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**High Speed CMOS
32-Bit Transceivers
in Millipaq™**

QS74FCT4X245ATQ3
QS74FCT4X245CTQ3
QS74FCT4X2245ATQ3

FEATURES/BENEFITS

- 32-bit Function compatible to the 74F245, 74ABT245, 74FCT245T and 74FCT2245T
- QS74FCT4X245T: $I_{OL} = 64 \text{ mA}$
- QS74FCT4X2245T: $I_{OL} = 12 \text{ mA}$
- Low CMOS power consumption
- Ground bounce controlled outputs
- A and C speed grades; $4.1 \text{ ns } t_{PD}$ for C
- Smallest footprint 32-bit logic solution
- 80-pin, 150-mil Millipaq package (Q3)
- Easy layout flow-through pinout
- Tube or tape-and-reel shipment
- TTL-compatible input and output levels
- Undershoot clamp diodes on all inputs

DESCRIPTION

The FCT4X245T and FCT4X2245T are 32-bit non-inverting transceivers with three-state outputs that are useful for bus-oriented applications. The Transmit/Receive (T/\bar{R}) inputs determine the direction of data flow, whether from A-to-B or B-to-A, and the Output Enable (\overline{OE}) inputs enable the selected port for output. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression (see QSI Application Note AN-01), and outputs will not load an active bus when V_{CC} is removed from the device. The Millipaq 80-pin small outline package provides the smallest possible footprint while also offering an easy to layout flow-through, dual-in-line format.

Figure 1. Functional Block Diagram

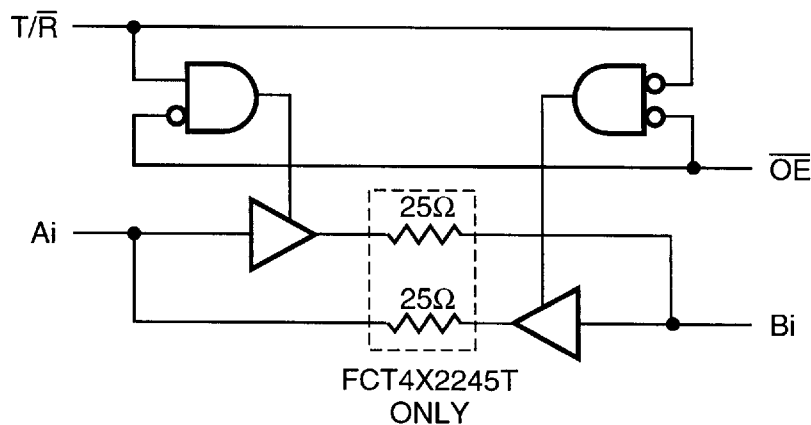


Figure 2. Pin Configuration
(All Pins Top View)

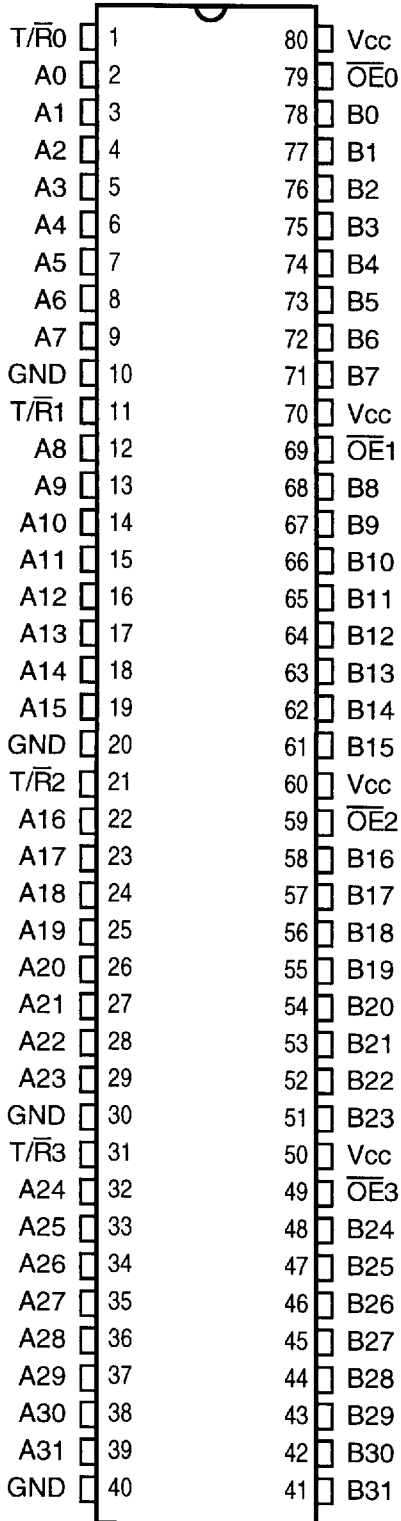


Table 1. Pin Description

Name	I/O	Description
Ai	I/O	Data Bus A
Bi	I/O	Data Bus B
T/R0	I	Direction for A/B7-A/B0
T/R1	I	Direction for A/B15-A/B8
T/R2	I	Direction for A/B23-A/B16
T/R3	I	Direction for A/B31-A/B24
OE0	I	Output Enables for A/B7-A/B0
OE1	I	Output Enables for A/B15-A/B8
OE2	I	Output Enables for A/B23-A/B16
OE3	I	Output Enables for A/B24-A/B31

Table 2. Function Table

OE _n	T/R _n	Bus A	Bus B	Function
H	X	Hi-Z	Hi-Z	Disable
L	L	Output	Input	Bus B to Bus A
L	H	Input	Output	Bus A to Bus B

Table 3. Absolute Maximum Ratings

Supply Voltage to Ground	-0.5V to +7.0V
DC Output Voltage V_{OUT}	-0.5V to +7.0V
DC Input Voltage V_{IN}	-0.5V to +7.0V
AC Input Voltage (for a pulse width ≤ 20 ns)	-3.0V
DC Input Diode Current with $V_{IN} < 0$	-20 mA
DC Output Diode Current with $V_{OUT} < 0$	-50 mA
DC Output Current Max. Sink Current/Pin	120 mA
Maximum Power Dissipation	1.4 Watts (0 LFPM)
T_{STG} Storage Temperature	-65° to +150°C

Note: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to this device resulting in functional or reliability type failures.

