

**SERIES:** VHK150W-DIN | **DESCRIPTION:** DC-DC CONVERTER

**FEATURES**

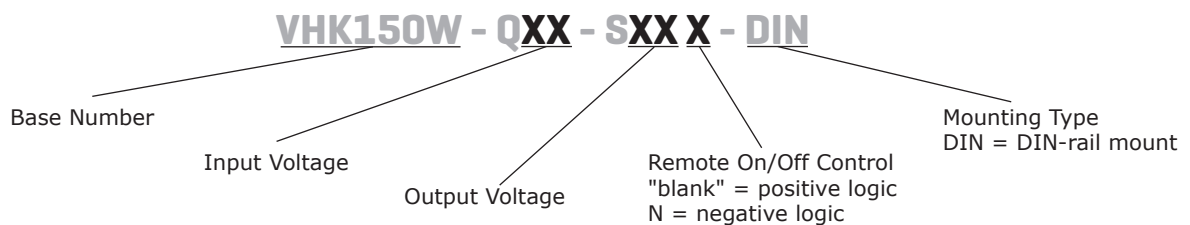
- up to 150 W isolated output
- rugged metal enclosure with integrated heat sink
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- single output from 5~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 90%
- comes with DIN-rail mount



MODEL	input voltage range	output voltage	output current max	output power max	ripple and noise <sup>1</sup> max	efficiency typ
	(Vdc)	(Vdc)	(A)	(W)	(mVp-p)	(%)
VHK150W-Q24-S5-DIN	9 ~ 36	5	25	125	100	87
VHK150W-Q24-S12-DIN	9 ~ 36	12	12.5	150	150	86
VHK150W-Q24-S15-DIN	9 ~ 36	15	10	150	150	86
VHK150W-Q24-S24-DIN	9 ~ 36	24	6.5	156	240	86.5
VHK150W-Q24-S28-DIN	9 ~ 36	28	5.4	150	280	87
VHK150W-Q24-S48-DIN	9 ~ 36	48	3.12	150	480	84
VHK150W-Q48-S5-DIN	18 ~ 75	5	25	125	100	90
VHK150W-Q48-S12-DIN	18 ~ 75	12	12.5	150	150	88
VHK150W-Q48-S15-DIN	18 ~ 75	15	10	150	150	88
VHK150W-Q48-S24-DIN	18 ~ 75	24	6.5	156	240	87.5
VHK150W-Q48-S28-DIN	18 ~ 75	28	5.4	150	280	89
VHK150W-Q48-S48-DIN	18 ~ 75	48	3.12	150	480	87

Note: 1. Ripple and noise are measured at full load, 20 MHz BW with 10µF tantalum capacitor and 1µF ceramic capacitor across output.

**PART NUMBER KEY**



## INPUT

parameter	conditions/description	min	typ	max	units
operating input voltage	24 Vdc input models	9	24	36	Vdc
	48 Vdc input models	18	48	75	Vdc
under voltage shutdown	24 Vdc input		8.8		Vdc
		power up	8		Vdc
	48 Vdc input		17		Vdc
		power down	16		Vdc
CTRL <sup>1</sup>	positive logic	models ON (>3.5 Vdc or open circuit)			
		models OFF (0~1.8 Vdc)			
	negative logic	models ON (0~1.8 Vdc)			
		models OFF (>3.5 Vdc or open circuit)			
filter	pi filter				
input fuse	30A time delay fuse for 24 Vin models, 15A time delay fuse for 48 Vin models				

Note: 1. Open collector refer to -Vin

## OUTPUT

parameter	conditions/description	min	typ	max	units
maximum capacitive load	5 V output models			30,000	μF
	12 V output models			12,500	μF
	15 V output models			10,000	μF
	24 V input, 24 & 28 V output models			1,800	μF
	48 V input, 24 & 28 V output models			2,200	μF
	48 V output models	47		1,000	μF
line regulation <sup>2</sup>	measured from high line to low line			±0.2	%
load regulation <sup>2</sup>	measured from full load to zero load			±0.2	%
voltage accuracy <sup>2</sup>				±1.5	%
adjustability			±10		%
switching frequency			250		kHz
transient response	25% step load change			500	μs
temperature coefficient			±0.03		%/°C

Note: 2. A 47 μF aluminum capacitor is required on the output for 48 Vdc output models.

