



HIGH-SPEED CMOS BUS INTERFACE 10-BIT REGISTER

IDT74FCTL2821T

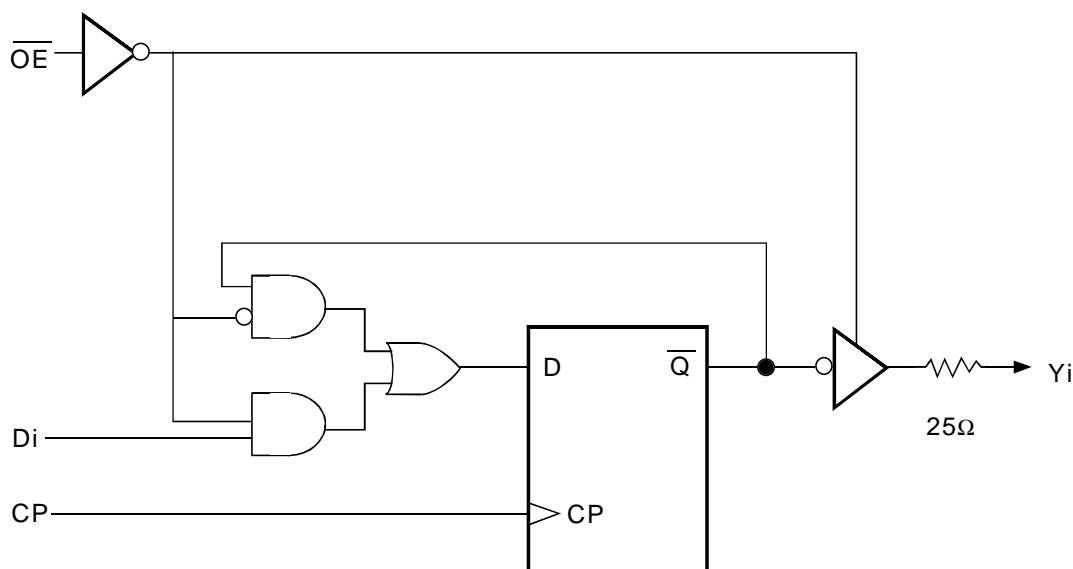
FEATURES:

- Pin and function compatible to the Quality QS74FCT Family
- Extended commercial range of -40°C to $+85^{\circ}\text{C}$
- CMOS power levels: $<7.5\text{mW}$ static
- Available in PDIP, SOIC, and QSOP packages
- Undershoot clamp diodes on all inputs
- True TTL input and output compatibility
- Ground bounce controlled outputs
- Reduced output swing of 0 to 3.5V
- Built-in 25Ω series resistor outputs reduce reflection and other system noise
- $I_{OL} = 12\text{mA}$

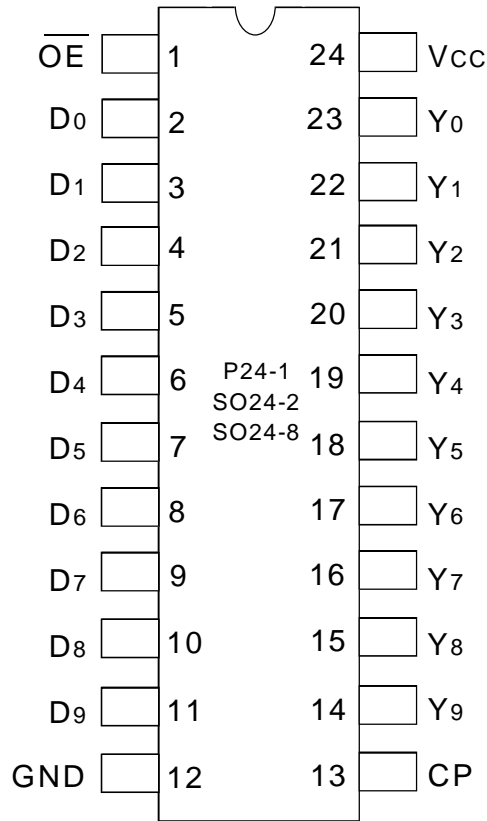
DESCRIPTION:

The IDT74FCTL2821T is a 10-bit high-speed CMOS TTL-compatible buffered register with 3-state outputs, ideal for driving high capacitance loads such as memory address and data buses. The 2821 device is a 25Ω resistor output version, useful for driving transmission lines and reducing system noise. The 2821 series parts can replace the 821 series to reduce noise in an existing design. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression. Outputs will not load an active bus when V_{CC} is removed from the device.

