

Structure Silicon Monolithic Integrated Circuit  
 Product Name Compound LED Driver for cellular phone

Type **BD6085GUL**

Features Charge Pump DC/DC  
 LCD Back Light LED Driver / Flash LED Driver  
 Variable LDO

oAbsolute Maximum Ratings (Ta=25 °C)

| Parameter                   | Symbol | Limits    | Unit | Condition |
|-----------------------------|--------|-----------|------|-----------|
| Maximum Applied voltage     | VMAX   | 7         | V    |           |
| Power Dissipation           | Pd     | 1325      | mW   |           |
| Operating Temperature Range | Topr   | -35 ~ +85 | °C   |           |
| Storage Temperature Range   | Tstg   | -55 ~+150 | °C   |           |

note) Power dissipation deleting is 10.6mW/°C, when it's used in over 25 °C.

(It's deleting is on the board that is ROHM's standard)

oOperating conditions (VBAT≥VIO, Ta=-35~85 °C)

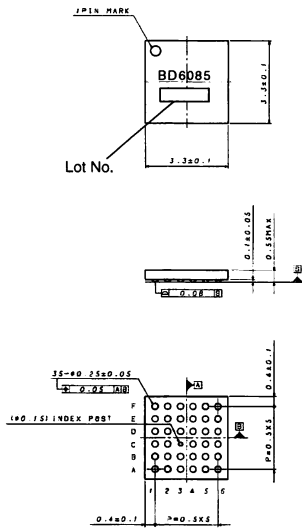
| Parameter          | Symbol | Limits   | Unit | Condition |
|--------------------|--------|----------|------|-----------|
| VBAT input voltage | VBAT   | 2.7~5.5  | V    |           |
| VIO pin voltage    | VIO    | 1.65~3.3 | V    |           |

\*This chip is not designed to protect itself against radioactive rays.

