



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

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

SSR01	-	12	S	05
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	Input Range	Frequency	Nominal Output	Output Voltage Trim Range	Output Current		Input Current @ No Load	Efficiency (1)	
	VDC	VDC		VDC	VDC	@Min. Load	@Full Load		mA	Min. Vin
			kHz			A	A		%	%
SSR01-05S2P5	5	3.0 ~ 5.5	410	2.5	1.2 ~ 3.63	0	1	6	95.5	95.0
SSR01-12S3P3	12	4.6 ~ 36	300	3.3	1.5 ~ 5.5			1.5	87.5	80.0
SSR01-12S05	12	6.5 ~ 36	580	5	2.5 ~ 8.0			3	91.5	83.5
SSR01-12S09	12	10.5 ~ 36	580	9	4.5 ~ 12.6			4	94.5	89.0
SSR01-24S12	24	13.5 ~ 36	580	12	4.5 ~ 13.5			4	95.0	91.0
SSR01-24S15	24	16.5 ~ 36	580	15	4.5 ~ 15.5			4	95.5	92.5

NEGATIVE OUTPUT APPLICATION

Model Number	Nominal Input	Input Range	Frequency	Nominal Output	Output Voltage Trim Range	Output Current		Input Current @ No Load	Efficiency (1)	
	VDC	VDC		VDC	VDC	@Min. Load	@Full Load		mA	Min. Vin
			kHz			mA	mA		%	%
SSR01-12S3P3	12	4.6 ~ 32	300	-3.3	-1.5 ~ -5.5	0	-600	3	74.0	77.5
SSR01-12S05	12	4.6 ~ 31	580	-5	-2.5 ~ -8.0		-400	3	80.0	78.5
SSR01-12S09	12	7 ~ 27	580	-9	-4.5 ~ -12.6		-300	7	85.0	82.0
SSR01-24S12	12	7 ~ 24	580	-12	-4.5 ~ -13.5		-300	7	84.5	86.0
SSR01-24S15	12	7 ~ 21	580	-15	-4.5 ~ -15.5		-200	10	85.5	84.0

INPUT SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating input voltage range for positive output ⁽²⁾	Vin>Vout(set)+0.5V Vin>Vout(set)+1.5V	3.0 4.6		5.5 36	VDC
Operating input voltage range for negative output ⁽²⁾	See table 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 10% to 90% of Full Load	-0.6 -0.3		+0.6 +0.3	%
Ripple and noise	Measured by 20MHz bandwidth Vout = 1.2 ~ 8VDC Vout = 8.1 ~ 15.5VDC		50 75		mVp-p
Temperature coefficient		-0.015		+0.015	%/°C
Dynamic load response	50% load step change		150 250		mV µs
Over load protection	Positive output		400 200		%
Short circuit protection					Continuous, automatics recovery
Capacitor Load ⁽³⁾				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		5 5		ms
Remote ON/OFF	Positive output : Referred to GND pin Negative output : Referred to -Vout pin			Open or 2 ~ 5VDC Short or 0 ~ 0.8VDC	
	DC-DC ON DC-DC OFF				
	Input current of Ctrl pin Remote off input current	-0.1	1.2	0.1	mA mA

GENERAL SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Safety meets					IEC /UL/ EN60950-1
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 ⁷ 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
Lead-free reflow solder process					IPC J-STD-020E
Moisture sensitivity level(MSL)					IPC J-STD-033C Level 1
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. The input voltage can be increased to 42VDC by external capacitors.
 - 2.1 For Positive output: Input capacitor is necessary when input voltage 36VDC increased to 42VDC. The input capacitor suggestion is 22uF.
 - 2.2 For Negative output application:

The input and output capacitors are necessary for negative output application when the 36VDC increased to 42VDC, and the suggestion of capacitors: The C1 is 22uF and the C2 is 10uF. (Please refer to the figure of positive to negative output application)

Consider to the maximum duty of internal controller. In the trim down application, these are some condition that input range can't increase to 42VDC.

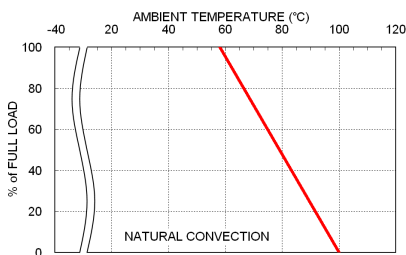
Model Number	Output voltage(Trim down)	Input range
SSR01-12S09	-4.5 ~ -6VDC	$V_{in} + V_{out} \leq 36VDC$
SSR01-24S12	-4.5 ~ -6VDC	$V_{in} + V_{out} \leq 36VDC$
SSR01-24S15	-4.5 ~ -6VDC	$V_{in} + V_{out} \leq 36VDC$

3. Test by minimum input and constant resistive load.

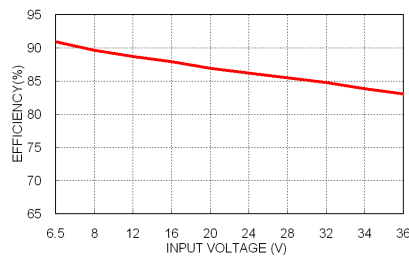
CAUTION: This power module is not internally fused. An input line fuse must always be used.

