

## System Lens Drivers for Digital Cameras/SLRs (Single-lens Reflex)

# 1-2ch Lens Drivers for SLRs (Single-lens Reflex)



BD65491FV, BD65492MUV

No.11014EAT05

## ●Description

The BD65491FV motor driver provides 1 Full-ON Drive H-bridge channel, while BD65492MUV provides 2 Full-ON Drive H-bridge channels. These lens driver series feature wide range operating from 1.8V and low power consumption by high switching speed in a compact surface mount package.

## ●Features

- 1) Low ON-Resistance Power DMOS output:  
Full-ON Drive block with 0.35Ω Typ. (BD65491FV)  
Full-ON Drive block with 0.9Ω Typ. (BD65492MUV)
- 2) Range of motor power supply voltage: 1.8V to 16.0V
- 3) Charge pump-less type with p-channel DMOS for the upper side transistor
- 4) The highest performance in regard to switching speed, and 4-values selection  
Turn On Time: 150ns (BD65491FV), 200ns (BD65492MUV)  
Turn Off Time: 50ns (BD65491FV), 80ns (BD65492MUV)
- 5) Drive mode switch function
- 6) Maximum output current for H-bridge:  
DC maximum 1.2A (BD65491FV), 1.0A (BD65492MUV)  
Peak maximum 4.0A (BD65491FV)
- 7) Control input pins corresponding to the signal of 1.8V system
- 8) Built-in UVLO (Under Voltage Lockout Protection) function and TSD (Thermal Shut Down) circuit
- 9) Standby current: 0μA Typ.

## ●Absolute Maximum Ratings

Parameter	Symbol	Ratings		Unit
		BD65491FV	BD65492MUV	
Power supply voltage	VCC	-0.5~+7.0	-0.5~+7.0	V
Motor power supply voltage	VM	-0.5~+20.0	-0.5~+20.0	V
Control input voltage	VIN	-0.5~VCC+0.5	-0.5~VCC+0.5	V
Power dissipation	Pd	870 <sup>*1</sup>	700 <sup>*2</sup>	mW
			2200 <sup>*3</sup>	mW
			3560 <sup>*4</sup>	mW
Junction temperature	Tjmax	+150	+150	°C
Storage temperature range	Tstg	-55~+150	-55~+150	°C
H-bridge output current (DC)	Iout	-1200~+1200 <sup>*5</sup>	-1000~+1000 <sup>*5</sup>	mA/ch
H-bridge output current (Peak <sup>*6</sup> )		-3200~+3200 <sup>*6</sup>		mA/ch
H-bridge output current (Peak <sup>*7</sup> )		-4000~+4000 <sup>*7</sup>		mA/ch

\*1 Reduced by 6.96mW/°C over 25°C, when mounted on a glass epoxy board (70mm × 70mm × 1.6mm)

\*2 Reduced by 5.6mW/°C over 25°C, when mounted on a glass epoxy 1-layer board (74.2mm × 74.2mm × 1.6mm).  
In surface layer copper foil area: 10.29mm<sup>2</sup>

\*3 Reduced by 17.6mW/°C over 25°C, when mounted on a glass epoxy 4-layers board (74.2mm × 74.2mm × 1.6mm).  
In surface & the back layers copper foil area: 10.29mm<sup>2</sup>, in 2&3-layers copper foil area: 5505mm<sup>2</sup>.

\*4 Reduced by 28.4mW/°C over 25°C, when mounted on a glass epoxy 4-layers board (74.2mm × 74.2mm × 1.6mm).  
In all 4-layers copper foil area: 5505mm<sup>2</sup>.

\*5 Must not exceed Pd, ASO, or Tjmax of 150°C.

\*6 Peak=100msec (Duty≤20%)

\*7 Peak=10msec (Duty≤5%)

●Operating Conditions (Ta=-30 to +85°C)

Parameter	Symbol	Ratings		Unit
		BD65491FV	BD65492MUV	
Power supply voltage	VCC	2.5~5.5	2.5~5.5	V
Motor power supply voltage	VM	1.8~16.0	1.8~16.0	V
Control input voltage	VIN	0~VCC	0~VCC	V
Logic input frequency	FIN	0~500	0~500	kHz
Min. logic input pulse width	TIN	0.2* <sup>8</sup>	0.5	μs

\*8 TR1=TR2=Lo

●Electrical Characteristics (Unless otherwise specified Ta=+25°C, VCC=3.0V, VM=5.0V)

