**Pushbutton to GND**

- Pushbutton to GND
- 1KΩ
- 100nF

- Pin Goes LOW when button pressed
- To reduce the interferences add a capacitor

**Pushbutton to 12V**

- Pushbutton to 12V
- 470Ω

- Pin Goes HIGH when button pressed

**Pushbutton to 5V**

- Pushbutton to 5V
- 10KΩ

- Pin Goes HIGH when button pressed

**Using Internal Pullup**

- 5V
- 1KΩ

**Optocoupled inputs**

- Used when galvanic separation between external circuitry and Arduino circuit is required

- MAX +12V
- 1KΩ

**Trimmer or Potentiometer**

- 5V

- Analog Input

**Photoresistor**

- 5V

- Analog Input

---

**Optocoupled inputs**

- Used when galvanic separation between external circuitry and Arduino circuit is required

- MAX +12V
- 1KΩ

- IN

---

**Pushbutton to 12V**

- Should you need to connect Arduino inputs to a DC voltage higher than 5V

- +12V

- Pin Goes HIGH when button pressed

**Pushbutton to 5V**

- Pushbutton to 5V
- 10KΩ

- Pin Goes HIGH when button pressed

**Trimmer or Potentiometer**

- 5V

- Analog Input

**Using Internal Pullup**

- 5V
- 1KΩ

**Optocoupled inputs**

- Used when galvanic separation between external circuitry and Arduino circuit is required

- MAX +12V
- 1KΩ

IN

---

**Pushbutton to 12V**

- Should you need to connect Arduino inputs to a DC voltage higher than 5V

- +12V

- Pin Goes HIGH when button pressed

---

**Optocoupled inputs**

- Used when galvanic separation between external circuitry and Arduino circuit is required

- MAX +12V
- 1KΩ

IN
**Connect a Led**

470Ω

OUT

K

A

K

**Connect a Lamp (DC Low Voltage)**

1N4007

2N2222

**Dual LEDs or bi-color LED**

HIGH

OUT

LOW

**LED clusters**

+12V

#Leds Resistor Value

<table>
<thead>
<tr>
<th>#Leds</th>
<th>Resistor Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1KΩ</td>
</tr>
<tr>
<td>2</td>
<td>820Ω</td>
</tr>
<tr>
<td>3</td>
<td>750Ω</td>
</tr>
<tr>
<td>4</td>
<td>680Ω</td>
</tr>
<tr>
<td>5</td>
<td>470Ω</td>
</tr>
<tr>
<td>6</td>
<td>390Ω</td>
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</tbody>
</table>

Led goes ON when pin is set to LOW

Led goes ON when pin is set to HIGH

Lamp goes ON when pin is set to LOW

Leds goes ON when pin is set to LOW

**Notes:**

- **5V**
- **+12V**
- **NPN**
- **2.2KΩ**

**References:**

- www.pighixxx.com
- 03 APR 2013
- ver 1 rev 0
Connect a Mosfet

Mosfet excited when pin is set to HIGH

Connect a Relay

Relay goes ON when pin is set to HIGH

Connect an Audio Amplifier

Connect a Buzzer

Recommended only for Switch or in Low frequency applications.
Connect a Triac

Connect a Speaker

You can use 2 PWM pin
Connect a DC Motor

Set Pin to HIGH Motor ON

You can also use a PWM pin

Connect an Encoder

Counterclockwise

Fase 1(A)

Fase 2(B)

Connect a RGB Led Strip

You can also use a PWM pin

+12V

Connect an Encoder

+12

IRL540

IRL540

100KΩ

100Ω

1µF

100nF

10KΩ

10KΩ
Connect a Microphone

Connect a Servo

Connect to an external power supply!
Charlieplexing

Out1 Out2 Out3
L L L
L Hi
H Li
i LH
i HL
L i H
Hi L

H=High, L=Low, i=Input

7 Segments Display

OUT

5V

common

OUT

OUT

OUT

OUT

OUT

OUT

OUT
7 Segments Display (Common Anode) with Multiplexing

5V common

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OUT
7 Segments Display (Common Anode) with MAX7221

Current | 1.5V | 2.0V | 2.5V | 3.0V | 3.5V
--------|------|------|------|------|------
40mA    | 12KΩ | 12KΩ | 13KΩ | 18KΩ | 18KΩ |
30mA    | 18KΩ | 17KΩ | 16KΩ | 15KΩ | 14KΩ |
20mA    | 30KΩ | 28KΩ | 26KΩ | 24KΩ | 22KΩ |
10mA    | 68KΩ | 64KΩ | 68KΩ | 56KΩ | 51KΩ |
Connect a LCD HITACHI 44780 compatible

Use PWM to change LCD brightness.

