

SERIES: VHK100W-DIN | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

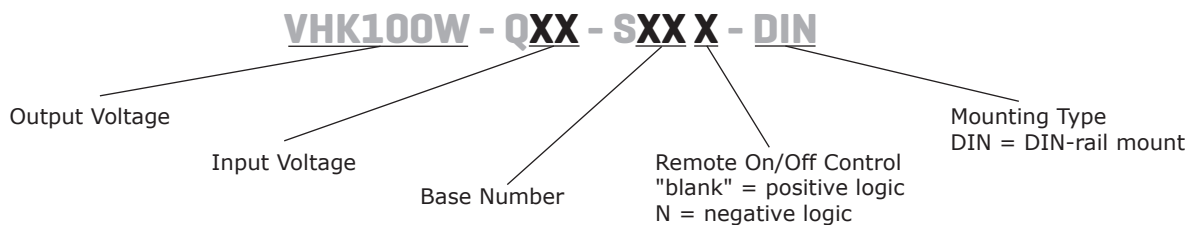
- up to 100 W isolated output
- rugged metal enclosure with integrated heat sink
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- single output from 3.3~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 87%
- comes with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



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

Note: 1. Ripple and noise are measured at full load, 20 MHz BW with 10µF tantalum capacitor and 1µF ceramic capacitor across output. The 48 Vdc output models only require the 1µF 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 2.07 (107.5 x 101.8 x 52.6 mm) | | | | inch |
| case material | steel and aluminum extrusion | | | | |
| weight | | | 651 | | g |

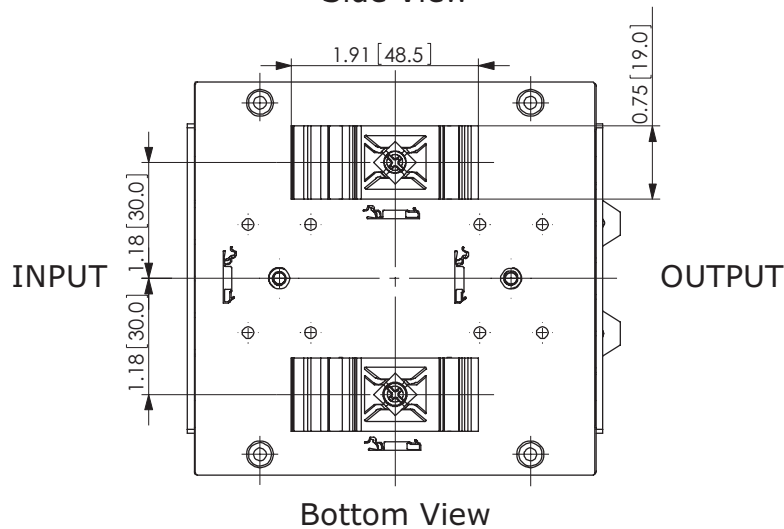
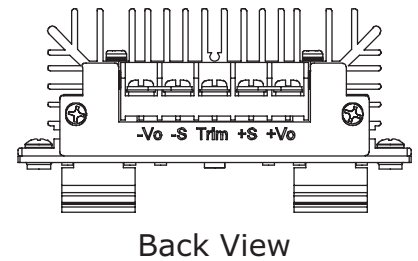
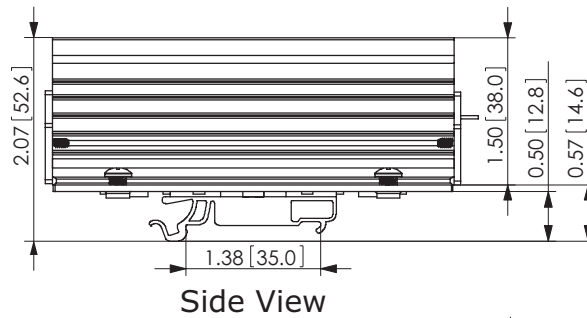
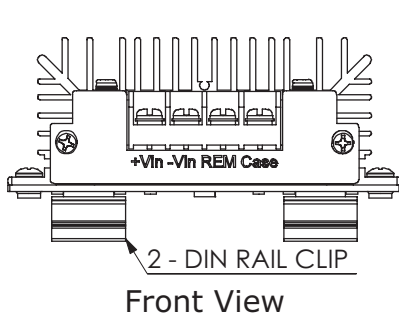
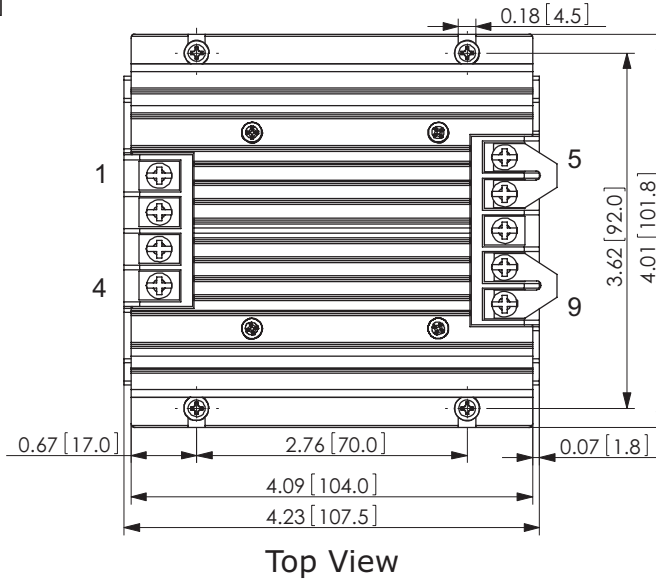
MECHANICAL DRAWING

