System Lens Driver Series for Digital Still Cameras / Single-lens Reflex Cameras

1 to 2ch Lens Drivers
for Single-Lens Reflex Cameras

Pb Free
ROHM Electronic Components

RoHS
Directive Compliance

BD6735FV, BD6736FV

No.09014EAT03

● **Description**

The BD6735FV motor driver provides 2 Full-ON Drive H-bridge channels, while BD6736FV provides 1 Full-ON Drive H-bridge channel. ROHM's lens driver series features high voltage resistance and large current output in a compact surface mount package, making it ideally suited for smaller systems such as Single-Lens Reflex with Interchangeable Lenses.

● **Features**

1) Low ON-Resistance Power MOS output: Full-ON Drive block with 1.0Ω Typ. (BD6735FV)
   Full-ON Drive block with 0.35Ω Typ. (BD6736FV)
2) DMOS output allowing a range power supply: 2.0V to 8.0V (BD6735FV), 2.0V to 9.0V (BD6736FV)
3) Built-in step-up circuit for the DMOS gate voltage drive
4) Drive mode switching function
5) H bridge maximum output current: DC maximum 1.0A (BD6735FV and BD6736FV), Peak maximum 3.2A (BD6736FV)
6) UVLO (Under Voltage Lockout Protection) function
7) Built-in TSD (Thermal Shut Down) circuit
8) Standby current consumption: 0µA Typ.

● **Absolute Maximum Ratings**

Parameter	Symbol	Limit		Unit
		BD6735FV	BD6736FV	
Power supply voltage	VCC	-0.5 to +10.0	-0.5 to +10.0	V
Motor power supply voltage	VM	-0.5 to +10.0	-0.5 to +10.0	V
Charge pump step-up power supply voltage	VBST	-0.5 to +15.0	-0.5 to +15.0	V
Control input voltage	VIN	-0.5 to VCC+0.5	-0.5 to VCC+0.5	V
Power dissipation	Pd	810[※1]	810[※1]	mW
Operating temperature range	Topr	-30 to +75	-30 to +75	℃
Junction temperature	Tjmax	+150	+150	℃
Storage temperature range	Tstg	-55 to +150	-55 to +150	℃
H-bridge output current (DC)	Iout	-1000 to +1000[※2]	-1000 to +1000[※2]	mA/ch
H-bridge output current (Peak)	Ipeak	-	-3200 to +3200[※3]	mA/ch

※1 Reduced by 6.48mW/℃ over 25℃, when mounted on a glass epoxy board (70mm × 70mm × 1.6mm).
※2 Must not exceed Pd, ASO, or Tjmax of 150℃
※3 Peak=100msec

● **Operating Conditions (Ta=-30 to +75℃)**

Parameter	Symbol	Limit		Unit
		BD6735FV	BD6736FV	
Power supply voltage	VCC	2.0 to 8.0	2.0 to 9.0	V
Motor power supply voltage	VM	2.0 to 8.0	2.0 to 9.0	V
Control input voltage	VIN	0 to VCC	0 to VCC	V
Logic input frequency	FIN	0 to 100	0 to 100	kHz
Min. logic input pulse width	TIN	0.5	0.5	µs

●**Electrical Characteristics**
1) BD6735FV and BD6736FV Electrical Characteristics (Unless otherwise specified, Ta=25°C, VCC=5.0V, VM=5.0V)

| Parameter	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
Overall						
Circuit current during standby operation	ICCST	-	0	1	µA	PS=0V
Circuit current (BD6735FV)	ICC	0.5	2.0	4.0	mA	PS=H, FIN=100kHz
Circuit current (BD6736FV)	ICC	0.5	1.5	4.0	mA	PS=H, FIN=100kHz
Power saving (PS)						
High-level input voltage	VPSH	2.0	-	VCC	V	
Low-level input voltage	VPSL	-0.3	-	0.5	V	
High-level input current	IPSH	25	50	100	µA	VPSH=5V
Low-level input current	IPSL	-1	0	1	µA	VPSL=0V
Control input (BD6735FV; INxA, INxB, PWMEN, and BD6736FV; INA, INB, PWM)						
High-level input voltage	VINH	2.0	-	VCC	V	
Low-level input voltage	VINL	-0.3	-	0.7	V	
High-level input current	IINH	25	50	100	µA	VINH=5V
Low-level input current	IINL	-1	0	1	µA	VINL=0V
UVLO						
UVLO voltage	VUVLO	1.5	-	1.9	V	
BD6735FV Full-ON Drive block (ch1 and ch2)						
Output ON-Resistance	RON	-	1.0	1.35	Ω	Io=±700mA on high and low sides in total
BD6736FV Full-ON Drive block (ch1)						
Output ON-Resistance	RON	-	0.35	0.5	Ω	Io=±500mA on high and low sides in total

