

DC/DC converter

BP5450

8V to 16V input, 1.5 to 5V/1.2A output

●Description

BP5450 is a 2-output DC/DC converter that uses PWM system. It contains control circuits, switching devices, rectifying devices, and coils, and operates by only connecting an I/O smoothing capacitor, and an output voltage setting resistor.

High efficiency of power conversion enables the module to make small with no heat sink required.

It can be applied to various purposes by setting the output voltage and controlling output ON and OFF.

●Applications

Power supplies for OA appliances(copy machine, personal computer, facsimile), AV appliances, Car stereo, Car navigation system, Communication appliances, industrial appliances.

●Features

- 1) 2-output
- 2) High power conversion
- 3) Output ON-OFF pin
- 4) Output voltage setting pin (Vo range:1.5 to 5V(Typ.))
- 5) Built-in reset \cdot ∇ shaped overcurrent protection circuit
- 6) Small number of external components required
- 7) Heat sink unnecessary
- 8) Short \cdot small package:SIP18

●Absolute maximum ratings (Ta=25°C)

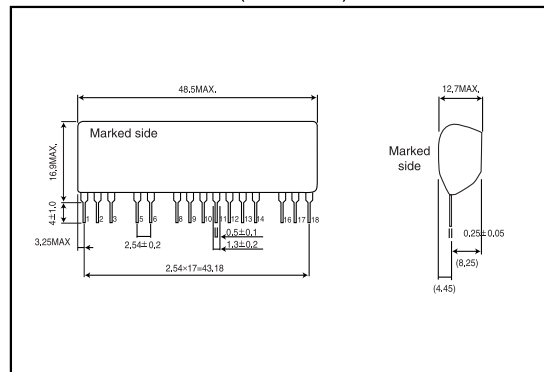
Parameter	Symbol	Limits	Unit	Condition
Input voltage	V_{in}	24	V	DC
Operating temperature range	T_{opr}	-20 to +85	°C	
Storage temperature range	T_{stg}	-25 to +100	°C	
Allowable max surface temperature	T_{smax}	100	°C	Ambient temperature+The module self-heating \leq T_{smax}
Power dissipation(1 output)	P_{d1}	1.0	W	Only 1 output operating ^{*1}
Power dissipation(2 output operating)	P_{d2}	1.3	W	2 output simultaneous operating ^{*1}
Maximum output current	$I_o(\text{Max.})$	1200	mA	^{*1}
Maximum output voltage	$V_o(\text{Max.})$	6.0	V	

*1 Load must be decreased by ambient temperature, input voltage, and output voltage. Please refer to derating curve.

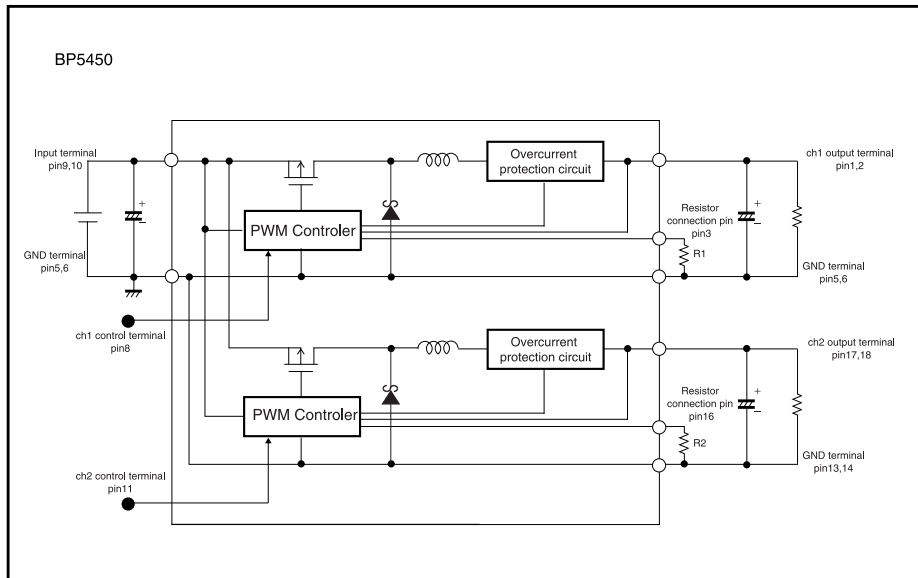
●Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input voltage	V_{in}	8.0	12.0	16.0	V

●External dimensions (Unit : mm)



● Block diagram



● Pin descriptions

BP5450

Pin No.	Pin description
1	ch1 output pin
2	ch1 output pin
3	ch1 Output voltage adjustment R1 pin
5	GND
6	GND
8	ch1 ON/OFF control pin
9	12V input pin
10	12V input pin

Pin No.	Pin description
11	ch2 ON/OFF control pin
12	NC
13	GND
14	GND
16	ch2 Output voltage adjustment R2 pin
17	ch2 output pin
18	ch2 output pin

Pin4,7,15pin is not used.

