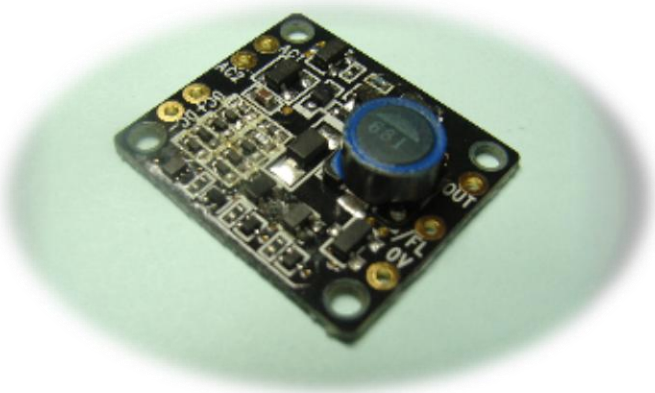
Ultra-Low Power Consumption
Energy Harvesting Power Management Module
EHPM Series



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Features of the EHPM series

1. A power management module specialized for energy harvesting, compatible with power-generating elements that output high voltage and have high output impedance.
   (Optimal for piezoelectric and capacitive energy harvesting elements)

2. Ultra-low power consumption. (Standby power: less than 2 µW)

3. Operates with an average input current as low as 0.5 µA.

4. High efficiency with over 60% at an average input current of 1 µA.

5. Wide input voltage range available. (10 V to 50 V in 5 V steps, and 100 V)

6. Selectable output voltage: 3.3 V or 5 V.

7. Capable of accepting AC input voltage.

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Specification

Model		EHPM-10-AB	EHPM-15-AB	EHPM-20-AB	EHPM-25-AB	EHPM-30-AB
Average input voltage (V)	VinAV	10	15	20	25	30
Input discharge start voltage (V)	VinDIS	11	17	23	28	34
Average output voltage (V)	VoutAV	3.38V or 5.13V (selectable)				
Output upper limit voltage (V)	Vouthigh	3.47V or 5.25V				
Output lower limit voltage (V)	Voutlow	3.3V or 5.0V				
Operable average input current (uA)	IinMIN	0.5	0.5	0.5	0.5	0.5
Maximum average input current(mA)	IinMAX	10.0	10.0	5.0	5.0	5.0
Maximum output current (mA)	IoutMAX(3.3V)	2.0	5.0	9.0	11.0	13.0
	IoutMAX(5V)	2.0	5.0	6.0	8.0	9.0
full charge signal		Available (open drain, active low, maximum voltage 60V, sink current 100mA, voltage 0.9V or less at low)				
AC power input		Possible (AC1, AC2 input)				

Model		EHPM-35-AB	EHPM-40-AB	EHPM-45-AB	EHPM-50-AB	EHPM-100-AB
Average input voltage (V)	VinAV	35	40	45	50	100
Input discharge start voltage (V)	VinDIS	40	45	51	57	114
Average output voltage (V)	VoutAV	3.38V or 5.13V (selectable)				
Output upper limit voltage (V)	Vouthigh	3.47V or 5.25V				
Output lower limit voltage (V)	Voutlow	3.3V or 5.0V				
Operable average input current (uA)	IinMIN	0.5	0.5	0.5	0.5	0.5
Maximum average input current(mA)	IinMAX	5.0	5.0	5.0	5.0	5.0
Maximum output current (mA)	IoutMAX(3.3V)	15.0	18.0	20.0	20.0	40.0
	IoutMAX(5V)	11.0	13.0	14.0	15.0	30.0
full charge signal		Available (open drain, active low, maximum voltage 60V, sink current 100mA, voltage 0.9V or less at low)				
AC power input		Possible (AC1, AC2 input)				

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Efficiency

Model			EHPM-10-AB	EHPM-15-AB	EHPM-20-AB	EHPM-25-AB	EHPM-30-AB
Efficiency (%) (Typical value)	Average input current at 1uA	Ef1in(Vout=3.3V)	60	65	66	68	68
		Ef1in(Vout=5V)	60	65	68	70	70
	Average input current at 5uA	Ef5in(Vout=3.3V)	77	77	75	75	75
		Ef5in(Vout=5V)	80	79	79	79	79
	Average output current at 5uA	Ef5out(Vout=3.3V)	71	70	68	68	67
		Ef5outVout=(5V)	76	74	74	73	72

