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- Function, Pinout, and Drive Compatible
 With FCT, F Logic, and AM29825
- Reduced V_{OH} (Typically = 3.3 V) Version of Equivalent FCT Functions
- Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics
- I_{off} Supports Partial-Power-Down Mode Operation
- Matched Rise and Fall Times
- Fully Compatible With TTL Input and Output Logic Levels
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)
- 64-mA Output Sink Current
 32-mA Output Source Current
- High-Speed Parallel Register With Positive-Edge-Triggered D-Type Flip-Flops
- Buffered Common Clock-Enable (EN) and Asynchronous-Clear (CLR) Inputs
- 3-State Outputs

(TOP VIEW) OE₁ OE₂ 2 23 OE₃ D_0 3 22 Y₀ $D_1 \square 4$ 21 | Y₁ D_2 5 20 | Y₂ 19 | Y₃ $D_3 \coprod 6$ 18 Y₄ $D_4 \square 7$ D₅ 8 $D_6 \square 9$ 16∐ Y₆ 15 🛮 Y₇ D₇ 10 14 🛮 EN CLR | 11 GND 12 13 **∏** CP

Q PACKAGE

description

This bus-interface register is designed to eliminate the extra packages required to buffer existing registers and provide extra data width for wider address/data paths or buses carrying parity. The CY74FCT825T is an 8-bit buffered register with all the CY74FCT823T controls, plus multiple enables (\overline{OE}_1 , \overline{OE}_2 , \overline{OE}_3) to allow multiuser control of the interface, e.g., \overline{CS} , DMA, and RD/ \overline{WR} . This device is ideal for use as an output port requiring high I_{OL}/I_{OH} .

This device is designed for high-capacitance load drive capability, while providing low-capacitance bus loading at both inputs and outputs. Outputs are designed for low-capacitance bus loading in the high-impedance state.

This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

ORDERING INFORMATION

TA	PACKAGET		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QSOP – Q	Tape and reel	6	CY74FCT825CTQCT	FCT825C

[†] Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



PIN DESCRIPTION

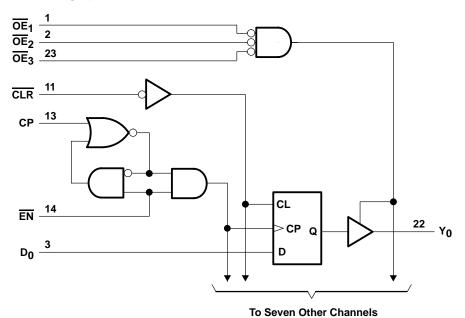
NAME	I/O	DESCRIPTION					
D	I	D flip-flop data inputs					
CLR	CLR I When CLR is low and OE is low, Q outputs are low. When CLR is high, data can be entered into the register.						
CP	0	Clock pulse for the register. Enters data into the register on the low-to-high clock transition.					
Υ	0	Register 3-state outputs					
EN	I	Clock enable. When $\overline{\text{EN}}$ is low, data on the D input is transferred to the Q output on the low-to-high clock transition. When $\overline{\text{EN}}$ is high, the Q outputs do not change state, regardless of the data or clock input transitions.					
ŌĒ	ı	Output control. When OE is high, the Youtputs are in the high-impedance state. When OE is low, true register data is present at the Youtputs.					

FUNCTION TABLE

		INPUTS				RNAL PUTS	FUNCTION
OE	CLR	EN	D	СР	Q	Y	
Н	Н	L	L	1	L	Z	Z
Н	Н	L	Н	\uparrow	Н	Z	
Н	L	Х	Х	Х	L	Z	Clear
L	L	Χ	Χ	Х	L	L	Clear
Н	Н	Н	Х	Х	NC	Z	Hold
L	Н	Н	Χ	Х	NC	NC	Hold
Н	Н	L	L	1	L	Z	
Н	Н	L	Н	\uparrow	Н	Z	Load
L	Н	L	L	\uparrow	L	L	Load
L	Н	L	Н	1	Н	Н	

