. 3 3

## Description

The CAT3636 is a high efficiency fractional charge pump that can drive up to six LEDs programmable by a one wire digital interface. The inclusion of a 1.33x fractional charge pump mode increases devic4eo639.6 (efficien uTf0.s1/cey )23.036 ef06 ef061 8i.208 71s4e22F(s[da99))di.33x

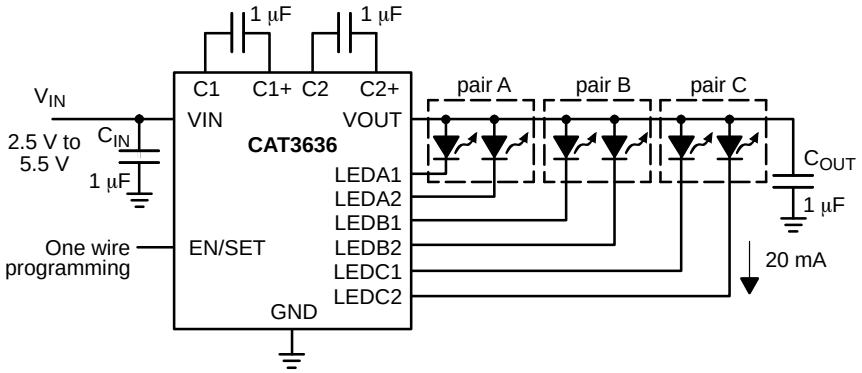



**Figure 1. Typical Application Circuit**

**Table 1. ABSOLUTE MAXIMUM RATINGS**

| Parameter | Rating | Unit |
|---|---|---|
| VIN, LEDx, C1±, C2± voltage | 6 | V |
| VOUT Voltage | 7 | V |
| EN/SET Voltage | VIN + 0.7 V | V |
| Storage Temperature Range | 65 to +160 | °C |
| Junction Temperature Range (Note 3) | 40 to +150 | °C |
| Lead Temperature | 300 | °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.

**Table 2. RECOMMENDED OPERATING CONDITIONS**

| Parameter | Range | Unit |
|---|---|---|
| VIN | 2.5 to 5.5 | V |
| Ambient Temperature Range (Note 3) | 40 to +85 | °C |
| $I_{LED}$ per LED pin | 0 to 32 | mA |
| Total Output Current | 0 to 192 | mA |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

C

## TYPICAL PERFORMANCE CHARACTERISTICS

($V_{IN}$ = 3.6 V, $I_{OUT}$ = 120 mA (6 LEDs at 20 mA), $C_{IN}$ = $C_{OUT}$ = C1 = C2 = 1 μF, $T_{AMB}$ = 25°C unless otherwise specified.)

