Motherboard Structure

Everything you need to know about this structure

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Presentation Overview

1. What is Motherboard?
   - Anatomy of a motherboard
   - Standard Size
   - Main blocks
   - North bridge and south bridge
   - Chipsets
   - Power section
2. Today's technology
   - Manufacturing companies
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What is motherboard?

Your computer is made of different electrical boards and circuits. All these circuits are offered to the customer in a package called motherboard

> *Essentially, it's like the central hub that enables all the parts of a computer to work together.*
> — *ChatGPT*

This part of the computer is as important as the most important components of the computer, i.e. CPU and GPU.

Standard Size

of motherboard

The main motherboard sizes are as follows:

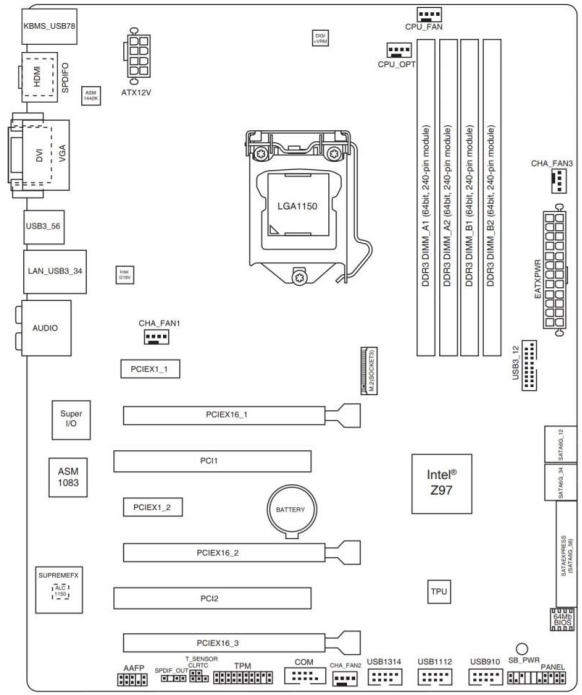
- Standard ATX ($244mm \times 305mm$)
- Micro ATX ($244mm \times 244mm$)
- Mini ITX ($150mm \times 150mm$)

Figure: Standard motherboard size

Main blocks

Figures

(a) Standard ATX motherboard Z97 pro gaming



(b) Block diagram of Z97 pro gaming motherboard

Main blocks

Overview

in (figure 2b) we can see this blocks:

- LGA 1150
- RAM slots
- M2 connector
- HDMI connector
- VGA connector
- Audio connector
- USB connector
- ...

Main blocks

LGA 1150

Land Grid Array or LGA is the CPU socket that named by Intel. The number 1150 indicates number of socket pins.

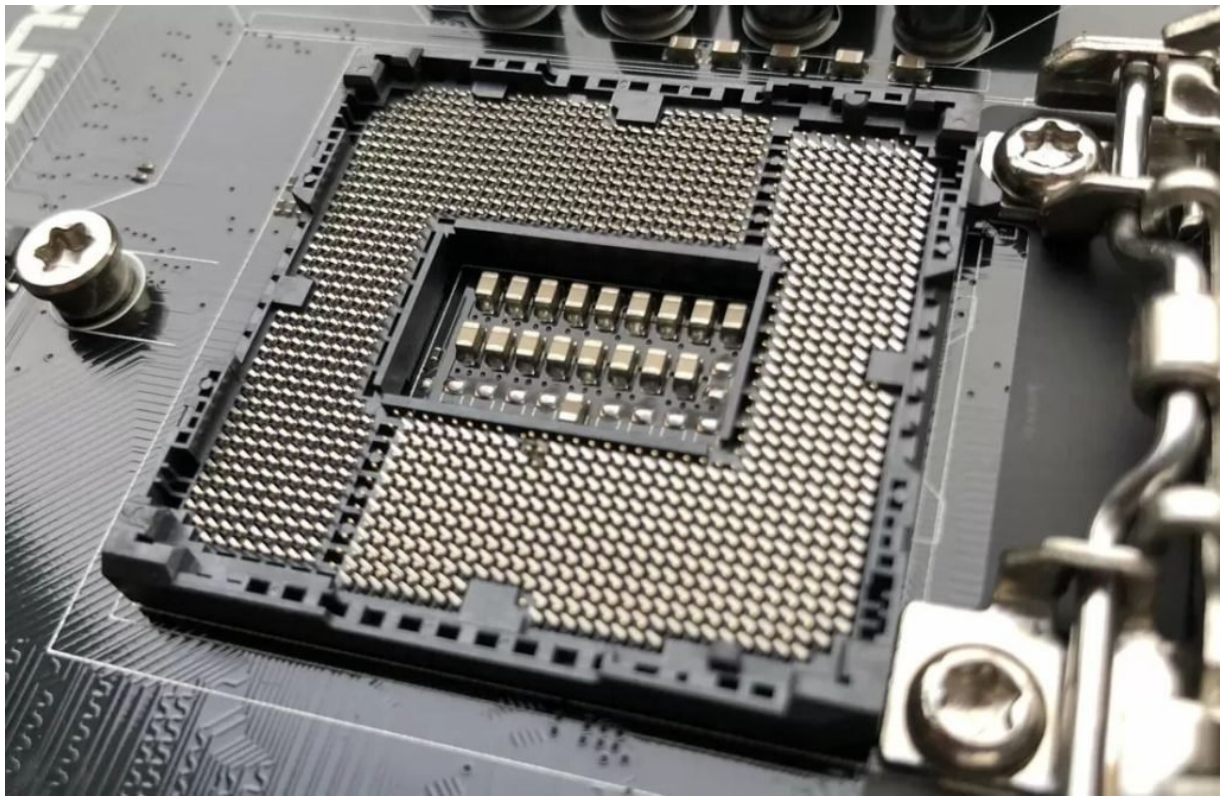


Figure: LGA socket

Main blocks

Ram slots

The nearest slots and sockets to the CPU are DRAM slots, that called system memory.
These parts are directly connected to the CPU and the number of DRAMs in each motherboard depends on the type of CPU.

Figure: RAM slots

Main blocks

M2 connector

This socket is used to connect the SSD memory to the motherboard.

