HIGH-SPEED CMOS BUS INTERFACE 9-BIT REGISTER

IDTQS74FCT2823AT/BT

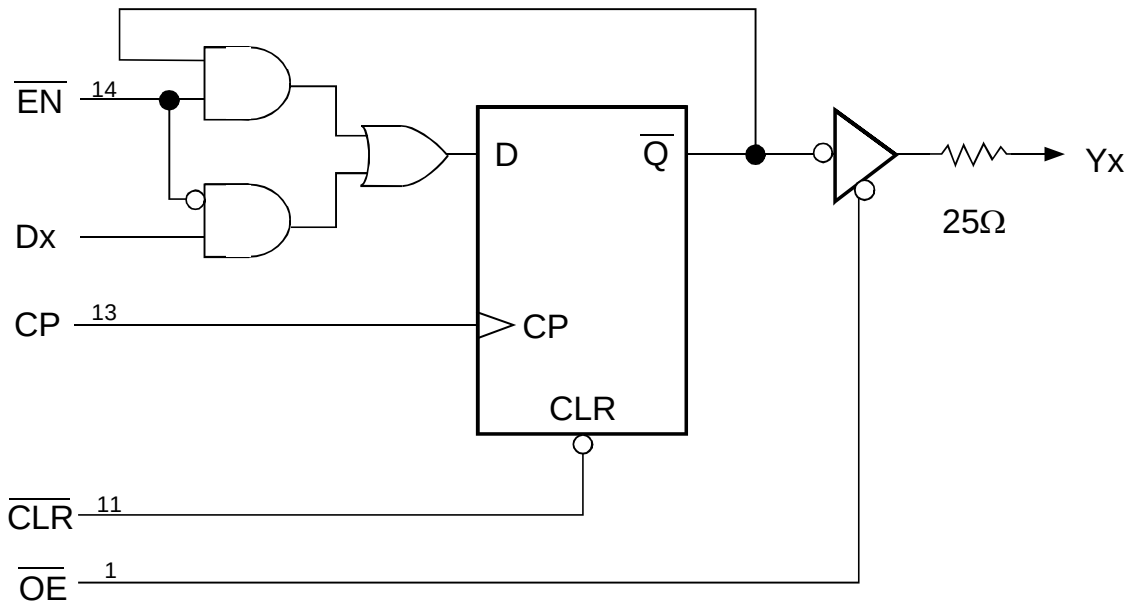
FEATURES:

- **CMOS power levels: <7.5mW static**
- **Undershoot clamp diodes on all outputs**
- **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**
- **A and B speed grades**
- **I_{OL} = 12mA**
- **Available in QSOP package**

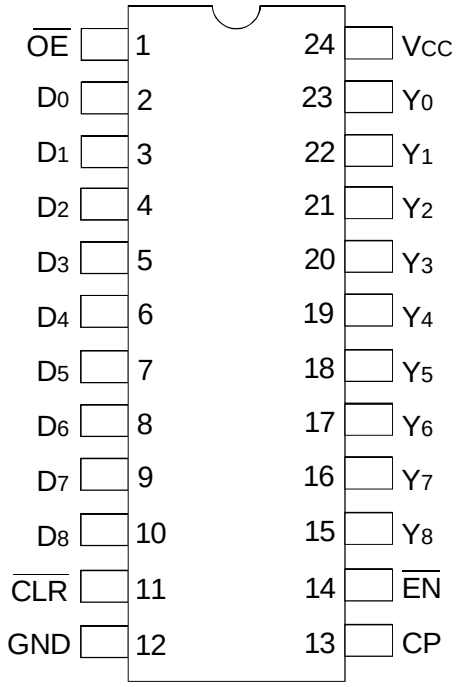
DESCRIPTION:

The IDTQS74FCT2823T is a 9-bit high-speed CMOS TTL-compatible buffered register with 3-state outputs, with a 25Ω resister that is useful for driving transmission lines and reducing system noise. The 2823 series parts can replace the 823 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 Vcc is removed from the device.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



QSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
V_{TERM}	Terminal Voltage with Respect to GND	–0.5 to +7	V
T_{STG}	Storage Temperature	–65 to +150	°C
I_{OUT}	DC Output Current Max Sink Current/Pin	120	mA
I_{IK}	Input Diode Current, V_{IN} < 0	–20	mA
I_{OK}	Output Diode Current, V_{OUT} < 0	–50	mA

