PAQ65D48 SERIES

Instruction Manual

■ Before Using This Power Module

Be sure to take note of precautions and warnings indicated in this manual when using this product. Improper usage may lead to electric shock or fire. Be sure to read this instruction manual thoroughly before using this product.

■ Caution

- There are high voltage and high temperature components within this product. Refrain from disassembling this product or touching its internal components as this may lead to electric shock or burned.
- When the unit is operating, keep your hands and face away from the unit. You may get injured by accident.
- Confirm connections to input/output terminals and signal terminals are correct as indicated in the instruction manual.
- Attach a fast blow type external fuse to each module to ensure safety operation and compliance to each safety standard approval.
- This power module is designed for professional installation within the end user equipment.
- Use isolated voltage by reinforced or double insulation as input power source.
- Do not inject abnormal voltage to output terminal and signal terminal from the outside.
- The injection of reverse voltage or over voltage exceeding nominal output voltage to output terminals might cause damage to internal output capacitor (Functional Polymerized Capacitor)
- The application circuits and their parameter are for reference only. Be sure to verify effectiveness of application circuits and their parameters before finalizing circuit design.
- The information in this document is subject to change without prior notice. For actual design-in, please refer to the latest publications of data sheet, etc., for the most up-to date specifications of the unit.
- No part of this document may be copied or reproduced in any form, or by any mean without prior written consent of Densei-Lambda.

■ Note : CE Marking

CE Marking, when applied to a product covered by instruction manual indicates compliance with the low voltage directive in that is complies with EN60950

DWG. No. : PA566-04-01B

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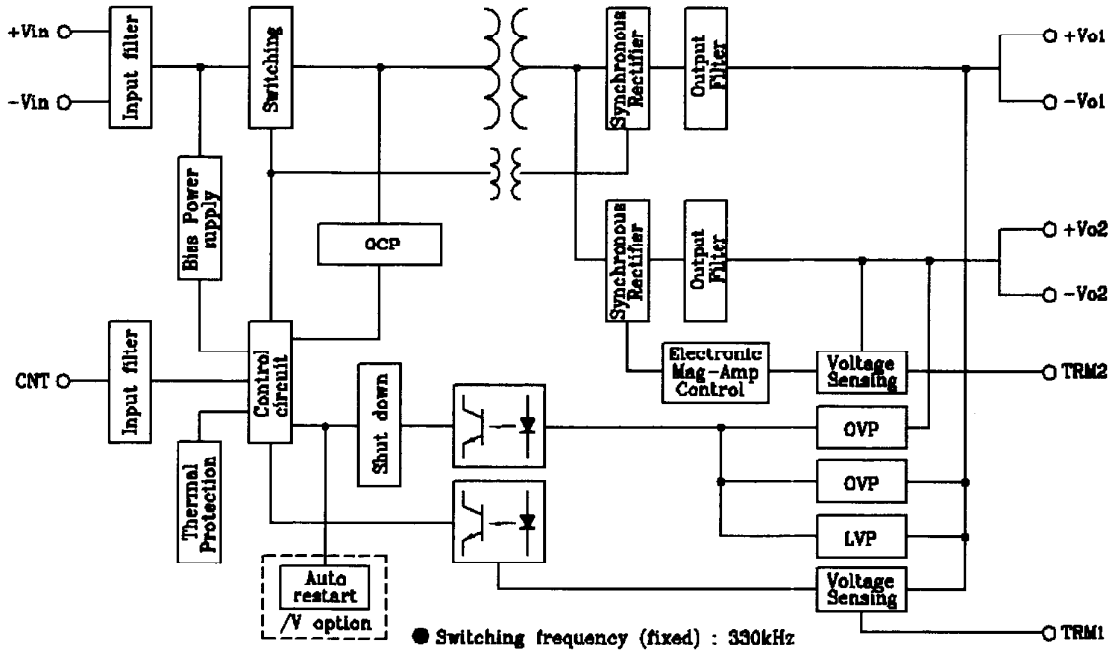
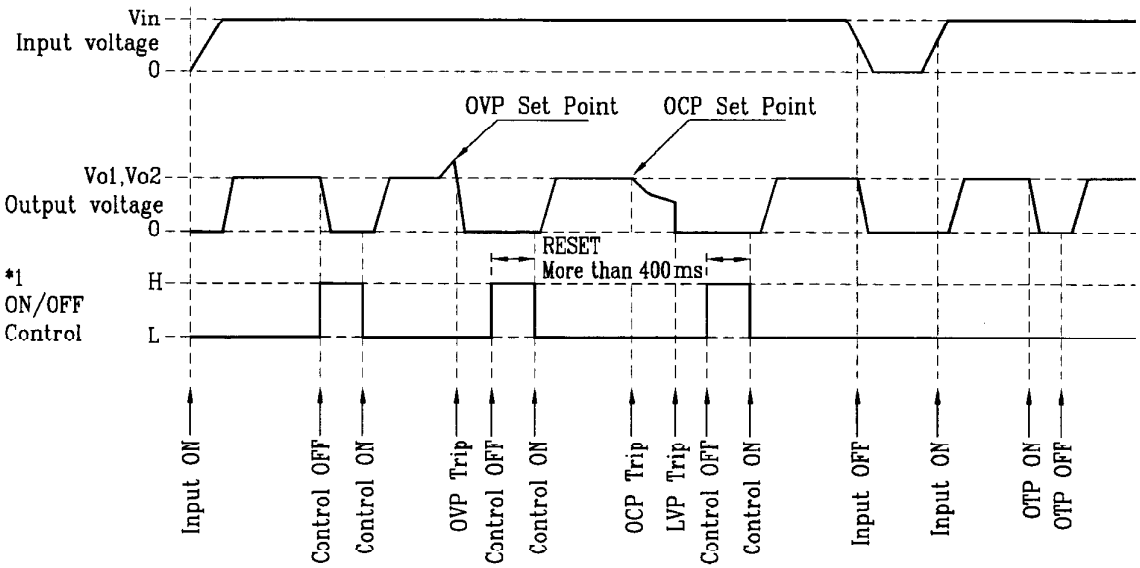
■ Block Diagram



■ Sequence Time Chart (for Standard Model with Latch type OVP and OCP)



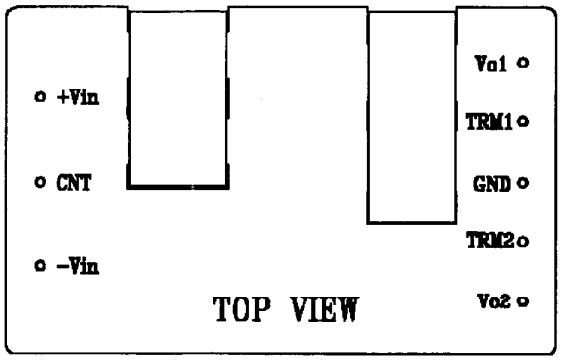
*1 Level : H ≥ 2(V) or Open 0 ≤ L ≤ 0.8(V) or Short