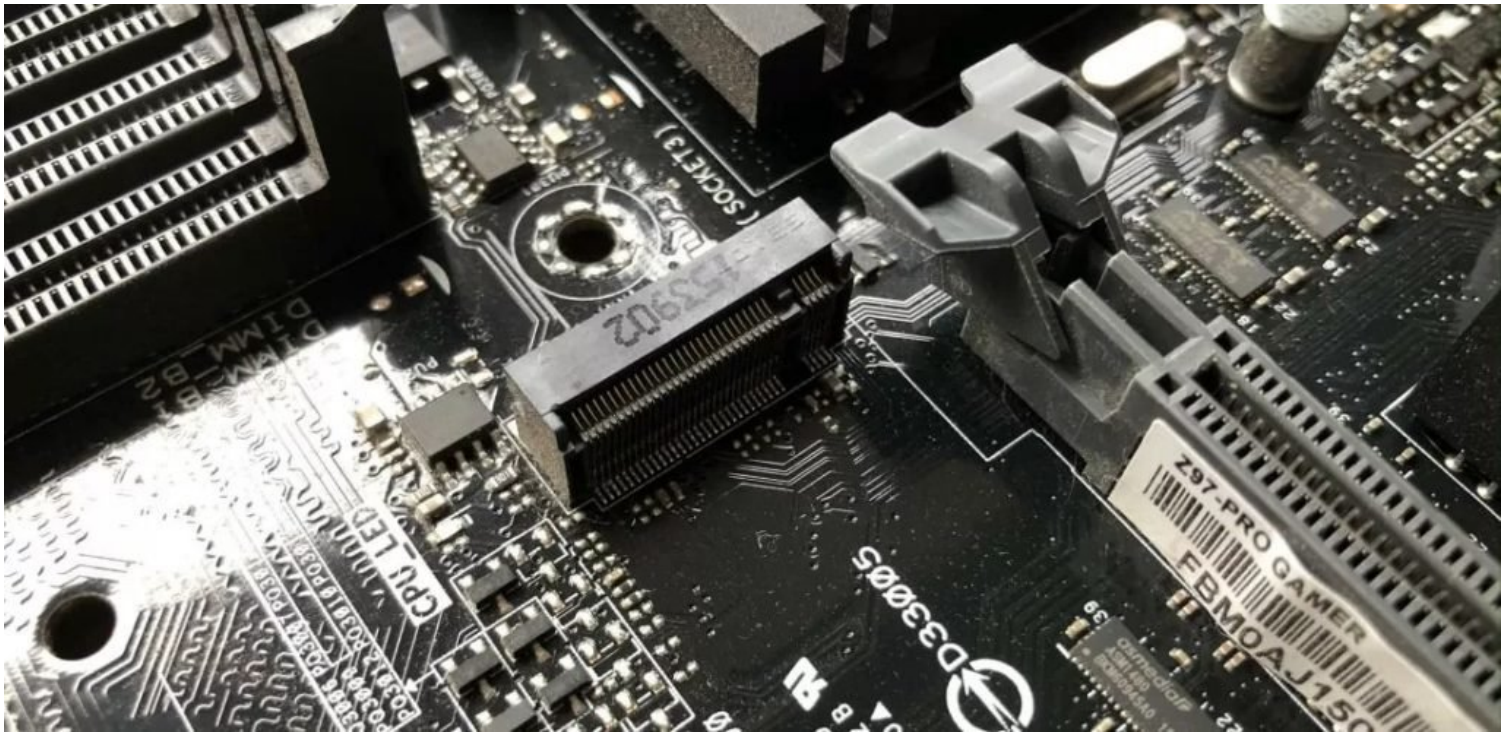


Figure: M2 connector

Port & connections

I/O connectors

This motherboard has these I/Os:

- PS/2: *to connect keyboard and mouse*
- DVI-D: *to connect to the GPU*
- VGA: *to connect old displays device*
- HDMI
- Ethernet
- USB2 and USB3
- Audio jacks

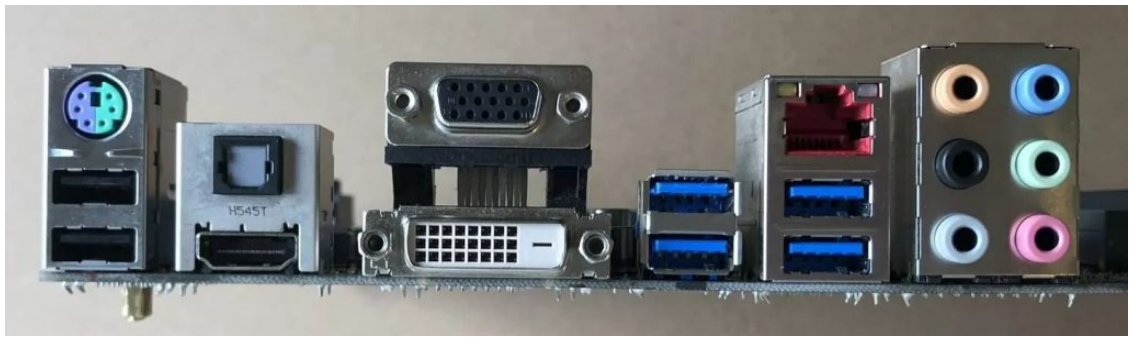


Figure: I/O connector

North & south bridge

1. The NB and SB are components of older motherboard architectures.
2. The NB manages communication between the processor, memory, and high-speed components like the graphics card.
3. The SB handles connections to slower peripherals like USB, SATA, and audio devices.

However, in modern motherboard designs, the functions of the North and South bridges have been integrated into a single chip called the Platform Controller Hub (PCH). (check figure 2a)

