Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

DC/DC converter

BP5250/BP5250-24

The BP5250/BP5250-24 are DC/DC converters for step-down that can drive PchFET using PWM system. The voltage setting resistor and the combination of external power elements enable you to make any power circuit to your liking. High-efficient DC/DC converter can be made easy by adding external components such as I/O smoothing capacitor without designing circuit.

● Applications

OA appliances(copy machine,personal computer, facsimile), AV appliances (car navigation, DVD etc.), and industrial appliances.

● Features

1) High power conversion(η=90% Vin=12V 5V/2A)
2) Power save pin(Leakage current at OFF mode : IR=10μAMAX)
3) Output voltage can be established from 1.5V to 9V in the VADJ pin.(For BP5250, however, output voltage is limted by input voltage.)
4) With recovery type overcurrent protection function (Detection current can be established by the external current detection resistance.)
5) Power circuit can be made easy by adding external smoothing capacitor and power element.
6) Reference voltage accuracy 1.25V$\pm$1%

### ● Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit	Condition
		BP5250	BP5250-24		
Input voltage	Vi	24	30	V	DC
ESD endurance	Vsurge	1		kV	(EIAJ ED4701-1C-111A)
Operating temperature range	Topr	−40 ~ +85		°C	
Storage temperature range	Tstg	−50 ~ +100		°C	
Allowable max surface temperature	Tfmax	100		°C	Ambient temperature+The module self-heating $\leq$ Tfmax
The power saving terminal voltage	VCTL	24	30	V	Vi $\geq$ VCTL

● Recommended operating conditions (Ta=25°C)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Input voltage	BP5250	Vi	8	12	16	V
	BP5250-24		20	24	27	V

