LAMPIRAN A

PROGRAM KWH METER DIGITAL DAN ALAT PENCATAT

PROGRAM UTAMA PADA BAGIAN KWH METER DIGITAL

```
#include <MsTimer2.h>
#include <LiquidCrystal.h>
#include <EEPROM.h>

extern unsigned long timer0_overflow;

LiquidCrystal lcd(16,17,18,20,21,22,23);

int count = 0;
float  kwh = 0, energi = 0, power = 0;
volatile char ir = 0;
const int id = 123;


void ircheck()
{
   if ( bit_is_clear(PINB,PB2) )
   ir++;
}
```

```
void setup()
{
  Serial.begin(9600);
  lcd.begin(16,2);
  bitClear(DDRB,PB2);
  MsTimer2::set(20, ircheck); // sampling per 20 ms
  MsTimer2::start();
}

void loop()
{

  unsigned int volt = 0, amp = 0;
  char buff[12];
  int x;
  int count = 0;
  float fasa, fase, amps,volts,kwh;
  unsigned long periode;
  float delta = 0.0;
  timer0_overflow = 0;
```

```
int t = 0;



while( millis()  < 3600000 )
{
  if ( bit_is_set(PINB,PB1) )
  {
    delayMicroseconds(2000);
    unsigned long temp = micros();
    while( bit_is_set(PINB,PB1) );
    delayMicroseconds(2000);
    delta += micros() - temp;
    count++;
  }
  amp  =  analogRead(0);
  volt =  analogRead(1);
  if ( amp >= 680 && amp <=700)
    {
     float amps = (0.081 *(float)amp) - 54.87 ;
    }
  if ( amp >= 635 && amp <= 679)

    {
```

```
      float amps = (0.01 * (float)amp) - 6.63 ;
     }
    float volts = ((float) volt * 4.94)/(0.0170 *1024);

    delta = delta / (float) count / 1000.0;

    periode = 1000 / ( count / 2 ) ;
    fasa = (float) (delta - 1.89 ) / (float) periode; //1,89 sebagai faktor koreksi
    fase = cos(fasa * PI * 2);
    power = (volts * amps * fase)/1000;
    energi = energi + power;




  }
}
 kwh = energi/1000;
 EEPROM.write(02, kwh);
 float pemakaian = power/1000 * 3600;

  lcd.clear();
  lcd.setCursor(0,0);
```

```
 lcd.print("daya = ");
 lcd.print(pemakaian);
 lcd.setCursor(13,0);
 lcd.print("kWH ");

 delay(1000);
 lcd.setCursor(0,1);
 lcd.print("phase: ");
 lcd.print(fase);
 delay(1000);




// Perintah di bawah dikirmkan ke zigbee
 if ( ir > 0 ) {
   lcd.clear();
   lcd.print("Sending...");
   lcd.setCursor(0,1);
   lcd.print(kwh);
   lcd.print("id");
   lcd.print(id);
```

```
    delay(3000);
    Serial.write('@');
    Serial.print(kwh);
    Serial.print(id);
    ir = 0;
  }



}
```

PROGRAM PADA BAGIAN PENCATAT

```
#include<Fat16.h>
#include<Fat16util.h>

#include<LiquidCrystal.h>



LiquidCrystallcd(16,17,18,20,21,22,23);

SdCard card;
Fat16 file;

#define error(s) error_P(PSTR(s))

voiderror_P(const char* str) {
if (card.errorCode) {
lcd.clear();
lcd.print("SD error: ");
  }
while(1);
}
```

```
void setup()
{
Serial.begin(9600);
bitClear(DDRA,PA0);
bitSet(PORTA,PA7);
bitSet(DDRA,PA7);
bitSet(PORTA,PA4);
bitSet(DDRA,PA4);
bitClear(PORTB,PB0);
bitSet(DDRB,PB0);
lcd.begin(16,2);
lcd.clear();
lcd.print("kWh mtr digital");
delay(3000);
lcd.clear();
lcd.print("press button 1");
}

void loop()
{
chari, buff[12];

if ( bit_is_clear(PINA,PA0) )
```

```
  {
bitClear(PORTA,PA4);
bitSet(PORTB,PB0);
delay(500);
while( bit_is_clear(PINA,PA0));
bitClear(PORTB,PB0);
delay(100);
bitSet(PORTA,PA4);
  }
if ( Serial.available() > 0 )
  {
bitClear(PORTA,PA7);
charch = Serial.read();
if ( ch == '@' ) {
delay(1000);
i = 0;
while( Serial.available() > 0 ) {
buff[i] = Serial.read();
i++;
        }
buff[i] = 0;
lcd.clear();
lcd.print(buff);
```

```
bitClear(PORTA,PA7);
delay(200);
bitSet(PORTA,PA7);
delay(2000);
lcd.clear();
lcd.print("Inisialisasi SD");
delay(1000);
if (!card.init()) error("card.init");
if (!Fat16::init(&card)) error("Fat16::init");
char name[] = "PRINT00.TXT";
for ( i = 0; i< 100; i++) {
name[5] = i/10 + '0';
name[6] = i%10 + '0';
if (file.open(name, O_CREAT | O_EXCL | O_WRITE)) break;
        }
if (!file.isOpen()) error ("create");
lcd.clear();
lcd.print(name);
delay(1000);

file.writeError = false;
file.println(buff);
if (file.writeError || !file.sync()) error ("print or sync");
```

```
lcd.clear();
lcd.print("Done");
delay(1000);
      }
   }



}
```

