HARRIS SEMICONDUCTOR CD74FCT163245

December 1996

Fast CMOS 3.3V 16-Bit Bidirectional Transceiver

Features

- Advanced 0.6 micron CMOS Technology
- Advanced Low Power CMOS Operation
- Excellent Output Drive Capability:
  - Balanced Drives (24mA Sink and Source)
  - Compatible with LVC™ Class of Products.
- Pin Compatible with Industry Standard Double-Density Pinouts
- Low Ground Bounce Outputs
- Hysteresis on All Inputs
- Control Inputs Can Be Driven by 3.3V or 5V Devices
- Multiple Center Pin and Distributed V_{CC}/GND Pins Minimizing Switching Noise

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74FCT163245AMT	-40 to 85	48 Ld TSSOP	M48.240-P
CD74FCT163245ASM	-40 to 85	48 Ld SSOP	M48.300-P
CD74FCT163245CMT	-40 to 85	48 Ld TSSOP	M48.240-P
CD74FCT163245CSM	-40 to 85	48 Ld SSOP	M48.300-P
CD74FCT163245MT	-40 to 85	48 Ld TSSOP	M48.240-P
CD74FCT163245SM	-40 to 85	48 Ld SSOP	M48.300-P

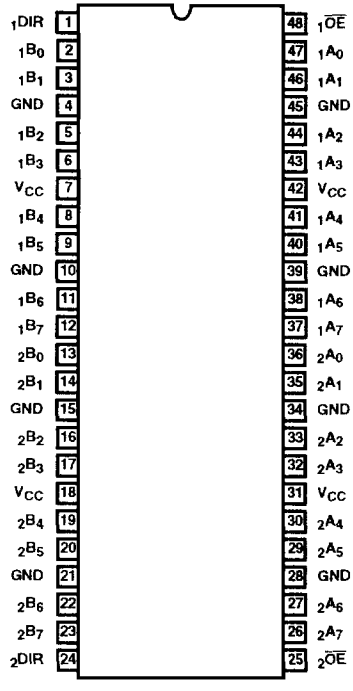
NOTE: When ordering, use the entire part number Add the suffix 96 to obtain the variant in the tape and reel.

Description

The CD74FCT163245 is a 16-bit bidirectional transceiver designed for asynchronous two-way communication between data buses. The direction control input pin ($_X$DIR) determines the direction of data flow through the bidirectional transceiver. The Direction and Output Enable controls are designed to operate this device as either two independent 8-bit transceivers or one 16-bit transceiver. The output enable ($_X\overline{OE}$) input, when HIGH, disables both A and B ports by placing them in HIGH Z condition.

Pinout

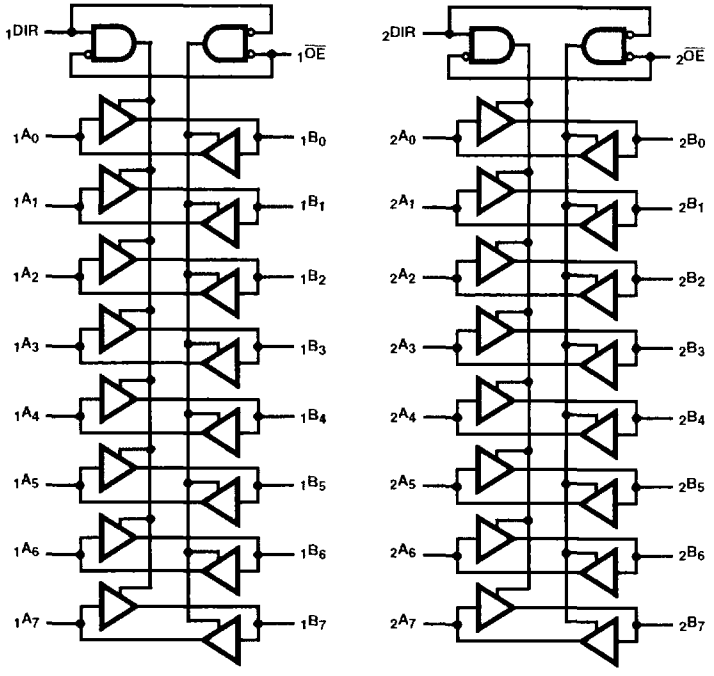
CD74FCT163245
(SSOP, TSSOP)
TOP VIEW



7 3.3V FCT

File Number **4193.2**

Functional Block Diagram



TRUTH TABLE (NOTE 1)

INPUTS		OUTPUTS
x$\overline{OE}$	xDIR	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	Z

NOTE:

1. H = High Voltage Level
   L = Low Voltage Level
   X = Don't Care
   Z = High Impedance

Pin Descriptions

PIN NAME	DESCRIPTION
x$\overline{OE}$	Three-State Output Enable Inputs (Active LOW)
xDIR	Direction Control Input
xAx	Side A Inputs or Three-State Outputs
xBx	Side B Inputs or Three-State Outputs
GND	Ground
V_{CC}	Power

