



# 3.3 Volt CMOS 16-Bit Buffer/Line Driver

QS74FCT2X3244

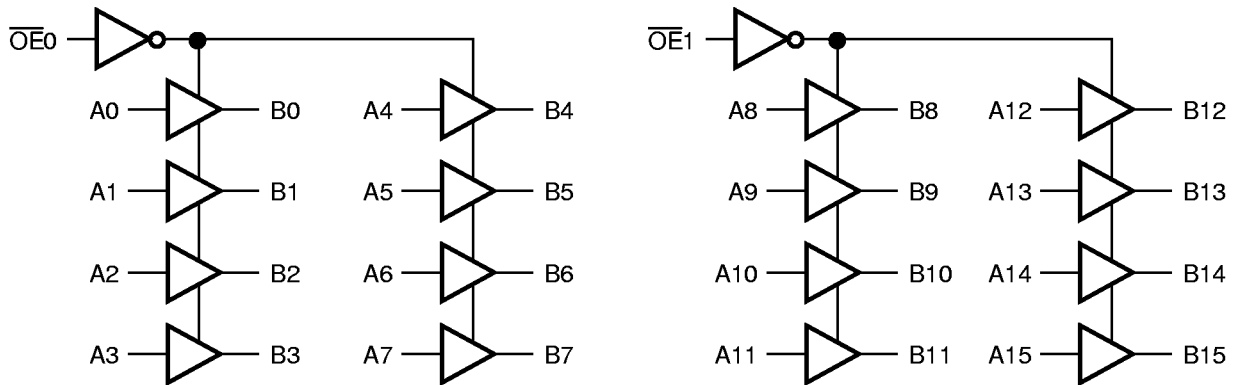
## FEATURES/BENEFITS

- Pin and function compatible to the QSFCT2X244
- Available in 40-pin QVSOP
- Undershoot clamp diodes on all inputs
- Ground bounce controlled outputs
- Low power QCMOS: 0.07  $\mu$ W typ static
- JEDEC low voltage spec compatible
- $I_{OL} = 24$  mA Com.
- TTL-compatible input and output levels
- Extended temperature  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- 2.7V to 3.6V Supply Voltage

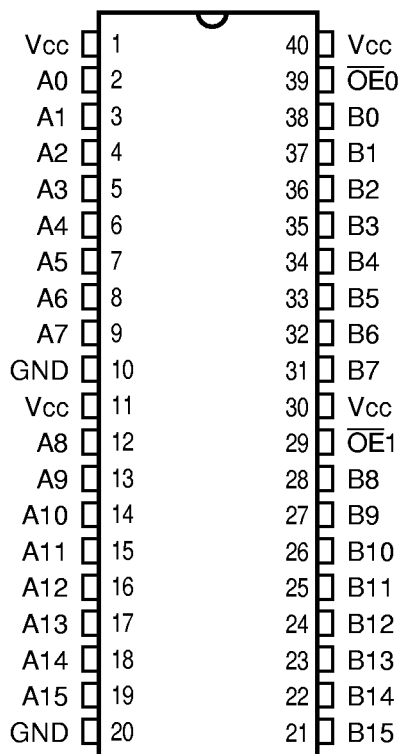
## DESCRIPTION

The FCT2X3244 is a 16-bit buffer/line driver with three-state outputs that is ideal for driving high-capacitance loads as in memory address and data buses. All inputs have clamp diodes for undershoot noise suppression and all outputs have ground bounce suppression (see QSI Application Note AN-001). Control pins can be driven by 3.3V or 5V components. Ultra-low power QCMOS technology makes this product ideal for portable computing systems or communications devices.

## FUNCTIONAL BLOCK DIAGRAM



**PIN CONFIGURATION**  
(All Pins Top View)



**PIN DESCRIPTION**

Name	I/O	Description
Ai	I/O	Data Bus A Inputs
Bi	I/O	Data Bus B Outputs
$\overline{OE}0$	I	Output Enables for A/B7-A/B0
$\overline{OE}1$	I	Output Enables for A/B15-A/B8

**FUNCTION TABLE**

$\overline{OE}n$	Input A	Output B
H	X	Hi-Z
L	L	L
L	H	H

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage to Ground .....	-0.5V to +4.6V
DC Input/Output Voltage .....	-0.5V to Vcc + 0.5V
DC Control Pin Voltage V <sub>IN</sub> .....	-0.5V +7.0V
AC Input Voltage (for a pulse width ≤ 20 ns) .....	-3.0V
DC Input Diode Current with V <sub>IN</sub> < 0 .....	±20 mA
DC Output Diode Current with V <sub>OUT</sub> < 0 .....	±50 mA
DC Output Current Max. Sink Current/Pin .....	±60 mA
Maximum Power Dissipation .....	0.5 watts
T <sub>STG</sub> 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.

