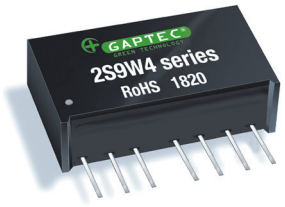
GAPTEC®
GREEN TECHNOLOGY



2S9W4 series

2W - Dual/Single Output - Wide Input - Isolated & Regulated
SIP - DC-DC Converter

DC-DC Converter 2 Watt

- High efficiency up to 79%
- 4:1 wide input voltage range
- Regulated outputs
- I/O Isolation 1500VDC
- Short circuit protection (SCP)
- External On/Off control
- Internal SMD construction
- Operating Temperature: -40°C to +85°C
- UL94-V0 Package
- RoHS Compliance

The 2S9W4 series are specially designed for applications where a wide range input voltage power supplies are isolated from the input power supply in a distributed power supply system on a circuit board.

These products apply to:
1) Where the voltage of the input power supply is wide range (voltage range ≤4:1)
2) Where isolation is necessary between input and output (isolation voltage ≤1500VDC)
3) Where the regulation of the output voltage and the output ripple noise are demanded

Common specifications	
Short circuit protection:	Continuous, automatic recovery
Temperature rise at full load:	15°C TYP
Cooling:	Free air convection
Operation temperature range:	-40°C~+85°C
Storage temperature range:	-55°C ~+125°C
Lead temperature range:	300°C MAX, 1.5mm from case for 10 sec
Storage humidity range:	< 95%
Case material:	Plastic [UL94-V0]
MTBF (MIL-HDBK-217F @25°C):	>1,000,000 hours
Weight:	5.8g

Input specifications					
Item	Test condition	Min	Typ	Max	Units
Input filter	Capacitance filter				
Input surge voltage	• 24VDC • 48VDC	-0.7 -0.7		50 100	VDC VDC
Start-up voltage	• 24VDC • 48VDC		7.5 16.5	9 18	VDC VDC

Isolation specifications					
Item	Test condition	Min	Typ	Max	Units
Isolation voltage	Tested for 1 minute and leakage 1mA max	1500			VDC
Isolation resistance	Test at 500VDC	1000			MΩ
Isolation capacitance	Input/Output, 100KHz/1V		80		pF

EMC specifications	
Conducted emissions	CISPR22/EN55022 CLASS A (External Circuit Refer to EMI recommended circuit)
ESD	IEC61000-4-2 Contact ±4KV Perfect criteria B (External Circuit Refer to ESD recommended circuit)
EFT**	IEC61000-4-4 ±2KV Perfect criteria B (External Circuit Refer to EMS recommended circuit)
Surge**	IEC61000-4-5 ±2KV Perfect criteria B (External Circuit Refer to EMS recommended circuit)

Output specifications					
Item	Test condition	Min	Typ	Max	Units
Output power	Refer to product program	0.2		2	W
Voltage accuracy	• positive accuracy • negative accuracy		±1 ±3	±3 ±5	% %
Output voltage balance	Dual output, balanced loads		0.3	0.6	%
Line regulation	Input voltage from low to high		±0.2	±0.75	%
Load regulation*	10% to 100% full load		±0.5	±1.5	%
Transient Recovery Time	25% load step change			25	ms
Transient Response Deviation	25% load step change		±3	±5	%
Temperature drift	100% full load			±0.03	%/°C
Ripple & Noise**	20MHz Bandwidth		50	150	mVp-p
Switching frequency	100% load, input voltage range		300		KHz

* Dual output models unbalanced load: ±5% max.
** Test ripple and noise by "parallel cable" method. See detailed operation instructions at Testing of Power Converter section, application notes.

Example:
2S9W_2405S1.5RP
2 = 2 Watt; S9 = SIP9; W = wide input; 24 = 9-36Vin; 05 = 5Vout;
S = Single Output; 1.5 = 1500VDC; R = Regulated Output
P = Short Circuit Protection

Note:
1. The load shouldn't be less than 10%, otherwise ripple will increase dramatically.
2. Operation under 10% load will not damage the converter; However, they may not meet all specification listed.
3. All specifications measured at Ta = 25°C, humidity <75%, nominal input voltage and rated output load unless otherwise specified.
4. In this datasheet, all the test methods of indications are based on corporate standards.
5. Only typical models listed, other models may be different, please contact our technical person for more details.

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Specifications subject to change without notice.

