

# MRF2800 SERIES

## 2800W TELECOM RECTIFIERS



### Output

- 50A, 48V/54V
- 100A, 24V/27V

### Features

- 91% efficiency including series output diode
- High power density 7.8W/in<sup>3</sup>, 475mW/cm<sup>3</sup>
- LCD front panel meter option
- Input and output circuit breakers option
- Comprehensive alarm signal packages
- Acoustic noise control
- -40°C to +65°C operation
- Field replaceable dust filter option
- Fan cooled
- Hot-pluggable

**T**he new MRF2800 Series rectifiers from Advance Power offers the latest in high power density technology for critical fault tolerant applications. The hot-pluggable MRF2800 delivers up to 2800 watts of output power in a 65°C ambient temperature. The rectifier's fan management system automatically adjusts the fan speed to suit load and ambient temperature. Input current harmonic distortion is minimized by the rectifier's active power factor correction.

Four MRF2800 rectifiers can be inserted into a 4U high 23" **powerdeck**<sup>®</sup> chassis to produce a current of 200A for 48V, or 400A for 24V systems. Up to 2100A at 54V can be configured in a single 42U x 19" cabinet using multiple **powerdeck**<sup>®</sup> shelves.

A fully featured unit including input/output breakers and 3 1/2 digit front panel display is offered in the larger MRF28E package. MRF28H versions can accommodate the wide range of signals options.

### Applications

- PSTN, central office
- Network datacom
- Distributed power systems
- N+1 redundant power systems
- Mobile base stations
- PABX

### Systems & Power Shelves

**powerdeck**<sup>®</sup> MS28A - is a "rack-ready" pre-wired 19" x 4U modular power shelf housing up to three hot-pluggable rectifiers.

**Power Systems** - Available in cabinets and relay frames configured using **powerdeck**<sup>®</sup> and other rack mounting modules such as distribution, fuse panels and system controllers.



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### Input Specifications

			Minimum	Typical	Maximum
Voltage Range, $V_{IN}$	Single phase TN-S (as defined by IEC 364)	Operating Absolute maximum	176Vac	230Vac	264Vac 300Vac
Frequency			45Hz		66Hz
R.M.S. Current	Maximum power output	230Vac input 176Vac input			13.9A 16.3A
Peak Inrush Current	264Vac input 230Vac input			13.0A	19.5A
Power	2800W output power Maximum load (current limit)			3,140W	3,400W
Apparent Power Factor			98%	99%	
Efficiency	$V_{IN}=230Vac$ , $P_{OUT}=2800W$ Includes integral series output diode	54V 27V	90% 88%	91% 89%	
Harmonic Distortion	Units comply with the requirements of EN61000-3-2			3%	10%thd
Turn On Voltage			165Vac	172Vac	176Vac
Turn Off Voltage			145Vac	152Vac	156Vac
Fusing	Internally fitted fuses in live and neutral lines			20AT	
Input Circuit Breaker	MRF28E version only. Double pole type			25A	

### 54V Output Specifications (For Additional Data, See General Output Specifications, p.4)

			Minimum	Typical	Maximum
Nominal Voltage, $V_{OUT}$			54.4V	54.5V	54.6V
Adjustment Range	For more details see "front panel features" section (p.7) Front panel adjustment is not available with A signals option		47.8V		58.0V
Maximum terminal voltage					59.0V
Current, $I_{MAX}$ Continuous	<65°C ambient. $V_{OUT}=54.5V$ , $V_{IN}>198Vac$ ,		50.0A		
Current Limit	Rectifier automatically reduces its current limit set point with changes in ambient temperature, input voltage and output voltage. Current limit characteristics are shown in figures 1 and 2, and table 1, (p.3). Also see float current limit adjust (p.8)				
Output Short Circuit	See figures 1 and 2, (p.3)				
Power, $P_{MAX}$ Continuous	$V_{IN}>198Vac$				2,800W
Load Regulation	Load change from 0 to $I_{MAX}$				75mV
Line Regulation	Input voltage change over the operating range				75mV

### 54V Output Specifications *Continued*

		Minimum	Typical	Maximum
<b>Combined Regulation</b>	A combination of load change from 0 to 100% and input voltage variation over the operating range			100mV
<b>Dynamic Regulation Maximum Deviation</b>	A step change in output current from 10% to 90% of full load			±1V
<b>Recovery</b>	To within 500mV of final value			2ms
<b>Hold up time</b>	V <sub>OUT</sub> 54.5V dropped to 54.2V, 220Vac input, 50A output V <sub>OUT</sub> 54.5V dropped to 40V, 220Vac input, 50A output	10ms	16ms 32ms	
<b>Output Overvoltage</b>	User adjustable with D signals option	59.0V	59.5V	59.9V
<b>Parallel Voltage</b>	Maximum allowable voltage applied to output terminals			80V
<b>Output Circuit Breaker</b>	MRF28E version only Single pole in the negative line (positive line optional)		60A	

### 54V Output Current Limit Characteristics

Foldback Setting

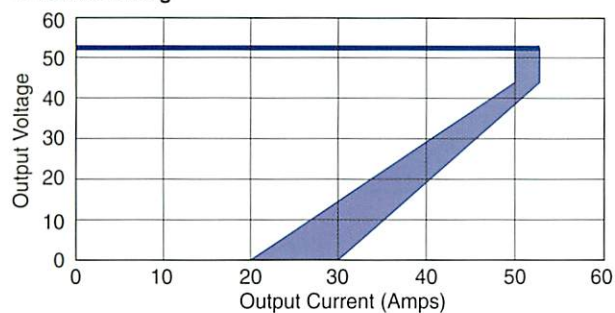


Figure 1

Constant Current Setting

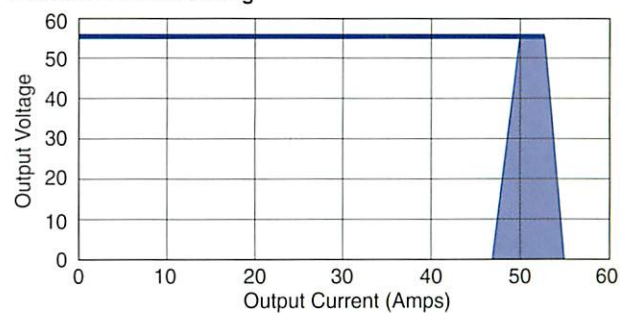


Figure 2

(Table 1)

### Operating Conditions

Ambient Temperature (°C)	V <sub>IN</sub>	V <sub>OUT</sub>	Minimum	Typical	Maximum
65	198	54.5	50.0A		52.5A
65	198	59.0	45.0A		47.8A
65	176	54.5	44.3A		47.1A
65	176	59.0	40.7A		43.2A

# MRF2800 SERIES

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### General Output Specifications 54V & 27V

		Minimum	Typical	Maximum
Remote Sense	Total lead voltage drop			1V
Start Up Time	From application of line input to output voltage achieving regulation	1.0s	1.5s	3.3s
Rise Time	Time for $V_{OUT}$ to rise monotonically to its full value		100ms	
Reverse Quiescent Current	Source = $V_{OUT}$ connected to output of non energized unit			5mA
Temperature Coefficient	Temperature range -25°C to +55°C		±0.015%/°C	
Noise, Low Frequency	Frequency range 10Hz -100kHz			40mV p-p
Noise, Broadband	Frequency range 10Hz - 100MHz Individual harmonics Complies with requirements of ETS300386-2-3 and BTNR2511			15mV rms 2mV peak
Noise, Psophometric	Weighted to C.C.I.T.T. No. 1 C message weighted			0.7mV rms 29dBmC
Noise, Acoustic	Minimized by allowing fan speed to vary with load current and ambient temperature	100% $I_{MAX}$ 65°C 198 VacIN 100% $I_{MAX}$ 45°C 230 VacIN 75% $I_{MAX}$ 45°C 230 VacIN 50% $I_{MAX}$ 45°C 230 VacIN 50% $I_{MAX}$ 25°C 230 VacIN	47dBA 45dBA 42dBA 38dBA	54dBA
Series Output Diode	Units are fitted with a series diode in the positive output			
Series Voltage	Units connected in series			150V

### 27V Output Specifications (For Additional Data, See General Output Specifications, Above)

		Minimum	Typical	Maximum
Nominal Voltage, $V_{OUT}$		27.20V	27.25V	27.30V
Adjustment Range	For more details see "front panel features" section (p.7) Front panel adjustment is not available with A signals option	23.9V		29.0V
Maximum Terminal Voltage				29.5V
Current, $I_{MAX}$ Continuous	<55°C ambient. $V_{OUT}$ =27.25V, $V_{IN}$ >198Vac,	100A		
Current Limit	Rectifier automatically reduces its current limit set point with changes in ambient temperature, input voltage and output voltage. Current limit characteristics are shown in figures 3 and 4 and table 2 (p.5). Also see float current limit adjust (p.8)			
Output Short Circuit	See figures 3 and 4, (p.5)			
Power, $P_{MAX}$ Continuous	$V_{IN}$ >198Vac			2,800W
Load Regulation	Load change from 0 to $I_{MAX}$			50mV
Line Regulation	Input voltage change over the operating range			50mV

