

Dimmable 5V LED desk lamp

A dimmable desk lamp that can be powered from any 5V/1A DC source

Version 1.0

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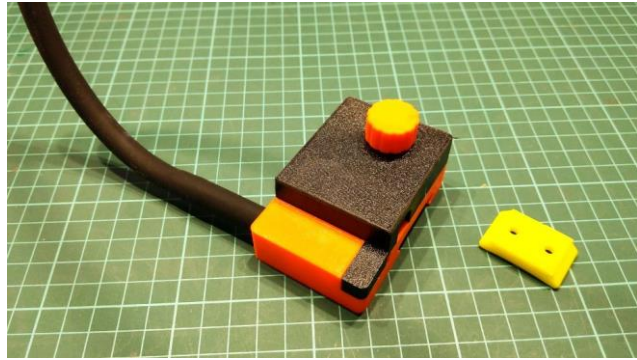
Contents

Introduction	2
The schematic	2
The BOM	3
The PCB	5
The case	6
Operating the lamp	7
Bibliography	7
The software	7
Bibliography	9
Document History	9

Introduction

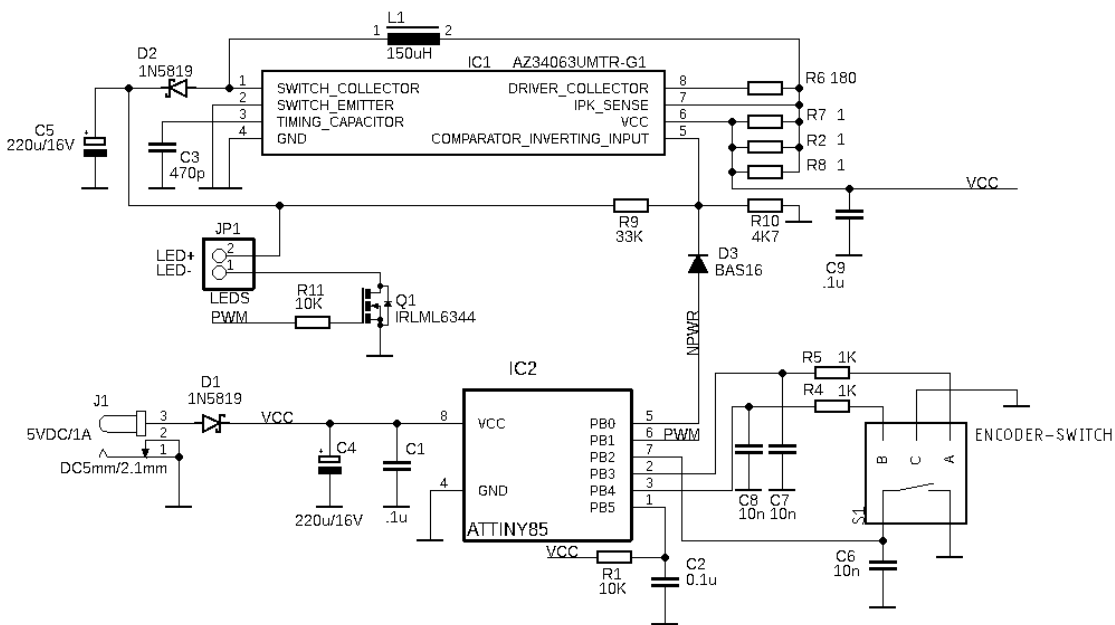
This is a LED desk lamp that can be easily mounted in any position using a removable mount and powered for any 5V/1A power supply, even from a power bank. The light can be controlled from a rotary encoder and has soft-on soft-off capabilities.

The final products look like in the following pictures.



The schematic

Schematic is presented in the following picture. The used LEDs module is designed for 280mA at a voltage around 9.5V.



To power the LEDs module, a step-up voltage converter built around IC1 is used. The schematic is based on the IC datasheet. The current limit is established through R2-R7-R8 (3 resistors in parallel for a higher power). Output voltage is set through the R9/R10 divider, calculated in order to get 1.25V on the IC1 pin 5 for the desired output voltage. You can modify the resistors to match your specific LEDs module.

To set the dim level and on/off status a rotary encoder is used, controlling an ATTINY85 that generates the PWM signal.

