SPS1R5 Series – Isolated DC/DC Converters
4.5 – 9Vdc Input, Maximum Power: 1.5W

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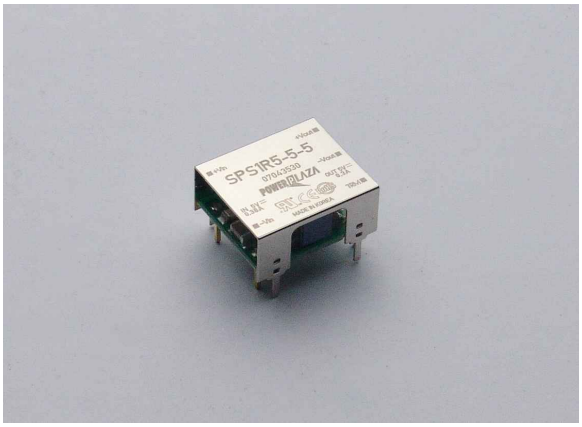
SPS1R5-5 Series –small size isolated DC/DC converters

Features

- High Efficiency
- Wide operating temperature range
  (-40°C to +85°C)
- Wide 2:1 input range
- Dimensions 18.50 x 8.50 x 16.0 (mm)
- Built–in over current protection circuit
- Input – Output Isolated
- Remote on/off control
- Long Life Design
- Trimmable output voltage(single output)
- Open case type
  (employ only ceramic capacitor)
- Safety agency approval
  UL (UL 60950-1,CSA C22.2 NO.60950-1):
  E227474
  CE (EN 60950) through TÜV
- **RoHS directive**



Applications

- Telecommunication
- Datacom
- Instrumentation/ Equipments
- Distributed Power Systems

Description

SPS Series is an isolated DC/DC converter offering designers low cost and space-efficient solution, Remote on/off, precisely regulated, over current protection.

The -40°C to 85°C operating temperature range makes the SPS series ideal for mixed analog/digital Subsystems, data communication equipments, distributed power systems. They are an excellent choice for both new design-information network system and upgrading older systems

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage Continuous	4.5	-	9	Vdc	
Operating Ambient Temperature	-40	-	85	˚C	
Storage Temperature	-40	-	105	˚C	
I/O Isolation Voltage	-	-	500	VAC	

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device

Electrical Specifications

Input Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Operating voltage Range		4.5	5	9	Vdc
Maximum Input current (At nominal input voltage and Maximum Output Power)	I_{in}		0.381		A
No load input current					
SPS1R5-5-3R3					mA
SPS1R5-5-5			37		mA
SPS1R5-5-12			40		mA
SPS1R5-5-15					mA
SPD1R5-5-1212			49		mA
SPD1R5-5-1515			49		mA

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Output Characteristics

T_A = +25˚C, Vin = 4.5 ~ 9V unless otherwise specified

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage tolerance	V_o	-	-	±2	%
Output Current	Io				
SPS1R5-5-3R3				0.4	A
SPS1R5-5-5				0.3	A
SPS1R5-5-12				0.13	A
SPS1R5-5-15				0.1	A
SPD1R5-5-1212				65	mA
SPD1R5-5-1515				50	mA
Output Regulation; - Line Regulation (From minimum input voltage to maximum input voltage, constant load)		-	-	±0.5	%
- Load Regulation (From no load to maximum load)		-	-	±1	%
Output Current Limit (Automatic recovery)		>105			%
Output Ripple and noise (Vin = 5V, and Io =Max output current Bandwidth 20MHz, 1uF Ceramic cap)	mVp-p	-	-	1% of Output Voltage	mV
Efficiency					
SPS1R5-5-3R3			73		%
SPS1R5-5-5			78		%
SPS1R5-5-12			81		%
SPS1R5-5-15			81		%
SPD1R5-5-1212			80		%
SPD1R5-5-1515			80		%
(100% of max Io, V_{in} = 5V)					

Dynamic Load Response (1uF Ceramic 50% to 100 %, 100% to 50%, Tr = 100uS)				±3% of Output Voltage	mV
Start – Up Time		-	-	10	ms
Turn – on overshoot		-	-	5	%
Maximum output capacitance					μF

Isolation Specifications

Parameter	Symbol	Min	Typ	Max	Unit
I/O Isolation Voltage (AC500V, 1 Min) - Input-Output: - Input-Case: - Output-case:			 - - -	 500 500 500	 VAC VAC VAC
Isolation Resistance - Output-Case (at DC500V at 25˚C And 70%RH for 1 min)	RISO	>100	-	-	MΩ
Isolation Capacitance	CISO				pF

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Switching Frequency			-		KHz
Remote ON/OFF control - Positive Logic On = short to - Vin Off = open					 Vdc

Output voltage trim range			±10		%
MTBF(MIL-HDBK-217F)			$9x10^5$		hrs
Dimensions (W.H.L)			18.50 x 8.50x 16.0		mm
Weight		-	3.3	-	Grams

Environmental

Parameter	Symbol	Min	Typ	Max	Unit
Operating Temperature		-40		85	˚C
Operating Humidity (RH non-condensing)		5		95	%
Storage Temperature		-40		105	˚C

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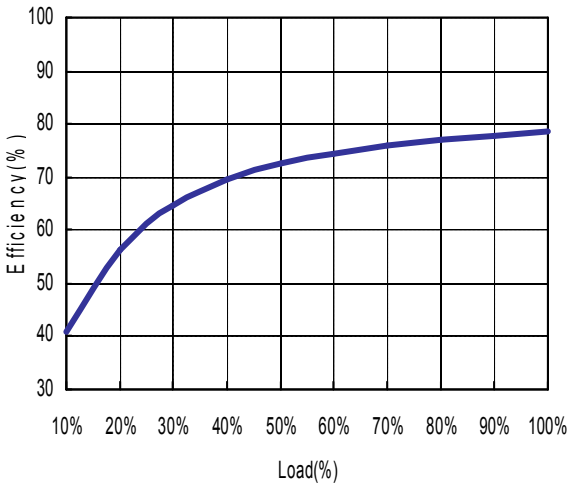
Characteristic Curves

