

Structure Silicon Monolithic Integrated Circuit

Product Name Step-up DC/DC converter for middle size LCD panel

Type **BD6066EKN**

Features High efficiency PWM step-up DC/DC converter (fsw=1MHz)  
Extended resolution current driver 4ch  
Driving\*12 series x 4parallel =48 white LEDs  
(\*white LED Vf=3.2Vmax)

○Absolute Maximum Ratings (Ta=25 °C)

| Parameter                   | Symbol | Rating     | Unit | Condition                                         |
|-----------------------------|--------|------------|------|---------------------------------------------------|
| Maximum applied voltage1    | VMAX1  | 7          | V    | TEST,ISET,VREG,<br>SENSP,SENSN,SW,<br>EN1,EN2,PWM |
| Maximum applied voltage2    | VMAX2  | 15.5       | V    | LED1,LED2,LED3,LED4                               |
| Maximum applied voltage3    | VMAX3  | 30.5       | V    | VBAT                                              |
| Maximum applied voltage4    | VMAX4  | 50.5       | V    | VDET                                              |
| Power dissipation1          | Pd1    | 560        | mW   | *1                                                |
| Power dissipation2          | Pd2    | 880        | mW   | *2                                                |
| Power dissipation3          | Pd3    | 2650       | mW   | *3                                                |
| Operating temperature range | Topr   | -30 ~ +85  | °C   | -                                                 |
| Storage temperature range   | Tstg   | -55 ~ +150 | °C   | -                                                 |

(\*1) Reduced 4.5mW/°C With Ta>25 °C when not mounted on a heat radiation Board

(\*2) Reduced 7.0mW/°C With Ta>25 °C when mounted on a 70mm x 70mm x 1.6mm glass epoxy Board which has 1 layers (60mm x 60mm).

(\*3) Reduced 21.2mW/°C With Ta>25 °C when mounted on a 70mm x 70mm x 1.6mm glass epoxy Board which has 2 layers (60mm x 60mm).

○Operating conditions (Ta=-30 to +85 °C)

| Parameter      | Symbol | Rating     |      |      | Unit | Condition |
|----------------|--------|------------|------|------|------|-----------|
|                |        | Min.       | Typ. | Max. |      |           |
| Supply voltage | VBAT   | 2.7 ~ 22.0 |      |      | V    |           |

This product isn't designed to protect itself against radioactive rays.

Status of this document

The English version of this document is the formal specification.

A customer may use this translation version only for a reference to help reading the formal version.

If there are any differences in translation version of this document, formal version takes priority.

## ○Electrical Characteristics

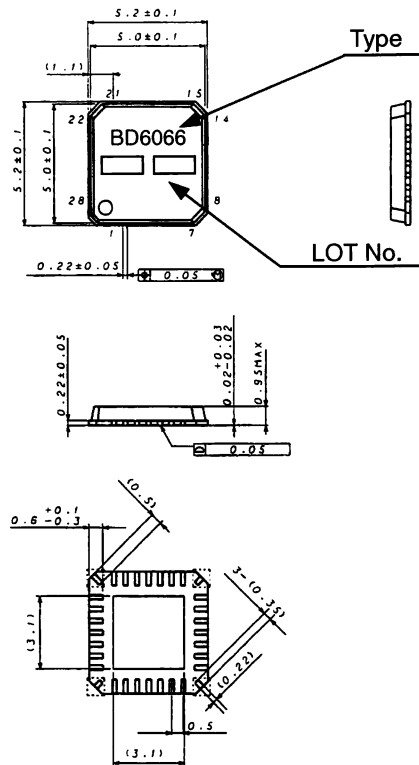
(Unless otherwise noted, VBAT=12V, Ta = +25 °C)

