LAMPIRAN A

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
RISET DAN TEKNOLOGI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id **E-mail** : info@polsri.ac.id

KESEPAKATAN BIMBINGAN LAPORAN AKHIR (LA)

Kami yang bertanda tangan di bawah ini,

Pihak Pertama

Nama	: Juliansyah Akbar
NPM	: 061930320498
Jurusan	: Teknik Elektro
Program Studi	: DIII Teknik Elektronika

Pihak Kedua

Nama	: Dr. Eng. Tresna Dewi, S.T., M.Eng.
NIP	: 197711252000032001
Jurusan	: Teknik Elektro
Program Studi	: DIII Teknik Elektronika

Pada hari ini Selasa 18 Januari 2022 telah sepakat untuk melakukan konsultasi bimbingan Laporan Akhir.

Konsultasi bimbingan sekurang-kurangnya 1 (satu) kali dalam satu minggu. Pelaksanaan bimbingan pada setiap hari Senin pukul 80.00 – 12.00 WIB tempat di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Laporan Akhir.

Palembang, 18 Januari 2022

Pihak Pertama,

(Juliansyah Akbar)
NIM 061930320498

Pihak Kedua,

(Dr. Eng. Tresna Dewi, S.T., M.Eng.)
NIP 197711252000032001

Mengetahui,
Ketua Jurusan

(Ir. Iskandar Lutfi, M.T)
NIP 196501291991031002

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN RISET DAN TEKNOLOGI
DIREKTORAT PENDIDIKAN TINGGI VOKASI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

LEMBAR BIMBINGAN LAPORAN AKHIR

Nama Mahasiswa : Juliansyah Akbar
NIM : 061930320498
Jurusan/Program Studi : Teknik Elektro / D3 Teknik Elektronika
Judul Laporan : Rancang Bangun Robot Penyemprot Pestisida Otomatis Tenaga Surya
Pembimbing I : Dr. Eng. Tresna Dewi, S.T., M.Eng

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	22-12-2021	Menentukan Tema Laporan Akhir	2
2.	28-12-2021	Rapat Pembahasan Projek dan Peminjaman R.	2
3.	5-01-2022	Penentuan Judul Bahasan Laporan Akhir	2
4.	18-01-2022	Bimbingan Proposal Laporan Akhir	2
5.	25-01-2022	Revisi Bab 1-3 Proposal Laporan Akhir	2
6.	05-02-2022	Survey lokasi Projek Laporan Akhir	2
7.	09-02-2022	Pengesahan Proposal Laporan Akhir	2
8.	27-02-2022	Pengerjaan Projek Pemasangan Plastik Greenhouse	2
9.	01-03-2022	Bimbingan Persiapan alat LA	2
10.	14-03-2022	Bimbingan Progres Perancangan Robot LA	2
11.	28-03-2022	Konsultasi Perancangan Mekanik Alat	2
12.	11-04-2022	Konsultasi Perancangan Desain Robot	2

Palembang, ...
Mengetahui,
Koordinator Program Studi,

Dewi Permata Sari, ST., M.Kom
NIP. 197612132000032001

Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/KPS harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN RISET DAN TEKNOLOGI
DIREKTORAT PENDIDIKAN TINGGI VOKASI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polisri.ac.id

LEMBAR BIMBINGAN LAPORAN AKHIR

Nama Mahasiswa : Juliansyah Akbar
NIM : 061930320498
Jurusan/Program Studi : Teknik Elektro / D3 Teknik Elektronika
Judul Laporan : Rancang Bangun Robot Penyemprot Pestisida Otomatis Tenaga Surya
Pembimbing I : Dr. Eng. Tresna Dewi, S.T., M.Eng

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
13.	26-04-2022	Bimbingan spesifikasi Panel Surya	2
14.	23-05-2022	Konsultasi perancangan Panel Surya Robot.	2
15.	26-05-2022	Pengerjaan Projek Greenhouse bersama Dosen	2
16.	6-06-2022	Konsultasi Pengubahan Baterai Robot.	2
17.	13-06-2022	Bimbingan Progres Alat (Pengubahan Baterai Robot)	2
18.	21-06-2022	Progres Akhir Alat dan Pengujian Alat	2
19.	30-06-2022	konsultasi Bab 1-3 laporan akhir	2
20.	3-07-2022	Perancangan Robot bersama Dosen	2
21.	7-07-2022	Pengambilan Data Alat	2
22.	11-07-2022	Bimbingan Bab 4 Laporan Akhir	2
23.	13-07-2022	Konsultasi kesiapan alat dan laporan	2
24.	20-07-2022	Konsultasi Bab 1-5 / Acc laporan Akhir	2

Palembang, ...
Mengetahui,
Koordinator Program Studi,

Dewi Permata Sari, ST., M.Kom
NIP. 197612132000032001

Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/KPS harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

LAMPIRAN B

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
RISET DAN TEKNOLOGI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

KESEPAKATAN BIMBINGAN LAPORAN AKHIR (LA)

Kami yang bertanda tangan di bawah ini,

Pihak Pertama

Nama	: Juliansyah Akbar
NPM	: 061930320498
Jurusan	: Teknik Elektro
Program Studi	: DIII Teknik Elektronika

Pihak Kedua

Nama	: Yurni Oktarina, S.T., M.T.
NIP	: 197710162008122001
Jurusan	: Teknik Elektro
Program Studi	: DIII Teknik Elektronika

Pada hari ini Selasa 18 Januari 2022 telah sepakat untuk melakukan konsultasi bimbingan Laporan Akhir.

Konsultasi bimbingan sekurang-kurangnya 1 (satu) kali dalam satu minggu. Pelaksanaan bimbingan pada setiap hari Senin pukul 80.00 – 12.00 WIB tempat di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Laporan Akhir.

Palembang, 18 Januari 2022

Pihak Pertama,

(Juliansyah Akbar)
NIM 061930320498

Pihak Kedua,

(Yurni Oktarina, S.T., M.T.)
NIP 197710162008122001

Mengetahui,
Ketua Jurusan

(Ir. Iskandar Lutfi, M.T)
NIP 196501291991031002

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN RISET DAN TEKNOLOGI
DIREKTORAT PENDIDIKAN TINGGI VOKASI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

LEMBAR BIMBINGAN LAPORAN AKHIR

Nama Mahasiswa : Juliansyah Akbar
NIM : 061930320498
Jurusan/Program Studi : Teknik Elektro / D3 Teknik Elektronika
Judul Laporan : Rancang Bangun Robot Penyemprot Pestisida Otomatis Tenaga Surya
Pembimbing II : Yurni Oktarina, S.T., M.T.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	22-12-2021	Menentukan Tema Laporan Akhir	
2.	28-12-2021	Rapat Pembahasan Projek dan Pemintaan Robot	
3.	05-01-2022	Penentuan Judul Bahasan Laporan Akhir	
4.	18-01-2022	Bimbingan Proposal Laporan Akhir	
5.	25-01-2022	Revisi Bab 1-3 Proposal Laporan Akhir	
6.	05-02-2022	Survey Lokasi Projek Greenhouse LA	
7.	09-02-2022	Pengesahan Proposal Laporan Akhir	
8.	24-02-2022	Pergerjaan Projek Pemasangan Plastik Greenhouse	
9.	01-03-2022	Sosialisasi Kerja sama Projek LA	
10.	14-03-2022	Progres Perancangan Robot untuk LA	
11.	28-03-2022	Konsultasi Perancangan Mekanik Robot	
12.	11-04-2022	Konsultasi Perancangan Desain Robot.	

Palembang, ...
Mengetahui,
Koordinator Program Studi,

Dewi Permata Sari, ST., M.Kom
NIP. 197612132000032001

Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/KPS harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN RISET DAN TEKNOLOGI
DIREKTORAT PENDIDIKAN TINGGI VOKASI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

LEMBAR BIMBINGAN LAPORAN AKHIR

Nama Mahasiswa : Juliansyah Akbar
NIM : 061930320498
Jurusan/Program Studi : Teknik Elektro / D3 Teknik Elektronika
Judul Laporan : Rancang Bangun Robot Penyemprot Pestisida Otomatis Tenaga Surya
Pembimbing II : Yurni Oktarina, S.T., M.T.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
13.	25-04-2022	Bimbingan Spesifikasi Panel Surya	
14.	23-05-2022	Perancangan Panel Surya Robot	
15.	26-05-2022	Projek Greenhouse bersama Dosen	
16.	6-06-2022	Pengisian Baterai Robot.	
17.	13-06-2022	Konsultasi Progres Alat	
18.	21-06-2022	Progres akhir alat dan Pengujian Alat	
19.	30-06-2022	Bimbingan Bab 1-3 Laporan Akhir	
20.	3 Juli 2022	Perancangan robot bersama Dosen	
21.	7-07-2022	Pengambilan Data Alat	
22.	11-07-2022	Bimbingan Bab 4, laporan Akhir	
23.	13-07-2022	Kesiapan Alat dan Laporan.	
24.	21	Acc [illegible] → Lanjut ujian LA	

Palembang, ...
Mengetahui,
Koordinator Program Studi,

Dewi Permata Sari, ST., M.Kom
NIP. 197612132000032001

Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/KPS harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

LAMPIRAN C

KEMENTERIAN PENDIDIKAN,KEBUDAYAAN
RISET,DAN TEKNOLOGI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

REKOMENDASI UJIAN LAPORAN AKHIR (LA)

Pembimbing Laporan Akhir memberikan rekomendasi kepada,

Nama	:	Juliansyah Akbar
NIM	:	061930320498
Jurusan/Program Studi	:	Teknik Elektro/DIII Teknik Elektronika
Judul Laporan Akhir	:	Rancang Bangun Robot Penyemprot Pestisida Otomatis Tenaga Surya

Mahasiswa tersebut telah memenuhi persyaratan dan dapat mengikuti Ujian Laporan Akhir (LA) pada Tahun Akademik 2021/2022

Palembang, 20 Juli 2022

Pembimbing I,

(Dr.Eng.Tresna Dewi, S.T., M.Eng)
NIP. 197711252000032001

Pembimbing II,

(Yurni Oktarina, S.T., M.T)
NIP. 197710162008122001

LAMPIRAN D

No. Dok. : F-PBM-22 | Tgl. Berlaku : 13 Desember 2010 | No. Rev. : 00

KEMENTERIAN PENDIDIKAN,KEBUDAYAAN
RISET,DAN TEKNOLOGI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 fax. 0711-355918
Website : www.polisriwijaya.ac.id **E-mail** : info@polsri.ac.id

REVISI UJIAN LAPORAN AKHIR (LA)

Ruang : V
Dosen Penguji : Renny Maulidda, ST, MT
Nama Mahasiswa : Juliansyah Akbar
NIM : 061930320498
Jurusan/Program Studi : Teknik Elektro/DIII Teknik Elektronika
Judul Laporan Akhir : Rancang Bangun Robot Penyemprot Pestisida Otomatis Tenaga Surya

No	Uraian Revisi	Paraf
1	Perbaikan penulisan	
2	Tambahkan data kecepatan robot	

Palembang, 1 Agustus 2022
Dosen Penguji

(Renny Maulidda, ST, MT)

KEMENTERIAN PENDIDIKAN,KEBUDAYAAN
RISET,DAN TEKNOLOGI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 fax. 0711-355918
Website : www.polisriwijaya.ac.id **E-mail** : info@polsri.ac.id

PELAKSANAAN REVISI LAPORAN AKHIR (LA)

Mahasiswa berikut,

Nama Mahasiswa	:	Juliansyah Akbar
NIM	:	061930320498
Jurusan/Program Studi	:	Teknik Elektro/DIII Teknik Elektronika
Judul Laporan Akhir	:	Rancang Bangun Robot Penyemprot Pestisida Otomatis Tanaga Surya

Telah melaksanakan revisi terhadap Laporan Akhir yang diujikan pada hari Senin tanggal 15 bulan Agustus tahun 2022 Pelaksanaan revisi terhadap Laporan Akhir tersebut telah disetujui oleh Dosen Penguji yang memberikan revisi :

No	Komentar	Nama Dosen Penguji *)	Tanggal	Tanda Tangan
1.		Dr. Eng. Tresna Dewi, S.T., M.Eng	23/08/22	
2.	Tidak direvisi	Dewi Permata Sari, S.T., M.Kom	15/08/22	
3.	Acc	Renny Maulidda, S.T., M.T	15/8/22	

Palembang, 15 Agustus 2022
Ketua Penguji **)

(Dr. Eng. Tresna Dewi, S.T., M.Eng)
NIP. 197711252000032001

LAMPIRAN D

Tampak Depan Robot Penyemprot Pestisida

Tampak Belakang Robot Penyemprot Pestisida

Penyemprotan Sedang dilakukan
oleh Robot Penyemprot Pestisida

Lajur 1

Lajur 2

Lajur 3

LAMPIRAN E

ACS712

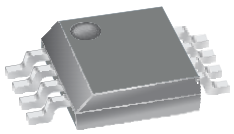
Fully Integrated, Hall Effect-Based Linear Current Sensor with 2.1 kVRMS Voltage Isolation and a Low-Resistance Current Conductor

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 kV_{RMS} 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

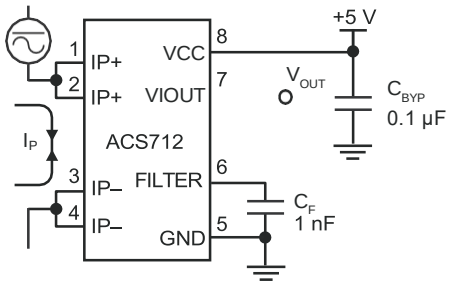
The Allegro® ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switched-mode power supplies, and overcurrent fault protection.

The device consists of a precise, low-offset, linear Hall sensor 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 is sensed by the integrated Hall IC and converted 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 sensing. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power

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 sensed current, I_P , within the range specified. C_F is recommended for noise management, with values that depend on the application.

Description (continued)

loss. The thickness of the copper conductor allows survival of the device at up to 5× overcurrent conditions. The terminals of the conductive path are electrically isolated from the sensor leads (pins 5 through 8). This allows the ACS712 current sensor to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques.

The ACS712 is provided in a small, surface mount SOIC8 package. The leadframe is plated with 100% matte tin, which is compatible with standard lead (Pb) free printed circuit board assembly processes. Internally, the device is Pb-free, except for flip-chip high-temperature Pb-based solder balls, currently exempt from RoHS. The device is fully calibrated prior to shipment from the factory.

Selection Guide

Part Number	Packing*	T_A (°C)	Optimized Range, I_P (A)	Sensitivity, Sens (Typ) (mV/A)
ACS712ELCTR-05B-T	Tape and reel, 3000 pieces/reel	–40 to 85	±5	185
ACS712ELCTR-20A-T	Tape and reel, 3000 pieces/reel	–40 to 85	±20	100
ACS712ELCTR-30A-T	Tape and reel, 3000 pieces/reel	–40 to 85	±30	66

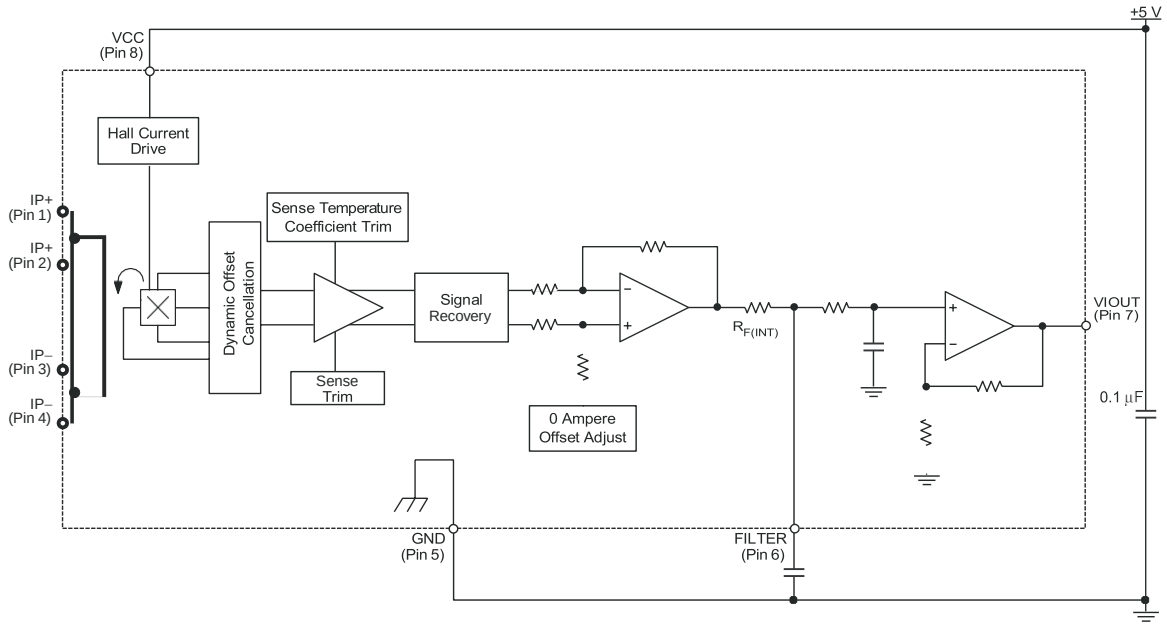
*Contact Allegro for additional packing options.

Absolute Maximum Ratings

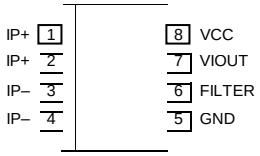
Characteristic	Symbol	Notes	Rating	Units
Supply Voltage	V_{CC}		8	V
Reverse Supply Voltage	V_{RCC}		–0.1	V
Output Voltage	V_{IOUT}		8	V
Reverse Output Voltage	V_{RIOUT}		–0.1	V
Reinforced Isolation Voltage	V_{ISO}	Pins 1-4 and 5-8; 60 Hz, 1 minute, T_A=25°C	2100	V
		Voltage applied to leadframe (Ip+ pins), based on IEC 60950	184	V_{peak}
Basic Isolation Voltage	$V_{ISO(bsc)}$	Pins 1-4 and 5-8; 60 Hz, 1 minute, T_A=25°C	1500	V
		Voltage applied to leadframe (Ip+ pins), based on IEC 60950	354	V_{peak}
Output Current Source	$I_{IOUT(Source)}$		3	mA
Output Current Sink	$I_{IOUT(Sink)}$		10	mA
Overcurrent Transient Tolerance	I_P	1 pulse, 100 ms	100	A
Nominal Operating Ambient Temperature	T_A	Range E	–40 to 85	ºC
Maximum Junction Temperature	T_J(max)		165	ºC
Storage Temperature	T_{stg}		–65 to 170	ºC

Parameter	Specification
Fire and Electric Shock	CAN/CSA-C22.2 No. 60950-1-03 UL 60950-1:2003 EN 60950-1:2001

Functional Block Diagram



Pin-out Diagram



Terminal List Table

Number	Name	Description
1 and 2	IP+	Terminals for current being sensed; fused internally
3 and 4	IP–	Terminals for current being sensed; fused internally
5	GND	Signal ground terminal
6	FILTER	Terminal for external capacitor that sets bandwidth
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal

COMMON OPERATING CHARACTERISTICS[1] over full range of T_A, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
ELECTRICAL CHARACTERISTICS						
Supply Voltage	V_{CC}		4.5	5.0	5.5	V
Supply Current	I_{CC}	V_{CC} = 5.0 V, output open	–	10	13	mA
Output Capacitance Load	C_{LOAD}	VIOUT to GND	–	–	10	nF
Output Resistive Load	R_{LOAD}	VIOUT to GND	4.7	–	–	kΩ
Primary Conductor Resistance	$R_{PRIMARY}$	T_A = 25°C	–	1.2	–	mΩ
Rise Time	t_r	I_P = I_P(max), T_A = 25°C, C_{OUT} = open	–	5	–	µs
Frequency Bandwidth	f	–3 dB, T_A = 25°C; I_P is 10 A peak-to-peak	–	80	–	kHz
Nonlinearity	E_{LIN}	Over full range of I_P	–	1.5	–	%
Symmetry	E_{SYM}	Over full range of I_P	98	100	102	%
Zero Current Output Voltage	$V_{IOUT(Q)}$	Bidirectional; I_P = 0 A, T_A = 25°C	–	V_{CC} × 0.5	–	V
Power-On Time	t_{PO}	Output reaches 90% of steady-state level, T_J = 25°C, 20 A present on leadframe	–	35	–	µs
Magnetic Coupling[2]			–	12	–	G/A
Internal Filter Resistance[3]	$R_{F(INT)}$			1.7		kΩ

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

[2]1G = 0.1 mT.

