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System Lens Driver Series for Mobile Phone Cameras

Parallel Interface Type Lens Drivers for Stepping Motor

BD6360GUL

●Description

The BD6360GUL motor driver provides 2 Full-ON Drive H-bridge channel.
It is offered in an ultra small functional lens system for use in an auto focus or zoom system using a stepping motor.
And It integrates a power supply and wave-shaping circuit for the photo-interrupter necessary in order to determine the location of the motor.

●Features

BD6360GUL

1) Ultra-small chip size package：2.1mm×2.1mm×0.55mm
2) Low ON-Resistance Power CMOS output：on high and low sides in total typ. 1.00Ω
3) ESD resistance (Human Body Model)：8kV
4) Built-in voltage-regulator circuit for photo-interrupter and comparator circuits with hysteresis for photo-interrupter output waveform
5) Input mode selection function (1.8V can be put into each control input terminal)
6) Built-in UVLO (Under Voltage Lockout Protection) function
7) Built-in TSD (Thermal Shut Down) circuit
8) Standby current consumption: 0μA Typ.

●Absolute Maximum Ratings (Ta=+25℃)

Parameter	Symbol	Limit	Unit
Power supply voltage	VCC	-0.3～+6.5	V
Control input voltage	VIN	-0.3～VCC+0.3	V
Power dissipation	Pd	730※1	mW
Operating temperature range	Topr	-25～+85	°C
Junction temperature	Tjmax	+150	°C
Storage temperature	Tstg	-55～+150	°C
H-bridge output current	Iout	-500～+500※2	mA/ch

※1 Reduced by 5.84mW/°C over 25°C, when mounted on a glass epoxy board (50mm × 58mm × 1.75mm; 8 layers)
※2 Must not exceed Pd, ASO, or Tjmax of 150°C.

●Operating Conditions

Parameter	Symbol	Limit	Unit
Power supply voltage	VCC	+2.3～+5.5	V
Control input voltage	VIN	0～VCC	V
H-bridge output current	Iout	-400～+400※3	mA/ch

※3 Must not exceed Pd or ASO.

●Electrical Characteristics

BD6360GUL Electrical Characteristics (Unless otherwise specified Ta=25°C, VCC=3.0V)

Parameter	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
Overall						
Circuit current during standby operation	ICCST	-	0	5	μA	PS=0V
Circuit current	ICC	-	1.1	1.8	mA	PS=3V with no signal, and no load
Control input (VIN=IN1A, IN1B, IN2A, IN2B, SEL, PS)						
High level input voltage	VINH	1.5	-	VCC	V	
Low level input voltage	VINL	0	-	0.5	V	
High level input current	IINH	15	30	60	μA	VINH=3V, pull down resistance typ.100kΩ
Low level input current	IINL	-1	0	-	μA	VINL=0V
UVLO						
UVLO voltage	VUVLO	1.6	-	2.2	V	
Photo-interrupter (PI) comparator						
Input bias current	IBIPI	-3	0	3	μA	
Output low level voltage	VLOPI	0	-	0.5	V	Io=+1mA
Output igh level voltage	VHIPI	VCC-0.5	-	VCC	V	Io=-1mA
Threshold voltage	VTHPI	1.2	1.3	1.4	V	Lo→Hi threshold voltage
Hysteresis voltage	VHYSPI	200	300	400	mV	Hi→Lo threshold voltage VTHPI-VHYSPI
Photo-interrupter (PI) regulator						
ON-Resistance	RONSW	-	-	10	Ω	Io=-30mA
OFF current	ILSW	-1.0	0	-	μA	BIAS=0V
Full-ON Drive block (ch1 and ch2)						
Output ON-Resistance	RON	-	1.00	1.25	Ω	Io=+400mA on high and low sides in total
Output AC characteristic						
Turn-on time	-	-	-	2.0	μs	Io=±400mA
Turn-off time	toff	-	0.08	0.5	μs	Io=±400mA
Rise time	tr	0.1	0.15	1.0	μs	Io=±400mA
Fall time	tf	-	0.03	0.2	μs	Io=±400mA