units: inch[mm]

tolerance: X.XX = $\pm 0.02[\pm 0.5]$
 X.XXX = $\pm 0.010[\pm 0.25]$

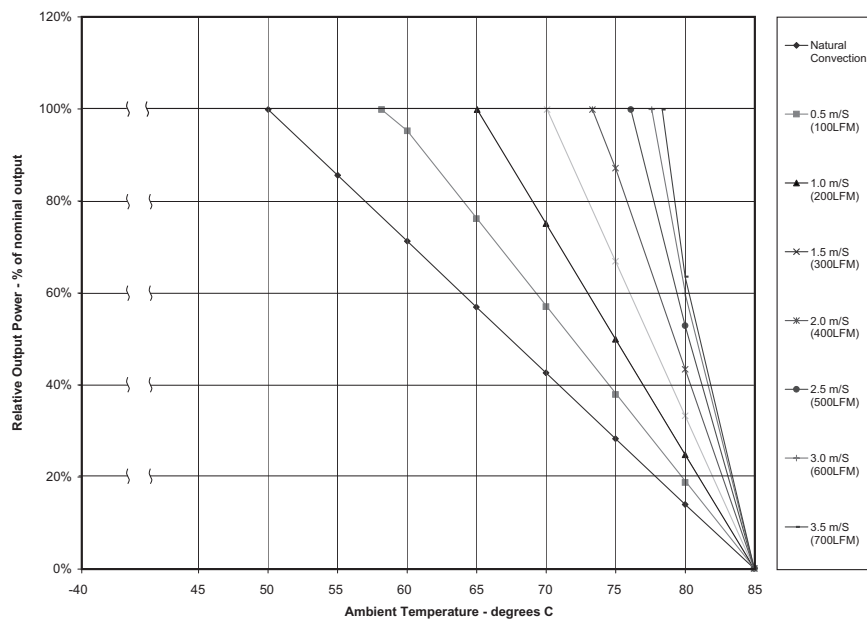
wire range: 22~12 AWG
 screw size: #6-32
 mounts to TS35 rails

