6-C a e C a ge P r^{1} LED D e EZD r^{1}

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%







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).



Figure 1. Typical Application Circuit

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Unit	
VIN, LEDxx voltage			

 Table 3. ELECTRICAL OPERATING CHARACTERISTICS

 VIN = 3.6 V, EN = High, ambient temperature of 25°C (over recommended operating conditions unless specified otherwise)

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
lq	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 _{QSHDN}	Shutdown Current	V _{EN} = 0 V		0	1	μΑ
I _{LED}	LED Current Range with 6 LEDs		0		31	mA
I _{LED-ACC}	LED Current Accuracy	$1 \text{ mA} \le I_{\text{LED}} \le 31 \text{ mA}$		±3		%

I_{LED-DEV} LED Channel Matching



Figure 2. Enable LED Timing Diagram

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



Table 5. PIN DESCRIPTIONS

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 μ 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 ENM and ENS. ENM controls the four LED channels MAIN1 to MAIN4. ENS controls the two LED lines SUB1 and SUB2. ENM and ENS work the same way. The chip must first be enabled by setting the enable input EN high. On the first ENM or 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 ENM or ENS, the LED current is decreased by 1 mA. On the 32nd 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 consecutives 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, , and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. Onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or incruit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi