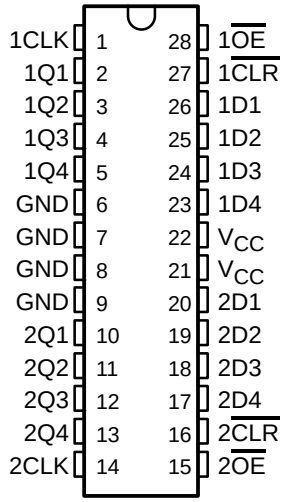
- **3-State Buffer-Type Outputs Drive Bus Lines Directly**
- **Asynchronous Clear**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Center-Pin V_{CC} and GND Configurations Minimize High-Speed Switching Noise**
- ***EPIC*™ (Enhanced-Performance Implanted CMOS) 1-μm Process**
- **500-mA Typical Latch-Up Immunity at 125°C**
- **Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs**

DW OR NT PACKAGE
(TOP VIEW)



description

This dual 4-bit D-type edge-triggered flip-flop features 3-state outputs designed specifically for bus driving. This makes these devices particularly suitable for implementing buffer registers, I/O ports, and working registers.

The flip-flops enter data on the low-to-high transition of the clock. The 74AC11874 has clear ($1\overline{CLR}$ and $2\overline{CLR}$) inputs and noninverting outputs. Taking $\overline{CLR}$ low causes the four Q outputs to go low independently of the clock.

The 74AC11874 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE
(each 4-bit flip-flop)

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

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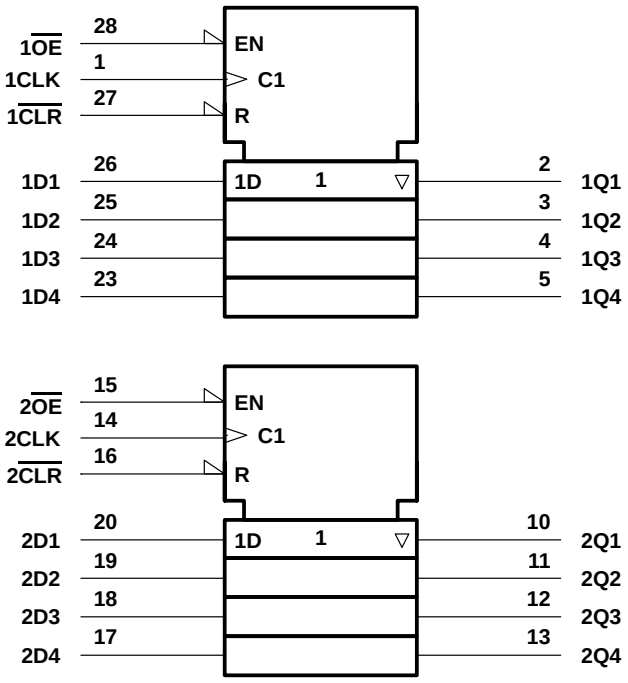
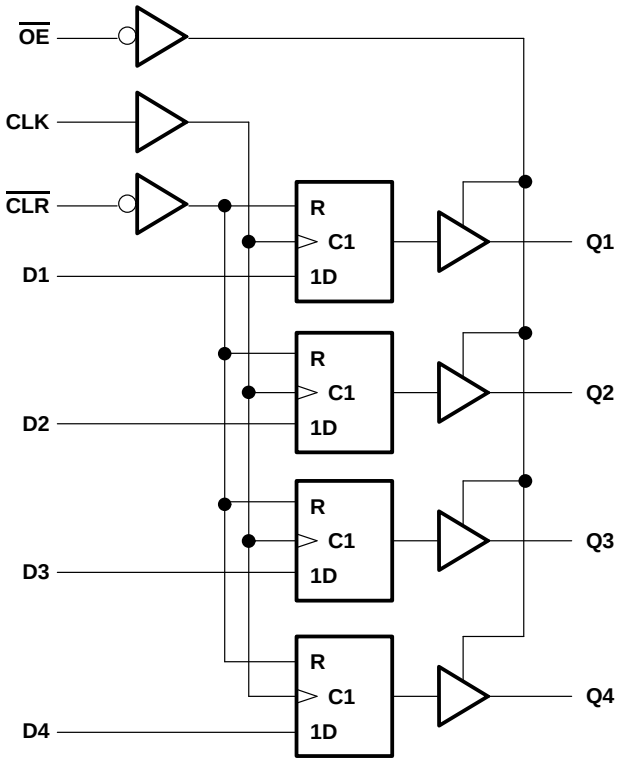
logic symbol†



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

logic diagram, each quad flip-flop (positive logic)



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 pins . . . . . ±200 mA
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.

