

High efficiency switching-type motor driver

BP5807

The BP5807 is an output-variable type 3-output DC motor driver module. This module can change the output voltage for driving the DC motor by inputting PWM signal or DC voltage into the control terminal. The power conversion rate is high, and power saving of the application can be realized, since the input voltage can be changed into the specified output voltage by the switching system. Further, this module can be used as the output-variable type DC / DC converter as well.

● Applications

Refrigerator, The rotation-control type DC motor driver and the output-variable type DC / DC converter

● Features

- 1) Electrical power loss is small even when there is a difference between the input voltage and motor driving voltage, since electrical power conversion efficiency is high (90% Typ.) as the switching system is employed for changing the voltage.
- 2) Motor driving voltage can be set to any optional value by the output voltage control signal.
- 3) The control signal corresponds with both PWM signal and DC voltage.
- 4) The control terminal is easy to be designed, as it is only one-terminal type.
- 5) The three outputs are independent.
- 6) This can be used as the output-variable type DC / DC converter as well.
- 7) Space-saving package of SIP.

● Absolute maximum ratings (Ta=25°C)

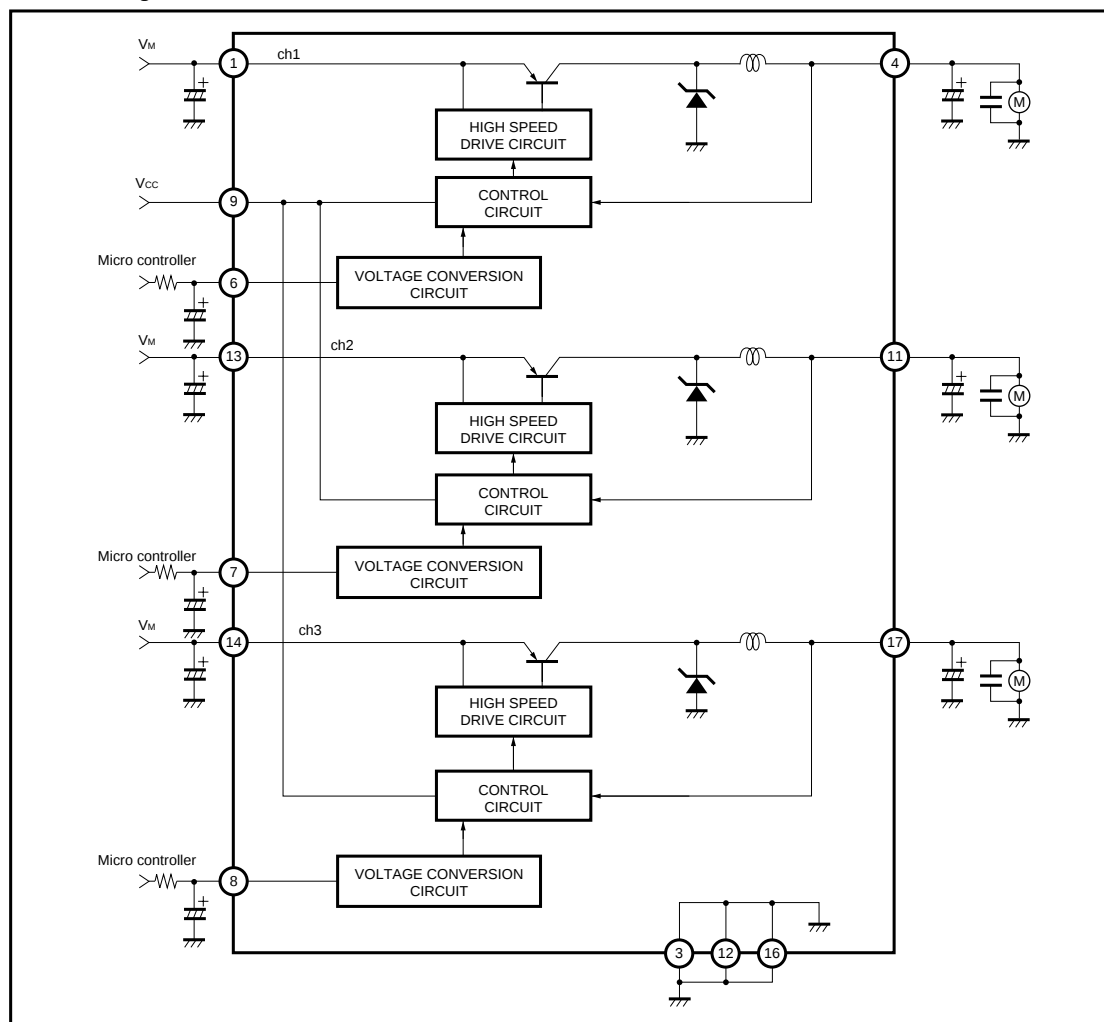
Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	7	V
Motor drive power supply voltage	V _M	16.0	V
Output current	I _{o1, 2, 3}	0.6(1.3 at peak)*1	A
CTL input voltage	V _{CTL}	7	V
Operating temperature range	T _{opr}	-10 ~ +70	°C
Storage temperature range	T _{stg}	-25 ~ +80	°C

