CUI INC
a bel group

SERIES: VHK150W-DIN | **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%
- comes with DIN-rail mount

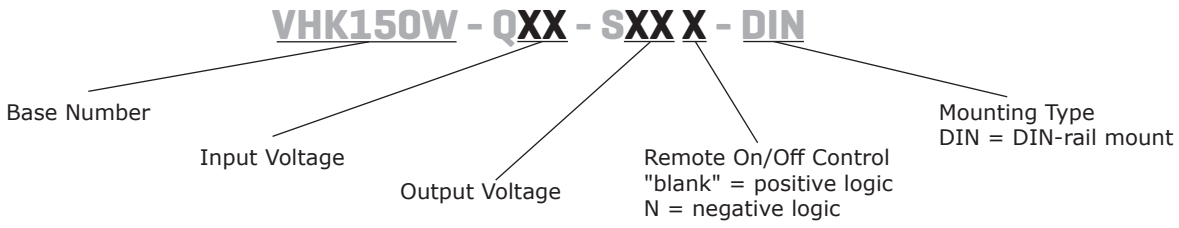
RoHS CE

MODEL

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 (%)
VHK150W-Q24-S5-DIN	9 ~ 36	5	25	125	100	87
VHK150W-Q24-S12-DIN	9 ~ 36	12	12.5	150	150	86
VHK150W-Q24-S15-DIN	9 ~ 36	15	10	150	150	86
VHK150W-Q24-S24-DIN	9 ~ 36	24	6.5	156	240	86.5
VHK150W-Q24-S28-DIN	9 ~ 36	28	5.4	150	280	87
VHK150W-Q24-S48-DIN	9 ~ 36	48	3.12	150	480	84
VHK150W-Q48-S5-DIN	18 ~ 75	5	25	125	100	90
VHK150W-Q48-S12-DIN	18 ~ 75	12	12.5	150	150	88
VHK150W-Q48-S15-DIN	18 ~ 75	15	10	150	150	88
VHK150W-Q48-S24-DIN	18 ~ 75	24	6.5	156	240	87.5
VHK150W-Q48-S28-DIN	18 ~ 75	28	5.4	150	280	89
VHK150W-Q48-S48-DIN	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 48 Vdc input models		9 18	24 48	36 75	Vdc Vdc
under voltage shutdown	24 Vdc input	power up power down		8.8 8		Vdc Vdc
	48 Vdc input	power up power down		17 16		Vdc 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	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[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		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

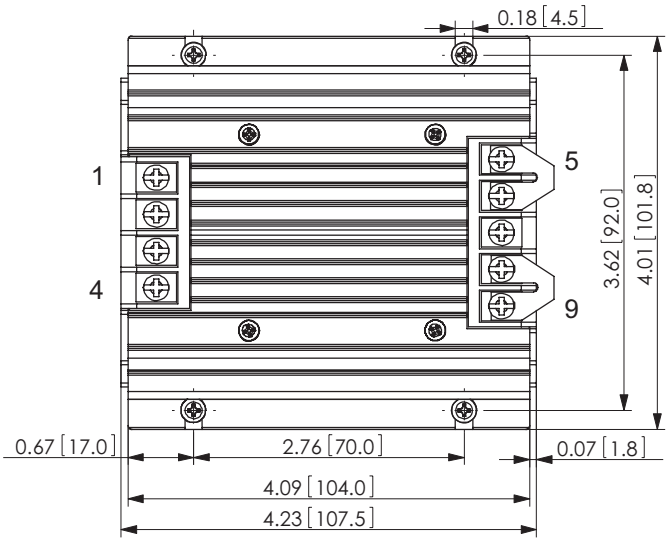
parameter	conditions/description	min	typ	max	units
dimensions	4.23 x 4.01 x 2.07 (107.5 x 101.8 x 52.6 mm)				inch
case material	steel and aluminum extrusion				
weight			651		g

MECHANICAL DRAWING

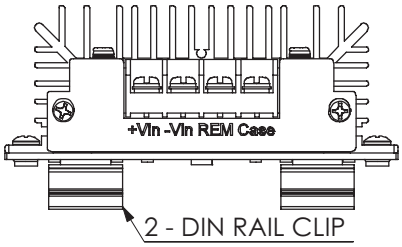
units: inch[mm]
tolerance: X.XX = ±0.02[±0.5]
X.XXX = ±0.010[±0.25]

