



SERIES: VHK100W | DESCRIPTION: DC-DC CONVERTER

FEATURES

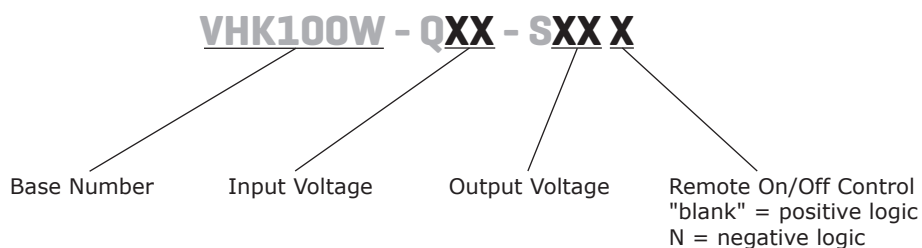
- up to 100 W isolated output
- rugged metal enclosure with integrated heat sink
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- single output from 3.3~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 87%



| MODEL | input voltage | output voltage | output current | output power | ripple and noise ¹ | efficiency |
|------------------|---------------|----------------|----------------|--------------|-------------------------------|------------|
| | range (Vdc) | (Vdc) | max (A) | max (W) | max (mVp-p) | typ (%) |
| VHK100W-Q24-S3R3 | 9 ~ 36 | 3.3 | 20 | 66 | 100 | 80 |
| VHK100W-Q24-S5 | 9 ~ 36 | 5 | 20 | 100 | 100 | 82 |
| VHK100W-Q24-S12 | 9 ~ 36 | 12 | 8.3 | 100 | 150 | 84 |
| VHK100W-Q24-S15 | 9 ~ 36 | 15 | 6.7 | 100 | 150 | 85.5 |
| VHK100W-Q24-S24 | 9 ~ 36 | 24 | 4.17 | 100 | 240 | 85 |
| VHK100W-Q24-S28 | 9 ~ 36 | 28 | 3.57 | 100 | 280 | 86 |
| VHK100W-Q24-S48 | 9 ~ 36 | 48 | 2.08 | 100 | 480 | 84 |
| VHK100W-Q48-S3R3 | 18 ~ 75 | 3.3 | 20 | 66 | 100 | 79 |
| VHK100W-Q48-S5 | 18 ~ 75 | 5 | 20 | 100 | 100 | 84.5 |
| VHK100W-Q48-S12 | 18 ~ 75 | 12 | 8.3 | 100 | 150 | 85.5 |
| VHK100W-Q48-S15 | 18 ~ 75 | 15 | 6.7 | 100 | 150 | 86.5 |
| VHK100W-Q48-S24 | 18 ~ 75 | 24 | 4.17 | 100 | 240 | 87 |
| VHK100W-Q48-S28 | 18 ~ 75 | 28 | 3.57 | 100 | 280 | 86 |
| VHK100W-Q48-S48 | 18 ~ 75 | 48 | 2.08 | 100 | 480 | 85 |

Note: 1. Ripple and noise are measured at full load, 20 MHz BW with 10 μ F tantalum capacitor and 1 μ F ceramic capacitor across output. The 48 Vdc output models only require the 1 μ 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 power down | | 8 | | Vdc |
| 48 Vdc input | power up | | 17 | | Vdc |
| | power down | | 16 | | Vdc |
| CTRL ¹ | 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 | 20A time delay fuse for 24 Vin models, 10A 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 | | | 20,000 | μF |
| | 12 V output models | | | 8,300 | μF |
| | 15 V output models | | | 6,700 | μF |
| | 24 & 28 V output models | | | 2,200 | μF |
| | 48 V output models | 47 | | 470 | μF |
| line regulation ² | measured from high line to low line | | | ±0.2 | % |
| load regulation ² | measured from full load to zero load | | | ±0.2 | % |
| voltage accuracy ² | | | | ±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 | | 105 | | °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 1.50 (107.5 x 101.76 x 38.0 mm) | | | | inch |
| case material | steel and aluminum extrusion | | | | |
| weight | | | 502 | | g |