●**Electrical Characteristics**
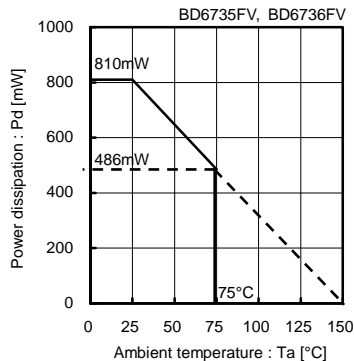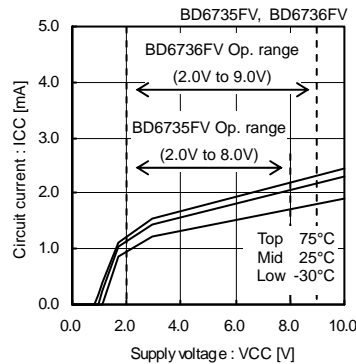

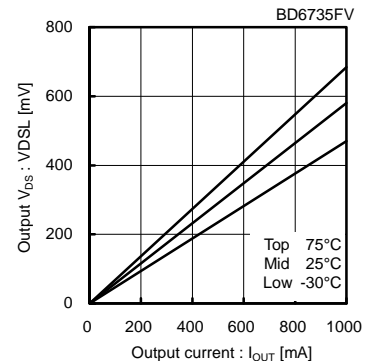Fig.1 Power Dissipation Reduction

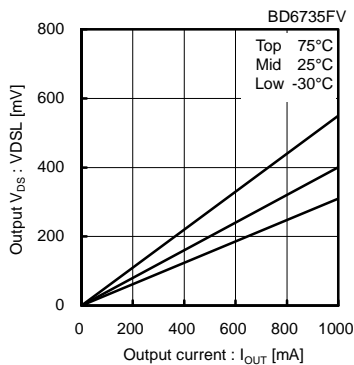Fig.2 Circuit current

Fig.3 Output ON-Voltage on High-Side
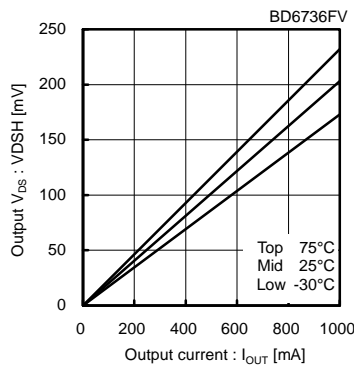

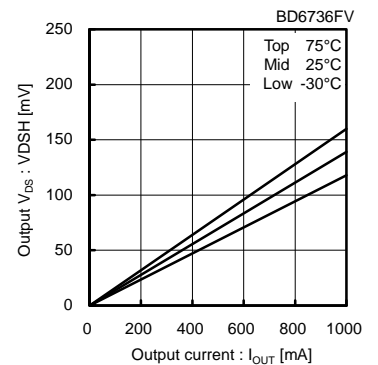Fig.4 Output ON-Voltage on Low-Side

Fig.5 Output ON-Voltage on High-Side

Fig.6 Output ON-Voltage on Low-Side

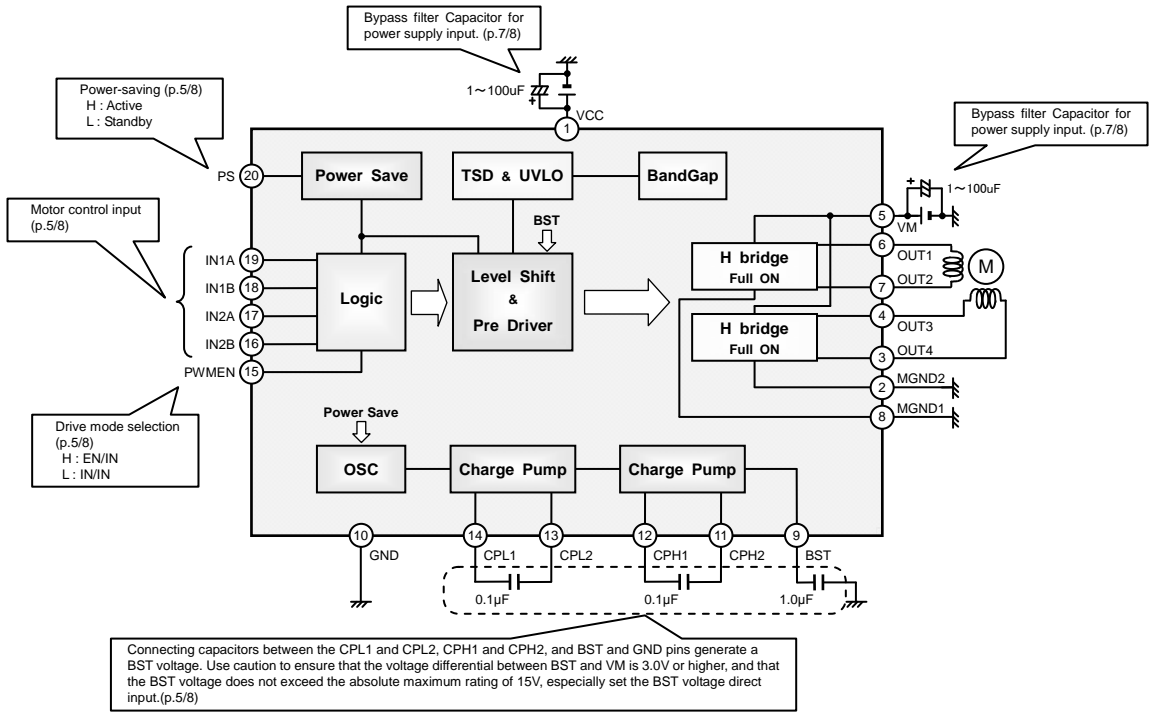## ●Application Circuit Diagram, Pin Function, and Pin Arrangement

Bypass filter Capacitor for power supply input. (p.7/8)

1~100uF

Power-saving (p.5/8)
H : Active
L : Standby

Motor control input (p.5/8)

Drive mode selection (p.5/8)
H : EN/IN
L : IN/IN

Bypass filter Capacitor for power supply input. (p.7/8)

1~100uF

Connecting capacitors between the CPL1 and CPL2, CPH1 and CPH2, and BST and GND pins generate a BST voltage. Use caution to ensure that the voltage differential between BST and VM is 3.0V or higher, and that the BST voltage does not exceed the absolute maximum rating of 15V, especially set the BST voltage direct input.(p.5/8)

