



3.3 Volt CMOS 8-Bit Buffers/Line Drivers

QS74FCT3540
QS74FCT3541
QS74FCT32540
QS74FCT32541

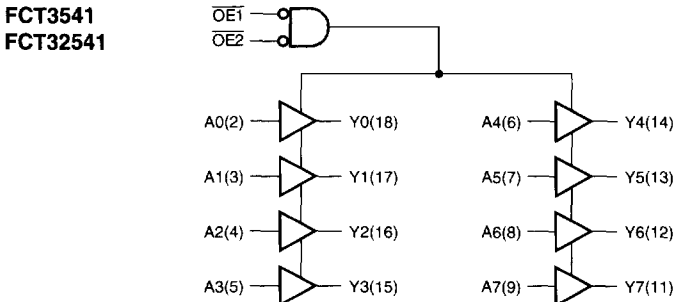
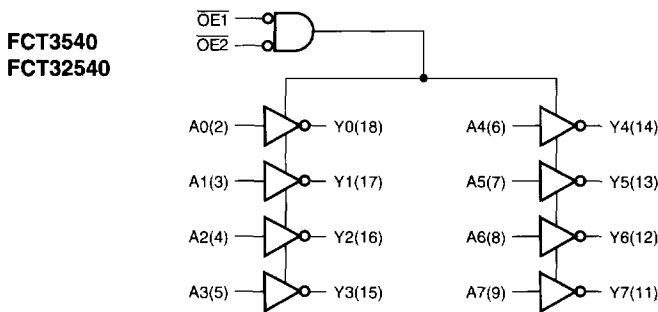
FEATURES/BENEFITS

- Pin and function compatible to the 74F540/1
74LVT540/1 and 74FCT540T/1T
- Available in SOIC and QSOP
- Undershoot clamp diodes on all inputs
- Ground bounce controlled outputs
- Low power QCMOS: 0.03 μ W typ static
- JEDEC spec compatible
- $I_{OL} = 24$ mA Com.
- TTL-compatible input and output levels
- Extended temperature -40°C to $+85^{\circ}\text{C}$
- 2.7V to 3.6V Supply Voltage
- 5V compatible input pins

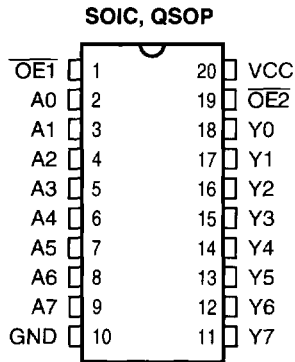
DESCRIPTION

The FCT3540 and FCT3541 are 8-bit buffers/line drivers 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). Input pins can be driven by 3.3V or 5V components allowing voltage transition in mixed supply systems. Ultra-low power QCMOS technology makes this product ideal for portable computing systems or communications devices.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATIONS (All Pins Top View)



PIN DESCRIPTION

| Name | I/O | Description |
|-------------------------------------|-----|---------------|
| A7-A0 | I | Data Inputs |
| Y7-Y0 | O | Data Outputs |
| $\overline{OE1}$, $\overline{OE2}$ | I | Output Enable |

FUNCTION TABLE

| $\overline{OE1}$ | $\overline{OE2}$ | Input A | 3540 | 3541 | Function |
|------------------|------------------|---------|----------|----------|-----------------|
| | | | Output Y | Output Y | |
| H | X | X | Hi-Z | Hi-Z | Disable Outputs |
| X | H | X | Hi-Z | Hi-Z | |
| L | L | L | H | L | Enable Outputs |
| L | L | H | L | H | |

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| | |
|---|--------------------------------|
| Supply Voltage to Ground | -0.5V to +4.6V |
| DC Output Voltage V_{OUT} | -0.5V to $V_{CC} + 0.5V^{(2)}$ |
| 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 $V_{IN} < 0$ | ± 20 mA |
| DC Output Diode Current with $V_{OUT} < 0$ | ± 50 mA |
| DC Output Current Max. Sink Current/Pin | ± 60 mA |
| Maximum Power Dissipation | 0.5 watts |
| T_{STG} Storage Temperature | -65° to +150°C |

Note:

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to this device resulting in functional or reliability type failures.
2. Not to exceed 4.6V

CAPACITANCE

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

| Pins | SOIC | QSOP | Unit |
|------------|------|------|------|
| 1, 19 | 4 | 4 | pF |
| 2-9, 11-18 | 8 | 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 | °C |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate ⁽¹⁾ | 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 ⁽¹⁾ | 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 |
| ΔV _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} = Max., 0 ≤ V _{IN} < V _{CC} | — | — | 1 | μA |
| I _{OZ} | Off-State Output Current (Hi-Z) | V _{CC} = Max., 0 ≤ V _{IN} ≤ V _{CC} | — | — | 5 | μA |
| I _{OS} | Short Circuit Current | V _{CC} = Max., V _{OUT} = GND ^(2,3) | -60 | — | -225 | mA |
| V _{IC} | Input Clamp Voltage | V _{CC} = Min., I _{IN} = -18 mA ⁽³⁾ | — | -0.7 | — | V |
| V _{OH} | Output HIGH Voltage | V _I = V _{IH} or V _{IL} , V _{CC} = Min, I _{OH} = -100 μA | V _{CC} -0.2 | — | — | V |
| | | V _I = V _{IH} or V _{IL} , V _{CC} = 3V, I _{OH} = -8 mA | 2.4 | — | — | V |
| V _{OL} | Output LOW Voltage (FCT3XXX) | V _I = V _{IH} or V _{IL} , V _{CC} = Min, I _{OL} = 100 μA | — | — | 0.2 | V |
| | | V _I = V _{IH} or V _{IL} , V _{CC} = 3V, I _{OL} = 16 mA | — | — | 0.4 | V |
| | | V _I = V _{IH} or V _{IL} , V _{CC} = 3V, I _{OL} = 24 mA | — | — | 0.5 | V |
| V _{OL} | Output LOW Voltage (FCT32XXX-25Ω) | V _I = V _{IH} or V _{IL} , V _{CC} = 3V, I _{OL} = 8 mA | — | — | 0.5 | V |
| R _{OUT} | Output Resistance ⁽⁴⁾ (FCT32XXX-25Ω) | V _{CC} = 3V, I _{OL} = 8 mA | — | 40 | — | Ω |

