

# COMPUTER SCIENCES

## KNOWING YOUR COMPUTER I (COMPONENTS: CPU, RAM, HD)

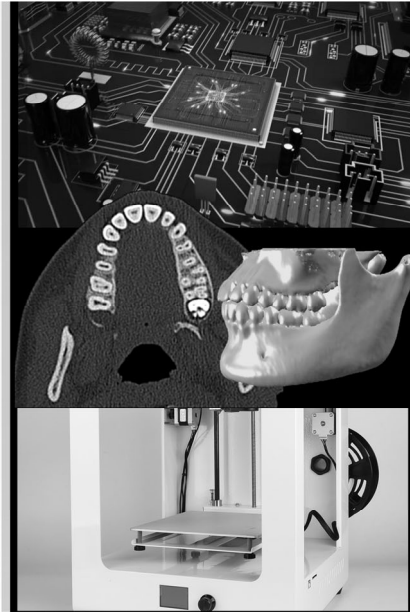
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# COMPUTER COMPONENTS

Desktop computer



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# COMPUTER COMPONENTS I

- CPU 中央處理器 ➤ Processing/computing core
- Memory modules 記憶體 ➤ Temporary data storage (small capacity, faster access)
- Hard Disk Drives 硬碟 ➤ Long-term data storage
- Solid State Drives 固態硬碟 (large capacity, relatively slow access)

Please download handouts from (Week 3)  
[http://cflu.lab.nycu.edu.tw/CFLU\\_course\\_CompSci.html](http://cflu.lab.nycu.edu.tw/CFLU_course_CompSci.html)

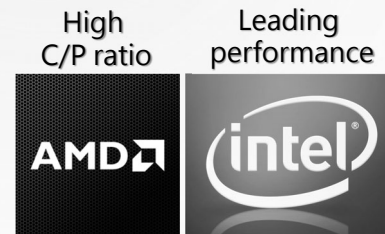
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# CPU 中央處理器

- CPU: Central Processing Unit
- Computer Processing Core (the brain of computer)
  - ✓ Calculation execution
  - ✓ Logic judgment
  - ✓ Equipment control



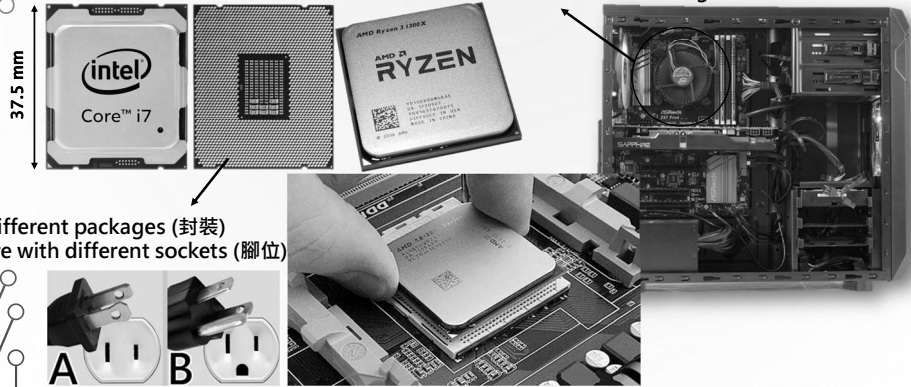
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# CENTRAL PROCESSING UNIT (CPU)

Beneath the CPU cooling fan!



Different packages (封裝) are with different sockets (腳位)

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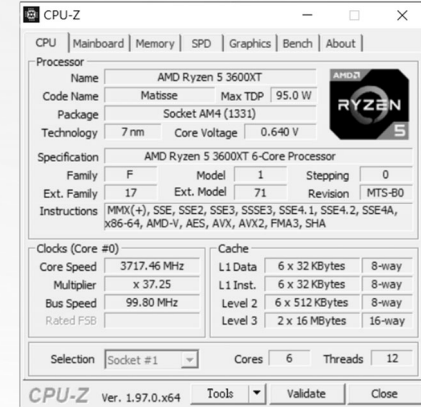
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# SPECIFICATION OF CPU

Download CPU-Z from

<http://www.cpubid.com/software/cpu-z.html>

- 型號 Name
- 運作頻率/時脈 Clock
- 核心代號 Code Name
- 封裝 Package
- 快取記憶體 Cache Memory
- 核心數 Cores
- 執行緒數 Threads
- 製程 Technology
- 內建繪圖核心 Graphics core
- 最高功耗 Max TDP



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# SPECIFICATION OF CPU

If you'd like to assemble/upgrade your computer

- 型號 Name
- 運作頻率/時脈 Clock
- 核心代號 Code Name
- 封裝 Package (腳位Socket)
- 快取記憶體 Cache Memory
- 核心數 Cores
- 執行緒數 Threads
- 製程 Technology
- 內建繪圖核心 Graphics core
- 最高功耗 Max TDP



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# SPECIFICATION OF CPU

Generally, the higher the value, the more expensive the price.

