A. Coding Sensor LDR

```
void setup() {
  Serial.begin(9600);//mengaktifkan fungsi serial
}
void loop() {
  //membaca nilai LDR pada pin analog 0
  int sensorValue = analogRead(A0);
  //mencetak nilai yang terbaca pada serial monitor
  Serial.println(sensorValue);
  delay(2000);        //delay untuk memperlambat pembacaan
}
```

B. Coding Sensor Hujan

```
const int sensor_hujan = 12;
const int LED = 13;

void setup () {
  Serial.begin(9600);
pinMode (sensor_hujan, INPUT);
pinMode (LED, OUTPUT); }

void loop() {
  delay(1000);
int kondisi_sensor = digitalRead(sensor_hujan);
if (kondisi_sensor == LOW){
digitalWrite(LED, HIGH);
Serial.println("Kondisi Hujan");
Serial.println("1");
}
else {
  digitalWrite(LED, LOW);
  Serial.println("Kondisi panas");
  Serial.println("0");
}
}
```

C. Limit Switch

```
const int buttonPin1 = 2;
const int buttonPin2 = 3;
const int ledPin = 13;


int buttonState1 = 0;
int buttonState2 = 0;
void setup() {
  // initialize the digital pin as an output.
  pinMode(buttonPin1, INPUT);
  pinMode(ledPin, OUTPUT);
  pinMode(buttonPin2, INPUT);
  Serial.begin(9600);
}
```

```
void loop() {
  buttonState1 = digitalRead(buttonPin1);
  if (buttonState1 == LOW) {
  digitalWrite(ledPin,HIGH);
  Serial.println("Pakaian sudah Dijemur");
  }
  else{
    digitalWrite(ledPin, LOW);
}
  buttonState2 = digitalRead(buttonPin2);
  if (buttonState2 == LOW) {
  digitalWrite(ledPin,HIGH);
  Serial.println("Pakaian sudah DiMasukan");
  }
  else{
    digitalWrite(ledPin, LOW);
}
}
```

D. Coding Motor Dc

```
int in1=7;   //inisial pin input1/in1 masuk pin 13
int in2=6;   //inisial pin input2/in2 masuk pin 12


void setup() {
  // put your setup code here, to run once:
pinMode(in1,OUTPUT);    //pin in1 sebagai OUTPUT
pinMode(in2,OUTPUT);    //pin in2 sebagai OUTPUT
Serial.begin(9600);    //Serial komunikasi arduino
}

void loop() {
  // put your main code here, to run repeatedly:
digitalWrite(in1,HIGH);   //in1 mendapat tegangan positif
digitalWrite(in2,LOW);    //in2 tidak dapat tegangan/negatif
//jika in1 dapat tegangan dan in2 tidak,maka motor bergerak maju
Serial.println("masuk");   //menampilkan di serial monitor bahwa motor bergerak maju
delay(5000);
digitalWrite(in1,LOW);    //in1 tidak dapat tegangan/negatif
digitalWrite(in2,HIGH);   //in2 mendapat tegangan positif
//jika in1 tidak dapat tegangan dan in2 dapat tegangan,maka motor bergerak mundur
Serial.println("keluar"); //menampilkan di serial monitor bahwa motor bergerak mundur
delay(5000);
}
```

E. Coding Modul ESP8266-01

```
#include <stdlib.h>
#include <SoftwareSerial.h>
#define SSID "ganaskondang" //nama wifinya
#define PASS "16201017" //password wifi routernya
#define Baud_Rate 9600
#define Delay_Time 1000
#define WRITE_APIKEY "VDE0IKY1DNX84"//channel read apikey
```

```
SoftwareSerial espSerial (2,3);
boolean found = false;
bool kirimdata; //cek status kirim data

void setup(){
  Serial.begin(Baud_Rate);
  Serial.println("AT");

  delay(5000);

  //sambungkan ke wifi
  Serial.println("AT+CWMODE=1");//mode wifi client
  delay(2000);

  String cmd = "AT+CWJAP=\"";//at command konek ke wifi router
  cmd += SSID;
  cmd += "\",\"";
  cmd += PASS;
  cmd += "\"";//simpelnya ya gini AT+CWJAP="SSID","PASS";

  Serial.println(cmd);
  delay(1000);

  if(Serial.find("OK")){
    digitalWrite(4,HIGH);
    digitalWrite(3,LOW);
  }else{
    digitalWrite(4,LOW);
    digitalWrite(3,HIGH);
  }
  //end sambungan ke wifi
}
void loop(){
  //inisialisasi alamat server
  String cmd = "AT+CIPSTART=\"TCP\",\"184.106.153.149\",80";//ip api.thingspeak.com
  Serial.println(cmd);
  delay(500);

  //coba kirim data
  String getStr = "GET /update?api_key=";
  getStr += WRITE_APIKEY;
  getStr += "&field1=";
  getStr += "150";//silahkan ganti nilai sensor
  getStr += "\r\n\r\n";

  //Serial.print("AT+CIPSEND=");
  //Serial.println(cmd.length());
  cmd = "AT+CIPSEND=";
  cmd += String(getStr.length());

  Serial.println(cmd);
```

```
  if(Serial.find(">")){
    Serial.print(getStr);
  }else{
    Serial.println("AT+CIPCLOSE");
  }

  if(Serial.find("OK")){
    for(int a = 0; a < 5; a++){
      digitalWrite(4,HIGH);
      digitalWrite(3,LOW);
      delay(200);
      digitalWrite(4,LOW);
      digitalWrite(3,HIGH);
      delay(200);
    }
  }else{
    for(int a = 0; a < 5; a++){
      digitalWrite(4,HIGH);
      digitalWrite(3,HIGH);
      delay(200);
      digitalWrite(4,LOW);
      digitalWrite(3,LOW);
      delay(200);
    }
  }

  //end coba kirim data
  delay(5000);
}
```

F. Coding Keseluruhan Hardware yang di uji

```
#include <SoftwareSerial.h>

#define DEBUG true

String WSSID="ganaskondang";
String PASS="16201017";
String API="V3OGHQDVXL80DGWB";
String HOST="api.thingspeak.com";
String PORT="80";
String Datafield1 = "field1"; //alamat pengiriman data cahaya
String Datafield2 = "field2"; //alamat pengiriman data hujan
String Datafield3 = "field3"; //alamat pengiriman data asin

int r1 = 7;
int r2 = 6;
int Lswitch1 = 5;
int Lswitch2 = 4;
int LDR = A0;
int hujan = 8;
```

```
SoftwareSerial espSerial(2,3);
boolean found = false;
int buttonstate = 0;
int buttonstate2 = 0;
int LDRread;
int adahujan;


void setup()
{
  Serial.begin(9600);
  pinMode(r1, OUTPUT);
  pinMode(r2, OUTPUT);
  pinMode(Lswitch1, INPUT_PULLUP);
  pinMode(Lswitch2, INPUT_PULLUP);
     espSerial.begin(115200);
     espData("AT+RST",1000,DEBUG);
     espData("AT+CWMODE=1",1000,DEBUG);
     espData("AT+CWJAP=\""+ WSSID +"\",\""+ PASS +"\"",1000,DEBUG);
     delay(1000);
}
  void loop()
{
  buttonstate = digitalRead(Lswitch1);
  buttonstate2 = digitalRead(Lswitch2);
  LDRread = analogRead(A0);
  hujan = digitalRead(8);
  adahujan = hujan;


  if ((LDRread >= 250 ) || (adahujan == 0 )) {
      digitalWrite(r1, HIGH);
      digitalWrite(r2, LOW);
      if (buttonstate == LOW) {
      digitalWrite(r1, LOW);
      }
     }
  else if ((LDRread <= 250) || (adahujan == 1)) {
    digitalWrite(r2, HIGH);
    digitalWrite(r1, LOW);
    if (buttonstate2 == LOW) {
    digitalWrite(r2, LOW);
    }
    }
    datasenda();
    datasendb();
    datasendc();
   }

void datasenda()
  {
```

```
    adahujan;
    String sendData="GET /update?api_key="+ API + "&" + Datafield3 + "=" +String(adahujan);
     espData("AT+CIPMUX=1",1000,DEBUG);
         espData("AT+CIPSTART=0,\"TCP\",\""+ HOST +"\","+ PORT ,1000,DEBUG);
         espData("AT+CIPSEND=0," +String(sendData.length()+4),1000,DEBUG);
         espSerial.find(">");
         espSerial.println(sendData);
    }
void datasendb()
{
  adahujan;
  String sendData="GET /update?api_key="+ API + "&" + Datafield2 + "=" +String(adahujan);
     espData("AT+CIPMUX=1",1000,DEBUG);
        espData("AT+CIPSTART=0,\"TCP\",\""+ HOST +"\","+ PORT ,1000,DEBUG);
        espData("AT+CIPSEND=0," +String(sendData.length()+4),1000,DEBUG);
        espSerial.find(">");
        espSerial.println(sendData);
}
void datasendc()
{
  LDRread;
  String sendData="GET /update?api_key="+ API + "&" + Datafield1 + "=" +String(LDRread);
     espData("AT+CIPMUX=1",1000,DEBUG);
        espData("AT+CIPSTART=0,\"TCP\",\""+ HOST +"\","+ PORT ,1000,DEBUG);
        espData("AT+CIPSEND=0," +String(sendData.length()+4),1000,DEBUG);
        espSerial.find(">");
        espSerial.println(sendData);
}
String espData(String command,const int timeout,boolean debug)
{
 Serial.print("AT Command ==> ");
 Serial.print(command);
 Serial.println("  ");
 Serial.println(buttonstate);
 Serial.println(buttonstate2);
 Serial.println(LDRread);
 Serial.println(adahujan);
//   Serial.println(asinan);
 String response ="";
 espSerial.println(command);
 long int time=millis();
 while ((time+timeout)>millis())
 {
   while(espSerial.available())
   {
    char c=espSerial.read();
    response +=c;
   }
 }
 if(debug){
 }
 return response;
```

}

Product Folder  

DRV8833 Dual H-Bridge Motor Driver

1 Features

- Dual-H-Bridge Current-Control Motor Driver
  - Can Drive Two DC Motors or One Stepper Motor
  - Low MOSFET ON-Resistance: HS + LS 360 mΩ
- Output Current (at V_M = 5 V, 25°C)
  - 1.5-A RMS, 2-A Peak per H-Bridge in PWP and RTY Package Options
  - 500-mA RMS, 2-A Peak per H-Bridge in PW Package Option
- Outputs can be in Parallel for
  - 3-A RMS, 4-A Peak (PWP and RTY)
  - 1-A RMS, 4-A Peak (PW)
- Wide Power Supply Voltage Range: 2.7 to 10.8 V
- PWM Winding Current Regulation and Current Limiting
- Thermally Enhanced Surface-Mount Packages

2 Applications

- Battery-Powered Toys
- POS Printers
- Video Security Cameras
- Office Automation Machines
- Gaming Machines
- Robotics

3 Description

The DRV8833 device provides a dual bridge motor driver solution for toys, printers, and other mechatronic applications.

The device has two H-bridge drivers, and can drive two DC brush motors, a bipolar stepper motor, solenoids, or other inductive loads.

The output driver block of each H-bridge consists of N-channel power MOSFETs configured as an H-bridge to drive the motor windings. Each H-bridge includes circuitry to regulate or limit the winding current.

Internal shutdown functions with a fault output pin are provided for overcurrent protection, short-circuit protection, undervoltage lockout, and overtemperature. A low-power sleep mode is also provided.

The DRV8833 is packaged in a 16-pin WQFN package with PowerPAD™ (Eco-friendly: RoHS & no Sb/Br).

Device Information[1]

PART NUMBER	PACKAGE	BODY SIZE (NOM)
DRV8833	TSSOP (16)	5.00 mm × 4.40 mm
	HTSSOP (16)	5.00 mm × 4.40 mm
	WQFN (16)	4.00 mm × 4.00 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Simplified Schematic

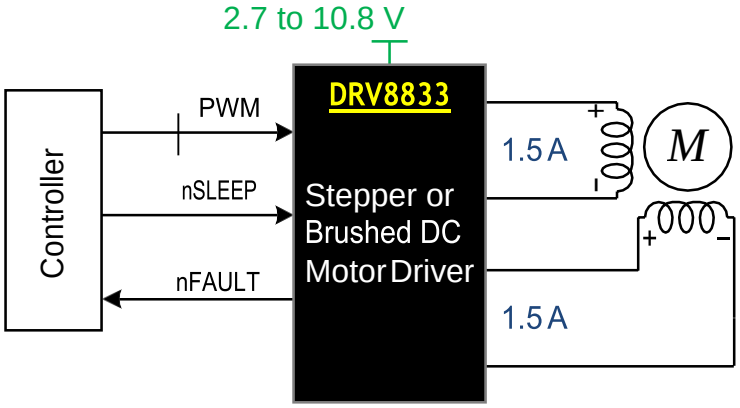


Table of Contents

4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision D (March 2015) to Revision E — **Page**

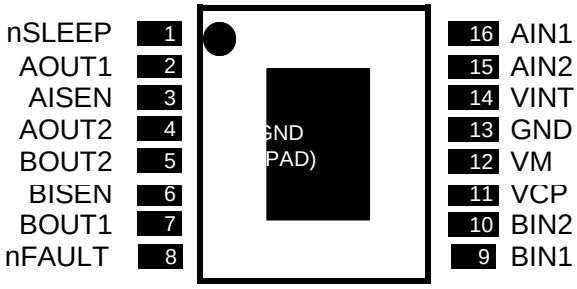
- Updated *Features* bullets to include specifications for other packages 1
- Added note back to *Pin Functions* regarding the different I/O types 3
- Corrected the device name and current regulation description in *Overview* 8
- Corrected output current to 1.5-A RMS from 700-mA RMS 8

Changes from Revision C (January 2013) to Revision D — **Page**

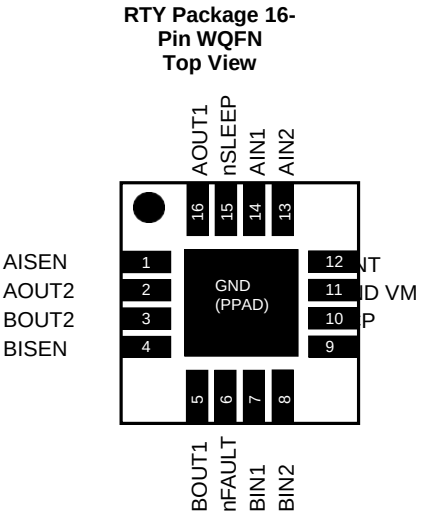
- Added *ESD Ratings table*, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section 1

5 Pin Configuration and Functions

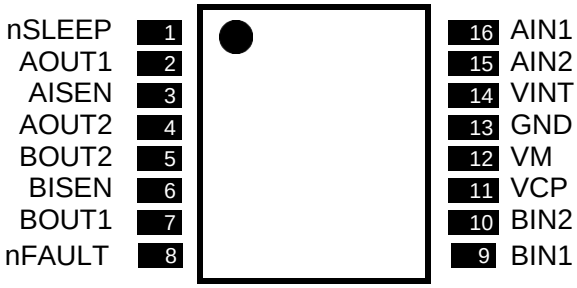
PWP Package 16-Pin HTSSOP Top View



RTY Package 16-Pin WQFN Top View



PW Package 16-Pin TSSOP Top View



Pin Functions

PIN			I/O(1)	DESCRIPTION	EXTERNAL COMPONENTS OR CONNECTIONS
NAME	WQFN	HTSSOP, TSSOP			
POWER AND GROUND					
GND	11 PPAD	13	—	Device ground. HTSSOP package has PowerPAD.	Both the GND pin and device PowerPAD must be connected to ground.
VINT	12	14	—	Internal supply bypass	Bypass to GND with 2.2-µF, 6.3-V capacitor.
VM	10	12	—	Device power supply	Connect to motor supply. A 10-µF (minimum) ceramic bypass capacitor to GND is recommended.
VCP	9	11	IO	High-side gate drive voltage	Connect a 0.01-µF, 16-V (minimum) X7R ceramic capacitor to VM.
CONTROL					
AIN1	14	16	I	Bridge A input 1	Logic input controls state of AOUT1. Internal pulldown.
AIN2	13	15	I	Bridge A input 2	Logic input controls state of AOUT2. Internal pulldown.
BIN1	7	9	I	Bridge B input 1	Logic input controls state of BOUT1. Internal pulldown.
BIN2	8	10	I	Bridge B input 2	Logic input controls state of BOUT2. Internal pulldown.
nSLEEP	15	1	I	Sleep mode input	Logic high to enable device, logic low to enter low-power sleep mode and reset all internal logic. Internal pulldown.

(1) I = Input, O = Output, OZ = Tri-state output, OD = Open-drain output, IO = Input/output

Pin Functions (continued)

PIN			I/O(1)	DESCRIPTION	EXTERNAL COMPONENTS OR CONNECTIONS
NAME	WQFN	HTSSOP, TSSOP			
STATUS					
nFAULT	6	8	OD	Fault output	Logic low when in fault condition (overtemperature, overcurrent)
OUTPUT					
AISEN	1	3	IO	Bridge A ground / I_{SENSE}	Connect to current sense resistor for bridge A, or GND if current control not needed
BISEN	4	6	IO	Bridge B ground / I_{SENSE}	Connect to current sense resistor for bridge B, or GND if current control not needed
AOUT1	16	2	O	Bridge A output 1	Connect to motor winding A
AOUT2	2	4	O	Bridge A output 2	
BOUT1	5	7	O	Bridge B output 1	Connect to motor winding B
BOUT2	3	5	O	Bridge B output 2	

6 Specifications

6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
VM	Power supply voltage	–0.3	11.8	V
Digital input pin voltage		–0.5	7	V
xISEN pin voltage		–0.3	0.5	V
Peak motor drive output current		Internally limited		A
T_J	Operating junction temperature	–40	150	°C
T_{stg}	Storage temperature	–60	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)	±4000	V
	Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)	±1500	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

T_A = 25°C (unless otherwise noted)

		MIN	NOM	MAX	UNIT
V_M	Motor power supply voltage range(1)	2.7		10.8	V
V_{DIGIN}	Digital input pin voltage range	–0.3		5.75	V
I_{OUT}	RTY package continuous RMS or DC output current per bridge(2)			1.5	A

(1) $R_{DS(ON)}$ increases and maximum output current is reduced at VM supply voltages below 5 V.
(2) V_M = 5 V, power dissipation and thermal limits must be observed.

6.4 Thermal Information

THERMAL METRIC(1)		DRV8833 PWP (HTSSOP) 16 PINS	DRV8833 RTY (WQFN) 16 PINS	DRV8833 PW (TSSOP) 16 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	40.5	37.2	103.1	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	32.9	34.3	38	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	28.8	15.3	48.1	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	0.6	0.3	3	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	11.5	15.4	47.5	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	4.8	3.5	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, SPRA953.

6.5 Electrical Characteristics

T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
POWER SUPPLY						
I_{VM}	VM operating supply current	V_M = 5 V, xIN1 = 0 V, xIN2 = 0 V	1.7		3	mA
I_{VMQ}	VM sleep mode supply current	V_M = 5 V		1.6	2.5	µA
V_{UVLO}	VM undervoltage lockout voltage	V_M falling			2.6	V
V_{HYS}	VM undervoltage lockout hysteresis		90			mV
LOGIC-LEVEL INPUTS						
V_{IL}	Input low voltage	nSLEEP			0.5	V
		All other pins			0.7	
V_{IH}	Input high voltage	nSLEEP	2.5			V
		All other pins	2			
V_{HYS}	Input hysteresis		0.4			V
R_{PD}	Input pulldown resistance	nSLEEP	500			kΩ
		All except nSLEEP	150			
I_{IL}	Input low current	VIN = 0			1	µA
I_{IH}	Input high current	VIN = 3.3 V, nSLEEP		6.6	13	µA
		VIN = 3.3 V, all except nSLEEP	16.5		33	
t_{DEG}	Input deglitch time		450			ns
nFAULT OUTPUT (OPEN-DRAIN OUTPUT)						
V_{OL}	Output low voltage	I_O = 5 mA			0.5	V
I_{OH}	Output high leakage current	V_O = 3.3 V			1	µA
H-BRIDGE FETs						
$R_{DS(ON)}$	HS FET on resistance	V_M = 5 V, I_O = 500 mA, T_J = 25°C	200			mΩ
		V_M = 5 V, I_O = 500 mA, T_J = 85°C			325	
		V_M = 2.7 V, I_O = 500 mA, T_J = 25°C	250			
		V_M = 2.7 V, I_O = 500 mA, T_J = 85°C			350	
	LS FET on resistance	V_M = 5 V, I_O = 500 mA, T_J = 25°C	160			
		V_M = 5 V, I_O = 500 mA, T_J = 85°C			275	
		V_M = 2.7 V, I_O = 500 mA, T_J = 25°C	200			
		V_M = 2.7 V, I_O = 500 mA, T_J = 85°C			300	
I_{OFF}	Off-state leakage current	V_M = 5 V, T_J = 25°C, V_{OUT} = 0 V	–1		1	µA
MOTOR DRIVER						
f_{PWM}	Current control PWM frequency	Internal PWM frequency	50			kHz
t_R	Rise time	V_M = 5 V, 16 Ω to GND, 10% to 90% V_M	180			ns
t_F	Fall time	V_M = 5 V, 16 Ω to GND, 10% to 90% V_M	160			ns
t_{PROP}	Propagation delay INx to OUTx	V_M = 5 V	1.1			µs
t_{DEAD}	Dead time (1)	V_M = 5 V	450			ns
PROTECTION CIRCUITS						
I_{OCP}	Overcurrent protection trip level		2	3.3		A
t_{DEG}	OCP Deglitch time		4			µs
t_{OCP}	Overcurrent protection period		1.35			ms
t_{TSD}	Thermal shutdown temperature	Die temperature	150	160	180	°C

(1) Internal dead time. External implementation is not necessary.

Electrical Characteristics (continued)

T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
CURRENT CONTROL						
V_{TRIP}	xISEN trip voltage		160	200	240	mV
t_{BLANK}	Current sense blanking time		3.75			µs
SLEEP MODE						
t_{WAKE}	Start-up time	nSLEEP inactive high to H-bridge on			1	ms

6.6 Typical Characteristics

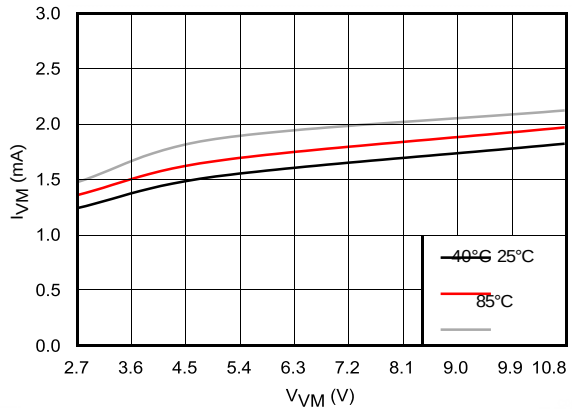


Figure 1. Operating Current

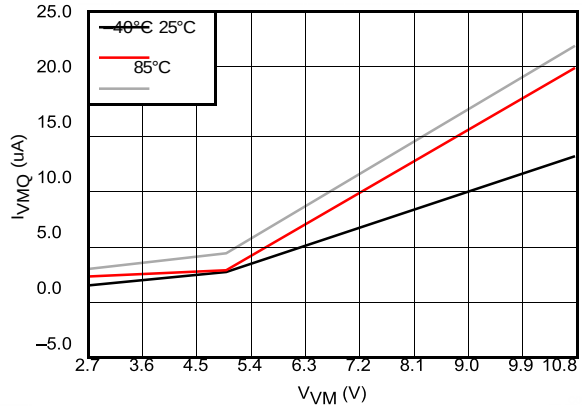


Figure 2. Sleep Current

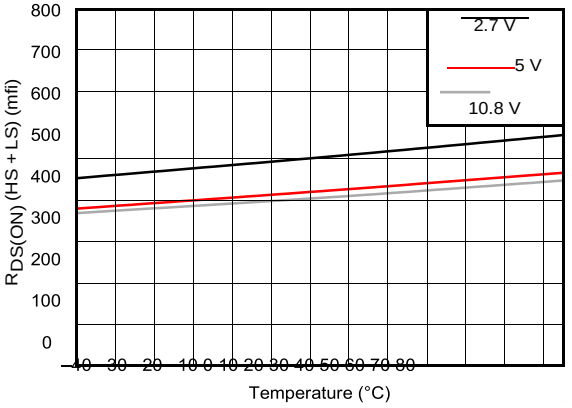


Figure 3. $R_{DS(on)}$ (HS + LS)

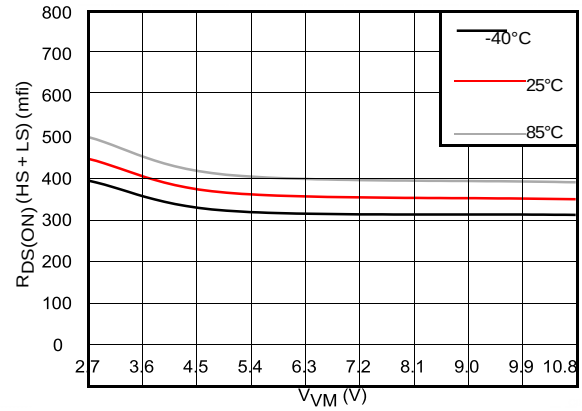


Figure 4. $R_{DS(on)}$ (HS + LS)

7 Detailed Description

7.1 Overview

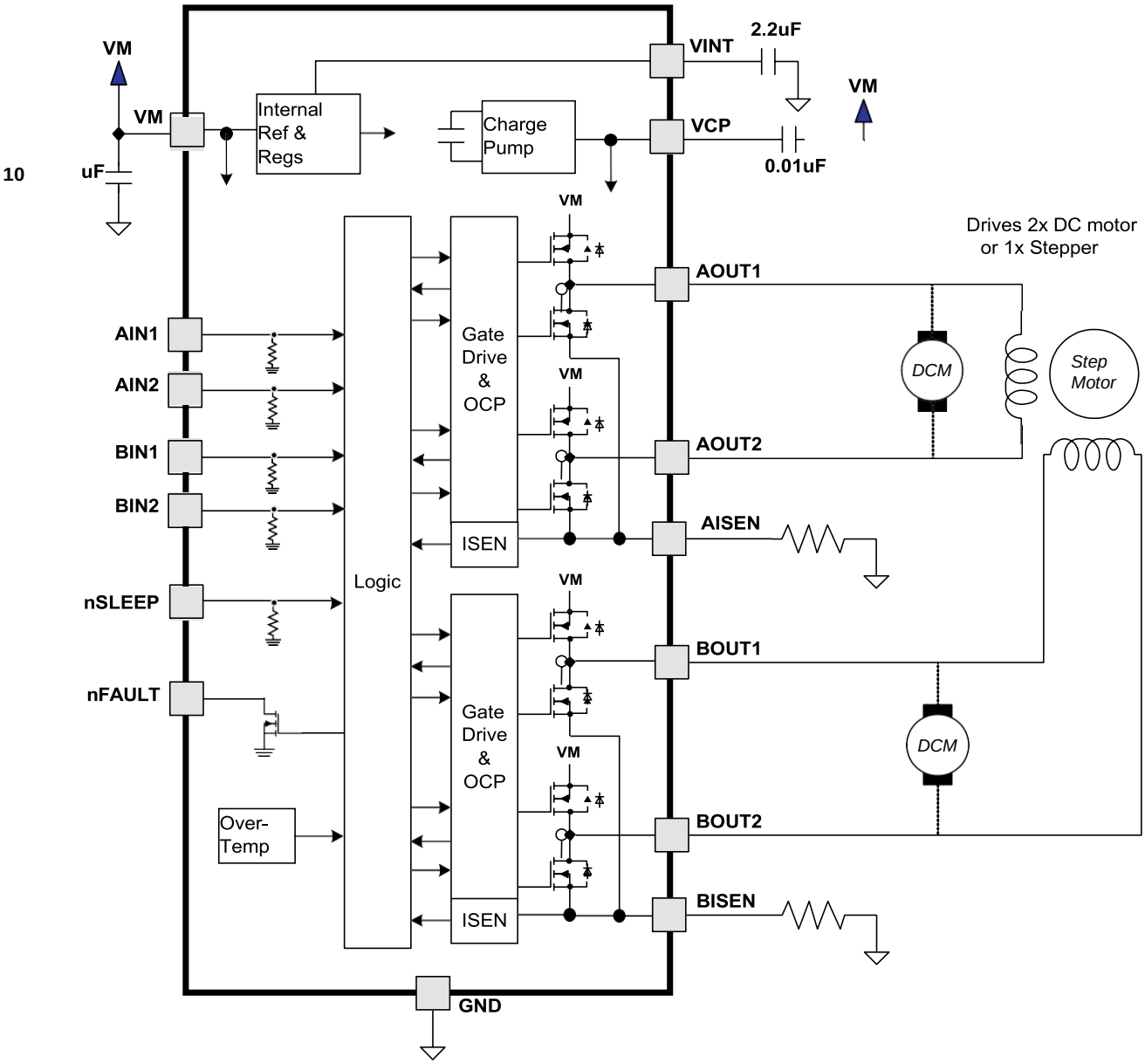
The DRV8833 device is an integrated motor driver solution for brushed DC or bipolar stepper motors. The device integrates two NMOS H-bridges and current regulation circuitry. The DRV8833 can be powered with a supply voltage from 2.7 to 10.8 V and can provide an output current up to 1.5-A RMS.

A simple PWM interface allows easy interfacing to the controller circuit. The

current regulation is a fixed frequency PWM slow decay.

The device includes a low-power sleep mode, which lets the system save power when not driving the motor.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Fixed-Frequency PWM Motor Drivers

DRV8833 contains two identical H-bridge motor drivers with current-control PWM circuitry. Figure 5 shows a block diagram of the circuitry.

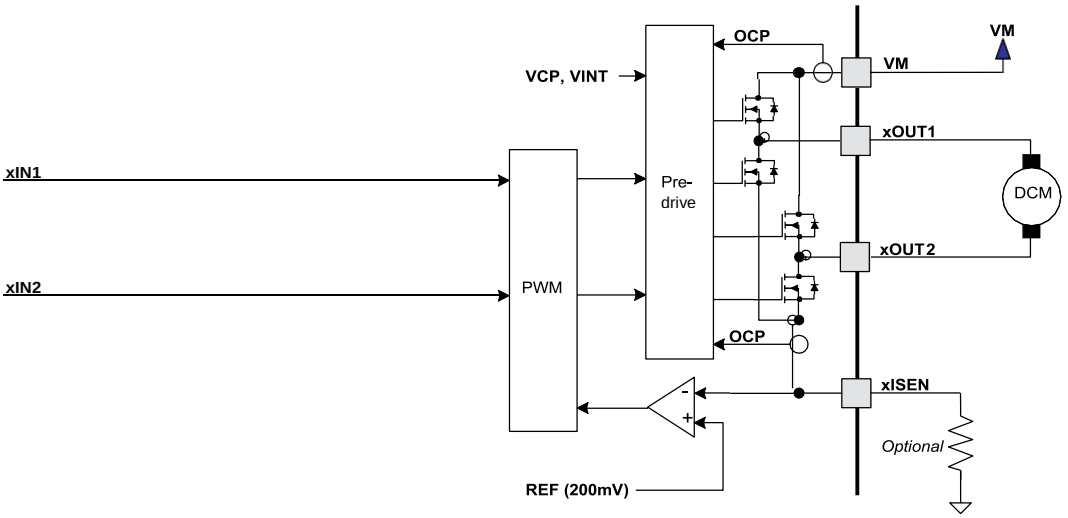


Figure 5. Motor Control Circuitry

7.3.2 Bridge Control and Decay Modes

The AIN1 and AIN2 input pins control the state of the AOUT1 and AOUT2 outputs; similarly, the BIN1 and BIN2 input pins control the state of the BOUT1 and BOUT2 outputs. Table 1 shows the logic.

Table 1. H-Bridge Logic

xIN1	xIN2	xOUT1	xOUT2	FUNCTION
0	0	Z	Z	Coast/fast decay
0	1	L	H	Reverse
1	0	H	L	Forward
1	1	L	L	Brake/slow decay

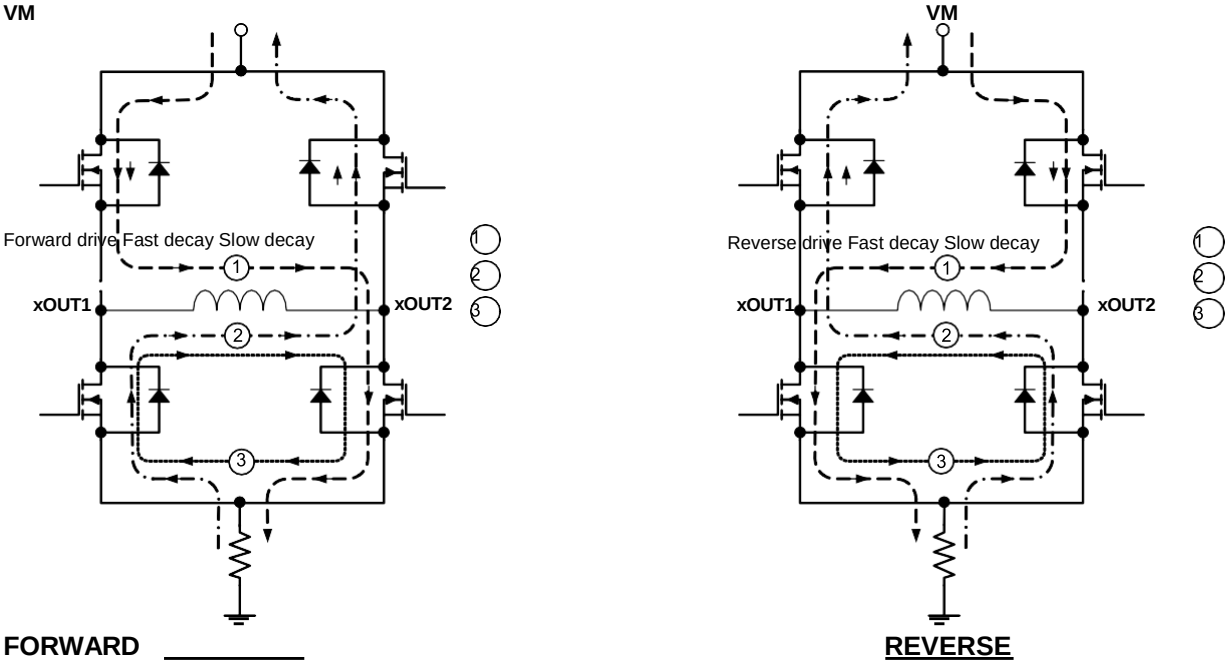
The inputs can also be used for PWM control of the motor speed. When controlling a winding with PWM, when the drive current is interrupted, the inductive nature of the motor requires that the current must continue to flow. This is called recirculation current. To handle this recirculation current, the H-bridge can operate in two different states: fast decay or slow decay. In fast decay mode, the H-bridge is disabled and recirculation current flows through the body diodes; in slow decay, the motor winding is shorted.

To PWM using fast decay, the PWM signal is applied to one xIN pin while the other is held low; to use slow decay, one xIN pin is held high.

Table 2. PWM Control of Motor Speed

xIN1	xIN2	FUNCTION
PWM	0	Forward PWM, fast decay
1	PWM	Forward PWM, slow decay
0	PWM	Reverse PWM, fast decay
PWM	1	Reverse PWM, slow decay

Figure 6 shows the current paths in different drive and decay modes.



FORWARD **REVERSE**

Figure 6. Drive and Decay Modes

7.3.3 Current Control

The current through the motor windings may be limited, or controlled, by a fixed-frequency PWM current regulation, or current chopping. For DC motors, current control is used to limit the start-up and stall current of the motor. For stepper motors, current control is often used at all times.

When an H-bridge is enabled, current rises through the winding at a rate dependent on the DC voltage and inductance of the winding. If the current reaches the current chopping threshold, the bridge disables the current until the beginning of the next PWM cycle. Immediately after the current is enabled, the voltage on the xISEN pin is ignored for a fixed period of time before enabling the current sense circuitry. This blanking time is fixed at 3.75 µs. This blanking time also sets the minimum on time of the PWM when operating in current chopping mode.

The PWM chopping current is set by a comparator which compares the voltage across a current sense resistor connected to the xISEN pins with a reference voltage. The reference voltage is fixed at 200 mV.

The chopping current is calculated in Equation 1.

$$I_{CHOP} = \frac{200\ mV}{R_{ISENSE}} \quad (1)$$

Example: If a 1-Ω sense resistor is used, the chopping current will be 200 mV/1 Ω = 200 mA.

Once the chopping current threshold is reached, the H-bridge switches to slow decay mode. Winding current is recirculated by enabling both of the low-side FETs in the bridge. This state is held until the beginning of the next fixed-frequency PWM cycle.

If current control is not needed, the xISEN pins should be connected directly to ground.

7.3.4 nSLEEP Operation

Driving nSLEEP low will put the device into a low power sleep state. In this state, the H-bridges are disabled, the gate drive charge pump is stopped, all internal logic is reset, and all internal clocks are stopped. All inputs are ignored until nSLEEP returns inactive high. When returning from sleep mode, some time (up to 1 ms) needs to pass before the motor driver becomes fully operational. To make the board design simple, the nSLEEP can be pulled up to the supply (VM). TI recommends using a pullup resistor when this is done. This resistor limits the current to the input in case VM is higher than 6.5 V. Internally, the nSLEEP pin has a 500-kΩ resistor to GND. It also has a clamping Zener diode that clamps the voltage at the pin at 6.5 V. Currents greater than 250 µA can cause damage to the input structure. Hence the recommended pullup resistor would be between 20 kΩ and 75 kΩ.

7.3.5 Protection Circuits

The DRV8833 is fully protected against undervoltage, overcurrent and overtemperature events.

7.3.5.1 Overcurrent Protection (OCP)

An analog current limit circuit on each FET limits the current through the FET by limiting the gate drive. If this analog current limit persists for longer than the OCP deglitch time, all FETs in the H-bridge will be disabled and the nFAULT pin will be driven low. The driver will be re-enabled after the OCP retry period (t_{OCP}) has passed. nFAULT becomes high again at this time. If the fault condition is still present, the cycle repeats. If the fault is no longer present, normal operation resumes and nFAULT remains deasserted. Please note that only the H-bridge in which the OCP is detected will be disabled while the other bridge will function normally.

Overcurrent conditions are detected independently on both high- and low-side devices; that is, a short to ground, supply, or across the motor winding will all result in an overcurrent shutdown. Overcurrent protection does not use the current sense circuitry used for PWM current control, so it functions even without presence of the xISEN resistors.

7.3.5.2 Thermal Shutdown (TSD)

If the die temperature exceeds safe limits, all FETs in the H-bridge will be disabled and the nFAULT pin will be driven low. Once the die temperature has fallen to a safe level, operation will automatically resume.

7.3.5.3 Undervoltage Lockout (UVLO)

If at any time the voltage on the VM pin falls below the undervoltage lockout threshold voltage, all circuitry in the device will be disabled, and all internal logic will be reset. Operation will resume when VM rises above the UVLO threshold. nFAULT is driven low in the event of an undervoltage condition.

Table 3. Device Protection

FAULT	CONDITION	ERROR REPORT	H-BRIDGE	INTERNAL CIRCUITS	RECOVERY
VM undervoltage (UVLO)	$V_M < 2.5$ V	None	Disabled	Disabled	$V_M > 2.7$ V
Overcurrent (OCP)	$I_{OUT} > I_{OCP}$	FAULTn	Disabled	Operating	OCP
Thermal Shutdown (TSD)	$T_J > T_{TSD}$	FAULTn	Disabled	Operating	$T_J < T_{TSD} - T_{HYS}$

7.4 Device Functional Modes

The DRV8833 is active unless the nSLEEP pin is brought logic low. In sleep mode, the H-bridge FETs are disabled (Hi-Z). The DRV8833 is brought out of sleep mode automatically if nSLEEP is brought logic high. tWAKE must elapse before the outputs change state after wakeup.

Table 4. Modes of Operation

FAULT	CONDITION	H-BRIDGE	INTERNAL CIRCUITS
Operating	nSLEEP pin high	Operating	Operating
Sleep mode	nSLEEP pin low	Disabled	Disabled
Fault encountered	Any fault condition met	Disabled	See Table 3

8 Application and Implementation

NOTE
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

The DRV8833 is used in brushed DC or stepper motor control. The following design procedure can be used to configure the DRV8833 in a brushed DC motor application. The inputs and outputs are connected in parallel to achieve higher current.

8.2 Typical Application

The two H-bridges in the DRV8833 can be connected in parallel for double the current of a single H-bridge. The internal dead time in the DRV8833 prevents any risk of cross-conduction (shoot-through) between the two bridges due to timing differences between the two bridges. Figure 7 shows the connections.

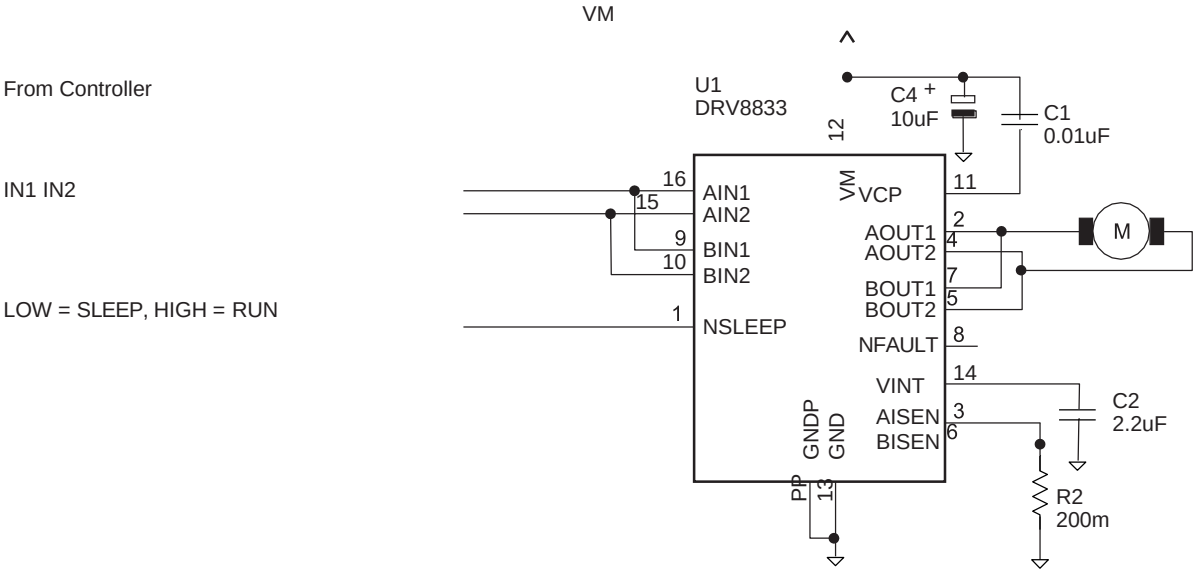


Figure 7. Parallel Mode

8.2.1 Design Requirements

Table 5. Design Parameters

DESIGN PARAMETER	REFERENCE	EXAMPLE VALUE
Motor voltage	V_M	10 V
Motor RMS current	I_{RMS}	0.8 A
Motor start-up current	I_{START}	2 A
Motor current trip point	I_{TRIP}	2.5 A

8.2.2 Detailed Design Procedure

8.2.2.1 Motor Voltage

The motor voltage to use will depend on the ratings of the motor selected and the desired RPM. A higher voltage spins a brushed DC motor faster with the same PWM duty cycle applied to the power FETs. A higher voltage also increases the rate of current change through the inductive motor windings.

8.2.2.2 Motor Current Trip Point

When the voltage on pin xISEN exceeds V_{TRIP} (0.2 V), current regulation is activated. The R_{ISENSE} resistor should be sized to set the desired I_{CHOP} level.

$$R_{ISENSE} = 0.2\ V / I_{CHOP} \quad (2)$$

To set I_{CHOP} to 1 A, R_{SENSE} = 0.2 V / 1 A = 0.2 Ω.

8.2.2.3 Sense Resistor

For optimal performance, it is important for the sense resistor to be:

- Surface-mount
- Low inductance
- Rated for high enough power
- Placed closely to the motor driver

The power dissipated by the sense resistor equals $I_{RMS}^2 \times R$. For example, if peak motor current is 3 A, RMS motor current is 2 A, and a 0.05-Ω sense resistor is used, the resistor will dissipate $2\ A \times 0.05\ \Omega = 0.2$ W. The power quickly increases with higher current levels.

Resistors typically have a rated power within some ambient temperature range, along with a derated power curve for high ambient temperatures. When a PCB is shared with other components generating heat, margin should be added. For best practice, measure the actual sense resistor temperature in a final system, along with the power MOSFETs, as those are often the hottest components.

Because power resistors are larger and more expensive than standard resistors, the common practice is to use multiple standard resistors in parallel, between the sense node and ground. This distributes the current and heat dissipation.

8.2.3 Application Curve

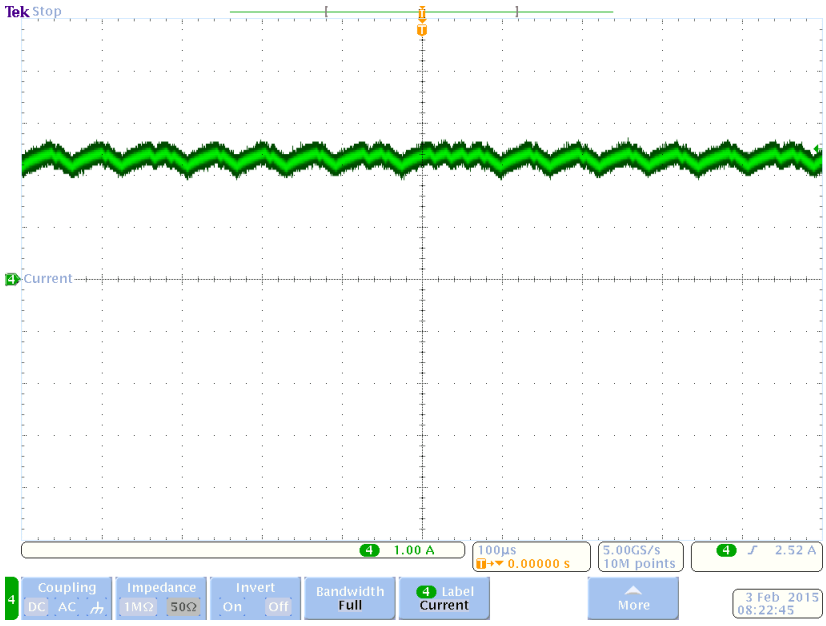


Figure 8. Current Regulation

9 Power Supply Recommendations

9.1 Bulk Capacitance

Having an appropriate local bulk capacitance is an important factor in motor drive system design. It is generally beneficial to have more bulk capacitance, while the disadvantages are increased cost and physical size.

The amount of local capacitance needed depends on a variety of factors, including:

- The highest current required by the motor system
- The capacitance and ability to source current
- The amount of parasitic inductance between the power supply and motor system
- The acceptable voltage ripple
- The type of motor used (brushed DC, brushless DC, stepper)
- The motor braking method

The inductance between the power supply and the motor drive system limits the rate current can change from the power supply. If the local bulk capacitance is too small, the system responds to excessive current demands or dumps from the motor with a change in voltage. When adequate bulk capacitance is used, the motor voltage remains stable and high current can be quickly supplied.

The data sheet generally provides a recommended value, but system-level testing is required to determine the appropriate sized bulk capacitor.

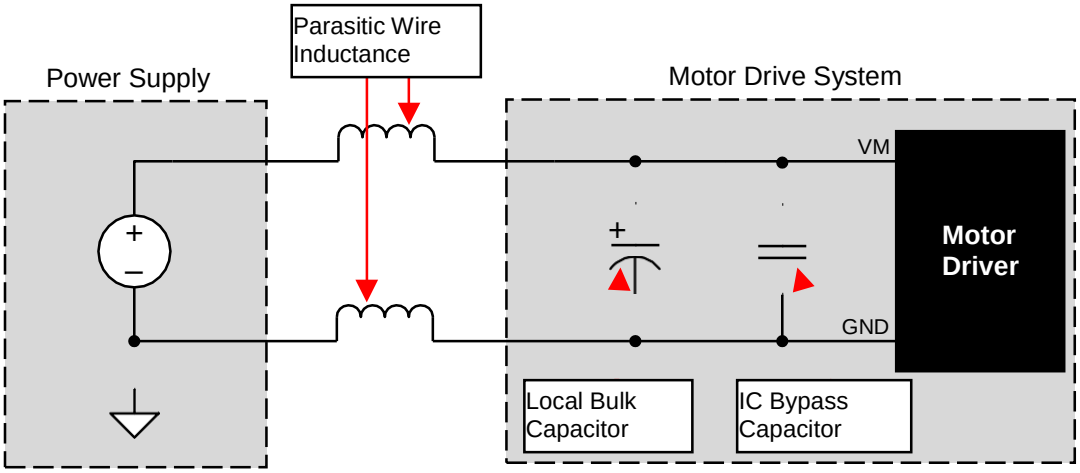


Figure 9. Example Setup of Motor Drive System With External Power Supply

The voltage rating for bulk capacitors should be higher than the operating voltage, to provide margin for cases when the motor transfers energy to the supply.

9.2 Power Supply and Logic Sequencing

There is no specific sequence for powering up the DRV8833. The presence of digital input signals is acceptable before VM is applied. After VM is applied to the DRV8833, the device begins operation based on the status of the control pins.

10 Layout

10.1 Layout Guidelines

The VM pin should be bypassed to GND using low-ESR ceramic bypass capacitors with a recommended value of 10-µF rated for VM. This capacitor should be placed as close to the VM pin as possible with a thick trace or ground plane connection to the device GND pin.

A low-ESR ceramic capacitor must be placed in between the VM and VCP pins. TI recommends a value of 0.01-µF rated for 16 V. Place this component as close to the pins as possible.

Bypass VINT to ground with a 2.2-µF ceramic capacitor rated 6.3 V. Place this bypass capacitor as close to the pin as possible.

10.1.1 Heatsinking

The PowerPAD package uses an exposed pad to remove heat from the device. For proper operation, this pad must be thermally connected to copper on the PCB to dissipate heat. On a multilayer PCB with a ground plane, this can be accomplished by adding a number of vias to connect the thermal pad to the ground plane. On PCBs without internal planes, copper area can be added on either side of the PCB to dissipate heat. If the copper area is on the opposite side of the PCB from the device, thermal vias are used to transfer the heat between top and bottom layers.

For details about how to design the PCB, refer to TI application report, *PowerPAD™ Thermally Enhanced Package* (SLMA002) and TI application brief, *PowerPAD™ Made Easy* (SLMA004), available at www.ti.com.

In general, the more copper area that can be provided, the more power can be dissipated.

NOTE

The PW package option is not thermally enhanced and TI recommends adhering to the power dissipation limits.