## PROTECTIONS

parameter	conditions/description	min	typ	max	units
short circuit protection	continuous				
over current protection	% nominal output current	110		140	%
over voltage protection		115		140	%
over temperature protection	shutdown		110		°C

## SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	for 1 minute: input to output; input to case; output to case	1,500			Vdc
isolation resistance		10			MΩ
RoHS	2011/65/EU (CE)				

## ENVIRONMENTAL

parameter	conditions/description	min	typ	max	units
operating temperature	see derating curve	-40		85	°C
storage temperature		-55		105	°C

## MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	4.23 x 4.01 x 2.07 (107.5 x 101.8 x 52.6 mm)				inch
case material	steel and aluminum extrusion				
weight			651		g

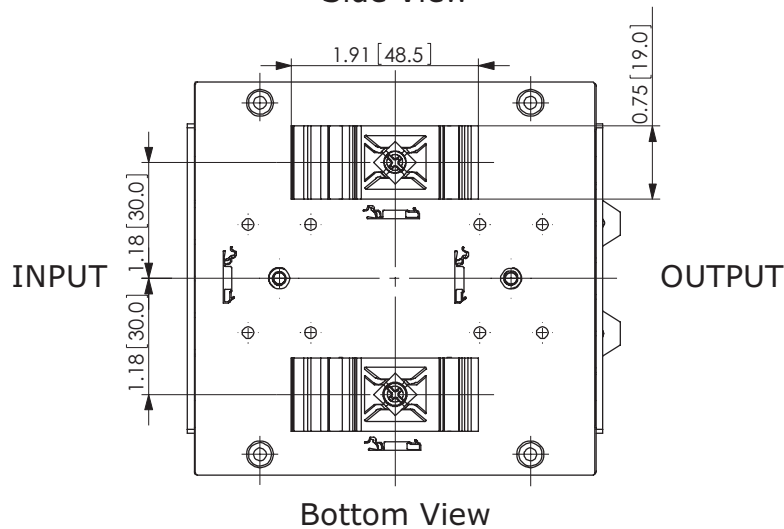
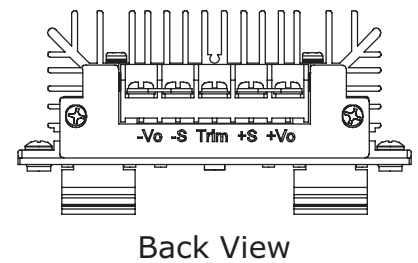
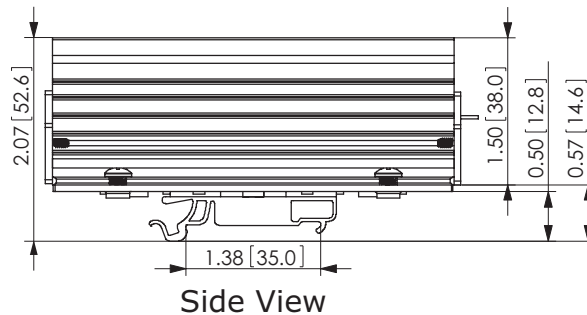
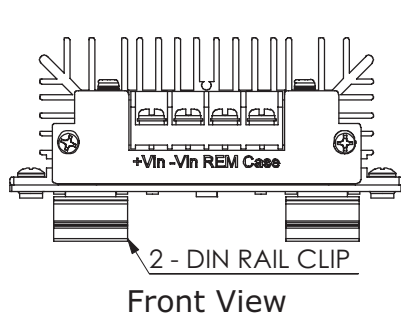
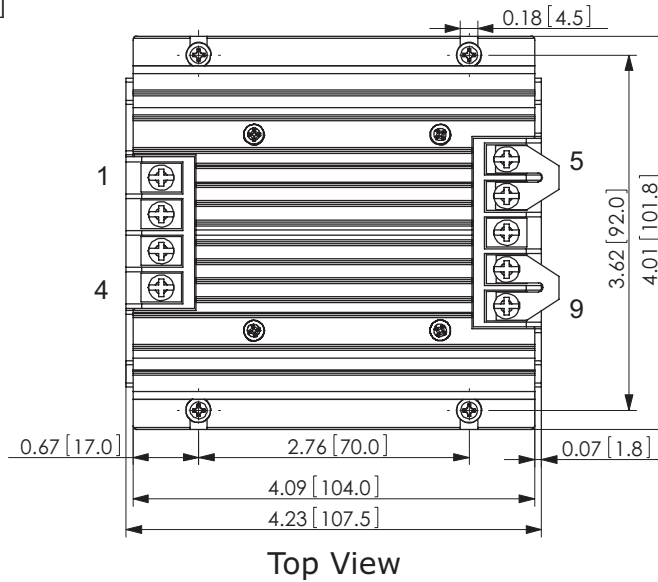
## MECHANICAL DRAWING

