

# CAT3616

## 6-Channel LED Driver with EZDim™

### Description

The CAT3616 is a high efficiency 1x/1.5x fractional charge pump with programmable dimming current in six LED channels. To ensure uniform brightness in LCD backlight applications, each LED channel delivers an accurate regulated current.

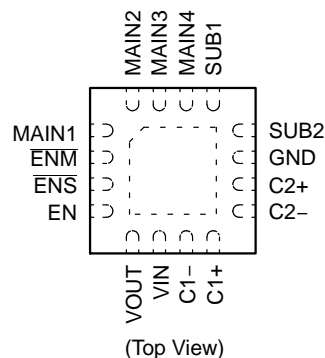
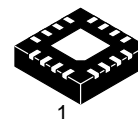
Low noise and input ripple is achieved by operating at a constant switching frequency of 1 MHz which allows the use of small external ceramic capacitors. The 1x/1.5x fractional charge pump supports a wide range of input voltages from 3 V to 5.5 V with efficiency up to 91%, and is ideal for Li-Ion battery powered devices.

Two groups of LEDs, main (MAIN1 to MAIN4) and sub (SUB1 and SUB2) are programmable through the  $\overline{\text{ENM}}$  (active low) and  $\overline{\text{ENS}}$  inputs. Independent current from 1 mA to 31 mA with a 1 mA step are set by toggling the  $\overline{\text{ENM}}$  and  $\overline{\text{ENS}}$  inputs. The enable EN input pin allows to shutdown the device with zero quiescent current.

The device is available in a 16-pad TQFN package with a max height of 0.8 mm.

### Features

- 6 LED Channels with Tight Matching
- Independent Main and Sub Channels
- 1-wire EZDim™ Programmable LED Current
- Accurate 1 mA Dimming Level
- Power Efficiency up to 91%



CDAH  
AXXX  
YMCC

### ORDERING INFORMATION

Device	Package	Shipping
CAT3616HV4-T2 (Note 1)	TQFN-16 (Pb-Free)	2,000/ Tape & Reel
CAT3616HV4-GT2 (Note 2)	TQFN-16 (Pb-Free)	2,000/ Tape & Reel

1. Matte-Tin Plated Finish (RoHS-compliant).
2. NiPdAu Plated Finish (RoHS-compliant).

# CAT3616

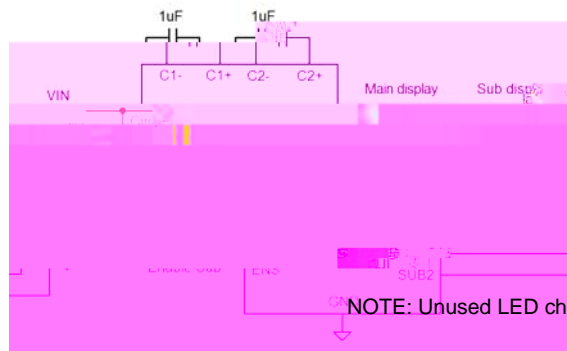


Figure 1. Typical Application Circuit

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Unit
VIN, LEDxx voltage		

# CAT3616

**Table 3. ELECTRICAL OPERATING CHARACTERISTICS**

V<sub>IN</sub> = 3.6 V, EN = High, ambient temperature of 25°C (over recommended operating conditions unless specified otherwise)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>Q</sub>	Quiescent Current	1x mode, all LEDs Off 1x mode, all LEDs On 1.5x mode, all LEDs Off		0.5 2.2 3.5		mA
I <sub>QSHDN</sub>	Shutdown Current	V <sub>EN</sub> = 0 V		0	1	μA
I <sub>LED</sub>	LED Current Range with 6 LEDs		0		31	mA
I <sub>LED-ACC</sub>	LED Current Accuracy	1 mA ≤ I <sub>LED</sub> ≤ 31 mA		±3		%
I <sub>LED-DEV</sub>	LED Channel Matching					