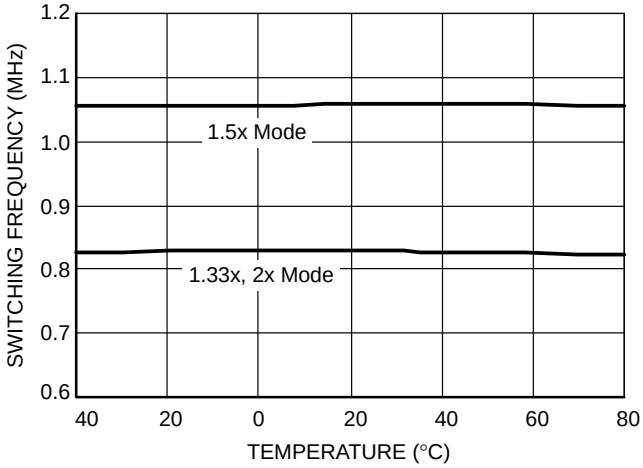



**Figure 8. Switching Frequency vs. Temperature**

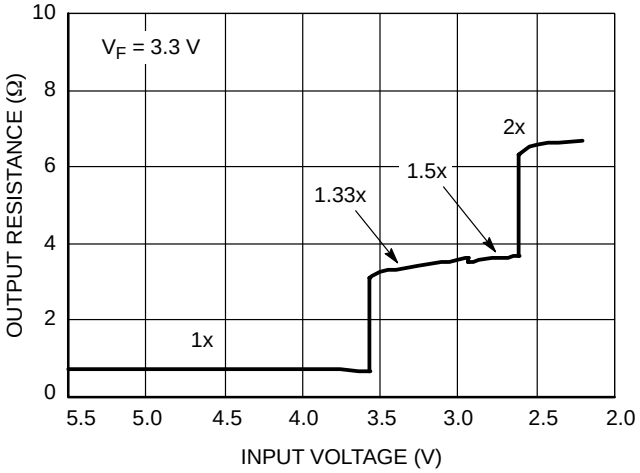



**Figure 9. Output Resistance vs. Input Voltage**

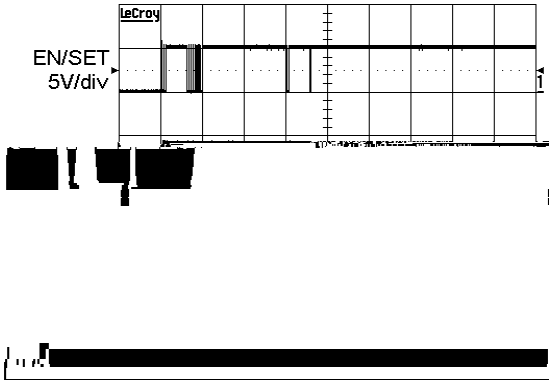



**Figure 10. Power Up in 1x Mode**

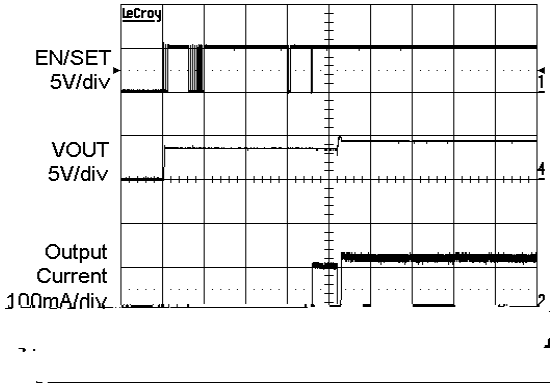



**Figure 11. Power Up in 1.33x Mode**

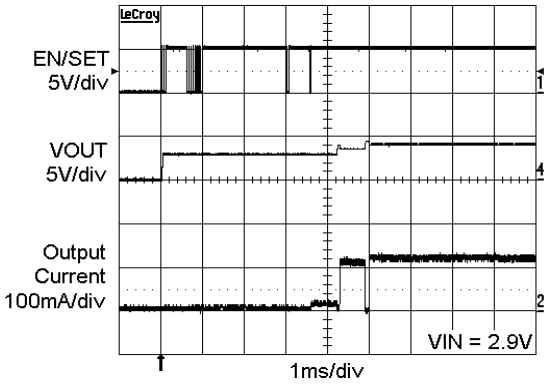



**Figure 12. Power Up in 1.5x Mode**

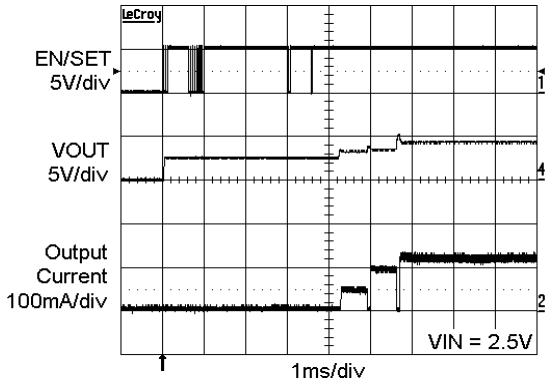



**Figure 13. Power Up in 2x Mode**

## TYPICAL PERFORMANCE CHARACTERISTICS

($V_{IN}$ = 3.6 V, $I_{OUT}$ = 120 mA (6 LEDs at 20 mA), $C_{IN}$ = $C_{OUT}$ = C1 = C2 = 1 μF, $T_{AMB}$ = 25°C unless otherwise specified.)

