

SN74ALS533A, SN74AS533A OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

SDAS270 – DECEMBER 1994

- Eight Latches in a Single Package
- 3-State Bus-Driving Inverting Outputs
- Full Parallel Access for Loading
- Buffered Control Inputs
- pnp Inputs Reduce dc Loading on Data Lines
- Package Options Include Plastic Small-Outline (DW) Packages and Standard Plastic (N) 300-mil DIPs

description

These 8-bit D-type transparent latches feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

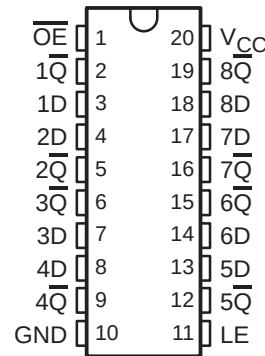
While latch-enable (LE) input is high, the $\bar{Q}$ outputs follow the complements of the data (D) inputs. When LE is taken low, the $\bar{Q}$ outputs are latched at the inverses of the levels set up at the D inputs. The SN74ALS533A and SN74AS533A are functionally equivalent to the SN74ALS373A and SN74AS373, except for having inverted outputs.

A buffered output-enable ($\overline{OE}$) input places the eight outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

$\overline{OE}$ does not affect the internal operations of the latches. Old data can be retained or new data can be entered while the outputs are off.

The SN74ALS533A and SN74AS533A are characterized for operation from 0°C to 70°C.

DW OR N PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each latch)

INPUTS			OUTPUT $\bar{Q}$
$\overline{OE}$	LE	D	
L	H	H	L
L	H	L	H
L	L	X	$\bar{Q}_0$
H	X	X	Z

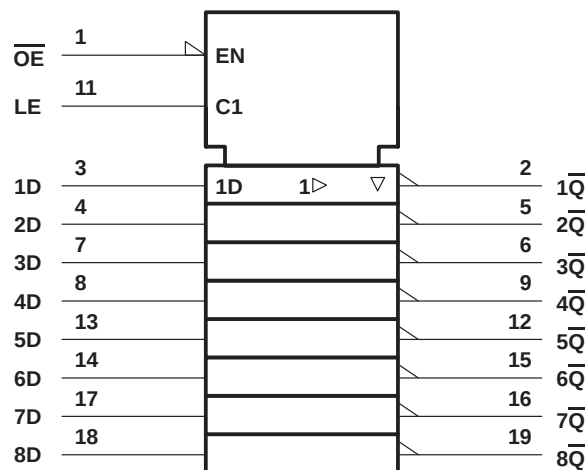
SN74ALS533A, SN74AS533A

OCTAL D-TYPE TRANSPARENT LATCHES

WITH 3-STATE OUTPUTS

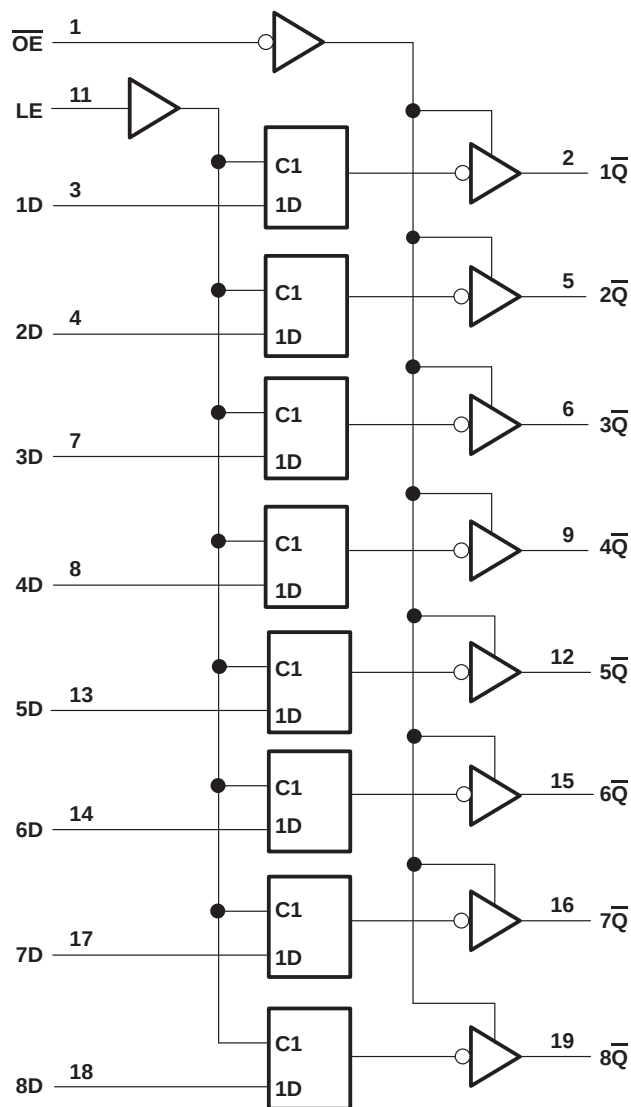
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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