### 27V Output Specifications *Continued*

		Minimum	Typical	Maximum
<b>Combined Regulation</b>	A combination of load change from 0 to 100% and input voltage variation over the operating range			50mV
<b>Dynamic Regulation Maximum Deviation</b>	A step change in output current from 10% to 90% of full load			±500mV
<b>Recovery</b>	To within 250mV of final value			2ms
<b>Hold up time</b>	$V_{OUT}$ 27.25V dropped to 27.1V, 220Vac input, 100A output $V_{OUT}$ 27.25V dropped to 20V, 220Vac input, 100A output	9ms	14ms 28ms	
<b>Output Overvoltage</b>	User adjustable with D signals option	31.0V	31.5V	32.0V
<b>Parallel Voltage</b>	Maximum allowable voltage applied to output terminals			36.0V
<b>Output Circuit Breaker</b>	MRF28E version only Single pole in the positive line (negative line optional)		120A	

### 27V Output Current Limit Characteristics

Foldback Setting

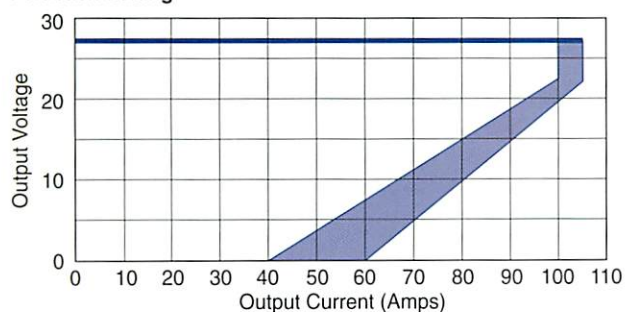


Figure 3

Constant Current Setting

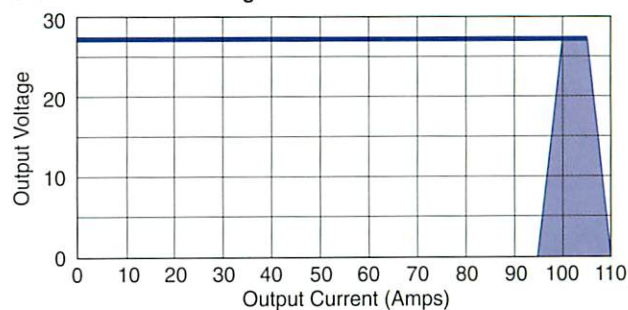


Figure 4

(Table 2)

### Operating Conditions

Ambient Temperature (°C)	$V_{IN}$	$V_{OUT}$	Minimum	Typical	Maximum
55	198	27.25	100.0A		105.0A
55	198	29.5	90.0A		95.5A
55	176	27.25	88.7A		94.1A
55	176	29.5	81.3A		86.4A

# MRF2800 SERIES

## 2800W TELECOM RECTIFIERS

### Basic Signals *(Available on all Versions. See Pinout Information p.10)*

			Minimum	Typical	Maximum
<b>Post Mate Enable (Input)</b>	Connect to (-) sense to enable the unit	Start-up delay			2s
Note: Connection must be made to operate unit					
<b>Current Share</b>	Accuracy $I_{OUT} = I_{MAX}$				±10%
<b>Voltage Trim, See Figures 5 and 6</b>	Scale factor	54V 27V		-1.56V/V -0.7V/V	
	Offset	Trim port open circuit		5.1V	
	Current	$V_{TRIM} = 2V$		-97μA	
	Referenced to (-) sense	$V_{TRIM} = 8V$		97μA	
<b>Margin Low</b>	Reduction in $V_{OUT}$ with margin low pin connected to (+) sense		2.2V	2.25V	2.3V
	Factory adjustment range		0V		5V
<b>Current Monitor</b>	Monitor output (unloaded). Referenced to (-) sense		97mV/A	100mV/A	103mV/A
	Output impedance			5.1kΩ	
<b>Auxiliary Output</b>	Referenced to opto common	Voltage		12V	
		Current		100mA	
	Protected against current and thermal overload				
<b>Output Healthy Relay and GREEN LED</b>	Minimum 'healthy' voltage to energize relay and LED	54V	38V	40V	43V
		27V	19V	20V	22V
	Contact voltage rating		50V		
	Break current rating		1A		

