

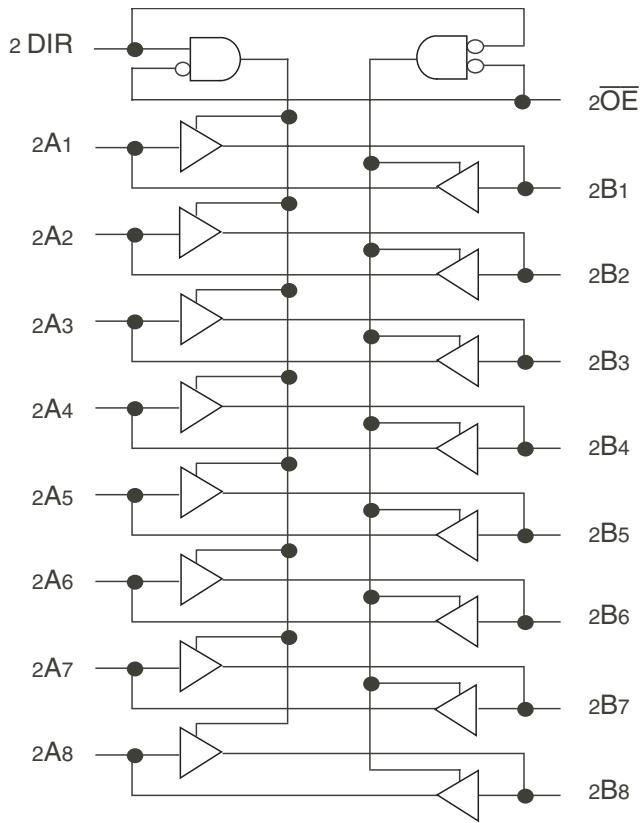
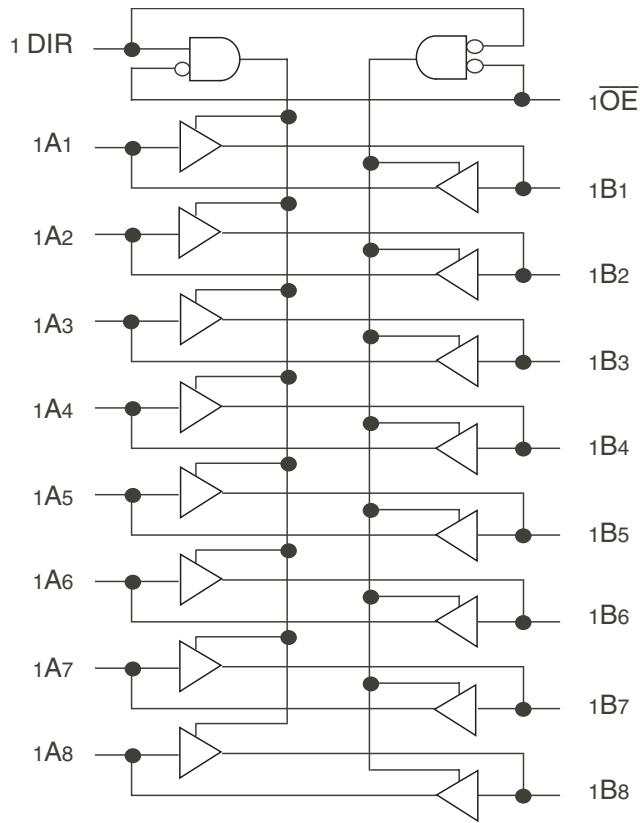
FEATURES:

- 0.5 MICRON CMOS Technology
- High-speed, low-power CMOS replacement for ABT functions
- Typical $t_{sk(o)}$ (Output Skew) < 250ps
- Low input and output leakage $\leq 1\mu\text{A}$ (max.)
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model ($C = 200\text{pF}$, $R = 0$)
- Balanced Output Drivers:
 - $\pm 24\text{mA}$ (industrial)
 - $\pm 16\text{mA}$ (military)
- Reduced system switching noise
- Typical VOLP (Output Ground Bounce) < 0.6V at $\text{Vcc} = 5\text{V}$, $\text{TA} = 25^\circ\text{C}$
- Available in the following packages:
 - Industrial: SSOP, TSSOP
 - Military: CERPACK

DESCRIPTION:

The FCT162245T 16-bit transceiver is built using advanced dual metal CMOS technology. These high-speed, low-power transceivers are ideal for synchronous communication between two buses (A and B). The Direction and Output Enable controls operate these devices as either two independent 8-bit transceivers or one 16-bit transceiver. The direction control pin ($x\text{DIR}$) controls the direction of data flow. The output enable pin ($x\text{OE}$) overrides the direction control and disables both ports. All inputs are designed with hysteresis for improved noise margin.

The FCT162245T has balanced output drive with current limiting resistors. This offers low ground bounce, minimal undershoot, and controlled output fall times—reducing the need for external series terminating resistors. The FCT162245T is a plug-in replacement for the FCT16245T and ABT16245 for on-board interface applications.

FUNCTIONAL BLOCK DIAGRAM

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MILITARY AND INDUSTRIAL TEMPERATURE RANGES

SEPTEMBER 2009

PIN CONFIGURATION

1DIR	1	48	1 \overline{OE}
1B1	2	47	1A1
1B2	3	46	1A2
GND	4	45	GND
1B3	5	44	1A3
1B4	6	43	1A4
VCC	7	42	VCC
1B5	8	41	1A5
1B6	9	40	1A6
GND	10	39	GND
1B7	11	38	1A7
1B8	12	37	1A8
2B1	13	36	2A1
2B2	14	35	2A2
GND	15	34	GND
2B3	16	33	2A3
2B4	17	32	2A4
VCC	18	31	VCC
2B5	19	30	2A5
2B6	20	29	2A6
GND	21	28	GND
2B7	22	27	2A7
2B8	23	26	2A8
2DIR	24	25	2 \overline{OE}

SSOP/ TSSOP/ CERPACK
TOP VIEW

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Description	Max	Unit
VTERM ⁽²⁾	Terminal Voltage with Respect to GND	-0.5 to +7	V
VTERM ⁽³⁾	Terminal Voltage with Respect to GND	-0.5 to V _{CC} +0.5	V
TSTG	Storage Temperature	-65 to +150	°C
I _{OUT}	DC Output Current	-60 to +120	mA

NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- All device terminals except FCT162XXXT AND FCT166XXXT (A-Port) Output and I/O terminals.
- Output and I/O terminals terminals for FCT162XXXT AND FCT166XXXT (A-Port).

CAPACITANCE (TA = +25°C, F = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	3.5	6	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	3.5	8	pF

NOTE:

- This parameter is measured at characterization but not tested.

PIN DESCRIPTION

Pin Names	Description
x \overline{OE}	Output Enable Inputs (Active LOW)
xDIR	Direction Control Input
xAx	Side A Inputs or 3-State Outputs
xBx	Side B Inputs or 3-State Outputs

FUNCTION TABLE⁽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	High Z State

NOTE:

- H = HIGH Voltage Level
- L = LOW Voltage Level
- X = Don't Care
- Z = High-Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$; Military: $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
V_{IH}	Input HIGH Level	Guaranteed Logic HIGH Level		2	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic LOW Level		—	—	0.8	V
I_{IH}	Input HIGH Current (Input pins) ⁽⁵⁾	$V_{CC} = \text{Max.}$	$V_I = V_{CC}$	—	—	± 1	μA
	Input HIGH Current (I/O pins) ⁽⁵⁾			—	—	± 1	
I_{IL}	Input LOW Current (Input pins) ⁽⁵⁾		$V_I = \text{GND}$	—	—	± 1	
	Input LOW Current (I/O pins) ⁽⁵⁾			—	—	± 1	
I_{OZH}	High Impedance Output Current	$V_{CC} = \text{Max.}$	$V_O = 2.7\text{V}$	—	—	± 1	μA
I_{OZL}	(3-State Output pins) ⁽⁵⁾		$V_O = 0.5\text{V}$	—	—	± 1	
V_{IK}	Clamp Diode Voltage	$V_{CC} = \text{Min.}$, $I_{IN} = -18\text{mA}$		—	-0.7	-1.2	V
I_{OS}	Short Circuit Current	$V_{CC} = \text{Max.}$, $V_O = \text{GND}$ ⁽³⁾		-80	-140	-250	mA
V_H	Input Hysteresis	—		—	100	—	mV
I_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$ $V_{IN} = \text{GND or } V_{CC}$		—	5	500	μA

