Descriptions

150W isolated，DC/DC Converter

RoHS

CE Report EN62368-1

UKCA Report BS EN62368

Features

- Ultra-wide input voltage range: 43-160VDC
- High efficiency up to 89%
- Low no-load power consumption
- Reinforced insulation, input - output isolation test voltage: 3k VAC, input - case isolation test voltage: 2.1k VAC
- Operating ambient temperature range: -40℃ to +105℃
- Input under-voltage protection, output short-circuit, over-current, over-voltage, over-temperature protection
- Industry standard 1/2 brick

Applications

- Railway systems

Selection Guide

Certification	Part No.①	Input Voltage (VDC)			Output		Full Load Efficiency (%) Min./Typ.	Max. Capacitive Load(μF)
		Nominal	Range	Max.②	Voltage (VDC)	Current (mA) Max./Min.		
EN/BS EN	DRWHB150-F1D05	110	43-66	170	5	19200/0	86/88	26400
			66-160			24000/0		33000
EN/BS EN	DRWHB150-F1D12		43-66		12	10000/0	87/89	10000
			66-160			12500/0		12500
EN/BS EN	DRWHB150-F1D15		43-66		15	8000/0	87/89	5400
			66-160			10000/0		6800
EN/BS EN	DRWHB150-F1D24		43-66		24	4375/0	87/89	3080
			66-160			6250/0		4400
--	DRWHB150-F1D36		43-66		36	3333/0	81/83	2200
			66-160			4167/0		2200
EN/BS EN	DRWHB150-F1D48		43-66		48	2496/0	86/88	800

			66-160			3120/0		1000

Note:

① Use "H" suffix for heat sink mounting," E5" suffix for chassis mounting. We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;

② Exceeding the maximum input voltage may cause permanent damage.

③The minimum input voltage and starting voltage of E5 Model are 1VDC higher than those of horizontal package due to input reverse polarity protection function.

④ Efficiencies for E5 Model's is decreased by 2% due to the input reverse polarity protection function.

Specifications

Product Specifications	Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Specifications	Input Current (full load / no-load)	Nominal input voltage	5VDC output	--	1240/25	1586/45	mA
			12VDC, 15VDC output	--	1533/25	1568/45	
			24VDC output	--	1516/25	1550/45	
			36VDC output	--	1663/25	1683/45	
			48VDC output	--	1548/25	1584/45	
	Reflected Ripple Current	Nominal input voltage		--	100	--	
	Surge Voltage (1sec. max.)			-0.7	--	180	VDC
	Start-up Voltage			--	--	43	
	Under-voltage Protection			--	40	--	
	Input Filter			Pi filter			
	Hot Plug			Unavailable			
	Ctrl①	Module on		Ctrl pin open or pulled high (3.5-12VDC)			
		Module off		Ctrl pin -Vin or pulled low (0-1.2VDC)			
		Input current when off		--	2	8	mA
Output Specifications	Voltage Accuracy	Nominal input voltage, 0%-100% load		--	±1	±3	%
	Linear Regulation	Input voltage variation from low to high at full load		--	±0.1	±0.3	
	Load Regulation	Nominal input voltage, 0%-100% load		--	±0.3	±0.5	
	Transient Recovery Time	25% load step change, nominal input voltage		--	200	500	μs
	Transient Response Deviation		5VDC output	--	--	±10	%
			Others	--	±3	±5	
	Temperature Coefficient	Full load		--	--	±0.03	%/℃
	Ripple & Noise	20MHz bandwidth, 10%-100%Io load	36VDC output	--	--	500	mVp-p
			48VDC output	--	200	300	
			Others	--	100	200	
	Trim			90	--	110	%
	Output Voltage Remote Compensation (sense)			--	--	105	
	Over-temperature Protection	Maximum surface temperature of the product.		--	105	115	℃
	Over-voltage Protection	Input voltage range	5VDC output	110	--	160	%Vo
			Others	110	--	140	
	Over-current Protection	Input voltage range		110	140	190	%Io
	Short-circuit Protection			Hiccup, continuous, self-recovery			
General	Isolation	Input-output	Electric Strength test for 1	3000	--	--	VAC

