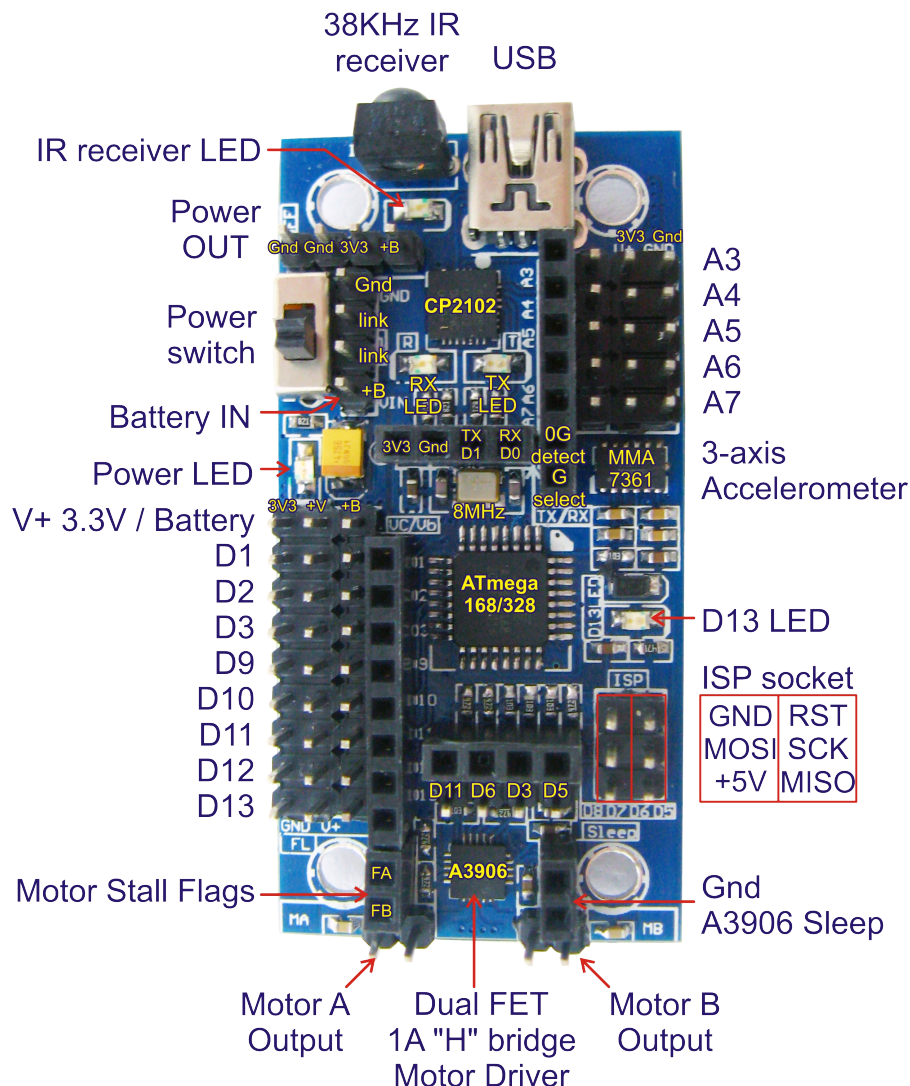


Micro Magician robot controller



The Micro Magician robot controller is the perfect choice for small / low voltage robot projects. This low cost Arduino compatible controller is packed full of features:

- Small size of just 60mm x 30mm
- Supply voltage from 3.6V to 9V with 3.3V regulator and reverse polarity protection
- ATmega168 or ATmega328 MCU at 8MHz
- Dual 1A FET "H" bridge with electronic braking, current limiting and overload detect
- 3 axis accelerometer with 0G detection and either 1.5G or 6G full range sensitivity
- 38KHz IR receiver with signal detection LED
- Up to 8 servos can plug directly into the controller when V+ is set to Battery
- 3.3V and GND outputs available for powering sensors
- All I/O pins (except D4) have both male and female header pins
- Status LEDs for Power, RX, TX, IR signal and D13.

Power

The Micro Magician is designed to work on voltages as low as 3.6V allowing it to be powered by 3xNiMh cells or a single Li-Ion cell. Do not exceed 9V otherwise damage to the A3906 motor driver may occur.

