

# PFE1100-12-054ND

## 1100W, 12V<sub>DC</sub> Output



## FEATURES

- Best-in-class, 80 PLUS certified "Platinum" efficiency
- Best-in-class, "Platinum level" efficiency
- Wide input voltage range: 40 – 72 VDC
- Always-On 16.5W programmable standby output (3.3/5 V)
- Hot-plug capable
- Parallel operation with active digital current sharing
- High density design: 25.6 W/in<sup>3</sup>
- Small form factor: 54.5 x 40.0 x 321.5 mm
- I2C communication interface for control, programming and monitoring with PSMI and PMBus™ protocol
- Overtemperature, output overvoltage and overcurrent protection
- 256 Bytes of EEPROM for user information
- 2 Status LEDs: IN OK and OUT OK with fault signaling

## DESCRIPTION

The PFE1100-12-054ND is an 1100 watt DC to DC power supply that converts DC input into a main output of 12 VDC for powering intermediate bus architectures (IBA) in high performance and reliability servers, routers, and network switches. The PFE1100-12-054ND meets international safety standards and displays the CE-Mark for the European Low Voltage Directive (LVD).

## APPLICATIONS

- High performance servers
- Routers
- Switches

## 1 ORDERING INFORMATION

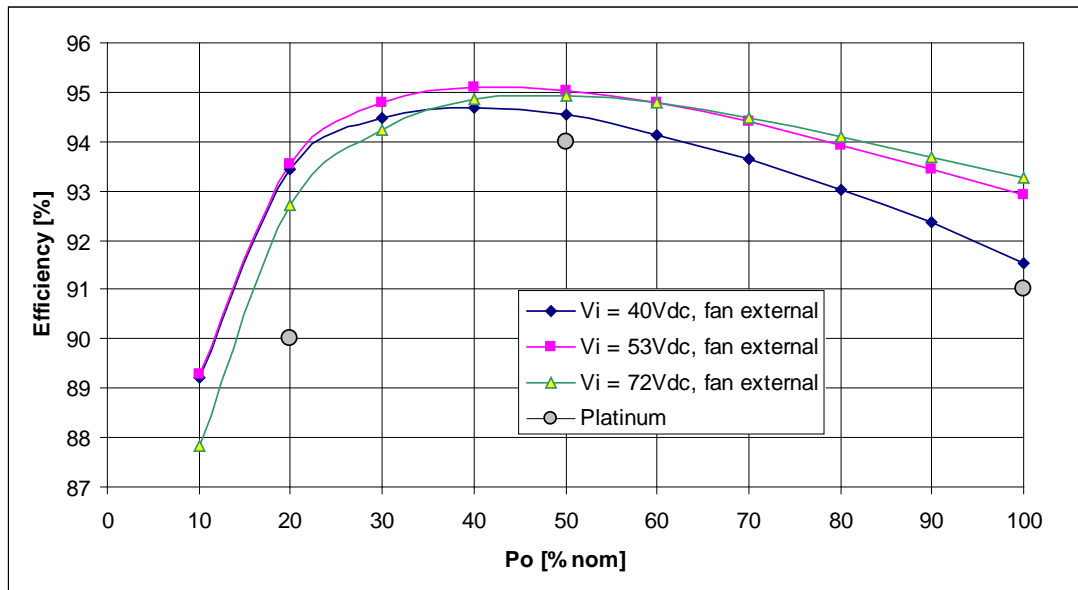
PFE	1100	-	12	-	054	N	D
Product Family PFE Front-Ends	Power Level 1100 W	Dash	V1 Output 12 V	Dash	Width 54 mm	Airflow N: Normal R: Reversed	Input A: AC D: DC

## 2 INPUT SPECIFICATIONS

General Condition:  $T_A = 0 \dots 45 \text{ }^\circ\text{C}$  unless otherwise noted.

