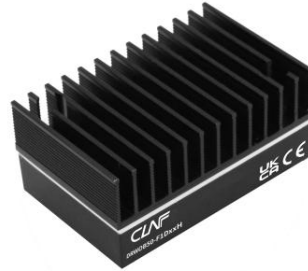


Descriptions

50W isolated, DC/DC Converter



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°C to +105°C
- Input under-voltage protection, output short-circuit, over-current, over-voltage, over-temperature protection
- Industry standard 1/4 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	DRWQB50-F1D03(H)	110 (43-160)	170	3.3	11364/0	84/86	20000
EN/BS EN	DRWQB50-F1D05(H)			5	10000/0	85/87	10000
EN/BS EN	DRWQB50-F1D12(H)			12	4167/0	86/88	3000
EN/BS EN	DRWQB50-F1D15(H)			15	3333/0	86/88	2350
EN/BS EN	DRWQB50-F1D24(H)			24	2083/0	87/89	1500
EN/BS EN	DRWQB50-F1D48(H)			48	1041/0	85/87	240
--	DRWQB50-F1D03(H)E5(D6) ^③	110 (43-160)	170	3.3	11364/0	82/84	20000
--	DRWQB50-F1D05(H)E5(D6)			5	10000/0	83/85	10000
--	DRWQB50-F1D12(H)E5(D6)			12	4167/0	84/86	3000
--	DRWQB50-F1D15(H)E5(D6)			15	3333/0	84/86	2350
--	DRWQB50-F1D24(H)E5(D6)			24	2083/0	85/87	1500
EN/BS EN	DRWQB50-F1D24HD6						

--	DRWQB50-F1D48(H)E5(D6)		48	1041/0	83/85	240
Note: ① Use "H" suffix for heat sink 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. ③ Use "E5" suffix for chassis mounting and "D6" suffix for DIN-Rail mounting. The minimum input voltage range and the start-up voltage of the E5/D6 product model are 1VDC higher than the horizontal package; ④ Efficiencies for E5 /D6 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	3.3VDC output	--	397/10	406/20	mA
			24VDC output	--	511/10	523/20	
			12VDC, 15VDC output	--	517/10	529/20	
			05VDC, 48VDC output	--	523/10	535/20	
	Reflected Ripple Current	Nominal input voltage	--	50	--	VDC	
	Surge Voltage (1sec. max.)		-0.7	--	180		
	Start-up Voltage		--	--	43		
	Under-voltage Protection		--	40	--		
	Input Filter		Pi filter				
	Hot Plug		Unavailable				
Ctrl ^①	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 Specifications	Voltage Accuracy	Nominal input voltage, 0%-100% load	--	±1	±3	%	
	Linear Regulation	Input voltage variation from low to high at full load	3.3VDC, 5VDC output	--	--		±0.5
			Others	--	±0.1		±0.3
	Load Regulation	Nominal input voltage, 10%-100% load	3.3VDC, 5VDC output	--	±0.5		±1.0
			Others	--	±0.3	±0.5	
	Transient Recovery Time		--	200	500	μs	
	Transient Response Deviation	25% load step change	3.3VDC, 5VDC output	--	±6	±9	%
			Others	--	±3	±5	
	Temperature Coefficient	Full load	--	--	±0.03	%/°C	
	Ripple & Noise ^②	20MHz bandwidth, 10%Io-100%Io load	48VDC output	--	200	300	mVp-p
			Others	--	100	200	
	Trim		90	--	110	%	
	Output Voltage Remote Compensation(sense)		--	--	105		
	Over-temperature Protection	Max. temperature	--	105	115	°C	
Over-voltage Protection	Input voltage range	3.3VDC, 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 Specifications	Isolation	Input-output	Electric Strength test for 1 minute with a leakage current of 5mA max.	3000	--	--	VAC
		Input-case		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°C		500	--	--	khours
Environmental Specifications	Operating Temperature Range	See temperature derating curves		-40	--	+105	°C
	Storage Humidity	Non-condensing		5	--	95	%RH
	Storage Temperature			-55	--	+125	°C
	Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10 seconds		--	--	+300	
	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			
Mechanical Specifications	Case Material	Aluminum alloy case; Black plastic bottom, flame-retardant and heat-resistant (UL94 V-0)					
	Dimensions	DRWQB50-F1Dxx		60.80 × 39.20 × 12.70mm			
		DRWQB50-F1DxxH		61.50 × 39.20 × 27.70mm			
		DRWQB50-F1DxxE5		135.00 × 70.00 × 22.60mm			
		DRWQB50-F1DxxD6		137.00 × 70.00 × 28.10mm			
		DRWQB50-F1DxxHE5		135.00 × 70.00 × 36.20mm			
		DRWQB50-F1DxxHD6		137.00 × 70.00 × 41.70mm			
	Weight	DRWQB50-F1Dxx		88.0g(Typ.)			
		DRWQB50-F1DxxH		119.0g(Typ.)			
		DRWQB50-F1DxxE5		164.0g(Typ.)			
DRWQB50-F1DxxD6		237.0g(Typ.)					
DRWQB50-F1DxxHE5		200.0g(Typ.)					
DRWQB50-F1DxxHD6		268.0g(Typ.)					
Cooling Method	Free air convection or forced convection						
<p>Note:</p> <p>①The Ctrl pin voltage is referenced to input -Vin.</p> <p>②Ripple & Noise for 48VDC output at 0%Io-100%Io load ≤ 400mV, others outputs at 0%Io-100%Io load ≤ 300mV, the measuring method of ripple and noise, please refer to Fig. 1 .</p>							