Supply voltage, V_{CC}	7 V
Input voltage, V_I	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T_A : SN74ALS533A	0°C to 70°C
Storage temperature range	–65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

		SN74ALS533A			UNIT
		MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			V
V_{IL}	Low-level input voltage			0.8	V
I_{OH}	High-level output current			–2.6	mA
I_{OL}	Low-level output current			24	mA
t_w	Pulse duration, LE high	15			ns
t_{su}	Setup time, data before LE↓	15			ns
t_h	Hold time, data after LE↓	7			ns
T_A	Operating free-air temperature	0		70	°C

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

PARAMETER	TEST CONDITIONS		SN74ALS533A		UNIT
			MIN	TYP†	
V _{IK}	V _{CC} = 4.5 V,	I _I = −18 mA	−1.5		V
V _{OH}	V _{CC} = 4.5 V to 5.5 V,	I _{OH} = −0.4 mA	V _{CC} − 2		V
	V _{CC} = 4.5 V,	I _{OH} = −2.6 mA	2.4	3.2	
V _{OL}	V _{CC} = 4.5 V	I _{OL} = 12 mA	0.25	0.4	V
		I _{OL} = 24 mA	0.35	0.5	
I _{OZH}	V _{CC} = 5.5 V,	V _O = 2.7 V	20		μA
I _{OZL}	V _{CC} = 5.5 V,	V _O = 0.4 V	−20		μA
I _I	V _{CC} = 5.5 V,	V _I = 7 V	0.1		mA
I _{IH}	V _{CC} = 5.5 V,	V _I = 2.7 V	20		μA
I _{IL}	V _{CC} = 5.5 V,	V _I = 0.4 V	−0.1		mA
I _O [‡]	V _{CC} = 5.5 V,	V _O = 2.25 V	−30	−112	mA
I _{CC}	V _{CC} = 5.5 V	Outputs high	10	17	mA
		Outputs low	17	26	
		Outputs disabled	18.5	28	

† All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

SN74ALS533A, SN74AS533A

OCTAL D-TYPE TRANSPARENT LATCHES

WITH 3-STATE OUTPUTS

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switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T _A = MIN to MAX†		UNIT
			SN74ALS533A		
			MIN	MAX	
t _{PLH}	D	$\overline{Q}$	4	19	ns
t _{PHL}			4	13	
t _{PLH}	LE	Any $\overline{Q}$	5	23	ns
t _{PHL}			4	18	
t _{PZH}	$\overline{OE}$	Any $\overline{Q}$	1	17	ns
t _{PZL}			4	18	
t _{PHZ}	$\overline{OE}$	Any $\overline{Q}$	2	10	ns
t _{PLZ}			2	16	

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

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

Supply voltage, V _{CC}	7 V
Input voltage, V _I	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T _A : SN74AS533A	0°C to 70°C
Storage temperature range	–65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

		SN74AS533A			UNIT
		MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			V
V _{IL}	Low-level input voltage			0.8	V
I _{OH}	High-level output current			–15	mA
I _{OL}	Low-level output current			48	mA
t _w	Pulse duration, LE high	2			ns
t _{su}	Setup time, data before LE↓	2			ns
t _h	Hold time, data after LE↓	3			ns
T _A	Operating free-air temperature	0		70	°C



