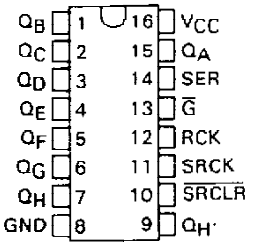
SN54LS595, SN54LS596, SN74LS595, SN74LS596
8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES

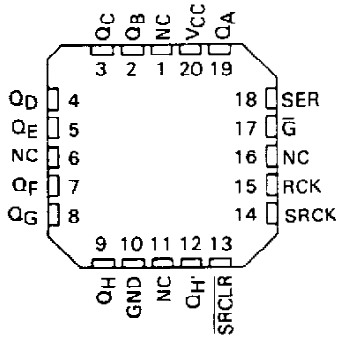
SDLS006 D2634, JANUARY 1981 - REVISED MARCH 1988

- 8-Bit Serial-In, Parallel-Out Shift Registers with Storage
- Choice of 3-State ('LS595) or Open-Collector ('LS596) Parallel Outputs
- Shift Register Has Direct Clear
- Accurate Shift Frequency: DC to 20 MHz

SN54LS595, SN54LS596 . . . J OR W PACKAGE
SN74LS595, SN74LS596 . . . N PACKAGE
(TOP VIEW)



SN54LS595, SN54LS596 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

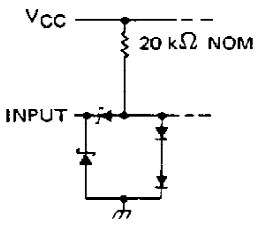
description

These devices each contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has parallel 3-state ('LS595) or open-collector ('LS596) outputs. Separate clocks are provided for both the shift register and the storage register. The shift register has a direct-overriding clear, serial input, and serial output pins for cascading.

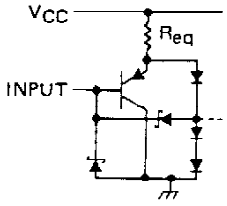
Both the shift register and storage register clocks are positive-edge triggered. If the user wishes to connect both clocks together, the shift register state will always be one clock pulse ahead of the storage register.