● Block diagram
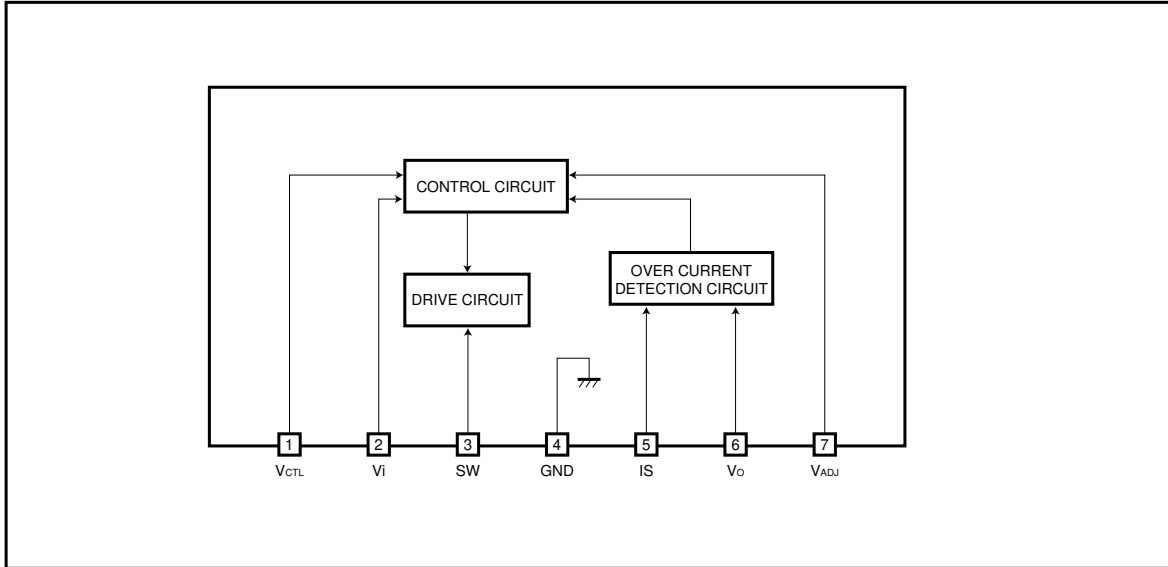
● Pin descriptions

Pin No.	Pin name	Function
1	V_{CTL}	Power save terminal.Setting the voltage on this terminal to Low or high impedance turns the output OFF. Normally connect to Vi for use.
2	Vi	Input voltage terminal. Inserting a bypass capacitor of 0.1μF between this and pin 4 GND is recommended.
3	SW	Terminal to drive the external FET gate.
4	GND	GND terminal. Connect the negative terminal of the I/O smoothing capacitor and the anode terminal of the flywheel diode nearby.
5	IS	Overcurrent detection terminal. The value of the resistor inserted between this and pin 6 sets the output current capacity.
6	Vo	Output voltage monitor terminal.
7	V_{ADJ}	Output voltage setting terminal. The values of the resistors inserted between this and pin 6 and between this and GND set the output voltage capacity.

● **Electrical characteristics** (Unless otherwise noted, Vi=12V : BP5250, Vi=24V : BP5250-24, Ta=25°C)

| Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Test Circuit
Output ADJ Pin voltage	V_{ADJ}	1.225	1.25	1.275	V	VSW L→H	Fig.1
Over current detection off set voltage1	V_{LT1}	60	68	76	mV	VSW L→H V_{ADJ}=1.25V	Fig.2
Over current detection off set voltage2	V_{LT2}	20	28	36	mV	VSW L→H V_{ADJ}=0V	Fig.2
CTL pin ON voltage	V_{CTLH}	2	–	–	V	VSW H→L	Fig.3
CTL pin OFF voltage	V_{CTLL}	–	–	1	V	VSW L→H	Fig.3
CTL sink current	I_{CTL}	40	50	70	μA	V_{CTL}=5V	Fig.3
Stand by current	I_{STB}	–	0	10	μA	V_{CTL}=0V	Fig.3

● **Measurement circuit**
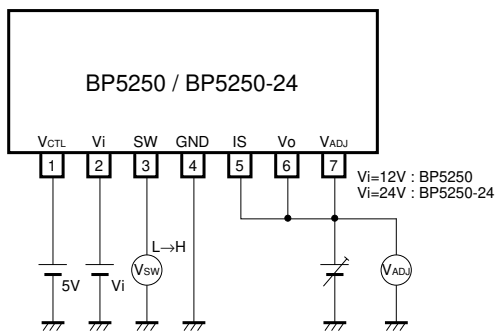
Fig.1 Output ADJ terminal voltage measurement circuit
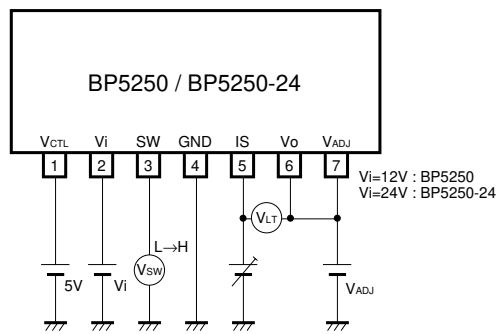
Over current detection off set voltage 1 : V_{ADJ}=1.25V
Over current detection off set voltage 2 : V_{ADJ}=0V

Fig.2 Over current detection off set voltage measurement circuit
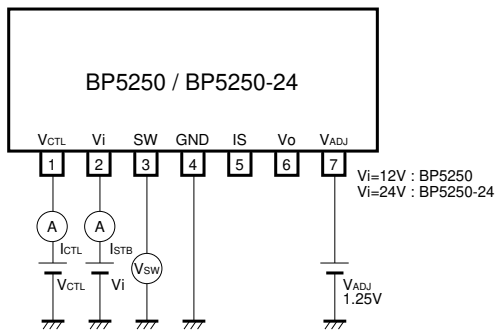
CTL sink current : V_{CTL}=5V
Stad by current : V_{CTL}=0V

Fig.3 Control terminal voltage sink current ·
Stand by sink current measurement circuit

