

PCA9745B – 16-channel constant-current LED sink (our CR drive)

NXP · HTSSOP-28 + thermal pad · SPI · ~\$3

WHAT IT IS

A chip with 16 independent "current sinks." Each output pulls a programmable, CONSTANT current to ground – set it to 12 mA and it holds 12 mA regardless of LED forward-voltage, temperature, or rail sag. You wire LEDs common-anode (all anodes to +V_LED), cathodes to the 16 outputs. SPI tells it each channel's current.

KEY SPECS (what matters to us)

16 channels · per-channel 8-bit IREF (256 current steps)
Each channel: ON / OFF / PWM – we use ON (no PWM = carrier-free)
Output current up to ~57 mA/ch; we run ~12 mA
Built-in open/short LED fault detection + thermal shutdown
SPI up to ~10 MHz, daisy-chainable

SIGNALS / PINS WE USE

SCLK/SDI/SDO/~CS – SPI (shares our spine)
~OE – output enable (hard-low = outputs follow registers)
~RESET (pull-up) · REXT (sets the global max current) · VDD 3.3V
OUT0..15 – the 16 current sinks → LED cathodes

ELECTRICAL · GOTCHAS

It DISSIPATES $(V_{LED} - V_f) \times I$ inside the chip → keep V_LED at 5 V, NOT 12 V, or it cooks. Exposed pad must have thermal vias to copper. Held at max current it can thermal-shut-down (the D-01 floor relay sidesteps that by going to a true 0 Ω short with LEDs OFF).

WHY IT'S IN OUR SYSTEM

This is THE drive chip – it replaced an entire DAC→op-amp→transistor current-source stack (one ~\$3 part instead of ~3 chips per channel). The fork that hung over the rebuild for two sessions; RESOLVED when its 8-bit current steps read STEPLESS on the CRT. Carrier-free (no PWM) means no flicker landscape, no line-rate beat. One chip drives a whole 4-channel unit (16 outputs = 4 cells × 4 channels).