# P-DUKE POWER

# HSRP6 Series

Non-Isolation DC-DC Converter

3 YEARS WARRANTY

RoHS COMPLIANT

REACH COMPLIANT


Automobile | Automation | Datacom

IPC | Industry | Measurement

Telecom | Boat | Charger

Medical | PV | Railway

CE

NON -isolation | NO Min. Load Required | OCP | OTP | SCP

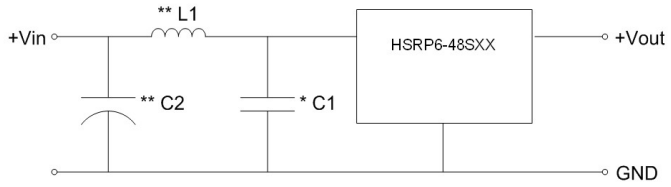
## PART NUMBER STRUCTURE

| HSRP6 | - | 48 | S | 05 | - | A |
|---|---|---|---|---|---|---|
| **Series Name** | | **Input Voltage (VDC)** | **Output Quantity** | **Output Voltage (VDC)** | | **Mounting Options** |
| | | * See table as below | **S:**Single | **3P3:**3.3<br>**05:**5<br>**6P5:**6.5<br>**09:**9<br>**12:**12<br>**15:**15<br>**24:**24 | | **□:** Vertical Mounting<br>**A:** Horizontal Mounting |

**TECHNICAL SPECIFICATION** All specifications are typical at nominal input, full load and 25℃ unless otherwise noted

| Model Number | Input Range | Output Voltage | Output Current @Full Load | Input Current @ No Load | Efficiency | | Maximum Capacitor Load |
|---|---|---|---|---|---|---|---|
| | | | | | 24Vin | 48Vin | |
| | VDC | VDC | mA | mA | % | % | μF |
| HSRP6-48S3P3 | 9 ~ 72 | 3.3 | 600 | 3 | 85.0 | 81.0 | 1920 |
| HSRP6-48S05 | 9 ~ 72 | 5 | 600 | 3 | 89.0 | 85.0 | 1260 |
| HSRP6-48S6P5 | 9 ~ 72 | 6.5 | 600 | 3 | 90.5 | 87.5 | 960 |
| HSRP6-48S09 | 14 ~ 72 | 9 | 600 | 3 | 92.0 | 89.0 | 700 |
| HSRP6-48S12 | 17 ~ 72 | 12 | 600 | 3 | 92.5 | 91.0 | 530 |
| HSRP6-48S15 | 20 ~ 72 | 15 | 600 | 3 | 94.0 | 92.0 | 420 |
| HSRP6-48S24 | 33 ~ 72 | 24 | 400 | 3 | — | 93.5 | 330 |

## INPUT SPECIFICATIONS

| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating input voltage range | | HSRP6-48S3P3 | 9 | 48 | 72 | |
| | | HSRP6-48S05 | 9 | 48 | 72 | |
| | | HSRP6-48S6P5 | 9 | 48 | 72 | |
| | | HSRP6-48S09 | 14 | 48 | 72 | VDC |
| | | HSRP6-48S12 | 17 | 48 | 72 | |
| | | HSRP6-48S15 | 20 | 48 | 72 | |
| | | HSRP6-48S24 | 33 | 48 | 72 | |
| Start up time | Constant resistive load<br>With maximum capacitor | Power up<br>Vout≦15VDC<br>Vout＝24VDC | | 25<br>50 | | ms |
| Input filter |  | | | Capacitor type | | |

* It's recommended to equip the external input capacitors at the input of the module.Typical value is 2.2μF/100V.

** If the input will be switched electromechanically, the input should install an external C2 and L1 to avoid voltage transient.

| | |
|---|---|
| C1 | 2.2μF/100V |
| C2 | 33μF/100V E/C |
| L1 | 4.7μH |

## OUTPUT SPECIFICATIONS

| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Voltage accuracy | | | -2.5 | | +2.5 | % |
| Line regulation | Low Line to High Line at Full Load | | -0.9 | | +0.9 | % |
| Load regulation | 10% to 100% of Full Load | | -0.6 | | +0.6 | % |
| Ripple and noise | Measured by 20MHz bandwidth | | | | | |
| | | Vout≦15VDC | | 50 | | mVp-p |
| | | Vout＝24VDC | | 75 | | |
| Temperature coefficient | | | -0.02 | | +0.02 | %/℃ |
| Dynamic load response | 50% load step change | Peak deviation | | 90 | 180 | mV |
| | | Recovery time | | 150 | 250 | us |
| Over load protection | % of Iout rated | | | 200 | | % |
| Short circuit protection | | | | Continuous, automatics recovery | | |

## GENERAL SPECIFICATIONS

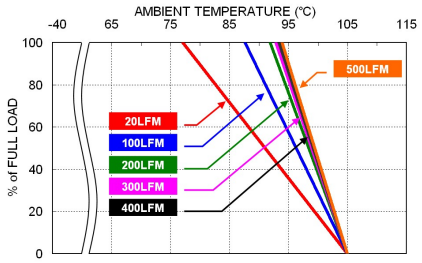
| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Switching frequency | Nominal input, Full Load | 48S3P3 | 117 | 180 | 243 | |
| | | 48S05 | 130 | 200 | 270 | |
| | | 48S6P5 | 130 | 200 | 270 | |
| | | 48S09 | 195 | 300 | 405 | kHz |
| | | 48S12 | 247 | 380 | 513 | |
| | | 48S15 | 293 | 450 | 608 | |
| | | 48S24 | 416 | 640 | 864 | |
| Safety meets | | | | | IEC/ EN/ UL62368-1 | |
| Case material | | | | | Non-conducted black plastic | |
| Potting material | | | | | Epoxy (UL94 V-0) | |
| Weight | | | | | 3.0g (0.106oz) | |
| MTBF | MIL-HDBK-217F, Full load | | | | 1.816 x $10^7$ hrs | |