[3]$R_{F(INT)}$ forms an RC circuit via the FILTER pin.

COMMON THERMAL CHARACTERISTICS[1]

			Min.	Typ.	Max.	Units
Operating Internal Leadframe Temperature	T_A	E range	–40	–	85	°C
					Value	Units
Junction-to-Lead Thermal Resistance[2]	$R_{\theta JL}$	Mounted on the Allegro ASEK 712 evaluation board			5	°C/W
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	Mounted on the Allegro 85-0322 evaluation board, includes the power consumed by the board			23	°C/W

[1]Additional thermal information is available on the Allegro website.

[2]The Allegro evaluation board has 1500 mm^2 of 2 oz. copper on each side, connected to pins 1 and 2, and to pins 3 and 4, with thermal vias connecting the layers. Performance values include the power consumed by the PCB. Further details on the board are available from the Frequently Asked Questions document on our website. Further information about board design and thermal performance also can be found in the Applications Information section of this datasheet.

x05B PERFORMANCE CHARACTERISTICS T_A = –40°C to 85°C[1], 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	$\Delta I_{OUT(Q)}$	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 T_A = –40°C to 85°C[1], 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	$\Delta I_{OUT(Q)}$	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 T_A = –40°C to 85°C[1], 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	64	66	68	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	$\Delta I_{OUT(Q)}$	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	–	%

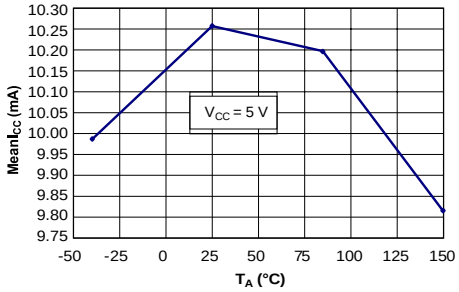
[1]Device may be operated at higher primary current levels, I_P, and ambient temperatures, T_A, provided that the Maximum Junction Temperature, T_J(max), is not exceeded.

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

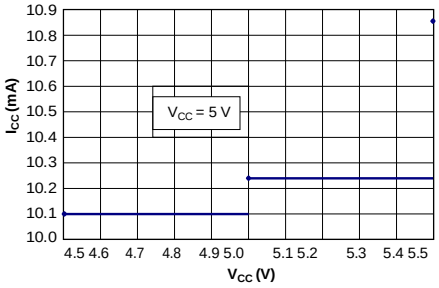
Characteristic Performance

I_P = 5 A, unless otherwise specified

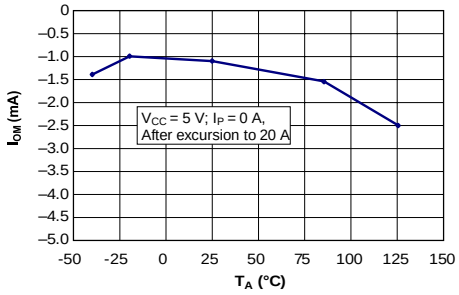
Mean Supply Current versus Ambient Temperature



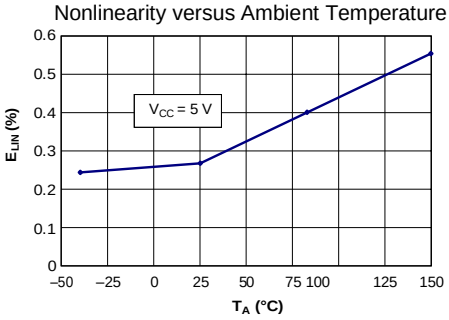
Supply Current versus Supply Voltage



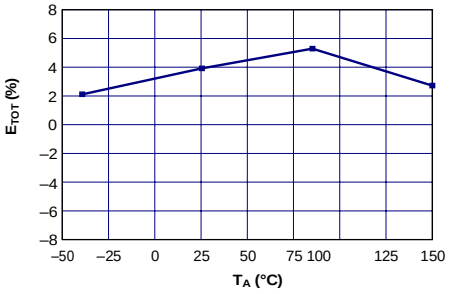
Magnetic Offset versus Ambient Temperature



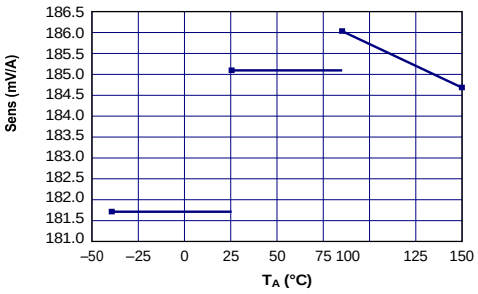
Nonlinearity versus Ambient Temperature



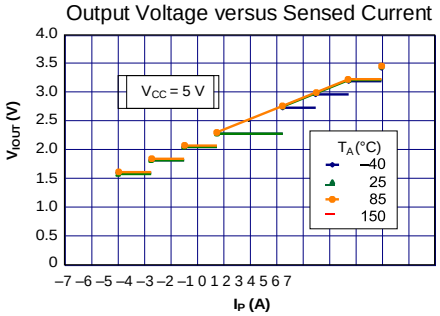
Mean Total Output Error versus Ambient Temperature



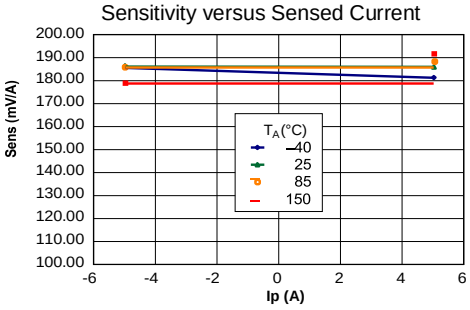
Sensitivity versus Ambient Temperature



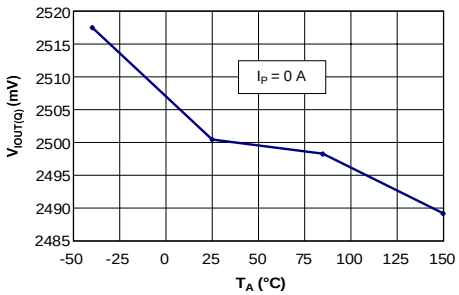
Output Voltage versus Sensed Current



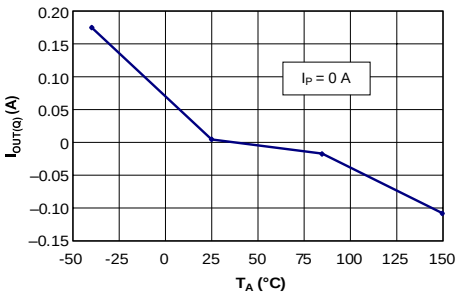
Sensitivity versus Sensed Current



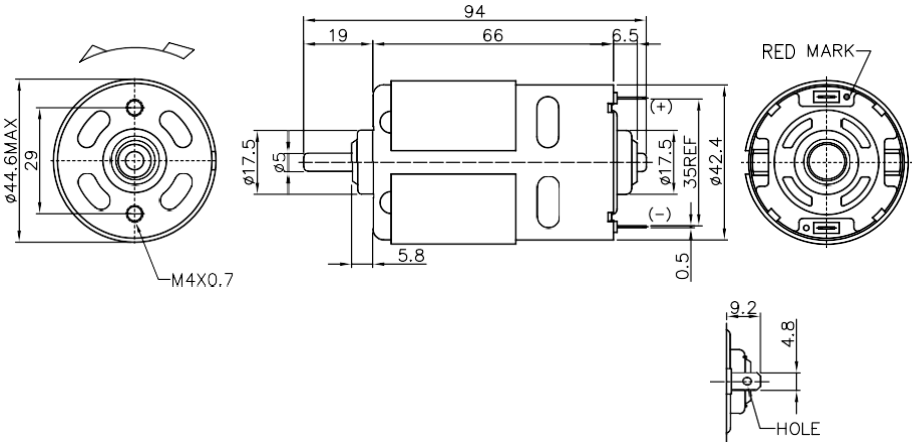
0 A Output Voltage versus Ambient Temperature



0 A Output Voltage Current versus Ambient Temperature



770 series Ø45 mm 21-114 W



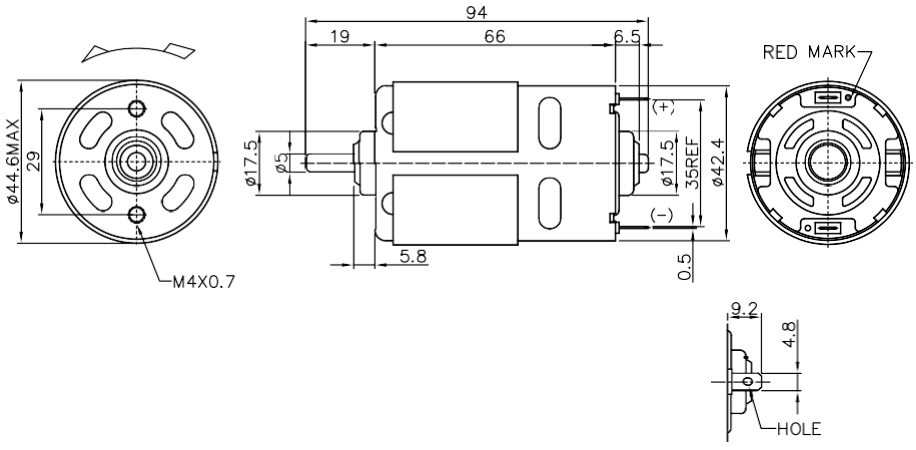
Model - □ - □

Cabron brush = C
Metal brush = M

V = Varistor
C = Capacitor

MOTOR DATA				
Part name	770-4087-CC	770-7040-CC	770-8525F-CC	770-32165-CC
Diameter (mm)	45	45	45	45
Lenth (mm)	66	66	66	66
Nominal voltage (V)	12	12	12	24
Nominal speed (rpm)	3500	8400	13500	3900
Nominal torque (mNm)	56.1	59.3	80.3	52.9
Nominal current A	2.8	6.0	12.1	1.3
No load speed (rpm)	4550	9700	16000	4650
No load current A	0.60	1.30	1.80	0.22
Stall torque (mNm)	334.1	595.7	587.9	397.1
Starting current (A)	14.1	56.9	83.0	8.6
Output (W)	21	53	114	22
Efficiency (%)	63	73	79	74
Operating temperature deg. C	-10..+60	-10..+60	-10..+60	-10..+60

775 series Ø45 mm 103-198 W



Model - □ - □

Cabron brush = C
Metal brush = M

V = Varistor
C = Capacitor

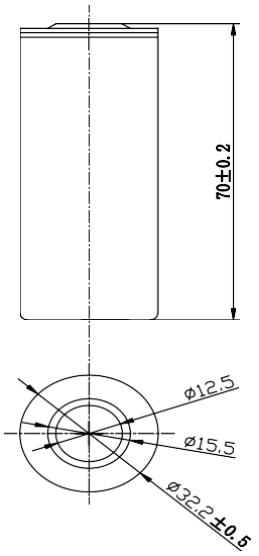
MOTOR DATA				
Part name	775-9008F-CC	775-9009F-C-CC	775-8013F-C-CC	775-5520F-CC
Diameter (mm)	45	45	45	45
Lenth (mm)	66	66	66	66
Nominal voltage (V)	7.2	12	18	24
Nominal speed (rpm)	12300	18000	18700	18400
Nominal torque (mNm)	80.0	102.6	100.8	94.3
Nominal current A	20.1	21.1	15.8	10.7
No load speed (rpm)	14600	21000	22000	21000
No load current A	3.20	2.80	3.00	1.70
Stall torque (mNm)	508.8	806.4	837.3	705.9
Starting current (A)	108.7	143.7	110.4	68.1
Output (W)	103	194	198	182
Efficiency (%)	72	77	70	71
Operating temperature deg. C	-10..+60	-10..+60	-10..+60	-10..+60

LiFePO4 Battery 32650-5Ah

沃特玛®
OptimumNano

Cylindrical Lithium Iron Phosphate Battery

OPT-32650F



Brief Introduction

OptimumNano always develop and produce **32650** cells to or assemble battery packs to satisfy the requirements of high performance and operational reliability of our customers. We also have the **14500/18650/22650/26650** cells to meet all your requirements.

Key Features

- Attractive cycle life
- Extended safety performance
- Wide operating temperature range
- Unrivalled high temperature performance
- Green energy without metal contaminant
- High capacity
- Steady output voltage
- Little self-discharge
- Double safety protection
- Withstanding very high level of vibrations and shocks

Safety Characteristics

- Over-charge/Over-discharge Ability to withstand over-charge/withstand over-discharge, and there is no fire, no exploding and work well
- Short circuit Ability to withstand short circuit, and there is no fire, no exploding
- Acupuncture Ability to withstand nail puncturing, and there is no fire, no exploding
- Thermal shock Ability to withstand thermal shock, and there is no fire, no exploding

Electrical Charateristics

Nominal Voltage	3.2V
Nominal Capacity (at 0.5C, 25 degC)	6Ah
Impedance (Max. at1000Hz)	≤10mΩ
Expected Cycle Life	More than 2000 cycles, with 1C charge and discharge rate, at 25 ℃

Mechanical Characteristics

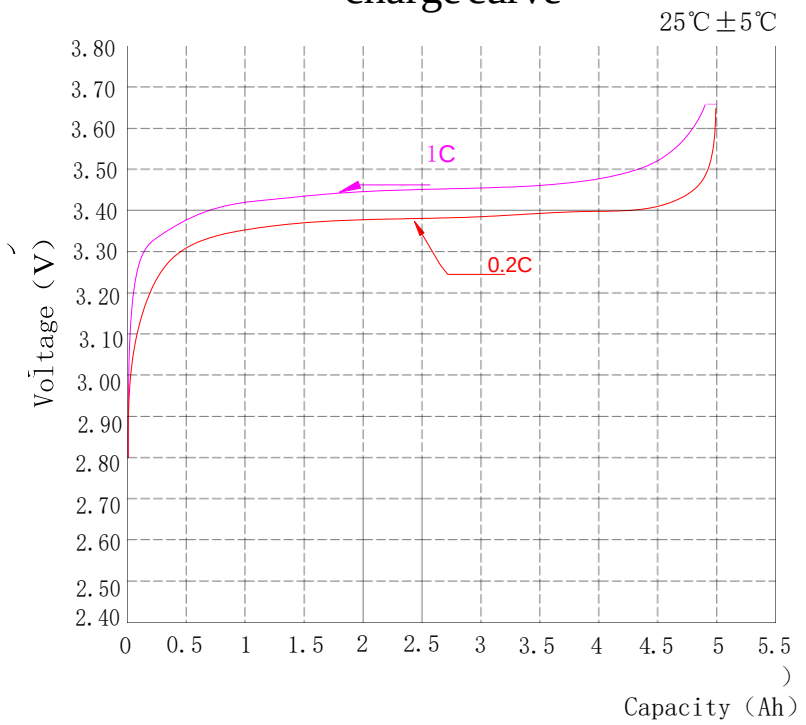
Diameter	32.2±0.5mm
Height	70.0±0.2mm
Weight	~145g

Operation Conditions

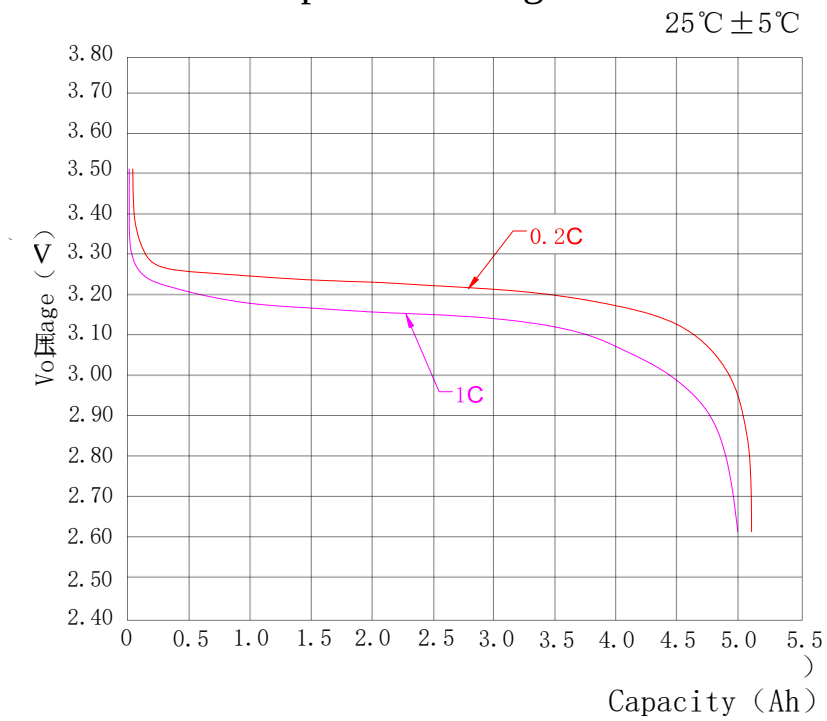
Charge Method	CC-CV
Max. Charge Voltage	3.65V
Continuous Charge Current	0.2C
Charge Temperature	0℃～45℃
Continuous Discharge Current	1C
Max. Discharge Current	2C
Peak Instant Discharge Current(10 Seconds)	3C
Discharge Cut-off Voltage	2.5V
Discharge Temperature	-20℃～65℃
Storage Temperature	-20℃～40℃
Self Discharge (Stored at 50% SOC)	<= 3%/month

Typical Performance Curve

charge curve



Diploid discharge curve



Storage and Transportation

1. Based on the character of cell, proper environment for transportation of LiFePO4 battery pack need to be created to protect the battery.
2. During transportation, 50% SOC must be kept to ensure that short circuit, appearance of liquid in the battery or immersion of battery in liquid never occur.
3. Battery should be kept at -20℃～45℃ in warehouse where it's dry, clean and well-ventilated.
4. During loading of battery, attention must be paid against dropping, turning over and serious stacking.

