CA 3644

LED Driver, 4-Channel

The CAT3644 is a high efficiency fractional charge pump that can drive up to four LEDs programmable by a one wire digital interface. The inclusion of a 1.33x fractional charge pump mode increases device efficiency by up to 10% over traditional 1.5x charge pumps with no added external capacitors.

Low noise input ripple is achieved by operating at a constant switching frequency which allows the use of small external ceramic capacitors.

re is patented.

- High Efficiency 1.33x Charge Pump
- Charge Pump: 1x, 1.33x, 1.5x, 2x
- Drives up to 4 LEDs at 25 mA Each
- 1−wire EZDim LED Current Programming
- Power Efficiency up to 92%
- Low Noise Input Ripple in All Modes
- “Zero” Current Shutdown Mode
- Soft Start and Current Limiting
- Short Circuit Protection
- Thermal Shutdown Protection
- 3 mm x 3 mm, 16−pad TQFN Package
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

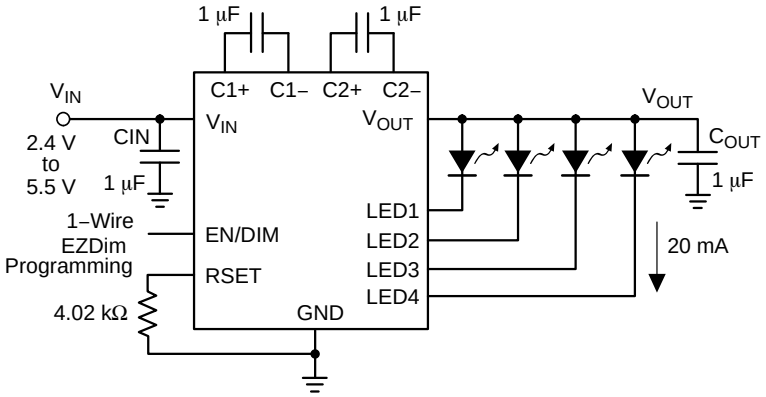
JAAG
AXXX
YWW

- LCD Display Backlight
- Cellular Phones
- Digital Still Cameras
- Handheld Devices

		†

Semiconductor Components Industries, LLC, 2014

Publication Order Number:



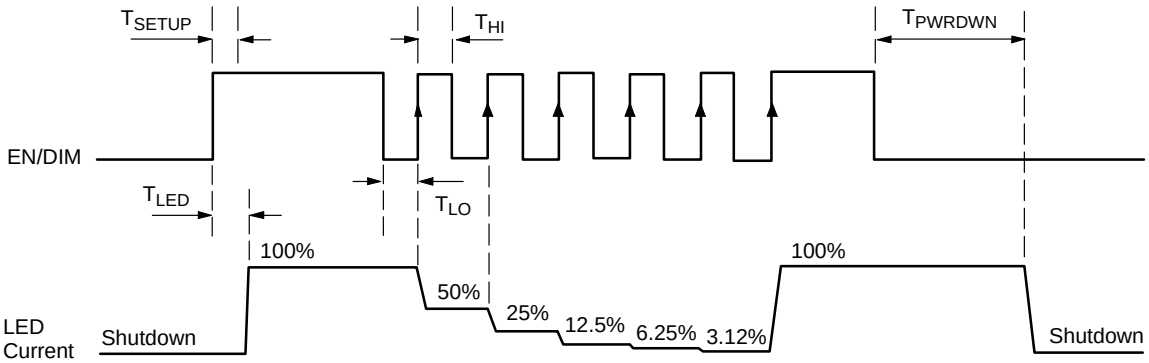
V_{IN}, LEDx, C1±, C2±, EN/DIM voltage	6	V
V_{OUT} voltage	7	V
Storage Temperature Range	−65 to +160	°C
Junction Temperature Range	−40 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

(over recommended operating conditions unless specified otherwise) V_{IN} = 3.6 V, EN = High, T_{AMB} = 25°

(For 2.4 V ≤ V_{IN} ≤ 5.5 V, over full ambient temperature range −40°C to +85°C.)