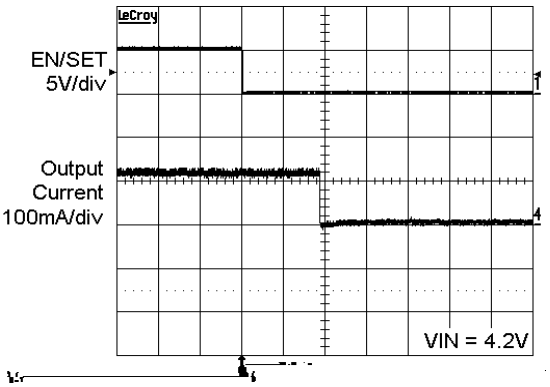



**Figure 14. Power Down Delay (1x Mode)**

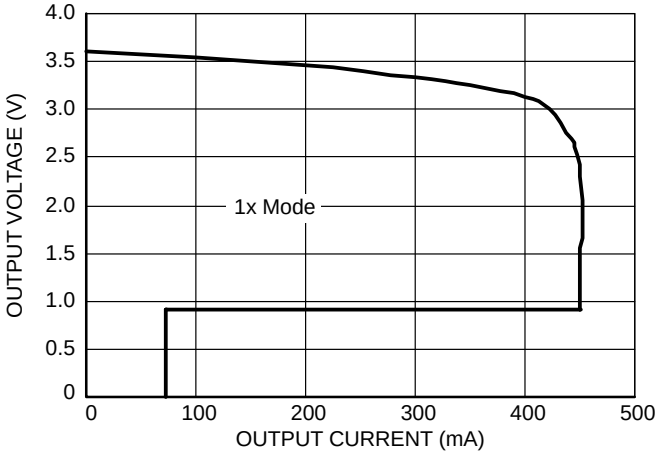



**Figure 15. Foldback Current Limit**

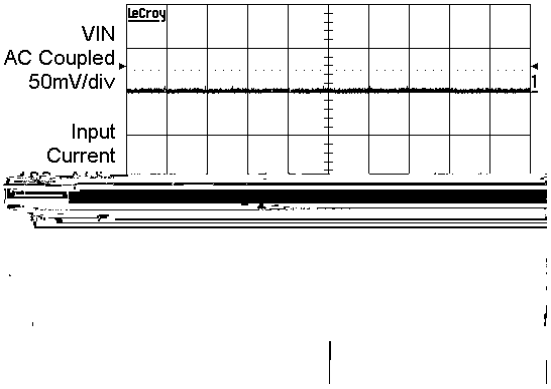



**Figure 16. Operating Waveforms in 1x Mode**

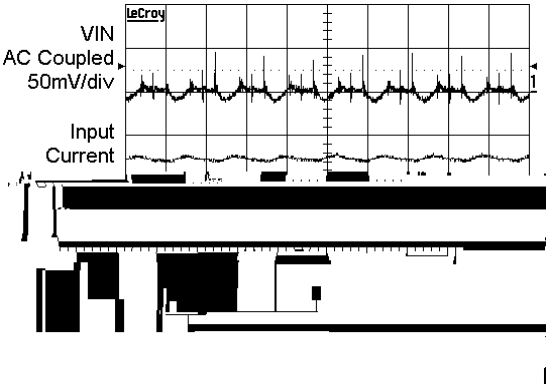



**Figure 17. Switching Waveforms in 1.33x Mode**

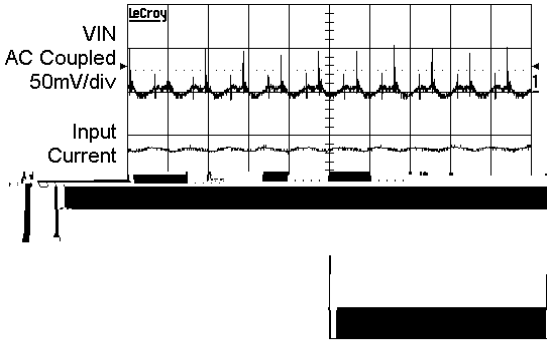



**Figure 18. Switching Waveforms in 1.5x Mode**

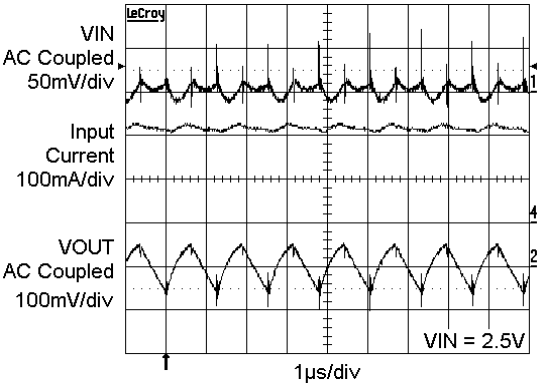



**Figure 19. Switching Waveforms in 2x Mode**

**Table 5. PIN DESCRIPTION**

| Pin # | Name | Function |
|---|---|---|
| 1 | LEDC2 | LEDC2 cathode terminal |
| 2 | LEDC1 | LEDC1 cathode terminal |
| 3 | LEDB2 | LEDB2 cathode terminal |
| 4 | LEDB1 | LEDB1 cathode terminal |
| 5 | LEDA2 | LEDA2 cathode terminal |
| 6 | LEDA1 | LEDA1 cathode terminal |
| 7 | VOUT | Charge pump output, connect to LED anodes |
| 8 | VIN | Charge pump input, connect to battery or supply |
| 9 | C1+ | Bucket capacitor 1, positive terminal |
| 10 | C1 | Bucket capacitor 1, negative terminal |
| 11 | C2+ | Bucket capacitor 2, positive terminal |
| 12 | C2 | Bucket capacitor 2, negative terminal |
| 13/14 | NC | No connect |
| 15 | GND | Ground reference |
| 16 | EN/SET | Device enable (active high) and 1 wire control input |
| TAB | TAB | Connect to GND on the PCB |

