

# EMERALD TECH

**110Vin 28Vout 1000 Watts**

## **Technical Specification EF110S28M36P**

### **High Efficiency Military Converter**

**1000 Watts**



### **Description**

The EF110S28M36P super brick DC/DC converters is a high density, high reliability power converter. The EF family of high efficiency DC/DC converters offer current levels that exceed other same size military power converters on the market. They are targeted specifically at the aerospace, aircraft portable weaponry industry and distributed power system. With a wide input voltage range of 85-120 VDC and output 28 VDC, Output power 1000W, the model features input undervoltage lockout, output overvoltage protection, overtemperature protection, output overload protection and programmable current limiting, single bus current share and N+1 Redundancy. The fully enclosed, encapsulated construction with aluminum heat spreader design achieves efficient heat transfer with no hot spots. The use of patent-pending hybrid planar transformer technology and other patent-pending design concepts facilitate maximum power delivery with the highest efficiency of up to 94%. The converters combine creative design concepts with highly derated power devices to achieve very high reliability, high performance and low cost solution to systems designers requiring maximum power in small footprints.

### **Applications**

- Aerospace, Aircraft
- Complex power system
- Portable weaponry
- Distributed Power Architecture

### **Features**

- Input: 110V, Output: 36A/28V, 1000W.
- Tight output regulation, typical  $\pm 0.5\%$
- No minimum load required
- Ripple & Noise ( 20Mhz BW) 150 mv (pk-pk) typical
- Input operating range 85-120V
- On/Off pin and remote sense
- Output adjustment +/-10% range
- Remote sense compensation
- Parallelable up to 6000 Watts
- N+1 Redundance
- 1500V, 10M $\Omega$  input-to-output isolation
- Output overcurrent and overvoltage protection
- Over Temperature protection
- Input Under voltage protection
- MTBF of 1,500,000 hours @ 50°C ( Bellcore )

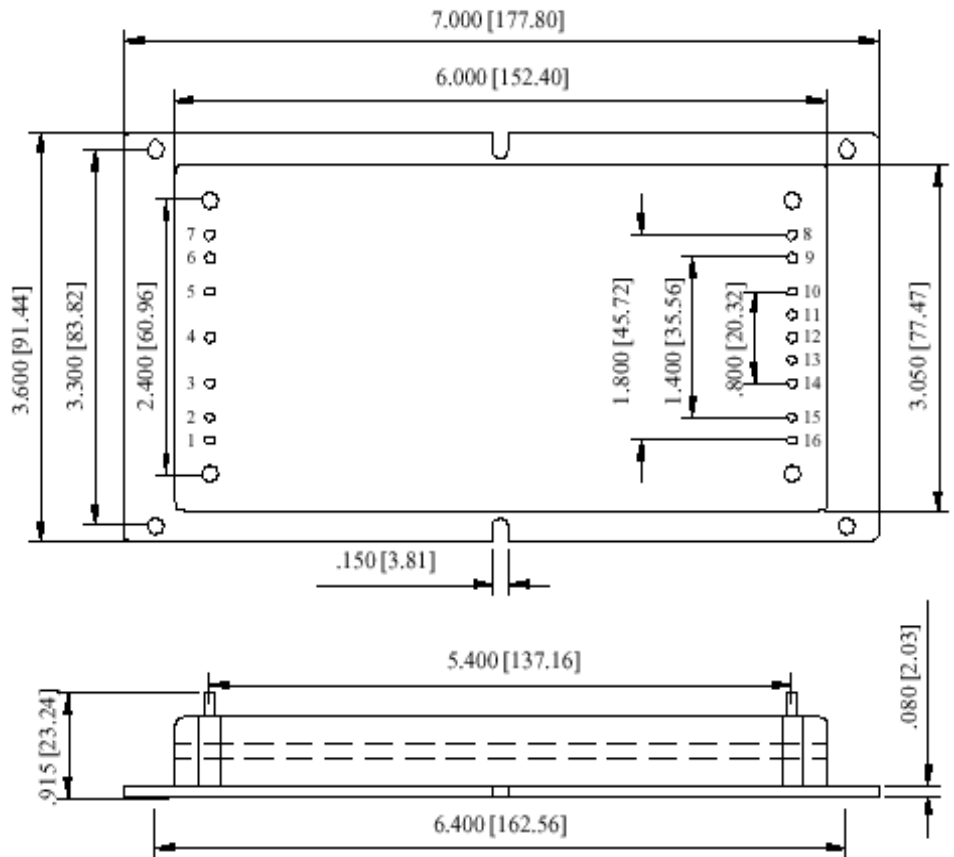
**Part Number and Selection Information**