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
All Circuits						
Stand-by Current	I <sub>CCST</sub>	-	0	1	μA	V <sub>PS</sub> =0V
Circuit Current1 (BD65491FV)	I <sub>CC1</sub>	0.5	0.80	1.25	mA	V <sub>PS</sub> =3V, Open Mode
Circuit Current1 (BD65492MUV)	I <sub>CC1</sub>	0.5	0.90	1.25	mA	V <sub>PS</sub> =3V, Open Mode
Circuit Current2 (BD65491FV)	I <sub>CC2</sub>	0.5	0.85	1.3	mA	V <sub>PS</sub> =3V, CW & CCW Mode
Circuit Current2 (BD65492MUV)	I <sub>CC2</sub>	0.5	0.95	1.3	mA	V <sub>PS</sub> =3V, CW & CCW Mode
Circuit Current3 (BD65491FV)	I <sub>CC3</sub>	0.5	0.85	1.3	mA	V <sub>PS</sub> =3V, Short Brake Mode
Circuit Current3 (BD65492MUV)	I <sub>CC3</sub>	0.5	0.95	1.3	mA	V <sub>PS</sub> =3V, Short Brake Mode
PS Input (PS)						
High-level input voltage	V <sub>PSH</sub>	1.45	-	VCC	V	
Low-level input voltage	V <sub>PSL</sub>	0	-	0.5	V	
High-level input current	I <sub>PSH</sub>	15	30	60	μA	V <sub>PS</sub> =3V
Low-level input current	I <sub>PSL</sub>	-1	0	1	μA	V <sub>PS</sub> =0V
Control Input (IN=BD65491FV: INA, INB, PWM, TR1, TR2) (IN=BD65492MUV: IN1A, IN1B, IN2A, IN2B, PWM)						
High-level input voltage	V <sub>INH</sub>	1.45	-	VCC	V	
Low-level input voltage	V <sub>INL</sub>	0	-	0.5	V	
High-level input current	I <sub>INH</sub>	15	30	60	μA	V <sub>IN</sub> =3V
Low-level input current	I <sub>INL</sub>	-1	0	1	μA	V <sub>IN</sub> =0V
Under Voltage Locked Out (UVLO)						
UVLO Voltage	V <sub>UVLO</sub>	2.0	-	2.4	V	
BD65491FV Full ON type H-Bridge Driver (ch1)						
Output ON-Resistance	R <sub>ON</sub>	-	0.35	0.5	Ω	I <sub>o</sub> =±500mA, Upper & Lower total
Turn On Time 0	T <sub>ON0</sub>	-	150	300	ns	20Ω Loading, TR1=Lo, TR2=Lo
Turn Off Time 0	T <sub>OFF0</sub>	-	50	200	ns	20Ω Loading, TR1=Lo, TR2=Lo
Turn On Time 1	T <sub>ON1</sub>	-	250	500	ns	20Ω Loading, TR1=Hi, TR2=Lo
Turn Off Time 1	T <sub>OFF1</sub>	-	70	200	ns	20Ω Loading, TR1=Hi, TR2=Lo
Turn On Time 2	T <sub>ON2</sub>	-	350	800	ns	20Ω Loading, TR1=Lo, TR2=Hi
Turn Off Time 2	T <sub>OFF2</sub>	-	90	250	ns	20Ω Loading, TR1=Lo, TR2=Hi
Turn On Time 3	T <sub>ON3</sub>	-	500	1000	ns	20Ω Loading, TR1=Hi, TR2=Hi
Turn Off Time 3	T <sub>OFF3</sub>	-	110	250	ns	20Ω Loading, TR1=Hi, TR2=Hi
BD65492MUV Full ON type H-Bridge Driver (ch1,ch2)						
Output ON-Resistance	R <sub>ON</sub>	-	0.9	1.2	Ω	I <sub>o</sub> =±500mA, Upper & Lower total
Turn On Time	T <sub>ON</sub>	-	200	400	ns	20Ω Loading
Turn Off Time	T <sub>OFF</sub>	-	80	400	ns	20Ω Loading