■ Terminal Descriptions

•Standard Model Input and Output Terminal Descriptions

Input Terminal
+Vin : Positive Input
CNT : ON/OFF Control
-Vin : Negative Input

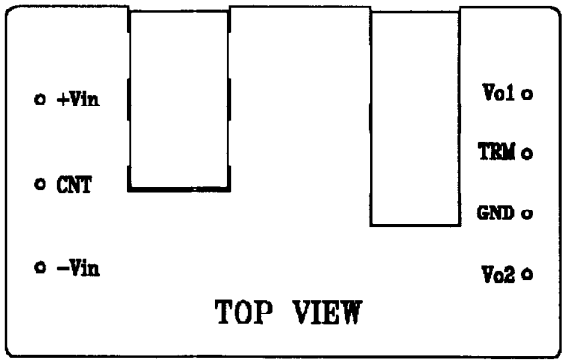
Output Terminal
Vo1 : Channel 1 (CH1) positive Output
TRM1 : CH1 Output Voltage Trimming
GND : Output Ground (for CH1 & CH2)
TRM2 : CH2 Output Voltage Trimming
Vo2 : Channel 2 (CH2) positive Output



•/C Option Model Input and Output Terminal Descriptions

Input Terminal
+Vin : Positive Input
CNT : ON/OFF Control
-Vin : Negative Input

Output Terminal
Vo1 : Channel 1 (CH1) positive Output
TRM : CH1 & CH2 Output
Voltage Trimming
GND : Output Ground (for CH1 & CH2)
Vo2 : Channel 2 (CH2) positive Output



■ Explanation on Specifications

1. Basic Connection

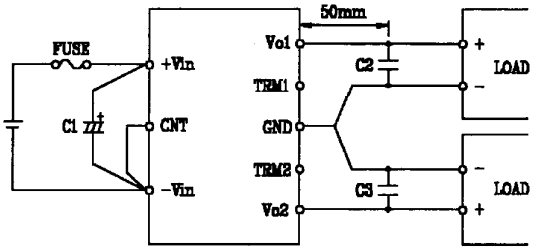


Fig.1-1 : Basic Connection

Input Fuse
PAQ65D48 Series module is not internally fused. To ensure safe operation and to receive each Safety Standards approval, please connect an external fuse (fast-blow type) as shown in Fig.1-1. **Recommended input fuse current rating is 5A.**

Fuse must be connected to the +Vin side if −Vin side is used as ground, or fuse must be connected to −Vin side if +Vin side is used as a ground.

C1 : 33μF
Input capacitor C1 is recommended to stabilized the module when the module is powered from a high impedance source. Select the electrolytic capacitor with low ESR and sufficient allowable ripple current. Verify actual ripple current value by actual measurement. **The recommended capacitor value is 33μF and above (Voltage rating 100V or above).**

Note:
1. Use low impedance electrolytic capacitor with excellent temperature characteristics. (Nippon Chemicon LXV Series or equivalent)
2. When the input line inductance becomes excessively high due to insertion of choke coil operation of the power module could become unstable. For this case, increase C1 value more than the value indicated above.
3. When the ambient temperature becomes lower than −20°C, it is recommended to use 33uF ceramic capacitor.

C2 and C3 : 22μF
To reduce spike noise voltage at the output, connect a 22μF ceramic capacitor across the +Vo and GND of each output. The position of the capacitor should be within 50mm distance from the output terminals. Also, take note that output spike noise voltage could vary according to PCB wiring design.

Note :
1. Total maximum capacitance that can be connected between +Vo and GND is 4,700μF for each output.
2. If using electrolytic capacitor, use a low impedance type (such as Nippon Chemicon LXV series or equivalent) with excellent temperature characteristics or parallel a few electrolytic capacitors; especially at negative temperature operation.

C4 :
When switches or connectors are used between input source and PAQ65D48 Series input terminals, impulse surge voltage is generated due to input throw-in by switch on/off or due to inserting/removing of power module from the active line. For this case, connect an additional electrolytic **capacitor C4 of 33μF** as shown in Fig.1-2 and Fig.1-3.

Also, there will be in-rush current flows at input throw-in condition. Therefore, be sure to verify the capability of switch or fuse to withstand I^2t at line throw-in.

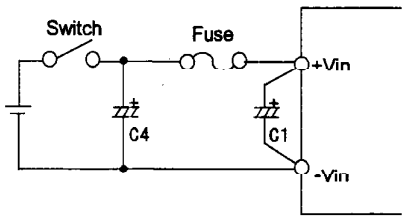


Fig.1-2 : Input filter(C4) with Switch

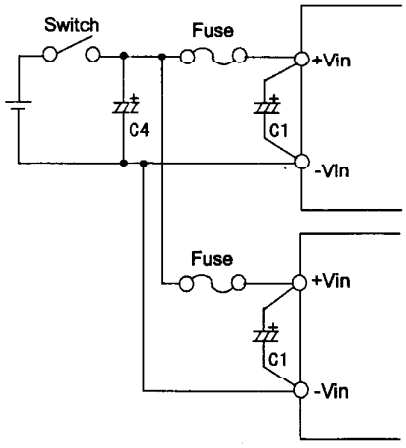


Fig.1-3 : Input Filter with Switch when Multiple Power Modules are used.

Reverse input connections
A reverse input voltage polarity applied will cause the module to damage. For cases where reverse connections are possible, connect a protective diode and fuse as shown in Fig.1-4. Use protective diode with higher voltage rating than the input voltage, and with higher surge current rating than the fuse.

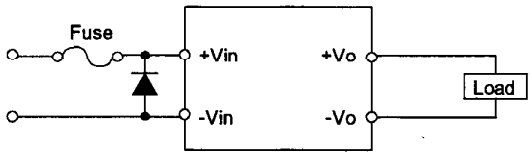


Fig.1-4 : Protection for Reversed Input Connection

2. Input Voltage Range

The operating **Input Voltage Range** for PAQ65D48 Series is **36~76VDC.**

Ripple voltage (Vrpl) which results from rectification and filtering of commercial AC line is included within the input voltage as shown in Fig.2-1. For example, input voltage waveform peak value must not exceed above input voltage range.

In addition, the **allowable input ripple voltage** must be limited within **4 Volt peak – peak.** When this value is exceeded, the output ripple voltage will becomes large.

