G-BOT
PERSONAL ASSISTANT MEDI BOT FOR OLD AGE PEOPLE

PROJECT REPORT

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in
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PROJECT REPORT

Submitted in partial fulfilment of
the requirements for the award of Bachelor of Technology in

Electronics and Communication Engineering

of the A P J Abdul Kalam Technological University.

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CERTIFICATE

This is to certify that this report entitled *G-BOT*, is a bonafide record of the Project work done by Ajesh R (BJK19EC002), Akhila S (BJK19EC004), Sravan S (BJK19EC019), Swathi Chithran (BJK19EC020) under our guidance towards partial fulfilment of therequirements for the award of the Degree of Bachelor of Technology in Electronics and Communication Engineering of the A P J Abdul Kalam Technological University during the year 2022-2023.

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DECLARATION

We Ajesh R, Akhila S, Sravan S, Swathi Chithran hereby declare that, this project report entitled 'G-BOT' is the bonafide work of ours carried out under the supervision of Ms. Anju D S, Assistant Professor, Dept. of ECE. We declare that, to the best of our knowledge, the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion to any other candidate. The content of this report is not being presented by any other student to this or any other University for the award of a degree.

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Place: Kollam
Date:

ABSTRACT

Many older adults value their independence and prefer to age in place. Robots can be designed to assist older people with performing everyday livelihood tasks and maintaining their independence at home. Worldwide demographic trends of a growing societies raise the demand for assistive technologies for senior people, including in particular robotic aids. Robot systems can support the domestic medication of an elderly person. So, our project 'An IOT Based Personal Assistant Medi-BOT for old age people (G-BOT)' is aimed at providing a helping hand for our older generations. The BOT has functions such as providing the right medicines at the right time, providing water, video calling to their loved ones using voice commands. The BOT can also be used to monitor the old ones. During any emergency situations the bot will be able to provide notifications and calls to the relatives of the user and also give information to the nearest medical emergency crew to save the users life. So, G-Bot can provide a fruitful life for the old age people by giving them care, attention and the entertainment they need on time. Thus, organizing their life and their day-to-day schedules.

Keywords: Automated medicine dispenser; GSM emergency SMS; provide water; voice commands; Arduino IDE

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CHAPTER 1

INTRODUCTION

In today's busy World as most of the people don't have time to be with the old age people. People might not be able to take care of them. The consumption of medicines for such people is really difficult. Old ones might not be able to keep a track on the time to consume their medicines. Many of them will be having memory loss or diseases like dementia. So our project 'A Personal Assistant Medi-BOT for old age people (G-BOT= Geriatric-Bot)' is aimed at providing a helping hand for our older generations. Our bot will surely make the life of the old people much organized and easier. The BOT has functions such as providing the right medicines at the right time, providing water, speaking out the time and sending SOS SMS in case of an emmergency. During any emergency situations the bot will be able to provide notifications and thus alert the relatives of the user and also give information to the nearest medical emergency crew to save the users life. It also have the functionality of providing water with the help of a voice command. Our bot will have added functionalities like internet connected voice assistance that will help in providing small entertainments and getting information's through the internet with the help of a voice command, it will also have added functionalities like making a remainder for any events stated by the user, these features can be added in the near future, due to time limitations we haven't included them. The bot will travel towards the patient and provides the medicine and water at the right time. So our bot will become a new stepping stone for medicine dispensing and old age assistant bots.

CHAPTER 2

PROBLEM DEFINITION

People are very busy with their life, they are now unable to give care or help their old ones all the time. They are unable to even speak to them or entertain them. The increasing age of the people will reduce their memory capacity and their illnesses, they may not be able to walk all the time, they may need more rest, some may be bedridden, some won't be able to think logically. So for taking their medicines on the right time and for getting remainder for doing their daily needs out bot will aid them. It will be difficult for them to walk and drink water all the time so they will ignore the fact that they need to drink water and will skip it. If it was possible to provide water at the right time near them then they will drink it. Our bot will also aid them for this purpose. It will be difficult for old age people to identify the time on the clock due to lack of proper eye sight. Our Bot will aid them in this process. During the old age they may need constant surveillance .Their children can get SOS sms if something goes wrong. Sometimes there won't be anyone in the house so in case there is some medical emergency something bad can happen. Our bot will provide emergency alerts to their relatives and the emergency services near them. So immidiate attention can be givent to the patient.

CHAPTER 3

LITERATURE SURVEY

3.1. Design and Proto type of Smart Automated Pill Dispenser (2020-21)

The product is a stationary machine of the size of a box which dispenses medicines which are filled in it at the right time. It also gives are minder about having the medicine at right time.

3.2. HERA: Home Environment Robot Assistant (2019)

The bot act as a companion for kids by providing music and knowledge using voice command. The bot also provides alarm facility to wake kids up cheerfully. It simply can define as a companion for kids to make them cheerful as well as bring out the talent within them.

3.3. Robot for Delivery of Medicines to Patients in Health Care

The bot can be used to give medicine to patient by not going near the patients. The bot is controlled using a remote. By using the remote the bot is moved towards the patient from which the medicine can be consumed by the patient. The project was done during covid when going near the patient was not a good idea for nurses to give medicine.

CHAPTER 4

FINAL SOLUTION

G-Bot was able to solve the problem of old age people's timely medicine consumption. The bot was able to provide water and speak out time whenever asked. The bot is able to move towards the user and provide them the medicine and water so they don’t need to walk towards it also. Voice commands helped in hands free operations. Medical emergencies were handled properly on time. The family of the old age people will be able provide help when an emergency situation arises as g bot will alert them during emergencies. G-Bot is a complete solution for the problems faced by the old people during their 70 sand 80s. Self-charging facility of the bot enable all time working of the bot.

CHAPTER 5

BLOCK DIAGRAM

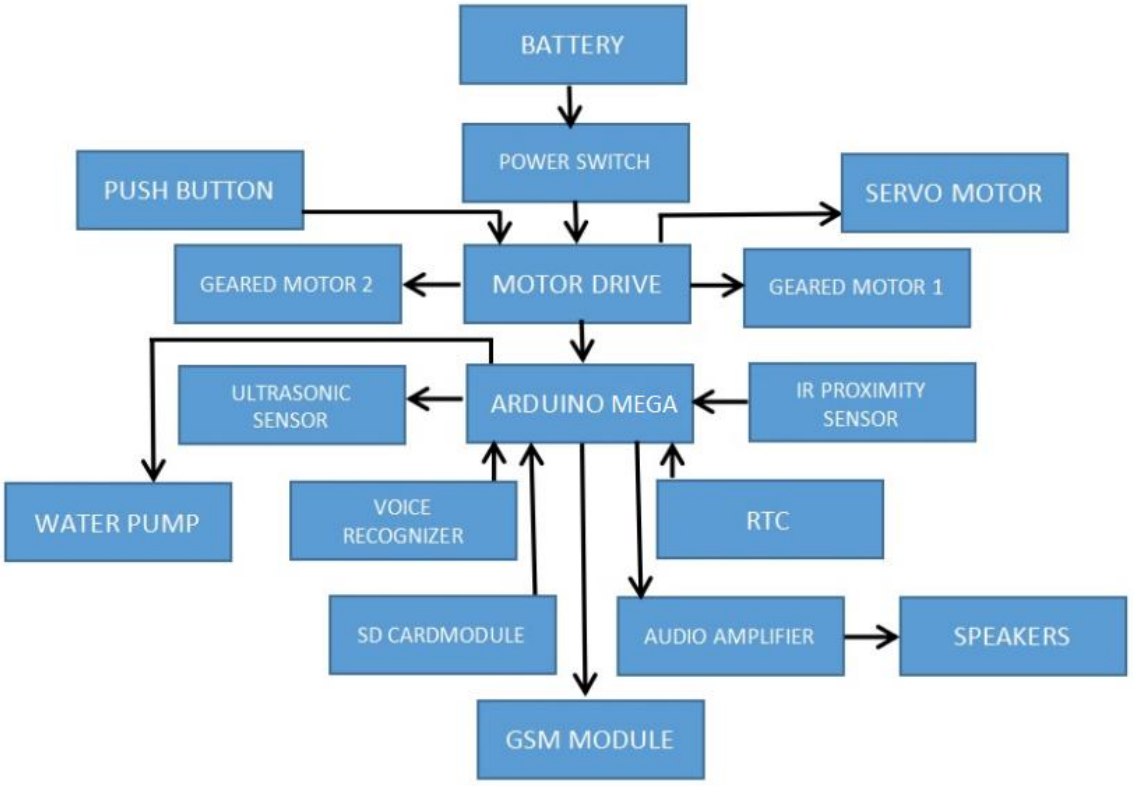


Figure 5.1 Block diagram of system

EXPLANATION OF BLOCK DIAGRAM

The Arduino Mega 2560 is powered by a 12V battery. The RTC module connect to the Arduino will send the accurate time to it. When the time for medication is reached the Arduino sends information to the servo motor so that it will move towards the patient following a given path. This movement is facilitated with the help of the ultrasonic sensor and the proximity sensors. The DC-DC boost converter is used for providing proper high voltage to the geared motors. When the bot reaches near the user the servo motors will work the medicine dispenser and the medicines are provided to the user. Whenever a voice command is received through the voice recognizer needed output is given or provided as voice message. The SD card module is used for saving the needed programs which can be accessed by the Arduino. Audio amplifier amplifies the output audio signal and sends out voice message through the speaker. The LCD display displays all the required digital outputs.

CHAPTER 6

FLOW CHART

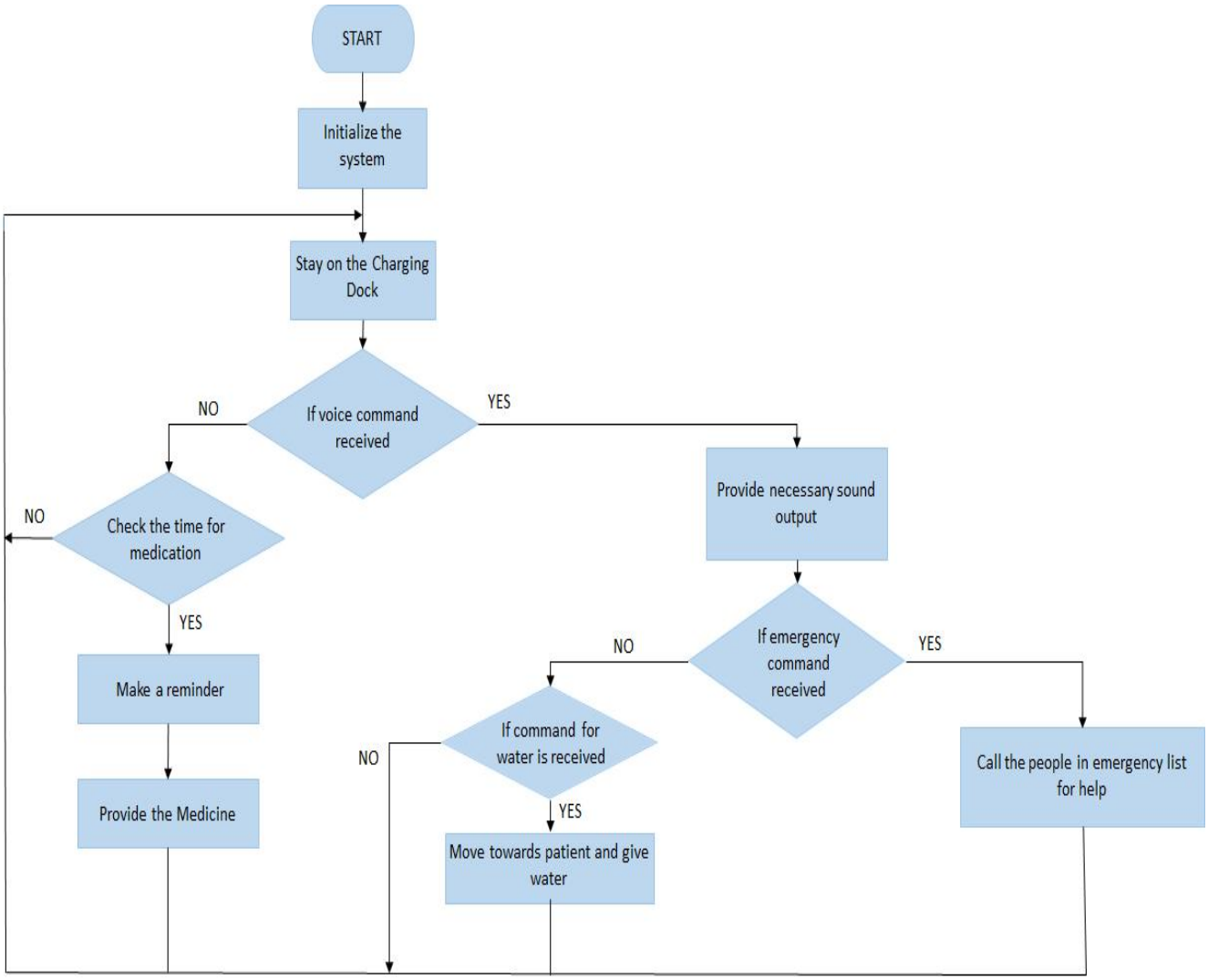


Fig 6.1 Flow chart of system

EXPLANATION OF BLOCK DIAGRAM

Initialize the system and bot will stays on the charging doc itself. Bot checks whether any voice command is received.

If any voice command is received,

Provide necessary sound outputs. Bot checks whether any emergency command is received. If received, call the people in emergency list for help. If not received, bot checks any command for water is received. If received, move towards the patient and provide water. If not, command received bot stays on the charging doc.

If no voice command is received,

Bot checks the time of medication. If time of medication is reached make a reminder and provide the medicine. If time of medication is not reached is bot stays on the charging doc.

CHAPTER 7

HARDWARE DESCRIPTIONS

7.1 ARDUINO MEGA 2560

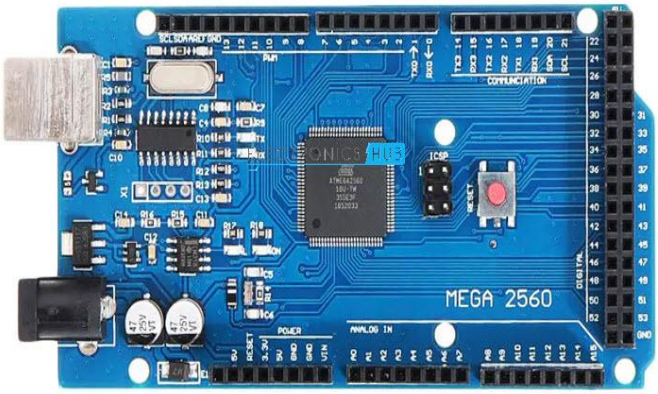


Fig.7.1.1 Arduino MEGA 2560

The Arduino Mega2560 has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial

SPECIFICATIONS

- Advanced RISC architecture – On-chip 2-cycle multiplier
- High endurance, non-volatile memory segments
- JTAG (IEEE 1149.1 compliant) interface
- QTouch library support
- Power-on reset (POR) and programmable brown-out detection
- Internal Calibrated RC oscillator
- External and internal interrupt sources

7.1 GEARED MOTOR (12V 60 RPM)

Fig7.2.1 Geared Motor

Geared motors are used in G-BOT to provide high torque. A geared DC motor has a gear assembly attached to the motor. This speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed.

SPECIFICATIONS

- Motor Type : DC with Gear Box, Metal Gears
- Base Motor : DC 18000 RPM
- Shaft Type : Circular 6mm Dia with M3 thread hole.
  30 mm shaft Length
- RPM : 60 RPM at 12V
- Weight : 180 Gms
- Max Load Current: Up to 7.5A (Max)

7.1 MOTOR DRIVER (VNH2SP30)

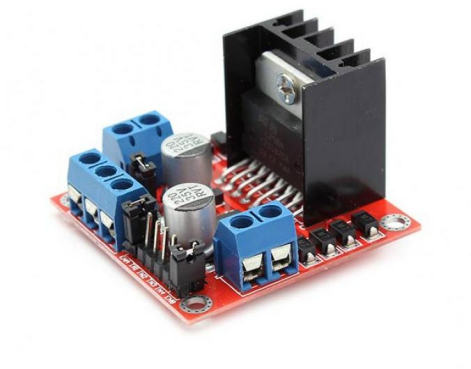


Fig7.3.1 MOTOR DRIVER (L298N)

We use motor drivers to give high power to the motor by using a small voltage signal from a micro controller or a control system. If the microprocessor transmits a HIGH input to the motor driver. The driver will rotate the motor in one direction keeping the one pin as HIGH and one pin as LOW.

SPECIFICATIONS

- Dual H Bridge Motor Drive
- L298N Motor Driver IC
- Drives up to 2 Bi-Directional motors
- Integrated 5V power regulator
- 5V to 35V power regulator
- 5V to 35V drive voltage
- 2A max drive current

7.4 SERVO MOTOR(MG995)

Fig.7.4.1 SERVO MOTOR(MG995)

Servo motors are used for robotic applications that require precision positioning. Before diving too deeply into the ways servos are used in robotics.

SPECIFICATIONS

- Operating voltage : 4.8V
- Idle current : 5mA
- No load speed: 0.17sec/60°
- Running current: 350mA
- Peak stall torque: 9.0kg.cm

7.5 VOICE RECOGNIZER (SKU: 25586)

Fig.7.5.1 VOICE RECOGNIZER (SKU: 25586)

The Voice Recognizer used in robot to understand spoken instructions. So, the robot can recognize defined commands and the design robot will navigate based on the instruction through Voice Recognizer.

SPECIFICATIONS:

- Voltage: 4.4 -5.5 V
- Current:40 mA
- Digital Port: UART Port and GPIO 5V TTL Level
- Simulate Port: 3.5mm mono microphone connector and microphone pin interface
- Recognition accuracy: 99% (in an ideal environment)
- Supports up to 80 voice commands, 1500ms per voice (one or two words)
- Up to 7 voice commands are valid at the same time

7.6 12V 7Ah BATTERY

Figure 7.6.1 12v 7ah BATTERY

The main sources of electrical for robots are batteries. The type of battery that is used for a robot varies depending on the safety, life cycle and weight. Lead acid batteries are commonly used battery.

SPECIFICATIONS

- Nominal Voltage: 12v.
- Nominal Capacity @ 20hr rate (AH): 7.0.
- Discharge Current @ 20hr rate (mA): 350.
- Dimensions: 15.1 x 6.5 x 9.4cm (5.95 x 2.56 x 3.7")
- Weight: 2.7kg.

7.7 SPEAKER =5W 8Ohms

Figure 7.7.1 Speaker =5W 8Ohms

A speaker in robot to deliver a speech or to make the sound from the robot louder. It is a electroacoustic transducer that convert and electrical audio signal into a corresponding sound.

SPECIFICATIONS

- Power: Rated Power / Maximum Power 5.0W / 5.5W.
- Impedance: 8 Ohms Plus/Minus 15%.
- Size: 70 mm * 31 mm * 16 mm / 3.1 inch * 1.2 inch * 0.63 inch (L* W * T).
- Compatible With Arduino, Robot, Raspberry Pi, Advertising Machine, Game Machine, Integrated Machine Special Speaker etc, Projects.

7.8 AUDIO AMPLIFIR

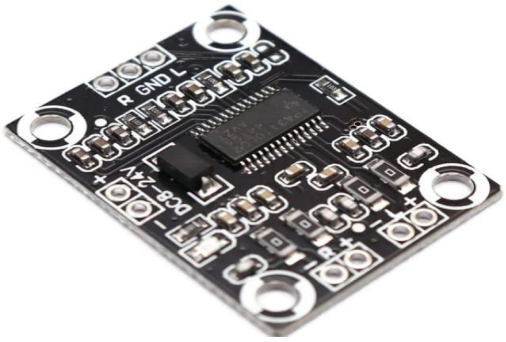


Figure 7.8.1 Audio Amplifier

It is designed to drive Professional Stereo Audio Speakers. This Amplifier Board is mostly used with 8-ohm speakers but it can successfully drive the speaker as low as 4 ohms. It's a very highly efficient board which eliminates the need of using a heat sink. This device is fullly protected against the shorts to GND, VCC & Output to Output.

SPECIFICATIONS

- Operating voltage range: 8V to 24V
- Amplifier chip: TPA3110 / HDX8816A
- Output power: 2 x 15W
- Dimension: 25mm x 33mm x 3mm

7.9 Timer RTC (ds3231)

Figure 7.9.1 Timer RTC (ds3231)

A Real Time Clock or RTC is a digital clock with a primary function to keep accurate track of time even when a power supply is turned off or a device is placed in low power mode. RTC's are comprised of a controller, oscillator and an embedded quartz crystal resonator.

SPECIFICATIONS

- 318 temporary data storage RAM
- Working current of 2.0V, less than 300nA
- 8 pin DIP package or optional 8 pin SOIC package based on the surface assembly
- Simple 3 wire interface

7.10 Ultrasonic sensor JSN-SR04T

Figure 7.10.1 Ultrasonic sensor JSN-SR04T

The ultrasonic sensor is useful for detecting objects that are some distance away from the robot. However, unlike the touch sensor, the ultrasonic sensor does not rely on physical contact. The distance gives more space in which respond.

SPECIFICATIONS

- Operating Voltage: 5 V
- Sonar Sensing Range: 2-400 cm
- Max. Sensing Range: 4500 cm
- Frequency: 40 KHz

- Thickness: 2.8-3.1 mm
- The diameter of mounting hole: 3.8mm
- Mounting Bracket Material: acrylic

7.11 SD Card Module 5V I2C

Figure 7.11.1 SD Card Module 5V I2C

An SD Card module is an essential component for all microprocessor / microcontroller which helps in data login and creates a local data backup which can be accessed at any point later in time, unlike in systems which lack a card reader module where the data from sensor or other input devises is immediately lost as soon as the system powers off.

SPECIFICATIONS

- Support Micro SD Card (<=2G), Micro SDHC card (<=32G) (high-speed card)
- The level conversion circuit board that can interface level is 5V or 3.3V
- Power supply is 4.5V ~ 5.5V, 3.3V voltage regulator circuit board
- Communication interface is a standard SPI interface
- 4 M2 screw positioning holes for easy installation
- Size: 4.1 x 2.4cm

7.12 Water pump

Figure 7.12.1 Water pump

A mini submersible water pump is a centrifugal water pump, which means that it uses a motor to power an impeller that is designed to rotate and push water outwards.

