

Boo-Ree Multimedia Inc.

BMC513 Tenor Board Application Note

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1. Summary of the BMC513 Tenor Board

- Tenor B/D 는 BMC513 을 사용해 Application 을 개발할 때 필요한 Evaluation Board 이며, 이 문서는 Tenor Board 의 사용을 위한 H/W, S/W 의 사용 설명하는 Application note 이다.

1.1) Components of the Tenor B/D

- Tenor B/D
- DC 5V Adaptor
- USB A to Mini Cable
- Development Tool Install CD

1.2) Board overview

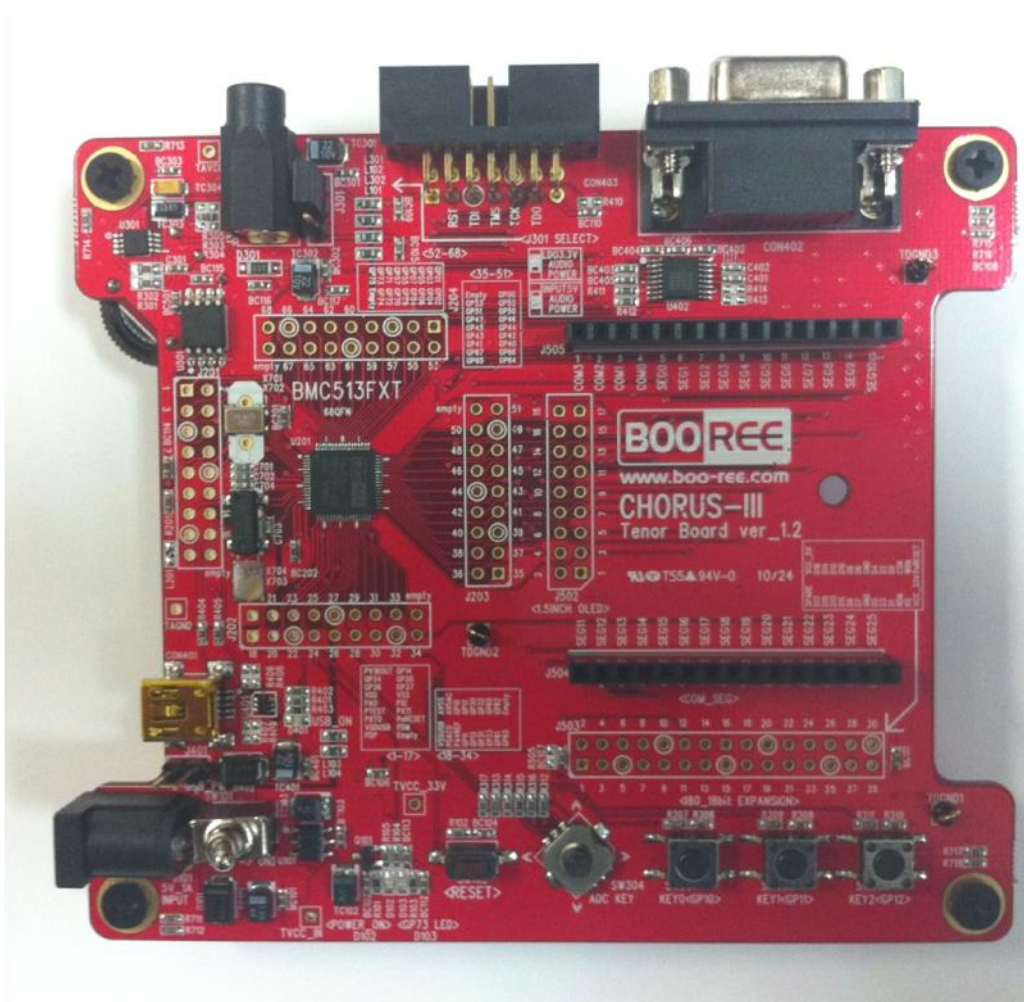


FIGURE. 1

2. Features of BMC513FXT

- **Fast 8-bit RISC 8051 core MCU**
 - Advanced RISC B51 core using 1-clock per instruction
 - Dual DPTRs (Data Pointer Registers) for fast block move
- **Hardwired ADPCM Voice Codec**
 - Embedded own ADPCM Codec(BRAC®) with a dedicated DMA
 - Selectable sampling frequency from 4KHz to 48KHz
 - Built-in Low Pass Filter & 3 times up-sampling
 - 3-bit / 4-bit data compression
 - Volume control with mute feature
 - Automatic DMA access to external Serial Flash (up to 1Gbit)
 - IBB(Input Bit stream Buffer) mode for direct playback of voice data in X-RAM
 - Voice Recording
- **Hardwired BRJPEG Decoder**
 - Embedded own DCT based image decoder
 - 128x128 10 frame decoding @ 12MHz
 - 192x192 10 frame decoding @ 24MHz
 - Built-in processing engines for image engine
 - Variable length decoding engine
 - Inverse DCT engine
 - Support additional MAC/MUL/ADD/SUM instructions with up to 16 data input
- **VDMA**
 - Two dimensional DMA engine with on the fly additional functions
 - Color space conversion from YCbCr to RGB
 - Mixing foreground and background images
 - Alpha blending with 4444 and 5551 formats
 - Local I80LCD channel to read/write RGB data to/from external frame memory
- **Memories**
 - 384Kbytes embedded NOR Flash Memory(e-FLASH) for program and data
 - Sector Endurance: 10,000 Cycles
 - Greater than 10 years Data Retention
 - This memory is protected from writing after reset
 - 256Bytes On-chip data SRAM(I-RAM)
 - 4Kbytes On-chip Extended data SRAM(X-RAM)
 - Up to 1Gbits, Serial NOR Flash externally Expandable
- **JTAG Interface**
 - On-Chip Debug and In-System Programming through JTAG

➤ **ADC**

- 6(80QFP)/4(68QFN) channels 10-bit
- Max. 20uS conversion time, Max 50K SPS @3MHz ADC conversion clock
- Programmable input clock frequency

➤ **1 channel 10-bit D/A Converter**

➤ **Serial Flash Controller**

- Master-only interface with dual DMA functions
- BSPI clock is divided by 2 from F_{sys}(system clock)
- BSPI is mainly used for external serial flash
- BSPI on-the-fly function by a dedicated DMA (high-speed data read even during voice Playback)

➤ **UART**

- Supports 5-bit, 6-bit, 7-bit, or 8-bit serial data transmit / receive (TX / RX)
- Supports external clocks for the UART operation
- Programmable baud rate
- Supports IrDA 1.0
- Loopback mode for testing
- Insertion of one or two Stop bits per frame
- Parity checking
- LSB first

➤ **RTC**

- Time information (seconds/minutes/hours) directly in BCD code
- Calendar information (date/month/year/day of week) directly in BCD code up to year 9999
- Leap year generator
- Wake-up signal generation: support on the STOP mode
- Alarm interrupt
- Cyclic interrupt: the interrupt cycle may be 1/512, 1/256, 1/64, 1/16, 1/4, 1/2, and 1 second

➤ **USB Device**

- Fully Compliant to USB 2.0 full-speed specification (maximum 12Mbps)
- Complete Device Configuration
- Compatible with both OpenHCI and intel UHCI Standards
- Support 5 Endpoints (1 Control Endpoint, 4Data Endpoints with logical endpoint numbering)
- EP0: 16 Bytes Control/Status Endpoint
- EP1/2: 64 Bytes Data Endpoint (IN/OUT) supporting automatic double buffering
- EP3/4: 16 Bytes Data Endpoint (IN/OUT) supporting automatic double buffering
- Supports Bulk Data Transfer
- CRC16 Generation and CRC5/CRC16 Checking
- Suspend/Resume Control
- On-Chip USB Transceiver

-
- **Timers with Pulse Width Modulation (PWM)**
 - 3 channels 16-bit Programmable Timers
 - Interval Mode, Toggle, Capture Mode or PWM Mode
 - 3 PWM output, Timer output and Capture input
 - Supports external clock sources
 - **SPI**
 - Full-duplex, 3-wire or 4-wire Synchronous Data Transfer
 - Support Master and Slave operation
 - Serial clock with programmable polarity and phase
 - Baud rate clock selectable in Master mode
 - MSB First or LSB First Data Transfer
 - Support 1 Byte / 2 Byte operation
 - **Watchdog Timer**
 - 8-bit Timer with pre-scaler
 - If an overflow of watchdog timer is generated, a reset is issued
 - **I80LCD Interface**
 - Support parallel/serial external LCD interfaces
 - 8-bit, 9-bit, 16-bit, 18-bit parallel I80 interface
 - 3-wire, 4wire serial interface
 - Support VDMA local bus interface
 - **LCD Controller/Driver**
 - 32(80QFP)/30(68QFN) segments and 4 common terminals
 - 1/2, 1/3 and 1/4 duty selectable
 - 16 level LCD contrast control by software
 - LCD display data memory registers
 - **Other Features**
 - 30 programmable interrupt sources (10(80QFP) / 8(QFN) external interrupt sources)
 - Low power consumption
 - **Low Voltage Reset (LVR)**
 - Criteria voltage: 2.0V
 - **On-Chip Regulator**
 - VDD to 1.8V conversion
 - VDD to 3.3V conversion
 - **Power Down Mode**
 - IDLE: only CPU clock stops
 - STOP: selected system clock and CPU clock stop
-

➤ **Clock Circuit**

- External crystal: 4MHz ~ 12MHz
- External resonator: 4MHz ~ 8MHz
- Internal typ. 16MHz oscillator
- External crystal: 32.768KHz
- Internal typ. 32.768KHz oscillator
- On chip PLL: MAX 48MHz

➤ **Operating Frequency**

- MAX. 24MHz

➤ **Operating Voltages**

- 2.2V to 5.5V at 4 - 12MHz

➤ **Operating Temperature Range**

- -40°C ~ 80°C

➤ **I/O and Package type**

- 61(80QFP)/51(68QFN) GPIOs
- 68-pin (8x8 mm) QFN
- 80-pin (14x20 mm) QFP

➤ **SMART option**

- RDP (Flash Read Protection)
- HDP (Flash Program Protection)

3.2) Power Plan

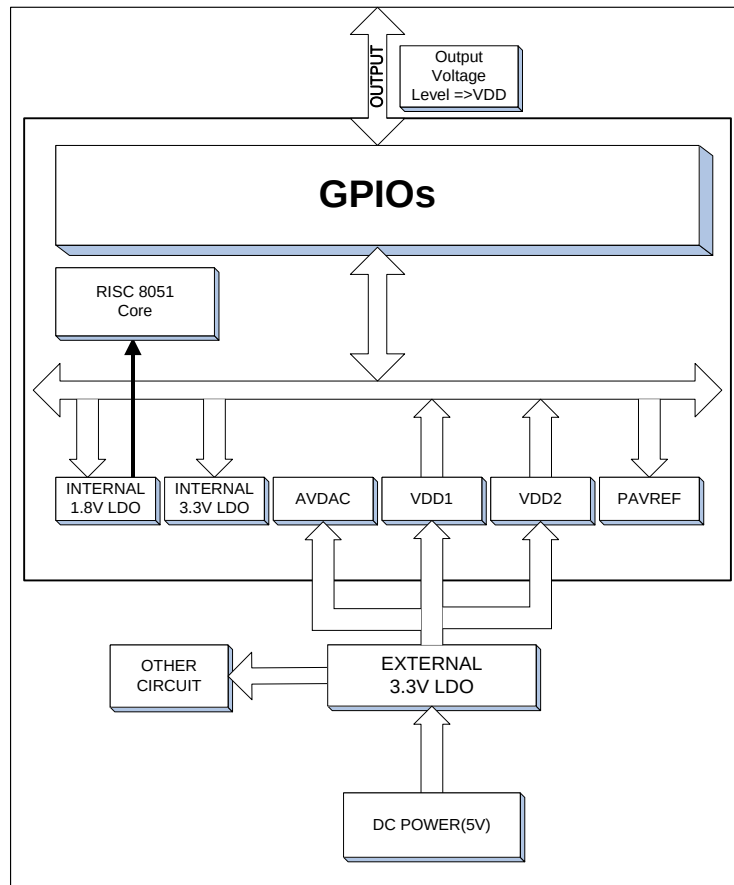


FIGURE. 3

- VDD2 pin is the only 80QFP
- Internal LDO 는 내부 Core 와 Block 을 위한 전원

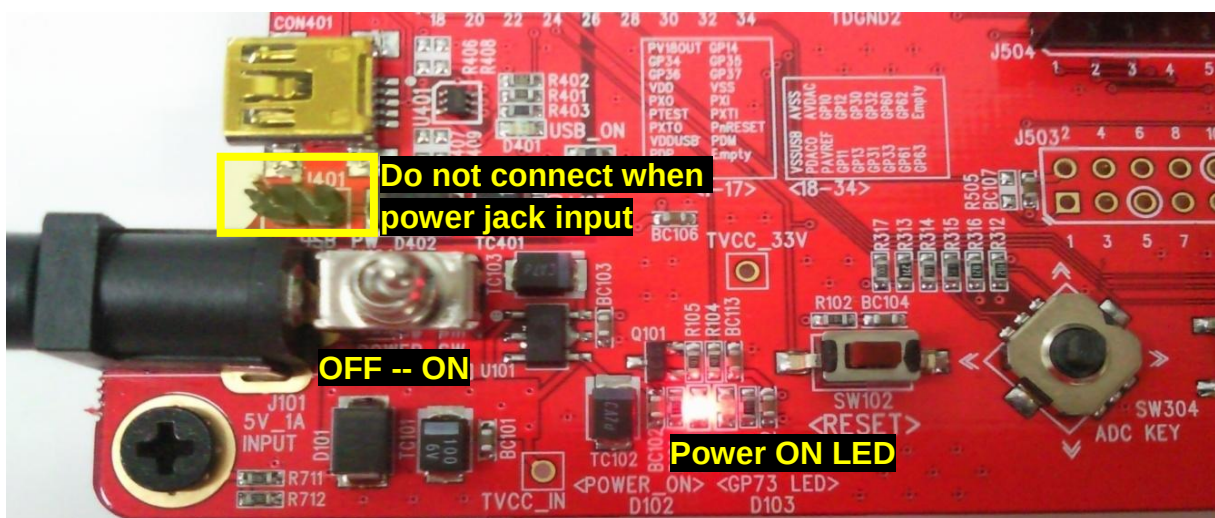


FIGURE. 4

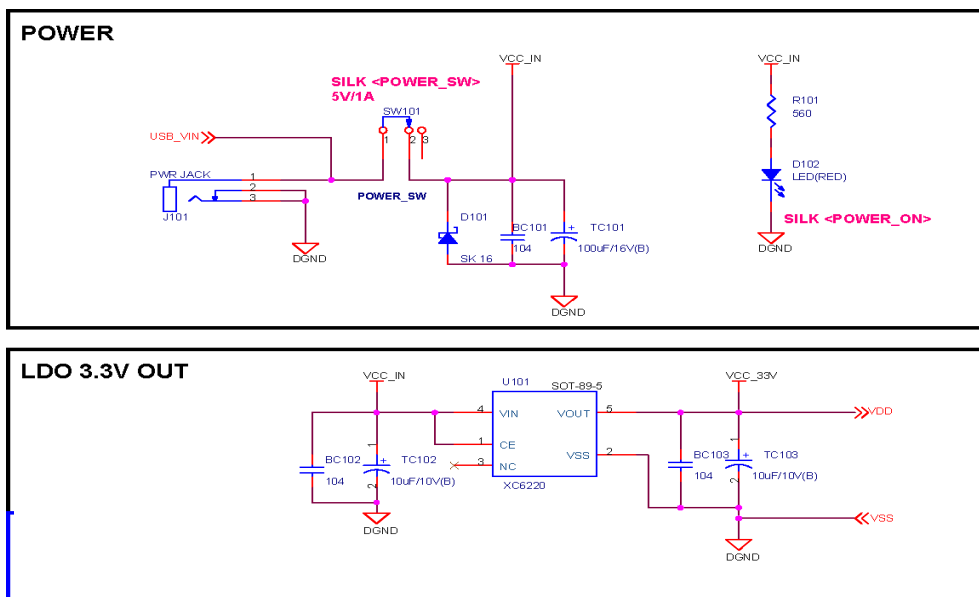


FIGURE. 5

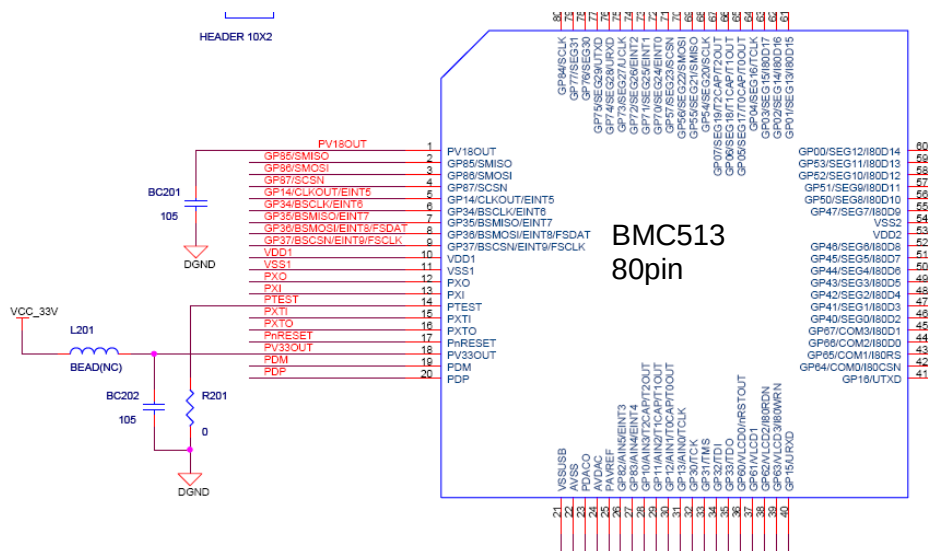


FIGURE. 6

- Tenor B/D Package 에 포함된 DC 5V/1A Adapter 를 통해 전원을 공급
- USB 전원을 사용할 경우 Figure.4 를 참조하여 [J401] header 을 단아주어야 한다. [J401]을 닫은 상태에선 USB 케이블과 adapter 전원을 동시에 삽입하면 안된다.
- **BMC513 의 GPIO output level 은 VDD 로 입력되는 전압 값 과 동일하다.**
Input Voltage : 2.2V ~ 5.5V (Tenor Board = 3.3V Input)
- BMC513 의 내부 LDO out pin 에 1uF 세라믹 캐패시터를 최대한 가깝게 실장해주며, L201 (Bead)는 실장 하지 않는다.

3.3) Main Chip(BMC513) & Clock

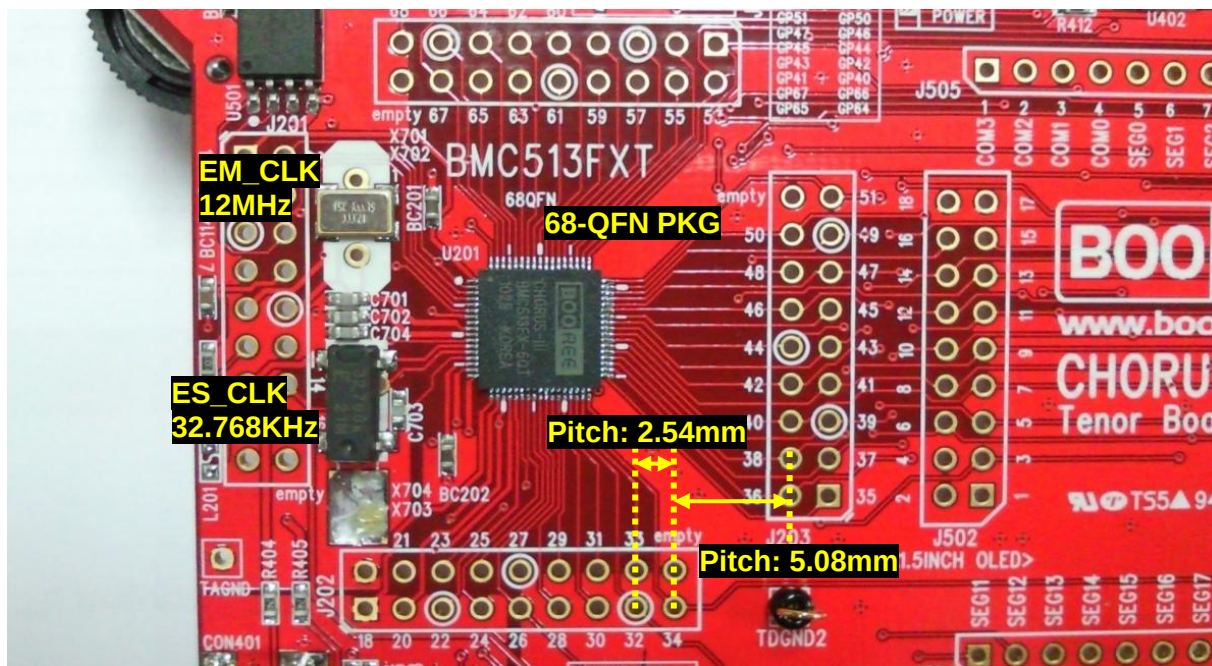


FIGURE. 7

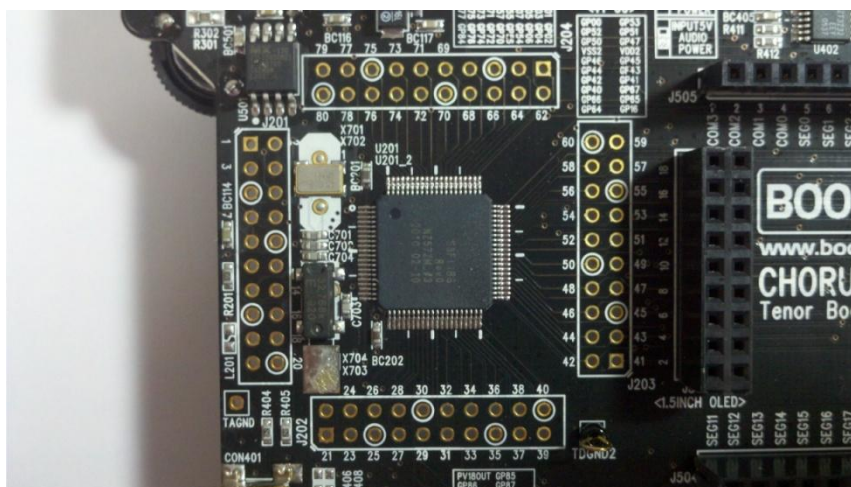


FIGURE. 8

- BMC513 주위의 Header Hole 은 소켓보드사용, Side Board 부착 또는 Signal 측정 등의 목적으로 사용되며, 각 Pitch 는 2.54mm 간격으로 만능기판의 부착이 가능하다.
- 68pin (QFN) - 72hole (4hole empty) , 80pin (QFP) - 80 hole
※ Figure.8 의 TQFP(80pin) Package 는 현재 QFP Package 로 대체되었다.
- External Clock (12MHz & 32.768KHz) 는 SMD type 이 실장 되어있으나, 제거 후 DIP type 로 대체할 수 있다.