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
I_{ODL}	Output LOW Current	$V_{CC} = 5\text{V}$, $V_{IN} = V_{IH}$ or V_{IL} , $V_O = 1.5\text{V}$ ⁽³⁾		60	115	200	mA
I_{ODH}	Output HIGH Current	$V_{CC} = 5\text{V}$, $V_{IN} = V_{IH}$ or V_{IL} , $V_O = 1.5\text{V}$ ⁽³⁾		-60	-115	-200	mA
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -16\text{mA}$ MIL $I_{OH} = -24\text{mA}$ IND	2.4	3.3	—	V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = 16\text{mA}$ MIL $I_{OH} = 24\text{mA}$ IND	—	0.3	0.55	V

NOTES:

1. For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $V_{CC} = 5.0\text{V}$, $+25^\circ\text{C}$ ambient.
3. Not more than one output should be tested at one time. Duration of the test should not exceed one second.
4. Duration of the condition can not exceed one second.
5. This test limit for this parameter is $\pm 5\mu\text{A}$ at $T_A = -55^\circ\text{C}$.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾				Min.	Typ. ⁽²⁾	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	V _{CC} = Max. V _{IN} = 3.4V ⁽³⁾				—	0.5	1.5	mA
I_{CCD}	Dynamic Power Supply Current ⁽⁴⁾	V _{CC} = Max. Outputs Open x \bar{OE} = xDIR = GND One Input Toggling 50% Duty Cycle		V _{IN} = V _{CC} V _{IN} = GND		—	60	100	μ A/MHz
I_C	Total Power Supply Current ⁽⁶⁾	V _{CC} = Max. Outputs Open f _i = 10MHz 50% Duty Cycle x \bar{OE} = xDIR = GND One Bits Toggling		V _{IN} = V _{CC} V _{IN} = GND		—	0.6	1.5	mA
		V _{CC} = Max. Outputs Open f _i = 2.5MHz 50% Duty Cycle x \bar{OE} = xDIR = GND Sixteen Bits Toggling		V _{IN} = 3.4V V _{IN} = GND		—	0.9	2.3	
		V _{CC} = Max. Outputs Open f _i = 2.5MHz 50% Duty Cycle x \bar{OE} = xDIR = GND Sixteen Bits Toggling		V _{IN} = V _{CC} V _{IN} = GND		—	2.4	4.5 ⁽⁵⁾	
		V _{CC} = Max. Outputs Open f _i = 2.5MHz 50% Duty Cycle x \bar{OE} = xDIR = GND Sixteen Bits Toggling		V _{IN} = 3.4V V _{IN} = GND		—	6.4	16.5 ⁽⁵⁾	

NOTES:

1. For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.

2. Typical values are at V_{CC} = 5.0V, +25°C ambient.3. Per TTL driven input (V_{IN} = 3.4V). All other inputs at V_{CC} or GND.

4. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.

5. Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.6. $I_C = I_{Quiescent} + I_{Inputs} + I_{Dynamic}$ $I_C = I_{CC} + \Delta I_{CC} D_H N_I + I_{CCD} (f_{CP} N_C P/2 + f_i N_I)$ I_{CC} = Quiescent Current (I_{CC1}, I_{CC2} and I_{CC3}) ΔI_{CC} = Power Supply Current for a TTL High Input (V_{IN} = 3.4V)D_H = Duty Cycle for TTL Inputs HighN_I = Number of TTL Inputs at D_HI_{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 FrequencyN_i = Number of Inputs at f_i

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Condition ⁽¹⁾	54FCT162445T		54/74FCT162245AT				54/74FCT162245CT				Unit	
			Mil.		Ind.		Mil.		Ind.		Mil.			
			Min. ⁽²⁾	Max.										
t _{PLH}	Propagation Delay A to B, B to A	CL = 50pF RL = 500 Ω	1.5	7.5	1.5	4.6	1.5	4.9	1.5	3.5	1.5	4.5	ns	
			1.5	10	1.5	6.2	1.5	6.5	1.5	4.4	1.5	6.2	ns	
	Output Enable Time x \bar{OE} to A or B		1.5	10	1.5	5	1.5	6	1.5	4	1.5	5.2	ns	
			1.5	10	1.5	6.2	1.5	6.5	1.5	4.8	1.5	6.2	ns	
	Output Disable Time x \bar{OE} to A or B		1.5	10	1.5	5	1.5	6	1.5	4	1.5	5.2	ns	
			1.5	10	1.5	6.2	1.5	6.5	1.5	4.8	1.5	6.2	ns	
	t _{SK(0)}		—	0.5	—	0.5	—	0.5	—	0.5	—	0.5	ns	