Electromagnetic Compatibility (EMC)

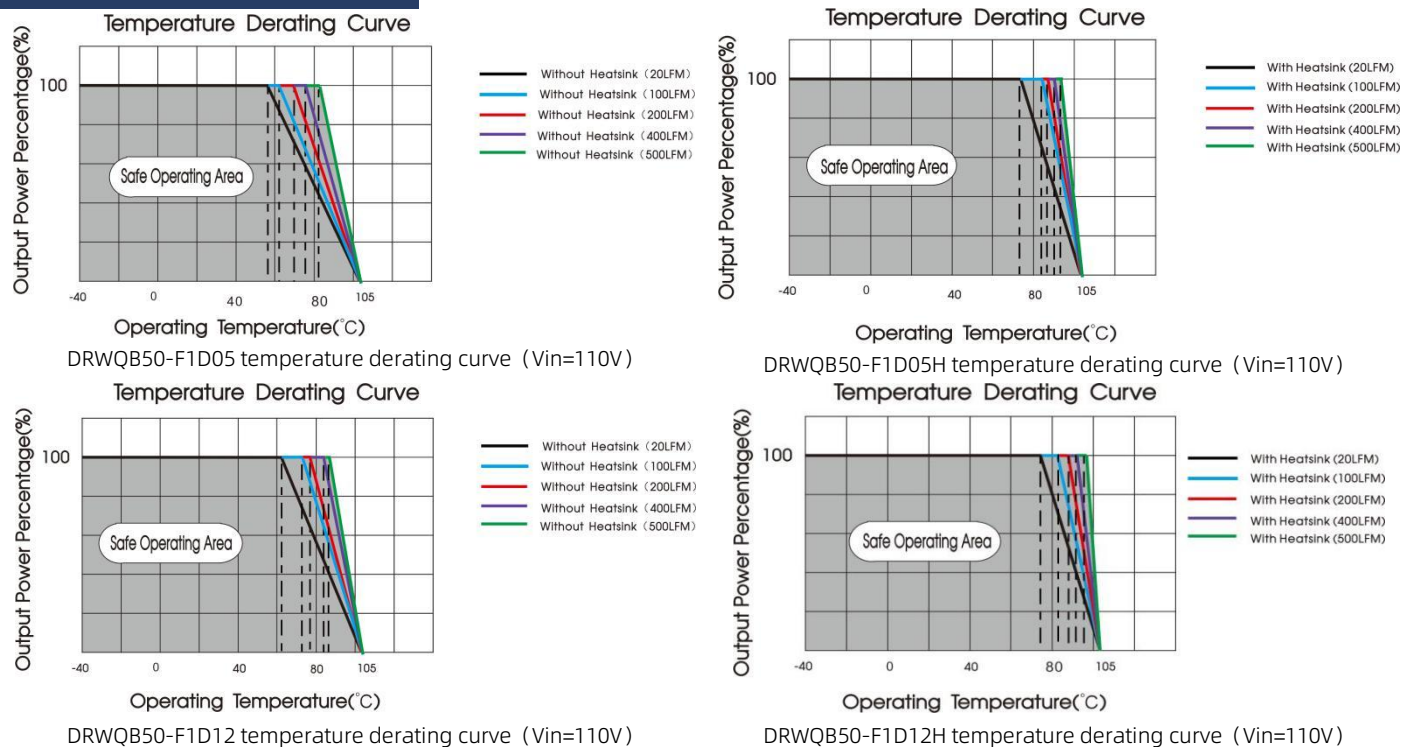
Emissions	CE	CISPR32/EN55032	150KHz-30MHz	Class B (see Fig. 3 for recommended circuit)	
	RE*	CISPR32/EN55032	30MHz-1GHz	Class B (see Fig. 3 for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2	GB/T17626.2	Contact ±6KV, Air ±8KV	perf.Criteria A
	RS	IEC/EN61000-4-3	GB/T17626.3	20V/m	perf.Criteria A
	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 DRWQB50-F1Dxx series (without heatsink).

