망고 **M32** 하드웨어 설명

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STM32F103RBT6

Example: STM32 F 103 C 8 T 7 xxx

Device family

STM32 = ARM-based 32-bit microcontroller

Product type

F = general-purpose

Device subfamily

103 = performance line

Pin count

T = 36 pins
C = 48 pins
R = 64 pins
V = 100 pins

Flash memory size(1)

8 = 64 Kbytes of Flash memory
B = 128 Kbytes of Flash memory

Package

H = BGA
T = LQFP
U = VFQFPN

Temperature range

6 = Industrial temperature range, –40 to 85 °C.
7 = Industrial temperature range, –40 to 105 °C.

Options

xxx = programmed parts
TR = tape and real

STM32F103RB 특징

Pinout	Low-density devices		Medium-density devices		High-density devices		
	16 KB Flash	32 KB Flash(1)	64 KB Flash	128 KB Flash	256 KB Flash	384 KB Flash	512 KB Flash
	6 KB RAM	10 KB RAM	20 KB RAM	20 KB RAM	48 KB RAM	64 KB RAM	64 KB RAM
144					5 × USARTs 4 × 16-bit timers, 2 × basic timers 3 × SPIs, 2 × I^2Ss, 2 × I2Cs USB, CAN, 2 × PWM timers 3 × ADCs, 1 × DAC, 1 × SDIO FSMC (100 and 144 pins)		
100			3 × USARTs 3 × 16-bit timers 2 × SPIs, 2 × I^2Cs, USB, CAN, 1 × PWM timer 2 × ADC				
64	2 × USARTs 2 × 16-bit timers 1 × SPI, 1 × I^2C, USB, CAN, 1 × PWM timer 2 × ADCs						
48							
36							

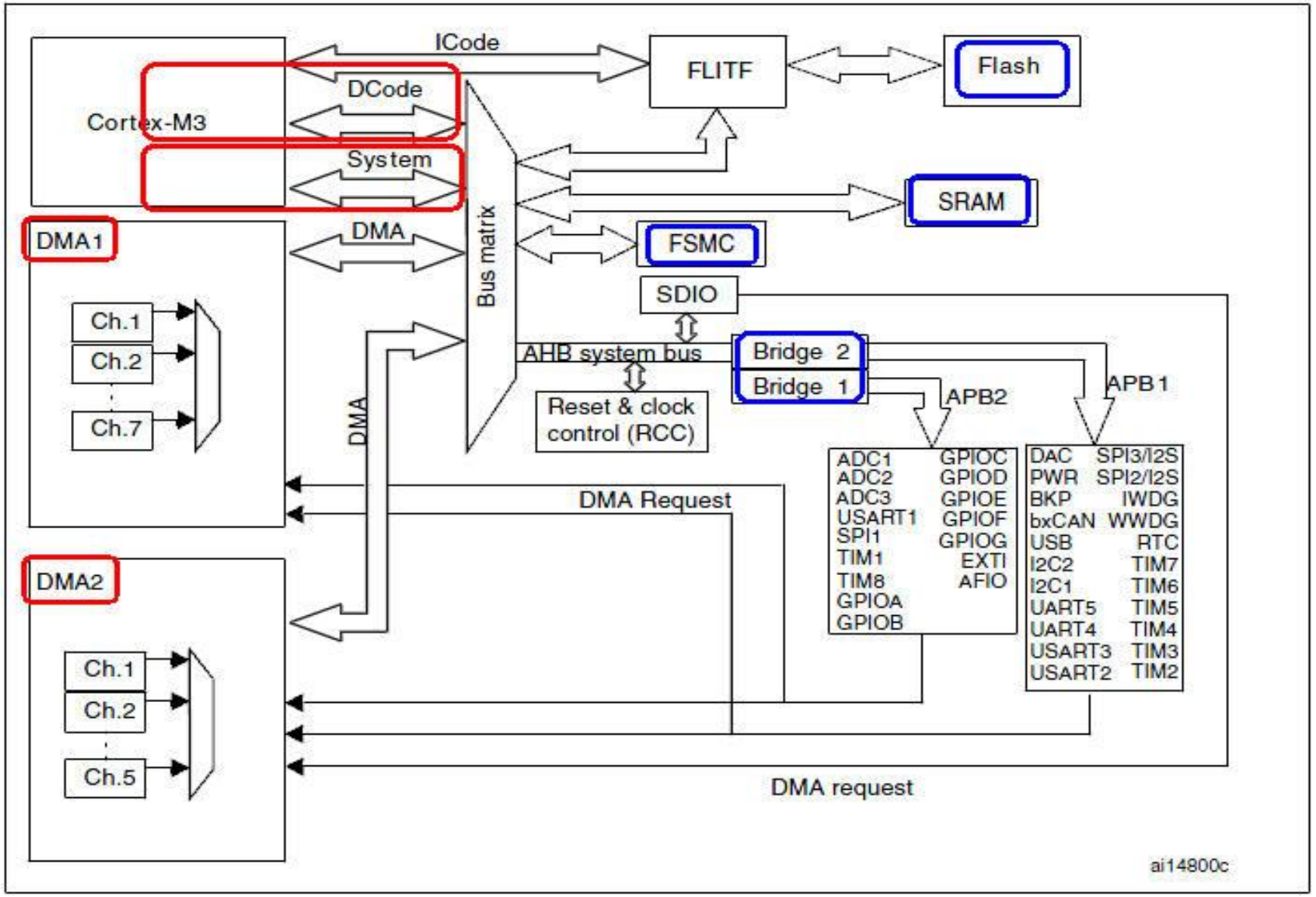
- Core: ARM 32-bit Cortex™-M3 CPU
- 최대 클럭 주파수는 72 MHz이다.
- 1.25 DMIPS/MHz (Dhrystone 2.1)
- 한 cycle의 곱셈과 hardware 나눗셈을 제공한다.
- 64 혹은 128 Kbytes의 Flash memory를 가진다.
- 20 Kbytes의 SRAM을 내장하고 있다.

