

# 54ACTQ16374

*54ACTQ16374 16-Bit D Flip-Flop with TRI-STATE Outputs*



Literature Number: SNOS589

# 54ACTQ16374

## 16-Bit D Flip-Flop with TRI-STATE® Outputs

### General Description

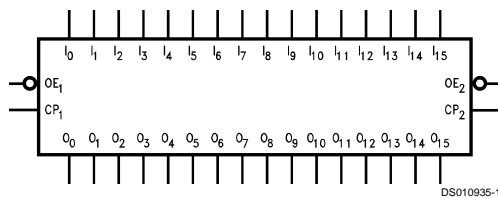
The 'ACTQ16374 contains sixteen non-inverting D flip-flops with TRI-STATE outputs and is intended for bus oriented applications. The device is byte controlled. A buffered clock (CP) and Output Enable (OE) are common to each byte and can be shorted together for full 16-bit operation.

The 'ACTQ16245 utilizes NSC Quiet Series technology to guarantee quiet output switching and improved dynamic threshold performance. FACT Quiet Series® features GTO® output control for superior performance.

### Features

- Utilizes NSC FACT Quiet Series technology
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Buffered Positive edge-triggered clock
- Separate control logic for each byte
- 16-bit version of the 'ACTQ374
- Outputs source/sink 24 mA
- Standard Microcircuit Drawing (SMD) 5962-9452801

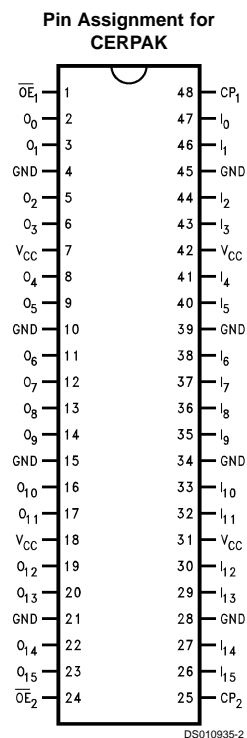
### Logic Symbol



### Pin Description

Pin Names	Description
$\overline{OE}_n$	Output Enable Input (Active Low)
$CP_n$	Clock Pulse Input
$I_0-I_{15}$	Inputs
$O_0-O_{15}$	Outputs

### Connection Diagram



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## Functional Description

The 'ACTQ16374 consists of sixteen edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The device is byte controlled with each byte functioning identically, but independent of the other. The control pins can be shorted together to obtain full 16-bit operation. Each byte has a buffered clock and buffered Output Enable common to all flip-flops within that byte. The description which follows applies to each byte. Each flip-flop will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock ( $CP_n$ ) transition. With the Output Enable ( $\overline{OE}_n$ ) LOW, the contents of the flip-flops are available at the outputs. When  $\overline{OE}_n$  is HIGH, the outputs go to the high impedance state. Operation of the  $\overline{OE}_n$  input does not affect the state of the flip-flops.

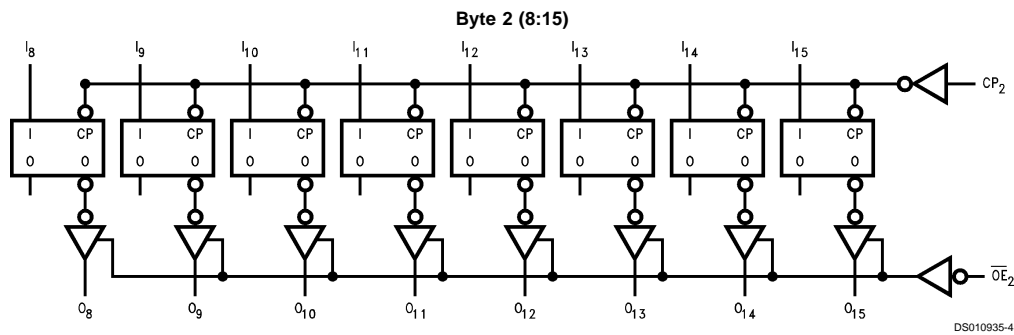
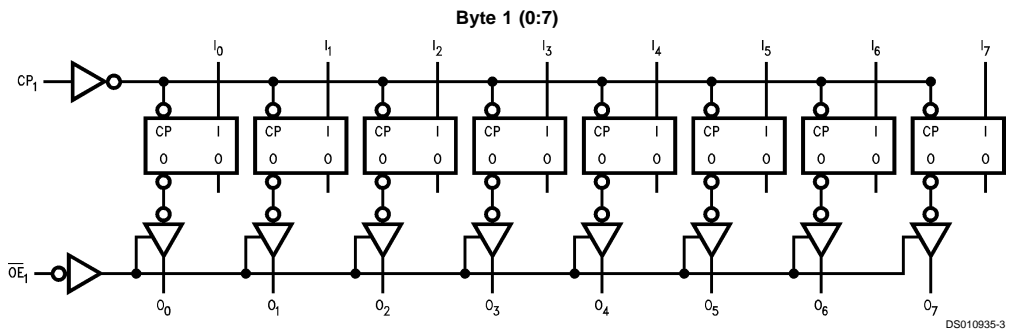
## Truth Tables