Specifications		Input-case	minute with a leakage current of 5mA max.	2100	--	--	
		Output-case	Electric Strength test for 1 minute with a leakage current of 1mA max.	1500	--	--	VDC
	Insulation Resistance	Input-output resistance at 500VDC		1000	--	--	MΩ
	Isolation Capacitance	Input-output capacitance at 100kHz/0.1V		--	2200	--	pF
	Switching Frequency	PFM mode		--	170	--	kHz
	MTBF	MIL-HDBK-217F@25℃		500	--	--	k hours
	Operating Temperature Range	According to the operating temperature range		-40	--	+105	℃
	Storage Humidity	Non-condensing		5	--	95	%RH
	Storage Temperature			-55	--	+125	℃
	Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10 seconds		--	--	+300	
	Thermal Resistance	DRWHB150-F1D05 DRWHB150-F1D12 DRWHB150-F1D24 DRWHB150-F1D36 DRWHB150-F1D48	100LFM	4.3	--	--	℃/W
			200LFM	2.8	--	--	
		DRWHB150-F1D05H	Natural convection	3.5	--	--	
			100LFM				
		DRWHB150-F1D12H DRWHB150-F1D15H	Natural convection	3.4	--	--	
		DRWHB150-F1D24H DRWHB150-F1D36H DRWHB150-F1D48H	100LFM	2.8	--	--	
	Shock and Vibration Test			IEC/EN61373 - Category 1, Grade B			
Mechanical Specifications	Case Material	Black plastic; flame-retardant and heat-resistant (UL94-V0) & Aluminum alloy case					
	Dimensions	DRWHB150-F1Dxx		61.00 × 58.00 × 13.80mm			
		DRWHB150-F1DxxH		62.00 × 58.00 × 31.80mm			
		DRWHB150-F1DxxE5		135.00 × 70.00 × 22.40mm			
		DRWHB150-F1DXXHE5		135.00 × 70.00 × 40.40mm			
	Weight	DRWHB150-F1Dxx		139.0g(Typ.)			
		DRWHB150-F1DxxH		194.0g(Typ.)			
		DRWHB150-F1DxxE5		219.0g(Typ.)			
		DRWHB150-F1DXXHE5		274.0g(Typ.)			
	Cooling Method	Free air convection or forced convection					

Note: ①The Ctrl pin voltage is referenced to input -Vin.

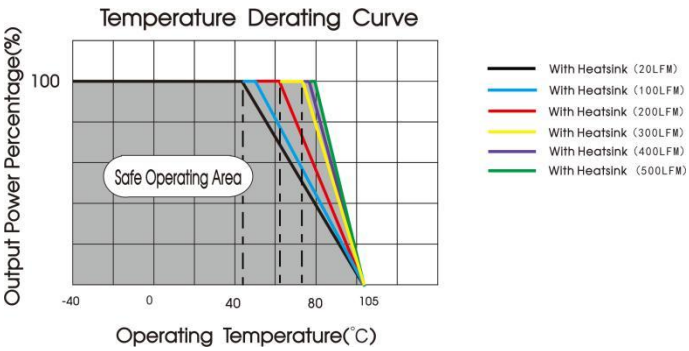
Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032 150kHz-30MHz Class B (see Fig. 3 for recommended circuit)	
	RE*	CISPR32/EN55032 30MHz-1GHz Class B (see Fig. 3 for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2 GB/T17626.2 Contact ±6kV, Air ±8kV	perf.Criteria A
	RS	IEC/EN61000-4-3 GB/T17626.3 20V/m	perf.Criteria A
	CS	IEC/EN61000-4-6 GB/T17626.6 10Vr.m.s	perf.Criteria A
	EFT	IEC/EN61000-4-4 GB/T17626.4 ±2kV (5kHz, 100kHz) (see Fig. 3 for recommended circuit)	perf.Criteria A
	Surge	IEC/EN61000-4-5 GB/T17626.5 line to line ±2kV (1.2μs/50μs 2Ω) (see Fig. 3 for recommended circuit)	perf.Criteria A
Note: *The standard only suit for DRWHB150-F1Dxx series (without heatsink).			

