



Integrated Device Technology, Inc.

# FAST CMOS 16-BIT BIDIRECTIONAL TRANSCEIVERS

IDT54/74FCT16245T/AT/CT/ET  
IDT54/74FCT162245T/AT/CT/ET  
IDT54/74FCT166245T/AT/CT  
IDT54/74FCT162H245T/AT/CT/ET

## FEATURES:

- **Common features:**
  - 0.5 MICRON CMOS Technology
  - **High-speed, low-power CMOS replacement for ABT functions**
  - **Typical tsk(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 = 200pF, R = 0)
  - 25 mil pitch SSOP and Cerpack Packages and 19.6 mil pitch TSSOP Package
  - Extended commercial range of -40°C to +85°C
- **Features for FCT16245T/AT/CT/ET:**
  - High drive outputs (-32mA IOH, 64mA IOL)
  - Power off disable outputs permit "live insertion"
  - Typical VOLP (Output Ground Bounce) < 1.0V at VCC = 5V, TA = 25°C
- **Features for FCT162245T/AT/CT/ET:**
  - Balanced Output Drivers:  $\pm 24\text{mA}$  (commercial),  $\pm 16\text{mA}$  (military)
  - Reduced system switching noise
  - Typical VOLP (Output Ground Bounce) < 0.6V at VCC = 5V, TA = 25°C

## DESCRIPTION:

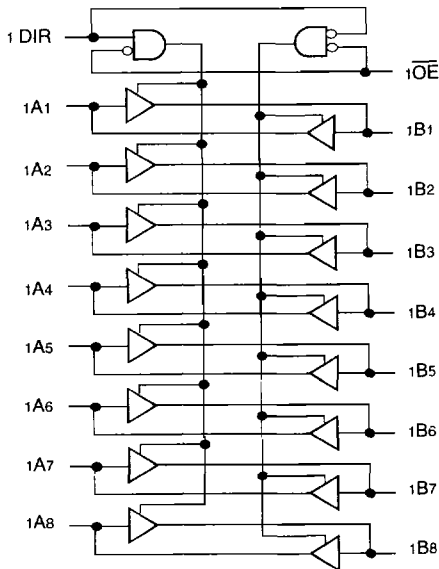
The 16-bit transceivers are built using advanced dual metal CMOS technology. These high-speed, low-power transceivers are ideal for synchronous communication between two busses (A and B). The Direction and Output Enable controls operate these devices as either two independent 8-bit transceivers or one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

The FCT16245T are ideally suited for driving high-capacitance loads and low-impedance backplanes. The output buffers are designed with power off disable capability to allow "live insertion" of boards when used as backplane drivers.

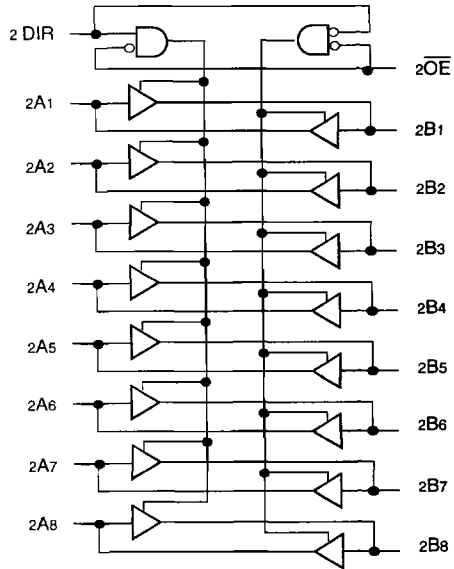
The FCT162245T have balanced output drive with current limiting resistors. This offers low ground bounce, minimal undershoot, and controlled output fall times—reducing the need for external series terminating resistors. The FCT162245T are plug-in replacements for the FCT16245T and ABT16245 for on-board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

The FCT166245T are suited for very low noise, point-to-point driving where there is a single receiver, or a light lumped

