



Size: 2in x 1.60in x 0.40in (50.8mm x 40.6mm x 10.2mm)

OPTIONS

- Heatsink
- Single or Dual Output
- Output Voltage
- Input Voltage

FEATURES

- 30 Watts Maximum Output Power
- Output Current up to 6A
- Single and Dual Outputs
- Standard 2.0" x 1.6" x 0.4" Package
- 2:1 Wide Input Voltage Range
- High Efficiency up to 90%
- 1600VDC I/O Isolation
- Remote ON/OFF Control
- Fixed Switching Frequency
- Short Circuit, Over Voltage, Over Load, and Over Temperature Protection
- Six-Sided Continuous Shield
- CE Marked
- UL60950-1, EN60950-1, and IEC60950-1 Safety Approvals
- ISO9001 Certified Manufacturing Facilities
- RoHS II & REACH

APPLICATIONS

- Wireless Networks
- Telecom/Datacom
- Industry Control Systems
- Measurement Equipment
- Semiconductor Equipment

DESCRIPTION

The ZF series of DC/DC power converters provides up to 30 watts of output power in a standard 2.0" x 1.6" x 0.4" package. This series has single and dual output models with 2:1 input voltage ranges of 9-18VDC, 18-36VDC, and 36-75VDC. Some features include high efficiency up to 90%, 1600VDC I/O isolation, remote ON/OFF, and voltage adjustability. This series is also protected against over voltage, over load, short circuit, and over temperature conditions. All models are RoHS compliant and have UL60950-1, EN60950-1, and IEC60950-1 safety approvals.

MODEL SELECTION TABLE

Single Output

Model Number	Input Voltage Range	Output Voltage	Output Current		Ripple & Noise ⁽¹⁾	Input Current		Output Power	Maximum Capacitive Load ⁽⁴⁾	Efficiency ⁽¹⁾	UL Approval ⁽⁹⁾
			Min Load	Full Load		No Load ⁽²⁾	Full Load ⁽³⁾				
ZF12S1.5-6000	12VDC (9-18VDC)	1.5VDC	0mA	6000mA	50mVp-p	100mA	1014mA	9W	85,800µF	78%	-
ZF12S1.8-6000		1.8VDC	0mA	6000mA	50mVp-p	100mA	1169mA	10.8W	65,000µF	81%	-
ZF12S2.5-6000		2.5VDC	0mA	6000mA	50mVp-p	110mA	1582mA	15W	33,000µF	83%	-
ZF12S3.3-6000		3.3VDC	0mA	6000mA	50mVp-p	115mA	2037mA	19.8W	19,500µF	85%	-
ZF12S5-6000		5VDC	0mA	6000mA	50mVp-p	95mA	3012mA	30W	10,200µF	87%	-
ZF12S12-2500		12VDC	0mA	2500mA	75mVp-p	170mA	2976mA	30W	3,240µF	88%	-
ZF12S15-2000		15VDC	0mA	2000mA	75mVp-p	210mA	2976mA	30W	1,100µF	88%	-
ZF24S1.5-6000	24VDC (18-36VDC)	1.5VDC	0mA	6000mA	50mVp-p	50mA	493mA	9W	85,800µF	80%	-
ZF24S1.8-6000		1.8VDC	0mA	6000mA	50mVp-p	35mA	580mA	10.8W	65,000µF	82%	UL60950-1
ZF24S2.5-6000		2.5VDC	0mA	6000mA	50mVp-p	45mA	780mA	15W	33,000µF	84%	UL60950-1
ZF24S3.3-6000		3.3VDC	0mA	6000mA	50mVp-p	50mA	1010mA	19.8W	19,500µF	86%	UL60950-1
ZF24S5-6000		5VDC	0mA	6000mA	50mVp-p	50mA	1490mA	30W	10,200µF	88%	UL60950-1
ZF24S12-2500		12VDC	0mA	2500mA	75mVp-p	80mA	1470mA	30W	3,240µF	89%	UL60950-1
ZF24S15-2000		15VDC	0mA	2000mA	75mVp-p	90mA	1470mA	30W	1,100µF	89%	UL60950-1
ZF48S1.5-6000	48VDC (36-75VDC)	1.5VDC	0mA	6000mA	50mVp-p	20mA	244mA	9W	85,800µF	81%	-
ZF48S1.8-6000		1.8VDC	0mA	6000mA	50mVp-p	20mA	290mA	10.8W	65,000µF	83%	UL60950-1
ZF48S2.5-6000		2.5VDC	0mA	6000mA	50mVp-p	25mA	390mA	15W	33,000µF	85%	UL60950-1
ZF48S3.3-6000		3.3VDC	0mA	6000mA	50mVp-p	30mA	500mA	19.8W	19,500µF	87%	UL60950-1
ZF48S5-6000		5VDC	0mA	6000mA	50mVp-p	35mA	740mA	30W	10,200µF	89%	UL60950-1
ZF48S12-2500		12VDC	0mA	2500mA	75mVp-p	35mA	730mA	30W	3,240µF	90%	UL60950-1
ZF48S15-2000		15VDC	0mA	2000mA	75mVp-p	55mA	730mA	30W	1,100µF	90%	UL60950-1