LAMPIRAN B

DATASHEET KOMPONEN

ACS712

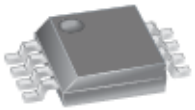
Fully Integrated, Hall Effect-Based Linear Current Sensor IC with 2.1 kVRMS Isolation and a Low-Resistance Current Conductor

Features and Benefits

- Low-noise analog signal path
- Device bandwidth is set via the new FILTER pin
- 5 µs output rise time in response to step input current
- 80 kHz bandwidth
- Total output error 1.5% at T_A= 25°C
- Small footprint, low-profile SOIC8 package
- 1.2 mΩ internal conductor resistance
- 2.1 kVRMS minimum isolation voltage from pins 1-4 to pins 5-8
- 5.0 V, single supply operation
- 66 to 185 mV/A output sensitivity
- Output voltage proportional to AC or DC currents
- Factory-trimmed for accuracy
- Extremely stable output offset voltage
- Nearly zero magnetic hysteresis
- Ratiometric output from supply voltage

TÜV America
Certificate Number:
U8V 06 05 54214 010

Package: 8 Lead SOIC (suffix LC)



Approximate Scale 1:1

Description

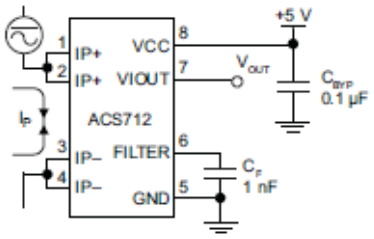
The Allegro® ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switch-mode power supplies, and overcurrent fault protection. The device is not intended for automotive applications.

The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging.

The output of the device has a positive slope (>$V_{IOUT(Q)}$) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power loss. The thickness of the copper conductor allows survival of

Continued on the next page…

Typical Application



Application 1. The ACS712 outputs an analog signal, V_{OUT}, that varies linearly with the uni- or bi-directional AC or DC primary sampled current, I_P, within the range specified. C_F is recommended for noise management, with values that depend on the application.

x05B PERFORMANCE CHARACTERISTICS[1] T_A = –40°C to 85°C, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Optimized Accuracy Range	I_P		–5	–	5	A
Sensitivity	Sens	Over full range of I_P, T_A = 25°C	180	185	190	mV/A
Noise	$V_{NOISE(PP)}$	Peak-to-peak, T_A = 25°C, 185 mV/A programmed Sensitivity, C_F = 47 nF, C_{OUT} = open, 2 kHz bandwidth	–	21	–	mV
Zero Current Output Slope	$\Delta V_{OUT(Q)}$	T_A = –40°C to 25°C	–	–0.26	–	mV/°C
		T_A = 25°C to 150°C	–	–0.08	–	mV/°C
Sensitivity Slope	ΔSens	T_A = –40°C to 25°C	–	0.054	–	mV/A/°C
		T_A = 25°C to 150°C	–	–0.008	–	mV/A/°C
Total Output Error[2]	E_{TOT}	I_P =±5 A, T_A = 25°C	–	±1.5	–	%

[1]Device may be operated at higher primary current levels, I_P, and ambient temperatures, T_A, provided that the Maximum Junction Temperature, $T_{J(max)}$, is not exceeded.

[2]Percentage of I_P, with I_P = 5 A. Output filtered.

x20A PERFORMANCE CHARACTERISTICS[1] T_A = –40°C to 85°C, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Optimized Accuracy Range	I_P		–20	–	20	A
Sensitivity	Sens	Over full range of I_P, T_A = 25°C	96	100	104	mV/A
Noise	$V_{NOISE(PP)}$	Peak-to-peak, T_A = 25°C, 100 mV/A programmed Sensitivity, C_F = 47 nF, C_{OUT} = open, 2 kHz bandwidth	–	11	–	mV
Zero Current Output Slope	$\Delta V_{OUT(Q)}$	T_A = –40°C to 25°C	–	–0.34	–	mV/°C
		T_A = 25°C to 150°C	–	–0.07	–	mV/°C
Sensitivity Slope	ΔSens	T_A = –40°C to 25°C	–	0.017	–	mV/A/°C
		T_A = 25°C to 150°C	–	–0.004	–	mV/A/°C
Total Output Error[2]	E_{TOT}	I_P =±20 A, T_A = 25°C	–	±1.5	–	%

[1]Device may be operated at higher primary current levels, I_P, and ambient temperatures, T_A, provided that the Maximum Junction Temperature, T_J(max), is not exceeded.

