



**THE DATASHEET OF  
CY74FCT373ATQCT**

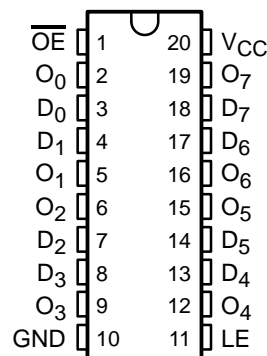


# CY54FCT373T, CY74FCT373T 8-BIT LATCHES WITH 3-STATE OUTPUTS

SCCS021B – MAY 1994 – REVISED OCTOBER 2001

- Function and Pinout 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
- 3-State Outputs
- CY54FCT373T
  - 32-mA Output Sink Current
  - 12-mA Output Source Current
- CY74FCT373T
  - 64-mA Output Sink Current
  - 32-mA Output Source Current

CY54FCT373T . . . D PACKAGE  
CY74FCT373T . . . Q OR SO PACKAGE  
(TOP VIEW)



## description

The 'FCT373T devices consist of eight latches with 3-state outputs for bus-organized applications. When the latch-enable (LE) input is high, the flip-flops appear transparent to the data. Data that meets the required setup times are latched when LE transitions from high to low. Data appears on the bus when the output-enable ( $\overline{OE}$ ) input is low. When  $\overline{OE}$  is high, the bus output is in the high-impedance state. In this mode, data can be entered into the latches.

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.



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.

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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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

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**8-BIT LATCHES**  
**WITH 3-STATE OUTPUTS**

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**ORDERING INFORMATION**

T <sub>A</sub>	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QSOP – Q	Tape and reel	4.7	CY74FCT373CTQCT	FCT373C
	SOIC – SO	Tube	4.7	CY74FCT373CTSOC	FCT373C
		Tape and reel	4.7	CY74FCT373CTSOCT	
	QSOP – Q	Tape and reel	5.2	CY74FCT373ATQCT	FCT373A
		SOIC – SO	Tube	5.2	CY74FCT373ATSOC
	Tape and reel		5.2	CY74FCT373ATSOCT	
SOIC – SO	Tube	8	CY74FCT373TSOC	FCT373	
	Tape and reel	8	CY74FCT373TSOCT		
-55°C to 125°C	CDIP – D	Tube	5.6	CY54FCT373ATDMB	

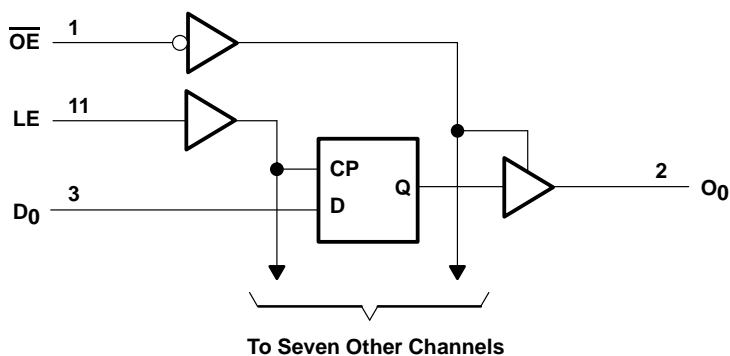
† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

**FUNCTION TABLE**

INPUTS			OUTPUT
$\overline{OE}$	LE	D	O
L	H	H	H
L	H	L	L
L	L	X	Q <sub>0</sub>
H	X	X	Z

H = High logic level, L = Low logic level,  
 X = Don't care, Z = High-impedance state,  
 Q<sub>n</sub> = Previous state of flip flops (Q<sub>n-1</sub>)

**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, $\theta_{JA}$ (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)**

	CY54FCT373T			CY74FCT373T			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			32			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.

