Microprocessor

1st Week: Introduction

syllabus.1

1. Professor : Yongjun Park (박영준 교수님)
   TA : Kyujin Kim (김규진), IT&BT building 701,
   e-mail : wowow11111@naver.com

2. 4 absence -> F grade (maybe)

3. 75% Lecture class, 25% Practice class

syllabus.2

4. Homework every week, (will be submitted via GitLab)
   Homework proves your attendance (Correctness is not graded☺)

5. Slides and Lectures will be uploaded on Blackboard every week
   (portal.hanyang.ac.kr)

6. For this semester, there will be no actual class using demo boards. Videos will be provided.

microcontroller.microprocessor

- Small, integrated processors
- Universal use due to high performance
  - 64-bit high performance microprocessor released
- Evolution of microprocessors
  - Developed 4-bit microprocessor 4004 (Intel, 1971)
  - 8-bit microprocessor development
    - Intel: 8008 (1972), 8080 (1974), 8085 (1976)
    - Motorola: MC6800 (1947), MC6805 (1976), MC6809 (1977)
    - Zilog: Z80 (1976)
  - 8, 16, 32, 64-bit microprocessor development
    - Intel: 80186, 20286, 80386, 80486, Pentium ...
    - Motorola: 68000, 68020, 68040, 68060 ...

microcontroller.microcontroller

- Various components are integrated for intelligence and miniaturization.
  - Micro-processor Core
  - Memory (Size, Type, etc.)
  - Peripheral Devices
  - I / O Ports
- Evolution of Microcontrollers
  - Developed TI (Texas Instruments) TMS1000 (1975)
  - Intel 8-bit M / C 8048 (MCS-48), Motorola 8-bit MC6801 (1976)
  - Intel 8-bit M / C 8051 (MCS-51) (1980)
  - Intel 16-bit MCS-96 (1982)
  - Intel 32-bit M / C 80960 (1988)

microcontroller.characteristic

- Enhanced Input/Output (I/O) capability for peripheral sensing and control
- Built-in Timer/Counter, communication port
- Interrupt processing
- Bit manipulation ability
- Smaller & lighter
- Low Cost
  - Reduce parts, production, development cost/time
- Flexible & Scalable (with SW modification)
- Enhanced Reliability
  - Simple System
  - Low Failure Rate
  - Easy to Maintain

microcontroller.application

- Industry: Motor control, robot control, process control, numerical control, toys, etc.
- Measurement: Medical instrument, oscilloscope, etc.
- Appliances: Microwave oven, gas oven, rice cooker, washing machine, etc.
- Military: missile control, Torpedo control, spacecraft induction control, etc.
- Communication: Mobile phone, modem, wired / wireless telephone, repeater, etc.
- Office: Copier, Printer, Plotter, Hard disk drive, etc.
- Automobile: ignition timing control, fuel injection control, transmission control, etc.
- Life: Electronic clock, calculator, game machine, cash register, thermostat, etc.

microcontroller.directionOfImprovement

- High Performance
  - High-performance microcontroller with 32-bit ARM Core
- Multi-function
  - Multi-function microcontroller with various special functions
- Small Size
  - Microcontroller for Micro-Embedded System
- Low Power
  - Ultra-low-power microcontroller that can operate for a long time with a small battery
- Low Cost
  - Low cost microcontrollers under $1

avr.characteristic.1

- RISC (Reduced Instruction Set Code) Architecture
  - Enhanced RISC Architecture
  - Register based Architecture with 32 8-bit General Purpose Registers
  - 1MIPS/MHz
- Harvard Architecture
- Very Low Power Consumption & Wide Range of Operating Voltages
  - Operating Voltages: 1.8V to 5.5V
- Various Operating Mode
- Internal Memories
  - 256KB Self-programmable instruction Flash Memory
  - 4KB data EEPROM
  - 16KB SRAM

avr.characteristic.2

- Various Product Models
  - 8 to 100 pins for Many Different Peripheral Devices

(Parallel I/O Port, Internal Clock Generator, 8/16-bit Timer/Counter, Watchdog Timer, UART, SPI, 10-bit ADC, etc.)

