

CHASSIS MOUNT DC-DC CONVERTERS

4:1 WIDE INPUT RANGE, 150 WATTS

RAILWAY APPLICATIONS

FWD(D)150 SERIES



FEATURES

- 4:1 Wide Input Range (9-36, 43-160Vdc)
- No Minimum Load Required
- High Efficiency: Up to 89%
- Built In EN55011 and EN55022 Class A Filter
- Input to Output Isolation: 2250Vdc
- Adjustable Output Voltage
- Six-Sided Continuous Shield
- 3.68" × 2.07" × 0.67" Wall Mount Package
- UL60950-1, EN60950-1 IEC60950-1, and EN50155 Approved
- CE Marked
- RoHS and Reach Compliant

SELECTION GUIDE All specifications are typical at nominal input, full load and 25°C, unless otherwise noted.

Input Voltage Range Vdc	Output Voltage Vdc	Output Current at Full Load A	Input Current No Load ⁽³⁾ mA	Efficiency ⁽⁴⁾ %	Model Number	Max. Capacitor Load µF
9-36	12	12.5	70	86	FWD150-24S12 FWD150-24S12	40000
9-36	15	10	80	86	FWD150-24S15 FWD150-24S15	26000
9-36	24	6.3	95	87	FWD150-24S24 FWD150-24S24	10000
9-36	28	5.4	120	87	FWD150-24S28 FWD150-24S28	7600
9-36	48	3.2	130	86	FWD150-24S48 FWD150-24S48	2600
18-75	12	12.5	50	87	FWD150-48S12 FWD150-48S12	40000
18-75	15	10	60	87	FWD150-48S15 FWD150-48S15	26000
18-75	24	6.3	60	88	FWD150-48S24 FWD150-48S24	10000
18-75	28	5.4	70	88	FWD150-48S28 FWD150-48S28	7600
18-75	48	3.2	70	87	FWD150-48S48 FWD150-48S48	2600
43-160	12	12.5	25	88	FWD150-110S12 FWD150-110S12	40000
43-160	15	10	25	89	FWD150-110S15 FWD150-110S15	26000
43-160	24	6.3	25	89	FWD150-110S24 FWD150-110S24	10000
43-160	28	5.4	25	89	FWD150-110S28 FWD150-110S28	7600
43-160	48	3.2	35	88	FWD150-110S48 FWD150-110S48	2600

Remote Control Option:
Positive (Standard): **No Suffix**
Negative: **Suffix "N"**

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Input Specifications			Output Specifications		
Operating input voltage range, Vdc	9 Min., 24 Typ., 36 Max.	24V(nom)	Voltage accuracy, %	-1 Min., +1 Max.	
	18 Min., 48 Typ., 75 Max.	48V(nom)			
	43 Min., 110 Typ., 160 Max.	110V(nom)	Line regulation, %	-0.2 Min., +0.2 Max.	Low Line to High Line at Full Load
Start up voltage, Vdc	9 Max.	24V(nom)	Load regulation, %	-0.4 Min., +0.4 Max. No Load to Full Load	
	18 Max.	48V(nom)			
	43 Max.	110V(nom)	Voltage and adjustability, %	+20 Max.	Use a resistor across on the Trim1 and Trim2 to adjust the output voltage.
Shutdown voltage	7.9 Min., 8.5 Max.	24V(nom)	Ripple and Noise, mVp-p	Measured by 20MHz bandwidth	
	15.6 Min., 16.8 Max.	48V(nom)			
	33 Min., 36 Max.	110V(nom)			
Start up time, ms	35 Typ.	Constant resistive load, Power up		100 Typ.	With a 12Vout, 15Vout
	35 Typ.	Remote ON/OFF		200 Typ.	With a 24Vout, 28Vout
Input surge voltage 1,000mS Max., Vdc	50 Max.	24V(nom)		350 Typ.	With a 48Vout
	100 Max.	48V(nom)	Temperature coefficient, %/°C	-0.02 Min., +0.02 Max.	
	185 Max.	110V(nom)	Transient response recovery time, µs	200 Typ.	25% load step change
Input filter	Pi type		Over voltage protection, %	125 Min., 140 Max.	% of Vout(nom); Hiccup mode
		Referenced to -Vin pin	Over load protection, %	105 Min., 120 Max.	% of Iout rated; CC mode
	Open or 3 - 12Vdc	Positive logic (standard) DC-DC ON	Short circuit protection	Continuous, automatic recovery	
	Short or 0 - 1.2Vdc	Positive logic (standard) DC-DC OFF			
	Short or 0 - 1.2Vdc	Negative logic (option) DC-DC ON			
	Open or 3 - 12Vdc	Negative logic (option) DC-DC OFF			
Remote ON/OFF	-0.5 Min., 1 Max., mA	Input current of Ctrl pin			
	3.5mA Typ.	Remote off input current			

