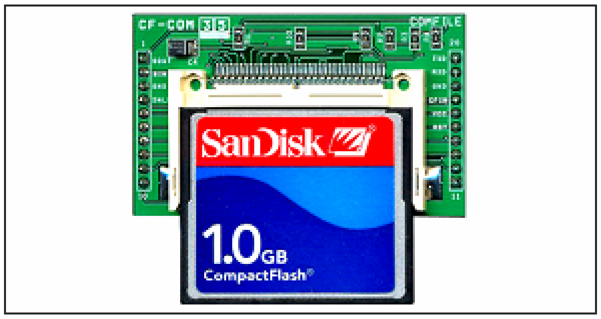
CUBLOC Peripheral

Serial Compact Flash

Serial CF Card Module User Manual



1. Intro

The Serial CF Card Module allows the user to read Compact Flash cards using RS232C serial communication. You will be able to interface with CUBLOC, CuTOUCH, or any other control device that supports RS232C.

2. Features

- Simple commands through RS232C communication for creating files, writing and reading data.
- Industrial Standard FAT16 supported (FAT32 is not supported)
- Up to 2Gigabytes of CF Card supported.
- Read/Write Text and Binary data
- Korean Language supported
- Terminal Mode for using with MCUs or PC's Hyperterminal
- Automatic Card detection
- Status pins for Card detection
- 2 Wire (RX and TX) for 5V or 3V RS232C
- No parity, 8bit Data, 1 stop bit
- Set baud rates using commands
- Baud rates supported (bps) : 4800, 9600, 19200, 38400, 57600, 115200
- Current Consumption
    - ▪ CF-COM5 (5V): 25mA(Idle)
    - ▪ CF-COM3 (3V): 7mA(Idle)
    - ▪ Read/Write Operation (Add ~ 40mA)
- Firmware Upgrade through Internet

3. Specifications

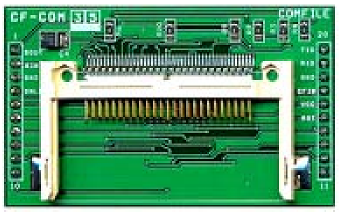
Model	CF-COM5	CF-COM3
Voltage	4.5~5.5V	2.7~5.5V
Read Speed	- 115200 bps: 20KB/s - 9600 bps: 6KB/s	- 115200 bps: 15KB/s - 9600 bps: 5KB/s
Write Speed	- 115200 bps: 5KB/s - 9600 bps: 0.8KB/s	- 115200 bps: 4KB/s - 9600 bps: 0.5KB/s

*** Warning**

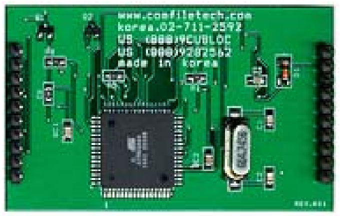
- The CF card comes in FAT16 as factory default. Please do not re-format the CF card in FAT32.
- Please format the CF card as FAT16 for CF cards in FAT32 before using.
- Please do not eject CF card during read/write operations. This can cause loss/error to your files.
- LEXAR media's CF Cards have less compatibility, we recommend to SanDisk.
- Depending on the CF Card model, read/write speed may differ slightly.

4. Dimensions

■ Front



■ Back



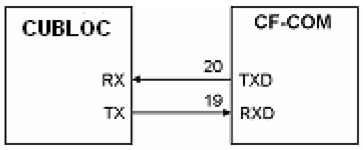
■ Pin Specification

Pin	Name	Description
1	SOUT	Serial Output pin for Firmware Upgrade
2	SIN	Serial Input pin for Firmware Upgrade
3, 18	GND	GROUND
4	DNLD	Firmware Upgrade Status Pin - During Firmware Upgrade: LOW - Normal: HIGH
15	RST	RESET (Pull up with 10K resistor)
16	VCC	Power (5V: 4.5~5.5V, 3V: 2.7~5.5V).
17	CFIN	CF Card Detection - CF Inserted: LOW - CF Not Inserted: HIGH
19	RXD	RS232C Input pin for 5V(CF-COM5) or 3V(CF-COM3) level
20	TXD	RS232C Output pin for 5V(CF-COM5) or 3V(CF-COM3) level
5~10	reserved	Reserved for future I/O ports

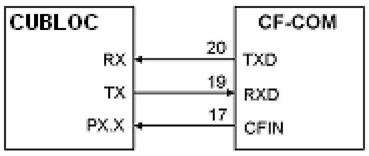
Do not connect TXD/RXD directly to PC's serial port as PC uses 12V RS232 levels. You need to use a MAX232 chip to convert 5V to 12V level before doing so.

