

Input Ranges :
9-75 VDC

Output Output:
Single Output
3.3V - 24V
Bipolar Output
±5.0V, ±12V, ±15V
Triple Output
+5.0V / ±12V,
+5.0V / ±15V

Output Power:
15 - 20 W



The **F** DC-DC converters feature high power density, high efficiency and excellent line & load regulation. Using innovative design technique, state-of-the-art Current Mode PWM control, and Surface Mount packaging & manufacturing technology, the FS series provides up to 20 watts of well regulated power in a encapsulated 2.0" x 2.0" x 0.40" metal case with six-sided EMI/RFI shielding. Automatic feed forward compensation, pulse-by-pulse current limiting, and output short circuit protection are standard for all models.

These converters are designed for wide input range telecommunications, industrial and instrument applications. The wide input range (2:1 & 4:1) is ideal for battery or unregulated input applications.

No external components are needed for normal operation. Low ESR capacitors are used to minimize the conductive noise. This package is ideal for all I/O board system and distributed DC power configurations.

FEATURES

General:

- Small footprint : 2.0" x 2.0"
- Current-Mode Control
- Input/Output Isolation
- Input Voltage from 9 to 75Vdc
- 2:1 & 4:1 Input Voltage Range
- High conversion efficiency to 84%
- Line & load regulation to ±1.0%
- Fixed operating frequency
- Six-Sided Shielding

Isolation:

- Isolation Voltage >500V

APPLICATIONS

- Distributed Power Systems
- Workstations
- Computer Equipment
- Communications Equipment

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1. Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause performance degradation, adversely effect longterm reliability, and cause permanent damage to the device.

Parameter	Conditions / Description	Min	Max	Units
Input Voltage				
Continuous	12	-0.3	20	Vdc
	24	-0.3	38	Vdc
	48	-0.3	78	Vdc
	W24	-0.3	38	Vdc
	W48	-0.3	78	Vdc
Transient (100mSec.)	12	-0.3	22	Vdc
	24	-0.3	40	Vdc
	48	-0.3	80	Vdc
	W-24	-0.3	40	Vdc
	W-48	-0.3	80	Vdc
Operating Temperature	All models, base plate temperature	-40	+95	°C
Storage Temperature	Ambient	-55	+105	°C
Isolation Voltage	Input to Output		+700	Vdc

2. Input Specifications

Parameter	Conditions / Description	Min	Nom	Max	Units
Input Voltage					
Voltage Range (Continuous)	12	9	12	18	Vdc
	24	18	24	36	Vdc
	48	36	48	75	Vdc
	W-24	10	24	36	Vdc
	W-48	20	48	75	Vdc

3. Enable (On-Off Control)

Parameter	Conditions / Description	Min	Nom	Max	Units
Enable Pin					
Open Circuit Voltage			5		Vdc
Source Current				1	mA
Positive Logic	Standard				
On-Control	Logic High or Floating	5.0		18	Vdc
Off-Control		-0.5		1.8	Vdc
Negative Logic	Not Available				

* Enable pin can be left floating if not used.

4. Output Specifications

Parameter	Conditions / Description	Min	Nom	Max	Units
Voltage Accuracy	Please see table				%
Output Current	Please see table				Adc
Output Trim	Not Available				%Vout
Over Voltage Protection	Not available				Vdc
Line Regulation				±1.0	%Vout
Load Regulation				±1.0	%Vout
Transient Respoonse	50% ± 25% step load change		400		µSec.
Ripple & Noise	Please see table				mVp-p
Switching Frequency			100		KHz

5. Output Trim

Parameter	Conditions / Description	Min	Nom	Max	Units
Negative Trim	Standard				
Trim Up	Trim Pin to (-)Vout			10	%Vdc
Trim Down	Trim Pin to (+)Vout	10			%Vdc
Positive Trim	Not Available				

