

PAH650-380W Power Factor Correction Module

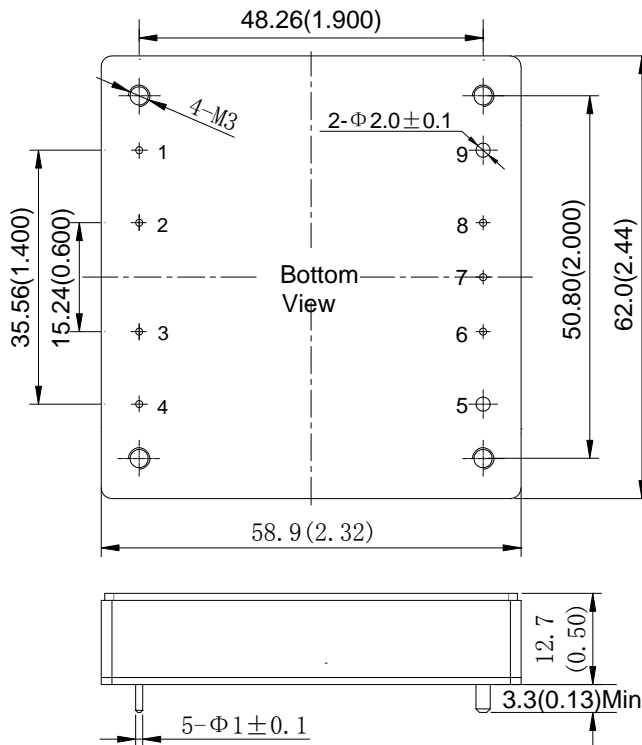
Input 85Vac-265Vac, Output 380V/1.71A, Industry Standard Half Brick

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Outline Diagram



Features

- ◆ Half-Brick (62.0mm×58.9mm×12.7mm)
- ◆ Typical Power Factor 0.98 (220Vac, full load)
- ◆ Input Under Voltage Protection
- ◆ Output Overvoltage Protection
- ◆ Start-up Surge Current Suppression Function
- ◆ Post-stage Load Enabling Function
- ◆ Typical Efficiency up to 96% (220V, full load)
- ◆ 1500Vac Isolation Voltage(Input to Case; Output to Case)
- ◆ Operating Ambient Temperature: -40°C ~ 85°C
- ◆ Over Temperature Protection: 110°C Typ.
- ◆ Cooperative Use of Post-stage and High Voltage Input Module(YPD Series)

| Pin | Symbol | Function |
|-----|--------|---------------------------------------|
| 1 | N | AC Input, Neutral Line |
| 2 | NP | No pin |
| 3 | NP | No pin |
| 4 | L | AC Input, Live Line |
| 5 | +Vo | Positive Output Voltage |
| 6 | AUX | Auxiliary Power Supply |
| 7 | ENA | Load Enabling Pin |
| 8 | R | External Surge Suppression Resistance |
| 9 | -Vo | Negative Output Voltage |

Case material: Black flame retardant Plastic;
 Pins: copper with gold plating
 Aluminum baseplate can be connected to Protective Earth pin by M3 screw.
 Notes: all dimensions in mm(inches)
 Tolerances: X.X±0.5mm(X.XX±0.02)
 X.XX±0.25mm(X.XXX±0.010)

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Specifications

Unless otherwise specified, all values are given at room temperature and standard atmosphere pressure, pure resistive load and basic connection.

| Input | Symbol | Min | Typ | Max | Unit | Conditions |
|-------------------------|-------------|------|------|-----|------|-------------------------|
| Input Voltage | V_{in} | 85 | 220 | 265 | Vac | — |
| Maximum Input Current | I_{in} | — | — | 4 | A | $V_{in,min}, I_o=0.79A$ |
| Input Frequency | f | 47 | 50 | 63 | Hz | — |
| Power Factor | PF | 0.95 | 0.98 | — | — | $I_{o,nom}$ |
| Start-up Delay Time | T_{delay} | — | 100 | — | ms | $V_{in,nom}, I_{o,nom}$ |
| Under Voltage Threshold | V_{UVLO} | 65 | — | 75 | Vac | — |