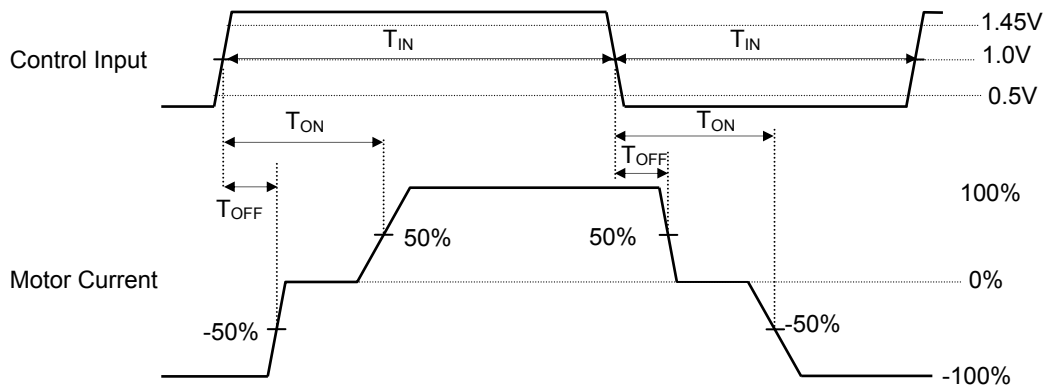


Fig.1 Definition of AC characteristic from control input to motor motion

●Reference data

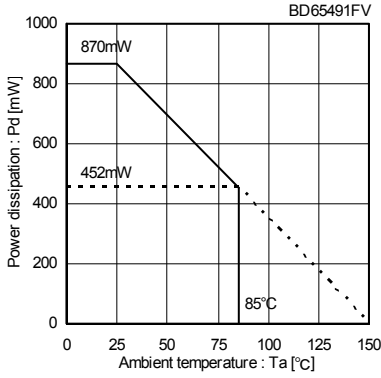


Fig.2 Power Dissipation Curve

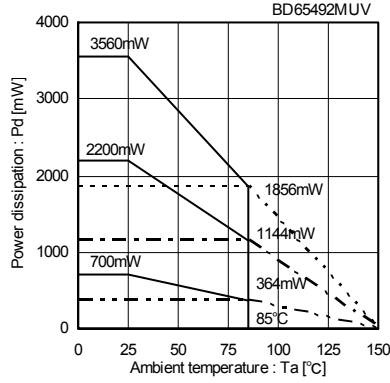


Fig.3 Power Dissipation Curve

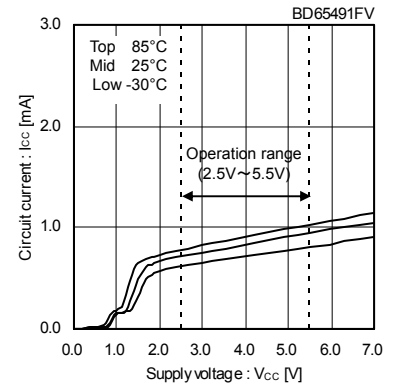


Fig.4 Circuit current (Open Mode)

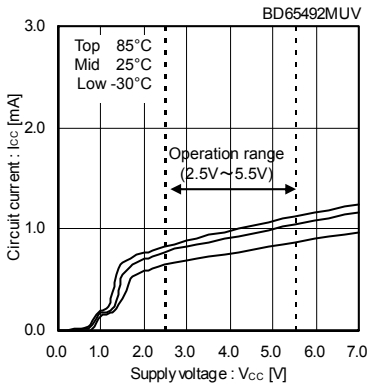


Fig.5 Circuit current (Open Mode)

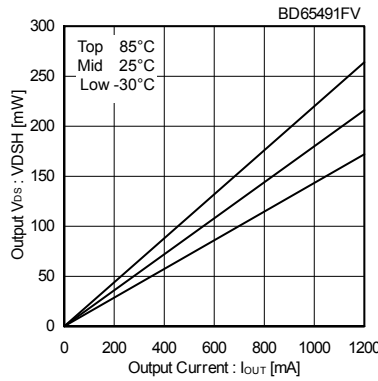


Fig.6 Output ON-Resistance on High-Side (VM=5V, Vcc=3V)

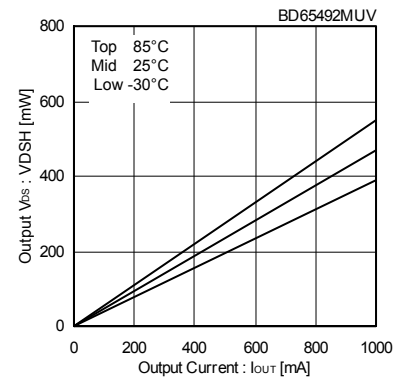


Fig.7 Output ON-Resistance on High-Side (VM=5V, Vcc=3V)

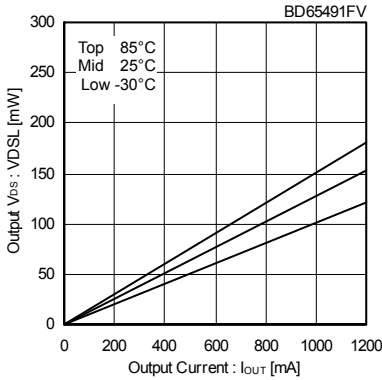


Fig.8 Output ON-Resistance on Low-Side (VM=5V, Vcc=3V)

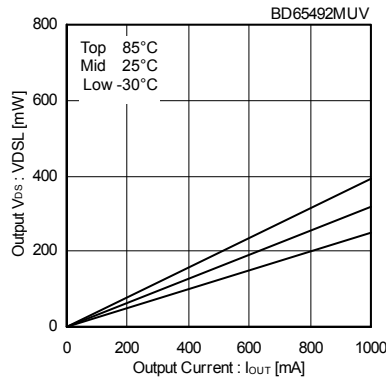


Fig.9 Output ON-Resistance on Low-Side (VM=5V, Vcc=3V)