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

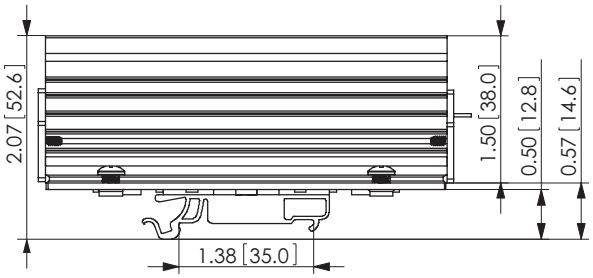
PIN CONNECTIONS	
PIN	FUNCTION
1	+Vin
2	-Vin
3	REM
4	CASE
5	+Vo
6	+S
7	TRIM
8	-S
9	-Vo



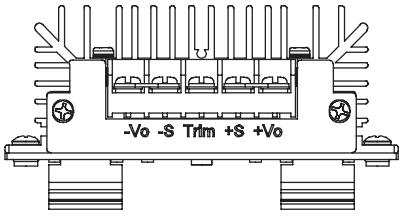
Top View



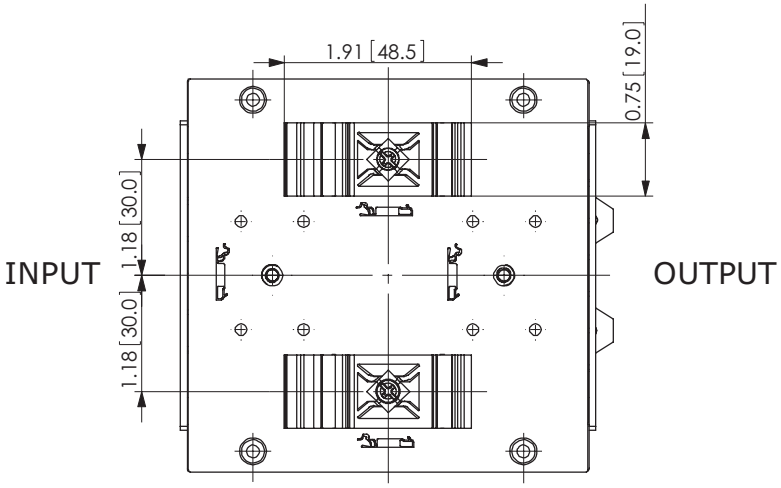
Front View



Side View

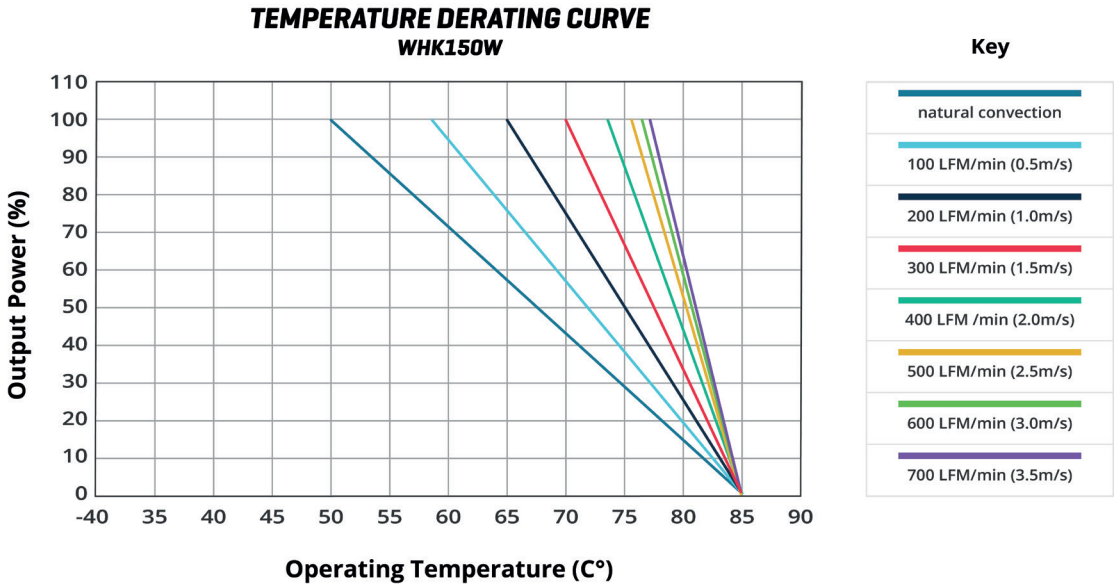


Back View



