

MAX. Power 50.0W Isolated DC-DC Converter

KSP50 Series Small Size Excellent Efficiency DC-DC Converter



Features

- Six side shield compact size
 - Excellent Efficiency & Reliability
 - Built in ceramic Capacitor only (high reliability)
 - Isolated Input – Output
 - 300kHz fixed frequency & Current mode Control
 - Low output Ripple & Noise
 - Built-in over current protection circuit
 - Built-in over voltage protection circuit
 - Positive logic input remote on/off control
 - Wide 2 :1 input range
 - Built-in Input UVLO (Under Voltage Lock Out)
- Adjustable output voltage
 - RoHS compatible design
 - Safety : NRTL/CE Standard(UL/EN60950-1) (Approvals pending)

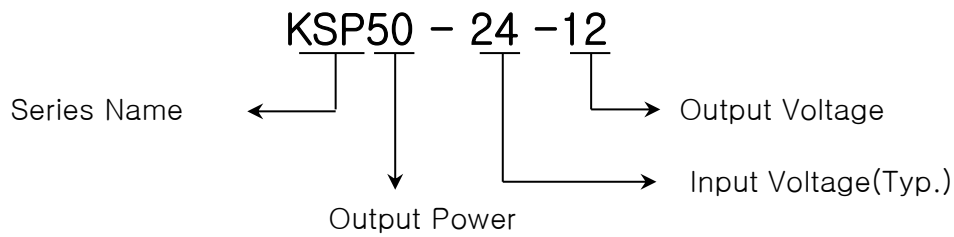
Applications

- Electric car, Railroad
- Distributed Power Systems
- Data and telecommunication
- Industrial applications
- FA control

Environment

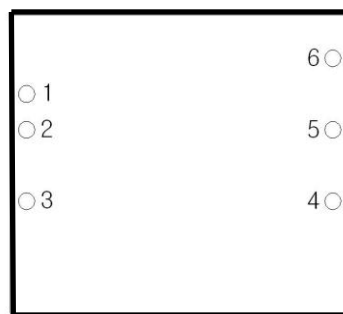
- Operating Temperature : $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$ (Refer to derating curve)
- Operating Humidity : 5% ~ 95% RH (Non condensing)
- Storage Temperature : $-40^{\circ}\text{C} \sim 105^{\circ}\text{C}$
- Cooling : Free-Air Convection or Forced air (Refer to derating curve)
- MTBF : $3.6 * 10^5$ hrs

