DC / DC converter

BP5232A25 / BP5232A33 / BP5233A33 / BP5234A33

The BP5232A25, BP5232A33, BP5233A33 and BP5234A33 are DC / DC converters that use PWM system and VFM system. They contain control circuits, switching devices and coils, and operate by only connecting an I/O smoothing capacitor.
With a high efficiency of power conversion, the modules are available in stand-alone SIP packages with no heat sink required.

●Applications

Power supplies for copiers, personal computers, facsimiles, industrial equipment, and AV equipment.

●Features

1) High power conversion efficiency. (BP5233A33 : 93%)
2) Large output current.
3) Low current consumption with no load. (BP5233A33 : 200μA Typ.)
4) High conversion efficiency. (85% at output current of 100mA)
5) Applicable to various purposes by fine-adjusting output voltage with external circuits.
6) Built-in ON / OFF switch.
7) Heat sink unnecessary.

●Absolute maximum ratings (Ta = 25°C)

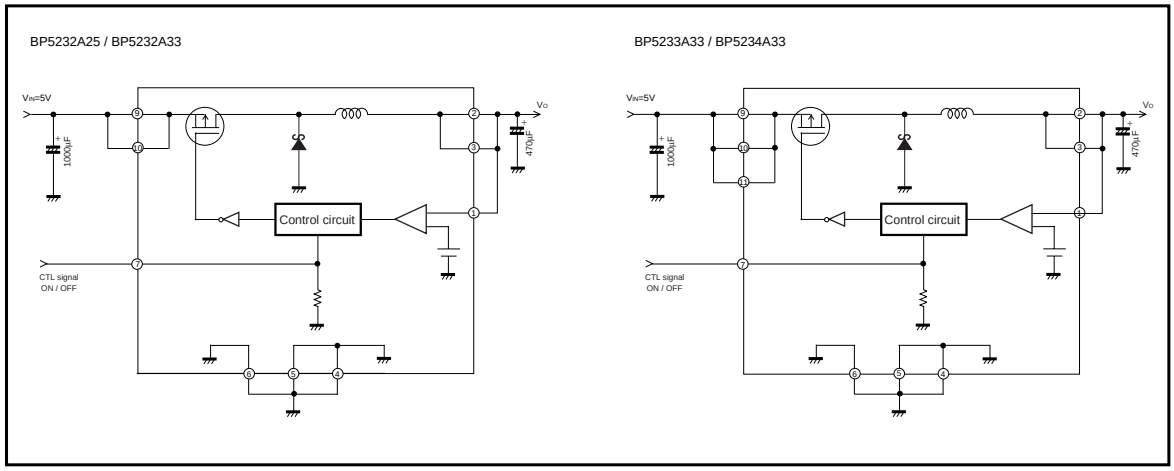
Parameter	Symbol	Limits				Unit
		BP5232A25	BP5232A33	BP5233A33	BP5234A33	
Input voltage	V_{IN}	7				V
Output current	I_O	2*	2*	3*	4*	A
Operating temperature	Topr	−20 to +55				°C
Storage temperature	Tstg	−25 to +80				°C

* Derating required according to the input voltage and ambient temperature.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input voltage	V_{IN}	4.5	5.0	5.5	V

●Block diagram



●Pin descriptions

BP5232A25 , 5232A33

Pin No.	Pin description
1	Feed back
2	$V_{OUT}1$
3	$V_{OUT}2$
4	GND
5	GND

Pin No.	Pin description
6	GND
7	CTL
9	$V_{IN}1$
10	$V_{IN}2$

Pin 8 is removed.

BP5233A33 , BP5234A33

Pin No.	Pin description
1	Feed back
2	$V_{OUT}1$
3	$V_{OUT}2$
4	GND
5	GND

Pin No.	Pin description
6	GND
7	CTL
9	$V_{IN}1$
10	$V_{IN}2$
11	$V_{IN}3$

Pin 8 is removed.

●Electrical characteristics

BP5232A25 (Unless otherwise noted, V_{IN}=5V, I_O=1A, SW=1, Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Input voltage	V_{IN}	4.5	5	5.5	V		Fig.1
Output voltage	V_O	2.4	2.5	2.6	V		Fig.1
Output current	I_O	–	–	2	A	∗1	Fig.1
Current consumption at no load	I_{IN}	–	200	300	μA		Fig.1
Load regulation	ΔV_O	–	13	33	mV	I_O=0.1A to 2A	Fig.1
Output ripple voltage	υγ	–	33	100	mV_{PP}	∗2	Fig.1
Power conversion efficiency	η	84	89	–	%		Fig.1
CTL pin ON voltage	V_{ON}	1.8	–	–	V		Fig.1
CTL pin OFF voltage	V_{OFF}	– (Alternatively, when OPEN)	–	0.3	V	SW=2	Fig.1

∗1 Derating required according to the input voltage and ambient temperature.
∗2 Pulse noise not included.

