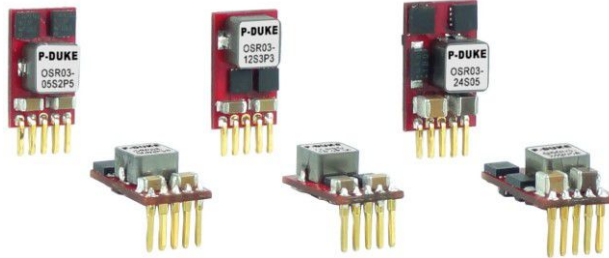




**3**  
YEARS  
WARRANTY

ROHS  
COMPLIANT

REACH  
COMPLIANT



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



Railway



NON  
-isolation

ADJ.  
Output  
Voltage

NO  
Min. Load  
Required

Positive  
to  
Negative  
Output Appl.

REMOTE  
ON  
OFF

OCP

SCP

### PART NUMBER STRUCTURE

| OSR03       | - | 24                                  | S                  | 05  | A   |
|-------------|---|-------------------------------------|--------------------|---|---|
| Series Name |   | Input<br>Voltage<br>(VDC)           | Output<br>Quantity | Output<br>Voltage<br>(VDC)                                  | Assembly<br>Options                                     |
| Positive    |   | 05:2.5~5.5<br>12:4.5~14<br>24:10~30 | S:Single           | 2P5: 0.6~ 3.3<br>3P3: 0.59~6.0<br>05: 3.0~6.0<br>12: 5.0~15 | <input type="checkbox"/> Standard<br>A: Horizontal type |
| Negative    |   | 05:4.7~13<br>12:10~27<br>24:10~25   |                    | 3P3: -0.59~ -6.0<br>05: -3.0~ -6.0<br>12: -5.0~ -15         |   |

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

**Positive output application**

| Model Number | Input Range<br>VDC | Output Voltage<br>VDC | Output Current @ FullLoad<br>A | Input Current @ No Load<br>mA | Efficiency<br>% | Maximum Capacitor Load            |                                    |
|--------------|--------------------|-----------------------|--------------------------------|-------------------------------|-----------------|-----------------------------------|------------------------------------|
|              |                    |                       |                                |                               |                 | ESR $\geq$ 1m $\Omega$<br>$\mu$ F | ESR $\geq$ 10m $\Omega$<br>$\mu$ F |
| OSR03-05S2P5 | 2.5 ~ 5.5          | 0.6 ~ 3.3             | 3                              | 20                            | 95.0@2.5Vo      | 1000                              | 3000                               |
| OSR03-12S3P3 | 4.5 ~ 14           | 0.59 ~ 6.0            | 3                              | 25                            | 93.0@3.3Vo      | 1000                              | 3000                               |
| OSR03-24S05  | 10 ~ 30            | 3.0 ~ 6.0             | 3                              | 25                            | 91.0@5.0Vo      | 1000                              | 3000                               |
| OSR03-24S12  | 10 ~ 30            | 5.0 ~ 15              | 3                              | 30                            | 95.0@12Vo       | 500                               | 1200                               |

**Negative output application**

| Model Number | Input Range<br>VDC | Output Voltage<br>VDC | Output Current @ FullLoad<br>A | Input Current @ No Load<br>mA | Efficiency<br>% | Maximum Capacitor Load |
|--------------|--------------------|-----------------------|--------------------------------|-------------------------------|-----------------|------------------------|
|              |                    |                       |                                |                               |                 | $\mu$ F                |
| OSR03-12S3P3 | 4.7 ~ 13           | -0.59 ~ -6.0          | -2.2                           | 35                            | 90.0@-3.3Vo     | 780                    |
| OSR03-24S05  | 10 ~ 27            | -3.0 ~ -6.0           | -2.2                           | 35                            | 90.0@-5.0Vo     | 2200                   |
| OSR03-24S12  | 10 ~ 25            | -5.0 ~ -15            | -1.2                           | 60                            | 91.0@-12Vo      | 580                    |

\*OSR03-12S3P3: When use negative output application and |Vo| trim up >3.3V, the Output Current maximum is 1.5A

\*Please see page 2 input specifications for input range details.

