

Structure Silicon Monolithic Integrated Circuit

Product Name Compound LED Driver for cellular phone

Type **BD6088GUL**

Features Charge pump system DC/DC
LED Driver for LCD Backlight
Ambient light sensor interface/Built-in general-purpose port (With a slope circuit)

● Absolute Maximum Ratings (Ta=25 °C)

Parameter	Symbol	Limits	Unit
Maximum Applied voltage	VMAX	7	V
Power Dissipation	Pd	1380 Note1)	mW
Operating Temperature Range	Topr	-30 ~ +85	°C
Storage Temperature Range	Tstg	-55 ~ +150	°C

Note1) Power dissipation deleting is 11.04mW/°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, Ta=-30~85 °C)

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

* Radiation-proof is not designed.

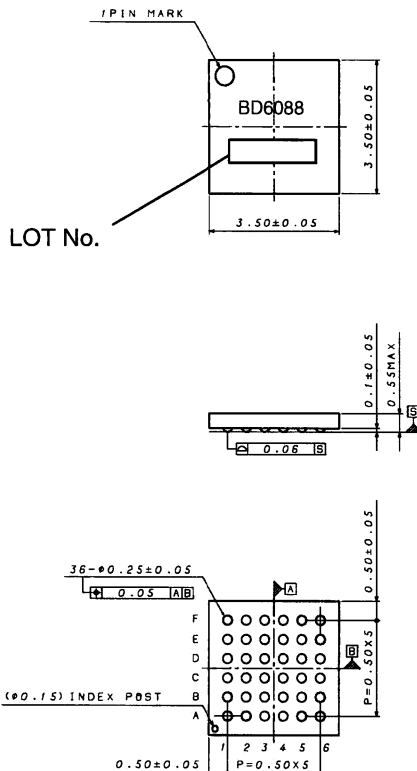
● Electrical Characteristics (Unless otherwise specified, Ta=25 °C, VBAT=3.6V, VIO= 2.6V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
【Circuit Current】						
VBAT Circuit current 1	IBAT1	-	0.1	3.0	μA	RESETB=0V, VIO= 0V
VBAT Circuit current 2	IBAT2	-	0.5	3.0	μA	RESETB=0V, VIO=2.6V
VBAT Circuit current 3	IBAT3	-	61	65	mA	DC/DC x1 mode, I _o =60mA VBAT=4.0V
VBAT Circuit current 4	IBAT4	-	92	102	mA	DC/DC x1.5 mode, I _o =60mA VBAT=3.6V
VBAT Circuit current 5	IBAT5	-	123	140	mA	DC/DC x2 mode, I _o =60mA VBAT=2.7V
VBAT Circuit current 6	IBAT6	-	0.25	1.0	mA	ALC Operating ALCEN=1, AD cycle=0.5s setting Except sensor current
【LED Driver】						
LED current Step (Setup)	I _{LEDSTP1}	128			Step	LED1~6
LED current Step (At slope)	I _{LEDSTP2}	256			Step	LED1~6
LED Maximum setup current	I _{MAXWLED}	-	25.6	-	mA	LED1~6
LED current accuracy	I _{WLED}	-7%	15	+7%	mA	I _{LED} =15mA setting, V _{LED} =1.0V
LED current Matching	I _{LEDMT}	-	-	4	%	Between LED1~6 at V _{LED} =1.0V, I _{LED} =15mA
LED OFF Leak current	I _{LKLED}	-	-	1.0	μA	V _{LED} =4.5V
【DC/DC (Charge Pump)】						
Output Voltage 1	V _{oCP1}	-	V _f +0.2	V _f +0.25	V	V _f is forward direction of LED
Output Voltage 2	V _{oCP2}	3.705	3.9	4.095	V	Fixation Voltage Output Model I _o =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	
Drive ability	I _{OUT}	-	-	150	mA	VBAT ≥ 3.2V, V _{OUT} =3.9V
Switching frequency	f _{osc}	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	V _{OUT} =0V
【Sensor Interface】						
SBIAS Output Voltage	V _{oS}	2.85	3.0	3.15	V	I _o =200μA
		2.47	2.6	2.73	V	I _o =200μA
SBIAS Maximum Output current	I _{omaxS}	30	-	-	mA	V _o =2.6V setting
SBIAS Discharge resistor at OFF	R _{OFFS}	-	1.0	1.5	kΩ	
SSENS Input range	V _{ISS}	0	-	V _{oS} × 255/256	V	
ADC resolution	ADRES	8			bit	
ADC integral calculus non-linearity	ADINL	-3	-	+3	LSB	
ADC differential calculus non-linearity	ADDNL	-1	-	+1	LSB	
【SDA, SCL】 (I²C Interface)						
L level input voltage	V _{ILI}	-0.3	-	0.25 × V _{IO}	V	
H level input voltage	V _{HI}	0.75 × V _{IO}	-	VBAT +0.3	V	
Hysteresis of Schmitt trigger input	V _{hysI}	0.05 × V _{IO}	-	-	V	
L level output voltage	V _{OLI}	0	-	0.3	V	SDA Pin, I _{OL} =3 mA
Input current	I _{inI}	-	-	1	μA	Input Voltage = 0.1×V _{IO} ~0.9×V _{IO}
【RESETB】 (CMOS Input Pin)						
L level input voltage	V _{ILR}	-0.3	-	0.25 × V _{IO}	V	
H level input voltage	V _{IHR}	0.75 × V _{IO}	-	VBAT +0.3	V	
Input current	I _{inR}	-	-	1	μA	Input Voltage = 0.1×V _{IO} ~0.9×V _{IO}