MECHANICAL DRAWING

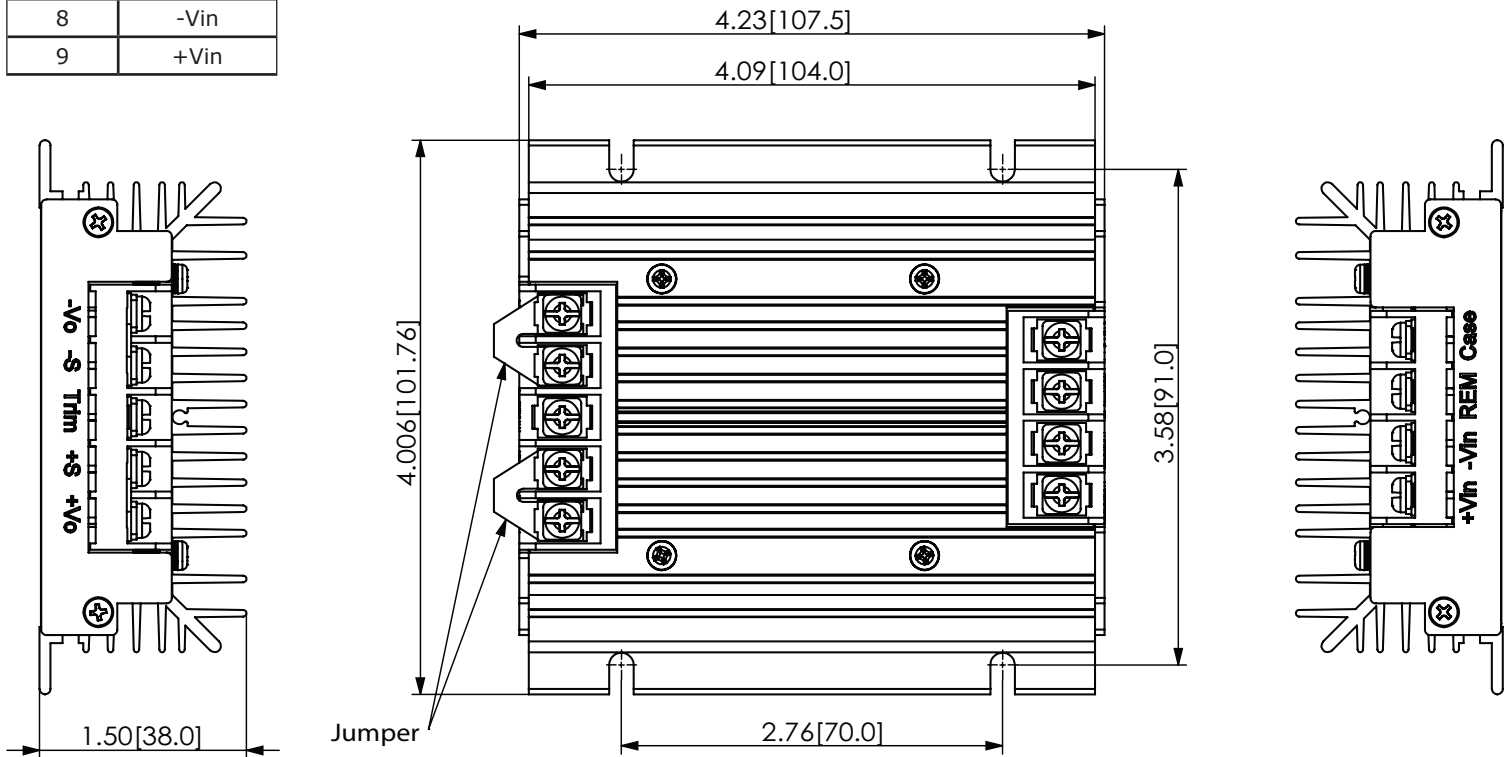
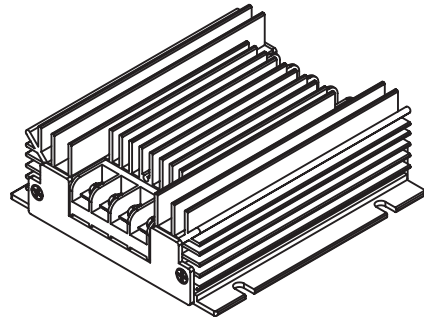
units: inch[mm]