*1 Derating required according to the output voltage and ambient temperature.

● Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V _{CC}	4.75	5.0	5.25	V
Motor drive power supply voltage	V _M	13	14	15	V

● Block diagram



● Pin descriptions

Pin No.	Pin name	Function
1,13,14	V _M	Input power supply pin for motor drive ; connect a low impedance capacitor with a recommended capacitance of 100μF/35V.
3,12,16	GND	Ground pin
4	Vo1	Output pin for motor drive (ch1) ; connect a low impedance capacitor with a recommended capacitance of 470μF / 35V.
6	CTL1	Output voltage control pin (ch1) ; PWM signal or DC signal is inputted. The output voltage can be changed either by changing the duty of PWM signal or by changing the DC voltage value. ^{*1}
7	CTL2	Output voltage control pin (ch2) ; PWM signal or DC signal is inputted. The output voltage can be changed either by changing the duty of PWM signal or by changing the DC voltage value. ^{*1}
8	CTL3	Output voltage control pin (ch3) ; PWM signal or DC signal is inputted. The output voltage can be changed either by changing the duty of PWM signal or by changing the DC voltage value.
9	V _{cc}	Power supply pin
11	Vo2	Output pin for motor drive (ch2) ; connect a low impedance capacitor with a recommended capacitance of 470μF / 35V.
17	Vo3	Output pin for motor drive (ch3) ; connect a low impedance capacitor with a recommended capacitance of 470μF / 35V.

^{*1} Make sure to use the external CR.

● **Electrical characteristics** (Unless otherwise noted, $T_a=25^\circ\text{C}$, $V_{CC}=5\text{V}$, $V_M=14\text{V}$, $I_{O1}=I_{O2}=I_{O3}=0.4\text{A}$, $f_{CTL}=50\text{Hz}$, $D_{CTL}=100\%$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Output voltage	$V_{O1, 2, 3}$	11.82	12.82	13.52	V	
		11.82	12.82	13.0	V	$V_M=13\text{V}$
		5.41	6.41	7.41	V	$D_{CTL1, 2, 3}=50\%$
Ripple noise voltage	v	—	50	150	mV _{P-P}	*1
Efficiency	η	80	90	—	%	*2
CTL frequency	f_{CTL}	50	—	—	Hz	

*1 Spike noise is not included.

*2 Efficiency = $\frac{V_{O1} \times I_{O1} + V_{O2} \times I_{O2} + V_{O3} \times I_{O3}}{V_M \times I_M}$