Power Module

BP5232A33 (Unless otherwise noted, V_{IN}=5V, I_O=1A, SW=1, Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Input voltage	V_{IN}	4.5	5	5.5	V		Fig.1
Output voltage	V_O	3.17	3.3	3.43	V		Fig.1
Output current	I_O	–	–	2	A	∗1	Fig.1
Current consumption at no load	I_{IN}	–	200	300	μA		Fig.1
Load regulation	ΔV_O	–	16	42	mV	I_O=0.1A to 2A	Fig.1
Output ripple voltage	υγ	–	33	100	mV_{PP}	∗2	Fig.1
Power conversion efficiency	η	88	93	–	%		Fig.1
CTL pin ON voltage	V_{ON}	1.8	–	–	V		Fig.1
CTL pin OFF voltage	V_{OFF}	– (Alternatively, when OPEN)	–	0.3	V	SW=2	Fig.1

∗1 Derating required according to the input voltage and ambient temperature.
∗2 Pulse noise not included.

BP5233A33 (Unless otherwise noted, V_{IN}=5V, I_O=1.5A, SW=1, Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Input voltage	V_{IN}	4.5	5	5.5	V		Fig.2
Output voltage	V_O	3.17	3.3	3.43	V		Fig.2
Output current	I_O	–	–	3	A	∗1	Fig.2
Current consumption at no load	I_{IN}	–	200	300	μA		Fig.2
Load regulation	ΔV_O	–	16	42	mV	I_O=0.1A to 3A	Fig.2
Output ripple voltage	υγ	–	33	150	mV_{PP}	∗2	Fig.2
Power conversion efficiency	η	88	93	–	%		Fig.2
CTL pin ON voltage	V_{ON}	1.8	–	–	V		Fig.2
CTL pin OFF voltage	V_{OFF}	– (Alternatively, when OPEN)	–	0.3	V	SW=2	Fig.2

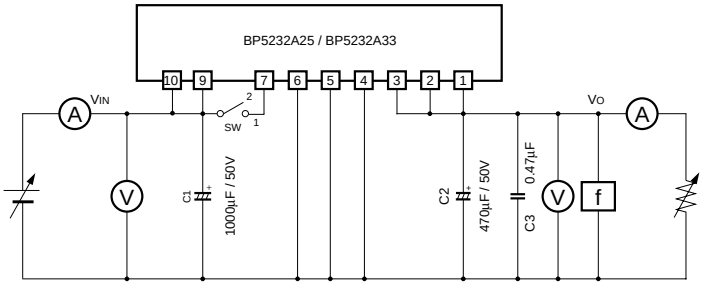
∗1 Derating required according to the input voltage and ambient temperature.
∗2 Pulse noise not included.

BP5234A33 (Unless otherwise noted, V_{IN}=5V, I_O=2A, SW=1, Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Input voltage	V_{IN}	4.5	5	5.5	V		Fig.2
Output voltage	V_O	3.17	3.3	3.43	V		Fig.2
Output current	I_O	–	–	4	A	∗1	Fig.2
Current consumption at no load	I_{IN}	–	200	300	μA		Fig.2
Load regulation	ΔV_O	–	16	42	mV	I_O=0.1A to 4A	Fig.2
Output ripple voltage	υγ	–	33	150	mV_{PP}	∗2	Fig.2
Power conversion efficiency	η	88	93	–	%		Fig.2
CTL pin ON voltage	V_{ON}	1.8	–	–	V		Fig.2
CTL pin OFF voltage	V_{OFF}	– (Alternatively, when OPEN)	–	0.3	V	SW=2	Fig.2

∗1 Derating required according to the input voltage and ambient temperature.
∗2 Pulse noise not included.