Model			EHPM-35-AB	EHPM-40-AB	EHPM-45-AB	EHPM-50-AB	EHPM-100-AB
Efficiency (%) (Typical value)	Average input current at 1uA	Ef1in(Vout=3.3V)	68	69	70	69	65
		Ef1in(Vout=5V)	71	72	73	72	70
	Average input current at 5uA	Ef5in(Vout=3.3V)	74	74	74	74	69
		Ef5in(Vout=5V)	78	78	78	78	74
	Average output current at 5uA	Ef5out(Vout=3.3V)	65	65	65	65	60(※)
		Ef5outVout=(5V)	71	71	71	70	68(※)

(※)Measured at 10μA output current

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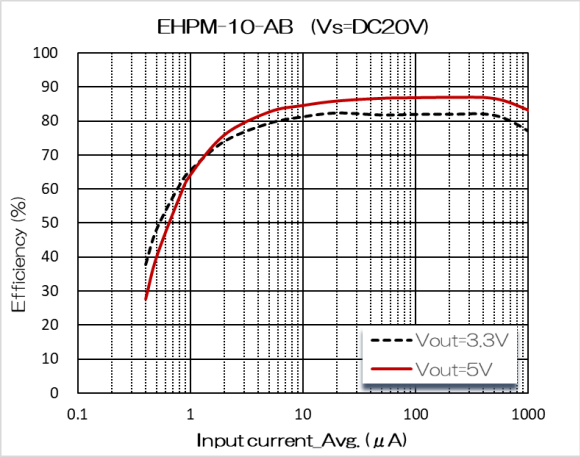
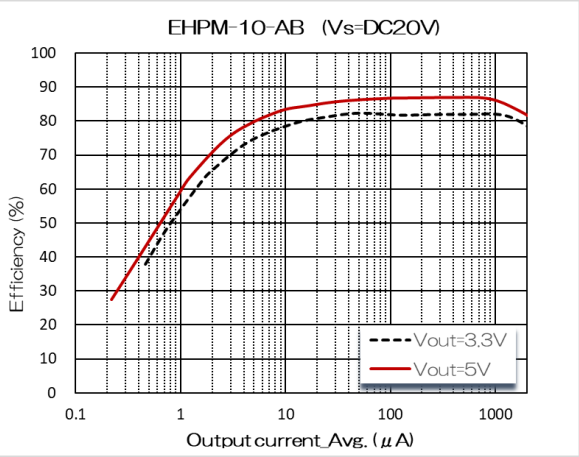
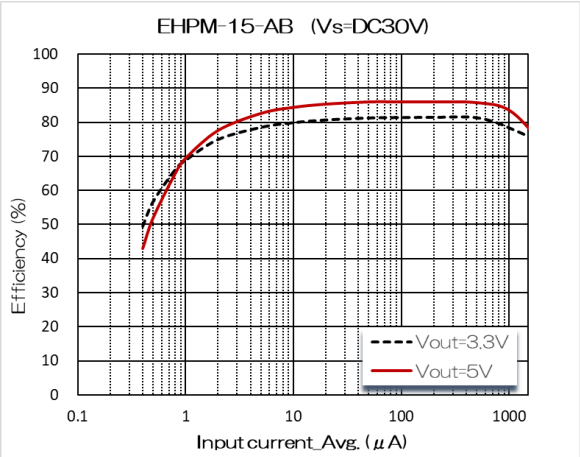
Efficiency characteristics

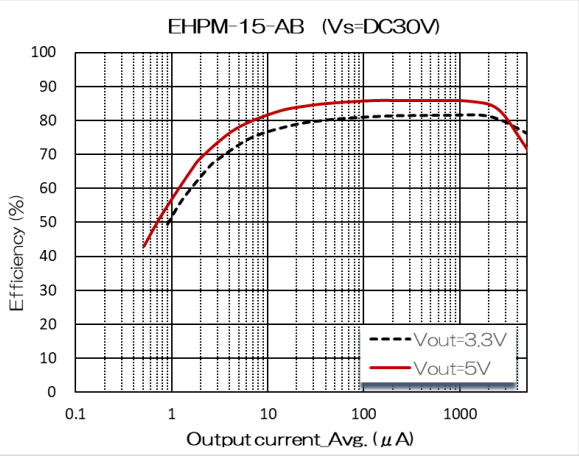
EHPM-10-AB (VinAV=10V)





EHPM-15-AB (VinAV=15V)