● Application example
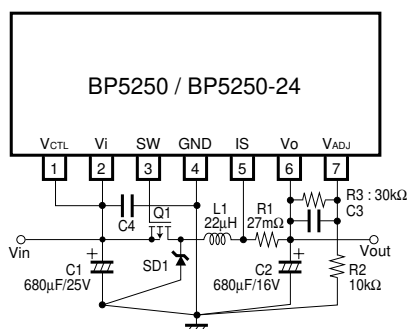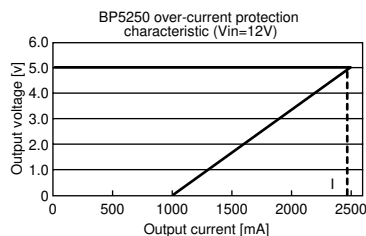
(1) Application circuit example is shown in the Fig.4.

BP5250 / BP5250-24

V_CTL | Vi | SW | GND | IS | Vo | V_ADJ
1 | 2 | 3 | 4 | 5 | 6 | 7

C4
Q1
L1 22µH
R1 27mΩ
R3 : 30kΩ
C3
Vin
C1 680µF/25V
SD1
C2 680µF/16V
R2 10kΩ
Vout

Fig.4

∗Application
Input voltage 12V
Output current 2A
Output voltage 5V
Q1 : 2SJ529S/Hitachi
SD : RB050L-40/ROHM
L1 : CDRH124-220L/Sumida
C1 : 680µF/25V(ZL series)/Rubycon
C2 : 680µF/10V(ZL series)/Rubycon
C3 : 0.1µF/16V
C4 : 0.1µF/25V

R1 : Over-current detection resistance R1=0.068/I (0.068V : offset voltage)
Overcurrent protection characteristic at R1=27mΩ is shown below.

BP5250 over-current protection characteristic (Vin=12V)

[Graph: Output voltage [V] (y-axis 0 to 6.0) vs Output current [mA] (x-axis 0 to 2500)]

R2, R3 : Outpur voltage establishment resistance

$Vo = VADJ \times (1 + R3/R2)$
$(R2 + R3 \leq 55k\Omega)$

Establishment example

Vo(V)	R2(Ω)	R3(Ω)
8.0	3.3k	18k
5.0	10k	30k
3.3	20k	33k
2.5	10k	10k
1.5	10k	2k

· There is a posibility that the C1 exceeds the allowable ripple current. Note the allowable ripple current of the capacitor to be used.
· R2+R3≤55KΩ is recommended for R2,3 to make the most of output voltage accuracy.
· Output voltage range is limited by input voltage. Please refer to the Fig.8.

(2) When the load current is increased.
It is possible by arrangement in a parallel connecting Q1, 2 and SD1,2

BP5250 / BP5250-24

V_CTL | Vi | SW | GND | IS | Vo | V_ADJ
1 | 2 | 3 | 4 | 5 | 6 | 7
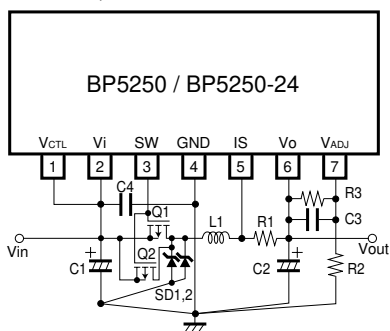
C4
Q1
L1
R1
R3
C3
Vin
C1
Q2
SD1,2
C2
R2
Vout

Fig.5

· When Q1 and Q2 are connected parallel, use of a device with small gate capacity is recommended. Large gate capacity reduces the switching speed, which may cause a larger FET loss, exceeding the allowable loss value.
· When 2SJ529S is connected parallel, the rated load current 3A is the maximum atVi=12V,Vo=5V

(3) When the power saving function is used.
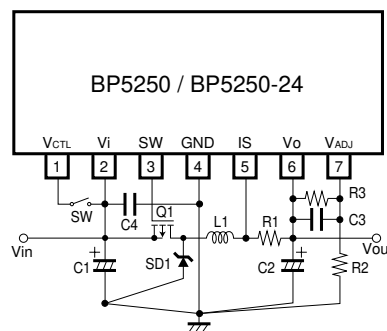The output is off when the V_CTL pin is set to the Low or high-impedance.