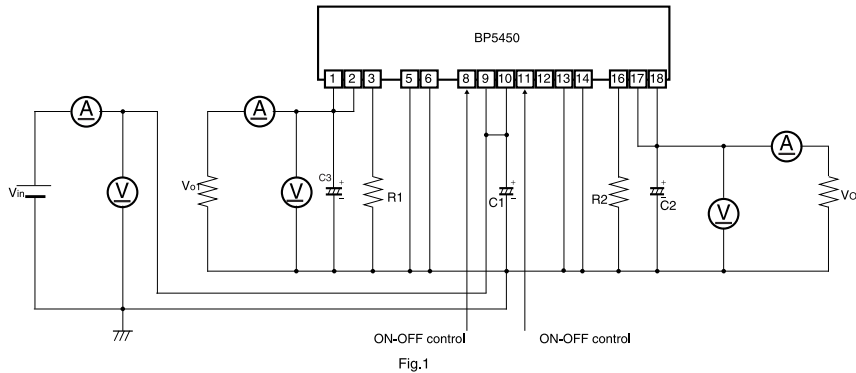
For output voltage adjustment R1, and R2, please use the resistor (Power dissipation : more than 1/10W, Resistor : less than 68kΩ).
If the precision for output voltage is required, the product of 0.5% precision should be used.

● **Electrical characteristic BP5450** (Unless otherwise noted, Ta=25°C, Vin=12V(DC), Io1=1000mA, Io2=1000mA)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Input voltage	V _{in}	8.0	12.0	16.0	V	DC	Fig.1
Output voltage 1	V _{O1}	3.09	3.26	3.43	V	R1=6.2k ,Precision1%	Fig.1
Output voltage 2	V _{O2}	4.75	5.0	5.25	V	R2=3.3k ,Precision1%	Fig.1
Output current 1	I _{O1}	—	—	1200	mA	*1	Fig.1
Output current 2	I _{O2}	—	—	1200	mA	*1	Fig.1
Line regulation 1	V _{r1}	—	—	0.10	V	Vin=8 to 16V *3	Fig.1
Line regulation 2	V _{r2}	—	—	0.10	V	Vin=8 to 16V *3	Fig.1
Load regulation 1	V _{l1}	—	—	0.10	V	Io1=0 to 1000mA *4	Fig.1
Load regulation 2	V _{l2}	—	—	0.10	V	Io2=0 to 1000mA *4	Fig.1
Output ripple voltage 1	V _{p1}	—	0.05	0.10	V _{PP}	*2	Fig.1
Output ripple voltage 2	V _{p2}	—	0.05	0.10	V _{PP}	*2	Fig.1
Control ON voltage 1	V _{on1}	2	—	V _{in}	V		Fig.1
Control ON voltage 2	V _{on2}	2	—	V _{in}	V		Fig.1
Control OFF voltage 1	V _{off1}	—	—	1	V		Fig.1
Control OFF voltage 2	V _{off2}	—	—	1	V		Fig.1
Stand by input current	I _{stb}	—	0	0.02	mA	V _{ct1} =V _{ct2} =GND	Fig.1
Oscillation frequency	f _{osc}	—	300	—	kHz		Fig.1
Power conversion efficiency	η	82	85	—	%	V _{ct1} =V _{ct2} =Vin *5	Fig.1

- *1 Load must be decreased by ambient temperature, input voltage, and output voltage. Please refer to the derating curve.
- *2 Output ripple voltage may be changed by the used smoothing capacitor, measurement environment, and layout of peripheral parts.
- *3 Line regulation : Regulation of input voltage accompanied with the regulation of input voltage. Regulation is measured with output current fixed.
- *4 Load regulation : Regulation of input voltage accompanied with the regulation of output voltage. Regulation is measured with input voltage fixed.
- *5 Power conversion efficiency $\eta = \frac{(V_{O1} \times I_{O1}) + (V_{O2} \times I_{O2})}{V_{in} \times I_{in}} \times 100[\%]$
- *6 Output ripple voltage : Measured in PEAK-TO-PEAK of ripple current, and BAND WIDTH 20MHz. Spike noise is not included.

● **Application circuit**



- *The circuit above is the minimum required circuit to guarantee the electric characteristics.
- *GND pin (pin5,6 and pin13,14) are connected inside.
- *Output voltage setting resistor R1,R2 must be used. When R1,R2 is not used, Vo=1.25V.