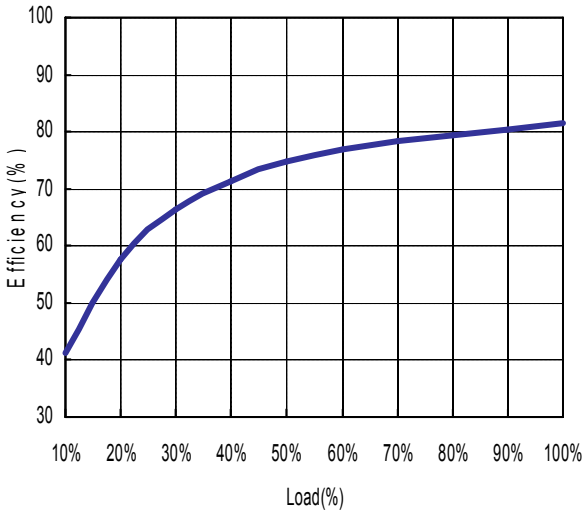
Efficiency Curves

- SPS1R5-5-5 -



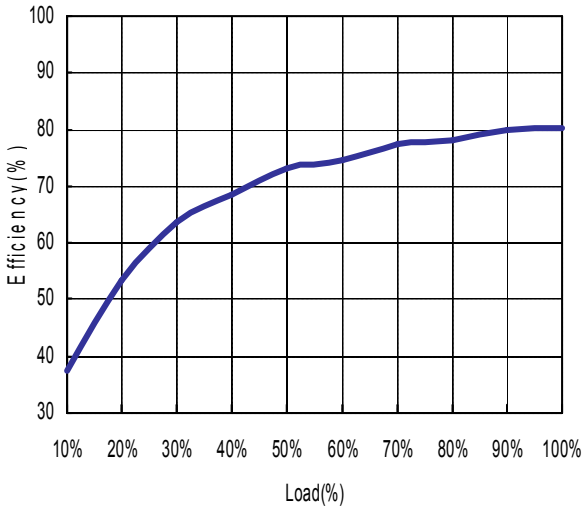
Vin=5V, Vo=5V@0.3A , At 25°C

- SPS1R5-5-12-



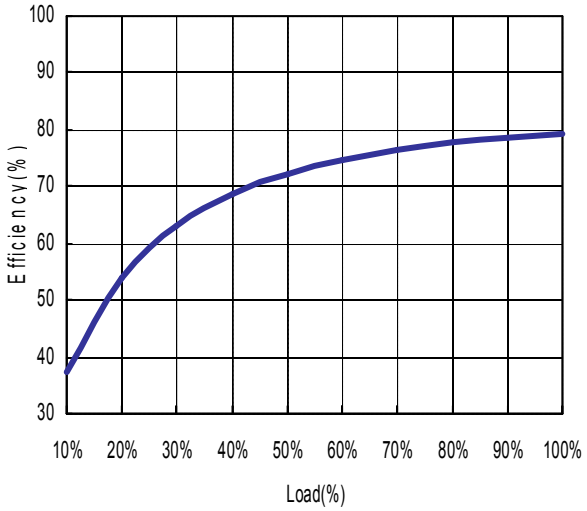
Vin=5V, Vo=12V@0.13A , At 25°C

- SPD1R5-5-1212 -



Vin=5V, Vo=+12V,-12V@0.065A , At 25°C

- SPD1R5-5-1515 -



Vin=5V, Vo=+15V,-15V@0.050A , At 25°C

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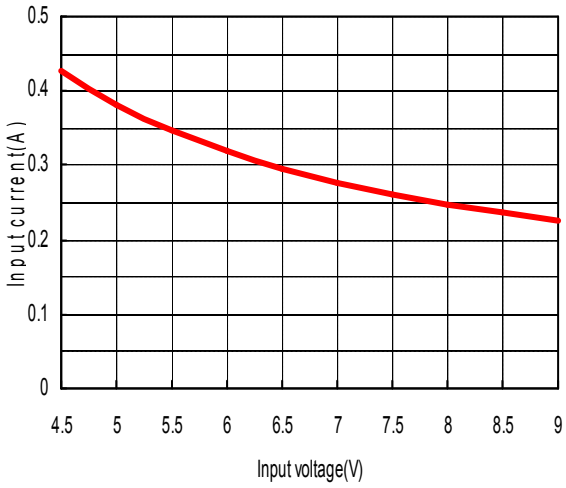
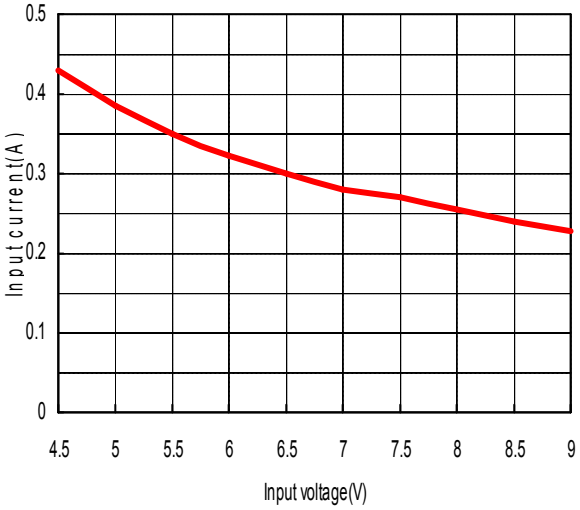
Input Voltage vs Input Current