BP5250 / BP5250-24

V_CTL | Vi | SW | GND | IS | Vo | V_ADJ
1 | 2 | 3 | 4 | 5 | 6 | 7

SW
C4
Q1
L1
R1
R3
C3
Vin
C1
SD1
C2
R2
Vout

Fig.6

● Output voltage establishment range

Output voltage establishment range is changed by input voltage.Please refer to the Fig.8.
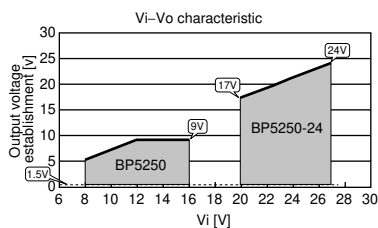
Vi–Vo characteristic

Fig.8

● Caution note for operation

(1) Output voltage establishment range is changed by input voltage.Please refer to the Fig.8.
(2) Layout of external parts may significantly change the output spike noise or characteristics or cause abnomal oscillation and temperature increase. Note the following for layout.
    · Provide the input smoothing electroytic capacitor close to the FET source and pin 2 of the module.
    · Provide the output smoothing electrolytic capacitor close to pin 6 of the module together with the current detection resistor
    · Large current may run into the coil, current detection resistor and output through the FET source-drain.Try to use a solid pattern as much as possible.
    · FET drain, coil and flywheel diode may generate heat by power loss. Try to use a solid pattern so that the heat may be released. Measure a rise in temperature of each element and make sure that it is not abnormal.
    · Provide the negative terminal of the I/O smoothing capacitor and anode terminal of the flywheel diode close to GND pin 4 of the module.
    · Connect the negative terminal of the I/O smoothing electrolytic capacitor and anode terminal of the flywheel diode nearby.
(3) Output load may cause large ripple current in the I/O smoothing electrolytic capacitor. Note the allowable ripple current of the capacitor to be used.
(4) As the output smoothing electrolytic capacitor, one with especially low impedance is recommended for suppresing output ripple voltage. Select a capacitor suited for the use.
(5) Please be sure to use protection circuit function.(R1 should not be 0Ω.)

● Output voltage establishment and application circuit example

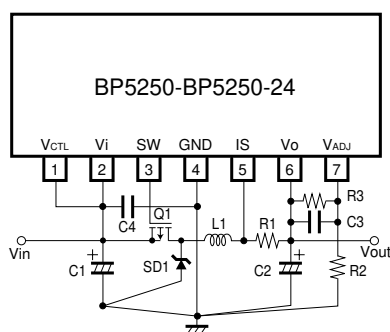∗Application example
  Input voltage 12V
  Output voltage 5V
    Q1 : 2SJ529S/hitachi
    SD : RB050L-40/ROHM
    L1 : CDRH124-220L/Sumida
    C1 : 680μF/25V(ZL seried)/Rubycon
    C2 : 680μF/16V(ZL series)/Rubycon
    C3 : 0.1μF/16V/ROHM
    C4 : 0.1μF/25V/ROHM

    R1 : 27mΩ/SUSUMU
    R2 : 10kΩ/ROHM
    R3 : 30kΩ/ROHM

Fig.9

(1) Output voltage and resistance
　Output voltage Vo is determined by output ADJ pin voltage(VADJ) and R2, R3.

$$Vo=VADJ \times (1+R3/R2)[V] \quad VADJ=1.25V$$

　Note) Please set the resistance to R2+R3≤55KΩ to make the best use of
　　　　this module performance.

Establishment example

Vo(V)	R2(Ω)	R3(Ω)
8.0	3.3k	18k
5.0	10k	30k
3.3	20k	33k
2.5	10k	10k
1.5	10k	2k

(2) FET(Q1)
　FET is determined by taking the peak current flowed to the external FET, drain-source voltage(VDS),
　ON resistance(RDS(ON)), input capacity(Ciss), allowable loss of package, and area of safe operation.