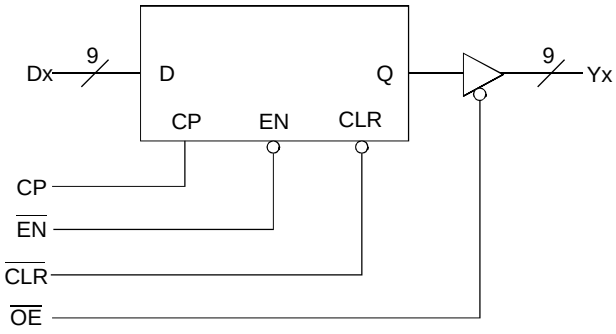
NOTE:
1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

CAPACITANCE (T_A = +25°C, F = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C_{IN}(2)	Input Capacitance	V_{IN} = 0V	4	—	pF
C_{IN}(3)	Input Capacitance	V_{IN} = 0V	8	—	pF
C_{OUT}(4)	Output Capacitance	V_{OUT} = 0V	6	—	pF
C_{OUT}(5)	Output Capacitance	V_{OUT} = 0V	8	—	pF

NOTES:
1. This parameter is measured at characterization but not tested.
2. Pins 1, 3-11, 13.
3. Pin 2.
4. Pins 15-22.
5. Pins 14, 23.

LOGIC SYMBOL



PIN DESCRIPTION

Pin Names	I/O	Description
Dx	I	D Flip-Flop Data Inputs
$\overline{CLR}$	I	When the clear input is LOW and $\overline{OE}$ is LOW, the Yx outputs are LOW. When clear input is HIGH, data can be entered into the register.
CP	I	Clock Pulse for the register. Enters data into the register on the LOW-to-HIGH transition.
Yx	O	Register 3-State Outputs
EN	I	Clock Enable. When the clock enable is LOW, data on the Dx input is transferred to the Yx output on the LOW-to-HIGH clock transition. When the clock enable is HIGH, the Yx outputs do not change state, regardless of the data or clock input transitions.
$\overline{OE}$	I	Output Control. When the $\overline{OE}$ input is HIGH, the Yx outputs are in the high impedance state. When the $\overline{OE}$ input is LOW, the TRUE register data is present at the Yx outputs.

FUNCTION TABLE(1)

Inputs					Internal	Outputs	
OE	CLR	EN	Dx	CP	Qx	Yx	Function
H	X	L	L	↑	L	Z	High Z
H	X	L	H	↑	H	Z	High Z
H	L	X	X	X	L	Z	Clear
L	L	X	X	X	L	L	Clear
H	H	H	X	X	NC	Z	Hold
L	H	H	X	X	NC	NC	Hold
H	H	L	L	↑	L	Z	Load
H	H	L	H	↑	H	Z	Load
L	H	L	L	↑	L	L	Load
L	H	L	H	↑	H	H	Load

NOTE:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care
   NC = No Change
   ↑ = LOW-to-HIGH transition
   Z = High-Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Industrial: T_A = –40°C to +85°C, V_{CC} = 5.0V ±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} = Max.	0 ≤ V_{IN} ≤ V_{CC}	—	—	±5	µA
I_{IL}	Input LOW Current						
I_{OZ}	Off-State Output Current (Hi-Z)	V_{CC} = Max	0 ≤ V_{IN} ≤ V_{CC}	—	—	±5	µA
I_{OR}	Current Drive	V_{CC} = Max., V_{OUT} = 2.0V(2)		50	—	—	mA
V_{IC}	Input Clamp Voltage	V_{CC} = Min, I_{IN} = -18mA , T_A = 25°C(2)		—	–0.7	–1.2	V
V_{OH}	Output HIGH Voltage	V_{CC} = Min.	I_{OH} = -15mA	2.4	—	—	V
V_{OL}	Output LOW Voltage	V_{CC} = Min.	I_{OL} = 12mA	—	—	0.5	V
R_{OUT}(3)	Output Resistance	V_{CC} = Min.	I_{OH} = 12mA	18	25	40	Ω

NOTES:
1. Typical values are at V_{CC} = 5.0V, T_A = 25°C.
2. This parameter is measured at characterization but not tested.
3. R_{OUT} changed on March 8, 2002. See rear page for more information.

