

# Make-Ps®

## DC/DC CONVERTER

# 200FR series

## Single & Dual Output DC/DC Converter

### FEATURES

- Up to 61 % Efficiency
- Single and Dual Output, 2 watt converter
- Available in 5, 12, 24 and 48 VDC Inputs
- Industry Standard Pinout
- Short Circuit Protection

### DESCRIPTIONS

The 200FR series 2 watt power modules are specially designed to provide low output ripple, and tight regulation in a low-profile 24 pin DIP package. The series consists of 20 models with input voltages of 5V, 12V, 24V and 48V, and offers regulated output voltages of 5V, 12V, 15V,  $\pm 12V$  and  $\pm 15V$ .

The  $-25^{\circ}\text{C}$  to  $+71^{\circ}\text{C}$  operating temperature range makes it ideal for data communication equipment, mobile battery driven equipment, distributed power systems, telecommunication equipment, mixed analog/digital subsystems, automatic test instrumentation and industrial robot systems.

### OUTPUT CHARACTERISTICS

	Min	Typ	Max	Unit/Comments
Output Voltage Set Point	$\pm 2.0$	$\pm 4.0$		% Output voltage at nominal line & FL
Output Voltage Balance (Duals)	$\pm 1.0$	$\pm 3.0$		% Equal Output Loads
Line Regulation	$\pm 0.2$	$\pm 0.5$		% Output voltage measured from min. input line to maximum
Load Regulation	$\pm 0.2$	$\pm 0.5$		% Output voltage measured from FL to 10% load
Ripple/Noise		45	50	mV p-p, Nom.Line @FL, 20MHz B.W., using 1 $\mu\text{f}$ bypass capacitor
Ripple/Noise			75	mV p-p, Over Line, Load & Temp., 20 MHz B.W., using 1 $\mu\text{f}$ bypass capacitor
Overload Protection	120			%Rated Output Load
Short Circuit Protection				Continuous, Automatic Recovery
Transient Response Deviation			$\pm 6$	% deviation of Vout for a 50% load change
Transient Recovery Time			50	$\mu\text{S}$ for 50% load change
Temperature Coefficient	$\pm 0.01$	$\pm 0.02$		% per degree C



### INPUT CHARACTERISTICS

	Min	Typ	Max	Unit/Comments
Input Voltage				
5 VDC Input Models	4.5	5	5.5	VDC
12 VDC Input Models	10.8	12	13.2	VDC
24 VDC Input Models	21.6	24	26.4	VDC
48 VDC Input Models	43.2	48	52.8	VDC
Input Fuse Requirements				
5 VDC Input Models		1500		mA; Slow blow type
12 VDC Input Models		700		mA; Slow blow type
24 VDC Input Models		350		mA; Slow blow type
48 VDC Input Models		135		mA; Slow blow type
Reverse Polarity Input Current			0.5	Amp
Short Circuit Input Power			2000	mW
Input Filter				Pi Filter

### GENERAL CHARACTERISTICS

	Min	Typ	Max	Unit/Comments
Switching Frequency	40	80		kHz
Isolation Voltage	500			VDC, 1 minute
Isolation Resistance	1000			Mohm, 500VDC
Isolation Capacitance		100	150	pF, 100kHz, 1Volt
MTBF (MIL-HBK-217F)	800			Thousand Hours, +25°C, Ground Benign

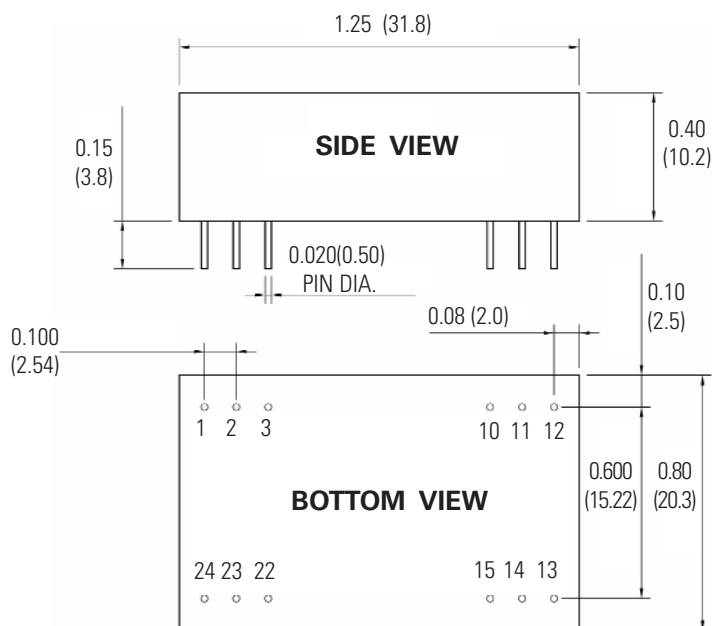
**ENVIRONMENTAL SPECIFICATIONS**

	Min	Typ	Max	Unit/Comments
Operating Temp. Range	-25		+71	°C; Ambient
Operating Temp. Range	-25		+90	°C; Case
Storage Temp. Range	-40		+125	°C
Relative Humidity			95	% Humidity; non-condensing
Cooling				Free-Air Convection

**PHYSICAL CHARACTERISTICS**

	Unit/Comments
Case Size	1.25 X 0.8 X 0.4 inches (31.8 X 20.3 X 10.2 mm)
Case Material	Non-Conductive Black Plastic
Flammability	UL94V-0
Weight	12.1 Grams

**OUTLINE DRAWING**



**PIN OUT CHART**

Pins	Single	Dual
1	+ Vin	+ Vin
2	NC	- Vout
3	NC	Common
10	- Vout	Common
11	+ Vout	+ Vout
12	- Vin	- Vin
13	- Vin	- Vin
14	+ Vout	+ Vout
15	- Vout	Common
22	NC	Common
23	NC	-V out
24	+ Vin	+V in

NC = No Connection

**Notes:**

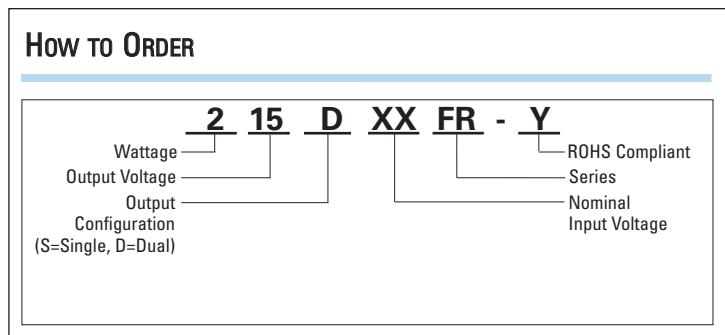
1. Unless otherwise specified dimensions are in inches (mm).

Tolerances	Inches	mm
	X.XX = ±0.02	X.X = ±0.5
	X.XXX = ±0.010	X.XX = ±0.25
Pin :	±0.002	±0.05

All specifications are typical at nominal input, nominal load and 25°C unless otherwise specified.

Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low ESR capacitor of 2.2mF for the 5V input devices, a 1.0mF for the 12V input devices and a 0.47mF for the 24V and 48V devices.

## How To ORDER

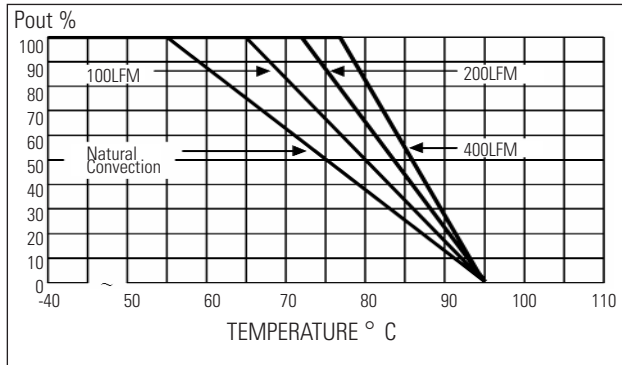


## MODEL SELECTION CHART

Model	Nominal Input Voltage (VDC)	Output Voltage (VDC)	Full Load Output Current (mA)	No Load Input Current (mA)	Full Load Input Current (mA)	Reflected Ripple Current (mA)	Efficiency (%)
205S5FR	5	5	400	80	800	80	50
212S5FR	5	12	165	80	730	80	54
215S5FR	5	15	133	80	690	80	57
212D5FR	5	±12	±83	80	740	80	53
215D5FR	5	±15	±66	80	770	80	51
205S12FR	12	5	400	40	330	30	50
212S12FR	12	12	165	40	295	30	56
215S12FR	12	15	133	40	265	30	62
212D12FR	12	±12	±83	40	280	30	59
215D12FR	12	±15	±66	40	280	30	59
205S24FR	24	5	400	20	163	15	51
212S24FR	24	12	165	20	135	15	61
215S24FR	24	15	133	20	135	15	61
212D24FR	24	±12	±83	20	135	15	61
215D24FR	24	±15	±66	20	135	15	61
205S48FR	48	5	400	10	83	10	50
212S48FR	48	12	165	10	70	10	59
215S48FR	48	15	133	10	70	10	59
212D48FR	48	±12	±83	10	80	10	51
215D48FR	48	±15	±66	10	80	10	51

DERATING CURVES

MODEL 200FR - 5V output only



MODEL 200FR - all other outputs