Warnings and Tips

In order to prevent the battery leaking, getting hot and exploding, please pay attention to preventing measure as following:

Warning!

- Never throw the battery into water, keep it under dry, shady and cool circumstance when not use.
- Never upside down the positive and negative.
- Never connect the positive and negative of battery with metal.
- Never ship or store the battery together with metal
- Never knock, throw or trample the battery.
- Never cut through the battery with nail or other edge tool.

Tips!

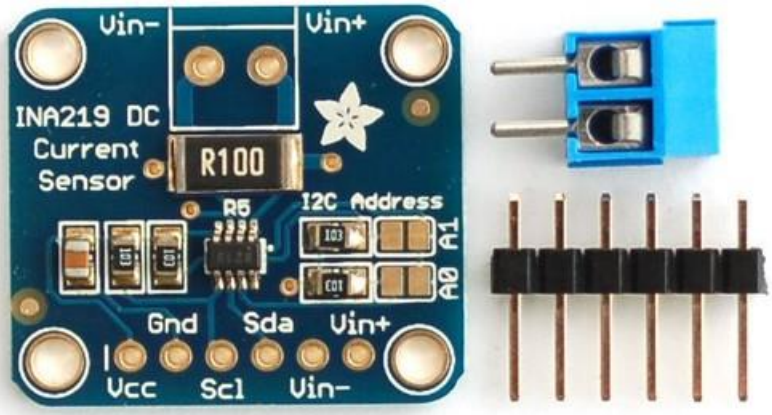
- Never use or keep the battery under the high temperature. Otherwise it will cause battery heat, get into fire or lose some function and reduce the life. The proposed temperature for long-term storage is 10-45℃.
- Never throw the battery into fire or heating machine to avoid fire, explosion and environment pollution; scrap battery should be returned to the supplier and handled by the recycle station.
- Never use the battery under strong static and strong magnetic field, otherwise it will destroy the protecting device.
- If battery leaked, the electrolyte get into eyes, please don't knead, please wash eyes by water and send to hospital. Otherwise it will hurt eyes.
- If battery emit peculiar smell, heating, distortion or appear any unconventionality during using, storage or charging process, please take it out from device or charge and stop using.
- Never cut the battery in socket directly; please use the stated charger when charging.
- Check the voltage of battery and relevant connectors before using the battery. It can't be used until everything turns out to be normal.
- Prior to charging, fully check the insulativity, physical condition and ageing status, since breakage and ageing are never allowed; the pack voltage must not be less than the cutoff voltage, if not, it's abnormal and that battery needs to be labeled. The user should contact our Customer Service Dept and it can't be charged until repaired by our staff.
- The battery should be stored in 50% SOC. It needs to be charged once if out of use for as long as half a year.
- Clean the dirty electrode, if any, with a clean dry cloth, or poor contact or operation failure may occur.

Contact US

OptimumNano Energy Co., Ltd
Add: No. 68, Lanjing North Road, Pingshan New District, Shenzhen, China 518118
Tel: +86-755-87640787 **Fax: +86-755-84630785**
E-mail: optimum@optimum-china.com **Web: www.optimumnanoenergy.com**

Overview

The INA219B breakout board will solve all your power-monitoring problems. Instead of struggling with two multimeters, you can use this breakout to measure both the high side voltage and DC current draw over I2C with 1% precision.



Why the High Side?

Most current-measuring devices such as our current panel meter are only good for *low side* measuring. That means that unless you want to get a battery involved, you have to stick the measurement resistor between the target ground and true ground.

Since the voltage drop across the resistor is proportional to the current draw, this means that the ground reference will change with varying current. Having a shifting ground reference can cause problems for many circuits.

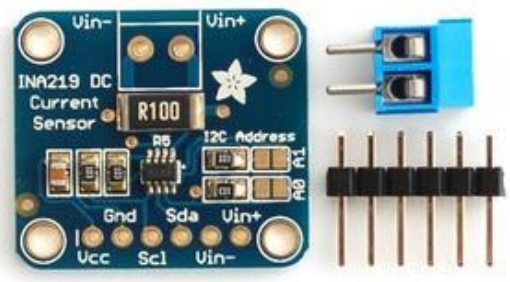
The INA219B chip is much smarter - it can handle high side current measuring, up to +26VDC, even though it is powered with 3 or 5V. It will also report back that high side voltage, which is great for tracking battery life or solar panels.

How does it work?

A precision amplifier measures the voltage across the 0.1 ohm, 1% sense resistor. Since the amplifier maximum input difference is ±320mV this means it can measure up to ±3.2 Amps. With the internal 12 bit ADC, the resolution at ±3.2A range is 0.8mA. With the internal gain set at the minimum of div8, the max current is ±400mA and the resolution is 0.1mA. Advanced hackers can remove the 0.1 ohm current sense resistor and replace it with their own to change the range (say a 0.01 ohm to measure up 32 Amps with a resolution of 8mA)

Note that when switching inductive loads, the instantaneous voltage levels may greatly exceed steady-state levels due to inductive kickback. Chip damage can occur if you do not take precautions to protect against

Assembly



The board comes with all surface-mount components pre-soldered. Additional parts are included to help integrate the INA219 breakout board into your project.

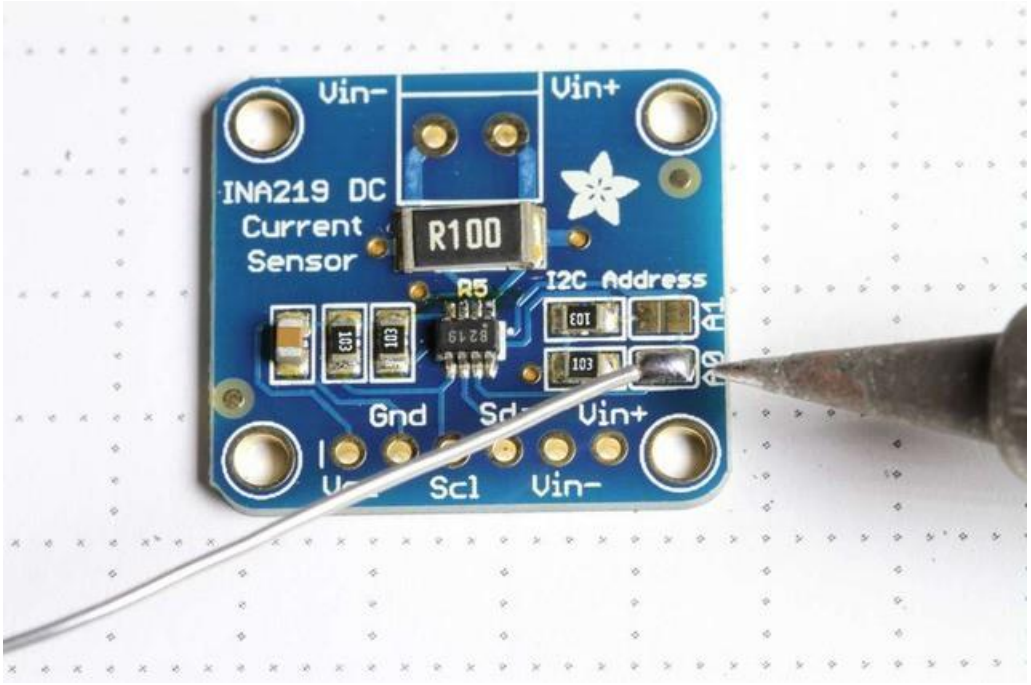
Wires can be soldered directly to the holes on the edge of the board. But for breadboard use, you will want to solder on the included 6-pin header.

The load can be connected via the header, or using the included 2-pin screw-terminal.

Addressing the Boards

If more than one INA219 breakout board is used, each board must be assigned a unique address. This is done with the address jumpers on the right edge of the board. The I2C base address for each board is 0x40. The binary address that you program with the address jumpers is added to the base I2C address.

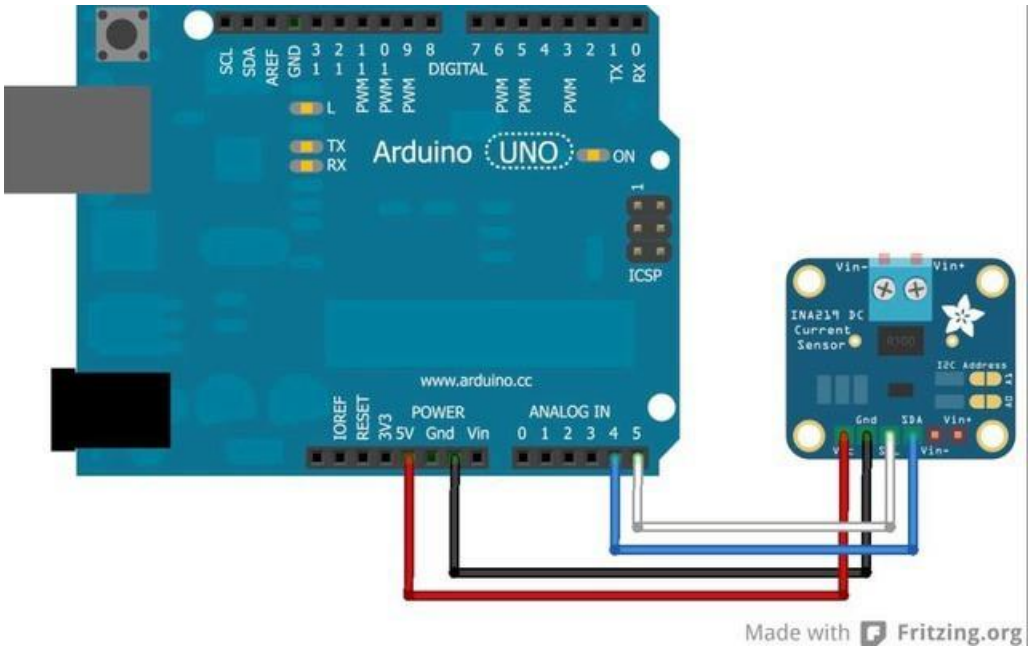
To program the address offset, use a drop of solder to bridge the corresponding address jumper for each binary '1' in the address.



Up to 4 boards may be connected. Addressing is as follows:
Board 0: Address = 0x40 Offset = binary 00000 (no jumpers required)
Board 1: Address = 0x41 Offset = binary 00001 (bridge A0 as in the photo above)
Board 2: Address = 0x44 Offset = binary 00100 (bridge A1)
Board 3: Address = 0x45 Offset = binary 00101 (bridge A0 & A1)

Wiring

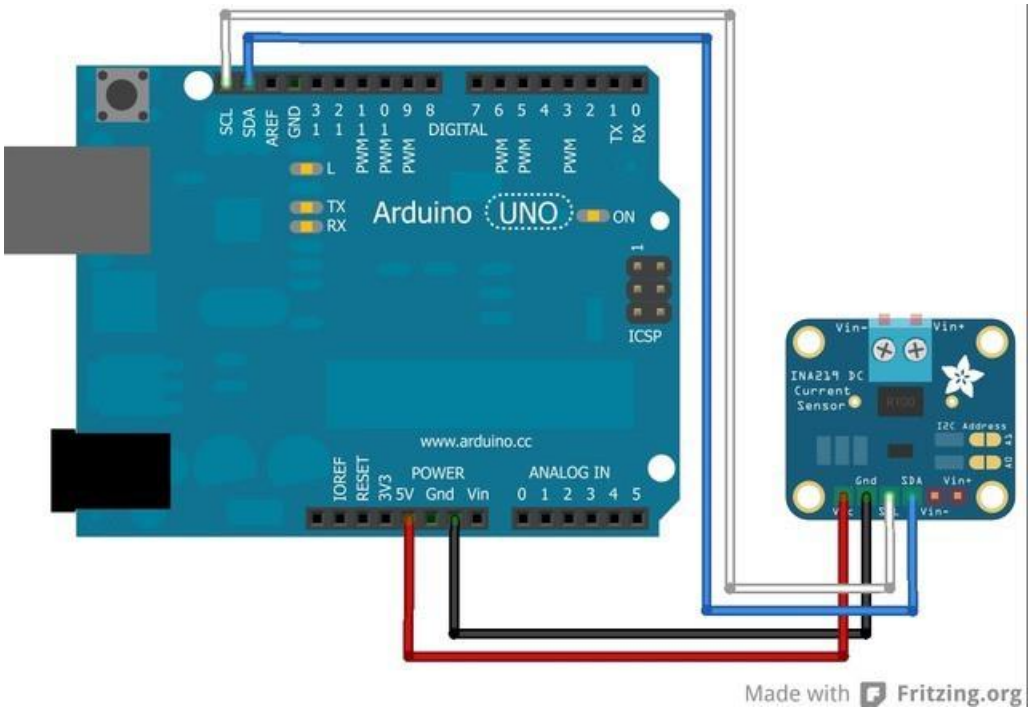
The INA219 breakout board can be powered by the 5v pin on your Arduino and communicates via I2C.



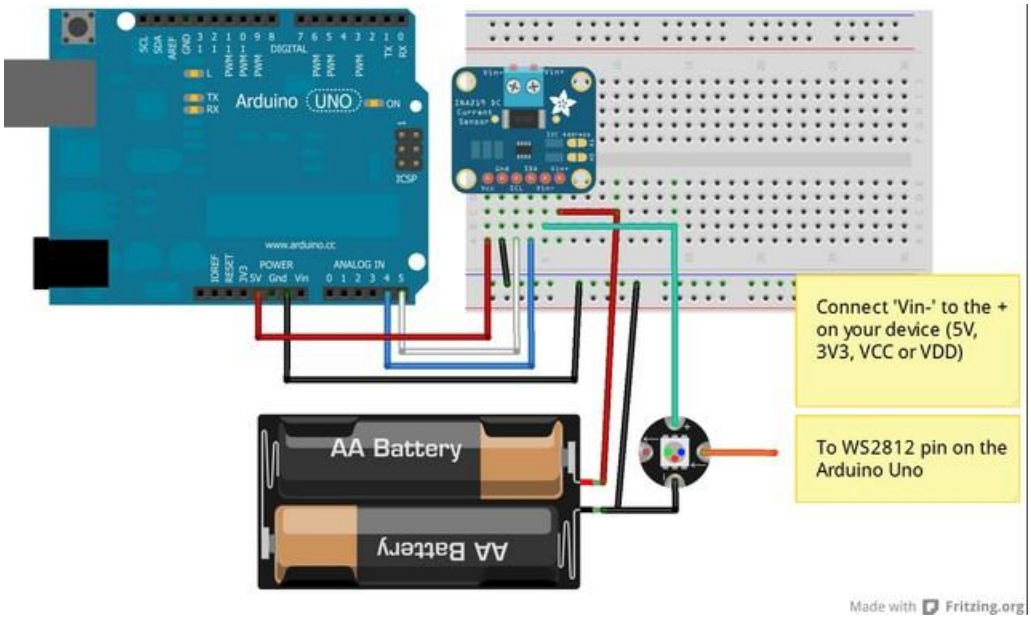
Connect to the microprocessor

- **Connect GND to GND**
- **Connect VCC to 5v**
- **Then connect SDA to SDA (Analog pin 4 on pre-R3 Arduinos)**
- **And connect SCL to SCL (Analog pin 5 on pre-R3 Arduinos)**

On R3 and later Arduinos, you can connect to the new dedicated SDA & SCL pins next to the AREF pin. On pre-R3 Megas, SDA & SCL are on pins 20 & 21.



Next we must insert the INA219 current sensor into the circuit we want to measure:



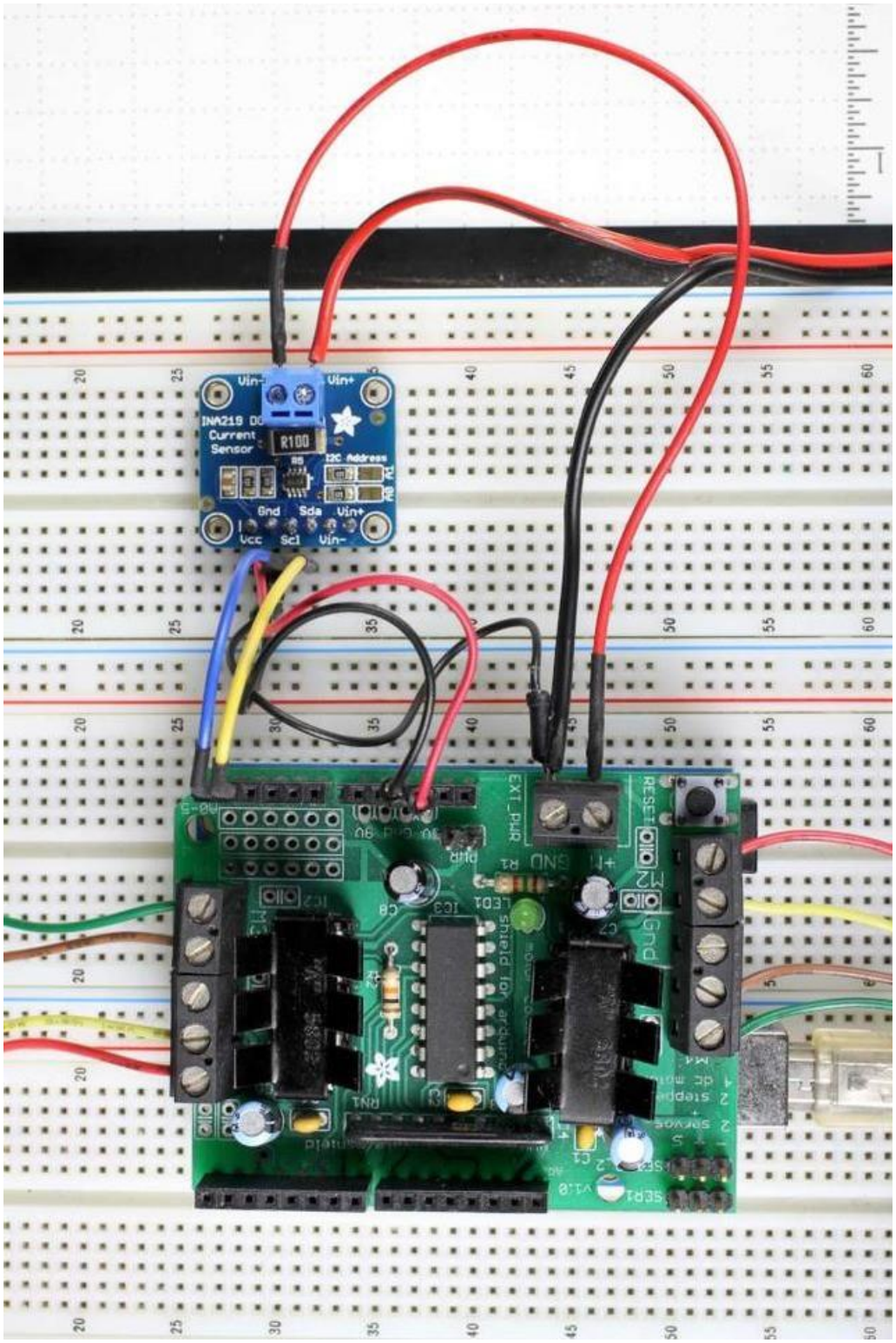
Be careful inserting noisy loads that can cause a sharp current draw, such as DC motors, since they can cause problems on the power lines and may cause the INA219 to reset, etc. When using a DC motor or a similar device, be sure to include a large capacitor to decouple the motor from the power supply and use a snubber diode to protect against inductive spikes.

