



FAST CMOS 20-BIT BUFFER

IDT54/74FCT16827AT/BT/CT/ET

FEATURES:

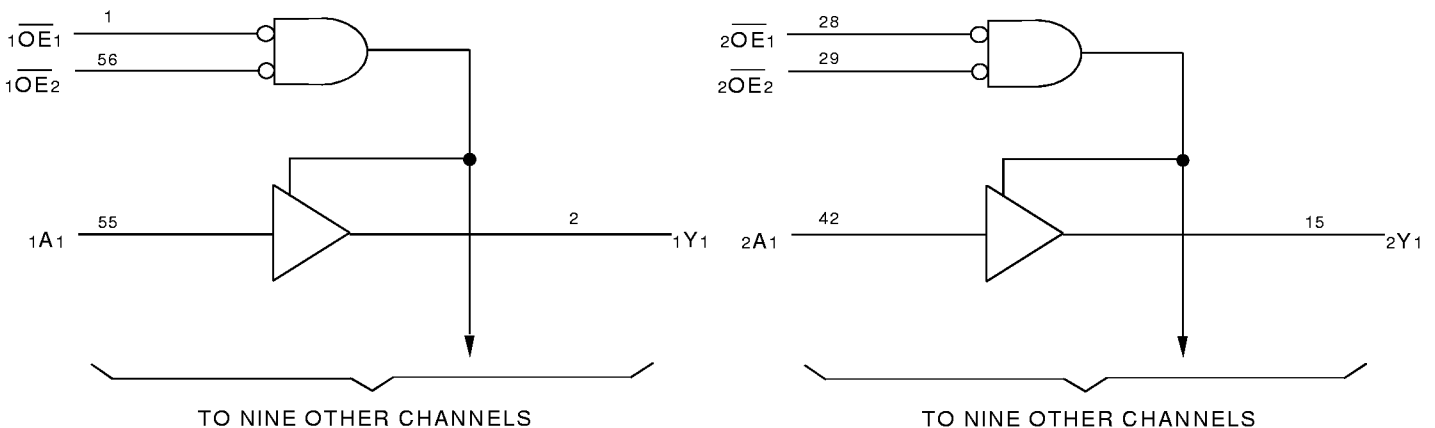
- 0.5 MICRON CMOS Technology
- High-speed, low-power CMOS replacement for ABT functions
- Typical tsk(o) (Output Skew) < 250ps
- Low input and output leakage $\leq 1\mu\text{A}$ (max.)
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 25 mil pitch SSOP, 19.6 mil pitch TSSOP, 15.7 mil pitch TVSOP and 25 mil pitch CERPACK packages
- Extended commercial range of -40°C to +85°C
- Vcc = 5V $\pm 10\%$
- 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

DESCRIPTION:

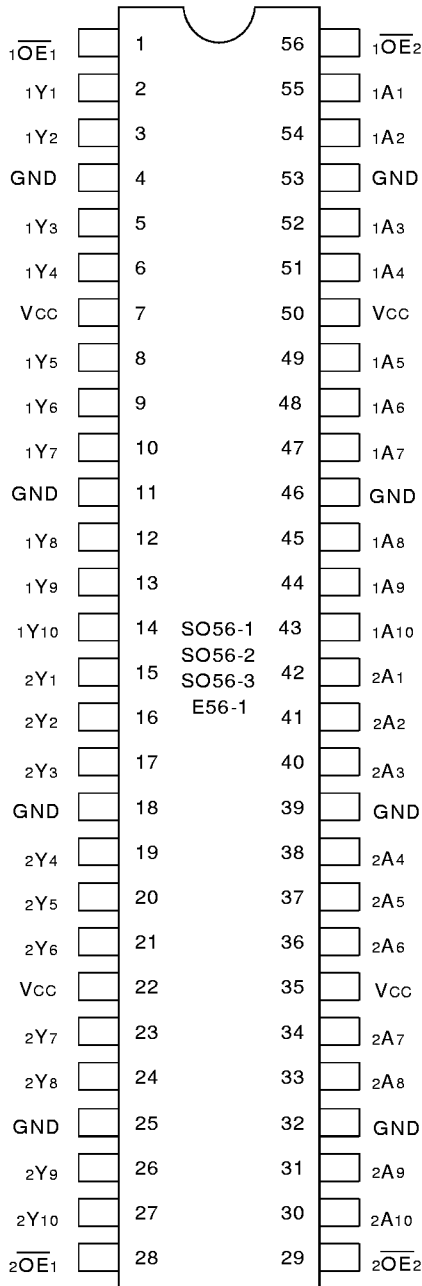
The FCT16827AT/BT/CT/ET 20-bit buffers are built using advanced dual metal CMOS technology. These 20-bit bus drivers provide high-performance bus interface buffering for wide data/address paths or buses carrying parity. Two pair of NAND-ed output enable controls offer maximum control flexibility and are organized to operate the device as two 10-bit buffers or one 20-bit buffer. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

