



Integrated Device Technology, Inc.

3.3V CMOS 16-BIT BUFFER/LINE DRIVER

IDT74FCT163244/A/C

FEATURES:

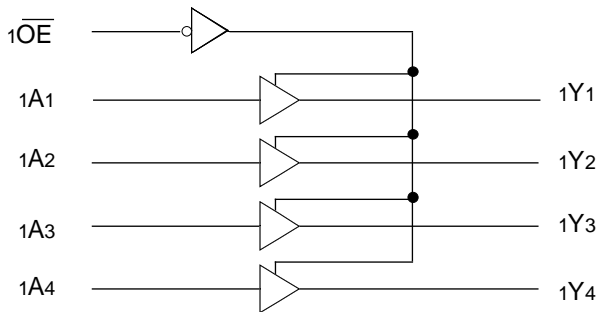
- 0.5 MICRON CMOS Technology
- **Typical tsk(o) (Output Skew) < 250ps**
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- Packages include 25 mil pitch SSOP, 19.6 mil pitch TSSOP and 15.7 mil pitch TVSOP
- Extended commercial range of -40°C to +85°C
- VCC = 3.3V ±0.3V, Normal Range or VCC = 2.7 to 3.6V, Extended Range
- CMOS power levels (0.4µW typ. static)
- Rail-to-Rail output swing for increased noise margin
- Low Ground Bounce (0.3V typ.)
- Inputs (except I/O) can be driven by 3.3V or 5V components

DESCRIPTION:

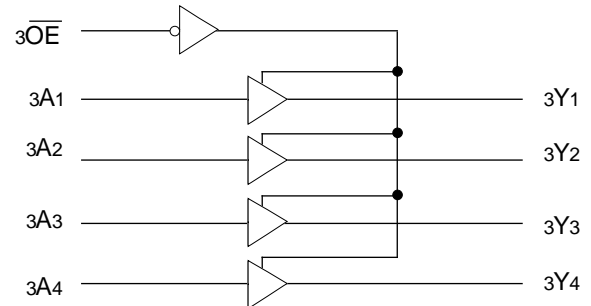
The FCT163244/A/C 16-bit buffer/line drivers are built using advanced dual metal CMOS technology. These high-speed, low-power devices offer bus/backplane interface capability with improved packing density. These devices have a flow-through organization for simplifying board layout. The three-state controls operate these devices in a Quad-Nibble, Dual-Byte or single 16-bit word mode. All inputs are designed with hysteresis for improved noise margin.

The inputs of the FCT163244/A/C can be driven from either 3.3V or 5V devices. This feature allows the use of these devices as translators in a mixed 3.3V/5V supply system. Thus, the FCT163244/A/C can be used as buffers to connect 5V components to a 3.3V bus.

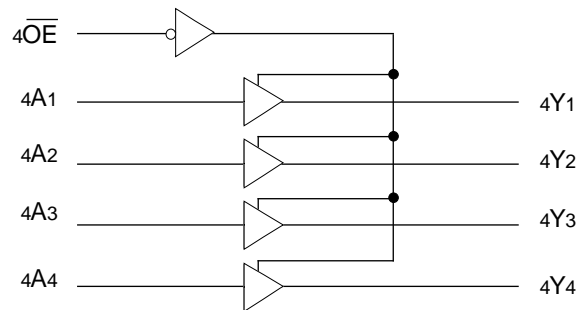
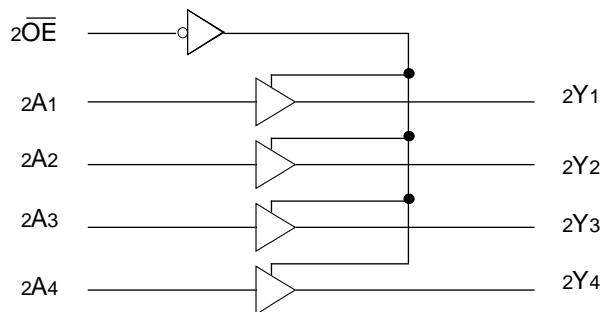
FUNCTIONAL BLOCK DIAGRAM



