6. Digital Clock

동국대학교 경주캠퍼스 정보통신공학과
남윤석 교수

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Read Me

1. CD 디렉토리 구성

USEK-DC(121018)
- 0010_Digital Clock V20
  - 100_Circuit : 설계 화일
  - 200_Firmware : 프로그램 화일
  - 300_CAD : 캐드 화일
  - 400_Datasheet : 부품 데이터 시트
  - 500_Documents : 설계 문서
  - 600_Etc : 기타 참고 자료
- 0020-조립가이드-동영상 : 조립 동영상

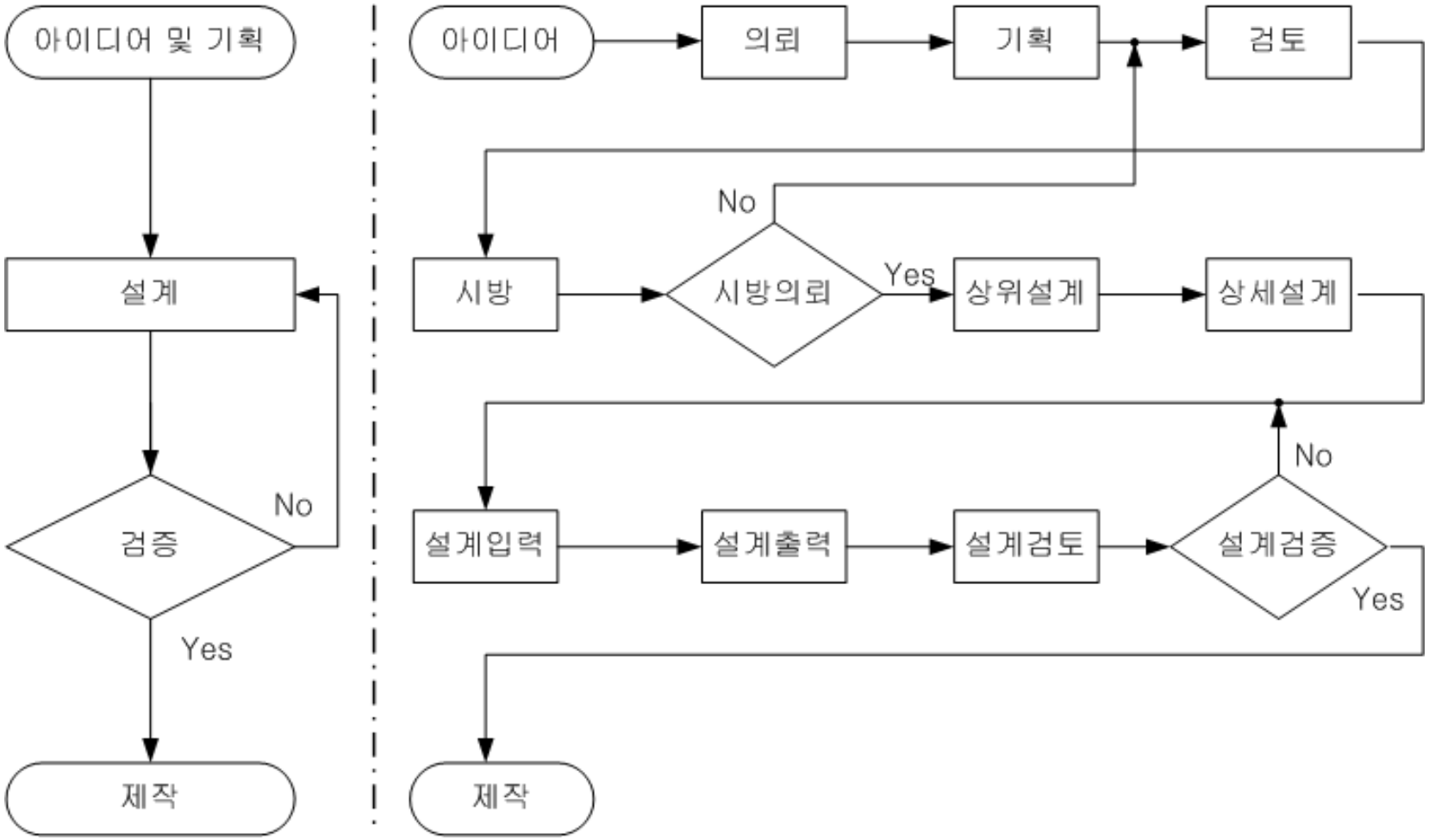
2. 제품의 조립은 조립동영상과 500_Documents 아래의 “06-조립메뉴얼.hwp”파일을 참고