3.3.1) 68PIN Header Pin Map

← (J201)		↓ (J202)		→ (J203)		↑ (J204)	
pin NO	NAME	pin NO	NAME	pin NO	NAME	pin NO	NAME
1	PV18OUT	1	VSSUSB	1	GP64	1	GP01
2	GP14	2	AVSS	2	GP65	2	GP02
3	GP34	3	PDACO	3	GP66	3	GP03
4	GP35	4	AVDAC	4	GP67	4	GP04
5	GP36	5	PAVREF	5	GP40	5	GP05
6	GP37	6	GP10	6	GP41	6	GP06
7	VDD	7	GP11	7	GP42	7	GP07
8	VSS	8	GP12	8	GP43	8	GP54
9	PXO	9	GP13	9	GP44	9	GP55
10	PXI	10	GP30	10	GP45	10	GP56
11	PTEST	11	GP31	11	GP46	11	GP57
12	PXTI	12	GP32	12	GP47	12	GP70
13	PXTO	13	GP33	13	GP50	13	GP71
14	PnRESET	14	GP60	14	GP51	14	GP72
15	PV33OUT	15	GP61	15	GP52	15	GP73
16	PDM	16	GP62	16	GP53	16	GP74
17	PDP	17	GP63	17	GP00	17	GP75
18	empty	18	empty	18	empty	18	Empty

CHART. 1

3.3.2) 80PIN Header Pin Map

← (J201)		↓ (J202)		→ (J203)		↑ (J204)	
pin NO	NAME	pin NO	NAME	pin NO	NAME	pin NO	NAME
1	PV18OUT	1	VSSUSB	1	GP16	1	GP01
2	GP85	2	AVSS	2	GP64	2	GP02
3	GP86	3	PDACO	3	GP65	3	GP03
4	GP87	4	AVDAC	4	GP66	4	GP04
5	GP14	5	PAVREF	5	GP67	5	GP05
6	GP34	6	GP82	6	GP40	6	GP06
7	GP35	7	GP83	7	GP41	7	GP07
8	GP36	8	GP10	8	GP42	8	GP54
9	GP37	9	GP11	9	GP43	9	GP55
10	VDD1	10	GP12	10	GP44	10	GP56
11	VSS1	11	GP13	11	GP45	11	GP57
12	PXO	12	GP30	12	GP46	12	GP70
13	PXI	13	GP31	13	VDD2	13	GP71
14	PTEST	14	GP32	14	VSS2	14	GP72
15	PXTI	15	GP33	15	GP47	15	GP73
16	PXTO	16	GP60	16	GP50	16	GP74
17	PnRESET	17	GP61	17	GP51	17	GP75
18	PV33OUT	18	GP62	18	GP52	18	GP76
19	PDM	19	GP63	19	GP53	19	GP77
20	PDP	20	GP15	20	GP00	20	GP84

CHART. 2

3.4) Key

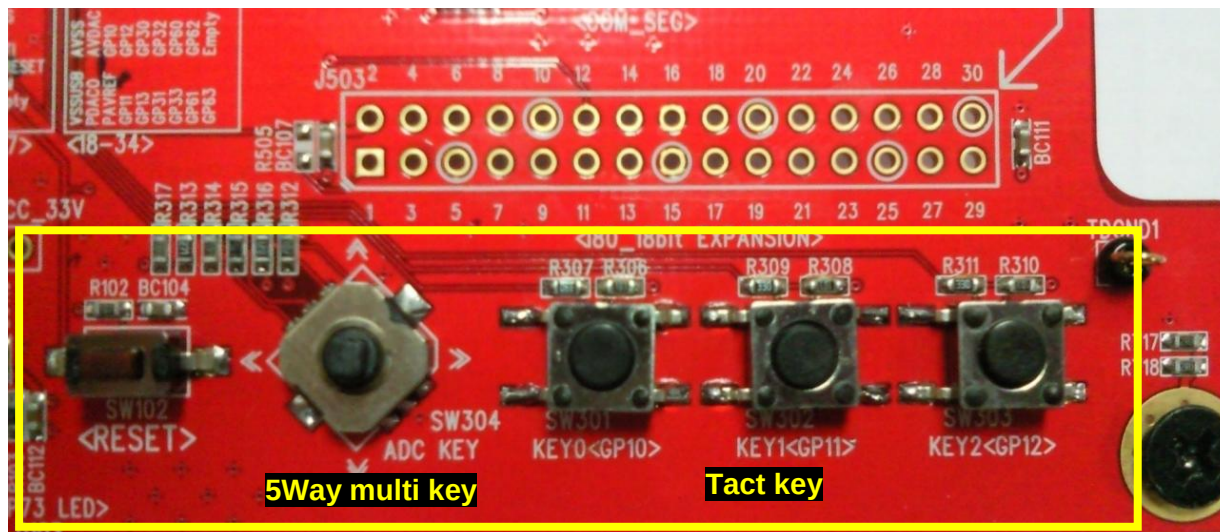


FIGURE. 9

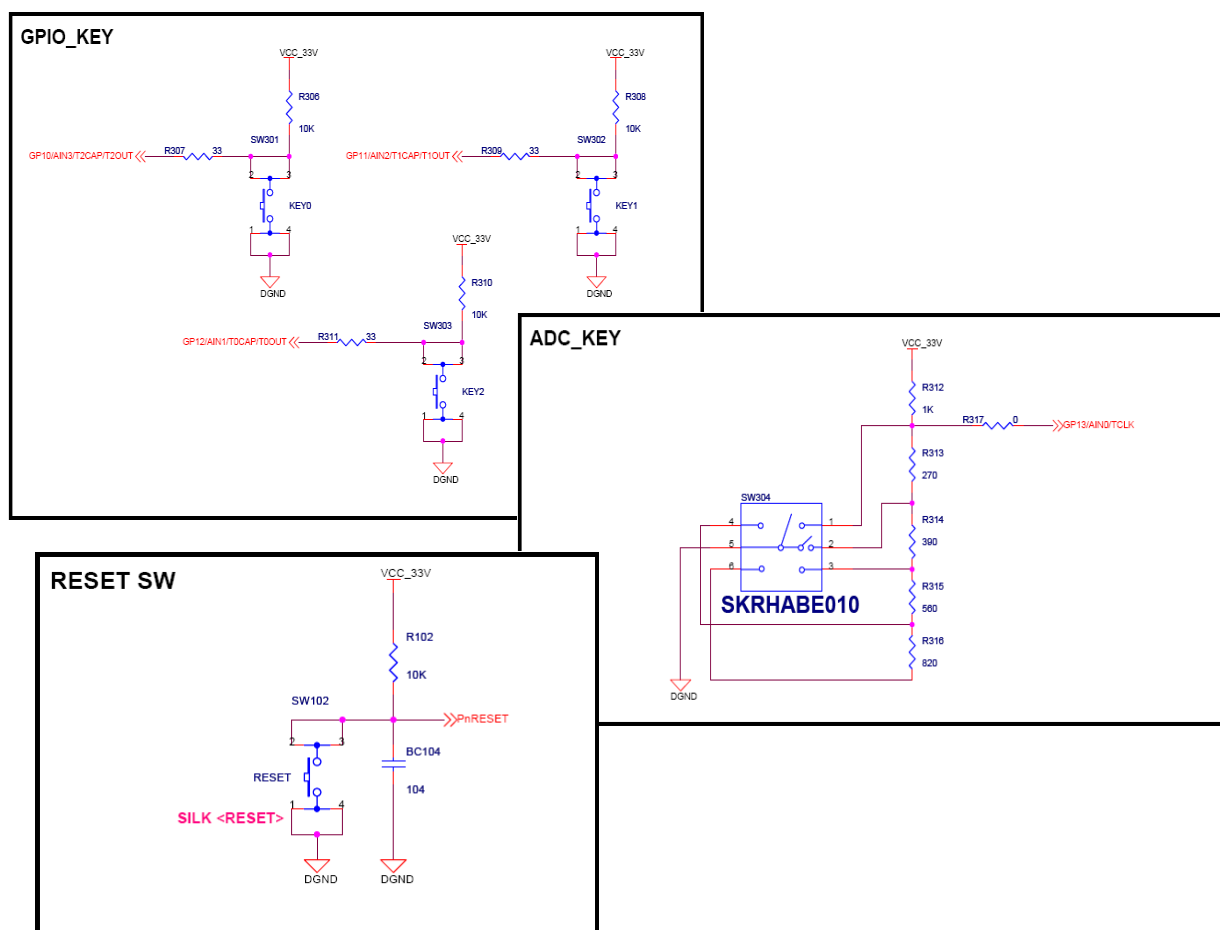


FIGURE. 10

- Reset key
 - BMC513 reset time -> Min: 2uS
 - [R102]: 10kΩ / [BC104]: 100nF
 - 시정수 : 10K x 100n = about 1ms

- Multi key
 - 5Way multi key ((↑), (↓), (←), (→), (push))
 - GP13/AIN0 Input

- Tact key
 - Key0 -> GP10/AIN3/T2CAP/T2OUT
 - Key1 -> GP11/AIN2/T1CAP/T1OUT
 - Key2 -> GP12/AIN1/T0CAP/T0OUT

3.5) Audio Part

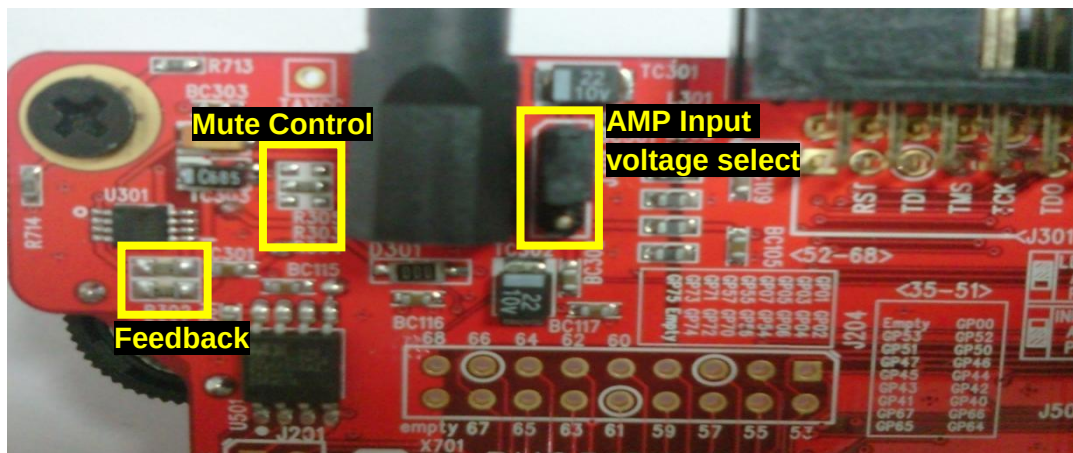


FIGURE. 10

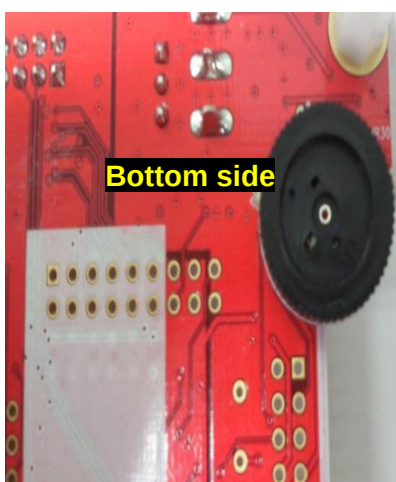


FIGURE. 11

[J301] Voltage select Header

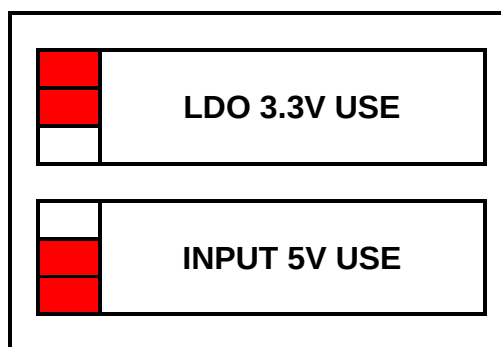


CHART. 3

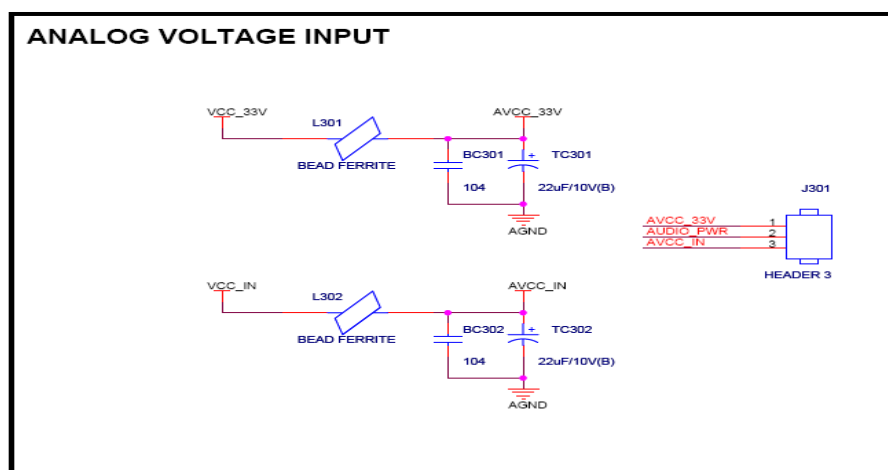


FIGURE. 12

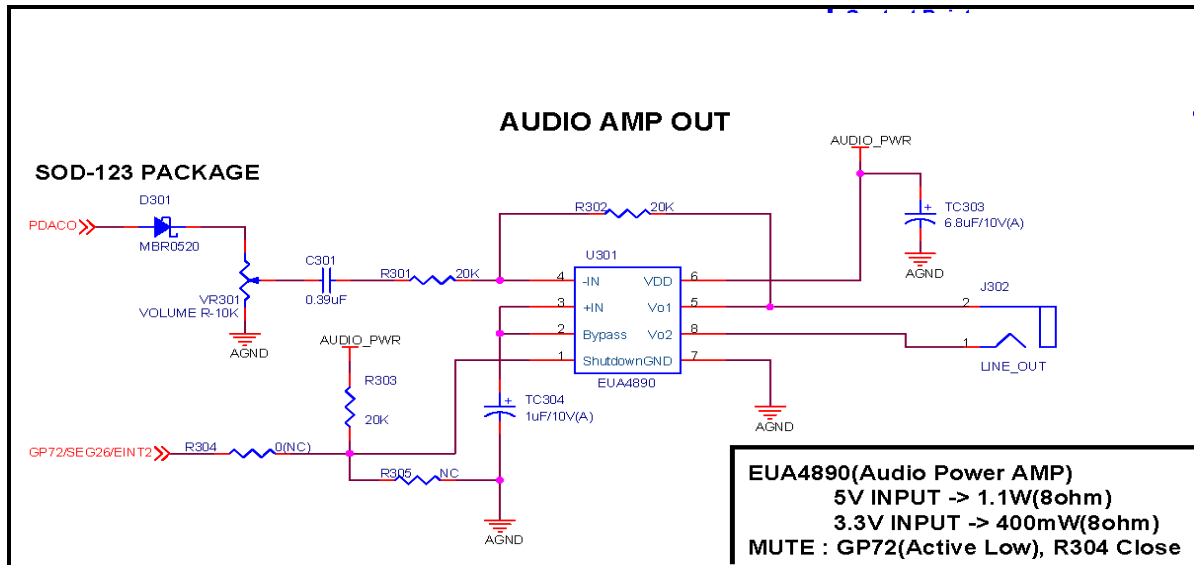


FIGURE. 13

- Audio AMP
 - EUA4890. BTL AMP
 - 5V Input -> 1.1W output
 - 3.3V input -> 400mW output
- Mute control
 - AMP Shutdown (Active low) 의 기능을 활성화 하려면 [R304] 저항을 실장 해야 한다.
 - 저항 실장 후 GP72 를 통해 control 가능.
- DACO 라인은 다른 라인의 간섭을 최소화 하기 위해 PCB 상 내층(2layer)배선.

3.6) I80 LCD Interface

- I80 Interface 는 8-bit 전용과 18-bit 까지 확장 할 수 있는 Header 가 존재하며, 각 header 의 Pin Map 을 참조하여 Side Board 를 제작하여 테스트 해야 한다.

3.6.1) I80 8-bit Interface header



FIGURE. 14

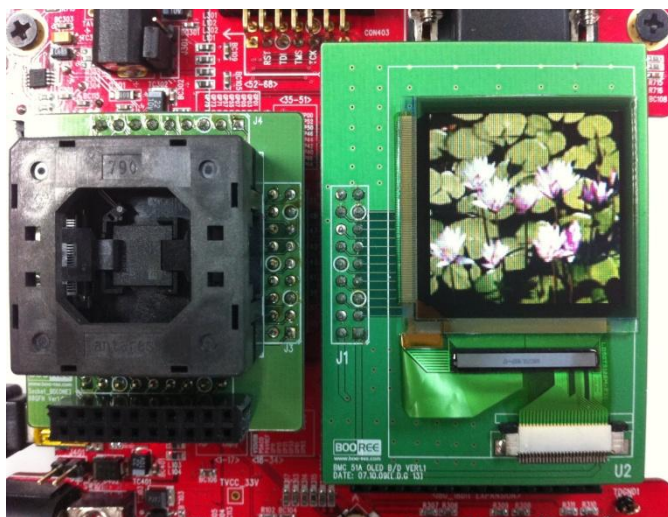


FIGURE. 15

— I80 8-bit Parallel Header Pin Map —

I80 8bit header		
pin NO	Connection	NAME
1		VCC_33V
2		VCC_IN
3	44/GP45	I80D7
4	32/GP61	SPARE
5	42/GP43	I80D5
6	43/GP44	I80D6
7	40/GP41	I80D3
8	41/GP42	I80D4
9	38/GP67	I80D1

pin NO	Connection	NAME
10	39/GP40	I80D2
11	36/GP65	I80RS
12	37/GP66	I80D0
13	33/GP62	I80RDN
14	35/GP64	I80CSN
15	14/PnRESET	RESET
16	34/GP63	I80WRN
17		GND
18		GND

CHART. 4

- Pin No. 4 의 SPARE 핀은 LCD Back Light Control 등의 목적으로 사용되며, SPARE 핀을 사용하려면 [R505]/ 0Ω 저항을 실장 해야 한다.
VCC_IN 은 보드로 입력되는 전원을 의미하며, Tenor 의 경우 DC 5V 이다.

3.6.2) I80 Interface all port

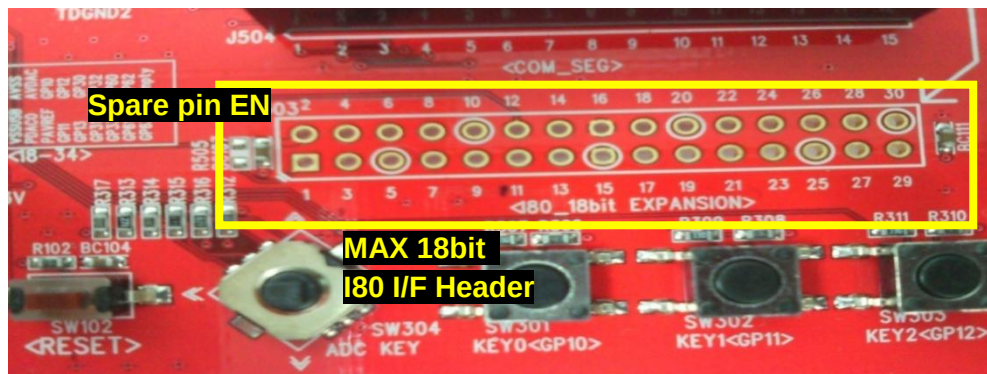


FIGURE. 16

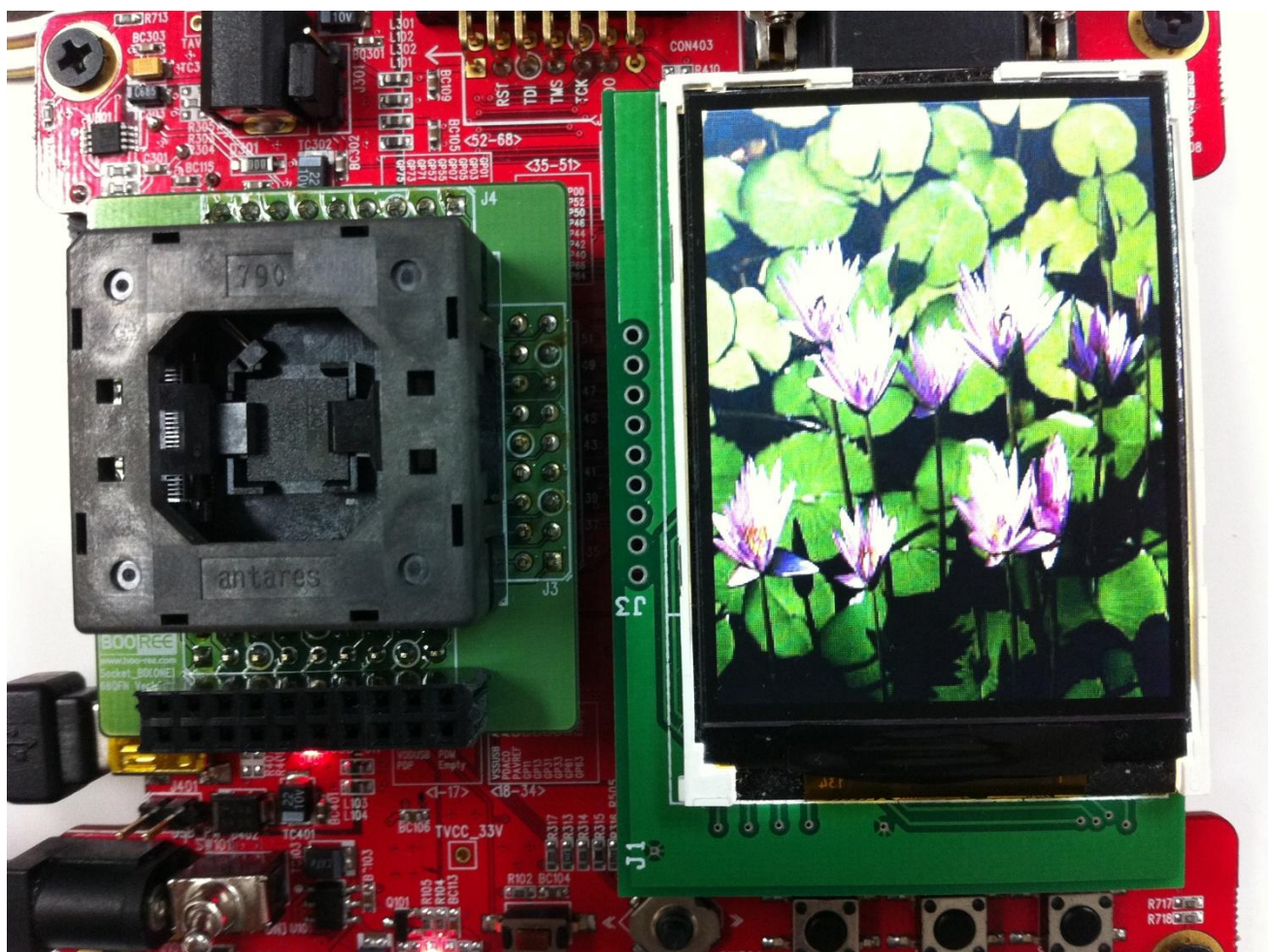


FIGURE. 17

- I80 Interface port 의 Header 이며 MAX. 18-bit 까지 사용할 수 있다. 8-bit 과 같이 전용 보드를 제작하여 사용해야 한다.

— I80 All Port Parallel Header Pin Map —

I80 I/F ALL Port		
pin NO	Connection	NAME
1	32/GP61	SPARE
2		VCC_IN
3	54/GP03	I80D17
4	53/GP02	I80D16
5	52/GP01	I80D15
6	51/GP00	I80D14
7	50/GP53	I80D13
8	49/GP52	I80D12
9	48/GP51	I80D11
10	47/GP50	I80D10
11	46/GP47	I80D9
12	45/GP46	I80D8
13	44/GP45	I80D7
14	43/GP44	I80D6
15		GND
16		GND
17	42/GP43	I80D5
18	41/GP42	I80D4
19	40/GP41	I80D3
20	39/GP40	I80D2
21	38/GP67	I80D1
22	37/GP66	I80D0
23	33/GP62	I80RDN
24	35/GP64	I80CSN
25	36/GP65	I80RS
26	34/GP63	I80WRN
27		VCC_33V
28	14/PnRESET	RESET
29	NC	NC
30	NC	NC

CHART. 5

3.7) LCD Driver controller

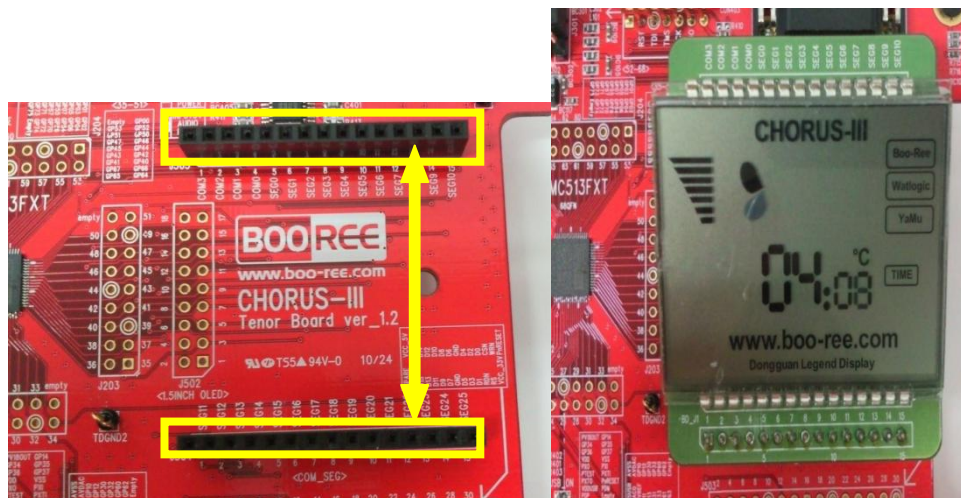


FIGURE. 18

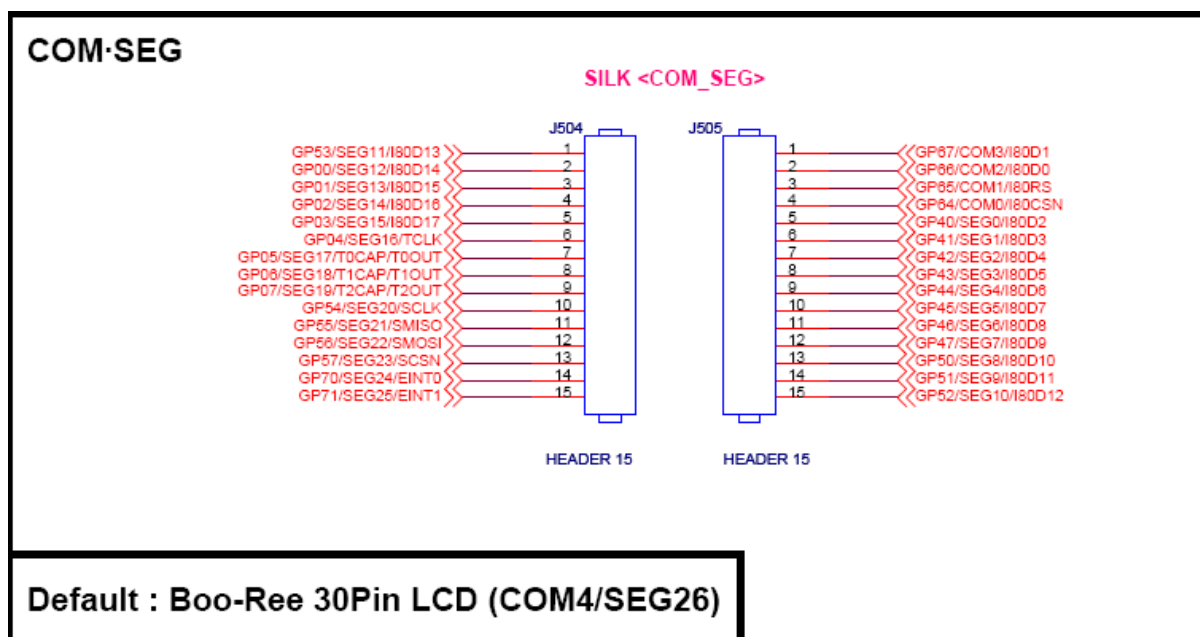


FIGURE. 19

- Figure.18 의 Segment LCD 는 BOO-REE 사 에서 제작한 보드로써 26SEG 와 4COM Signal 을 사용한다.
- 사용 하지 않는 SEG pin 은 GPIO 레지스터 설정 에서 input or output Mode 로 설정해 주어야 한다.