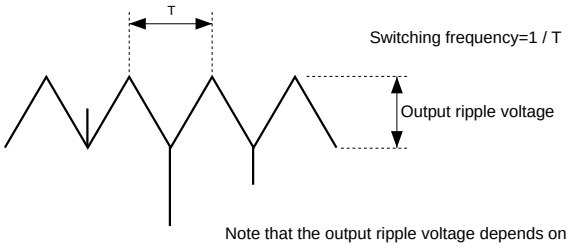
●Measurement circuit



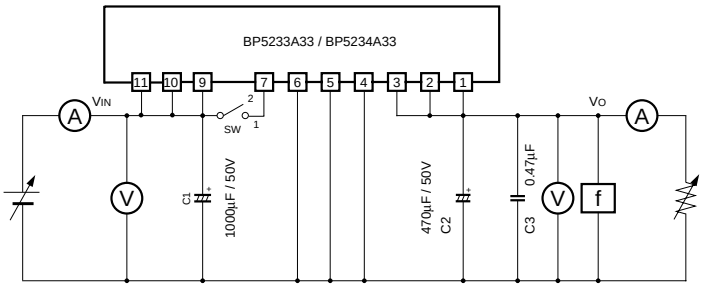
f : frequency counter
C1, C2 : Low impedance type
C3 : film capacitor

∗A large ripple current flows to the input smoothing capacitor due to the output load. Be minded to use within the allowable ripple current of the capacitor.
∗The capacitor with a particularly low impedance is used as the output smoothing capacitor C2 so as to suppress the output ripple voltage. Select the capacitor according to the purpose of use in each case.

Fig.1



Note that the output ripple voltage depends on the type and characteristics of the output capacitor.



f : frequency counter
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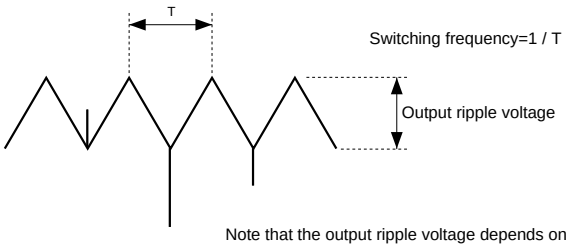
∗A large ripple current flows to the input smoothing capacitor due to the output load. Be minded to use within the allowable ripple current of the capacitor.
∗The capacitor with a particularly low impedance is used as the output smoothing capacitor C2 so as to suppress the output ripple voltage. Select the capacitor according to the purpose of use in each case.

Fig.2



Note that the output ripple voltage depends on the type and characteristics of the output capacitor.

●Circuit operation

(1) The basic application examples are shown in Fig.3. The externally installed parts are only the input and output smoothing capacitors.
(2) Switching on and off the output voltage is allowed. The output can be switched off by making pin 7 to be low or open (high impedance). (See Fig.4.)
(3) Fine adjustment of the output voltage is allowed. The fine adjustment of output voltage can be performed from pin 1 via the resistor by connecting the output terminal (pin 2, 3) and GND. (See Fig.5.)

Basic application

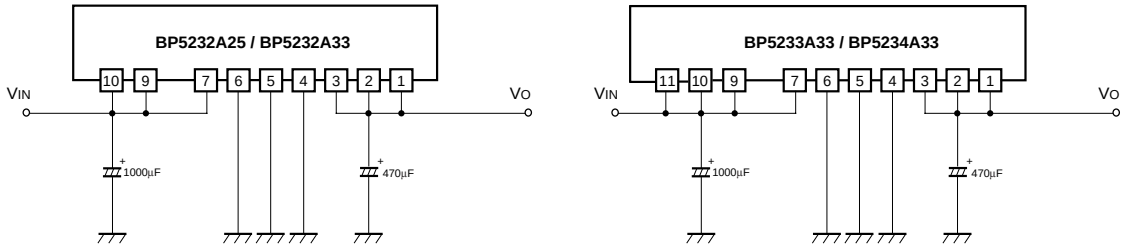


Fig.3

Output ON / OFF control

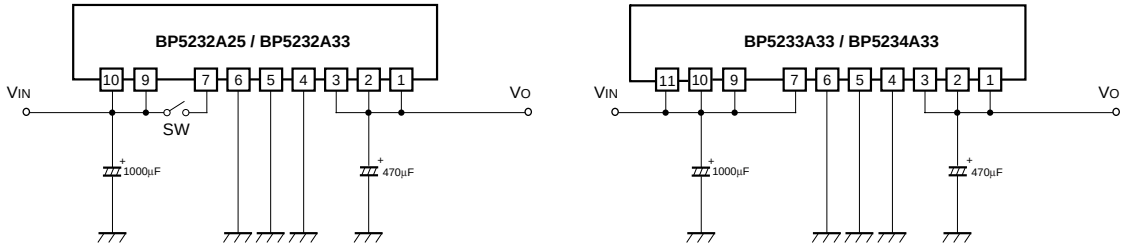
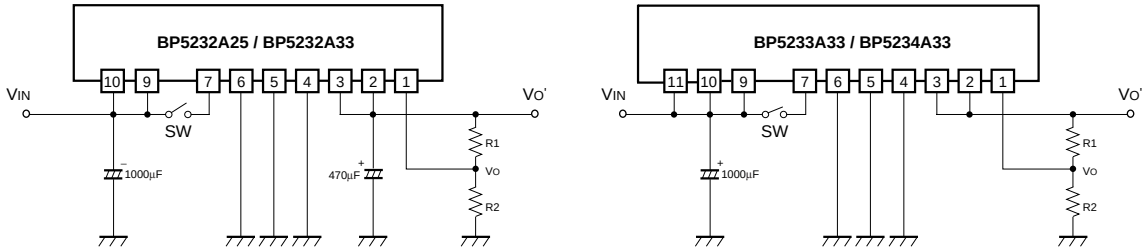


