

This little board is intended to make adding class marker leds to a hood diesel or switcher faster and easier. It should fit inside either hood of most any O scale or near scale diesel, switcher, GG1, boxcab, or subway car. It's 9 x 35 mm overall size, with pads to fit a right side 2mm post type led, and two alternate locations for a left side led. The 28mm C-C spacing between left and right leds is for narrower hoods; the 32mm C-C is for wider ones. Which to use will depend on what fits the particular engine best. Choose the closest fit and bend the led leads slightly if required. The board could also be used for engine number board leds, ditch lights, or caboose side marker leds. You can use 1.8, 2, 3, or 5mm leds, round or flat face, any color in this board.

Only one left end pad should be used because they are wired in parallel on the board. The left end can be shortened when using the narrower pads, by using a Dremel to cut the board just outside the D3 pad connections. See picture below. Note that components can be installed on either the front or back (or both) sides of the board, and it can be installed in any position that will work.

The board includes pads for a series load resistor R1. Resistor values vary dramatically depending on the power source voltage and the led color. A current of 10+ ma is needed for good intensity for 2mm green marker leds for instance, but some colors look equally good with as little as 1-2 ma. Refer to the attached table of Marker LEDs R1 Values for guidance in selecting the best R1 resistor for similar color intensity. Alternatively you can install a trim pot such as a 5K Bourns 3362P style in place of R1, for adjustment to get the marker led intensity that looks right for your application.

There is also a series pad for a 1N4148 or similar GP diode, to rectify the track AC if no DC power source is available. In this case you may need to experiment with a pot for R1 per above, but reducing the value of R1 by 40-60% from the table values seems to work well. This allows for the fact it's only half wave DC, and an additional diode is now in the circuit. When using DC simply omit diode D1 and jumper the pads.

You can also use the D1 pads to wire another led into the circuit, such as a 3mm headlight led for instance. Try reducing the value of R1 by about 33% from the table values; and this only works with red, blue and yellow markers. (The forward voltages are too unbalanced for this to work properly with green markers)

To assemble the board first solder the two leds of choice into the board making the leads fairly short (6mm or less), observing polarity, then install the other components. You can use a standard 0.1" pitch 2 pin header and connector for wiring, such as JST-XH or EH style, for convenient shell removal in the future. Otherwise simply solder 2 short lengths of #30 or so wire to the pads to connect it to a convenient power source.

Then install the board by inserting the leds into existing class light holes (bending the leads as needed) using CA glue, or similar. (Note that a #46 drill bit will make a perfect size hole for 2mm post leds if the shell does not already have holes. A 5/64" bit will also work but may be a little tight.) The board should not need any other means of support once the leds are affixed. Then attach the power wires to the source as required. Note that if no other power source is available (as in the case of a dummy engine or conventional operation), you can likely connect the board directly to the existing headlight (or reverse light) harness or bulb socket. If you want constant voltage lighting for conventional, use a 6 volt regulator board and a resistor sized for 6 vdc.

The left end D2 & D3 diode pads can also be used for a close mounted (4mm C-C) pair or single 3mm led headlight. In this case the R1 value should be 2-3K ohm for a 12 vdc supply, and needs to be ¼ watt. The board can be shortened with a Dremel just to the right of the right D1 pad and the left R1 pad. See picture below. The D1 pads are then used for R1. The right hand R1 lead should be soldered to the remaining R1 lead hole to complete the circuit. The board length is only about 23mm when used this way.

My plan is to pre-build a few of these at a time in various led colors, ready to drop in whenever needed.

Showing cut lines for narrow hood diesel, and for dual headlight application:

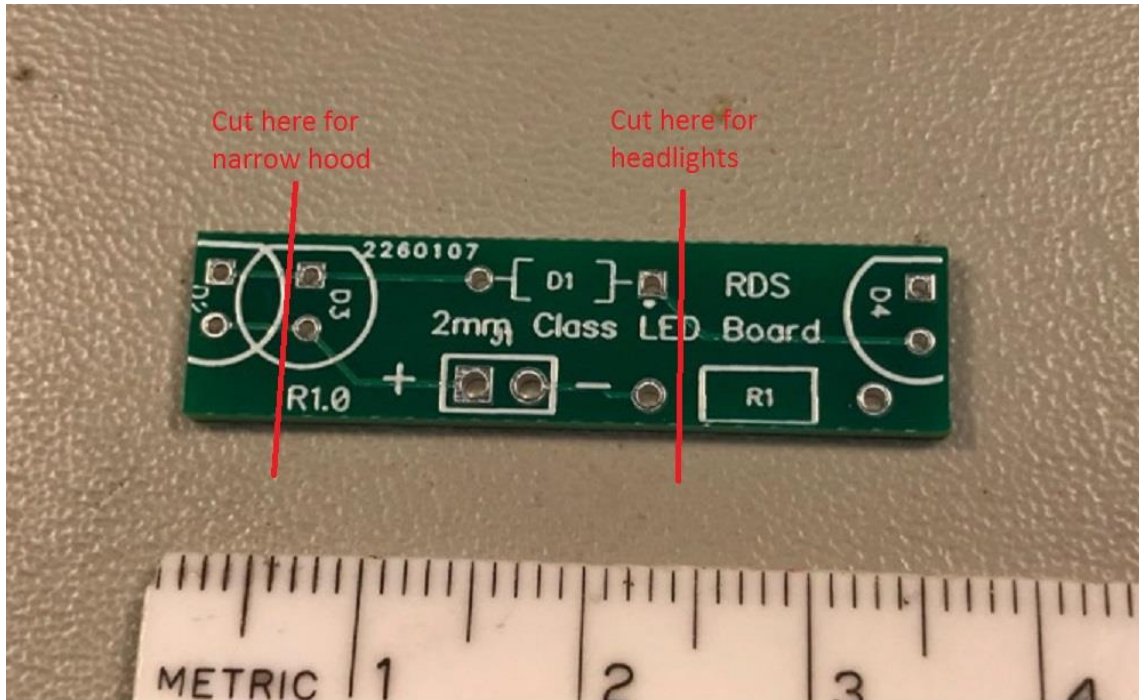


Table of R1 values in ohms for various DC supply voltages for 2 x various color leds, at equal brightness:

LED color - amps	% Load	6 volts (PS2/3)	8 volts	10 volts	12 volts	14 volts	16 volts	18 volts
Green 13ma	100	150	300	470	620	750	1K	1.2K
Red 3ma	20	120	1.5K	2.4K	3.3K	3.9K	4.7K	5.1K
White 1.8ma	15	220	1.5K	2.4K	3.3K	4.7K	5.6K	6.8K
Blue 1.2ma	10	510	2.4K	3.6K	5.1K	6.8K	8.2K	10K
Yellow 2.5ma	20	750	1.5K	2.4K	3.3K	3.9K	4.7K	5.6K

These values are a guideline only and are the minimums to use. You may want to experiment a bit.

To reduce brightness incrementally choose the resistor value for the next higher voltage.

The % loads are based on approx equal light intensities for each color, and is very subjective.

Note that two series leds will work with a supply as low as 6VDC, but less may be insufficient to overcome the combined forward voltages.