— COM/SEG LCD Header Pin Map —

J504		J505	
pin NO	NAME	pin NO	NAME
1	SEG11	1	COM3
2	SEG12	2	COM2
3	SEG13	3	COM1
4	SEG14	4	COM0
5	SEG15	5	SEG0
6	SEG16	6	SEG1
7	SEG17	7	SEG2
8	SEG18	8	SEG3
9	SEG19	9	SEG4
10	SEG20	10	SEG5
11	SEG21	11	SEG6
12	SEG22	12	SEG7
13	SEG23	13	SEG8
14	SEG24	14	SEG9
15	SEG25	15	SEG10

CHART. 6

EXPANSION PIN MAP			
Chip NO	NAME	Chip NO	NAME
38/GP67	COM3	53/GP02	SEG14
37/GP66	COM2	54/GP03	SEG15
36/GP65	COM1	55/GP04	SEG16
35/GP64	COM0	56/GP05	SEG17
39/GP40	SEG0	57/GP06	SEG18
40/GP41	SEG1	58/GP07	SEG19
41/GP42	SEG2	59/GP54	SEG20
42/GP43	SEG3	60/GP55	SEG21
43/GP44	SEG4	61/GP56	SEG22
44/GP45	SEG5	62/GP57	SEG23
45/GP46	SEG6	63/GP70	SEG24
46/GP47	SEG7	64/GP71	SEG25
47/GP50	SEG8	65/GP72	SEG26
48/GP51	SEG9	66/GP73	SEG27
49/GP52	SEG10	67/GP74	SEG28
50/GP53	SEG11	68/GP75	SEG29
51/GP00	SEG12	(80pin only)	SEG30
52/GP01	SEG13	(80pin only)	SEG31

CHART. 7

3.8) USB/UART/JTAG

3.8.1) USB 2.0 Device

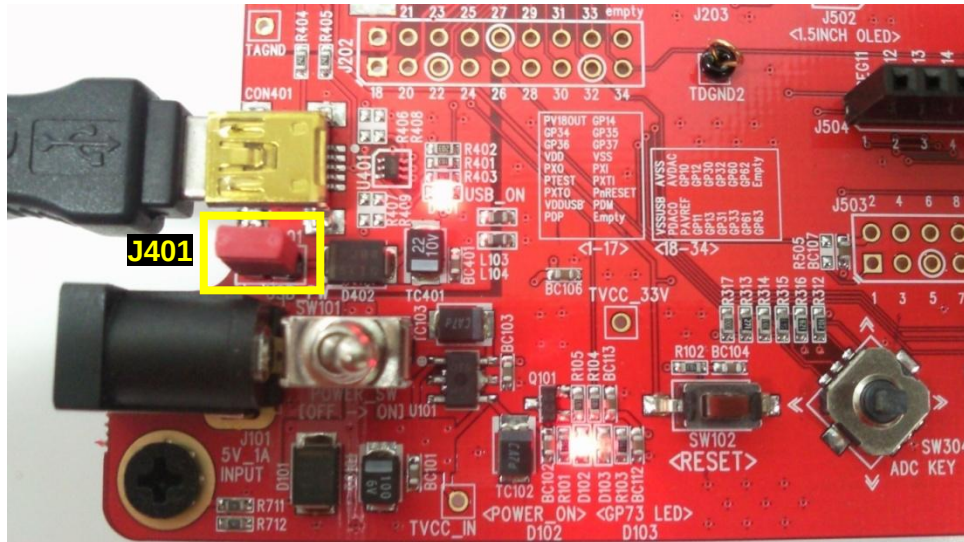


FIGURE. 20

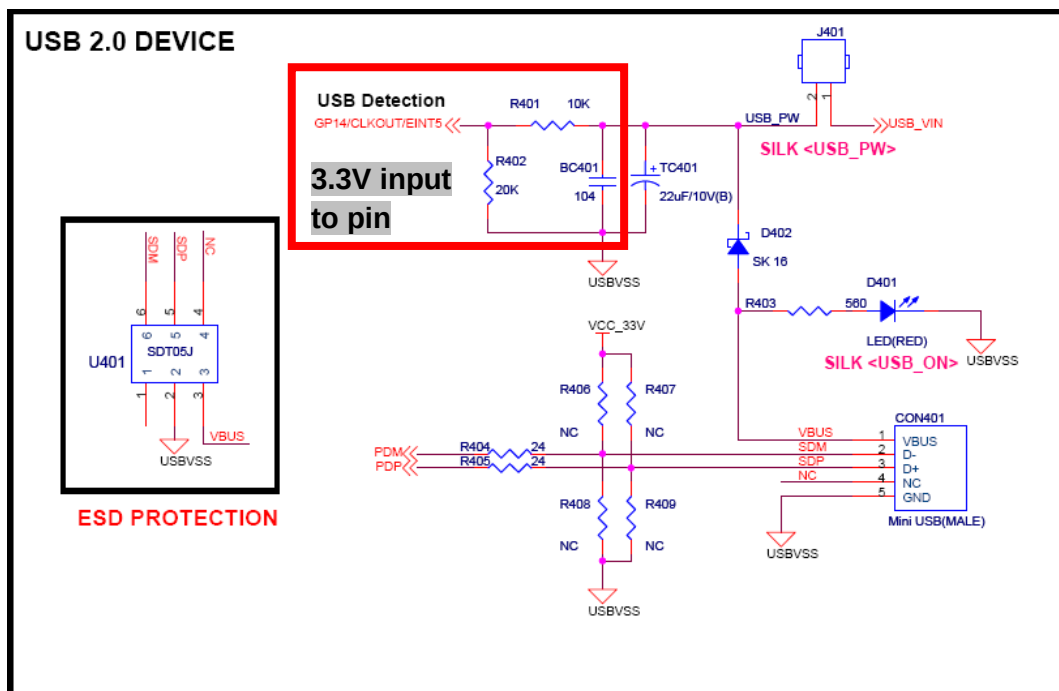


FIGURE. 21

- USB 5V 전원을 메인 전원으로 사용시 [J401] header 을 닫아주면 된다.
3.3V 분압된 USB 전원은 GP14/EINT5 pin 과 연결되어 Detection 기능으로 사용한다.

3.8.2) UART / JTAG

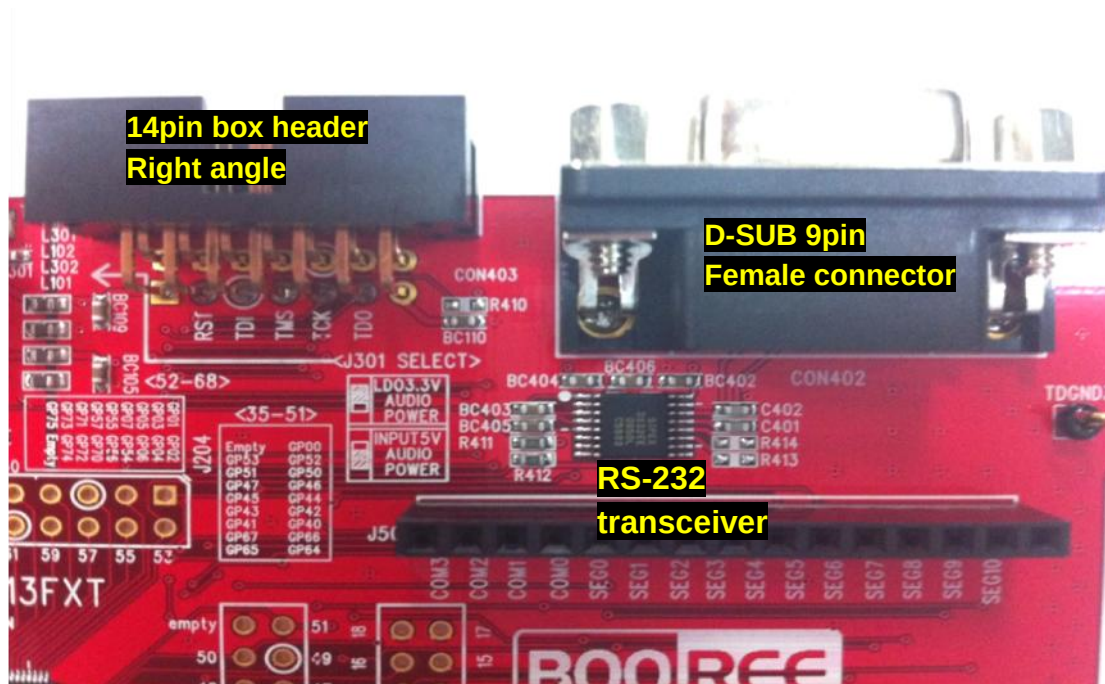


FIGURE. 22

- RS-232 Transceiver IC 내장으로 별도의 장비 없이 시리얼 케이블만 통해 통신 가능
※ DB9 시리얼 케이블은 별도로 구매 해야 한다.
- GP74 - URXD (Receive Data Input for UART)
GP75 - UTXD (Transmit Data Output for UART)

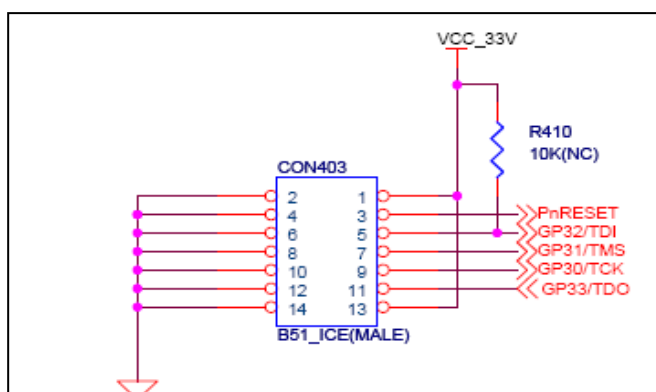


FIGURE. 23

- 14pin JTAG Connector 를 사용하며, 연결 케이블은 ICE 장비 구매시 포함되어있다. (SPICE Guide 참조)
- GP3[3:0] 일반 GPIO 로 사용하려면 JTAGOFF 레지스터 설정

4. Schematic

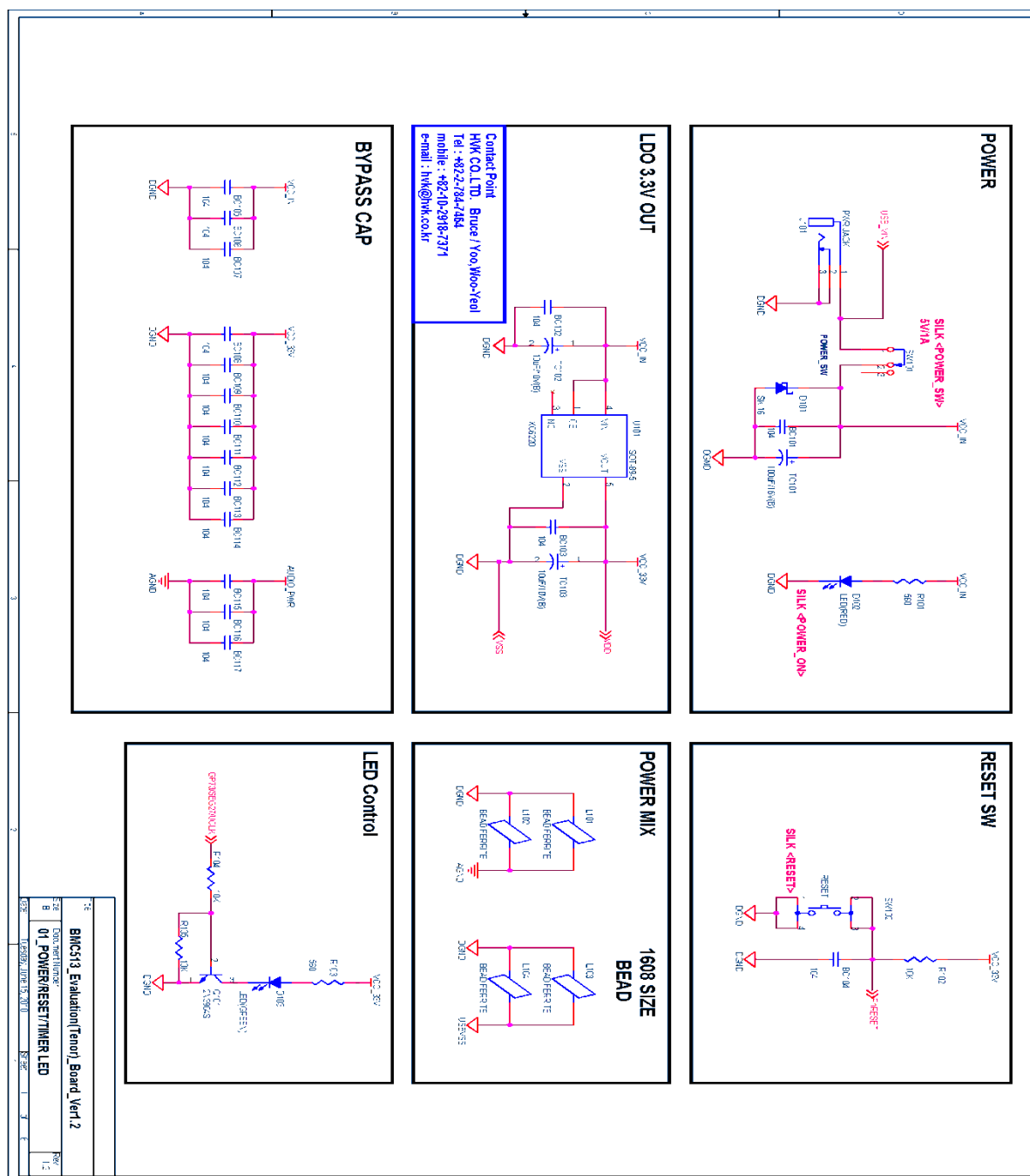


FIGURE. 24



27

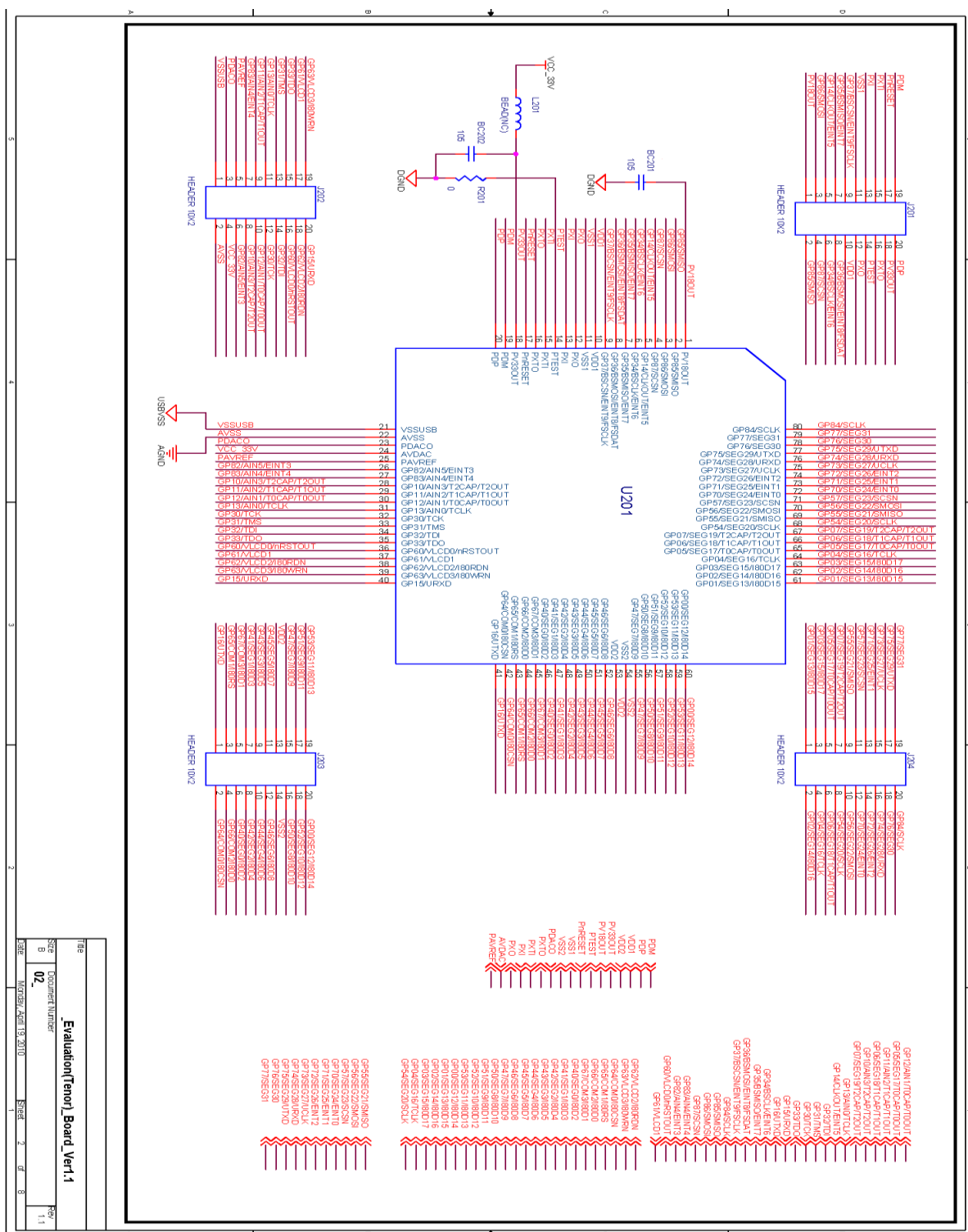


FIGURE 26

➤ 80QFP Package

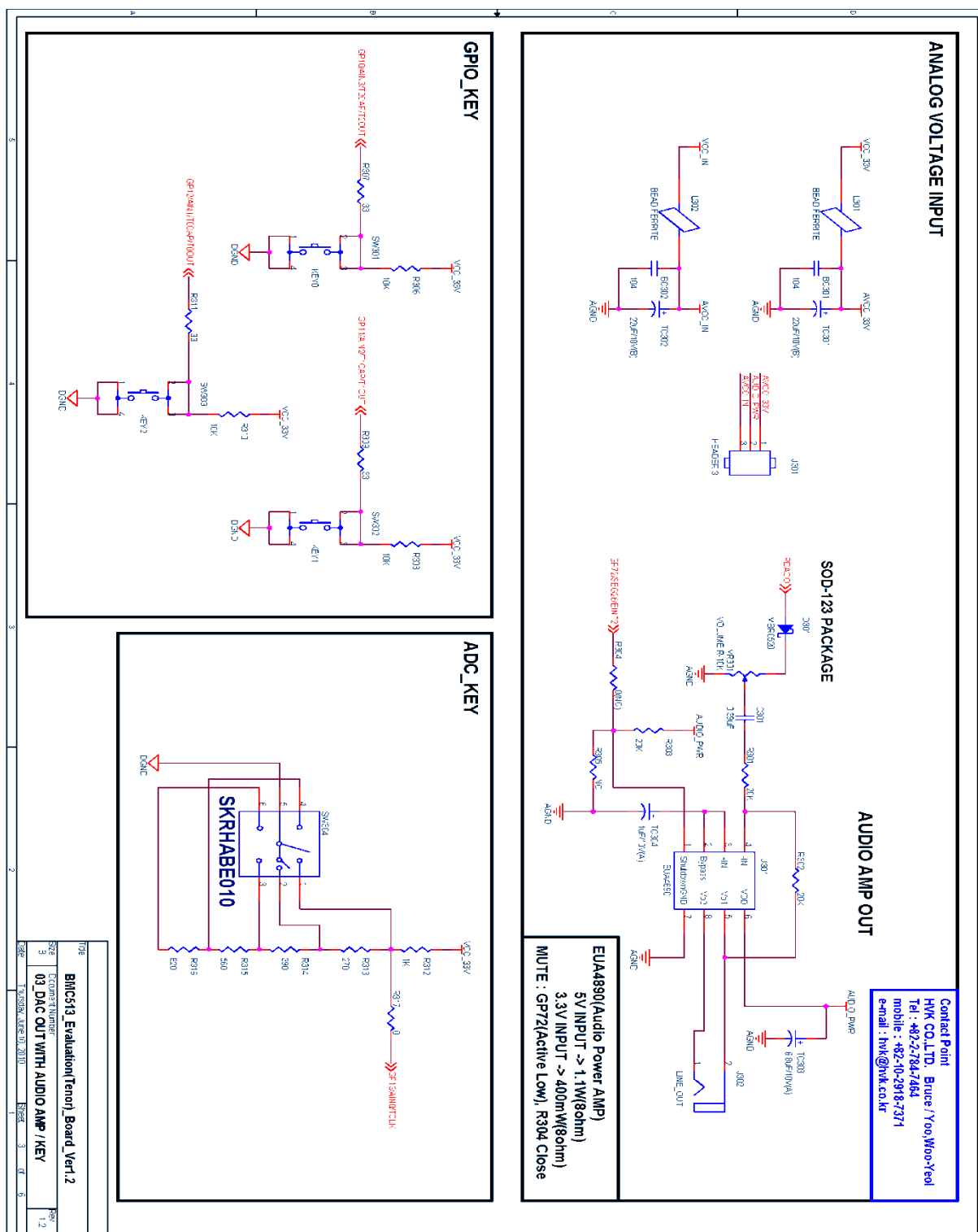


FIGURE. 27

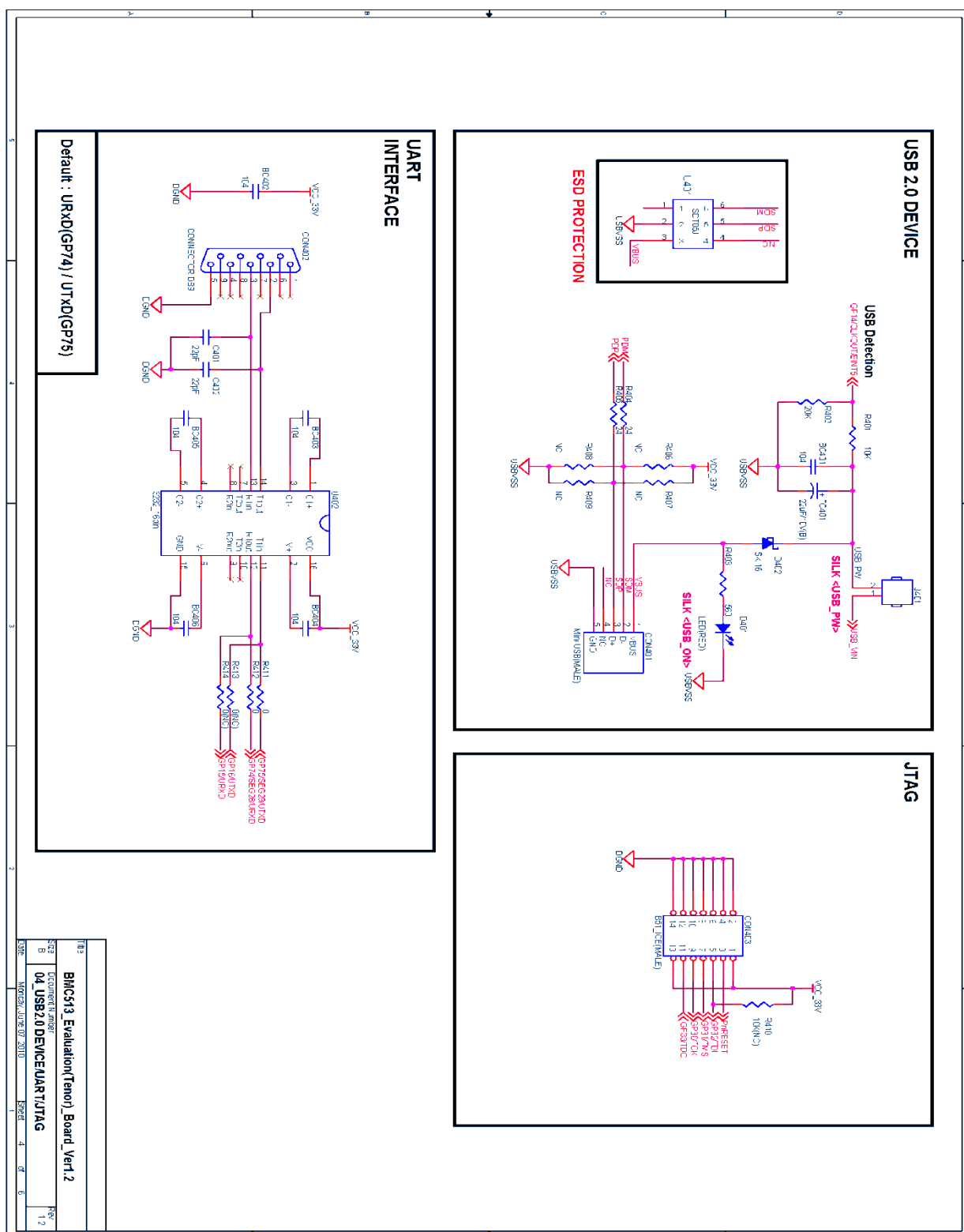


FIGURE. 28



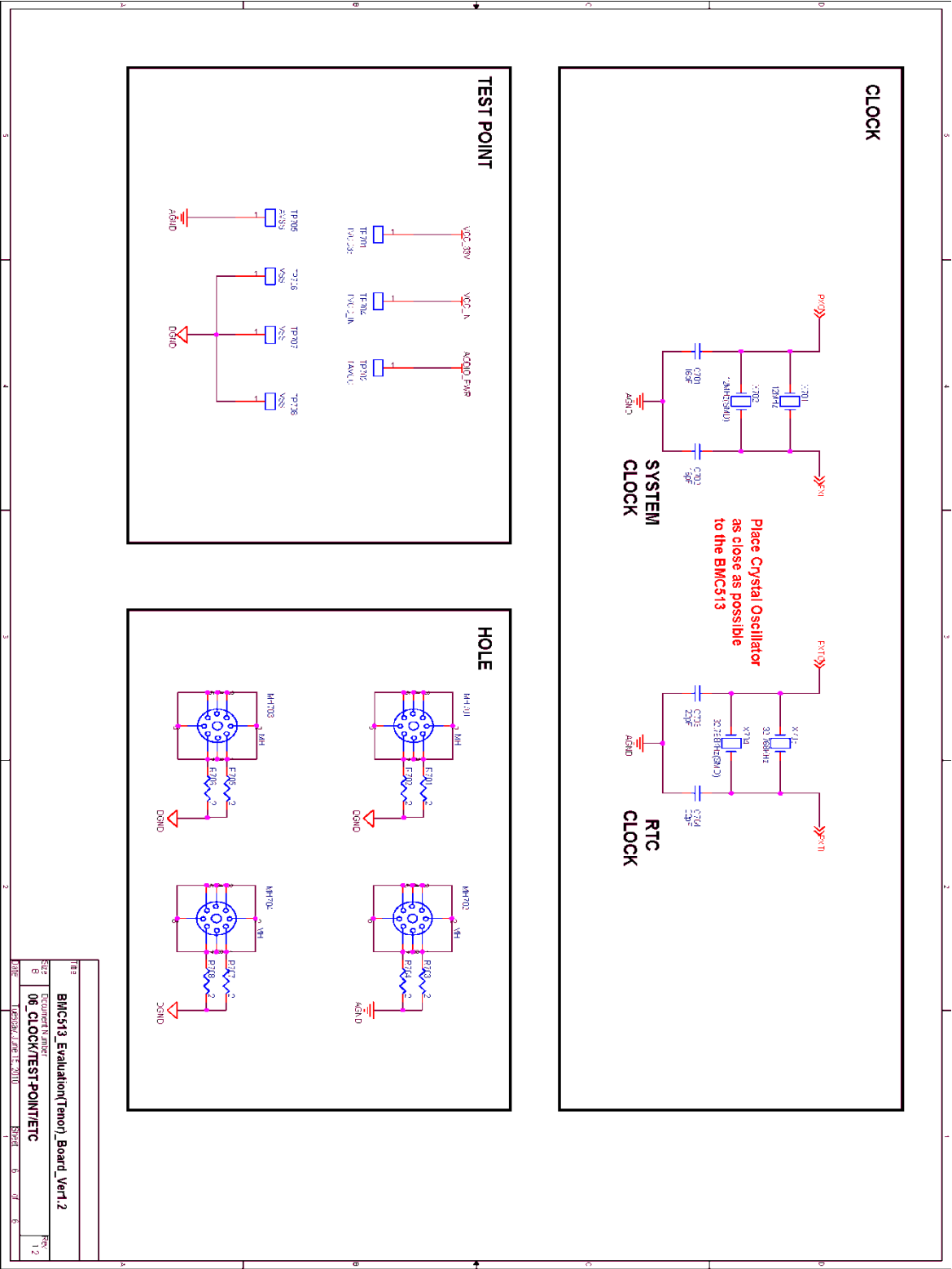


FIGURE. 30

5. SDK (Software Development Kit)

- BOO-REE Multimedia 에서 제공하는 IDE(Integrated Development Environment)
PowerStudio (현재 Ver 2.6)는 BMC Series 의 시스템을 개발하기 위한 통합 개발 환경으로
Microsoft Windows(XP 이상) 환경에서 사용 가능하다.