Inputs			Outputs
$CP_1$	$\overline{OE}_1$	$I_0-I_7$	$O_0-O_7$
N	L	H	H
N	L	L	L
L	L	X	(Previous)
X	H	X	Z

Inputs			Outputs
$CP_2$	$\overline{OE}_2$	$I_8-I_{15}$	$O_8-O_{15}$
N	L	H	H
N	L	L	L
L	L	X	(Previous)
X	H	X	Z

H = High Voltage Level  
 L = Low Voltage Level  
 X = Immaterial  
 Z = High Impedance

## Logic Diagrams



## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V
DC Input Diode Current ( $I_{IK}$ )	
$V_I = -0.5V$	-20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Output Diode Current ( $I_{OK}$ )	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Source/Sink Current ( $I_O$ )	±50 mA
DC $V_{CC}$ or Ground Current per Output Pin	±50 mA
Junction Temperature CDIP	+175°C
Storage Temperature	-65°C to +150°C

## Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ ) 'ACTQ	4.5V to 5.5V
Input Voltage ( $V_I$ )	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ ): 54ACTQ	-55°C to +125°C
Minimum Input Edge Rate (dV/dt) 'ACTQ Devices	125 mV/ns
$V_{IN}$ from 0.8V to 2.0V	
$V_{CC}$ @ 4.5V, 5.5V	

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

## DC Electrical Characteristics for 'ACTQ Family Devices

Symbol	Parameter	$V_{CC}$ (V)	54ACTQ	Units	Conditions
			$T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$		
			Guaranteed Limits		
$V_{IH}$	Minimum High Input Voltage	4.5	2.0	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	2.0		
$V_{IL}$	Maximum Low Input Voltage	4.5	0.8	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	0.8		
$V_{OH}$	Minimum High Output Voltage	4.5	4.4	V	$I_{OUT} = -50 \mu A$
		5.5	5.4		
		4.5	3.70	V	(Note 2) $V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA}$
		5.5	4.70		
$V_{OL}$	Maximum Low Output Voltage	4.5	0.1	V	$I_{OUT} = 50 \mu A$
		5.5	0.1		
		4.5	0.50	V	(Note 2) $V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 24 \text{ mA}$
		5.5	0.50		
$I_{OZ}$	Maximum TRI-STATE Leakage Current	5.5	±10.0	μA	$V_I = V_{IL}, V_{IH}$ $V_O = V_{CC}, \text{GND}$
$I_{IN}$	Maximum Input Leakage Current	5.5	±1.0	μA	$V_I = V_{CC}, \text{GND}$
$I_{CCT}$	Maximum $I_{CC}$ /Input	5.5	1.6	mA	$V_I = V_{CC} - 2.1V$
$I_{CC}$	Max Quiescent Supply Current	5.5	160.0	μA	$V_{IN} = V_{CC}$ or GND (Note 6)
$I_{OLD}$	(Note 3) Minimum Dynamic Output Current	5.5	50	mA	$V_{OLD} = 1.65V \text{ Max}$
$I_{OHD}$	Output Current		50	mA	$V_{OHD} = 3.85V \text{ Min}$
$V_{OLP}$	Quiet Output Maximum Dynamic $V_{OL}$	5.0	0.8	V	(Notes 4, 5)
$V_{OLV}$	Quiet Output Minimum Dynamic $V_{OL}$	5.0	-0.8	V	(Notes 4, 5)