## Pin Function

**VIN** is the supply pin for the charge pump. A small 1 μF ceramic bypass capacitor is required between the VIN pin and ground near the device. The operating input voltage range is from 2.5 V to 5.5 V. Whenever the input supply falls below the under−voltage threshold (2 V) all the LED channels will be automatically disabled and the device register are reset to default values.

**EN/SET** is the enable and one wire addressable control logic input for all LED channels. Guaranteed levels of logic high and logic low are set at 1.3 V and 0.4 V respectively. When EN/SET is initially taken high, the device becomes enabled and all LED currents remain at 0 mA. To place the device into zero current mode, the EN/SET pin must be held low for more than 1.5 ms.

**VOUT** is the charge pump output that is connected to the LED anodes. A small 1 μF ceramic bypass capacitor is required between the VOUT pin and ground near the device.

**GND** is the ground reference for the charge pump. The pin must be connected to the ground plane on the PCB.

**C1+, C1−** are connected to each side of the ceramic bucket capacitor C1.

**C2+, C2−** are connected to each side of the ceramic bucket capacitor C2.

**LEDxx** provide the internal regulated current for each of the LED cathodes. These pins enter high−impedance zero current state whenever the device is placed in shutdown mode.

**TAB** is the exposed pad underneath the package. For best thermal performance, the tab should be soldered to the PCB and connected to the ground plane.