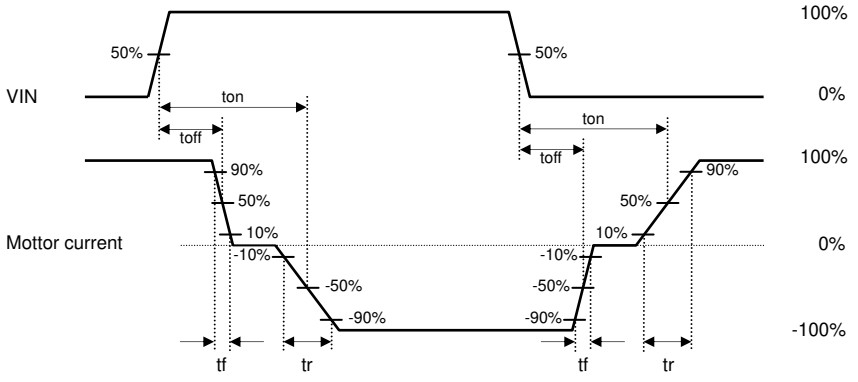


Fig.1 BD6360GUL I/O Switching Waveform

●Power Dissipation Reduction

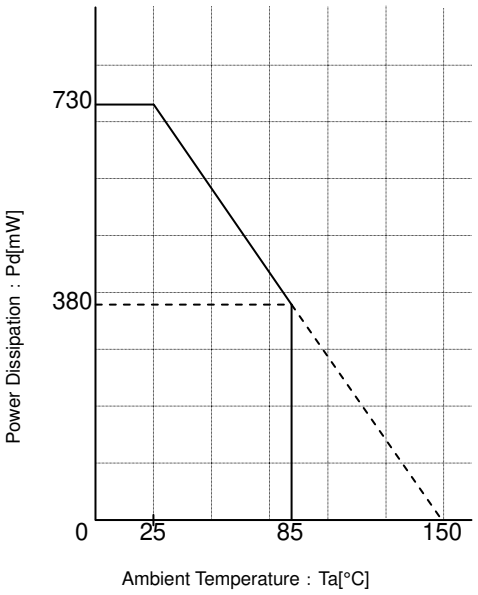


Fig.2 BD6360GUL Power Dissipation Reduction

●Electrical Characteristic Diagrams

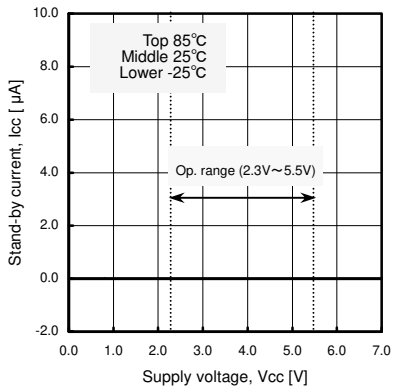


Fig.3 Standby Current

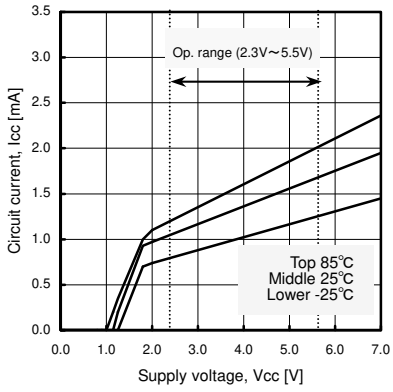


Fig.4 Circuit Current

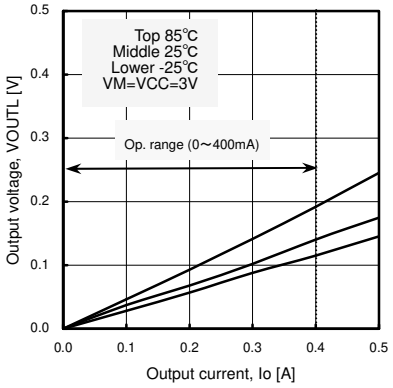


Fig.5 NMOS Output Voltage

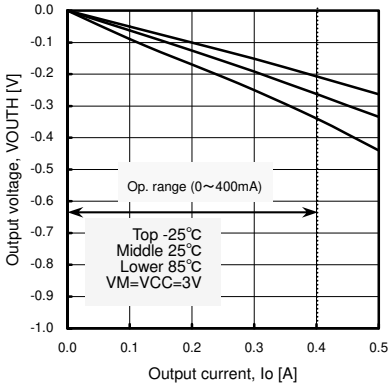


Fig.6 PMOS Output Voltage

