\* Connect 5V\_IN (J1) with 5 volts power pin of Raspberry Pi (RasPi).

\* Connect GATE\_IN (J2) with any GPIO pin of RasPi which is set as an output. RasPi's GPIO pins drive with 3.3 volts. Don't apply 5 volts to GATE\_IN (J2).

\* Connect GND (J3) with any ground pin of RasPi.

\* Q1 is a N-channel power MOSFET (enhancement mode).
I used 2SK4017. Equivalents are needed to have enough drain current, on 3.3 volts of gate-source voltage.

\* D1 to D4 are 3mm LEDs. I used 4 of LT3U31P; the forward voltage (VF) is 1.85 to 2.5 volts, and the maximum forward current (IF) is 30 milliamperes.

\* R1 is the current limiter for the J2 to J3 circuit.

There is parasitic capacitance between Gate and Source of the MOSFET.

This capacitance makes the peak current when Gate is switched on.

The peak current may make your RasPi brownout,

so R1 is applied to limit the peak current.

However, MOSFETs have leakage current between Gate and Source.

and the leakage makes voltage drop on R1.

\* R2 is the current limiter for the J1 to J3 circuit. I calculated this as described below.

(5 - (2 \* 1.85)) / 0.005 = 260: (260 \* 260) / (260 + 260) = 130:

5 is the voltage from the power supply, 1.85 is the minimum forward voltage of each LED.

The forward voltage is multiplied by 2 because 2 LEDs lined in series are the same product and color.

0.005 is the current of the circuit to light LEDs.

260 is the resistance for each pair of LEDs.

Two pairs of LEDs are lined in parallel, so the resistance can be combined in parallel.

So I used a 120 ohms resistor which the value is close to 130 ohms.

My experience was 12.5 milliamperes at the J1 to J3 circuit when Gate is on.

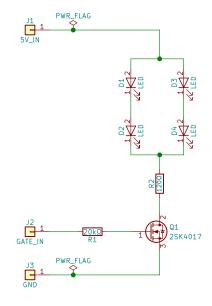
This means LEDs are driven with 6.25 milliamperes because two pairs of LEDs are lined in parallel.

This calculation assumes that all LEDs are the same product and color. The forward voltages of LEDs vary depending on products and/or colors. If you use different pairs of LEDs, different combinations of products and colors, on each line, you don't combine resistance in parallel (R2) and apply resistors for each line.

Note that the actual forward voltage of each LED is approx. 1.7 volts in my experience.

\* The power supply of 5V\_IN (J1) needs enough power (maximum amperage) to drive all LEDs, and R2 register needs enough maximum power rating for the voltage drop on R2 and the current. I suggest that you test the maximum current of the J1 to J3 circuit.

You may want more LEDs in series and more lines in parallel. To do this, you need a more powerful power supply than 5 volts of RasPi. Connect 5V\_IN (J1) with the positive terminal of the power supply, and connect GND (J3) with the negative terminal (0 volts) of the power supply. Then don't forget to earth RasPi and the power supply separately. In this case, don't connect GND (J3) with any ground pin of RasPi. High power current heats up RasPi even if it flows in the ground, because the ground of RasPi has a little resistance.



The value of R2 is the combined resistance. If you use different pairs of LEDs on each line, You don't combine resistance in parallel, and apply resistors for each line.

This method is for the constant-voltage power supply.

This schematic is exempt from warranty, responsibility, and liability from any kind and any damage.

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## JimmyKenMerchant

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