## Block Diagram

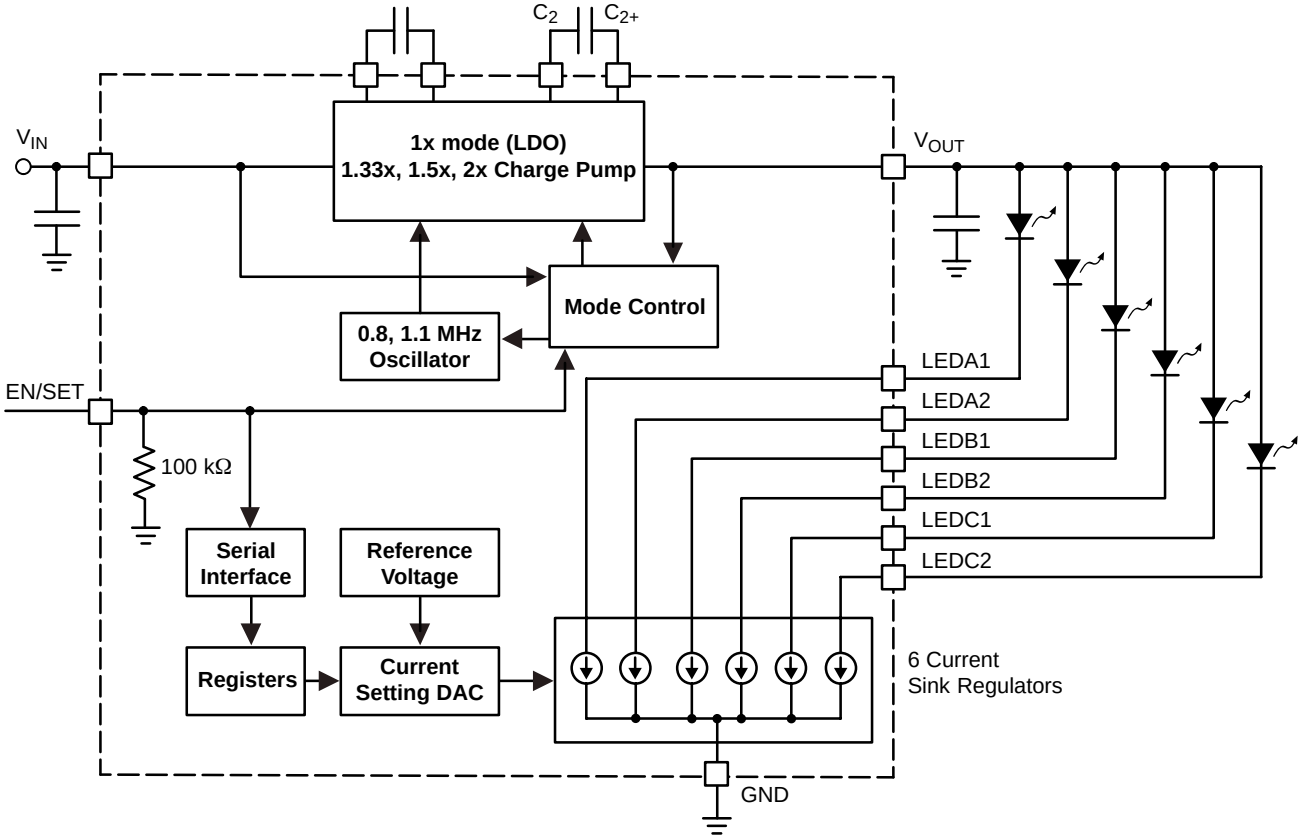


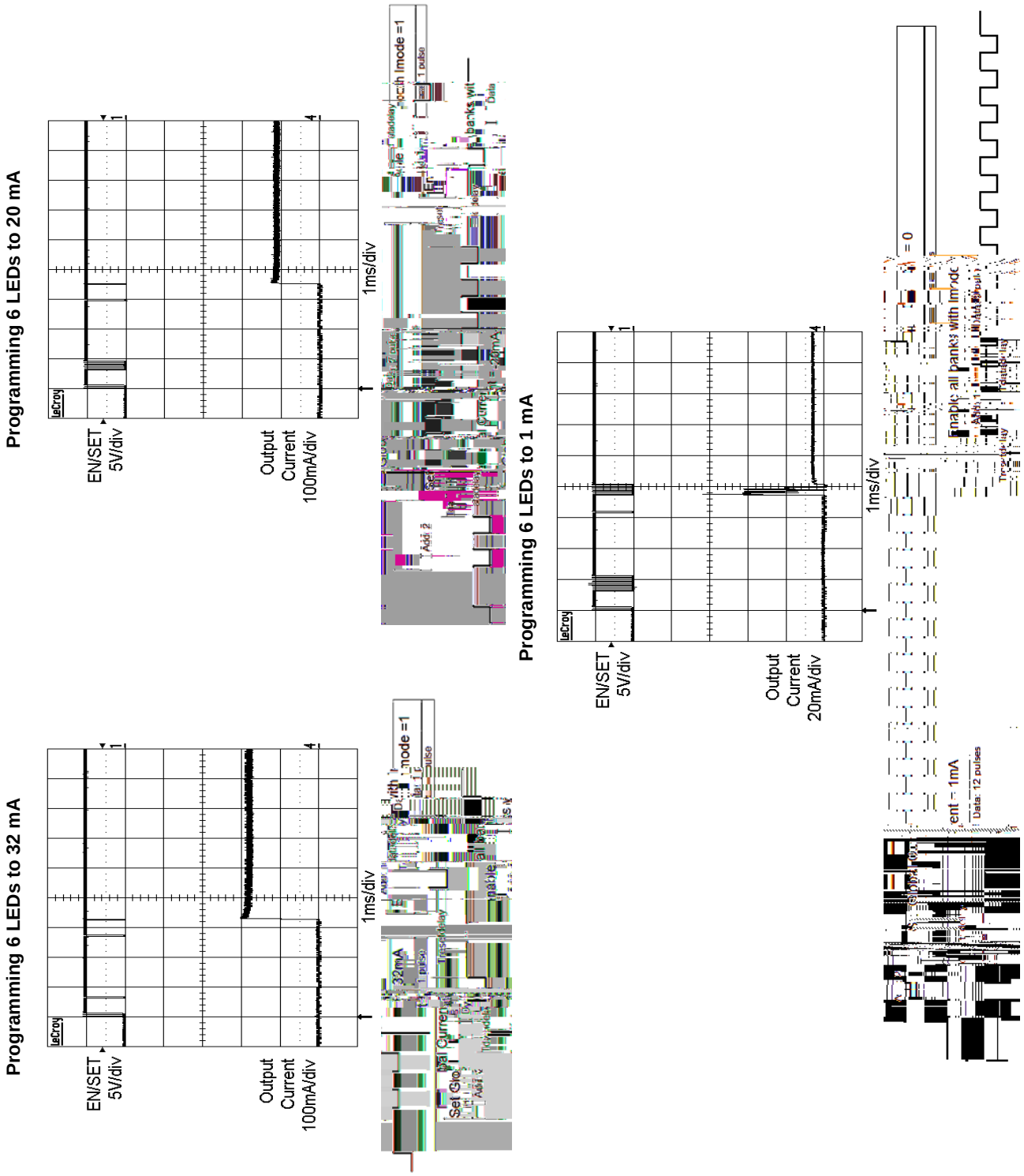

**Figure 20. CAT3636 Functional Block Diagram**

## Register Configuration and Programming

**Table 6. REGISTER ADDRESS AND DATA**

| Register | Address Pulses | Description | Bits | DATA Pattern | | | |
|---|---|---|---|---|---|---|---|
| | | | | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| REG1 | 1 | Bank Enable and IMODE | 4 | IMODE | ENA | ENB | ENC |
| REG2 | 2 | Global Current Setting | 4 | See Table 8 for values | | | |

## Programming Examples



**TQFN16, 3x3**
CASE 510AD