

# 54AC/74AC373 • 54ACT/74ACT373

## Octal Transparent Latch with TRI-STATE® Outputs

### General Description

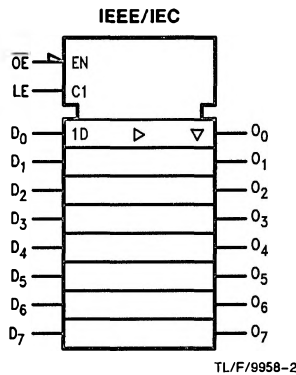
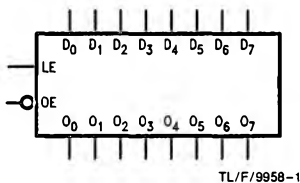
The 'AC/'ACT373 consists of eight latches with TRI-STATE outputs for bus organized system applications. The flip-flops appear transparent to the data when Latch Enable (LE) is HIGH. When LE is LOW, the data that meets the setup time is latched. Data appears on the bus when the Output Enable (OE) is LOW. When OE is HIGH, the bus output is in the high impedance state.

### Features

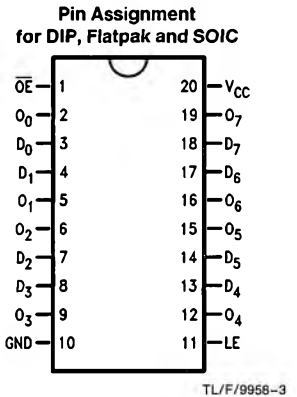
- Eight latches in a single package
- TRI-STATE outputs for bus interfacing
- Outputs source/sink 24 mA
- 'ACT373 has TTL-compatible inputs
- Standard Military Drawing (SMD)
  - 'AC373: 5962-87555
  - 'ACT373: 5962-87556

**Ordering Code:** See Section 8

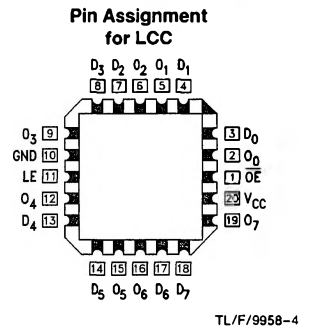
### Logic Symbols



### Connection Diagrams



Pin Names	Description
D <sub>0</sub> -D <sub>7</sub>	Data Inputs
LE	Latch Enable Input
OE	Output Enable Input
O <sub>0</sub> -O <sub>7</sub>	TRI-STATE Latch Outputs



## Functional Description

The 'AC/ACT373 contains eight D-type latches with TRI-STATE standard outputs. When the Latch Enable (LE) input is HIGH, data on the  $D_n$  inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its D input changes. When LE is LOW, the latches store the information that was present on the D inputs a setup time preceding the HIGH-to-LOW transition of LE. The TRI-STATE standard outputs are controlled by the Output Enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is LOW, the standard outputs are in the 2-state mode. When  $\overline{OE}$  is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the latches.

## Truth Table

Inputs			Outputs
LE	$\overline{OE}$	$D_n$	$O_n$
X	H	X	Z
H	L	L	L
H	L	H	H
L	L	X	$O_0$

H = HIGH Voltage Level

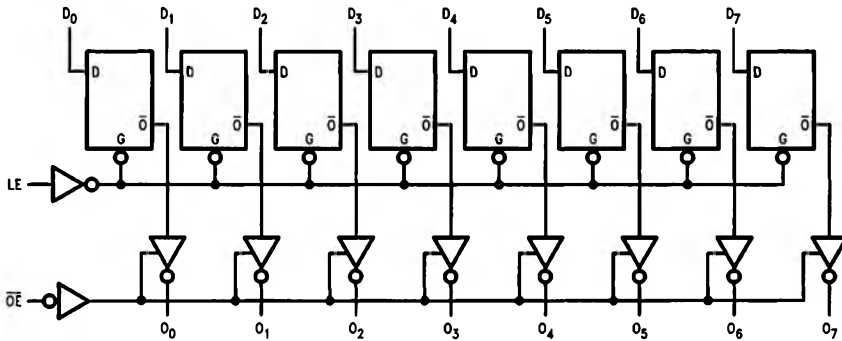
L = LOW Voltage Level

Z = High Impedance

X = Immaterial

$O_0$  = Previous  $O_0$  before HIGH to Low transition of Latch Enable

## Logic Diagram



TL/F/9958-5

Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## Absolute Maximum Rating (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 Input Voltage ( $V_I$ )	-0.5V to $V_{CC} + 0.5V$
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 or Sink Current ( $I_O$ )	$\pm 50$ mA
DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ )	$\pm 50$ mA
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Junction Temperature ( $T_J$ )	
CDIP	175°C
PDIP	140°C

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.

## Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ )	2.0V to 6.0V
'AC	4.5V to 5.5V
'ACT	
Input Voltage ( $V_I$ )	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	
74AC/ACT	-40°C to +85°C
54AC/ACT	-55°C to +125°C
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
'AC Devices	
$V_{IN}$ from 30% to 70% of $V_{CC}$	
$V_{CC}$ @ 3.3V, 4.5V, 5.5V	125 mV/ns
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
'ACT Devices	
$V_{IN}$ from 0.8V to 2.0V	
$V_{CC}$ @ 4.5V, 5.5V	125 mV/ns

## DC Characteristics for 'AC Family Devices

Symbol	Parameter	$V_{CC}$ (V)	74AC			54AC		74AC		Units	Conditions
			$T_A = +25^\circ\text{C}$			$T_A = -55^\circ\text{C to } +125^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			
			Typ	Guaranteed Limits							
$V_{IH}$	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1		2.1		V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	3.15	3.15		3.15				
		5.5	2.75	3.85	3.85		3.85				
$V_{IL}$	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9		0.9		V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	1.35	1.35		1.35				
		5.5	2.75	1.65	1.65		1.65				
$V_{OH}$	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9		2.9		V	$I_{OUT} = -50 \mu\text{A}$	
		4.5	4.49	4.4	4.4		4.4				
		5.5	5.49	5.4	5.4		5.4				
$V_{OL}$	Maximum Low Level Output Voltage	3.0		2.56	2.4		2.46		V	* $V_{IN} = V_{IL}$ or $V_{IH}$ -12 mA $I_{OH}$ -24 mA -24 mA	
		4.5		3.86	3.7		3.76				
		5.5		4.86	4.7		4.76				
$V_{OL}$	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1		0.1		V	$I_{OUT} = 50 \mu\text{A}$	
		4.5	0.001	0.1	0.1		0.1				
		5.5	0.001	0.1	0.1		0.1				
$V_{OL}$	Maximum Low Level Output Voltage	3.0		0.36	0.50		0.44		V	* $V_{IN} = V_{IL}$ or $V_{IH}$ 12 mA $I_{OL}$ 24 mA 24 mA	
		4.5		0.36	0.50		0.44				
		5.5		0.36	0.50		0.44				
$I_{IN}$	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$		$\pm 1.0$		$\mu\text{A}$	$V_I = V_{CC}, \text{GND}$	

\*All outputs loaded, thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

## DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V <sub>CC</sub> (V)	74AC		54AC		74AC		Units	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -55°C to +125°C		T <sub>A</sub> = -40°C to +85°C			
			Typ	Guaranteed Limits						
I <sub>OZ</sub>	Maximum TRI-STATE® Current	5.5		±0.5	±10.0	±10.0	±5.0	±5.0	μA	V <sub>I</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub> V <sub>I</sub> = V <sub>CC</sub> , GND V <sub>O</sub> = V <sub>CC</sub> , GND
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5			50	50	75	75	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>		5.5			-50	-50	-75	-75	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		8.0	160.0	160.0	80.0	80.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

Note: I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.

I<sub>CC</sub> for 54AC @ 25°C is identical to 74AC @ 25°C.

## DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V <sub>CC</sub> (V)	74ACT		54ACT		74ACT		Units	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -55°C to +125°C		T <sub>A</sub> = -40°C to +85°C			
			Typ	Guaranteed Limits						
V <sub>IH</sub>	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0	2.0	2.0	2.0	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	1.5	2.0	2.0	2.0	2.0	2.0		
V <sub>IL</sub>	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	0.8	0.8	0.8	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	1.5	0.8	0.8	0.8	0.8	0.8		
V <sub>OH</sub>	Minimum High Level Output Voltage	4.5	4.49	4.4	4.4	4.4	4.4	4.4	V	I <sub>OUT</sub> = -50 μA
		5.5	5.49	5.4	5.4	5.4	5.4	5.4		
		4.5		3.86	3.70	3.70	3.76	3.76	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> -24 mA I <sub>OH</sub> = -24 mA
		5.5		4.86	4.70	4.70	4.76	4.76		
V <sub>OL</sub>	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	0.1	0.1	0.1	V	I <sub>OUT</sub> = 50 μA
		5.5	0.001	0.1	0.1	0.1	0.1	0.1		
		4.5		0.36	0.50	0.50	0.44	0.44	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> 24 mA I <sub>OL</sub> = 24 mA
		5.5		0.36	0.50	0.50	0.44	0.44		
I <sub>IN</sub>	Maximum Input Leakage Current	5.5		±0.1	±1.0	±1.0	±1.0	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND
I <sub>OZ</sub>	Maximum TRI-STATE® Current	5.5		±0.5	±10.0	±10.0	±5.0	±5.0	μA	V <sub>I</sub> = V <sub>IL</sub> , V <sub>IH</sub> V <sub>O</sub> = V <sub>CC</sub> , GND
I <sub>CC</sub> T	Maximum I <sub>CC</sub> /Input	5.5	0.6		1.6	1.6	1.5	1.5	mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1V
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5			50	50	75	75	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>		5.5			-50	-50	-75	-75	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		8.0	160.0	160.0	80.0	80.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

Note: I<sub>CC</sub> for 54ACT @ 25°C is identical to 74ACT @ 25°C.

