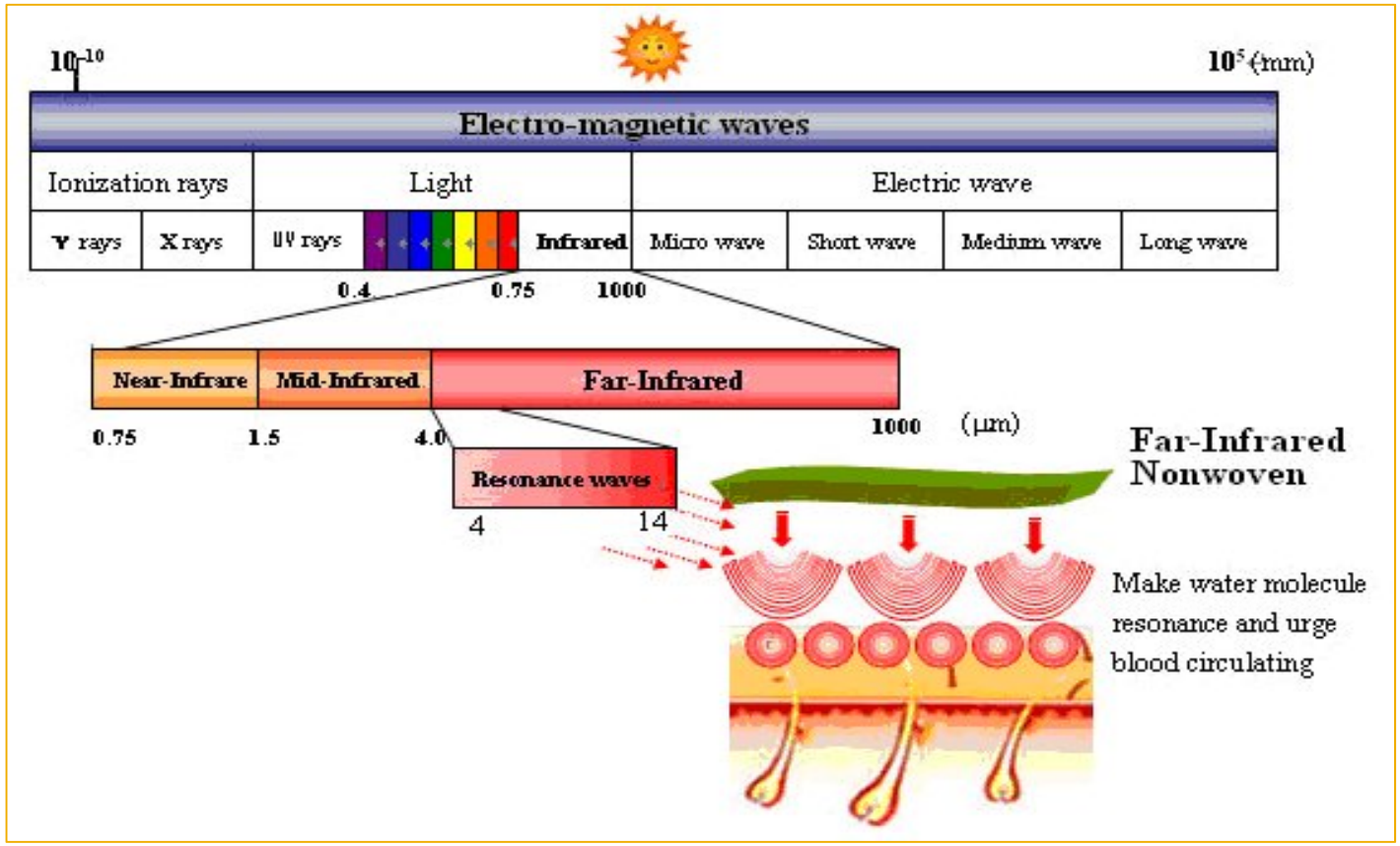
6주차

2017. 04. 6.

- 이번 학기 강의내용

주	주제	강의내용
1	지난학기 review	지난학기에 배운 마이크로컨트롤러의 기본 기능에 대한한 review
2	모터 1	모터 구동 이론, DC 모터
3	모터 2	STEP 모터
4	LCD 1	Character Liquid Crystal Display 기본 실습
5	LCD 2	Character Liquid Crystal Display 응용 + 4x4 키패드
6	무선통신 1	적외선(Infrared) 통신 기본
7	무선통신 2	적외선(Infrared) 통신 remote controller제작
8	중간고사	중간고사
9	데이터변환 1	SPI 통신 (Digital-to-Analog Converter)
10	데이터변환 2	데이터 변환 응용(DAC 출력-음악 만들기)
11	데이터변환 3	타이머 카운터 응용(음악 만들기)
12	데이터변환 4	아날로그-디지털 변환기 (ADC) 아날로그 컴퍼레이터
13	센서 인터페이스 1	온도센서 압력센서 기울기센서
14	센서 인터페이스 2	광센서(cds) 포토인터럽터 텀 프로젝트 기안(1인 1 프로젝트, 졸업 작품과 연계 금지)
15	텀 프로젝트	텀 프로젝트 중간 점검
16	기말고사	텀 프로젝트 발표 및 시연

