1-Channel Low-Power LED Driver

Description

The CAT3661 is a high efficiency low power fractional charge pump that drives one LED with up to 5 mA of current. Soft-start current limiting and short-circuit protection are optimized for use with coin cell batteries.

Low noise input ripple and constant switching frequency allows the use of small external ceramic capacitors. This makes the CAT3661 ideal for EMI sensitive applications. The charge pump supports a wide range of input voltages from 2.0 V to 5.5 V.

The CAT3661 has a built-in circuitry to provide feedback to a microcontroller of Open/Short LED and Low battery events. The Low battery indicator trip point is internally fixed at 2.4 V. External resistors can be added to raise or lower the trip voltage, if needed.

The device is packaged in the tiny 16-lead TQFN 3 mm x 3 mm package with a max height of 0.8 mm.

The inclusion of a 1.33x fractional charge pump mode increases device efficiency by up to 10% over traditional 1.5x tri-mode charge pumps with no added external capacitors. The 1.33x charge pump with two fly capacitors is a patented architecture exclusive to ON Semiconductor.

Features

- Charge Pump: 1x, 1.33x, 1.5x, 2x
- Drives One LED up to 5 mA
- Optimized for Coin Cell Battery Operation
- Open/Short LED Fault Detection
- Adjustable Low Battery Detection
- Low Quiescent Current 150 µA Typical
- Power Efficiency up to 92%
- Low Noise Input Ripple in All Modes
- “Zero” Current Shutdown Mode
- Soft Start and Short Circuit Current Limiting
- Thermal Shutdown Protection
- 3 mm x 3 mm, 16-pad TQFN Package
- This Device is Pb-Free, Halogen Free/BFR Free and is RoHS Compliant

Typical Applications

- Low Power LCD Display Backlight
- Low Power Handheld Device Backlight

See detailed description of the pins function on page 8 of this data sheet.

MARKING DIAGRAM

JAAU
AXXX
YWW

JAAU = CAT3661HV3–GT2
A = Assembly Location
XXX = Last Three Digits of Assembly Lot Number
Y = Production Year (Last Digit)
WW = Production Week (Two Digits)

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.
Figure 1. Typical Application Circuit

Table 1. ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Lead Finish</th>
<th>Package</th>
<th>Shipping†</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT3661HV3−GT2</td>
<td>NiPdAu</td>
<td>TQFN (Pb−Free)</td>
<td>2000 / Tape &amp; Reel</td>
</tr>
</tbody>
</table>

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Table 2. ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN voltage</td>
<td>GND−0.3 to 6</td>
<td>V</td>
</tr>
<tr>
<td>VOUT voltage</td>
<td>GND−0.3 to 7</td>
<td>V</td>
</tr>
<tr>
<td>EN, nFLTB, nFLTL, LED, RSET voltage (Note 1)</td>
<td>GND−0.3 to 6</td>
<td>V</td>
</tr>
<tr>
<td>C1±, C2± voltage</td>
<td>GND−0.3 to 6</td>
<td>V</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>−65 to +160</td>
<td>℃</td>
</tr>
<tr>
<td>Junction Temperature Range</td>
<td>−40 to +150</td>
<td>℃</td>
</tr>
<tr>
<td>Lead Temperature</td>
<td>300</td>
<td>℃</td>
</tr>
<tr>
<td>ESD Rating HBM (Human Body Model)</td>
<td>2000</td>
<td>V</td>
</tr>
<tr>
<td>ESD Rating MM (Machine Model)</td>
<td>200</td>
<td>V</td>
</tr>
</tbody>
</table>

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.

1. EN, nFLTL, nFLTB, LED and RSET can be driven above VIN up to the absolute maximum voltage.

Table 3. RECOMMENDED OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>2.0 to 5.5</td>
<td>V</td>
</tr>
<tr>
<td>Ambient Temperature Range</td>
<td>−40 to +85</td>
<td>℃</td>
</tr>
<tr>
<td>LED current</td>
<td>0.1 to 5</td>
<td>mA</td>
</tr>
<tr>
<td>nFLTB, nFLTL pull−up resistor current</td>
<td>0 to 1</td>
<td>mA</td>
</tr>
<tr>
<td>LED Forward Voltage Range (Vf)</td>
<td>1.3 to 4.2</td>
<td>V</td>
</tr>
</tbody>
</table>

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.

