



High Speed CMOS 16-Bit Latched Transceiver

QS74FCT16543T
QS74FCT162543T

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: 0.5 ns $t_{SK(O)}$
- Flow-through pinout for easy layout
- Power off disable allows hot plugging
- Extended commercial temperature: -40°C to $+85^{\circ}\text{C}$
- Input hysteresis for noise immunity
- Multiple power and ground pins for low noise

FCT16543T

- High drive standard FCT-T outputs: $I_{OL} = +64 \text{ mA}$, $I_{OH} = -32 \text{ mA}$
- Incident switching for driving buses and large loads

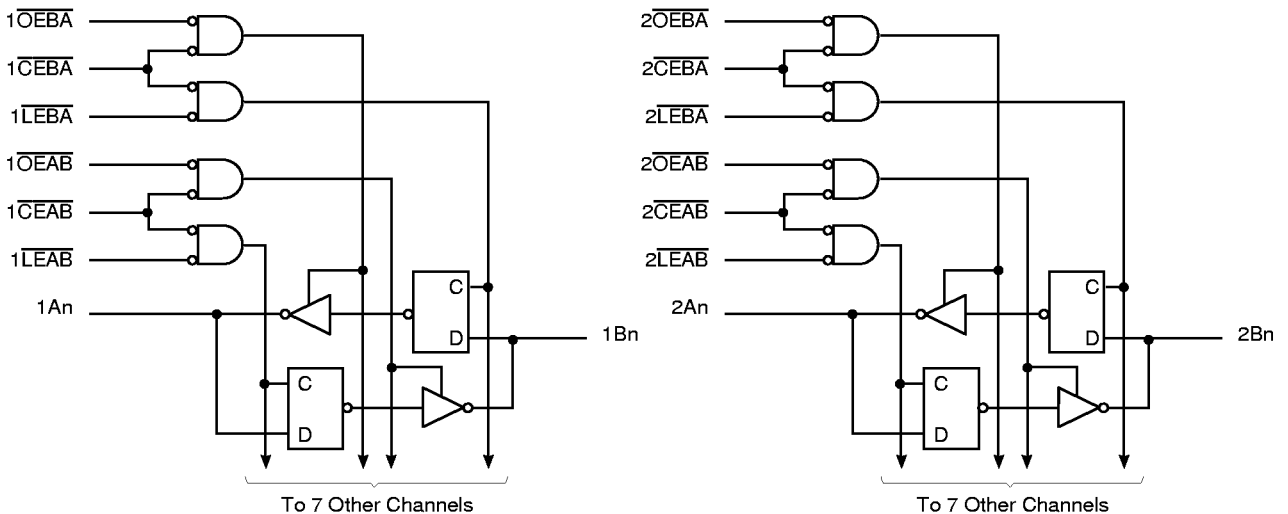
FCT162543T

- Balanced output drivers: $\pm 24 \text{ mA}$
- Reduced switching noise for point to point signals

DESCRIPTION

The FCT16543 family of products are 16-bit latched bus transceivers with three-state outputs that are ideal for driving address and data buses. Two independent 8-bit D-type latched transceivers are used with separate input and output control to permit independent control of data flow in either direction. 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) and many power and ground pins provide low ground bounce. To accommodate hot-plug or live insertion applications, both versions of this product were designed not to load an active bus when V_{CC} is removed. In applications where bus signals are point-to-point or driving light capacitance loads, the balanced drive FCT162543 is recommended.