Connect to the circuit

- **Connect V+ to the positive terminal of the power supply for the circuit under test.**

- **Connect V- to the positive terminal or lead of the load. This puts the sense resistor in-line with the circuit.**
- **Finally, connect a wire from the negative terminal of the power supply to GND. This allows the sensor to measure the load voltage as well as the load current.**

The photo below shows an INA219 breakout board configured to measure the motor supply current on an Adafruit Motor Shield.



Arduino Code

Programming the Adafruit INA219 breakout board is simple using our library:

Install the Library

- **Download the library from the Downloads button below**

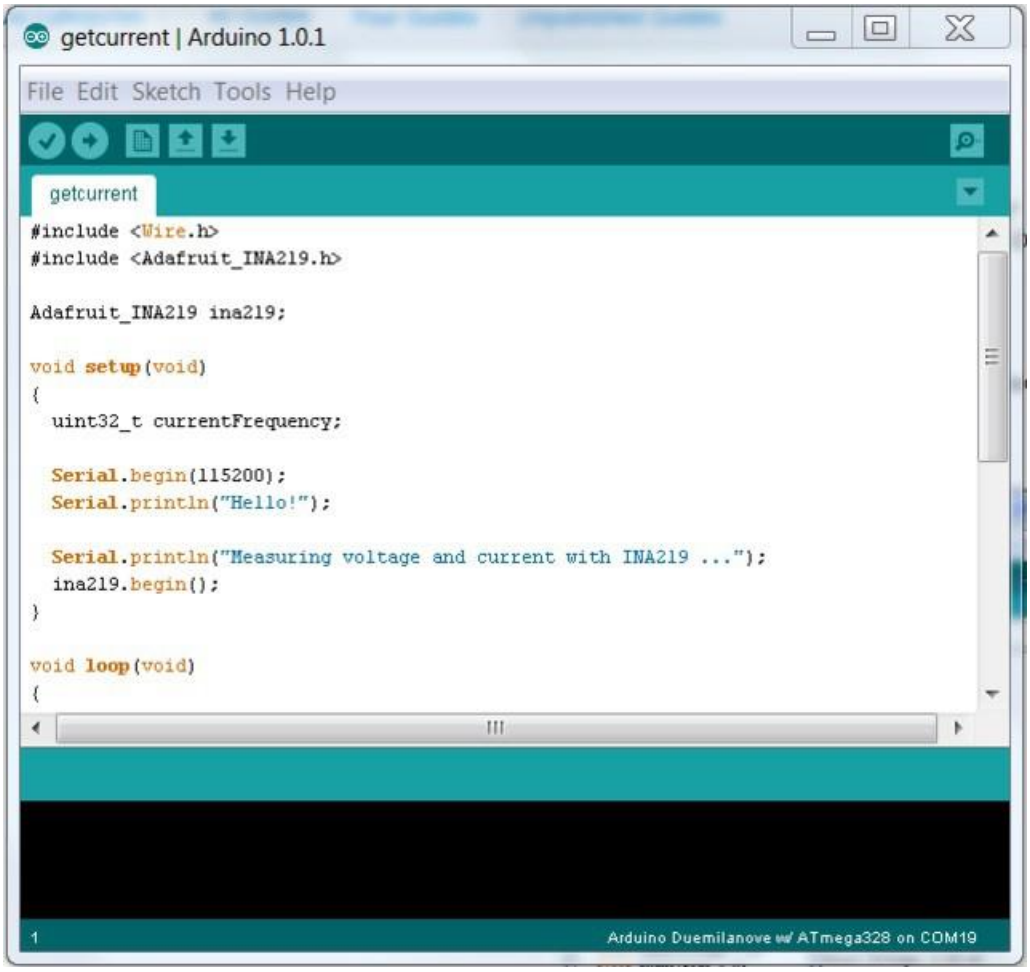
Download Adafruit_INA219

https://adafru.it/rMD

- **Expand the .zip file to the Libraries folder in your Arduino Sketchbook folder** *(If you don't know where this is, open File->Preferences in the IDE and it will tell you the location of your sketchbook folder)***.**
- **Rename the folder to Adafruit_INA219**
- **Close** *all* **instances of the IDE, then re-open one, so that the IDE will recognize the new library.**

Load the Example

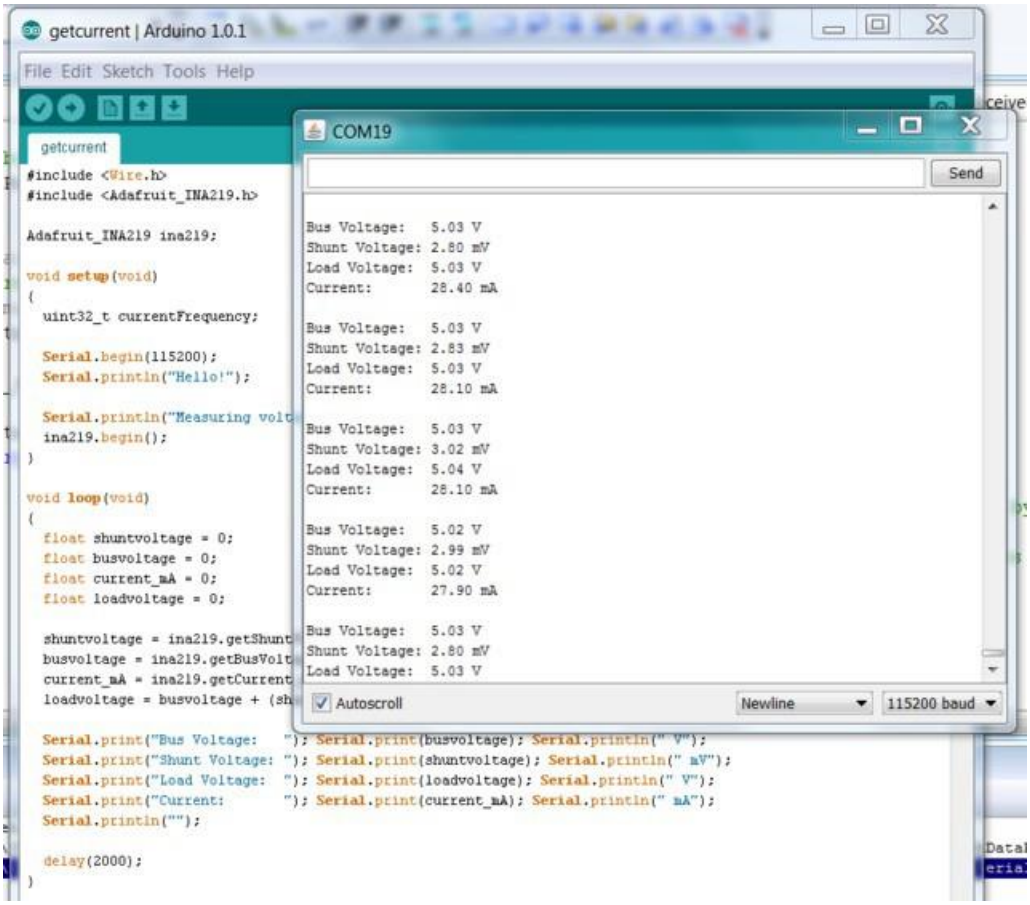
- **Select "***File->Examples->Adafruit_INA219->getcurrent***"**
- **The "getcurrent" example code should open in a new IDE window.**



Run it!

- **Click on the upload button in the IDE. When it is "done uploading"**
- **Open your Serial Monitor and set the speed to 115200 baud.**

The output should appear similar to the sample below:



Customize it

You can adapt, expand or modify the example code to suit your project requirements. For a detailed description of the available library functions, see the Library Reference on the next page:

Construction and Initialization Functions:

Adafruit_INA219(uint8_t addr = INA219_ADDRESS);

Constructs an instance of the Adafruit_INA219. If no address is specified, the default address (0x40) is used. If more than one INA219 module is connected, it should be addressed as shown on the Assembly page and the configured address passed to the constuctor.

void begin(void);

Initializes I2C communication with the Adafruit_INA219 device using the default configuration values.

Example:

```
#include <Wire.h>
#include <Adafruit_INA219.h>

Adafruit_INA219 ina219_A;
Adafruit_INA219 ina219_B(0x41);


void setup(void)
{
  ina219_A.begin(); // Initialize first board (default address 0x40)
  ina219_B.begin(); // Initialize second board with the address 0x41
}
```

Sensor Reading Functions:

float getBusVoltage_V(void);

Reads the voltage between GND and V-. This is the total voltage seen by the circuit under test. (Supply voltage - shunt voltage).

The return value is in Volts.

float getShuntVoltage_mV(void);

Reads the voltage between V- and V+. This is the measured voltage drop across the shunt resistor.

The return value is in Milivolts.

float getCurrent_mA(void);

Reads the current, derived via Ohms Law from the measured shunt voltage.

The return value is in Milliamps.

Example:

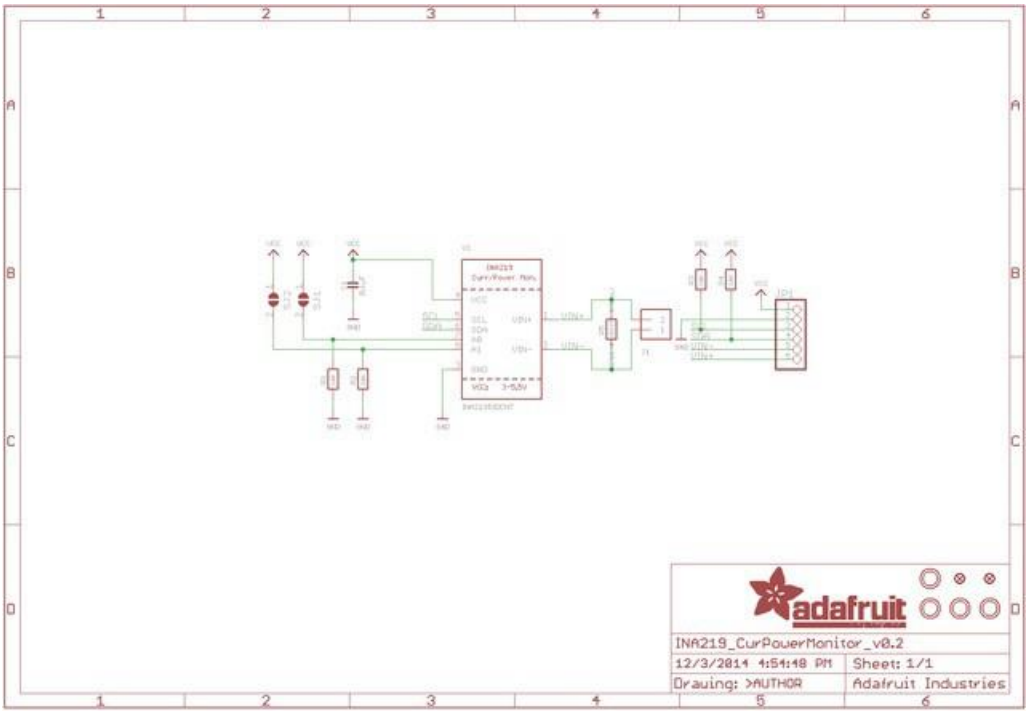
```
float shuntvoltage = 0;
float busvoltage = 0;
float current_mA = 0;
float loadvoltage = 0;

shuntvoltage = ina219.getShuntVoltage_mV();
busvoltage = ina219.getBusVoltage_V();
current_mA = ina219.getCurrent_mA();
loadvoltage = busvoltage + (shuntvoltage / 1000);

Serial.print("Bus Voltage:   "); Serial.print(busvoltage); Serial.println(" V");
Serial.print("Shunt Voltage: "); Serial.print(shuntvoltage); Serial.println(" mV");
Serial.print("Load Voltage:  "); Serial.print(loadvoltage); Serial.println(" V");
Serial.print("Current:       "); Serial.print(current_mA); Serial.println(" mA");
Serial.println("");
```

Downloads

Datasheets & Files

- Eagle PCB files for the INA219 breakout board
- Arduino driver library
- Data Sheet for the INA219 chip
- Fritzing object in the Adafruit Fritzing library

Schematic & Fabrication Print



Arduino 25V Voltage Sensor Module

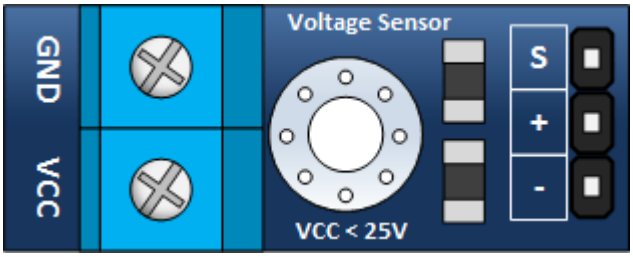
The Basics

The Arduino analog input is limited to a 5 VDC input. If you wish to measure higher voltages, you will need to resort to another means. One way is to use a voltage divider. The one discussed here is found all over Amazon and eBay.

It is fundamentally a 5:1 voltage divider using a 30K and a 7.5K Ohm resistor.

Keep in mind, you are restricted to voltages that are less than 25 volts. More than that and you will exceed the voltage limit of your Arduino input.

Basic Connection



Inputs

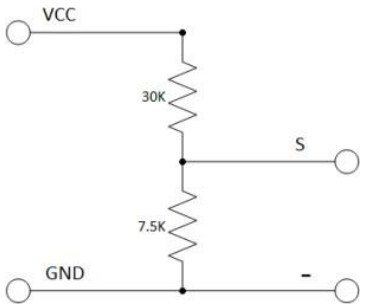
- **GND –** This is where you connect the low side of the voltage you are measuring. Caution! : This is the same electrical point as your Arduino ground.
- **VCC:** The is where you connect the high side of the voltage you are measuring

Outputs

- **S:** This connects to your Arduino analog input.
- **– (or minus):** This connects to your Arduino ground.
- **+:** This is not connected. It does absolutely nothing… zilch… nada… jack diddly doo doo.

Schematic

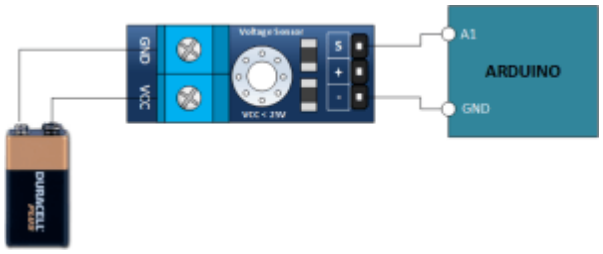
The schematic for this is pretty straight forward. As previously mentioned, its just a couple of resistors. In fact, you could build your own in a pinch.



Tutorial

The Connections

Find yourself a 9 volt battery and connect it, your voltage sensor module and Arduino as shown below.

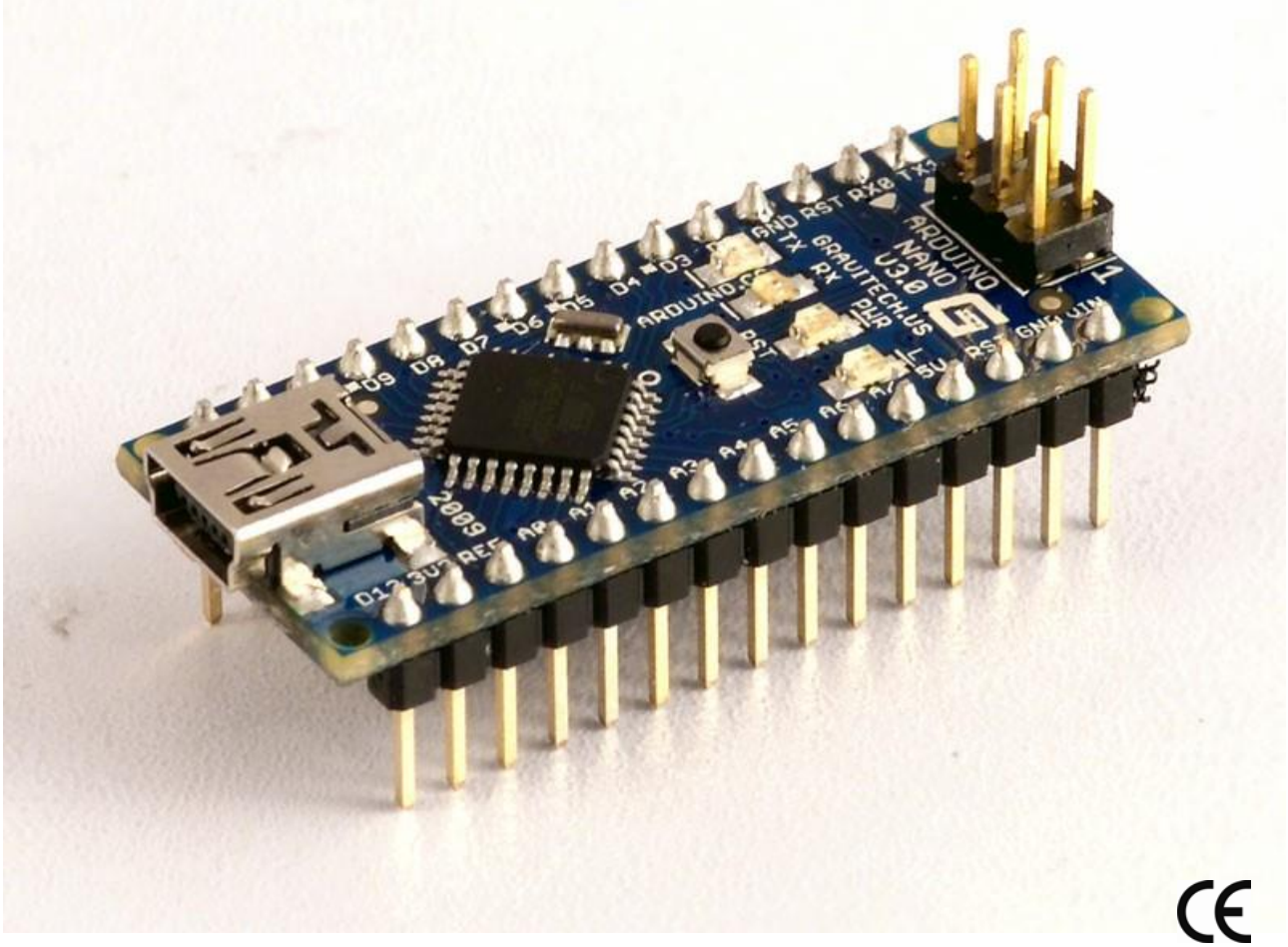


The Sketch

Enter the following sketch, upload it and go to town. If you open your Arduino serial monitor you will be able to see the voltage.

```
/*
DC Voltmeter Using a Voltage Divider
Based on Code Created By
T.K.Hareendran
*/

int analogInput = A1;
float vout = 0.0;
float vin =  0.0;
float R1 = 30000.0; //
float R2 = 7500.0; //
int value = 0;
void setup(){
   pinMode(analogInput, INPUT);
   Serial.begin(9600);
   Serial.print("DC VOLTMETER");
}
void loop(){
   // read the value at analog input
   value = analogRead(analogInput);
   vout = (value * 5.0) / 1024.0; // see text
   vin = vout / (R2/(R1+R2));

Serial.print("INPUT V= ");
Serial.println(vin,2);
delay(500);
}
```

Arduino Nano



Product Overview

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.0) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Nano was designed and is being produced by Gravitech.