Notes:

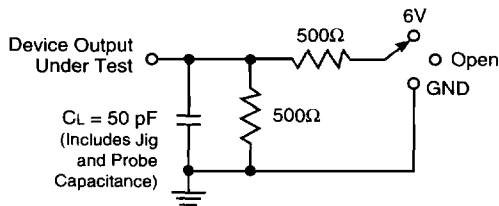
1. Typical values indicate V_{CC} = 3.3V and T_A = 25°C.
2. Not more than one output should be shorted and the duration is ≤1 second.
3. These parameters are guaranteed by design but not tested.
4. R_{OUT} represents total output impedance and includes added series termination resistance.

POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions ⁽¹⁾ | Min | Typ | Max | Unit |
|------------------|-------------------------------------|--|-----|------|-----|------------|
| I _{cc} | Quiescent Power Supply Current | V _{cc} = Max., freq = 0 0V ≤ V _{IN} ≤ 0.2V or V _{cc} -0.2V ≤ V _{IN} ≤ V _{cc} | — | 0.01 | 20 | μA |
| ΔI _{cc} | Supply Current per Input @ TTL HIGH | V _{cc} = Max., freq = 0, V _{IN} = V _{cc} - 0.6V | — | 1.0 | 20 | μA |
| Q _{cc0} | Supply Current per Input per MHz | V _{cc} = Max., Outputs Open and Enabled One Bit Toggling @ 50% Duty Cycle Other Inputs at GND or V _{cc} ^(2,3) | — | 40 | 85 | μA/ MHz |

Notes:

- For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
- For flip-flops, Q_{cc0} is measured by switching one of the data input pins so that the output changes every clock cycle. This 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_c can be computed using the above parameters as explained in the Technical Overview section.



| Test | Switch |
|------------------------------------|--------|
| t _{PHL} /t _{PLH} | Open |
| t _{PZL} /t _{PLZ} | 6V |
| t _{PZH} /t _{PHZ} | GND |

Load Circuit for Outputs

Notes

- Input pulse characteristics: 0V to 2.7V, t_r = t_f = 2.5 ns (10% to 90%), transition measured at 1.5V, pulse generator Z_{out} = 50Ω.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Recommended operating conditions apply unless otherwise specified.

FCT3540/32540

| Symbol | Description ⁽¹⁾ | 3540, 32540 (V _{CC} = 3.3V ± 0.3V) | | 3540A, 32540A (V _{CC} = 3.3V ± 0.3V) | | Unit |
|--------------------------------------|--|--|-----|--|-----|------|
| | | Min | Max | Min | Max | |
| t _{PLH} t _{PHL} | Propagation Delay A _i to Y _i , FCT3540 | 1.5 | 8.5 | 1.5 | 4.8 | ns |
| t _{PLH} t _{PHL} | Propagation Delay A _i to Y _i , FCT32540 | 1.5 | 8.5 | 1.5 | 4.8 | ns |
| t _{PZH} t _{PZL} | Output Enable \overline{OE} to Y _i , FCT3540 | 1.5 | 10 | 1.5 | 6.2 | ns |
| t _{PZH} t _{PZL} | Output Enable \overline{OE} to Y _i , FCT32540 | 1.5 | 10 | 1.5 | 6.2 | ns |
| t _{PLZ} t _{PHZ} | Disable Time ⁽²⁾ | 1.5 | 9.5 | 1.5 | 5.6 | ns |

Notes:

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

FCT3541/32541

| Symbol | Description ⁽¹⁾ | 3541, 32541 (V _{CC} = 3.3V ± 0.3V) | | 3541A, 32541A (V _{CC} = 3.3V ± 0.3V) | | Unit |
|--------------------------------------|--|--|-----|--|-----|------|
| | | Min | Max | Min | Max | |
| t _{PLH} t _{PHL} | Propagation Delay A _i to Y _i , FCT3541 | 1.5 | 8 | 1.5 | 4.8 | ns |
| t _{PLH} t _{PHL} | Propagation Delay A _i to Y _i , FCT32541 | 1.5 | 8 | 1.5 | 4.8 | ns |
| t _{PZH} t _{PZL} | Output Enable \overline{OE} to Y _i , FCT3541 | 1.5 | 10 | 1.5 | 6.2 | ns |
| t _{PZH} t _{PZL} | Output Enable ⁽²⁾ \overline{OE} to Y _i , FCT32541 | 1.5 | 10 | 1.5 | 6.2 | ns |
| t _{PLZ} t _{PHZ} | Disable Time ⁽²⁾ | 1.5 | 9.5 | 1.5 | 5.6 | ns |

Notes:

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