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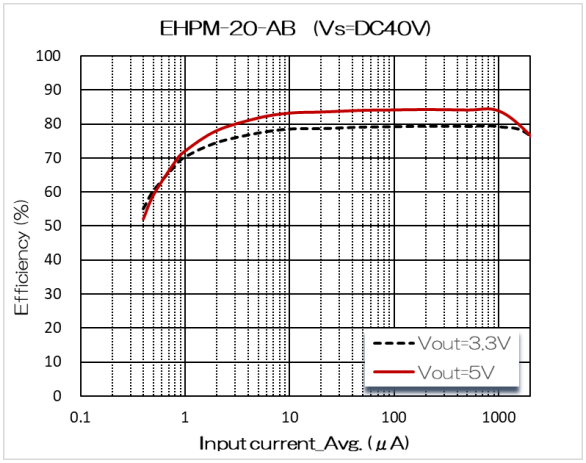
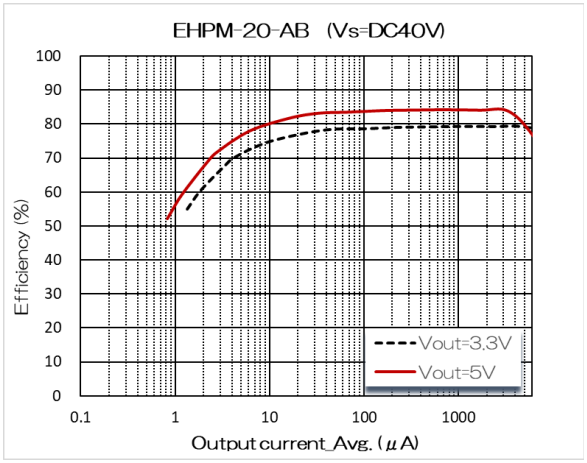
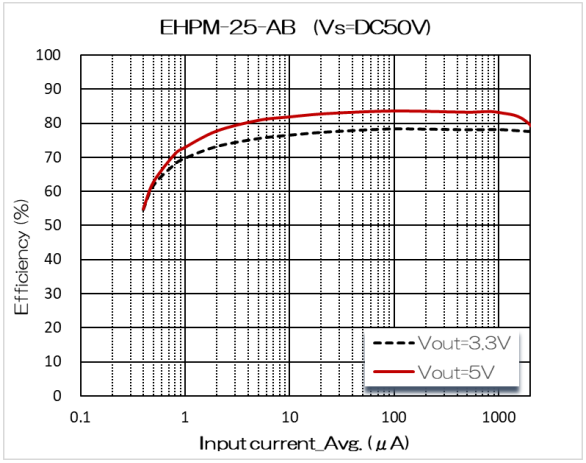
Efficiency characteristics

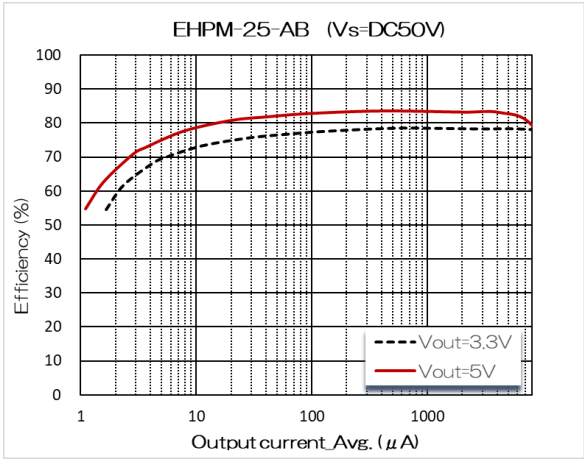
EHPM-20-AB (VinAV=20V)





EHPM-25-AB (VinAV=25V)





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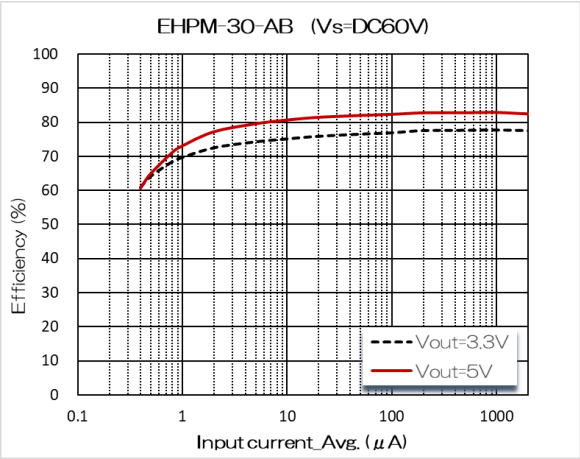
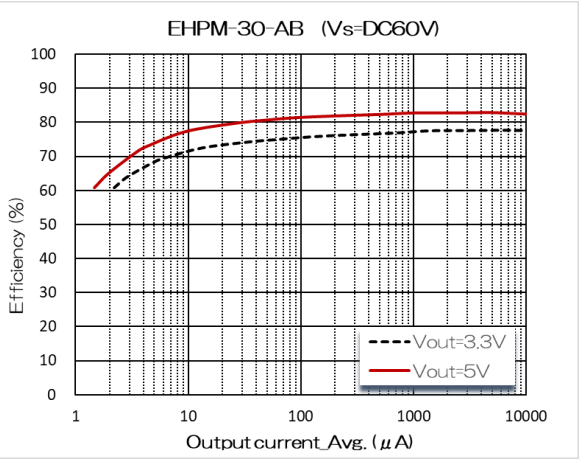
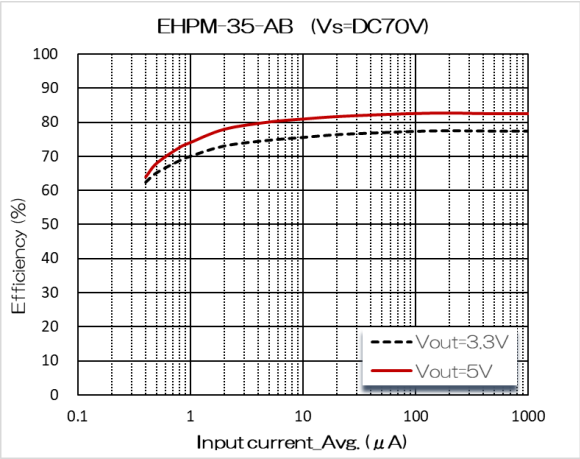
Efficiency characteristics