The FCT16827AT/BT/CT/ET 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.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



SSOP/ TSSOP/ TVSOP/ CERPACK
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
VTERM ⁽²⁾	Terminal Voltage with Respect to GND	-0.5 to +7	V
VTERM ⁽³⁾	Terminal Voltage with Respect to GND	-0.5 to V _{CC} +0.5	V
TSTG	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.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

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

FUNCTION TABLE(1)

Inputs			Outputs
x \overline{OE} 1	x \overline{OE} 2	xAx	xYx
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	X	Z

NOTE:

- 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 $+85^\circ\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$; 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} = 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 = GND	—	—	±1	
	Input LOW Current (I/O pins) ⁽⁵⁾			—	—	±1	
I _{OZH}	High Impedance Output Current	V _{CC} = Max.	V _O = 2.7V	—	—	±1	μA
I _{OZL}	(3-State Output pins) ⁽⁵⁾		V _O = 0.5V	—	—	±1	
V _{IK}	Clamp Diode Voltage	V _{CC} = Min., I _{IN} = -18mA		—	-0.7	-1.2	V
I _{OS}	Short Circuit Current	V _{CC} = Max., V _O = GND ⁽³⁾		-80	-140	-250	mA
V _H	Input Hysteresis	—		—	100	—	mV
I _{CC1} I _{CC2} I _{CC3}	Quiescent Power Supply Current	V _{CC} = Max. V _{IN} = GND or V _{CC}		—	5	500	μA

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OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
I _O	Output Drive Current	V _{CC} = Max., V _O = 2.5V ⁽³⁾		-50	—	-180	mA
V _{OH}	Output HIGH Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OH} = -3mA	2.5	3.5	—	V
			I _{OH} = -12mA MIL.	2.4	3.5	—	V
			I _{OH} = -15mA COM'L.				
			I _{OH} = -24mA MIL. I _{OH} = -32mA COM'L. ⁽⁴⁾	2	3	—	V
V _{OL}	Output LOW Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OH} = 48mA MIL. I _{OH} = 64mA COM'L.	—	0.2	0.55	V
I _{OFF}	Input/Output Power Off Leakage ⁽⁵⁾	V _{CC} = 0V, V _{IN} or V _O ≤ 4.5V		—	—	±1	μA

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.
- 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 ±5μA at T_A = -55°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 $\overline{xOE}_1 = \overline{xOE}_2 = \text{GND}$ 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 $\overline{xOE}_1 = \overline{xOE}_2 = \text{GND}$ 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 $\overline{xOE}_1 = \overline{xOE}_2 = \text{GND}$ Twenty Bits Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	3	5.5 ⁽⁵⁾	
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	8	20.5 ⁽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.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$
 $I_C = I_{CC} + \Delta I_{CC} \text{ DHNT} + I_{CCD} (f_{CP} \text{NCP}/2 + f_i \text{Ni})$
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ}\text{)}$
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input (} V_{IN} = 3.4V\text{)}$
 $\text{DH} = \text{Duty Cycle for TTL Inputs High}$
 $\text{NT} = \text{Number of TTL Inputs at DH}$
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$
 $\text{NCP} = \text{Number of Clock Inputs at } f_{CP}$
 $f_i = \text{Input Frequency}$
 $\text{Ni} = \text{Number of Inputs at } f_i$