| Output | Symbol | Min | Typ | Max | Unit | Conditions |
|-------------------------------|-----------------|-------|-------|-----------|---------|---|
| Output Power | P_o | — | — | 650 | W | $V_{in}:176\sim 265Vac$ |
| | | — | — | 300 | W | $V_{in}:85\sim 176Vac$ |
| Output Voltage | V_o | 372.4 | 380.0 | 387.6 | V | — |
| Output Current | I_o | — | 1.71 | — | A | $V_{in}:176\sim 265Vac$ |
| | | — | 0.79 | — | A | $V_{in}:85\sim 176Vac$ |
| Line Regulation | S_V | — | — | ± 0.5 | $\%V_o$ | $V_{in}:176\sim 265Vac, I_o=1.71A$ $V_{in}:85\sim 176Vac, I_o=0.79A$ |
| Load Regulation | S_I | — | — | ± 1.0 | $\%V_o$ | $I_o: 0\%\sim 100\%I_{o,nom}$ |
| Peak to Peak Ripple and Noise | ΔV_{pp} | — | — | 20 | V | 20MHz bandwidth; See“Recommended Connection”about output capacitance value |
| Output Overshoot | V_{TO} | 0 | — | 10 | $\%V_o$ | $V_{in}:85\sim 265Vac, I_{o,nom}$ |
| Output Capacitive Range | — | 400 | — | 1000 | μF | — |
| OVP Set Point | $V_{ov,set}$ | 391 | — | 407 | V | — |
| Current Limit Inception | $I_{o,lim}$ | 1.88 | — | 3.08 | A | $V_{in}:176\sim 265Vac$ |
| Rise Time | T_{rise} | — | 57 | — | ms | $V_{in,nom}, I_{o,nom}$ |
| AUX Output Voltage | V_{AUX} | 11 | — | 16 | V | — |
| AUX Output Current | I_{AUX} | 0 | — | 50 | mA | — |

| General | Symbol | Min | Typ | Max | Unit | Conditions |
|---------------------------------|-----------|------|-----|-----|-------------|---|
| Efficiency | η | — | 96 | — | % | $V_{in}=220Vac, I_o=1.71A$ |
| Switching Frequency | f_s | — | 200 | — | kHz | — |
| Isolation Resistance | R_{iso} | 50 | — | — | $M\Omega$ | Under normal atmospheric pressure, Relative humidity:90%, Test voltage:500Vdc |
| Isolation Voltage | V_{iso} | 1500 | — | — | Vac | Input to case Leak Current: 5mA |
| | | 1500 | — | — | Vac | Output to case Leak Current: 5mA |
| Operating Baseplate Temperature | — | -40 | — | 100 | $^{\circ}C$ | — |

