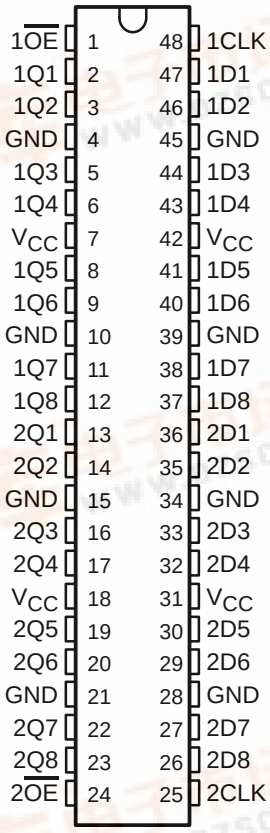
SN74ACT16374Q-EP
16-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOP WITH 3-STATE OUTPUTS

SCAS679B – MAY 2002 – REVISED JULY 2002

- **Controlled Baseline**
  - **One Assembly/Test Site, One Fabrication Site**
- **Extended Temperature Performance of –40°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product Change Notification**
- **Qualification Pedigree†**
- **Member of the Texas Instruments Widebus™ Family**
- **Inputs Are TTL-Voltage Compatible**
- **3-State Bus Driving True Outputs**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Distributed V_{CC} and GND Pins Minimize High-Speed Switching Noise**

† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, highly accelerated stress test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life.

DL PACKAGE
(TOP VIEW)



description

The SN74ACT16374Q-EP is a 16-bit edge-triggered D-type flip-flop with 3-state outputs, designed specifically for driving highly capacitive or relatively low-impedance loads. It is particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

This device can be used as two 8-bit flip-flops or one 16-bit flip-flop. On the positive transition of the clock (CLK) input, the Q outputs of the flip-flop take on the logic levels set up at the data (D) inputs.

An output-enable ($\overline{OE}$) input can be used to place the outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state provides the capability to drive bus lines in a bus-organized system, without need for interface or pullup components. $\overline{OE}$ does not affect the internal operations of the flip-flop. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

ORDERING INFORMATION

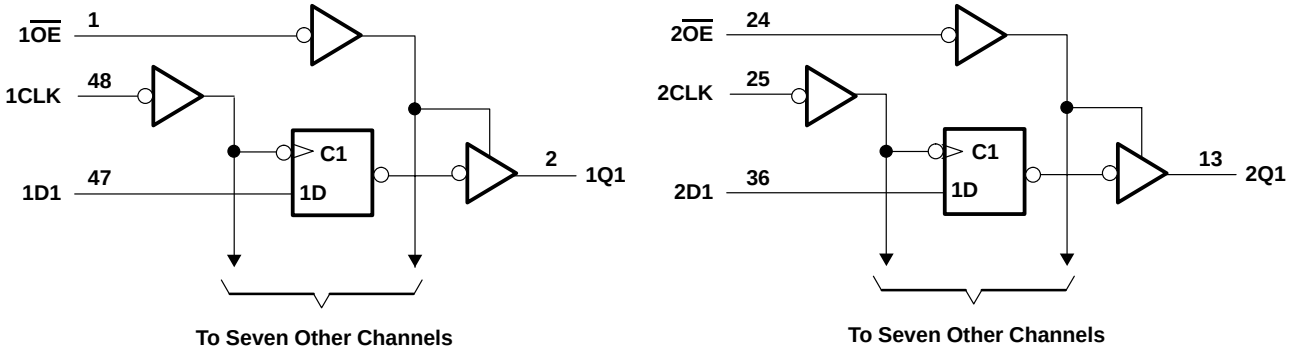
T_A	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	SSOP – DL	Tape and reel	SN74ACT16374QDLREP	ACT16374QEP

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE
(each section)

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

logic diagram (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}) . . . . . ±24 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . . ±24 mA
Continuous current through V_{CC} or GND . . . . . ±260 mA
Maximum power dissipation at T_A = 55°C (in still air) (see Note 2): DL package . . . . . 1.2 W
Storage temperature range, T_{stg} . . . . . –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.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

recommended operating conditions (see Note 3)

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage (see Note 4)	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			V
V_{IL}	Low-level input voltage			0.8	V
V_I	Input voltage	0		V_{CC}	V
V_O	Output voltage	0		V_{CC}	V
I_{OH}	High-level output current			–16	mA
I_{OL}	Low-level output current			16	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0		10	ns/V
T_A	Operating free-air temperature	–40		125	°C

NOTES: 3. All unused inputs of the device must be at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.
4. All V_{CC} and GND pins must be connected to the proper-voltage power supply.

