

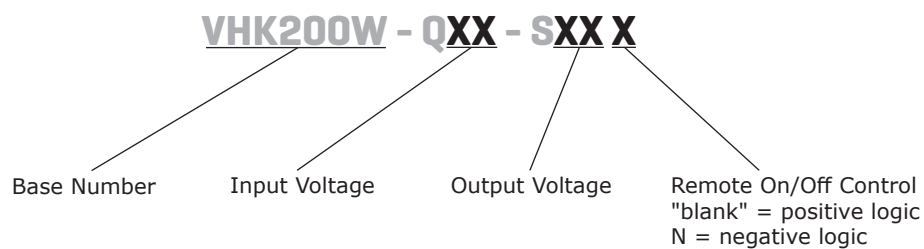
**SERIES: VHK200W | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- up to 200 W isolated output
- rugged metal enclosure with integrated heat sink
- 4:1 input range (10~36 Vdc, 18~75 Vdc)
- single output from 12~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 88%



MODEL	input voltage range (Vdc)	output voltage (Vdc)	output current max (A)	output power max (W)	ripple and noise <sup>1</sup> max (mVp-p)	efficiency
						typ (%)
VHK200W-Q24-S12	10 ~ 36	12	16.7	200	150	84
VHK200W-Q24-S15	10 ~ 36	15	13.3	200	150	84
VHK200W-Q24-S24	10 ~ 36	24	8.3	200	240	84
VHK200W-Q24-S28	10 ~ 36	28	7.14	200	280	87
VHK200W-Q24-S48	10 ~ 36	48	4.2	200	480	87
VHK200W-Q48-S12	18 ~ 75	12	16.7	200	150	86
VHK200W-Q48-S15	18 ~ 75	15	13.3	200	150	86
VHK200W-Q48-S24	18 ~ 75	24	8.3	200	240	86
VHK200W-Q48-S28	18 ~ 75	28	7.14	200	280	87
VHK200W-Q48-S48	18 ~ 75	48	4.2	200	480	88

Note: 1. Ripple and noise are measured at full load, 20 MHz BW with 10 $\mu$ F tantalum capacitor and 1 $\mu$ F ceramic capacitor across output. The 48 Vdc output models require a 10 $\mu$ F aluminum capacitor and 1 $\mu$ F ceramic capacitor across the output.  
 2. An external input capacitor of 470 $\mu$ F for 24 Vdc input models and 47 $\mu$ F for 48 Vdc input models is recommended to reduce input ripple voltage.

**PART NUMBER KEY**


## INPUT

parameter	conditions/description	min	typ	max	units
operating input voltage	24 Vdc input models	10	24	36	Vdc
	48 Vdc input models	18	48	75	Vdc
under voltage shutdown	24 Vdc input	power up	9.5		Vdc
		power down	8.5		Vdc
	48 Vdc input	power up	17		Vdc
		power down	16		Vdc
remote on/off <sup>1</sup>	positive logic	models ON (>3.5 Vdc or REM pin open circuit)			
		models OFF (REM pin 0~1.2 Vdc)			
	negative logic	models ON (REM pin 0~1.2 Vdc)			
		models OFF (>3.5 Vdc or REM pin open circuit)			
filter	pi filter				
input fuse	40A time delay fuse for 24 Vin models, 20A 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	12, 15, & 24 V output models			2,200	μF
	28 V output models	100		2,200	μF
	48 V output models	47		2,200	μF
line regulation <sup>2</sup>	measured from low line to high line			±0.2	%
load regulation <sup>2</sup>	measured from zero load to full load			±0.2	%
voltage accuracy				±1.5	%
adjustability				±10	%
switching frequency				250	kHz
transient response	25% step load change			500	μs
temperature coefficient				±0.03	%/°C

Note: 2. A 100 μF aluminum capacitor is required on the output for the 28 Vdc output models. 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	at 90% output voltage	110		160	%
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
safety approvals	certified to 62368-1: EN, IEC				
RoHS	2011/65/EU				

## 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 1.50 [107.5 x 101.8 x 38.0 mm]				inch
case material	steel and aluminum extrusion				
weight			502		g