Model Name Structure



Pin assignments & Function

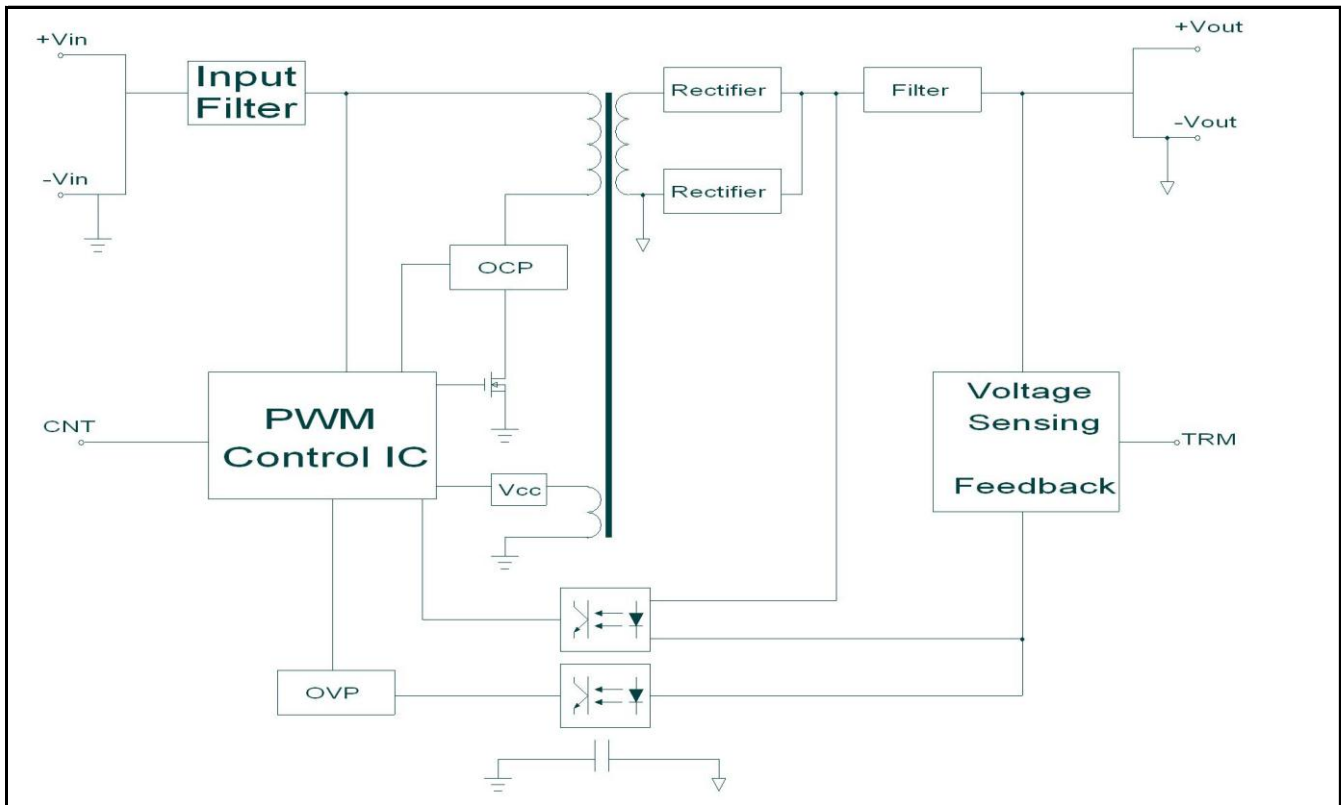
<Top View>



- Single Output Name & Function

PIN No.	NAME	FUNCTION
1	CNT	Remote on/off Control
2	-Vin	Negative terminal for Vin
3	+Vin	Positive terminal for Vin
4	+Vout	Positive terminal for Vout
5	-Vout	Negative terminal for Vout
6	TRM	Vout variation($\pm 10\%$) by external parts

Internal Circuit Architecture



Maximum Ratings

Characteristics		Symbol	Min.	Typ.	Max.	Unit
Input Voltage Continuous	KSP50 - 24 - XX	Vin	18	-	36	VDC
	KSP50 - 48 - XX		36	-	75	
	KSP50 - 72 - XX		55	-	90	
Operating Ambient Temperature		Ta	-40	-	70	°C
Storage Temperature		Tstg	-40	-	105	°C
Withstand Voltage			-	-	500	Vac

Electrical Characteristics

- Input Section

Ta : 25°C, Vin : Typical Input Voltage

Characteristics		Symbol	Min.	Typ.	Max.	Unit	
Operating Voltage Range	KSP50 - 24 - XX	Vin	18	24	36	VDC	
	KSP50 - 48 - XX		36	48	75		
	KSP50 - 72 - XX		55	72	90		
Under Voltage Lock Out (UVLO)	Power up Threshold		KSP50-24	15	16	17	VDC
			KSP50-48	31	33	35	
			KSP50-72	46	48	50	
	Power down Threshold (after turn-on)		KSP50-24	14	15	16	
			KSP50-48	29	31	33	
			KSP50-72	43	45	47	
Maximum Input Current (Vin : rated, Io : 100%)	KSP50 - 24 - XX	Iin		2.28		A	
	KSP50 - 48 - XX		1.14				
	KSP50 - 72 - XX		0.78				
No Load Input Current (Vin : rated)	KSP50 - 24 - XX					mA	
	KSP50 - 48 - XX						
	KSP50 - 72 - XX						

- Output Section

Ta : 25°C, Vin : Minimum, Typical, Maximum Input Voltage

Characteristics		Symbol	Min.	Typ.	Max.	Unit
Output Voltage Accuracy		Vo	-	-	±2	%
Regulation	Line Regulation (From min. Vin to max. Vin, constant load)		-	-	±0.5	%
	Load Regulation (From no load to maximum load)		-	-	±1	%
Output Ripple and Noise (Vin : Rated, Io : Max., BW : 20MHz, use the external capacitor between +Vo and -Vo (MLCC : 105, el-cap. : 47uF))		mVp-p	-	-	1% of Vout note1	mVp-p (peak to peak)