General Specifications					
Isolation voltage, Vdc	1 minute	Input to Output	2250 Min.		
	1 minute	Input (Output) to Case	1600 Min.		
Isolation resistance, GΩ	500Vdc		1 Min.		
Isolation capacitance, pF					3500 Max.
Switching frequency, kHz	24Vdc Input	48Vout	248 Min.	275 Typ.	303 Max.
		Others	270 Min.	300 Typ.	330 Max.
	48Vdc Input	48Vout	248 Min.	275 Typ.	303 Max.
		Others	270 Min.	300 Typ.	330 Max.
	110Vdc Input	All	203 Min.	225 Typ.	248 Max.

Environmental Specifications				
Operating case temperature, °C		-40 Min.		+110 Max.
Over temperature protection, °C			+110 Typ.	
Storage temperature range, °C		-55 Min.		+125 Max.
Thermal impedance ⁽¹⁾ , °C/W	Vertical direction by natural convection (20LFM)			
	Only mount on the iron base-plate		+2.55 Typ.	
	Mount on the iron base-plate and top side with 7G-0058A Heat-sink		+2.0 Typ.	
Thermal shock		MIL-STD-810F		
Shock		EN61373, MIL-STD-810F		
Vibration		EN61373, MIL-STD-810F		
Relative humidity		5% to 95% RH		

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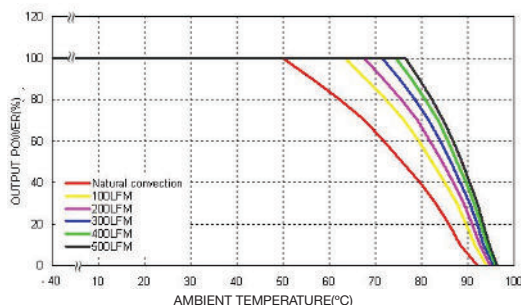
Physical Specifications		EMC Specifications		
Design meet safety standard	UL60950-1, EN60950-1, IEC60950-1, EN50155, CE	Specifications	Conditions	Level
Case material	Aluminum	EMI ⁽²⁾	EN55011, EN55022	DC-DC Module, Class A
Base material	Aluminum	ESD	EN61000-4-2	Air ±8kV and Contact ±6kV
Potting material	Silicon (UL94-V0)	Radiated immunity	EN61000-4-3	10V/m
Weight	225g (7.94oz.), FWB150 220g (7.76oz.), FWD150	Fast transient ⁽³⁾	EN61000-4-4	±2kV
MTBF	4.954×10 ⁵ hrs, MIL-HDBK-217F, Full load	Surge ⁽³⁾	EN61000-4-5	EN55024 ±1kV, EN50155 ±2kV
Dimensions	3.68" × 2.07" × 0.67"	Conducted immunity	EN61000-4-6	10 Vr.m.s
				Perf. Criteria A

Note:

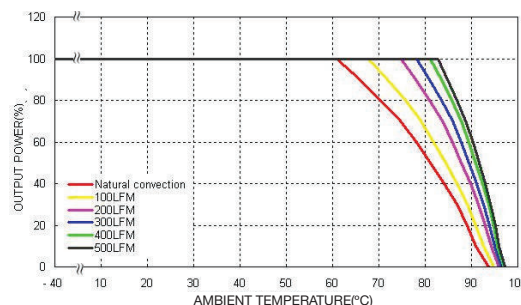
- (1)The iron base-plate dimension is 19" * 3.5" * 0.063" (The height is EIA standard 2U).
(2)The heat-sink is optional and P/N is 7G-0058A-F.
- The standard modules meet EMI Class A without external components.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5.
The filter capacitor Polytron suggest: FWB(D)150-24SXX : Nippon chemi-con KY series, 470µF/50V.
FWB(D)150-24SXX :: Nippon chemi-con KY series, 220µF/100V.
FWB(D)150-110SXX : Nippon chemi-con KXJ series, 150µF/200V.

CAUTION: This power module is not internally fused; an input line fuse must always be used. If the load was having sourcing capability (Ex: Battery or Super Capacitor), an output line fuse must always be used.

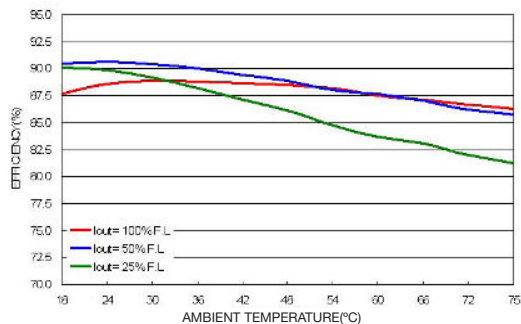
Characteristic Curve



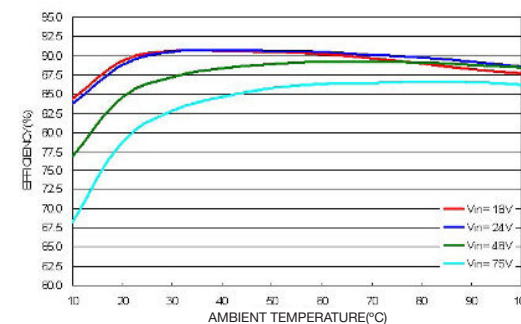
FWB(D)150-48S24 Derating Curve (Note 1)



FWB(D)150-48S24 Derating Curve (Note 1)
With Heat-sink



FWB(D)150-48S24 Efficiency vs. Input Voltage



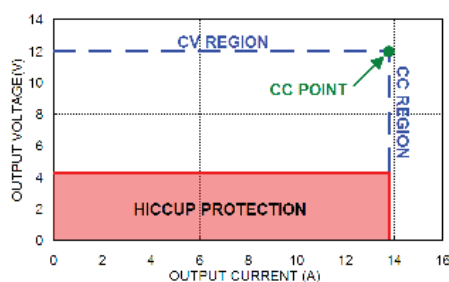
FWB(D)150-48S24 Efficiency vs. Output Load

FWB(D)150 SERIES

Characteristic Curve (Continued)

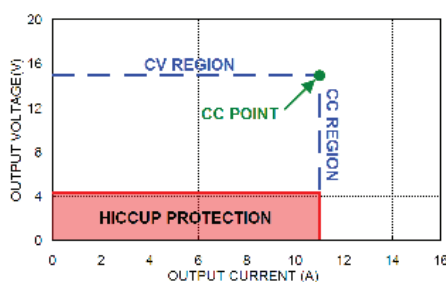
FWB(D)150-XXS12

Vout vs. Iout



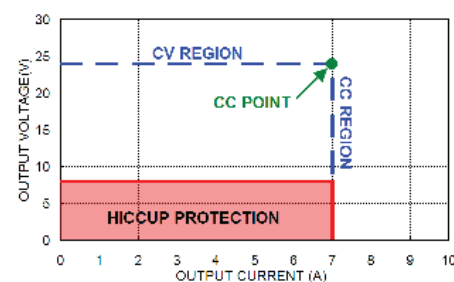
FWB(D)150-XXS15

Vout vs. Iout



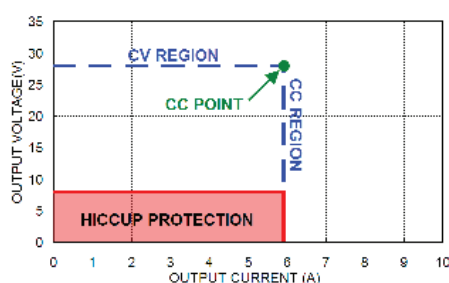
FWB(D)150-XXS24

Vout vs. Iout



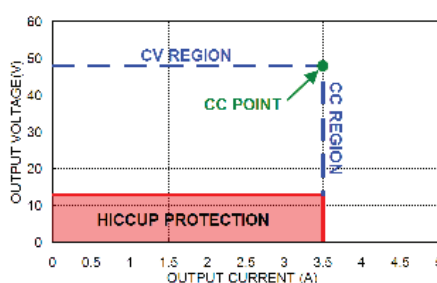
FWB(D)150-XXS28

Vout vs. Iout



FWB(D)150-XXS48

Vout vs. Iout



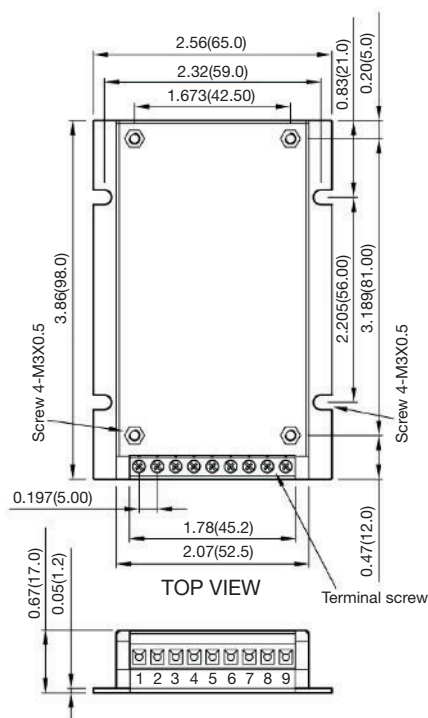
Note:

1. This series can operate in CC and CV mode, so it can operate at up to 200 watts. The Vout adjustability is 20% of output voltage and the output current can operate 1.1 times and above when in CC mode.
Example 1: Vout=15V, full load=10A and normal output =150W. If trim up 20% and in CC mode, the total power will be 198W [(15V*1.2)*(10A*1.1)].
Example 2: Vout=48V and full load=3.2A, but 3.5A when in CC mode. The total power will be up to 201.6 watt. (48V*1.2)*3.5A=201.6W.
2. CV Region: In normal operation. The output current in datasheet
Condition: Resistance Load > Vout / Iout (CC Point)
3. CC Region: If the output load current are over rating. The output current will keep in a constant value. And output voltage will fall.
Condition: Resistance Load < Vout / Iout (CC Point)
4. Hiccup Protection: If the output resistance is become short. It will operate in hiccup protection.
Condition: FWB(D)150-XXS12, FWB(D)150-XXS15: Vout < 4.3V (typ.) to Output Short.
FWB(D)150-XXS24, FWB(D)150-XXS28: Vout < 8.0V (typ.) to Output Short.
FWB(D)150-XXS48: Vout < 13V(typ.) to Output Short.

FWD(D)150 SERIES

Mechanical Drawing

FWD150 Dimensions

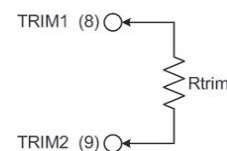


PIN CONNECTION

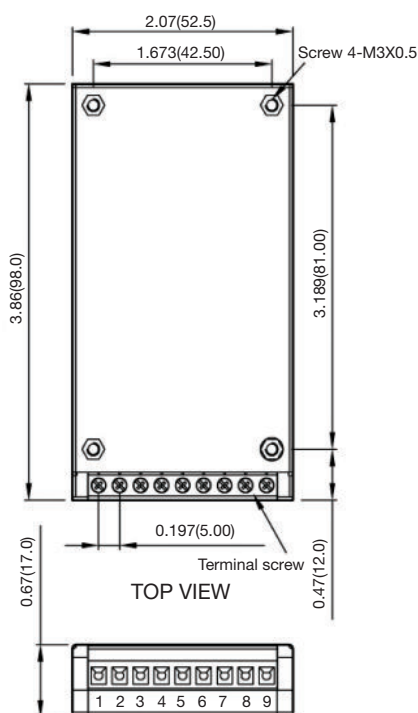
PIN	DEFINE	RECOMMEND MATCHING WIRE (AWG)
1	+Vin	14-16
2	+Vin	14-16
3	-Vin	14-16
4	-Vin	14-16
5	Ctrl	14-24
6	+Vout	14-16
7	-Vout	14-16
8	Trim 1	14-24
9	Trim 2	14-24

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.



FWD150 Dimensions

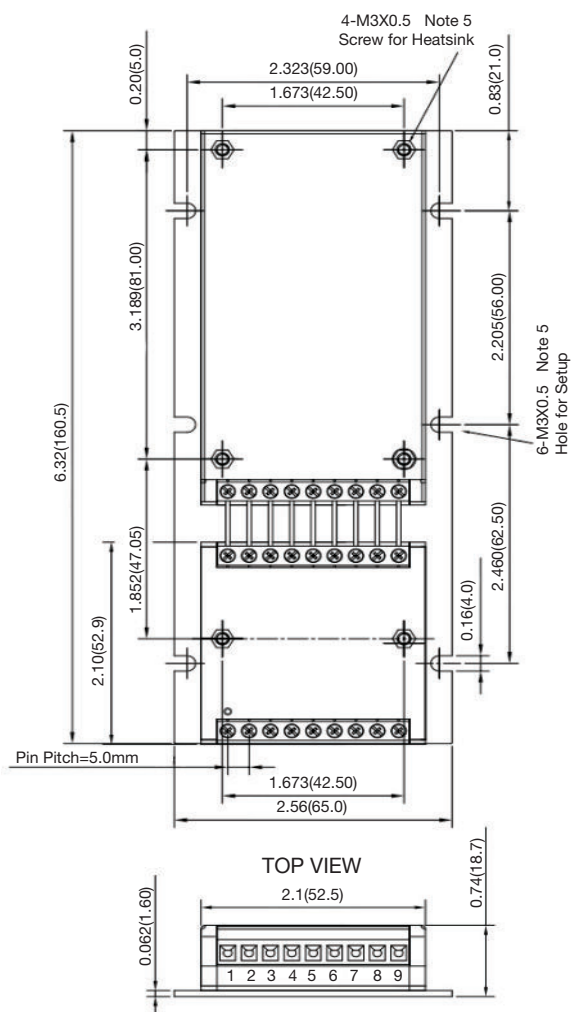


1. All dimensions in inch (mm)
2. Tolerance: $x.xx \pm 0.02 (x.x \pm 0.5)$
 $x.xxx \pm 0.01 (x.xx \pm 0.25)$
3. Pole pitch tolerance $\pm 0.01 (0.25)$
4. Screw locked torque: MAX 5.0kgf-cm(0.49N-m)
5. Terminal screw locked torque: MAX 2.5kgf-cm(0.25N-m)

Mechanical Drawing (Continued)

FWB150-24SXX Dimensions

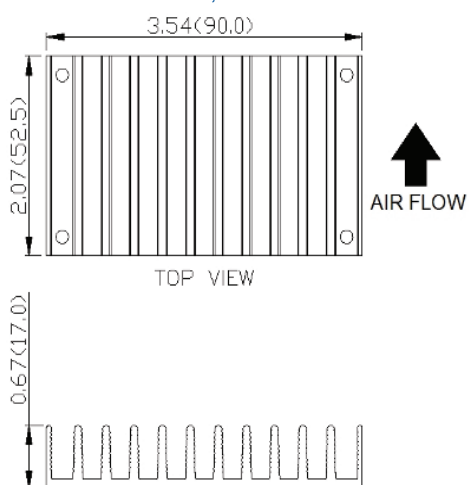
FWB150-48SXX Dimensions



1. All dimensions in inch (mm)
2. Tolerance: $x.xx \pm 0.02$ ($x.x \pm 0.5$)
 $x.xxx \pm 0.01$ ($x.xx \pm 0.25$)
3. Pole pitch tolerance ± 0.01 (0.25)
4. Screw locked torque: MAX 5.0kgf-cm(0.49N-m)
5. Terminal screw locked torque: MAX 2.5kgf-cm(0.25N-m)

Heat-Sink Type Options

7G-0058A-F, Suffix:-HC



1. All dimensions in inch (mm)
2. Tolerance: $x.xx \pm 0.02$ ($xx.x \pm 0.5$)
 $x.xxx \pm 0.01$ ($x.xx \pm 0.25$)