STM32F103 Family

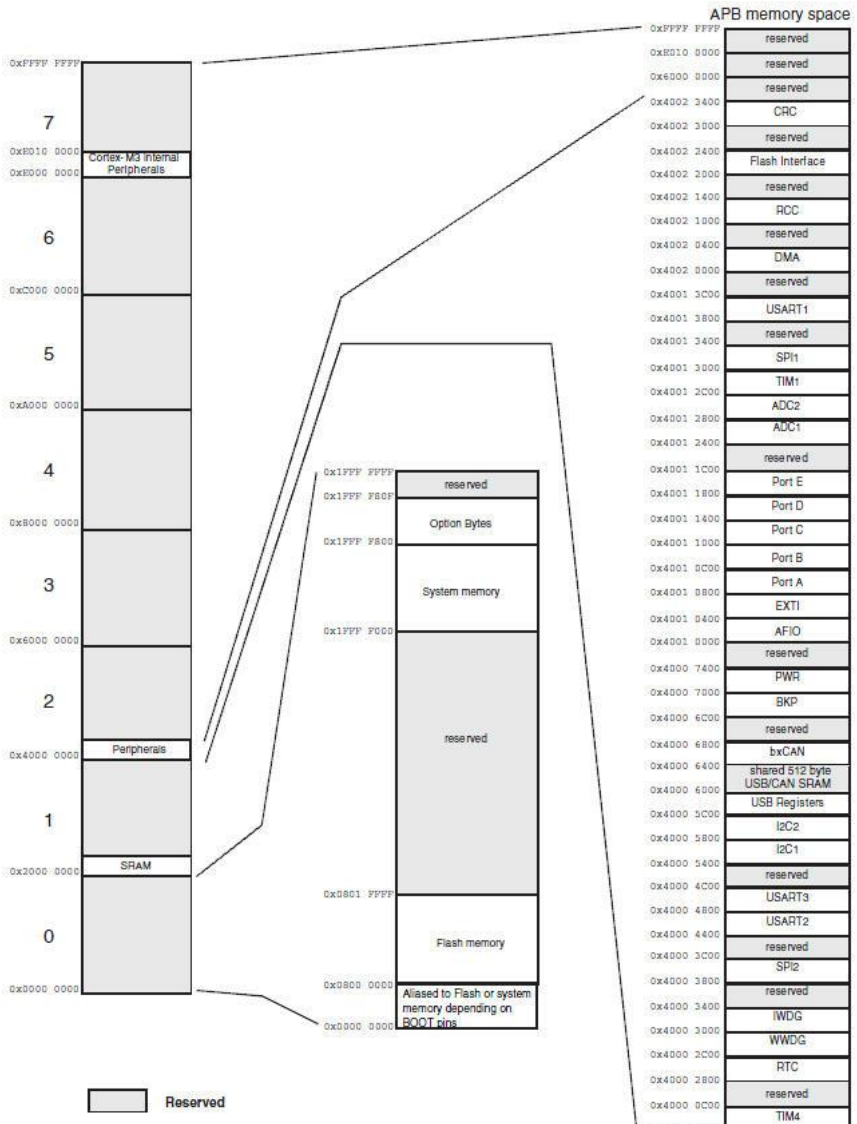
Peripheral		STM32F103Tx	STM32F103Cx		STM32F103Rx		STM32F103Vx	
Flash - Kbytes		64	64	128	64	128	64	128
SRAM - Kbytes		20	20	20	20		20	
Timers	General-purpose	3	3	3	3		3	
	Advanced-control	1	1		1		1	
Communication	SPI	1	2	2	2		2	
	I^2C	1	2	2	2		2	
	USART	2	3	3	3		3	
	USB	1	1	1	1		1	
	CAN	1	1	1	1		1	
GPIOs		26	37		51		80	
12-bit synchronized ADC Number of channels		2 10 channels	2 10 channels		2 16 channels		2 16 channels	
CPU frequency		72 MHz						
Operating voltage		2.0 to 3.6 V						
Operating temperatures		Ambient temperatures: –40 to +85 °C /–40 to +105 °C (see *Table 9*) Junction temperature: –40 to + 125 °C (see *Table 9*)						
Packages		VFQFPN36	LQFP48		LQFP64, TFBGA64		LQFP100, LFBGA100	

