Pololu 3pi Robot

Quick-Start Sheet

Overview

The Pololu 3pi robot is a small, high-performance, autonomous robot designed to excel in line-following and maze-solving competitions. Powered by four AAA batteries (not included) and a unique power system that runs the motors at a regulated 9.25 V, 3pi is capable of speeds up to 100 cm/second while making precise turns and spins that don't vary with the battery voltage. This results in highly consistent and repeatable performance of well-tuned code even as the batteries run low. The robot comes fully assembled with two micro metal gearmotors, five reflectance sensors, an 8x2 character LCD, a buzzer, three user pushbuttons, and more, all connected to a user-programmable AVR microcontroller. The 3pi measures approximately 3.7 inches (9.5 cm) in diameter and weighs 2.9 oz (83 g) without batteries.

The 3pi is based on an Atmel ATmega328P microcontroller running at 20 MHz with 32KB of flash program memory and 2KB data memory. The use of the ATmega328P microcontroller makes the 3pi compatible with the popular Arduino development platform. Free C and C++ development tools are also available, and an extensive set of libraries make it a breeze to interface with all of the integrated hardware. Sample programs are available to show how to use the various 3pi components, as well as how to perform more complex behaviors such as line following and maze solving.

Contacting Pololu

You can visit the Pololu web site at `http://www.pololu.com/` for the complete 3pi documentation, including the user's guide, software libraries, sample programs, application examples, datasheets, pictures, and troubleshooting tips. There is also a forum at `http://forum.pololu.com/` where you can interact with other 3pi users and exchange code and project ideas.

We would be delighted to hear from you about your project and about your experience with our product. You can contact us through our online feedback form, by email at `support@pololu.com`, or through the forum mentioned above. Please tell us what we did well, what we could improve, what you would like to see in the future, or anything else you would like to say!
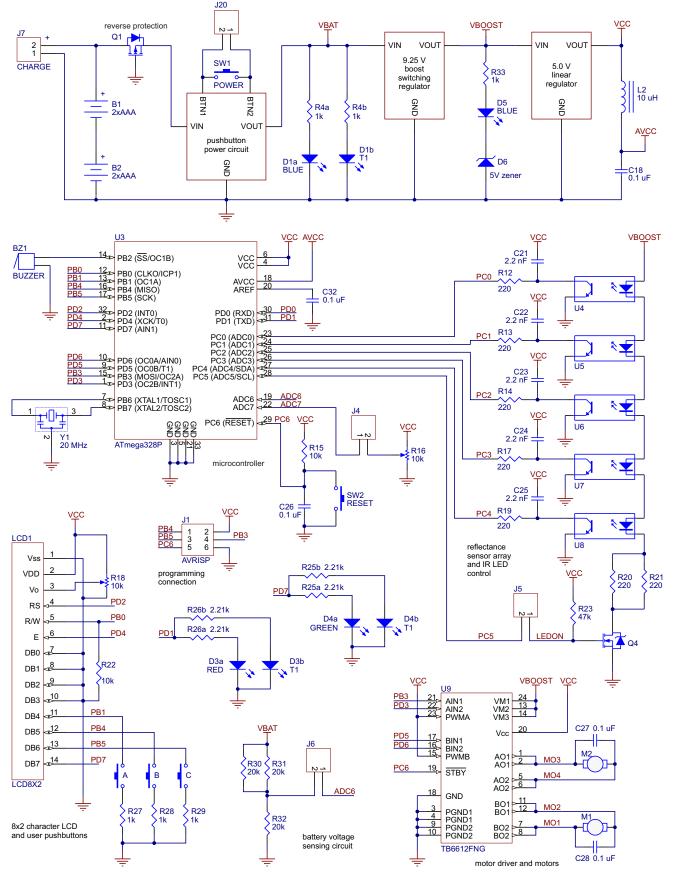
Required Accessories

- **4 AAA batteries.** Any AAA cells will work, but we recommend NiMH batteries, which are rechargeable and can be purchased from Pololu or at a local store. If you use rechargeable batteries, you will also need a battery charger. Battery chargers designed to connect to external series battery packs may be used with the 3pi's battery charger port.

- **AVR ISP programmer with 6-pin connector.** The 3pi features an ATmega328P microcontroller, which requires an external programmer such as the Pololu USB AVR programmer or Atmel's AVRISP series. The 3pi has a standard 6-pin programming connector, so your programmer will need to have a 6-pin ISP cable for connecting to the target device. (You will also need whatever cable your programmer requires to connect to a computer.)

- **A desktop or laptop computer.** You will need a personal computer for developing your code and loading it onto the 3pi. The 3pi can be programmed on Windows, Mac, and Linux operating systems, but Pololu support for Macs is limited.

