



## SERIES: VHK75W | DESCRIPTION: DC-DC CONVERTER

### FEATURES

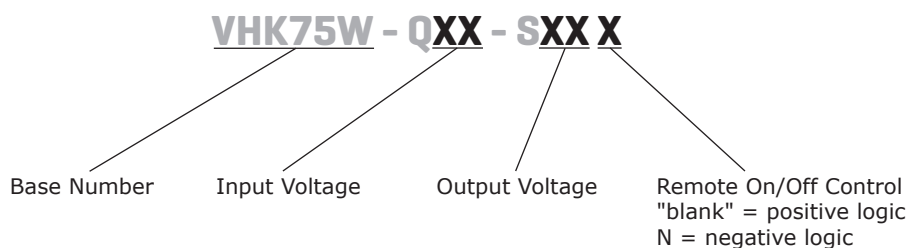
- up to 75 W isolated output
- rugged metal enclosure with integrated heat sink
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- single output from 3.3~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 84%



| MODEL           | input voltage | output voltage | output current | output power | ripple and noise <sup>1</sup> | efficiency |
|-----------------|---------------|----------------|----------------|--------------|-------------------------------|------------|
|                 | range (Vdc)   | (Vdc)          | max (A)        | max (W)      | max (mVp-p)                   | typ (%)    |
| VHK75W-Q24-S3R3 | 9 ~ 36        | 3.3            | 15             | 50           | 100                           | 77         |
| VHK75W-Q24-S5   | 9 ~ 36        | 5              | 15             | 75           | 100                           | 80         |
| VHK75W-Q24-S12  | 9 ~ 36        | 12             | 6.25           | 75           | 150                           | 81.5       |
| VHK75W-Q24-S15  | 9 ~ 36        | 15             | 5              | 75           | 150                           | 82.5       |
| VHK75W-Q24-S24  | 9 ~ 36        | 24             | 3.12           | 75           | 240                           | 83         |
| VHK75W-Q24-S48  | 9 ~ 36        | 48             | 1.56           | 75           | 480                           | 80         |
| VHK75W-Q48-S3R3 | 18 ~ 75       | 3.3            | 15             | 50           | 100                           | 78         |
| VHK75W-Q48-S5   | 18 ~ 75       | 5              | 15             | 75           | 100                           | 81         |
| VHK75W-Q48-S12  | 18 ~ 75       | 12             | 6.25           | 75           | 150                           | 82.5       |
| VHK75W-Q48-S15  | 18 ~ 75       | 15             | 5              | 75           | 150                           | 83.5       |
| VHK75W-Q48-S24  | 18 ~ 75       | 24             | 3.12           | 75           | 240                           | 84         |
| VHK75W-Q48-S48  | 18 ~ 75       | 48             | 1.56           | 75           | 480                           | 82         |

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 only require the 1 $\mu$ F ceramic capacitor across the 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<br>power down   |     | 8   |     | Vdc   |
|                         | 48 Vdc input   |     | 17  |     | Vdc   |
|                         | power up<br>power down   |     | 16  |     | Vdc   |
| CTRL <sup>1</sup>       | positive logic   |     |     |     |       |
|                         | models ON (open circuit)<br>models OFF (0~0.8 Vdc)                             |     |     |     |       |
|                         | negative logic   |     |     |     |       |
|                         | models ON (0~0.8 Vdc)<br>models OFF (open circuit)                             |     |     |     |       |
| filter                  | pi filter  |     |     |     |       |
| input fuse              | 15A time delay fuse for 24 Vin models,<br>8A 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      | 3.3 and 5 V output models            |     |       | 15,000 | μF    |
|                              | 12 V output models                   |     |       | 6,250  | μF    |
|                              | 15 V output models                   |     |       | 5,000  | μF    |
|                              | 24 V output models                   |     |       | 3,120  | μF    |
|                              | 48 V output models                   |     |       | 1,560  | 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             |                                      |     |       | ±1     | %     |
| adjustability                |                                      |     | ±10   |        | %     |
| switching frequency          |                                      |     | 300   |        | 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 |     | 160 | %     |
| over voltage protection     |                          | 115 |     | 140 | %     |
| over temperature protection | shutdown                 |     | 100 |     | °C    |
|                             | restart threshold        |     | 70  |     | °C    |