### Output Voltage Programming

#### 54V Output

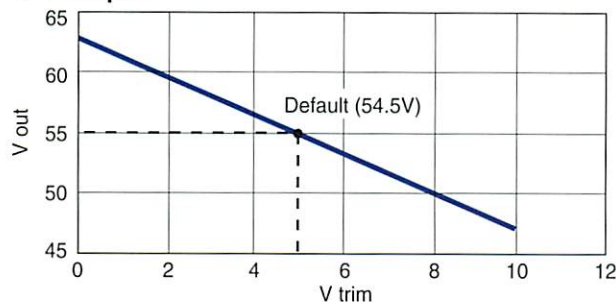


Figure 5

#### 27V Output

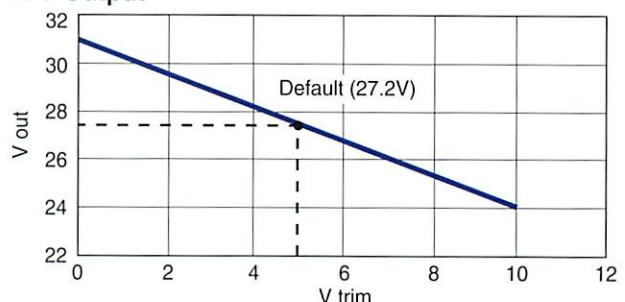


Figure 6

### Enhanced Signals

*(Available on MRF28HXXB or D and MRF28EXXD Versions Only. See p.10 and foot notes)*

			Minimum	Typical	Maximum
<b>Program Down (Input)</b>	5V applied to program pin with respect to opto common	54V 27V	45.6V 22.8V	45.8V 22.9V	46.0V 23.0V
<b>Remote On/Off (Input)</b>	Voltage applied to remote on/off pins	Voltage to inhibit Current to inhibit		5V 10mA	
<b>Remote Boost (Input)</b>	Voltage applied to remote boost pin with respect to optos common	Voltage to activate Current to activate		5V 10mA	
<b>Output Breaker Open Signal<sup>1</sup></b>	Relay contact opens when output breaker is open	Voltage Current		50V 1A	

<sup>1</sup> MRF28E version only

### Enhanced Signals *Continued*

		Minimum	Typical	Maximum
Open Collector Opto-Coupled Signals	Opto activates (Output voltage LOW)			0.8V
	Opto resets (Output voltage HIGH)	2.5V		
	V <sub>CE</sub> withstand	50.0V		
	Sink current (Output voltage LOW)			5mA
	Opto signals referenced to optos common			
Opto characteristics common to all of the following signals:				
Standby Signal <sup>4</sup> and YELLOW LED	Remote off activates opto and LED			
Input Healthy Signal and YELLOW LED	Input voltage rising activates opto and LED	165V	172V	176V
	Input voltage falling resets opto and LED	145V	152V	156V
Output Healthy Signal and GREEN LED	Output voltage above limits, but below overvoltage trip activates opto and LED	54V 27V	38V 40V 20V	43V 22V
	Current Limit Signal and RED LED	Output current demand >I <sub>MAX</sub> activates opto and LED	See output specification	
Overvoltage Trip Signal and RED LED	Output voltage rising activates opto and LED	54V 27V	59.0V 31.0V	59.5V 31.5V 59.9V 32.0V
	Reset when line input is interrupted or remote on/off is applied			
Output Current Healthy <sup>5</sup> and GREEN LED	Output current demand >15% I <sub>MAX</sub> activates opto and LED	54V 27V	4.6A 9.2A	8.6A 17.2A
Thermal Control Signal and YELLOW LED	Thermal control of current limit activates opto and LED			
Over Temperature Signal and RED LED	Exceeding internal sensor's upper limit activates opto and LED		120°C	
	Reset occurs once sensor falls below lower limit		110°C	
Fan Fail Signal and RED LED	Fan failure activates signals and LED with B signals option As above but sharing Overtemperature LED (dedicated LED omitted) with D signals option			
Boost (Equalise) Active Signal and YELLOW LED	Use of boost mode activates opto and LED Activated by front panel switch or remote boost signal			

### Front Panel Features

(Available on MRF28HXXB or D and MRF28EXXD Versions Only. See p.10 and foot notes)

		Minimum	Typical	Maximum
Test Points <sup>2</sup>	Output impedance 5.1kΩ	Voltage		
		Current	97mV/A	100mV/A 103mV/A
LCD Meter <sup>1</sup>	3 1/2 digit backlit LCD display Can be switched to display either voltage or current Accuracy: Voltage Current		±100mV	
			±3%	
Float/Boost Select	Switch selectable higher or lower preset output voltage/current limit. Remote boost (input) overrides selection			

