Transistor to Gate

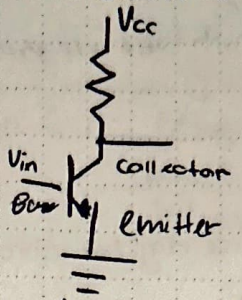
Transistors

An electronic device that is used to control the flow of electricity in electronic equipment with atleast 3 electrodes so there a small voltage controls a larger voltage.

Can act as an amplifier

Can act as a switch.

Completely off or completely on

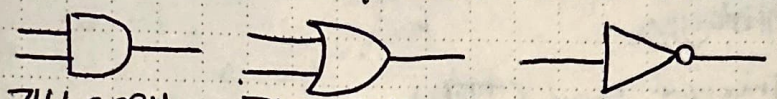


Gate

Transistors and resistors can be arranged to create desired outputs based on specific inputs as a logic gate.

Transistors have only 2 states (on or off) so the binary number system and Boolean Algebra describe the relationship of inputs to outputs of these gates.

These input to output relationships can be shown in truth tables



74LS08N and gate

74LS32N or gate

74LS04N not gate

Gate to Integrated Circuits (IC)

Integrated Circuit

An electronic circuit having many components, such as transistors, diodes, resistors, and capacitors in a single package.

Transistors → Gate → Integrated Circuit

Integrated Circuits (IC) and Socket

1. DIP: Dual Inline Package
2. SOIC: Small Outline Integrated Circuit
3. PLCC: Plastic Leaded Chip Carrier

Gates and Truth Table

Truth table is a list of all possible input variables to a digital circuit, listed in ascending binary order, and the output for each input combination.

Inputs X & Y could be a button or switch

Output Z could be a buzzer or LED

For 2 inputs there can only be 4 possible arrangement of inputs

IN X	IN Y	Out Z
0	0	?
0	1	?
1	0	?
1	1	?

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Witness:	Date:	

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Title: 1.1.6 Digital Component Identification

Interpreting a Truth Table

The structure of a truth table depends on being able to count in binary which is the base-2 number system.

The ascending rows in this truth table represent a count of (0-3) in the binary number system.

Truth Tables and Binary

All possible input values to a digital circuit are listed in ascending binary order on the truth table.

Integrated Circuits

All logic gates are available as an Integrated Circuit (IC)

ICs are categorized in 3 different ways:

Underlying Technology

- Transistor-Transistor Logic (TTL)
- Complementary Metal Oxide Semiconductor (CMOS)

Scale of Integration

- Small Scale Integration (SSI)
- Medium Scale Integration (MSI)
- Large Scale Integration (LSI)
- Very Large Scale Integration (VLSI)

Package Style

- Through-Hole technology (THT)
- Dual Inline Package (DIP)
- Surface-Mount technology (SMT)
- Small Outline IC (SOIC)
- Plastic Leaded Chip Carrier (PLCC)
- Quad Flat Pack (QFP)

TTL vs CMOS

Transistor-Transistor Integration (TTL)

Constructed from Bipolar Junction Transistors (BJT)

Faster than CMOS but uses more power

Complementary Metal Oxide Semiconductor (CMOS)

Constructed from Metal Oxide Semiconductor Field-Effect

Uses less power, slower, and vulnerable to electrostatic-discharge

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IC Density of Integration

Density of Integration	Gates per IC
SSI	10
MSI	10-100
LSI	100-10000
VLSI	10000-100000
ULSI	100000-1000000
GSI	>1000000

IC Package Style

Through-Hole Technology

THT components are easier to hand assemble because they are much larger.

Larger, proto-boards, most high-end electronics components don't use this style

Surface Mount Technology

SMT Components are mounted on the surface of the PCB.

Smaller, Expensive, cannot be used on proto-boards

TTL Logic Sub-Families

Offoy 1

Standard TTL	Infix	Example	Comments
Low Power	none L	7404 74L04	Slowest, High power Less power than standard
Schottky	S	74S04	Faster, high power
Low Power Schottky	LS	74LS04	faster, lower power
Advanced Schottky	AS	74AS04	Very fast, high power
Advanced Low-Power Schottky	ALS	74ALS04	fastest, good power

Manufacturer Datasheets

A manufacturer datasheet for a logic gate contains the following information:

- General Description
- Connection (pin-out diagram) Diagram
- Function Table
- Operating Conditions
- Electrical characteristics
- Switching characteristics
- Physical Dimensions

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