## PBL 38085

# Integrated circuit for transformerless driving of battery powered EL (electroluminicent) lamps 

## Description.

PBL 38085 is a monolithic integrated circuit for supplying power to an EL (electroluminicent) lamp. This is intended to replace the LCD background illumination system in battery powered handheld equipment with a low power EL- lamp. Especially suitable for mobile phones where current saving is highly important, as background illumination for both LCD and keyboard. Output voltage max. 190V, min. 170V at max. 2 mA constant current charge / discharge of the EL- lamp. Application dependent parameters such as charge / discharge current are set by an external resistor. Two control signals are needed one for the switcher and one for the lamp. The output voltage is set under 170 V by the duty cycle and the switching frequency of the control signal, over 170 V by an amplitude limiter that switches the switcher off. The switching frequency is app. 50 kHz . The light intensity is controlled by the dutycycle of the switcher control signal. The lamp control signal is divided by two by the circuit. The wave form of the output AC-signal is either triangular or trapezoid depending of the capacitance of the EL-lamp, charge / discharge current and frequency of the lamp control signal. The triangular or trapezoid wave form of the EL-lamp driving voltage and the high switching frequency minimizes audible noise from the lamp and also reduces upcoming electrical noise and harmonics.


## Key features.

- Minimum number of external components for function: 1 choke, 1 filter-capacitor and 1 resistor.
- Easy adaption to various lamp specifications.
- Easy dimming function by controlling the duty cycle.
- Extensive current saving feature compared with LEDs.
- Power down function $\ll 1 \mu \mathrm{~A}$.
- Supply voltage down to 3 V .
- Comes in a $3 \times 3 \mathrm{~mm}$ package
- Lights up to 20 nF lamp capacitance area depending on lamp parameter $\mathrm{nF} / \mathrm{cm}^{2}$.


Functional diagram.

## Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit |
| :--- | :---: | :---: | :---: | :---: |
| Supply voltage, continuous | $\mathrm{V}+$ | 0 | 90 | V |
| All inputs (zener protection) |  |  | 6.5 | V |
| Operating temperature range | $\mathrm{T}_{\text {Amb }}$ | -30 | +85 | ${ }^{\circ} \mathrm{C}$ |
| Storage temperature range | $\mathrm{T}_{\text {Stg }}$ | -55 | +150 | ${ }^{\circ} \mathrm{C}$ |

## Electrical Characteristics

At $\mathrm{T}_{\text {Amb }}=25^{\circ} \mathrm{C} \quad \mathrm{V}+=2.75 \mathrm{~V}$ if no otherwise stated. For further conditions see figure.

| Parameter | Condition | Symbol | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Battery voltage |  | $\mathrm{V}_{\text {Bat }}$ | 1.5 | 3.6 | 65* | V |
| $\mathrm{V}_{\text {BAT }}$ quiescent curren | V+ off |  |  |  | 0.1 | $\mu \mathrm{A}$ |
| Logic supply voltage |  | V+ | 2.4 | 2.75 | 5.5 | V |
| V+ operating supply current | SC + LC 50\% 50\% |  |  |  |  |  |
| V+ quiescent supply current | SC = 0; LC = 0 |  |  | 5 | $\mu \mathrm{A}$ |  |
| Logic low level input voltage |  |  |  |  | $0.3 \times \mathrm{V}+$ | V |
| Logic high level input voltage |  |  | $0.7 \mathrm{xV}+$ |  |  | V |
| Logic low level input current |  |  | -100 |  | 100 | $\mu \mathrm{A}$ |
| DC/DC converter: |  |  |  |  |  |  |
| Booster output voltage, int.limited |  |  |  | 90 |  | V |
| Switch transistor sat. voltage | 80mA inductor current |  |  |  | 0.6 | V |
| Switching frequency, set by the |  |  |  |  |  |  |
| SC-signal frequency |  |  |  | 50 |  | kHz |
| H-BRIDGE: |  |  |  |  |  |  |
| Output voltage EL1 - EL2 |  |  | 170 |  |  | $\mathrm{V}_{\mathrm{pp}}$ |
| Output unbalance voltage EL1 - EL2 |  |  | -5 |  | +5 | V |
| Output sink/source current range lower limit |  |  |  |  | 0.1 | mA |
| Output sink/source current range upper limit |  |  | 1.5 |  |  | mA |
| Output current x resistance product ( note1) |  | $\mathrm{I}_{\text {SET }}{ }^{*} \mathrm{R}_{\text {SET }}$ | 9.5 | 10 | 10.5 | V |
| Output drive frequency, set by the LC-signal frequency |  |  |  | 250 |  | Hz |

Note1: This product is the EL1/EL2 output current multiplied by the resistor value connected to $I_{\text {SET }}$. Voltace at the $I_{\text {SET }}$ pin is dependent of the $\mathrm{V}+$ voltage asit is a quota of that voltage.

* Battery voltage max. 65 V requires correctly chosen duty cycle and inductance.


Pin configuration.

## Pin Descriptions:

Refer to pin configuration.

| SO | Name | Function | SO | Name | Function |
| :--- | :--- | :--- | :---: | :--- | :--- |
|  |  |  |  |  |  |
| 1 | GND | Ground connection | 6 | EL2 | EL - lamp connection |
| 2 | SC | Switch control input | 7 | NC | No connection |
| 3 | ISET | Control input for lamp driving capability | 8 | EL1 | EL - lamp connection |
| 4 | LC | Lamp frequency control input | 9 | C | Boost capacitor connection |
| 5 | V+ | Supply voltage | 10 | L | Inductor connection |



Reference picture.


Some circuit curve forms .

## 10 - pin mini SOP



Dim. millimeters tol.

| A | 1.10 | max. |
| :--- | :--- | :--- |
| B | 0.23 | +0.07 <br> C 0.18 |
| D | 0.050 |  |
| E | 3.00 | $\pm 0.1$ |
| F | 4.90 | $\pm 0.15$ |
| G | 0.55 | $\pm 0.15$ |
| H | 3.00 | $\pm 0.1$ |
| K | 0.10 | $\pm 0.05$ |
| $\alpha$ | $3.0^{\circ}$ | $\pm 3.0^{\circ}$ |



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Ordering Information
Package
Temp. Range
Part No.
10 pin plastic mini SOP -30 to $85^{\circ} \mathrm{C}$ PBL $38085 / 1 \mathrm{MSOT}$ Tape and Reel