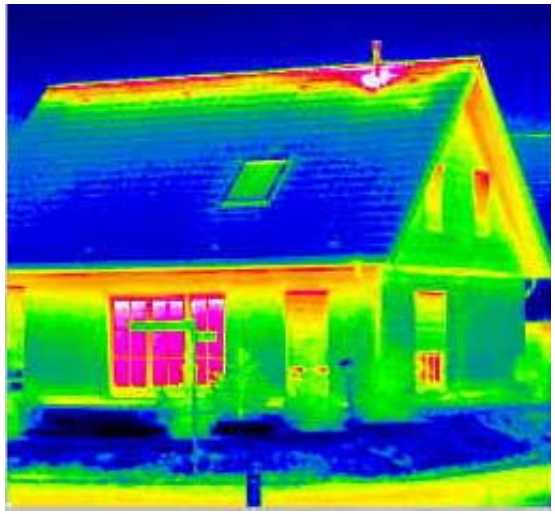
Infrared wave



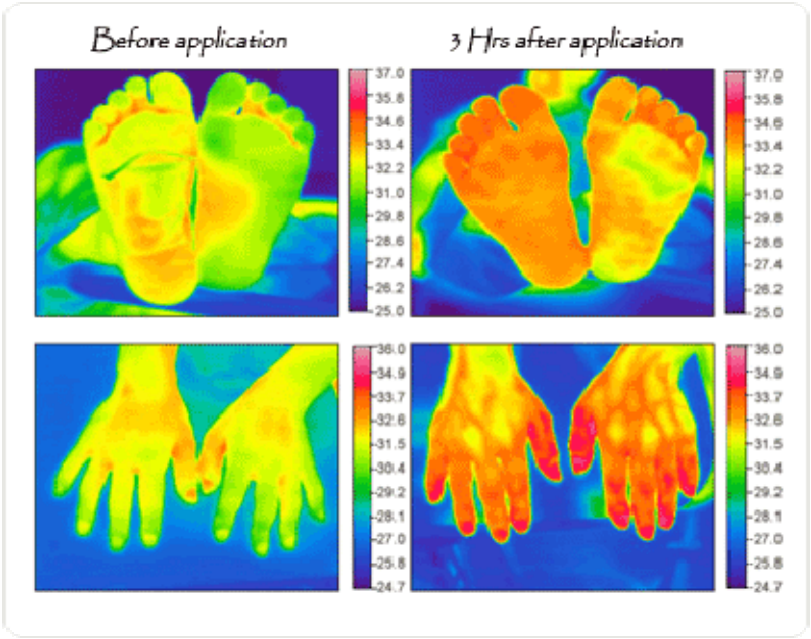
Electro-Magnetic Waves

- Infrared waves are a part of the electromagnetic spectrum and form the region of the spectrum that is not visible to the human eye.

- Even though the infrared spectrum is not visible to the human eye, there are electronic sensors that can detect Infra Red waves and can be used for various applications.

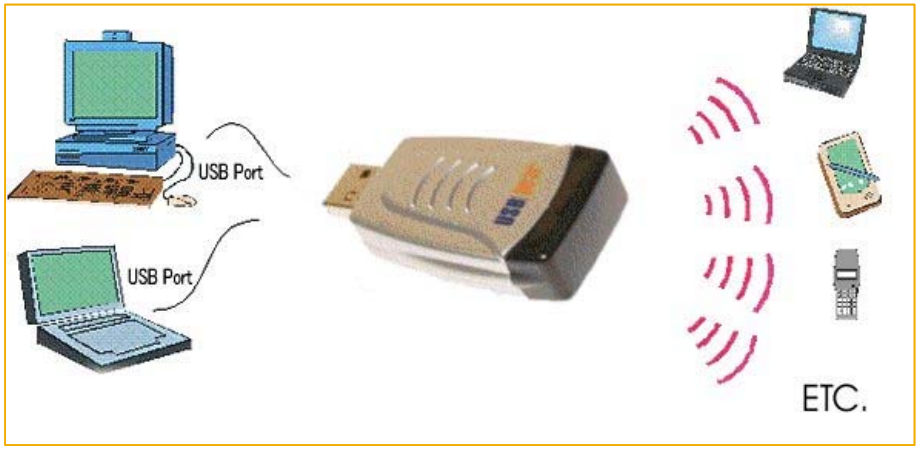


Construction



Medical

Electronics



Communication

- The two most popular mediums in the wireless arena are Infrared (IR) and Radio Frequency (RF).

- IR technologies are better suited for short distance, low-to-medium data throughput, and wireless communication channels.

- Two common types of IR technologies are currently in use.
  1. TV Remote (TVR)
  2. IrDA (Infrared Data Association) standard protocol.

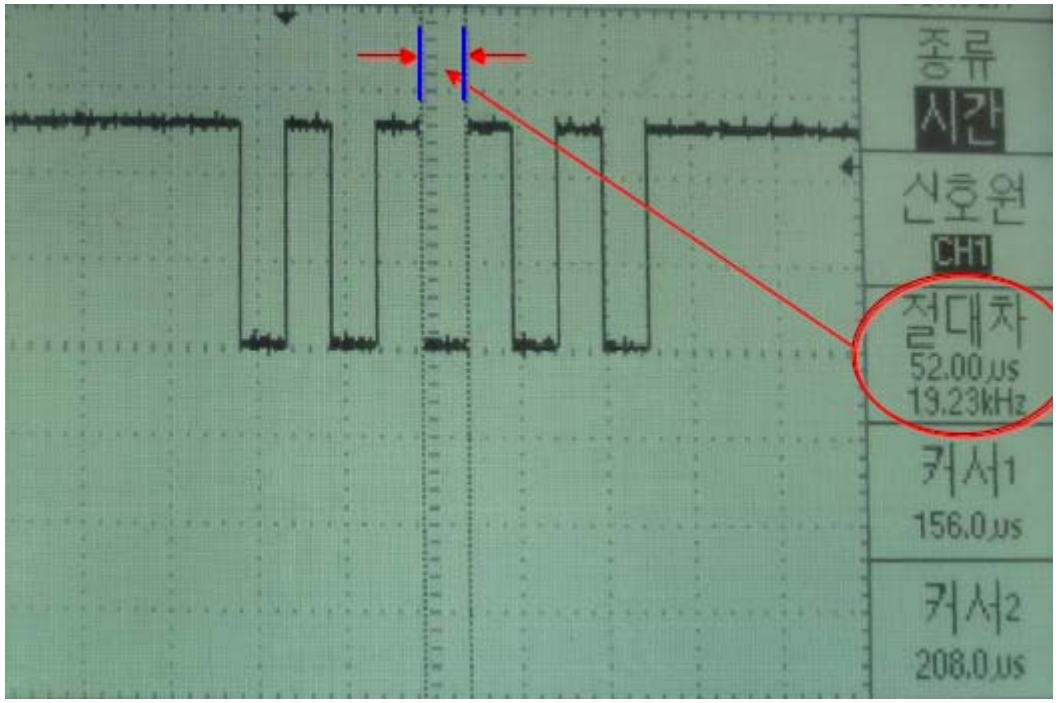
- The IrDA (Infrared Data Association) has defined the standard as a wireless communication link between two devices in which the information is transmitted using infrared light.