MODEL SELECTION TABLE
Dual Output

Model Number	Input Voltage Range	Output Voltage	Output Current		Ripple & Noise ⁽¹⁾	Input Current		Output Power	Maximum Capacitive Load ⁽⁴⁾	Efficiency ⁽¹⁾	UL Approval ⁽⁹⁾
			Min Load	Full Load		No Load ⁽²⁾	Full Load ⁽³⁾				
ZF12D12-1250	12VDC (9-18VDC)	±12VDC	0mA	±1250mA	100mVp-p	60mA	3012mA	30W	±1020µF	87%	-
ZF12D15-1000		±15VDC	0mA	±1000mA	100mVp-p	40mA	3012mA	30W	±675µF	87%	-
ZF24D12-1250	24VDC (18-36VDC)	±12VDC	0mA	±1250mA	100mVp-p	30mA	1488mA	30W	±1020µF	88%	-
ZF24D15-1000		±15VDC	0mA	±1000mA	100mVp-p	30mA	1488mA	30W	±675µF	88%	-
ZF48D12-1250	48VDC (36-75VDC)	±12VDC	0mA	±1250mA	100mVp-p	20mA	744mA	30W	±1020µF	88%	-
ZF48D15-1000		±15VDC	0mA	±1000mA	100mVp-p	20mA	744mA	30W	±675µF	88%	-