Bottom View

DERATING CURVES



TEST CONFIGURATION

Figure 1

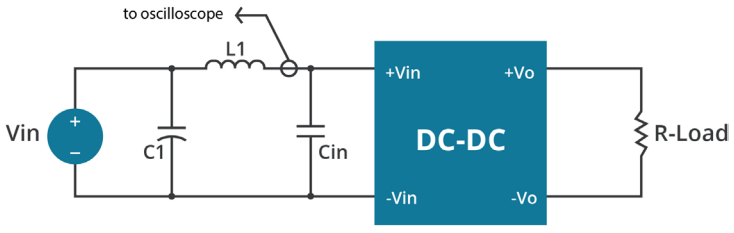


Table 1
External Components

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

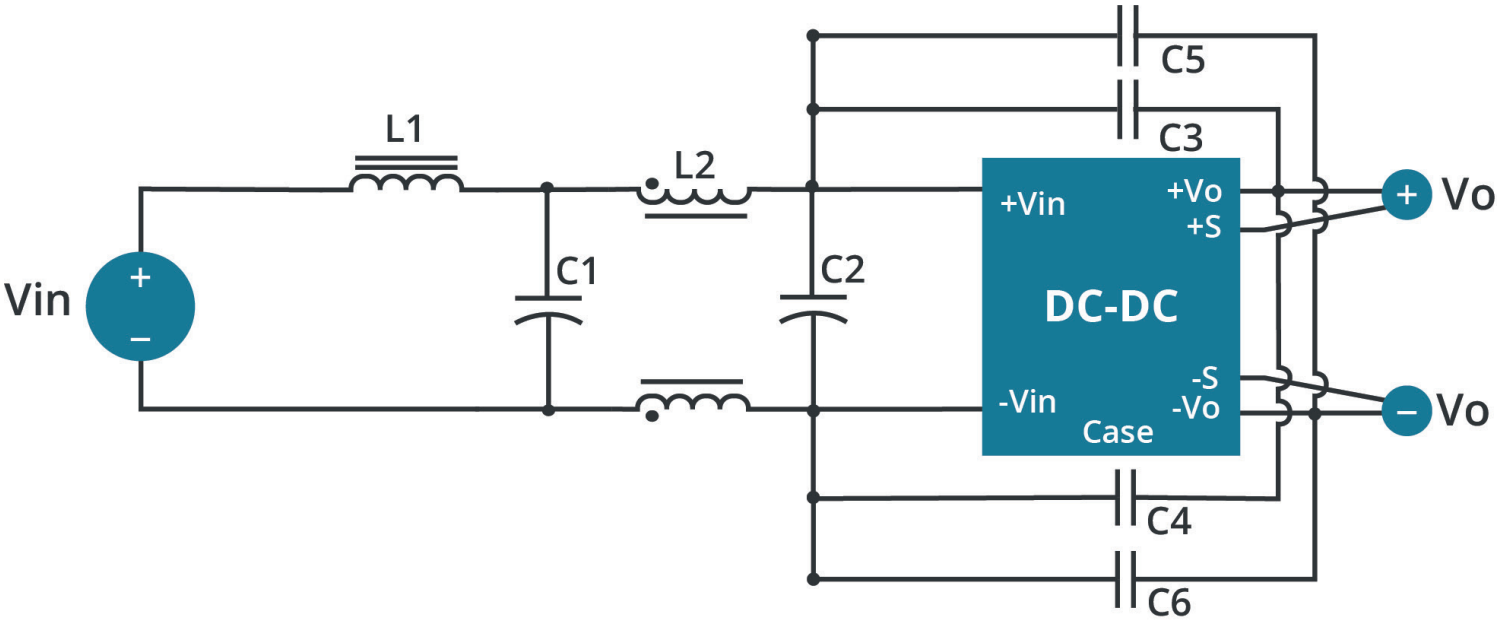


Table 2
Class A Recommended Components

Model	C1[1]	C2[1]	C3[2]	C4[2]	C5[2]	C6[2]	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

