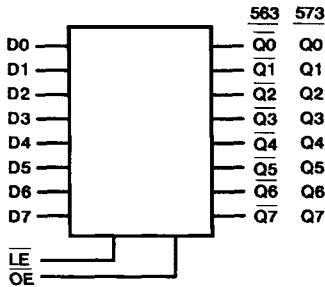


CD54/74FCT563, CD54/74FCT563AT CD54/74FCT573, CD54/74FCT573AT

July 1990



FUNCTIONAL DIAGRAM

Octal Transparent Latch, 3-State

CD54/74FCT563, CD54/74FCT563AT - Inverting
CD54/74FCT573, CD54/74FCT573AT - Non-Inverting

Type Features:

- Buffered inputs
- Typical propagation delay:
3.9ns @ VCC = 5V, TA = +25°C, CL = 50pF (FCT573AT)

The CD54/74FCT563, 563AT, 573 and 573AT octal transparent latches use a small-geometry BICMOS technology. The output stage is a combination of bipolar and CMOS transistors that limits the output-HIGH level to two diode drops below VCC. This resultant lowering of output swing (0V to 3.7V) reduces power bus ringing (a source of EMI) and minimizes VCC bounce and ground bounce and their effects during simultaneous output switching. The output configuration also enhances switching speed and is capable of sinking 32 to 48 milliamperes.

The CD54/74FCT563, 563AT, 573 and 573AT outputs are transparent to the inputs when the Latch Enable (\overline{LE}) is HIGH. When the Latch Enable (\overline{LE}) goes LOW, the data is latched. The Output Enable (\overline{OE}) controls the 3-state outputs. When the Output Enable (\overline{OE}) is HIGH, the outputs are in the high-impedance state. The latch operation is independent of the state of the Output Enable.

The CD54/74FCT563, 563AT, 573 and 573AT are supplied in 20-lead dual-in-line plastic packages (E suffix) and in 20-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over two temperature ranges: Commercial (0°C to +70°C) and Extended Industrial (-55°C to +125°C).

The CD54FCT563 and 573 are also available in chip form (H suffix). These unpackaged devices are operable over the -55°C to +125°C temperature range.

Family Features:

- SCR-latchup-resistant BICMOS process and circuit design
- FCTXXX Types - Speed of bipolar FAST*/AS/S;
- FCTXXXAT Types - 30% faster than FAST/AS/S with significantly reduced power consumption
- 48/32-mA output sink current (commercial/extended industrial)
- Output voltage swing limited to 3.7V @ VCC = 5V
- Controlled output-edge rates
- Input/output isolation to VCC
- BICMOS technology with low quiescent power

* FAST is a registered trademark of Fairchild Semiconductor Corp.

TRUTH TABLE

| OUTPUT ENABLE | LATCH ENABLE | DATA | 563, 563AT OUTPUT | 573, 573AT OUTPUT |
|---------------|--------------|------|-------------------|-------------------|
| L | H | H | L | H |
| L | H | L | H | L |
| L | L | l | H | L |
| L | L | h | L | H |
| H | X | X | Z | Z |

H = High voltage level.

L = Low voltage level.

l = Low voltage level one set-up time prior to the high-to-low latch enable transition.

h = High voltage level one set-up time prior to the high-to-low latch enable transition.

X = Irrelevant.

Z = High-impedance.

4

TECHNICAL DATA

MAXIMUM RATINGS, Absolute-Maximum Values:

| | | |
|--|-------|------------------------------------|
| DC SUPPLY-VOLTAGE (VCC) | ..... | -0.5V to 6V |
| DC INPUT DIODE CURRENT, I _{IK} (for V _I < -0.5V) | ..... | -20mA |
| DC OUTPUT DIODE CURRENT, I _{OK} (for V _O < -0.5V) | ..... | -50mA |
| DC OUTPUT SINK CURRENT per Output Pin, I _O | ..... | +70mA |
| DC OUTPUT SOURCE CURRENT per Output Pin, I _O | ..... | -30mA |
| DC VCC CURRENT (I _{CC}) | ..... | 140mA |
| DC GROUND CURRENT (I _{GND}) | ..... | 400mA |
| POWER DISSIPATION PER PACKAGE (PD): | | |
| For TA = -55°C to +100°C (PACKAGE TYPE E) | ..... | 500mW |
| For TA = +100°C to +125°C (PACKAGE TYPE E) | ..... | Derate Linearly at 8mW/°C to 300mW |
| For TA = -55°C to +70°C (PACKAGE TYPE M) | ..... | 400mW |
| For TA = +70°C to +125°C (PACKAGE TYPE M) | ..... | Derate Linearly at 6mW/°C to 70mW |
| OPERATING-TEMPERATURE RANGE (TA): | | |
| PACKAGE TYPE E, M | ..... | -55°C to +125°C |
| STORAGE TEMPERATURE (T _{stg}) | ..... | -65°C to +150°C |
| LEAD TEMPERATURE (DURING SOLDERING): | | |
| At distance 1/16 in. ± 1/32 in. (1.59mm ± 0.79mm) from case for 10s maximum | ..... | +265°C |
| Unit inserted into PC board min. thickness 1/16 in. (1.59mm) with solder contacting lead tips only | ..... | +300°C |

RECOMMENDED OPERATING CONDITIONS:

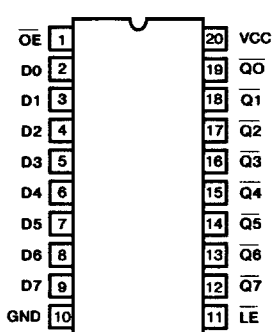
The following are normal operating ranges for these devices. For maximum reliability, devices should always be operated within these ranges.

| CHARACTERISTIC | LIMITS | | UNITS |
|--|--------|-------|-------|
| | MIN | MAX | |
| Supply-Voltage Range, VCC*: CD74 Series, TA = 0°C to 70°C | 4.75 | 5.25 | V |
| CD54 Series, TA = -55°C to +125°C | 4.5 | 5.5 | V |
| DC Input Voltage, V _I | 0 | VCC | V |
| DC Output Voltage, V _O | 0 | ≤ VCC | V |
| Operating Temperature, TA | -55 | +125 | °C |
| Input Rise and Fall Slew Rate, dt/dv | 0 | 10 | ns/V |

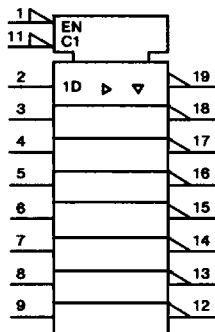
* Unless otherwise specified, all voltages are referenced to ground.

CD54/74FCT563, CD54/74FCT563AT TYPES

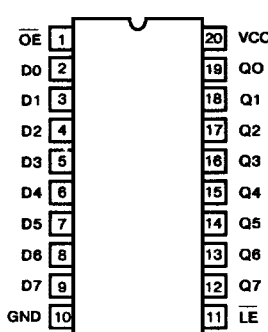
CD54/74FCT573, CD54/74FCT573AT TYPES



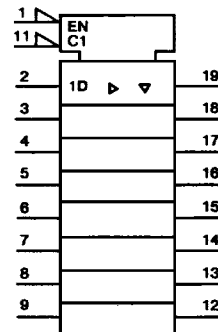
TERMINAL ASSIGNMENT



IEC LOGIC SYMBOL



TERMINAL ASSIGNMENT



IEC LOGIC SYMBOL

STATIC ELECTRICAL CHARACTERISTICS

FCT Series: 74FCT Commercial Temperature Range, 0°C to +70°C; VCC max = 5.25V, VCC min = 4.75V

