RHENXV
Your Vision, Our Solutions

DC - DC CONVERTERS

50 WATTS

DCWF1DxxQB-50W

FEATURES

- Low no-load power consumption
- Input under-voltage protection, output short-circuit, over-current, over-voltage, over-temperature protection
- Industry standard 1/4 brick
- High efficiency up to 89%
- Ultra-wide input voltage range: 43-160VDC
- Operating ambient temperature range: -40°C to +105°C
- Reinforced insulation, input - output isolation test voltage: 3k VAC, input - case isolation test voltage: 2.1k VAC

Applications

- Railway systems

MODEL NUMBERING

DCWF1DxxQB-50W

- Series Name
- Wide Input
- Output Voltage
- Rated Wattage
- Packaging Form

SELECTION GUIDE

Product Model	Input Voltage Range (Nominal/Max)	Output Voltage	Output Current (mA) (Max./Min.)	Efficiency % (Min./Typ.)	Maximum Capacative load (μF)
DCWF1D03QB-50W	43-160 (110/170)	3.3	11364/0	82/86	20000
DCWF1D05QB-50W		5	10000/0	83/87	10000
DCWF1D12QB-50W		12	4167/0	84/88	3000
DCWF1D15QB-50W		15	3333/0	84/88	2350
DCWF1D24QB-50W		24	2083/0	85/89	1500
DCWF1D48QB-50W		48	1041/0	83/87	240

Note: *Use suffix “ST” for chassis mounting, suffix “H” for heatsink and suffix “DR” for DIN-Rail mounting

INPUT CHARACTERISTICS

Parameter	Operating Conditions	Min.	Typ.	Max.	Units
Input Current (Rated load)	Nominal voltage input 3.3VDC	--	397	406	mA
	Nominal voltage input 24VDC	--	511	523	mA
	Nominal voltage input 12, 15VDC	--	517	529	mA
	Nominal voltage input 5, 48VDC	--	523	535	mA
Input Current (No load)	Nominal voltage input 3.3VDC		10	20	mA
	Nominal voltage input 24VDC	--	10	20	mA
	Nominal voltage input 12, 15VDC	--	10	20	mA
	Nominal voltage input 5, 48VDC	--	10	20	mA
Reflected Ripple Current	Nominal input voltage	--	50	--	mA
Input impulse voltage (1sec. max.)		-0.7	--	180	VDC
Starting Voltage		--	--	43	VDC
Under-voltage Protection		--	40	--	VDC
Input Filter		Pi filter			
Ctrl*	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	10	mA

OUTPUT CHARACTERISTICS

Parameter	Operating Conditions		Min.	Typ.	Max.	Units
Voltage Accuracy Rate	Nominal input voltage, 0%-100% load		--	±1	±3	%
Line Regulation Rate	Input voltage variation from low to high at full load	3.3VDC, 5VDC output	--	--	±0.5	%
		Others	--	±0.1	±0.3	%
Load Regulation Rate	Nominal input voltage, 10%-100% load	3.3VDC, 5VDC output	--	±0.5	±1.0	%
		Others	--	±0.3	±0.5	%

Parameter	Operating Conditions		Min.	Typ.	Max.	Units
Dynamic Response Recovery Time			--	200	500	μs
Dynamic Response Step Deviation	25% load step change	3.3VDC, 5VDC output	--	±6	±9	%
		Others	--	±3	±5	%
Temperature Drift Coefficient	Full load		--	--	±0.03	%/°C
Trim			90	--	110	%
Ripple & Noise	20MHz bandwidth, 10%Io-100%Io load	48VDC output	--	200	300	mVp-p
		Others	--	100	200	mVp-p
Output Voltage Remote Compensation (Sense)			--	--	105	%
Over Voltage Protection	Input Voltage Range	3.3VDC, 5VDC output	110	--	160	%Vo
		Others	110	--	140	%Vo
Over Temperature Protection	Surface Max. Temperature		--	105	115	°C
Over Current Protection	Input Voltage Range		110	140	190	%Io
Short Circuit Protection			Hiccup, continuous, self-recovery			

GENERAL CHARACTERISTICS

Parameter	Operating Conditions		Min.	Typ.	Max.	Units
Isolation	Input-output	Electric Strength test for 1 minute with a leakage current of 5mA max.	3000	--	--	VAC
	Input-case		2100	--	--	VAC
	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°C		500	--	--	K hours
Working Temperature	See temperature derating curves		-40	--	+105	°C
Storage Humidity	Non-condensing		5		95	%RH

Parameter	Operating Conditions	Min.	Typ.	Max.	Units
Storage Temperature		-55	--	+125	°C
Soldering Temperature Resistance of Pins	The distance from the welding spot to the shell is 1.5mm, 10seconds	--	--	+300	°C
Cooling Test		EN60068-2-1			
Dry Heat		EN60068-2-2			
Damp Heat		EN60068-2-30			
Shock and Vibration Test		IEC/EN61373 - Category 1, Grade B			

EMC CHARACTERISTICS

	Parameter	Category	Content	
EMI	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)	
EMS	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
	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 fo recommended circuit)	perf. Criteria A
	CS	IEC/EN61000-4-6 GB/T17626.6	10Vr.m.s	perf. Criteria A

Note: *The standard only suit for DCWF1D_QB-50W series (without heatsink)

EMC CHARACTERISTICS (EN50155)

	Parameter	Category	Content	
EMI	CE	EN50121-3-2 EN55016-2-1	150kHz-500kHz 99dBuV (see Fig.2 for recommended circuit) 500kHz-30MHz 93dBuV (see Fig.2 for recommended circuit)	
	RE	EN50121-3-2 EN55016-2-1	30MHz-230MHz 40dBuV/m at 10m(see Fig.2 for recommended circuit) 230MHz-1GHz 47dBuV/m at 10m (see Fig. 2 for recommended circuit)	
EMS	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

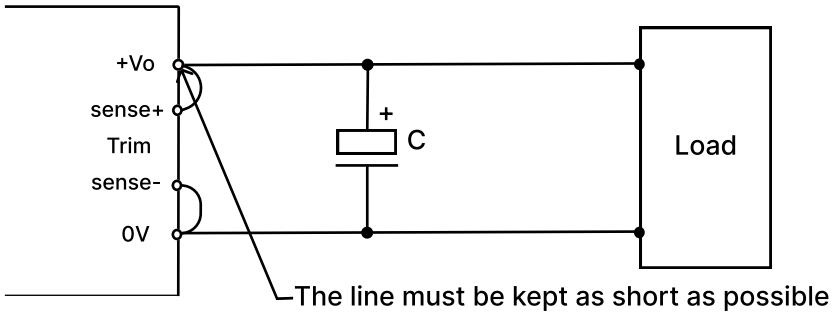
PHYSICAL CHARACTERISTICS

Parameter	Conditions	
Case Material	Aluminum alloy case; Black plastic bottom, flame-retardant and heat-resistant (UL94 V-0)	
Dimensions	DCWF1DxxQB-50W	60.80 × 39.20 × 12.70 mm
	DCWF1DxxQB-50WH	61.50 × 39.20 × 27.70 mm
	DCWF1DxxQB-50WST	135.00 × 70.00 × 22.60 mm
	DCWF1DxxQB-50WDR	137.00 × 70.00 × 28.10 mm
	DCWF1DxxQB-50WHST	135.00 × 70.00 × 36.20 mm
	DCWF1DxxQB-50WHDR	137.00 × 70.00 × 41.70 mm
Weight	DCWF1DxxQB-50W	88.0g (Typ.)
	DCWF1DxxQB-50WH	119.0g (Typ.)
	DCWF1DxxQB-50WST	164.0g (Typ.)
	DCWF1DxxQB-50WDR	237.0g (Typ.)
	DCWF1DxxQB-50WHST	200.0g (Typ.)
	DCWF1DxxQB-50WHDR	268.0g (Typ.)
Cooling Method	Free air convection or forced convection	

CIRCUIT DESIGN AND APPLICATION

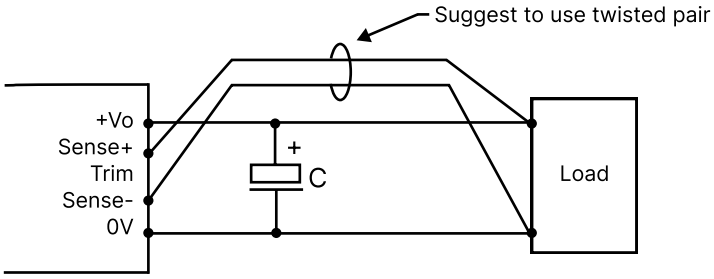
1. Remote Sense Application

1. Remote Sense Connection if not used



Notes：
1. If 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.
2. The 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. PCB-tracks or cables/wires for Remote Sense must be kept as short as possible. Twisted pair or shielded wires are suggested for remote compensation and must be kept 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.

1. Ripple & noise

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

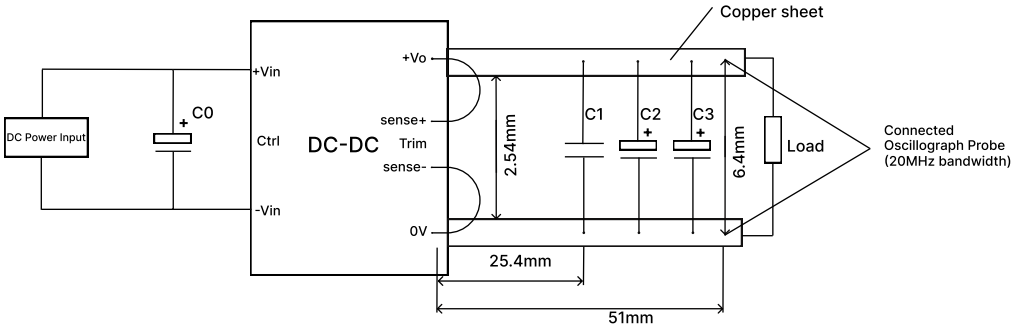


Fig.1

Capacitors Output Voltage Value	C0(μF)	C1(μF)	C2(μF)	C3(μF)
3.3VDC	100	1	10	1000
5VDC				680
12VDC				220
15VDC				220
24VDC				220
48VDC				220