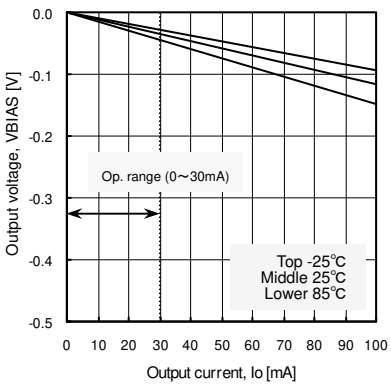


Fig.7 BIAS Output Voltage

●Block Diagram, Application Circuit Diagram, Pin Arrangement and Pin Function Table

1)BD6360GUL Block Diagram, Application Circuit Diagram, Pin Arrangement and Pin Function Table

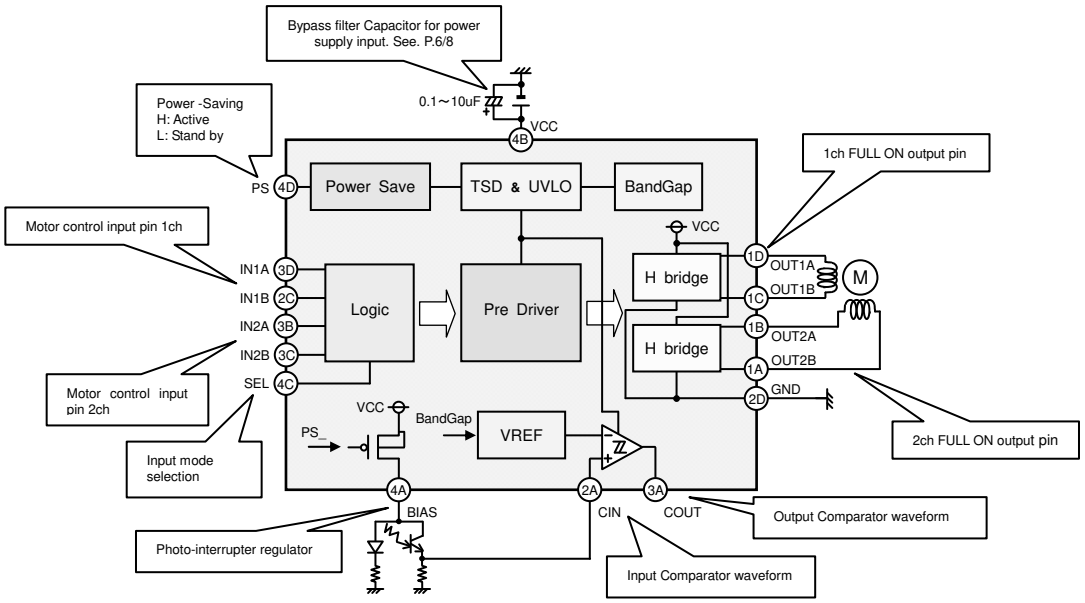


Fig.8 BD6360GUL Application Circuit Diagram

	1	2	3	4
A	OUT2B	CIN	COUT	BIAS
B	OUT2A	INDEX POST	IN2A	VCC
C	OUT1B	IN1B	IN2B	SEL
D	OUT1A	GND	IN1A	PS

Fig.9 BD6360GUL Pin Arrangement (Top View)