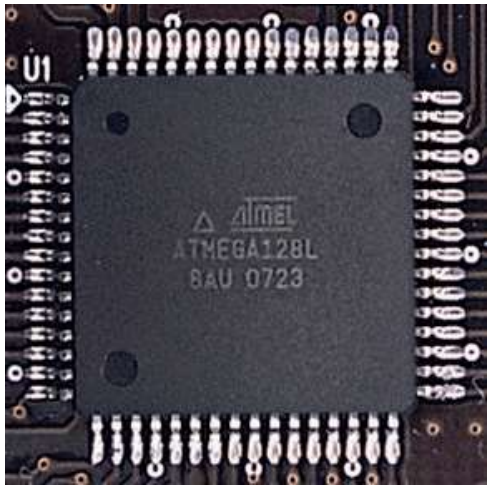
- Extension of Data Memory or I/O Devices
  - By using The External System Bus
- Many Types of Interrupts & Processing Capability
- Free/Low Cost S/W Development Kits
  - AVR Studio
- Internal ISP (In System Program) Function

avr.types

- Tiny Series
  - 6~32 Pins Package
  - 0.5~16KB Program Memory
  - Limited Peripheral Set
  - Low Speed/Performance/Cost
- Mega Series
  - 28~100 Pins Package
  - 4~256KB Program Memory
  - Extended Instruction Set
  - Extensive Peripheral Set
  - High Speed/Performance/Cost

atmega128.details

- Atmel 8-bit Microcontroller
- 32 8-bit General Purpose Registers & Peripheral Control Registers
- 6-type Sleep Modes
- 8-channel 10-bit ADC Interface
- RISC Pipeline
  - 1 Instruction per Clock Period
- Separated Bus
  - Program Memory Bus & Data Memory Bus
- Enhanced RISC Architecture (16MIPS @ 16Mhz)
  - 133 Instruction Set (in 1 Cycle)
- Programmable 128KB ISP Flash Memory
- 4KB EEPROM & 4KB SRAM
- JTAG SUPPORT