<sup>1</sup> MRF28E version only

<sup>2</sup> MRF28H version only

<sup>3</sup> MRF28HXXD and MRF28E versions only

<sup>4</sup> MRF28HXXB version only

<sup>5</sup> No LED on MRF28HXXD and MRF28E versions

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## 2800W TELECOM RECTIFIERS

### Front Panel Features *Continued*

		Minimum	Typical	Maximum
Float Voltage Adjust	54V	52.0V		58.0V
	27V	26.0V		29.0V
Boost (Equalise) Voltage Adjust	54V	53.0V		60.0V
	27V	26.5V		30.0V
Overvoltage Trip Adjust <sup>3</sup>	54V	58.0V		63.0V
	27V	29.0V		31.5V
Float Current Limit Adjust <sup>3</sup>	54V	25.0A		52.0A
	27V	50.0A		102.5A
Boost Current Limit Adjust <sup>3</sup>	54V	20.0A		40.0A
	27V	40.0A		80.0A

<sup>1</sup> MRF28E version only

<sup>4</sup> MRF28HXXB version only

<sup>2</sup> MRF28H version only

<sup>5</sup> No LED on MRF28HXXD and MRF28E versions

<sup>3</sup> MRF28HXXD and MRF28E versions only

### Approvals & Safety Standards

EN60950	CE marked to the EC low voltage directive
UL1950	CSA NRTL/C approved, file number LR58666
C22.2 #950	CSA NRTL/C approved, file number LR58666

All versions are reliably SELV. For operation above 60V, a non-SELV version must be ordered. Consult Advance for details.

This power supply is designed for incorporation within an enclosure. For user safety, the enclosure must protect the user against accidental contact with any electrical hazard, associated with the power supply.

### Electromagnetic Compatibility

<b>Emission</b>	Compliant with EN50081-1(92) with compliance to the following specific conditions: <b>Conducted input 0 – 2kHz</b> EN61000-3-2 <b>Conducted input 0.15 – 30MHz</b> EN55022-B <b>Radiated 0.03 – 1GHz</b> EN55022-B at 10m <b>Conducted output</b> ETS300386-2-3
<b>Immunity</b>	Compliant with EN50082-1(92) with compliance to the following specific conditions: <b>ESD</b> EN61000-4-2 failure criteria A. 4kV contact. <b>RF Field</b> EN61000-4-3. 3Vm–1 80% amplitude modulation 0.08 – 1GHz. <b>Fast Transients</b> EN61000-4-4 failure criteria B. 1kV on ac line, 500V on dc lines. <b>Surge</b> EN61000-4-5. 2kV line to ground, 1kV line to line on ac input. 500V line to ground and line to line on dc output. <b>Conducted RF</b> EN61000-4-6. 3Vrms 80% amplitude modulation 0.15 – 80MHz



## Isolation

		Minimum	Typical	Maximum
Primary to Ground	Test voltage	1500Vac		
Secondary to Ground	Test voltage	500Vac		
Primary to Secondary	Test voltage	3000Vac		
Ground Leakage Current	240V, 60Hz input			3.5mA
Output to Ground Voltage	Working voltage			150Vdc
Signal to Ground Voltage	Working voltage			150Vdc
Signal to Output Voltage	Working voltage			150Vdc

## Environmental Specifications

		Minimum	Typical	Maximum
Ambient Temperature	Operational (See tables 1 and 2 for details)	-25°C		+65°C
	Starting	-40°C		+65°C
	Non-operational	-40°C		+85°C
Humidity	Non-condensing			
	Operational Non-Operational	0% RH 0% RH		85% RH 95% RH
Altitude	Operational	0m		3,000m
		0ft		10,000 ft
	Non-Operational	0m		10,000m
		0ft		30,000 ft
Vibration	Compliant with the requirements of BS2011 Test Fc <b>Drop and topple</b> EN60068-2-31 Test Ec <b>Bump</b> EN60068-2-47 Test Eb <b>Transportation</b> BS2011 Part 2.1 Test Fc in original packing <b>Drop</b> EN60068-2-32 Test Ed in original packing			
Pollution	EN60950 degree 2, i.e. office type environments			

## Mechanical Specifications

### MRF28H

### MRF28E

External Dimensions	5.0 x 5.5 x 13.0 in., (127.0 x 139.7 x 330.6 mm)	5.0 x 7.5 x 14.5 in., (127.0 x 190.5 x 368.3 mm)
Front Panel Dimensions	See mechanical drawing (p.11)	5.2 x 8.7 in., (132.1 x 221 mm)
Weight	11.0 lb., (5.0 kg)	14.6 lb., (6.6 kg)
Fixings	Units are designed for power shelf mounting	Units are designed for power shelf mounting
Mounting Orientation	See p.11 for mounting options	Front panel vertical
Ventilation and Cooling	Free air flow through the ventilation slots in the front and rear of the unit is required Units are cooled by integral, customer replaceable fan	
Finish	Front panel is finished in grey with blue legend and the body is finished in gold coloured chemical etch	
Connectors	See figure 8, (p.10)	
Dust Filter (Optional)	Reticulated, open cell polyester based polyurethane foam. See figure 7, (p.10). Use Advance specified part only	

