



FAST CMOS 16-BIT BUFFER/LINE DRIVER

IDT54/74FCT166244T/AT/CT

FEATURES:

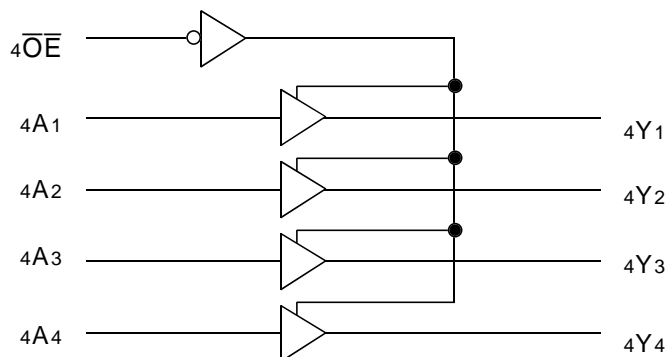
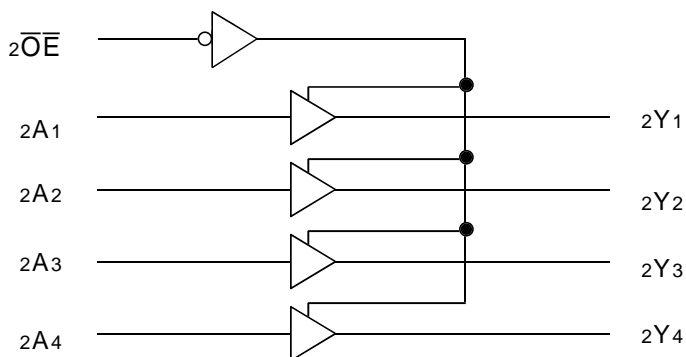
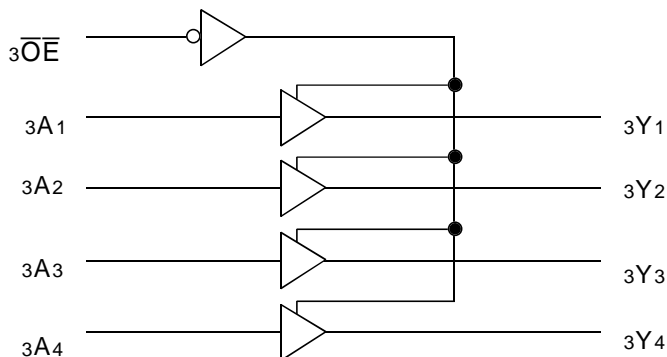
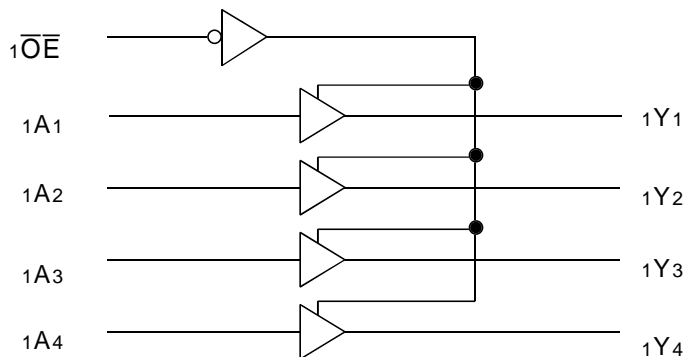
- 0.5 MICRON CMOS Technology
- High-speed, low-power CMOS replacement for ABT functions
- Typical $t_{sk(o)}$ (Output Skew) < 250ps
- Low input and output leakage $\leq 1\mu A$ (max.)
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 25 mil pitch SSOP, 19.6 mil pitch TSSOP, 15.7 mil pitch TVSOP and 25 mil pitch CERPACK packages
- Extended commercial range of $-40^{\circ}C$ to $+85^{\circ}C$
- Light Drive Balanced Output:
 - $\pm 8mA$ (commercial)
 - $\pm 6mA$ (military)
- Minimal system switching noise
- Typical VOLP (Output Ground Bounce) < 0.25V at $V_{CC} = 5V, T_A = 25^{\circ}C$

DESCRIPTION:

The 16-Bit Buffer/Line Driver is for bus interface or signal buffering applications requiring high speed and low power dissipation. These devices have a flow through pin organization, and shrink packaging to simplify board layout. All inputs are designed with hysteresis for improved noise margin. The three-state controls allow independent 4-bit, 8-bit or combined 16-bit operation. These parts are plug in replacements for 54/74ABT16244 where higher speed, lower noise or lower power dissipation levels are desired.