<External components>

Symbol	Applications	Characteristics	Maker	Part name
C1	Capacitor for input voltage smoothing	470μF/50V Low impedance type for power supply	Nichicon	UHD1H471MHR
C2,C3	Capacitor for output voltage smoothing	470μF/10V Low impedance type for power supply	Nichicon	UHC1A471MPR
R1	ch1 output voltage setting resistor	6.2k precision 1%		
R2	ch2 output voltage setting resistor	3.3k precision 1%		

● Application example

For actual usage, Please kindly evaluate and confirm our part mounted in your product, Especially, Please make sure to confirm the load current does not exceed Max. rated current by using the current probe.

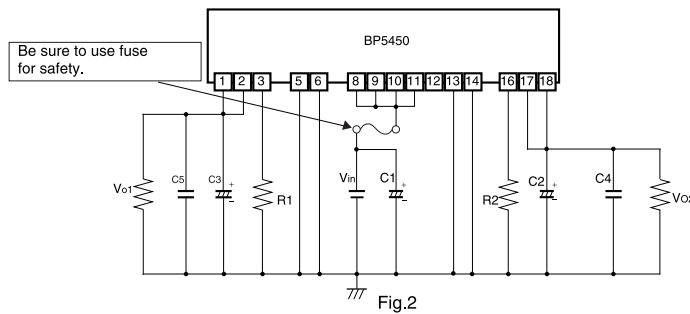


Fig.2

<Output voltage setting resistor>

Vo[V]	R1(or R2) [Ω]
5.0	3.3k
3.26	6.2k
2.5	10k
1.5	51k

▪Equation(channel1)

$$Vo1 = Vref \times \left(1 + \frac{10k \pm 1\%}{R1}\right) [V]$$

*Vref=1.25V ±1%

▪Equation(channel2)

$$Vo2 = Vref \times \left(1 + \frac{10k \pm 1\%}{R2}\right) [V]$$

● External components setting

Symbol	Part name	Required characteristics
FUSE	Fuse	Please make sure to use quick acting fuse 2.0 to 3.0A.
C1	Capacitor for input voltage smoothing	Capacitance : 100 to 470μF, Rated voltage : 25V or higher, Ripple current is 700mA or above.
C2,C3	Capacitor for output voltage smoothing	Capacitance : 100 to 470μF, Rated voltage : 10V or higher, ESR is 50 to 100mΩ. Ripple current is 750mA or above.
C4,C5	For noise terminal voltage reduction	Capacitance : 0.01 to 0.1μF, Rated voltage : 10V or higher, Film capacitor or ceramic capacitor. Please set it, if necessary.
R1,R2	Output voltage setting resistor	Power dissipation : 1/10W or higher, Resistance : 68kΩ or lower. If the precision for output voltage is required, please use the product of 0.5% precision.

- (1) Please use it with R1, and R2 connected.
- (2) Select R1, and R2 in the range of 3.0k to 68k. Please use R1, and R2 not to be shorted.
- (3) When I/O voltage is adjusted, Be sure to set in the range of Vo=1.5 to 5.0V(Typ.).
- (4) Select a capacitor for input voltage smoothing that has large allowable ripple current.
- (5) When output ripple voltage is reduced, select a capacitor for output voltage smoothing that has low ESR (Equivalent series resistance.).
- (6) When spike noise is reduced, use a capacitor for noise reduction, if necessary.
- (7) Though GND pin(5,6 and 13,14pin) are connected inside, they must be connected outside.
- (8) Please set a capacitor for I/O smoothing at the marked side of power module and connect with each pin using shortest wire.
- (9) Vref 1.25V has ±1 dispersion at Ta=25°C.

● Derating curve

Please set output voltage and output current to make power dissipation of 1-output 1W or less, and to make sum of 2-outputs power dissipation 1.3W or less.
 Power dissipation need to be reduced depending on the ambient temperature. Make sure to use it in the range of derating curve below.

*Power dissipation $Pd=(Vin \times Iin)-(Vo \times Io)$ [W]

[1-output power dissipation]

Power dissipation of 1-output must be in the range of derating curve below.

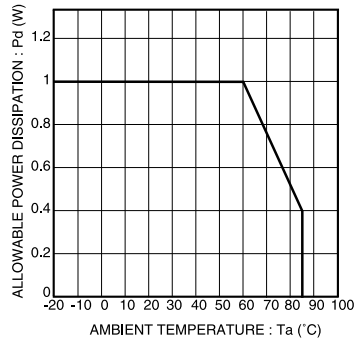


Fig.3 Derating curve of 1-output
 When the ambient temperature is 60 to 85°C
 Derating curve=-0.025[°C/W]

[Power dissipation when 2-outputs operating]

Sum of 2-outputs power dissipation must be in the range of derating curve below.