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

| Parameter                                   | Symbol              | Limit |      |                      | Unit | Condition   |
|---|---------------------|-------|------|----------------------|------|---|
|   |                     | Min.  | Typ. | Max.                 |      |   |
| <b>【Circuit Current】</b>                    |                     |       |      |                      |      |   |
| VBAT Circuit current 1                      | IBAT1               | -     | 0.1  | 1.0                  | μA   | RESETB=0V, VIO=0V   |
| VBAT Circuit current 2                      | IBAT2               | -     | 0.5  | 3.0                  | μA   | RESETB=0V, VIO=1.8V   |
| VBAT Circuit current 3                      | IBAT3               | -     | 90   | 150                  | μA   | LDO1=LDO2=ON, I <sub>LDO</sub> =0mA<br>Other blocks=OFF   |
| VBAT Circuit current 4                      | IBAT4               | -     | 90   | 150                  | μA   | LDO3=LDO4=ON, I <sub>LDO</sub> =0mA<br>Other blocks=OFF   |
| VBAT Circuit current 5                      | IBAT5               | -     | 390  | 600                  | μA   | LDO1=LDO2=ON, I <sub>LDO</sub> =0mA<br>DC/DC x1mode,<br>I <sub>LED</sub> =2.8125(30x3/32)mA x 4ch |
| VBAT Circuit current 6                      | IBAT6               | -     | 61   | 65                   | mA   | DC/DC x1mode, I <sub>LED</sub> =60mA<br>VBAT=3.7V, LED Vf=3.0V                                    |
| VBAT Circuit current 7                      | IBAT7               | -     | 84   | 94                   | mA   | DC/DC x1.33mode, I <sub>LED</sub> =60mA<br>VBAT=3.1V, LED Vf=3.0V                                 |
| VBAT Circuit current 8                      | IBAT8               | -     | 94   | 104                  | mA   | DC/DC x1.5 mode, I <sub>LED</sub> =60mA<br>VBAT=2.9V, LED Vf=3.5V                                 |
| VBAT Circuit current 9                      | IBAT9               | -     | 128  | 136                  | mA   | DC/DC x2 mode, I <sub>LED</sub> =60mA<br>VBAT=2.9V, LED Vf=4.0V                                   |
| <b>【LED Driver】</b>                         |                     |       |      |                      |      |   |
| LED current Step                            | I <sub>LEDSTP</sub> | 32    |      |                      | Step | LED1~7  |
| White LED Maximum setup current             | IMAXWLED            | -     | 30   | -                    | mA   | LED1~7 (Normal mode)  |
| Flash LED Maximum setup current             | IMAXFLED            | -     | 120  | -                    | mA   | LED5~7 (Flash mode)   |
| White LED current accuracy                  | I <sub>WLED</sub>   | -7%   | 15   | +7%                  | mA   | I <sub>LED</sub> =15mA setting (Normal mode)<br>At V <sub>LED</sub> =1.0V                         |
| Flash LED current accuracy                  | I <sub>FLED</sub>   | -     | 60   | -                    | mA   | I <sub>LED</sub> =60mA setting (Flash mode)<br>At V <sub>LED</sub> =1.0V                          |
| LED current Matching                        | I <sub>LEDMT</sub>  | -     | -    | 4                    | %    | Between LED1~7 at V <sub>LED</sub> =1.0V  |
| Flash / Normal current ratio                | RATFL               | 3.2   | 4    | 4.8                  | A/A  | LED5~7, Flash mode/Normal mode<br>At V <sub>LED</sub> =1.0V                                       |
| LED OFF Leak current                        | ILKLED              | -     | -    | 1.0                  | μA   | V <sub>LED</sub> =4.5V  |
| <b>【DC/DC (Charge Pump)】</b>                |                     |       |      |                      |      |   |
| Maximum Output voltage                      | V <sub>oCP</sub>    | 4.65  | 5.1  | 5.55                 | V    |   |
| Current Load                                | I <sub>OUT</sub>    | -     | -    | 480                  | mA   | VBAT≥3.2V, V <sub>OUT</sub> =4V   |
| Oscillator frequency                        | f <sub>osc</sub>    | 0.72  | 0.9  | 1.08                 | MHz  |   |
| Over Voltage Protection detect voltage      | OVP                 | 5.0   | 5.5  | 6.0                  | V    |   |
| Short Circuit current limit                 | I <sub>lim</sub>    | -     | 250  | 500                  | mA   | V <sub>OUT</sub> =0V  |
| <b>【Regulator (LDO1, LDO2, LDO3, LDO4)】</b> |                     |       |      |                      |      |   |
| Output voltage                              | V <sub>o</sub>      | 1.164 | 1.20 | 1.236                | V    | I <sub>o</sub> =50mA  |
|   |                     | 1.261 | 1.30 | 1.339                | V    | I <sub>o</sub> =50mA  |
|   |                     | 1.455 | 1.50 | 1.545                | V    | I <sub>o</sub> =50mA  |
|   |                     | 1.552 | 1.60 | 1.648                | V    | I <sub>o</sub> =50mA  |
|   |                     | 1.746 | 1.80 | 1.854                | V    | I <sub>o</sub> =50mA <Initial Voltage of LDO1,3>  |
|   |                     | 2.134 | 2.20 | 2.266                | V    | I <sub>o</sub> =50mA  |
|   |                     | 2.328 | 2.40 | 2.472                | V    | I <sub>o</sub> =50mA  |
|   |                     | 2.425 | 2.50 | 2.575                | V    | I <sub>o</sub> =50mA <Initial Voltage of LDO2>  |
|   |                     | 2.522 | 2.60 | 2.678                | V    | I <sub>o</sub> =50mA  |
|   |                     | 2.619 | 2.70 | 2.781                | V    | I <sub>o</sub> =50mA  |
|   |                     | 2.716 | 2.80 | 2.884                | V    | I <sub>o</sub> =50mA <Initial Voltage of LDO4>  |
|   |                     | 2.813 | 2.90 | 2.987                | V    | I <sub>o</sub> =50mA  |
|   |                     | 2.910 | 3.00 | 3.090                | V    | I <sub>o</sub> =50mA  |
|   |                     | 3.007 | 3.10 | 3.193                | V    | I <sub>o</sub> =50mA  |
|   |                     | 3.104 | 3.20 | 3.296                | V    | I <sub>o</sub> =50mA  |
| 3.201                                       | 3.30                | 3.399 | V    | I <sub>o</sub> =50mA |      |   |