구분	칩 이름	Flash 크기 범위
Low-density devices	STM32F101xx, STM32F102xx, STM32F103xx	16 ~ 32 Kbytes.
Medium-density devices	STM32F101xx, STM32F102xx, STM32F103xx	64 ~ 128 Kbytes
High-density devices	STM32F101xx, STM32F103xx	256 ~ 512 Kbytes

STM32F103 Block Diagram



Memory Mapping



Flash register & Main memory

Block	Name	Base addresses	Size (bytes)
Flash memory interface registers	FLASH_ACR	0x4002 2000 - 0x4002 2003	4
	FLASH_KEYR	0x4002 2004 - 0x4002 2007	4
	FLASH_OPTKEYR	0x4002 2008 - 0x4002 200B	4
	FLASH_SR	0x4002 200C - 0x4002 200F	4
	FLASH_CR	0x4002 2010 - 0x4002 2013	4
	FLASH_AR	0x4002 2014 - 0x4002 2017	4
	Reserved	0x4002 2018 - 0x4002 201B	4
	FLASH_OBR	0x4002 201C - 0x4002 201F	4
	FLASH_WRPR	0x4002 2020 - 0x4002 2023	4

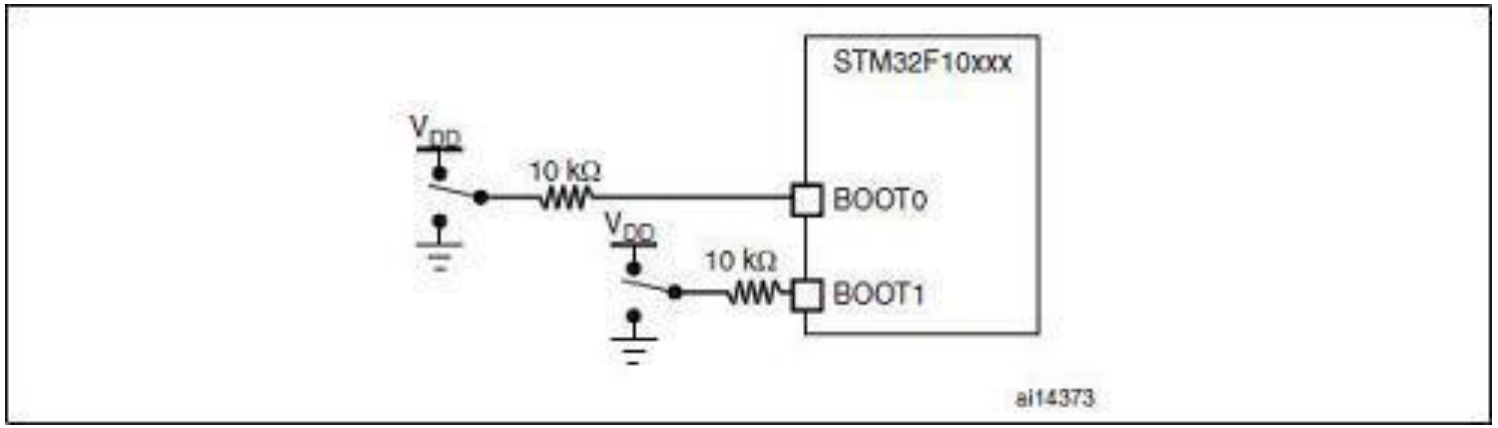
Block	Name	Base addresses	Size (bytes)
Main memory	Page 0	0x0800 0000 - 0x0800 03FF	1 Kbyte
	Page 1	0x0800 0400 - 0x0800 07FF	1 Kbyte
	Page 2	0x0800 0800 - 0x0800 0BFF	1 Kbyte