5. How to connect data lines

■ Processor Connection (CUBLOC, etc)

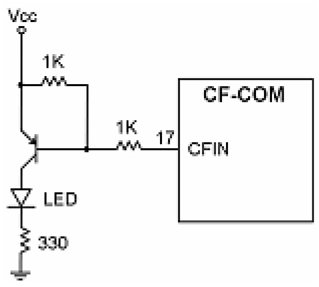


■ CFIN Pin Connection



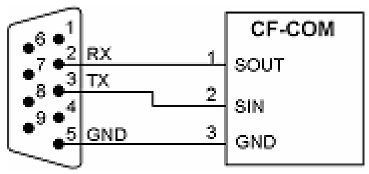
You can check the status of CF card insertion by connecting CFIN pin to one of your processor's input pins.

■ How to connect CFIN pin to an LED

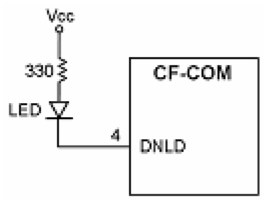


You will be able to see the LED light up when the CF card in inserted.

■ How to connect data lines for Firmware Upgrade



■ How to connect Firmware Upgrade Status Pin to LED



6. Communication Protocol

■ Basics

Command [Filename] [Option] Data] CR LF

Command, Filename, Option, and data are separated by a space (HEX 0x20). Depending on the command, Filename, Option, and Data can be required. All Commands must be followed by a CR (Carriage Return, 0x0D) and LF (Line Feed, 0x0A).

For example, to store "Hello World" into text.txt, you would do:

In C:

```
printf("fputs test.txt /w Hello World \r\n");
```

In CUBLOC:

```
Putstr 1, "fputs test.txt /w Hellow World",cr,lf
```

■ Return Values

The CF-COM will reply as follows:

<Message>

- <u>Normal</u>

When command is processed successfully, the CF-COM will return a capitalized 'O' or in hex, 0x4F.

- <u>Error</u>

When command is not processed successfully, an error will occur and the CF-COM will return a capitalized 'E' or in hex, 0x45.

<Data>

When reading a file, the CF-COM will return the data after the message

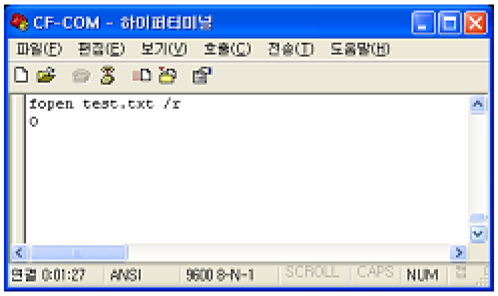
■ MCU Mode and Terminal Mode

<MCU Mode> is used when you are connecting CF-COM to another control device such as CUBLOC.

The factory default is set to MCU Mode.

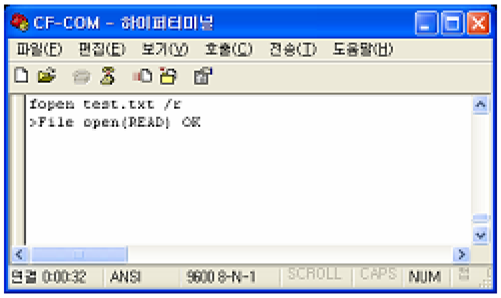
<Terminal Mode> is used when you are connecting CF-COM to PC's Hyperterminal or similar program for testing and debugging. The returned messages are in a more detailed format.