BD6360GUL Pin Function Table

No.	Pin name	Function
1A	OUT2B	H-bridge output pin ch2 B
2A	CIN	Comparator circuits with output waveform input pin
3A	COUT	Comparator circuits with output waveform output pin
4A	BIAS	Voltage-regulator for photo-interrupter
1B	OUT2A	H-bridge output pin ch2 A
2B		
3B	IN2A	Control input pin ch2 A
4B	VCC	Power supply pin
1C	OUT1B	H-bridge output pin ch1 B
2C	IN1B	Control input pin ch1 B
3C	IN2B	Control input pin ch2 B
4C	SEL	Input mode selection pin ch1
1D	OUT1A	H-bridge output pin ch1 A
2D	GND	Ground pin
3D	IN1A	Control input pin ch1 A
4D	PS	Power-saving pin

●I/O Truth Table

BD6360GUL I/O Truth Table (x=1or2)

mode	INPUT				OUTPUT		Output mode
	PS	SEL	INxA	INxB	OUTxA	OUTxB	
EN/IN	H	L	L	X	Z	Z	Standby
			H	L	H	L	Forward rotation
			H	H	L	H	Reverse rotation
IN/IN		H	L	L	Z	Z	Standby
			L	H	L	H	Reverse rotation
			H	L	H	L	Forward rotation
			H	H	L	L	Brake
-	L	X	X	X	Z	Z	Standby

At forward rotation, current flows from OUTxA to OUTxB. At reverse rotation, current flows form OUTxB to OUTxA.
L: Low, H: High, X: Don't care, Z: Hi impedance

●Function Explanation

1) Power save function
When the L voltage is applied the PS pin, the IC's inside circuit stop, and when 0V applied, the circuit current became 0μA(Typ.), especially.
When the IC drive, Serial input while the PS pin applied H voltage. (See the electrical characteristics; P.2/8)

2) Control Input Pin
IN1A, IN1B, IN2A, IN2B, SEL pins
The IN1A, IN1B, IN2A, IN2B are used to program and control the motor drive modes.
And, when the L voltage is applied to the SEL pin, the I/O logic can be set to EN(Enable)/IN mode, when the H voltage is applied to the one, the I/O logic can be set to IN/IN mode. (See the electrical characteristics; P2/8, and the I/O Truth Table; P5/8)

3) H-bridge on the output stage
Specify maximum current applied to the H-bridge within the operating range, in consideration of power dissipation.
(See the Operating Conditions; P.1/8)

4) Photo-interrupter regulator
Pay attention to the ON resistance with regard to the power source of the Photo interrupter.
(See the electrical characteristics; P.2/8)

5) The wave-shaping circuit convert
The wave-shaping circuit convert the distorted output signals from the photo-interrupter into clean rectangular waves, then outputs them to the DSP.
A hysteresis function is included that blocks output signal chatter caused by input signal noise.