직렬 통신 (USART)

BPS (Bit Per Second)

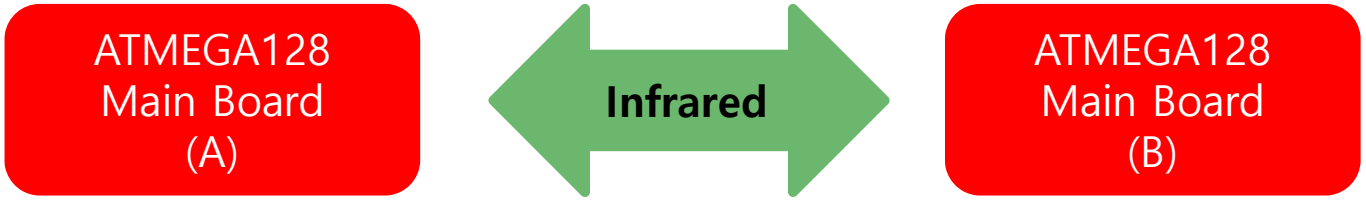
- 1초에 몇 비트를 보낼 것인지 결정
- 19,200 bps → 1초에 19,200 비트를 보냄

  ex) 2,400 bps, 28,800 bps, 38,400 bps, 57,600 bps, 114,200 bps 등



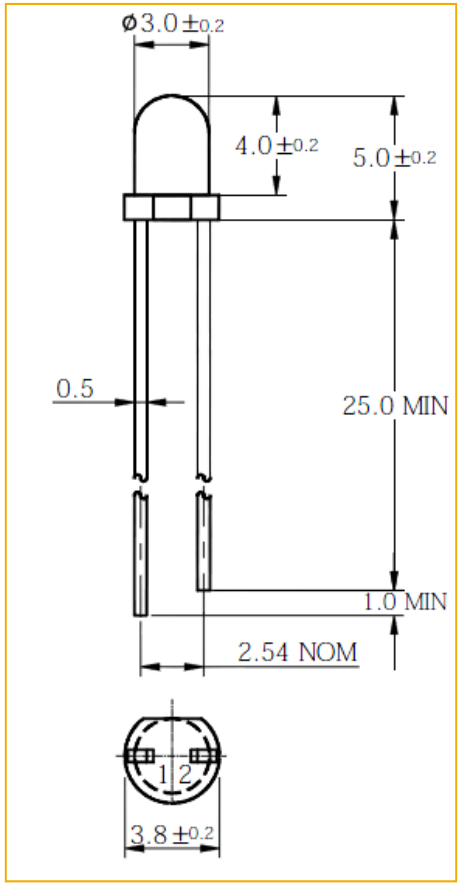
통신 파형 측정

적외선 통신 개요

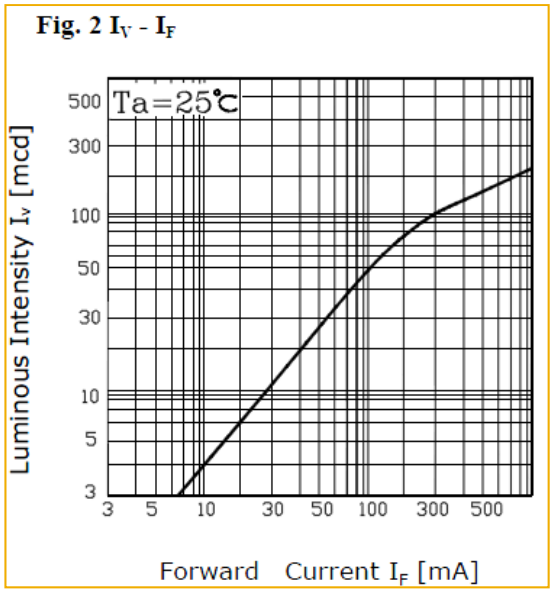


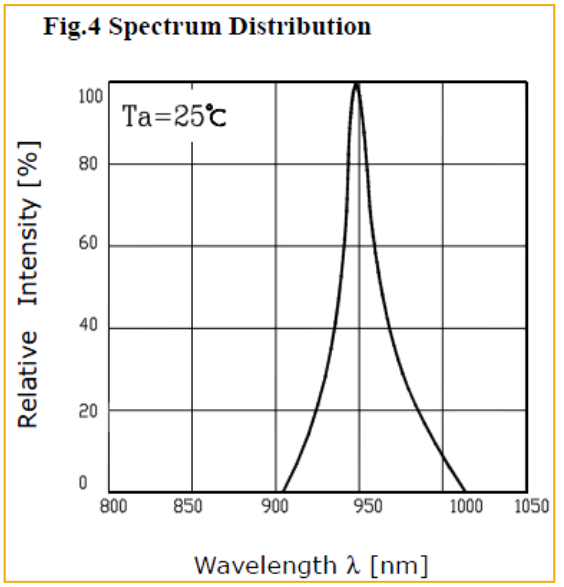
LEDs
LCD
DC/STEP Motor

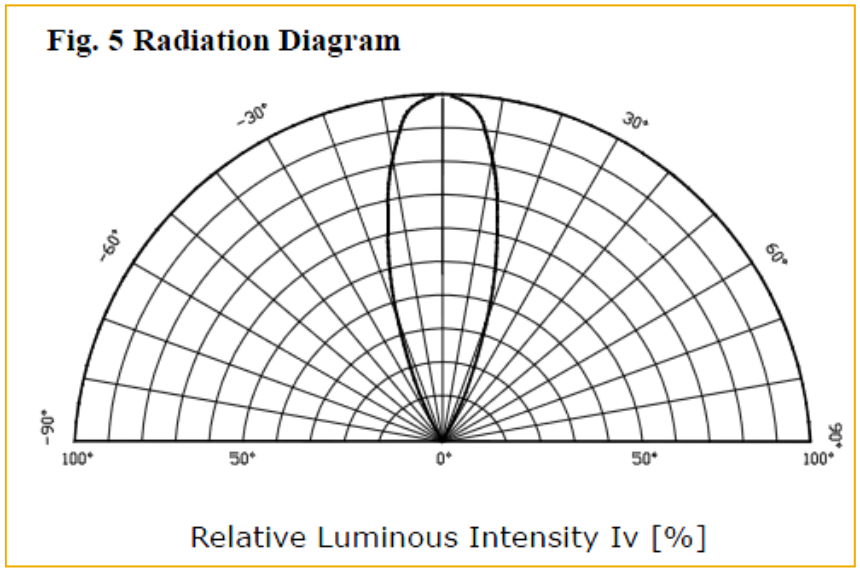
적외선 송신(CL-1L5R)



외형







적외선 수신(KM-603LM)

The KSM-60□LM consist of a PIN Photodiode of high speed and a preamplifier IC in the package as an receiver for Infrared remote control systems

FEATURES

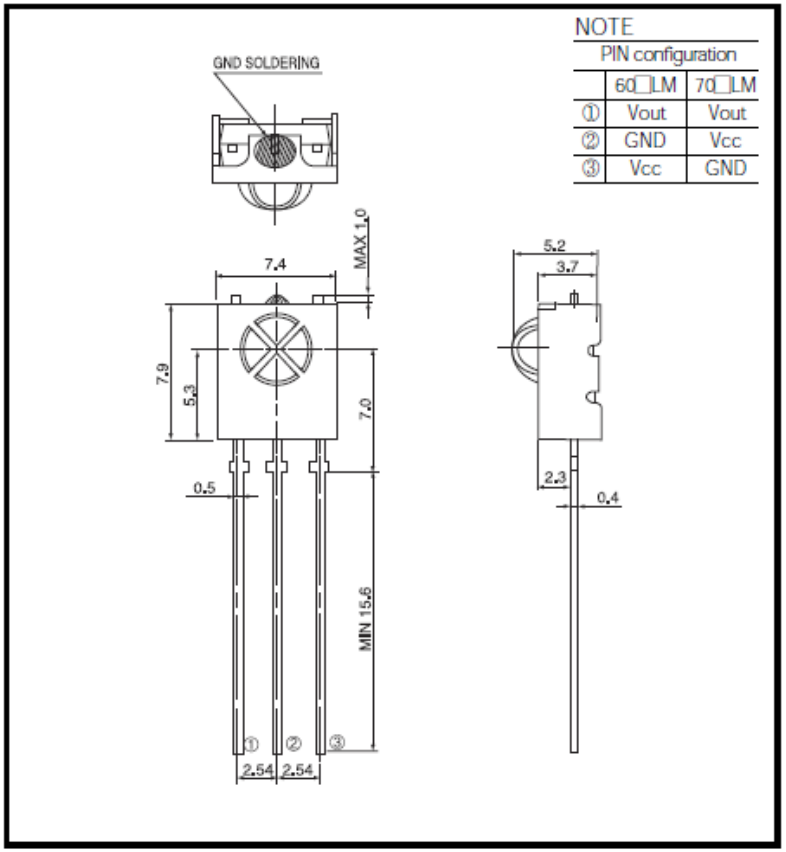
- One mold small package
- 5 Volt supply voltage, low power consumption
- Shielded against electrical field disturbance
- High immunity against ambient light
- Easy interface with the main board
- TTL and CMOS compatibility

APPLICATIONS

- TV, VTR, Acoustic Devices, Air Conditioners, Car Stereo Units, Computers, Interior controlling appliances, and all appliances that require remote controlling

DIMENSIONS

(Unit : mm)



MAXIMUM RATINGS

(Ta=25℃ Unless otherwise noted)

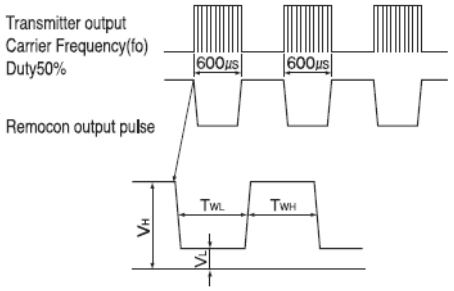
Parameter	Symbol	Rating	Unit
Supply Voltage	Vcc	5.5	V
Operating Temperature	Topr.	-10~+60	℃
Storage Temperature	Tstg.	-20~+75	℃
Soldering Temperature	Tsol.	260(Max 5 sec)	℃