D3 allows the DC-DC step-up converter to be switched off when light is off, to significantly reduce current consumption.

The BOM

This is the complete list of parts (BOM):

Part	Value	Description
R1,R11	10K	1206 SMD resistor
R2,R7,R8	1	1206 SMD resistor
R4,R5	1K	1206 SMD resistor
R6	180	1206 SMD resistor
R9	33K	1206 SMD resistor
R10	4K7	1206 SMD resistor
C1,C2,C9	.1u	1206 SMD capacitor
C3	470p	1206 SMD capacitor
C4,C5	220u/16V	Electrolytic capacitor
C6,C7,C8	10n	1206 SMD capacitor
D1,D2	1N5819	1.0A SCHOTTKY BARRIER RECTIFIER (DO-41 case)
D3	BAS16	DIODE (SOT23 case)
IC1	AZ34063UMTR-G1	1.5A Step-Down/Up DC-DC Converter (SOIC-8 case)
IC2	ATTINY85	8-bit Microcontroller (SOIC-8 case)
J1	DC5mm/2.1mm	DC POWER JACK
JP1	LEDS module	LED module 280mA/10V
L1	150uH	DR127 High Power Density, High Efficiency, Shielded Inductor
Q1	IRLML6344	30V Single N-Channel HEXFET Power MOSFET (5A, SOT-23 case)
S1		Rotary Encoder w/ Select Switch

Let's now see where we can find the main components from a trusted source.

1206 SMD capacitors (~ \$14/pcs.) at:

https://uk.farnell.com/w/c/passive-components/capacitors/ceramic-capacitors/smd-ceramic-multilayer-mlcc-capacitors?voltage-rating=50v&ceramic-capacitor-case=1206-3216-metric-&packaging=cuttape&range=inc-in-stock|exc-delivery-surcharge&sort=P_PRICE



1206 SMD resistors (~.1c/pcs.) at:

<https://uk.farnell.com/w/c/passive-components/resistors-fixed-value/chip-smd-resistors/prl/results?resistor-case-style=1206-3216-metric-&packaging=cuttape&st=1206%20resistor>



1N5819 Schottky Rectifier, 40 V, 1 A, Single, DO-41 (DO-204AL), 2 Pins, 900 mV (~ 5c/pcs.) at:

<https://uk.farnell.com/multicomp/1n5819/schottky-rectifier-1a-40v-do-204al/dp/2675095?st=1n5819>



BAS16 – General purpose Switching Diode (~ 5c/pcs.) at:

<https://ro.farnell.com/on-semiconductor/bas16wt1g/diode-signal-75v-sc70-full-reel/dp/2440766?st=bas16>



AZ34063UMTR-G1 - 1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER (~ 5c/pcs.) at:

<https://ro.mouser.com/ProductDetail/Diodes-Incorporated/AZ34063UMTR-G1?qs=FKu9oBikfSmOGMIC%2Fa3O3g%3D%3D>



ATTINY85 - 8 Bit MCU, AVR Series Microcontrollers, 10 MHz, 8 KB, 500 Byte (~ \$1/pcs.) at:

<https://ro.farnell.com/microchip/attiny85v-10sh/mcu-8bit-avr-8k-flash-8soic-eiaj/dp/1972178?st=ATTINY85>



LEDS module – obtained from an EGLO Japura LED lamp, together with the goose neck (~ 1/pcs.) at:

<https://www.decorino.ro/lampa-birou-japura-led-2-7w>



DC 5mm/2.1mm power connector (~50c/pcs.) at:

<https://www.conxelectronic.ro/ro/conectori-dc/4716-PRIZA-DC-2-1-MM-PANOU-PLASTIC.html>



PCS127MT151 - SMD; 150uH; 1,42A; 280mΩ; 12x12x8mm (~50c/pcs.) at:

<https://www.conxelectronic.ro/ro/conectori-dc/4716-PRIZA-DC-2-1-MM-PANOU-PLASTIC.html>



IRLML6344TRPBF - Power MOSFET, N Channel, 30 V, 5 A, 0.022 ohm, SOT-23 (~30c/pcs.) at:

<https://www.conxelectronic.ro/ro/conectori-dc/4716-PRIZA-DC-2-1-MM-PANOU-PLASTIC.html>



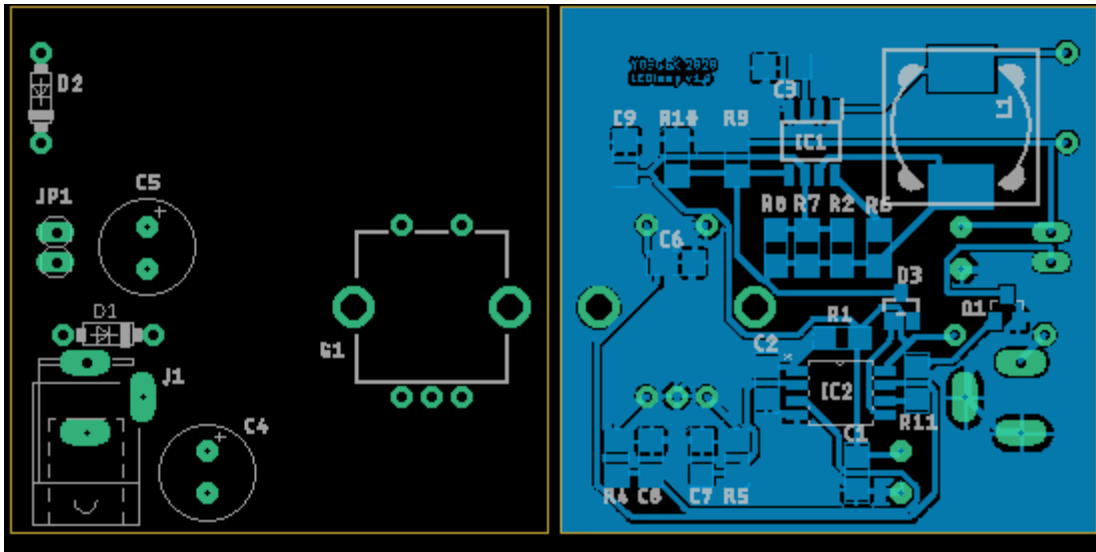
PEC11R-4215F-S0024 - Incremental Rotary Encoder, 24 Detents, 24 Pulses, Quadrature Output (~\$1.2/pcs.) at:

<https://ro.farnell.com/bourns/pec11r-4215f-s0024/incremental-encoder-2ch-24pulse/dp/2474844>



The PCB

A single side PCB is used. SMD components are mounted on the back of the PCB.

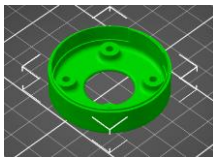


Eagle files are available by request.

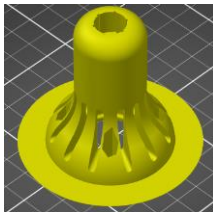
The case

You can easily 3d print the case, the actuators mounting template and the protection cap.

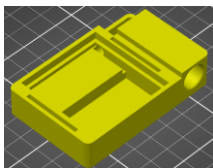
Lamp front



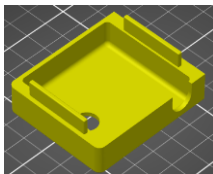
Case main body



Case bottom



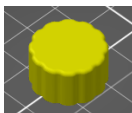
Case top



Case small top



Button



The STL files can be downloaded from here: <https://www.yo3ggx.ro/leddeskklamp/case.zip>

Operating the lamp

To operate the lamp, press on the rotary encoder for soft-start/soft-stop. When light is on, set dimming level rotating the button. If you go up to the maximum luminosity, a short blank will notify you. After a stop, previous level is saved.