Index

Technical Specification

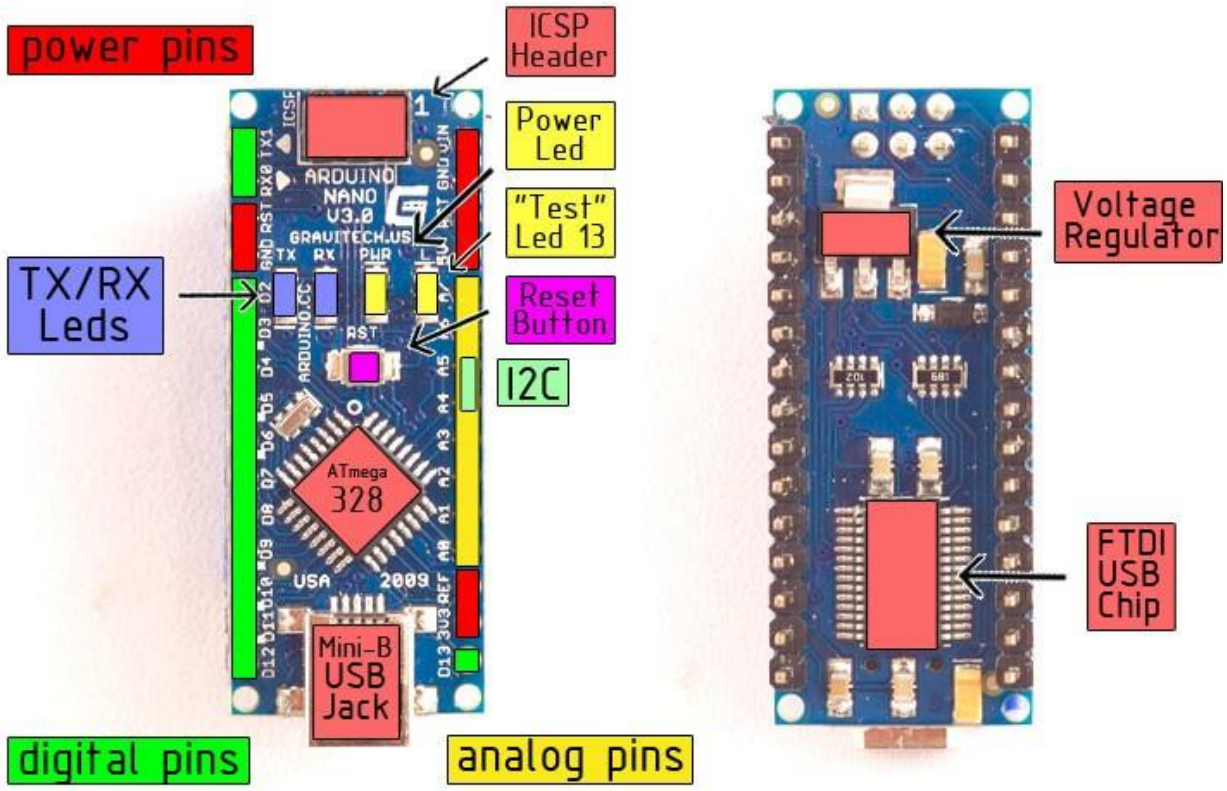
Arduino Nano 3.0 (ATmega328): schematic, Eagle files.

Arduino Nano 2.3 (ATmega168): manual (pdf), Eagle files. *Note:* since the free version of Eagle does not handle more than 2 layers, and this version of the Nano is 4 layers, it is published here unrouted, so users can open and use it in the free version of Eagle.

Summary

Microcontroller	Atmel ATmega168 or ATmega328
Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by bootloader
SRAM	1 KB (ATmega168) or 2 KB (ATmega328)
EEPROM	512 bytes (ATmega168) or 1 KB (ATmega328)
Clock Speed	16 MHz
Dimensions	0.73" x 1.70"

the board



Power

The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

The FTDI FT232RL chip on the Nano is only powered if the board is being powered over USB. As a result, when running on external (non-USB) power, the 3.3V output (which is supplied by the FTDI chip) is not available and the RX and TX LEDs will flicker if digital pins 0 or 1 are high.

Memory

The ATmega168 has 16 KB of flash memory for storing code (of which 2 KB is used for the bootloader); the ATmega328 has 32 KB, (also with 2 KB used for the bootloader). The ATmega168 has 1 KB of SRAM and 512 bytes of EEPROM (which can be read and written with the EEPROM library); the ATmega328 has 2 KB of SRAM and 1 KB of EEPROM.

Input and Output

Each of the 14 digital pins on the Nano can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip.
- **External Interrupts: 2 and 3.** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- **PWM: 3, 5, 6, 9, 10, and 11.** Provide 8-bit PWM output with the analogWrite() function.
- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).** These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.
- **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Nano has 8 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the analogReference() function. Additionally, some pins have specialized functionality:

- **I^2C: 4 (SDA) and 5 (SCL).** Support I^2C (TWI) communication using the Wire library (documentation on the Wiring website).

There are a couple of other pins on the board:

- **AREF.** Reference voltage for the analog inputs. Used with analogReference().
- **Reset.** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

See also the mapping between Arduino pins and ATmega168 ports.

Communication

The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega168 and ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with the Arduino software) provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Nano's digital pins.

The ATmega168 and ATmega328 also support I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. To use the SPI communication, please see the ATmega168 or ATmega328 datasheet.

Programming

The Arduino Nano can be programmed with the Arduino software (download). Select "Arduino Diecimila, Duemilanove, or Nano w/ ATmega168" or "Arduino Duemilanove or Nano w/ ATmega328" from the **Tools > Board** menu (according to the microcontroller on your board). For details, see the reference and tutorials.

The ATmega168 or ATmega328 on the Arduino Nano comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.

Automatic (Software) Reset

Rather then requiring a physical press of the reset button before an upload, the Arduino Nano is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the FT232RL is connected to the reset line of the ATmega168 or ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Nano is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Nano. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

How to use Arduino

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP).

Arduino is a cross-platoform program. You'll have to follow different instructions for your personal OS. Check on the Arduino site for the latest instructions. *http://arduino.cc/en/Guide/HomePage*

Linux Install

Windows Install

Mac Install

Once you have downloaded/unzipped the arduino IDE, you'll need to install the FTDI Drivers to let your PC talk to the board. First **Plug the Arduino to your PC via USB cable.**

Blink led

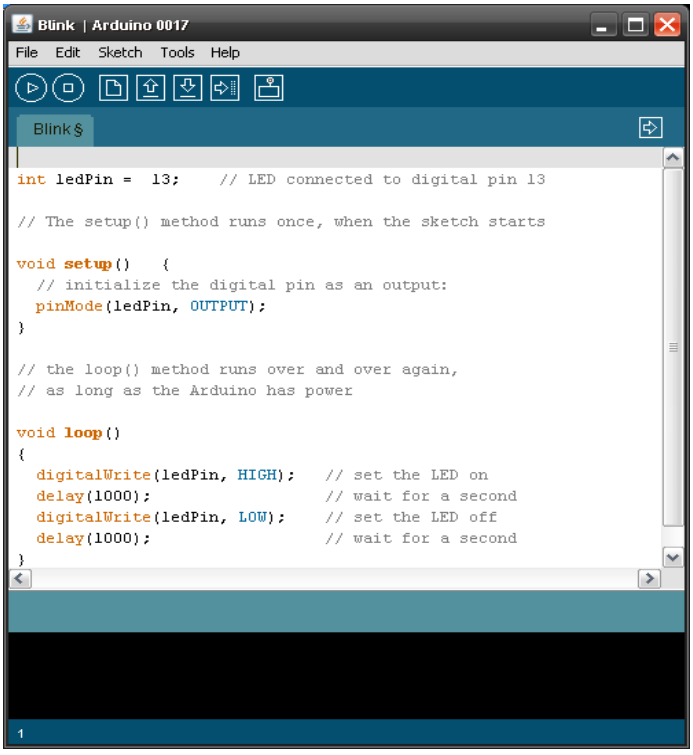
Now you're actually ready to "burn" your first program on the arduino board. To select "blink led", the physical translation of the well known programming "hello world", select

File>Sketchbook>
Arduino-0017>Examples>
Digital>Blink

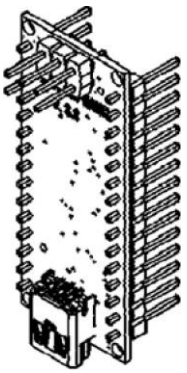
Once you have your skecth you'll see something very close to the screenshot on the right.

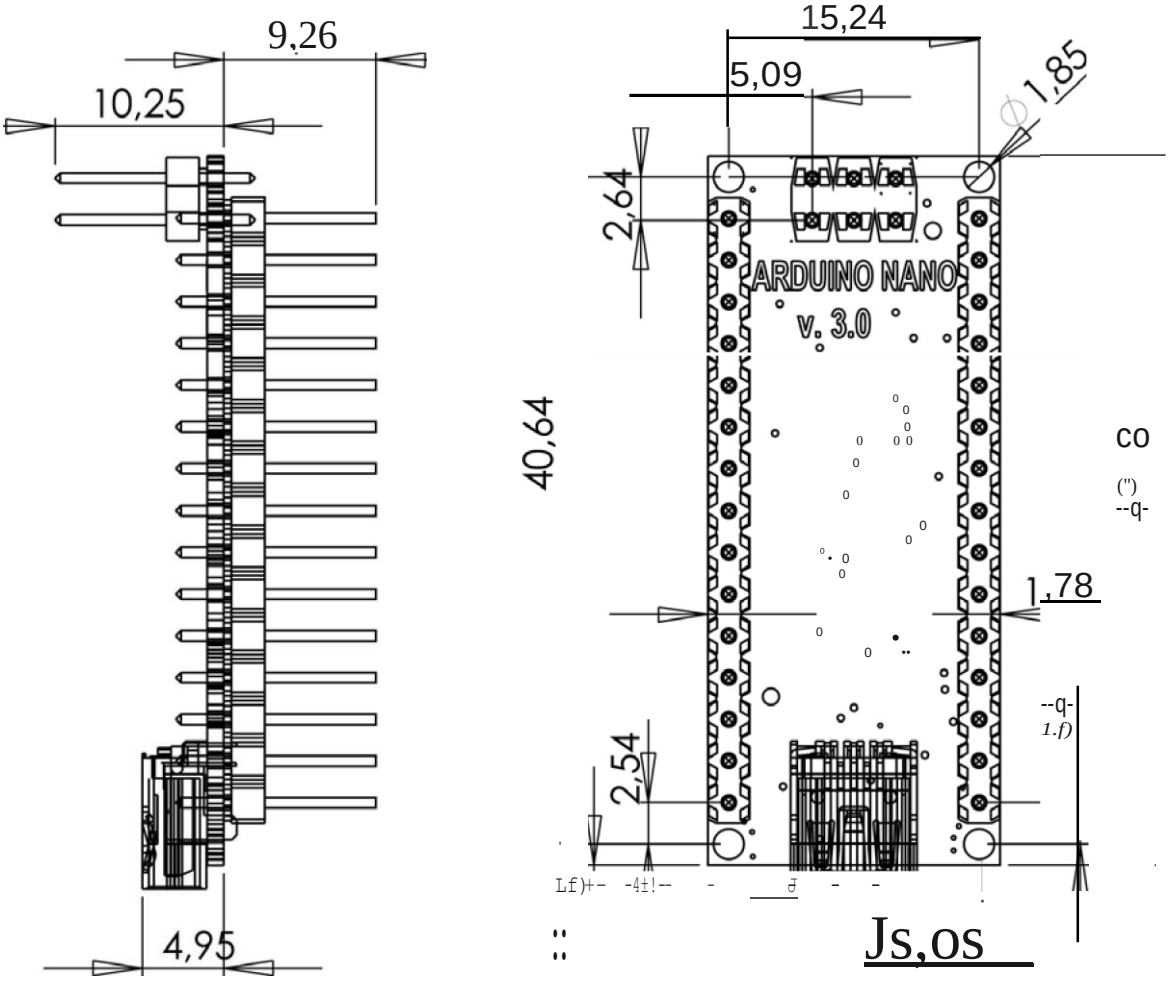
In **Tools>Board** select Arduino NANO and with the AtMEGA you're using (probably 328)

Now you have to go to
Tools>SerialPort
and select the right serial port, the one arduino is attached to.



Dimensioned Drawin





Terms & Conditions

1. Warranties

1.1 The producer warrants that its products will conform to the Specifications. This warranty lasts for one (1) years from the date of the sale. The producer shall not be liable for any defects that are caused by neglect, misuse or mistreatment by the Customer, including improper installation or testing, or for any products that have been altered or modified in any way by a Customer. Moreover, The producer shall not be liable for any defects that result from Customer's design, specifications or instructions for such products. Testing and other quality control techniques are used to the extent the producer deems necessary.

1.2 If any products fail to conform to the warranty set forth above, the producer's sole liability shall be to replace such products. The producer's liability shall be limited to products that are determined by the producer not to conform to such warranty. If the producer elects to replace such products, the producer shall have a reasonable time to replacements. Replaced products shall be warranted for a new full warranty period.

1.3 EXCEPT AS SET FORTH ABOVE, PRODUCTS ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." THE PRODUCER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING PRODUCTS, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE

1.4 Customer agrees that prior to using any systems that include the producer products, Customer will test such systems and the functionality of the products as used in such systems. The producer may provide technical, applications or design advice, quality characterization, reliability data or other services. Customer acknowledges and agrees that providing these services shall not expand or otherwise alter the producer's warranties, as set forth above, and no additional obligations or liabilities shall arise from the producer providing such services.

1.5 The Arduino™ products are not authorized for use in safety-critical applications where a failure of the product would reasonably be expected to cause severe personal injury or death. Safety-Critical Applications include, without limitation, life support devices and systems, equipment or systems for the operation of nuclear facilities and weapons systems. Arduino™ products are neither designed nor intended for use in military or aerospace applications or environments and for automotive applications or environment. Customer acknowledges and agrees that any such use of Arduino™ products which is solely at the Customer's risk, and that Customer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

1.6 Customer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products and any use of Arduino™ products in Customer's applications, notwithstanding any applications-related information or support that may be provided by the producer.

2. Indemnification

The Customer acknowledges and agrees to defend, indemnify and hold harmless the producer from and against any and all third-party losses, damages, liabilities and expenses it incurs to the extent directly caused by: (i) an actual breach by a Customer of the representation and warranties made under this terms and conditions or (ii) the gross negligence or willful misconduct by the Customer.

3. Consequential Damages Waiver

In no event the producer shall be liable to the Customer or any third parties for any special, collateral, indirect, punitive, incidental, consequential or exemplary damages in connection with or arising out of the products provided hereunder, regardless of whether the producer has been advised of the possibility of such damages. This section will survive the termination of the warranty period.

4. Changes to specifications

The producer may make changes to specifications and product descriptions at any time, without notice. The Customer must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." The producer reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The product information on the Web Site or Materials is subject to change without notice. Do not finalize a design with this information.

Shenzhen Global Technology Co., Ltd

4 cell 16.8V 40A 18650 lithium battery protection board (with recovery function - AUTO Recovery)

Model: BMS-40A-4S-E / B / S

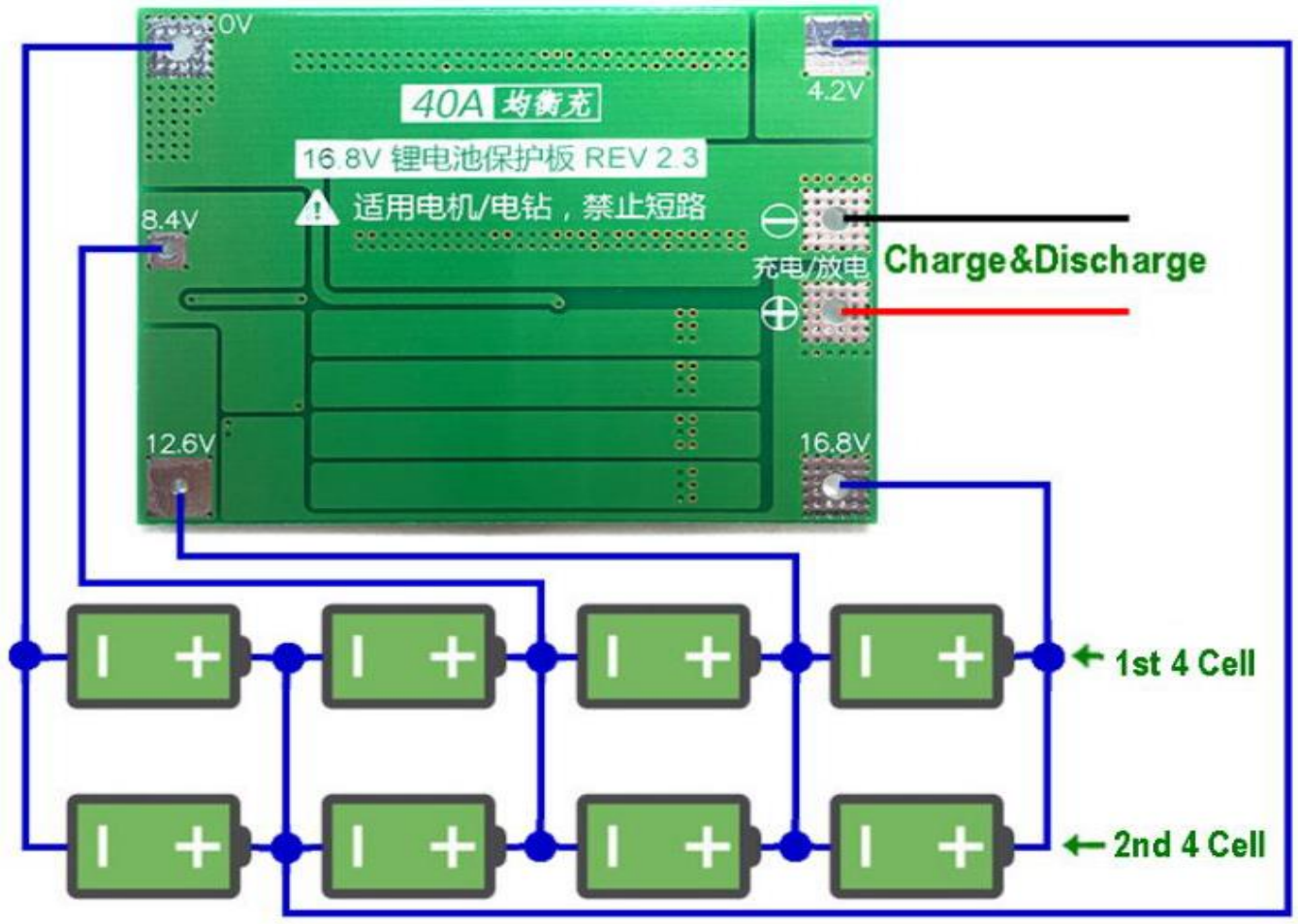
Integrated with 10 low internal resistance MOSFETS, continuous discharge 40A, 100mA equalizing current, suitable for electric drills, sprayers, LED lights, low power inverters (400W).