5.1) Power Studio

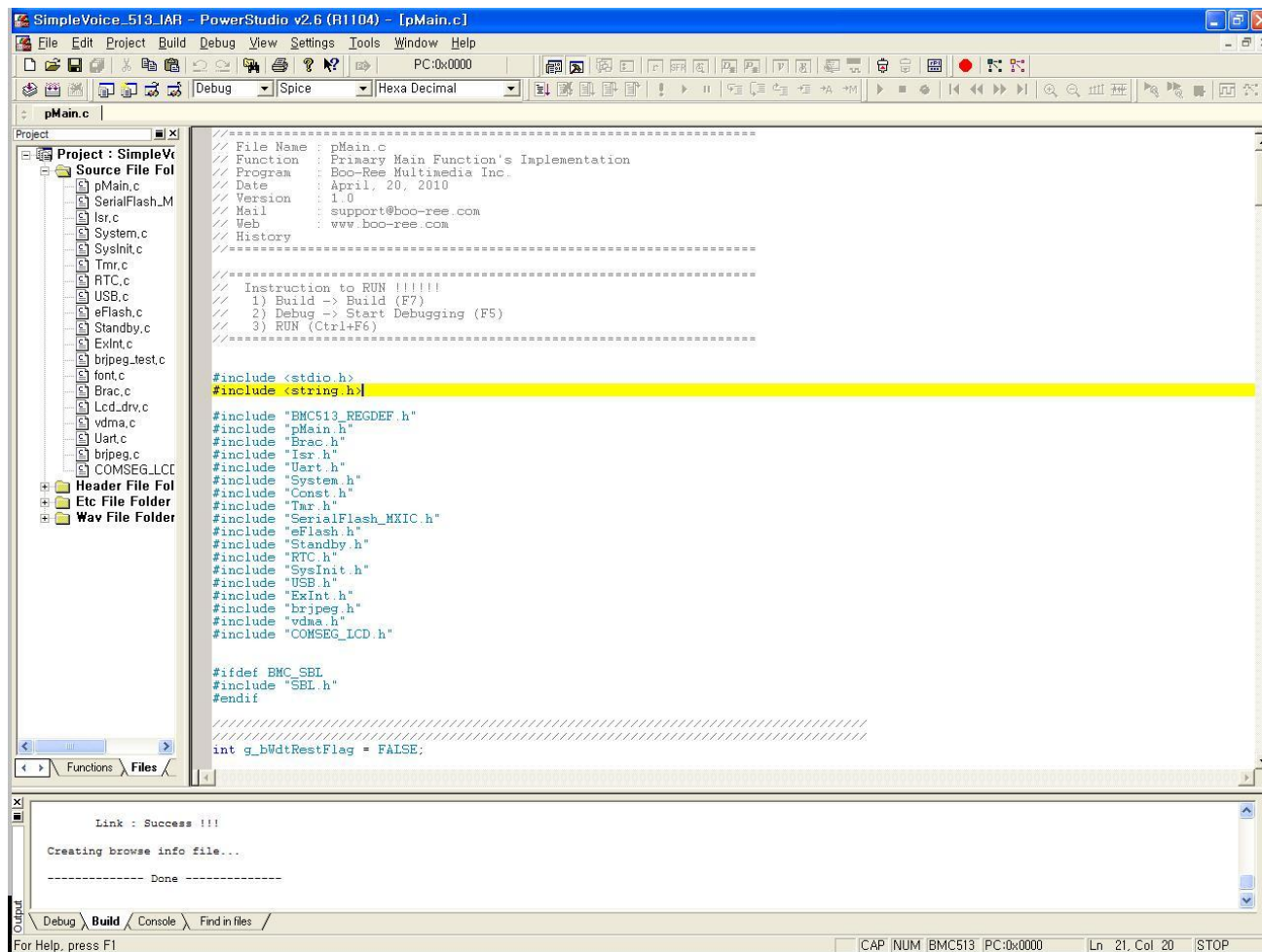


FIGURE. 31

- PowerStudio 는 홈페이지:([www. Boo-ree.com](http://www.Boo-ree.com)) 또는 제품 구매 시 제공되는 CD Package 를 통하여 설치 가능하며, 자세한 내용은 Manual 을 참조
Manual : (Default C:\Program Files\PowerStudio\Doc)
- 개발 환경의 세팅을 완료하기 위해선 PowerStudio 설치 와 Compiler 의 설치,
ICE 장비 (SPICE)의 Driver 설치를 해야 한다. Compiler Path 설정과 Compiler
버전에 따른 라이브러리 추가가 필요하다.

5.2) Compiler Path Setting

- PowerStudio 의 설치가 완료됐다면, Compiler Path Setting 을 해주어야 한다
IAR Compiler 만을 지원하며,

<http://www.iar.com/website1/1.0.1.0/675/1/>

위 주소에서 30 일 평가판을 다운로드 하여 사용할 수 있다.

(IAR Embedded Workbench for 8051 7.60)

Compiler 가 준비됐다면 아래 그림을 참조하여 Path Setting 을 완료한다.

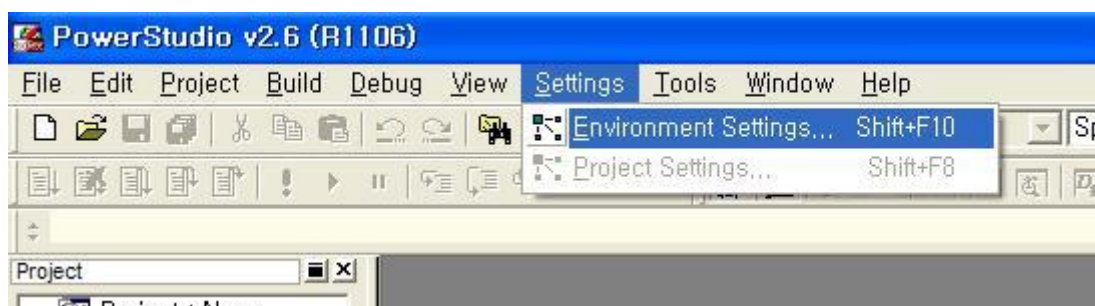


FIGURE. 32

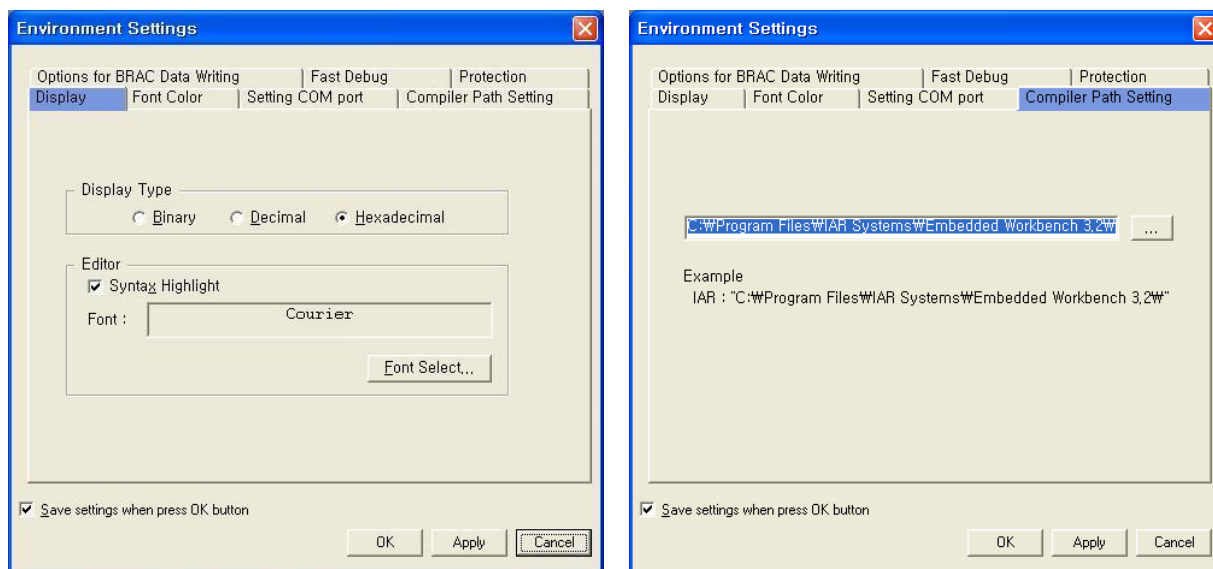


FIGURE. 33

- [Compiler Path Setting] 탭으로 이동하면 Default Path 로 Figure.33 과 같이 설정되어있다.
IAR Workbench3.2 를 Default 로 설정되어 있으며, 다른 버전 사용하고 있다면,
Example 을 참조하여 Path 설정을 해주면 된다.

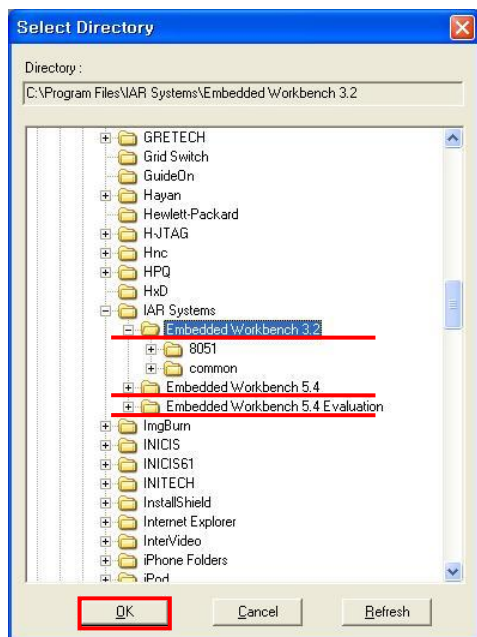


FIGURE. 34

- Compiler 의 각 최상위 폴더 까지만 지정한다.

Figure.34 참조.

5.3) Add Library

5.3.1) Embedded Workbench 3.2 Library

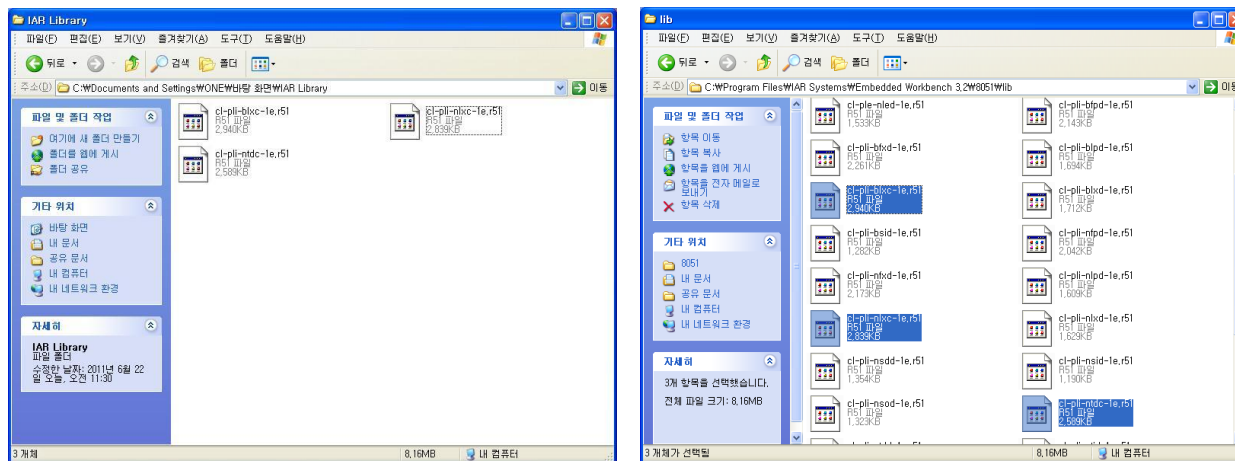


FIGURE. 35

- Workbench 3.2 용 Library 를 복사하여(3 개 파일)
C:\Program Files\IAR Systems\Embedded Workbench 3.2\8051\lib
경로에 추가

5.3.2) Embedded Workbench 5.4 Library

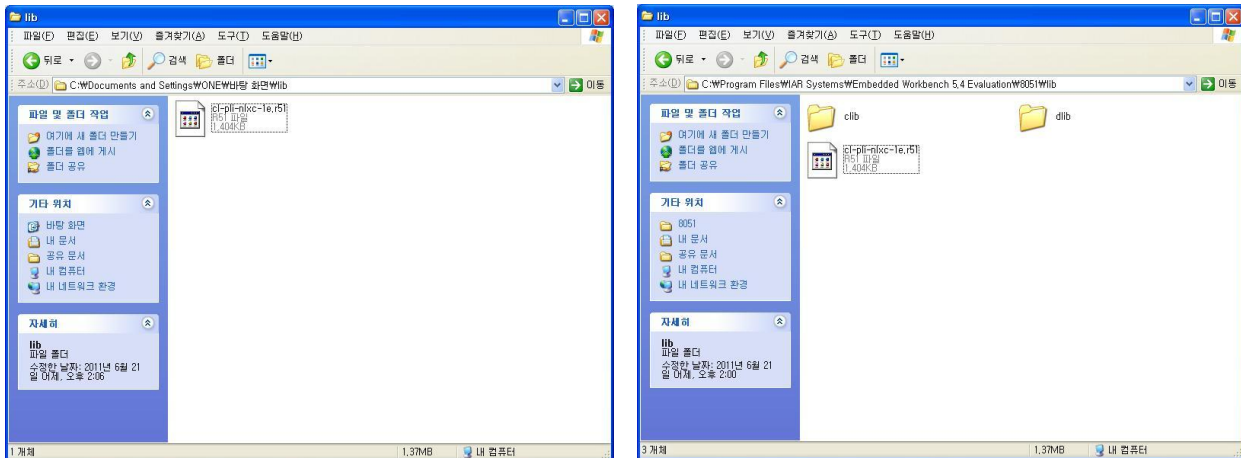


FIGURE. 36

- Workbench 5.4 용 Library 를 복사하여(1 개 파일)
C:\Program Files\IAR Systems\Embedded Workbench 5.4 Evaluation\8051\lib
경로에 추가 (Workbench 5.4 Evaluation)

5.4) SPICE(ICE) Driver Setting

- PowerStudio (PC) 와 Tenor B/D(Target device) 를 연결하여 Program Download 및 Debugging 을 하기 위해서 SPICE(ICE) 장비를 사용한다.

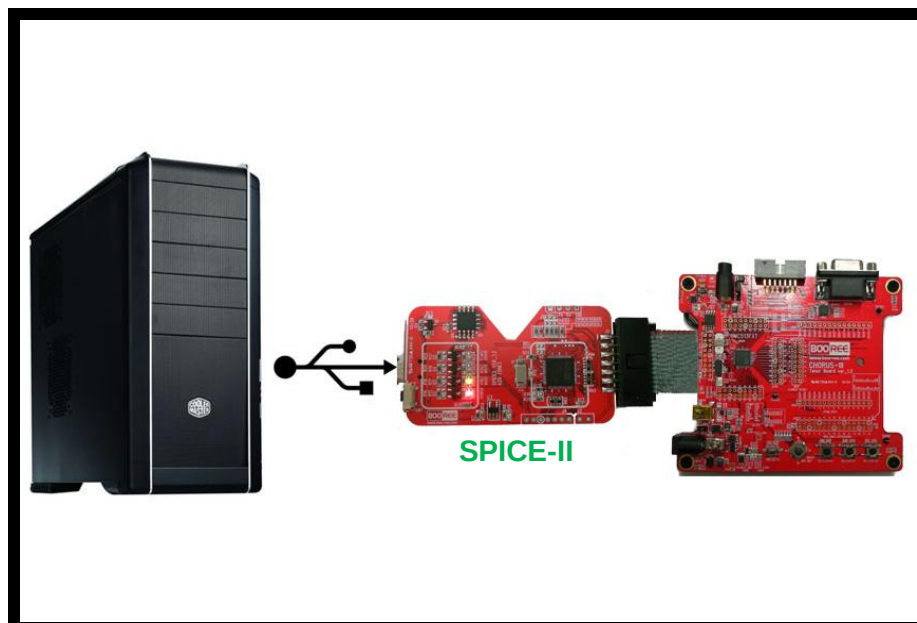


FIGURE. 37

5.4.1) SPICE USB Driver 설치

- USB 케이블을 통해 SPICE 를 연결하면 Driver 를 검색한다. USB Driver 는 PowerStudio 설치 폴더 내 Driver 폴더에서 찾을 수 있다.

SPICE 는 현재 Windows7 64bit 는 지원하지 않는다.

Path : (Default C:\Program Files\PowerStudio\Driver\USB)

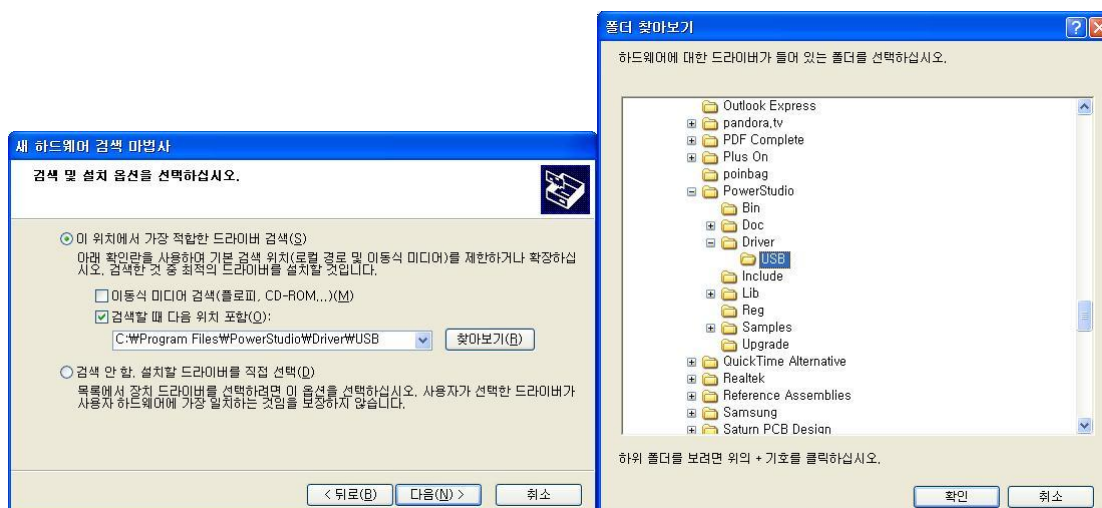


FIGURE. 38

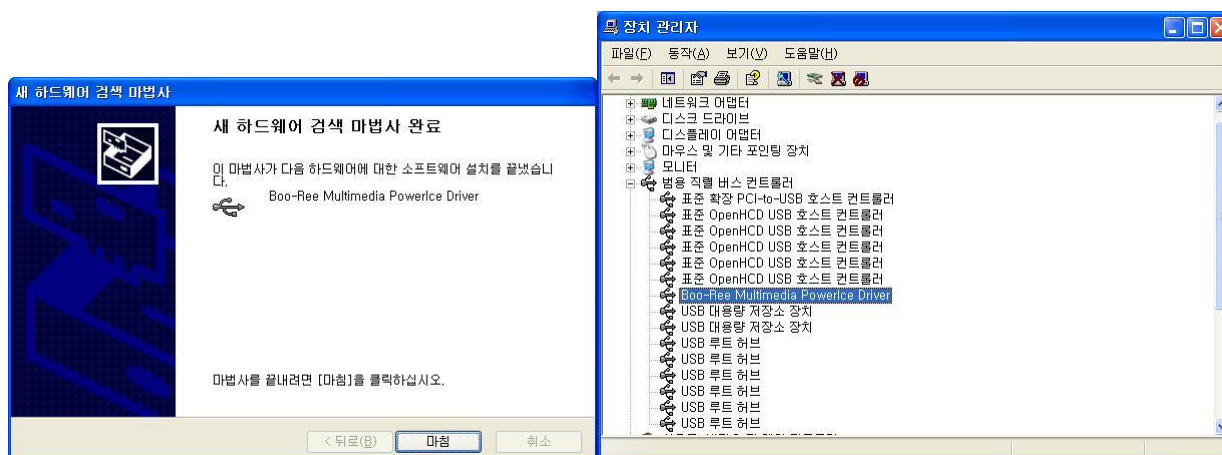


FIGURE. 39

5.4.2) SPICE 연결상태 확인

- SPICE의 동작 상태는 4개의 LED로 Display되며, 각 자세한 내용은 SPICE manual을 참고. Driver가 정상적으로 설치된 후 SPICE의 LED Display는 아래와 같다.



FIGURE. 40

POWER	USB/MODE	RUN/WRITE	STOP/ERROR
ON	ON	OFF	OFF

5.4.3) ICE selection in PowerStudio

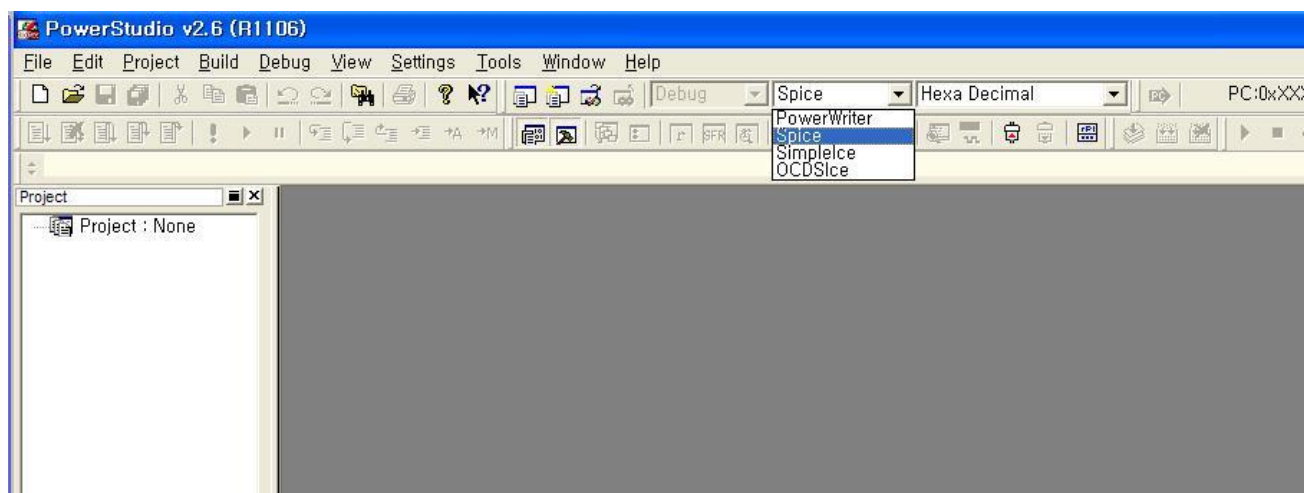


FIGURE. 41

- ICE selection까지 완료하면 시스템 개발을 위한 환경 설정은 완료되었다. PowerStudio를 통한 Project 관리, 다운로드, 디버깅 방법 등은 PowerStudio manual을 참조하기 바란다.

