PAH200H48-*/B**Instruction Manual

Contents

* Note : This instruction manual describes only changed items from the standard model's instruction manual.
Please refer to "PAH200H48 Series instruction more details.

DWG NO. : C170-04-02/B

1. Output Derating

There is no restriction on mounting direction but there should be enough consideration for airflow so that heat does not accumulate around the power module vicinity. Determine external components configuration and mounting direction on PCB such that air could flow through power module at forced air cooling or convection cooling.

By maintaining baseplate temperature below 100°C, operation is possible. But according to the models, output derating is needed as shown in Fig. 1-1.

Measure baseplate temperature at center of baseplate as indicated in Fig.1-2. For better improvement of power module reliability, more derating of baseplate temperature when using is recommended.

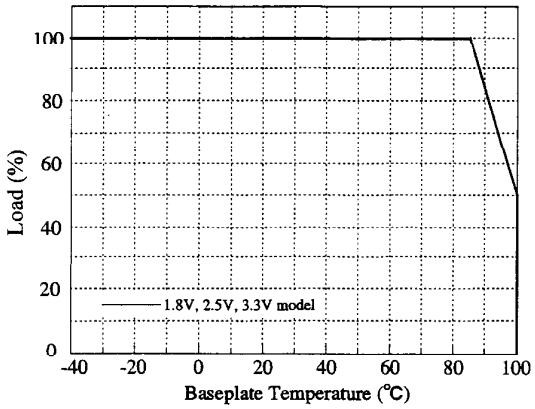

Fig.1-1 PAH200H48/B Output Derating

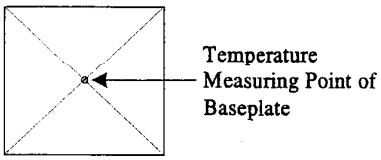

Fig.1-2 Temperature Measuring Point of Baseplate

Forced air cooling to power module improve radiation capability more than convection cooling.

Fig. 1-3 indicates thermal resistance value between baseplate and air at standard vertical mounting.

For details on standard vertical mounting, refer to "PAH200H48 Series Instruction Manual".

Fig. 1-4 to 1-6 indicates power dissipation (Pd) of each models at following condition.

Output Voltage	: Nominal value
Ambient Temperature	: 50°C

An example of thermal design using these condition is shown as follows.

(1) Example of Thermal design

Calculate minimum necessary air velocity at following condition.

Use Model	: PAH200H48-3R3/B
Input Voltage	: 48V
Max Output Current	: 50A
Max Ambient Temperature	: 50℃
Mounting Method	: Standard Vertical Mounting (Without Heatsink)

Power dissipation is as shown in Fig.1-6

Pd=18.0 (W)

Maximum baseplate temperature (Tbp) at output current 50A is as shown in Fig.1-1

Tbp=90 (℃)

Therefore

$Tbp = Ta + \theta_{bp-a} \times Pd$

Ta : Ambient temperature (°C)

θ_{bp-a} : Thermal Resistance (°C/W)

(Baseplate − Air)

Equation is as follows.

$$\theta_{bp-a} = \frac{Tbp - Ta}{Pd}$$

=2.2(°C/W)

Air Velocity is as shown in Fig.1-3

Air Velocity =1.0(m/s)

This is minimum necessary air velocity at above condition.

Measure actual baseplate temperature and verify it is same as the design. If there are discrepancy, re-check each condition and re-design.

Note

1) Data shown in Fig.1-3 to 1-6 is the typical value and it changes depends on measurement condition. Recommend to design with sufficient margin against calculation value.
2) When the condition of input voltage and output voltage are different and it is impossible to determine power dissipation (Pd) from Fig.1-4 to 1-6, calculate power dissipation as follows.

$$Pd = Pin - Pout = \frac{100 - \eta}{\eta} \times Pout$$

Pin : Input Power (W)
Pout : Output Power (W)
η :Efficiency (%)

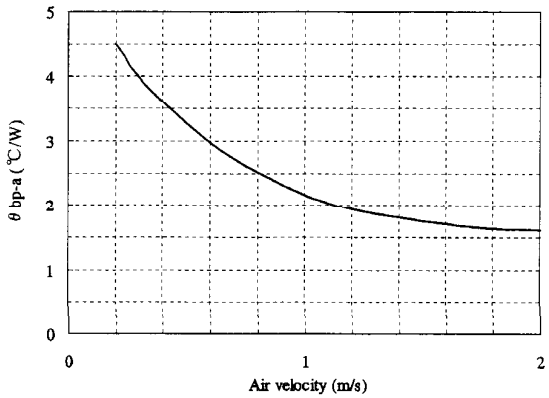

Fig.1-3 Thermal resistance at Baseplate – Air vs Air velocity (typical value)