# CAT3616

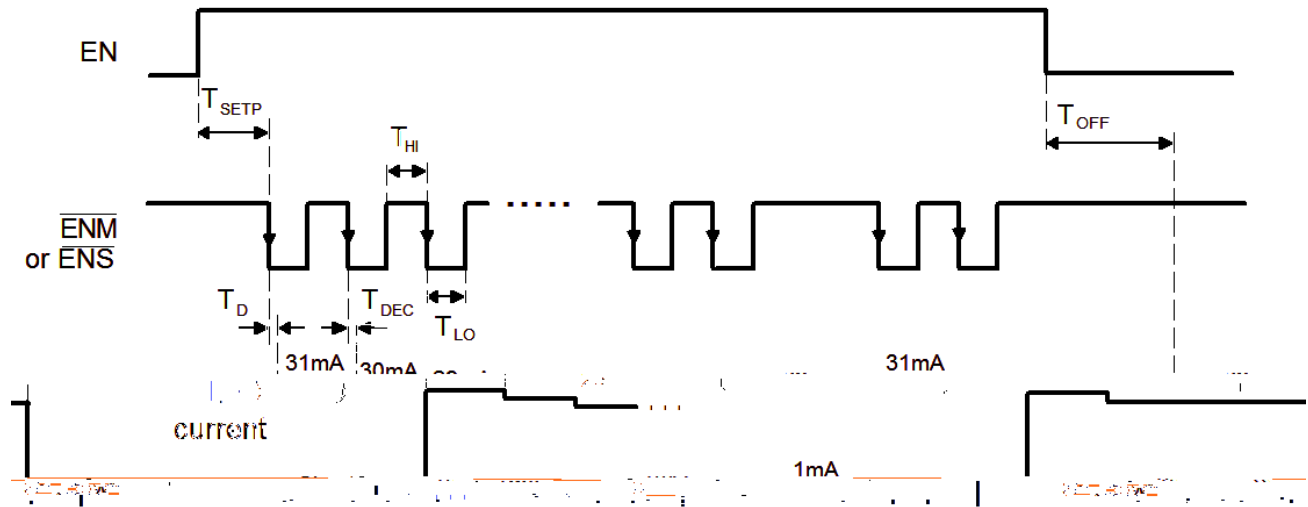


Figure 2. Enable LED Timing Diagram

# CAT3616

## TYPICAL CHARACTERISTICS

(VIN = 3.6 V, IOUT = 90 mA (6 LEDs at 15 mA), EN = VIN, ENM

# CAT3616

## TYPICAL CHARACTERISTICS

(VIN = 3.6 V, IOUT = 90 mA (6 LEDs at 15 mA), EN = VIN, ENM = ENS = GND,  
CIN = C1 = C2 = COUT = 1 μF, TAMB = 25°C, unless otherwise specified.)

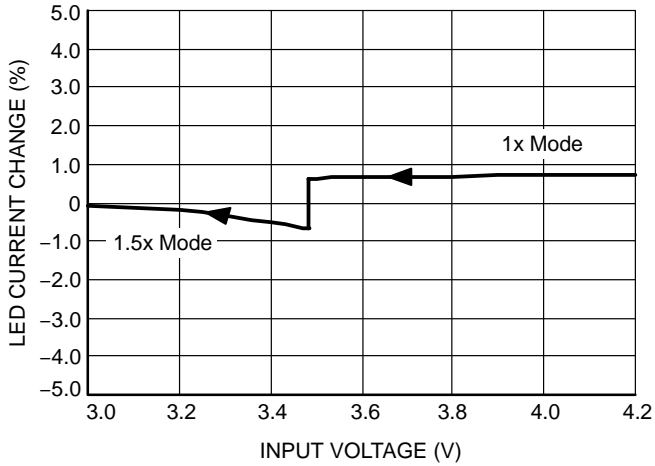


Figure 9. LED Current Change vs. Input Voltage

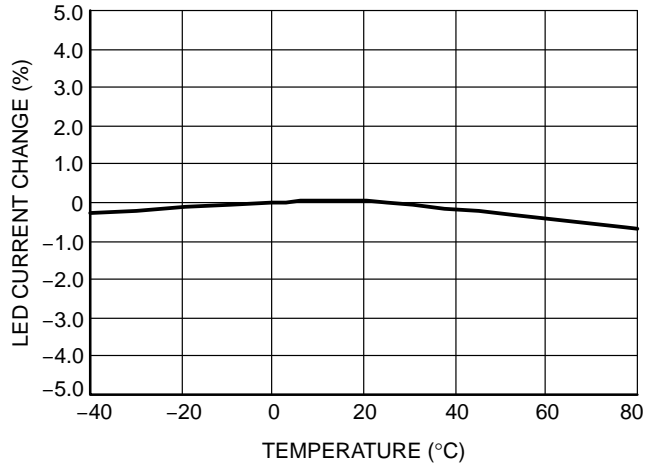


Figure 10. LED Current Change vs. Temperature

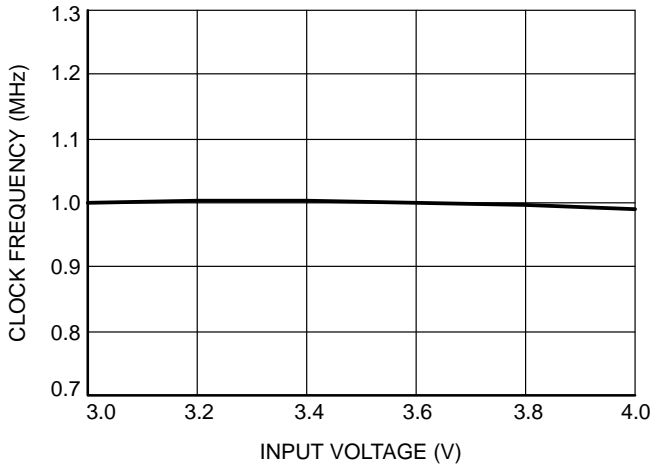


Figure 11. Oscillator Frequency vs. Input Voltage

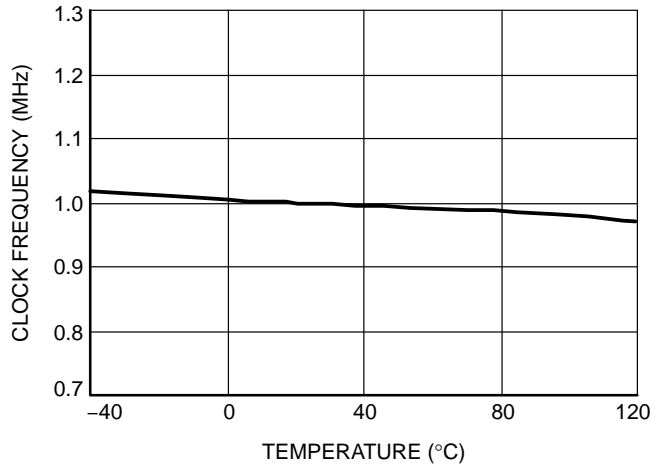


Figure 12. Oscillator Frequency vs. Temperature

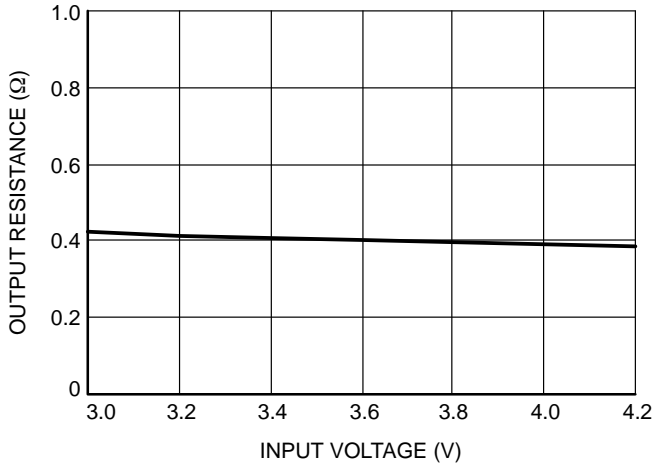


Figure 13. Output Resistance vs. Input Voltage (1x Mode)

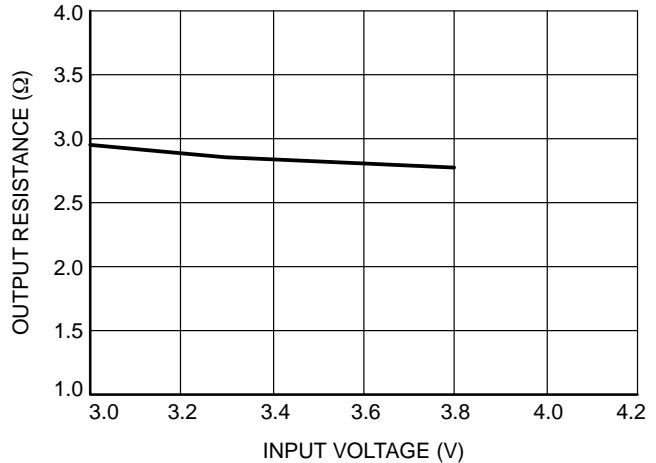


Figure 14. Output Resistance vs. Input Voltage (1.5x Mode)







# CAT3616

**Table 5. PIN DESCRIPTIONS**

Pin #	Name	Function
1	MAIN1	

Block Diagram

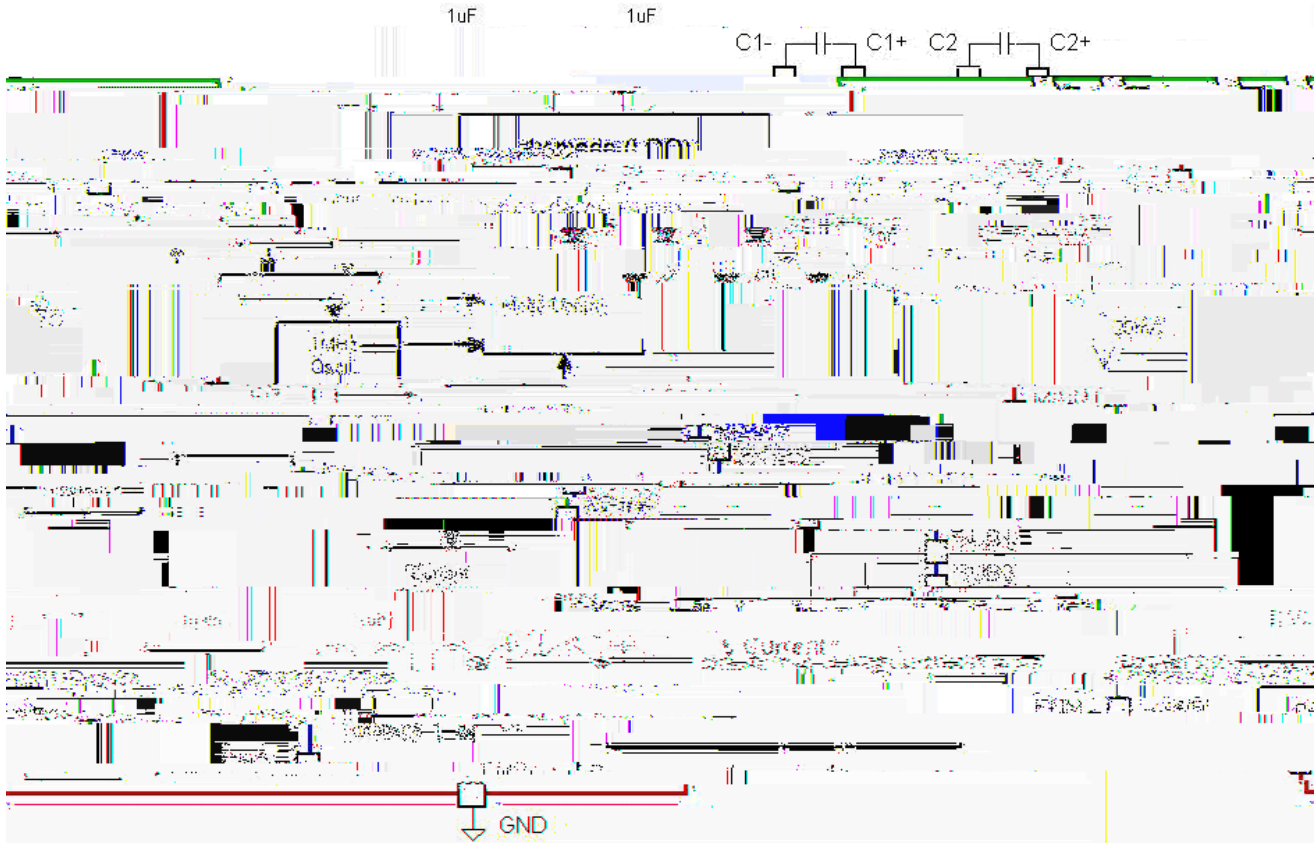


Figure 24. CAT3616 Functional Block Diagram

Basic Operation

At power-up, the CAT3616 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 (after 400  $\mu$ s) into 1.5x mode.

In 1.5x mode, the output is approximately equal to 1.5 times the input supply voltage (less any internal voltage losses).

The above sequence is repeated each and every time the chip is powered-up or is taken out of shutdown mode (via EN pin).

**LED Current Setting**

The LED current is controlled by toggling the input signals  $\overline{\text{ENM}}$  and  $\overline{\text{ENS}}$ .  $\overline{\text{ENM}}$  controls the four LED channels MAIN1 to MAIN4.  $\overline{\text{ENS}}$  controls the two LED lines SUB1 and SUB2.  $\overline{\text{ENM}}$  and  $\overline{\text{ENS}}$  work the same way. The chip must first be enabled by setting the enable input EN high. On the first  $\overline{\text{ENM}}$  or  $\overline{\text{ENS}}$  transition from high to low, the LED current in the associated LEDs is set to the full scale 31 mA. On each consecutive falling edge of  $\overline{\text{ENM}}$  or  $\overline{\text{ENS}}$ , the LED current is decreased by 1 mA. On the 32<sup>nd</sup> pulse, the LED channel is turned off and the current drops to 0 mA.