PARAMETER	CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
$V_{i \text{ nom}}$	Nominal input voltage		53		VDC
$V_i$	Input voltage ranges	Normal operating ( $V_{i \text{ min}}$ to $V_{i \text{ max}}$ )		72	VDC
$I_{i \text{ max}}$	Max input current			33	$A_{\text{rms}}$
$I_{i \text{ p}}$	Inrush Current Limitation	$V_{i \text{ min}}$ to $V_{i \text{ max}}$		60	$A_{\text{p}}$
$V_{i \text{ on}}$	Turn-on input voltage <sup>1</sup>	Ramping up		45	VDC
$V_{i \text{ off}}$	Turn-off input voltage <sup>1</sup>	Ramping down		40	VDC
$\eta$	Efficiency without fan	$V_{i \text{ nom}}, 0.1 \cdot I_{x \text{ nom}}, V_{x \text{ nom}}, T_A = 25 \text{ }^\circ\text{C}$		89.3	%
		$V_{i \text{ nom}}, 0.2 \cdot I_{x \text{ nom}}, V_{x \text{ nom}}, T_A = 25 \text{ }^\circ\text{C}$		93.5	
		$V_{i \text{ nom}}, 0.5 \cdot I_{x \text{ nom}}, V_{x \text{ nom}}, T_A = 25 \text{ }^\circ\text{C}$		95	
		$V_{i \text{ nom}}, I_{x \text{ nom}}, V_{x \text{ nom}}, T_A = 25 \text{ }^\circ\text{C}$		92.9	
$T_{\text{hold}}$	Hold-up Time	$V_i > 10.8 \text{ V}, V_{\text{SB}}$ within regulation, $V_i = 53 \text{ VDC}, P_{x \text{ nom}}$		5	ms

Figure 1 – Efficiency



<sup>1</sup> The Front-End is provided with a minimum hysteresis of 3 V during turn-on and turn-off within the ranges.

### 3 OUTPUT SPECIFICATIONS

General Condition:  $T_a = 0 \dots +45 \text{ °C}$  unless otherwise noted.

