



CY74FCT163543

16-Bit Latched Transceiver

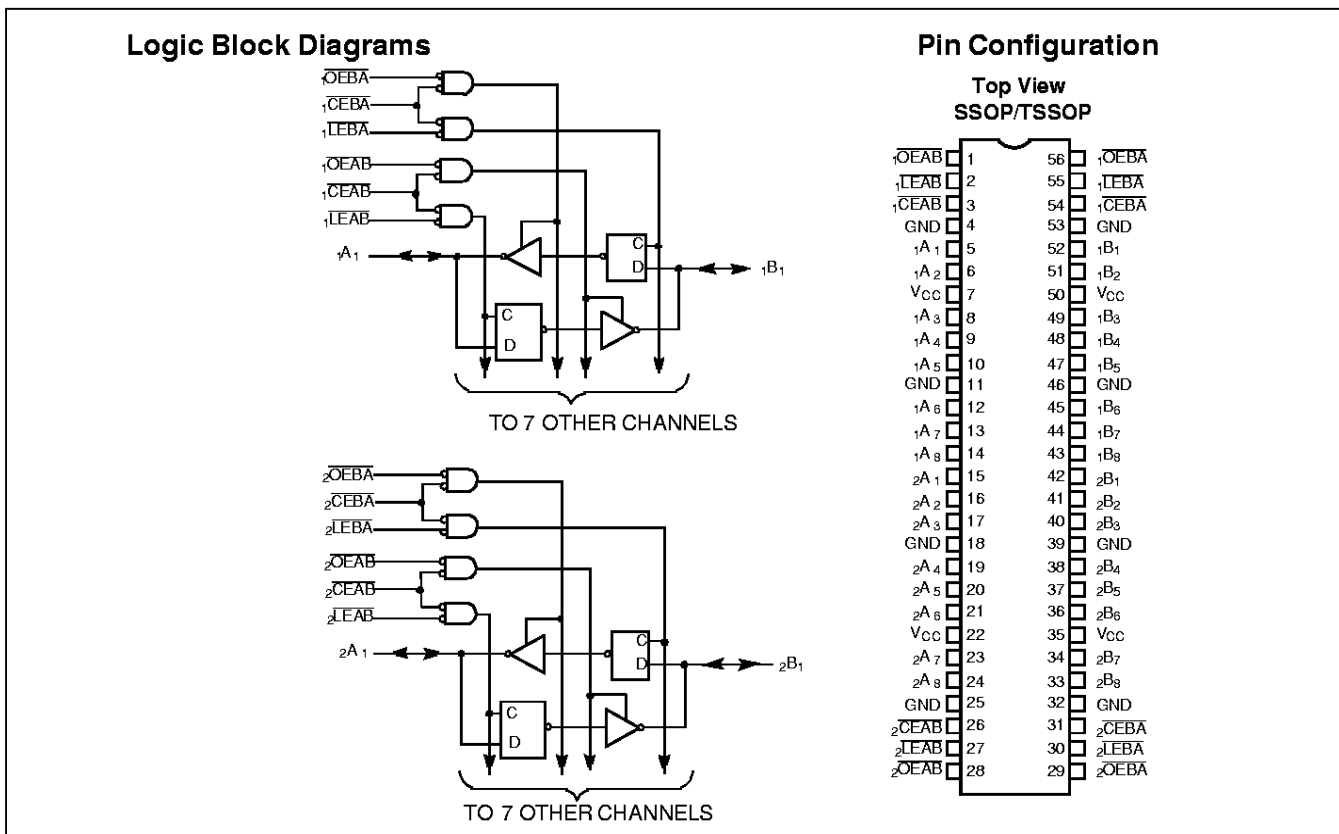
Features

- 5V tolerant Inputs and Outputs
- 24 mA balanced drive outputs
- Low power, pin-compatible replacement for LCX, LPT, LVC, LVCH & LVT families
- FCT-C speed at 5.1 ns
- Power-off disable outputs permits live insertion
- Edge-rate control circuitry for significantly improved noise characteristics
- Typical output skew < 250 ps
- ESD > 2000V
- TSSOP (19.6-mil pitch) and SSOP (25-mil pitch) packages
- Extended commercial temperature range of -40°C to +85°C
- V_{CC} = 3.3V ± 0.3V Normal Range
- V_{CC} = 2.7V to 3.6V Extended Range
- Typical V_{OLP} (ground bounce) < 0.3V at V_{CC} = 3.3V, T_A = 25°C
- Input hysteresis of 100 mV