SPECIFICATIONS

All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current unless otherwise noted.
 We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS		Min	Typ	Max	Unit
INPUT SPECIFICATIONS						
Operating Input Voltage Range	12VDC nominal input models		9	12	18	VDC
	24VDC nominal input models		18	24	36	
	48VDC nominal input models		36	48	75	
Start-Up Voltage	12VDC nominal input models				9	VDC
	24VDC nominal input models				17.8	
	48VDC nominal input models				36	
Shutdown Voltage	12VDC nominal input models			8		VDC
	24VDC nominal input models			16		
	48VDC nominal input models			33		
Input Surge Voltage (100ms)	12VDC nominal input models				36	VDC
	24VDC nominal input models				50	
	48VDC nominal input models				100	
Input Reflected Ripple Current	Nominal input and Full Load			30		mAp-p
Input Filter			L-C type			
OUTPUT SPECIFICATIONS						
Output Voltage			See Table			
Voltage Accuracy			-1.0		+1.0	%
Line Regulation	Low Line to High Line at Full Load	Single Output	-0.2		+0.2	%
		Dual Output	-0.5		+0.5	%
Load Regulation	No Load to Full Load	Single Output	-0.5		+0.5	%
		Dual Output	-1.0		1.0	%
Voltage Adjustability			-10		+10	%
Cross Regulation	Asymmetrical load 25%/100% FL	Dual Output	-5.0		+5.0	%
Output Power			See Table			
Output Current			See Table			
Minimum Load			0			mA
Maximum Capacitive Load			See Table			
Ripple & Noise	Measured by 20MHz bandwidth with a 0.1µF/50V MLCC	Single Output: 1.5V, 1.8V, 2.5V, 3.3V, 5V Models		50		mVp-p
		Single Output: 12V, 15V Models		75		
		All Dual Outputs		100		
Transient Response Recovery Time	25% Load Step Change			300		µs
Start-Up Time	Constant resistive load	Power Up		25		ms
		Remote ON/OFF		25		
Temperature Coefficient			-0.02		+0.02	%/°C
REMOTE ON/OFF CONTROL⁽⁵⁾						
Positive Logic	DC-DC ON		Open or 3~12VDC			
	DC-DC OFF		Short or 0~1.2VDC			
Input Current of CTRL Pin			-0.5		+0.5	mA
Remote OFF Input Current				2.5		mA
PROTECTION						
Short Circuit Protection			Continuous, Automatic Recovery			
Over Load Protection	% of I _{out} rated				150	%
Over Voltage Protection	Zener diode clamp	1.5V, 1.8V, 2.5V, 3.3V output models		3.9		VDC
		5V output models		6.2		
		12V output models		15		
		15V output models		18		
Over Temperature Protection				+115		°C