SPECIFICATIONS

- Material: Polyvinyl Chloride
- Style: Submersible
- Power Source : ac/dc
- Maximum Flow Rate :120 Liters Per Hour

7.13 IR PROXIMITY SENSOR

Figure 7.13.1 IR Proximity Sensor

- Detection range: Few centimetres to several meters.
- Operating voltage: IR Proximity sensor include 3.3V,5V & 12V

7.14 SIM900A

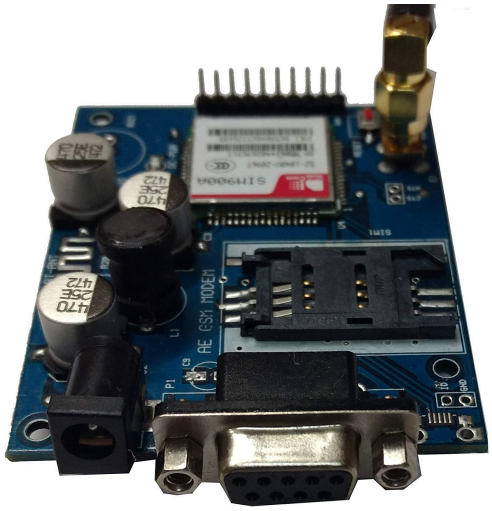


Figure 7.14.1 SIM900A

This is an ultra-compact and reliable wireless module. The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications allowing you to benefit from small dimensions and cost-effective solutions

SPECIFICATIONS

Dimensions: 24x24x3mm

Weight: 3.4g

Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)

SIM application toolkit

Supply voltage range: 3.2 ... 4.8V

Low power consumption: 1.0mA (sleep mode)

Operation temperature: -40°C to +85 °C

CHAPTER 8

CIRCUIT DIAGRAM

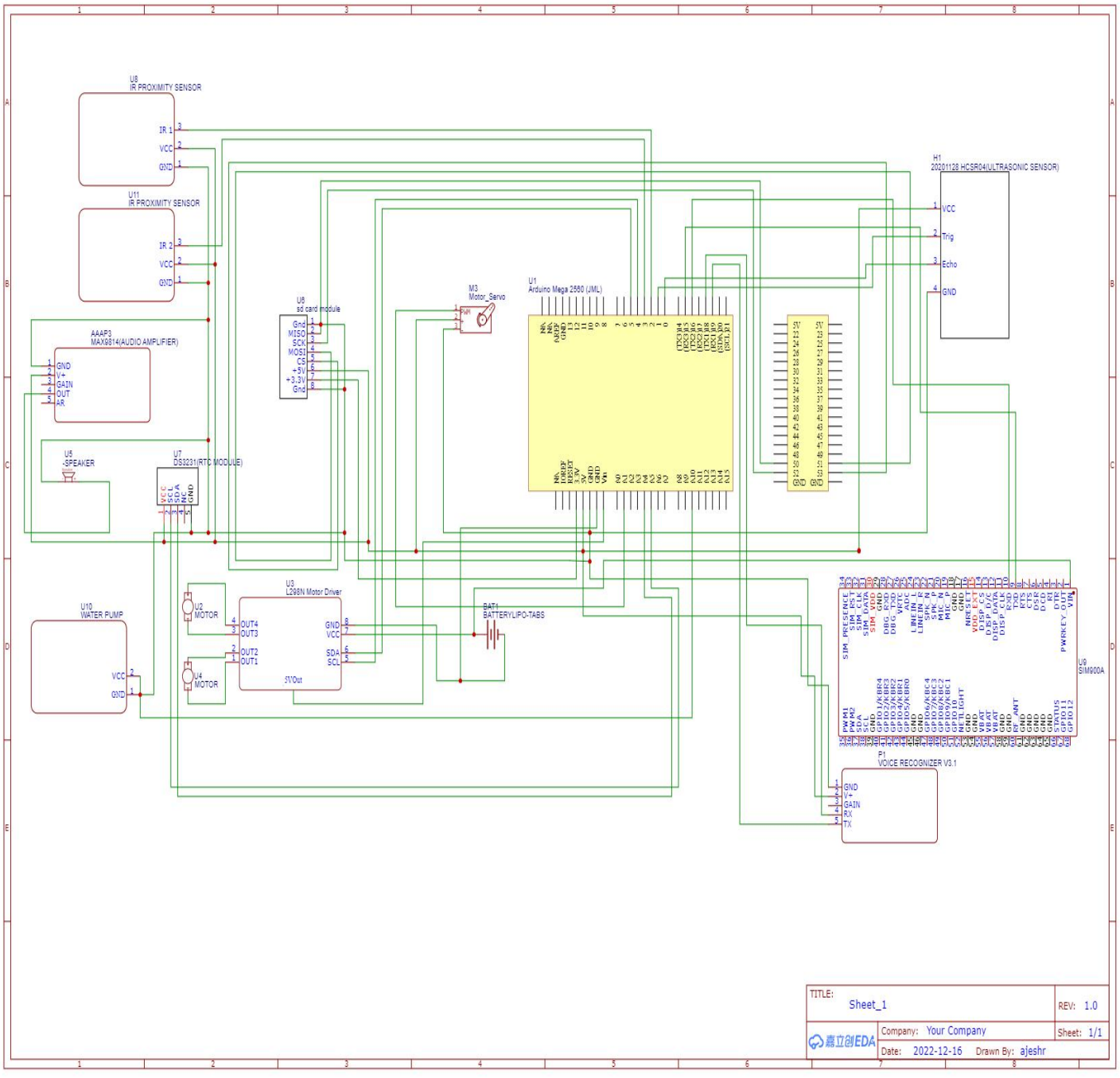


Figure 8.1 Circuit diagram

EXPLANATION OF CIRCUIT DIAGRAM

The figure shows the detailed circuit diagram of G-Bot : The 12v battery powers the motor drive with 12v supply and the 5v output from the motor driver gives power to the Arduino. The Rtc module connected to the Arduino sends the live time to the Arduino using its SCL and SDA pins which are connected to the Arduino mega to establish an I2C communication. When the required time is reached, the Arduino mega collects data from the IR proximity sensors which are connected to the digital pins of the Arduino from the IR1 and IR2 pins of the IR proximity sensor modules which is powered by 5v by the Arduino mega. According to the sensor readings the motor drive is given instructions to turn the 2 geared motors. The IN1, IN2, IN3&IN4 are the 4 pins that controls the direction in which the motors are to be driven by the motor drive the EnA and EnB pins connected to the Arduino from the motor drive controls the speed of the motors. The ultrasonic sensor is connected to the Arduinos digital pins to check whether any obstacles are Infront of the bot. For that the eco and the trigger pins provides information to the Arduino. The voice recognizer module is constantly checking for voice signals. The RX pin of the voice recognizer is connected to the Arduinos TX pin and the TX pin of the voice recognizer is connected to the RX pin of the Arduino. A 5v supply is provided to the voice recognizer by the Arduino. These pins help recognize any voice signals and provide necessary outputs. The water pump is connected to the Arduino to pump water during medicine dispensing period and on voice commands. In case of any emergency a voice command can be given which will be recognized by the voice recognizer, the GSM module whose transmitter and receiver pins are connected to the pins 15 and 16 gets activated and sends the emergency message to the saved contacts. In case of voice command for time the speaker connected with the out pin of amplifier whose pins are connected to the amplifier gives the sound output of the time at that instance. The main feature of the G-BOT which is to give medicine is made possible with the help of a servo motor which rotates at particular delay to drop the medicine at right time. The servo motor is connected to the A1 pin of the Arduino along with VCC and GND connected appropriately

CHAPTER 9

SOFTWARE PLATFORM

9.1 Arduino IDE:

The Arduino projects provides the Arduino Integrated Development Environment (IDE), which is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The program or code written in the Arduino IDE is often called as sketching. We need to connect the Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '. ino.'

The Arduino IDE will appear as:

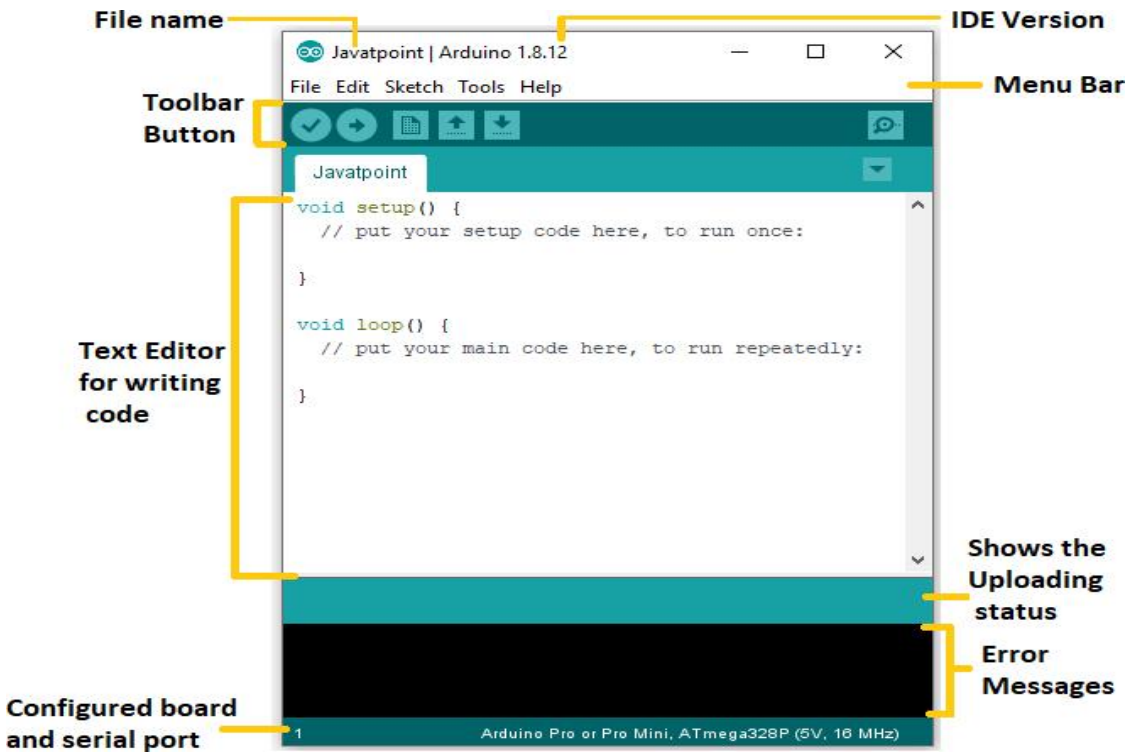


Figure 9.1.1 Arduino IDE

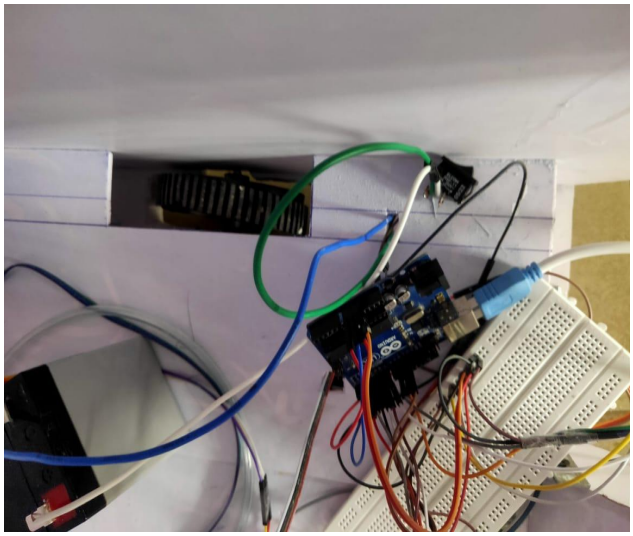
CHAPTER 10
COST ESTIMATION

SI.NO	COMPONENTS	NO OF COMPONENTS	COST
1	Arduino Mega 2580	1	2000
2	Geared Motor	2	840
3	Motor Drive	3	250
4	Servo Motor	1	300
5	Voice Recognizer	1	2100
6	Battery	1	1000
7	Speaker	1	100
8	Audio Amplifier	1	70
9	Timer RTC	1	350
10	SIM900A	1	1000
11	Ultrasonic Sensor	1	100
12	Water pump	1	200
13	SD Card Module	1	70
14	IR Proximity Sensor	2	300
15	Body		3500
	TOTAL		12180

CHAPTER 11

RESULTS

Figure 11(a,b,c)



CHAPTER 12

FUTURE SCOPE

G-Bot can be used as a complete medical and geriatric bot with functionalities like guided walking for the old age, giving medicines to bedridden people by providing water and medicine near their mouth. This bot can also be used for providing food to the patients. It can be used in hospitals as an assistant bot. We can add connect home automated technologies so that the bot will have access to all the devices in the house so that it can easily operate every device with just a voice command or can think by itself and operate the devices according to the conditions required in the house. We can connect the bot to the hospitals on line servers so that the bot can monitor the patients and the data's collected can be used by the doctors for medical purposes. This bot can be used to move the old age people outside the house or towards aids during an emergency situation. G-Bot can also help the old age people in all their day-to-day activities and become a complete assistant thus eliminating the need of a human assistant in the house. The bot can also take the role of an automated surveillance device and become a security for the house.

CHAPTER 13

CONCLUSION

An IOT Based Personal Assistant Medi-BOT for old age people (G-BOT)' is aimed at providing a helping hand for our older generations. Our bot will surely make the life of the old people much organized and easier. The Bot has functions such as providing the right medicines at the right time, providing water, video calling to their loved ones using voice commands. The Bot can also be used to monitor the old ones with the help of the video camera which can be accessed using a smartphone or a computer, during any emergency situation the Bot will be able to provide notifications and calls to the relatives of the user and also give information to the nearest medical emergency crew to save the users life. It also has the functionality of providing water with the help of a voice command. Our bot will have added functionalities like internet connected voice assistance that will help in providing small entertainments and getting information's through the internet with the help of a voice command. The Bot will travel towards the patient and provides the medicine and water at the right time. It will also have added functionalities like making a remainder for any events stated by the user. So, our project will become a new milestone in the field of medicine dispensers and geriatric Bots.

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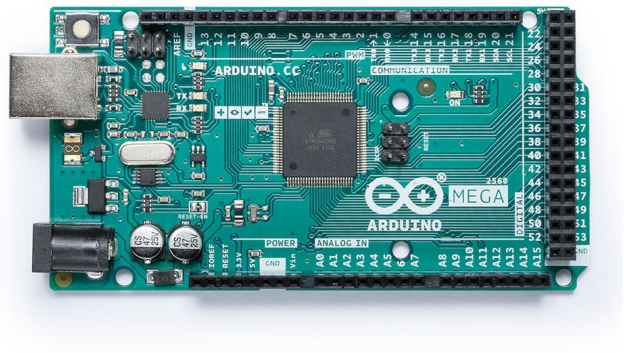
APPENDIX

Product Reference Manual
SKU: A000067



Description

Arduino® Mega 2560 is an exemplary development board dedicated for building extensive applications as compared to other maker boards by Arduino. The board accommodates the ATmega2560 microcontroller, which operates at a frequency of 16 MHz. The board contains 54 digital input/output pins, 16 analog inputs, 4 UARTs (hardware serial ports), a USB connection, a power jack, an ICSP header, and a reset button.

Target Areas

3D Printing, Robotics, Maker

Features

- **ATmega2560 Processor**
  - Up to 16 MIPS Throughput at 16MHz
  - 256k bytes (of which 8k is used for the bootloader)
  - 4k bytes EEPROM
  - 8k bytes Internal SRAM
  - 32 × 8 General Purpose Working Registers
  - Real Time Counter with Separate Oscillator
  - Four 8-bit PWM Channels
  - Four Programmable Serial USART
  - Controller/Peripheral SPI Serial Interface
- **ATmega16U2**
  - Up to 16 MIPS Throughput at 16 MHz
  - 16k bytes ISP Flash Memory
  - 512 bytes EEPROM
  - 512 bytes SRAM
  - USART with SPI master only mode and hardware flow control (RTS/CTS)
  - Master/Slave SPI Serial Interface
- **Sleep Modes**
  - Idle
  - ADC Noise Reduction
  - Power-save
  - Power-down
  - Standby
  - Extended Standby
- **Power**
  - USB Connection
  - External AC/DC Adapter
- **I/O**
  - 54 Digital
  - 16 Analog
  - 15 PWM Output

Contents

1 The Board

Arduino® Mega 2560 is a successor board of Arduino Mega, it is dedicated to applications and projects that require large number of input output pins and the use cases which need high processing power. The Arduino® Mega 2560 comes with a much larger set of IOs when we compare it with traditional Uno board considering the form factor of both the boards.

1.1 Application Examples

- **Robotics**: Featuring the high processing capacitity, the Arduino Mega 2560 can handle the extensive robotic applications. It is compatible with the motor controller shield that enables it to control multiple motors at an instance, thus making it perfect of robotic applications. The large number of I/O pins can accommodate many robotic sensors as well.
- **3D Printing**: Algorithms play a significant role in implementation of 3D printers. Arduino Mega 2560 has the power to process these complex algorithms required for 3D printing. Additionally, the slight changes to the code is easily possible with the Arduino IDE and thus 3D printing programs can be customized according to user requirements.
- **Wi-Fi**: Integrating wireless functionality enhances the utility of the applications. Arduino Mega 2560 is compatible with WiFi shields hence allowing the wireless features for the applications in 3D printing and Robotics.

1.2 Accessories

1.3 Related Products

- Arduino® Uno Rev 3
- Arduino® Nano
- Arduino® DUE without headers

2 Ratings

2.1 Recommended Operating Conditions

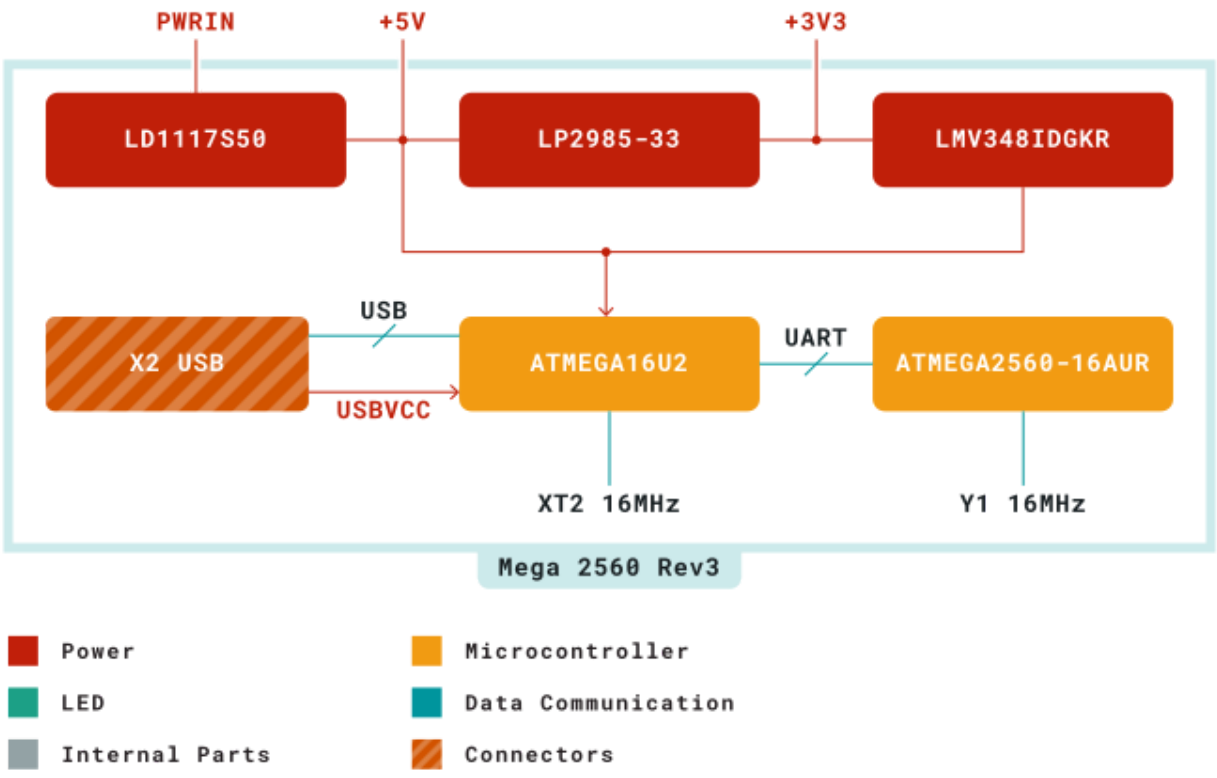
Symbol	Description	Min	Max
TOP	Operating temperature:	-40 °C	85 °C

2.2 Power Consumption

Symbol	Description	Min	Typ	Max	Unit
PWRIN	Input supply from power jack		TBC		mW
USB VCC	Input supply from USB		TBC		mW
VIN	Input from VIN pad		TBC		mW

3 Functional Overview

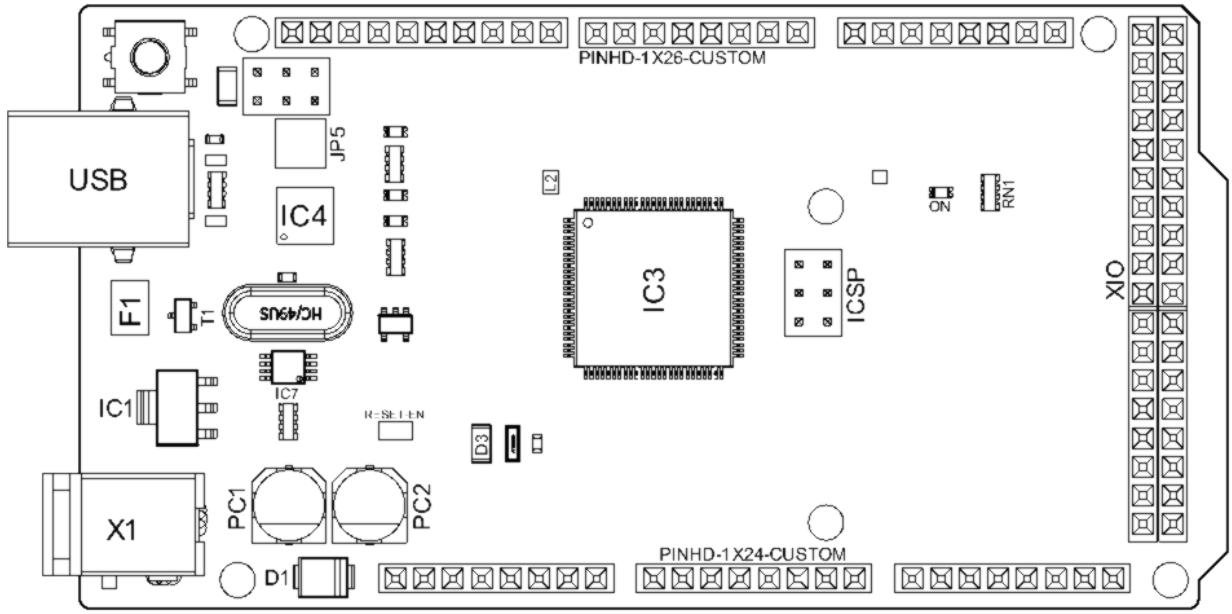
3.1 Block Diagram



Arduino MEGA Block Diagram

3.2 Board Topology

Front View



Arduino MEGA Top View

Ref.	Description	Ref.	Description
USB	USB B Connector	F1	Chip Capacitor
IC1	5V Linear Regulator	X1	Power Jack Connector
JP5	Plated Holes	IC4	ATmega16U2 chip
PC1	Electrolytic Alumninum Capacitor	PC2	Electrolytic Alumninum Capacitor
D1	General Purpose Rectifier	D3	General Purpose Diode
L2	Fixed Inductor	IC3	ATmega2560 chip
ICSP	Connector Header	ON	Green LED
RN1	Resistor Array	XIO	Connector

SONGLE RELAY

松乐继电器 ® SONGLE RELAY	RELAY ISO9002	SRD

1. MAIN FEATURES

☐ Switching capacity available by 10A in spite of small size design for highdensity P.C. board mounting technique.

☐ UL,CUL,TUV recognized.

☐ Selection of plastic material for high temperature and better chemical solution performance.

☐ Sealed types available.

☐ Simple relay magnetic circuit to meet low cost of mass production.

2. APPLICATIONS

☐ Domestic appliance, office machine, audio, equipment, automobile, etc.

(Remote control TV receiver, monitor display, audio equipment high rushing current use application.)

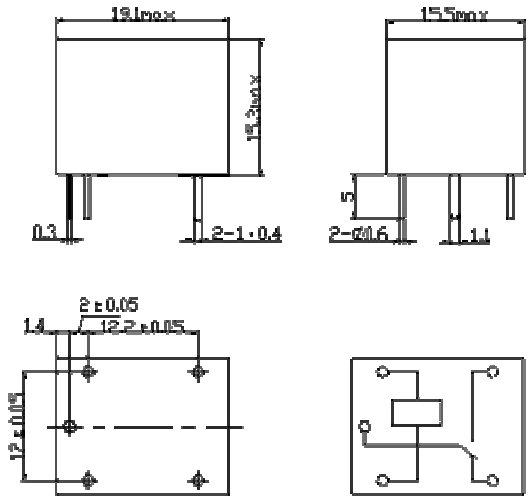
3. ORDERING INFORMATION

SRD	XX VDC	S	L	C
Model of relay	Nominal coil voltage	Structure	Coil	Contact form
SRD	03|05|06|09|12|24|48VDC	S:Sealed type	L:0.36W	A:1 form A
				B:1 form B
		F:Flux free type	D:0.45W	C:1 form C

4. RATING

CCC	FILE NUMBER:CQC03001003729	7A/240VDC
CCC	FILE NUMBER:CQC03001003731	10A/250VDC
UL /CUL	FILE NUMBER: E167996	10A/125VAC 28VDC
TUV	FILE NUMBER: R50056114	10A/250VAC 30VDC

5. DIMENSION(unit:mm) DRILLING(unit:mm) WIRING DIAGRAM



6. COIL DATA CHART (AT20 ö C)

Coil Sensitivity	Coil Voltage Code	Nominal Voltage (VDC)	Nominal Current (mA)	Coil Resistance (Ω) ☐ 10%	Power Consumption (W)	Pull-In Voltage (VDC)	Drop-Out Voltage (VDC)	Max-Allowable Voltage (VDC)
SRD (High Sensitivity)	03	03	120	25	abt. 0.36W	75%Max.	10% Min.	120%
	05	05	71.4	70				
	06	06	60	100				
	09	09	40	225				
	12	12	30	400				
	24	24	15	1600				
	48	48	7.5	6400				
SRD (Standard)	03	03	150	20	abt. 0.45W	75% Max.	10% Min.	110%
	05	05	89.3	55				
	06	06	75	80				
	09	09	50	180				
	12	12	37.5	320				
	24	24	18.7	1280				
	48	48	10	4500	abt. 0.51W			

7. CONTACT RATING

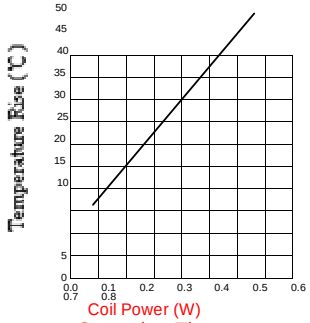
Item \ Type	SRD FORM C	SRD FORM A
Contact Capacity	7A 30VDC	10A 30VDC
Resistive Load (cosΦ=1)	10A 125VAC	10A 240VAC
Inductive Load (cosΦ=0.4 L/R=7msec)	10A 250VAC	5A 120VAC 5A 28VDC
	3A 120VAC 3A 28VDC	
Max. Allowable Voltage	250VAC/110VDC	250VAC/110VDC
Max. Allowable Power Force	800VAC/240W	1200VA/300W
Contact Material	AgCdO	AgCdO

8. PERFORMANCE (at initial value)

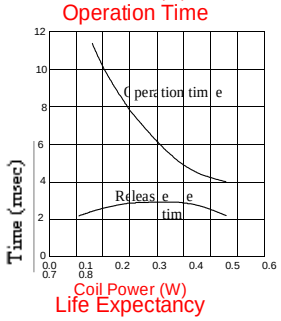
Item \ Type	SRD
Contact Resistance	100mΩ Max.
Operation Time	10msec Max.
Release Time	5msec Max.
Dielectric Strength	
Between coil & contact	1500VAC 50/60HZ (1 minute)
Between contacts	1000VAC 50/60HZ (1 minute)
Insulation Resistance	100 MΩ Min. (500VDC)
Max. ON/OFF Switching	
Mechanically	300 operation/min
Electrically	30 operation/min
Ambient Temperature	-25 ☐C to +70 C
Operating Humidity	45 to 85% RH
Vibration	
Endurance	10 to 55Hz Double Amplitude 1.5mm
Error Operation	10 to 55Hz Double Amplitude 1.5mm
Shock	
Endurance	100G Min.
Error Operation	10G Min.
Life Expectancy	
Mechanically	10^7 operations. Min. (no load)
Electrically	10^5 operations. Min. (at rated coil voltage)
Weight	abt. 10grs.

