ZXLD383

PROVISIONAL DATA SHEET – Subject to change without prior notice
Single or Multi Cell LED Driver Solution with Enable Control

Summary

The ZXLD383 is a single or multi cell LED driver designed for applications requiring step-up voltage conversion from a very low input voltage and on/off enable control. The IC generates constant current pulses that are ideal for driving single or multiple LEDs over a wide range of operating voltages. It includes an on/off enable input that can be driven directly from a photocell array or an open collector/drain logic output. The enable input features an ultra-low voltage drop diode to ground, eliminating the need for a photocell array isolation diode in Garden Light applications.

The ZXLD383 uses a PFM control technique to drive an internal switching transistor which exhibits a low saturation resistance. This ensures high efficiency, even for input voltages as low as 1.0V.

The IC can start up under full load and operates down to an input voltage of below 0.9V.

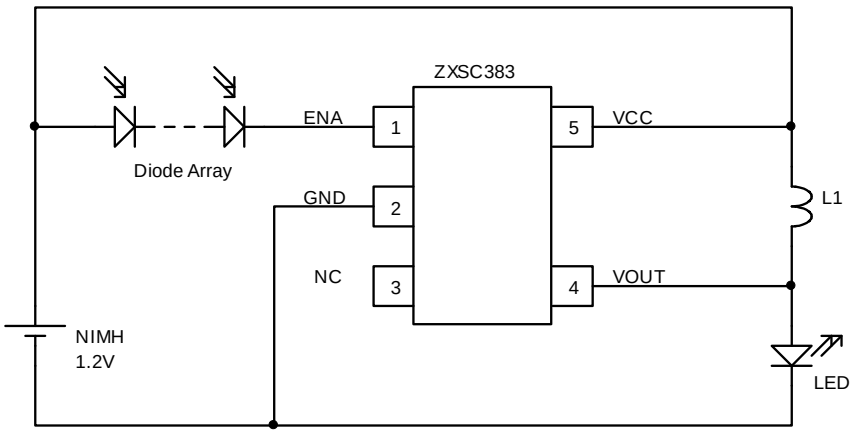
The ZXLD383 is offered in the space saving SOT23-5 package or in die form, offering an excellent cost vs performance solution for single cell LED driving applications.

FEATURES

- 85% Efficiency
- User adjustable output current
- Single cell operation (0.9V minimum)
- Low saturation voltage switching transistor
- SOT23-5 package
- Available also in Die form
- Simple Application circuit

APPLICATIONS

- Garden Lights
- Door/Pathway illumination
- LED flashlights and torches
- LED backlights
- White LED driver
- Gated Boost Supply Generator



Absolute maximum ratings

Supply Voltage (Vcc)	-0.6V to 6V
Output Voltage (Vout)	-0.6V to 20V
Enable Voltage (Vena)	-1V to 3.5V
Supply Current	20mA
Output Switch Current	800mA
Power Dissipation SOT23-5	450mW
Power Dissipation Die	1W
Operating Temperature Range	-20°C to +85°C
Storage Temperature Range	-55°C to +150°C

Electrical Characteristics

Measured at T_{AMB} = 25°C, L = 4.7uH, I_{ENA} = 0 and V_{CC} = 1.5V unless otherwise specified.

Parameter	Conditions	Limits			Units
		Min	Typ	Max	
Supply Voltage Operating Range	L = 10uH	0.9		3.3	V
Minimum Supply Start-up Voltage	L = 10uH		0.8	0.9	V
Supply Current Quiescent		2	4	8	mA
Supply Current Shutdown	$V_{ENA} = V_{CC} – 0.8V$		17	30	uA
Supply Current Under-Voltage	V_{CC} = 0.6V			20	uA
Switch Current	At turn-off	250	320	400	mA
Switch Saturation Voltage	I_{OUT} = 200mA		100	300	mV
Switch Leakage Current	V_{OUT} = 20V, V_{ENA} = 0V			10	uA
Mean LED Current	V_{LED} = 3.5V	40	50	65	mA
Efficiency	V_{LED} = 3.5V		85		%
Operating Frequency	V_{LED} = 3.5V		350		kHz
Discharge Pulse Width		0.7	1.5	2.5	us
Enable Input Threshold		V_{CC} - 0.8	V_{CC} - 0.4	V_{CC} - 0.2	V
Enable Input Current	V_{ENA} = 0.2V	0	-5	-20	uA
Enable Input Voltage	I_{ENA} = -20mA	0	-100	-250	mV

Typical Characteristics

Note: V_{LED} = 3.5V for all graphs

DEVICE DESCRIPTION

The ZXLD383 is a simple PFM, DC-DC controller combined with a high performance internal switching transistor, enabling the production of a high efficiency boost converter for use in single cell applications. It includes a dual function Enable input which serves both as an operation inhibit control and an ultra-low voltage drop isolation diode for battery charging purposes in Garden Light applications. A block diagram is shown for the ZXLD383 in Fig 1.