Two link inputs allow two battery holders to be linked in series otherwise they can be ignored. A female header provides power output for external devices controlled via the onboard power switch.

The controller can be powered via the USB port or ISP socket for programming but battery power is needed for the motor controller and servos. Polarity protection prevents damage if the battery is accidentally connected the wrong way.

A3906 Dual FET “H” bridge

The A3906 motor driver can drive two DC brushed motors or 1 stepper motor. The FET “H” bridges have a very low voltage drop so each output has been internally limited to 900mA to prevent damage from accidental short circuits. Electronic braking is possible by driving both inputs high. When not in use the A3906 can be put into sleep mode and it's control pins used for other purposes.

MMA7361L 3-axis accelerometer

The MMA7361L detects acceleration due to both gravity and motion on all three axis's. The sensitivity defaults to +/- 1.5g but +/- 6g can be selected. This feature gives robots a sense of balance and can be used to detect if the robot is about to fall over. If the robot has fallen over then this sensor can aid self-righting maneuvers. The ability to detect acceleration can also be used to determine if the robot is moving or has been involved in a collision eliminating the need for bumper switches. This sensor uses Analog inputs A0, A1 and A2.

Connecting Servos

The digital outputs D1, D2, D3, D9, D10, D11, D12, D13 can be used to drive servos. Use the V+ selection jumper to connect the V+ rail to +Bat. This will power your servos directly from the battery.

38KHz IR receiver

The built in IR receiver allows the controller to receive commands from a universal TV remote. This allows you to send the robot instructions while it is on the move and can be very useful for diagnostics. This sensor is hardwired to D4 and has a status LED to indicate when a signal is being received.

Software

The Micro Magician can be programmed using a USB cable and the Arduino IDE, which is free from the internet. The controller comes preinstalled with the Arduino Pro (3.3V @8MHz) ATmega168 or ATmega328 bootloader.

To make the Micro Magician easier to use, an Arduino library “**microM**” has been written. This library includes functions for the on-board hardware and generates several global variables that can be accessed in your programs for reading information or changing default settings.

microM.Setup()

This function initialises Timer 2 for use with the microM library. It is only required when using the global byte **microM.ircommand** and **microM.Impact()** function. Timer 2 is also used by some other libraries and commands such as “Tone()”. Use **microM.Setup()** to re-initialise timer 2 afterward.

Detecting impacts with the 3 axis accelerometer

microM.Impact() This function uses timer 2 and monitors the 3 axis accelerometer at regular intervals looking for sudden changes that would indicate an impact. The global integer, **microM.sensitivity** determines the minimum magnitude to register as an impact. The default value is 50.

Because any object will vibrate when sustaining an impact, only the initial sensor readings will be valid. After initial impact has occurred, a timeout period determined by a global integer variable, **microM.devibrate** prevents false readings. This value defaults to 100 (approximately 500mS) but can be increased for large robots.

- **microM.deltx** – integer represents the impact magnitude along the X-axis.
- **microM.deltx** – integer represents the impact magnitude along the Y-axis.
- **microM.deltz** – integer represents the impact magnitude along the Z-axis.
- **microM.magnitude** – integer represents the total impact magnitude vector.

Use the magnitude integer to determine if there is an impact and then use the delta X,Y and Z integers to determine the direction of impact. This allows the accelerometer to replace bumper switches on a robot.

As reading the analog inputs takes a relatively long time (260uS) the raw data is also available via these global integers to save your program reading them a second time.

- **microM.xaxis**
- **microM.yaxis**
- **microM.zaxis**

Reading the IR receiver

The **microM** ISR (interrupt service routine) initialized by the **microM.Setup()** function includes a Sony SIRC decoder. When using a universal remote programmed to use a Sony IR Code the receiver can be read using the global variable **microM.ircommand**.

If you wish to use an external IR receiver connected to a different IO pin then use **microM.irpin** to change the input pin. This value defaults to 4.