10.2 Layout Example

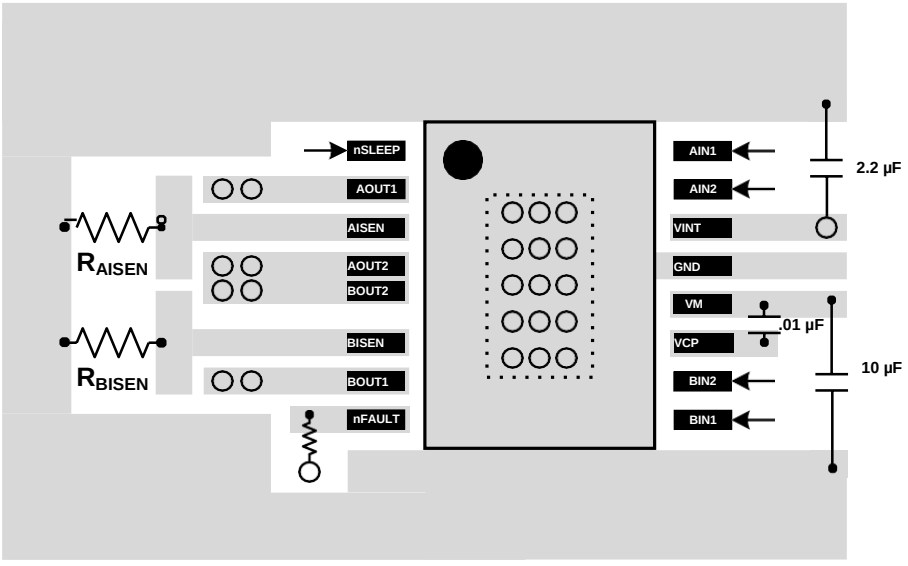


Figure 10. Recommended Layout Example

10.3 Thermal Considerations

10.3.1 Maximum Output Current

In actual operation, the maximum output current achievable with a motor driver is a function of die temperature. This, in turn, is greatly affected by ambient temperature and PCB design. Basically, the maximum motor current will be the amount of current that results in a power dissipation level that, along with the thermal resistance of the package and PCB, keeps the die at a low enough temperature to stay out of thermal shutdown.

The dissipation ratings given in the data sheet can be used as a guide to calculate the approximate maximum power dissipation that can be expected to be possible without entering thermal shutdown for several different PCB constructions. However, for accurate data, the actual PCB design must be analyzed through measurement or thermal simulation.

10.3.2 Thermal Protection

The DRV8833 has thermal shutdown (TSD) as described above. If the die temperature exceeds approximately 150°C, the device will be disabled until the temperature drops by 45°C.

Any tendency of the device to enter TSD is an indication of either excessive power dissipation, insufficient heatsinking, or too high an ambient temperature.

10.4 Power Dissipation

Power dissipation in the DRV8833 is dominated by the DC power dissipated in the output FET resistance, or $R_{DS(ON)}$. There is additional power dissipated due to PWM switching losses, which are dependent on PWM frequency, rise and fall times, and VM supply voltages. These switching losses are typically on the order of 10% to 30% of the DC power dissipation.

The DC power dissipation of one H-bridge can be roughly estimated by Equation 3.

$$P_{TOT} = \left(HS - R_{DS(ON)} \times I_{OUT(RMS)}^2\right) + \left(LS - R_{DS(ON)} \times I_{OUT(RMS)}^2\right) \quad (3)$$

where

- P_{TOT} is the total power dissipation
- HS - $R_{DS(ON)}$ is the resistance of the high-side FET
- LS - $R_{DS(ON)}$ is the resistance of the low-side FET
- $I_{OUT(RMS)}$ is the RMS output current being applied to the motor

$R_{DS(ON)}$ increases with temperature, so as the device heats, the power dissipation increases. This must be taken into consideration when sizing the heatsink.

11 Device and Documentation Support

11.1 Documentation Support

11.1.1 Related Documentation

For related documentation see the following:

- *PowerPAD™ Thermally Enhanced Package*, SLMA002
- *PowerPAD™ Made Easy*, SLMA004
- *Current Recirculation and Decay Modes*, SLVA321
- *Calculating Motor Driver Power Dissipation*, SLVA504
- *Understanding Motor Driver Current Ratings*, SLVA505

11.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

11.3 Trademarks

PowerPAD, E2E are trademarks of Texas Instruments.
All other trademarks are the property of their respective owners.

11.4 Electrostatic Discharge Caution

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.

11.5 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
DRV8833PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	8833PW	Samples
DRV8833PWP	ACTIVE	HTSSOP	PWP	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DRV8833	Samples
DRV8833PWPR	ACTIVE	HTSSOP	PWP	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DRV8833	Samples
DRV8833PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	8833PW	Samples
DRV8833RTYR	ACTIVE	QFN	RTY	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DRV8833	Samples
DRV8833RTYT	ACTIVE	QFN	RTY	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DRV8833	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

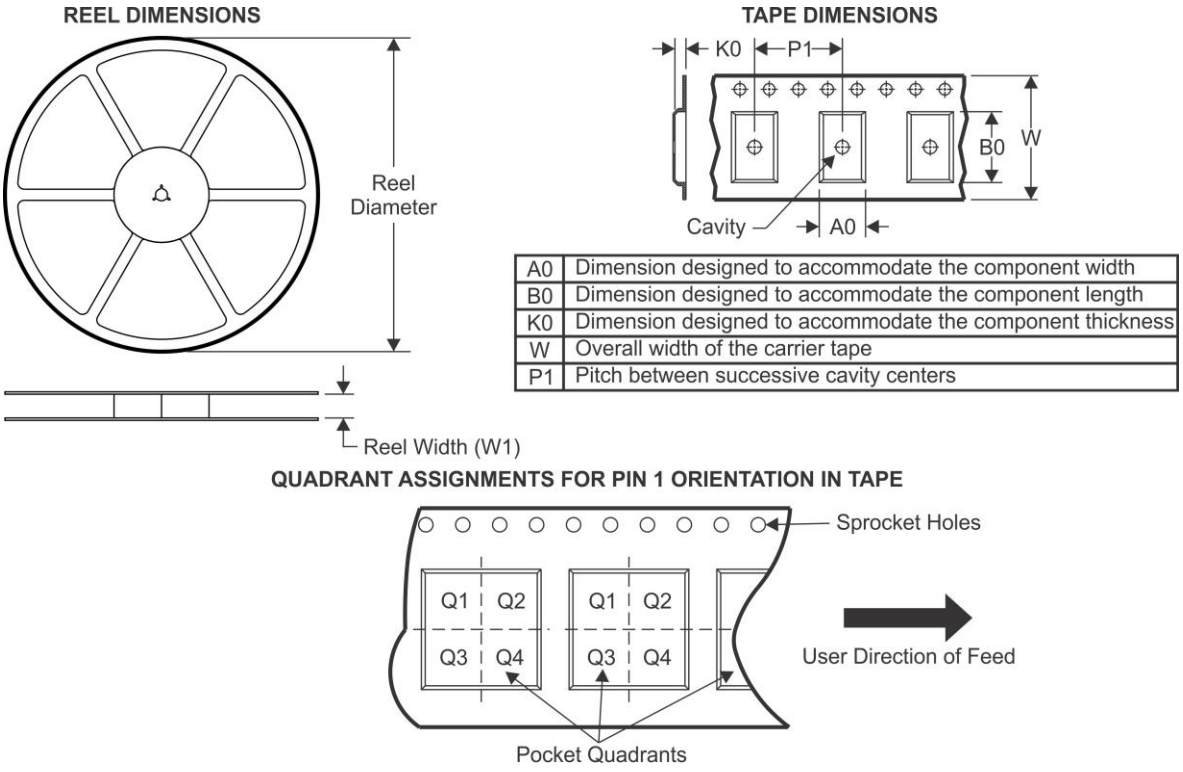
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

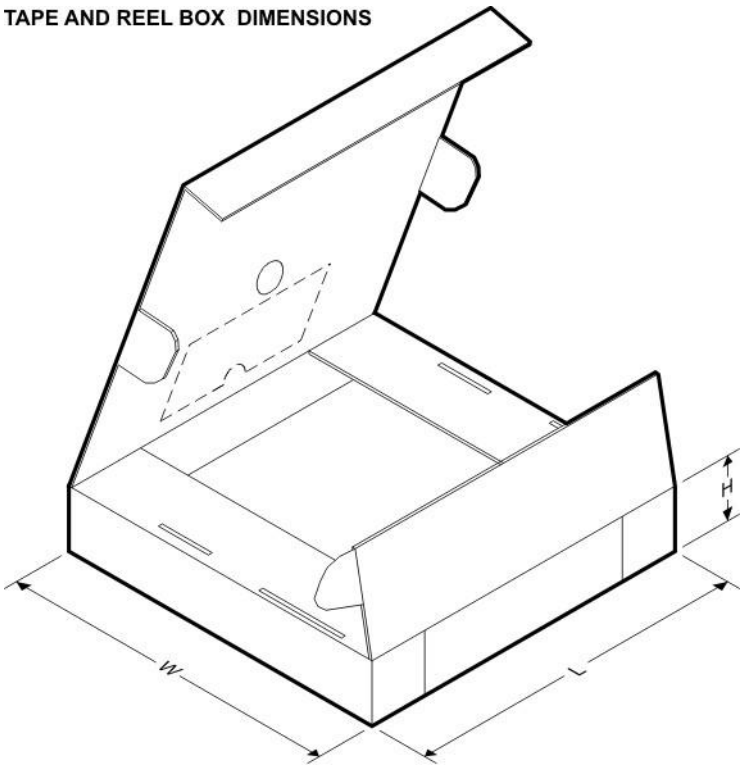


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DRV8833PWPR	HTSSOP	PWP	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
DRV8833PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
DRV8833RTYR	QFN	RTY	16	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
DRV8833RTYT	QFN	RTY	16	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2

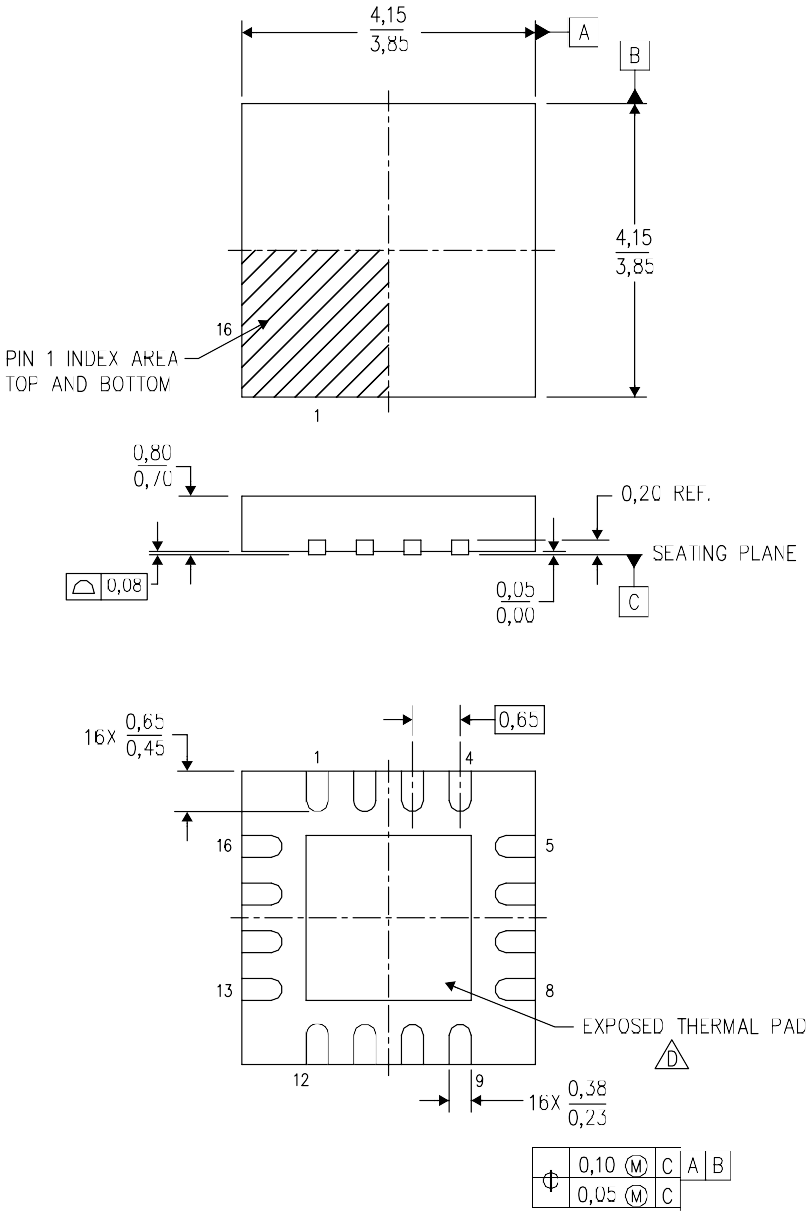
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DRV8833PWPR	HTSSOP	PWP	16	2000	367.0	367.0	35.0
DRV8833PWR	TSSOP	PW	16	2000	367.0	367.0	35.0
DRV8833RTYR	QFN	RTY	16	3000	367.0	367.0	35.0
DRV8833RTYT	QFN	RTY	16	250	210.0	185.0	35.0

RTY (S–PWQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5–1994.
B. This drawing is subject to change without notice.
C. Quad Flatpack, No–leads (QFN) package configuration.
D. The package thermal pad must be soldered to the board for therma and mechanical performance. See the Product Data Sheet for details regarding the exposec therma pad dimensions.
E. Falls within JEDEC MO–220.

THERMAL PAD MECHANICAL DATA

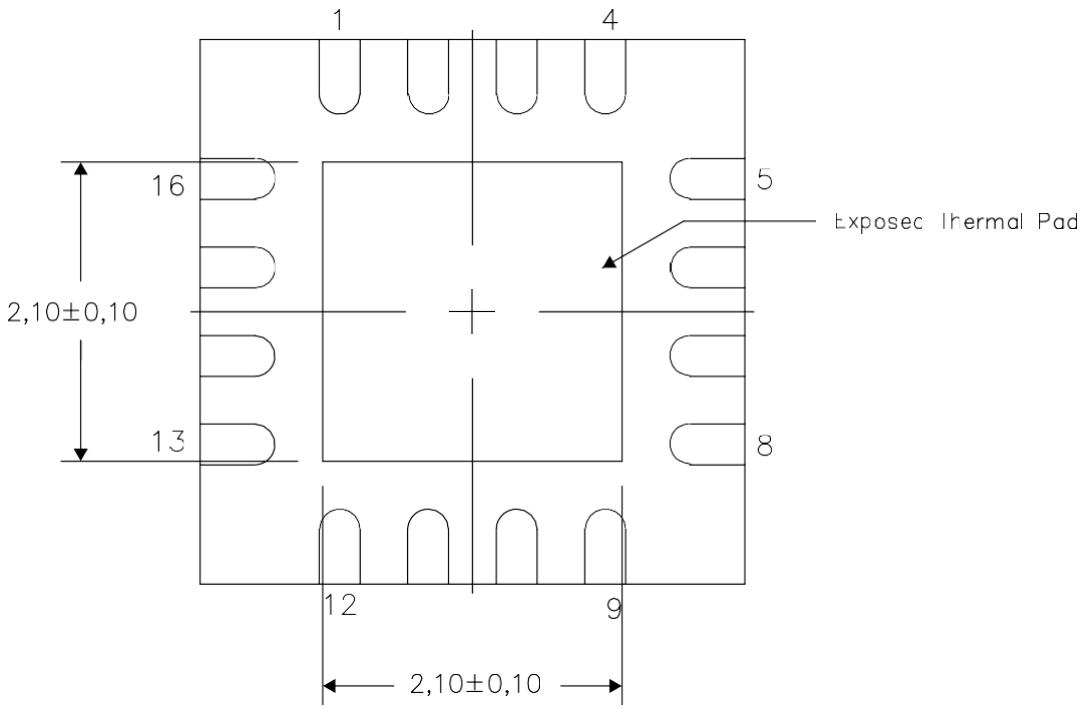
RTY (S–PWQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No–Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

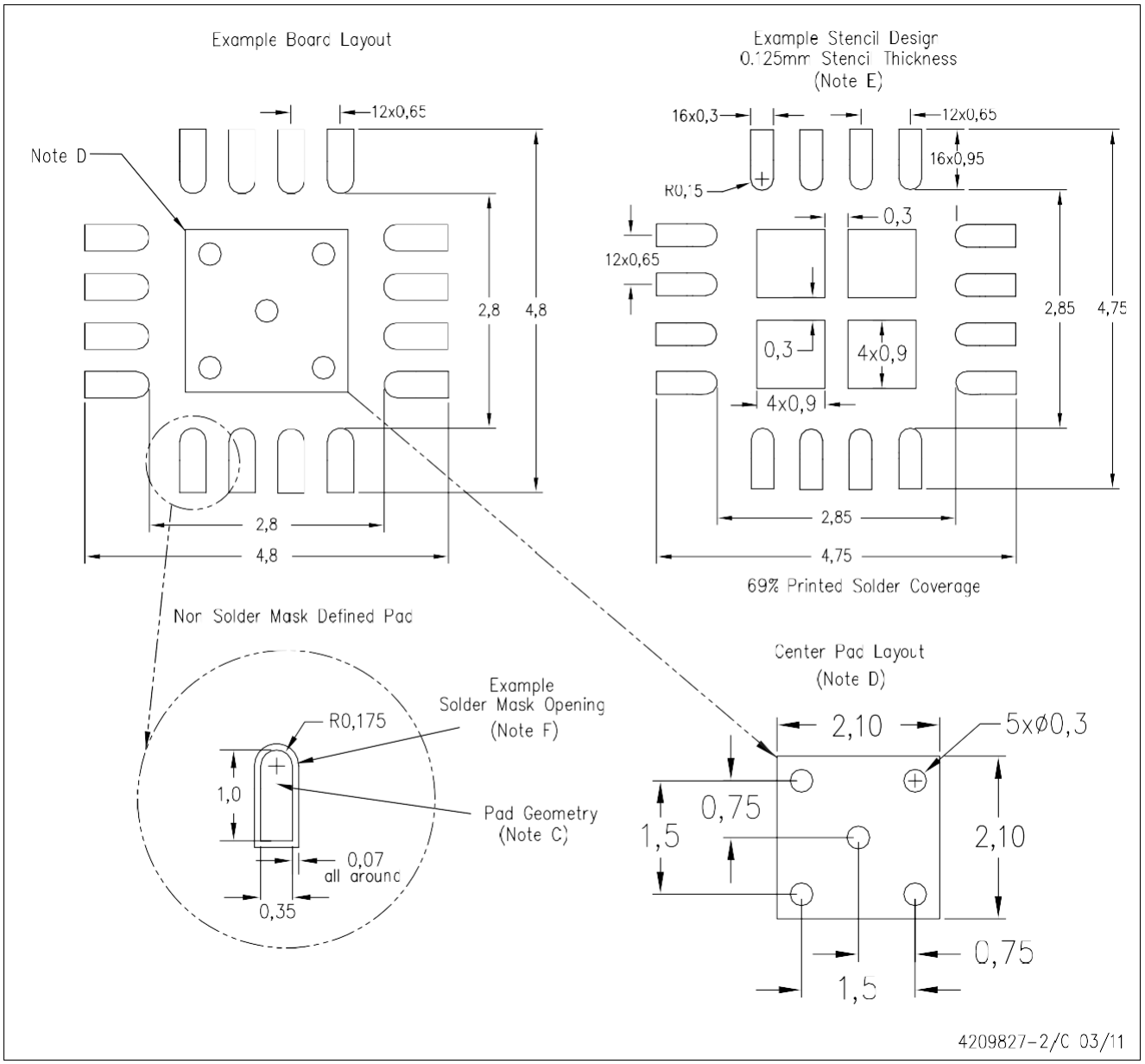
Exposed Thermal Pad Dimensions

4206277–2/E 03/11

NOTE: A. All linear dimensions are in millimeters

LAND PATTERN DATA

RTY (S–PWQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



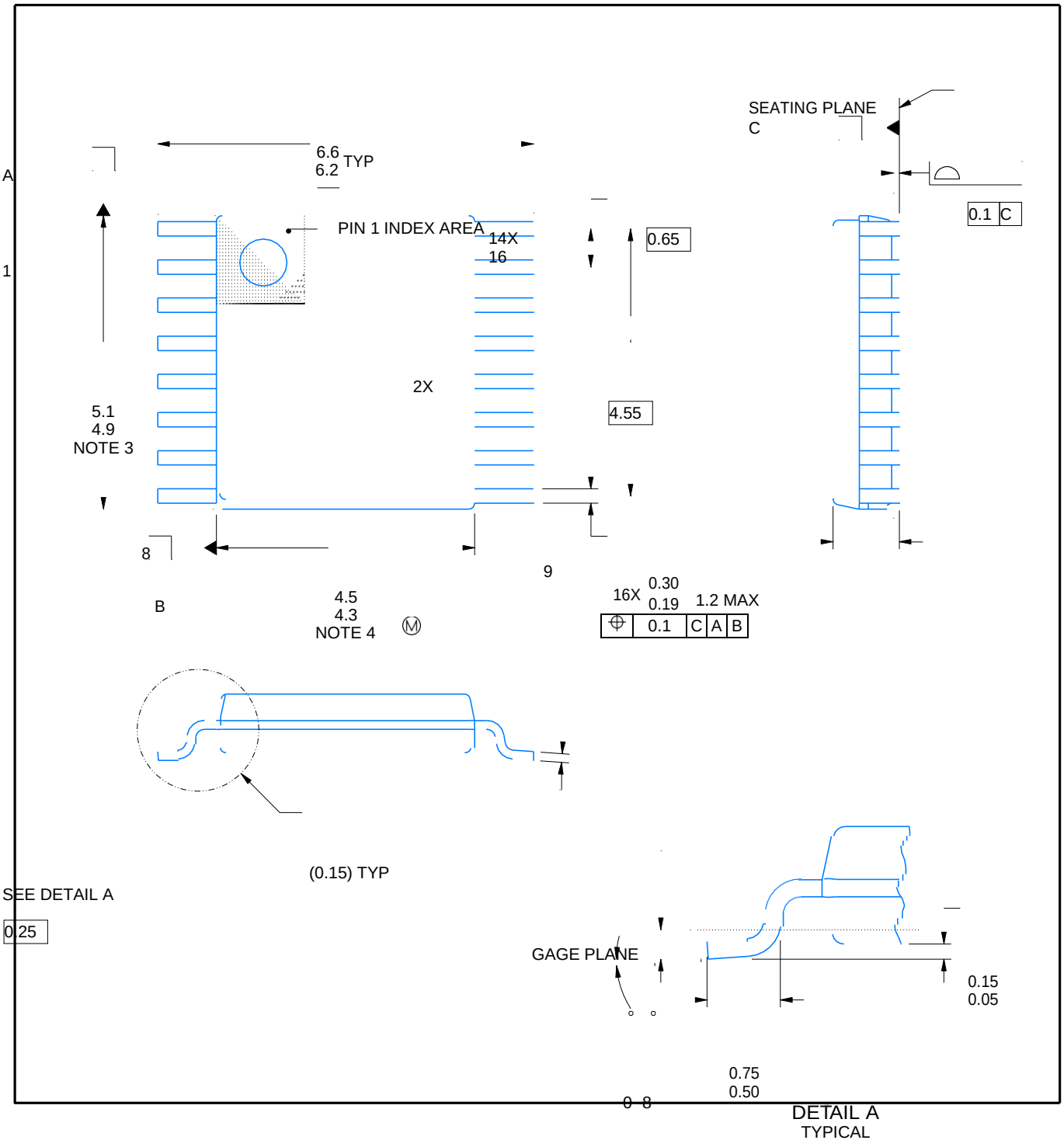
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quac Flat–Pack Packages, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http: //www.ti.com>.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
F. Customers should contact their board fabrication site for solder mask tolerances.

PW0016A

P E OUTLINE

TS .2 mm max height

SMALL OUTLINE PACKAGE



4220204/A 02/2017

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

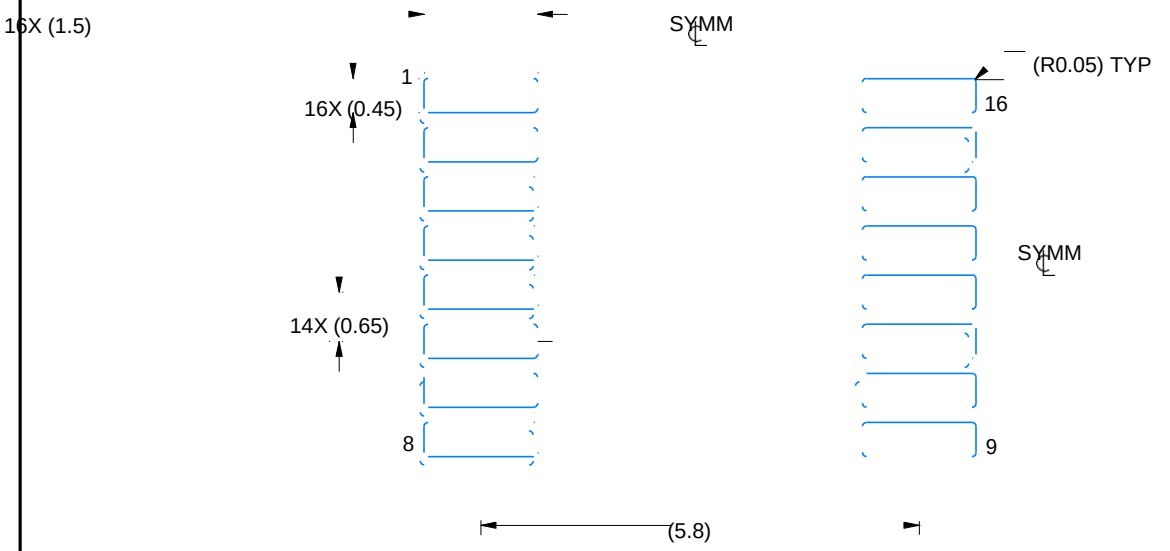
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

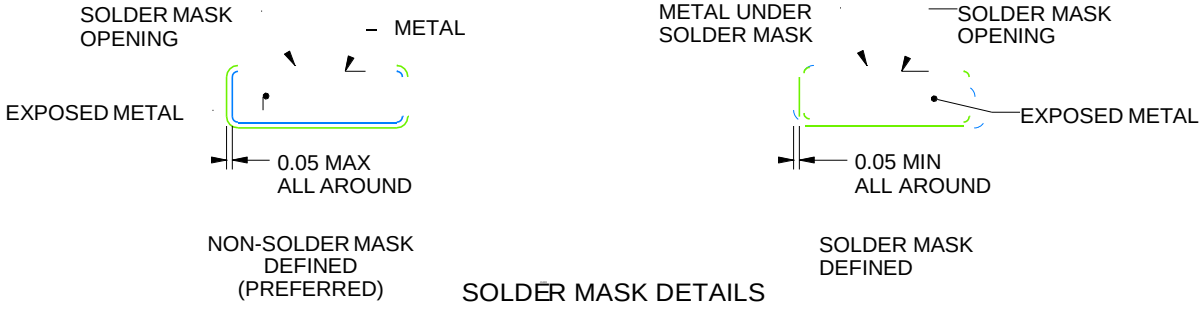
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

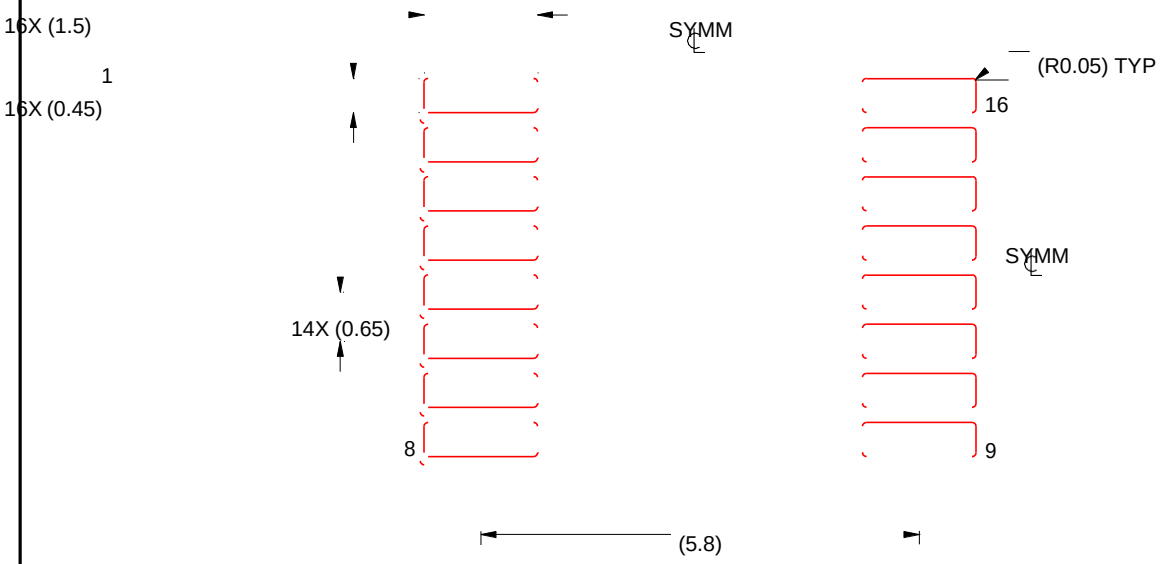
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/A 02/2017

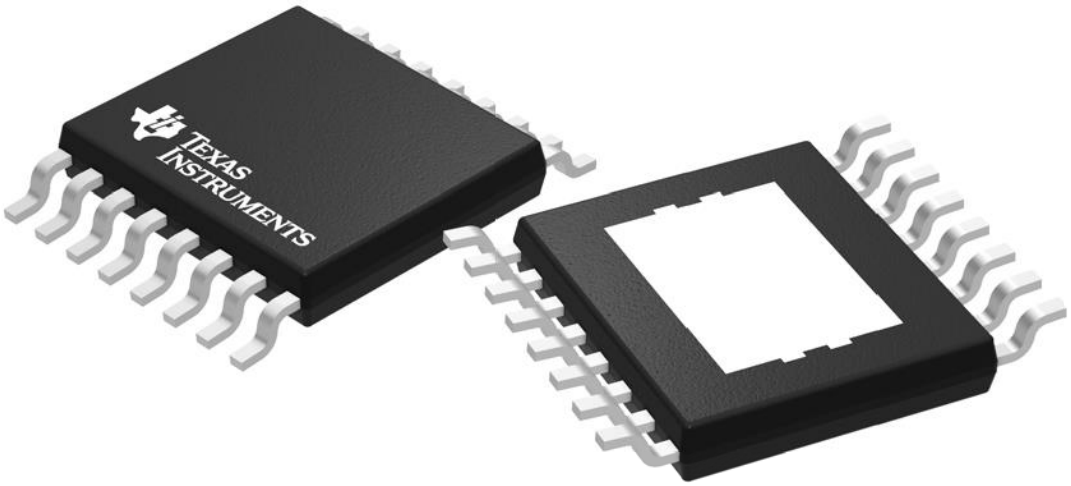
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

GENERIC PACKAGE VIEW

PWP 16 **PowerPAD™ TSSOP - 1.2 mm max height**

PLASTIC SMALL OUTLINE



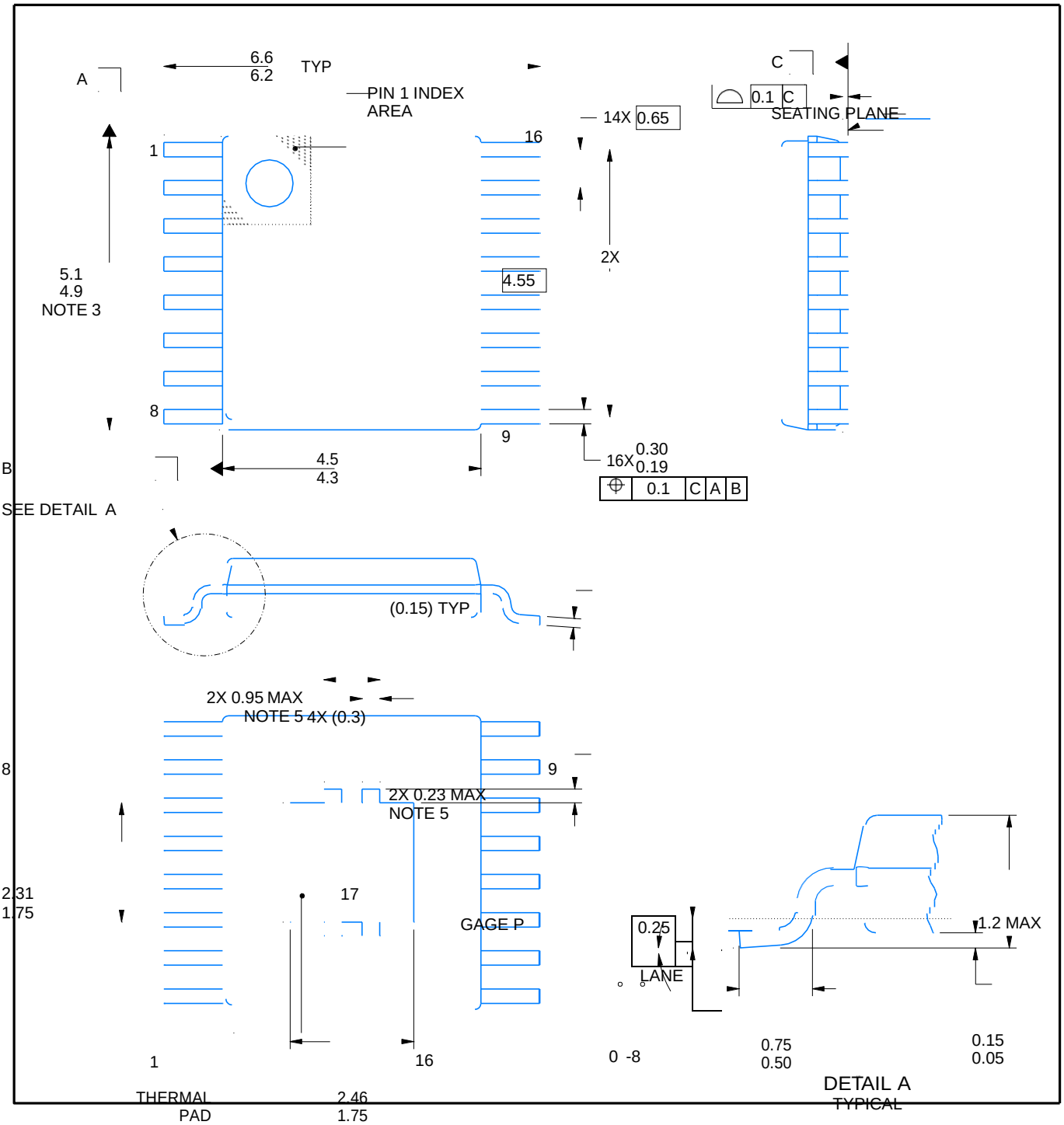
Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4073225-3/J

PACKAGE OUTLINE

PWP0016C — TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4224559/B 01/2019

PowerPAD is a trademark of Texas Instruments.

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing

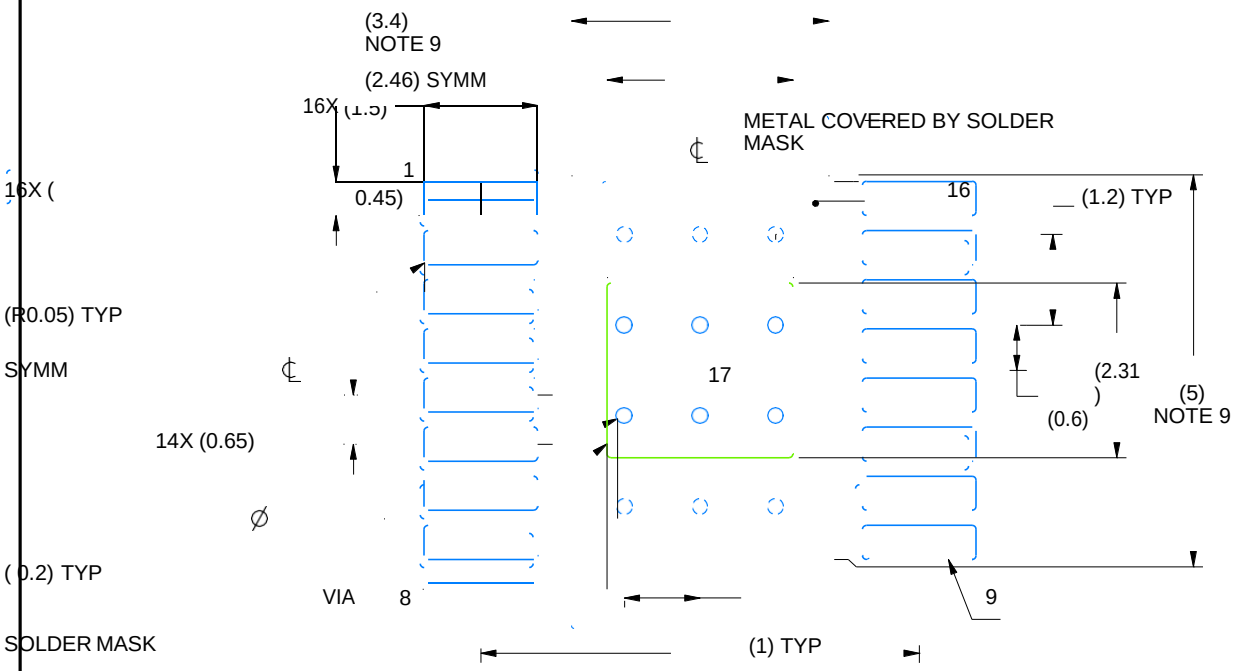
per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-153.
5. Features may differ or may not be present.

EXAMPLE BOARD LAYOUT

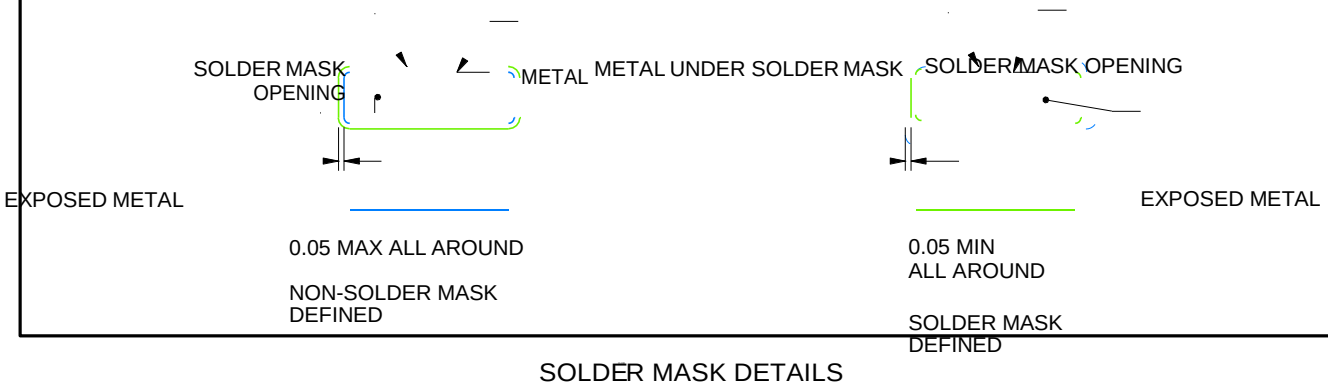
PWP0016C

PowerPAD™ TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN SCALE: 10X



SOLDER MASK DETAILS

4224559/B 01/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature numbers SLMA002 (www.ti.com/lit/slma002) and SLMA004 (www.ti.com/lit/slma004).
9. Size of metal pad may vary due to creepage requirement.

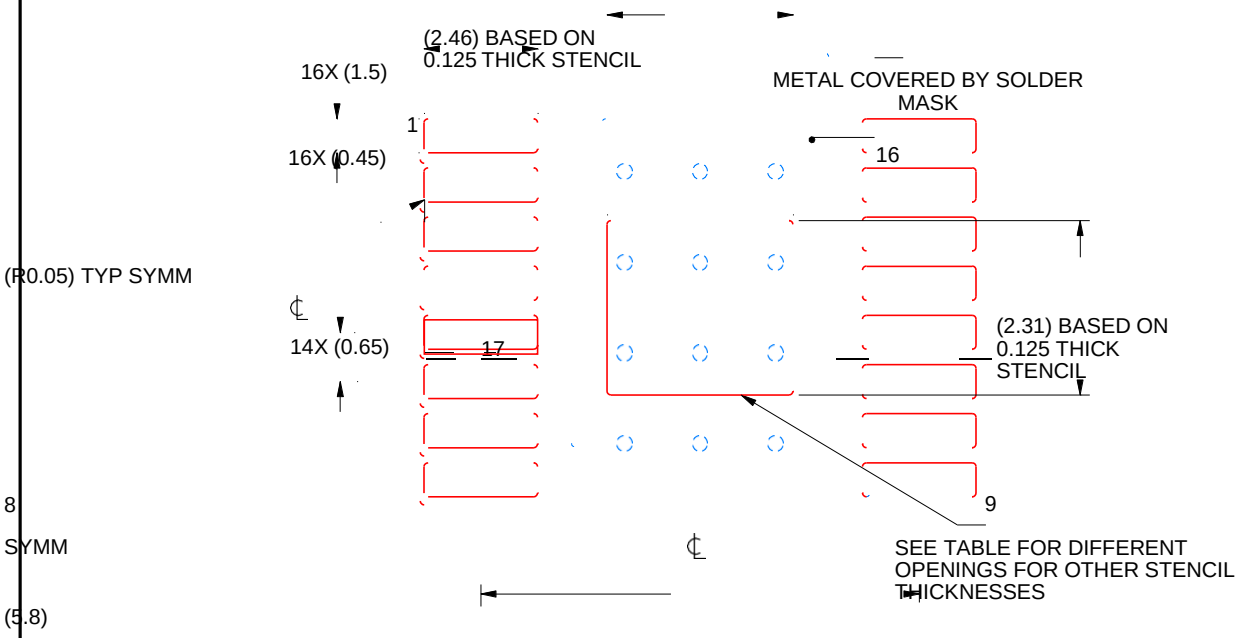
10. Vias are optional depending on application, refer to device data sheet. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

PWP0016C

PowerPAD™ TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE

BASED ON 0.125 mm THICK STENCIL SCALE: 10X

STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	2.75 X 2.58
0.125	2.46 X 2.31 (SHOWN)
0.15	2.25 X 2.11
0.175	2.08 X 1.95

4224559/B 01/2019

NOTES: (continued)

11. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
12. Board assembly site may have different recommendations for stencil design.

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RAIN SENSOR MODULE

Description

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer.

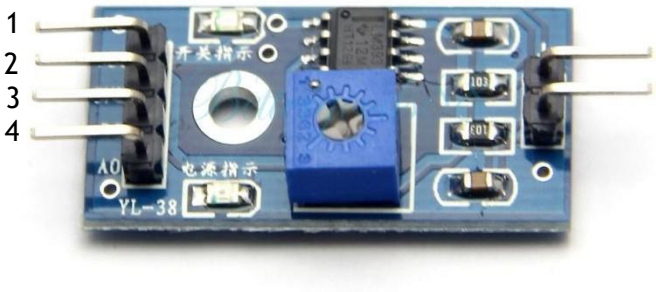
The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the

switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

Specifications

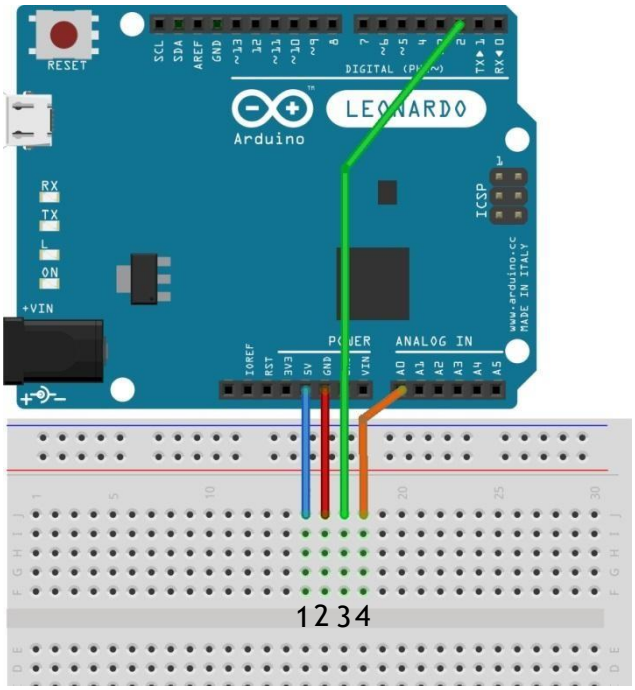
- Adopts high quality of RF-04 double sided material.
- Area: 5cm x 4cm nickel plate on side,
- Anti-oxidation, anti-conductivity, with long use time;
- Comparator output signal clean waveform is good, driving ability, over 15mA;
- Potentiometer adjust the sensitivity;
- Working voltage 5V;
- Output format: Digital switching output (0 and 1) and analog voltage output AO;
- With bolt holes for easy installation;
- Small board PCB size: 3.2cm x 1.4cm;
- Uses a wide voltage LM393 comparator

Pin Configuration

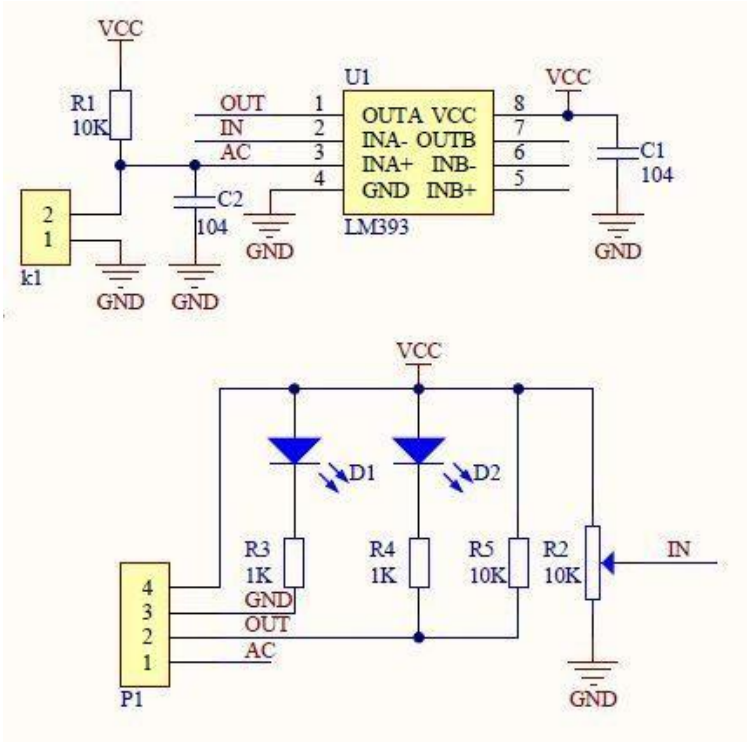


1. VCC: 5V DC
2. GND: ground
3. DO: high/low output
4. AO: analog output

Wiring Diagram



Schematic Diagram



Sample Sketch

```
void setup(){
  Serial.begin(9600);
  pinMode(2, OUTPUT);
}

void loop(){
  //analog output
  if(analogRead(0)<300) Serial.println("Heavy Rain");
  else if(analogRead(0)<500) Serial.println("Moderate Rain"); else
  Serial.println("No Rain");

//   //digital output
//   if(digitalRead(2) == HIGH) Serial.println("No Rain
Detected");
//   else Serial.println("Rain Detected");

  delay(250);
}
```

How to Test

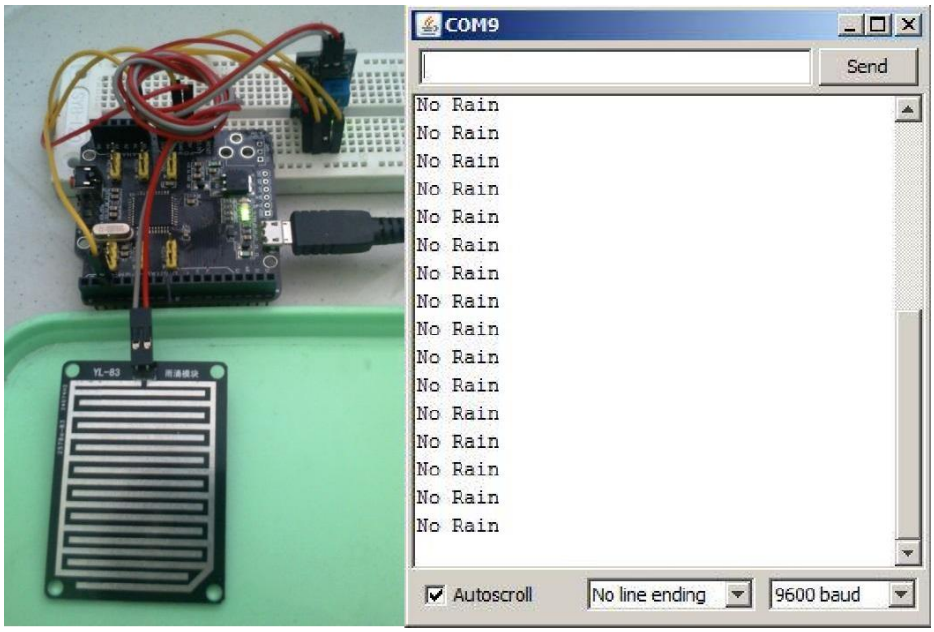
The components to be used are:

- Microcontroller (any compatible arduino)
- Rain sensor module
- Pin connectors
- Breadboard
- USB cable

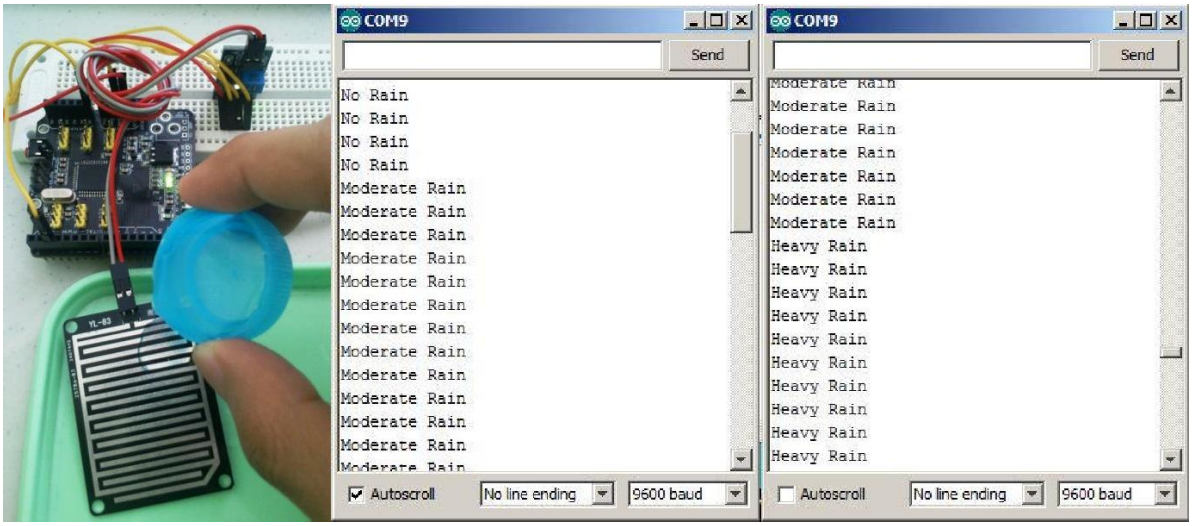
1. Connect the components based on the figure shown in the wiring diagram using pin connectors. VCC pin is connected to the 5V power supply, GND pin is connected to the GND, DO pin is connected to a digital I/O pin and the AO pin is connected to the analog output pin. Pin number will be based on the actual program code.
2. After hardware connection, insert the sample sketch into the Arduino IDE.
3. Using a USB cable, connect the ports from the microcontroller to the computer.
4. Upload the program.
5. See the results in the serial monitor.

Testing Results

The serial monitor shows the results when the raining module was soaked with water. Based on the amount of water, the analog output can read different levels of amount of water drop.



As water is continuously dropped to the module,



ESP-01 WiFi Module

Version1.0

sherry@aithinker.com

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Notice

Product version upgrades or other reasons, possible changes in the contents of this manual. AI-Thinker reserves in the absence of any notice or indication of the circumstances the right to modify the content of this manual. This manual is used only as a guide, Ai-thinker make every effort to provide accurate information in this manual, but Ai-thinker does not ensure that manual content without error, in this manual all statements, information and advice nor does it constitute any express or implied warranty.

Table of Contents

1. Preambles

ESP-01 WiFi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on-board antenna.

The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building a separate network controller.

ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers.