schematics of inputs and outputs

EQUIVALENT OF SERIAL INPUT

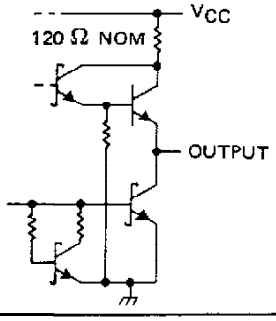


EQUIVALENT OF ALL OTHER INPUTS

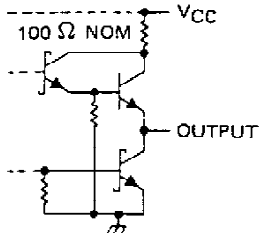


RCK, SRCK: R_{eq} = 10 kΩ NOM
ALL OTHER: R_{eq} = 13 kΩ NOM

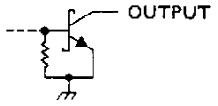
TYPICAL OF Q_H' OUTPUTS



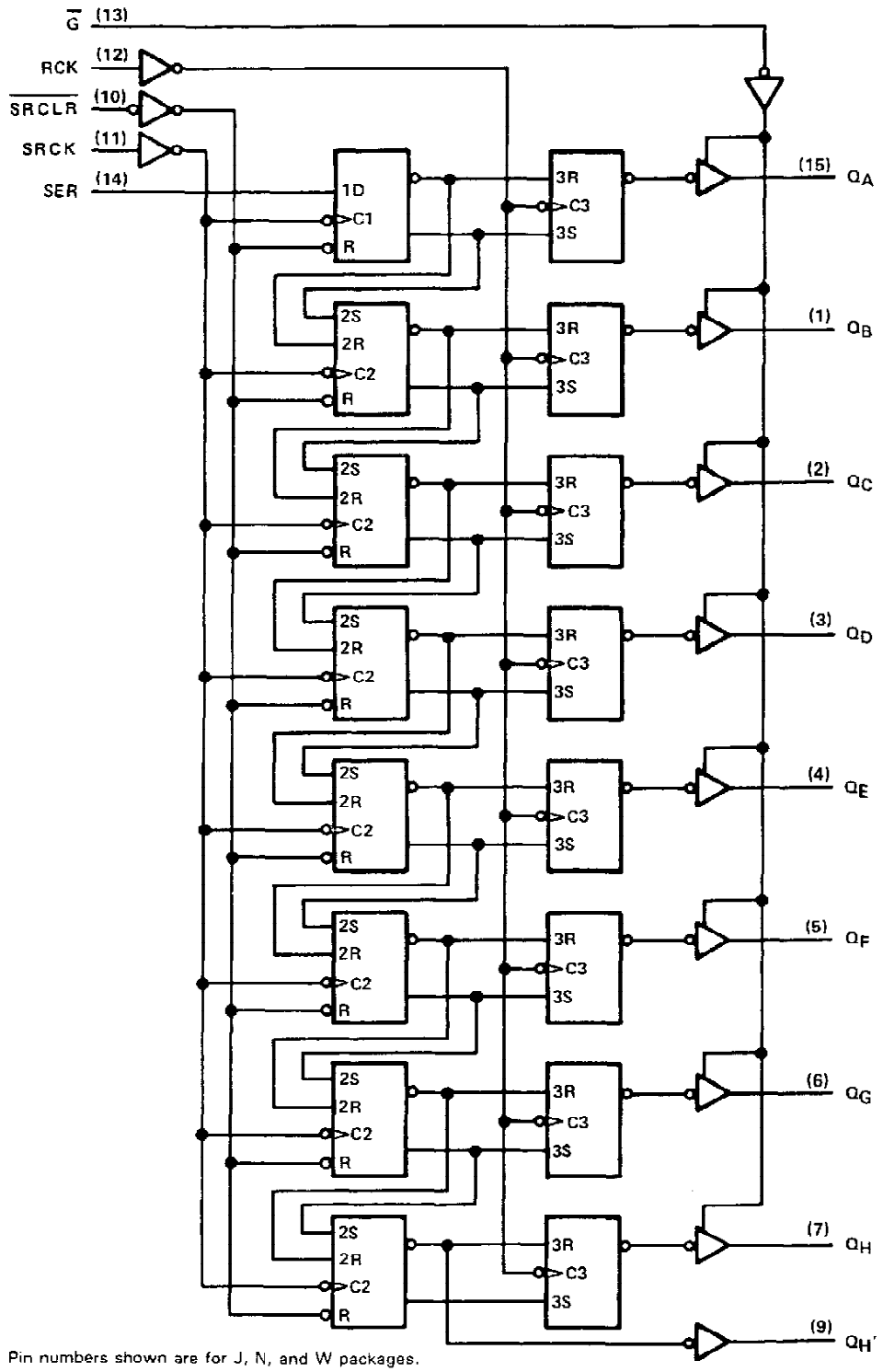
TYPICAL OF ALL OTHER OUTPUTS ('LS595)



TYPICAL OF ALL OTHER OUTPUTS ('LS596)

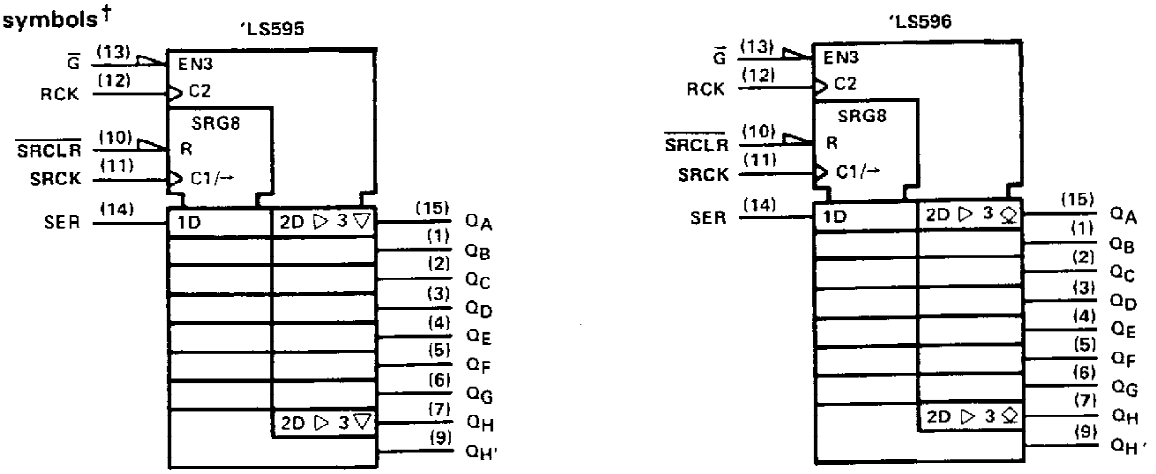


logic diagram (positive logic)