3. 제품의 조립 후 동작 테스트는 조립가이드-동영상 아래의 “24-동작확인1.avi”와 “25-동작확인2.avi'파일을 참고

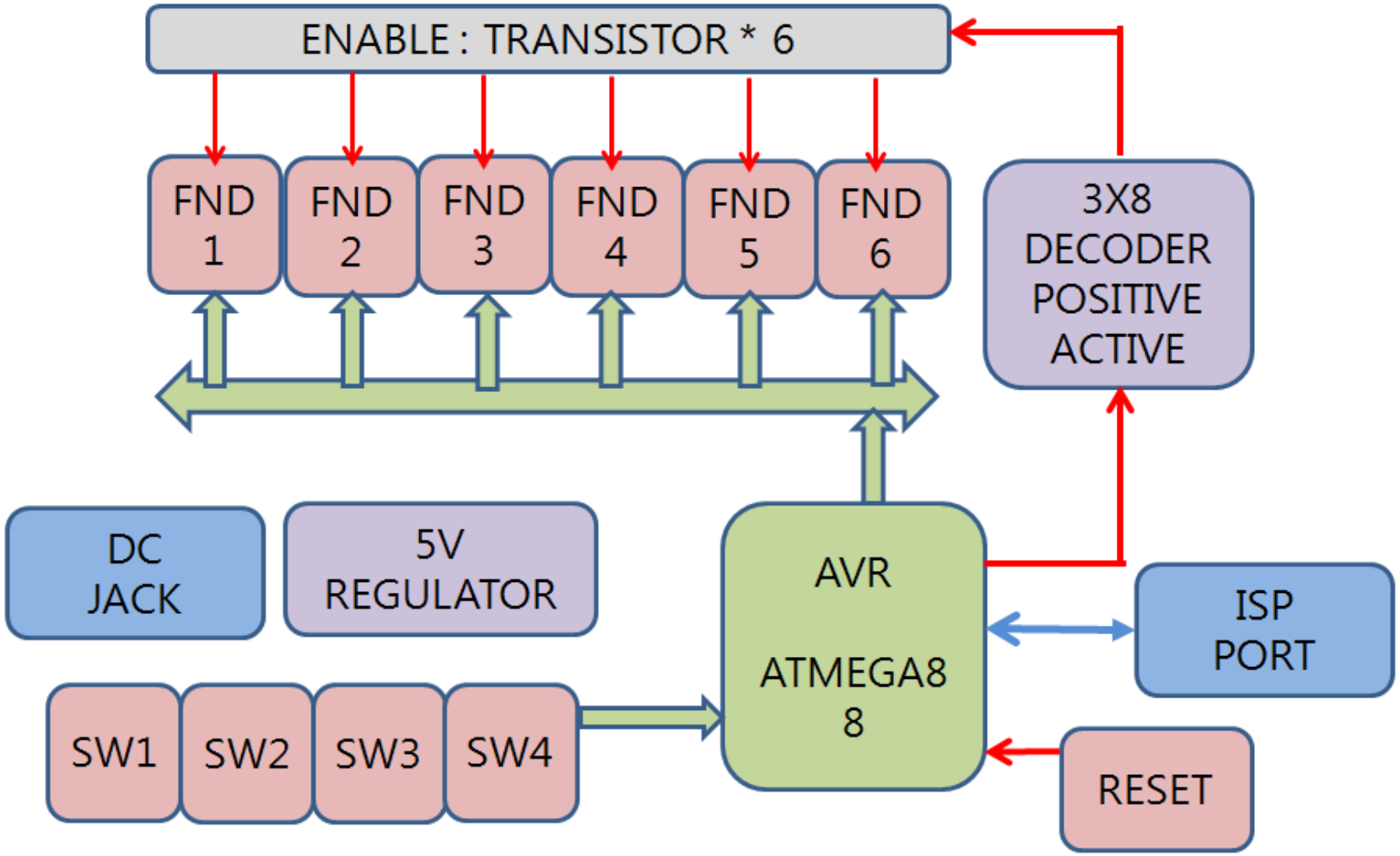
4. 프로그램의 다운로드는 AVR Studio를 이용하여 500_Documents 아래의 “07-프로그램셋팅가이드.hwp”파일을 참고하여 셋팅을 바꾸고, “200_Firmware₩default” 아래의 “usek-digitlclock-a20.hex”를 다운로드 한다.
다운로드는 500_Documents 아래의 “그램설치 및 다운로드가이드.hwp”를 참고