6. Sample Project (F/W) Download

- Tenor B/D 전용 F/W 인 [Simple Voice] 를 제공하며, Sample project 는 BMC513 을 개발하는데 유용한 Header 파일과 각 기능별 Sample source 를 제공한다.
SimpleVoice 를 Download 후 테스트 하기 위해선 DB9 시리얼 케이블을 연결해야 한다.

6.1) SimpleVoice Open & Build

6.1.1) Open Project

- Sample Path (Default C:\Program Files\PowerStudio\Samples\BMC513\SimpleVoice)

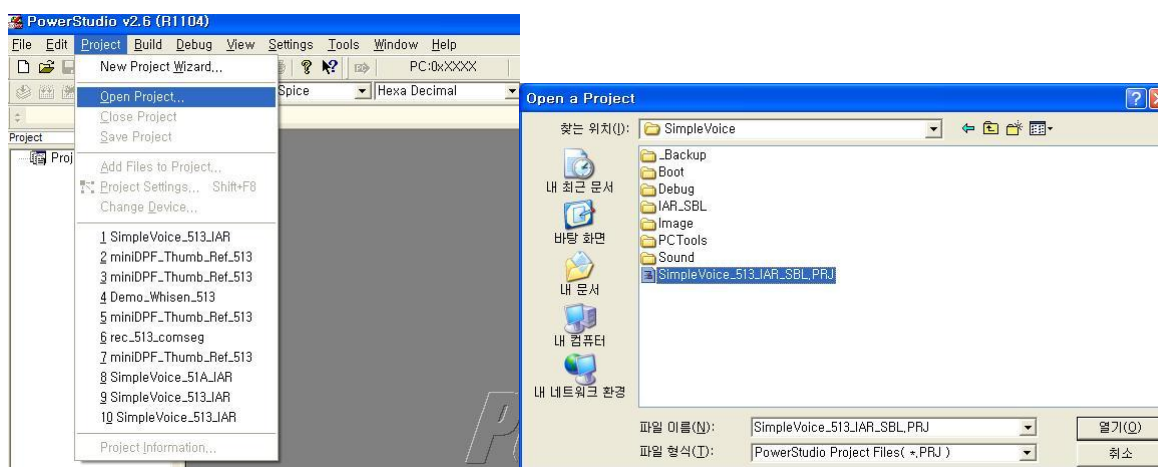


FIGURE. 42

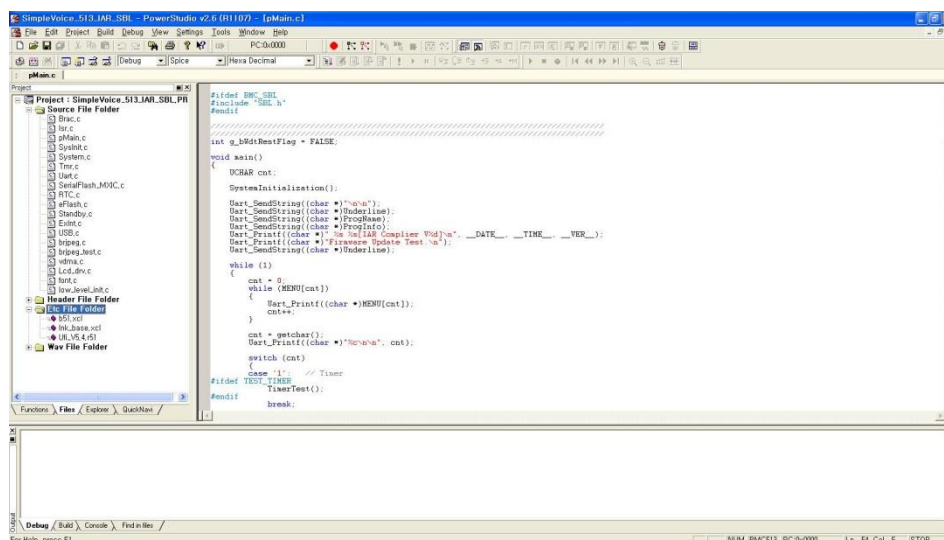
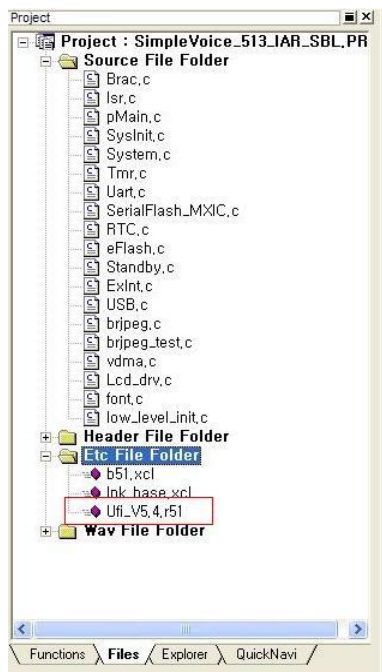


FIGURE. 43

6.1.2) Project Build

➤ Project 를 build 하기 전에 컴파일러 버전에 맞는 UFI Library 를 확인 해야 한다.



- Project Windows -> Ufi_Vx.x.r51 확인
- Compiler Path 를 설정한 버전과 맞지 않으면
Build 가 안될 수도 있다
다른 Library 를 추가하기 위해 기존 항목을
지우고
새로 추가 하여 사용하면 된다.

FIGURE. 44

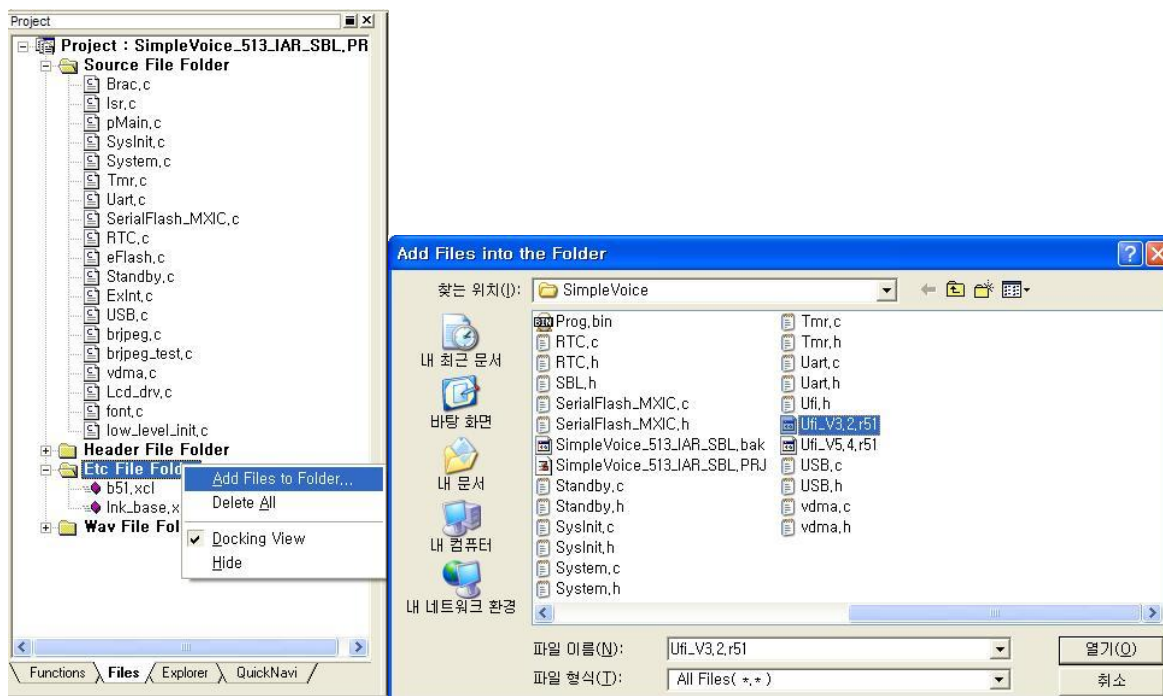


FIGURE. 45

➤ Project Rebuild

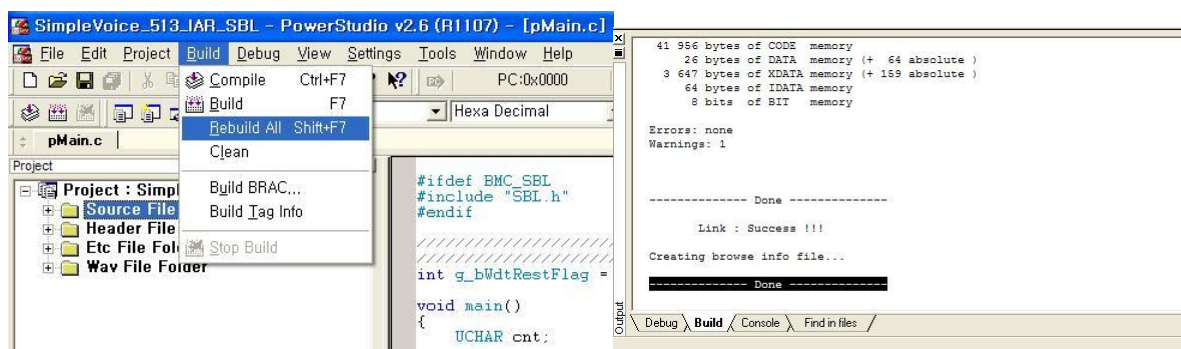


FIGURE. 46

➤ Output Path : C:\Program Files\PowerStudio\Samples\BMC513\SimpleVoice\Debug

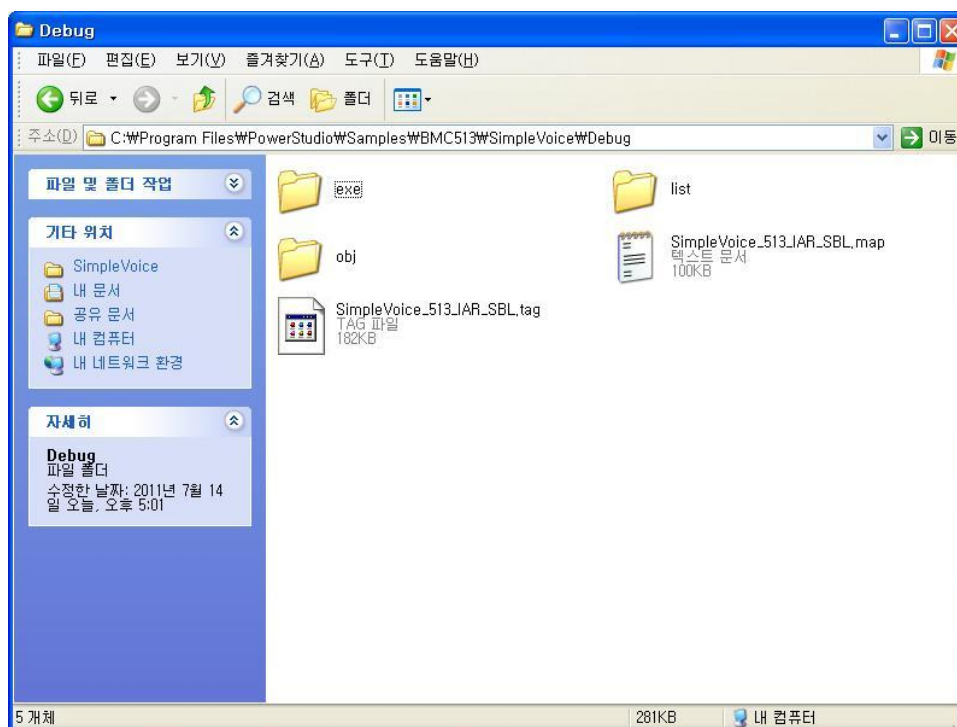


FIGURE. 47

6.2) SimpleVoice Download

- PowerStudio 를 통해 코드를 Download 하는 방법은 총 3 가지 이다.(Debug mode 포함) Project File 을 열어 Download 하는 방법과 Binary File 을 직접 Download 하는 방법으로 나누어지며 각 기능은 RDP(Read Protection) 을 지원한다.

6.2.1) Debugging Mode

- [Debug] -> Start Debugging or  클릭하면 Download 를 시작한다. (단축키 F5)

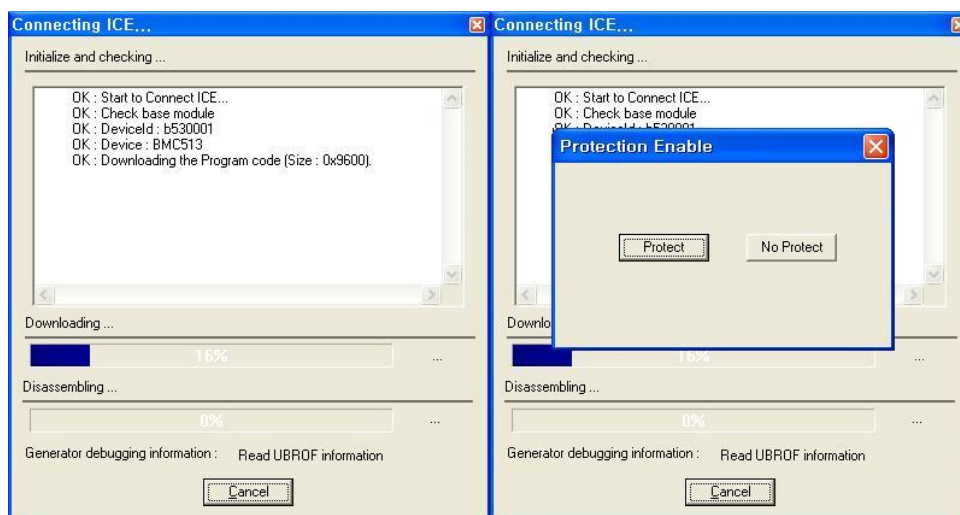


FIGURE. 48

- RDP 가 활성화 되어있다면, Figure.48 과 같이 Download 후 Protection 여부를 선택하는 창이 나온다. 이때 Protect 를 선택하면 Debugging Mode 로 진입할 수 없다. Debugging Mode 진입 후 각 창의 기능은 PowerStudio manual 참고.

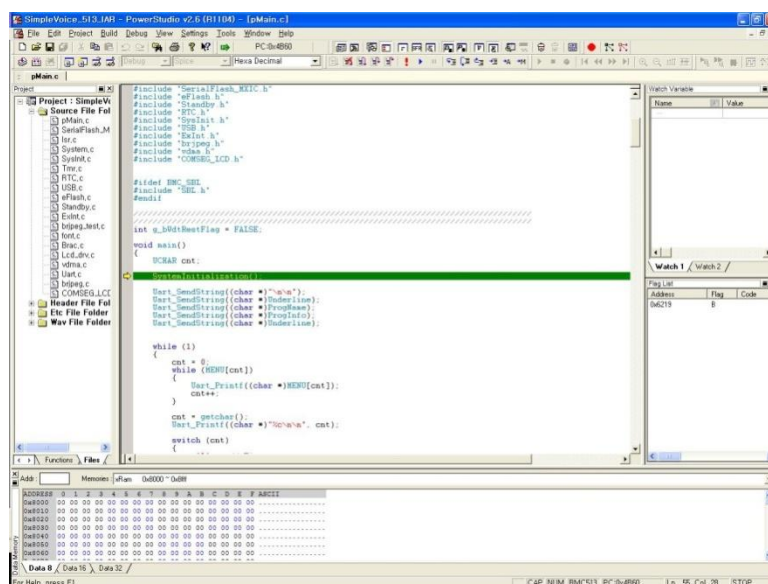


FIGURE. 49

6.2.2) Program Download

- [Tools] -> Program Download 클릭 (단축키 ctrl + shift + F5)
Download 진행과정은 Debugging Mode 와 동일하다.

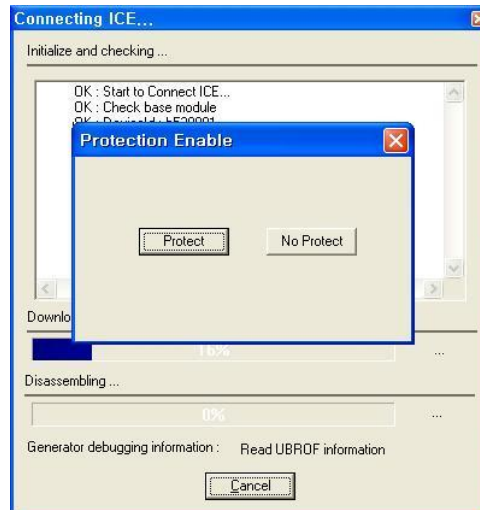


FIGURE. 50

- [Protect]을 선택하여 RDP Enable 해주면, Verify 과정 Fail 이 되며, 다음 다운로드 시 RDP 을 확인할 수 있다. (Chip Erase 후 Download 가능하다)



FIGURE. 51

6.2.3) Flash Data Manager...

- [Tools] -> Flash Data Manager... 클릭
- Flash Data Manager 의 경우 Project build 후 생성된 *.bin file 을 Download 한다.
Internal NOR Flash or External Serial Flash 의 특정 번지에 Code Data 또는
Voice, Image data(*.bin) 을 Download / Upload 할 수 있다.

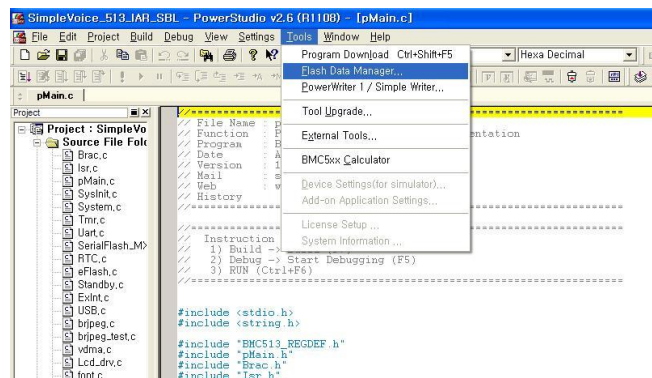


FIGURE. 52

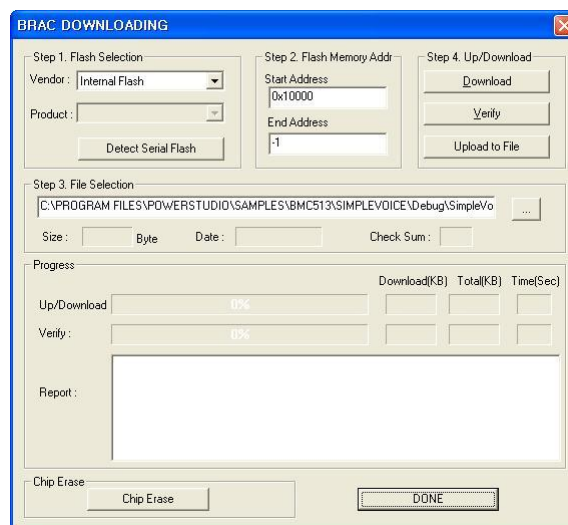


FIGURE. 53

- Step1. Flash Selection -> Internal NOR Flash or External Serial Flash selection
- Step2. Flash Memory Addr -> Download 대상의 번지 지정
- Step3. File Selection -> *.bin / *.brc 선택. (*.brc 는 voice data 압축 파일의 format)
- Step4. Up/Download -> RDP 가 Enable 된 칩은 Upload 할 수 없다.

- Chip Erase -> Erase all sector
- Serial Flash Detect -> Serial Flash 의 ID 를 읽어 Vendor 를 표시해준다.

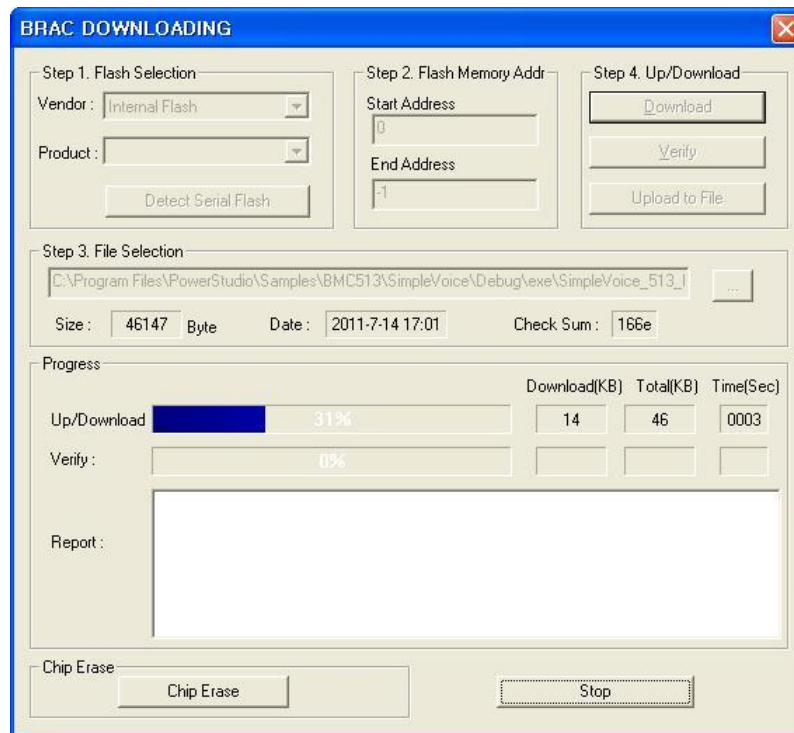


FIGURE. 54

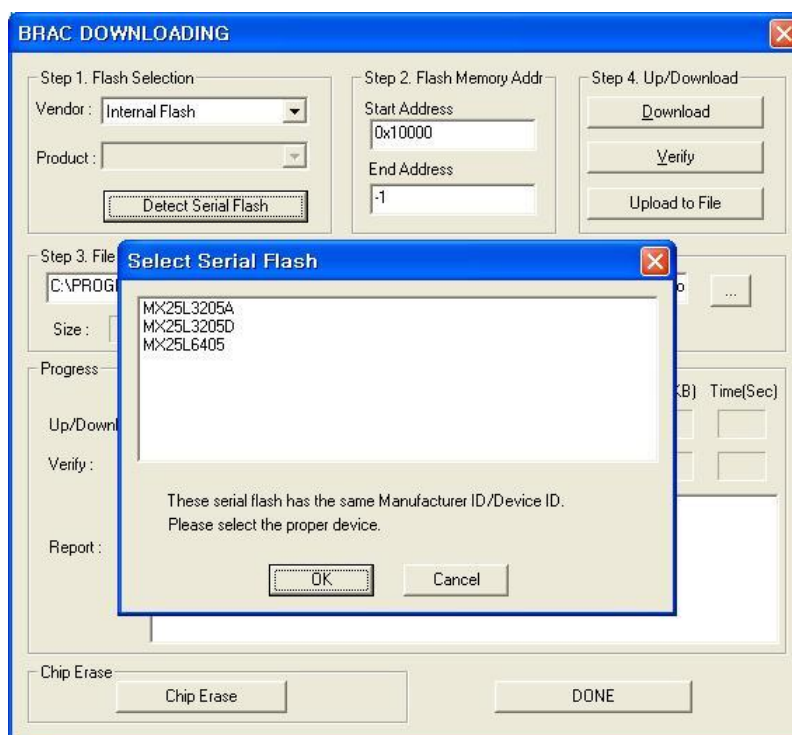
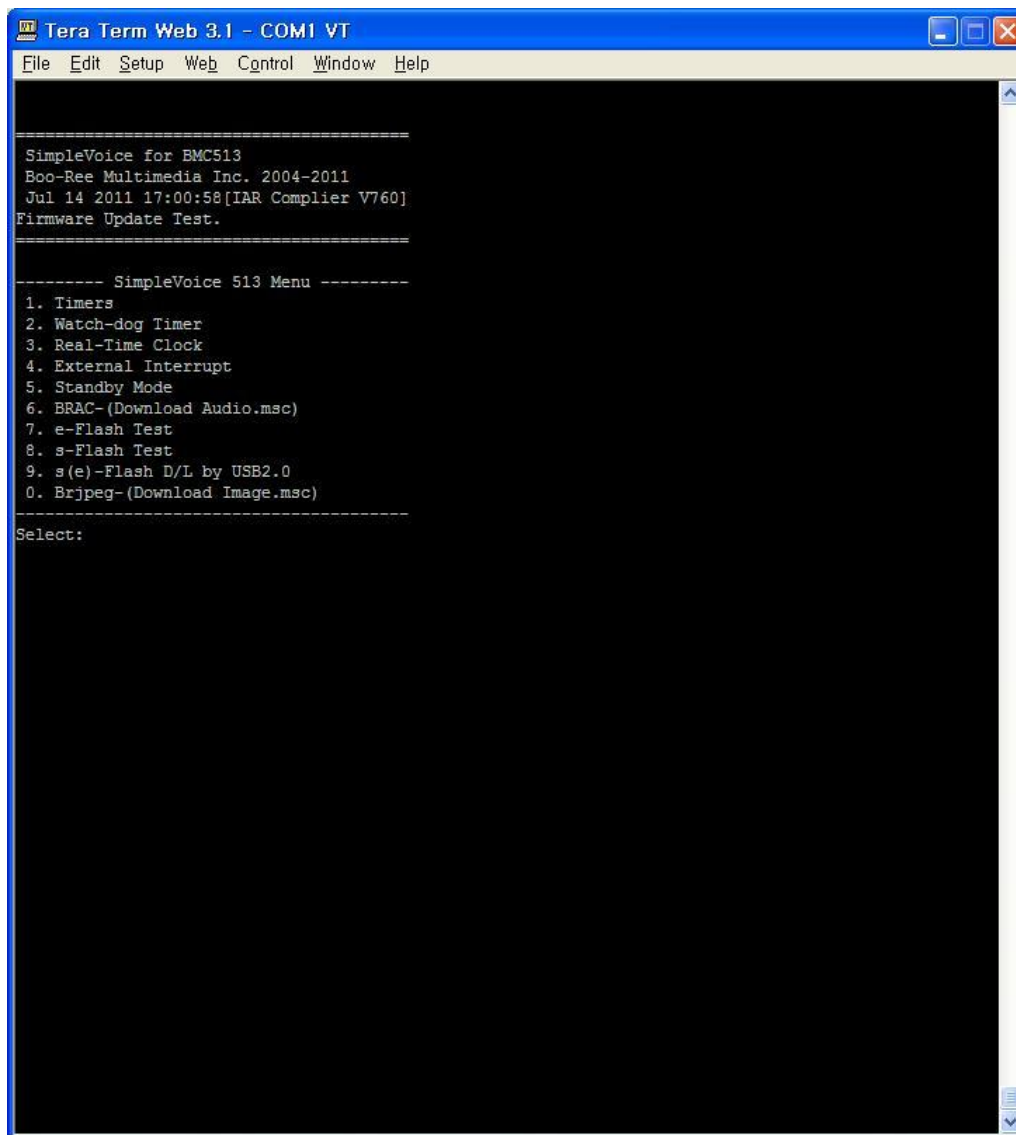


FIGURE. 55

➤ Download (Figure.54) / Serial Flash Detection (Figure.55)

7. Simple Voice Description

- [Simple Voice] Download 후 테스트를 위해선 UART 연결이 되어있어야 한다.
9Pin D-SUB Connect 에 시리얼 케이블 연결 후 하이퍼터미널(PC program)의 Baud Rate 을 [57600]으로 설정한다.
Code Download 방법에 따라 [Debugging Mode -> RUN] / [Download only -> B/D Reset] 하여 코드를 실행하면 아래와 같은 UART 메시지가 출력된다.