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

logic symbols†



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

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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage . . . . . 7 V
Off-state output voltage . . . . . 5.5 V
Operating free-air temperature range: SN54LS595, SN54LS596 . . . . . −55°C to 125°C
SN74LS595, SN74LS596 . . . . . 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
V_{OH}	High-level output voltage	Q_A thru Q_H, 'LS596 only			5.5			5.5	V
I_{OH}	High-level output current	Q_H'			−1			−1	mA
		Q_A thru Q_H, 'LS595 only			−1			−2.6	
I_{OL}	Low-level output current	Q_H'			8			16	mA
		Q			12			24	
f_{SRCK}	Shift clock frequency		0		20	0		20	MHz
$t_{w(SRCK)}$	Duration of shift clock pulse		25			25			ns
$t_{w(RCK)}$	Duration of register clock pulse		20			20			ns
$t_{w(\overline{SRCLR})}$	Duration of shift clear pulse, low level		20			20			ns
t_{su}	Setup time	$\overline{SRCLR}$ inactive before SRCK ↑	20			20			ns
		SER before SRCK ↑	20			20			
		SRCK ↑ before RCK ↑ (see Note 2)	40			40			
		$\overline{SRCLR}$ low before RCK ↑	40			40			
t_h	Hold time	SER after SRCK ↑	0			0			ns
T_A	Operating free-air temperature		−55		125	0		70	°C

NOTE 2: This setup time ensures the register will see stable data from the shift-register outputs. The clocks may be connected together, in which case the storage register state will be one clock pulse behind the shift register.

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_{IK}		V_{CC} = MIN, I_I = −18 mA				−1.5			−1.5	V
V_{OH}	'LS595 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		
	Q_H'		I_{OH} = −1 mA	2.4	3.2		2.4	3.2		
I_{OH}	'LS596 Q	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX, V_{OH} = 5.5 V				0.1			0.1	mA
V_{OL}	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	
	Q_H'		I_{OL} = 8 mA		0.25	0.4		0.25	0.4	
			I_{OL} = 16 mA					0.35	0.5	
I_{OZH}	'LS595 Q	V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = MAX, V_{OH} = 2.7 V				20			20	μA
I_{OZL}	'LS595 Q	V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = MAX, V_{OH} = 0.4 V				−20			−20	μA
I_I		V_{CC} = MAX, V_I = 7 V				0.1			0.1	mA
I_{IH}		V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	SER	V_{CC} = MAX, V_I = 0.4 V				−0.4			−0.4	mA
	All others					−0.2			−0.2	
I_{OS}§	'LS595 Q	V_{CC} = MAX, V_O = 0 V		−30		−130	−30		−130	mA
	Q_H'			−20		−100	−20		−100	
I_{CCH}	'LS595	V_{CC} = MAX, All possible inputs grounded, All outputs open			33	50		33	50	mA
	'LS596				30	45		30	45	
I_{CCL}	'LS595				42	65		42	65	mA
	'LS596				36	55		36	55	
I_{CCZ}	'LS595				44	65		44	65	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, and 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	'LS595			'LS596			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	SRCK ↑	Q_H'	R_L = 1kΩ, C_L = 30 pF		12	18		14	21	ns
t_{PHL}					17	25		20	30	ns
t_{PLH}	RCK ↑	Q_A thru Q_H	R_L = 667 Ω, C_L = 45 pF		12	18		28	42	ns
t_{PHL}					24	35		24	35	ns
t_{PZH}	$\overline{G}$ ↓	Q_A thru Q_H			20	30				ns
t_{PZL}					25	38				ns
t_{PHZ}	$\overline{G}$ ↑	Q_A thru Q_H	R_L = 667 Ω, C_L = 5 pF		20	30				ns
t_{PLZ}					25	38				ns
t_{PLH}	$\overline{G}$ ↑	Q_A thru Q_H	R_L = 667 Ω, C_L = 45 pF					40	60	ns
t_{PHL}	$\overline{G}$ ↓	Q_A thru Q_H						25	38	ns
t_{PHL}	$\overline{SRCLR}$ ↓	Q_H'	R_L = 1 kΩ, C_L = 30 pF		24	35		24	35	ns

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

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-8671701EA	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8671701EA SNJ54LS595J	Samples
5962-8671701FA	ACTIVE	CFP	W	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	Samples
5962-8671701FA	ACTIVE	CFP	W	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	Samples
SN54LS595J	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54LS595J	Samples
SN54LS595J	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54LS595J	Samples
SN74LS595D	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	Samples
SN74LS595D	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	Samples
SN74LS595DG4	ACTIVE	SOIC	D	16	40	TBD	Call TI	Call TI	0 to 70		Samples
SN74LS595DG4	ACTIVE	SOIC	D	16	40	TBD	Call TI	Call TI	0 to 70		Samples
SN74LS595DR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	Samples
SN74LS595DR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS595	Samples
SN74LS595N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74LS595N	Samples
SN74LS595N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74LS595N	Samples
SNJ54LS595J	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8671701EA SNJ54LS595J	Samples
SNJ54LS595J	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8671701EA SNJ54LS595J	Samples
SNJ54LS595W	ACTIVE	CFP	W	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	Samples
SNJ54LS595W	ACTIVE	CFP	W	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8671701FA SNJ54LS595W	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

