SDAS225A - DECEMBER 1982 - REVISED JANUARY 1995

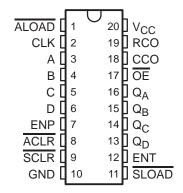
- Carry Output for n-Bit Cascading
- Buffer-Type Outputs Drive Bus Lines Directly
- Choice of Asynchronous or Synchronous Clearing and Loading
- Internal Look-Ahead Circuitry for Fast Cascading
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

#### description

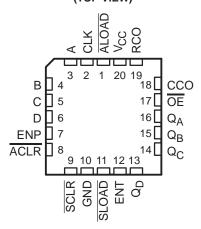
These binary counters are programmable and offer synchronous and asynchronous clearing as well as synchronous and asynchronous loading. All synchronous functions are executed on the positive-going edge of the clock.

The clear function is initiated by applying a low level to either asynchronous clear (ACLR) or synchronous clear (SCLR). ACLR (direct clear) overrides all other functions of the device, while SCLR overrides only the other synchronous functions. Data is loaded from the A, B, C, and D inputs by applying a low level to asynchronous load (ALOAD) or by the combination of a low level at synchronous load (SLOAD) and a positive-going clock transition. The counting function is enabled only when enable P (ENP), enable T (ENT), ACLR, ALOAD, SCLR, and SLOAD are all high.

SN54ALS561A... J PACKAGE SN74ALS561A... DW OR N PACKAGE (TOP VIEW)



SN54ALS561A . . . FK PACKAGE (TOP VIEW)



A high level at the output-enable ( $\overline{OE}$ ) input forces the Q outputs into the high-impedance state, and a low level enables those outputs. Counting is independent of  $\overline{OE}$ . ENT is fed forward to enable the ripple-carry output (RCO) to produce a high-level pulse while the count is maximum (15). The clocked carry output (CCO) produces a high-level pulse for a duration equal to that of the low level of the clock when RCO is high and the counter is enabled (ENP and ENT are high); otherwise, CCO is low. CCO does not have the glitches commonly associated with a ripple-carry output. Cascading is normally accomplished by connecting RCO or CCO of the first counter to ENT of the next counter. However, for very high-speed counting, RCO should be used for cascading because CCO does not become active until the clock returns to the low level.

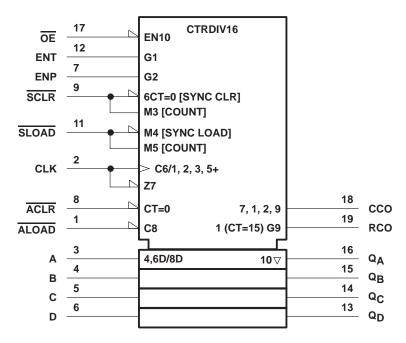
The SN54ALS561A is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74ALS561A is characterized for operation from 0°C to 70°C.

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#### **FUNCTION TABLE**

		ODEDATION						
ŌE	ACLR	ALOAD	SCLR	SLOAD	ENT	ENP	CLK	OPERATION
Н	Х	Х	Χ	Х	Χ	Χ	Χ	Q outputs disabled
L	L	X	X	X	Χ	X	X	Asynchronous clear
L	Н	L	X	X	Χ	Χ	X	Asynchronous load
L	Н	Н	L	X	Χ	Χ	$\uparrow$	Synchronous clear
L	Н	Н	Н	L	Χ	Χ	$\uparrow$	Synchronous load
L	Н	Н	Н	Н	Н	Н	$\uparrow$	Count
L	Н	Н	Н	Н	L	Χ	Χ	Inhibit counting
L	Н	Н	Н	Н	Χ	L	X	Inhibit counting