FUNCTIONAL BLOCK DIAGRAM



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

SSOP, TSSOP

1 $\overline{\text{OEAB}}$	1	56	1 $\overline{\text{OEBA}}$
1 $\overline{\text{LEAB}}$	2	55	1 $\overline{\text{LEBA}}$
1 $\overline{\text{CEAB}}$	3	54	1 $\overline{\text{CEBA}}$
GND	4	53	GND
1A1	5	52	1B1
1A2	6	51	1B2
VCC	7	50	VCC
1A3	8	49	1B3
1A4	9	48	1B4
1A5	10	47	1B5
GND	11	46	GND
1A6	12	45	1B6
1A7	13	44	1B7
1A8	14	43	1B8
2A1	15	42	2B1
2A2	16	41	2B2
2A3	17	40	2B3
GND	18	39	GND
2A4	19	38	2B4
2A5	20	37	2B5
2A6	21	36	2B6
VCC	22	35	VCC
2A7	23	34	2B7
2A8	24	33	2B8
GND	25	32	GND
2 $\overline{\text{CEAB}}$	26	31	2 $\overline{\text{CEBA}}$
2 $\overline{\text{LEAB}}$	27	30	2 $\overline{\text{LEBA}}$
2 $\overline{\text{OEAB}}$	28	29	2 $\overline{\text{OEBA}}$

PIN DESCRIPTION

Name	Description
$\overline{\text{xOEAB}}$	A to B Output Enable Inputs (Active LOW)
$\overline{\text{xOEBA}}$	B to A Output Enable Inputs (Active LOW)
$\overline{\text{xCEAB}}$	A to B Enable Inputs (Active LOW)
$\overline{\text{xCEBA}}$	B to A Enable Inputs (Active LOW)
$\overline{\text{xLEAB}}$	A to B Latch Enable Inputs (Active LOW)
$\overline{\text{xLEBA}}$	B to A Latch Enable Inputs (Active LOW)
xAx	A to B Data Inputs or B to A 3-State Outputs
xBx	B to A Data Inputs or A to B 3-State Outputs

FUNCTION TABLE

Inputs			Latch Status	Output Buffers
$\overline{\text{xCEAB}}$	$\overline{\text{xLEAB}}$	$\overline{\text{xOEAB}}$	xAx to xBx	xBx
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

Notes:

- * = Before $\overline{\text{xLEAB}}$ LOW-to-HIGH Transition
 H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Don't Care
- A-to-B data flow shown: B-to-A flow control is the same, except using $\overline{\text{xCEBA}}$, $\overline{\text{xLEBA}}$, $\overline{\text{xOEBA}}$

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 $V_{IN} < 0$ V	-20 mA
DC Output Diode Current with $V_{OUT} < 0$ V	-50 mA
DC Output Current Max. Sink Current/Pin	120 mA
Maximum Power Dissipation	1.0 watts
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.

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	—	—	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 ⁽⁴⁾	—	100	—	mV
$ I_{IH} $ $ I_{IL} $	Input Current Input HIGH or LOW	$V_{CC} = \text{Max.}, 0 \leq V_{IN} < V_{CC}$	—	—	1	μA
$ I_{OZ} $	Off-State Output Current (Hi-Z)	$V_{CC} = \text{Max.}, 0 \leq V_{OUT} \leq V_{CC}$	—	—	1	μA
$ I_{OFF} $	Power off leakage	$V_{CC} = 0\text{V}, V_{IN}/\text{OUT} \leq 4.5\text{V}^{(5)}$	—	—	1	μA
I_{OS}	Short Circuit Current	$V_{CC} = \text{Max.}, V_{OUT} = \text{GND}^{(3,4)}$	-80	-140	-225	mA
V_{IK}	Input Clamp Voltage	$V_{CC} = \text{Min.}, I_{IN} = -18 \text{ mA}$	-	-0.7	-1.2	V

Notes:

1. For conditions shown as Max or Min use appropriate value specified under Recommended Operating Conditions for the applicable device type.
2. Typical values indicate $V_{CC} = 5.0\text{V}$ and $T_A = 25^\circ\text{C}$.
3. Not more than one output should be tested at one time. Duration of test should not exceed one second.
4. These parameters are guaranteed by design but not tested.
5. The test limit for this parameter is $\pm 5 \mu\text{A}$ at $T_A = -55^\circ\text{C}$