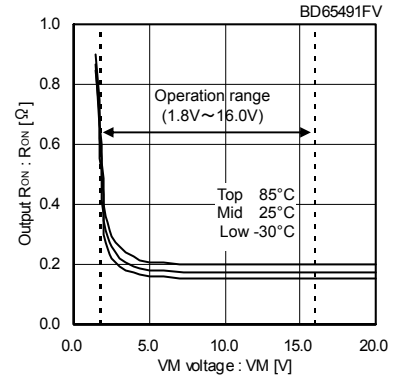


Fig.10 Output ON-Resistance on High-Side (VM Dependency, Vcc=3V)

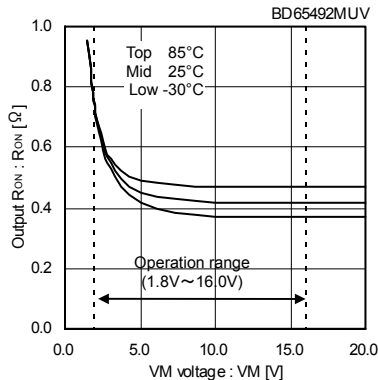


Fig.11 Output ON-Resistance on High-Side (VM Dependency, Vcc=3V)

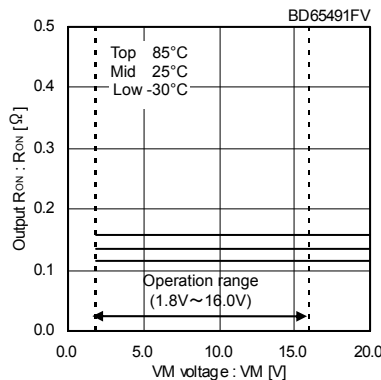


Fig.12 Output ON-Resistance on Low-Side (VM Dependency, Vcc=3V)

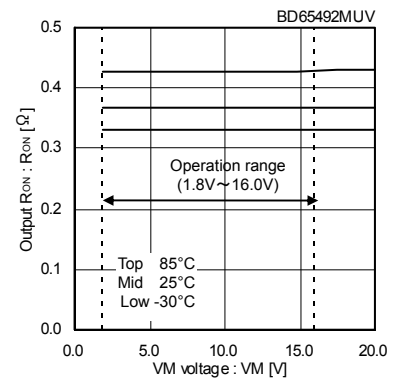


Fig.13 Output ON-Resistance on Low-Side (VM Dependency, Vcc=3V)

●Application Circuit Diagram, Pin Function, Pin Arrangement, and I/O Circuit Diagram

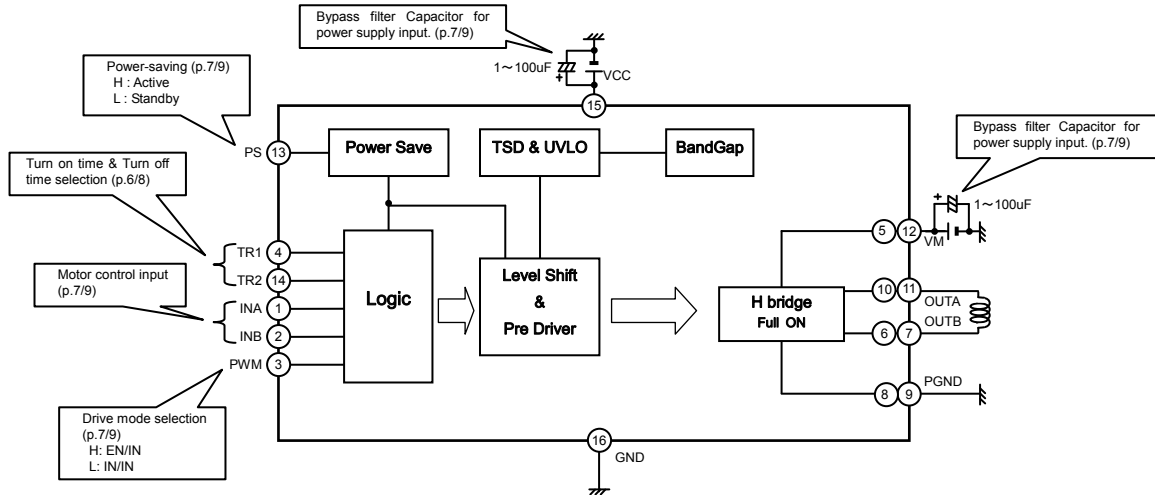
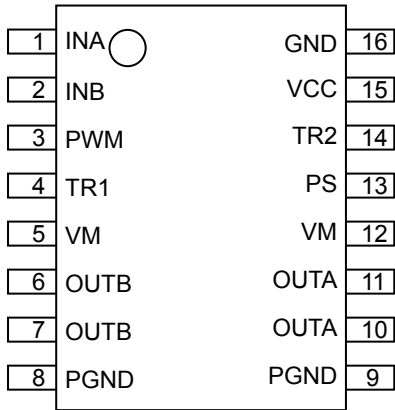