[2]Percentage of I_P, with I_P = 20 A. Output filtered.

x30A PERFORMANCE CHARACTERISTICS[1] T_A = –40°C to 85°C, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Optimized Accuracy Range	I_P		–30	–	30	A
Sensitivity	Sens	Over full range of I_P, T_A = 25°C	63	66	69	mV/A
Noise	$V_{NOISE(PP)}$	Peak-to-peak, T_A = 25°C, 66 mV/A programmed Sensitivity, C_F = 47 nF, C_{OUT} = open, 2 kHz bandwidth	–	7	–	mV
Zero Current Output Slope	$\Delta V_{OUT(Q)}$	T_A = –40°C to 25°C	–	–0.35	–	mV/°C
		T_A = 25°C to 150°C	–	–0.08	–	mV/°C
Sensitivity Slope	ΔSens	T_A = –40°C to 25°C	–	0.007	–	mV/A/°C
		T_A = 25°C to 150°C	–	–0.002	–	mV/A/°C
Total Output Error[2]	E_{TOT}	I_P = ±30 A, T_A = 25°C	–	±1.5	–	%

[1]Device may be operated at higher primary current levels, I_P, and ambient temperatures, T_A, provided that the Maximum Junction Temperature, T_J(max), is not exceeded.

[2]Percentage of I_P, with I_P = 30 A. Output filtered.

1. XBee®/XBee-PRO® RF Modules

The XBee and XBee-PRO RF Modules were engineered to meet IEEE 802.15.4 standards and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between devices.

The modules operate within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each other.

Key Features

Long Range Data Integrity

XBee

- Indoor/Urban: up to 100' (30 m)
- Outdoor line-of-sight: up to 300' (90 m)
- Transmit Power: 1 mW (0 dBm)
- Receiver Sensitivity: -92 dBm

XBee-PRO

- Indoor/Urban: up to 300' (90 m), 200' (60 m) for International variant
- Outdoor line-of-sight: up to 1 mile (1600 m), 2500' (750 m) for International variant
- Transmit Power: 63mW (18dBm), 10mW (10dBm) for International variant
- Receiver Sensitivity: -100 dBm

RF Data Rate: 250,000 bps

Advanced Networking & Security

Retries and Acknowledgements

DSSS (Direct Sequence Spread Spectrum)

Each direct sequence channels has over 65,000 unique network addresses available

Source/Destination Addressing

Unicast & Broadcast Communications

Point-to-point, point-to-multipoint and peer-to-peer topologies supported

Low Power

XBee

- TX Peak Current: 45 mA (@3.3 V)
- RX Current: 50 mA (@3.3 V)
- Power-down Current: < 10 µA

XBee-PRO

- TX Peak Current: 250mA (150mA for international variant)
- TX Peak Current (RPSMA module only): 340mA (180mA for international variant
- RX Current: 55 mA (@3.3 V)
- Power-down Current: < 10 µA

ADC and I/O line support

Analog-to-digital conversion, Digital I/O

I/O Line Passing

Easy-to-Use

No configuration necessary for out-of box RF communications

Free X-CTU Software (Testing and configuration software)

AT and API Command Modes for configuring module parameters

Extensive command set

Small form factor

Worldwide Acceptance

FCC Approval (USA) Refer to Appendix A [p64] for FCC Requirements. Systems that contain XBee®/XBee-PRO® RF Modules inherit Digi Certifications.

ISM (Industrial, Scientific & Medical) **2.4 GHz frequency band**

Manufactured under **ISO 9001:2000** registered standards

XBee®/XBee-PRO® RF Modules are optimized for use in the United States, Canada, Australia, Japan, and Europe. Contact Digi for complete list of government agency approvals.

Specifications

Table 1-01. Specifications of the XBee®/XBee-PRO® RF Modules

Specification	XBee	XBee-PRO
Performance		
Indoor/Urban Range	Up to 100 ft (30 m)	Up to 300 ft. (90 m), up to 200 ft (60 m) International variant
Outdoor RF line-of-sight Range	Up to 300 ft (90 m)	Up to 1 mile (1600 m), up to 2500 ft (750 m) international variant
Transmit Power Output (software selectable)	1mW (0 dBm)	63mW (18dBm)* 10mW (10 dBm) for International variant
RF Data Rate	250,000 bps	250,000 bps
Serial Interface Data Rate (software selectable)	1200 bps - 250 kbps (non-standard baud rates also supported)	1200 bps - 250 kbps (non-standard baud rates also supported)
Receiver Sensitivity	-92 dBm (1% packet error rate)	-100 dBm (1% packet error rate)
Power Requirements		
Supply Voltage	2.8 – 3.4 V	2.8 – 3.4 V
Transmit Current (typical)	45mA (@ 3.3 V)	250mA (@3.3 V) (150mA for international variant) RPSMA module only: 340mA (@3.3 V) (180mA for international variant)
Idle / Receive Current (typical)	50mA (@ 3.3 V)	55mA (@ 3.3 V)
Power-down Current	< 10 µA	< 10 µA
General		
Operating Frequency	ISM 2.4 GHz	ISM 2.4 GHz
Dimensions	0.960" x 1.087" (2.438cm x 2.761cm)	0.960" x 1.297" (2.438cm x 3.294cm)
Operating Temperature	-40 to 85º C (industrial)	-40 to 85º C (industrial)
Antenna Options	Integrated Whip, Chip or U.FL Connector, RPSMA Connector	Integrated Whip, Chip or U.FL Connector, RPSMA Connector
Networking & Security		
Supported Network Topologies	Point-to-point, Point-to-multipoint & Peer-to-peer	
Number of Channels (software selectable)	16 Direct Sequence Channels	12 Direct Sequence Channels
Addressing Options	PAN ID, Channel and Addresses	PAN ID, Channel and Addresses
Agency Approvals		
United States (FCC Part 15.247)	OUR-XBEE	OUR-XBEEPRO
Industry Canada (IC)	4214A XBEE	4214A XBEEPRO
Europe (CE)	ETSI	ETSI (Max. 10 dBm transmit power output)*
Japan	R201WW07215214	R201WW08215111 (Max. 10 dBm transmit power output)*
Australia	C-Tick	C-Tick

