



Integrated Device Technology, Inc.

3.3V CMOS 16-BIT BUFFER/LINE DRIVER

IDT54/74FCT163244/A/C

FEATURES:

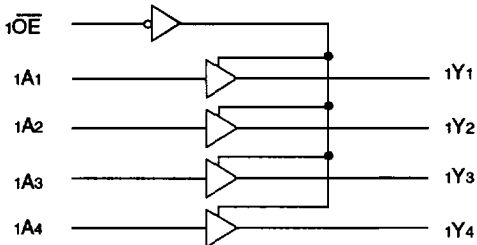
- 0.5 MICRON CMOS Technology
- **Typical tsk(o) (Output Skew) < 250ps**
- ESD > 2000V per MIL-STD-883, Method 3015;
- > 200V using machine model (C = 200pF, R = 0)
- 25 mil Center SSOP and Cerpack Packages and 19.6 mil pitch TSSOP Package
- Extended commercial range of -40°C to +85°C
- VCC = 3.3V ±0.3V, 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
- Military product compliant to MIL-STD-883, Class B
- Low Ground Bounce (0.3V typ.)
- Inputs (except I/O) can be driven by 3.3V or 5V components

DESCRIPTION:

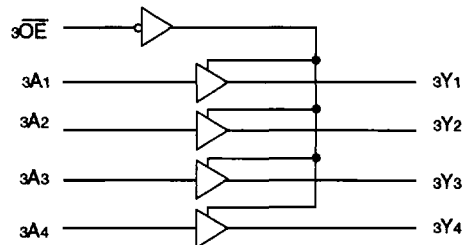
The FCT163244/A/C 16-bit buffer/line drivers are built using advanced dual metal CMOS technology. These high-speed, low-power devices offer bus/backplane interface capability with improved packing density. These devices have a flow-through organization for simplifying board layout. The three-state controls 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.

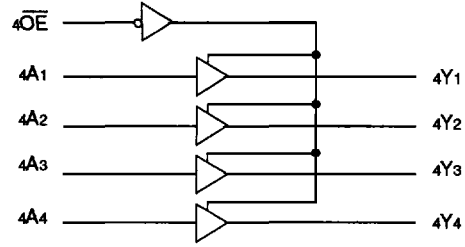
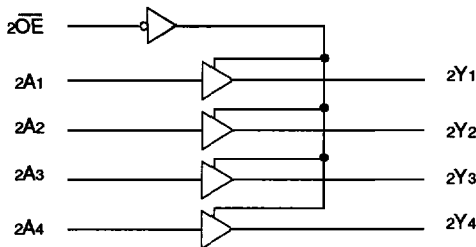
FUNCTIONAL BLOCK DIAGRAM



2532 drw 01



2532 drw 02



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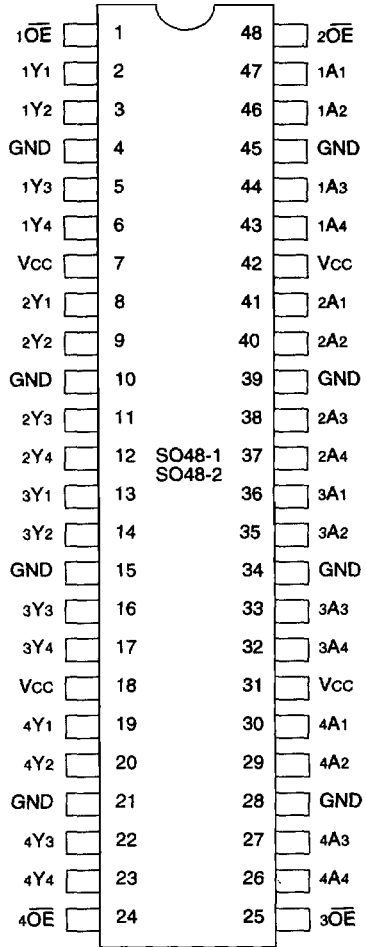
MILITARY AND COMMERCIAL TEMPERATURE RANGES