Electromagnetic Compatibility (EMC) (EN50155)

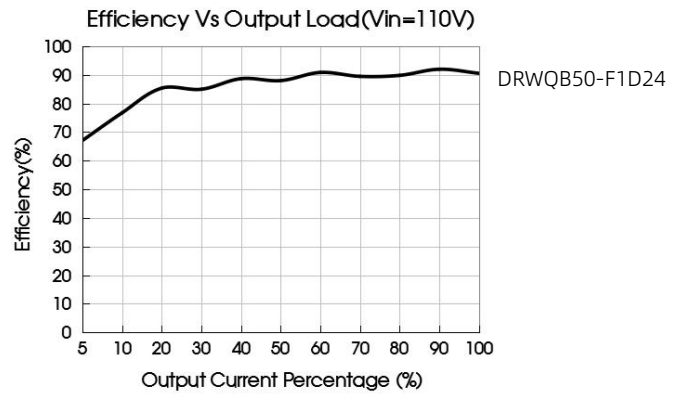
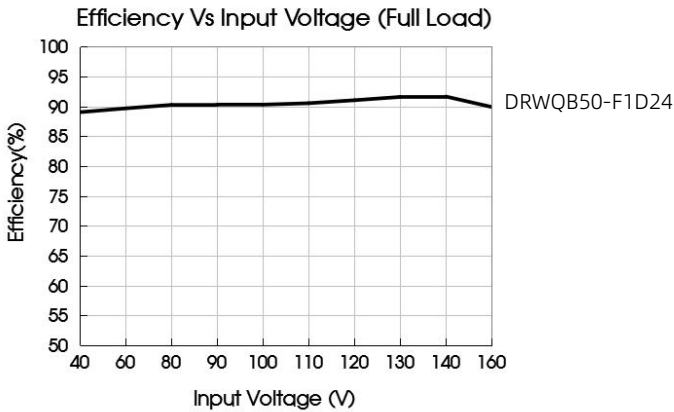
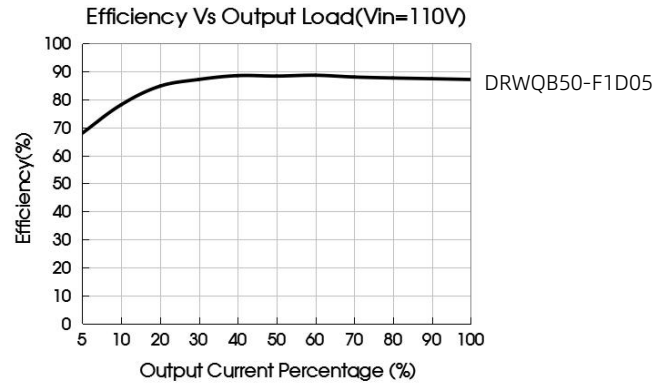
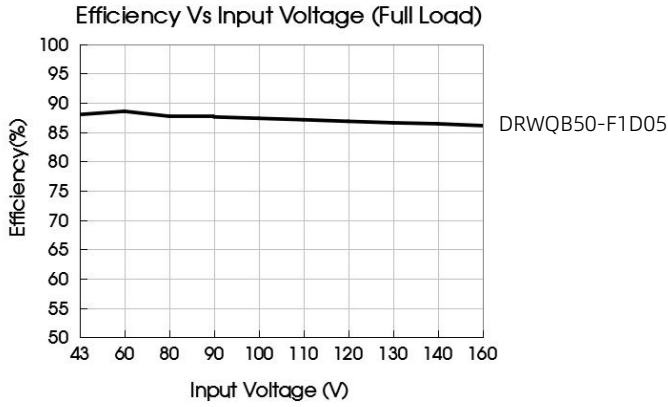
Emissions	CE	EN50121-3-2	150kHz-500kHz	99dBuV	(see Fig. 2 for recommended circuit)
		EN55016-2-1	500kHz-30MHz	93dBuV	(see Fig. 2 for recommended circuit)
Emissions	RE	EN50121-3-2	30MHz-230MHz	40dBuV/m at 10m	(see Fig. 2 for recommended circuit)
		EN55016-2-1	230MHz-1GHz	47dBuV/m at 10m	(see Fig. 2 for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