* See Appendix A for region-specific certification requirements.

Antenna Options: The ranges specified are typical when using the integrated Whip (1.5 dBi) and Dipole (2.1 dBi) antennas. The Chip antenna option provides advantages in its form factor; however, it typically yields shorter range than the Whip and Dipole antenna options when transmitting outdoors.For more information, refer to the "XBee Antennas" Knowledgebase Article located on Digi's Support Web site

DT-I/O INFRA RED RECEIVER

Infra Red Receiver merupakan suatu modul penerima data melalui gelombang infra merah dengan frekuensi carrier sebesar 38 kHz. Modul ini dapat difungsikan sebagai input dalam aplikasi transmisi data nirkabel seperti robotik, sistem pengaman, datalogger, absensi, dan sebagainya.

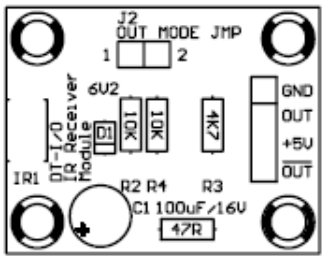
Spesifikasi Hardware

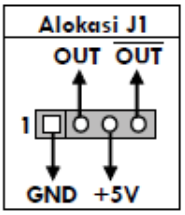
1. Tegangan kerja: +5 VDC.
2. Frekuensi carrier penerima infra merah: 38 kHz.
3. Panjang gelombang puncak 950 nm.
4. Sudut penerimaan ±45°.
5. Memiliki 2 output: non-inverting (OUT) dan inverting ($\overline{OUT}$). Keduanya kompatibel dengan level tegangan TTL, CMOS, dan RS-232.

	Menerima IR 38 kHz	Tidak Menerima IR 38 kHz
Logika pada OUT	0	1
Logika pada $\overline{OUT}$	1	0

6. Kompatibel penuh dengan DT-51™ Minimum System (MinSys) ver 3.0, DT-51™ PetraFuz, DT-BASIC Series, DT-51™ Low Cost Series, DT-AVR Low Cost Series, dan lain-lain.

Tata Letak & Pengaturan Jumper





Konfigurasi J2 (OUT MODE JMP)	
J2 	Jika jumper tidak terpasang, maka output yang dapat digunakan adalah pin OUT (J1 pin 2)
J2 	Jika jumper terpasang, maka output yang dapat digunakan adalah pin $\overline{OUT}$ (J1 pin 4)