Absolute Maximum Ratings

DC Input Voltage . . . . . -0.5V to 7.0V
DC Output Current 120mA

Operating Conditions

Operating Temperature Range . . . . . -40°C to 85°C
Supply Voltage to Ground Potential
Inputs and V_{CC} Only . . . . . -0.5V to 7.0V
Supply Voltage to Ground Potential
Outputs and D/O Only . . . . . -0.5V to 7.0V

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} (°C/W)
TSSOP Package	94
SSOP Package	76

Maximum Junction Temperature . . . . . 150°C
Maximum Storage Temperature Range . . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . . 300°C
(Lead Tips Only)

CAUTION. Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

PARAMETER	SYMBOL	(NOTE 3) TEST CONDITIONS		MIN	(NOTE 4) TYP	MAX	UNITS
DC ELECTRICAL SPECIFICATIONS Over the Operating Range T_A = -40°C to 85°C, V_{CC} = 2.7V to 3.6V							
Input HIGH Voltage (Input Pins)	V_{IH}	Guaranteed Logic HIGH Level		2.2	-	5.5	V
Input HIGH Voltage (I/O Pins)	V_{IH}	Guaranteed Logic HIGH Level		2.2	-	V_{CC} + 0.5	V
Input LOW Voltage (Input and I/O Pins)	V_{IL}	Guaranteed Logic LOW Level		-0.5	-	0.8	V
Input HIGH Current (Input Pins)	I_{IH}	V_{CC} = Max	V_{IN} = 5.5V	-	-	±1	µA
Input HIGH Current (I/O Pins)	I_{IH}	V_{CC} = Max	V_{IN} = V_{CC}	-	-	±1	µA
Input LOW Current (Input Pins)	I_{IL}	V_{CC} = Max	V_{IN} = GND	-	-	±1	µA
Input LOW Current (I/O Pins)	I_{IL}	V_{CC} = Max	V_{IN} = GND	-	-	±1	µA
High Impedance Output Current (Three-State)	I_{OZH}	V_{CC} = Max	V_{OUT} = V_{CC}	-	-	±1	µA
	I_{OZL}	V_{CC} = Max	V_{OUT} = GND	-	-	±1	µA
Clamp Diode Voltage	V_{IK}	V_{CC} = Min, I_{IN} = -18mA		-	-0.7	-1.2	V
Output HIGH Current	I_{ODH}	V_{CC} = 3.3V V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V (Note 5)		-36	-60	-110	mA
Output LOW Current	I_{ODL}	V_{CC} = 3.3V V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V (Note 5)		50	90	200	mA
Output HIGH Voltage	V_{OH}	V_{CC} = Min, V_{IN} = V_{IH} or V_{IL}	I_{OH} = -0.1mA	V_{CC} - 0.2	-	-	V
			I_{OH} = -3mA	2.4	3.0	-	V
		V_{CC} = 3.0V, V_{IN} = V_{IH} or V_{IL}	I_{OH} = -8mA	2.4 (Note 8)	3.0	-	V
			I_{OH} = -24mA	2.0	-	-	V
Output LOW Voltage	V_{OL}	V_{CC} = Min, V_{IN} = V_{IH} or V_{IL}	I_{OL} = 0.1mA	-	-	0.2	V
			I_{OL} = 16mA	-	0.2	0.4	V
			I_{OL} = 24mA	-	0.3	0.5	V

7
3.3V FCT

Electrical Specifications (Continued)

PARAMETER	SYMBOL	(NOTE 3) TEST CONDITIONS		MIN	(NOTE 4) TYP	MAX	UNITS
Short Circuit Current (Note 6)	I_{OS}	V_{CC} = Max (Note 5), V_{OUT} = GND		-60	-85	-240	mA
Input Hysteresis	V_H			-	150	-	mV
CAPACITANCE $T_A = 25^oC$, f = 1MHz							
Input Capacitance (Note 7)	C_{IN}	V_{IN} = 0V		-	4.5	6	pF
Output Capacitance (Note 7)	C_{OUT}	V_{OUT} = 0V		-	5.5	8	pF
POWER SUPPLY SPECIFICATIONS							
Quiescent Power Supply Current	I_{CC}	V_{CC} = Max	V_{IN} = GND or V_{CC}	-	0.1	10	µA
Quiescent Power Supply Current TTL Inputs HIGH	ΔI_{CC}	V_{CC} = Max	V_{IN} = VCC - 0.6V (Note 9)	-	2.0	30	µA
Dynamic Power Supply Current (Note 10)	I_{CCD}	V_{CC} = Max, Outputs Open $_x\overline{OE}$ = $_x$DIR = GND One Bit Toggling 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	-	50	75	µA/ MHz
Total Power Supply Current (Note 12)	I_C	V_{CC} = Max, Outputs Open f_i = 10MHz, 50% Duty Cycle $_x\overline{OE}$ = $_x$DIR = GND One Bit Toggling	V_{IN} = V_{CC} - 0.6V V_{IN} = GND	-	0.5	0.8	mA
		V_{CC} = Max, Outputs Open f_i = 2.5MHz, 50% Duty Cycle $_x\overline{OE}$ = $_x$DIR = GND 16 Bits Toggling	V_{IN} = V_{CC} - 0.6V V_{IN} = GND	-	2.0	3.3 (Note 11)	mA