Functional Description

The CY74FCT163543 is a 16-bit, high-speed, low power latched transceiver that is organized as two independent 8-bit D-type latched transceivers, containing two sets of eight D-type latches with separate Latch Enable (\overline{LEAB} , \overline{LEAB}) and Output Enable (\overline{OEAB} , \overline{OEAB}) controls for each set to permit independent control of inputting and outputting in either direction of data flow. For data flow from A to B, for example, the A-to-B input Enable (\overline{CEAB}) must be LOW in order to enter data from A or to take data from B, as indicated in the truth table. With \overline{CAEB} LOW, a LOW signal on the A-to-B Latch Enable (\overline{LEAB}) makes the A-to-B latches transparent; a subsequent LOW-to-HIGH transition of the \overline{LEAB} signal puts the A latches in the storage mode and their outputs no longer follow the A inputs. With \overline{CEAB} and \overline{OEAB} both LOW, the three-state B output buffers are active and reflect the data present at the output of the A latches. Control of data from B to A is similar, but uses \overline{CEAB} , \overline{LEAB} , and \overline{OEAB} inputs.

The CY74FCT163543 has 24-mA balanced output drivers with current limiting resistors in the outputs. This reduces the need for external terminating resistors and provides for minimal undershoot and reduced ground bounce. The inputs and outputs are capable of being driven by 5.0V buses, allowing them to be used in mixed voltage systems as translators. The outputs are also designed with a power off disable feature enabling them to be used in applications requiring live insertion. Flow-through pinout and small shrink packaging simplify board design





Pin Description

Name	Description
OEAB	A-to-B Output Enable Input (Active LOW)
OEBA	B-to-A Output Enable Input (Active LOW)
CEAB	A-to-B Enable Input (Active LOW)
CEBA	B-to-A Enable Input (Active LOW)
LEAB	A-to-B Latch Enable Input (Active LOW)
LEBA	B-to-A Latch Enable Input (Active LOW)
A	A-to-B Data Inputs or B-to-A Three-State Outputs
B	B-to-A Data Inputs or A-to-B Three-State Outputs

Function Table^[1]

Inputs			Latch Status	Output Buffers
CEAB	LEAB	OEAB	A to B	B
H	X	X	Storing	High Z
X	H	X	Storing	X
X	X	H	X	High Z
L	L	L	Transparent	Current A Inputs
L	H	L	Storing	Previous A Inputs ^[2]

Maximum Ratings^[3, 4]

(Above which the useful life may be impaired. For user guidelines, not tested.)

- Storage Temperature -55°C to +125°C
- Ambient Temperature with Power Applied..... -55°C to +125°C
- Supply Voltage Range 0.5V to +4.6V
- DC Input Voltage -0.5V to +7.0V
- DC Output Voltage -0.5V to +7.0V
- DC Output Current (Maximum Sink Current/Pin) -60 to +120 mA

- Power Dissipation..... 1.0W
- Static Discharge Voltage >2001V (per MIL-STD-883, Method 3015)

Operating Range

Range	Ambient Temperature	V _{CC}
Commercial	-40°C to +85°C	2.7V to 3.6V

Electrical Characteristics Over the Operating Range V_{CC}=2.7V to 3.6V

Parameter	Description	Test Conditions	Min.	Typ. ^[5]	Max.	Unit
V _{IH}	Input HIGH Voltage		2.0		5.5	V
V _{IL}	Input LOW Voltage				0.8	V
V _H	Input Hysteresis ^[6]			100		mV
V _{IK}	Input Clamp Diode Voltage	V _{CC} =Min., I _{IN} =-18 mA		-0.7	-1.2	V
I _{IH}	Input HIGH Current	V _{CC} =Max., V _I =5.5V			±1	µA
I _{IL}	Input LOW Current	V _{CC} =Max., V _I =GND			±1	µA
I _{OZH}	High Impedance Output Current (Three-State Output pins)	V _{CC} =Max., V _{OUT} =5.5V			±1	µA
I _{OZL}	High Impedance Output Current (Three-State Output pins)	V _{CC} =Max., V _{OUT} =GND			±1	µA
I _{ODL}	Output LOW Current ^[7]	V _{CC} =3.3V, V _{IN} =V _{IH} or V _{IL} , V _{OUT} =1.5V	50	90	200	mA
I _{ODH}	Output HIGH Current ^[7]	V _{CC} =3.3V, V _{IN} =V _{IH} or V _{IL} , V _{OUT} =1.5V	-36	-60	-110	mA

Notes:

1. A-to-B data flow shown; B-to-A flow control is the same, except using CEBA, LEBA, and OEBA.
2. Data prior to LEAB LOW-to-HIGH Transition H = HIGH Voltage Level. L = LOW Voltage Level. X = Don't Care. Z = High Impedance.
3. Operation beyond the limits set forth may impair the useful life of the device. Unless noted, these limits are over the operating free-air temperature range.
4. Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
5. Typical values are at V_{CC}= 3.3V, T_A= +25°C ambient.
6. This parameter is guaranteed but not tested.
7. 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 in order to minimize internal chip heating and more accurately reflect operational values. Otherwise prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parametric tests. In any sequence of parameter tests, I_{OS} tests should be performed last.