BMS-40A-4S-S Standard BMS 4 cell 16.8V 40A lithium battery protection board (with recovery function - AUTO Recovery)
Starting motor less than 60A / power less than 100W.
BMS-40A-4S-E Same as above with the difference of Starting motor less than 80A / power less than 135W.

BMS-40A-4S-B Battery balance version, Starting motor less than 80A / power less than 135W.

Application range: Suitable for lithium batteries with a normal voltage of 3.7V and fully charged 4.2V.
including 1860 to 26650, Polymer lithium batteries.
PCB Size: -Std & Enh. 55 x 45 x 3.4mm
"PCB Size: -Balance 60 x 46 x 3.4mm
Weight: 9.3g and 10.3g
Charging Voltage: 16.8 ~ 18.1V
Continues discharge max: 40A
If heat dissipation environment is not adequate please reduce load
Continues discharge normal: 40A
Standard version (-S): Applicable to start electric motor with current below 60A and power up to 100W.
Enhanced version (-E): Applicable to start electric motor with current below 80A and power up to 135W, with interference function.

Recommended conditions:



Shenzhen Global Technology Co., Ltd

4S40A : Electric parameter	Min	Nor	Max	Unit	Notes
Self consuming current	12	18	24	uA	
Overcharge protection voltage	4.2	4.25	4.3	V	
Balance charging start voltage	4.17	4.12	4.23	V	Balanced Version
Balance current	95	100	105	mA	Balanced Version
Balance charging Power	1.56	1.72	1.91	W	Balanced Version
Over-charge recovery voltage	4.1	4.15	4.2	V	
Over-discharge protection voltage A	2.4	2.5	2.6	V	
Voltage after over discharge protection	2.8	3	3.2	V	1C Discharge
Voltage after over discharge protection	3.2	3.5	3.8	V	2C Discharge
Over-discharge recovery voltage	2.9	3.2	3.3	V	
Rds（on）	2.5	3	3.5	mΩ	
Over-current protection current (-S)	54	60	66	A	Standard version
Over-current protection current (-B & -E)	70	80	90	A	Balance & Enhanced Version
Over-current delay time	100	150	200	ms	
Continue work current	0	40	40	A	Resistive load
Continue output power	0	672	672	W	Resistive load
Environment temperature	-40	25	85	°C	

Trouble shooting:

Fault phenomenon	Fault Checking and Causes	Action
Unable to charge	Measure the voltage of 4 batteries. If the voltage of one group of batteries is exceeds about 4.25V, the protection board will start overcharge protection.	Match the batteries well, and don't mix the good batteries with the bad ones (normal function, no warranty)
Unable to discharge	Measure the voltage of 4 groups of batteries. If the voltage of one group of batteries is less than 2.7V, the protection board will start overcharge protection.	Match the batteries well, and don't mix the good batteries with the bad ones (normal function, no warranty)
Charge / discharge failure	0V、4.2V、8.4V、12.6V, 16.8V wrong connection	Rewire or renew the board (Human fault, no warranty)
Overcharge/over-discharge failure	0V、4.2V、8.4V、12.6V, 16.8V wrong connection	Rewire or renew the board (Human fault, no warranty)
Discharge protection	Check the battery pack whether has sufficient discharge capacity and the starting current of the load whether exceeds the over-current protection current of the protective board.	Replacement of batteries with stronger discharge or protective board with larger current (beyond working range, no warranty
Element virtual welding	There is no connection between one pin of the component and PCB welding.	by return)
Element continuous welding	There is a short circuit between two or more pins of a component.	Remove components and re-weld (Maintainable by return)
Electrostatic breakdown A	In the absence of electricity, measure the G, D and S pins of MOS transistors. If the forward and reverse resistances of any two pins are 0Ω, it has been damaged.	Removal and replacement MOSFETs transistors
Electrostatic breakdown B	Remove the MOSFET's transistors and measure the resistance values of G and D poles, G and S pins. If there is breakdown, the resistance should be infinite under normal conditions.	Removal and replacement MOSFETs transistors

Note 1: The successful start of the drill requires three 15C-20C power battery, or six 10C-15C power battery (ordinary 18650 cannot start the drill!!).

Note 2: Strictly according to map wiring 0V, 4.2V, 8.4V, 12.6V, 16.8V, do not deliberately short circuit.

Note 3: When the load of the brush motor is used, try to connect a non-polar capacitor (withstand voltage above 25V, capacity 10uF-100uF) to the motor's positive and negative terminals to prevent the reverse spike from the motor. Break the MOSFET's.

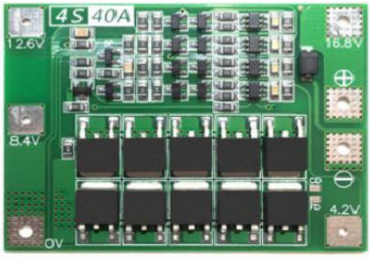
Note 4: 4 groups of batteries in series, please ensure that the voltage of each group of batteries, if not the same, please fill each battery separately and then use in series.

For battery test, discharge and the voltage that drop faster in a particular battery group there are poor batteries in this group.

For some of the poor basis of electronic customers to explain:

Balanced charge is only auxiliary functions, try not to put a good battery and poor battery mixed together! 4 sets of battery capacity / resistance closer to the better! (3 good battery +1 Poor battery use effect = 4 poor battery use effect).

BALANCE VERSION



ENHANCED VERSION

Shenzhen City, Guangdong Science and Technology Co., Ltd. Address: China's Shenzhen Futian District, Shenzhen Huaqiang North Road

DATA SHEET

Code: SCC-30A-PWM-LCD

SOLAR CHARGE CONTROLLER **SCC-30A-PWM-LCD**

Solar panels are a clean and ecological source of electricity. Obtaining this energy, however, poses a number of challenges for device designers. The amount of energy produced by the panel is strongly dependent on the angle of incidence and the intensity of the light falling on the surface of the cells. This, in turn, leads to unstable power supply parameters at the output, as even shading a small part of the panel may drastically reduce the efficiency.

The optimal solution to the above-mentioned problems is the use of a set consisting of a solar panel, a battery and a charge controller. Such a set allows to ensure constant parameters of power supply to receivers, and also to store energy produced excessively for later use.

The SCC-30A-PWM-LCD solar charge controller allows you to connect panels connected to each other both in series and in parallel - remembering not to exceed the permissible values of current and voltage at the input of the device. Due to the operating characteristics of the PWM controllers, it should be remembered that when the panels are connected in series, the rated voltage at the output for charging the battery is 24V.

Attention! Solar controllers are adapted to work with solar panels. Do not use them with any other power source.

Regulation Type:	PWM
Rated voltage:	12 / 24 V
Rated current:	30 A
Permitted voltage range:	• ≤ 23 V for 12 V battery - The range of the highest operating voltage of a set of panels connected to one input of the controller • ≤ 46 V for 24 V battery - The range of the highest operating voltage of a set of panels connected to one input of the controller
Output voltage:	Equal to the voltage at the battery terminals
Battery charging current:	max. 30 A
Load Current:	max. 10 A
Main features:	• 2 x USB power output : 5 V / 2.5 A, • The device is designed to charge only AGM, gel and lead-acid batteries, • LCD display, • LED diodes indicating the device operation status, • Operation modes : - 24H - the load is powered all the time - 1H ... 23H - the load is powered for the selected number of hours after sunset - 0H - the load is powered from dusk till dawn
Weight:	0.13 kg
Dimensions:	134 x 70 x 30 mm

DELTA-OPTI Monika Matysiak; https://www.delta.poznan.pl
POL; 60-713 Poznań; Graniczna 10
e-mail: delta-opti@delta.poznan.pl; tel: +(48) 61 864 69 60

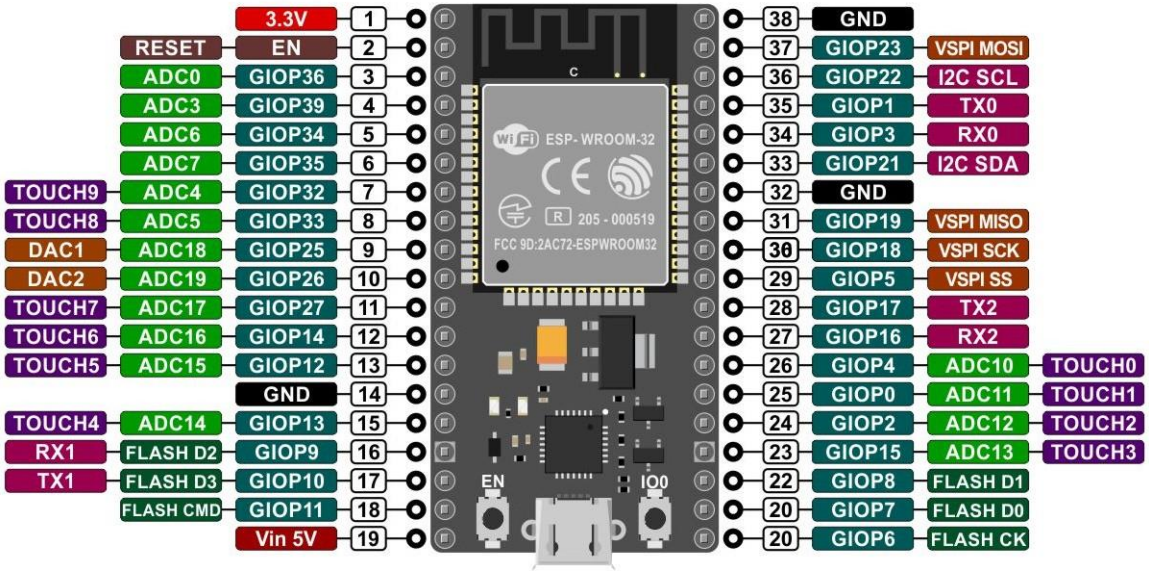
ESP32

- **Periferal pada ESP32**

Sebagaimana pernah dibahas pada tulisan yang lalu, ESP32 memiliki periferal sebagai berikut

- 18 kanal ADC (Analog-to- Digital Converter)
- 3 antarmuka SPI
- 3 antarmuka UART
- 2 antarmuka I2C
- 16 kanal output PWM
- 2 kanal DAC (*Digital to Analog Converte*r)
- 2 antarmuka I2S
- 10 GPIO sensor kapasitif

Fitur ADC (*analog to digital Converter*) dan DAC (*Digital To Analog Converter)* spesifik dapat digunakan hanya pada pin -pin tertentu saja. Sedangkan fitur UART, I2C, SPI, PWM dapat diaktifkan secara *programmatically.* Berikut adalah diagram pin – pin pada *development Board* ESP32



Meskipun begitu, tidak semua pin dengan fitur tertentu pada ESP32 cocok digunakan untuk semua keperluan di dalam project. Tabel berikut menunjukkan pin – pin yang paling baik digunakan sebagai input, output dan beberapa catatan yang perlu diperhatikan saat menentukan pin mana yang digunakan.

Pin yang diberi *highlight* hijau, bisa digunakan di dalam project. Sedangkan pin dengan *highlight* kuning bisa digunakan namun dengan catatan yang perlu diperhatikan, karena terdapat perilaku yang tak terduga terutama saat proses boot. Pin dengan highlight merah tidak direkomendasikan sebagai **input** ataupun **output**.

GPIO	Input	Output	Catatan
0	pulled up	OK	output sinyal PWM saat **boot**
1	TX pin	OK	output debug saat **boot**
2	OK	OK	Terhubung ke LED on board
3	OK	TX pin	HIGH saat boot
4	OK	OK	
5	OK	OK	output sinyal PWM saat boot
6	x	x	terhubung dengan SPI Flash terintegrasi
7	x	x	terhubung dengan SPI Flash terintegrasi
8	x	x	terhubung dengan SPI Flash terintegrasi
9	x	x	terhubung dengan SPI Flash terintegrasi
10	x	x	terhubung dengan SPI Flash terintegrasi
11	x	x	terhubung dengan SPI Flash terintegrasi
12	OK	OK	boot gagal ketika mendapatkan input high
13	OK	OK	
14	OK	OK	output sinyal PWM saat boot
15	OK	OK	output sinyal PWM saat boot
16	OK	OK	
17	OK	OK	
18	OK	OK	
19	OK	OK	
20	OK	OK	
21	OK	OK	
22	OK	OK	
23	OK	OK	
24	OK	OK	

25	OK	OK	
26	OK	OK	
27	OK	OK	
28	OK	OK	
29	OK	OK	
30	OK	OK	
31	OK	OK	
32	OK	OK	
33	OK	OK	
34	OK	OK	
35	OK	OK	
36	OK		Hanya input
37	OK		Hanya input
38	OK		Hanya input
39	OK		Hanya input

- **Pin Hanya Untuk Input**

GPIO 34 hingga 39 hanyalah dipergunakan sebagai input. Pin – pin tersebut tidak memiliki *pull up internal* atau resistor pull down. Berikut adalah pin – pin tersebut

- GPIO 34
- GPIO 35
- GPIO 36
- GPIO 39

- **SPI flash terintegrsi dengan ESP-WROOM-32**

GPIO 6 hingga GPIO 11 dapat diakses oleh beberapa *development board* ESP32. Namun pin – pin tersebut terhubung kepada **SPI Flash** yang teritegrasi dengan ESP-WROOM-32 sehingga tidak direkomendasikan digunakan untuk keperluan lain. Jadi jangan gunakan pin – pin berikut

- GPIO 6 (SCK/CLK)
- GPIO 7 (SDO/SD0)
- GPIO 8 (SDI/SD1)
- GPIO 9 (SHD/SD2)
- GPIO 10 (SWP/SD3)
- GPIO 11 (CSC/CMD)

- **Capacitive touch GPIO**

ESP32 memiliki 10 sensor sentuh kapasitif yang dapat mengindera benda apapun yang menyimpan muatan listrik seperti kulit manusia. Sehingga pin – pin tersebut dapat mendeteksi variasi induksi ketika GPIO disentuh dengan jari. Pin ini dapat dengan mudah diintegrasikan dengan bantalan kapasitif dan menggantikan tombol mekanik.

Berikut adalah sensor internal sentuh yang terhubung dengan GPIO

- T0 (GPIO 4)
- T1 (GPIO 0)
- T2 (GPIO 2)
- T3 (GPIO 15)
- T4 (GPIO 13)
- T5 (GPIO 12)
- T6 (GPIO 14)
- T7 (GPIO 27)
- T8 (GPIO 33)
- T9 (GPIO 32)

- **Analog to Digital Converter (ADC)**

ESP32 memiliki 18 kanal masukan ADC 12 bit, sedangkan ESP8266 hanya 1 kanal ADC 10 bit. Berikut adalah GPIO yang dapat dipergunakan sebagai ADC berikut dengan kanalnya.

- ADC1_CH0 (GPIO 36)
- ADC1_CH1 (GPIO 37)
- ADC1_CH2 (GPIO 38)
- ADC1_CH3 (GPIO 39)
- ADC1_CH4 (GPIO 32)
- ADC1_CH5 (GPIO 33)
- ADC1_CH6 (GPIO 34)
- ADC1_CH7 (GPIO 35)
- ADC2_CH0 (GPIO 4)
- ADC2_CH1 (GPIO 0)
- ADC2_CH2 (GPIO 2)
- ADC2_CH3 (GPIO 15)
- ADC2_CH4 (GPIO 13)
- ADC2_CH5 (GPIO 12)
- ADC2_CH6 (GPIO 14)
- ADC2_CH7 (GPIO 27)
- ADC2_CH8 (GPIO 25)
- ADC2_CH9 (GPIO 26)

- **Digital to Analog Converter (DAC)**

Ada 2 kanal DAC 8 bit pada ESP32 yang berfungsi untuk mengubah sinyal digital ke keluaran tegangan analog. Berikut adalah GPIO dan kanal tersebut

- DAC1 (GPIO25)
- DAC2 (GPIO26)

- **GPIO Real Time Clock**

ESP32 juga dilengkapi dengan GPIO yang diarahkan ke RTC subsistem rendah daya yang dapat digunakan ketika ESP32 dalam kondisi *deep sleep.* GPIO RTC ini dapat digunakan untuk membangungkan ESP32 dari kondisi deep sleep ketika co-prosesor ULP (*Ultra Low Power*) sedang berjalan. Berikut adalah GPIO yang dapat digunakan sebagai *external wake up source*

- RTC_GPIO0 (GPIO36)
- RTC_GPIO3 (GPIO39)
- RTC_GPIO4 (GPIO34)
- RTC_GPIO5 (GPIO35)
- RTC_GPIO6 (GPIO25)
- RTC_GPIO7 (GPIO26)
- RTC_GPIO8 (GPIO33)
- RTC_GPIO9 (GPIO32)
- RTC_GPIO10 (GPIO4)
- RTC_GPIO11 (GPIO0)
- RTC_GPIO12 (GPIO2)
- RTC_GPIO13 (GPIO15)
- RTC_GPIO14 (GPIO13)
- RTC_GPIO15 (GPIO12)
- RTC_GPIO16 (GPIO14)
- RTC_GPIO17 (GPIO27)

- **PWM**

ESP32 memiliki 16 kanal PWM independen yang dapat dikonfigurasi untuk menghasilkan sinyal PWM dengan pengaturan yang berbeda – beda. Semua pin yang dapat menjadi keluaran dapat dipergunakan sebagai pin PWM (kecuali GPIO 34 hingga 39)

Untuk mengatur sinyal PWM, perlu ditentukan terlebih dahulu parameter – parameter berikut pada program

- Frekuensi gelombang;
- *Duty cycle*;
- Kanal PWM;
- GPIO mana yang dipergunakan sebagai keluaran gelombang.