Fig.7 BD6735FV Application Circuit Diagram

Fig.8 BD6735FV Pin Arrangement (Top View)

BD6735FV Pin Function Table

No.	Pin Name	Function
1	VCC	Power supply pin
2	MGND2	Motor ground pin 2
3	OUT4	H-bridge output pin 4
4	OUT3	H-bridge output pin 3
5	VM	Motor power supply pin
6	OUT1	H-bridge output pin 1
7	OUT2	H-bridge output pin 2
8	MGND1	Motor ground pin 1
9	BST	Charge pump step-up power supply pin
10	GND	Ground pin
11	CPH2	Capacitor connection pin for second charge 2
12	CPH1	Capacitor connection pin for second charge 1
13	CPL2	Capacitor connection pin for first charge 2
14	CPL1	Capacitor connection pin for first charge 1
15	PWMEN	Drive mode selection pin
16	IN2B	Control input pin ch2 B
17	IN2A	Control input pin ch2 A
18	IN1B	Control input pin ch1 B
19	IN1A	Control input pin ch1 A
20	PS	Power-saving pin

Bypass filter Capacitor for power supply input. (p.7/8)

1~100uF

VCC

Power-saving (p.5/8)
H : Active
L : Standby

Bypass filter Capacitor for power supply input. (p.7/8)

1~100uF

PS ⑲

Power Save

TSD & UVLO

BandGap

Motor control input (p.5/8)