<MCU Mode return Message in Hyperterminal>


CF-COM - 하이퍼터미널
파일(F) 편집(E) 보기(V) 호출(C) 전송(T) 도움말(H)
연결 0:01:27 ANSI 9600 8-N-1 SCROLL CAPS NUM

```
fopen test.txt /r
O
```

<Terminal Mode return Message>


CF-COM - 하이퍼터미널
파일(F) 편집(E) 보기(V) 호출(C) 전송(T) 도움말(H)
연결 0:00:32 ANSI 9600 8-N-1 SCROLL CAPS NUM

```
fopen test.txt /r
>File open(READ) OK
```

■ Commands For Terminal Mode

mode

mode [Option] CR LF

- Operation: Select MCU Mode or Terminal Mode.
- Option

/t	Terminal Mode
/m	MCU Mode

- Example

```
mode /t
>Mode: terminal(full message)
mode /m
>Mode: MCU(simple message)init
```

init

init CR LF

- Operation: Initialize the CF Card.
- Example:

```
init
>Initialize OK
```

cd

cd [Change Directory] CR LF

- Operation: Change directory. Directory name must be within 40 characters.
- Example 1: Change directory to mydir\sub1

```
cd mydir\sub1
>Change directory OK: mydir1\sub1
```

- Example 2: Change directory to root directory

```
cd \
>Change directory OK: \
```

dir

dir CR LF

- Operation: List Directory
- Return Value: Filenames are returned with size of file inside (). Directory names are return with brackets [].

- Example

```
dir
ROOT\\
SINE.DAT (210)
TEST.TXT (7618)
[MYDIR1]
[MYDIR2]
```

fsize

fsize [Filename] CR LF

- Operation: Display File size.
- Return Value: File Size
- Example (Terminal Mode)

```
fsize test.txt
  >File Size: 7618 bytes
```

- Example (MCU Mode)

```
fsize test.txt
  7618
```

dsize

dsize CR LF

- Operation: Display Total Disk Space of the CF Card.
- Return Value: Total Disk Space of CF Card
- Example (Terminal Mode)

```
dsize
  >Total size: 128032768 bytes (125 MB)
```

- Example (MCU Mode)

```
dsize
  128032768
```

ftime

ftime [Filename] CR LF

- Operation: Display File creation and Last-Modified times.
- Return Value: File creation and Last-modified times.
- Example(Terminal Mode)

```
fsize test.txt
  >File created:   08/01/2005   15:37:13
   File modified: 07/21/2005   11:10:08
```

- Example(MCU Mode)

```
  ftime test.txt
  08/01/2005   15:37:13
07/21/2005   11:10:08
```

* This product does not have a real time clock, therefore when doing a file write, the Creation and Last-Modified times are not recorded. Only files created or modified in the PC will show Creation and Last-Modified times.

md

md [Directory] CR LF

- Operation: Make Directory.
- Example

```
md mydir1
>Make directory OK
md mydir1\sub1
>Make directory OK
```

rd

rd [Directory] CR LF

- Operation: Remove Directory.
- Example

```
rd mydir1
>Remove directory OK
rd mydir1\sub1
>Remove directory OK
```

* Please remove the files within the directory before removing. This command only will remove empty directories.

del

del [Filename] CR LF

- Operation: Delete File.
- Example

```
del test.txt
>Delete file OK
del mydir1\test.txt
>Delete file OK
```

fcreate

md [Filename] CR LF

- Operation: Create a new file with size 0.
- Example:

```
fcreate test.txt
>File create OK
fcreate mydir1\test.txt
>File create OK
```

* fcreate command will create a file with size 0. Therefore all read/write commands with options Open File (/r) or Append File (/a) cannot be used.

rename

rename [Source Filename] [Destination Filename] CR LF

- Operation: File의 이름을 바꿉니다.
- Example: test.txt File을 test2.dat 라는 이름으로 바꾸기

```
rename test.txt test2.dat
  >Rename OK
```

fopen

fopen [Filename] [/Option] CR LF

- Operation: Open File.
- Option

/r	File Read
/w	File Write
/a	File Append

- Example: File Read

```
fopen test.txt /r
  >File open(READ) OK
```

- Example: File Overwrite

```
fopen test.txt /w
  >File open(WRITE) OK
```

- Example: File Append

```
fopen test.txt /a
  >File open(APPEND) OK
```

* After opening a File, you must use File Close (fclose) command to close the File.
* Only 1 File may be opened at one time.
* /r and /a Option cannot be used with Files of size 0.