## FUNCTIONAL BLOCK DIAGRAM



2545 drw 01



2545 drw 02

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MILITARY AND COMMERCIAL TEMPERATURE RANGES

JUNE 1996

**FEATURES: (Cont'd.)**

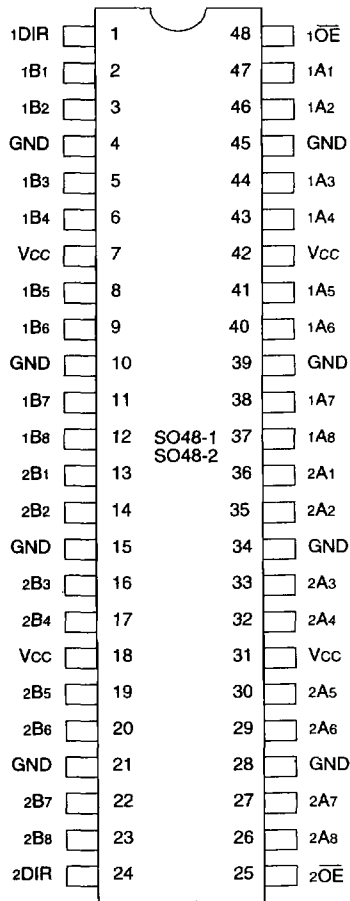
- **Features for FCT166245T/AT/CT:**
  - Light Drive A Port: ±8mA (commercial), ±6mA (military)
  - High Drive B Port: +64mA, -32mA (commercial), +48mA, -24mA (military)
  - Minimal system switching noise
  - Typical VOLP (Output Ground Bounce) < 0.25V at Vcc = 5V, TA = 25°C (A Port Switching)
- **Features for FCT162H245T/AT/CT/ET:**
  - Bus Hold retains last active bus state during 3-state
  - Eliminates the need for external pull up resistors

**DESCRIPTION: (Cont'd.)**

load (<100pF). The buffers are designed to limit the output current to levels which will avoid noise and ringing on the signal lines without using external series terminating resistors. These parts have a ±8mA driver on the "A" Port and a +64/-32mA driver on the "B" Port, making them ideal for interfacing noisy system busses to noise sensitive interfaces.

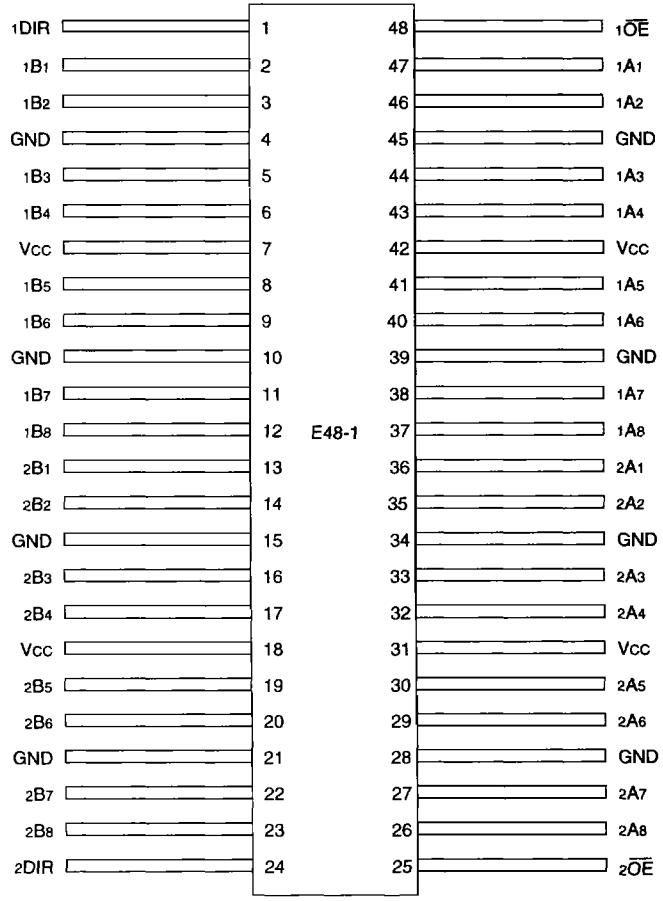
The FCT162H245T have "Bus Hold" which retains the input's last state whenever the input goes to high impedance. This prevents "floating" inputs and eliminates the need for pull-up/down resistors.