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WITH 3-STATE OUTPUTS
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		SN74AS533A			UNIT
			MIN	TYP†	MAX	
V _{IK}	V _{CC} = 4.5 V, I _I = −18 mA		−1.5			V
V _{OH}	V _{CC} = 4.5 V to 5.5 V, I _{OH} = −2 mA		V _{CC} − 2			V
	V _{CC} = 4.5 V, I _{OH} = −15 mA		2.4	3.3		
V _{OL}	V _{CC} = 4.5 V, I _{OL} = 48 mA		0.34		0.5	V
I _{OZH}	V _{CC} = 5.5 V, V _O = 2.7 V		50			μA
I _{OZL}	V _{CC} = 5.5 V, V _O = 0.4 V		−50			μA
I _I	V _{CC} = 5.5 V, V _I = 7 V		0.1			mA
I _{IH}	V _{CC} = 5.5 V, V _I = 2.7 V		20			μA
I _{IL}	V _{CC} = 5.5 V, V _I = 0.4 V		−0.02	−0.5		mA
I _O [‡]	V _{CC} = 5.5 V, V _O = 2.25 V		−30	−112		mA
I _{CC}	V _{CC} = 5.5 V	Outputs high	62	100		mA
		Outputs low	64	100		
		Outputs disabled	71	110		

[†] All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

[‡] The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

switching characteristics (see Figure 1)

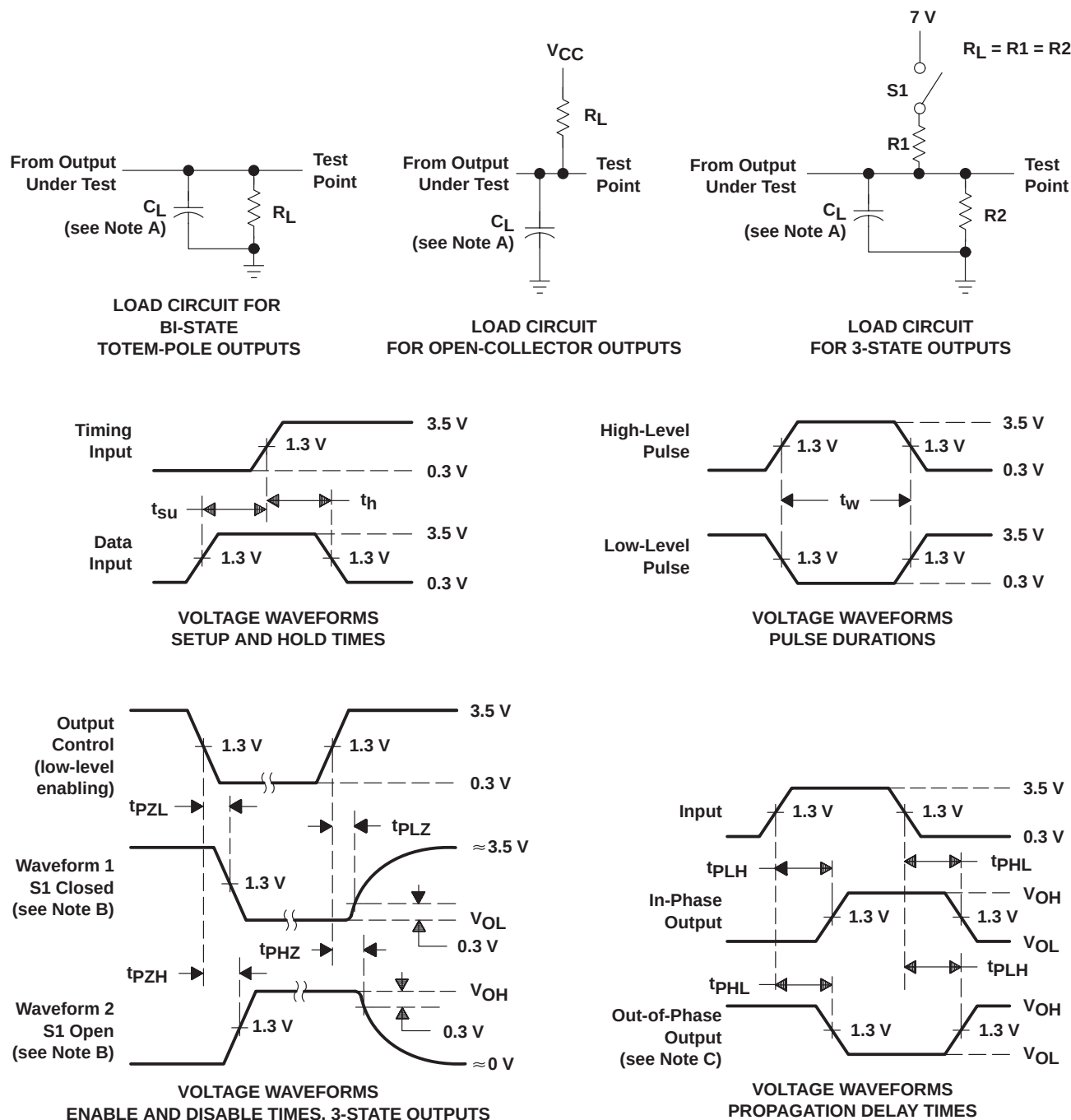
PARAMETER	FROM (INPUT)	TO (OUTPUT)	VCC = 4.5 V to 5.5 V, CL = 50 pF, R1 = 500 Ω, R2 = 500 Ω, TA = MIN to MAX§		UNIT
			SN74AS533A		
			MIN	MAX	
tPLH	D	$\overline{Q}$	4	7.5	ns
tPHL			4	7	
tPLH	LE	Any $\overline{Q}$	5	9	ns
tPHL			4	8	
tPZH	$\overline{OE}$	Any $\overline{Q}$	2	6.5	ns
tPZL			4	9.5	
tPHZ	$\overline{OE}$	Any $\overline{Q}$	2	6.5	ns
tPLZ			3	7	