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Table 4. ELECTRICAL OPERATING CHARACTERISTICS
(Recommended operating conditions unless otherwise specified. \( C_{IN}, C_{OUT} = C_{FLY} \) are 1 \( \mu \)F ceramic capacitors and \( V_{IN} \) is set to 3.6 V)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiescent Current</td>
<td>1x mode, no load, ( V_{IN} = 3.4 ) V 1.33x mode, no load, ( V_{IN} = 3.0 ) V 1.5x mode, no load, ( V_{IN} = 2.4 ) V 2x mode, no load, ( V_{IN} = 2.1 ) V</td>
<td>( I_Q )</td>
<td>130</td>
<td>160</td>
<td>160</td>
<td>( \mu )A</td>
</tr>
<tr>
<td>Shutdown Current</td>
<td>( V_{EN} = 0 ) V</td>
<td>( I_{QSHDN} )</td>
<td>1</td>
<td></td>
<td></td>
<td>( \mu )A</td>
</tr>
<tr>
<td>LED Current Accuracy (Chip to Chip)</td>
<td>( (I_{LED} - I_{LEDNOM}) / I_{LEDNOM} )</td>
<td>( I_{LED-ACC} )</td>
<td>±2</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>LED Current Accuracy</td>
<td>( R_{SET} = 60 ) k( \Omega )</td>
<td>( I_{LED-3} )</td>
<td>2.7</td>
<td>3</td>
<td>3.3</td>
<td>mA</td>
</tr>
<tr>
<td>Gain (( I_{LED} ) / ( I_{RSET} ))</td>
<td>( I_{LED} = 3 ) mA</td>
<td>Gain</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSET Regulated Voltage</td>
<td>( I_{LED} = 3 ) mA</td>
<td>( V_{RSET} )</td>
<td>0.57</td>
<td>0.6</td>
<td>0.63</td>
<td>V</td>
</tr>
<tr>
<td>Output Resistance (open loop)</td>
<td>1x mode 1.33x mode, ( V_{IN} = 3 ) V 1.5x mode, ( V_{IN} = 2.7 ) V 2x mode, ( V_{IN} = 2.4 ) V</td>
<td>( R_{OUT} )</td>
<td>15</td>
<td>40</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Charge Pump Frequency</td>
<td>1.33x and 2x mode</td>
<td>( F_{OSC} )</td>
<td>100</td>
<td>130</td>
<td></td>
<td>kHz</td>
</tr>
<tr>
<td>Input Current Limit Gain from ( I_{RSET} )</td>
<td>( I_{LED} = 3 ) mA</td>
<td>( G_{L_MAX} )</td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED Channel Short Detection Voltage</td>
<td>( I_{LED} = 3 ) mA</td>
<td>( V_{SH} )</td>
<td>1</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>LED Channel Short Test Current</td>
<td>( V_{OUT} - V_{LED} &lt; V_{SH} )</td>
<td>( I_{SH} )</td>
<td>5</td>
<td></td>
<td></td>
<td>( \mu )A</td>
</tr>
<tr>
<td>LED Channel Open/Short Timeout</td>
<td>( I_{LED} = 3 ) mA</td>
<td>( T_{OLED} )</td>
<td>2</td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>Transition Thresholds at LED pin</td>
<td>1x to 1.33x or 1.33x to 1.5x or 1.5x to 2x</td>
<td>( LED_{TH} )</td>
<td>100</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Transition Filter Delay</td>
<td>( I_{LED} = 3 ) mA</td>
<td>( T_{DF} )</td>
<td>400</td>
<td></td>
<td></td>
<td>( \mu )s</td>
</tr>
<tr>
<td>nFLTBL, nFLTTL low voltage threshold (Open Drain)</td>
<td>nFLTBL, nFLTTL Driven low 100 ( \mu )A pull up</td>
<td>( V_{FLTLO} )</td>
<td>0.2</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>EN Pin</td>
<td>– Internal Pull–down Resistor – Logic High Level – Logic Low Level</td>
<td>( R_{EN} )</td>
<td>1.3</td>
<td></td>
<td></td>
<td>( \Omega )</td>
</tr>
<tr>
<td>Thermal Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Thermal Hysteresis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Low battery Vin Trip point Voltage</td>
<td>( ADJH = V_{IN} ) ( ADJL = GND )</td>
<td>( V_{LB} )</td>
<td>2.30</td>
<td>2.40</td>
<td>2.50</td>
<td>V</td>
</tr>
<tr>
<td>Low Battery ADJ Trip Point (Internal)</td>
<td>( V_{IN} = 2.4 ) V</td>
<td>( V_{ADJ} )</td>
<td>0.57</td>
<td>0.6</td>
<td>0.63</td>
<td>V</td>
</tr>
<tr>
<td>Low Battery Divider Network Resistance</td>
<td>( R_{HI} + R_{LO} )</td>
<td>( R_{ADJ} )</td>
<td>640</td>
<td>800</td>
<td>960</td>
<td>( \Omega )</td>
</tr>
<tr>
<td>Low Battery Resistor Divider Gain</td>
<td>( R_{HI} + R_{LO} / R_{LO} )</td>
<td>( G_{ADJ} )</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low battery nFLTBL Pulse Duration</td>
<td>Upon EN, ( V_{IN} = 2.4 ) V</td>
<td>( T_{BATTLO} )</td>
<td>400</td>
<td>500</td>
<td>600</td>
<td>ms</td>
</tr>
<tr>
<td>Undervoltage lockout (UVLO) threshold</td>
<td></td>
<td>( V_{UVLO} )</td>
<td>1.9</td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
TYPICAL CHARACTERISTICS

\( V_{IN} = 3 \, \text{V}, \, I_{LED} = 3 \, \text{mA}, \, V_F = 3 \, \text{V}, \, T_{AMB} = 25^\circ \text{C}, \) typical application circuit unless otherwise specified.

Figure 2. Quiescent Current vs. Input Voltage

Figure 3. Total Supply Current vs. Input Voltage

Figure 4. LED Current vs. LED Pin Voltage

Figure 5. LED Current vs. RSET

Figure 6. Enable Voltage vs. Input Voltage

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TYPICAL CHARACTERISTICS

\((V_{\text{IN}} = 3 \, \text{V}, \, I_{\text{LED}} = 3 \, \text{mA}, \, V_{\text{F}} = 3 \, \text{V}, \, T_{\text{AMB}} = 25^\circ \text{C}, \) typical application circuit unless otherwise specified.)

**Figure 7. Quiescent Current vs. Temperature**

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

**Figure 9. LED Current Change vs. Input Voltage**

**Figure 10. LED Current Change vs. Temperature**

**Figure 11. Efficiency vs. Input Voltage**

**Figure 12. Efficiency vs. Lithium Coin Cell Voltage**

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TYPICAL CHARACTERISTICS

(VIN = 3 V, ILED = 3 mA, VF = 3 V, TAMB = 25°C, typical application circuit unless otherwise specified.)

Figure 13. Power Up in 1x Mode

Figure 14. Power Up in 1.33x Mode

Figure 15. Power Up in 1.5x Mode

Figure 16. Power Up in 2x Mode

Figure 17. Operating Waveforms in 1x Mode

Figure 18. Operating Waveforms in 1.33x Mode
TYPICAL CHARACTERISTICS

(VIN = 3 V, ILED = 3 mA, VF = 3 V, TAMB = 25°C, typical application circuit unless otherwise specified.)

Figure 19. Operating Waveforms in 1.5x Mode

Figure 20. Operating Waveforms in 2x Mode

Figure 21. Open LED

Figure 22. LED Pin Shorted to VOUT

Figure 23. Enable with Low Battery
Table 5. PIN DESCRIPTION

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Pin Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RSET</td>
<td>Connect resistor RSET to set the LED current</td>
</tr>
<tr>
<td>2</td>
<td>nFLTB</td>
<td>Battery Fault output, Open drain output. (Active low)</td>
</tr>
<tr>
<td>3</td>
<td>nFLTL</td>
<td>LED Fault output, Open drain output. (Active low)</td>
</tr>
<tr>
<td>4</td>
<td>EN</td>
<td>Device enable (Active high)</td>
</tr>
<tr>
<td>5</td>
<td>LED</td>
<td>LED cathode terminal</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>Not connected inside the package</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>Not connected inside the package</td>
</tr>
<tr>
<td>8</td>
<td>VOUT</td>
<td>Charge pump output connected to the LED anodes</td>
</tr>
<tr>
<td>9</td>
<td>C2−</td>
<td>Bucket capacitor 2 Negative terminal</td>
</tr>
<tr>
<td>10</td>
<td>C2+</td>
<td>Bucket capacitor 2 Positive terminal</td>
</tr>
<tr>
<td>11</td>
<td>C1+</td>
<td>Bucket capacitor 1 Positive terminal</td>
</tr>
<tr>
<td>12</td>
<td>C1−</td>
<td>Bucket capacitor 1 Negative terminal</td>
</tr>
<tr>
<td>13</td>
<td>VIN</td>
<td>Positive supply connection to battery</td>
</tr>
<tr>
<td>14</td>
<td>ADJH</td>
<td>Battery trip point threshold adjust high</td>
</tr>
<tr>
<td>15</td>
<td>ADJL</td>
<td>Battery trip point threshold adjust low</td>
</tr>
<tr>
<td>16</td>
<td>GND</td>
<td>Ground supply connection</td>
</tr>
<tr>
<td>TAB</td>
<td>GND</td>
<td>Connect to GND on the PCB</td>
</tr>
</tbody>
</table>

Pin Functions

VIN is the supply pin for the device. A small 1 µF ceramic bypass capacitor is required between the VIN pin and ground near the device.

EN is the device enable pin. Levels of logic high and logic low are set at 1.3 V and 0.4 V respectively to enable interface to low voltage controllers. EN pin is compatible with voltages higher than VIN.

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. This 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.

LED provides the internal regulated current source for the LED cathode. This pin enters 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.

RSET is connected to a resistor (RSET) to set the full scale current for the LEDs. The voltage at this pin regulated to 0.6 V. The ground side of the external resistor should be star connected back to the GND of the PCB. In shutdown mode, RSET becomes high impedance.

nFLTL is an active low open–drain output that provides a fault flag for an open/short LED condition. If used, this pin requires a pull–up resistor.

nFLTB is an active low open–drain output that provides a fault flag for a low battery condition. If used, this pin requires a pull–up resistor. nFLTB and nFLTL can be shorted together for one Fault output (ORed function).

ADJH is an external connection to the top of the low battery sense resistor divider network. This pin should be shorted to VIN if a trip point of 2.4 V is required.

ADJL is an external connection to the bottom of the low battery sense resistor divider network. This pin should be shorted to GND if a trip point of 2.4 V is required.
**Basic Operation**

At power-up, the CAT3661 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 the LED current, the device remains in 1x operating mode.

If the input voltage is insufficient or falls to a level where the LED regulated current cannot be maintained, the device automatically switches into 1.33x mode (after a fixed delay time of about 400 \mu s). 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.

If the device detects a sufficient input voltage is present to drive the LED current 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 300 mV.

**LED Current Setting**

The current flowing out of the RSET pin to ground mirrors the current in the LED channel with a gain of 300. The LED current can be adjusted from 0.1 mA to 5 mA. Connecting a resistor between RSET and GND allows a reference current to flow due to the voltage on the RSET pin being regulated to 0.6 V. The internal gain of the current mirror is 300. It is possible to calculate the current in the LED channel by the following equation:

\[
I_{LED} = \frac{0.6 \, V}{R_{SET}} \times 300
\]

**Adjustable Battery Indicator**

The CAT3661 contains an adjustable low battery indicator that is active when the device is enabled. If the voltage on the internal resistor divider trip point node is less than V_{ADJ} (0.6 V), the nFLTB output is driven low and remains low for 500 ms after the EN pin is driven high. The CAT3661 will still function normally below this voltage.
range. Extra external resistors can be added to the top or bottom of the internal resistor divider network to alter the divider ratio gain factor. The low battery indicator trip point can be calculated by the following formula:

\[ V_{LB} = V_{\text{ADJ}} \times G_{\text{ADJ}} \]

\( V_{LB} \) = Low Battery Voltage Trip Point
\( V_{ADJ} \) = Low Battery Comparator Trip point (0.6 V)
\( G_{ADJ} \) = Resistor Divider Gain (4 internally)

To obtain a low battery trip point of 2.4 V, the ADJH pin is shorted to VIN, and the ADJL pin is tied to GND.

To increase the low battery trip point, insert a resistor between ADJH and VIN. To consequently lower the low battery trip point, insert a resistor between ADJL and GND. The following formula shows how to calculate the modified resistor divider gain:

\[ G_{ADJM} = \frac{R_{ADJ} + R_H}{(R_{ADJ}/G_{ADJ}) + R_L} \]

\( G_{ADJM} \) = Modified resistor divider gain
\( R_{ADJ} \) = Total resistance of divider (800 kΩ typ.)
\( R_H \) = High external resistor (ADJH to VIN)
\( R_L \) = Low external resistor (ADJL to GND)

For \( V_{LB} > 2.4 \) V, use \( R_L = 0 \) Ω and \( R_H (\text{kΩ}) \equiv 200 \) \((V_{LB}/0.6 - 1) - 600\)

For \( V_{LB} < 2.4 \) V, use \( R_H = 0 \) Ω and \( R_L (\text{kΩ}) \equiv 600 \) \((0.6/(V_{LB} - 0.6)) - 200\)

Figure 26 shows the external resistor value for low battery voltage trip points \( (V_{LB}) \) between 2 V and 3.2 V. For \( V_{LB} \) above 2.4 V, \( R_L = 0 \) Ω. For \( V_{LB} \) below 2.4 V, \( R_H = 0 \) Ω.