Note that sudden input voltage change may cause variation of output voltage transitionally.

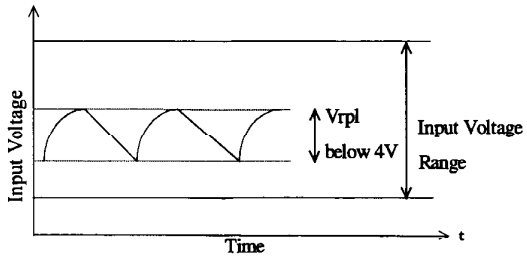


Fig.2-1 : Input Ripple Voltage

3. Output Voltage Adjustment Range

Output voltage can be adjusted by using the trim function. There are 2 options available for the trim function, which are

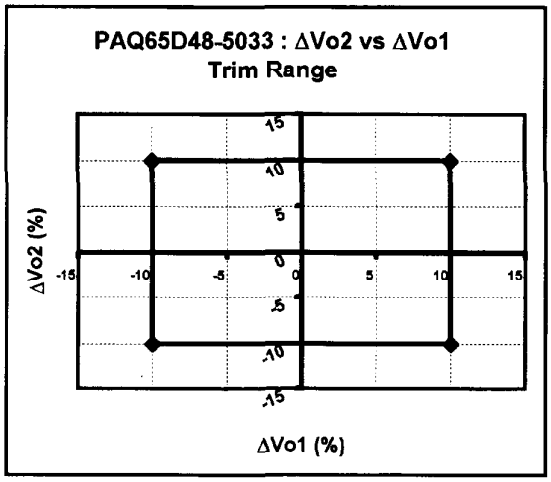
a) **Standard Model Trim** : 2 independent trim to adjust each output voltage individually. Note that the height of power module is 8.9mm.

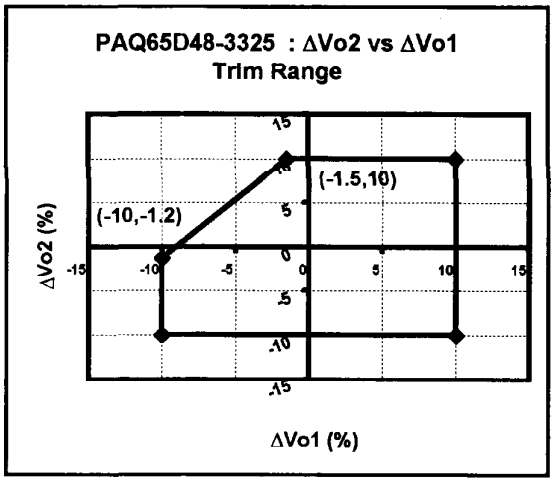
When both output voltage trim function are being use, make sure that Vo1 – Vo2 is always equal or larger than 0.5V; (Vo1 – Vo2 ≥ 0.5V). The allowable trim range for both output are as shown in the next page, Page 7, Figure 3-1.

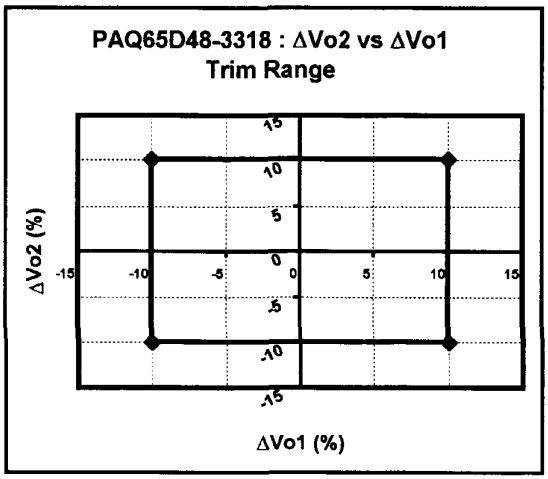
b) **/C Option Model Trim** : A single trim to adjust both the output voltage simultaneously. Note that the height for this option model is 10.2mm. This model is compatible to other manufacturers power module.

Note :

a) OVP might trigger when output voltage adjustment exceeds the maximum allowable range specified in the following section.
b) Output under voltage protection for Vo1 might trigger if Vo1 is decrease below the minimum allowable range.
c) When increasing the output voltage, reduce the output current accordingly so as not to exceed the maximum output power.
d) When decreasing the output voltage, the allowable output current is the same as nominal voltage output current.







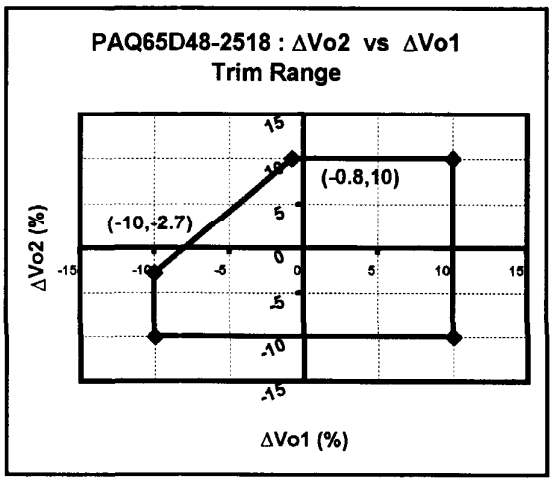


Fig.3-1 : PAQ65D48 Standard Model Trim Range

3.1 Standard Model Trim

As mentioned above the standard product comes with 2 independent trim pins to adjust each output voltage individually. Vo1/Vo2 output voltage can be adjusted by connecting an external resistor (R_{adj}) between TRM1/TRM2 to either

a) Vo1/Vo2 terminal : to adjust to higher output voltage; Fig.3-2 or
b) GND terminal : to adjust to lower output voltage; Fig.3-3.

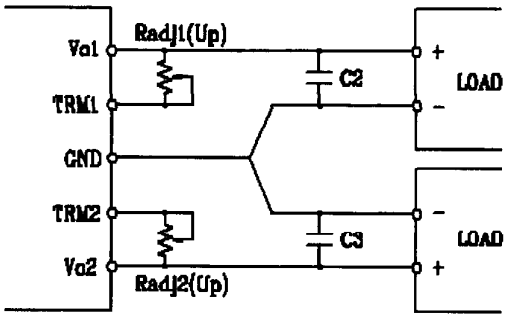


Fig.3-2 : Connection for output voltage trim up

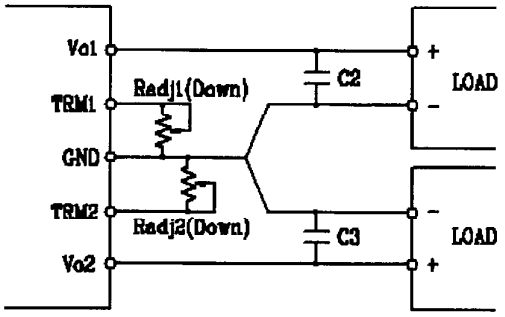


Fig.3-3 : Connection for output voltage trim down

The required external resistor values to tune up or down the output voltage for the respective standard models can be found in Page 9 and 10.