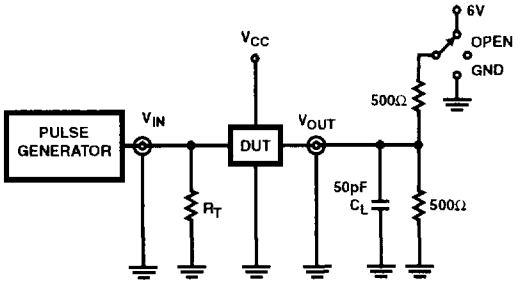
Switching Specifications Over Operating Range (Note 13)

PARAMETER	SYMBOL	(NOTE 14) TEST CONDITIONS	CD74FCT163245 (NOTE 15) MIN	CD74FCT163245 MAX	CD74FCT163245A (NOTE 15) MIN	CD74FCT163245A MAX	CD74FCT163245C (NOTE 15) MIN	CD74FCT163245C MAX	UNITS
Propagation Delay A to B, B to A	t_{PLH}, t_{PHL}	C_L = 50pF, R_L = 500Ω	1.5	7.0	1.5	4.6	1.5	4.1	ns
Output Enable Time $x\overline{OE}$ to A or B	t_{PZH}, t_{PZL}		1.5	9.5	1.5	6.2	1.5	5.8	ns
Output Disable Time (Note 16) $x\overline{OE}$ to A or B	t_{PHZ}, t_{PLZ}		1.5	7.5	1.5	5.0	1.5	4.8	ns
Output Enable Time xDIR to A or B	t_{PZH}, t_{PZL}		1.5	9.5	1.5	6.2	1.5	5.8	ns
Output Disable Time xDIR to A or B (Note 16)	t_{PHZ}, t_{PLZ}		1.5	7.5	1.5	5.0	1.5	4.8	ns
Output Skew(17)	$t_{SK(O)}$		-	0.5	-	0.5	-	0.5	ns

NOTES:

3. For conditions shown as Max or Min, use appropriate value specified under Electrical Specifications for the applicable device type.
4. Typical values are at V_{CC} = 3.3V, 25°C ambient and maximum loading.
5. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
6. This parameter is guaranteed but not tested.
7. This parameter is determined by device characterization but is not production tested.
8. $V_{OH} = V_{CC} - 0.6V$ at rated current.
9. Per TTL driven input; all other inputs at V_{CC} or GND.
10. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
11. Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.
12. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
    $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$
    I_{CC} = Quiescent Current
    ΔI_{CC} = Power Supply Current for a TTL High Input
    D_H = Duty Cycle for TTL Inputs High
    N_T = Number of TTL Inputs at D_H
    I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
    f_{CP} = Clock Frequency for Register Devices (Zero for Non-Register Devices)
    N_{CP} = Number of Clock Inputs at f_{CP}
    f_i = Input Frequency
    N_i = Number of Inputs at f_i
    All currents are in milliamps and all frequencies are in megahertz.
13. Propagation Delays and Enable/Disable times are with V_{CC} = 3.3V ±0.3V, normal range. For V_{CC} = 2.7V, extended range, all Propagation Delays and Enable/Disable times should be degraded by 20%.
14. See test circuits and waveforms.
15. Minimum limits are guaranteed but not tested on Propagation Delays.
16. This parameter is guaranteed but not production tested.
17. Skew between any two outputs, of the same package, switching in the same direction. This parameter is guaranteed by design.

Test Circuits and Waveforms



SWITCH POSITION

TEST	SWITCH
t_{PLZ}, t_{PZL}, Open Drain	6V
t_{PHZ}, t_{PZH}	GND
t_{PLH}, t_{PHL}	Open

DEFINITIONS:

C_L = Load capacitance, includes jig and probe capacitance.

R_T = Termination resistance, should be equal to Z_{OUT} of the Pulse Generator.

NOTE:

18. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; $Z_{OUT} \leq 50\Omega$; t_f, $t_r \leq 2.5$ns.

FIGURE 1. TEST CIRCUIT

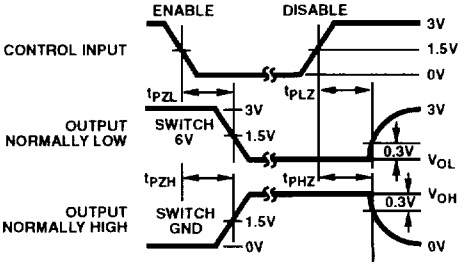


FIGURE 2. ENABLE AND DISABLE TIMING

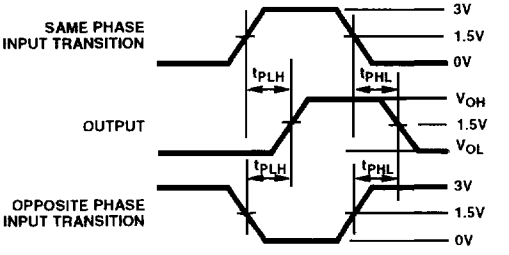


FIGURE 3. PROPAGATION DELAY