North & south bridge

Figure

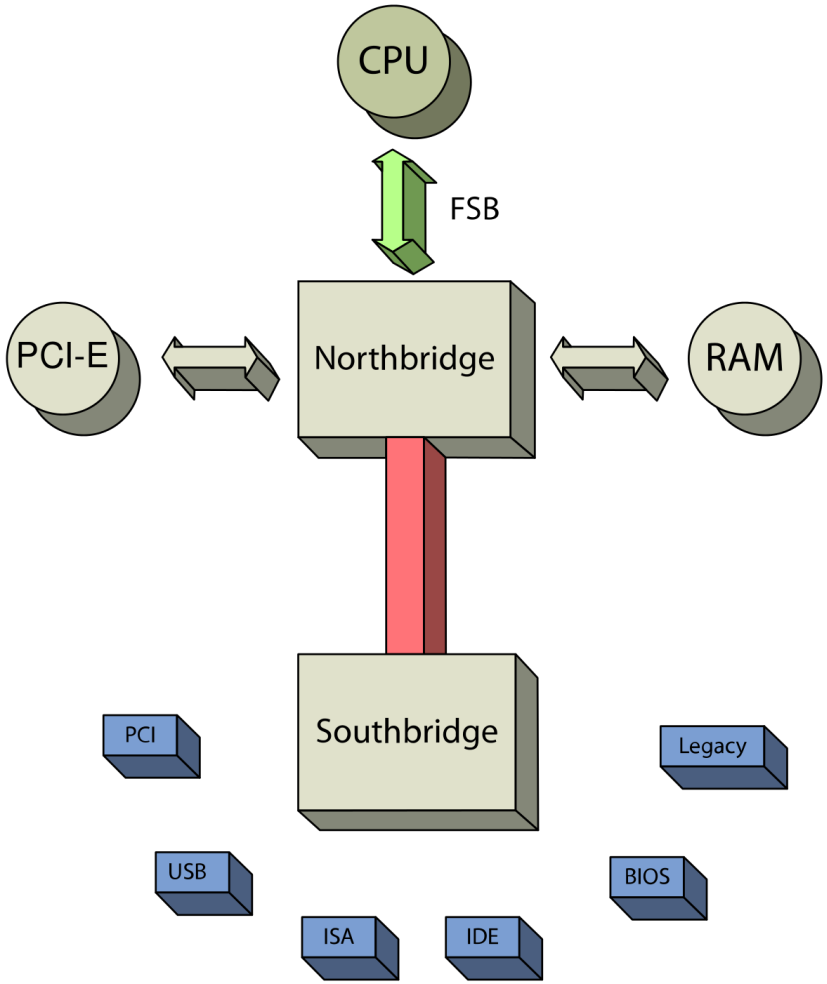


Figure: NB and SB

North & south bridge

Figure

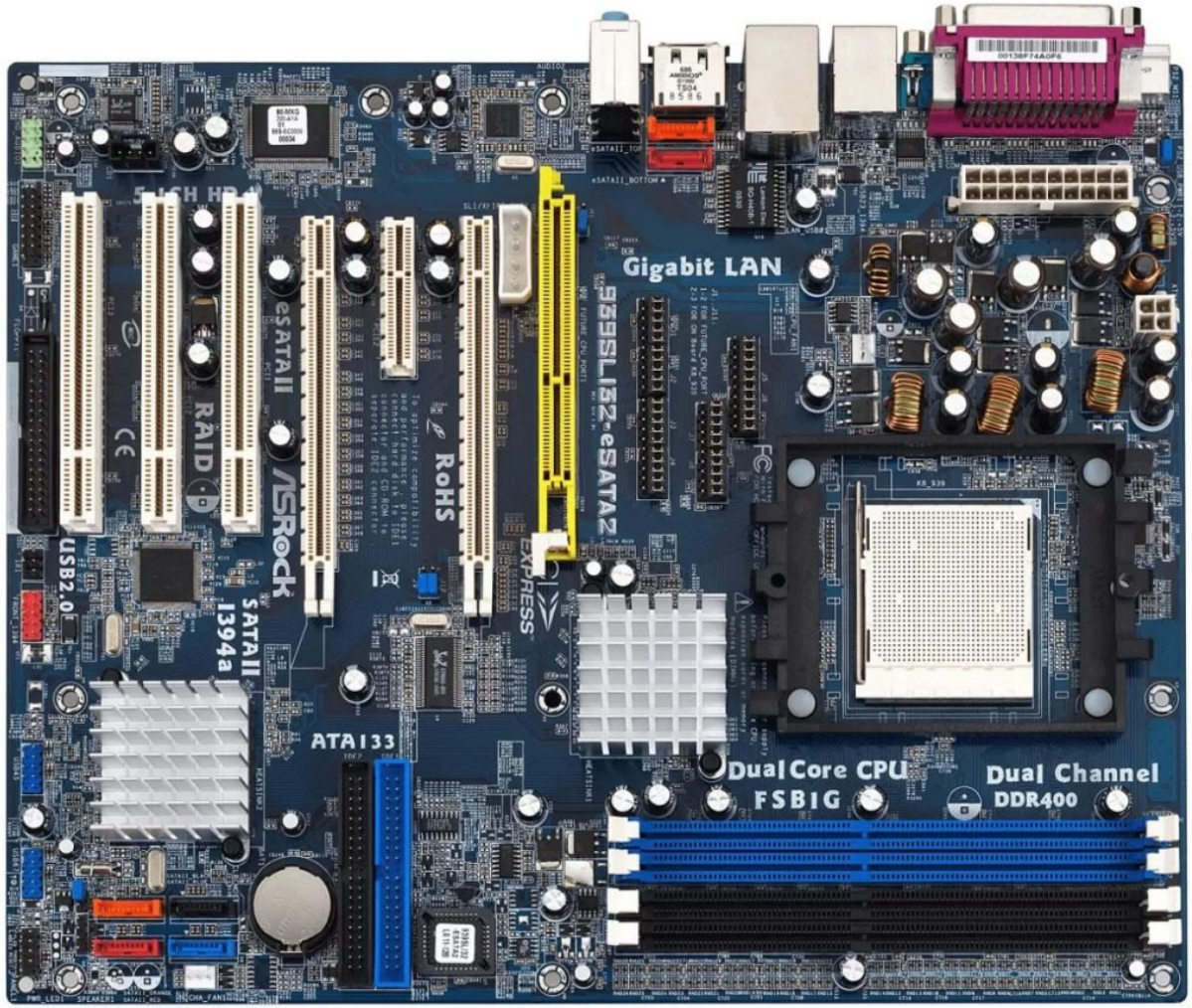


Figure: Real NB and SB

Chipsets

