TEXAS INSTRUMENTS

SCCS030 - May 1994 - Revised March 2000

CY54/74FCT543T

8-Bit Latched Registered Transceiver

Features

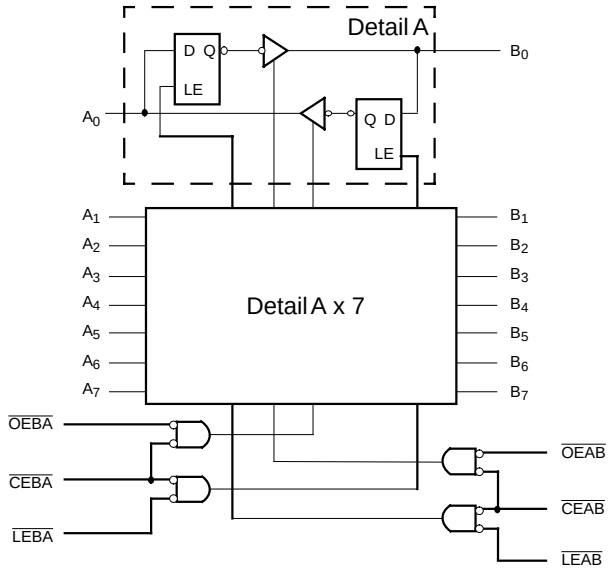
- **Function, pinout, and drive compatible with FCT and F logic**
- **FCT-C speed at 5.3 ns max. (Com'l)**
  FCT-A speed at 6.5 ns max. (Com'l)
- **Reduced V_{OH} (typically = 3.3V) versions of equivalent FCT functions**
- **Edge-rate control circuitry for significantly improved noise characteristics**
- **Power-off disable feature**
- **Matched rise and fall times**
- **Fully compatible with TTL input and output logic levels**
- **ESD > 2000V**
- **Sink current 64 mA (Com'l), 48 mA (Mil)**
  Source current 32 mA (Com'l), 12 mA (Mil)
- **Separation controls for data flow in each direction**
- **Back to back latches for storage**
- **Extended commercial range of –40°C to +85°C**

Functional Description

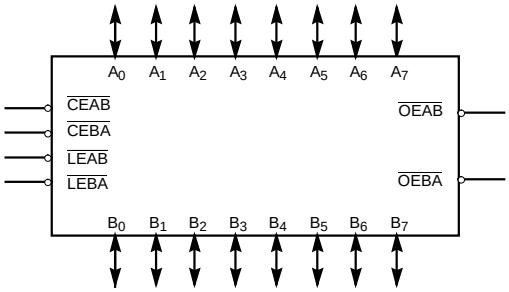
The FCT543T octal latched transceiver contains two sets of eight D-type latches with separate latch enable ($\overline{LEAB}$, $\overline{LEBA}$) and output enable ($\overline{OEAB}$, $\overline{OEBA}$) controls for each set to permit independent control of inputting and outputting in either direction of data flow. For data flow from A to B, for example, the A-to-B enable ($\overline{CEAB}$) input must be LOW in order to enter data from A or to take data from B, as indicated in the truth table. With $\overline{CEAB}$ LOW, a LOW signal on the A-to-B latch enable ($\overline{LEAB}$) input 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 output no longer change with the A inputs. With $\overline{CEAB}$ and $\overline{OEAB}$ both LOW, the three-stage 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 outputs are designed with a power-off disable feature to allow for live insertion of boards.

Functional Block Diagram

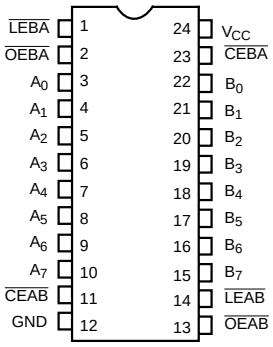


Logic Block Diagram



Pin Configurations

SOIC/QSOP
Top View



Pin Description

Name	Description
$\overline{OEAB}$	A-to-B Output Enable Input (Active LOW)
$\overline{OEBA}$	B-to-A Output Enable Input (Active LOW)
$\overline{CEAB}$	A-to-B Enable Input (Active LOW)
$\overline{CEBA}$	B-to-A Enable Input (Active LOW)
$\overline{LEAB}$	A-to-B Latch Enable Input (Active LOW)
$\overline{LEBA}$	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, 2]

Inputs			Latch	Outputs
$\overline{CEAB}$	$\overline{LEAB}$	$\overline{OEAB}$	A-to-B[3]	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

Maximum Ratings[4, 5]