## SAFETY AND COMPLIANCE

| parameter            | conditions/description  | min   | typ | max | units |
|----------------------|---|-------|-----|-----|-------|
| isolation voltage    | for 1 minute: input to output; input to case;<br>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 1.50 (107.5 x 101.76 x 38.0 mm) |     |     |     | inch  |
| case material | steel and aluminum extrusion                  |     |     |     |       |
| weight        |   |     | 502 |     | g     |

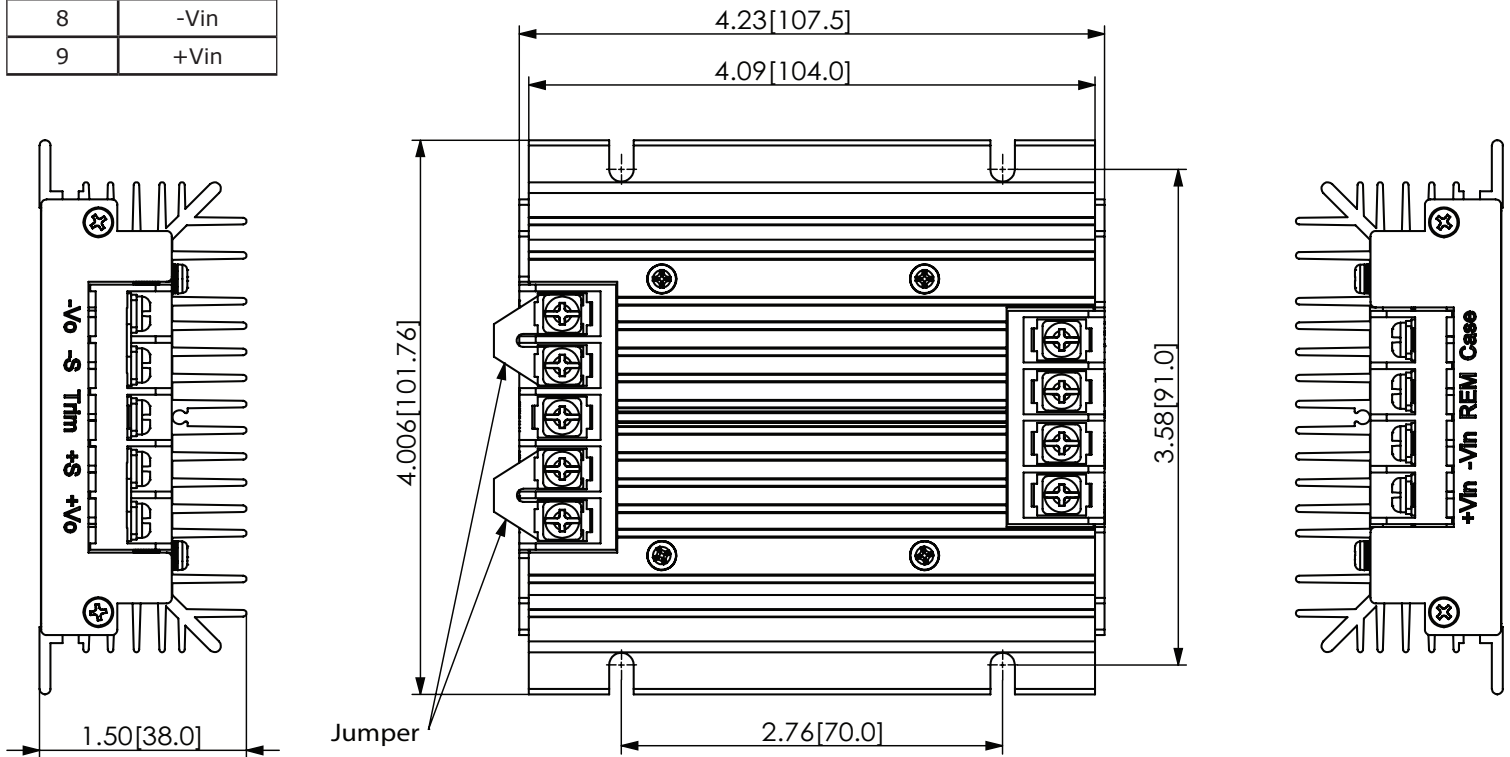
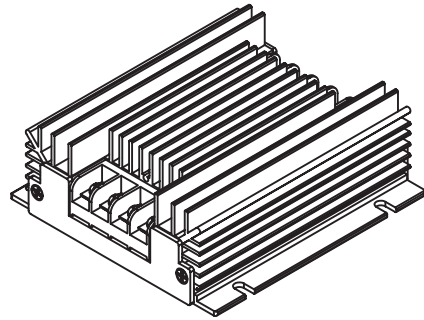
## MECHANICAL DRAWING

