

600 to 700 Watt 2.4x4.6 Inch Package FB 2:1 Input Range



- o High Efficiency up to 92%
- o Fixed Switching Frequency
- o Input Under-Voltage Protection
- o Over Temperature Protection
- o Over Voltage/Current Protection
- o Remote ON/OFF Control
- o Full-Brick Size meet Industrial Standard
- o Fully Isolated 1500 VDC
- o UL60950-1 Approval

MODEL NUMBER	INPUT VOLTAGE ¹⁾	OUTPUT VOLTAGE	OUTPUT CURRENT MAX.	INPUT CURRENT		%EFF	CAPACITOR LOAD MAX. ²⁾
				NO LOAD	FULL LOAD		
600FBRS24W12LC	18-36 VDC	12 VDC	50 A	150 mA	28.09 A	88	10000 µF
600FBRS24W24LC		24 VDC	25 A		27.78 A	89	
600FBRS24W28LC		28 VDC	21.5 A		27.87 A	90	
600FBRS24W32LC		32 VDC	19 A		27.84 A	91	
600FBRS24W48LC		48 VDC	12.5 A	200 mA	27.47 A		
600FBRS48W12LC	36-75 VDC	12 VDC	50 A	90 mA	13.89 A	90	10000 µF
600FBRS48W24LC		24 VDC	25 A	100 mA	13.59 A	92	
600FBRS48W28LC		28 VDC	25 A	105 mA	16.03 A	91	
600FBRS48W32LC		32 VDC	19 A	90 mA	13.77 A	92	
600FBRS48W48LC		48 VDC	12.5 A	130 mA	13.59 A		

NOTE:

1. Nominal Input Voltage 24, 48 VDC.

2. The Output Terminal of all models required a minimum capacitor 470 µF to maintain specified Regulation.

SPECIFICATIONS

All Specifications Typical At Nominal Line, Full Load, and 25°C Unless Otherwise Noted

INPUT SPECIFICATIONS

Input Voltage Range		2:1
Input Surge Voltage (100 ms max.)	24 V 48 V	50 VDC max. 100 VDC max.
Under Voltage Lockout	24 Vin power up 24 Vin power down 48 Vin power up 48 Vin power down	17 V 16 V 35 V 33 V
Input Over Voltage Protection	24 Vin Turn off 24 Vin Turn on 48 Vin Turn off 48 Vin Turn on	40 V 38 V 80 V 77 V
Negative Logic Remote ON/OFF ³⁾	Turns the module on as long as a current (1-10 mA) is flowing between +on/off and -on/off and inactive when no current is flowing	
Input Filter		Pi Type

OUTPUT SPECIFICATIONS

Voltage Accuracy		±1.5% max.
Transient Response	25% Step Load Change	<500µ sec.
Load Share Accuracy		±10% at 50% to 100% Full Load
External Trim Adj. Range		60 to 110%
Auxiliary Output Voltage/Current		10 ±3 VDC/20 mA max.
Ripple and Noise at 20 MHz BW ⁴⁾	12 V	60 mV RMS max. 120 mV p-p max.
	24 V	100 mV RMS max. 240 mV p-p max.
	28 V	100 mV RMS max. 280 mV p-p max.
	32 V	120 mV RMS max. 320 mV p-p max.
	48 V	200 mV RMS max. 480 mV p-p max.
Temperature Coefficient		±0.03%/°C
Short Circuit Protection		Continuous
Line Regulation ⁵⁾		±0.2% max.
Load Regulation ⁶⁾		±0.5% max.
Over Voltage Protection trip Range, % Vo nom.		115-140%
Current Limit		110% ~ 150% Nominal Output
Start Up Time		160 ms

NOTE:

3. Positive Logic Remote ON/OFF (Suffix "R") Turns the module off as long as a current (1-10 mA) is flowing between +on/off and -on/off and active when no current is flowing
4. Output Ripple and Noise measured with 10 µF tantalum and 1 µF ceramic Capacitor across Output.
5. Measured from High Line to Low Line.
6. Measured from Full Load to Zero Load.
7. An external input Capacitor 220 µF for all models are recommended to reduce input ripple voltage.
8. The output adjustment circuit and trim equations show as figure 1 and figure 2.
9. If the remote sense feature is not be used, the +sense pin should be connected to the +Vout pin and the - sense pin should be connected to the -Vout pin. (refer application note)