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

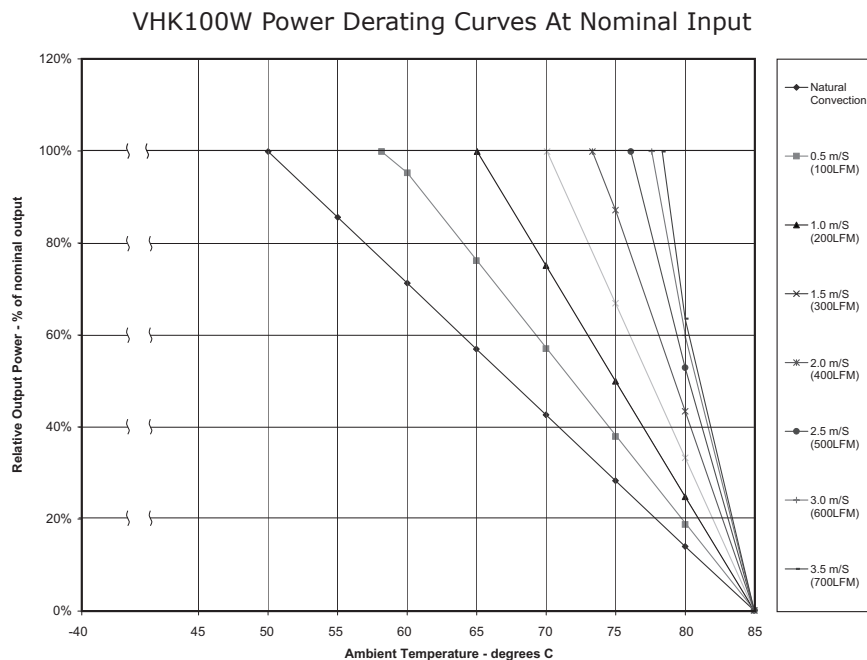
wire range: 22~12 AWG

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



TEST CONFIGURATION

Figure 1

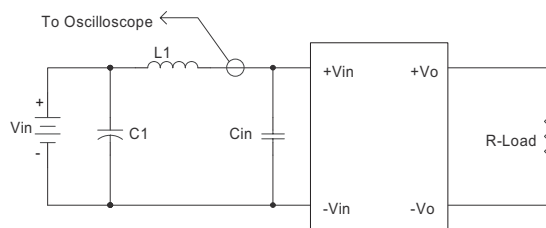


Table 1

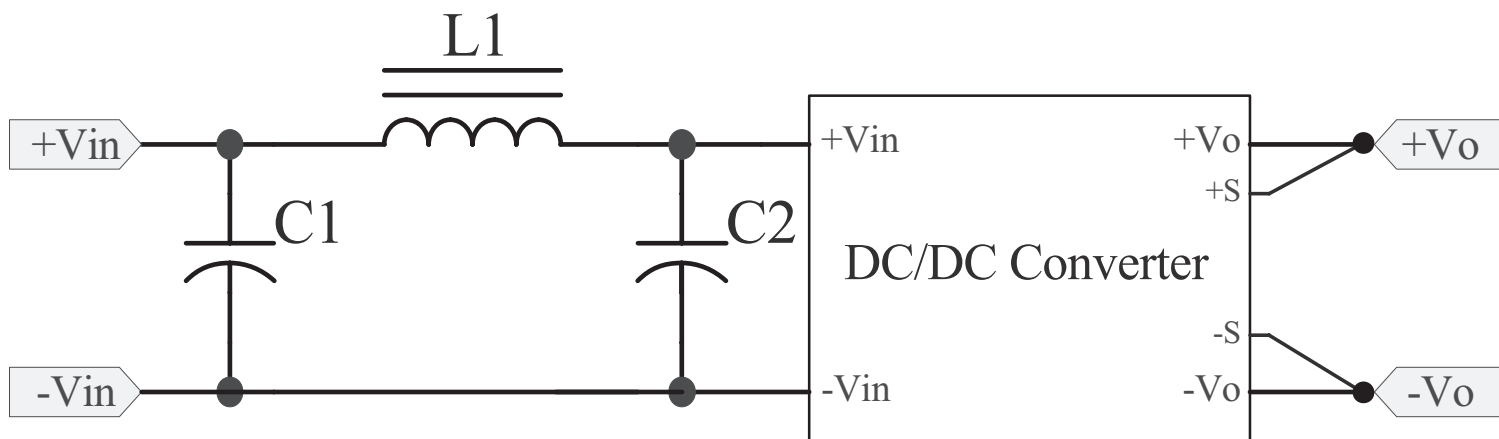
| External components | |
|---------------------|------------------------------|
| L1 | 12μH |
| C1 | 220μF, ESR < 0.1Ω at 100 KHz |
| Cin | 33μF, ESR < 0.7Ω at 100 KHz |

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
(for all models)



EMC RECOMMENDED CIRCUITS (CONTINUED)