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

Storage Temperature ..... –65°C to +150°C

Ambient Temperature with Power Applied..... –65°C to +135°C

Supply Voltage to Ground Potential..... –0.5V to +7.0V

DC Input Voltage ..... –0.5V to +7.0V

DC Output Voltage..... –0.5V to +7.0V

DC Output Current (Maximum Sink Current/Pin) .....120 mA

Power Dissipation 0.5W

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

Operating Range

Range	Range	Ambient Temperature	V_{CC}
Commercial	DT	0°C to +70°C	5V ± 5%
Commercial	T, AT, CT	–40°C to +85°C	5V ± 5%
Military[6]	All	–55°C to +125°C	5V ± 10%

Notes:

1. H = HIGH Voltage Level. L = LOW Voltage Level. X = Don't Care.
2. A-to-B data flow shown: B-to-A flow control is the same, except using $\overline{CEBA}$, $\overline{LEBA}$, and $\overline{OEBA}$.
3. Before $\overline{LEAB}$ LOW-to-HIGH Transition.
4. Unless otherwise noted, these limits are over the operating free-air temperature range.
5. Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
6. T_A is the "instant on" case temperature.

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		Min.	Typ.[7]	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC}=Min., I_{OH}=–32 mA	Com'l	2.0			V
		V_{CC}=Min., I_{OH}=–15 mA	Com'l	2.4	3.3		V
		V_{CC}=Min., I_{OH}=–12 mA	Mil	2.4	3.3		V
V_{OL}	Output LOW Voltage	V_{CC}=Min., I_{OL}=64 mA	Com'l		0.3	0.55	V
		V_{CC}=Min., I_{OL}=48mA	Mil		0.3	0.55	V
V_{IH}	Input HIGH Voltage			2.0			V
V_{IL}	Input LOW Voltage					0.8	V
V_H	Hysteresis[8]	All inputs			0.2		V
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_{IN}=V_{CC}				5	µA
I_{IH}	Input HIGH Current[8]	V_{CC}=Max., V_{IN}=2.7V				±1	µA
I_{IL}	Input LOW Current[8]	V_{CC}=Max., V_{IN}=0.5V				±1	µA
I_{OZH}	Off State HIGH-Level Output Current	V_{CC}=Max., V_{OUT} = 2.7V				10	µA
I_{OZL}	Off State LOW-Level Output Current	V_{CC}= Max., V_{OUT} = 0.5V				–10	µA
I_{OS}	Output Short Circuit Current[9]	V_{CC}=Max., V_{OUT}=0.0V		–60	–120	–225	mA
I_{OFF}	Power-Off Disable	V_{CC}=0V, V_{OUT}=4.5V				±1	µA

Capacitance[8]

Parameter	Description	Typ.[7]	Max.	Unit
C_{IN}	Input Capacitance	5	10	pF
C_{OUT}	Output Capacitance	9	12	pF

Notes:

7. Typical values are at V_{CC}=5.0V, T_A=+25˚C ambient.
8. This parameter is specified but not tested.
9. 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.

Power Supply Characteristics

Parameter	Description	Test Conditions	Typ.[7]	Max.	Unit
I_{CC}	Quiescent Power Supply Current	V_{CC}=Max., $V_{IN}\leq$0.2V, $V_{IN}\geq V_{CC}$–0.2V	0.1	0.2	mA
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs)	V_{CC}=Max., V_{IN}=3.4V,[10] f_1=0, Outputs Open	0.5	2.0	mA
I_{CCD}	Dynamic Power Supply Current[11]	V_{CC}=Max., One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{CEAB}$ and $\overline{OEAB}$=LOW, $\overline{CEBA}$=HIGH, $V_{IN}\leq$0.2V or $V_{IN}\geq V_{CC}$–0.2V	0.06	0.12	mA/MHz
I_C	Total Power Supply Current[12]	V_{CC}=Max., f_0=10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling at f_1=5 MHz, $\overline{CEAB}$ and $\overline{OEAB}$=LOW,$\overline{CEBA}$=HIGH, $f_0=\overline{LEAB}$ = 10 MHz, $V_{IN}\leq$0.2V or $V_{IN}\geq V_{CC}$–0.2V	0.7	1.4	mA
		V_{CC}=Max., f_0=10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling at f_1=5 MHz, $\overline{CEAB}$ and $\overline{OEAB}$=LOW, $\overline{CEBA}$=HIGH, $f_0=\overline{LEAB}$ = 10 MHz, V_{IN}=3.4V or V_{IN}=GND	1.2	3.4	mA
		V_{CC}=Max., f_0=10 MHz, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f_1=5 MHz, $\overline{CEAB}$ and $\overline{OEAB}$=LOW, $\overline{CEBA}$=HIGH, $f_0=\overline{LEAB}$ = 10 MHz, $V_{IN}\leq$0.2V or $V_{IN}\geq V_{CC}$–0.2V	2.8	5.6[13]	mA
		V_{CC}=Max., f_0=10 MHz, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f_1=5 MHz, $\overline{CEAB}$ and $\overline{OEAB}$=LOW, $\overline{CEBA}$=HIGH, $f_0=\overline{LEAB}$ = 10 MHz, V_{IN}=3.4V or V_{IN}=GND	5.1	14.6[13]	mA

Notes:

10. Per TTL driven input (V_{IN}=3.4V); all other inputs at V_{CC} or GND.
11. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
12. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
    $I_C = I_{CC}+\Delta I_{CC}D_HN_T+I_{CCD}(f_0/2 + f_1N_1)$
    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
    f_1 = Input signal frequency
    N_1 = Number of inputs changing at f_1
    All currents are in milliamps and all frequencies are in megahertz.
13. Values for these conditions are examples of the I_{CC} formula. These limits are specified but not tested.

