

ADJUSTABLE LED DRIVER WITH INTERNAL SWITCH AND OPEN CIRCUIT PROTECTION IN SC70-6

DESCRIPTION

The ZXLD1100 is a PFM inductive boost converter designed for driving 2, 3 or 4 series connected white LEDs from a Li-Ion cell and up to 8 LEDs from a 5V supply. The device operates from an input supply of between 2.5V and 5.5V and provides an adjustable output current of up to 50mA.

The ZXLD1100 includes the output switch and peak current sense resistor, and can operate with a maximum output voltage of 28V.

Quiescent current is typically 60 μ A and a shutdown function is provided to reduce this current to less than 500nA in the 'off' state.

Output current can be adjusted by applying a PWM control signal to the 'Enable' pin. Depending upon the control frequency, this will provide either a continuous or a 'chopped' output current. The PWM filter components are contained within the chip.

The ZXLD1100 contains an internal avalanche diode to protect the output switch. This allows the device to operate indefinitely if the load is open circuit. Input supply current during this condition is less than 1mA.

The device is assembled in a low profile SC70-6 pin package with industry standard pinout.

ADVANCED FEATURES

- Internal 30V NDMOS switch, current sense and open circuit protection
- True Analog Dimming via PWM

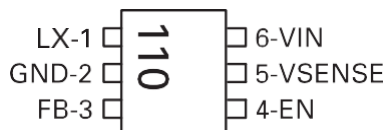
FEATURES

- Low profile SC70 6 pin package
- Internal PWM filter for flicker free output
- High efficiency (80% typ)
- Wide input voltage range: 2.5V to 5.5V
- Up to 50mA output current
- Low quiescent current: (60 μ A typ)
- 500nA maximum shutdown current
- Up to 1MHz switching frequency
- Low external component count
- Inherently matched LED currents

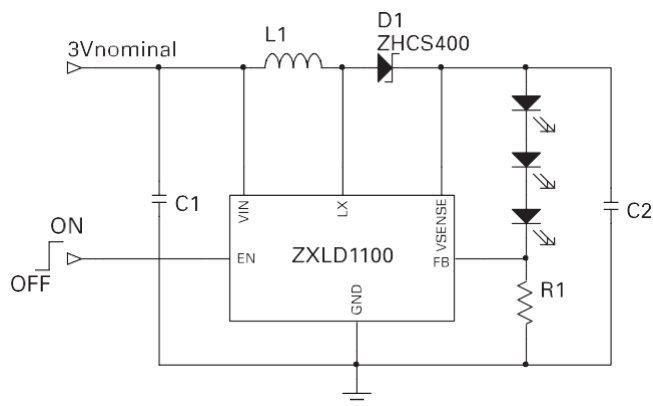
APPLICATIONS

- Mobile phones
- Digital cameras
- PDAs
- LCD modules
- Portable internet appliances
- Palmtop computers

PIN CONNECTIONS



TYPICAL APPLICATION CIRCUIT



ZXLD1100

ORDERING INFORMATION

| DEVICE | DEVICE DESCRIPTION | TEMPERATURE RANGE | PART MARK | TAPING OPTIONS |
|------------|---------------------------|-------------------|-----------|----------------|
| ZXLD1100H6 | Boost convertor in SC70-6 | -40 to +85°C | 110 | TA, TC |

ZXLD1100H6TA = 7" reel of 3,000 devices

ZXLD1100H6TC = 13" reel of 10,000 devices

ABSOLUTE MAXIMUM RATINGS (Voltages to GND unless otherwise stated)

| PARAMETER | SYMBOL | LIMIT | UNIT |
|-----------------------|-----------------------|------------|------|
| Input voltage | (V _{IN}) | 7 | V |
| LX output voltage | (V _{LX}) | 30 | V |
| Switch output current | (I _{LX}) | 500 | mA |
| Power dissipation | (PD) | 300 | mW |
| Operating temperature | (T _{OP}) | -40 to 85 | °C |
| Storage temperature | (T _{ST}) | -55 to 150 | °C |
| Junction temperature | (T _{J MAX}) | 125 | °C |

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ELECTRICAL CHARACTERISTICS (at $V_{IN} = 3V$, $T_{amb} = 25^{\circ}C$ unless otherwise stated⁽¹⁾)

