

ECE 480 – Design team 6

Voltage step down using voltage regulator.

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EXECUTIVE SUMMARY

Every electronic device requires some direct current (DC) voltage in order to be able to function. But different chips inside the device need some specific voltage. The circuit element that steps down the supplied standard DC voltage in order to satisfy the voltage needs of the chips inside the device, is called voltage regulator.

KEYWORDS

Voltage, step down, chip, microcontroller

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1. OBJECTIVE

The purpose of this application note is to explain the reason voltage regulator circuits are required in the systems.

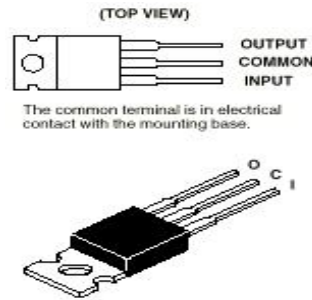
2. INTRODUCTION

Microcontroller and capacitance-to-digital converter are devices that required a specified voltage supplied to their input pins in order to function. The problem encountered with that is the fact that some other circuit devices in the system might require some other voltage different from the microcontroller and C-D convert's. This is can be overcame by using voltage regulator circuit. The voltage regulator will be stepping down the supplied voltage to the required needs without modification of the circuit or lowering down the input voltage.

3. BACKGROUND

As previously noted, the system will be supplied a certain DC voltage in order to drive the system. But to have the microcontroller and C-D converter functioning 5volts voltage must be supplied to both of them. Voltage regulator is used to step down the input voltage and after that keeping the output voltage at 5 volts constant regardless of the input voltage supplied to voltage regulator. Since the variation of the input voltage might burn the chips and make them dysfunctional.

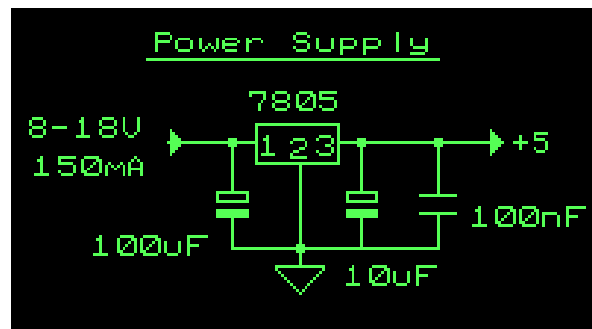
LM7805 is a part of LM78XX series three terminal positive regulators. The input leg of the voltage regulator can hold up to 36 volts DC supplied to it, common leg (ground) and the output leg, which will be outputting the regulated voltage we need. In order to boost the accuracy and the regulated voltage 0.1microfarad capacitor is usually required between common leg and the output. The capacitor will be responsible for elimination of high frequency AC voltage, which can create noise in the system, and combine with the regulated output voltage.



Picture 2. The LM 7805

4. IMPLEMENTATION

The main advantage of the voltage regulator is its simplicity in design and almost absolute fault proof. As previously noted we will need 5 volts DC in order to drive the microcontroller and C-D converter. The below design was chosen for its uncomplicated design and parts availability in the shop.



Picture 1. Voltage regulator circuit

After checking the microcontroller and C-D converter datasheets, it was noted that any current up to 100 mA will be able to drive those chips. The voltage regulator will be able to supply us up to 150 mA current with a constant 5 volts out at the output pin regardless the input voltage, which should be in the range of 8-18 volts for best performance. Since if we keep the input voltage unnecessary high, the regulator might dissipate the excessive voltage as heat, and as a result shut down. In that condition if the input voltage is too high, the designer should provide adequate heat sink in order to prevent the regulator from

overheating. The 100 nanofarad, 100 and 10 microfarad capacitors are used in order to strip down any AC voltage.

5. RESULTS

The voltage regulator was sent a 12 volts DC signal, in order to test the output voltage which should be at 5volts DC. As a result the output voltage came out to be 4.987 volts after the measurements with the multimeter was taken.

6. RECOMMENDATIONS

The voltage regulator has a capability to output up to 1 A current. If that amount of current needed to be outputted, the voltage regulator must be supplied with a heat sink in order to function, since excessive heat will shut the regulator down. Usually it's also desired to keep the input voltage at 3-4 volts above the required output voltage, and 0.1 microfarad capacitor should be blocking the AC voltage between the common (ground) and output pins.

7. CONCLUSION

In conclusion, the use of voltage regulator circuits can be a fast and inexpensive method for stepping down the input voltage to some smaller values. One of the advantages of this particular setup is the fact that all the parts can be found easily in the market without any money expenses, since the whole system might cost you one or two dollars and can be considered as the cheapest part in the whole system.

8. REFERENCES

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