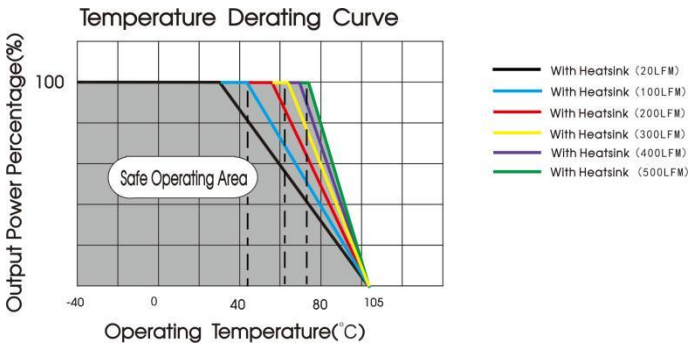
Electromagnetic Compatibility (EMC) (EN50155)

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

Typical Characteristic Curves

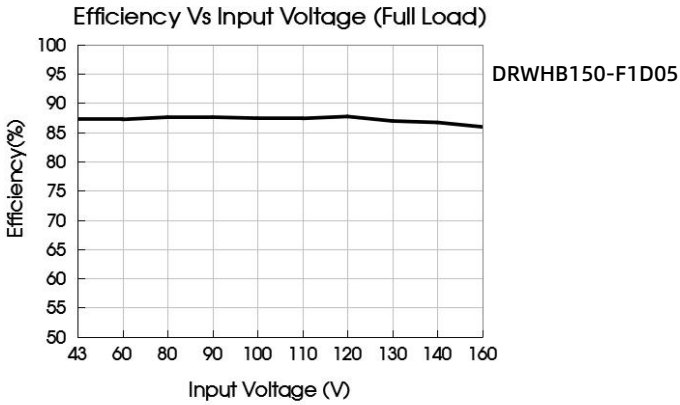


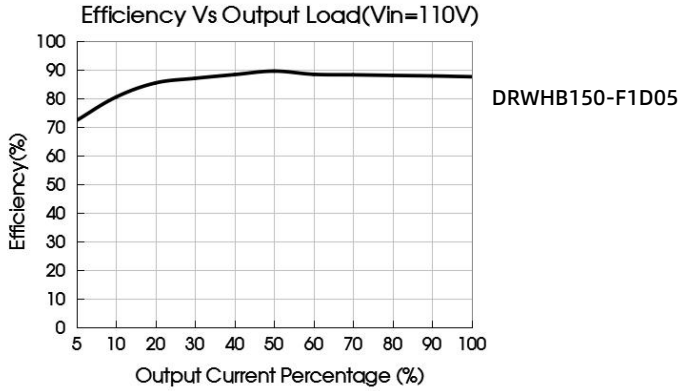
DRWHB150-F1D05H temperature derating curve (Vin=110V)