9.REFERENCE DATA

Coil Temperature Rise

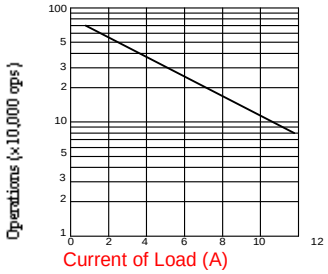


Operation Time

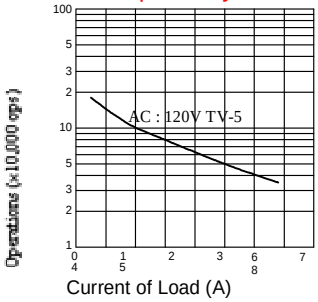


Life Expectancy

AC120V/DC24V cosΦ=1



Life Expectancy



15-W STEREO CLASS-D AUDIO POWER AMPLIFIER

Check for Samples: TPA3121D2

FEATURES

- **10-W/Ch Stereo Into an 8-Ω Load From a 24-V Supply**
- **15-W/Ch Stereo Into a 4-Ω Load from a 22-V Supply**
- **30-W/Ch Mono Into an 8-Ω Load from a 22-V Supply**
- **Operates From 10 V to 26 V**
- **Can Run From +24 V LCD Backlight Supply**
- **Efficient Class-D Operation Eliminates Need for Heat Sinks**
- **Four Selectable, Fixed-Gain Settings**
- **Internal Oscillator to Set Class D Frequency (No External Components Required)**
- **Single-Ended Analog Inputs**
- **Thermal and Short-Circuit Protection With Auto Recovery**
- **Space-Saving Surface Mount 24-Pin TSSOP Package**
- **Advanced Power-Off Pop Reduction**

APPLICATIONS

- **Flat Panel Display TVs**
- **DLP® TVs**
- **CRT TVs**
- **Powered Speakers**

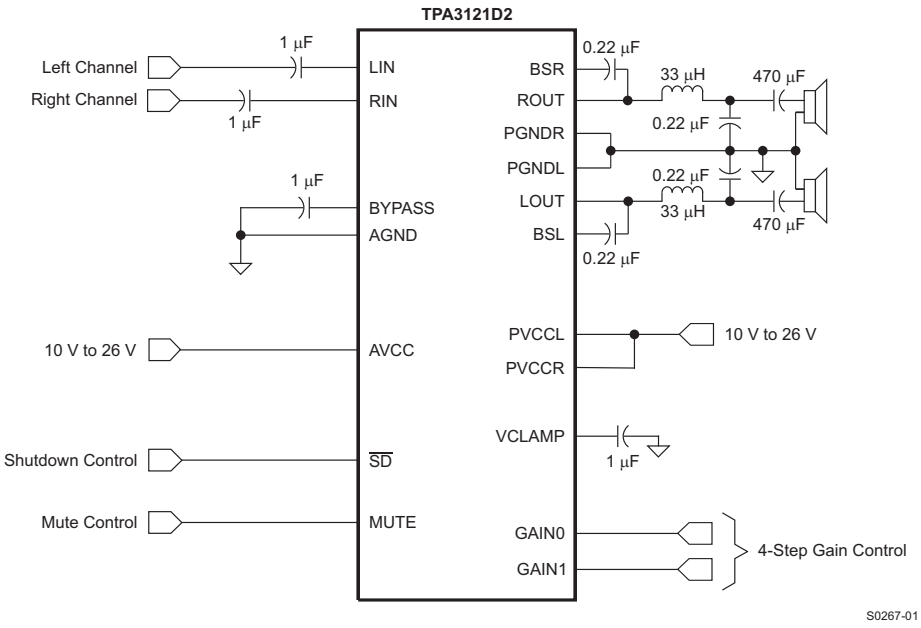
DESCRIPTION

The TPA3121D2 is a 15-W (per channel), efficient, class-D audio power amplifier for driving stereo speakers in a single-ended configuration or a mono speaker in a bridge-tied-load configuration. The TPA3121D2 can drive stereo speakers as low as 4 Ω. The efficiency of the TPA3121D2 eliminates the need for an external heat sink when playing music.

The gain of the amplifier is controlled by two gain select pins. The gain selections are 20, 26, 32, and 36 dB.

The patented start-up and shutdown sequences minimize pop noise in the speakers without additional circuitry.

SIMPLIFIED APPLICATION CIRCUIT



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

DLP is a registered trademark of Texas Instruments.
System Two, Audio Precision are trademarks of Audio Precision, Inc.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

PWP (TSSOP) PACKAGE
(TOP VIEW)

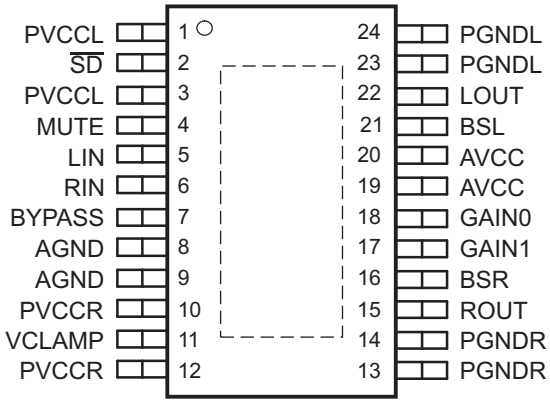


Table 1. TERMINAL FUNCTIONS

TERMINAL		I/O/P	DESCRIPTION
NAME	24-PIN (PWP)		
$\overline{SD}$	2	I	Shutdown signal for IC (low = disabled, high = operational). TTL logic levels with compliance to AVCC
RIN	6	I	Audio input for right channel
LIN	5	I	Audio input for left channel
GAIN0	18	I	Gain select least-significant bit. TTL logic levels with compliance to AVCC
GAIN1	17	I	Gain select most-significant bit. TTL logic levels with compliance to AVCC
MUTE	4	I	Mute signal for quick disable/enable of outputs (high = outputs switch at 50% duty cycle, low = outputs enabled). TTL logic levels with compliance to AVCC
BSL	21	I/O	Bootstrap I/O for left channel
PVCCL	1, 3	P	Power supply for left-channel H-bridge, not internally connected to PVCCR or AVCC
LOUT	22	O	Class-D ½-H-bridge positive output for left channel
PGNDL	23, 24	P	Power ground for left-channel H-bridge
VCLAMP	11	P	Internally generated voltage supply for bootstrap capacitors
BSR	16	I/O	Bootstrap I/O for right channel
ROUT	15	O	Class-D ½-H-bridge negative output for right channel
PGNDR	13, 14	P	Power ground for right-channel H-bridge.
PVCCR	10, 12	P	Power supply for right-channel H-bridge, not connected to PVCCL or AVCC
AGND	9	P	Analog ground for digital/analog cells in core
AGND	8	P	Analog ground for analog cells in core
BYPASS	7	O	Reference for preamplifier inputs. Nominally equal to AVCC/8. Also controls start-up time via external capacitor sizing.
AVCC	19, 20	P	High-voltage analog power supply. Not internally connected to PVCCR or PVCCL
Thermal pad	Die pad	P	Connect to ground. Thermal pad should be soldered down on all applications to secure the device properly to the printed wiring board.

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) (1)

			VALUE	UNIT
V_{CC}	Supply voltage	AVCC, PVCC	–0.3 to 30	V
V_I	Logic input voltage	$\overline{SD}$, MUTE, GAIN0, GAIN1	–0.3 to V_{CC} + 0.3	V
V_{IN}	Analog input voltage	RIN, LIN	–0.3 to 7	V
	Continuous total power dissipation		See the Thermal Inforamtion Table	
T_A	Operating free-air temperature range		–40 to 85	°C
T_J	Operating junction temperature range		–40 to 150	°C
T_{stg}	Storage temperature range		–65 to 150	°C
R_L	Load resistance (minimum value)	SE Output Configuration	3.2	Ω
		BTL Output Configuration	6.4	
ESD	Electrostatic Discharge	Human body model (all pins)	±2	kV
		Charged-device model (all pins)	±500	V

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

THERMAL INFORMATION

THERMAL METRIC(1)(2)		TPA3121D2 PWP 24 PINS	UNITS
θ_{JA}	Junction-to-ambient thermal resistance	30.9	°C/W
θ_{JCtop}	Junction-to-case (top) thermal resistance	29.6	
θ_{JB}	Junction-to-board thermal resistance	9.0	
ψ_{JT}	Junction-to-top characterization parameter	0.5	
ψ_{JB}	Junction-to-board characterization parameter	3.6	
θ_{JCbot}	Junction-to-case (bottom) thermal resistance	0.7	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.
(2) For thermal estimates of this device based on PCB copper area, see the TI PCB Thermal Calculator.

RECOMMENDED OPERATING CONDITIONS

			MIN	MAX	UNIT
V_{CC}	Supply voltage	PVCC, AVCC	10	26	V
V_{IH}	High-level input voltage	$\overline{SD}$, MUTE, GAIN0, GAIN1	2		V
V_{IL}	Low-level input voltage	$\overline{SD}$, MUTE, GAIN0, GAIN1		0.8	V
I_{IH}	High-level input current	$\overline{SD}$, $V_I = V_{CC}$, V_{CC} = 30 V		125	μA
		MUTE, $V_I = V_{CC}$, V_{CC} = 30 V		125	
		GAIN0, GAIN1, $V_I = V_{CC}$, V_{CC} = 24 V		125	
I_{IL}	Low-level input current	$\overline{SD}$, V_I = 0, V_{CC} = 30 V		1	μA
		MUTE, V_I = 0 V, V_{CC} = 30 V		1	
		GAIN0, GAIN1, V_I = 0 V, V_{CC} = 24 V		1	
T_A	Operating free-air temperature		–40	85	°C

DC CHARACTERISTICS

T_A = 25°C, V_{CC} = 24 V, R_L =8Ω (unless otherwise noted)

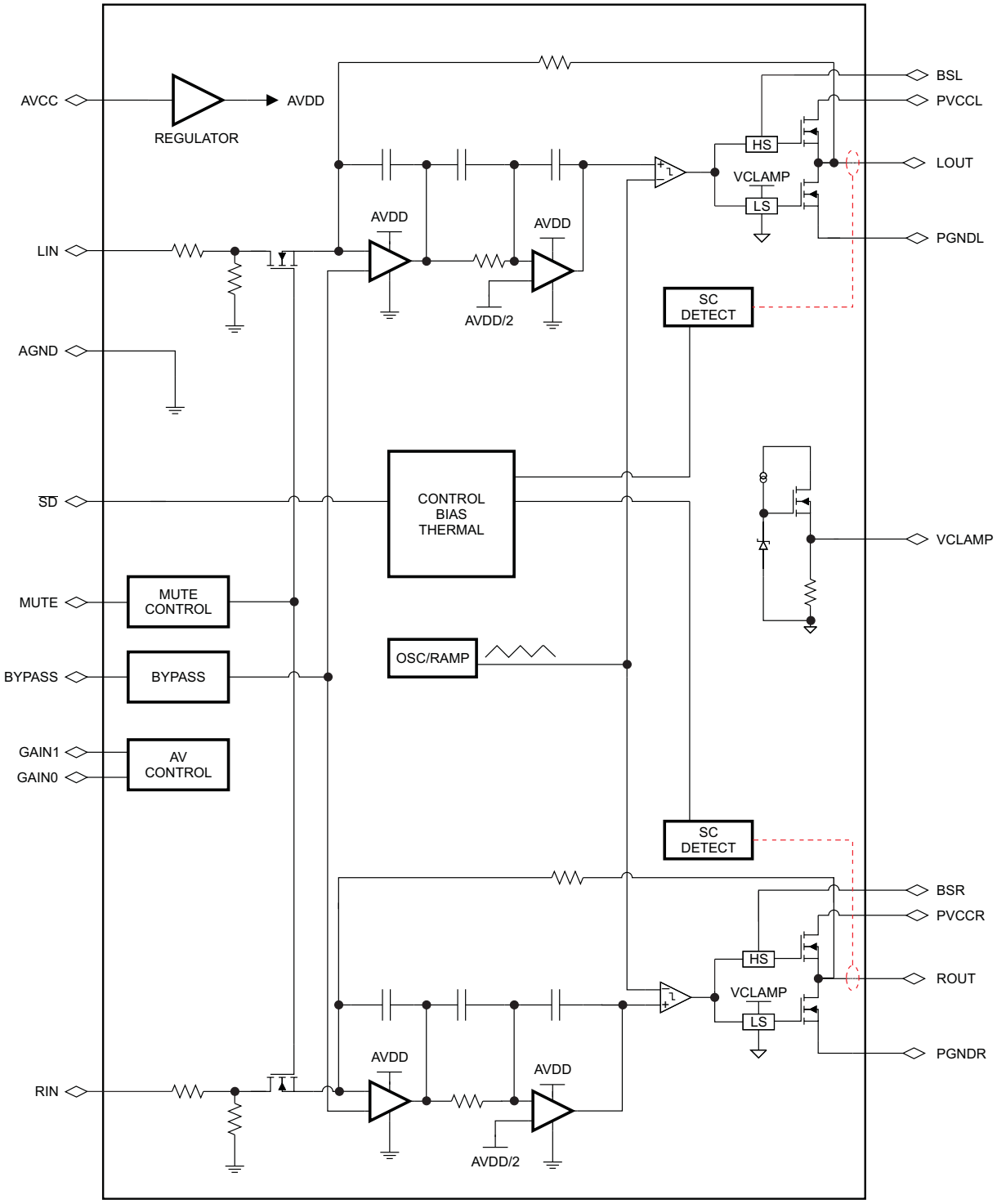
PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
| V_{OS} |	Class-D output offset voltage (measured differentially in BTL mode as shown in Figure 36)	V_I = 0 V, A_V = 36 dB			7.5	50	mV
$V_{(BYPASS)}$	Bypass output voltage	No load			AVCC/8		V
$I_{CC(q)}$	Quiescent supply current	$\overline{SD}$ = 2 V, MUTE = 0 V, no load			16	30	mA
$I_{CC(q)}$	Quiescent supply current in mute mode	MUTE = 0.8 V, no load			16		mA
$I_{CC(q)}$	Quiescent supply current in shutdown mode	$\overline{SD}$ = 0.8 V, no load			0.39	1	mA
$r_{DS(on)}$	Drain-source on-state resistance				210	450	mΩ
G	Gain	GAIN1 = 0.8 V	GAIN0 = 0.8 V	18	20	22	dB
			GAIN0 = 2 V	24	26	28	
		GAIN = 2 V	GAIN0 = 0.8 V	30	32	34	
			GAIN0 = 2 V	34	36	38	
	Mute attenuation	V_I = 1 Vrms			-75		dB

AC CHARACTERISTICS

T_A = 25°C, V_{CC} = 24 V, R_L = 8Ω (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
ksvr	Supply ripple rejection	V_{CC} = 24, V_{ripple} = 200 mV_{PP} Gain = 20 dB	100 Hz		–48		dB
			1 kHz		–52		
P_O	Output power at 1% THD+N	V_{CC} = 24 V, f = 1 kHz			8		W
	Output power at 10% THD+N	V_{CC} = 24 V, f = 1 kHz			10		
THD+N	Total harmonic distortion + noise	f = 1 kHz, P_O = 5 W			0.04%		
V_n	Output integrated noise floor	20 Hz to 22 kHz, A-weighted filter, Gain = 20 dB			125		μV
					–78		dBV
	Crosstalk	P_O = 1 W, f = 1 kHz; gain = 20 dB			–70		dB
SNR	Signal-to-noise ratio	Max output at THD+N < 1%, f = 1 kHz, gain = 20 dB			92		dB
	Thermal trip point				150		°C
	Thermal hysteresis				30		°C
f_{OSC}	Oscillator frequency			250	300	350	kHz
Δt mute	Mute delay	Time from mute input switches high until outputs muted			120		msec
Δt unmute	Unmute delay	Time from mute input switches low until outputs unmuted			120		msec

FUNCTIONAL BLOCK DIAGRAM



SMARTRONICS

MH26866

12-7E | 12V 7Ah

Valve Regulated Lead Acid Battery / AGM Technology

P# 12-7E 302

*E: Economic series

Specifications

Nominal Voltage(V)		12V
Nominal Capacity		
20 hr rate	(0.350A to 1.80V/cell,25°C (77°F)	7.0AH
10 hr rate	(0.68A to 1.80V/cell,25°C (77°F)	6.8AH
5 hr rate	(1.13A to 1.750V/cell,25°C (77°F)	5.65AH
1C	(4.56A to 1.60V/cell,25°C (77°F)	4.56AH
Weight		Approx. 2.32 kg (5.128lbs)
Internal Resistance		Approx. 30mΩ
Maximum Discharge Current		350A (5sec)

Charging Methods at 25°C (77°F)

Cycle use:

Initial Charging Current less than	2.8A
Charging Voltage	2.40V~2.45VPC
Coefficient	-30.0mV/°C

Standby use:

No limit on Initial Charging Current Voltage

Charging Voltage	2.23V~2.30VPC
Coefficient	-20.0mV/°C

Operating Temperature Range

Charge	-10~60°C (14~140°F)
Discharge	-20~60°C (-4~140°F)
Storage	-20~60°C (-4~140°F)
Case Material	ABS
Terminal	F1

Description of torque value of hard ware for the terminals

Recommended torque value	M6: 7 N-m (122kgf-cm)
Maximum allowable torque value	M6: 9 N-m (153kgf-cm)

Self-Discharge

This series batteries may be stored for up to 6 months at 25°C (77°F) and then a freshening charge is required. For higher temperatures the time interval will be shorter.

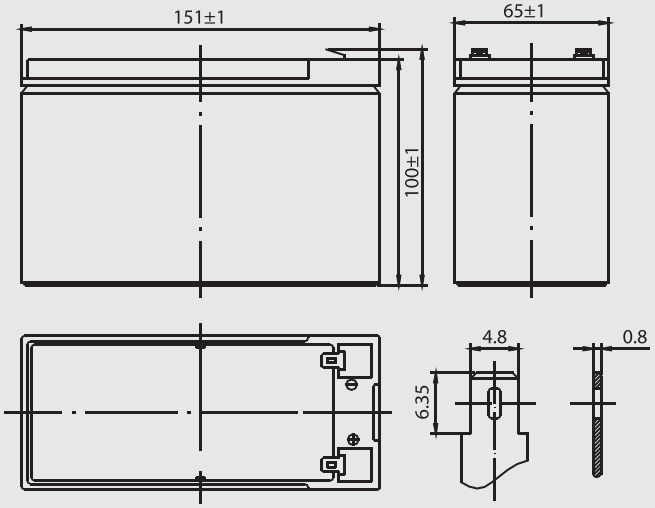
For: Backup Power i.e. UPS, ...

Design life:

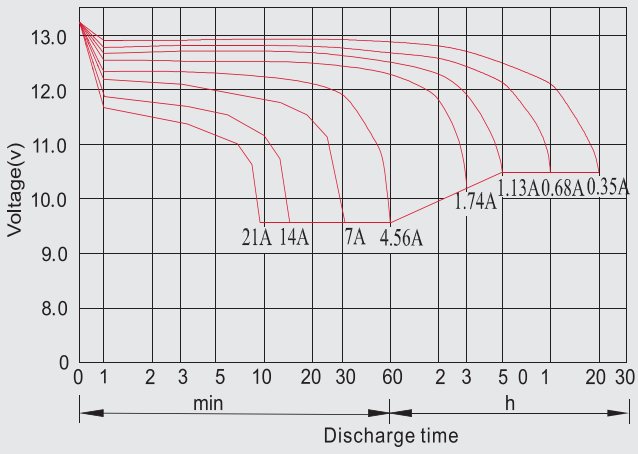
3-5 years (Ambient Temperature 20°c)

Dimensions

Terminal F1



Discharge Characteristics



Constant Current Discharge (Amperes) at 25 °C (77°F)

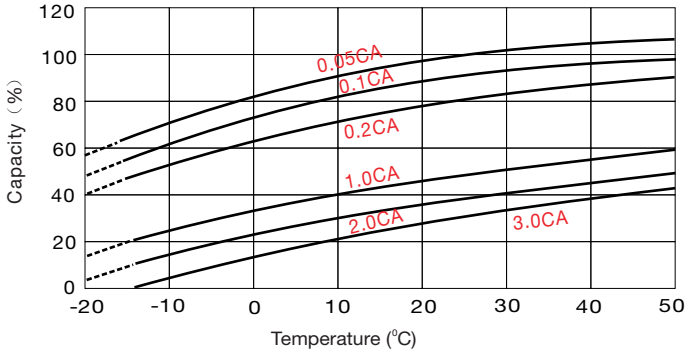
F.V (V/cell) \ Time	5min	10min	15min	30min	60min	3h	5h	10h	20h
1.80	22.8	14.8	12.4	7.03	3.84	1.63	1.08	0.66	0.344
1.75	24.4	15.7	13.0	7.24	4.04	1.68	1.13	0.68	0.350
1.70	26.0	16.7	13.6	7.62	4.22	1.74	1.17	0.69	0.355
1.65	27.5	17.5	14.2	7.90	4.40	1.80	1.22	0.69	0.359
1.60	29.1	18.4	14.8	8.30	4.56	1.84	1.26	0.70	0.363

Constant Power Discharge (Watts/cell) at 25 °C (77°F)

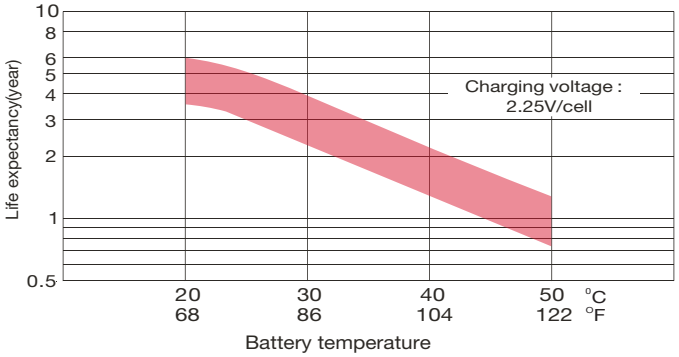
F.V (V/cell) \ Time	5min	10min	15min	30min	45min	1h	2h	3h	5h
1.80	41.6	28.0	23.3	12.9	9.75	7.62	4.50	3.19	2.15
1.75	44.5	29.8	24.3	13.4	10.10	7.99	4.65	3.30	2.21
1.70	46.9	31.6	25.4	14.0	10.50	8.23	4.80	3.40	2.25
1.65	49.4	33.3	26.5	14.6	11.00	8.59	4.94	3.50	2.29
1.60	52.0	35.1	27.5	15.2	11.50	8.97	5.06	3.59	2.33

Specifications subject to change without notice.

