



Integrated Device Technology, Inc.

HIGH-PERFORMANCE CMOS BUS TRANSCEIVERS

IDT54/74FCT861A/B/C
IDT54/74FCT863A/B/C
IDT54/74FCT864A/B/C
T-52-31

FEATURES:

- Equivalent to AMD's Am29861-64 bipolar registers in pinout/function, speed and output drive over full temperature and voltage supply extremes
- IDT54/74FCT861A/863A/864A equivalent to FAST™ speed
- IDT54/74FCT861B/863B/864B 25% faster than FAST™
- High-speed symmetrical bidirectional transceivers
- $I_{OL} = 48\text{mA}$ (commercial) and 32mA (military)
- Clamp diodes on all inputs for ringing suppression
- CMOS power levels (1mW typ. static)
- TTL input and output level compatible
- CMOS output level compatible
- Substantially lower input current levels than AMD's bipolar Am29800 Series ($5\mu\text{A}$ max.)
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Military product compliant to MIL-STD-883, Class B

DESCRIPTION:

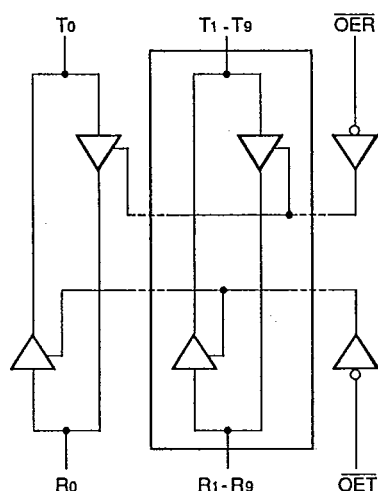
The IDT54/74FCT800 series is built using advanced CEMOS™, a dual metal CMOS technology.

The IDT54/74FCT860 series bus transceivers provide high-performance bus interface buffering for wide data/address paths or buses carrying parity. The IDT54/74FCT863/864 9-bit transceivers have NAND-ed output enables for maximum control flexibility.

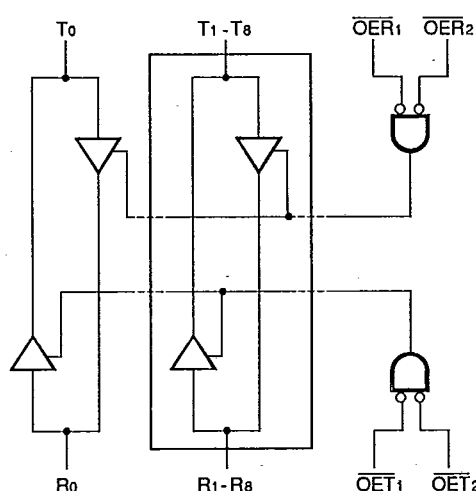
All of the IDT54/74FCT800 high-performance interface family are designed for high-capacitance load drive capability while providing low-capacitance bus loading at both inputs and outputs. All inputs have clamp diodes and all outputs are designed for low-capacitance bus loading in the high-impedance state.

FUNCTIONAL BLOCK DIAGRAMS

IDT54/74FCT861



IDT54/74FCT863/864



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PRODUCT SELECTOR GUIDE

	Device	
	10-Bit	9-Bit
Non-inverting	IDT54/74FCT861	IDT54/74FCT863
Inverting		IDT54/74FCT864

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CEMOS is a trademark of Integrated Device Technology, Inc.
FAST is a registered trademark of National Semiconductor Co.