　For the basic circuit example(Fig.9), FET of 2SJ529S/Hitachi is used.
　Please use FET with the characteristic equal to or than this one.Especially, the input capacity(Ciss), and
　ON resistance may cause a larger FET loss. Note the FET with the characteristic equal to or higher to be
　used.
　The characteristic of 2SJ529S is
　　VDS　　　=−60V
　　ID　　　　=−10A
　　RDS(ON) =0.17ΩTYP(ID=−5A, VDS=−4V)
　　Pch　　　=20W(Tc=25°C)
　　Ciss　　　=580PF

(3) Inductor(L1)
　inductor L1 is determined by the following expression in consideration of output ripple current.

$$L1 \geq n \times (Vi-Vo)/Io \times 1/f \times Vo/Vi \ [H]$$

　　Vi　: Input voltage [V]
　　Vo : Output voltage [V]
　　Io　: Output current [A]
　　f　　: Oscillation frequency (≒190KHz)
　　n　: Ripple current condition
　　　　 Io/n is ripple current. Normally, n=2.5~5 is recommended.

　L is determined from above.
　Peak current flowed into the inductor by the determined L is

$$ip=Io+(Vi-Vo)/2 \times 1/L1 \times 1/f \times (1-Vo/Vi) \ [A]$$

　ip for actual usage is calculated back by the L of the expression above.
　Ripple current ir by the determined L is

$$ir=(Vi-Vo)/L1 \times 1/f \times Vo/Vi \ [A]$$

　As stated above, after L1[H] inductor and the ip[A] peak current are determined, an inductor for these
　specifications can be determined. Output ripple voltage is determined by the multiplication of the ir[A] ripple
　current and the impedance of the smoothing capacitor.

　　Vr=ir × Zc
　　Vr : Output ripple voltage [Vp-p]
　　Zc : Impedance of smoothing capacitor[Ω]

(4) Flywhell diode(SD1)
· Rated current must be twice as much as the maximum overload current(Iomax) or more.
· Rated voltage must be 1.3 times as much as the maximum input voltage or more.
· Please use the high-speed switching schottky barrierdiode that reverse recovery time is 50ns or less.
· If it used in high temperature, please be careful about the temperature characteristics of IR.

Input voltage VS. DC reverse voltage
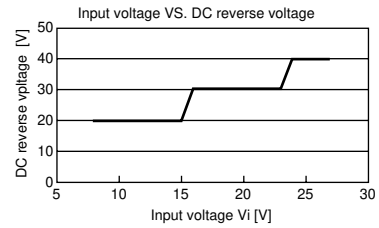
(5) Overcurrent detection resisor(R1)
Overcurrent detection resistor is determined by the following expression.

R1=VLT1/Iomax [mΩ]
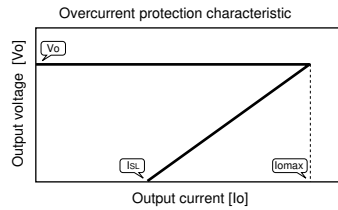
VLT1 : Overcurrent offset voltage1(60~76mV)
Iomax : Maximum overload current [A]

And, ISL current at short circuit is

ISL=VLT2/R1 [A]
VLT2 : Overcurrent detection offset voltage2(20~36mV)

Overcurrent protection characteristic

From the above-mentioned, fold-back current characteristic when the overcurrent protection is operated is shown. Both Iomax, and ISL may be different value from the actual value because they are detected at the peak current. Please make sure to confirm it in the actual operating.

(6) Input smoothing capacitor(C1)
Large ripple current flow into the input smoothing capacitor. The current is determined by the following expression. For actual usage, please use the larger one than this numeric value.

$$Irms=ir \times \sqrt{Vo/3Vi} +(ip-ir) \times \sqrt{Vo/Vi} \ [A]$$

Irms : Input ripple current actual-value [Arms]
ir   : Ripple current [A]
ip   : Peak current [A]
V   : Input voltage [V]
Vo   : Output voltage [V]

· Voltage of the used capacitor must be more than $Vi \times 2$.
· Allowable ripple current of the used capacitor must be larger than the ripple current.