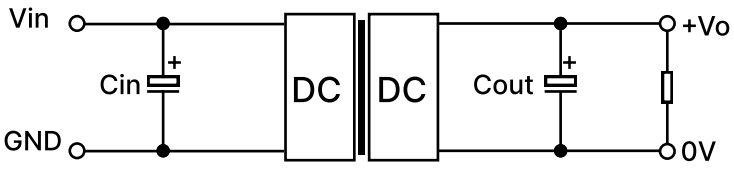


Figure 2: Application circuit

Output voltage	Cin (μF)	Cout (μF)
3.3VDC	100	1000
5VDC		680
12VDC		220
15VDC		220
24VDC		220
48VDC		220

3. EMC compliance recommended circuit

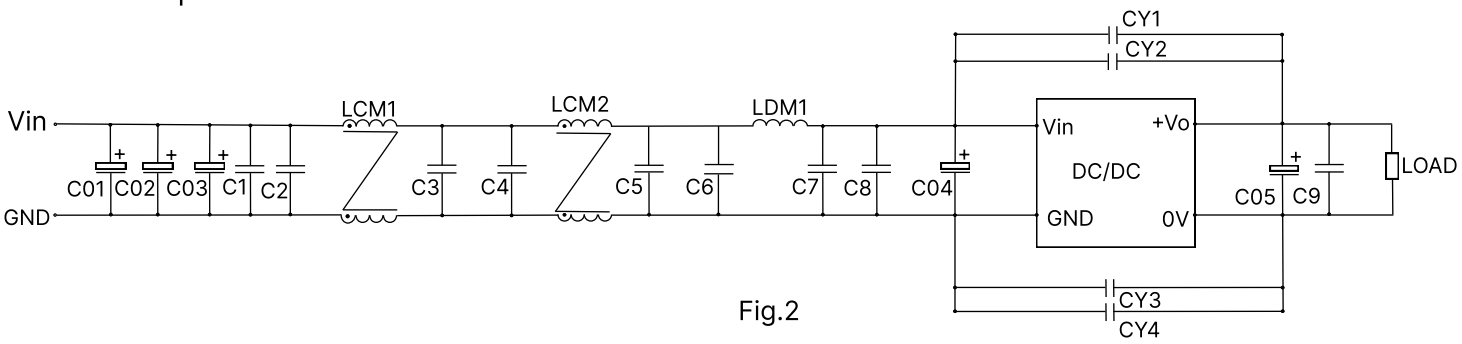


Fig.2

Components	Value
C01, C02, C03, C04	220uF/200V (electrolytic capacitor)
C05	220uF/63V (electrolytic capacitor)
LDM1	1.5uH (Shielded inductor)
C1, C2, C3, C4, C5, C6, C7, C8, C9	2.2uF/250V
CY1, CY2, CY3, CY4	2200 pF /400VAC (Y safety capacitor)
LCM1	3A MAX 4700*2μH
LCM2	3A MAX 2000*2μH

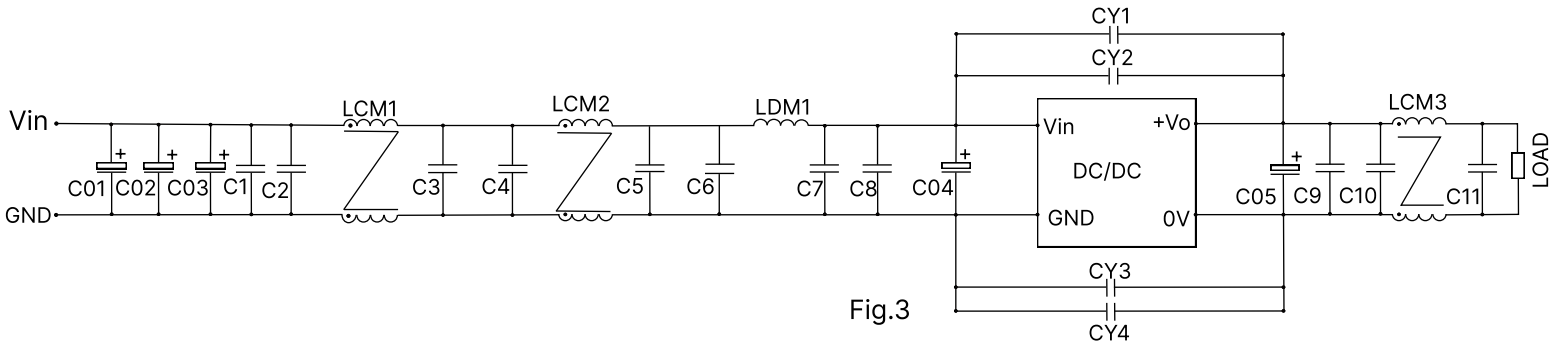
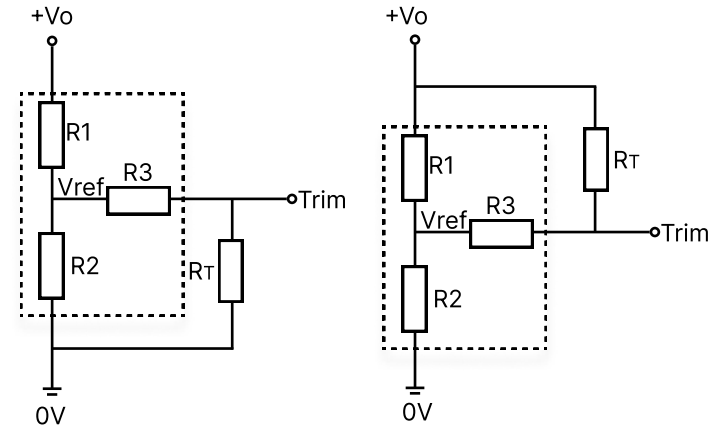


Fig.3

Components	Value
C01, C02, C03, C04	220uF/200V (electrolytic capacitor)
C05	220uF/63V (electrolytic capacitor)
LDM1	1.5uH (Shielded inductor)
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11	2.2uF/250V
CY1, CY2, CY3, CY4	2200 pF /400VAC (Y safety capacitor)
LCM1	3A MAX 4700*2μH
LCM2	3A MAX 2000*2μH
LCM3	36*2（μH）/7A
	36*2（μH）/13A
	36*2（μH）/25A

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



Trim up　　Trim Down

TRIM resistor connection
(dashed line shows internal resistor network)

The Calculation formula for trip resistance

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

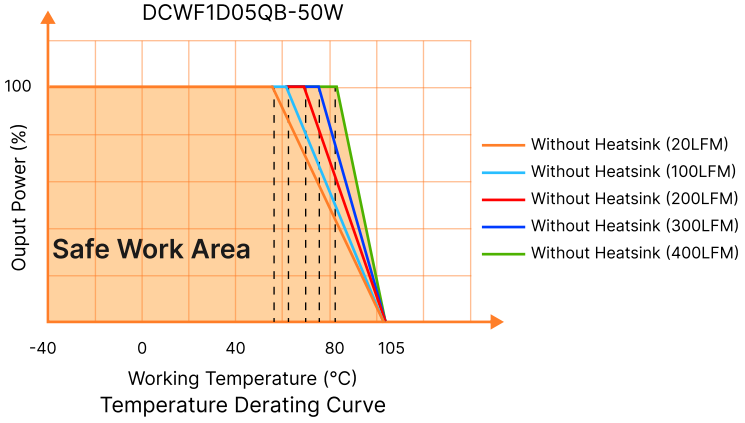
Trim down: $R_T \frac{aR_1}{R_1-a} - R_3$　　$a = \frac{Vo'-Vref}{Vref} R_2$

Note：.
For R1, R2, R3 and Vref values refer to table 1.
RT = Trim Resistor value; .a = self-defined parameter
Vo'= desired output voltage

Vout(V)	3.3(VDC)	5(VDC)	12(VDC)	15(VDC)	24(VDC)	48(VDC)
R1(KΩ)	4.74	8.74	11	14.49	24.87	58.7
R2(KΩ)	2.87	2.87	2.87	2.87	2.87	3.21
R3(KΩ)	9.66	11	11	16	21	11
Vref(V)	1.25	1.25	2.5	2.5	2.5	2.5