- 運作頻率/時脈 Clock
  - Processing Speed, Unit: GHz (processing 1 billion commands per second)
- 快取記憶體 Cache
  - Built-in memory to improve system performance
  - Faster speed and more expensive
  - 3 levels: L1 / L2 / L3
  - Check capacity (MB)
- 核心數 (Core) vs. 執行緒數 (Thread)
  - Core: Independent processor unit
  - Thread: jobs at the same time
- 內建繪圖核心 Graphics core
  - If the high-end graphics card is not required.
  - Intel: HD/UHD series
  - AMD: Radeon/Vega series
  - 內建顯示卡、內顯

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# MONITOR CPU WINDOWS SYSTEM AS AN EXAMPLE

- Press "Ctrl + Alt + Del" to start Task Manager (工作管理員).

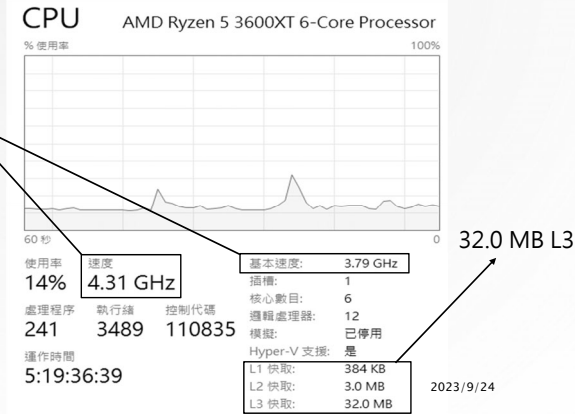
The actual CPU operation speed is often faster than the maximum speed.

## Overclocking technology

- Turbo Boost (Intel)
- Turbo Core (AMD)

In power saving mode, the computing speed will be reduced by about half!

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# CPU PINS ↔ SOCKET

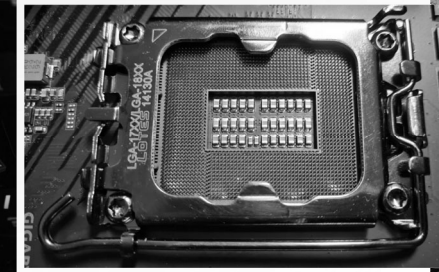
- Please confirm whether the CPU pins and the socket on the motherboard match.

Intel Core i7 12700 CPU



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LGA 1700 socket (motherboard)



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# CPU MODEL NAMES

core核心/thread執行緒

## • AMD (美商超微)

### • RYZEN 3000/4000/5000 series

- 部分無內顯、L3快取

- R9-十二核24緒
- R7-八核16緒
- R5-四核8緒、六核12緒
- R3-四核4緒
- TR-Threadripper超頻版

### • A series APU - 有內顯、無L3快取

- A10
- A8
- A6

## • Intel (英特爾)

### • Xeon - 無內顯、工作站伺服器用

- E5 - 八核16緒、十核
- E3 - 四核8緒

### • Core i9 - 八核16緒~十八核36緒

### • Core i7 - 六核12緒、八核8緒

- Broadwell-E (極致版)
- Comet Lake(第10代)、Rocket Lake (第11代)、Alder Lake (第12代)

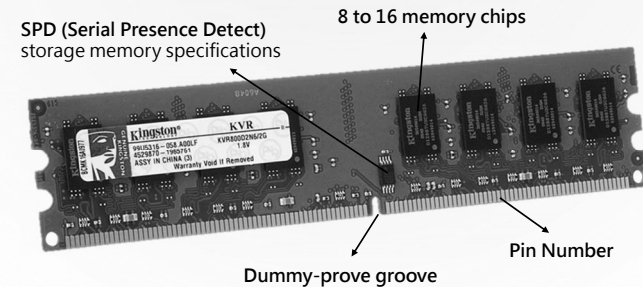
- Core i5 - 四核、六核
- Core i3 - 雙核、四核
- Pentium - 雙核、低L3快取 (入門)
- Celeron - 雙核、低L3快取 (入門)

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# MEMORY MODULES 記憶體

- Random Access Memory (RAM)
- Temporary data storage and high access speed

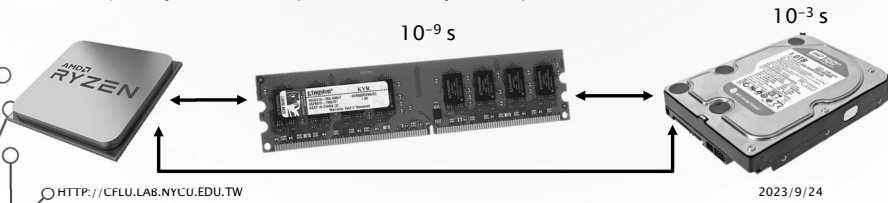


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# RAM FEATURES

- Fast access: in  $10^{-9}$  seconds
- Read and write data at any time
- Need power to maintain memory!
- A bridge between the CPU and the storage device
- Capacity size and speed affect system performance



# GENERATION

- DDR5 *Newest~*
  - DDR4
  - DDR3
  - DDR2
  - DDR1
  - SDRAM
- DDR: Double Data Rate (double the amount of data can be transferred in a unit time.)

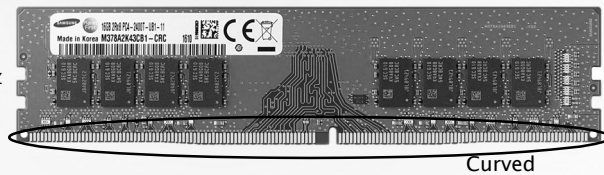
Generally 2 to 8 RAMs can be installed.



# RAM DDR4 VS. DDR3

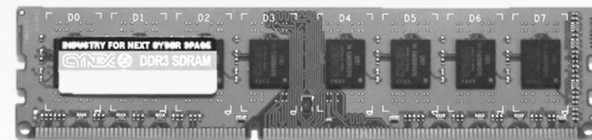
*Newest~* (higher data transfer speed and capacity)

**DDR4**  
288 pins (針腳)  
Clock 2133~4266MHz  
Up to 64 GB  
Low voltage of 1.2V



Curved

**DDR3**  
240 pins (針腳)  
Clock 800~2800MHz  
Up to 16 GB  
Voltage of 1.5V



flat

# RAM DDR5 VS. DDR4

Features	DDR4	DDR5	DDR5 Advantages
Speed	1.6 to 3.2 GT/s 0.8 to 1.6 GHz clock	4.8 to 8.4 GT/s 1.6 to 4.2 GHz clock	Higher bandwidth
IO Voltage	1.2 V	1.1 V	Lower power
Power Management	On motherboard	On DIMM PMIC	Better power efficiency Better scalability
Channel Architecture	72-bit data channel (64 data + 8 ECC) 1 channel per DIMM	40-bit data channel (32 data + 8 ECC) 2 channels per DIMM	Higher memory efficiency Lower latency
Burst Length	BC4, BL8	BC8, BL16	Higher memory efficiency
Max. Die Density	16Gb	64Gb	Higher capacity DIMMs
More Intelligence	SPD (I <sup>2</sup> C)	SPD Hub & Temperature Sensors (I <sup>2</sup> C)	Enhanced system management Greater telemetry for thermal management

<https://www.rambus.com/blogs/get-ready-for-ddr5-dimm-chipsets/>

# RAM Clock & Latency

- Clock Rate/Frequency (MHz) 運作時脈
- CAS Latency 延遲時間 CL值
  - Cycle time from receipt of request to actual read/write process
  - The smaller the value, the better.

**DDR3 2133**

Memory Slot Selection

Slot #1	DDR4	Correction	
Module Size	16384 MBytes	Registered	
Max Bandwidth	DDR4-2132 (1066 MHz)	Ranks	Dual
Manufacturer	Kingston	SPD Ext.	
Part Number	9905625-066.A00G	Week/Year	48 / 16
Serial Number	1B0274C6		

Timings Table

	JEDEC #4	JEDEC #5	JEDEC #6	JEDEC #7
Frequency	962 MHz	1037 MHz	1066 MHz	1066 MHz
CAS# Latency	13.0	14.0	15.0	16.0
RAS# to CAS#	13	14	15	15
RAS# Precharge	13	14	15	15
tRAS	32	35	36	36
tRC	45	49	50	50
Command Rate				
Voltage	1.20 V	1.20 V	1.20 V	1.20 V

# DUAL CHANNEL · QUAD CHANNEL

- The motherboard/chipset can support simultaneous transmission of multiple RAMs.
  - CPU can handle double the amount of data and improve performance.

