

# 54ACT11821, 74ACT11821 10-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCAS156A – NOVEMBER 1990 – REVISED APRIL 1993

- Inputs Are TTL-Voltage Compatible
- Provides Extra Data Width Necessary for Wider Address/Data Paths or Buses With Parity
- Flow-Through Architecture Optimizes PCB Layout
- Center-Pin  $V_{CC}$  and GND Configurations Minimize High-Speed Switching Noise
- EPIC™ (Enhanced-Performance Implanted CMOS) 1- $\mu$ m Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Ceramic 300-mil DIPs

## description

These 10-bit flip-flops feature 3-state outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. They are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

On the positive transition of the clock the Q outputs will follow the D inputs.

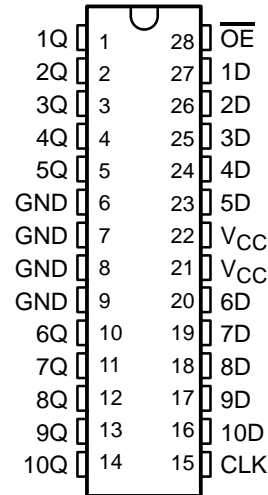
A buffered output enable ( $\overline{OE}$ ) input can be used to place the ten outputs in either a normal logic state (high or low level) or a high-impedance state. In the high-impedance state the outputs neither load nor drive the bus lines significantly.

The high-impedance state and increased drive provide the capability to drive the bus lines in a bus-organized system without need for interface or pull-up components.

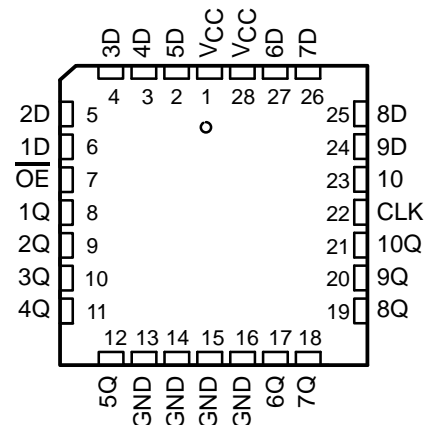
The output enable ( $\overline{OE}$ ) does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The 54ACT11821 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The 74ACT11821 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

54ACT11821 . . . JT PACKAGE  
74ACT11821 . . . DW PACKAGE  
(TOP VIEW)



54ACT11821 . . . FK PACKAGE  
(TOP VIEW)



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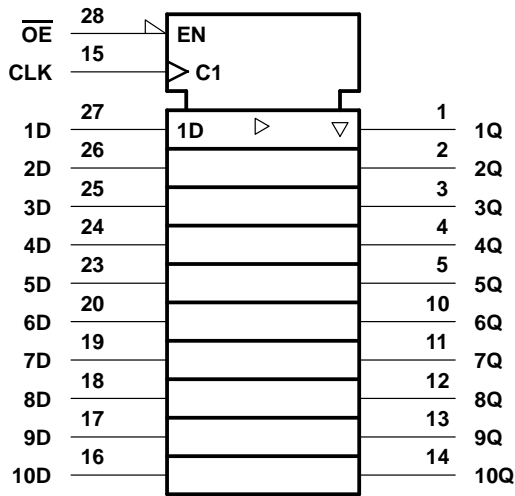
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FUNCTION TABLE  
(each flip-flop)