5. ISP 프로그래머의 경우 한백전자의 USB ISP를 사용할 경우 6pin Molex 커넥터에 연결을 하고, 그 외의 ISP 프로그래머는 BoxHeader 커넥터를 이용한다.

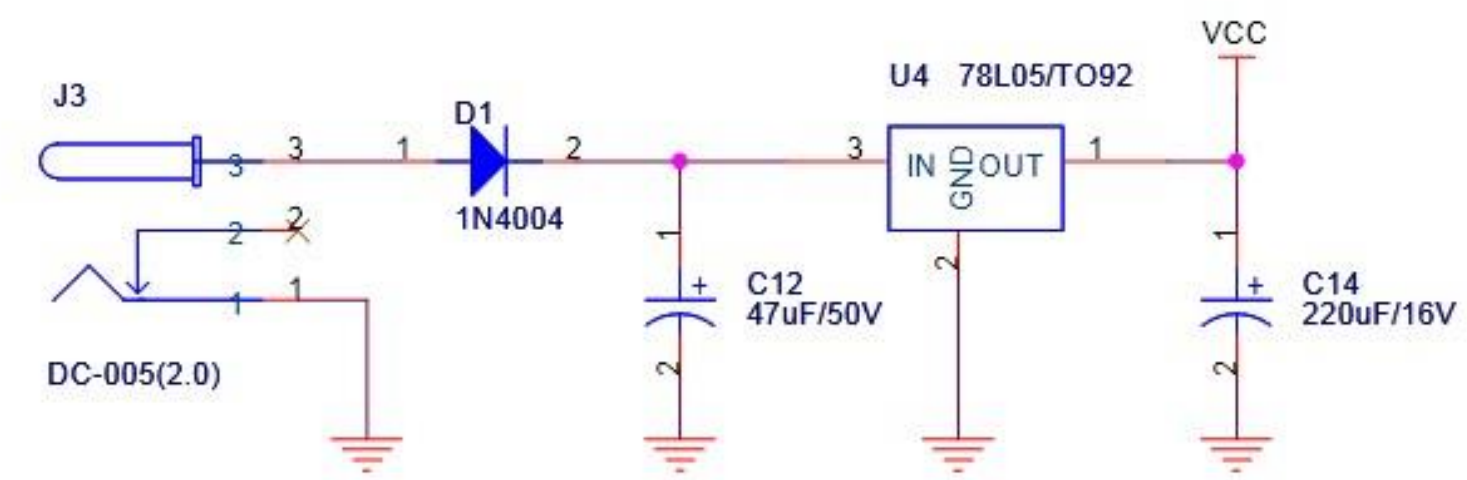
Documents : 개발 절차



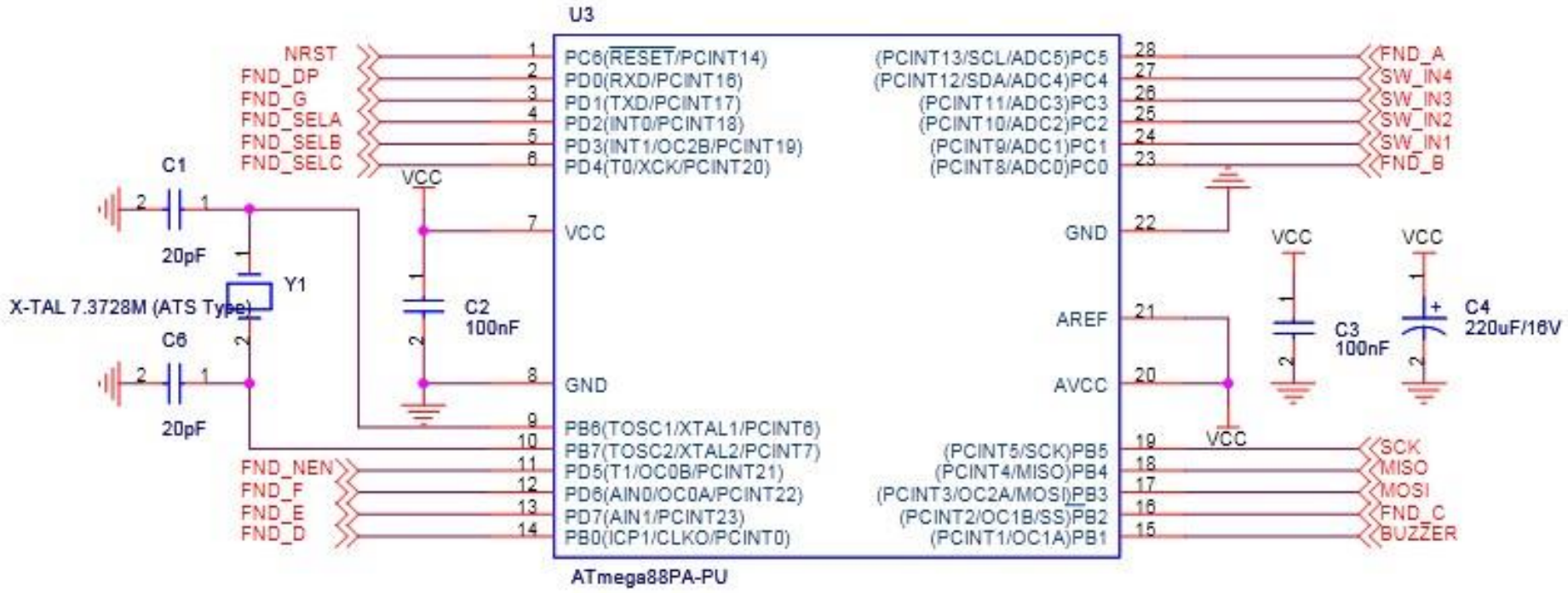
Documents : Block Diagram



Documents : 상세설계 – 전원



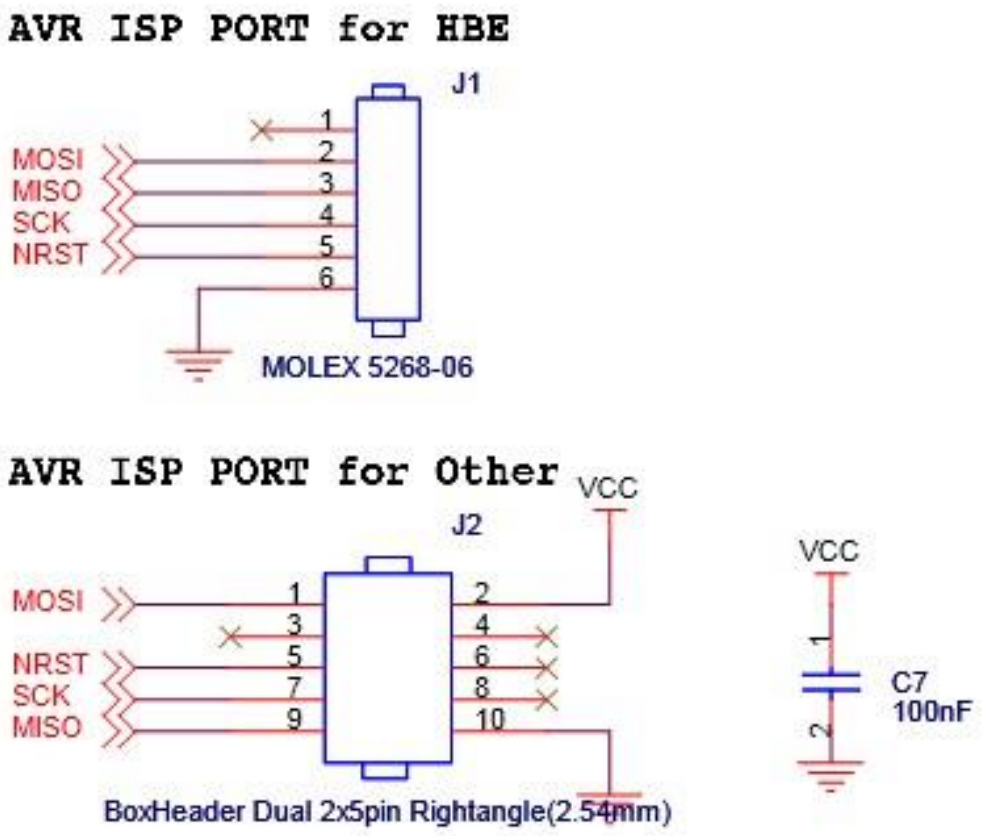
Documents : 상세설계 – 프로세서



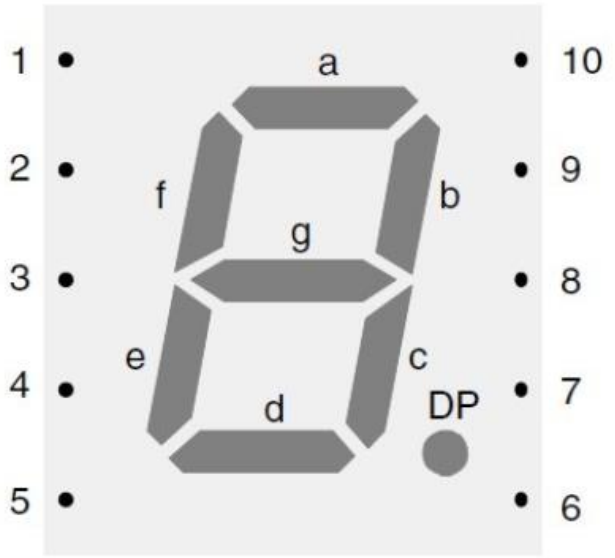
Documents : 상세설계 – ISP

- ISP(In-System Programmable)

RESET
SCK(System Clock)
MOSI(Master Out, Slave In)
MISO(Master In, Slave Out)

