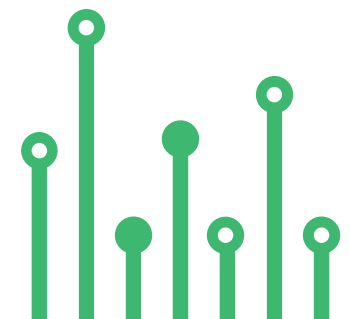


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High Power DC Motor Speed and Direction Control using RC Transmitter, Arduino Compatible



SKU: EL135516

MOTOR CONTROL

High Power DC Motor Speed and Direction Control using RC Transmitter – Arduino Compatible



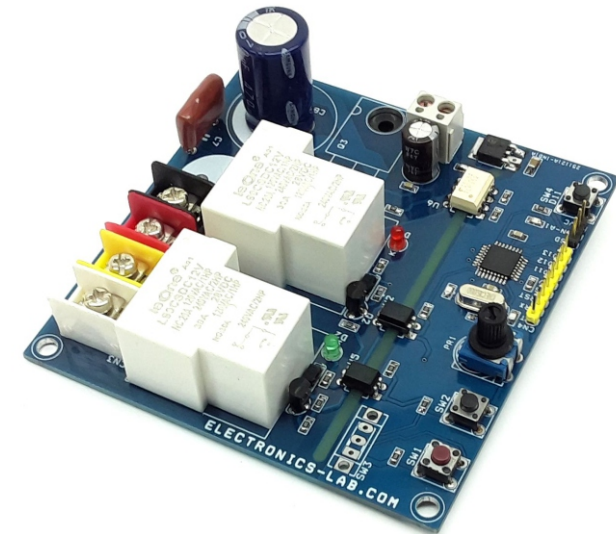
The project presented here is a low-cost solution to control the speed and direction of a high-power brushed DC motor using RC (Radio Remote Control) transmitter. This is an Arduino-compatible board, consisting of an Atmega328 chip, 2 x Relay for motor direction control, MOSFET for speed control using PWM input, Tactile switch, Slide switch, and Connector for RC Receiver interface. Traditional DC motor controllers are based on solid-state circuitry known as H-Bridge. Here the H-bridge configuration is created using 2x high-power Relays which can handle high voltage as well as high current. Additionally, MOSFET Q3 is used to control the speed of the motor by applying a PWM signal. This MOSFET can be removed in case of only direction control is required. In this case short the Drain and source pin of MOSFET. The project requires 3 control input signals 2 x CCW/CW direction control, and 1x PWM input. All inputs are optically isolated to prevent noise and high voltage going into logic circuitry. A large size of heatsink is a must for MOSFET.

