383-776

# CD54/74AC74
# CD54/74ACT74

**MAXIMUM RATINGS,** *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE ($V_{CC}$) ..... -0.5 to 6 V
DC INPUT DIODE CURRENT, $I_{IK}$ (for $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V) ..... ±20 mA
DC OUTPUT DIODE CURRENT, $I_{OK}$ (for $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V) ..... ±50 mA
DC OUTPUT SOURCE OR SINK CURRENT per Output Pin, $I_O$ (for $V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V) ..... ±50 mA
DC $V_{CC}$ or GROUND CURRENT ($I_{CC}$ or $I_{GND}$) ..... ±100 mA*
POWER DISSIPATION PER PACKAGE ($P_D$):
For $T_A$ = -55 to +100°C (PACKAGE TYPE E) ..... 500 mW
For $T_A$ = +100 to +125°C (PACKAGE TYPE E) ..... Derate Linearly at 8 mW/°C to 300 mW
For $T_A$ = -55 to +70°C (PACKAGE TYPE M) ..... 400 mW
For $T_A$ = +70 to +125°C (PACKAGE TYPE M) ..... Derate Linearly at 6 mW/°C to 70 mW
OPERATING-TEMPERATURE RANGE ($T_A$): ..... -55 to +120°C
STORAGE TEMPERATURE ($T_{stg}$) ..... -65 to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s maximum ..... +265°C
Unit inserted into PC board min. thickness 1/16 in. (1.59 mm) with solder contacting lead tips only ..... +300°C

For up to 4 outputs per device; add ± 25 mA for each additional output.

**RECOMMENDED OPERATING CONDITIONS:**
**For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:**

| CHARACTERISTIC | LIMITS | | UNITS |
|---|---|---|---|
| | MIN. | MAX. | |
| Supply-Voltage Range, $V_{CC}$*: (For $T_A$ = Full Package-Temperature Range) | | | |
| AC Types | 1.5 | 5.5 | V |
| ACT Types | 4.5 | 5.5 | V |
| DC Input or Output Voltage, $V_I$, $V_O$ | 0 | $V_{CC}$ | V |
| Operating Temperature, $T_A$ | -55 | +125 | °C |
| Input Rise and Fall Slew Rate, dt/dv | | | |
| at 1.5 V to 3 V(AC Types) | 0 | 50 | ns/V |
| at 3.6 V to 5.5 V(AC Types) | 0 | 20 | ns/V |
| at 4.5 V to 5.5 V(ACT Types) | 0 | 10 | ns/V |

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

# CD54/74AC74
# CD54/74ACT74

## STATIC ELECTRICAL CHARACTERISTICS: AC Series

| CHARACTERISTICS | TEST CONDITIONS | | $V_{CC}$ (V) | AMBIENT TEMPERATURE ($T_A$) - °C | | | | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | +25 | | -40 to +85 | | -55 to +125 | | |
| | $V_I$ (V) | $I_O$ (mA) | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| High-Level Input Voltage $V_{IH}$ | | | 1.5 | 1.2 | — | 1.2 | — | 1.2 | — | V |
| | | | 3 | 2.1 | — | 2.1 | — | 2.1 | — | |
| | | | 5.5 | 3.85 | — | 3.85 | — | 3.85 | — | |
| Low-Level Input Voltage $V_{IL}$ | | | 1.5 | — | 0.3 | — | 0.3 | — | 0.3 | V |
| | | | 3 | — | 0.9 | — | 0.9 | — | 0.9 | |
| | | | 5.5 | — | 1.65 | — | 1.65 | — | 1.65 | |
| High-Level Output Voltage $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -0.05 | 1.5 | 1.4 | — | 1.4 | — | 1.4 | — | V |
| | | -0.05 | 3 | 2.9 | — | 2.9 | — | 2.9 | — | |
| | | -0.05 | 4.5 | 4.4 | — | 4.4 | — | 4.4 | — | |
| | | -4 | 3 | 2.58 | — | 2.48 | — | 2.4 | — | |
| | | -24 | 4.5 | 3.94 | — | 3.8 | — | 3.7 | — | |
| | #, * | -75 | 5.5 | — | — | 3.85 | — | — | — | |
| | | -50 | 5.5 | — | — | — | — | 3.85 | — | |
| Low-Level Output Voltage $V_{OL}$ | $V_{IH}$ or $V_{IL}$ | 0.05 | 1.5 | — | 0.1 | — | 0.1 | — | 0.1 | V |
| | | 0.05 | 3 | — | 0.1 | — | 0.1 | — | 0.1 | |
| | | 0.05 | 4.5 | — | 0.1 | — | 0.1 | — | 0.1 | |
| | | 12 | 3 | — | 0.36 | — | 0.44 | — | 0.5 | |
| | | 24 | 4.5 | — | 0.36 | — | 0.44 | — | 0.5 | |
| | #, * | 75 | 5.5 | — | — | — | 1.65 | — | — | |
| | | 50 | 5.5 | — | — | — | — | — | 1.65 | |
| Input Leakage Current $I_I$ | $V_{CC}$ or GND | | 5.5 | — | ±0.1 | — | ±1 | — | ±1 | μA |
| Quiescent Supply Current, FF $I_{CC}$ | $V_{CC}$ or GND | 0 | 5.5 | — | 4 | — | 40 | — | 80 | μA |