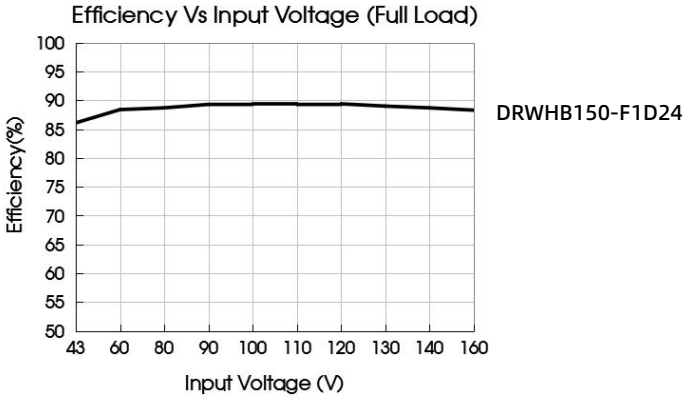


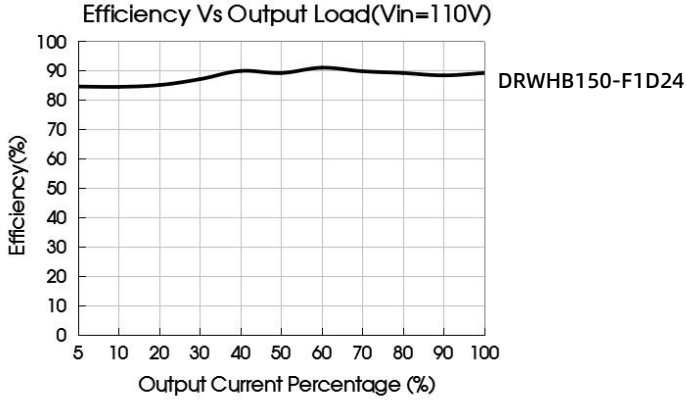
DRWHB150-F1D48H temperature derating curve (Vin=110V)

Notes: Temperature derating curves and efficiency curves are typical test values.



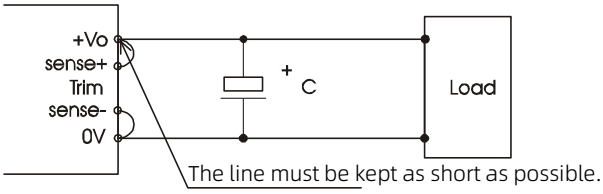






Remote Sense Application

1. Remote Sense Connection if not used

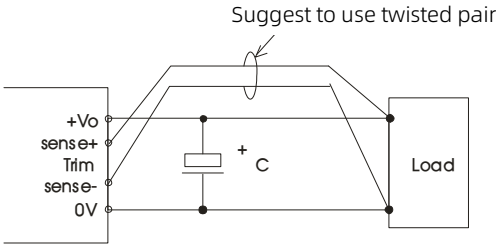


Notes:

①If the sense function is not used for remote regulation the user must connect the +Sense to + Vo and -Sense to 0V at the DC-DC converter pins and will compensate for voltage drop across pins only;

②The connections between Sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

2. Remote Sense Connection used for Compensation



Notes:

1. Using remote sense with long wires may cause unstable output, please contact technical support if long wires must be used;
2. If using remote compensation, please use twisted pair or shielded wire, and keep the leads as short as possible;
3. We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range;
4. Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple. Consult technical support or factory for further advice of sense operation.

Design Reference

1. Ripple & Noise

All the DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 1.

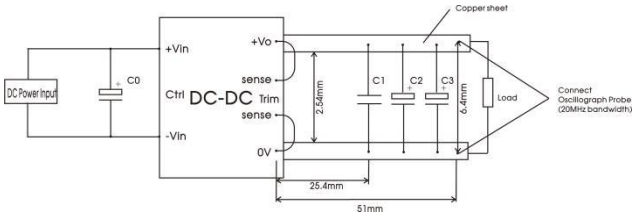


Fig. 1

Capacitors value / Output voltage	C0(μF)	C1(μF)	C2(μF)	C3(μF)
5VDC	100μF /200V	1μF/16V	10μF/16V	330μF/16V
12VDC		1μF/25V	10μF/25V	330μF/25V
15VDC		1μF/25V	10μF/25V	330μF/25V
24VDC		1μF/50V	10μF/50V	330μF/50V
36VDC		1μF/100V	10μF/100V	330μF/100V
48VDC		1μF/100V	10μF/100V	330μF/100V

Note: E5 package does not need C0 capacitor.