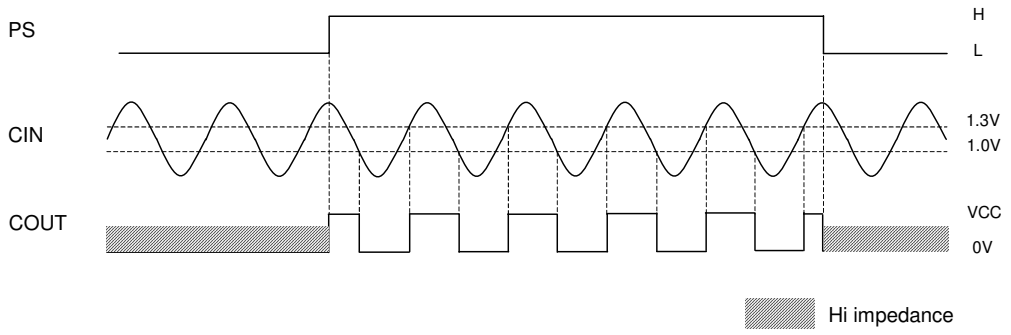


Fig.10 BD6360GUL Photo-interrupter I/O Timing Chart

●I/O Circuit Diagram

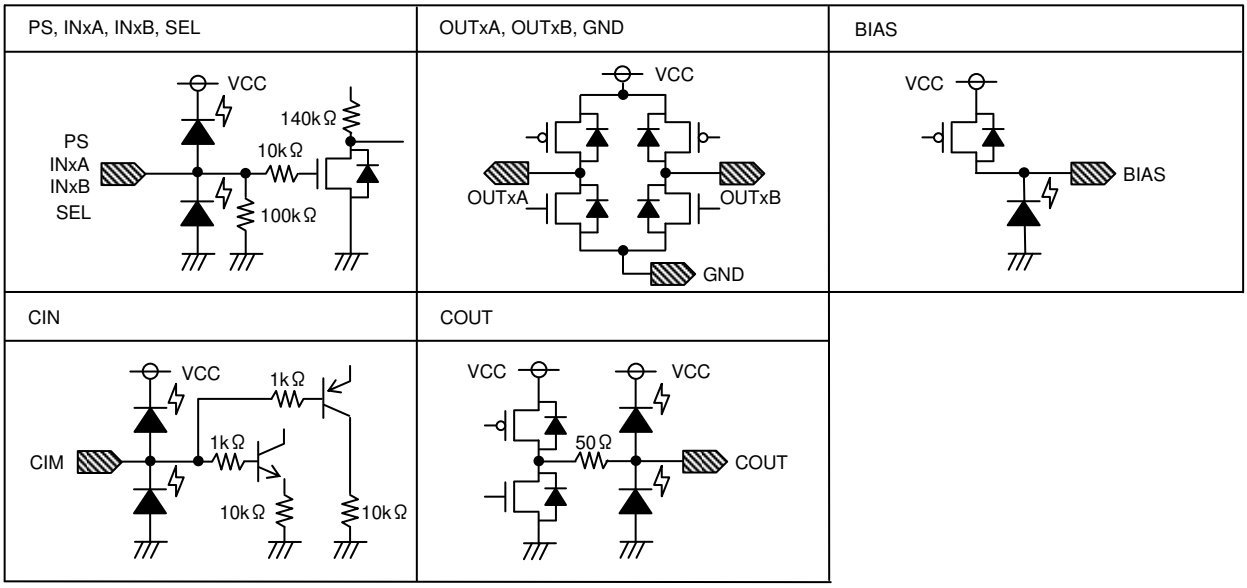


Fig.11 BD6360GUL I/O Circuit Diagram（Resistance values are typical ones）

●Operation Notes

1) Absolute maximum ratings
Use of the IC in excess of absolute maximum ratings, such as the applied voltage (VCC) or operating temperature range (Topr), may result in IC damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure, such as a fuse, should be implemented when using the IC at times where the absolute maximum ratings may be exceeded.

2) Storage temperature range (Tstg)
As long as the IC is kept within this range, there should be no problems in the IC's performance. Conversely, extreme temperature changes may result in poor IC performance, even if the changes are within the above range.

3) Power supply and wiring
Be sure to connect the power terminals outside the IC. Do not leave them open. Because a return current is generated by a counter electromotive force of the motor, take necessary measures such as putting a Capacitor between the power source and the ground as a passageway for the regenerative current. Be sure to connect a Capacitor of proper capacitance (0.1μF to 10μF) between the power source and the ground at the foot of the IC, and ensure that there is no problem in properties of electrolytic Capacitors such as decrease in capacitance at low temperatures. When the connected power source does not have enough current absorbing capability, there is a possibility that the voltage of the power source line increases by the regenerative current an exceeds the absolute maximum rating of this product and the peripheral circuits.
Therefore, be sure to take physical safety measures suc h as putting a zener diode for a voltage clamp between the power source an the ground.
For this IC with a part consists of the CMOS block, it is possible that rush current may flow instantaneously due to the unstable internal logic. Therefore, give special consideration to power coupling capacitance, width of power and ground wirings, and routing of wiring.

4) Ground terminal and wiring
The potential at GND terminals should be made the lowest under any operating conditions. Ensure that there are no terminals where the potentials are below the potential at GND terminals, including the transient phenomena. Use short and thick power source and ground wirings to ensure low impedance.

5) Thermal design
Use a proper thermal design that allows for a sufficient margin of the power dissipation (Pd) at actual operating conditions.

6) Pin short and wrong direction assembly of the device.
Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if positive and ground power supply terminals are reversed. The IC may also be damaged if pins are shorted together or are shorted to other circuit's power lines.