FUNCTIONAL BLOCK DIAGRAM

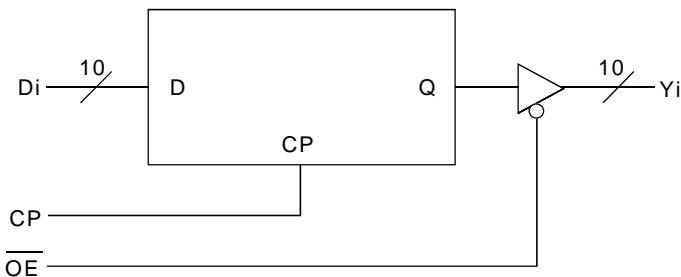


PIN CONFIGURATION



PDIP/ SOIC/ QSOP
TOP VIEW

LOGIC SYMBOL



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 +7	V
TSTG	Storage Temperature	- 65 to +150	°C
I _{OUT}	DC Output Current	120	mA
I _{IK}	Continuous Clamp Current, V _I < 0 or V _O < 0	- 20	mA
I _{OK}		- 50	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.
- V_{CC} terminals.
- All terminals except V_{CC}.

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 _{OUT}	Output Capacitance	V _{OUT} = 0V	8	12	pF

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NOTE:

- This parameter is measured at characterization but not tested.

PIN DESCRIPTION

Name	I/O	Description
Di	I	The D flip-flop data inputs.
CP	I	Clock Pulse for the Register; enters data into the register on the LOW-to-HIGH transition.
Yi	O	The register three-state outputs.
OE	I	Output Control. When the OE input is HIGH, the Y _i outputs are in the high impedance state. When the OE input is LOW, the TRUE register data is present at the Y _i outputs.

FUNCTION TABLE ⁽¹⁾

Inputs			Int.	O/P	Function
OE	Di	CP	Qi	Yi	
H	L	↑	L	Hi-Z	High Z
H	H	↑	H	Hi-Z	High Z
H	L	↑	L	Hi-Z	Load
H	H	↑	H	Hi-Z	Load
L	L	↑	L	L	Load
L	H	↑	H	H	Load

NOTE:

- H = HIGH
L = LOW
↑ = LOW-to-HIGH Transition
Z = High-Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Extended Commercial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 5\%$

Symbol	Parameter	Test Conditions		Min.	Typ. ⁽¹⁾	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
ΔV_T	Input Hysteresis	$V_{TLH} - V_{THL}$ for all inputs		—	0.2	—	V
I_{IH}	Input HIGH Current	$V_{CC} = \text{Max.}$	$0 \leq V_{IN} < V_{CC}$	—	—	5	μA
I_{IL}	Input LOW Current						
I_{OZ}	Off-State Output Current (Hi-Z)	$V_{CC} = \text{Max.}$	$0 \leq V_{IN} \leq V_{CC}$	—	—	5	μA
I_{OR}	Current Drive	$V_{CC} = \text{Min.}, V_{OUT} = 2.0\text{V}^{(2)}$		50	—	—	mA
V_{IC}	Input Clamp Voltage	$V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}, T_A = 25^{\circ}\text{C}$		—	-0.7	-1.2	V
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}$	$I_{OH} = -24\text{mA}$	2.4	—	—	V
V_{OL}	Output LOW Voltage - 25Ω	$V_{CC} = \text{Min.}$	$I_{OL} = 12\text{mA}$	—	—	0.5	V
R_{OUT}	Output Resistance - 25Ω	$V_{CC} = \text{Min.}$	$I_{OL} = 12\text{mA}$	20	28	40	Ω

NOTES:

1. Typical values are at $V_{CC} = 5.0\text{V}$, $T_A = 25^{\circ}\text{C}$.

2. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.