It provides unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

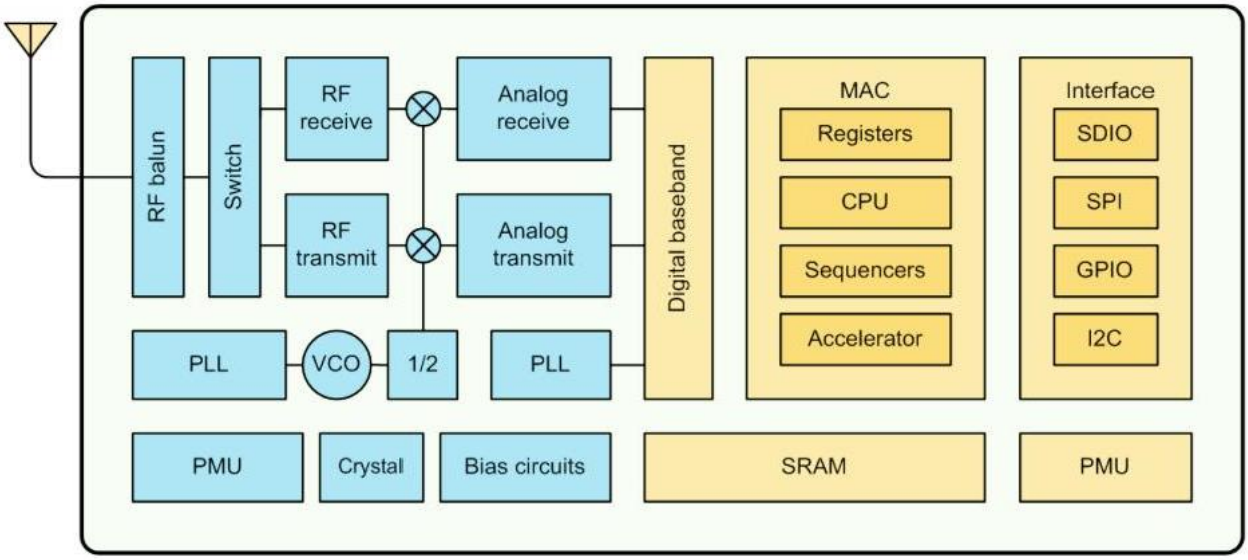


Figure 1 ESP8266EX Block Diagram

ESP8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor.

When ESP8266EX hosts the application, it boots up directly from an external flash. In has integrated cache to improve the performance of the system in such applications.

Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any micro controllerbased design with simple connectivity (SPI/SDIO or I2C/UART interface).

ESP8266EX is among the most integrated WiFi chip in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor, with on-chip SRAM, besides the Wi-Fi functionalities. ESP8266EX is often integrated with external sensors and other application specific devices through its GPIOs; codes for such applications are provided in examples in the SDK.

Espressif Systems' Smart Connectivity Platform (ESCP) demonstrates sophisticated system-level features include fast sleep/wake context switching for energy-efficient VoIP, adaptive radio biasing. for low-power operation, advance signal processing, and spur cancellation and radio co-existence features for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation.

1.1. Features

- 802.11 b/g/n
- Integrated low power 32-bit MCU
- Integrated 10-bit ADC
- Integrated TCP/IP protocolstack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- Supports antenna diversity
- Wi-Fi 2.4 GHz, support WPA/WPA2
- Support STA/AP/STA+AP operation modes
- Support Smart Link Function for both Android and iOS devices
- Support Smart Link Function for both Android and iOS devices
- SDIO 2.0, (H) SPI, UART, I2C, I2S, IRDA, PWM, GPIO

- STBC, 1x1 MIMO, 2x1 MIMO
- A-MPDU & A-MSDU aggregation and 0.4s guard interval
- Deep sleep power <10uA, Power down leakage current < 5uA
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)
- +20dBm output power in 802.11b mode
- Operating temperature range -40C ~ 125C

1.2. Parameters

Table 1 below describes the major parameters.

Table 1 Parameters

Categories	Items	Values
WiFi Paramters	WiFi Protocles	802.11 b/g/n
	Frequency Range	2.4GHz-2.5GHz (2400M-2483.5M)
Hardware Paramaters	Peripheral Bus	UART/HSPI/I2C/I2S/Ir Remote Contorl
		GPIO/PWM
	Operating Voltage	3.0~3.6V
	Operating Current	Average value: 80mA
	Operating Temperature Range	-40°~125°
	Ambient Temperature Range	Normal temperature
	Package Size	14.3mm*24.8mm*3mm
	External Interface	N/A
Software Parameters	Wi-Fi mode	station/softAP/SoftAP+station
	Security	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Upgrade	UART Download / OTA (via network) / download and write firmware via host
	Ssoftware Development	Supports Cloud Server Development / SDK for custom firmware development
	Network Protocols	IPv4, TCP/UDP/HTTP/FTP
	User Configuration	AT Instruction Set, Cloud Server, Android/iOS App

2. Pin Descriptions

There are altogether 8 pin counts, the definitions of which are described in Table 2 below。

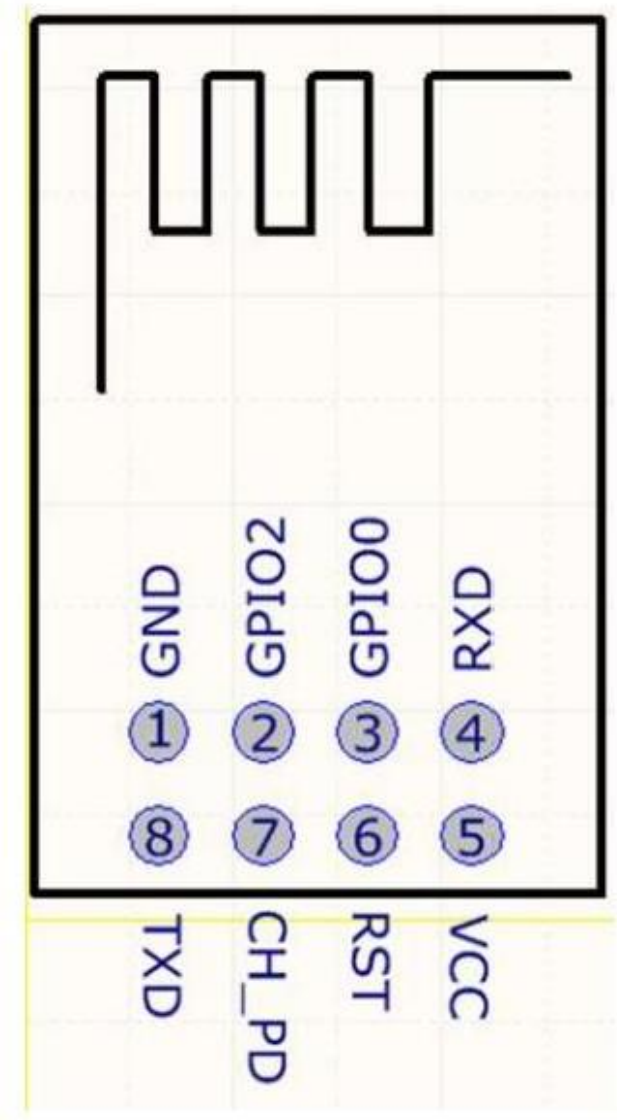


Table 2 ESP-01 Pin design

Table 2 Pin Descriptions

NO.	Pin Name	Function
1	GND	GND
2	GPIO2	GPIO,Internal Pull-up
3	GPIO0	GPIO,Internal Pull-up
4	RXD	UART0,data received pin RXD
5	VCC	3.3V power supply (VDD)
6	RST	1) External reset pin, active low 2) Can loft or external MCU ,
7	CH_PD	Chip enable pin. Active high
8	TXD	UART0,data send pin RXD

Table 3 Pin Mode

Mode	GPIO15	GPIO0	GPIO2
UART	Low	Low	High
Flash Boot	Low	High	High

Table 4 Receiver Sensitivity

Parameters	Min	Typical	Max	Unit
Input frequency	2412		2484	MHz
Input impedance		50		Ω
Input reflection			-10	dB
Output power of PA for 72.2Mbps	15.5	16.5	17.5	dBm
Output power of PA for 11b mode	19.5	20.5	21.5	dBm
Sensitivity				
DSSS, 1Mbps		-98		dBm
CCK, 11Mbps		-91		dBm
6Mbps (1/2 BPSK)		-93		dBm
54Mbps (3/4 64-QAM)		-75		dBm
HT20, MCS7 (65Mbps, 72.2Mbps)		-72		dBm
Adjacent Channel Rejection				
OFDM, 6Mbps		37		dB
OFDM, 54Mbps		21		dB
HT20, MCS0		37		dB
HT20, MCS7		20		dB

3. Packaging and Dimension

The external size of the module is 14.3mm*24.8mm*3mm, as is illustrated in Figure 3 below. The type of flash integrated in this module is an SPI flash, the capacity of which is 1 MB, and the package size of which is SOP-210mil. The antenna applied on this module is a 3DBi PCB-on-board antenna.

Figure 3 [Module Pin Counts, 8 pin, 14.3 mm *24.8 mm *3.0 mm]

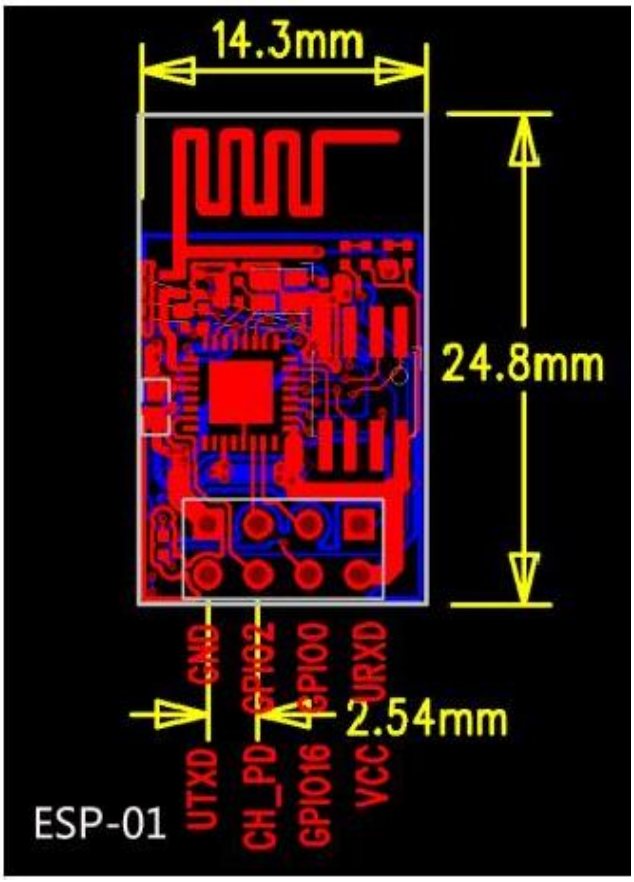


Figure 4 Top View of ESP-01 WiFi Module

Table 5 Dimension of ESP-01 WiFi Module

Length	Width	Height	PAD Size(Bottom)	Pin Pitch
14.3 mm	24.8 mm	3 mm	0.9 mm x 1.7 mm	2.54 mm

4. Functional Descriptions

4.1. MCU

ESP8266EX is embedded with Tensilica L106 32-bit micro controller (MCU), which features extra low power consumption and 16-bit RSIC. The CPU clock speed is 80MHz. It can also reach a maximum value of 160MHz. ESP8266EX is often integrated with external sensors and other specific devices through its GPIOs; codes for such applications are provided in examples in the SDK.

4.2. Memory Organization

4.2.1. Internal SRAM and ROM

ESP8266EX WiFi SoC is embedded with memory controller, including SRAM and ROM. MCU can visit the memory units through iBus, dBus, and AHB interfaces. All memory units can be visited upon request, while a memory arbiter will decide the running sequence according to the time when these requests are received by the processor.

According to our current version of SDK provided, SRAM space that is available to users is assigned as below:

- RAM size < 36kB, that is to say, when ESP8266EX is working under the station mode and is connected to the router, programmable space accessible to user in heap and data section is around 36kB.)
- There is no programmable ROM in the SoC, therefore, user program must be stored in an external SPI flash.

4.2.2. External SPI Flash

This module is mounted with an 1 MB external SPI flash to store user programs. If larger definable storage space is required, a SPI flash with larger memory size is preferred. Theoretically speaking, up to 16 MB memory capacity can be supported.

Suggested SPI Flash memory capacity:

- OTA is disabled: the minimum flash memory that can be supported is 512 kB;
- OTA is enabled: the minimum flash memory that can be supported is 1 MB.

Several SPI modes can be supported, including Standard SPI, Dual SPI, and Quad SPI.

Therefore, please choose the correcct SPI mode when you are downloading into the flash, otherwise firmwares/programs that you downloaded may not work in the right way.

4.3. Crystal

Currently, the frequency of crystal oscillators supported include 40MHz, 26MHz and 24MHz. The accuracy of crystal oscillators applied should be ±10PPM, and the operating temperature range should be between -20°C and 85°C.

When using the downloading tools, please remember to select the right crystal oscillator type. In circuit design, capacitors C1 and C2, which are connected to the earth, are added to the input and output terminals of the crystal oscillator respectively. The values of the two capacitors can be flexible, ranging from 6pF to 22pF, however, the specific capacitive values of C1 and C2 depend on further testing and adjustment on the overall performance of the whole circuit. Normally, the capacitive values of C1 and C2 are within 10pF if the crystal oscillator frequency is 26MHz, while the values of C1 and C2 are 10pF<C1, C2<22pF if the crystal oscillator frequency is 40MHz.

4.4. Interfaces

Table 6 Descriptions of Interfaces

Interface	Pin Name	Description
HSPI	IO12(MISO) IO13(MOSI) IO14(CLK) IO15(CS)	SPI Flash 2, display screen, and MCU can be connected using HSPI interface.
PWM	IO12(R) IO15(G) IO13(B)	Currently the PWM interface has four channels, but users can extend the channels according to their own needs. PWM interface can be used to control LED lights, buzzers, relays, electronic machines, and so on.
IR Remote Control	IO14(IR_T) IO5(IR_R)	The functionality of Infrared remote control interface can be implemented via software programming. NEC coding, modulation, and demodulation are used by this interface. The frequency of modulated carrier signal is 38KHz.
ADC	TOUT	ESP8266EX integrates a 10-bit analog ADC. It can be used to test the power-supply voltage of VDD3P3 (Pin3 and Pin4) and the input power voltage of TOUT (Pin 6). However, these two functions cannot be used simultaneously. This interface is typically used in sensor products.
I2C	IO14(SCL) IO2(SDA)	I2C interface can be used to connect external sensor products and display screens, etc.

Interface	Pin Name	Description
UART	**UART0:** TXD (U0TXD) RXD (U0RXD) IO15 (RTS) IO13 (CTS) **UART1:** IO2(TXD)	Devices with UART interfaces can be connected with the module. Downloading: U0TXD+U0RXD or GPIO2+U0RXD Communicating: UART0: U0TXD, U0RXD, MTDO (U0RTS), MTCK (U0CTS) Debugging: UART1_TXD (GPIO2) can be used to print debugging information.
		By default, UART0 will output some printed information when the device is powered on and is booting up. If this issue exerts influence on some specific applications, users can exchange the inner pins of UART when initializing, that is to say, exchange U0TXD, U0RXD with U0RTS, U0CTS.
I2S	**I2S Input:** IO12 (I2SI_DATA) ; IO13 (I2SI_BCK); IO14 (I2SI_WS); **I2S Output:** IO15 (I2SO_BCK); IO3 (I2SO_DATA); IO2 (I2SO_WS).	I2S interface is mainly used for collecting, processing, and transmission of audio data.

4.5. Absolute Maximum Ratings

Table 7 Absolute Maximum Ratings

Rating	Condition	Value	Unit
Storage Temperature		-40 to 125	°C
Maximum Soldering Temperature		260	°C
Supply Voltage	IPC/JEDEC J-STD-020	+3.0 to +3.6	V

4.6. Recommended Operating Conditions

Table 8 Recommended Operating Conditions

Operating Condition	Symbol	Min	Typ	Max	Unit
Operating Temperature		-40	20	125	°C
Supply voltage	VDD	3.0	3.3	3.6	V

4.7. Digital Terminal Characteristics

Table 9 Digital Terminal Characteristics

Terminals	Symbol	Min	Typ	Max	Unit
Input logic level low	V_{IL}	-0.3		0.25VDD	V
Input logic level high	V_{IH}	0.75VDD		VDD+0.3	V
Output logic level low	V_{OL}	N		0.1VDD	V
Output logic level high	V_{OH}	0.8VDD		N	V

Note: Test conditions: VDD = 3.3V, Temperature = 20 ℃, if nothing special is stated.

5. RF Performance

Description	Min.	Typ.	Max	Unit
Input frequency	2400		2483.5	MHz
Input impedance		50		ohm
Input reflection			-10	dB
Output power of PA for 72.2Mbps	15.5	16.5	17.5	dBm
Output power of PA for 11b mode	19.5	20.5	21.5	dBm
Sensitivity				
CCK, 1Mbps		-98		dBm
CCK, 11Mbps		-91		dBm
6Mbps (1/2 BPSK)		-93		dBm
54Mbps (3/4 64-QAM)		-75		dBm
HT20, MCS7 (65Mbps, 72.2Mbps)		-72		dBm
Adjacent Channel Rejection				
OFDM, 6Mbps		37		dB
OFDM, 54Mbps		21		dB
HT20, MCS0		37		dB
HT20, MCS7		20		dB

Table 10 RF Performance

6. Power Consumption

Parameters	Min	Typical	Max	Unit
Tx802.11b, CCK 11Mbps, P OUT=+17dBm		170		mA
Tx 802.11g, OFDM 54Mbps, P OUT =+15dBm		140		mA
Tx 802.11n, MCS7, P OUT =+13dBm		120		mA
Rx 802.11b, 1024 bytes packet length , -80dBm		50		mA
Rx 802.11g, 1024 bytes packet length, -70dBm		56		mA
Rx 802.11n, 1024 bytes packet length, -65dBm		56		mA
Modem-Sleep①		15		mA
Light-Sleep②		0.9		mA
Deep-Sleep③		10		uA

Table 11 Power Consumption

❶Modem-Sleep requires the CPU to be working, as in PWM or I2S applications. According to 802.11 standards (like U-APSD), it saves power to shut down the Wi-Fi Modem circuit while maintaining a Wi-Fi connection with no data transmission. E.g. in DTIM3, to maintain a sleep 300mswake 3ms cycle to receive AP's Beacon packages, the current is about 15mA.

❷ During Light-Sleep, the CPU may be suspended in applications like Wi-Fi switch. Without data transmission, the Wi-Fi Modem circuit can be turned off and CPU suspended to save power according to the 802.11 standard (U-APSD).

E.g. in DTIM3, to maintain a sleep 300ms-wake 3ms cycle to receive AP's Beacon packages, the current is about 0.9mA.

❸ Deep-Sleep does not require Wi-Fi connection to be maintained. For application with long time lags between data transmission, e.g. a temperature sensor that checks the temperature every 100s ,sleep 300s and waking up to connect to the AP (taking about 0.3~1s), the overall average current is less than 1mA.

7. Reflow Profile

Table 12 Instructions

T_S max to T_L (Ramp-up Rate)	3°C/second max
Preheat Temperature Min.(T_S Min.) Temperature Typical.(T_S Typ.) Temperature Min.(T_S Max.) Time(T_S)	 150°C 175°C 200°C 60~180 seconds
Ramp-up rate (T_L to T_P)	3°C/second max
Time Maintained Above: --Temperature(T_L)/Time(T_L)	 217°C/60~150 seconds
Peak Temperature(T_P)	260°C max. for 10 seconds
Target Peak Temperature (T_P Target)	260°C +0/-5°C
Time within 5°C of actual peak(t_P)	20~40 seconds
T_S max to T_L (Ramp-down Rate)	6°C/second max
Tune 25°C to Peak Temperature (t)	8 minutes max

8. Schematics

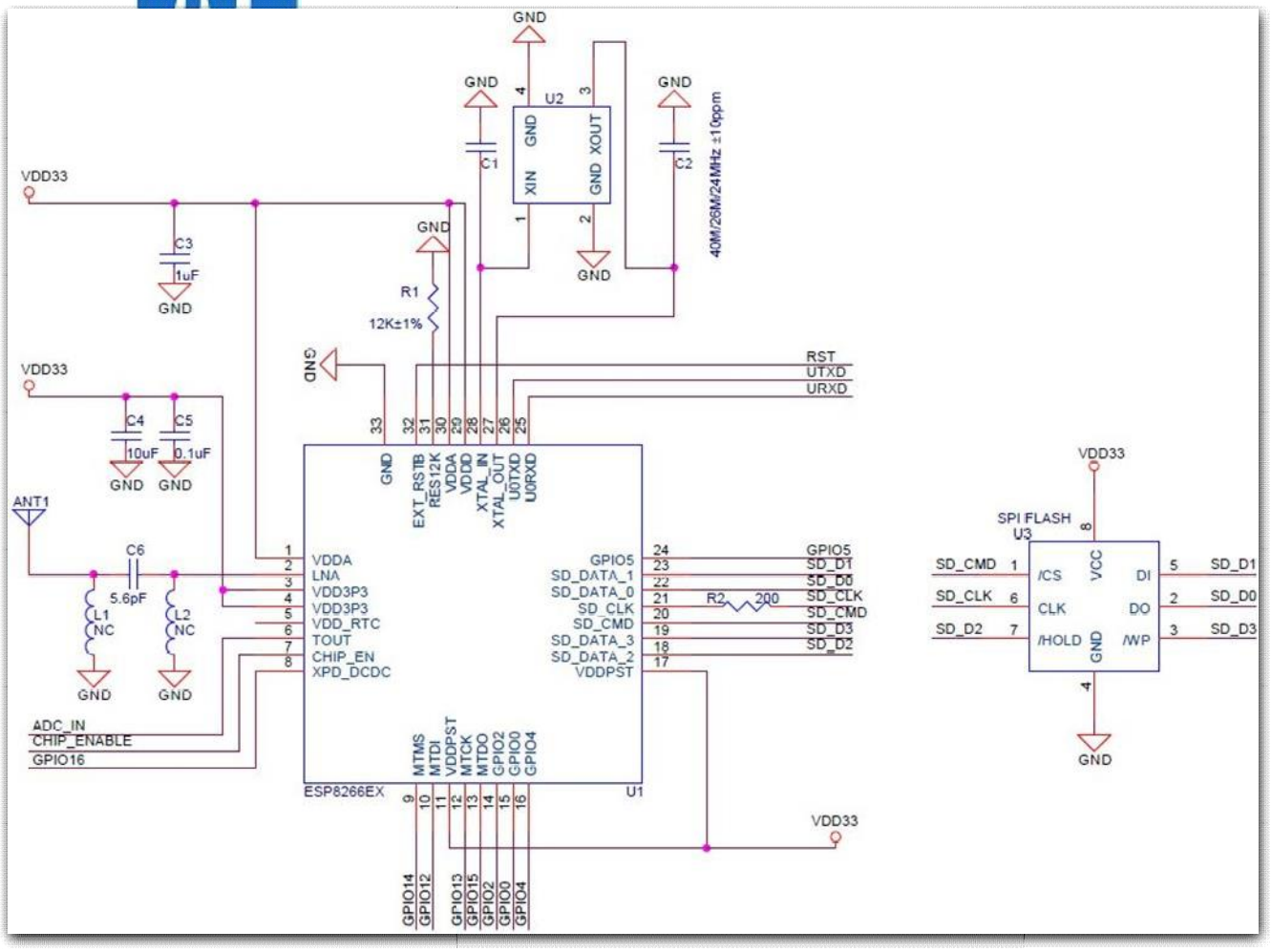


Figure 4 Schematics of Esp-01 WiFi Module

DC MOTORS

SERVO

Compact DC Motors

Japan Servo's DC Miniature Motors are widely used in a variety of application fields, from copiers and other office equipment, to remote-controlled equipment, medical equipment, vending machines, and game machines.

These motors may be combined with Japan Servo's full line of gearheads to meet a wide range of torque and output speed specifications.

Japan Servo provides a practical and economic choice as drive actuators. Strict quality control ensure reliable performance as well as prompt delivery at reasonable price. Japan Servo provides a full variation line-up of stock model and customized design motors to best meet your specific application needs.

DMN Series

Long life

High quality

High output

Low noise

RoHS-compliant

Features

- ***Long-life:***

  Intermittent operation over 1 million cycles with optimized brush design[*1]
- ***Continuous operating life of 3000 hours[*1]***
- ***High output: High heat dissipation and heat resistance achieves higher output***
- ***High strength: High radial load capacity due to robust construction, large diameter output shaft and ball bearings***
- ***Low noise and increased insulation due to new resin brush holders***
- ***Large selection of gear heads and reduction ratios are available to meet all needs***
- ***Also available with magnetic revolution sensor and noise filter[*2]***

1 Differs depending on environment and application. Contact us for details. ***2*** Scheduled for release April 2006.

Long Life

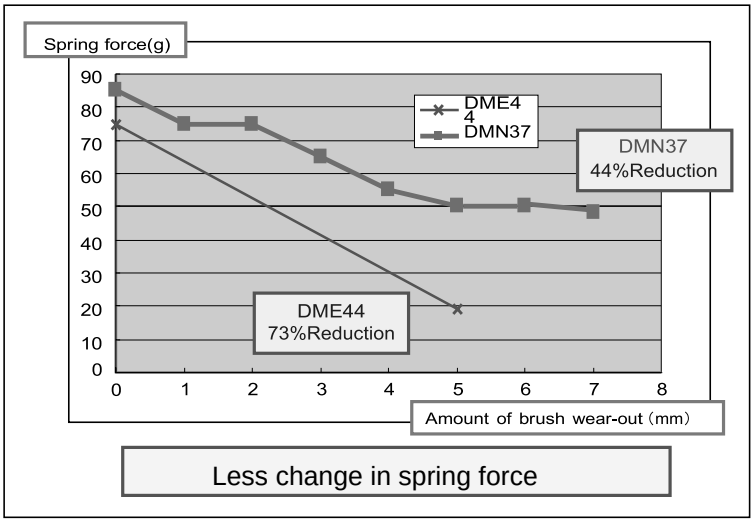
■ Life time

DME Series	DME25	DME33	DME34	DME37	DME44
	1000Hours			2000Hours	
DMN Series	DMN29			DMN37	
	3000Hours			3000Hours	

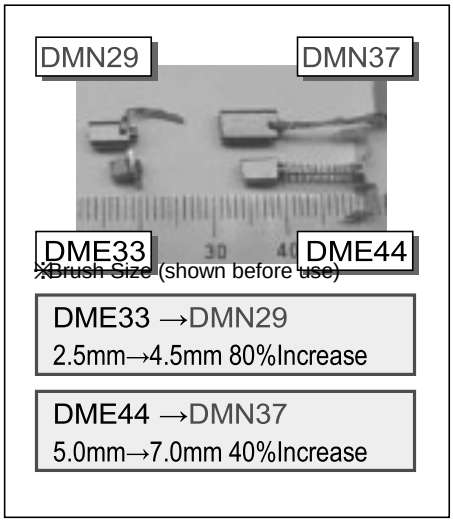
■Continuous Operation :

※The motor life-time is dependent upon actual application conditions. Please consult us for more information.

■ Brush Wear Rate

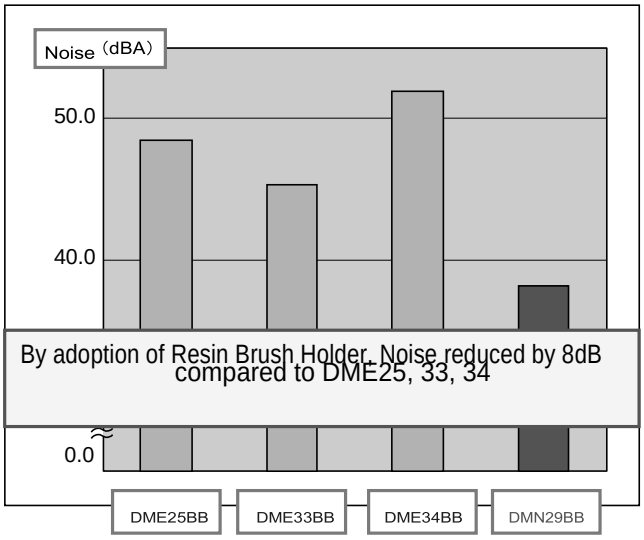


■ Brush Length

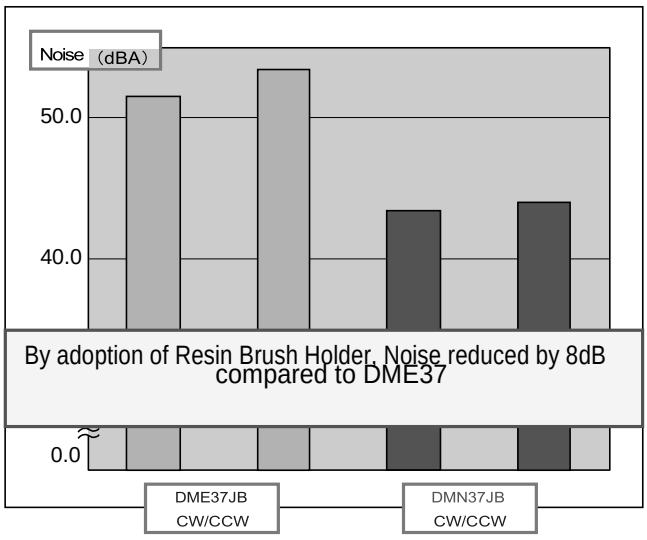


Comparison of Noise

■ DME25/33/34 ⇨ DMN29 ■

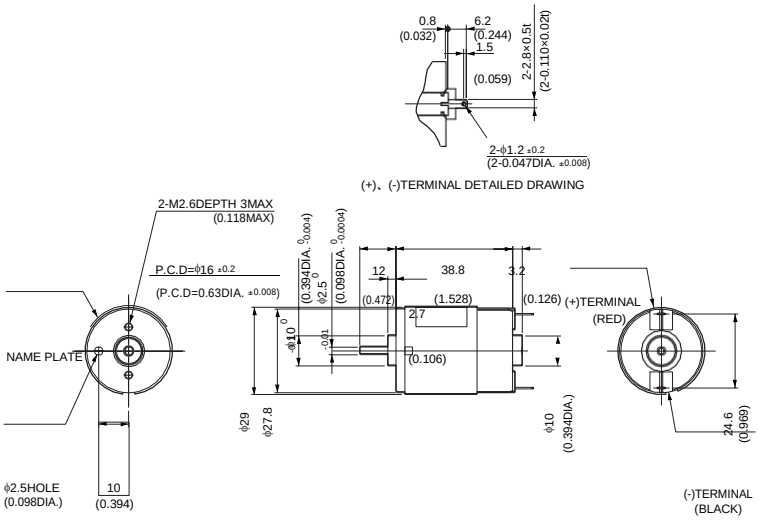


■ DME37 ⇨ DMN37 ■



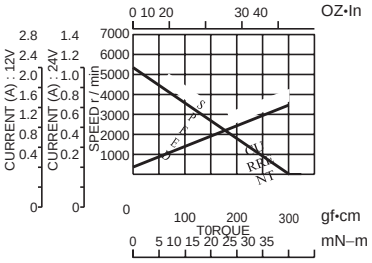
DMN29

● DIMENSIONS Unit mm(inch)

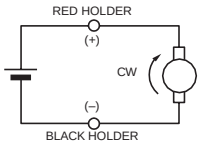


● CURRENT, SPEED-TORQUE CURVE

DMN29



● CONNECTION



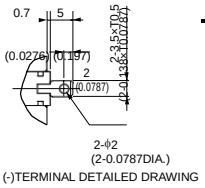
□ STANDARD SPECIFICATIONS

Model	Rated						No load		Stall torque		Weight	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in		
	W	V	mN-m	oz·in	A	r/min	A	r/min			g	lb
DMN29BA	3.0	12	7.8	1.11	0.42	3700	0.07	5000	30	4.17	90	0.20
DMN29BB	3.0	24	7.8	1.11	0.21	3700	0.05	5000	30	4.17	90	0.20

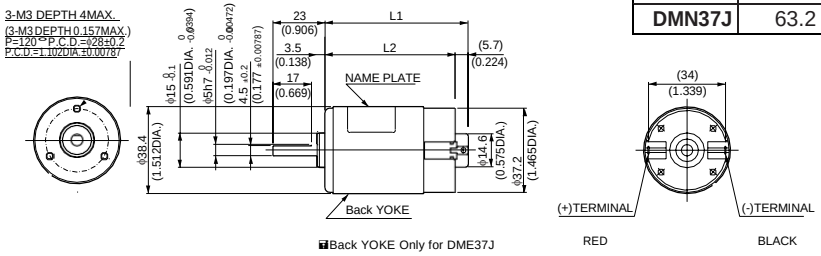
DMN37

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	4.6W	0.78A
SB	24V	4.6W	0.37A
BA	12V	7.2W	1.01A
BB	24V	7.2W	0.53A
KA	12V	9.2W	1.20A
KB	24V	9.2W	0.60A
JB	24V	14.7W	0.94A

□ DIMENSIONS Unit mm(inch)



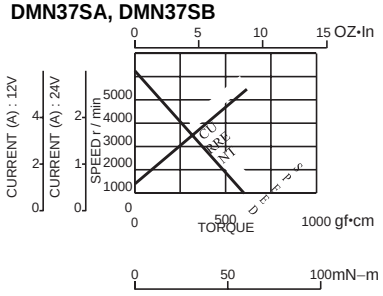
Model	L1		L2	
	(mm)	(inch)	(mm)	(inch)
DMN37S	45.2	1.780	39.5	1.555
DMN37B	53.2	2.094	47.5	1.870
DMN37K	58.2	2.291	52.5	2.067
DMN37J	63.2	2.488	57.5	2.264



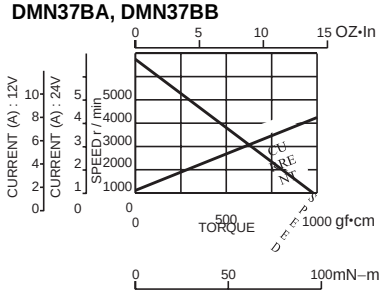
Back YOKE Only for DME37J

□ CURRENT, SPEED-TORQUE CURVE

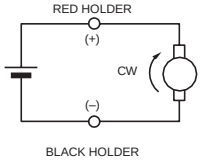
DMN37SA, DMN37SB



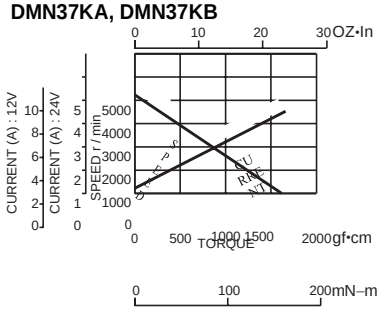
DMN37BA, DMN37BB



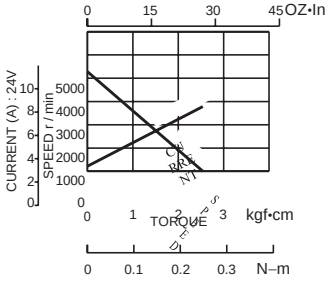
● CONNECTION



DMN37KA, DMN37KB



DMN37JB



□ STANDARD SPECIFICATIONS

Model	Rated						No load		Stall torque		Weight	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in		
	W	V	mN-m	oz·in	A	r/min	A	r/min			g	lb
DMN37SA	4.6	12	9.8	1.39	0.78	4500	0.26	5500	54	7.64	130	0.29
DMN37SB	4.6	24	9.8	1.39	0.37	4500	0.12	5500	54	7.64	130	0.29
DMN37BA	7.2	12	14.7	2.08	1.01	4700	0.25	5500	98	13.89	180	0.40
DMN37BB	7.2	24	14.7	2.08	0.53	4700	0.13	5500	98	13.89	180	0.40
DMN37KA	9.2	12	24.5	3.47	1.20	3600	0.27	4300	160	23.61	210	0.46
DMN37KB	9.2	24	24.5	3.47	0.60	3600	0.14	4300	160	23.61	210	0.46
DMN37JB	14.7	24	39.2	5.55	0.94	3600	0.16	4300	240	34.72	240	0.53

Intermittent ratings are given for DMN37JB. (Duty 50%)

Structure

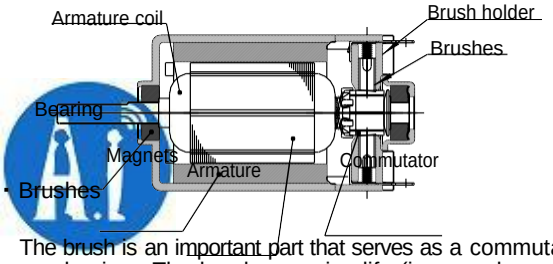


Fig. 1

- Brushes
The brush is an important part that serves as a commutating mechanism. The brush's service life (in accordance with wear) will be the service life of the direct-current motor.
- Commutator
In general, copper is the material used, but to counteract how it softens at high temperatures, a small amount of silver is mixed with it.
- Armature coil
In general, electric wire known as magnet wire is used. Wire diameter is selected in accordance with the motor's specifications, and the wire is connected to the commutator bar by means of welding, soldering or other such methods.
- Armature
For the armature, magnetic steel sheet is used to increase magnetic flux density.
- Magnets
Broadly speaking, the magnets used in the motor can be classified in terms of whether they are ferrite, alnico, rare earth, etc. Magnets are selected in accordance with usage purpose, based on their features.
- Bearing
There are ball bearings and sleeve bearings, and they are used in accordance with purpose. The ball bearing is the type that is appropriate for uses involving large bending loads.

Current and rotating torque characteristics

The magnet DC motor has dropping characteristics (rotation speed) and rising characteristics, as shown in Figure 2. When applied voltage V is changed, as shown in Figure 2, torque-rotating speed characteristics will be proportional to the valtde for V, but current-torque characteristics will only change very slightly. (For details, please refer to the relational expression for current and torque rotating speed.)

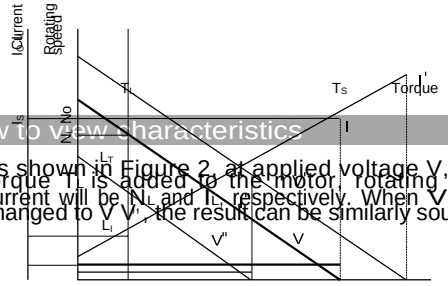


Fig. 2

How to view characteristics

As shown in Figure 2, at applied voltage V, when load torque TL is added to the motor, rotating speed and current will be N_L and I_L respectively. When V has been changed to V V', the result can be similarly sought. No-load rotating speed, No, and stalling (starting) torque, T_S, will be proportional to the applied voltage; thus, the values for when a 24V motor, for example, is used at 20V or 18V will be on the order of those shown in Table 1. (No-load current Io will be sufficiently small compared with the stalling current and can thus be disregarded.)

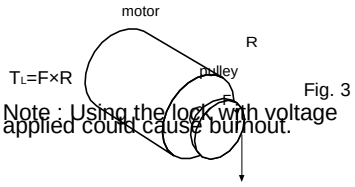
When changing the rated voltage substantially (from 24V to 6V, for example), it will be necessary to depend on actual measurement.

However, use at something other than the rated voltage could cause abnormal brush wear and startup malfunctions. Thus, we ask that you confirm the usage conditions.

Voltage	No-load rotating speed No	Stalling torque Ts	Stalling current Is
24V	5000r/min	40mN-m	1.0A
20V	$\frac{20}{24}$ ×5000 4166	$\frac{20}{24}$ ×40 33	$\frac{20}{24}$ × 1 0.83
18V	$\frac{18}{24}$ ×5000 3750	$\frac{18}{24}$ ×40 30	$\frac{18}{24}$ × 1 0.75

Table 1

Explanation of Terminology

Term/Symbol	Content
No-load rotating speed No	Rotating speed with no load
No-load current Io	Input current with no load
Stalling torque Ts	Max. value for motor-generated torque. In general, a DC motor's stalling torque is equal to its starting torque.
Load torque T_L	As shown in Figure 3, when a pulley with radius R is attached to the motor and force of F is applied to the pulley's circumference, the torque generated, T_L, can be derived by multiplying F and R ($F \times R = T_L$).  Fig. 3 Note : Using the lock with voltage applied could cause burnout.

Relational expressions for torque, rotating speed and current

Relational expressions are as follows.

If the no-load rotating speed from formula 1 is taken to be No when load torque T_L is zero, there will be no load; thus, if $T_L = 0$, the following will be the case.

No-load rotating speed No will be determined from the size of the motor's friction torque T_O. If T_O is low, the no-load rotating speed from formula 3 will be roughly proportional to the applied voltage. In addition, stalling (starting) torque will equal the load torque when rotating speed N from formula 1 is zero, resulting in the following:

Starting torque will be roughly proportional to the applied voltage. Current will be as follows:

From this formula, when load torque T_L and friction torque are constant, the current will be constant with no relation to applied voltage. The no-load current will be the value that makes the load torque zero in formula 5, but friction torque T_O will change slightly in accordance with rotating speed; thus, there will be some change caused by the applied voltage.

If motor output is designated as P (W), torque as T (N・m) and rotating speed as N (r/min), motor output P (W) will be as follows.

$$P = 0.105 \times T \times N \cdots\cdots \text{Formula 6}$$

N : Rotating speed V : Applied voltage r : Armature-circuit resistance
T_O : Motor's friction torque
T_L : Load torque
K_1 and K_2 : Motor-specific constant

Technical Description:

Operating Precautions

DC motors are compact and display high output, and their speed is easy to control. They may be driven by battery or any other power supply and are therefore also easy to use. However, inappropriate power supply may lead to burnout or abnormal brush wear.

Problems with power supply, installation, and general precautions and problems with a motor installed in-circuit will be described.

• Overload and lock-up

An excessive amount of load torque is applied during overloaded driving or when locked up, causing an excessive current flow with heat damage being incurred by the motor. Therefore, overloaded or locked-up use is to be avoided. (Locking up for 5 or more seconds results in damage to a motor. Do not lock up a motor for 5 or more seconds.)

• Applied voltage

Be sure to use a motor at its rated voltage (+IUVI), and avoid any surge voltage. We can specially manufacture motors designed with an electrical

path protecting the motor from surges and reversed polarity. us for details.

• Applying non-rated supply voltages

Applying a voltage higher than the motor's rating results in a temperature increase, leading to heat damage or lowered service life. Scoring of the

commutator surface by sparks and mechanical brush wear arising from vibration may also occur.

Applying a voltage lower than the motors rating may eventually result in the motor failing to start. This is due to the build up of carbon powder on the commutator.

Motors are manufactured for use within +IOVo of the tions.

Please contact us if you need to use motors outside the

• Brush wear promoted by power supply ripples

Brush wear may be mechanical wear due to brush and sion or electrical wear due to sparking between the brush the latter being the most common. Brush wear is therefore by ripples in the power supply voltage, and use of genera recommended. However, when rectifying AC for use by a motor, be sure to use full-wave rectification with a capacitor or similar element in a smoothing circuit.

• Ambient conditions

The service life of a DC motor is dependant upon its rectifying action. Care must be taken to ensure good commutation, as dust, oil, gas, water, etc. Water, etc, on the commutator surface results in poor rectification and increases brush wear.

• Changing the brush position

The brushes are generally fixed in position such that rotational speed and current characteristics are maintained equivalent in both clockwise and counter-clockwise directions. These are basically determined based on the position of the magnetic poles. Rotating the motor after not carefully relocating parts such as the brush holder (for fixing the brushes) or rear cover results in misalignment of the brushes and magnets. This will produce change in the above characteristics in the rotational direction or cause poor rectification, leading to abnormal brush wear. Therefore, changing of the brush positioning is to be avoided.

• Installed orientation

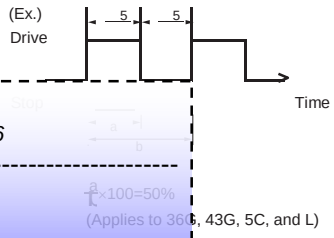
Motors are generally designed for use with a horizontal output shaft. Special consideration must be given to components including bearings and grease washers when intended for an upward- or downward-facing output shaft. Please contact us for details.

Further, avoid installing a motor in a manner in which grease from the gear head would tend to enter the motor (e.g., with an upward-facing output shaft).

• Noise generation

Electrical noise is generated as a result of sparks from commutation between the brushes and commutator. Please contact us for assistance with lowering noise.

• Gear heads for intermittent drive



(Applies to 36 , 43G, 5C, and L)

Fig. 5

The gearhead is assembled with a fixed shaft about which a gear revolves and transmits power. It is not suited to continuous drive. You should maintain the duty ratio between ON and OFF states at no more than 50%, with the maximum ON state not exceeding 5 seconds.

ad combination

a gear head with a pinion shaft, gently fit the gear head left, being careful that the pinion and the gear in the gly clash with each other.

cause noise-producing scratches in the pinion and the ilures by a decreased service life and are the cause of

• Load variation

Even with torque below the rated load, a motor will incur more damage than might be imagined if there is frequent load variation. Exercise caution with operating conditions and load restrictions.

• Insulation resistance

The insulation resistance of a brush motor will naturally continue to decrease as its running time increases. The figures for resistance given in the catalog are for a new motor.

• Service life

Service life depends greatly on operating conditions and environment. Please contact us for details.

• Other aspects

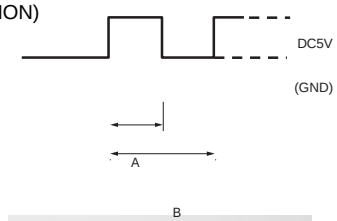
Oil may seep out of the grease in the gear head depending on operating conditions, storage environment, etc.

This does not present any problems in the use of the gear head. However, contamination of the machine or equipment to which the geared motor is fitted may occur.

Motors with pulse generators:

There are two types of pulse generators that are featured in DME series motors : the magnetic and optical revolution sensor. (Note, the optical revolution sensor is available only in the DME34 model.) Both are incremental revolution sensor. And all the above generators can output Single Phase pulse signal only. When TWO Phase signal is required, contact our sales agent near you or directly to us. We may quote on case by case basis.

● STANDARD SPECIFICATION OF REVOLUTION SENSOR

REVOLUTION SENSOR TYPE	MAGNETIC	OPTICAL
PULSE PER REVOLUTION	12P/rev.	24P/rev.
INPUT VOLTAGE	DC5V±10%	DC5V±10%
CURRENT CONSUMPTION	5mA nominal	25mA nominal
DUTY (B/A)	50±20%	50±10%
OUTPUT WAVEFORM (COMMON)		

Magnetic Type

Optical Type

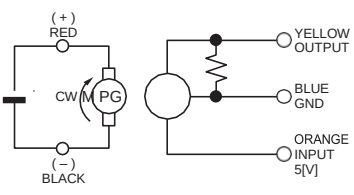
Magnetic Revolution Sensor :

Compared to the optical revolution sensor, the magnetic revolution sensor is more resistant to high temperatures, dust contaminations, vibrations and impact shocks. The design of the magnetic revolution sensor type motor is also more simple. In incremental type revolution sensor, pulse output signals are sent to a counter wherein the incremented value is displayed. Signal noise, here, lead to performance errors. Magnetic type revolution sensors are especially vulnerable to signal noise since the signal levels are usually very low (20mA to 30mA). Thus, make sure magnetic revolution sensor type motors are provided proper magnetic shielding, and signal lines are as short as possible (ideally within 5m).

Optical Revolution Sensor:

Long-life LED is used as the light emitter, and a phototransistor is used as the light detector. When using optical revolution sensor type motors, special considerations are needed to protect against dust and extreme temperatures. The most frequent causes of trouble in optical revolution sensors are : dust build-ups impairing proper optical properties ; and extreme leading to deterioration in light emission performance. Japan Servo can thus ensure full rated performance only in ambient temperatures between 0 to 40 degrees centigrade, and in dust-free conditions.

● CONNECTION



DC SMALL MOTORS DME Series

The DME Series motor is a feasible and practical DC motor that is used popularly in many applications.

According to user demands, Japan Servo combines the DME motor with a wide variation of high-performance gear-boxes to further increase the application possibilities for the DME Series.

Also, in response to demands for a simple, low-cost motor that has a certain amount of controllability, Japan Servo provides DME models that feature pulse generators (magnetic or optical PG).

For certain models of the DME Series, the motor and gearboxes can be ordered separately, allowing for much greater versatility by combining various type motors with a wide range of reduction gears. Please refer to the product line-up chart to select the DME Series motor that is just right for your specific needs.

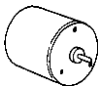
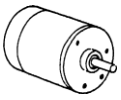
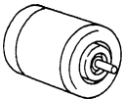
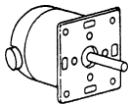
●DME SERIES MOTOR'S CONSTRUCTION AND CHARACTERISTICS.

MODEL	BRUSH HOLDING	CORE SLOTS	BEARING	MAGNET	LIFE* (hrs)	OUTPUT POWER (W)								PAGE
						S	B	K	J	5		10	15	
DME25	Holder	3 slots	Sintered sleeve bearing	Anisotropic	1000		K			◎3				12
DME33	Spring plate	3 slots	Sintered sleeve bearing	Isotropic	1000	K				◎0.7				15
				Anisotropic			K			◎3				
DME34	Spring plate	3 slots	Sintered sleeve bearing	Isotropic	1000 (500)	K				◎1.3				21
				Anisotropic			K			◎	4.5			
								K			◎7			
DME37	Holder	7 slots	Sintered sleeve bearing	Anisotropic	2000	K				◎	4.6			29
							K				◎7.2			
								K				9.2		
									K				◎17.2	
DME44	Holder	10 slots	Ball bearing	Anisotropic	2000	K						9.2		34
							K					◎	14.8	
DME60	Holder	12 slots	Sint. sleeve/Ball bearing	Isotropic	2000	K						◎	13	38
				Anisotropic			K						26	

FEATURE	BRUSH HOLDER	BEARING	MAGNET
	Holder:Long-life 2000hours (1000 hours only for DME25, due to its high-speed operation)	Ball bearing :Long-life	Anisotropic :High output
	Spring plate:Standard 1000hours	Sintered sleeve bearing :Standard	Isotropic :Standard

*Operated in motor alone, and single direction.