## Application Information

### Single Wire Dimming Application

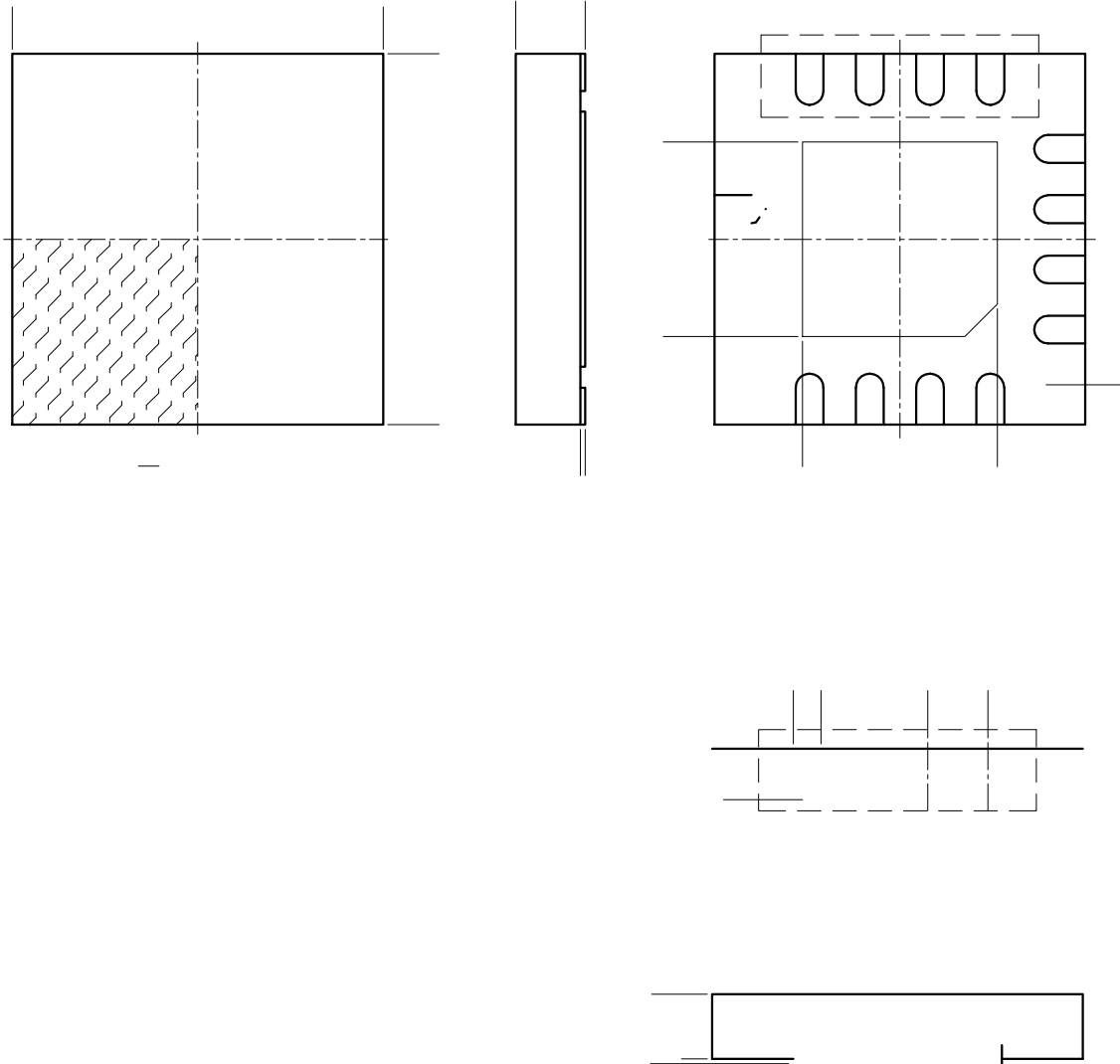
The dimming control can be achieved through a single wire interface by connecting together all three logic input signals EN,  $\overline{\text{ENM}}$  and  $\overline{\text{ENS}}$  as shown on Figure 25.

The common enable signal is set high to enable the driver. On the first negative going pulse, the LEDs turn full on. The

pulse low state duration (between the falling and rising edges) must be shorter than 0.5 msec. Any consecutive pulses reduce the LED current by 1 mA. The enable signal is kept low for more than 1.5 msec to turn off all the LED channels and set the driver in shutdown mode, as shown on

**TQFN16, 4x4**  
CASE 510AE-01  
ISSUE A

DATE 18 MAR 2009



onsemi

onsemi

onsemi

onsemi

— — — — —  
— onsemi —  
— onsemi —

onsemi

onsemi

onsemi

