

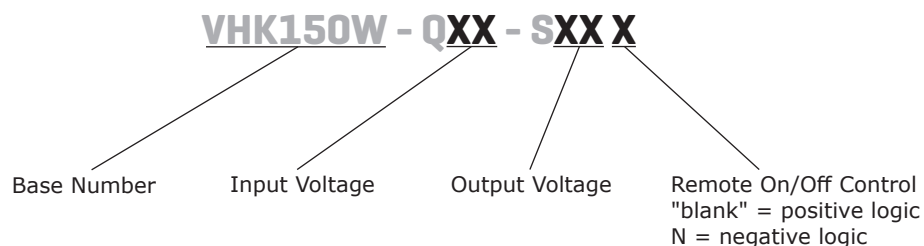
**SERIES: VHK150W | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- 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%



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	9 ~ 36	5	25	125	100	87
VHK150W-Q24-S12	9 ~ 36	12	12.5	150	150	86
VHK150W-Q24-S15	9 ~ 36	15	10	150	150	86
VHK150W-Q24-S24	9 ~ 36	24	6.5	156	240	86.5
VHK150W-Q24-S28	9 ~ 36	28	5.4	150	280	87
VHK150W-Q24-S48	9 ~ 36	48	3.12	150	480	84
VHK150W-Q48-S5	18 ~ 75	5	25	125	100	90
VHK150W-Q48-S12	18 ~ 75	12	12.5	150	150	88
VHK150W-Q48-S15	18 ~ 75	15	10	150	150	88
VHK150W-Q48-S24	18 ~ 75	24	6.5	156	240	87.5
VHK150W-Q48-S28	18 ~ 75	28	5.4	150	280	89
VHK150W-Q48-S48	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 power down		8		Vdc
	48 Vdc input		17		Vdc
	power up 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 1.50 [107.5 x 101.8 x 38.0 mm]				inch
case material	steel and aluminum extrusion				
weight			502		g

## MECHANICAL DRAWING

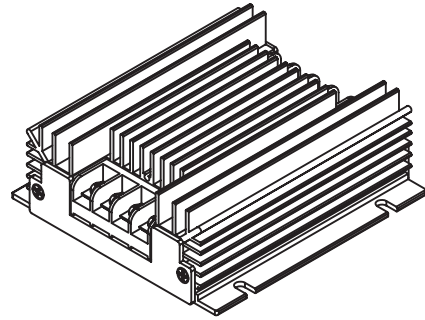
units: inch[mm]

general tolerance: ±0.04[±1.0]

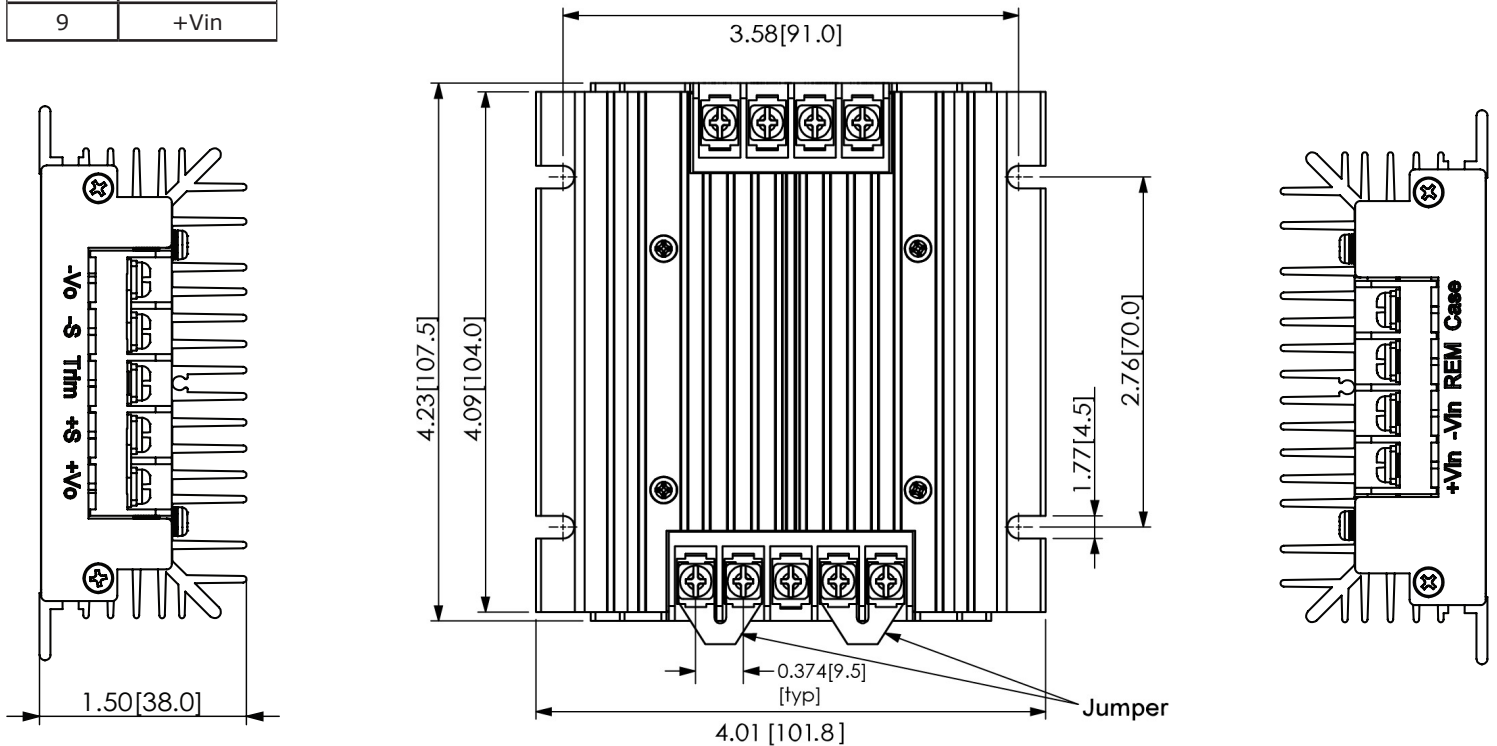
wire range: 22~12 AWG

screw size: #6-32

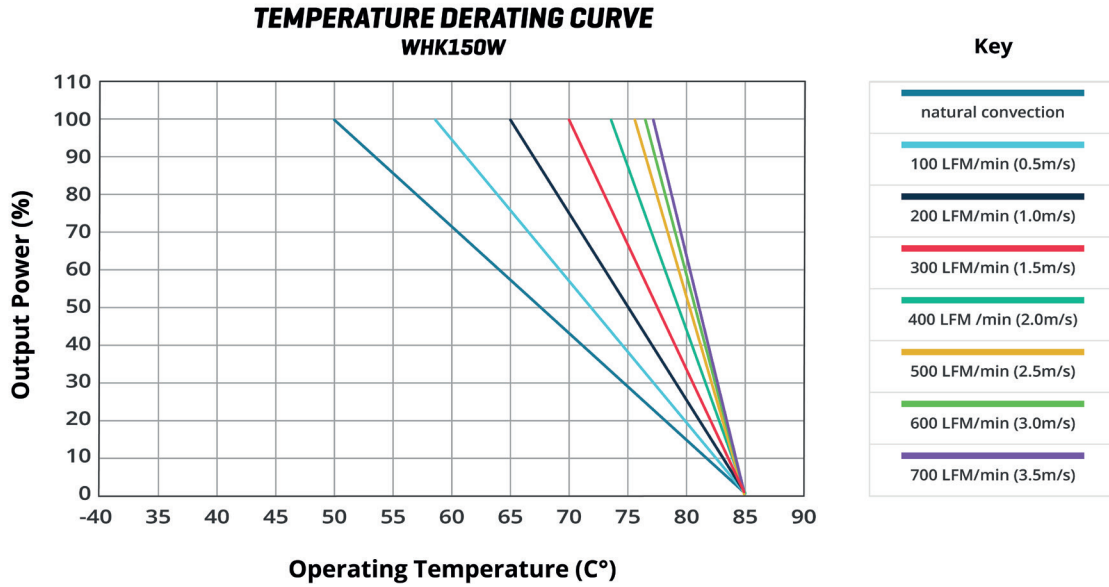
connector tightening torque: 1.4 N·m (max)



