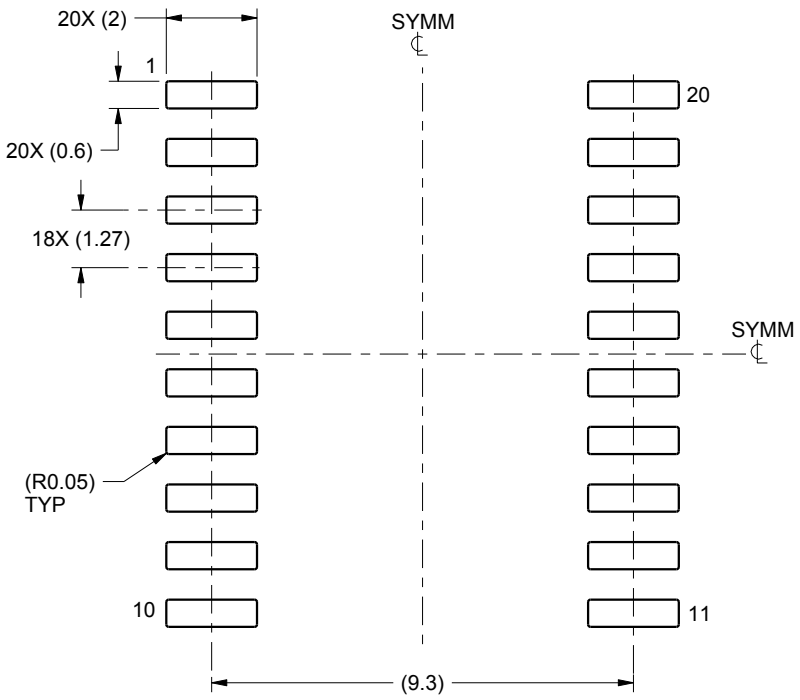
SOIC - 2.65 mm max height

SOIC

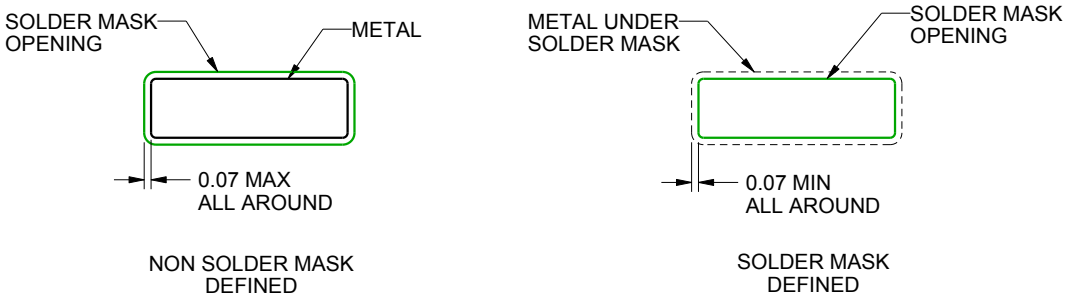


NOTES:

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-013.



LAND PATTERN EXAMPLE
SCALE:6X

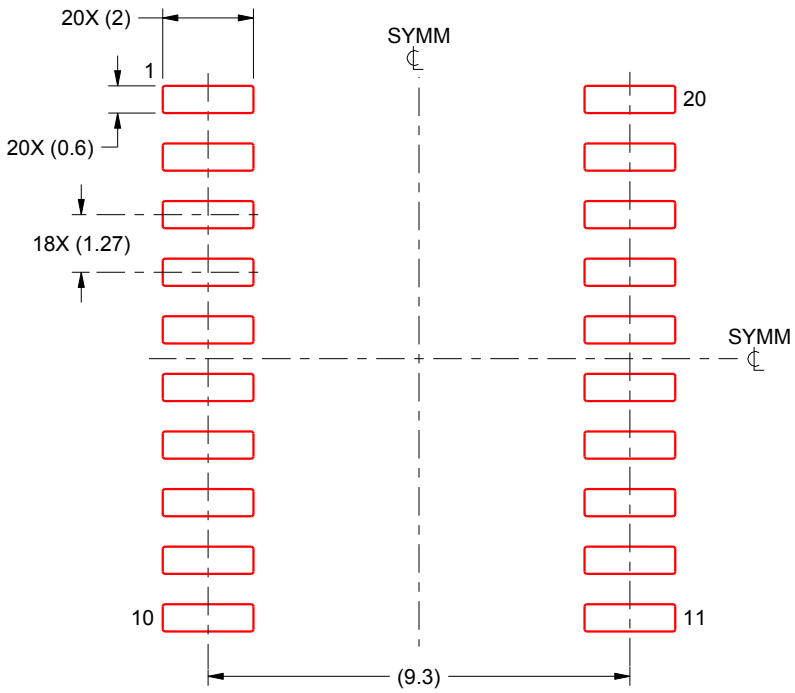


SOLDER MASK DETAILS

4220724/A 05/2016

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.

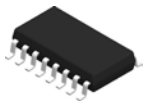


SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A 05/2016

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.

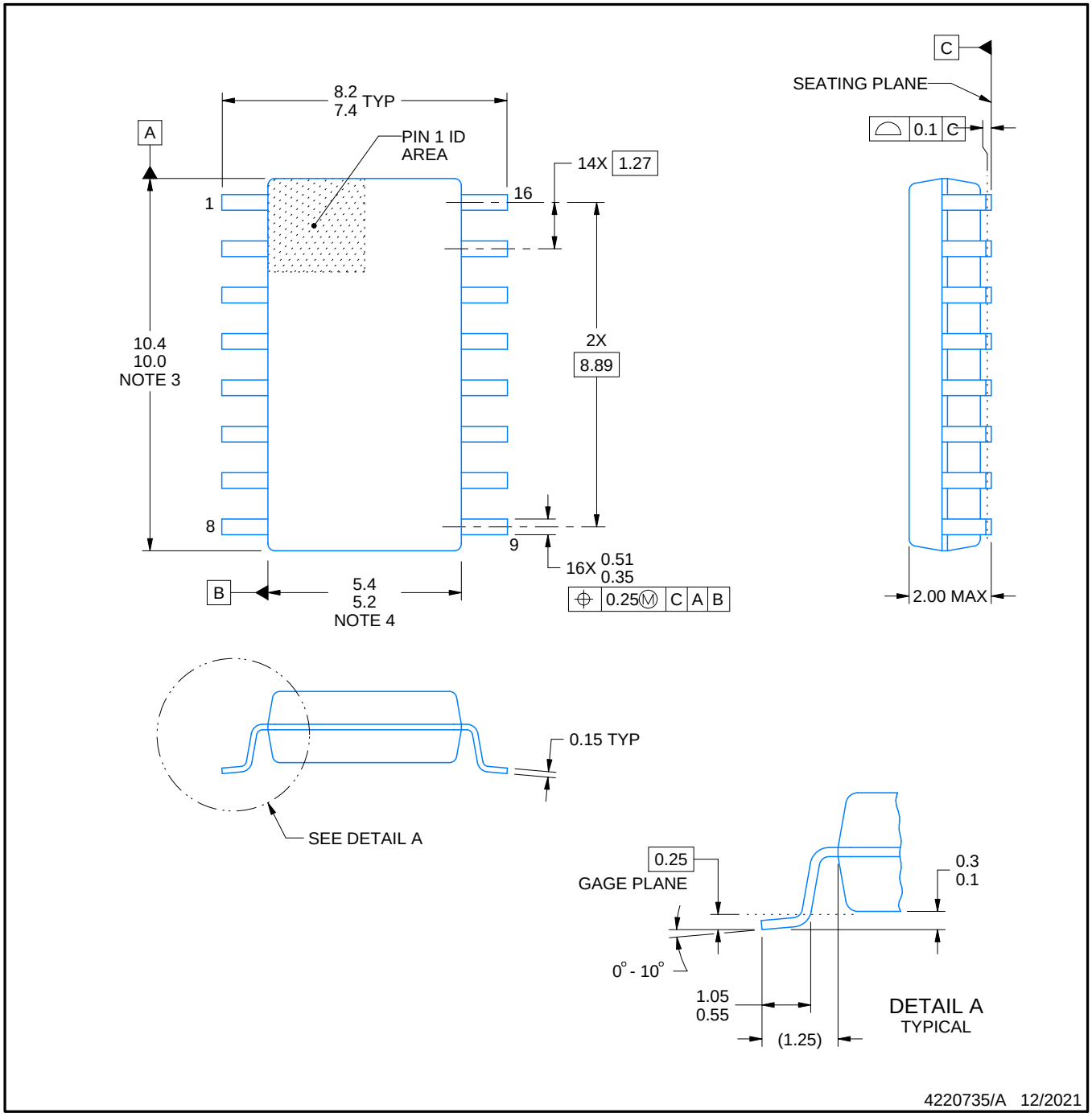


PACKAGE OUTLINE

NS0016A

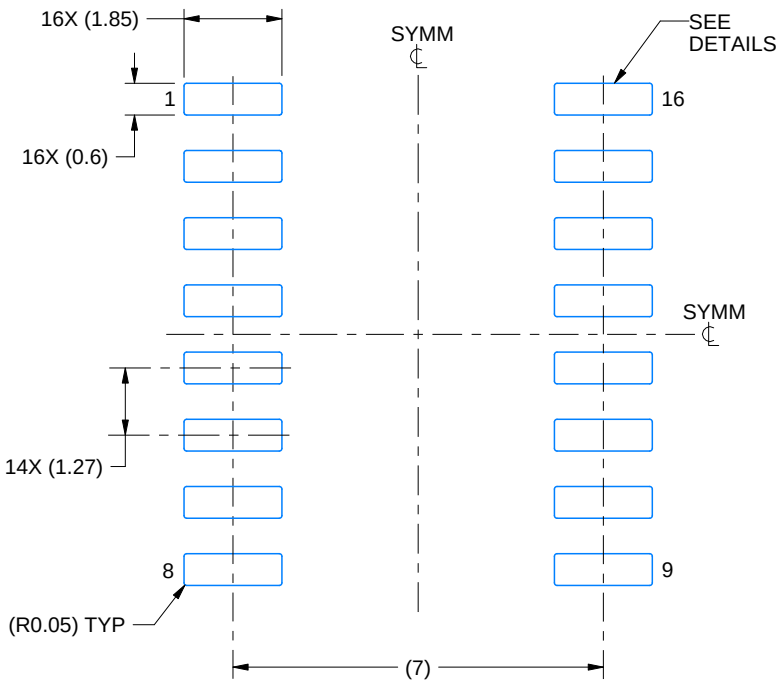
SOP - 2.00 mm max height

SOP

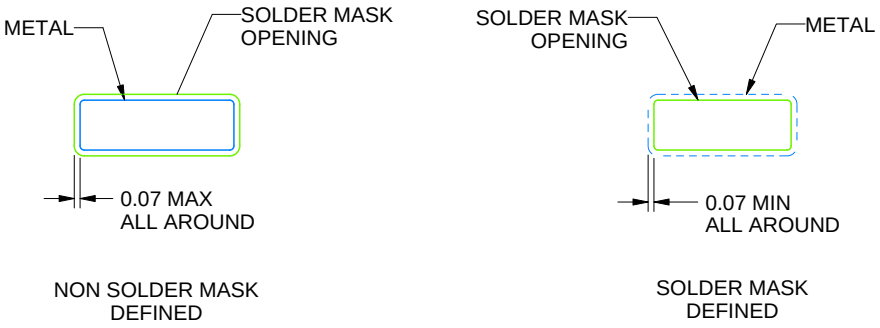


NOTES:

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 0.25 mm, per side.



LAND PATTERN EXAMPLE
SCALE:7X



NON SOLDER MASK
DEFINED

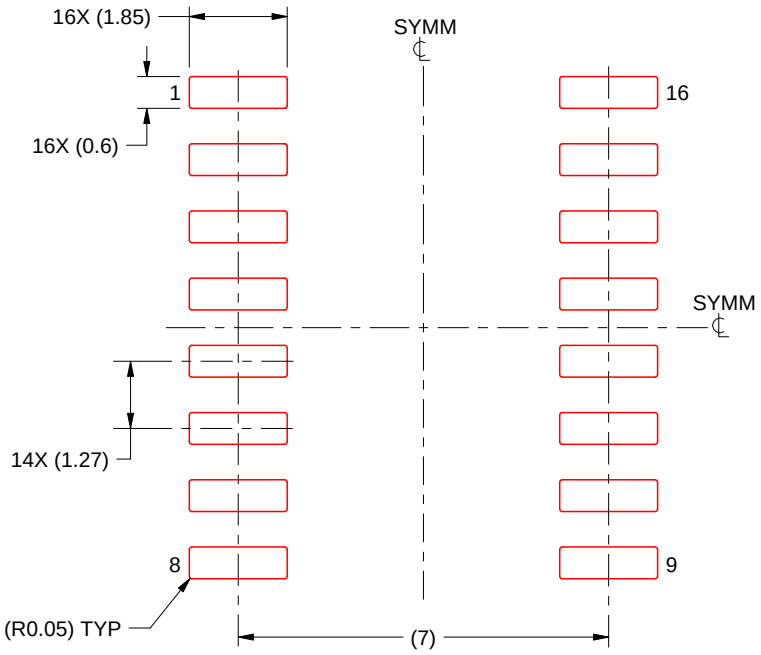
SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

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



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

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

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