OTHER QUALIFIED VERSIONS OF SN54LS595, SN74LS595 :

- Catalog : SN74LS595
- Military : SN54LS595

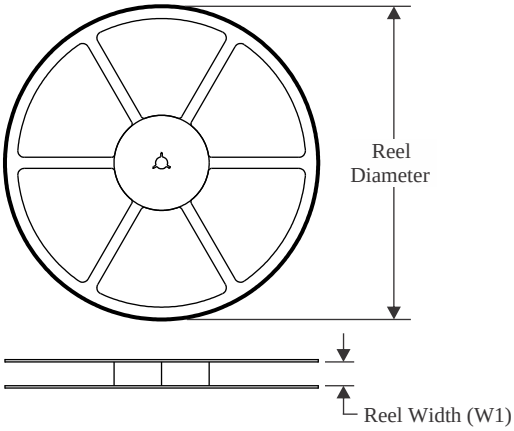
NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

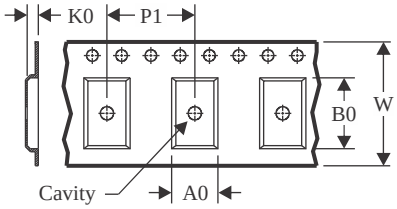
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

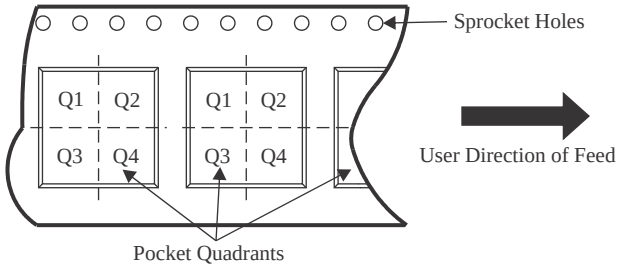


TAPE DIMENSIONS



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

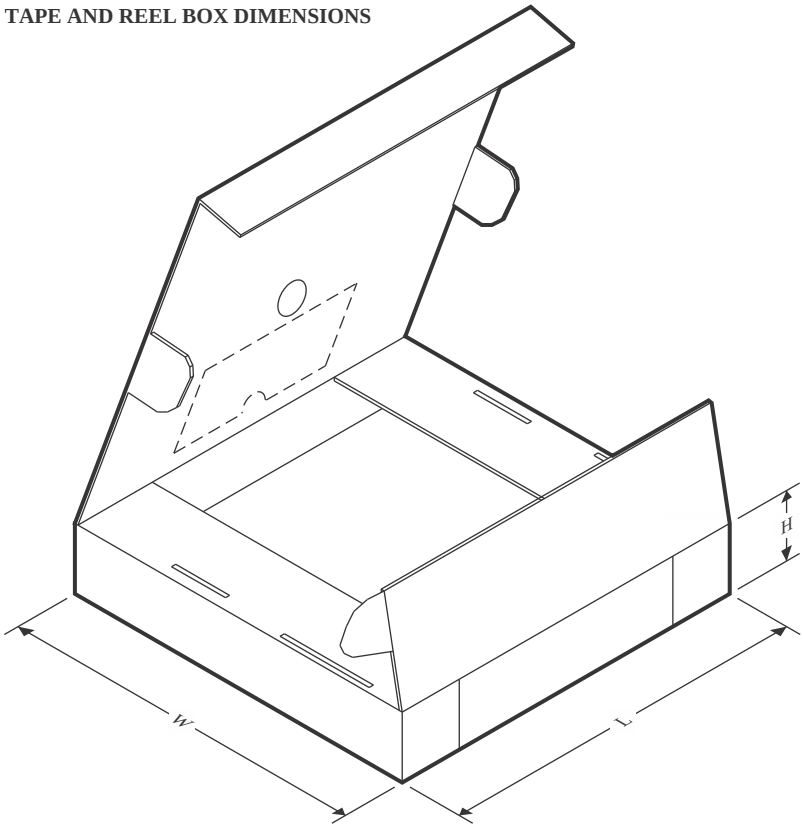
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74LS595DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

