

## 54ACTQ377 Octal D Flip-Flop with Clock Enable

### General Description

The ACTQ377 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common buffered Clock (CP) input loads all flip-flops simultaneously, when the Clock Enable ( $\overline{CE}$ ) is LOW.

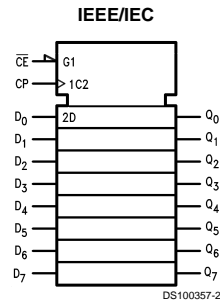
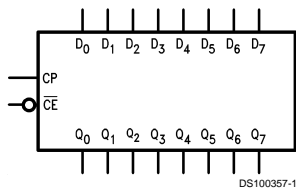
The register is fully edge-triggered. The state of each D input, one setup time before the LOW-to-HIGH clock transition, is transferred to the corresponding flip-flop's Q output. The  $\overline{CE}$  input must be stable only one setup time prior to the LOW-to-HIGH clock transition for predictable operation.

The ACTQ377 utilizes FACT Quiet Series<sup>®</sup> technology to guarantee quiet output switching and improved dynamic threshold performance. FACT Quiet Series features GTO<sup>®</sup> output control and undershoot corrector in addition to a split ground bus for superior performance.

### Features

- Ideal for addressable register applications
- Clock enable for address and data synchronization applications
- Eight edge-triggered D flip-flops
- Buffered common clock
- Outputs source/sink 24 mA
- See '273 for master reset version
- See '373 for transparent latch version
- See '374 for TRI-STATE<sup>®</sup> version
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- TTL-compatible inputs and outputs
- Standard Microcircuit Drawing (SMD) 5962-9219001

### Logic Symbols

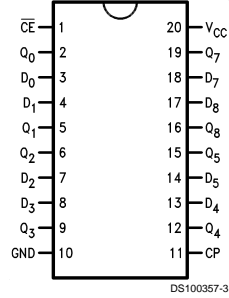


Pin Names	Description
D <sub>0</sub> -D <sub>7</sub>	Data Inputs
$\overline{CE}$	Clock Enable (Active LOW)
Q <sub>0</sub> -Q <sub>7</sub>	Data Outputs
CP	Clock Pulse Input

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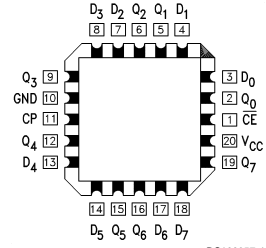
## Connection Diagrams

Pin Assignment  
for DIP and Flatpak



DS100357-3

Pin Assignment  
for LCC



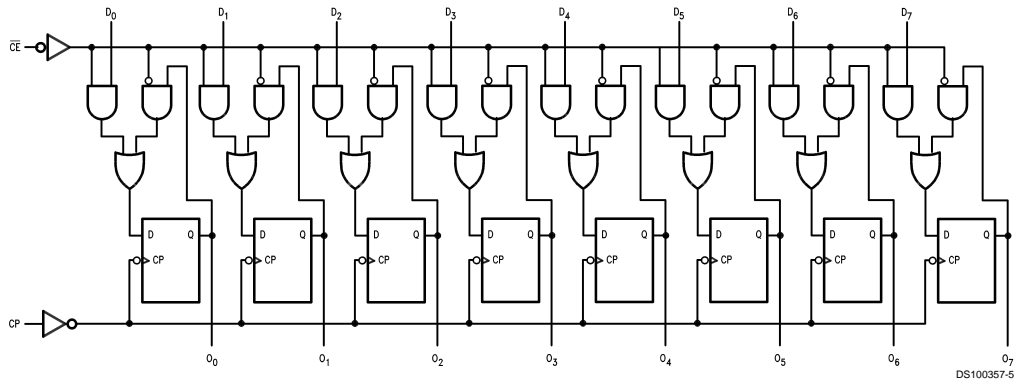
DS100357-4

## Mode Select-Function Table

Operating Mode	Inputs			Outputs
	CP	$\overline{CE}$	$D_n$	$Q_n$
Load '1'	N	L	H	H
Load '0'	N	L	L	L
Hold (Do Nothing)	N	H	X	No Change
	X	H	X	No Change

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
N = LOW-to-HIGH Clock Transition

## Logic Diagram



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

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## 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 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

## 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 ( $\Delta V/\Delta t$ )	'ACTQ Devices	
$V_{IN}$ from 0.8V to 2.0V		
$V_{CC}$ @ 4.5V, 5.5V		125 mV/ns

