

7.7 Using the PCA9685 with and without external drivers

The PCA9685 LED output drivers are 5.5 V only tolerant and can sink up to 25 mA at 5 V.

If the device needs to drive LEDs to a higher voltage and/or higher current, use of an external driver is required.

- INVRT bit (MODE2 register) can be used to keep the LED PWM control firmware the same independently of the type of external driver. This bit allows LED output polarity inversion/non-inversion only when $\overline{OE} = 0$.
- OUTDRV bit (MODE2 register) allows minimizing the amount of external components required to control the external driver (N-type or P-type device).

Table 12. Use of INVRT and OUTDRV based on connection to the LEDn outputs when $\overline{OE} = 0$ ^[1]

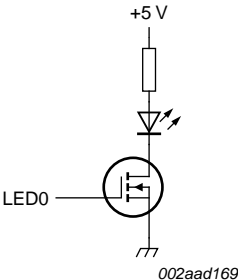
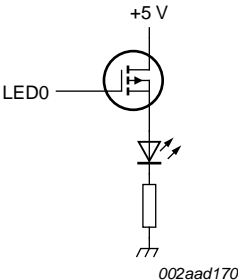
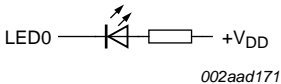
INVRT	OUTDRV	Direct connection to LEDn		External N-type driver		External P-type driver	
		Firmware	External pull-up resistor	Firmware	External pull-up resistor	Firmware	External pull-up resistor
0	0	formulas and LED output state values inverted	LED current limiting R ^[2]	formulas and LED output state values inverted	required	formulas and LED output state values apply	required
0	1	formulas and LED output state values inverted	LED current limiting R ^[2]	formulas and LED output state values apply ^[3]	not required ^[3]	formulas and LED output state values inverted	not required
1	0	formulas and LED output state values apply ^[2]	LED current limiting R	formulas and LED output state values apply	required	formulas and LED output state values inverted	required
1	1	formulas and LED output state values apply ^[2]	LED current limiting R	formulas and LED output state values inverted	not required	formulas and LED output state values apply ^[4]	not required ^[4]

[1] When $\overline{OE} = 1$, LED output state is controlled only by OUTNE[1:0] bits (MODE2 register).

[2] Correct configuration when LEDs directly connected to the LEDn outputs (connection to V_{DD} through current limiting resistor).

[3] Optimum configuration when external N-type (NPN, NMOS) driver used.

[4] Optimum configuration when external P-type (PNP, PMOS) driver used.

 <p>INVRT = 0 OUTDRV = 1</p> <p>Fig 13. External N-type driver</p>	 <p>INVRT = 1 OUTDRV = 1</p> <p>Fig 14. External P-type driver</p>	 <p>INVRT = 1 OUTDRV = 0</p> <p>Fig 15. Direct LED connection</p>
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