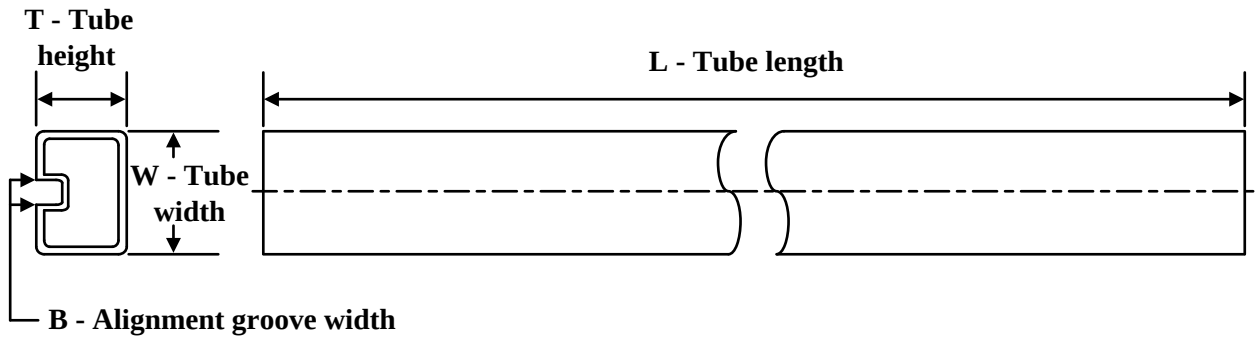
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS595DR	SOIC	D	16	2500	340.5	336.1	32.0