units: inch[mm]

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

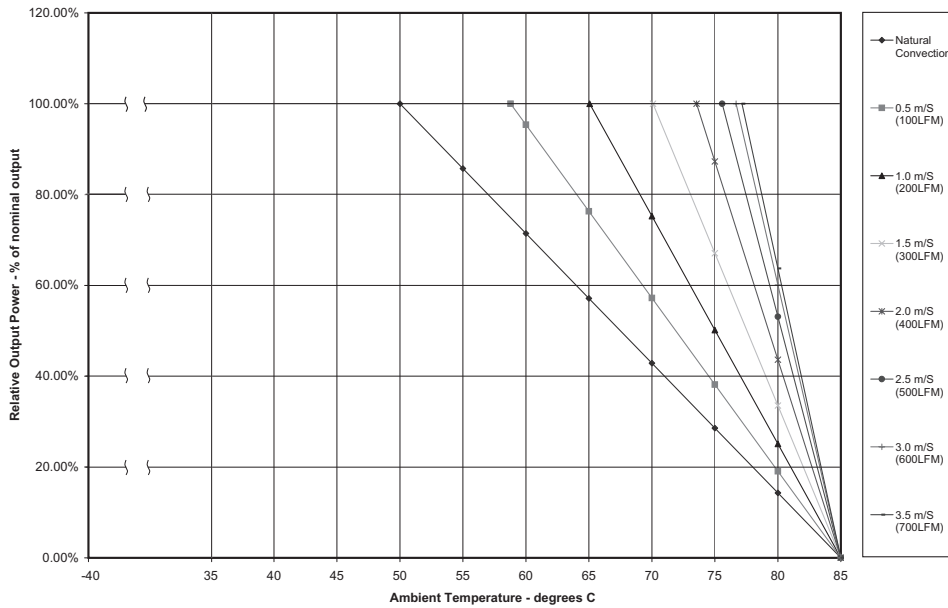
wire range: 22~12 AWG  
 screw size: #6-32

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | FUNCTION |
| 1               | -Vo      |
| 2               | -S       |
| 3               | trim     |
| 4               | +S       |
| 5               | +Vo      |
| 6               | case     |
| 7               | on/off   |
| 8               | -Vin     |
| 9               | +Vin     |