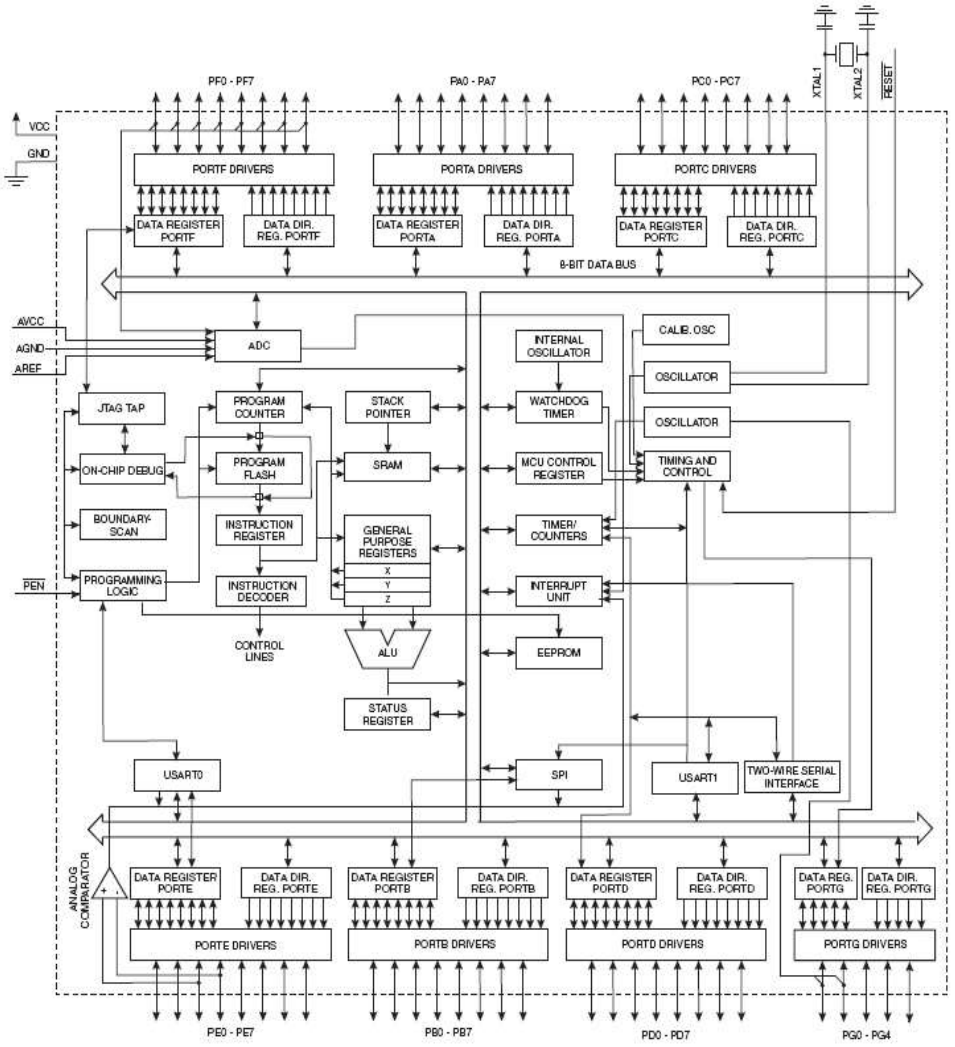
atmega128.peripherals

- 2 8-bit Timer/Counter, 2 16-bit Timer/Counter
- 2 8-bit PWM Channels
- 6 2~16-bit Programmable PWM Channels
- 2 Extend 16-bit Timers/Counters
- Real Time Count
- Output Compare Modulator
- 8 channel, 10-bit ADC
- Two-wire Serial Interface
- 2 UARTs
- Master/Slave SPI
- Programmable Watchdog Timer
- Analog Comparator

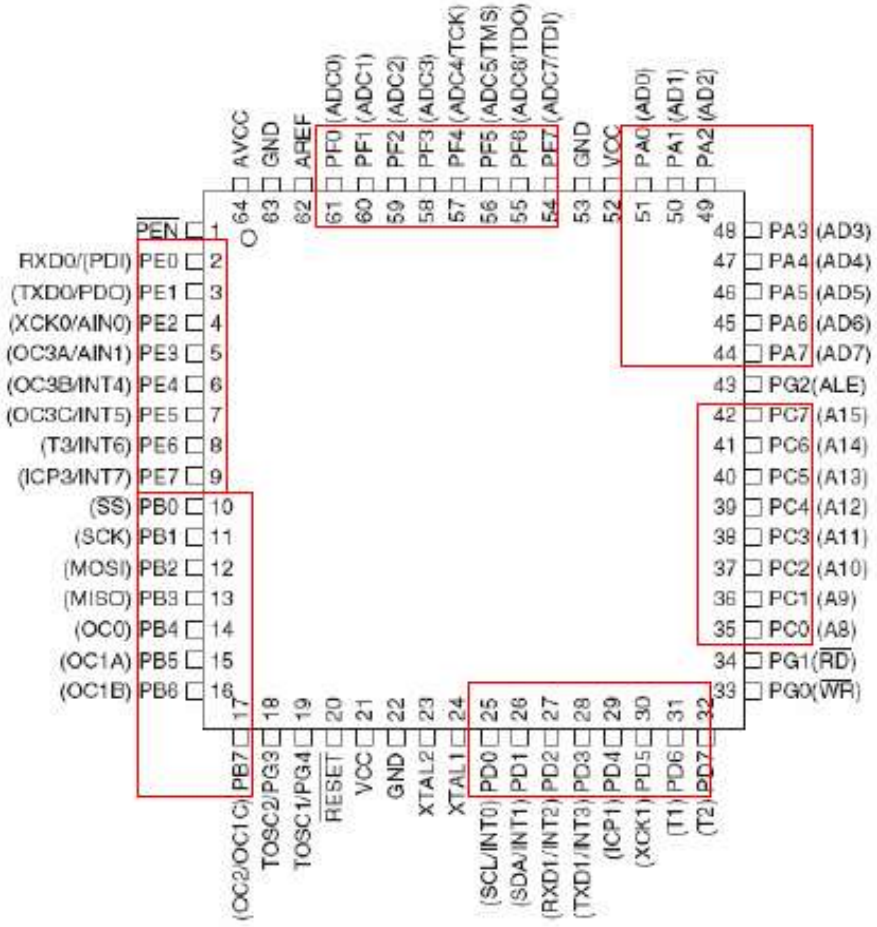
atmega128.core

- Power-on Reset
- Programmable Brown-out Detection
- Internal Calibrated RC Oscillator
- Internal/External Interrupt Sources
- 6 Sleep Modes
- Software Selectable Clock Frequency
- Global Pull-up Disable
- 53 Programmable I/O Lines
- 64-lead TQFP and 64-pad QFN/MLF
- Operating Voltages: 2.7V ~ 5.5V
- Speeding Grades: 0 ~ 8/16Mhz

