Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{IH}	HIGH Level Input Voltage	2			V
V_{IL}	LOW Level Input Voltage			0.8	V
I_{OH}	HIGH Level Output Current			−0.4	mA
I_{OL}	LOW Level Output Current			8	mA
T_A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA			−1.5	V
V_{OH}	HIGH Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max	2.7	3.4		V
V_{OL}	LOW Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min		0.35	0.5	V
		I_{OL} = 4 mA, V_{CC} = Min		0.25	0.4	
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 7V			0.1	mA
I_{IH}	HIGH Level Input Current	V_{CC} = Max, V_I = 2.7V			20	μA
I_{IL}	LOW Level Input Current	V_{CC} = Max, V_I = 0.4V			−0.36	mA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 3)	−20		−100	mA
I_{CCH}	Supply Current with Outputs HIGH	V_{CC} = Max		0.8	1.6	mA
I_{CCL}	Supply Current with Outputs LOW	V_{CC} = Max		2.4	4.4	mA

Note 2: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Switching Characteristics

at V_{CC} = 5V and T_A = 25°C

Symbol	Parameter	R_L = 2 kΩ				Units
		C_L = 15 pF		C_L = 50 pF		
		Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	3	10	4	15	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	3	10	4	15	ns

FIGURE 2.19 74LS00 manufacturer's specifications. *(Reprinted with permission from Fairchild Semiconductor and National Semiconductor.)*

tor heats up, it slows down. As it cools, its speed increases. Outside of the recommended operating temperature, the device is not guaranteed to function, because the effects of temperature become so severe that functionality is compromised. There are four common temperature ranges for ICs: commercial (0 to 70°C), industrial (–40 to 85°C), automotive (–40 to 125°C), and military (–55 to 125°C). It is more difficult to manufacture an IC that operates over wider temperature ranges. As such, more demanding temperature grades are often more expensive than the commercial grade.

Other parameters establish the safe operating limits for input signals as well as the applied voltage thresholds that represent logic 0 and 1 states. Minimum and maximum input levels are expressed as either absolute voltages or voltages relative to the supply voltage pins of the device. Exceeding these voltages may damage the device. Logic threshold specifications are provided to ensure that the logic input voltages are such that the device will function as intended and not confuse a 1 for a 0, or vice versa. There is also a limit to how must current a digital output can drive. Current output specifications should be known so that a chip is not overloaded, which could result in either permanent damage to the chip or the chip's failure to meet its published specifications.

- *DC electrical characteristics.* DC parameters specify the voltages and currents that the IC will present to other circuitry to which it is connected. Whereas recommended operating conditions specify the environment under which the chip will properly operate, DC electrical characteristics specify the environment that the chip itself will create. Output voltage specifications define the logic 0 and 1 thresholds that the chip is guaranteed to drive under all legal operating conditions. These specifications confirm that the chip is compatible with other chips in the same family and also allow an engineer to determine if the output levels are compatible with another chip that it may be driving.

  Input current specifications characterize the load that the chip presents to whatever circuit is driving it. When either logic state is applied to the chip, a small current flows between the driver and the chip in question. Quantifying these currents enables an engineer to ensure compatibility between multiple ICs. When one IC drives several other ICs, the sum of the input currents should not exceed the output current specification of the driver.
- *AC electrical characteristics or switching characteristics).* AC parameters often represent the greatest complexity and level of detail in a digital IC's specifications. They are the guaranteed timing parameters of inputs and outputs. If the IC is purely combinatorial (e.g., 74LS00), timing may just be matter of specifying propagation delays and rise and fall times. Logic ICs with synchronous elements (e.g., flops) have associated parameters such as setup, hold, clock frequency, and output valid times.

Keep in mind that each manufacturer has a somewhat different style of presenting these specifications. The necessary information should exist, but data sheet sections may be named differently; they may include certain information in different groupings, and terminology may be slightly different.

Specifications may be provided in mixed combinations of minimum, typical/nominal, and maximum. When a minimum or maximum limit is not specified, it is understood to be self-evident or subject to a physical limitation that is beyond the scope of the device. Using Fairchild's 74LS00 as an example, no minimum output current is specified, because the physical minimum is very near zero. The actual output current is determined by the load that is being driven, assuming that the load draws no more than the specified maximum. Other specifications are shown under certain operating conditions. A well written data sheet provides guaranteed specifications under worst-case conditions. Here, the logic 1 output voltage (V_{OH}) is specified as a minimum of 2.5 V under conditions of minimum supply voltage (V_{CC}), maximum output current (I_{OH}), and maximum logic-low input voltage (V_{IL}). These are worst-case conditions. When V_{CC} decreases, so will V_{OH}. When I_{OH} increases, it places a greater load on the output, dragging it down to its lowest level.