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

recommended operating conditions

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		3	5	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 3 V	2.1			V
		V_{CC} = 4.5 V	3.15			
		V_{CC} = 5.5 V	3.85			
V_{IL}	Low-level input voltage	V_{CC} = 3 V			0.9	V
		V_{CC} = 4.5 V			1.35	
		V_{CC} = 5.5 V			1.65	
V_I	Input voltage		0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 3 V			–4	mA
		V_{CC} = 4.5 V			–24	
		V_{CC} = 5.5 V			–24	
I_{OL}	Low-level output current	V_{CC} = 3 V			12	mA
		V_{CC} = 4.5 V			24	
		V_{CC} = 5.5 V			24	
$\Delta t/\Delta v$	Input transition rise or fall rate		0		10	ns/V
T_A	Operating free-air temperature		–40		85	°C

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

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
V_{OH}	I_{OH} = – 50 μA	3 V	2.9			2.9		V
		4.5 V	4.4			4.4		
		5.5 V	5.4			5.4		
	I_{OH} = – 4 mA	3 V	2.58			2.48		
	I_{OH} = – 24 mA	4.5 V	3.94			3.8		
		5.5 V	4.94			4.8		
	I_{OH} = –75 mA†	5.5 V				3.85		
V_{OL}	I_{OL} = 50 μA	3 V			0.1		0.1	V
		4.5 V			0.1		0.1	
		5.5 V			0.1		0.1	
	I_{OL} = 12 mA	3 V			0.36		0.44	
	I_{OL} = 24 mA	4.5 V			0.36		0.44	
		5.5 V			0.36		0.44	
	I_{OL} = 75 mA†	5.5 V					1.65	
I_I	V_I = V_{CC} or GND	5.5 V			±0.1		±1	μA
I_{OZ}	V_O = V_{CC} or GND	5.5 V			±0.5		±5	μA
I_{CC}	V_I = V_{CC} or GND, I_O = 0	5.5 V			8		80	μA
C_i	V_I = V_{CC} or GND	5 V		4.5				pF
C_o	V_O = V_{CC} or GND	5 V		13.5				pF

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

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C		MIN	MAX	UNIT
			MIN	MAX			
f_{clock}	Clock frequency		0	60	0	60	MHz
t_w	Pulse duration	$\overline{CLR}$ low	4		4		ns
		CLK high or low	8.3		8.3		
t_{su}	Setup time before CLK↑	Data	3		3		ns
		$\overline{CLR}$ inactive	1.5		1.5		
t_h	Hold time after CLK↑	Data	1		1		ns

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

			T_A = 25°C		MIN	MAX	UNIT
			MIN	MAX			
f_{clock}	Clock frequency		0	125	0	125	MHz
t_w	Pulse duration	$\overline{CLR}$ low	4		4		ns
		CLK high or low	4		4		
t_{su}	Setup time before CLK↑	Data	2		2		ns
		$\overline{CLR}$ inactive	1.5		1.5		
t_h	Hold time after CLK↑	Data	1		1		ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
f_{max}			60			60		MHz
t_{PLH}	CLK	Q	2.9	7.3	11	2.9	12.5	ns
t_{PHL}			3.7	8.8	13.1	3.7	14.6	
t_{PHL}	$\overline{CLR}$	Q	3.9	9.3	14	3.9	15.7	ns
t_{PZH}	OE	Q	2.1	5.6	8.7	2.1	9.8	ns
t_{PZL}			3.1	8.4	13.1	3.1	14.9	
t_{PHZ}	OE	Q	4	6.2	8.2	4	8.7	ns
t_{PLZ}			3.9	6.3	8.5	3.9	9	

