Descriptions

20W isolated , DC-DC Converter

VDB20-W Series

RoHS

Features

- Ultra-wide 4:1 input voltage range
- High efficiency up to 91%
- I/O isolation test voltage 1.5k VDC
- Input under-voltage protection, output short-circuit, over-current, over–voltage protection
- Operating ambient temperature range -40℃ to +105℃
- Input reverse polarity protection available with chassis(E2S) or 35mm DIN-rail mounting(D4S) version
- Meets EN50155 railway standard

Applications

- Industrial control
- home appliances
- Instrumentation
- Communication
- Railway

Selection Guide

Part No. ①	Input Voltage (VDC)		Output		Full Load Efficiency④ (%) Min./Typ.	Capacitive Load (μF)Max.
	Nominal② (Range)	Max.③	Voltage (VDC)	Current(mA) Max./Min.		
VDB20-24S03W	24 (9-36)	40	3.3	5000/0	86/88	10000
VDB20-24S05W			5	4000/0	88/90	10000
VDB20-24S06W			6	3333/0	87/89	10000
VDB20-24S12W			12	1667/0	88/90	1600
VDB20-24S15W			15	1333/0	87/89	1000
VDB20-24S24W			24	833/0	89/91	500
VDB20-24D05W			±5	±2000	84/86	2000
VDB20-24D12W			±12	±833	88/90	800
VDB20-24D15W			±15	±667	88/90	600
VDB20-24D24W			±24	±417	86/88	300
VDB20-48S03W	48 (18-75)	80	3.3	5000/0	86/88	10000
VDB20-48S05W			5	4000/0	88/90	10000
VDB20-48S12W			12	1667/0	89/91	1600
VDB20-48S15W			15	1333/0	89/91	1000
VDB20-48S24W			24	833/0	89/91	500

Notes :

①Use “H” suffix for heat sink mounting, “E2S” suffix for chassis mounting and “D4S” suffix for DIN-Rail mounting. We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;

②The E2S and D4S Model’s start-up and minimum input voltages are increased by 1VDC due to the input reverse polarity protection circuit;

③Absolute maximum stress rating without damage (not recommended);

④t. Efficiency is measured at nominal input voltage and rated output load; efficiencies for E2S and D4S Model’s is decreased by 2% due to the input reverse polarity protection circui

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Specifications

Product Specifications	Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Specifications	Input Current (full load / no-load)	24VDC nominal input series	3.3V output	--	782/30	800/50	mA
			5V output	--	926/35	947/55	
			6V output	--	936/50	958/70	
			12V output	--	926/6	947/15	
			15V output	--	916/6	937/15	
			24V output	--	916/10	937/20	
			Others	--	958/10	/20	
		48VDC nominal input series, nominal input voltage	3.3V output	--	391/15	400/30	
			5V output	--	463/20	474/30	
			12V output	--	458/3	469/15	
			15V output	--	458/3	469/15	
			24V output	--	458/4	469/15	
	Reflected Ripple Current	Nominal input series		--	30	--	
	Surge Voltage (1sec. max.)	24VDC nominal input series		-0.7	--	50	VDC
		48VDC nominal input series		-0.7	--	100	
	Start-up Voltage	24VDC nominal input series		--	--	9	
		48VDC nominal input series		--	--	18	
	Under-voltage Protection	24VDC nominal input series		5.5	6.5	--	
		48VDC nominal input series		12	15.5	--	
	Start-up Time	Nominal input voltage & constant resistance load		--	10	--	ms
	Input Filter			Pi filter			
	Hot Plug			Unavailable			
	Remote ON/OFF ①	Module on		Ctrl pin open or pulled high (TTL 3.5-12VDC)			
		Module off		Ctrl pin pulled low to GND (0-1.2VDC)			
		Input current when off		--	2	7	mA
Output Specifications	Voltage Accuracy	0%-100% load		--	±1	±3	%
	Linear Regulation	Input voltage variation from low to high at full load		--	±0.2	±0.5	
	Load Regulation	5%-100% load		--	±0.5	±1	
	Transient Recovery Time	25% load step change, nominal input voltage	All	--	300	500	μs
	Transient Response Deviation		3.3V/ 5V/ 6V output	--	±5	±8	%
			Others	--	±3	±5	
	Temperature Coefficient	Full load		--	--	±0.03	%/°C
	Ripple & Noise②	20MHz bandwidth, 5%-100% load (Single output)		--	50	100	mV p-p
		20MHz bandwidth, 5%-100% load (Dual output)		--	100	200	mV p-p