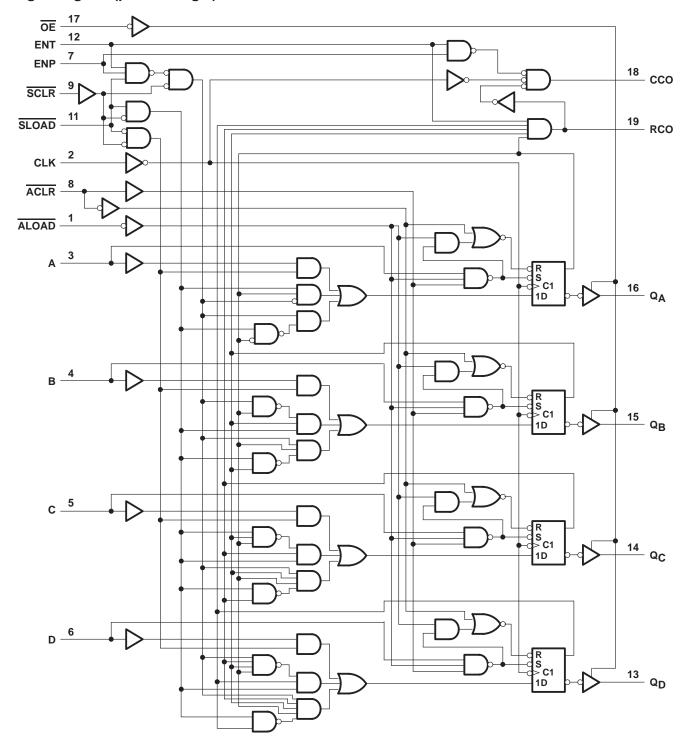
## logic symbol†



<sup>&</sup>lt;sup>†</sup> This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

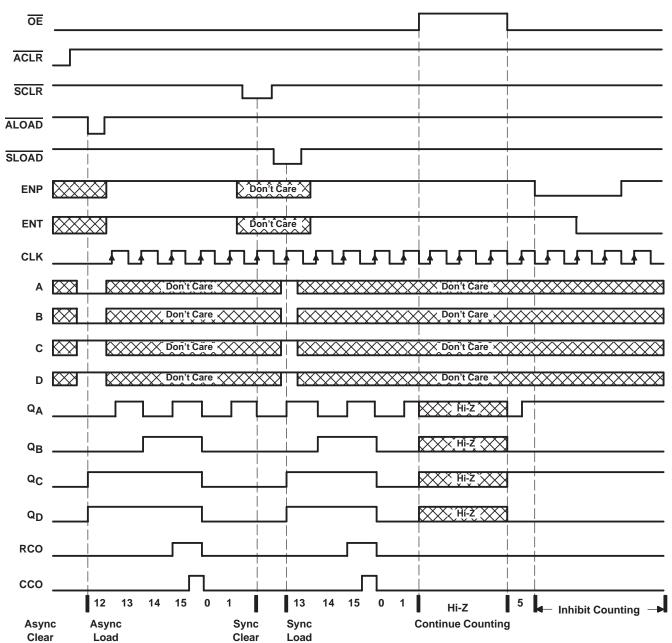


# logic diagram (positive logic)





## typical load, count, and inhibit sequences





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

Supply voltage, V <sub>CC</sub>	7 \
Input voltage, V <sub>I</sub>	7 \
Operating free-air temperature range, T <sub>A</sub> : SN54ALS561A	-55°C to 125°C
SN74ALS561A	0°C to 70°C
Storage temperature range	-65°C to 150°C