54FCT Extended Industrial Temperature Range, -55°C to +125°C; VCC max = 5.5V, VCC min = 4.5V

| CHARACTERISTICS | | TEST CONDITIONS | | | AMBIENT TEMPERATURE (TA) | | | | | | UNITS |
|---|-----------------|----------------------|---------|------------|--------------------------|------|--------------|------|-----------------|------|-------|
| | | VI (V) | IO (mA) | VCC (V) | +25°C | | 0°C to +70°C | | -55°C to +125°C | | |
| | | | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| High-Level Input Voltage | VIH | | | 4.5 to 5.5 | 2 | - | 2 | - | 2 | - | V |
| Low-Level Input Voltage | VIL | | | 4.5 to 5.5 | - | 0.8 | - | 0.8 | - | 0.8 | V |
| High-Level Output Voltage | VOH | VIH or VIL | -15 | MIN | 2.4 | - | 2.4 | - | - | - | V |
| | | | -12 | MIN | 2.4 | - | - | - | 2.4 | - | V |
| Low-Level Output Voltage | VOL | VIH or VIL | 48 | MIN | - | 0.55 | - | 0.55 | - | - | V |
| | | | 32 | MIN | - | 0.55 | - | - | - | 0.55 | V |
| High-Level Input Current | I _{IH} | VCC | | MAX | - | 0.1 | - | 1 | - | 1 | μA |
| Low-Level Input Current | I _{IL} | GND | | MAX | - | -0.1 | - | -1 | - | -1 | μA |
| 3-State Leakage Current | IOZH | VCC | | MAX | - | 0.5 | - | 10 | - | 10 | μA |
| | | GND | | MAX | - | -0.5 | - | -10 | - | -10 | μA |
| Short-Circuit Output Current * | IOS | VCC or GND VO = 0 | | MAX | -60 | - | -60 | - | -60 | - | mA |
| Input Clamp Voltage | V _{IK} | VCC or GND | -18 | MIN | - | -1.2 | - | -1.2 | - | -1.2 | V |
| Quiescent Supply Current, MSI | ICC | VCC or GND | 0 | MAX | - | 8 | - | 80 | - | 500 | μA |
| Additional Quiescent Supply Current per Input Pin TTL Inputs High, 1 Unit Load | ΔICC | 3.4V † | | MAX | - | 1.6 | - | 1.6 | - | 2 | mA |

* Not more than one output should be shorted at one time. Test duration should not exceed 100ms.

† Inputs that are not measured are at VCC or GND.

FCT Input Loading: All inputs are 1 unit load. Unit load is ΔICC limit specified in Static Characteristics Chart, e.g., 1.6mA max. @ +70°C.

PREREQUISITE FOR SWITCHING

| CHARACTERISTICS | SYMBOL | V _{CC} (V) | CD54/74FCT563, 573 | | | | | | CD54/74FCT563AT, 573AT | | | | | | UNITS |
|------------------------------------|-----------------|------------------------|---------------------------------------|-----|--------------|-----|-----------------|-----|------------------------|-----|--------------|-----|-----------------|--|-------|
| | | | AMBIENT TEMPERATURE (T _A) | | | | | | | | | | | | |
| | | | +25°C | | 0°C to +70°C | | -55°C to +125°C | | +25°C | | 0°C to +70°C | | -55°C to +125°C | | |
| | | | TYP | MIN | MAX | MIN | MAX | TYP | MIN | MAX | MIN | MAX | | | |
| \overline{LE} Pulse Width | t _W | 5† | - | 6 | - | 6 | - | - | 5 | - | 6 | - | ns | | |
| Setup Time Data to \overline{LE} | t _{SU} | 5 | - | 2 | - | 2 | - | - | 2 | - | 1.5 | - | ns | | |
| Hold Time Data to \overline{LE} | t _H | 5 | - | 1.5 | - | 1.5 | - | - | 1.5 | - | 2 | - | ns | | |