## MECHANICAL DRAWING

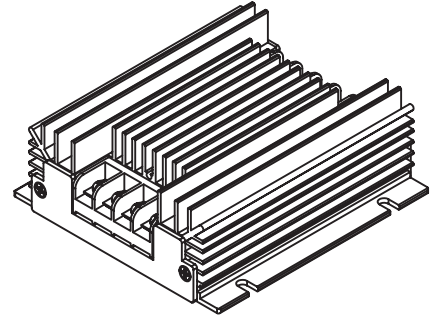
units: inch[mm]

general tolerance:  $\pm 0.04[\pm 1.0]$

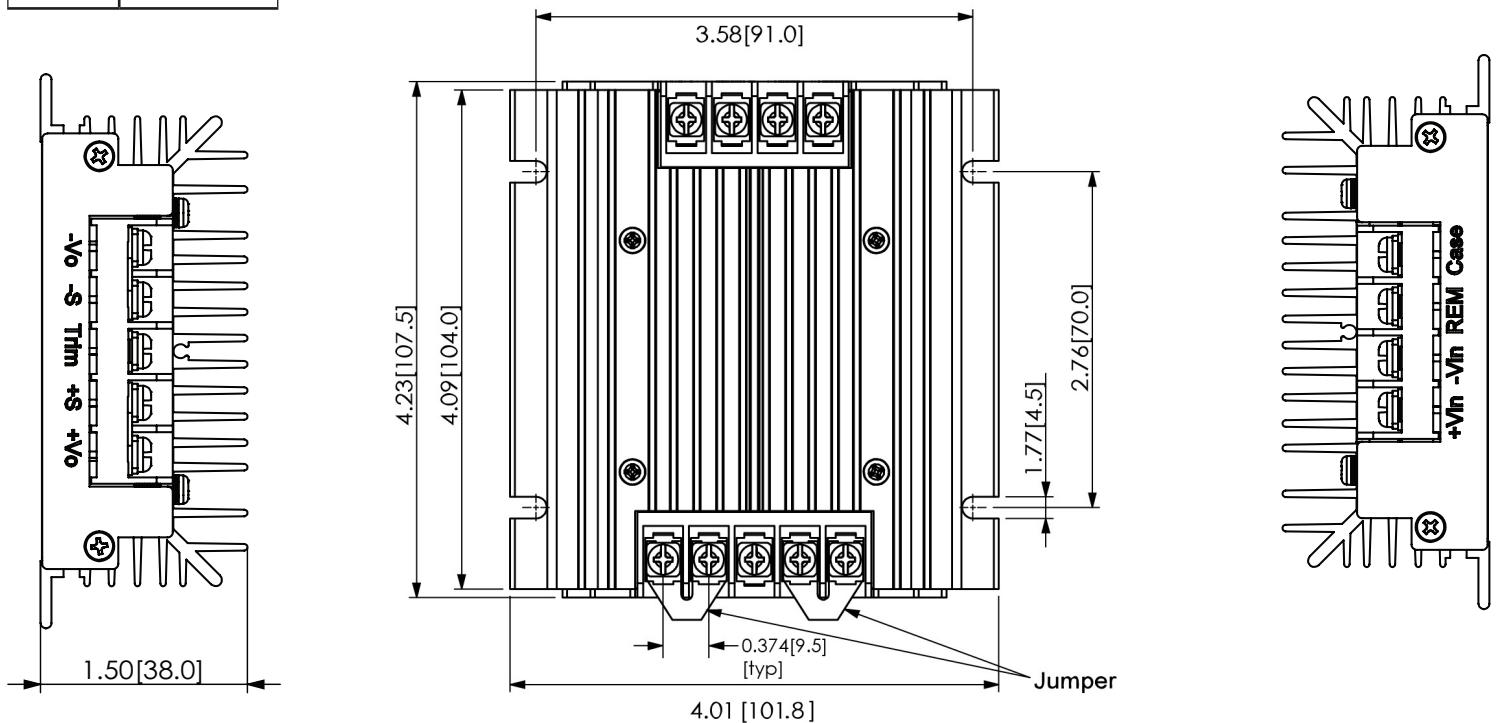
wire range: 22~12 AWG

screw size: #6-32

connector tightening torque: 1.4 N·m (max)

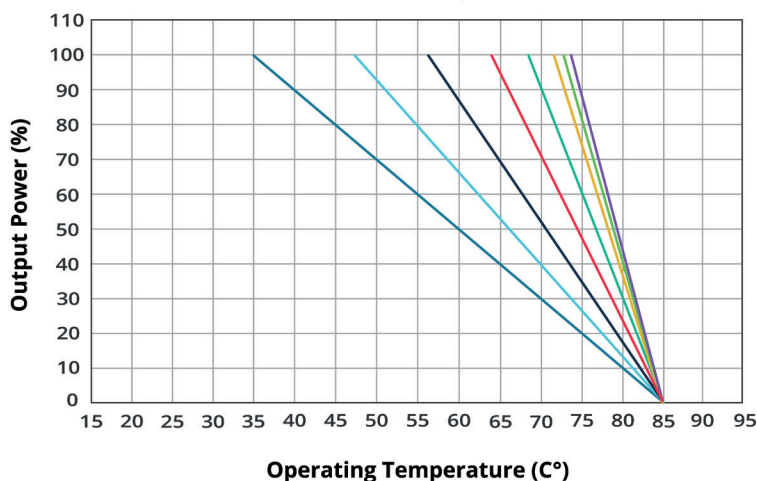


PIN CONNECTIONS	
PIN	FUNCTION
1	-Vo
2	-S
3	trim
4	+S
5	+Vo
6	case
7	REM
8	-Vin
9	+Vin