## DERATING CURVES

VHK75W Power Derating Curves At Nominal Input



## TEST CONFIGURATION

Figure 1

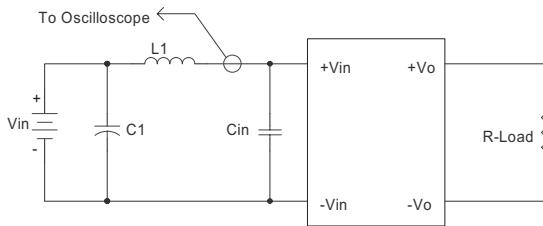


Table 1

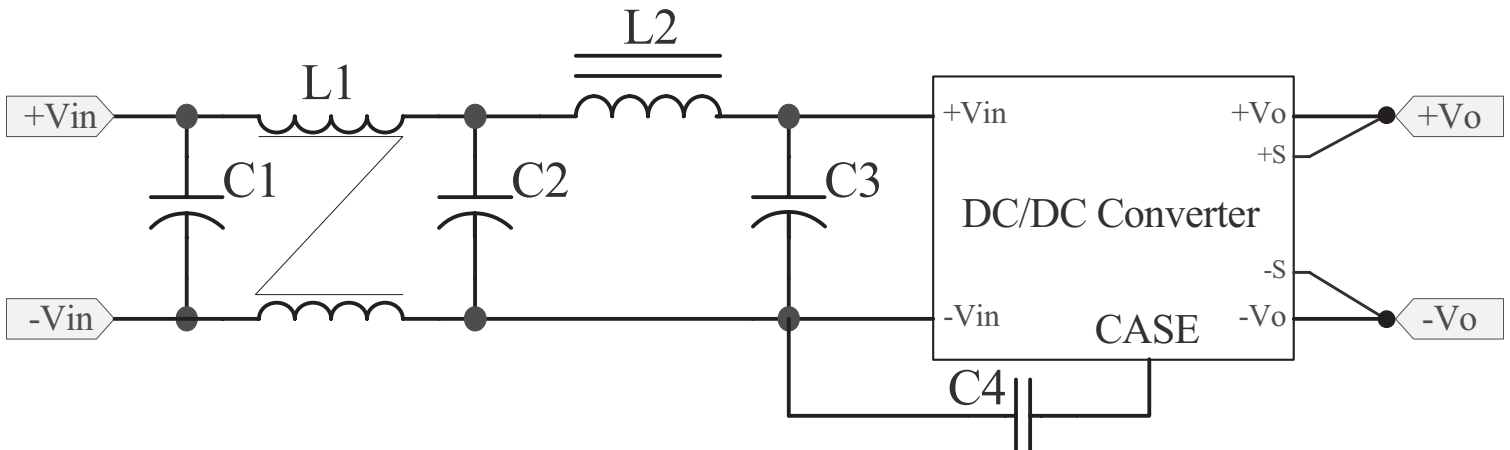
| External components |                              |
|---------------------|------------------------------|
| L1                  | 12μH                         |
| C1                  | 220μF, ESR < 0.1Ω at 100 KHz |
| Cin                 | 100μF, ESR < 0.1Ω at 100 KHz |

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

## EMC RECOMMENDED CIRCUITS

### EN55022 CLASS A

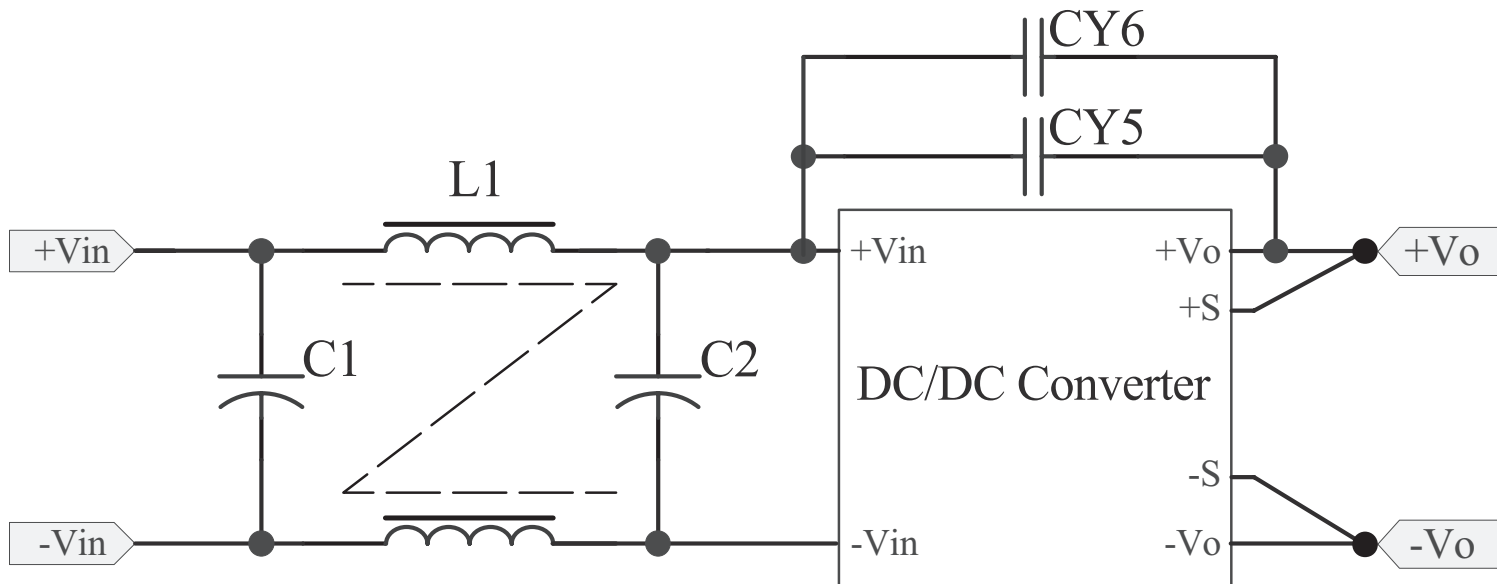
Figure 2  
Recommended Circuit for EN55022 Class A  
(for all 3.3, 5, 12, 15, & 24 Vdc output models)



