



# P-DUKE POWER

## SSR01 Series

DC-DC Converter  
Up to 15 Watts

**3**  
YEARS  
WARRANTY

ROHS  
COMPLIANT

REACH  
COMPLIANT



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



Railway



NON  
-isolation

ADJ.  
Output  
Voltage

LOW  
Standby  
Power

NO  
Min. Load  
Required

Positive  
to  
Negative  
Output Appl.

REMOTE  
ON  
OFF

OCP

OTP

SCP

### PART NUMBER STRUCTURE

#### POSITIVE OUTPUT

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)
SSR01 -	12	S	05
05:	3.0 ~ 5.5	S:Single	2P5:2.5
12:	4.6 ~ 36		3P3:3.3
	6.5 ~ 36		05:5
	10.5 ~ 36		09:9
24:	13.5 ~ 36		12:12
	16.5 ~ 36		15:15

**PART NUMBER STRUCTURE (CONTINUED)**
**NEGATIVE OUTPUT**

<b>SSR01</b> -	<b>12</b>	<b>S</b>	<b>05</b>
Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)
	12: 4.6 ~ 32 4.6 ~ 31 7 ~ 72	S:Single	3P3:3.3 05:5 09:9
	24: 7 ~ 24 7 ~ 21		12:12 15:15

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

**POSITIVE OUTPUT APPLICATION**

Model Number	Nominal Input VDC	Min. Vin VDC	Max. Vin VDC	Output Voltage Trim Range VDC	Output Current		Input Current @ No Load mA	Efficiency (1)	
					@Min. Load	@Full Load		Min. Vin	Max. Vin
					A	A		%	%
SSR01-05S2P5	5	3.0	5.5	1.2 ~ 3.63	0	1	6	95.5	95.0
SSR01-12S3P3	12	4.6	36*	1.5 ~ 5.5			1.5	87.5	80.0
SSR01-12S05	12	6.5		2.5 ~ 8.0			3	91.5	83.5
SSR01-12S09	12	10.5		4.5 ~ 12.6			4	94.5	89.0
SSR01-24S12	24	13.5		4.5 ~ 13.5			4	95.0	91.0
SSR01-24S15	24	16.5		4.5 ~ 15.5			4	95.5	92.5

\* The value could be higher than 36 to the maximum value of 42 if choose 22μF for Input capacitor use.

**NEGATIVE OUTPUT APPLICATION**

Model Number	Nominal Input VDC	Min. Vin VDC	Max. Vin VDC	Output Voltage Trim Range VDC	Output Current		Input Current @ No Load mA	Efficiency (1)	
					@Min. Load	@Full Load		Min. Vin	Max. Vin
					mA	mA		%	%
SSR01-12S3P3	12	4.6	$\leq 36^{**} -  V_{out} $	-1.5 ~ -5.5	0	-600	3	74.0	77.5
SSR01-12S05	12	4.6		-2.5 ~ -8.0			3	80.0	78.5
SSR01-12S09	12	7		-4.5 ~ -12.6			7	85.0	82.0
SSR01-24S12	12	7	$\leq 36 -  V_{out} $	-4.5 ~ -13.5			7	84.5	86.0
SSR01-24S15	12	7		-4.5 ~ -15.5			10	85.5	84.0

\*\* The value could be higher than 36 to the maximum value of 42 if choose 22μF for C1 use. Please refer to the schematic in Negative Output Application section.

INPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range for Positive output	Vin>Vout(set)+0.5V		3.0		5.5	VDC
	Vin>Vout(set)+1.5V		4.6		36	
Operating input voltage range for Negative output	Vin+ Vout  ≤ 36V		4.6		32	VDC
Maximum input current	Vin=Vin(min); Io=Io(max)				1	A
Input filter						Capacitor type

OUTPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy			-2.0		+2.0	%
Line regulation			-0.2		+0.2	%
Load regulation	0% to 100% of Full Load		-0.6		+0.6	%
	10% to 90% of Full Load		-0.3		+0.3	
Ripple and noise	Measured by 20MHz bandwidth	Vout = 1.2 ~ 8VDC		50		mVp-p
		Vout = 8.1 ~ 15.5VDC		75		
Temperature coefficient			-0.015		+0.015	%/°C
Dynamic load response	50% load step change	Peak deviation		150	250	mV
		Recovery time		250	350	µs
Over load protection	Positive output	SSR01-05S2P5		400		%
		Others		200		
Short circuit protection						Continuous, automatics recovery
Capacitor Load <sup>(3)</sup>						470 µF
Output voltage overshoot-startup						1.0 %

FEATURE SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Start up time	Nominal input and Constant resistive load	Power up		5		ms
		Remote ON/OFF		5		
Remote ON/OFF	Positive output : Referred to GND pin Negative output : Referred to -Vout pin	Positive logic DC-DC ON		Open or 2 ~ 5VDC		mA
		DC-DC OFF		Short or 0 ~ 0.8VDC		
		Input current of Ctrl pin	-0.1		0.1	
		Remote off input current		1.2		mA

GENERAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Switching frequency	Nominal input, Full Load	05S2P5		410		kHz
		12S3P3		300		
		12S05		580		
		12S09		580		
		24S12		580		
		24S15		580		
Safety meets						IEC/ EN/ UL62368-1
Case material						Non-conductive black plastic
Base materia						Non-conductive black plastic
Weight						1.7g(0.060oz)
MTBF	MIL-HDBK-217F, Full load					1.457 x 10 <sup>7</sup> hrs

## ENVIRONMENTAL SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating temperature range	With derating	-40		+105	°C
Maximum case temperature				105	°C
Over temperature protection	Internal IC junction		170		°C
Storage temperature range		-55		+125	°C
Moisture sensitivity level(MSL)	Verification according to IPC J-STD-020E			IPC J-STD-033C Level 1	
Lead-free reflow solder process				The time above 217°C 30~60sec. Peak temperature 245°C max. Time above 240°C 10sec. max.	
Thermal shock				MIL-STD-810F	
Vibration				MIL-STD-810F	
Relative humidity	Non-condensing			5% to 95% RH	

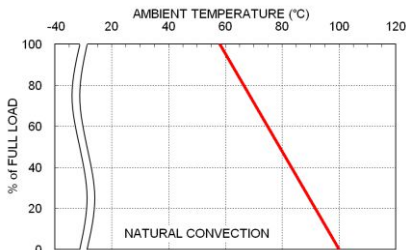
### Note:

1. Typical value at min. or max. input voltage and full load.
2. Test by minimum input and constant resistive load.

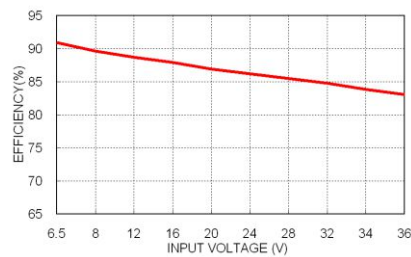
**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

