

CY54FCT245T, CY74FCT245T 8-BIT TRANSCEIVERS WITH 3-STATE OUTPUTS

SCCS018B – MAY 1994 – REVISED NOVEMBER 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
- CY54FCT245T
 - 48-mA Output Sink Current
 - 12-mA Output Source Current
- CY74FCT245T
 - 64-mA Output Sink Current
 - 32-mA Output Source Current
- 3-State Outputs

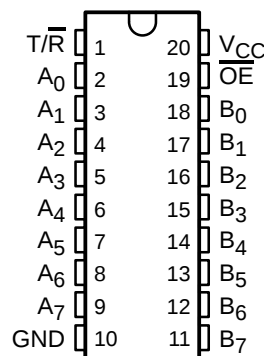
description

The 'FCT245T devices contain eight noninverting bidirectional buffers with 3-state outputs and are intended for bus-oriented applications.

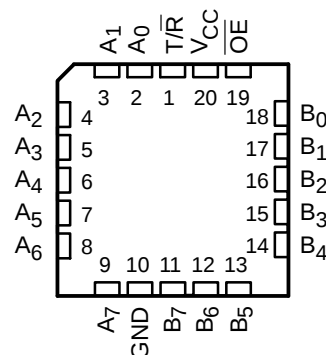
The transmit/receive ($T/\bar{R}$) input determines the direction of data flow through these bidirectional transceivers. Transmit (active high) enables data from A ports to B ports. The output enable ($\overline{OE}$), when high, disables both the A and B ports by putting them in the high-impedance state.

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.

CY54FCT245T . . . D PACKAGE
CY74FCT245T . . . P, Q, OR SO PACKAGE
(TOP VIEW)



CY54FCT245T . . . L PACKAGE
(TOP VIEW)



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**TEXAS
INSTRUMENTS**

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ORDERING INFORMATION

T _A	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QSOP – Q	Tape and reel	3.8	CY74FCT245DTQCT	FCT245D
	QSOP – Q	Tape and reel	4.1	CY74FCT245CTQCT	FCT245C
	SOIC – SO	Tube	4.1	CY74FCT245CTSOC	FCT245C
		Tape and reel	4.1	CY74FCT245CTSOCT	
	DIP – P	Tube	4.6	CY74FCT245ATPC	CY74FCT245ATPC
	QSOP – Q	Tape and reel	4.6	CY74FCT245ATQCT	FCT245A
	SOIC – SO	Tube	4.6	CY74FCT245ATSOC	FCT245A
		Tape and reel	4.6	CY74FCT245ATSOCT	
	QSOP – Q	Tape and reel	7	CY74FCT245TQCT	FCT245
–55°C to 125°C	SOIC – SO	Tube	7	CY74FCT245TSOC	FCT245
		Tape and reel	7	CY74FCT245TSOCT	
	CDIP – D	Tube	4.5	CY54FCT245CTDMB	
	LCC – L	Tube	4.5	CY54FCT245CTLMB	
	CDIP – D	Tube	4.9	CY54FCT245ATDMB	
	LCC – L	Tube	4.9	CY54FCT245ATLMB	
	CDIP – D	Tube	7.5	CY54FCT245TDMB	
	LCC – L	Tube	7.5	CY54FCT245TLMB	

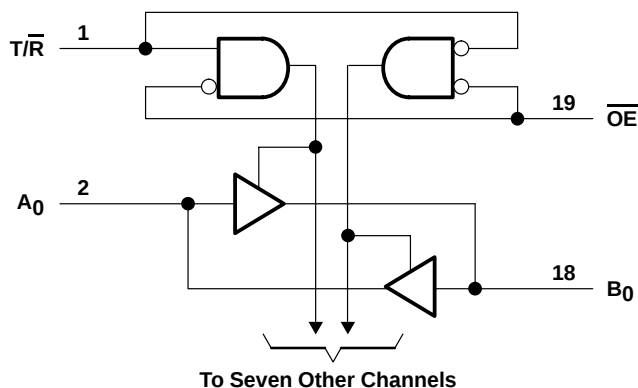
† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE

INPUTS		OPERATION
$\overline{OE}$	$\overline{T/R}$	
L	L	B data to bus A
L	H	A data to bus B
H	X	Z

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

logic diagram (positive logic)



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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): P package	69°C/W
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)