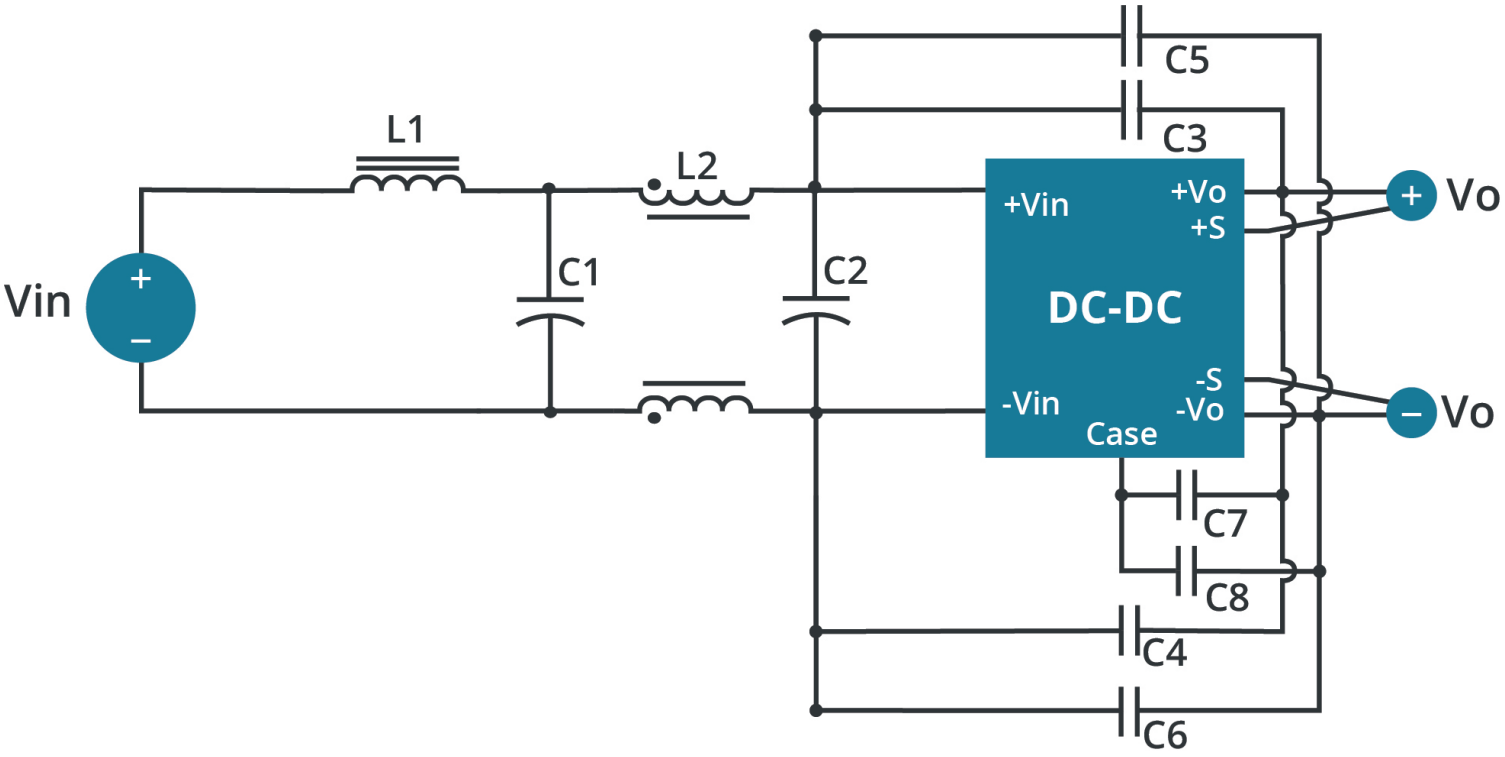


Table 3
Class B Recommended Components

Model	C1[1]	C2[1]	C3[2]	C4[2]	C5[2]	C6[2]	C7[2]	C8[2]	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

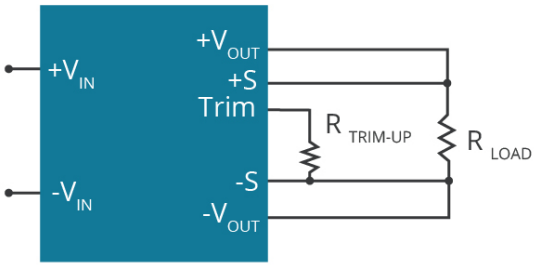
Notes: 1. Aluminum capacitor
2. Ceramic capacitor

APPLICATION NOTES

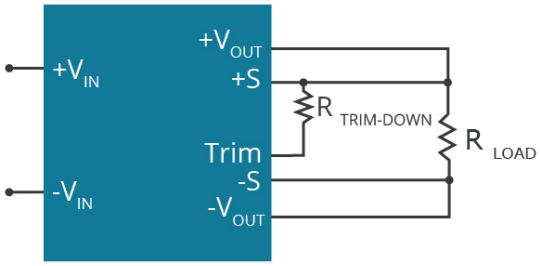
1. **Output Voltage Trimming**
   Leave open if not used.

Figure 4

Trim up



Trim down



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

Formula for Trim up

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

Formula for Trim down

Table 4

V_{NOM}	R_{TOP}	R_{BOTTOM}	R_O	V_{REF}	V_F
(Vdc)	(kΩ)	(kΩ)	(kΩ)	(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_{TOP}, R_{BOTTOM}, R_O, V_{REF} ,and V_F refer to Table 4 (fixed internal values).
R_{TRIM}: Trim resistance
a: User-defined parameter, no actual meanings
V_{NOM}: Nominal output voltage
V_{OUT}: Target output voltage

Note: 1. 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	12/17/2013
1.01	changed DIN-rail mount	06/16/2014
1.02	updated spec	01/05/2015
1.03	updated derating curves	06/18/2015
1.04	company logo updated	02/08/2021
1.05	derating curve and circuit drawings updated	09/07/2021
1.06	output voltage trimming updated	05/29/2023
1.07	company address updated	11/14/2024

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

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