fclose

fclose CR LF

- Operation: Close File.
- Example

```
fopen test.txt /r
  >File open(OPEN) OK
  fclose
  >File close OK
```

fputc

fputc [Filename] [/Option] [1 Byte Data] CR LF

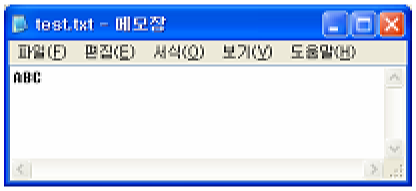
- Operation: Write 1 byte to the File.
- Option

/w   File Write)

/a   File Append)

- Example

```
fputc test.txt /w A
>Put character OK
fputc test.txt /a B
>Put character OK
fputc test.txt /a C
>Put character OK
```



```
ABC
```

fputs

fputs [Filename] [/Option] [String] CR LF

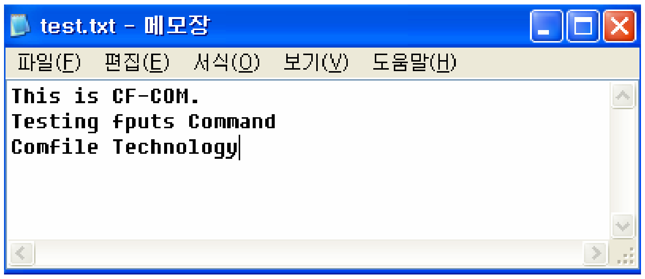
- Operation: Write up to 256 characters of String data to the File.
- Option

/w File Write)

/a   File Append)

- Example

```
fputs test.txt /w This is CF-COM.
>Put string OK
fputs test.txt /a Testing fputs Command
>Put string OK
fputs test.txt /a Comfile Technology
>Put string OK
```



```
This is CF-COM.
Testing fputs Command
Comfile Technology
```

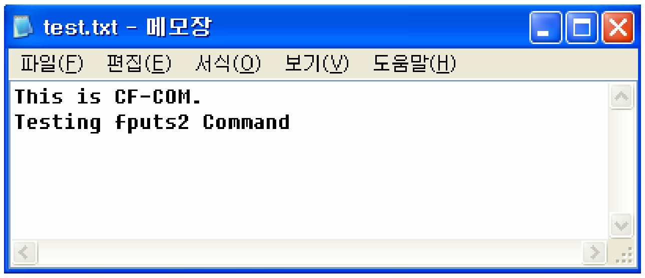
fputs2

fputs2 CR LF

- Operation: Write until ^Z (Ctrl + Z, ASCII Code 0x1A) is received. Up to 256 bytes or characters may be written.

- Example

```
fopen test.txt /w
>File open(WRITE) OK
fputs2
>File put string ready.
This is CF-COM.
>Put string OK (continue or ^Z)
Testing fputs2 Command
 Ctrl + Z >fputs2 end
```



```
This is CF-COM.
Testing fputs2 Command
```

* fopen command must be used before using fputs2 command.

* <Ctrl + Z> will automatically close the file and fclose command does not have to be called.

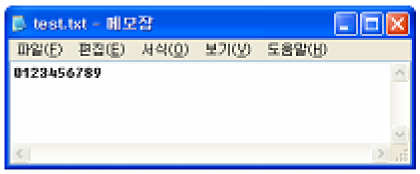
fwrite

fwrite [/ # of bytes to write] CR LF

- Operation: Write up to set # of bytes (Up to 512 bytes per Operation).

- Example

```
fopen test.txt /w
>File open(WRITE) OK
fwrite /4
>Packet size: 4 bytes
0123>Packet 4 bytes write OK
fwrite /6
>Packet size: 6 bytes
456789>Packet 6 bytes write OK
fclose
>File close OK
```



```
0123456789
```

* fopen command must be used before using fwrite command.

fgetc

fgetc [/# of bytes to read] CR LF

- Operation: Read up to set # of bytes (Up to 256 bytes per Operation).

