

CY54FCT240T, CY74FCT240T 8-BIT BUFFERS/LINE DRIVERS WITH 3-STATE OUTPUTS

SCCS017A – MAY 1994 – REVISED OCTOBER 2001

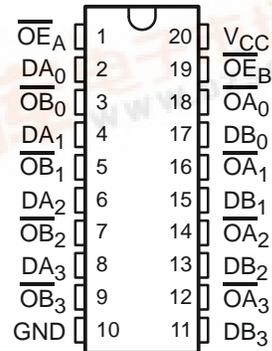
- **Function, Pinout, and Drive Compatible With FCT and F Logic**
- **Reduced V_{OH} (Typically = 3.3 V) Versions of Equivalent FCT Functions**
- **Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)
- **Matched Rise and Fall Times**
- **Fully Compatible With TTL Input and Output Logic Levels**
- **CY54FCT240T**
 - 48-mA Output Sink Current
 - 12-mA Output Source Current
- **CY74FCT240T**
 - 64-mA Output Sink Current
 - 32-mA Output Source Current
- **3-State Outputs**

description

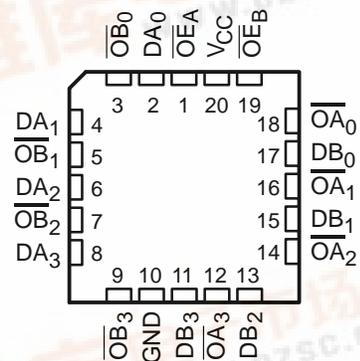
The 'FCT240T devices are octal buffers and line drivers designed to be employed as memory address drivers, clock drivers, and bus-oriented transmitters/receivers. These devices provide speed and drive capabilities equivalent to their fastest bipolar logic counterparts, while reducing power consumption. The input and output voltage levels allow direct interface with TTL, NMOS, and CMOS devices without external components.

These devices are 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.

CY54FCT240T . . . D PACKAGE
CY74FCT240T . . . Q OR SO PACKAGE
(TOP VIEW)



CY54FCT240T . . . L PACKAGE
(TOP VIEW)



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.

CY54FCT240T, CY74FCT240T 8-BIT BUFFERS/LINE DRIVERS WITH 3-STATE OUTPUTS

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ORDERING INFORMATION

TA	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SOIC – SO	Tube	4.3	CY74FCT240CTSOC	FCT240C
		Tape and reel	4.3	CY74FCT240CTSOCT	
	QSOP – Q	Tape and reel	4.3	CY74FCT240CTQCT	FCT240C
	SOIC – SO	Tube	4.8	CY74FCT240ATSOC	FCT240A
		Tape and reel	4.8	CY74FCT240ATSOCT	
	QSOP – Q	Tape and reel	4.8	CY74FCT240ATQCT	FCT240A
	SOIC – SO	Tube	8	CY74FCT240TSOC	FCT240
Tape and reel		8	CY74FCT240TSOCT		
QSOP – Q	Tape and reel	8	CY74FCT240TQCT	FCT240	
-55°C to 125°C	CDIP – D	Tube	4.7	CY54FCT240CTDMB	
	CDIP – D	Tube	5.1	CY54FCT240ATDMB	
	LCC – L	Tube	5.1	CY54FCT240ATLMB	
	CDIP – D	Tube	9	CY54FCT240TDMB	

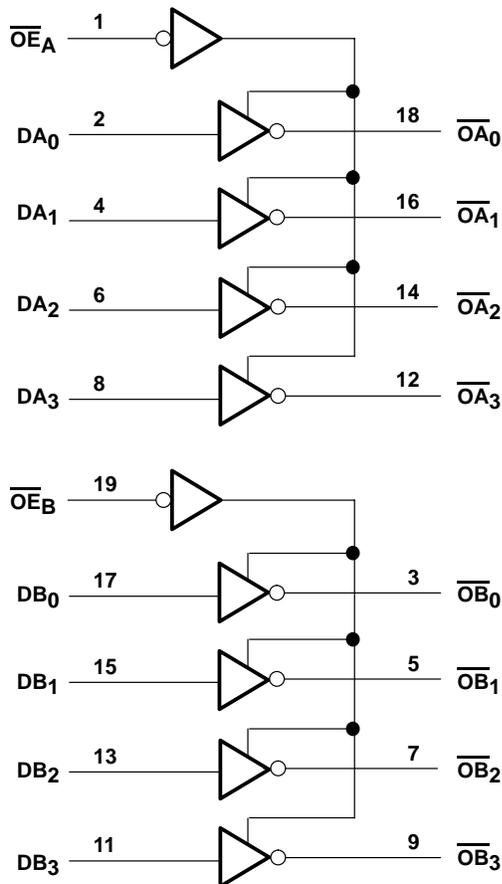
† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

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 state

logic diagram (positive logic)



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 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.