## ENVIRONMENTAL SPECIFICATIONS

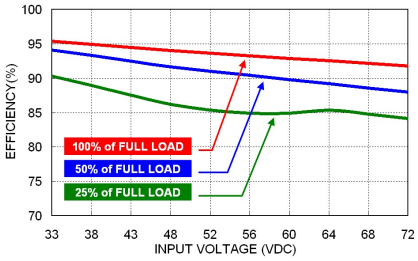
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Operating ambient temperature | With derating | -40 | | +105 | ℃ |
| Maximum case temperature | | | | 105 | ℃ |
| Over temperature protection | Internal IC junction | | 165 | | ℃ |
| Storage temperature range | | -55 | | +125 | ℃ |
| Thermal shock | | | | MIL-STD-810F | |
| Shock | | | | MIL-STD-810F | |
| Vibration | | | | MIL-STD-810F | |
| Relative humidity | | | | 5% to 95% RH | |

**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

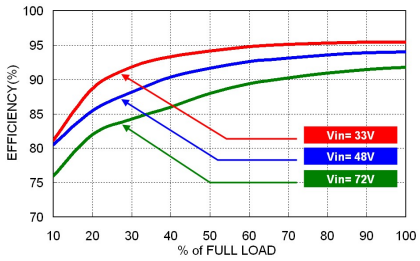
## CHARACTERISTIC CURVE




HSRP6-48S24 Derating Curve




HSRP6-48S24 Efficiency vs. Input Voltage




HSRP6-48S24 Efficiency vs. Output Load

## FUSE CONSIDERATION

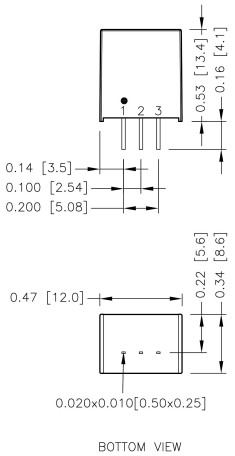
This power module is not internally fused. An input line fuse must always be used.
This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.
The input line fuse suggest as below：

| Model | Fuse Rating (A) | Fuse Type |
|---|---|---|
| HSRP6-48S3P3、HSRP6-48S05、HSRP6-48S24 | 0.8 | Slow-Blow |
| HSRP6-48S6P5、HSRP6-48S09、HSRP6-48S12、HSRP6-48S15 | 1.0 | Slow-Blow |

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

## MECHANICAL DRAWING

**Standard**: Vertical mounting

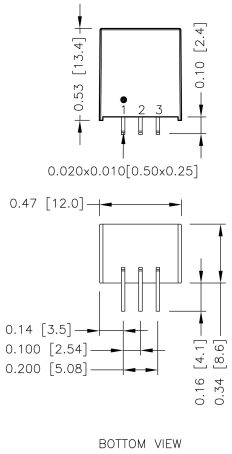



**PIN CONNECTION**

| PIN | DEFINITION |
|---|---|
| 1 | +Vin |
| 2 | GND |
| 3 | +Vout |

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
   x.xxx±0.010 [x.xx±0.25]
3. Pin dimension tolerance ±0.004[0.10]

**Suffix-A**: Horizontal mounting



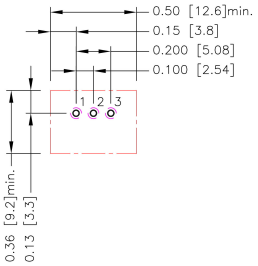

**PIN CONNECTION**

| PIN | DEFINITION |
|---|---|
| 1 | +Vin |
| 2 | GND |
| 3 | +Vout |

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
   x.xxx±0.010 [x.xx±0.25]
3. Pin dimension tolerance ±0.004[0.10]

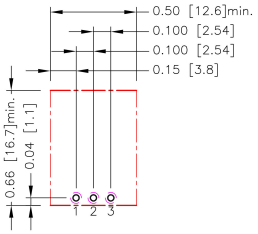
## RECOMMENDED PAD LAYOUT

**Standard**:




All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3:∅0.031[0.80]
Top view pad 1.2.3:∅0.039[1.00]
Bottom view pad 1.2.3:∅0.063[1.60]

**Suffix-A**:



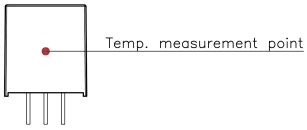

All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3:∅0.031[0.80]
Top view pad 1.2.3:∅0.039[1.00]
Bottom view pad 1.2.3: ∅0.063[1.60]

## THERMAL CONSIDERATIONS

The power module operates in a variety of thermal environments.
However, sufficient cooling should be provided to help ensure reliable operation of the unit.
Heat is removed by conduction, convection, and radiation to the surrounding Environment.
Proper cooling can be verified by measuring the point as the figure below.
The temperature at this location should not exceed “Maximum case temperature”.
When Operating, adequate cooling must be provided to maintain the test point temperature at or below “Maximum case temperature”.
You can limit this Temperature to a lower value for extremely high reliability.

The unit will shutdown if the internal IC junction exceeds 165℃ (typical), but the thermal shutdown is not intended as a guarantee that the unit will survive temperature beyond its rating. The module will automatically restarts after it cools down.

■ Thermal test condition with vertical direction by natural convection (20LFM) and mounted on a PCB with 1oz copper and 0.8mm thickness.




FRONT VIEW

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