H = High logic level, L = Low logic level, X = Don't care, NC = No change, ↑ = Low-to-high transition, Z = High-impedance state

logic diagram (positive logic)





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absolute maximum rating over operating free-air temperature range (unless otherwise noted)†

Supply voltage range to ground potential	0.5 V to 7 V
DC input voltage range	0.5 V to 7 V
DC output voltage range	0.5 V to 7 V
DC output current (maximum sink current/pin)	120 mA
Package thermal impedance, θ_{JA} (see Note1)	61°C/W
Ambient temperature range with power applied, T _A	65°C to 135°C
Storage temperature range, T _{stg}	. −65°C to 150°C

[†] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions (see Note 2)

		MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.75	5	5.25	V
VIH	High-level input voltage	2			V
VIL	Low-level input voltage			8.0	V
ІОН	High-level output current			-32	mA
l _{OL}	Low-level output current			64	mA
T _A	Operating free-air temperature	-40		85	°C

NOTE 2: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITION	S	MIN	TYP	MAX	UNIT
VIK	$V_{CC} = 4.75 \text{ V},$	$I_{IN} = -18 \text{ mA}$			-0.7	-1.2	V
\/a	Vaa – 4.75.V	I _{OH} = -32 mA		2			V
VOH	V _{CC} = 4.75 V	$I_{OH} = -15 \text{ mA}$	$I_{OH} = -15 \text{ mA}$				V
VOL	$V_{CC} = 4.75 \text{ V},$	$I_{OL} = 64 \text{ mA}$			0.3	0.55	V
V _{hys}	All inputs				0.2		V
Ι _Ι	$V_{CC} = 5.25 \text{ V},$	$V_{IN} = V_{CC}$				5	μΑ
lін	V _{CC} = 5.25 V,	$V_{IN} = 2.7 \text{ V}$				±1	μΑ
I _{IL}	$V_{CC} = 5.25 \text{ V},$	V _{IN} = 0.5 V				±1	μΑ
lozh	$V_{CC} = 5.25 \text{ V},$	V _{OUT} = 2.7 V				10	μΑ
lozL	$V_{CC} = 5.25 \text{ V},$	V _{OUT} = 0.5 V				-10	μΑ
los [‡]	$V_{CC} = 5.25 \text{ V},$	V _{OUT} = 0 V		-60	-120	-225	mA
l _{off}	$V_{CC} = 0 V$,	V _{OUT} = 4.5 V				±1	μΑ
l _{CC}	$V_{CC} = 5.25 \text{ V},$	$V_{IN} \le 0.2 V$,	$V_{IN} \ge V_{CC} - 0.2 \text{ V}$		0.1	0.2	mA
ΔlCC	V _{CC} = 5.25 V, V _{IN} =	3.4 V , $f_1 = 0$, Outputs or	oen		0.5	2	mA
ICCD¶		oit switching at 50% duty of 0.2 V or $V_{IN} \ge V_{CC} - 0.00$			0.06	0.12	mA/ MHz
		One bit switching at f ₁ = 5 MHz	$V_{IN} \le 0.2 \text{ V or}$ $V_{IN} \ge V_{CC} - 0.2 \text{ V}$		0.7	1.4	
I _C #	V _{CC} = 5.25 V,	at 50% duty cycle	$V_{IN} = 3.4 \text{ V or GND}$		1.2	3.4	mA
I.C.,	Outputs open, OE = EN = GND	Eight bits switching at f ₁ = 2.5 MHz	$V_{IN} \le 0.2 \text{ V or}$ $V_{IN} \ge V_{CC} - 0.2 \text{ V}$		1.6	3.2	ША
		at 50% duty cycle	$V_{IN} = 3.4 \text{ V or GND}$		3.9	12.2	
C _i					5	10	pF
Co					9	12	pF

[†] Typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}\text{C}$.