Fig.4

Output voltage fine adjustment



VO' value setting equations

$$V_{O'}=V_O\left(1+\frac{R1}{R2}\right) \qquad R1+R2 \leq 50k\Omega$$

It is recommended that the output voltage should be adjusted within the range of ±10% of the rated output voltage, so that the performance of the module can fully be exhibited.

Fig.5

●Operation notes

(1) The output current should be reduced according to an increase in the input voltage or ambient temperature. Use the module within the derating curve range.
(2) In case that the output is controlled by switching on and off utilizing pin 7 or in case that the input voltage is applied, a large inrush electrical current may flow. Be minded to use within the allowable operating range. This allowable operating range is specified by the safety operating range of the switching transistor in the module. The amount of the inrush current varies depending on the output impedance of the input power supply or the capacity value of the capacitor to be connected to the output.
(3) Protection circuit for output current is incorporated. In case that the output is short-circuited, the output will be latched by switching off. The protection circuit can be cancelled by making CTL terminal active state (CTL= HIGH), after once making it standby state (CTL=LOW), or by resupplying the power. However, in case that the protection circuit is cancelled by resupplying the power source, it may not be cancelled even by resupplying the power source in the state that the electrical charge is remained in CIN (the state that voltage is remained in VIN) even after the power source is switched off.
(4) The rising time of the input voltage should be made within 5ms. There may be a case that the protection circuit is activated.
(5) I / O smoothing capacitors should be connected between I / O and GND terminals.
(6) Normally, use by short-circuiting pins 1, 2, 3, pins 4, 5, 6, and pins 9, 10, 11 (BP5232A25) respectively.
(7) A large ripple current flows to the input smoothing capacitor due to the output load. Be minded to use within the allowable ripple current of the capacitor.
(8) The capacitor with a particularly low impedance is used as the output smoothing capacitor C2 so as to suppress the output ripple voltage. Select the capacitor according to the purpose of use in each case.