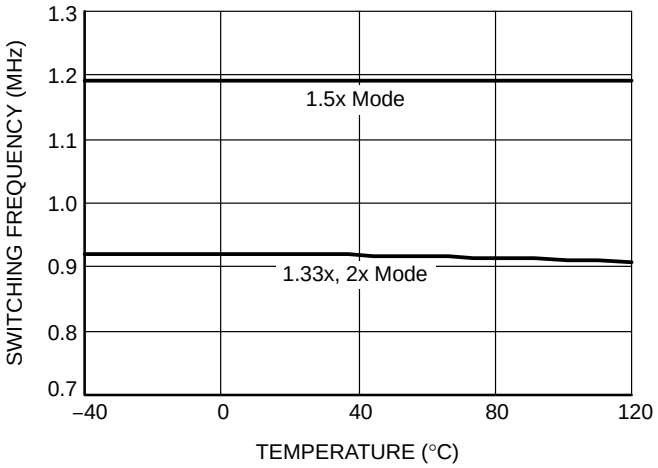
T_{SETUP}	EN/DIM setup from shutdown		10			µs
T_{LO}	EN/DIM program low time		0.2		100	µs
T_{HI}	EN/DIM program high time		0.2			µs
T_{PWRDWN}	EN/DIM low time to shutdown		1.5			ms
T_{LED}	LED current settling time			40		µs

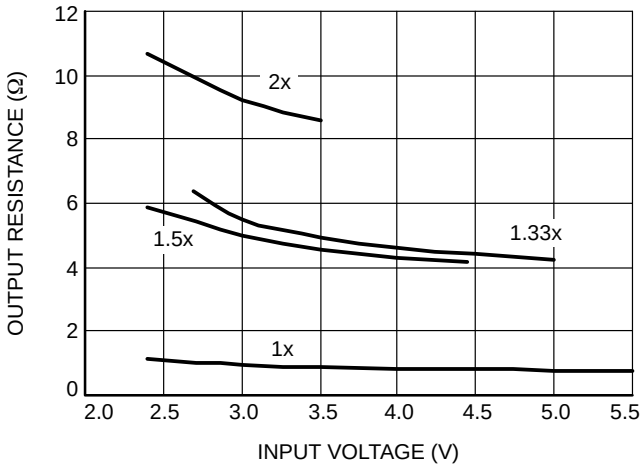


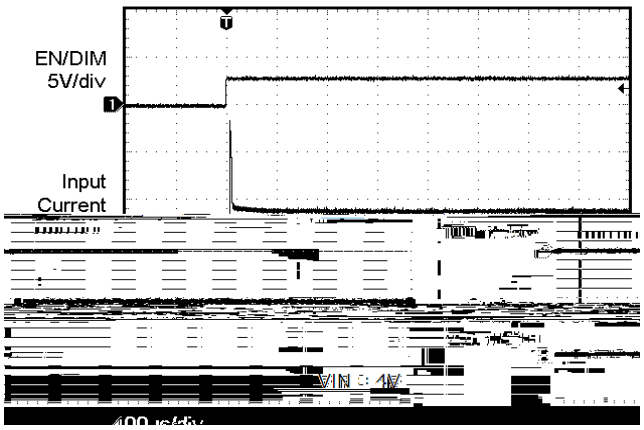
The nominal LED current is set by the external resistor connected between the RSET pin and ground. Table 5 lists standard resistor values for several LED current settings.

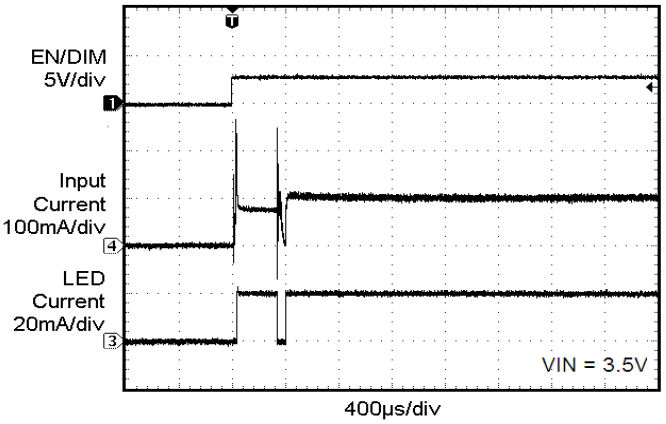
	Ω
2	40.0
5	15.8
10	7.87
15	5.23
20	4.02
25	3.16
30	2.67