†5V: min. is @ 4.5V

5V: min. is @ 4.75V for 0°C to +70°C

typ is @ 5V

SWITCHING CHARACTERISTICS: t_r, t_f = 2.5ns, C_L = 50pF, R_L = See Figure 4

| CHARACTERISTICS | SYMBOL | V _{CC} (V) | CD54/74FCT563, 573 | | | | | | CD54/74FCT563AT*, 573AT | | | | | | UNITS | |
|--|-----------------|-------------------------------------|---------------------------------------|------------|--------------|-----|-----------------|------|-------------------------|------------|--------------|-----|-----------------|----|-------|----|
| | | | AMBIENT TEMPERATURE (T _A) | | | | | | | | | | | | | |
| | | | +25°C | | 0°C to +70°C | | -55°C to +125°C | | +25°C | | 0°C to +70°C | | -55°C to +125°C | | | |
| | | | TYP | MIN | MAX | MIN | MAX | TYP | MIN | MAX | MIN | MAX | | | | |
| Propagation Delays: Data to Outputs | FCT563/AT | t _{PLH} , t _{PHL} | 5† | 5 | 1.5 | 8 | 1.5 | 8.5 | | | | | | ns | | |
| | FCT573/AT | t _{PLH} , t _{PHL} | 5 | 5 | 1.5 | 8 | 1.5 | 8.5 | 3.9 | 1.5 | 5.7 | 1.5 | 6.5 | ns | | |
| \overline{LE} to Outputs | FCT563/AT | t _{PLH} , t _{PHL} | 5 | 9 | 1.5 | 13 | 1.5 | 14 | | | | | | ns | | |
| | FCT573/AT | t _{PLH} , t _{PHL} | 5 | 9 | 2 | 13 | 2 | 15 | 4.4 | 2 | 7 | 2 | 7.5 | ns | | |
| Output Enable Times | FCT563/AT | t _{PZL} , t _{PZH} | 5 | 6.5 | 1.5 | 11 | 1.5 | 12.5 | | | | | | ns | | |
| | FCT573/AT | t _{PZL} , t _{PZH} | 5 | 7 | 1.5 | 12 | 1.5 | 13.5 | 6 | 1.5 | 8 | 1.5 | 9.5 | ns | | |
| Output Disable Times | FCT563/AT | t _{PLZ} , t _{PHZ} | 5 | 5.6 | 1.5 | 7 | 1.5 | 8.5 | | | | | | ns | | |
| | FCT573/AT | t _{PLZ} , t _{PHZ} | 5 | 6 | 1.5 | 7.5 | 1.5 | 10 | 4 | 1.5 | 5.8 | 1.5 | 6.5 | ns | | |
| Power Dissipation Capacitance | FCT563/AT | CPD § | - | 34 Typical | | | | | | 34 Typical | | | | | | pF |
| | FCT573/AT | CPD § | - | 34 Typical | | | | | | 34 Typical | | | | | | pF |
| Min. (Valley) VOHV During Switching of Other Outputs (Output Under Test Not Switching) | VOHV See Fig. 1 | 5 | 0.5 Typical @ +25°C | | | | | | | | | | V | | | |
| Max. (Peak) VOLP During Switching of Other Outputs (Output Under Test Not Switching) | VOLP See Fig. 1 | 5 | 1 Typical @ +25°C | | | | | | | | | | V | | | |
| Input Capacitance | CI | - | - | - | 10 | - | 10 | - | - | 10 | - | 10 | pF | | | |
| 3-State Output Capacitance | CO | - | - | - | 15 | - | 15 | - | - | 15 | - | 15 | pF | | | |

†5V: min. is @ 5.5V

max. is @ 4.5V

5V: min. is @ 5.25V for 0°C to +70°C

max. is @ 4.75V for 0°C to +70°C

typ is @ 5V

§CPD, measured per function, is used to determine the dynamic power consumption.

