

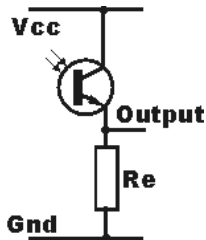
## ORU12 ELECTRONICS

### MOTOR ENCODER CIRCUITS

#### Common collector phototransistor circuit

The common collector, or emitter follower phototransistor circuit configuration has effectively the same topology as the normal common emitter transistor circuit - the emitter is taken to ground via a load resistor, and the output for the circuit being taken from the emitter connection of the device.

The circuit generates an output that moves from the low state to a high state when light is detected.



**Common collector / emitter follower phototransistor circuit**

#### Phototransistor circuit operation

The phototransistor circuits can be used on one of two basic modes of operation. They are called active or linear mode and a switch mode.

Operation in the "linear" or active mode provides a response that is very broadly proportional to the light stimulus. In reality the phototransistor does not give a particularly linear output to the input stimulus and it is for this reason that this mode of operation is more correctly termed the active mode.

The operation of the phototransistor circuit in the switch mode is more widely used in view of the non-linear response of the phototransistor to light. When there is little or no light, virtually no current will flow in the transistor, and it can be said to be in the "off" state. However as the level of light increases, current starts to flow. Eventually a point is reached where the phototransistor becomes saturated and the level of current cannot increase. In this situation the phototransistor is said to be saturated. The switch mode, therefore has two levels: - "on" and "off" as in a digital or logic system. This type of phototransistor mode is useful for detecting objects, sending data or reading encoders, etc.

With most circuits not using the base connection (even if it is available), the only way to change the mode of operation of the circuit is to change the value of the load resistor. This is set by estimating the maximum current anticipated from the light levels encountered.

Using this assumption, the following equations can be used:

$$\begin{aligned} \text{Active mode: } V_{CC} &> R_L \times I_c \\ \text{Switch mode: } V_{CC} &< R_L \times I_c \end{aligned}$$

Where

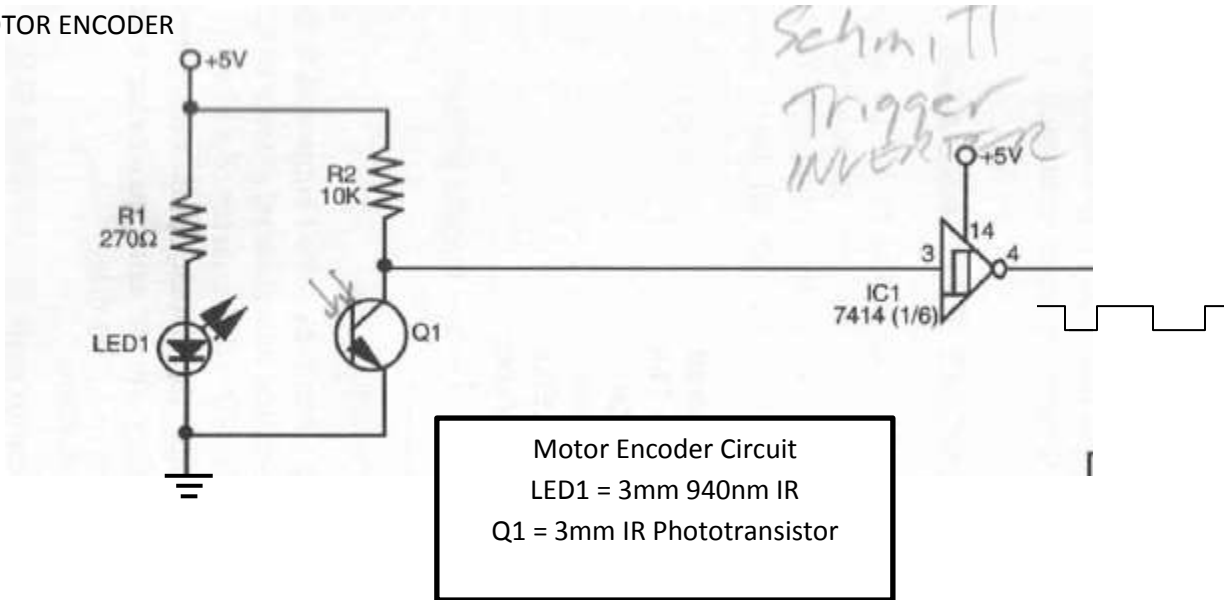
$R_L$  = load resistor (i.e.  $R_c$  or  $R_e$  in the diagrams above).