units: inch[mm]

tolerance: X.XX = ±0.02[±0.5]  
 X.XXX = ±0.010[±0.25]

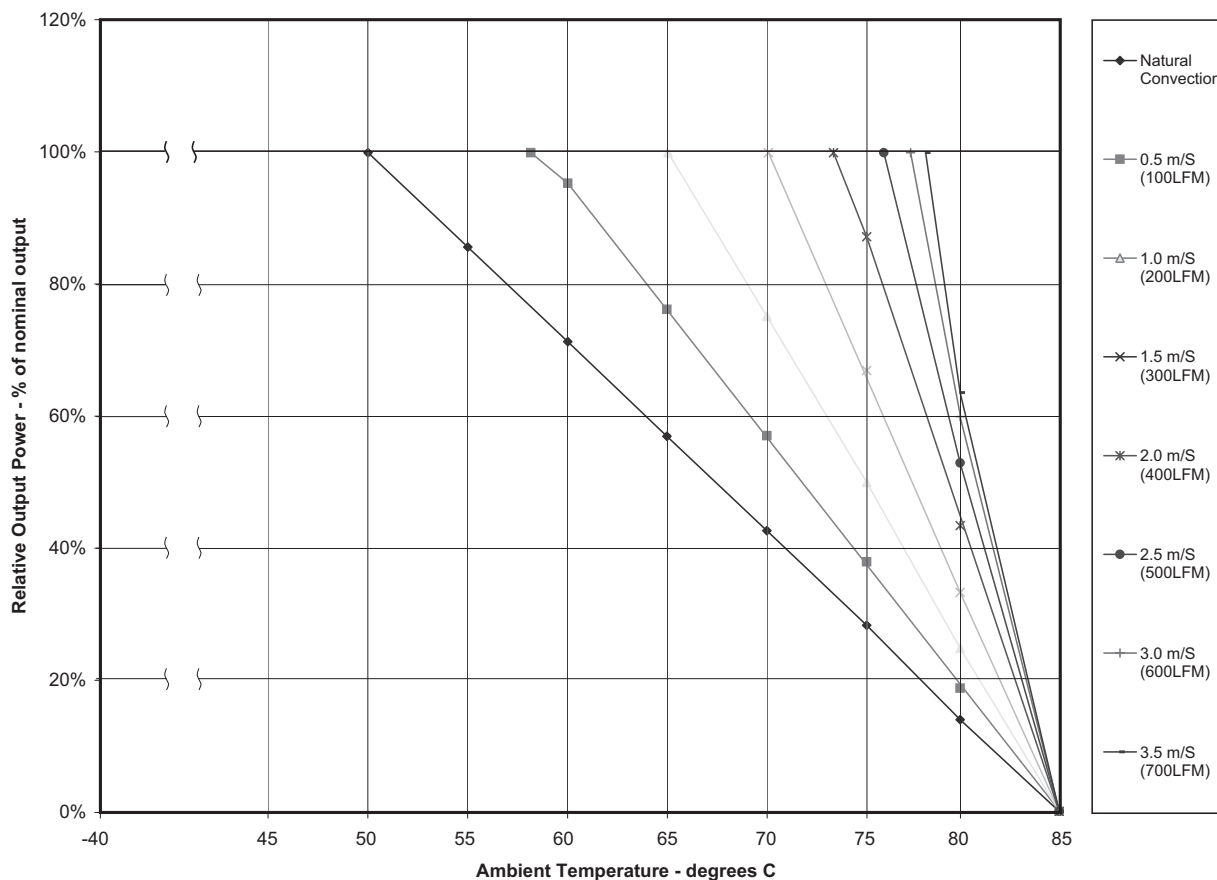
wire range: 22~12 AWG  
 screw size: #6-32  
 mounts to TS35 rails