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	Over-voltage Protection			110	--	160	
	Over-current Protection	Input voltage range		110	150	190	%Io
	Short-circuit Protection			Hiccup, continuous, self-recovery			
General Specifications	Isolation	Input-output Electric Strength Test for 1 minute with a leakage current of 1mA max.		1500	--	--	VDC
		Input/output-case Electric Strength Test for 1 minute with a leakage current of 1mA max.		1000	--	--	
	Insulation Resistance	Input-output resistance at 500VDC		1000	--	--	MΩ
	Isolation Capacitance	Input-output capacitance at 100kHz/0.1V		--	2000	--	pF
	Operating Temperature	See Fig. 1	3.3V/ 5V /6V output	-40	--	+95	℃
			Others	-40	--	+105	
	Storage Temperature			-55	--	+125	
	Storage Humidity	Non-condensing		5	--	95	%RH
	Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10 seconds		--	--	+300	℃
	Vibration			IEC/EN61373 - Category 1, Grade B			
	Switching Frequency③	PWM mode	3.3V/ 5V/ 6V output	--	300	--	kHz
			Others	--	270	--	
	MTBF	MIL-HDBK-217F@25℃		1000	--	--	k hours
Mechanical Specifications	Case Material	Aluminum alloy					
	Dimensions	Horizontal package (without heat sink)		25.40 × 25.40 × 11.70 mm			
		Horizontal package (with heat sink)		25.40 × 25.40 × 16.20 mm			
		E2S wiring package (without heat sink)		76.00 × 31.50 × 21.20 mm			
		E2S wiring package (with heat sink)		76.00 × 31.50 × 25.20 mm			
		D4S Din-rail package (without heat sink)		76.00 × 31.50 × 25.80 mm			
		D4S Din-rail package (with heat sink)		76.00 × 31.50 × 29.80 mm			
	Weight	without heat sink	Horizontal package/E2S wiring package/D4S Din-rail package	15.0g/38.0g/58.0g (Typ.)			
		with heat sink	Horizontal package/E2S wiring package/D4S Din-rail package	20.0g/40.0g/60.0g (Typ.)			
	Cooling method	Free air convection					

Note:

①The Ctrl pin voltage is referenced to input GND.

②Under 0% -5% load conditions, ripple & noise does not exceed 5%Vo. The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information.

③Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

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Electromagnetic Compatibility (EMC)

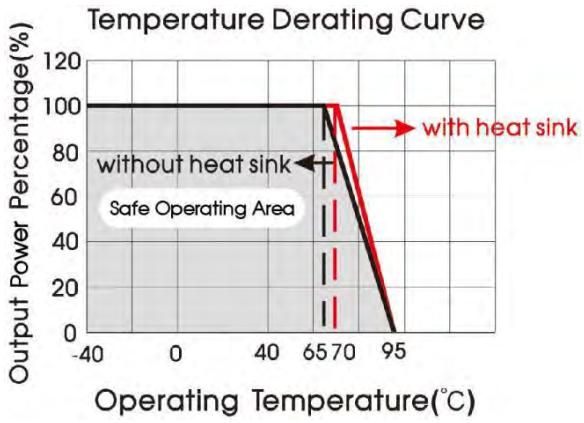
Emissions	CE	CISPR32/EN55032	CLASS B (see Fig.3-② for recommended circuit)
	RE	CISPR32/EN55032	CLASS B (see Fig.3-② for recommended circuit)
Immunity	ESD	IEC/EN61000-4-2 Contact ±6kV, Air ±8kV	perf. Criteria B
	RS	IEC/EN61000-4-3 10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4 ±2kV (see Fig.3-① for recommended circuit)	perf. Criteria A
	Surge	IEC/EN61000-4-5 line to line ±2kV (see Fig.3-①for recommended circuit)	perf. Criteria B
	CS	IEC/EN61000-4-6 3 Vr.m.s	perf. Criteria A