- SPS1R5-5-5 -



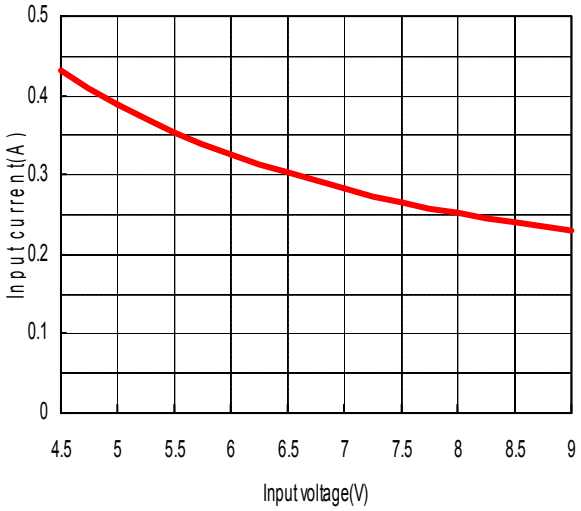
Vin=5V, Vo=5V@0.3A, At 25°C

- SPS1R5-5-12 -



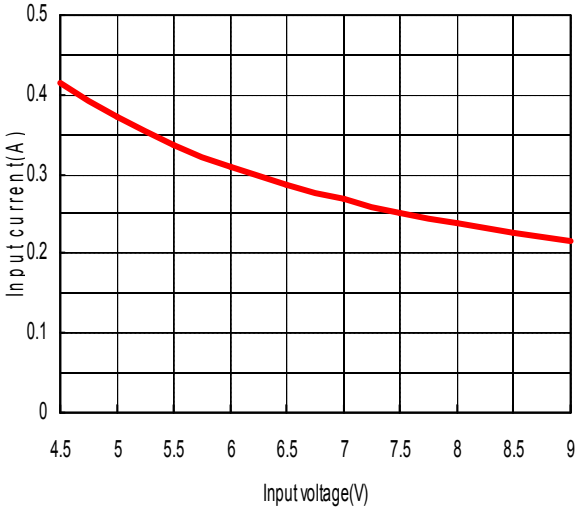
Vin=5V, Vo=12V@0.13A , At 25°C

- SPD1R5-5-1212 -



Vin=5V, Vo=+12V,-12V@0.065A , At 25°C

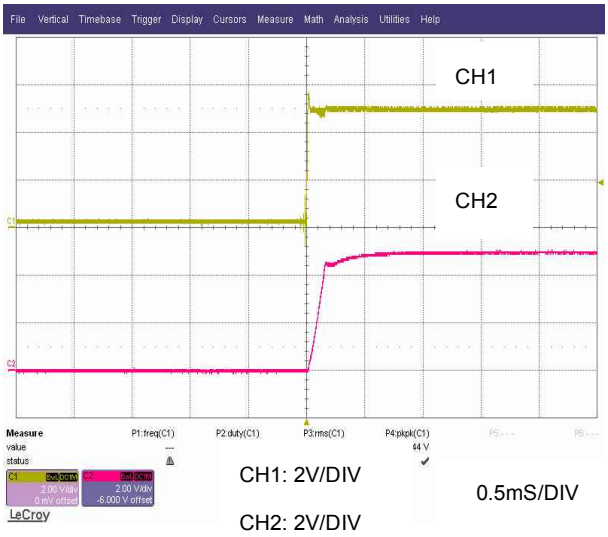
- SPD1R5-5-1515 -



Vin=5V, Vo=+15V,-15V@0.050A , At 25°C

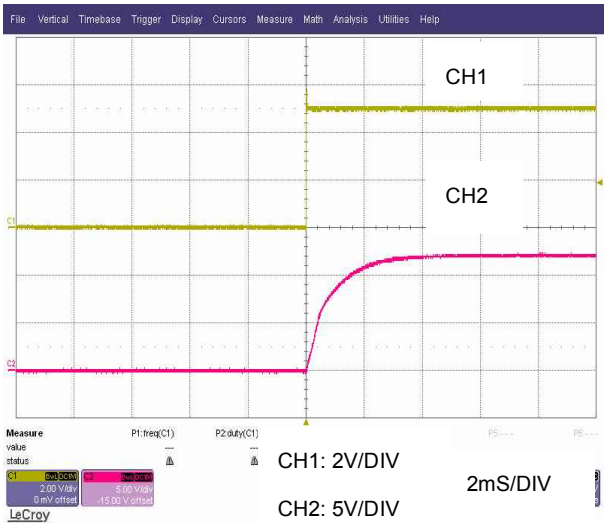
Start-up from Vin

- SPS1R5-5-5 -