note1. 3.3Vout : 75mVp-p, 5Vout : 75mVp-p

Characteristics		Symbol	Min.	Typ.	Max.	Unit
Output Current	KSP50 - XX - 3R3	I _o	-	-	11.0	A
	KSP50 - XX - 05		-	-	10.0	
	KSP50 - XX - 12		-	-	4.2	
	KSP50 - XX - 15		-	-	3.3	
Output Current Limit (OCP : Over Current Protection, recovers automatically)			105	-	-	%
Dynamic Load Response (V _{in} : rated, I _o : from 25% to 50%, from 50% to 25%, BW : 20MHz, Freq. : 100Hz, Duty : 0.5, Tr/Tf : 100us)			-	-	3% of V _{out}	mVp-p (peak to peak)
Start - Up Time		T _{start}	-	-	10	ms
Turn - on Overshoot			-	-	5	%
Efficiency (V _{in} : Rated. I _o : Max.)	KSP50 - 24 - 3R3		-	90	-	%
	KSP50 - 24 - 05		-	92	-	
	KSP50 - 24 - 12		-	93	-	
	KSP50 - 24 - 15		-	93	-	
	KSP50 - 48 - 3R3		-	90	-	%
	KSP50 - 48 - 05		-	92	-	
	KSP50 - 48 - 12		-	93	-	
	KSP50 - 48 - 15		-	93	-	
	KSP50 - 72 - 3R3		-	90	-	%
	KSP50 - 72 - 05		-	91	-	
	KSP50 - 72 - 12		-	90	-	
	KSP50 - 72 - 15		-	90	-	

Isolation Characteristics

Characteristics		Symbol	Min.	Typ.	Max.	Unit
Withstand Voltage (AC500V, 1minute)	Input - Output		-	-	500	Vac
	Input - Case		-	-	500	Vac
	Output - Case		-	-	500	Vac
Isolation Resistance (DC500V at 25°C and 70%RH)	Output - Case	Riso	100	-	-	MΩ

General Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Remote on / off control (CNT Pin, Positive Logic Module on : Logic High or open Module off : Logic Low or Short to -Vin)	CNT				
External Trim Adj. Range (TRM Pin, Vout variation by external parts)	TRM	-10	-	+10	%
Switching Frequency			300		kHz
MTBF (MIL-HDBK-217F)			3.6 * 10 ⁵		hrs
Dimension (W x H x L)		51.0 x 43.2 x 16.0			mm
Weight		-	74	-	grams

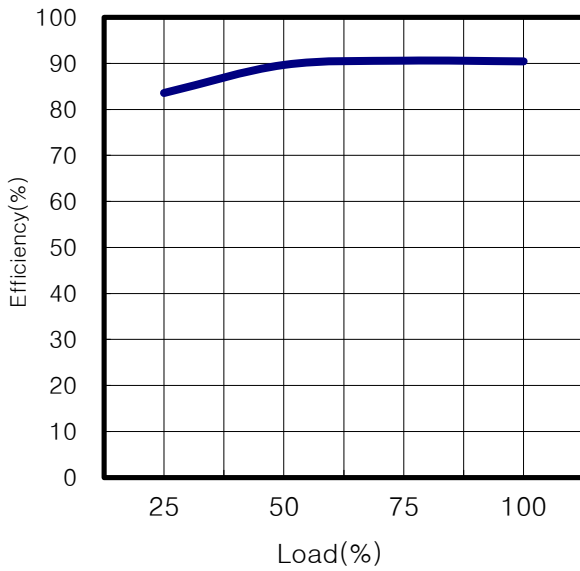
Environment

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Operating Temperature Range	Ta	-40	-	85	°C
Operating Humidity (non Condensing)		5	-	95	%RH
Storage Temperature	Tstg	-40	-	105	°C