Optional connection to BC337 transistor for 4-bit mode.

Connect to ground if LCD brightness is not used.

**ARDUINO**

**Basic Connections**

**THE UNOFFICIAL ARDUINO**

**www.pishixxx.com**

**03 APR 2013**

**VER 1 REV 0**
Connect via I2C a LCD HITACHI 44780 compatible

Used for 4bit mode
Connect a NOKIA LCD (Basic)

Only for 5V Arduino

NOKIA 3110

NOKIA 5110

Hello Arduino!

D12
D2
D3
D4
D5
D6
1N4148 x 4
VDD
D/C
SCE
SDIN
RES
SCK
SCE
GND
VOUT
LED
120Ω
4.7µF
3.3Ω
1.8Ω
Drive a Unipolar Stepper (Basic 1)

Drive a Bipolar Stepper (Basic 1)

External Motor Supply
Not Arduino Supply!

22Ω = 22Ω 22Ω

Zener 12V
All Resistor 1/4W

External Motor Supply
Not Arduino Supply!
Connect a graphical LCD via I2C

HELLO ARDUINO!
THANKS TO NICK GAMMON
WWW.GAMMON.COM.AU

MCP23017

ARDUINO

THE UNOFFICIAL ARDUINO

ARDUINO basic connections

Connect a graphical LCD via I2C

HELLO ARDUINO!
THANKS TO NICK GAMMON
WWW.GAMMON.COM.AU

MCP23017

ARDUINO

THE UNOFFICIAL ARDUINO

ARDUINO basic connections
Connect a SD Card

SD Card Pinout

Simple 3.3V Power Supply

Only for 5V Arduino
Connect a Temperature Sensor (LM35)

A K

LM35

GND

Out

VCC

5V

A0

18KΩ

A1

Connect to Composite Video

1KΩ

470Ω

9

Sync

Video

Connect to VGA

Connect a RTC (DS1307)

32768Khz

10KΩ

5V

No 3V Battery? Connect Vbat to ground.

Connect to Composite Video

Connect to VGA

Connect a RTC (DS1307)
Connect a Keypad

IN IN IN IN IN

Connect a Keypad (with Interrupt)

IN IN IN IN IN

1N4148 x 4
Connect a IR Sensor

IR: S - +
Vcc: +
Gnd: -
4.7µF: 100Ω
12KΩ: 5V

Recommended to suppress power supply disturbances

Connect a IR Emitter

OUT: 1KΩ
100nF: 39Ω
100nH: 5V

Forward Voltage Led
Forward Current Led
Source Voltage

R = \frac{V_{in} - V_{F}}{I_{F}} \times 1000

V_{F}: Source Voltage
I_{F}: Forward Current Led
Connect a MAX232

RS-232
TTL/CMOS

MAX232

Connect a MAX232

TX2
7

RX2
8

TX0
2

RX0
3

5V

RTS

Tx

Rx

VCC

GND

100nF

1KΩ

4 x 1µF

MAX232

TX

RX

RS-232
TTL/CMOS

Connect a MAX232
MIDI Interface

Multiple Buttons using 1 Analog Input
Connect a Digital Temperature Sensor (DS18B20)

A simple Rain Sensor with Arduino

Volt$_{in}$, Resistor Value

- 12 47Ω
- 24 1KΩ
- 48 2.2KΩ

AC input
Connect a PS2 Keyboard

- IN
- 100Ω
- NC
- 5V
- Clock
- Data
- NC
- IN
- 100Ω
- 100Ω

Scan Codes

```
Scan Codes

IN
IN
100Ω
100Ω

Connect a PS2 Keyboard

NC 6
5 Clock

5V 4
3 GND

1 Data

Scan Codes

~` 1 2 3 4 5 6 7 8 9 0 - =
delete

Q W E R T Y U I O P

caps lock

A S D F G H J K L

shift

Z X C V B N M

control

@?

0E 16 @E #^ $% 2E ^& 3E 4E + 5E 6E
```

www.pigihixxx.com

07 APR 2013
ver 1 rev 0
Connect a EEPROM via I2C

- Write operations Enabled
- Write operations Disabled

Address
- 0x00
- 0x01
- 0x02
- 0x03
- 0x04
- 0x05
- 0x06
- 0x07

Part Information

- 24x01x: 1Kb
- 24x02x: 2Kb
- 24x04x: 4Kb
- 24x08x: 8Kb
- 24x16x: 16Kb
- 24x32x: 32Kb
- 24x64x: 64Kb
- 24x128x: 128Kb
- 24x256x: 256Kb
- 24x512x: 512Kb
Connect a PS2 Dualshock® controller

A Simple programmer

MISO
SCK
MOSI
RESET
GND
5V
Port Expander (PCF8574xx)

PCF8574xx informs the microprocessor that there is incoming data or a change of data on its ports without having to communicate via the I2C communication bus.