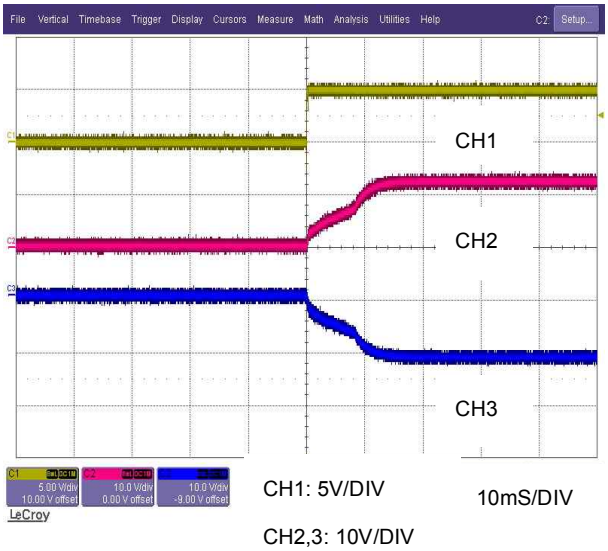
Vin=5V, Vo=5V@0.3A , At 25°C

- SPS1R5-5-12 -



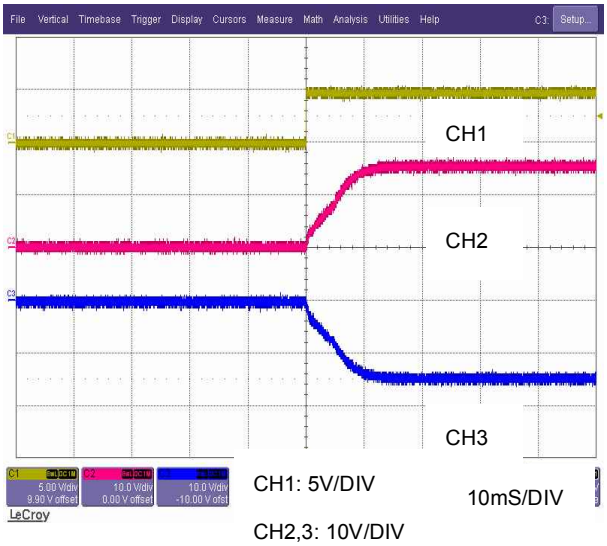
Vin=5V, Vo=12V@0.13A, At 25°C

- SPD1R5-5-1212 -



Vin = 5V, Vo=+12V,-12V@0.065A, At 25°C

- SPD1R5-5-1515 -



Vin = 5V, Vo=+15V,-15V@0.050A, At 25°C

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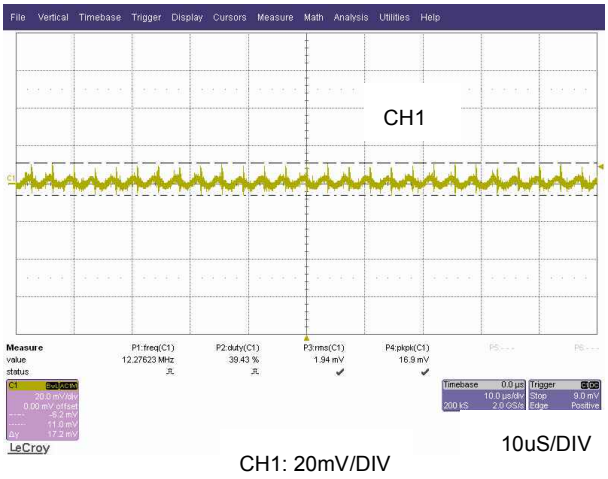
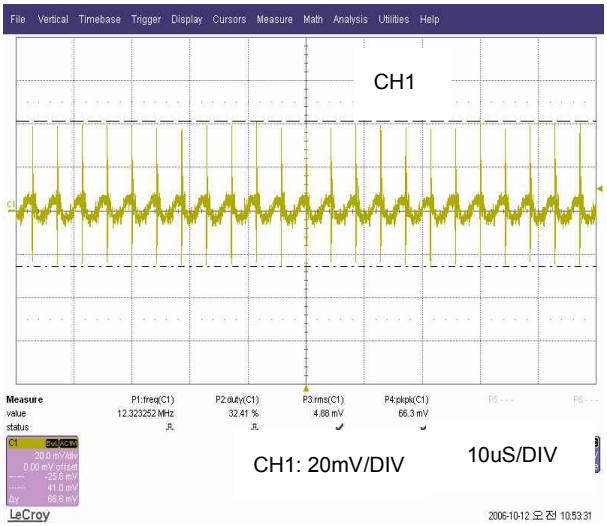
Output Ripple/Noise