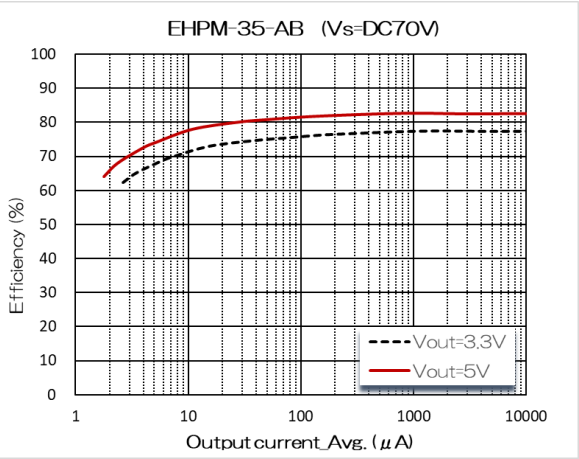
EHPM-30-AB (VinAV=30V)





EHPM-35-AB (VinAV=35V)





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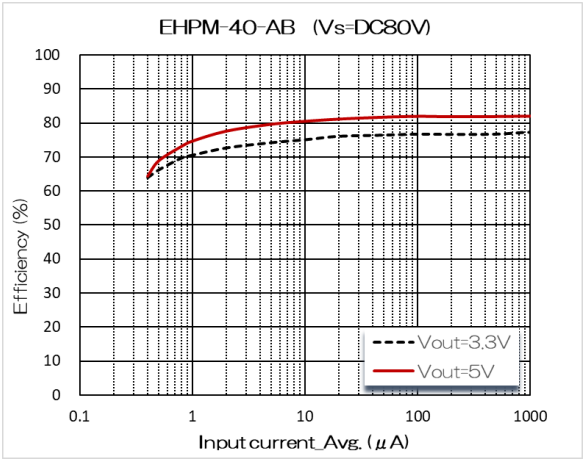
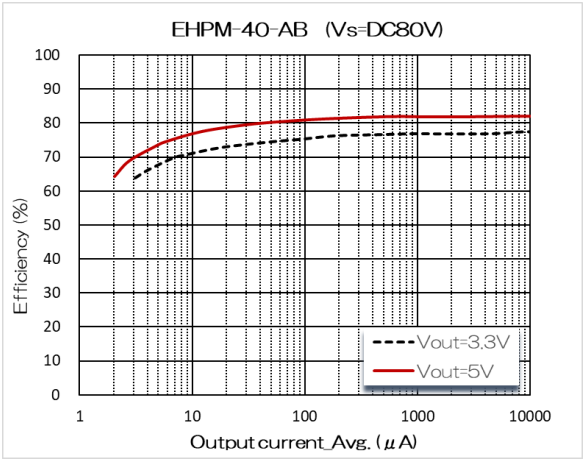
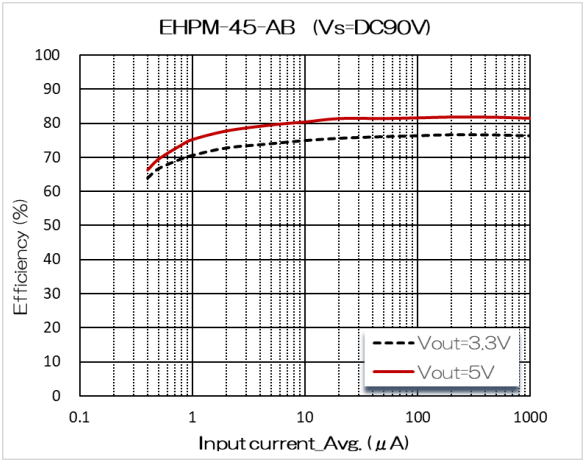
Efficiency characteristics