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



DERATING CURVES

VHK100W Power Derating Curves At Nominal Input



TEST CONFIGURATION

Figure 1

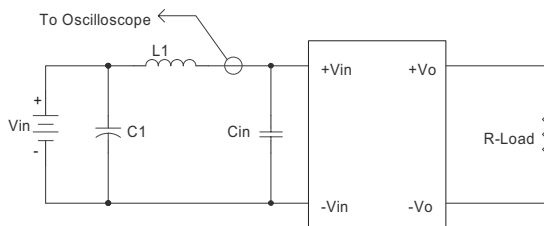


Table 1

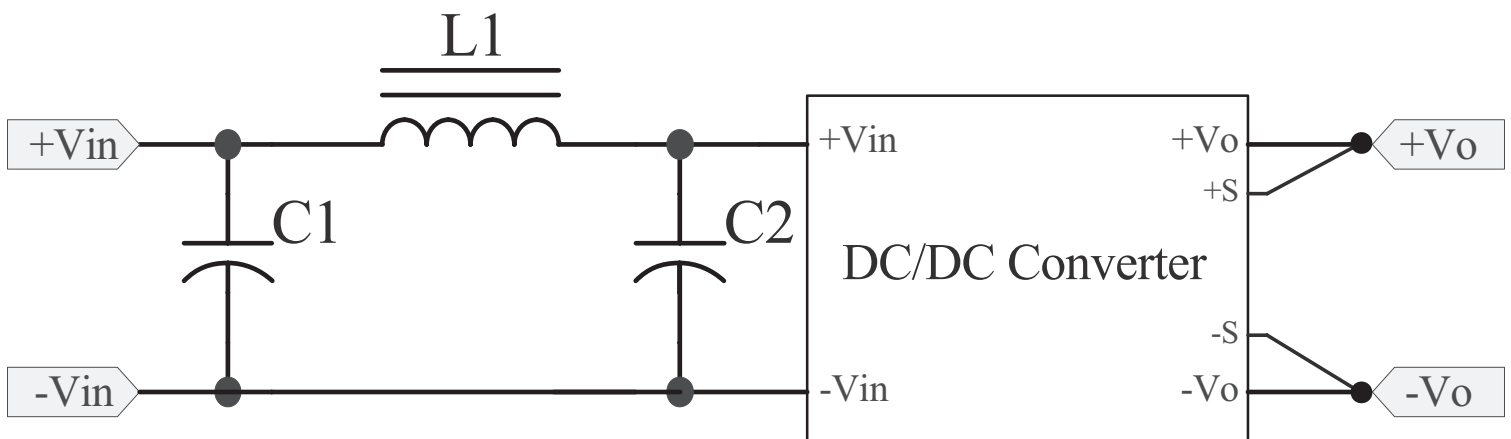
| External components | |
|---------------------|------------------------------|
| L1 | 12μH |
| C1 | 220μF, ESR < 0.1Ω at 100 KHz |
| Cin | 33μF, ESR < 0.7Ω at 100 KHz |