PCH chip in Z97 pro motherboard:

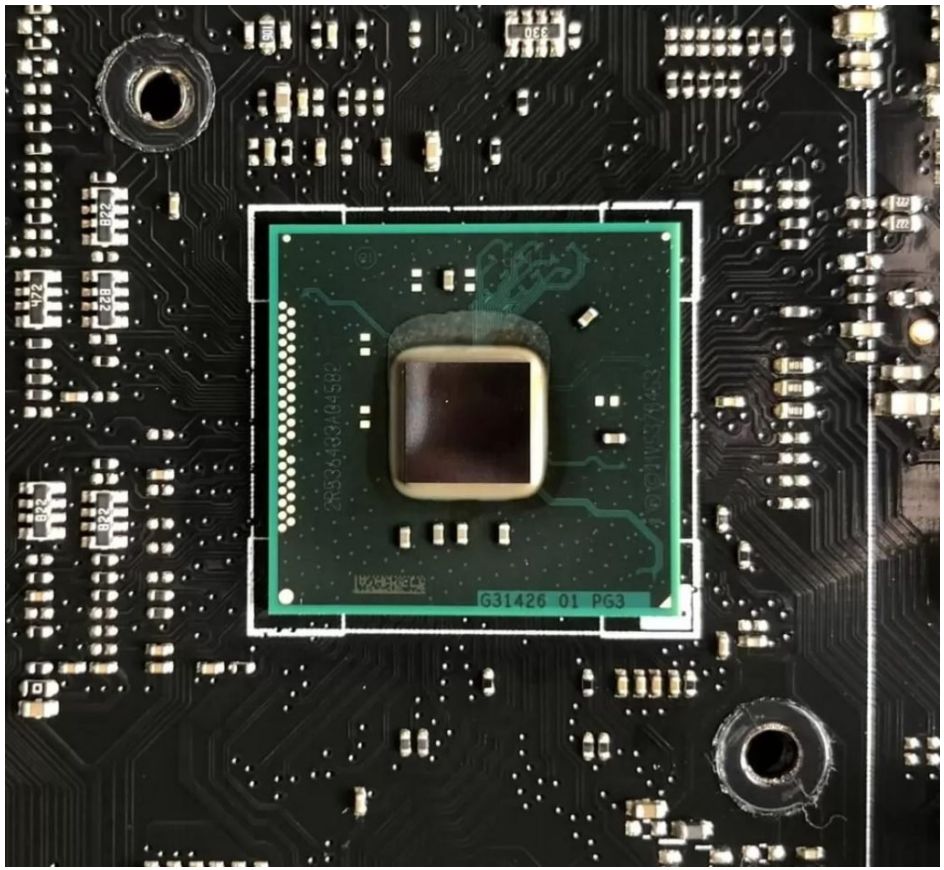


Figure: PCH chip of Z97 pro

Power section

Power Supply Unit or PSU provides the voltage and current of the board using a 24-pin connector called ATX.

