

SN54ALS573C, SN54AS573A, SN74ALS573C, SN74AS573A OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

SDAS048D – DECEMBER 1989 – REVISED JANUARY 1995

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- True Logic Outputs
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), Standard Plastic (N) and Ceramic (J) 300-mil DIPs, and Ceramic Flat (W) Packages

description

These octal 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.

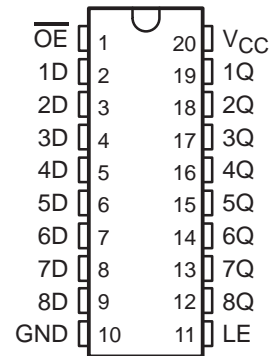
While the latch-enable (LE) input is high, outputs (Q) respond to the data (D) inputs. When LE is low, the outputs are latched to retain the data that was set up.

A buffered output-enable (\overline{OE}) input can be used to place the eight outputs in either a normal logic state (high or low) 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 the increased drive provide the capability to drive bus lines without interface or pullup components.

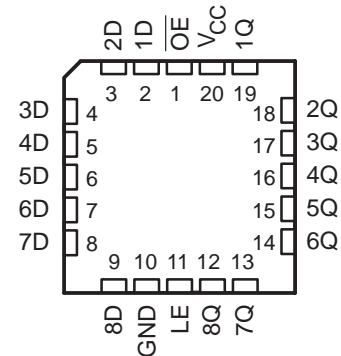
\overline{OE} does not affect internal operation of the latches. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54ALS573C and SN54AS573A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS573C and SN74AS573A are characterized for operation from 0°C to 70°C .

SN54ALS573C, SN54AS573A . . . J OR W PACKAGE
SN74ALS573C, SN74AS573A . . . DW OR N PACKAGE
(TOP VIEW)



SN54ALS573C, SN54AS573A . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each latch)

INPUTS			OUTPUT
\overline{OE}	LE	D	Q
L	H	H	H
L	H	L	L
L	L	X	Q_0
H	X	X	Z

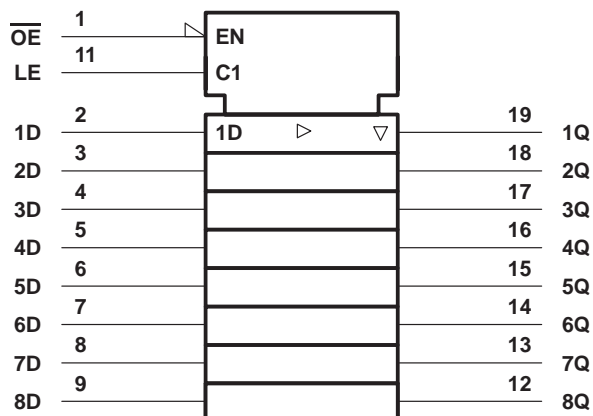
SN54ALS573C, SN54AS573A, SN74ALS573C, SN74AS573A

OCTAL D-TYPE TRANSPARENT LATCHES

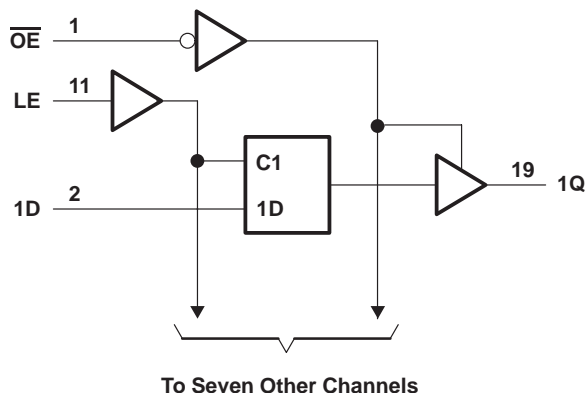
WITH 3-STATE OUTPUTS

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logic symbol†



logic diagram (positive logic)



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

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 : SN54ALS573C	-55°C to 125°C
SN74ALS573C	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

	SN54ALS573C			SN74ALS573C			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC} Supply voltage	4.5	5	5.5	4.5	5	5.5	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			-1			-2.6	mA
I_{OL} Low-level output current			12			24	mA
t_w Pulse duration, LE high	25			10			ns
t_{su} Setup time, data before LE↓	10			10			ns
t_h Hold time, data after LE↓	7			7			ns
T_A Operating free-air temperature	-55		125	0		70	°C