□ SELECTION CHART

	MOTOR SPECIFICATION					MOTOR ONLY	MOTORS WITH SENSOR		GEARED MOTORS	
	OUTPUT POWER		RATED VOLTAGE		RATED CURRENT		MAGNETIC REVOLUTION SENSOR	OPTICAL REVOLUTION SENSOR		
	W	CODE	V	CODE	A				**36G**	**43G**
DME25  	3	B	12	A	0.47	DME25BA			DME25B36GMA	DME25B43GMA
			24	B	0.23	DME25BB			DME25B36GMB	DME25B43GMB
DME33 	0.7	S	12	A	0.12	DME33SA	DME33SMA		DME33S36GMA	DME33S43GMA
			24	B	0.06	DME33SB	DME33SMB		DME33S36GMB	DME33S43GMB
	3	B	12	A	0.42	DME33BA	DME33BMA		DME33B36GMA	DME33B43GMA
			24	B	0.22	DME33BB	DME33BMB		DME33B36GMB	DME33B43GMB
DME34 	1.3	S	12	A	0.20	DME34SA	DME34SMA	DME34SEA	DME34S36GMA	DME34S43GMA
			24	B	0.10	DME34SB	DME34SMB	DME34SEB	DME34S36GMB	DME34S43GMB
	4.5	B	12	A	0.65	DME34BA	DME34BMA	DME34BEA	DME34B36GMA	DME34B43GMA
			24	B	0.31	DME34BB	DME34BMB	DME34BEB	DME34B36GMB	DME34B43GMB
	7	K	24	B	0.41	DME34KB	DME34KMB	DME34KEB		
DME37 	4.6	S	12	A	0.78	DME37SA	DME37SMA			
			24	B	0.37	DME37SB	DME37SMB			
	7.2	B	12	A	1.01	DME37BA	DME37BMA			
			24	B	0.53	DME37BB	DME37BMB			
	9.2	K	12	A	1.20	DME37KA	DME37KMA			
			24	B	0.60	DME37KB	DME37KMB			
	17.2	J	24	B	1.07	DME37JB	DME37JMB			
DME44	9.2	S	12	A	1.31	DME44SA	DME44SMA			
			24	B	0.65	DME44SB	DME44SMB			
	14.8	B	24	B	0.94	DME44BB	DME44BMB			
DME60	13	S	12	A	2.07	DME60SA				
			24	B	1.00	DME60SB				
	26	B	24	B	2.2	DME60BB				

12 24
PULSES PER REVOLUTION

□ MOTOR DESIGNATIONS

[1] MOTORS ONLY

DME **34** **B** **A**

- DME: SERIES NAME
- 34: MOTOR DIAMETER in (mm) 25, 33, 34, 37, 44, 60
- B: OUTPUT POWER — S: STANDARD TYPE; B: HIGH POWER TYPE1; K: HIGH POWER TYPE2; J: HIGH POWER TYPE3
- A: RATED VOLTAGE — A: DC12V; B: DC24V

[2] MOTORS WITH SENSOR

DME **34** **B** **M** **A**

- M: TYPE OF SENSOR — M: MAGNETIC REVOLUTION SENSOR; E: OPTICAL REVOLUTION SENSOR

[3] GEARED MOTORS

DME **34** **B** **36G** **10** **A**

- 36G: GEARBOX MODEL 36G, 43G, 50G, 5C, L
- 10: GEAR RATIO

[4] MOTOR AND GEARBOX SUPPLIED SEPARATELY

DME 37 B 6H FP A

TYPE OF PINION SHAFT

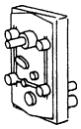
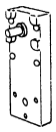
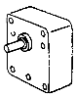
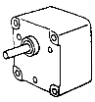
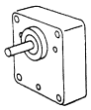
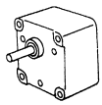
PINION SHAFT	MATCHING GEARBOX
6HP	6DG
6HFP	6DGF
8HP	8DG
8HFP	8DGF

6DG 15 F

GEARBOX TYPE
6DG, 6DGF, 8DG, 8DGF

GEAR RATIO

• Motors combined with gear heads are manufactured to order. The model code to be like: DME37B6DGF15B

	MOTOR AND GEARBOX SUPPLIED SEPERATELY							
	 50G	 5C	 L	 6DG	 6DGF	 8DG	 8DGF	PAGE
			DME25BLMA DME25BLMB	DME25B6HPA DME25B6HPB				12~14
		DME33S5CMA DME33S5CMB	DME33SLMA DME33SLMB	DME33S6HPA DME33S6HPB				15~20
	DME33B50GMA DME33B50GMB	DME33B5CMA DME33B5CMB	DME33BLMA DME33BLMB	DME33B6HPA DME33B6HPB				
		DME34S5CMA DME34S5CMB	DME34SLMA DME34SLMB	DME34S6HPA DME34S6HPB				21~28
	DME34B50GMA DME34B50GMB	DME34B5CMA DME34B5CMB	DME34BLMA DME34BLMB	DME34B6HPA DME34B6HPB		DME34B8HPA DME34B8HPB		
		DME34K5CMB	DME34KLMB			DME34K8HPB		
	DME37S50GMA DME37S50GMB			DME37S6HPA DME37S6HPB				
	DME37B50GMA DME37B50GMB			DME37B6HPA DME37B6HPB	DME37B6HFPA DME37B6HFPB	DME37B8HPA DME37B8HPB		29~33
	DME37K50GMA DME37K50GMB			DME37K6HPA DME37K6HPB	DME37K6HFPA DME37K6HFPB	DME37K8HPA DME37K8HPB		
					DME37J6HFPB	DME37J8HPB	DME37J8HFPB	
	DME44S50GMA DME44S50GMB			DME44S6HPA DME44S6HPB	DME44S6HFPA DME44S6HFPB	DME44S8HPA DME44S8HPB		34~37
					DME44B6HFPB	DME44B8HPB	DME44B8HFPB	
				DME60S6HPA DME60S6HPB	DME60S6HFPA DME60S6HFPB	DME60S8HPA DME60S8HPB	DME60S8HFPA DME60S8HFPB	38~40
					DME60B6HFPB	DME60B8HPB	DME60B8HFPB	
	NOTE: M DENOMINATOR OF REDUCTION RATIO			6DGM	6DGMF	8DGM	8DGMF	
				MODEL NAMES OF MATCHING GEARBOX.				

●GEAR-HEAD DESIGN

GEAR RATIO (Denominator)	36G	43G	50G	5C	L	6DG	6DGF	8DG	8DGF
5						TM	TM	TM	TM
9			TM						
10	TM	TM							
12.5						TM	ī	TM	TM
15						TM	ī	TM	TM
18	ī	ī	TM			TM	ī	TM	TM
20	ī	ī		ī					
25						ī	ī	ī	ī
27			ī						
30	ī	ī		ī	TM	ī	ī	ī	ī
36			ī			ī	ī	ī	ī
40				ī					
50	TM	TM		ī	TM	ī	TM	ī	TM
54			ī						
60	TM	TM		ī		ī	TM	ī	TM
72			ī						
75	TM	TM				ī	TM	ī	TM
80				ī					
96			TM						
100	TM	TM		ī		ī	TM	ī	TM
120	ī	ī			TM	ī	TM	ī	TM
144			TM						
150	ī	ī		ī	TM	TM	TM	ī	TM
180	ī	ī				TM	TM	ī	TM
192			TM						
200	ī	ī		TM	TM				
250	ī	ī		TM		TM		TM	
255					TM				
256			TM						
300	ī	ī		TM		TM		TM	
400	TM	TM		TM					
450						TM		TM	
500	TM	TM		TM		ī		ī	
600	TM	TM						ī	
750						ī		ī	
900						ī		ī	
1800						ī		ī	

TM: Output shaft rotates in the same direction with motor shaft.

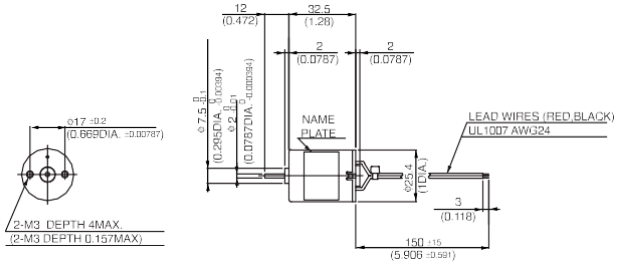
ī : Output shaft rotates reversed direction to motor shaft.

DME25

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
BA	12V	3W	0.47A
BB	24V	3W	0.23A

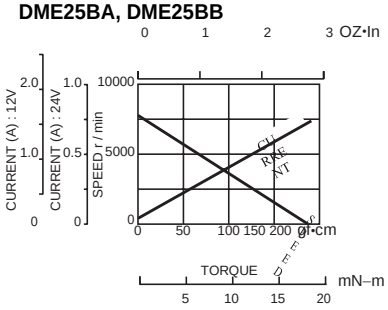
● DIMENSIONS Unit mm(inch)

DME25BA, DME25BB

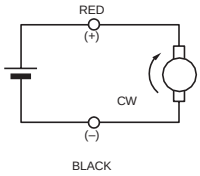


● CURRENT, SPEED-TORQUE CURVE

DME25BA, DME25BB



●CONNECTION



● STANDARD SPECIFICATIONS

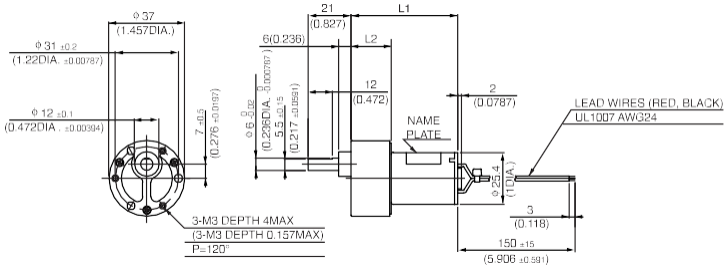
Model	Rated						No load		Stall torque		Weight	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in		
	W	V	mN-m	oz·in	A	r/min	A	r/min			g	lb
DME25BA	3	12	4.9	0.69	0.47	5800	0.07	8000	17.7	2.50	55	0.12
DME25BB	3	24	4.9	0.69	0.23	5800	0.04	8000	17.7	2.50	55	0.12

WITH GEARBOX
36G

Gear heads for intermittent drive

●DIMENSIONS Unit mm(inch)

DME25B36G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	52.3	2.059	19.8	0.78	160	0.35
18~30	54.8	2.157	22.3	0.878		
50~100	57.3	2.256	24.8	0.976		
120~300	59.8	2.354	27.3	1.075	180	0.40
400~600	62.3	2.453	29.8	1.173		

●with 36G TYPE GEARBOX

Model	Gear ratio		10	*18	*20	*30	50	60	75	100	*120	*150	*180
	Rated speed	r/min	580	322	290	193	116	96.6	77.3	58	48.3	40.1	35.2
DME25B36GM	Rated torque	N·m	0.04	0.068	0.071	0.1	0.15	0.18	0.23	0.32	0.34	0.39	0.39
		oz·in	5.55	9.03	10.14	15.28	22.22	26.39	33.33	45.83	48.61	55.55	55.55

Model	Gear ratio		*200	*250	*300	400	500	600
	Rated speed	r/min	32.5	27.2	23.3	17.9	14.6	12.4
DME25B36GM	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55

↻								

NOTE 1: Enter the required reduction ratio in the M.
2: ■ Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ↻.

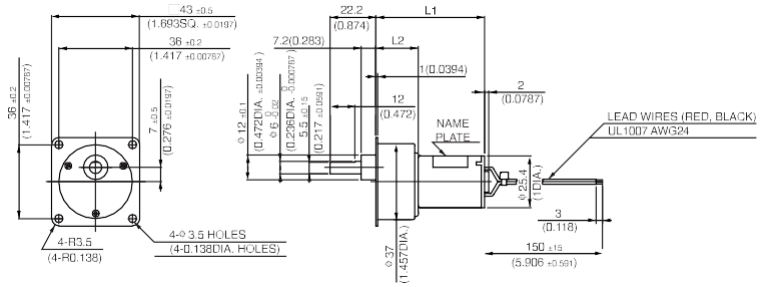
WITH GEARBOX

43G

Gear heads for intermittent drive

● DIMENSIONS Unit mm(inch)

DME25B43G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	50.8	2.000	18.3	0.720	160	0.35
18~30	53.3	2.098	20.8	0.819		
50~100	55.8	2.197	23.3	0.917		
120~300	58.3	2.295	25.8	1.016		
400~600	60.8	2.394	28.3	1.114		

● with 43G TYPE GEARBOX

Model	Gear ratio		10	*18	*20	*30	50	60	75	100	*120	*150
	Rated speed	r/min	580	322	290	193	116	96.6	77.3	58	48.3	40.1
DME25B43GM ②	Rated torque	N·m	0.04	0.068	0.071	0.1	0.15	0.18	0.23	0.32	0.34	0.39
		oz·in	5.55	9.03	10.14	15.28	22.22	26.39	33.33	45.83	48.61	55.55

Model	Gear ratio		*180	*200	*250	*300	400	500	600
	Rated speed	r/min	35.2	32.5	27.2	23.3	17.9	14.6	12.4
DME25B43GM ②	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55	55.55

WITH GEARBOX

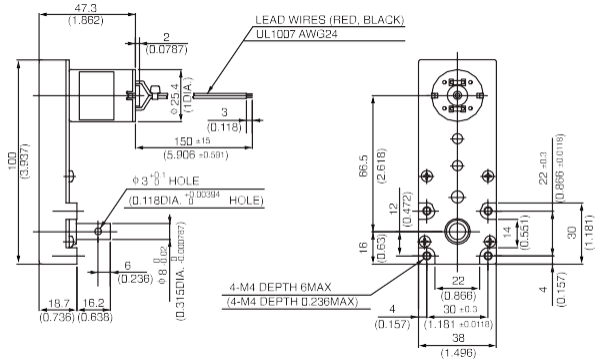
L

Gear heads for intermittent drive

L

● DIMENSIONS Unit mm(inch)

DME25BL



(WEIGHT 225 g 0.5 lb)

● with L TYPE GEARBOX

Model	Gear ratio		30	50	120	150	200	255
	Rated speed	r/min	193	116	48.3	38.6	29	22.7
DME25BLM ②	Rated torque	N·m	0.09	0.14	0.34	0.43	0.58	0.74
		oz·in	12.22	19.44	48.61	61.10	81.93	104.15

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ②.

DME25

WITH GEARBOX

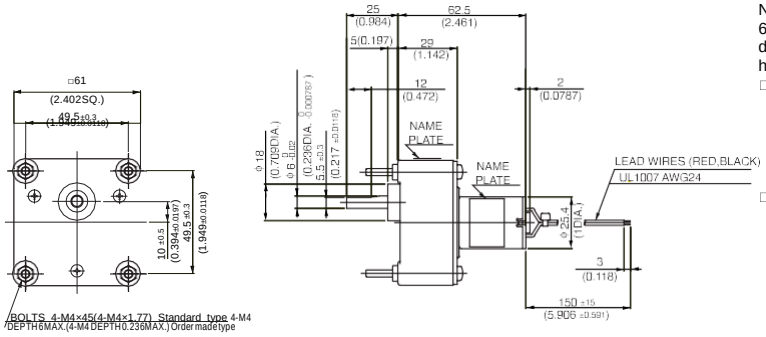
6DG

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
BA	12V	3W	0.47A
BB	24V	3W	0.23A

6DG

● DIMENSIONS Unit mm(inch)

DME25B6DG



NOTE:
6DG gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME25B6HPB (Pinion shaft motor)
  6DGM (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example :
  DME25B6HM**B**

(WEIGHT 355 g 0.78 lb)

● with 6DG TYPE GEARBOX MOTOR MODEL **DME25B6HP** ↻ & GEARBOX MODEL **6DG**M

Model	Gear ratio		5	12.5	15	*25	*30	*50	*75	*100	150	180	250
	Rated speed	r/min	1160	464	386	232	193	116	77.3	58	38.6	32.2	23.2
DME25B6HPM ↻ **&6DG**M	Rated torque	N·m	0.02	0.05	0.06	0.1	0.11	0.18	0.27	0.36	0.49	0.59	0.82
		oz·in	2.78	6.94	8.33	12.64	15.28	25.00	37.50	49.99	68.05	81.93	113.87

Model	Gear ratio		300	450	*500	*750	*900	*1800
	Rated speed	r/min	19.3	14.4	13	9.3	7.9	4.2
DME25B6HPM ↻ **&6DG**M	Rated torque	N·m	0.96	0.98	0.98	0.98	0.98	0.98
		oz·in	136.09	138.87	138.87	138.87	138.87	138.87

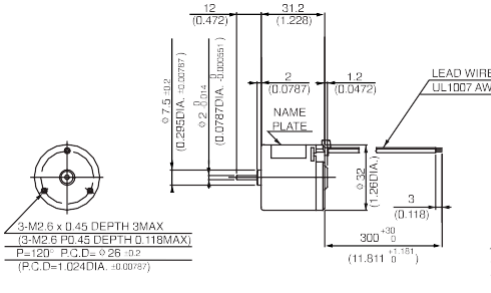
NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ↻.

DME33

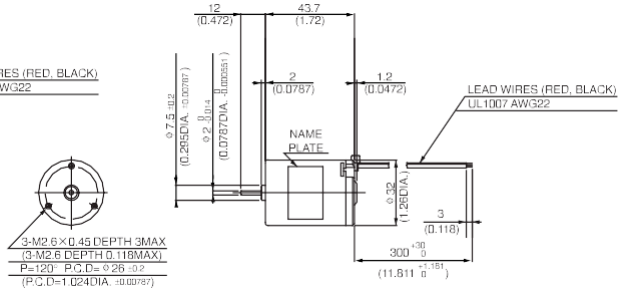
MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	0.7W	0.12A
SB	24V	0.7W	0.06A
BA	12V	3.0W	0.42A
BB	24V	3.0W	0.22A

DIMENSIONS Unit mm(inch)

DME33SA, DME33SB

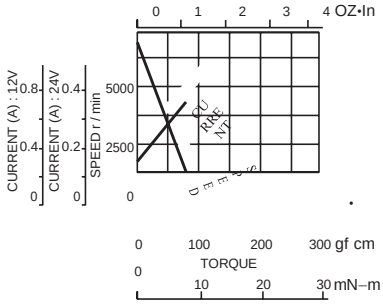


DME33BA, DME33BB

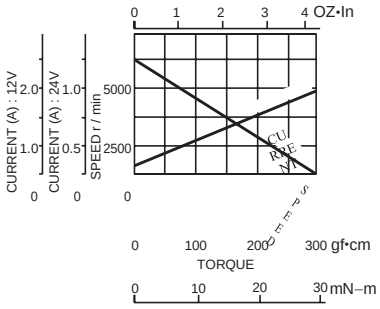


● CURRENT, SPEED-TORQUE CURVE

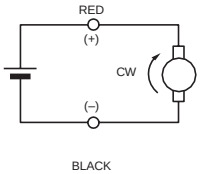
DME33SA, DME33SB



DME33BA, DME33BB



●CONNECTION

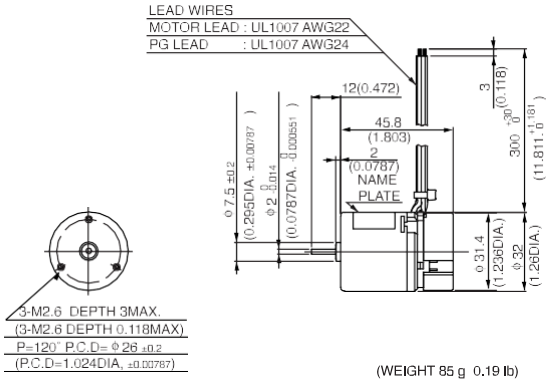


STANDARD SPECIFICATIONS

Model	Rated						No load		Stall torque		Weight	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in		
	W	V	mN-m	oz·in	A	r/min	A	r/min			g	lb
DME33SA	0.7	12	1.5	0.21	0.12	4500	0.05	5500	7.8	1.11	70	0.15
DME33SB	0.7	24	1.5	0.21	0.06	4500	0.02	5500	7.8	1.11	70	0.15
DME33BA	3	12	7.8	1.11	0.42	3700	0.06	5000	29	4.17	100	0.22
DME33BB	3	24	7.8	1.11	0.22	3700	0.04	5000	29	4.17	100	0.22

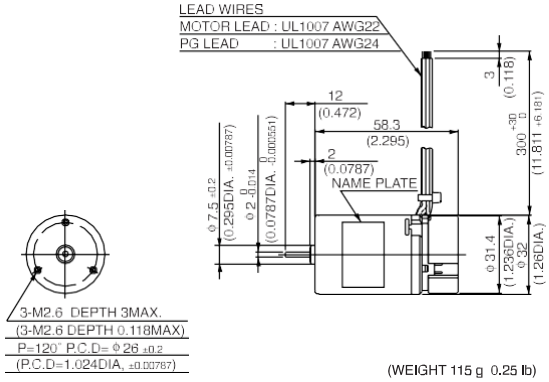
REVOLUTION SENSOR MAGNET TYPE

DME33SMA, DME33SMB



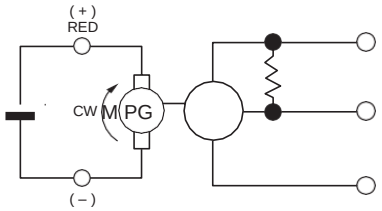
(WEIGHT 85 g 0.19 lb)

DME33BMA, DME33BMB



(WEIGHT 115 g 0.25 lb)

CONECTION OF REVOLUTION SENSOR



ORANGE

PUT 5[V]

YELLOW
OUTPUT

BLUE
GND

- SPECIFICATION OF REVOLUTION SENSOR SHOWN ON PAGE 8.

DME33

WITH GEARBOX

36G

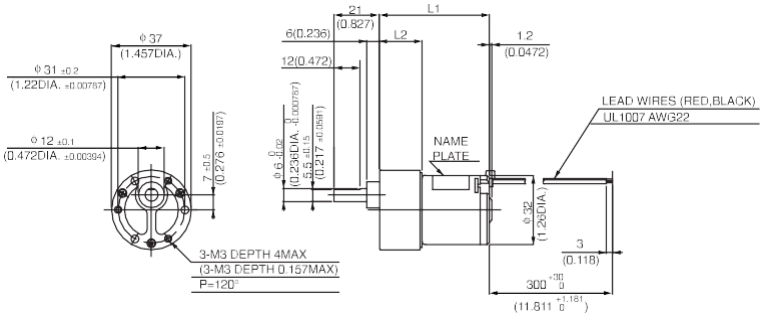
Gear heads for intermittent drive

36G

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	0.7W	0.12A
SB	24V	0.7W	0.06A
BA	12V	3.0W	0.42A
BB	24V	3.0W	0.22A

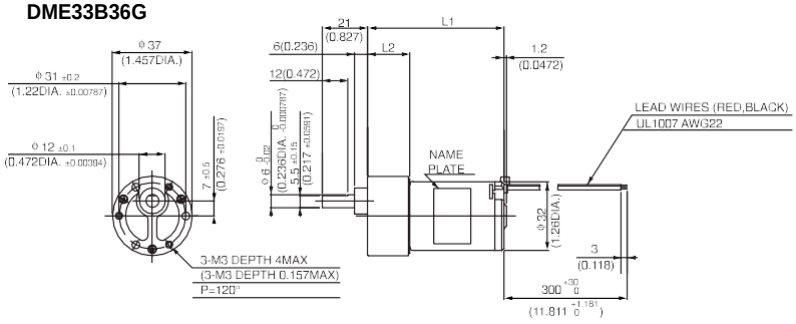
● DIMENSIONS Unit mm(inch)

DME33S36G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	51.0	2.008	19.8	0.78	170	0.37
18~30	53.5	2.106	22.3	0.878		
50~100	56.0	2.204	24.8	0.976		
120~300	58.5	2.303	27.3	1.075	190	0.42
400~600	61.0	2.402	29.8	1.173		

DME33B36G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	63.5	2.5	19.8	0.78	200	0.44
18~30	66.0	2.598	22.3	0.878		
50~100	68.5	2.697	24.8	0.976		
120~300	71.0	2.795	27.3	1.075	220	0.49
400~600	73.5	2.894	29.8	1.173		

□ with 36G TYPE GEARBOX

Model	Gear ratio		10	*18	*20	*30	50	60	75	100	*120	*150	*180
	Rated speed	r/min	450	250	225	150	90	75	60	45	37.5	30	25
DME33S36GM ↻	Rated torque	N·m	0.011	0.018	0.021	0.032	0.048	0.058	0.072	0.096	0.098	0.12	0.15
		oz·in	1.67	2.64	3.06	4.58	6.80	8.19	10.28	13.61	13.89	18.05	22.22
DME33B36GM ↻	Rated speed	r/min	370	205	185	123	74	61.6	49.3	40	34	28.4	24.4
	Rated torque	N·m	0.063	0.1	0.11	0.16	0.25	0.3	0.38	0.39	0.39	0.39	0.39
		oz·in	9.03	13.89	15.28	23.61	36.11	43.05	54.16	55.55	55.55	55.55	55.55

Model	Gear ratio		*200	*250	*300	400	500	600
	Rated speed	r/min	22.5	18	15	11.2	9	7.7
DME33S36GM ↻	Rated torque	N·m	0.16	0.21	0.25	0.31	0.39	0.39
		oz·in	23.61	30.55	36.11	44.44	55.55	55.55
DME33B36GM ↻	Rated speed	r/min	22.2	18.2	15.4	11.7	9.5	8
	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ↻.

WITH GEARBOX

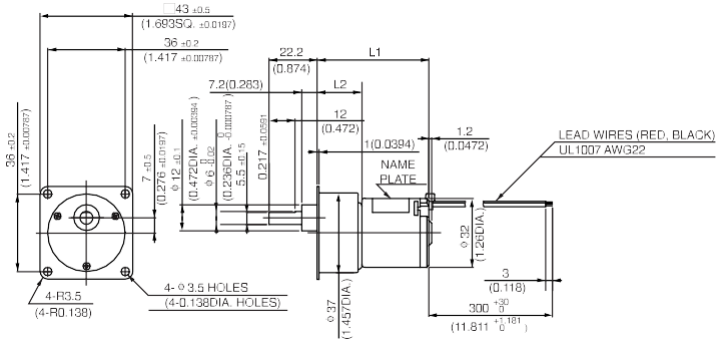
43G

Gear heads for intermittent drive

43G

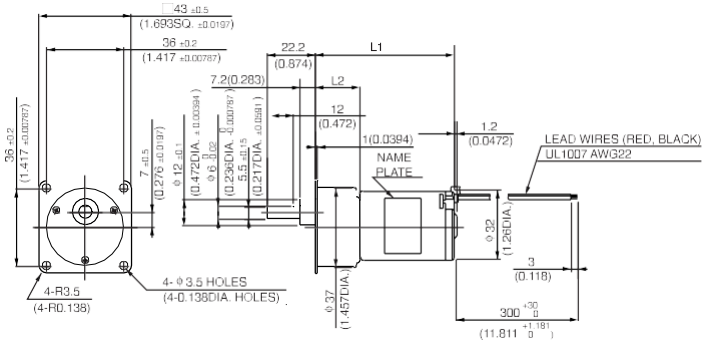
● DIMENSIONS Unit mm(inch)

DME33S43G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	49.5	1.949	18.3	0.720	200	0.44
18~30	52	2.047	20.8	0.819		
50~100	54.5	2.146	23.3	0.917		
120~300	57	2.244	25.8	1.016		
400~600	59.5	2.343	28.3	1.114		

DME33B43G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	62	2.441	18.3	0.720	220	0.49
18~30	64.5	2.539	20.8	0.819		
50~100	67	2.638	23.3	0.917		
120~300	69.5	2.736	25.8	1.016		
400~600	72	2.835	28.3	1.114		

□ with 43G TYPE GEARBOX

Model	Gear ratio		10	*18	*20	*30	50	60	75	100	*120	*150
	Rated speed	r/min	450	250	225	150	90	75	60	45	37.5	30
DME33S43GM ◯②	Rated torque	N·m	0.011	0.018	0.021	0.032	0.048	0.058	0.072	0.096	0.098	0.12
		oz·in	1.67	2.64	3.06	4.58	6.80	8.19	10.28	13.61	13.89	18.05
DME33B43GM ◯②	Rated speed	r/min	370	205	185	123	74	61.6	49.3	40	34	28.4
	Rated torque	N·m	0.064	0.1	0.11	0.16	0.25	0.3	0.38	0.39	0.39	0.39
		oz·in	9.03	13.89	15.28	23.61	36.11	43.05	54.16	55.55	55.55	55.55

Model	Gear ratio		*180	*200	*250	*300	400	500	600
	Rated speed	r/min	25	22.5	18	15	11.2	9	7.7
DME33S43GM ◯②	Rated torque	N·m	0.15	0.16	0.21	0.25	0.31	0.39	0.39
		oz·in	22.22	23.61	30.55	36.11	44.44	55.55	55.55
DME33B43GM ◯②	Rated speed	r/min	24.4	22.2	18.2	15.4	11.7	9.5	8
	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55	55.55

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ◯②.

DME33

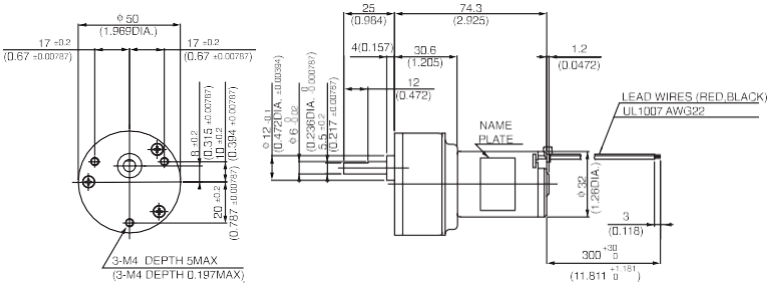
MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	0.7W	0.12A
SB	24V	0.7W	0.06A
BA	12V	3.0W	0.42A
BB	24V	3.0W	0.22A

WITH GEARBOX 50G

50G

● DIMENSIONS Unit mm(inch)

DME33B50G



(WEIGHT 300g 0.66 lb)

● with 50G TYPE GEARBOX

Model	Gear ratio		9	18	*27	*36	*54	*72	96	144	192	256
	Rated speed	r/min	411	205	137	102	68.5	51.3	38.5	25.7	19.3	15.7
DME33B50GM	Rated torque	N·m	0.057	0.11	0.15	0.21	0.3	0.41	0.49	0.74	0.98	0.98
		oz·in	8.05	15.28	20.83	29.16	43.05	58.33	69.44	104.15	138.87	138.87

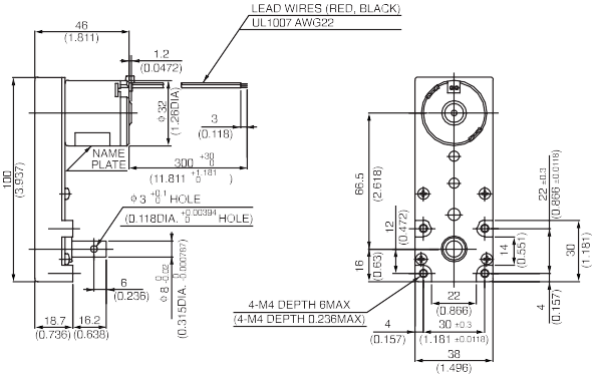
WITH GEARBOX L

Gear heads for intermittent drive

L

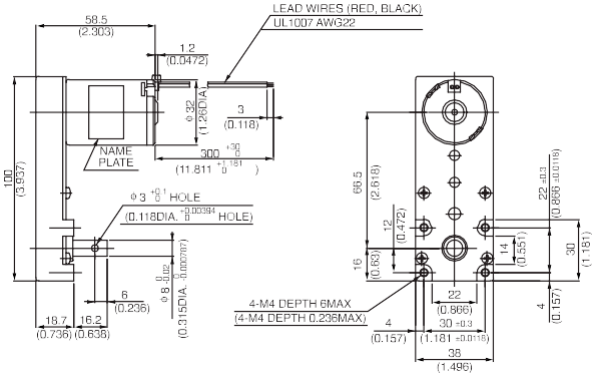
● DIMENSIONS Unit mm(inch)

DME33SL



(WEIGHT 240 g 0.53 lb)

DME33BL



(WEIGHT 270 g 0.6 lb)

● with L TYPE GEARBOX

Model	Gear ratio		30	50	120	150	200	255
	Rated speed	r/min	150	90	37.5	30	22.5	17.6
DME33SLM	Rated torque	N·m	0.025	0.043	0.098	0.13	0.17	0.22
		oz·in	3.61	6.11	13.89	18.05	23.61	30.55
DME33BLM	Rated speed	r/min	139	83.7	34.9	27.9	20.9	16.4
	Rated torque	N·m	0.086	0.14	0.34	0.43	0.58	0.74
		oz·in	12.22	19.44	48.61	61.10	81.93	104.15

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.

3: Enter the required voltage A or B in the ↻.

WITH GEARBOX

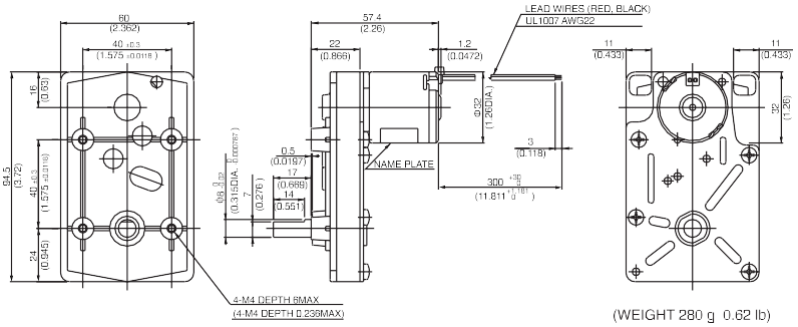
5C

Gear heads for intermittent drive

5C

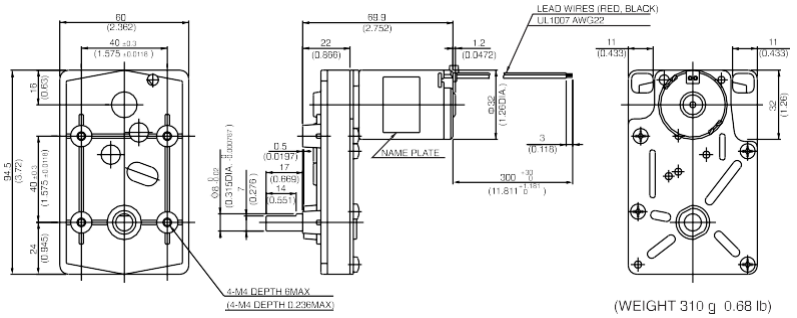
● DIMENSIONS Unit mm(inch)

DME33S5C



(WEIGHT 280 g 0.62 lb)

DME33B5C



(WEIGHT 310 g 0.68 lb)

□ with 5C TYPE GEARBOX

Model	Gear ratio		*20	*30	*40	*50	*60	*80	*100	*150	200	250
	Rated speed	r/min	225	150	112	90	75	56.2	45	30	22.5	18
DME33S5CM ◯	Rated torque	N·m	0.022	0.032	0.043	0.053	0.064	0.085	0.11	0.16	0.19	0.24
		oz·in	3.06	4.58	6.11	7.50	9.03	12.08	15.28	22.22	26.39	33.33
DME33B5CM ◯	Rated speed	r/min	185	123	92.5	74	61.6	46.2	37	24.6	18.8	16
	Rated torque	N·m	0.11	0.17	0.23	0.28	0.34	0.46	0.57	0.85	0.98	0.98
		oz·in	15.28	23.61	31.94	40.27	48.61	63.88	80.55	120.82	138.87	138.87

Model	Gear ratio		300	400	500
	Rated speed	r/min	15	11.2	9
DME33S5CM ◯	Rated torque	N·m	0.28	0.38	0.48
		oz·in	40.27	54.16	68.05
DME33B5CM ◯	Rated speed	r/min	13.9	10.9	9
	Rated torque	N·m	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ◯.

DME33

WITH GEARBOX

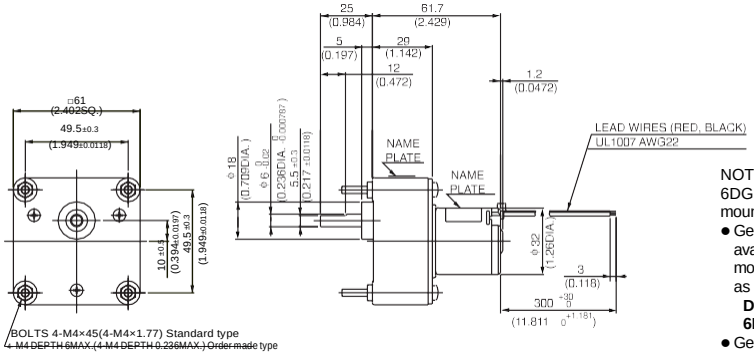
6DG

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	0.7W	0.12A
SB	24V	0.7W	0.06A
BA	12V	3.0W	0.42A
BB	24V	3.0W	0.22A

6DG

● DIMENSIONS Unit mm(inch)

DME33S6DG

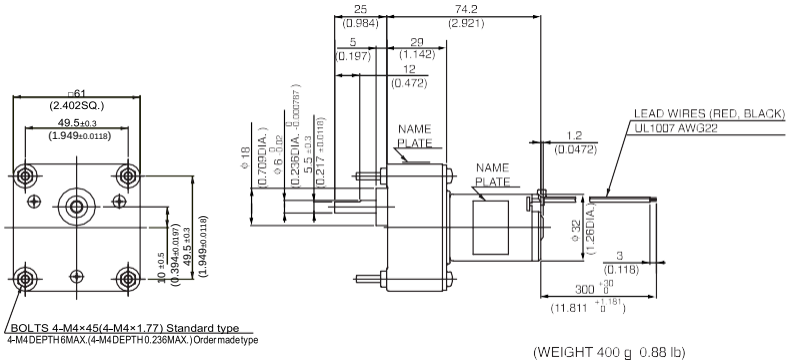


(WEIGHT 370 g 0.82 lb)

NOTE:
6DG gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME33B6HPB (Pinion shaft motor)
  6DGM (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME33B6H**M**B**

DME33B6DG



(WEIGHT 400 g 0.88 lb)

● with 6DG TYPE GEARBOX MOTOR MODEL **DME33S6HP** ↻ or **DME33B6HP** ↻ & GEARBOX MODEL **6DG**M

Model	Gear ratio		5	12.5	15	*25	*30	*50	*75	*100	150	180	250
	Rated speed	r/min	900	360	300	180	150	90	60	45	30	25	18
DME33S6HP ↻ **&6DG**M	Rated torque	N·m	0.006	0.015	0.018	0.026	0.032	0.053	0.08	0.11	0.14	0.17	0.24
		oz·in	0.83	2.08	2.50	3.75	4.58	7.50	11.39	15.28	19.44	23.61	33.33
DME33B6HP ↻ **&6DG**M	Rated speed	r/min	740	296	246	148	123	74	49.3	37	24.6	20.5	16
	Rated torque	N·m	0.031	0.079	0.095	0.14	0.17	0.28	0.42	0.57	0.77	0.92	0.98
		oz·in	4.44	11.25	13.47	19.44	23.61	40.27	59.71	80.55	108.32	130.54	138.87

Model	Gear ratio		300	450	*500	*750	*900	*1800
	Rated speed	r/min	15	10	9	6	5	2.4
DME33S6HP ↻ **&6DG**M	Rated torque	N·m	0.28	0.43	0.43	0.65	0.77	0.98
		oz·in	40.27	61.10	61.10	91.66	109.71	138.87
DME33B6HP ↻ **&6DG**M	Rated speed	r/min	13.9	9.9	8.9	6.1	5.2	2.7
	Rated torque	N·m	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87	138.87	138.87	138.87

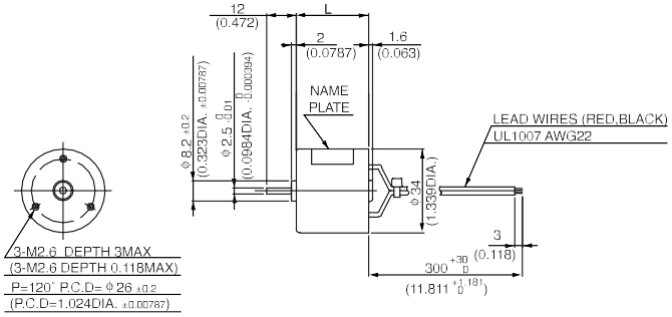
NOTE 1: Enter the required reduction ratio in the M.

2: ■ Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ⇦⇨.

DME34

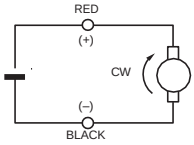
MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	1.3W	0.2A
SB	24V	1.3W	0.1A
BA	12V	4.5W	0.65A
BB	24V	4.5W	0.31A
KB	24V	7W	0.41A

● DIMENSIONS Unit mm(inch)



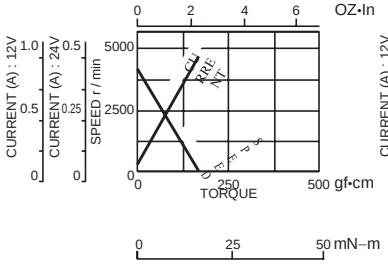
Model	L	Weight	
		g	lb
DME34SA DME34SB	29.5	100	0.22
DME34BA DME34BB	35.0	110	0.24
DME34KB	45	140	0.31

● CONNECTION

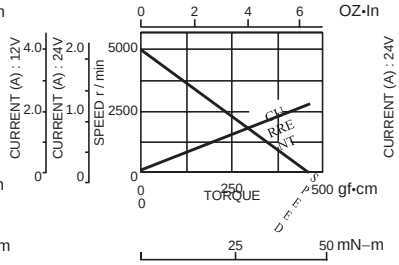


● CURRENT, SPEED-TORQUE CURVE

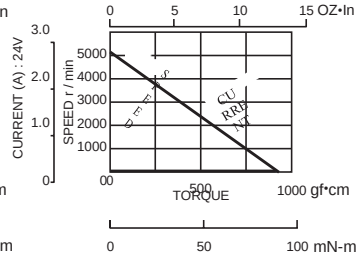
DME34SA, DME34SB



DME34BA, DME34BB



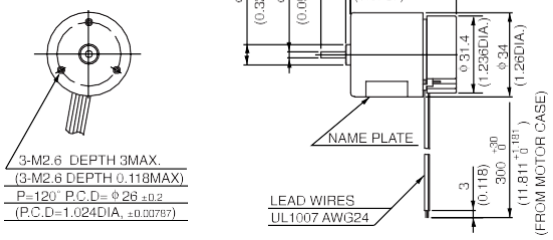
DME34KB



● STANDARD SPECIFICATIONS

Model	Rated						No load		Stall torque	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in
	W	V	mN-m	oz·in	A	r/min	A	r/min		
DME34SA	1.3	12	3.9	0.56	0.2	3300	0.04	4300	17	2.36
DME34SB	1.3	24	3.9	0.56	0.1	3300	0.02	4300	17	2.36
DME34BA	4.5	12	11.8	1.67	0.65	3700	0.07	5000	45	6.39
DME34BB	4.5	24	11.8	1.67	0.31	3700	0.04	5000	45	6.39
DME34KB	7	24	14.7	2.08	0.41	4300	0.06	5100	92	13.03

● REVOLUTION SENSOR MAGNET TYPE

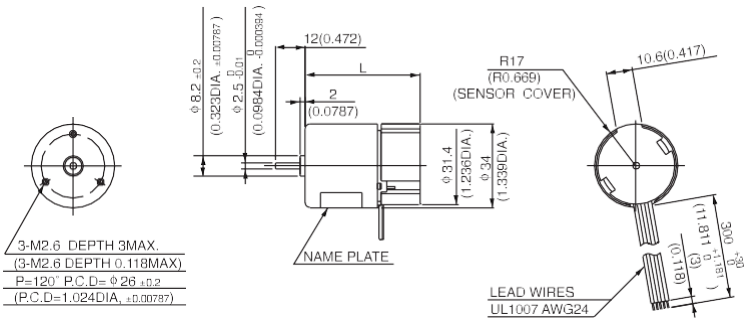


Model	L	Weight	
		g	lb
DME34SMA DME34SMB	43.1	110	0.24
DME34BMA DME34BMB	48.6	120	0.26
DME34KMB	58.6	150	0.33

DME34

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	1.3W	0.2A
SB	24V	1.3W	0.1A
BA	12V	4.5W	0.65A
BB	24V	4.5W	0.31A
KB	24V	7W	0.41A

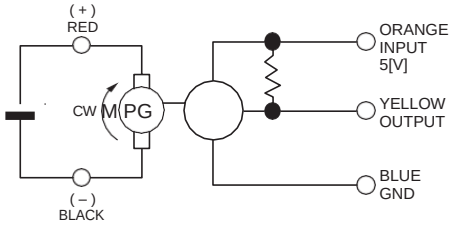
□ REVOLUTION SENSOR OPTICAL TYPE



Model	L	Weight	
		g	lb
DME34SEA DME34SEB	47.1	120	0.26
DME34BEA DME34BEB	52.6	130	0.29
DME34KEB	62.6	160	0.35

□ CONNECTION OF REVOLUTION SENSOR

DME34SMA, DME34SMB, DME34BMA, DME34BMB
DME34SEA, DME34SEB, DME34BEA, DME34BEB



□ SPECIFICATION OF REVOLUTION SENSOR ARE SHOWN ON PAGE 8.

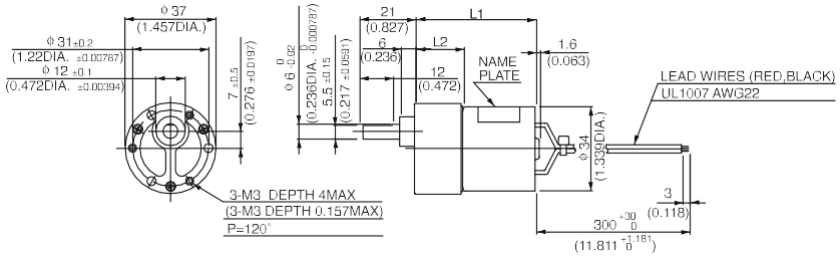
WITH GEARBOX
36G

Gear heads for intermittent drive

36G

● DIMENSIONS Unit mm(inch)

DME34S36G



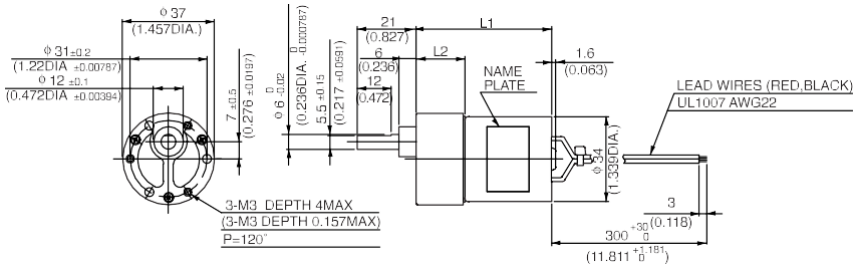
GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	49.3	1.941	19.8	0.78	200	0.44
18~30	51.8	2.039	22.3	0.878		
50~100	54.3	2.138	24.8	0.976		
120~300	56.8	2.236	27.3	1.075	220	0.49
400~600	59.3	2.335	29.8	1.173		

WITH GEARBOX

36G

Gear heads for intermittent drive

DME34B36G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	54.8	2.157	19.8	0.78	210	0.46
18~30	57.3	2.256	22.3	0.878		
50~100	59.8	2.354	24.8	0.976		
120~300	62.6	2.465	27.3	1.075	230	0.51
400~600	64.8	2.551	29.8	1.173		

□ with 36G TYPE GEARBOX

Model	Gear ratio		10	*18	*20	*30	50	60	75	100	*120	*150	*180
	Rated speed	r/min	330	183	165	110	66	55	44	33	27.5	22	18.6
DME34S36GM ◯	Rated torque	N·m	0.031	0.052	0.06	0.09	0.12	0.14	0.18	0.25	0.27	0.34	0.39
		oz·in	4.44	7.22	8.33	12.50	18.05	20.83	26.39	36.11	38.88	48.61	55.55
DME34B36GM ◯	Rated speed	r/min	370	205	185	123	74	65	54.9	43.4	36.5	30	25.5
	Rated torque	N·m	0.095	0.14	0.16	0.25	0.38	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	13.47	20.83	23.61	36.11	54.16	55.55	55.55	55.55	55.55	55.55	55.55

Model	Gear ratio		*200	*250	*300	400	500	600
	Rated speed	r/min	17.2	14.5	12.4	9.5	7.8	6.6
DME34S36GM ◯	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55
DME34B36GM ◯	Rated speed	r/min	23.1	18.8	15.8	12	9.6	8.1
	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ◯.

DME34

WITH GEARBOX

43G

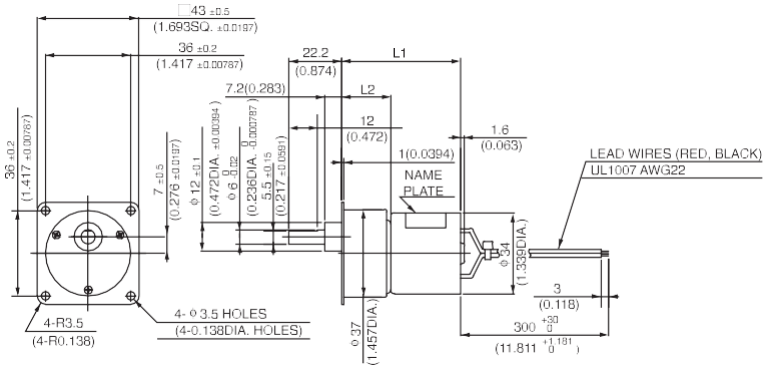
Gear heads for intermittent drive

43G

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	1.3W	0.2A
SB	24V	1.3W	0.1A
BA	12V	4.5W	0.65A
BB	24V	4.5W	0.31A
KB	24V	7W	0.41A

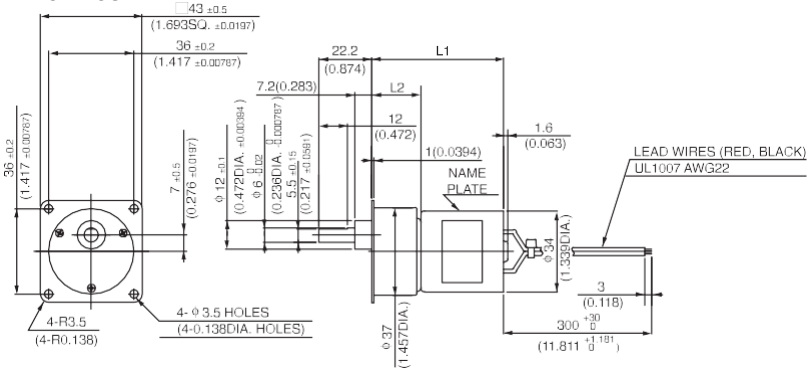
● DIMENSIONS Unit mm(inch)

DME34S43G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	47.8	1.882	18.3	0.720	200	0.44
18~30	50.3	1.980	20.8	0.819		
50~100	52.8	2.079	23.3	0.917		
120~300	55.3	2.177	25.8	1.016		
400~600	57.8	2.276	28.3	1.114		

DME34B43G



GEAR RATIO	L1		L2		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	g	lb
10	53.3	2.098	18.3	0.720	210	0.46
18~30	55.8	2.197	20.8	0.819		
50~100	58.3	2.295	23.3	0.917		
120~300	60.8	2.394	25.8	1.016		
400~600	63.3	2.492	28.3	1.114		

□ with 43G TYPE GEARBOX

Model	Gear ratio		10	*18	*20	*30	50	60	75	100	*120	*150
	Rated speed	r/min	330	183	165	110	66	55	44	33	27.5	22
DME34S43GM ◑	Rated torque	N·m	0.031	0.052	0.06	0.09	0.12	0.14	0.18	0.25	0.27	0.34
		oz·in	4.44	7.22	8.33	12.50	18.05	20.83	26.39	36.11	38.88	48.61
DME34B43GM ◑	Rated speed	r/min	370	205	185	123	74	65	54.9	43.4	36.5	30
	Rated torque	N·m	0.095	0.14	0.16	0.25	0.38	0.39	0.39	0.39	0.39	0.39
		oz·in	13.47	20.83	23.61	36.11	54.16	55.55	55.55	55.55	55.55	55.55

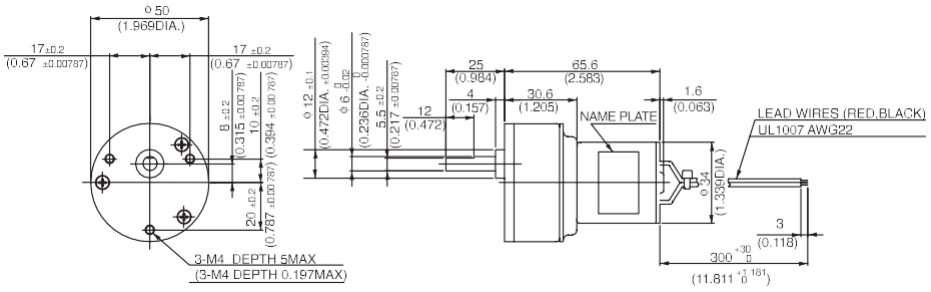
Model	Gear ratio		*180	*200	*250	*300	400	500	600
	Rated speed	r/min	18.6	17.2	14.5	12.4	9.5	7.8	6.6
DME34S43GM ◑	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55	55.55
DME34B43GM ◑	Rated speed	r/min	25.5	23.1	18.8	15.8	12	9.6	8.1
	Rated torque	N·m	0.39	0.39	0.39	0.39	0.39	0.39	0.39
		oz·in	55.55	55.55	55.55	55.55	55.55	55.55	55.55

WITH GEARBOX 50G

50G

● DIMENSIONS Unit mm(inch)

DME34B50G



(WEIGHT 310g 0.68lb)

● with 50G TYPE GEARBOX

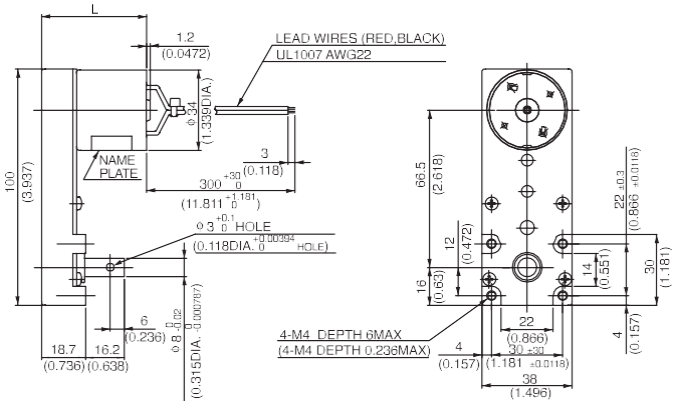
Model	Gear ratio		9	18	*27	*36	*54	*72	96	144	192	256
	Rated speed	r/min	411	205	137	102	68.5	51.4	38.5	26.7	21.5	17
DME34B50GM ◑	Rated torque	N·m	0.085	0.17	0.23	0.3	0.46	0.62	0.74	0.98	0.98	0.98
		oz·in	12.08	23.61	31.94	43.05	65.27	87.49	104.15	138.87	138.87	138.87

WITH GEARBOX L

Gear heads for intermittent drive

L

● DIMENSIONS Unit mm(inch)



Model	L	Weight	
		g	lb
DME34SL	44.3	270	0.6
DME34BL	49.8	280	0.62
DME34KL	59.8	310	0.68

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ◑.

