TI-RSLK MAX

Texas Instruments Robotics System Learning Kit

Texas Instruments

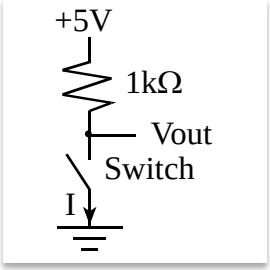
Module 8

Quiz: Interfacing Input and Output

Quiz: Interfacing input and output devices using LEDs and Switches

Q1 Switch Interfacing

Consider this negative logic switch circuit used in a +5V digital system. Do not consider the switch to be ideal. Rather, assume the resistance of the switch when the switch is open is 1 MΩ, and the resistance of the switch when the switch is closed is 1 Ω. How much current flows in mA through the switch when the switch is not pressed?

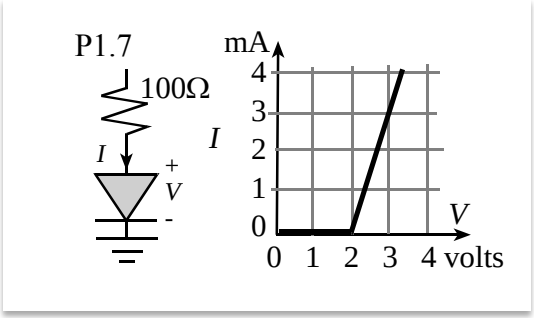


How much current in mA flows through the switch when the switch is pressed?

Q2 LED Interfacing

The output on P1.7 controls this LED. For LED voltages less than 2 volts, the LED current is 0. Assume the output high voltage of P1.7 is 3.3V. For voltages above 2 volts, the LED current is

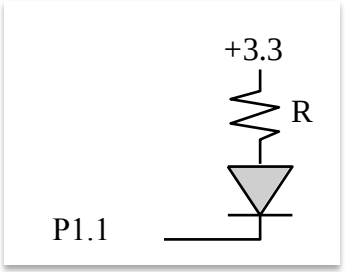
I = 3 * (*V* - 2), where *I* is in mA, *V* is in volts.



What are the current, voltage, and power to the LED when it is on?

Q3 LED Interfacing.

Consider an LED with a desired operating point of (I_d,V_d). Let V_{OL} V_{OH} I_{OL} and I_{OH} be the operating parameters of the digital output on P1.1. What is the design equation needed to calculate the desired resistance *R* for this circuit?



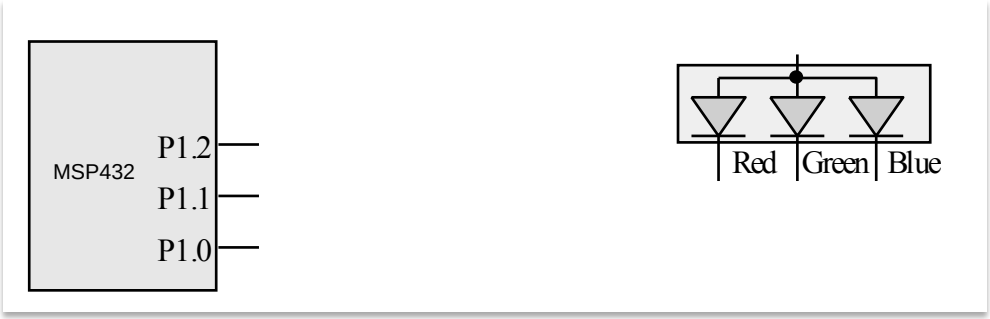
Quiz: Interfacing input and output devices using LEDs and Switches

Q4 Switch Interfacing

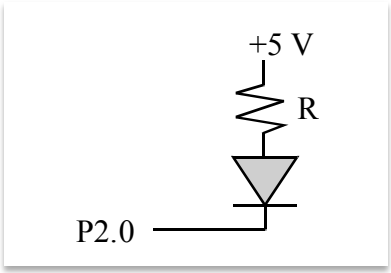
Interface a switch to P1.0. Implement the interface in negative logic. Assume the port pin is initialized as an input with internal pull-up. Minimize cost of the interface. Show hardware connections; no software is required.

Q5 LED Interfacing

Interface a multicolor LED to the microcontroller. Each color is controlled by a separate diode with an operating point of 2V, 25mA. You can use any number of 7406 inverters, and any number of resistors. Assume the V_{OL} of the 7406 is 0.5V. Assume the microcontroller output voltages are V_{OH} = 3.0V and V_{OL} = 0.1V. Specify values for any resistors needed. Show equations of your calculations used to select resistor values. Make each output control one color, positive logic.



Q6 This is not an MSP432, but rather assume this is another microcontroller running at 5V power. The following interface is used to interface a low current LED. Assume the LED voltage drop is 2 V. The resistor is 1000 Ω. When the software outputs a high, the voltage on P2.0 becomes 4.9 V. When the software outputs a low, the voltage on P2.0 becomes 0.5 V. What is the LED current when the LED is on? Is this positive or negative logic?



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