| Parameter                           | Symbol | Spec |      |      | Unit | Condition                                                 |
|-------------------------------------|--------|------|------|------|------|-----------------------------------------------------------|
|                                     |        | Min. | Typ. | Max. |      |                                                           |
| EN Terminal                         |        |      |      |      |      |                                                           |
| Low Input Voltage range             | VthL   | 0    | -    | 0.2  | V    |                                                           |
| High Input Voltage range1           | VthH1  | 1.4  | -    | 5.0  | V    | VBAT>5.0V                                                 |
| High Input Voltage range2           | VthH2  | 1.4  | -    | VBAT | V    | VBAT<5.0V                                                 |
| Input current                       | Iin    | -    | 8.3  | 14.0 | μA   | EN=2.5V                                                   |
| Output current                      | Iout   | -2.0 | -0.1 | -    | μA   | EN=0V                                                     |
| PWM Terminal                        |        |      |      |      |      |                                                           |
| Low Input Voltage range             | PWML   | 0    | -    | 0.2  | V    |                                                           |
| High Input Voltage range1           | PWMH1  | 1.4  | -    | 5.0  | V    | VBAT>5.0V                                                 |
| High Input Voltage range2           | PWMH2  | 1.4  | -    | VBAT | V    | VBAT<5.0V                                                 |
| PWM pull down resistor              | PWMR   | 300  | 500  | 700  | kΩ   |                                                           |
| Regulator                           |        |      |      |      |      |                                                           |
| VREG Voltage                        | VREG   | 4.0  | 5.0  | 6.0  | V    |                                                           |
| Under Voltage Lock Out              | UVLO   | 2.05 | 2.35 | 2.65 | V    |                                                           |
| Switching Regulator                 |        |      |      |      |      |                                                           |
| Input voltage range                 | Vin    | 3.1  | 12.0 | 22.0 | V    | (*1)                                                      |
| Quiescent Current 1                 | Iq1    | -    | 0.6  | 3.4  | μA   | EN=0V, VBAT=12V                                           |
| Quiescent Current 2                 | Iq2    | -    | 4.6  | 10   | μA   | EN=0V, VBAT=22V                                           |
| Current Consumption                 | Idd    | -    | 3.4  | 5.1  | mA   | EN=3.6V,<br>VDET=0V,ISET=24kΩ                             |
| LED Control voltage                 | VLED   | 0.4  | 0.5  | 0.6  | V    |                                                           |
| Over Current Limit voltage          | Ocp    | 70   | 100  | 130  | mV   | (*2)                                                      |
| SBD Open Protect                    | Sop    | -    | 0.2  | 1.4  | V    |                                                           |
| Switching frequency                 | fSW    | 0.8  | 1.0  | 1.2  | MHz  |                                                           |
| Duty cycle limit                    | Duty   | 92.5 | 95.0 | 99.0 | %    | LED1=LED2=LED3=LED4=0V                                    |
| Over Voltage Limit                  | Ovl    | 40.5 | 42.0 | 43.5 | V    | LED1=LED2=LED3=LED4=0V                                    |
| Start up time                       | Ts     | -    | 0.5  | 1.0  | ms   | Output voltage=24V                                        |
| Current driver                      |        |      |      |      |      |                                                           |
| LED maximum current                 | ILMAX  | -    | -    | 30   | mA   |                                                           |
| LED current accuracy                | ILACCU | -    | -    | ±5   | %    | ILED=20mA                                                 |
| LED current matching                | ILMAT  | -    | -    | ±3   | %    | ▪Each LED current / Average<br>(LED1,2,3,4)<br>▪ILED=20mA |
| ISET voltage                        | Iset   | 0.5  | 0.6  | 0.7  | V    |                                                           |
| LED current limiter                 | ILOCP  | 35   | 60   | 90   | mA   |                                                           |
| LED Terminal<br>OverVoltage Protect | LEDOVP | 12.5 | 13.5 | 14.5 | V    |                                                           |

(\*1) Electrical characteristics are guaranteed from 3.1V to 22V and operating is guaranteed from 2.7V to 3.1V.

(\*2) This parameter is tested with dc measurement.