# MRF2800 SERIES

## 2800W TELECOM RECTIFIERS

### Signals Pinout Information (See figure 8, Signals)

Pin	Function	Pin	Function
a1	Reserved	b1	Reserved
a2	Reserved	b2	Remote boost*
a3	Post mate enable	b3	Boost (Equalise) Active opto*
a4	Standby opto*†	b4	Reserved
a5	Program down*	b5	Reserved
a6	Auxiliary output	b6	Reserved
a7	Reserved	b7	Output current healthy opto*
a8	Over temperature opto*	b8	(-) sense
a9	Thermal control opto*	b9	Voltage trim
a10	Relay normally closed contact	b10	Over voltage opto*
a11	Relay common	b11	Current limit opto*
a12	Relay normally open contact	b12	Output healthy opto*
a13	Current share	b13	Input healthy opto*
a14	Remote on/off (com)*	b14	Optos common*
a15	Remote on/off (+ve)*	b15	Current monitor
a16	Margin low	b16	(+) sense

\* Only available with "B" or "D" signals.

† Output breaker open relay on MRF28E only.

Reserved: These pins are reserved for future options or internal use.

**Note:** The unit requires a link between pin a3 (post mate enable) and pin b8 (negative sense) to operate.

### Expanded View Showing Dust Filter

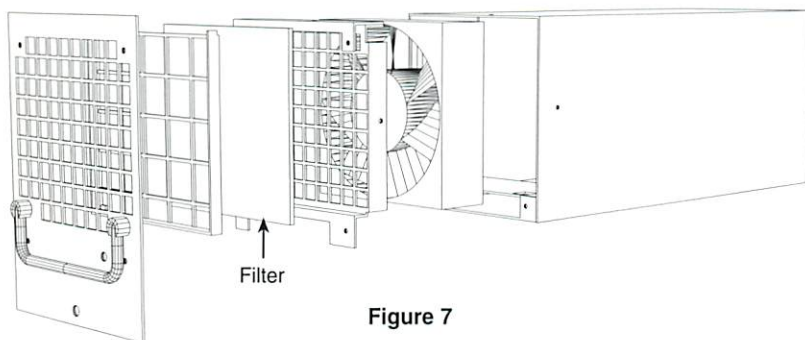


Figure 7

### Connector Details (Hot Pluggable Connections)

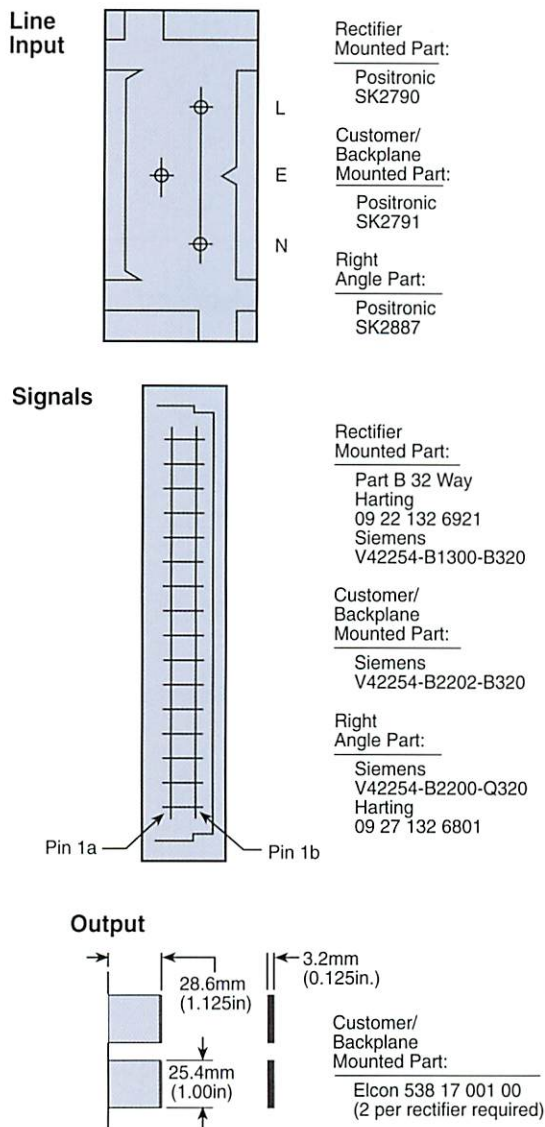


Figure 8

### Rectifier Operating Mode Switches

Mode setting switches are accessed through the side face of the rectifier.