Model Part Number	Input			Output		Efficiency 75% Load (%)
	Voltage (Volts)	Current (A)		Voltage	Current	
	Nominal	No load	Full load	(Volts)	(Amps)	
<b>EF110S28M36P</b>	110	0.2	9.9	28	36	94

Consult factory for other output voltage configurations

**Outline Information and Pin-out**

Pin Connection		Pin Size	
Pin #	Function	Inch	mm
1	Vin +	0.08"	2.03
2	Vin +	0.08"	2.03
3			
4	On/Off	0.08"	2.03
5			
6	Vin -	0.08"	2.03
7	Vin -	0.08"	2.03
8	Vo -	0.08"	2.03
9	Vo -	0.08"	2.03
10	S -	0.18"	2.03
11	LSHR	0.08"	2.03
12	TRIM	0.08"	2.03
13	ILIM	0.08"	2.03
14	S +	0.08"	2.03
15	Vo +	0.08"	2.03
16	Vo +	0.08"	2.03



**Notes:**

- 1). All dimensions are in inches [mm]  
0.08" [2.032mm], 0.18" [4.572mm]
- 2). Pin material: Brass
- 3). Pin finish: Tin/Lead plated
- 4). Baseplate material: Aluminum.
- 5). Outline dimension:  
6"(152.4)x3"(76.2)x0.55"(14.0)
- 6). Max. Weight: 490g

**Thermal Derating**

Vin = 110V
Full load (36A) from -55 °C to 125 °C base plate temperature, Linearly derate to zero from 125 °C to 135 °C.

The information and specifications contained in this brief are believed to be accurate and reliable at the time of publication. Specifications are subject to change without notice. Refer to product specification sheet for performance characteristics and application guidelines.

## Electrical Specification

Typical operating condition at Ta=25°C, Vin=110V unless otherwise noted.

PARAMETER	NOTES	MIN	TYP	MAX	UNIT
<b>Absolute maximum rating</b>					
Input voltage				125	V
Output Current				37	A
Operating case temperature		-55		125	°C
Storage temperature		-65		150	°C
<b>Input characteristics</b>					
Operating input voltage range		90	110	120	V
Turn on voltage threshold		85	86.5	88	V
Turn off voltage threshold		84	85.5	87	V
Transient withstand	Transient duration: 100ms			130	V
Maximum input current	Maximum load, 100Vin			12	A
Off state input current			3	5	mA
<b>Output characteristics</b>					
Output voltage set point		27	28	28.5	V
Output current	Continuous	0		36	A
Output voltage line regulation	100-120V input		±1	±1.5	%
Output voltage load regulation	10%-100%Load		±1	±1.5	%
Output voltage trim range	Percentage of nominal output	-10		+10	%
Output voltage ripple and noise	20MHz bandwidth, 100% Load, 110Vin		300	450	mV(pk-pk)
Remote sense compensation	Compensate load line drop			2	V
Temperature coefficient				±0.05	%/°C
Capacitive Load		0		10,000	μF
<b>Output dynamic characteristics</b>					
Startup time	5% to 95% of the output voltage		250	500	ms
Start up overshoot	110V input, 50% load			3	V
Transient recovery time	30% load change (2.0A/us)		300	500	μs
Transient Peak	30% load change (2.0A/us)			3	V
<b>Efficiency</b>					
Full load efficiency	110V input, 1000W output		94		%
<b>Protection</b>					
Output over current protection	Current limit set by 1V-5V at Ilim	40		45	A
Over voltage protection	Current limit set by voltage at Ilim	35	36.5	38	V
Over temperature protection	TBD (not active or linear fold back)		125	130	°C
<b>Parallel Operation</b>					
Current share control voltage	Single share bus	0.5		2.5	V
Share accuracy	Typical at 50% load		5	6	%
<b>Operation Environment</b>					
Operating temperature		-55		125	C
Ambient air pressure		Vacuum		Normal	
Humidity				95%	
Mechanical shock & vibration	Per customer specification				
<b>Miscellaneous</b>					
Switching frequency		160	180	200	KHz
ON/OFF control (Positive logic)					
Converter On		2.5		7	V
Converter Off	STF1000W-110-28	-1.0		1.2	V