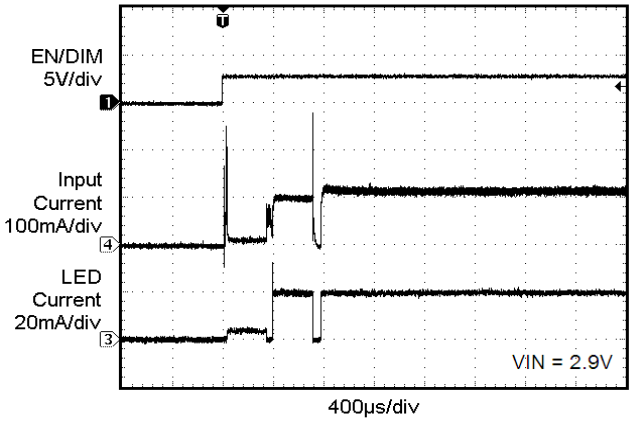
(V_{IN} = 3.6 V, I_{OUT} = 80 mA (4 LEDs at 20 mA), C_{IN} = C_{OUT} = C_1 = C_2 = 1 µF, T_{AMB} = 25°C unless otherwise specified.)

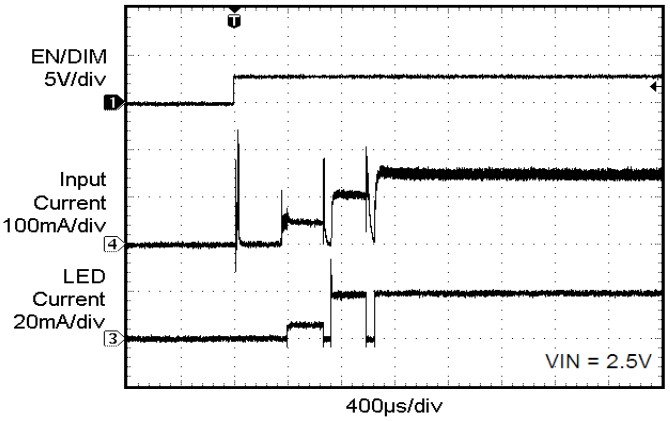




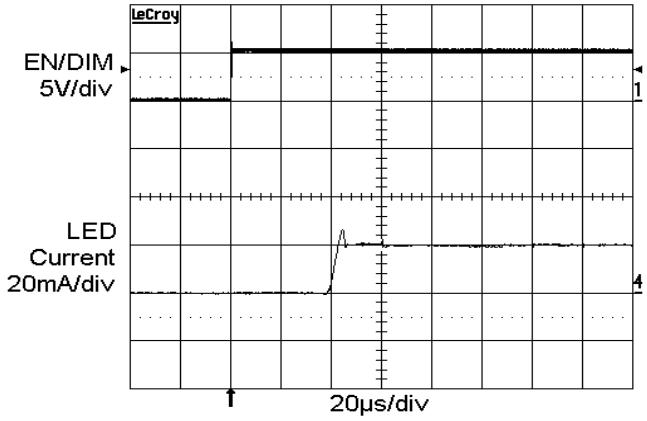