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Continue

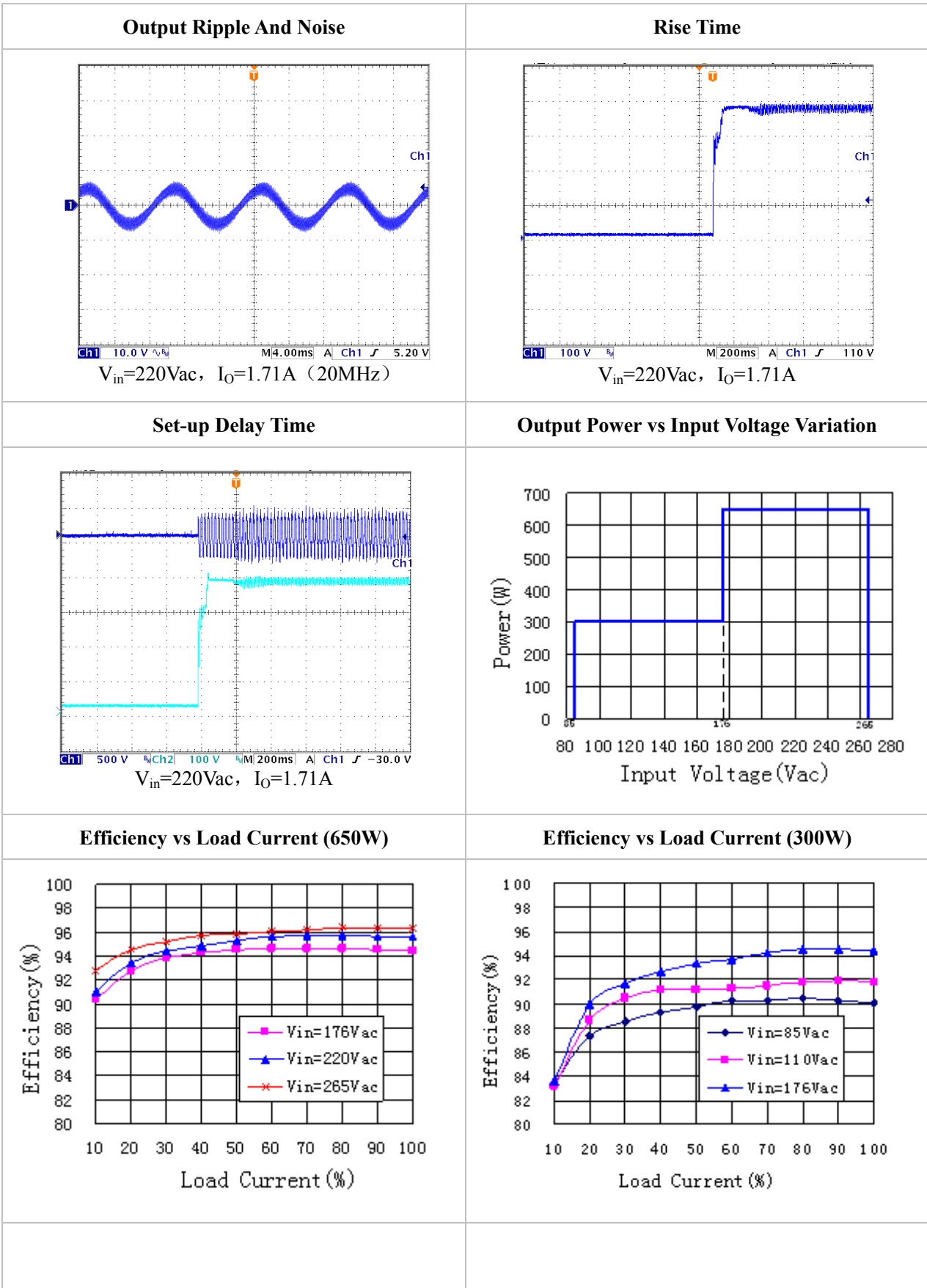
| General | Symbol | Min | Typ | Max | Unit | Conditions |
|-------------------------------|---|-----|-------------------|-------|------|-------------------------------------|
| Operating Ambient Temperature | — | -40 | — | 85 | °C | See Natural Cooling Derating |
| OTP Set Point | T _{ref} | 105 | 110 | 115 | °C | Baseplate Temperature |
| Storage Temperature | — | -55 | — | 125 | °C | — |
| Temperature Coefficient | S _T | — | — | ±0.02 | %/°C | — |
| MTBF | — | — | 1×10 ⁶ | — | h | BELLCORE TR-332 |
| Thermal resistance | R _{θCA} | — | 5.402 | — | °C/W | Natural Convection Without Heatsink |
| | R _{θCA} | — | 2.128 | — | °C/W | Natural Convection With Heatsink |
| | R _{θCA} | — | 4.488 | — | °C/W | 100LFM Convection Without Heatsink |
| | R _{θCA} | — | 1.558 | — | °C/W | 100LFM Convection With Heatsink |
| | R _{θCA} | — | 3.417 | — | °C/W | 200LFM Convection Without Heatsink |
| | R _{θCA} | — | 1.074 | — | °C/W | 200LFM Convection With Heatsink |
| | R _{θCA} | — | 3.121 | — | °C/W | 300LFM Convection Without Heatsink |
| | R _{θCA} | — | 0.881 | — | °C/W | 300LFM Convection With Heatsink |
| | R _{θCA} | — | 2.733 | — | °C/W | 400LFM Convection Without Heatsink |
| | R _{θCA} | — | 0.756 | — | °C/W | 400LFM Convection With Heatsink |
| Weight | — | — | 107 | — | g | — |
| Hand Soldering | Maximum soldering Temperature < 425°C, and duration < 5s | | | | | |
| Wave Soldering | Maximum soldering Temperature < 255°C, and duration < 10s | | | | | |

| EMC SPECIFICATIONS | Conditions | Level |
|-------------------------------|---|------------------------------|
| EMI Conducted emission | EN55032 | CLASS A(See Page 5) |
| Fast transient/burst immunity | IEC/EN61000-4-5 line to line(±1kV/2Ω); GB/T 17626.5 line to ground(±2kV/12Ω) | Perf. Criteria B(See Page 5) |
| Surge immunity | IEC/EN61000-4-4 ±2kV(5/50ns, 5kHz) GB/T 17626.4 | Perf. Criteria A(See Page 5) |

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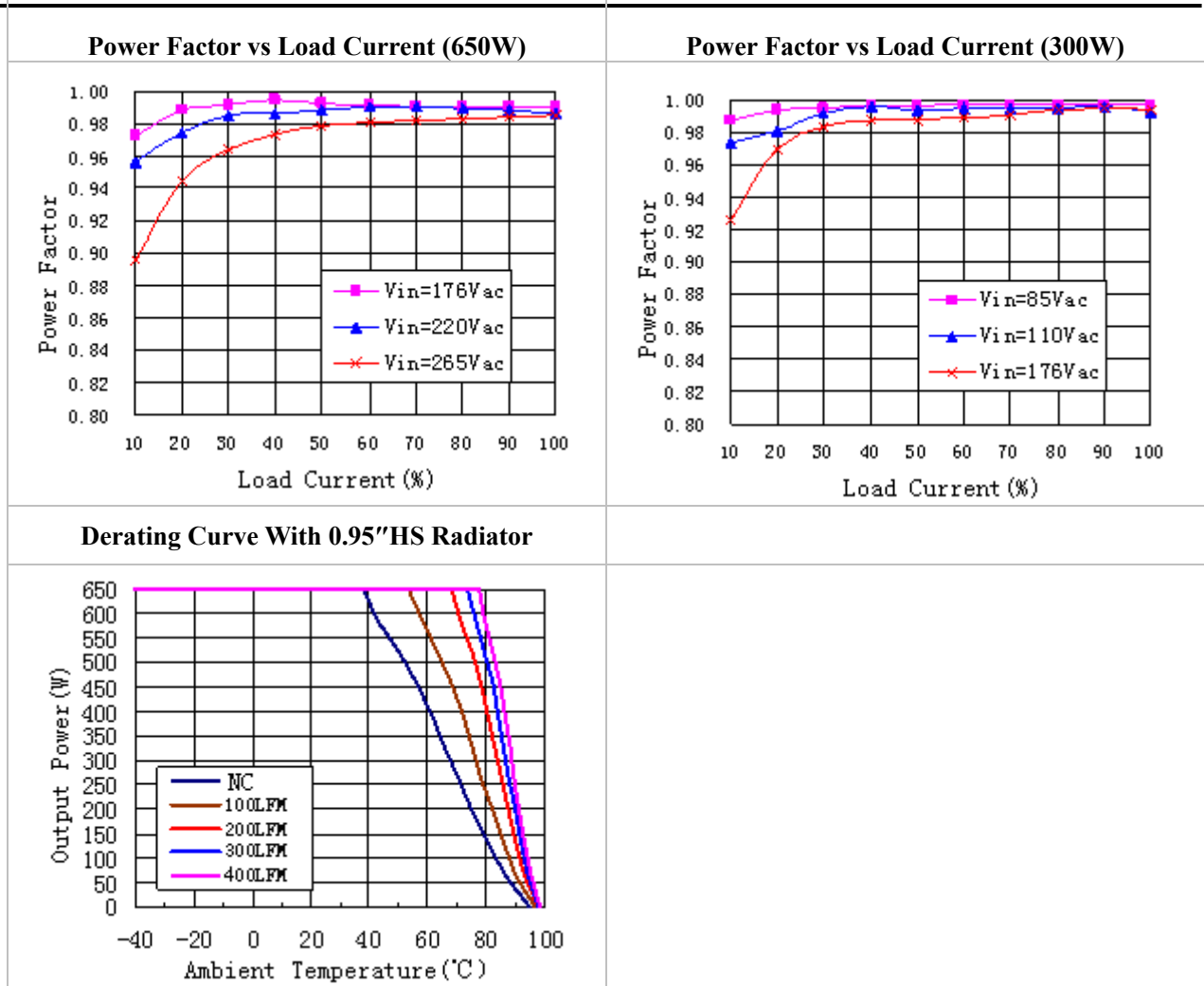
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Characteristic Curves