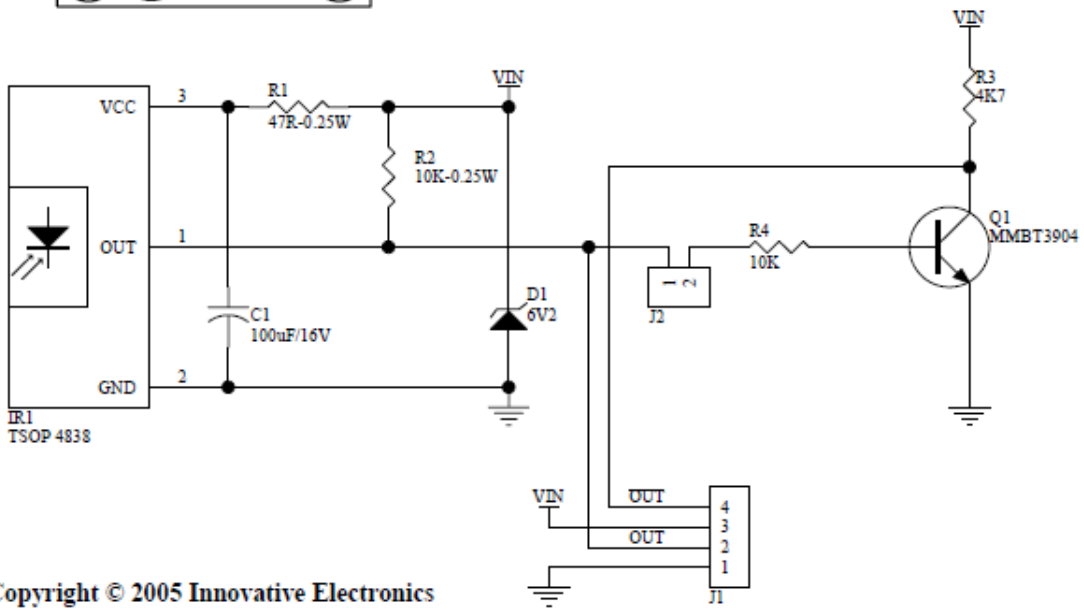
Prosedur Testing

1. Hubungkan sumber tegangan +5 VDC ke modul Infra Red Receiver.
2. Lepas jumper J2.
3. Ukur tegangan pada pin OUT dengan voltmeter. Nilainya akan berada pada logika '1' (sekitar 5 V).
4. Pasang jumper J2.
5. Ukur tegangan pada pin $\overline{OUT}$ dengan voltmeter. Nilainya akan berada pada logika '0' (sekitar 0 V).
6. Beri sinyal infra merah 38 kHz (dengan modul Infra Red Transmitter berjarak < 30 cm) secara terus menerus.
7. Lepas jumper J2.
8. Ukur tegangan pada pin OUT dengan voltmeter. Nilainya akan berada pada logika '0' (sekitar 0 V).
9. Pasang jumper J2.
10. Ukur tegangan pada pin $\overline{OUT}$ dengan voltmeter. Nilainya akan berada pada logika '1' (sekitar 5 V).

Datasheet TSOP4838 dapat di-download di www.innovativeelectronics.com pada bagian Support.

◊ *Terima Kasih atas kepercayaan Anda menggunakan produk kami, bila ada kesulitan, pertanyaan atau saran mengenai produk ini silahkan menghubungi technical support kami :*

support@innovativeelectronics.com



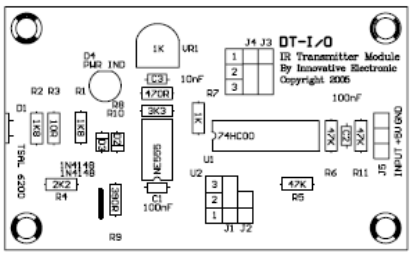
DT-I/O INFRA RED TRANSMITTER

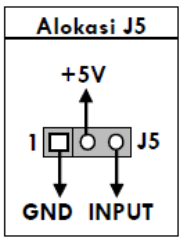
Infra Red Transmitter merupakan suatu modul pengirim data melalui gelombang infra merah dengan frekuensi carrier sebesar 38 kHz. Modul ini dapat difungsikan sebagai output dalam aplikasi transmisi data nirkabel seperti robotik, sistem pengaman, datalogger, absensi, dan sebagainya.

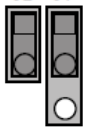
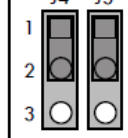
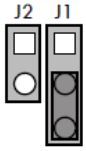
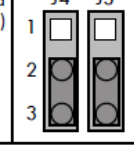
Spesifikasi Hardware

1. Tegangan kerja: +5 VDC.
2. Frekuensi carrier penerima infra merah: 38 kHz.
3. Panjang gelombang puncak 940 nm.
4. Sudut pancaran ±17°.
5. Jarak maksimum yang teruji pada sudut 0°: 16 m. Jarak maksimum sesuai datasheet: 35 m
6. Memiliki input yang kompatibel dengan level tegangan TTL, CMOS, dan RS-232.
7. Terdapat 2 mode output: non-inverting dan inverting.
8. Kompatibel penuh dengan DT-51™ Minimum System (MinSys) ver 3.0, DT-51™ PetraFuz, DT-BASIC Series, DT-51™ Low Cost Series, DT-AVR Low Cost Series, dan lain-lain.

Tata Letak





Konfigurasi J1 & J2		Konfigurasi J3 & J4	
	Input berlogika '0' (TTL/CMOS) atau '1' (RS-232) akan mengaktifkan output		Input berlogika '0' (TTL/CMOS) atau '1' (RS-232) akan mengaktifkan pembangkit frekuensi
	Input berlogika '1' (TTL/CMOS) atau '0' (RS-232) akan mengaktifkan output		Input berlogika '1' (TTL/CMOS) atau '0' (RS-232) akan mengaktifkan pembangkit frekuensi

Posisi J1 & J2	Posisi J3 & J4	Logika Input	Pemancar
1-2	1-2	0(TTL/CMOS) 1(RS-232)	Memancarkan IR berfrekwensi 38 kHz
		1(TTL/CMOS) 0(RS-232)	Tidak memancarkan IR
2-3	2-3	0(TTL/CMOS) 1(RS-232)	Tidak memancarkan IR
		1(TTL/CMOS) 0(RS-232)	Memancarkan IR berfrekwensi 38 kHz