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Condition ⁽¹⁾	FCT16827AT				FCT16827BT				Unit
			Com'l.		Mil.		Com'l.		Mil.		
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
t _{PLH} t _{PHL}	Propagation Delay xAX to xYx	CL = 50pF RL = 500Ω	1.5	8	1.5	9	1.5	5	1.5	6.5	ns
		CL = 300pF ⁽⁴⁾ RL = 500Ω	1.5	15	1.5	17	1.5	13	1.5	14	
t _{PZH} t _{PZL}	Output Enable Time xOEx to xYx	CL = 50pF RL = 500Ω	1.5	12	1.5	13	1.5	8	1.5	9	ns
		CL = 300pF ⁽⁴⁾ RL = 500Ω	1.5	23	1.5	25	1.5	15	1.5	16	
t _{PHZ} t _{PLZ}	Output Disable Time xOEx to xYx	CL = 5pF ⁽⁴⁾ RL = 500Ω	1.5	9	1.5	9	1.5	6	1.5	7	ns
		CL = 50pF RL = 500Ω	1.5	10	1.5	10	1.5	7	1.5	8	
tsk(o)	Output Skew ⁽³⁾		—	0.5	—	0.5	—	0.5	—	0.5	ns

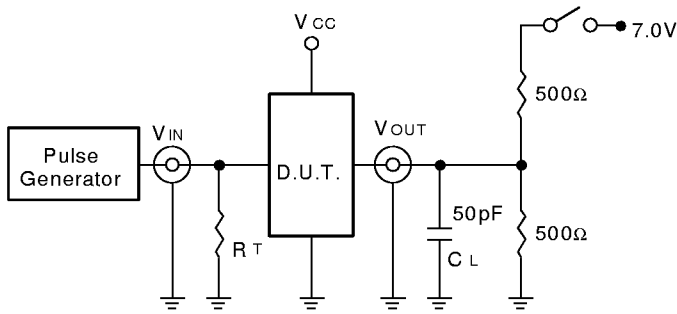
Symbol	Parameter	Condition ⁽¹⁾	FCT16827CT				FCT16827ET				Unit
			Com'l.		Mil.		Com'l.		Mil.		
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
t _{PLH} t _{PHL}	Propagation Delay xAX to xYx	CL = 50pF RL = 500Ω	1.5	4.4	1.5	5	1.5	3.2	—	—	ns
		CL = 300pF ⁽⁴⁾ RL = 500Ω	1.5	10	1.5	11	1.5	7	—	—	
t _{PZH} t _{PZL}	Output Enable Time xOEx to xYx	CL = 50pF RL = 500Ω	1.5	7	1.5	8	1.5	4.8	—	—	ns
		CL = 300pF ⁽⁴⁾ RL = 500Ω	1.5	14	1.5	15	1.5	9	—	—	
t _{PHZ} t _{PLZ}	Output Disable Time xOEx to xYx	CL = 5pF ⁽⁴⁾ RL = 500Ω	1.5	5.7	1.5	6.7	1.5	4	—	—	ns
		CL = 50pF RL = 500Ω	1.5	6	1.5	7	1.5	4	—	—	
tsk(o)	Output Skew ⁽³⁾		—	0.5	—	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.
4. This condition is guaranteed but not tested.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



SWITCH POSITION

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

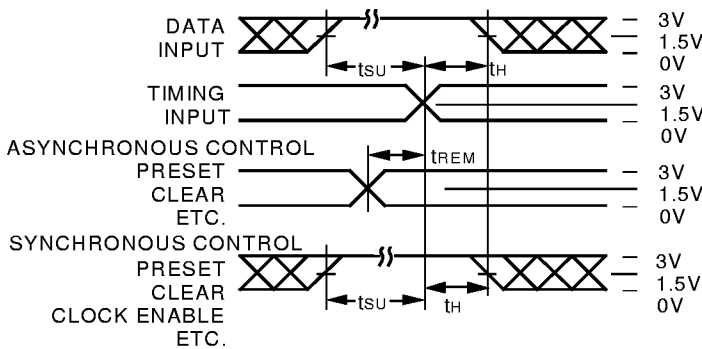
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DEFINITIONS:

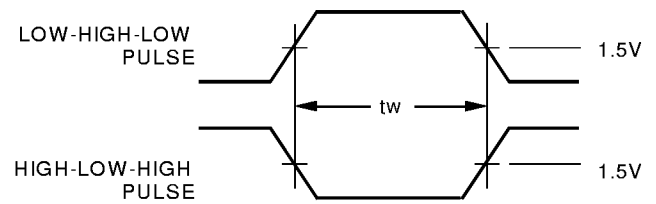
C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