PIN CONNECTIONS	
PIN	FUNCTION
1	+Vin
2	-Vin
3	REM
4	CASE
5	+Vo
6	+S
7	TRIM
8	-S
9	-Vo



## DERATING CURVES

VHK150W Power Derating Curves At Nominal Input



## TEST CONFIGURATION

Figure 1

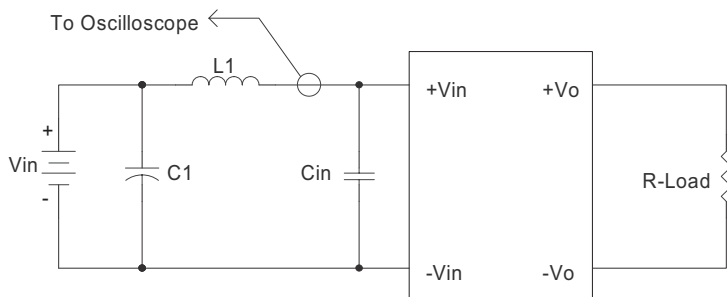


Table 1  
External Components

24 Vdc input models	
L1	1.2μH
C1	220μF, ESR < 0.1Ω at 100 KHz
Cin	330μF, ESR < 0.7Ω at 100 KHz
48 Vdc input models	
L1	12μH
C1	220μF, ESR < 0.1Ω at 100 KHz
Cin	33μF, ESR < 0.7Ω at 100 KHz

Note: Input reflected-ripple current is measured with an inductor L1 and Capacitor C1 to simulate source impedance.