- Example

```
fputs test.txt /w 0123456789
>Put string OK
fopen test.txt /r
>File open(READ) OK
fgetc /4
0123
fgetc /6
456789
fclose
>File close OK
```

* fopen command must be used before using fgetc command.

fgets

fgets CR LF

- Operation: Read 1 line of string (CR LF = new line).

- Example

```
fputs test.txt /w This is CF-COM.
>Put string OK
fputs test.txt /a Testing fgets Command
>Put string OK
fputs test.txt /a Comfile Technology
>Put string OK
fopen test.txt /r
>File open(READ) OK
fgets
This is CF-COM.
fgets
Testing fgets Command
fgets
Comfile Technology
fclose
>File close OK
```

* fopen command must be used before using fgets command.

fread

fread [Filename] CR LF

- Operation: Read all data in File

- Example

```
fputs test.txt /w This is CF-COM.
>Put string OK
fputs test.txt /a Testing fread Command.
>Put string OK
fputs test.txt /a Comfile Technology
>Put string OK
fread test.txt
This is CF-COM.
Testing fread Command.
Comfile Technology
```

reset

reset CR LF

- Operation: CF-COM을 하드웨어적으로 리셋 시킵니다.
- Example

```
reset
>System reset OK
```

baud

baud [Baud rate] CR LF

- Operation: Set the Baud rate for the serial communications.
- Example

```
baud /9600
>Baudrate: 9,600bps
```

card

card CR LF

- Operation: Return CF Card Status.
- Example: When CF Card Inserted

```
card
>CF card inserted
```

- Example: When CF Card Removed

```
card
>Error: CF card NOT inserted
```

* When CF Card is Removed and Re-inserted, the following message will appear.

<Terminal Mode>

```
card
>CF card inserting...
>CF card detected
```

<MCU Mode>

```
card
ID
```

MCU Mode returns 'O' (0x4F) for successful operations except when CF Card is Inserted, where a 'I' and a 'D' is returned.

help

help CR LF

- Operation: Show Help Menu.

■ Error Message

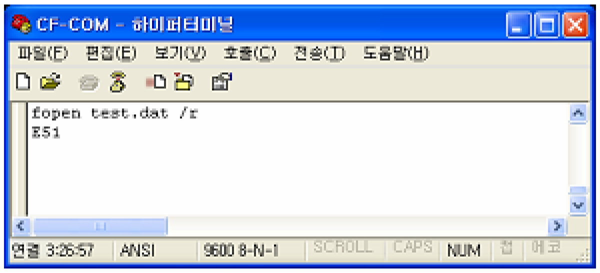
MCU Mode Error Codes.

Error Code	Explanation
E00	Command not recognized.
E10	Card not inserted.
E11	Card inserted but not initialized. (Please remove and re-insert the card)
E12	Error during Card Initialization.

Error Code	Explanation
E20	File creation Error during fcreate.
E21	File Delete Error
E22	File Rename Error
E30	md command Error
E31	rd command Error
E32	cd command Error
E40	fsize command Error
E41	ftime command Error
E50	fopen command Error
E51	fopen command Error
E52	fopen command Error
E53	fopen command Error
E54	File open already
E55	fclose command Error
E56	Command not available during fopen
E57	fopen must be used beforehand
E58	During fopen command, only options /r, /w/ /a may be used
E60	fgetc option not between 1 and 256 bytes
E61	Fgetc command my only use option /r
E70	fputc command may only use options /w or /a
E71	Data Write error during fputc
E72	Diromg fputs command, only options /w or /a may be used

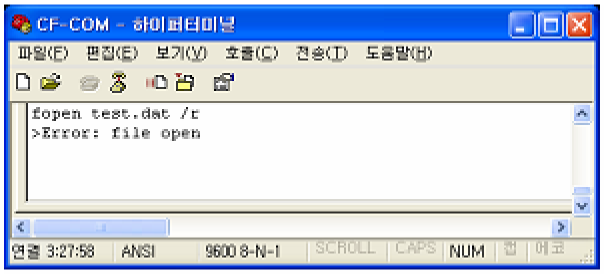
E73	fputs command Error
E74	fwrite option must be between 1 and 512 bytes
E80	baud rate setting Error