**PIN CONFIGURATIONS**



**SSOP  
TSSOP  
TOP VIEW**

2545 drw 03



**CERPACK  
TOP VIEW**

2545 drw 04

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**PIN DESCRIPTION**

Pin Names	Description
xOE	Output Enable Input (Active LOW)
xDIR	Direction Control Input
xAx	Side A Inputs or 3-State Outputs <sup>(1,2)</sup>
xBx	Side B Inputs or 3-State Outputs <sup>(1,3)</sup>

**NOTES:**

2545 tbl 01

- On FCT162H245T these pins have "Bus Hold". All other pins are standard inputs, outputs or I/Os.
- On FCT166245T this is the ±8mA Port.
- On FCT166245T this is the +64/-32mA Port.

**FUNCTION TABLE<sup>(1)</sup>**

Inputs		Outputs
xOE	xDIR	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	High Z State

**NOTE:**

2545 tbl 02

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

**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

Symbol	Rating	Commercial	Military	Unit
VTERM <sup>(2)</sup>	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
VTERM <sup>(3)</sup>	Terminal Voltage with Respect to GND	-0.5 to Vcc +0.5	-0.5 to Vcc +0.5	V
TA	Operating Temperature	-40 to +85	-55 to +125	°C
TBIAS	Temperature Under Bias	-55 to +125	-65 to +135	°C
TSTG	Storage Temperature	-55 to +125	-65 to +150	°C
PT	Power Dissipation	1.0	1.0	W
IOUT	DC Output Current	-60 to +120	-60 to +120	mA

**NOTES:**

2545 lmk 03

- 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 for FCT162XXXT and FCT166XXXT (A-Port).

**CAPACITANCE (TA = +25°C, f = 1.0MHz)**

Symbol	Parameter <sup>(1)</sup>	Conditions	Typ.	Max.	Unit
CIN	Input Capacitance	VIN = 0V	3.5	6.0	pF
CIO	I/O Capacitance	VOUT = 0V	3.5	8.0	pF

**NOTE:**

2545 lmk 04

- This parameter is measured at characterization but not tested.

### DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE (STANDARD PARTS)

Following Conditions Apply Unless Otherwise Specified:

Commercial: TA = -40°C to +85°C, VCC = 5.0V ± 10%; Military: TA = -55°C to +125°C, VCC = 5.0V ± 10%

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min.	Typ. <sup>(2)</sup>	Max.	Unit
V <sub>IH</sub>	Input HIGH Level	Guaranteed Logic HIGH Level	2.0	—	—	V
V <sub>IL</sub>	Input LOW Level	Guaranteed Logic LOW Level	—	—	0.8	V
I <sub>IH</sub>	Input HIGH Current (Input pins) <sup>(5)</sup>	V <sub>CC</sub> = Max. V <sub>I</sub> = V <sub>CC</sub>	—	—	±1	μA
	Input HIGH Current (I/O pins) <sup>(5)</sup>		—	—	±1	
I <sub>IL</sub>	Input LOW Current (Input pins) <sup>(5)</sup>	V <sub>I</sub> = GND	—	—	±1	μA
	Input LOW Current (I/O pins) <sup>(5)</sup>		—	—	±1	
I <sub>OZH</sub>	High Impedance Output Current (3-State Output pins) <sup>(5)</sup>	V <sub>CC</sub> = Max. V <sub>O</sub> = 2.7V	—	—	±1	μA
I <sub>OZL</sub>			V <sub>O</sub> = 0.5V	—	—	
V <sub>IK</sub>	Clamp Diode Voltage	V <sub>CC</sub> = Min., I <sub>IN</sub> = -18mA	—	-0.7	-1.2	V
I <sub>OS</sub>	Short Circuit Current	V <sub>CC</sub> = Max., V <sub>O</sub> = GND <sup>(3)</sup>	-80	-140	-225	mA
V <sub>H</sub>	Input Hysteresis	—	—	100	—	mV
I <sub>CC1</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = Max., V <sub>IN</sub> = GND or V <sub>CC</sub>	—	5	500	μA
I <sub>CCH</sub>						
I <sub>CCZ</sub>						