⚠ Important Safety Warnings

The 3pi robot is not intended for young children! Younger users should use this product only under adult supervision. **By using this product, you agree not to hold Pololu liable for any injury or damage related to the use or to the performance of this product. This product is not designed for, and should not be used in, applications where the malfunction of the product could cause injury or damage. Please take note of these additional precautions:**

- 3pi robots with serial numbers lower than 0J13816 might contain lead, so follow appropriate handling procedures, such as washing hands after handling and not licking the robot.

- Avoid placing the robot so that the underside of the PCB makes contact with conductive materials (e.g. do not place the 3pi in a bin filled with metal parts). This could inadvertently short out the batteries and damage your robot, even with the 3pi turned off.

- Since the PCB and its components are exposed, take standard precautions to protect your 3pi robot from ESD (electrostatic discharge), which could damage the on-board electronics. When picking up the 3pi, you should first touch a safe part of the robot such as the wheels, motors, batteries, or the edges of the PCB. If you first touch components on the PCB, you risk discharging through them. When handing the 3pi to another person, first touch their hand with your hand to equalize any charge imbalance between you so that you don't discharge through the 3pi as the exchange is made.

Pololu 3pi Robot Simplified Schematic Diagram

J7
2
1
CHARGE

reverse protection
Q1

J20
2 1

SW1
POWER
BTN1 BTN2
VIN VOUT
pushbutton
power circuit
GND

+ B1 2xAAA
+ B2 2xAAA

VBAT

R4a 1k
R4b 1k

D1a BLUE
D1b T1

VIN VOUT
9.25 V
boost
switching
regulator
GND

VBOOST

R33 1k
D5 BLUE
D6 5V zener

VIN VOUT
5.0 V
linear
regulator
GND

VCC

L2 10 uH

AVCC

C18 0.1 uF

BZ1
BUZZER

U3
14 PB2 (SS/OC1B)
PB0 12 PB0 (CLKO/ICP1)
PB1 13 PB1 (OC1A)
PB4 16 PB4 (MISO)
PB5 17 PB5 (SCK)
PD2 32 PD2 (INT0)
PD4 2 PD4 (XCK/T0)
PD7 11 PD7 (AIN1)
PD6 10 PD6 (OC0A/AIN0)
PD5 9 PD5 (OC0B/T1)
PB3 15 PB3 (MOSI/OC2A)
PD3 1 PD3 (OC2B/INT1)
7 PB6 (XTAL1/TOSC1)
8 PB7 (XTAL2/TOSC2)

VCC 6
VCC 4
AVCC 18
AREF 20
PD0 (RXD) 30 PD0
PD1 (TXD) 31 PD1
PC0 (ADC0) 23
PC1 (ADC1) 24
PC2 (ADC2) 25
PC3 (ADC3) 26
PC4 (ADC4/SDA) 27
PC5 (ADC5/SCL) 28
ADC6 19 ADC6
ADC7 22 ADC7
PC6 (RESET) 29 PC6
GND 3 GND 5 GND 21 GND 33

VCC AVCC
C32 0.1 uF

Y1 20 MHz
1 3
2

ATmega328P
microcontroller

VBOOST
C21 2.2 nF
PC0 R12 220 U4
C22 2.2 nF
PC1 R13 220 U5
C23 2.2 nF
PC2 R14 220 U6
C24 2.2 nF
PC3 R17 220 U7
C25 2.2 nF
PC4 R19 220 U8

reflectance
sensor array
and IR LED
control

J4
1 2
VCC
R16 10k
R15 10k
SW2 RESET
C26 0.1 uF

J5
1 2
PC5

VCC
R23 47k

LEDON

R20 220 R21 220

Q4

LCD1
VCC
Vss 1
VDD 2
Vo 3
RS 4 PD2
R/W 5 PB0
E 6 PD4
DB0 7
DB1 8
DB2 9
DB3 10
DB4 11 PB1
DB5 12 PB4
DB6 13 PB5
DB7 14 PD7
LCD8X2
R18 10k
R22 10k

8x2 character LCD
and user pushbuttons

A B C
R27 1k R28 1k R29 1k

J1
PB4 1 2 PB3
PB5 3 4
PC6 5 6
AVRISP
programming
connection

R26b 2.21k
R26a 2.21k
PD1
D3a RED D3b T1

R25b 2.21k
R25a 2.21k
PD7
D4a GREEN D4b T1

VBAT
R30 20k R31 20k
J6
1 2
ADC6
R32 20k
battery voltage
sensing circuit

U9
PB3 21 AIN1
PD3 22 AIN2
23 PWMA
PD5 17 BIN1
PD6 16 BIN2
15 PWMB
PC6 19 STBY
18 GND
3 PGND1
PGND1
9 PGND2
10 PGND2
VM1 24
VM2 13
VM3 14
Vcc 20
AO1 1
AO1 2 MO3
AO2 5
AO2 6 MO4
BO1 11
BO1 12 MO2
BO2 7
BO2 8 MO1
TB6612FNG
VBOOST VCC
C27 0.1 uF
M2
M1
C28 0.1 uF
motor driver and motors

rrc03a quickstart