Fig.14 BD65491FV Application Circuit

OBD65491FV Pin Function



No.	Pin Name	Function
1	INA	Control input pin A
2	INB	Control input pin B
3	PWM	Drive mode selection pin
4	TR1	Turn On Time & Turn Off Time selection pin 1
5	VM	Motor power supply pin
6	OUTB	H-bridge output pin B
7	OUTB	H-bridge output pin B
8	PGND	Motor ground pin
9	PGND	Motor ground pin
10	OUTA	H-bridge output pin A
11	OUTA	H-bridge output pin A
12	VM	Motor power supply pin
13	PS	Power-saving pin
14	TR2	Turn On Time & Turn Off Time selection pin 2
15	VCC	Power supply pin
16	GND	Ground pin

Fig.15 BD65491FV Pin Arrangement (Top View)

Each of the same named terminals (VM, PGND, OUTA, OUTB) must be connected together on the PCB (Printed Circuit Board).

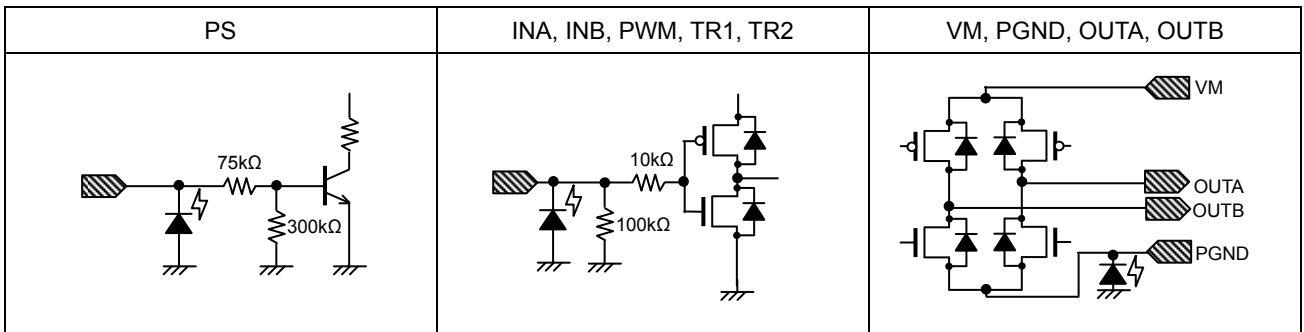


Fig.16 BD65491FV I/O Circuit Diagram

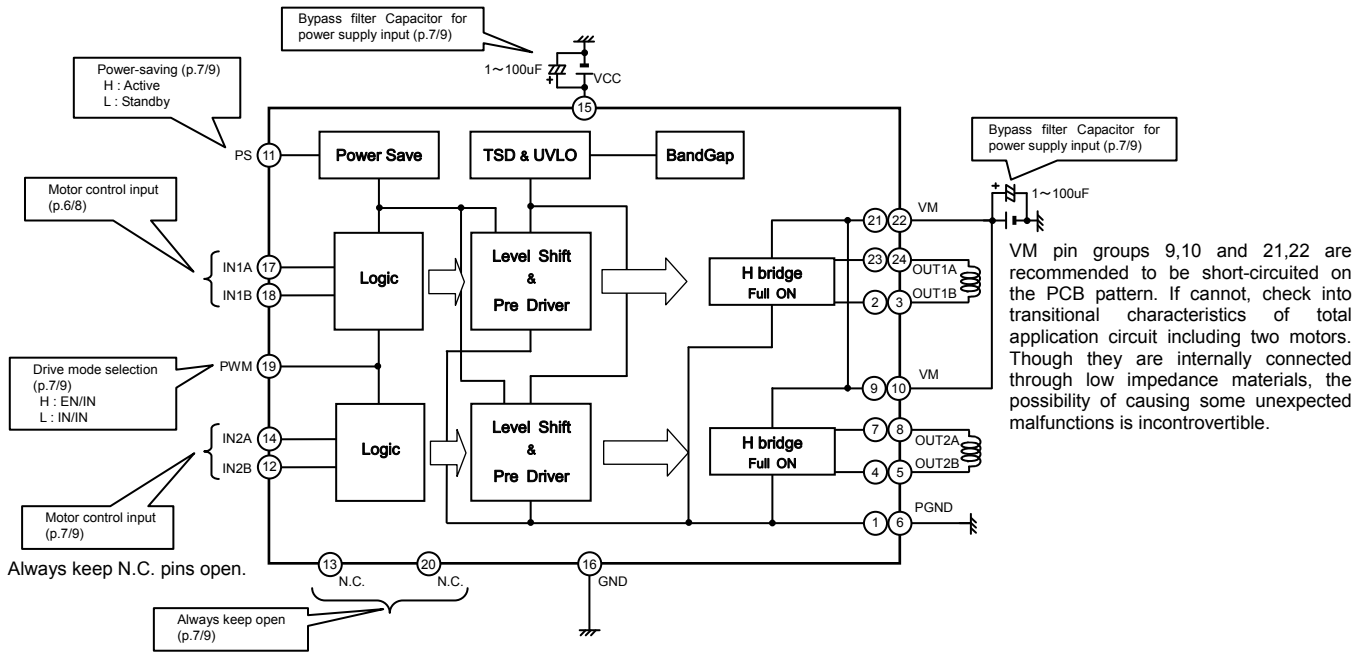


Fig.17 BD65492MUV Application Circuit

OBD65492MUV Pin Function

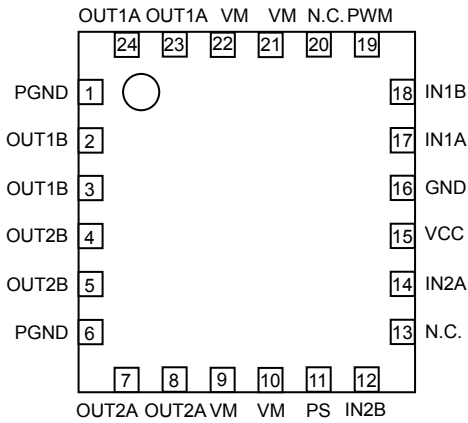


Fig. 18 BD65492MUV Pin Arrangement (Top View)

Each of the same named terminals (VM, PGND, OUT1A, OUT1B, OUT2A, OUT2B) must be connected together on the PCB (Printed Circuit Board).