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

# CD54/74AC74
# CD54/74ACT74

## STATIC ELECTRICAL CHARACTERISTICS: ACT Series

| CHARACTERISTICS | TEST CONDITIONS | | $V_{CC}$ (V) | AMBIENT TEMPERATURE ($T_A$) - °C | | | | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | +25 | | -40 to +85 | | -55 to +125 | | |
| | $V_I$ (V) | $I_O$ (mA) | | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. | |
| High-Level Input Voltage $V_{IH}$ | | | 4.5 to 5.5 | 2 | — | 2 | — | 2 | — | V |
| Low-Level Input Voltage $V_{IL}$ | | | 4.5 to 5.5 | — | 0.8 | — | 0.8 | — | 0.8 | V |
| High-Level Output Voltage $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -0.05 | 4.5 | 4.4 | — | 4.4 | — | 4.4 | — | V |
| | | -24 | 4.5 | 3.94 | — | 3.8 | — | 3.7 | — | |
| | #, * | -75 | 5.5 | — | — | 3.85 | — | — | — | |
| | | -50 | 5.5 | — | — | — | — | 3.85 | — | |
| Low-Level Output Voltage $V_{OL}$ | $V_{IH}$ or $V_{IL}$ | 0.05 | 4.5 | — | ±0.1 | — | ±1 | — | ±1 | V |
| | | 24 | 4.5 | — | 0.36 | — | 0.44 | — | 0.5 | |
| | #, * | 75 | 5.5 | — | — | — | 1.65 | — | — | |
| | | 50 | 5.5 | — | — | — | — | — | 1.65 | |
| Input Leakage Current $I_I$ | $V_{CC}$ or GND | | 5.5 | — | ±0.1 | — | ±1 | — | ±1 | μA |
| Quiescent Supply Current, FF $I_{CC}$ | $V_{CC}$ or GND | 0 | 5.5 | — | 4 | — | 40 | — | 80 | μA |
| Additional Quiescent Supply Current per Input Pin TTL Inputs High 1 Unit Load $\Delta I_{CC}$ | $V_{CC}$-2.1 | | 4.5 to 5.5 | | 2.4 | — | 2.8 | — | 3 | mA |

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.
*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

### ACT INPUT LOADING TABLE

| INPUT | UNIT LOAD* |
|---|---|
| D | 0.53 |
| $\overline{R}$, $\overline{S}$ | 0.58 |
| CP | 1 |

*Unit load is $\Delta I_{CC}$ limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