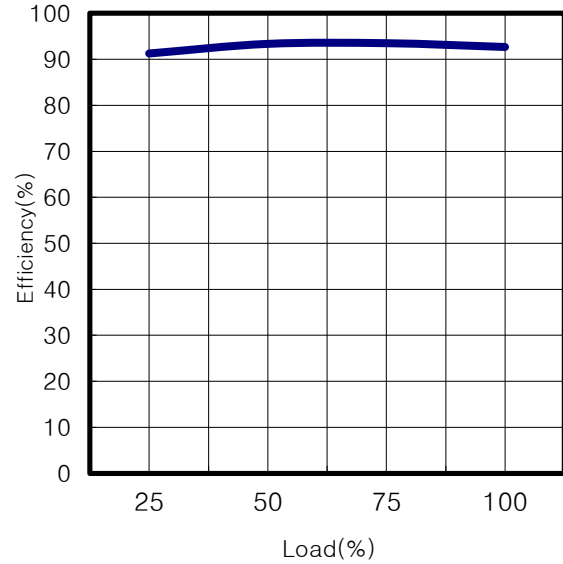
Characteristics Curves

KSP50 Series Efficiency Curves

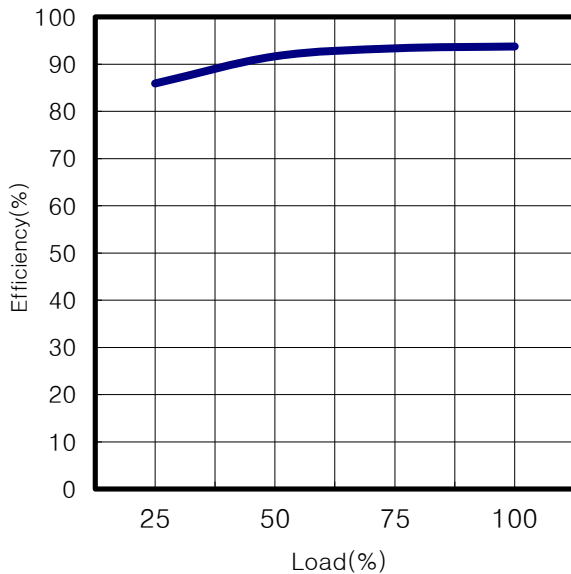
< KSP50 - 24 - 3R3 >



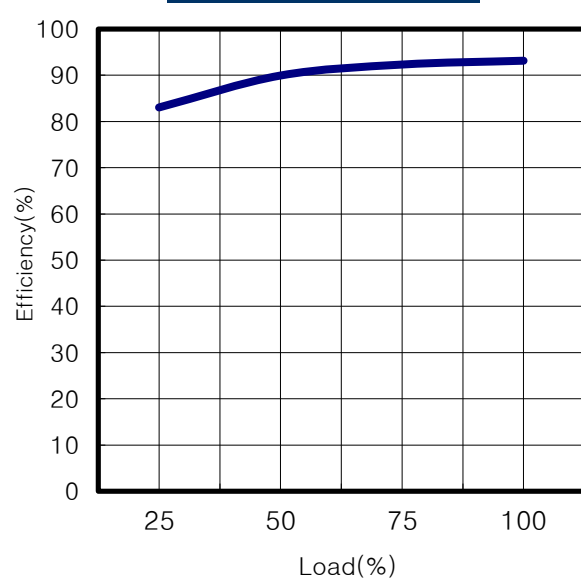
< KSP50 - 24 - 05 >



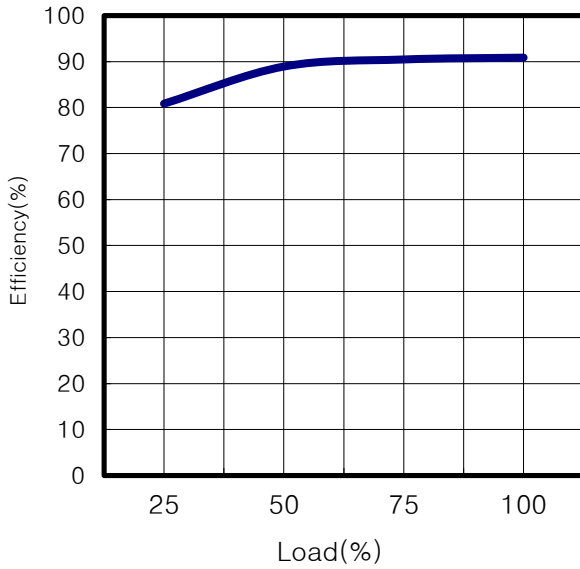
< KSP50 - 24 - 12 >



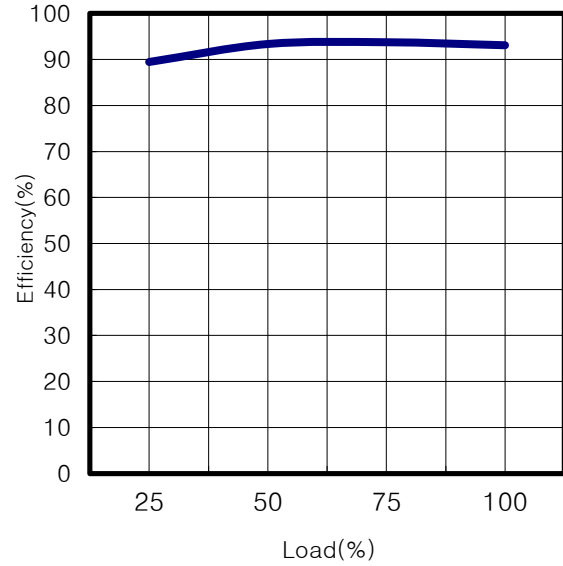
< KSP50 - 24 - 15 >



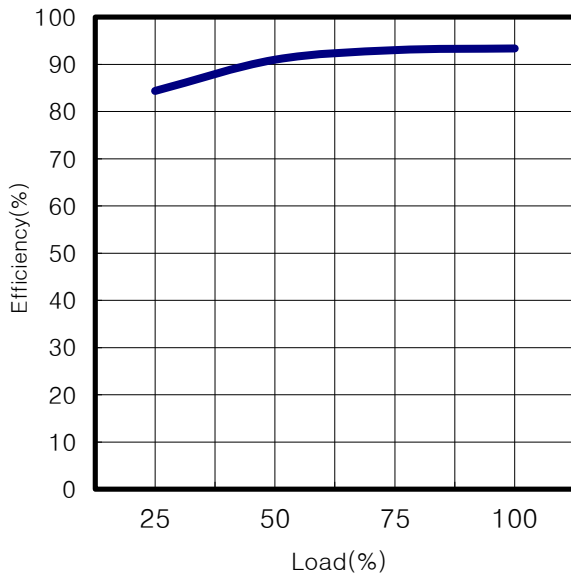
< KSP50 - 48 - 3R3 >



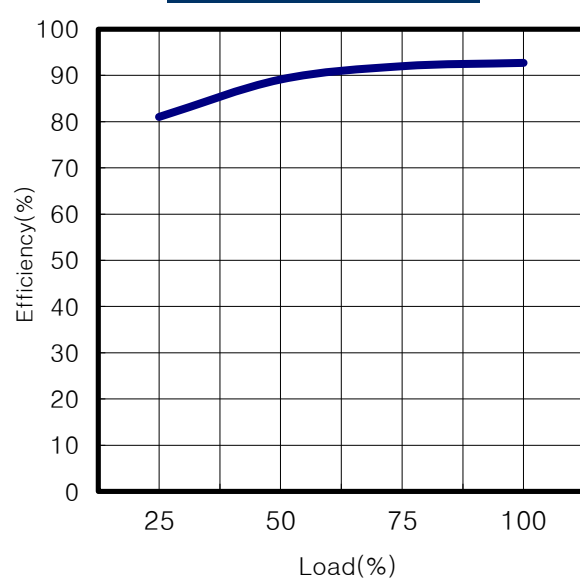
< KSP50 - 48 - 05 >