	Page 3	0x0800 0C00 - 0x0800 0FFF	1 Kbyte
	Page 4	0x0800 1000 - 0x0800 13FF	1 Kbyte
	.	.	.
	.	.	.
	.	.	.
	Page 127	0x0801 FC00 - 0x0801 FFFF	1 Kbyte
Information block	System memory	0x1FFF F000 - 0x1FFF F7FF	2 Kbytes
	Option Bytes	0x1FFF F800 - 0x1FFF F80F	16

Booting mode

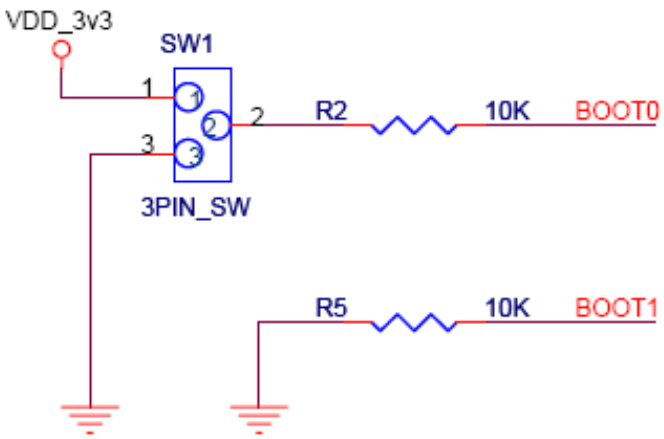
- STM32는 3개의 Booting mode가 있다.
  - Internal Flash Booting mode
  - SRAM Booting mode
  - System Memory Booting mode
- system memory booting mode는 외부 통신 interface를 통해서 CPU 내부 flash에 FW upgrade 기능을 가지는 booting mode이다. 부트로드 코드는 CPU 내부에 masking 되어있다.
- 기존의 UART에서만 FW upgrade 기능이 있었던 것과는 달리 **STM32F105xx, STM32F107xx에는 CAN 및 USB**를 통해서도 CPU 내부 NOR Flash에 코드를 upgrade할수 있는 기능 추가

BOOT mode selection pins		Boot mode	Aliasing
BOOT1	BOOT0		
x	0	Main Flash memory	Main Flash memory is selected as boot space
0	1	System memory	System memory is selected as boot space
1	1	Embedded SRAM	Embedded SRAM is selected as boot space