2545 Ink 05

### OUTPUT DRIVE CHARACTERISTICS FOR FCT16245T AND FCT166245T (B-PORT)

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min.	Typ. <sup>(2)</sup>	Max.	Unit	
I <sub>O</sub>	Output Drive Current	V <sub>CC</sub> = Max., V <sub>O</sub> = 2.5V <sup>(3)</sup>	-50	—	-180	mA	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min. V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -3mA	2.5	3.5	—	V
			I <sub>OH</sub> = -12mA MIL.	2.4	3.5	—	V
			I <sub>OH</sub> = -15mA COM'L.	—	—	—	—
			I <sub>OH</sub> = -24mA MIL. I <sub>OH</sub> = -32mA COM'L. <sup>(4)</sup>	2.0	3.0	—	V
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min. V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	—	0.2	0.55	V	
I <sub>OFF</sub>	Input/Output Power Off Leakage <sup>(5)</sup>	V <sub>CC</sub> = 0V, V <sub>IN</sub> or V <sub>O</sub> ≤ 4.5V	—	—	±1	μA	

2545 Ink 06

### OUTPUT DRIVE CHARACTERISTICS FOR FCT162245T

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min.	Typ. <sup>(2)</sup>	Max.	Unit	
I <sub>ODL</sub>	Output LOW Current	V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup>	60	115	200	mA	
I <sub>ODH</sub>	Output HIGH Current	V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup>	-60	-115	-200	mA	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min. V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	2.4	3.3	—	V	
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min. V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 48mA MIL.	—	0.3	0.55	V
			I <sub>OL</sub> = 64mA COM'L.				

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### OUTPUT DRIVE CHARACTERISTICS FOR FCT166245T (A-PORT ONLY)

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min.	Typ. <sup>(2)</sup>	Max.	Unit	
I <sub>ODL</sub>	Output LOW Current	V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup>	16	48	96	mA	
I <sub>ODH</sub>	Output HIGH Current	V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup>	-16	-48	-96	mA	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min. V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	2.4	3.3	—	V	
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min. V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = -6mA MIL.	—	0.3	0.55	V
			I <sub>OL</sub> = -8mA COM'L.				

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**NOTES:**

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 5.0V, +25°C ambient.
- Not more than one output should be tested at one time. Duration of the test should not exceed one second.
- Duration of the condition can not exceed one second.
- The test limit for this parameter is ± 5μA at TA = -55°C.



**DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE (BUS HOLD)**

Following Conditions Apply Unless Otherwise Specified:

Commercial:  $T_A = -40^{\circ}\text{C}$  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 <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
$V_{IH}$	Input HIGH Level		Guaranteed Logic HIGH Level		2.0	—	—	V
$V_{IL}$	Input LOW Level		Guaranteed Logic LOW Level		—	—	0.8	V
$I_{IH}$	Input HIGH Current <sup>(4)</sup>	Standard Input <sup>(5)</sup>	$V_{CC} = \text{Max.}$	$V_I = V_{CC}$	—	—	$\pm 1$	$\mu\text{A}$
		Standard I/O <sup>(5)</sup>			—	—	$\pm 1$	
		Bus Hold Input			—	—	$\pm 100$	
		Bus Hold I/O			—	—	$\pm 100$	
$I_{IL}$	Input LOW Current <sup>(4)</sup>	Standard Input <sup>(5)</sup>	$V_{CC} = \text{Max.}$	$V_I = \text{GND}$	—	—	$\pm 1$	$\mu\text{A}$
		Standard I/O <sup>(5)</sup>			—	—	$\pm 1$	
		Bus Hold Input			—	—	$\pm 100$	
		Bus Hold I/O			—	—	$\pm 100$	
$I_{BHH}$ $I_{BHL}$	Bus Hold Sustain Current <sup>(4)</sup>	Bus Hold Input	$V_{CC} = \text{Min.}$	$V_I = 2.0\text{V}$	-50	—	—	$\mu\text{A}$
$V_I = 0.8\text{V}$				+50	—	—		
$I_{OZH}$ $I_{OZL}$	High Impedance Output Current (3-State Output pins) <sup>(5,6)</sup>		$V_{CC} = \text{Max.}$	$V_O = 2.7\text{V}$	—	—	$\pm 1$	$\mu\text{A}$
		$V_O = 0.5\text{V}$		—	—	$\pm 1$		
$V_{IK}$	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	-225	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	$\mu\text{A}$