- **I2C (Inter-Integrated Circuit)**

Jika pembaca memprogram ESP32 menggunakan Arduini IDE, ada dua pin *default* yang mendukung I2C dan didukung oleh pustaka `Wire`, yaitu

- GPIO 21 (SDA)
- GPIO 22 (SCL)

- **SPI (*Serial Peripheral Interface*)**

Secara *default*, *mapping* pin untuk SPI di ESP 32 adalah sebagai berikut :

SPI	MOSI	MISO	CLK	CS
VSPI	GPIO 23	GPIO 19	GPIO 18	GPIO 5
HSPI	GPIO 13	GPIO 12	GPIO 14	GPIO 15

- **Interrupts**

Semua GPIO pada ESP32 dapat diatur sebagai *Interrupt*

- **Strapping Pins**

ESP32 memiliki 6 pin *strapping* sebagai berikut

- GPIO 0
- GPIO 2
- GPIO 4
- GPIO 5
- GPIO 12
- GPIO 15

Pin – pin tersebut digunakan oleh ESP32 saat mode *flashing* atau *bootloader*. Pada sebagian besar board development yang memiliki USB/Serial built-in. kondisi state pin ini tidak perlu dikuatirkan. Karena board yang akan mengaturnya ke kondisi yang sesuai saat mode *flashing* atau *boot*.

Meskipun begitu, jika terdapat periferal yang terhubung dengan ke-6 pin tersebut. Ada kemungkinan, proses *flashing* akan mengalami masalah. Penyebabnya bisa jadi karena periferal yang terhubung dengan pin – pin tersebut mencegah ESP32 masuk ke mode *flashing* atau *boot*.

- **Pin berada pada kondisi HIGH saat Boot**

Beberapa GPIO berubah kondisi *state*nya menjadi HIGH atau keluaran sinyal PWM saat boot atau reset. Ini berarti, akan terdapat keluaran yang tak terduga saat pin – pin GPIO berikut berada pada kondisi **reset** atau **boot.**

- GPIO 1
- GPIO 3
- GPIO 5
- GPIO 6 s/d GPIO 11 (terhubung dengan ESP32 yang terintegrasi dengan memori flash SPI – tidak direkomendasikan untuk digunakan).
- GPIO 14
- GPIO 15

- **Enable (EN)**

Pin **Enable** (EN) adalah pin enable regulator 3.3V yang di-pullup dengan resistor sehingga mengetanahkan pin tersebut (menghubungkan ke ground), akan mendisable regulator 3.3V. Sehingga pin ini dapat dihubungkan dengan *push button* misalnya, guna merestart ESP32

- **Arus Yang Dapat Ditarik Pada GPIO**

Arus maksimal yang dapat ditarik oleh periferal di tiap GPIO adalah 12mA, sebagaimana tertulis pada *datasheet*

Parameter	Symbol	Min	Max	Unit
Input low voltage	V_{IL}	-0.3	$0.25 \times V_{IO}$	V
Input high voltage	V_{IH}	$0.75 \times V_{IO}$	3.3	V
Input leakage current	I_{IL}	-	50	nA
Output low voltage	V_{OL}	-	$0.1 \times V_{IO}$	V
Output high voltage	V_{OH}	$0.8 \times V_{IO}$	-	V
Input pin capacitance	C_{pad}	-	2	pF
VDDIO	V_{IO}	1.8	3.3	V
Maximum drive capability	I_{MAX}	-	12	mA
Storage temperature range	T_{STR}	-40	150	°C

Ultrasonic Ranging Module HC - SR04

Product features:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:
(1) Using IO trigger for at least 10us high level signal,
(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
(3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
Test distance = (high level time×velocity of sound (340M/S) / 2,

Wire connecting direct as following:

- 5V Supply
- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground

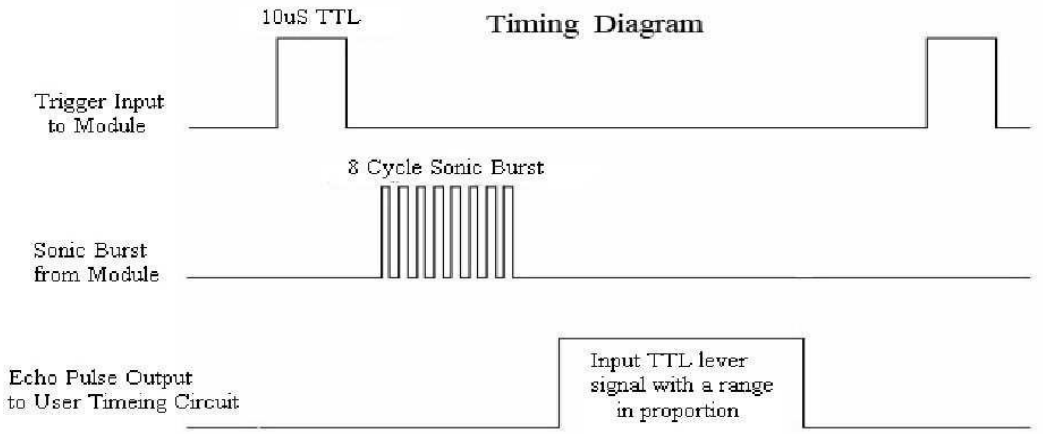
Electric Parameter

Working Voltage	**DC 5 V**
Working Current	**15mA**
Working Frequency	**40Hz**
Max Range	**4m**
Min Range	**2cm**
MeasuringAngle	**15 degree**
Trigger Input Signal	**10uS TTL pulse**
Echo Output Signal	**Input TTL lever signal and the range in proportion**
Dimension	**45*20*15mm**

Vcc Trig Echo GND

Timing diagram

The Timing diagram is shown below. You only need to supply a short 10uS pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula: uS / 58 = centimeters or uS / 148 =inch; or: the range = high level time * velocity (340M/S) / 2; we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.



Attention:

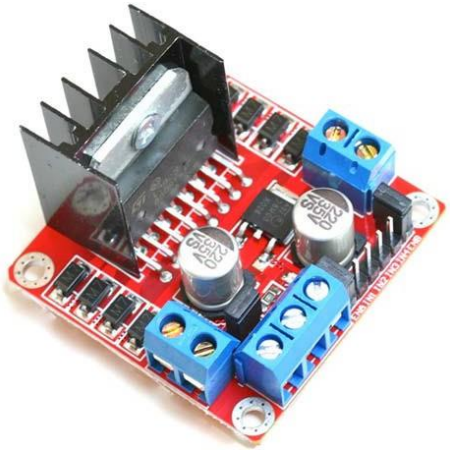
- The module is not suggested to connect directly to electric, if connected electric, the GND terminal should be connected the module first, otherwise, it will affect the normal work of the module.
- When tested objects, the range of area is not less than 0.5 square meters and the plane requests as smooth as possible, otherwise ,it will affect the results of measuring.

www.Elecfreaks.com

User Guide

L298N Dual H-Bridge Motor Driver

This dua l bidirectional motor driver, is based on the very popular L298 Dual H-Bridge Motor Driver Integrated Circuit. The circuit will allow you to easily and independently control two motors of up to 2A each in both directions.It is ideal for robotic applications and well suited for connection to a microcontroller requiring just a couple of control lines per motor. It can also be interfaced with simple manual switches, TTL logic gates, relays, etc. This board equipped with power LED indicators, on-board +5V regulator and protection diodes.

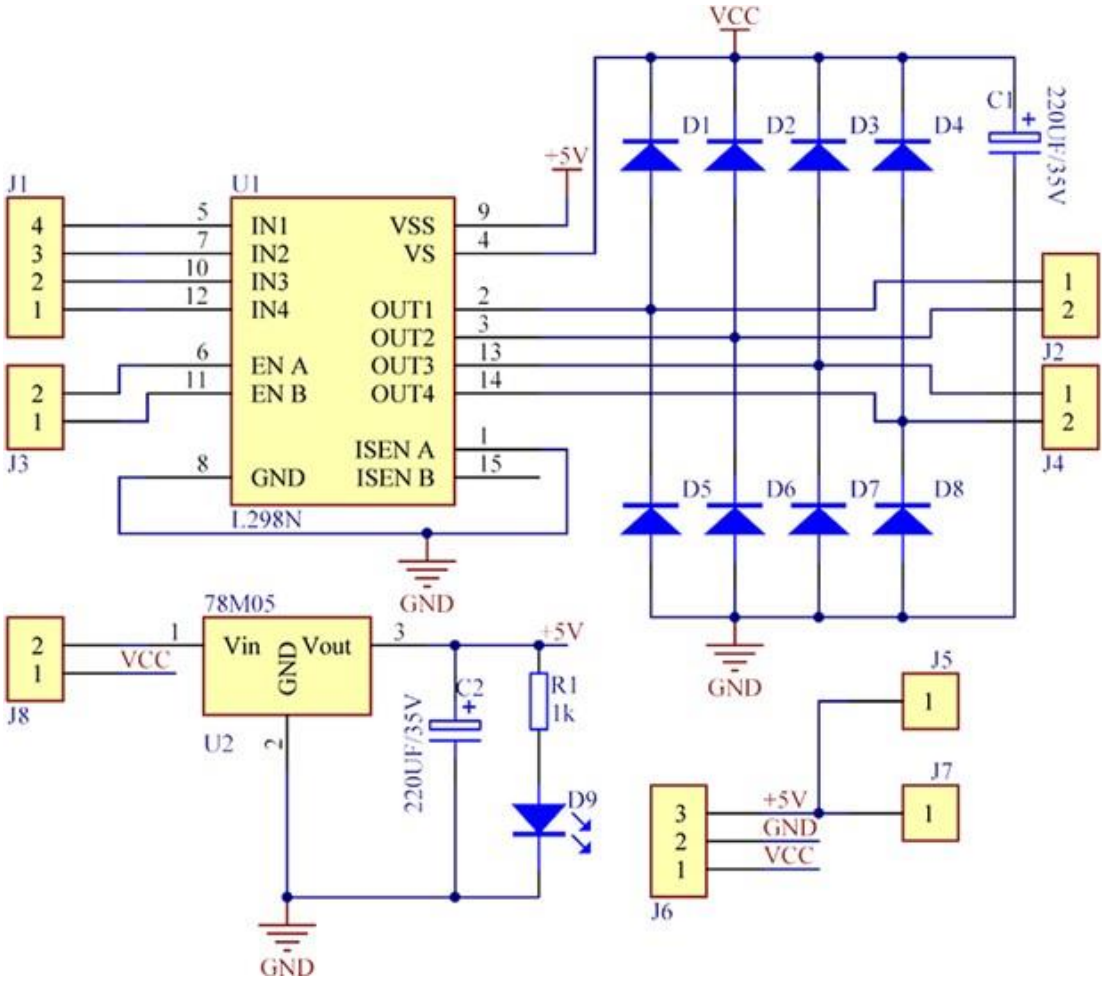


SKU: MDU-1049

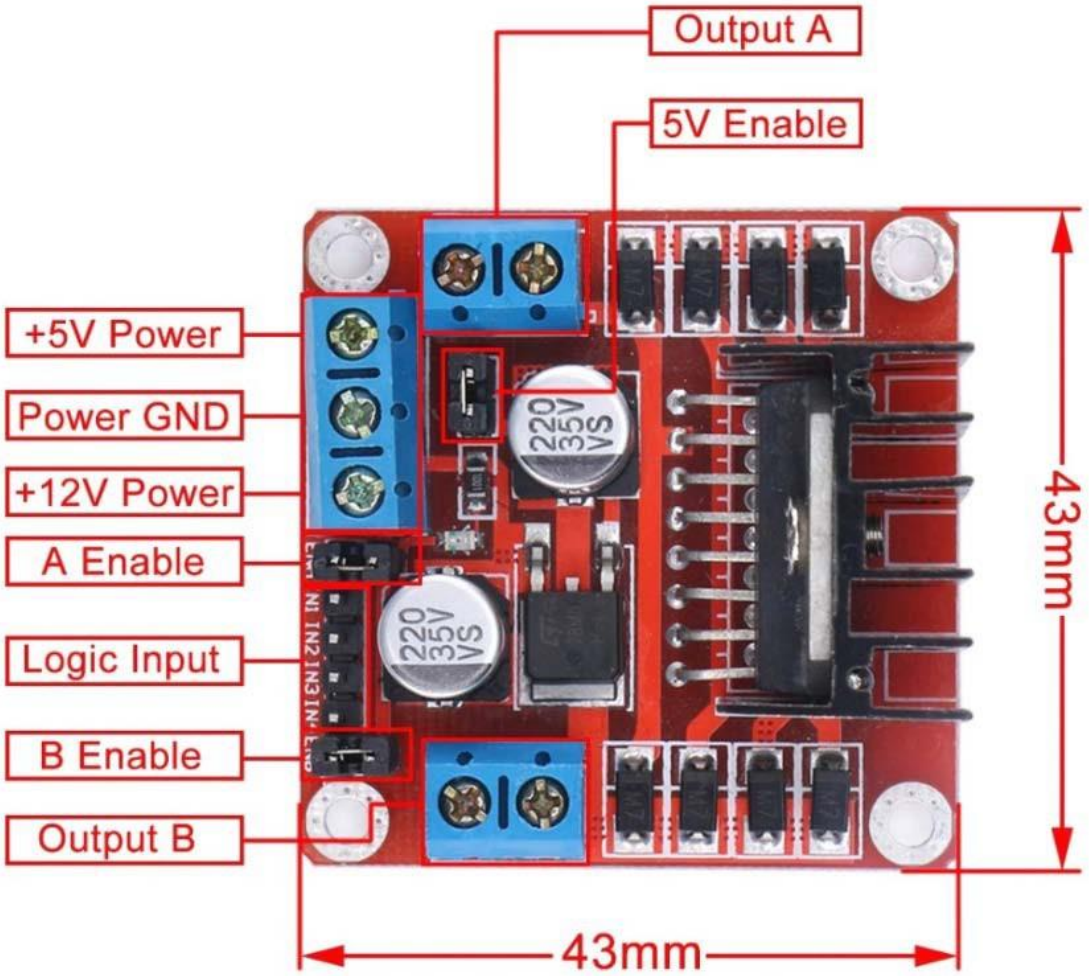
Brief Data:

- Input Voltage: 3.2V~40Vdc.
- Driver: L298N Dual H Bridge DC Motor Driver
- Power Supply: DC 5 V - 35 V
- Peak current: 2 Amp
- Operating current range: 0 ~ 36mA
- Control signal input voltage range :
- Low: -0.3V ≤ Vin ≤1.5V.
- High: 2.3V ≤ Vin ≤Vss.
- Enable signal input voltage range :
    - Low: -0.3 ≤ Vin ≤ 1.5V (control signal is invalid).
    - High: 2.3V ≤ Vin ≤ Vss (control signal active).
- Maximum power consumption: 20W (when the temperature T = 75 ℃).
- Storage temperature: -25 ℃ ~ +130 ℃.
- On-board +5V regulated Output supply (supply to controller board i.e. Arduino).
- Size: 3.4cm x 4.3cm x 2.7cm

Schematic Diagram:



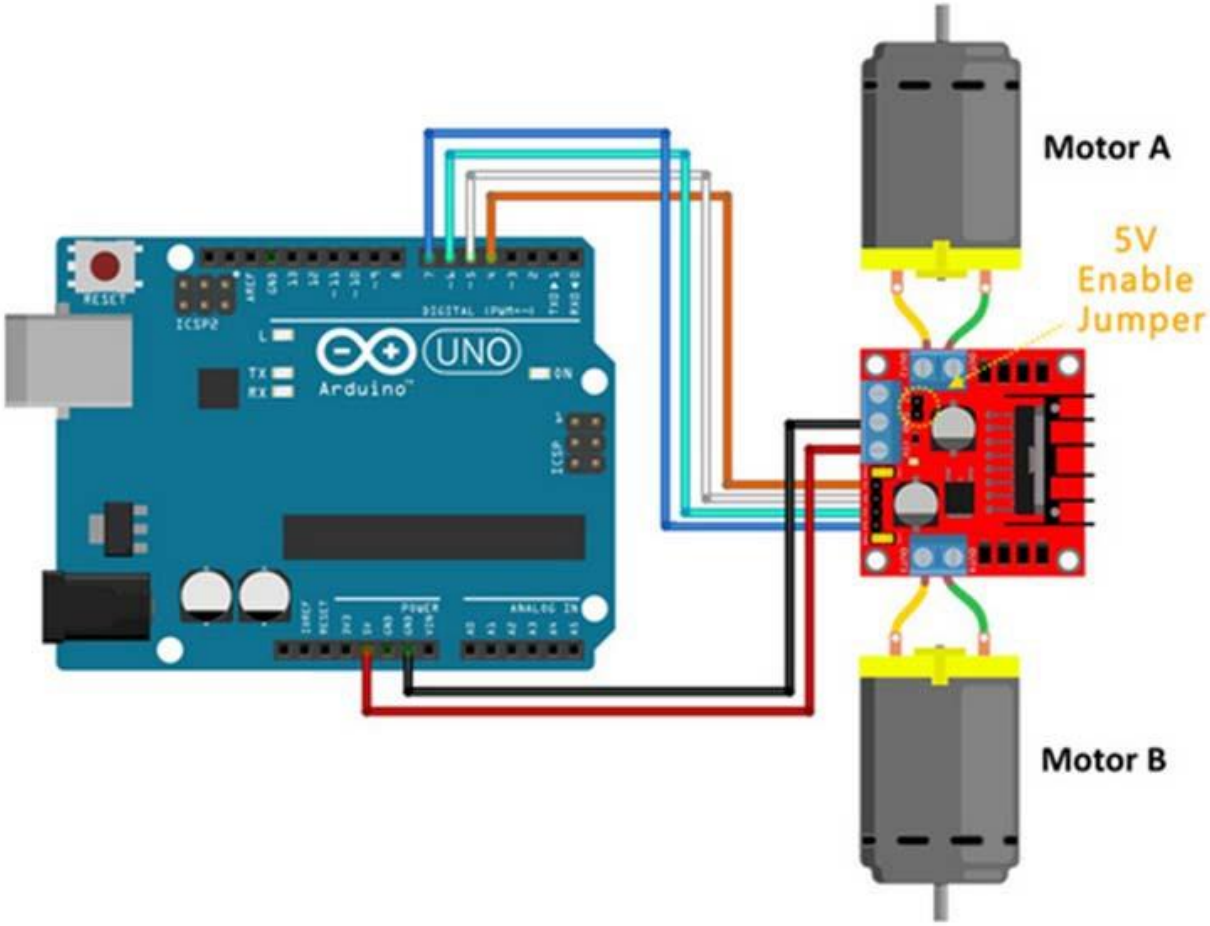
Board Dimension & Pins Function:



Connection Examples:

Controlling 2-DC Motor with +5V Arduino onboard Power Supply:

Below is the circuit connection use the on-board +5V power supply from Arduino board, and should be done without the 5V Enable Jumper on (Active 5V). This connection can drive two 5V DC motors simultaneously.



Sketch Listing:

Copy and paste the sketch below to Arduino IDE and upload to Arduino Uno/Mega board.