SN54ALS573C, SN54AS573A, SN74ALS573C, SN74AS573A

OCTAL D-TYPE TRANSPARENT LATCHES

WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS		SN54ALS573C		SN74ALS573C		UNIT
			MIN	TYP†	MAX	MIN	
V_{IK}	$V_{CC} = 4.5\text{ V}$,	$I_I = -18\text{ mA}$	-1.2		-1.2		V
V_{OH}	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$,	$I_{OH} = -0.4\text{ mA}$	$V_{CC} - 2$		$V_{CC} - 2$		V
	$V_{CC} = 4.5\text{ V}$	$I_{OH} = -1\text{ mA}$	2.4	3.3			
V_{OL}	$V_{CC} = 4.5\text{ V}$	$I_{OL} = 12\text{ mA}$	0.25	0.4	0.25	0.4	V
		$I_{OL} = 24\text{ mA}$			0.35	0.5	
I_{OZH}	$V_{CC} = 5.5\text{ V}$,	$V_O = 2.7\text{ V}$	20		20		μA
I_{OZL}	$V_{CC} = 5.5\text{ V}$,	$V_O = 0.4\text{ V}$	-20		-20		μA
I_I	$V_{CC} = 5.5\text{ V}$,	$V_I = 7\text{ V}$	0.1		0.1		mA
I_{IH}	$V_{CC} = 5.5\text{ V}$,	$V_I = 2.7\text{ V}$	20		20		μA
I_{IL}	$V_{CC} = 5.5\text{ V}$,	$V_I = 0.4\text{ V}$	-0.13		-0.1		mA
$I_{O\ddagger}$	$V_{CC} = 5.5\text{ V}$,	$V_O = 2.25\text{ V}$	-20	-112	-30	-112	mA
I_{CC}	$V_{CC} = 5.5\text{ V}$	Outputs high	10	17	10	17	mA
		Outputs low	15	24	15	24	
		Outputs disabled	16	27	16	27	

† 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)	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $C_L = 50\text{ pF}$, $R_1 = 500\ \Omega$, $R_2 = 500\ \Omega$, $T_A = \text{MIN to MAX}\S$				UNIT
			SN54ALS573C		SN74ALS573C		
			MIN	MAX	MIN	MAX	
t_{PLH}	D	Q	2	20	2	14	ns
t_{PHL}			2	17	2	14	
t_{PLH}	LE	Q	8	33	6	20	ns
t_{PHL}			8	24	6	19	
t_{PZH}	\overline{OE}	Q	4	28	3	18	ns
t_{PZL}			4	21	4	18	
t_{PHZ}	\overline{OE}	Q	2	20	1	10	ns
t_{PLZ}			3	26	1	15	

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



SN54ALS573C, SN54AS573A, SN74ALS573C, SN74AS573A

OCTAL D-TYPE TRANSPARENT LATCHES

WITH 3-STATE OUTPUTS

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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 : SN54AS573A	–55°C to 125°C
SN74AS573A	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

		SN54AS573A			SN74AS573A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{OH}	High-level output current			–12			–15	mA
I_{OL}	Low-level output current			32			48	mA
t_w^*	Pulse duration, LE high	5.5			4.5			ns
t_{su}^*	Setup time, data before LE↓	2			2			ns
t_h^*	Hold time, data after LE↓	3			3			ns
T_A	Operating free-air temperature	–55		125	0		70	°C

* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

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

PARAMETER	TEST CONDITIONS	SN54AS573A			SN74AS573A			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}	$V_{CC} = 4.5$ V, $I_I = -18$ mA			–1.2			–1.2	V
V_{OH}	$V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -2$ mA	$V_{CC} - 2$			$V_{CC} - 2$			V
	$V_{CC} = 4.5$ V, $I_{OH} = -12$ mA	2.4	3.2		2.4	3.3		
	$V_{CC} = 4.5$ V, $I_{OH} = -15$ mA							
V_{OL}	$V_{CC} = 4.5$ V, $I_{OL} = 32$ mA		0.28	0.5				V
	$V_{CC} = 4.5$ V, $I_{OL} = 48$ mA					0.33	0.5	
I_{OZH}	$V_{CC} = 5.5$ V, $V_O = 2.7$ V			50			50	μA
I_{OZL}	$V_{CC} = 5.5$ V, $V_O = 0.4$ V			–50			–50	μA
I_I	$V_{CC} = 5.5$ V, $V_I = 7$ V			0.1			0.1	mA
I_{IH}	$V_{CC} = 5.5$ V, $V_I = 2.7$ V			20			20	μA
I_{IL}	$V_{CC} = 5.5$ V, $V_I = 0.4$ V			–0.1			–0.5	mA
$I_{O§}$	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	–30		–112	–30		–112	mA
I_{CC}	$V_{CC} = 5.5$ V, Outputs high		56	93		56	93	mA
	$V_{CC} = 5.5$ V, Outputs low		55	90		55	90	
	$V_{CC} = 5.5$ V, Outputs disabled		65	106		65	106	

‡ All typical values are at $V_{CC} = 5$ 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} .