<MCU Mode Error Message >



```
fopen test.dat /r
E51
```

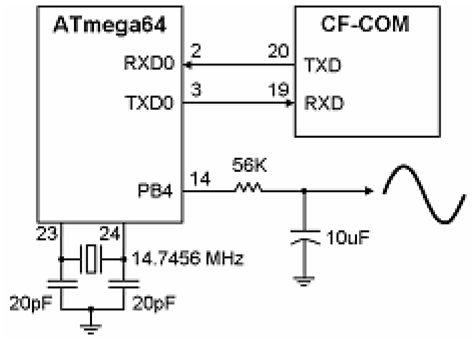
<Terminal Mode Error Message >



```
fopen test.dat /r
>Error: file open
```

7. Example 1: Read Sine Frequency File from the CF card and output as analog signal.

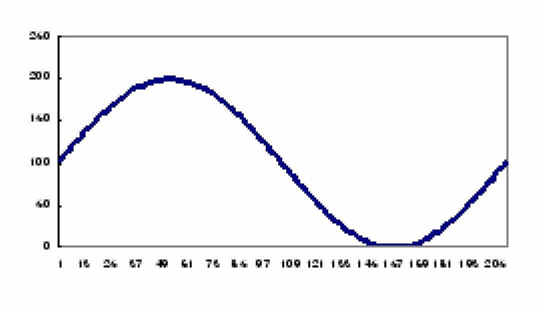
■ Circuit Schematics



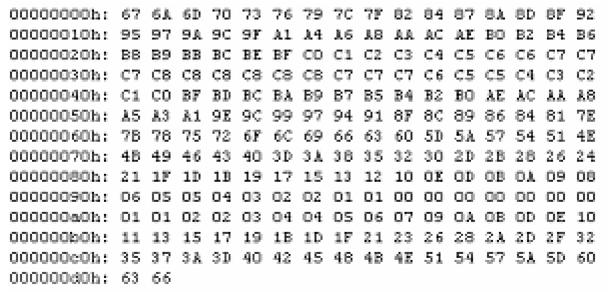
Please connect the CF-COM and the processor and set the processor's PWM to output and create an RC filter.

■ How to

Using your PC, store sine.dat File in the CF card. This File is a binary File that stores a sine wave such as shown below.



< sine.dat File – 210 bytes of data >

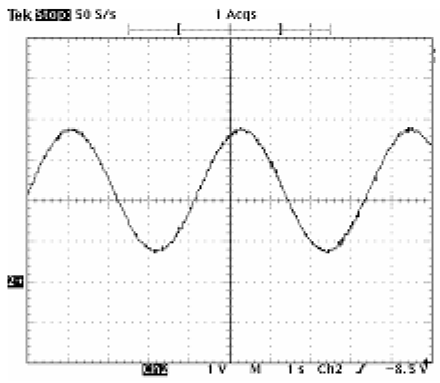


```
00000000h: 67 6A 6D 70 73 76 79 7C 7F 82 84 87 8A 8D 8F 92
00000010h: 95 97 9A 9C 9F A1 A4 A6 A8 AA AC AE B0 B2 B4 B6
00000020h: B8 B9 BB BC BE BF C0 C1 C2 C3 C4 C5 C6 C6 C7 C7
00000030h: C7 C8 C8 C8 C8 C8 C8 C7 C7 C7 C6 C5 C5 C4 C3 C2
00000040h: C1 C0 BF BD BC BA B9 B7 B5 B4 B2 B0 AE AC AA A8
00000050h: A5 A3 A1 9E 9C 99 97 94 91 8F 8C 89 86 84 81 7E
00000060h: 7B 78 75 72 6F 6C 69 66 63 60 5D 5A 57 54 51 4E
00000070h: 4B 49 46 43 40 3D 3A 38 35 32 30 2D 2B 28 26 24
00000080h: 21 1F 1D 1B 19 17 15 13 12 10 0E 0D 0B 0A 09 08
00000090h: 06 05 05 04 03 02 02 01 01 00 00 00 00 00 00 00
000000a0h: 01 01 02 02 03 04 04 05 06 07 09 0A 0B 0D 0E 10
000000b0h: 11 13 15 17 19 1B 1D 1F 21 23 26 28 2A 2D 2F 32
000000c0h: 35 37 3A 3D 40 42 45 48 4B 4E 51 54 57 5A 5D 60
000000d0h: 63 66
```

When the source code in the processor is executed, the sine.dat File from CF card is read and outputted as PWM signal. At this time, the PWM output is set as an RC filter, causing the digital signal to be outputted as analog signal. The RC filter acts as a generic DAC (digital-to-analog converter).