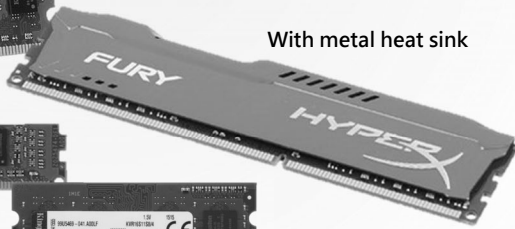


# TYPES OF MEMORY MODULE

For regular PC



With metal heat sink



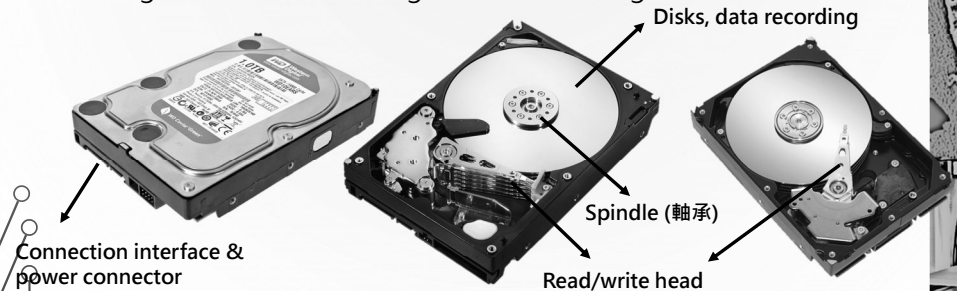
Small capacity or low voltage (special specification)



For laptops or mini PC

# HARD DRIVE

- Hard Disk Drives (HDD)
- Program installation, long-term data storage



## HDD FEATURES

- Large capacity: 1~10TB
- Faster data access than compact disc (CD)
- Lower cost: the cheapest of all storage media



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## BUFFER & ROTATION SPEED

- Buffer 緩衝區記憶體
  - The buffer allows the data to be integrated into a complete packet before being read by CPU or RAM.
- Rotation speed 轉速
  - The faster the rotation speed, the faster the search speed
  - 5400、5900、7200、10000、15000 RPM

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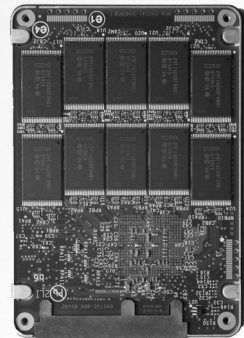
## SSD固態硬碟

- Solid-State Drive (SSD)
- SSD is based on NAND Flash memory, eliminating mechanical search and read.

Lightweight  
Fast reading and writing speed  
Short delay time  
Quiet, power saving, and shock resistant

TLC (三階儲存單元) → 1000~2000 writes  
MLC (多階儲存單元) → 10000 writes  
SLC (單階儲存單元) → 100000 writes

Unlimited reads!



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## SSD vs HDD

faster	✓	✗	slower
shorter lifespan	✗	✓	longer lifespan
more expensive	✗	✓	cheaper
non-mechanical (flash)	✓	✗	mechanical (moving parts)
shock-resistant	✓	✗	fragile

best for storing operating systems, gaming apps, and frequently used files

best for storing extra data, such as movies, photos, and documents

[HTTP://C](http://C)

<https://www.avast.com/c-ssd-vs-hdd>

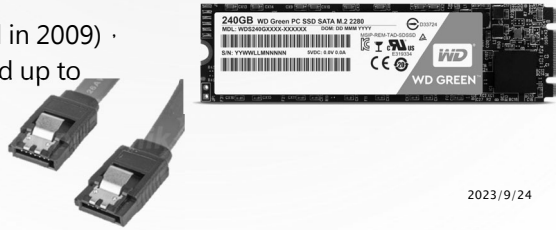
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# TRANSMISSION INTERFACE

- SATA (Serial Advanced Technology Attachment)
- Interface between motherboard and connecting devices (e.g. hard disk, optical disk drive)
- SATA3 (introduced in 2009) · Transmission speed up to 6.0Gbit/s °

Other common interfaces:

- mini-SATA (mSATA)
- M.2 (SATA)
- M.2 (PCIe)



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# THE END

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