Daytime Running Lights Controller

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Auto makers have been gradually switching to light emitting diode (LED) lighting for automotive headlamps because of its features such as high efficiency and long service life. In addition, from a safety perspective, applications of LED-driven daylight/daytime running lights (DRLs) for vehicles are spreading in many states.

The purpose of the circuit presented here is to activate DRLs on any lighting that uses LED and/or incandescent bulb in a vehicle. Before attempting to construct this circuit, remember that, you cannot directly hook up the circuit to any circuit that is controlled by the CANbus system in a vehicle. For example, if the parking lights of your vehicle are CANbus-controlled, the DRL circuit cannot be plugged to the parking-light circuit for DRL function.

But, if the fog-light circuit is not controlled by CANbus, then you can connect the DRL circuit to it. Author's prototype is shown in Fig. 1.

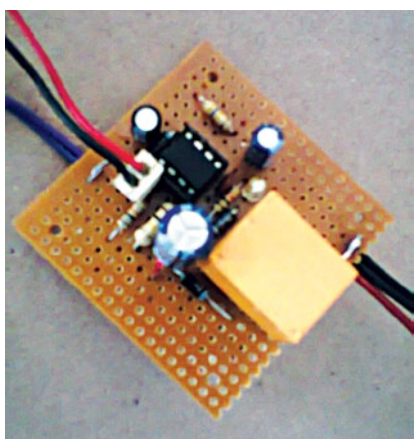

Fig. 1: Author's prototype

Circuit and working

Fig. 2 shows the circuit diagram of the DRL controller. It is built around timer NE555 (IC1), MOSFET 60NF06 (IRF1), 12V, 1C/O relay (RL1), DRLs and a few other components.

There are seven wires that come out of the circuit. The first connection (DRL-B and DRL-G) you will make is to the DRLs. These are the main wires that will make the bumper DRLs turn on when you start the vehicle (these will light up at start).

Connect DRL-B and DRL-G wires from the circuit directly to the DRLs at the bumper. The circuit activates when it senses ignition voltage. It does so by getting a signal from the main wire (IGN+) and the positive supply wire that runs from the circuit to the ignition-switched +12V power line. GND is main ground connection, and it must be connected directly to the negative battery (0V) terminal or the body of the vehicle.

Wiring Guide Table

Signal	Remarks
DRL-G	Negative (0V) of daytime running light
DRL-B	Positive (12V) of daytime running light
IGN+	Positive (12V) supply from ignition switch
HL+	Positive (12V) supply from headlight wiring
PL+	Positive (12V) supply from parking-light wiring
PB+	Positive (12V) supply from parking-brake/hand-brake wiring
GND	Common ground (0V) connection/vehicle body

You might have to extend the wire, if it does not reach the battery, by running sufficient length of the automotive wire from the circuit to the negative terminal of the battery. If you want the DRLs to switch off when you turn your headlights and/or parking lights on, connect HL+ and PL+ to the existing headlight and parking-light wires, respectively.

Wire connection PB+ is optional; you do not have to connect it unless you want the DRLs to work with the parking brake (hand brake). The potmeter (VR1) can be used to adjust the brightness of DRLs as per requirement. Note that, you can modify the circuit's default

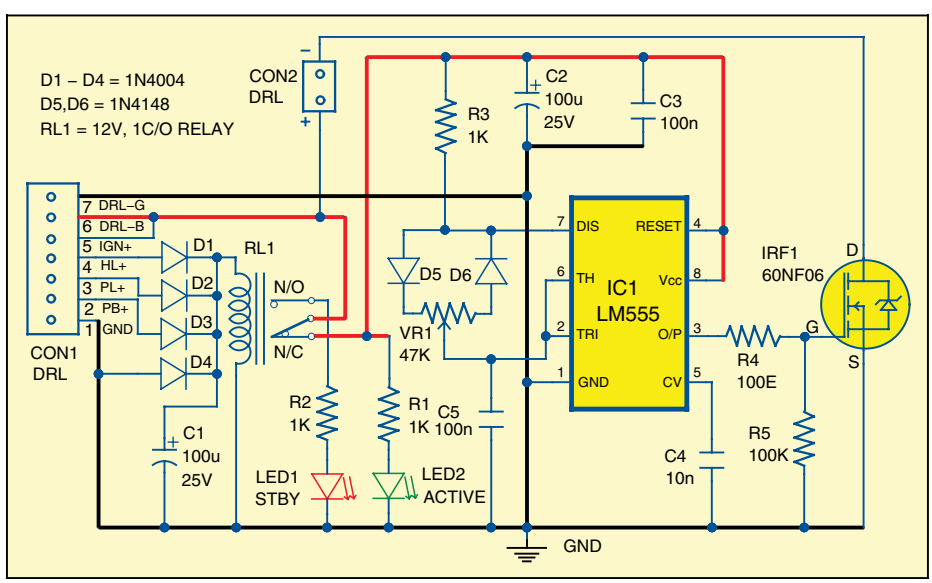

Fig. 2: Circuit diagram of the DRL controller

PARTS LIST

Semiconductors:

IC1	- LM555 timer
D1-D4	- 1N4004 rectifier diode
D5-D6	- 1N4148 signal diode
IRF1	- 60NF06 MOSFET
LED1, LED2	- 5mm LED

Resistors (all 1/4-watt, ±5% carbon):

R1-R3	- 1-kilo-ohm
R4	- 100-ohm
R5	- 100-kilo-ohm
VR1	- 47-kilo-ohm potmeter

Capacitors:

C1, C2	- 100µF, 25V electrolytic
C3, C5	- 100nF ceramic disk
C4	- 10nF ceramic disk

Miscellaneous:

RL1	- 12V, 1C/O relay
CON1	- 7-pin connector
CON2	- 2-pin connector
DRL	- Daylight running lights

Set Off mode as per your choice, or according to the relevant law of the land.

The default Set Off mode of the DRL is given below:

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IGN+ (ignition): ON→DRL: ON
HL+/PL+/PB+ (headlight/park light/hand
brake): ON→DRL: OFF
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The circuit is a simple pulse-width modulator (PWM) built around the ubiquitous 555 timer. User-controllable PWM output from IC1 is used to switch on the DRLs through MOSFET 60NF06 (as MOSFET on DRL ground is connected to circuit ground).

Here, 555 is configured as astable and, hence, it is possible to have completely-independent control of charge and discharge times of the timing capacitor by using two external diodes (D5 and D6). The 12V 1C/O electromagnetic relay in the circuit is used to enable/disable the DRL controller circuitry, as per status of the headlight/parking light/hand brake. LED1 indicates standby and LED2 indicates the active modes of the DRL controller.

Fig. 3: Photograph of the DRL

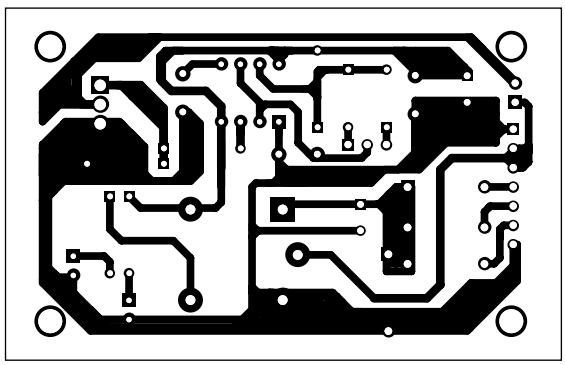

Fig. 4: Actual-size PCB of the DRL

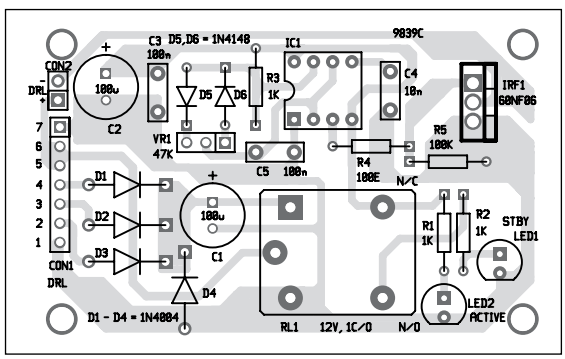

Fig. 5: Component layout of the PCB

Note. Driving the MOSFET from a noisy line calls for a small series gate resistor close to the MOSFET. Using a low-value 100-ohm resistor (R4) between the MOSFET driver and MOSFET gate terminal dampens down any ringing oscillations caused by lead inductance and gate capacitance, which can otherwise exceed the maximum voltage allowed on the gate terminal. Also, using pull-down 100k resistor (R5) from the gate to the source of the MOSFET is a good practice.

Construction and testing

An actual-size, single-side PCB for the DRL controller circuit is shown in Fig. 4 and its component layout in Fig. 5. Enclose the circuit in a suitable small box with connectors CON1 and CON2 on the front side to connect the seven control signals and the DRL.

After assembling the circuit, refer to the wiring guide table before connecting these to the PCB board.

Panel-mount the input and output interface, as required. ●

T.K. Hareendran is an electronics hobbyist, freelance technical writer and circuit designer