3.2 /C Option Model Trim

This option model comes only with one trim pin to adjust both the output voltage simultaneously. Note that the height for this option model is 10.2mm. This model is compatible to other manufacturers power module.

Vo1 and Vo2 output voltage can be adjusted simultaneously by connecting an external resistor (R_{adj}) between TRM to either

a) GND terminal : to adjust to higher output voltage; Fig.3-4 or
b) Vo2 terminal : to adjust to lower output voltage; Fig.3-5.

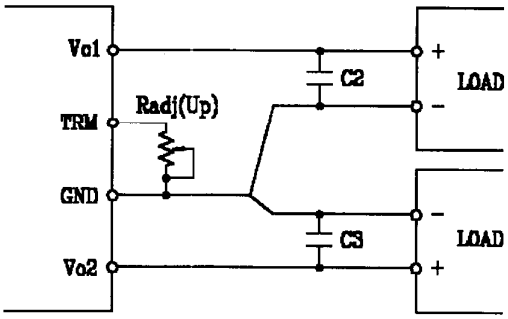


Fig. 3-4 : Connection for output voltage trim up

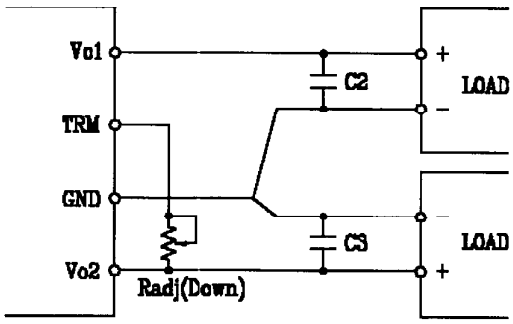


Fig. 3-5 : Connection for output voltage trim down

The required external resistor values to tune up or down the output voltage for the respective /C option models can be found in Page 11.

3.1.1 Standard PAQ65D48-5033 model

(i) 5.0V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj1\text{-}up}$ (kΩ)	837	422	284	215	174	146	126	112	100	91.0

(ii) 3.3V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj2\text{-}up}$ (kΩ)	459	232	156	118	95.2	80.1	69.3	61.1	54.8	49.8

(iii) 5.0V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj1\text{-}down}$ (kΩ)	265	131	86.5	64.2	50.7	41.8	35.4	30.6	26.9	23.9

(iv) 3.3V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj2\text{-}down}$ (kΩ)	265	131	86.5	64.2	50.7	41.8	35.4	30.6	26.9	23.9

3.1.2 Standard PAQ65D48-3325 model

(i) 3.3V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj1\text{-}up}$ (kΩ)	94.2	47.4	31.9	24.1	19.4	16.3	14.1	12.4	11.1	10.1

(ii) 2.5V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj2\text{-}up}$ (kΩ)	58.3	29.3	19.7	14.8	11.9	10.0	8.63	7.60	6.79	6.15

(iii) 3.3V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj1\text{-}down}$ (kΩ)	54.4	26.8	17.6	13.0	10.3	8.42	7.11	6.12	5.36	4.74

(iv) 2.5V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj2\text{-}down}$ (kΩ)	54.4	26.8	17.6	13.0	10.3	8.42	7.11	6.12	5.36	4.74

3.1.3 Standard PAQ65D48-3318 model

(i) 3.3V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj1\text{-}up}$ (kΩ)	301	152	102	77.3	62.4	52.5	45.4	40.0	35.9	32.6

(ii) 1.8V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj2\text{-}up}$ (kΩ)	120	60.3	40.5	30.6	24.7	20.8	17.9	15.8	14.2	12.8

(iii) 3.3V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj1\text{-}down}$ (kΩ)	94.2	46.5	30.6	22.7	17.9	14.7	12.5	10.7	9.42	8.36

(iv) 1.8V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj2\text{-}down}$ (kΩ)	94.2	46.5	30.6	22.7	17.9	14.7	12.5	10.7	9.42	8.36

3.1.4 Standard PAQ65D48-2518 model

(i) 2.5V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj1\text{-}up}$ (kΩ)	205	103	69.4	52.5	42.4	35.6	30.8	27.2	24.4	22.1

(ii) 1.8V : Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
$R_{adj2\text{-}up}$ (kΩ)	120	60.3	40.5	30.6	24.7	20.8	17.9	15.8	14.2	12.8

(iii) 2.5V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj1\text{-}down}$ (kΩ)	94.2	46.5	30.6	22.7	17.9	14.7	12.5	10.7	9.42	8.36

(iv) 1.8V : Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj2\text{-}down}$ (kΩ)	94.2	46.5	30.6	22.7	17.9	14.7	12.5	10.7	9.42	8.36

3.2.1 PAQ65D48-5033/C option model

(i) Common Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
R_{adj-up} (kΩ)	50.0	23.0	14.0	9.2	6.4	4.5	3.1	2.1	1.3	0.0

(ii) Common Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj-down}$ (kΩ)	67.0	30.0	17.0	11.0	7.8	5.4	3.7	2.4	1.4	0.0

3.2.2 PAQ65D48-3325/C option model

(i) Common Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
R_{adj-up} (kΩ)	46.0	20.4	12.1	7.9	5.2	3.5	2.2	1.3	0.61	0.0

(ii) Common Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj-down}$ (kΩ)	56.9	25.0	13.8	8.8	5.8	3.8	2.3	1.3	0.43	0.0

3.2.3 PAQ65D48-3318/C option model

(i) Common Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
R_{adj-up} (kΩ)	13.5	6.2	3.8	2.6	1.9	1.4	1.05	0.79	0.59	0.43

(ii) Common Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj-down}$ (kΩ)	15.2	6.9	4.2	2.8	1.98	1.43	1.03	0.74	0.51	0.33

3.2.4 PAQ65D48-2518/C option model

(i) Common Output Trim Up

Trim Up ΔVo (%)	1	2	3	4	5	6	7	8	9	10
R_{adj-up} (kΩ)	13.5	6.2	3.8	2.6	1.9	1.4	1.05	0.79	0.59	0.43

(ii) Common Output Trim down

Trim down ΔVo (%)	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
$R_{adj-down}$ (kΩ)	15.2	6.9	4.2	2.8	1.98	1.43	1.03	0.74	0.51	0.33

4. Maximum Ripple and Noise

The standard measurement for output ripple and noise is as shown in Fig.4-1. Connect a 22μF ceramic capacitors for each output (C2 and C3) at 50mm away from the output terminal. Use a normal probe with 20MHz bandwidth scope to measure the ripple and noise at the position of C2 and C3. Upon measurement of the ripple voltage, make sure that the oscilloscope probe leads are not too long.