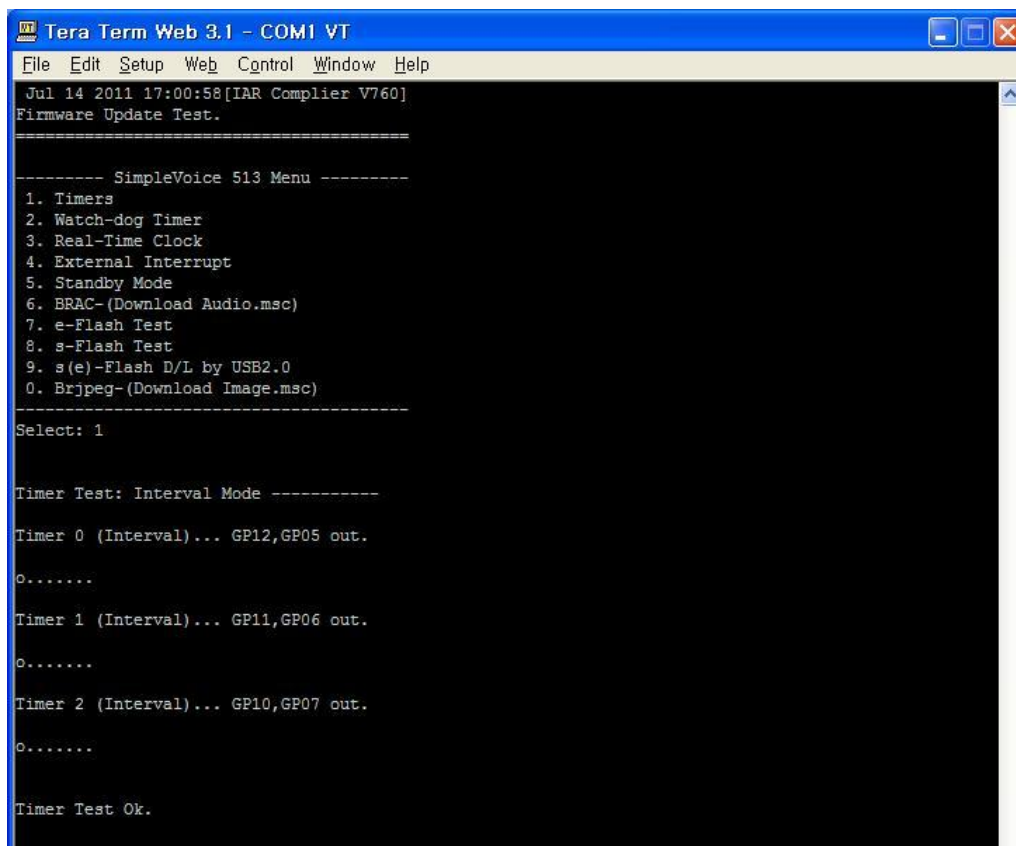
```
Tera Term Web 3.1 - COM1 VT
File Edit Setup Web Control Window Help

=====
SimpleVoice for BMC513
Boo-Ree Multimedia Inc. 2004-2011
Jul 14 2011 17:00:58[IAR Compiler V760]
Firmware Update Test.
=====

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjjpeg-(Download Image.msc)
-----
Select:
```

FIGURE. 56

7.1) Timer



```

Tera Term Web 3.1 - COM1 VT
File Edit Setup Web Control Window Help
Jul 14 2011 17:00:58[IAR Compiler V760]
Firmware Update Test.
=====
----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpeg-(Download Image.msc)
=====
Select: 1

Timer Test: Interval Mode -----
Timer 0 (Interval)... GP12,GP05 out.
0.....
Timer 1 (Interval)... GP11,GP06 out.
0.....
Timer 2 (Interval)... GP10,GP07 out.
0.....
Timer Test Ok.
  
```

FIGURE. 57

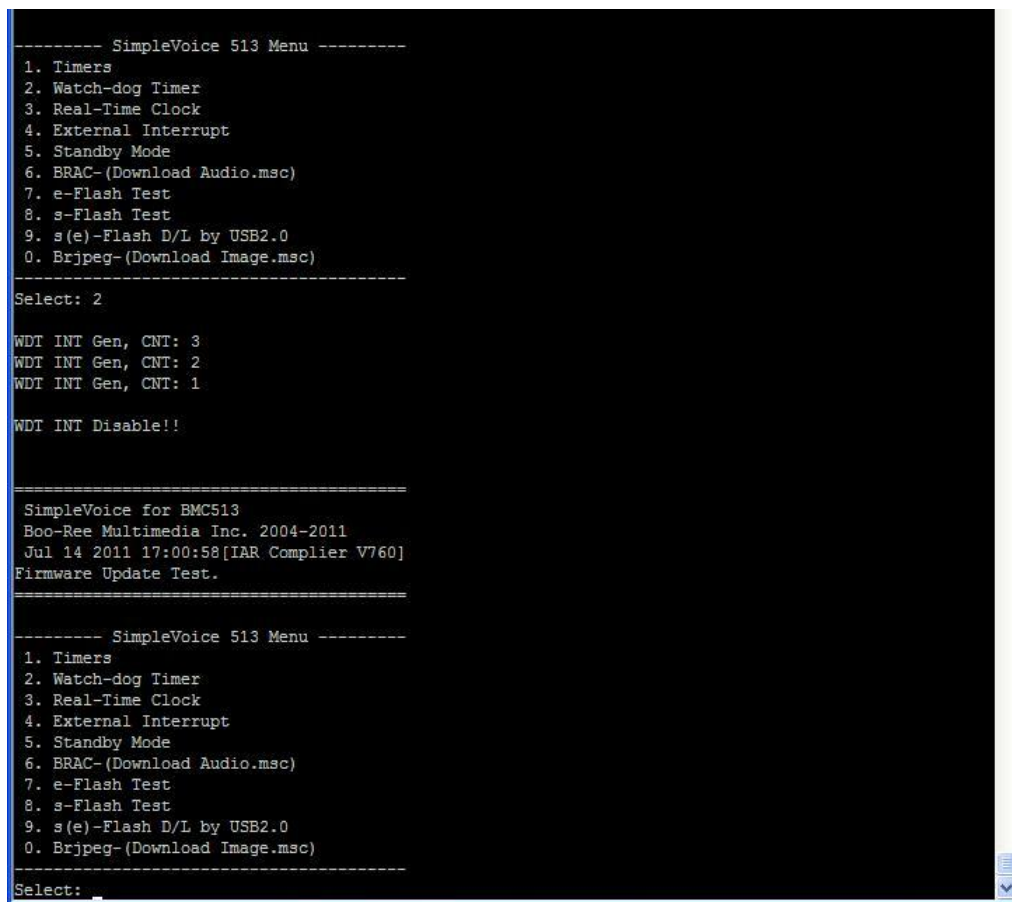
➤ 1 번을 선택하면 Timer 테스트가 진행된다.

Timer0/1/2 에 대한 각 Output 을 확인할 수 있으며, GPIO Pin 을 통해 Signal output 을 확인할 수 있으며 LED Toggle 도 확인할 수 있다.

Timer0 부터 순서대로 1ms , 5ms , 10ms 로 주기로 Timer Interrupt 발생.

Timer_Init(); 함수를 통해 Timer 설정을 확인할 수 있다.

7.2) Watch-dog



```

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpege-(Download Image.msc)
-----
Select: 2

WDT INT Gen, CNT: 3
WDT INT Gen, CNT: 2
WDT INT Gen, CNT: 1

WDT INT Disable!!

=====
SimpleVoice for BMC513
Boo-Ree Multimedia Inc. 2004-2011
Jul 14 2011 17:00:58[IAR Compiler V760]
Firmware Update Test.
=====

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpege-(Download Image.msc)
-----
Select: _

```

FIGURE. 58

- 2 번을 선택하면 WDT Timer 가 Enable 되어 WDT interrupt 발생.
Count 3 까지 WDT Clear 해주며, 3 번 후에 interrupt disable 하여,
Clear 되지 않을 때 Reset 이 발생한다.

WDT_Init(); 함수를 통해 설정을 확인할 수 있다.

7.3) Real-Time Clock

```

=====
SimpleVoice for BMC513
Boo-Ree Multimedia Inc. 2004-2011
Jul 14 2011 17:00:58[IAR Compiler V760]
Firmware Update Test.
=====

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpeg-(Download Image.msc)
-----
Select: 3

- rtc Test -

1. ALARM mode
2. CLOCK mode
> Choice:

```

FIGURE. 59

➤ Alarm mode & Clock mod

```

- rtc Test -

1. ALARM mode
2. CLOCK mode
> Choice: 1

2011/07/06 Wednesday 13:30.01
2011/07/06 Wednesday 13:30.02
2011/07/06 Wednesday 13:30.03
2011/07/06 Wednesday 13:30.04
2011/07/06 Wednesday 13:30.05
2011/07/06 Wednesday 13:30.06
2011/07/06 Wednesday 13:30.07
2011/07/06 Wednesday 13:30.08
2011/07/06 Wednesday 13:30.09
2011/07/06 Wednesday 13:30.10
2011/07/06 Wednesday 13:30.11
2011/07/06 Wednesday 13:30.12
2011/07/06 Wednesday 13:30.13
2011/07/06 Wednesday 13:30.14
2011/07/06 Wednesday 13:30.15
2011/07/06 Wednesday 13:30.16
2011/07/06 Wednesday 13:30.17
2011/07/06 Wednesday 13:30.18
2011/07/06 Wednesday 13:30.19
2011/07/06 Wednesday 13:30.20
2011/07/06 Wednesday 13:30.21
2011/07/06 Wednesday 13:30.22
2011/07/06 Wednesday 13:30.23
2011/07/06 Wednesday 13:30.24
2011/07/06 Wednesday 13:30.25
2011/07/06 Wednesday 13:30.26
2011/07/06 Wednesday 13:30.27
2011/07/06 Wednesday 13:30.28
2011/07/06 Wednesday 13:30.29
2011/07/06 Wednesday 13:30.30
2011/07/06 Wednesday 13:30.31
2011/07/06 Wednesday 13:30.32

```

FIGURE. 60

- 년/ 월/ 일/ 요일/ 시간 을 표시하며, Alarm mode 에서는 1 분간, Clock mode 에서는 Reset 될 때까지 진행 한다.

AlarmTest(); / ClockTest(); 함수를 통해 설정을 확인할 수 있다.

7.4) External Interrupt

```
=====
SimpleVoice for BMC513
Boo-Ree Multimedia Inc. 2004-2011
Jul 15 2011 10:03:09[IAR Compiler V760]
=====

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpeg-(Download Image.msc)
-----

Select: 4

*****
* This function is not available on Tennor B/D!! *
* Make a test using Jumper or Side board      *
*****

External interrupt test...

Falling edge: EINT0 , EINT1
-
```

FIGURE. 61

- Tenor B/D 에는 External interrupt 를 테스트 할 수 있는 스위치가 연결되어있지 않다. 그러므로 이 항목의 테스트를 위해선 GPIO header 에서 별도의 스위치로 Jumper 를 연결하거나, Side Board 를 제작해야 한다.
External Interrupt 0 / 1 의 Falling / Rising / Both, edge 를 테스트 할 수 있다.

```
External interrupt test...

Falling edge: EINT0 , EINT1
ExInt0 Event
ExInt1 Event
Falling edge: Test OK!!

Rising edge: EINT0 , EINT1
ExInt0 Event
ExInt1 Event
Rising edge: Test OK!!

Both edge: EINT0 , EINT1
ExInt0 Event
ExInt0 Event
ExInt1 Event
ExInt1 Event
Both edge: Test OK!!
```

FIGURE. 62

- 각 Edge 별 interrupt 발생을 확인 하고 테스트는 종료된다.

7.5) Standby Mode

- BMC513 의 Stop mode 와 wake-up 을 테스트하며 Port, RTC, Watch-dog 3 개의 방법으로 wake-up

```

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpege-(Download Image.msc)
-----
Select: 5

STOP Mode
Wake-up select
1. Port(EINT0,EINT1)
2. RTC
3. Watch-dog
> Choice: _

```

FIGURE. 63

7.5.1) Port Wake-up

- EINT0/1 을 이용하며 [6.4]]와 같이 스위치를 따로 연결해 주어야 한다.
STOP mode 진입 후 EINT0 or EINT1 이 'LOW' 일 때
Wake-up 하며, state 값을 통해 wake up 확인 가능하다.

```

STOP Mode
Wake-up select
1. Port(EINT0,EINT1)
2. RTC
3. Watch-dog
> Choice: 1

** Make a test using Jumper or Side board **
Into Stop Mode

** Make a test using Jumper or Side board **
Into Stop Mode wake up state = 40

Wake-up port

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpege-(Download Image.msc)
-----
Select: _

```

FIGURE. 64

7.5.2) RTC Wake-up

- RTC Wake-up 테스트 이며 1 초 간격으로 총 10 번 wake-up 된다.

```

STOP Mode
Wake-up select
1. Port(EINT0,EINT1)
2. RTC
3. Watch-dog
> Choice: 2

Into Stop Mode
2A:36.19 wake up state = 20

Wake-up rtc.... 2
-- 2A:36.21 wake up state = 20

Wake-up rtc.... 3
-- 2A:36.23 wake up state = 20

Wake-up rtc.... 4
-- 2A:36.25 wake up state = 20

Wake-up rtc.... 5
-- 2A:36.27 wake up state = 20

Wake-up rtc.... 6
-- 2A:36.29 wake up state = 20

Wake-up rtc.... 7
-- 2A:36.31 wake up state = 20

Wake-up rtc.... 8
-- 2A:36.33 wake up state = 20

Wake-up rtc.... 9
-- 2A:36.35 wake up state = 20

Wake-up rtc.... 10
-- 2A:36.37

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpeg-(Download Image.msc)
-----
Select: _

```

FIGURE. 65

7.5.3) WDT Wake-up

- WDT Timer 가 overflow 될 때 Wake-up
Timer 값은 STOP_mode_wdt(); 함수 에서 설정

```

STOP Mode
Wake-up select
1. Port(EINT0,EINT1)
2. RTC
3. Watch-dog
> Choice: 3

Into Stop Mode wake up state = 10

Wake-up watch-dog....

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpeg-(Download Image.msc)
-----
Select: _

```

FIGURE. 66

7.6) BRAC

- BRAC test 통해 Voice data Decoding 과 DAC Output 을 Test 할 수 있다.
Test 에 앞서 Voice data 를 Serial Flash 에 다운로드 해야 하며, 다운로드 방법은 아래의 [7.9) s(e)-Flash D/L by USB]을 참고하여 진행하기 바란다.
- Sample Voice data Path : File name (Audio.msc)
C:\Program Files\PowerStudio\Samples\BMC513\SimpleVoice\Sound\Sound_Source
- Audio.msc File 의 header 정보는 같은 폴더 내 Audio.h 를 통해 확인 할 수 있다.

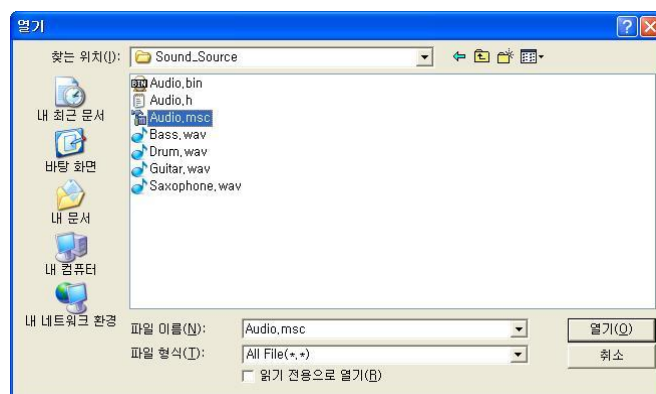


FIGURE. 67

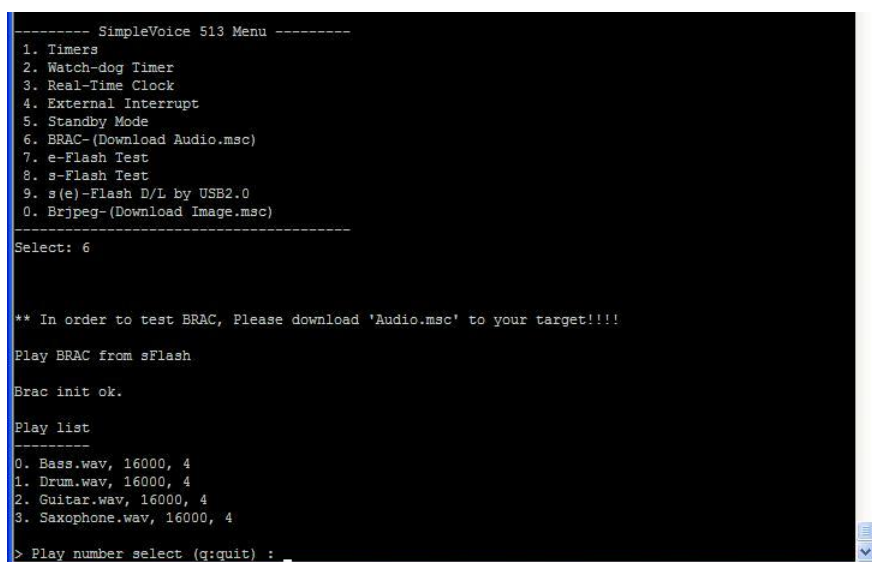


FIGURE. 68

- 각 항목은 [num] , [data name], [샘플링 주파수], [압축률] 의 정보를 보여주며, 출력 하고자 하는 음원의 번호를 선택하여 출력 확인
- DACO 의 출력은 Speaker 를 연결하여 확인하며, 음량은 Volume 저항을 통해 조절한다.

7.7) e-Flash Test

- E-Flash 의 Bank2 에 대해 Block / Sector Erase 와 Write test 를 진행하며, error count 의 결과를 출력한다.
- ※ Simple Voice D/L 할 때 RDP enable 하였다면, Test 결과 Error 출력이 될 수 있으니, e-Flash test 는 RDP 를 해제한 후 D/L 해야 한다.

```

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brijpeg-(Download Image.msc)
-----
Select: 7

===== e-Flash Test =====
Notice: You should be select ONLY e-Flash Test
Disable all other functions except e-Flash function.
Should be check program size and then
modify DATA_AREA_START_ADDR value in eFlash.h file.

### Block/Sector Erase & Byte Program Test

# Block Erase - Bank 2 (0x10000 - 0x1FFFF)
Erase .....
Verify/
Verify End!
Block Erase Error Count = 0

# Sector Erase - Bank 2 (0x10000 - 0x18000)
Erase .....
Verify/
Verify End!
Sector Erase Error Count = 0

# Write Program - Bank 2 (0x10000 - 0x18000)
Program .....
Verify/
Verify End!
Program Error Count = 0

### Total Error = 0
- Block Erase Error = 0
- Sector Erase Error = 0
- Byte Program Error = 0
All e-Flash Test is Done.

### Block/Sector Erase & Byte Program Test

# Block Erase - Bank 2 (0x10000 - 0x1FFFF)
Erase .....
Verify/
Verify End!
Block Erase Error Count = 0

# Sector Erase - Bank 2 (0x10000 - 0x18000)
Erase .....
Verify/
Verify End!
Sector Erase Error Count = 0

# Write Program - Bank 2 (0x10000 - 0x18000)
Program .....
Verify/
Verify End!
Program Error Count = 32640

### Total Error = 32640
- Block Erase Error = 0
- Sector Erase Error = 0
- Byte Program Error = 32640
All e-Flash Test is Done.
  
```

FIGURE. 69

- Read Protection 으로 인해 Write program Error !

7.8) s-Flash Test

- Serial Flash Test 항목으로 진입하면 Flash 의 정보와 함께 3 가지 테스트가 가능하다.
- ※ Serial Flash 의 테스트를 진행하면 Flash data 의 삭제나 변형이 생기므로,
중요한 data 는 미리 Back up 해두어야 한다.

7.8.1) Serial Flash Chip Erase

- S-Flash 의 모든 Block 을 삭제한다.

```

=====
SimpleVoice for BMC513
Boo-Ree Multimedia Inc. 2004-2011
Jul 15 2011 12:00:16[IAR Compiler V760]
=====

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpege-(Download Image.msc)

Select: 8

ManufacturerID = 0xC2
DeviceID0 = 0x20
DeviceID1 = 0x16

1 : Serial Flash Chip Erase
2 : Serial Flash Read
3 : Serial Flash Main Test
Chip Erase Start -> Done.
1 : Serial Flash Chip Erase
2 : Serial Flash Read
3 : Serial Flash Main Test
Chip Erase Start ->

```

FIGURE. 70

```

0x 0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 10 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 20 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 30 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 40 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 50 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 60 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 70 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 80 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x 90 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x A0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x B0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x C0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x D0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x E0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x F0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x100 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x110 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x120 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x130 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x140 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x150 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x160 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x170 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x180 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x190 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x1A0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x1B0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x1C0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x1D0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x1E0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x1F0 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x200 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x210 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x220 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x230 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x240 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x250 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

```

FIGURE. 71

7.8.2) Serial Flash Read

- S-Flash data 를 read 한다. 256 Byte 단위로 read 하며,
read 중 빠져 나오려면 ‘q’ or ‘Q’ 를 눌러준다.
예제로 [7.6]] 의 voice data 를 read (Figure.72)

```

ManufacturerID = 0xC2
DeviceID0 = 0x20
DeviceID1 = 0x16

1 : Serial Flash Chip Erase
2 : Serial Flash Read
3 : Serial Flash Main Test

0x 0 : 04 00 00 26 03 C1 B0 80 3E 04 03 C1 D7 03 B8 96
0x 10 : 80 3E 04 07 7A 6E 03 D4 2B 80 3E 04 0B 4E 9A 03
0x 20 : CF 39 80 3E 04 00 00 32 64 04 72 76 12 01 99 10
0x 30 : 10 12 11 01 98 18 12 41 76 34 9A 10 51 55 25 AB
0x 40 : 52 45 76 12 21 33 23 92 98 99 90 DD 0B 21 03 C2
0x 50 : BE 8A 0C 10 F4 9B BA B8 BA AB DD 1A FC 0A 9A 28
0x 60 : DA F1 98 9A A8 A9 98 A9 09 DA BC BA C1 98 B7 30
0x 70 : B0 2A 0B 29 A1 34 BB 16 21 23 A5 75 3B 09 12 12
0x 80 : 52 AC 24 D4 04 18 21 29 74 B1 86 9C 88 02 A9 9F
0x 90 : A0 2A 0E 90 0B 55 97 92 20 32 42 81 44 42 09 B4
0x A0 : 90 44 37 1A 3C A8 43 3C D3 82 1A C2 B2 D9 40 53
0x B0 : A7 2E 11 A3 A0 AA D9 3D E3 01 A8 98 74 CA 4C 99
0x C0 : 2A C0 50 40 9E D8 AB AB 89 85 9F 99 2A 20 9F 19
0x D0 : A9 01 14 54 E4 4B C3 6C 8B 09 A9 A3 AC B4 CA 35
0x E0 : 9E AB 78 92 59 8F A9 9B B9 99 11 21 36 40 45 73
0x F0 : 91 33 98 17 99 92 19 08 89 21 B9 05 36 A7 2A C1

```

FIGURE. 72

7.8.3) Serial Flash Main Test

- S-Flash 의 0 ~ 0x1ffff 번지까지 Block Erase / Program 을 반복한다.
값은 0xAA ,0x55 를 반복해서 Write

```

-> Verify: 0x1A0000 - 0x1Affff / Ok.
-> Block Program: 0x1A0000 - 0x1Affff / End.
-> Verify: 0x1A0000 - 0x1Affff / Ok.
-> Block Erase: 0x1B0000
-> Verify: 0x1B0000 - 0x1Bffff / Ok.
-> Block Program: 0x1B0000 - 0x1Bffff / End.
-> Verify: 0x1B0000 - 0x1Bffff / Ok.
-> Block Erase: 0x1C0000
-> Verify: 0x1C0000 - 0x1Cffff / Ok.
-> Block Program: 0x1C0000 - 0x1Cffff / End.
-> Verify: 0x1C0000 - 0x1Cffff / Ok.
-> Block Erase: 0x1D0000
-> Verify: 0x1D0000 - 0x1Dffff / Ok.
-> Block Program: 0x1D0000 - 0x1Dffff / End.
-> Verify: 0x1D0000 - 0x1Dffff / Ok.
-> Block Erase: 0x1E0000
-> Verify: 0x1E0000 - 0x1Effff / Ok.
-> Block Program: 0x1E0000 - 0x1Effff / End.
-> Verify: 0x1E0000 - 0x1Effff / Ok.
-> Block Erase: 0x1F0000
-> Verify: 0x1F0000 - 0x1Fffff / Ok.
-> Block Program: 0x1F0000 - 0x1Fffff / End.
-> Verify: 0x1F0000 - 0x1Fffff / Ok.

Serial Flash Test Done