No.	Pin Name	Function
1	PGND	Motor ground pin
2	OUT1B	H-bridge output pin ch.1 B
3	OUT1B	H-bridge output pin ch.1 B
4	OUT2B	H-bridge output pin ch.2 B
5	OUT2B	H-bridge output pin ch.2 B
6	PGND	Motor ground pin
7	OUT2A	H-bridge output pin ch.2 A
8	OUT2A	H-bridge output pin ch.2 A
9	VM	Motor power supply pin
10	VM	Motor power supply pin
11	PS	Power-saving pin
12	IN2B	Control input pin ch.2 B
13	N.C.	
14	IN2A	Control input pin ch.2 A
15	VCC	Power supply pin
16	GND	Ground pin
17	IN1A	Control input pin ch.1 A
18	IN1B	Control input pin ch.1 B
19	PWM	Drive mode selection pin
20	N.C.	
21	VM	Motor power supply pin
22	VM	Motor power supply pin
23	OUT1A	H-bridge output pin ch.1 A
24	OUT1A	H-bridge output pin ch.1 A

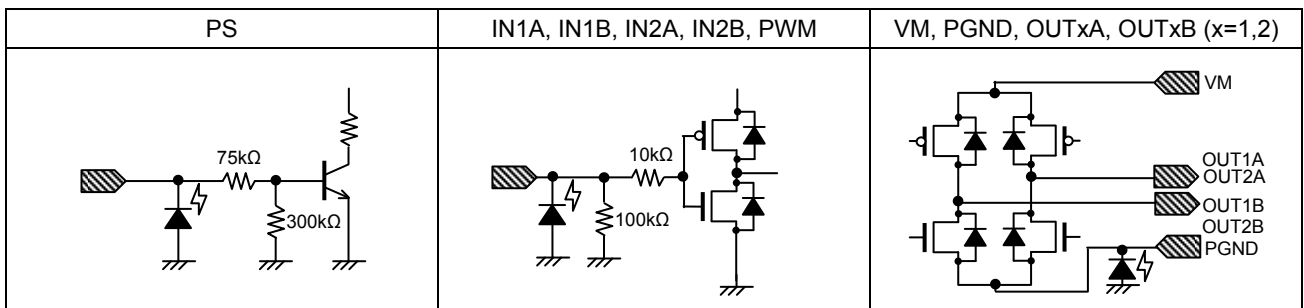


Fig. 19 BD65492MUV I/O Circuit Diagram

●Function Explanation

1) Power-saving function

When Low-level voltage is applied to PS pin, the IC will be turned off internally. During operating mode, PS pin should be High-level. (See the Electrical Characteristics; p.2/9)