SPECIFICATIONS

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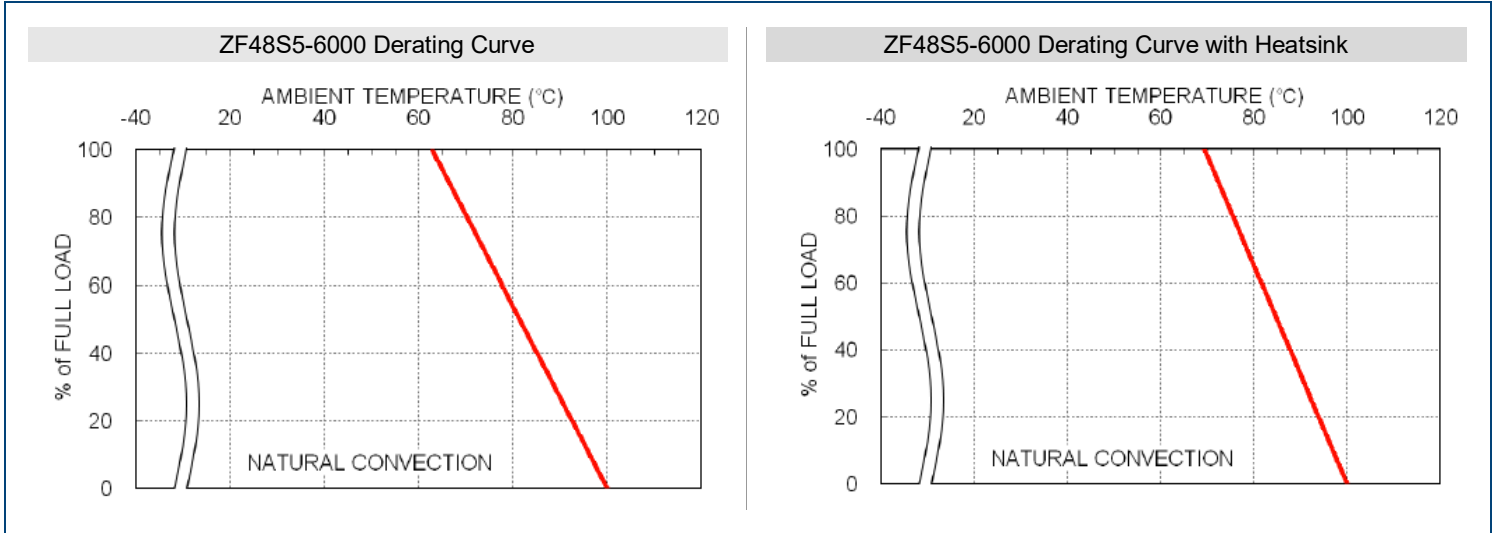
SPECIFICATION	TEST CONDITIONS	Min	Typ	Max	Unit
ENVIRONMENTAL SPECIFICATIONS					
Operating Ambient Temperature	With Derating	-40		+85	°C
Storage Temperature		-55		+125	°C
Maximum Case Temperature				+100	°C
Thermal Impedance ⁽⁶⁾	Natural Convection		10		°C/W
	Natural Convection with Heatsink		8.24		
Relative Humidity		5		95	% RH
Thermal Shock		MIL-STD-810F			
Vibration		MIL-STD-810F			
MTBF	MIL-HDBK-217F, Full Load		1,283,000		hours
GENERAL SPECIFICATIONS					
Efficiency		See Table			
Switching Frequency		270	300	330	kHz
Isolation Voltage (1 minute)	Input to Output	1600			VDC
	Input to Case	1600			
	Output to Case	1600			
Isolation Resistance	500VDC	1			GΩ
Isolation Capacitance				1000	pF
PHYSICAL SPECIFICATIONS					
Weight		1.69oz (48g)			
Dimensions (L x W x H)		2.0in x 1.60in x 0.40in (50.8mm x 40.6mm x 10.2mm)			
Case Material		Nickel-Coated Copper			
Base Material		FR4 PCB			
Potting Material		Epoxy (UL94 V-0)			
Shielding		Six-Sided			
SAFETY & EMC CHARACTERISTICS					
Safety Approvals		UL60950-1 ⁽⁹⁾ EN60950-1 IEC60950-1			
EMI ⁽⁷⁾	EN55022	Class A			
		Class B			
ESD	EN61000-4-2	Air ±8kV Contact ±6kV			Perf. Criteria B
Radiated Immunity	EN61000-4-3	10 V/m			Perf. Criteria A
Fast Transient ⁽⁸⁾	EN61000-4-4	±2kV			Perf. Criteria B
Surge ⁽⁸⁾	EN61000-4-5	±1kV			Perf. Criteria B
Conducted Immunity	EN61000-4-6	10 Vr.m.s			Perf. Criteria A
Power Frequency Magnetic Field	EN61000-4-8	100A/m continuous; 1000A/m 1 second			Perf. Criteria A