**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 Characteristics for 'ACTQ Family Devices

Symbol	Parameter	$V_{CC}$ (V)	54ACTQ	Units	Conditions
			$T_A =$		
			-55°C to +125°C		
			Guaranteed Limits		
$V_{IH}$	Minimum High Level Input Voltage	4.5	2.0	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	2.0		
$V_{IL}$	Maximum Low Level Input Voltage	4.5	0.8	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	0.8		
$V_{OH}$	Minimum High Level 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 $V_{IH}$ $I_{OH} = -24$ mA $I_{OH} = -24$ mA
		5.5	4.70		
$V_{OL}$	Maximum Low Level 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 $V_{IH}$ $I_{OL} = 24$ mA $I_{OL} = 24$ mA
		5.5	0.50		
$I_{IN}$	Maximum Input Leakage Current	5.5	$\pm 1.0$	$\mu A$	$V_I = V_{CC}, GND$
$I_{CCT}$	Maximum $I_{CC}/Input$	5.5	1.6	mA	$V_I = V_{CC} - 2.1V$
$I_{OLD}$	(Note 3) Minimum Dynamic	5.5	50	mA	$V_{OLD} = 1.65V$ Max
$I_{OHD}$	Output Current	5.5	-50	mA	$V_{OHD} = 3.85V$ Min
$I_{CC}$	Maximum Quiescent Supply Current	5.5	160.0	$\mu A$	$V_{IN} = V_{CC}$ or GND
$V_{OLP}$	Quiet Output Maximum Dynamic $V_{OL}$	5.0	1.5	V	(Note 4)

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

Symbol	Parameter	V <sub>CC</sub> (V)	54ACTQ		Units	Conditions
			T <sub>A</sub> = -55°C to +125°C			
			Guaranteed Limits			
V <sub>OLV</sub>	Quiet Output Minimum Dynamic V <sub>OL</sub>	5.0	-1.2		V	(Note 4)

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

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

**Note 4:** Max number of outputs defined as (n). Data inputs are driven 0V to 3V, one output GND.

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V) (Note 5)	54ACTQ		Units	Fig. No.
			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF			
			Min	Max		
f <sub>max</sub>	Maximum Clock Frequency	5.0	85		MHz	
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>n</sub>	5.0	1.5	10.0	ns	
t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub>	5.0	1.5	10.0	ns	

**Note 5:** Voltage Range 5.0 is 5.0V ±0.5V

## AC Operating Requirements

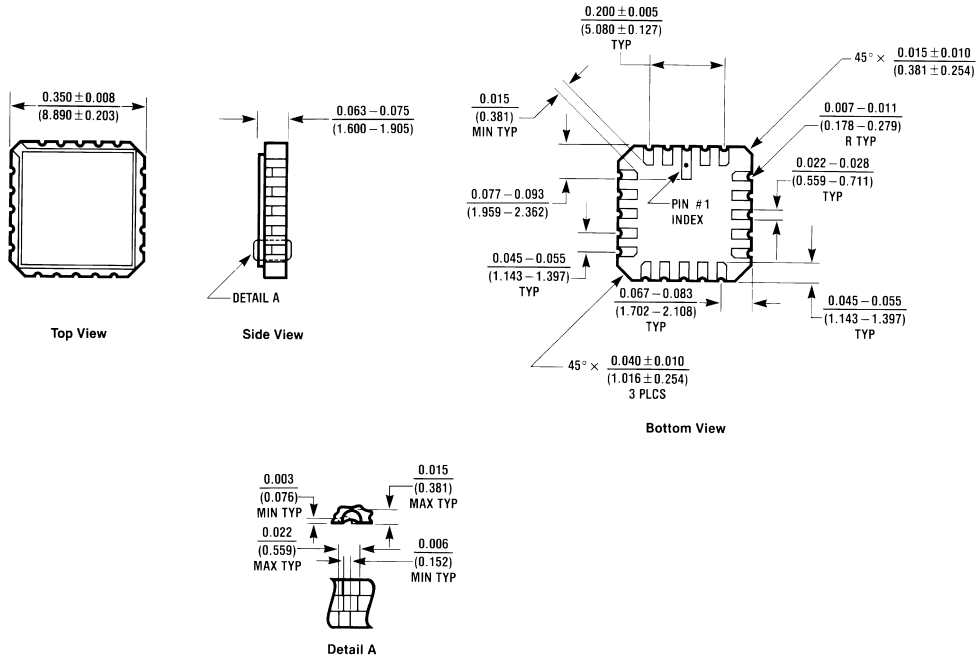
Symbol	Parameter	V <sub>CC</sub> (V) (Note 6)	54ACTQ		Units	Fig. No.
			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF			
			Guaranteed Minimum			
t <sub>s</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to CP	5.0	4.0		ns	
t <sub>h</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP	5.0	1.5		ns	
t <sub>s</sub>	Setup Time, HIGH or LOW $\overline{CE}$ to CP	5.0	5.0		ns	
t <sub>h</sub>	Hold Time, HIGH or LOW $\overline{CE}$ to CP	5.0	1.5		ns	
t <sub>w</sub>	CP Pulse Width HIGH or LOW	5.0	5.0		ns	