## DERATING CURVES

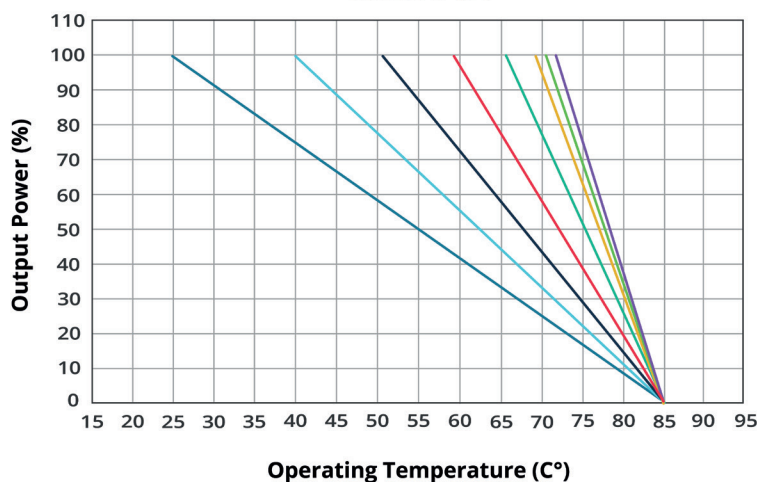
**TEMPERATURE DERATING CURVE**  
WHK200W-Q48



**Key**

natural convection
100ft/min (0.5m/s)
200ft/min (1.0m/s)
300ft/min (1.5m/s)
400ft/min (2.0m/s)
500ft/min (2.5m/s)
600ft/min (3.0m/s)
700ft/min (3.5m/s)

**TEMPERATURE DERATING CURVE**  
WHK200W-Q24

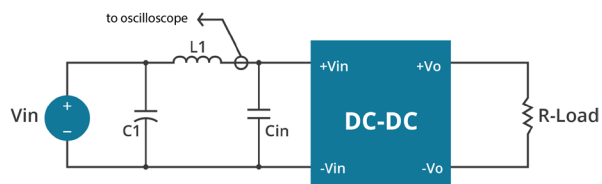


**Key**

natural convection
100ft/min (0.5m/s)
200ft/min (1.0m/s)
300ft/min (1.5m/s)
400ft/min (2.0m/s)
500ft/min (2.5m/s)
600ft/min (3.0m/s)
700ft/min (3.5m/s)

## TEST CONFIGURATION

**Figure 1**



**Table 1**

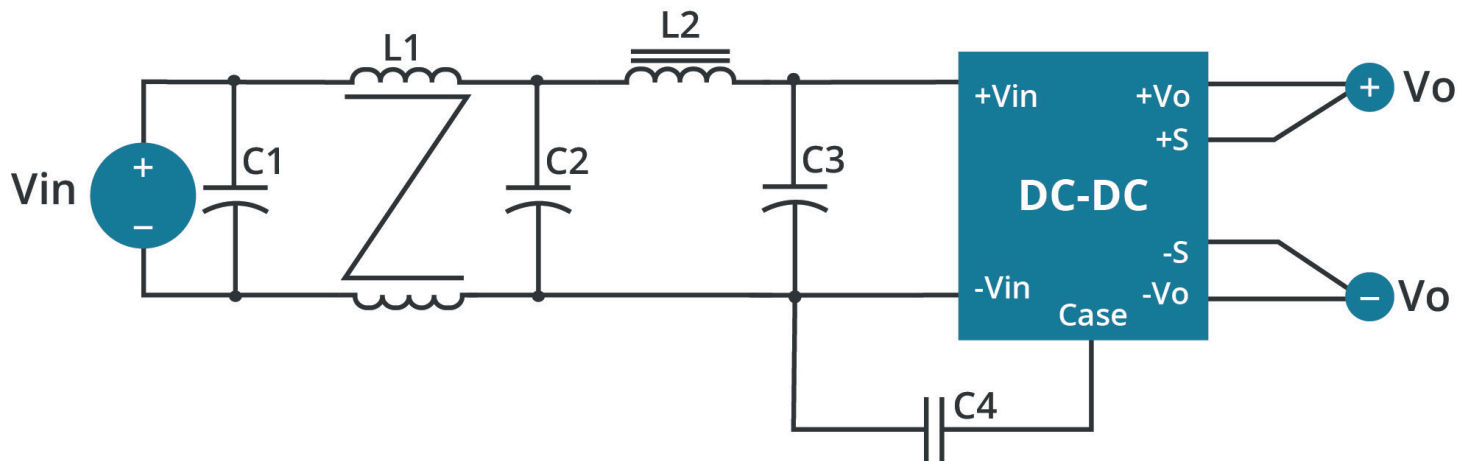
External components	
for 24 Vdc input models	
L1	1.2 $\mu$ H
Cin	470 $\mu$ F, ESR < 0.2 $\Omega$ at 100 KHz
for 48 Vdc input models	
L1	12 $\mu$ H
Cin	47 $\mu$ F, ESR < 0.7 $\Omega$ at 100 KHz