**INPUT SPECIFICATIONS**

| Parameter   | Conditions                           | Min.                         | Typ. | Max. | Unit           |     |
|---|--------------------------------------|------------------------------|------|------|----------------|-----|
| Operating input voltage range   | Positive output application          |                              |      |      |                |     |
|   | 05S2P5 (Vin>Vo+0.5V)                 | 05Vin(nom), 0.6 ~ 3.3Vout    |      | 2.5  | 5.5            | VDC |
|   | 12S3P3 (Vin>Vo+2.0V)                 | 12Vin(nom), 0.59 ~ 6.0Vout   |      | 4.5  | 14             |     |
|   | 24S05 (Vin>Vo+3.0V)                  | 24Vin(nom), 3.0 ~ 6.0Vout    |      | 10   | 30             |     |
|   | 24S12 (Vin>Vo+3.0V)                  | 24Vin(nom), 5.0 ~ 15Vout     |      | 10   | 30             |     |
|   | Negative output application          |                              |      |      |                |     |
|   | 12S3P3 (Vin <sub>max</sub> =14- Vo ) | 12Vin(nom), -0.59 ~ -6.0Vout |      | 4.7  | 13             | VDC |
|   | 24S05 (Vin <sub>max</sub> =30- Vo )  | 12Vin(nom), -3.0 ~ -6.0Vout  |      | 10   | 27             |     |
| 24S12 (Vin <sub>max</sub> =30- Vo )                                       | 12Vin(nom), -5.0 ~ -15Vout           |                              | 10   | 25   |                |     |
| *OSR03-12S3P3: When Vo,set < 0.9V, the input voltage range is 4.5V to 9V. |                                      |                              |      |      |                |     |
| Maximum input current   | Vin=Vin(min); Io=Io(max)             |                              |      |      | A              |     |
|   | 05S2P5                               |                              | 3.0  |      |                |     |
|   | 12S3P3                               |                              | 2.6  |      |                |     |
|   | 24S05                                |                              | 2.2  |      |                |     |
| Input filter  | 24S12                                |                              | 3.0  |      | Capacitor type |     |
|   |                                      |                              |      |      |                |     |

| OUTPUT SPECIFICATIONS            |  |  |                                 |      |      |         |
|----------------------------------|--|--|---------------------------------|------|------|---------|
| Parameter                        | Conditions   |  | Min.                            | Typ. | Max. | Unit    |
| Voltage accuracy                 |  |  | -2.0                            |      | +2.0 | %       |
| Line regulation                  | $V_o \geq 2.5V$  |  |                                 | 0.2  |      | %       |
|                                  | $V_o < 2.5V$   |  |                                 | 5    |      | mV      |
| Load regulation                  | 0% to 100% of F.L.   | $V_o \geq 2.5V$  |                                 | 0.8  |      | %       |
|                                  |  | $V_o < 2.5V$   |                                 | 20   |      | mV      |
|                                  | 10% to 90% of F.L.   | $V_o \geq 2.5V$  |                                 | 0.6  |      | %       |
|                                  |  | $V_o < 2.5V$   |                                 | 15   |      | mV      |
| Ripple and noise                 | Positive output application<br>Measured by 20MHz bandwidth |  |                                 |      |      |         |
|                                  |  |  | 05S2P5                          | 30   |      |         |
|                                  |  |  | 12S3P3                          | 60   |      |         |
|                                  | With a 2.2 $\mu$ F MLCC                                    |  | 24S05                           | 75   |      | mVp-p   |
|                                  | With a 2.2 $\mu$ F MLCC                                    |  | 24S12                           | 150  |      |         |
|                                  | Negative output application (In Figure 1)                  |  |                                 |      |      |         |
|                                  |  | 12S3P3   | 60                              |      |      |         |
|                                  |  | With a C1=10 $\mu$ F/50V MLCC and a<br>C2=10 $\mu$ F/25V MLCC  | 24S05                           | 75   |      | mVp-p   |
|                                  |  | 24S12  | 150                             |      |      |         |
| Temperature regulation           | $T_A = -40^\circ C$ to $+85^\circ C$                       |  | -1                              |      | +1   | %       |
| Dynamic load response            | 50% load step change                                       | Peak deviation Others  |                                 | 150  | 250  | mV      |
|                                  |  | Peak deviation 24S12   |                                 | 250  | 500  | mV      |
|                                  |  | Recovery time  |                                 | 120  | 220  | $\mu$ s |
| Over load protection             | % of Iout rated; Hiccup mode                               | 05S2P5   |                                 | 280  |      | %       |
|                                  |  | 12S3P3 ; 24S05 ; 24S12   |                                 | 220  |      |         |
| Short circuit protection         |  |  | Continuous, automatics recovery |      |      |         |
| Output voltage overshoot-startup |  |  |                                 |      | 1    | %       |
| Voltage adjustability            | (See Figure 2)   | 05S2P5   | 0.6                             |      | 3.3  | VDC     |
|                                  |  | 12S3P3   | 0.59                            |      | 6    |         |
|                                  |  | 24S05  | 3                               |      | 6    |         |
|                                  |  | 24S12  | 5                               |      | 15   |         |
|                                  |  | *Output voltage can be adjusted by connecting a single resistor between the TRIM and GND pins of the module.<br>To calculate the value of the resistor <b>Rtrim</b> for a particular output voltage <b>Vo</b> , use the following equation: in <b>Table1</b> |                                 |      |      |         |

