



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

### FEATURES

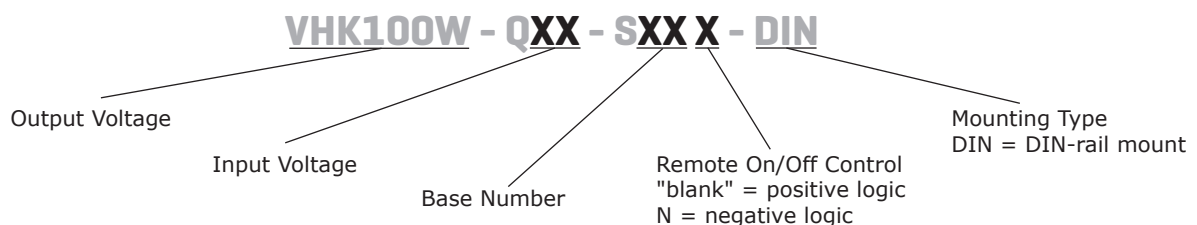
- up to 100 W isolated output
- rugged metal enclosure with integrated heat sink
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- single output from 3.3~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 87%
- comes with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



MODEL	input voltage	output voltage	output current	output power	ripple and noise <sup>1</sup>	efficiency
	range (Vdc)	(Vdc)	max (A)	max (W)	max (mVp-p)	typ (%)
VHK100W-Q24-S3R3-DIN	9 ~ 36	3.3	20	66	100	80
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 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 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	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 <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		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

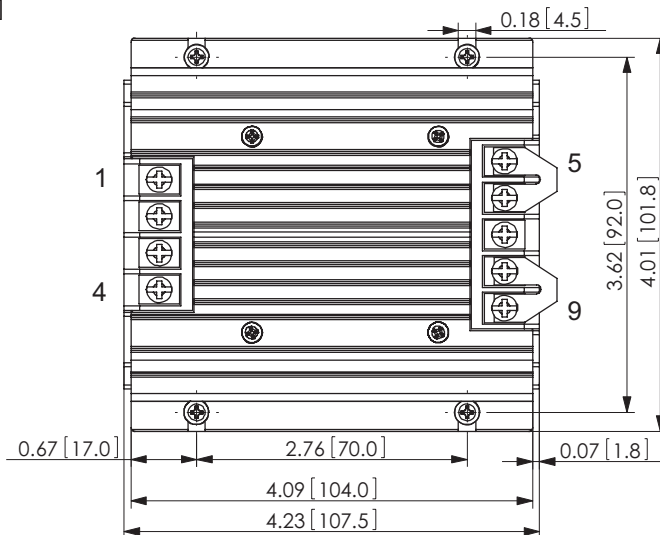
## MECHANICAL DRAWING

units: inch[mm]

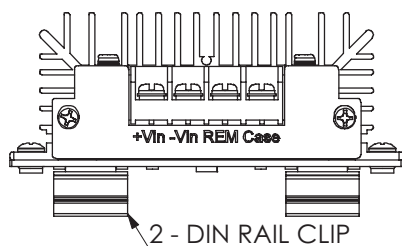
tolerance: X.XX = ±0.02[±0.5]  
 X.XXX = ±0.010[±0.25]

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

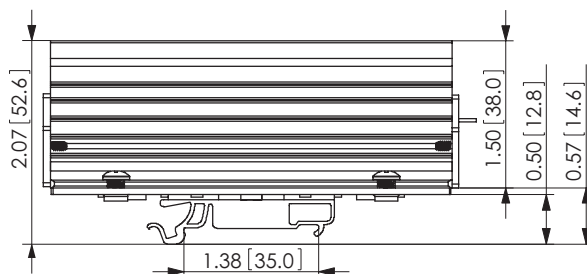
PIN CONNECTIONS	
PIN	FUNCTION
1	+Vin
2	-Vin
3	REM
4	CASE
5	+Vo
6	+S
7	TRIM
8	-S
9	-Vo



