



## 54ACT/74ACT825 8-Bit D Flip-Flop

### General Description

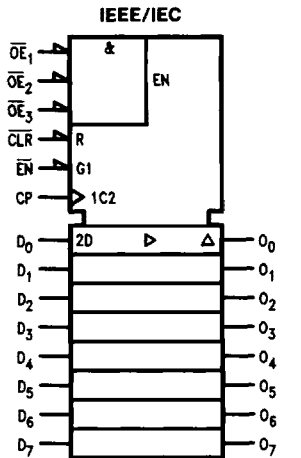
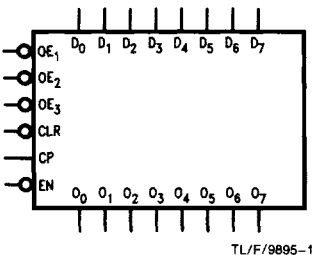
The 'ACT825 is an 8-bit buffered register. They have Clock Enable and Clear features which are ideal for parity bus interfacing in high performance microprogramming systems. Also included are multiple enables that allow multi-use control of the interface. The 'ACT825 has noninverting outputs and is fully compatible with AMD's Am29825.

### Features

- Outputs source/sink 24 mA
- Inputs and outputs are on opposite sides
- 'ACT825 has TTL-compatible inputs
- Standard Military Drawing (SMD)
  - 'ACT825: 5962-91611

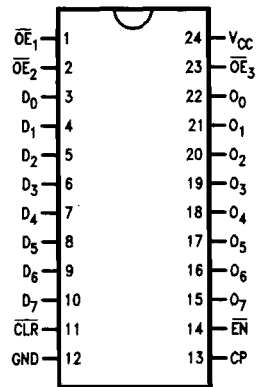
**Ordering Code:** See Section 8

### Logic Symbols

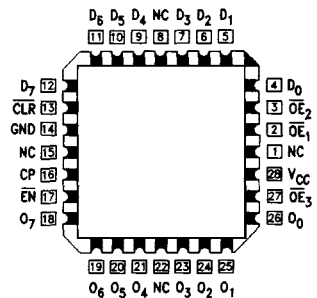


### Connection Diagrams

Pin Assignment  
for DIP, Flatpak and SOIC



Pin Assignment  
for LCC



Pin Names	Description
D <sub>0</sub> -D <sub>7</sub>	Data Inputs
O <sub>0</sub> -O <sub>7</sub>	Data Outputs
$\overline{OE}_1, \overline{OE}_2, \overline{OE}_3$	Output Enables
$\overline{EN}$	Clock Enable
$\overline{CLR}$	Clear
CP	Clock Input

## Functional Description

The 'ACT825 consists of eight D-type edge-triggered flip-flops. These devices have TRI-STATE® outputs for bus systems, organized in a broadside pinning. In addition to the clock and output enable pins, the buffered clock (CP) and buffered Output Enable ( $\overline{OE}$ ) are common to all flip-flops. The flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH CP transition. With  $\overline{OE}_1$ ,  $\overline{OE}_2$  and  $\overline{OE}_3$  LOW, the contents of the flip-flops are available at the outputs. When one of  $\overline{OE}_1$ ,  $\overline{OE}_2$  or  $\overline{OE}_3$  is HIGH, the outputs go to the high impedance state.

Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops. The 'ACT825 has Clear ( $\overline{CLR}$ ) and Clock Enable ( $\overline{EN}$ ) pins. These pins are ideal for parity bus interfacing in high performance systems.

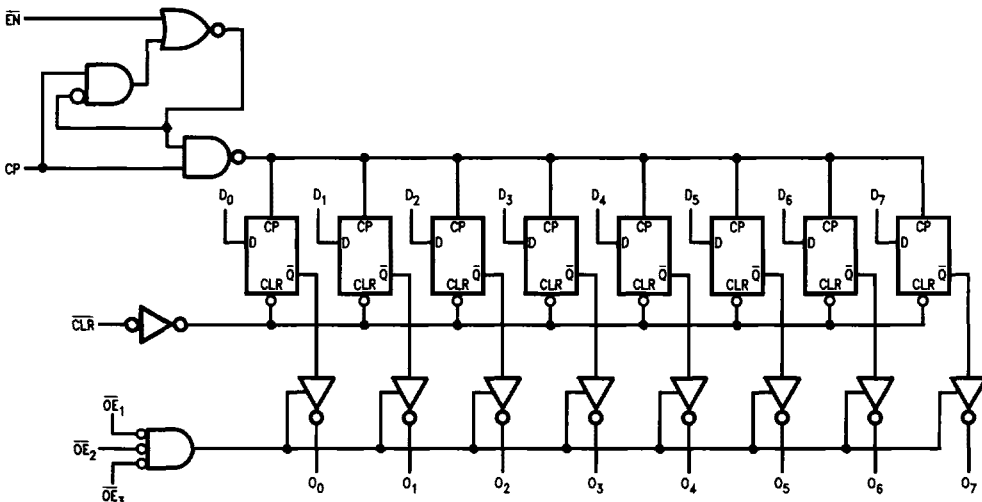
When  $\overline{CLR}$  is LOW and  $\overline{OE}$  is LOW, the outputs are LOW. When  $\overline{CLR}$  is HIGH, data can be entered into the flip-flops. When  $\overline{EN}$  is LOW, data on the inputs is transferred to the outputs on the LOW-to-HIGH clock transition. When  $\overline{EN}$  is HIGH, the outputs do not change state, regardless of the data or clock input transitions.