DME34

WITH GEARBOX
L

Gear heads for intermittent drive

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	1.3W	0.2A
SB	24V	1.3W	0.1A
BA	12V	4.5W	0.65A
BB	24V	4.5W	0.31A
KB	24V	7W	0.41A

with L TYPE GEARBOX

Model	Gear ratio		30	50	120	150	200	255
	Rated speed	r/min	110	66	27	22	16	13
DME34SLM	Rated torque	N·m	0.07	0.11	0.28	0.34	0.46	0.59
		oz·in	9.72	15.28	38.88	48.61	65.27	83.32
DME34BLM	Rated speed	r/min	123	74	30.8	25.1	20.4	16.8
	Rated torque	N·m	0.21	0.34	0.83	0.98	0.98	0.98
		oz·in	29.16	48.61	118.04	138.87	138.87	138.87
DME34KLMB	Rated speed	r/min	143	86.0	36.2	30.0	23.2	18.6
	Rated torque	N·m	0.26	0.43	0.98	0.98	0.98	0.98
		oz·in	36.81	60.88	138.87	138.87	138.87	138.87

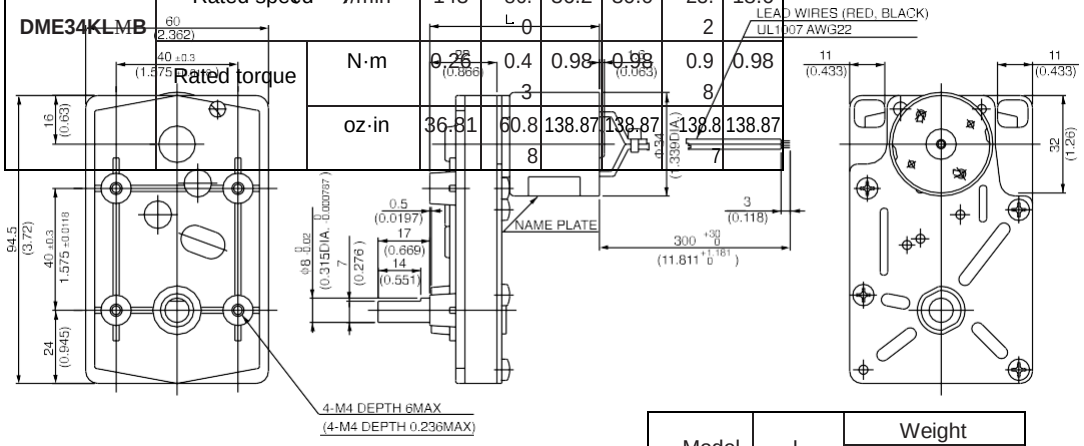
NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ○.

WITH GEARBOX 5C

Gear heads for intermittent drive

5C

● DIMENSIONS Unit:mm(inch)



Model	L	Weight	
		g	lb
DME34S5C	55.7	310	0.68
DME34B5C	61.2	320	0.71
DME34K5C	71.2	350	0.77

● with 5C TYPE GEARBOX

Model	Gear ratio		*20	*30	*40	*50	*60	*80	*100	*150	200	250
	Rated speed	r/min	165	110	82.5	66	55	41.2	33	22	16.5	13.2
DME34S5CM	Rated torque	N·m	0.057	0.085	0.11	0.14	0.17	0.23	0.28	0.42	0.51	0.64
		oz·in	8.05	12.08	15.28	19.44	23.61	31.94	40.27	59.71	72.21	90.27
DME34B5CM	Rated speed	r/min	185	123	92.5	74	61.6	46.2	37	26.7	20.8	17.3
	Rated torque	N·m	0.17	0.25	0.34	0.42	0.51	0.69	0.85	0.98	0.98	0.98
		oz·in	23.61	36.11	48.61	59.71	72.21	97.21	120.82	138.87	138.87	138.87
DME34K5CMB	Rated speed	r/min	215	143	107	86.0	71.6	53.7	43.7	30.7	23.4	19.1
	Rated torque	N·m	0.21	0.32	0.43	0.53	0.64	0.85	0.98	0.98	0.98	0.98
		oz·in	29.73	45.31	60.88	75.04	90.62	120.35	138.87	138.87	138.87	138.87

Model	Gear ratio		300	400	500
	Rated speed	r/min	11	8.3	7
DME34S5CM	Rated torque	N·m	0.77	0.98	0.98
		oz·in	108.32	138.87	138.87
DME34B5CM	Rated speed	r/min	14.8	11.4	9.3
	Rated torque	N·m	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87
DME34K5CMB	Rated speed	r/min	16.1	12.2	9.87
	Rated torque	N·m	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87

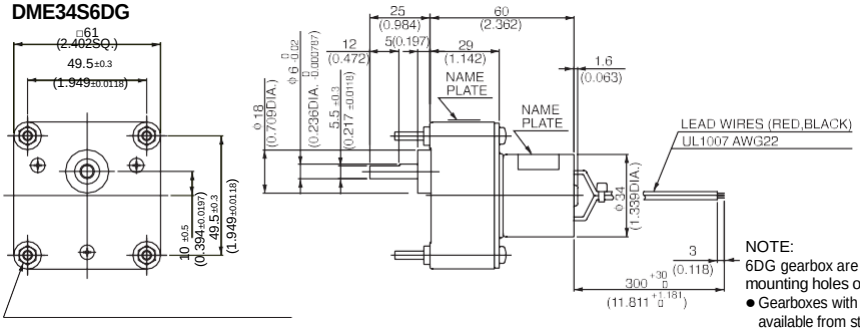
NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.

3: Enter the required voltage A or B in the ↻.

6DG

DIMENSIONS Unit mm(inch)

DME34S6DG

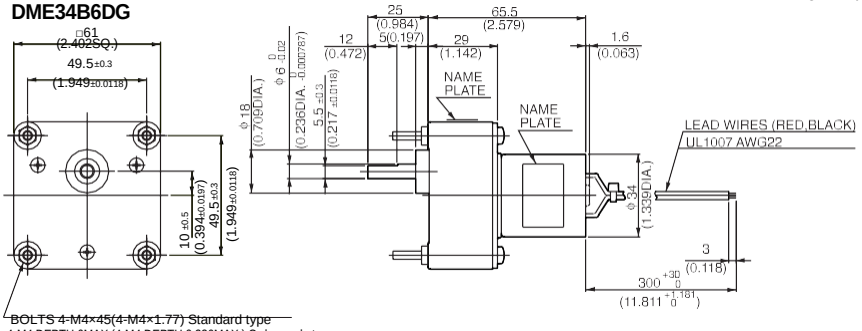


(WEIGHT 400g 0.88lb)

NOTE:
6DG gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME34B6HPB (Pinion shaft motor)
  6DGM (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME34B6H**M**B**

DME34B6DG



(WEIGHT 410g 0.9 lb)

● with 6DG TYPE GEARBOX MOTOR MODEL **DME34S6HP** ↄ, **DME34B6HP** ↄ & GEARBOX MODEL **6DG**M

Model	Gear ratio		5	12.5	15	*25	*30	*50	*75	*100	150	180	250
	Rated speed	r/min	660	264	220	132	110	66	44	33	22	18.3	13.2
DME34S6HP ↄ **&6DG**M	Rated torque	N·m	0.016	0.04	0.048	0.072	0.085	0.14	0.22	0.28	0.38	0.46	0.64
		oz·in	2.22	5.55	6.67	10.14	12.08	19.44	30.55	40.27	54.16	65.27	90.27
DME34B6HP ↄ **&6DG**M	Rated speed	r/min	740	296	246	148	123	74	49.3	37	26	22.7	17.3
	Rated torque	N·m	0.047	0.12	0.14	0.22	0.26	0.42	0.64	0.85	0.98	0.98	0.98
		oz·in	6.67	16.66	19.44	30.55	36.11	59.71	90.27	120.82	138.87	138.87	138.87

Model	Gear ratio		300	450	*500	*750	*900	*1800
	Rated speed	r/min	11	7.6	6.9	5	4.2	2.2
DME34S6HP ↄ **&6DG**M	Rated torque	N·m	0.76	0.98	0.98	0.98	0.98	0.98
		oz·in	108.32	138.87	138.87	138.87	138.87	138.87
DME34B6HP ↄ **&6DG**M	Rated speed	r/min	14.8	10.3	9.2	6.3	5.3	2.7
	Rated torque	N·m	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87	138.87	138.87	138.87

DME34

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	1.3W	0.2A
SB	24V	1.3W	0.1A
BA	12V	4.5W	0.65A
BB	24V	4.5W	0.31A
KB	24V	7W	0.41A

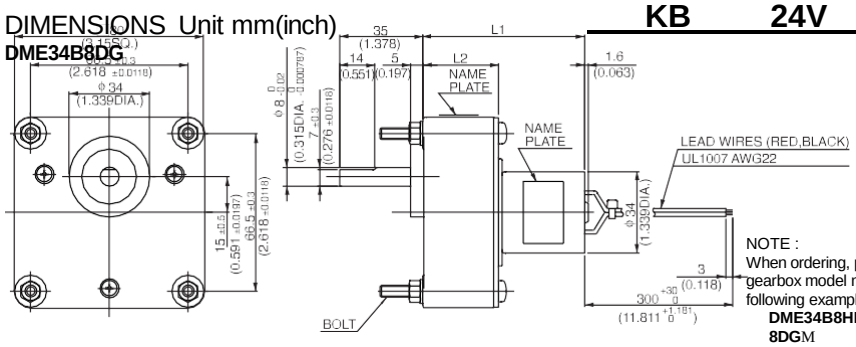
WITH GEARBOX

8DG

8DG

● DIMENSIONS Unit mm(inch)

DME34B8DG

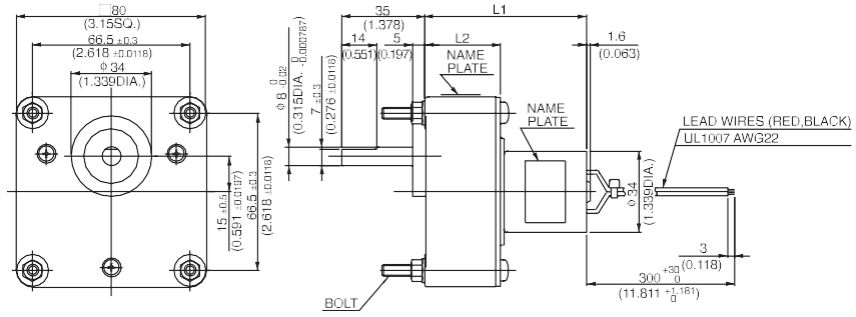


NOTE :
When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
DME34B8HPB (Pinion shaft motor)
8DGM (Gearbox)

GEAR RATIO	L1		L2		BOLT		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	kg	lb
30~150	68.5	2.697	32	1.26	M5X50	M5X1.969	0.61	1.34
250~1800	78.5	3.090	42	1.65	M5X60	M5X2.362	0.71	1.56

● DIMENSIONS Unit mm(inch)

DME34K8H



GEAR RATIO	L1		L2		BOLT		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	kg	lb
30~150	78.5	3.090	32	1.26	M5X50	M5X1.969	0.75	1.65
250~1800	88.5	3.484	42	1.65	M5X60	M5X2.362	0.85	1.87

● with 8DG TYPE GEARBOX MOTOR MODEL **DME34B8HP** ↻ & GEARBOX MODEL **8DG**M

Model	Gear ratio		*30	*50	*75	*100	*150	250	300	*500	*750	*1800
	Rated speed	r/min	123	74	49.3	37	24.6	14.8	12.3	7.4	5.3	2.5
DME34B8HP ↻ **&8DG**M	Rated torque	N·m	0.25	0.42	0.64	0.85	1.3	1.9	2.3	3.4	3.9	3.9
		oz·in	36.11	59.71	90.27	120.82	180.53	263.86	319.40	486.05	555.49	555.49
DME34K8HP ↻ **&8DG**M	Rated speed	r/min	143	86.0	57.3	43.0	28.6	17.2	14.3	8.7	6.1	2.7
	Rated torque	N·m	0.32	0.53	0.80	1.0	1.6	2.4	2.9	3.9	3.9	3.9
		oz·in	45.31	75.04	113.27	141.59	226.54	339.82	410.61	555.49	555.49	555.49

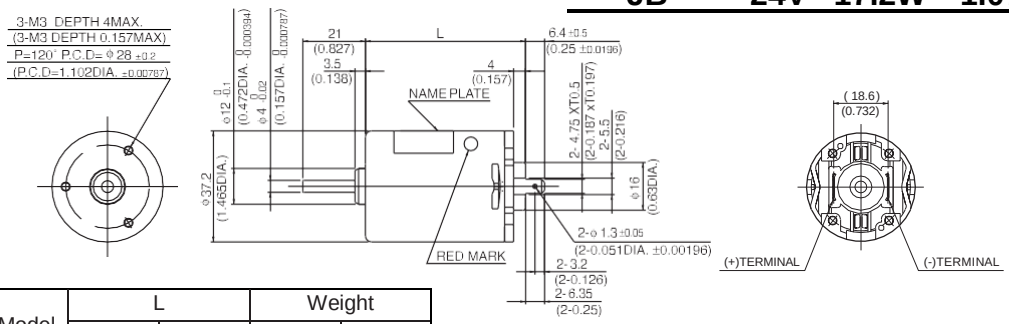
NOTE 1: Enter the required reduction ratio in the M.

2: ■ Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ⟲.

DME37

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	4.6W	0.78A
SB	24V	4.6W	0.37A
BA	12V	7.2W	1.01A
BB	24V	7.2W	0.53A
KA	12V	9.2W	1.20A
KB	24V	9.2W	0.60A
JB	24V	17.2W	1.07A

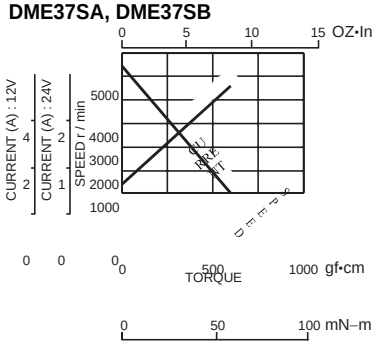
DIMENSIONS Unit mm(inch)



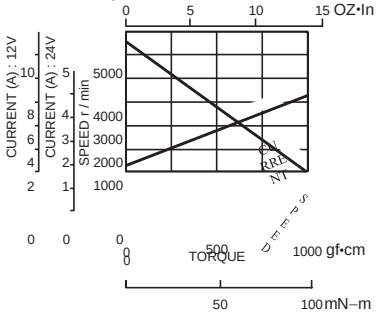
Model	L		Weight	
	(mm)	(inch)	g	lb
DME37SA DME37SB	45.7	1.8	130	0.28
DME37BA DME37BB	53.7	2.11	180	0.40
DME37KA DME37KB	58.7	2.31	210	0.46
DME37JB	63.7	2.51	240	0.53

● CURRENT, SPEED-TORQUE CURVE

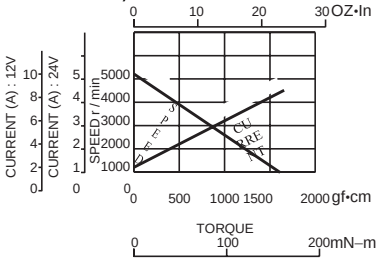
DME37SA, DME37SB



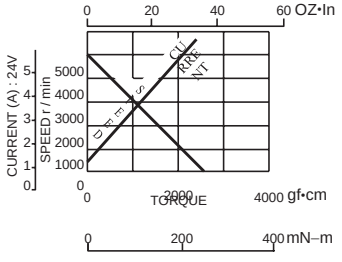
DME37BA, DME37BB



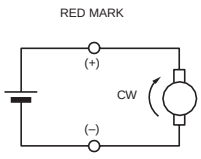
DME37KA, DME37KB



DME37JB



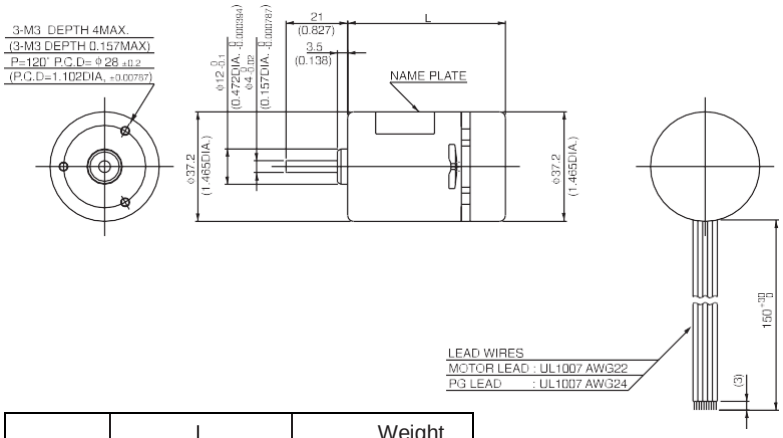
●CONNECTION



STANDARD SPECIFICATIONS

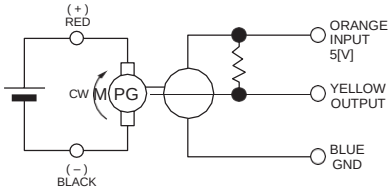
Model	Rated						No load		Stall torque	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in
	W	V	mN-m	oz·in	A	r/min	A	r/min		
DME37SA	4.6	12	10	1.42	0.78	4500	0.26	5500	54	7.64
DME37SB	4.6	24	10	1.42	0.37	4500	0.12	5500	54	7.64
DME37BA	7.2	12	15	2.12	1.01	4700	0.25	5500	98	13.88
DME37BB	7.2	24	15	2.12	0.53	4700	0.13	5500	98	13.88
DME37KA	9.2	12	24.5	3.5	1.20	3600	0.27	4300	160	22.66
DME37KB	9.2	24	24.5	3.5	0.60	3600	0.14	4300	160	22.66
DME37JB	17.2	24	39	5.52	1.07	4200	0.18	5000	240	34

□ REVOLUTION SENSOR MAGNET TYPE



Model	L		Weight	
	mm	inch	g	lb
DME37SMA **DME37SMB**	53.7	2.11	140	0.31
DME37BMA **DME37BMB**	61.7	2.43	190	0.42
DME37KMA **DME37KMB**	66.7	2.63	220	0.49
DME37JMB	71.7	2.82	250	0.55

● CONNECTION OF REVOLUTION SENSOR



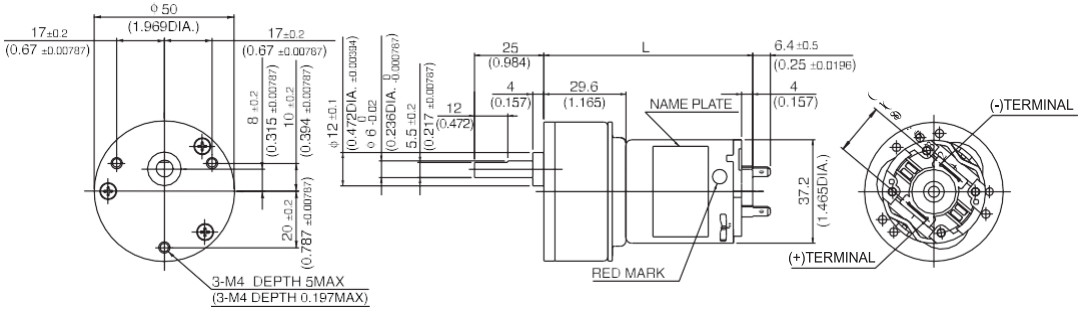
□ SPECIFICATION OF REVOLUTION SENSOR ARE SHOWN ON PAGE 8.

WITH GEARBOX

50G

50G

□ DIMENSIONS Unit mm(inch)



Model	L		Weight	
	(mm)	(inch)	g	lb
DME37S50G	75.3	2.96	280	0.62
DME37B50G	83.3	3.28	330	0.73
DME37K50G	88.3	3.48	360	0.79

□ with 50G TYPE GEARBOX

Model	Gear ratio		9	18	*27	*36	*54	*72	96	144	192	256
	Rated speed	r/min	500	250	166	125	83.3	62.5	46.8	31.2	24.5	19.1
DME37S50GM	Rated torque	N·m	0.072	0.14	0.19	0.25	0.38	0.51	0.62	0.93	0.98	0.98
		oz·in	10.14	19.44	26.39	36.11	54.16	72.21	87.49	130.54	138.87	138.87
DME37B50GM	Rated speed	r/min	522	261	174	130	87	65.2	48.9	34.2	26.4	20.2
	Rated torque	N·m	0.11	0.22	0.28	0.38	0.58	0.76	0.92	0.98	0.98	0.98
		oz·in	15.28	30.55	40.27	54.16	81.93	108.32	130.54	138.87	138.87	138.87
DME37K50GM	Rated speed	r/min	400	200	133	100	66.6	52.3	40.1	27.8	21.2	16.1
	Permission torque	N·m	0.17	0.35	0.48	0.63	0.96	0.98	0.98	0.98	0.98	0.98
		oz·in	25	50	68.05	90.27	136.09	138.87	138.87	138.87	138.87	138.87

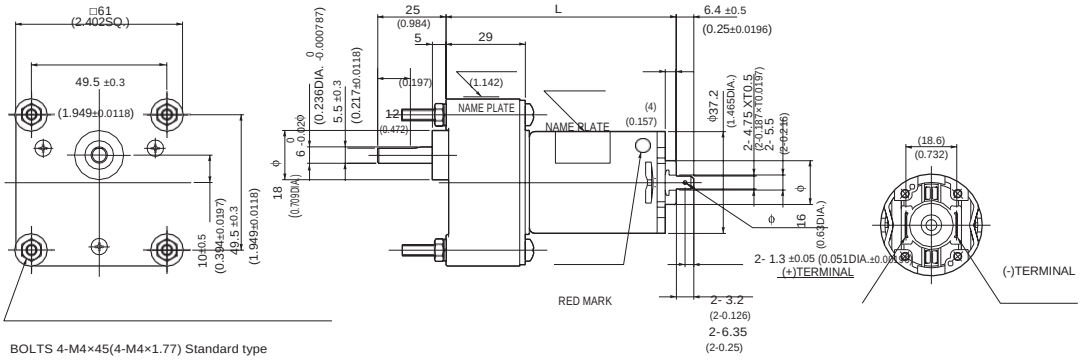
DME37

WITH 6DG GEARBOX

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	4.6W	0.78A
SB	24V	4.6W	0.37A
BA	12V	7.2W	1.01A
BB	24V	7.2W	0.53A
KA	12V	9.2W	1.20A
KB	24V	9.2W	0.60A
JB	24V	17.2W	1.07A

6DG

● DIMENSIONS Unit mm(inch)



BOLTS 4-M4×45(4-M4×1.77) Standard type
4- M4 DEPTH 6MAX.(4-M4 DEPTH 0.236MAX.) Order made type

NOTE:

6DG gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME37B6HPB (Pinion shaft motor)
  6DGM (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME37B6H**M

Model	L		Weight	
	(mm)	(inch)	g	lb
DME37S6H	76.2	3.0	430	0.95
DME37B6H	84.2	3.31	480	1.06
DME37K6H	89.2	3.51	510	1.12

● with 6DG TYPE GEARBOX MOTOR MODEL **DME37S6HP** ↻, **DME37B6HP** ↻ , **DME37K6HP** ↻ & GEARBOX MODEL **6DG**M

Model	Gear ratio		5	12.5	15	*25	*30	*50	*75	*100	150	180	250
	Rated speed	r/min	900	360	300	180	150	90	60	45	30	25.8	19.5
DME37S6HP ↻ **&6DG**M	Rated torque	N·m	0.039	0.098	0.12	0.18	0.22	0.35	0.53	0.72	0.96	0.98	0.98
		oz·in	5.55	13.89	16.66	25.00	30.55	49.99	74.99	101.38	136.09	138.87	138.87
DME37B6HP ↻ **&6DG**M	Rated speed	r/min	940	376	313	188	156	94	62.6	47.7	33	28	20.7
	Rated torque	N·m	0.059	0.15	0.18	0.26	0.32	0.53	0.8	0.98	0.98	0.98	0.98
		oz·in	8.33	20.83	25.00	37.50	45.83	74.99	113.87	138.87	138.87	138.87	138.87
DME37K6HP ↻ **&6DG**M	Rated speed	r/min	720	288	240	144	120	72	50.5	39.1	26.7	22.5	16.5
	Permission torque	N·m	0.098	0.24	0.29	0.44	0.53	0.89	0.98	0.98	0.98	0.98	0.98
		oz·in	13.89	34.72	41.66	62.49	74.99	126.37	138.87	138.87	138.87	138.87	138.87

Model	Gear ratio		300	450	*500	*750	*900	*1800
	Rated speed	r/min	16.6	11.4	10.3	7	5.9	3
DME37S6HP ↻ **&6DG**M	Rated torque	N·m	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87	138.87	138.87	138.87
DME37B6HP ↻ **&6DG**M	Rated speed	r/min	17.4	11.8	10.6	7.1	6	3
	Rated torque	N·m	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87	138.87	138.87	138.87
DME37K6HP ↻ **&6DG**M	Rated speed	r/min	13.8	9.3	8.4	5.6	4.7	2.3
	Permission torque	N·m	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87	138.87	138.87	138.87

r B in the ⟲.

NOTE 1: Enter the required reduction ratio in the M.

2:

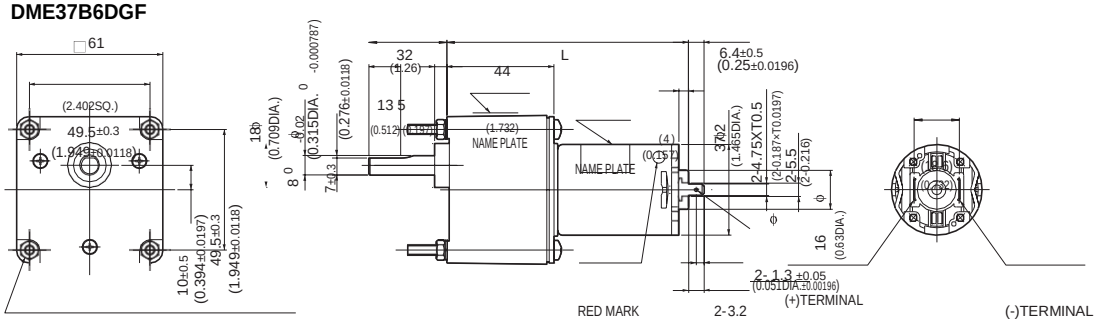
Rotation of gearbox shaft is in reverse of rotation of motor.

3: Enter the required voltage Ao

6DGF

● DIMENSIONS Unit mm(inch)

DME37B6DGF



BOLTS 4-M4×60(4-M4×2.36) Standard type
4-M4 DEPTH 6MAX.(4-M4 DEPTH 0.236MAX.) Order made type

(WEIGHT 0.53kg 1.17lb)

(2-0.126)
2-6.35
(2-0.25)

NOTE:
6DGF gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME37B6HFPB (Pinion shaft motor)
  6DGMF (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME37B6HF**M**B**

● with 6DGF TYPE GEARBOX MOTOR MODEL **DME37B6HFP** , **DME37K6HFP** , **DME37J6HFPB** & GEARBOX MODEL **6DG**M**F**

Model	Gear ratio		5	*12.5	*15	*25	*30	50	75	100	150	180
	Rated speed	r/min	940	376	313	188	156	94	62.6	47	31.3	26.1
DME37B6HFP **& 6DG**M**F**	Rated torque	N·m	0.059	0.13	0.16	0.26	0.32	0.48	0.73	0.96	1.4	1.7
		oz·in	8.33	18.05	22.22	37.50	45.83	68.05	102.76	136.09	194.42	236.08
DME37K6HFP	Rated speed	r/min	720	288	240	144	120	72	48	36	24	20.6
	Permission torque	N·m	0.098	0.21	0.26	0.44	0.53	0.8	1.1	1.5	2.3	2.4
		oz·in	13.89	30.55	37.5	62.49	74.99	113.88	166.65	222.19	333.29	347.18
DME37J6HFPB **& 6DG**M**F**	Rated speed	r/min	840	336	280	168	140	84	56	42.3	29.9	25.4
	Permission torque	N·m	0.15	0.35	0.42	0.71	0.85	1.2	1.8	2.4	2.4	2.4
		oz·in	22.22	49.99	59.71	101.38	120.82	180.53	263.86	347.18	347.18	347.18

NOTE 1: Enter the required reduction ratio in the M.

2: ■ Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ⟲.

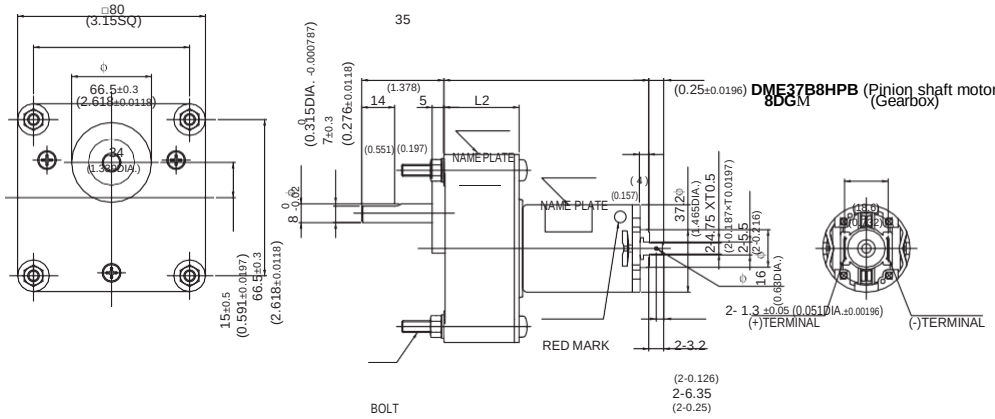
WITH GEARBOX

8DG

8DG

● DIMENSIONS Unit mm(inch)

DME37B8DG



L1 6.4±0.5

NOTE :
When ordering, please write the motor model and gearbox model numbers separately, as in the following example:

Model	GEAR RATIO	L1		L2		BOLT		WEIGHT	
		(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	g	lb
DME37B8HP	30~150	87.2	3.433	32	1.26	M5X50	M5X1.969	680	1.5
	250~1800	97.2	3.826	42	1.654	M5X60	M5X2.362	780	1.72
DME37K8HP	30~150	92.2	3.63	32	1.26	M5X50	M5X1.969	710	1.57
	250~1800	102.2	4.024	42	1.654	M5X60	M5X2.362	810	1.79
DME37J8HP	30~150	97.2	3.827	32	1.26	M5X50	M5X1.969	740	1.63
	250~1800	107.2	4.22	42	1.654	M5X60	M5X2.362	840	1.85

● with 8DG TYPE GEARBOX MOTOR MODEL **DME37B8HP** ↻ , **DME37K8HP** ↻ , **DME37J8HPB** & GEARBOX MODEL **8DG**M

Model	Gear ratio		*30	*50	*75	*100	*150	250	300	*500	*750	*1800	
DME37B8HP ↻ & 8DGM	Rated speed	r/min	156	94	62.6	47	31.3	18.8	15.6	9.5	6.7	2.9	
	Rated torque	N·m	0.32	0.53	0.8	1.1	1.6	2.4	2.8	3.9	3.9	3.9	
		oz·in	45.83	74.99	113.87	152.76	222.19	333.29	402.73	555.49	555.49	555.49	
DME37K8HP ↻ & 8DGM	Rated speed	r/min	120	72	48	36	24	14.4	12.4	7.8	5.4	2.3	
	Permission torque	N·m	0.53	0.89	1.2	1.7	2.6	3.9	3.9	3.9	3.9	3.9	
		oz·in	74.99	126.37	180.53	249.97	374.95	555.49	555.49	555.49	555.49	555.49	
DME37J8HPB & 8DGM	Rated speed	r/min	140	84	56	42	28.4	18	15.3	9.4	6.4	2.7	
	Permission torque	N·m	0.85	1.3	2.1	2.8	3.9	3.9	3.9	3.9	3.9	3.9	
		oz·in	120.82	194.42	305.52	402.73	555.49	555.49	555.49	555.49	555.49	555.49	

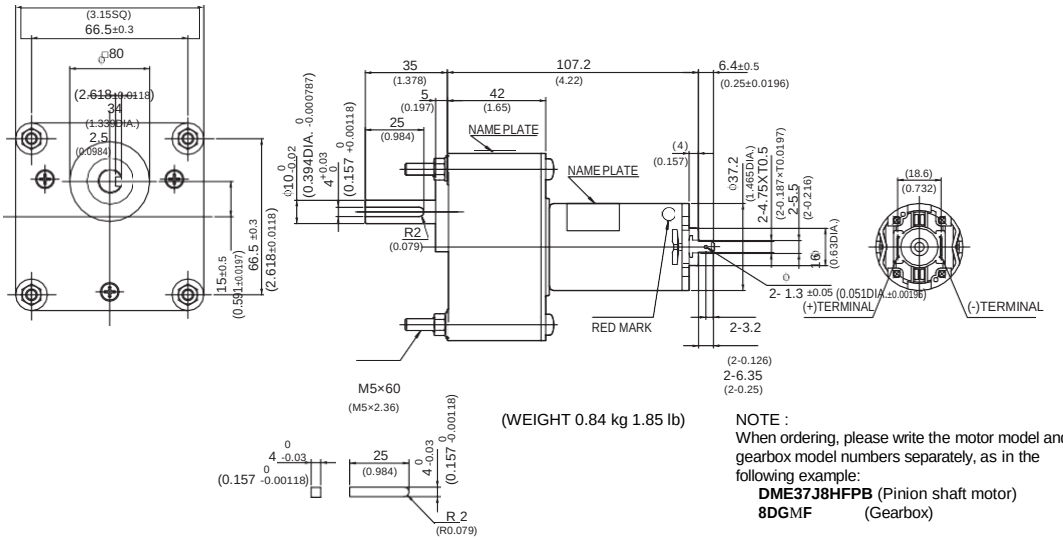
WITH GEARBOX

8DGF

8DGF

● DIMENSIONS Unit mm(inch)

DME37J8DGF



(WEIGHT 0.84 kg 1.85 lb)

NOTE :
When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
DME37J8HFPB (Pinion shaft motor)
8DGMF (Gearbox)

● with 8DGF TYPE GEARBOX MOTOR MODEL **DME37J8HFPB** & GEARBOX MODEL **8DG**M**F**

Model	Gear ratio		*25	*30	50	75	100	180
	Rated speed	r/min	168	140	84	56	42	23.3
DME37J8HFPB	Permission	N·m	0.71	0.85	1.3	1.8	2.5	4.6
& 8DGM**F**	torque	oz·in	101.38	120.82	194.42	263.86	361.07	652.7

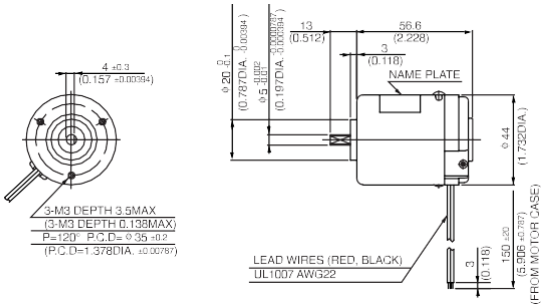
NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ○.

DME44

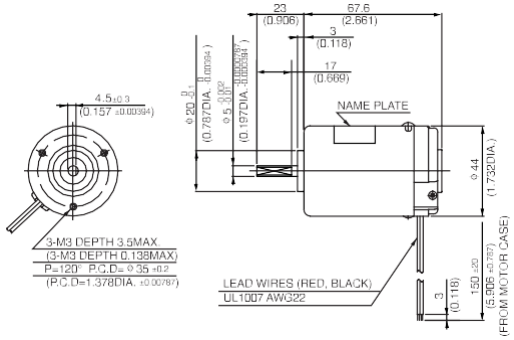
MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	9.2W	1.31A
SB	24V	9.2W	0.65A
BB	24V	14.8W	0.94A

● DIMENSIONS Unit mm(inch)

DME44SA, DME44SB

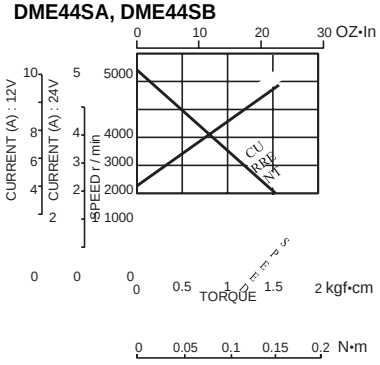


DME44BA, DME44BB

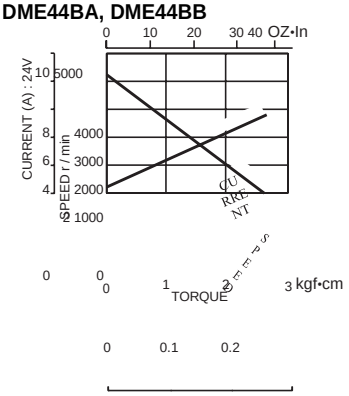


● CURRENT, SPEED-TORQUE CURVE

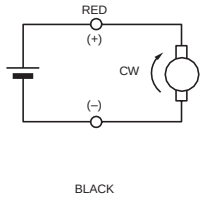
DME44SA, DME44SB



DME44BA, DME44BB



● CONNECTION

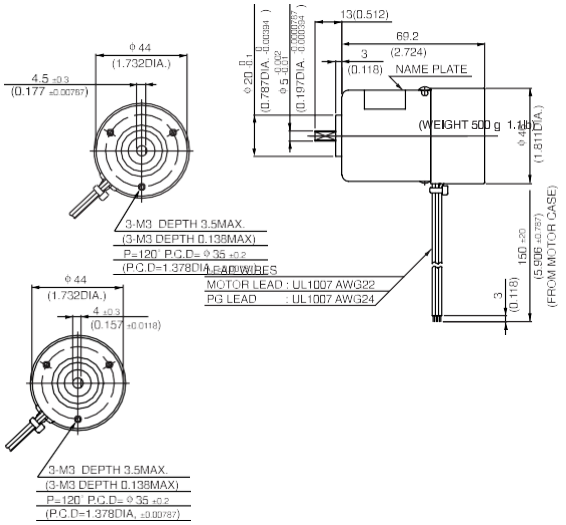


□ STANDARD SPECIFICATIONS

Model	Rated						No load		Stall torque		Weight	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in		
	W	V	mN-m	oz·in	A	r/min	A	r/min			g	lb
DME44SA	9.2	12	24	3.47	1.31	3600	0.31	4300	150	22.22	300	0.66
DME44SB	9.2	24	24	3.47	0.65	3600	0.15	4300	150	22.22	300	0.66
DME44BB	14.8	24	39	5.55	0.94	3600	0.16	4300	250	36.11	400	0.88

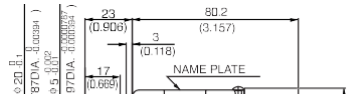
● REVOLUTION SENSOR MAGNET TYPE

DME44SMA, DME44SMB



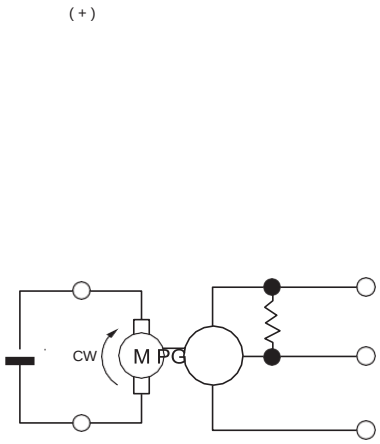
(WEIGHT 400 g 0.88 lb)

DME44BMB



● CONNECTION OF REVOLUTION SENSOR

DME44SMA, DME44SMB, DME44BMB



TION SENSOR ARE SHOWN ON PAGE 8.

□ SPECIFICATIONOFREVOLU

RED

(–) BLACK

ORANGE INPUT 5 [V]

YELLOW OUTPUT

BLU E GND

DME44

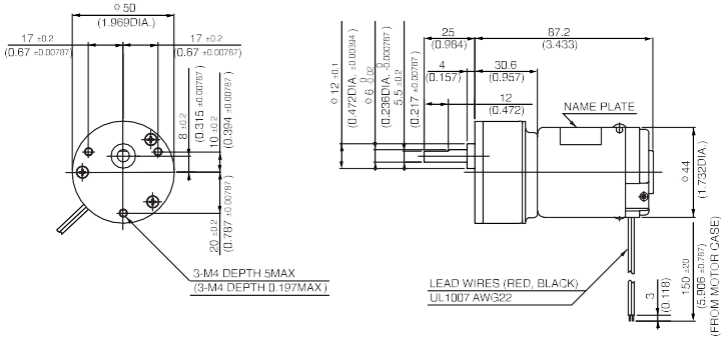
MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	9.2W	1.31A
SB	24V	9.2W	0.65A
BB	24V	14.8W	0.94A

WITH GEARBOX 50G

50G

● DIMENSIONS Unit mm(inch)

DME44S50G



(WEIGHT 400 g 0.88lb)

● with 50G TYPE GEARBOX

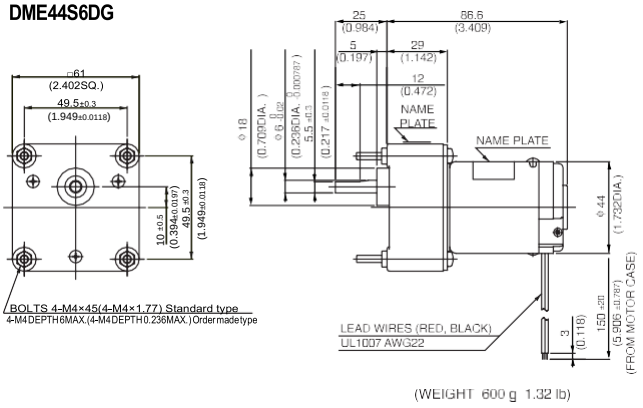
Model	Gear ratio		9	18	*27	*36	*54	*72
	Rated speed	r/min	400	200	133	100	66.6	52.3
DME44S50GM	Rated torque	N·m	0.18	0.35	0.48	0.64	0.96	0.98
		oz·in	25.00	49.99	68.05	90.27	136.09	138.87

WITH GEARBOX 6DG

6DG

● DIMENSIONS Unit mm(inch)

DME44S6DG



(WEIGHT 600 g 1.32 lb)

NOTE:
6DG gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME44S6HPB (Pinion shaft motor)
  6DGM (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME44S6H**M**B**

● with 6DG TYPE GEARBOX MOTOR MODEL **DME44S6HP** ↻ & GEARBOX MODEL **6DG**M

Model	Gear ratio		5	12.5	15	*25	*30	*50	*75	*100	150	180	250
	Rated speed	r/min	720	288	240	144	120	72	50.5	39.1	26.7	22.5	16.5
DME44S6HP ↻ **&6DG**M	Rated torque	N·m	0.1	0.25	0.29	0.44	0.53	0.89	0.98	0.98	0.98	0.98	0.98
		oz·in	13.89	34.72	41.66	62.49	74.99	126.37	138.87	138.87	138.87	138.87	138.87

Model	Gear ratio		300	450	*500	*750	*900	*1800
	Rated speed	r/min	13.8	9.3	8.4	5.6	4.7	2.3
DME44S6HP ↻ **&6DG**M	Rated torque	N·m	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87	138.87	138.87	138.87

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.

3: Enter the required voltage A or B in the ⟲.

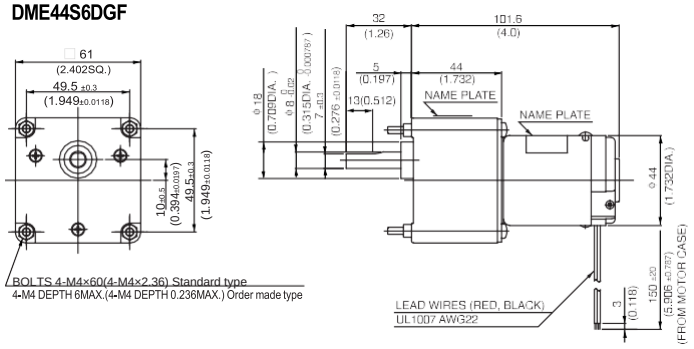
WITH GEARBOX

6DGF

6DGF

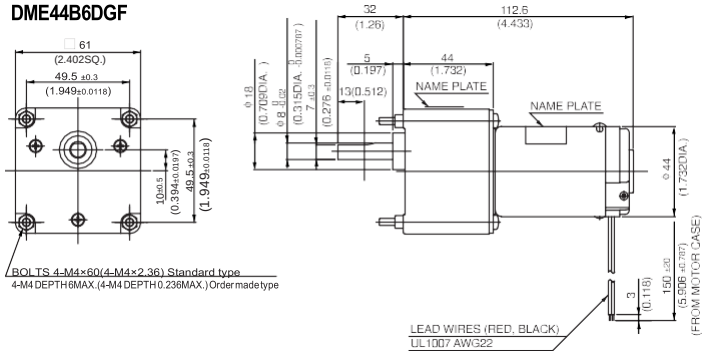
● DIMENSIONS Unit mm(inch)

DME44S6DGF



(WEIGHT 0.7 kg 1.54 lb)

DME44B6DGF



(WEIGHT 0.8 kg 1.76 lb)

NOTE:
6DGF gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME44B6HFPB (Pinion shaft motor)
  6DGM**F** (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME44B6HF**M**B**

● with 6DGF TYPE GEARBOX MOTOR MODEL **DME44S6HFP**, **DME44B6HFPB** & GEARBOX MODEL **6DG**M**F**

Model	Gear ratio		5	*12.5	*15	*25	*30	50	75	100	150	180
	Rated speed	r/min	720	288	240	144	120	72	48	36	24	20.6
DME44S6HFP & 6DGM**F**	Rated torque	N·m	0.1	0.22	0.27	0.44	0.53	0.80	1.2	1.6	2.4	2.4
		oz·in	13.89	30.55	37.50	62.49	74.99	113.87	166.65	222.19	333.29	347.18
DME44B6HFPB & 6DGM**F**	Rated speed	r/min	720	288	240	144	120	72	48	36.3	25.7	21.8
	Rated torque	N·m	0.16	0.35	0.43	0.72	0.85	1.3	1.9	2.4	2.4	2.4
		oz·in	22.22	49.99	59.71	101.38	120.82	180.53	263.86	347.18	347.18	347.18

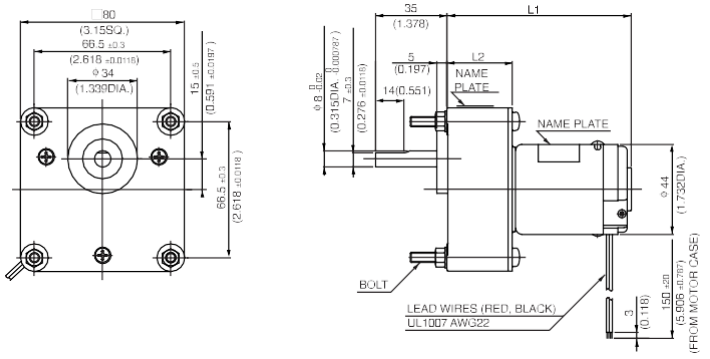
WITH GEARBOX

8DG

8DG

● DIMENSIONS Unit mm(inch)

DME44S8DG



NOTE :
When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
DME44B8HPB (Pinion shaft motor)
8DGM (Gearbox)

GEAR RATIO	L1		L2		BOLT		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	kg	lb
30~150	90.1	3.547	32	1.26	M5X50	M5X1.969	0.8	1.76
250~1800	100.1	3.941	42	1.654	M5X60	M5X2.362	0.9	1.98

NOTE 1: Enter the required reduction ratio in the M.
2: ■ Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ◇.

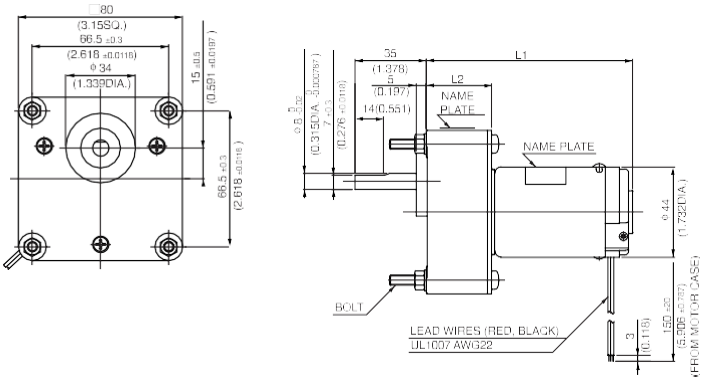
DME44

WITH GEARBOX

8DG

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	9.2W	1.31A
SB	24V	9.2W	0.65A
BB	24V	14.8W	0.94A

DME44B8DG



GEAR RATIO	L1		L2		BOLT		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	kg	lb
30~150	101.1	3.98	32	1.26	M5X50	M5X1.969	0.9	1.98
250~1800	111.1	4.374	42	1.654	M5X60	M5X2.362	1.0	2.2

● with 8DG TYPE GEARBOX MOTOR MODEL **DME44S8HP** ↻, **DME44B8HPB** & GEARBOX MODEL **8DG**M

Model	Gear ratio		*30	*50	*75	*90	*100	*150	250
	Rated speed	r/min	120	72	48	40	36	24	14.4
DME44S8HP ↻ **&8DG**M	Rated torque	N·m	0.53	0.89	1.3	1.6	1.8	2.7	3.9
		oz·in	74.99	126.37	180.53	222.19	249.97	374.95	555.49
DME44B8HPB **&8DG**M	Rated speed	r/min	120	72	48	40	36	24.4	15.5
	Rated torque	N·m	0.85	1.4	2.1	2.5	2.8	3.9	3.9
		oz·in	120.82	194.42	305.52	361.07	402.73	555.49	555.49

Model	Gear ratio		300	*500	*750	*1800
	Rated speed	r/min	12.4	7.8	5.4	2.3
DME44S8HP ↻ **&8DG**M	Rated torque	N·m	3.9	3.9	3.9	3.9
		oz·in	555.49	555.49	555.49	555.49
DME44B8HPB **&8DG**M	Rated speed	r/min	13.1	8	5.5	2.3
	Rated torque	N·m	3.9	3.9	3.9	3.9
		oz·in	555.49	555.49	555.49	555.49

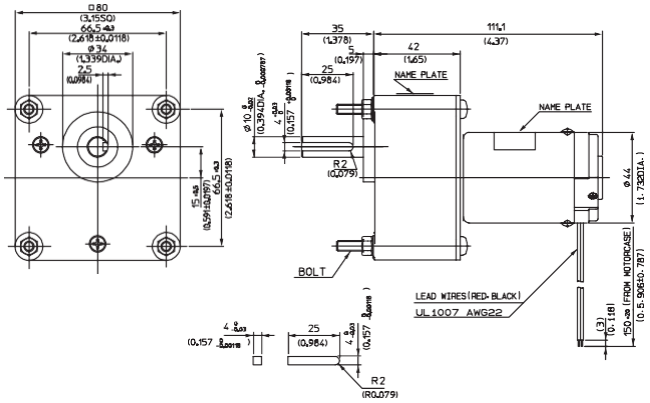
WITH GEARBOX

8DGF

8DGF

● DIMENSIONS Unit mm(inch)

DME44B8DGF



NOTE :
When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
DME44B8HFPB (Pinion shaft motor)
8DGMF (Gearbox)

GEAR RATIO	BOLT		WEIGHT	
	(mm)	(inch)	kg	lb
25~150	M5X60	M5X2.36	1.0	2.2

□ with 8DGF TYPE GEARBOX MOTOR MODEL **DME44B8HFPB** & GEARBOX MODEL **8DG**MF

Model	Gear ratio		*25	*30	50	75	100	150
	Rated speed	r/min	144	120	72	48	36	24
DME44B8HPB		N·m	0.71	0.85	1.3	1.9	2.5	3.8

& 8DGM**F**	Rated torque	oz·in	101.38	120.82	194.42	263.86	361.07	541.60

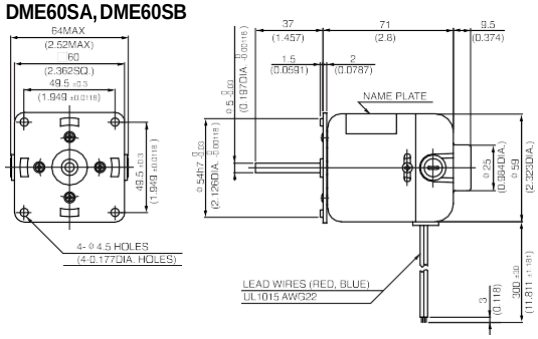
NOTE 1: Enter the required reduction ratio in the M.
2: Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the .