JUNE 1996

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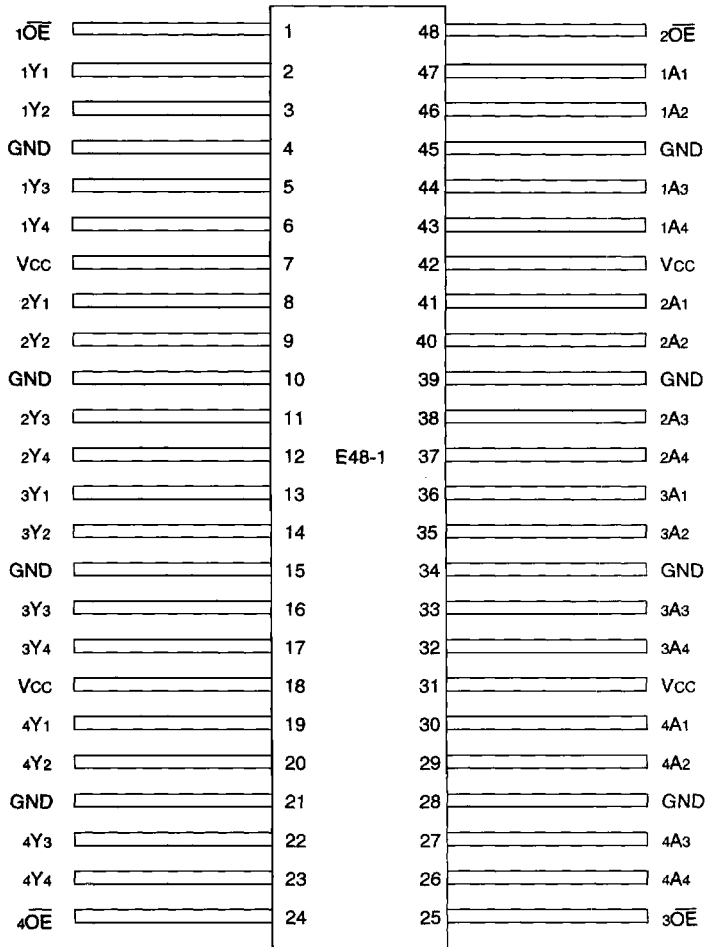
2532/8

PIN CONFIGURATIONS



**SSOP
 TSSOP
 TOP VIEW**

2532 drw 03



**CERPACK
 TOP VIEW**

2532 drw 04

PIN DESCRIPTION

| Pin Names | Description |
|-----------|---|
| xOE | 3-State Output Enable Inputs (Active LOW) |
| xAx | Data Inputs |
| xYx | 3-State Outputs |

2532 tbl 01

FUNCTION TABLE⁽¹⁾

| Inputs | | Outputs |
|--------|-----|---------|
| xOE | xAx | xYx |
| L | L | L |
| L | H | H |
| H | X | Z |

NOTE:

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

2532 tbl 02

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| Symbol | Rating | Commercial | Military | Unit |
|----------------------|--------------------------------------|-------------------|-------------------|------|
| VTERM ⁽²⁾ | Terminal Voltage with Respect to GND | -0.5 to +4.6 | -0.5 to +4.6 | V |
| VTERM ⁽³⁾ | Terminal Voltage with Respect to GND | -0.5 to +7.0 | -0.5 to +7.0 | V |
| VTERM ⁽⁴⁾ | 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 +60 | -60 to +60 | mA |

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 | VOUT = 0V | 3.5 | 8.0 | pF |

NOTE:

- This parameter is measured at characterization but not tested.

2532 lmk 04

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.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Commercial: TA = -40°C to +85°C, VCC = 2.7V to 3.6V; Military: TA = -55°C to +125°C, VCC = 2.7V to 3.6V