Take note that output ripple voltage and output spike noise may vary depending on PCB wiring design. Generally, output ripple voltage and output spike noise can be reduced by increasing value of external capacitor.

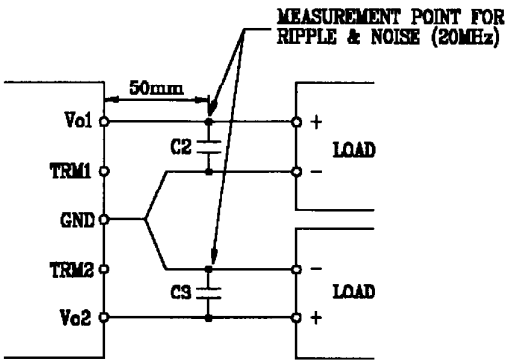


Fig.4-1 : Measurement method for ripple and noise

5. Maximum Line Regulation

Maximum line regulation is the maximum value of output voltage change when input voltage is gradually varied within specified input voltage range. The measurement point for the input and output voltage are ±Vin, +Vo1, +Vo2 and GND (output terminal point) respectively.

6. Maximum Load Regulation

Maximum load regulation is the value of output voltage change when output current is gradually varied within specified output current range. The measurement point for the input and output voltage are ±Vin, +Vo1, +Vo2 and GND (output terminal point) respectively. When using at dynamic load mode, the output voltage fluctuation might increase.

7. Over Current Protection (OCP)

This power module has built-in OCP function. Output will recover when short circuit or overload conditions are release immediately. OCP setting value is fixed and therefore, can not be externally adjusted. Also, take note, when output voltage drops down below lower side of adjustment range for 20ms~50ms by output short circuit or over load conditions, output might be shut down and latch.

Output can be recovered by manual reset (≥ 400 ms) of the control ON/OFF terminal or by turning input line off and then turning it on again. **Auto-restart (/V option)** from OCP shutdown is available; please refer to the next section.

8. Over Voltage Protection (OVP)

This power module has built-in OVP function. OVP set point is a percentage of nominal output voltage value. When output voltage exceed OVP set point, output voltage shut down. OVP set point is fixed and therefore can not be changed. When OVP is triggered, output can be recovered by i) turning input line off and then turning it on again after the input voltage drop below the value indicated below, or ii) by manual reset of the control ON/OFF terminal (≥ 400 ms).

Input Voltage for OVP reset : 26VDC and below

/V Option (auto-restart)

The /V optional model will re-start with delay of 400ms~900ms after shutdown by OCP or OVP triggering . When over voltage and over current are removed, output will recover normally.

9. Over Thermal Protection (OTP)

This power module has built-in OTP function. This function operates and shuts down the output when temperature of the power module rises excessively. The power module will recover automatically when the unit cools down. Take note that OTP will operate again unless the cause of abnormal heat of the power module is eliminated.

For the details of OTP, refer to the clause of ("Mounting method and Thermal Condition")

10. ON/OFF Control (CNT Terminal)

Without turning the input supply on and off, the output can be enabled and disabled using this function. This function also can be used for output sequence of multiple modules.

ON/OFF control circuit is on the primary side (the input side), CNT Terminal pin. For secondary control, isolation can be achieved through the use of a opto coupler or relay.

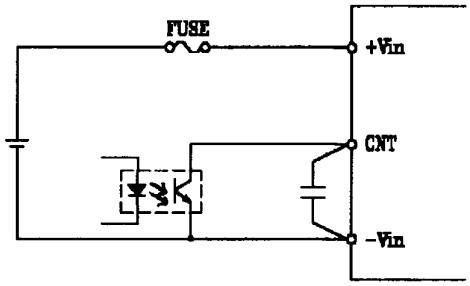


Fig.10-1 : CNT connection

There are 2 types of option which are negative logic (standard model) and positive logic (/P Option).

a) Negative Logic (Standard Model)

CNT Level to −Vin Terminal	Output Status
H Level (H ≥ 2V) or Open	OFF
L Level (L ≤ 0.8V) or Short	ON

b) Positive Logic (/P Option)

CNT Level to −Vin Terminal	Output Status
H Level (H ≥ 2V) or Open	ON
L Level (L ≤ 0.8V) or Short	OFF

- For standard model, when control function is not used, CNT terminal is shorted to −Vin terminal.
- When using long wiring, for prevention of noise, attach a 0.1 · F capacitor between CNT Terminal and −Vin terminal.
- At L level, maximum source current from CNT Terminal to −Vin terminal is 0.5mA.
- The maximum CNT Terminal voltage when it is opened is 6V.
- When the voltage at CNT pin is between 0.8V and 2V, the output voltage is undefined.

11. Operating Ambient Temperature

The operating ambient temperature is from −40°C~ 85°C. However, the output load should be derated accordingly to the ambient temperature and airflow speed (refer to Mounting Method & Thermal Condition). 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 airflow through the power module from force air or convection cooling is not blocked.

12. Operating Ambient Humidity

Take note that moisture could lead to power module abnormal operation or damage.

13. Storage Ambient Temperature

Abrupt temperature change would cause condensation built-up that leads to poor solderability of terminals of the power module.

14. Storage Ambient Humidity

High temperature and humidity can cause the terminals on the module to oxidize. The quality of the solder will become worse.

15. Cooling Method

Force air cooling is recommended. Convection cooling is also possible. For the details of derating, refer to "Mounting Method and Thermal condition ".

16. Ambient Temperature vs. Output Voltage Drift

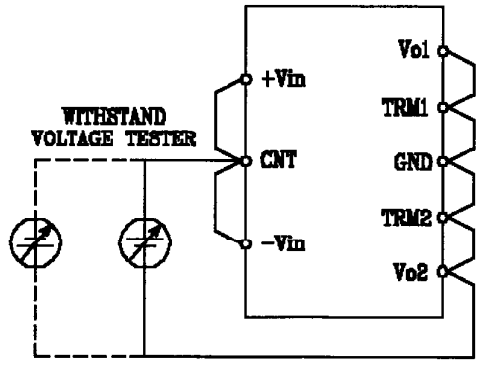
Temperature coefficient is defined as the rate of voltage change when ambient temperature is changed during operation.