(7) Output smoothing capacitor(C2)
Output smoothing capacitor is determined by the impedance of smoothing capacitor from the mark value of output ripple voltage.

$$Zc \leq Vr/ir \ [\Omega]$$

Zc : Impedance of capacitor [Ω]
Vr : Mark value of output ripple voltage[Vp-p]
ir : Ripple current [A]

· Voltage of the used capacitor must be more than $Vo \times 2$.
· Allowable ripple current of the used capacitor must be larger than the ripple current.

● External dimensions (Units : mm)

20.0Max.

5.2Max.

13.0Max.

4±1.0

1 2 3 4 5 6 7

0.5±0.1

1.3±0.2

P=2.54±0.2

3.0Max.

2.54×6=15.24

0.255±0.05

2.7Max.

2.5Max.

SIP9
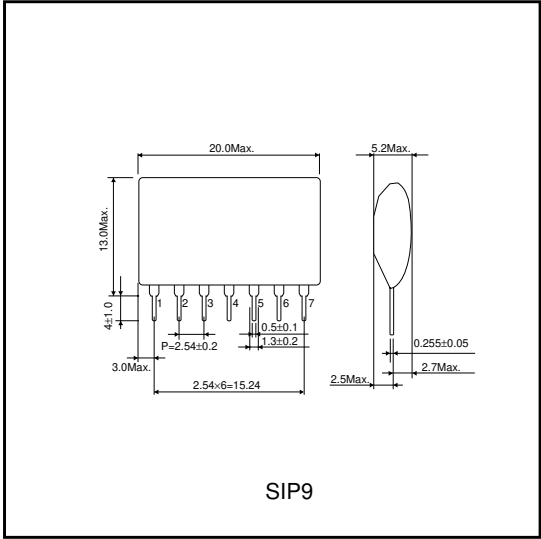
● BP5250 external reference components

Input voltage12V

Outpur current	1A					Note
output voltage	1.5V±3%	2.5V±3%	3.3V±3%	5V±3%	8V±3%	
Q 1	CPH6306	CPH6306	CPH6306	CPH6306	CPH6306	
SD1	RB050L-40	RB050L-40	RB050L-40	RB050L-40	RB050L-40	
L1	17~34μH±10%	26~52μH±10%	31~63μH±10%	38~77μH±10%	35~70μH±10%	
	1.3A or higher	1.3A or higher	1.3A or higher	1.4A or higher	1.5A or higher	Rated current
C1	0.4Arms or higher	0.5Arms or higher	0.6Arms or higher	0.7Arms or higher	0.9Arms or higher	Allowable ripple currnt
	220~4700μF	220~4700μF	220~4700μF	220~4700μF	330~4700μF	
C2	0.3Arms or higher	0.3Arms or higher	0.3Arms or higher	0.3Arms or higher	0.3Arms or higher	Allowable ripple currnt
	220~1000μF	220~1000μF	220~1000μF	220~1000μF	220~1000μF	
C3	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	
C4	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	
R1	56mΩ±5% less than	56mΩ±5% less than	56mΩ±5% less than	56mΩ±5% less than	56mΩ±5% less than	
R2	10kΩ±1%	10kΩ±1%	20kΩ±1%	10kΩ±1%	3.3kΩ±1%	
R3	2kΩ±1%	10kΩ±1%	33kΩ±1%	30kΩ±1%	18kΩ±1%	