Electromagnetic Compatibility (EMC) (EN50155)

Emissions	CE	EN50121-3-2 150kHz-500kHz 99dBuV (see Fig.3-② for recommended circuit)	
		EN55016-2-1 500kHz-30MHz 93dBuV (see Fig.3-② for recommended circuit)	
	RE	EN50121-3-2 30MHz-230MHz 40dBuV/m at 10m (see Fig.3-② for recommended circuit)	
		EN55016-2-1 230MHz-1GHz 47dBuV/m at 10m (see Fig.3-② for recommended circuit)	
Immunity	ESD	EN50121-3-2 Contact ±6kV/Air ±8kV	perf. Criteria A
	RS	EN50121-3-2 20V/m	perf. Criteria A
	EFT	EN50121-3-2 ±2kV 5/50ns 5kHz (see Fig.3-① for recommended circuit)	perf. Criteria A
	Surge	EN50121-3-2 line to line ±1kV (42Ω, 0.5μF) (see Fig.3-① for recommended circuit)	perf. Criteria A
	CS	EN50121-3-2 0.15MHz-80MHz 10V r.m.s	perf. Criteria A

Typical Characteristic Curve

Nominal input voltage, 3.3V, 5V, 6V output



Nominal input voltage, 12V, 15V, 24V output

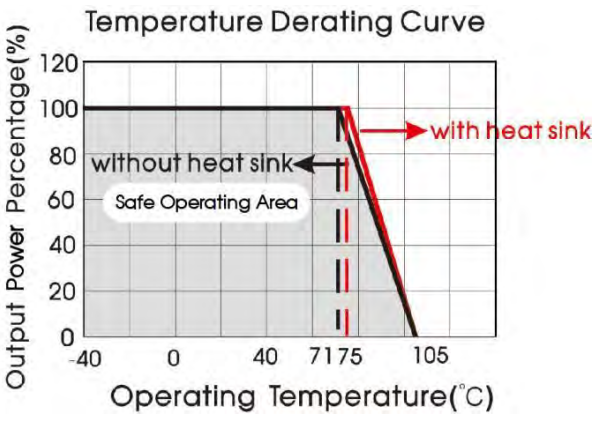


Fig. 1

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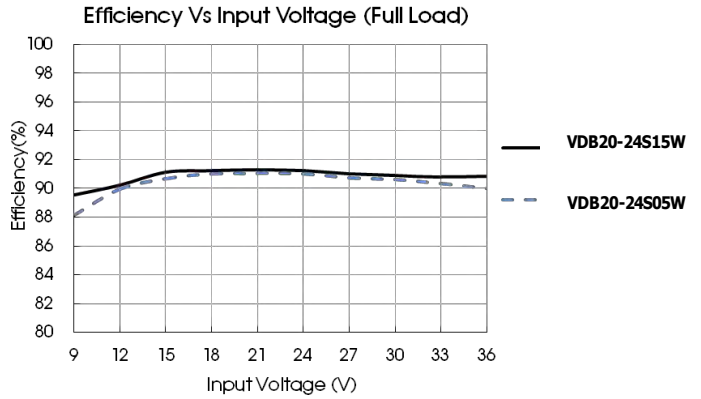