BST

VM

INA ⑱
INB ⑰

Logic

Level Shift & Pre Driver

H bridge
Full ON

OUTA

OUTB

MGND

PWM ⑯

Power Save

Drive mode selection (p.5/8)
H : EN/IN
L : IN/IN

OSC

Charge Pump

Charge Pump

GND ⑩

CPL1 ⑮ CPL2 ⑭

CPH1 ⑬ CPH2 ⑫

BST ⑪

0.1μF

0.1μF

1.0μF

Connecting capacitors between the CPL1 and CPL2, CPH1 and CPH2, and BST and GND pins generate a BST voltage. Use caution to ensure that the voltage differential between BST and VM is 3.0V or higher, and that the BST voltage does not exceed the absolute maximum rating of 15V, especially set the BST voltage direct input. (p.5/8)
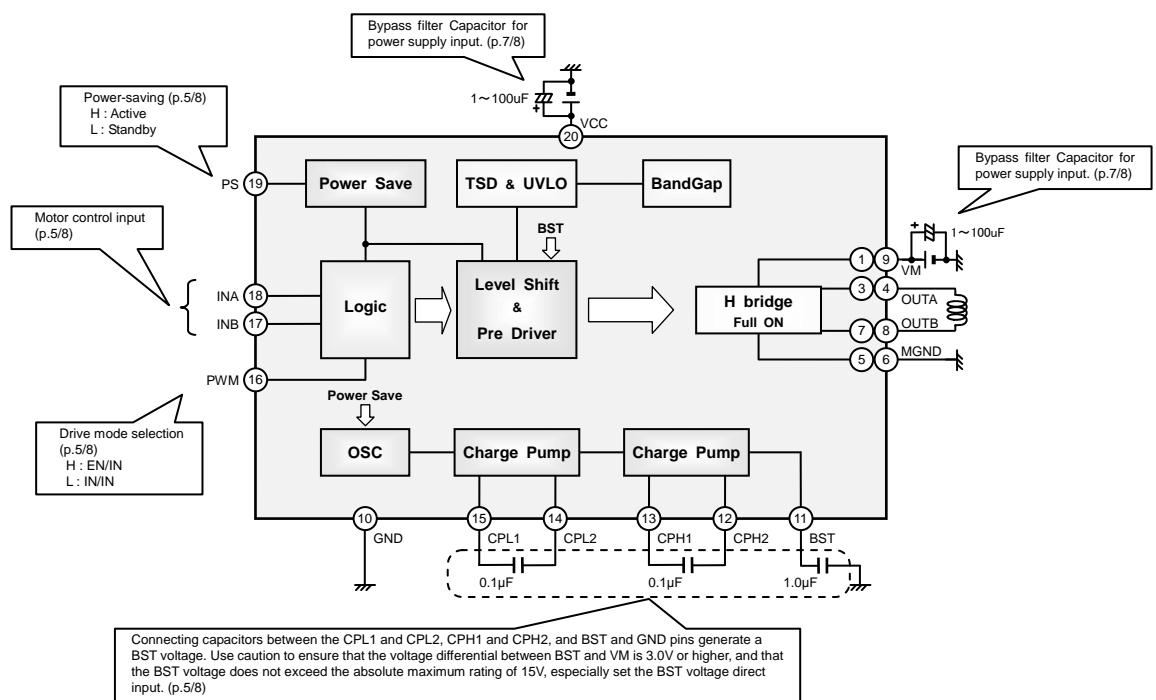
Fig.9 BD6736FV Application Circuit Diagram
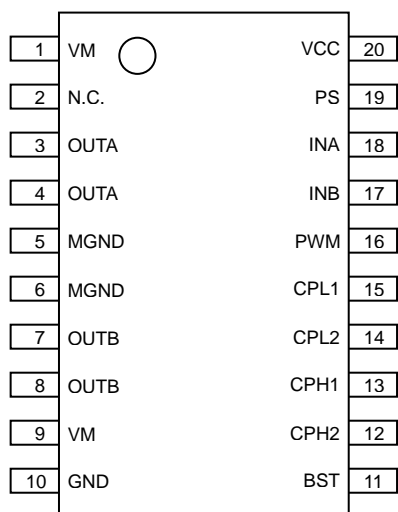
Fig.10 BD6736FV Pin Arrangement (Top View)

BD6736FV Pin Function Table

No.	Pin Name	Function
1	VM	Motor power supply pin
2	N.C.	-
3	OUTA	H-bridge output pin A
4	OUTA	H-bridge output pin A
5	MGND	Motor ground pin
6	MGND	Motor ground pin
7	OUTB	H-bridge output pin B
8	OUTB	H-bridge output pin B
9	VM	Motor power supply pin
10	GND	Ground pin
11	BST	Charge pump step-up power supply pin
12	CPH2	Capacitor connection pin for second charge 2
13	CPH1	Capacitor connection pin for second charge 1
14	CPL2	Capacitor connection pin for first charge 2
15	CPL1	Capacitor connection pin for first charge 1
16	PWM	Drive mode selection pin
17	INB	Control input pin ch1 B
18	INA	Control input pin ch1 A
19	PS	Power-saving pin
20	VCC	Power supply pin