Switching Characteristics Over the Operating Range[14]

Parameter	Description	FCT543T				FCT543AT		Unit	Fig. No.[15]
		Military		Commercial		Commercial			
		Min.[14]	Max.	Min.[14]	Max.	Min.[14]	Max.		
t_{PLH} t_{PHL}	Propagation Delay Transparent Mode A to B or B to A	2.0	10.0	2.5	8.5	2.5	6.5	ns	1, 3
t_{PLH} t_{PHL}	Propagation Delay $\overline{LEBA}$ to A, $\overline{LEAB}$ to B	2.5	14.0	2.5	12.5	2.5	8.0	ns	1, 5
t_{PZH} t_{PZL}	Output Enable Time $\overline{OEBA}$ or $\overline{OEAB}$ to A or B $\overline{CEBA}$ or $\overline{CEAB}$ to A or B	2.0	14.0	2.0	12.0	2.0	9.0	ns	1, 7, 8
t_{PZH} t_{PZL}	Output Disable Time $\overline{OEBA}$ or $\overline{OEAB}$ to A or B $\overline{CEBA}$ or $\overline{CEAB}$ to A or B	2.0	13.0	2.0	9.0	2.0	7.5	ns	1, 7, 8
t_S	Set-Up Time HIGH or LOW, A or B to $\overline{LEBA}$ or $\overline{LEAB}$	3.0		2.0		2.0		ns	9
t_H	Hold Time HIGH or LOW, A or B to $\overline{LEBA}$ or $\overline{LEAB}$	2.0		2.0		2.0		ns	9
t_W	Pulse Width LOW[8] $\overline{LEBA}$ or $\overline{LEAB}$	5.0		5.0		5.0		ns	5

Parameter	Description	FCT543CT		Unit	Fig. No.[15]
		Commercial			
		Min.[14]	Max.		
t_{PLH} t_{PHL}	Propagation Delay Transparent Mode A to B or B to A	2.5	5.3	ns	1, 3
t_{PLH} t_{PHL}	Propagation Delay $\overline{LEBA}$ to A, $\overline{LEAB}$ to B	2.5	7.0	ns	1, 5
t_{PZH} t_{PZL}	Output Enable Time $\overline{OEBA}$ or $\overline{OEAB}$ to A or B $\overline{CEBA}$ or $\overline{CEAB}$ to A or B	2.0	8.0	ns	1, 7, 8
t_{PZH} t_{PZL}	Output Disable Time $\overline{OEBA}$ or $\overline{OEAB}$ to A or B $\overline{CEBA}$ or $\overline{CEAB}$ to A or B	2.0	6.5	ns	1, 7, 8
t_S	Set-Up Time, HIGH or LOW, A or B to $\overline{LEBA}$ or $\overline{LEAB}$	2.0		ns	9
t_H	Hold Time, HIGH or LOW, A or B to $\overline{LEBA}$ or $\overline{LEAB}$	2.0		ns	9
t_W	Pulse Width LOW $\overline{LEBA}$ or $\overline{LEAB}$[8]	5.0		ns	5

Notes:
14. Minimum limits are specified but not tested on Propagation Delays.
15. See “Parameter Measurement Information” in the General Information Section.

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
5.3	CY74FCT543CTQCT	Q13	24-Lead (150-Mil) QSOP	Commercial
	CY74FCT543CTSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	
6.5	CY74FCT543ATQCT	Q13	24-Lead (150-Mil) QSOP	Commercial
	CY74FCT543ATSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	
8.5	CY74FCT543TQCT	Q13	24-Lead (150-Mil) QSOP	Commercial
	CY74FCT543TSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	
10.0	CY54FCT543TDMB	D14	24-Lead (300-Mil) CerDIP	Military