PARAMETER		CONDITIONS / DESCRIPTION	MIN	NOM	MAX	UNIT
<b>Main Output <math>V_1</math></b>						
$V_{1 \text{ nom}}$	Nominal output voltage	$0.5 \cdot I_{1 \text{ nom}}, T_{\text{amb}} = 25 \text{ °C}$		12.0		VDC
$V_{1 \text{ set}}$	Output setpoint accuracy		-0.5		+0.5	% $V_{1 \text{ nom}}$
$dV_{1 \text{ tot}}$	Total regulation	$V_{1 \text{ min}}$ to $V_{1 \text{ max}}, 0$ to $100\% I_{1 \text{ nom}}, T_{a \text{ min}}$ to $T_{a \text{ max}}$	-1		+1	% $V_{1 \text{ nom}}$
$P_{1 \text{ nom}}$	Nominal output power	$V_1 = 12 \text{ VDC}$		1080		W
$I_{1 \text{ nom}}$	Nominal output current	$V_1 = 12 \text{ VDC}$		90.0		ADC
$V_{1 \text{ pp}}$	Output ripple voltage	$V_{1 \text{ nom}}, I_{1 \text{ nom}}, 20 \text{ MHz BW},$ $10\text{nF}/16\text{V}/\text{X7R}/1210 + 10\text{uF}/16\text{V}$ at $V_1$			150	mVpp
$dV_{1 \text{ Load}}$	Load regulation	$V_1 = V_{1 \text{ nom}}, 0 - 100\% I_{1 \text{ nom}}$		80		mV
$dV_{1 \text{ Line}}$	Line regulation	$V_1 = V_{1 \text{ min}} \dots V_{1 \text{ max}}$		10		mV
$I_{1 \text{ max}}$	Current limitation		95		105	ADC
$dI_{\text{share}}$	Current sharing	Deviation from $I_{1 \text{ tot}} / N, I_1 > 10\%$	-3		+3	A
$dV_{\text{dyn}}$	Dynamic load regulation	$\Delta I_1 = 50\% I_{1 \text{ nom}}, I_1 = 5 \dots 100\% I_{1 \text{ nom}},$ $dI/dt = 1 \text{ A}/\mu\text{s}, \text{ recovery within } 1\% \text{ of } V_{1 \text{ nom}}$	-0.6		0.6	V
$T_{\text{rec}}$	Recovery time		1	ms		
$t_{\text{AC } V_1}$	Start-up time from DC	$V_1 = 10.8 \text{ VDC}$		2		sec
$t_{V_1 \text{ rise}}$	Rise time	$V_1 = 10 \dots 90\% V_{1 \text{ nom}}$	1		10	ms
$C_{\text{Load}}$	Capacitive loading	$T_a = 25 \text{ °C}$			10 000	$\mu\text{F}$
<b>Standby Output <math>V_{\text{SB}}</math></b>						
$V_{\text{SB nom}}$	Nominal output voltage	$0.5 \cdot I_{\text{SB nom}}, T_{\text{amb}} = 25 \text{ °C}$	$V_{\text{SB\_SEL}} = 1$		3.3	VDC
			$V_{\text{SB\_SEL}} = 0$		5.0	VDC
$V_{\text{SB set}}$	Output setpoint accuracy		$V_{\text{SB\_SEL}} = 0 / 1$	-0.5	+0.5	% $V_{1 \text{ nom}}$
$dV_{\text{SB tot}}$	Total regulation	$V_{1 \text{ min}}$ to $V_{1 \text{ max}}, 0$ to $100\% I_{\text{SB nom}}, T_{a \text{ min}}$ to $T_{a \text{ max}}$	-2		+2	% $V_{\text{SB nom}}$
$P_{\text{SB nom}}$	Nominal output power	$V_{\text{SB\_SEL}} = 0 / 1$		16.5		W
$I_{\text{SB nom}}$	Nominal output current	$V_{\text{SB}} = 3.3 \text{ VDC}$		5		ADC
		$V_{\text{SB}} = 5.0 \text{ VDC}$		3.3		ADC
$V_{\text{SB pp}}$	Output ripple voltage	$V_{\text{SB nom}}, I_{\text{SB nom}}, 20 \text{ MHz BW},$ $10\text{nF}/16\text{V}/\text{X7R}/1210 + 10\text{uF}/16\text{V}$ at $V_{\text{SB}}$			100	mVpp
$dV_{\text{SB}}$	Droop	$0 - 100\% I_{\text{SB nom}}$	$V_{\text{SB\_SEL}} = 1$		67	mV
			$V_{\text{SB\_SEL}} = 0$		44	mV
$I_{\text{SB max}}$	Current limitation	$V_{\text{SB\_SEL}} = 1$	5.25		6	ADC
		$V_{\text{SB\_SEL}} = 0$	3.45		4.3	ADC
$dV_{\text{SB dyn}}$	Dynamic load regulation	$\Delta I_{\text{SB}} = 50\% I_{\text{SB nom}}, I_{\text{SB}} = 5 \dots 100\% I_{\text{SB nom}}, dI/dt = 0.5$ $\text{A}/\mu\text{s}, \text{ recovery within } 1\% \text{ of } V_{1 \text{ nom}}$	-3		3	% $V_{\text{SB nom}}$
$T_{\text{rec}}$	Recovery time				250	$\mu\text{s}$
$t_{\text{AC } V_{\text{SB}}}$	Start-up time from DC input	$V_{\text{SB}} = 90\% V_{\text{SB nom}}$			2	sec
<b>Standby Output <math>V_{\text{SB}}</math> (Cont.)</b>						
$t_{V_{\text{SB}} \text{ rise}}$	Rise time	$V_{\text{SB}} = 10 \dots 90\% V_{\text{SB nom}}$	4		10	ms
$C_{\text{Load}}$	Capacitive loading	$T_{\text{amb}} = 25 \text{ °C}$			10000	$\mu\text{F}$

## 4 SIGNALING AND CONTROL

### 4.1 FRONT LEDS

Table 1: LED Status

OPERATING CONDITION	LED SIGNALING
<i>IN LED (INPUT OK)</i>	
DC Line within range	Solid Green
DC Line UV condition	Off
Redundant Operation - PSU1 operating and PSU2 has input power removed	Solid Yellow (PSU2) <sup>1)</sup>
<i>OUT LED <sup>2)</sup> (OUTPUT OK)</i>	
PSON High	Blinking Yellow (1:1)
Hot-Standby Mode	Blinking Yellow/Green (1:2)
$V_1$ or $V_{SB}$ out of regulation	Solid Yellow
Over temperature shutdown	
Output over voltage shutdown ( $V_1$ or $V_{SB}$ )	
Output over current shutdown ( $V_1$ or $V_{SB}$ )	
Fan error (>15%)	
Over temperature warning	Blinking Yellow/Green (2:1)
Minor fan regulation error (>5%, <15%)	Blinking Yellow/Green (1:1)
Redundant Operation - PSU1 operating and PSU2 has input power removed	Off (PSU2)
<sup>1)</sup> The LEDs will be ON till input power from PSU1 is removed.	
<sup>2)</sup> The order of the criteria in the table corresponds to the testing precedence in the controller.	

