

# CY54FCT273T, CY74FCT273T 8-BIT REGISTERS

SCCS020A – MARCH 1995 – 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
- Matched Rise and Fall Times
- 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
- CY54FCT273T
  - 32-mA Output Sink Current
  - 12-mA Output Source Current
- CY74FCT273T
  - 64-mA Output Sink Current
  - 32-mA Output Source Current

## description

The 'FCT273T devices consist of eight edge-triggered D-type flip-flops with individual D inputs and Q outputs. The common buffered-clock (CP) and master-reset ( $\overline{MR}$ ) inputs load and reset all flip-flops simultaneously. These devices are edge-triggered registers. The state of each D input (one setup time before the low-to-high clock transition) is transferred to the corresponding flip-flop's Q output. All outputs are forced low by a low logic level on the  $\overline{MR}$  input.

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.

CY54FCT273T . . . D PACKAGE  
CY74FCT273T . . . Q OR SO PACKAGE  
(TOP VIEW)



CY54FCT273T . . . L PACKAGE  
(TOP VIEW)



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**TEXAS  
INSTRUMENTS**

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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	5.8	CY74FCT273CTQCT	FCT273C
	SOIC – SO	Tube	5.8	CY74FCT273CTSOC	FCT273C
		Tape and reel	5.8	CY74FCT273CTSOCT	
	QSOP – Q	Tape and reel	7.2	CY74FCT273ATQCT	FCT273A
		SOIC – SO	Tube	7.2	CY74FCT273ATSOC
	Tape and reel		7.2	CY74FCT273ATSOCT	
-55°C to 125°C	QSOP – Q	Tape and reel	13	CY74FCT273TQCT	FCT273
	SOIC – SO	Tube	13	CY74FCT273TSOC	FCT273
		Tape and reel	13	CY74FCT273TSOCT	
LCC – L	Tube	8.3	CY54FCT273ATLMB		

† 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 Q	OPERATING MODE
$\overline{\text{MR}}$	CP	D		
L	X	X	L	Reset (clear)
H	↑	h	H	Load '1'
H	↑	l	L	Load '0'

H = High logic level steady state, h = High logic level one setup time prior to low-to-high clock transition, L = Low logic level steady state, l = Low logic level one setup time prior to the low-to-high transition, X = Don't care, ↑ = Low-to-high clock transition

## logic diagram (positive logic)



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

	CY54FCT273T			CY74FCT273T			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.

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

PARAMETER	TEST CONDITIONS	CY54FCT273T			CY74FCT273T			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>off</sub>	V <sub>CC</sub> = 0 V, V <sub>OUT</sub> = 4.5 V			±1			±1	μA
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>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§, 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§, 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



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

PARAMETER	TEST CONDITIONS		CY54FCT273T		CY74FCT273T		UNIT	
			MIN	TYP†	MAX	MIN		TYP†
$I_{CCD}^{\ddagger}$	$V_{CC} = 5.5$ V, Outputs open, One bit switching at 50% duty cycle, $\overline{MR} = V_{CC}$ , $V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V		0.06	0.12			mA/ MHz	
	$V_{CC} = 5.25$ V, Outputs open, One bit switching at 50% duty cycle, $\overline{MR} = V_{CC}$ , $V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V				0.06	0.12		
$I_C^{\#}$	$V_{CC} = 5.5$ V, $f_0 = 10$ MHz, Outputs open, $MR = V_{CC}$	One bit switching at $f_1 = 2.5$ MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V	0.7	1.4		mA	
			$V_{IN} = 3.4$ V or GND	1.2	3.4			
	Eight bits switching at $f_1 = 2.5$ MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V	1.6	3.2 $\parallel$				
		$V_{IN} = 3.4$ V or GND	3.9	12.2 $\parallel$				
	$V_{CC} = 5.25$ V, $f_0 = 10$ MHz, Outputs open, $MR = V_{CC}$	One bit switching at $f_1 = 5$ MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V			0.7		1.4
			$V_{IN} = 3.4$ V or GND			1.2		3.4
Eight bits switching at $f_1 = 5$ MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V				1.6	3.2 $\parallel$		
	$V_{IN} = 3.4$ V or GND				3.9	12.2 $\parallel$		
$C_i$			5	10	5	10	pF	
$C_o$			9	12	9	12	pF	

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

‡ 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 ( $V_{IN} = 3.4$  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.