Prosedur Testing

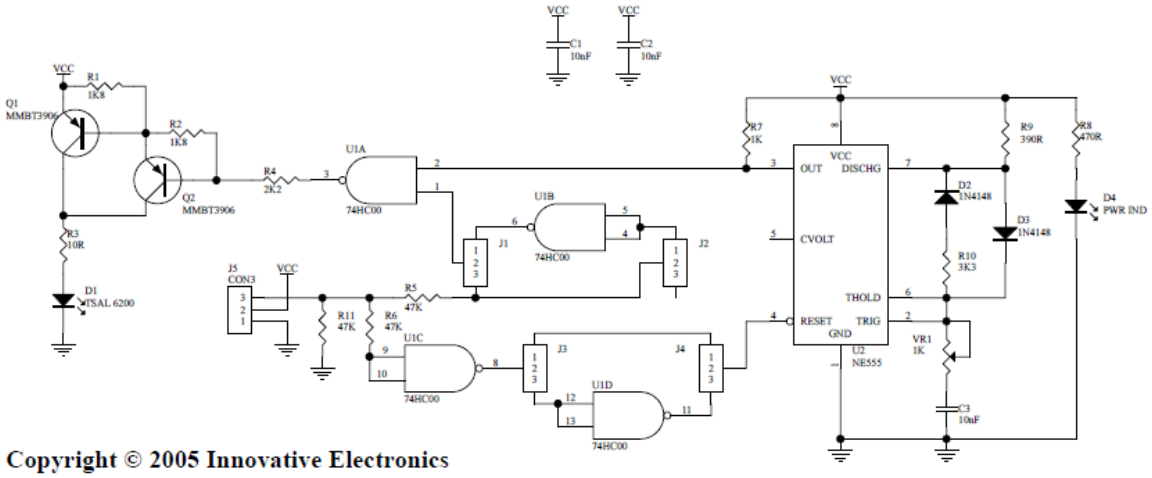
1. Hubungkan sumber tegangan +5 VDC ke modul Infra Red Transmitter.
2. Pindah semua jumper ke posisi 1-2.
3. Hubungkan pin INPUT dengan ground.
4. Jika menggunakan DT-I/O Infra Red Receiver, lepas jumper pada Infra Red Receiver dan arahkan pemancar ke penerima (berjarak < 30 cm). Pin OUT DT-I/O Infra Red Receiver akan berlogika 0 (TTL/CMOS).

Jika tidak menggunakan Infra Red Receiver, gunakan kamera digital dan multimeter yang dilengkapi pengukur frekuensi. Lihat pemancar dengan kamera digital, maka akan tampak cahaya putih pada pemancar. Ukur frekuensi pin/kaki 3 pada IC 74HC00N dengan pengukur frekuensi, maka fekuensinya akan berada di kisaran 38 kHz.

Datasheet TSAL6200 dapat di-download di www.innovativeelectronics.com pada bagian Support.

◊ *Terima Kasih atas kepercayaan Anda menggunakan produk kami, bila ada kesulitan, pertanyaan atau saran mengenai produk ini silahkan menghubungi technical support kami :*

support@innovativeelectronics.com



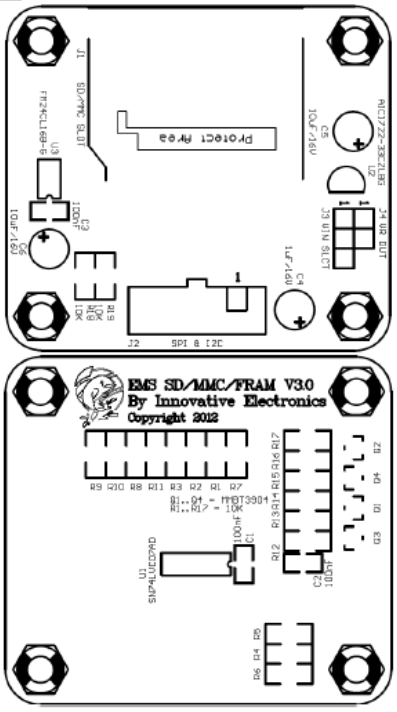
EMS (Embedded Module Series) SD/MMC/FRAM v3

EMS SD/MMC/FRAM merupakan suatu modul untuk mempermudah antarmuka antara SD Card (atau MMC) dan mikrokontroler dengan pilihan tegangan supply dan I/O 5 VDC atau 3,3 VDC. SD Card (atau MMC) dapat digunakan sebagai memori yang dapat diganti dengan mudah sehingga memudahkan dalam ekspansi ke kapasitas memori yang lebih besar. Tersedia Ferroelectric Nonvolatile RAM (FRAM) yang dapat digunakan sebagai buffer sementara dalam mengakses SD Card (atau MMC) atau sebagai tempat penyimpan data lain. Modul ini dapat digunakan antara lain sebagai penyimpan data pada sistem absensi, sistem antrian, atau aplikasi datalogging lainnya.

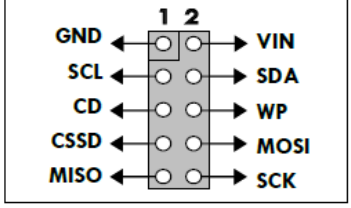
Spesifikasi Hardware

1. Pilihan tegangan supply dan I/O: +5 VDC atau +3,3 VDC.
2. Jenis kartu yang didukung: SD Card (dan MMC).
3. Antarmuka SD Card (dan MMC) dengan mikrokontroler secara SPI.
4. Tersedia 2 KByte Ferroelectric Nonvolatile RAM FM24CL16B.
5. Antarmuka FRAM dengan mikrokontroler secara Two-Wire Interface.
6. Tersedia contoh aplikasi untuk DT-51™ Low Cost Series dan DT-AVR Low Cost Series dalam bahasa BASIC untuk MCS-51® (BASCOM-8051©) dan bahasa C untuk AVR® (CodeVisionAVR©).
7. Kompatibel dengan DT-51™ Low Cost series, DT-AVR Low Cost series, dan DT-AVR Bootloader Micro System series. Mendukung DT-51™ Minimum System (MinSys) ver 3.0, DT-51™ PetraFuz, CPU Module series dan lain-lain.