NOTES

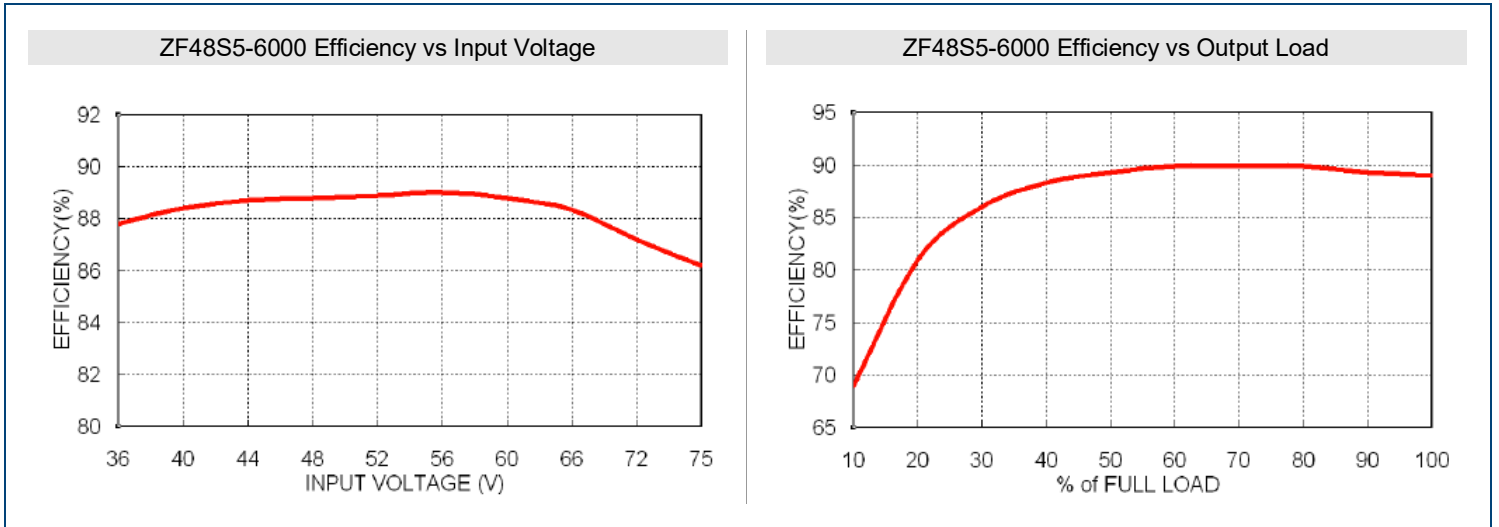
- (1) Typical value at nominal input voltage and full load.
- (2) Typical value at nominal input voltage and no load.
- (3) Maximum value at nominal input voltage and full load.
- (4) Test by minimum Vin and constant resistive load.
- (5) The ON/OFF control pin is referenced to -Vin.
- (6) Heatsink is optional and P/N: 7G-0011C-F
- (7) The ZF series can meet EN55022 Class A with an external capacitor in parallel with the input pins.
Recommended: 12Vin Models: 6.8µF/50V 1812 MLCC
24Vin Models: 6.8µF50V 1812 MLCC
48Vin Models: 2.2µF/100V 1812 MLCC
- (8) An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5.
The filter capacitor suggested is Nippon chemi-con KY series, 220µF/100V, ESR 48mΩ.
- (9) UL approval can be added to any products not currently listed if required.

CAUTION: This power module is not internally fused. An input line fuse must always be used.
Due to advances in technology, specifications subject to change without notice.

DERATING CURVES



EFFICIENCY GRAPHS



MECHANICAL DRAWINGS

PIN CONNECTION

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
4	Ctrl	Ctrl
5	No Pin	+Vout
6	+Vout	Common
7	-Vout	-Vout
8	Trim	Trim

EXTERNAL OUTPUT TRIMMING
Output can be externally trimmed by using the method shown below. () for dual output trim.

TRIM UP

TRIM DOWN

Notes:

- All dimensions in inch (mm)
- Tolerance: x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
- Pin pitch tolerance ±0.01 (0.25)
- Pin dimension tolerance ±0.004(0.1)

RECOMMENDED FILTERS

Recommended Filter for EN55022 Class B Compliance

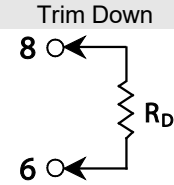
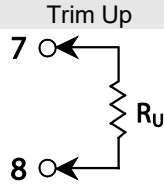
Recommended EN55022 Class B Filter Circuit Layer

The components used in the figure above are as follows:

	C1	C2	C3	C4	C5 & C6	L1
ZF12xxx-xxxx	4.7µF/50V 1812 MLCC	N/A	4.7µF/50V 1812 MLCC	N/A	1000pF/2KV MLCC	450µH Common Choke PMT-048
ZF24xxx-xxxx	6.8µF/50V 1812 MLCC	N/A	6.8µF/50V 1812 MLCC	N/A	1000pF/2KV MLCC	450µH Common Choke PMT-048
ZF48xxx-xxxx	2.2µF/100V 1812 MLCC	2.2µF/100V 1812 MLCC	2.2µF/100V 1812 MLCC	2.2µF/100V 1812 MLCC	1000pF/2KV MLCC	450µH Common Choke PMT-048