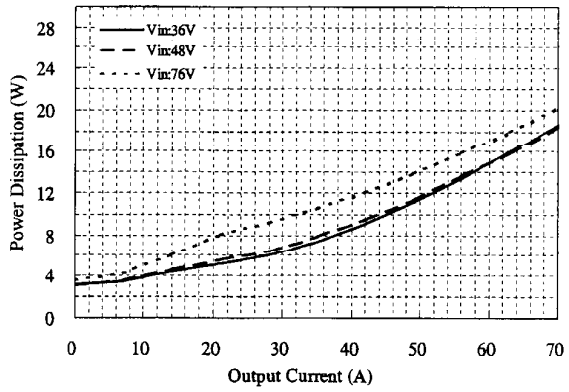

Fig.1-4 PAH200H48-1R8/B Power dissipation vs Output Current
(Output voltage : Nominal, Ta=50°C;typical value)

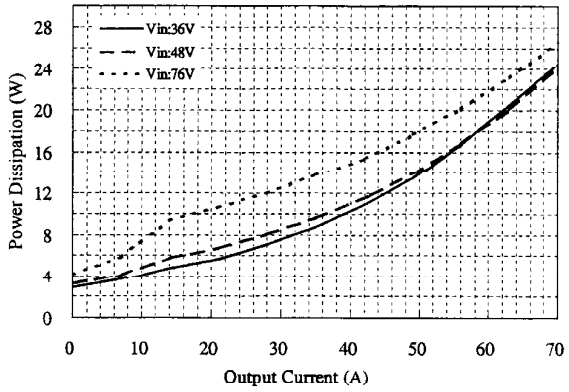

Fig.1-5 PAH200H48-2R5/B Power dissipation vs Output Current
(Output voltage : Nominal, Ta=50°C;typical value)

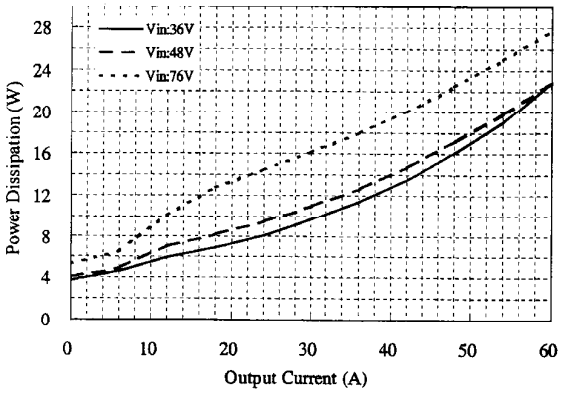

Fig.1-6 PAH200H48-3R3/B Power dissipation vs Output Current
(Output voltage : Nominal, Ta=50°C;typical value)

(2) Output derating against ambient temperature (reference value)

Following the previous design example, output derating against ambient temperature can be determined by the following conditions as shown in Fig.1-7 to 1-9.
These value are for reference only. Be sure to verify baseplate temperature is within output derating as shown in Fig.1-1.for actual design-in

Input Voltage : 48V
Output Voltage : Nominal value
Cooling Method : Convection cooling or forced air cooling (1m/s, 2m/s)
Mounting Method : Standard vertical Mounting

At this case, convection cooling means 0.2m/s air flows by power module heating itself.

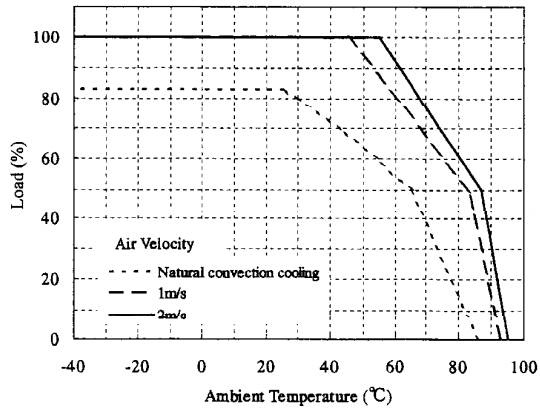

Fig.1-7 PAH200H48-1R8/B Output Derating at Ambient Temperature (Vin=48V: reference value)

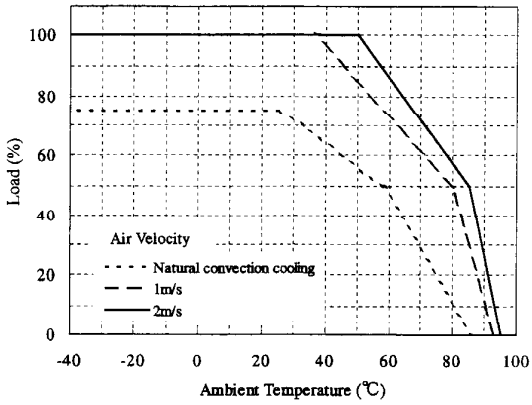

Fig.1-8 PAH200H48-2R5/B
Output Derating at Ambient Temperature
(Vin=48V: reference value)

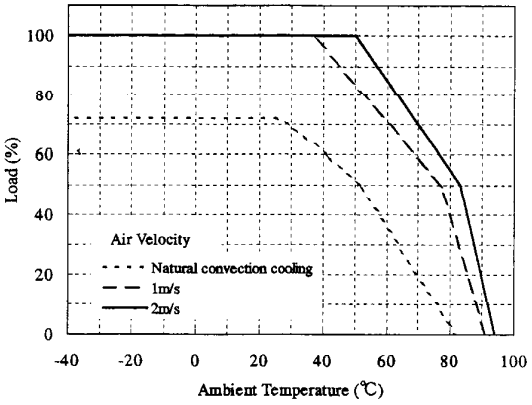

Fig.1-9 PAH200H48-3R3/B
Output Derating at Ambient Temperature
(Vin=48V: reference value)

2. PCB Mounting Method

By the following instruction shown in Fig2-1, mount power module onto printed circuit board.