## CAPACITANCE

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

Pins	QVSOP Typ	Unit
1, 11, 29, 39	4	pF
2-9, 12-19, 21-28, 31-38	8	pF

**Note:** Capacitance is characterized but not tested.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Description	Min	Max	Unit
$V_{CC}$	Supply Voltage	2.7	3.6	V
$V_{IN}$	Input Voltage	0	$V_{CC}$	V
$V_{OUT}$	Output Voltage	0	$V_{CC}$	V
$T_A$	Ambient Operating Temperature	-40	+85	$^\circ\text{C}$
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate <sup>(1)</sup>	0	8	ns/V

**Notes:**

1. As measured between 0.8V and 2V.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Recommended operating conditions apply unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ <sup>(1)</sup>	Max	Unit
$V_{IH}$	Input HIGH Voltage	Input Pins	2.0	—	5.5	V
		I/O Pins	2.0	—	$V_{CC}+0.5$	V
$V_{IL}$	Input LOW Voltage	Input Pins	-0.5	—	0.8	V
$\Delta V_T$	Input Hysteresis	$V_{TLH} - V_{THL}$ for All Inputs	—	0.2	—	V
$ I_{IH} $ $ I_{IL} $	Input Current Input HIGH or LOW	$V_{CC} = \text{Max.}$ , $0 \leq V_{IN} < V_{CC}$	—	—	1	$\mu\text{A}$
$ I_{OZ} $	Off-State Output Current (Hi-Z)	$V_{CC} = \text{Max.}$ , $0 \leq V_{IN} \leq V_{CC}$	—	—	5	$\mu\text{A}$
$I_{OS}$	Short Circuit Current	$V_{CC} = \text{Max.}$ , $V_{OUT} = \text{GND}$ <sup>(2,3)</sup>	-60	—	-225	mA
$V_{IC}$	Input Clamp Voltage	$V_{CC} = \text{Min.}$ , $I_{IN} = -18\text{ mA}$ <sup>(3)</sup>	—	-0.7	—	V
$V_{OH}$	Output HIGH Voltage	$V_I = V_{IH}$ or $V_{IL}$ , $V_{CC} = \text{Min.}$ , $I_{OH} = -100\ \mu\text{A}$	$V_{CC}-0.2$	—	—	V
		$V_I = V_{IH}$ or $V_{IL}$ , $V_{CC} = 3\text{V}$ , $I_{OH} = -8\text{ mA}$	2.4	—	—	
$V_{OL}$	Output LOW Voltage	$V_I = V_{IH}$ or $V_{IL}$ , $V_{CC} = \text{Min.}$ , $I_{OL} = 100\ \mu\text{A}$	—	—	0.2	V
		$V_I = V_{IH}$ or $V_{IL}$ , $V_{CC} = 3\text{V}$ , $I_{OL} = 16\text{ mA}$	—	—	0.4	V
		$V_I = V_{IH}$ or $V_{IL}$ , $V_{CC} = 3\text{V}$ , $I_{OL} = 24\text{ mA}$	—	—	0.5	V

**Notes:**

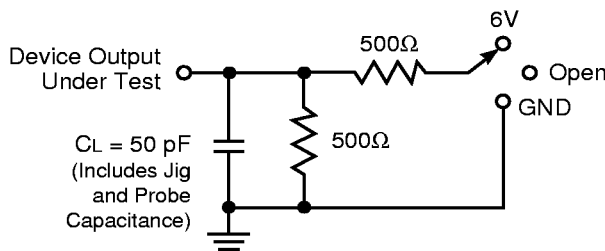
1. Typical values indicate  $V_{CC} = 3.3\text{V}$  and  $T_A = 25^\circ\text{C}$ .
2. Not more than one output should be shorted and the duration is  $\leq 1$  second.
3. These parameters are guaranteed by design but not tested.

