

20DRW4_2.25 series

20W - DC-DC Converter - Wide input - Isolated & Regulated - Single Output



DC-DC Converter

20 Watt

- ⊕ Wide 4:1 input voltage range
Isolation Voltage: 2.25kVDC
- ⊕ Operating temperature range:
-40°C to +85°C
- ⊕ Short circuit protection (SCP)
- ⊕ International standard pin-out
- ⊕ Meet the IEC60950, UL60950,
EN60950 approval
- ⊕ High efficiency up to 86%
- ⊕ Low ripple & noise
- ⊕ CLSPR32/EN55032 CLASS
A EMI compliant without
external components
- ⊕ RoHS Compliance
- ⊕ Over voltage protection
- ⊕ Over load protection
- ⊕ Input under voltage protection
- ⊕ Meets requirements of railway
standard EN50155

The 20DRW4_2.25 series are isolated 20W DC-DC converter products have an ultra-wide 4:1 input voltage and feature efficiencies of up to 86%. Input to output isolation is tested with 2250VDC and the converters safely operate in an ambient temperature of -40°C to +85°C and are offered with various mounting options ideally suiting electronic equipment and railway vehicle applications using 72V, 96V and 110V battery voltages. The modules are fully featured, protected and include remote On/Off and Trim function for output voltage adjustment.



UL-62368-1 (E347551)

Common specifications

Short circuit protection:	Continuous, self-recovery
Cooling:	Free air convection
Operation temperature range:	-40°C~+85°C
Storage temperature range:	-55°C~+125°C
Soldering temperature:	300°C MAX, 1.5mm from case for 10sec
Switching frequency*:	300kHz TYP, PWM mode
Storage humidity range:	5-95% Min.-Max.
Shock and vibration test:	IEC61373 - Category 1, Grade B
Case material:	Aluminum alloy
Potting material:	Epoxy (UL94V-0)
MTBF (MIL-HDBK-217F @25°C):	>1,000 Khours
Dimensions:	50.80*25.40*11.80mm 50.80*25.40*16.30mm (heatsink)
Weight:	26g/34g (heatsink)

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

Input specifications

Item	Test condition	Min	Typ	Max	Units
Input current (full load / no load)	• 3.3V output • 5V output • Others	183/10 217/10 214/3	188/20 222/20 219/8		mA
Reflected ripple current	Nominal Vin and full load			25	mA
Surge voltage	1sec. max.	-0.7		180	VDC
Starting voltage	100% load			40	VDC
Shutdown voltage		28	33		VDC
Starting time	Nominal Vin and constant resistive load		10		ms
Input filter	Pi Type				
Hot plug	Unavailable				
Ctrl (the voltage of Ctrl pin is relative to input pin GND)	• Module switch ON • Module switch OFF • Input current when switched OFF	Ctrl suspended or connected to TTL high level (3.5-12VDC) Ctrl pin connected to GND or low level (0-1.2VDC)		2 7	mA

Example:

20DRW4_1100552.25

20= 20Watt; D= DIP; R= series; W4= wide input (4:1) 40-160Vin; 5Vout;
S= single output; 2.25= 2250VDC

Output specifications

Item	Test condition	Min	Typ	Max	Units
Voltage accuracy	0%-100% load		±1	±3	%
Line regulation	Full load, low to high		±0.2	±0.5	%
Load regulation	0%-100% load		±0.5	±1	%
Transient recovery time	25% load step change		300	500	µs
Transient response deviation	normal Vin, 25% load step change • 3.3V/5V output • Others		±3 ±3	±8 ±5	% %
Temperature coefficient	Full load		±0.02	±0.03	%/°C
Ripple and noise*	20MHz bandwidth, 5%-100% load		50	100	mVp-p
Trim		90		110	%Vo
Over voltage protection	Input voltage range	110		160	%Vo
Over current protection	Input voltage range	120		210	%Io

Note: *Under 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 specific operation.

Isolation specifications

Item	Test condition	Min	Typ	Max	Units
Isolation voltage*	• Input-output • Input and output respectively on the shell	2250 1600			VDC VDC
Isolation resistance	Input-output, test at 500VDC	1000			MΩ
Isolation capacitance	Input-output, 100KHz/0.1V		2200		pF

* Test time of 1 minute and the leak current lower than 1mA.

Note:

- The maximum capacitive load offered were tested at input voltage range and full load;
- Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta = 25°C, humidity <75%RH with nominal input voltage and rated output load;
- All index testing methods in this datasheet are based on company corporate standards;
- Other product application information, please see DC-DC (railway power supply) Converter Application Notes for specific operation methods;
- We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see „Features“ and „EMC“;
- 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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EMC specifications (EN60950)				
Emissions	CE	CISPR32/EN55032	CLASS A (see Fig.3 for recommended circuit)/ CLASS B (see Fig.5-② for recommended circuit)	
Emissions	RE	CISPR32/EN55032	CLASS A (without external components)/ CLASS B (see Fig.5-② for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2	Contact ±6kV/Air ±8kV	perf. Criteria B
Immunity	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A
Immunity	EFT	IEC/EN61000-4-4	±4kV (see Fig.4 or Fig.5-③ for recommended circuit)	perf. Criteria B
Immunity	Surge	IEC/EN61000-4-5	line to line ±2kV (2Ω 18uF see Fig.4 for recommended circuit) line to ground ±4kV (12Ω 9uF see Fig.4 for recommended circuit)	perf. Criteria B perf. Criteria B
Immunity	Surge	EN50121-3-2	line to line ±1kV (42Ω 0.5uF see Fig.5-③ for recommended circuit) line to ground ±2kV (42Ω 0.5uF see Fig.5-③ for recommended circuit)	perf. Criteria B perf. Criteria B
Immunity	CS	IEC/EN61000-4-6	10 Vr.m.s	perf. Criteria A
EMC specifications (EN50155)				
Emissions	CE	EN50121-3-2 EN55016-2-1	150kHz-500kHz 99dBuV 500kHz-30MHz 93dBuV	
Emissions	RE	EN50121-3-2 EN55016-2-1	30MHz-230MHz 40dBuV/m at 10m 230MHz-1GHz 47dBuV/m at 10m	
Immunity	ESD	EN50121-3-2	Contact ±6kV/Air ±8kV	perf. Criteria B
Immunity	RS	EN50121-3-2	20V/m	perf. Criteria A
Immunity	EFT	EN50121-3-2	±2kV 5/50ns 5kHz	perf. Criteria A
Immunity	Surge	EN50121-3-2	line to line ±1kV (42Ω, 0.5μF) line to ground ±2kV (42Ω, 0.5μF)	perf. Criteria B perf. Criteria B
Immunity	CS	EN50121-3-2	0.15MHz-80MHz 10 Vr.m.s	perf. Criteria A

Note: All the tests are measured under the conditions of inputs capacitor 100uF/200V or FC-CX1D filter (the recommended circuit please see Fig.3 or see Fig.4).

Product Selection Guide

Approval	Model	Input Voltage (VDC)		Output		Full Load Efficiency*** (%) Min./Typ.	Capacitive Load (μF)Max.
		Nominal (Range)	Max.**	Voltage (VDC)	Current(mA) Max./Min.		
---	20DRW4_11003S2.25	110 (40-160)	170	3.3	5000/0	80/82	10000
---	20DRW4_11005S2.25	110 (40-160)	170	5	4000/0	82/84	10000
---	20DRW4_11012S2.25	110 (40-160)	170	12	1667/0	83/85	1600
---	20DRW4_11015S2.25	110 (40-160)	170	15	1333/0	84/86	1000
UL	20DRW4_11024S2.25	110 (40-160)	170	24	833/0	84/86	470