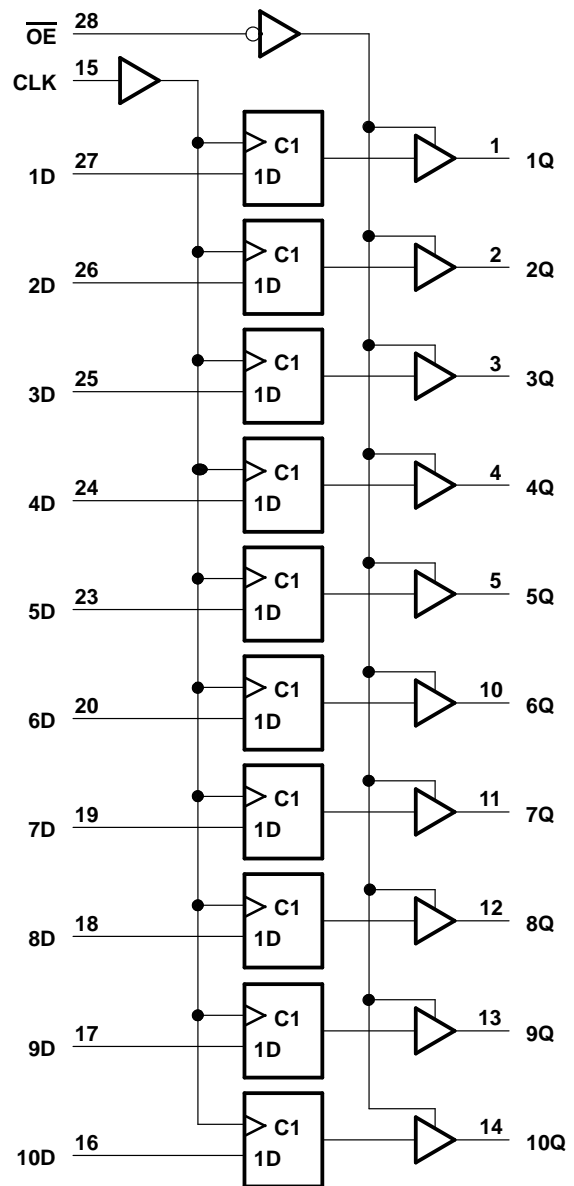
INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	L	X	$Q_0$
L	H	X	$Q_0$
L	↓	X	$X_0$
H	X	X	Z

logic symbol†



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

logic diagram (positive logic)



Pin numbers shown are for the DW, JT, and NT packages.

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

Supply voltage range, $V_{CC}$ .....	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1) .....	–0.5 V to $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Note 1) .....	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) .....	±20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	±50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	±50 mA
Continuous current through $V_{CC}$ or GND .....	±250 mA
Storage temperature range .....	–55°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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

## recommended operating conditions (see Note 2)

	54ACT11821			74ACT11821			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
$V_I$ Input voltage	0		$V_{CC}$	0		$V_{CC}$	V
$V_O$ Output voltage	0		$V_{CC}$	0		$V_{CC}$	V
$I_{OH}$ High-level output current			–24			–24	mA
$I_{OL}$ Low-level output current			24			24	mA
$\Delta t/\Delta v$ Input transition rise or fall rate	0		10			10	ns/V
$T_A$ Operating free-air temperature	–55		125	–40		85	°C

NOTE 2: Unused or floating inputs must be held high or low.

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			54ACT11821		74ACT11821		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	4.5 V	4.4			4.4		4.4		V
		5.5 V	5.4			5.4		5.4		
	I <sub>OH</sub> = -24 mA	4.5 V	3.94			3.7		3.8		
		5.5 V	4.94			4.7		4.8		
	I <sub>OH</sub> = -50 mA <sup>†</sup>	5.5 V				3.85				
I <sub>OH</sub> = -75 mA <sup>†</sup>	5.5 V						3.85			
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	4.5 V				0.1		0.1		V
		5.5 V				0.1		0.1		
	I <sub>OL</sub> = 24 mA	4.5 V				0.36		0.5		
		5.5 V				0.36		0.5		
	I <sub>OL</sub> = 50 mA <sup>†</sup>	5.5 V						1.65		
I <sub>OL</sub> = 75 mA <sup>†</sup>	5.5 V						1.65			
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V				±0.1		±1		μA
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	5.5 V				±0.5		±10		μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V				8		160		μA
ΔI <sub>CC</sub> <sup>‡</sup>	One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND	5.5 V				0.9		1		mA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V				4.5				pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	5 V				12				pF

<sup>†</sup> Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

<sup>‡</sup> This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or V<sub>CC</sub>.