● Electrical Characteristics (Unless otherwise specified, Ta=25 °C, VBAT=3.6V, VIO= =2.6V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
【WPWMIN】 (NMOS Input Pin)						
L level input voltage	VILA	-0.3	-	0.3	V	
H level input voltage	VIHA	1.4	-	VBAT +0.3	V	
Input Current	IinA	-	-	1	μA	Input Voltage = 0.1×VBAT~0.9×VBAT
PWM input minimum High pulse width	PWmin	80	-	-	μs	WPWMIN Pin
【OUTCNT】 (Pull-down resistance NMOS Input Pin)						
L level input voltage	VILA	-0.3	-	0.3	V	
H level input voltage	VIHA	1.4	-	VBAT +0.3	V	
Input Current	IinA	-	3.6	10	μA	Vin=1.8V
【OUT1~4】 (NMOS Open Drain Output Pin)						
L level output voltage	VOLG	-	-	0.3	V	IOL=10mA
Output Leak current	ILKG	-	-	1.0	μA	Vout=3.6V
【GC1, GC2】 (Sensor Gain Control CMOS Output Pin)						
L level output voltage	VOLS	-	-	0.2	V	IOL=1mA
H level output voltage	VOHS	VoS -0.2	-	-	V	IOH=1mA
【KBLT】 (Key Back Light Control CMOS Output Pin)						
L level output voltage	VOLK	-	-	0.2	V	IOL=1mA
H level output voltage	VOHK	VIO -0.2	-	-	V	IOH=1mA
Pull-down resistance	RPUDK	-	1.0	2.0	MΩ	Vin=3.3V

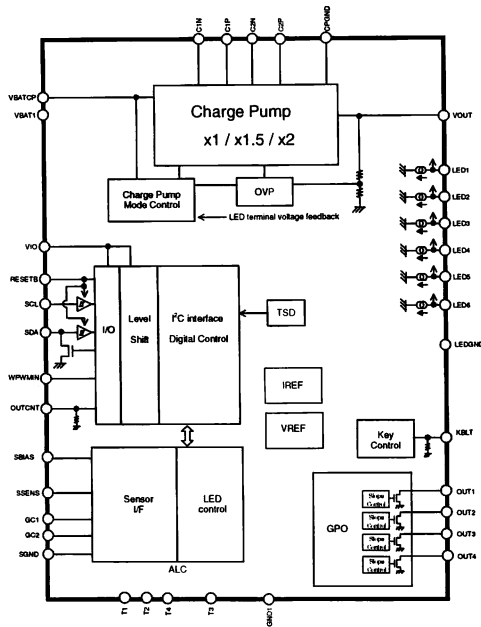
● Outside size figure



Drawing No: EX929-5005

VCSP50L3(36pin) (unit : mm)

● Block Diagram



● Pin List

PIN	PIN NAME	PIN	PIN NAME
B6	VBATCP	A2	LED1
F4	VBAT1	B1	LED2
A1	T1	B2	LED3
A6	T2	C2	LED4
F6	T3	D1	LED5
F1	T4	D2	LED6
F5	VIO	E1	SBIAS
B3	RESETB	F2	SSENS
E4	SDA	E2	GC1
D3	SCL	E3	GC2
A5	CPGND	F3	SGND
A3	GND1	D4	OUT1
C1	LEDGND	E5	OUT2
A4	C1N	D5	OUT3
C5	C1P	E6	OUT4
B5	C2N	C4	WPWMIN
C6	C2P	C3	OUTCNT
D6	VOUT	B4	KBLT

● 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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