* Trim pin can be left floating if not used

6. Environmental and Mechanical Specifications

Parameter	Conditions / Description	Min	Nom	Max	Units
Operating Temperature	PCB Temperature	-40		+95	°C
Storage Temperature		-55		+105	°C
Temperature Coefficient				±0.02	%/°C
Shock	Halfsine wave, 3 axes	50			g
Sinusoidal Vibration	GR-63-CORE, Section 5.4.2	1			g
Humidity	Relative Humidity, Non-Condensing			95	%R.H.
Weight			6.7 (190)		Oz (g)
MTBF (calculated)	Bellcore TR-NWT-000332 method 1 - parts count	0.5			MHrs

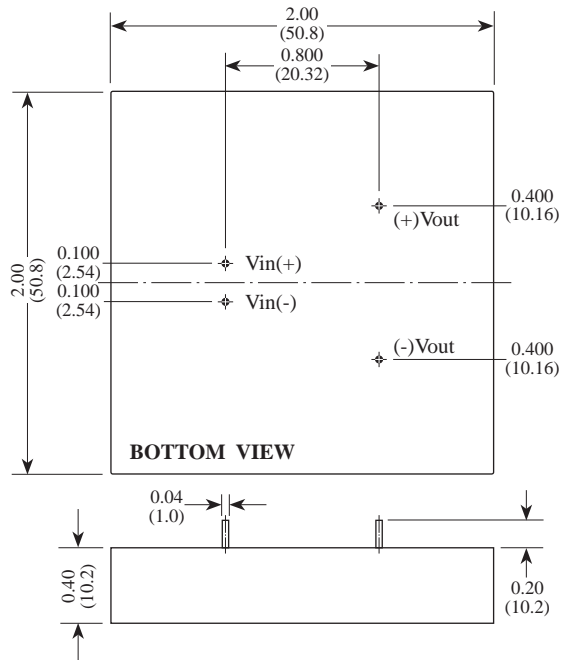
7. Isolation Specifications

Parameter	Conditions / Description	Min	Nom	Max	Units
Isolation Voltage					
Input to Output		500			Vdc
I/O to Case		500			Vdc
Isolation Resistance	Input to Output	10			MΩ
Isolation Capacitance	Input to Output		3		nF

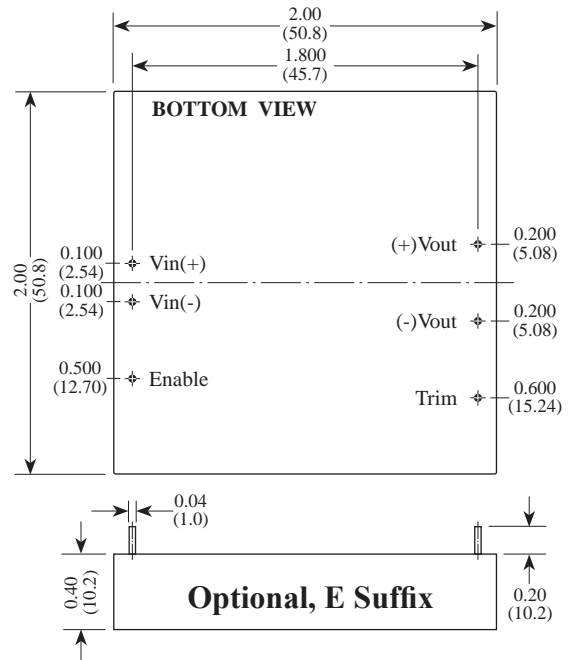
INPUT		OUTPUT								EFF. (typ.)	MODEL NO.
Nominal (Range)	Max. Output Power	Voltage (V)			Current (A)		Ripple & Noise		Over Load Protection		
		Set Point	Min.*	Max.*	Min.	Max.	Peak-Peak	R.M.S.			
12 (9 - 18)	10W	3.30	3.20	3.40	0.3	3.0	75mV	15mV	Pulse by Pulse Current Limiting	76%	F15S1203
	13W		3.20	3.40	0.4	4.0	75mV	15mV		76%	F20S1203
	15W	5.00	4.90	5.10	0.3	3.0	75mV	15mV		80%	F15S1205
	20W		4.90	5.10	0.4	4.0	75mV	15mV		80%	F20S1205
	15W	12.0	11.88	12.12	0.12	1.25	100mV	25mV		82%	F15S1212
	20W		11.88	12.12	0.17	1.67	100mV	25mV		82%	F20S1212
	15W	15.0	14.85	15.15	0.1	1.0	120mV	30mV		82%	F15S1215
	20W		14.85	15.15	0.13	1.34	120mV	30mV		82%	F20S1215
	15W	24.0	23.76	24.24	0.06	0.63	200mV	40mV		82%	F15S1224
	20W		23.76	24.24	0.08	0.84	200mV	40mV		82%	F20S1224
24 (18 - 36)	10W	3.30	3.20	3.40	0.3	3.0	75mV	15mV	Pulse by Pulse Current Limiting	78%	F15S2403
	13W		3.20	3.40	0.4	4.0	75mV	15mV		78%	F20S2403
	15W	5.00	4.90	5.10	0.3	3.0	75mV	15mV		82%	F15S2405
	20W		4.90	5.10	0.4	4.0	75mV	15mV		82%	F20S2405
	15W	12.0	11.88	12.12	0.12	1.25	100mV	25mV		84%	F15S2412
	20W		11.88	12.12	0.17	1.67	100mV	25mV		84%	F20S2412
	15W	15.0	14.85	15.15	0.1	1.0	120mV	30mV		84%	F15S2415
	20W		14.85	15.15	0.13	1.34	120mV	30mV		84%	F20S2415
	15W	24.0	23.76	24.24	0.06	0.63	200mV	40mV		84%	F15S2424
	20W		23.76	24.24	0.08	0.84	200mV	40mV		84%	F20S2424
48 (36 - 75)	10W	3.30	3.20	3.40	0.3	3.0	75mV	15mV	Pulse by Pulse Current Limiting	78%	F15S4803
	13W		3.20	3.40	0.4	4.0	75mV	15mV		78%	F20S4803
	15W	5.00	4.90	5.10	0.3	3.0	75mV	15mV		82%	F15S4805
	20W		4.90	5.10	0.4	4.0	75mV	15mV		82%	F20S4805
	15W	12.0	11.88	12.12	0.12	1.25	100mV	25mV		84%	F15S4812
	20W		11.88	12.12	0.17	1.67	100mV	25mV		84%	F20S4812
	15W	15.0	14.85	15.15	0.1	1.0	120mV	30mV		84%	F15S4815
	20W		14.85	15.15	0.13	1.34	120mV	30mV		84%	F20S4815
	15W	24.0	23.76	24.24	0.06	0.63	200mV	40mV		84%	F15S4824
	20W		23.76	24.24	0.08	0.84	200mV	40mV		84%	F20S4824
W-24 (10 - 36)	10W	3.30	3.20	3.40	0.3	3.0	75mV	15mV	76%	FW150S2403	
	13W	5.00	4.90	5.10	0.4	3.0	75mV	15mV	80%	FW15S2405	
	15W	12.0	11.88	12.12	0.1	1.25	100mV	25mV	82%	FW10S2412	
	15W	15.0	14.85	15.15	0.08	1.0	120mV	30mV	82%	FW15S2415	
	15W	24.0	23.76	24.24	0.04	0.63	200mV	40mV	82%	FW15S2424	
W-48 (18 - 75)	10W	3.30	3.20	3.40	0	3.0	75mV	15mV	76%	FW15S4803	
	13W	5.00	4.90	5.10	0	3.0	75mV	15mV	80%	FW15S4805	
	15W	12.0	11.88	12.12	0.1	1.25	100mV	25mV	82%	FW15S4812	
	15W	15.0	14.85	15.15	0.06	1.0	120mV	30mV	82%	FW15S4815	
	15W	24.0	23.76	24.24	0.04	0.63	200mV	40mV	82%	FW15S4824	

* Combined Line & Load Regulation.