## EMC RECOMMENDED CIRCUITS (CONTINUED)

### EN55022 CLASS A

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



**Table 2**  
**Class A Recommended Components**

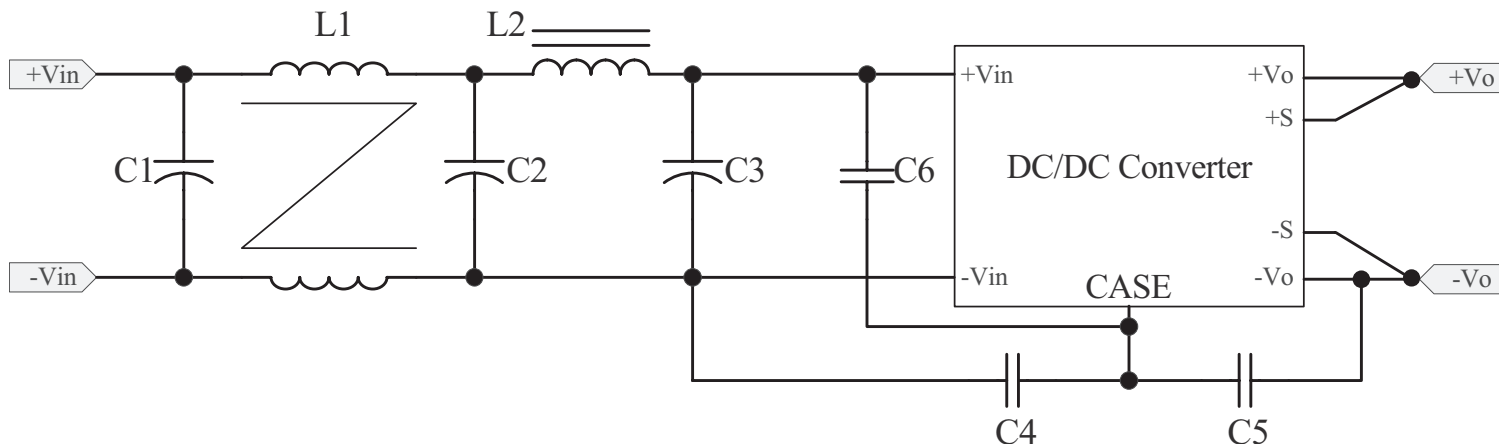
| Model           | C1 <sup>1</sup> | C2 <sup>1</sup> | C3 <sup>1</sup> | C4 <sup>2</sup> | CY5 <sup>2</sup> | CY6 <sup>2</sup> | L1       | L2     |
|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|----------|--------|
| VHK75W-Q24-S3R3 | NC              | 47 µF/50 V      | 47 µF/50 V      | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q24-S5   | NC              | 47 µF/50 V      | 47 µF/50 V      | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q24-S12  | NC              | 47 µF/50 V      | 47 µF/50 V      | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q24-S15  | NC              | 47 µF/50 V      | 47 µF/50 V      | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q24-S24  | NC              | 100 µF/50 V     | 100 µF/50 V     | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q24-S48  | 220 µF/50 V     | 100 µF/50 V     | NC              | NC              | 1000 pF/2 kV     | 1000 pF/2 kV     | 0.223 mH | NC     |
| VHK75W-Q48-S3R3 | NC              | 47 µF/100 V     | 47 µF/100 V     | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q48-S5   | NC              | 47 µF/100 V     | 47 µF/100 V     | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q48-S12  | NC              | 47 µF/100 V     | 47 µF/100 V     | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q48-S15  | NC              | 47 µF/100 V     | 47 µF/100 V     | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q48-S24  | NC              | 47 µF/100 V     | 47 µF/100 V     | 2200 pF/2 kV    | NC               | NC               | Short    | 3.4 µH |
| VHK75W-Q48-S48  | 56 µF/100 V     | 39 µF/100 V     | NC              | NC              | 1000 pF/2 kV     | 470 pF/2 kV      | 0.223 mH | NC     |