atmega128.architecture



atmega128.pin



- ATmega128 Packages
  - 64 Pins
  - TQFP or MLF
  - 6 General Purpose I/O Ports

atmega128.pin.controlSignals

- Reset (Pin 20)
- XTAL1, XTAL2 (Pin 24, Pin 23)
- Vcc (Pin 21, 51)
- GND (Pin 22, 53, 63)
- AVCC (Pin 64)
- AREF (Pin 62)
- PEN (Pin 1)

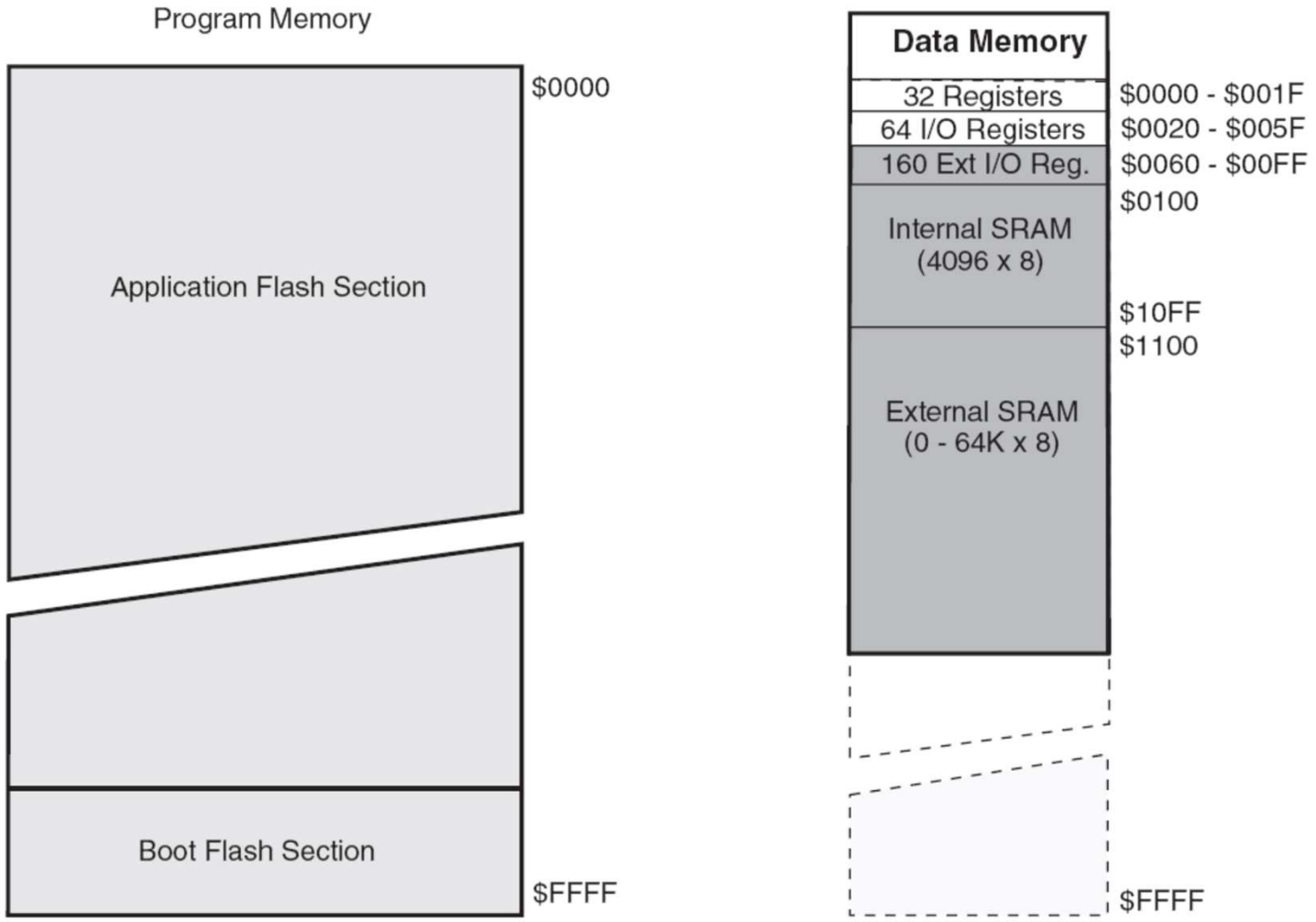
atmega128.pin.gpioSignals

- GPIO: General Purpose I/O
- PortA (PA7 ~ PA0: Pin 44 ~ 51)
  - External Memory Address Bus (A7-A0) and Data Bus (D7-D0)
- PortB (PB7 ~ PB0: Pin 10 ~ 17)
  - SPI Port or PWM Port
- PortC (PC7 ~ PC0: Pin 35 ~ 42)
  - External Memory Address Bus (A15-A8)
- PortD (PD7 ~ PD0: Pin 25 ~ 31)
  - Timer or External Interrupt Port
- PortE (PE7 ~ PE0: Pin 2~ 9)
  - Timer, External Interrupt, Analog Analyzer, USART Port
- PortF (PF7 ~ PF0: Pin 54 ~ 61)
  - AD Converter or JTAG IF Port
- PortG (PG7 ~ PG0: Pin 19, 18, 43, 34, 33)