Function Table

Inputs					Internal	Output	Function
$\overline{OE}$	$\overline{CLR}$	$\overline{EN}$	CP	$D_n$	Q	O	
H	X	L	↗	L	L	Z	High-Z
H	X	L	↗	H	H	Z	High-Z
H	L	X	X	X	L	Z	Clear
L	L	X	X	X	L	L	Clear
H	H	H	X	X	NC	Z	Hold
L	H	H	X	X	NC	NC	Hold
H	H	L	↗	L	L	Z	Load
H	H	L	↗	H	H	Z	Load
L	H	L	↗	L	L	L	Load
L	H	L	↗	H	H	H	Load

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 Z = High Impedance  
 ↗ = LOW-to-HIGH Transition  
 NC = No Change

## Logic Diagram



TL/F/9895-5

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 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 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
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 ( $V_{CC}$ )	4.5V to 5.5V
*ACT	
Input Voltage ( $V_I$ )	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	
74ACT	-40°C to +85°C
54ACT	-55°C to +125°C
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 Electrical Characteristics

Symbol	Parameter	$V_{CC}$ (V)	74ACT			54ACT		74ACT		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	4.5	1.5	2.0	2.0	2.0	2.0	2.0	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		5.5	1.5	2.0	2.0	2.0	2.0	2.0			
$V_{IL}$	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	0.8	0.8	0.8	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		5.5	1.5	0.8	0.8	0.8	0.8	0.8			
$V_{OH}$	Minimum High Level	4.5	4.49	4.4	4.4	4.4	4.4	4.4	V	$I_{OUT} = -50 \mu\text{A}$	
		5.5	5.49	5.4	5.4	5.4	5.4	5.4			
		4.5		3.86	3.70	3.76			V	* $V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -24 \text{ mA}$ $-24 \text{ mA}$	
		5.5		4.86	4.70	4.76					
$V_{OL}$	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	0.1	0.1	0.1	V	$I_{OUT} = 50 \mu\text{A}$	
		5.5	0.001	0.1	0.1	0.1	0.1	0.1			
		4.5		0.36	0.50	0.44			V	* $V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OL} = 24 \text{ mA}$ $24 \text{ mA}$	
		5.5		0.36	0.50	0.44					
$I_{IN}$	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\pm 1.0$	$\mu\text{A}$	$V_I = V_{CC}, \text{GND}$		
$I_{OZ}$	Maximum TRI-STATE Current	5.5		$\pm 0.5$	$\pm 10.0$	$\pm 5.0$	$\pm 5.0$	$\mu\text{A}$	$V_I = V_{IL}, V_{IH}$ $V_O = V_{CC}, \text{GND}$		
$I_{CCT}$	Maximum $I_{CC}$ /Input	5.5	0.6		1.6	1.5		mA	$V_I = V_{CC} - 2.1V$		
$I_{OLD}$	†Minimum Dynamic Output Current	5.5			50	75		mA	$V_{OLD} = 1.65V \text{ Max}$		
		5.5			-50	-75		mA	$V_{OHD} = 3.85V \text{ Min}$		
$I_{CC}$	Maximum Quiescent Supply Current	5.5		8.0	160	80		$\mu\text{A}$	$V_{IN} = V_{CC}$ 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:  $I_{CC}$  limit 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)	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		
f <sub>max</sub>	Maximum Clock Frequency	5.0	120	158		95		109	MHz		
t <sub>PLH</sub>	Propagation Delay CP to O <sub>n</sub>	5.0	1.5	5.5	9.5	1.5	11.5	1.5	10.5	ns	2-3, 4
t <sub>PHL</sub>	Propagation Delay CP to O <sub>n</sub>	5.0	2.0	5.5	9.5	1.5	11.5	1.5	10.5	ns	2-3, 4
t <sub>PHL</sub>	Propagation Delay $\overline{\text{CLR}}$ to O <sub>n</sub>	5.0	2.5	8.0	13.5	1.5	18.0	2.0	15.5	ns	2-3, 4
t <sub>PZH</sub>	Output Enable Time $\overline{\text{OE}}$ to O <sub>n</sub>	5.0	1.5	6.0	10.5	1.5	11.5	1.5	11.5	ns	2-5
t <sub>PZL</sub>	Output Enable Time $\overline{\text{OE}}$ to O <sub>n</sub>	5.0	2.0	6.5	11.0	1.5	12.5	1.5	12.0	ns	2-6
t <sub>PHZ</sub>	Output Disable Time $\overline{\text{OE}}$ to O <sub>n</sub>	5.0	1.5	6.5	11.0	1.5	13.5	1.5	12.0	ns	2-5
t <sub>PLZ</sub>	Output Disable Time $\overline{\text{OE}}$ to O <sub>n</sub>	5.0	1.5	6.0	10.5	1.5	13.0	1.5	11.5	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 CP	5.0	0.5	2.5	4.0	2.5	ns	2-7		
t <sub>h</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP	5.0	0	2.5	2.5	2.5	ns	2-7		
t <sub>s</sub>	Setup Time, HIGH or LOW $\overline{\text{EN}}$ to CP	5.0	0	2.0	4.0	2.5	ns	2-7		
t <sub>h</sub>	Hold Time, HIGH or LOW $\overline{\text{EN}}$ to CP	5.0	0	1.0	2.0	1.0	ns	2-7		
t <sub>w</sub>	CP Pulse Width HIGH or LOW	5.0	2.5	4.5	6.0	5.5	ns	2-4		
t <sub>w</sub>	$\overline{\text{CLR}}$ Pulse Width, LOW	5.0	3.0	5.5	7.0	5.5	ns	2-4		
t <sub>rec</sub>	$\overline{\text{CLR}}$ to CP Recovery Time	5.0	1.5	3.5	4.5	4.0	ns	2-4, 7		

\*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> = OPEN
C <sub>PD</sub>	Power Dissipation Capacitance	44	pF	V <sub>CC</sub> = 5.0V