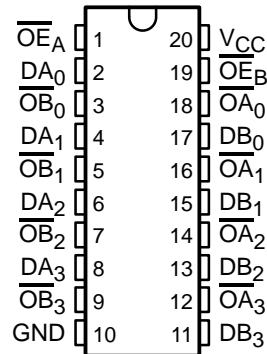


CY74FCT2240T 8-BIT BUFFER/LINE DRIVER WITH 3-STATE OUTPUTS

SCCS036A – SEPTEMBER 1994 – REVISED OCTOBER 2001

- Function and Pinout Compatible With FCT and F Logic
- 25-Ω Output Series Resistors Reduce Transmission-Line Reflection Noise
- TTL-Output-Level Version of Equivalent FCT Functions
- Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics
- I_{off} Supports Partial-Power-Down Mode Operation
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)
- Fully Compatible With TTL Input and Output Logic Levels
- 12-mA Output Sink Current
15-mA Output Source Current
- 3-State Outputs

Q OR SO PACKAGE
(TOP VIEW)



description

The CY74FCT2240T is an octal buffer and line driver that includes on-chip 25-Ω terminating resistors at each of the outputs to minimize noise resulting from reflections or standing waves in high-performance applications. The on-chip resistors reduce overall board space and component count. Designed to be employed as a memory address driver, clock driver, and bus-oriented transmitter/receiver, this device provides speed and drive capabilities commensurate with its fastest bipolar logic counterparts, while reducing power dissipation. The input and output voltage levels allow direct interface with TTL, NMOS, and CMOS devices, without the need for external components.

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

T_A	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QSOP – Q	Tape and reel	4.1	CY74FCT2240CTQCT	FCT2240C
	SOIC – SO	Tube	4.1	CY74FCT2240CTSOC	FCT2240C
		Tape and reel	4.1	CY74FCT2240CTSOCT	
	QSOP – Q	Tape and reel	4.8	CY74FCT2240ATQCT	FCT2240A
	SOIC – SO	Tube	8	CY74FCT2240TSOC	FCT2240
		Tape and reel	8	CY74FCT2240TSOCT	

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



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

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CY74FCT2240T

8-BIT BUFFER/LINE DRIVER

WITH 3-STATE OUTPUTS

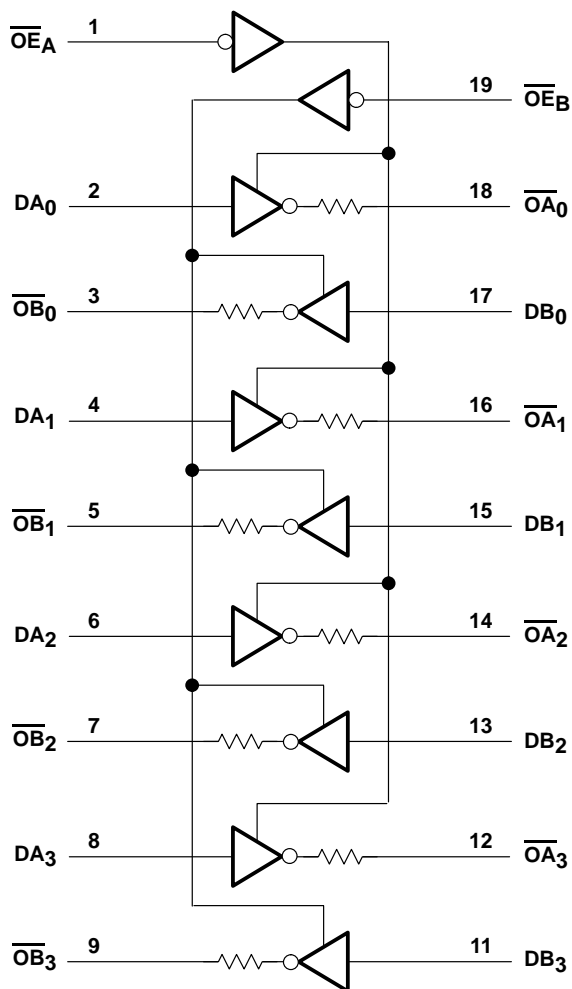
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FUNCTION TABLE

INPUTS			OUTPUT
\overline{OE}_A	\overline{OE}_B	D	\overline{O}
L	L	L	H
L	L	H	L
H	H	X	Z

H = High logic level, L = Low logic level,
X = Don't care, Z = High-impedance (off) state

logic diagram



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absolute maximum ratings 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 Note 1): Q package	68°C/W
SO package	58°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.