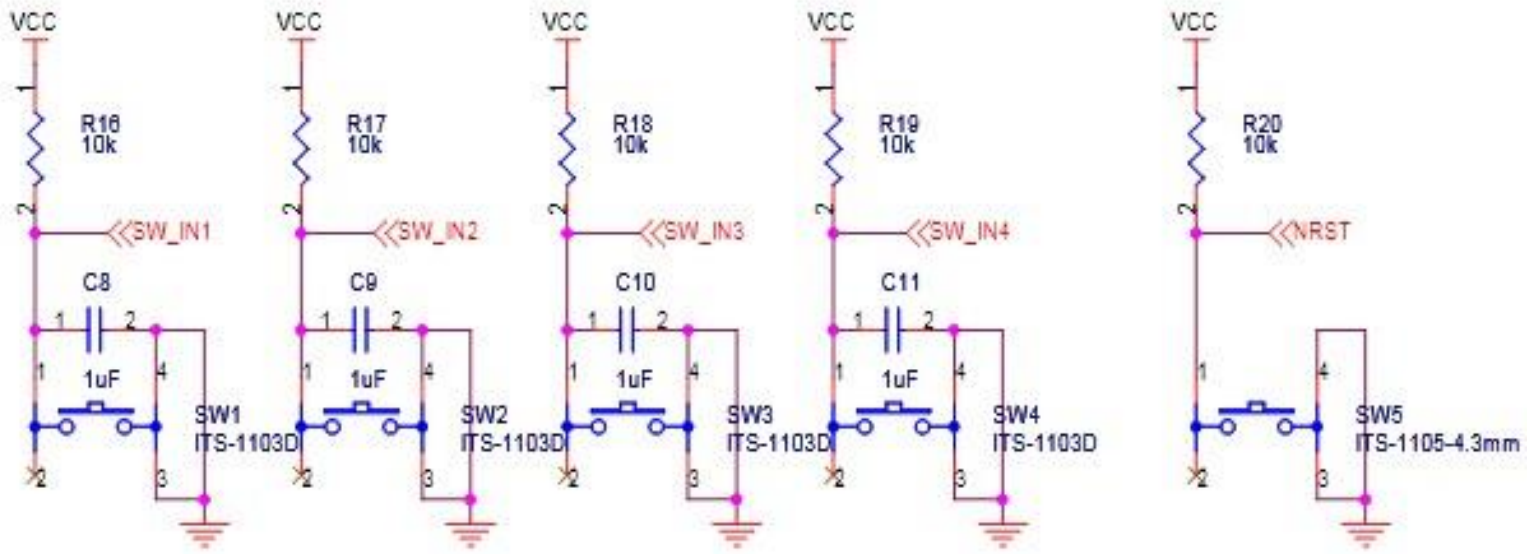


Documents : 상세설계 - FND

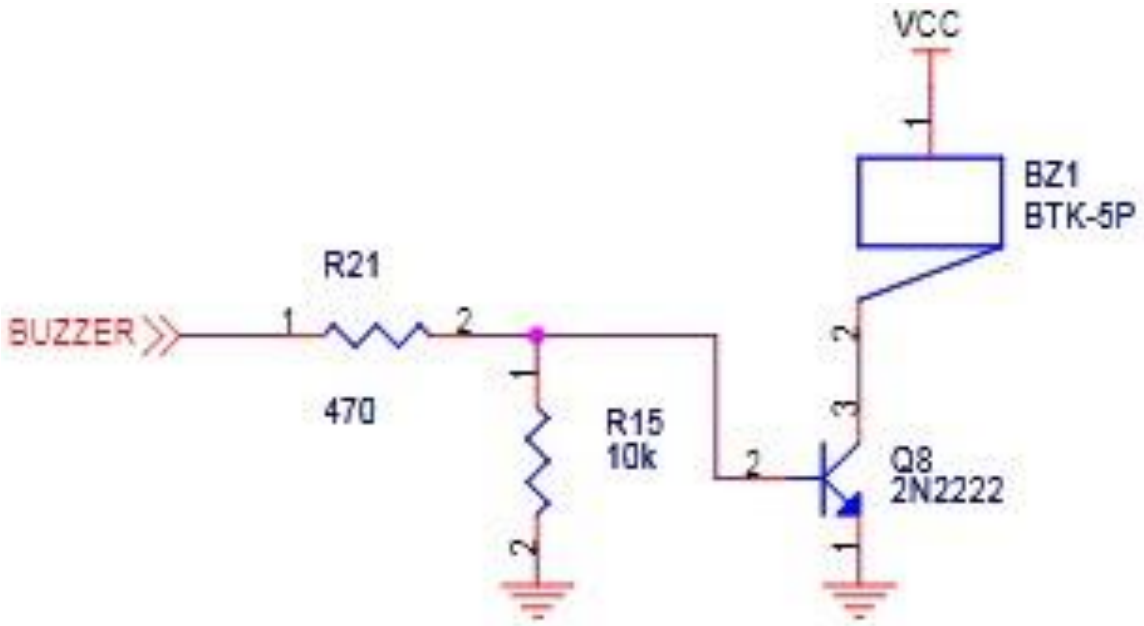


1	g
2	f
3	A (C)
4	e
5	d
6	DP
7	c
8	A (C)
9	b
10	a

Documents : 상세설계 – 스위치



Documents : 상세설계 - 부저



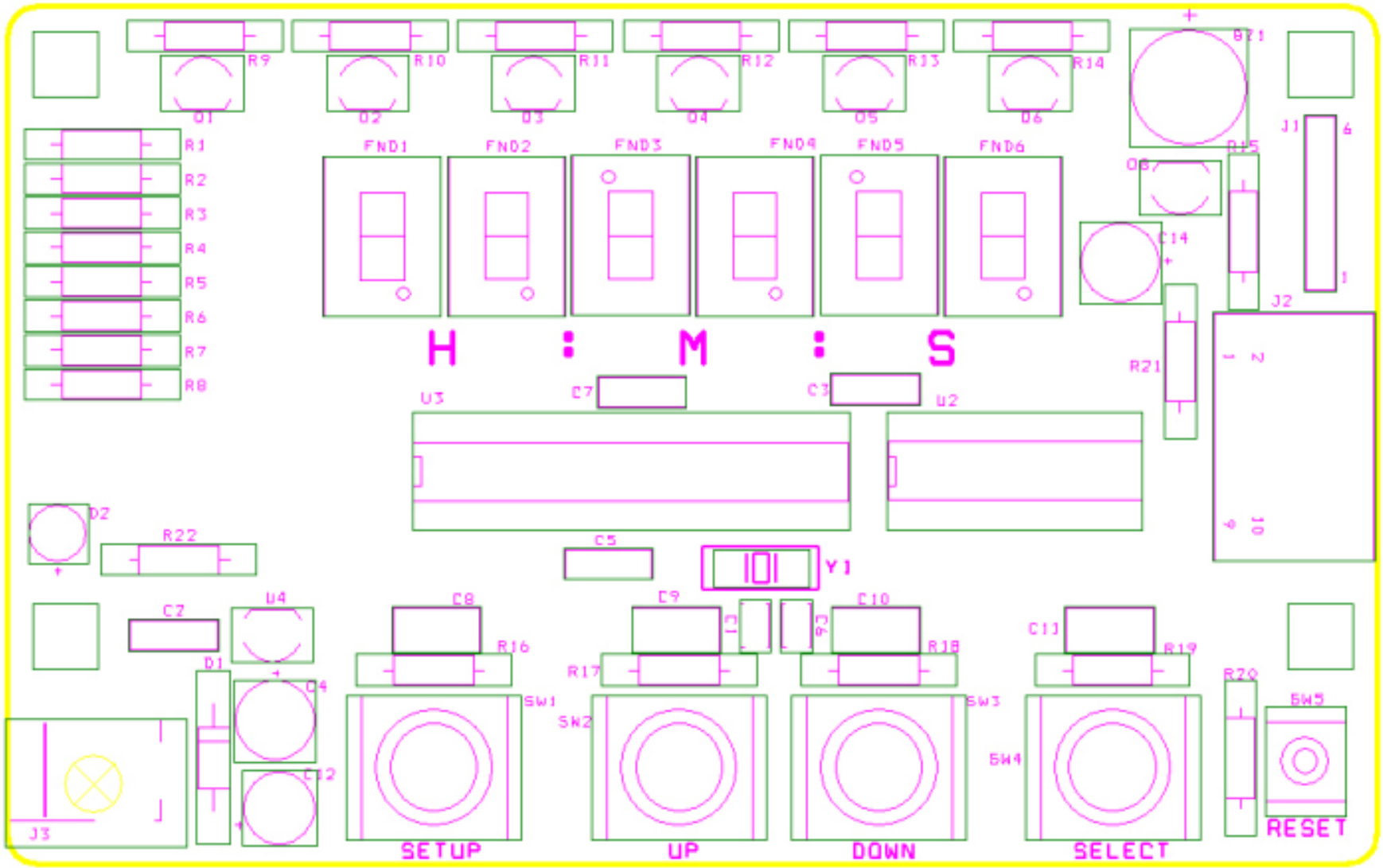
Component List

No.	Group	Part Name	부품 번호	수량
1	PCB	USEK-DIGITALCLOCK 120mm*75mm,2Layer,1.6T,0.5oz	-	1
2	IC	ATMEGA88PA-PU, MCU, DIP-28PIN	U3	1
3	IC	74HC238P, TTL, 3*8DECODER, DIP-16PIN	U2	1
4	REGULATOR	LM78L05, LIENAR REGULATOR, TO-92	U4	1
5	CRYSTAL	7.3728M, X-TAL, ATS TYPE	Y1	1
6	RESISTOR	470ohm, 1/4W, 1%	R1,R2,R3,R4,R5,R6,R7,R8,R9, R10,R11,R12,R13,R14,R21	15
7	RESISTOR	1k, 1/4W, 1%	R22	1
8	RESISTOR	10k, 1/4W, 1%	R15,R16,R17,R18,R19,R20	6
9	CAPACITOR	20pF, CERAMIC, LEAD TYPE	C1,C6	2
10	CAPACITOR	100nF, MONO, LEAD TYPE	C2,C3,C5,C7	4
11	CAPACITOR	1uF, MONO, LEAD TYPE	C8,C9,C10,C11	4
12	CAPACITOR	47uF/50V, Electrolytic Capacitor	C12	1
13	CAPACITOR	220uF/16V, Electrolytic Capacitor	C4,C14	2
14	FND	S-3191CSR, CATHOD COMMON	FND1,FND2,FND3,FND4,FND 5,FND6	6