Electrical Characteristics Over the Operating Range $V_{CC}=2.7V$ to $3.6V$ (continued)

Parameter	Description	Test Conditions	Min.	Typ. ^[5]	Max.	Unit
V_{OH}	Output HIGH Voltage	$V_{CC}=\text{Min.}, I_{OH} = -0.1 \text{ mA}$	$V_{CC}-0.2$			V
		$V_{CC}=3.0V, I_{OH} = -8 \text{ mA}$	2.4	3.0		
		$V_{CC}=3.0V, I_{OH} = -24 \text{ mA}$	2.0	3.0		
V_{OL}	Output LOW Voltage	$V_{CC}=\text{Min.}, I_{OL} = 0.1 \text{ mA}$			0.2	V
		$V_{CC}=\text{Min.}, I_{OL} = 24 \text{ mA}$		0.3	0.5	
I_{OS}	Short Circuit Current ^[7]	$V_{CC}=\text{Max.}, V_{OUT}=\text{GND}$	-60	-135	-240	mA
I_{OFF}	Power-Off Disable	$V_{CC}=0V, V_{OUT}\leq 4.5V$			± 100	μA

Capacitance^[6] ($T_A = +25^\circ\text{C}, f = 1.0 \text{ MHz}$)

Parameter	Description	Test Conditions	Typ. ^[5]	Max.	Unit
C_{IN}	Input Capacitance	$V_{IN} = 0V$	4.5	6.0	pF
C_{OUT}	Output Capacitance	$V_{OUT} = 0V$	5.5	8.0	pF

Power Supply Characteristics

Parameter	Description	Test Conditions	Typ. ^[5]	Max.	Unit	
I_{CC}	Quiescent Power Supply Current	$V_{CC}=\text{Max.}$ $V_{IN}\leq 0.2V,$ $V_{IN}\geq V_{CC}-0.2V$	0.1	10	μA	
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs HIGH)	$V_{CC}=\text{Max.}$ $V_{IN}=V_{CC}-0.6V$ ^[8]	2.0	30	μA	
I_{CCD}	Dynamic Power Supply Current ^[9]	$V_{CC}=\text{Max.},$ One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE}=\text{GND}$	50	75	$\mu\text{A}/\text{MHz}$	
I_C	Total Power Supply Current ^[10]	$V_{CC}=\text{Max.}, f_1=10 \text{ MHz},$ 50% Duty Cycle, Outputs Open, One Bit Toggling, $\overline{OE}=\text{GND}$	$V_{IN}=V_{CC}$ or $V_{IN}=\text{GND}$	0.5	0.8	mA
			$V_{IN}=V_{CC}-0.6V$ or $V_{IN}=\text{GND}$	0.5	0.8	mA
		$V_{CC}=\text{Max.}, f_1=2.5 \text{ MHz},$ 50% Duty Cycle, Outputs Open, Sixteen Bits Toggling, $\overline{OE}=\text{GND}$	$V_{IN}=V_{CC}$ or $V_{IN}=\text{GND}$	2.0	3.0 ^[11]	mA
			$V_{IN}=V_{CC}-0.6V$ or $V_{IN}=\text{GND}$	2.0	3.3 ^[11]	mA

Notes:

8. Per TTL driven input; all other inputs at V_{CC} or GND.
9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
10.
 - $I_C = I_{CC} + I_{INPLTS} + I_{DYNAMIC}$
 - $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0 N_C / 2 + f_1 N_1)$
 - I_{CC} = Quiescent Current with CMOS input levels
 - ΔI_{CC} = Power Supply Current for a TTL HIGH input ($V_{IN}=3.4V$)
 - 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
 - N_C = Number of clock inputs changing at f_0
 - f_1 = Input signal frequency
 - N_1 = Number of inputs changing at f_1
11. All currents are in milliamps and all frequencies are in megahertz.
11. Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.