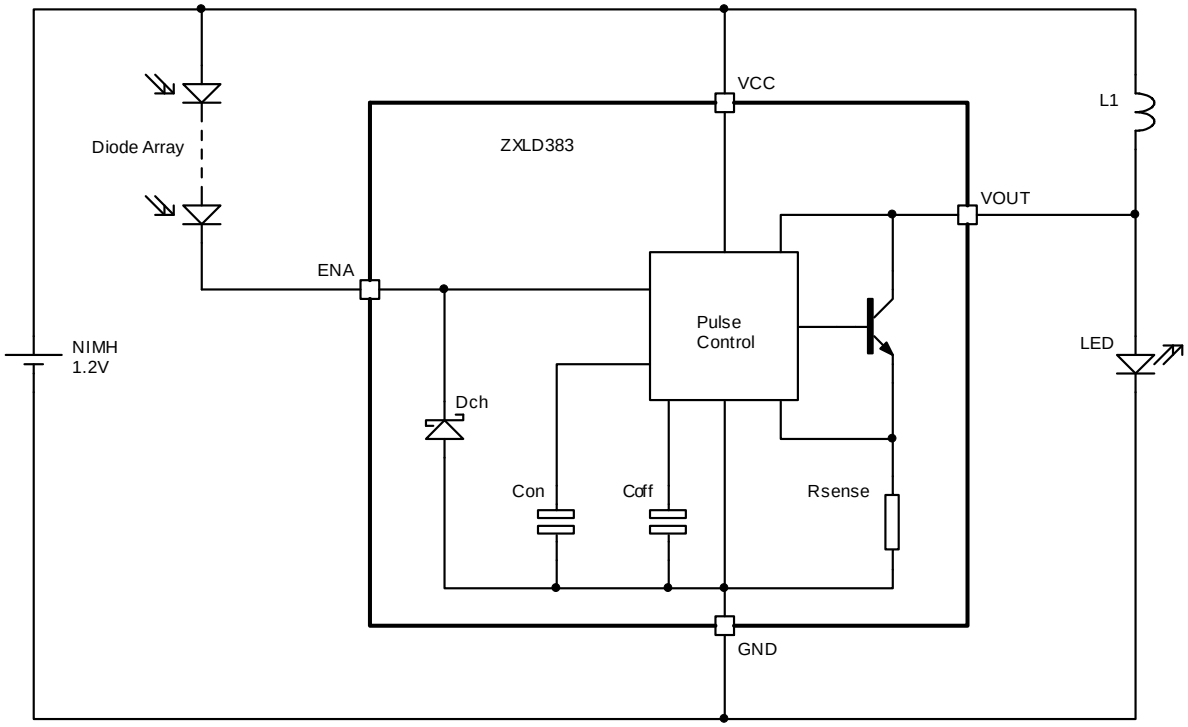


Fig 1. ZXLD383 Block Diagram

With power applied and the enable pin held at V_{CC}, an oscillator within the pulse control block forces the internal switching transistor to switch on to start an energy charge cycle. The low saturation voltage switch pulls the V_{OUT} pin close to ground which forces the supply voltage across the external inductor L1. This causes a current to build up, storing energy in the inductor. During this phase, switch current and supply voltage are monitored and used by the pulse control circuit to determine the optimum drive conditions and on-time. At the end of the energy charge cycle, the internal switch is turned off rapidly, interrupting the current flow through L1 which causes the voltage on V_{OUT} to rise dramatically. When the voltage on V_{OUT} reaches the load LED's forward (on) voltage, the inductor current is transferred from the internal switch to the LED, starting the energy discharge cycle. With the voltage across the inductor reversed, the current flowing through it (and the LED) now falls. When the inductor current reaches zero, the voltage on the V_{OUT} pin falls back towards V_{CC}. This action is sensed by the pulse control circuit and is combined with the output of an off-period timer to initiate the next energy charge cycle. Except for low level losses, all the energy stored in the inductor during a charge cycle is channelled to the load LED during the following discharge cycle.