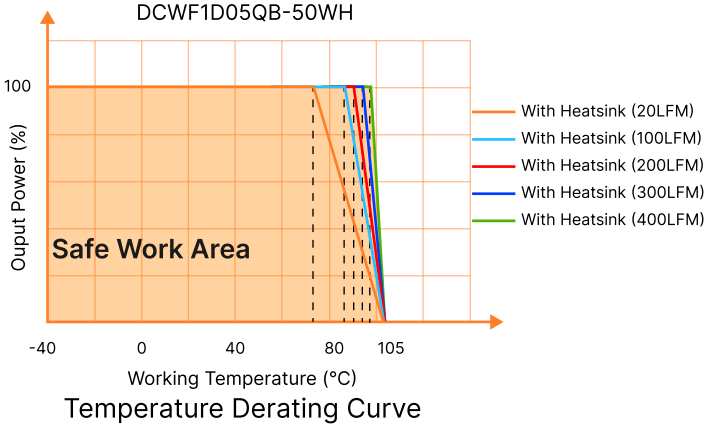
PRODUCT CHARACTERISTIC CURVE

DCWF1D05QB-50W



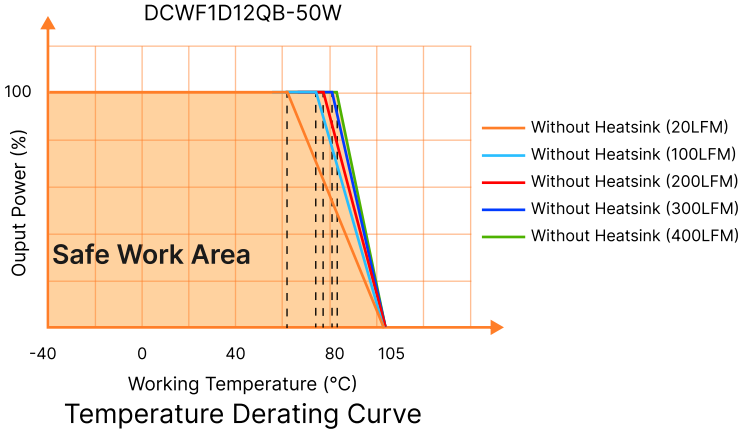
Temperature Derating Curve

DCWF1D05QB-50WH



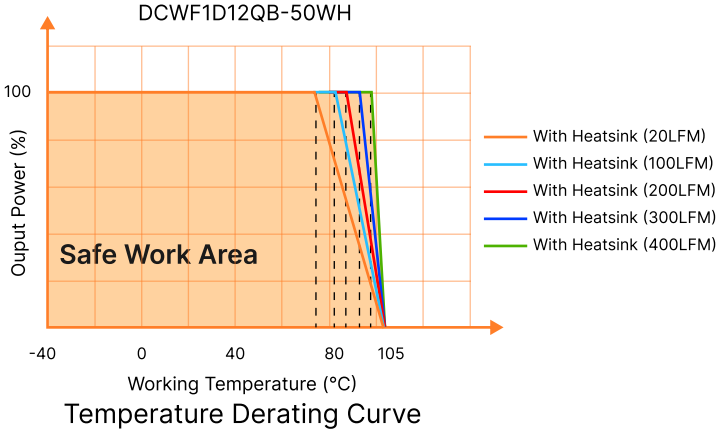
Temperature Derating Curve

DCWF1D12QB-50W

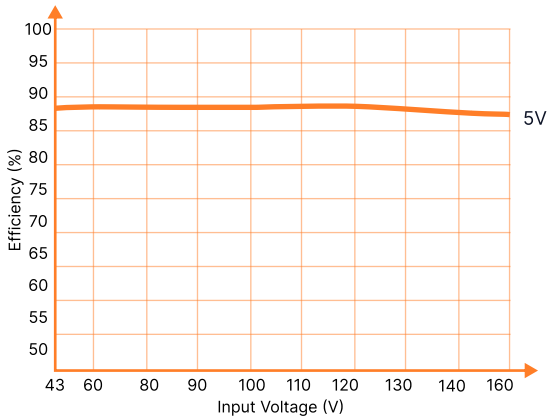


Temperature Derating Curve

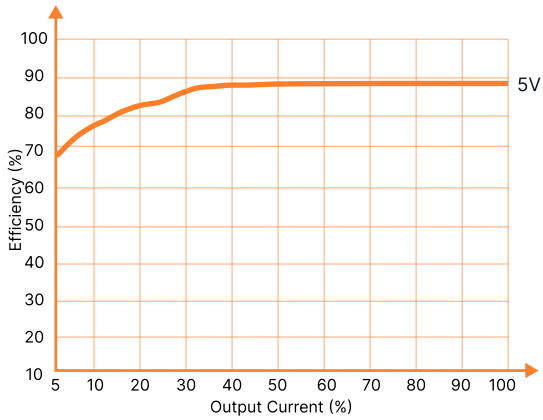
DCWF1D12QB-50WH



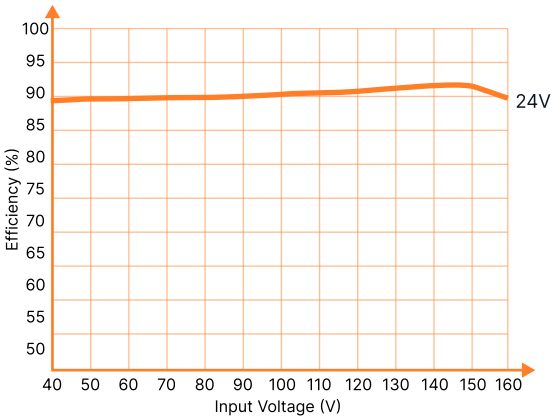
Temperature Derating Curve



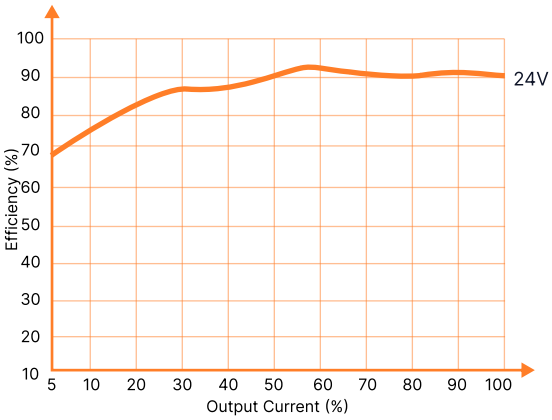
Efficiency Vs Input Voltage (Full Load)



