National Semiconductor

August 1998

54ACTQ533
Quiet Series Octal Transparent Latch with TRI-STATE® Outputs

General Description

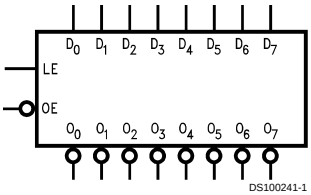
The ACTQ533 consists of eight latches with TRI-STATE outputs for bus organized system applications. The flip-flops appear transparent to the data when Latch Enable (LE) is HIGH. When LE is low, the data satisfying the input timing requirements is latched. Data appears on the bus when the Output Enable (OE) is LOW. When OE is HIGH, the bus output is in the high impedance state.

The ACTQ533 utilizes NSC Quiet Series technology to guarantee quiet output switching and improve dynamic threshold performance. FACT Quiet Series™ features GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

Features

- I_{CC} and I_{OZ} reduced by 50%
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Improved latch up immunity
- Eight latches in a single package
- TRI-STATE outputs drive bus lines or buffer memory address registers
- Outputs source/sink 24 mA
- Inverted version of the ACTQ373
- 4 kV minimum ESD immunity

Logic Symbols



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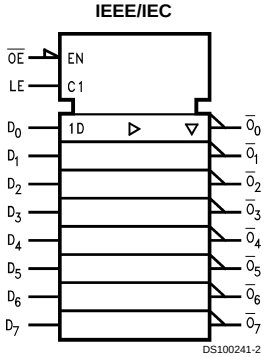

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Pin Names	Description
D_0–D_7	Data Inputs
LE	Latch Enable Input
$\overline{OE}$	Output Enable Input
$\overline{O}_0$–$\overline{O}_7$	TRI-STATE Latch Outputs

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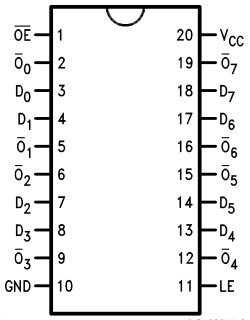
FACT® is a registered trademark of Fairchild Semiconductor Corporation.
FACT Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

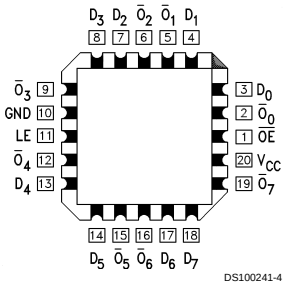
Connection Diagrams

Pin Assignment for DIP and Flatpak



DS100241-3

Pin Assignment for LCC



DS100241-4

Functional Description

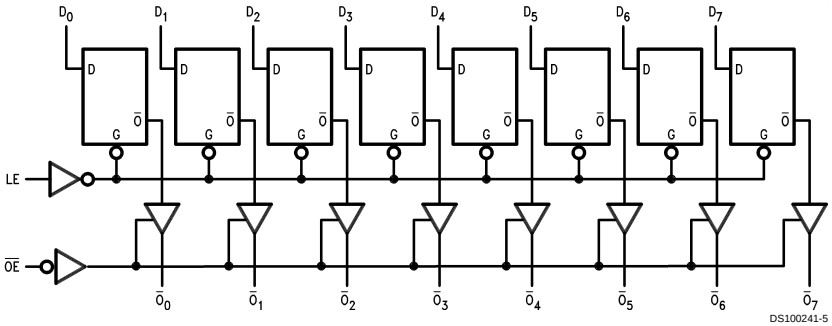
The ACTQ533 contains eight D-type latches with TRI-STATE standard outputs. When the Latch Enable (LE) input is HIGH, data on the D_n inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change state each time its D input changes. When LE is LOW, the latches 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	$\overline{\textbf{OE}}$	$\mathbf{D_n}$	$\overline{\mathbf{O}}_\mathbf{n}$
X	H	X	Z
H	L	L	H
H	L	H	L
L	L	X	$\overline{O}_0$

H = HIGH Voltage Level
L = LOW Voltage Level
Z = High Impedance
X = Immaterial
$\overline{O}_0$ = Previous $\overline{O}_0$ before HIGH to Low transition of Latch Enable

Logic Diagram



DS100241-5

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 to V_{CC} + 0.5V
DC Output Source or Sink Current (I_O) ±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND}) ±50 mA
Storage Temperature (T_{STG}) −65˚C to +150˚C
DC Latchup Source or Sink Current ±300 mA
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 ΔV/Δt
'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.

Note 2: All commercial packaging is not recommended for applications requiring greater than 2000 temperature cycles from −40˚C to +125˚C.

DC Characteristics for 'ACTQ Family Devices

Symbol	Parameter	V_{CC} (V)	54ACTQ T_A = −55˚C to +125˚C Guaranteed Limits	Units	Conditions
V_{IH}	Minimum High Level Input Voltage	4.5	2.0	V	V_{OUT} = 0.1V
		5.5	2.0		or V_{CC} − 0.1V
V_{IL}	Maximum Low Level Input Voltage	4.5	0.8	V	V_{OUT} = 0.1V
		5.5	0.8		or V_{CC} − 0.1V
V_{OH}	Minimum High Level Output Voltage	4.5	4.4	V	I_{OUT} = −50 μA
		5.5	5.4		
					(Note 3) V_{IN} = V_{IL} or V_{IH}
		4.5	3.70	V	I_{OH} = −24 mA
		5.5	4.70		I_{OH} = −24 mA
V_{OL}	Maximum Low Level Output Voltage	4.5	0.1	V	I_{OUT} = 50 μA
		5.5	0.1		
					(Note 3) V_{IN} = V_{IL} or V_{IH}
		4.5	0.50	V	I_{OL} = 24 mA
		5.5	0.50		I_{OL} = 24 mA
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	μA	V_I = V_{CC}, GND
I_{OZ}	Maximum TRI-STATE Leakage Current	5.5	±5.0	μA	V_I = V_{IL}, V_{IH} V_O = V_{CC}, GND
I_{CCT}	Maximum I_{CC}/Input	5.5	1.6	mA	V_I = V_{CC} − 2.1V

DC Characteristics for 'ACTQ Family Devices (Continued)

Symbol	Parameter	V_{CC} (V)	54ACTQ T_A = −55°C to +125°C Guaranteed Limits	Units	Conditions
I_{OLD}	Minimum Dynamic	5.5	50	mA	V_{OLD} = 1.65V Max
I_{OHD}	Output Current (Note 4)	5.5	−50	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5	80.0	µA	V_{IN} = V_{CC} or GND (Note 5)
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	5.0	1.7	V	(Notes 6, 7)
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	5.0	−1.2	V	(Notes 6, 7)

Note 3: All outputs loaded; thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: I_{CC} for 54ACTQ @ 25°C is identical to 74ACQ @ 25°C.

Note 6: Plastic DIP package.

Note 7: Max number of outputs defined as (n). Data inputs are driven 0V to 3V. One output @ GND.

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V) (Note 8)	54ACTQ T_A = −55°C to +125°C C_L = 50 pF Min	54ACTQ T_A = −55°C to +125°C C_L = 50 pF Max	Units	Fig. No.
t_{PHL}, t_{PLH}	Propagation Delay D_n to O_n	5.0	1.5	9.0	ns	
t_{PHL}, t_{PLH}	Propagation Delay LE to O_n	5.0	1.5	10.5	ns	
t_{PZL}, t_{PZH}	Output Enable Time	5.0	1.5	10.5	ns	
t_{PHZ}, t_{PLZ}	Output Disable Time	5.0	1.5	10.5	ns	

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

Note 9: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}). Parameter guaranteed by design.