Characteristic Curve



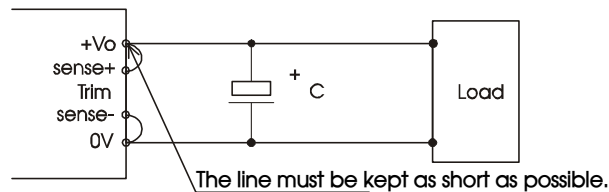
Notes:

1. Temperature derating curves and efficiency curves are typical test values.
2. Temperature derating curve in accordance with our laboratory test conditions for testing, the actual use of environmental conditions if the customer is not consistent, to ensure that the product aluminum shell temperature does not exceed 100 °C, can be used within any rated load range.



Remote Sense Application

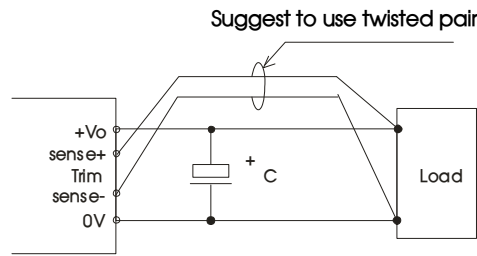
1. Remote Sense Connection if not used



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 wairs 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.

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.

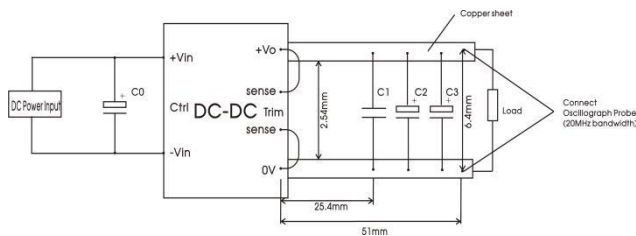


Fig.1

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

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 C_{in} and C_{out} 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.



Capacitors value	Cout(μ F)	Cin(μ F)
Output voltage		
3.3VDC	1000	100
5VDC	680	
12VDC	220	
15VDC		
24VDC		
48VDC		

3. EMC compliance recommended circuit

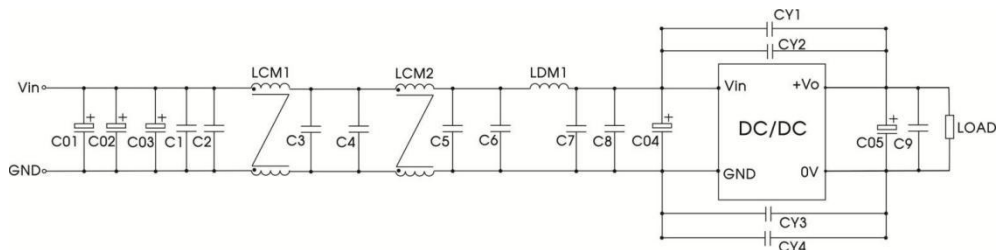


Fig.2

C01, C02, C03, C04	220 μ F/200V (electrolytic capacitor)
C05	220 μ F/63V (electrolytic capacitor)
LDM1	1.5 μ H (Shielded inductor)
C1, C2, C3, C4, C5, C6, C7, C8, C9	2.2 μ F/250V
CY1, CY2, CY3, CY4	2200 pF /400VAC (Y safety capacitor)
LCM1	4700 μ H*2, 3A
LCM2	1000 μ H*2, 3A