POWER SUPPLY CHARACTERISTICS

Following Conditions Apply Unless Otherwise Specified:

Extended Commercial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 5\%$

Symbol	Parameter	Test Conditions ⁽¹⁾	Min.	Max.	Unit
I_{CC}	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$ freq = 0 $0\text{V} \leq V_{IN} \leq 0.2\text{V}$ or $V_{CC} - 0.2\text{V} \leq V_{IN} \leq V_{CC}$	—	1.5	mA
ΔI_{CC}	Supply Current per Input TTL Inputs HIGH	$V_{CC} = \text{Max.}$ $V_{IN} = 3.4\text{V}^{(2)}$ freq = 0	—	2	mA
I_{CCD}	Supply Current per Input per MHz	$V_{CC} = \text{Max.}$ Outputs Open and Enabled One Bit Toggling 50% Duty Cycle Other inputs at GND or $V_{CC}^{(3,4)}$	—	0.25	mA/MHz

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NOTES:

1. For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.

2. Per TLL driven input ($V_{IN} = 3.4\text{V}$).

3. For flip-flops, I_{CCD} is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance.

4. $I_{CC} = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$

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

I_{CC} = Quiescent Current

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

D_H = Duty Cycle for TTL Inputs High

N_T = Number of TTL Inputs at D_H

I_{CCD} = Dynamic Current Caused by an Output Transition Pair (HLH or LHL)

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

f_i = Input Frequency

N_i = Number of Inputs at f_i

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

SWITCHING CHARACTERISTICS OVER OPERATING RANGE⁽¹⁾

Following Conditions Apply Unless Otherwise Specified:

Extended Commercial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 5\%$

Symbol	Parameter	74FCTL2821AT		74FCTL2821BT		Unit
		Min.	Max.	Min.	Max.	
t _{PHL} t _{PLH}	Clock to Y Delay $\overline{\text{OE}} = \text{LOW}$	—	10	—	7.5	ns
t _{PHL} t _{PLH}	Clock to Y Delay $\overline{\text{OE}} = \text{LOW}$ ⁽²⁾	—	20	—	15	ns
t _{SU}	Data to CP Setup Time	4	—	3	—	ns
t _H	Data to CP Hold Time	2	—	1.5	—	ns

NOTES:

1. $C_{\text{LOAD}} = 50\text{pF}$, $R_{\text{LOAD}} = 500\Omega$ unless otherwise noted.
2. $C_{\text{LOAD}} = 300\text{pF}$

TIMING REQUIREMENTS OVER OPERATING RANGE⁽¹⁾

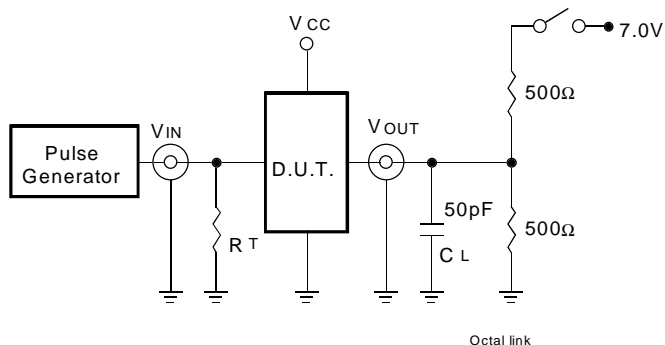
Symbol	Parameter ⁽²⁾	74FCTL2821AT		74FCTL2821BT		Unit
		Min.	Max.	Min.	Max.	
t _{PWH} t _{PWL}	Clock Pulse Width HIGH or LOW	7	—	6	—	ns
t _{PZH} t _{PZL}	Output Enable Time $\overline{\text{OE}}$ to Y_i	—	12	—	8	ns
t _{PZH} t _{PZL}	Output Enable Time ⁽³⁾ $\overline{\text{OE}}$ to Y_i	—	23	—	—	ns
t _{PHZ} t _{PLZ}	Output Disable Time ⁽⁴⁾ $\overline{\text{OE}}$ to Y_i	—	7	—	6.5	ns
t _{PHZ} t _{PLZ}	Output Disable Time $\overline{\text{OE}}$ to Y_i	—	9	—	7.5	ns