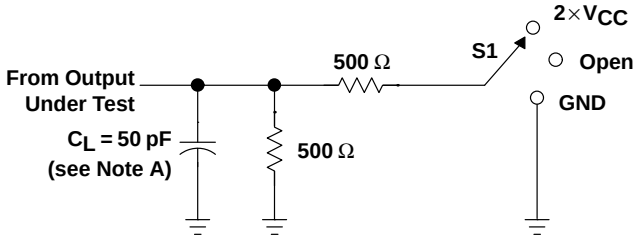
switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
f_{max}			125			125		MHz
t_{PLH}	CLK	Q	2.3	5.2	7.4	2.3	8.3	ns
t_{PHL}			2.9	6.1	8.6	2.9	9.6	
t_{PHL}	$\overline{CLR}$	Q	2.9	6.3	8.9	2.9	10	ns
t_{PZH}	OE	Q	1.5	4	5.9	1.5	6.6	ns
t_{PZL}			2.3	5.4	7.8	2.3	8.8	
t_{PHZ}	OE	Q	3.8	5.7	7.3	3.8	7.7	ns
t_{PLZ}			3.7	5.5	7.1	3.7	7.5	

operating characteristics, V_{CC} = 5 V, T_A = 25°C

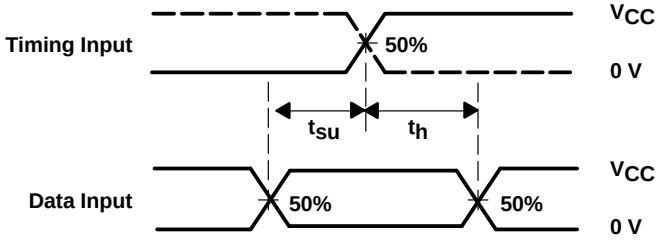
PARAMETER			TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per flip-flop	Outputs enabled	C_L = 50 pF, f = 1 MHz	31	pF
		Outputs disabled		13	

PARAMETER MEASUREMENT INFORMATION

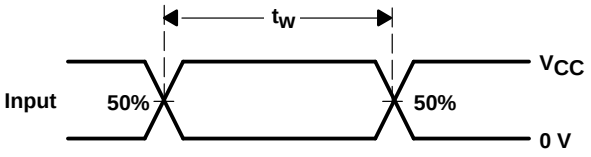


LOAD CIRCUIT FOR OUTPUTS

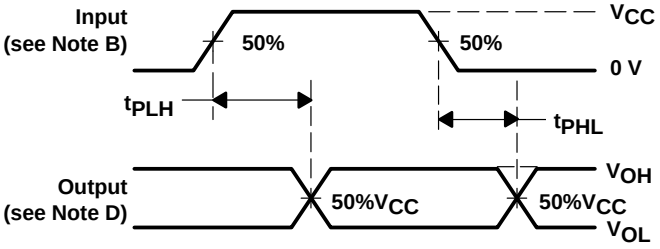
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND



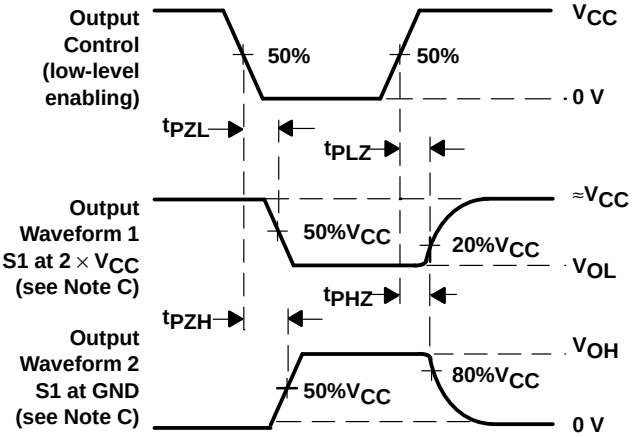
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns. For testing pulse duration: $t_r = t_f$ = 1 to 3 ns. Pulse polarity can be either high-to-low-to-high or low-to-high-to-low.
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 transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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