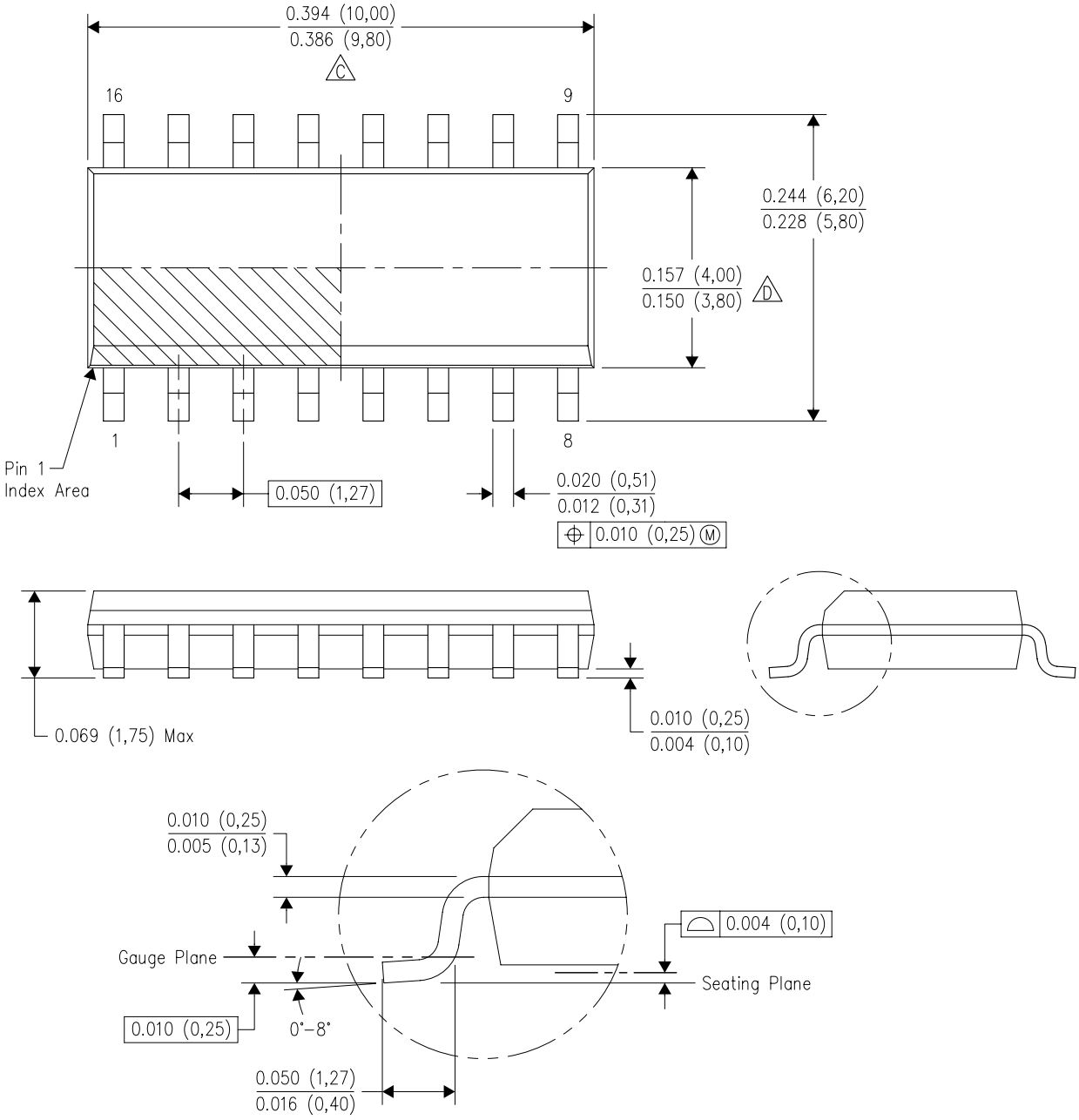
TUBE



*All dimensions are nominal

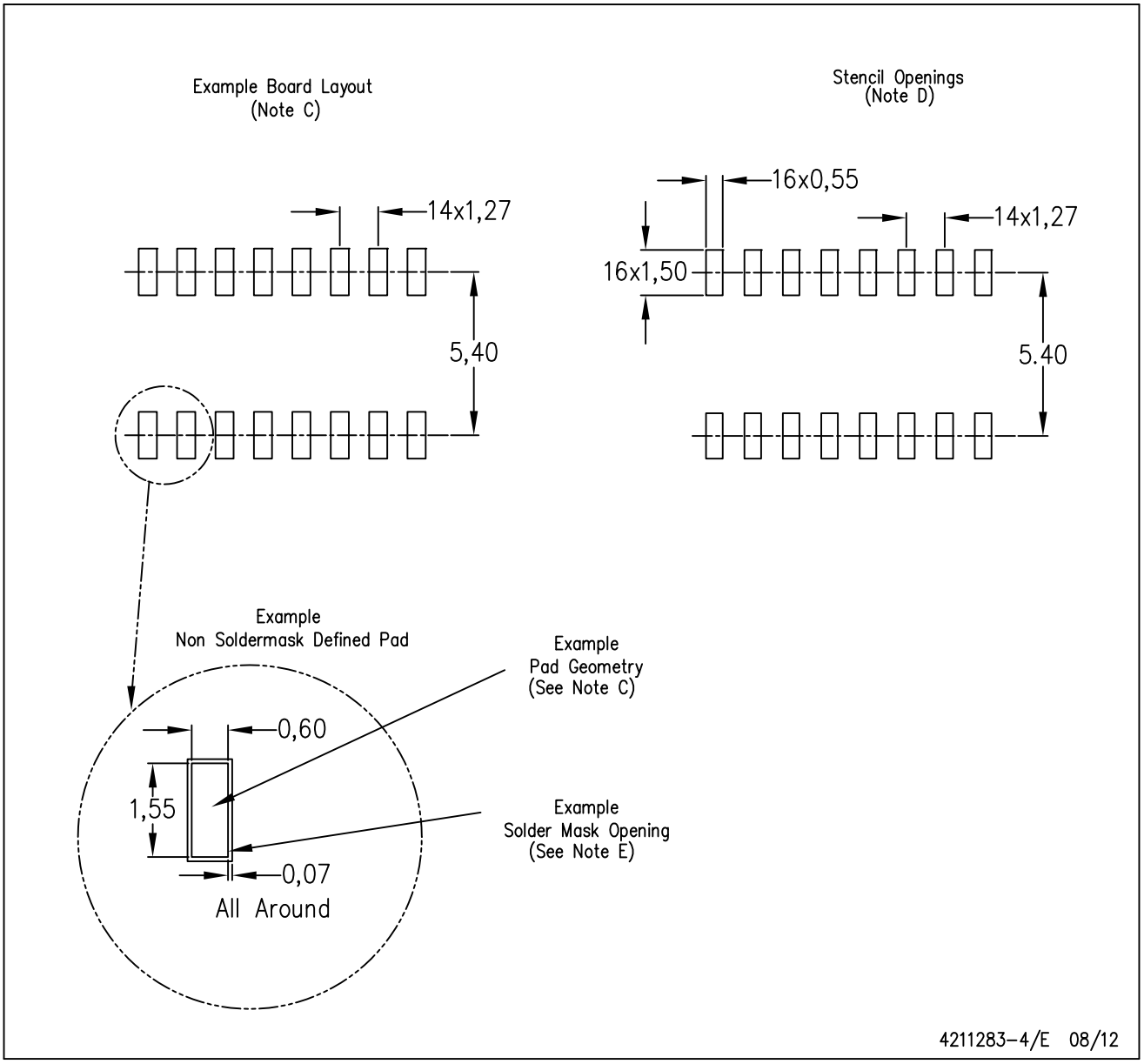
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-8671701FA	W	CFP	16	1	506.98	26.16	6220	NA
SN74LS595D	D	SOIC	16	40	507	8	3940	4.32
SN74LS595N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS595N	N	PDIP	16	25	506	13.97	11230	4.32
SNJ54LS595W	W	CFP	16	1	506.98	26.16	6220	NA

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.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE

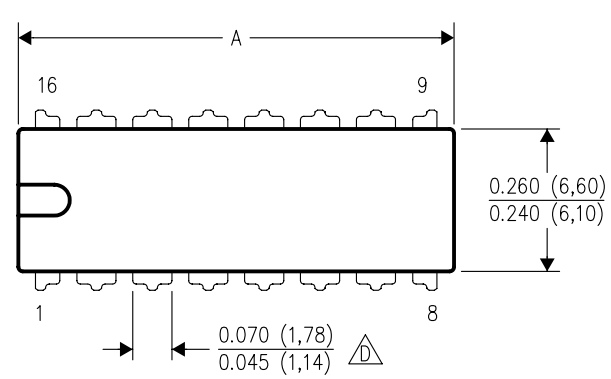


NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

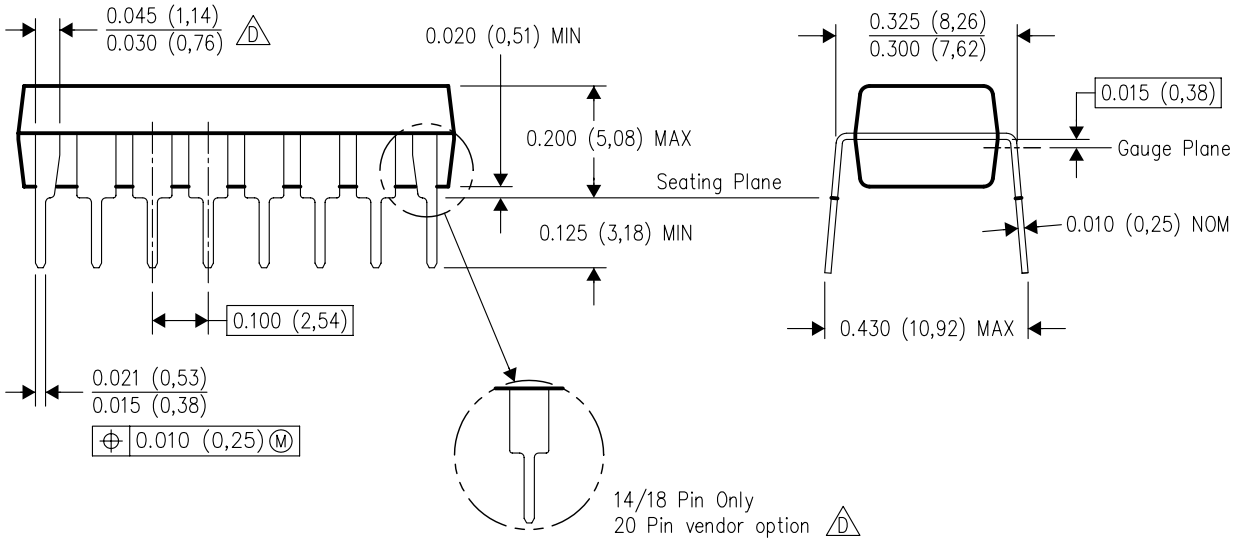
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