timing requirements over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

		T <sub>A</sub> = 25°C		54ACT11821		74ACT11821		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	0	125	0	125	0	125	MHz
t <sub>w</sub>	Pulse duration, CLK high or low	4		4		4		ns
t <sub>su</sub>	Setup time, data before CLK <sup>↑</sup>	2.5		2.5		2.5		ns
t <sub>h</sub>	Hold time, data after CLK <sup>↑</sup>	1.5		1.5		1.5		ns

switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T <sub>A</sub> = 25°C			54ACT11821		74ACT11821		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			125			125		125		MHz
t <sub>PLH</sub>	CLK	Any Q	4.7	7.6	10.4	4.7	12.6	4.7	11.7	ns
t <sub>PHL</sub>			5	8.1	11	5	12.9	5	12.1	
t <sub>PZH</sub>	$\overline{OE}$	Any Q	3.1	6.1	9.1	3.1	10.8	3.1	10	ns
t <sub>PZL</sub>			4.1	7.6	11	4.1	13.2	4.1	12.3	
t <sub>PHZ</sub>	$\overline{OE}$	Any Q	4.8	7.2	9.2	4.8	10.6	4.8	10.1	ns
t <sub>PLZ</sub>			4.8	6.8	8.6	4.8	9.8	4.8	9.4	

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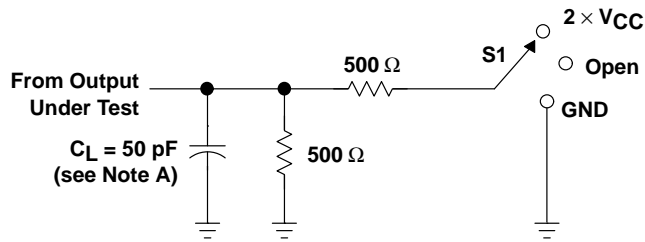
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operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

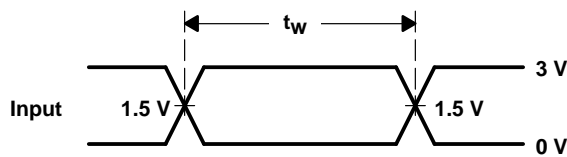
PARAMETER		TEST CONDITIONS	TYP	UNIT
$C_{pd}$	Power dissipation capacitance per flip-flop	Outputs enabled	45	pF
		Outputs disabled	31	

## PARAMETER MEASUREMENT INFORMATION

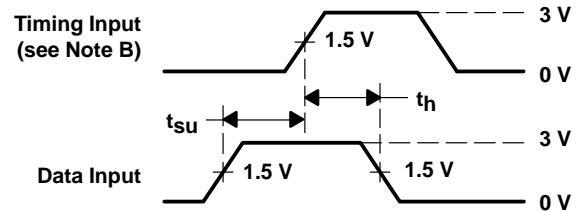


LOAD CIRCUIT

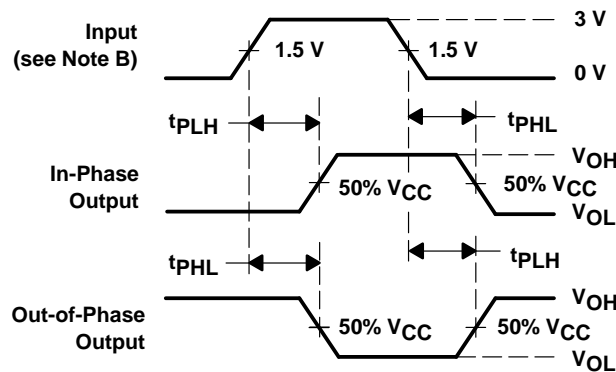
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND



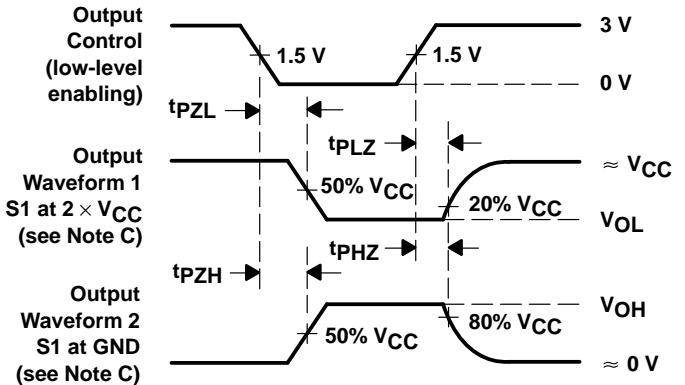
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

NOTES: A.  $C_L$  includes probe and jig capacitance.

B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r = 3\text{ ns}$ ,  $t_f = 3\text{ ns}$ .

C. 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.

D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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