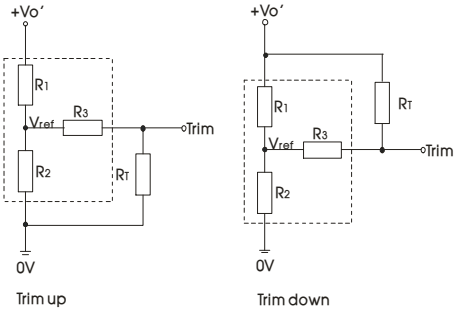
2. Typical application

We recommended using EMC circuit, otherwise please ensure that at least a 100μF electrolytic capacitors is connected at the input in order to ensure adequate voltage surge suppression and protection.

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.

capacitor value / Output Voltage	Cin(μF)	Cout(μF)
5VDC	100μF/200V	330μF/16V
12VDC		330μF/25V
15VDC		330μF/25V
24VDC		330μF/50V
36VDC		330μF/100V
48VDC		330μF/100V

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



TRIM resistor connection (dashed line shows internal resistor network)

Trim resistor calculation:

$$\text{up:}\quad R_T=\frac{aR_2}{R_2-a}-R_3 \qquad a=\frac{V_{ref}}{V_o'-V_{ref}}\cdot R_1$$

$$\text{down:}\quad R_T=\frac{aR_1}{R_1-a}-R_3 \qquad a=\frac{V_o'-V_{ref}}{V_{ref}}\cdot R_2$$

Table1

Vo / resistance	5(VDC)	12(VDC)	15(VDC)	24(VDC)	36(VDC)	48(VDC)
R1(kΩ)	2.87	11	14.49	24.87	38.41	58.69
R2(kΩ)	2.87	2.87	2.87	2.87	2.86	3.21
R3(kΩ)	4	11	16	21	15	7.89
Vref(V)	2.5	2.5	2.5	2.5	2.5	2.5

Note: Value for R1, R2, R3, and Vref refer to the above table 1. RT: Resistance of Trim. a: User-defined parameter, no actual meanings. Vo': The trim up/down voltage.

4. EMC compliance circuit

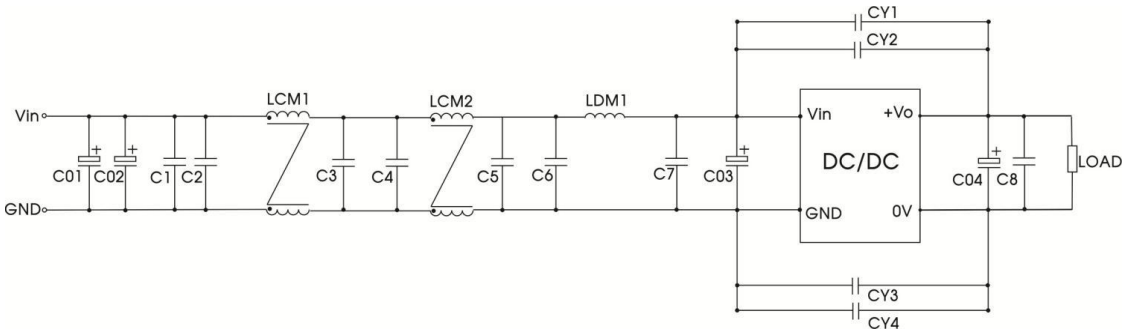


Fig.2

Components	Value
C01, C02, C03	220uF/200V
C04	220uF/63V
LDM1	1.5uH(Shielded inductor)
C1, C2, C3, C4, C5, C6, C7, C8, C9	2.2uF/250V
CY1, CY2, CY3, CY4	2200 pF /400VAC
LCM1	4700*2uH,3A
LCM2	1000*2μH,3A