MILITARY AND COMMERCIAL TEMPERATURE RANGES

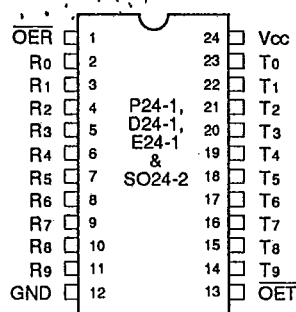
JUNE 1990

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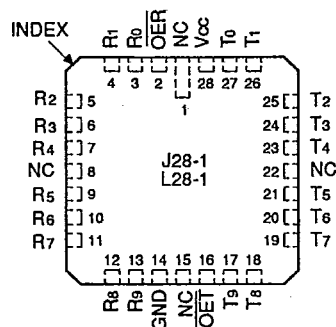
MILITARY AND COMMERCIAL TEMPERATURE RANGES

PIN CONFIGURATIONS

IDT54/74FCT861 10-BIT TRANSCEIVER

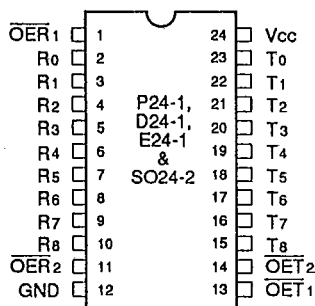


DIP/CERPACK/SOIC
TOP VIEW

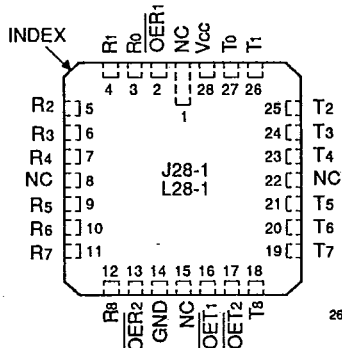


LCC/PLCC
TOP VIEW

IDT54/74FCT863/864 9-BIT TRANSCEIVERS



DIP/CERPACK/SOIC
TOP VIEW



LCC/PLCC
TOP VIEW

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IDT54/74FCT861A/B/C, IDT54/74FCT863A/B/C, IDT54/74FCT864A/B/C
HIGH-PERFORMANCE CMOS BUS TRANSCEIVERS

MILITARY AND COMMERCIAL TEMPERATURE RANGES

PIN DESCRIPTION

Name	I/O	Description
IDT54/74FCT861		
$\overline{OET}$	I	When LOW in conjunction with $\overline{OET}$ HIGH activates the RECEIVE mode.
$\overline{OET}$	I	When LOW in conjunction with $\overline{OET}$ HIGH activates the TRANSMIT mode.
Ri	I/O	10-bit RECEIVE input/output.
Ti	I/O	10-bit TRANSMIT input/output.
IDT54/74FCT863/864		
$\overline{OETi}$	I	When LOW in conjunction with $\overline{OETi}$ HIGH activates the RECEIVE mode.
$\overline{OETi}$	I	When LOW in conjunction with $\overline{OETi}$ HIGH activates the TRANSMIT mode.
Ri	I/O	9-bit RECEIVE input/output.
Ti	I/O	9-bit TRANSMIT input/output.

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FUNCTION TABLE⁽¹⁾

IDT54/74FCT861/863 (Non-Inverting)

Inputs				Outputs		Function
$\overline{OET}$	$\overline{OER}$	Ri	Ti	Ri	Ti	
L	H	L	N/A	N/A	L	Transmitting
L	H	H	N/A	N/A	H	Transmitting
H	L	N/A	L	L	N/A	Receiving
H	L	N/A	H	H	N/A	Receiving
H	H	X	X	Z	Z	High Z

NOTE:

1. H = HIGH, L = LOW, Z = High Impedance, X = Don't Care, N/A = Not Applicable.

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FUNCTION TABLE⁽¹⁾

IDT54/74FCT864 (Inverting)

Inputs				Outputs		Function
$\overline{OET}$	$\overline{OER}$	Ri	Ti	Ri	Ti	
L	H	L	N/A	N/A	H	Transmitting
L	H	H	N/A	N/A	L	Transmitting
H	L	N/A	L	H	N/A	Receiving
H	L	N/A	H	L	N/A	Receiving
H	H	X	X	Z	Z	High Z