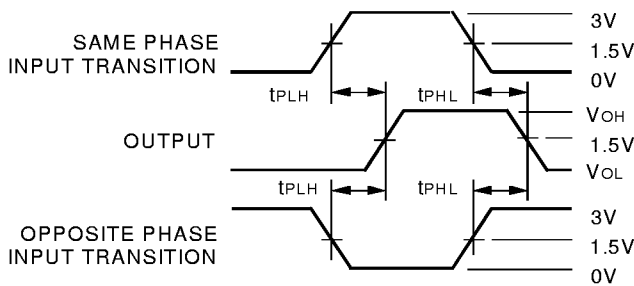
SET-UP, HOLD, AND RELEASE TIMES



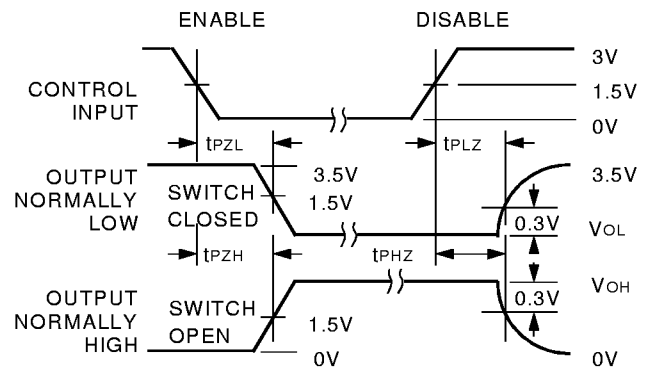
PULSE WIDTH



PROPAGATION DELAY



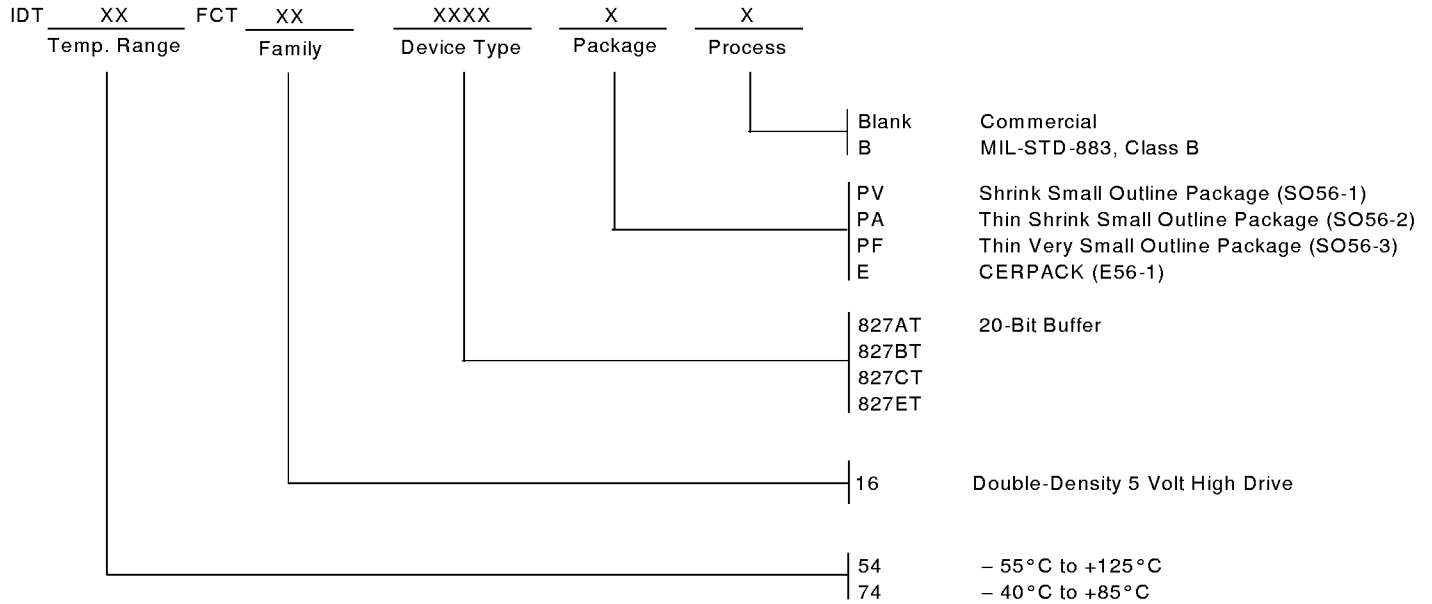
ENABLE AND DISABLE TIMES



NOTES:

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

ORDERING INFORMATION



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