● **Measurement circuit**

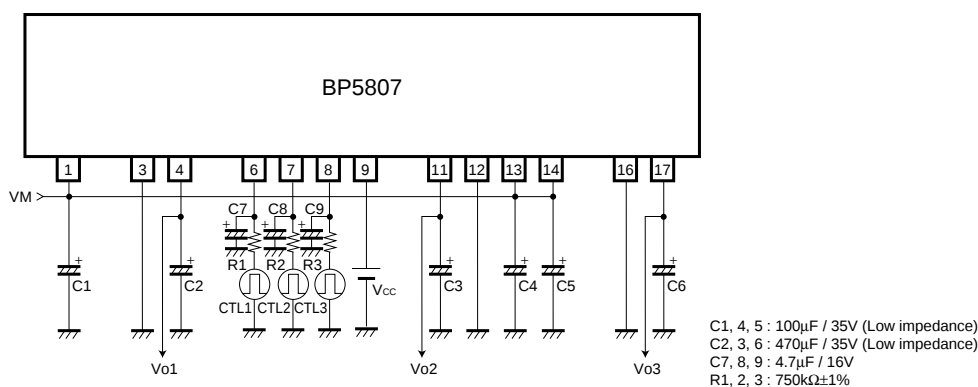


Fig.1

● **Circuit operations**

(1) Description

BP5807 is a DC motor driver that can establish any output voltage by inputting PWM signal and DC voltage into the control pin(6, 7, 8pin).Electrical power loss is small even when there is a difference between the input voltage and output voltage, since changing from the input voltage into the specified output voltage can be made by the switching system. This module is most suitable in case that the number of rotation of the motor is controlled by changing the driving voltage, or in case that the motor of a lower specified voltage than 14V is driven by the electrical power source of 14V.

(2) Control signals

- 1) PWM signal : the output voltage will be controlled by that duty. The larger the duty is, the higher the output voltage will be. It is necessary to be attentive, because the output voltage value changes depending on the H-level and L-level values of PWM signal as well, at this time.
- 2) DC voltage : the output voltage will be controlled by that voltage value. The higher the voltage, the higher the output voltage will be.

- (3) The two outputs are independent. It is possible to control each output independently with a different kind of the control signal (PWM signal or DC voltage).

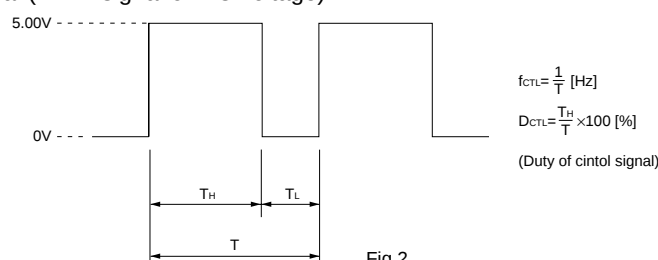


Fig.2

● Application example

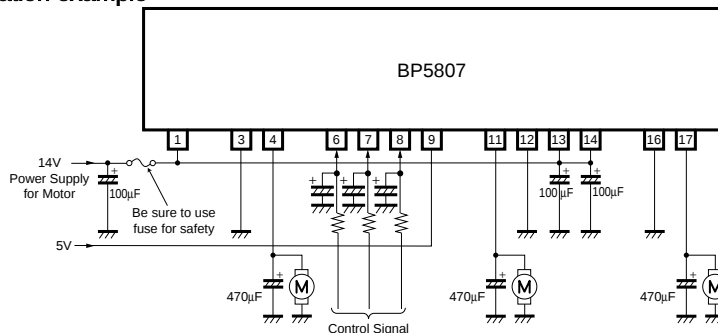


Fig.3

● Operation notes

- (1) The output current should be reduced according to an increase in the output voltage or ambient temperature. Use the module within the derating curve range.
- (2) The protection circuit for output current is not incorporated. Be sure to take safety measures such as fusing if short-circuit loads or overcurrent is probable.
- (3) External capacitor
Since the switching system is employed for the purpose of changing the voltage, ripple current flows to the capacitor to be added to pins 1, 4, 11, 13, 14, 17. Select the product of which allowable ripple current is more than this value.

● Electrical characteristic curves

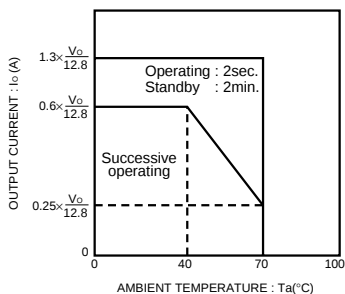


Fig.4 Derating curve

EX. Output voltage : 8V
 $0.6 \times \frac{8}{12.8} = 0.375A$

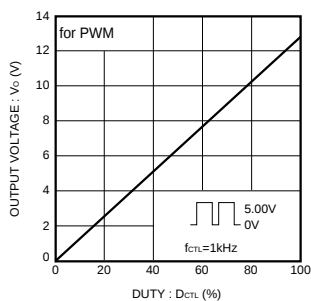


Fig.5 Output voltage vs. Duty

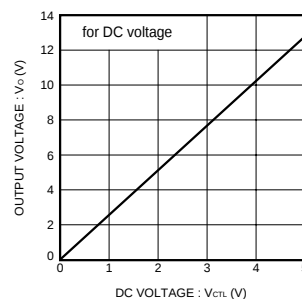
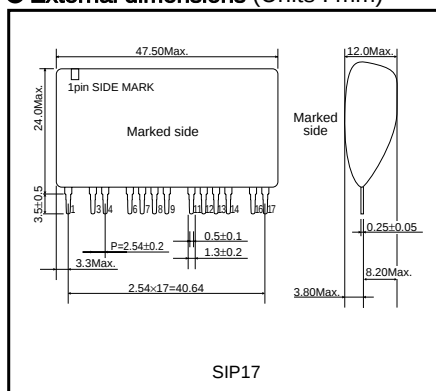