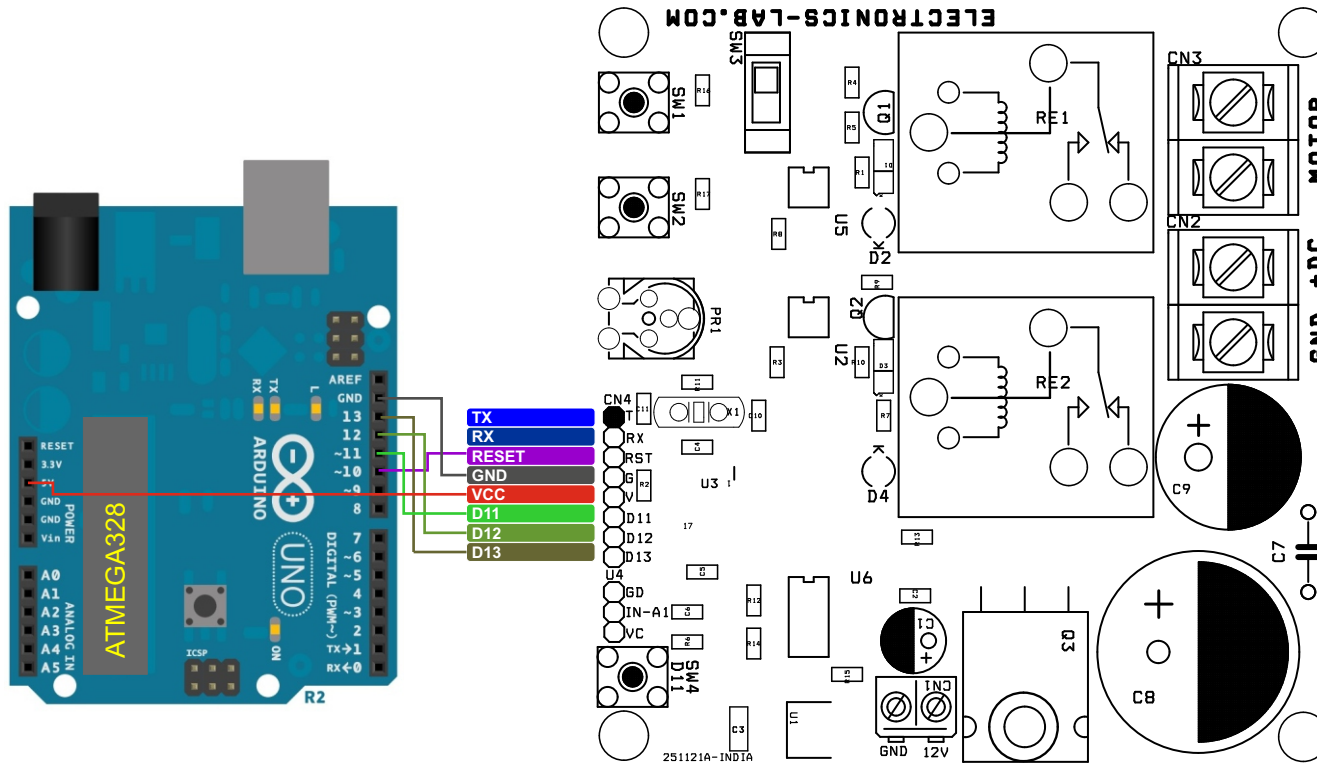
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Note: This board will work with any standard RC remote. In this project, we tested it with HOTRC DS-600 6CH 2.4GHz Radio System. Standard RC radio outputs is 50Hz – 1mS(1000uS) to 2mS(2000uS)