Standard Pin-Out



Alternate Pin-Out

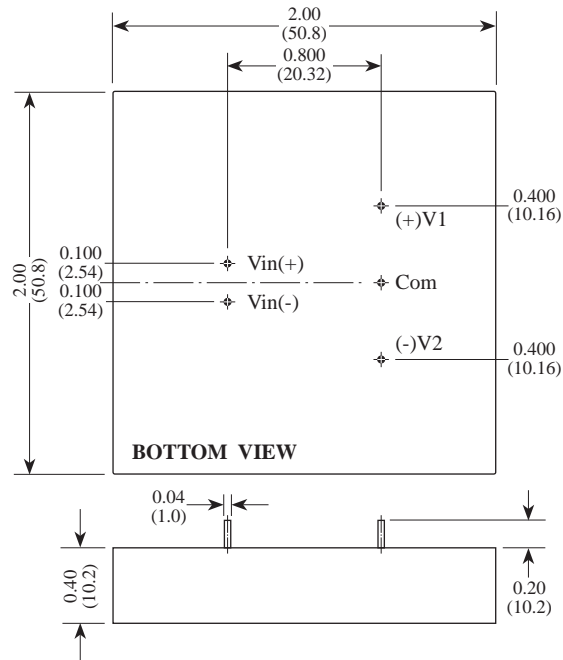


Product Numbering System & Selection Guide

F	15	S	24	03	E
Series No.	Output Power	No Output	Input Voltage	Output Voltage	Options
F	15 : 15W 20 : 20W	S : Single	12 : 10-20V 24 : 18-36V 48 : 36-75V	03 : 3.3V 05 : 5.0V 12 : 12V 15 : 15V	E : Alternate Pin-Out
FW			24 : 10-36V 48 : 18-75V	24 : 24V	