The low battery trip point does not operate for adjustments below 2.0 V VIN.

The inclusion of the ADJH pin allows monitoring of supplies other than the supply to the CAT3661. Simply connect ADJH pin directly to the supply to be monitored and the low battery indicator will function as normal when the device is enabled. When EN is low, no current will flow in the resistor divider network allowing ‘zero’ current shutdown mode.

**Under Voltage Lockout**

If the voltage on VIN is less than \( V_{UVLO} \) threshold, the nFLTB output is driven low and the device enters a low power state where the LED output is off.

When the device is in shutdown (EN low), the nFLTB pin will float high to ‘zero’ current state.
Protection Mode

Open LED Protection
An LED is deemed open circuit if the LED current sink is unable to regulate the LED channel to the programmed current for greater than 2 ms. The driver will sense this condition and the nFLTL pin will be driven low. The device will be placed into a standby−mode until the Open LED condition is removed or the device is re−enabled (EN goes low then high again) at which point the Open LED condition will be evaluated.

Short LED Protection
An LED is deemed to be short circuit if the difference between VOUT pin and LED pin is less than 1.0 V when the programmed current is driven in the channel for greater than 2 ms. If this is the case, then the LED sink is turned off and a 5 μA test current is placed in the channel. The nFLTL pin is driven low. Once the short condition is removed normal operation will resume and nFLTL will be floated high.

When the device is shutdown (EN low), the nFLTL pin will float high to ‘zero’ current state.

Input Current Limiting
The charge pump contains an input current limit circuit that limits the current flowing in RSET. Use the following formula:

\[ I_{\text{MAX}} = \frac{0.6 \text{ V}}{R_{\text{SET}}} \times 1000 \]

The input current limit insures the battery is never loaded with more than 3.3 times the LED current during a short circuit condition, Charge Pump startup condition or charge pump mode change. The device will only ever use a maximum of 2 times the programmed LED current plus quiescent operating current when in normal 2x mode of operation.

LED Selection
LEDs with forward voltages (V_F) ranging from 1.3 V to 4.2 V may be used. Selecting LEDs with lower V_F is recommended in order to improve the efficiency by keeping the driver in 1x mode longer as the battery voltage decreases.

Over Voltage, Over Temperature Protection
As soon as VOUT is pumped above 4.5 V, the driver will stop advancing modes if the LED sink is not in regulation. This indicates a possible Open LED condition and stops the device from seeing excessive voltages on the output pin greater than the absolute maximum ratings for VOUT. An additional fail safe over−voltage detector prevents the VOUT output from ever exceeding 6.5 volts.

If the die temperature exceeds +150°C, the driver will enter a thermal protection shutdown mode and the LED will be turned off. The nFLTL pin will be driven low. Once the device temperature drops by about 20°C, the device will resume normal operation and nFLTL will be floated high.

External Components
The driver requires four external 1 μF ceramic capacitors for decoupling input, output, and for the charge pump “fly” capacitors. Capacitors type X5R and X7R are recommended for the LED driver application. In all charge pump modes, the input current ripple is kept very low by design and an input bypass capacitor of 1 μF is sufficient. In 1x mode, the device operates in linear mode and does not introduce switching noise back onto the supply.

Lithium coin cell batteries have high internal resistances so a robust current limit is a very important feature of the device to prevent large voltage droops from triggering device resets during operation of the CAT3661.
CAT3661

PACKAGE DIMENSIONS

TQFN16, 3x3
CASE 510AD
ISSUE A

E2
A3
A1
A
L
D2
D
E2
E
L
D

PIN#1 INDEX AREA

TOP VIEW

SIDE VIEW

BOTTOM VIEW

FRONT VIEW

<table>
<thead>
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Notes:
1. All dimensions are in millimeters.
2. Complies with JEDEC MO-220.
3. All packages are RoHS–compliant (Lead–free, Halogen–free).
4. The standard lead finish is NiPdAu.

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