# CY54FCT373T, CY74FCT373T

## 8-BIT LATCHES

### WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS	CY54FCT373T			CY74FCT373T			UNIT
		MIN	TYP†	MAX	MIN	TYP†	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = 4.5 V, I <sub>IN</sub> = -18 mA	-0.7	-1.2					V
	V <sub>CC</sub> = 4.75 V, I <sub>IN</sub> = -18 mA				-0.7	-1.2		
V <sub>OH</sub>	V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = -12 mA	2.4	3.3					V
	V <sub>CC</sub> = 4.75 V	I <sub>OH</sub> = -32 mA			2			
		I <sub>OH</sub> = -15 mA			2.4	3.3		
V <sub>OL</sub>	V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 32 mA	0.3	0.55					V
	V <sub>CC</sub> = 4.75 V, I <sub>OL</sub> = 64 mA				0.3	0.55		
V <sub>hys</sub>	All inputs	0.2			0.2			V
I <sub>I</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = V <sub>CC</sub>			5				μA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = V <sub>CC</sub>					5		
I <sub>IH</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 2.7 V			±1				μA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 2.7 V					±1		
I <sub>IL</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0.5 V			±1				μA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 0.5 V					±1		
I <sub>OZH</sub>	V <sub>CC</sub> = 5.5 V, V <sub>OUT</sub> = 2.7 V			10				μA
	V <sub>CC</sub> = 5.25 V, V <sub>OUT</sub> = 2.7 V					10		
I <sub>OZL</sub>	V <sub>CC</sub> = 5.5 V, V <sub>OUT</sub> = 0.5 V			-10				μA
	V <sub>CC</sub> = 5.25 V, V <sub>OUT</sub> = 0.5 V					-10		
I <sub>OS</sub> ‡	V <sub>CC</sub> = 5.5 V, V <sub>OUT</sub> = 0 V	-60	-120	-225				mA
	V <sub>CC</sub> = 5.25 V, V <sub>OUT</sub> = 0 V				-60	-120	-225	
I <sub>off</sub>	V <sub>CC</sub> = 0 V, V <sub>OUT</sub> = 4.5 V			±1			±1	μA
I <sub>CC</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> ≤ 0.2 V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2 V	0.1	0.2					mA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> ≤ 0.2 V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2 V				0.1	0.2		
ΔI <sub>CC</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 3.4 V <sup>§</sup> , f <sub>1</sub> = 0, Outputs open	0.5	2					mA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 3.4 V <sup>§</sup> , f <sub>1</sub> = 0, Outputs open				0.5	2		

† Typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 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<sub>OS</sub> tests should be performed last.

§ Per TTL-driven input (V<sub>IN</sub> = 3.4 V); all other inputs at V<sub>CC</sub> or GND



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

PARAMETER	TEST CONDITIONS		CY54FCT373T		CY74FCT373T		UNIT	
			MIN	TYP†	MAX	MIN		TYP†
$I_{CCD}^{\ddagger}$	$V_{CC} = 5.5\text{ V}$ , Outputs open, One input switching at 50% duty cycle, $\overline{OE} = \text{GND}$ , $V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$		0.06	0.12			mA/ MHz	
	$V_{CC} = 5.25\text{ V}$ , Outputs open, One input switching at 50% duty cycle, $\overline{OE} = \text{GND}$ , $V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$				0.06	0.12		
$I_{C}^{\#}$	$V_{CC} = 5.5\text{ V}$ , Outputs open, $\overline{OE} = \text{GND}$ , $LE = V_{CC}$	One bit switching at $f_1 = 10\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$	0.7	1.4		mA	
			$V_{IN} = 3.4\text{ V}$ or GND	1	2.4			
		Eight bits switching at $f_1 = 2.5\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$	1.3	2.6 $\parallel$			
			$V_{IN} = 3.4\text{ V}$ or GND	3.3	10.6 $\parallel$			
	$V_{CC} = 5.25\text{ V}$ , Outputs open, $\overline{OE} = \text{GND}$ , $LE = V_{CC}$	One bit switching at $f_1 = 10\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$			0.7		1.4
			$V_{IN} = 3.4\text{ V}$ or GND			1		2.4
		Eight bits switching at $f_1 = 2.5\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$			1.3		2.6 $\parallel$
			$V_{IN} = 3.4\text{ V}$ or GND			3.3		10.6 $\parallel$
$C_i$			6	10	6	10	pF	
$C_o$			8	12	8	12	pF	

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

$\ddagger$  This parameter is derived for use in total power-supply calculations.