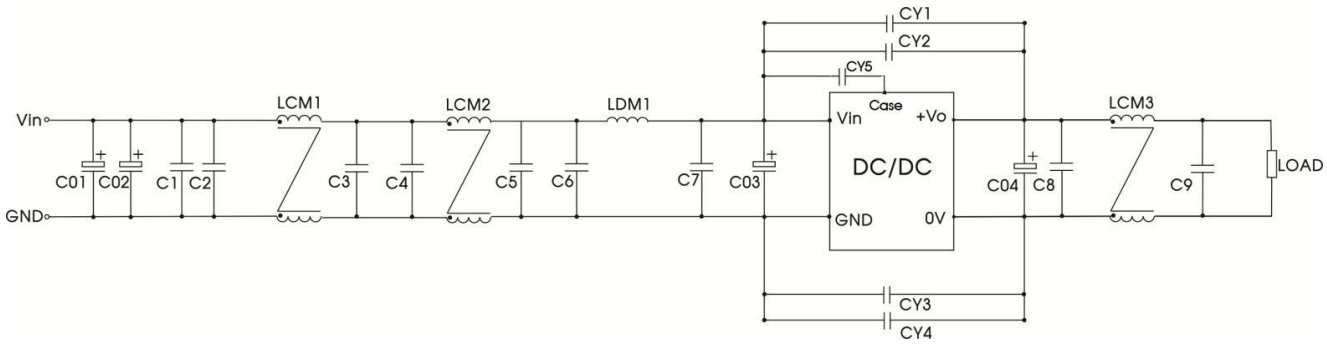
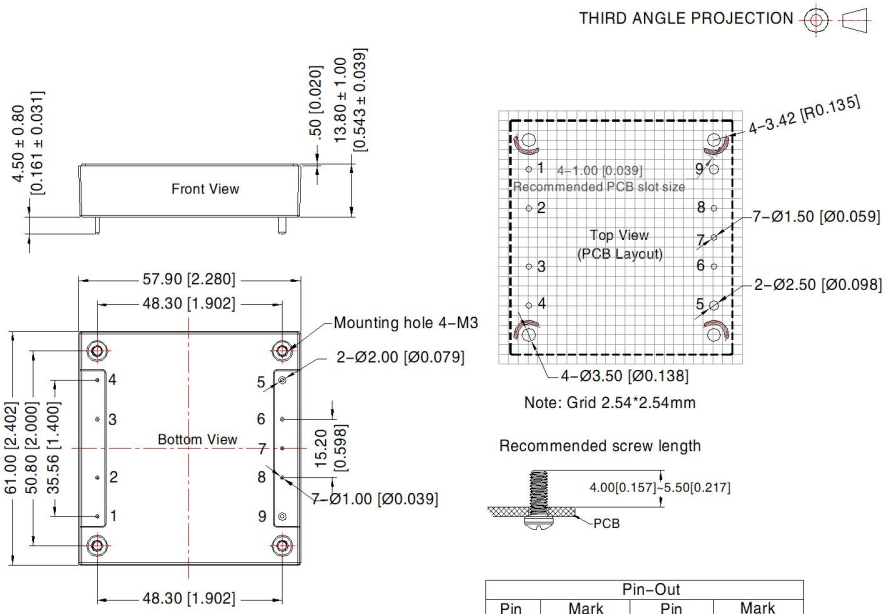


Fig.3

C01、C02、C03	220uF/200V
C04	220uF/63V
LDM1	1.5uH(Shielded inductor)
C1, C2, C3, C4, C5, C6, C7, C8	2.2uF/250V
CY1, CY2, CY3, CY4	2200 pF /400VAC(Y safety capacitor)
LCM1	4700*2uH,3A
LCM2	1000*2μH,3A
LCM3	36*2μH (7A max.)
	36*2μH (13A max.)
	36*2μH (25A max.)