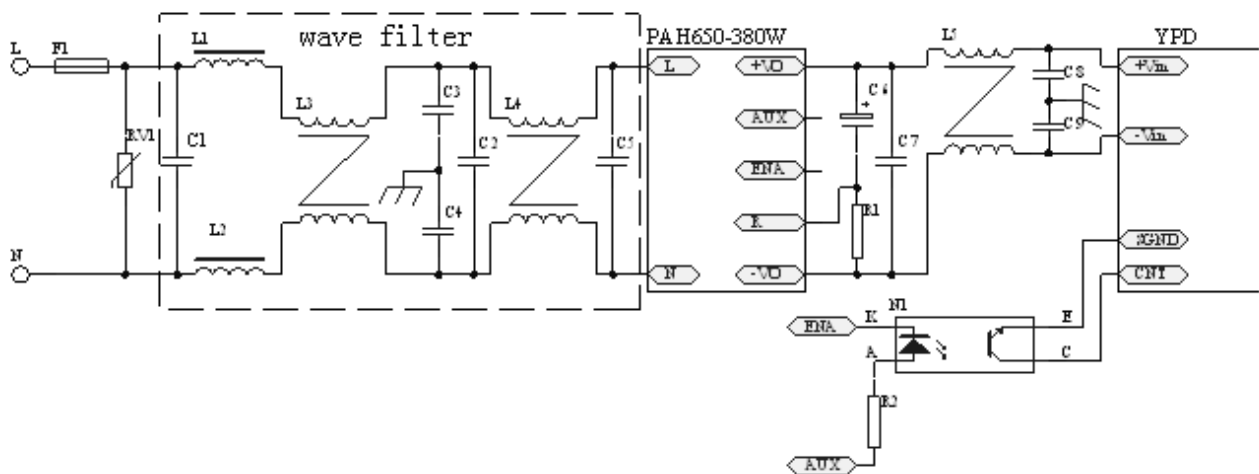
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Design Considerations

Recommended Connection



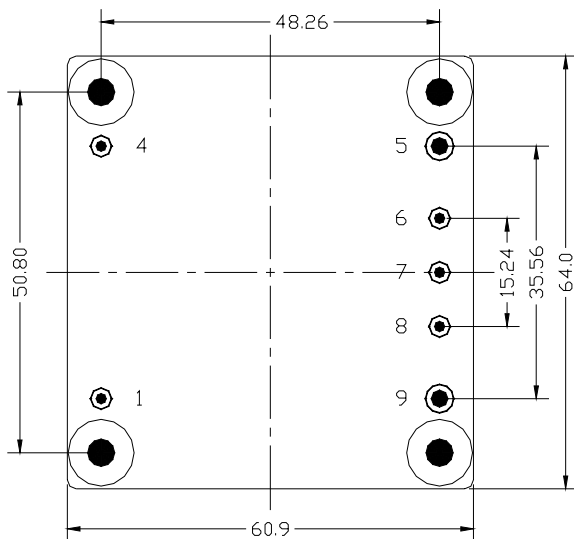
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Parameter declaration:

| Part No. | Components | Part No. | Components |
|----------|---------------|----------|-------------|
| F1 | 10A | C8、C9 | 1nF/400VAC |
| RV1 | 471KD10 | L1、L2 | 320μH |
| C1 | 0.68μF/275VAC | L3 | 0.6mH |
| C2 | 0.68μF/275VAC | L4 | 17mH |
| C3、C4 | 1nF/400VAC | L5 | 1mH |
| C5 | 0.68μF/275VAC | R1 | 10Ω/10W |
| C6 | 540μF/450V | R2 | 2kΩ/0.25W |
| C7 | 1μF/450V | N1 | Optocoupler |

Recommended Layout



| NO. | Recommendation & Notes |
|-------------|---|
| Pad Design | 5 and 9 pad holes:2.5 mm,pad diameter including holes:5.0mm ;other pad holes: 1.5 mm, pad diameter including holes: 3.0 mm. The fixed holes at the four corners are metallized, with diameter of 4.1mm and Pad diameter including holes of 8.5mm is keep-out layer.Fix the product on the user board with M3 screw. |
| Safety | Isolated modules, care to the spacing between input and output, input and protective ground,output and protective ground. |
| Electric al | The Vin(-) and Vo(-) planes should be placed under of the module separately. Avoid routing sensitive signal or high disturbance AC signal under the module . |

Start-up Surge Current Suppression Function

Power Factor Correction Module is built in Start-up Surge Current Suppression Function,so external surge suppression resistance is required when using.The surge suppression resistance is connected between R and -Vo,and output electrolytic capacitor is connected between +Vo and R.The following formulas can be used to select resistance values.

$$R = \frac{V_{in} \times \sqrt{2}}{I_{inrush}} (\Omega) = \frac{265 \times \sqrt{2}}{35} (\Omega) = 10.7\Omega \quad V_{in} : \text{Input Voltage} \quad I_{inrush} : \text{Start-up Surge Current}$$

Short connection between R and -Vo and additional start-up surge current suppression circuit are required when not using the function.