Tata Letak



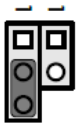
Alokasi Pin J2



SCL dan SDA sudah terhubung ke resistor pull-up. Apabila modul terhubung ke jaringan Two-Wire Interface, maka pull-up pada modul lain dapat dilepas.

Pin	Nama	Fungsi pada Modul	Keterangan
1	GND	Input	Referensi Ground
2	VIN	Input	Terhubung ke Sumber Tegangan +5 VDC atau 3,3 VDC
3	SCL	Input	Serial Clock untuk akses FRAM
4	SDA	Input/ Output	Serial Data untuk transaksi data dari/ke FRAM
5	CD	Output	Card Detect, berlogika 0 jika ada kartu yang dimasukkan, berlogika 1 jika tidak ada kartu
6	WP	Output	Write Protect, berlogika 0 jika saklar pada SD Card tidak berada pada posisi dikunci, berlogika 1 jika SD Card dalam posisi dikunci
7	CSSD	Input	Chip Select, diberi logika 0 untuk mengakses SD Card, diberi logika 1 jika tidak mengakses SD Card
8	MOSI	Input	Jalur data masuk ke SD Card
9	MISO	Output	Jalur data keluar dari SD Card
10	SCK	Input	Jalur clock dari mikrokontroler untuk mengakses SD Card

Jumper VIN SLCT (J3) dan VR OUT (J4) harus diatur sesuai dengan tegangan VIN dan I/O yang digunakan.

VIN = +5 VDC	VIN = +3,3 VDC
 J3: Posisi 1-2 J4: Dipasang	 J3: Posisi 2-3 J4: Dilepas

Isi CD/DVD

1. Contoh aplikasi dengan CodeVisionAVR© dan BASCOM-8051© (untuk DT-AVR LCMS).
2. Contoh aplikasi CodeVisionAVR© (untuk DT-AVR ATmega128L BMS).
3. Datasheet.
4. Manual EMS SD/MMC/FRAM.
5. Website Innovative Electronics.

Prosedur Testing

Atur *jumper* J3 ke posisi 1-2 dan pasang *jumper* J4, lalu ikuti petunjuk pada contoh aplikasi **AN SD BAS51.PDF** untuk MCS-51® (BASCOM-8051©) dan **AN SD CVAVR.PDF** untuk AVR® (CodeVisionAVR©).

National Semiconductor

August 2000

LM124/LM224/LM324/LM2902
Low Power Quad Operational Amplifiers

General Description

The LM124 series consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which now can be more easily implemented in single power supply systems. For example, the LM124 series can be directly operated off of the standard +5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

Unique Characteristics

- In the linear mode the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage
- The unity gain cross frequency is temperature compensated
- The input bias current is also temperature compensated

Advantages

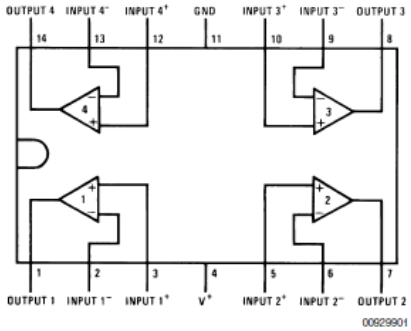
- Eliminates need for dual supplies
- Four internally compensated op amps in a single package
- Allows directly sensing near GND and V_{OUT} also goes to GND
- Compatible with all forms of logic
- Power drain suitable for battery operation

Features

- Internally frequency compensated for unity gain
- Large DC voltage gain 100 dB
- Wide bandwidth (unity gain) 1 MHz (temperature compensated)
- Wide power supply range:
  Single supply 3V to 32V
  or dual supplies ±1.5V to ±16V
- Very low supply current drain (700 µA)—essentially independent of supply voltage
- Low input biasing current 45 nA (temperature compensated)
- Low input offset voltage 2 mV and offset current: 5 nA
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0V to V^+ − 1.5V

Connection Diagrams

Dual-In-Line Package



Top View

Order Number LM124J, LM124AJ, LM124J/883 (Note 2), **LM124AJ/883** (Note 1), **LM224J, LM224AJ, LM324J, LM324M, LM324MX, LM324AM, LM324AMX, LM2902M, LM2902MX, LM324N, LM324AN, LM324MT, LM324MTX or LM2902N LM124AJRQML and LM124AJRQMLV**(Note 3)
See NS Package Number J14A, M14A or N14A

 DS009299

LM193/LM293/LM393/LM2903 Low Power Low Offset Voltage Dual Comparators

Check for Samples: LM193-N, LM2903-N, LM293-N, LM393-N

FEATURES

- Wide supply
  - Voltage range: 2.0V to 36V
  - Single or dual supplies: ±1.0V to ±18V
- Very low supply current drain (0.4 mA) — independent of supply voltage
- Low input biasing current: 25 nA
- Low input offset current: ±5 nA
- Maximum offset voltage: ±3 mV
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- Low output saturation voltage,: 250 mV at 4 mA
- Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems
- Available in the 8-Bump (12 mil) micro SMD package
- See AN-1112 for micro SMD considerations