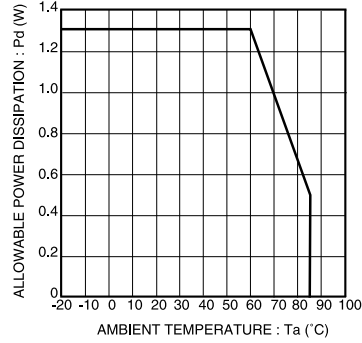


Fig.4 Derating curve when 2-outputs simultaneous operating
 When the ambient temperature is 60 to 85°C
 Derating curve=-0.0325[°C/W]

[Circuit dissipation of 1-output]

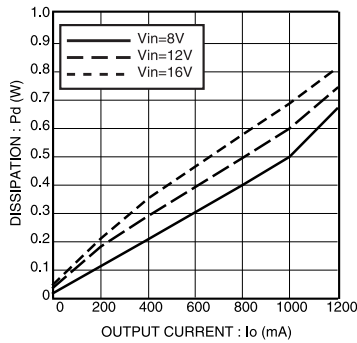


Fig.5 Circuit dissipation at Vo=2.5V

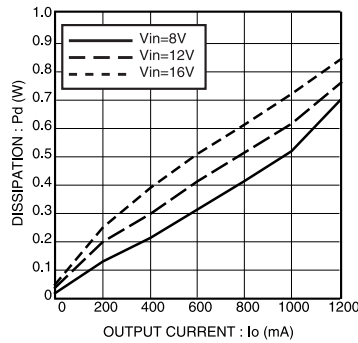


Fig.6 Circuit dissipation at Vo=3.3V

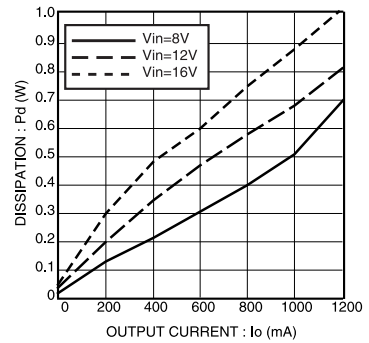


Fig.7 Circuit dissipation at Vo=5.0V

● **Electrical characteristic curves**

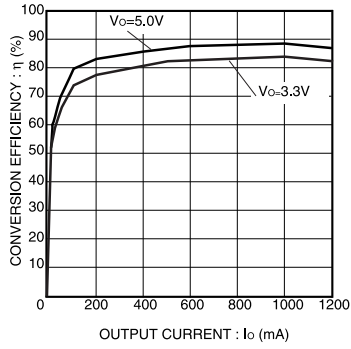


Fig.8 Power conversion efficiency

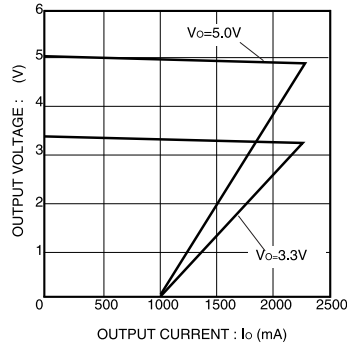


Fig.9 Load regulation

● **Measurement of temperature**

Please consider the propriety of the design by measuring the surface temperature of the module by reference to the derating curve(P63).

Please design it considering that the total of self-heating and ambient temperature for the most heated part of this module must not be exceeded 100°C when it is estimated.

The black-painted part shown below is the most heated part of this module.

If this module should be used when its surface temperature exceeds 100°C, there is fear that it exceeds the temperature rating of internal components and the reliability of this module may be declined strikingly.

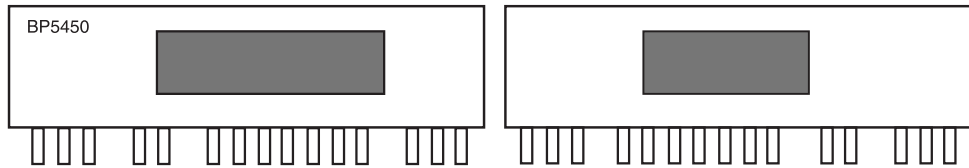


Fig.10 Most heated part

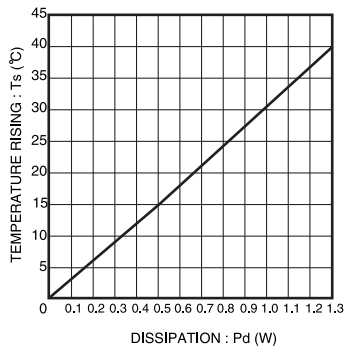


Fig.11 Temperature rising curve(reference data)

When you design the frame of the set, please set this module to operate efficiently.
And, be careful not to put heating components around the module.

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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:
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 - [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.

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