2) Control input

(1) INA and INB pin (BD65491FV) IN1A, IN1B, IN2A and IN2B pin (BD65492MUV)

These pins are used to program and control the motor drive modes.  
(See the Electrical Characteristics; p.2/9, and I/O Truth Table; p.7/9)

(2) PWM pin

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.2/9, and I/O Truth Table; p.7/9)

(3) TR1 and TR2 pin (BD65491FV)

These pins are used to control the turn on time and turn off time for H-bridge transistors.  
(See the Electrical Characteristics; p.2/9, and I/O Truth Table; p.7/9)

3) VM pins

The 2-channel H-bridges (BD65492MUV) can be controlled independently.  
But control two motors at same voltage, because each VM pin is internally short-circuited.  
(See the Application Circuit; p.6/9)

●I/O Truth Table

BD65491FV I/O Truth Table

Input Mode	INPUT				OUTPUT		Mode	
	PS	PWM	INA	INB	OUTA	OUTB		
EN/IN	H	H	L	X	L	L	Short Brake	
			H	L	H	L	CW	
			H	H	L	H	CCW	
IN/IN		L	L	L	L	Z	Z	Open
				H	L	H	L	CW
				L	H	L	H	CCW
-		L	X	H	H	L	L	Short Brake
	X			X	Z	Z	Open	
	X			X	Z	Z	Open	

L : Low, H : High, X : Don't care, Z : Hi impedance  
CW : current flows from OUTA to OUTB, CCW : current flows from OUTB to OUTA

BD65492MUV I/O Truth Table

Input Mode	INPUT				OUTPUT		Mode	
	PS	PWM	IN1A/2A	IN1B/2B	OUT1A/2A	OUT1B/2B		
EN/IN	H	H	L	X	L	L	Short Brake	
			H	L	H	L	CW	
			H	H	L	H	CCW	
IN/IN		L	L	L	L	Z	Z	Open
				H	L	H	L	CW
				L	H	L	H	CCW
-		L	X	H	H	L	L	Short Brake
	X			X	Z	Z	Open	
	X			X	Z	Z	Open	

L : Low, H : High, X : Don't care, Z : Hi impedance  
CW : current flows from OUTxA to OUTxB, CCW : current flows from OUTxB to OUTxA (X=1,2)

BD65491FV Turn On Time & Turn Off Time Truth Table for H-Bridge Transistors

TR1	TR2	Turn On Time [ns]	Turn Off Time [ns]
L	L	150	50
H	L	250	70
L	H	350	90
H	H	500	110

L : Low, H : High

●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 (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. 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) Power supply pins and lines  
None of the VM line for the H-bridge 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 lose 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.
  - 3) 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 PGND 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.
  - 4) Thermal design  
Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.
  - 5) 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.
  - 6) ASO  
When using the IC, set the output transistor for the motor so that it does not exceed absolute maximum ratings or ASO.
  - 7) Thermal shutdown circuit  
This IC incorporates a TSD (thermal shutdown) circuit. If the temperature of the chip reaches the following temperature, the motor coil output will be opened. The TSD circuit is designed only to shut the IC off to prevent runaway thermal operation. It is not designed to protect the IC or guarantee its operation. Do not continue to use the IC after operating this circuit or use the IC in an environment where the operation of this circuit is assumed.
- | TSD ON temperature [°C] (Typ.) | Hysteresis temperature [°C] (Typ.) |
|--------------------------------|------------------------------------|
| 175                            | 20                                 |
- 8) N.C. PIN  
Always keep N.C. pins open.
  - 9) Thermal PAD  
Connect the Thermal PAD with a small signal GND terminal.
  - 10) 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.