2532 drw 01



2532 drw 02

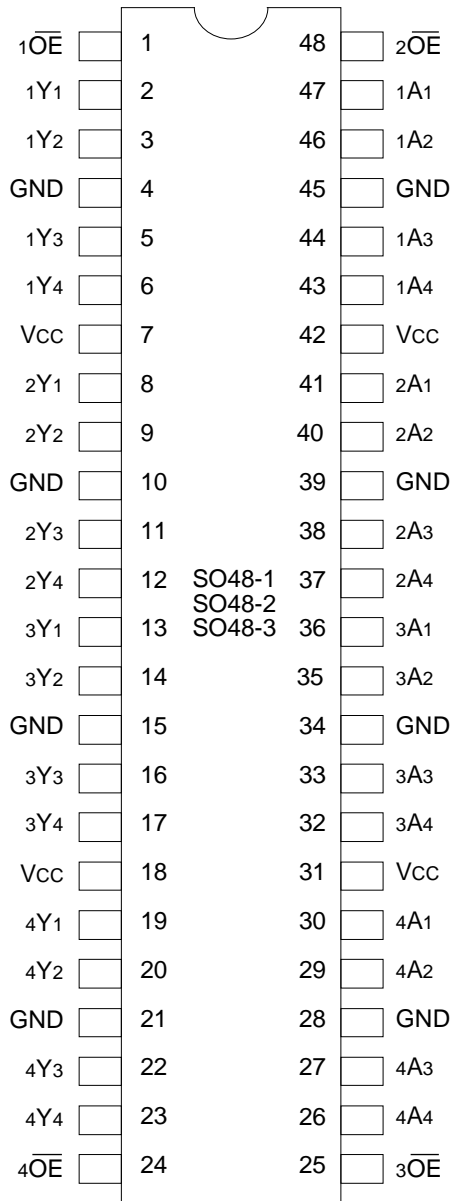


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COMMERCIAL TEMPERATURE RANGES

AUGUST 1996

PIN CONFIGURATIONS



SSOP/
TSSOP/TVSOP
TOP VIEW

2532 drw 03

PIN DESCRIPTION

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

2532 tbl 01

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Description	Max.	Unit
VTERM ⁽²⁾	Terminal Voltage with Respect to GND	-0.5 to +4.6	V
VTERM ⁽³⁾	Terminal Voltage with Respect to GND	-0.5 to +7.0	V
VTERM ⁽⁴⁾	Terminal Voltage with Respect to GND	-0.5 to VCC + 0.5	V
TSTG	Storage Temperature	-65 to +150	°C
IOUT	DC Output Current	-60 to +60	mA

NOTES:

2532 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.
- VCC terminals.
- Input terminals.
- Output and I/O terminals.

CAPACITANCE (TA = +25°C, f = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
CIN	Input Capacitance	VIN = 0V	3.5	6.0	pF
COUT	Output Capacitance	VOU = 0V	3.5	8.0	pF

NOTE:

2532 lmk 04

- This parameter is measured at characterization but not tested.

FUNCTION TABLE⁽¹⁾

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

NOTE:

2532 tbl 02

- 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:
Commercial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 2.7\text{V}$ to 3.6V

