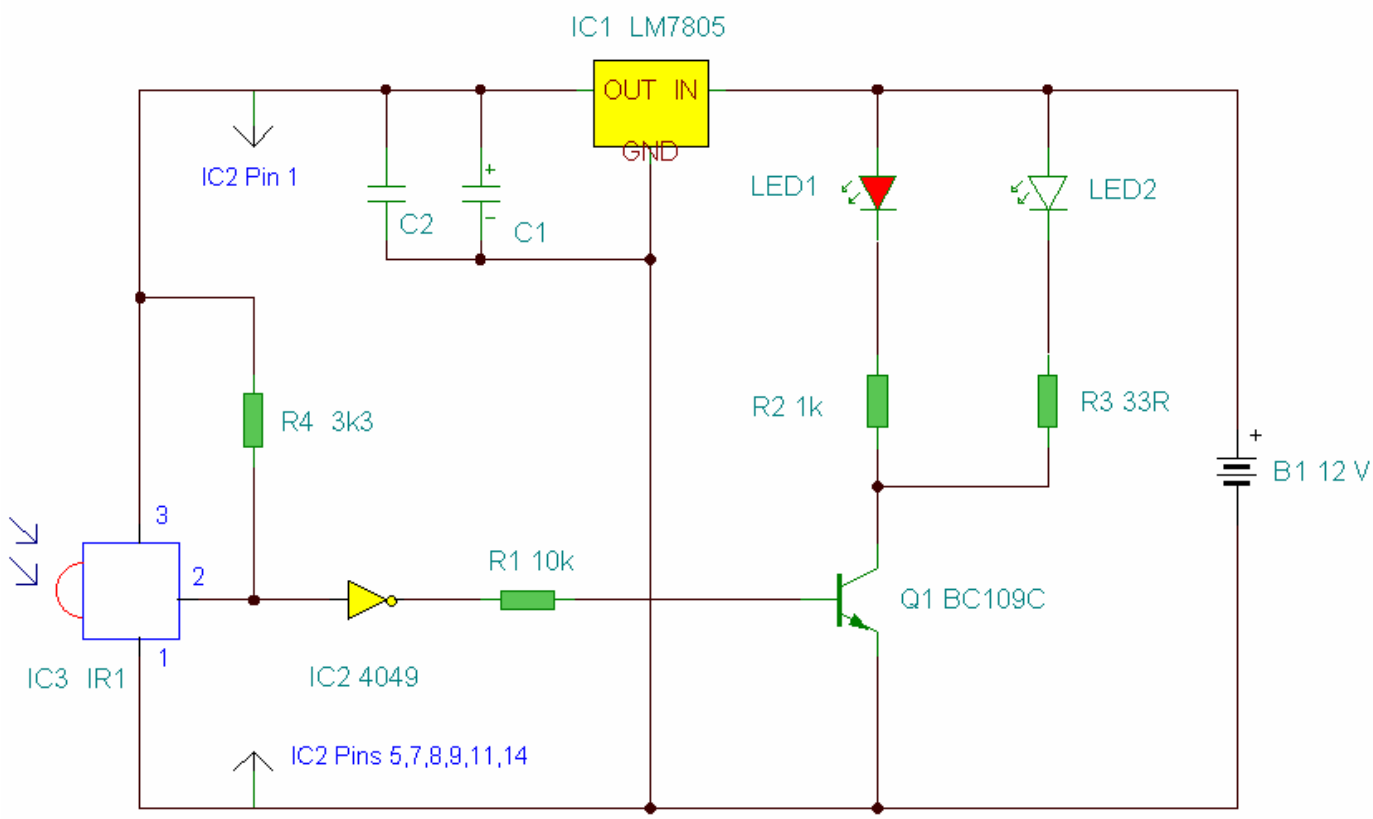
IR Remote Control Extender Circuit (Mark 2)

Description:

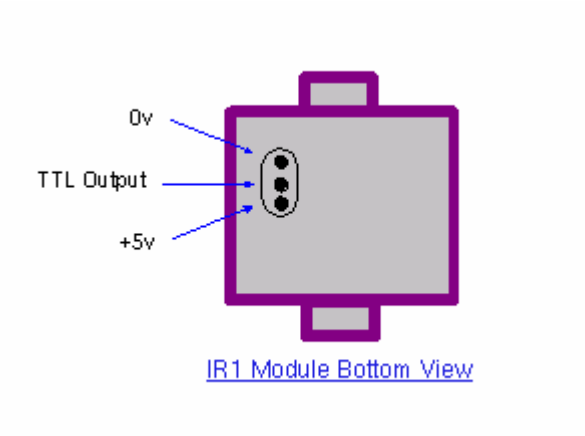
This is an improved IR remote control extender circuit. It has high noise immunity, is resistant to ambient and reflected light and has an increased range from remote control to the extender circuit of about 7 meters. It should work with any domestic apparatus that use 36-38kHz for the IR carrier frequency. Please note that this is NOT compatible with some satellite receivers that use 115KHz as a carrier frequency.



Notes:

The main difference between this version and the previous circuit, is that this design uses a commercially available Infra Red module. This module, part number IR1 is available from Harrison Electronics in the UK. The IR module contains a built in photo diode, amplifier circuit and buffer and decoder. It is centerd on the common 38kHz carrier frequency that most IR controls use. The module removes most of the carrier allowing decoded pulses to pass to the appliance. Domestic TV's and VCR's use extra filtering is used to completely remove the carrier. The IR1 is packaged in a small aluminium case, the connections viewed from underneath are shown below:

Infra Red Module, IR1 Pinout



IR1 Module Bottom View

How It works:

The IR1 module (IC3) operates on 5 Volt dc. This is provided by the 7805 voltage regulator, IC1. Under quiescent (no IR signal) conditions the voltage on the output pin is high, around 5 volts dc. This needs to be inverted and buffered to drive the IR photo emitter LED, LED2. The buffering is provided by one gate (pins 2 & 3) of a hex invertor the CMOS 4049, IC2. The IR1 module can directly drive TTL logic,but a pull-up resistor, R4 is required to interface to CMOS IC's. This resistor ensures that the signal from a remote control will alternate between 0 and 5 volts. As TTL logic levels are slightly different from CMOS, the 3.3k resistor R4 is wired to the +5 volt supply line ensuring that the logic high signal will be 5 volts and not the TTL levels 3.3 volts. The resistor does not affect performance of the IR module, but DOES ensure that the module will correctly drive the CMOS buffer without instability.
The output from the 4049 pin 2 directly drives transistor Q1, the 10k resistor R1 limiting base current. LED1 is a RED LED, it will flicker to indicate when a signal from a remote control is received. Note that in this circuit, the carrier is still present, but at a reduced level, as well as the decoded IR signal. The CMOS 4049 and BC109C transistor will amplify both carrier and signal driving LED2 at a peak current of about 120 mA when a signal is received. If you try to measure this with a digital meter, it will read much less, probably around 30mA as the meter will measure the average DC value, not the peak current. Any equipment designed to work between 36 and 40kHz should work, any controls with carrier frequencies outside this limit will have reduced range, but should work. The exception here is that some satellite receivers have IR controls that use a higher modulated carrier of around 115KHz. At present, these DO NOT work with my circuit, however I am working on a Mark 3 version to re-introduce the carrier.

Parts List:

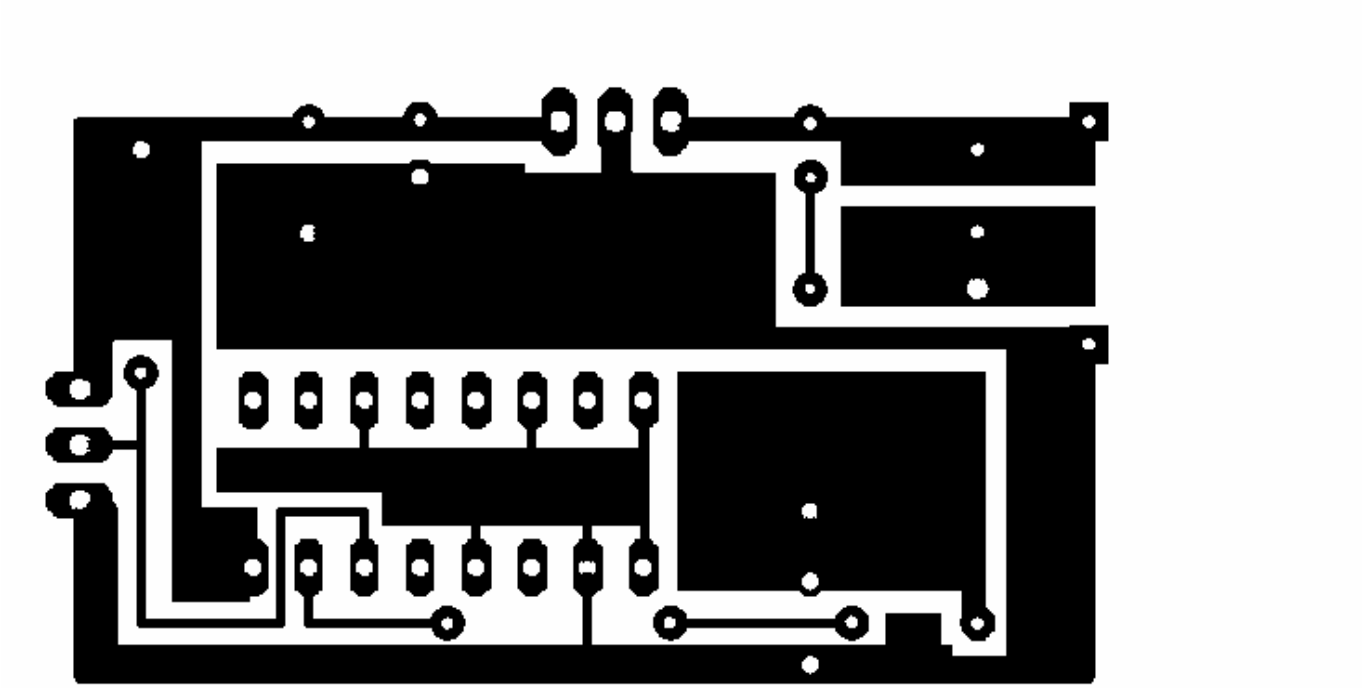
C1 100u 10V
C2 100n polyester
R1 10k
R2 1k
R3 33R 1W
R4 3k3
Q1 BC109C
IC1 LM7805
IC2 CMOS 4049B
IC3 IR1 module from Harrison Electronics See Last paragraph
LED1 Red LED (or any visible colour)
LED2 TIL38 or part YH70M from Maplin Electronics
Pinouts for the IC's can be found on my IC pinout page, click here.

Testing:

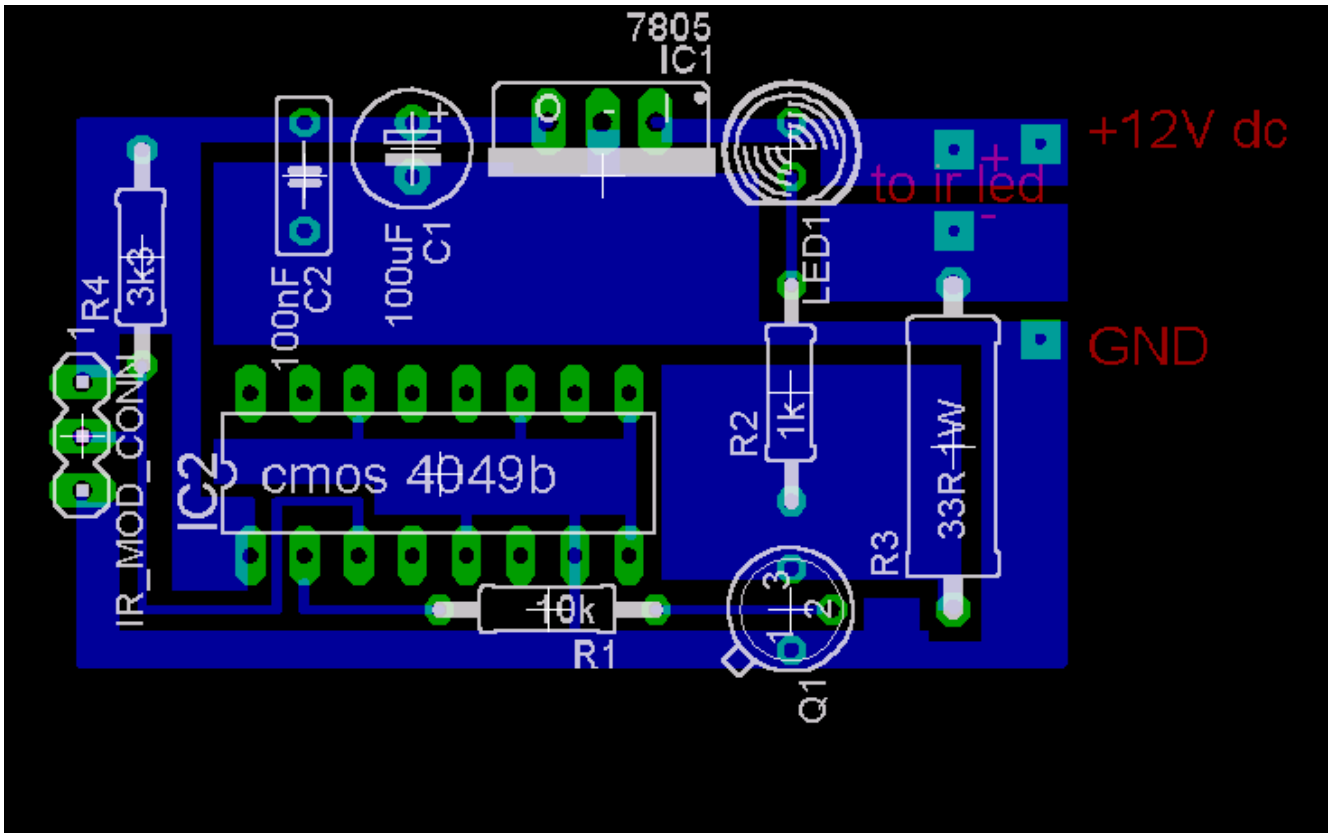
This circuit should not present too many problems. If it does not work, arm yourself with a multimeter and perform these checks. Check the power supply for 12 Volt dc. Check the regulator output for 5 volt dc. Check the input of the IR module and also Pin 1 of the 4049 IC for 5 volts dc. With no remote control the output at pin 2 should be zero volts. Using a remote control pin 2 will read 5 volts and the Red LED will flicker. Measuring current in series with the 12 volt supply should read about 11mA quiescent, and about 40/50mA with an IR signal. If you still have problems measure the voltage between base and emitter of Q1. With no signal this should be zero volts, and rise to 0.6-0.7 volts dc with an IR signal. Any other problems, please email me, but please do the above tests first.

PCB Template:

Once again a PCB template has been kindly drafted for this project by Domenico.



A magnified view showing the component side is shown below:



Alternatives to IC3:

The part number IR1 from Harrison Electronics is no longer available. They do supply an alternative IR decoder which I have tested and works. Other alternative Infrared decoders are shown below, note however that all DO NOT share the same pinout. I advise anyone making this to check the corresponding data sheets.
Vishay TSOP 1738
Vishay TSOP 1838
Radio Shack 276-0137
Sony SBX 1620-12
Sharp GP1U271R

Equipment Controlled Successfully:

If you have built this circuit and it works successfullt please let me know and I will build the list. Email details of the Manufacturer, device and remote control model number. The remote model number is usually on the front or back of the remote.
Technics CDP770 Remote: EUR64713

Last Revision: 24 October 2002