The FCT166244T/AT/CT are suited for very low noise, point-to-point driving where there is a single receiver, or a very light lumped 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.

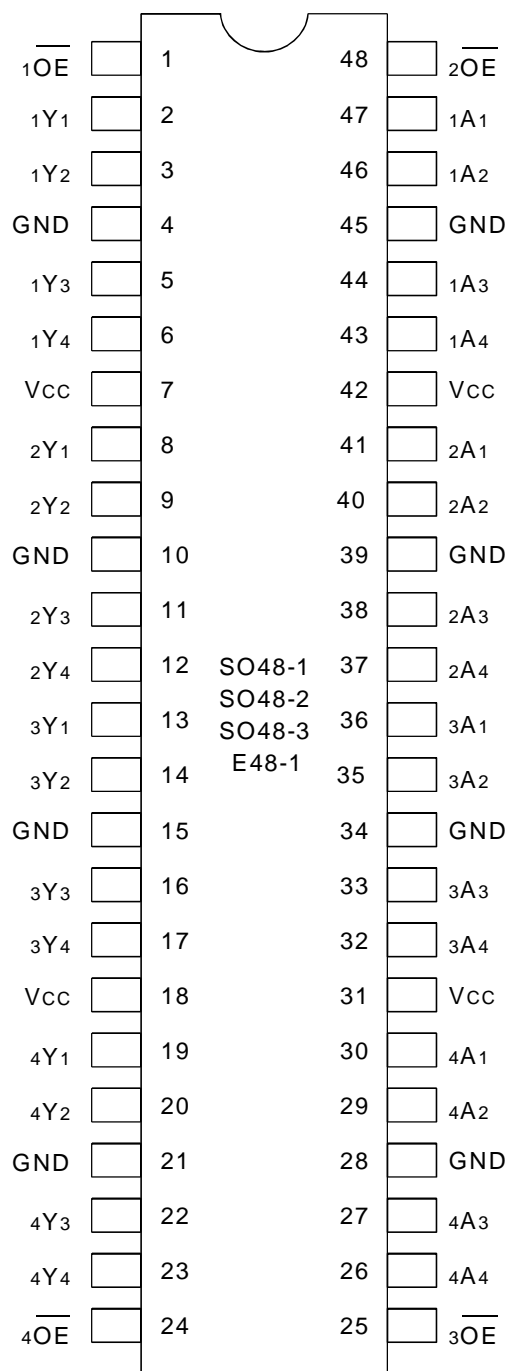
FUNCTIONAL BLOCK DIAGRAM



MILITARY AND COMMERCIAL TEMPERATURE RANGES

AUGUST 1999

PIN CONFIGURATION



SSOP/TSSOP/TVSOP/CERPACK
TOP VIEW

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Description	Max	Unit
$V_{TERM}^{(2)}$	Terminal Voltage with Respect to GND	-0.5 to +7	V
$V_{TERM}^{(3)}$	Terminal Voltage with Respect to GND	-0.5 to $V_{CC}+0.5$	V
T_{STG}	Storage Temperature	-65 to +150	°C
I_{OUT}	DC Output Current	-60 to +120	mA

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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 FCT162XXXXT Output and I/O terminals.
- Output and I/O terminals for FCT162XXXXT and FCT166XXXXT.

CAPACITANCE ($T_A = +25^\circ\text{C}$, $f = 1.0\text{MHz}$)

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

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NOTE:

- This parameter is measured at characterization but not tested.