Boot Mode 선택



Boot Mode Selection

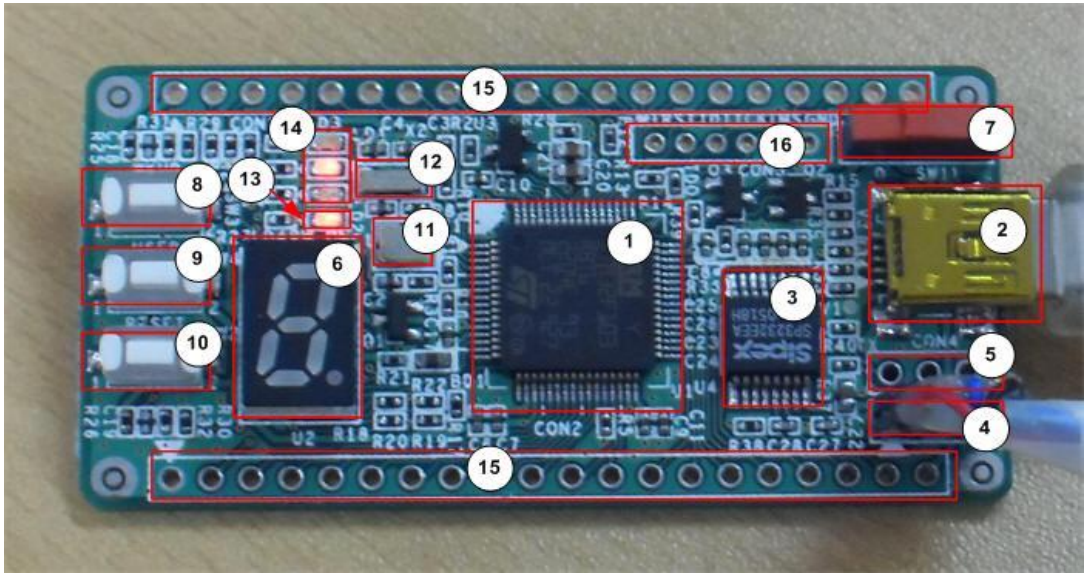


Boot Mode Selection		Boot Mode
Boot1	Boot0	
X	0	User Flash memory
0	1	System Memory
1	1	Embeded SRAM

Low-power modes

- Sleep mode
  - 오직 CPU만 멈추어있는 상태. 모든 peripherals는 계속 동작을 수행하고 있고, interrupt/event 발생시 CPU를 깨울 수 있다.
- Stop mode
  - SRAM과 registers의 값 유지. 모든 1.8 V domain에 있는 Clocks은 멈추게 된다. PLL, HSI RC, HSE crystal oscillators는 disabled 된다. voltage regulator는 normal 상태에 있거나 low power mode로 들어갈 수 있다.
  - Stop mode로부터 device가 깨어날 수 있는 것은 EXTI line의 어떤 것으로부터도 가능하다.
- Standby mode
  - 가장 적은 전력 소모. internal voltage regulator가 switch off 되기 때문에 모든 전체 1.8 V domain이 power off 된다. PLL, HSI RC, HSE crystal oscillators 또한 모두 switch off 된다. Backup domain과 Standby circuitry 레지스터를 제외하고, SRAM과 register contents는 모두 소실.
  - Standby mode로부터 벗어나기 위해서는, external reset (NRST pin), IWDG reset, WKUP pin에서의 rising edge, RTC alarm 중의 하나를 받아야 한다.

Mango-M32



번호	설명	번호	설명
1	STM32F103xx MCU	2	USB mini-B Connector
3	SP3232 UART-RS232C Level Converter	4	RS232C Port #1 (UART 1)
5	RS232C Port #2 (UART 2)	6	7-Segment LED
7	Boot Select Switch (BOOT0)	8	WKUP Button
9	USER Button	10	RESET Button
11	12MHz Crystal	12	32.768KHz Crystal
13	Power LED	14	Indicator LEDs
15	20핀*2열 HEADER Connector	16	JTAG Connector

Ref 1

- NVIC - Nested vectored interrupt controller
- EXTI - External interrupt/event controller
- SPI - Serial peripheral interface
- CAN - Controller area network
- FSMC - Flexible static memory controller
- FLITF - Flash memory interface