| FEATURE SPECIFICATIONS |  |  |      |      |   |      |
|------------------------|--|--|------|------|---|------|
| Parameter              | Conditions   |  | Min. | Typ. | Max.  | Unit |
| Rise time              | Time for $V_o$ to rise from 10% to 90% $V_o$                         |  |      |      | 6   | ms   |
|                        |  |  |      |      | 10  |      |
| Remote on/off          | The ON/OFF control pin voltage is referenced to GND (Positive logic) |  |      |      |   |      |
|                        | 05S2P5   |  |      |      | ON = Open or $V_{in(max)}$<br>OFF=0V < $V_r$ < 0.3V |      |
|                        | Others   |  |      |      | ON = 1V < $V_r$ < 12V<br>OFF=0V < $V_r$ < 0.3V      |      |

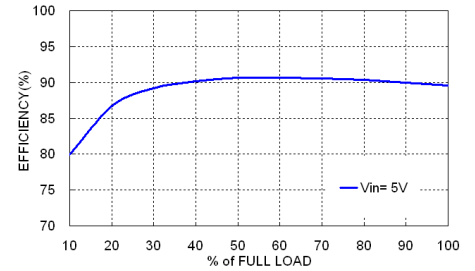
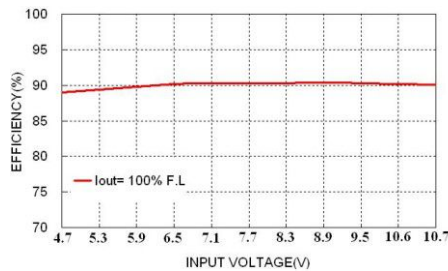
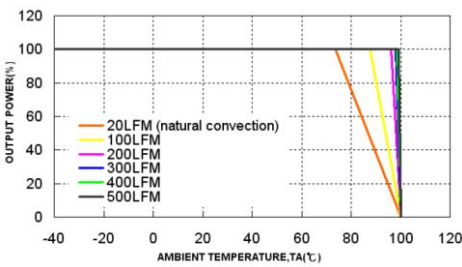
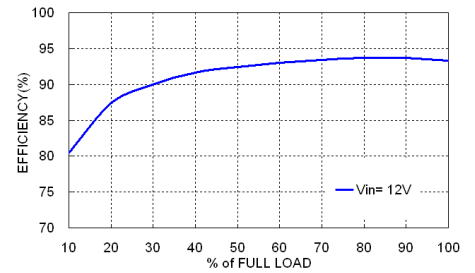
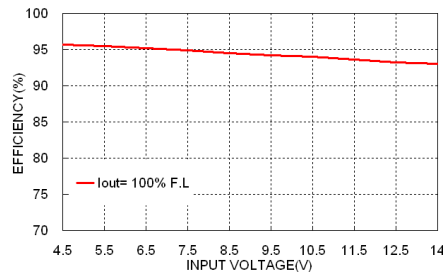
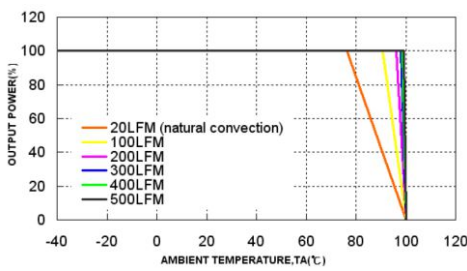
| GENERAL SPECIFICATIONS |                          |  |                             |      |      |      |
|------------------------|--------------------------|--|-----------------------------|------|------|------|
| Parameter              | Conditions               |  | Min.                        | Typ. | Max. | Unit |
| Switching frequency    | 05S2P5 ; 12S3P3          |  | 540                         | 600  | 660  | kHz  |
|                        | 24S05 ; 24S12            |  | 270                         | 300  | 330  |      |
| Safety meets           |                          |  | IEC/ EN/ UL62368-1          |      |      |      |
| Case material          |                          |  | Open frame                  |      |      |      |
| Potting material       |                          |  | None                        |      |      |      |
| Weight                 | 05S2P5 ; 12S3P3          |  | 1.7g(0.060oz)               |      |      |      |
|                        | 24S05 ; 24S12            |  | 2.1g(0.074oz)               |      |      |      |
| MTBF                   | MIL-HDBK-217F, Full load |  | 4.467 x 10 <sup>6</sup> hrs |      |      |      |

## ENVIRONMENTAL SPECIFICATIONS

| Parameter                   | Conditions     | Min. | Typ. | Max. | Unit         |
|-----------------------------|----------------|------|------|------|--------------|
| Operating temperature range |                | -40  |      | +85  | °C           |
| Storage temperature range   |                | -55  |      | +125 | °C           |
| Thermal shock               |                |      |      |      | MIL-STD-810F |
| Relative humidity           | Non-condensing |      |      |      | 5% to 95% RH |

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

## CHARACTERISTIC CURVE



## 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 |
|--------------|-----------------|-----------|
| OSR03-05S2P5 | 5               | Slow-Blow |
| OSR03-12S3P3 | 5               | Slow-Blow |
| OSR03-24S05  | 5               | Slow-Blow |
| OSR03-24S12  | 5               | Slow-Blow |