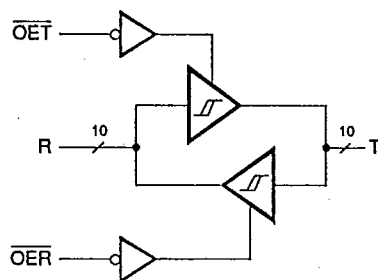
NOTE:

1. H = HIGH, L = LOW, Z = High Impedance, X = Don't Care, N/A = Not Applicable.

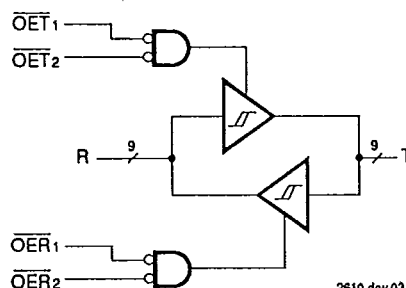
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LOGIC SYMBOLS

IDT54/74FCT861



IDT54/74FCT863/864



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ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Rating	Commercial	Military	Unit
VTERM ⁽²⁾	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
VTERM ⁽³⁾	Terminal Voltage with Respect to GND	-0.5 to V _{CC}	-0.5 to V _{CC}	V
T _A	Operating Temperature	0 to +70	-55 to +125	°C
T _{BIAS}	Temperature Under Bias	-55 to +125	-65 to +135	°C
T _{STG}	Storage Temperature	-55 to +125	-65 to +150	°C
P _T	Power Dissipation	0.5	0.5	W
I _{OUT}	DC Output Current	120	120	mA

NOTES:

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- 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. No terminal voltage may exceed V_{CC} by +0.5V unless otherwise noted.
- Inputs and V_{CC} terminals only.
- Outputs and I/O terminals only.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	6	10	pF
C _{IO}	I/O Capacitance	V _{OUT} = 0V	8	12	pF

NOTE:

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- This parameter is guaranteed by characterization but not tested.

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DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified: V_{LC} = 0.2V, V_{HC} = V_{CC} - 0.2VCommercial: T_A = 0°C to +70°C, V_{CC} = 5.0V ± 5%; Military: T_A = -55°C to +125°C, V_{CC} = 5.0V ± 10%

Symbol	Parameter	Test Conditions ⁽¹⁾	Min.	Typ. ⁽²⁾	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 (Except I/O pins)	V _{CC} = Max. V _I = V _{CC}	—	—	5	μA
		V _I = 2.7V	—	—	5 ⁽⁴⁾	
I _{IL}	Input LOW Current (Except I/O pins)	V _I = 0.5V	—	—	-5 ⁽⁴⁾	μA
		V _I = GND	—	—	-5	
I _{IH}	Input HIGH Current (I/O pins Only)	V _{CC} = Max. V _I = V _{CC}	—	—	15	
		V _I = 2.7V	—	—	15 ⁽⁴⁾	
I _{IL}	Input LOW Current (I/O pins Only)	V _I = 0.5V	—	—	-15 ⁽⁴⁾	
		V _I = GND	—	—	-15	
V _{IK}	Clamp Diode Voltage	V _{CC} = Min., I _N = -18mA	—	-0.7	-1.2	V
I _{OS}	Short Circuit Current	V _{CC} = Max. ⁽³⁾ , V _O = GND	-75	-120	—	mA
V _{OH}	Output HIGH Voltage	V _{CC} = 3V, V _{IN} = V _{LC} or V _{HC} , I _{OH} = -32μA	V _{HC}	V _{CC}	—	V
		V _{CC} = Min. V _{IN} = V _{IH} or V _{IL} I _{OH} = -300μA	V _{HC}	V _{CC}	—	
		I _{OH} = -15mA MIL.	2.4	4.3	—	
		I _{OH} = -24mA COM'L.	2.4	4.3	—	
V _{OL}	Output LOW Voltage	V _{CC} = 3V, V _{IN} = V _{LC} or V _{HC} , I _{OL} = 300μA	—	GND	V _{LC}	V
		V _{CC} = Min. V _{IN} = V _{IH} or V _{IL} I _{OL} = 300μA	—	GND	V _{LC} ⁽⁴⁾	
		I _{OL} = 32mA MIL. ⁽⁵⁾	—	0.3	0.5	
		I _{OL} = 48mA COM'L. ⁽⁵⁾	—	0.3	0.5	

NOTES:

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- 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 and maximum loading.
- Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
- This parameter is guaranteed but not tested.
- These are maximum I_{OL} values per output, for 10 outputs turned on simultaneously. Total maximum I_{OL} (all outputs) is 480mA for commercial and 320mA for military. Derate I_{OL} for number of outputs exceeding 10 turned on simultaneously.