## CHARACTERISTIC CURVE

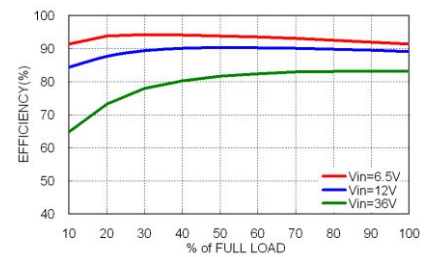
### POSITIVE OUTPUT



SSR01-12S05 Derating Curve

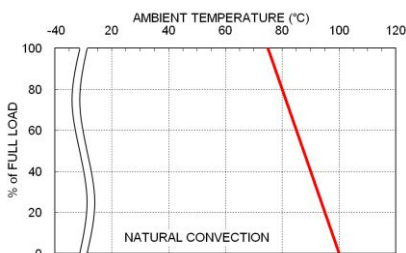


SSR01-12S05 Efficiency vs. Input Voltage



SSR01-12S05 Efficiency vs. Output Load

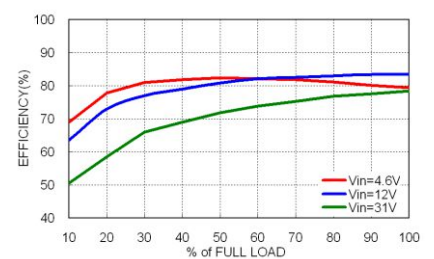
### NEGATIVE OUTPUT



SSR01-12S05 Derating Curve



SSR01-12S05 Efficiency VS Input Voltage



SSR01-12S05 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 :

### POSITIVE OUTPUT

Model	Fuse Rating (A)	Fuse Type
SSR01-05S□□	2	Slow-Blow
SSR01-12S□□	2.5	Slow-Blow
SSR01-24S□□	1.6	Slow-Blow

### NEGATIVE OUTPUT

Model	Fuse Rating (A)	Fuse Type
SSR01-12S□□	1.6	Slow-Blow
SSR01-24S□□	1.25	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

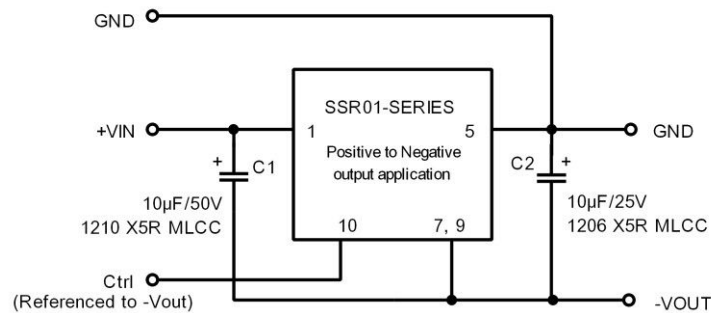


Figure 1

C1 and C2 are required and should be fitted close to the converter pins.  
Maximum capacitive load including C2 is 470uF.

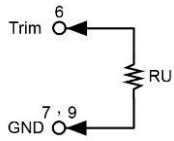
## TRIM APPLICATION

Output voltage can be programmed by connecting an external resistor between Trim and GND pins or Trim and +Vout pin.  
 Without this external resistor, the output voltage will be  $V_{out,nom}$ .  
 Using the following equation to calculate the value of external resistor for desired output voltage.  
 The external Trim resistor needs to be at least 1/16W resistors.

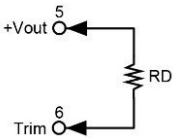
### EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.