OUTPUT VOLTAGE ADJUSTMENT

Output voltage adjustability is for single output models only. Output voltage set-point adjustment allows the user to increase or decrease the output voltage set-point of a module. This is accomplished by connecting an external resistor between the TRIM pin and either the +OUTPUT or -OUTPUT pins. With an external resistor between the TRIM and -OUTPUT pins, the output voltage set-point increases. With an external resistor between the TRIM and +OUTPUT pins, the output voltage set-point decreases. The external TRIM resistor needs to be at least 1/16W resistance.



ZFXXS1.5-6000		
Trim	V _{out,up}	R _U
1%	1.515V	4.578kΩ
2%	1.530V	2.605kΩ
3%	1.545V	1.227kΩ
4%	1.560V	0.808kΩ
5%	1.575V	0.557kΩ
6%	1.590V	0.389kΩ
7%	1.605V	0.270kΩ
8%	1.620V	0.180kΩ
9%	1.635V	0.110kΩ
10%	1.650V	0.054kΩ

ZFXXS1.8-6000		
Trim	V _{out,up}	R _U
1%	1.818V	11.639kΩ
2%	1.836V	5.205kΩ
3%	1.854V	3.060kΩ
4%	1.872V	1.988kΩ
5%	1.890V	1.344kΩ
6%	1.908V	0.915kΩ
7%	1.926V	0.609kΩ
8%	1.944V	0.379kΩ
9%	1.962V	0.202kΩ
10%	1.980V	0.057kΩ

ZFXXS1.5-6000		
Trim	V _{out,down}	R _D
1%	1.485V	5.704kΩ
2%	1.470V	2.571kΩ
3%	1.455V	1.527kΩ
4%	1.440V	1.005kΩ
5%	1.425V	0.692kΩ
6%	1.410V	0.483kΩ
7%	1.395V	0.334kΩ
8%	1.380V	0.222kΩ
9%	1.365V	0.135kΩ
10%	1.350V	0.065kΩ

ZFXXS1.8-6000		
Trim	V _{out,down}	R _D
1%	1.782V	14.660kΩ
2%	1.764V	6.570kΩ
3%	1.746V	3.874kΩ
4%	1.728V	2.525kΩ
5%	1.710V	1.716kΩ
6%	1.692V	1.177kΩ
7%	1.674V	0.792kΩ
8%	1.656V	0.503kΩ
9%	1.638V	0.278kΩ
10%	1.620V	0.098kΩ

ZFXXS2.5-6000		
Trim	V _{out,up}	R _U
1%	2.525V	37.076kΩ
2%	2.550V	16.675kΩ
3%	2.575V	9.874kΩ
4%	2.600V	6.474kΩ
5%	2.625V	4.434kΩ
6%	2.650V	3.074kΩ
7%	2.675V	2.102kΩ
8%	2.700V	1.374kΩ
9%	2.725V	0.807kΩ
10%	2.750V	0.354kΩ

ZFXXS3.3-6000		
Trim	V _{out,up}	R _U
1%	3.333V	57.930kΩ
2%	3.366V	26.465kΩ
3%	3.399V	15.577kΩ
4%	3.432V	10.283kΩ
5%	3.465V	7.106kΩ
6%	3.498V	4.988kΩ
7%	3.531V	3.476kΩ
8%	3.564V	2.341kΩ
9%	3.597V	1.459kΩ
10%	3.630V	0.753kΩ

ZFXXS2.5-6000		
Trim	V _{out,down}	R _D
1%	2.475V	49.641kΩ
2%	2.450V	22.481kΩ
3%	2.425V	13.428kΩ
4%	2.400V	8.902kΩ
5%	2.375V	6.186kΩ
6%	2.350V	4.375kΩ
7%	2.325V	3.082kΩ
8%	2.300V	2.112kΩ
9%	2.275V	1.358kΩ
10%	2.250V	0.754kΩ

