100QBRW4_3 series

100W - Single Output DC-DC Converter - Wide Input - Isolated & Regulated

DC-DC Converter 100W

- Ultra-wide input voltage range: 43-160VDC
- High efficiency up to 91%
- Low no-load power consumption
- Reinforced insulation, input - output isolation test voltage: 3kVAC, input - case isolation test voltage: 2.1kVAC
- Operating ambient temp. 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
- EN50155 approved

100QBRW4_3 series is a high-performance product specifically designed for a variety of railway applications. The DC-DC converters feature 100W output power with no requirement for minimum load, wide input voltage from 43-160VDC, and allowing operating temperature as high as 105°C. The products also provide input under-voltage protection, output over-voltage, short-circuit and over-temperature protection. Additional functions include remote On/Off control, remote sense compensation and output voltage trim adjustment. EN50155 approved and they are widely used in railway systems and associated equipment.

Common specifications

Short circuit protection:	Hiccup, continuous, self-recovery
Operation temperature range:	-40°C ~ +105°C
Storage humidity range:	Non-condensing 5 ~ < 95%RH
Storage temperature range:	-55°C ~ +125°C
Lead temperature:	300°C MAX, 1.5mm from case for 10 sec
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
Switching frequency:	PFM mode 220KHz TYP
MTBF (MIL-HDBK-217F @ 25°C):	500 Khours MIN
Casing material:	Aluminum alloy case; Black plastic bottom, flame-retardant and heat-resistant (UL94 V-0)
Cooling:	Free air convection or forced convection
Dimensions	60.80 × 39.20 × 12.70mm (without heatsink) 61.50 × 39.20 × 27.80mm (with heatsink)
Weight:	78.0g TYP. (without heatsink) 109.0g TYP. (with heatsink)

Input specifications

Item	Test condition	Min	Typ	Max	Units
Input current (No load/full load)	Nominal input • 3.3VDC output • 24VDC output • 12/15VDC output • 05/48VDC output		 793/10 1000/10 1022/10 1034/10	 812/20 1022/20 1045/20 1058/20	 mA mA mA mA
Reflected ripple current	Nominal input		100		mA
Surge voltage	(1sec max)	-0.7		180	VDC
Start-up Voltage				43	VDC
Under-voltage Protection			40		VDC
Input Filter	Unavailable				
Ctrl*	• Module on • Module off • Input current when off	Ctrl pin open or pulled high (3.5-12VDC) Ctrl pin -Vin or pulled low (0-1.2VDC) 2		10	 mA

*The Ctrl pin voltage is referenced to input -Vin.

Example:
100QBRW4_110S3
100 = 100 Watt; QBR = Quarter Brick; W4 = Wide input range (4:1);
110 = Nominal Output Voltage; S = Single Output; 3 = 3000 VDC isolation

Output specifications

Item	Test condition	Min	Typ	Max	Units
Voltage accuracy	Nominal input, 10%-100% load		±1	±3	%
Line regulation	Input voltage variation low to high at full load • 3.3VDC, 5VDC output • Others		 ±0.1	 ±0.5 ±0.3	 % %
Load regulation	Nominal input, 10%-100% load • 3.3VDC, 5VDC output • Others		 ±0.5 ±0.3	 ±1.0 ±0.5	 % %
Transient Recovery Time	25% load step change		200	500	µs
Transient Response Deviation	25% load step change • 3.3VDC, 5VDC output • Others		 ±6 ±3	 ±9 ±5	 % %
Temperature drift	full load			±0.03	%/°C
Ripple & Noise*	20MHz bandwidth, 10%Io-100%Io load • 3.3VDC, 5VDC output • Others		 200 100	 300 200	 mVp-p mVp-p
Trim		90		110	%
Output voltage remote Compensation (Sense)				105	%
Over-temperature Protection	Surface max. temperature		105	115	%
Output Over-voltage Protection	Input voltage range • 3.3VDC, 5VDC output • Others	 110 110		 160 140	 %Vo %Vo
Output Over-current Protection	Input voltage range	110	140	190	%Io

* Ripple & 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 .

Isolation specifications

Item	Test condition	Min	Typ	Max	Units
Insulation voltage	Electric Strength test for 1min leakage current 5mA max. • Input-output • Input-case leakage current 1mA max. • Output-case	 3000 2100 1500			 VDC VDC VDC
Insulation resistance	Test at 500VDC	1000			MΩ
Isolation Capacitance	Input/output, 100KHz/0.1V		2200		pF

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EMC specifications		
Emissions	CE	CISPR32/EN55032 150KHz-30MHz Class B (see Fig. 3)
Emissions	RE	CISPR32/EN55032 30MHz-1GHz Class B (see Fig. 3)
Immunity	ESD	IEC/EN61000-4-2 GB/T17626.2 Contact ±6KV, Air ±8KV perf.Criteria A
Immunity	RS	IEC/EN61000-4-3 GB/T17626.3 20V/m perf.Criteria A
Immunity	CS	IEC/EN61000-4-6 GB/T17626.6 10Vr.m.s perf.Criteria A
Immunity	EFT	IEC/EN61000-4-4 GB/T17626.4 ±2KV (5KHz, 100KHz) (see Fig. 3) perf.Criteria A
Immunity	Surge	IEC/EN61000-4-5 GB/T17626.5 line to line ±2KV (1.2μs/50μs 2Ω) (see Fig. 3) perf.Criteria A

EMC specifications (EN50155)		
Emissions	CE	EN50121-3-2 150kHz-500kHz 99dBuV (see Fig. 2) EN55016-2-1 500kHz-30MHz 93dBuV (see Fig. 2)
Emissions	RE	EN50121-3-2 30MHz-230MHz 40dBuV/m at 10m (see Fig. 2) EN55016-2-1 230MHz-1GHz 47dBuV/m at 10m (see Fig. 2)
Immunity	ESD	EN50121-3-2 Contact ±6KV/Air ±8KV perf. Criteria A
Immunity	RS	EN50121-3-2 20V/m perf. Criteria A
Immunity	EFT	EN50121-3-2 ±2kV 5/50ns 5kHz (see Fig. 2) perf. Criteria A
Immunity	Surge	EN50121-3-2 line to line ±1KV (42Ω, 0.5μF) (see Fig. 2) perf. Criteria A
Immunity	CS	EN50121-3-2 0.15MHz-80MHz 10V r.m.s perf. Criteria A

Note:

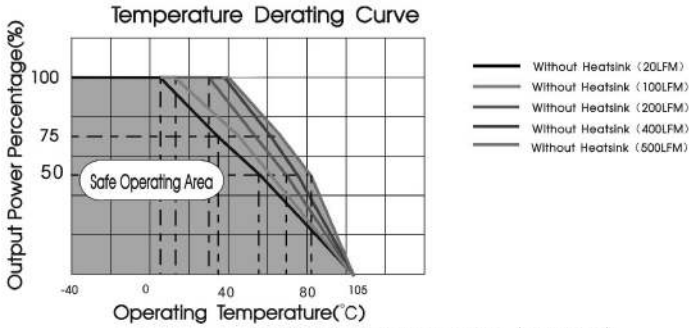
1. Recommended used in more than 5% load, if the load is lower than 5%, then the ripple index of the product may exceed the specification, but does not affect the reliability of the product;
2. The max capacitive load should be tested within the input voltage range and under full load conditions;
3. Recommends that customers plus silicone film or thermal grease between the module and the heatsink, In order to ensure good heat dissipation;
4. Unless otherwise specified, data in this datasheet should be tested under the conditions of Ta = 25°C, humidity < 75% when inputting nominal voltage and outputting rated load;
5. All index testing methods in this datasheet are based on our company's corporate standards;
6. The performance indexes of the product models listed in this datasheet are as above, but some indexes of non-standard model products will exceed the abovementioned requirements, and please directly contact our technicians for specific information;
7. We can provide product customization service;
8. Specifications of this product are subject to changes without prior notice.
9. The products do not support parallel connection of their output

Product Selection Guide

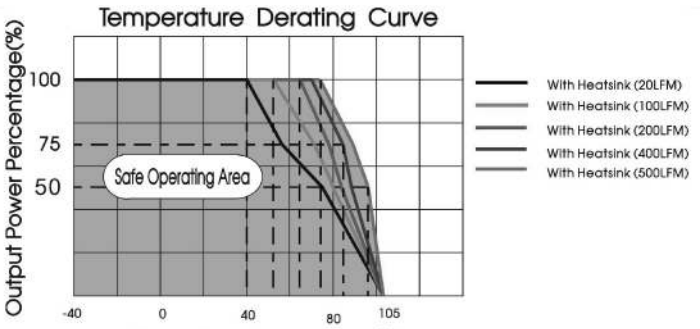
Part Number	Input Voltage [VDC] Nominal (range)	Input Voltage [VDC] Max.*	Output Voltage [VDC]	Output Current [mA, max/min]	Efficiency [%, typ]	Capacitive load [μF, max]
100QBRW4_11003S3	110 (43-160)	170	3.3	22727/0	84/86	40000
100QBRW4_11005S3	110 (43-160)	170	5	20000/0	86/88	20000
100QBRW4_11012S3	110 (43-160)	170	12	8333/0	87/89	6000
100QBRW4_11015S3	110 (43-160)	170	15	6667/0	87/89	4700
100QBRW4_11024S3	110 (43-160)	170	24	4167/0	89/91	3000
100QBRW4_11048S3	110 (43-160)	170	48	2083/0	86/88	480

① We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;
② When input voltage at 43-66VDC , the output power and max. capacitive load need to be derated to 80%;
③ Exceeding the maximum input voltage may cause permanent damage.

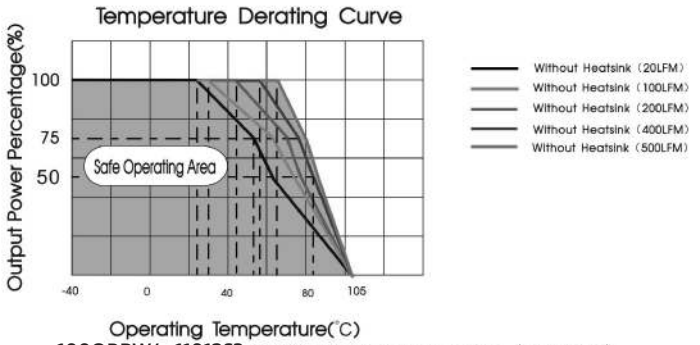
Typical Characteristic Curves



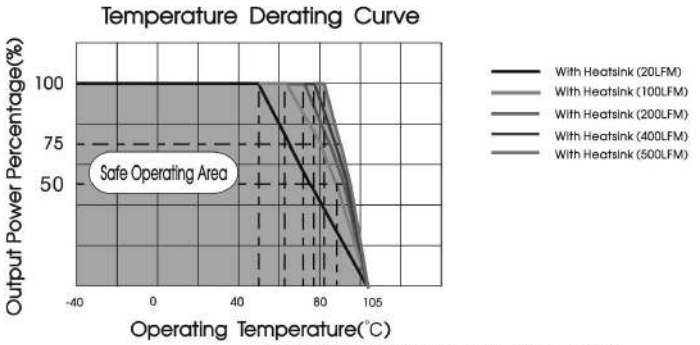
100QBRW4_11005S3 temperature derating curve (Vin=110V)



100QBRW4_11005S3 temperature derating curve (Vin=110V)



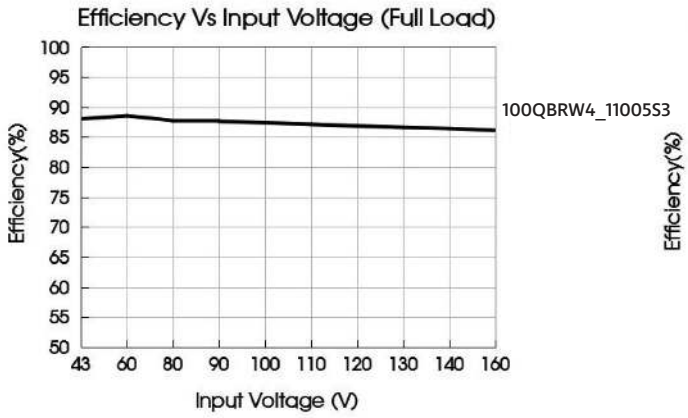
100QBRW4_11012S3 temperature derating curve (Vin=110V)

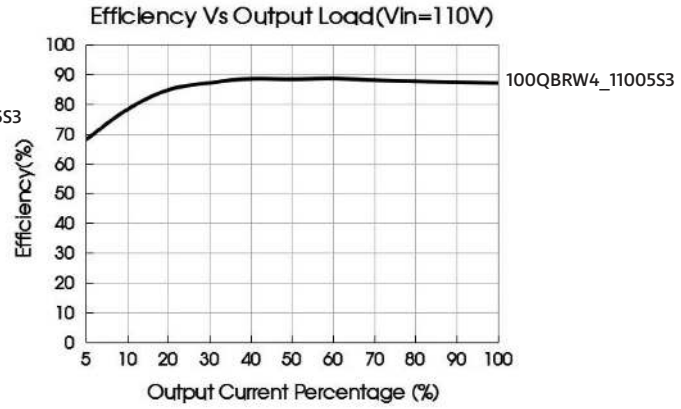


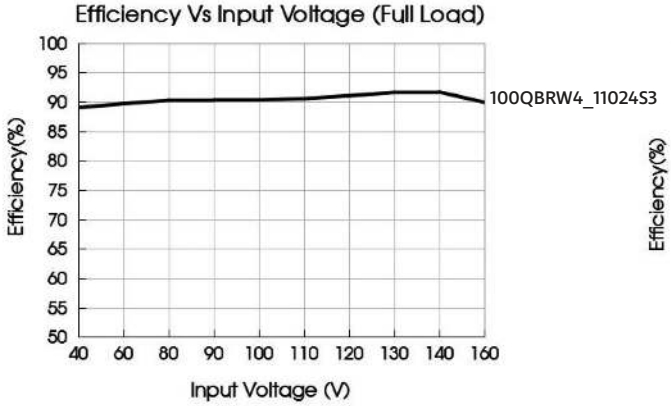
100QBRW4_11012S3 temperature derating curve (Vin=110V)

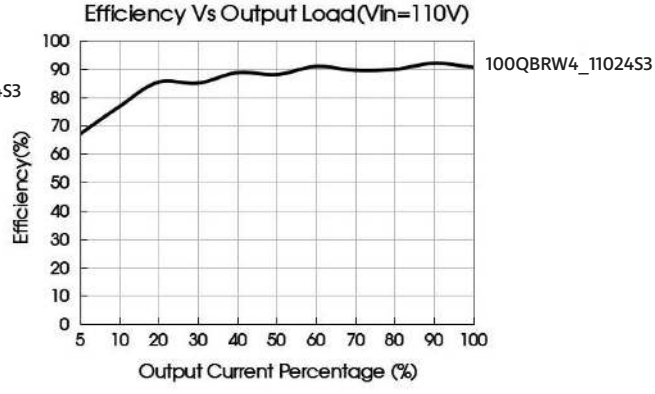
Notes:
1. Temperature derating curves and efficiency curves are typical test values.
2. Temperature derating curve in accordance with our laboratory test conditions for testing, the actual use of environmental conditions if the customer is not consistent, to ensure that the product aluminum shell temperature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

Efficiency curves



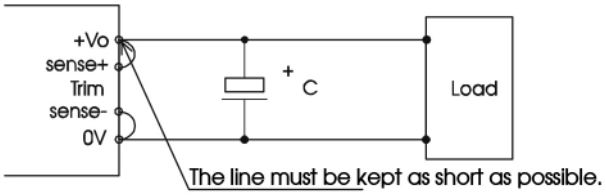






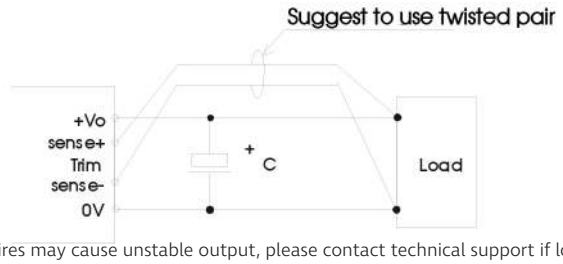
Sense of application and precautions

1. When Remote Sense is 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. When Remote Sense is not used



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.

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.

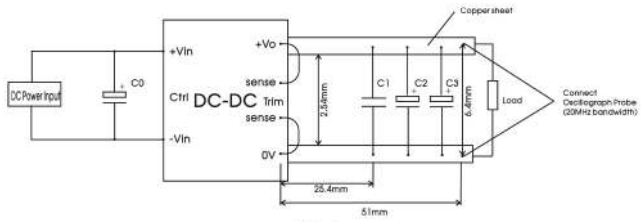


Fig.1

Vout	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 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.

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

EMC compliance recommended

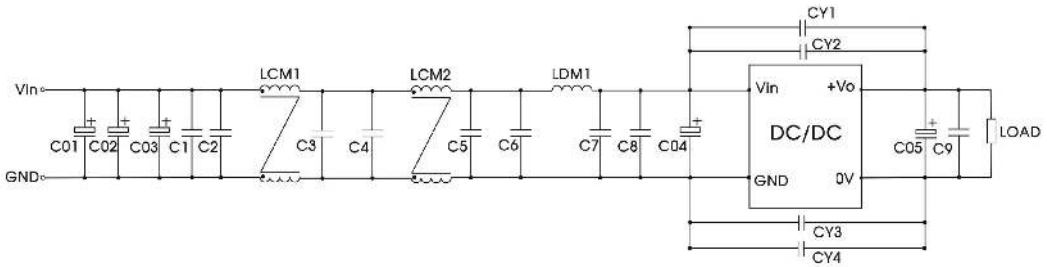


Fig.2

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	FL2D-30-472
LCM2	FL2D-30-102

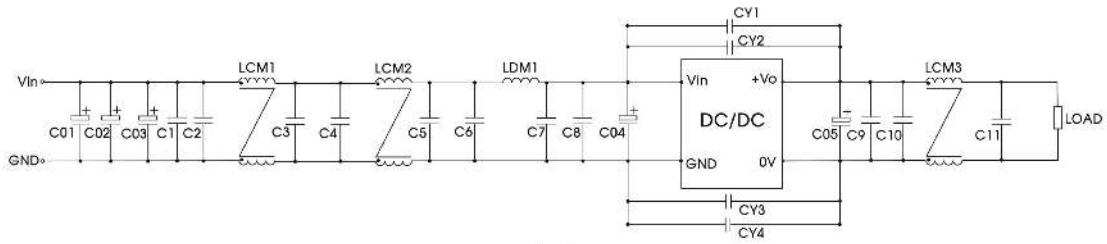
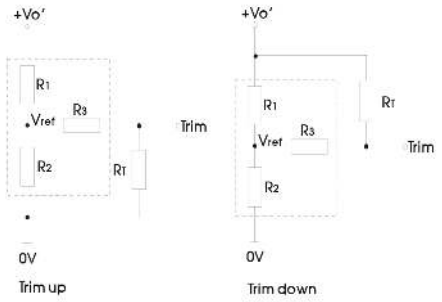


Fig.3

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	FL2D-30-472
LCM2	FL2D-30-102
LCM3	FL2D-70-360C (7A max.) FL2D-A3-360C (13A max.) FL2D-B5-360C (25A max.)

Trim Function for Output Voltage Adjustment (open if unused)



TRIM resistor connection (dashed line shows internal resistor network)

Trim resistor calculation:

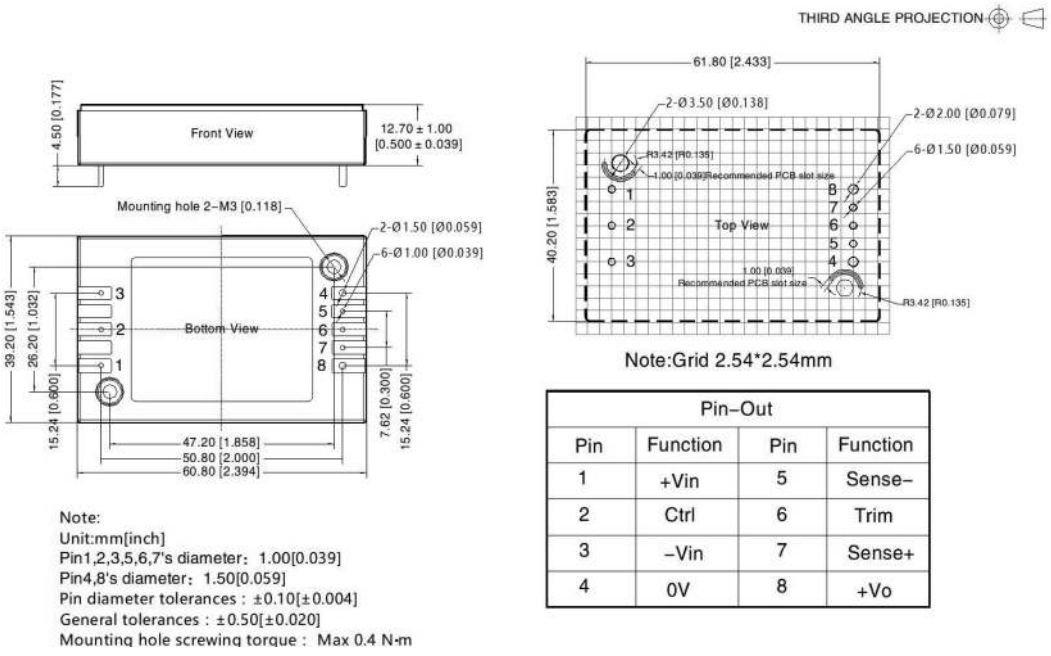
$$\text{up: } R_T = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{V_{ref}}{V_o' - V_{ref}} R_1$$

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

resistance	Vo					
	3.3(VDC)	5(VDC)	12(VDC)	15(VDC)	24(VDC)	48(VDC)
R1(KΩ)	4.83	8.80	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)	1.24	1.24	2.5	2.5	2.5	2.5

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

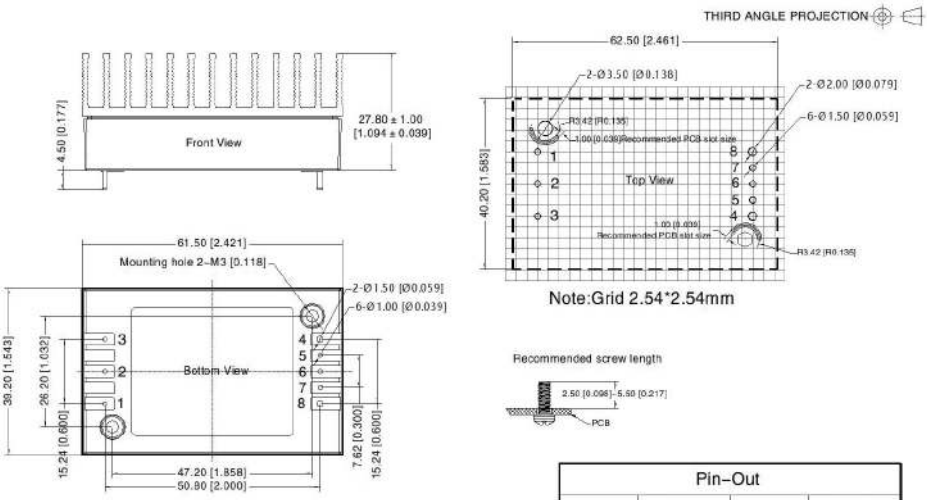
Mechanical dimensions and recommended layout (without heatsink)



Pin-Out			
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 : ±0.10[±0.004]
General tolerances : ±0.50[±0.020]
Mounting hole screwing torque : Max 0.4 N-m

Mechanical dimensions and recommended layout (with heatsink)



Pin-Out			
Pin	Function	Pin	Function
1	+Vin	5	Sense-
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3	-Vin	7	Sense+
4	0V	8	+Vo

Note:
Unit:mm[inch]
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