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

Where:

$I_C$  = Total supply current

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

$\Delta I_{CC}$  = 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 input transition pair (HLH or LHL)

$f_0$  = Clock frequency for registered devices, otherwise zero

$f_1$  = Input signal frequency

$N_1$  = Number of inputs changing at  $f_1$

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

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



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

	CY54FCT373T		CY54FCT373AT		UNIT
	MIN	MAX	MIN	MAX	
t <sub>w</sub> Pulse duration, LE high	6		6		ns
t <sub>su</sub> Setup time, data before LE↑	2		2		ns
t <sub>h</sub> Hold time, data after LE↑	1.5		1.5		ns

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

	CY74FCT373T		CY74FCT373AT		CY74FCT373CT		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub> Pulse duration, LE high	6		5		5		ns
t <sub>su</sub> Setup time, data before LE↑	2		2		2		ns
t <sub>h</sub> Hold time, data after LE↑	1.5		1.5		1.5		ns

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

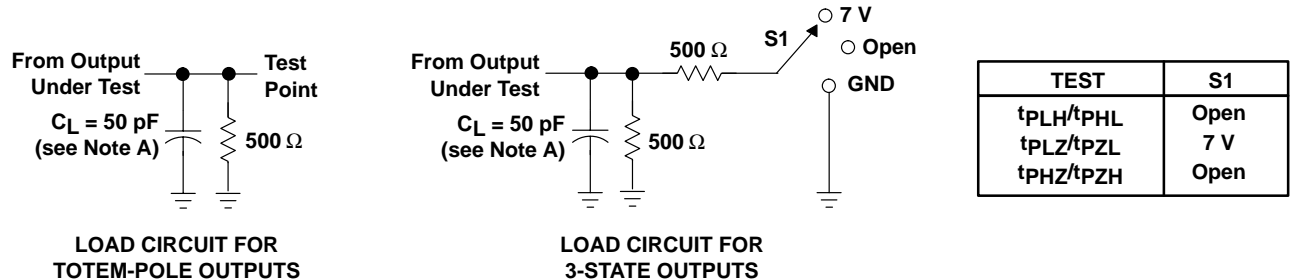
PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY54FCT373AT		UNIT
			MIN	MAX	
t <sub>PLH</sub>	D	O	1.5	5.6	ns
t <sub>PHL</sub>			1.5	5.6	
t <sub>PLH</sub>	LE	O	2	9.8	ns
t <sub>PHL</sub>			2	9.8	
t <sub>PZH</sub>	$\overline{OE}$	O	1.5	7.5	ns
t <sub>PZL</sub>			1.5	7.5	
t <sub>PHZ</sub>	$\overline{OE}$	O	1.5	6.5	ns
t <sub>PLZ</sub>			1.5	6.5	

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY74FCT373T		CY74FCT373AT		CY74FCT373CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	D	O	1.5	8	1.5	5.2	1.5	4.7	ns
t <sub>PHL</sub>			1.5	8	1.5	5.2	1.5	4.7	
t <sub>PLH</sub>	LE	O	2	13	2	8.5	2	5.5	ns
t <sub>PHL</sub>			2	13	2	8.5	2	5.5	
t <sub>PZH</sub>	$\overline{OE}$	O	1.5	12	1.5	6.5	1.5	5.5	ns
t <sub>PZL</sub>			1.5	12	1.5	6.5	1.5	5.5	
t <sub>PHZ</sub>	$\overline{OE}$	O	1.5	7.5	1.5	5.5	1.5	5	ns
t <sub>PLZ</sub>			1.5	7.5	1.5	5.5	1.5	5	