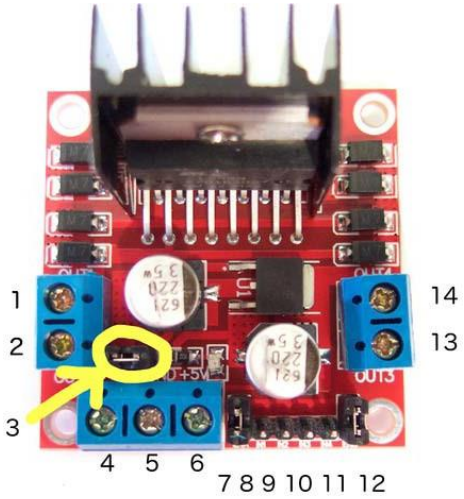
```
/*========================================================================
//  Author      : Handson Technology
//  Project     : Arduino Uno
//  Description : L298N Motor Driver
//  Source-Code : L298N_Motor.ino
//  Program: Control 2 DC motors using L298N H Bridge Driver
//========================================================================
*/

// Definitions Arduino pins connected to input H Bridge
int IN1 = 4;
int IN2 = 5;
int IN3 = 6;
int IN4 = 7;

void setup()
{
 // Set the output pins
```

```
 pinMode(IN1, OUTPUT);
 pinMode(IN2, OUTPUT);
 pinMode(IN3, OUTPUT);
 pinMode(IN4, OUTPUT);
}

void loop()
{
 // Rotate the Motor A clockwise
 digitalWrite(IN1, HIGH);
 digitalWrite(IN2, LOW);
 delay(2000);
 // Motor A
 digitalWrite(IN1, HIGH);
 digitalWrite(IN2, HIGH);
 delay(500);

 // Rotate the Motor B clockwise
 digitalWrite(IN3, HIGH);
 digitalWrite(IN4, LOW);
 delay(2000);
 // Motor B
 digitalWrite(IN3, HIGH);
 digitalWrite(IN4, HIGH);
 delay(500);

 // Rotates the Motor A counter-clockwise
 digitalWrite(IN1, LOW);
 digitalWrite(IN2, HIGH);
 delay(2000);
 // Motor A
 digitalWrite(IN1, HIGH);
 digitalWrite(IN2, HIGH);
 delay(500);

 // Rotates the Motor B counter-clockwise
 digitalWrite(IN3, LOW);
 digitalWrite(IN4, HIGH);
 delay(2000);
 // Motor B
 digitalWrite(IN3, HIGH);
 digitalWrite(IN4, HIGH);
 delay(500);
}
```

Controlling Stepper Motor

In this example we have a typical NEMA-17 stepper motor with four wires:

The key to successful stepper motor control is identifying the wires - that is which one is which. You will need to determine the A+, A-, B+ and B- wires. With our example motor these are red, green, yellow and blue. Now let's get the wiring done.



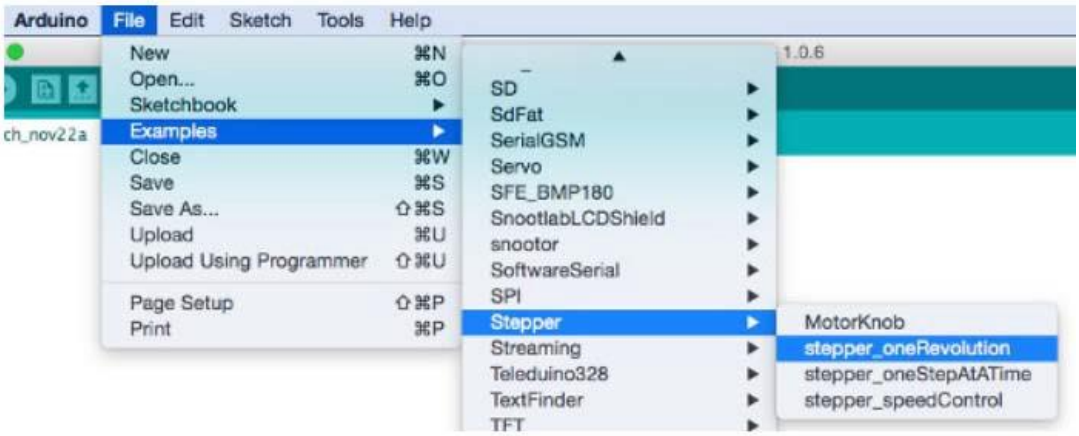
Connect the A+, A-, B+ and B- wires from the stepper motor to the module connections 1, 2, 13 and 14 respectively. Place the jumpers included with the L298N module over the pairs at module points 7 and 12. Then connect the power supply as required to points 4 (positive) and 5 (negative/GND).

Once again if your stepper motor's power supply is less than 12V, fit the jumper to the module at point 3 which gives you a neat 5V power supply for your Arduino.

Next, connect L298N module pins IN1, IN2, IN3 and IN4 to Arduino digital pins D8, D9, D10 and D11 respectively. Finally, connect Arduino GND to point 5 on the module, and Arduino 5V to point 6 if sourcing 5V from the module.

Controlling the stepper motor from your sketches is very simple, thanks to the *Stepper* Arduino library included with the Arduino IDE as standard.

To demonstrate your motor, simply load the "*stepper_oneRevolution"* sketch that is included with the *Stepper* library, for example:



Finally, check the value for

```
const int stepsPerRevolution = 200;
```

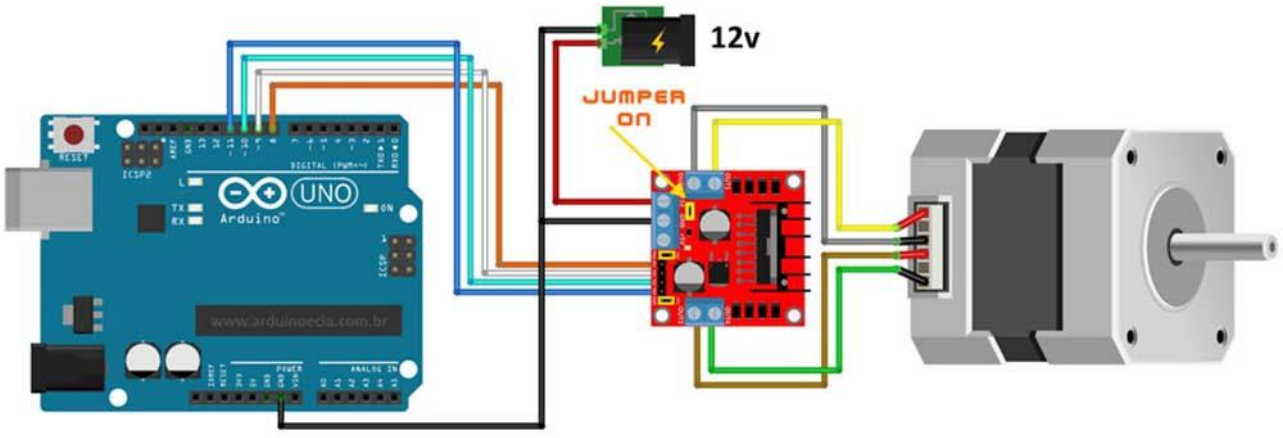
in the sketch and change the 200 to the number of steps per revolution for your stepper motor, and also the speed which is preset to 60 RPM in the following line:

```
myStepper.setSpeed(60);
```

Now you can save and upload the sketch, which will send your stepper motor around one revolution, then back again. This is achieved with the function

```
myStepper.step(stepsPerRevolution); // for clockwise
myStepper.step(-stepsPerRevolution); // for anti-clockwise
```

Connection for the sketch "*stepper_oneRevolution":*



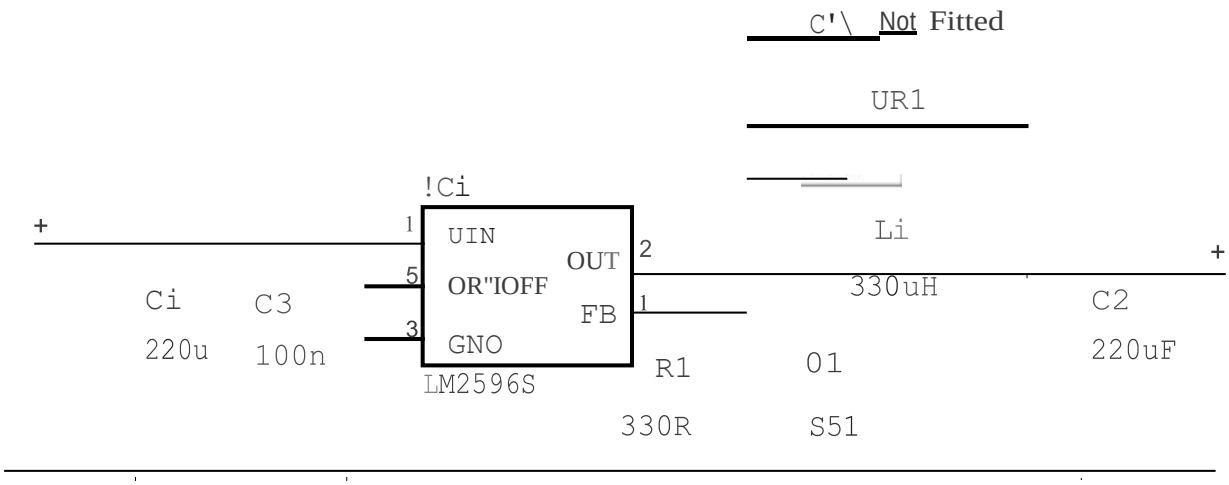
Web Resources:

LM2596 DC-DC Adjustable PSU Module

LM2596 DC to DC step down regulator, adjustable +1.23 to 35vdc output, 2A. Ideal for battery operated projects requiring a regulated powersupply.

Specifications

Regulator Type:	Step Down (Non Isolated input to Output)
Input Voltage:	+4 to 40vdc
Output Voltage:	+1.23 to 35vdc
Output Current:	2A rated, (3A maximum with heatsink)
Efficiency:	Up to 92% (when output voltage is set high)
Switching Frequency:	150kHz
Dropout Voltage:	2vdc minimum
Protection:	Short circuit current limiting
Load Regulation:	+/- 0.5%
Voltage Regulation:	+/- 2.5%
Temperature:	-40 to +85 deg C (output power less than 10Watts)
Board Size:	43.6mm L x 21mm W x 14mm H
Data Sheet:	National LM2596


C'\ Not Fitted
UR1
!Ci
+
1
UIN
OUT
2
Li
+
5
OR"IOFF
FB
1
Ci
220u
C3
100n
3
GNO
LM2596S
330uH
C2
220uF
R1
330R
01
S51

THEPOWERPEOPLE

Merlin Solar Flexible Panels

Semi-Flexible Solar Panels

Semi-flexible solar panels with high-efficiency Sunpower mono crystalline cells can be curved to a maximum 30 degree and are widely used in RV, Marine, Caravan and applied to all irregular surfaces.

Easy Installation

- Semi-Flexible solar panels can be affixed by adhesive or grommets (with which you can easily attach or detach the panels.)
- Holes on panels are pre-drilled for fast mounting and securing, perfect for non-permanent installations.

Reliability

- The Junction Box is sealed and waterproof

Flexible and Widely Compatibility

- Our flexible solar panels can be curved to a maximum 30 degree arc.
- Versatile instillation options; applications for RV, Boat, Cabin, Tent, Yachts or any irregular surfaces.

High Efficiency

- The efficiency of semi flexible solar panel is up to 25%

Model Number	SLPA050-18	SLPA100-18	SLPA150-18
Solar Cell	Sunpower Solar Cell		
Laminated Way	ETFE Lamination		
Number of cells and connection	32 cell series	64 cell series	93 cell series
Test condition	1000W/M² Am1.5 T=25°C R=5.5Ω		
Operating Tempature	-10°C TO 80°C		
Error	-10%		
Maximum Power(Pm)	50W	100W	150W
Voltage at max power(Vm)	17.6V	17.6V	26.0V
Curent at max power(Im)	2.84A	5.68A	5.78A
Short Circuit Current(Isc)	3.12A	6.25A	9.10A
Open circuit voltage (Voc)	20.8V	20.8V	21.1V
Dimension of module	555*535*2.5MM	1065*540*2.5MM	1080*780*2.5MM
Weight	1.2KG%	1.95KG	2.68KG
Junction Box/Connector	OP65/MC4 0.5M	IP65/MC4 0.8M	1P65/MC4 0.8M

Merlin Equipment Limited, Clyst Court, Hill Barton Business Park, Exeter, EX5 1SA United Kingdom

T: +44 (0) 1202 697979 F: +44 (0) 1202 691919 W: www.merlinequipment.com

Specifications

Processor:
Broadcom BCM2837B0, Cortex-A53
64-bit SoC @ 1.4 GHz

Memory:
1GB LPDDR2 SDRAM

Connectivity:
- 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE
- Gigabit Ethernet over USB 2.0 (maximum throughput 300 Mbps)
- 4 × USB 2.0 ports

Access:
Extended 40-pin GPIO header

Video & sound:
- 1 × full size HDMI
- MIPI DSI display port
- MIPI CSI camera port
- 4 pole stereo output and composite video port

Multimedia:
H.264, MPEG-4 decode (1080p30); H.264 encode (1080p30); OpenGL ES 1.1, 2.0 graphics

SD card support:
Micro SD format for loading operating system and data storage

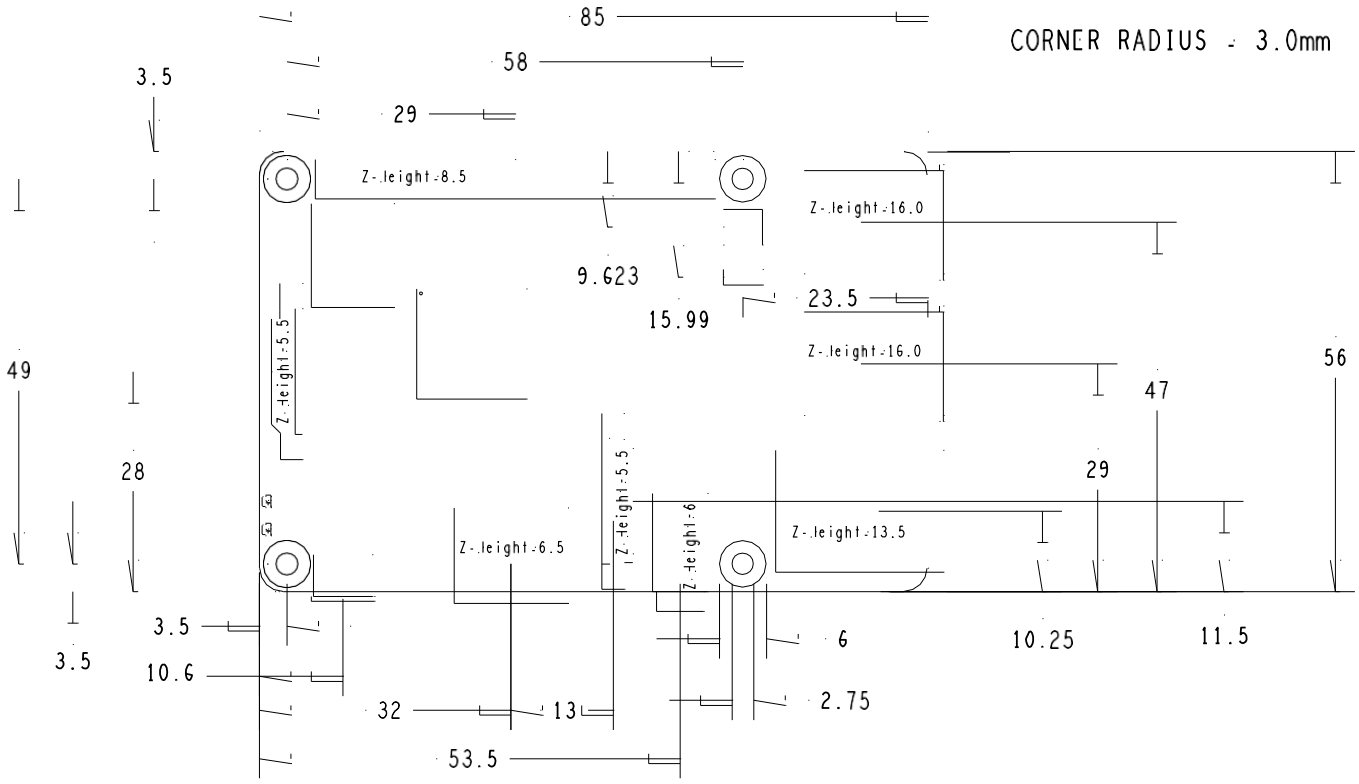
Input power:
- 5 V/2.5 A DC via micro USB connector
- 5 V DC via GPIO header
- Power over Ethernet (PoE)–enabled (requires separate PoE HAT)

Environment:
Operating temperature, 0–50°C

Compliance:
For a full list of local and regional product approvals, please visit www.raspberrypi.org/products/raspberry-pi-3-model-b+

Production lifetime:
The Raspberry Pi 3 Model B+ will remain in production until at least January 2023.

Physical specifications



Warnings

- This product should only be connected to an external power supply rated at 5V/2.5A DC. Any external power supply used with the Raspberry Pi 3 Model B+ shall comply with relevant regulations and standards applicable in the country of intended use.
- This product should be operated in a well-ventilated environment and, if used inside a case, the case should not be covered.
- Whilst in use, this product should be placed on a stable, flat, non-conductive surface and should not be contacted by conductive items.
- The connection of incompatible devices to the GPIO connection may affect compliance, result in damage to the unit, and invalidate the warranty.
- All peripherals used with this product should comply with relevant standards for the country of use and be marked accordingly to ensure that safety and performance requirements are met. These articles include but are not limited to keyboards, monitors, and mice when used in conjunction with the Raspberry Pi.
- The cables and connectors of all peripherals used with this product must have adequate insulation so that relevant safety requirements are met.

Safety instructions

To avoid malfunction of or damage to this product, please observe the following:

- Do not expose to water or moisture, or place on a conductive surface whilst in operation.
- Do not expose to heat from any source; the Raspberry Pi 3 Model B+ is designed for reliable operation at normal ambient temperatures.
- Take care whilst handling to avoid mechanical or electrical damage to the printed circuit board and connectors.
- Whilst it is powered, avoid handling the printed circuit board, or only handle it by the edges to minimise the risk of electrostatic discharge damage.

Specifications for WEBCAM-720P

Astrum 720p Hd USB Black Webcam With Mic

Astrum 720p Hd USSBlack Webcam With Mic

Astrum

Out of Stock

This product is no longeravailable for purchase. This information is for reference purposes only.
Click heretobrowsetor similar products and for great alternatives'

Qven,iew:

Full HD webcam that delivers high quality audio and video in MPG/ Y\JV format. It 3-axis clamp fits perfectly to all devices, laptops LCD,LED and CRT mo nitor s. Suppo r ts 72 0p reso lution (192 0x10 80p) with 30fps outp ut.

Specific atio ns:

Specifications

Product Code	WEBCAM-720P
Resolution	Upto 1080P full HD
Support	Mac OS / Windows / Linux / IOS / Android
Mic	External Microphone
Interface	USS 2.0
ImageFormat	JPG / BMP
Color	Black/ Red
Video Formats	MPEG / YUV
Video Resolutions	1920 x 1080 at 30fps
Connectors	USS Port / Micro USS Cable
Compatibility	Universal
Camera	720 pixels
Connectivity	USS 2.0
Mobile Compatibilty	IOS and Andro id
UseFor	Mult i-Purpose
Grip	Rubber
Cable Length	140cm
Sensor	CMOS Sensor
SupportPhonesize	All
Dimensions	20.0 x 16.5 x 5.2 cm
Weight	191g
Package Contents	1 HD Webcam