CHARACTERISTIC CURVE

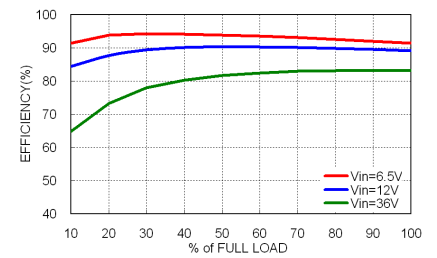
POSITIVE OUTPUT



SSR01-12S05 Derating Curve

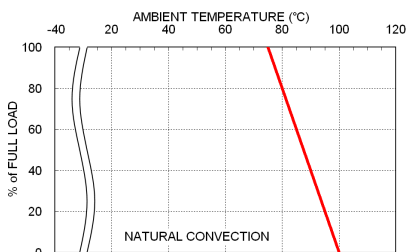


SSR01-12S05 Efficiency vs. Input Voltage

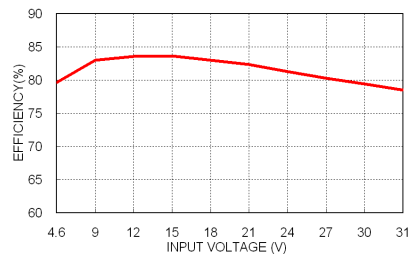


SSR01-12S05 Efficiency vs. Output Load

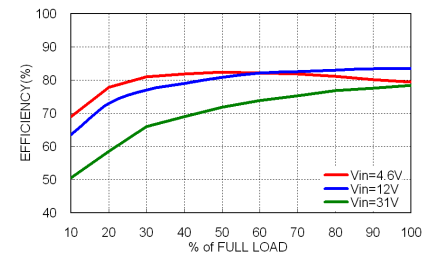
NEGATIVE OUTPUT



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

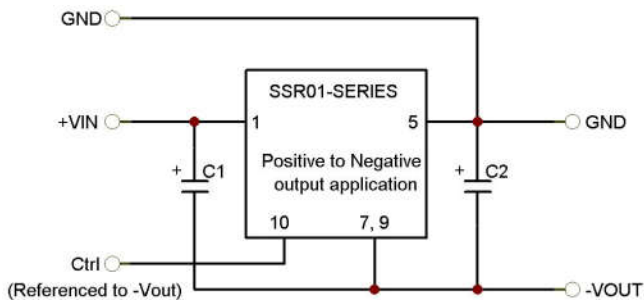
Model	Fuse Rating (A)	Fuse Type
SSR01-05S□□	2	Slow-Blow
SSR01-12S□□	2.5	Slow-Blow
SSR01-24S□□	1.6	Slow-Blow

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



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

C1	10uF / 50V	1210 X5R MLCC
C2	10uF / 25V	1206 X5R MLCC

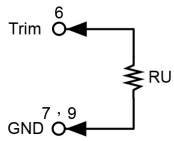
TRIM APPLICATION

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.

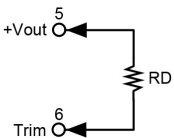
EXTERNAL OUTPUT TRIMMING

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

Trim-up

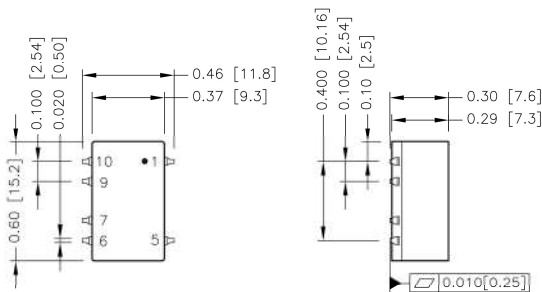


Trim-down



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



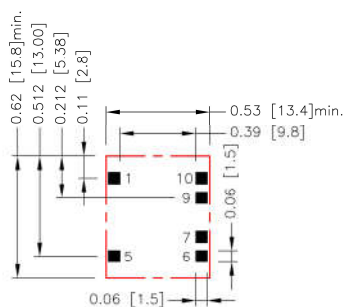
BOTTOM VIEW

PIN CONNECTION

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

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

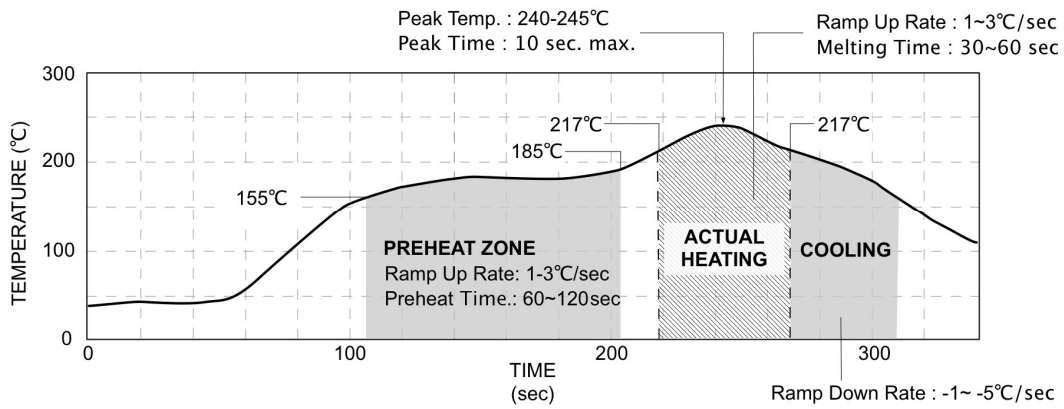
The unit will shutdown if the internal IC junction exceeds 170°C (typical), but the thermal shutdown is not intended as a guarantee that the unit will survive temperature beyond its rating. The module will automatically restarts after it cools down.

- 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.