- SPS1R5-5-5 -



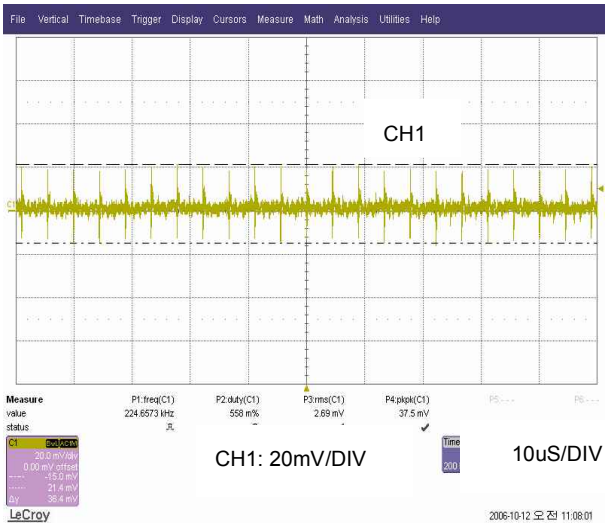
Vin=5V, Vo=5V@0.3A ,At 25°C

- SPS1R5-5-12 -



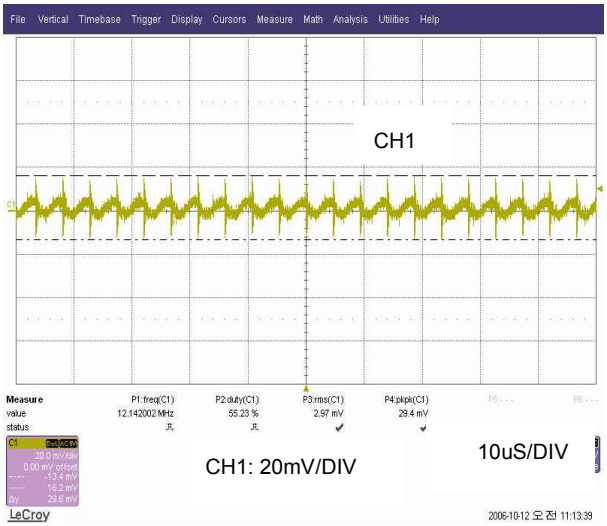
Vin=5V, Vo=12V@0.13A, At 25°C

- SPD1R5-5-1212 -



Vin = 5V, Vo=+12V,-12V@0.065A,At 25°C

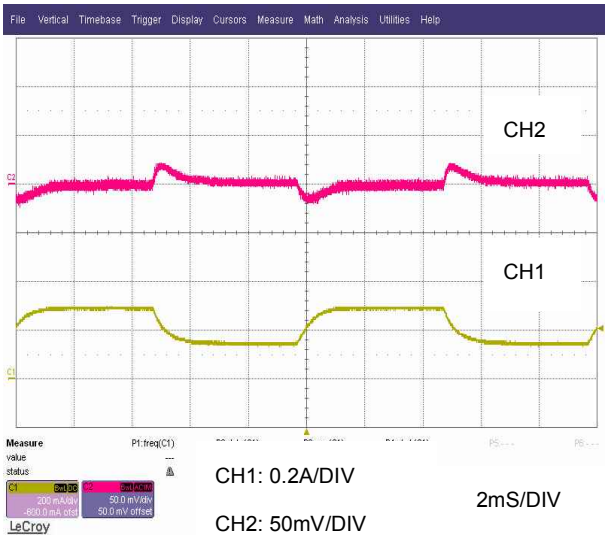
- SPD1R5-5-1515 -



Vin = 5V, Vo=+15V,-15V@0.050A,At 25°C

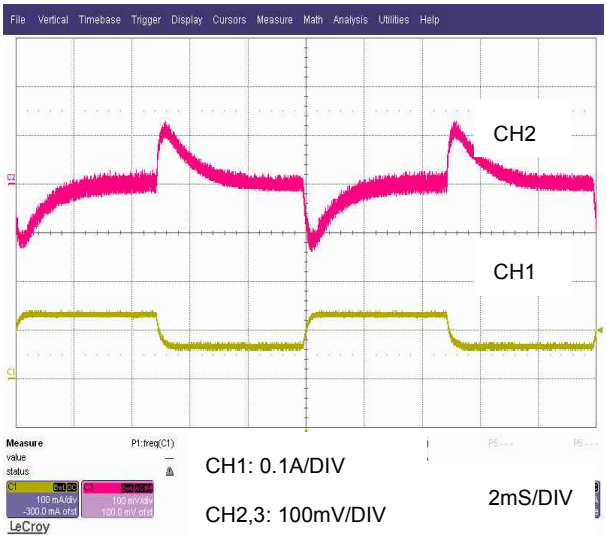
Output Load Transient Response

- SPS1R5-5-5 -



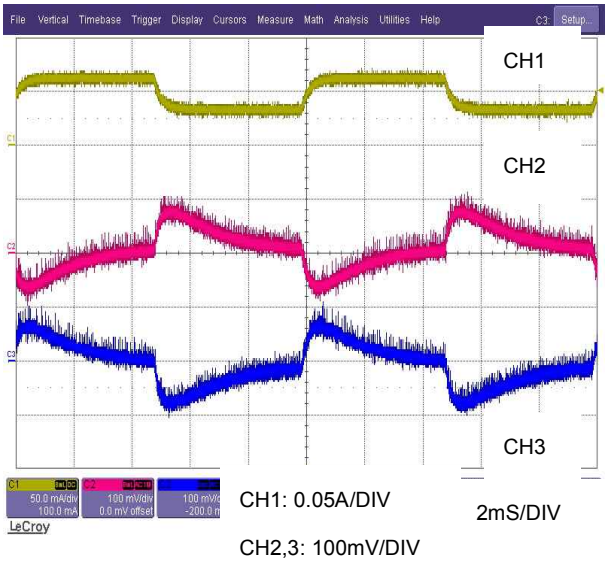
Vin=5V, Vo=5V@0.3A ,At 25°C

- SPS1R5-5-12 -



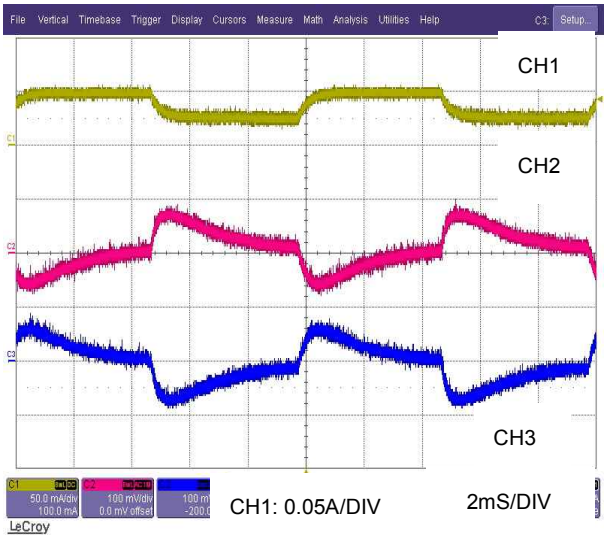
Vin=5V, Vo=12V@0.13A,At 25°C

- SPD1R5-5-1212 -



Vin = 5V, Vo=+12V,-12V@0.065A,At 25°C

- SPD1R5-5-1515 -



Vin=5V, Vo=+15V,-15V@0.050A,At 25°C

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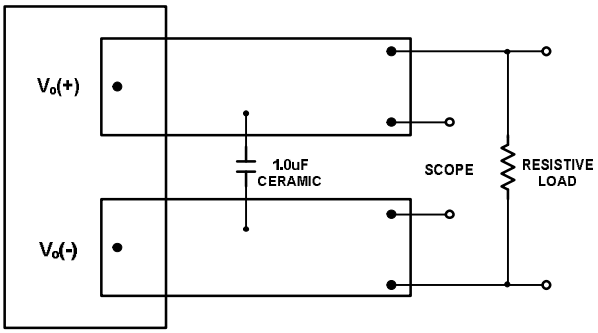
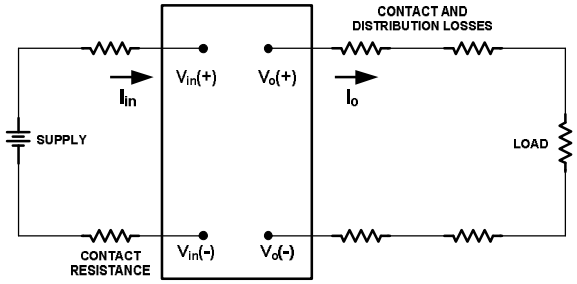
TEST Configurations

Output ripple and noise Test



* Conductor from Vout-pins to capacitors = 50mm (1.97in)

Output Voltage and Efficiency Test



*All measurements are taken at the module terminals when Socketing, place Kelvin connections at module terminals to Avoid measurement errors due to socket contact resistance

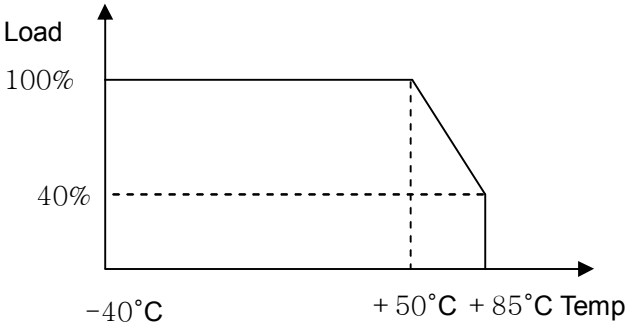
Efficiency

$$\eta = \left(\frac{[V_O(+) - V_O(-)] \times I_O}{[V_{in}(+) - V_{in}(-)] \times I_{in}} \right) \times 100\%$$

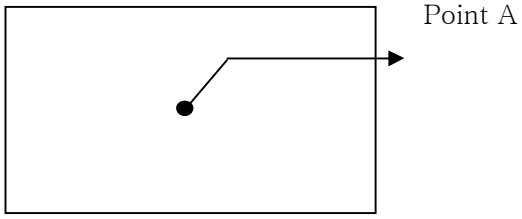
Thermal Considerations

SPS series has wide operating temperature range from -40˚C to +85˚C.