ADVANTAGES

- High precision comparators
- Reduced V_{OS} drift over temperature
- Eliminates need for dual supplies
- Allows sensing near ground
- Compatible with all forms of logic
- Power drain suitable for battery operation

DESCRIPTION

The LM193 series consists of two independent precision voltage comparators with an offset voltage specification as low as 2.0 mV max for two comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates. The LM193 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the LM193 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

The LM393 and LM2903 parts are available in National's innovative thin micro SMD package with 8 (12 mil) large bumps.

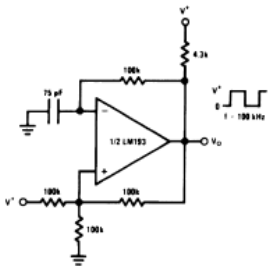


Figure 1. Squarewave Oscillator

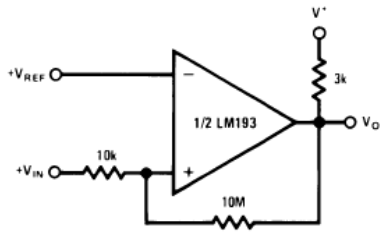


Figure 2. Non-Inverting Comparator with Hysteresis

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.

Features

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single-clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- Nonvolatile Program and Data Memories
  - 16K Bytes of In-System Self-Programmable Flash
    Endurance: 1,000 Write/Erase Cycles
  - Optional Boot Code Section with Independent Lock Bits
    In-System Programming by On-chip Boot Program
    True Read-While-Write Operation
  - 512 Bytes EEPROM
    Endurance: 100,000 Write/Erase Cycles
  - 1K Byte Internal SRAM
  - Programming Lock for Software Security
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four PWM Channels
  - 8-channel, 10-bit ADC
    8 Single-ended Channels
    7 Differential Channels in TQFP Package Only
    2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
  - 40-pin PDIP, 44-lead TQFP, and 44-pad MLF
- Operating Voltages
  - 2.7 - 5.5V for ATmega16L
  - 4.5 - 5.5V for ATmega16
- Speed Grades
  - 0 - 8 MHz for ATmega16L
  - 0 - 16 MHz for ATmega16

8-bit AVR® Microcontroller with 16K Bytes In-System Programmable Flash

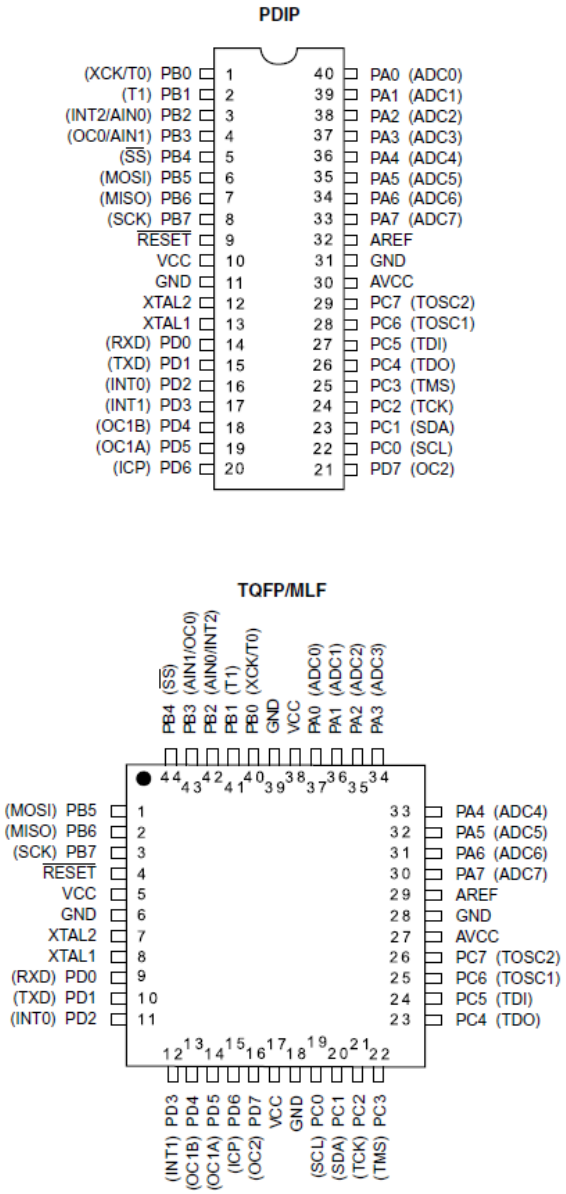
ATmega16
ATmega16L

Preliminary

Rev. 2466C–AVR–03/02

Pin Configurations

Figure 1. Pinouts ATmega16



Disclaimer

Typical values contained in this data sheet are based on simulations and characterization of other AVR microcontrollers manufactured on the same process technology. Min and Max values will be available after the device is characterized.