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

recommended operating conditions (see Note 2)

	MIN	NOM	MAX	UNIT
V_{CC} Supply voltage	4.75	5	5.25	V
V_{IH} High-level input voltage	2			V
V_{IL} Low-level input voltage			0.8	V
I_{OH} High-level output current			–15	mA
I_{OL} Low-level output current			12	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.



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

PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V _{IK}	V _{CC} = 4.75 V,	I _{IN} = -18 mA		-0.7	-1.2	V
V _{OH}	V _{CC} = 4.75 V,	I _{OH} = -15 mA	2.4	3.3		V
V _{OL}	V _{CC} = 4.75 V,	I _{OL} = 12 mA		0.3	0.55	V
R _{OUT}	V _{CC} = 4.75 V,	I _{OL} = 12 mA	20	25	40	Ω
V _{hys}	All inputs			0.2		V
I _I	V _{CC} = 5.25 V,	V _{IN} = V _{CC}			5	μA
I _{IH}	V _{CC} = 5.25 V,	V _{IN} = 2.7 V			±1	μA
I _{IL}	V _{CC} = 5.25 V,	V _{IN} = 0.5 V			±1	μA
I _{OZH}	V _{CC} = 5.25 V,	V _{OUT} = 2.7 V			10	μA
I _{OZL}	V _{CC} = 5.25 V,	V _{OUT} = 0.5 V			-10	μA
I _{OS} ‡	V _{CC} = 5.25 V,	V _{OUT} = 0 V	-60	-120	-225	mA
I _{off}	V _{CC} = 0 V,	V _{OUT} = 4.5 V			±1	μA
I _{CC}	V _{CC} = 5.25 V,	V _{IN} ≤ 0.2 V, V _{IN} ≥ V _{CC} - 0.2 V		0.1	0.2	mA
ΔI _{CC}	V _{CC} = 5.25 V, V _{IN} = 3.4 V§, f ₁ = 0, Outputs open			0.5	2	mA
I _{CCD} ¶	V _{CC} = 5.25 V, One input switching at 50% duty cycle, Outputs open, $\overline{OE}_A = \overline{OE}_B = \text{GND}$, V _{IN} ≤ 0.2 V or V _{IN} ≥ V _{CC} - 0.2 V			0.06	0.12	mA/MHz
I _C #	V _{CC} = 5.25 V, Outputs open, $\overline{OE}_A = \overline{OE}_B = \text{GND}$	One bit switching at f ₁ = 10 MHz at 50% duty cycle	V _{IN} ≤ 0.2 V or V _{IN} ≥ V _{CC} - 0.2 V	0.7	1.4	mA
			V _{IN} = 3.4 V or GND	1	2.4	
		Eight bits switching at f ₁ = 2.5 MHz at 50% duty cycle	V _{IN} ≤ 0.2 V or V _{IN} ≥ V _{CC} - 0.2 V	1.3	2.6	
			V _{IN} = 3.4 V or GND	3.3	10.6	
C _i				5	10	pF
C _o				9	12	pF

† Typical values are at V_{CC} = 5 V, T_A = 25°C.

‡ 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, I_{OS} tests should be performed last.

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

¶ This parameter is derived for use in total power-supply calculations.

I_C = I_{CC} + ΔI_{CC} × D_H × N_T + I_{CCD} (f₀/2 + f₁ × N₁)

Where:

I_C = Total supply current

I_{CC} = Power-supply current with CMOS input levels

ΔI_{CC} = Power-supply current for a TTL high input (V_{IN} = 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.