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recommended operating conditions (see Note 2)

	CY54FCT240T			CY74FCT240T			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC} Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V _{IH} High-level input voltage	2			2			V
V _{IL} Low-level input voltage			0.8			0.8	V
I _{OH} High-level output current			-12			-32	mA
I _{OL} Low-level output current			48			64	mA
T _A Operating free-air temperature	-55		125	-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	CY54FCT240T		CY74FCT240T		UNIT	
		MIN	TYP†	MAX	MIN		TYP†
V _{IK}	V _{CC} = 4.5 V, I _{IN} = -18 mA		-0.7	-1.2			V
	V _{CC} = 4.75 V, I _{IN} = -18 mA				-0.7	-1.2	
V _{OH}	V _{CC} = 4.5 V, I _{OH} = -12 mA	2.4	3.3				V
	V _{CC} = 4.75 V				2		
		I _{OH} = -32 mA				2.4	
V _{OL}	V _{CC} = 4.5 V, I _{OL} = 48 mA		0.3	0.55			V
	V _{CC} = 4.75 V, I _{OL} = 64 mA				0.3	0.55	
V _{hys}	All inputs		0.2		0.2		V
I _I	V _{CC} = 5.5 V, V _{IN} = V _{CC}			5			μA
	V _{CC} = 5.25 V, V _{IN} = V _{CC}					5	
I _{IH}	V _{CC} = 5.5 V, V _{IN} = 2.7 V			±1			μA
	V _{CC} = 5.25 V, V _{IN} = 2.7 V					±1	
I _{IL}	V _{CC} = 5.5 V, V _{IN} = 0.5 V			±1			μA
	V _{CC} = 5.25 V, V _{IN} = 0.5 V					±1	
I _{OZH}	V _{CC} = 5.5 V, V _{OUT} = 2.7 V			10			μA
	V _{CC} = 5.25 V, V _{OUT} = 2.7 V					10	
I _{OZL}	V _{CC} = 5.5 V, V _{OUT} = 0.5 V			-10			μA
	V _{CC} = 5.25 V, V _{OUT} = 0.5 V					-10	
I _{OS} ‡	V _{CC} = 5.5 V, V _{OUT} = 0 V	-60	-120	-225			mA
	V _{CC} = 5.25 V, V _{OUT} = 0 V				-60	-120	
I _{off}	V _{CC} = 0 V, V _{OUT} = 4.5 V			±1		±1	μA
I _{CC}	V _{CC} = 5.5 V, V _{IN} ≤ 0.2 V, V _{IN} ≥ V _{CC} - 0.2 V		0.1	0.2			mA
	V _{CC} = 5.25 V, V _{IN} ≤ 0.2 V, V _{IN} ≥ V _{CC} - 0.2 V				0.1	0.2	
ΔI _{CC}	V _{CC} = 5.5 V, V _{IN} = 3.4 V§, f ₁ = 0, Outputs open		0.5	2			mA
	V _{CC} = 5.25 V, V _{IN} = 3.4 V§, f ₁ = 0, Outputs open				0.5	2	
I _{CCD} ¶	V _{CC} = 5.5 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
	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	

† 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.

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

PARAMETER	TEST CONDITIONS		CY54FCT240T			CY74FCT240T			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
I _C #	V _{CC} = 5.5 V, Outputs open, OE _A = OE _B = 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				
	V _{CC} = 5.25 V, Outputs open, OE _A = OE _B = 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		
			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	5	10	pF		
C _o			9	12	9	12	pF		

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

$$\# I_C = I_{CC} + \Delta I_{CC} \times D_H \times N_T + I_{CCD} (f_0/2 + f_1 \times N_1)$$

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)	CY54FCT240T		CY54FCT240AT		CY54FCT240CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	D	\bar{O}	1.5	9	1.5	5.1	1.5	4.7	ns
t _{PHL}			1.5	9	1.5	5.1	1.5	4.7	
t _{PZH}	\overline{OE}	\bar{O}	1.5	10.5	1.5	6.5	1.5	5.7	ns
t _{PZL}			1.5	10.5	1.5	6.5	1.5	5.7	
t _{PHZ}	\overline{OE}	\bar{O}	1.5	10	1.5	5.9	1.5	4.6	ns
t _{PLZ}			1.5	10	1.5	5.9	1.5	4.6	

