

FEATURES/BENEFITS

- Pin and function compatible to the Am2952/3 29FCT52/53 and 29FCT52/53T
- Industrial temperature -40°C to 85°C
- CMOS power levels: $<7.5\text{mW}$ static
- Available in DIP, ZIP, SOIC, QSOP, HQSOP
- Undershoot clamp diodes on all inputs
- TTL-compatible input and output levels
- Ground bounce controlled outputs
- Reduced output swing of 0-3.5V
- Military product compliant to MIL-STD-883, Class B

FCT-T 2952T, 2953T

- JEDEC-FCT spec compatible
- A, B, and C speed grades with 5.5ns t_{PD} for C
- $I_{OL} = 64\text{mA}$ Ind., 48mA Mil.

FCT-T 2052T

- Built-in 25Ω series resistor outputs reduce reflection and other system noise
- A, B, and C speed grades with 5.5ns t_{PD} for C speed guaranteed with 50pF loads

DESCRIPTION

The QS29FCT52/53T are 8-bit high-speed CMOS TTL-compatible registered bus transceivers with three-state outputs that are ideal for driving high capacitance loads such as memory and address buses. The QS29FCT2052T device is a 25Ω resistor output version useful for driving transmission lines and reducing system noise. The FCT2052 series part can replace the FCT52/FCT53 series to reduce noise in an existing design. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression, and will not load an active bus when V_{CC} is removed from the device.

Figure 1. Functional Block Diagram

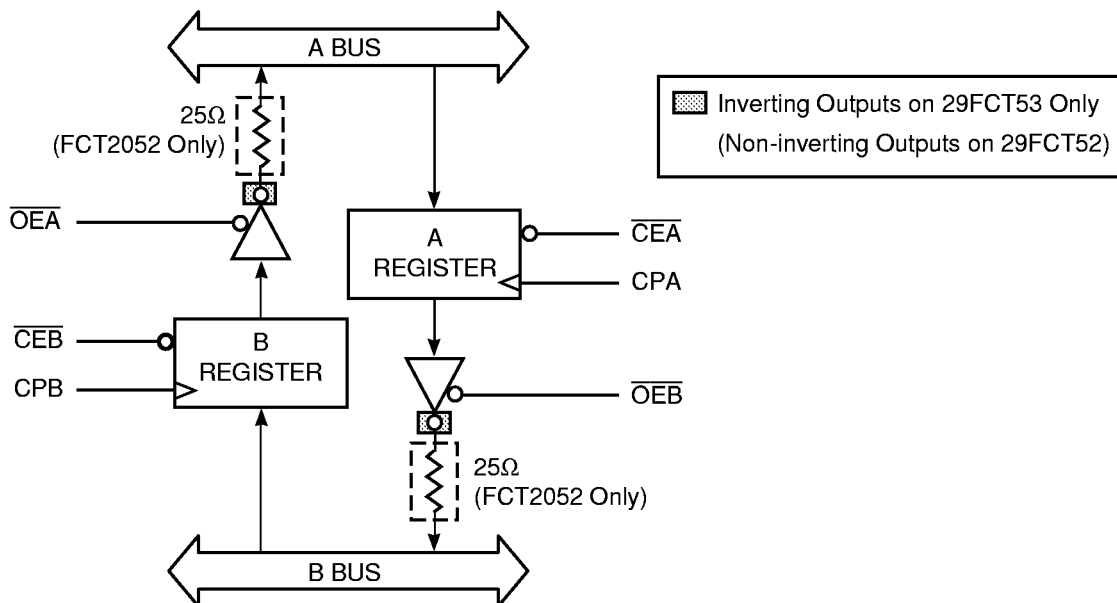
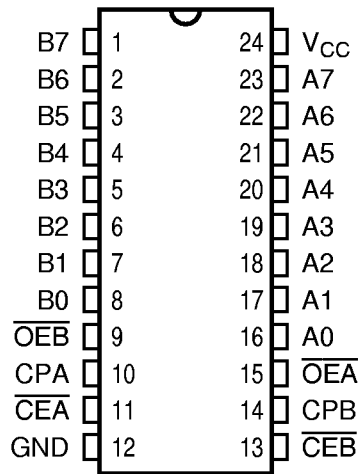


Figure 2. Pin Configurations (All Pins Top View)