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

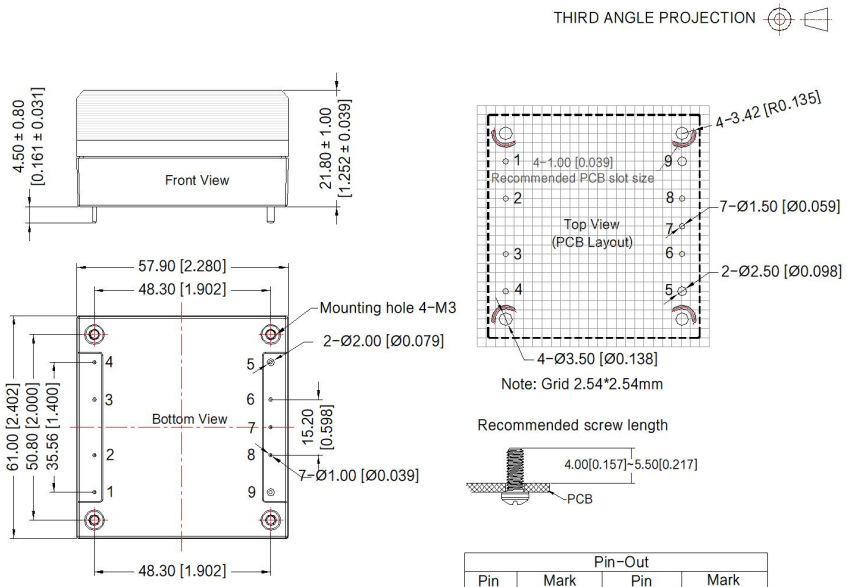
DRWHB150-F1Dxx Dimensions and Recommended Layout



Note:
Unit: mm[inch]
Pin1,2,3,4,6,7,8's diameter: 1.00[0.039]
Pin5,9's diameter: 2.00[0.079]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
Mounting hole screwing torque: Max 0.4 N.m

Pin-Out			
Pin	Mark	Pin	Mark
1	+Vin	6	Sense-
2	Ctrl	7	Trim
3	Case	8	Sense+
4	-Vin	9	+Vo
5	0V		

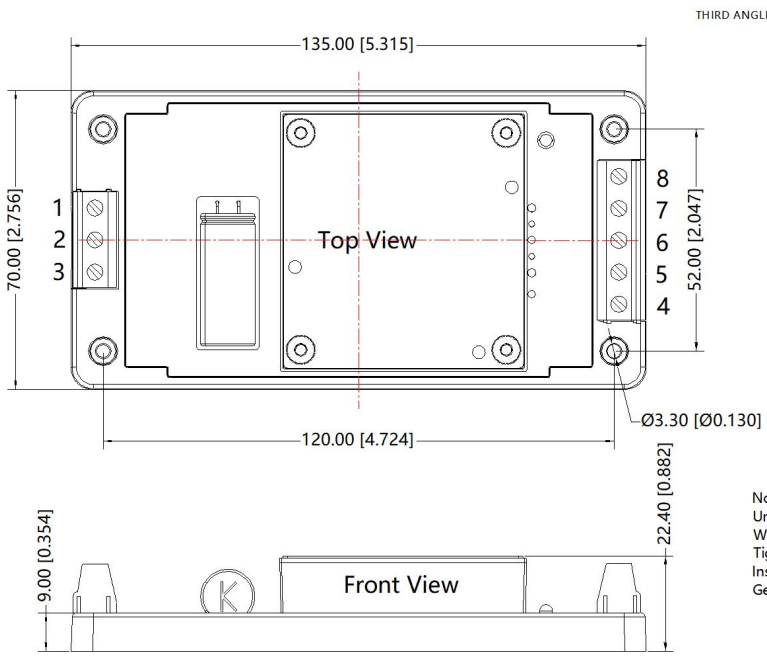
DRWHB150-F1DxxH Dimensions and Recommended Layout



Note:
Unit: mm[inch]
Pin1,2,3,4,6,7,8's diameter: 1.00[0.039]
Pin5,9's diameter: 2.00[0.079]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
Mounting hole screwing torque: Max 0.4 N.m