EN55022 CLASS A

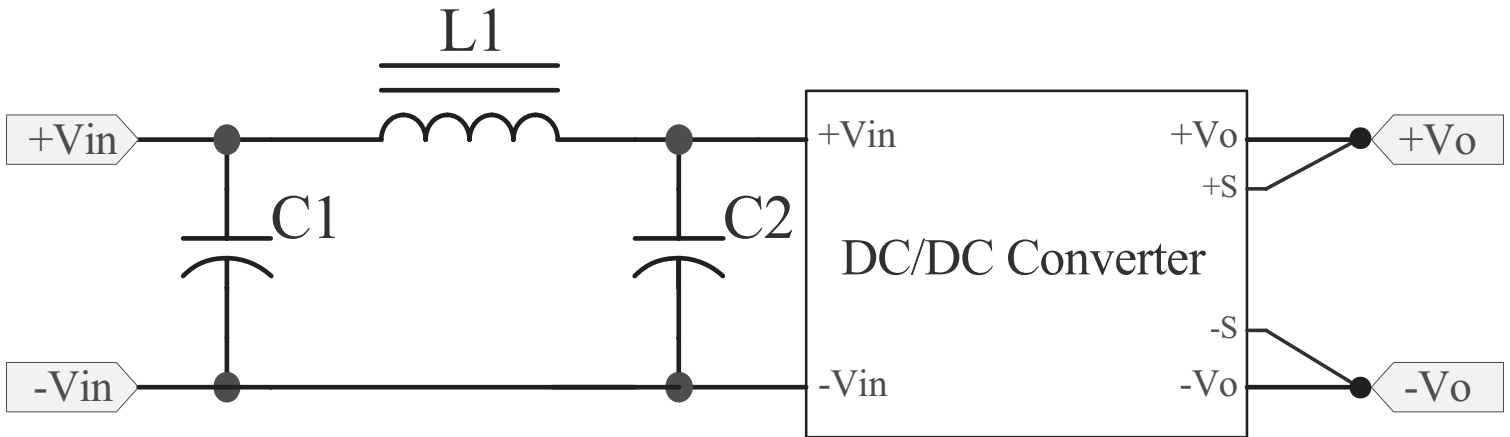
Table 2
Class A Recommended Components

| Model | C1 ¹ | C2 ¹ | L1 |
|------------------|-----------------|-----------------|--------|
| VHK100W-Q24-S3R3 | 47 μF/50 V | 47 μF/50 V | 3.4 μH |
| VHK100W-Q24-S5 | 47 μF/50 V | 47 μF/50 V | 3.4 μH |
| VHK100W-Q24-S12 | 47 μF/50 V | 47 μF/50 V | 3.4 μH |
| VHK100W-Q24-S15 | 47 μF/50 V | 47 μF/50 V | 3.4 μH |
| VHK100W-Q24-S24 | 47 μF/50 V | 47 μF/50 V | 3.4 μH |
| VHK100W-Q24-S28 | 47 μF/50 V | 47 μF/50 V | 3.4 μH |
| VHK100W-Q24-S48 | 47 μF/50 V | 47 μF/50 V | 3.4 μH |
| VHK100W-Q48-S3R3 | 47 μF/100 V | 47 μF/100 V | 3.4 μH |
| VHK100W-Q48-S5 | 47 μF/100 V | 47 μF/100 V | 3.4 μH |
| VHK100W-Q48-S12 | 47 μF/100 V | 47 μF/100 V | 3.4 μH |
| VHK100W-Q48-S15 | 47 μF/100 V | 47 μF/100 V | 3.4 μH |
| VHK100W-Q48-S24 | 47 μF/100 V | 47 μF/100 V | 3.4 μH |
| VHK100W-Q48-S28 | 47 μF/100 V | 47 μF/100 V | 3.4 μH |
| VHK100W-Q48-S48 | 47 μF/100 V | 47 μF/100 V | 3.4 μH |

Note: 1. Aluminum capacitors

EN55022 CLASS B

Figure 3
Recommended Circuit for EN55022 Class B
(for all 3.3, 5, 12, 15, 24, & 28 Vdc output models)



EMC RECOMMENDED CIRCUITS (CONTINUED)

EN55022 CLASS B

Figure 4
Recommended Circuit for EN55022 Class B
 (for all 48 Vdc output models)