DME60

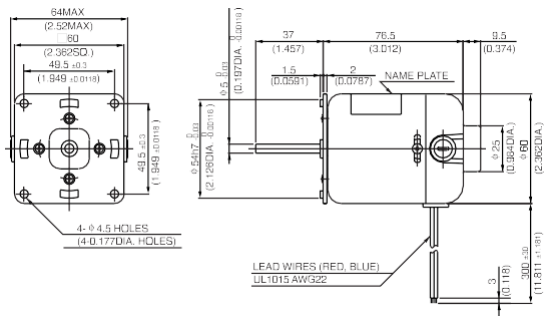
MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	13W	2.07A
SB	24V	13W	1A
BB	24V	26W	1.79A

DIMENSIONS Unit mm(inch)

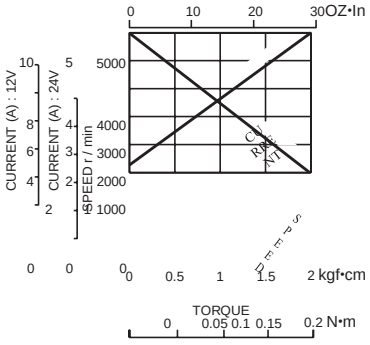
DME60SA, DME60SB



DME60BB



DME60SA, DME60SB



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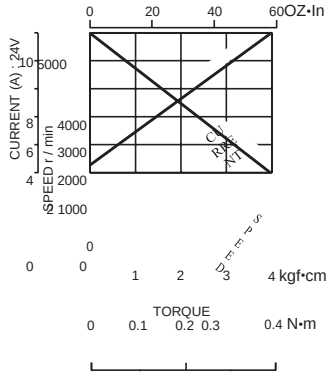
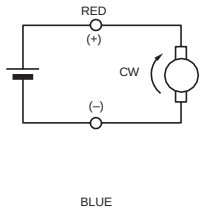




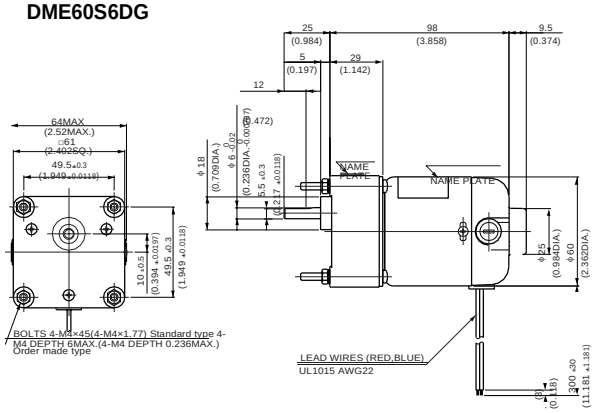
STANDARD SPECIFICATIONS

Model	Rated						No load		Stall torque		Weight	
	Output	Voltage	Torque		Current	Speed	Current	Speed	mN-m	oz·in		
	W	V	mN-m	oz·in	A	r/min	A	r/min			g	lb
DME60SA	13	12	29	4.17	2.07	4300	0.6	5000	196	16.66	600	1.32
DME60SB	13	24	29	4.17	1.00	4300	0.33	5000	196	16.66	600	1.32
DME60BB	26	24	59	8.33	1.79	4300	0.42	5000	392	55.55	650	1.43

WITH GEARBOX
6DG

DIMENSIONS Unit mm(inch)

DME60S6DG



NOTE:
6DG gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME60S6HPB (Pinion shaft motor)
  6DGM (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME60S6H**M**B**

with 6DG TYPE GEARBOX MOTOR MODEL **DME60S6HP** & GEARBOX MODEL **6DG**M

Model	Gear ratio		5	12.5	15	*25	*30	*50	*75	*100	150	180	250
	Rated speed	r/min	860	344	286	172	143	87.2	60.9	46.8	35	30	21
DME60S6HP **& 6DG**M	Rated torque	N·m	0.12	0.29	0.35	0.53	0.64	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	16.66	41.66	49.99	74.99	90.27	138.87	138.87	138.87	138.87	138.87	138.87

Model	Gear ratio	300	450	*500	*750	*900	*1800
	Rated speed r/min	17	12	9.8	6.6	5.5	2.7

DME60S6HP ⓑ **&6DG**M	Rated torque	N·m	0.98	0.98	0.98	0.98	0.98	0.98
		oz·in	138.87	138.87	138.87	138.87	138.87	138.87

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ⓑ.

DME60

WITH GEARBOX

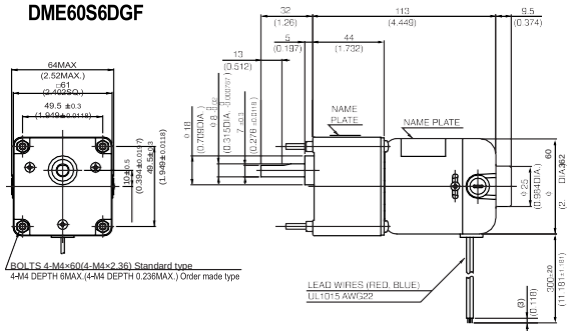
6DGF

6DGF

MODEL CODE	VOLTAGE	OUTPUT	CURRENT
SA	12V	13W	2.07A
SB	24V	13W	1A
BB	24V	26W	1.79A

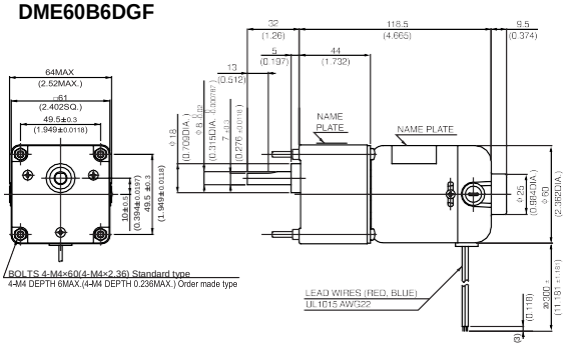
● DIMENSIONS Unit mm(inch)

DME60S6DGF



(WEIGHT 1.0 kg 2.2 lb)

DME60B6DGF



(WEIGHT 1.05 kg 2.3 lb)

NOTE:
6DGF gearbox are available with either 4.5mm diameter mounting holes or M4 x 6mm tapped holes.

- Gearboxes with 4.5mm diameter mounting holes are available from stock. When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
  DME60S6HFPB (Pinion shaft motor)
  6DGM**F** (Gearbox)
- Gearboxes with M4 x 6mm tapped mounting holes are available on request. When ordering, please write the combine motor and gearbox model, as in the following example : **DME60S6HF**M**B**

● with 6DGF TYPE GEARBOX MOTOR MODEL **DME60S6HFP** ○, **DME60B6HFPB** & GEARBOX MODEL **6DG**M**F**

Model	Gear ratio		5	*12.5	*15	*25	*30	50	75	100	150	180
	Rated speed	r/min	860	344	286	172	143	86	57.3	43	29.4	25
DME60S6HFP ○ **&6DG**M	Rated torque	N·m	0.12	0.27	0.32	0.53	0.64	0.96	1.4	1.9	2.4	2.4
		oz·in	16.66	37.50	45.83	74.99	48.61	136.09	194.42	263.86	347.18	347.18
DME60B6HFPB &6DGM	Rated speed	r/min	860	344	286	172	143	86	58.7	45	31.3	26.4
	Rated torque	N·m	0.24	0.53	0.64	1.0	1.3	1.9	2.4	2.4	2.4	2.4
		oz·in	33.33	74.99	90.27	152.76	180.53	263.86	347.18	347.18	347.18	347.18

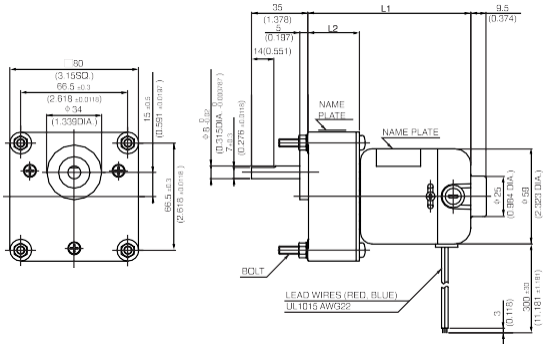
WITH GEARBOX

8DG

8DG

● DIMENSIONS Unit mm(inch)

DME60S8DG



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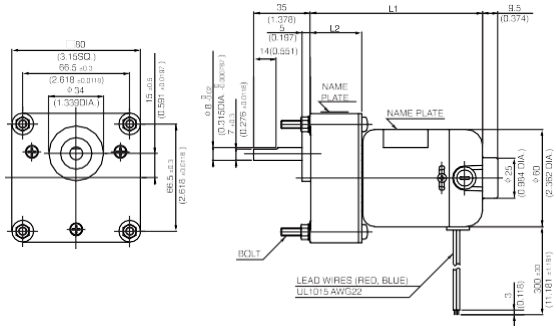


NOTE :
When ordering, please write the motor model and gearbox model numbers separately, as in the following example:
DME60B8HPB (Pinion shaft motor)
8DGM (Gearbox)

GEAR RATIO	L1		L2		BOLT		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	kg	lb
30~150	101	3.98	32	1.26	M5X50	M5X1.969	1.1	2.4
250~1800	111	4.37	42	1.654	M5X60	M5X2.362	1.2	2.6

GEAR RATIO	L1		L2		BOLT		WEIGHT	
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	kg	lb
30~150	106.5	4.193	32	1.26	M5X50	M5X1.969	1.15	2.5
250~1800	116.5	4.587	42	1.654	M5X60	M5X2.362	1.25	2.8

NOTE 1: Enter the required reduction ratio in the M.
2: ■Rotation of gearbox shaft is in reverse of rotation of motor.
3: Enter the required voltage A or B in the ○.

WITH GEARBOX
8DG

● with 8DG TYPE GEARBOX MOTOR MODEL **DME60S8HP**㉒, **DME60B8HPB** & GEARBOX MODEL **8DG**M

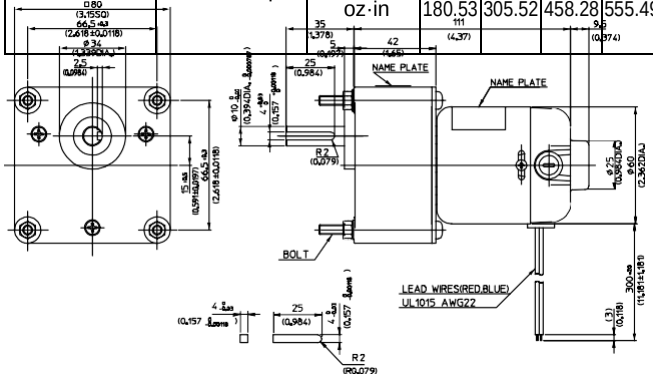
Model	Gear ratio		*30	*50	*75	*100	*150	250	300	*500	*750	*1800
	Rated speed	r/min	143	86	57.3	43	28.6	17.7	15.1	9.3	6.4	2.7
DME60S8HP ㉒ **& 8DG**M	Rated torque	N·m	0.64	1.0	1.6	2.1	3.2	3.9	3.9	3.9	3.9	3.9
		oz·in	90.27	152.76	222.19	305.52	458.28	555.49	555.49	555.49	555.49	555.49
DME60B8HPB & 8DGM	Rated speed	r/min	143	86	57.3	43.6	30.5	18.8	15.8	9.7	6.5	2.7
DME60S8DGF	Rated torque	N·m	1.3	2.1	3.2	3.9	3.9	3.9	3.9	3.9	3.9	3.9
		oz·in	180.53	305.52	458.28	555.49	555.49	555.49	555.49	555.49	555.49	555.49

NOTE :
When ordering, please write the motor model and gearbox model numbers separately as in the following example:
DME60B8HFPB (Pinion shaft motor)
8DGM**F** (Gearbox)

WITH GEARBOX
8DGF

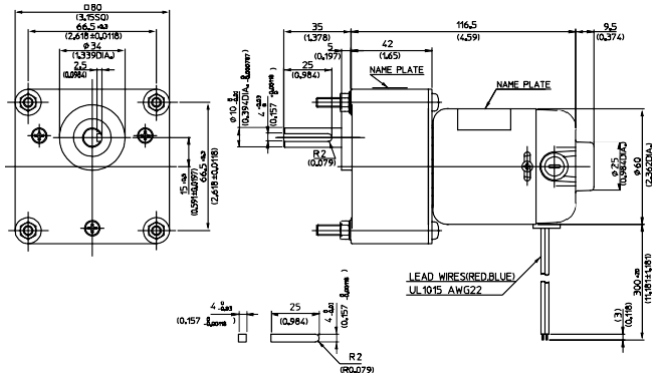
8DGF

● DIMENSIONS Unit mm(inch)



GEAR RATIO	BOLT		WEIGHT	
	(mm)	(inch)	kg	lb
25~150	M5X60	M5X2.36	1.20	2.6

DME60B8DGF



GEAR RATIO	BOLT		WEIGHT	
	(mm)	(inch)	kg	lb
25~150	M5X60	M5X2.36	1.25	2.8

● with 8DGF TYPE GEARBOX MOTOR MODEL **DME60S8HFP**㉒, **DME60B8HFPB** & GEARBOX MODEL **8DG**M**F**

Model	Gear ratio		*25	*30	50	75	100	150
	Rated speed	r/min	172	143	86	57.3	43	28.6
DME60S8HPF ㉒ **& 8DG**M**F**	Rated torque	N·m	0.53	0.64	0.96	1.4	1.9	2.9
		oz·in	74.99	90.27	152.76	194.42	263.86	402.73
DME60B8HFPB & 8DGM**F**	Rated speed	r/min	172	143	86	57.3	43	28.6
	Rated torque	N·m	1.0	1.3	1.9	2.9	3.8	5.8
		oz·in	152.76	180.53	305.52	402.73	541.60	819.34

NOTE 1: Enter the required reduction ratio in the M.
2: ㉒Rotation of gearbox shaft is in reverse of rotation of motor.

3: Enter the required voltage A or B in the <5>.

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WARNING

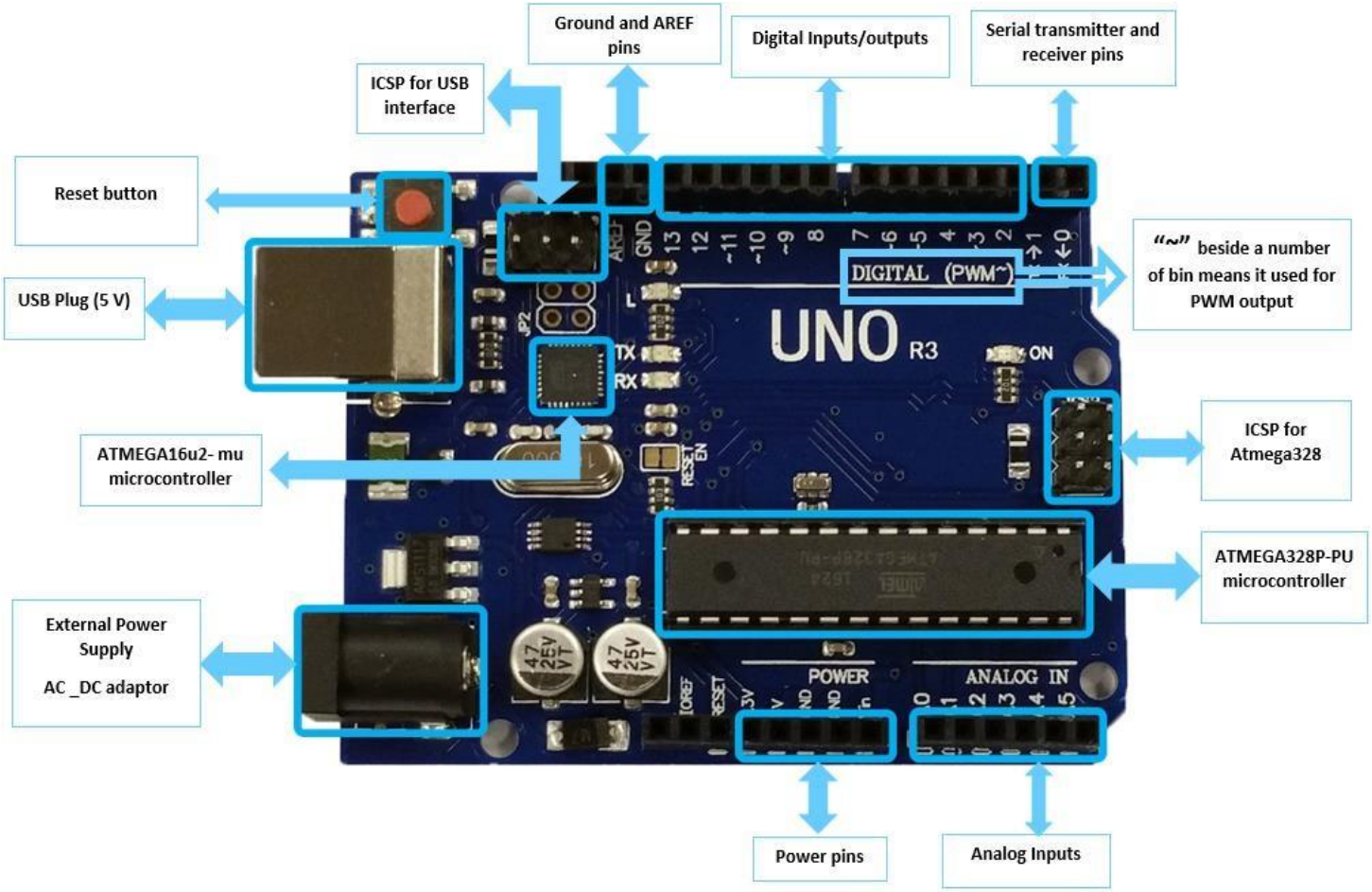
- Please do not exceed the specifications noted in this catalogue, otherwise there is a chance of electric shock, injury, or other damage.
- Any modifications made to this motor are beyond the limits of our guarantee NIDEC SERVO cannot take responsibility for any customer modifications.
- Please ensure that a thorough evaluation has been done before using this motor in medical equipment or other devices related to human lives.
- Please ensure that a thorough evaluation has been done before using this motor in applications that have a serious effect on the public.

NOTE

- Figures in this catalogue are average measured values. Please request the product delivery specification when preparing a purchase specification.
- The dimensions, specifications, and components contained in this catalogue are subject to change without prior notice due to further product improvements.

06SZ1K1

Arduino Uno R3



INTRODUCTION

Arduino is used for building different types of electronic circuits easily using of both a physical programmable circuit board usually microcontroller and piece of code running on computer with USB connection between the computer and Arduino.

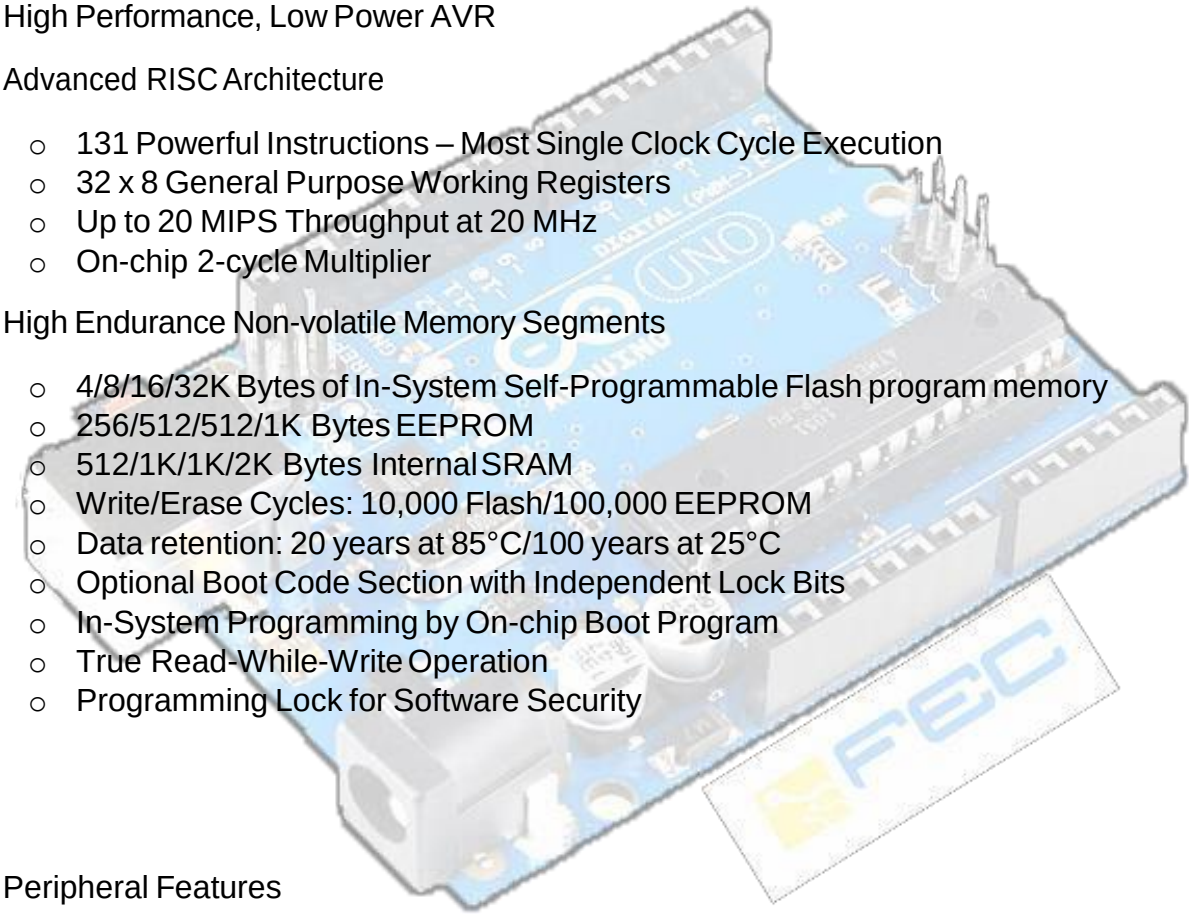
Programming language used in Arduino is just a simplified version of C++ that can easily replace thousands of wires with words.

ARDUINO UNO-R3 PHYSICAL COMPONENTS

ATMEGA328P-PU microcontroller

The most important element in Arduino Uno R3 is ATMEGA328P-PU is an 8-bit Microcontroller with flash memory reach to 32k bytes. It's features as follow:

- High Performance, Low Power AVR
- Advanced RISC Architecture
    - 131 Powerful Instructions – Most Single Clock Cycle Execution
    - 32 x 8 General Purpose Working Registers
    - Up to 20 MIPS Throughput at 20 MHz
    - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
    - 4/8/16/32K Bytes of In-System Self-Programmable Flash program memory
    - 256/512/512/1K Bytes EEPROM
    - 512/1K/1K/2K Bytes Internal SRAM
    - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
    - Data retention: 20 years at 85°C/100 years at 25°C
    - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
    - Programming Lock for Software Security



- Peripheral Features
    - Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
    - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
    - Real Time Counter with Separate Oscillator
    - Six PWM Channels
    - 8-channel 10-bit ADC in TQFP and QFN/MLF package
    - Temperature Measurement
    - 6-channel 10-bit ADC in PDIP Package
    - Temperature Measurement
    - Programmable Serial USART

- Master/Slave SPI Serial Interface
- Byte-oriented 2-wire Serial Interface (Philips I2 C compatible)
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- Interrupt and Wake-up on Pin Change

• Special Microcontroller Features

- Power-on Reset and Programmable Brown-out Detection
- Internal Calibrated Oscillator
- External and Internal Interrupt Sources
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

• I/O and Packages

- 23 Programmable I/O Lines
- 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

• Operating Voltage:

- 1.8 - 5.5V

• Temperature Range:

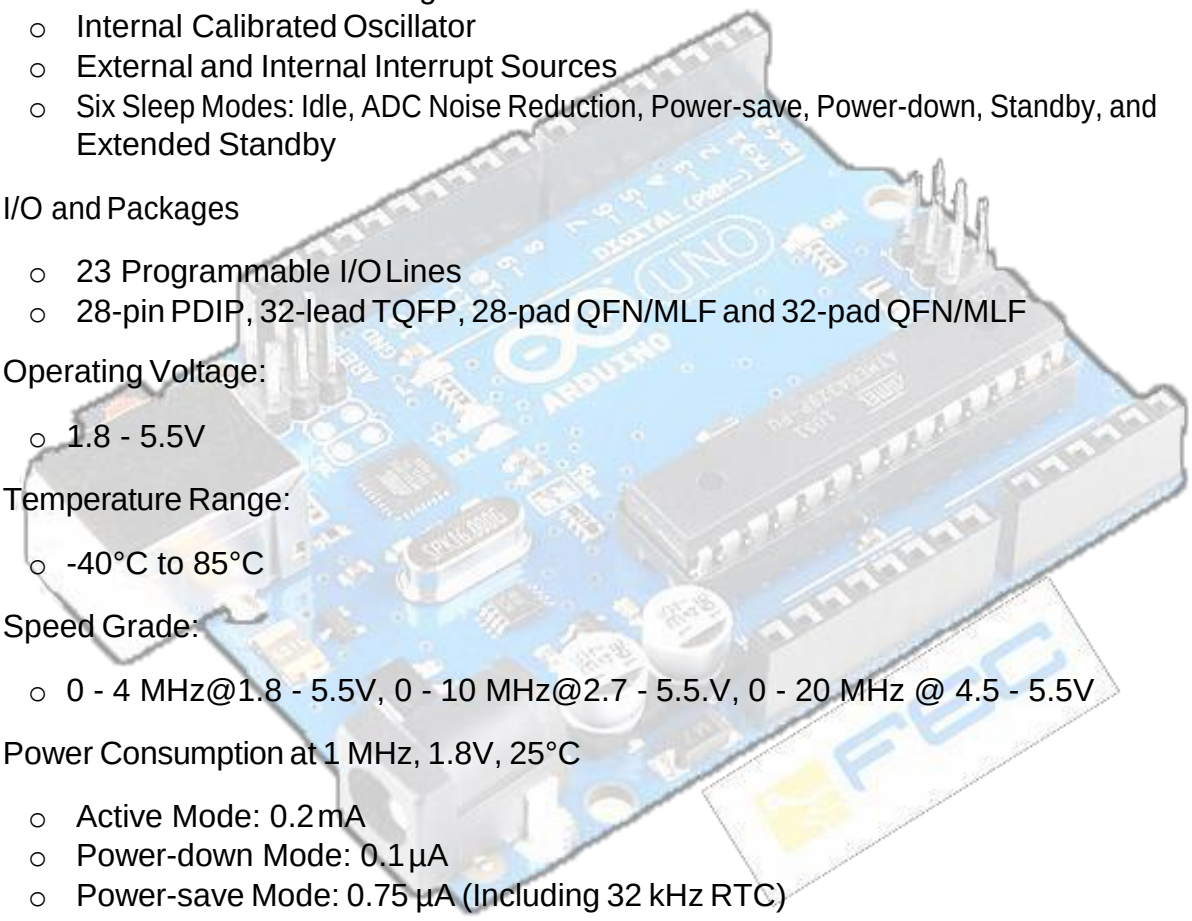
- -40°C to 85°C

• Speed Grade:

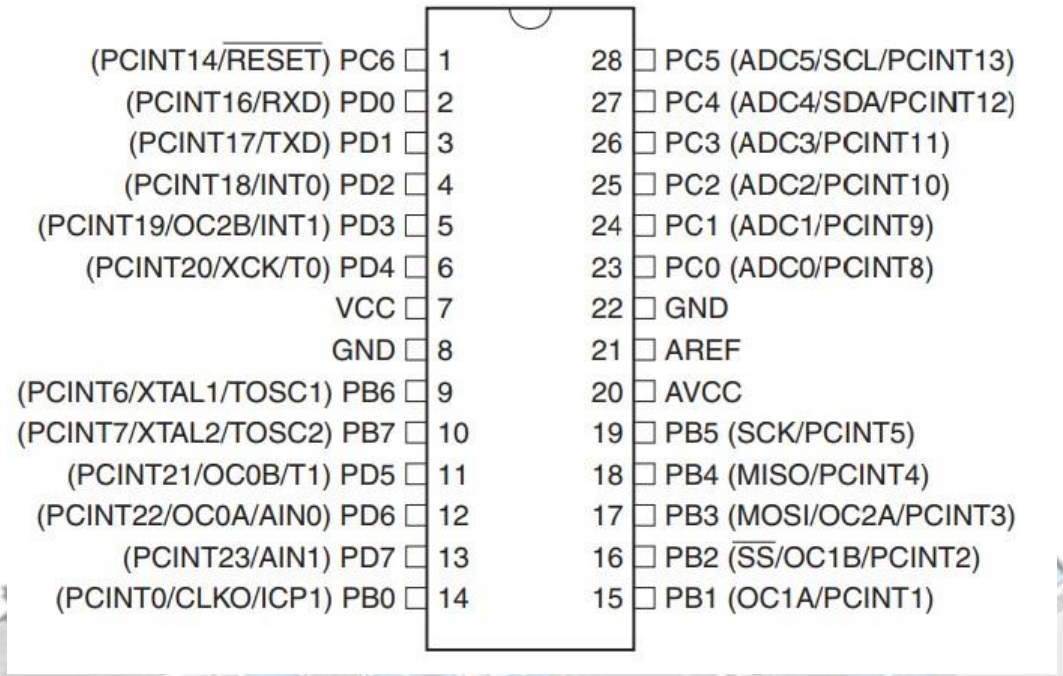
- 0 - 4 MHz@1.8 - 5.5V, 0 - 10 MHz@2.7 - 5.5.V, 0 - 20 MHz @ 4.5 - 5.5V

• Power Consumption at 1 MHz, 1.8V, 25°C

- Active Mode: 0.2 mA
- Power-down Mode: 0.1 µA
- Power-save Mode: 0.75 µA (Including 32 kHz RTC)



- Pin configuration



ATMEGA16u2- mu microcontroller

Is a 8-bit microcontroller used as USB driver in Arduino uno R3 it's features as follow:

- High Performance, Low Power AVR

• Advanced RISC Architecture

- 125 Powerful Instructions – Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Fully Static Operation
- Up to 16 MIPS Throughput at 16 MHz

• Non-volatile Program and Data Memories

- 8K/16K/32K Bytes of In-System Self-Programmable Flash
- 512/512/1024 EEPROM
- 512/512/1024 Internal SRAM
- Write/Erase Cycles: 10,000 Flash/ 100,000 EEPROM
- Data retention: 20 years at 85˚C/ 100 years at 25˚C

- Optional Boot Code Section with Independent Lock Bits
- In-System Programming by on-chip Boot Program hardware-activated after reset
- Programming Lock for Software Security

• USB 2.0 Full-speed Device Module with Interrupt on Transfer Completion

- Complies fully with Universal Serial Bus Specification REV 2.0
- 48 MHz PLL for Full-speed Bus Operation: data transfer rates at 12 Mbit/s
- Fully independent 176 bytes USB DPRAM for endpoint memory allocation
- Endpoint 0 for Control Transfers: from 8 up to 64-bytes
- 4 Programmable Endpoints:
  - IN or Out Directions
  - Bulk, Interrupt and Isochronous Transfers
  - Programmable maximum packet size from 8 to 64 bytes
  - Programmable single or double buffer
- Suspend/Resume Interrupts
- Microcontroller reset on USB Bus Reset without detach
- USB Bus Disconnection on Microcontroller Request

• Peripheral Features

- One 8-bit Timer/Counters with Separate Prescaler and Compare Mode (two 8-bit PWM channels)
- One 16-bit Timer/Counter with Separate Prescaler, Compare and Capture Mode (three 8-bit PWM channels)
- USART with SPI master only mode and hardware flow control (RTS/CTS)
- Master/Slave SPI Serial Interface
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- Interrupt and Wake-up on Pin Change

• On Chip Debug Interface (debug WIRE)

• Special Microcontroller Features

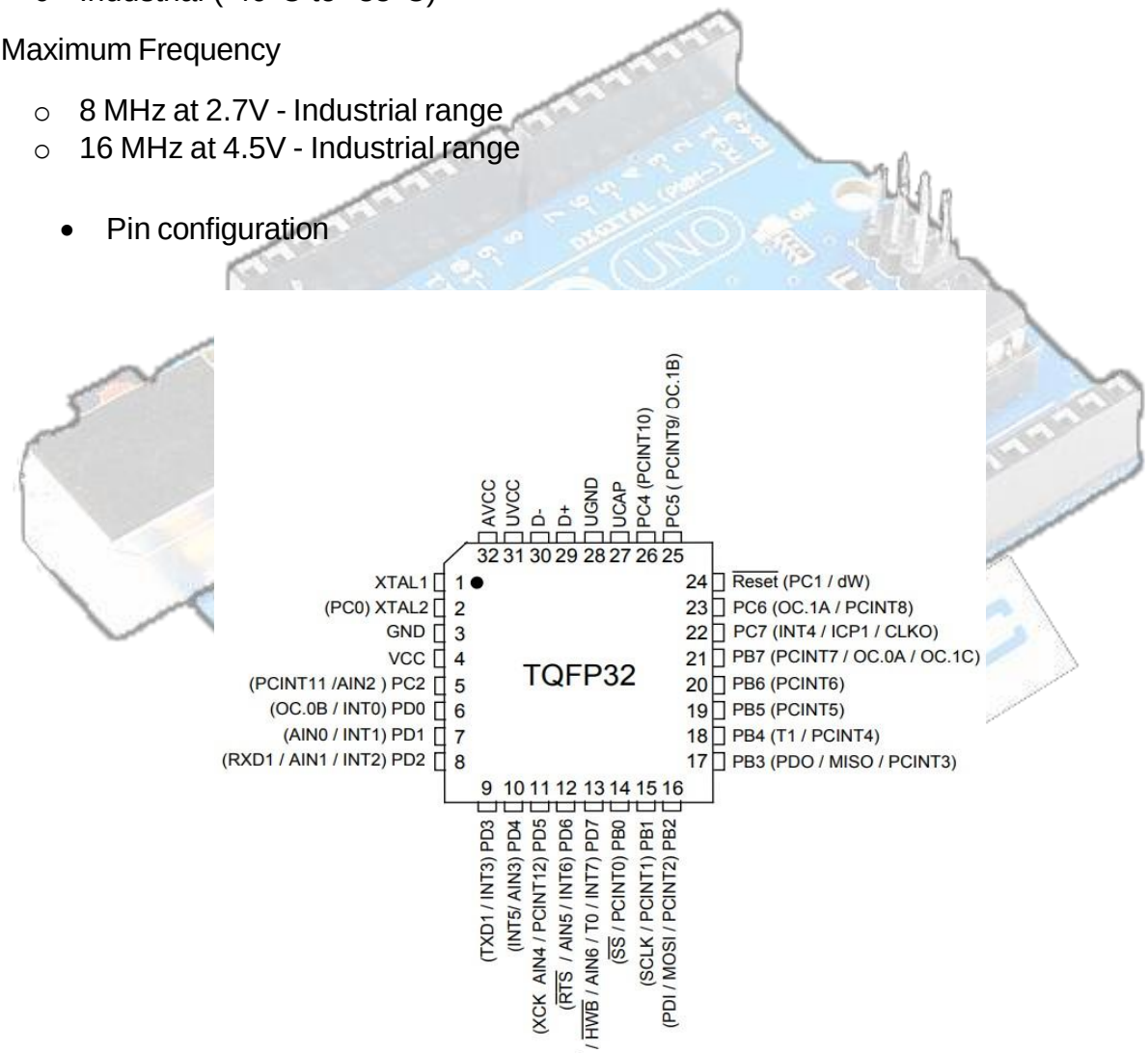
- Power-On Reset and Programmable Brown-out Detection
- Internal Calibrated Oscillator
- External and Internal Interrupt Sources
- Five Sleep Modes: Idle, Power-save, Power-down, Standby, and Extended Standby

• I/O and Packages

- 22 Programmable I/O Lines
- QFN32 (5x5mm) / TQFP32 packages

- Operating Voltages
  - 2.7 - 5.5V
- Operating temperature
  - Industrial (-40°C to +85°C)
- Maximum Frequency
  - 8 MHz at 2.7V - Industrial range
  - 16 MHz at 4.5V - Industrial range

- Pin configuration



OTHER ARDUINO UNO R3 PARTS

Input and Output

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

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

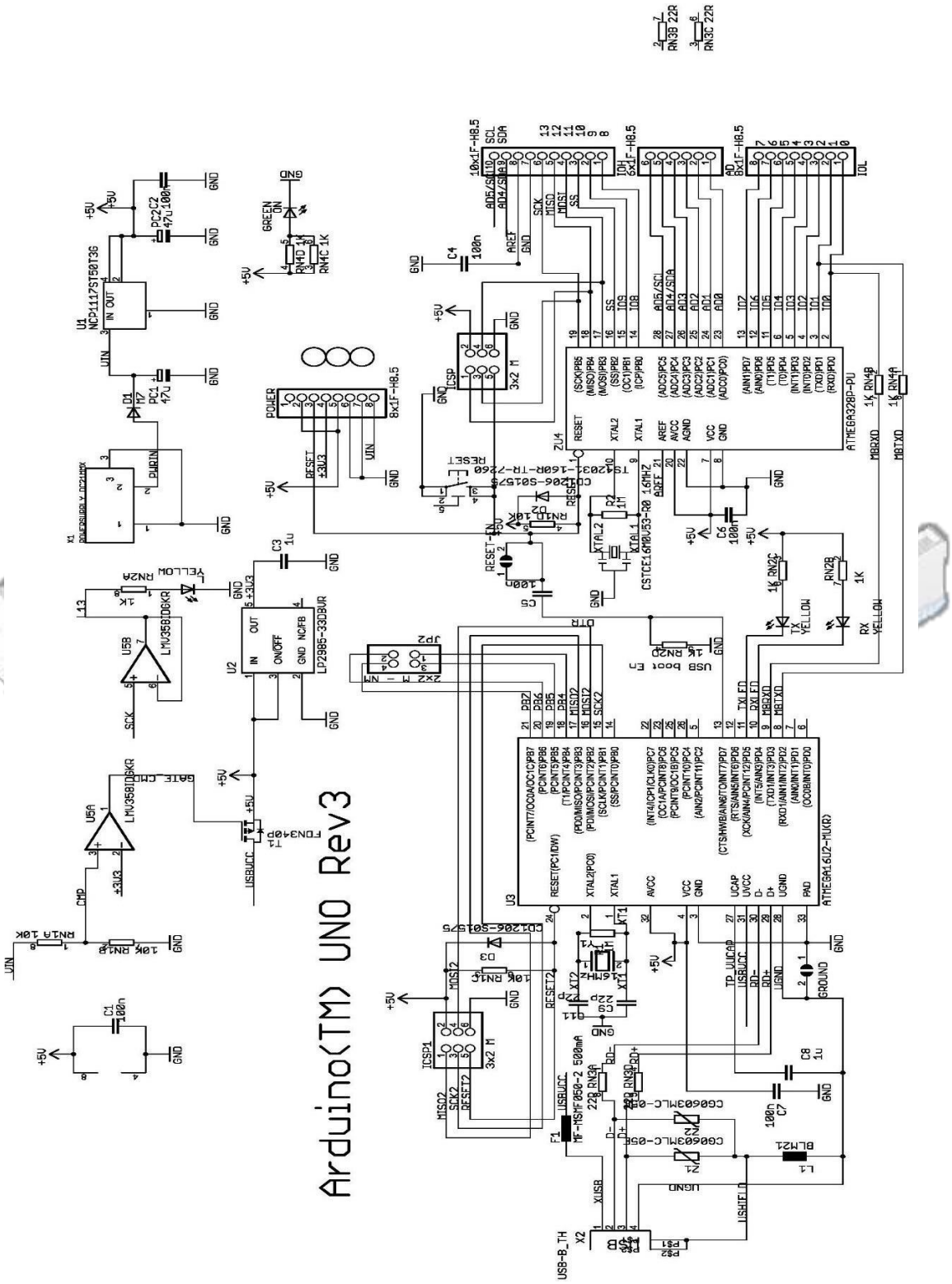
The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function. Additionally, some pins have specialized functionality:

- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

There are a couple of other pins on the board:

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

ARDUINO UNO R3 SCHEMATIC DIAGRAM



EN - For pricing and availability in your local country please visit one of the below links:

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AZ8107 AZ8112 AZ8166 AZ8169 AZ8104

AZ8104 AZ8166

EN
This Datasheet is presented by the manufacturer

DE
Dieses Datenblatt wird vom Hersteller bereitgestellt

FR
Cette fiche technique est présentée par le fabricant

’06–’07

Panasonic

Ideas for life

Limit Switches

These materials are printed on ECF pulp.
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Please contact .....

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http://www.nais-e.com/

Matsushita Electric Works, Ltd.

Panasonic

ARCT1B272E 200609-1YT

Printed in Japan.

Limit Switches
ARCT1B272E '06.9

Matsushita Electric Works, Ltd.

Panasonic
ideas for life

COMPACT SIZE LIMIT SWITCHES

VL (AZ8) Mini Limit Switches

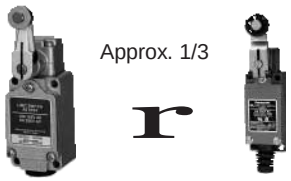
A compact and accurate vertical limit switch. Type with a lamp which makes maintenance convenient; either a neon AC powered lamp or an LED DC powered lamp.

Standard type (Roller arm) | With lamps

RoHS Directive compatibility information
http://www.nais-e.com/

FEATURES

1. Compact design approximately 1/3 of the AZ5 limit switches



AZ5 type | VL

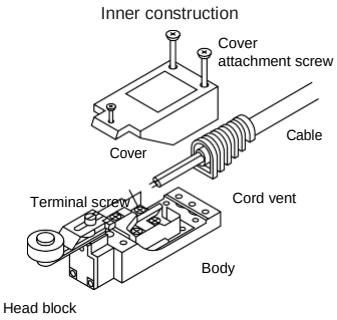
2. Au-clad contacts that can even use low level circuit and little chattering and bouncing

The built-in switch has Au-clad contacts with excellent contact reliability and uses a crossbar contact method, and moreover, has a dual cutoff circuit (1 Form A 1 Form B contact) with little chattering and bouncing due to computer-operated analysis.

3. Easy wiring with full-open terminals

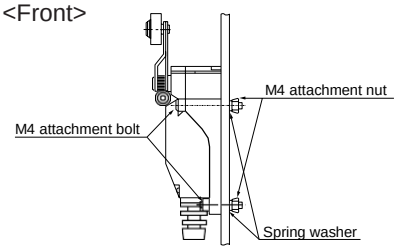
When the cover is removed, the terminals are open as far as the flank, so the necessity to insert your fingers into a case to complete the wiring has been removed. Moreover, the wiring space is large despite the compact size, and the terminals are spread in a tiered array, so that wiring work can be completed very easily.

The cable can either be screwed in directly, or can use U-shaped and circular pressure terminals.

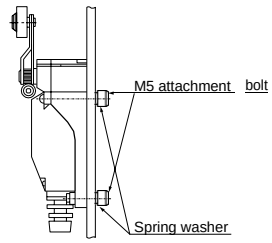


4. Mounting are possible to both front and back

<Front>



<Back>



5. Type with a lamp that can be used with a wide range of voltages

- With neon lamp
  Compatible with: 100 and 200V AC ;
  Even at 100V AC, sufficient luminosity is achieved through the diamond-cut lens. Also with a long lifespan of more than 20 thousand hours.
- With LED lamp
  Covers 6 to 48V DC and comes in three types, 6V DC, 12V DC, 24 to 48V DC
  Uses two highly luminescent LEDs and in addition, sufficient luminosity is achieved through the diamond-cut lens.

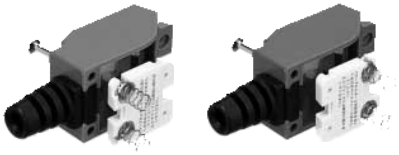
6. Lamp connection can be either spring type or lead wire type

- Spring type (wiring unnecessary)
  (With neon or LED lamp type)
  Wiring is unnecessary because the lamp is directly connected to the terminals. By simply changing the direction of the lamp holder attachment, it is possible to display both lights during inoperability and during operation (however, if both N.O.

and N.C. loads are connected, only the inoperability lamp can be displayed.)

Construction permits lamp attachment method to be changed.

Operating lamp | Inoperability lamp (with shipping)



- Lead wiring type <Current leakage: 0>
  (LED lamp type only)
  Because the wiring can be made parallel to the load, current leakage from the lamp can be reduced to 0. Even with a slight leak, the electronic circuit incurring the leak can be used safely.

7. Dust-proof, waterproof, oil resistant construction

The main unit and the cover are sealed with rubber packing, and the cord runner is doubly sealed by the cord vent. The actuator is sealed by both a rubber cap and an O ring in all models. Also, the lens and cover are formed simultaneously with the lamp type, and moreover, a nameplate is affixed to the upper surface, thereby improving the already excellent waterproof capabilities.
(Note: Applications directly involving the cord entrance and the locations which are always wet and oily, or submersion in water or oil, cannot be used.)

TYPICAL APPLICATIONS

Ideal for general plant facilities such as engineering machinery, conveyer machinery, and assembly lines
LED lamp type is also compatible with low-voltage DC control circuits such as in PCs and computers.

PRODUCT TYPE

1. Standard type

Actuator	Part No.
Push plunger	AZ8111
Roller plunger	AZ8112
Cross roller plunger	AZ8122
Roller arm	AZ8104
Adjustable roller arm	AZ8108
Adjustable rod	AZ8107
Flexible rod	AZ8166
Spring wire	AZ8169

Note) When ordering an overseas-specified product,refer to the “FOREIGN STANDARDS” given below.

2. With neon lamp

Lamp connection	Actuator	Lamp rating	Part No.
Spring type	Push plunger	100 to 200V AC	AZ811106
	Roller plunger		AZ811206
	Cross roller plunger		AZ812206
	Roller arm		AZ810406
	Adjustable roller arm		AZ810806
	Adjustable rod		AZ810706
	Flexible rod		AZ816606
	Spring wire		AZ816906

Note) When ordering an overseas-specified product,refer to the “FOREIGN STANDARDS” given below.

3. With LED

Lamp connection	Actuator	Lamp rating	
		12V DC	24 to 48V DC
		Part No.	
Spring type	Push plunger	AZ8111161	AZ811116
	Roller plunger	AZ8112161	AZ811216
	Cross roller plunger	AZ8122161	AZ812216
	Roller arm	AZ8104161	AZ810416
	Adjustable roller arm	AZ8108161	AZ810816
	Adjustable rod	AZ8107161	AZ810716
	Flexible rod	AZ8166161	AZ816616
	Spring wire	AZ8169161	AZ816916
Lead wire type	Push plunger	AZ8111661	AZ811166
	Roller plunger	AZ81122661	AZ811266
	Cross roller plunger	AZ8122661	AZ812266
	Roller arm	AZ8104661	AZ810466
	Adjustable roller arm	AZ8108661	AZ810866
	Adjustable rod	AZ8107661	AZ810766
	Flexible rod	AZ8166661	AZ816666
	Spring wire	AZ8169661	AZ816966

Notes) 1. LED rating 6V DC type is available. When ordering, add suffix 162(spring type) or 662(lead wire type) to the standard part No.

2. The 24 to 48V DC rated lamp is recommended for PC input use.

3. The roller arm and adjustable roller arm are available with metal rollers on a custom-made basis. Please inquire.

4. Option

	Application	Part No.
VL limit conduit adapter	VL, VL with lamp, VL-T	AZ8801

FOREIGN STANDARDS

Standard	Applicable product	Part No.
UL	File No. : E122222 Ratings : 5A 250V AC Pilot duty B300 Product type : Standard model, with neon lamp	Order by standard part No. However, add “9” to the end of the part No. for the model with neon lamp.
C-UL	File No. : E122222 Ratings : 5A 250V AC Pilot duty B300 Product type : Standard model, with neon lamp	
TÜV	File No. : J9551203 Ratings : AC-15 2A/250V~ Product type : Standard model only	Order by standard part No.

SPECIFICATIONS

1. Rating

1) Standard type

Load / Rated control voltage	Resistive load (cos ϕ 1)	Inductive load (cos ϕ 0.4)
125V AC	5A	3A
250V AC	5A	2A
125V DC	0.4A	0.1A

2) Types with neon lamp and with LED

Types	Rated control voltage	Resistive load (cos ϕ 1)	Inductive load (cos ϕ 0.4)
With Neon lamp	125V AC	5A	3A
	240V AC	5A	2A
With LED	24V DC	3A	–

2. Characteristics

Contact arrangement		1 Form A 1 Form B
Initial contact resistance, max.		15mΩ (By voltage drop 6 to 8V DC at rated current)
Contact material		Gold clad silver alloy (cadmium free)
Initial insulation resistance (At 500V DC)		Min. 100MΩ
Initial breakdown voltage		1,000Vrms for 1 min Between non-consecutive terminals 2,000Vrms for 1 min Between dead metal parts and each terminal 2,000Vrms for 1 min Between ground and each terminal
Shock resistance max.	In the free position	Max. 98m/s^2{10G}
	In the full operating position	Max. 294m/s^2{30G}
Vibration resistance		Standard type: Max. 55Hz Type with indicator: 10 to 50Hz, double amplitude of 1.5mm
Expected life (Min. operations)	Mechanical	10^7 (at 120 cpm)
	Electrical	3×10^5 (at rated resistive load) 5×10^6 (Magnetic contactor FC-100 200V AC load)
	Life of lamp	Min. 2×10^4 hours (Neon lamp type)
Ambient temperature/Ambient humidity		–20 to +60°C –4 to +140°F/Max. 95%
Max. operating speed		120 cpm

3. EN60947-5-1 performance

Item	Rating
Rated insulation voltage (Ui)	250VAC
Rated impulse withstand voltage (Uimp)	2.5kV
Switching overvoltage	2.5kV
Rated enclosed thermal current (Ithe)	5A
Conditional short-circuit current	100A
Short-circuit protection device	10A fuse
Protective construction	IP64
Pollution degree	3

4. Operating characteristics

Characteristics / Actuator	O.F. (N {gf}) max.	R.F. (N {gf}) min.	Pretravel (P.T.), max. mm inch	Movement Differential (M.D.), max. mm inch	Overtravel (O.T.), min. mm inch	Totaltravel (T.T.), min. mm inch
Push plunger Roller plunger Cross roller plunger	8.83 {900}	1.47 {150}	1.5 .059	0.7 .028	4 .028	5.5 .217
Roller arm	5.88 {600}	0.49 {50}	20°	10°	75°	95°
Adjustable roller arm	7.84 {800}~3.35 {342}	0.49 {50}~0.21 {21}	20°	10°	75°	95°
Adjustable rod	7.84 {800}~1.99 {203}	0.49 {50}~0.12 {12}	20°	10°	75°	95°
Flexible rod spring wire	0.88 {90}	–	30 (1.181)	–	20 (.787)	50 (1.969)

*Characteristics measured at bent condition: min. radius 100mm 3.937inch.