●Electrical characteristic curves

BP5232A25

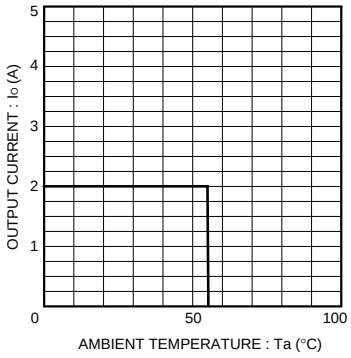


Fig.6 Derating cureve

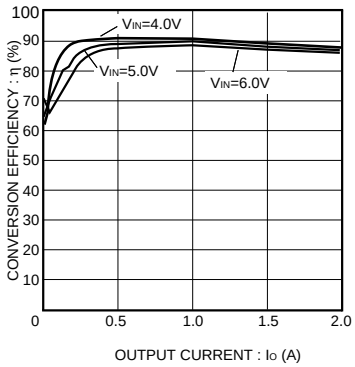


Fig.7 Conversion efficiency

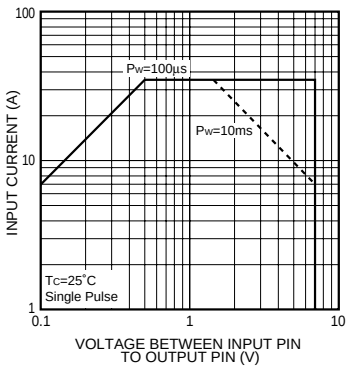


Fig.8 Safe operation range

BP5232A33

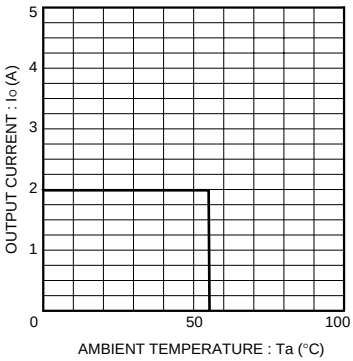


Fig.9 Derating cureve

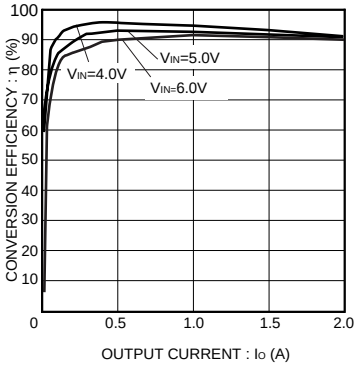


Fig.10 Conversion efficiency

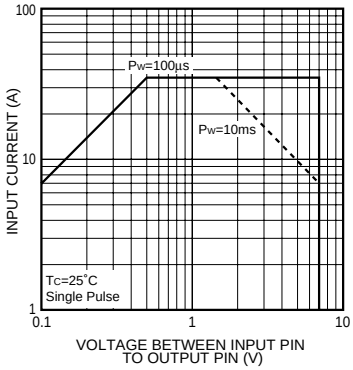


Fig.11 Safe operation range

BP5233A33

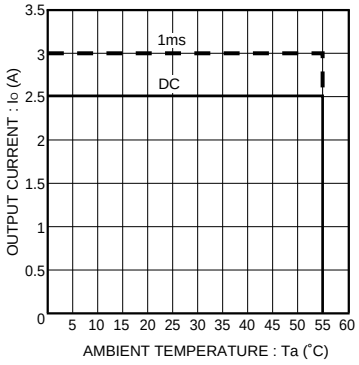


Fig.12 Derating curve

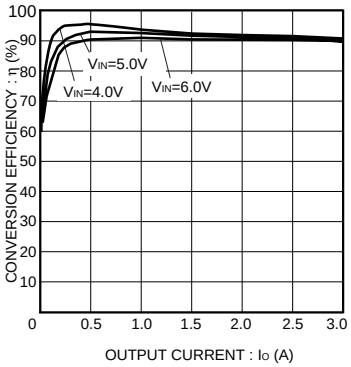


Fig.13 Conversion efficiency

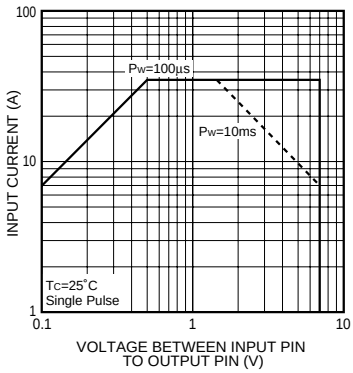


Fig.14 Safe operation range

BP5234A33

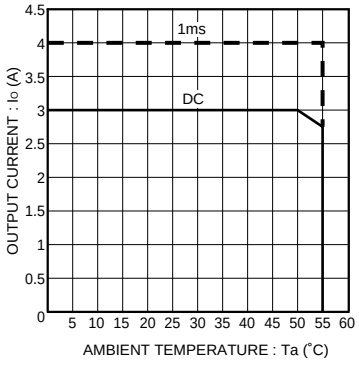


Fig.15 Derating cureve

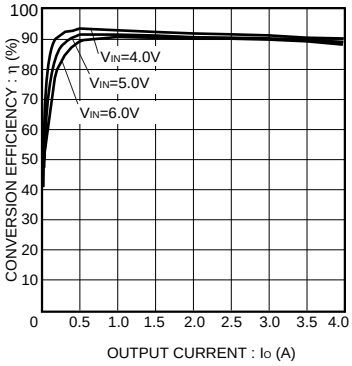


Fig.16 Conversion efficiency

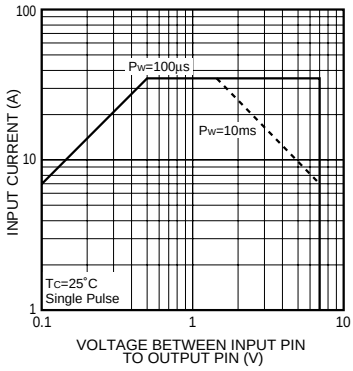
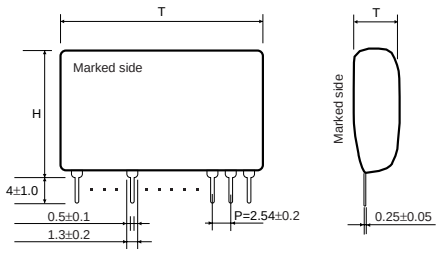


Fig.17 Safe operation range

●**External dimensions** (Unit : mm)



	L	H	T
BP5232A25	28.0	19.5	12.0
BP5232A33	28.0	19.5	12.0
BP5233A33	32.5	23.5	11.0
BP5234A34	38.5	23.5	12.5

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