CAPACITANCE

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

Pins	Typ	Max	Unit
All	6.0	9.0	pF

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	Supply Voltage	4.5	5.5	V
V _{IN}	Input Voltage	0	V _{CC}	V
V _{OUT}	Voltage Applied to Output or I/O	0	V _{CC}	V
Δt/Δv	Input Transition Slew Rate	—	10	ns/V
T _A	Operating Free Air Temperature	-40	+85	°C

OUTPUT DRIVE CHARACTERISTICS FOR FCT16543T

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Unit	
V _{OH}	Output HIGH Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OH} = -3 mA	2.5	3.4	—	V
			I _{OH} = -15 mA	2.4	3.2	—	V
			I _{OH} = -32 mA ⁽⁴⁾	2.0	3.0	—	V
V _{OL}	Output LOW Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OL} = 64 mA	—	0.3	0.55	V

OUTPUT DRIVE CHARACTERISTICS FOR FCT162543T

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Unit	
I _{ODL}	Output LOW Current	V _{CC} = 5V, V _{IN} = V _{IH} or V _{IL} V _{OUT} = 1.5V ⁽³⁾	60	115	150	mA	
I _{ODH}	Output HIGH Current	V _{CC} = 5V, V _{IN} = V _{IH} or V _{IL} V _{OUT} = 1.5V ⁽³⁾	-60	-115	-150	mA	
V _{OH}	Output HIGH Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OH} = -24 mA	2.4	3.1	—	V
V _{OL}	Output LOW Voltage	V _{CC} = Min. V _{IN} = V _{IH} or V _{IL}	I _{OL} = 24 mA	—	0.3	0.55	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} = 5.0V and T_A = 25°C.
3. Not more than one output should be shorted and the duration is ≤1 second.
4. Duration of the condition should not exceed one second.

POWER SUPPLY CHARACTERISTICS - FCT16543T, FCT162543T

Symbol	Parameter	Test Conditions ⁽¹⁾		Typ ⁽²⁾	Max	Unit
I _{CC} L I _{CC} H I _{CC} Z	Quiescent Power Supply Current	V _{CC} = Max., V _{IN} = GND or V _{CC}		5	500	μA
ΔI _{CC}	Supply Current per Input @ TTL HIGH	V _{CC} = Max., V _{IN} = 3.4V ⁽³⁾		0.5	1.5	mA
Q _{CCD}	Supply Current per Input per MHz ⁽⁴⁾	V _{CC} = Max., Outputs Open One Bit Toggling @ 50% Duty Cycle \overline{xCEAB} and \overline{xOEAB} = GND, \overline{xCEBA} = V _{CC}	V _{IN} = V _{CC} V _{IN} = GND	75	120	μA/MHz
I _C	Total Power Supply Current ⁽⁶⁾	V _{CC} = Max., Outputs Open One Bit Toggling @ 50% Duty Cycle f _i = 10 MHz, \overline{xCEBA} = V _{CC} \overline{xLEAB} , \overline{xCEAB} and \overline{xOEAB} = GND,	V _{IN} = V _{CC} V _{IN} = GND	0.8	1.7	mA
			V _{IN} = 3.4V V _{IN} = GND	1.3	3.2	mA
		V _{CC} = Max., Outputs Open Sixteen Bits Toggling @ 50% Duty Cycle f _i = 2.5 MHz, \overline{xCEBA} = V _{CC} \overline{xLEAB} , \overline{xCEAB} and \overline{xOEAB} = GND,	V _{IN} = V _{CC} V _{IN} = GND	3.8	6.5 ⁽⁵⁾	mA
			V _{IN} = 3.4V V _{IN} = GND	8.3	20 ⁽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} = 5.0V, +25°C ambient.
- Per TTL driven input (V_{IN} = 3.4V). 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}.
 $I_C = I_{CCQ} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP} / 2 + f_i N_i)$.
 I_{CCQ} = Quiescent Current (I_{CC}L, I_{CC}H, and I_{CC}Z).
 ΔI_{CC} = Power Supply Current for a TTL-High Input (V_{IN} = 3.4V).
 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_{CP} = Clock Frequency for Register devices (Zero for Non-Register Devices).
 N_{CP} = Number of Clock Inputs at f_{CP}.
 f_i = Input Frequency.
 N_i = Number of Inputs at f_i.