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

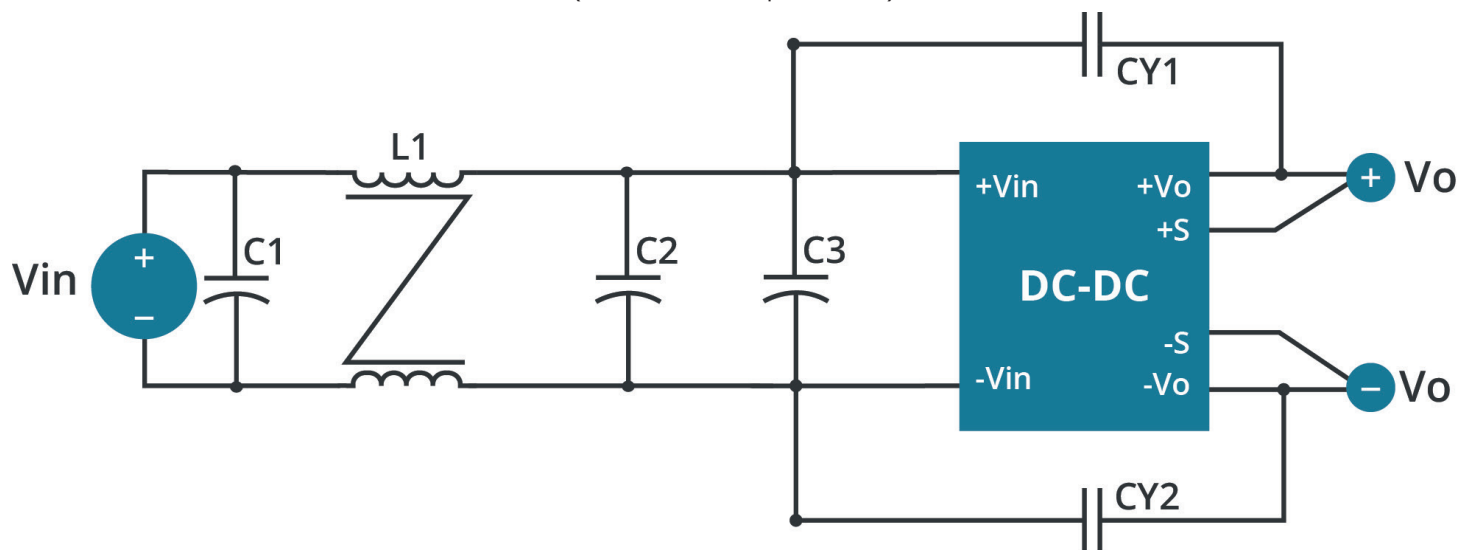
## EMC RECOMMENDED CIRCUITS

### EN55022 CLASS A

**Figure 2**  
Recommended Circuit for EN55022 Class A  
(for all 12, 15, 24, & 28 Vdc output models)



**Figure 3**  
Recommended Circuit for EN55022 Class A  
(for all 48 Vdc output models)



**Table 2**  
Class A Recommended Components

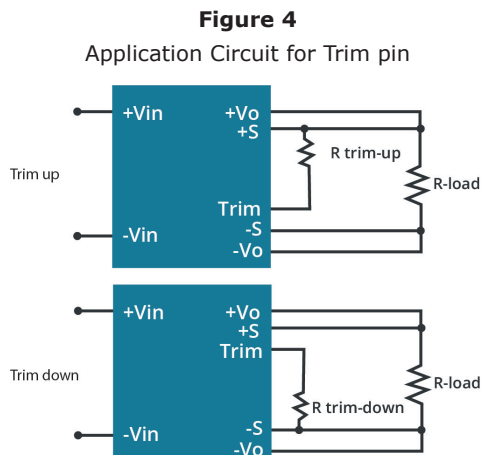
Model	C1 <sup>1</sup>	C2 <sup>1</sup>	C3 <sup>1</sup>	CY1 <sup>2</sup>	CY2 <sup>2</sup>	L1	L2
VHK200W-Q24-S12	120 $\mu$ F/100 V	120 $\mu$ F/100 V	NC	NC	NC	0.5 mH	SHORT
VHK200W-Q24-S15	47 $\mu$ F/100 V	47 $\mu$ F/100 V	NC	NC	NC	0.5 mH	SHORT
VHK200W-Q24-S24	100 $\mu$ F/100 V	100 $\mu$ F/100 V	NC	NC	NC	0.5 mH	SHORT
VHK200W-Q24-S28	100 $\mu$ F/100 V	100 $\mu$ F/100 V	NC	NC	NC	0.5 mH	SHORT
VHK200W-Q24-S48	100 $\mu$ F/100 V	100 $\mu$ F/100 V	100 $\mu$ F/100 V	680 pF/2 KV	680 pF/2 KV	1.0 mH	NC
VHK200W-Q48-S12	82 $\mu$ F/100 V	82 $\mu$ F/100 V	NC	NC	NC	0.5 mH	SHORT
VHK200W-Q48-S15	82 $\mu$ F/100 V	82 $\mu$ F/100 V	NC	NC	NC	0.5 mH	SHORT
VHK200W-Q48-S24	82 $\mu$ F/100 V	82 $\mu$ F/100 V	NC	NC	NC	0.7 mH	SHORT
VHK200W-Q48-S28	150 $\mu$ F/100 V	150 $\mu$ F/100 V	NC	NC	NC	0.5 mH	SHORT
VHK200W-Q48-S48	100 $\mu$ F/100 V	100 $\mu$ F/100 V	100 $\mu$ F/100 V	680 pF/2 KV	680 pF/2 KV	1.0 mH	NC

Notes: 1. Aluminum capacitors.  
2. Ceramic capacitors.

## APPLICATION NOTES

### 1. Output Voltage Trimming

Leave open if not used.



#### Formula for Trim Resistor

$$\Delta\% = \left( \frac{V_o - V_{o, nom}}{V_{o, nom}} \right) 100$$

**Trim-Up**

#### Trim-Up Formula

(for all 12, 15, 24, & 28<sup>1</sup> Vdc Output Models)

$$R_{trim - up} = \left( \frac{5.11V_{o, nom}(100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{511}{\Delta\%} - 10.22 \right) (K\Omega)$$