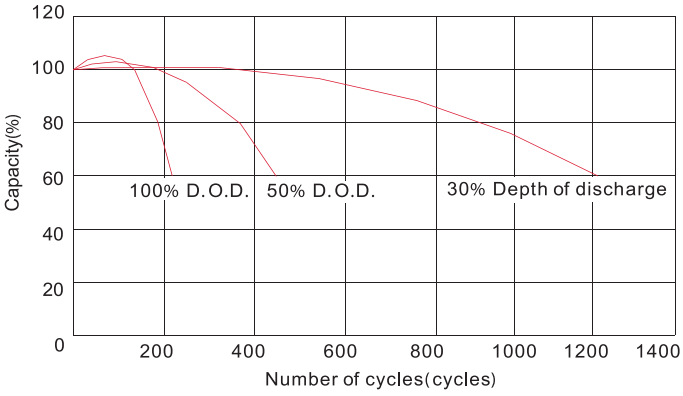
Temperature Effects in Relation to Battery Capacity



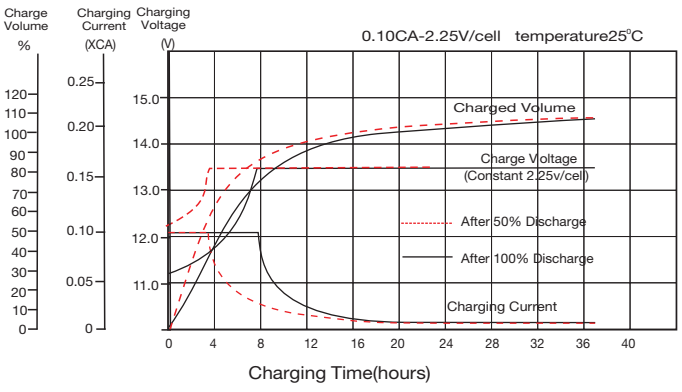
Effect of Temperature on Long Term Float Life



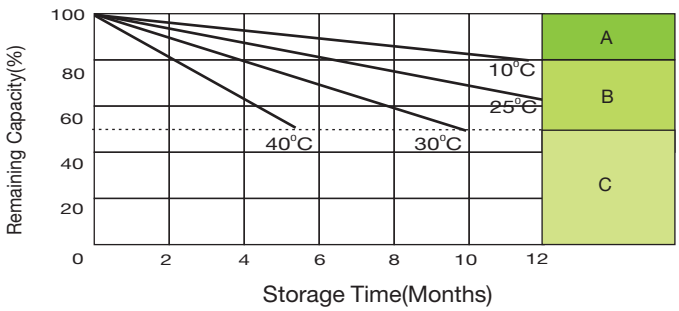
Cycle Life in Relation to Depth of Discharge



Float Charging Characteristics



Self Discharge Characteristics

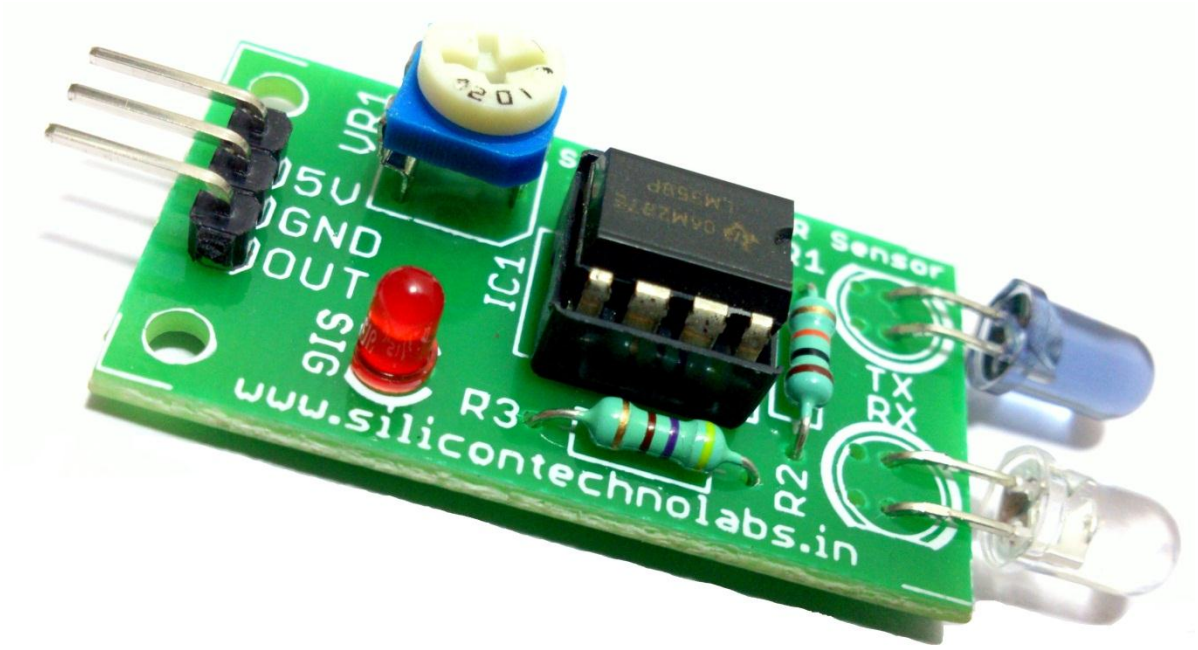


A No supplementary charge required (Carry out supplementary charge before use if 100% capacity is required.)

B Supplementary charge required before use. Optional charging way as below:

1. Charged for above 3 days at limited current 0.25CA and constant voltage 2.25V/cell.
2. Charged for above 20hours at limited current 0.25CA and constant voltage 2.45V/cell.
3. Charged for 8~10hours at limited current 0.05CA.

C Supplementary charge may often fail to recover the capacity. The battery should never be left standing till this is reached.



IR Proximity Sensor

1. Descriptions

The Multipurpose Infrared Sensor is an add-on for your line follower robot and obstacle avoiding robot that gives your robot the ability to detect lines or nearby objects. The sensor works by detecting reflected light coming from its own infrared LED. By measuring the amount of reflected infrared light, it can detect light or dark (lines) or even objects directly in front of it. An onboard RED LED is used to indicate the presence of an object or detect line. Sensing range is adjustable with inbuilt variable resistor.

The sensor has a 3-pin header which connects to the microcontroller board or Arduino board via female to female or female to male jumper wires. A mounting hole for easily connect one or more sensor to the front or back of your robot chassis.

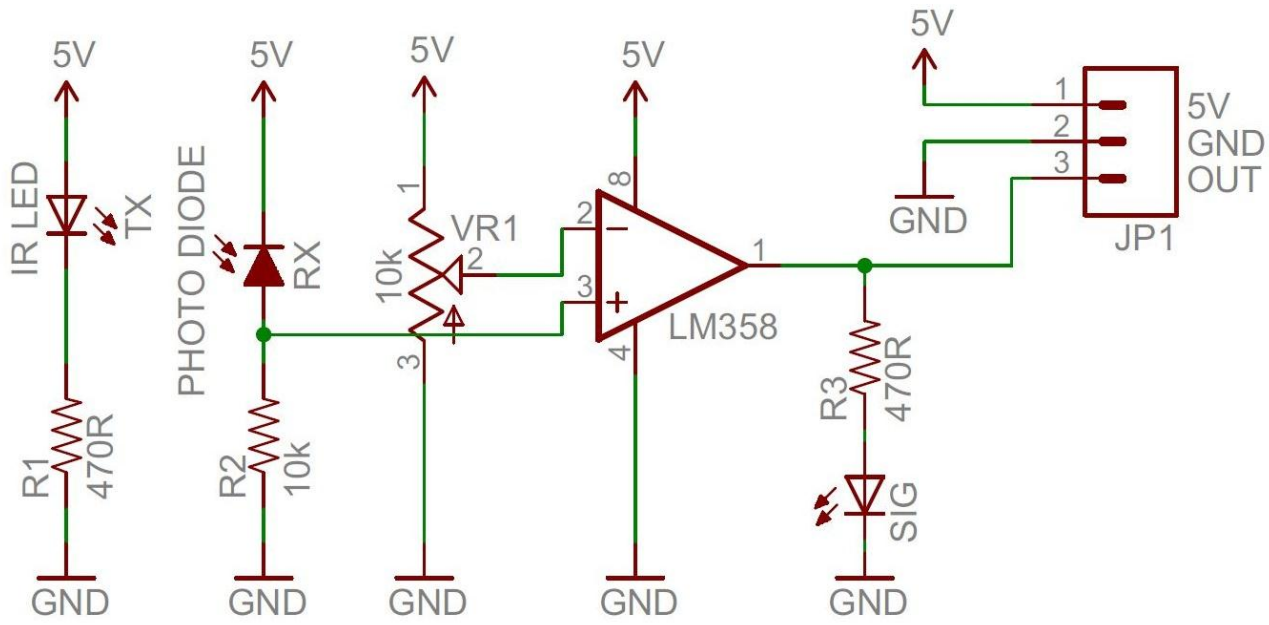
2. Features

- 5VDC operating voltage.
- I/O pins are 5V and 3.3V compliant.
- Range: Up to 20cm.
- Adjustable Sensing range.
- Built-in Ambient Light Sensor.
- 20mA supply current.
- Mounting hole.

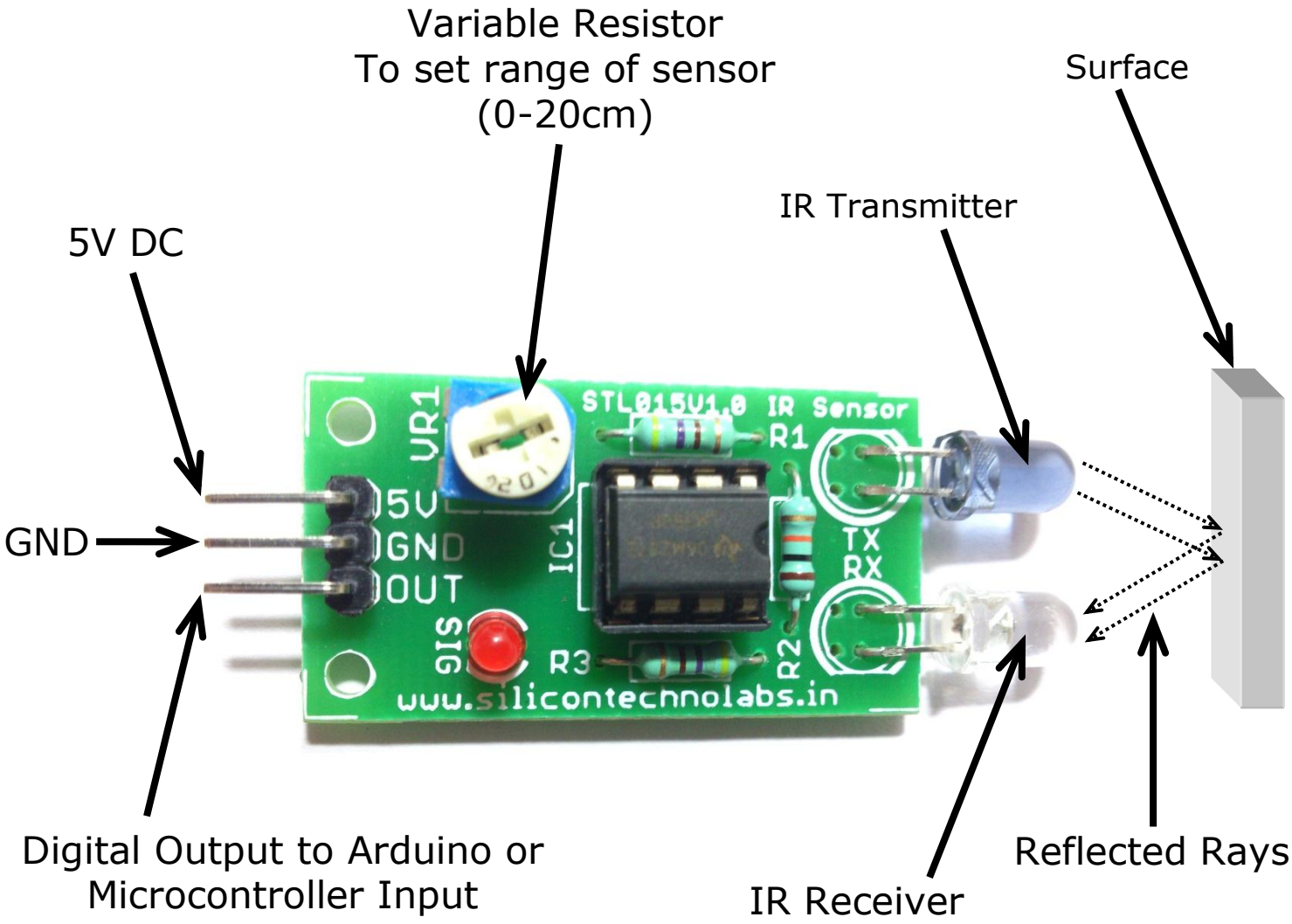
3. Specifications

- Size: 50 x 20 x 10 mm (L x B x H)
- Hole size: ϕ2.5mm

4. Schematics

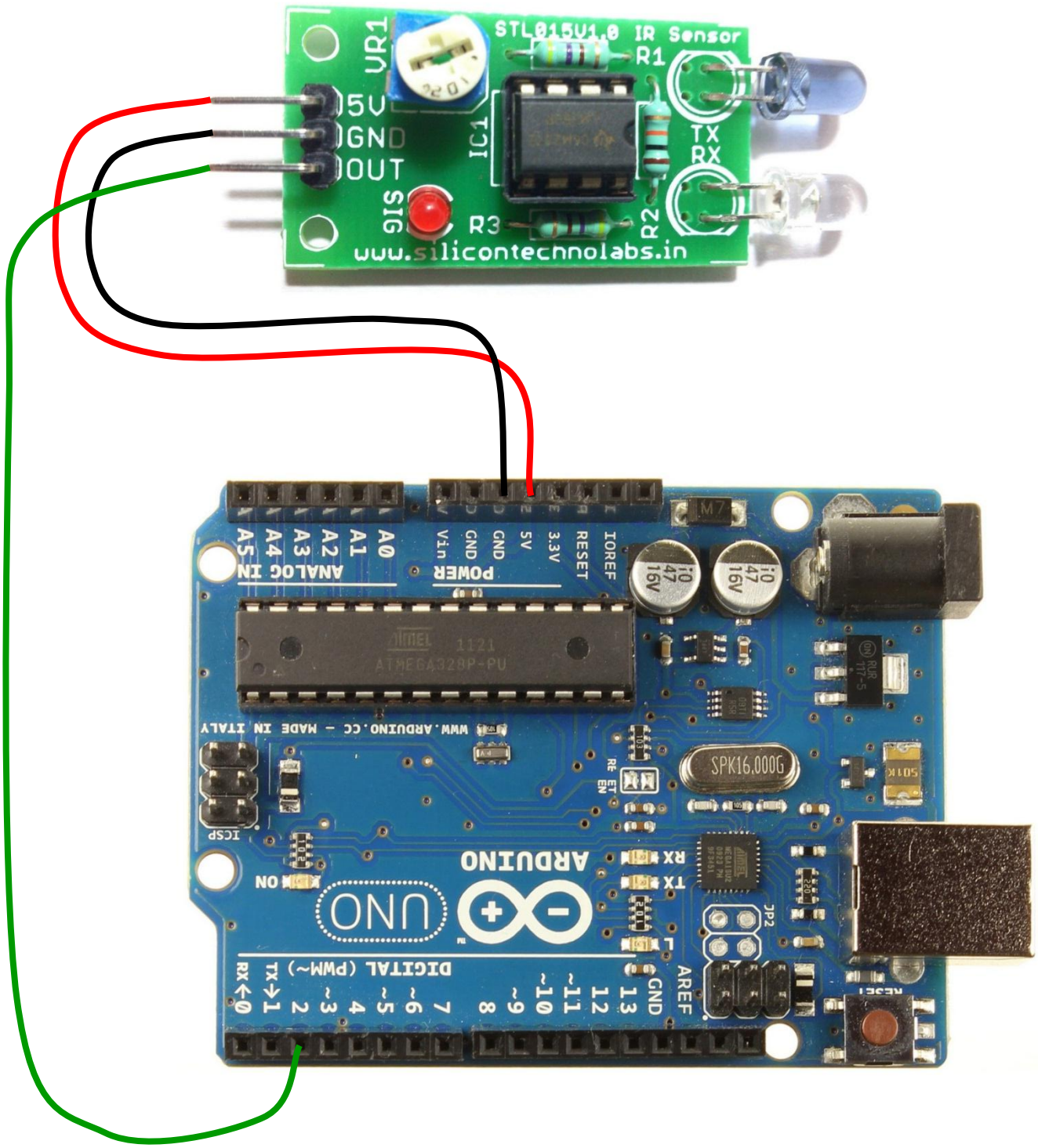


5.Hardware Details



6.Interface to Arduino

Now let's we build simple object counter using IR Proximity Sensor that's counts the Number of objects.Connect Silicon TechnoLabs IR Proximity Sensor to your arduino board as shown in below image.

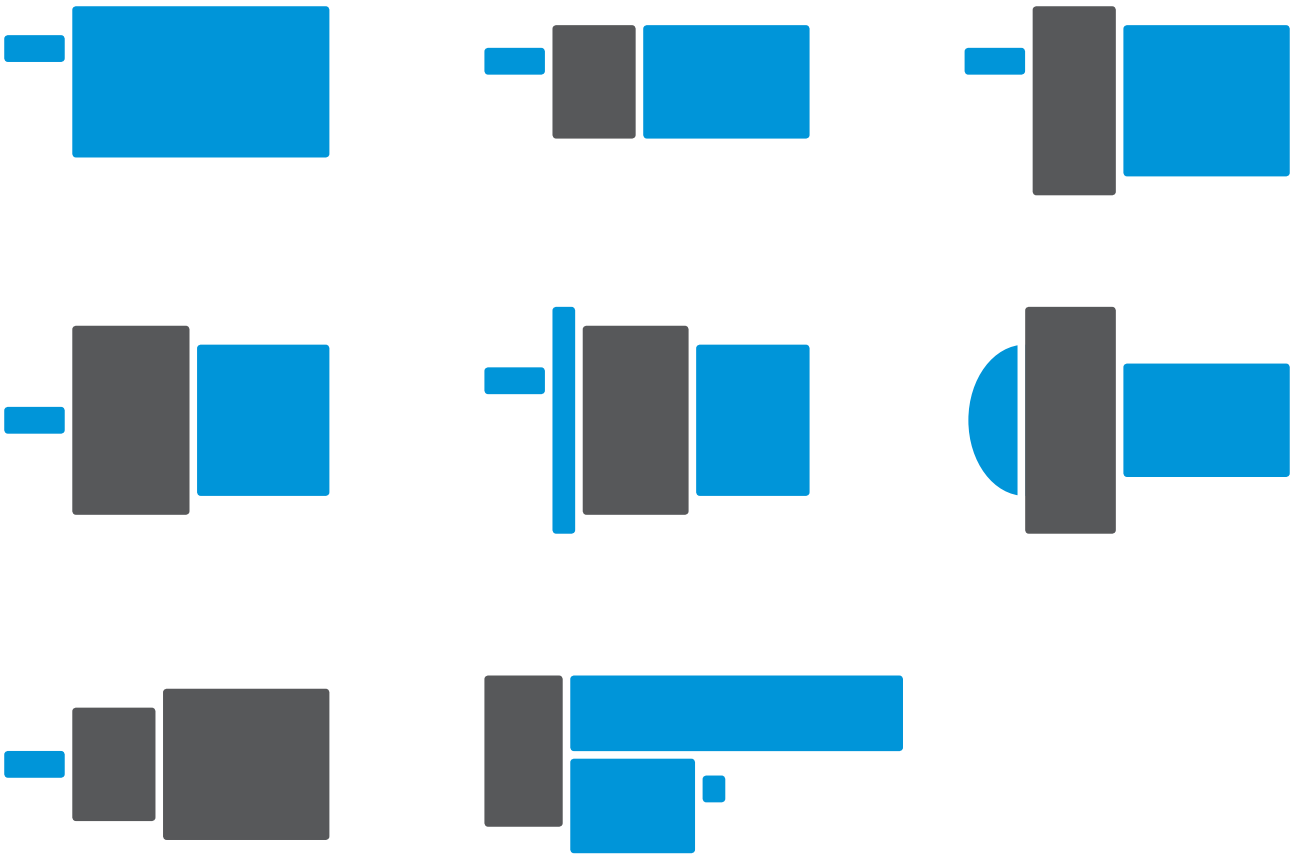


7.Arduino Sample Code

```
/*
 Object counter
 Counts the number of objects and prints the results to the serial monitor.
 The circuit:
 * OUT attached to pin 2
 Created 2015
 by Harshit Borad <http://www.silicontechnolabs.in>
*/
// constants won't change. They're used here to
// set pin numbers:
const int OUT = 2; // the number of the IR Proximity Sensor pin
const int ledPin =  13;// the number of the LED pin
// variables will change:
int Number_of_Object = 0;// variable for reading the Number of Objects passing from sensor
int SensorState = 0;
void setup()
{
  Serial.begin(9600);  // initialize serial communications at 9600 bps:
  pinMode(ledPin, OUTPUT);  // initialize the LED pin as an output:
  pinMode(OUT, INPUT);   // initialize the IR Proximity Sensor pin as an input:
}
void loop()
{
  SensorState = digitalRead(OUT);// read the state of the Sensor Signal
  // check if the Sensor Signal is HIGH then there is object in front of sensor
  // so increment Number_of_Object variable by one.
  if (SensorState == HIGH)
  {
    digitalWrite(ledPin, HIGH);// turn LED on:
    Number_of_Object++;
    Serial.println(Number_of_Object);// print the results to the serial monitor:
  }
  else
  {
    digitalWrite(ledPin, LOW);// turn LED off:
  }
}
```

Thank you

"Happy Coding"

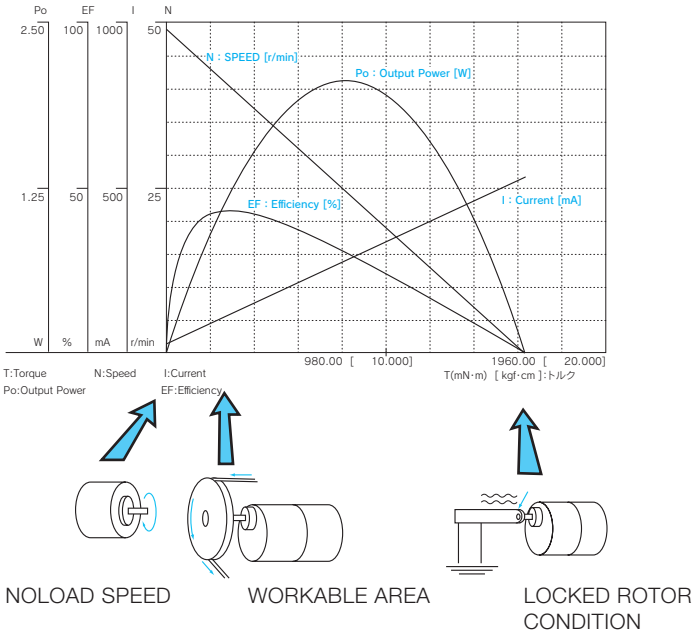


DC GEARED MOTOR

TSUKASA

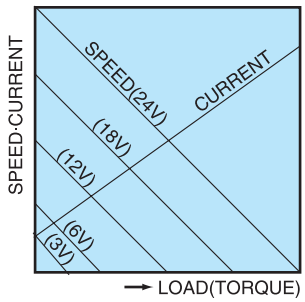
http://www.tsukasa-d.co.jp/

SPEED AND LOAD CHARACTERISTICS



The relationship between torque vs speed and current is linear as shown left ; as the load on a motor increases, speed will decrease.
The graph pictured here represents the characteristics of a typical motor.
As long as the motor is used in the area of high efficiency (as represented by the shaded area) long life and good performance can be expected. However, using the motor outside this range will result in high temperature rises and deterioration of motor parts.
If voltage in continuous applied to a motor in a locked rotor condition, the motor will heat up and fail in a relatively short time.
Therefore it is important that there is some form of protection against high temperature rises.
A motor's basic rating point is slightly lower than its maximum efficiency point.
Load torque can be determined by measuring the current drawn when the motor is attached to a machine whose actual load value is known.
We will select the most suitable motor for your application after receiving your information.

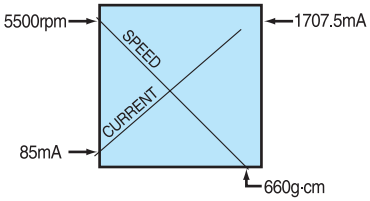
AS APPLIED VOLTAGE WILL BE CHANGED



As shown left, if the applied voltage is changed, no load speed and starting torque also change in proportion to the voltage.
Speed characteristics at a given voltage are parallel to those at other voltages.
Thus, a DC motor can be used at a voltage lower than the rated voltage.
But, below 1000 rpm, the speed becomes unstable, and the motor will not run smoothly.

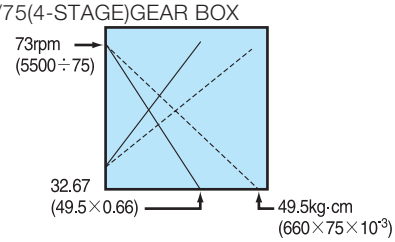
CHARACTERISTICS AND RATED PERFORMANCE OF A GEARED MOTOR

Ⓐ ex. TG-85C MOTOR ONLY



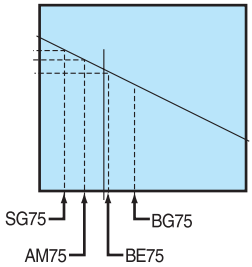
Speed reduction by means of a gear box results in increased torque.
The reduction/increase is determined by the gear ratio and efficiency of the gear box.

Ⓑ WITH 1/75(4-STAGE)GEAR BOX



Over-all efficiency depends on the number of reduction stages : one average is 90% per stage. Therefore : a two stage reduction gives 90×90=81% ; 3 stages will be 72.9% and a 4-stage reduction 66%.
The above mechanical loss effects the stall torque as shown left.
Stall torque of a geared motor can be calculated using the following formula : —Motor stall torque×gear ratio×efficiency.

Ⓒ ALLOWABLE TORQUE



The output loading on a gear box must never exceed the manufactures “specified rated torque” as this will cause premature gear failure.
It is particularly important to observe this at slow output speeds when the calculated output torque exceeds the specified rated torque.

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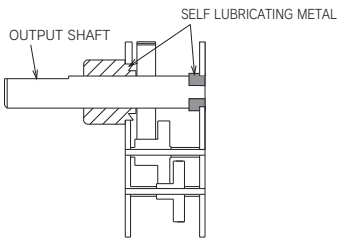
GEAR BOX CONSTRUCTION AND FEATURES

INTERMITTENT DUTY

(Suitable for less than 2sec. on & long enough off time)

STANDARD TYPE

GL, SS, LG, SG, AGD, WM, VG, VM, BG ⇨



STANDARD GEAR MECHANISM

Other than the output gear, the gears rotate around a shaft that is fixed to the plate.

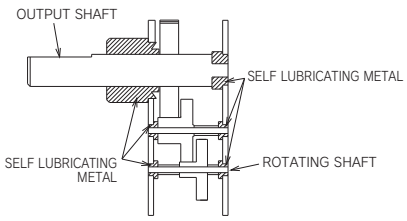
HEAVY LOAD

—self lubricating metal type.