^{\S} For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

SN74ALS533A, SN74AS533A OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

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PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 C. When measuring propagation delay items of 3-state outputs, switch S1 is open.
 D. All input pulses have the following characteristics: $PRR \leq 1 \text{ MHz}$, $t_r = t_f = 2 \text{ ns}$, duty cycle = 50%.
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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)
SN74ALS533ADW	Active	Production	SOIC (DW) 20	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS533A
SN74ALS533ADW.A	Active	Production	SOIC (DW) 20	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS533A
SN74ALS533AN	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74ALS533AN
SN74ALS533AN.A	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74ALS533AN
SN74ALS533ANSR	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS533A
SN74ALS533ANSR.A	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS533A

⁽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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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
SN74ALS533ANSR	SOP	NS	20	2000	330.0	24.4	8.4	13.0	2.5	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)
SN74ALS533ANSR	SOP	NS	20	2000	356.0	356.0	45.0

TUBE



*All dimensions are nominal

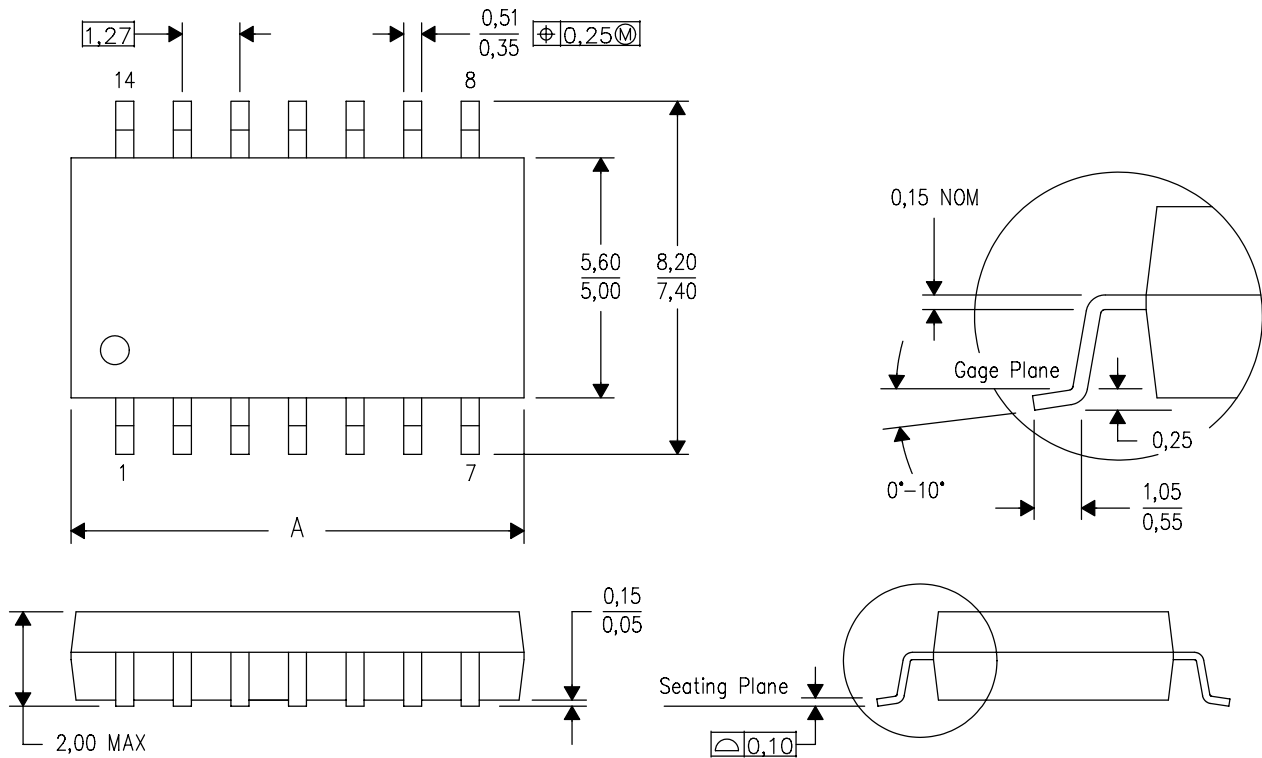
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74ALS533ADW	DW	SOIC	20	25	507	12.83	5080	6.6
SN74ALS533ADW.A	DW	SOIC	20	25	507	12.83	5080	6.6
SN74ALS533AN	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS533AN.A	N	PDIP	20	20	506	13.97	11230	4.32