**PREREQUISITE FOR SWITCHING: AC Series**

| CHARACTERISTICS | SYMBOL | $V_{CC}$ (V) | AMBIENT TEMPERATURE ($T_A$) - °C | | | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | -40 to +85 | | -55 to +125 | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Data to CP Setup Time | $t_{SU}$ | 1.5 | 39 | — | 44 | — | ns |
| | | 3.3* | 4.3 | — | 4.9 | — | |
| | | 5† | 3.1 | — | 3.5 | — | |
| Hold Time | $t_H$ | 1.5 | 0 | — | 0 | — | ns |
| | | 3.3 | 0 | — | 0 | — | |
| | | 5 | 0 | — | 0 | — | |
| Removal Time $\overline{R}$, $\overline{S}$ to CP | $t_{REM}$ | 1.5 | 30 | — | 34 | — | ns |
| | | 3.3 | 4.1 | — | 4.7 | — | |
| | | 5 | 2.4 | — | 2.7 | — | |
| Pulse Width $\overline{R}$, $\overline{S}$ | $t_W$ | 1.5 | 44 | — | 50 | — | ns |
| | | 3.3 | 4.9 | — | 5.6 | — | |
| | | 5 | 3.5 | — | 4 | — | |
| Pulse Width CP | $t_W$ | 1.5 | 49 | — | 56 | — | ns |
| | | 3.3 | 5.5 | — | 6.3 | — | |
| | | 5 | 3.9 | — | 4.5 | — | |
| CP Frequency | $f_{MAX}$ | 1.5 | 10 | — | 9 | — | MHz |
| | | 3.3 | 90 | — | 79 | — | |
| | | 5 | 125 | — | 110 | — | |

*3.3 V: min. is @ 3 V
†5 V: min. is @ 4.5 V

**SWITCHING CHARACTERISTICS: AC Series, $t_r$, $t_f$ = 3 ns, $C_L$ = 50 pF**

| CHARACTERISTICS | SYMBOL | $V_{CC}$ (V) | AMBIENT TEMPERATURE ($T_A$) - °C | | | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | -40 to +85 | | -55 to +125 | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Propagation Delays: CP to Q, $\overline{Q}$ | $t_{PLH}$ $t_{PHL}$ | 1.5 | — | 114 | — | 125 | ns |
| | | 3.3* | 3.6 | 12.7 | 3.5 | 14 | |
| | | 5† | 2.6 | 9.1 | 2.5 | 10 | |
| $\overline{R}$, $\overline{S}$ to Q, $\overline{Q}$ | $t_{PLH}$ | 1.5 | — | 120 | — | 132 | ns |
| | | 3.3 | 3.8 | 13.4 | 3.7 | 14.7 | |
| | | 5 | 2.7 | 9.5 | 2.6 | 10.5 | |
| | $t_{PHL}$ | 1.5 | — | 131 | — | 144 | ns |
| | | 3.3 | 4.1 | 14.6 | 4 | 16.1 | |
| | | 5 | 3 | 10.4 | 2.9 | 11.5 | |
| Power Dissipation Capacitance | $C_{PD}$§ | — | 55 Typ. | | 55 Typ. | | pF |
| Input Capacitance | $C_I$ | — | — | 10 | — | 10 | pF |

*3.3 V: min. is @ 3.6 V
max. is @ 3 V

†5 V: min. is @ 5.5 V
max. is @ 4.5 V

§$C_{PD}$ is used to determine the dynamic power consumption, per flip-flop.
$P_D = C_{PD} V_{CC}^2 f_i + \Sigma (C_L V_{CC}^2 f_o)$ where $f_i$ = input frequency
$f_o$ = output frequency
$C_L$ = output load capacitance
$V_{CC}$ = supply voltage.

# CD54/74AC74
# CD54/74ACT74

**PREREQUISITE FOR SWITCHING: ACT Series**

| CHARACTERISTICS | SYMBOL | $V_{CC}$ (V) | AMBIENT TEMPERATURE ($T_A$) - °C | | | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | -40 to +85 | | -55 to +125 | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Data to CP Setup Time | $t_{SU}$ | 5* | 3.5 | — | 4 | — | ns |
| Hold Time | $t_H$ | 5 | 0 | — | 0 | — | ns |
| Removal Time $\overline{R}$, $\overline{S}$ to CP | $t_{REM}$ | 5 | 2.4 | — | 2.7 | — | ns |
| Pulse Width $\overline{R}$, $\overline{S}$ | $t_W$ | 5 | 4.4 | — | 5 | — | ns |
| Pulse Width CP | $t_W$ | 5 | 5 | — | 5.7 | — | ns |
| CP Frequency | $f_{MAX}$ | 5 | 97 | — | 85 | — | MHz |

