

TTL User's Guide

Logic Products

INTRODUCTION

The TTL Logic devices described in this data manual differ widely in function, complexity and performance, but their electrical input and output characteristics are very similar and are defined and tested to guarantee compatibility. The data sheets that make up this book cover four major categories of TTL circuits and a series of TTL compatible interface products.

The oldest TTL product category is the gold-doped double-diffused type which is made up of the 7400 family of devices. This family reflects the same performance ranges and differ only in functions and pin configuration.

The remaining two categories of products are fabricated with a non-saturating Schottky clamped transistor technique. The 74S00 family of TTL products are very high performance, high power devices. The most popular TTL category is the 74LS Low Power Schottky family. These products feature the performance of the 74 family at about 1/4 the power.

ABSOLUTE MAXIMUM RATINGS

The Absolute Maximum Ratings constitute limiting values above which serviceability of the device may be impaired. Provisions should be made in system design and testing to limit voltages and currents as shown below.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	74	74S	74LS
V _{CC} supply voltage, continuous (Note a)	7.0V	7.0V	7.0V
Input voltage, continuous (Notes a and b)	-0.5V to +5.5V	-0.5V to +5.5V	-0.5V to +7.0V ^(b)
Input current, continuous	-30mA to +5mA	-30mA to +5mA	-30mA to +1mA
Voltage applied to HIGH outputs (Note a)	-0.5V to V _{CC}	-0.5V to 7.0V	-0.5V to V _{CC}
Voltage applied to "off" Open Collector outputs (Notes a and c)	-0.5V to 7.0V	-0.5V to 7.0V	-0.5V to 7.0V
Current into LOW standard output, continuous	30mA	40mA	15mA
Current into LOW buffer output, continuous	80mA	100mA	50mA
Operating free air temperature range (Com'l)	0°C to +70°C		
Storage temperature range	-65°C to +150°C		

NOTES:

- Voltages are referenced to device ground terminal.
- LS devices are generally limited to 7.0V maximum input voltage. Exceptions are called out on individual product data sheets.
- Some open collector devices are specially processed to handle higher output voltages of from 15V to 30V. The Absolute Maximum voltage for these devices is 10% over the specified V_{OUT} test condition.

OPERATING TEMPERATURE AND VOLTAGE RANGES

The nominal supply voltage (V_{CC}) for all TTL circuits is +5.0 volts. Commercial grade parts are guaranteed to perform with a ±5% supply tolerance (±250mV) over an ambient temperature range of 0°C to 70°C.

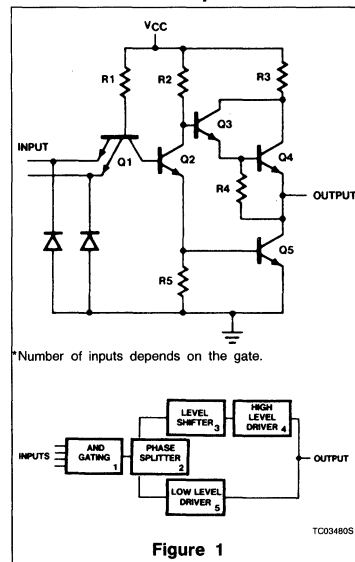
The actual junction temperature can be calculated by multiplying the power dissipation of the device with the thermal resistance of the package and adding it to the measured ambient temperature T_A or package (case) temperature T_C. The thermal resistance for the various packages in which the TTL products are offered is specified with the Package Information in Section 9 of this manual.

GENERAL TTL CIRCUIT CHARACTERISTICS

All TTL products are derived from a common NAND logic structure. The NAND circuit is actually five subcircuits as shown in Figure 1 and each performs a separate function. The input circuit (1) is an AND gate usually fabricated with a multi-emitter transistor which characterizes TTL technology. Many Schottky processed circuits have been designed with PNP or diode inputs in order to optimize the speed/power performance of the circuits.

The phase splitter (2) provides the inversion and amplification in the circuit. It determines whether the outputs are active level HIGH or active level LOW. The level shifter (3) pro-

NAND Gate Example



vides noise immunity between the HIGH and LOW output levels, and minimizes the possibility of having both HIGH level driver (4) and LOW level driver (5) on simultaneously.

The level shifter (3) and HIGH level driver (4) combine to form an emitter follower circuit that tracks the voltage at the collector of the