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GENERAL SPECIFICATION

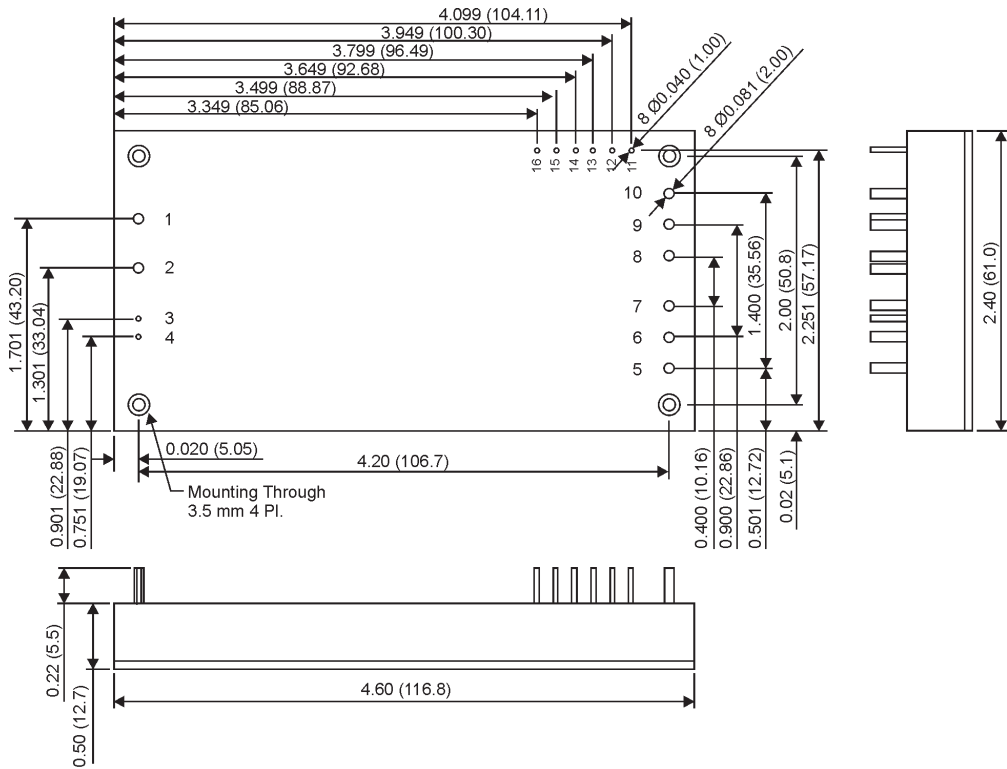
Efficiency		see table
Isolation Voltage	Input / Output	1500 VDC min.
	Input / Case	1500 VDC min.
	Output / Case	1500 VDC min.
Isolation Resistance		10 ⁷ Ohms min.
Isolation Capacitance		4000 pF
Switching Frequency	600FBRS48W12M, 600FBRS48W28M, 600FBRS48W32M	300 kHz
	Others	250 kHz
Operating Case Temperature Range		-40°C to +100°C
Storage Temperature Range		-55°C to +105°C
Humidity		95% RH max. non condensing
MTBF (MIL-STD-217F, GB, 25°C, Full Load)		450 khrs
Thermal Shutdown (Case Temperature)		+110°C
Dimensions		4.60x2.40x0.50 Inches (116.8x61.0x12.7 mm)
Case Material		Aluminum Baseplate with Plastic Case
Weight		220 g

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MECHANICAL SPECIFICATIONS

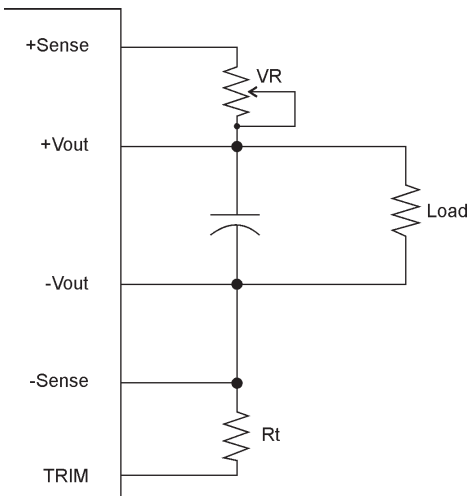
Case „FB“



PIN CONNECTIONS	
1	-INPUT
2	+INPUT
3	-REMOTE CONTROL
4	+REMOTE CONTROL
5-7	+OUTPUT
8-10	-OUTPUT
11	-SENSE
12	+SENSE
13	TRIM
14	PC/NC
15	IOG
16	AUX

All Dimensions in Inches (mm)
 Tolerances
 Inches: x.xx = ±0.02, x.xxx = ±0.010
 Millimeters: x.x = ±0.5, x.xx = ±0.25
 Pin DIA
 ±0.004
 ±0.1

APPLICATION NOTES



The output voltage can be determined by below equations:

$$V_f = \frac{1.24 \times \left(\frac{R_t \times 33}{R_t + 33} \right)}{7.68 + \left(\frac{R_t \times 33}{R_t + 33} \right)}$$

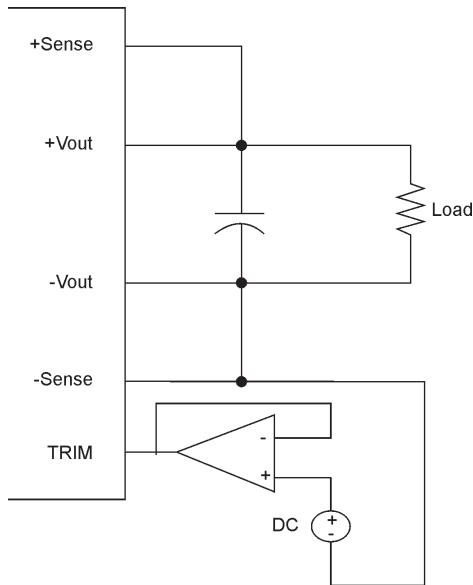
$$V_{out} = (V_o + V_R) \times V_f$$

Unit: kOhms
 V_o: Nominal Output Voltage
 R_t = 6.8 kOhms

Fig.1 The schematic of output voltage adjusted by using external resistor and/or variable resistor.