Trim-up

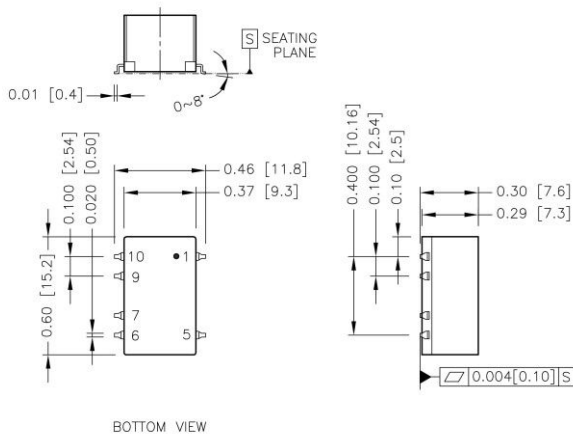


Trim-down



Model Number	$V_{out,nom}$	Trim up	Trim down
		$R_U(k\Omega)$	$R_D(k\Omega)$
SSR01-05S2P5	$ \pm 2.5V $	$= \frac{40.75}{V_o - 2.5}$	$= \frac{50.75 \cdot V_o - 40.75}{2.5 - V_o}$
SSR01-12S3P3	$ \pm 3.3V $	$= \frac{26.4}{V_o - 3.3}$	$= \frac{33 \cdot V_o - 26.4}{3.3 - V_o}$
SSR01-12S05	$ \pm 5.0V $	$= \frac{160}{V_o - 5.0}$	$= \frac{200 \cdot V_o - 160}{5.0 - V_o}$
SSR01-12S09	$ \pm 9.0V $	$= \frac{80}{V_o - 9.0}$	$= \frac{100 \cdot V_o - 80}{9.0 - V_o}$
SSR01-24S12	$ \pm 12.0V $	$= \frac{240}{V_o - 12.0}$	$= \frac{300 \cdot V_o - 240}{12.0 - V_o}$
SSR01-24S15	$ \pm 15.0V $	$= \frac{240}{V_o - 15.0}$	$= \frac{300 \cdot V_o - 240}{15.0 - V_o}$

## MECHANICAL DRAWING



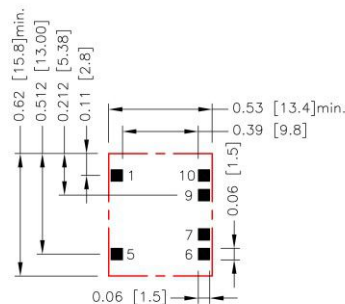
BOTTOM VIEW

### PIN CONNECTION

PIN	DEFINE
1	+Vin
5	+Vout
6	Trim
7	GND
9	GND
10	Ctrl

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

## RECOMMENDED PAD LAYOUT



All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Top view pad: 0.060x0.060 [1.50x1.50]

**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.

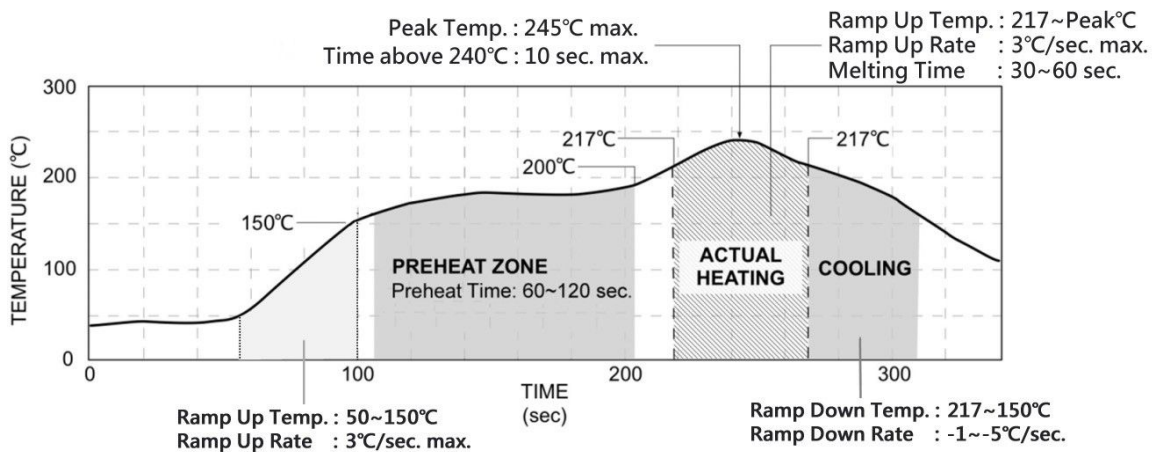
The unit will shutdown if the internal IC junction exceeds 170°C (typical), but the thermal shutdown is not intended as a guarantee that the unit will survive temperature beyond its rating. The module will automatically restarts after it cools down.

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



TOP VIEW

**LEAD FREE REFLOW PROFILE**



\*The curves define the maximum peak reflow temperature permissible measured on pin1 or Vin pin.