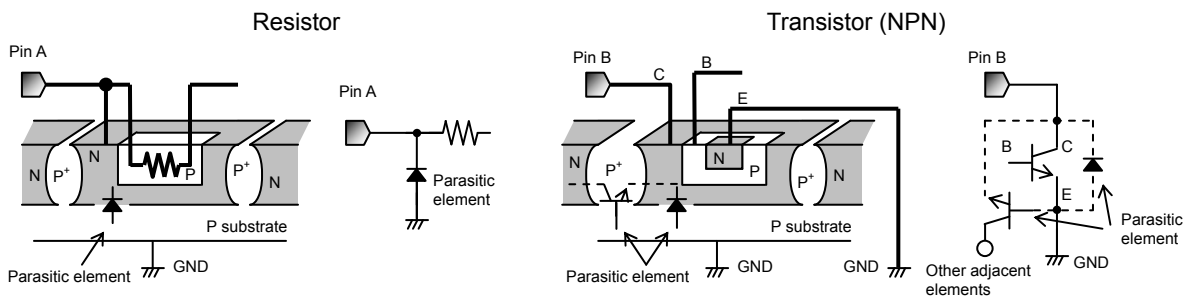


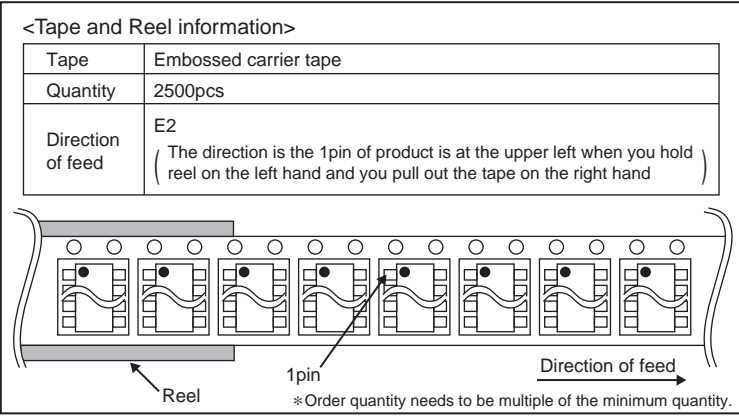
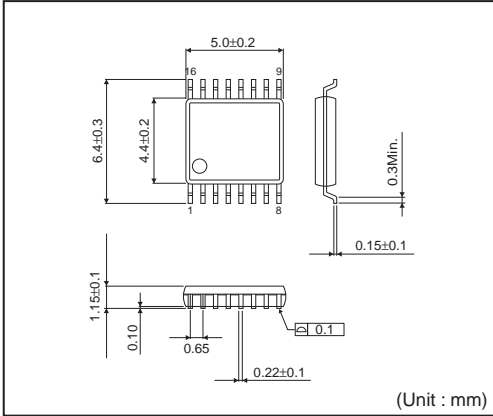
Fig.20 Example of Simple IC Architecture



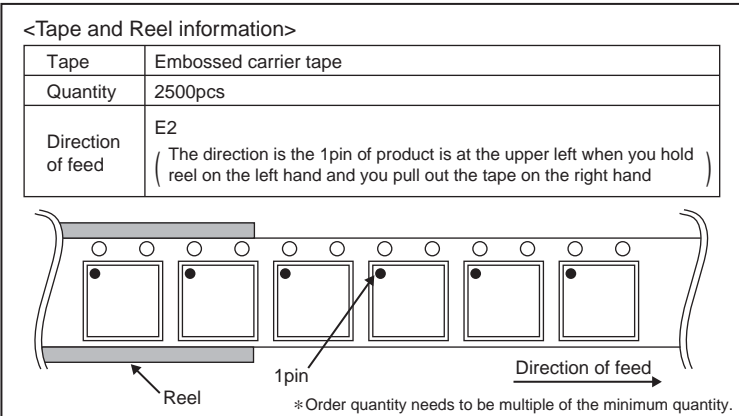
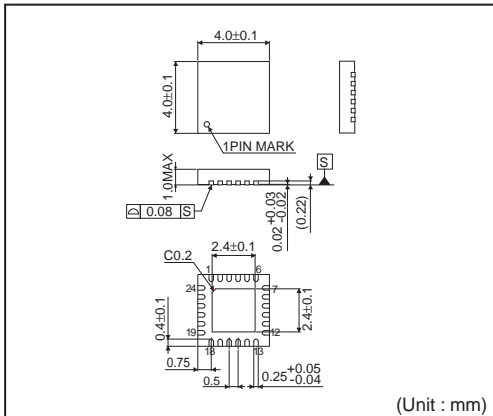
●Ordering part number

B	D	6	5	4	9	2	M	U	V	-	E	2
Part No.名		Part No. 65491 = 1ch 65492 = 2ch.					Package FV :SSOP-B16 MUV :VQFN024V4040			Packaging and forming specification E2: Embossed tape and reel		

SSOP-B16



VQFN024V4040



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The Products are not designed or manufactured to be used with any equipment, device or system which requires an extremely high level of reliability the failure or malfunction of which may result in a direct threat to human life or create a risk of human injury (such as a medical instrument, transportation equipment, aerospace machinery, nuclear-reactor controller, fuel-controller or other safety device). ROHM shall bear no responsibility in any way for use of any of the Products for the above special purposes. If a Product is intended to be used for any such special purpose, please contact a ROHM sales representative before purchasing.

If you intend to export or ship overseas any Product or technology specified herein that may be controlled under the Foreign Exchange and the Foreign Trade Law, you will be required to obtain a license or permit under the Law.



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More detail product informations and catalogs are available, please contact us.

### ROHM Customer Support System

<http://www.rohm.com/contact/>