Driving DC and stepper motors

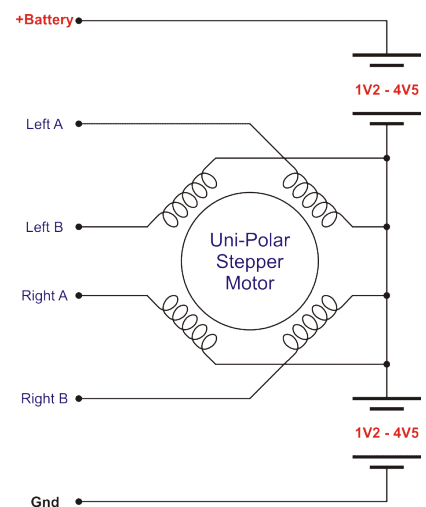
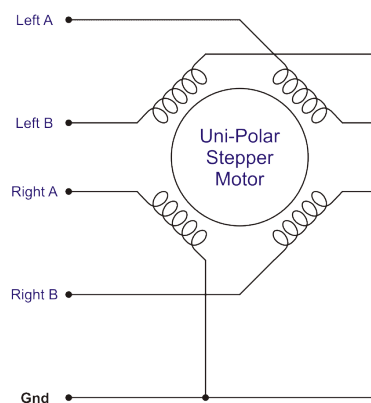
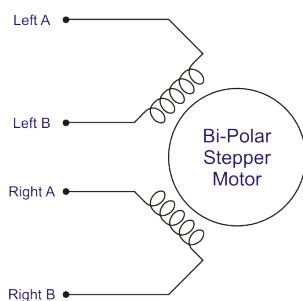
microM.Motors(leftspeed, rightspeed, leftbrake, rightbrake) function provides a simple means of controlling speed, direction and braking of two DC motors.

- **leftspeed** is an integer specifying speed and direction from -255 to +255.
- **rightspeed** is an integer specifying speed and direction from -255 to +255.
- **leftbrake** non zero values engage electronic braking on the left motor.
- **rightbrake** non zero values engage electronic braking on the right motor.

microM.Stepper(direction, mode) function provides an easy way to drive a stepper motor. Bi-polar and Uni-polar motors can be driven.

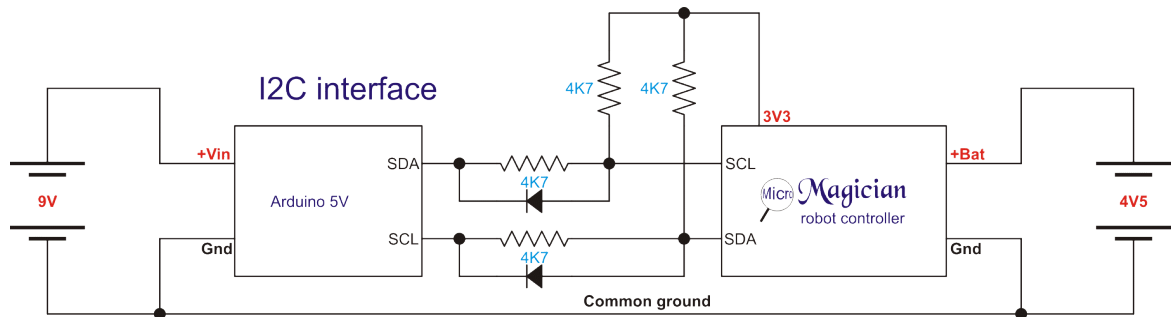
- **direction** integers greater than 0 step forward, less than 0 step reverse. A value of 0 will turn off power to the windings.
- **mode** full steps are the default. A non zero value indicates half steps.

Below is a diagram showing typical methods of connecting either a bi-polar (4 wire) or uni-polar (5 wire) stepper motor.