## External dimensions

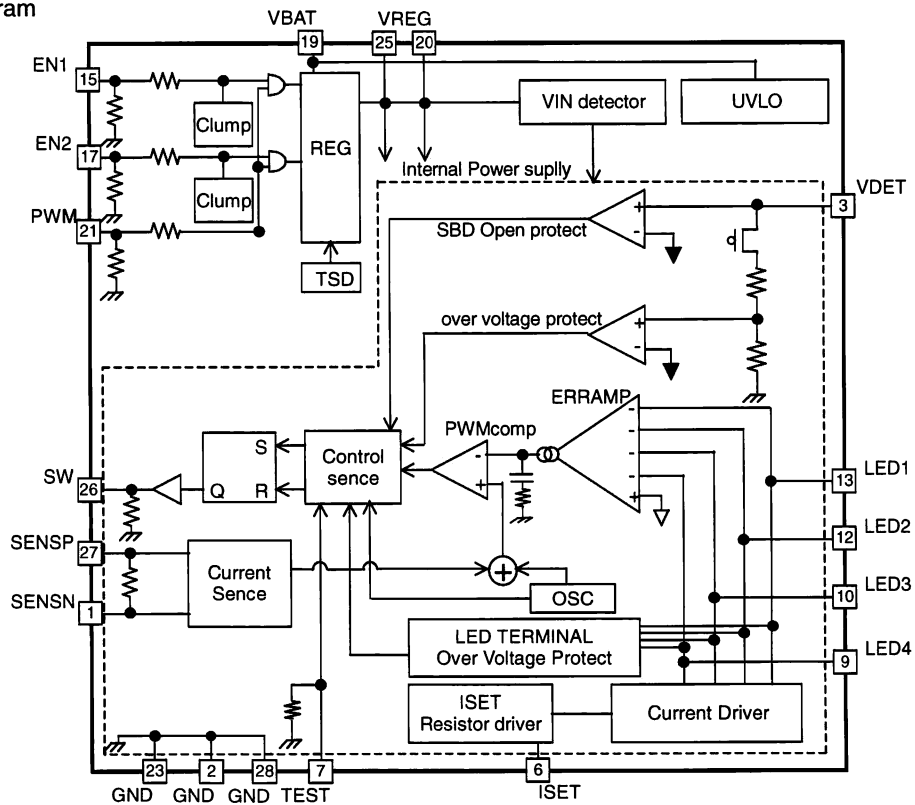


Package outline (HQQFN28V) (Unit : mm)

## Terminals

| PIN | PIN Name | PIN | PIN Name |
|-----|----------|-----|----------|
| 1   | SENSN    | 15  | EN1      |
| 2   | GND      | 16  | N.C.     |
| 3   | VDET     | 17  | EN2      |
| 4   | N.C.     | 18  | N.C.     |
| 5   | N.C.     | 19  | VBAT     |
| 6   | ISET     | 20  | VREG     |
| 7   | TEST     | 21  | PWM      |
| 8   | N.C.     | 22  | N.C.     |
| 9   | LED4     | 23  | GND      |
| 10  | LED3     | 24  | N.C.     |
| 11  | N.C.     | 25  | VREG     |
| 12  | LED2     | 26  | SW       |
| 13  | LED1     | 27  | SENSP    |
| 14  | N.C.     | 28  | GND      |

## Block diagram



○ 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 GND line

Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines. Pay attention to the interference by common impedance of layout pattern when there are plural power supplies and GND lines. Especially, when there are GND pattern for small signal and GND pattern for large current included the external circuits, please separate each GND pattern. Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. 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) GND voltage

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

(4) Short circuit between terminals 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 terminals or between the terminal and the power supply or the GND terminal, 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 terminals

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 terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics. And, as the unused input terminals may make unstable state occur in the internal circuit, please connect them to I/O GND.

(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)

When junction temperatures become 175°C (typ) 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) DC/DC converter

Please select the low DCR inductors to decrease power loss for DC/DC converter.

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