PIN DESCRIPTION

Pin Names	Description
\overline{xOE}	3-State Output Enable Inputs (Active LOW)
xAx	Data Inputs
xYx	3-State Outputs

FUNCTION TABLE⁽¹⁾

Inputs		Outputs
\overline{xOE}	xAx	xYx
L	L	L
L	H	H
H	X	Z

NOTE:

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

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

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 ⁽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 (3-State Output pins) ⁽⁵⁾	$V_{CC} = \text{Max.}$	$V_O = 2.7\text{V}$	—	—	± 1	μA
I_{OZL}			$V_O = 0.5\text{V}$	—	—	± 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}	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$		—	5	500	μA
I_{CCH}		$V_{IN} = \text{GND}$ or V_{CC}					
I_{CCZ}							

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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} , $V_O = 1.5\text{V}^{(3)}$		16	48	96	mA
I_{ODH}	Output HIGH Current	$V_{CC} = 5\text{V}$, $V_{IN} = V_{IH}$ or V_{IL} , $V_O = 1.5\text{V}^{(3)}$		-16	-48	-96	mA
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -6\text{mA MIL}$ $I_{OH} = -8\text{mA COM'L}$	2.4	3.3	—	V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 6\text{mA MIL}$ $I_{OL} = 8\text{mA COM'L}$	—	0.3	0.55	V

NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0\text{V}$, $+25^{\circ}\text{C}$ ambient.
- Not more than one output should be shorted 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 $\pm 5\mu\text{A}$ 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	$V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$		—	0.5	1.5	mA
I_{CCD}	Dynamic Power Supply Current ⁽⁴⁾	$V_{CC} = \text{Max.}$ Outputs Open $\overline{xOE} = \text{GND}$ One Input Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	60	100	$\mu A/\text{MHz}$
I_C	Total Power Supply Current ⁽⁶⁾	$V_{CC} = \text{Max.}$ Outputs Open $f_i = 10\text{MHz}$ 50% Duty Cycle $\overline{xOE} = \text{GND}$ One Bit Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	0.6	1.5	mA
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	0.9	2.3	
		$V_{CC} = \text{Max.}$ Outputs Open $f_i = 2.5\text{MHz}$ 50% Duty Cycle $\overline{xOE} = \text{GND}$ Sixteen Bits Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	2.4	4.5 ⁽⁵⁾	
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	6.4	16.5 ⁽⁵⁾	

NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0V$, $+25^\circ\text{C}$ 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.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP}/2 + f_i N_i)$
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ})$
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input (} V_{IN} = 3.4V)$
 $D_H = \text{Duty Cycle for TTL Inputs High}$
 $N_T = \text{Number of TTL Inputs at } D_H$
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$
 $N_{CP} = \text{Number of Clock Inputs at } f_{CP}$
 $f_i = \text{Input Frequency}$
 $N_i = \text{Number of Inputs at } f_i$

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Condition ⁽¹⁾	FCT166244T				FCT166244AT				Unit
			Com'l.		Mil.		Com'l.		Mil.		
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
tPLH tPHL	Propagation Delay xAX to xYx	CL = 50pF RL = 500Ω	1.5	6.5	1.5	7	1.5	4.8	1.5	5.1	ns
tPZH tPZL	Output Enable Time		1.5	8	1.5	8.5	1.5	6.2	1.5	6.5	ns
tPHZ tPLZ	Output Disable Time		1.5	7	1.5	7.5	1.5	5.6	1.5	5.9	ns
tsk(0)	Output Skew ⁽³⁾		—	0.5	—	0.5	—	0.5	—	0.5	ns

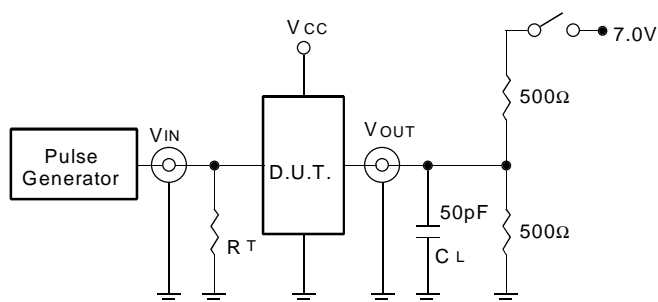
Symbol	Parameter	Condition ⁽¹⁾	FCT166244CT				Unit
			Com'l.		Mil.		
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
tPLH tPHL	Propagation Delay xAX to xYx	CL = 50pF RL = 500Ω	1.5	4.1	1.5	4.6	ns
tPZH tPZL	Output Enable Time		1.5	5.8	1.5	6.5	ns
tPHZ tPLZ	Output Disable Time		1.5	5.2	1.5	5.7	ns
tsk(0)	Output Skew ⁽³⁾		—	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.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