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**NOTES:**

1. For conditions shown as Max. or Min., 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. Pins with Bus Hold are identified in the pin description.
5. The test limit for this parameter is  $\pm 5\mu\text{A}$  at  $T_A = -55^{\circ}\text{C}$ .
6. Does not include Bus Hold I/O pins.

**POWER SUPPLY CHARACTERISTICS**

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
$\Delta I_{CC}$	Quiescent Power Supply Current TTL Inputs HIGH	$V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$		—	0.5	1.5	mA
$I_{CCD}$	Dynamic Power Supply Current <sup>(4)</sup>	$V_{CC} = \text{Max.}$ Outputs Open $\overline{xOE} = xDIR = GND$ One Input Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = GND$	—	60	100	$\mu A/MHz$
$I_C$	Total Power Supply Current <sup>(6)</sup>	$V_{CC} = \text{Max.}$ Outputs Open $f_i = 10MHz$ 50% Duty Cycle $\overline{xOE} = xDIR = GND$ One Bit Toggling	$V_{IN} = V_{CC}$ $V_{IN} = GND$	—	0.6	1.5	mA
			$V_{IN} = 3.4V$ $V_{IN} = GND$	—	0.9	2.3	
		$V_{CC} = \text{Max.}$ Outputs Open $f_i = 2.5MHz$ 50% Duty Cycle $\overline{xOE} = xDIR = GND$ Sixteen Bits Toggling	$V_{IN} = V_{CC}$ $V_{IN} = GND$	—	2.4	4.5 <sup>(5)</sup>	
			$V_{IN} = 3.4V$ $V_{IN} = GND$	—	6.4	16.5 <sup>(5)</sup>	

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**NOTES:**

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at  $V_{CC} = 5.0V$ , +25°C ambient.
- Per TTL driven input ( $V_{IN} = 3.4V$ ). All other inputs at  $V_{CC}$  or  $GND$ .
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the  $I_{CC}$  formula. These limits are guaranteed but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} \cdot DH_{NT} + I_{CCD} \cdot (f_{CP} \cdot N_{CP} / 2 + f_i \cdot N_i)$   
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ} \text{)}$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input (} V_{IN} = 3.4V \text{)}$   
 $DH = \text{Duty Cycle for TTL Inputs High}$   
 $NT = \text{Number of TTL Inputs at } DH$   
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$   
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$   
 $N_{CP} = \text{Number of Clock Inputs at } f_{CP}$   
 $f_i = \text{Input Frequency}$   
 $N_i = \text{Number of Inputs at } f_i$



**SWITCHING CHARACTERISTICS OVER OPERATING RANGE**

Symbol	Parameter	Condition <sup>(1)</sup>	FCT16245T/162245T <sup>(5)</sup>				FCT16245AT/162245AT <sup>(5)</sup>				Unit
			Com'l.		Mil.		Com'l.		Mil.		
			Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	
tPLH	Propagation Delay A to B, B to A	CL = 50pF RL = 500Ω	1.5	7.0	1.5	7.5	1.5	4.6	1.5	4.9	ns
tPZH	Output Enable Time xOE to A or B		1.5	9.5	1.5	10.0	1.5	6.2	1.5	6.5	ns
tPHZ	Output Disable Time xOE to A or B		1.5	7.5	1.5	10.0	1.5	5.0	1.5	6.0	ns
tPZH	Output Enable Time xDIR to A or B <sup>(4)</sup>		1.5	9.5	1.5	10.0	1.5	6.2	1.5	6.5	ns
tPHZ	Output Disable Time xDIR to A or B <sup>(4)</sup>		1.5	7.5	1.5	10.0	1.5	5.0	1.5	6.0	ns
tPLZ	Output Skew <sup>(3)</sup>		—	0.5	—	0.5	—	0.5	—	0.5	ns