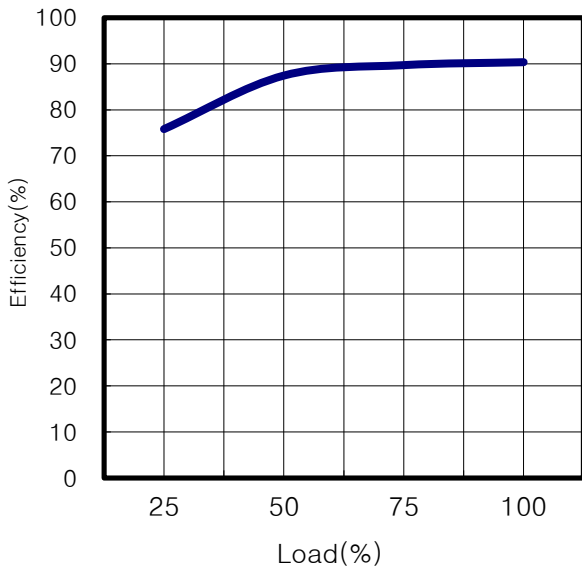
< KSP50 - 48 - 12 >



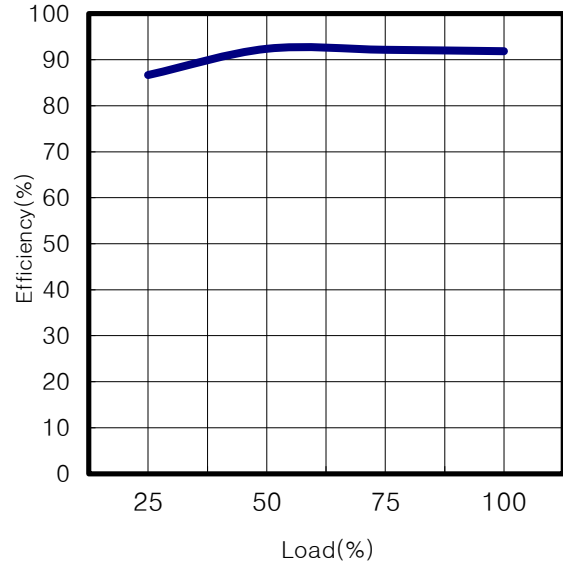
< KSP50 - 48 - 15 >



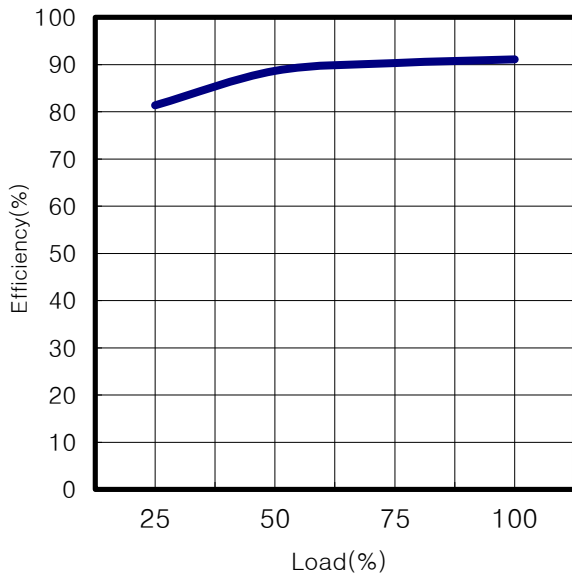
< KSP50 - 72 - 3R3 >



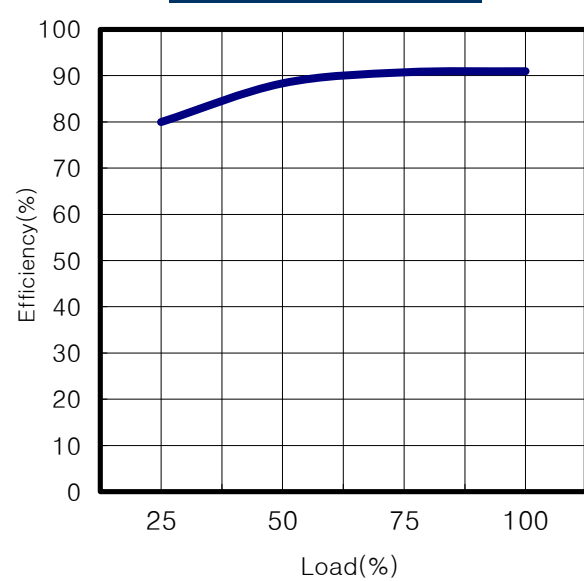
< KSP50 - 72 - 05 >



< KSP50 - 72 - 12 >



< KSP50 - 72 - 15 >



KSP50 Derating curve

<KSP50-24-XX>



<KSP50-48-XX>

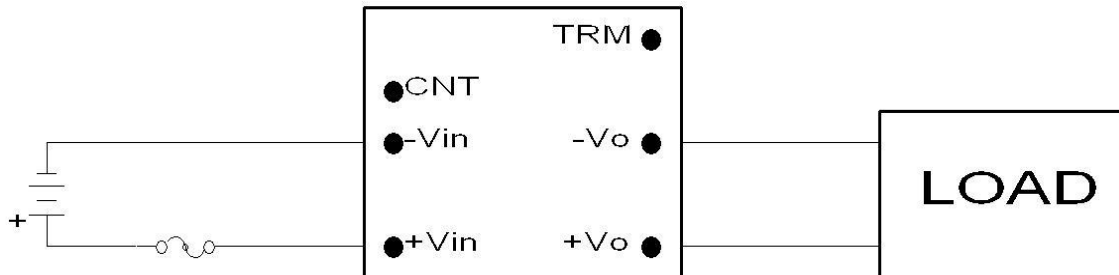


<KSP50-72-XX>



Application Sheet

Basic Connection



Input Section

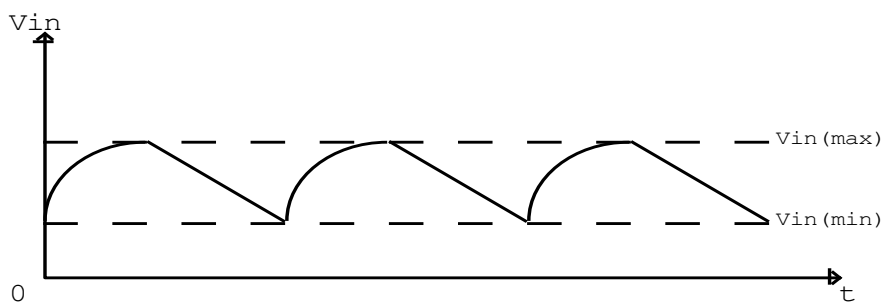
- Input fuse

Generally, encapsulated power supplies do not have internal fuse. To ensure safe operation, an external fuse(Regular or Slow Blow Type) is recommended.

Series	KSP50 Series
24V	6A
48V	3A
72V	2A

- Unstable Input

Input voltage is comprised of both the DC voltage(average rectified voltage)and the peak to peak ripple voltage. Peak to peak ripple voltage should be minimized so that the input voltage is within the standard input voltage range as follows.



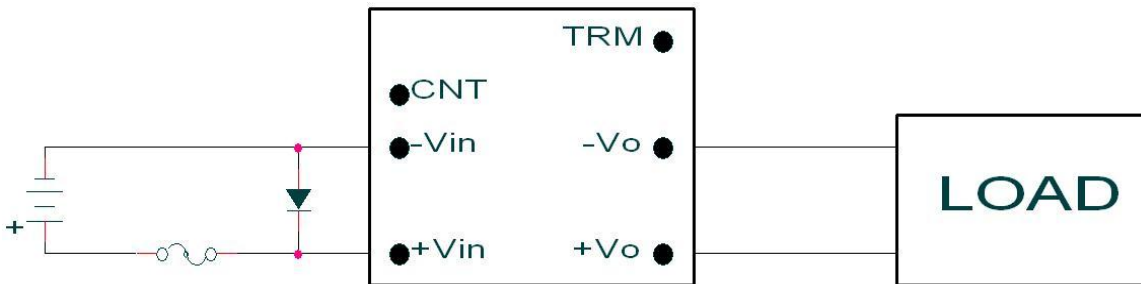
< Unstable Input >

- Battery Input

When using a battery as the input power supply, make sure that the maximum and minimum input voltage do not away out of the standard input voltage range.

- Input Reverse-polarity voltage protection

Accidently reversing the input connections could damage the module. Thus. If the connections may be accidentally reversed. Use a protective diode and an input fuse as shown below.



- Remote On/Off Control(CNT)

Without switching the input on/off, the output can be enabled and disabled using this function. This function is useful for sequence control when building multiple output power supplies. This control circuit is on the input side using the CNT pin. Ground of CNT pin is the input -V terminal.

CNT level for -Vin		OUTPUT
High level	Open	ON
Low level	Short to -Vin	OFF

< Positive Logic on/off Control >

- Under Voltage Lock Out(UVLO)

MODEL	Power Up Threshold (Typ.)	Power Down Threshold (Typ.)
KSP50 - 24 - XX	16V	15V
KSP50 - 48 - XX	33V	31V
KSP50 - 72 - XX	48V	45V

Output Section

– Output Ripple and Noise Measurement Method

The measurement for output ripple and noise are based on normal probe with 20MHz bandwidth scope. Upon measurement of the ripple voltage, make sure that the scope probe leads are not too long. If a precise measurement can be made, the noise occurs from circumference must be reduced.

– Line Regulation

The line regulation means to the change in output voltage when the input voltage is varied within the input voltage range, at constant load and constant ambient temperature. The measurement point for the input and output voltage are $\pm V_{in}$ pins, $\pm V_{out}$ pins respectively.

– Load Regulation

The load regulation means to the change in output voltage when the load is changed from minimum load to maximum load, at constant input voltage and constant ambient temperature. The measurement point for the input and output voltage are $\pm V_{in}$ pins, $\pm V_{out}$ pins respectively.

– Output Voltage Variation(TRM)

The output voltage can be varied within $\pm 10\%$ of the standard output voltage when use the external parts-resistors and variable resistor.

External Resistors :

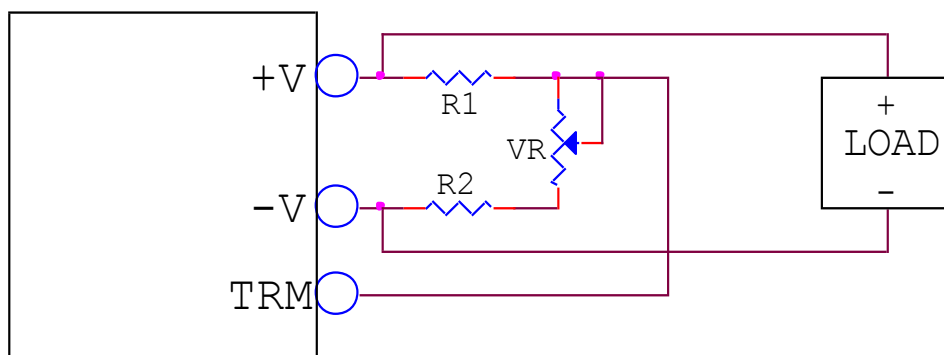
Resistance tolerance $\pm 5\%$

Variable Resistor(VR) :

Total resistance toloatace $\pm 20\%$

Remaining Resistance : Value less than 1%

Vo	R1	R2	VR
3.3V	150Ω	680Ω	1kΩ
5V	1kΩ	680Ω	1kΩ
12V	3.9kΩ	680Ω	1kΩ
15V	5.6kΩ	750Ω	1kΩ



< Trim Method >

– Over Current Protection(OCP)

The KSP50 series is built into an OCP(Over Current Protection) circuit. When the OCP triggers, the output voltage will be fall. If overload condition is removed, the output will automatically recover.

– Over Voltage Protection(OVP)

The KSP50 series is built into an OVP(Over Voltage Protection) circuit. When the OVP triggers, the output voltage is shutdown. The input must be taken out (for at least five seconds), and than reinputted manually. Otherwise, the module will not output.