Outpur current	2A					Note
output voltage	1.5V±3%	2.5V±3%	3.3V±3%	5V±3%	8V±3%	
Q 1	2SJ529S	2SJ529S	2SJ529S	2SJ529S	2SJ529S	
SD1	RB050L-40	RB050L-40	RB050L-40	RB050L-40	RB050L-40	
L1	9~17μH±10%	13~26μH±10%	16~31μH±10%	19~38μH±10%	17~35μH±10%	Rated current
	2.5A or higher	2.5A or higher	2.5A or higher	2.5A or higher	2.6A or higher	Allowable ripple currnt
C1	0.8Arms or higher	1Arms or higher	1Arms or higher	1.5Arms or higher	1.8Arms or higher	
	330~4700μF	330~4700μF	330~4700μF	680~4700μF	680~4700μF	Allowable ripple currnt
C2	0.6Arms or higher	0.6Arms or higher	0.6Arms or higher	0.6Arms or higher	0.7Arms or higher	
	560~1500μF	560~1500μF	560~1500μF	560~1500μF	560~1500μF	
C3	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	
C4	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	
R1	27mΩ±5% less than	27mΩ±5% less than	27mΩ±5% less than	27mΩ±5% less than	27mΩ±5% less than	
R2	10kΩ±1%	10kΩ±1%	20kΩ±1%	10kΩ±1%	3.3kΩ±1%	
R3	2kΩ±1%	10kΩ±1%	33kΩ±1%	30kΩ±1%	18kΩ±1%	

Outpur current	3A					Note
output voltage	1.5V±3%	2.5V±3%	3.3V±3%	5V±3%	8V±3%	
Q 1	2SJ529S×2	2SJ529S×2	2SJ529S×2	2SJ529S×2	2SJ529S×2	
SD1	RB050L-40×2	RB050L-40×2	RB050L-40×2	RB050L-40×2	RB050L-40×2	
L1	6~11μH±10%	9~17μH±10%	10~21μH±10%	13~26μH±10%	12~23μH±10%	Rated current
	3.7A or higher	3.7A or higher	3.8A or higher	3.8A or higher	3.9A or higher	Allowable ripple currnt
C1	1.2Arms or higher	1.5Arms or higher	1.8Arms or higher	2.2Arms or higher	2.7Arms or higher	
	470~4700μF	680~4700μF	680~4700μF	1000~4700μF	1500~4700μF	Allowable ripple currnt
C2	0.8Arms or higher	0.9Arms or higher	0.9Arms or higher	0.9Arms or higher	1Arms or higher	
	680~1500μF	680~1500μF	680~1500μF	680~1500μF	680~1500μF	
C3	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	0.1μF/16V (R)	
C4	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	0.1μF/25V (R)	
R1	18mΩ±5% less than	18mΩ±5% less than	18mΩ±5% less than	18mΩ±5% less than	18mΩ±5% less than	
R2	10kΩ±1%	10kΩ±1%	20kΩ±1%	10kΩ±1%	3.3kΩ±1%	
R3	2kΩ±1%	10kΩ±1%	33kΩ±1%	30kΩ±1%	18kΩ±1%	

● BP5250-24 external referene components
Input voltage24V

Output current	1A					Note
Output voltage	1.5V±3%	2.5V±3%	3.3V±3%	5V±3%	8V±3%	
Q 1	CPH6306	CPH6306	CPH6306	CPH6306	CPH6306	
SD1	RB050L-40	RB050L-40	RB050L-40	RB050L-40	RB050L-40	
L1	18~37µH±10%	30~59µH±10%	37~75µH±10%	52~105µH±10%	70~140µH±10%	
	1.3A or higher	1.3A or higher	1.3A or higher	1.3A or higher	1.3A or higher	Rated current
C1	0.3Arms or higher	0.4Arms or higher	0.4Arms or higher	0.5Arms or higher	0.7Arms or higher	Allowable ripple current
	33~4700µF	100~4700µF	100~4700µF	100~4700µF	100~4700µF	
C2	0.3Arms or higher	0.3Arms or higher	0.3Arms or higher	0.3Arms or higher	0.3Arms or higher	Allowable ripple current
	220~1000µF	220~1000µF	220~1000µF	220~1000µF	220~1000µF	
C3	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	
C4	0.1µF/50V (R)	0.1µF/50V (R)	0.1µF/50V (R)	0.1µF/50V (R)	0.1µF/50V (R)	
R1	56mΩ±5% less than	56mΩ±5% less than	56mΩ±5% less than	56mΩ±5% less than	56mΩ±5% less than	
R2	10kΩ±1%	10kΩ±1%	20kΩ±1%	10kΩ±1%	3.3kΩ±1%	
R3	2kΩ±1%	10kΩ±1%	33kΩ±1%	30kΩ±1%	18kΩ±1%	