Fig.6 Output voltage vs. DC voltage

● External dimensions (Units : mm)



Precautions on Use of ROHM Power Module

Safety Precautions

- 1) The products are designed and produced for application in ordinary electronic equipment (AV equipment, OA equipment, telecommunication equipment, home appliances, amusement equipment etc.).
If the products are to be used in devices requiring extremely high reliability (medical equipment, transport equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or operational error may endanger human life and sufficient fail-safe measures, please consult with the Company's sales staff in advance. If product malfunctions may result in serious damage, including that to human life, sufficient fail-safe measures must be taken, including the following:
 - [a] Installation of protection circuits or other protective devices to improve system safety
 - [b] Installation of redundant circuits in the case of single-circuit failure
- 2) The products are designed for use in a standard environment and not in any special environments. Application of the products in a special environment can deteriorate product performance. Accordingly, verification and confirmation of product performance, prior to use, is recommended if used under the following conditions:
 - [a] Use in various types of liquid, including water, oils, chemicals, and organic solvents
 - [b] Use outdoors where the products are exposed to direct sunlight, or in dusty places
 - [c] Use in places where the products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [d] Use in places where the products are exposed to static electricity or electromagnetic waves
 - [e] Use in proximity to heat-producing components, plastic cords, or other flammable items
 - [f] Use involving sealing or coating the products with resin or other coating materials
 - [g] Use involving unclean solder or use of water or water-soluble cleaning agents for cleaning after soldering
 - [h] Use of the products in places subject to dew condensation
- 3) The products are not radiation resistant.
- 4) The Company is not responsible for any problems resulting from use of the products under conditions not recommended herein.
- 5) The Company should be notified of any product safety issues. Moreover, product safety issues should be periodically monitored by the customer.

Precautions Regarding Application Example and External Circuits

- 1) If change is made to the constant of an external circuit, allow a sufficient margin due to variations of the characteristics of the products and external components, including transient characteristics, as well as static characteristics. Please be informed that the Company has not conducted investigations on whether or not particular changes in the application examples or external circuits would result in the infringement of patent rights of a third party.
- 2) The application examples, their constants, and other types of information contained herein are applicable only when the products are used in accordance with standard methods.
Therefore, if mass production is intended, sufficient consideration to external conditions must be made.

Prohibitions Regarding Industrial Property

- 1) These Specifications contain information related to the Company's industrial property. Any use of them other than pertaining to the usage of appropriate products is not permitted. Duplication of these Specifications and its disclosure to a third party without the Company's permission is prohibited.
- 2) Information and data on products, including application examples, contained in these specifications are simply for reference; the Company does not guarantee any industrial property rights, intellectual property rights, or any other rights of a third party regarding this information or data. Accordingly, the Company does not bear any responsibility for:
 - [a] infringement of the intellectual property rights of a third party
 - [b] any problems incurred by the use of the products listed herein.
- 3) The Company prohibits the purchaser of its products to exercise or use the intellectual property rights, industrial property rights, or any other rights that either belong to or are controlled by the Company, other than the right to use, sell, or dispose of the products.

Appendix

Notes

- No technical content pages of this document may be reproduced in any form or transmitted by any means without prior permission of ROHM CO.,LTD.
- The contents described herein are subject to change without notice. The specifications for the product described in this document are for reference only. Upon actual use, therefore, please request that specifications to be separately delivered.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by
- ROHM CO., LTD. is granted to any such buyer.
- Products listed in this document use silicon as a basic material.
Products listed in this document are no antiradiation design.

The products listed in this document are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys).

Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

About Export Control Order in Japan

Products described herein are the objects of controlled goods in Annex 1 (Item 16) of Export Trade Control Order in Japan.

In case of export from Japan, please confirm if it applies to "objective" criteria or an "informed" (by MITI clause) on the basis of "catch all controls for Non-Proliferation of Weapons of Mass Destruction.