Environment

– Temperature

Operation Temperature

The range of ambient temperature in °C over which a module can be operated safely at either rated or derated output power. Refer to derating curve as page 10.

Storage Temperature

The range of ambient temperature in °C over which a module may be stored long term without damage. The storage temperature range is from -40°C to 105°C.

– Humidity

Operating & Storage Humidity

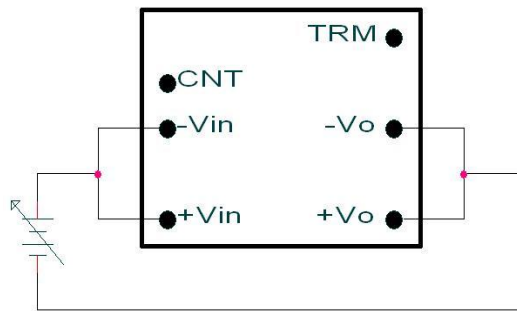
The range of ambient humidity in % over which a module can be operated safely at either rated or derated output power. The operating humidity range is from 5% to 95%RH.
The range of ambient humidity in % over which a module may be stored long term without damage. The storage humidity range is from 5% to 95%RH.

Isolation

Isolation Resistance

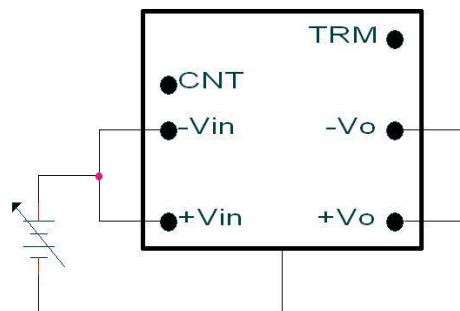
The electrical separation between input and output of a module by means of the power transformer. The isolation resistance is a function of materials and spacings employed throughout the module. Please don't test with a voltage above standard voltage for the Isolation Resistance Test.

<INPUT-OUTPUT>



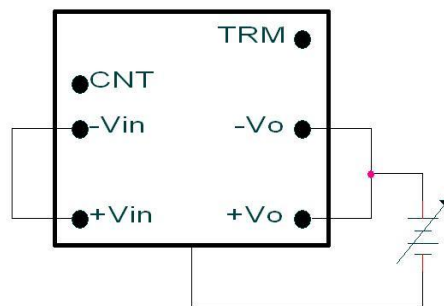
500VDC, 100MΩ

<INPUT-CASE>



500VDC, 100MΩ

<OUTPUT-CASE>

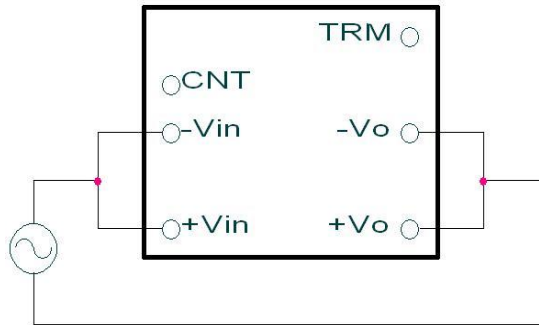


500VDC, 70MΩ

Withstand Voltage

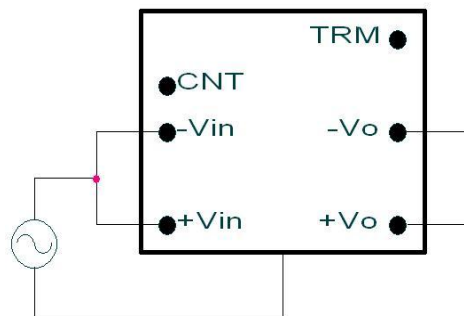
For the withstand voltage test, the applied voltage must be increased gradually from zero to the testing value, and then decreased gradually at shut down. Especially stay away from use of a timer. Where a pulse of several times the applied voltage can be generated.

<INPUT-OUTPUT>



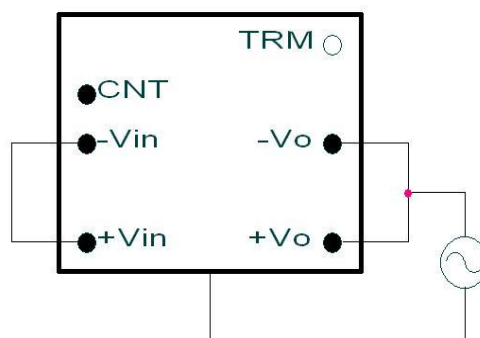
0.5kVAC 1minute

<INPUT-CASE>



0.5kVAC 1minute

<OUTPUT-CASE>



0.5kVAC 1minute

Outline Dimensions : All dimensions are in inches and (mm)