POWER SUPPLY CHARACTERISTICS

Following Conditions Apply Unless Otherwise Specified:

Industrial: T_A = -40°C to +85°C, V_{CC} = 5.0V ± 5%

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

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} = 3.4V).
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. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$
   I_{CC} = Quiescent Current
   ΔI_{CC} = Power Supply Current for a TTL High Input (V_{IN} = 3.4V)
   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)

Symbol	Parameter	FCT2823AT		FCT2823BT		Unit
		Min.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Clock to Y Delay $\overline{OE}$ = LOW	—	10	—	7.5	ns
t_{PLH} t_{PHL}	Clock to Y Delay $\overline{OE}$ = 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
t_{ENS}	$\overline{EN}$ to CP Setup Time	4	—	3	—	ns
t_{ENH}	$\overline{EN}$ to CP Hold Time	2	—	0	—	ns

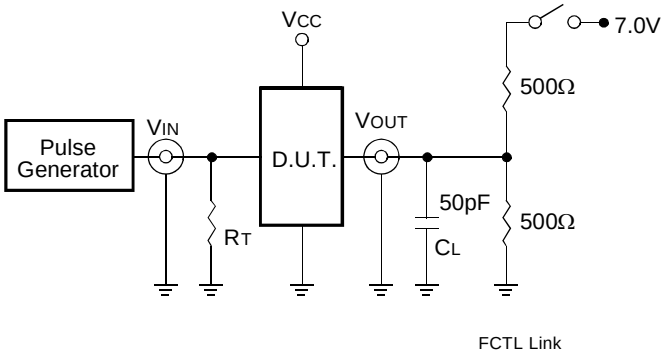
NOTES:
1. C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise noted.
2. C_{LOAD} = 300pF.

TIMING REQUIREMENTS OVER OPERATING RANGE(1)

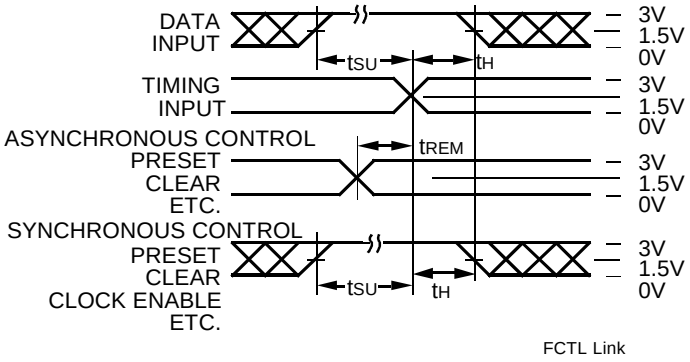
Symbol	Parameter(2)	FCT2823AT		FCT2823BT		Unit
		Min.	Max.	Min.	Max.	
t_{CLR}	$\overline{CLR}$ to Y Delay	—	11	—	9	ns
t_{REC}	$\overline{CLR}$ to CP Setup Time	6	—	6	—	ns
t_{PLH} t_{PHL}	Clock Pulse Width HIGH or LOW	7	—	6	—	ns
t_{PZH} t_{PZL}	Output Enable Time $\overline{OE}$ to Yx	—	12	—	8	ns
t_{PZH} t_{PZL}	Output Enable Time(3) $\overline{OE}$ to Yx	—	23	—	—	ns
t_{PHZ} t_{PLZ}	Output Disable Time(4) $\overline{OE}$ to Yx	—	7	—	6.5	ns
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{OE}$ to Yx	—	9	—	7.5	ns

NOTES:
1. C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise noted.
2. See Test Circuits and Waveforms
3. C_{LOAD} = 300pF.
4. C_{LOAD} = 5pF.

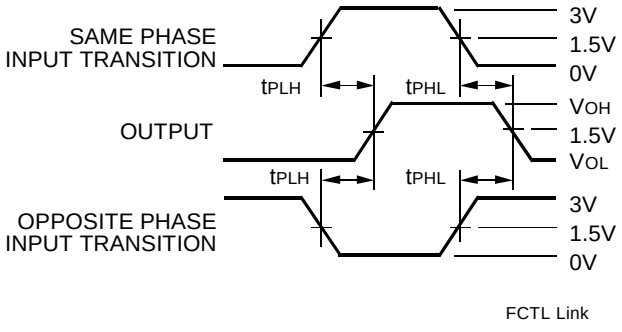
TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs



Set-Up, Hold, and Release Times



Propagation Delay

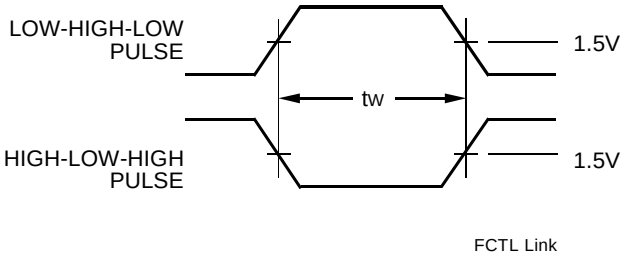
SWITCH POSITION

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

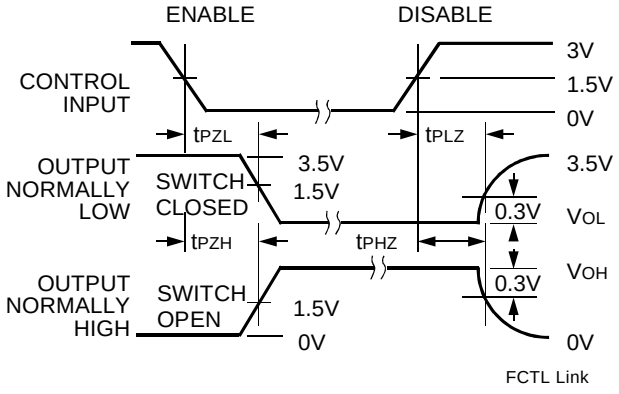
DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

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



Pulse Width

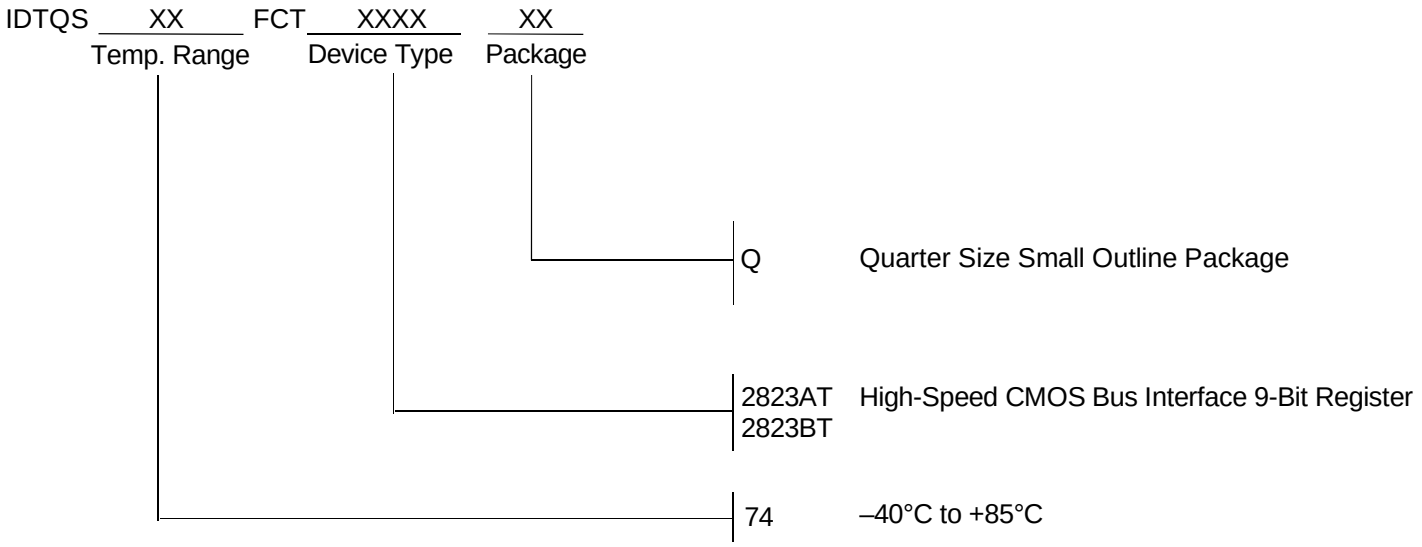


Enable and Disable Times

NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.

ORDERING INFORMATION



As per PCN L0201-02, the Output Resistance (R_{OUT}) specifications have changed as of March 8, 2002. The original specifications were:

Parameter	Description	Min.	Typ.	Max.	Unit
R_{OUT}	V_{CC} = Min, I_{OL} = 12mA	20	28	40	Ω

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