17. Withstand Voltage

This power module is designed to have a withstand voltage of 1.5kVDC between input to output. When conducting withstand voltage test during incoming inspection, be sure to apply DC voltage. Also, set the current limit value of the withstand voltage testing equipment to 10mA. Be sure to avoid conducting test with AC voltage because this would cause power

module damage. Furthermore, avoid throw in or shut off of the testing equipment when applying or when shutting down the test voltage. Instead, gradually increase or decrease the applied voltage. Take note especially not to use the timer of the test equipment because when the timer switches the applied voltage off, impulse voltage which has several times the magnitude of the applied voltage is generated causing damage to the power module.

For testing, short all the input side together and output side together as shown in the diagram below.



Test condition : 1.5kVDC 1minute (10mA)

Fig.17-1 : Withstand Voltage Test for Input-Output

18. Insulation Resistance

Use DC insulation tester (MAX 500V) between output and input. Insulation resistance value is 100Mohm and above at 500VDC applied voltage.

Make sure that during testing, the isolation testers does not produce a high pulse when the applied voltage is varied. Ensure that the tester is fully discharged after the test.

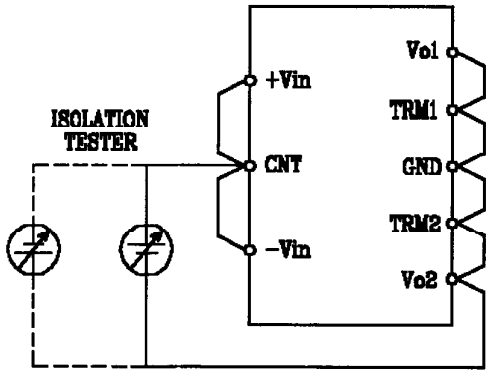


Fig.18-1 : Isolation test

19. Vibration

Vibration of power module is defined in case of mounting on PCB.

20. Shock

Value for the conditions of out shipping and packaging.

■ Mounting Method and Thermal Condition

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 flow through power module from force air or convection cooling is not blocked. Take note, output power derating is needed as shown in followings. (refer to output derating by ambient temperature).

For actual application with difficulty of air flow measurement, it is recommended to measure MOSFET Q15 temperature in order to ensure the power module operates within derating curve (refer to Output derating by MOSFET Q15 temperature).

The output derating by ambient temperature curves provided is based on the below set-up condition. It is therefore advisable to do actual thermal measurement on MOSFET Q15 before confirming the thermal design.

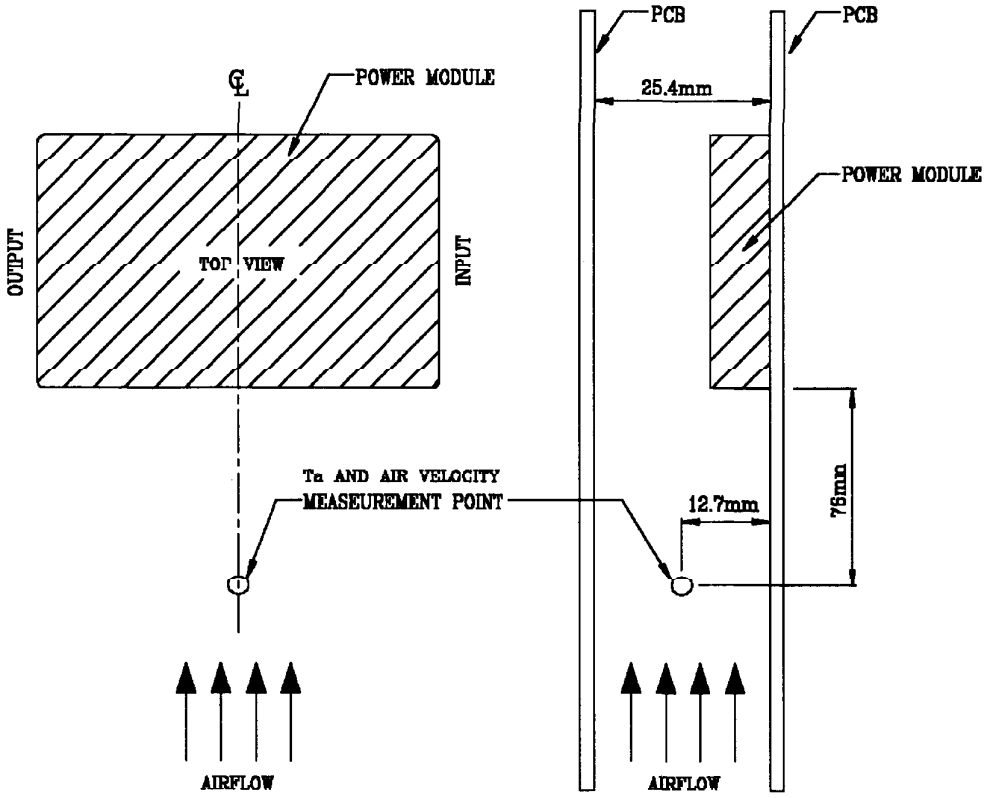


Fig.1-1 : Mounting method

1.1 Output Derating by ambient temperature

(a) Channel 1 Output Current (Io1) = 30 % rated load

Condition :	Vin			=	48Vdc,
	Io1	:	PAQ65D48-5033	=	3.6A (fixed)
			Other models	=	30% Rated Load (fixed)

Note : Derating is done by fixed Channel 1 (Io1) output current to 30%, except PAQ65D48-5033 model which is set to 3.6A, and reduce Channel 2 (Io2) output current.

PAQ65D48-5033 Output current derating curve
5V=3.6A(fixed), 3.3V=14.2A(variable)

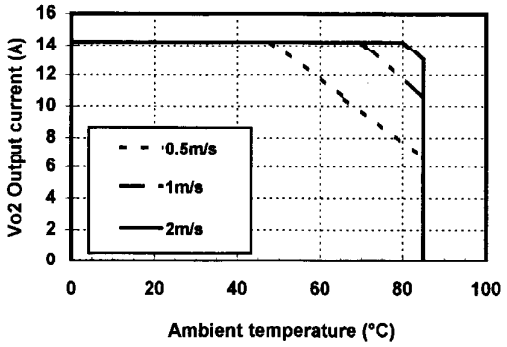


Fig. 1-2 : PAQ65D48-5033 Output Derating

PAQ65D48-3325 Output current derating curve
3.3V=4.5A(fixed), 2.5V=13.5A(variable)