●**Function Explanation**

1) Power-saving function

When Low-level voltage is applied to PS pin, the IC will be turned off internally and the circuit current will be 0μA (Typ.). During operating mode, PS pin should be High-level. (See the Electrical Characteristics; p.2/8)

2) Motor Control input

(1) INxA and INxB pins (BD6735FV), INA and INB pins (BD6736FV)

These pins are used to program and control the motor drive modes. (See the Electrical Characteristics; p.2/8, and I/O Truth Table; p.5/8)

(2) PWMEN pin (BD6735FV), PWM pin (BD6736FV)

When the High-level voltage is applied to the PWMEN pin (PWM pin), the I/O logic can be set to EN/IN mode. However, when the Low-level voltage is applied, the I/O logic can be set to IN/IN mode. (See the Electrical Characteristics; p.2/8, and I/O Truth Table; p.5/8)

3) H-bridge

The 2-channel H-bridges can be controlled independently. For this reason, it is possible to drive the H-bridges simultaneously, as long as the package thermal tolerances are not exceeded.

The H-bridge output transistors consist of Power DMOS with the charge pump step-up power supply BST.

The total H-bridge ON-Resistance on the high and low sides varies with the BST voltages.

4) Charge pump

Each output H-bridge on the high and low sides consists of Nch DMOS. Therefore, the gate voltage BST should be higher than the VM voltage to drive the Nch DMOS on the high side.

The BD6735FV and BD6736FV have a built-in charge pump circuit that generates BST voltage by connecting an external capacitor, between CPL1 and CPL2, CPH1 and CPH2, BST and GND.

In order to ensure better performance, the voltage differential between BST and VM must be 3.0V or higher, and the BST voltage must not exceed the absolute maximum rating of 15.0V.

●**I/O Truth Table**

BD6735FV I/O Truth Table

Drive mode	INPUT				OUTPUT		Output mode
	PS	PWM EN	IN1A/2A	IN1B/2B	OUT1/3	OUT2/4	
EN/IN	H	H	L	X	L	L	Brake
			H	L	H	L	CW
			H	H	L	H	CCW
IN/IN		L	L	L	Z	Z	Standby
			H	L	H	L	CW
			L	H	L	H	CCW
			H	H	L	L	Brake
-	L	X	X	X	Z	Z	Standby

L: Low, H: High, X: Don't care, Z: High Impedance

At CW, current flows from OUT1(3) to OUT2(4).   At CCW, current flows from OUT2(4) to OUT1(3).

BD6736FV I/O Truth Table

Drive mode	INPUT				OUTPUT		Output mode
	PS	PWM	INA	INB	OUTA	OUTB	
EN/IN	H	H	L	X	L	L	Brake
			H	L	H	L	CW
			H	H	L	H	CCW
IN/IN		L	L	L	Z	Z	Standby
			H	L	H	L	CW
			L	H	L	H	CCW
			H	H	L	L	Brake
-	L	X	X	X	Z	Z	Standby