Depending on the data stored in the CF Card, the user is able to output various waves or even ECG signals, allowing it to act

< Output Wave>

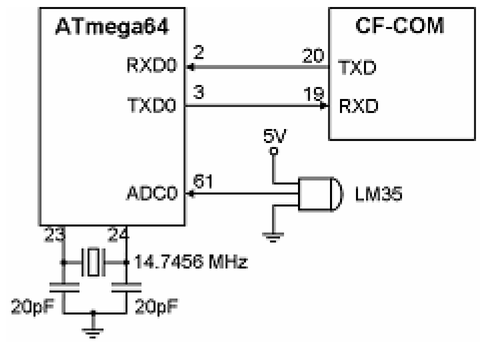


■ Source Code

```
/*********************************************
Project             :   Example 1
Compiler            : CodeVisionAVR
Chip type           : ATmega64
Clock frequency     : 14.745600 MHz
Data Stack size     : 1024
*********************************************/

#include <mega64.h>
#include <delay.h>
#include <stdio.h>

unsigned char RX_buff[210];
unsigned char fread_end=0;
unsigned int RX_count=0;

void init(void)
{
  WDTCR=0x00;      // Watchdog Timer disable
  #asm("cli")      // global interrupts disable

  UCSR0B=0x00;     // Set UART0 to 9,600bps
  UCSR0A=0x00;     // CF-COM must be also set to 9,600bps
  UCSR0C=0x06;
  UBRR0H=0x00;
  UBRR0L=0x5F;
  UCSR0B=0x98;

  PORTB=0x00;
  DDRB=0x10;       // Set PB4 as PWM

  // Timer/Counter 0 initialization
  // OC0 output: Non-Inverted PWM
  ASSR=0x00;
  TCCR0=0x67;
  TCNT0=0x00;
  OCR0=0x00;

  #asm("sei")      // global interrupts enable
}

void main(void)
{
  unsigned int i;

  init();

  printf("fread sine.dat\r\n");         // Read File

  while(1) {
    if (fread_end==1) {
      OCR0=RX_buff[i];                   // OutputPWM
      delay_ms(20);
      i++;
      if (i==RX_count)
        i=0;
    }// end if
  }// end while
}

//////////////////////////////////////////////
///   UART0 receive interrupt service routine
//////////////////////////////////////////////
interrupt [USART0_RXC] void usart0_rx_isr(void)
{
  unsigned char status, data;

  data=UDR0;

  // Store Sine Wave values from CF-COM in a buffer
  RX_buff[RX_count]=data;
  RX_count++;
  if (RX_count>208)
    fread_end=1;

}
```

8. Example 2: Read Temperature Sensor and store current temperature values in a File of CF Card.

■ Circuit Schematics



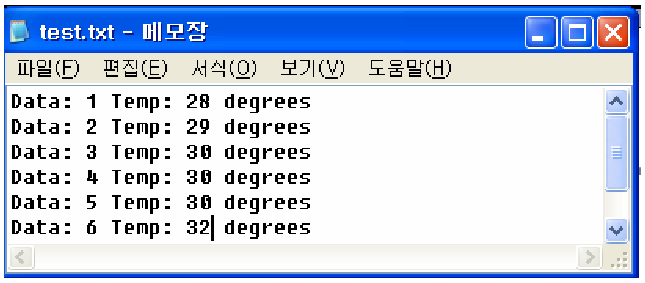
Connect the CF-COM and the processor. Connect the voltage output for temperature of LM35 to the ADC of the processor. LM35 output 0.01V per 1℃. For example, when LM35 voltage output is 0.26V, this means the current temperature is 26℃.

■ How to

When the source code in the processor is executed, thermo1.txt and thermo1.dat files are created in the CF card. Every 1 second, the Temperature is converted and stored in themo1.txt as text and thermo2.dat as binary values.