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

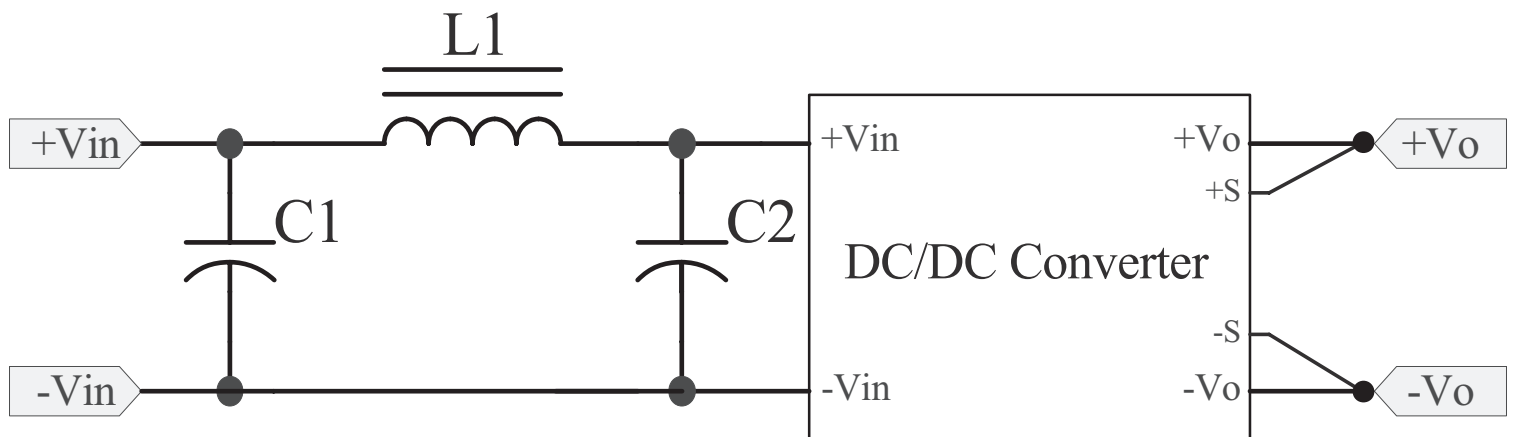
Table 2
Class A Recommended Components

| 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)

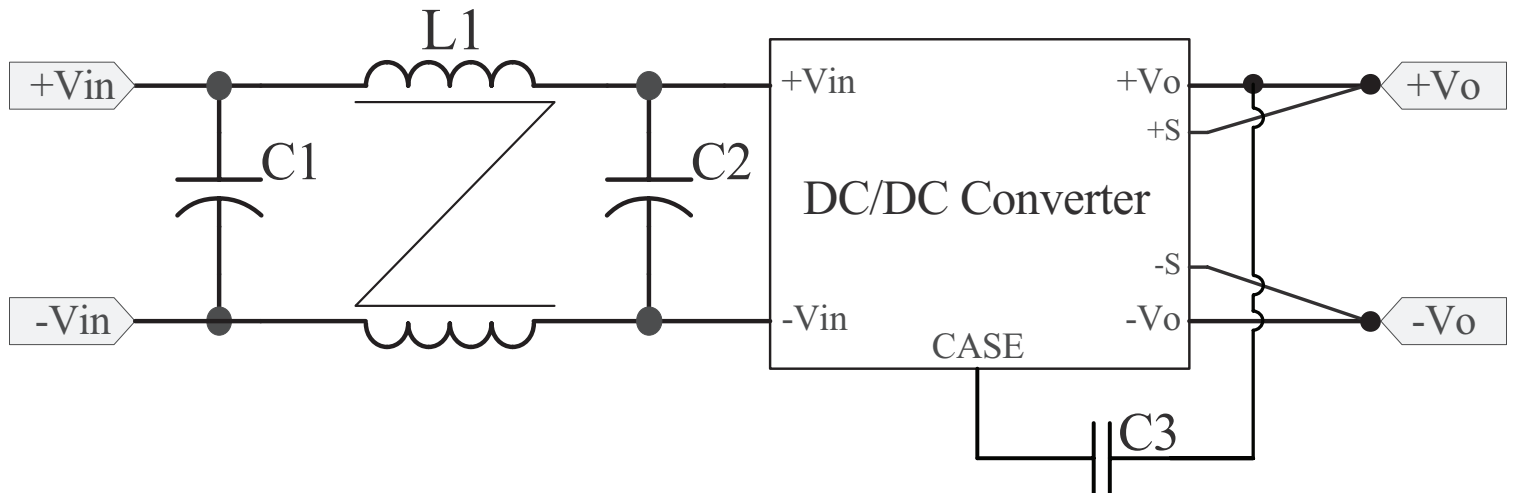


Table 3
Class B Recommended Components

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

Note: 1. Aluminum capacitors
 2. Ceramic capacitors

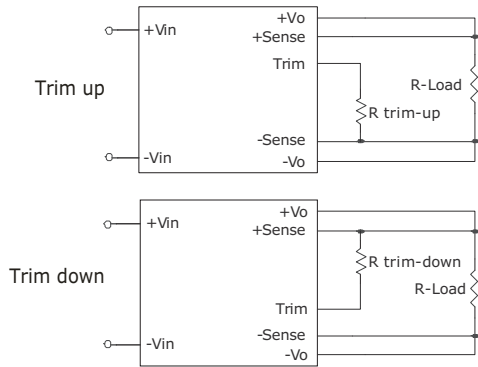
APPLICATION NOTES

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 |

REVISION HISTORY

| rev. | description | date |
|------|------------------------|------------|
| 1.0 | initial release | 12/16/2013 |
| 1.01 | changed DIN-rail mount | 06/16/2014 |

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



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