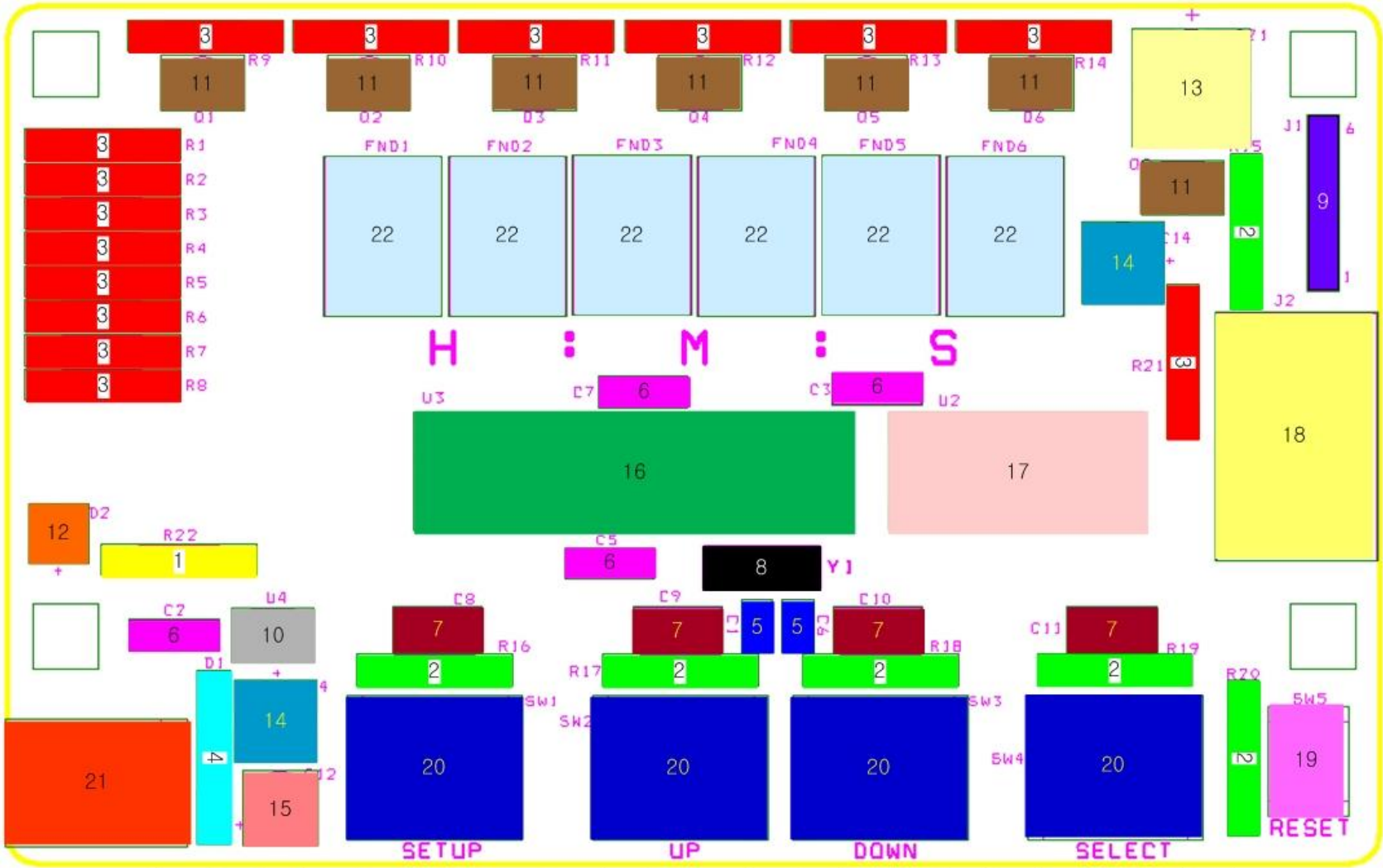
Component List

No.	Group	Part Name	부품 번호	수량
15	DIODE	1N4004, AXIAL LEAD TYPE	D1	1
16	LED	5AG3HD00, 5PIE, ROUND, GREEN	D2	1
17	TRANSISTOR	2N2222, TO-92	Q1,Q2,Q3,Q4,Q5,Q6,Q8	7
18	CONNECTOR	5268-06, MOLEX, RIGHT-ANGLE TYPE	J1	1
19	CONNECTOR	BoxHeader Dual 2x5pin Rightangle(2.54mm)	J2	1
20	CONNECTOR	DC-005 (2.0) , DC JACK	J3	1
21	SWITCH	ITS-1103D, TACT SWITCH	SW1,SW2,SW3,SW4	4
22	SWITCH	ITS-1105-4.3mm, TACK SWITCH	SW5	1
23	SPEAKER	BTK-5P, PIEZO BUZZER, DC5V, 9PIE	BZ1	1
24	COVER	아크릴 3T, 120MM*60MM, 적색디지털보드	-	1
25	SUPPORT	SUM-10, M-Type Support, 10mm 육각지지대(수)	-	4
26	SUPPORT	SUF-07, F-Type Support, 7mm 육각지지대(암)		2
27	SUPPORT	SUF-40, F-Type Support, 40mm 육각지지대(암)	-	2
28	BOLT	M3, 6MM, 둥근머리 검정색	-	4
29	AC ADAPTOR	CORD-TYPE,DCJACK내경2.1PIE, 12VDC 500mA	-	1

Assemble


R9
R10
R11
R12
R13
R14
D1
D2
D3
D4
D5
D6
BZ1
J1
R1
R2
R3
R4
R5
R6
R7
R8
FND1
FND2
FND3
FND4
FND5
FND6
Q7
C14
R15
J2
H : M : S
R21
U3
C7
C3
U2
D2
R22
C5
Y1
C2
U4
C8
C9
C10
C11
R16
R17
R18
R19
R20
D1
C4
C12
SW1
SW2
SW3
SW4
SW5
J3
SETUP
UP
DOWN
SELECT
RESET

Assemble : 키 작은 부품부터…



부품조립 순서

No.	Group	Part Name	부품 번호	수량
1	RESISTOR	1k, 1/4W, 1%	R22	1
2	RESISTOR	10k, 1/4W, 1%	R15,R16,R17,R18,R19,R20	6
3	RESISTOR	470ohm, 1/4W, 1%	R1,R2,R3,R4,R5,R6,R7,R8,R9,R10,R11, R12,R13,R14,R21	15
4	DIODE	1N4004, AXIAL LEAD TYPE	D1 (방향 주의 : 실크 기준)	1
5	CAPACITOR	20pF, CERAMIC, LEAD TYPE	C1,C6	2
6	CAPACITOR	100nF, MONO, LEAD TYPE	C2,C3,C5,C7	4
7	CAPACITOR	1uF, MONO, LEAD TYPE	C8,C9,C10,C11	4
8	CRYSTAL	7.3728M, X-TAL, ATS TYPE	Y1	1
9	CONNECTOR	5268-06, MOLEX, RIGHT-ANGLE TYPE	J1	1
10	REGULATOR	LM78L05, LIENAR REGULATOR, TO-92	U4 (부품, 방향 주의 : 실크 기준)	1
11	TRANSISTOR	2N2222, TO-92	Q1,Q2,Q3,Q4,Q5,Q6,Q8 (부품, 방향 주의 : 실크 기준)	7
12	LED	5AG3HD00, 5PIE, ROUND, GREEN	D2 (방향 주의 : 실크 기준)	1

부품조립 순서

No.	Group	Part Name	부품 번호	수량
13	SPEAKER	BTK-5P, PIEZO BUZZER, DC5V, 9PIE	BZ1 (방향 주의 : 실크 기준) 다리가 긴쪽 또는 + 표시 확인	1
14	CAPACITOR	220uF/16V, Electrolytic Capacitor	C4,C14 (방향 주의 : 실크 기준)	2
15	CAPACITOR	47uF/50V, Electrolytic Capacitor	C12 (방향 주의 : 실크 기준)	1
16	IC	ATMEGA88PA-PU, MCU, DIP-28PIN	U3 (Socket 사용)	1
17	IC	74HC238P, TTL, 3*8DECODER, DIP-16PIN	U2 (Socket 사용)	1
18	CONNECTOR	Box Header Dual 2x5pin Rightangle(2.54mm)	J2	1
19	SWITCH	ITS-1105-4.3mm, TACK SWITCH	SW5	1
20	SWITCH	ITS-1103D, TACT SWITCH	SW1,SW2,SW3,SW4	4
21	CONNECTOR	DC-005 (2.0) , DC JACK	J3	1
22	FND	S-3191CSR, CATHOD COMMON	FND1,FND2,FND3,FND4,FND5,FND6 (방향 주의 : 실크 동그라미기준)	6

22 : Silk의 동그라미 표시에 맞추어 개별 납땜 <= 팀원과 방향이 맞는지 확인!