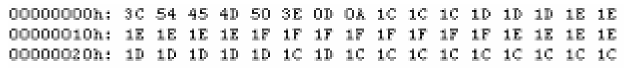
After a few seconds of execution, you may open thermo1.txt file in PC and verify the written data. You can also verify the binary data using programs such as UltraEdit.

< thermo1.txt >



```
Data: 1 Temp: 28 degrees
Data: 2 Temp: 29 degrees
Data: 3 Temp: 30 degrees
Data: 4 Temp: 30 degrees
Data: 5 Temp: 30 degrees
Data: 6 Temp: 32 degrees
```

< Binary File, thermo1.dat >



```
00000000h: 3C 54 45 4D 50 3E 0D 0A 1C 1C 1C 1D 1D 1D 1E 1E
00000010h: 1E 1E 1E 1E 1F 1F 1F 1F 1F 1F 1F 1F 1E 1E 1E 1E
00000020h: 1D 1D 1D 1D 1D 1C 1D 1C 1C 1C 1C 1C 1C 1C 1C 1C
```

■ Source Code

```
/************************************************
Project                 : Example 2
Compiler                : CodeVisionAVR
Chip type               : ATmega64
Clock frequency         : 14.745600 MHz
Data Stack size         : 1024
************************************************/

#include <mega64.h>
#include <delay.h>
#include <stdio.h>

#define ADC_VREF_TYPE   0xC0   // AVREF=internal 2.56V

char fRX=0;

//////////////////////////////////////////////
///     Read the AD conversion result
//////////////////////////////////////////////


unsigned int read_adc(unsigned char adc_input)
{
  unsigned long data=0;

  ADMUX=adc_input|ADC_VREF_TYPE;
  ADCSRA|=0x40;                    // Start AD Conversion
  while ((ADCSRA & 0x10)==0);   // Wait until finished
  ADCSRA|=0x10;
  data=ADCW;
  return (data);
}

void init(void)
{
  WDTCR=0x00;        // Disable Watchdog
  #asm("cli")        // global interrupts disable

  UCSR0B=0x00;       // Set UART0 to 9,600bps
  UCSR0A=0x00;       // CF-COM must also be set to 9,600bps
  UCSR0C=0x06;
  UBRR0H=0x00;
  UBRR0L=0x5F;
  UCSR0B=0x98;

  // ADC initialization
  // ADC Clock frequency: 115.200 kHz
  // ADC Voltage Reference: Int., cap. on AREF
  ADMUX=ADC_VREF_TYPE;
  ADCSRA=0x87;

  #asm("sei")          // global interrupts enable
}

void wait_message(void)
{
  // Wait reply from CF-COM
```

```
   while(fRX==0);
   fRX=0;
}

void main(void)
{
   unsigned int a=0;
   unsigned int temper=0;

   init();

   // Create File
   printf("fcreate thermo1.txt\r\n");
   wait_message();

   // Create File
   printf("fcreate thermo1.dat\r\n");
   wait_message();

   while(1) {

// After using fcreate, you may use option /a after writing to it using
option /w
  printf("fputs thermo1.txt /w <Temperature Example>\r\n");
  wait_message();
  printf("fputs thermo1.dat /w <TEMP>\r\n");
  wait_message();

   while(1) {

      a++;
      temper=read_adc(0)/1024.0*2.56*100;

      // Write to text file using fputs
      printf("fputs  thermo1.txt  /a  Data:%d,  Temp:  %d  'C\r\n",  a,
temper);
      wait_message();

      // Write to binary file using fputc
      printf("fputc thermo1.dat /a %c\r\n",(unsigned char)temper);
      wait_message();

      delay_ms(1000);    // Delay 1 second
   }// end while
}

////////////////////////////////////////////////
///    UART0 receive interrupt service routine
////////////////////////////////////////////////
interrupt [USART0_RXC] void usart0_rx_isr(void)
{
   unsigned char status, data;

   status=UCSR0A;
   data=UDR0;

   if (data=='O')   // OK reply: ASCII Code (0x4F)
      fRX=1;
}
```

9. Dimensions (Units: mm)