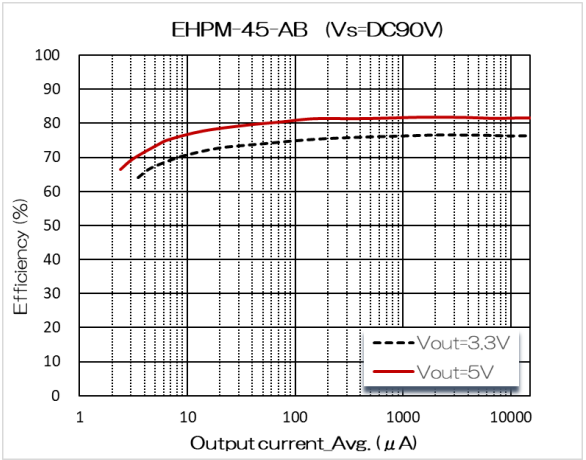
EHPM-40-AB (VinAV=40V)





EHPM-45-AB (VinAV=45V)





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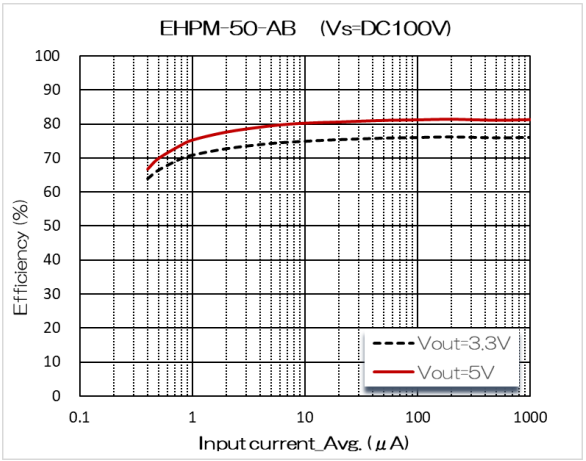
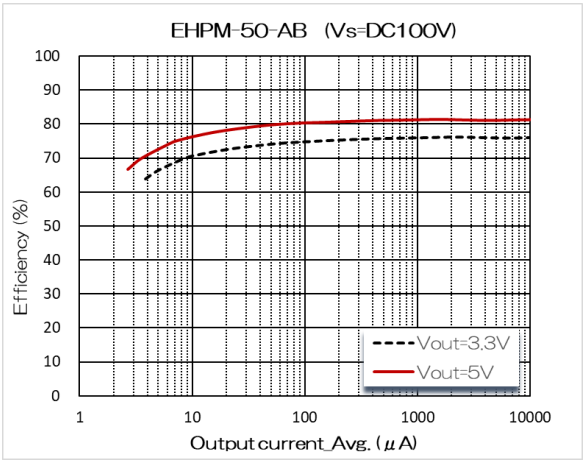
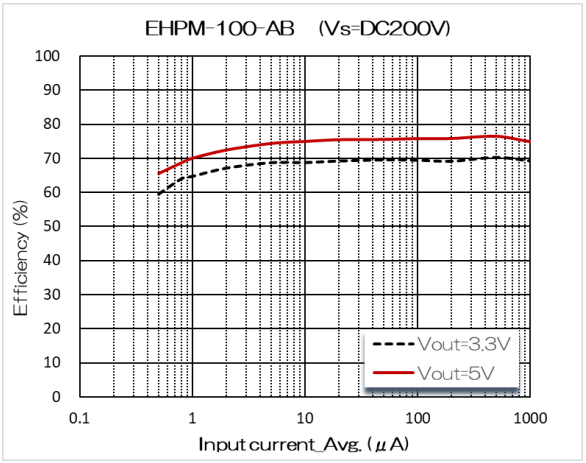
Efficiency characteristics

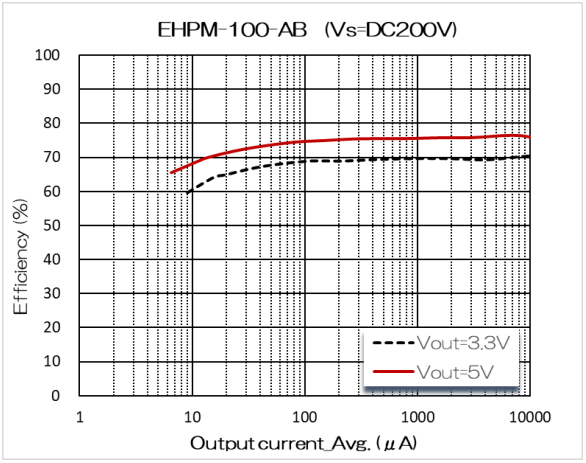
EHPM-50-AB (VinAV=50V)