Note: 1. Aluminum capacitors.  
 2. Ceramic capacitors.

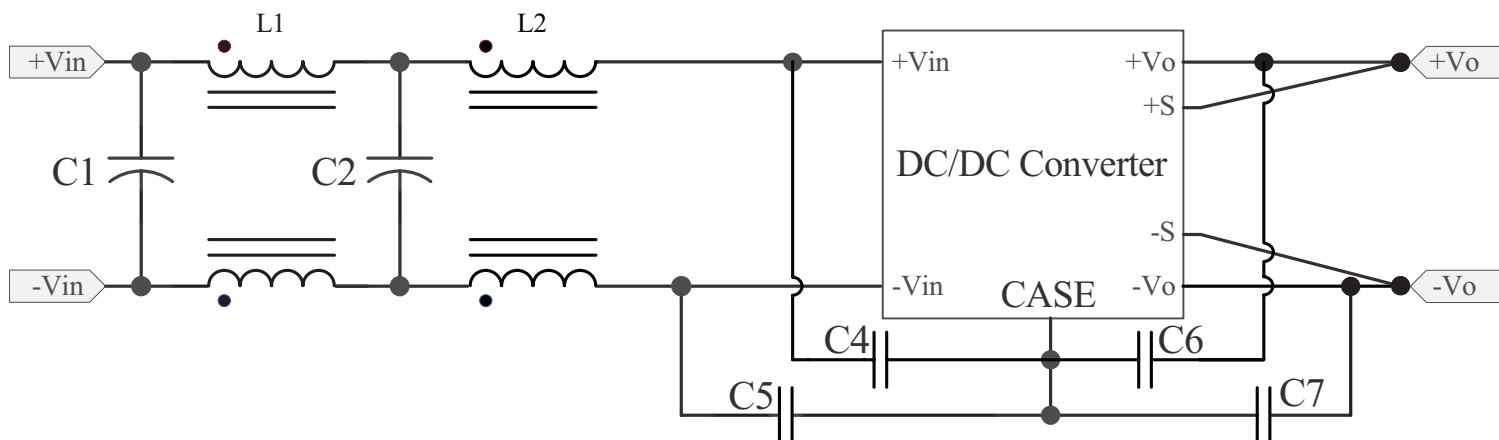
## EMC RECOMMENDED CIRCUITS (CONTINUED)

### EN55022 CLASS B

**Figure 4**  
**Recommended Circuit for EN55022 Class B**  
 (for all 3.3, 5, 12, & 15 Vdc output models as well as VHK75W-Q48-S24)