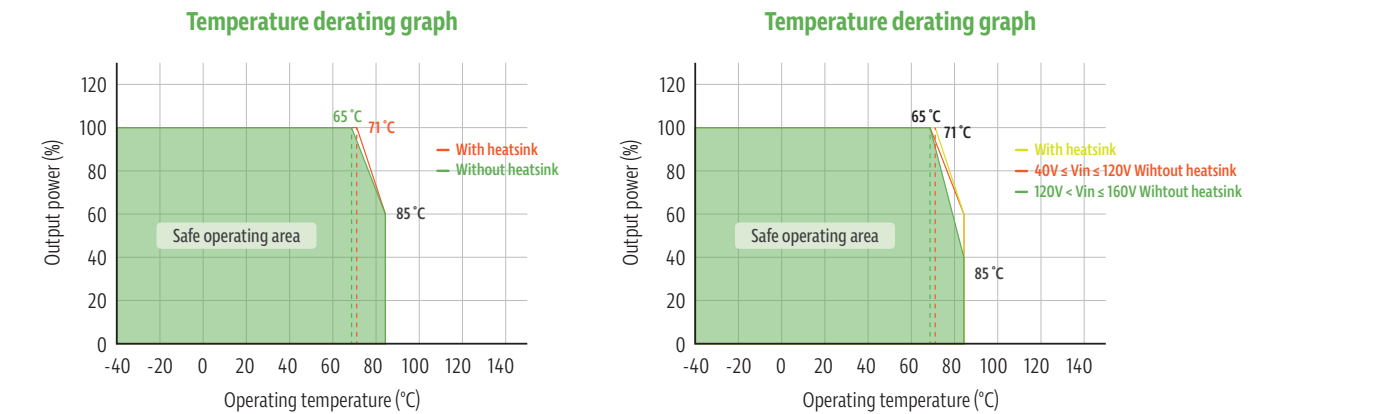
Note:

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

*** Efficiency is measured at nominal input voltage and rated output load; efficiencies for all models is decreased by 2% due to the input reverse polarity protection circuit.

Please add suffix /HS when ordering the converters with heatsink i.e. 20DRW4_11024S2.25/HS

Typical characteristics

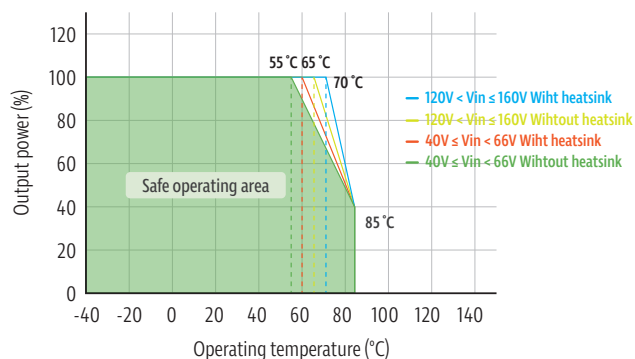


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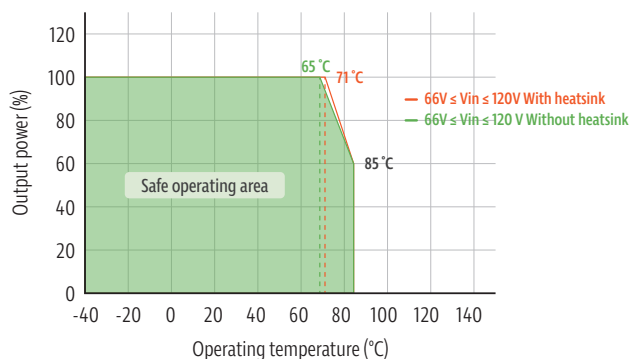
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Typical characteristics