SM, AMD, BE, BM, JM ⇨

—ballbearing at all stages

AP, BM ⇨



NON-LUBRICATED METAL BEARING GEAR MECHANISM

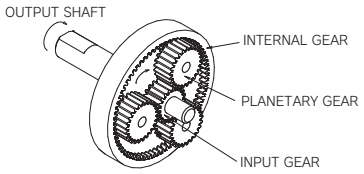
All gears, including the output gear, are attached to the shaft and supported by non-lubricated metal bearings. This type of mechanism is suitable for medium load applications and continuous duty cycle operation.

LOW COST VERSION—Plastic or sinterd metal. **EU, RU, VG, LG**

COMPACT SIZE TYPE

—Planetary

GU, EU, RU, FU KU, SU ⇨



PLANETARY GEAR MECHANISM

A heavy duty type gear mechanism using 3 mating gears to transmit torque to the output shaft. This type of mechanism is suitable for limited space applications.

Protection against overload and locked rotor

When the rotor is locked and voltage is applied to the motor terminals, the temperature of the motor windings will rise and eventually short-circuit.
The time until a short-circuit condition appears differs per motor type.
It is recommended that the motor is protected against such an overload by means of a fuse, current limiter or mechanical protection.

Protection against RFI/EMI caused by PWM control

An internally installed suppressor reduces electrical commutation noise caused by the brushes. Depending on the requirements, extra precautions sometimes are recommended such as an external capacitor, or filter circuit.
When driven in PWM at certain Frequencies it may occur that a motor does not start due to the combination of driving frequency and internally fitted capacitive noise suppressor.

Precautions for instantaneous reversing and dynamic braking

When the power supply to the motor is switched off, it is advisable to allow the motor to stop rotating before reversing the supply polarity.
Failure to do this will result in a very high instantaneous current.
It is possible to stop the motor within a few revolutions by applying a short-circuit across the motor terminals immediately after the motor is switched off. This method is very effective but may shorten brush life.

Vertical mounting with shaft up

In some cases when a motor-gear is mounted in this position, traces of lubrication oil can contaminate the brushes and commutator thus shortening brush life or causing a short-circuit. Please contact us when vertical mounting is required.

Speed detection and control

A number of models can be provided with a magnetic or optical encoder.
Please contact us for detailed information and assistance.

NEW PRODUCT

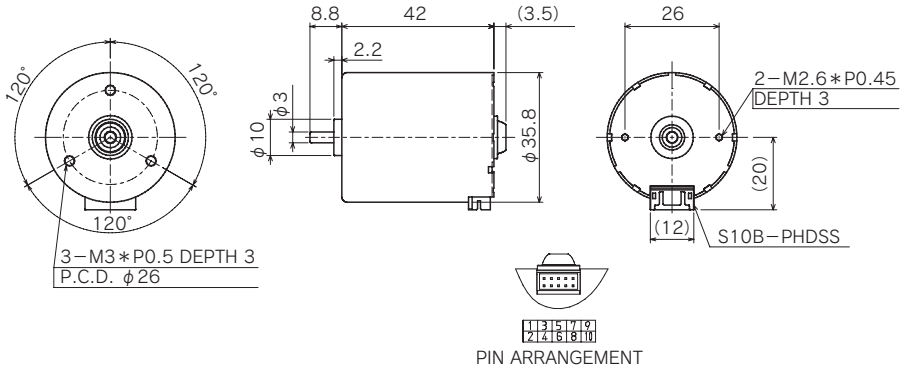
TG-55LA

BUILT-IN DRIVE CIRCUIT, COMPACT, BRUSHLESS MOTOR.

Single motor specification

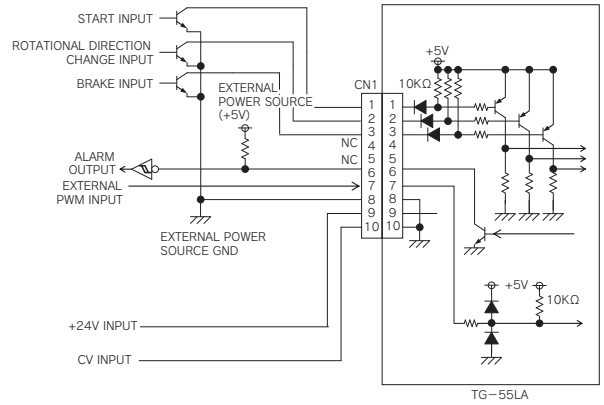
TYPE	RATED VOLTAGE (V)	NO-LOAD SPEED (r/min)	NO-LOAD CURRENT (mA)	TORQUE		RATED SPEED (r/min)	RATED CURRENT (mA)	DIRECTION OF ROTATION	WEIGHT (g)
				(mN・m)	(gf・cm)				
TG-55LA	24	3700	120	19.6	200	2400	420	BOTH DIRECTIONS	165

Single motor outline



PIN ARRANGEMENT

Reference Connection Diagram



Input/Output Signal

PIN No.	SIGNAL NAME	CONTENT	
1	START INPUT	"H" : STOP "L" : ROTATIONAL MOVEMENT	"H" : OPEN "L" : 0 ~ 0.7 V INPUT CURRENT: 3 mA MAX.
2	ROTATIONAL DIRECTION CHANGE INPUT*	"H" : CW ROTATION "L" : CCW ROTATION	
3	BRAKE INPUT	SELECT STOP METHOD AT ROTATIONAL MOVEMENT. "H" : BRAKE STOP "L" : BRAKE RELEASE	
4	UNUSED		
5	UNUSED		
6	ALARM OUTPUT	OUTPUT TRANSISTOR OFF ON DETECTING OVERHEAT, MOTOR LOCK OR OVERCURRENT.	OPEN COLLECTOR OUTPUT MAX. APPLIED VOLTAGE: 30 V MAX. CURRENT: 10 mA SATURATION VOLTAGE AT ON: 0.8 V MAX.
7	PWM INPUT	INPUT VOLTAGE: WITHIN 0 ~ 5 V FREQUENCY RANGE: 20 ~ 27 kHz	"H" FIXED: ROTATION STOP "L" FIXED: MAX. DUTY OPERATION (ROTATIONAL SPEED CHANGES SINCE CLOSED LOOP CONTROL IS NOT DONE.)
8	GND	GROUND FOR CONTROL INPUT SIGNAL (SAME POTENTIAL AS PIN 10)	
9	POWER INPUT	+24 V INPUT	
10		0 V INPUT (SAME POTENTIAL AS PIN 8)	

* Rotational direction is one with single motor. Refer to the specification of each geared motor for the rotational direction of the geared motor output shaft.

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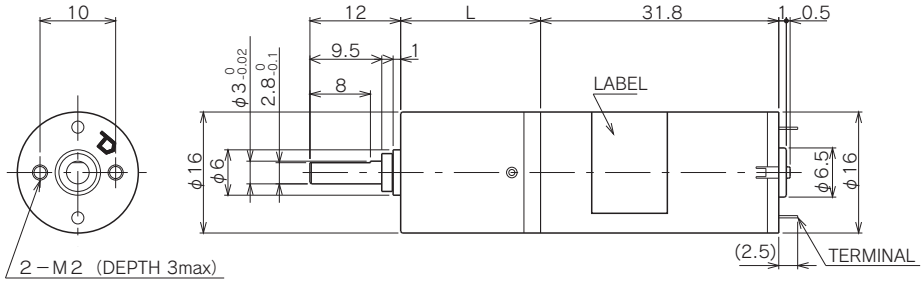
TG-87

(1.7W) φ16, COMPACT DESIGN.

APPLICATION ATM ／ MONEY COUNTING MACHINE ／ CARD READER ／ PRINTER ／ SECURITY CAMERA ／ CASSETTE LOADING ／ MEDICAL EQUIPMENT etc.

GU

TG-87A
TG-87B



Allowable torque-speed characteristics GU

MODEL	GEAR RATIO	1/3.5	1/4.9	1/12.5	1/17.3	1/24.1	1/44	1/61.2	1/85.1	1/118	1/155	1/216	1/300	1/418	1/581
TG-87A-GU (12V)	SPEED (r/min)	3336	2352	939	697	485	267	189	136	97.3	74.4	53.2	38.8	28.2	20.9
	TORQUE (mN·m)	2.9	4.9	9.8	9.8	19.6	29.4	49	68.6	98	107.8	156.8	196	245	245
	TORQUE (kgf·cm)	0.03	0.05	0.1	0.1	0.2	0.3	0.5	0.7	1	1.1	1.6	2	2.5	2.5
TG-87B-GU (24V)	SPEED (r/min)	3336	2352	939	697	485	267	189	136	97.3	74.4	53.2	38.8	28.2	20.9
	TORQUE (mN·m)	2.9	4.9	9.8	9.8	19.6	29.4	49	68.6	98	107.8	156.8	196	245	245
	TORQUE (kgf·cm)	0.03	0.05	0.1	0.1	0.2	0.3	0.5	0.7	1	1.1	1.6	2	2.5	2.5

GU

GEAR RATIO	L (mm)	STAGE	TORQUE (mN·m)	TORQUE (kgf·cm)	WEIGHT (g)
1/3.5 ～ 1/4.9	15.1	1	49	0.5	18
1/12.5 ～ 1/24.1	18.5	2	98	1	21
1/44 ～ 1/118	22	3	147	1.5	24
1/155	25.5	4	147	1.5	28
1/216 ～ 1/581	25.5	4	245	2.5	28

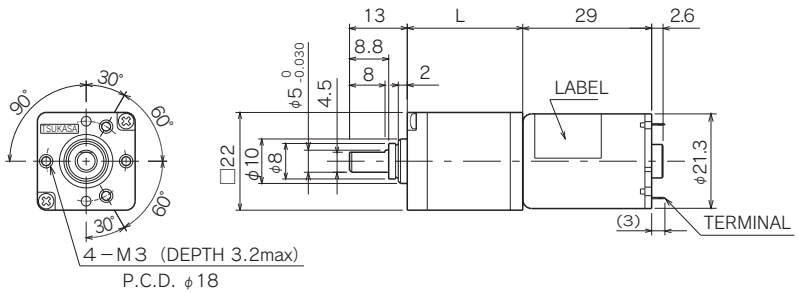
TG-01

(0.4 ～ 0.8W) φ21.3, COMPACT DESIGN.

APPLICATION ATM ／ MONEY COUNTING MACHINE ／ CARD READER ／ PRINTER ／ BLINDS ／ SECURITY CAMERA ／ CASSETTE LOADING ／ FINISHER ／ MEDICAL EQUIPMENT etc.

EU

TG-01F
TG-01G
TG-01H



Allowable torque-speed characteristics EU

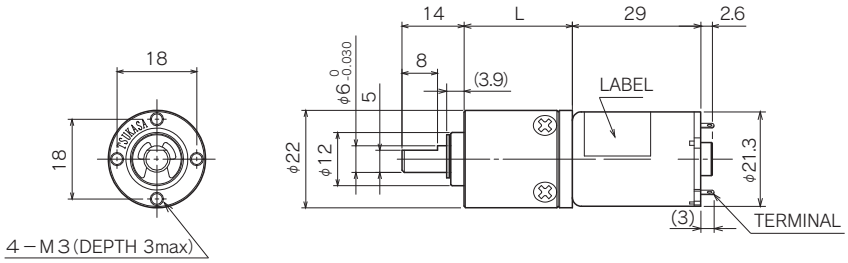
MODEL	GEAR RATIO	1/12.1	1/17.6	1/20.6	1/25.5	1/42.1	1/61.2	1/71.7	1/88.7	1/104	1/129
TG-01F-EU (24V)	SPEED (r/min)	316	225	194	149	94.1	62.6	53	43	36.7	29.5
	TORQUE (mN·m)	8.82	9.8	9.8	19.6	19.6	39.2	49	58.8	68.6	88.2
	TORQUE (kgf·cm)	0.09	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.9
TG-01G-EU (24V)	SPEED (r/min)	609	425	365	289	177	121	103	83	70.9	57.1
	TORQUE (mN·m)	8.82	8.82	9.8	19.6	19.6	39.2	49	58.8	68.6	88.2
	TORQUE (kgf·cm)	0.09	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.9
TG-01H-EU (12V)	SPEED (r/min)	600	420	361	285	175	119	101	81.8	69.9	56.3
	TORQUE (mN·m)	8.82	9.8	9.8	19.6	19.6	39.2	49	58.8	68.6	88.2
	TORQUE (kgf·cm)	0.09	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.9

EU

GEAR RATIO	L (mm)	STAGE	TORQUE (mN·m)	TORQUE (kgf·cm)	WEIGHT (g)
1/12.1 ～ 1/25.5	21	2	98	1	34
1/42.1 ～ 1/129	26	3	147	1.5	36

FU

TG-01F
TG-01G
TG-01H



Allowable torque-speed characteristics FU

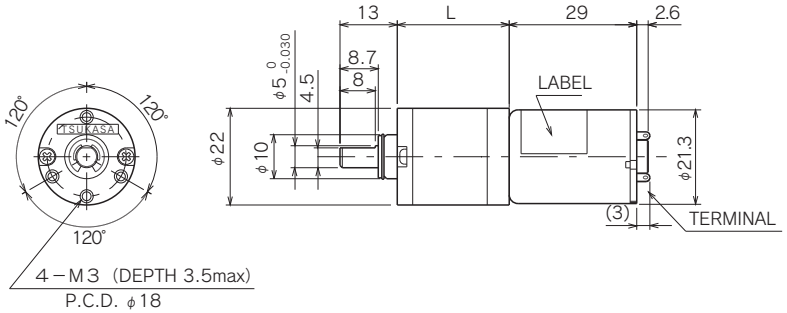
MODEL	GEAR RATIO	1/4	1/4.7	1/16	1/19	1/23	1/64	1/76	1/90	1/107	1/256	1/304	1/361	1/429	1/509
TG-01F-FU (24V)	SPEED (r/min)	1026	855	258	220	187	63.7	53.4	44.9	37.9	15.8	13.3	11.3	9.5	8
	TORQUE (mN·m)	2.94	3.92	9.8	9.8	9.8	39.2	49	58.8	68.6	147	176.4	196	245	294
	TORQUE (kgf·cm)	0.03	0.04	0.1	0.1	0.1	0.4	0.5	0.6	0.7	1.5	1.8	2	2.5	3
TG-01G-FU (24V)	SPEED (r/min)	1919	1604	481	409	347	119	100	84.3	71.1	29.7	25	21.2	17.8	14.9
	TORQUE (mN·m)	2.94	3.92	9.8	9.8	9.8	39.2	49	58.8	68.6	147	176.4	196	245	294
	TORQUE (kgf·cm)	0.03	0.04	0.1	0.1	0.1	0.4	0.5	0.6	0.7	1.5	1.8	2	2.5	3
TG-01H-FU (12V)	SPEED (r/min)	1924	1608	482	410	348	120	100	84.5	71.3	29.8	25.1	21.2	17.8	15
	TORQUE (mN·m)	2.94	3.92	9.8	9.8	9.8	39.2	49	58.8	68.6	147	176	196	245	294
	TORQUE (kgf·cm)	0.03	0.04	0.1	0.1	0.1	0.4	0.5	0.6	0.7	1.5	1.8	2	2.5	3

FU

GEAR RATIO	L (mm)	STAGE	TORQUE (mN·m)	TORQUE (kgf·cm)	WEIGHT (g)
1/4 ～ 1/4.7	19.5	1	49	0.5	41
1/16 ～ 1/23	24.5	2	98	1	49
1/64 ～ 1/107	29.5	3	196	2	57
1/256 ～ 1/509	34.5	4	294	3	66

RU

TG-01F
TG-01G
TG-01H



Allowable torque-speed characteristics RU

MODEL	GEAR RATIO	1/3.7	1/5	1/13.4	1/18.3	1/25	1/49.3	1/67.2	1/91.7	1/125	1/181	1/246	1/336	1/458	1/625
TG-01F-RU (24V)	SPEED (r/min)	1108	815	301	227	170	82.6	60.9	44.1	33.2	23.3	17.4	12.9	9.5	7
	TORQUE (mN·m)	2.94	3.92	9.8	9.8	9.8	29.4	39.2	58.8	58.8	58.8	58.8	58.8	58.8	58.8
	TORQUE (kgf·cm)	0.03	0.04	0.1	0.1	0.1	0.3	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6
TG-01G-RU (24V)	SPEED (r/min)	2079	1528	566	423	314	155	114	82.9	62	43.3	32.1	23.7	17.5	12.9
	TORQUE (mN·m)	2.94	3.92	9.8	9.8	9.8	29.4	39.2	58.8	58.8	58.8	58.8	58.8	58.8	58.8
	TORQUE (kgf·cm)	0.03	0.04	0.1	0.1	0.1	0.3	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6
TG-01H-RU (12V)	SPEED (r/min)	2084	1532	567	424	315	155	114	83.1	62.1	43.4	32.2	23.8	17.5	12.9
	TORQUE (mN·m)	2.94	3.92	9.8	9.8	9.8	29.4	39.2	58.8	58.8	58.8	58.8	58.8	58.8	58.8
	TORQUE (kgf·cm)	0.03	0.04	0.1	0.1	0.1	0.3	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6

RU

GEAR RATIO	L (mm)	STAGE	TORQUE (mN·m)	TORQUE (kgf·cm)	WEIGHT (g)
1/3.7 ～ 1/5	15.5	1	29.4	0.3	24
1/13.4 ～ 1/25	20.5	2	58.8	0.6	27
1/49.3 ～ 1/125	25.5	3	58.8	0.6	30
1/181 ～ 1/625	30.5	4	58.8	0.6	33

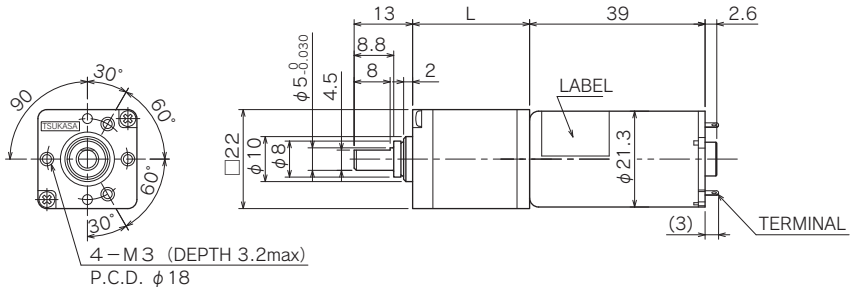
TG-201

(1.1 ～ 2.0W) φ21.3, HIGH POWER, COMPACT DESIGN, SLIM TYPE.

APPLICATION ATM ／ MONEY COUNTING MACHINE ／ CARD READER ／ PRINTER ／ BLINDS ／ SECURITY CAMERA ／ CASSETTE LOADING etc.

EU

TG-201A
TG-201B



Allowable torque-speed characteristics EU

MODEL	GEAR RATIO	1/12.1	1/17.6	1/20.6	1/25.5	1/42.1	1/61.2	1/71.7	1/88.7	1/104	1/129
TG-201A-EU (24V)	SPEED (r/min)	358	246	205	165	101	69.7	59.3	47.8	41.9	34.8
	TORQUE (mN·m)	19.6	29.4	39.2	49	68.6	98	117.6	147	147	147
	TORQUE (kgf·cm)	0.2	0.3	0.4	0.5	0.7	1	1.2	1.5	1.5	1.5
TG-201B-EU (24V)	SPEED (r/min)	541	359	313	246	151	103	87.5	72.7	63.2	52
	TORQUE (mN·m)	19.6	39.2	39.2	68.8	78.4	117.6	147	147	147	147
	TORQUE (kgf·cm)	0.2	0.4	0.4	0.6	0.8	1.2	1.5	1.5	1.5	1.5

EU

GEAR RATIO	L (mm)	STAGE	TORQUE (mN·m)	TORQUE (kgf·cm)	WEIGHT (g)
1/12.1 ～ 1/25.5	21	2	98	1	34
1/42.1 ～ 1/129	26	3	147	1.5	36

TSUKASA ELECTRIC CO.,Ltd CHUO 5-40-17, NAKANO-KU 164-0011, TOKYO, JAPAN PHONE : 81-3-5340-0331 FAX : 81-3-5340-0330

GPRS /GSM SIM900A MODEM

USER MANUAL

Overview

GSM GPRS SIM900A Modem

GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip(MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply . Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands

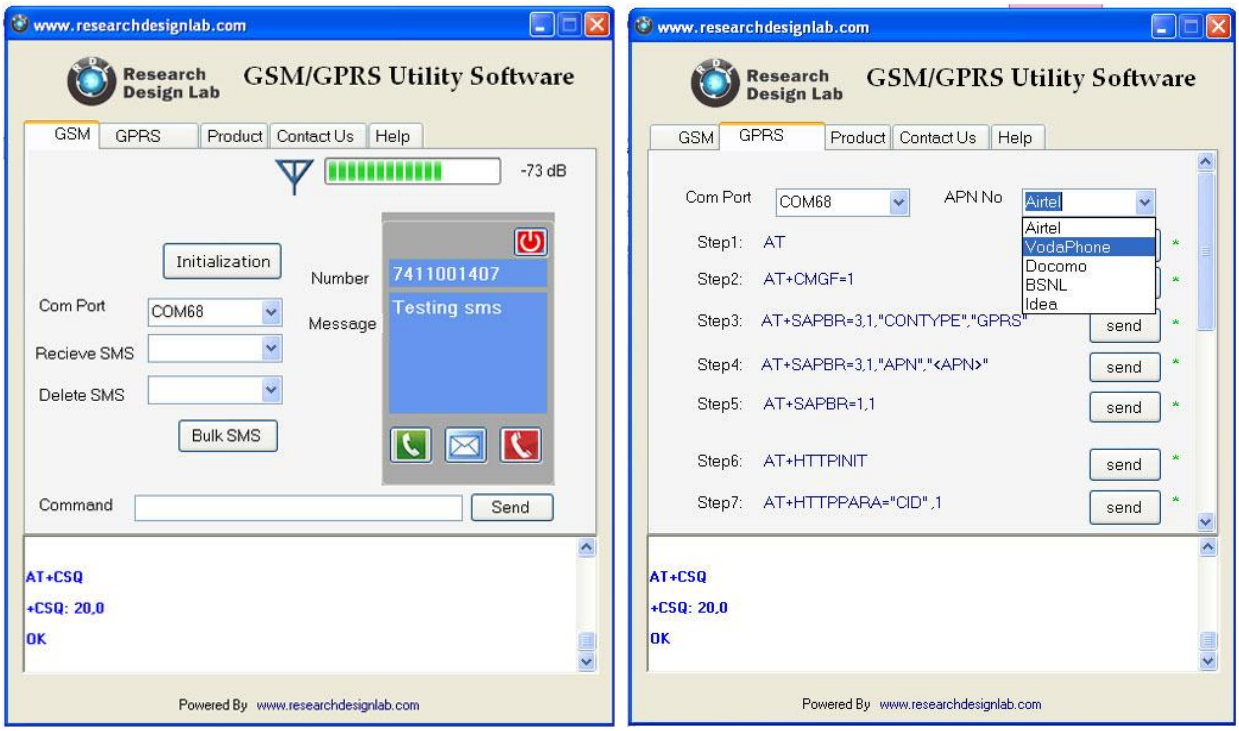
Features

- Dual-Band GSM/GPRS 900/ 1800 MHz.
- RS232 interface for direct communication with computer or MCU kit.
- Configurable baud rate.
- Power controlled using 29302WU IC.
- ESD Compliance.
- Enable with MIC and SPeaker socket.
- With slid in SIM card tray.
- With Stub antenna and SMA connector.
- Input Voltage: 12V DC.

Datasheets

- AT Commands datasheet
  https://drive.google.com/a/researchdesignlab.com/file/d/0BzrGD4zr88GnTkJwSll3dnhKbTg/edit?usp=sharing
- FTP Commands datasheet
  https://drive.google.com/a/researchdesignlab.com/file/d/0BzrGD4zr88GnVkhacjUtY2tIU2c/edit?usp=sharing
- TCP/IP Commands datasheet
  https://drive.google.com/a/researchdesignlab.com/file/d/0BzrGD4zr88GnUHRCQlJwUjdWTVU/edit?usp=sharing

GSM Utility Software



- Bulk Message sending
- AT command testing terminal
- Provides step by step GPRS setup

To download GSM/GPRS Utility software ,click on the link below

- https://docs.google.com/file/d/0BzrGD4zr88GnYll6dlFJT2NFY2s/edit
- http://www.4shared.com/file/rwyHmtGOba/GSM_GPRS_utility.html

Basic AT Commands for Testing

GSM AT Commands:

- TO CHECK THE MODEM:
  AT ↲
  OK
- TO CHANGE SMS SENDING MODE:
  AT+CMGF=1 ↲
  OK
- TO SEND NEW SMS:
  AT+CMGS=”MOBILE NO.” ↲
  <MESSAGE
  {CTRL+Z}
- TO RECEIVE SMS
  AT+CMGD=1 ↲ {to delete the message in buffer}
  AT+CMGR=1 ↲ {to receive first message AT+CMGR=1}
  {to receive second message AT+CMGR=2 and so on}
  +CMGL: 1,"REC READ","+85291234567",,"07/05/01,08:00:15+32",145,37
  <MESSAGE
- PREFERRED SMS MESSAGE STORAGE:
  AT+CPMS=? ↲
  +CPMS: (“SM”),(“SM”),(“SM”)
  OK
  AT+CPMS? ↲
  +CPMS: “SM”,19,30,”SM”,19,30,”SM”,19,30
- TO MAKE A VOICE CALL:
  ATD9876543210; ↲
- TO REDIAL LAST NO:
  ATDL ↲
- TO RECEIVE INCOMING CALL:
  ATA ↲
- TO HANGUP OR DISCONNECT A CALL:
  ATH ↲
- TO SET A PARTICULAR BAUDRATE:
  AT+IPR=? ↲ {To view the baud rate values}
  AT+IPR=0 ↲ {To set the modem to autobauding mode}
- OPERATOR SELECTION:
  AT+COPS=? ↲
  OK
  AT+COPS? ↲
  +COPS: 0,0,”AirTel”
  OK

- AT+CRC SET CELLULAR RESULT CODES FOR INCOMING CALL INDICATION:

  AT+CRC=? ↲
  +CRC: (0-1)
  OK
  AT+CRC? ↲
  +CRC: 0
  OK
  AT+CRC=1 ↲
  OK
  +CRING: VOICE

- READ OPERATOR NAMES.