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Symbol	Parameter	Condition <sup>(1)</sup>	FCT16245CT/162245CT <sup>(5)</sup>				FCT16245ET/162245ET <sup>(5)</sup>				Unit
			Com'l.		Mil.		Com'l.		Mil.		
			Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	
tPLH	Propagation Delay A to B, B to A	CL = 50pF RL = 500Ω	1.5	4.1	1.5	4.5	1.5	3.2	—	—	ns
tPZH	Output Enable Time xOE to A or B		1.5	5.8	1.5	6.2	1.5	4.4	—	—	ns
tPHZ	Output Disable Time xOE to A or B		1.5	4.8	1.5	5.2	1.5	4.0	—	—	ns
tPZH	Output Enable Time xDIR to A or B <sup>(4)</sup>		1.5	5.8	1.5	6.2	1.5	4.8	—	—	ns
tPHZ	Output Disable Time xDIR to A or B <sup>(4)</sup>		1.5	4.8	1.5	5.2	1.5	4.0	—	—	ns
tPLZ	Output Skew <sup>(3)</sup>		—	0.5	—	0.5	—	0.5	—	—	ns

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**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.
5. Including parts with Bus Hold.

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE**

Symbol	Parameter	Condition <sup>(1)</sup>	FCT166245T				FCT166245AT				FCT166245CT				Unit
			Com'l.		Mil.		Com'l.		Mil.		Com'l.		Mil.		
			Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	
tPLH tPHL	Propagation Delay A to B	CL = 50pF RL = 500Ω	1.5	4.6	1.5	4.9	1.5	4.1	1.5	4.5					ns
tPLH tPHL	Propagation Delay B to A		1.5	7.0	1.5	7.5	1.5	4.6	1.5	4.9					ns
tPZH tPZL	Output Enable Time xOE to B		1.5	6.2	1.5	6.5	1.5	5.8	1.5	6.2					ns
tPZH tPZL	Output Enable Time xOE to A		1.5	9.5	1.5	10.0	1.5	6.2	1.5	6.5					ns
tPHZ tPLZ	Output Disable Time xOE to B		1.5	5.0	1.5	6.0	1.5	4.8	1.5	5.2					ns
tPHZ tPLZ	Output Disable Time xOE to A		1.5	7.5	1.5	10.0	1.5	5.0	1.5	6.0					ns
tPZH tPZL	Output Enable Time xDIR to B <sup>(4)</sup>		1.5	6.2	1.5	6.5	1.5	5.8	1.5	6.2					ns
tPZH tPZL	Output Enable Time xDIR to A <sup>(4)</sup>		1.5	9.5	1.5	10.0	1.5	6.2	1.5	6.5					ns
tPHZ tPLZ	Output Disable Time xDIR to B <sup>(4)</sup>		1.5	5.0	1.5	6.0	1.5	4.8	1.5	5.2					ns
tPHZ tPLZ	Output Disable Time xDIR to A <sup>(4)</sup>		1.5	7.5	1.5	10.0	1.5	5.0	1.5	6.0					ns
tSK(o)	Output Skew <sup>(3)</sup>			0.5		0.5		0.5		0.5					ns

2645 tbl 13

**NOTES:**

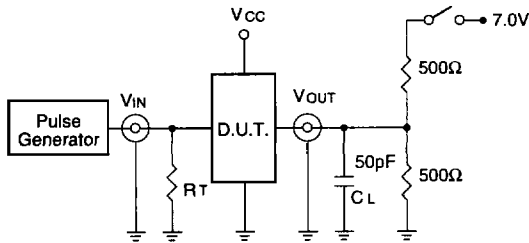
1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
4. This parameter is guaranteed but not tested.