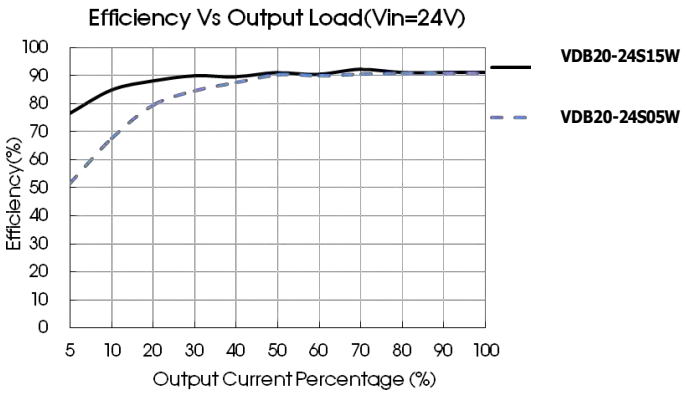

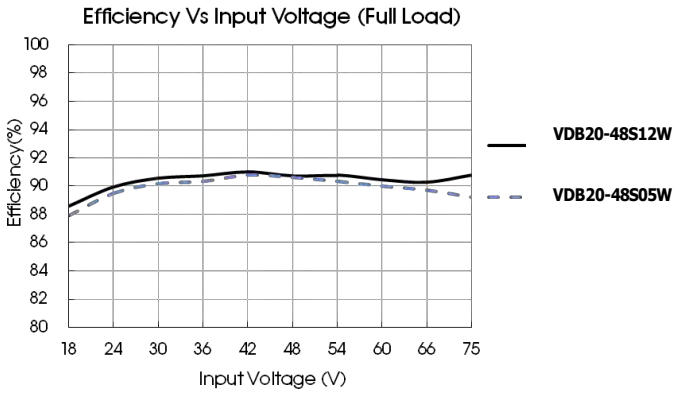

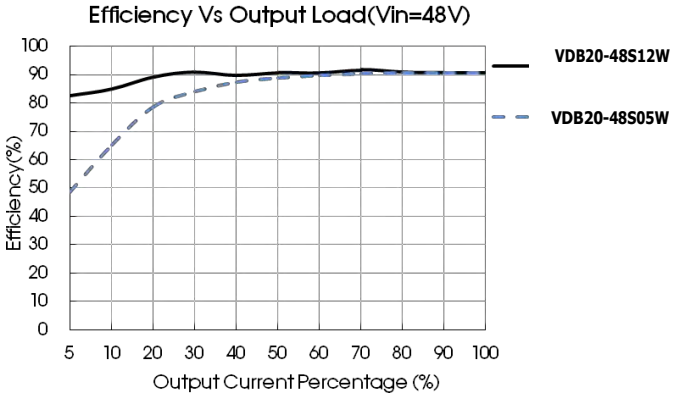

Design Reference

1. Typical application

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2.

Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.

Single Output

Vin (VDC)	Vout (VDC)	Cin	Cout
24	3.3/5/6	100μF/50V	100μF/16V
	12/15		100μF/25V
	24		47μF/50V
48	3.3/5	100μF/100V	100μF/16V
	12/15		100μF/25V
	24		47μF/50V

Dual Output

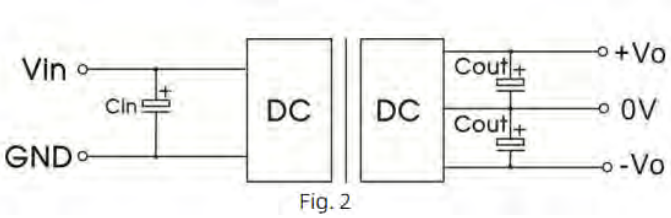

Fig. 2

Vin (VDC)	Vout (VDC)	Cin	Cout
24	±5	100μF/50V	10μF/16V
	±12/±15		10μF/25V
	±24		10μF/50V