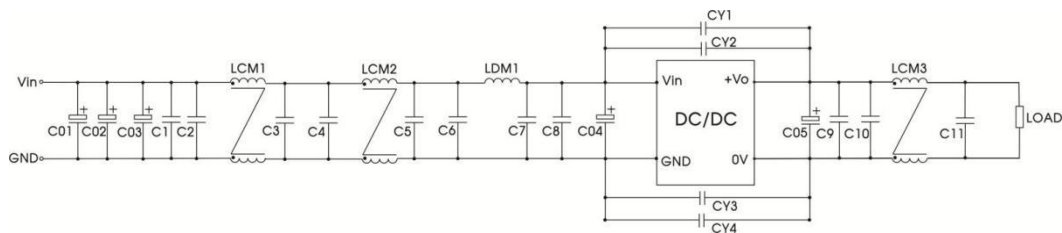
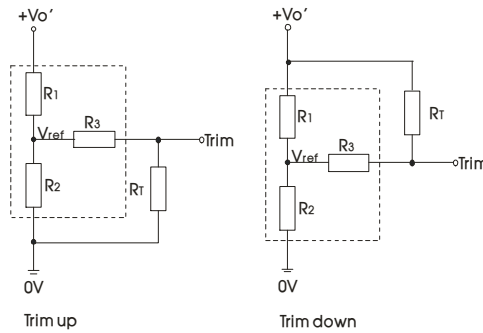


Fig.3

C01, C02, C03, C04	220 μ F/200V (electrolytic capacitor)
C05	220 μ F/63V (electrolytic capacitor)
LDM1	1.5 μ H (Shielded inductor)
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11	2.2 μ F/250V
CY1, CY2, CY3, CY4	2200 pF /400VAC (Y safety capacitor)
LCM1	4700 μ H*2, 3A
LCM2	1000 μ H*2, 3A
LCM3	36 μ H*2, 7A
	36 μ H*2, 13A
	36 μ H*2, 25A

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



TRIM resistor connection (dashed line shows internal resistor network)

Trim resistor calculation:

$$\begin{aligned} \text{up: } R_T &= \frac{aR_2}{R_2-a} - R_3 & a &= \frac{V_{ref}}{V_{o'} - V_{ref}} \cdot R_1 \\ \text{down: } R_T &= \frac{aR_1}{R_1-a} - R_3 & a &= \frac{V_{o'} - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

table 1

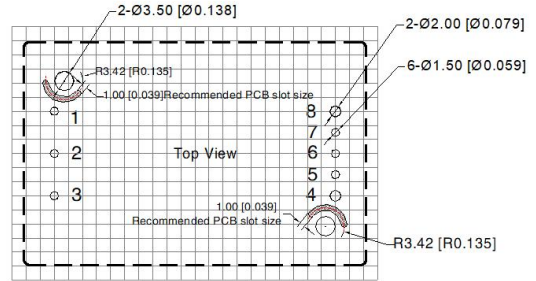
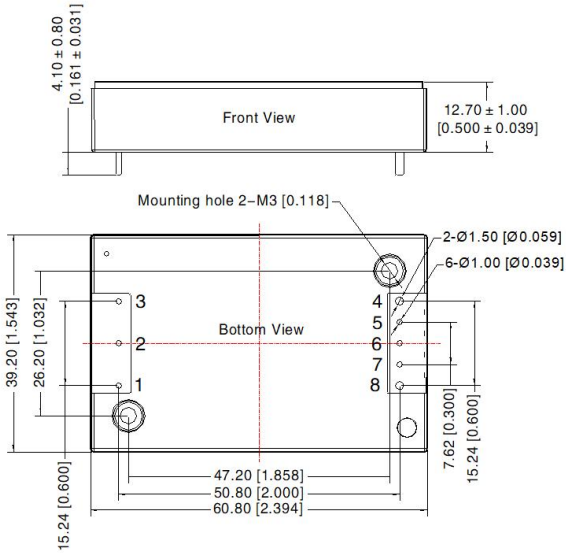
Vo resistance	3.3(VDC)	5(VDC)	12(VDC)	15(VDC)	24(VDC)	48(VDC)
R1(KΩ)	4.74	8.74	11	14.49	24.87	58.7
R2(KΩ)	2.87	2.87	2.87	2.87	2.87	3.21
R3(KΩ)	9.66	11	11	16	21	11
Vref(V)	1.25	1.25	2.5	2.5	2.5	2.5