**Figure 5**  
**Recommended Circuit for EN55022 Class B**  
 (for VHK75W-Q24-S24)



**Table 3**  
**Class B Recommended Components**  
 (for all 3.3, 5, 12, 15, & 24 Vdc output models)

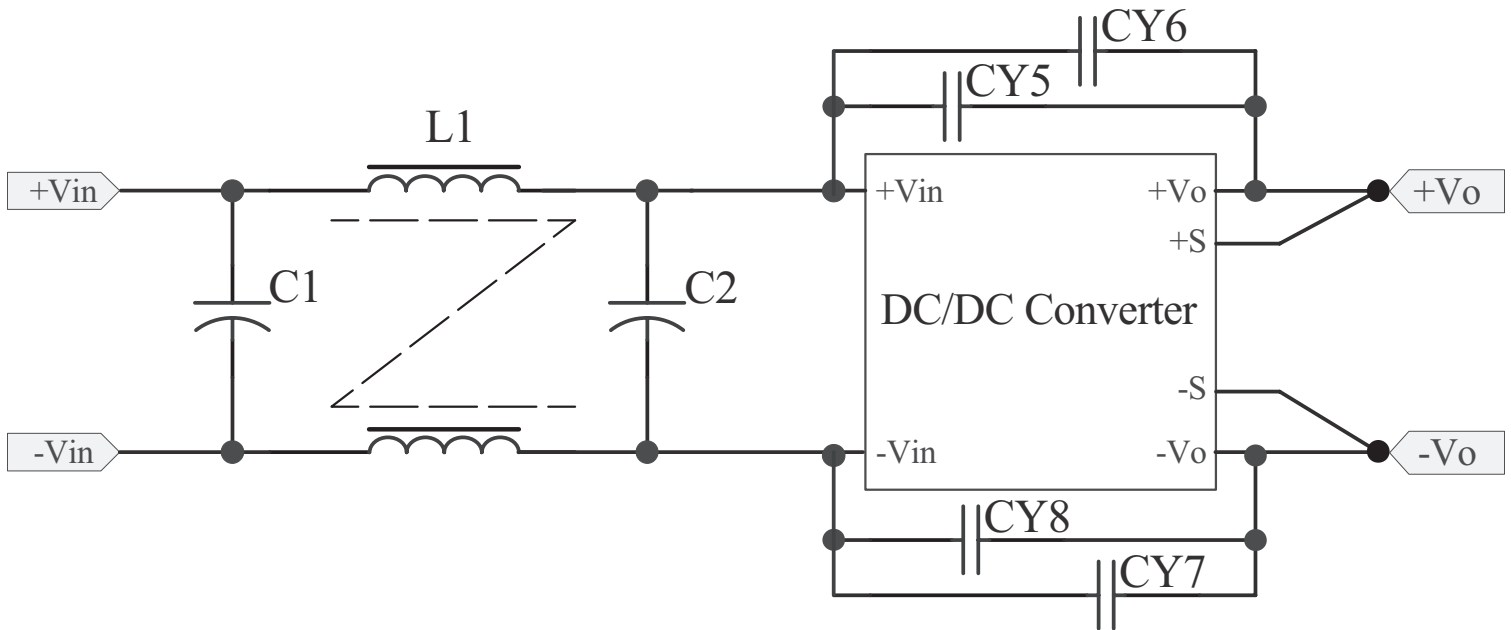
| Model           | C1 <sup>1</sup> | C2 <sup>1</sup> | C3 <sup>1</sup> | C4 <sup>2</sup> | C5 <sup>2</sup> | C6 <sup>2</sup> | C7 <sup>2</sup> | L1      | L2      |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---------|---------|
| VHK75W-Q24-S3R3 | 47 µF/50 V      | 47 µF/50 V      | 47 µF/50 V      | 3300 pF/2 kV    | 3300 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q24-S5   | 47 µF/50 V      | 47 µF/50 V      | 47 µF/50 V      | 2200 pF/2 kV    | 3300 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q24-S12  | 47 µF/50 V      | 47 µF/50 V      | 47 µF/50 V      | 3300 pF/2 kV    | 1000 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q24-S15  | 47 µF/50 V      | 47 µF/50 V      | 47 µF/50 V      | 2200 pF/2 kV    | 3300 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q24-S24  | 100 µF/50 V     | 100 µF/50 V     | NC              | 1000 pF/2 kV    | 1000 pF/2 kV    | 1000 pF/2 kV    | 1000 pF/2 kV    | 0.12 mH | 0.34 mH |
| VHK75W-Q48-S3R3 | 47 µF/100 V     | 47 µF/100 V     | 47 µF/100 V     | 3300 pF/2 kV    | 3300 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q48-S5   | 47 µF/100 V     | 47 µF/100 V     | 47 µF/100 V     | 3300 pF/2 kV    | 3300 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q48-S12  | 47 µF/100 V     | 47 µF/100 V     | 47 µF/100 V     | 3300 pF/2 kV    | 3300 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q48-S15  | 47 µF/100 V     | 47 µF/100 V     | 47 µF/100 V     | 3300 pF/2 kV    | 3300 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |
| VHK75W-Q48-S24  | 47 µF/100 V     | 47 µF/100 V     | 47 µF/100 V     | 2200 pF/2 kV    | 2200 pF/2 kV    | 1000 pF/2 kV    | NC              | 1.5 mH  | 3.4 µH  |