B.P.F CENTER FREQUENCY

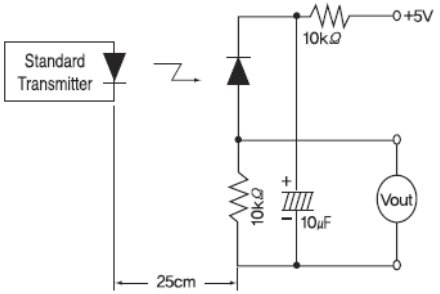
Model NO.	B.P.F Center Frequency(kHz)
KSM-○○1 LM	40.0
KSM-○○2 LM	36.7
KSM-○○3 LM	37.9
KSM-○○4 LM	32.7
KSM-○○5 LM	56.9

Measuring Methods

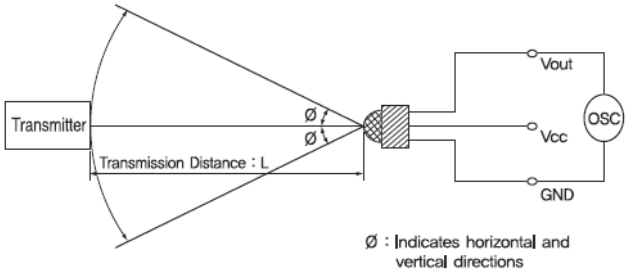
Output Pulse Width



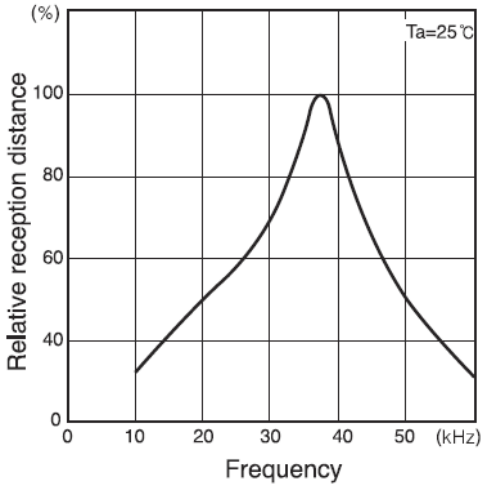
Standard Transmitter



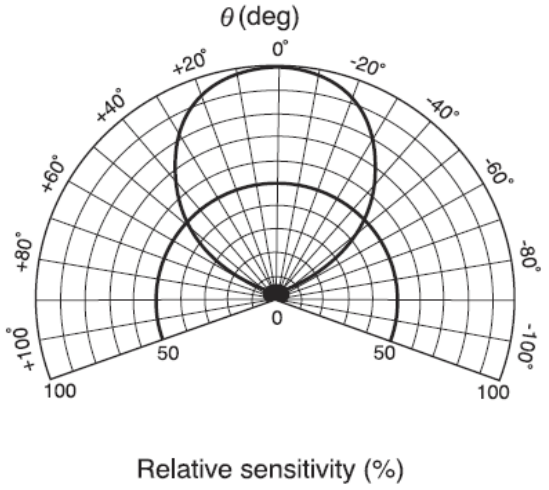
Test Condition of Transmission Distance



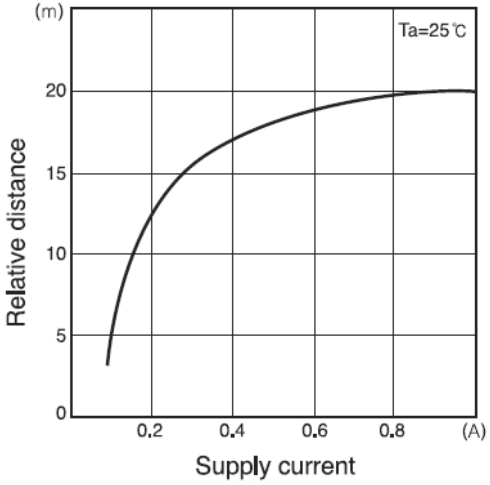
Relative reception distance Vs. Frequency(37.9kHz)