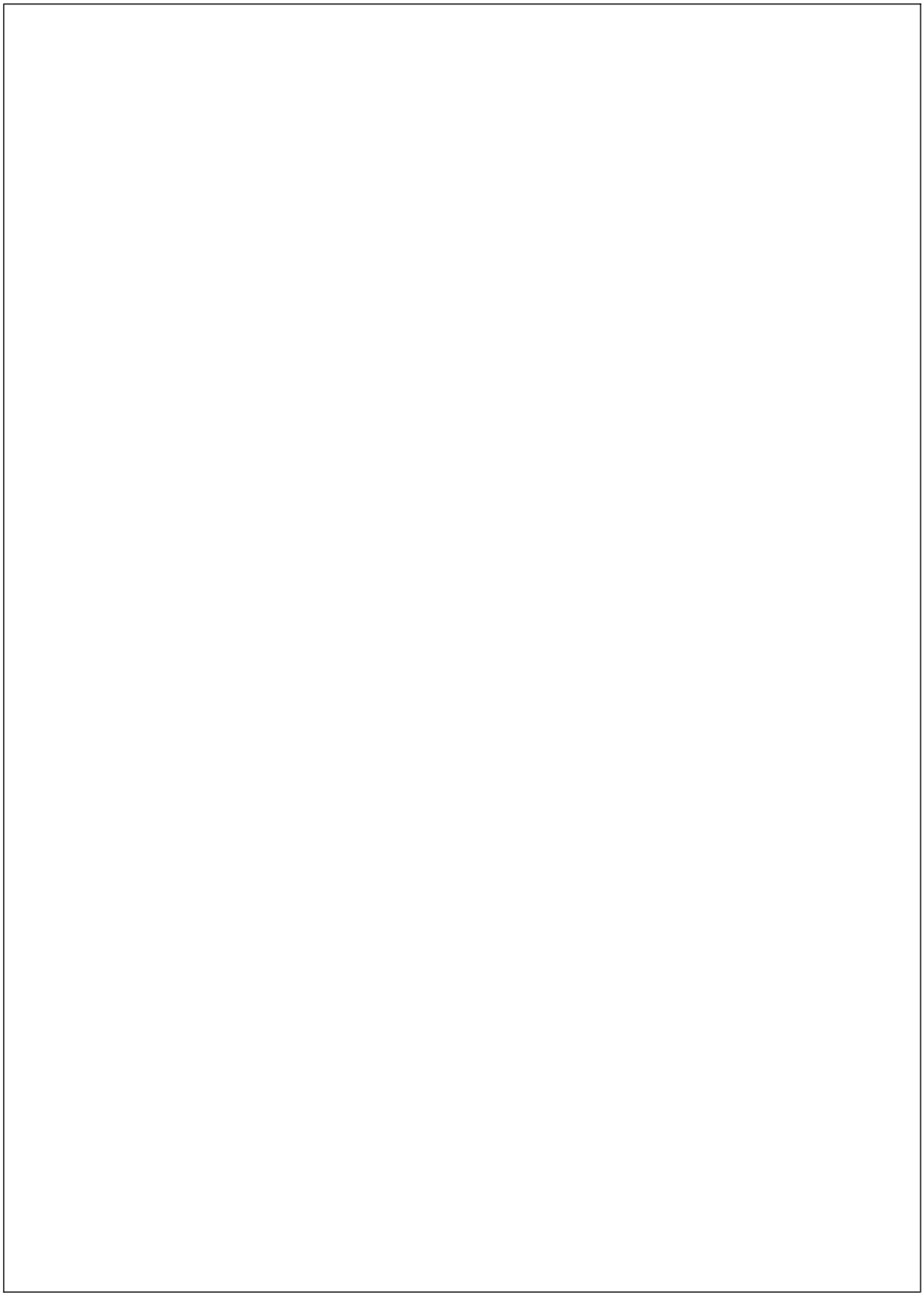
AC Operating Requirements

Symbol	Parameter	V_{CC} (V) (Note 10)	54ACTQ T_A = −55°C to +125°C C_L = 50 pF Guaranteed Minimum	Units	Fig. No.
t_S	Setup Time, HIGH or LOW D_n to LE	5.0	3.0	ns	
t_H	Hold Time, HIGH or LOW D_n to LE	5.0	1.5	ns	
t_W	LE Pulse Width, HIGH	5.0	5.0	ns	