Note: 1. Aluminum capacitors.  
 2. Ceramic capacitors.

## EMC RECOMMENDED CIRCUITS (CONTINUED)

### EN55022 CLASS B

**Figure 6**  
**Recommended Circuit for EN55022 Class B**  
 (for all 48 V output models)



**Table 4**  
**Class B Recommended Components**  
 (for all 48 V output models)

| Model          | C1 <sup>1</sup> | C2 <sup>1</sup> | CY5 <sup>2</sup> | CY6 <sup>2</sup> | CY7 <sup>2</sup> | CY8 <sup>2</sup> | L1       |
|----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|----------|
| VHK75W-Q24-S48 | 220 μF/50 V     | 220 μF/50 V     | 1500 pF/2 kV     | 1000 pF/2 kV     | 1000 pF/2 kV     | 1000 pF/2 kV     | 0.223 mH |
| VHK75W-Q48-S48 | 56 μF/100 V     | 56 μF/100 V     | 1000 pF/2 kV     | 1000 pF/2 kV     | 1000 pF/2 kV     | 1000 pF/2 kV     | 0.223 mH |

Note: 1. Aluminum capacitors.  
 2. Ceramic capacitors.

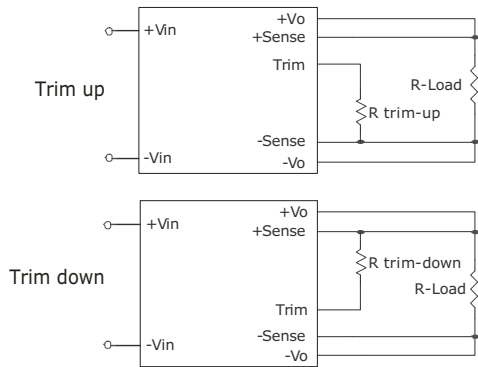
## APPLICATION NOTES

### 1. Output Voltage Trimming

Leave open if not used.

**Figure 7**

Application Circuit for Trim pin



### Formula for Trim Resistor

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

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

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  
 $R_1, R_2, R_3,$  and  $V_f$  are internal (see Table 5).

**Table 5**

| Vout (Vdc) | R1 (KΩ) | R2 (KΩ) | R3 (KΩ) | Vr (V) | Vf (V) |
|------------|---------|---------|---------|--------|--------|
| 3.3        | 3       | 12      | 18      | 1.24   | 0.46   |
| 5          | 2.32    | 8.2     | 0       | 2.5    | 0      |
| 12         | 9.1     | 51      | 18      | 2.5    | 0.46   |
| 15         | 12      | 82      | 18      | 2.5    | 0.46   |
| 24         | 20      | 100     | 20      | 2.5    | 0.46   |
| 48         | 36      | 270     | 14      | 3.085  | 1.15   |



## REVISION HISTORY

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| rev. | description                        | date       |
|------|------------------------------------|------------|
| 1.0  | initial release                    | 03/28/2007 |
| 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                       | 03/14/2013 |
| 1.06 | added trimming and EMI information | 12/16/2013 |

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

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