FND 특히 조심해서 다룰 것!!!

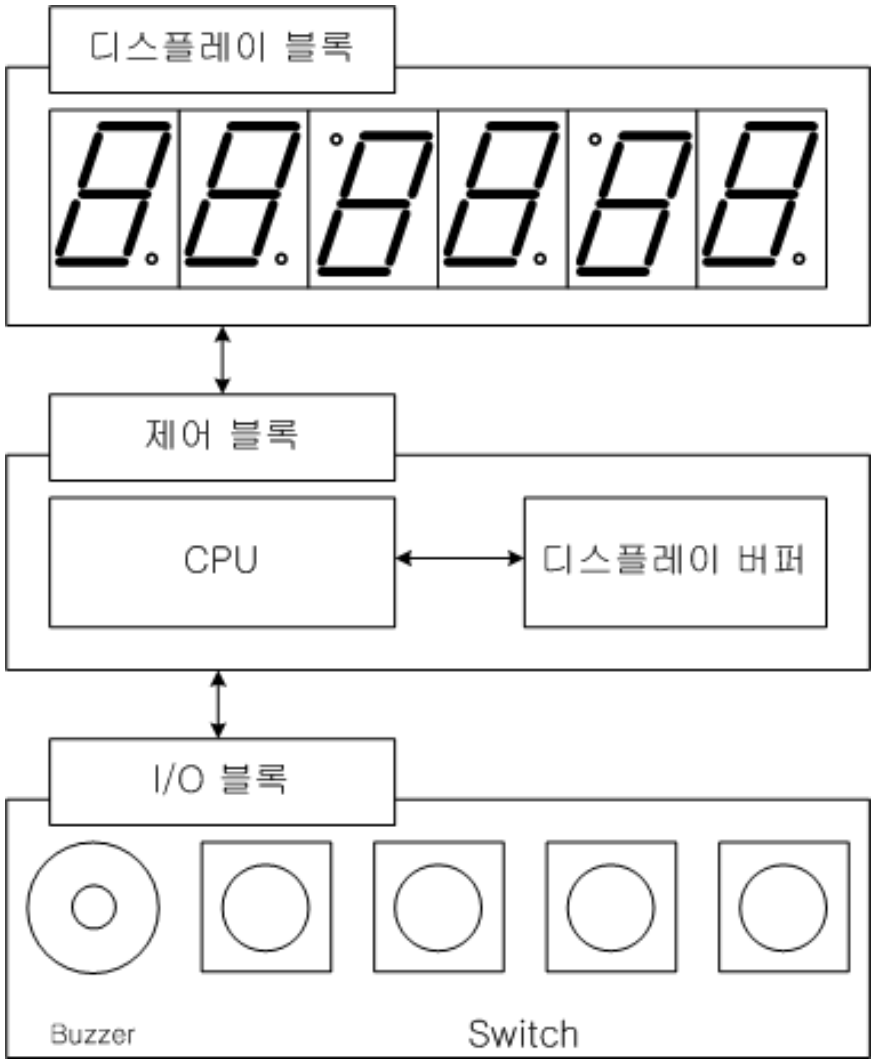
설정

스위치: Setup, Up, Down, Select

시간 설정 순서

1. Setup
2. 설정 : 시간/분/초에서 Up/Down으로 설정 후, Select
3. Setup : tl/분/초 설정 후, Setup

Reset : 시간 초기화



평가

- 평가기준
  - 동작 : 10점
    - ✓ 정상동작 : 10점
    - ✓ FND의 일부 OFF : 감점
    - ✓ 오동작 : 0점
  - 외관(납땜상태) : 5점

- 1인당 1개 시스템 : 여분 없음

부품

ATmega88

Features

- High performance, low power Atmel® AVR® 8-bit microcontroller
- Advanced RISC architecture
  - 131 powerful instructions – most single clock cycle execution
  - 32 × 8 general purpose working registers
  - Fully static operation
  - Up to 20 MIPS throughput at 20MHz
  - On-chip 2-cycle multiplier
- High endurance non-volatile memory segments
  - 4/8/16 Kbytes of in-system self-programmable flash program memory
  - 256/512/512 bytes EEPROM
  - 512/1K/1Kbytes internal SRAM
  - Write/erase cyles: 10,000 flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C()
  - Optional boot code section with independent lock bits
    - In-system programming by on-chip boot program
    - True read-while-write operation
  - Programming lock for software security
- QTouch® library support
  - Capacitive touch buttons, sliders and wheels
  - QTouch and QMatrix acquisition
  - Up to 64 sense channels
- Peripheral features
  - Two 8-bit timer/counters with separate prescaler and compare mode
  - One 16-bit timer/counter with separate prescaler, compare mode, and capture mode
  - Real time counter with separate oscillator
  - Six PWM channels
  - 8-channel 10-bit ADC in TQFP and QFN/MLF package
  - 6-channel 10-bit ADC in PDIP Package
  - Programmable serial USART
  - Master/slave SPI serial interface
  - Byte-oriented 2-wire serial interface (Philips I^2C compatible)

ATMEL®

8-bit Atmel Microcontroller with 4/8/16K Bytes In-System Programmable Flash

ATmega48/V
ATmega88/V
ATmega168/V

부품

74238

74HC238; 74HCT238

3-to-8 line decoder/demultiplexer

Rev. 03 — 16 July 2007 Product data sheet

1. General description

74HC238 and 74HCT238 are high-speed Si-gate CMOS devices and are pin compatible with Low-Power Schottky TTL (LSTTL).