QS74FCT16543T, QS74FCT162543T PRELIMINARY

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Recommended Operating Ranges apply unless otherwise specified.

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

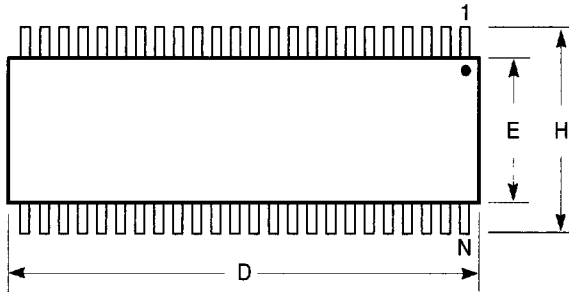
Symbol	Description ⁽¹⁾	FCT16543T FCT162543T		FCT16543AT FCT162543AT		FCT16543CT FCT162543CT		Unit
		Min	Max	Min	Max	Min	Max	
tPHL tPLH	Propagation Delay Transparent Mode xAx to xBx or xBx to xAx	1.5	8.5	1.5	6.5	1.5	5.3	ns
tPHL tPLH	Propagation Delay xLEBA to xAx, xLEAB to xBx	1.5	12.5	1.5	8.0	1.5	7.0	ns
tpZH tpZL	Output Enable Time xOEBA or xOEAB to xAx or xBx, xCEBA or xCEAB to xAx or xBx	1.5	12.0	1.5	9.0	1.5	8.0	ns
tPHZ tPLZ	Output Disable Time xOEBA or xOEAB to xAx or xBx, xCEBA or xCEAB to xAx or xBx	1.5	9.0	1.5	7.5	1.5	6.5	ns
tsu	Setup Time HIGH or LOW xAx or xBx to xLEBA or xLEAB	3.0	—	2.0	—	2.0	—	ns
tH	Hold Time HIGH or LOW xAx or xBx to xLEBA or xLEAB	2.0	—	2.0	—	2.0	—	ns
tw	Pulse Width LOW xLEBA or xLEAB	5.0	—	5.0	—	5.0	—	ns
tsk(o)	Output Skew ⁽²⁾	—	0.5	—	0.5	—	0.5	ns

Notes:

1. Minimums guaranteed but not tested. See Test Circuit and Waveforms.
2. Skew between any two outputs of the same package switching in the same direction.
This parameter is guaranteed by design but not tested.

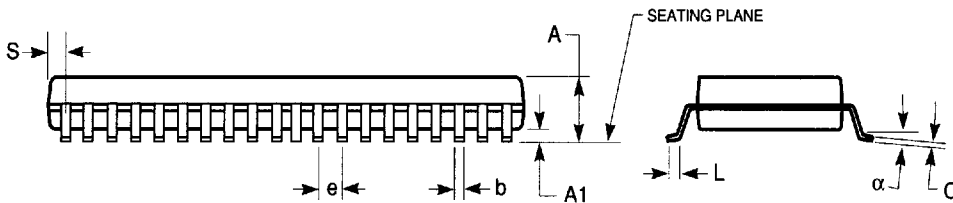
300-MIL SSOP - Package Code PV

**Shrink Small Outline Package
Plastic Small Outline Gull-Wing**



Notes:

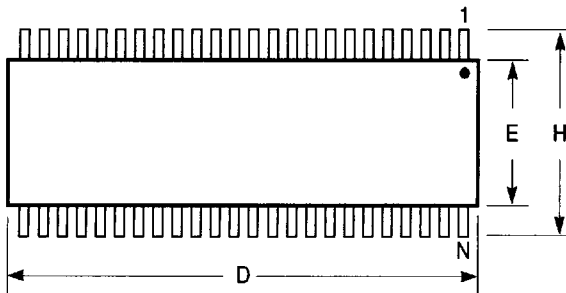
1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006in. per side.
5. Lead coplanarity is 0.004in. maximum.