The Load Enabling Pin

The inner part of the Load EN pin is an open-circuit collector node,which is common ground with -Vo.When used ,the applied voltage does not exceed 30V and the input current does not exceed 7mA.

When the system is powered on , The Load EN pin will be changed from high resistance to low resistance along with the output voltage of the power factor correction module rising more than 350V, the post-stage high voltage

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input module works; When the system is powered off, the Load EN pin will be changed from low resistance to high resistance along with the output voltage of the power factor correction module dropping less than 200V, the post-stage high voltage input module does not work.

Output Over Temperature Protection(OTP)

Power Factor Correction Module is built in over temperature protection function. When the temperature of the aluminium substrate reaches the over temperature protection point, the boost operation will stop automatically, and the Load EN pin will be changed from low resistance to high resistance until the over temperature protection is eliminated.

Due to the power factor correction module works in a full-wave rectification state when it is in over temperature protection state, if the input voltage is small, the load current will be large. So some applications should be taken to prevent module from damage caused by working on a full-wave rectification state for a long time. Such as the load EN pin keeping the enabling relationship with the post-stage when Cooperative Use of post-stage and high voltage input module (YPD Series), or connecting a fuse at load end in series.

Thermal Consideration

The loss of the modules in normal operation will be converted into heat which can cause the modules itself to rise in temperature. In order to ensure that the module can work normally at rated power, the client system needs to ensure that the aluminum baseplate temperature is less than 100°C.

When aluminum baseplate temperature is higher than 100°C, the derating curves should be referred or external heat dissipation measures. Forced air cooling or heatsink should be used. The air tunnel should be considered for forced air cooling, to avoid heated air be hindered or forming swirl; when heatsink used, it should be attached the module closely, through double-side thermal conductivity insulation adhesive or thermal conductivity silicone for heat exchange. It is necessary to select the appropriate radiator according to the heat resistance of the radiator without air cooling.

Safety Consideration

The module, as one component for the end user, should be installed into the equipment, and all the safety considerations are achieved under certain condition. It is required to meet safety requirements in system design for the user.

To avoid fire and be protected when short circuit occurred, it is recommended that a fast blow fuse with rating 2.5~3 times of module continuous input peak current is used in series at the input terminal. (Inrush current suppression circuit is required for greater filter capacitance at input terminal, or it will result in the misoperation of the fuse).

Product Installation

The product can be installed in user board, suggest using M3 screw to fix the products in user board, in order to enhance the bearing ability when impact and vibration coming. Note that, when you hammer the product using screws, this product shall be first fixed, again a needle pin welding, prevent strain soldered dot. Moreover the

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biggest torque of fastening screw cannot exceed 0.6 N.m, otherwise it will likely damage. the structural related to studs.

Metal surface of this product structured by aluminum PCB which has good thermal conductivity, mapping the overburden with heat conduction medias or thermal gaskets, then install proper radiator.

Proper radiator and flows through radiator wind will greatly enhance products cooling capacity. When you install radiator, you should be paid attention to the length of the bolt, ensure that has no relevant relatives with the screws fixed on PCB.

ESD Control

The modules are processed and manufactured in an ESD controlled environment and supplied in conductive packaging to prevent ESD damage from occurring before or during shipping. It is essential that they are unpacked and handled using an ESD control procedures. Failure to do so affects the lifetime of the module.

Cleaning Notice

The module is suitable for water washing, because it does not have any pockets where water could be trapped long-term. Users should ensure that the drying process is adequate and of sufficient duration to remove all water from the module after washing, do not power up the unit until it is completely dry.

Delivery Package Information

Package material is multiple wall corrugated ,internal material is anti-static foam ,it's surface resistance is from $10^5 \Omega$ to $10^{12} \Omega$. Tray capacity: 2×6=12 PCS/box ,Tray weight: 1.3kg; Carton capacity:15×12=180 PCS ,Carton weight:20.5kg.

Quality Statement

The modules are manufactured in accordance with ISO-9001 system requirements, in compliant with EN50155, and are monitored 100% by auto-testing system, 100% burn in.

The warranty for the modules is 5-year.

Contact Information

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