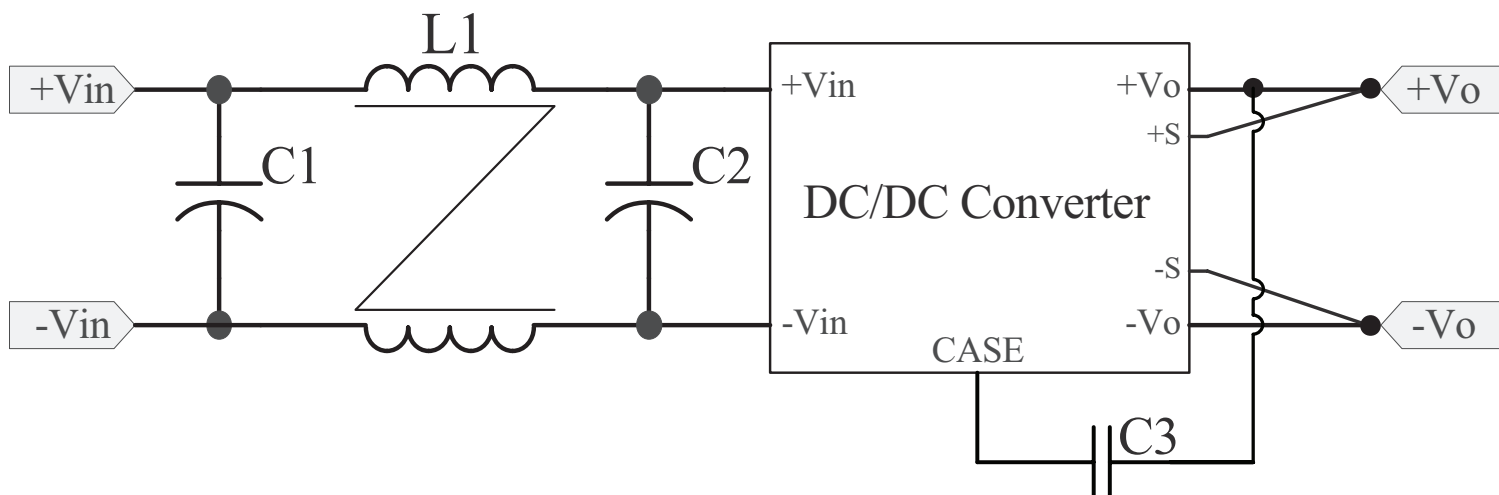


Table 3
Class B Recommended Components

| Model | C1 ¹ | C2 ¹ | C3 ² | L1 |
|------------------|------------------|------------------|-----------------|-------------|
| VHK100W-Q24-S3R3 | 220 μ F/50 V | 220 μ F/50 V | NC | 3.4 μ H |
| VHK100W-Q24-S5 | 220 μ F/50 V | 220 μ F/50 V | NC | 3.4 μ H |
| VHK100W-Q24-S12 | 220 μ F/50 V | 220 μ F/50 V | NC | 3.4 μ H |
| VHK100W-Q24-S15 | 220 μ F/50 V | 220 μ F/50 V | NC | 3.4 μ H |
| VHK100W-Q24-S24 | 220 μ F/50 V | 220 μ F/50 V | NC | 3.4 μ H |
| VHK100W-Q24-S28 | 220 μ F/50 V | 220 μ F/50 V | NC | 3.4 μ H |
| VHK100W-Q24-S48 | 100 μ F/50 V | 100 μ F/50 V | 2200 pF/2 KV | 0.53 mH |
| VHK100W-Q48-S3R3 | 47 μ F/100 V | 47 μ F/100 V | NC | 3.4 μ H |
| VHK100W-Q48-S5 | 47 μ F/100 V | 47 μ F/100 V | NC | 3.4 μ H |
| VHK100W-Q48-S12 | 47 μ F/100 V | 47 μ F/100 V | NC | 3.4 μ H |
| VHK100W-Q48-S15 | 47 μ F/100 V | 47 μ F/100 V | NC | 3.4 μ H |
| VHK100W-Q48-S24 | 47 μ F/100 V | 47 μ F/100 V | NC | 3.4 μ H |
| VHK100W-Q48-S28 | 47 μ F/100 V | 47 μ F/100 V | NC | 3.4 μ H |