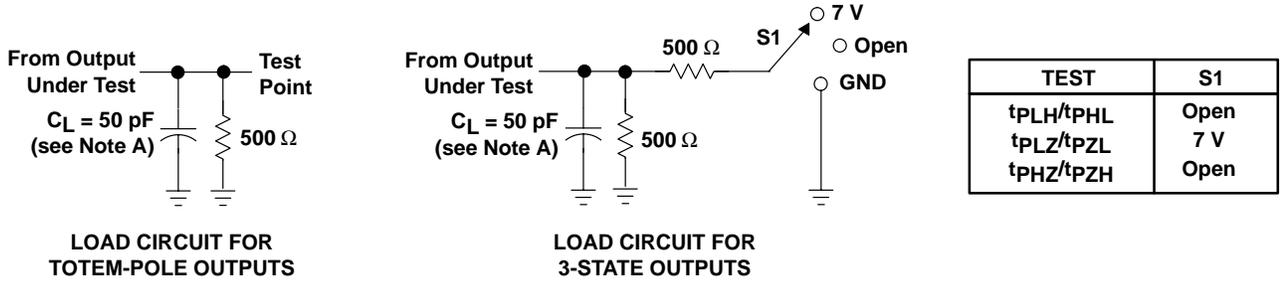
switching characteristics over operating free-air temperature range (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY74FCT240T		CY74FCT240AT		CY74FCT240CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	D	\bar{O}	1.5	8	1.5	4.8	1.5	4.3	ns
t _{PHL}			1.5	8	1.5	4.8	1.5	4.3	
t _{PZH}	\overline{OE}	\bar{O}	1.5	10	1.5	6.2	1.5	5	ns
t _{PZL}			1.5	10	1.5	6.2	1.5	5	
t _{PHZ}	\overline{OE}	\bar{O}	1.5	9.5	1.5	5.6	1.5	4.5	ns
t _{PLZ}			1.5	9.5	1.5	5.6	1.5	4.5	

CY54FCT240T, CY74FCT240T 8-BIT BUFFERS/LINE DRIVERS WITH 3-STATE OUTPUTS

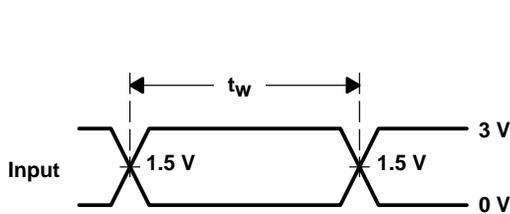
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PARAMETER MEASUREMENT INFORMATION

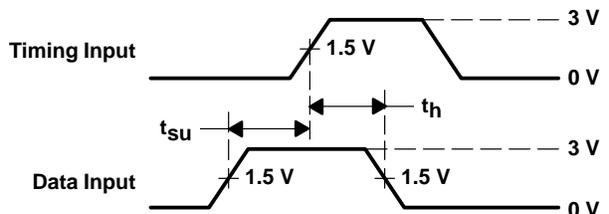


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

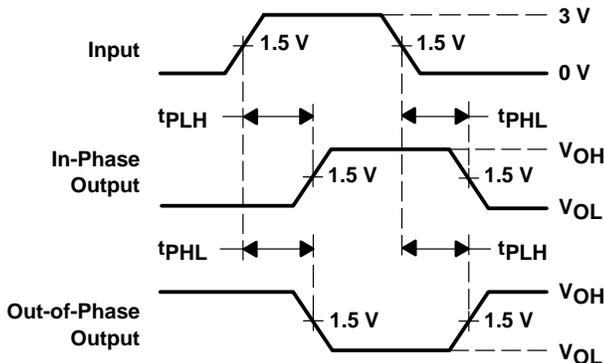
LOAD CIRCUIT FOR
3-STATE OUTPUTS



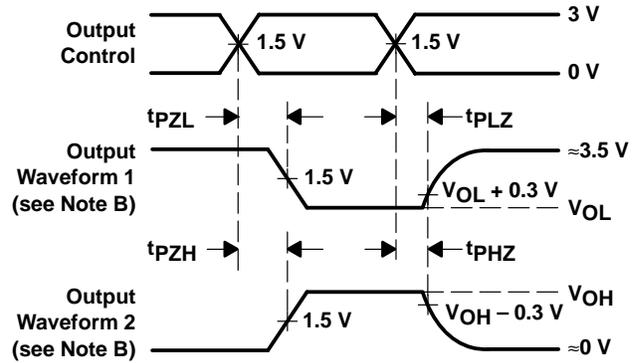
VOLTAGE WAVEFORMS
PULSE DURATION



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 Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9220301M2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-9220301MRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
5962-9220301MSA	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
5962-9220302M2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-9220302MRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
5962-9220302MSA	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
5962-9220303M2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-9220303MRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
5962-9220303MSA	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
5962-9221301MRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
5962-9221303M2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-9221303MRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
5962-9221305MRA	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT240ATDMB	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT240ATLMB	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244ATDMB	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244ATLMB	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244ATW	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244CTDMB	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244CTW	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244TDMB	ACTIVE	CDIP	J	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244TLMB	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
CY54FCT244TW	ACTIVE	CFP	W	20	1	None	Call TI	Level-NC-NC-NC
CY74FCT240ATQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240ATSOC	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240ATSOCT	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240CTQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240CTSOC	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240CTSOCT	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240TQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240TSOC	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT240TSOCT	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244ATPC	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CY74FCT244ATQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
CY74FCT244ATSOC	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244ATSOCT	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244CTQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244CTSOC	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244CTSOCT	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244DTQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244DTSOC	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244DTSOCT	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244TQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244TSOC	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CY74FCT244TSOCT	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM

⁽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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

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