ON/OFF control (Negative logic) Converter On Converter Off	EF110S28M36P	-1.0 2.5		1.2 7	V V
Calculated MTBF	Bellcore @ 50°C		1,000,000		Hrs
Weight			490	500	gram

## Basic operation and functions

### Input Power ( Pin 1&2, Pin 6&7)

Input power Vin(+) must be connected to Positive input voltage Pin 1&2; Input power common Vin(-) must be connected to Negative input voltage Pin 6&7.

### Output Power ( Pin 8&9, Pin 15&16 )

Output power Vout(+) must be connected to Positive output voltage Pin 8&9; Output power Vout(-) must be connected to Negative output voltage Pin 15&16.

### On/Off ( Pin 4 )

Control input pin to control on/off of the converter unit. Positive logic. On when voltage on this pin is greater than 2.5V and off when below 1.2V.

### Current Share ( Pin 11)

Single bus load share pin. When multiple units are connected in parallel to drive a common load, load current share can be achieved by connecting this pin of the all the units together. The voltage on this pin is proportional to the output current at 167mV/A.

Multiple EF converts can be used in parallel to drive a common load and allow N+1 redundancy architecture. In this mode of operation the load current can be shared by up to eight EF converters by just connecting the share but terminal (share) of the units together.

When paralleled, 95% of the total combined power ratings of the EF converters are available at the load. Overload and short circuit performance are not adversely affected during parallel operation.

### Current Limit (Pin 13)

Current limit control input. A signal ranging from 1V to 5V DC adjusts the current limit setting from 9A to 15A. Internal current limit setting is 10A when this Pin 13 is open. Leave this pin open during initial testing.

### Remote Sense ( Pin 10, Pin 14 )

Permits the user to maintain the accurate output voltage at the remote load terminals regardless of the line drop.

The Sense(-) (Pin 10) and Sense(+) (Pin 14) should be connected at the load or at the point where the regulation is needed.

The remote sense feature of the unit compensates for voltage drop occurring between the output pins of the unit and load. The Sense(-) (Pin 10) and Sense(+) (Pin 14) should be connected at the load or at the point where regulation is required.

If remote Sense is not required, the Sense(-) Pin must be connected to the Vout(-) Pin (Pin 9&10), and the Sense(+) Pin must be connected to the Vout(+) Pin (Pin 15&16) to ensure the unit will regulate at the specified output voltage. If these connections are not made, the unit's output voltage will be higher than the specified value.

The unit output over voltage protection senses the voltage across Vout(+) and Vout(-), and not across the sense lines, so the resistance between the output pins of the unit and the load should be minimized to prevent unwanted triggering of the OVP.

When using the remote sense feature, the output voltage at the unit can be increased by as much as 10% above the nominal rating, in order to maintain the required voltage across the load. Therefore, the designer must consider this condition.

Also when using the remote sense function, the output power must be taken care of, as not to exceed the maximum power capability of the unit.

### Output Voltage Trim (Pin12)

Output voltage adjusting input. A signal ranging from 1V to 5V at this pin changes the output voltage approximately from 23V to 33V. Internal setting is 28V±3V when this pin is open.