| VHK100W-Q48-S48 | 47 μ F/100 V | 47 μ F/100 V | 2200 pF/2 KV | 0.53 mH |

Note: 1. Aluminum capacitors
 2. Ceramic capacitors

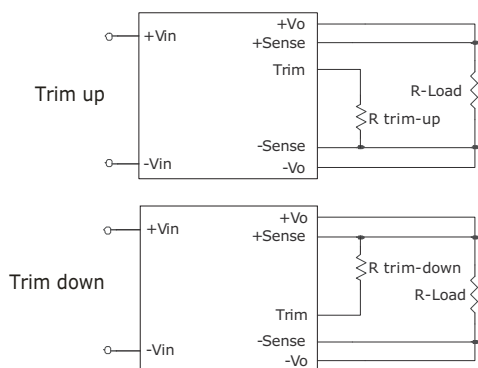
APPLICATION NOTES

1. Output Voltage Trimming

Leave open if not used.

Figure 5

Application Circuit for Trim pin



Formula for Trim Resistor

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

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

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_r are internal (see Table 4).

Table 4

| Vout (Vdc) | R1 (KΩ) | R2 (KΩ) | R3 (KΩ) | Vr (V) | Vf (V) |
|------------|---------|---------|---------|--------|--------|
| 3.3 | 3 | 12 | 4.3 | 1.24 | 0.46 |
| 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 | 2.5 | 0.53 |
| 48 | 36 | 270 | 5.1 | 2.5 | 0.46 |

Note: 1. All specifications are measured at $T_a=25^\circ C$, 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 | 03/14/2013 |
| 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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