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Output Voltage = TRIM
Terminal Voltage * Nominal Output Voltage

Fig.2 The schematic of output voltage adjusted by using external DC voltage.

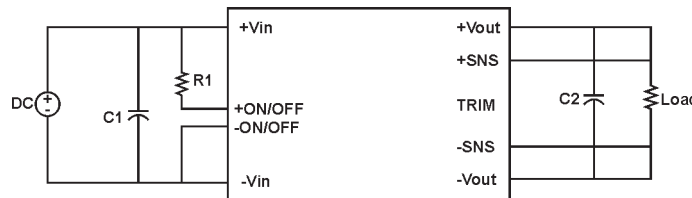
Output Remote Sensing

The 600FBR5 converter has the capability to remotely sense both lines of its output. This feature moves the effective output voltage regulation point from the output of the unit to the point of connection of the remote sense pins. This feature automatically adjusts the real output voltage of the 600FBR5 in order to compensate for voltage drops in distribution and maintain a regulated voltage at the point of load.

$$\text{The remote-sense voltage range is : } [(+V_{out}) - (-V_{out})] - [(+Sense) - (-Sense)] \leq 10\% \text{ of } V_{out, nominal}$$

If the remote sense feature is not to be used the sense pins should be connected locally. The +Sense pin should be connected to the +Vout pin at the module and the -Sense pin should be connected to the -Vout pin at the module.

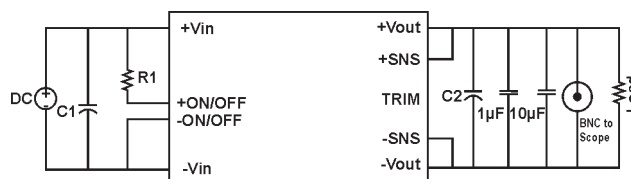
This is shown in the schematic below:



Note: Although the output voltage can be increase by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim. The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module can be increased and consequently increase the power output of the module if output current remains unchanged. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power (maximum rated power = $V_{o, set} \times I_{o, max}$.)

Output Ripple and Noise

Output ripple and noise is measured with 1.0 μF ceramic and 10 μF solid tantalum capacitors across the output.



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Output Capacitance

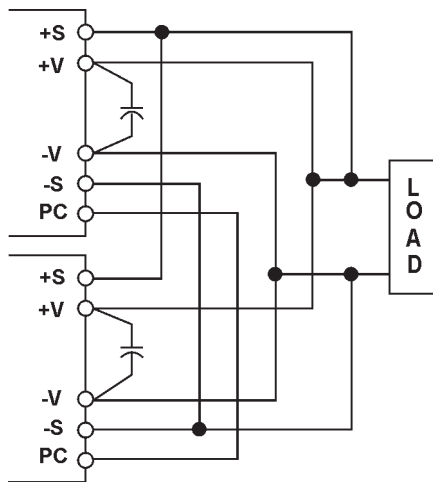
The 600FBRS converters provide unconditional stability with or without external capacitors. For good transient response, low ESR output capacitors should be located close to the point of load. PCB design emphasizes low resistance and inductance tracks in consideration of high current applications. Output capacitors with their associated ESR values have an impact on loop stability and bandwidth. The minimum output capacitance is 470 µF which need three or four times capacitance when operating below -20°C and the absolute maximum value of 600FBRS output capacitance is 10000 µF. For values larger than this, please contact M+R Multitronik.

Parallel Operation

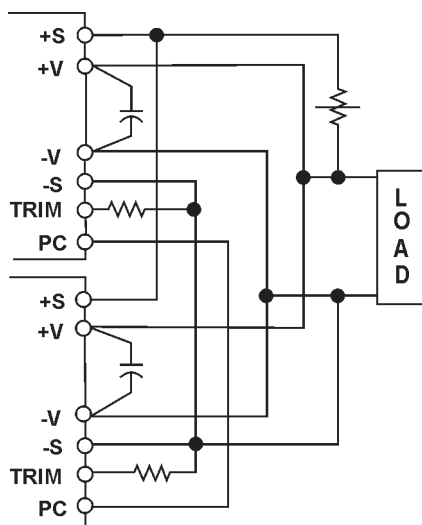
The 600FBRS are also designed for parallel operation. When paralleled, the load current can be equally shared between the modules by connecting the PC pins together.

There are two different parallel operations for 600FBRS, one is parallel operation when load can't be supplied by only one power unit: the other is the N+1 redundant operation which is high reliable for load of N units by using N+1 units.

(a) parallel operation



(b) parallel operation with programmed and adjustable output



NOTICE:
The information in this document has been carefully checked. However, no responsibility is assumed for inaccuracies! Specifications can be changed without notice. The latest and most complete information can be found on our website.