The 74HC238/74HCT238 decoders accept three binary weighted address inputs (A0, A1, A2) and when enabled, provide 8 mutually exclusive active HIGH outputs (Y0 to Y7). The 74HC238/74HCT238 features three enable inputs: two active LOW ($\overline{E}1$ and $\overline{E}2$) and one active HIGH (E3). Every output will be LOW unless $\overline{E}1$ and $\overline{E}2$ are LOW and E3 is HIGH. This multiple enable function allows easy parallel expansion of the "238" to a 1-to-32 (5 lines to 32 lines) decoder with just four "238" ICs and one inverter. The "238" can be used as an eight output demultiplexer by using one of the active LOW enable inputs as the data input and the remaining enable inputs as strobes. Unused enable inputs must be permanently tied to their appropriate active HIGH or LOW state.

The 74HC238/74HCT238 is similar to the 74HC138/74HCT138 but has non-inverting outputs.

부품

CRYSTAL

CTS ELECTRONIC COMPONENTS

ATS/ATS-SM Series
Quartz Crystal

FEATURES
- Standard HC-49/US (thru hole) and HC-49/US-SM (surface mount) Packages
- Stable Frequency Over Temperature and Drive Level
- **Fundamental and 3rd Overtone Crystals**
- Frequency Range 3.2 – 64 MHz
- Frequency Tolerance, ±30 ppm Standard
- Frequency Stability, ±50 ppm Standard
- Operating Temperature, –20°C to +70°C Standard, -40°C to +85°C Available
- Tape & Reel Packaging Available
- **RoHS/Green Compliant (6/6)**

APPLICATIONS
The ATS/ATS-SM crystal series offers excellent long-term stability and reliability in a proven resistance-weld metal package. The excellent shock performance makes it suitable for microprocessor, telecommunication, industrial, consumer electronics and networking applications.

cf. Crystal Oscillator
– 전원공급, 다리 4개

TRANSISTOR

MPS2222A NPN EPITAXIAL SILICON TRANSISTOR

T-29-21

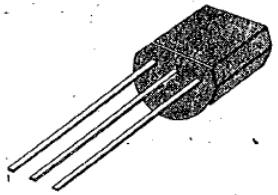
GENERAL PURPOSE TRANSISTOR
- Collector-Emitter Voltage: V_{CEO}=40V
- Collector Dissipation: P_C (max)=625mW

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	75	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

*Refer to MPS2222 for graphs

TO-92



1. Emitter 2. Base 3. Collector

부품

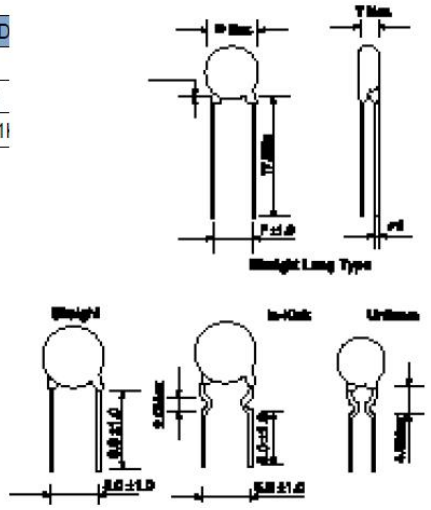
DISC CERAMIC CAPACITORS

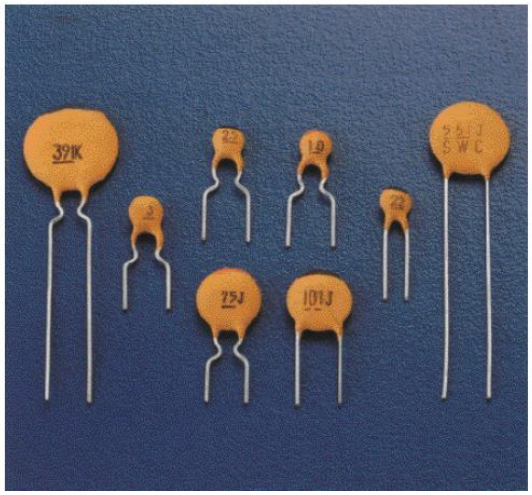
CLASS • Temperature Compensating Ceramic Capacitor

LEAD VARIATION (BULK TYPE)

Ceramic Capacitor

R.V (V.D
50
500
Above 1I





DATA SHEET

Magnetic Buzzer_Int'l

RoHS compliant

Φ9.0 x 5.0(h)mm

BTK – 5P

ORDERING CODE:	B T	K	–	5	P
	①	②		③	④

①	Magnetic Buzzer
②	Series Number
③	Rated Voltage
④	None: Pin type,

Buzzer

부품

DIODE

TSC

1N4001 THRU 1N4007, BY133

1.0 AMP. Silicon Rectifiers

Voltage Range
50 to 1300 Volts
Current
1.0 Ampere

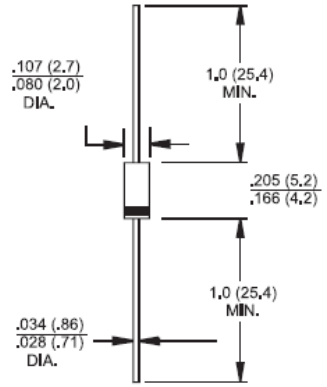
Features

- Low forward voltage drop
- High current capability
- High reliability
- High surge current capability

Mechanical Data

- Cases: Molded plastic
- Epoxy: UL 94V-0 rate flame retardant
- Lead: Axial leads, solderable per MIL-STD-202, Method 208 guaranteed
- Polarity: Color band denotes cathode end
- High temperature soldering guaranteed: 260℃/10 seconds/.375",(9.5mm) lead lengths at 5 lbs.,(2.3kg) tension
- Weight: 0.35 gram

DO-41



Dimensions in inches and (millimeters)

FAIRCHILD SEMICONDUCTOR®

www.fairchildsemi.com

MC78LXXA/LM78LXXA/MC78L05AA

3-Terminal 0.1A Positive Voltage Regulator

7805 Regulator

Features

- Maximum Output Current of 100mA
- Output Voltage of 5V, 6V, 8V, 12V, 15V, 18V and 24V
- Thermal Overload Protection
- Short Circuit Current Limiting
- Output Voltage Offered in ±5% Tolerance

Description

The MC78LXXA/LM78LXXA/MC78L05AA series of fixed voltage monolithic integrated circuit voltage regulators are suitable for application that required supply current up to 100mA.

TO-92 SOT-89

1. Output 2. GND 3. Input