Notes) 1. Keep the total travel values in the specified range. Otherwise the actuator force may rise to several times the operating force, resulting in a mechanical failure or much shorter service life.
2. For the operating characteristics, refer to the TECHNICAL INFORMATION.

5. Protective construction

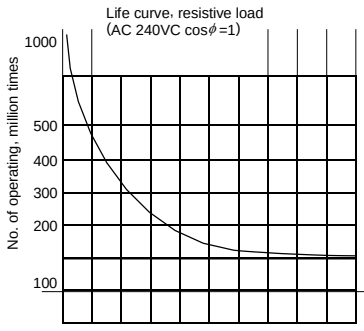
Protective construction / IEC	VL Mini limit switch	VL Mini limit switch (with lamp)
IP60	o	o
IP64	o	o

6.Lamp rating

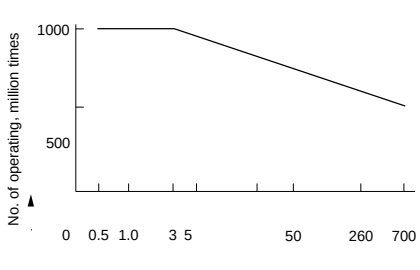
Types	Rated operating voltage	Operating voltage range	Internal resister
Neon lamp	100 to 200V AC	80 to 240V AC	120kΩ
LED	6V DC	5 to 15V DC	2.4kΩ
	12V DC	9 to 28V DC	4.7kΩ
	24 to 48V DC	20 to 55V DC	15kΩ

DATA

1. Life curve



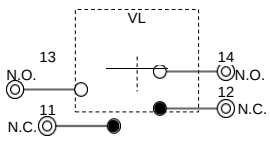
2. Actual load life curve (relay coil load)



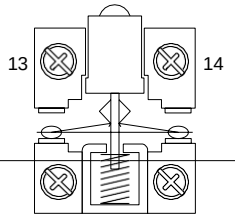
NK HC HP HG VC-20 FC-10 FC-35 FC-100

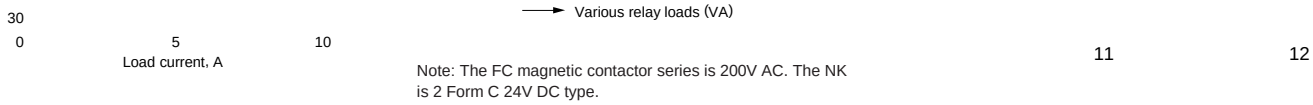
WIRING DIAGRAM

Output circuit



Terminal





Note: The FC magnetic contactor series is 200V AC. The NK is 2 Form C 24V DC type.

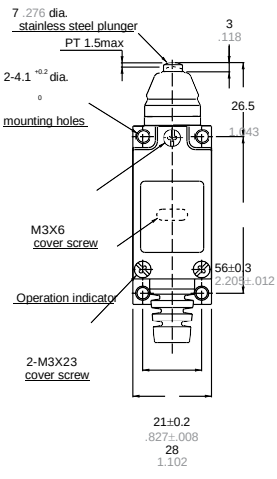
DIMENSIONS

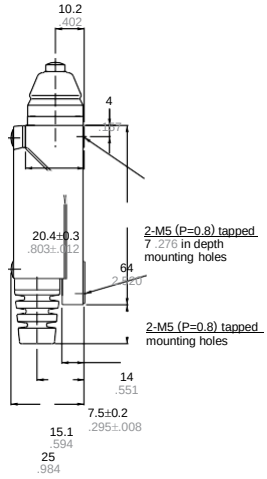
mm inch

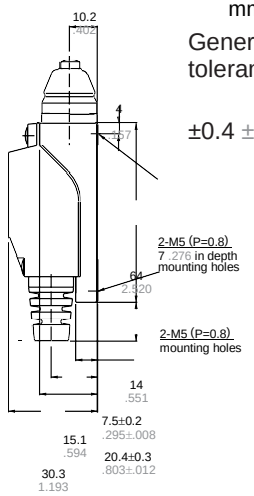
General tolerance: ±0.4 ±.016

Push plunger
Standard type

AZ8111

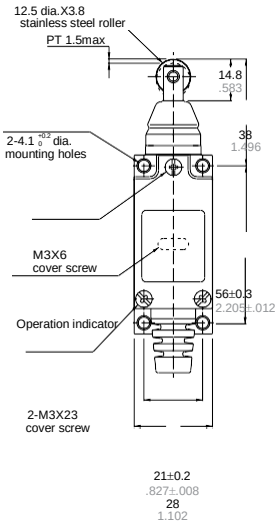


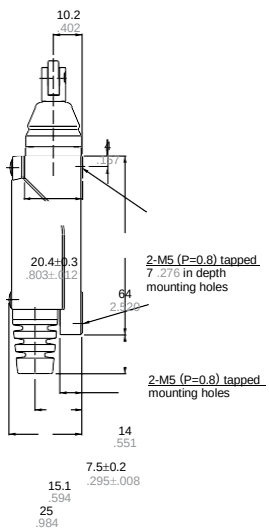


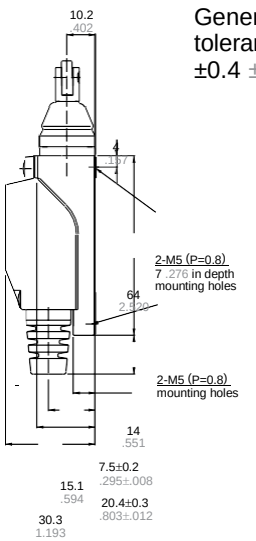


Standard type | With lamp

Roller plunger
Standard type
AZ8112

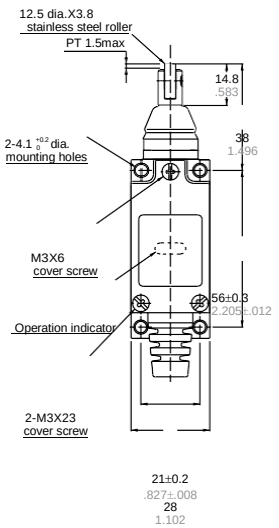


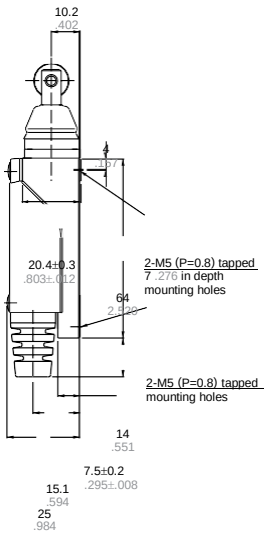


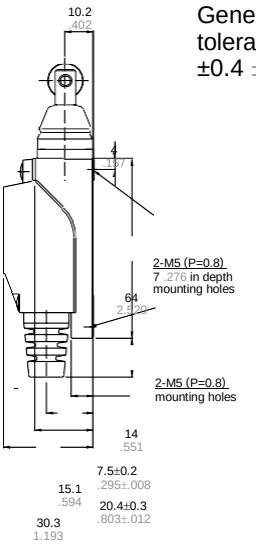


Standard type | With lamp

Cross roller plunger
Standard type
AZ8122



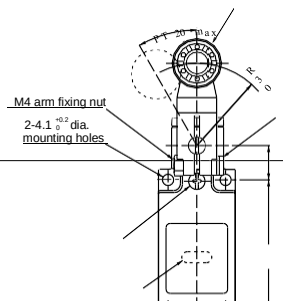


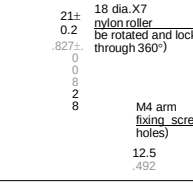


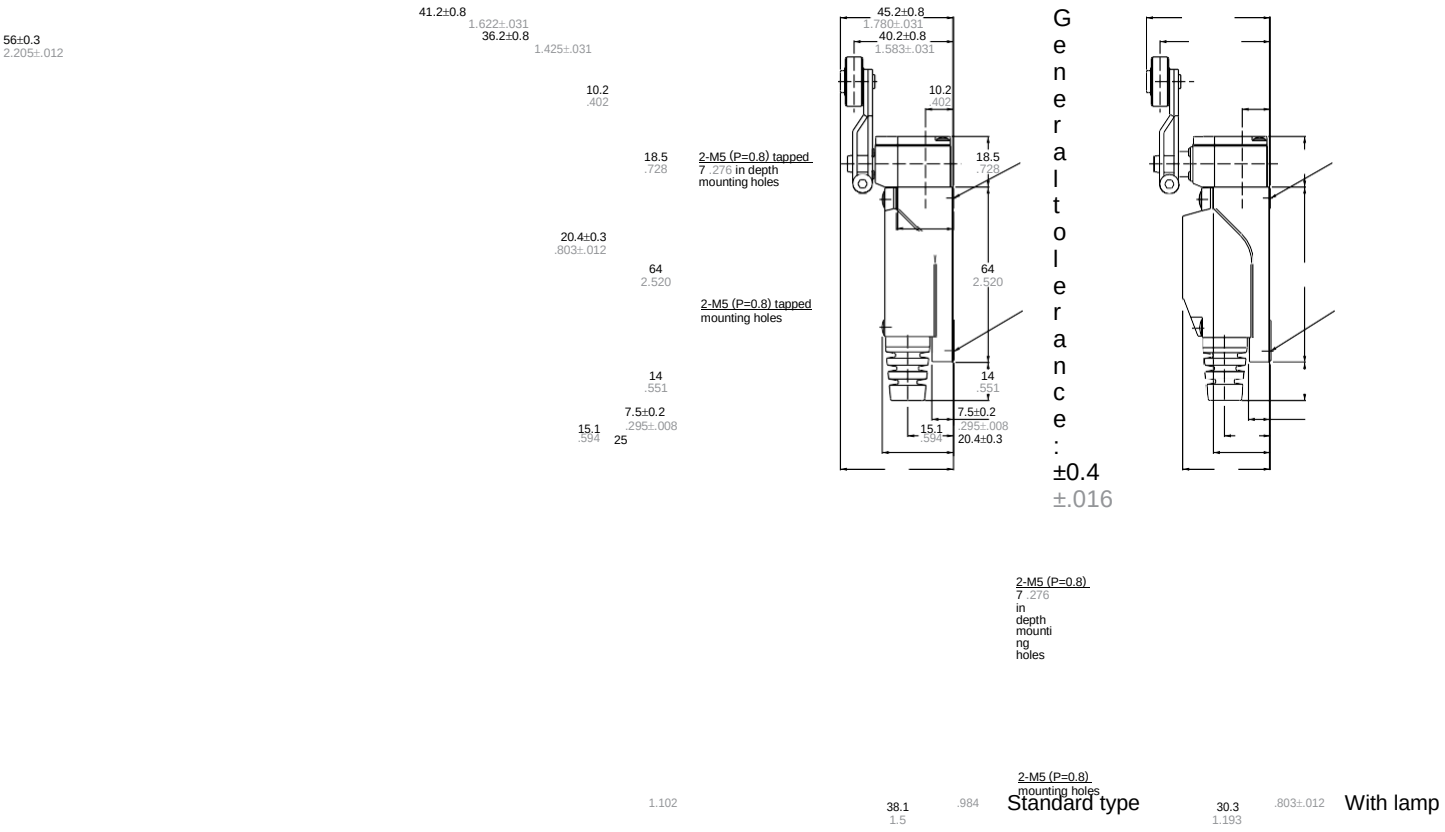
Standard type | With lamp

Roller arm
Standard type
AZ8104

Weight: 156.5g





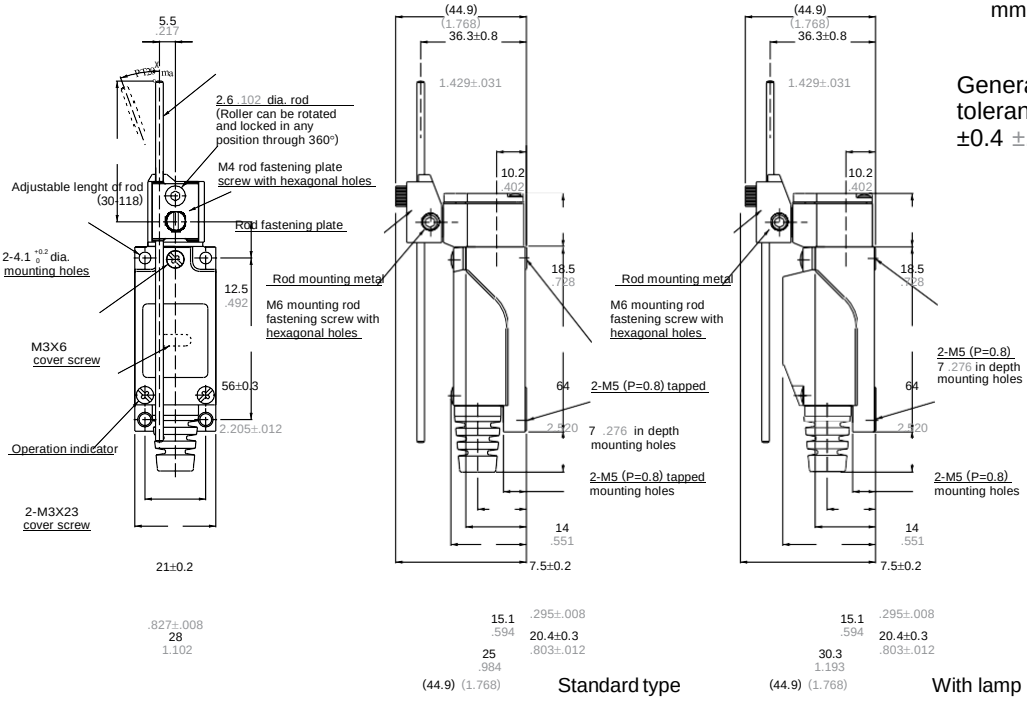

56±0.3
2.205±.012
41.2±0.8
1.622±.031
36.2±0.8
1.425±.031
10.2
.402
18.5
.728
2-M5 (P=0.8) tapped
7 .276 in depth
mounting holes
20.4±0.3
.803±.012
64
2.520
2-M5 (P=0.8) tapped
mounting holes
14
.551
7.5±0.2
.295±.008
15.1
.594
25
1.102
45.2±0.8
1.780±.031
40.2±0.8
1.583±.031
10.2
.402
18.5
.728
64
2.520
14
.551
7.5±0.2
.295±.008
15.1
.594
20.4±0.3
General tolerance:
±0.4
±.016
2-M5 (P=0.8)
7 .276
in
depth
mounti
ng
holes
2-M5 (P=0.8)
mounting holes
38.1
1.5
.984
Standard type
30.3
1.193
.803±.012
With lamp

VL (AZ8)

Adjustable rod
Standard type

mm inch

AZ8107

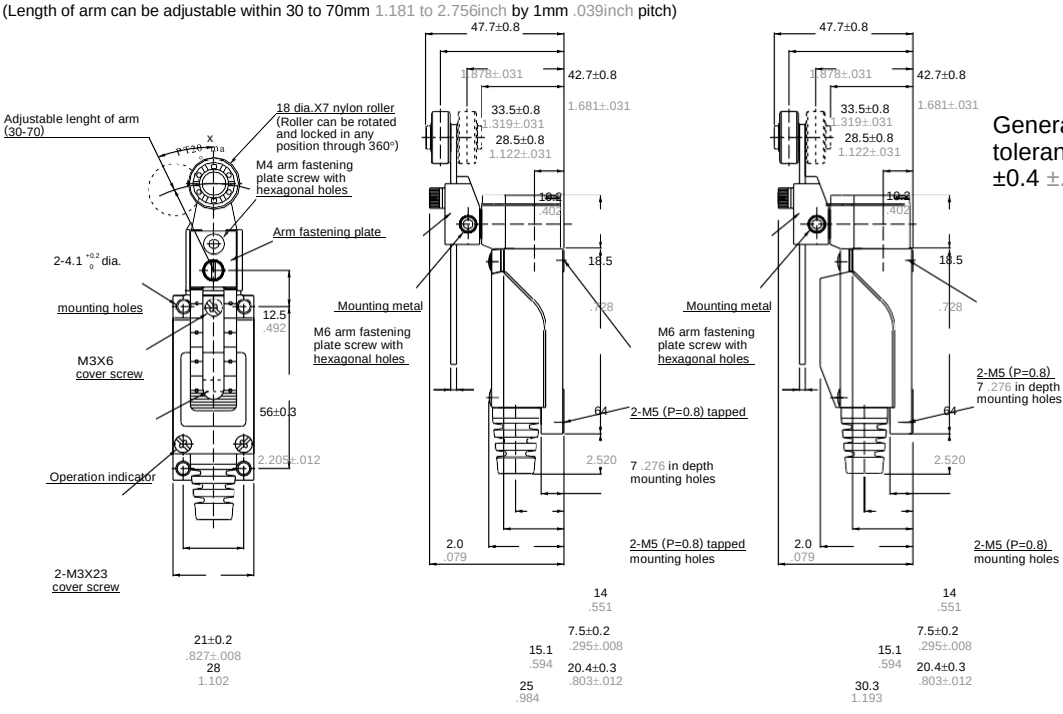


General tolerance: ±0.4 ±.016

Adjustable roller arm
Standard type

(Length of arm can be adjustable within 30 to 70mm 1.181 to 2.756inch by 1mm .039inch pitch)

AZ8108

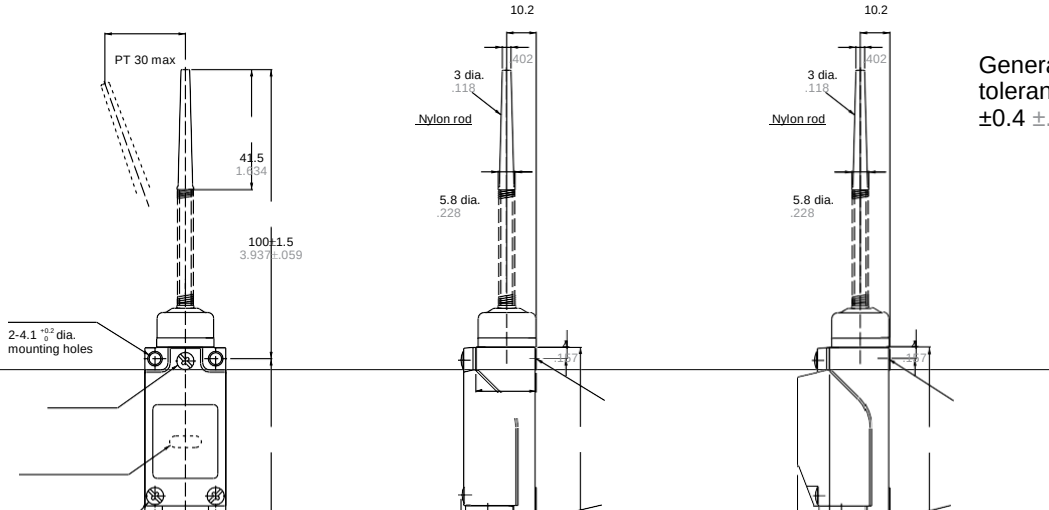


General tolerance: ±0.4 ±.016

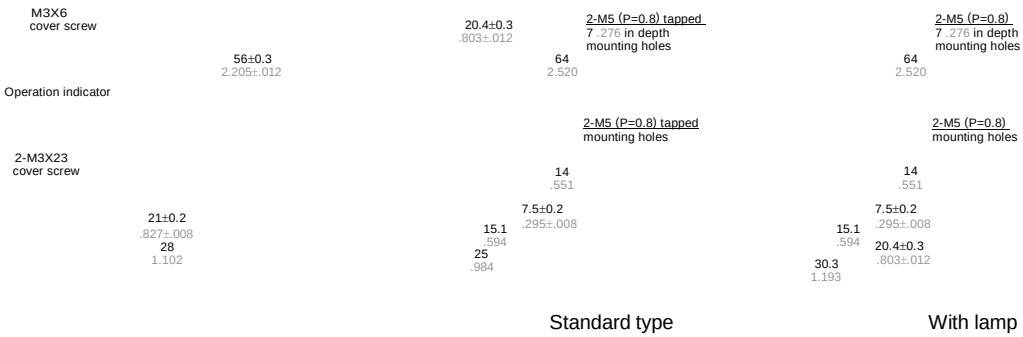
Flexible rod type (Should be used with less than 50mm 1.969inch of T.T.)
Standard type

AZ8166

Weight: 112g



General tolerance: ±0.4 ±.016

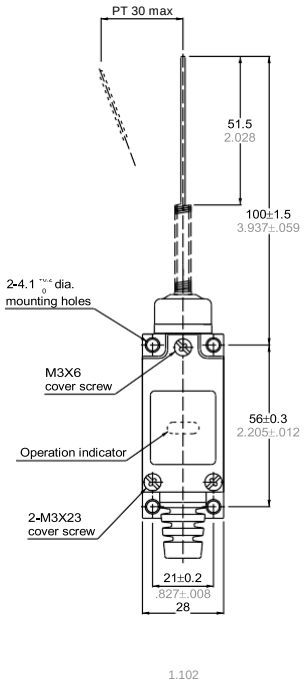

M3X6
cover screw
56±0.3
2.205±.012
Operation indicator
2-M3X23
cover screw
21±0.2
.827±.008
28
1.102
20.4±0.3
.803±.012
2-M5 (P=0.8) tapped
7 .276 in depth
mounting holes
64
2.520
2-M5 (P=0.8) tapped
mounting holes
14
.551
7.5±0.2
.295±.008
15.1
.594
25
.984
Standard type
2-M5 (P=0.8)
7 .276 in depth
mounting holes
64
2.520
2-M5 (P=0.8)
mounting holes
14
.551
7.5±0.2
.295±.008
15.1
.594
20.4±0.3
.803±.012
30.3
1.193
With lamp

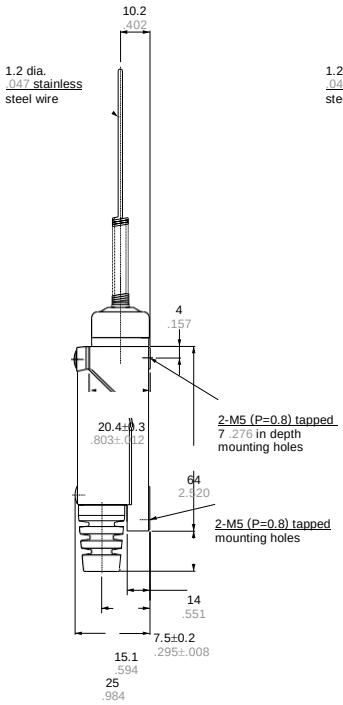
Spring wire (Should be used with less than 50mm 1.969inch of T.T.)

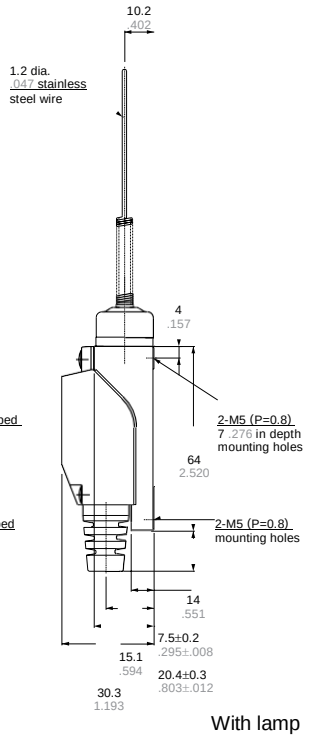
General tolerance: ±0.4 ±.016

Standard type
AZ8169

Weight: 112g







Standard type

With lamp

mm inch

OPTION

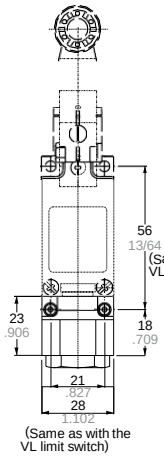
VL Limit Conduit Adapter

AZ8801

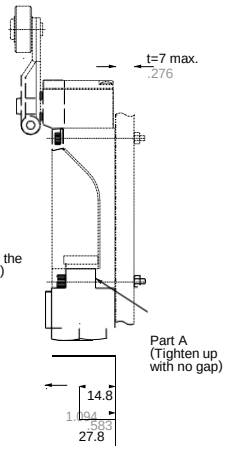
Applicable wire

Electric wire name	Finished outside diameter
Vinyl cabtire cord (VCTF)	8.7 to 11 dia. .343 to .433 dia.
Vinyl cabtire cable (VCT)	

(A set of mounting hex. socket screws is supplied.)



(Front)



(Side)

Note: Diagram shows adapter when installed to an AZ8104.

LAMP LIGHTING CIRCUIT

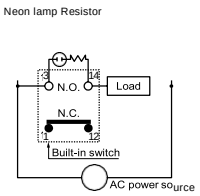
1. Spring type

1) When connecting load to N.O. side:
When the switch is at free position, the lamp is lit, and when the switch operates, the lamp turns off. (Use the lamp holder in the same condition as when it was at the time of shipment.)

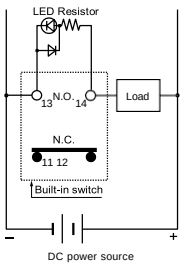
2) When connecting load to N.C. side:
When connecting switch is at free position, the lamp turns off, and when the switch operates, the lamp is lit.
(Use the lamp holder, changing it direction by 180°.)

3) When connecting loads to both N.O. and N.C. sides: Same as in 1).
(Use the lamp holder in the same condition as when it was at the time of shipment. In this case, it is impossible to use it, changing its direction by 180°.)

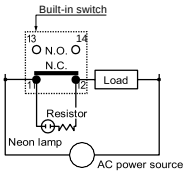
(With neon lamp)



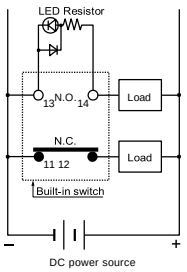
(With LED)



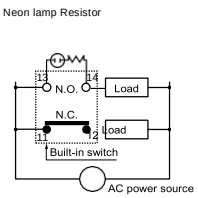
(With neon lamp)



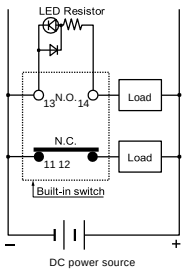
(With LED)



(With neon lamp)



(With LED)

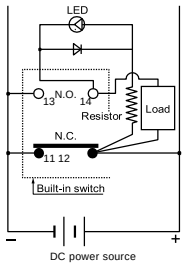


2. Lead wire type (only for types with LED)

1) When giving indication on N.O. side and N.C. side, operation is same as that in the case of the spring type. However, when load is connected to both N.O. side and N.C. side, indication can be given on both N.C. side and N.O. side.

2) When the indication circuit is connected with load in parallel:
Load performs the same operation as the indication circuit does.
(When load operates, the lamp is lit, and when load is turned off, the lamp goes out.)

- More loads than for one circuit cannot be controlled.
- There is no leakage current.

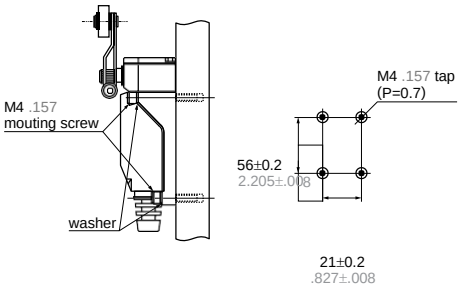


MOUNTING DIMENSIONS

mm inch

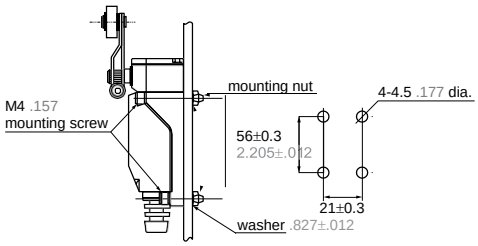
1. Surface mounting

1) When installation hole is tapped.



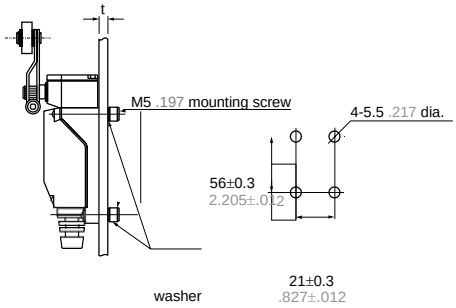
Depth of screw holes > 15mm .591inch

2) Through hole mounting



Thickness of panel < 5mm .197inch

2. Rear mounting



Length of bolt < panel thickness t+7mm .276inch

WIRING (unit: mm inch)

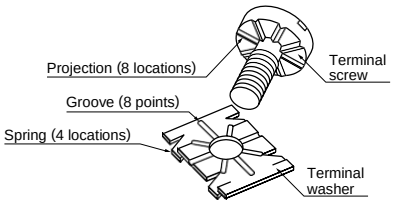
1. Insulation distance greater than 6.4 mm

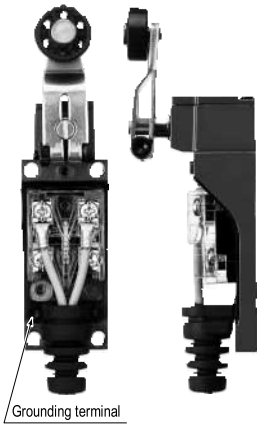
Reinforced plastic with superior electrical insulation characteristics is used in the wiring and charging sections. Despite its compactness, to maintain stable insulation performance, the insulation distance for each part is greater than 6.4 mm without using an insulation sheet.

(Complies with UL, CSA, and VDE.)

2. Includes ground terminal

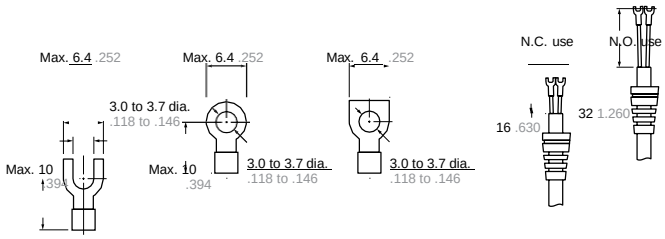
3. Loose stop terminals used.



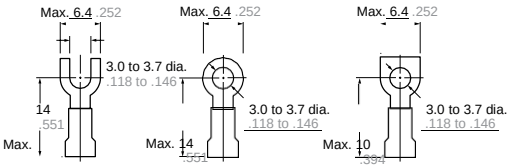


Applicable fasten terminal

Fasten terminal



With insulated grip



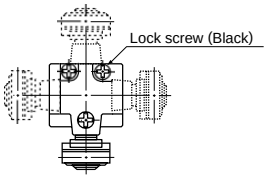
Applicable wire

Wire name	Applicable wire		
	Wire-strand	Conductor	Finished outside diameter
Vinyl cabtire cord (VCTF)	2-wire 3-wire 4-wire	0.75mm²·1.25mm² 2.0mm² 0.75mm²·1.25mm²	Round shape
Vinyl cabtire cable (VCT)	2-wire	0.75mm²	6 dia. to 9 dia.
600V vinyl insulation sealed cable (VVF)	2-wire	1.0 dia. to 1.2 dia.	Flat shape Max. 9.4
		1.6 dia.	

Head block direction change

(Roller arm, adjustable roller arm, adjustable rod types)

Actuator heads may be moved in 90° increments to any of four directions, by removing one screw.



CAUTIONS

1. Over travel (O.T.)

1) When overtravel is too large, life is shortened due to possible damage to the mechanism. Please use in the following appropriate range.

Types	Overtravel
Plunger (AZ8111, 8112, 8122)	1.5 to 2.0mm .059 to .079inch
Roller Arm (AZ8104, 8107, 8108)	20 to 30°
Flexible Rod (AZ8166, 8169)	15 to 20mm .591 to .787inch (at the top)

2. Ambient conditions

1) Because these switches are not of immersion protected construction, their use in water or oil should be avoided. Also, locations where water or oil can normally impinge upon the switch or where there is an excessive accumulation of dust should be avoided.

2) The use of these switches under the following conditions should be avoided. If the following conditions should become necessary, we recommend consulting us first.

- Use where there will be direct contact with organic solvents, strong acids or alkalis, or direct exposure to their vapors.
- Use where inflammable or corrosive gases exist.

3) Use within an ambient temperature of –20 to +60°C –4 to +140°F. (However, do not allow it to freeze.)

4) In order to maintain the reliability at a high level under practical conditions of use, the actual operating conditions should be checked for the benefit of the quality of the product.

5) If OT is too big, the life of limit switch will be shortened switching friction. Use it with enough margin of OT. 70% of OT standard value will be good for use.

6) Do not use the switch in a silicon atmosphere. Case should be taken where organic silicon rubber, adhesive, sealing material, oil, grease or lead wire generates silicon.

7) When wiring, do not connect the lead wires directly to the terminals, but use the crimp terminals and tighten them to a torque of 0.39 to 0.59 N·m {4 to 6 kg·cm}.

8) Avoid use in excessively dusty environments where actuator operation would be hindered.

9) When used outdoors (in places where there is exposure to direct sunlight or rain such as in multistory car parks) or in environments where ozone is generated, the influence of these environments may cause deterioration of the rubber material. Please consult us if you intend to use a switch in environments such as these.

10) Do not store in places where organic gas might be generated or in places of high dust content or high humidity.

3. Installation

1) Tighten the three cover installation screws equally. Tightening torque is 0.2 to 0.29 N·m (2 to 3 kg·cm).

2) Avoid having extra cord length pushed into the cord vent. Any extra length when wiring should be allowed to rest in its natural position.

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Document: Datasheet Date: 28-Jul-08 Model #: 3190 Product's Page: www.sunrom.com/p-510.html

Light Dependent Resistor - LDR

Two cadmium sulphide(cds) photoconductive cells with spectral responses similar to that of the human eye. The cell resistance falls with increasing light intensity. Applications include smoke detection, automatic lighting control, batch counting and burglar alarm systems.

Applications

Photoconductive cells are used in many different types of circuits and applications.

Analog Applications

- Camera Exposure Control
- Auto Slide Focus - dual cell
- Photocopy Machines - density of toner
- Colorimetric Test Equipment
- Densitometer
- Electronic Scales - dual cell
- Automatic Gain Control – modulated light source
- Automated Rear View Mirror

Digital Applications

- Automatic Headlight Dimmer
- Night Light Control
- Oil Burner Flame Out
- Street Light Control
- Absence / Presence (beam breaker)
- Position Sensor

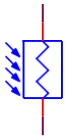
Electrical Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Cell resistance	1000 LUX 10 LUX	- -	400 9	- -	Ohm K Ohm
Dark Resistance	-	-	1	-	M Ohm
Dark Capacitance	-	-	3.5	-	pF
Rise Time	1000 LUX 10 LUX	- -	2.8 18	- -	ms ms
Fall Time	1000 LUX 10 LUX	- -	48 120	- -	ms ms
Voltage AC/DC Peak		-	-	320	V max
Current		-	-	75	mA max
Power Dissipation				100	mW max
Operating Temperature		-60	-	+75	Deg. C

Guide to source illuminations

Light source Illumination	LUX
Moonlight	0.1
60W Bulb at 1m	50
1W MES Bulb at 0.1m	100
Fluorescent Lighting	500
Bright Sunlight	30,000

FIGURE 1 CIRCUIT SYMBOL

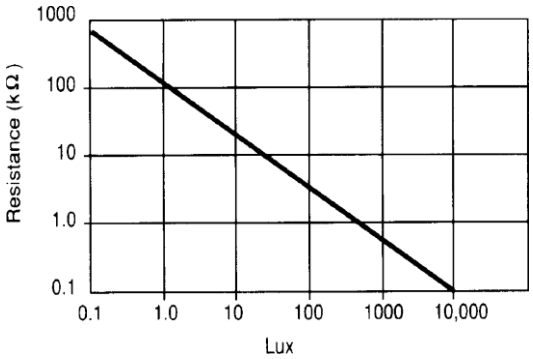


R1
LDR SUNROM #3190

Sensitivity

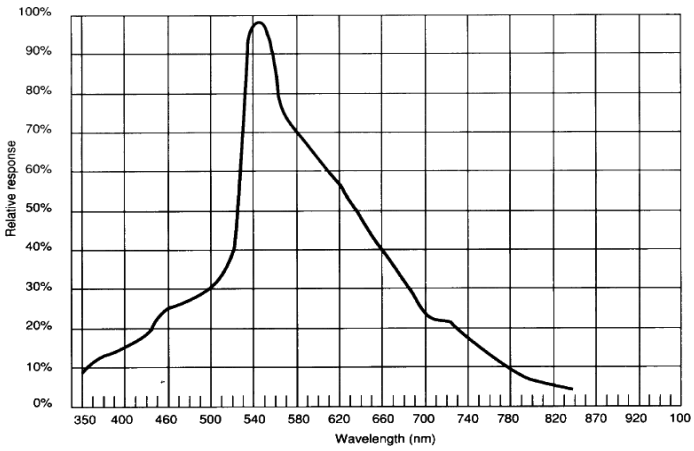
The sensitivity of a photodetector is the relationship between the light falling on the device and the resulting output signal. In the case of a photocell, one is dealing with the relationship between the incident light and the corresponding resistance of the cell.

FIGURE 2 RESISTANCE AS FUNCTION OF ILLUMINATION



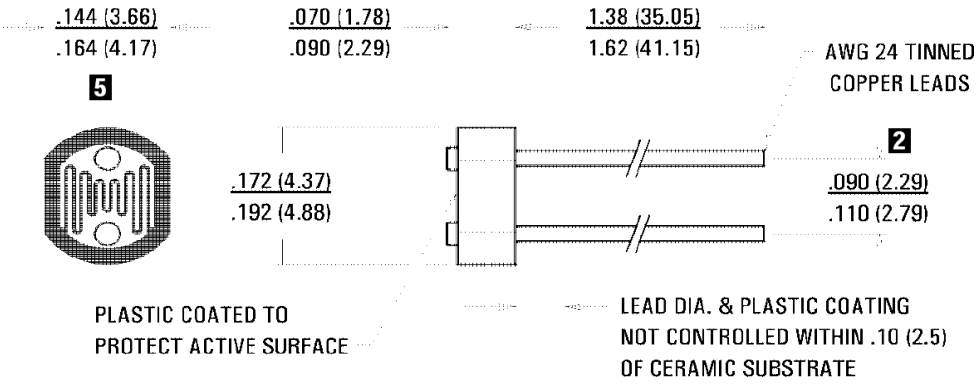
Spectral Response

Figure 3 Spectral response



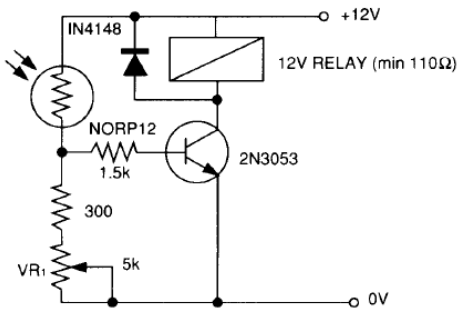
Like the human eye, the relative sensitivity of a photoconductive cell is dependent on the wavelength (color) of the incident light. Each photoconductor material type has its own unique spectral response curve or plot of the relative response of the photocell versus wavelength of light.

Dimensions



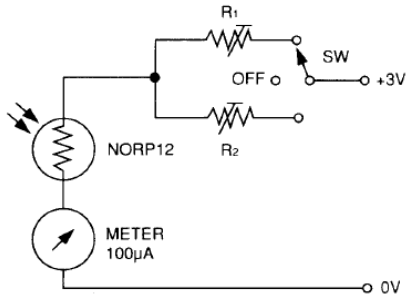
Typical Application Circuits

Figure 6 Sensitive light operated relay



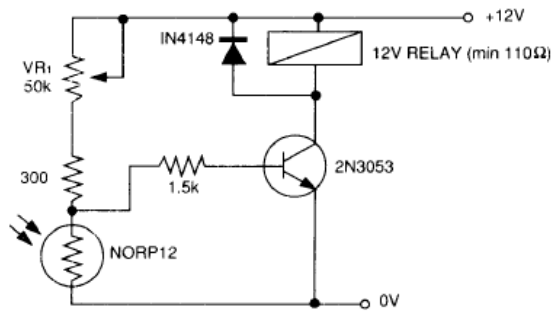
Relay energised when light level increases above the level set by VR_1

Figure 9 Logarithmic law photographic light meter



Typical value $R^1 = 100k\Omega$
$R^2 = 200k\Omega$ preset to give two overlapping ranges.
(Calibration should be made against an accurate meter.)

Figure 7 Light interruption detector



As Figure 6 relay energised when light level drops below the level set by VR_1

Figure 8 Automatic light circuit

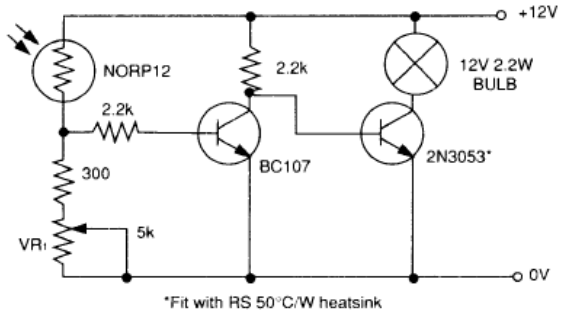
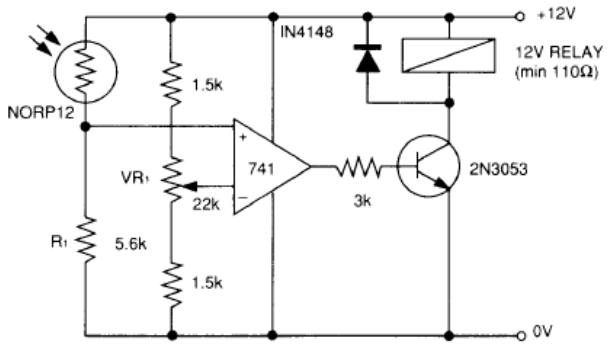


Figure 10 Extremely sensitive light operated relay



(Relay energised when light exceeds preset level.) Incorporates a balancing bridge and op-amp. R_1 and NORP12 may be interchanged for the reverse function.

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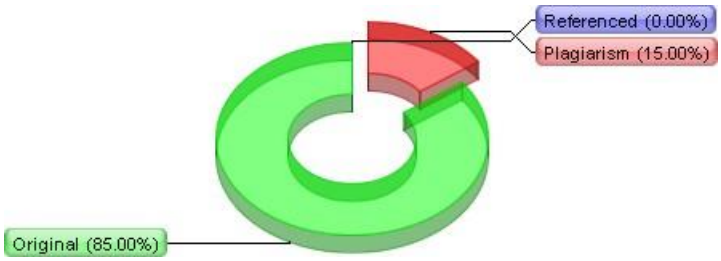

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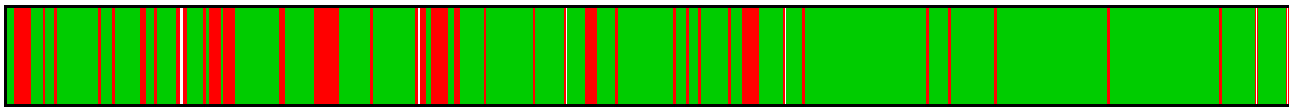

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BAB 1PENDAHULUAN

Latar Belakang

Berkembangnya teknologi yang sangat pesat mendorong manusia untuk berusaha mengatasi masalah yang timbul khususnya yang berhubungan dengan kegiatan sehari - hari. Jawa Tengah khusu snya Kota Cilacap yang dikelilingi oleh laut dan sungai mengakibatkan salah satu usaha mikronya adalah pembuatan ikan asin, dimana selama ini pengeringan ikan dilakukan dengan cara menjemur ikan langsung dibawah sinar

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matahari .Hasil perikanan merupakan komoditas yang mudah mengalami proses mutu dan pembusukan, dimana hal ini terjadi setelah ikan ditangkap. Dengan demikian perlu pena nganan yang cepat, tepat dan benar untuk menjaga kualitasnya sebelum dipasarkan dan sampai ke tangan konsumen. Sehingga masyarakat nelayan mengupayakan dengan usaha pengolahan dan pengawetan ikan dengan berbagai cara perlakuanya yaitu pengeringan / pengasinan. Jenis usaha pengolahan dan pengawetan ikan yang banyak didominasi di Kabupaten Cilacap adalah pengeringan / pengasinan. Dimana sentra - sentra olahan ikan asin kering ini berada di Kelurahan Cilacap Selatan khususnya daerah pesisir pantai Cilacap. Beberapa olahan ikan asin kering yang biasa dilakukan daerah tersebut masih tradisional

hanya menjemur ikan langsung dibawah sinar matahari .Penjemuran dengan cara ini seringkali menjadi kendala jika panas sinar

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matahari tidak sesuai dengan yang

dibutuhkan semisalnya cuaca mendung bahkan jika tiba - tiba turun hujan terkadang tidak cukup waktu untuk mengambil ikan ikan yang sedang dijemur. Apa lagi disaat masyarakat ada urusan diluar rumah sehingga kegiatan menjemur ikan, biasa ditinggalkan berpergian atau bekerja [1].Arduino adalah suatu perangkat prototype elektronik berbasis mikrokontroler

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yang fleksibel dan open source, perangkat keras dan perangkat

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lunaknya mudah digunakan. Perangkat ini ditunjukan bagi siapapun yang tertarik untuk memanfaatkan mikrokontroler secara praktis dan mudah. Banyak dari mereka yang telah mengembangkan teknologi untuk dapat meringankan beban nelayan dengan memanfaatkan teknologi seperti IoT. Adapun kemampuan IoT seperti berbagi data, remote control, dan sebagainya. Oleh karena itu perkembangan teknologi IoT saat ini dapat merambah ke setiap bidang kehidupan. Pemanfaatan teknologi modern pada bidang Perikanan diharapkan dapat meningkatkan hasil nelayan terutama ikan asin [2]. Oleh karena itu pada Tugas Akhir ini penulis akan membuat alat yang memanfaatkan Smartphone sebagai media dalam mempermudah komunikasi pada alat yang akan dirancang. IoT dapat dikombinasikan dengan berbagai perangkat, seperti Arduino Uno, Node MCU dan lainnya. Pada Tugas Akhir ini sistem pengendali yang digunakan adalah Arduino Uno R3 dan Modem Wifi ESP 8266 - 01 karena pada perangkat ini sendiri memiliki jaringan wireless sehingga untuk menghubungkan Arduino Uno, Smartphone dengan IoT sendiri mudah untuk dilakukan.

