Structure　Silicon Monolithic Integrated Circuit

Product Name　Compound LED Driver for cellular phone

Type　**BD6086GU**

Features　Charge pump system DC/DC
LED Driver for LCD Backlight／RGB LED driver
Ambient light sensor interface／Built-in general-purpose port

● Absolute Maximum Ratings (Ta=25 °C)

| Parameter | Symbol | Limits | Unit | Condition |
|---|---|---|---|---|
| Maximum Applied voltage | VMAX | 7 | V | |
| Power Dissipation | Pd | 1900 Note1) | mW | |
| Operating Temperature Range | Topr | -25 ~ +85 | °C | |
| Storage Temperature Range | Tstg | -55 ~ +150 | °C | |

Note1) Power dissipation deleting is 15.2mW/°C, when it's used in over 25 °C.
(It's deleting is on the board that is ROHM's standard)

● Operating conditions (VBAT≥VIO, VBAT≥VGPIO, Ta=-25~85 °C)

| Parameter | Symbol | Limits | Unit | Condition |
|---|---|---|---|---|
| VBAT input voltage | VBAT | 2.7 ~ 5.5 | V | |
| VIO pin voltage | VIO | 1.65 ~ 3.3 | V | |
| VGPIO pin voltage | VGPIO | 1.65 ~ 3.3 | V | |

* Radiation-proof is not designed.

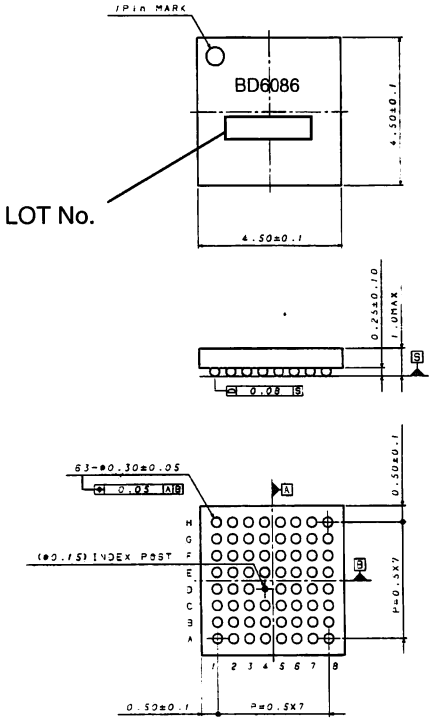
● Electrical Characteristics (Unless otherwise specified, Ta=25 °C, VBAT=3.6V, VIO=VGPIO=1.8V)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| 【Circuit Current】 | | | | | | |
| VBAT Circuit current 1 | IBAT1 | - | 0.1 | 3.0 | μA | RESETB=0V, VIO=VGPIO=0V |
| VBAT Circuit current 2 | IBAT2 | - | 0.5 | 3.0 | μA | RESETB=0V, VIO=1.8V, VGPIO=0V |
| VBAT Circuit current 3 | IBAT3 | - | 7.5 | 11.3 | μA | REG1,REG2 Low consumption mode Io=0mA, VIO=1.8V, VGPIO=0V (control is register setup) |
| VBAT Circuit current 4 | IBAT4 | - | 110 | 165 | μA | REG1,REG2 Nomal mode Io=0mA (control is register setup) |
| VBAT Circuit current 5 | IBAT5 | - | 61 | 65 | mA | DC/DC x1mode, Io=60mA VBAT=4.0V |
| VBAT Circuit current 6 | IBAT6 | - | 92 | 102 | mA | DC/DC x1.5mode, Io=60mA VBAT=3.6V |
| VBAT Circuit current 7 | IBAT7 | - | 123 | 140 | mA | DC/DC x2mode, Io=60mA VBAT=2.7V |
| VBAT Circuit current 8 | IBAT8 | - | 0.35 | 1.0 | mA | ALC operating Setup of ALCEN=1, AD cycle =0.5s Sensor current removes |
| 【LED Driver】 | | | | | | |
| LED Maximum setup current 1 | IMAX1 | - | - | 25.6 | mA | WLED1~7, LED terminal voltage =1V |
| LED Maximum setup current 2 | IMAX2 | - | - | 30.48 | mA | RGB1 group, RGB2 group LED terminal voltage =1V RGBISET=100kΩ |
| LED current accurate 1 | ILED1 | 18 | 20 | 22 | mA | WLED1~7, ILED=20mA setup LED terminal voltage =1V |
| LED current accurate 2 | ILED2 | 18 | 20 | 22 | mA | RGB1 group, RGB2 group ILED=20mA, RGBISET =120kΩ LED terminal voltage =1V |
| LED current Matching | ILEDMT | - | 5 | 10 | % | WLED1~7 RGB1 group, RGB2 group |
| LED OFF Leak current | ILKL | - | - | 1.0 | μA | |
| 【DC/DC (Charge Pump)】 | | | | | | |
| Output voltage 1 | VoCP1 | - | Vf+0.2 | Vf+0.25 | V | Vf is forward direction of LED |
| Output voltage 2 | VoCP2 | 3.705 | 3.9 | 4.095 | V | At fixed voltage output mode, Io=60mA VBAT≥3.2V |
| | | 3.99 | 4.2 | 4.41 | V | |
| | | 4.275 | 4.5 | 4.725 | V | |
| | | 4.56 | 4.8 | 5.04 | V | |
| Load stability | Iout | - | - | 255 | mA | VBAT≥3.2V, VOUT=4V |
| Oscillator frequency | fosc | 0.8 | 1.0 | 1.2 | MHz | |
| Over voltage protection detect voltage | OVP | - | 6.0 | 6.5 | V | |
| Over current protection detect current | OCP | - | 250 | 375 | mA | VOUT=0V |
| 【Sensor interface】 | | | | | | |
| SBIAS Output voltage | VoS | 2.85 | 3.0 | 3.15 | V | Io=200μA |
| | | 2.47 | 2.6 | 2.73 | V | Io=200μA |
| SBIAS Maximum OutputCurrent | IomaxS | 30 | - | - | mA | Vo=2.6Vsetup |
| SBIAS Discharge resister at OFF | ROFFS | - | 1.0 | 1.5 | kΩ | |
| SSENS input voltage range | VISS | 0 | - | VoS× 255/256 | V | |
| ADC integral calculus non-linearity | ADINL | -3 | - | +3 | LSB | |
| ADC differential calculus non-linearity | ADDNL | -1 | - | +1 | LSB | |
| SSENS Input impedance | RSSENS | 1 | - | - | MΩ | |