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|----------------|--|---|------|------|----------|---------------|
| V_{IN} | Input voltage | | 2.5 | | 5.5 | V |
| I_{IN} | Supply current | | | | | |
| | Quiescent | $V_{EN} = V_{IN}$, $I_{LX} = 0$, Output not switching | | 60 | 100 | A |
| | Shutdown | $V_{EN} = 0V$ | | | 500 | nA |
| V_{FB} | FB pin control voltage | | 90.5 | | 109.5 | mV |
| I_{FB} | FB pin input current | | | | 100 | nA |
| f_{LX} | Operating frequency | $L=10\text{ H}$, $V_{OUT}=10V$, $I_{OUT}=20\text{ mA}$ | | 0.35 | 1 | MHz |
| T_{OFF} | LX output 'OFF' time | | 350 | 500 | | ns |
| T_{ON} | LX output 'ON' time ⁽²⁾ | | | | 5 | μs |
| I_{LXpk} | Switch peak current limit | $L=10\text{ H}$, $V_{OUT}=10V$, $I_{OUT}=20\text{ mA}$ | | 320 | | mA |
| R_{LX} | Switch 'On' resistance | | | 1.5 | | |
| $I_{LX(leak)}$ | Switch leakage current | $V_{LX} = 20V$ | | | 1 | μA |
| V_{OUT} | Controller output voltage | Normal operation VSENSE pin open-circuit or grounded | | | 28 | V |
| $V_{OUT(MAX)}$ | Controller output voltage with output open circuit ⁽³⁾ | VSENSE connected to Vout | 25 | 30 | | V |
| V_{ENH} | EN pin High level Input voltage | Device active | 1.5 | | V_{IN} | V |
| V_{ENL} | EN pin Low level Input voltage | Device in shutdown | | | 0.4 | V |
| I_{ENL} | EN pin Low level input current | $V_{EN} = 0V$ | | | -100 | nA |
| I_{ENH} | EN pin High level input current | $V_{EN} = V_{IN}$ | | | 1 | A |
| $T_{EN(hold)}$ | EN pin turn off delay ⁽⁴⁾ | V_{EN} switched from high to low | | 120 | | μs |
| $\Delta T/T$ | PWM duty cycle range at 'EN' input for filtered PWM control ⁽⁵⁾ | $10\text{ kHz} < f < 100\text{ kHz}$, $V_{ENH} = V_{IN}$ | 20 | | 100 | % |
| f_{LPF} | Internal PWM low pass filter cut-off frequency | | | 4 | | kHz |
| A_{LPF} | Filter attenuation | $f=30\text{ kHz}$ | | 52.5 | | dB |

NOTES:

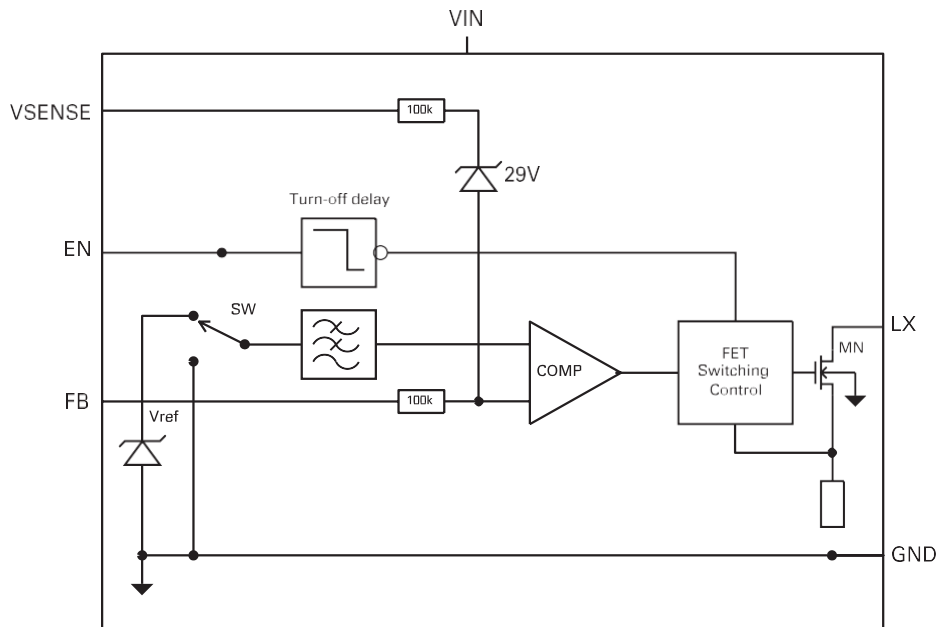
- (1) Production testing of the device is performed at 25°C. Functional operation of the device over a -40°C to +85°C temperature range is guaranteed by design, characterization and process control.
- (2) Nominal 'on' time (T_{ONnom}) is defined by the input voltage (V_{IN}), coil inductance (L) and peak current (I_{LXpkdc}) according to the expression:
 $T_{ONnom} = (I_{LX(pkdc)} \times L / V_{IN}) + 200\text{ ns}$.
- (3) When using the open circuit protection feature, the maximum output voltage under normal operation should be maintained below the minimum value specified, in order to prevent possible disturbance of the current control loop.
- (4) This is the time for which the device remains active after the EN pin has been asserted low. This delay is necessary to allow the output to be maintained during dc PWM mode operation.
- (5) The minimum PWM signal frequency during this mode of operation is to ensure that the device remains active during PWM control. This provides a continuous dc output current. For lower frequencies, the device will be gated 'on' and 'off' during PWM control.
- (6) The maximum PWM signal frequency during this mode of operation should be kept as low as possible to minimize errors due to the turn-off delay of the device (see Enable pin turn-off delay).

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PIN DESCRIPTION

| PIN NO. | NAME | DESCRIPTION |
|---------|----------|---|
| 1 | LX | Output of NDMOS switch |
| 2 | GND | Ground (0V) |
| 3 | FB | Feedback pin for current control loop (connect resistor R1 from this pin to GND for output current $I=100\text{mV}/R1$) |
| 4 | EN | Enable input (active high to turn on device) Also used to adjust output current by PWM signal. Connect to V_{in} for permanent operation. |
| 5 | VSENSE | Output voltage sense (used for open circuit protection). Connect to GND if not required. |
| 6 | V_{IN} | Input voltage (2.5V to 5.5V). Decouple with capacitor close to device. |

BLOCK DIAGRAM



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