  - External Memory Strobe Signal, Real Time Counter Timer Oscillator

atmega128.memoryArchitecture.1

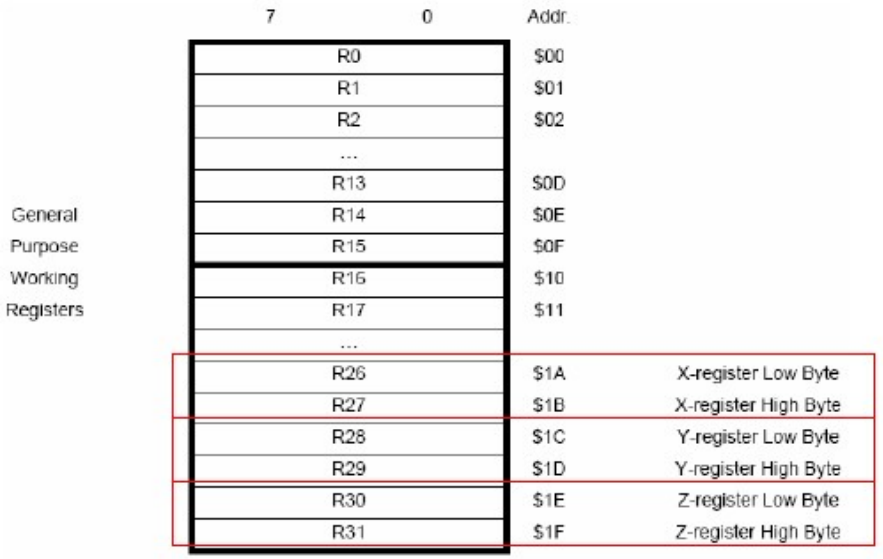
- Harvard Architecutre
- Program Memory
- Data Memory
  - RAM
    - Registers
    - SRAM: 4KB
  - ROM
    - EEPROM: 4KB
  - External Data Memory

atmega128.memoryArchitecture.2



atmega128.memoryArchitecture.3

- ATmega128 Program Memory
  - Internal 128KB Flash Memory
  - 16-bit Address
  - Boot Flash Section & Application Flash Section
- ATmega128 Data Memory (Register)
  - General Purpose Register
  - Special Function Register
    - I/0 Registers
    - Extend I/O Registers



atmega128.clocks

- CPU Clock
- I/O Clock
- Flash Clock
- Asynchronous Timer Clock
- ADC Clock

atmega128.sleepModes

- Idle Mode
- ADC Noise Reduction Mode
- Power-down Mode
- Power-save Mode
- Standby Mode
- Extended Standby Mode