● Electrical Characteristics (Unless otherwise specified, Ta=25 °C, VBAT=3.6V, VIO=VGPIO=1.8V)

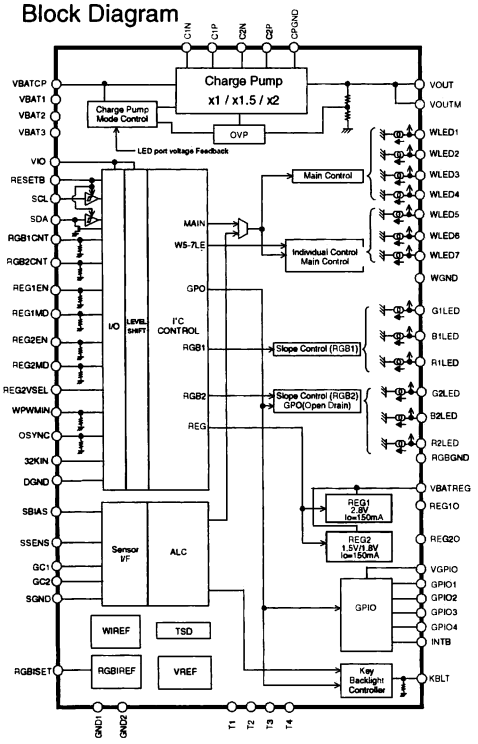
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| 【REG1】 | | | | | | |
| Output voltage 1 | Vo11 | 2.716 | 2.80 | 2.884 | V | Io=150mA, VBAT≥3.1V (Normal mode) |
| Output voltage 2 | Vo12 | 2.668 | 2.80 | 2.912 | V | Io=100μA, VBAT≥3.1V (Low consumption mode) |
| I/O voltage difference | Vsat1 | - | 0.2 | 0.3 | V | VBAT=2.5V, Io=150mA (Normal mode) |
| Load stability | ΔVo1 | - | 10 | 60 | mV | Io=1～150mA (Normal mode) |
| Input stability | ΔVi1 | - | 10 | 60 | mV | VBAT=3.2~5.5V, Io=150mA (Normal mode) |
| Ripple Rejection Ratio | RR1 | 40 | 50 | - | dB | f=100Hz, Vin=200mVp-p (Normal mode) |
| Short circuit current limit | Ilim01 | - | 225 | 450 | mA | Vo=0V (Normal mode) |
| Discharge resister at OFF | ROFF1 | - | 1.0 | 1.5 | kΩ | |
| 【REG2】 | | | | | | |
| Output voltage 1 | Vo21 | 1.74 | 1.80 | 1.86 | V | Io=150mA (Normal mode) |
| | | 1.44 | 1.50 | 1.56 | V | |
| Output voltage 2 | Vo22 | 1.71 | 1.80 | 1.89 | V | Io=100μA (At low consumption mode) |
| | | 1.425 | 1.50 | 1.575 | V | |
| Load stability | ΔVo2 | - | 10 | 60 | mV | Vo21=1.8V setup Io=1~150mA (Normal mode) |
| Input stability | ΔVi2 | - | 10 | 60 | mV | Vo21=1.8V setup, VBAT=3.2~5.5V Io=150mA (Normal mode) |
| Ripple Rejection Ratio | RR2 | 45 | 55 | - | dB | Vo21=1.8V setup f=100Hz Vin=200mVp-p (Normal mode) |
| Short circuit current limit | Ilim02 | - | 225 | 450 | mA | Vo=0V (Normal mode) |
| Discharge resister at OFF | ROFF2 | - | 1.0 | 1.5 | kΩ | |