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

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

Standard (without heatsink) Dimension and Recommended Layout

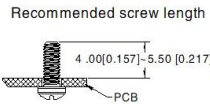
THIRD ANGLE PROJECTION



Note: Grid 2.54*2.54mm

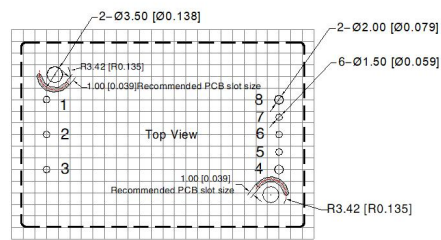
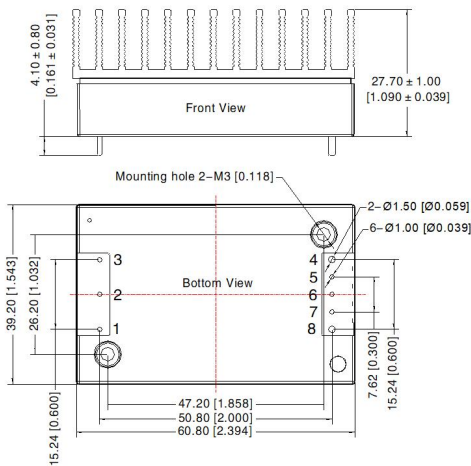
Pin	Mark	Pin	Mark
1	+Vin	5	Sense-
2	Ctrl	6	Trim
3	-Vin	7	Sense+
4	0V	8	+Vo

Note:
 Unit:mm[inch]
 Pin1,2,3,5,6,7's diameter: 1.00[0.039]
 Pin4,8's diameter: 1.50[0.059]
 Pin diameter tolerances: $\pm 0.10[\pm 0.004]$
 General tolerances: $\pm 0.50[\pm 0.020]$
 Mounting hole screwing torque: Max 0.4 N · m