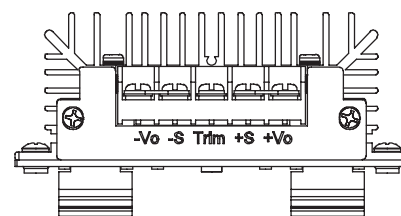
Top View



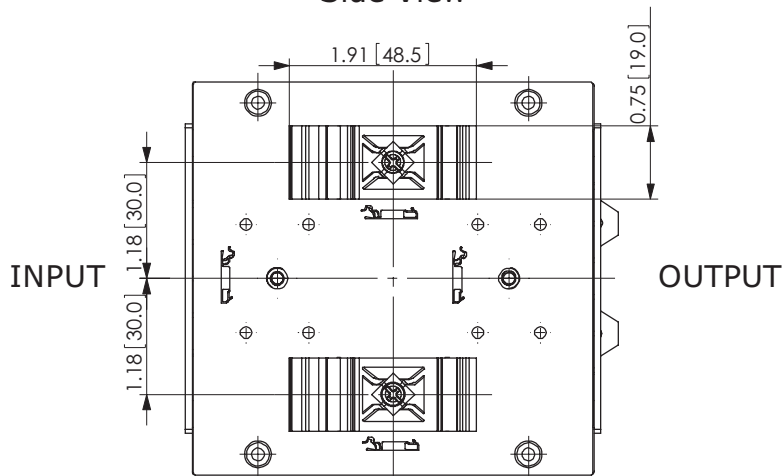
Front View



Side View

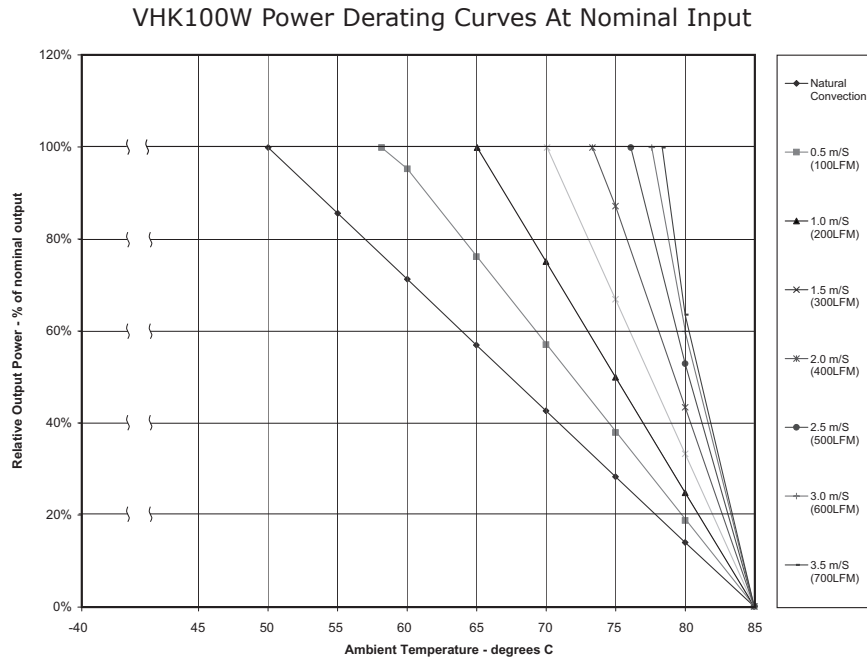


Back View

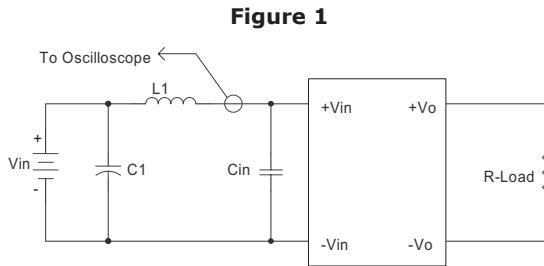


Bottom View

## DERATING CURVES



## TEST CONFIGURATION



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

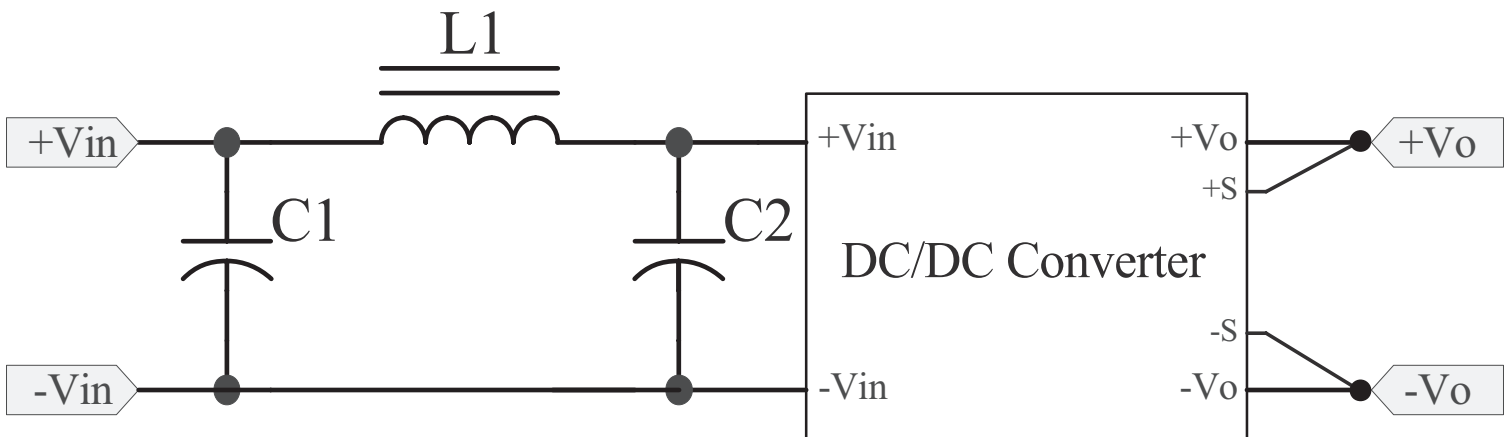