7) Avoiding strong magnetic field
Malfunction may occur if the IC is used around a strong magnetic field.

8) ASO
Ensure that the output transistors of the motor driver are not driven under excess conditions of the absolute maximum ratings and ASO.

9) TSD (Thermal Shut Down) circuit
If the junction temperature (Tjmax) reaches 175°C , the TSD circuit will operate, and the coil output circuit of the motor will open. There is a temperature hysterics of approximately 25°C. The TSD circuit is designed only to shut off the IC in order to prevent runaway thermal operation. It is not designed to protect the IC or guarantee its operation. The performance of the IC's characteristics is not guaranteed and it is recommended that the device is replaced after the TSD is activated.

10) Testing an application board
When testing the IC on an application board, connecting a Capacitor to a pin with low impedance subjects the IC to stress. Always discharge Capacitors after each process or step. Always turn the IC's power supply off before connecting it to, or removing it from a jig or fixture, during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting and storing the IC.

11) Regarding the input pin of the IC
This monolithic IC contains P^+ isolation and P substrate layers between adjacent elements to keep them isolated. P-N junctions are formed at the intersection of these P layers with the N layers of other elements, creating a parasitic diode or transistor. For example, the relation between each potential is as follows:

When GND > Pin A, the P-N junction operates as a parasitic diode.

When GND > Pin B, the P-N junction operates as a parasitic diode and transistor.

Parasitic elements can occur inevitably in the structure of the IC. The operation of parasitic elements can result in mutual interference among circuits, operational faults, or physical damage. Accordingly, methods by which parasitic elements operate, such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin, should not be used.

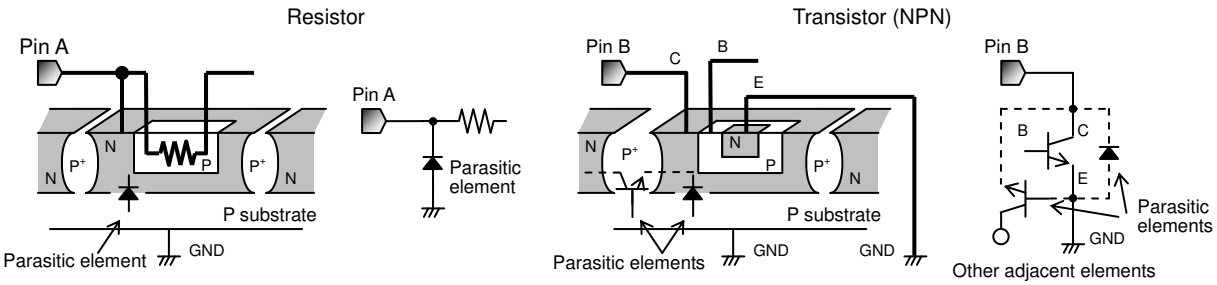


Fig.12 Example of Simple IC Architecture

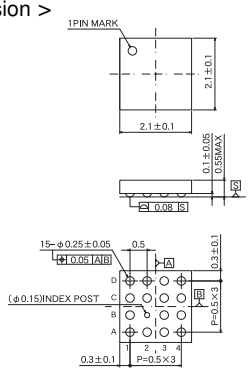
●Selecting a Model Name when Ordering

B	D	6	3	6	0	G	U	L	–	E	2

ROHM model name	Part number	Package type	Taping type
	6360 : FULL ON 2ch	GUL : VCSP50L2	E2 : Reel-wound embossed taping

VCSP50L2

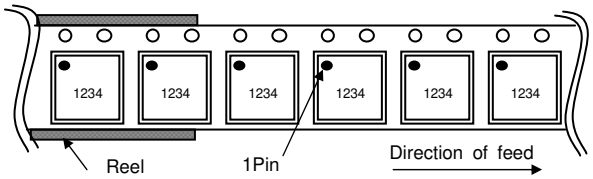
< Dimension >



(Unit:mm)

< Tape and Reel information >

Tape	Embossed carrier tape (with dry pack)
Quantity	3000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand.)



※When you order , please order in times the amount of package quantity.

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