Standard (with heatsink) Dimension and Recommended Layout

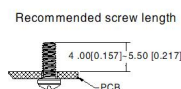
THIRD ANGLE PROJECTION



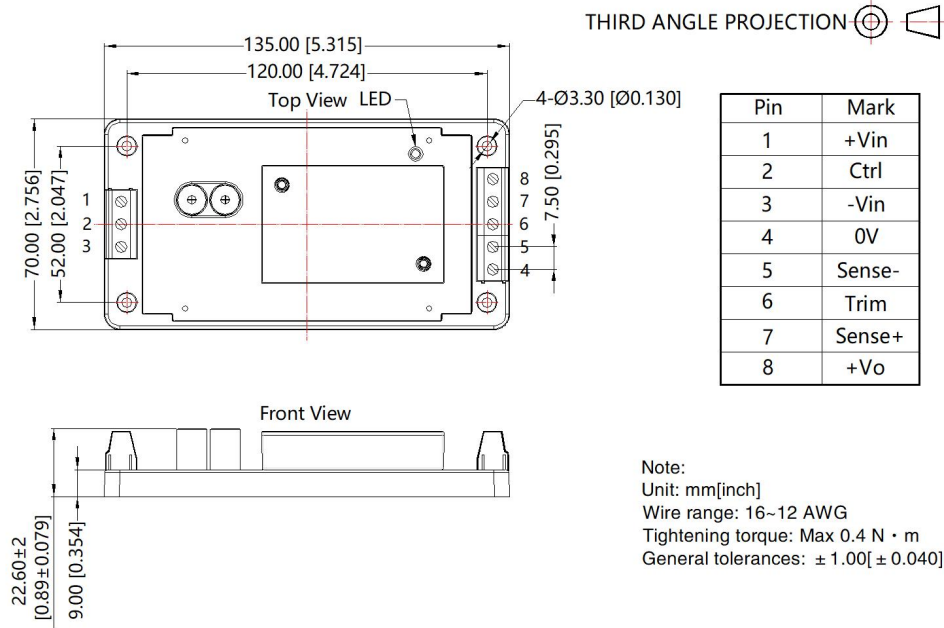
Note: Grid 2.54*2.54mm

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

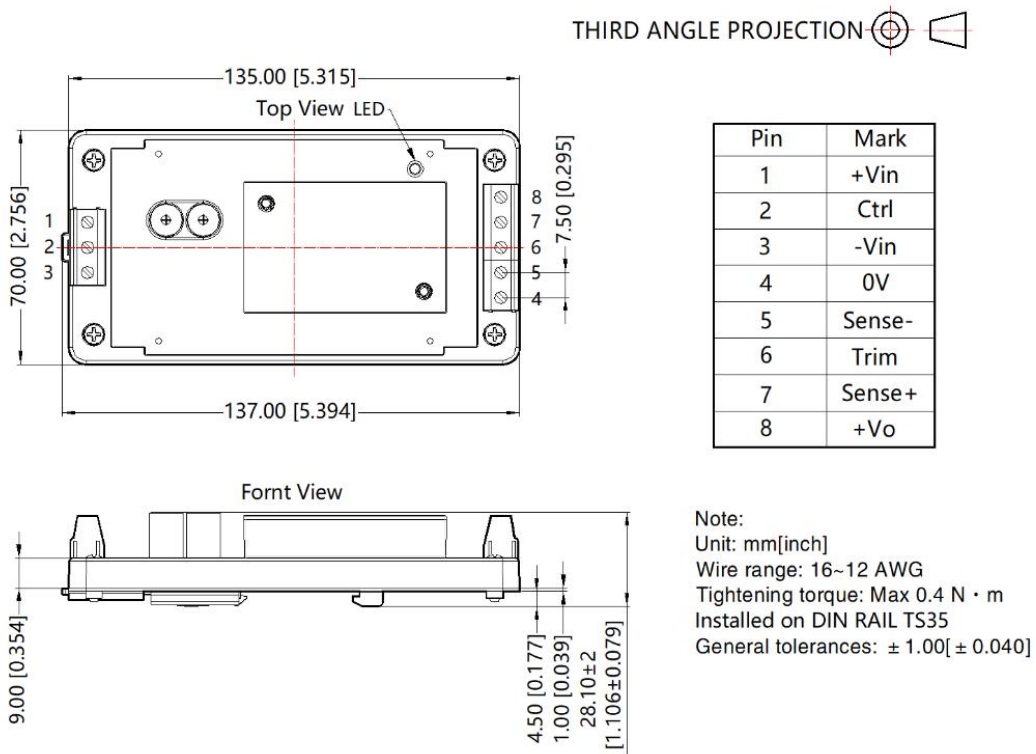
Note:
 Unit:mm[inch]
 Pin1,2,3,5,6,7's diameter: 1.00[0.039]
 Pin4,8's diameter: 1.50[0.059]
 Pin diameter tolerances: $\pm 0.10[\pm 0.004]$
 General tolerances: $\pm 0.50[\pm 0.020]$
 Mounting hole screwing torque: Max 0.4 N · m