● Outside size figure




VCSP85H4(63pin) (unit : mm)

## ● Block Diagram




## ● Pin List

| PIN | PIN NAME | PIN | PIN NAME | PIN | PIN NAME |
|---|---|---|---|---|---|
| B8 | VBATCP | C7 | C1P | D5 | RGB1CNT |
| A2 | VBAT1 | A7 | C2N | D6 | RGB2CNT |
| H5 | VBAT2 | C8 | C2P | F4 | REG1EN |
| H6 | VBAT3 | D8 | VOUT | G3 | REG2EN |
| H3 | VBATREG | D7 | VOUTM | H7 | SBIAS |
| A1 | T1 | C4 | RGBISET | G8 | SSENS |
| A8 | T2 | H4 | REG1O | F5 | GC1 |
| H8 | T3 | H2 | REG2O | F6 | GC2 |
| H1 | T4 | B2 | WLED1 | G5 | OSYNC |
| F8 | VIO | B1 | WLED2 | G7 | SGND |
| G1 | VGPIO | C2 | WLED3 | F3 | GPIO1 |
| F7 | RESETB | D2 | WLED4 | E3 | GPIO2 |
| E6 | SDA | D1 | WLED5 | D3 | GPIO3 |
| E7 | SCL | E2 | WLED6 | C3 | GPIO4 |
| A6 | CPGND | E1 | WLED7 | F2 | KBLT |
| F1 | GND1 | B3 | R1LED | G2 | INTB |
| G6 | GND2 | A3 | G1LED | E5 | 32KIN |
| C1 | WGND | B4 | B1LED | C5 | REG1MD |
| A4 | RGBGND | B5 | R2LED | C6 | REG2MD |
| E8 | DGND | A5 | G2LED | G4 | WPWMIN |
| B7 | C1N | B6 | B2LED | E4 | REG2VSEL |

## ● Cautions on use

(1) Absolute Maximum Ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.

(2) Power supply and ground line

Design PCB pattern to provide low impedance for the wiring between the power supply and the ground lines. Pay attention to the interference by common impedance of layout pattern when there are plural power supplies and ground lines. Especially, when there are ground pattern for small signal and ground pattern for large current included the external circuits, please separate each ground pattern. Furthermore, for all power supply pins to ICs, mount a capacitor between the power supply and the ground pin. At the same time, in order to use a capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the occurrence of capacity dropout at a low temperature, thus determining the constant.

(3) Ground voltage

Make setting of the potential of the ground pin so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no pins are at a potential lower than the ground voltage including an actual electric transient.

(4) Short circuit between pins and erroneous mounting

In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between pins or between the pin and the power supply or the ground pin, the ICs can break down.

(5) Operation in strong electromagnetic field

Be noted that using ICs in the strong electromagnetic field can malfunction them.

(6) Input pins

In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input pin. Therefore, pay thorough attention not to handle the input pins, such as to apply to the input pins a voltage lower than the ground respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input pins when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input pins a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

(7) External capacitor

In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.

(8) Thermal shutdown circuit (TSD)

This LSI builds in a thermal shutdown (TSD) circuit. When junction temperatures become detection temperature or higher, the thermal shutdown circuit operates and turns a switch OFF. The thermal shutdown circuit, which is aimed at isolating the LSI from thermal runaway as much as possible, is not aimed at the protection or guarantee of the LSI. Therefore, do not continuously use the LSI with this circuit operating or use the LSI assuming its operation.

(9) Thermal design

Perform thermal design in which there are adequate margins by taking into account the permissible dissipation (Pd) in actual states of use.

(10) LDO

Use each output of LDO by the independence. Don't use under the condition that each output is short-circuited because it has the possibility that an operation becomes unstable.

(11) About the pin for the test, the un-use pin

Prevent a problem from being in the pin for the test and the un-use pin under the state of actual use. Please refer to a function manual and an application notebook. And, as for the pin that doesn't specially have an explanation, ask our company person in charge.

(12) Rush Current

Rush current may flow in instant in the internal logic unfixed state by the power supply injection order and delay. Therefore, be careful of power supply coupling capacity, a power supply and the width of grand pattern wiring, and leading about.

(13) About the function description or application note or more.

The function manual and the application notebook are the design materials to design a set. So, the contents of the materials aren't always guaranteed. Please design application by having fully examination and evaluation include the external elements.

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