National Semiconductor

September 1998

54ACTQ16245
16-Bit Transceiver with TRI-STATE® Outputs

General Description

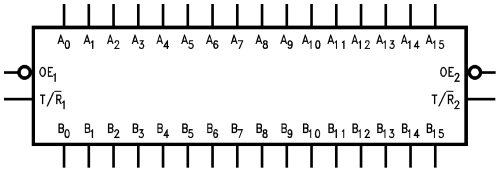
The 'ACTQ16245 contains sixteen non-inverting bidirectional buffers with TRI-STATE outputs and is intended for bus oriented applications. The device is byte controlled. Each has separate control inputs which can be shorted together for full 16-bit operation. The T/$\overline{R}$ inputs determine the direction of data flow through the device. The $\overline{OE}$ inputs disable both the A and B ports by placing them in a high impedance state.

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
- Bidirectional non-inverting buffers
- Separate control logic for each byte
- 16-bit version of the 'ACTQ245
- Outputs source/sink 24 mA
- Standard Microcircuit Drawing (SMD) 5962-9562001

Logic Symbol



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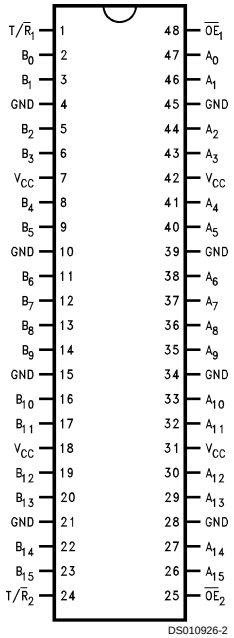
Pin Description

Pin Names	Description
$\overline{OE}_n$	Output Enable Input (Active Low)
T/$\overline{R}$	Transmit/Receive Input
A_0–A_{15}	Side A Inputs/Outputs
B_0–B_{15}	Side B Outputs/Inputs

Connection Diagram

Pin Assignment for CERPAK



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Functional Description

The 'ACTQ16245 contains sixteen non-inverting bidirectional buffers with TRI-STATE 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. The following description applies to each byte. When the T/$\overline{R}$ input is HIGH, then Bus A data is transmitted to Bus B. When the T/$\overline{R}$ input is LOW, Bus B data is transmitted to Bus A. The TRI-STATE outputs are controlled by an Output Enable ($\overline{OE}_n$) input for each byte. When $\overline{OE}_n$ is LOW, the outputs are in 2-state mode. When $\overline{OE}_n$ is HIGH, the outputs are in the high impedance mode, but this does not interfere with entering new data into the inputs.

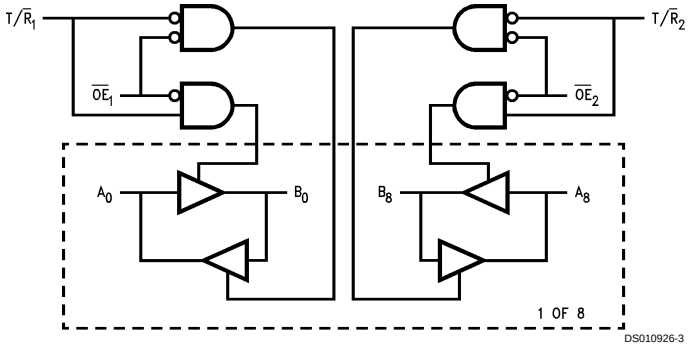
Truth Tables

Inputs		Outputs
$\overline{OE}_1$	T/$\overline{R}_1$	
L	L	Bus B_0–B_7 Data to Bus A_0–A_7
L	H	Bus A_0–A_7 Data to Bus B_0–B_7
H	X	HIGH-Z State on A_0–A_7, B_0–B_7

Inputs		Outputs
$\overline{OE}_2$	T/$\overline{R}_2$	
L	L	Bus B_8–B_{15} Data to Bus A_8–A_{15}
L	H	Bus A_8–A_{15} Data to Bus B_8–B_{15}
H	X	HIGH-Z State on A_8–A_{15}, B_8–B_{15}

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

Logic Diagram



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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 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	
C-DIP	+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 varaibles. National does not recommend operation of FACT™ circuits outside databook specifications.

DC Electrical 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 Input Voltage	4.5	2.0	V	V_{OUT} = 0.1V
		5.5	2.0		or V_{CC} − 0.1V
V_{IL}	Maximum Low Input Voltage	4.5	0.8	V	V_{OUT} = 0.1V
		5.5	0.8		or V_{CC} − 0.1V
V_{OH}	Minimum High Output Voltage	4.5	4.4	V	I_{OUT} = −50 µA
		5.5	5.4		
					(Note 2) 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 Output Voltage	4.5	0.1	V	I_{OUT} = 50 µA
		5.5	0.1		
					(Note 2) 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_{OZT}	Maximum I/O Leakage Current	5.5	±10.0	µA	V_I = V_{IL}, V_{IH} V_O = V_{CC}, GND
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	µA	V_I = V_{CC}, 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}	Minimum Dynamic Output Current (Note 3)	5.5	50	mA	V_{OLD} = 1.65V Max
I_{OHD}			50	mA	V_{OHD} = 3.85V 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)

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.

DC Electrical Characteristics for 'ACTQ Family Devices (Continued)

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.