**Table 1**

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

## EMC RECOMMENDED CIRCUITS

### EN55022 CLASS A

**Figure 2**  
Recommended Circuit for EN55022 Class A  
(for all models)



## EMC RECOMMENDED CIRCUITS (CONTINUED)

### EN55022 CLASS A

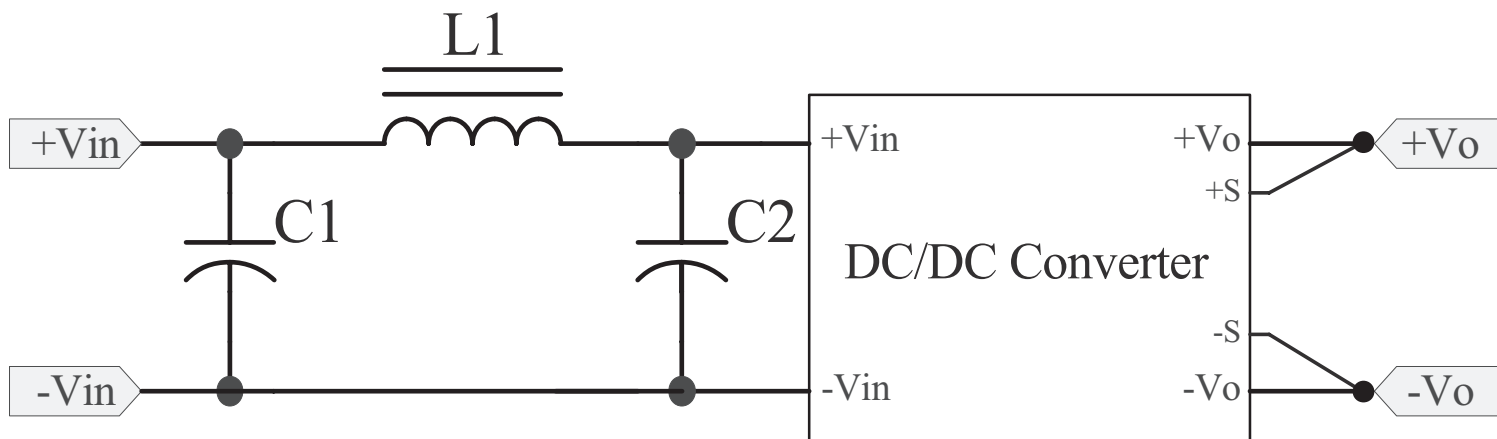
**Table 2**  
Class A Recommended Components