L: Low, H: High, X: Don't care, Z: High Impedance

At CW, current flows from OUTA to OUTB.   At CCW, current flows from OUTB to OUTA.
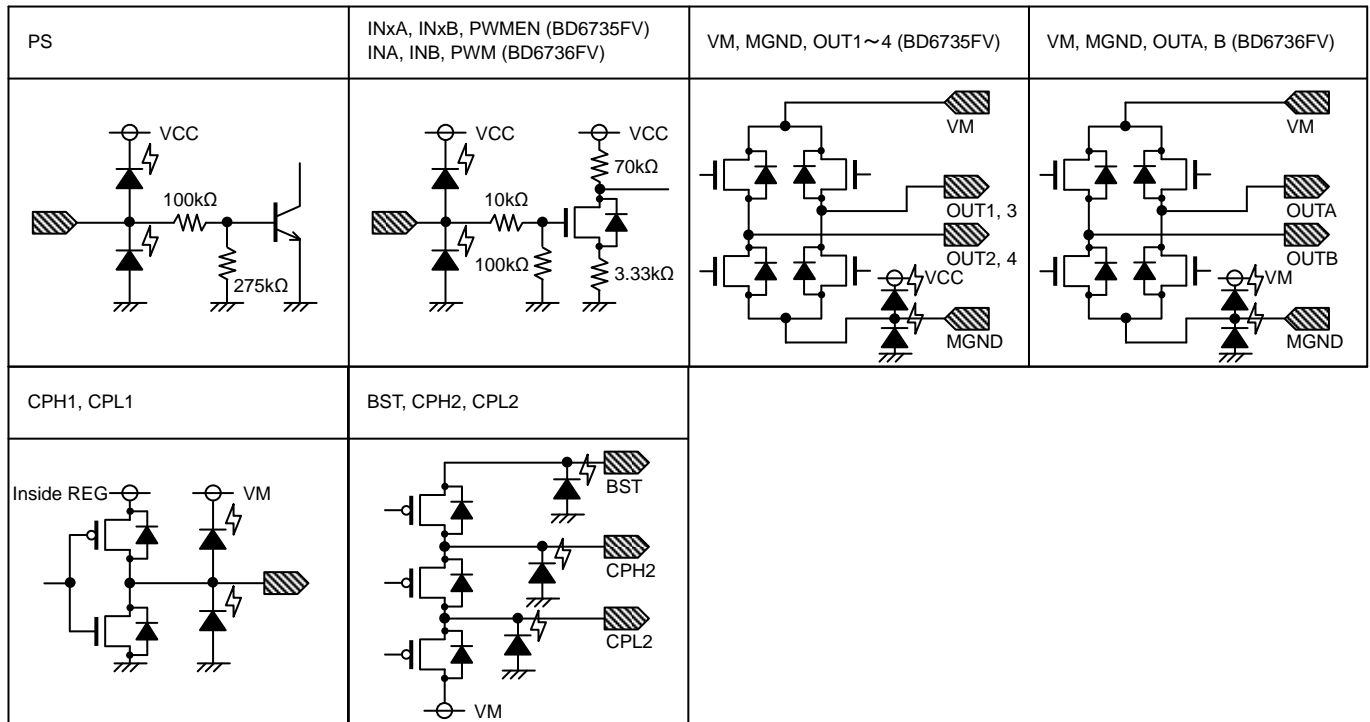
●I/O Circuit Diagram

PS	INxA, INxB, PWMEN (BD6735FV) INA, INB, PWM (BD6736FV)	VM, MGND, OUT1~4 (BD6735FV)	VM, MGND, OUTA, B (BD6736FV)
CPH1, CPL1	BST, CPH2, CPL2		

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

●**Notes for use**

1) Absolute maximum ratings

Use of the IC in excess of absolute maximum ratings such as the applied voltage or operating temperature range 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. The implementation of a physical safety measure such as a fuse should be considered when use of the IC in a special mode where the absolute maximum ratings may be exceeded is anticipated.

2) Storage temperature range

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 pins and lines

None of the VM line for the H-bridges is internally connected to the VCC power supply line, which is only for the control logic or analog circuit. Therefore, the VM and VCC lines can be driven at different voltages. Although these lines can be connected to a common power supply, do not open the power supply pin but connect it to the power supply externally.

Regenerated current may flow as a result of the motor's back electromotive force. Insert capacitors between the power supply and ground pins to serve as a route for regenerated current. Determine the capacitance in full consideration of all the characteristics of the electrolytic capacitor, because the electrolytic capacitor may loose some capacitance at low temperatures. If the connected power supply does not have sufficient current absorption capacity, regenerative current will cause the voltage on the power supply line to rise, which combined with the product and its peripheral circuitry may exceed the absolute maximum ratings. It is recommended to implement a physical safety measure such as the insertion of a voltage clamp diode between the power supply and ground pins.

For this IC with 2 power supplies and a part consists of the CMOS block, it is possible that rush current may flow instantaneously due to the internal powering sequence and delays, and to the unstable internal logic, respectively. Therefore, give special consideration to power coupling capacitance, width of power and ground wirings, and routing of wiring.

4) Ground pins and lines

Ensure a minimum GND pin potential in all operating conditions. Make sure that no pins are at a voltage below the GND at any time, regardless of whether it is a transient signal or not.

When using both small signal GND and large current MGND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the application's reference point so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

The power supply and ground lines must be as short and thick as possible to reduce line impedance.

