PT4301, PT4303

4 Channel 1×/1.5× Auto-Adjust Charge Pump White LED Driver

GENERAL DESCRIPTION

The PT4301/03 is a 4-channel 1x/1.5x auto-adjust charge pump white LED driver that achieves high efficiency for Li-Ion battery supply. The LED current can be set by an external resistor. Only one small resistor and four 1μF small ceramic capacitors are needed as external components to construct a LED driver, which makes the PT4301/03 an ideal choice for portable applications. The LED fault detection circuit in the PT4301/03 improves the reliability of the system.

The PT4301/03 has three dimming modes that allow users to adjust the brightness of the four LEDs individually or all together. The first two dimming modes can be controlled through the EN/SET pin either by applying a serial digital code, in which case the LED currents can be set with eight levels of up to 20mA, or by providing a pulse-width-modulation (PWM) signal input. The third dimming mode relies on the feature that the four LEDs can be turned on and off selectively by a three-bit digital code at the three control inputs in the PT4301, or a two-bit digital code at the two control inputs in the PT4303. Therefore, individual dimming control can be realized by applying PWM signals at those control inputs. The built-in soft-start circuit eliminates the inrush current during power on and 1x/1.5x mode switching. Thermal shut down and current limiter prevent the PT4301/03 from being damaged by high level current through the device. The ultra small shutdown current of less than 1μA extends the battery life significantly. The PT4301/03 is available in a QFN-16 package.

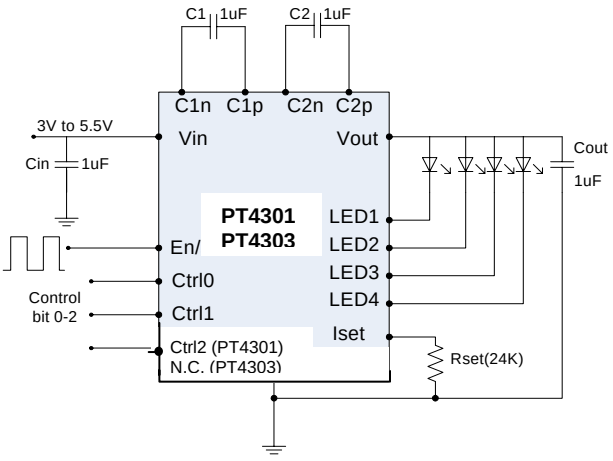
FEATURES

- 1×/1.5× auto-adjust charge pump
- LED current set by external resistor
- Programmable 4-channel LED current up to 20mA with 8 levels control through en/set pin
- Individual LED dimming control through PWM signals at 3 (PT4301) or 2 (PT4303) control inputs
- LED fault detection
- <3% channel to channel current mismatch
- Less than 1uA shut down current
- Built-in soft-start and soft mode switching

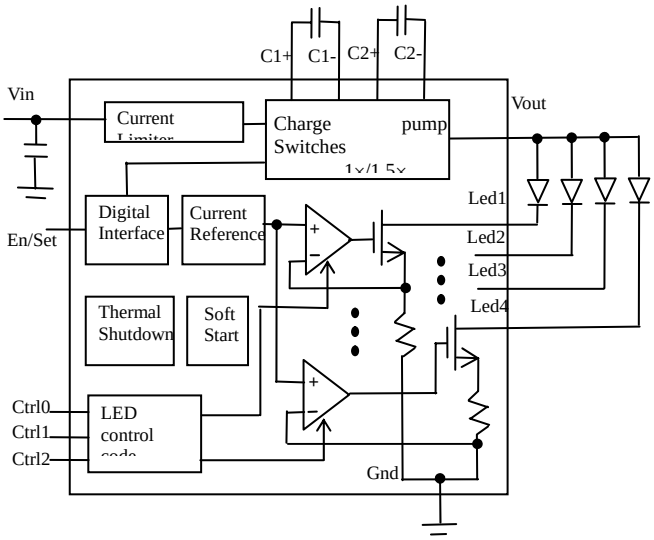
APPLICATIONS

- Cell Phones
- Handheld Computers and PDAs
- Digital Cameras
- Small LCD Displays
- Programmable current sink