EHPM-100-AB (VinAV=100V)





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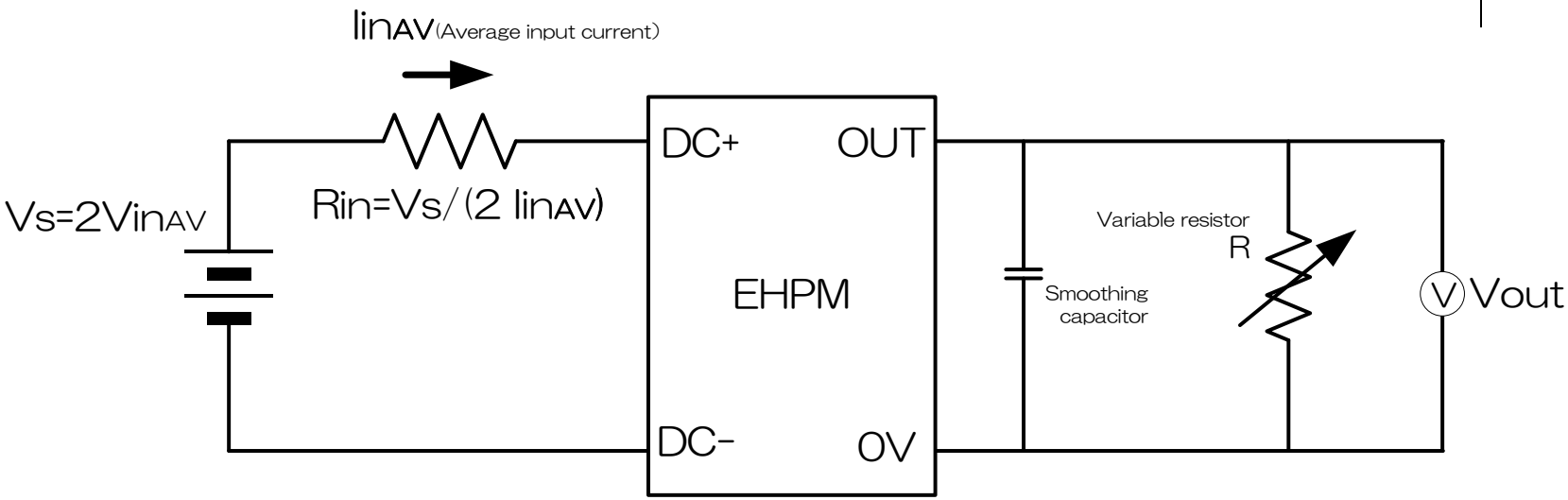
Efficiency measurement circuit



Efficiency calculation：

Efficency (Ef)=((Vout)^2/R)/(VinAV • linAV)

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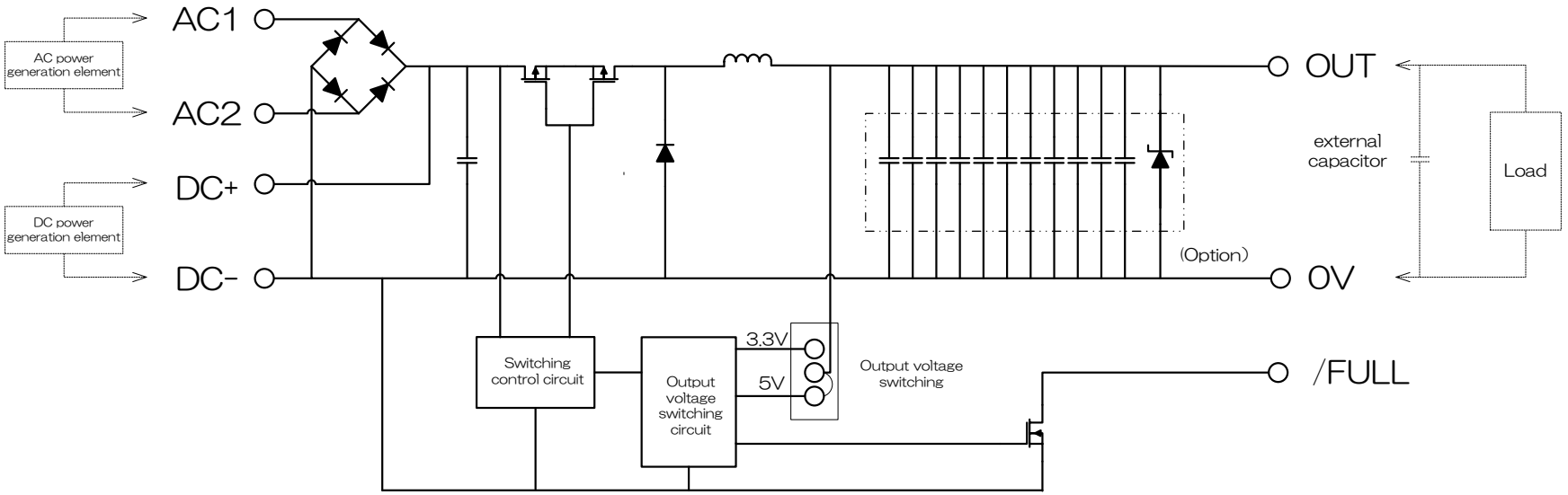
Block Diagram



(Note) If you do not connect an external capacitor to the OUT output, mount a ceramic capacitor (3216 size) of 100μF or more in the optional area.

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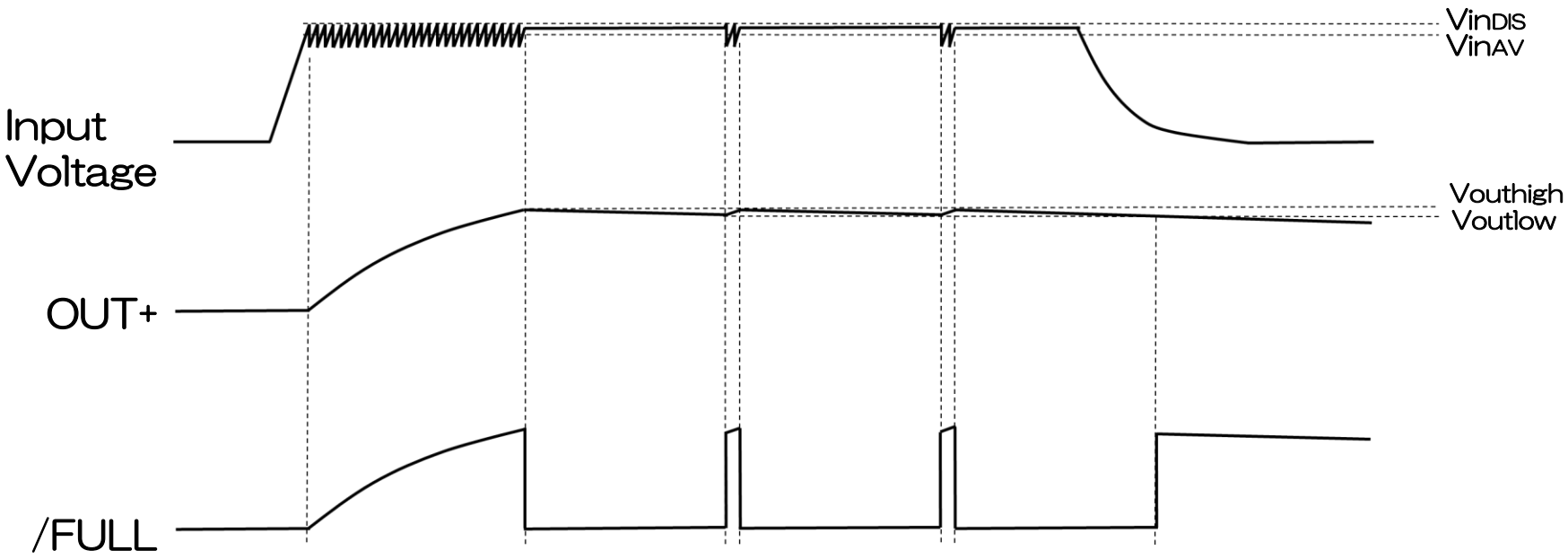
Time chart



(Note) The /FULL signal above is the waveform when pulled up at OUT+ (Output voltage)

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Model description

EHPM－AA－XX

①　②　③

①Series model (fixed)
②Input average voltage (eg 25→25V)
③Output voltage (eg AB → 3.3V and 5V setting selection)

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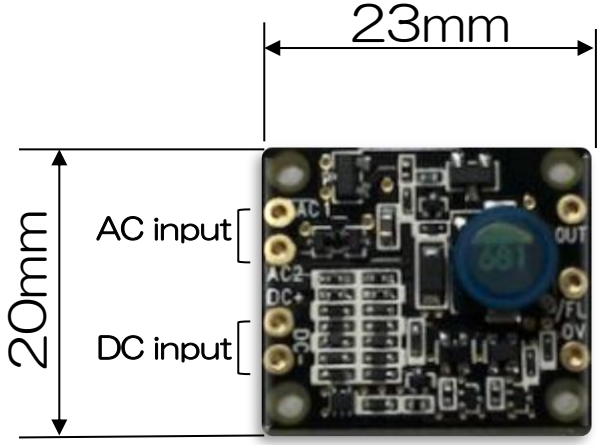
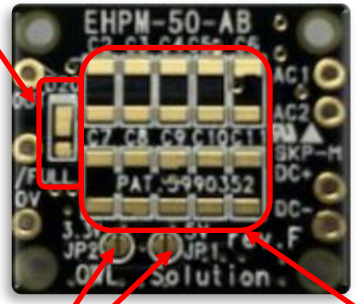
Appearance (EHPM-XX-AB) ※