Bibliography

M38 module datasheet: <https://www.sunrom.com/get/996418>

DAEX19SL-4 datasheet: <https://www.parts-express.com/pedocs/specs/295-261--dayton-audio-daex19sl-4-specifications.pdf>

The software

This is the software that you must program in the ATTINY using your preferred method. Copy and paste the code in Arduino IDE.

```
#include "avr/interrupt.h"
/*
  ATTiny 85 LED dimmer with rotary encoder and soft-start / soft-stop
  Dan Toma (YPO3GGX) - Mar 14, 2020

  pin  port      usage
  2    PB3      Channel B
  3    PB4      Channel A
  5    PB0      Light On/Off output
  6    PB1      LED PWM output
  7    PB2      On/Off button

  */

#define LED PB1                // pin 5
#define BUTTON PB2            // pin 7
#define ENCA PB4              // pin 3
#define ENCB PB3              // pin 2
#define POWER PB0             // pin 6
#define ON 1
#define OFF 0
#define MINVALUE 10           // minimum light intensity when on

volatile int stat = OFF;      // light status OFF at power up
bool previousB = false;
int stp = 4;                  // increment/decrement for brightness (64 steps)
volatile int portReading = 0;
volatile int value = 255;     // dimmer value, between 0 and 255
volatile int updated = 0;     // 0 - no update, 1 - BUTTON pressed, 2 - rotated
bool maxpulse = false;       // if true, a short pulse when level at max, only one time

void setup() {
  pinMode(BUTTON, INPUT_PULLUP); // Pull up reduces need for external resistor
  pinMode(POWER, OUTPUT);        // light power ON/OFF
  pinMode(LED, OUTPUT);          // PWM LED output
  pinMode(ENCA, INPUT_PULLUP);   // Inputs for rotary encoder
  pinMode(ENCB, INPUT_PULLUP);
  analogWrite(LED, value);        // LED off when power on
  digitalWrite(POWER, ON);
  GIMSK |= (1 << PCIE);          // Enable PCINT interrupt in the general interrupt mask
  //GIMSK = 0b00100000;         //turn on pin change
```

```

PCMSK |= (1 << ENCA) | (1 << ENCB) | (1 << BUTTON);          // Set ENCA, ENCB and BUTTON as
interrupts
//PCMSK = 0b00011000;          // turn on interrupts for pin 2 (PB3) and 3 (PB4)
sei(); //turn interrupts on
}

void loop() {
  if (updated == 1) {          // button pressed (soft start/stop)
    updated = 0;
    if (stat == ON) {
      digitalWrite(POWER, OFF);
      for (int i = 0; i <= value; i++) { // soft start
        analogWrite(LED, i);
        delay(4);
      }
    } else {
      for (int i = value; i >= 0; i--) { // soft stop
        analogWrite(LED, i);
        delay(4);
      }
      digitalWrite(POWER, ON);
    }
  } else if (updated == 2) {          // rotation up/down
    updated = 0;
    if (stat == OFF)
      return;
    else if (value < MINVALUE)
      value = MINVALUE;
    else if (value > 255)
      value = 255;
    if ((value == 255) & maxpulse) {
      maxpulse = false;
      digitalWrite(LED, OFF);          // send a short blank (first time only) to know
that the brightness is at maximum
      delay(100);
    }
    analogWrite(LED, value);          // set PWM factor
  }
}

/* Pin change interrupt vector */
ISR (PCINT0_vect) {
  //read the port quickly, masking out other pins
  portReading = PINB & 28;          // ENCA, ENCB and BUTTON (bits 4,3,2)
  // read button
  if (updated != 0)
    return;
  if ((portReading & (1 << BUTTON)) == 0) {          // button pressed
    if (stat == OFF) {
      stat = ON;
    } else {
      stat = OFF;
    }
    updated = 1;
  } else if (stat == OFF) {          // do not deal with the knob is in OFF
state
    updated = 0;
    return;
  } else if ((portReading & (1 << ENCA)) == 0) {          //read channel A
    updated = 2;
    //determine what part of the waveform we are on
    if (previousB) {
      value -= stp;
      maxpulse = true;
    } else {
      value += stp;
    }
  }
}

```



```
}  
//record b channel for use next time round  
previousB = (portReading & (1 << ENCB)) == 0;  
}
```

Bibliography

- ATTINY datasheet http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-2586-AVR-8-bit-Microcontroller-ATtiny25-ATtiny45-ATtiny85_Datasheet-Summary.pdf
- AZ34063U Datasheet <https://www.diodes.com/assets/Datasheets/AZ34063U.pdf>
- Rotary Encoder Datasheet <http://www.farnell.com/datasheets/2360546.pdf>

Document History

Initial version of the document (v1.0).

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