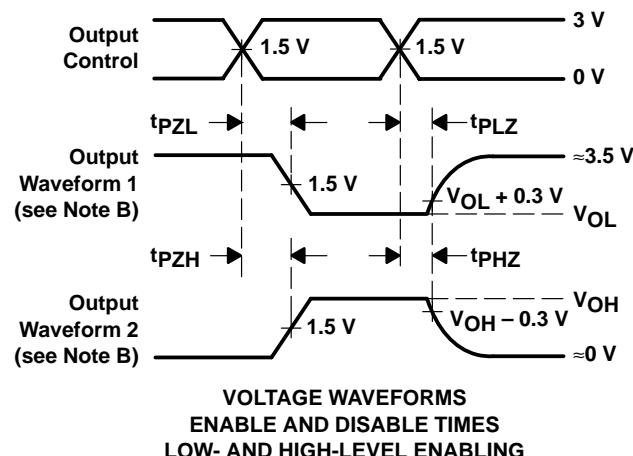
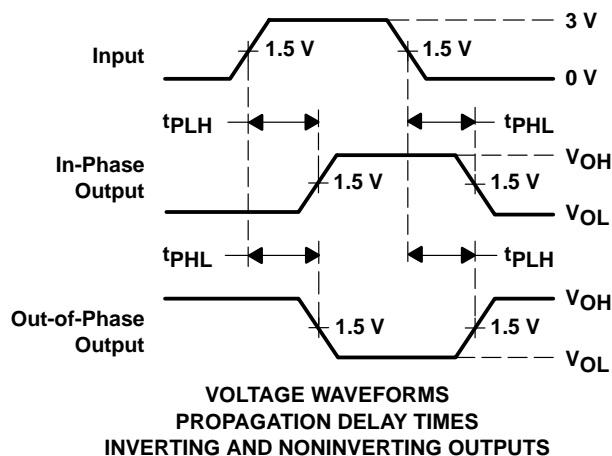
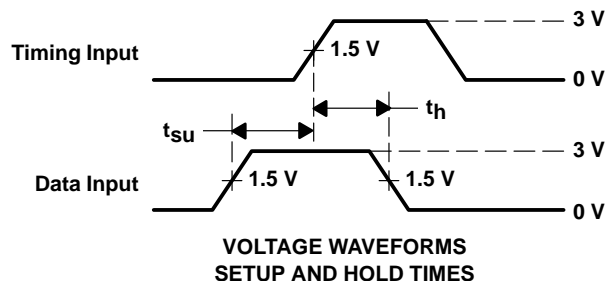
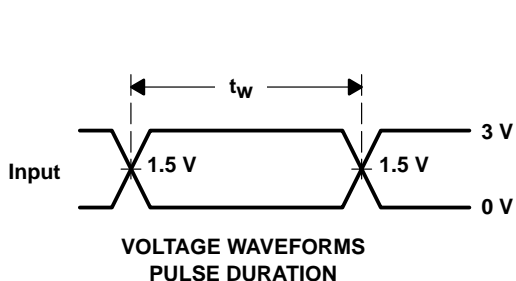


PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR 3-STATE OUTPUTS



- 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 (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9221701MRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9221701MR A	<a href="#">Samples</a>
5962-9221702MRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9221702MR A CY54FCT373ATDM B	<a href="#">Samples</a>
5962-9221703M2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9221703M2A	<a href="#">Samples</a>
CY54FCT373ATDMB	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9221702MR A CY54FCT373ATDM B	<a href="#">Samples</a>
CY74FCT373ATQCT	ACTIVE	SSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT373A	<a href="#">Samples</a>
CY74FCT373ATQCTE4	ACTIVE	SSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT373A	<a href="#">Samples</a>
CY74FCT373ATSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT373A	<a href="#">Samples</a>
CY74FCT373TSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT373	<a href="#">Samples</a>

(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.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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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
CY74FCT373ATQCT	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)
CY74FCT373ATQCT	SSOP	DBQ	20	2500	367.0	367.0	38.0

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