However, it should be required a enough air flow for more reliable operation. Output derating curve provide designers with a quantity of a current under the desired ambient temperature and velocity of a airflow



If the device is installed in a system, the device's temperature of point A should be checked if does not exceed specified temperature as below. Please make sure that the ambient temperature does not exceed 85˚C.



Output	1.5W	3W	6W	10W
Temp	90˚C	90˚C	95˚C	100˚C

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Feature Description

Input Fuse

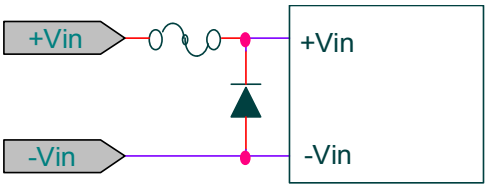
In order to comply with safety requirements, SPS series has a fuse built in.

	5V	12V	24V	48V
SPS1R5	2A	1A	0.75A	0.75A
SPS3	3A	2.5A	1A	1A
SPS6	5A	2.5A	2A	1.5A
SPS10	6A	4A	2.5A	2A

Input Reverse-polarity voltage protection

Input reverse voltage protection has not built in this product.

So, you can set up a circuit externally as described below if necessary



Input Output Filter

SPS series have an internal input filter. To minimize the ripple and noise of the input voltage, additional external capacitor is required (10uF ~ 680uF)

To reduce a output ripple and noise, external capacitor is required at the output of the device

Remote ON/OFF Control (CNT)

By using CNT pin you can control the output without turning the input power on or off.

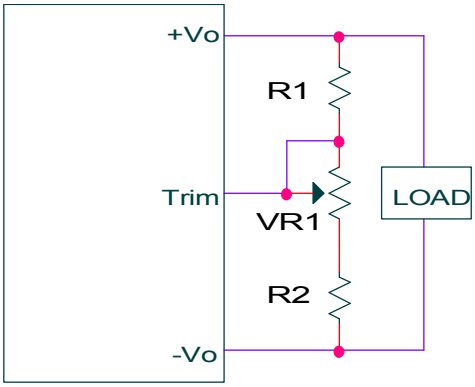
If you need not this function short CNT Pin to –Vin (Except 1.5W)

CNT Level for –Vin	OUTPUT
Open	OFF
Short	ON

Output voltage variation (Trim)

Output Voltage adjusted by using trim pin within ±10% of output voltage.