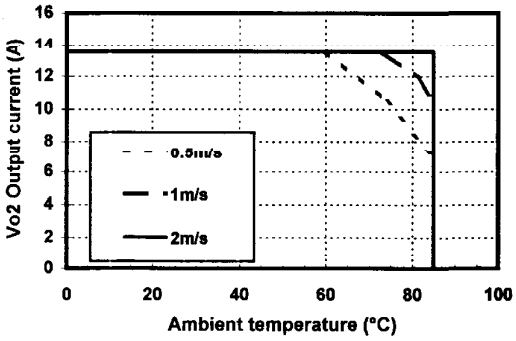


Fig. 1-3 : PAQ65D48-3325 Output Derating

PAQ65D48-3318 Output current derating curve
3.3V=4.5A(fixed), 1.8V=13.5A(variable)

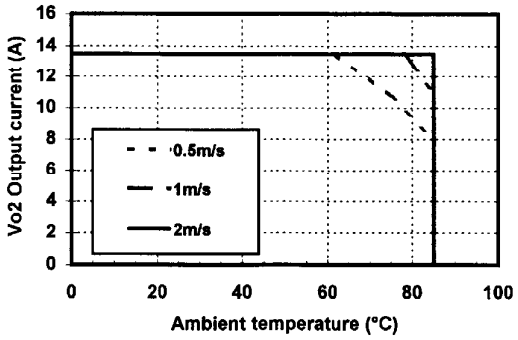


Fig. 1-4 : PAQ65D48-3318 Output Derating

PAQ65D48-2518 Output current derating curve
2.5V=4.5A(fixed), 1.8V=13.5A(variable)

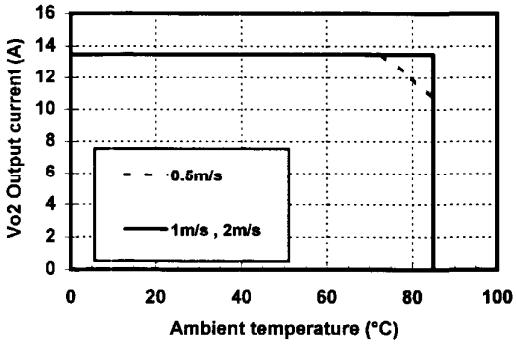


Fig. 1-5 : PAQ65D48-2518 Output Derating

(b) Channel 1 Output Current (Io1) = 50 % rated load

Condition :	Vin			=	48Vdc,
	Io1	:	PAQ65D48-5033	=	6A (fixed)
			Other models	=	50% Rated Load (fixed)

Note : Derating is done by fixed Channel 1 (Io1) output current to 50%, except PAQ65D48-5033 model which is set to 6A, and reduce Channel 2 (Io2) output current.

PAQ65D48-5033 Output current derating curve
5V=6A(fixed), 3.3V=10.6A(variable)

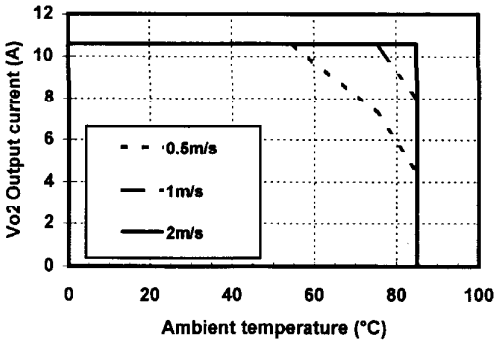


Fig. 1-6 : PAQ65D48-5033 Output Derating

PAQ65D48-3325 Output current derating curve
3.3V=7.5A(fixed), 2.5V=9.9A(variable)

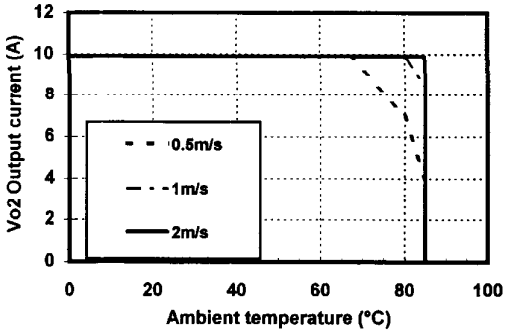


Fig. 1-7 : PAQ65D48-3325 Output Derating

PAQ65D48-3318 Output current derating curve
3.3V=7.5A(fixed), 1.8V=10.5A(variable)

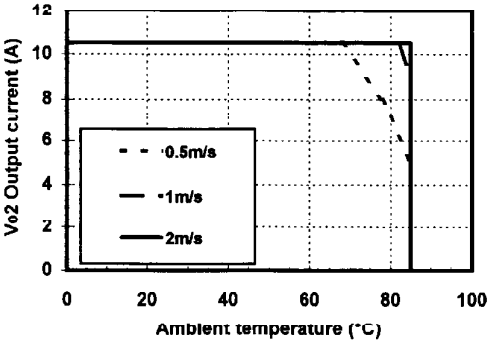


Fig. 1-8 : PAQ65D48-3318 Output Derating

PAQ65D48-2518 Output current derating curve
2.5V=7.5A(fixed), 1.8V=10.5A(variable)

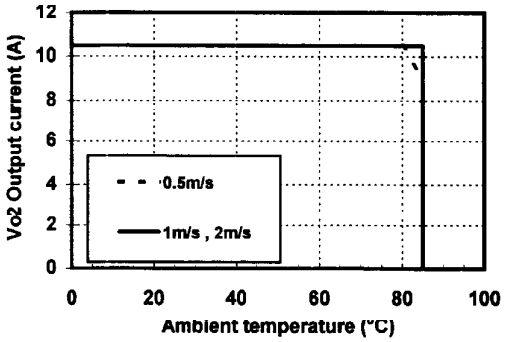


Fig. 1-9 : PAQ65D48-2518 Output Derating

1.2 Output derating by MOSFET Q15

It is recommended to use the output derating curve by measuring MOSFET Q15 temperature if there is difficulty in taking the actual airflow and ambient temperature in actual application. Fig.1-10 shows the position of MOSFET Q15 for thermal measurement. Connect a thermocouple at the center of this device body. Make sure that at any operating condition, the temperature for this device should not exceed 125 °C as shown in Figure 1-11 output derating curve. If exceeded, the Over Thermal Protection (OTP) of power module will operates and output will shutdown.