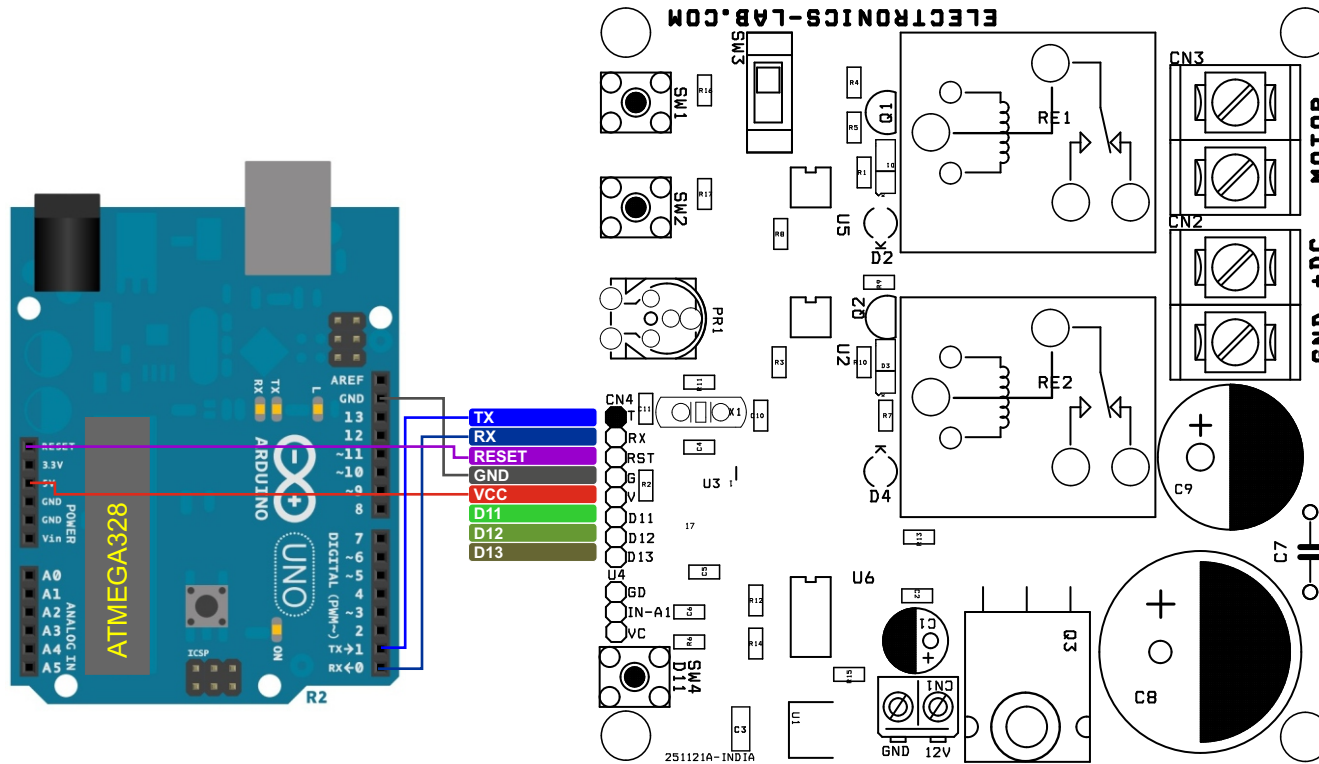
Features

- Power Supply for Relay and MOSFET 12V to 15V DC @ 100mA
- Power Supply Motor 12V to 90V DC (Maximum 100V DC)
- Motor Load 20Amps (Maximum 30Amps)
- Optocoupler Between Micro-Controller U1 and 2X Relays and MOSFET for optical isolation
- 2 x Inputs for Direction Control and Brake
- One PWM Signal to Control the speed of Motor 0 to 100 % Duty Cycle
- PWM Frequency up to 20Khz
- 2x LEDs for direction indication
- PCB Dimensions 97 x 93.82mm
- 4 x 4mm Mounting Holes





Boot-Loader Connections



Arduino Programming Connections

ARDUINO CODE AND PROGRAMMING

A new ATmega328 chip requires a bootloader. Refer to the connection diagram for the Arduino boot-loader and Arduino programming. The Arduino example code is available as a download. The user will be able to control the speed and direction of the brushed DC motor using RC remote Joystick. Connector U4 is provided to connect the RC receiver. ATMEGA328 chip reads the RC signal and generates 2 x CW/CCW TTL signals for motor direction control and one PWM signal. Two direction control signals control the Relay RE1 and RE2, contacts of relay configured in such a way where bidirectional output is provided to the motor, MOSFET drives the PWM signal for motor speed control. All three signals have optocouplers U2, U5, and U6 between motor control circuitry and ATMEGA328 chip which provides noise immunity and high voltage/current going to the digital circuitry.

Arduino Code Credits:

modified code, original author Tech at Home Channel

More Info, Boot-Loader, and Arduino Programming: <https://docs.arduino.cc/built-in-examples/arduino-isp/ArduinoToBreadboard>

Arduino Pin

- Arduino Digital Pin D3 and D4 = Relay Control, DC Motor Direction Control, D3 High – D4 Low = CCW, D3 Low – D4 High = CW
- Arduino Digital Pin D5 = MOSFET Gate Driver (PWM for Motor Speed Control) – Duty Cycle (0 to 100%) Frequency up to 20Khz

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Note: The project has been designed for multi-purpose motor applications. For the RC receiver interface use the U4 connector, the user may not install the following components SW1, SW2, R16, R17, SW4, SW3, and PR1 as they are not required.

Read below for the power supply requirements. The project works well with 2 power inputs. One for the MOSFET Gate Driver/Logic supply and 2nd for the motor supply. Advisable to use 3 power inputs for complete isolation between the motor output power driver and the logic circuit.

Power Supply:

The project requires 3 power inputs for complete isolation between the microcontroller and motor output power driver.

- 5V Logic supply (Do not solder U1 LM7805 and R15) for full isolation between Micro-Controller U3 and motor output power 2 X Relay and MOSFET Q3,
- Use Pin 4 and Pin 5 of CN4 for 5V Power Input
- 12V to 15V DC supply for MOSFET gate driver
- Motor Power Supply 12V to 90V DC

The project also can work well with only 2 power inputs

12V to 15V DC Gate Driver (Solder U1 LM7805 and Resistor R15) for Dual power input.
Motor Supply 12V to 90V

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Single Power Supply for 12V to 15V Motor

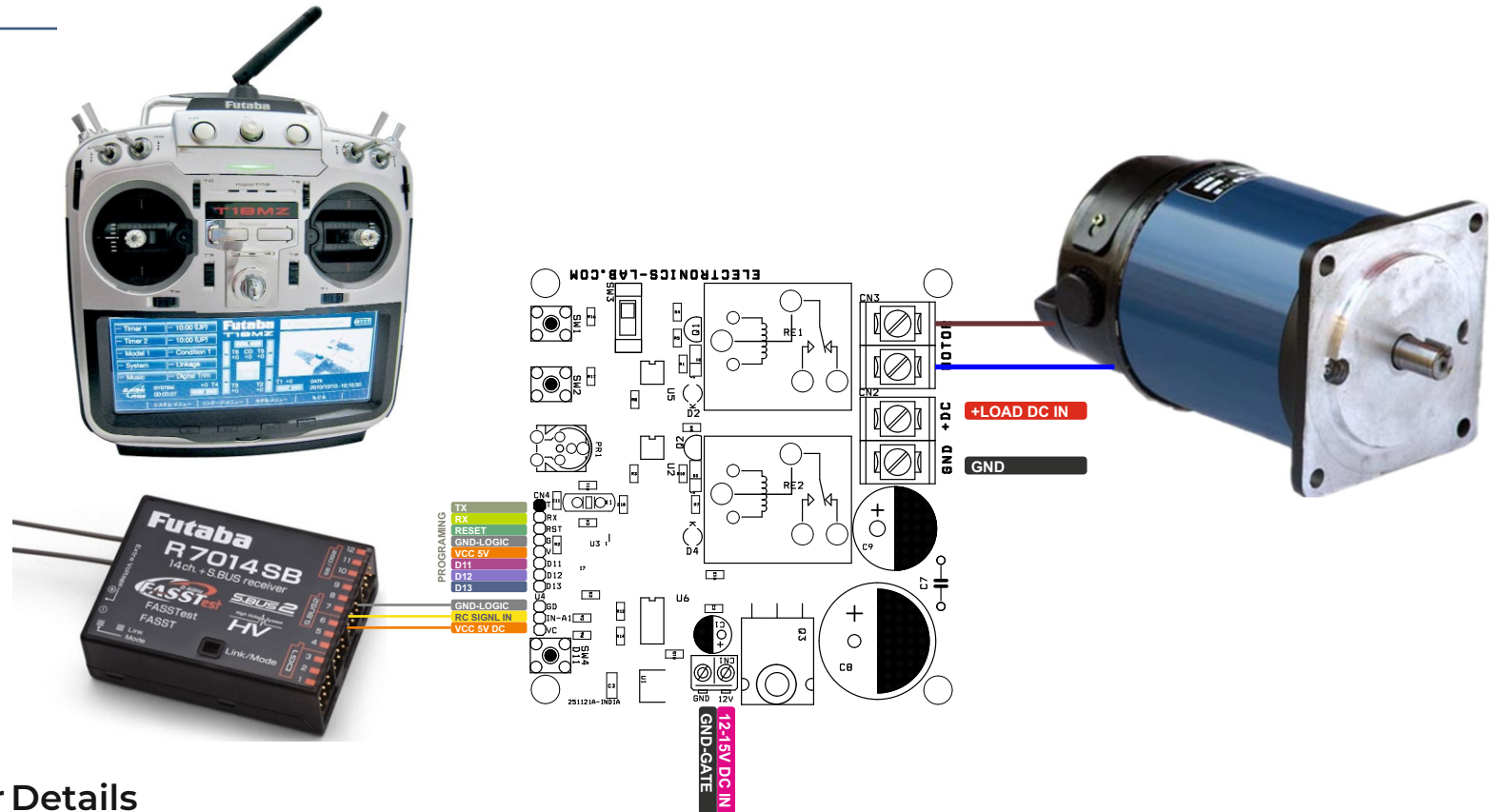
The project can work with a single supply for a lower voltage (12-15V) motor, Install U1 LM7805, R15 Resistor.
Tie GND-Pin2 + GD-Pin2 and +12V-Pin1 + DC-L Pin 1 of the CN1 and CN2 and apply 12V to 15V

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Arduino-compatible hardware consists following important components which can be used for various applications as per user requirements.