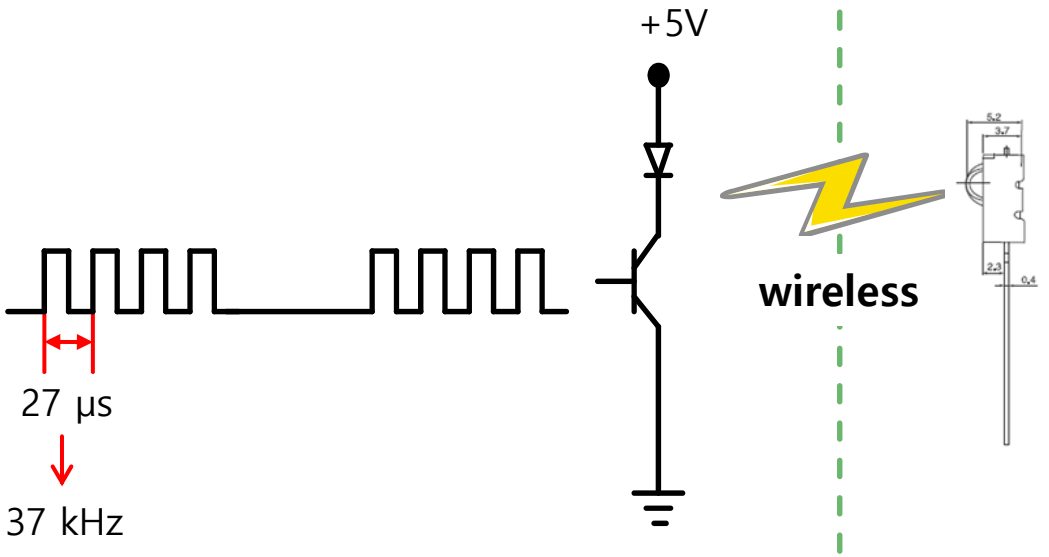
Radiant pattern

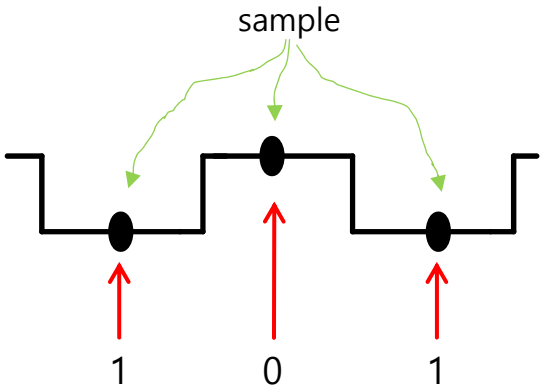


Relative distance Vs. Supply current



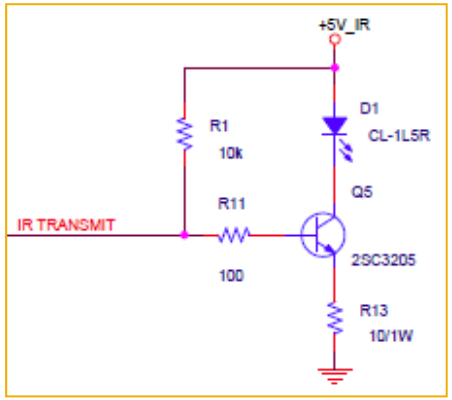
송/수신 개념도



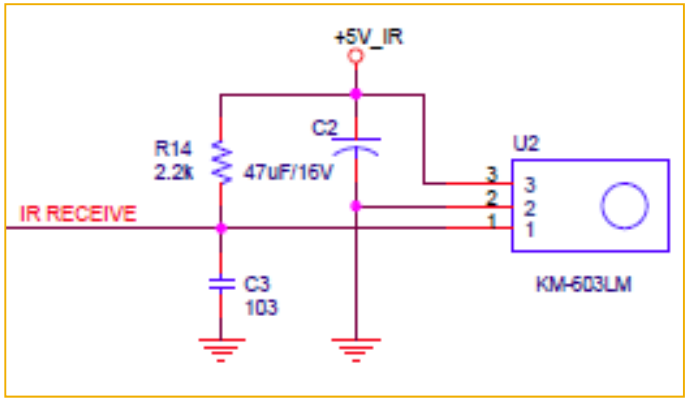


Transmitter

Receiver

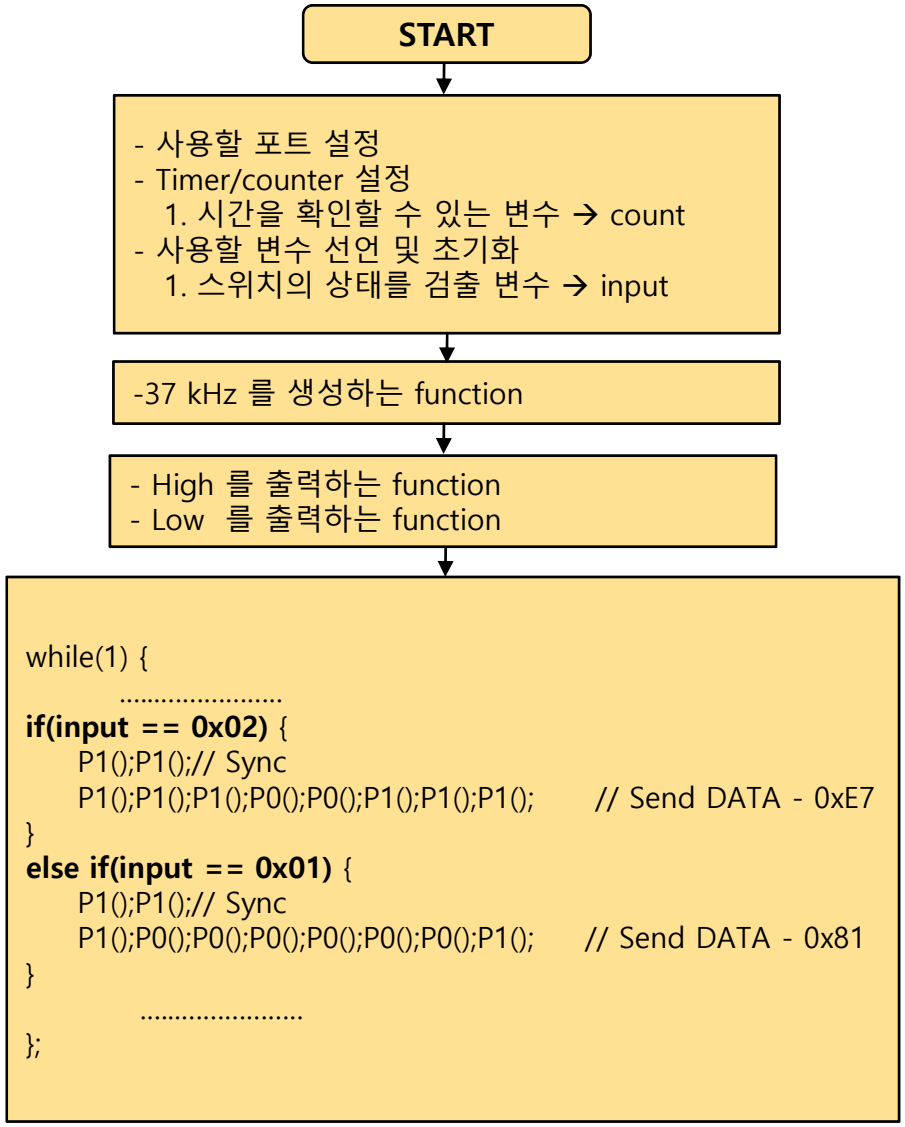


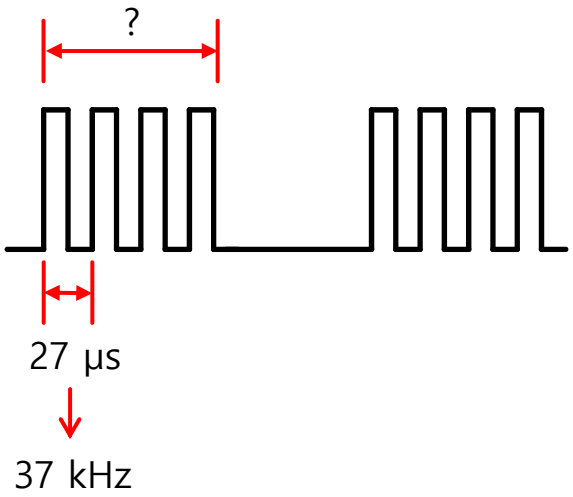
송신부 회로



수신부 회로

송신 알고리즘





오실로스코프를 이용하여
반드시 파형 확인할 것!!

```
unsigned int flag, count = 0;

SIGNAL(SIG_OVERFLOW0)
{
    if(count>60)
        count = 0;
    else
        count++;

    if(flag>2300)
        flag = 0;
    else
        flag++;

    TCNT0 = 0x00;
}
```

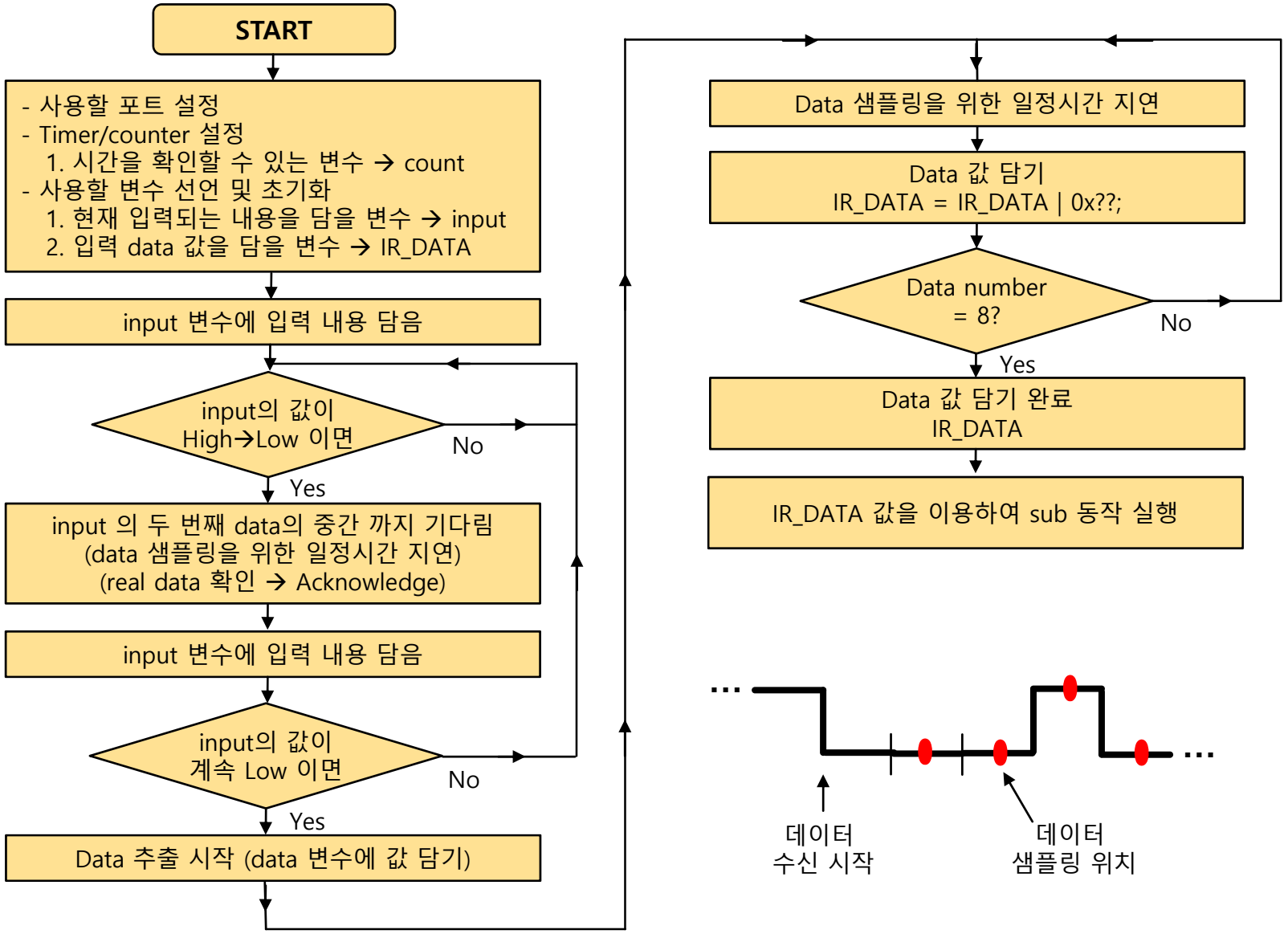
```
int g37khz(void)
{
    unsigned int i,j,k,l = 0;
    PORTB = 0x00;
    for(i=1; i<=20; i++)
      for(j=1; j<8; j++)

    PORTB = 0x10;
    for(k=1; k<=20; k++)
      for(l=1; l<5; l++)
}
```

```
void P1(void)
{
    count = 0;
    while(count<50)
    {
        g37khz();
    }
}
```

```
void P0(void)
{
    count = 0;
    while(count<50) {};
}
```

```
while(1)
{
    input = 0x00;                   // Input value initialize
    input = PORTD & 0xF0;           // Input value capture
    __delay_cycles(1000000);        // Chattering
            if(input == 0x??)
            {
                P1();P1();          // Sync
                P1();P1();P1();P0();P0();P1();P1();P1();     // Send DATA - 0xE7
            }
            else if(input == 0x??)
            {
                P1();P1();          // Sync
                P1();P0();P0();P0();P0();P0();P0();P1();     // Send DATA - 0x81
            }
}
```