Absolute max per pin 25mA
Absolute max 150mA for entire package

In applications requiring additional drive, two port pins may be connected together to sink up to 50-mA current.

A typical Application

How to connect multiple devices
Shift Register (74HC595)

- **(Ser)** Input for the next pin that gets shifted in.
- **(Output Enable)** This pin enables the output when tied to GND & disabled when HIGH.
- **(RCLK)** Needs to be pulled HIGH to set the output to the new shift register values. This must be pulled high directly after SRCLK has gone LOW again.
- **(Serial Clear)** Will empty the whole Shift Register if pulled LOW. Must be pulled HIGH to enable.

How to connect multiple devices

A typical Application

- **Absolute max per pin 20mA**
Connect a Distance Sensor (Sharp GP2Y0A21)

Connect a Digital Potentiometer (MCP4161)

Connect a DAC (MCP4921)

Connect a DAC (MCP4921)
THE UNOFFICIAL ARDUINO

basic connections

TOLERANCE

GOLD +5%
SILVER +10%

MULTIPLIER

BLACK = 0
BROWN = 1
RED = 2
ORANGE = 3
YELLOW = 4
GREEN = 5
BLUE = 6
VIOLET = 7
GRAY = 8
WHITE = 9

x1Ω
x10Ω
x100Ω
x1,000Ω
x10,000Ω
x100,000Ω
x1,000,000Ω

KΩ = x1,000Ω
MΩ = x1,000,000Ω
**Ceramic Capacitor Code**

<table>
<thead>
<tr>
<th>Significant Digit</th>
<th>1st</th>
<th>2nd</th>
<th>Multiplier</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
<td>10pF</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td></td>
<td></td>
<td>100pF</td>
</tr>
<tr>
<td>3</td>
<td>1,000</td>
<td></td>
<td></td>
<td>1kF</td>
</tr>
<tr>
<td>4</td>
<td>10,000</td>
<td></td>
<td></td>
<td>10kF</td>
</tr>
<tr>
<td>5</td>
<td>100,000</td>
<td></td>
<td></td>
<td>100kF</td>
</tr>
<tr>
<td>6</td>
<td>1,000,000</td>
<td></td>
<td></td>
<td>1M</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
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<tr>
<td>9</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- C ±0.25pF
- J ±5%
- K ±10%
- M ±20%
- D ±0.5pF
- Z +80% -20%

**Conversion Table:**

- 1,000pF = ±10%

**Symbols:**

- pF
- nF
- µF

**Diagram:**

A ceramic capacitor is shown with the value 102K, indicating a value of 1,000pF ±10%.
Polyester Film-Mylar Capacitor Code

- **Significant Digit:**
  - F: 1~2%
  - G: 2%
  - J: 5%
  - K: 10%
  - M: 20%

- **Multiplier:**
  - 0: none
  - 1: 10
  - 2: 100
  - 3: 1,000
  - 4: 10,000
  - 5: 100,000
  - 6
  - 7
  - 8
  - 9

- **Working Voltage:**
  - 100V

- **Example Code:**
  - 334K
  - working voltage: 100V
  - capacitance: 0.33 µF ±20%