**AC Electrical Characteristics:** See Section 2 for Waveforms

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC			54AC		74AC		Units	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Min	Typ	Max	Min	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay D <sub>n</sub> to O <sub>n</sub>	3.3 5.0	1.5 1.5	10.0 7.0	13.5 9.5	1.0 1.0	16.5 11.5	1.5 1.5	15.0 10.5	ns	2-3, 4
t <sub>PHL</sub>	Propagation Delay D <sub>n</sub> to O <sub>n</sub>	3.3 5.0	1.5 1.5	9.5 7.0	13.0 9.5	1.0 1.0	16.0 11.5	1.5 1.5	14.5 10.5	ns	2-3, 4
t <sub>PLH</sub>	Propagation Delay LE to O <sub>n</sub>	3.3 5.0	1.5 1.5	10.0 7.5	13.5 9.5	1.0 1.0	16.5 12.0	1.5 1.5	15.0 10.5	ns	2-3, 4
t <sub>PHL</sub>	Propagation Delay LE to O <sub>n</sub>	3.3 5.0	1.5 1.5	9.5 7.0	12.5 9.5	1.0 1.0	15.0 11.0	1.5 1.5	14.0 10.5	ns	2-3, 4
t <sub>PZH</sub>	Output Enable Time	3.3 5.0	1.5 1.5	9.0 7.0	11.5 8.5	1.0 1.0	14.0 10.5	1.0 1.0	13.0 9.5	ns	2-5
t <sub>PZL</sub>	Output Enable Time	3.3 5.0	1.5 1.5	8.5 6.5	11.5 8.5	1.0 1.0	13.5 10.0	1.0 1.0	13.0 9.5	ns	2-6
t <sub>PHZ</sub>	Output Disable Time	3.3 5.0	1.5 1.5	10.0 8.0	12.5 11.0	1.0 1.0	16.0 13.5	1.0 1.0	14.5 12.5	ns	2-5
t <sub>PLZ</sub>	Output Disable Time	3.3 5.0	1.5 1.5	8.0 6.5	11.5 8.5	1.0 1.0	13.0 10.5	1.0 1.0	12.5 10.0	ns	2-6

\*Voltage Range 3.3 is 3.3V ±0.3V  
Voltage Range 5.0 is 5.0V ±0.5V

**AC Operating Requirements:** See Section 2 for Waveforms

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC		54AC	74AC	Units	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF	T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Typ	Guaranteed Minimum				
t <sub>s</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to LE	3.3 5.0	3.5 2.0	5.5 4.0	6.5 5.0	6.0 4.5	ns	2-7
t <sub>h</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to LE	3.3 5.0	-3.0 -1.5	1.0 1.0	1.0 1.0	1.0 1.0	ns	2-7
t <sub>w</sub>	LE Pulse Width, HIGH	3.3 5.0	4.0 2.0	5.5 4.0	6.5 5.0	6.0 4.5	ns	2-3

\*Voltage Range 3.3 is 3.3V ±0.3V  
Voltage Range 5.0 is 5.0V ±0.5V

## AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	V <sub>CC</sub> * (V)	74ACT			54ACT		74ACT		Units	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Min	Typ	Max	Min	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay D <sub>n</sub> to O <sub>n</sub>	5.0	2.5	8.5	10.0	1.0	12.5	1.5	11.5	ns	2-3, 4
t <sub>PHL</sub>	Propagation Delay D <sub>n</sub> to O <sub>n</sub>	5.0	2.0	8.0	10.0	1.0	12.5	1.5	11.5	ns	2-3, 4
t <sub>PLH</sub>	Propagation Delay LE to O <sub>n</sub>	5.0	2.5	8.5	11.0	1.0	12.5	2.0	11.5	ns	2-3, 4
t <sub>PHL</sub>	Propagation Delay LE to O <sub>n</sub>	5.0	2.0	8.0	10.0	1.0	11.5	1.5	11.5	ns	2-3, 4
t <sub>PZH</sub>	Output Enable Time	5.0	2.0	8.0	9.5	1.0	11.5	1.5	10.5	ns	2-5
t <sub>PZL</sub>	Output Enable Time	5.0	2.0	7.5	9.0	1.0	11.0	1.5	10.5	ns	2-6
t <sub>PHZ</sub>	Output Disable Time	5.0	2.5	9.0	11.0	1.0	14.0	2.5	12.5	ns	2-5
t <sub>PLZ</sub>	Output Disable Time	5.0	1.5	7.5	8.5	1.0	11.0	1.0	10.0	ns	2-6

\*Voltage Range 5.0 is 5.0V ±0.5V

## AC Operating Requirements: See Section 2 for Waveforms

Symbol	Parameter	V <sub>CC</sub> * (V)	74ACT		54ACT	74ACT		Units	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF	T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Typ	Guaranteed Minimum					
t <sub>s</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to LE	5.0	3.0	7.0	8.5	8.0	ns	2-7	
t <sub>h</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to LE	5.0	0	0	1.0	1.0	ns	2-7	
t <sub>w</sub>	LE Pulse Width, HIGH	5.0	2.0	7.0	8.5	8.0	ns	2-3	

\*Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = 5.0V
C <sub>PD</sub>	Power Dissipation Capacitance	40.0	pF	V <sub>CC</sub> = 5.0V