JEDEC#	MO-118AA			MO-118AB		
DWG#	PSS-48B			PSS-56B		
Symbol	Min	Nom	Max	Min	Nom	Max
A	0.095	0.102	0.110	0.095	0.102	0.110
A1	0.008	0.012	0.016	0.008	0.012	0.016
b	0.008	0.010	0.0135	0.008	0.010	0.0135
C	0.005	0.008	0.010	0.005	0.008	0.010
D	0.620	0.625	0.630	0.720	0.725	0.730
E	0.291	0.295	0.299	0.291	0.295	0.299
e	0.025 BSC			0.025 BSC		
H	0.395	0.410	0.420	0.395	0.410	0.420
L	0.020	0.030	0.040	0.020	0.030	0.040
N	48			56		
alpha	0°	5°	8°	0°	5°	8°
S	0.022	0.025	0.028	0.022	0.025	0.028

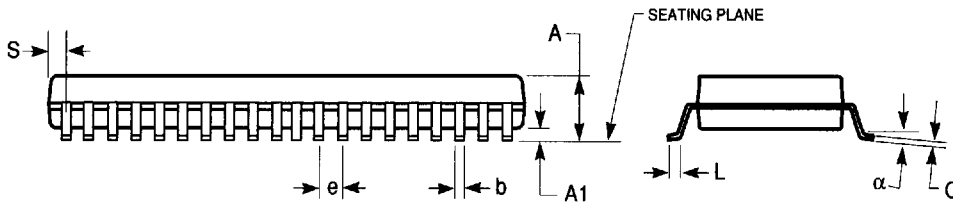
240-MIL TSSOP - Package Code PA

Thin Shrink Small Outline Package
Plastic Small Outline Gull-Wing



Notes:

1. Refer to applicable symbol list.
2. N is the number of lead positions.
3. Dimensions D, E, and S are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006 in. per side.
4. Lead coplanarity is 0.004in. maximum.



JEDEC#	MO-153ED			MO-153EE			MO-153ED			MO-153EE		
DWG#	PSS-48C			PSS-56C			PSS-48C			PSS-56C		
Symbol	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A	0.039	0.043	0.047	0.039	0.043	0.047	1.00	1.10	1.20	1.00	1.10	1.20
A1	0.002	0.004	0.006	0.002	0.004	0.006	0.05	0.10	0.15	0.05	0.10	0.15
b	0.006	0.008	0.011	0.006	0.008	0.011	0.17	0.20	0.27	0.17	0.20	0.27
C	0.004	0.006	0.008	0.004	0.006	0.008	0.09	0.15	0.20	0.09	0.15	0.20
D	0.488	0.492	0.496	0.547	0.551	0.555	12.40	12.50	12.60	13.90	14.00	14.10
E	0.236	0.240	0.244	0.236	0.240	0.244	6.00	6.10	6.20	6.00	6.10	6.20
e	0.0197 BSC			0.0197 BSC			0.50 BSC			0.50 BSC		
H	0.315	0.319	0.323	0.315	0.319	0.323	8.00	8.10	8.20	8.00	8.10	8.20
L	0.018	0.024	0.030	0.018	0.024	0.030	0.45	0.60	0.75	0.45	0.60	0.75
N	48			56			48			56		
alpha	0°	5°	8°	0°	5°	8°	0°	5°	8°	0°	5°	8°
S	0.015	0.020	0.025	0.006	0.010	0.014	0.38	0.50	0.65	0.15	0.25	0.35

DIMENSIONS IN INCHES

DIMENSIONS IN MILLIMETERS

7466803 0003757 T&T

QUALITY SEMICONDUCTOR, INC.