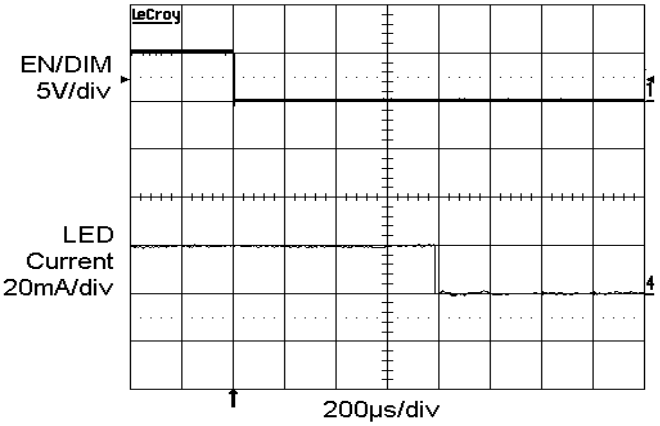


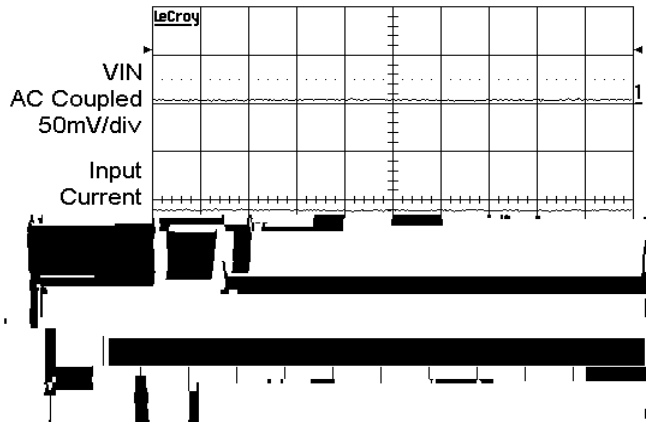


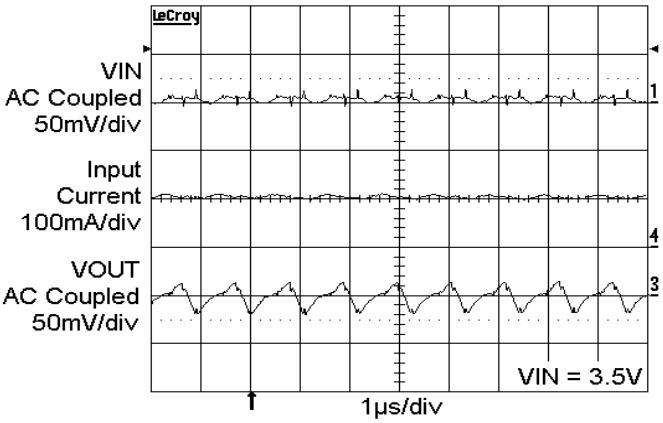


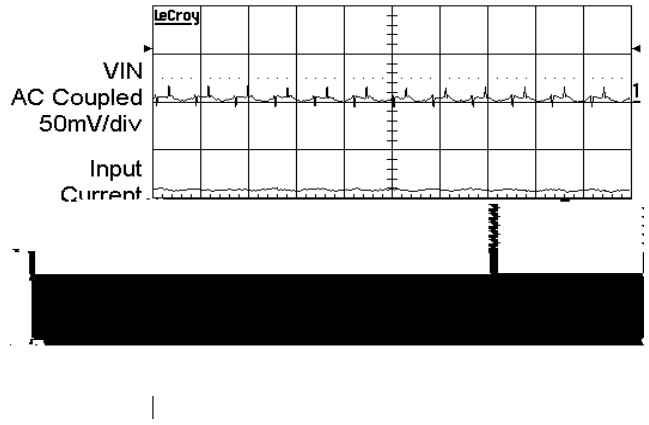
(V_{IN} = 3.6 V, I_{OUT} = 80 mA (4 LEDs at 20 mA), C_{IN} = C_{OUT} = C_1 = C_2 = 1 µF, T_{AMB} = 25°C unless otherwise specified.)