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

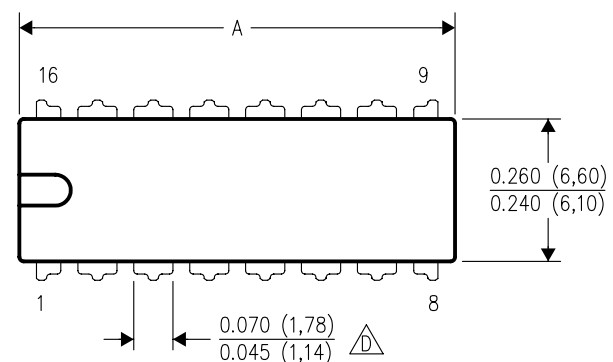
4040062/C 03/03

- 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.

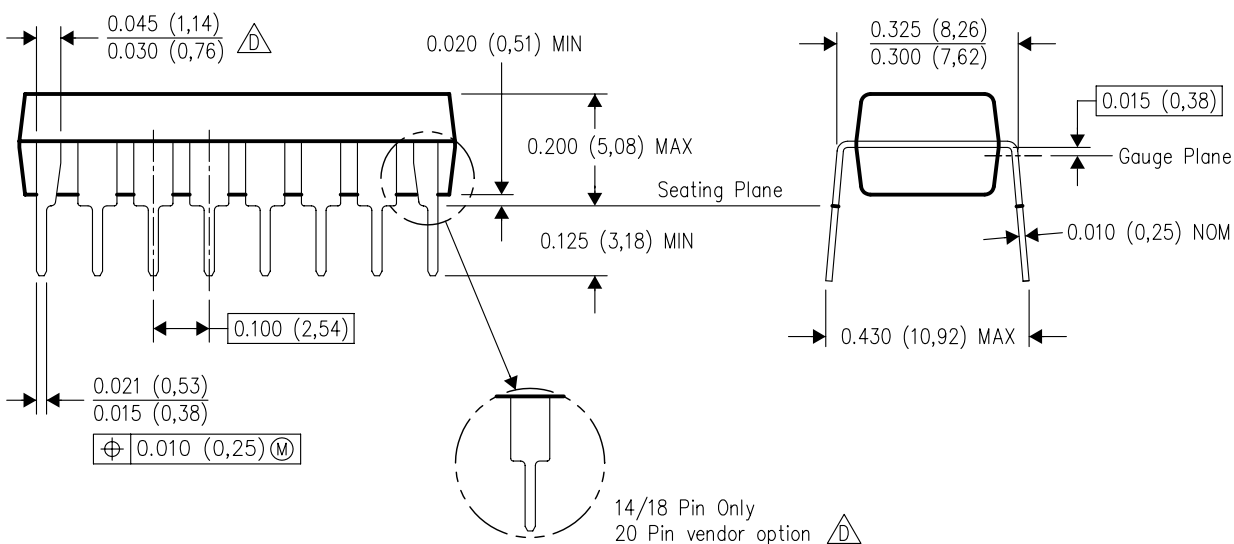
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	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