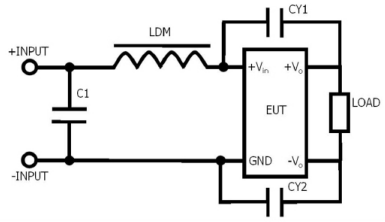
2S9W4 series

2W - Dual/Single Output - Wide Input - Isolated & Regulated
SIP - DC-DC Converter

Part Number	Input Voltage [VDC]			Output Voltage [VDC]	Current [mA]		Efficiency [%, Typ.]
	Nominal	Range	Max*		Max	Min	
2S9W4_2403S1.5RP	24	9-36	40	3.3	500	50	68
2S9W4_2405S1.5RP	24	9-36	40	5	400	40	75
2S9W4_2409S1.5RP	24	9-36	40	9	222	22	78
2S9W4_2412S1.5RP	24	9-36	40	12	167	16	79
2S9W4_2415S1.5RP	24	9-36	40	15	133	13	79
2S9W4_4803S1.5RP	48	18-72	80	3.3	500	50	72
2S9W4_4805S1.5RP	48	18-72	80	5	400	40	75
2S9W4_4812S1.5RP	48	18-72	80	12	167	16	78
2S9W4_4815S1.5RP	48	18-72	80	15	133	13	79
2S9W4_2405D1.5RP	24	9-36	40	±5	±200	±20	75
2S9W4_2409D1.5RP	24	9-36	40	±9	±111	±11	78
2S9W4_2412D1.5RP	24	9-36	40	±12	±83	±8	78
2S9W4_2415D1.5RP	24	9-36	40	±15	±67	±7	78
2S9W4_4805D1.5RP	48	18-72	80	±5	±200	±20	76
2S9W4_4812D1.5RP	48	18-72	80	±12	±83	±8	78
2S9W4_4815D1.5RP	48	18-72	80	±15	±67	±7	79

EMC recommended circuit

2S9W4_S1.5RP

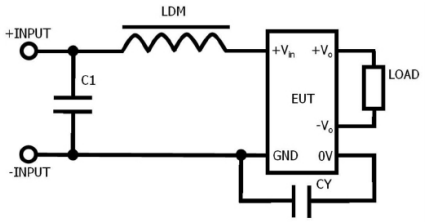


Recommended parameters:

Vin: 24V
① C1: 4.7μF/50V
② LDM: 6.8μH
③ CY2: 100pF/2000V

Vin: 48V
① C1: 4.7μF/100V
② LDM: 6.8μH
③ CY1: 100pF/2000V
④ CY2: 100pF/2000V

2S9W4_D1.5RP

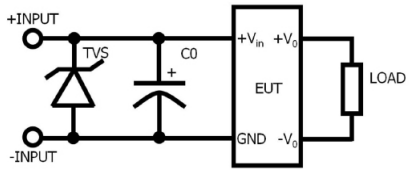


Recommended parameters:

Vin: 24V
① C1: 4.7μF/50V
② LDM: 6.8μH
③ CY: 1000pF/2000V

Vin: 48V
① C1: 4.7μF/100V
② LDM: 6.8μH
③ CY: 1000pF/2000V

EMS recommended external circuit

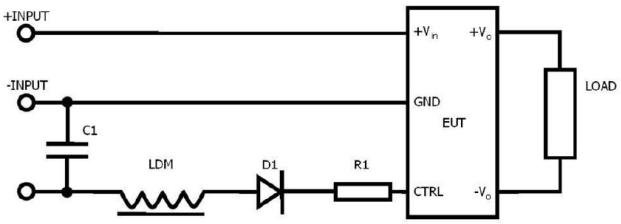


Recommended parameters:

Vin: 24V
① TVS: SMCJ40A,1500W
② C0: 680μF/50V

Vin: 48V
① TVS: SMCJ90A,1500W
② C0: 680μF/100V

ESD recommended external circuit

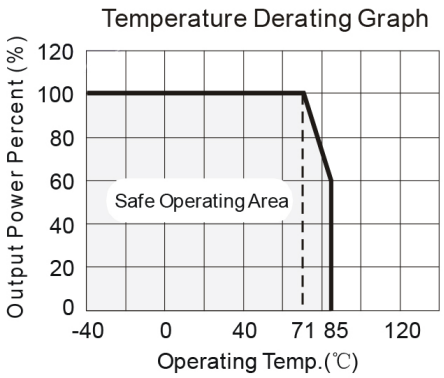


Recommended parameters:

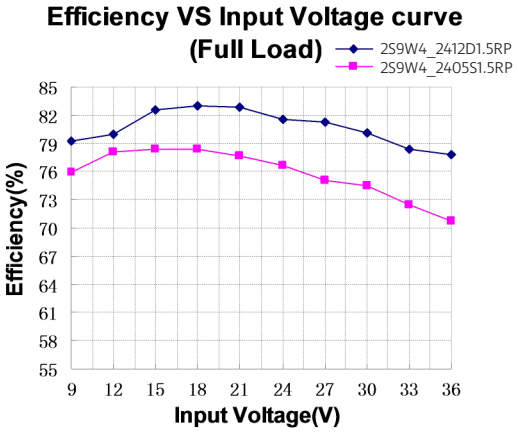
Vin: 24V
① C1: 1μF/50V
② LDM: 0.18μH
③ D1: RB050LA; Schottky diodes
④ R1: 510Ω

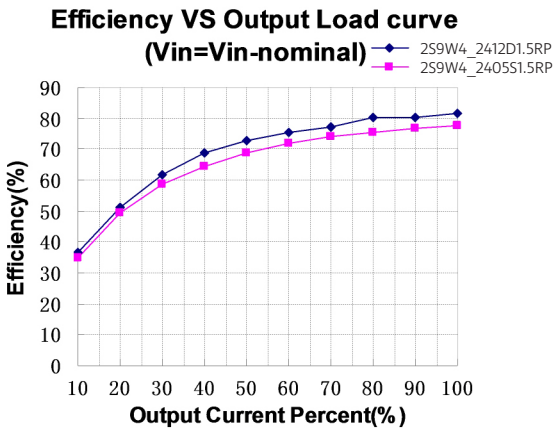
Vin: 48V
① C1: 1μF/100V
② LDM: 0.18μH
③ D1: RB050LA; Schottky diodes
④ R1: 510Ω

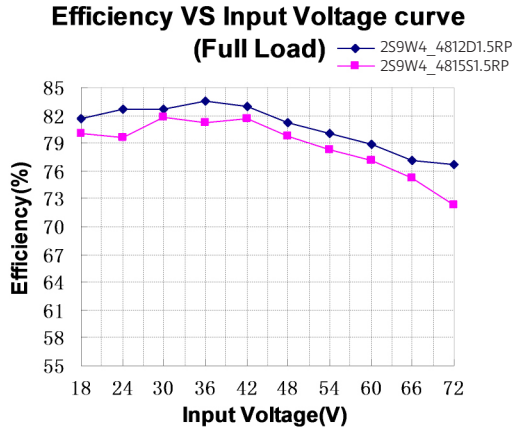
Typical characteristics

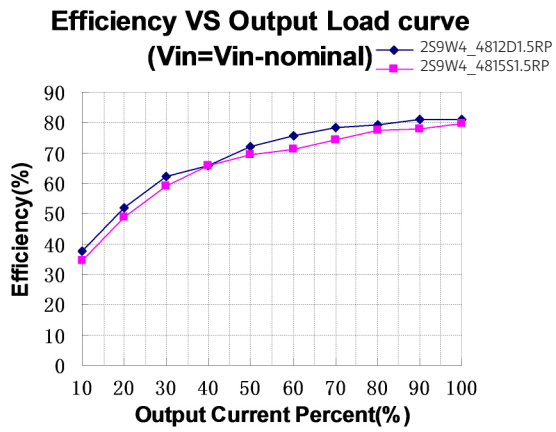


Efficiency

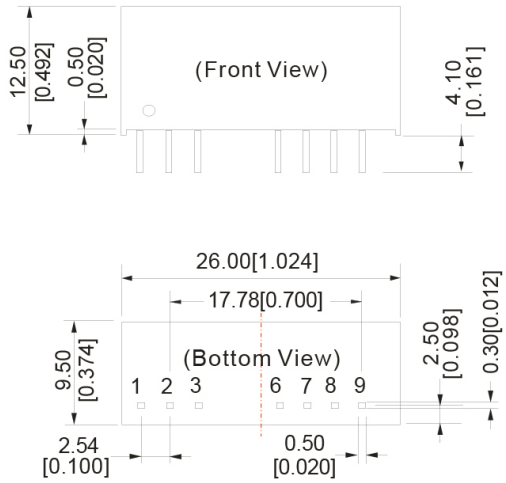








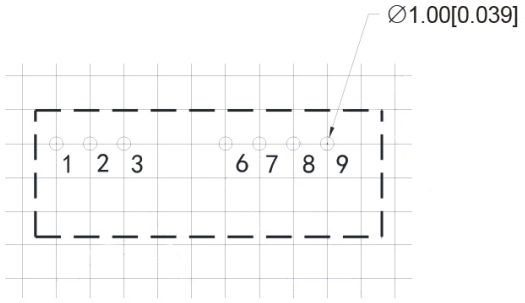
Mechanical dimensions



Note:
Unit: mm[inch]

Pin section tolerances: ±0.10mm (±0.004inch)
General tolerances: ±0.25mm (±0.010inch)

Recommended footprint

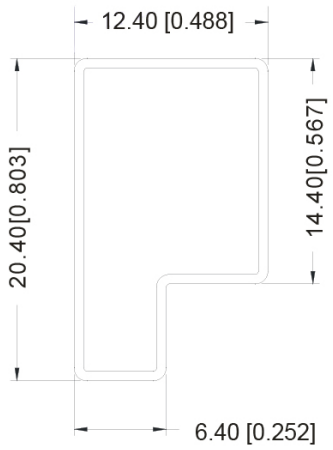


Note: Grid 2.54*2.54mm.

FOOTPRINT DETAILS		
Pin	Single	Dual
1	GND	GND
2	Vin	Vin
3	CTRL	CTRL
6	+Vo	+Vo
7	NC	0V
8	NC	NC
9	0V	-Vo

NC:No Connection

Tube outline



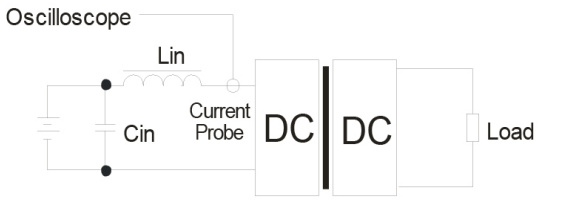
Note:
Unit: mm[inch]
General tolerances: ±0.50mm [±0.020inch]

L=530mm [20.866inch]
Tube quantity: 18pcs

L=220mm [8.661inch]
Tube quantity: 7pcs

Test configurations

Input Reflected-Ripple Current Test Setup
Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.



Lin(4.7μH) Cin(220μF, ESR < 1.0Ω at 100 KHz)

Application note

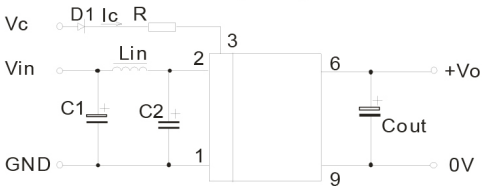
Requirement on output load
To ensure this module can operate efficiently and reliably, During operation, the minimum output load is not less than 10% of the full load, and that this product should never be operated under no load! If the actual output power is very small, please connect a resistor with proper resistance at the output end in parallel to increase the load, or use our company's products with a lower rated output power.

Overload Protection
Under normal operating conditions, the output circuit of these products has no protection against overload. The simplest method is to connect a self-recovery fuse in series at the input end or add a circuit breaker to the circuit.

Recommended circuit
If you want to further decrease the input/output ripple, an "LC" filtering network may be connected to the input and output ends of the DC/DC converter, see (Figure 1).
However, the capacitance of the output filter capacitor must be proper. If the capacitance is too big, a startup problem might arise. For every channel of output, provided the safe and reliable operation is ensured, the greatest capacitance of its filter capacitor must less than the Max. Capacitive Load.

General: C1/C2: 10-100µF
Cout: 100µF
Lin: 4.7µH - 120µH

Single Output



Dual Output

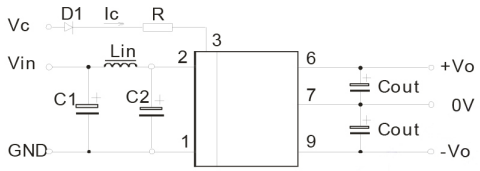


Figure 1

TRL Terminal
When open or high impedance, the converter work well; When this pin is 'high'; the converter shutdown; It should be note that the input current (Ic) should between 5-10mA, exceeding the maximum 20mA will cause permanence damage to the converter. The value of R Can be derived as follows :

$$R = \frac{V_C - V_D - 1.0}{I_C}$$

Input current
When it is used in unregulated power supply, be sure that the fluctuating range of the power supply and the rippled voltage do not exceed the module standard. Input current of power supply should afford the flash startup average current of this kind of DC/DC module (figure 2).

General: Vin:24V Iave =426mA
Vin:48V Iave =213mA

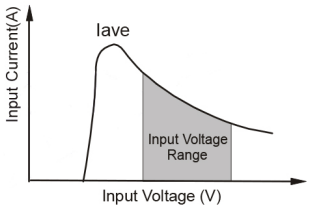


Figure 2

No parallel connection or plug and play