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2. EMC compliance circuit

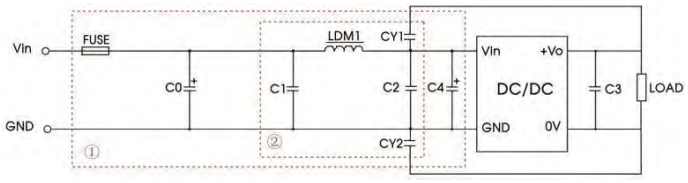


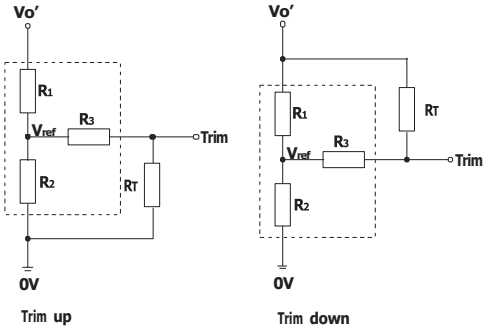
Fig. 3

Notes: We use Part ① in Fig. 3 for Immunity tests and Part ② for Emissions test. Selecting based on needs.

Parameter description:

Model	Vin: 24VDC	Vin: 48VDC
FUSE	Select fuse value according to actual input current	
C0, C4	330μF/50V	330μF/100V
C1, C2	4.7μF/50V	4.7μF/100V
C3	Refer to the Cout in Fig.2	
LDM1	2.2μH/4A	2.2μH/2A
CY1, CY2	1nF/2kV	

3. Trim Function for Output Voltage Adjustment (open if unused)



TRIM resistor connection (dashed line shows internal resistor network)

Calculating Trim resistor values:

$$\text{up: } R_T = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{Vref}{Vo' - Vref} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \qquad a = \frac{Vo' - Vref}{Vref} R_2$$

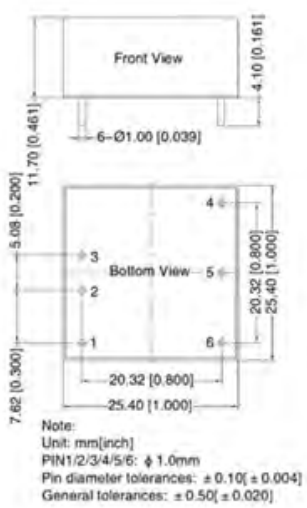
R_T = Trim Resistor value;

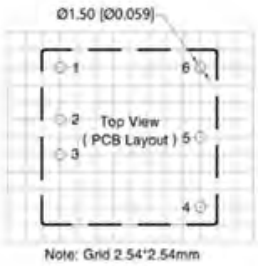
a = self-defined parameter;

Vout(V)	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)
3.3	4.775	2.87	15	1.25
5	2.894	2.87	10	2.5
6	4.064	2.87	10	2.5
12	11.000	2.87	17.4	2.5
15	14.494	2.87	17.4	2.5
24	24.872	2.87	20	2.5

4. The products do not support parallel connection of their output

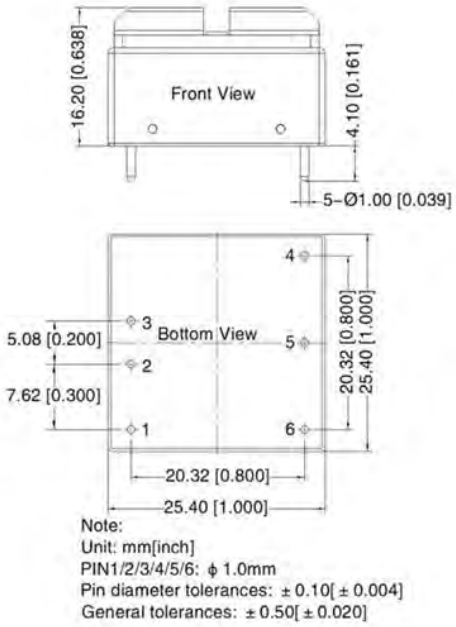
Horizontal Package (without heat sink) Dimensions and Recommended Layout