NOTES:

1. $C_{\text{LOAD}} = 50\text{pF}$, $R_{\text{LOAD}} = 500\Omega$ unless otherwise noted.
2. See Test Circuits and Waveforms.
3. $C_{\text{LOAD}} = 300\text{pF}$
4. $C_{\text{LOAD}} = 5\text{pF}$

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



SWITCH POSITION

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

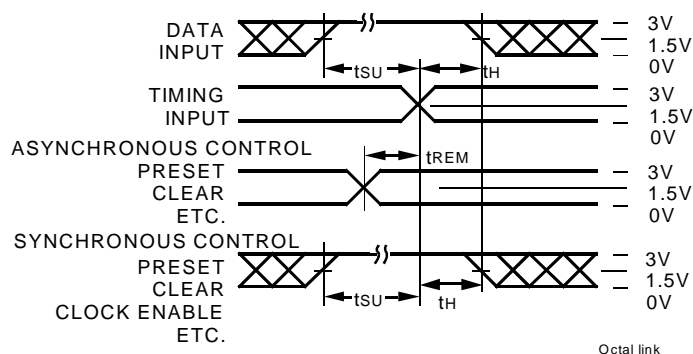
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DEFINITIONS:

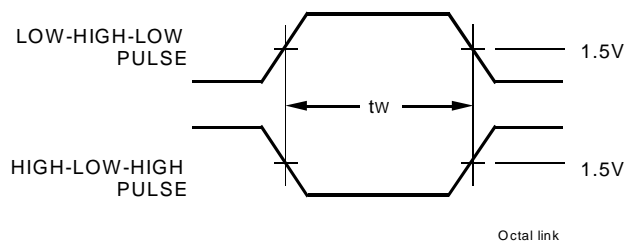
CL = Load capacitance: includes jig and probe capacitance.

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

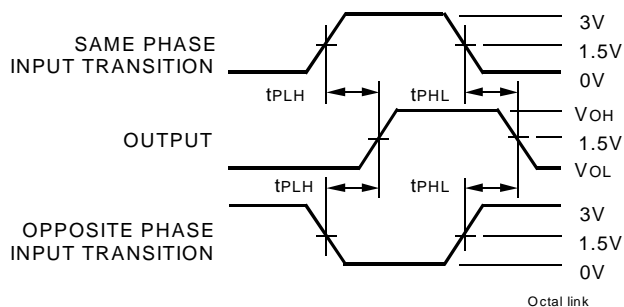
SET-UP, HOLD, AND RELEASE TIMES



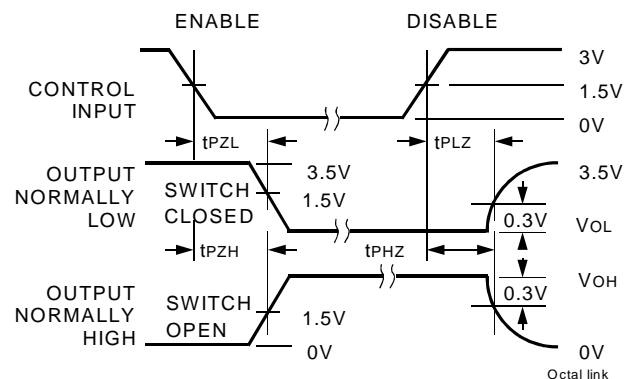
PULSE WIDTH



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	FCTL	XXXX	XX	
Temp. Range		Device Type		Package	
				P	Plastic DIP (P24-1)
				SO	Small Outline IC (gull wing) (SO24-2)
				Q	Quarter-size Small Outline Package (SO24-8)
				2821AT	High-Speed CMOS Bus Interface 10-Bit Register
				2821BT	
				74	−40°C to +85°C



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