SWITCH POSITION

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

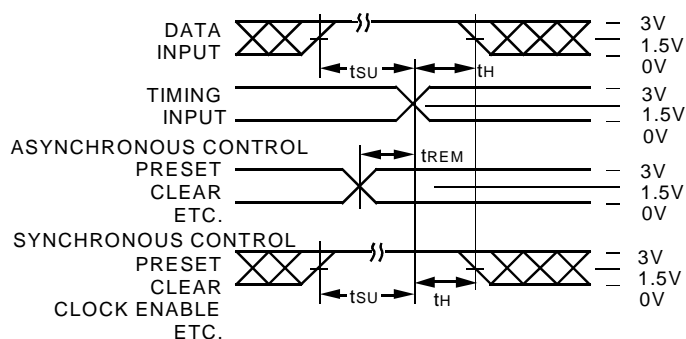
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DEFINITIONS:

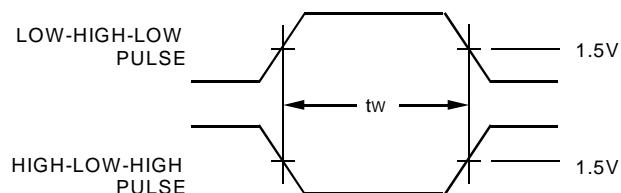
CL = Load capacitance: includes jig and probe capacitance.

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

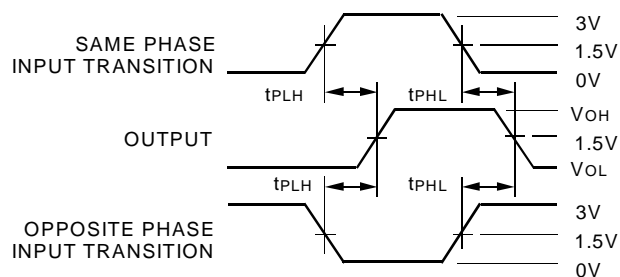
SET-UP, HOLD, AND RELEASE TIMES



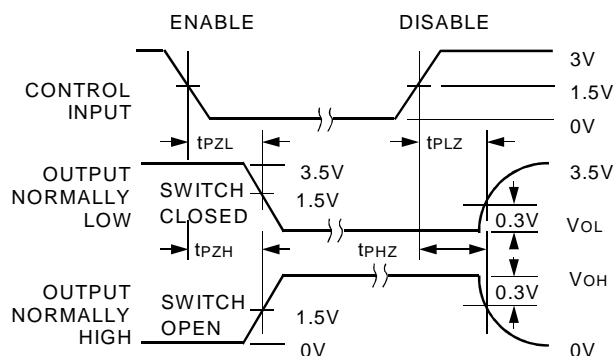
PULSE WIDTH



PROPAGATION DELAY



ENABLE AND DISABLE TIMES



NOTES:

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

ORDERING INFORMATION

IDT	XX	FCT	XXX	X	XXXX	XX	X		
	Temp. Range		Family	Bus Hold	Device Type	Package	Process		
								Blank	Commercial
								B	MIL-STD-883, Class B
								PV	Shrink Small Outline Package (SO48-1)
								PA	Thin Shrink Small Outline Package (SO48-2)
								PF	Thin Very Small Outline Package (SO48-3)
								E	CERPACK (E48-1)
								244T	16-Bit Buffer/Line Driver
								244AT	
								244CT	
								Blank	No Bus-Hold
								166	16-Bit, 5 Volt, Light Drive
								54	- 55°C to +125°C
								74	- 40°C to +85°C



CORPORATE HEADQUARTERS

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