```

```

0x 0 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 10 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 20 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 30 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 40 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 50 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 60 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 70 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 80 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x 90 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x A0 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x B0 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x C0 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x D0 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x E0 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55
0x F0 : AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55 AA 55

```

FIGURE. 73

7.9) s(e)-Flash D/L by USB

- USB 를 이용하여 Data D/L 를 하기 위해 Tenor B/D Package 에 포함된 USB Mini 케이블을 이용해 PC 와 연결한다. 연결 후 UART 통신 창에서 9 번 항목을 선택하면 Tenor B/D 가 USB 대용량 저장 장치로 PC 와 연결된다.
PC 와 연결이 되었다면 Data D/L 전용 PC Program BrScd 를 실행하여 Tenor B/D 에 Voice , Picture, F/W 파일 등을 Download 한다.
*.msc 포맷의 파일을 Download 해야 하며, msc 의 header 정보에 따라 Internal or External Flash 에 각각 Download 된다.
PC Program BrScd 의 자세한 사용법은 [8.1) PC Tool Manual] 항목을 참고하기 바란다.
- BrScd Path : C:\Program Files\PowerStudio\Samples\BMC513\SimpleVoice\PCTools\Bin

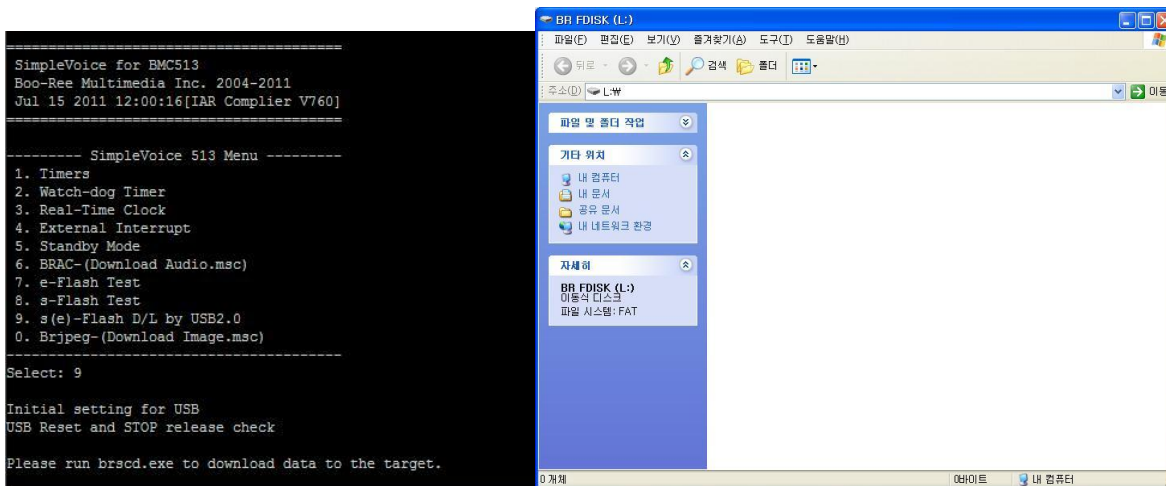


FIGURE. 74

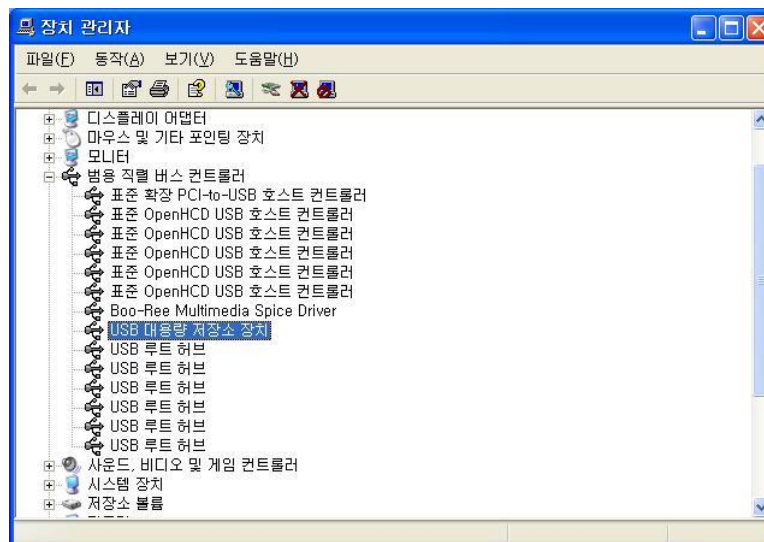


FIGURE. 75

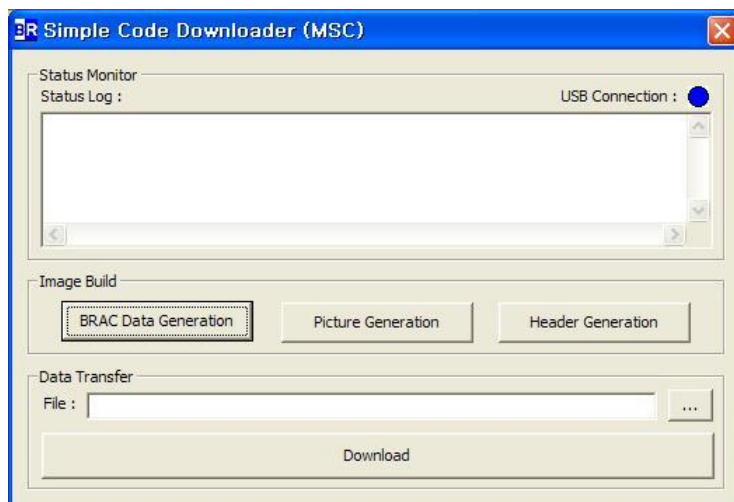
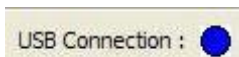
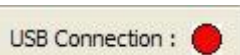


FIGURE. 76

- USB 가 정상적으로 PC 와 연결되면 BrScd 창에 연결을 알리는



화면이 표시되며, 연결이 안됐다면



표시

- Simple Voice 의 테스트 중 0. BRJPEG / 6. BRAC 의 테스트를 위해 각각의 data 를 다운로드 한다.



클릭하여 각 Path 의 Voice / Image data 를 불러온 후



클릭하여 다운로드 진행

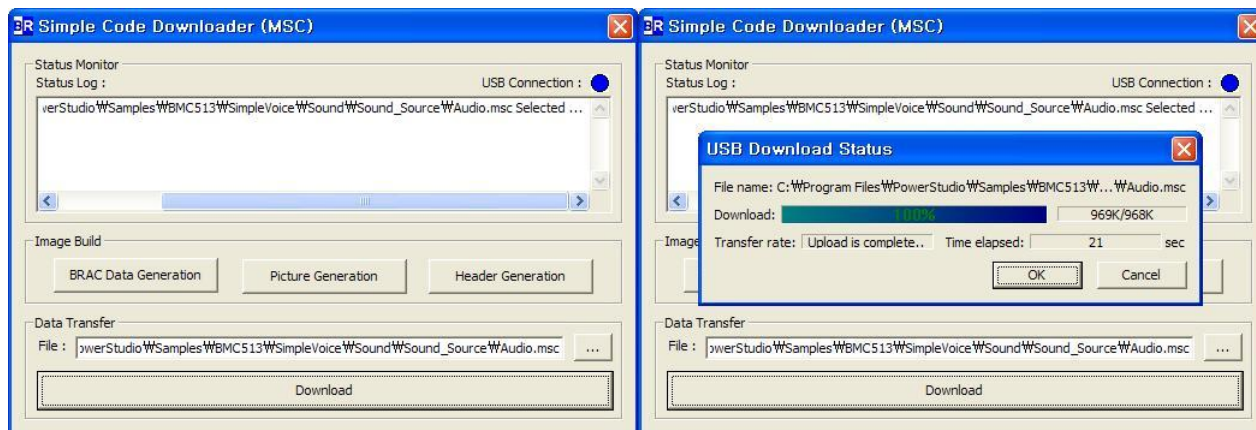


FIGURE. 77

```
Initial setting for USB
USB Reset and STOP release check

Please run brscd.exe to download data to the target.
Type : 2, Start Address : 0, Total Size : 0xF1E00
block : 0, offset : 0
Update Done!
```

FIGURE. 78

7.10) Brjpeg

- Brjpeg 의 테스트를 위해 [7.6) BRAC] 과 마찬가지로 Source data 가 필요하며 BrScd 를 이용하여 Download 한다. Simple Voice 는 Default 로 128x128 OLED 로 설정되어 있으며 Simple Voice 에서 128x128 / 240x320 사이즈의 Sample 이미지를 제공한다. 아래의 Path 를 참고하여 Download 후 테스트를 진행한다.
- Path: C:\Program Files\PowerStudio\Samples\BMC513\SimpleVoice\Image\Image Source (128x128 / 240x320 폴더가 각각 존재)

```

----- SimpleVoice 513 Menu -----
1. Timers
2. Watch-dog Timer
3. Real-Time Clock
4. External Interrupt
5. Standby Mode
6. BRAC-(Download Audio.msc)
7. e-Flash Test
8. s-Flash Test
9. s(e)-Flash D/L by USB2.0
0. Brjpeg-(Download Image.msc)
-----
Select: 0

brjpeg_test_init_data() : type(2), Image number(4)
> Display Image number select 0~4(q:quit) :

```

FIGURE. 79

- Image 번호를 선택하여 출력을 확인할 수 있다.

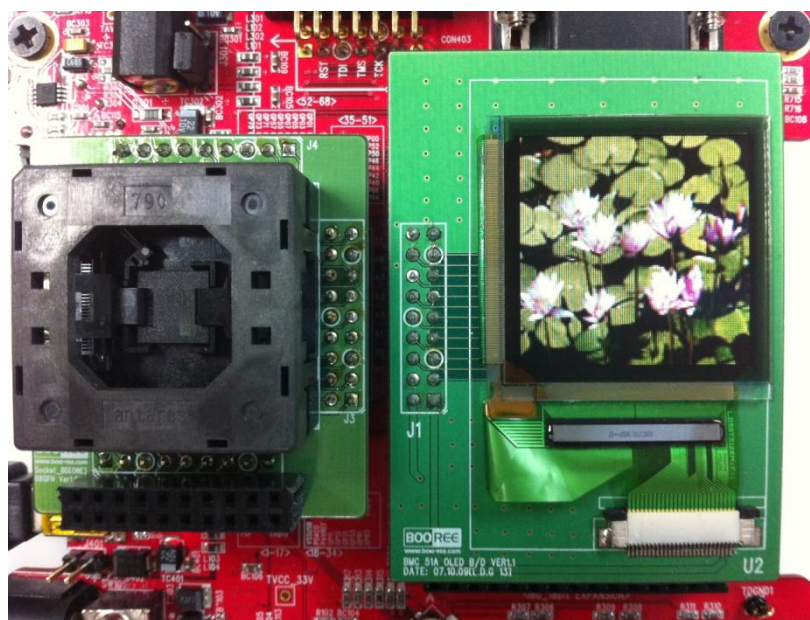


FIGURE. 80

8. PC Tool Manual & F/W Update

8.1) PC Tool(BrScd) Manual

- Simple Voice 와 함께 제공되는 PC Tool 로 명칭은 BrScd 이다.
Voice / Picture / Firmware 파일을 압축하여 *.msc file 로 generation 하며,
USB 를 통해 Download 한다.
- BrScd Path : C:\Program Files\PowerStudio\Samples\BMC513\SimpleVoice\PCTools\Bin

8.1.1) BRAC Data Generation

- *.wav 포맷의 voice data 를 *.msc 포맷으로 압축.
- BrScd 실행 후  클릭하면 아래와 같은 창이 나온다.

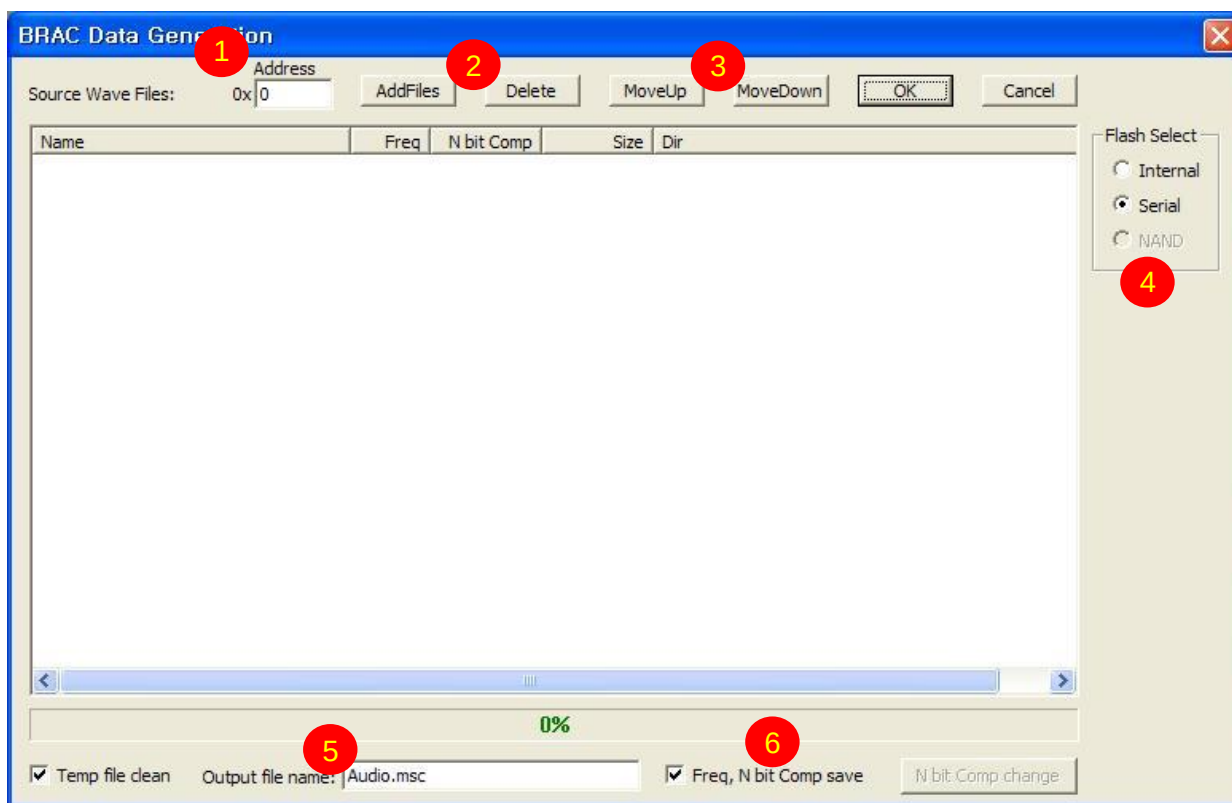


FIGURE. 81

- 1. Start Address 지정.
- 2. 파일의 추가 또는 삭제 (Simple Voice 코드에선 16KHz.mono 형식만 지원한다.)
- 3. 추가한 파일의 순서 교체
- 4. Flash Select. Internal NOR Flash or External Serial Flash
- 5. Output file name (Output file 은 wav 파일을 불러온 폴더에 생성)
- 6. Output file 에 대하여 샘플링 주파수와 압축률에 대한 정보 포함 여부

- **AddFiles** 을 클릭하여 파일 추가.

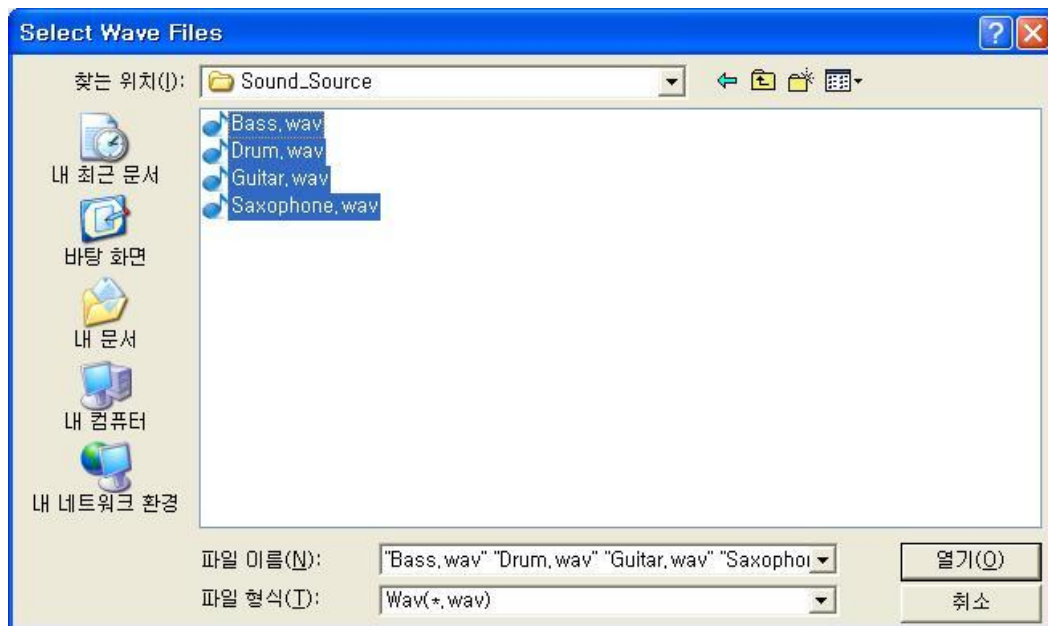


FIGURE. 82

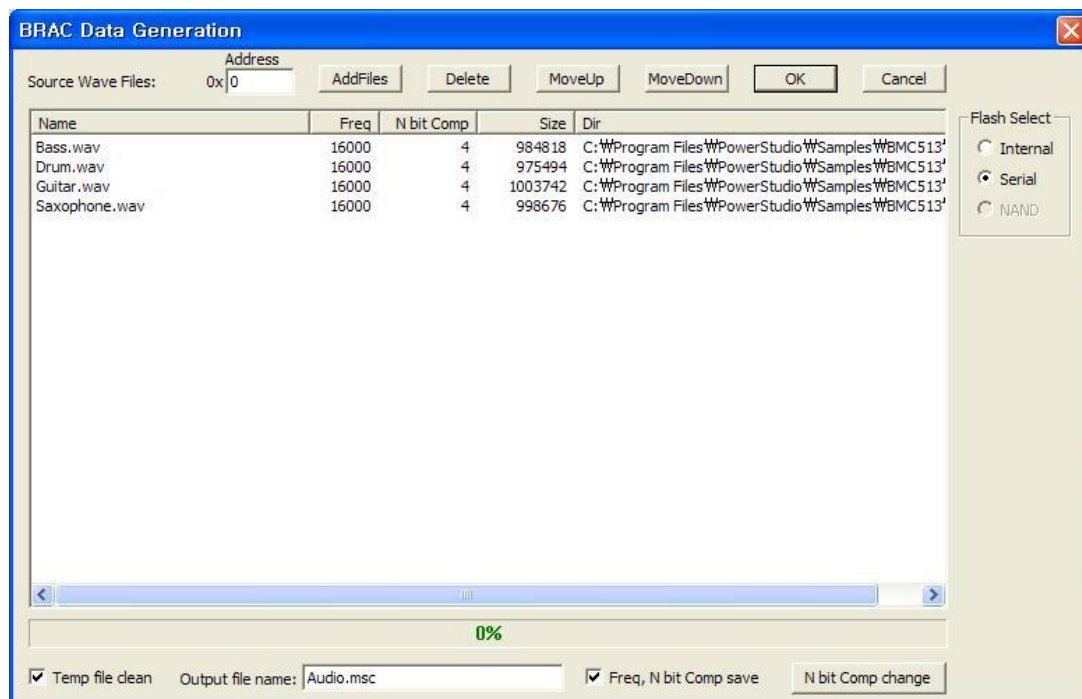


FIGURE. 83

- 각 설정 확인 후 **OK** 클릭하면 File generation

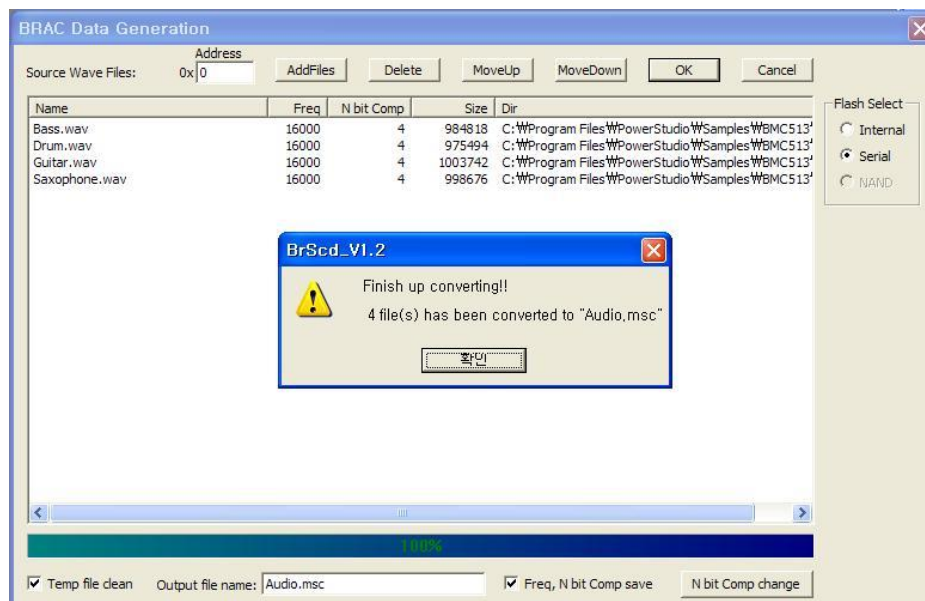


FIGURE. 84

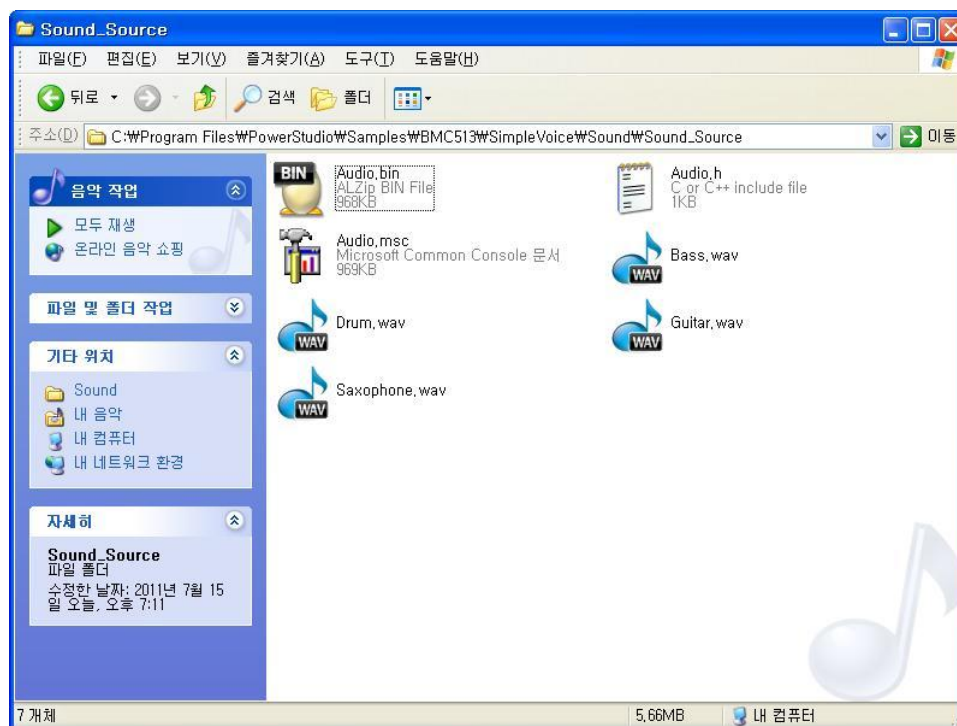
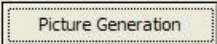


FIGURE. 85

➤ Output File information

1. Audio.bin - generation 완료된 voice data. Flash Data Manager(PowerStudio)를 통해 직접 e-Flash or s-Flash 에 Write 할 수 있다.
2. Audio.msc - Audio.bin file 의 header 에 1024 Bytes 의 data 가 추가된 BrScd Voice data ([8.2) Header information] 참고)
3. Audio.h - Voice data 의 header file

8.1.2) Picture Generation

- *.bmp 포맷의 image data 를 *.msc 포맷으로 압축.
- BrScd 실행 후  클릭하면 아래와 같은 창이 나온다.

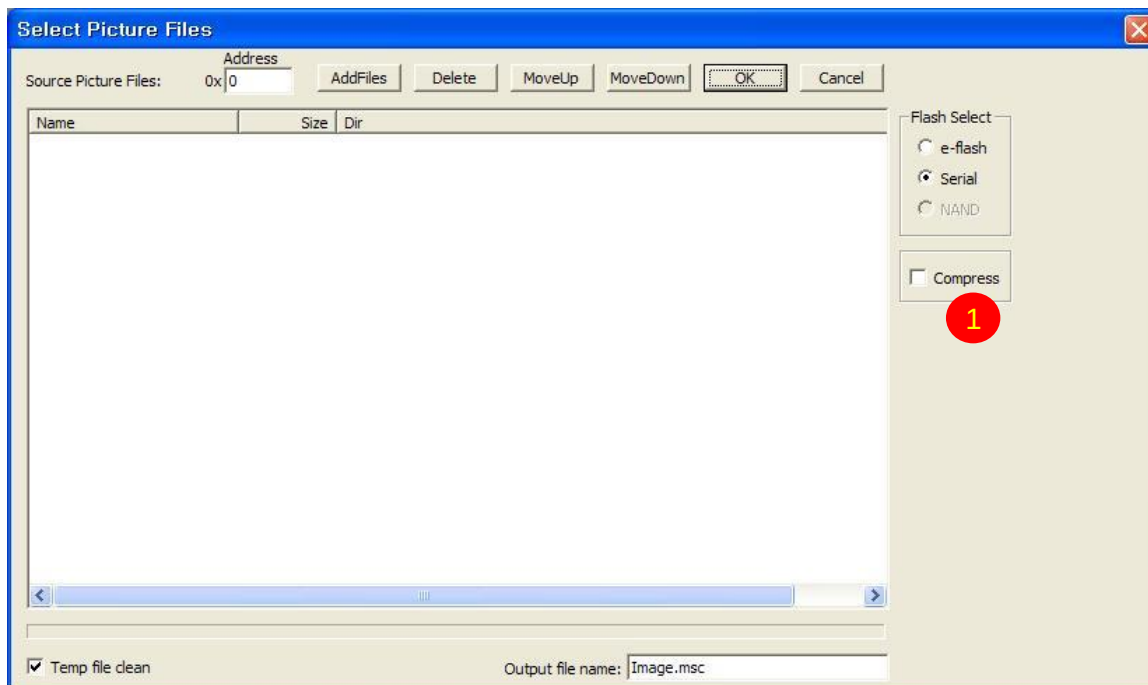


FIGURE. 86

- 1. Image 의 압축 여부를 선택
- 1 번을 제외한 나머지 기능은 BRAC Data Generation 과 동일하다.