The front-end has 2 front LEDs showing the status of the supply. LED number one is green and indicates DC power is on or off, while LED number two is bi-colored: green and yellow, and indicates DC power presence or fault situations. For the position of the LEDs see Figure 5.

### 4.2 GRAPHICAL USER INTERFACE

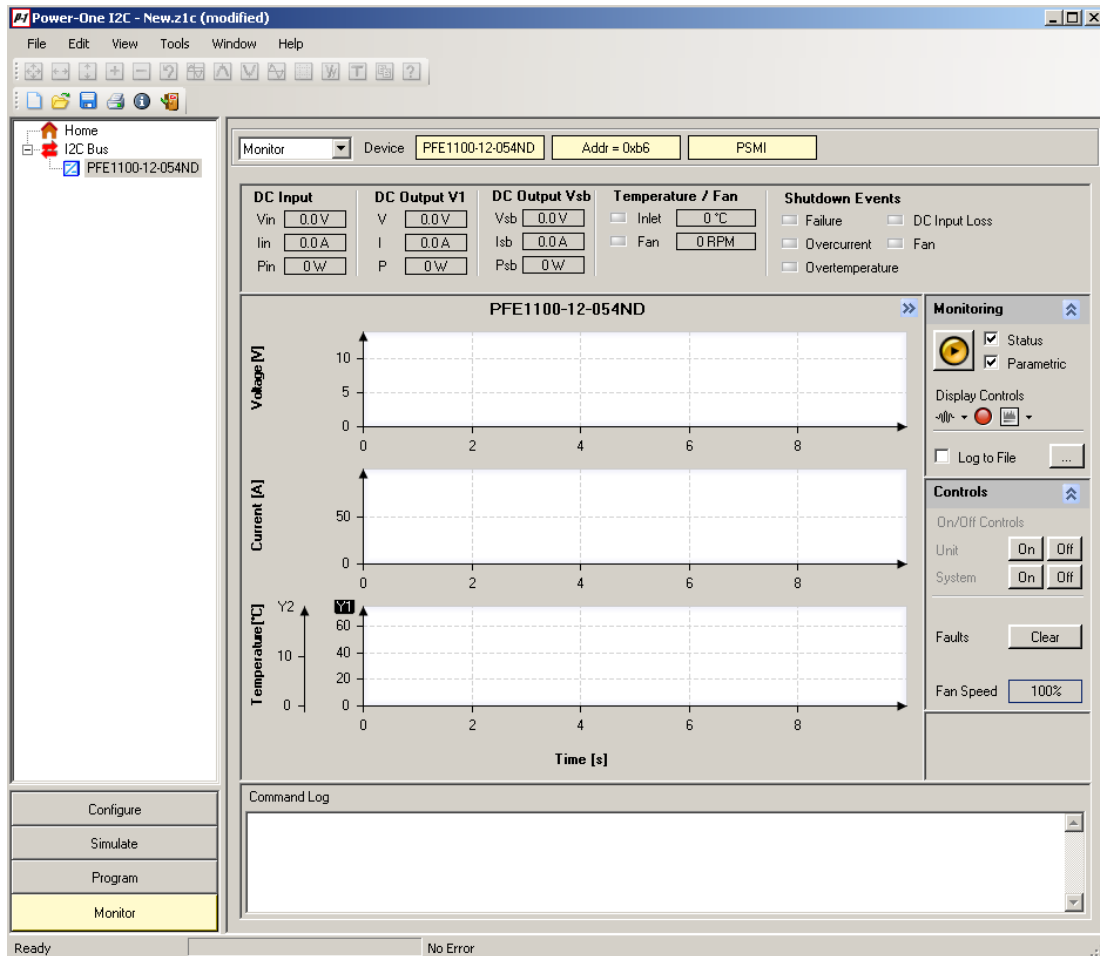
Power-One provides with its "Power-One I<sup>2</sup>C Utility" a Windows<sup>®</sup> XP/Vista/Win7 compatible graphical user interface allowing the programming and monitoring of the PFE1100-12-054ND Front-End. The utility can be downloaded on [www.power-one.com](http://www.power-one.com) and supports both the PSMI and PMBus<sup>™</sup> protocols.