- ATMEGA328 Microcontroller
- MOSFET to control the Speed of the motor with the help of PWM (Arduino Digital Pin D5)
- 2 x Relay for Motor Direction Control (Arduino Digital Pin D3 and D4)
- 3 Pin Header to Connect Radio Remote Receiver or Analog Input (Arduino A1) – Connector U4
- Trimmer Potentiometer for Analog Input (Arduino A0) – Don't Install for this project
- CN4: Arduino Programming and Boot-Loader Connector
- SW1, SW2 = Tactile Switch (Optional) Control the Relay 1 and Relay 2 Directly – Don't Install for this project
- SW3: Slider Switch for Direct Direction Control – Don't Install for this project
- SW4: Tactile Switch Arduino Digital Pin D11

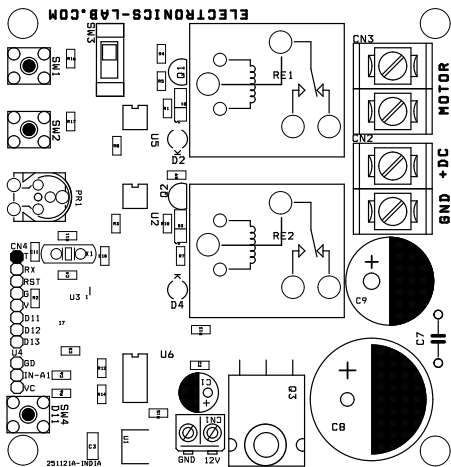
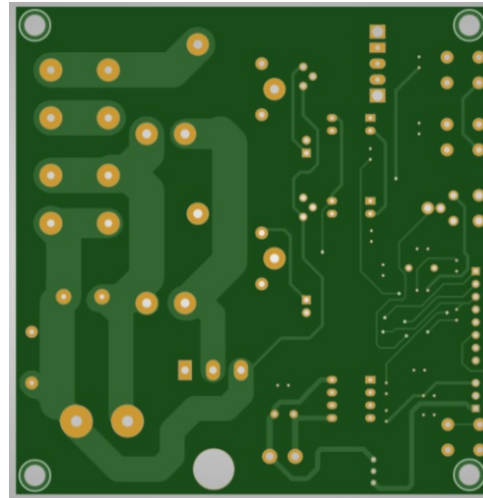
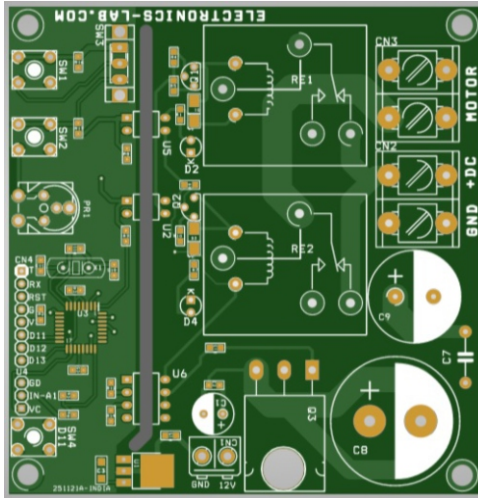
Connections



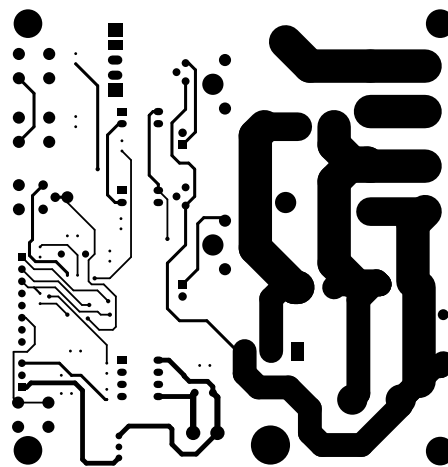
Connections and Other Details

- CN1: Pin 1 = 12V DC for MOSFET Gate Driver, Pin 2 = GND
- CN2: Pin 1 = +Motor Power Supply 12V to 90V DC, Pin 2 = GND
- CN3: Pin 1 = Motor, Pin 2 = Motor
- CN4: Programming Connector Pin 1 = TX, Pin 2 = RX, Pin 3 = Reset, Pin 4 = GND, Pin 5 = VCC, Pin 6 = D11, Pin 7 = D12, Pin 8 = D13
- D2, D4 LED = Motor Direction LED
- SW1, SW2: Optional Direction Switch
- SW3: Optional Direction Switch
- SW4: Optional Switch Connected to Arduino D11
- U4: RC Receiver or Analog In (Arduino Analog A1)
- Pr1: Potentiometer Connected to Arduino Analog A0