### recommended operating conditions

				SN54ALS561A			SN74ALS561A			UNIT
				MIN	NOM	MAX	MIN	NOM	MAX	UNII
Vсс	Supply voltage			4.5	5	5.5	4.5	5	5.5	V
VIH	High-level input voltage		2			2			V	
VIL	Low-level input voltage					0.7			0.8	V
1	High level systems are accessed	Q outputs				-1			-2.6	A
ЮН	High-level output current	CCO and RCO				-0.4			-0.4	mA
	Lauren autaut aumant	Q outputs				12			24	
lOL	Low-level output current	CCO and RCO			4			8	mA	
fclock	Clock frequency			0		20	0		30	MHz
	Pulse duration	ACLR or ALOAD I	20			15			ns	
t <sub>W</sub>		CLK high	20			16.5				
		CLK low	25			16.5				
		ENP, ENT	High	25			20			
			Low	25			20			
		Data at A, B, C, D		25			20			
	- · · · · · · · · · · · · · · · · · · ·		Low	21			15			
t <sub>su</sub>	Setup time before CLK↑	SCLR	High (inactive)	35			30			ns
			Low	20			15			
		SLOAD	High (inactive)	35			30			
		ACLR or ALOAD i	12			10				
t <sub>h</sub>	Hold time after CLK↑ for da	ata, ENP, ENT, SCLF	0			0			ns	
T <sub>A</sub>	Operating free-air tempera	ture		-55		125	0	-	70	°C



<sup>†</sup> 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.

## **SN54ALS561A**, **SN74ALS561A SYNCHRONOUS 4-BIT COUNTERS WITH 3-STATE OUTPUTS**

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

PARAMETER		TEST COL	SN5	4ALS56	1A	SN7	UNIT				
		lesi coi	TEST CONDITIONS			MAX	MIN	TYP <sup>†</sup>	MAX	UNII	
٧ıK		V <sub>CC</sub> = 4.5 V,	I <sub>I</sub> = -18 mA			-1.5			-1.5	V	
	All outputs	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$	$I_{OH} = -0.4 \text{ mA}$	V <sub>CC</sub> -2	2		V <sub>CC</sub> -2	2			
Vон	Q outputs	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	$I_{OH} = -1 \text{ mA}$	2.4	3.3					V	
	Q outputs	V <sub>CC</sub> = 4.5 V	$I_{OH} = -2.6 \text{ mA}$				2.4	3.2			
	Q outputs	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	I <sub>OL</sub> = 12 mA		0.25	0.4		0.25	0.4		
\/a.	Qoulpuis	V <sub>CC</sub> = 4.5 V	I <sub>OL</sub> = 24 mA					0.35	0.5	V	
VOL	CCO and RCO	V <sub>CC</sub> = 4.5 V	I <sub>OL</sub> = 4 mA		0.25	0.4		0.25	0.4		
	CCO and RCO		$I_{OL} = 8 \text{ mA}$					0.35	0.5		
lozh		V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 2.7 V			20			20	μΑ	
lozL		V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 0.4 V			-20			-20	μΑ	
1.	ENP and ENT	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	\/. <b>7</b> \/			0.2			0.2	A	
11	Other inputs	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 7 V		0.1				0.1	mA	
Luci	ENP and ENT	V 55V	V. 07V			40			40	^	
lН	Other inputs	$V_{CC} = 5.5 \text{ V},$	V <sub>I</sub> = 2.7 V			20			20	μΑ	
I <sub>IL</sub>		$V_{CC} = 5.5 V,$	V <sub>I</sub> = 0.4 V			-0.2			-0.2	mA	
. +	CCO and RCO	V 55V	V- 2.25 V	-15		-70	-15		-70	mA	
lO‡	Q	$V_{CC} = 5.5 \text{ V},$	$V_0 = 2.25 \text{ V}$	-20		-112	-30		-112		
			Outputs high		17	27		17	27	mA	
ICC		V <sub>CC</sub> = 5.5 V	Outputs low		21	33		21	33		
			Outputs disabled		22	36		22	36		