*Min. is @ 4.5 V

**SWITCHING CHARACTERISTICS: ACT Series, $t_r$, $t_f$ = 3 ns, $C_L$ = 50 pF**

| CHARACTERISTICS | SYMBOL | $V_{CC}$ (V) | AMBIENT TEMPERATURE ($T_A$) - °C | | | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | -40 to +85 | | -55 to +125 | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Propagation Delays: CP to Q, $\overline{Q}$ | $t_{PLH}$ $t_{PHL}$ | 5* | 2.5 | 8.6 | 2.4 | 9.5 | ns |
| $\overline{R}$, $\overline{S}$ to Q, $\overline{Q}$ | $t_{PLH}$ | 5 | 3 | 10.5 | 2.9 | 11.5 | ns |
| | $t_{PHL}$ | 5 | 3.2 | 11.4 | 3.1 | 12.5 | |
| Power Dissipation Capacitance | $C_{PD}$† | — | 55 Typ. | | 55 Typ. | | pF |
| Input Capacitance | $C_I$ | — | — | 10 | 10 | — | pF |

*Min. is @ 5.5 V
Max. is @ 4.5 V.

†$C_{PD}$ is used to determine the dynamic power consumption, per flip-flop.
$P_D = C_{PD}V_{CC}^2 f_i + \Sigma (C_L V_{CC}^2 f_o) + V_{CC} \Delta I_{CC}$ where $f_i$ = input frequency
$f_o$ = output frequency
$C_L$ = output load capacitance
$V_{CC}$ = supply voltage.

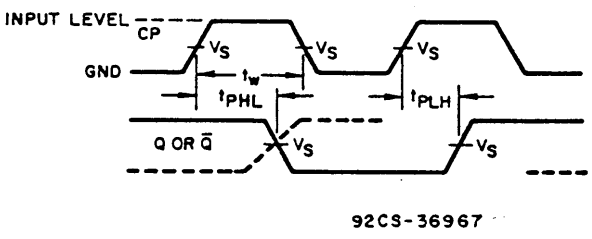



*Fig. 1 - Clock prerequisite and propagation delays.*

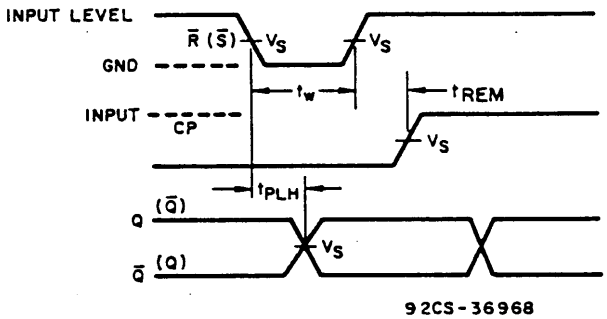
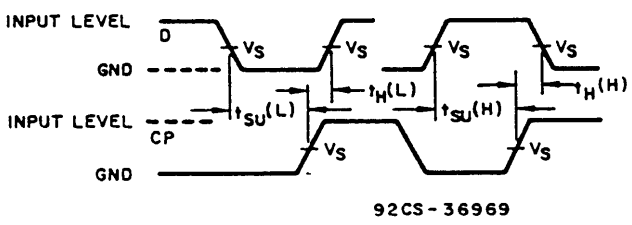



*Fig. 2 - $\overline{Reset}$ or $\overline{Set}$ prerequisite and propagation delays.*



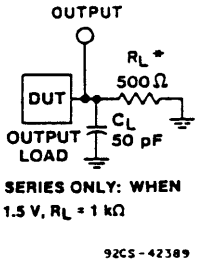




*Fig. 3 - Data prerequisite times.*

| | CD54/74AC | CD54/74ACT |
|---|---|---|
| Input Level | $V_{cc}$ | 3 V |
| Input Switching Voltage, Vs | 0.5 $V_{cc}$ | 1.5 V |
| Output Switching Voltage, Vs | 0.5 $V_{cc}$ | 0.5 $V_{cc}$ |