Switch Number	Switch Set OFF	Switch Set ON	Standard Setting
1	(+) Sense remote	(+) Sense local	ON
2	(-) Sense remote	(-) Sense local	ON
3	Output set 54.5V/27.25V	Reduce output by at least 4.2V/2.1V To offset output voltage adjust range	OFF
5	Constant current limit	Foldback current limit	ON

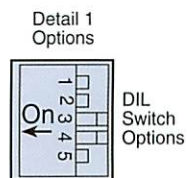
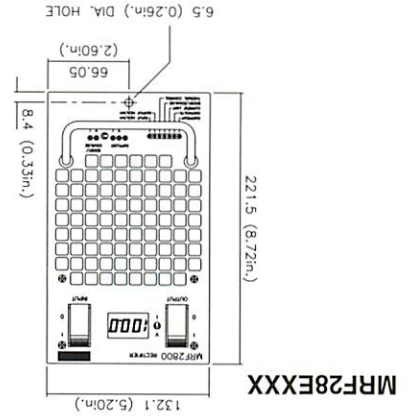
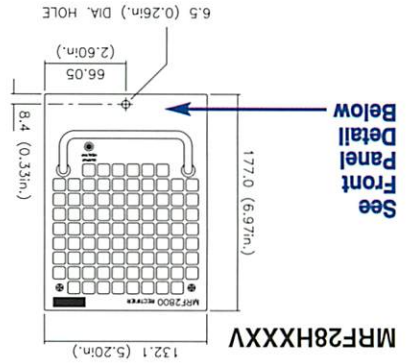
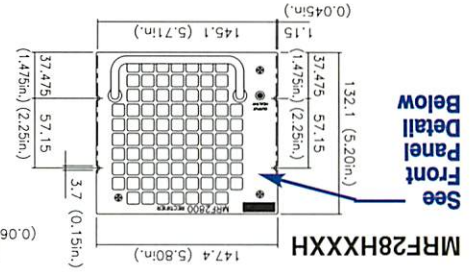


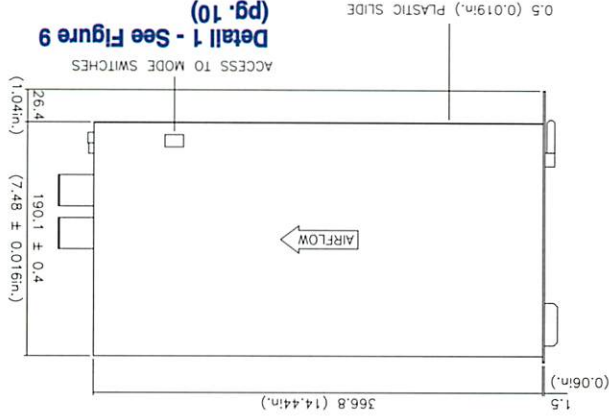
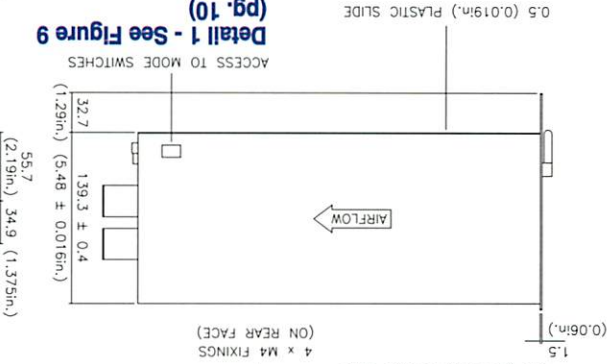
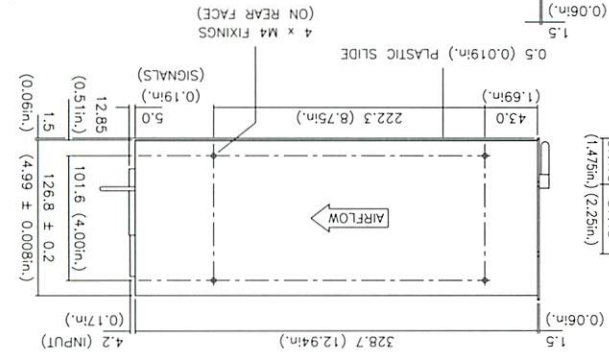
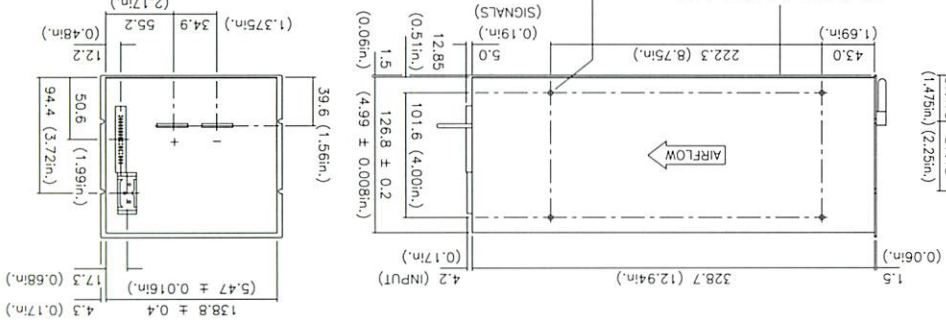
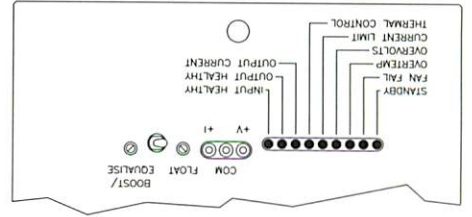
Figure 9