- **Conversion:**
  - pF, nF, µF

- **Table:**

<table>
<thead>
<tr>
<th>Code</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>1002</td>
<td>.001</td>
<td>1,000pF</td>
<td>103</td>
<td>10n .01</td>
</tr>
<tr>
<td>122</td>
<td>.0012</td>
<td>1,200pF</td>
<td>123</td>
<td>12n .012</td>
</tr>
<tr>
<td>152</td>
<td>.0015</td>
<td>1,500pF</td>
<td>153</td>
<td>15n .015</td>
</tr>
<tr>
<td>182</td>
<td>.0018</td>
<td>1,800pF</td>
<td>183</td>
<td>18n .018</td>
</tr>
<tr>
<td>222</td>
<td>.0022</td>
<td>2,200pF</td>
<td>223</td>
<td>22n .022</td>
</tr>
<tr>
<td>272</td>
<td>.0027</td>
<td>2,700pF</td>
<td>273</td>
<td>27n .027</td>
</tr>
<tr>
<td>332</td>
<td>.0032</td>
<td>3,300pF</td>
<td>333</td>
<td>33n .033</td>
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<td>39n .039</td>
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<td>473</td>
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<tr>
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<td>5,600pF</td>
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<tr>
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<td>.0068</td>
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<td>683</td>
<td>68n .068</td>
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<tr>
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<td>.0082</td>
<td>8,200pF</td>
<td>823</td>
<td>82n .082</td>
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<tr>
<td>102</td>
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<td>10,000pF</td>
<td>104</td>
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<tr>
<td>122</td>
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<td>124</td>
<td>120n .12</td>
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<tr>
<td>152</td>
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<td>220n .22</td>
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<td>272</td>
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<tr>
<td>332</td>
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<td>182</td>
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<td>180,000pF</td>
<td>184</td>
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<td>.22</td>
<td>220,000pF</td>
<td>224</td>
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<td>272</td>
<td>.27</td>
<td>270,000pF</td>
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<tr>
<td>332</td>
<td>.33</td>
<td>330,000pF</td>
<td>334</td>
<td>3300n .33</td>
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<tr>
<td>392</td>
<td>.39</td>
<td>390,000pF</td>
<td>394</td>
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<tr>
<td>472</td>
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<tr>
<td>562</td>
<td>.56</td>
<td>560,000pF</td>
<td>564</td>
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<tr>
<td>682</td>
<td>.68</td>
<td>680,000pF</td>
<td>684</td>
<td>6800n .68</td>
</tr>
<tr>
<td>822</td>
<td>.82</td>
<td>820,000pF</td>
<td>824</td>
<td>8200n .82</td>
</tr>
</tbody>
</table>
Drive a Motor (L298)

- ENABLE B
- INPUT 3
- LOGIC SUPPLY VOLTAGE V
- INPUT 4
- OUTPUT 1
- OUTPUT 2
- CURRENT SENSING A
- OUTPUT 3
- OUTPUT 4
- CURRENT SENSING B

- 100nF
- 100µF 50V

- 1N4007
- 5V
- VIN
Drive a Stepper (L293)

- L293D
- 100µF 50V
- 100nF

Connect VCC1, VCC2, GND, IN1, OUT1, IN2, IN3, OUT2, IN4, OUT4, 1/4en, 3/4en, and VIN as shown in the diagram.

Ensure all connections are properly made to avoid damage to the L293D.
Arduino Logic Analyzer

Current Sense

Zener 5.1V

IN

OUT

IN+

IN-

GND

LM358

100nF

1Ω

1KΩ

5.6KΩ

Analog Input

See instructions at la.pighixx.com
Arduino Component Tester (basic)

1. Always be sure to discharge capacitors before connecting them to the Tester!

2. To get full accuracy use 1% tolerance resistors.

3. Download sketch at at.pighixxx.com

Arduino version by PighiXXX
Simple Transistor Comparison Table

<table>
<thead>
<tr>
<th>TRANSISTOR Name</th>
<th>Pinout</th>
<th>MAX Collector Current</th>
<th>MAX working Voltage</th>
<th>hFE Amplification</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC327</td>
<td></td>
<td>45V - 100mA</td>
<td>100mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC337</td>
<td></td>
<td>45V - 800mA</td>
<td>100mA</td>
<td>cbe</td>
</tr>
<tr>
<td>2N2222</td>
<td></td>
<td>40V - 600mA</td>
<td>100mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC546</td>
<td></td>
<td>45V - 100mA</td>
<td>420@2mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC547</td>
<td></td>
<td>45V - 100mA</td>
<td>420@2mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC548</td>
<td></td>
<td>30V - 100mA</td>
<td>200@2mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC549</td>
<td></td>
<td>30V - 100mA</td>
<td>200@2mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC556</td>
<td></td>
<td>45V - 100mA</td>
<td>420@2mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC557</td>
<td></td>
<td>45V - 100mA</td>
<td>420@2mA</td>
<td>cbe</td>
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<tr>
<td>BC558</td>
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<td>200@2mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC559</td>
<td></td>
<td>30V - 100mA</td>
<td>200@2mA</td>
<td>cbe</td>
</tr>
<tr>
<td>BC639</td>
<td></td>
<td>80V - 1A</td>
<td>40@150mA</td>
<td>ecb</td>
</tr>
<tr>
<td>BC640</td>
<td></td>
<td>80V - 1A</td>
<td>63@150mA</td>
<td>ecb</td>
</tr>
</tbody>
</table>

PNP NPN