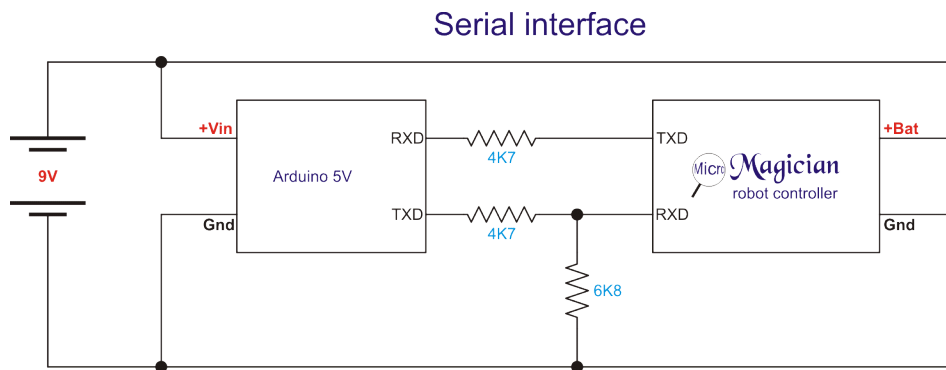


Interfacing to 5V systems and devices

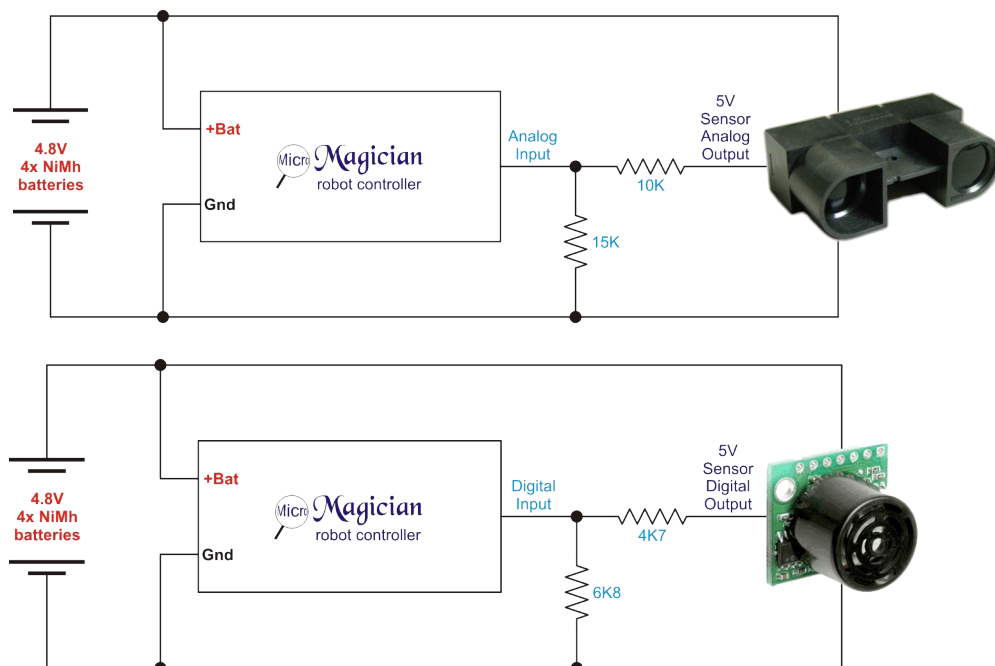
The micro Magician is a 3.3V system but you can still interface with 5V systems and devices by following a few simple precautions. When 5V devices or systems are powered from a separate battery or power supply then the ground of the 5V system should be connected to the ground of the Magician controller.



The digital I/O pins of the micro Magician should have at least 4K7 resistance in series when connecting to a 5V device. This will limit the current through the MCU's clamping diodes to a safe level.