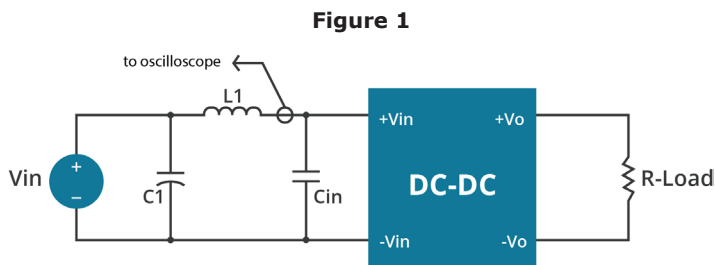
PIN CONNECTIONS	
PIN	FUNCTION
1	-Vo
2	-S
3	trim
4	+S
5	+Vo
6	case
7	on/off
8	-Vin
9	+Vin



## DERATING CURVES



## TEST CONFIGURATION



**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

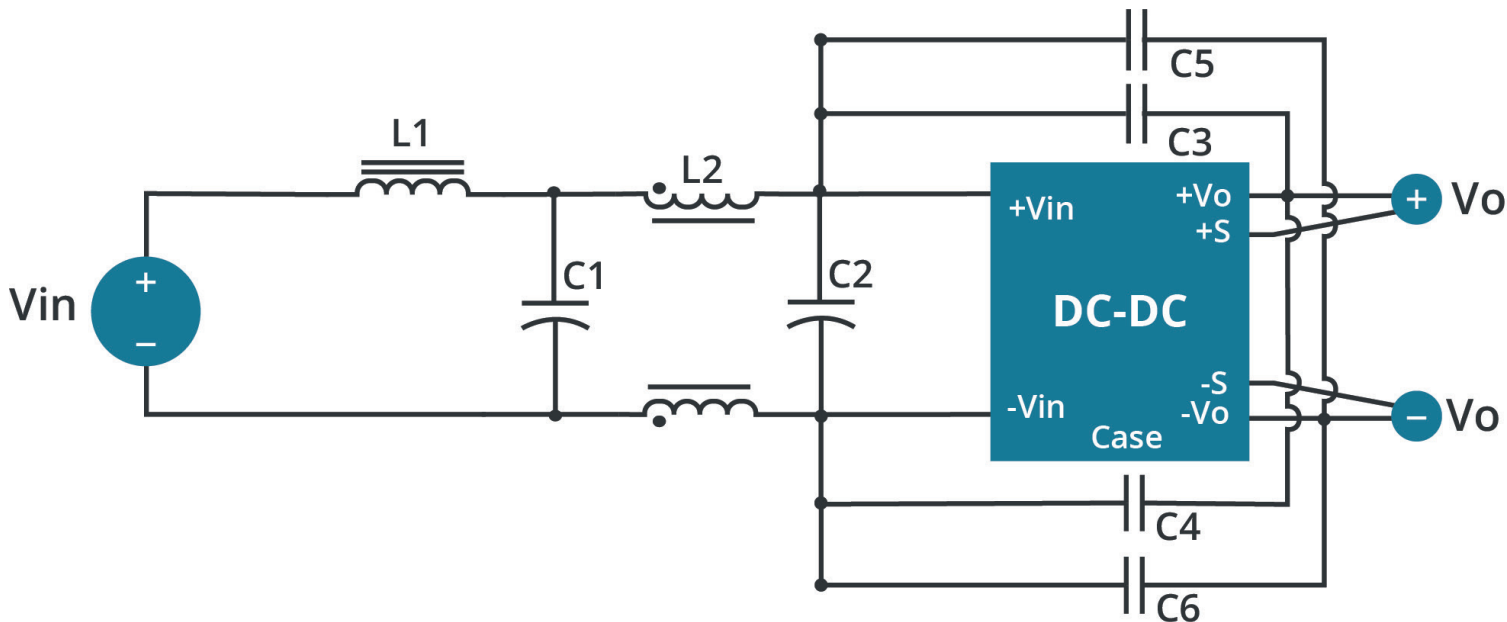


Table 2  
Class A Recommended Components

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

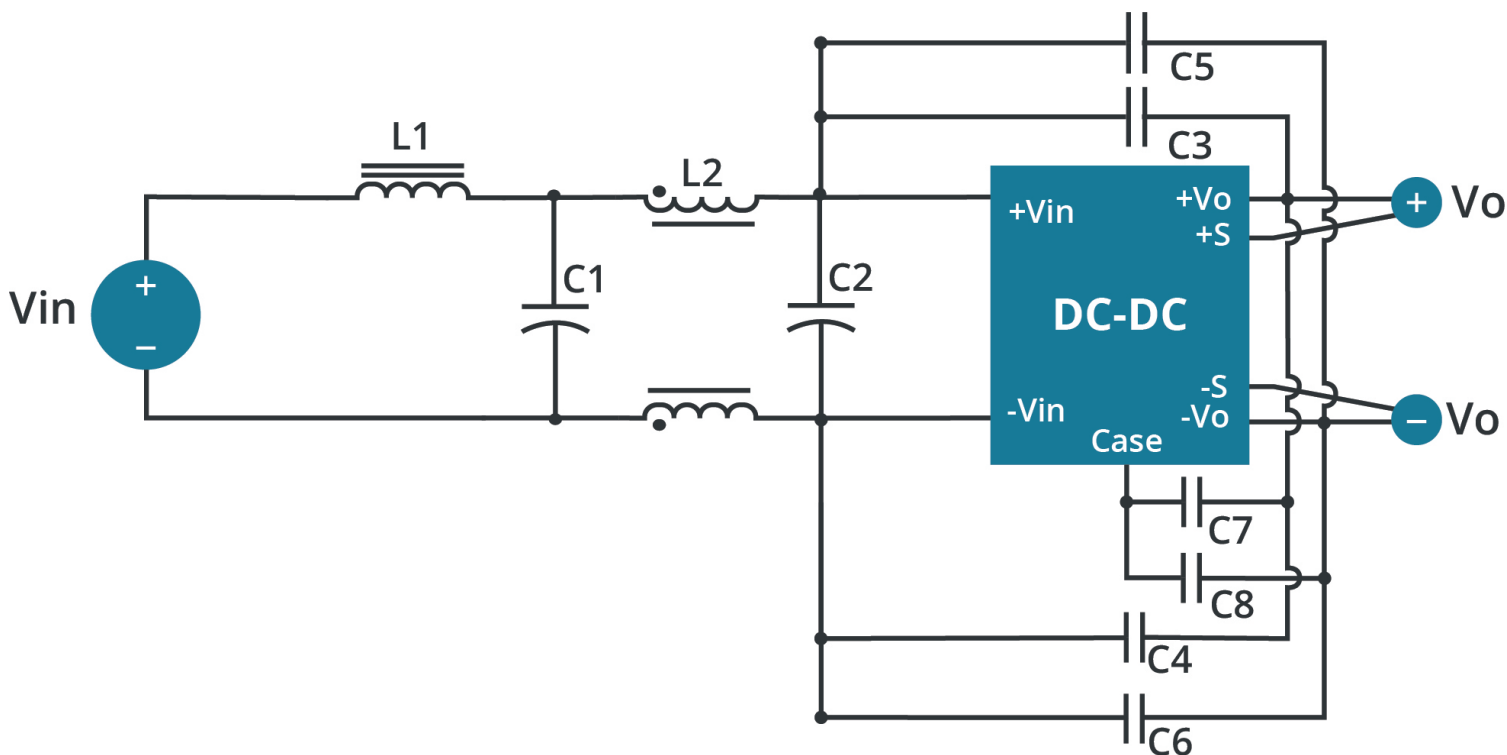


Table 3  
Class B Recommended Components

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

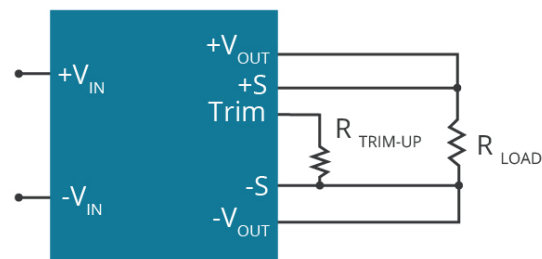
## APPLICATION NOTES

### 1. Output Voltage Trimming

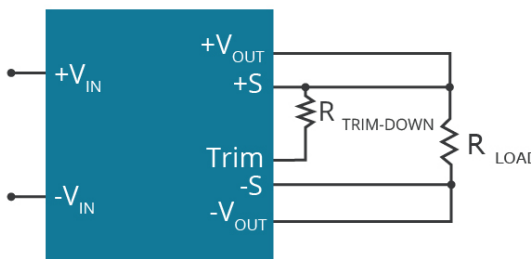
Leave open if not used.

Figure 4

Trim up



Trim down