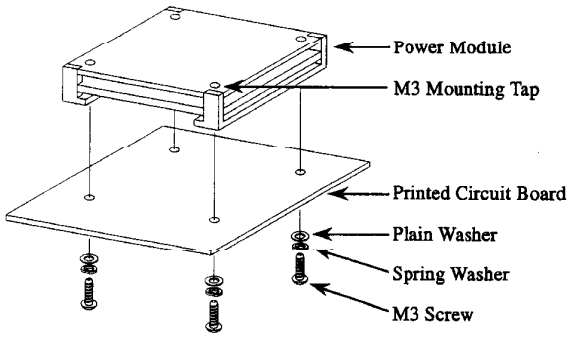

Fig.2-1 Installation of Printed Circuit Board

(1) Method to Fix

To fix a power module onto printed circuit board, use M3 screws and mount it to the tapped holes (4 places) of the module. Recommended torque is 0.54N·m.

(2) M3 Mounting Tapped Holes

M3 mounting tapped holes of power module are connected to baseplate. Connect baseplate terminal to FG (Frame Ground) by using this M3 mounting tapped holes.

(3) Mounting Holes on Printed Circuit Board

Refer to the following sizes when determining diameter of hole and land diameter of printed circuit board.

PAH200H48/B

Input/Signal terminal pin (ϕ 1.0mm)

Hole diameter : ϕ 1.5mm

Land diameter : ϕ 3.0mm

Output terminal pin (ϕ 2.0mm)

Hole diameter : ϕ 2.5mm

Land diameter : ϕ 4.5mm

M3 Mounting Tap (FG)

Hole diameter : ϕ 3.5mm

Land diameter : ϕ 5.5mm

(4) Clearance from Customer Board

Minimum clearance between PAH200H48/B and a customer board is 0.6mm

The power module may influence by noise, care must be taken when wire the signal line.

3. Heatsink Installation Method

(1) Method to Fix

To fix the power module onto heatsink, use M3 screws and mount it to the tapped holes (4 places) at the baseplate side. Recommended torque is 0.54N·m.

Use with thermal grease or thermal sheet in between heatsink and baseplate to minimize the contact thermal resistance and to enhance the heat conductivity. Also use the no-warped heatsink and make sure good contact between baseplate and heatsink.
(Refer to Fig.3-1)

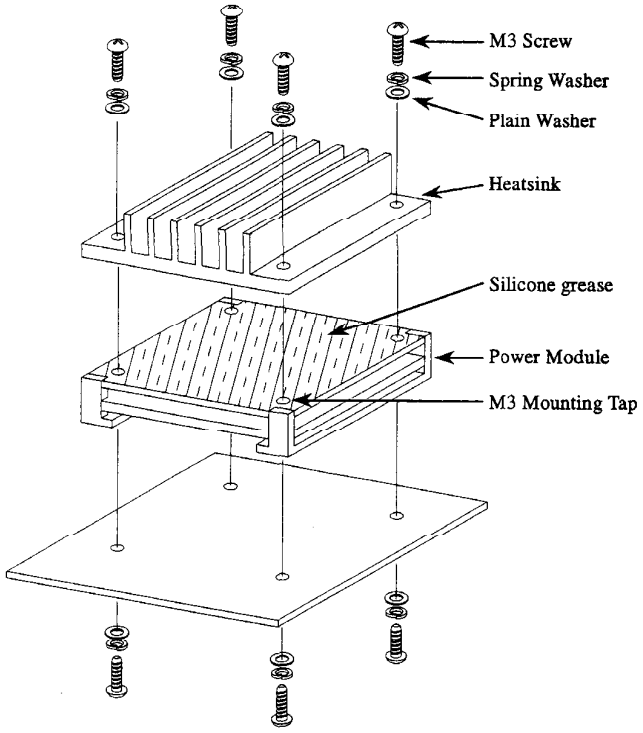

Fig. 3-1 Installation of Heatsink

(2) Mounting Hole of Heatsink

The recommended mounting hole diameter of the heatsink is ϕ 3.5mm.

4. Vibration

The vibration specification of the module is determined assuming that only the power module is mounted on printed circuit board. To prevent excessive force to the module and the printed circuit board, fix the heatsink to the chassis as well as to the module when a large size of heatsink is used.