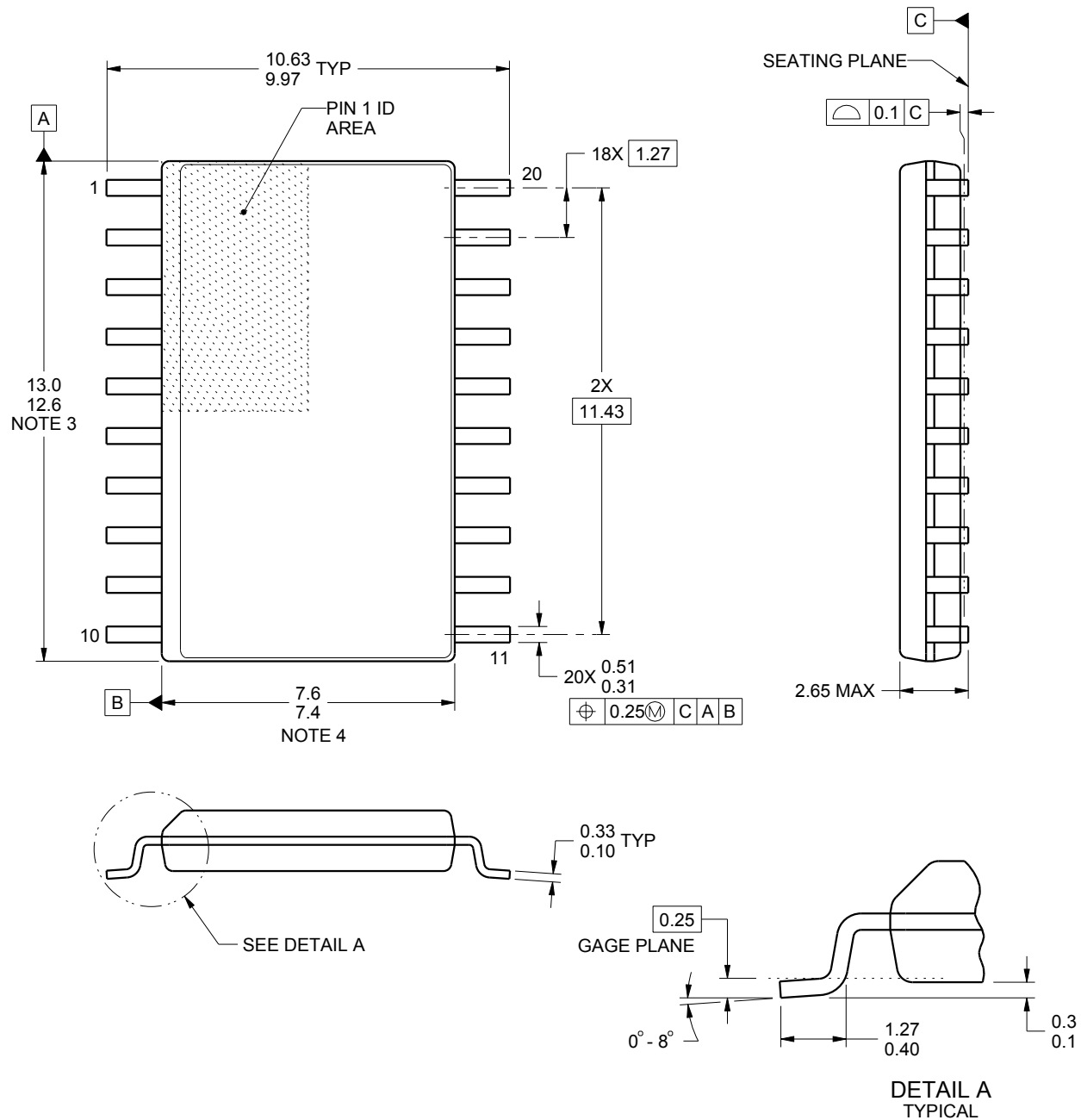
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 -  The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW0020A