‖ 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)**

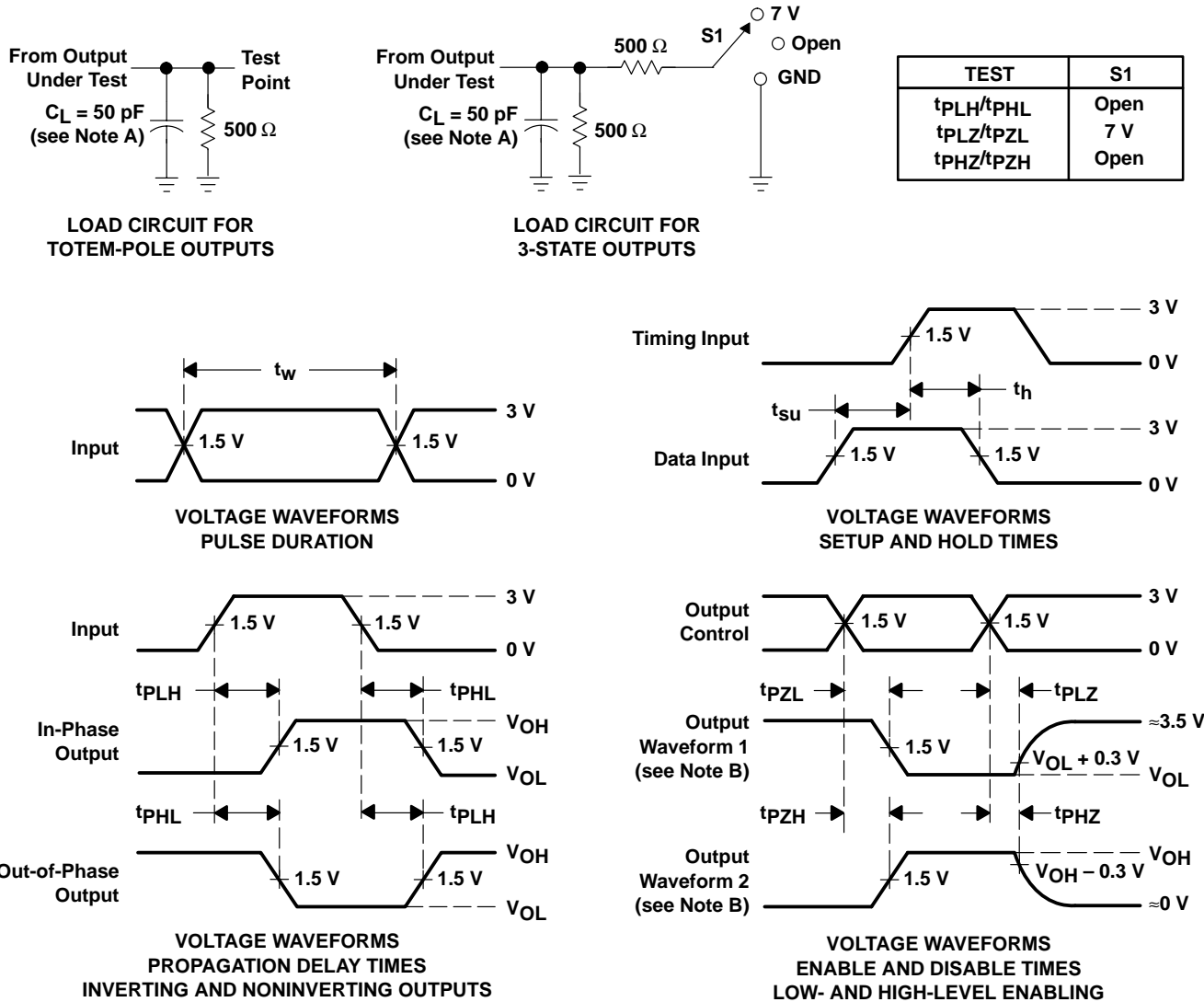
			CY74FCT273T		CY54FCT273AT		CY74FCT273AT		CY74FCT273CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration, high or low	CP	6		6		6		6		ns
		$\overline{\text{MR}}$	6		6		6		6		
t <sub>su</sub>	Setup time, high or low	D before CP↑	2		2		2		2		ns
t <sub>h</sub>	Hold time, high or low	D after CP↑	1.5		1.5		1.5		1.5		ns
t <sub>rec</sub>	Recovery time	$\overline{\text{MR}}$ after CP↑	2		2.5		2		2		ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY74FCT273T		CY54FCT273AT		CY74FCT273AT		CY74FCT273CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	CP	Q	2	13	2	8.3	2	7.2	2	5.8	ns
t <sub>PHL</sub>			2	13	2	8.3	2	7.2	2	5.8	
t <sub>PLH</sub>	$\overline{\text{MR}}$	Q	2	13	2	8.3	2	7.2	2	6.1	ns
t <sub>PHL</sub>			2	13	2	8.3	2	7.2	2	6.1	



PARAMETER MEASUREMENT INFORMATION



- 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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9221503M2A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9221503M2A CY54FCT 273ATLMB	Samples
5962-9221503MRA	ACTIVE	CDIP	J	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9221503MR A	Samples
CY54FCT273ATLMB	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9221503M2A CY54FCT 273ATLMB	Samples
CY74FCT273ATQCT	ACTIVE	SSOP	DBQ	20	2500	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT273A	Samples
CY74FCT273ATSOC	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT273A	Samples
CY74FCT273ATSOCT	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT273A	Samples
CY74FCT273CTQCT	ACTIVE	SSOP	DBQ	20	2500	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT273C	Samples
CY74FCT273CTSOC	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT273C	Samples
CY74FCT273TQCT	ACTIVE	SSOP	DBQ	20	2500	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT273	Samples
CY74FCT273TSOC	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT273	Samples
CY74FCT273TSOCT	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT273	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) **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".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.



**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of  $\leq 1000$ ppm threshold. Antimony trioxide based flame retardants must also meet the  $\leq 1000$ ppm threshold requirement.

(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 finish/Ball material - Orderable Devices 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.

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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
CY74FCT273ATQCT	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT273ATSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
CY74FCT273CTQCT	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT273TQCT	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT273TSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY74FCT273ATQCT	SSOP	DBQ	20	2500	356.0	356.0	35.0
CY74FCT273ATSOCT	SOIC	DW	20	2000	367.0	367.0	45.0
CY74FCT273CTQCT	SSOP	DBQ	20	2500	356.0	356.0	35.0
CY74FCT273TQCT	SSOP	DBQ	20	2500	356.0	356.0	35.0
CY74FCT273TSOCT	SOIC	DW	20	2000	367.0	367.0	45.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-9221503M2A	FK	LCCC	20	1	506.98	12.06	2030	NA
CY54FCT273ATLMB	FK	LCCC	20	1	506.98	12.06	2030	NA
CY74FCT273ATSOC	DW	SOIC	20	25	507	12.83	5080	6.6
CY74FCT273CTSOC	DW	SOIC	20	25	507	12.83	5080	6.6
CY74FCT273TSOC	DW	SOIC	20	25	507	12.83	5080	6.6

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