Switching Characteristics Over the Operating Range^[12,15]

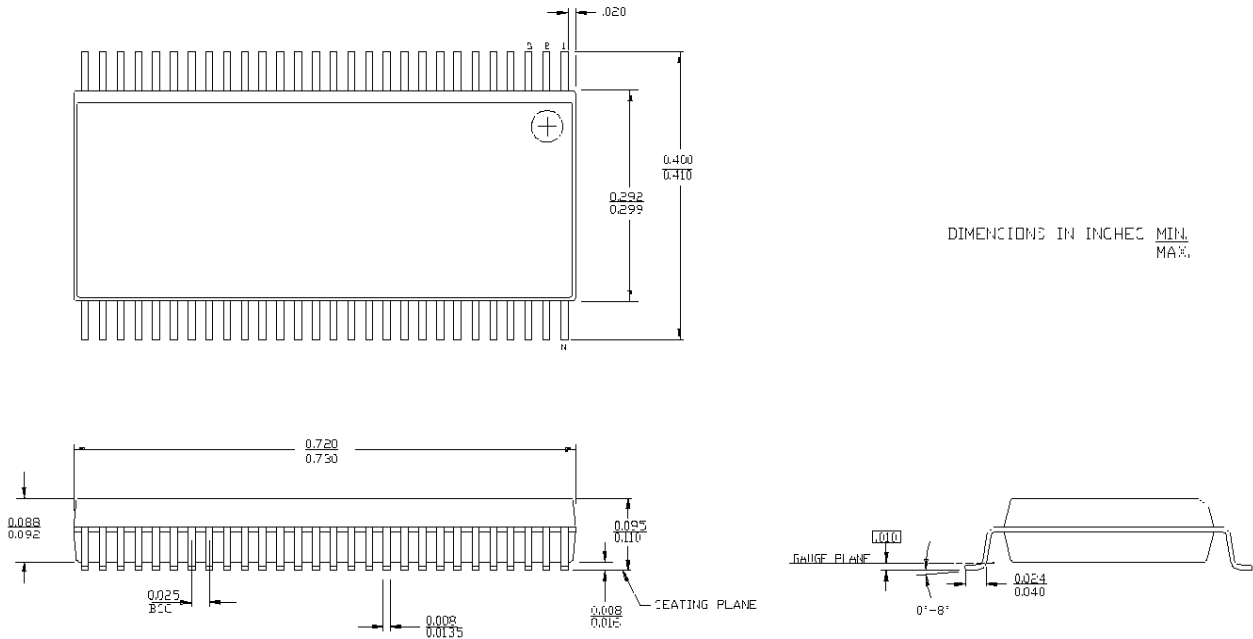
Parameter	Description	CY74FCT163543A		CY74FCT163543C		Unit	Fig. No. ^[13]
		Min.	Max.	Min.	Max.		
t _{PLH} t _{PHL}	Propagation Delay, Transparent Mode A to B or B to A	1.5	6.5	1.5	5.1	ns	1, 3
t _{PLH} t _{PHL}	Propagation Delay LEBA to A, LEAB to B	1.5	8.0	1.5	5.6	ns	1, 5
t _{PZH} t _{PZL}	Output Enable Time OEBA or OEAB to A or B CEBA or CEAB to A or B	1.5	9.0	1.5	7.8	ns	1, 7, 8
t _{PHZ} t _{PLZ}	Output Disable Time OEBA or OEAB to A or B CEBA or CEAB to A or B	1.5	7.5	1.5	6.5	ns	1, 7, 8
t _{SU}	Set-up Time HIGH or LOW A or B to LEAB or LEBA	2.0	—	2.0	—	ns	4
t _H	Hold Time HIGH or LOW A or B to LEAB or LEBA	2.0	—	2.0	—	ns	4
t _W	LEBA or LEAB Pulse Width LOW	4.0	—	4.0	—	ns	5
t _{SK(O)}	Output Skew ^[14]	—	0.5	—	0.5	ns	—

Ordering Information CY74FCT163543

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
5.1	CY74FCT163543CPAC	Z56	56-Lead (240-Mil) TSSOP	Commercial
	CY74FCT163543CPVC	O56	56-Lead (300-Mil) SSOP	
6.5	CY74FCT163543APAC	Z56	56-Lead (240-Mil) TSSOP	Commercial
	CY74FCT163543APVC	O56	56-Lead (300-Mil) SSOP	

Notes:

- 12. Minimum limits are guaranteed but not tested on Propagation Delays.
- 13. See "Parameter Measurement Information" in the General Information section.
- 14. Skew between any two outputs of the same package switching in the same directional. This parameter is guaranteed by design.
- 15. For V_{CC} = 2.7, propagation delay, output enable and output disable times should be degraded by 20%.

Package Diagrams
56-Lead Shrunk Small Outline Package O56

56-Lead Thin Shrunk Small Outline Package Z56