PDIP, SOIC, QSOP, HQSOP



ZIP

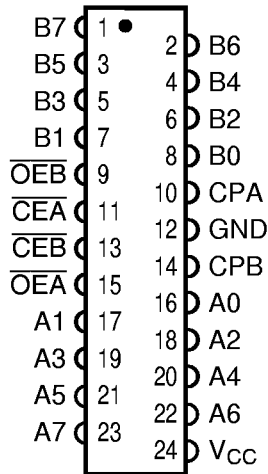


Table 1. Pin Description

| Name | I/O | Description |
|-------------------------|-----|--------------------------------|
| A7-A0 | I/O | A Bus |
| B7-B0 | I/O | B Bus |
| CPA | I | Register A Clock Input |
| CPB | I | Register B Clock Input |
| $\overline{\text{CEA}}$ | I | Register A Clock Enable |
| $\overline{\text{CEB}}$ | I | Register B Clock Enable |
| $\overline{\text{OEA}}$ | I | Output Enable, Reg. B to Bus A |
| $\overline{\text{OEB}}$ | I | Output Enable, Reg. A to Bus B |

Table 2. Function Tables

| Inputs | | | | | | Outputs | |
|--------|-----|------------------|------------------|------------------|------------------|---------|--------|
| CPA | CPB | \overline{CEA} | \overline{CEB} | \overline{OEA} | \overline{OEB} | A7-A0 | B7-B0 |
| X | X | X | X | H | L | Hi-Z | Reg. A |
| X | X | X | X | L | H | Reg. B | Hi-Z |
| X | X | X | X | H | H | Hi-Z | Hi-Z |
| X | X | X | X | L | L | Reg. B | Reg. A |

| Inputs | | | | Outputs | |
|--------|-----|------------------|------------------|---------|-------|
| CPA | CPB | \overline{CEA} | \overline{CEB} | A7-A0 | B7-B0 |
| X | X | H | H | Hold | Hold |
| ↑ | X | L | H | Load | Hold |
| X | ↑ | H | L | Hold | Load |
| X | ↑ | L | L | X | Load |
| ↑ | X | L | L | Load | X |

Table 3. 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 $V_{IN} < 0$ | -20mA |
| DC Output Diode Current with $V_{OUT} < 0$ | -50mA |
| DC Output Current Max. Sink Current/Pin | 120mA |
| Maximum Power Dissipation | 0.5 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.

Table 4. Capacitance⁽¹⁾

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

| Pins ⁽²⁾ | SOIC | QSOP | PDIP | ZIP | Unit |
|---------------------|------|------|------|-----|------|
| 1-11, 13-23 | 8 | 8 | 9 | 10 | pF |

Notes:

1. Capacitance is characterized but not tested.
2. Pin reference for 24-pin package.

Table 5. DC Electrical Characteristics Over Operating Range

Industrial $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{CC} = 5.0\text{V} \pm 5\%$

Military $T_A = -55^{\circ}\text{C}$ to 125°C , $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol | Parameter | Test Conditions | Min | Typ ⁽¹⁾ | 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 | — | 0.2 | — | V |
| $ I_{IH} $ $ I_{IL} $ | Input Current Input HIGH or LOW | $V_{CC} = \text{Max.}, 0 \leq V_{IN} < V_{CC}$ | — | — | 5 | μA |
| $ I_{OZ} $ | Off-State Output Current (Hi-Z) | $V_{CC} = \text{Max.}, 0 \leq V_{IN} \leq V_{CC}$ | — | — | 5 | μA |
| I_{OS} | Short Circuit Current (FCTXXX) | $V_{CC} = \text{Max.}, V_{OUT} = \text{GND}^{(2,3)}$ | -60 | — | — | mA |
| I_{OR} | Current Drive (FCT2XXX - 25 Ω) | $V_{CC} = \text{Max.}, V_{OUT} = 2.0\text{V}^{(3)}$ | 50 | — | — | mA |
| V_{IC} | Input Clamp Voltage | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}, T_A = 25^{\circ}\text{C}^{(3)}$ | — | -0.7 | -1.2 | V |
| V_{OH} | Output HIGH Voltage | $V_{CC} = \text{Min.}, I_{OH} = -12\text{mA (MIL)}$ $I_{OH} = -15\text{mA (IND)}$ | 2.4 2.4 | — — | — — | V |
| V_{OL} | Output LOW Voltage (FCTXXX) | $V_{CC} = \text{Min.}, I_{OL} = 48\text{mA (MIL)}$ $I_{OL} = 64\text{mA (IND)}$ | — — | — — | 0.55 0.55 | V |
| V_{OL} | Output LOW Voltage (FCT2XXX - 25 Ω) | $V_{CC} = \text{Min.}, I_{OL} = 12\text{mA (MIL)}$ $I_{OL} = 12\text{mA (IND)}$ | — — | — — | 0.50 0.50 | V |
| R_{OUT} | Output Resistance (FCT2XXX - 25 Ω) | $V_{CC} = \text{Min.}, I_{OL} = 12\text{mA (MIL)}$ $I_{OL} = 12\text{mA (IND)}$ | — 20 | 25 28 | — 40 | Ω |

Notes:

1. Typical values indicate $V_{CC} = 5.0\text{V}$ and $T_A = 25^{\circ}\text{C}$.
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.