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HIGH-PERFORMANCE CMOS BUS TRANSCEIVERS

MILITARY AND COMMERCIAL TEMPERATURE RANGES

POWER SUPPLY CHARACTERISTICS

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$V_{LC} = 0.2V$; $V_{HC} = V_{CC} - 0.2V$

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
I_{CC}	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$ $V_{IN} \geq V_{HC}$; $V_{IN} \leq V_{LC}$		—	0.2	1.5	mA
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	$V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$		—	0.5	2.0	mA
I_{CCD}	Dynamic Power Supply Current ⁽⁴⁾	$V_{CC} = \text{Max.}$, Outputs Open $\overline{OER}$ or $\overline{OET} = \text{GND}$ One Input Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$	—	0.15	0.25	mA/ MHz
I_C	Total Power Supply Current ⁽⁶⁾	$V_{CC} = \text{Max.}$, Outputs Open $f_i = 10\text{MHz}$ 50% Duty Cycle $\overline{OER}$ or $\overline{OET} = \text{GND}$ One Bit Toggling	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$ (FCT)	—	1.7	4.0	mA
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	2.0	5.0	
		$V_{CC} = \text{Max.}$, Outputs Open $f_i = 2.5\text{MHz}$ 50% Duty Cycle $\overline{OER}$ or $\overline{OET} = \text{GND}$	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$ (FCT)	—	3.2	6.5 ⁽⁵⁾	
		Eight Bits Toggling	$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	5.2	14.5 ⁽⁵⁾	

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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 $V_{CC} = 5.0V$, $+25^\circ\text{C}$ 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. $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$

$I_C = I_{CC} + \Delta I_{CCDHNT} + I_{CCD}(f_{CP}/2 + f_i N_i)$

$I_{CC} = \text{Quiescent Current}$

$\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4V)$

$DH = \text{Duty Cycle for TTL Inputs High}$

$N_T = \text{Number of TTL Inputs at } DH$

$I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$

$f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$

$f_i = \text{Input Frequency}$

$N_i = \text{Number of Inputs at } f_i$

All currents are in milliamps and all frequencies are in megahertz.



SWITCHING CHARACTERISTICS OVER OPERATING RANGE

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Symbol	Parameter	Condition ⁽¹⁾	FCT861A/863A/864A				FCT861B/863B/864B				FCT861C/863C/864C				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.	
tPLH tPHL	Propagation Delay Ri to Ti or Ti to Ri FCT861/863	CL = 50pF RL = 500Ω	—	8.0	—	9.0	—	6.0	—	6.5	—	—	—	—	ns
		CL = 300pF ⁽³⁾ RL = 500Ω	—	15.0	—	17.0	—	13.0	—	14.0	—	—	—	—	ns
tPLH tPHL	Propagation Delay Ri to Ti or Ti to Ri FCT864	CL = 50pF RL = 500Ω	—	7.5	—	9.0	—	5.5	—	6.5	—	—	—	—	ns
		CL = 300pF ⁽³⁾ RL = 500Ω	—	14.0	—	16.0	—	13.0	—	14.0	—	—	—	—	ns
tPZH tPZL	Output Enable Time OET to Ti or OER to Ri	CL = 50pF RL = 500Ω	—	12.0	—	13.0	—	8.0	—	9.0	—	—	—	—	ns
		CL = 300pF ⁽³⁾ RL = 500Ω	—	20.0	—	22.0	—	15.0	—	16.0	—	—	—	—	ns
tPHZ tPLZ	Output Disable Time OET to Ti or OER to Ri	CL = 5pF ⁽³⁾ RL = 500Ω	—	9.0	—	9.0	—	6.0	—	7.0	—	—	—	—	ns
		CL = 50pF RL = 500Ω	—	10.0	—	10.0	—	7.0	—	8.0	—	—	—	—	ns