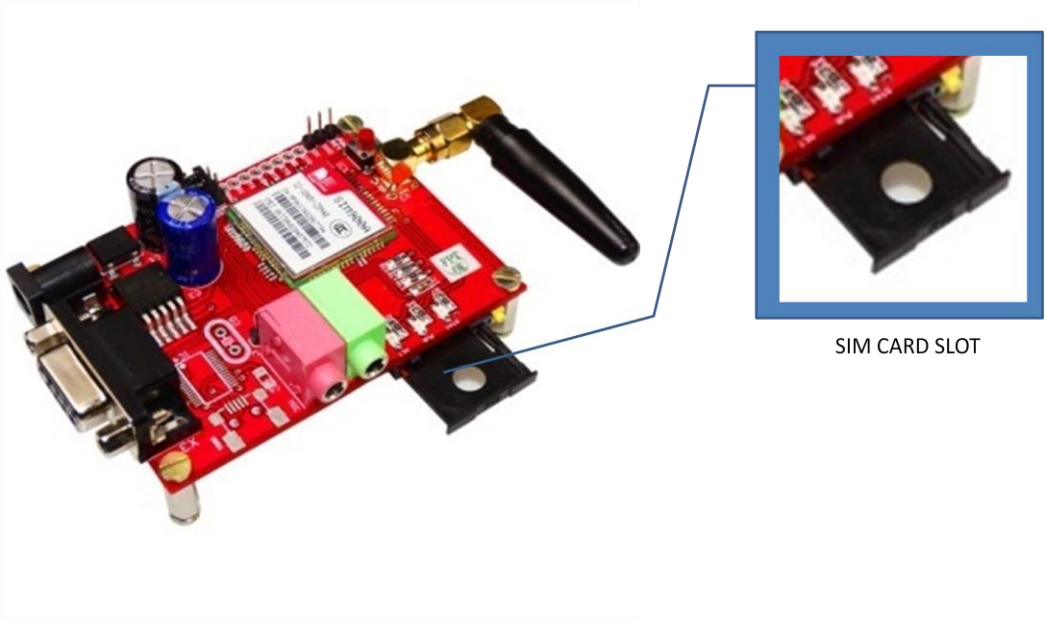
  AT+COPN=? ↲
  OK
  AT+COPN ↲
  +COPN: “472001″,”DHIMOBILE”
  +COPN: “60500
  +COPN: “502012″,”maxis mobile”
  +COPN:
  +COPN: “502013″,”TMTOUCH”
  +COPN
  +COPN: “502016″,”DiGi”
  +COPN: “502017″,”TIMECel”"
  +COPN: “502019″,”CELCOM GSM”

GPRS Commands:

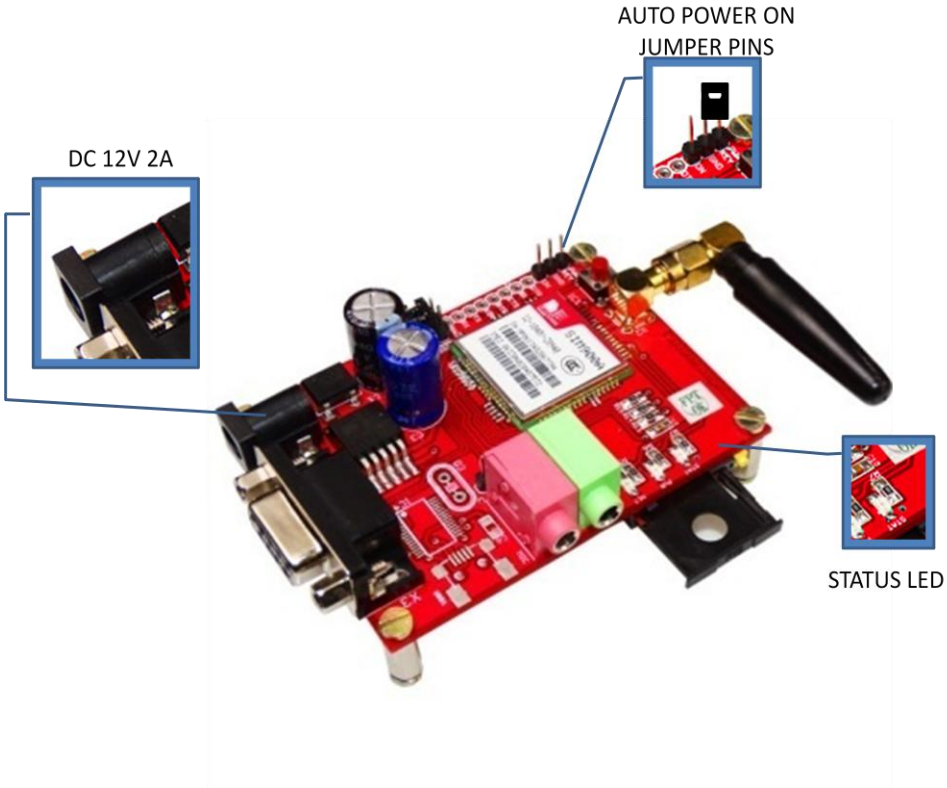
Command	Description
AT+CGATT ↲	ATTACH/DETACH FROM GPRS SERVICE
AT+CGDCONT ↲	DEFINE PDP CONTEXT
AT+CGQMIN ↲	QUALITY OF SERVICE PROFILE (MINIMUM ACCEPTABLE)
AT+CGQREQ ↲	QUALITY OF SERVICE PROFILE (REQUESTED)
AT+CGACT ↲	PDP CONTEXT ACTIVATE OR DEACTIVATE
AT+CGDATA ↲	ENTER DATA STATE
AT+CGPADDR ↲	SHOW PDP ADDRESS
AT+CGCLASS ↲	GPRS MOBILE STATION CLASS
AT+CGEREP ↲	CONTROL UNSOLICITED GPRS EVENT REPORTING
AT+CGREG ↲	NETWORK REGISTRATION STATUS
AT+CGSMS ↲	SELECT SERVICE FOR MO SMS MESSAGES
AT+CGCOUNT ↲	GPRS PACKET COUNTERS

MODULE SETUP

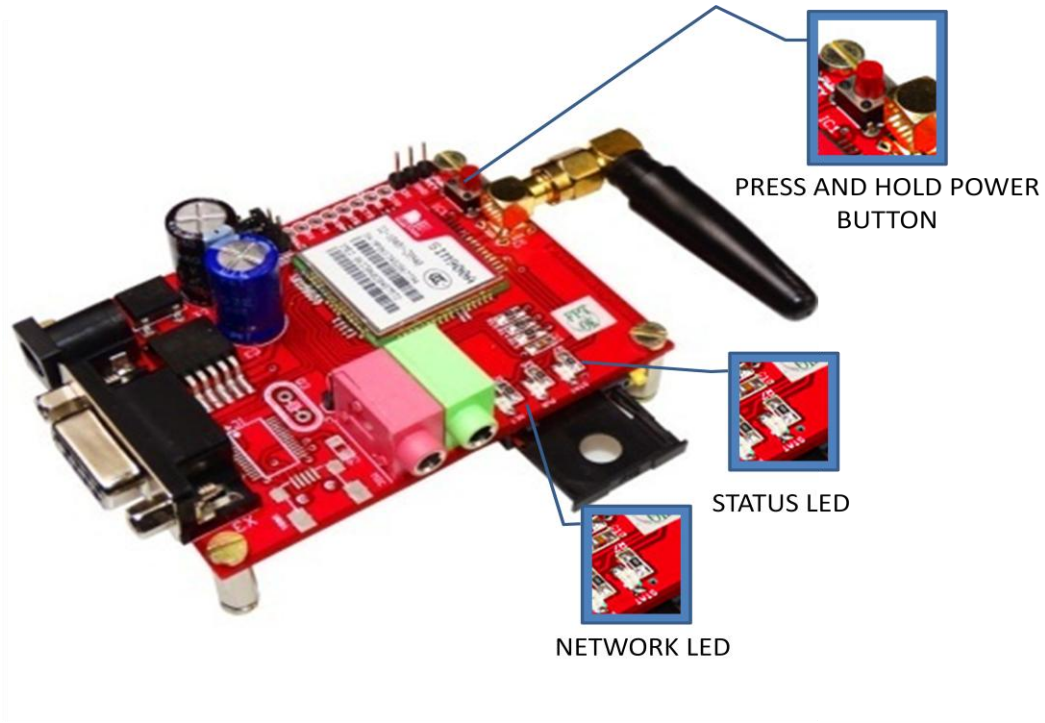
step 1 : Insert SIMcard into the SIM slot.



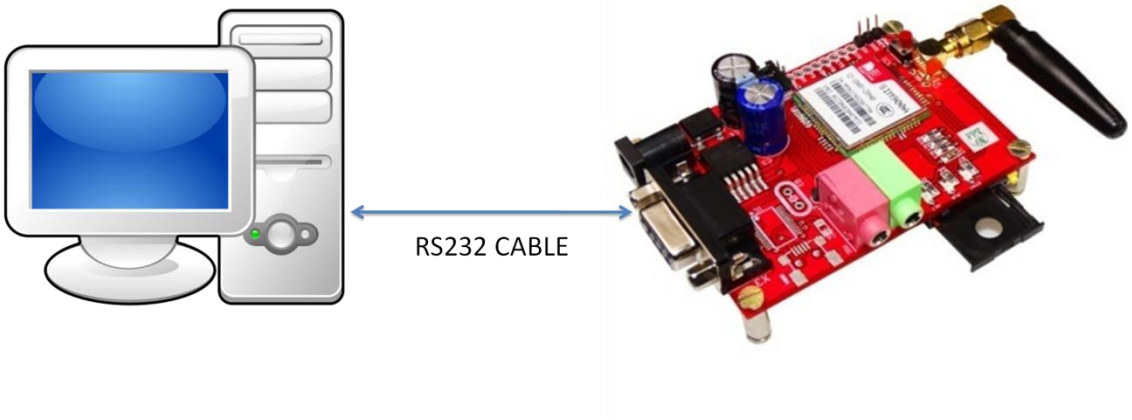
step 2 : Plug in 12V -2A DC power adapter, power led is lit (place jumper between PWRkey and on pin for only to turn ON automatically).



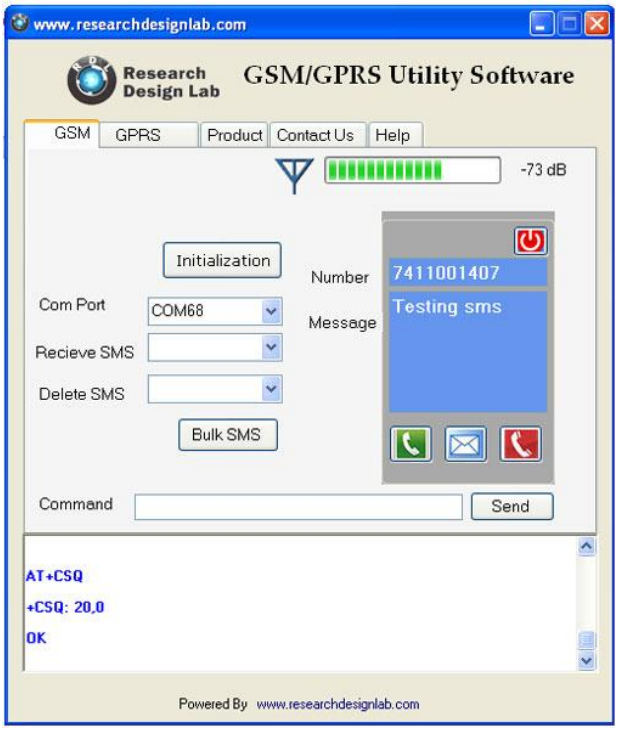
step 3 : Press and hold power button (To turn on manually without jumper)

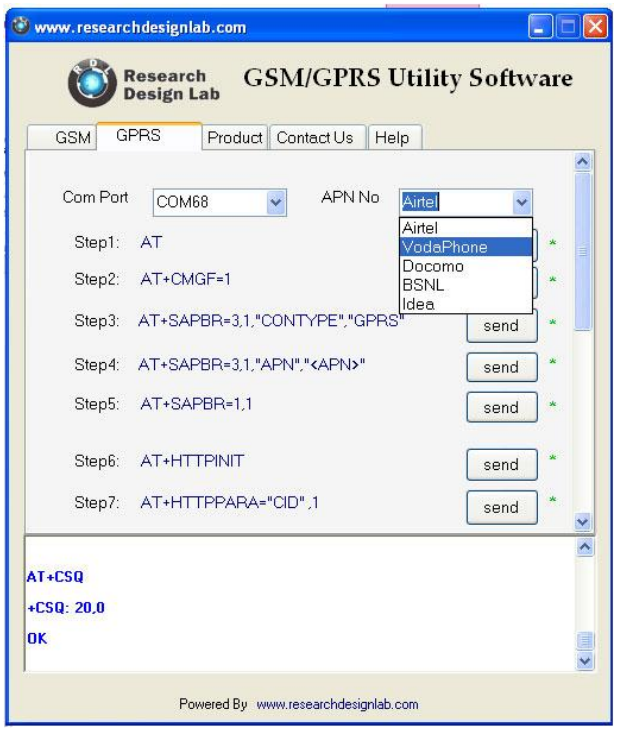


step 4 : Connect to PC through RS232 cable



step 5 : open GSM/GPRS utility software ,choose appropriate COM port and use AT commands listed in this manual for basic testing GPRS GSM/messaging and voice calling.

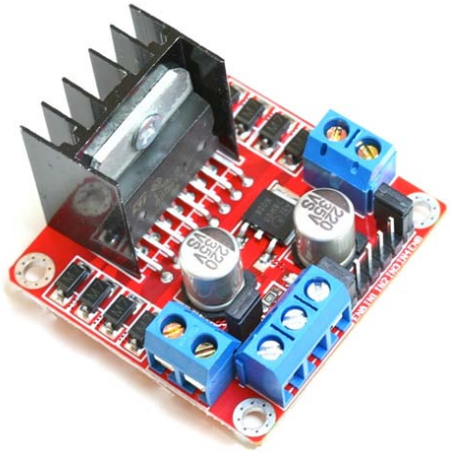




User Guide

L298N Dual H-Bridge Motor Driver

This dual 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.

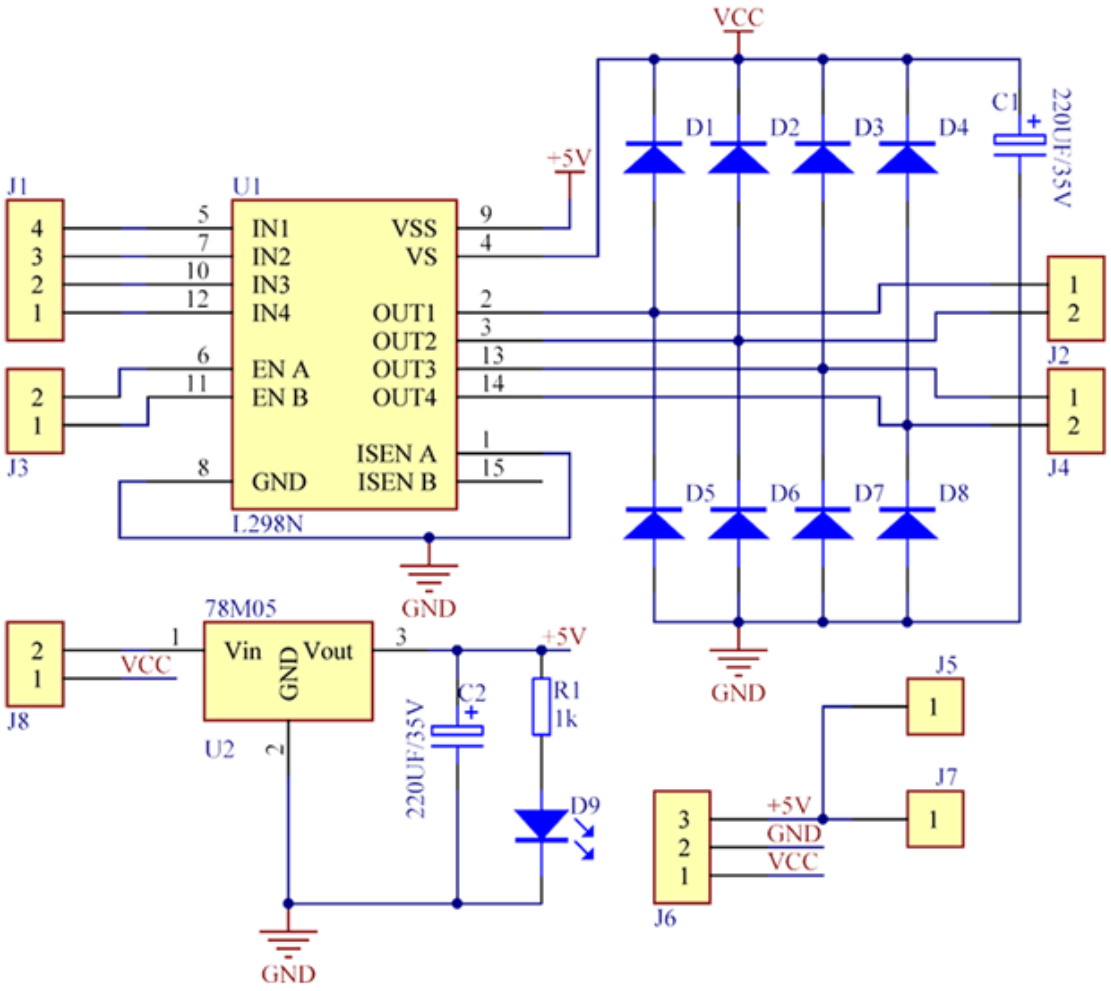


SKU: MDU-1049

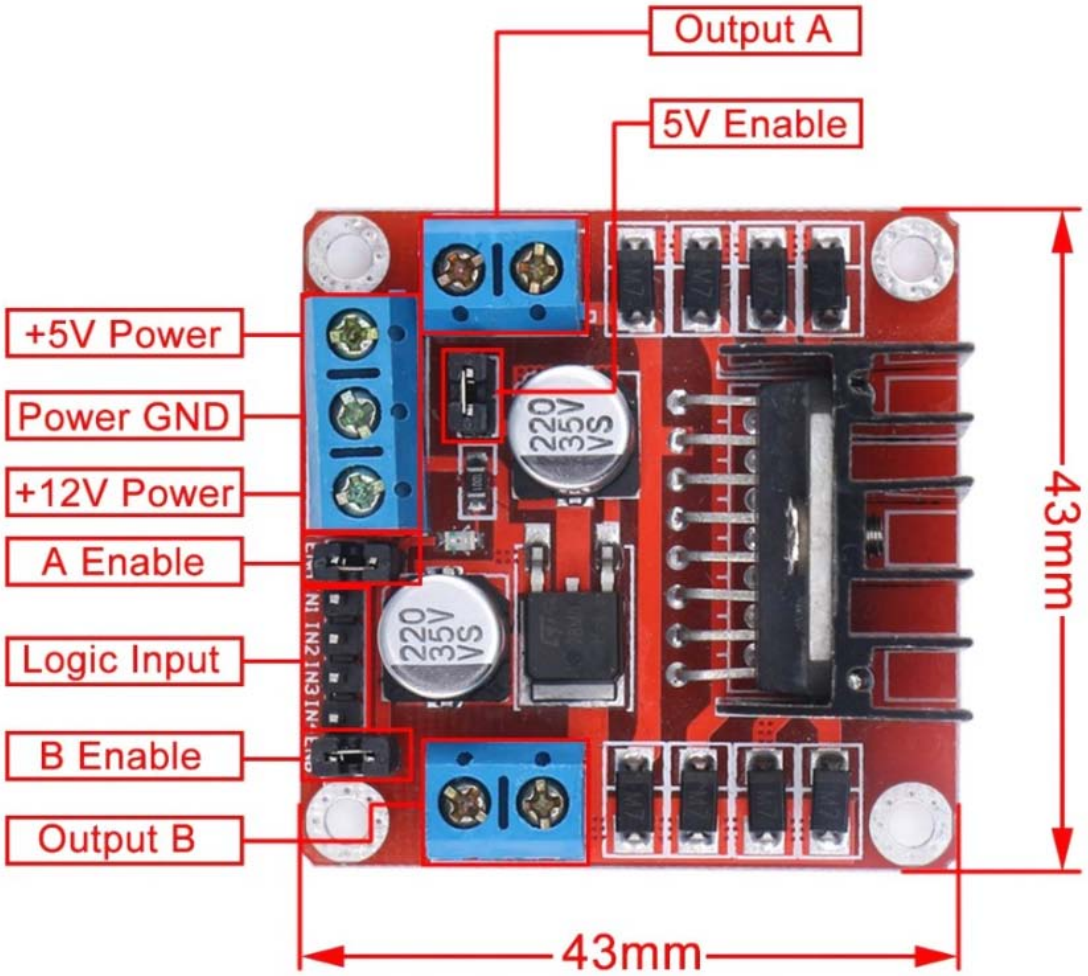
Brief Data:

- 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:



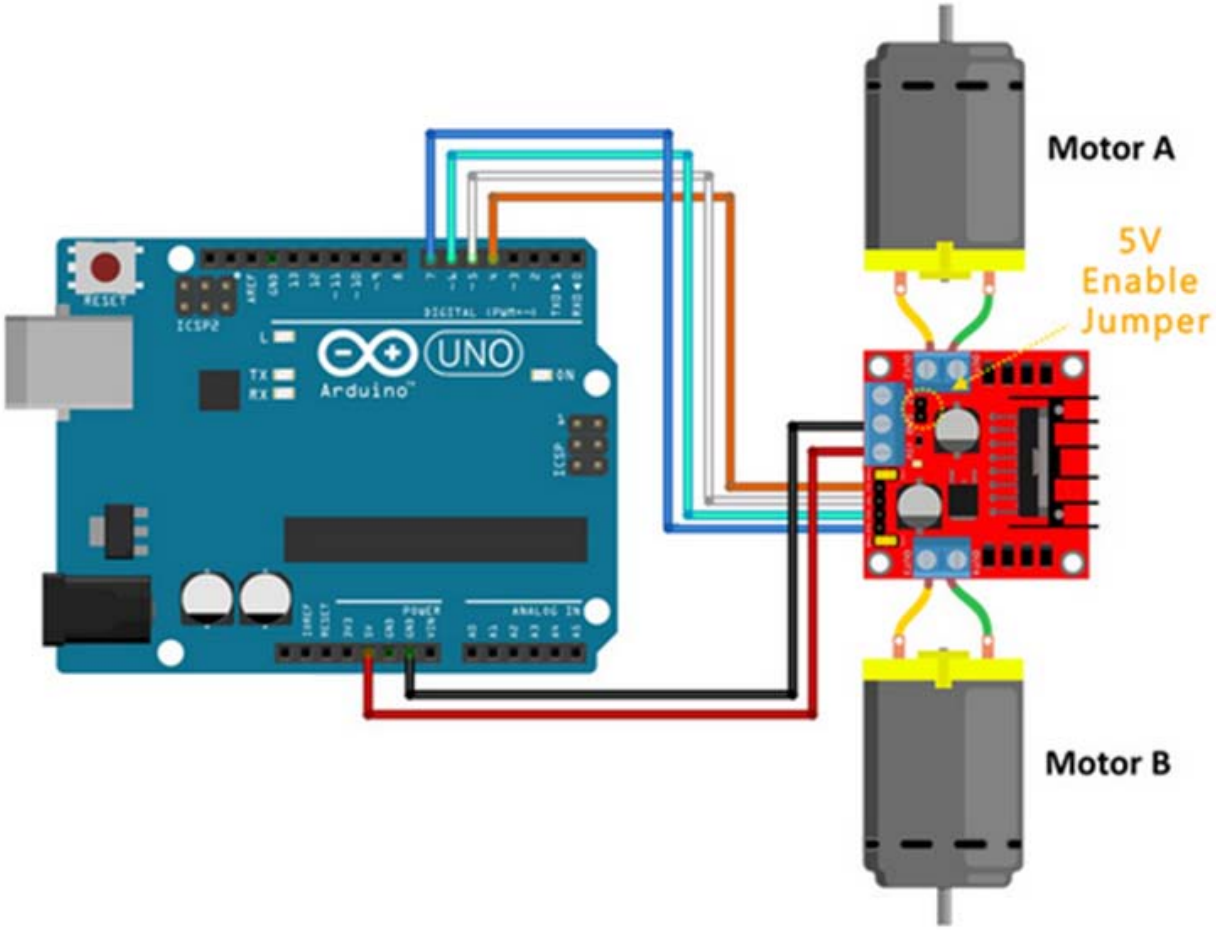
Board Dimension & Pins Function:



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
```

DS3231

Extremely Accurate I²C-Integrated RTC/TCXO/Crystal

General Description

The DS3231 is a low-cost, extremely accurate I²C real-time clock (RTC) with an integrated temperature-compensated crystal oscillator (TCXO) and crystal. The device incorporates a battery input, and maintains accurate timekeeping when main power to the device is interrupted. The integration of the crystal resonator enhances the long-term accuracy of the device as well as reduces the piece-part count in a manufacturing line. The DS3231 is available in commercial and industrial temperature ranges, and is offered in a 16-pin, 300-mil SO package.

The RTC maintains seconds, minutes, hours, day, date, month, and year information. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with an $\overline{\text{AM}}$/PM indicator. Two programmable time-of-day alarms and a programmable square-wave output are provided. Address and data are transferred serially through an I²C bidirectional bus.

A precision temperature-compensated voltage reference and comparator circuit monitors the status of V_{CC} to detect power failures, to provide a reset output, and to automatically switch to the backup supply when necessary. Additionally, the $\overline{\text{RST}}$ pin is monitored as a pushbutton input for generating a µP reset.

Benefits and Features

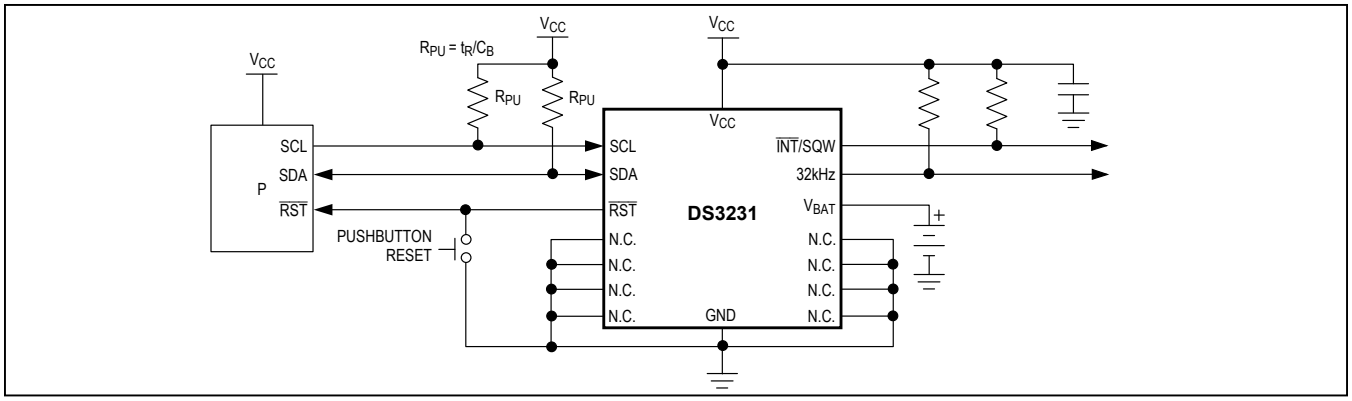
- Highly Accurate RTC Completely Manages All Timekeeping Functions
  - Real-Time Clock Counts Seconds, Minutes, Hours, Date of the Month, Month, Day of the Week, and Year, with Leap-Year Compensation Valid Up to 2100
  - Accuracy ±2ppm from 0°C to +40°C
  - Accuracy ±3.5ppm from -40°C to +85°C
  - Digital Temp Sensor Output: ±3°C Accuracy
  - Register for Aging Trim
  - $\overline{\text{RST}}$ Output/Pushbutton Reset Debounce Input
  - Two Time-of-Day Alarms
  - Programmable Square-Wave Output Signal
- Simple Serial Interface Connects to Most Microcontrollers
  - Fast (400kHz) I²C Interface
- Battery-Backup Input for Continuous Timekeeping
  - Low Power Operation Extends Battery-Backup Run Time
  - 3.3V Operation
- Operating Temperature Ranges: Commercial (0°C to +70°C) and Industrial (-40°C to +85°C)
- Underwriters Laboratories® (UL) Recognized

Applications

- Servers
- Telematics
- Utility Power Meters
- GPS

Ordering Information and Pin Configuration appear at end of data sheet.

Typical Operating Circuit



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maxim integrated™

Absolute Maximum Ratings

Voltage Range on Any Pin Relative to Ground ....-0.3V to +6.0V
Junction-to-Ambient Thermal Resistance (θ_{JA}) (Note 1)73°C/W
Junction-to-Case Thermal Resistance (θ_{JC}) (Note 1) ....23°C/W
Operating Temperature Range
DS3231S .....0°C to +70°C
DS3231SN..... -40°C to +85°C
Junction Temperature.....+125°C
Storage Temperature Range..... -40°C to +85°C
Lead Temperature (soldering, 10s) .....+260°C
Soldering Temperature (reflow, 2 times max) .....+260°C
(see the *Handling*, *PCB Layout*, *and Assembly* section)

Note 1: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to **www.maximintegrated.com/thermal-tutorial**.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

(T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{CC}		2.3	3.3	5.5	V
	V_{BAT}		2.3	3.0	5.5	V
Logic 1 Input SDA, SCL	V_{IH}		0.7 x V_{CC}		V_{CC} + 0.3	V
Logic 0 Input SDA, SCL	V_{IL}		-0.3		0.3 x V_{CC}	V

Electrical Characteristics

(V_{CC} = 2.3V to 5.5V, V_{CC} = Active Supply (see Table 1), T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Typical values are at V_{CC} = 3.3V, V_{BAT} = 3.0V, and T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Active Supply Current	I_{CCA}	(Notes 4, 5)	V_{CC} = 3.63V			200	µA
			V_{CC} = 5.5V			300	
Standby Supply Current	I_{CCS}	I²C bus inactive, 32kHz output on, SQW output off (Note 5)	V_{CC} = 3.63V			110	µA
			V_{CC} = 5.5V			170	
Temperature Conversion Current	$I_{CCSCONV}$	I²C bus inactive, 32kHz output on, SQW output off	V_{CC} = 3.63V			575	µA
			V_{CC} = 5.5V			650	
Power-Fail Voltage	V_{PF}			2.45	2.575	2.70	V
Logic 0 Output, 32kHz, $\overline{INT}$/SQW, SDA	V_{OL}	I_{OL} = 3mA				0.4	V
Logic 0 Output, $\overline{RST}$	V_{OL}	I_{OL} = 1mA				0.4	V
Output Leakage Current 32kHz, $\overline{INT}$/SQW, SDA	I_{LO}	Output high impedance		-1	0	+1	µA
Input Leakage SCL	I_{LI}			-1		+1	µA
$\overline{RST}$ Pin I/O Leakage	I_{OL}	$\overline{RST}$ high impedance (Note 6)		-200		+10	µA
V_{BAT} Leakage Current (V_{CC} Active)	I_{BATLKG}				25	100	nA

Electrical Characteristics (continued)

(V_{CC} = 2.3V to 5.5V, V_{CC} = Active Supply (see Table 1), T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Typical values are at V_{CC} = 3.3V, V_{BAT} = 3.0V, and T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Frequency	f_{OUT}	V_{CC} = 3.3V or V_{BAT} = 3.3V			32.768		kHz
Frequency Stability vs. Temperature (Commercial)	$\Delta f/f_{OUT}$	V_{CC} = 3.3V or V_{BAT} = 3.3V, aging offset = 00h	0°C to +40°C			±2	ppm
			>40°C to +70°C			±3.5	
Frequency Stability vs. Temperature (Industrial)	$\Delta f/f_{OUT}$	V_{CC} = 3.3V or V_{BAT} = 3.3V, aging offset = 00h	-40°C to <0°C			±3.5	ppm
			0°C to +40°C			±2	
			>40°C to +85°C			±3.5	
Frequency Stability vs. Voltage	Δf/V				1		ppm/V
Trim Register Frequency Sensitivity per LSB	Δf/LSB	Specified at:	-40°C		0.7		ppm
			+25°C		0.1		
			+70°C		0.4		
			+85°C		0.8		
Temperature Accuracy	Temp	V_{CC} = 3.3V or V_{BAT} = 3.3V		-3		+3	°C
Crystal Aging	$\Delta f/f_O$	After reflow, not production tested	First year		±1.0		ppm
			0–10 years		±5.0		

Electrical Characteristics

(**V_{CC} = 0V, V_{BAT} = 2.3V to 5.5V**, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Active Battery Current	I_{BATA}	$\overline{EOSC}$ = 0, BBSQW = 0, SCL = 400kHz (Note 5)	V_{BAT} = 3.63V			70	µA
			V_{BAT} = 5.5V			150	
Timekeeping Battery Current	I_{BATT}	$\overline{EOSC}$ = 0, BBSQW = 0, EN32kHz = 1, SCL = SDA = 0V or SCL = SDA = V_{BAT} (Note 5)	V_{BAT} = 3.63V		0.84	3.0	µA
			V_{BAT} = 5.5V		1.0	3.5	
Temperature Conversion Current	I_{BATTC}	$\overline{EOSC}$ = 0, BBSQW = 0, SCL = SDA = 0V or SCL = SDA = V_{BAT}	V_{BAT} = 3.63V			575	µA
			V_{BAT} = 5.5V			650	
Data-Retention Current	I_{BATTDR}	$\overline{EOSC}$ = 1, SCL = SDA = 0V, +25°C				100	nA

AC Electrical Characteristics

(V_{CC} = $V_{CC(MIN)}$ to $V_{CC(MAX)}$ or V_{BAT} = $V_{BAT(MIN)}$ to $V_{BAT(MAX)}$, V_{BAT} > V_{CC}, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Note 2)

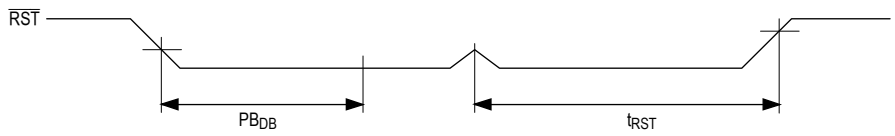
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
SCL Clock Frequency	f_{SCL}	Fast mode	100		400	kHz
		Standard mode	0		100	
Bus Free Time Between STOP and START Conditions	t_{BUF}	Fast mode	1.3			µs
		Standard mode	4.7			
Hold Time (Repeated) START Condition (Note 7)	$t_{HD:STA}$	Fast mode	0.6			µs
		Standard mode	4.0			
Low Period of SCL Clock	t_{LOW}	Fast mode	1.3			µs
		Standard mode	4.7			
High Period of SCL Clock	t_{HIGH}	Fast mode	0.6			µs
		Standard mode	4.0			
Data Hold Time (Notes 8, 9)	$t_{HD:DAT}$	Fast mode	0		0.9	µs
		Standard mode	0		0.9	
Data Setup Time (Note 10)	$t_{SU:DAT}$	Fast mode	100			ns
		Standard mode	250			
START Setup Time	$t_{SU:STA}$	Fast mode	0.6			µs
		Standard mode	4.7			
Rise Time of Both SDA and SCL Signals (Note 11)	t_R	Fast mode	20 + 0.1C_B		300	ns
		Standard mode			1000	
Fall Time of Both SDA and SCL Signals (Note 11)	t_F	Fast mode	20 + 0.1C_B		300	ns
		Standard mode			300	
Setup Time for STOP Condition	$t_{SU:STO}$	Fast mode	0.6			µs
		Standard mode	4.7			
Capacitive Load for Each Bus Line	C_B	(Note 11)			400	pF
Capacitance for SDA, SCL	$C_{I/O}$			10		pF
Pulse Width of Spikes That Must Be Suppressed by the Input Filter	t_{SP}			30		ns
Pushbutton Debounce	PB_{DB}			250		ms
Reset Active Time	t_{RST}			250		ms
Oscillator Stop Flag (OSF) Delay	t_{OSF}	(Note 12)		100		ms
Temperature Conversion Time	t_{CONV}			125	200	ms

Power-Switch Characteristics

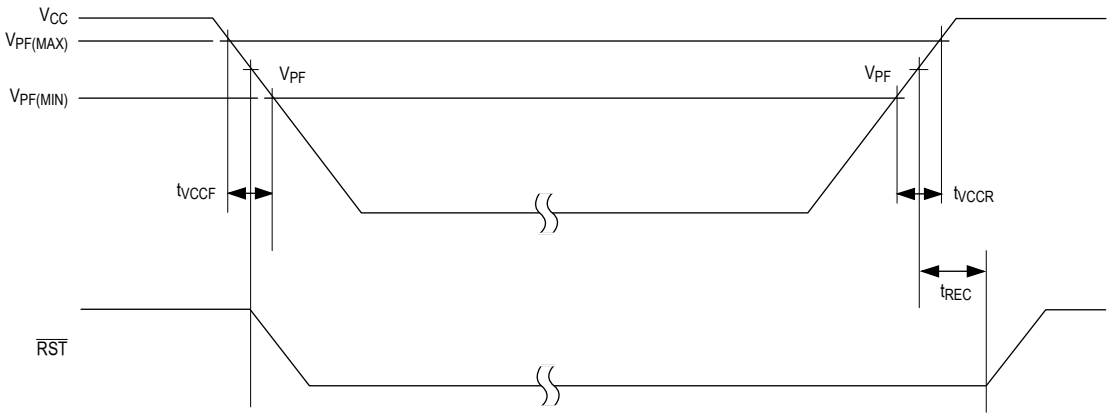
(T_A = T_{MIN} to T_{MAX})

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_{CC} Fall Time; $V_{PF(MAX)}$ to $V_{PF(MIN)}$	t_{VCCF}		300			µs
V_{CC} Rise Time; $V_{PF(MIN)}$ to $V_{PF(MAX)}$	t_{VCCR}		0			µs
Recovery at Power-Up	t_{REC}	(Note 13)		250	300	ms

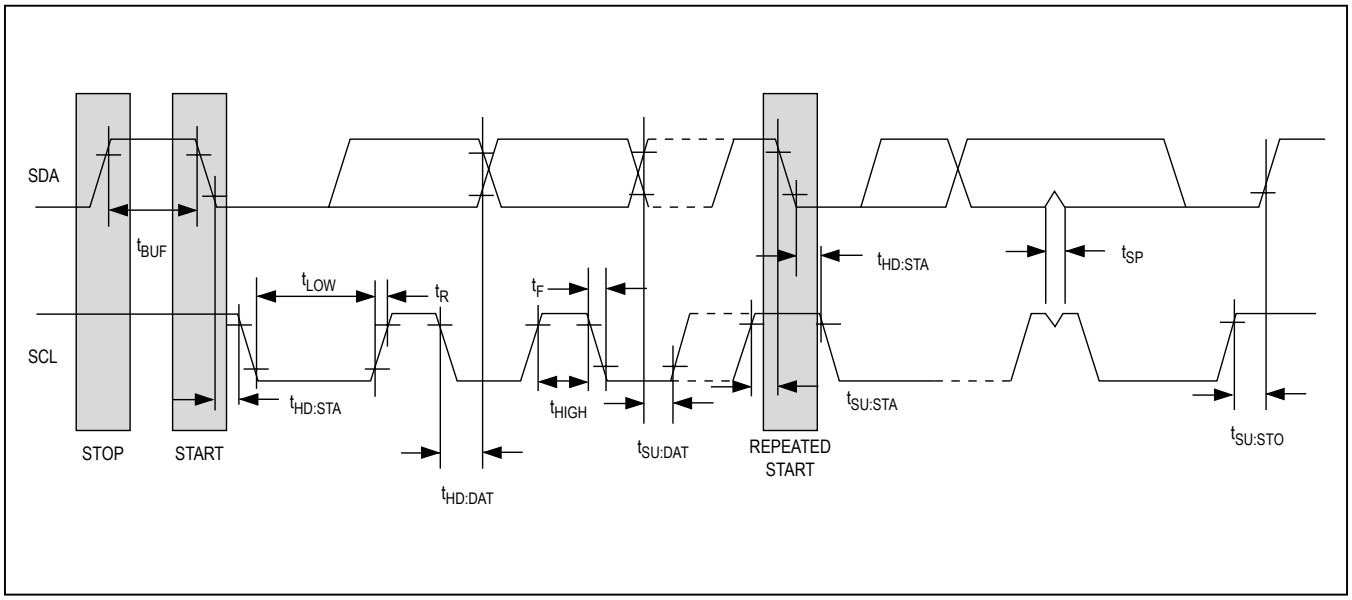
Pushbutton Reset Timing



Power-Switch Timing



Data Transfer on I2C Serial Bus



WARNING: Negative undershoots below -0.3V while the part is in battery-backed mode may cause loss of data.

Note 2: Limits at -40°C are guaranteed by design and not production tested.

Note 3: All voltages are referenced to ground.

Note 4: I_{CCA}—SCL clocking at max frequency = 400kHz.

Note 5: Current is the averaged input current, which includes the temperature conversion current.

Note 6: The $\overline{RST}$ pin has an internal 50kΩ (nominal) pullup resistor to V_{CC}.

Note 7: After this period, the first clock pulse is generated.

Note 8: A device must internally provide a hold time of at least 300ns for the SDA signal (referred to the $V_{IH(MIN)}$ of the SCL signal) to bridge the undefined region of the falling edge of SCL.

Note 9: The maximum $t_{HD:DAT}$ needs only to be met if the device does not stretch the low period (t_{LOW}) of the SCL signal.

Note 10: A fast-mode device can be used in a standard-mode system, but the requirement $t_{SU:DAT} \geq 250ns$ must then be met. This is automatically the case if the device does not stretch the low period of the SCL signal. If such a device does stretch the low period of the SCL signal, it must output the next data bit to the SDA line $t_{R(MAX)} + t_{SU:DAT} = 1000 + 250 = 1250ns$ before the SCL line is released.

Note 11: C_B—total capacitance of one bus line in pF.