External dimensions

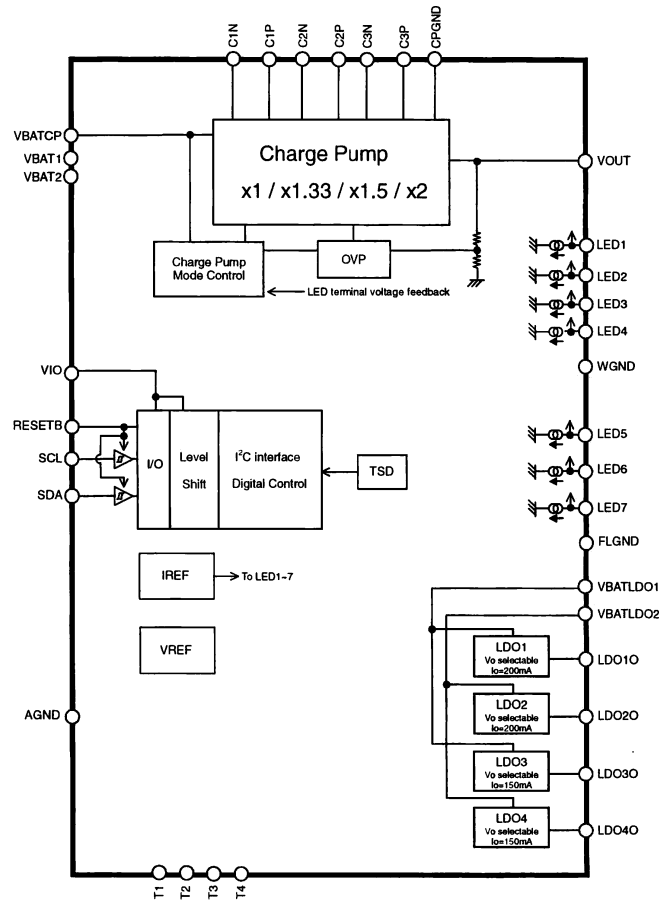


VCSP50L3 (35pin) (Unit : mm)

Terminals

| PIN | PIN Name | PIN | PIN Name |
|-----|----------|-----|----------|
| B6  | VBATCP   | C6  | C1P      |
| F3  | VBAT1    | C5  | C2N      |
| E3  | VBAT2    | B5  | C2P      |
| F5  | VBATLDO1 | A4  | C3N      |
| F2  | VBATLDO2 | A5  | C3P      |
| A1  | T1       | B4  | VOUT     |
| A6  | T2       | E5  | LDO1O    |
| F6  | T3       | E1  | LDO2O    |
| F1  | T4       | E4  | LDO3O    |
| E6  | VIO      | E2  | LDO4O    |
| D3  | RESETB   | A3  | LED1     |
| D5  | SDA      | B3  | LED2     |
| D4  | SCL      | A2  | LED3     |
| C4  | CPGND    | B1  | LED4     |
| F4  | AGND     | C1  | LED5     |
| B2  | WGND     | D1  | LED6     |
| C2  | FLGND    | D2  | LED7     |
| D6  | C1N      |     |          |

Block diagram



REV. B

## ○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) About the rush current

For ICs with more than one power supply, it is possible that rush current may flow instantaneously due to the internal powering sequence and delays. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of wiring.

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

The function description 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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