## EMC RECOMMENDED CIRCUITS

### EN55022 CLASS A

Figure 2  
Recommended Circuit for EN55022 Class A

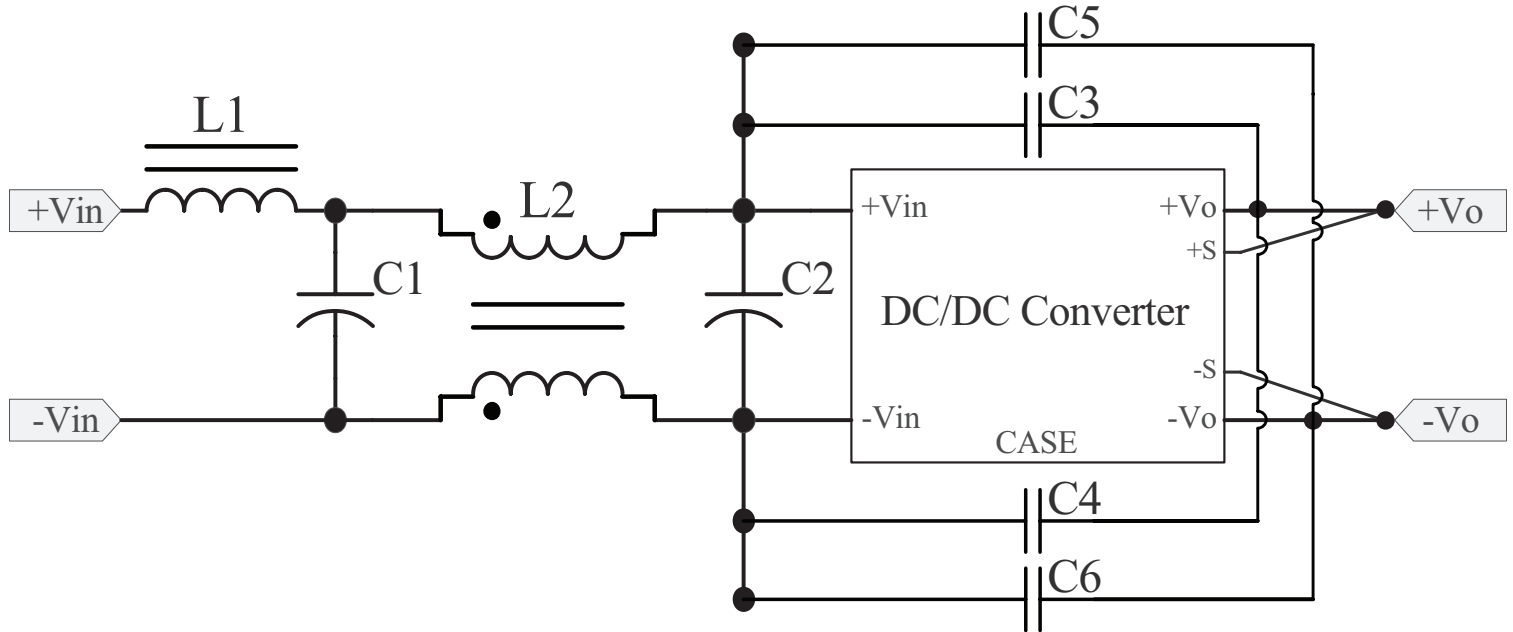


Table 2  
Class A Recommended Components

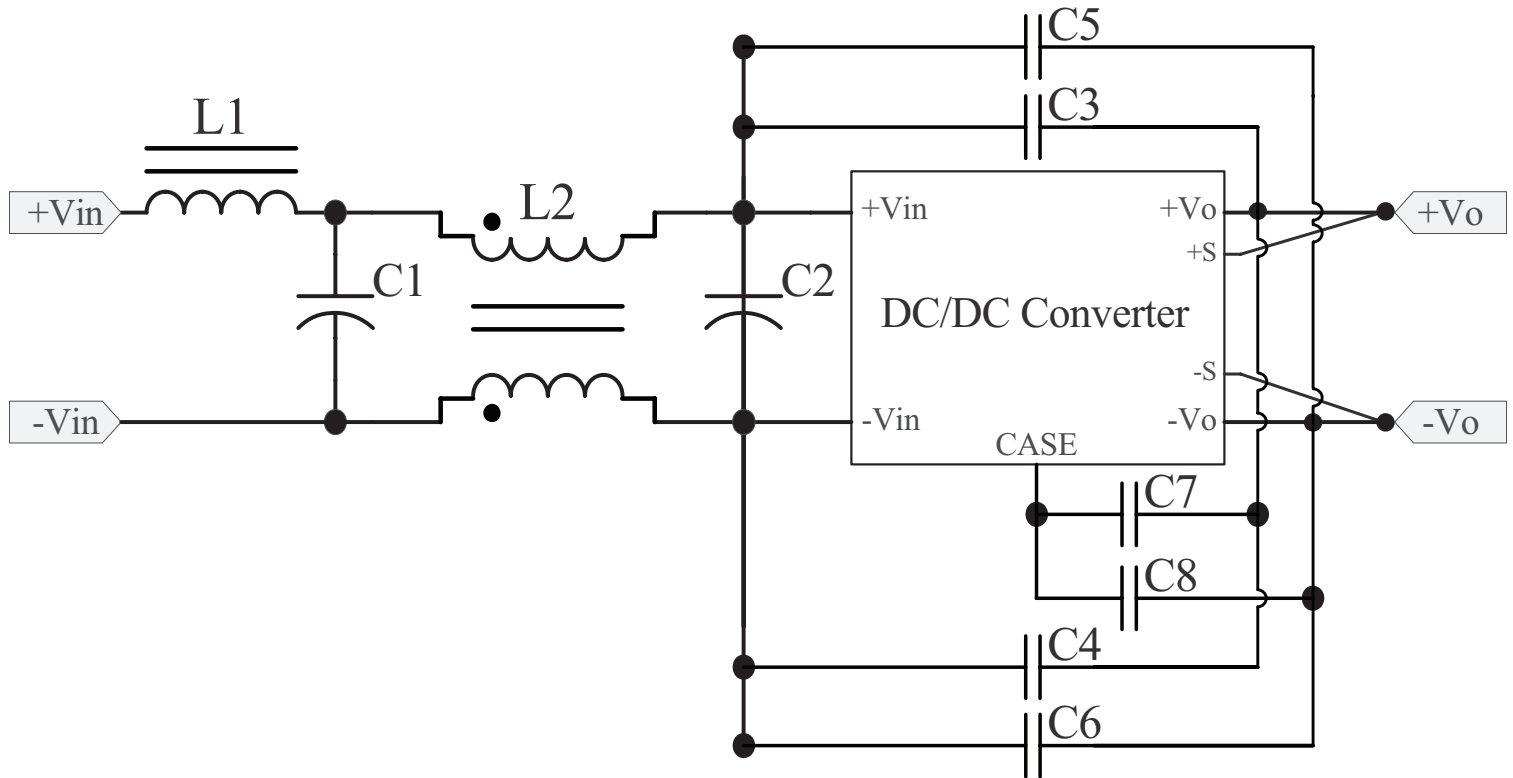
Model	C1 <sup>1</sup>	C2 <sup>1</sup>	C3 <sup>2</sup>	C4 <sup>2</sup>	C5 <sup>2</sup>	C6 <sup>2</sup>	L1	L2
VHK150W-Q24-S5	100 µF/50 V	100 µF/50 V	NC	NC	NC	NC	SHORT	0.5 mH
VHK150W-Q24-S12	100 µF/50 V	100 µF/50 V	NC	NC	NC	NC	SHORT	0.5 mH
VHK150W-Q24-S15	100 µF/50 V	100 µF/50 V	NC	NC	NC	NC	SHORT	0.5 mH
VHK150W-Q24-S24	100 µF/50 V	100 µF/50 V	680 pF	680 pF	470 pF	680 pF	SHORT	0.5 mH
VHK150W-Q24-S28	100 µF/50 V	100 µF/50 V	2200 pF	NC	680 pF	2200 pF	SHORT	0.6 mH
VHK150W-Q24-S48	100 µF/50 V	100 µF/50 V	1000 pF	NC	470 pF	1000 pF	SHORT	0.6 mH
VHK150W-Q48-S5	47 µF/100 V	47 µF/100 V	NC	NC	NC	NC	SHORT	0.5 mH
VHK150W-Q48-S12	47 µF/100 V	47 µF/100 V	NC	680 pF	NC	NC	SHORT	0.5 mH
VHK150W-Q48-S15	47 µF/100 V	47 µF/100 V	680 pF	1000 pF	NC	NC	SHORT	0.5 mH
VHK150W-Q48-S24	47 µF/100 V	47 µF/100 V	680 pF	680 pF	470 pF	680 pF	SHORT	0.5 mH
VHK150W-Q48-S28	47 µF/100 V	47 µF/100 V	2200 pF	NC	680 pF	2200 pF	SHORT	0.6 mH
VHK150W-Q48-S48	47 µF/100 V	47 µF/100 V	2200 pF	1500 pF	1500 pF	2200 pF	SHORT	0.5 mH