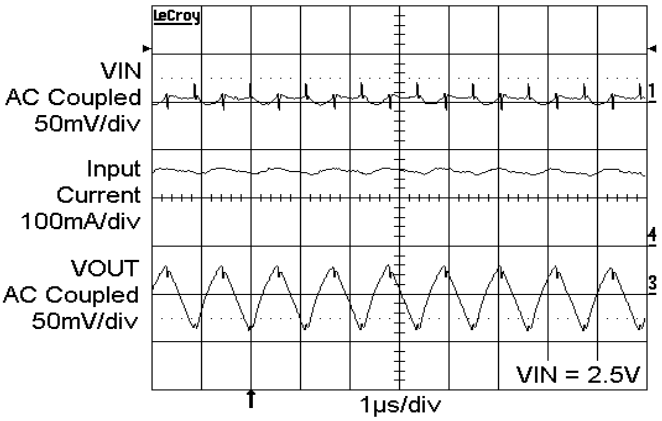




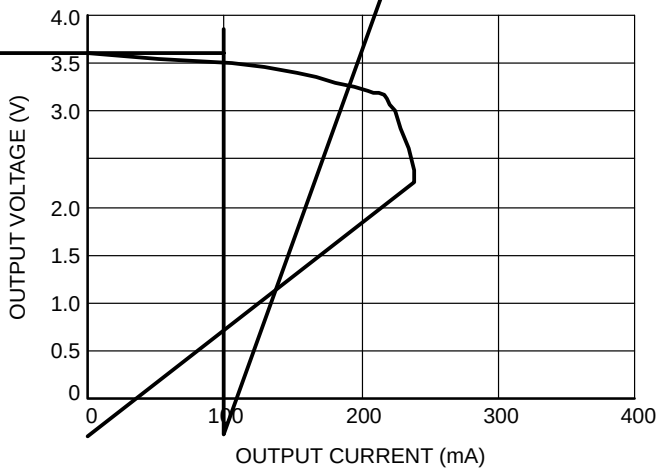


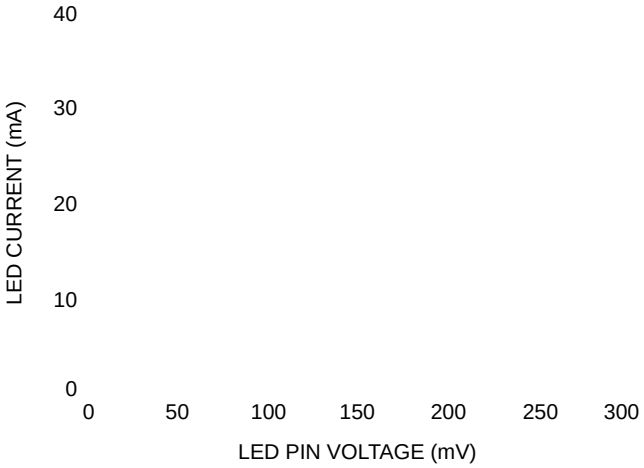


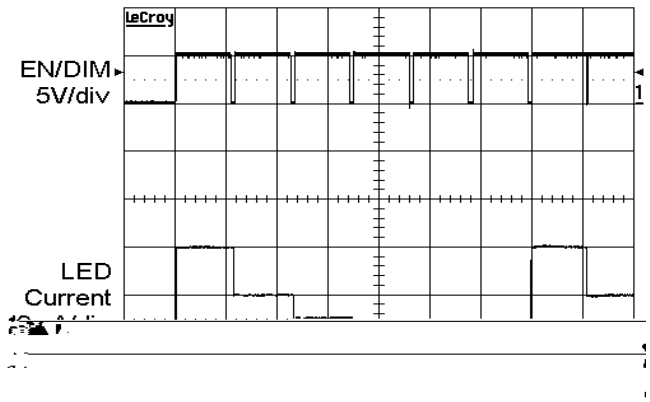


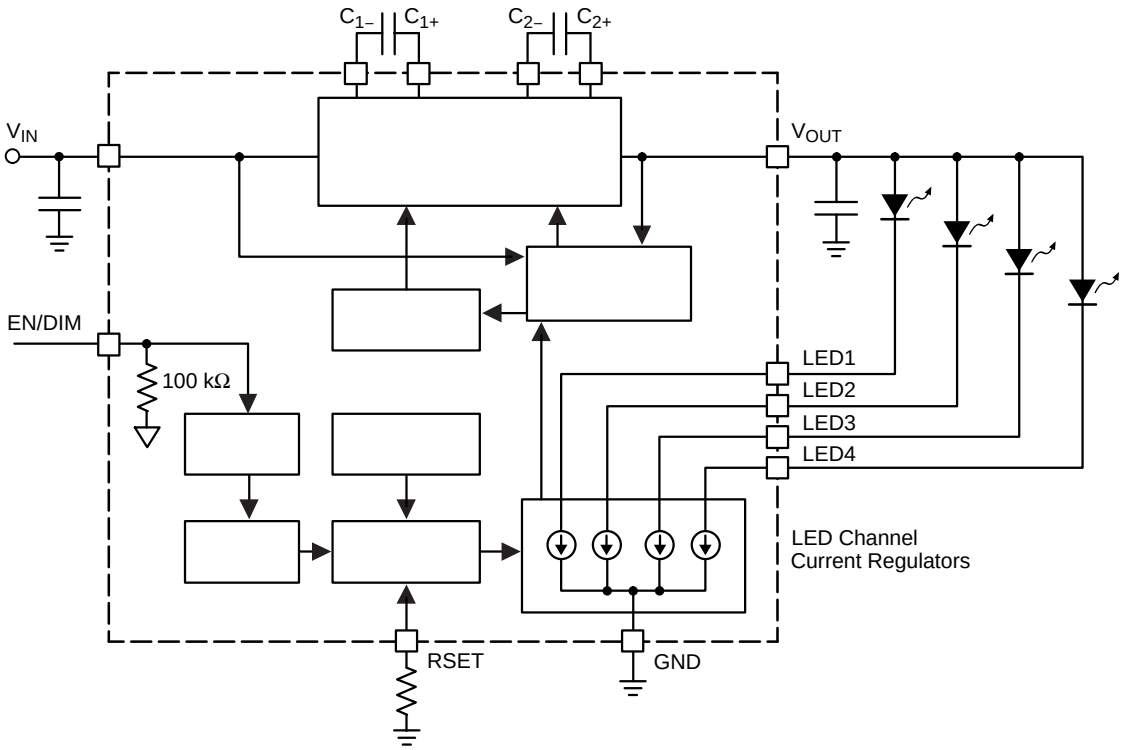


(V_{IN} = 3.6 V, I_{OUT} = 80 mA (4 LEDs at 20 mA), C_{IN} = C_{OUT} = C_1 = C_2 = 1 μF, T_{AMB} = 25°C unless otherwise specified.)









At power−up, the CAT3644 starts operating in 1x mode where the output will be approximately equal to the input supply voltage (less any internal voltage losses). If the output voltage is sufficient to regulate all LED currents, the device remains in 1x operating mode.

If the input voltage is insufficient or falls to a level where the regulated currents cannot be maintained, the device automatically switches into 1.33x mode (after a fixed delay time of about 400 μs). In 1.33x mode, the output voltage is approximately equal to 1.33 times the input supply voltage (less any internal voltage losses).

This sequence repeats in the 1.33x and 1.5x mode until the driver enters the 2x mode. In 1.5x mode, the output voltage is approximately equal to 1.5 times the input supply voltage. While in 2x mode, the output is approximately equal to 2 times the input supply voltage.

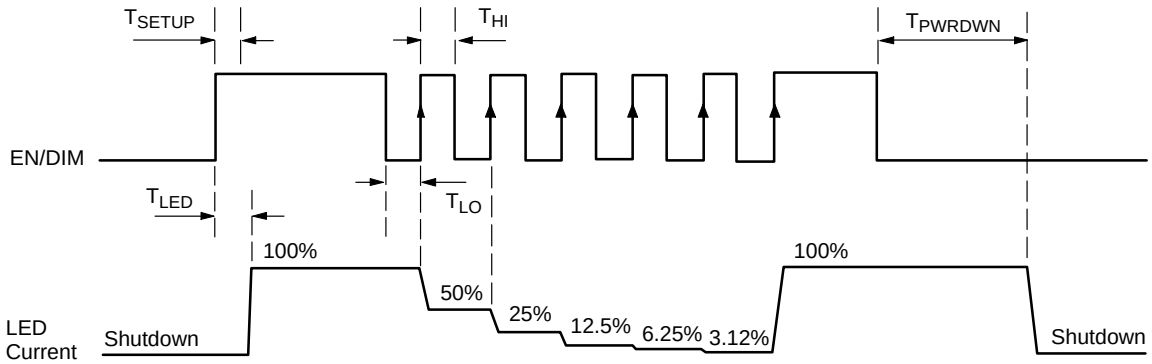