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

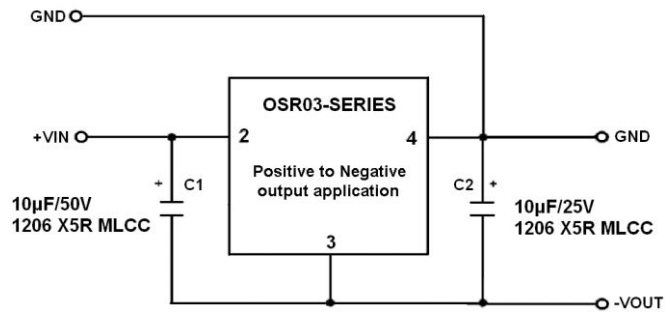
**NEGATIVE OUTPUT APPLICATION**


Figure 1

C1 and C2 are required and should be fitted close to the converter pins

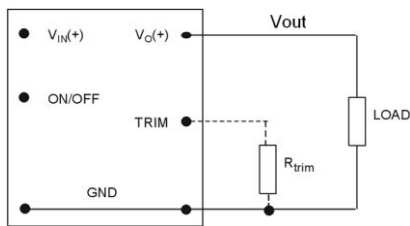
**TRIM APPLICATION**


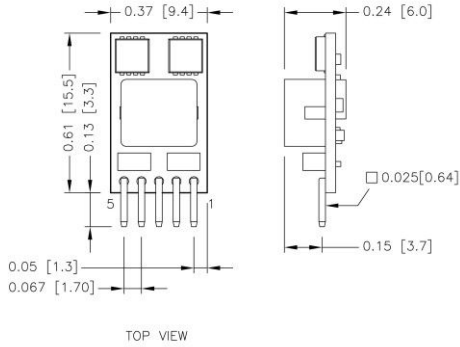
Figure 2

| Model        | $R_{trim\_up}$ (k $\Omega$ )                  |
|--------------|---|
| OSR03-05S2P5 | $\left( \frac{1.2}{V_o - 0.6} \right) - 0.01$ |
| OSR03-12S3P3 | $\left( \frac{1.18}{V_o - 0.59} \right)$      |
| OSR03-24S05  | $\left( \frac{11.2}{V_o - 3} \right)$         |
| OSR03-24S12  | $\left( \frac{8.4}{V_o - 5} \right)$          |