Table 4. Capacitance

$T_A = 25^\circ\text{C}$, $f = 1$ MHz, $V_{IN} = 0\text{V}$, $V_{OUT} = 0\text{V}$

Pins	Typ	Unit
1, 11, 21, 31, 49, 59, 69, 79	4	pF
2-9, 12-19, 22-29, 32-39 41-48, 51-58, 61-68, 71-78	8	pF

Note: Capacitance is characterized but not production tested.

Table 5. DC Electrical Characteristics Over Operating Range

Commercial $T_A = 0^\circ\text{C}$ to 70°C , $V_{CC} = 5.0\text{V} \pm 5\%$

Symbol	Parameter	Test Conditions	Min	Typ ⁽¹⁾	Max	Unit
V_{IH}	Input HIGH Voltage	Logic HIGH for All Inputs	2.0	—	—	V
V_{IL}	Input LOW Voltage	Logic LOW for All Inputs	—	—	0.8	V
ΔV_T	Input Hysteresis	$V_{TLH} - V_{THL}$ for All Inputs ⁽³⁾	—	0.2	—	V
$ I_{IH} $ $ I_{IL} $	Input Current Input HIGH or LOW	$V_{CC} = \text{Max.}$, $0 \leq V_{IN} < V_{CC}$	—	—	5	μA
$ I_{OZ} $	Off-State Output Current (Hi-Z)	$V_{CC} = \text{Max.}$, $0 \leq V_{IN} \leq V_{CC}$	—	—	5	μA
I_{OS}	Short Circuit Current QS74FCT4X245T	$V_{CC} = \text{Max.}$, $V_{OUT} = \text{GND}$ ^(2,3)	-60	—	—	mA
I_{OR}	Current Drive QS74FCT4X2245T (25 Ω)	$V_{CC} = \text{Max.}$, $V_{OUT} = 2.0\text{V}$	50	—	—	mA
V_{IC}	Input Clamp Voltage	$V_{CC} = \text{Min.}$, $I_{IN} = -18$ mA ⁽³⁾	—	-0.7	-1.2	V
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}$, $I_{OH} = -15$ mA	2.4	—	—	V
V_{OL}	Output LOW Voltage QS74FCT4X245T	$V_{CC} = \text{Min.}$, $I_{OL} = 64$ mA	—	—	0.55	V
V_{OL}	Output LOW Voltage QS74FCT4X2245T (25 Ω)	$V_{CC} = \text{Min.}$, $I_{OL} = 12$ mA	—	—	0.50	V
R_{OUT}	Output Resistance QS74FCT4X2245T (25 Ω)	$V_{CC} = \text{Min.}$, $I_{OL} = 12$ mA	20	28	40	Ω

Notes:

1. Typical values indicate $V_{CC} = 5.0\text{V}$ and $T_A = 25^\circ\text{C}$.
2. Not more than one output should be shorted and the duration is ≤ 1 second.
3. These parameters are guaranteed by design but not production tested.

Table 6. Power Supply Characteristics

Symbol	Parameter	Test Conditions ⁽¹⁾	Typ	Max	Unit
I _{cc}	Quiescent Power Supply Current	V _{CC} = Max., Freq = 0 0V ≤ V _{IN} ≤ 0.2V or V _{CC} -0.2V ≤ V _{IN} ≤ V _{CC}	—	6.0	mA
ΔI _{cc}	Supply Current per Input @ TTL HIGH	V _{CC} = Max., V _{IN} = 3.4V, Freq = 0 ⁽²⁾	—	2.0	mA
Q _{CCD}	Supply Current per Output per MHz	V _{CC} = Max., Outputs Open and Enabled One Bit Toggling @ 50% Duty Cycle Other Inputs at GND or V _{CC} ^(3,4)	90	—	μA/ MHz

Notes:

- For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
- Per TTL driven input (V_{IN} = 3.4V).
- For flip-flops, Q_{CCD} is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance. This parameter is guaranteed by design but not production tested.
- Total power supply current (I_c) can be computed using the above parameters as explained in *FCT-T Family Characteristics*.

Table 7. Switching Characteristics Over Operating Range

Commercial T_A = 0°C to 70°C, V_{CC} = 5.0V ± 5%

C_{LOAD} = 50 pF, R_{LOAD} = 500Ω unless otherwise noted.

Symbol	Description ⁽¹⁾	4X245A/4X2245A		4X245C		Unit
		Min	Max	Min	Max	
t _{PHL} t _{PLH}	Propagation Delay A _i to B _i	1.5	4.6	1.5	4.1	ns
t _{PZH} t _{PZL}	Output Enable Time OE, T/R to A/B	1.5	6.2	1.5	5.8	ns
t _{PHZ} t _{PLZ}	Output Disable Time ⁽²⁾ OE, T/R to A/B	1.5	5.0	1.5	4.5	ns
t _{SKO}	Rising Edge Skew ⁽²⁾	—	1.0	—	1.0	ns

Notes:

- Minimums guaranteed but not production tested. See Test Circuit and Waveforms.
- This parameter is guaranteed but not production tested.