수신 알고리즘


START
- 사용할 포트 설정
- Timer/counter 설정
1. 시간을 확인할 수 있는 변수 → count
- 사용할 변수 선언 및 초기화
1. 현재 입력되는 내용을 담을 변수 → input
2. 입력 data 값을 담을 변수 → IR_DATA
input 변수에 입력 내용 담음
input의 값이 High→Low 이면
No
Yes
input 의 두 번째 data의 중간 까지 기다림
(data 샘플링을 위한 일정시간 지연)
(real data 확인 → Acknowledge)
input 변수에 입력 내용 담음
input의 값이 계속 Low 이면
No
Yes
Data 추출 시작 (data 변수에 값 담기)
Data 샘플링을 위한 일정시간 지연
Data 값 담기
IR_DATA = IR_DATA | 0x??;
Data number = 8?
No
Yes
Data 값 담기 완료
IR_DATA
IR_DATA 값을 이용하여 sub 동작 실행
데이터 수신 시작
데이터 샘플링 위치

```
// IR parameters

void IR_Receive(void);
unsigned char count_ir = 0;
unsigned char ss_control = 0;   // START/STOP Control
unsigned char IR_data = 0, IR_temp_data = 0;
unsigned char IR_command[] = {0xE7, 0x81};
```

```
void IR_Receive(void)
{
    IR_data = 0x00;
    IR_temp_data = 0x00;

    IR_temp_data = PINB & 0x20;
    if(IR_temp_data == 0x00) {
        count_ir = 0;
        while(count_ir<150);        // Wait second data
        IR_temp_data = PINB & 0x20;
        if(IR_temp_data == 0x00) {  // if the second data is 0,
            // 7(MSB)
            count_ir = 0;
            while(count_ir<100);    // wait next data
            if((IR_temp_data = PINB & 0x20) == 0x00) // if the data is written in 0,
            IR_data = IR_data | 0x80;               // Write IR_data to 1.
            // 6
            count_ir = 0;
            while(count_ir<100);
            if((IR_temp_data = PINB & 0x20) == 0x00)
            IR_data = IR_data | 0x40;
            // 5
            count_ir = 0;
            while(count_ir<100);
            if((IR_temp_data = PINB & 0x20) == 0x00)
            IR_data = IR_data | 0x20;
            // 4
            count_ir = 0;
            while(count_ir<100);
            if((IR_temp_data = PINB & 0x20) == 0x00)
            IR_data = IR_data | 0x10;
```

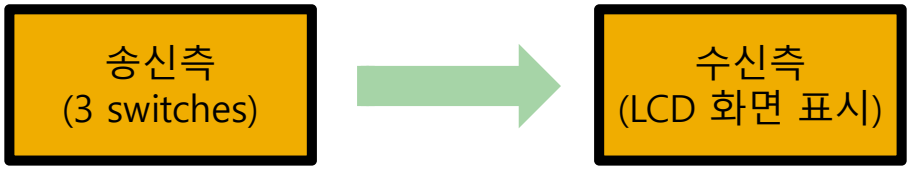
```
            // 3
            count_ir = 0;
            while(count_ir<100);
            if((IR_temp_data = PINB & 0x20) == 0x00)
            IR_data = IR_data | 0x08;
             //2
            count_ir = 0;
            while(count_ir<100);
            if((IR_temp_data = PINB & 0x20) == 0x00)
            IR_data = IR_data | 0x04;
             //1
            count_ir = 0;
            while(count_ir<100);
            if((IR_temp_data = PINB & 0x20) == 0x00)
            IR_data = IR_data | 0x02;
            // 0(LSB)
            count_ir = 0;
            while(count_ir<100);
            if((IR_temp_data = PINB & 0x20) == 0x00)
            IR_data = IR_data | 0x01;
        }
    }
 if(IR_data == IR_command[0]) {
              PORTA^= 0x01;      //  LED toggle
    }
    else if(IR_data == IR_command[1]) {
              PORTA^= 0x02;      // LED toggle
    }
}
```

```
void main(void)
{

        초기화 구문들 넣을 곳

        while(1)
        {
                IR_Receive();
        }

}
```

실험 실습

1. 회로도의 net 이름 IR_TRANSMIT과 IR_RECEIVE에 오실로스코프를 이용하여 적외선 송수신시 파형을 기록하고 자신의 송수신코드와 일치하는지 확인 하시오.
   : Time/Div와 Volt/Div제시 할 것.

2. 2인 1조 work
   : 송신 측의 3개의 키의 숫자 값에 따라 눌려진 스위치의 값을 수신 측의 LCD에 표시하는 코드 작성



Report

1. 적외선 mission 구현 !