Figure: ATX connector

Power section

In today's motherboards, there is another 8-pin output in the power supply unit.

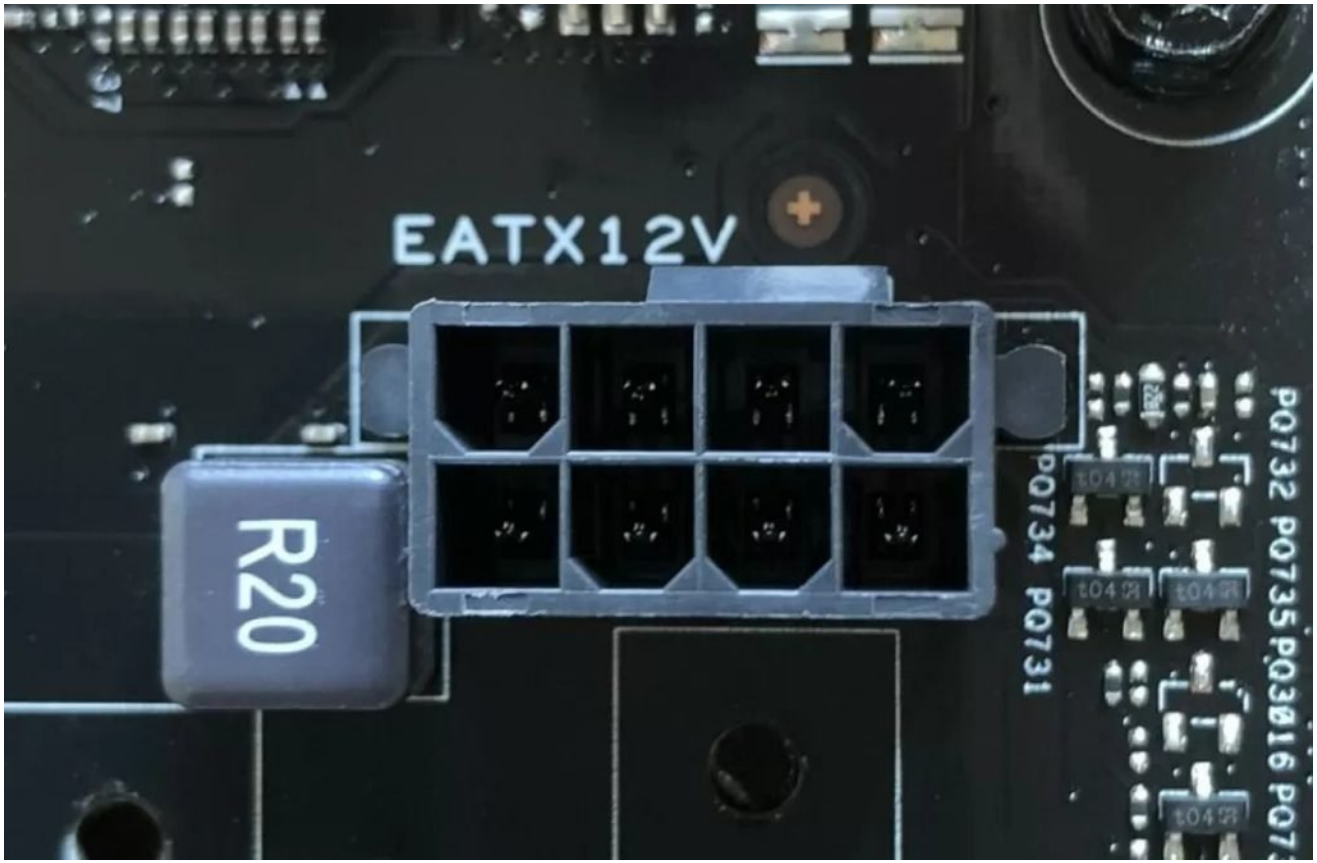


Figure: ATX connector

Power section

Figure

In this figure, you can see the output voltages of these two connectors:

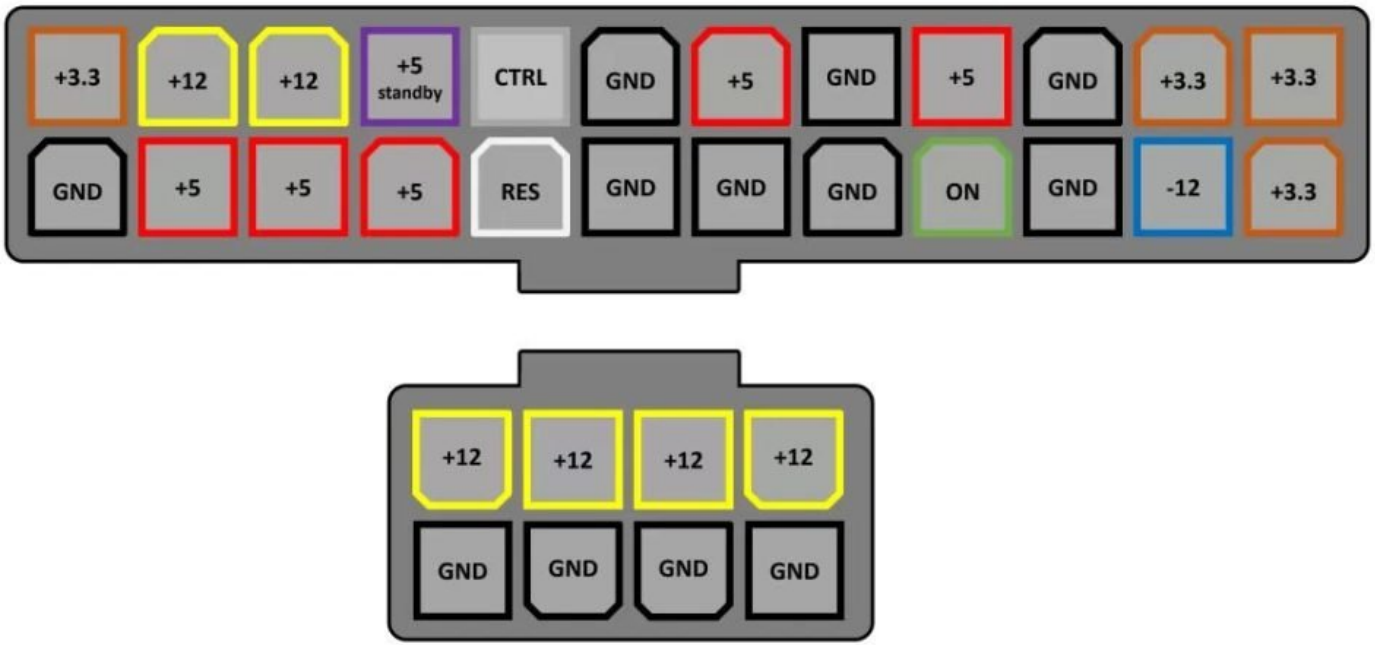


Figure: ATX output schematic

Power section

Gray area!

In what voltage range do today's CPUs work?

- Today's CPUs doesn't work with constant voltage.
- less than 0.8 volts when in low power mode.
- 1.4 volts or more in full power mode.

Therefore, there must be a unit in the motherboard that reduces the 12 V output voltage of the PSU to this range.

This unit is called Voltage Regulation Modules or VRM

Manufacturing companies

Top motherboard manufacturers:

1. ASRock
2. Asus
3. Biostar
4. EVGA Corporation
5. Gigabyte Technology
6. MSI (Micro-Star International)
7. Intel

Types of motherboard

Here are some common types of motherboards:

1. ATX *(Advanced Technology eXtended)*
2. Micro ATX
3. Mini ITX
4. Extended ATX
5. ITX
6. BTX

References

 Digiato: link

 Wikipedia: link

The End

Questions? Comments?