Where:

I_C = Total supply current

ICC = Power-supply current with CMOS input levels

ΔICC = Power-supply current for a TTL high input (VIN = 3.4 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 input transition pair (HLH or LHL)

f₀ = Clock frequency for registered devices, otherwise zero

f₁ = Input signal frequency

N₁ = Number of inputs changing at f₁

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

Values for these conditions are examples of the I_{CC} formula.



[‡] Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample-and-hold techniques are preferable to minimize internal chip heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output can raise the chip temperature well above normal and cause invalid readings in other parametric tests. In any sequence of parameter tests, IOS tests should be performed last.

[§] Per TTL-driven input (V_{IN} = 3.4 V); all other inputs at V_{CC} or GND

 $[\]P$ This parameter is derived for use in total power-supply calculations.

 $^{^{\#}}$ IC = I_{CC} + Δ I_{CC} × D_H × N_T + I_{CCD} (f₀/2 + f₁ × N₁)

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

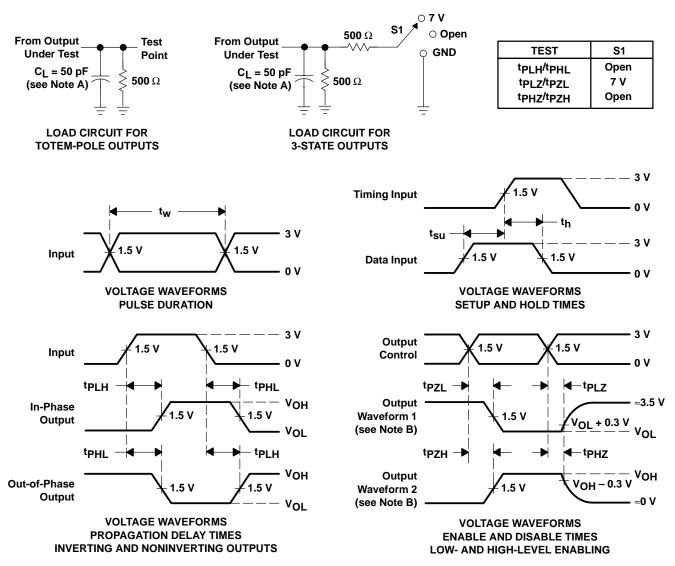
	PARAMETER		TEST LOAD	CY74FC1	Г825AT	CY74FCT	825BT	CY74FCT	825CT	UNIT
			TEST LOAD	MIN	MAX	MIN	MAX	MIN	MAX	UNIT
Γ.	Pulse duration	CP	C _L = 50 pF,	7		6		6		ns
t _W	ruise duration	CLR low	$R_L = 500 \Omega$	6		6		6		115
[.	Saturations hafers CR [↑] Data		$C_L = 50 \text{ pF},$	4		3		3		ns
t _{su}	Setup time, before CP↑	EN	$R_L = 500 \Omega$	4		3		3	3	
Γ.	Hold time, after CP↑	Data	C _L = 50 pF,	2		1.5		1.5		ns
th	Hold time, after CP1	EN	$R_L = 500 \Omega$	2		0		0		115
t _{rec}	Recovery time	CLR before CP↑	$C_L = 50 \text{ pF},$ $R_L = 500 \Omega$	6		6		6		ns

switching characteristics over operating free-air temperature range (see Figure 1)