The GUI allows automatic discovery of the units connected to the communication bus and will show them in the navigation tree. In the monitoring view the power supply can be controlled and monitored.

If the GUI is used in conjunction with the PFE1100-12-054ND Evaluation Kit it is also possible to control the PSON pin(s) of the power supply.

Further there is a button to disable the internal fan for approximately 5 seconds (not implemented yet). This allows the user to take input power measurements without fan consumptions to check efficiency compliance to the Climate Saver Computing Platinum specification.

Figure 2: PC Bus to uC (Graphical User Interface)



The monitoring screen also allows to enable the hot-standby mode on the power supply. The mode status is monitored and by changing the load current it can be monitored when the power supply is being disabled for further energy savings. This obviously requires 2 power supplies being operated as a redundant system (like the evaluation kit).

**NOTE:** The user of the GUI needs to ensure that only one of the power supplies have the hot-standby mode enabled.

## 5 ELECTROMAGNETIC COMPATIBILITY

### 5.1 IMMUNITY

NOTE: Most of the immunity requirements are derived from EN 55024:1998/A2:2003.

TEST	STANDARD / DESCRIPTION	CRITERIA
ESD Contact Discharge	IEC / EN 61000-4-2, ±8 kV, 25+25 discharges per test point (metallic case, LEDs, connector body)	B
ESD Air Discharge	IEC / EN 61000-4-2, ±15 kV, 25+25 discharges per test point (non-metallic user accessible surfaces)	B
Radiated Electromagnetic Field	IEC / EN 61000-4-3, 10 V/m, 1 kHz/80% Amplitude Modulation, 1 μs Pulse Modulation, 10 kHz...2 GHz	A
Burst	IEC / EN 61000-4-4, level 3 Input DC port ±1 kV, 1 minute DC port ±0.5 kV, 1 minute	B
Surge	IEC / EN 61000-4-5 Line to earth: ±0.5 kV Line to line: ±0.5 kV	B
RF Conducted Immunity	IEC/EN 61000-4-6, Level 3, 10 Vrms, CW, 0.1 ... 80 MHz	A

### 5.2 EMISSION

TEST	STANDARD / DESCRIPTION	CRITERIA
Conducted Emission	EN55022 / CISPR 22: 0.15 ... 30 MHz, QP and AVG, single unit, $V_i = 53$ VDC, $P_{x\text{ nom}}$	Class A 6 dB margin
	EN55022 / CISPR 22: 0.15 ... 30 MHz, QP and AVG, 2 units in rack system, $V_i = 53$ VDC, $P_{x\text{ nom}}$	Class A 6 dB margin
Radiated Emission	EN55022 / CISPR 22: 30 MHz ... 1 GHz, QP, single unit, $V_i = 53$ VDC, $P_{x\text{ nom}}$	Class A 6 dB margin
	EN55022 / CISPR 22: 30 MHz ... 1 GHz, QP, 2 units in rack system, $V_i = 53$ VDC, $P_{x\text{ nom}}$	Class A 6 dB margin
Acoustical Noise	Sound power statistical declaration (ISO 9296, ISO 7779, IS9295) @ 50% load	62 dBA

## 6 ENVIRONMENTAL

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT	
$T_A$	Ambient Temperature	$V_{i\text{ min}}$ to $V_{i\text{ max}}$ , $I_{h\text{ nom}}$ , $I_{SB\text{ nom}}$	0		+45	°C
$T_{A\text{ ext}}$	Extended Temp. Range	Derated output	+45		+65	°C
		$V_{i\text{ min}}$ to $V_{i\text{ max}}$ / $h < 77A$ , $I_{SB\text{ nom}}$			+55	°C
		$V_{i\text{ min}}$ to $V_{i\text{ max}}$ / $h < 35A$ , $I_{SB\text{ nom}}$			+65	°C
$T_S$	Storage Temperature	Non-operational	-20		+70	°C
$N_a$	Audible Noise	Sound power @ $V_{i\text{ nom}}$ , 50% $I_{o\text{ nom}}$ , $T_A = 25^\circ\text{C}$		62		dBA