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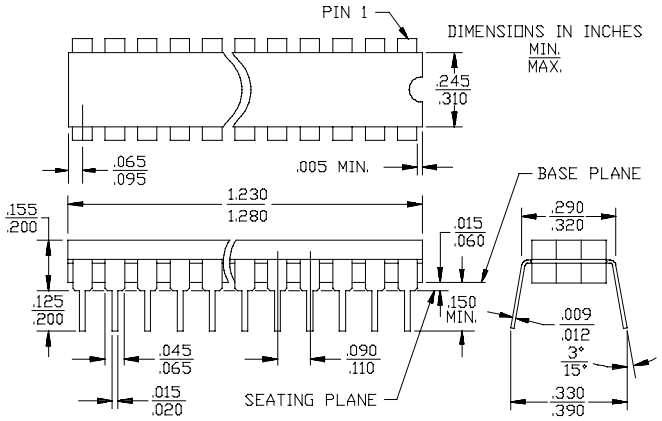
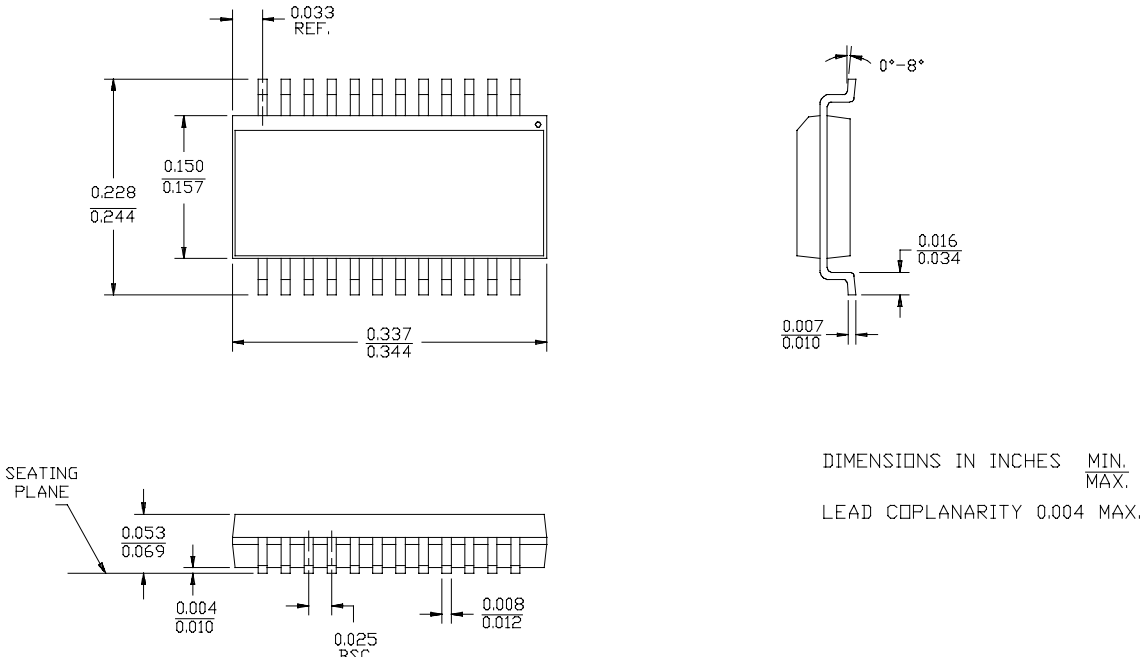
Package Diagrams

24-Lead (300-Mil) CerDIP D14
MIL-STD-1835 D-9 Config.A

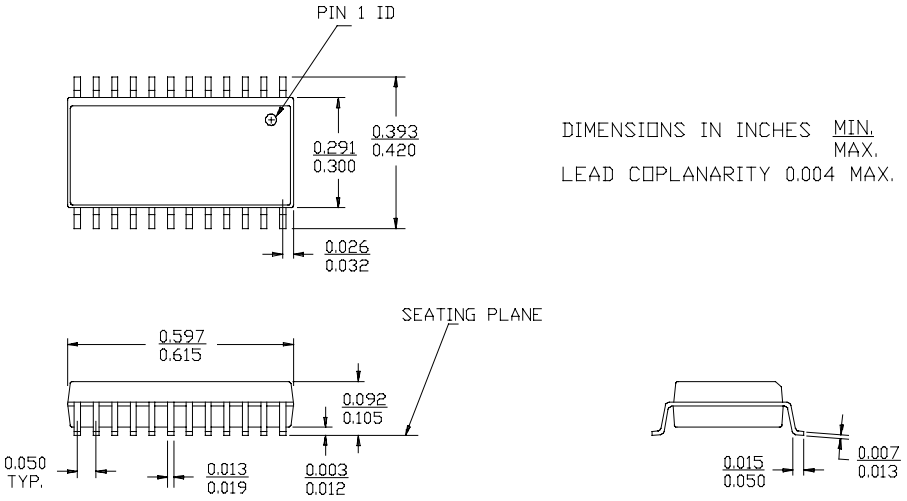


24-Lead Quarter Size Outline Q13



Package Diagrams (continued)

24-Lead (300-Mil) Molded SOIC S13



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