**Dimensions Units in mm (Inches)**



**Front Panel Detail**

**B - Signals**



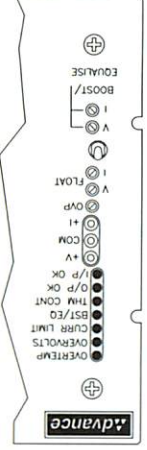
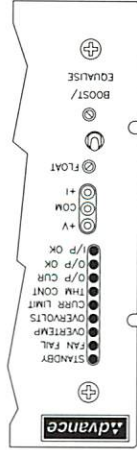
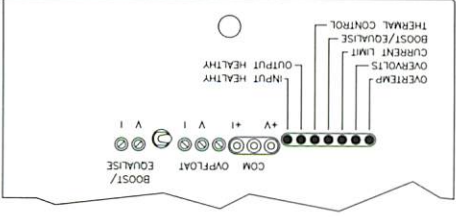
**Detail 1 - See Figure 9 (pg. 10)**

**Detail 1 - See Figure 9 (pg. 10)**

**Detail 1 - See Figure 9 (pg. 10)**

**D - Signals**

**Figure 10**



# MRF2800 SERIES

2800W TELECOM RECTIFIERS

## Ordering Information

Example: MRF28H54BV

**MRF28**

**H**

Packaging  
H - Standard  
E - Enhanced

**54**

Nominal  
Output  
Voltage

**B**

Signals  
A - Basic  
B - Enhanced  
D - Enhanced

**V**

Package  
Orientation  
H - Horizontal  
V - Vertical

Part Number	Output Voltage	Boost V	Boost I
1MRF28H54AH	54.5V	n/a	n/a
1MRF28H54AV	54.5V	n/a	n/a
1MRF28H54BH	54.5V	57.6V	n/a
1MRF28H54BV	54.5V	57.6V	n/a
1MRF28H54DH	54.5V	57.6V	40.0A
1MRF28H54DV	54.5V	57.6V	40.0A
1MRF28H27AH	27.25V	n/a	n/a
1MRF28H27AV	27.25V	n/a	n/a
1MRF28H27BH	27.25V	28.8V	n/a
1MRF28H27BV	27.25V	28.8V	n/a
1MRF28H27DH	27.25V	28.8V	80.0A
1MRF28H27DV	27.25V	28.8V	80.0A
1MRF28E54D	54.5V	57.6V	40.0A
1MRF28E27D	27.25V	28.8V	80.0A

**Note:** All units are factory set to local sense and foldback current limit  
54V units have a margin low voltage of 52.25V. Consult Advance for other settings  
27V units have a margin low voltage of 25.0V. Consult Advance for other settings  
Consult Advance for special signals and other requirements

## Accessory Table

Part Number	Product
1MKC2801	Connector kit consisting output and signals connectors
1MKC2802	Connector kit consisting of right angle input, output and signals connectors
1MS28A	<i>powerdeck</i> <sup>®</sup> MS28A, 19" x 4U mounting shelf to accommodate up to 3 MRF28HXXXV units
1MS28B	<i>powerdeck</i> <sup>®</sup> MS28B, 23" x 4U mounting shelf to accommodate up to 4 MRF28HXXXV units
1MCA28A	Input and output connector PCB assembly
1MAF28	Replacement Dust filter

Consult your Advance Power sales group for other product accessories

## Warranty

All Advance Power products are under warranty against faulty manufacture and faulty components for a period of twelve months from the date of delivery. Please refer to conditions of sale for full details.

We reserve the right to amend specifications without prior notification.

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## Other Products

### Power Supplies

- AC-DC multi output
- AC-DC single output
- DC-DC converters

### Telecommunications Power

- Inverters
- Rectifiers
- Sub-systems
- Complete systems

### Custom Capabilities

- Complete power systems
- Product development
- Accessories

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