

Current Amplifying using a Line Driver

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EXECUTIVE SUMMARY

In electronics it is sometimes necessary to drive an entire system using a microcontroller. However, since a microcontroller can only output a low current signal it is essential to boost the current in order to allow the output signal to operate other components. A way of creating a higher power signal is by using a line driver. The line driver discussed in this application note is a 20 pin chip that can accept multiple input signals and output these signals with a higher current level. This strength of this method is its simplicity.

KEYWORDS

Microcontroller, relay, line driver, current

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1. OBJECTIVE

The purpose of this application note is to instruct how to boost the output current signal of a microcontroller so it can cause a relay to switch. By accomplishing this a microcontroller can be used to drive an entire system.

2. INTRODUCTION

Microcontrollers have the capability to output a pulse width modulated signal. This is a very useful ability because it allows a microcontroller to drive a system. The only issue with this concept is that the current of the signal coming from a microcontroller is a very low amperage. For example a PIC microcontroller only outputs a 7mA current. It is difficult to drive a system on such a small amount of power. To allow the microcontroller voltage to control a system, relays are used because they can input a small voltage value and output a larger voltage by causing a switch within the system. However the issue with this implementation is that relays typically require a current much higher than 7mA. In order to allow the microcontroller to drive the system a current booster must be used between the microcontroller output and the relay input.

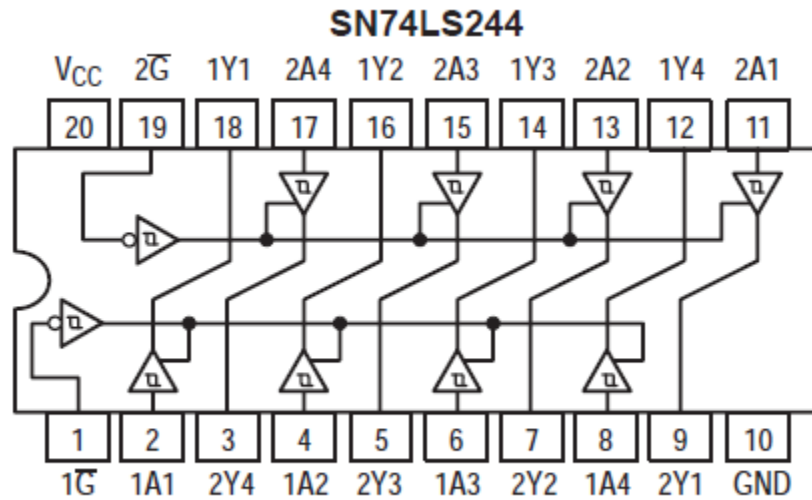
3. BACKGROUND

As stated previously the current leaving the microprocessor is has a very low current value. The amount of current required to switch the relay is much larger than the microcontroller is able to output on its own. To achieve this higher current a line driver can be used to cause a current boost. However the disadvantage to using this solution is that the voltage coming from the microprocessor drops significantly after being passed

through this current boosting component. This would not be a problem if not for the fact that relays have a specific control voltage. The lowest allowable control voltage for a relay is 70 percent of the rated control voltage. If the control voltage of the relay is too low no switch will occur in the system.

4. IMPLEMENTATION

The advantage of this current boosting method is that it is simple to implement and can easily be used to boost more than one signal of current. The line driver used in this implementation is a 20 pin chip. Two of the pins are used to enable the logic gates within the chip itself, two other pins are attached to a 5 volt supply and ground, while the rest of the pins are the inputs and outputs. Since so many pins can be used as inputs, the user can send multiple signals to the line driver and output the same signals with a boosted current. To output a current boosted signal the enable pins must be attached to ground since they are passed through a active low logic gate within the chip. These pins correspond to pins 1 and 19. This allows the line driver to accept inputs. If an input is considered “HIGH” then the chip will output a current boosted signal. To be considered a “HIGH” input the voltage must be over to 2 volts. If the voltage is below 0.8 volts it is considered a “LOW” input. Pins 2, 4, 6, and 8 are inputs, and are enabled through pin 1. The corresponding output pins are 18, 16, 14, and 12 respectively. For example if the line driver were to receive a 7mA current in pin 2, pin 18 would output a 50mA current as long as the input voltage was greater than 2 volts. Similarly input pins 17, 15, 13, and 11 correspond to output pins 3, 5, 7, and 9. This second set of input and outputs are enabled by pin 19 to. A diagram of the chip logic is displayed on the following page.



5. RESULTS

Using a PIC microcontroller a 7mA signal was sent into the line driver. The result was a 50mA signal, so the line driver was successful in boosting the current to an appropriate amount. However, the PIC microcontroller outputs a 4.6 volt signal which is then dropped to about 3.5 volts after passing through the line driver. Since this is the exact threshold value for the control voltage in the relay it is difficult to ensure that this method is reliable in supplying the appropriate power.

6. RECOMMENDATIONS

Since the output voltage of the line driver causes the input voltage to drop lower than the value required to drive a relay it is necessary to resolve this issue. This problem can be solved by using a non inverting op amp. The resistors used for the op amp need to be selected to output around 5 volts. The output of the line driver can be the input to op amp and the op amp output can then be sent to the relay.

7. CONCLUSION

In conclusion, the use of a line driver can be a very simple and quick way to boost the output current signal of a microcontroller. However, a major drawback to using this component is that it reduces the voltage level of the signal that is being amplified for more current. If there is low voltage requirement on the components being driven by this enlarged signal then this is a great method to implement. For those systems that have a higher voltage requirement, voltage amplifying techniques will need to be used at the output of the line driver to make up for the voltage drop that takes place within the component.

8. REFERENCES

Alldatasheet.com. 2005. Web. <<http://pdf1.alldatasheet.com/datasheet-pdf/view/27995/TI/SN74LS244.html>>.

DatasheetCatalog.com. Dec. 1999. Web.

<http://www.datasheetcatalog.org/datasheets/134/375530_DS.pdf>.