Use of trim function can cause the output power to increase, so you should not use beyond the SPS's specified output power rating



Output voltage	VR	R1	R2
3.3V	500Ω	1kΩ	560Ω
5V	1kΩ	1kΩ	680Ω
12V	1kΩ	3.9kΩ	680Ω
15V	1kΩ	5.6k	750Ω

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Over current Protection(OCP)

SPS series built in over current protection circuit Which operates when the output current is over 105% of rating and automatically recovers when over current condition is removed

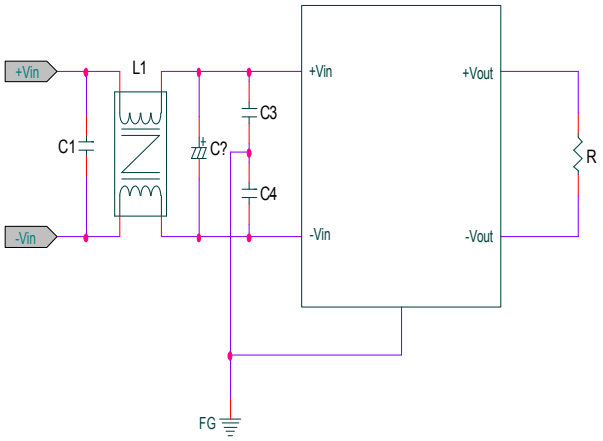
If load is connected to a inductive or constant current load such as lamp of motor, output may not start up.

Over Voltage Protection(OVP)

SPS series has not built in overvoltage protection circuit. So, you need to set up a circuit externally which can protect the over voltage if necessary.

EMI Characteristic (conducted Emission)

In order to reduce conducted noise install an external input filter as shown in below.



Model Number	L1	C1	C2	C3,C4
SPS1R5-5-5	0.5mH	22uF (MLCC)	220uF	472
SPS1R5-12-5	0.5mH	100uF (MLCC)	220uF	472
SPS1R5-24-5	1mH	22uF	220uF	472
SPS1R5-48-5	1mH	22uF	220uF	472

Complies with CISPR 22 CLASS B

Soldering Information

The product is intended for through hole mounting in a PCB, When wave soldering is used, the temperature on the pins is specified to maximum 260°C for maximum 10 seconds

when hand soldering, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheatin

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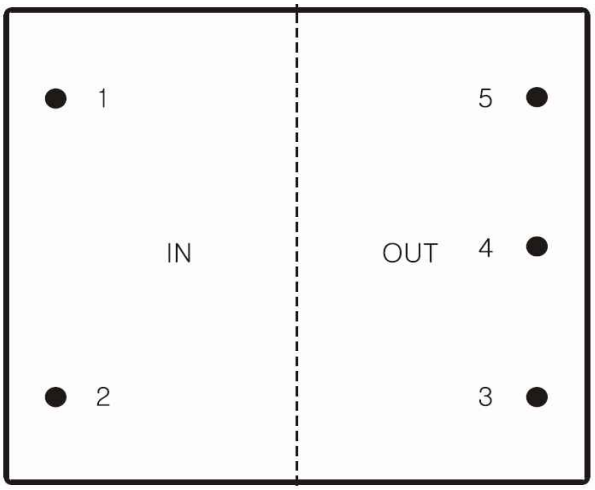
Pin assignments



Single output

PIN NO	NAME	FUNCTION
1	+Vin	Positive terminal for 5V
2	-Vin	Negative terminal for 5V
3	Trim	Output voltage variation
4	-Vout	Negative terminal for Vout
5	+Vout	Positive terminal for Vout

Dual output

PIN NO	NAME	FUNCTION
1	+Vin	Positive terminal for 5V
2	-Vin	Negative terminal for 5V
3	-Vout	Negative terminal for Vout
4	Com	
5	+Vout	Positive terminal for Vout

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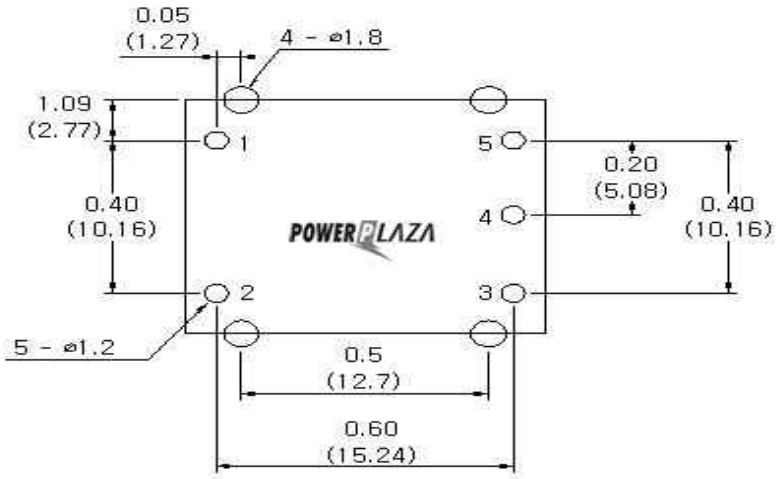
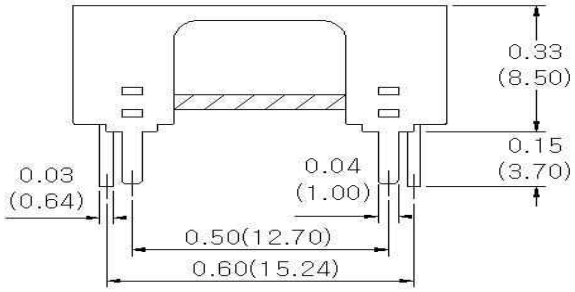
Mechanical Specification