## DC Electrical Characteristics for 'ACTQ Family Devices (Continued)

**Note 2:** All outputs loaded; thresholds associated with output under test.

**Note 3:** Maximum test duration 2.0 ms; one output loaded at a time.

**Note 4:** Maximum number of outputs that can switch simultaneously is n. (n - 1) outputs are switched LOW and one output held LOW.

**Note 5:** Maximum number of outputs that can switch simultaneously is n. (n - 1) outputs are switched HIGH and one output held HIGH.

**Note 6:**  $I_{CC}$  for 54ACTQ @ 25°C is identical to 74ACTQ @ 25°C.

## AC Electrical Characteristics

Symbol	Parameter	$V_{CC}$ (V) (Note 7)	54ACTQ		Units
			$T_A =$ -55°C to +125°C $C_L = 50$ pF		
			Min	Max	
$f_{max}$	Maximum Clock Frequency	5.0	65		MHz
$t_{PLH}$ $t_{PHL}$	Propagation Delay CP to $O_n$	5.0	3.0	10.5	ns
$t_{PZH}$ $t_{PZL}$	Output Enable Time	5.0	3.0	10.5	ns
$t_{PHZ}$ $t_{PLZ}$	Output Disable Time	5.0	2.0	9.0	ns

**Note 7:** Voltage Range 5.0 is 5.0V ± 0.5V.

## AC Operating Requirements

Symbol	Parameter	$V_{CC}$ (V) (Note 8)	54ACTQ		Units
			$T_A =$ -55°C to +125°C $C_L = 50$ pF		
			Guaranteed Limits		
$t_S$	Setup Time, HIGH or LOW, Input to Clock	5.0	3.0		ns
$t_H$	Hold Time, High or LOW, Input to Clock	5.0	1.0		ns
$t_W$	CP Pulse Width, HIGH or LOW	5.0	5.0		ns

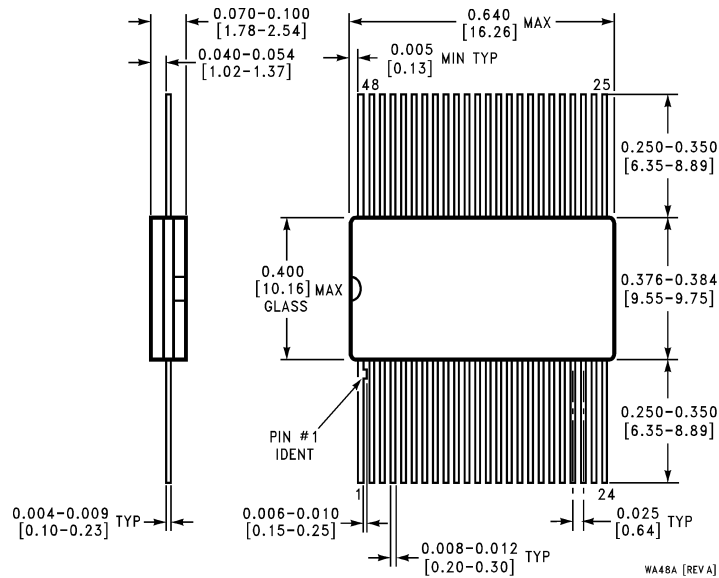
**Note 8:** Voltage Range 5.0 is 5.0V±0.5V.

## Capacitance

Symbol	Parameter	Typ	Units	Conditions
$C_{IN}$	Input Capacitance	4.5	pF	$V_{CC} = 5.0V$
$C_{PD}$	Power Dissipation	95	pF	$V_{CC} = 5.0V$



**Physical Dimensions** inches (millimeters) unless otherwise noted



**48-Lead CERPAK  
 NS Package Number WA48A**

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