INPUT		OUTPUT										Short Circuit Protection	Over Temp. Protect	EFF. (typ.)	MODEL NO.
Nominal (Range)	Max Output Power	Voltage (V)				Current (A)			Ripple & Noise						
		#	Set Point	Min.*	Max.*	#	Min.	Max.	Peak-Peak	R.M.S.					
12 (9-18)	15W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	82%	F15D1205
			-V2	-5.00	-4.80	+5.20	-I2	-0.15	-1.5	75mV	15mV				
	20W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			82%	F20D1205
			-V2	-5.00	-4.80	+5.20	-I2	-0.2	-2.0	75mV	15mV				
	15W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.06	+0.63	100mV	20mV			84%	F15D1212
			-V2	-12.00	-11.80	+12.20	-I2	-0.06	-0.63	100mV	20mV				
	20W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.08	+0.84	100mV	20mV			84%	F20D1212
			-V2	-12.00	-11.80	+12.20	-I2	-0.08	-0.84	100mV	20mV				
	15W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.05	+0.50	120mV	25mV			84%	F15D1215
			-V2	-15.00	-14.70	-15.30	-I2	-0.05	-0.50	120mV	25mV				
	20W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.06	+0.67	120mV	25mV			84%	F20D1215
			-V2	-15.00	-14.70	-15.30	-I2	-0.06	+0.67	120mV	25mV				
24 (18-36)	15W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	82%	F15D2405
			-V2	-5.00	-4.80	+5.20	-I2	-0.15	-1.5	75mV	15mV				
	20W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			82%	F20D2405
			-V2	-5.00	-4.80	+5.20	-I2	-0.2	-2.0	75mV	15mV				
	15W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.06	+0.63	100mV	20mV			84%	F15D2412
			-V2	-12.00	-11.80	+12.20	-I2	-0.06	-0.63	100mV	20mV				
	20W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.08	+0.84	100mV	20mV			84%	F20D2412
			-V2	-12.00	-11.80	+12.20	-I2	-0.08	-0.84	100mV	20mV				
	15W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.05	+0.50	120mV	25mV			84%	F15D2415
			-V2	-15.00	-14.70	-15.30	-I2	-0.05	-0.50	120mV	25mV				
	20W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.06	+0.67	120mV	25mV			84%	F20D2415
			-V2	-15.00	-14.70	-15.30	-I2	-0.06	+0.67	120mV	25mV				
48 (36 - 75)	15W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	82%	F15D4805
			-V2	-5.00	-4.80	+5.20	-I2	-0.15	-1.5	75mV	15mV				
	20W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			82%	F20D4805
			-V2	-5.00	-4.80	+5.20	-I2	-0.2	-2.0	75mV	15mV				
	15W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.06	+0.63	100mV	20mV			84%	F15D4812
			-V2	-12.00	-11.80	+12.20	-I2	-0.06	-0.63	100mV	20mV				
	20W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.08	+0.84	100mV	20mV			84%	F20D4812
			-V2	-12.00	-11.80	+12.20	-I2	-0.08	-0.84	100mV	20mV				
	15W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.05	+0.50	120mV	25mV			84%	F15D4815
			-V2	-15.00	-14.70	-15.30	-I2	-0.05	-0.50	120mV	25mV				
	20W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.06	+0.67	120mV	25mV			84%	F20D4815
			-V2	-15.00	-14.70	-15.30	-I2	-0.06	+0.67	120mV	25mV				
W-24 (10-36)	15W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	80%	FW15D2405
			-V2	-5.00	-4.80	+5.20	-I2	-0.15	-1.5	75mV	15mV				
	15W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.06	+0.63	100mV	20mV			82%	FW15D2412
			-V2	-12.00	-11.80	+12.20	-I2	-0.06	-0.63	100mV	20mV				
15W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.05	+0.50	120mV	25mV	82%	FW15D2415			
		-V2	-15.00	-14.70	-15.30	-I2	-0.05	-0.50	120mV	25mV					
W-48 (20-75)	15W	±5.0V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	80%	FW15D4805
			-V2	-5.00	-4.80	+5.20	-I2	-0.15	-1.5	75mV	15mV				
	15W	±12V	+V1	+12.00	+11.90	+12.10	+I1	+0.06	+0.63	100mV	20mV			82%	FW15D4812
			-V2	-12.00	-11.80	+12.20	-I2	-0.06	-0.63	100mV	20mV				
	15W	±15V	+V1	+15.00	+14.85	+15.15	+I1	+0.05	+0.50	120mV	25mV			82%	FW15D4815
			-V2	-15.00	-14.70	-15.30	-I2	-0.05	-0.50	120mV	25mV				

* Combined Line & Load (Low Line to High Line, Min. Load to Full Load)