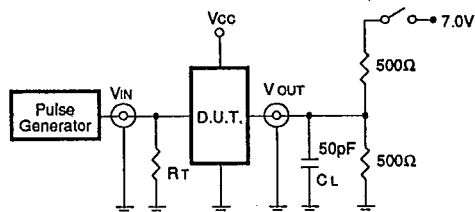
NOTES:

1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. This parameter guaranteed but not tested.

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TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



SWITCH POSITION

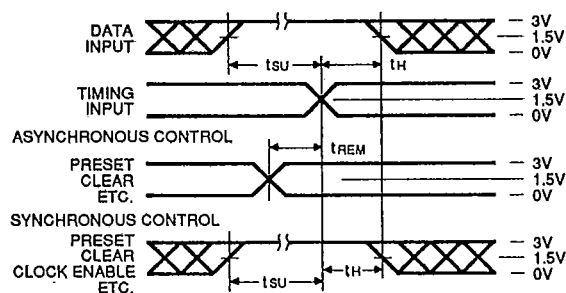
Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Outputs	Open

DEFINITIONS:

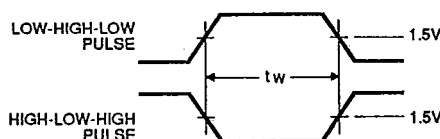
CL = Load capacitance: includes jig and probe capacitance.
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

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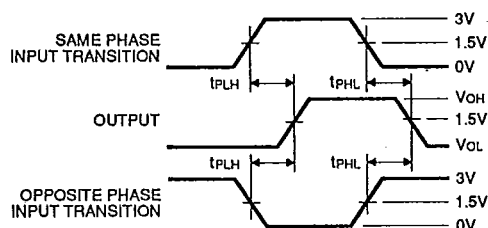
SET-UP, HOLD AND RELEASE TIMES



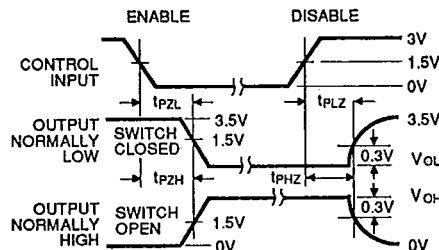
PULSE WIDTH



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 ≤ 1.0 MHz; $Z_0 \leq 50\Omega$; $t_r \leq 2.5$ ns; $t_f \leq 2.5$ ns.

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HIGH-PERFORMANCE CMOS BUS TRANSCEIVERS

MILITARY AND COMMERCIAL TEMPERATURE RANGES

ORDERING INFORMATION

T-52-31

IDT	XX	FCT	XXXX	X	X
Temperature Range	Device Type	Package	Process		
				Blank B	Commercial MIL-STD-883, Class B
				P	Plastic DIP
				D	CERDIP
				E	CERPACK
				J	Plastic Leaded Chip Carrier
				L	Leadless Chip Carrier
				SO	Small Outline IC
			861A		10-Bit Non-inverting Transceiver
			861B		Fast 10-Bit Non-inverting Transceiver
			861C		Super Fast 10-Bit Non-inverting Transceiver
			863A		9-Bit Non-inverting Transceiver
			863B		Fast 9-Bit Non-inverting Transceiver
			863C		Super Fast 9-Bit Non-inverting Transceiver
			864A		9-Bit Inverting Transceiver
			864B		Fast 9-Bit Inverting Transceiver
			864C		Super Fast 9-Bit Inverting Transceiver
			54		-55°C to +125°C
			74		0° to +70°C

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