Table 6. Power Supply Characteristics

| Symbol | Parameter | Test Conditions ⁽¹⁾ | Min | Max | Unit |
|-----------------|-------------------------------------|--|-----|------|------------|
| I_{CC} | Quiescent Power Supply Current | $V_{CC} = \text{Max.}$, freq = 0 $0V \leq V_{IN} \leq 0.2V$ or $V_{CC}-0.2V \leq V_{IN} \leq V_{CC}$ | — | 1.5 | mA |
| ΔI_{CC} | Supply Current per Input @ TTL HIGH | $V_{CC} = \text{Max.}$, $V_{IN} = 3.4V$, freq = 0 ⁽²⁾ | — | 2.0 | mA |
| Q_{CCD} | Supply Current per Input per MHz | $V_{CC} = \text{Max.}$, Outputs Open and Enabled One Bit Toggling @ 50% Duty Cycle Other Inputs at GND or V_{CC} ^(3,4) | — | 0.25 | mA/ MHz |

Notes:

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input ($V_{IN} = 3.4V$).
3. For flip-flops, Q_{CCD} 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.
4. I_C can be computed using the above parameters as explained in the Technical Overview section.

Table 7. Switching Characteristics Over Operating Range

Industrial $T_A = -40^\circ\text{C}$ to 70°C , $V_{CC} = 5.0\text{V} \pm 5\%$

Military $T_A = -55^\circ\text{C}$ to 125°C , $V_{CC} = 5.0\text{V} \pm 10\%$

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

| Symbol | Description | | 52/53A 2052A | | 52/53B 2052B | | 52/53C 2052C | | Unit |
|-----------|---|-----|-----------------|------|-----------------|-----|-----------------|-----|------|
| | | | Min | Max | Min | Max | Min | Max | |
| t_{PHL} | Propagation Delay ⁽¹⁾ | Ind | 2 | 10 | 2 | 6.5 | 2 | 5.8 | ns |
| t_{PLH} | CP to Ai, Bi, 52/53 | Mil | 2 | 11 | 2 | 7.2 | 0 | 6.8 | |
| t_{PHL} | Propagation Delay ⁽¹⁾ | Ind | 2 | 10 | 2 | 6.5 | 2 | 5.8 | ns |
| t_{PLH} | CP to Ai, Bi, 2052 | Mil | 2 | 11 | 2 | 7.2 | 0 | 6.8 | |
| t_{PZH} | Output Enable Time ⁽¹⁾ | Ind | 1.5 | 10.5 | 1.5 | 6.5 | 1.5 | 6.5 | ns |
| t_{PZL} | \overline{OE} to Ai, Bi, 52/53 | Mil | 1.5 | 13 | 1.5 | 7.5 | 1.5 | 7.5 | |
| t_{PZH} | Output Enable Time ⁽¹⁾ | Ind | 1.5 | 10.5 | 1.5 | 7.0 | 1.5 | 7.0 | ns |
| t_{PZL} | \overline{OE} to Ai, Bi, 2052 | Mil | 1.5 | 13 | 1.5 | 7.5 | 1.5 | 7.5 | |
| t_{PHZ} | Output Disable Time ^(1,2) | Ind | 2 | 10 | 2 | 5.5 | 1.5 | 5.5 | ns |
| t_{PLZ} | \overline{OE} to Ai, Bi | Mil | 2 | 11 | 2 | 6.5 | 1.5 | 6.5 | |
| t_S | Data Setup Time Ai, Bi, to CP | Ind | 2 | — | 2 | — | 2 | — | ns |
| | | Mil | 2.5 | — | 2 | — | 2 | — | |
| t_H | Data Hold Time Ai, Bi, to CP | Ind | 2 | — | 1.5 | — | 1.5 | — | ns |
| | | Mil | 2 | — | 1.5 | — | 1.5 | — | |
| t_{SCE} | Clock Enable Setup Time, \overline{CE} to CP | Ind | 2 | — | 2 | — | 2 | — | ns |
| | | Mil | 2 | — | 2 | — | 2 | — | |
| t_{HCE} | Clock Enable Hold Time, \overline{CE} to CP | Ind | 2 | — | 2 | — | 2 | — | ns |
| | | Mil | 2 | — | 2 | — | 2 | — | |
| t_W | Clock Pulse Width ⁽²⁾ HIGH or LOW | Ind | 3 | — | 3 | — | 3 | — | ns |
| | | Mil | 3 | — | 3 | — | 3 | — | |

Notes:

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