Temperature derating graph



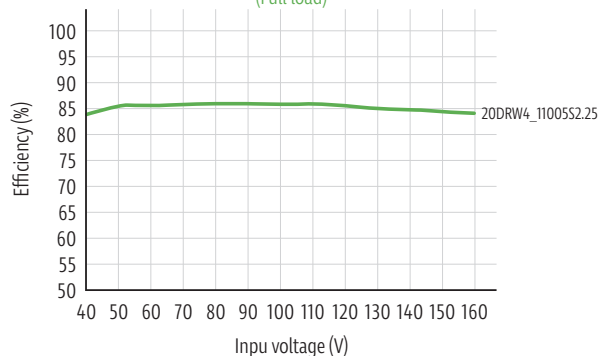
Temperature derating graph



Efficiency

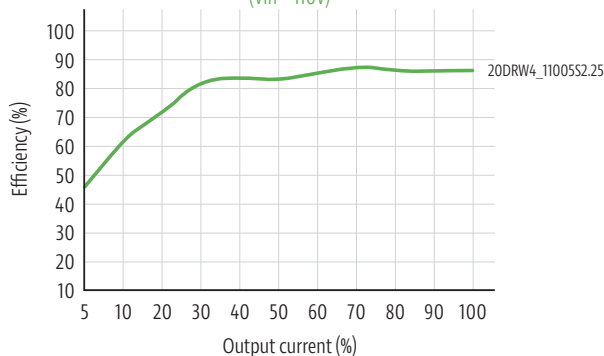
Efficiency vs input voltage

(Full load)



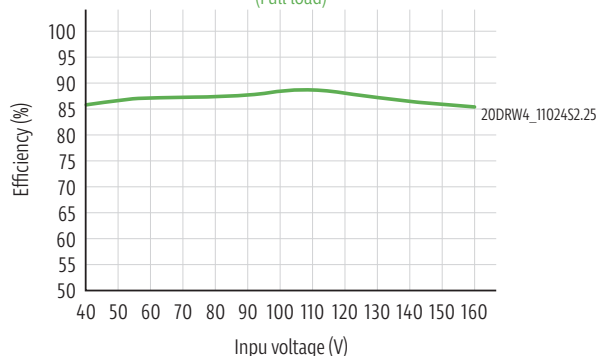
Efficiency vs output load

(Vin = 110V)



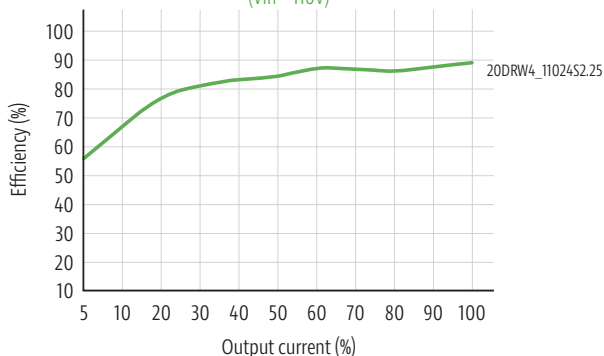
Efficiency vs input voltage

(Full load)



Efficiency vs output load

(Vin = 110V)



Typical application

All the 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 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 max. capacitive load value of the product.

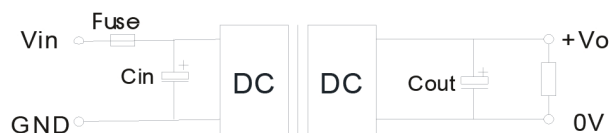


Fig 2

Vout (VDC)	Fuse	Cin	Cout
3.3/5	2A slow blow	10μF - 47μF/250V	470μF/16V
12/15	2A slow blow	10μF - 47μF/250V	220μF/25V
24	2A slow blow	10μF - 47μF/250V	100μF/50V

EMC solution recommended circuit

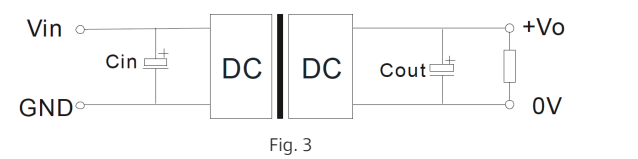


Fig. 3 List of components:

Cin	27uF -100uF/250V
Cout	Refer to the Cout in fig. 1

Notes: Fig. 3 Cin please use the 250V withstand voltage of the capacitor.

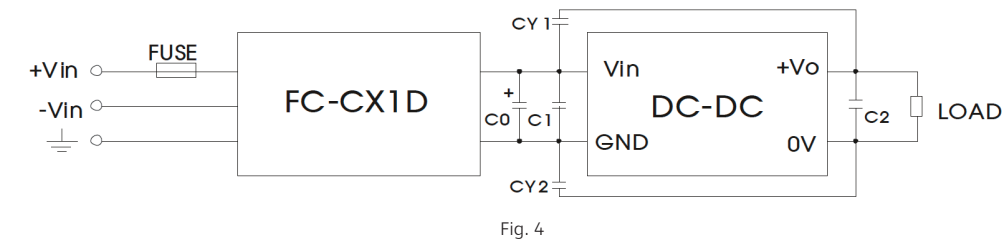
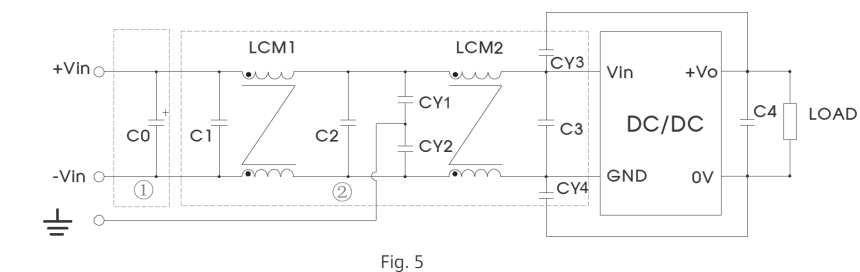


Fig. 4 List of components:

FUSE	Choose according to actual input current
FC-CX1D	FC-CX1D: Mornsun EMC filter, Input voltage range: 40V-160V
C0	100uF/200V
C1	Refer to the Cin in Fig.2
C2	Refer to the Cout in Fig.2
CY1, CY2	1000pF/400VAC



Notes: Part ① in the Fig. 5 is used for EMS test and part ② for EMI test

Figure 4 parameter description:

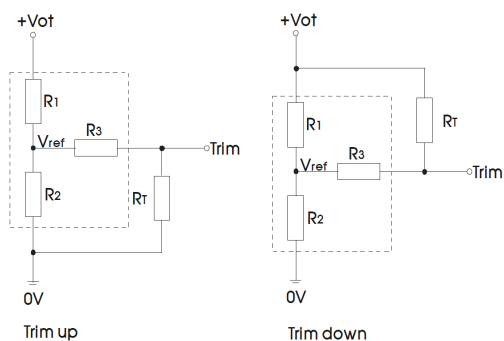
C0	100uF/200V
C1, C2	0.22uF/250V
C3	Refer to the Cin in Fig.2
LCM1	2.2mH(FL2D-10-222)
LCM2	0.53mH (material: TN150P-RH12.7*12.7*7.9)
CY1, CY2, CY3, CY4	1000pF/400VAC
C4	Refer to the Cout in Fig.2

The products do not support parallel connection of their output

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Trim application & trim resistance



Calculating Trim resistor values:

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

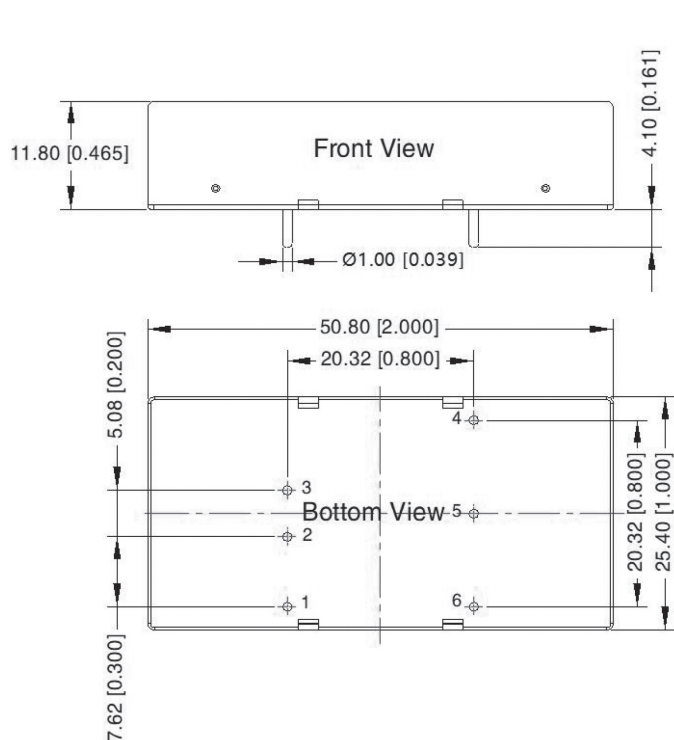
$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \quad a = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$$

R_T = Trim Resistor value;
 a = self-defined parameter
 V_o' = desired output voltage

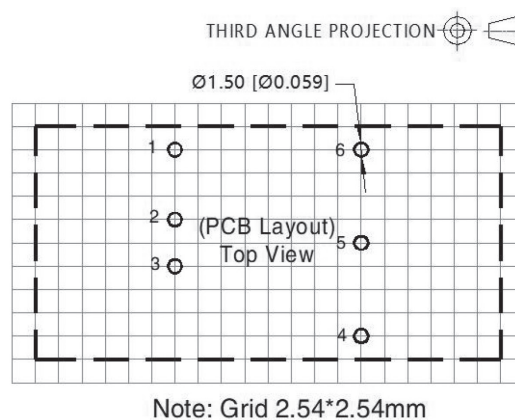
TRIM resistor connection (dashed line shows internal resistor network)

Vout(V)	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)
3.3	4.772	2.87	10	1.25
5	2.883	2.87	10	2.5
12	11.000	2.87	15	2.5
15	14.384	2.87	15	2.5
24	24.872	2.87	17.8	2.5

Mechanical dimensions (without heatsink)

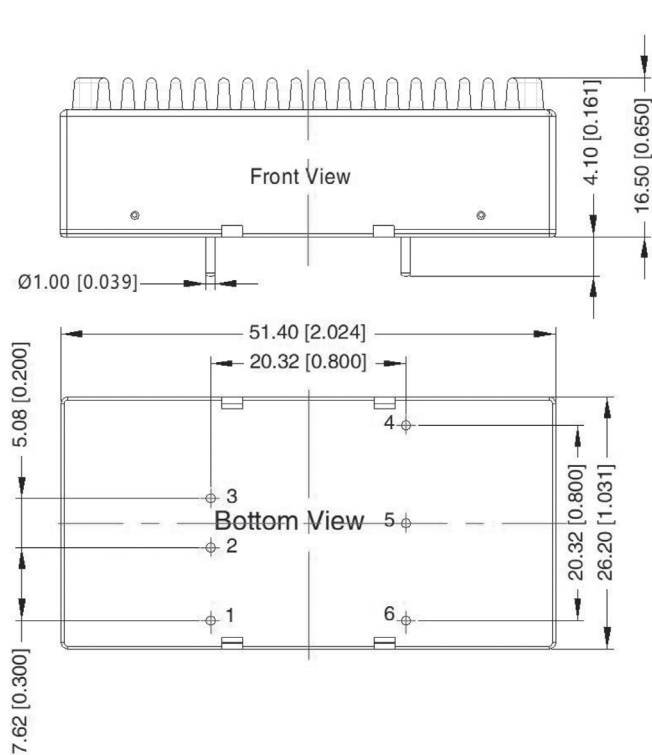


Note:
 Unit:mm and [inch]
 Pin section tolerances: ± 0.10 [± 0.004]
 General tolerances: ± 0.50 [± 0.020]



Pin-Out	
Pin	Function
1	Ctrl
2	GND
3	Vin
4	+Vo
5	Trim
6	0V

Mechanical dimensions (with heatsink)



THIRD ANGLE PROJECTION

Pin-Out	
Pin	Function
1	Ctrl
2	GND
3	Vin
4	+Vo
5	Trim
6	0V

Note:
Unit:mm and [inch]
General tolerances: ±0.50[±0.020]