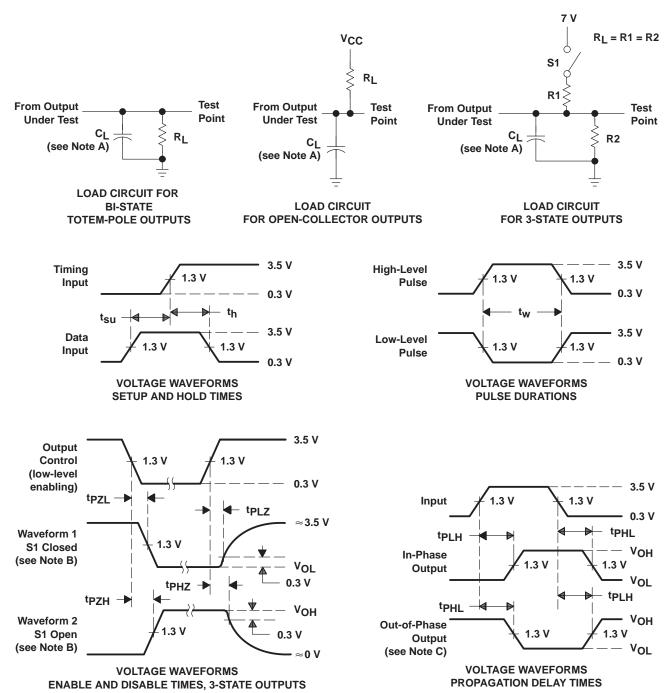
<sup>†</sup> All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C. ‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

## switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	C <sub>I</sub> R'	$V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, R1 = 500 $\Omega$ , R2 = 500 $\Omega$ , $T_A$ = MIN to MAX $^\dagger$				
			SN54AL	S561A	SN74AL			
			MIN	MAX	MIN	MAX		
f <sub>max</sub>			20		30		MHz	
<sup>t</sup> PLH	CLK	Any Q	4	15	4	12	ns	
<sup>t</sup> PHL	OLK	Ally Q	5	21	5	18	113	
<sup>t</sup> PLH	CLK	RCO	9	35	9	29	ns	
<sup>t</sup> PHL	OLIX	Koo	8	29	8	24	113	
<sup>t</sup> PLH	CLK	cco	8	35	8	26	ns	
<sup>t</sup> PHL	OLK .	000	5	20	5	16		
<sup>t</sup> PLH	ALOAD	Any Q	10	38	10	35	ns	
<sup>t</sup> PHL	ALOAD	Arry Q	7	27	7	23		
<sup>t</sup> PLH	ALOAD	RCO	15	50	15	40	ns	
<sup>t</sup> PHL	ALOAD	, KCO	12	35	12	30		
<sup>t</sup> PLH	ALOAD	CCO	25	65	25	55	ns	
<sup>t</sup> PHL	ALOAD	000	12	42	12	33		
<sup>t</sup> PLH	A D OD	Any Q	8	35	8	30	ns	
<sup>t</sup> PHL	A, B, C, or D	Arry Q	7	27	7	22		
t <sub>PLH</sub>	ENT	RCO	5	20	5	16	20	
<sup>t</sup> PHL	ENT	RCO	4	18	4	14	ns	
<sup>t</sup> PLH	ENT	ссо	12	35	12	32	20	
<sup>t</sup> PHL	ENT	000	4	15	4	12	ns	
<sup>t</sup> PLH	END	ссо	5	22	5	18	20	
<sup>t</sup> PHL	ENP	000	4	14	4	12	ns	
<sup>t</sup> PHL	ACLR	Any Q	7	28	7	22	ns	
<sup>t</sup> PZH	=	A O	5	24	5	19		
<sup>t</sup> PZL	ŌĒ	Any Q	8	28	8	23	ns	
<sup>†</sup> PHZ	ŌĒ	A O	2	12	2	10		
t <sub>PLZ</sub>	1 OE	Any Q	2	20	4	15	ns	

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

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



NOTES: A. C<sub>L</sub> 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,  $t_f = t_f = 2$  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



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#### **PACKAGING INFORMATION**

Orderable Device	Status (1) F	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
SN74ALS561AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Purchase Samples
SN74ALS561ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Purchase Samples
SNJ54ALS561AJ	OBSOLETE	CDIP	J	20		TBD	Call TI	Call TI	Samples Not Available

(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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#### OTHER QUALIFIED VERSIONS OF SN54ALS561A, SN74ALS561A:

Catalog: SN74ALS561A

Military: SN54ALS561A





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NOTE: Qualified Version Definitions:

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

### 14 LEADS SHOWN



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



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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