PARAMETER	FROM	то	TEST LOAD	CY74FC1	825AT	CY74FCT8	25BT	CY74FC1	825CT	UNIT
PARAMETER	(INPUT)	(OUTPUT)	TEST LOAD	MIN	MAX	MIN	MAX	MIN	MAX	UNIT
^t PLH	СР	Y	C _L = 50 pF,		10		7.5		6	ns
^t PHL	OI .		$R_L = 500 \Omega$		10		7.5		6	110
t _{PLH}	СР	Υ	$C_L = 300 \text{ pF},$		20		15		12.5	ns
t _{PHL}	GF .		$R_L = 500 \Omega$		20		15		12.5	115
^t PLH	CLR	Υ	$C_L = 50 \text{ pF},$ $R_L = 500 \Omega$		14		9		8	ns
^t PZH	ŌE	Υ	$C_L = 50 \text{ pF},$		12		8		7	no
t _{PZL}	OE	ī	$R_L = 500 \Omega$		12		8		7	ns
^t PZH	ŌE	Y	C _L = 300 pF,		23		15		12.5	ns
^t PZL	OE		$R_L = 500 \Omega$		23		15		12.5	110
^t PHZ	ŌE	Y	C _L = 5 pF,		7		6.5		6	20
tPLZ	OE	ī	$R_L = 500 \Omega$		7		6.5		6	ns
^t PHZ	ŌE	Y	$C_L = 50 \text{ pF},$		8		7.5		6.5	ns
tPLZ) L	ı	$R_L = 500 \Omega$		8		7.5		6.5	110



PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_I includes probe and jig capacitance.

- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms







24-Jan-2013

PACKAGING INFORMATION

Orderable Device	Status	Package Type	U		Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Top-Side Markings	Samples
	(1)		Drawing			(2)		(3)		(4)	
CY74FCT825ATSOC	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT825A	Samples
CY74FCT825ATSOCE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT825A	Samples
CY74FCT825ATSOCG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT825A	Samples
CY74FCT825CTQCT	ACTIVE	SSOP	DBQ	24	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT825C	Samples
CY74FCT825CTQCTE4	ACTIVE	SSOP	DBQ	24	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT825C	Samples
CY74FCT825CTQCTG4	ACTIVE	SSOP	DBQ	24	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT825C	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes. **Pb-Free** (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between

the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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⁽⁴⁾ Only one of markings shown within the brackets will appear on the physical device.



PACKAGE OPTION ADDENDUM

24-Jan-2013

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PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
В0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CY74FCT825CTQCT	SSOP	DBQ	24	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

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*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY74FCT825CTQCT	SSOP	DBQ	24	2500	367.0	367.0	38.0

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.

- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- D. Falls within JEDEC MS-013 variation AD.



DBQ (R-PDSO-G24)

PLASTIC SMALL-OUTLINE PACKAGE



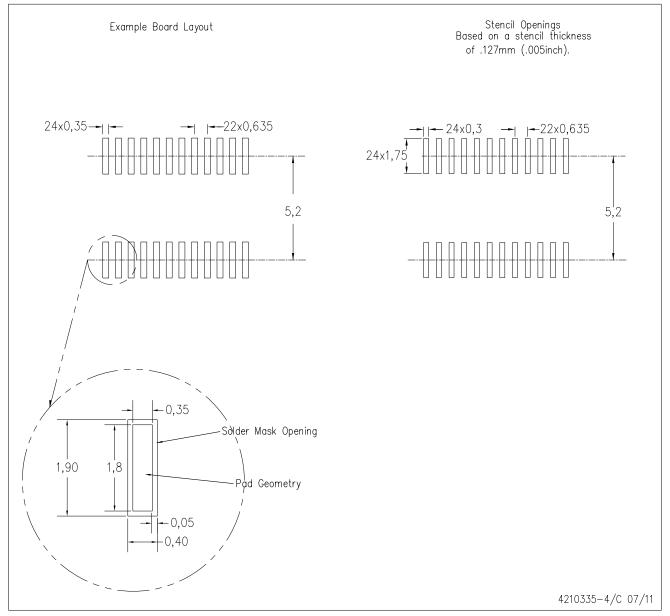
NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15) per side.
- D. Falls within JEDEC MO-137 variation AE.



DBQ (R-PDSO-G24)

PLASTIC SMALL OUTLINE PACKAGE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.



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