## TEST CIRCUITS AND WAVEFORMS

### TEST CIRCUITS FOR ALL OUTPUTS



2545 drw 05

### SWITCH POSITION

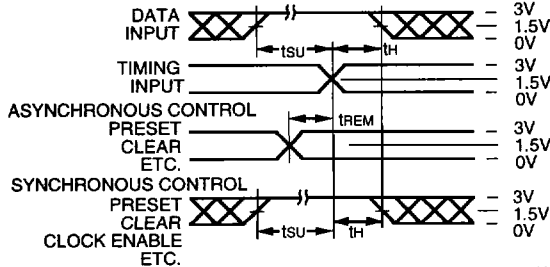
Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

#### DEFINITIONS:

$C_L$  = Load capacitance: includes jig and probe capacitance.  
 $R_T$  = Termination resistance: should be equal to  $Z_{OUT}$  of the Pulse Generator.

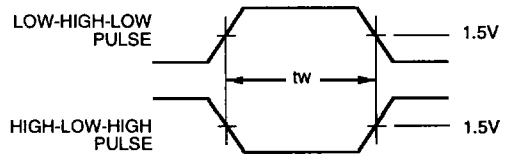
2545 Ink 14

### SET-UP, HOLD AND RELEASE TIMES



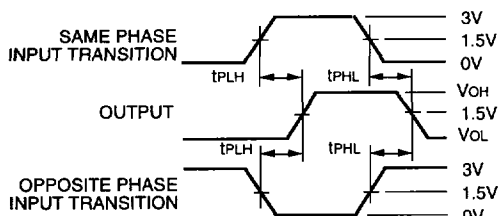
2545 drw 06

### PULSE WIDTH



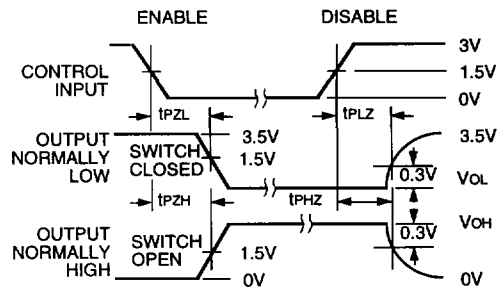
2545 drw 07

### PROPAGATION DELAY



2545 drw 08

### ENABLE AND DISABLE TIMES

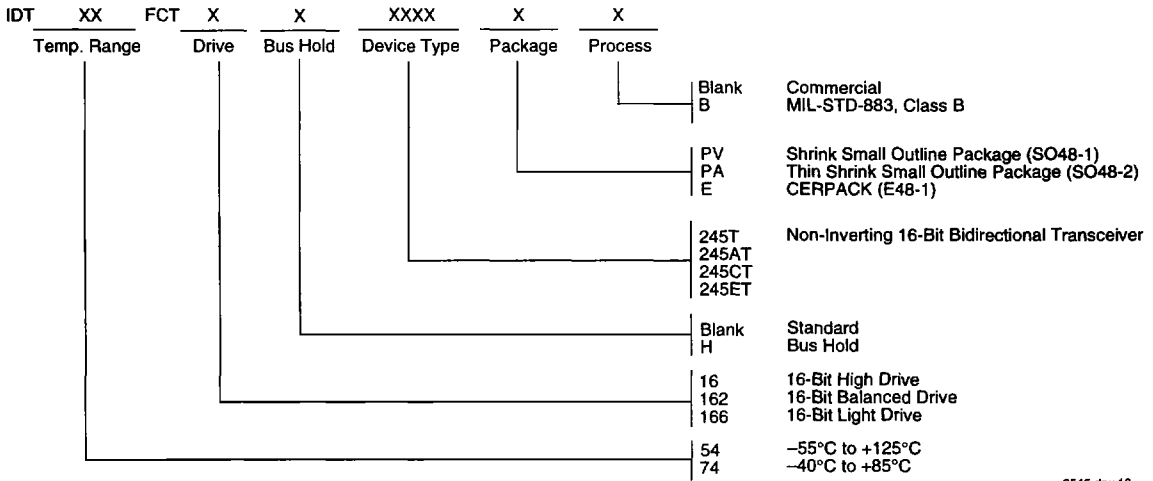


#### NOTES:

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

2545 drw 09

**ORDERING INFORMATION**



2545 drw 10