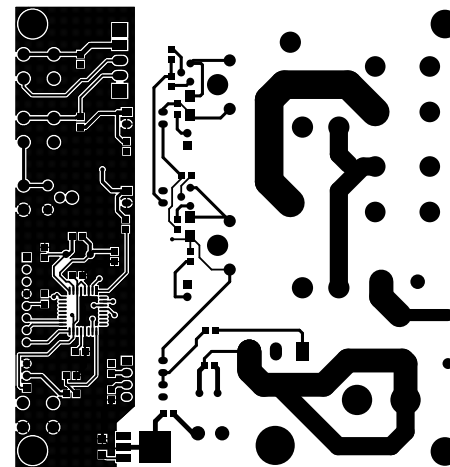
PCB



SILK SCREEN TOP



BOTTOM LAYER

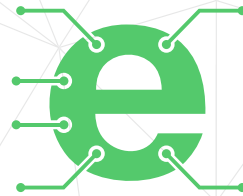


TOP LAYER

PCB DIMENSIONS 97 X 93.82MM

Parts List

BOM						
NO	QNTY	REF	DESC	MANUFACTURER	SUPPLIER	SUPPLIER'S PART NO
1	1	CN1	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
2	1	CN2	2 PIN BARRIER BLOCK PITCH 9.53MM	TE CONNECTIVITY	DIGIKEY	
3	1	CN3	2 PIN BARRIER BLOCK PITCH 9.53MM	TE CONNECTIVITY	DIGIKEY	
4	1	CN4	8 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5321-ND
5	1	C1	220uF/25V	RUBYCON	DIGIKEY	1189-3720-3-ND
6	3	C2,C4,C5	0.1uF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
7	1	C3	10uF/25V CERAMIC SMD SIZE 1206	YAGEO/MURATA	DIGIKEY	
8	4	PR1,SW3,C6,C9	DO NOT INSTALL			
9	1	C7	0.1uF/100V	VISHAY	DIGIKEY	BFC2373FF104MD-ND
10	1	C8	470uF/100V	NICHICON	DIGIKEY	493-1683-ND
11	2	C10,C11	22PF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
12	2	D1,D3	SM4007	SMC DIODE	DIGIKEY	1655-1N4007FLCT-ND
13	2	D2,D4	LED 3MM RED OR RED + GREEN	AMERICAN OCTO	DIGIKEY	2460-L314HD-ND
14	2	Q1,Q2	MPSA13	ON SEMI	DIGIKEY	2156-MPSA13RA-ND
15	1	Q3	FDH3632	ON SEMI	DIGIKEY	FDH3632FS-ND
16	2	RE1,RE2	12V RELAY/30A	CIT RELAY AND SWITCH	DIGIKEY	2449-L115F11CM12VDCS.9-ND
17	2	R1,R7	1K 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
18	1	R2	10K 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
19	4	R3,R8,R16,R17	470E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
20	4	R4,R5,R9,R10	2K2 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
21	1	R6	10E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
22	1	R11	1M 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
23	2	R12,R14	220E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
24	1	R13	2.2E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
25	1	R15	0E SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
26	3	SW1,SW2,SW4	4 PIN TACTILE SWITCH	NKK SWITCH	DIGIKEY	HP0215AFKP2-ND
27	1	U1	LM78M05 DPAK	ON SEMI	DIGIKEY	MC78M15ABDTRKGOSCT-ND
28	2	U2,U5	PC817 4 PIN THT	AMERICAN BRIGHT	DIGIKEY	BPC-817(BBIN)-ND
29	1	U3	ATMEGA328TQPF-32	MICROCHIP	DIGIKEY	ATMEGA328PB-AURCT-ND
30	1	U4	3 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5316-ND
31	1	U6	TLP350/TLP250 8 PIN DIP	TOSHIBA SEMI	DIGIKEY	TLP350H(F)-ND
32	1	X1	16Mhz	ECS INC	DIGIKEY	X1103-ND



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