Note 12: The parameter t_{OSF} is the period of time the oscillator must be stopped for the OSF flag to be set over the voltage range of $0.0V \leq V_{CC} \leq V_{CC(MAX)}$ and $2.3V \leq V_{BAT} \leq 3.4V$.

Note 13: This delay applies only if the oscillator is enabled and running. If the $\overline{EOSC}$ bit is a 1, t_{REC} is bypassed and $\overline{RST}$ immediately goes high. The state of $\overline{RST}$ does not affect the I2C interface, RTC, or TCXO.

Micro SD Card Module for Arduino

The module (Micro-SD Card Adapter) is a Micro SD card reader module, and the SPI interface via the file system driver, microcontroller system to complete the Micro-SD card read and write files. Arduino users can directly use the Arduino IDE comes with an SD card to complete the library card initialization and read-write.

Features:

- Supports micro SD card (<=2G), micro SDHC card (<=32G) (high-speed card)
- Level conversion circuit board that can interface level is 5V or 3.3V
- Power supply is 4.5V ~ 5.5V, 3.3V voltage regulator circuit board
- Communication interface is a standard SPI interface
- 4 M2 screw positioning holes for easy installation
- Size: 4.1 x 2.4cm

Control Interface:

A total of six pins (GND, VCC, MISO, MOSI, SCK, CS), GND to ground, VCC is the power supply, MISO, MOSI, SCK is the SPI bus, CS is the chip select signal pin.

3.3V regulator circuit:

LDO regulator output 3.3V as level converter chip, Micro SD card supply.

Level conversion circuit:

Micro SD card into the direction of signals into 3.3V, MicroSD card toward the direction of the control interface MISO signal is also converted to 3.3V, general AVR microcontroller system can read the signal

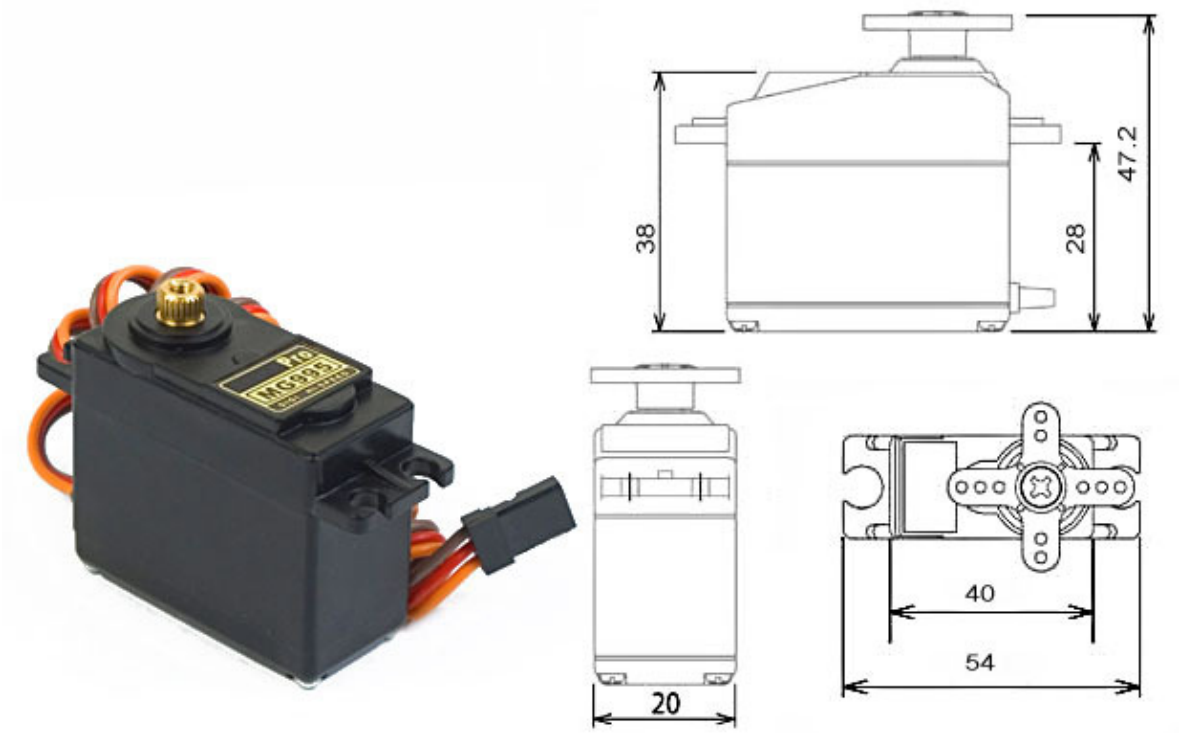
Micro SD card connector:

Since the bomb deck for easy card insertion and removal.

Positioning holes:

4 M2 screws positioning hole diameter of 2.2mm, the module is easy to install positioning, to achieve inter-module combination

MG995 High Speed
Metal Gear Dual Ball Bearing Servo

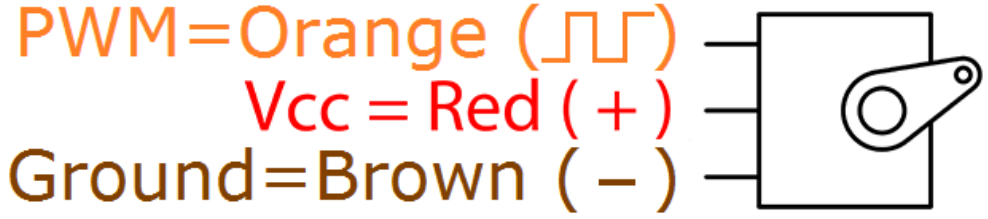


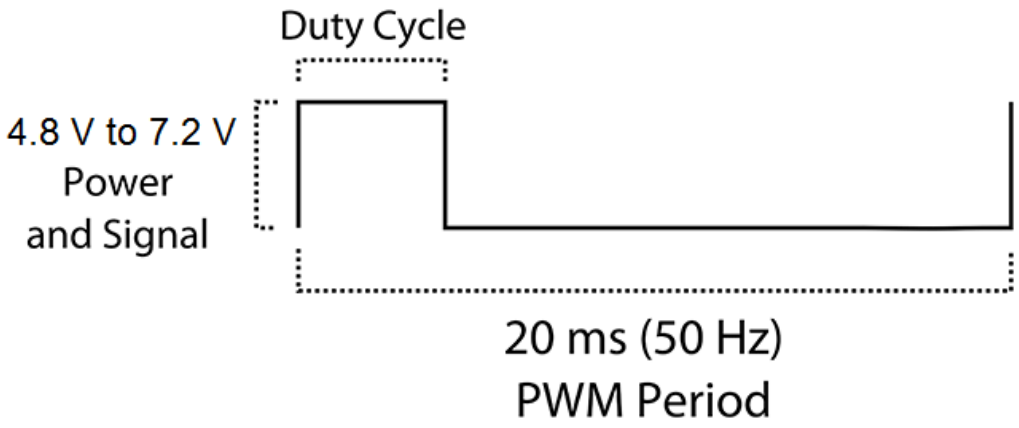
The unit comes complete with 30cm wire and 3 pin 'S' type female header connector that fits most receivers, including Futaba, JR, GWS, Cirrus, Blue Bird, Blue Arrow, Corona, Berg, Spektrum and Hitec.

This high-speed standard servo can rotate approximately 120 degrees (60 in each direction). You can use any servo code, hardware or library to control these servos, so it's great for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. The MG995 Metal Gear Servo also comes with a selection of arms and hardware to get you set up nice and fast!

Specifications

- Weight: 55 g
- Dimension: 40.7 x 19.7 x 42.9 mm approx.
- Stall torque: 8.5 kgf·cm (4.8 V), 10 kgf·cm (6 V)
- Operating speed: 0.2 s/60º (4.8 V), 0.16 s/60º (6 V)
- Operating voltage: 4.8 V a 7.2 V
- Dead band width: 5 µs
- Stable and shock proof double ball bearing design
- Temperature range: 0 ºC – 55 ºC


PWM=Orange
Vcc = Red (+)
Ground=Brown (–)


Duty Cycle
4.8 V to 7.2 V
Power
and Signal
20 ms (50 Hz)
PWM Period

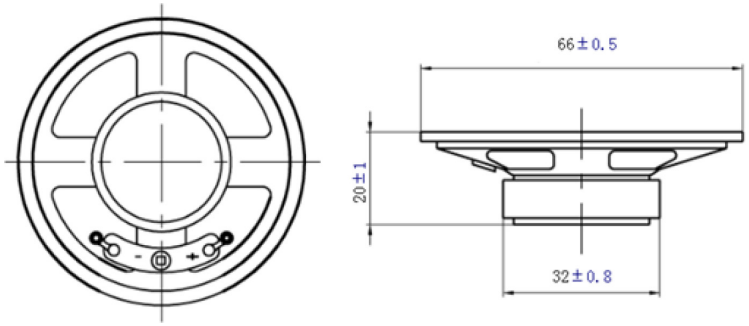
8 Ohm Speakers

multicomp PRO

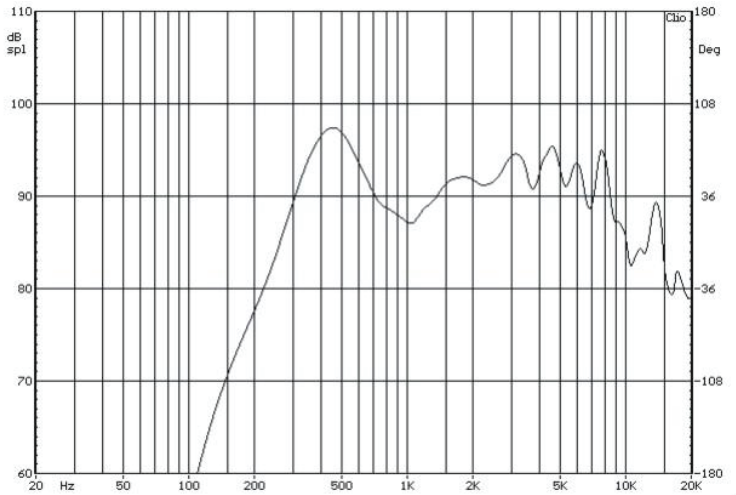
RoHS Compliant

Specifications

Rated impedance at 1kHz/1V	: 8Ω ±15%Ω
Rated input power	: 2W
Maximum input power	: 3W
Resonant Frequency (f0) / 1V	: 500Hz ±20%Hz
Frequency Range	: 0Hz-5kHz
Sound pressure level at 1kHz/1W/0.5m baffleboard (IEC)	: 85 ±3dB
Total harmonic distortion at 1kHz/1W	: 5%Max
Voice coil diameter	: 13.3mm
Magnet (Nd-Fe-B)	: 32mm × 18mm × 6mm
Operating Temperature	: -20°C to +60°C
Storage Temperature	: -25°C to +70°C
Weight	: 50g ±10%



Dimensions : Millimetres



Material
Frame & Yoke - SPCC
PCB terminal - Paper Cu
Diaphragm & Cap - Mylar
Voice coil - Cu
Magnet - Ferrite

IP rating - IP67

Polarity - When a positive DC Current is applied to the voice coil terminal marked +or red, the diaphragm shall move forward

Buzz, rattle - Must be free of audible noise (buzzes and rattles) at 4Vsine wave between F0-2,000Hz.

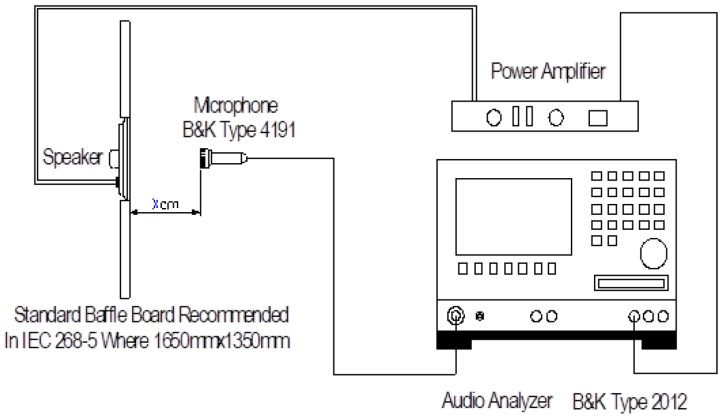
8 Ohm Speakers

Item	Specifications
High temp. Test	Keep 96 hours at +70°C ±3°C and leave 3 hours in normal temperature and then check
Low temp. Test	Keep 96 hours at -30°C ±3°C and leave 3 hours in normal temperature and then check
Humidity test	Keep 96 hours at +40°C ±3°C relative humidity 90 ±5% and leave 3 hours in normal temperature and then checked.
Thermal cycle test.	Low temperature: -20°C ±3°C , temperature: +60°C ±3°C, cycle: 1 hour/ cycle each, and then keep 5 cycles in a room.
Vibration	Speaker shall be measured after being applied vibration of amplitude of 1.52mm with 10 to 55Hz band of vibration frequency to each of X, Y, Z 3 direction for 2 hours
Drop test	Drop the speakers contained in normal box onto the board 40mm thick 10 times from the height of 75cm
Load test	Rated Power white noise is applied for 96 hours
Terminal strength test	Capable of withstand 1N load for 30 seconds without resulting in any damage or rejection.

Test Condition
STANDARD
Temperature : 15°C to 35°C
Relative humidity : 45% to 85%,
Atmospheric pressure : 860mbar to 1060mbar.
JUDGEMENT
Temperature : 20 ±3°C
Relative humidity : 60% to 70%,
Atmospheric pressure : 860mbar to 1060mbar

Standard Test Fixture
Input Power : 1W
Zero Level : -dB
Mode : TSR
Potentiometer Range : 50dB
Sweep Time : 0.5sec

Standard test condition of speaker



X = 50cm

Part Number Table

Description	Part Number
Speaker, Mylar Cone, 8ohm, 2W, 66mm Dia	MP004284

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

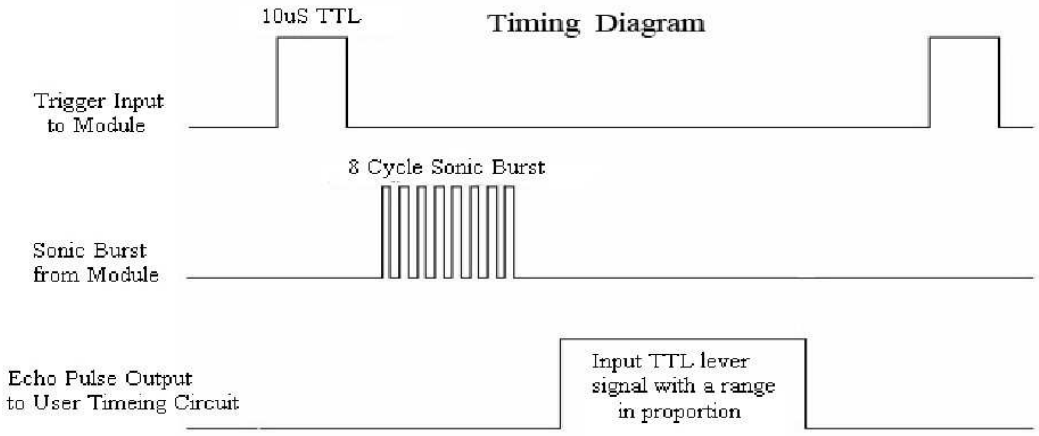
Electric Parameter

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.



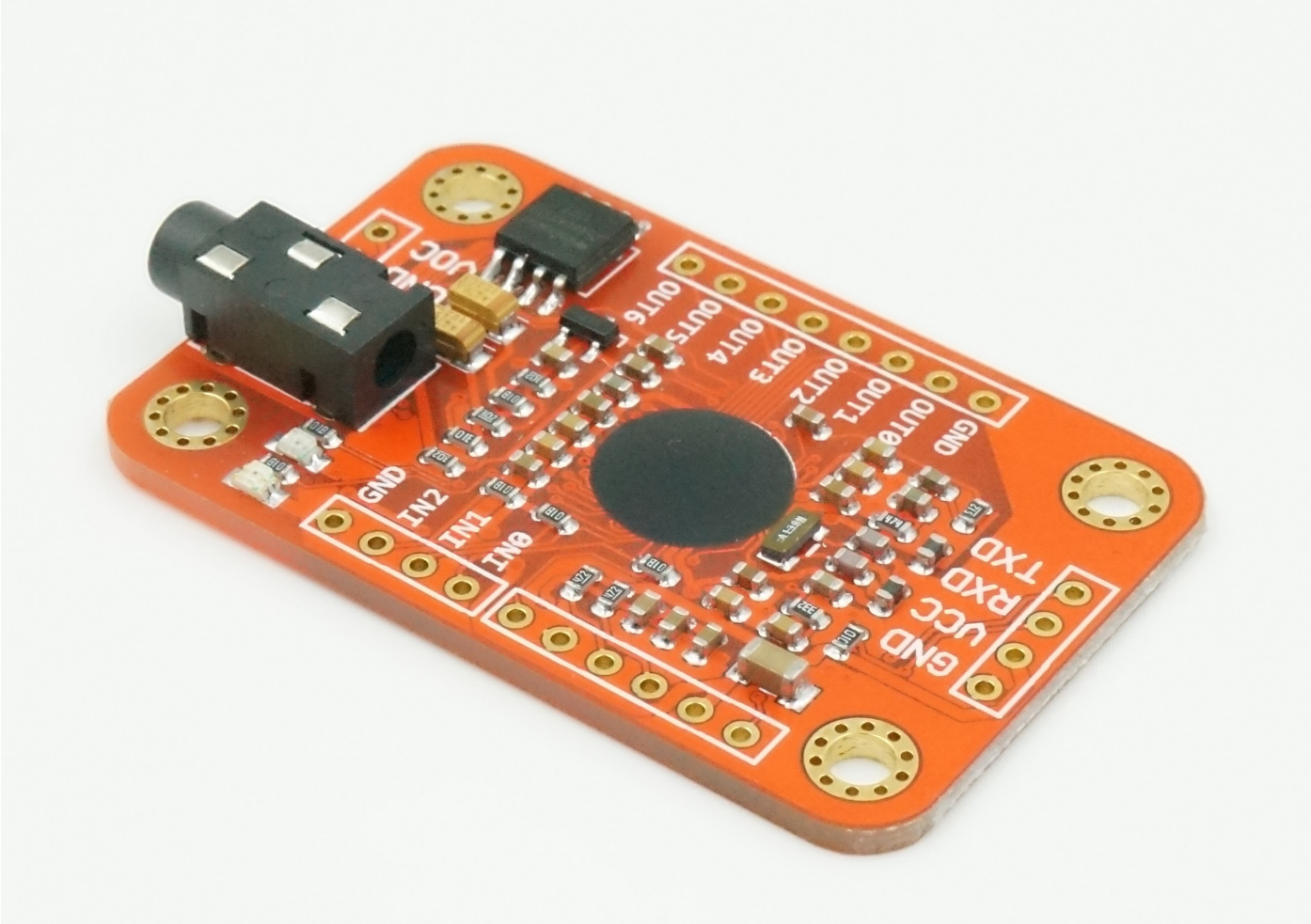
Attention:

- 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

Voice Recognition Module V3

Speak to Control (Arduino compatible)

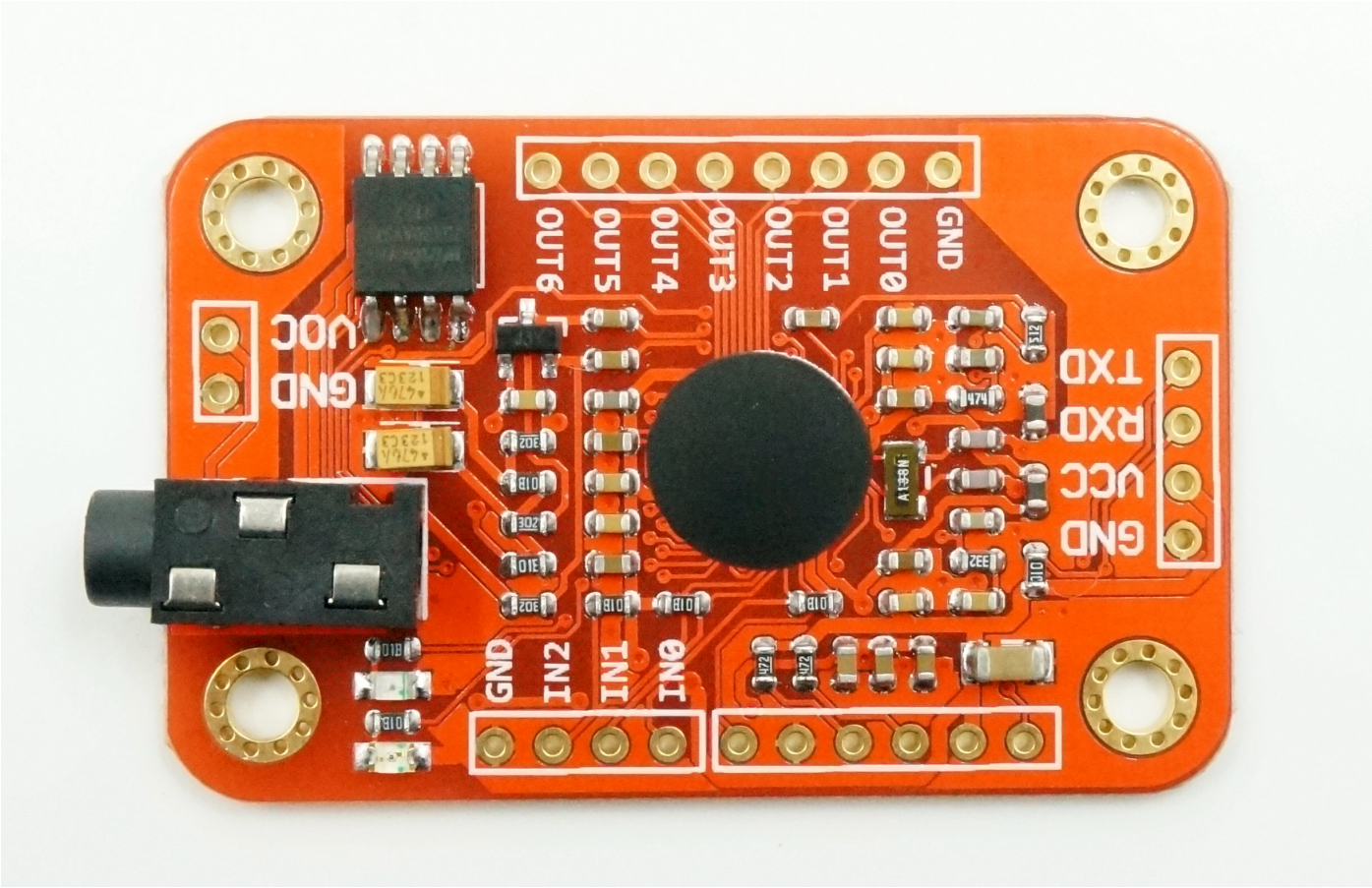


Overview

ELECHOUSE Voice Recognition Module is a compact and easy-control speaking recognition board.

This product is a speaker-dependent voice recognition module. It supports up to 80 voice commands in all. Max 7 voice commands could work at the same time. Any sound could be trained as command. Users need to train the module first before let it recognizing any voice command.

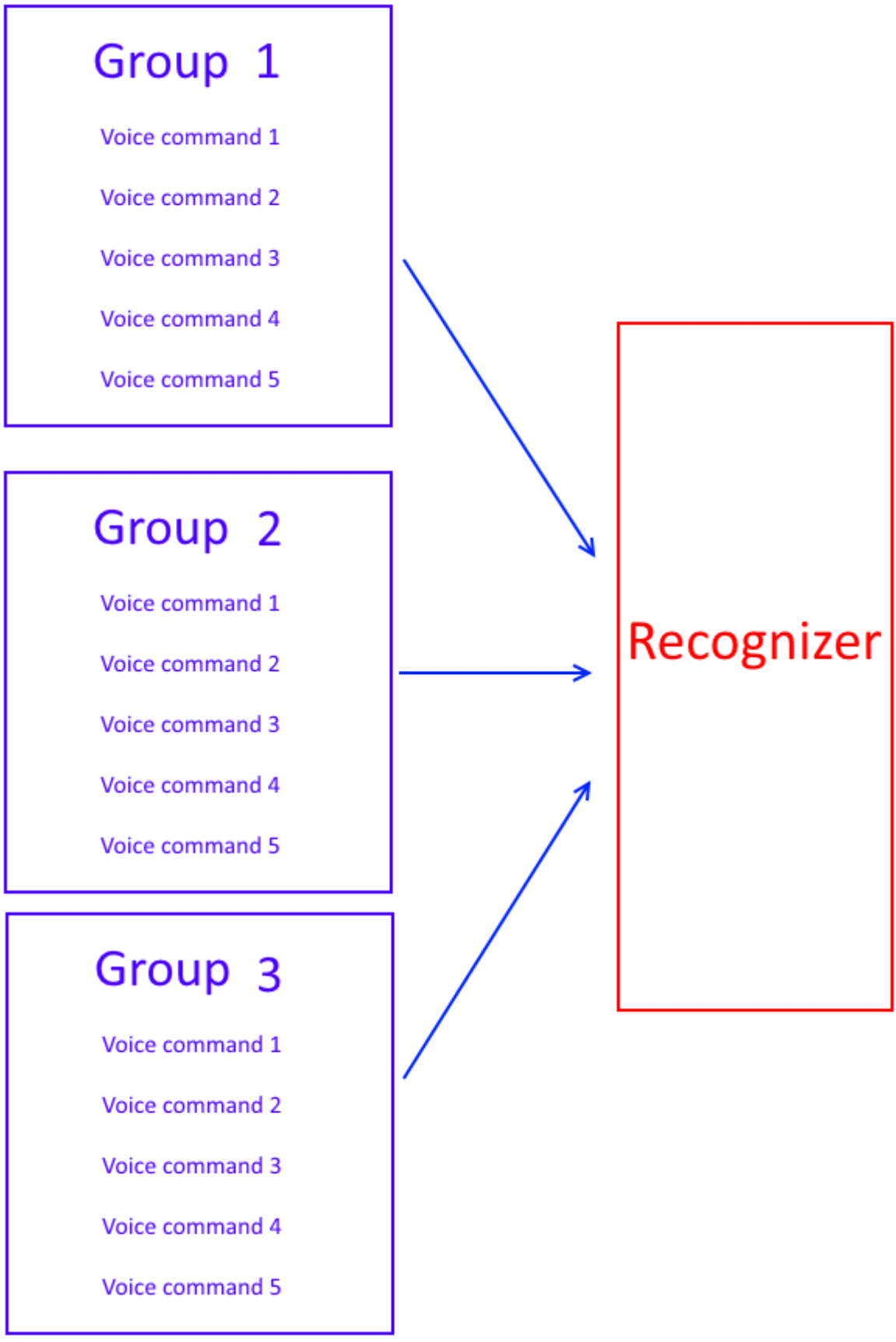
This board has 2 controlling ways: Serial Port (full function), General Input Pins (part of function). General Output Pins on the board could generate several kinds of waves while corresponding voice command was recognized.



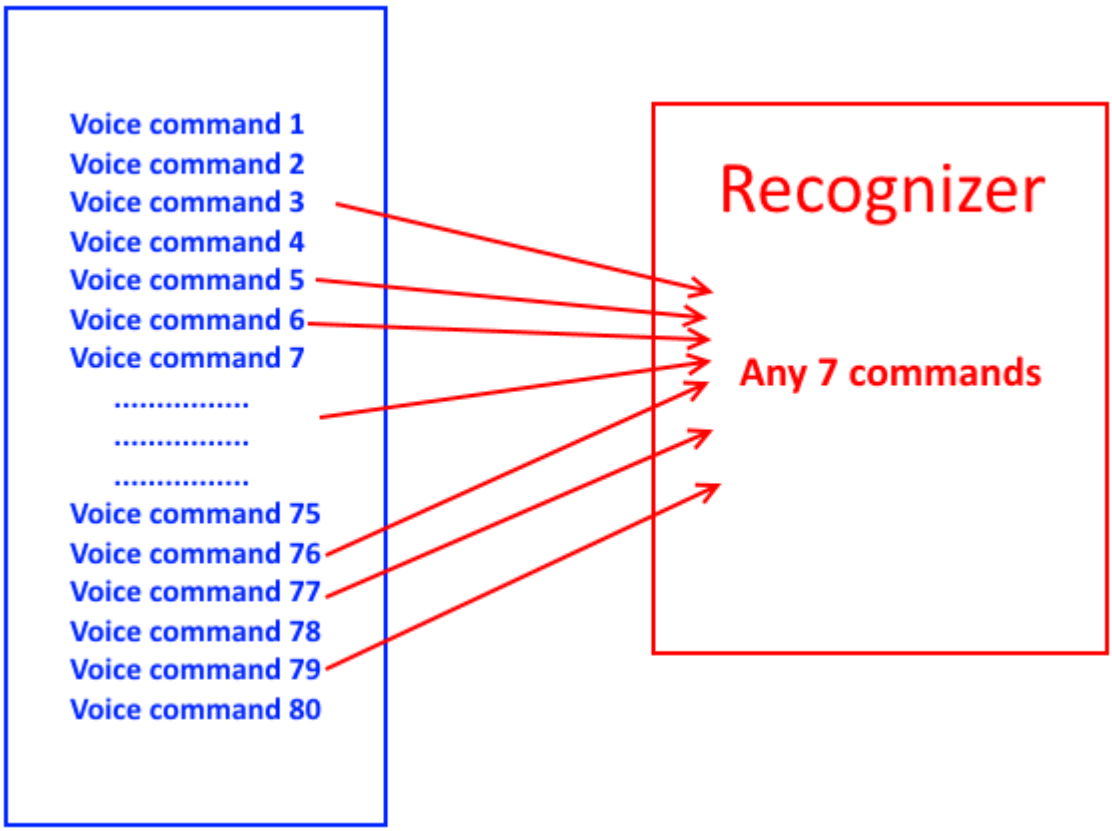
What’s new?

We already have Voice Recognition module V2. It supports 15 commands in all and only 5 commands at the same time.

On V2, voice commands are separated into 3 groups while you training it. And only one group (5 commands) could to be imported into Recognizer. It means only 5 voice commands are effective at the same time.



On V3, voice commands are stored in one large group like a library. Any 7 voice commands in the library could be imported into recognizer. It means 7 commands are effective at the same time.



Parameter

- Voltage: 4.5-5.5V
- Current: <40mA
- Digital Interface: 5V TTL level for UART interface and GPIO
- Analog Interface: 3.5mm mono-channel microphone connector + microphone pin interface
- Size: 31mm x 50mm
- Recognition accuracy: 99% (under ideal environment)

Feature

- Support maximum 80 voice commands, with each voice 1500ms (one or two words speaking)
- Maximum 7 voice commands effective at same time
- Arduino library is supplied
- Easy Control: UART/GPIO
- User-control General Pin Output

Terminology

- VR3 -- Voice Recognition Module V3
- Recognizer -- a container where acting voice commands (max 7) were loaded. It is core part of voice recognition module. For example, it works like “playing balls”. You have 80 players in your team. But you could not let them all play on the court together. The rule only allows 7 players playing on the court. Here the Recognizer is the list which contains names of players working on the court.
- Recognizer index -- max 7 voice commands could be supported in the recognizer. The recognizer has 7 regions for each voice command. One index corresponds to one region: 0~6
- Train -- the process of recording your voice commands
- Load -- copy trained voice to recognizer

- Voice Command Record -- the trained voice command store in flash, number from 0 to 79
- Signature -- text comment for record
- Group -- help to manage records, each group 7 records. System group and user group are supported.

Instruction

Here we will introduce the Arduino Library and VR3 Protocol

For Arduino

Prepare

- Voice Recognition V3 module with microphone
- Arduino board (UNO recommended)
- Arduino Sensor Shield V07 (optional)
- Arduino IDE
- Voice Recognition V3 library (Download zip file)

Hardware and Software Preparation

1. Connect your Voice Recognition V3 Module with Arduino, By Default:

```
Arduino                    VR Module
  5V          ---->          5V
   2          ---->          TX
   3          ---->          RX
 GND          ---->          GND
```

2. Download VoiceRecognitionV3 library. (download zip file or use `git clone https://github.com/elechouse/VoiceRecognitionV3.git` command)
3. If using zip file, extract **VoiceRecognitionV3.zip** to `Arduino Sketch\libraries` folder, or if you use `git clone` command copy **VoiceRecognitionV3** to `Arduino Sketch\libraries` .

Train

1. Open **vr_sample_train** (File -> Examples -> VoiceRecognitionV3 -> vr_sample_train)
2. Choose right Arduino board(Tool -> Board, UNO recommended), Choose right serial port.
3. Click **Upload** button, wait until Arduino is uploaded.
4. Open **Serial Monitor**. Set baud rate 115200, set send with **Newline** or **Both NL & CR**.