Symbol	Parameter	Test Conditions ⁽¹⁾	Min.	Typ. ⁽²⁾	Max.	Unit	
V _{IH}	Input HIGH Level (Input pins)	Guaranteed Logic HIGH Level	2.0	—	5.5	V	
	Input HIGH Level (I/O pins)		2.0	—	V _{CC} +0.5		
V _{IL}	Input LOW Level (Input and I/O pins)	Guaranteed Logic LOW Level	-0.5	—	0.8	V	
I _{IH}	Input HIGH Current (Input pins)	V _{CC} = Max.	V _I = 5.5V	—	—	μA	
	Input HIGH Current (I/O pins)						V _I = V _{CC}
I _{IL}	Input LOW Current (Input pins)		V _I = GND	—	—		±1
	Input LOW Current (I/O pins)		V _I = GND	—	—		±1
IOZH	High Impedance Output Current (3-State Output pins)	V _{CC} = Max.	V _O = V _{CC}	—	—	μA	
IOZL			V _O = GND	—	—		±1
V _{IK}	Clamp Diode Voltage	V _{CC} = Min., I _{IN} = -18mA	—	-0.7	-1.2	V	
IODH	Output HIGH Current	V _{CC} = 3.3V, V _{IN} = V _{IH} or V _{IL} , V _O = 1.5V ⁽³⁾	-36	-60	-110	mA	
IODL	Output LOW Current	V _{CC} = 3.3V, V _{IN} = V _{IH} or V _{IL} , V _O = 1.5V ⁽³⁾	50	90	200	mA	
V _{OH}	Output HIGH Voltage	V _{CC} = Min.	I _{OH} = -0.1mA	V _{CC} -0.2	—	V	
		V _{IN} = V _{IH} or V _{IL}	I _{OH} = -3mA	2.4	3.0		—
		V _{CC} = 3.0V V _{IN} = V _{IH} or V _{IL}	I _{OH} = -8mA	2.4 ⁽⁵⁾	3.0		—
V _{OL}	Output LOW Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OL} = 0.1mA	—	—	V	
			I _{OL} = 16mA	—	0.2		0.4
			I _{OL} = 24mA	—	0.3		0.55
		V _{CC} = 3.0V V _{IN} = V _{IH} or V _{IL}	I _{OL} = 24mA	—	0.3		0.50
I _{OS}	Short Circuit Current ⁽⁴⁾	V _{CC} = Max., V _O = GND ⁽³⁾	-60	-135	-240	mA	
V _H	Input Hysteresis	—	—	150	—	mV	
ICCL ICCH IC CZ	Quiescent Power Supply Current	V _{CC} = Max., V _{IN} = GND or V _{CC}	—	0.1	10	μA	

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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} = 3.3V, +25°C ambient.
- Not more than one output should be tested at one time. Duration of the test should not exceed one second.
- This parameter is guaranteed but not tested.
- V_{OH} = V_{CC} - 0.6V at rated current.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	$V_{CC} = \text{Max.}$	$V_{IN} = V_{CC} - 0.6V^{(3)}$	—	2.0	30	μA
I_{CCD}	Dynamic Power Supply Current ⁽⁴⁾	$V_{CC} = \text{Max.}$ Outputs Open 50% Duty Cycle $\overline{xOE} = \text{GND}$ One Input Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	50	75	$\mu A / \text{MHz}$
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	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	0.5	0.8	mA
			$V_{IN} = V_{CC} - 0.6V$ $V_{IN} = \text{GND}$	—	0.5	0.8	
		$V_{CC} = \text{Max.}$ Outputs Open $f_i = 2.5\text{MHz}$ 50% Duty Cycle $\overline{xOE} = \text{GND}$ Sixteen Bits Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	2.0	3.0 ⁽⁵⁾	
			$V_{IN} = V_{CC} - 0.6V$ $V_{IN} = \text{GND}$	—	2.0	3.3 ⁽⁵⁾	

2532 tbl 06

NOTES:

- For conditions shown as max. or min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 3.3V$, $+25^\circ\text{C}$ ambient.
- Per TTL driven input; 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.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$
 $I_C = I_{CC} + \Delta I_{CC} \cdot D_{HNT} + I_{CCD} \cdot (f_{CP} \cdot N_{CP} / 2 + f_i \cdot N_i)$
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ} \text{)}$
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input}$
 $D_H = \text{Duty Cycle for TTL Inputs High}$
 $N_T = \text{Number of TTL Inputs at } D_H$
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$
 $N_{CP} = \text{Number of Clock Inputs at } f_{CP}$
 $f_i = \text{Input Frequency}$
 $N_i = \text{Number of Inputs at } f_i$