	CY54FCT245T			CY74FCT245T CY74FCT245AT CY74FCT245CT CY74FCT245DT			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	CY54FCT245T			CY74FCT245T			UNIT
		MIN	TYP [†]	MAX	MIN	TYP [†]	MAX	
V_{IK}	$V_{CC} = 4.5 \text{ V}$, $I_{IN} = -18 \text{ mA}$	-0.7	-1.2					V
	$V_{CC} = 4.75 \text{ V}$, $I_{IN} = -18 \text{ mA}$				-0.7	-1.2		
V_{OH}	$V_{CC} = 4.5 \text{ V}$, $I_{OH} = -12 \text{ mA}$	2.4	3.3					V
	$V_{CC} = 4.75 \text{ V}$, $I_{OH} = -32 \text{ mA}$				2			
	$I_{OH} = -15 \text{ mA}$				2.4	3.3		
V_{OL}	$V_{CC} = 4.5 \text{ V}$, $I_{OL} = 48 \text{ mA}$	0.3	0.55					V
	$V_{CC} = 4.75 \text{ V}$, $I_{OL} = 64 \text{ mA}$				0.3	0.55		
V_{hys}	All inputs	0.2			0.2			V
I_I	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = V_{CC}$			5				μA
	$V_{CC} = 5.25 \text{ V}$, $V_{IN} = V_{CC}$						5	
I_{IH}	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 2.7 \text{ V}$			± 1				μA
	$V_{CC} = 5.25 \text{ V}$, $V_{IN} = 2.7 \text{ V}$						± 1	
I_{IL}	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 0.5 \text{ V}$			± 1				μA
	$V_{CC} = 5.25 \text{ V}$, $V_{IN} = 0.5 \text{ V}$						± 1	
I_{OZH}	$V_{CC} = 5.5 \text{ V}$, $V_{OUT} = 2.7 \text{ V}$			10				μA
	$V_{CC} = 5.25 \text{ V}$, $V_{OUT} = 2.7 \text{ V}$						10	
I_{OZL}	$V_{CC} = 5.5 \text{ V}$, $V_{OUT} = 0.5 \text{ V}$			-10				μA
	$V_{CC} = 5.25 \text{ V}$, $V_{OUT} = 0.5 \text{ V}$						-10	
$I_{OS}^{\ddagger}$	$V_{CC} = 5.5 \text{ V}$, $V_{OUT} = 0 \text{ V}$	-60	-120	-225				mA
	$V_{CC} = 5.25 \text{ V}$, $V_{OUT} = 0 \text{ V}$				-60	-120	-225	
I_{off}	$V_{CC} = 0 \text{ V}$, $V_{OUT} = 4.5 \text{ V}$			± 1			± 1	μA
I_{CC}	$V_{CC} = 5.5 \text{ V}$, $V_{IN} \leq 0.2 \text{ V}$, $V_{IN} \geq V_{CC} - 0.2 \text{ V}$	0.1	0.2					mA
	$V_{CC} = 5.25 \text{ V}$, $V_{IN} \leq 0.2 \text{ V}$, $V_{IN} \geq V_{CC} - 0.2 \text{ V}$				0.1	0.2		
ΔI_{CC}	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 3.4 \text{ V}^{\S}$, $f_1 = 0$, Outputs open	0.5	2					mA
	$V_{CC} = 5.25 \text{ V}$, $V_{IN} = 3.4 \text{ V}^{\S}$, $f_1 = 0$, Outputs open				0.5	2		
$I_{CCD}^{\P}$	$V_{CC} = 5.5 \text{ V}$, One input switching at 50% duty cycle, Outputs open, T/R or OE = GND and $V_{IN} \leq 0.2 \text{ V}$ or $V_{IN} \geq V_{CC} - 0.2 \text{ V}$	0.06	0.12					mA/ MHz
	$V_{CC} = 5.25 \text{ V}$, One input switching at 50% duty cycle, Outputs open, T/R or OE = GND and $V_{IN} \leq 0.2 \text{ V}$ or $V_{IN} \geq V_{CC} - 0.2 \text{ V}$				0.06	0.12		

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

[‡] 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 ($V_{IN} = 3.4 \text{ V}$); 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			CY54FCT245T			CY74FCT245T			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
I _C [#]	V _{CC} = 5.5 V, Outputs <u>open</u> , T/R or OE = 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	3.4					
		Eight bits switching at f ₁ = 2.5 MHz at 50% duty cycle	V _{IN} ≤ 0.2V 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 <u>open</u> , T/R or OE = 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	3.4		
		Eight bits switching at f ₁ = 2.5 MHz at 50% duty cycle	V _{IN} ≤ 0.2V 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 ₀				9	12		9	12	pF	

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

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

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 ($V_{IN} = 3.4 \text{ V}$)

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.

|| 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)	CY54FCT245T		CY54FCT245AT		CY54FCT245CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	A or B	B or A	1.5	7.5	1.5	4.9	1.5	4.5	ns
t _{PHL}			1.5	7.5	1.5	4.9	1.5	4.5	
t _{PZH}	$\overline{OE}$ or T/ $\overline{R}$	A or B	1.5	10	1.5	6.5	1.5	6.2	ns
t _{PZL}			1.5	10	1.5	6.5	1.5	6.2	
t _{PHZ}	$\overline{OE}$ or T/ $\overline{R}$	A or B	1.5	10	1.5	6	1.5	5.2	ns
t _{PLZ}			1.5	10	1.5	6	1.5	5.2	

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY74FCT245T		CY74FCT245AT		CY74FCT245CT		CY74FCT245DT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	A or B	B or A	1.5	7	1.5	4.6	1.5	4.1	1.5	3.8	ns
t _{PHL}			1.5	7	1.5	4.6	1.5	4.1	1.5	3.8	
t _{PZH}	$\overline{OE}$ or T/ $\overline{R}$	A or B	1.5	9.5	1.5	6.2	1.5	5.8	1.5	5	ns
t _{PZL}			1.5	9.5	1.5	6.2	1.5	5.8	1.5	5	
t _{PHZ}	$\overline{OE}$ or T/ $\overline{R}$	A or B	1.5	7.5	1.5	5	1.5	4.8	1.5	4.3	ns
t _{PLZ}			1.5	7.5	1.5	5	1.5	4.8	1.5	4.3	



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

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