$I_c$  = maximum anticipated current.

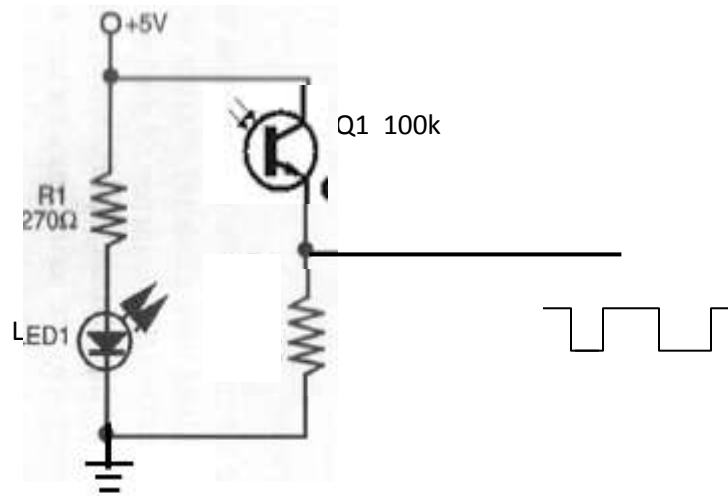
$V_{CC}$  = supply voltage.

# ORU12 ELECTRONICS (CONT'D)

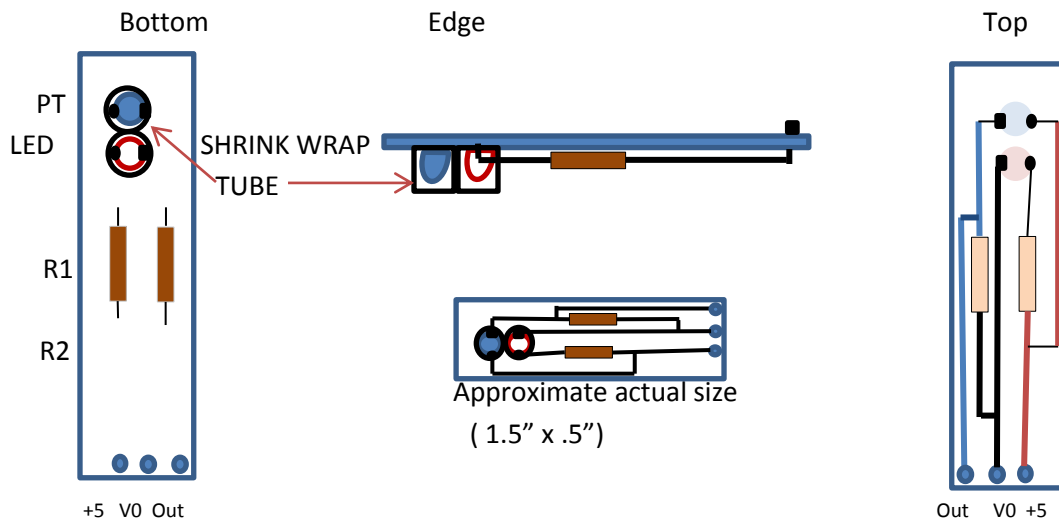
## MOTOR ENCODER



Alternatively, this could work without  
 Need for 7414 if value of R2 is such  
 That Q1 works in "Switch mode"  
 100K seems to work just fine.



### Physical Layout

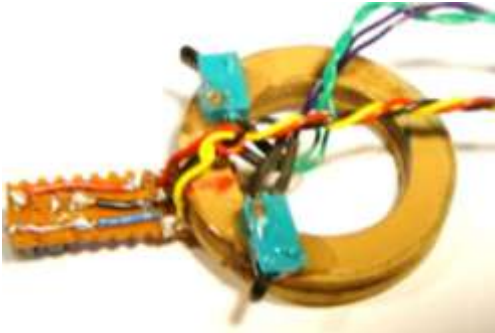


**ORU12 ELECTRONICS (CONT'D)**

BODY ROTATION GEAR MOTOR ENCODER



FINISHED ASSEMBLY



ATTACHED – IN PLACE