**POWER SUPPLY CHARACTERISTICS**

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min	Typ	Max	Unit
I <sub>CC</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = Max., freq = 0 0V ≤ V <sub>IN</sub> ≤ 0.2V or V <sub>CC</sub> -0.2V ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>	—	0.02	40	μA
ΔI <sub>CC</sub>	Supply Current per Input @ TTL HIGH	V <sub>CC</sub> = Max., freq = 0, V <sub>IN</sub> = V <sub>CC</sub> - 0.6V	—	1.0	20	μA
Q <sub>CCD</sub>	Supply Current per Input per MHz	V <sub>CC</sub> = Max., Outputs Open and Enabled One Bit Toggling @ 50% Duty Cycle Other Inputs at GND or V <sub>CC</sub> <sup>(2,3)</sup>	—	40	85	μA/ MHz

**Notes:**

- For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
- Q<sub>CCD</sub> 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 tested.
- I<sub>C</sub> can be computed using the above parameters as explained in the Technical Overview section.



Test	Switch
t <sub>PHL</sub> /t <sub>PLH</sub>	Open
t <sub>PZL</sub> /t <sub>PLZ</sub>	6V
t <sub>PZH</sub> /t <sub>PHZ</sub>	GND

**Load Circuit for Outputs**

**Notes**

- Input pulse characteristics: 0V to 2.7V, tr = tf = 2.5 ns (10% to 90%), transition measured at 1.5V, pulse generator Z<sub>OUT</sub> = 50Ω.

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE**

Commercial T<sub>A</sub> = 0°C to 70°C, V<sub>CC</sub> = 3.3V ± 0.3V

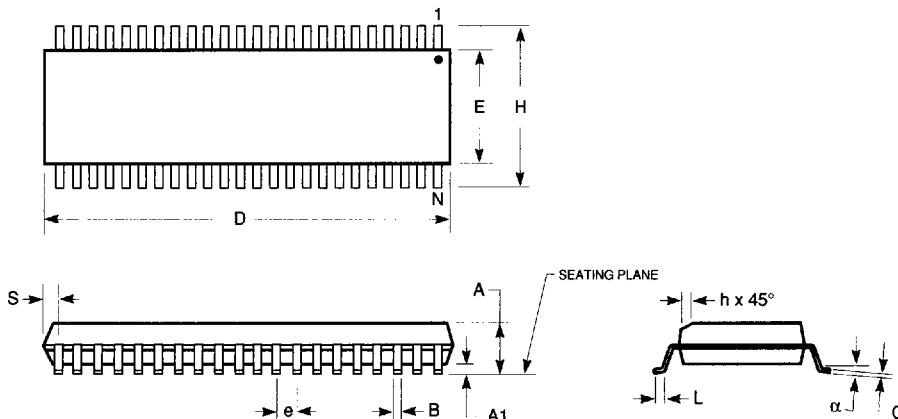
C<sub>LOAD</sub> = 50 pF, R<sub>LOAD</sub> = 500Ω unless otherwise noted.

Symbol	Description <sup>(1)</sup>	2X3244		2X3244A		Unit
		Min	Max	Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay A <sub>i</sub> to B <sub>i</sub>	1.5	6.5	1.5	4.8	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable $\overline{\text{OE}}$ to B <sub>i</sub>	1.5	8	1.5	6.2	ns
t <sub>PLZ</sub> t <sub>PHZ</sub>	Disable Time <sup>(2)</sup>	1.5	7	1.5	5.6	ns

**Notes:**

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

**150-MIL QVSOP™ - Package Code Q1/Q2**  
**150-Mil Wide Plastic Small Outline Gull-Wing**



JEDEC#	MO-154BB			MO-154AB		
DWG#	PSS-40A (Q2)			PSS-48A (Q1)		
Symbol	Min	Nom	Max	Min	Nom	Max
A	0.059	0.065	0.069	0.059	0.065	0.069
A1	0.004	0.006	0.008	0.004	0.006	0.008
B	0.0067	0.008	0.009	0.0051	0.0063	0.008
C	0.0075	0.008	0.0098	0.0075	0.008	0.0098
D	0.386	0.390	0.394	0.386	0.390	0.394
E	0.150	0.154	0.157	0.150	0.154	0.157
e	0.0197 BSC, 0.5mm			0.0157 BSC, 0.4mm		
H	0.228	0.236	0.244	0.228	0.236	0.244
h	0.010	0.013	0.016	0.010	0.013	0.016
L	0.020	0.024	0.030	0.020	0.024	0.030
N	40			48		
$\alpha$	0°	5°	8°	0°	5°	8°
S	0.006	0.008	0.010	0.012	0.014	0.016

**Notes:**

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
5. Lead coplanarity is 0.003in. maximum.

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