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switching characteristics (see Figure 1)

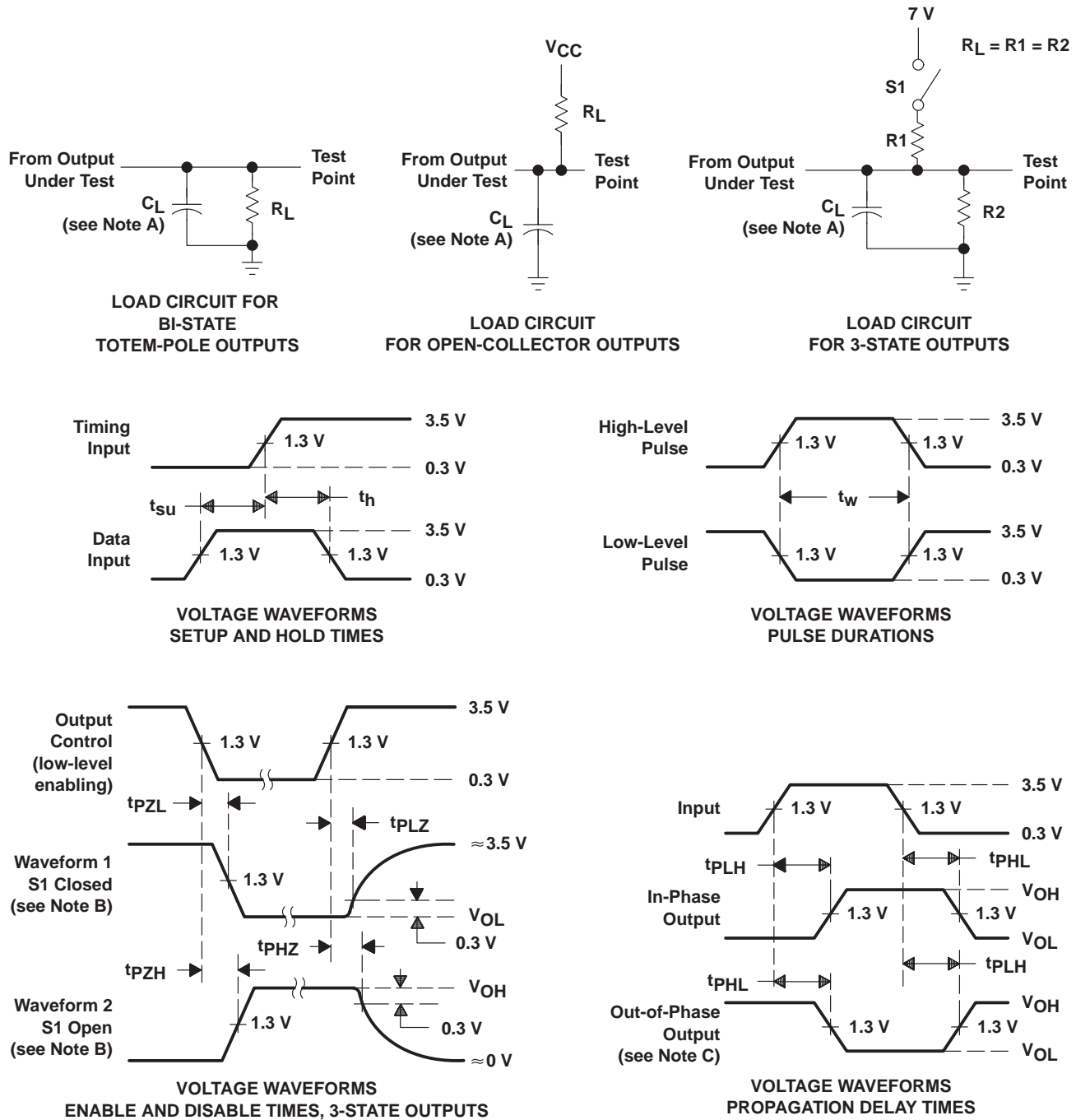
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX†				UNIT
			SN54AS573A		SN74AS573A		
			MIN	MAX	MIN	MAX	
t _{PLH}	D	Q	3	11	3	8	ns
t _{PHL}			3	8	3	7	
t _{PLH}	LE	Q	6	16.5	6	13	ns
t _{PHL}			4	9	4	7.5	
t _{PZH}	$\overline{\text{OE}}$	Q	2	8	2	6.5	ns
t _{PZL}			4	11	4	9.5	
t _{PHZ}	$\overline{\text{OE}}$	Q	2	8	2	6.5	ns
t _{PLZ}			2	8	2	7	

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

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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: $PRR \leq 1$ MHz, $t_r = t_f = 2$ 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 Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
84012012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
8401201RA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
8401201SA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
JM38510/38201B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/38201BRA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SN54ALS573CJ	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SN54AS573AJ	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SN74ALS573CDBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
SN74ALS573CDBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CDWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS573CN3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74ALS573CNE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS573CNSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CNSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS573CNSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS573ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS573ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS573ADWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS573ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS573ADWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS573ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
						no Sb/Br)		
SN74AS573AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS573AN3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74AS573ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ54ALS573CFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54ALS573CJ	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54ALS573CW	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SNJ54AS573AFK	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
SNJ54AS573AJ	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type

⁽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⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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TAPE AND REEL INFORMATION



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
SN74ALS573CDBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74ALS573CDWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74ALS573CNSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1
SN74AS573ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	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)
SN74ALS573CDBR	SSOP	DB	20	2000	346.0	346.0	33.0
SN74ALS573CDWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74ALS573CNSR	SO	NS	20	2000	346.0	346.0	41.0
SN74AS573ADWR	SOIC	DW	20	2000	346.0	346.0	41.0

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- 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.
 D. Falls within JEDEC MO-150

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

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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 metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- 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.

W (R-GDFP-F20)

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-F20

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AC.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

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

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