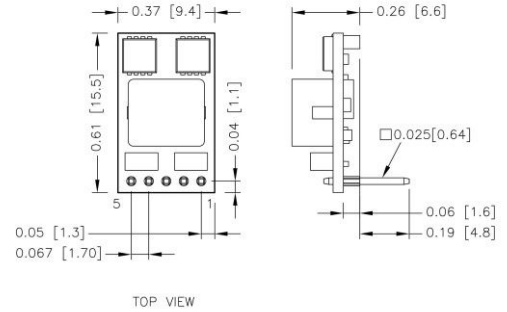
Table 1

## MECHANICAL DRAWING

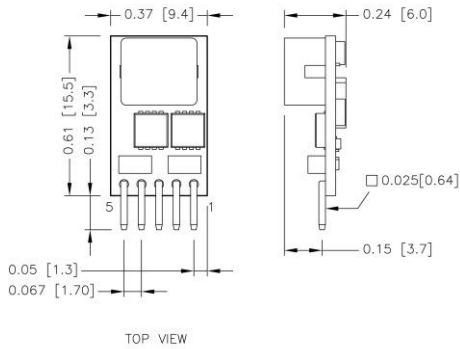
**OSR03-05S2P5**



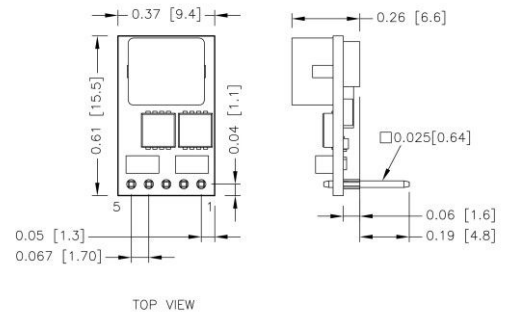
**OSR03-05S2P5A**



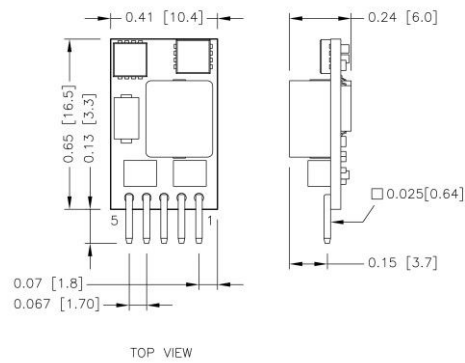
**OSR03-12S3P3**



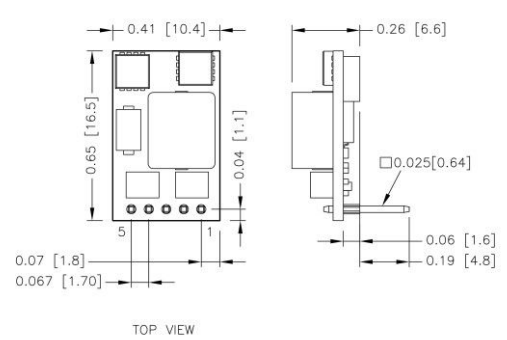
**OSR03-12S3P3A**



**OSR03-24S05/OSR03-24S12**



**OSR03-24S05A/OSR03-24S12A**



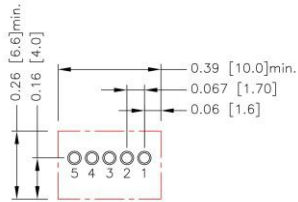
### PIN CONNECTION

| PIN | DEFINE |
|-----|--------|
| 1   | Ctrl   |
| 2   | +Vin   |
| 3   | GND    |
| 4   | +Vout  |
| 5   | Trim   |

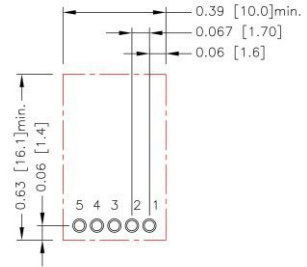
- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.01 [x.xx±0.25]
- Pin dimension tolerance ±0.004[0.10]

**RECOMMENDED PAD LAYOUT**

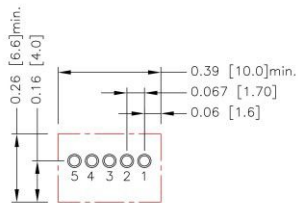
**OSR03-05S2P5**



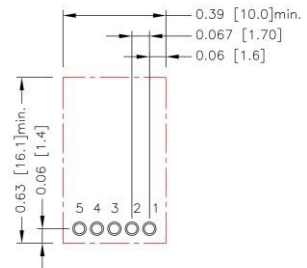
**OSR03-05S2P5A**



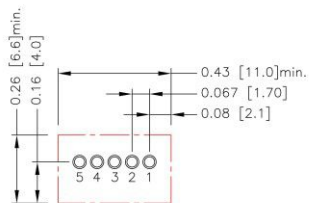
**OSR03-12S3P3**



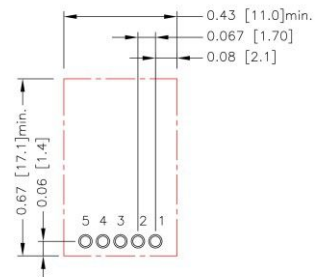