NOTES:

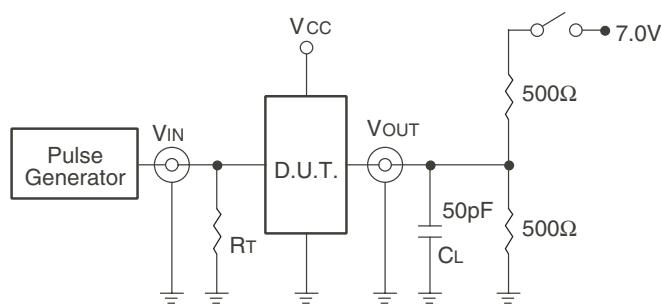
1. See test circuit and waveforms.

2. Minimum limits are guaranteed but not tested on Propagation Delays.

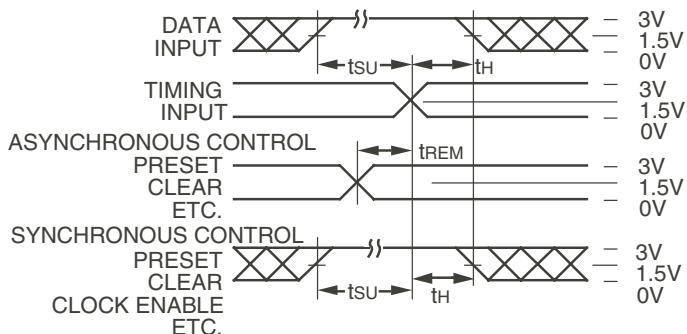
3. Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

4. This parameter is guaranteed but not tested.

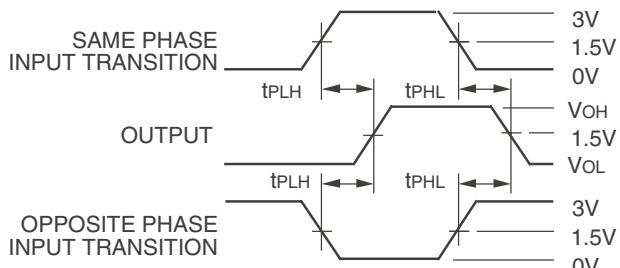
TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Waveforms



Set-up, Hold, and Release Times



Propagation Delay

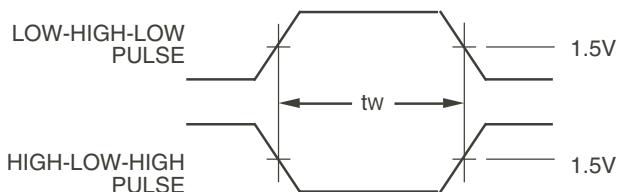
SWITCH POSITION

Test	Switch
Open Drain	Closed
Disable Low	
Enable Low	
All Other Tests	Open

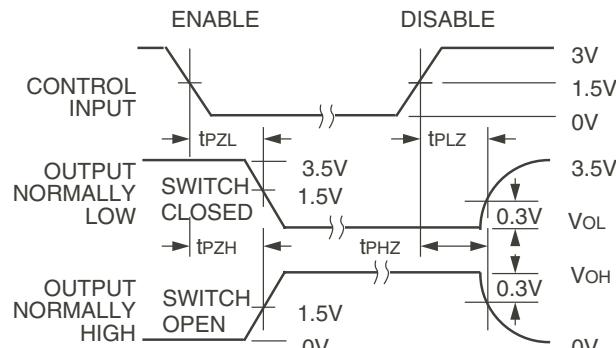
DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.

RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.



Pulse Width



Enable and Disable Times

NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate \leq 1.0MHz; $t_f \leq 2.5\text{ns}$; $t_r \leq 2.5\text{ns}$.

ORDERING INFORMATION

XX Temp. Range	FCT	XXX Family	XXXX Device Type	XX Package	X Process	
					Blank	Industrial MIL-STD-883, Class B
					B	
					PVG	<u>Industrial Options</u> Shrink Small Outline Package - Green
					PAG	Thin Shrink Small Outline Package - Green
					E	<u>Military Options</u> CERPACK
				245T 245AT 245CT		16-Bit Buffer/Line Driver
					162	Double-Density, 5 Volt, Balanced Drive
					54	55 C to +125 C
					74	40 C to +85 C

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