If the device detects a sufficient input voltage is present to drive all LED currents in 1x mode, it will change automatically back to 1x mode. This only applies for changing back to the 1x mode. The difference between the input voltage when exiting 1x mode and returning to 1x mode is called the 1x mode transition hysteresis (V_{HYS}) and is about 500 mV.

At power−up, the initial LED current is set to full scale (100% brightness) by the external resistor R_{SET} as follows:

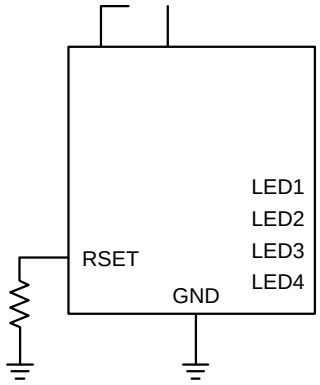
$$\text{LED current} = 132 \times \frac{0.6\ \text{V}}{R_{SET}}$$

The EN/DIM pin has two primary functions. One function enables and disables the device. The other function is LED current dimming with six different levels by pulsing the input signal, as shown on Figure 26. On each consecutive pulse rising edge, the LED current is divided by half to 50%, then 25%, 12.5%, 6.25% and 3.125% dimming levels. Pulses faster than the minimum T_{LO} may be ignored and filtered by the device. Pulses longer than the maximum T_{LO} may shutdown the device.

The LED driver enters a “zero current” shutdown mode if EN/DIM is held low for 1.5 ms or more.



For applications not requiring all the channels, it is recommended the unused LED pins be tied directly to V_{OUT} (see Figure 27).



TQFN16, 3x3