Efficiency Vs Output Load (Vin=110V)



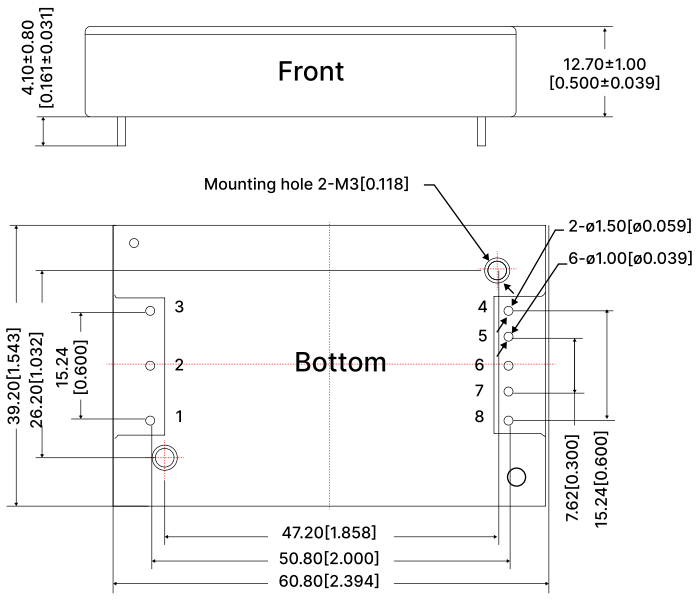
Efficiency Vs Input Voltage (Full Load)



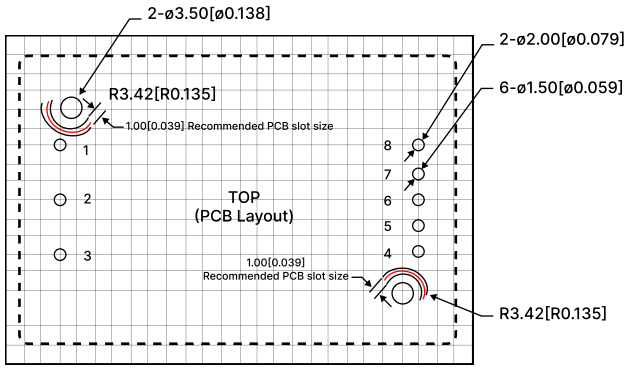
Efficiency Vs Output Load (Vin=110V)

DIMENSIONS AND INSTALLATION

DCWF1D_QB-50W (without heatsink)



THIRD ANGLE PROJECTION

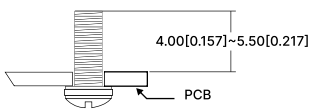


Note: Grid 2.54*2.54mm

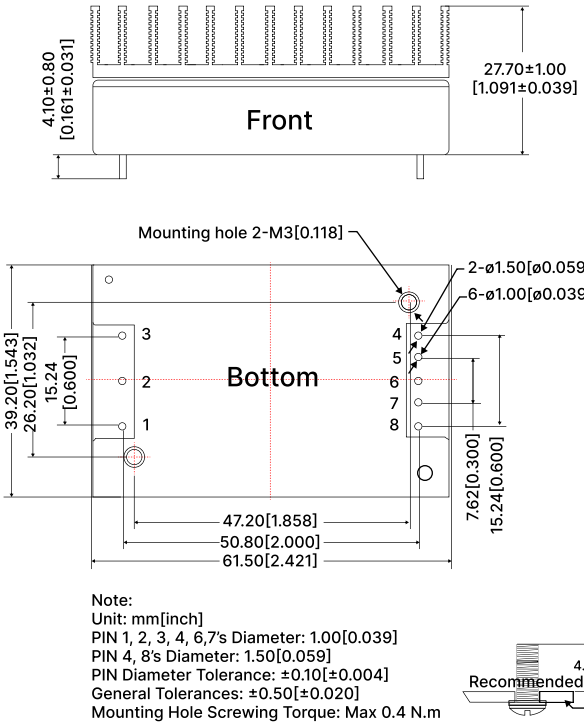
Pin	Function	Pin	Function
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+V0

Note:
Unit: mm[inch]
PIN 1, 2, 3, 4, 6,7's Diameter: 1.00[0.039]
PIN 4, 8's Diameter: 1.50[0.059]
PIN Diameter Tolerance: ±0.10[±0.004]
General Tolerances: ±0.50[±0.020]
Mounting Hole Screwing Torque: Max 0.4 N.m

Recommended Screw length



DCWF1D_QB-50WH (with heatsink)



Note:
Unit: mm[inch]
PIN 1, 2, 3, 4, 6,7's Diameter: 1.00[0.039]
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PIN Diameter Tolerance: ±0.10[±0.004]
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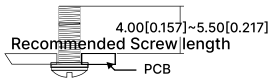
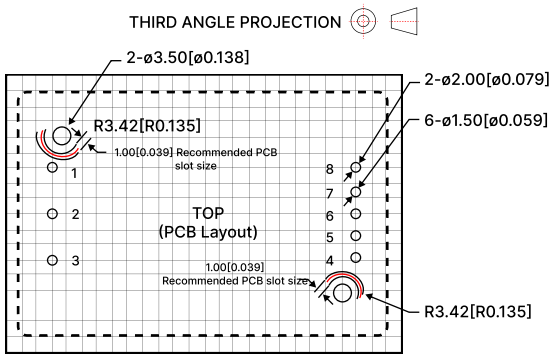


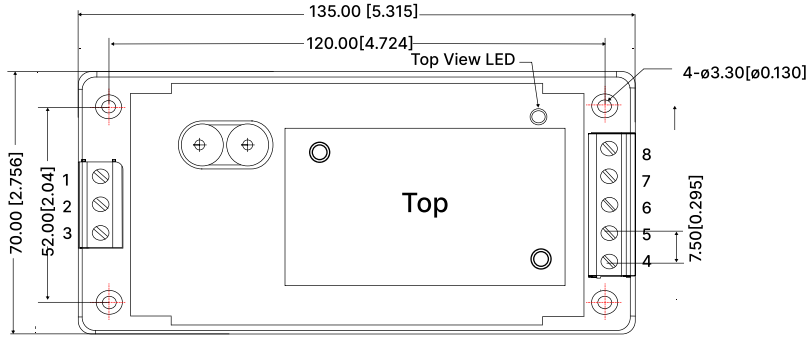
THIRD ANGLE PROJECTION

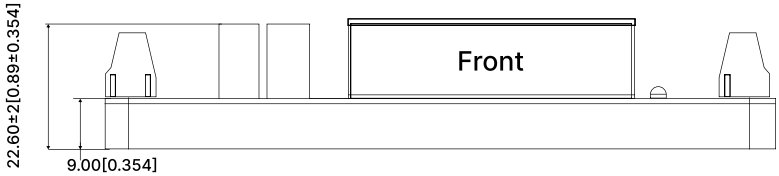


Note: Grid 2.54*2.54mm

Pin	Function	Pin	Function
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+V0

DCWF1D_QB-50WST (without heatsink)





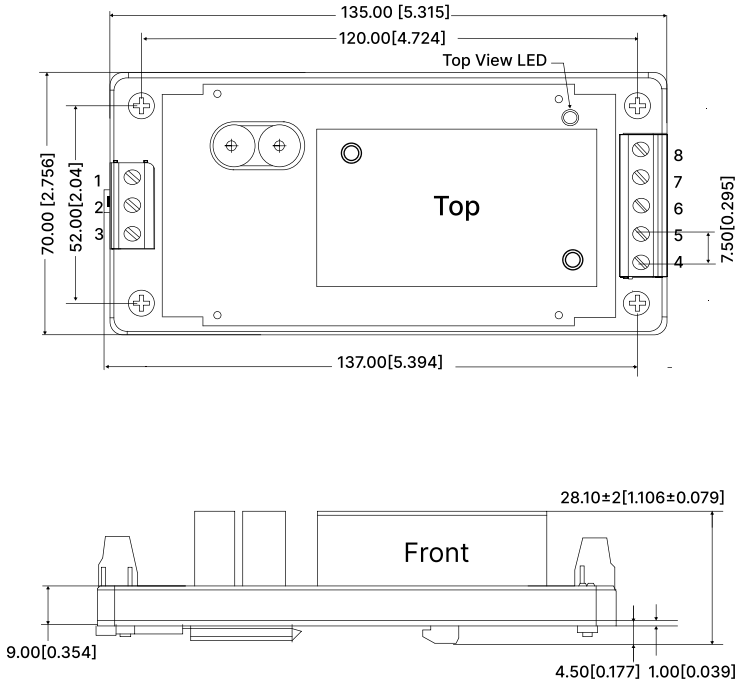
THIRD ANGLE PROJECTION

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

Note:
Unit: mm[inch]
Wire Range: 16-12 AWG
Tightening Torque: Max:0.4 N-m
General Tolerances: ±1.00[±0.040]

DCWF1D_QB-50WDR (without heatsink)

THIRD ANGLE PROJECTION

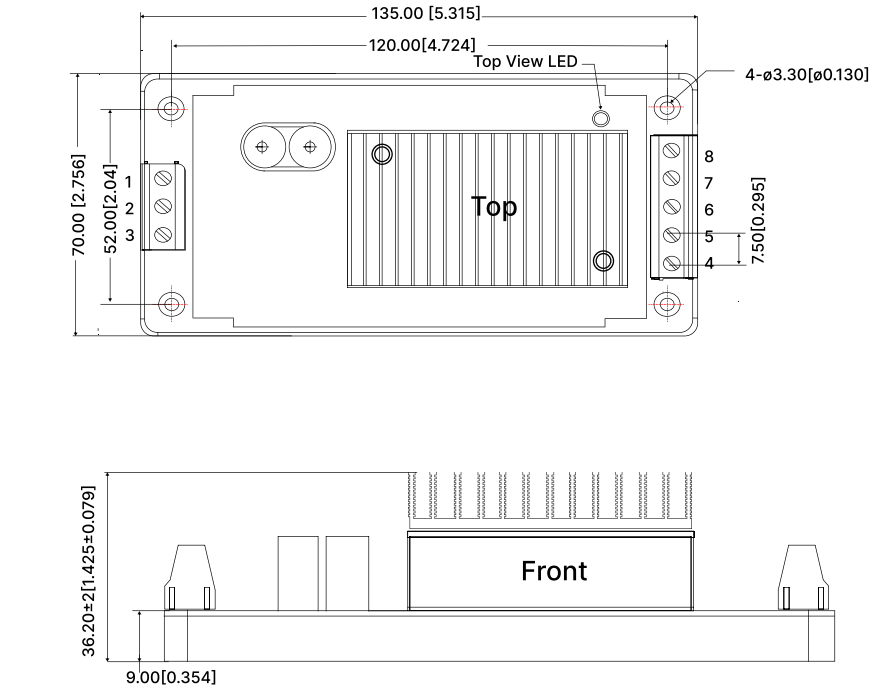


Pin	Function
1	+Vin
2	Ctrl
3	-Vin
4	0V
5	Sense-
6	Trim
7	Sense+
8	+Vo

Note:
Unit: mm[inch]
Wire Range: 16-12 AWG
Tightening Torque: Max:0.4 N-m
Installed on DIN RAIL TS35
General Tolerances: ±1.00[±0.040]

DCWF1D_QB-50WHST (with heatsink)

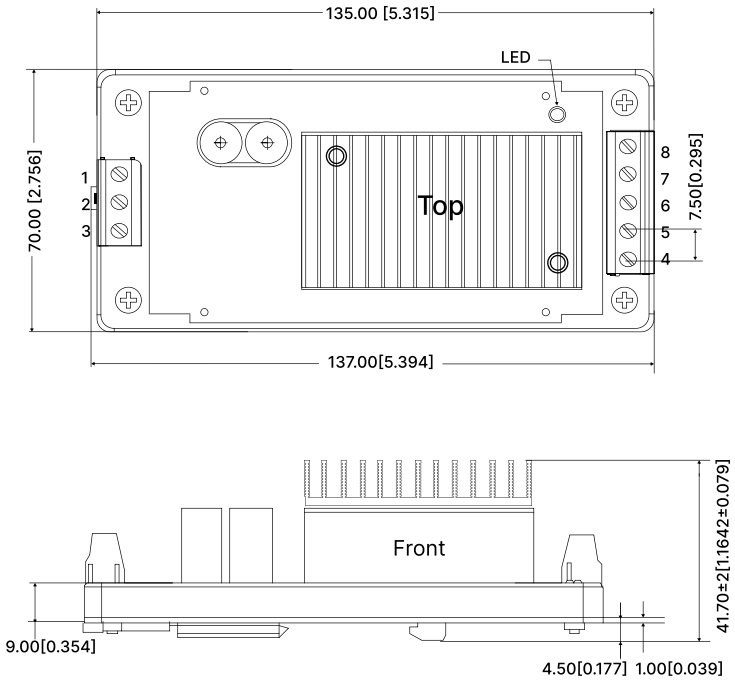
THIRD ANGLE PROJECTION



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

Note:
Unit: mm[inch]
Wire Range: 16-12 AWG
Tightening Torque: Max:0.4 N-m
General Tolerances: ±1.00[±0.040]

DCWF1D_QB-50WHDR (with heatsink)



THIRD ANGLE PROJECTION

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

Note:
Unit: mm[inch]
Wire Range: 16-12 AWG
Tightening Torque: Max:0.4 N-m
Installed on DIN RAIL TS35
General Tolerances: ±1.00[±0.040]

NOTE

1. If the product works under the minimum required load, it cannot guarantee that the performance of the product complies with all the performance indicators in this manual;
2. The maximum capacitive load is tested under the input voltage range and full load condition;
3. Unless otherwise stated, all indexes in this manual are measured at Ta=25°C, humidity <75%RH, nominal input voltage and rated output load;
4. All index testing methods in this manual are based on the enterprise standards of the company;
5. Our company can provide product customization, specific needs can directly contact our technical staff;