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit | |
|------------------|--|--|------------------|-------------------|---------------------|---------|------|------|
| VIH | Input HIGH Level (Input pins) | Guaranteed Logic HIGH Level | | 2.0 | — | 5.5 | V | |
| | Input HIGH Level (I/O pins) | | | 2.0 | — | VCC+0.5 | | |
| VIL | Input LOW Level (Input and I/O pins) | Guaranteed Logic LOW Level | | -0.5 | — | 0.8 | V | |
| IIH | Input HIGH Current (Input pins) ⁽⁶⁾ | VCC = Max. | VI = 5.5V | — | — | ±1 | µA | |
| | Input HIGH Current (I/O pins) ⁽⁶⁾ | | VI = VCC | — | — | ±1 | | |
| IIL | Input LOW Current (Input pins) ⁽⁶⁾ | | VI = GND | — | — | ±1 | | |
| | Input LOW Current (I/O pins) ⁽⁶⁾ | | VI = GND | — | — | ±1 | | |
| IOZH | High Impedance Output Current (3-State Output pins) ⁽⁶⁾ | VCC = Max. | VO = VCC | — | — | ±1 | µA | |
| | | | VO = GND | — | — | ±1 | | |
| VIK | Clamp Diode Voltage | VCC = Min., IIN = -18mA | | — | -0.7 | -1.2 | V | |
| IODH | Output HIGH Current | VCC = 3.3V, VIN = VIH or VIL, VO = 1.5V ⁽³⁾ | | -36 | -60 | -110 | mA | |
| IODL | Output LOW Current | VCC = 3.3V, VIN = VIH or VIL, VO = 1.5V ⁽³⁾ | | 50 | 90 | 200 | mA | |
| VOH | Output HIGH Voltage | VCC = Min. | IOH = -0.1mA | VCC-0.2 | — | — | V | |
| | | | IOH = -3mA | 2.4 | 3.0 | — | | |
| | | VIN = VIH or VIL | VCC = 3.0V | IOH = -6mA MIL. | 2.4 ⁽⁵⁾ | 3.0 | | — |
| | | | VIN = VIH or VIL | IOH = -8mA COM'L. | — | — | | — |
| VOL | Output LOW Voltage | VCC = Min. | IOL = 0.1mA | — | — | 0.2 | V | |
| | | | IOL = 16mA | — | 0.2 | 0.4 | | |
| | | VIN = VIH or VIL | IOL = 24mA | — | 0.3 | 0.55 | | |
| | | | VCC = 3.0V | IOL = 24mA | — | 0.3 | | 0.50 |
| VIN = VIH or VIL | — | — | — | — | — | | | |
| IOS | Short Circuit Current ⁽⁴⁾ | VCC = Max., VO = GND ⁽³⁾ | | -60 | -135 | -240 | mA | |
| VH | Input Hysteresis | — | | — | 150 | — | mV | |
| ICCL | Quiescent Power Supply Current | VCC = Max., VIN = GND or VCC | COM'L. | — | 0.1 | 10 | µA | |
| | | | MIL. | — | 0.1 | 100 | | |

2532 Ink 05

NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at VCC = 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.
- VOH = VCC - 0.6V at rated current.
- The test limit for this parameter is ±5µA at TA = -55°C.

POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit |
|------------------|---|--|---------------------------------|------|---------------------|--------------------|---------------|
| ΔI_{CC} | Quiescent Power Supply Current TTL Inputs HIGH | Vcc = Max. | VIN = Vcc - 0.6V ⁽³⁾ | — | 2.0 | 30 | μA |
| I _{CCD} | Dynamic Power Supply Current ⁽⁴⁾ | Vcc = Max. Outputs Open 50% Duty Cycle $\overline{xOE} = GND$ One Input Toggling | VIN = Vcc VIN = GND | — | 50 | 75 | $\mu A / MHz$ |
| I _C | Total Power Supply Current ⁽⁶⁾ | Vcc = Max. Outputs Open fi = 10MHz 50% Duty Cycle $\overline{xOE} = GND$ One Bit Toggling | VIN = Vcc VIN = GND | — | 0.5 | 0.8 | mA |
| | | | VIN = Vcc - 0.6V VIN = GND | — | 0.5 | 0.8 | |
| | | Vcc = Max. Outputs Open fi = 2.5MHz 50% Duty Cycle $\overline{xOE} = GND$ Sixteen Bits Toggling | VIN = Vcc VIN = GND | — | 2.0 | 3.0 ⁽⁵⁾ | |
| | | | VIN = Vcc - 0.6V VIN = 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 Vcc = 3.3V, +25°C ambient.
- Per TTL driven input; all other inputs at Vcc 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 Icc formula. These limits are guaranteed but not tested.
- I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}
 $I_C = I_{CC} + \Delta I_{CC} \cdot DH_{NT} + I_{CCD} (f_{CP} N_{CP} / 2 + f_i N_i)$
 I_{CC} = Quiescent Current (I_{CC1}, I_{CC2} and I_{CC3})
 ΔI_{CC} = Power Supply Current for a TTL High Input
 DH = Duty Cycle for TTL Inputs High
 NT = Number of TTL Inputs at DH
 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

SWITCHING CHARACTERISTICS OVER OPERATING RANGE⁽⁴⁾

| Symbol | Parameter | Condition ⁽¹⁾ | FCT163244 | | FCT163244A | | | | FCT163244C | | | | Unit | | |
|--------------------|----------------------------|--------------------------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|------|---------------------|------|
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | Com'l. | | | Mil. | |
| | | | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | | Min. ⁽²⁾ | Max. |
| t _{PLH} | Propagation Delay | CL = 50pF RL = 500Ω | 1.5 | 6.5 | 1.5 | 7.0 | 1.5 | 4.8 | 1.5 | 5.1 | 1.5 | 4.1 | | ns | |
| t _{PHL} | xAx to xYx | | | | | | | | | | | | | | |
| t _{PZH} | Output Enable Time | | 1.5 | 8.0 | 1.5 | 8.5 | 1.5 | 6.2 | 1.5 | 6.5 | 1.5 | 5.8 | | | ns |
| t _{PZL} | | | | | | | | | | | | | | | |
| t _{PHZ} | Output Disable Time | | 1.5 | 7.0 | 1.5 | 7.5 | 1.5 | 5.6 | 1.5 | 5.9 | 1.5 | 5.2 | | | ns |
| t _{PLZ} | | | | | | | | | | | | | | | |
| t _{SK(O)} | Output Skew ⁽³⁾ | | — | 0.5 | — | 0.5 | — | 0.5 | — | 0.5 | — | 0.5 | | ns | |

2532 tbl 07

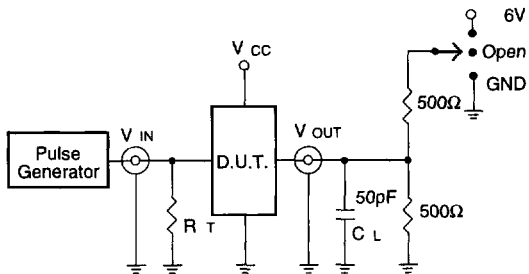
NOTES:

- 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 Vcc = 3.3V ± 0.3V, Normal Range. For Vcc = 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

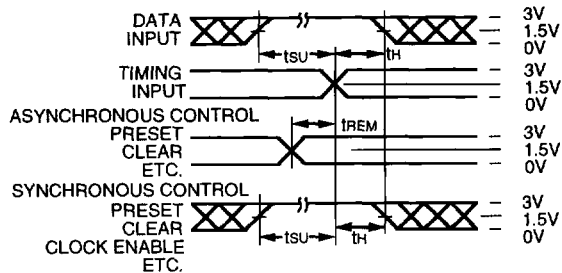
| Test | Switch |
|-----------------|--------|
| Open Drain | 6V |
| Disable Low | |
| Enable Low | |
| Disable High | GND |
| Enable High | |
| All Other tests | Open |

DEFINITIONS:

2532 lmk 08

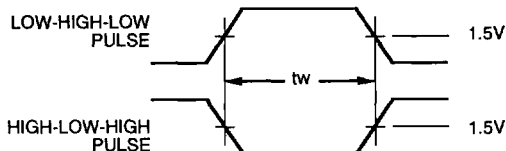
C_L = Load capacitance; includes jig and probe capacitance.
R_T = Termination resistance; should be equal to Z_{OUT} of the Pulse Generator.

SET-UP, HOLD AND RELEASE TIMES



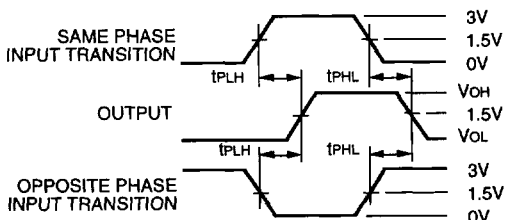
2532 drw 06

PULSE WIDTH



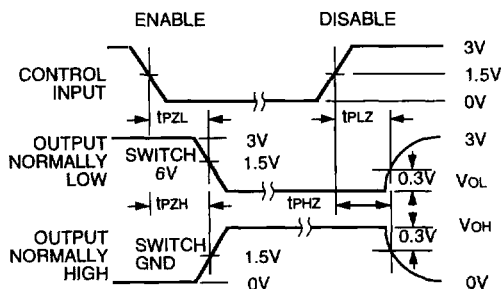
2532 drw 07

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 ≤ 1.0MHz; t_r ≤ 2.5ns; t_r ≤ 2.5ns.
- If V_{CC} is below 3V, input voltage swings should be adjusted not to exceed V_{CC}.

ORDERING INFORMATION

| IDT | XX | FCT | XXXX | X | X | |
|-------------|----|-------------|------|---------|---------|------------------------------------|
| Temp. Range | | Device Type | | Package | Process | |
| | | | | Blank | B | Commercial MIL-STD-883, Class B |
| | | | | | | PV PA E |
| | | | | | | |
| | | 54 74 | | | | -55°C to +125°C -40°C to +85°C |

2532 tdl 07