ZFXXS3.3-6000		
Trim	V _{out,down}	R _D
1%	3.267V	69.470kΩ
2%	3.234V	31.235kΩ
3%	3.201V	18.490kΩ
4%	3.168V	12.117kΩ
5%	3.135V	8.294kΩ
6%	3.102V	5.745kΩ
7%	3.069V	3.924kΩ
8%	3.036V	2.559kΩ
9%	3.003V	1.497kΩ
10%	2.970V	0.647kΩ

ZFXXS5-6000		
Trim	V _{out,up}	R _U
1%	5.050V	36.570kΩ
2%	5.100V	16.580kΩ
3%	5.150V	9.917kΩ
4%	5.200V	6.585kΩ
5%	5.250V	4.586kΩ
6%	5.300V	3.253kΩ
7%	5.350V	2.302kΩ
8%	5.400V	1.588kΩ
9%	5.450V	1.032kΩ
10%	5.500V	0.588kΩ

ZFXXS12-2500		
Trim	V _{out,up}	R _U
1%	12.120	367.910kΩ
2%	12.240	165.950kΩ
3%	12.360	98.636kΩ
4%	12.480	64.977kΩ
5%	12.600	44.782kΩ
6%	12.720	31.318kΩ
7%	12.840	21.701kΩ
8%	12.960	14.488kΩ
9%	13.080	8.879kΩ
10%	13.200	4.391kΩ

ZFXXS5-6000		
Trim	V _{out,down}	R _D
1%	4.950V	45.533kΩ
2%	4.900V	20.612kΩ
3%	4.850V	12.306kΩ
4%	4.800V	8.152kΩ
5%	4.750V	5.660kΩ
6%	4.700V	3.999kΩ
7%	4.650V	2.812kΩ
8%	4.600V	1.922kΩ
9%	4.550V	1.230kΩ
10%	4.500V	0.676kΩ

ZFXXS12-2500		
Trim	V _{out,down}	R _D
1%	11.880V	460.990kΩ
2%	11.760V	207.950kΩ
3%	11.640V	123.600kΩ
4%	11.520V	81.423kΩ
5%	11.400V	56.118kΩ
6%	11.280V	39.249kΩ
7%	11.160V	27.199kΩ
8%	11.040V	18.162kΩ
9%	10.920V	11.132kΩ
10%	10.800V	5.509kΩ

ZFXXS15-2000		
Trim	V _{out,up}	R _U
1%	15.150V	404.180kΩ
2%	15.300V	180.590kΩ
3%	15.450V	106.060kΩ
4%	15.600V	68.796kΩ
5%	15.750V	46.437kΩ
6%	15.900V	31.531kΩ
7%	16.050V	20.883kΩ
8%	16.200V	12.898kΩ
9%	16.350V	6.687kΩ
10%	16.500V	1.718kΩ

ZFXXS15-2000		
Trim	V _{out,down}	R _D
1%	14.850V	499.820kΩ
2%	14.700V	223.410kΩ
3%	14.550V	131.270kΩ
4%	14.400V	85.204kΩ
5%	14.250V	57.563kΩ
6%	14.100V	39.136kΩ
7%	13.950V	25.974kΩ
8%	13.800V	16.102kΩ
9%	13.650V	8.424kΩ
10%	13.500V	2.282kΩ

COMPANY INFORMATION

Wall Industries, Inc. has created custom and modified units for over 50 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on-time and on budget. Our ISO9001: 2015 certification is just one example of our commitment to producing a high quality, well-documented product for our customers.

Our past projects demonstrate our commitment to you, our customer. Wall Industries, Inc. has a reputation for working closely with its customers to ensure each solution meets or exceeds form, fit and function requirements. We will continue to provide ongoing support for your project above and beyond the design and production phases. Give us a call today to discuss your future projects.

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