Pin-Out			
Pin	Mark	Pin	Mark
1	+Vin	6	Sense-
2	Ctrl	7	Trim
3	Case	8	Sense+
4	-Vin	9	+Vo
5	0V		

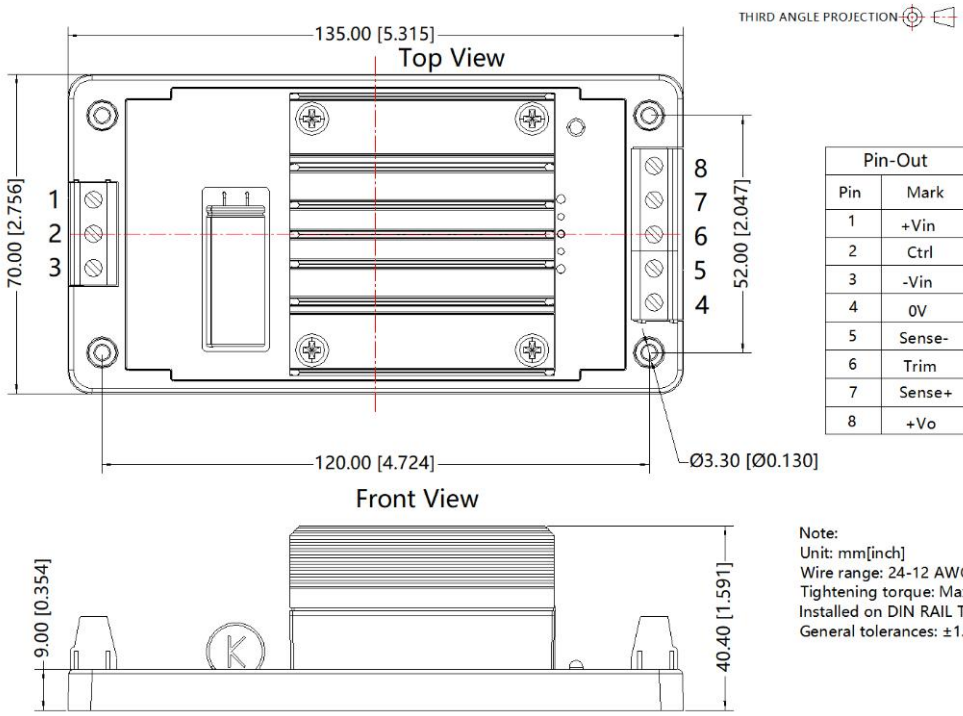
DRWHB150-F1DxxE5 Dimensions



Pin-Out	
Pin	Mark
1	+Vin
2	Ctrl
3	-Vin
4	0V
5	Sense-
6	Trim
7	Sense+
8	+Vo

Note:
Unit: mm[inch]
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N·m
Installed on DIN RAIL TS35
General tolerances: ±1.00[±0.039]

DRWHB150-F1DxxHE5 Dimensions



Pin-Out	
Pin	Mark
1	+Vin
2	Ctrl
3	-Vin
4	0V
5	Sense-
6	Trim
7	Sense+
8	+Vo

Note:
Unit: mm[inch]
Wire range: 24-12 AWG
Tightening torque: Max 0.4 N·m
Installed on DIN RAIL TS35
General tolerances: ±1.00[±0.039]

Note:

1. Recommend to use module with more than 5% load, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. It is suggested to take our recommended circuit for EMC testing. If the customer needs to meet the performance of the surge and without taking recommended solution of ours, please make sure the residual voltage of surge less than 180V;
4. It is suggested that customers use enamel film or thermal grease between the heat sink and the module when using the heat sink to ensure good heat dissipation;
5. 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;
6. All index testing methods in this datasheet are based on company corporate standards;
7. We can provide customized and matched filter modules. For details, please contact our technical staff;
8. Products are related to laws and regulations: see "Features" and "EMC";
9. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.