Output current	2A					Note
Output voltage	1.5V±3%	2.5V±3%	3.3V±3%	5V±3%	8V±3%	
Q 1	2SJ529S	2SJ529S	2SJ529S	2SJ529S	2SJ529S	
SD1	RB050L-40	RB050L-40	RB050L-40	RB050L-40	RB050L-40	
L1	9~18µH±10%	15~30µH±10%	19~38µH±10%	26~52µH±10%	35~70µH±10%	
	2.5A or higher	2.5A or higher	2.5A or higher	2.5A or higher	2.5A or higher	Rated current
C1	0.6Arms or higher	0.7Arms or higher	0.8Arms or higher	1Arms or higher	1.3Arms or higher	Allowable ripple current
	100~4700µF	100~4700µF	220~4700µF	220~4700µF	220~4700µF	
C2	0.6Arms or higher	0.6Arms or higher	0.6Arms or higher	0.6Arms or higher	0.6Arms or higher	Allowable ripple current
	560~1500µF	560~1500µF	560~1500µF	560~1500µF	560~1500µF	
C3	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	
C4	0.1µF/50V (R)	0.1µF/50V (R)	0.1µF/50V (R)	0.1µF/50V (R)	0.1µF/50V (R)	
R1	27mΩ±5% less than	27mΩ±5% less than	27mΩ±5% less than	27mΩ±5% less than	27mΩ±5% less than	
R2	10kΩ±1%	10kΩ±1%	20kΩ±1%	10kΩ±1%	3.3kΩ±1%	
R3	2kΩ±1%	10kΩ±1%	33kΩ±1%	30kΩ±1%	18kΩ±1%	

Output current	3A					Note
Output voltage	1.5V±3%	2.5V±3%	3.3V±3%	5V±3%	8V±3%	
Q 1	2SJ529S×2	2SJ529S×2	2SJ529S×2	2SJ529S×2	2SJ529S×2	
SD1	RB050L-40×2	RB050L-40×2	RB050L-40×2	RB050L-40×2	RB050L-40×2	
L1	6~12µH±10%	10~20µH±10%	13~25µH±10%	17~35µH±10%	23~47µH±10%	
	3.8A or higher	3.8A or higher	3.8A or higher	3.8A or higher	3.8A or higher	Rated current
C1	0.9Arms or higher	1Arms or higher	1.2Arms or higher	1.5Arms or higher	1.9Arms or higher	Allowable ripple current
	220~4700µF	220~4700µF	220~4700µF	470~4700µF	470~4700µF	
C2	0.9Arms or higher	0.9Arms or higher	0.9Arms or higher	0.9Arms or higher	0.9Arms or higher	Allowable ripple current
	680~1500µF	680~1500µF	680~1500µF	680~1500µF	680~1500µF	
C3	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	0.1µF/16V (R)	
C4	0.1µF/25V (R)	0.1µF/25V (R)	0.1µF/25V (R)	0.1µF/25V (R)	0.1µF/25V (R)	
R1	18mΩ±5% less than	18mΩ±5% less than	18mΩ±5% less than	18mΩ±5% less than	18mΩ±5% less than	
R2	10kΩ±1%	10kΩ±1%	20kΩ±1%	10kΩ±1%	3.3kΩ±1%	
R3	2kΩ±1%	10kΩ±1%	33kΩ±1%	30kΩ±1%	18kΩ±1%	

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 othe 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.