※XX=10、15、20、25、30、35、40、45、50



PWB thickness t=1.0
Parts height 5 mm or less

For limiting output voltage
Zener diode can be mounted
(Support other than 5V/3.3V)



10 ceramic capacitors of 1206 size
can be mounted as
storage/smoothing capacitors.

Output voltage limit selection jumper

	JP1	JP2
At 5V limit	Short	Open
At 3.3V limit	Open	Short
No output limit	Open	Open

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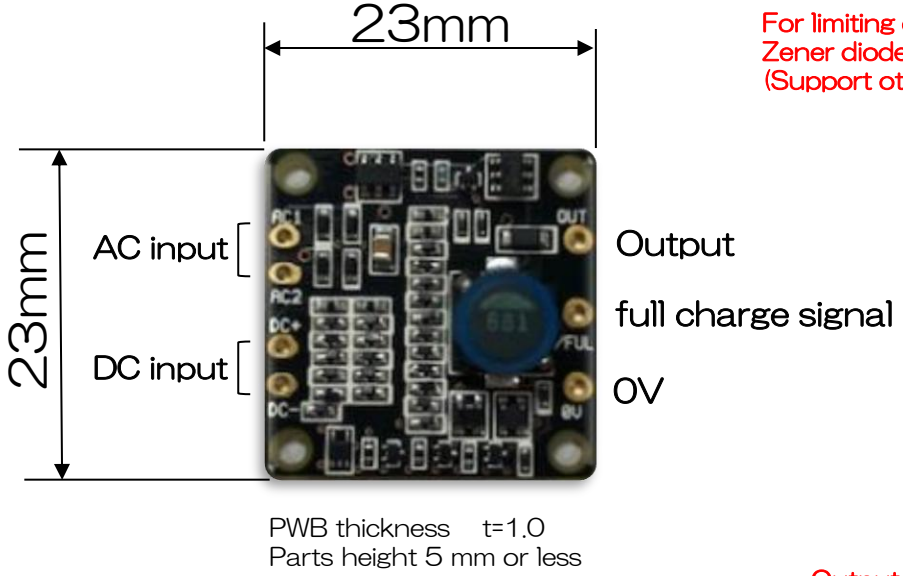
Appearance（EHPM-100-AB）



PWB thickness　t=1.0
Parts height 5 mm or less

For limiting output voltage
Zener diode can be mounted
(Support other than 5V/3.3V)

10 ceramic capacitors of 1206 size
can be mounted as
storage/smoothing capacitors.

Output voltage limit selection jumper

	JP1	JP2
At 5V limit	Short	Open
At 3.3V limit	Open	Short
No output limit	Open	Open

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One-point advice for module

1 . When the power generation element is DC output
Please select a type with an input average voltage (VinAV)
that is approximately 50% of the open circuit voltage.
eg) EHPM-25-AB is optimal when the open-circuit voltage
of the power generation element is 50V.

2. When the power generation element is AC output (near sine wave)
Please select a type with an input average voltage (VinAV)
that is approximately 30 to 40% of the maximum open voltage.
eg) When the maximum open circuit voltage of
the power generation element is 50V
EHPM-15-AB or EHPM-20-AB is optimal.

3. When the power generation element is AC output
and the input average current is lower than 1 μA
Try a type with an input average voltage (VinAV)
that is 5 to 10 V lower than the one selected in 2.

(Finally, please check with the actual EHPM board)

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Precautions for use

1. When the output is limited (3.3V, 5V limit),
   do not apply a voltage of 7V or more to the output from the outside.
   Internal elements may be destroyed.

2. When using without limiting the output, do not apply a voltage of 30V or more to the output from the outside.
   The internal elements may be destroyed.

3. Connect a capacitor of 100μF or more between OUT output and 0V.
   If you do not have an external capacitor,
   mount one or more ceramic capacitors (1206 size) of
   100μF on C2 to C11 on this board.

4. When using J1 and J2 (no output limit) open,
   please limit the OUT output voltage externally.
   By mounting a Zener diode on EHPM board,
   you can easily limit the voltage of the OUT output.

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