## 7 MECHANICAL

PARAMETER	DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT	
	Dimensions	Width		54.5		mm
		Height		40.0		
		Depth		321.5		
$M$	Weight		1.12		kg	

Figure 3 - Side View 1

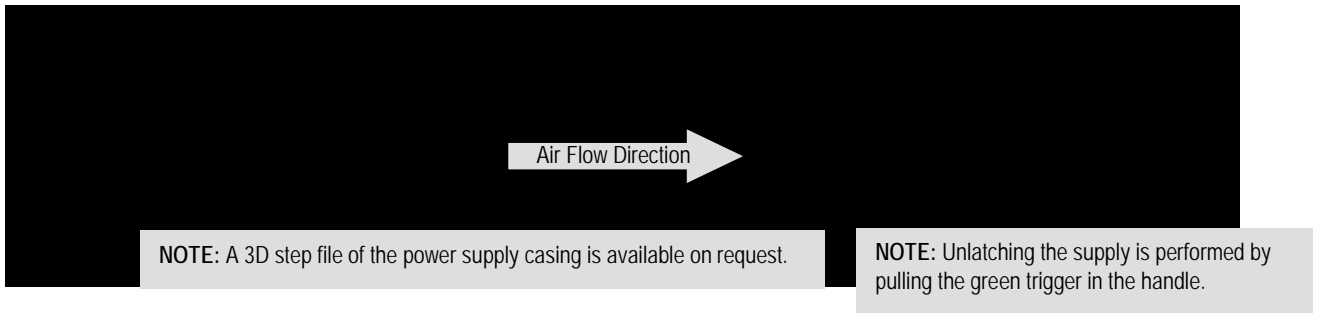


Figure 4 - Top View

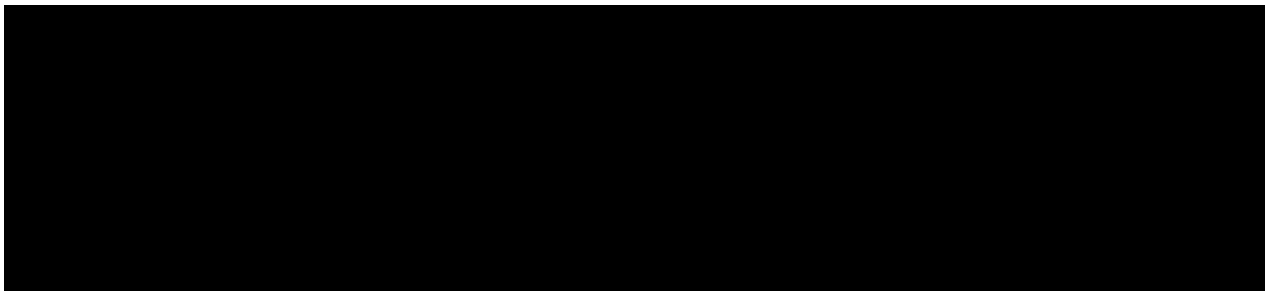


Figure 5 - Side View 2

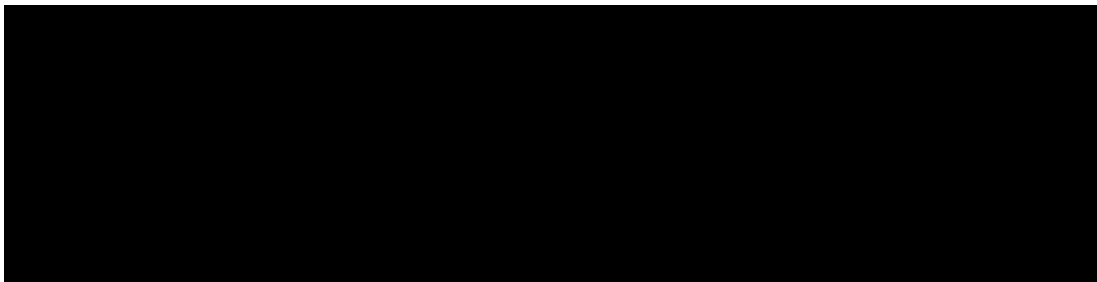
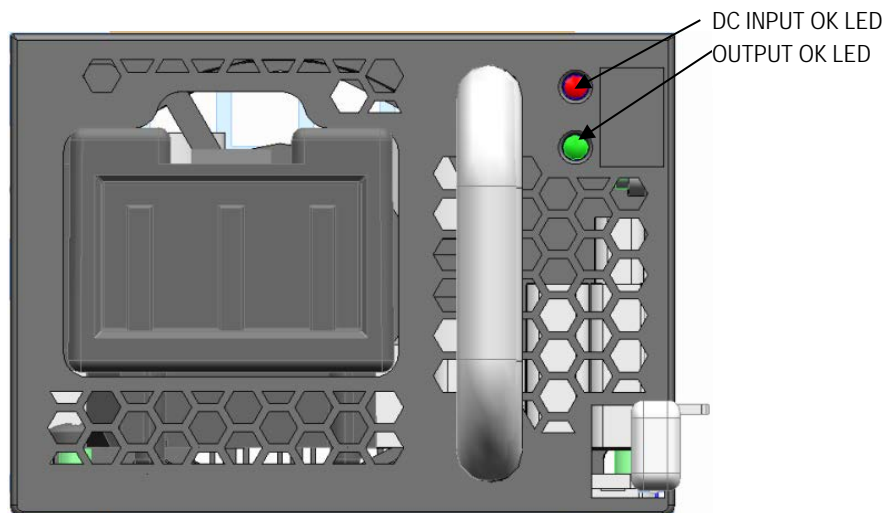
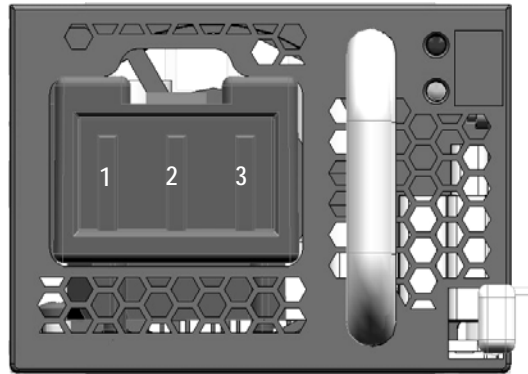


Figure 6 - Front and Rear View