PD (per package) = V_{CC} ICC + Σ (V_{CC}² fi CPD + VO² to CL + V_{CC} ΔICC D) where:V_{CC} = supply voltage

ΔICC = flow through current x unit load

CL = output load capacitance

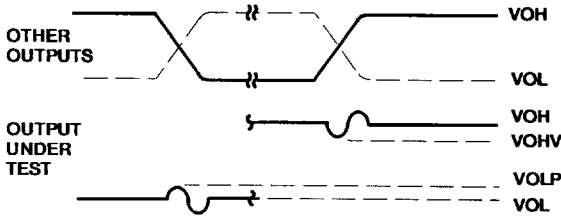
D = duty cycle of input high

fo = output frequency

fi = input frequency

* Contact local Sales Office for availability

PARAMETER MEASUREMENT INFORMATION



NOTES:

1. VOLP is measured with respect to a ground reference near the output under test. VOHV is measured with respect to VOH.
2. Input pulses have the following characteristics:
PRR ≤ 1MHz, tr = 2.5ns, tf = 2.5ns, skew 1ns.
3. R.F. fixture with 700-MHz design rules required. IC should be soldered into test board and bypassed with 0.1µF capacitor. Scope and probes require 700-MHz bandwidth.

Figure 1 - Simultaneous switching transient waveforms.

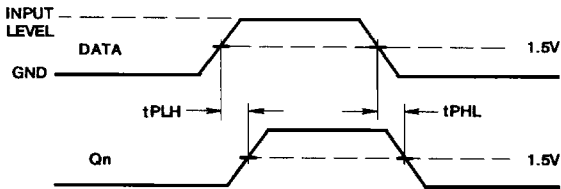
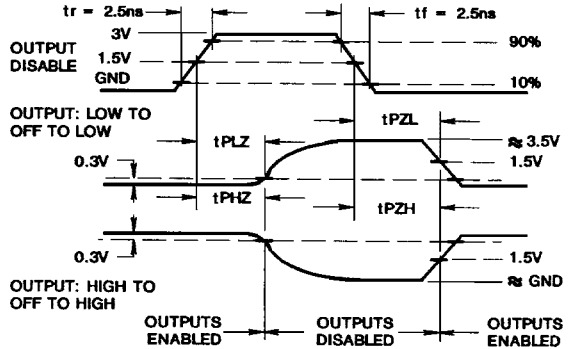
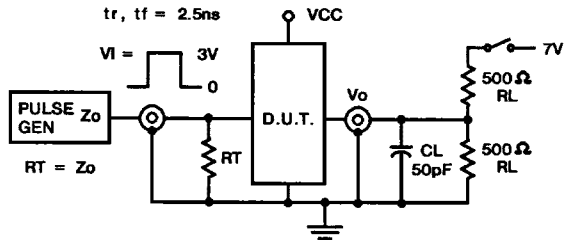


Figure 2 - Data to Qn output propagation delays.



| TEST | SWITCH POSITION |
|------------------------|-----------------|
| tPLZ, tPZL, OPEN DRAIN | CLOSED |
| tPHZ, tPZH, tPLH, tPHL | OPEN |

Figure 4 - Three-state propagation delay times and test circuit.

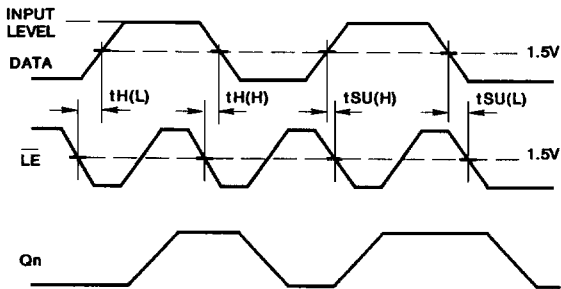


Figure 3 - Latch Enable prerequisite times.

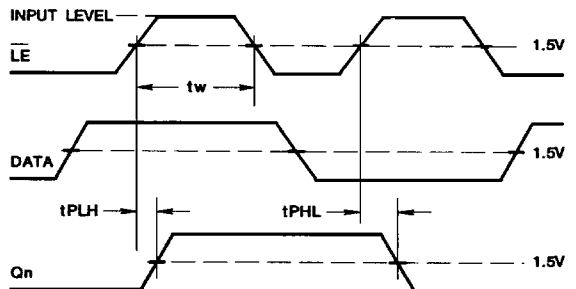


Figure 5 - Latch Enable propagation delays.

4
TECHNICAL DATA