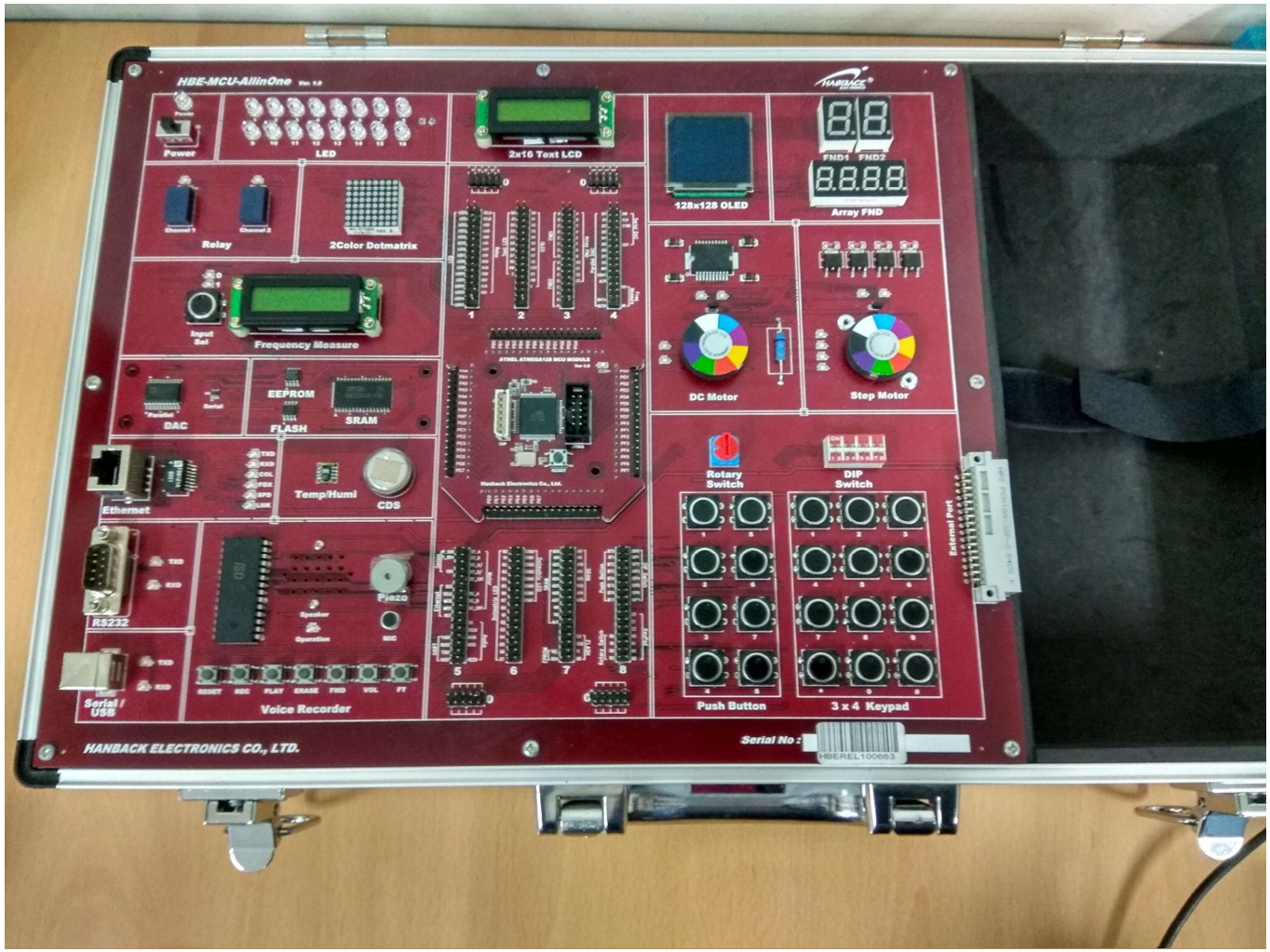
atmega128.resetModes

- Power-on Reset
- External Reset
- Watchdog Reset
- Brown-out Reset
- JTAG AVR Reset

atmega128.dataSheet

http://www.atmel.com/images/doc2467.pdf

atmega128


HBE-MCU-AllinOne
Power
LED
2x16 Text LCD
128x128 OLED
FND1 FND2
Array FND
Relay
2Color Dotmatrix
Frequency Measure
DC Motor
Step Motor
DAC
EEPROM
FLASH
SRAM
Ethernet
Temp/Humi
CDS
Rotary Switch
DIP Switch
RS232
Piezo
Serial / USB
Voice Recorder
Push Button
3 x 4 Keypad
HANBACK ELECTRONICS CO., LTD.
Serial No :

Thank you