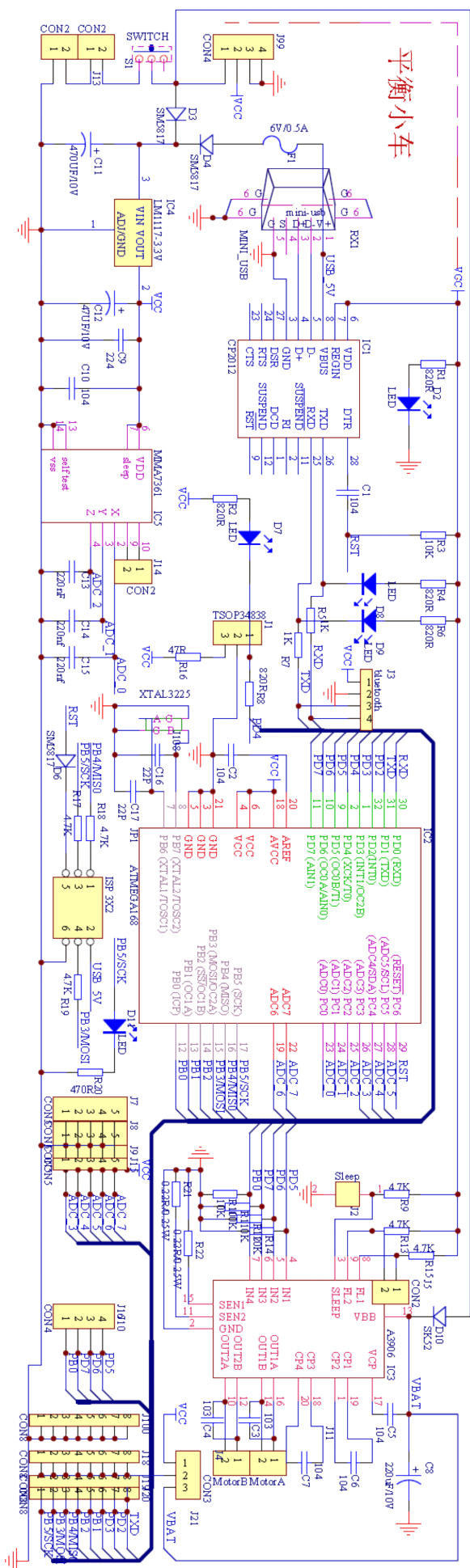


When connecting 5V analog sensors to the analog inputs of the micro Magician a voltage divider should be used to limit the maximum input voltage to 3V. The diagrams below demonstrates the best way to connect 5V digital or analog sensors.



Micro Magician

robot controller



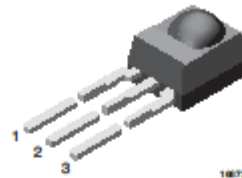


IR Receiver Modules for Remote Control Systems

Description

The TSOP348... series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter.

The demodulated output signal can directly be decoded by a microprocessor. TSOP348... is the standard IR remote control receiver series for 3 V supply voltage, supporting all major transmission codes.



Features

- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against electrical field disturbance
- TTL and CMOS compatibility
- Output active low
- Supply voltage: 2.7 V to 5.5 V
- Improved immunity against ambient light



Mechanical Data

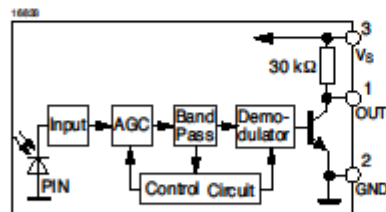
Pinning:

1 = OUT, 2 = GND, 3 = V_S

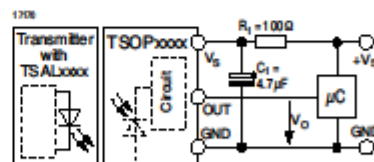
Parts Table

Part	Carrier Frequency
TSOP34830	30 kHz
TSOP34833	33 kHz
TSOP34836	36 kHz
TSOP34837	36.7 kHz
TSOP34838	38 kHz
TSOP34840	40 kHz
TSOP34856	56 kHz

Block Diagram



Application Circuit



$R_1 + C_1$ recommended to suppress power supply disturbances.

The output voltage should not be hold continuously at a voltage below $V_O = 2.0$ V by the external circuit.



±1.5g, ±6g Three Axis Low-g Micromachined Accelerometer

The MMA7361L is a low power, low profile capacitive micromachined accelerometer featuring signal conditioning, a 1-pole low pass filter, temperature compensation, self test, 0g-Detect which detects linear freefall, and g-Select which allows for the selection between 2 sensitivities. Zero-g offset and sensitivity are factory set and require no external devices. The MMA7361L includes a Sleep Mode that makes it ideal for handheld battery powered electronics.