5) Thermal design
Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in 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) Actions in strong magnetic field
Use caution when using the IC in the presence of a strong magnetic field as doing so may cause the IC to malfunction.

8) ASO
When using the IC, set the output transistor for the motor so that it does not exceed absolute maximum ratings or ASO.

9) Thermal shutdown circuit
If the junction temperature (Tjmax) reaches 175°C (BD6735FV Typ.) and 160°C (BD6736FV Typ.), the TSD circuit will operate, and the coil output circuit of the motor will open. There is a temperature hysteresis of approximately 20°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 on 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) Application example
The application circuit is recommended for use. Make sure to confirm the adequacy of the characteristics. When using the circuit with changes to the external circuit constants, make sure to leave an adequate margin for external components including static and transitional characteristics as well as dispersion of the IC.

12) Regarding 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.
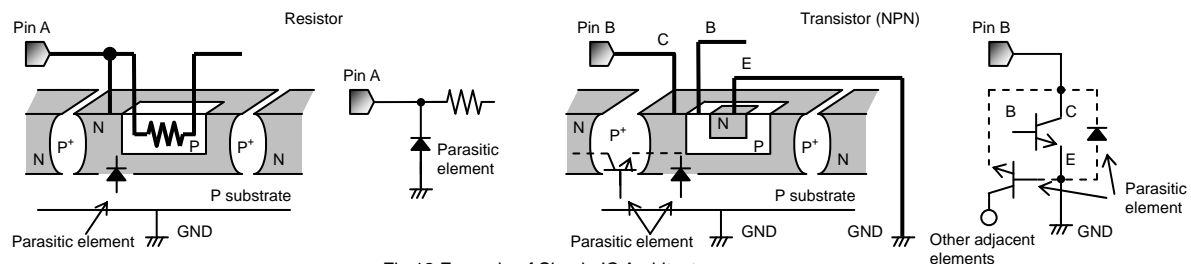

Fig.12 Example of Simple IC Architecture

●**Ordering part number**

| B | D | | 6 | 7 | 3 | 5 | | F | V | - | E | 2 |

Part No.

Part No.
6735 : 8.0V power supply voltage
6736 : 9.0V power supply voltage
      3.2A peak current

Package
FV : SSOP-B20

Packaging and forming specification
E2: Embossed tape and reel

SSOP-B20
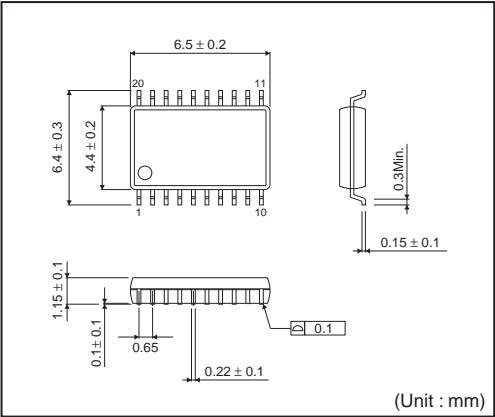
<table>
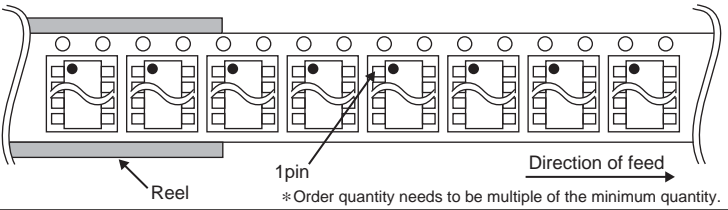<tr><td colspan="2"><Tape and Reel information></td></tr>
<tr><td>Tape</td><td>Embossed carrier tape</td></tr>
<tr><td>Quantity</td><td>2500pcs</td></tr>
<tr><td>Direction of feed</td><td>E2
(The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)</td></tr>
</table>

6.5 ± 0.2
6.4 ± 0.3
4.4 ± 0.2
0.3Min.
0.15 ± 0.1
1.15 ± 0.1
0.1± 0.1
0.65
0.22 ± 0.1
0.1

(Unit : mm)

1pin

Reel

Direction of feed

＊Order quantity needs to be multiple of the minimum quantity.

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment [Note 1], transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   - [a] Installation of protection circuits or other protective devices to improve system safety
   - [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   - [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   - [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   - [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   - [f] Sealing or coating our Products with resin or other coating materials
   - [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   - [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Notice - GE
Rev.002

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

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