PACKAGE OUTLINE

SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

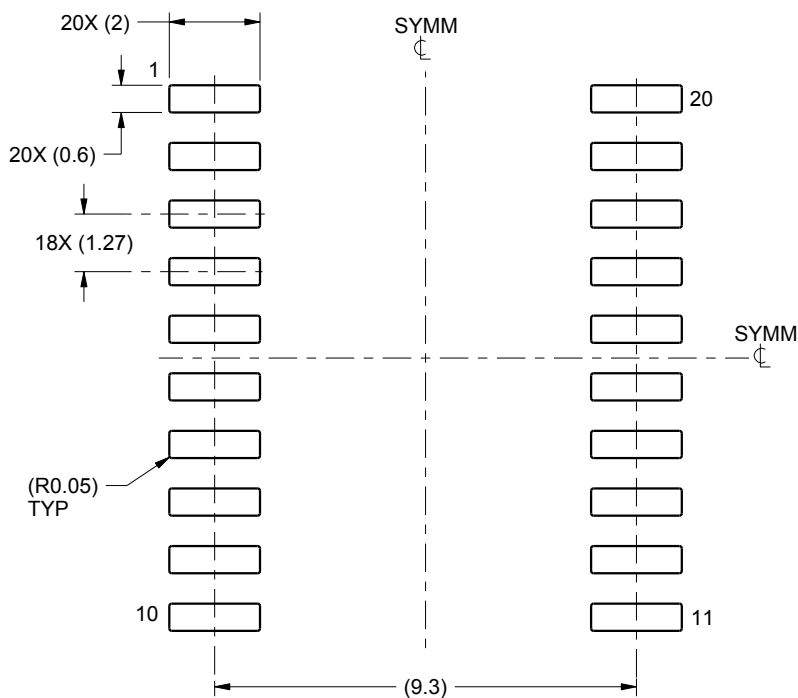
NOTES:

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-013.

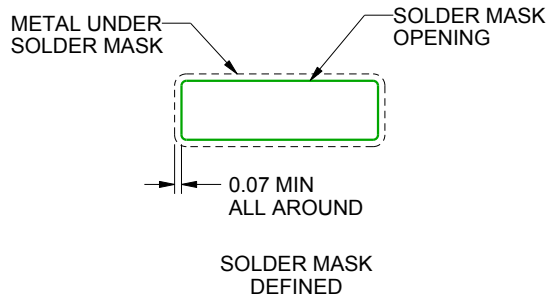
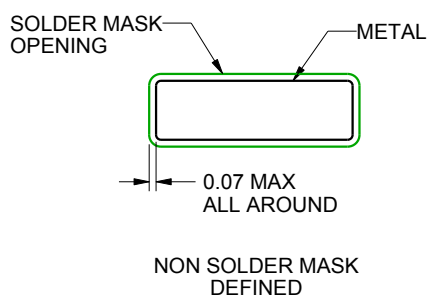
DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

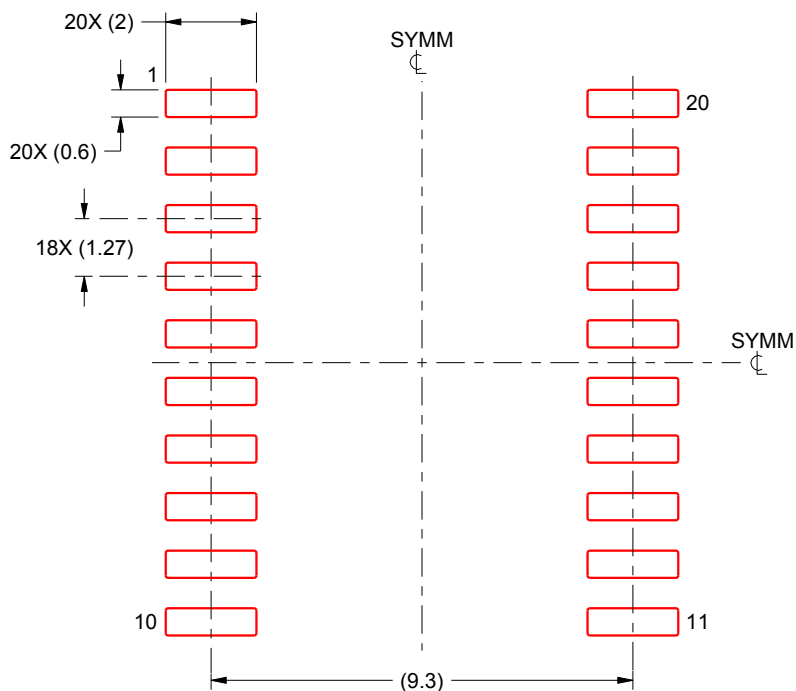
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



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.

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