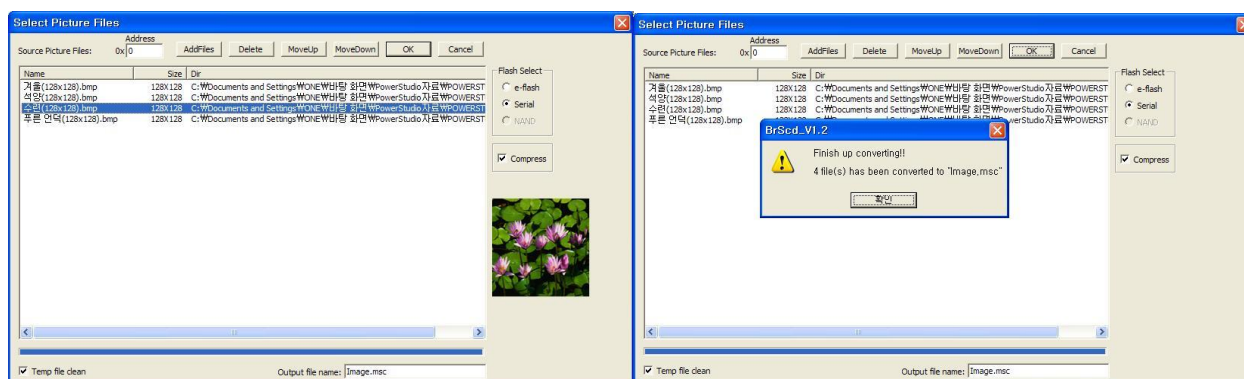
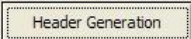


FIGURE. 87

8.1.3) Header Generation

- Firmware Update 등의 목적으로 *.bin -> *.msc 변환
- BrScd 실행 후  클릭하면 아래와 같은 창이 나온다.

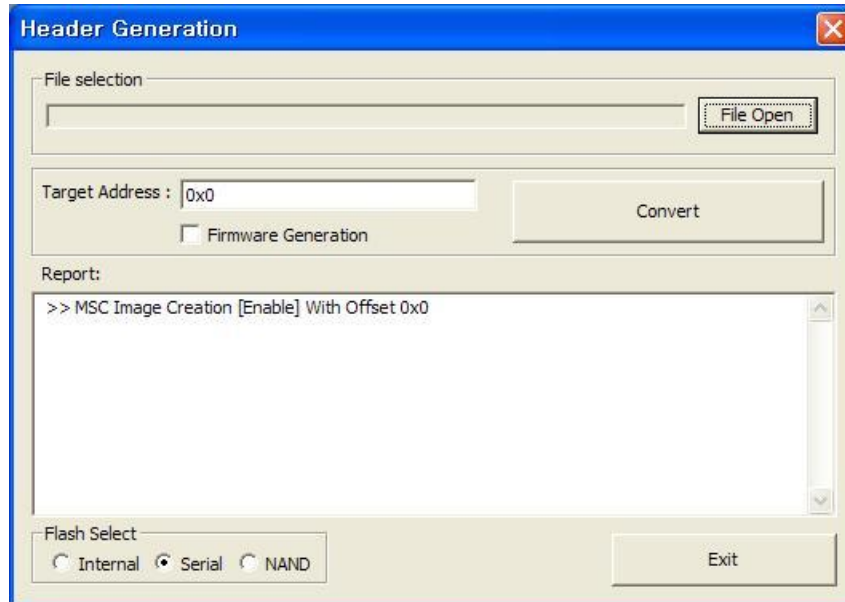
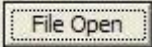


FIGURE. 88

-  을 클릭하여 변환할 F/W file open (*.bin)

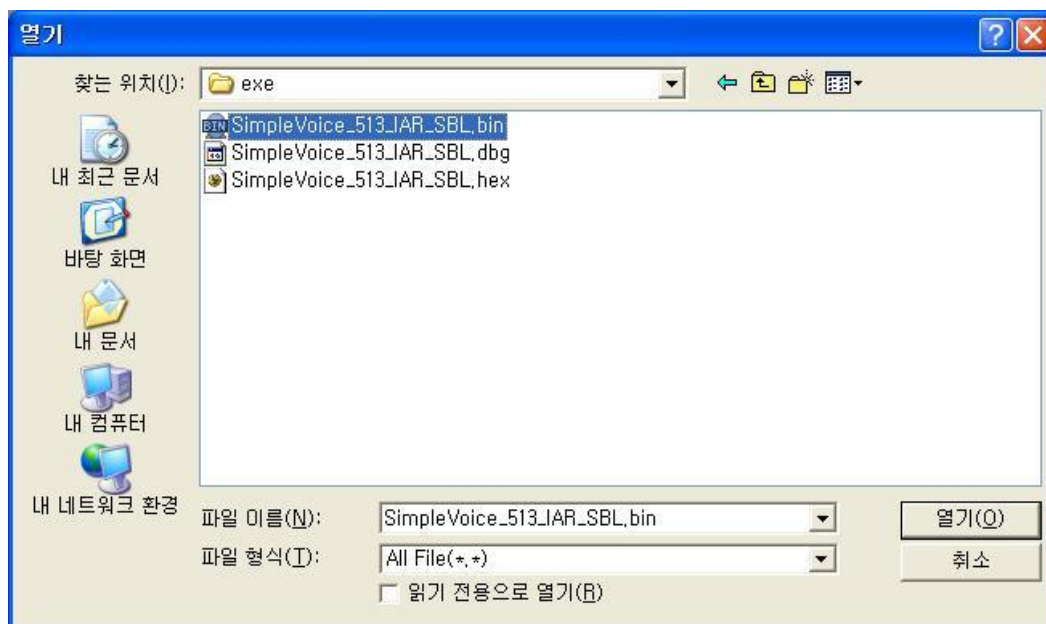


FIGURE. 89

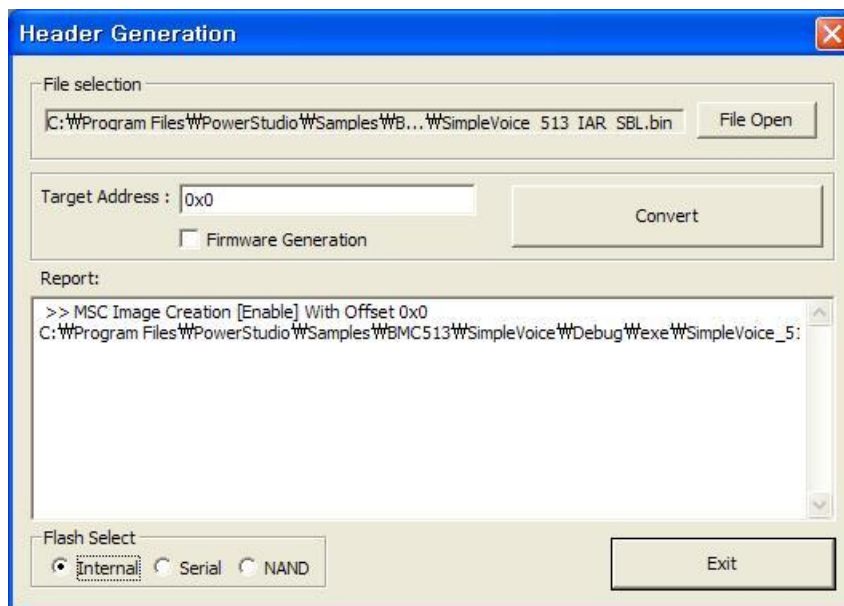
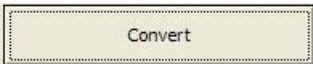


FIGURE. 90

- Flash , address 확인 후  클릭하여 file 변환

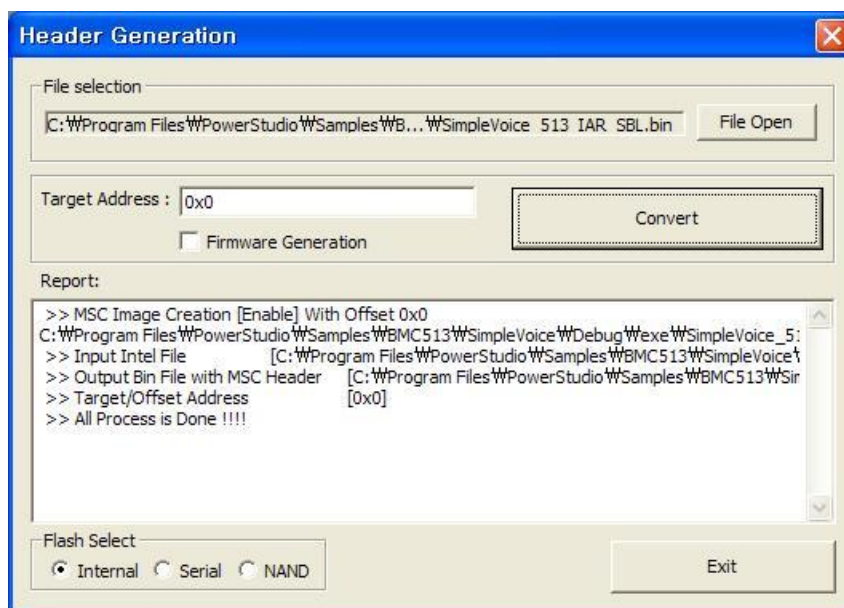


FIGURE. 91

- Output file 은 binary file 을 불러온 폴더에 생성

8.2) Header Information

➤ 1. HEADER Info.

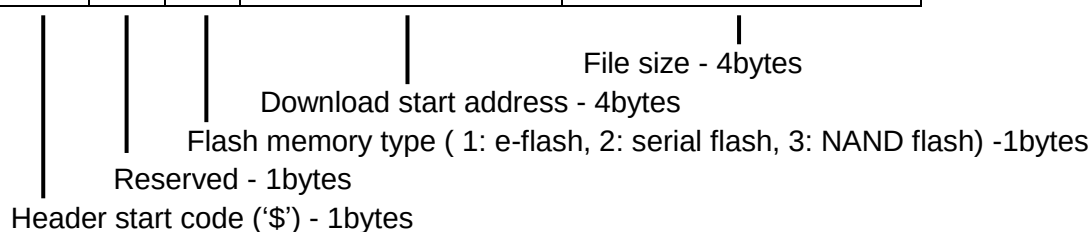
0x0000 - 0x03FF (1024 Bytes)

Header information (0x0000 - 0x000B, 12 Bytes)

"BRMSC"	0	0	0x4A	0x48	0x4B	0x49	0x4D
---------	---	---	------	------	------	------	------

Header information (0x0100 - 0x010A, 11 Bytes)

\$	0	1	0x08000000	0x00010000
----	---	---	------------	------------



➤ 2. BRAC(Audio) Info.

0x400 - (9xn+2 Bytes, n= File count)

File count:	1byte - 0x01 - 0xFF	
File position:	3byte	9bytes per 1BRAC data
File size:	3byte	
Sampling Freq:	2byte	
N bit Comp:	1byte	
Reserved:	1byte	

➤ 3. Image Info.

0x400 - (8xn+3 Bytes, n= File count)

File count:	2byte	
Memtype:	1byte	
Image width:	2byte	8bytes per 1 Image data
Image height:	2byte	
File position:	4byte	

8.3) F/W Update

- Simple Voice 의 Boot mode 를 이용하여 Firmware Update 하며,
Update 용 F/W code 제작 -> Boot mode 진입 -> F/W Download 의 순서로 진행한다.

8.3.1) F/W code Generation

- BrScd 를 실행하여 update 할 F/W source 를 *.msc 파일로 변환한다.
코드의 변환 방법은 [8.1.3) Header Generation] 참고.

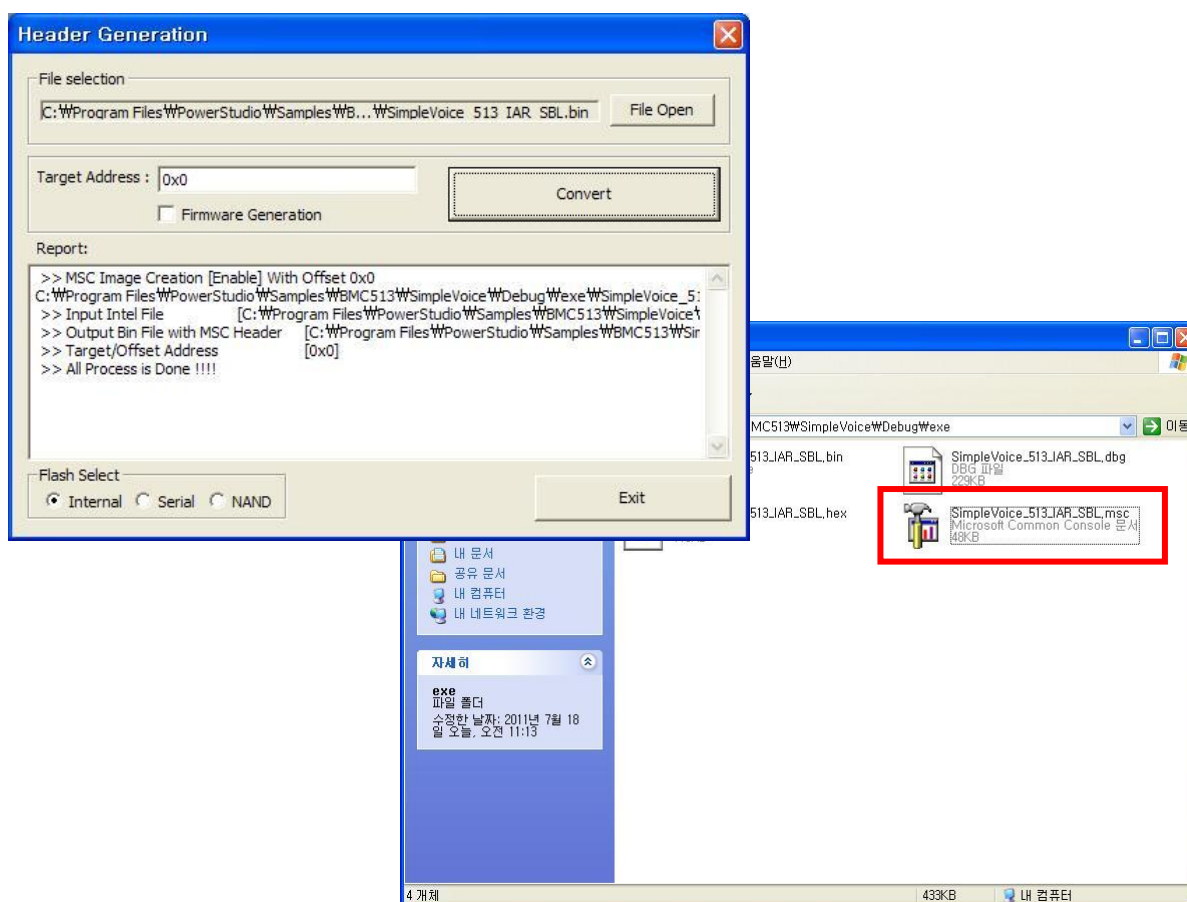


FIGURE. 92

8.3.2) Boot mode

- *.msc 포맷으로 변환된 F/W 의 다운로드를 위해 Boot mode 로 진입 해야 한다. Boot mode 를 사용하기 위해서는 SimpleVoice Project 의 low_level_init.c 코드의 __low_level_init(); 함수의 H/W Port setting 을 해야하며, Tenor B/D 의 경우 GP1.2 (KEY2) 로 setting 하면 된다. Mode 진입 방법은 Tenor B/D 의 KEY2 를 누른 상태로 Power On or Reset 하면 Boot mode 로 실행된다.

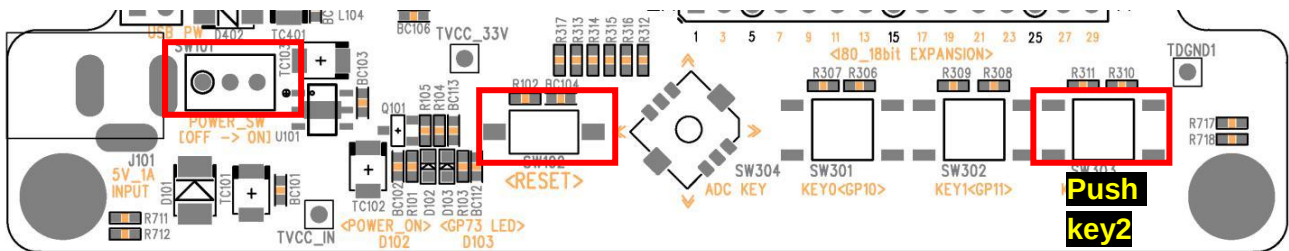


FIGURE. 93

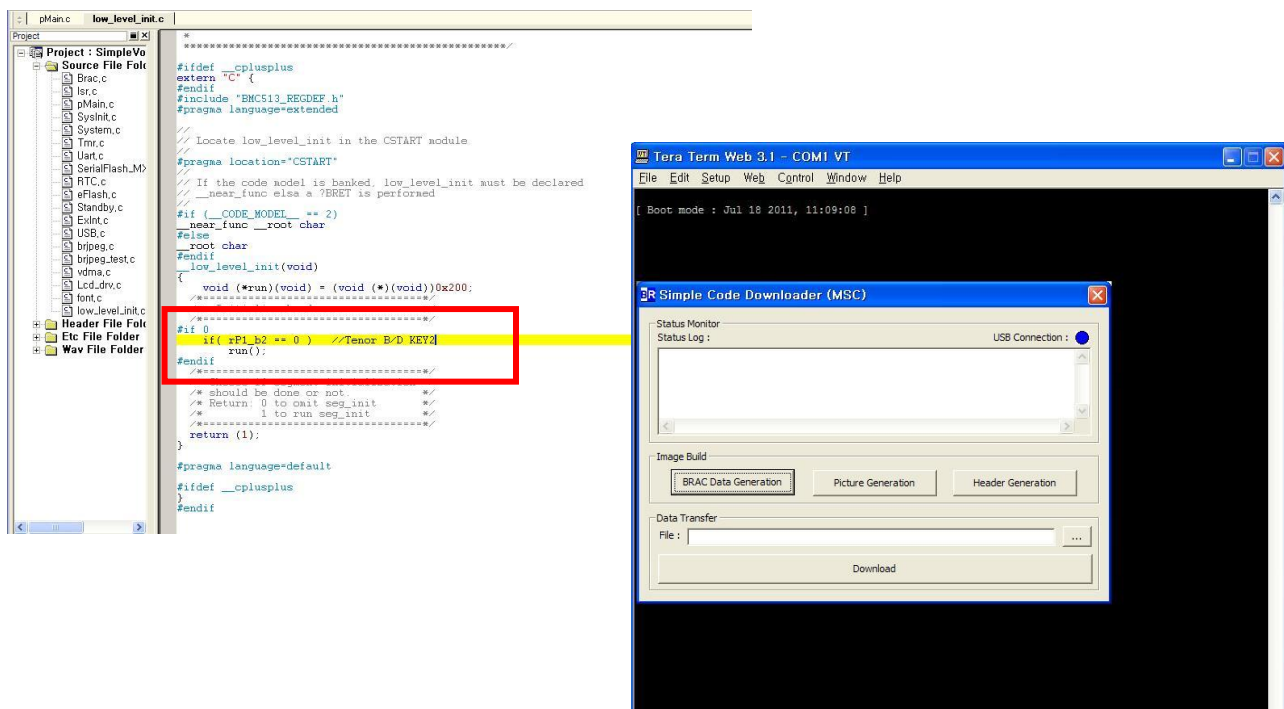


FIGURE. 94

- [Figure.94] 의 '#if 0' 부분을 '#if 1' 로 수정하면 Boot mode 사용이 가능하다.
- Boot mode 로 진입 후 USB 케이블을 연결하면 Tenor B/D 는 대용량 저장소 장치로 PC 에 인식되며, BrScd 를 사용할 수 있게 된다. 이 상태에서 [8.3.1) F/W code Generation] 에서 변환된 F/W file 을 불러와 다운로드 하면 Firmware update 가 완료된다.

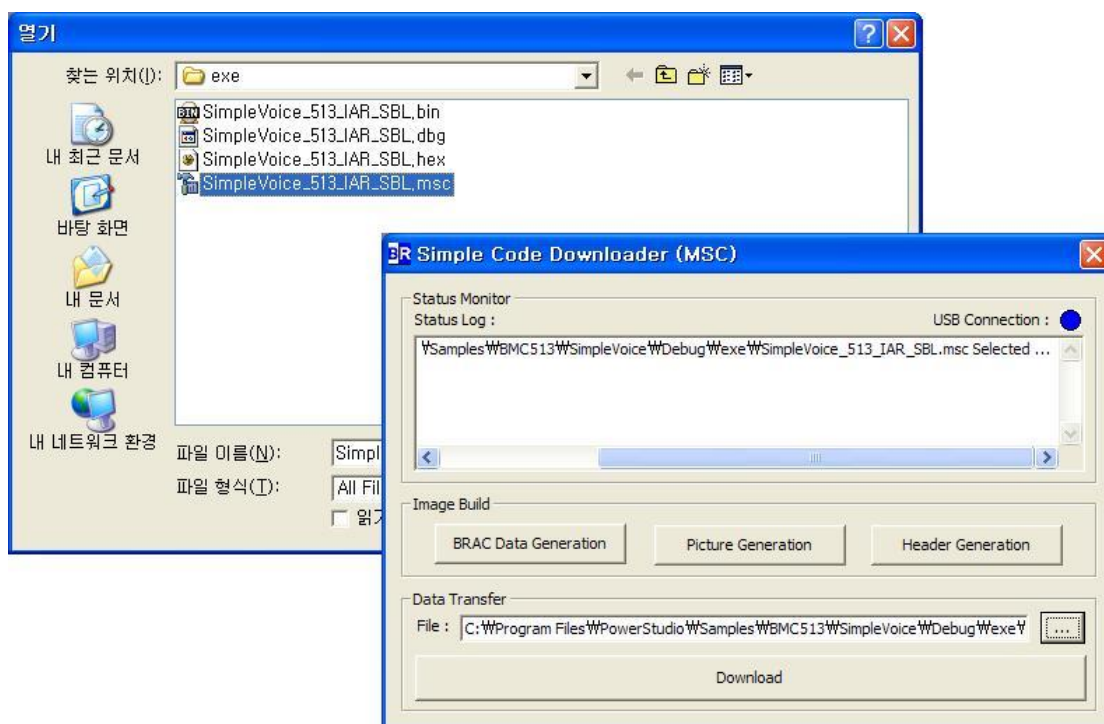


FIGURE. 95

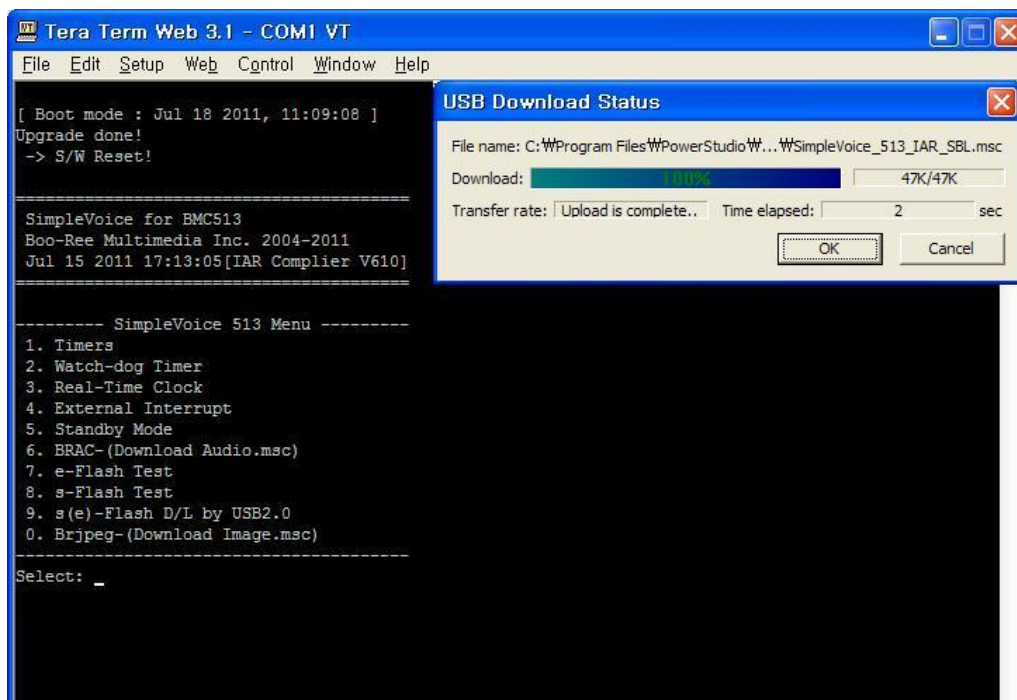


FIGURE. 96

➤ Software Reset 후 F/W Update 완료