**OSR03-12S3P3A**



**OSR03-24S05/OSR03-24S12**



**OSR03-24S05A/OSR03-24S12A**



All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1.2.3.4.5:  $\Phi 0.039[1.00]$   
 Top view pad 1.2.3.4.5:  $\Phi 0.051[1.30]$   
 Bottom view pad 1.2.3.4.5:  $\Phi 0.051[1.30]$

## 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.

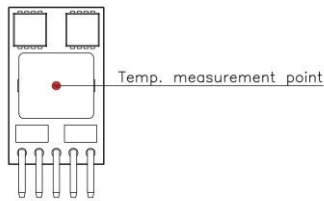
Proper cooling can be verified by measuring the point as the figure below.

The temperature at this location should not exceed 100°C.

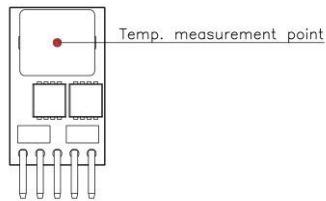
When Operating, adequate cooling must be provided to maintain the test point temperature at or below 100°C.

Although the maximum point Temperature of the power modules is 85°C, you can limit this Temperature to a lower value for extremely high reliability.

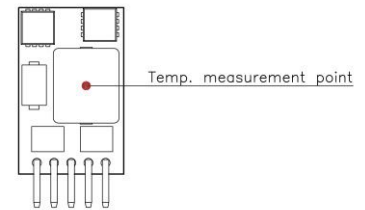
- Thermal test condition with vertical direction by natural convection (20LFM).



OSR03-05S2P5



OSR03-12S3P3



OSR03-24S05/OSR03-24S12