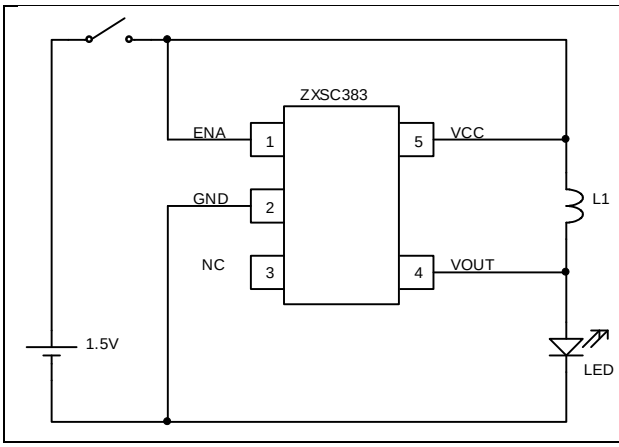
The current fed into the load LED has a sawtooth waveform, the average (DC) value of which is kept constant by the pulse control circuit for varying supply voltage and temperature. It is possible to change the output current given by the ZXLD383 by changing the value of inductor L1. The larger the inductance of L1, the lower the output current. A table/graph showing the relationship between inductance and output current is given later in this datasheet. Since the output current of the ZXLD383 is a sawtooth waveform, its peak value is substantially larger than the DC/average value. The table also provides this data.

The internal switching transistor has a minimum collector-emitter breakdown voltage of 20V and this sets the maximum load voltage allowable. The minimum value is set by a feature of the pulse control circuit that requires the load voltage to be at least 0.5V greater than V_{CC}. (The device will function with load voltages smaller than this but output current regulation will be impaired.) Higher than nominal load voltages will lower the average (DC) output current generated for a given inductor value.

The Enable pin inhibits the operation of the output switch if held at a potential of Vcc-0.8V or lower. It also includes a diode to ground which allows the input to be wired directly to a photocell array that will then both enable operation of the converter when in darkness and charge the IC's power source in daylight conditions. The diode function is performed by an active circuit that gives an ultra low forward voltage drop (typically less than 0.1V at 20mA). This allows the use of a lower output voltage photocell array (lower cost) without degrading performance.

APPLICATION EXAMPLES

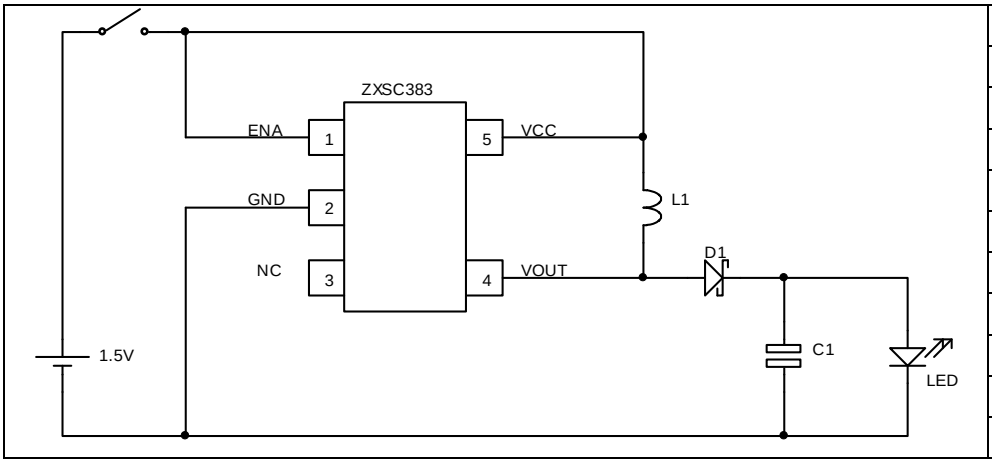
Standard Operating Mode



L (uH)	I_{LED}(peak) (mA) (Estimated)	I_{LED}(avg) (mA) (Estimated)
47	60	9
22	120	20
15	190	30
10	260	45
6.8	380	55
4.7	510	67
3.3	640	76
	(Estimated)	(Estimated)

Note: V_{LED} = 3.5V

Low Ripple LED Current Mode



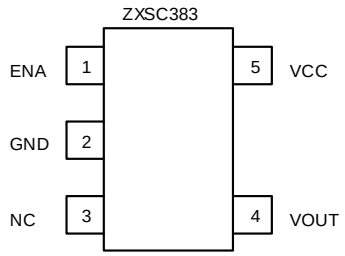
L (uH)	I_{LED} (mA)
(Estimated)	(Estimated)
47	8
22	18
15	27
10	41
6.8	50
4.7	61
3.3	69
(Estimated)	(Estimated)

Note: V_{LED} = 3.5V, D1 = ZHCS1000, C1 = 1uF (low ESR)

PIN DESCRIPTIONS

Pin No.	Name	Description
1	Ena	Enable / Photodiode array battery charge input
2	Gnd	Ground
3	NC	Not connected (internally open circuit)
4	V_{OUT}	Switch output external inductor/LED
5	V_{CC}	Supply voltage, generally Alkaline, NiMH or NiCd single cell

PINOUT DIAGRAM



Top View

PACKAGING INFORMATION

ORDERING INFORMATION

Device	Package	Part Mark

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