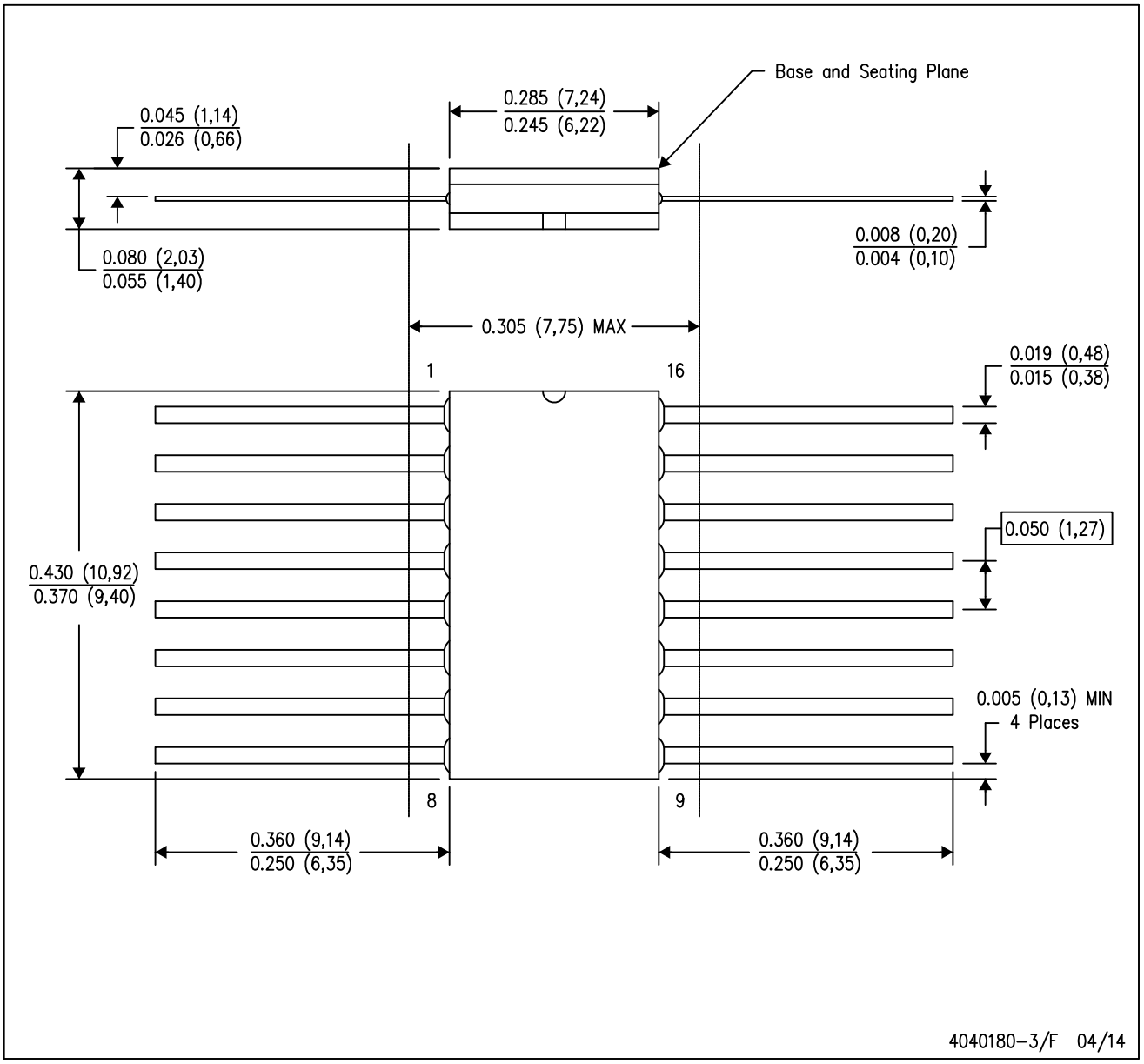
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



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.

W (R–GDFP–F16) CERAMIC DUAL FLATPACK

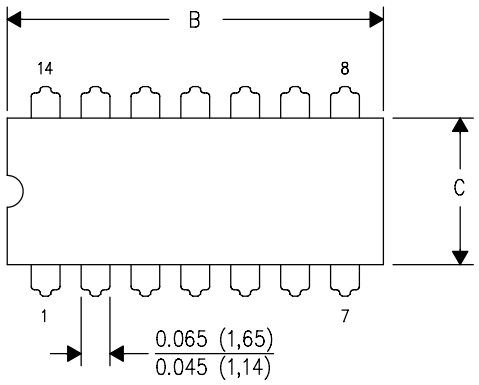


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP2–F16

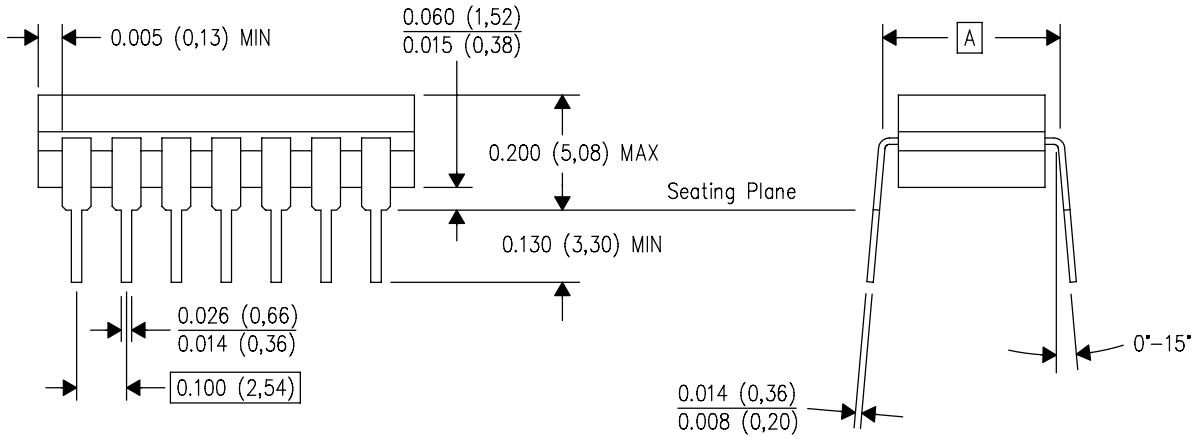
J (R–GDIP–T**)

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.

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