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

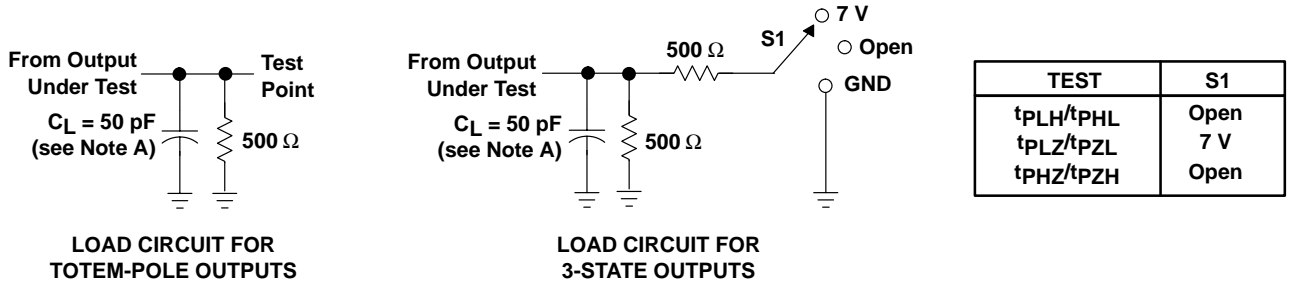
PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY74FCT2240T		CY74FCT2240AT		CY74FCT2240CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	D	\bar{O}	1.5	8	1.5	4.8	1.5	4.1	ns
t _{PHL}			1.5	8	1.5	4.8	1.5	4.1	
t _{PZH}	\bar{OE}	\bar{O}	1.5	10	1.5	6.5	1.5	5.8	ns
t _{PZL}			1.5	10	1.5	6.5	1.5	5.8	
t _{PHZ}	\bar{OE}	\bar{O}	1.5	9.5	1.5	5.9	1.5	5.2	ns
t _{PLZ}			1.5	9.5	1.5	5.9	1.5	5.2	



CY74FCT2240T
8-BIT BUFFER/LINE DRIVER
WITH 3-STATE OUTPUTS

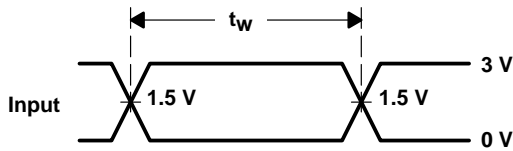
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PARAMETER MEASUREMENT INFORMATION

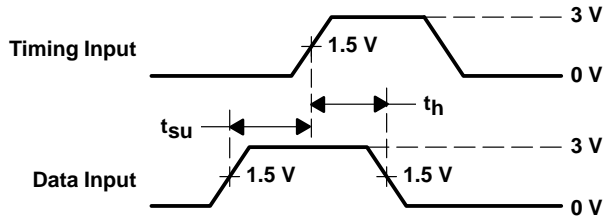


LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

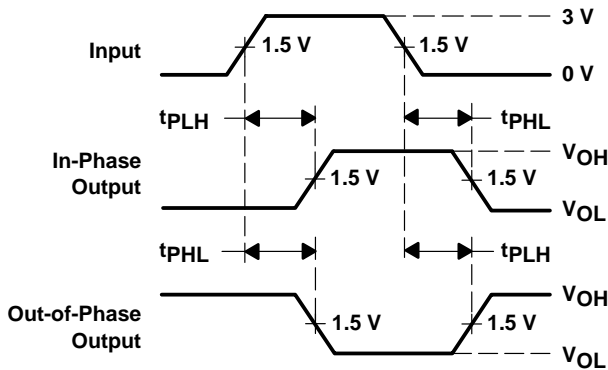
LOAD CIRCUIT FOR 3-STATE OUTPUTS



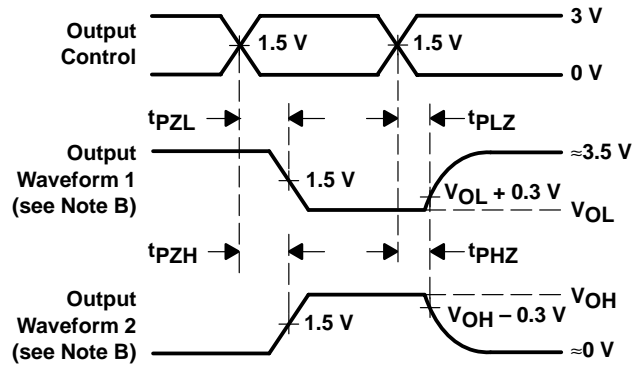
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- NOTES: A. C_L 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

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CY74FCT2240CTQCT	Active	Production	SSOP (DBQ) 20	2500 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT2240C
CY74FCT2240CTQCT.B	Active	Production	SSOP (DBQ) 20	2500 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT2240C
CY74FCT2240CTQCTE4	Active	Production	SSOP (DBQ) 20	2500 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT2240C

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CY74FCT2240CTQCT	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY74FCT2240CTQCT	SSOP	DBQ	20	2500	353.0	353.0	32.0

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