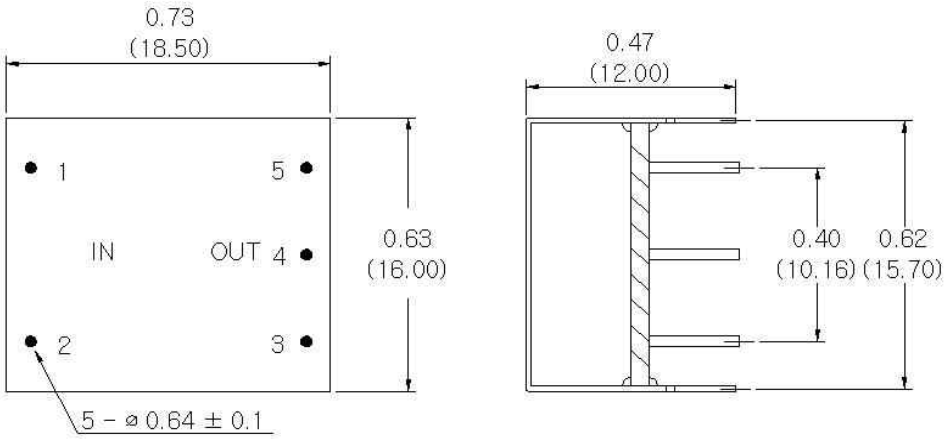
TOP VIEW



SIDE VIEW



OTHER VIEW



All dimensions are inches and (mm)

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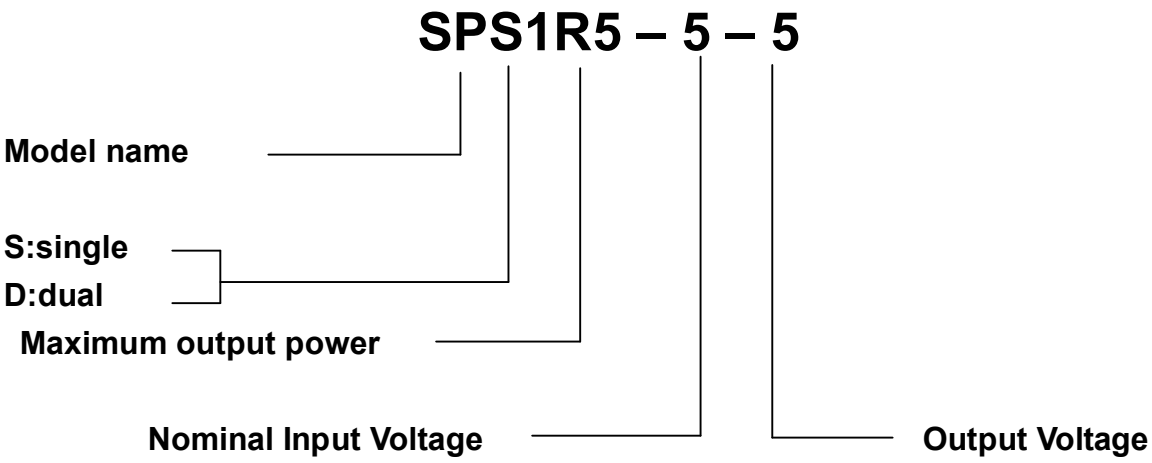
Ordering Information

Input	Output1, Output2	Maximum Power	Ripple & Noise Typ.	Efficiency Typ.	Model Number
4.5 - 9V	3.3V@0.4A	1.32W	50mVp-p	73%	SPS1R5-5-3R3
	5V@0.3A	1.5W	50mVp-p	78%	SPS1R5-5-5
	12V@0.13A	1.56W	120mVp-p	81%	SPS1R5-5-12
	15V@0.1A	1.5W	150mVp-p	81%	SPS1R5-5-15
	+12V@65mA, -12V@65mA	1.56W	120mVp-p	80%	SPD1R5-5-1212
	+15V@50mA, -15V@50mA	1.5W	150mVp-p	80%	SPD1R5-5-1515
9 – 18V	3.3V@0.4A	1.32W	50mVp-p	73%	SPS1R5-12-3R3
	5V@0.3A	1.5W	50mVp-p	78%	SPS1R5-12-5
	12V@0.13A	1.56W	120mVp-p	81%	SPS1R5-12-12
	15V@0.1A	1.5W	150mVp-p	81%	SPS1R5-12-15
	+12V@65mA, -12V@65mA	1.56W	120mVp-p	80%	SPD1R5-12-1212
	+15V@50mA, -15V@50mA	1.5W	150mVp-p	80%	SPD1R5-12-1515
18 – 36V	3.3V@0.4A	1.32W	50mVp-p	73%	SPS1R5-24-3R3
	5V@0.3A	1.5W	50mVp-p	78%	SPS1R5-24-5
	12V@0.13A	1.56W	120mVp-p	81%	SPS1R5-24-12
	15V@0.1A	1.5W	150mVp-p	81%	SPS1R5-24-15
	+12V@65mA, -12V@65mA	1.56W	120mVp-p	80%	SPD1R5-24-1212
	+15V@50mA, -15V@50mA	1.5W	150mVp-p	80%	SPD1R5-24-1515
36 – 76V	3.3V@0.4A	1.32W	70mVp-p	73%	SPS1R5-48-3R3
	5V@0.3A	1.5W	70mVp-p	78%	SPS1R5-48-5
	12V@0.13A	1.56W	120mVp-p	80%	SPS1R5-48-12
	15V@0.1A	1.5W	150mVp-p	80%	SPS1R5-48-15
	+12V@65mA, -12V@65mA	1.56W	120mVp-p	80%	SPD1R5-48-1212

	+15V@50mA, -15V@50mA	1.5W	150mVp-p	80%	SPD1R5-48-1515

Part number structure



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