Features

- 3mm x 5mm x 1.0mm LGA-14 Package
- Low Current Consumption: 400 μ A
- Sleep Mode: 3 μ A
- Low Voltage Operation: 2.2 V – 3.6 V
- High Sensitivity (800 mV/g @ 1.5g)
- Selectable Sensitivity ($\pm 1.5g$, $\pm 6g$)
- Fast Turn On Time (0.5 ms Enable Response Time)
- Self Test for Freefall Detect Diagnosis
- 0g-Detect for Freefall Protection
- Signal Conditioning with Low Pass Filter
- Robust Design, High Shocks Survivability
- RoHS Compliant
- Environmentally Preferred Product
- Low Cost

Typical Applications

- 3D Gaming: Tilt and Motion Sensing, Event Recorder
- HDD MP3 Player: Freefall Detection
- Laptop PC: Freefall Detection, Anti-Theft
- Cell Phone: Image Stability, Text Scroll, Motion Dialing, E-Compass
- Pedometer: Motion Sensing
- PDA: Text Scroll
- Navigation and Dead Reckoning: E-Compass Tilt Compensation
- Robotics: Motion Sensing

ORDERING INFORMATION

Part Number	Temperature Range	Package Drawing	Package	Shipping
MMA7361LT	-40 to +85°C	1977-01	LGA-14	Tray
MMA7361LR1	-40 to +85°C	1977-01	LGA-14	7" Tape & Reel
MMA7361LR2	-40 to +85°C	1977-01	LGA-14	13" Tape & Reel

MMA7361L

MMA7361L: XYZ AXIS
ACCELEROMETER
 $\pm 1.5g$, $\pm 6g$

Bottom View



14 LEAD
LGA
CASE 1977-01

Top View

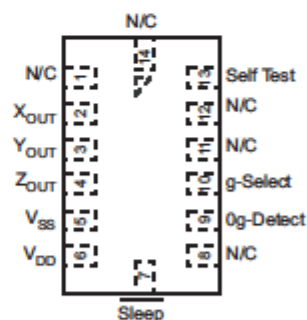


Figure 1. Pin Connections

Low Voltage Stepper and Single/Dual DC Motor Driver

Features and Benefits

- 2.5 to 9 V operation
- Internal PWM current limit control
- Synchronous rectification for reduced power dissipation
- Peak current output flag
- Undervoltage lockout
- Low $R_{DS(on)}$ outputs
- Small package
- Brake mode for DC motors
- Sleep function
- Crossover-current protection
- Thermal shutdown

Description

Designed for pulse width modulated (PWM) control of low voltage stepper motors, and single and dual DC motors, the A3906 is capable of output currents up to 1 A per channel and operating voltages from 2.5 to 9 V.

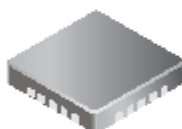
The A3906 has an internal fixed off-time PWM timer that sets a peak current based on the selection of a current sense resistor. An overcurrent output flag is provided that notifies the user when the current in the motor winding reaches the peak current determined by the sense resistor. The fault output does not affect driver operation.

The A3906 is provided in a 20-contact, 4 mm × 4 mm, 0.75 mm nominal overall height QFN, with exposed pad for enhanced thermal dissipation. It is lead (Pb) free, with 100% matte tin leadframe plating.

Applications include the following:

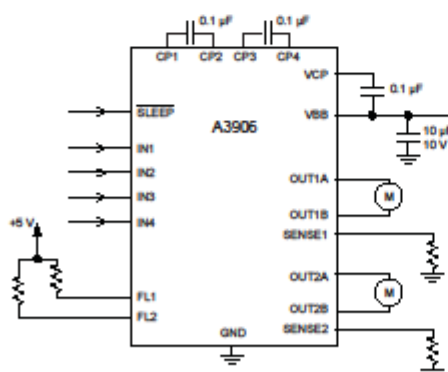
- Digital still cameras (DSC)
- Cell phone cameras
- USB powered devices
- Battery powered devices

Package: 20-contact QFN (suffix ES)

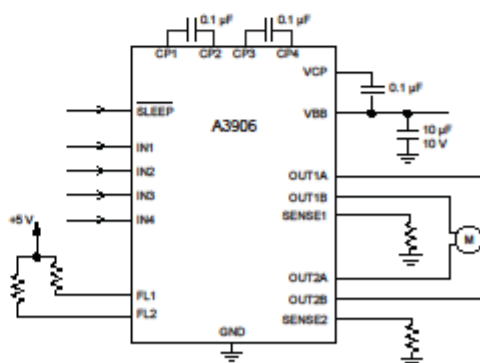


Approximate size

Typical Applications



Dual DC motor application



Stepper motor application