TYPICAL APPLICATIONS

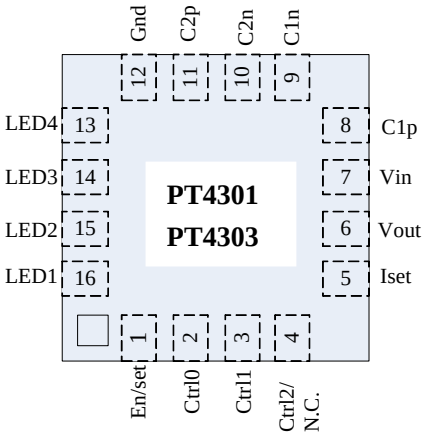


BLOCK DIAGRAM



PACKAGES

QFN16(4X4mm)



PIN DESCRIPTIONS

Names	Pin No.	Description
1	En/set	Chip enable and programming pin
2 to 3	Ctrl0 to 1	LED current control bit 0 to 1
4	Ctrl2 (PT4301) N.C. (PT4303)	LED current control bit 2 for PT4301 Unconnected for PT4303
5	Iset	LED currents pre-set Pin
6	Vout	Output voltage source
7	Vin	Power supply
8	C1p	Positive terminal of fly capacitor 1
9	C1n	Negative terminal of fly capacitor 1
10	C2n	Negative terminal of fly capacitor 2
11	C2p	Positive terminal of fly capacitor 2
12	Gnd	Ground
13 to 16	LED1 to 4	Current sink for LED

ELECTRICAL CHARACTERISTICS

V_{DD}=3.5V, , C1=C2=C_{in}=C_{out}=1μF, T_A=25℃, unless specified otherwise.

SYMBOL	ITEMS	CONDITIONS	Min.	Typ.	Max.	UNIT
Input Characteristics						
V_{IN}	Input Voltage		3		5.5	V
I_{OFF}	Operating Current（Shutdown）	En/Set=0		0.1	1	μA
Iq	Operating Current（Quiescent）	No load Current		1.5	3	mA
I_{OLP}	Over Load Protection	Short vout to gnd		600		mA
Charge Pump						
F_{CLK}	Switching Frequency		0.6	1	1.4	MHz
T_{SS}	Soft-start time			550		μs
V_{15-1}	The Threshold of 1.5X-> 1X	V_{LED1}=V_{LED2}=3.5V, I_{LED}=25mA		4		V
V_{1-15}	The Threshold of 1X-> 1.5X	V_{LED1}=V_{LED2}=3.5V, I_{LED}=25mA		3.8		V
Output Characteristics						
I_{OUT}	Maximum LED output current	3.0<vin<5.5, V_{LED}=3.5V, en/set set the output to maximum current, and Rset=24KΩ	18	20	22	mA
I_{Match} (note1)	Current match between D1, D2, D3 and D4	3.0<vin<5.5， output maximum current			3	%
V_{ovp}	Over output voltage protection	Vin=4, Open all led		5.5		V
Chip Enable						
V_{IL}	En/Set, Ctrl0，Ctrl1, Ctrl2 Maximum Low Level Threshold	Vin=5			1.4	V
V_{IH}	En/Set, Ctrl0 to 2 Minimum high level threshold	Vin=5	1.8			V
I_I	En/Set, Ctrl0，Ctrl1, Ctrl2 Input Current	V_{in}=$V_{en/set}$=V_{Ctrl0}=V_{Ctrl1}=V_{Ctrl2}=5V	-1		1	uA
Tctrl	Ctrl0 to 2 minimum pulse width when dimming with PWM signal			100		us
TsetL	En/Set low level width		0.3		75	us
TsetH	En/Set high level width			50		ns
Toff	En/Set shut down low level width				500	us
Thermal						
T_{SD}	Thermal Shut Down Threshold	Temperature rise	150	160	170	°C
T_{HY}	Thermal Shut Down Hysteresis			10		°C

Note1: I_{Match}=| Δ I_{LEDmax}/I_{LEDavg} |×100%

PACKAGE INFORMATION

QFN16: