

FEATURES/BENEFITS

- Pin and function compatible with T.I. Widebus™ and IDT Double-Density™ families
- CMOS power levels: <math><1\mu\text{W}</math> typical standby
- SSOP (PV) and TSSOP (PA) packages
- Low output skew: 0.5ns $t_{SK(O)}$
- Flow-through pinout for easy layout
- Extended commercial temperature: -40°C to $+85^{\circ}\text{C}$
- Extended 3.3V supply range 2.7V to 3.6V
- JEDEC compatible LVTTTL output levels for 3.3V
- Input hysteresis for noise immunity
- Multiple power and ground pins for low noise
- A and C speed grades: 5.4ns t_{PD} for C
- 5V tolerant inputs for 5V to 3.3V translation

DESCRIPTION

The FCT163646 is a 16-bit bus registered transceiver with three-state outputs that is ideal for driving address and data buses. The FCT163646 is organized for transmission of data between A bus and B bus either directly or from the internal storage registers. Easy board layout is facilitated by the use of flow-through pinouts and byte enable controls provide architectural flexibility for systems designers. All outputs have ground bounce suppression circuitry (See QSI Application Note AN-01). Multiple power and ground pins result in low ground and V_{CC} bounce. This JEDEC LVTTTL compliant 3.3V device is useful for 5V to 3.3V applications, since all inputs will support 5V signals.

Figure 1. Functional Block Diagram

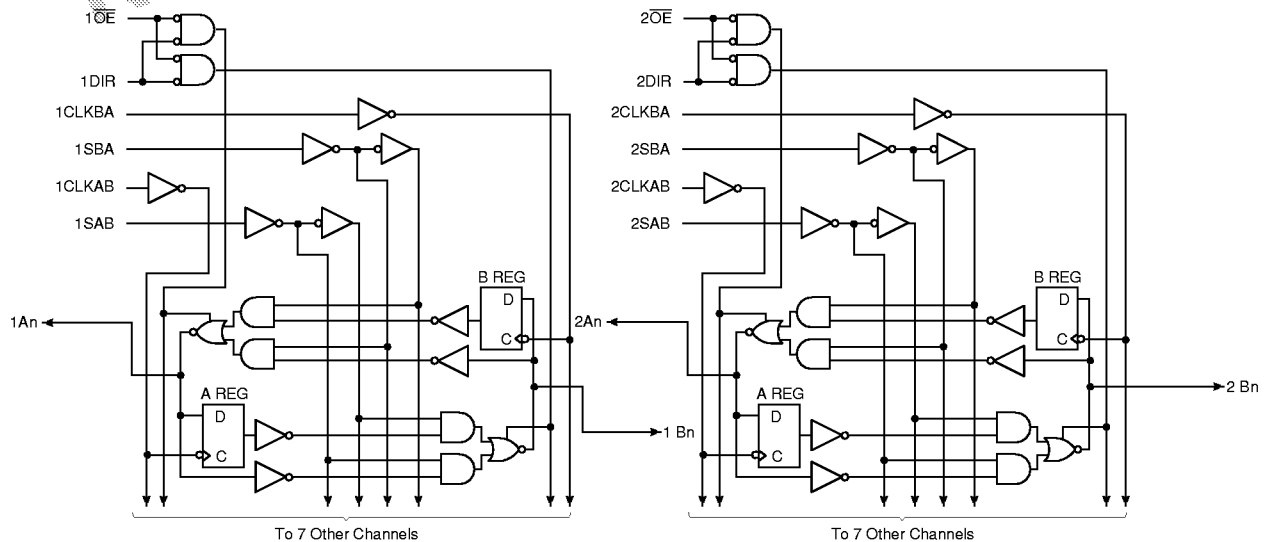


Figure 2. Pin Configuration
(All Pins Top View)
SSOP, TSSOP

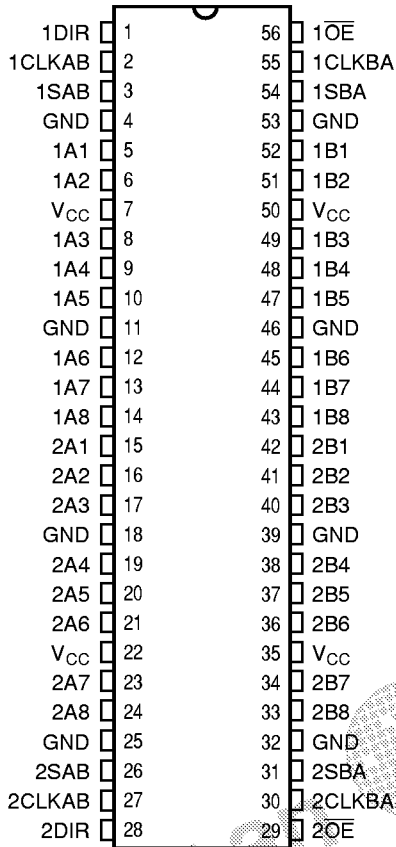


Table 1. Pin Description

Name	Description
xAx	Data Register A Inputs Data Register B Outputs
xBx	Data Register B Inputs Data Register A Outputs
xCLKAB, xCLKBA	Clock Inputs
xSAB, xSBA	Output Source Select Inputs
xDIR, xOE	Output Enable Inputs

Table 2. Function Table

Inputs						Data I/O ⁽¹⁾		Operation or Function
xOE	xDIR	xCLKAB	xCLKBA	xSAB	xSBA	xAx	xBx	
H	X	H or L	H or L	x	x	Input	Input	Isolation
H	X	↑	↑	X	X			Store A and B Data
L	L	X	X	X	L	Output	Input	Real Time B Data to A Bus
L	L	X	H or L	X	H			Stored B Data to A Bus
L	H	X	X	L	X	Input	Output	Real Time A Data to B Bus
L	H	H or L	X	H	X			Stored A Data to B Bus

Notes:

- The data output functions may be enabled or disabled by various signals at the xOE or xDIR inputs. Data input functions are always enabled, i.e. data at the bus pins will be stored on every LOW-to-HIGH transition on the clock inputs.
- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
↑ = LOW-to-HIGH Transition

Table 3. Capacitance

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

Symbol	Parameter	Typ	Unit
C_{IN}	Input Capacitance	7.0	pF
C_{OUT}	Output Capacitance	8.0	pF

Note: Capacitance is characterized but not production tested.

Table 4. Absolute Maximum Ratings

Supply Voltage to Ground	-0.5V to +4.6V
DC Output Voltage V_{OUT}	-0.5V to $V_{CC} + 0.5\text{V}$
DC Input Voltage V_{IN}	-0.5V to +7.0V
AC Input Voltage (for a pulse width $\leq 20\text{ns}$)	-3.0V
DC Input Diode Current with $V_{IN} < 0$	-20mA
DC Output Diode Current with $V_{OUT} < 0$	-50mA
DC Output Current Max. Sink Current/Pin	120mA
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 5. Recommended Operating Conditions

Symbol		Min	Max	Unit
V_{CC}	Supply Voltage	2.7	3.6	V
V_{IN}	Input Voltage	-0.5	5.5	V
V_{OUT}	Voltage Applied to Output or I/O	0	V_{CC}	V
$\Delta t/\Delta v$	Input Transition Slew Rate	—	10	ns/V
T_A	Operating Free Air Temperature	-40	+85	°C

Table 6. DC Electrical Characteristics Over Operating Range

Recommended Operating Ranges apply unless otherwise noted.

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Unit	
V_{IH}	Input HIGH Voltage	Logic HIGH for All Inputs	2.0	—	5.5	V	
V_{IL}	Input LOW Voltage	Logic LOW for All Inputs	-0.5	—	0.8	V	
ΔV_T	Input Hysteresis ⁽⁴⁾	$V_{TLH} - V_{THL}$ for All Inputs	—	150	—	mV	
$ I_{IH} $	Input HIGH Current (Input pins)	$V_{CC} = \text{Max.}$ $V_I = 5.5V$	—	—	1	μA	
	Input HIGH Current (I/O pins)						$V_I = V_{CC}$
$ I_{IL} $	Input LOW Current (Input pins)	$V_{CC} = \text{Max.}$ $V_I = \text{GND}$	—	—	1	μA	
	Input LOW Current (I/O pins)						$V_I = \text{GND}$
$ I_{OZ} $	Off-State Output Current (Hi-Z)	$V_{CC} = \text{Max.}, V_{OUT} = 0V,$ $V_{OUT} = V_{CC}$	—	—	1	μA	
I_{OS}	Short Circuit Current ^(3,4)	$V_{CC} = \text{Max.}, V_{OUT} = \text{GND}$	-60	-140	-240	mA	
V_{OH}	Output HIGH Voltage	$V_{CC} = 2.7V$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -0.1mA$ $I_{OH} = -3.0mA$	$V_{CC} - 0.2$ 2.4	—	—	V
		$V_{CC} = 3.0V$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -8mA$	2.4	—	—	V
V_{OL}	Output LOW Voltage	$V_{CC} = 2.7V$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 0.1mA$ $I_{OL} = 16mA$ $I_{OL} = 24mA$	—	—	0.2 0.4 0.55	V
		$V_{CC} = 3.0V$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 24mA$	—	—	0.5	V
V_{IK}	Input Clamp Voltage ⁽⁴⁾	$V_{CC} = \text{Min.}, I_{IN} = -18mA$	—	-0.7	-1.2	V	

Notes:

1. For conditions shown as Max or Min use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values indicate $V_{CC} = 3.3V$ and $T_A = 25^\circ C$.
3. Not more than one output should be shorted at one time. Duration of test should not exceed one second.
4. These parameters are guaranteed by design but not production tested.

Table 7. Power Supply Characteristics

Symbol	Parameter	Test Conditions ⁽¹⁾	Typ ⁽²⁾	Max	Unit	
I_{CC}	Quiescent Power Supply Current	$V_{CC} = 3.6V$, Freq = 0 $V_{IN} = GND$ or V_{CC}	0.1	10	μA	
ΔI_{CC}	Supply Current per Input @ TTL HIGH	$V_{CC} = 3.6V$, $V_{IN} = V_{CC} - 0.6V^{(3)}$	2.0	30	μA	
I_{CCD}	Supply Current per Input per MHz ⁽⁴⁾	$V_{CC} = 3.6V$, Outputs Open One Bit Toggling @ 50% Duty Cycle $xDIR = x\overline{OE} = GND$	$V_{IN} = V_{CC}$ $V_{IN} = GND$	65 100	$\mu A/$ MHz	
I_C	Total Power Supply Current ⁽⁶⁾	$V_{CC} = 3.6V$, Outputs Open One Bit Toggling @ 50% Duty Cycle $f = 5MHz$, $f_{CP} = 10MHz$ (xCLKBA) $xDIR = x\overline{OE} = GND$,	$V_{IN} = V_{CC} - 0.6V$ $V_{IN} = GND$	0.5 ⁽⁵⁾	0.8 ⁽⁵⁾	mA
		$V_{CC} = 3.6V$, Outputs Open Sixteen Bits Toggling @ 50% Duty Cycle $f = 2.5MHz$, $f_{CP} = 10MHz$ (xCLKBA) $xDIR = x\overline{OE} = GND$	$V_{IN} = V_{CC} - 0.6V$ $V_{IN} = GND$	2.0 ⁽⁵⁾	3.3 ⁽⁵⁾	mA

Notes:

- For conditions shown as Min. or Max., use the appropriate values specified under Recommended Operating Conditions for applicable device type.
- Typical values are at $V_{CC} = 3.3V$, +25°C ambient.
- Per TTL driven input. All Other Inputs at V_{CC} or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed by design but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CCQ} + \Delta I_{CC} D_H N_T + I_{CCD} f N_O$
 I_{CCQ} = Quiescent Current (I_{CCL} , I_{CCH} , and I_{CCZ}).
 ΔI_{CC} = Power Supply Current for a TTL-High Input ($V_{IN} = V_{CC} - 0.6V$).
 D_H = Duty Cycle for TTL High Inputs.
 N_T = Number of TTL High Inputs.
 I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL).
 f = Average Switching Frequency per Output.
 N_O = Number of Outputs Switching.

Table 8. Switching Characteristics Over Operating Range

Recommended operating ranges apply unless otherwise noted.

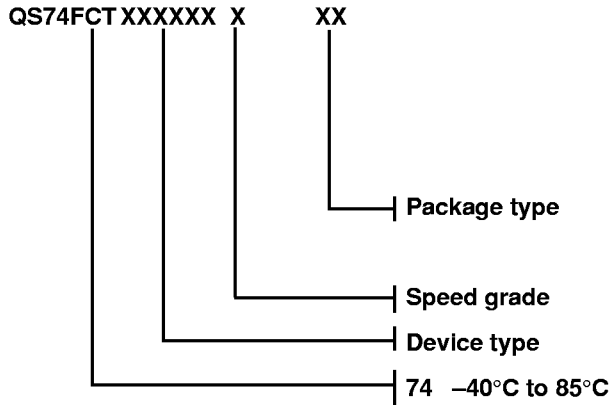
$C_{LOAD} = 50\text{pF}$, $R_{LOAD} = 500\Omega$ unless otherwise noted.

Symbol	Description ^(1,2)	FCT163646A		FCT163646C		Unit
		Min	Max	Min	Max	
t_{PHL} t_{PLH}	Propagation Delay Bus to Bus	2.0	6.3	1.5	5.4	ns
t_{PZH} t_{PZL}	Output Enable Time xDIR or xOE to Bus	2.0	9.8	1.5	7.8	ns
t_{PHZ} t_{PLZ}	Output Disable Time ⁽²⁾ xDIR or xOE to Bus	2.0	6.3	1.5	6.3	ns
t_{PHL} t_{PLH}	Propagation Delay Clock to Bus	2.0	6.3	1.5	5.7	ns
t_{PHL} t_{PLH}	Propagation Delay xSAB or xSBA to Bus	2.0	7.7	1.5	6.2	ns
t_{SU}	Setup Time HIGH or LOW Bus to Clock	2.0	—	2.0	—	ns
t_H	Hold Time HIGH or LOW Bus to Clock	1.5	—	1.5	—	ns
t_W	Clock Pulse Width ⁽²⁾ LOW or HIGH	5.0	—	5.0	—	ns
$t_{SK(O)}$	Output Skew ⁽³⁾	—	0.5	—	0.5	ns

Notes:

1. Minimums guaranteed but not tested on propagation delays. See Test Circuit and Waveforms.
2. Switching characteristics are with $V_{CC} = 3.3 \pm 0.3\text{V}$. For 2.7V V_{CC} operation, parameters should be degraded by 20%.
3. Guaranteed by design, but not production tested.
4. Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by characterization but not production tested.

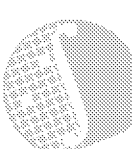
ORDERING INFORMATION



Device Type:
163646

Speed Grades:
A
C

Package Type:
PV – SSOP, 300 mil
PA – TSSOP, 240 mil

Now an  IDT company