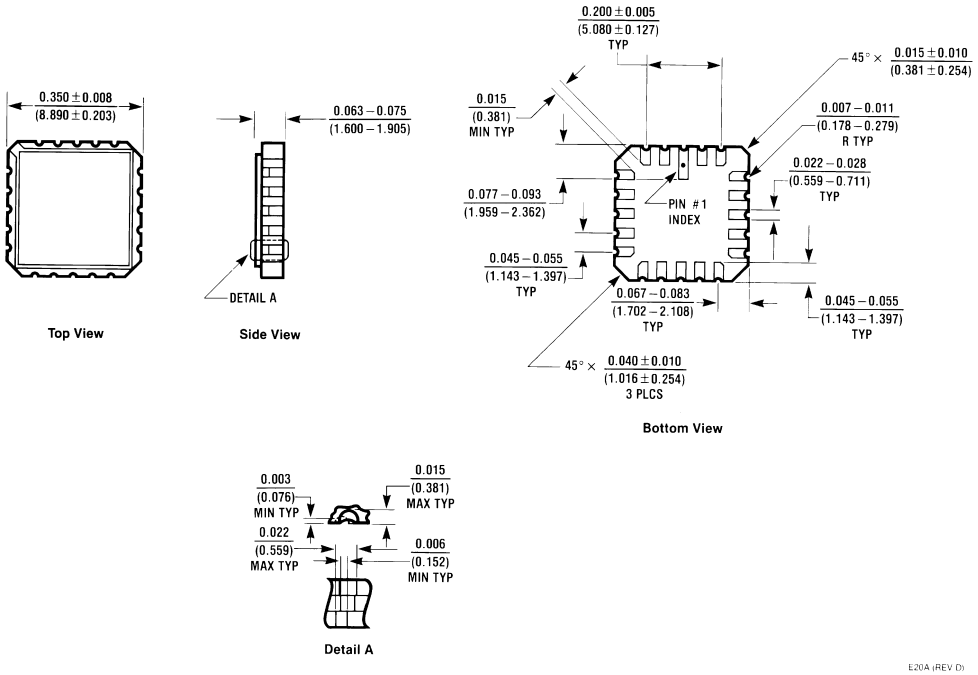
Note 10: Voltage Range 5.0 is 5.0V ±0.5V.

Capacitance

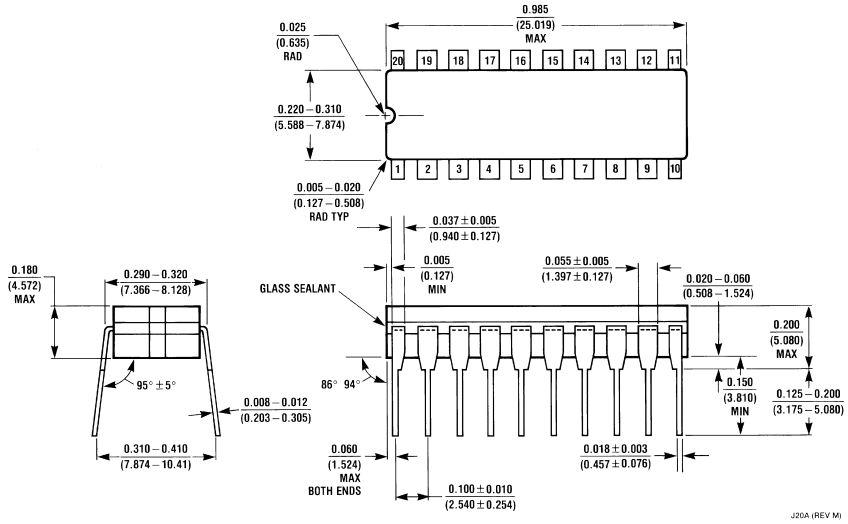
Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = OPEN
C_{PD}	Power Dissipation Capacitance	40	pF	V_{CC} = 5.0V



Physical Dimensions inches (millimeters) unless otherwise noted

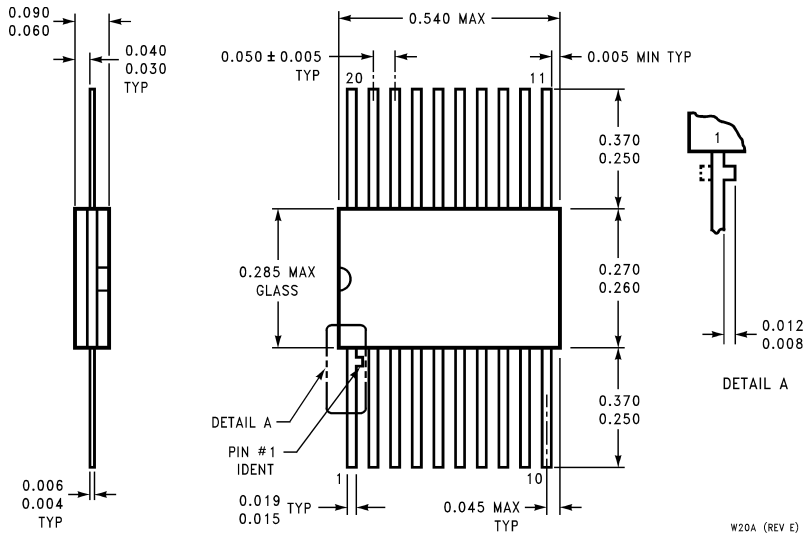


20-Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A



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

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