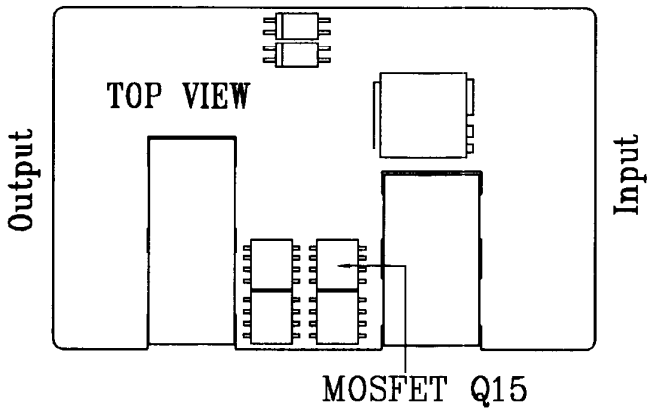


Fig.1-10 : MOSFET Q15 Position

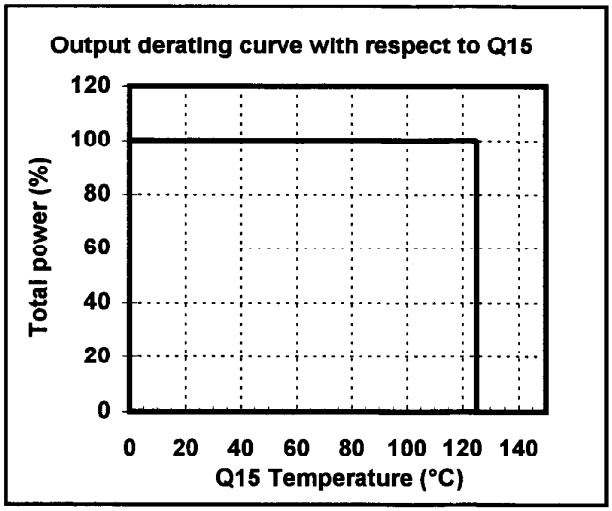


Fig.1-11 : PAQ65D48 Output Derating curve by MOSFET Q15 Temperature

2. Mounting Method

(a) Prohibition area of pattern wiring

For the standard model, avoid wiring pattern on PCB in shaded area as shown in Figure 2-1 as it may cause insulation problem. Since the power module may influence by noise, care must be taken when wire the signal line on the unshaded area. Note that for /C option, it is not necessary to have keep out area for PCB pattern.

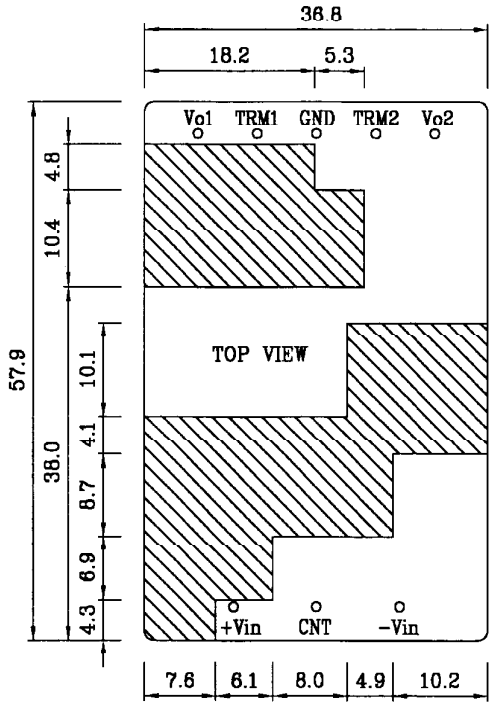


Fig.2-1 : Prohibition area of wiring pattern

(b) Mounting hole on PCB

Below is the recommended diameter of hole and land of PCB.

Type	PAQ65D48
Terminal Pin	ϕ 1.0mm
Hole Diameter	ϕ 1.3mm
Land Diameter	ϕ 2.8mm

For position of the holes, see outline drawing of the power module.

(c) Recommended Material of PCB

Recommended materials of the printed circuit board is double sided glass epoxy with through holes. (thickness :t=1.6mm)

(d) Output Pattern Width

When several to tens amperes of current flows to output pattern, voltage would drop and heat generation would be higher for narrow pattern. Relationship between current and pattern width changes depending on material of printed circuit board, thickness of conductor and temperature rise allowance. Fig. 2-2 shows an example of a 35μm copper glass epoxy printed circuit board. For example, when 5A of current flows and temperature rise below 10°C are expected, pattern width shall be more than 4.2mm with 35μm copper plate (generally 1mm/A is standard).

Confirmation is definitely necessary for designing because characteristics shown in Fig. 2 2 depends on manufactures of printed circuit board.

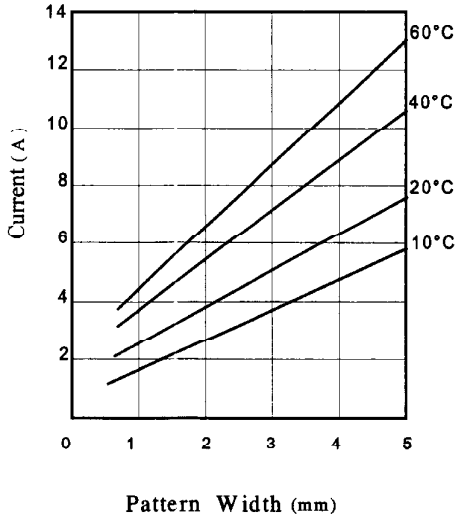


Fig.2-2 Characteristic of current allowance

3. Recommended Soldering Condition

Recommended soldering temperature is as follows.

(1) Soldering dip : 260°C within 6 seconds
Pre-heat condition : 110°C 30~40 seconds
(2) Soldering iron : 350°C within 3seconds

4. Recommended Cleaning Condition

Recommended cleaning condition after soldering is as follows.

- Cleaning solvent : IPA (isopropyl alcohol)
- Cleaning Procedure : Use brush and dry the solvent completely.

Note : For other cleaning methods, contact us.

■ Before concluding power module damage

Verify following items before concluding power module damage.

1) No output voltage
- Is specified input voltage applied?
- Are the ON/OFF control terminal (CNT terminal), output voltage trimming terminal(TRIM) correctly connected?
- For cases where output voltage adjustment is used, is the resistor or variable resistor setting, connections correctly done?
- Are there no abnormalities in the output load used?

2) Output voltage is high
- For cases where output voltage adjustment is used, is the resistor or volume setting, connections correctly done?

3) Output voltage is low
- Is specified input voltage applied?
- For cases where output voltage adjustment is used, is the resistor or variable resistor setting, connections correctly done?
- Are there no abnormalities in the output load used?

4) Load regulation and line regulation is large
- Is specified input voltage applied?
- Are the input terminals and the output terminals firmly connected?
- Is the input or output wire too thin?

5) Output ripple voltage is large
- Is the measuring method used the same or equivalent with the specified method in the Application Notes?
- Is the input ripple voltage value within the specified value?