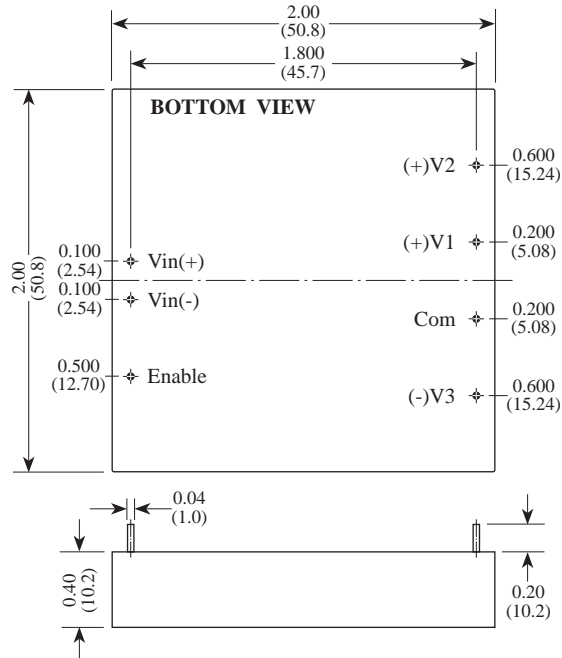


Product Numbering System & Selection Guide

F	15	D	24	05
Series No.	Output Power	No Output	Input Voltage	Output Voltage
F	15 : 15W 20 : 20W	D : Dual	12 : 9-18V 24 : 18-36V 48 : 36-75V	05 : 5.0V 12 : 12V 15 : 15V 24 : 24V
FW			24 : 10-36V 48 : 20-75V	

INPUT		OUTPUT										Short Circuit Protection	Over Temp. Shutdown /Recover	EFF. (typ.)	MODEL NO.
Nominal (Range)	Max Output Power	Voltage (V)					Current (A)			Ripple & Noise					
		#	Set Point	Min.*	Max.*	#	Min.	Max.	Peak-Peak	R.M.S.					
12 (9 - 18)	15W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	82%	F15T1205-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.03	+0.32	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.03	-0.32	100mV	25mV				
	20W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			82%	F20T1205-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.04	+0.42	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.04	-0.42	100mV	25mV				
	15W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV			82%	F15T1205-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.25	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.25	120mV	30mV				
	20W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+2.0	75mV	15mV			82%	F20T1205-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.34	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.34	120mV	30mV				
24 (18 - 36)	15W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	84%	F15T2405-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.03	+0.32	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.03	-0.32	100mV	25mV				
	20W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			84%	F20T2405-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.04	+0.42	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.04	-0.42	100mV	25mV				
	15W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV			84%	F15T2405-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.25	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.25	120mV	30mV				
	20W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+2.0	75mV	15mV			84%	F20T2405-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.34	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.34	120mV	30mV				
48 (36 - 75)	15W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	84%	F15T4805-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.03	+0.32	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.03	-0.32	100mV	25mV				
	20W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			84%	F20T4805-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.04	+0.42	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.04	-0.42	100mV	25mV				
	15W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV			84%	F15T4805-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.25	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.25	120mV	30mV				
	20W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+2.0	75mV	15mV			84%	F20T4805-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.34	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.34	120mV	30mV				
24W (10 - 36)	15W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	80%	FW15T2405-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.03	+0.32	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.03	-0.32	100mV	25mV				
	15W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			80%	FW15T2405-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.25	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.25	120mV	30mV				
48W (20 - 75)	15W	+5.0V ±12V	+V1	+5.00	+4.90	+5.10	+I1	+0.15	+1.5	75mV	15mV	Pulse by Pulse Current Limiting	Not Available	82%	FW15T4805-12
			+V3	+12.0	+11.0	+13.5	+I2	+0.03	+0.32	100mV	25mV				
			-V2	-12.0	-11.0	-13.5	+I3	-0.03	-0.32	100mV	25mV				
	15W	+5.0V ±15V	+V1	+5.00	+4.90	+5.10	+I1	+0.2	+2.0	75mV	15mV			82%	FW15T4805-15
			+V3	+15.0	+14.0	+16.5	+I2	+0.03	+0.25	120mV	30mV				
			-V2	-15.0	-14.5	-16.5	+I3	-0.03	-0.25	120mV	30mV				

* Combined Line & Load (Low Line to High Line, Min. Load to Full Load)
(+V1 is Regulated and +V2/-V3 are Semi-Regulated).



Product Numbering System

F	20	T	24	05	-	12
Series No.	Output Power*	No Output		Input Voltage	+V1 Output	+V2/-V3 Outputs
F	15 : 15W 20 : 20W	T	Triple	12 : 9-18V 24 : 18-36V 48 : 36-75V	05 : 5.0V	12 : ±12V 15 : ±15V
FW				24 : 10-36V 48 : 20-75V		