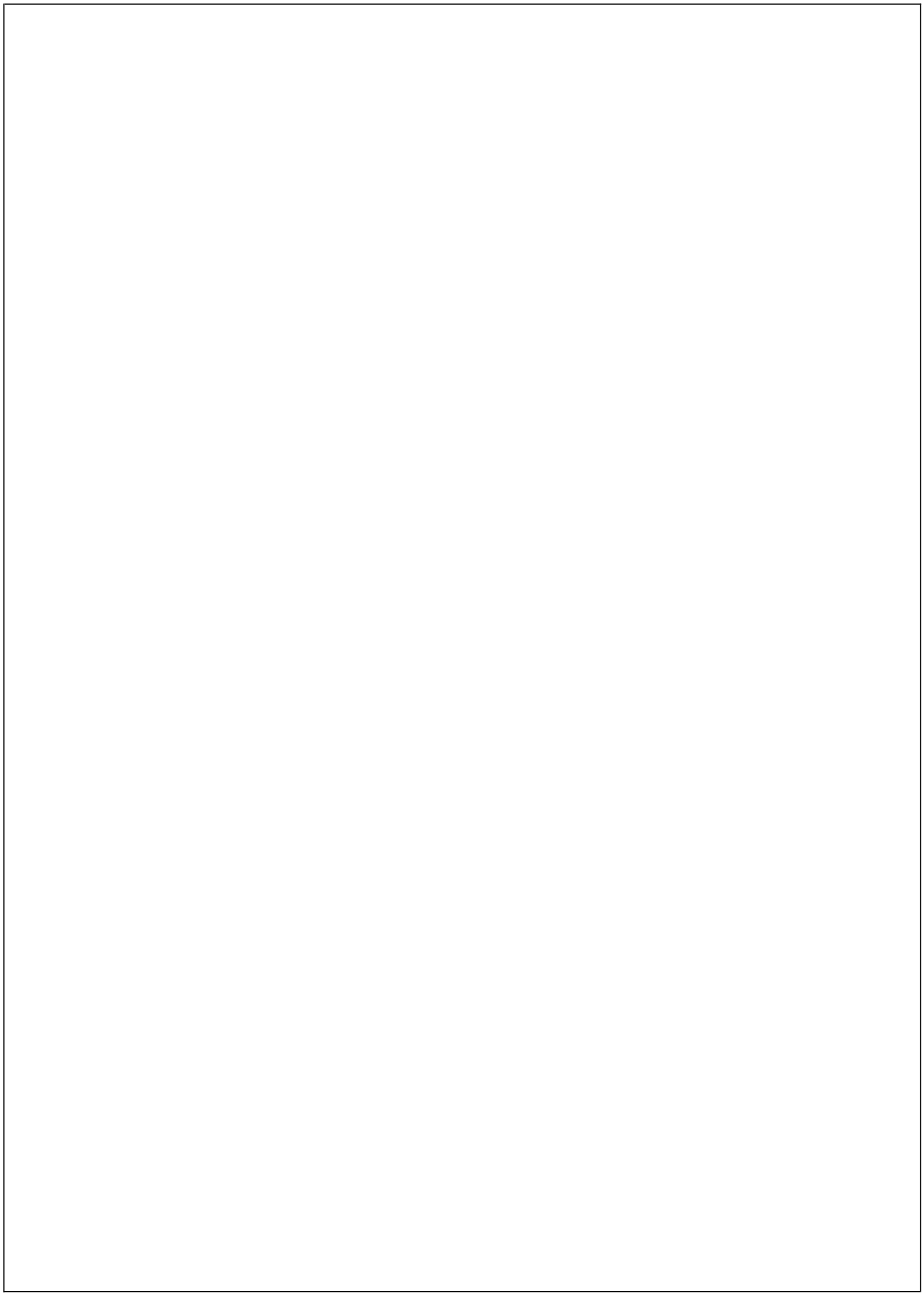
AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V) (Note 7)	54ACTQ T_A = −55˚C to +125˚C C_L = 50 pF		Units
			Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay A_n, B_n to B_n, A_n	5.0	2.0 2.0	9.5 9.5	ns
t_{PZH}, t_{PZL}	Output Enable Time	5.0	2.5 2.5	11.0 13.0	ns
t_{PHZ}, t_{PLZ}	Output Disable Time	5.0	1.5 1.5	9.5 9.5	ns

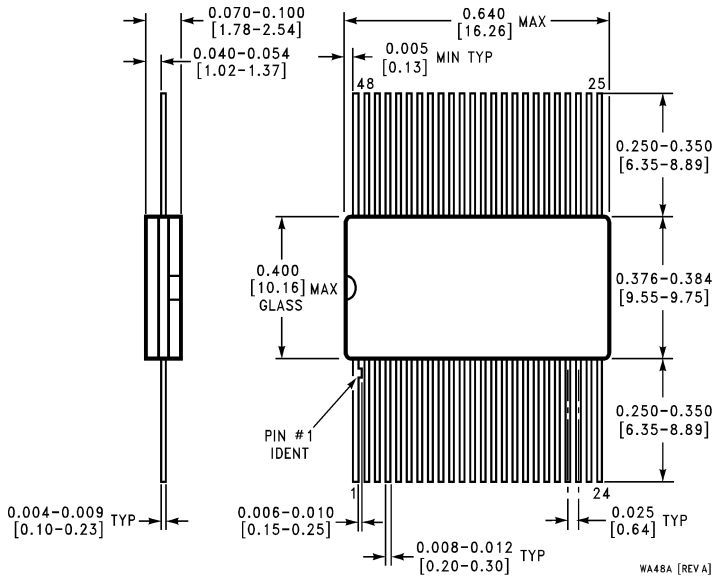
Note 7: Voltage Range 5.0 is 5.0V ±0.5V.

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Pin 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 (F)
NS Package Number WA48A

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