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		4.5 V	4.4			4.4		V
			5.5 V	5.4			5.4		
	I_{OH} = –16 mA		4.5 V	3.94			3.7		
			5.5 V	4.94			4.7		
	I_{OH} = –24 mA†		5.5 V				3.85		
V_{OL}	I_{OL} = 50 μA		4.5 V			0.1		0.1	V
			5.5 V			0.1		0.1	
	I_{OL} = 16 mA		4.5 V			0.36		0.5	
			5.5 V			0.36		0.5	
	I_{OL} = 24 mA†		5.5 V					0.5	
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		±10	μA
I_{CC}	$V_I = V_{CC}$ or GND,	I_O = 0	5.5 V			8		160	μA
ΔI_{CC}‡	One input at 3.4 V,	Other inputs at GND or V_{CC}	5.5 V			0.9		1	mA
C_i	$V_I = V_{CC}$ or GND		5 V		4.5				pF
C_o	$V_O = V_{CC}$ or GND		5 V		12				pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.
‡ This is the increase in supply current for each input that is at one of the specified TTL-voltage levels rather than 0 V to V_{CC}.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

			T_A = 25°C		MIN	MAX	UNIT
			MIN	MAX			
f_{clock}	Clock frequency		0	65	0	65	MHz
t_w	Pulse duration	CLK low	7.5		7.5		ns
		CLK high	4.5		4.5		
t_{su}	Setup time, data before CLK↑		6.5		6.5		ns
t_h	Hold time, data after CLK↑		1		1		ns

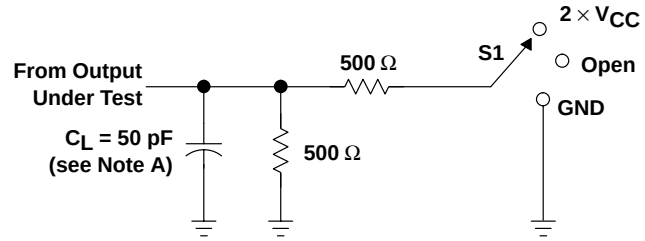
switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
f_{max}			65			65		MHz
t_{PLH}	CLK	Q	5.1	8.8	10.9	5.1	13.2	ns
t_{PHL}			5.3	8.8	10.9	5.3	13.1	
t_{PZH}	$\overline{OE}$	Q	3.7	8.4	10.5	3.7	12.7	ns
t_{PZL}			4.4	9.7	11.9	4.4	14.3	
t_{PHZ}	$\overline{OE}$	Q	5.4	7.9	9.8	5.4	10.9	ns
t_{PLZ}			4.9	7.2	9.1	4.9	10.2	

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

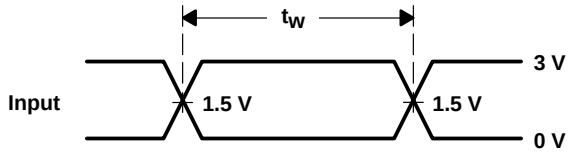
PARAMETER			TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance per flip-flop	Outputs enabled	C_L = 50 pF,	f = 1 MHz	52	pF
		Outputs disabled			38	

PARAMETER MEASUREMENT INFORMATION

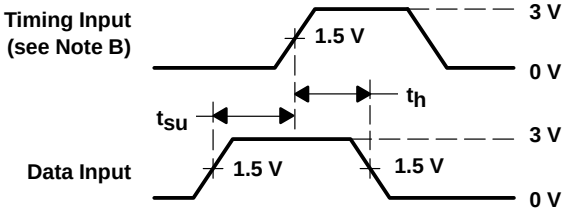


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	2 × V_{CC}
t_{PHZ}/t_{PZH}	GND

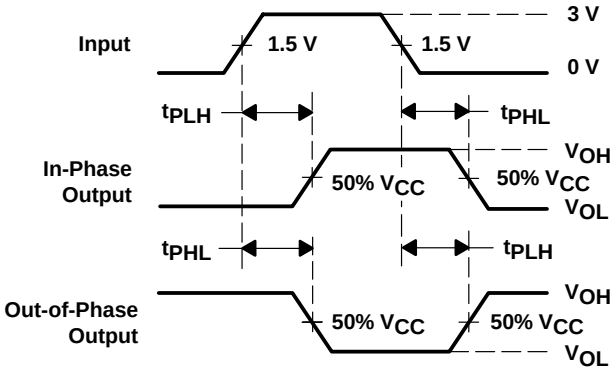
LOAD CIRCUIT



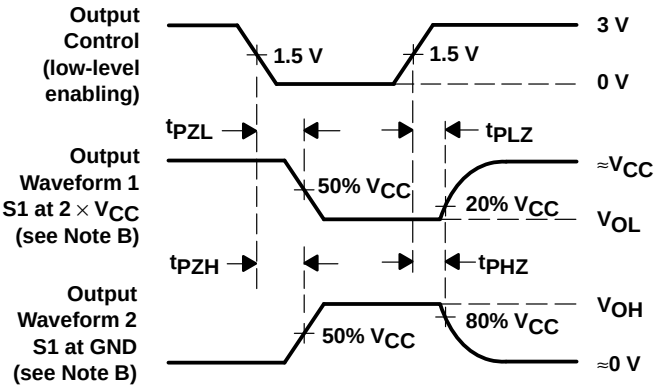
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

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. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 3 ns, t_f = 3 ns.
D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGE OPTION ADDENDUM

26-Sep-2005

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN74ACT16374QDLREP	ACTIVE	SSOP	DL	48	1000	TBD	Call TI	Level-1-235C-UNLIM
V62/03603-01XE	ACTIVE	SSOP	DL	48	1000	TBD	Call TI	Level-1-235C-UNLIM

(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.