Judul pada Tugas Akhir ini adalah " RANCANG BANGUN ALAT PAPAN PENJEMUR IKAN ASIN SECARA NIRKABEL MENGGUNAKAN KONSEP IOT (INTERNET OF THINGS) ".RUMUSAN MASALAHRumusan

masalah yang menjadi pokok dalam tugas akhir ini yaitu :Bagaimana mengendalikan otomatis sensor hujan terhadap tiga kondisi yaitu gelap, terang dan hujan ?Bagaimana proses mekanika sistem Algoritma kendali tiga kondisi cuaca ?Bagaimana perancangan interface pada platform Android/Smartphone?B ATASAN MASALAHYang menjadi batasan masalah dalam perancangan pada Tugas Akhir ini adalah :Menggunakan jaringan internet. Menggunakan sensor hujan tipe FC-37.Hanya focus pada komunikasi sistem satu arah saja. Memonitoring secara nirkabel.TUJUAN PENELITIAN Pada pembuatan atau rancangan alat ini pasti memiliki tujuan a gar bisa dikembangkan maupun digunakan oleh masyarakat. Oleh karena itu tujuan yang ingin di capai dalam penelitian ini adalah :Merancang sebuah alat jemuran ikan asin dengan aplikasi android menggunakan komunikasi Wireless.Mengimplementasikan sistem alat papan jemuran ikan asin dengan aplikasi android, dengan menggunakan komunkasi Wirelees agar dapat digunakan oleh masyarakat.MANFAAT PENELITIAN Manfaat yang dapat dalam penelit ian pembuatan alat ini berupa

:Memberikan kemudahan dalam mengontrol alat jemuran ikan asin dalam jarak jauh. Menciptakan inovasi alat baru dengan memanfaatkan teknologi IoT, sehingga dapat dikembangkan untuk menjadi lebih baik. SISTEMATIKA PENULISAN Untuk mempermudah pemaham laporan Tugas Akhir ini maka lapor an ini di bagi beberapa bagian. Bab 1 Berisi tentang latar belakang, rumusan masalah, batasan masalah, tujuan, manfaat penelitian dan sistematika penulisan. Bab 2 membahas tentang dasar teori dan komponen - komponen yang akan digunakan,spesifikasi dari beberapa alat yang digunakan. Pada bab 3 ini berisi tentang perancangan sistem, pembuatan alat, parameter untuk kerja dari alat yang akan di bangun / dirancang. Bab 4 ini berisi tentang hasil dari pengujian setiap bagian alat yang dirancang dan analisa sistem berdasarkan hasil simulasi. Kesimpulan dan saran serta pengembangan untuk kedepanya dideskripsikan pada bab 5.BAB 2DASAR TEORI KAJIAN PUSTAKA "RANCANG BANGUN MINIATUR ALAT PENJEMUR

IKAN ASIN BERBASIS MIKROKONTROLER" yang dibuat oleh penulis menggunakan mikrokontroler Atmega16 sebagai sistem pengendali yang membaca masukan dari sensor cahaya dan sensor air untuk selanjutnya akan menggerakan motor DC yang akan membuka atau menutup atap. Penelitian ini dibuat oleh (Nina & Ali kasim, 2018) [3].Pada penelitian yang

dilakukan oleh (Monilia Sitophila Heriyanto dan Samsul Hidayat, 2014) dalam jurnal yang berjudul "RANCANG BANGUN ATAP OTOMATIS MENGGUNAKAN SENSOR LDR dan SENSOR HUJAN BERBASIS MIKROKONTROLER ". Adapun cara
kerjanya yaitu menutup dan membuka atap otomatis berdasarkan hasil dari inputan sensor cahaya (LDR) dan sensor hujan. Apabila terdeteksi hujan maka sensor hujan akan mengirim perintah ke mikrokontroler untuk mengambil tindakan menutup atap sirip agar jemuran pakaian terlindungi dari hujan, dan sebaliknya apabila terdeteksi cuaca cerah dan tidak hujan maka atap sirip akan membuka [4]. Kemudian pada penelitian yang dilakukan oleh (Arif Budi Laksono dan Zaenal Abidin, 2014) dengan peneitian yang berjudul "PERANCANGAN DAN PEMBUATAN ALAT JEMURAN OTOMATIS DENGAN SENSOR DETEKSI BASAH" menyimpulkan jika sensor cahaya mendeteksi adanya cahaya maka motor akan berputar dan menarik tambang keluar, sehingga posisi jemuran berada di luar, dan jika sensor cahaya tidak mendeteksi adanya cahaya maka motor akan menarik tambang jemuran untuk masuk, sehingga posisi jemuran berada didalam [5].Kesamaan Tugas Akhir yang akan penulis buat dengan laporan tersebut adalah sama - sama sistem jemuran otomatis yang menggunakan sensor LDR. Perbedaan adalah pada pengaplikasian ke alat penjemur ikan asin, dengan mengontrol jarak jauh dengan Modul Wifi ESP8266-01 dan Android.DASAR TEORI 2.2.1 .Ikan AsinGambar 2.1 Ikan asin Merupakan bahan makanan yang terbuat dari daging ikan yang di awetkan dengan menambahkan banyak garam. Dengan metode pengawetan ini daging ikan yang biasanya membusuk dalam waktu singkat dapat disimpan di suhu kamar untuk jangka waktu berbulan- bulan, walaupun biasanya harus ditutup rapat. Ikan seabagi bahan makanan yang mengandung protein

tinggi dan mengandung asam amino essensial yang diperlukan oleh tubuh.Pengolahan ikan asin secara tradisional hampir selalu membutuhkan bantuan sinar matahari untuk mempercepat pengeringan dan mencegah agar ikan tidak menjadi busuk. Masalahnya matahari tidak selalu bersinar dengan cukup setiap harinya, terutama di musim hujan dimana awan mendung seringkali menutupi langit. Akibatnya, banyak ikan yang tidak terawetkan dengan baik, menurun kualitas dan bahkan membusuk [6]. Oleh karena itu penulis berfikir tentang bagaimana para nelayan maupun ibu rumah tangga yang mayoritas orang nelayan meminimalize kegiatan rumah semisalnya nyuci baju, berbelanja dan kegiatan di luar rumah.
2.2.2.
Penjemuran AlamiGambar 2.2 Penjemuran Ikan Asin Penjemuran alami yang sederhana adalah menggunakan sinar matahari langsung atau tidak langsung. Penjemuran alami memanfaatkan radiasi surya, suhu dan kelembaban udara sekitar serta kecepatan untuk proses pengeringan pada ikan asin. Pengeringan dengan cara penjemuran mempunyai beberapa kelemahan antara lain tergantung dengan cuaca, dan memerlukan tempat penjemuran yang luas, mudah terkontaminasi dan memerlukan waktu yang lama [6].2.2.3 .Arduino Uno R3Arduino Uno Adalah Board mikrokontroler berbasis ATmega328. Board ini memiliki 14 pin input / output digital dimana 6 pin dapat digunakan sebagai output PWM dan 6 pin input analog, 16 MHz osilator Kristal, koneksi USB, Jack dapat digunakan, cukup hanya menghubungkan board Arduino Uno ke computer dengan menggunakan kabel USB atau sumber tegangan bisa didapat dari adaptor AC - DC atau Baterai.Fitur terbaru yang terdapat pada board Arduino Sebagai Berikut :1 ,0 pinout : menambahkan SDA dan SCL pin yang dekat ke pin yang baru lainnya, ditempatkan dekat pin RESET. Dengan 10 REF yang memungkinkan sebagai Buffer untuk beradaptasi dengan tegangan yang disediakan dari board sistem. Pengembangan sistem akan lebih kopatibel dengan prosessor yang menggunakan AVR yang beroperasi dengan 5V dan dengan Arduino. Karena yang beroperasi dengan 3,3V, yang kedua adalah pin tidak terhubung, yang disediakan untuk tujuan pengembangnnya [7].Circuit Reset Gambar 2.3 Board Arduino
Uno R3.Penjelasan per-bagian dari board arduino yang ditunjukan pada gambar 2.1 dapat dijelaskan pada tabel 2.1 adalah :Tabel 2. 1 Keterangan Fungsi Bagian Board ArduinoBagian Board Fungsi 14 pin Digital Pin 0-13 berfungsi untuk input atau output yang dapat diatur oleh program. Khusus untuk 6 buah pin 3,5,6,9,10, dan 11. Selain itu dapat difunsikan juga untuk pin analog output.USB Berfungsi untuk: Memuat program dari komputer ke dalam board.Komunikasi serial anatar board dan komputerMemberi daya listrik pada boardSambungan SV1 Sambungan atau jumper untuk memilih daya board, apakah dari sumber eksternal atau menggunakan USB.Q1-Kristal Jika mikrokontroler dianggap sebuah otak , maka Kristal adalah jantungnya karena komponen ini dapat menghasilkan detak-detak yangdikirim pada mikrokontroler agar melakukan sebuah operasi untuk setiap detaknya Tombol Reset S1 Untuk mer- reset board, sehingga program akan memuli lagi dari awal. Perhatikan bahwa tombol reset ini bukan untuk menghapus program pada mikokontroler.ICSP Port ICSP memungkinkan pengguna untuk memprogram mikrokontroler secara langsung, tanpa melalui bootloader. Umumnya pengguna Arduiino tida melakukan ini, sehingga ICSP tida terlalu didgunakan walaupun disediakan.IC 1 Mikrokontroler ATmega, komponen utama dari board arduino didalamnya terdapat CPU, ROM, dan RAM.X1 Jika hendak disuplai dengan sumber daya ekternal, board arduino dapat diberikan tegangan DC antara 9V sampa 12 V.6 Pin Analog /w:t (Pin 0-5)Pin ini berfungsi untuk membaca tegangan yang dihasilkan oleh sensor analog, seperti sensor suhu.Program dapat
membaca sebuah pin input 0-1-23, dimana hal itu mewakili nilai tegangan 0-5 V.Tabel 2. 2 Deskripsi Arduino Uno R3Mikrokontroler ATmega328 Operasi Voltage5V Input Voltage 7-12 V (Rekomendasi) Input Voltage 6- 20 V (Limits)I/O 14 pin (6 pin untuk PWM) Arus 50 mA Flash

Memory 32KB Bootloader SRAM 2 KB EEPROM 1 KB Kecepatan Hz 2 .2.4.Modul Wifi ESP8266-01Gambar 2.4 Board Modul Wifi ESP8266-01 Espresif system smart connectivity platform (ESCP) adalah sebuah alat yang bekinerja tinggi, integritas tinggi dan juga tersedia wireless SOC,menyediakan kemampuan besar sebagai penyedia wifi untuk sistem lain berfungsi pada aplikasi stand alone dengan harga yang rendah dan kebutuhan ruang yang sedikit.
ESP8266 adalah contoh dari produk rancangan ESCP yang menawarkan sebuah paket lengkap, termasuk modul [7].Beberapa cara menggukana modul ESP8266 :Sebagai wifi access menggunakan AT Command, diaman biasanya dimanfaatkan oleh Arduino untuk koneksi wifi.Merupaka sistem yang berdiri sendiri dengan menggunakan Arduino IDE yang sudah mensupport ESP8266. Sebagai sistem yang berdiri sendiri
menggunakan Node MCU dan menggunakan bahasa LUA. Beberapa cara untuk mengkoneksikan Wifi untuk ESP8266 :ESP8266 ini bertindak sebagai client atau suatu wifi router, sehingga saat konfigurasi dibutuhkan setting nama acces pointnya dan juga bisa dipassword.ES P8266 juga dapat bertidak menjadi Access Point dimana dapat menerima akses wifi dari hasil percobaan yang telah dilakukan, jika sebagai acces point hanya bisa menerima 2 koneksi wifi secara concurrent.2.2.5 .Sensor Cahaya atau LDR (Light Depende Resistor)Gambar 2.5 Sensor Cahaya / LDR (Light Dependent Resistor)Sensor adalah alat yang di gunakan untuk mendeteksi dan mengetahui magnitude tertentu. Sensor merupakan jenis transduser yang digunakan untuk mengubah variasi mekanis, magnetis, panas, sinar dan kimia menjadi tegangan dan arus listrik. Sensor cahaya (LDR) adalah alat yang di gunakan dalam bidang elektronika yang berfungsi untuk mengubah besaran cahaya menjadi besaran listrik. Sensor cahaya (Light Dependent Resistor) merupakan suatu jenis resistor yang peka terhadap cahaya. Nilai resistansi LDR akan berubah-ubah sesuai dengan intensitas cahaya yang diterima. Jika LDR tidak terkena cahaya maka nilai tahanan akan menjadi besar.

Sedangkan jika terkena cahaya nilai tahanan akan menjadi kecil.Cara kerja dari sensor LDR adalah mengubah energi dari foton menjadi elektron, umumnya satu foton dapat membangkitkan satu eletron. Beberapa komponen yang diguanakan pada rangkaian sensor cahaya adalah LDR (Light Dependent Resistor), Photodiode, dan Photo Transistor [8].2.2.6 .Sensor Air (Hujan) Gambar 2.6 Sensor Air / HujanMerupakan modul elektrik yang sering digunakan untuk detector air / hujan. Sensor hujan berbentuk panel bergaris dengan perinsip kerja apabila panel tersebut terdapat air maka arus yang ada pada panel akan terhambat dan driver akan mengirimkan sinyal pada mikrokontroler. Sensor yang difungsikan mendeteksi ada tidaknya kondisi rintik hujan yang dimana dimanfaatkan dalam berbagai aplikasi mulai dari yang sederhana hingga aplikasi yang kompleks [8].Fungsi Masing - masing port :Ground sebagai arus pin ground.Signal sebagai pin input.Vcc sebagai input masuknya catu daya. Tegangan : 3,3 V- 5V.Dimensi : Sensor (5cm x 4cm), Signal conditioner (3,2cm x 1,4cm).Potensiometer : mengatur sensitivitas module.2.2. 7.Motor DCGambar 2.7 Motor DCMerupakan suatu perangkat yang mengubah energy listrik menjadi energy kinetic atau gerakan (motion). Motor DC ini juga dapat disebut sebagai motor arus searah .seperti namanya, DC motor memiliki dua terminal dan memerlukan tegangan arus searah atau DC (Direct Current) untuk dapat menggerakan .Prinsip kerja Motor DC terdapat dua bagian utama pada sebuah Motor Listrik DC yaitu Stator dan Rotor . Stator adalah bagian motor yang tidak berputar , bagian yang statis ini terdiri dari rangka dan kumparan medan. Sedangkan Rotor adalah bagianyang berputar, bagian Rotor ini terdiri dari kumparan jangkar. Dua bagian utama ini dapat dibagi lagi menjadi beberapa komponen penting yaitu diantaranya adalah Yoke (kerangka Magnet), Poles (kutub Motor), Field Winding (kumparan medan magnet), Armanature Winding (kumparan Jangkar), Commutator (Komutator) dan Brusher (kuas / sikat arang). Pada prinsipnya motor listrik DC menggunakan fenomena electromagnet untuk bergerak, ketika arus listrik diberikan ke kumparan, permukaan kumparan yang bersifat utara akan bergerak menghadap ke magnet yang berkutub selatan dan sebaliknya [9].2.2.8 .Limit Switch (Saklar Pembatas)Limit Switch (Saklar Pembatas) adalah saklar atau perangkat elektromekanis yang mempunyai tuas actuator sebagai pengubah posisi kontak terminal dari normal open/no ke Close atau sebaliknya dari normal Close ke open. Posisi kontak akan berubah ketika tuas actuator tersebut terdoorong atau tertekan oleh suatu objek, sama hal nya dengan saklar pada umumnya, limit switch juga hanya mempunyai 2 kondisi, yaitu menghubungkan atau memutuskan aliran arus listrik. Dengan kata lain hanya mempunyai kondisi ON atau OFF.Fungsi limit Switch adalah dibuat dengan sistem kerja yang dikontrol oleh dorongan atau tekanan (kontak fisik) dari gerakan suatu objek pada actuator, sistem kerja ini bertujuan untuk membatasi gerakan ataupun menggendalikan suatu objek / mesin tersebut dengancara memutuskan atau menghubungkan aliran listrik yang melalui terminal kontaknya.Gambar 2.8 Limit Switch2.2.9 . Driver MotorDriver motor L9111 merupakan driver motor yang paling popular digunakan untuk mengontrol atau mengendalukan kecepatan dan arah pergerakan motor terutama untuk motor DC. Untuk IC utama yaitu IC L298N merupakan IC tipe H-bridge yang mampu mengendalikan beban-beban induktif seperti relay, solenoid, motor DC dan motor stepper.

Pada IC L298N terdiri dari transistor-transistor logic (TTL) dengan gerbang NAND yang berfungsi untuk

memudahkan dalam menentukan arah putaran suatu motor dc maupun motor stepper.Gambar 2.9 Driver Motor 2.2.10 .Internet Of Things (IOT)Internet Of Things atau IoT ini pada dasarnya dapat dikatakan menghubungkan benda - benda di sekitar kita untuk dapat berkomunikasi antara satu dengan yang lain melalui sebuah jaringan internet . konsep dari IoT ini bertujuan untuk memperluas manfaat dari konektivitas internet yang tersambung secara terus menerus. Adapun kemampuan seperti berbagai data, remote control

, dan sebagainya , termasuk juga pada benda nyata. Pada dasarnya, Internet Of Things

mengacu pada benda yang dapat diidentifikasikan secara unik sebagai repesentasi virtual dalam struktur berbasis internet
.Cara Kerja dari Internet Of Things yaitu dengan memanfaatkan sebuah argumentasi pemograman yang dimana tiap perintah argumenya itu menghasilkan sebuah interaksi antara sesame mesin yang terhubung secara otomatis.yang menjadi masalah terbesar dalam mengkonfigurasi IoT adalah menyusun jaringan komunikasi sendiri yang sangat komplek dan membutuhkan keamanan dari sistem yang sangat ketat [11]. BAB 3PERANCANGAN SISTEM ALAT YANG DIGUNAKAN Perancangan seperti pada umummnya, dalam "Rancang Bangun Alat Papan Penjemur Ikan Asin Secara Nirkabel Menggunakan Konsep Internet Of Things (IoT)" ini perlu adanya sebuah sistem dengan penunjang alat dan bahan sesuai dengan kebutuhan, dalam proses pembuatan dan perancangan alat dan bahan yang dipergunakan meliputi perangkat penyusun hardware dan perangkat penyusun software.Perangkat pada perancangan Tugas Akhir disusun sesuai dengan bagian masukan, proses, dan keluaran. Untuk bagian masukan hanya terdiri dari smartphone yang didalmnya telah terinstal perangkat penyusun software yaitu aplikasi ThingView yang telah ada pada Playstore. Pada aplikasi tersebut berfungsi sebagai monitoing keadaan cuaca disaat gelap , terang maupun hujan. Pentingnya sebuah perangkat proses agar dapat menghubungkan perintah yang diperintahkan dari perangkat masukan terhadap perangkat keluaran sebagai bentuk perintah dari perangkat masukan yang terdiri dari modul wifi ESP8266-01 merupakan modul komunikasi nirkabel melalui Wireless sehingga pengguna modul Wireless ESP8266-01 pada perancangan ini sebagai media komunikasi penghubung antara smartphone dengan mikrokontroler Arduino. Arduino berfungsi sebagai mikrokontroler atau otak pengendali dengan mengolah data yang dikirim dari perangkat modul ESP8266-01 sebagai bentuk perintah

dan kemudian diteruskan sebagai bentuk keluaran terhadap perangkat keluaran. Perangkat keluaran yang digunakan pada perancangan ini terdiri dari Motor DC sebagai penggerak untuk untuk masuk dan keluarnya Pengering ikan asin ini. Didalam alat tersebut ada beberapa sensor yang digunakan semisalnya sensor LDR berfungsi sebagai pendeteksi cahaya atau sinar matahari,selanjutnya sensor hujan berfungsi untuk menedeteksi air saat hujan, dan yang terakhir Limit Switch berfungsi untuk. Menghentikan gerak laju Motor Dc. ALUR PENELITIAN Dalam sebuah peranca ngan suatu penelitian diperlukan adanya alur penelitian supaya dalam melakukan perancangan dapat berjalan sesuai dengan yang telah direncanakan. Pada Flowchart ini menjelaskan suatu proses rancangan pada penelitian yang akan dibuat seperti pada gambar berikut:Perancangan Port Sensor Perancangan Port Wifi Baca Sensor Cahaya Cahaya mendeteksi gelapPapan Masuk Ya /w:t / Tidak Baca S ensor Hujan /w:t /w:r /w:p w:p w:rsidR="00B6698D" w:rsidRPr="00083D08" w:rsidRDefault="00B6698D" w:rsidP= /w:t /w:r /w:p w:p w:rsidR="00B6698D" w:rsidRPr="00083D08" w:rsidRDefault="00B6698D" w:rsidP /w:t /w:r w:r w:rsidRPr="00083D08" w:rsidRPr w:rFonts w:ascii="Times New Roman" w:hAnsi="Times Ne YaSensor Hujan mendeteksi hujan TidakPapan penjemur ikan asin state Gambar 3.1 Alur sistem alat papan Penjemur Ikan Asin. Berikut adalah penjelasan mengenai alur sistem rancang bangun alat papan penjemur ikan asin secara nirkabel menggunakan konsep IoT :Pada gam bar alur atau flowchart penelitian diatas menggambarkan bagaimana proses atau perancangan yang akan penulis buat. Langkah pertama Perancangan setiap port sensor air dan sensor hujan yang dilakukan oleh penulis dalam hal membandingkan kajian teori dari perancangan sebelumya,.

Pada perancangan ini dilakukan dengan mengumpulkan data dari buku-buku atau jurnal dari internet. Kemudian pada perancangan hardware merupakan proses pengumpulan alat dan bahan yang dibutuhkan dalam perancangan alat. Pada perancangan input ada sensor LDR dan sensor air sebagai pedeteksi cuaca hujan terang , gelap. Selanjunya penulis memerlukan perangkat Arduino Uno R3 sebagai pengolah data dari masukan modul Wifi ESP8266-01 dan modul Wifi ESP8266-01 merupakan sebagai media komunikasi dari Smartphone ke alat yang akan dirancang.Kemudian pada bagian output ada motor DC sebagai penggerak keluar masuknya papan dan yang terakhir limit Switch untuk mengehentikan gerak montor tersebut. Selanjutnya pada perancangan software maka akan ada grafik dan nilai resistansi pada smartphone. Selanjutnya adalah pengujian alat sesuai dengan parameter. Jika dalam pengujian terdapat kesalahan atau ketidak sesuaian maka akan dilakukan perancangan software dan hardware kembali sampai pengujian tersebut berhasil dan jika berhasil langsung dibuat hasil data berdasarkan pengujian dari perancangan alat tersebut. INPUT /w:t /w:r PROSES /w:t / OUTPUT /w:t /w:r /w:pGambar 3.2 Diagram Blok Sistem 3.3.

PERANCANGAN HARDWAREPada perancangan hardware ini merupakan perancangan beberapa perangkat yang menunjang dari pembuatan alat yang akan dibuat pada Tugas Akhir. Pada perancangan hardware terdiri dari bagian input, proses dan output yang dapat di lihat dalam diagram blok berikut ini :Dari gambar 3.2 menjelaskan tentang cara kerja sistem papan penjemur ikan asin secara nirkabel menggunakan konsep Internet Of Things (IoT) menggunakan komunikasi Wireless atau Wifi. Cara kerja pada perancangan ini dimulai dari smarphone android yang berperan sebagai Client yang di asumsikan sebagai transmitter (TX) yang harus menyalakan fasilitas Wireless terlebih dahulu agar dapat melakukan pairing terlebih dahulu dengan modul wifi esp8266-01. Modul Wireless ini diasumsikan sebagai Receiver (RX) yang terhubung dengan mikrokontroler arduino uno, sehingga dapat langsung mengakses perintah dari smarphone android.Dengan mengaktifkan fasilitas Wireless atau Wifi ini pada smartphone, akan terdeteksi oleh smartphone. Setelah itu, isi passwarod security pada Modul Wifi ESP8266-01 dengan mengisi bebas yang diinginkan, maka proses pairing telah selesai antara Tx dan Rx komunikasi Wireless telah terhubung. Data yang dikirim dari Arduino uno r3 ke android melalui

modul wifi esp8266-01.Dalam projek Tugas Akhir ini, blok diagram sendiri terdiri dari input, proses, dan output. Smarphone android merupakan output yang digunakan sebagai pengontrol atau menerima data dari arduino uno r3 adalah Xiomi Redmi Note5. Dengan pancaran sinyal wifi (Tx) yang diaktifkan dari smartphone dan diterima oleh modul wifi esp8266-01 (Rx) dapat mengontrol output dari projek Tugas Akhir ini. Modul Wifi ESP8266-01 merupakan jembatan komunikasi antar smartphone android dengan arduino uno. Dalam penggunaannya smartphone android akan memancarkan sinyal Wifi (Tx) yang memiliki frekuensi rendah 2,4 GHz.Mikrokontroler arduino uno merupakan komponen utama sebagai otak pengendali sistem dalam projek tugas akhir ini. Data yang dikirimkan melalui smartphone akan langsung terhubung dengan mikrokontroler arduino uno yang akan proses, kemudian akan memerintahkan rangkaian driver untuk menggerakan Motor DC. Pada rangkaian output terdapat motor DC. Motor DC merupakan perangkat elektromagnetis yang berfungsi untuk merubah gelombang listrik menjadi energi mekanik. Kemudian pada sensor LDR ini berguna untuk mengontrol kondisi cuaca cerah atau gelap, kemudian pada sensor hujan berguna untuk mengontrol keadaan di tempat pengering ikan asin tersebut apakah cuaca mau hujan atau tidak hujan.Gambar 3.3 Flowchart Perancangan HardwareBerikut adalah penjelasan dari Flowchart perancangan hardware, pada perancangan alat pada keseluruhan sensor akan dihubungkan dengan Arduino Uno R3. Pertama-tama pada pengujian cuaca panas sensor cahaya akan menerima pancaran cahaya ketika mendapatkan resistansi kurang dari 500 dan sensor hujan akan menerima resistansi 1 ketika sensor tidak terkena hujan maka motor dc keluar. Kemudan pada pengujian kedua cuaca malam sensor cahaya tidak menerima pancaran cahaya dari matahari atau

cuaca berubah menjadi gelap sensor akan mendapatkan resistansi lebih dari 650 dan masih tetap sensor hujan akan menerima resistani 1 ketika sensor tidak terkena hujan maka motor dc masuk. Kemudian pada pengujian ketiga cuaca hujan/mendung sensor cahaya tidak menerima pancaran matahari atau cuaca berubah mendung, sensor akan menerima resistansi 650 dan sensor hujan akan menerima resistani 0 atau ada hujan, maka motor dc masuk dan yang terakhir atau pengujian kelima cuaca panas dan hujan sensor cahaya akan menerima pancaran cahaya matahari dan terjadi hujan rintik sensor akan menerima resistansi 500 dan sensor hujan akan menerima resistansi 0 atau ada hujan maka motor dc masuk. Setelah seluruh sensor dan komponen terhubung selanjutnya adalah menghubungkan Modul ESP8266-01 ke Android, pada android kita mengakses terlebih dahulu ke website ThingSpeak agar saat memonitoring alat tersebut bisa di control melalui jarak jauh. Pembuatan aplikasi tersebut di website ThingSpeak. Kalo sudah buat kita sambungkan Wifi yang ada pada Modul ESP8266-01 dengan Wifi yang ada pada android.3.3
.1Perancangan Antarmuka Arduino Uno R3 dengan Modul Wifi ESP8266-01.Perangkat Modul Wifi ESP8266-01 berkomunikasi menggunakan Wifi dengan IC SoC ESP8266EX Serial-to-Wifi Communication Module ini merupakan komponen chip terintegrasi yang didesain untuk keperluan dunia masa kini yang serba tersambung. Sehingga dapat langsung untuk mengontrol data serial melalui computer agar dapat menggunakan fitur tersebut makan konfigurasi pin untuk rx dihubungkan ke pin tx yang ada pada Arduino Uno R3, selanjutnya pin tx pada Esp8266 ini dihubungkan ke Rx yang ada pada Arduino Uno R3 ini.
Sedangkan untuk vcc pada modul wifi esp8266-01 dihubungkan ke vcc pada Arduino dan vin pada Modul esp8266-01 dihubungkan ke pin 3,3v pada arduino, selanjuntya pin GND pada modul esp8266-01 di hubungkan ke pin gnd pada arduino dan tang terakhir pin enable pada modul esp8266-01 ini dihubungkan ke pin 3,3v pada arduino. Yang di perjelas pada gambar 3.1 dibawah ini.Gambar 3.4 Perancangan antarmuka Arduino Uno R3 dengan Modul Wifi ESP8266-0.Tabel 3.1 Konfigurasi Pin antara Arduino Uno R3 dengan Modul Wifi ESP8266-01Pin Modul Wifi ESP8266-01Arduino Uno R3 GND GND VIN 3,3v TX RX RX TX 3.3.2 Perancangan Antarmuka Arduino dengan Sensor LDR.Sensor LDR pada Projek Tugas Akhir ini Berfungsi sebagai pendeteksi Cuaca di sekitar Prototype alat papan penjemur ikan asin tersebut. Jika nanti cuaca Cerah dan Gelap maka sensor akan bekerja.Gambar 3.5 Perancangan Antarmuka Arduino dengan Sensor LDR.Tabel 3.2 Konfigurasi Pin antara Arduino Uno R3 dengan Sensor LDR.Pin Sensor Cahaya Arduino UNO R3 VCC 5v GND GND A0 A0 3.3 .3 Perancangan Antarmuka Arduino dengan Sensor Hujan.Pada tugas akhir ini menggunakan s ensor Air / Hujan. Sensor air ini Merupakan modul elektrik yang sering digunakan untuk detector air / hujan. Sensor hujan berbentuk panel bergaris dengan perinsip kerja apabila panel tersebut terdapat air maka arus yang ada pada panel akan terhambat dan driver akan mengirimkan sinyal pada mikrokontroler. Sensor yang difungsikan mendeteksi ada tidaknya kondisi rintik hujan yang dimana dimanfaatkan dalam berbagai aplikasi mulai dari yang sederhana hingga aplikasi yang kompleksGambar 3.6 Perancangan Antarmuka Sensor Air / hujan dengan ArduinoTabel 3.3 Konfigurasi Pin antara Sensor Air / hujan dengan ArduinoPin Sensor Hujan Arduino UNO R3 VCC 5v GND GND DO Port
43.3 .4 Perancangan Antarmuka Motor Dc dengan Arduino .Pada projek tugas akhir ini menggunakan Arduino Uno R3 yang memeiliki spesifikasi yang cukup mumpuni dalam memenuhi kebutuhan dari sistem pembuatan rancang bangun alat papan penjemur ikan asin secara nirkabel menggunakan konsep IoT dengan sistem pengendali Arduino Uno R3. Pada alat ini motor dc berfungsi sebagai penggerak yang akan menggerakan Papan Ikan Asin yang sudah diatur. Pada gambar 3.4 di bawah ini menunjukan pembagian pin yang digunakan oleh motor dc untuk menggerakan papan jemuran ikan asin dengan mengontrol melalui aplikasi yang sudah di buat di smartphone/ android.Gambar 3.7 Perancangan Antarmuka Arduino dengan

Motor DcTabel 3.4 Konfigurasi Pin antara Arduino Uno R3 dengan Motor DcPin Motor Dc Arduino UNO R3 VCC 5v GND GND B-1A Port 6B-1B Port 73.3.5 Perancangan Antarmuka Hardware KeseluruhanPerancangan hardware yang dirancang terdiri dari perangkat, Modul Wifi ESP 8266-01, Arduino Uno R3, Sensor LDR, Motor DC. Sensor Hujan. Limit Switch. Dalam sistem kerja perancangan yang dibuat mikrokontroler Arduino Uno R3 digunakan sebagai sistem utama dari perancangan yang dibuat dan terhubung langsung dengan sumber tegangan. Sumber tegangan yang dihubungkan menggunakan Adaptor pada mikrokontroler Arduino Uno R3 yang berasal dari PLN. Untuk komunikasi yang digunakan menggunakan modul WIFI ESP 8266-01 dengan sumber tegangan yang dibutuhkan disalurkan melalui Arduino Uno R3 sebesar 5V. Untuk bentuk keluaran dalam perancangan ini adalah motor dc sebagai penggerak papan pada alat Penjemur ikan asin. Perangkat keluaran tersebut membutuhkan tegangan masukkan lebih dari 5V namun pada board Arduino Uno R3 hanya dapat mengaktifkan tegangan sebesar 5
V. Oleh karena itu, dibutuhkan catu daya yang fungsinya sebagai saklar dan menyalurkan tegangan langsung dari adaptor DC dan tegangan langsung PLN atau AC.Gambar 3.8 Perancangan Antarmuka Hardware Keseluruhan3.3.6 Perancangan Visual Antarmuka Hardware Dan SofwarePada gambar 3.9 bentuk Visual hardware yang dirancang untuk mengenal bagan bagian hardware yang digunakanan. Dalam sistem kerja perancangan yang dibuat mikrokontroler Arduino R3 digunakan sebagai sistem utama dari perancangan yang dibuat dan terhubung langsung dengan sumber tegangan yang dihubungkan menggunakan adaptor pada mikrokontroler Arduino Uno R3 yang berasal dari PLN. Untuk komunikasi menggunakan Modul WIfi ESP8266-01 dengan sumber 3,3V - 5V. Untuk bentuk keluaran dalam

perancnagna ini adalah motor dc sebagai penggerak pada papan ikan asin. Perangat keluaran tersebut membutuhkan tegangan masukkan lebih dari 5V namun pada Arduino R3 hanya dapat mengaktifkan tegangan sebesar 5V.Gambar 3.9 Bentuk Tampilan Visual alat papan Penjemur ikan asin3.4. PERANGKAT SOFTWARE Pada perancangan perangkat lunak (Software) yang digunakan dalam penelitian ini yaitu pembuatan program yang digunakan mikrokontroler dalam memproses informasi. Pada saat pembuaat digunakan sebuah dofware Arduino IDE dengan bahasa pemograman bahasa C. selain itu pada peneilitan ini dibuat bernama Alat papan penjemur ikan asin. Aplikasi yang dipasang pada Smartphone untuk pemberitahuan informasi adanya hujan maupun cuaca cerah dibuat melalui aplikasi MIT App Inventor melalui web-based service pada browser secara online. Database atau Cloud yang digunakan untuk berkomunikasi antara Smarphone dan Arduino Uno R3 yaitu Thingspeack. Thingspeack sendiri akan menjadi jembatan pada komunikasi adri Arduino Uno R3 yang mampu mengirimkan data kepada Client secara real time.Inisialisasi Program Arduino Modul ESP 8266-01Cek ketersediaan modul ESP 8266-01 Sambungkan Modul Wifi 8266 -01 Tidak Apakah Modul Wifi Terhubung ? /w:t / /w:t /w:r w:r w:rsidRPr="000C1200" w:rPr w:rFonts w:ascii="Times New Ya Menerima perintah dari Smartphone /w:t /w:r /w:p w:p w:rsidR="00B6698D" w:rsidRPr="00083D08" w:rsidRDefault="00B6698D" w:rsidP /w:t /w:r /w:p w:p w:rsidR="00B6698D" w:rsidRDefault="00B6698D" w:rsidP="00B6698D" w:pPr w:s Menerjemahkan Perintah Menjalankan Perintah Gambar 3.10 Flowchart Perancangan Software Pemograman Arduino Uno3.4.1 Perancangan Template ThingSpeakThingSpeak merupakan aplikasi Internet Of Things open sorce dan API untuk menyimpan dan mengabil data dari berbagai hal menggunakan HTTP melalui internet atau melalui Local Area Network (LAN). ThingSpeak memungkinkan pembuata aplikasi pencatatan sensor dan jejaring sosial tentang hal-hal dengan pembaruan status. ThingSpeak memiliki dukungan terintegritas dari perangkat lunak komputasi numerik dari MathWorks, yang memungkinkan pengguna ThingSpeak untuk menganalisis dan memvisualisaikan data yang diunggah menggunakan Matlab tanpa memerlukan pembelian lisensi Matlab dari Mathworks. Pada tugas Akhir ini ThingSpeak digunakan sebagai template atau media dalam mempresentasikan data yang diunggah setiap saat oleh prototype papan penjemur ikan asin otomatis.

Berikut adalah langkah- langkah dalam membuat sebuah template atau akun dari ThingSpeak.Gambar 3.11 Pembuatan Template ThingSpeakPada gambar 3.11 merupakan langkah awal dalam pembuatan akun ThingSpeak dengan memasukan E-mail pribadi sebagai alamatnya kemudian pembuatan password agar tidak bisa di buka sama orang lain kecuali pemiliknya sendiri.Gambar 3.12 Pembuatan Channel atau Field pada ThingSpeakSesudah pembuatan akun E- mail dan Password maka langkah selanjutnya pada Gambar 3.11 adalah pembuatan channel baru, channel ini berfungsi sebagai template dalam menampilkan hasil data dari prototype yang sedang bekerja. Field sebagai penampil sebuah parameter yang akan digunakan.Gambar 3.13 Hasil Channel atau Field pada ThingSpeakPada gambar 3.12 merupakan grafik hasil data yang dihasilkan oleh prototype papan penjemur ikan asin, pada template ThingSpeak Tugas Akhir ini terdapat 2 parameter yang menunjukan hasil dari kerja alat papan penjemur ikan asin otomatis ini.3.4.1 Perancangan Aplikasi MIT APP Inventor Aplikasi yang terpasang pada Smartphone dibuat menggunakan MIT APP Inventor secara online. Pada gambar di bawah ini merupakan tampilan awal untuk pembuatan project baru, untuk dapat masuk pada software ini kita memasukan akun Gmail terlebih dahulu.Gambar 3.14 Tampilan awal MIT APP InventorUntuk pembuatan projek baru klik start new projek seperti pada gambar 3.14. Menu start new project ditampilkan pada gambar 3.15, untuk projek name diisi dengan nama yang diinginkan karena pada penelitian ini nama aplikasi akan muncul sebagai awal tampilan.Gambar 3.15 Memberikan Nama Project Pada gambar 3.16 merupakan tampilan untuk

layar awal aplikasi. Pada tampilan awal digunakan tombol Mulai utnuk membuka halaman projek berikutnya. Gambar 3.16 Tampilan Awal Tombol StarPada gambar 3.17 merupakan tampilan untuk layar kedua setelah tampilan awal Aplikasi mulai di tekan. Pada layar kedua ini terdapat kolom untuk menampilkan intensitas yang terdeteksi. Kolom ini dengan nama Intensitas Cahaya dan Intensitas Hujan.Gambar 3.17 Tampilan Di Dalam AplikasiPada aplikasi Project Tugas Akhir ini dapat berubah sesuai dengan kondisi cuaca .Nilai yang terdeteksi dan ditampilkan pada kolom Intesitas. untuk dapat menampilkan Grafik atau intensitas pada status tersebut digunakan sebuah Link yang dapat terhubung dengan Cloud Thingspeack. Pada kedua tampilan halaman awal dan aplikasi. Status terdapat pengkodean atau blocks untuk menjalankan aplikasi tersebut. Kode tersebut seperti puzzle yang di rangakai sedemikian rupa. Gambar 3.18 Blocks Halaman AwalGambar 3.19 Blocks Halaman AplikasiBAB 4HASIL DAN PEMBAHASAN Pada bab ini menjelaskan mengenai proses pegujian kerja alat dari tiap bagian komponen dan secara keseluruhan. Pengujian kali ini dilakukan untuk mengetahui cara kerja dari setiap sistem dari masing masing blok, serta menjelaskan tentang cara pengoprasian alat papan jemuran ikan asin secara nirkabel menggunakan konsep internet of thing tersebut sesuai dengan prosedur perancangan dan menjelaskan hasil yang diharapkan.HASIL PERANCANGAN Pada implementasi hasil perancangan ini menjelaskan tentang bagaimana bentuk alat Tugas Akhir ini diterapkna pada sebuah permasalahan yang melatar belakangi alat tersebut dibuat. Berdasarkan masalah latar belakang yang diterapkan pada alat ini yaitu dari faktor segi praktis supaya alat dalam keadaan seimbang atau dalam posisi horizontal. Hal ini dapat dilihat pada gambar dibawah ini.Gambar 4.1 Perancangan Perangkat Keseluruhaa Pada gambar 4.1 menggambarkan secara jelas kondisi pada alat

papan penjemur ikan asin secara otomatis. Pada gambar tersebut terdapat komponen, seperti motor dc, arduino uno r3, sensor cahaya / LDR, sensor hujan, limit switch dan modul wifi esp-8266,01. Pertama adalah limit switch, limit switch merupakan perangkat elektromekanis yang digunakan sebagai saklar pembatas atau penghenti laju motor dc ketika keadaan hujan, cerah maupun gelap. Pada gambar kedua motor dc , digunakan untuk menggerakan papan penjemur ikan asin saat terjad hujan , cerah maupun gelap. Selanjutnya pada alat ketiga adalah sensor hujan, pada alat ini berfungsi sebagai pendeteksi hujan atau tidak hujan, pada sensor hujan ini terdapat ic komparator yang dimana output dari sensor ini dapat berupa logika high dan low. Kemudian pada alat keempat adalah sensor cahaya merupakan sebuah alat yang digunakan untuk mengubah besaran cahaya menjadi besaran listrik. Kemudian alat yang terakhir atau keenam adalah Arduino uno r3 merupakan sebagai otak pada alat papan penjemur ikan asin tersebut. Untuk pemantauan hasil data dari perangkat ini digunakan aplikasi sebagai medianya, untuk aplikasi yang digunakan adalah Thingspeak .4.2 PENGUJIAN SISTEM RANGKAIAN Pengujian yang dilakukan kali ini untuk mengetahui setiap perangkat data berfungsi sesuai dengan perencanaan. Pengujian beberapa s ensor, modul Wireless ESP8266-01, motor dc dan akurasi data Thingspeak ke Smarphone.4.2.1 Pengujian Rangkaian Sensor Cahaya / LDR Pengujian ini bertujuan untuk mengetahui bahwa sensor cahaya/ ldr dapat bekerja dengan baik atau tidak. Pada pengujian ini dilakukan dengan 3 Cuaca yaitu pagi, siang dan sore.

Pada pengujian ini akan menampilkan serial monitor di setiap 3 cuaca tersebut apakah berfungsi atau tidak nya akan di uji dengan intensitas setiap cuaca yang akan keluar di serial monitor.Gambar 4.2 Pengujian Sensor LDR Gambar 4.3 Tampilan Listing program dan Serial Monitor Sensor LDRTabel 4.1 Pengujian Sensor LDR Di 3 Cuaca No Waktu Pagi Dengan Intensitas CahayaKeterangan 1 35 Berfungsi 2 34
Berfungsi 3 34 Berfungsi 4 34 Berfungsi 5 34 Berfungsi 6 36 Berfungsi 7 34 Berfungsi 8 34 Berfungsi 9 34
Berfungsi 10 35 Berfungsi 11 35 Berfungsi 12 34 Berfungsi 13 34 Berfungsi 14 35 Berfungsi 15 35 Berfungsi
16 34 Berfungsi 17 34 Berfungsi 18 34 Berfungsi 19 34 Berfungsi 20 35 Berfungsi 21 145 Berfungsi 22 170
Berfungsi 23 181 Berfungsi 24 184 Berfungsi 25 186 Berfungsi 26 184 Berfungsi 27 186
Berfungsi 28 188 Berfungsi 30 190 Berfungsi Berdasarkan Tabel 4.1, mempunyai perubahan resistansi yang besarnya tergantung pada cahaya. Resistor peka cahaya (Light Dependent Resistor/LDR) memanfaatkan bahan semikonduktor yang karakteristik listriknya berubah-ubah sesuai dengan cahaya yang diterima. Menunjukan bahwa sensor ldr dapat bekerja dengan baik . 4.2.2 Pengujian Koneksi Modul Wireless ESP 8266- 01Koneksi komunikasi Wireless (WIFI) merupakan akses awal untuk sistem monitoring alat ini. Tujuan dari pengujian kali ini yaitu untuk mengetahui Arduino Uno R3 mampu menerima data yang dikirimkan melalui komunikasi modul Wireless ESP 8266-01 dengan pengujian untuk mengetahui terkoneksi tidaknya Wireless ke Smartphone. Berikut hasil pengujian modul ESP-8266.01 dapat di lihat pada gambar di bawah ini.Gambar 4.4 Tampilan Listing program dan Serial Monitor pada Modul WirelessListing program tersebut mengenai perangkata mikrokontroler Arduino Uno R3 yang membaca komunikasi serial yang dikirimkan dari aplikasi Wireless terminal melalui Smartphone. Pada aplikasi akan membaca data yang dikirimkan berupa data decimal atau intensitas, karena tipe data yang dikirimkan yang digunakan pada program, maka untuk rancang bangun alat papan penjemur ikan asin menggunakan komunikasi Wireless berjalan dengan baik.

Dengan konversi atau data 48 yang masuk yang tercantum pada serial monitor. Dari data yang di dapat dari pengujian ini dapat sebagai tolak ukur pembuatan aplikasi smartphone agar dapat mengirimkan komunikasi serial yang dibaca oleh Arduino Uno R3.Tabel 4.2 Pengujian Modul Esp 8266-01 yang sudah terkoneksiPerintah AT Command Keterangan AT Test AT startup

AT+CWMODE 1 Terkonek AT+CWJAP "ganaskondang","16201017" AT+CIPSTART "TCP","184.106.153.149",80 AT_CIPSEND 48 AT+CIPCLOSE
Tutup koneksi TCP / UDP / SSL 4.2.3 Pengujian Drive Motor Dan Motor Dc Driver Motor L9110 digunakan sebagai pemicu dari arah pergerakan motor dc. Pada L9110 ,12V,800 mA, memiliki 2 buah pin enable, 4 buah pin input, dan 4 buah pin output yang mana memungkinkan bagi kita untuk mengontrol 2 buah motor dc, namun pada rangkaian driver kali ini dipakai 1 buah motor dc jadi pin yang cukup 1 buah enable (ENB/PIN VCC) sebagai tegangan dan (OUT/ PIN GND) sebagai mengenol kan sebuah tegangan disaat terjadi kebocoran tegangan pada drive motor . Pada 2 buah pin input maupun output untuk mengerakan motor dc dari satu arah kea arah berlawanan (2 buah pin input (IN/ B-1A dan Out/B-1B) yang dihubungkan dengan motor dc.Pengujian dilakukan dengan cara memberi inputan berupa logika "1" dan "0" pada masing - masing pin inputan secara bergantian kemudian melihat perubahan pada pergerakan motor yang terlebih dahulu sudah disambungkan pada pin pin output dari driver .Gambar 4.5 Pengujian Driver Motor dan Motor Dc.Berdasarkan gambar 4.6 Pengujian dilakukan dengan cara memberi inputan berupa logika "1" atau Masuk dan "0" atau Keluar pada masing masing pin inputan secara bergantian kemudian melihat perubahan pada pergerakan motor yang terlebih dahulu sudah disambungkan pada pin - pin output dari driver. Berikut adalah tabel hasil pengujian Driver.Tabel 4.3 Hasil Pengujian Rangakian Driver Motor L9110Pengujian ke : PIN L9110 Keterangan B-1A B-1B 1 1 0 Masuk (CW) 2 0 1 Keluar (CCW) 3 0 0 Tidak Berjalan Keterangan : CW = Clockwise (searah putaran jarum jam)CCW = CounterCLockwise (berlawanan arah jarum jam)Setelah melakukan pengujian pada driver motor, hasil yang didapatkan dari pengujian tersebut driver bekerja sesuia dengan keinginan. Jika input B-1A diberi logika 1 dan output B-1B diberi logika 0, maka motor bergerak berputar searah jarum jam (Clockwise), dengan input Arus kepada motor dc 5 -12V.

Sedangkan jika input B-1B dibuat logika 1 dan output B-1A diberi logika 0 maka motor bergerak berputar berlawanan jarum jam (counterclockwise) atau keluar . motor akan bergerak masuk (CW) pada saat B-1A diberi logika 1. Sedangkan motor bergerak akan keluar (CCW) dengan tegangan input arus motor dc sebesar -5 V, jika B-1B diberi logika 1. Jika B-1A dan B-1B diberi logika 0 maka motor penggerak tidak berjalan.4.2.4 Pengujian Rangkaian Sensor Hujan Pada pengujian sensor hujan ini bertujuan berfungsi tidaknya alat ini ketika sensor terkena air. Sensor hujan ini berfungsi untuk mendeteksi ada atau tidaknya air hujan. Pada pengujian ini sensor hujan akan diberi logika inputtan "1" ketikan ada air dan output atau tidak ada nya air diberi logika "0".Gambar 4.6 Pengujian Sensor Hujan/Raindrop Gambar 4.7 . Tampilan Listing Program pada Sensor HujanGambar 4.8 Serial Monitor Dan Sensor Hujan Pada Kondisi Panas atau 0.Gambar 4.9 Serial Monitor Dan Sensor Hujan Pada Kondisi Hujan atau 1.Tabel 4.4 Hasil Pengujian Rangakian Sensor Hujan/ RaindropNo Kondisi sensor Keterangan 1 1 Kondisi hujan 2 0 Kondisi panas Pada pengujian sensor hujan ini kita mengetahui bagaimana kinerja alat tersebut ketika diuji menggunakan air maupun tidak menggunakan air. Pada seral monitor kita akan mengetahui nilai sensor dan keadaan kondisi sensor tersebut dengan memberi nilai logika "1" ketikan ada hujan dan memberi nilai logika "0" ketika sensor tidak menerima hujan atau adanya kondisi panas.4.2.5 Pengujian Aplikasi Alat Papan Penjemur ikan Otomatis. Aplikasi yang telah dibuat dilakukan pengujian dengan tujuan untuk mengetahui aplikasi berkerja sesuai dengan perancangan atau tidak. Pada aplikasi ini telah dibuat tampilan saat masuk aplikasi ini , dengan membuat 2 halaman tampilan yaitu awal dan aplikasi. Pada gambar dibawah ini merupakan tampilan awal dari aplikasi papan penjemur ikan otomatis.Gambar 4.10 Tampilan Awal Aplikasi.Pada gambar 4.11 di atas merupakan tampilan awal aplikais alat papan penjemur ikan otomatis.
Pada tampilan di atas ada tombol Star yang berfungsi untuk membuka jendela halaman satunya. Di bawah
ini merupakan tampilan halaman 2 pada aplikasi yang sudah dibuat. Gambar 4.11 Tampilan Halaman Aplikasi.Pada gambar 4.11 di atas menunjukan bahwa halaman kedua dari tampilan awal bisa di akses. Pada tombol Cahaya berfungsi untuk mengkases ke web Thingspeak agar menampilan Field1 atau menampilkan grafik sensor ldr pada saat alat penjemur ikan otomatis itu berjalan. Gambar di bawah ini menampilkan grafik yang lebih dari 650 grafik akan naik . kemudian pada sensor ldr terkena pancaran sinar matahari dengan nilai resitansi kurang dari 500 grafik akan turun.Gambar 4.12 Tampilan Grafik Ketika 650.Gambar 4.13 Tampilan Grafik Ketika 500.Kemudian pada gambar 4.13 menampilkan grafik field 2 pada Thingspeak dengan tombol Hujan pada Gambar 4.11 berfungsi untuk menampilakn grafik di web Thingspeak. Pengujian menggunakan aplikasi dengan Thingspeak. Ketikan sensor hujan terkena hujan dengan nilai resistansi 1 atau ada hujan, kemudian pada keadaan tidak hujan nilai resistansi 0. Gambar 4.14 Tampilan Grafik Ketika Ada HujanGambar 4.15 Tampilan Grafik Ketika Tidak Ada Hujan.4.3 PENGUJIAN KESELURUHANSetelah seluruh tahapan pengujian piranti lunak dan piranti keras dilalui, maka selanjutnya dilakukan pengujian rangkaian keseluruhan. Pengujian rangkaian secara keseluruhan dilakukan untuk mengetahui keberhasilan sistem dalam menjalankan beberapa fungsi dalam satu waktu dengan menggabungkan seluruh fungsi pada satu program, selain itu pengujian rangkaian secara keseluruhan dilakukan dengan memperhatikan keluaran yang diharapkan dapat bekerja dengan baik. Pengujian ini dilakukan dari penyambungan konektifitas dari wifi pada smartphone dengan modul WIFI ESP 8266-01 beserta seluruh perlengkapan pendukung pada alat Tugas Akhir yang dikerjakan dengan diikuti perintah yang telah dirancang pada bab sebelumnya.Tabel 4.4 Hasil Pengujian Secara Keseluruhan No Nama Rancangan Hasil 1 Sensor Ldr Pengujian Di 3 Cuaca mempunyai perubahan resistansi yang besarnya tergantung pada cahaya.Menunjukan bahwa sensor ldr dapat bekerja dengan baik 2 Modul ESP 8266-01 Terkoneksi dengan Smartphone Berhasil terkoneksi dengan Menerima Wifi dengan nama "ganaskondang" dan password

"16201017"kemudian pada pengiriman data terdeteksi dengan nilai 48 data yang masuk.3 Drive Motor Dan Motor DC Ketika Motor Dc Sudah di coding perputarannya Pengujian Pertama ketika memanggil Inputan B1-A dalam keadaan Hujan motor Dc masuk ruangan .pengujian Kedua dengan memanggil B1.Bdalam keadaan cerah motor Dc akan keluar ruangan .4 Aplikasi Tombol Star Pada pengujian Tombol Star. Sudah berhasil dalam masuk ke halaman Aplikasi. Tombol Cahaya Pada pengujian Tombol Cahaya . sudah berhasil dalam masuk ke website Thingspeack dan keluar grafik yang sudah terkoneksi dengan Modul Wifi.Tombol Hujan Pada pengujian Tombol Hujan . sudah berhasil dalam masuk ke website Thingspeack dan keluar grafik yang sudah terkoneksi dengan Modul Wifi.BAB 5PENUTUP 5.1 KESIMPULANSe telah melakukan perancangan dan realisasi pada alat Tugas Akhir dengan judul Rancang Bangun Alat Papan Penjemur Ikan Asin Secara Nirkabel Menggunakan Konsep Iot (Internet Of Things), maka dapat disimpulkan beberapa hal, antara lain :Pada pembuatan sistem alat Papan Penjemur Ikan Asin Secara Nirkabel Menggunakan Konsep Iot ini semua sistem dapat bekerja dengan baik sesuai perancangan
.Kedua sensor dapat bekerja denganbaik, sensor LDR dapat mendeteksi adanya perbahan cahaya (dari
terang ke gelap atau sebaliknya) dan sensor hujan dapat mendeteksi adanya air atau tetesan air hujan.Alat mampu membaca keadaan cuaca, dimana dalam kondisi panas namun ada hujan. Dapat disimpulkan bahwa untuk menyatukan Internet Of Things dengan mikrokontroler menggunakan media wireless untuk menghubungkan, komponen yang digunakan untuk menghubung kan menggunakan modul wifi ESP 8266- 01 .5.2 SARANBerdasarkan pengujian dan pembahasan yang telah dilakukan secara keseluruhan pada

penelitian selanjunya terdapat beberapa saran apabila pembaca atau piak yang berkepentingan ingin melanjutkan peneliti ini sebagai berikut :Untuk penelitian selanjutnya dapat dikembangkan dengan menambahkan sistem notifikasi kepada user pada pemantau alatnya. Pada perkembangan kedepan semoga dapat menambahkan akses control alat papan ikan jemuran otomatis menggunakan weba taupun aplikasi. Untuk pengembangan alat perlu ditambahkan beberapa komponen pendukung lagi agar alat tersebut lebih baik. DAFTAR PUSTAKA [1] O. Adha, " Rancang Bangun Penjemur Ikan Asin Berbasis Mikrokontroler ATmega328 ," Sistem Komputer Untan, Jurnal Coding, 2015, pp. 22 - 31.[2] W. S. Siswanto S, "Jemuran Pakaian Otomatis Menggunakan Sensor Hujan dan Sensor LDR Berbasis Arduino Uno," Universitas Narotama Surabaya, e-Jurnal Narodroip, 2015, pp. 66-73. [3] S. Rivaldi, " Rancang Bangun Penjemur Ikan Asin Berbasis Mikrokontroler ," Bandung, Politeknik Negeri Bandung, 2017. [4] E. Risnawan ,
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