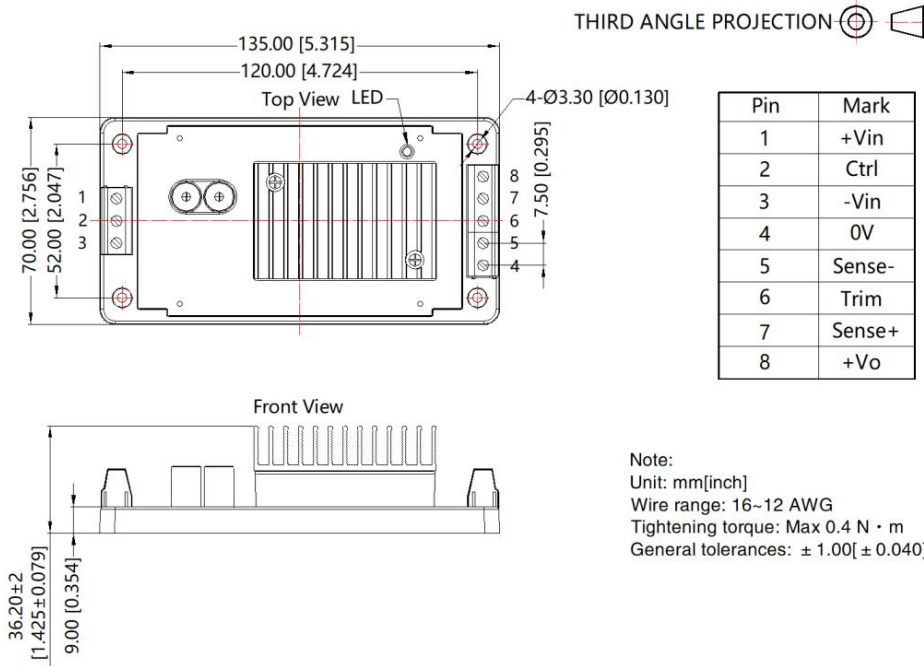
E5 (without heatsink) Dimension



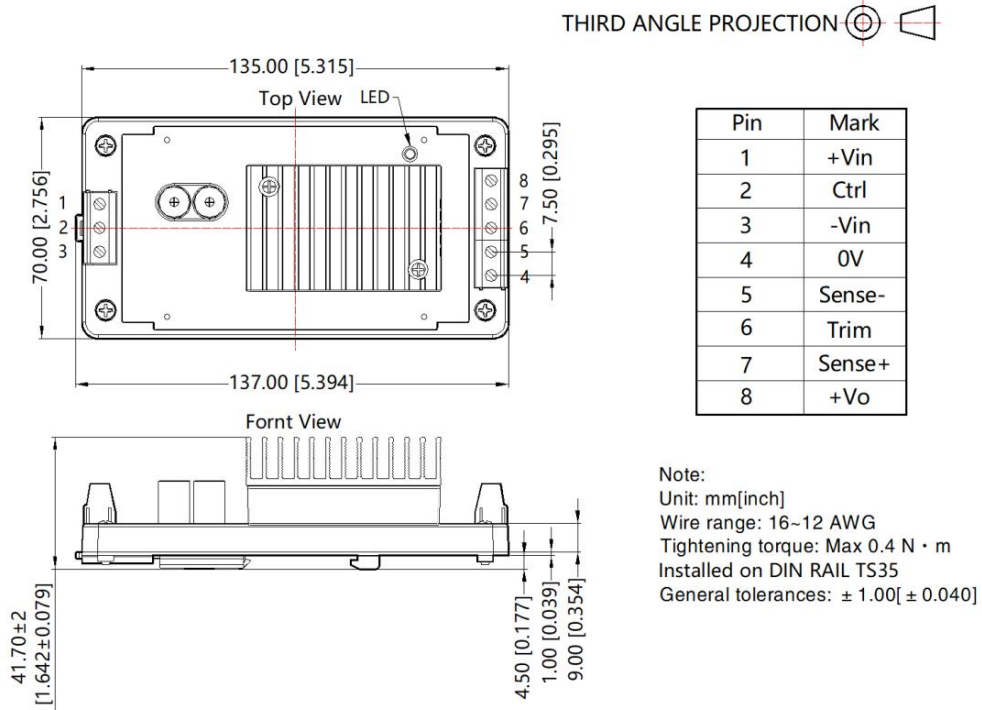
D6 (without heatsink) Dimension



E5 (with heatsink) Dimension



D6 (with heatsink) Dimension



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, data in this datasheet should be tested under the conditions of $T_a=25^{\circ}\text{C}$, humidity<75%RH with nominal input voltage and rated load;
6. All index testing methods in this datasheet are based on company corporate standards;
7. We provide product customization service and match filter module, please directly contact our technicians for specific information;
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.