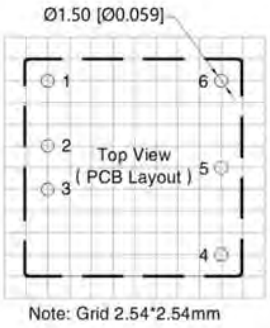




Pin-out						
PIN	1	2	3	4	5	6
Single	Ctrl	GND	Vin	+Vo	Trim	0V
Dual	Crtl	GND	Vin	+Vo	0V	-Vo

Horizontal Package (with heat sink) Dimensions





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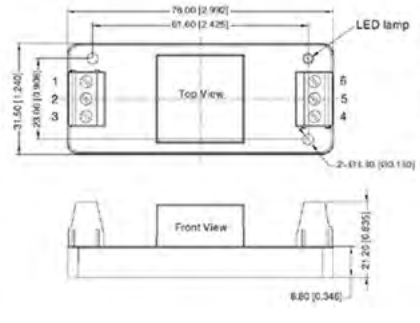
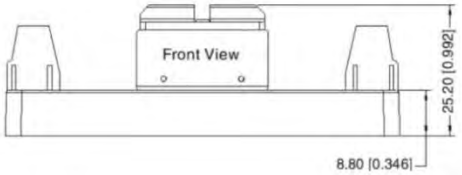
E2S without Heat Sink Dimensions



Pin-out						
PIN	1	2	3	4	5	6
Single	Ctrl	GND	Vin	+Vo	Trim	0V
Dual	Ctrl	GND	Vin	+Vo	0V	-Vo

Note:
Unit: mm[inch]
Wire range: 24–12 AWG
Tightening torque: Max 0.4 N • m
General tolerances: ± 1.00[± 0.039]

HE2S With Heat Sink Dimensions



Note:
Unit: mm[inch]
Wire range: 24–12 AWG
Tightening torque: Max 0.4 N • m
General tolerances: ± 1.00[± 0.039]

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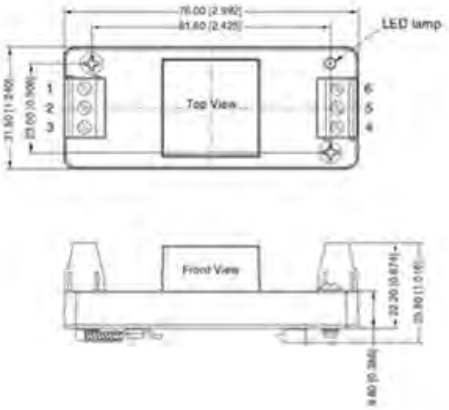
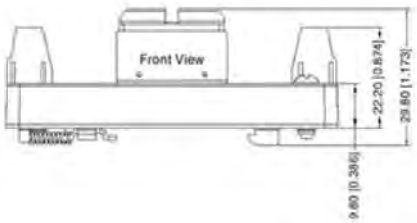
D4S Din Rail Without Heat Sink Dimensions



Pin-out						
PIN	1	2	3	4	5	6
Single	Ctrl	GND	Vin	+Vo	Trim	0V
Dual	Ctrl	GND	Vin	+Vo	0V	-Vo

Note:
Unit: mm[inch]
Mounting rail: TS35
Wire range: 24–12 AWG
Tightening torque: Max 0.4 N • m
General tolerances: ± 1.00[± 0.039]

HD4S Din Rail With Heat Sink Dimensions



Note:
Unit: mm[inch]
Mounting rail: TS35
Wire range: 24–12 AWG
Tightening torque: Max 0.4 N • m
General tolerances: ± 1.00[± 0.039]

Note:

1. The maximum capacitive load offered were tested at input voltage range and full load;
2. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
3. All index testing methods in this datasheet are based on company corporate standards;
4. We can provide product customization service, please contact our technicians directly for specific information;
5. Products are related to laws and regulations: see "Features" and "EMC";
6. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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