Model	C1 <sup>1</sup>	C2 <sup>1</sup>	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

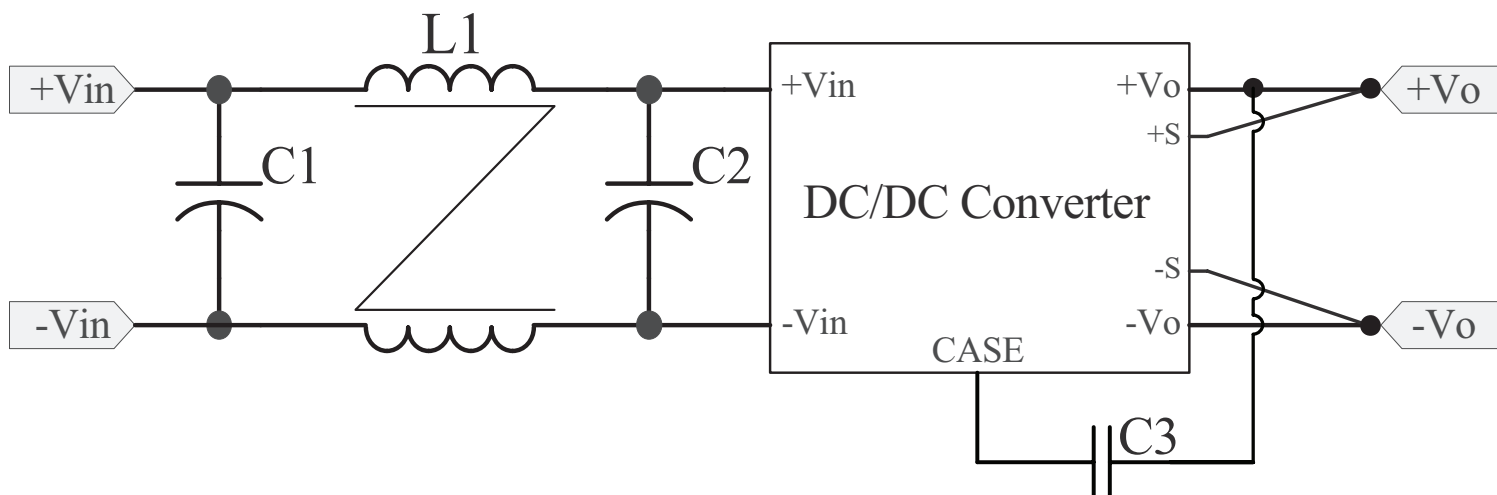
**Figure 3**  
Recommended Circuit for EN55022 Class B  
(for all 3.3, 5, 12, 15, 24, & 28 Vdc output models)



## 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 <sup>1</sup>	C2 <sup>1</sup>	C3 <sup>2</sup>	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

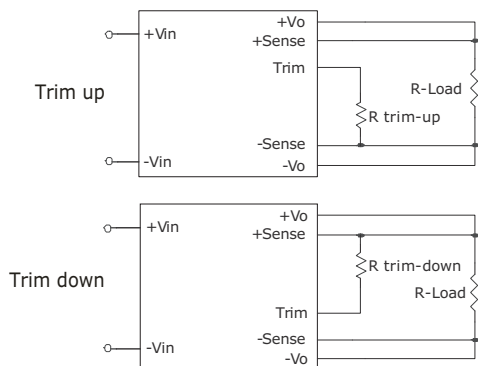
## APPLICATION NOTES

### 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

Note: 1. All specifications are measured at  $T_a=25^\circ C$ , nominal input voltage and full output load unless otherwise specified.

## REVISION HISTORY

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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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