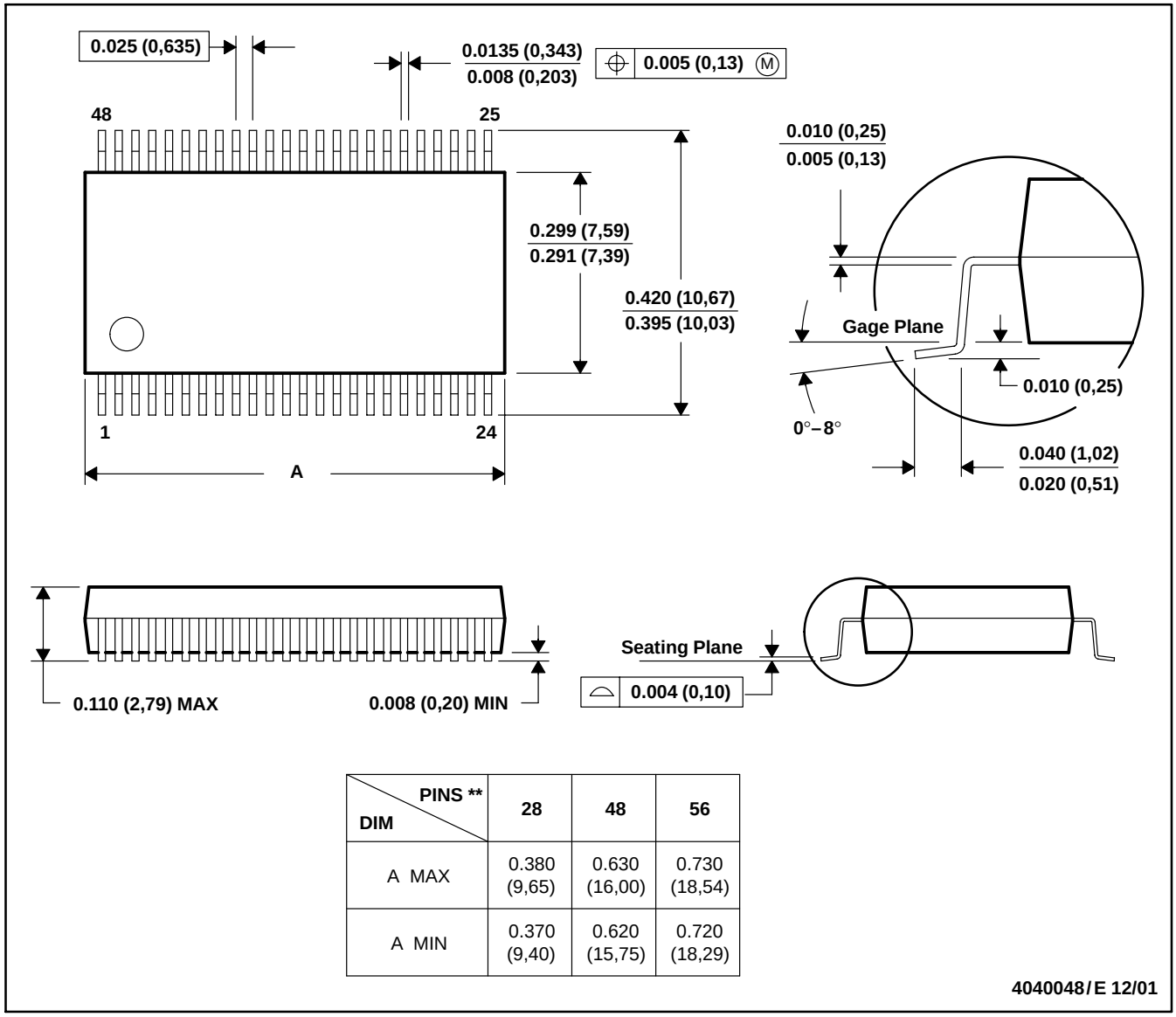
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): 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.
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.

MSSO001C – JANUARY 1995 – REVISED DECEMBER 2001

DL (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN



DIM \ PINS **	28	48	56
A MAX	0.380 (9,65)	0.630 (16,00)	0.730 (18,54)
A MIN	0.370 (9,40)	0.620 (15,75)	0.720 (18,29)

4040048/E 12/01

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 MO-118

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