SWITCHING CHARACTERISTICS OVER OPERATING RANGE⁽⁴⁾

Symbol	Parameter	Condition ⁽¹⁾	FCT163244		FCT163244A		FCT163244C		Unit
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
t_{PLH}	Propagation Delay	$CL = 50\text{pF}$ $RL = 500\Omega$	1.5	6.5	1.5	4.8	1.5	4.1	ns
t_{PHL}	xAx to xYx								
t_{PZH}	Output Enable Time		1.5	8.0	1.5	6.2	1.5	5.8	ns
t_{PZL}	Output Disable Time		1.5	7.0	1.5	5.6	1.5	5.2	
$t_{SK}(o)$	Output Skew ⁽³⁾		—	0.5	—	0.5	—	0.5	ns

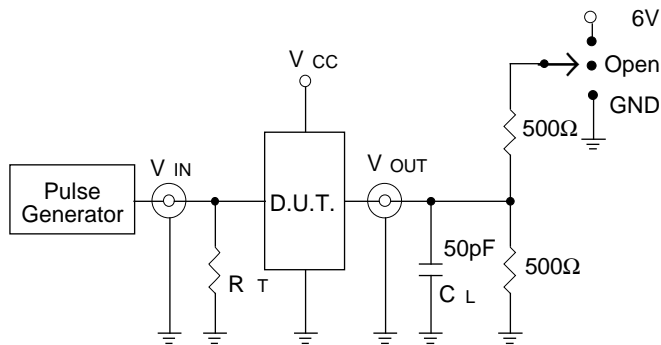
2532 tbl 07

NOTES:

- See test circuit and waveforms.
- Minimum limits are guaranteed but not tested on Propagation Delays.
- Skew between any two outputs, of the same package, switching in the same direction. This parameter is guaranteed by design.
- Propagation Delays and Enable/Disable times are with $V_{CC} = 3.3V \pm 0.3V$, Normal Range. For $V_{CC} = 2.7V$ to $3.6V$, Extended Range, all Propagation Delays and Enable/Disable times should be degraded by 20%.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



2532 drw 05

SWITCH POSITION

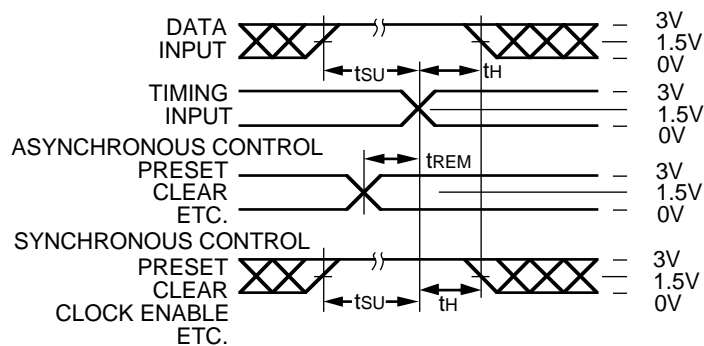
Test	Switch
Open Drain Disable Low Enable Low	6V
Disable High Enable High	GND
All Other tests	Open

DEFINITIONS:

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

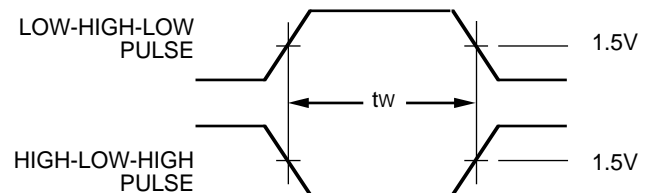
2532 Ink 08

SET-UP, HOLD AND RELEASE TIMES



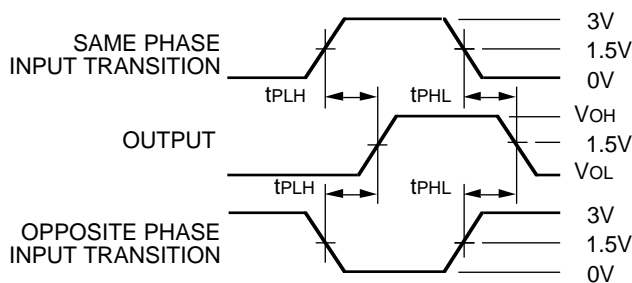
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PULSE WIDTH



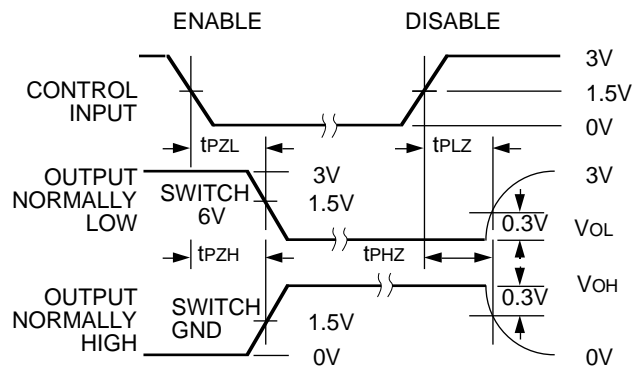
2532 drw 07

PROPAGATION DELAY



2532 drw 08

ENABLE AND DISABLE TIMES

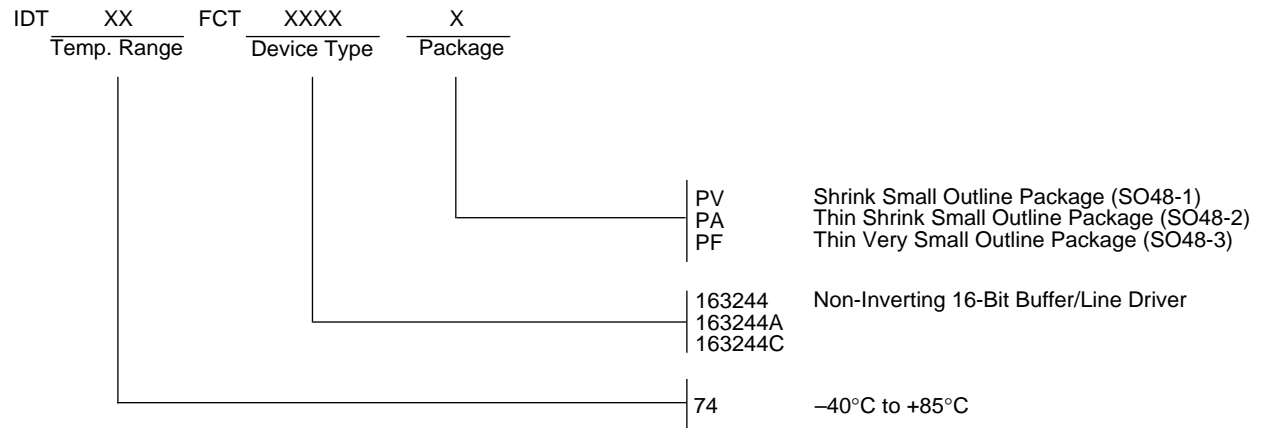


2532 drw 09

NOTES:

- Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
- Pulse Generator for All Pulses: Rate $\leq 1.0\text{MHz}$; $t_f \leq 2.5\text{ns}$; $t_r \leq 2.5\text{ns}$.
- If V_{CC} is below 3V, input voltage swings should be adjusted not to exceed V_{CC} .

ORDERING INFORMATION



2532 tbl 07