$$R_{\text{TRIM}} = \left( \frac{R_{\text{TOP}} (V_{\text{REF}} - V_F \left( \frac{R_{\text{BOTTOM}}}{R_{\text{BOTTOM}} + R_O} \right))}{V_{\text{OUT}} - V_{\text{OUT, NOM}}} \right) - \frac{R_{\text{BOTTOM}} R_O}{R_{\text{BOTTOM}} + R_O} \quad (\text{K } \Omega)$$

Formula for Trim up

$$R_{\text{TRIM}} = \frac{R_{\text{TOP}} (V_{\text{OUT}} - V_{\text{REF}})}{V_{\text{OUT, NOM}} - V_{\text{OUT}}} - R_{\text{BOTTOM}} \quad (\text{K } \Omega)$$

Formula for Trim down

Table 4

$V_{\text{NOM}}$	$R_{\text{TOP}}$	$R_{\text{BOTTOM}}$	$R_O$	$V_{\text{REF}}$	$V_F$
(Vdc)	(k $\Omega$ )	(k $\Omega$ )	(k $\Omega$ )	(V)	(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

Note: Value for  $R_{\text{TOP}}$ ,  $R_{\text{BOTTOM}}$ ,  $R_O$ ,  $V_{\text{REF}}$ , and  $V_F$  refer to Table 4 (fixed internal values).

$R_{\text{TRIM}}$ : Trim resistance

a: User-defined parameter, no actual meanings

$V_{\text{NOM}}$ : Nominal output voltage

$V_{\text{OUT}}$ : Target output voltage

Note: 1. All specifications are measured at  $T_a=25^\circ\text{C}$ , 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	09/06/2012
1.05	added 28 V output models	11/05/2012
1.06	misc. updates, added 5 V output models for both 24 and 48 V inputs	11/16/2012
1.07	updated spec	03/14/2013
1.08	added trimming and EMI information	12/17/2013
1.09	updated spec	01/05/2015
1.10	updated derating curves	06/18/2015
1.11	company logo updated	02/08/2021
1.12	derating curve and circuit figures updated	09/07/2021
1.13	mechanical tolerance updated	04/13/2022
1.14	output voltage trimming updated	05/29/2023

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



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