**Note 6:** Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

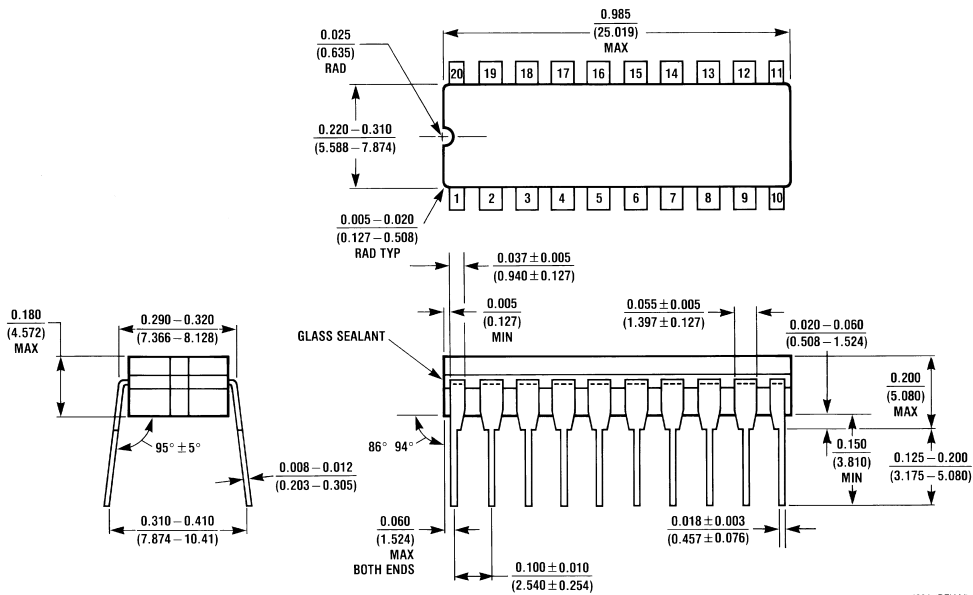
Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	10.0	pF	V <sub>CC</sub> = OPEN
C <sub>PD</sub>	Power Dissipation Capacitance	80.0	pF	V <sub>CC</sub> = 5.0V

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



E20A (REV D)

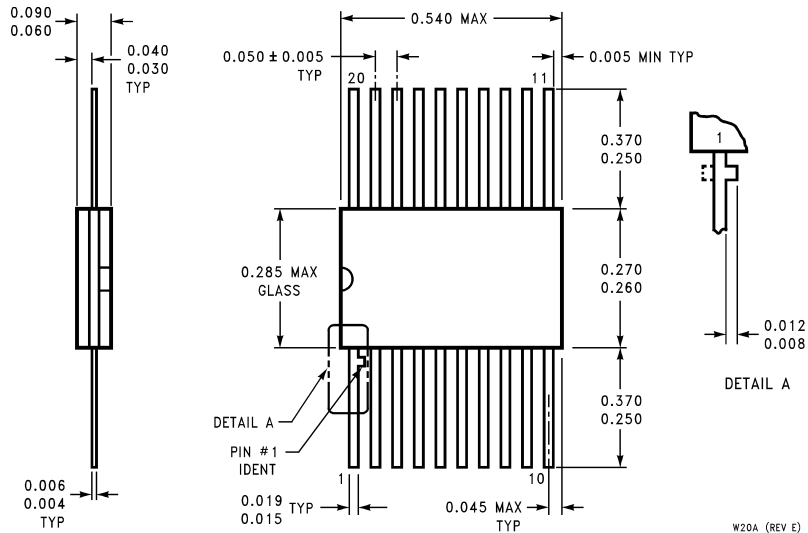
**20 Terminal Ceramic Leadless Chip Carrier (L)**  
**NS Package Number E20A**



J20A (REV M)

**20 Lead Ceramic Dual-In-Line Package (D)**  
**NS Package Number J20A**

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



**20 Lead Ceramic Flatpak (F)  
NS Package Number W20A**

W20A (REV E)

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