Notes: 1. Aluminum capacitor  
2. Ceramic capacitor

## EMC RECOMMENDED CIRCUITS (CONTINUED)

### EN55022 CLASS B

**Figure 3**  
Recommended Circuit for EN55022 Class B



**Table 3**  
Class B Recommended Components

Model	C1 <sup>1</sup>	C2 <sup>1</sup>	C3 <sup>2</sup>	C4 <sup>2</sup>	C5 <sup>2</sup>	C6 <sup>2</sup>	C7 <sup>2</sup>	C8 <sup>2</sup>	L1	L2
VHK150W-Q24-S5	220 μF/50 V	220 μF/50 V	680 pF	NC	NC	NC	NC	NC	3 μH	0.5 mH
VHK150W-Q24-S12	220 μF/50 V	220 μF/50 V	680 pF	680 pF	NC	NC	NC	NC	3 μH	0.5 mH
VHK150W-Q24-S15	220 μF/50 V	220 μF/50 V	680 pF	NC	NC	NC	NC	NC	3 μH	0.5 mH
VHK150W-Q24-S24	220 μF/50 V	220 μF/50 V	1000 pF	1000 pF	470 pF	680 pF	470 pF	330 pF	3 μH	0.5 mH
VHK150W-Q24-S28	220 μF/50 V	220 μF/50 V	2200 pF x2	1000 pF	470 pF	2200 pF x2	470 pF	470 pF	3.4 μH	0.6 mH
VHK150W-Q24-S48	220 μF/50 V	220 μF/50 V	2200 pF x4	1000 pF	1000 pF	2200 pF x4	NC	NC	3.4 μH	0.6 mH
VHK150W-Q48-S5	120 μF/100 V	120 μF/100 V	NC	680 pF	NC	NC	NC	NC	3 μH	0.5 mH
VHK150W-Q48-S12	120 μF/100 V	120 μF/100 V	NC	680 pF	NC	NC	NC	NC	3 μH	0.5 mH
VHK150W-Q48-S15	120 μF/100 V	120 μF/100 V	1000 pF	1000 pF	470 pF	1000 pF	330 pF	680 pF	3 μH	0.5 mH
VHK150W-Q48-S24	120 μF/100 V	120 μF/100 V	1000 pF	1000 pF	470 pF	1000 pF	330 pF	680 pF	3 μH	0.5 mH
VHK150W-Q48-S28	120 μF/100 V	120 μF/100 V	1000 pF	1000 pF	470 pF	1000 pF	470 pF	470 pF	3.4 μH	0.6 mH
VHK150W-Q48-S48	82 μF/100 V	120 μF/100 V	2200 pF + 470 pF	1500 pF	1000 pF	2200 pF + 470 pF	NC	NC	SHORT	0.5 mH

Notes: 1. Aluminum capacitor  
2. Ceramic capacitor

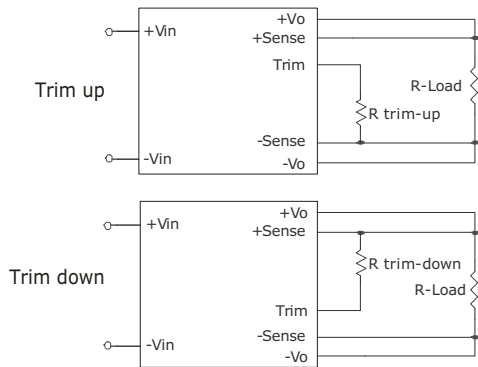
## APPLICATION NOTES

### 1. Output Voltage Trimming

Leave open if not used.

**Figure 4**

Application Circuit for Trim pin



### Formula for Trim Resistor

$$R_{trim - up} = \left( \frac{R_1(V_r - V_f(\frac{R_2}{R_2 + R_3}))}{V_o - V_{o, nom}} \right) - \frac{R_2 R_3}{R_2 + R_3} \text{ (k}\Omega\text{)}$$

$$R_{trim - down} = \frac{R_1(V_o - V_r)}{V_{o, nom} - V_o} - R_2 \text{ (k}\Omega\text{)}$$

Note:  $R_{trim-up}$  is the external resistor in  $k\Omega$   
 $R_{trim-down}$  is the external resistor in  $k\Omega$   
 $V_{o, nom}$  is the nominal output voltage  
 $V_o$  is the desired output voltage  
 $R_1, R_2, R_3,$  and  $V_r$  are internal (see Table 4).

**Table 4**

Vout (Vdc)	R1 (kΩ)	R2 (kΩ)	R3 (kΩ)	Vr (V)	Vf (V)
5	2.32	3.3	0	2.5	0
12	9.1	51	5.1	2.5	0.46
15	12	56	8.25	2.5	0.46
24	20	100	7.5	2.5	0.46
28	23.7	150	6.2	2.6	0.64
48	36	270	5.1	2.5	0.46

## REVISION HISTORY

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rev.	description	date
1.0	initial release	12/17/2013
1.01	changed DIN-rail mount	06/16/2014
1.02	updated spec	01/05/2015
1.03	updated derating curves	06/18/2015

The revision history provided is for informational purposes only and is believed to be accurate.



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