#### Trim-Up Formula

(for all 48 Vdc Output Models)

$$R_{trim - up} = \left( \frac{20V_{o, nom}(100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{2000}{\Delta\%} - 40 \right) (K\Omega)$$

$$\Delta\% = \left( \frac{V_{o, nom} - V_o}{V_{o, nom}} \right) 100$$

**Trim-Down**

#### Trim-Down Formula

(for all 12, 15, 24, & 28<sup>1</sup> Vdc Output Models)

$$R_{trim - down} = \left( \frac{511}{\Delta\%} - 10.22 \right) (K\Omega)$$

#### Trim-Down Formula

(for all 48 Vdc Output Models)

$$R_{trim - down} = \left( \frac{2000}{\Delta\%} - 40 \right) (K\Omega)$$

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

Notes: 1. For the 28 Vdc output models, a minimum input voltage of 10.8 Vdc is required to trim the 24 Vdc input models up 10%, and a minimum input voltage of 19 Vdc is required to trim the 48 Vdc input models up 10%.  
 2. All specifications are measured at Ta=25°C, nominal input voltage and full output load unless otherwise specified.

## REVISION HISTORY

rev.	description	date
1.0	initial release	10/11/2006
1.01	new template applied	12/21/2011
1.02	misc. updates and corrections	03/13/2012
1.03	updated mechanical drawing	03/27/2012
1.04	V-Infinity branding removed	06/27/2012
1.05	updated spec	03/18/2013
1.06	updated spec	05/08/2013
1.07	added trimming and EMI information	12/16/2013
1.08	trim equation updated	11/13/2020
1.09	derating curves updated	03/04/2021
1.10	pin connection table & remote on/off updated	05/20/2021
1.11	circuit figures updated	09/07/2021
1.12	safety approvals updated	03/02/2022
1.13	mechanical tolerance updated	05/09/2022

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



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