## 8 CONNECTIONS

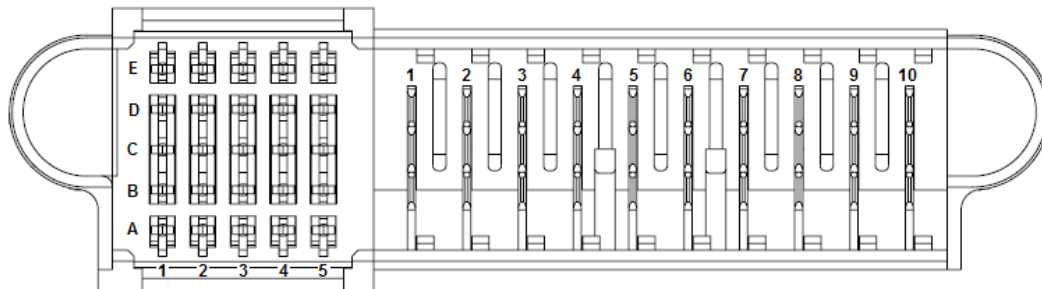
### 8.1 INPUT CONNECTOR



Unit: China Aviation (JOHNON OPTRONIC) P/N DP5ZJW0300-001  
Counter part: China Aviation (JOHNON OPTRONIC) P/N DP5TJY0300-001 (provided)

PIN	NAME	DESCRIPTION
<i>Input</i>		
1	Vin+	Input positive
2	Vin-	Input negative
3	PE	Ground

### 8.2 OUTPUT CONNECTOR






Unit: Tyco Electronics P/N 2-1926736-3      Note: Column 5 is lagging (short pins)  
Counter part: Tyco Electronics P/N 2-1926733-5

PIN	NAME	DESCRIPTION
<i>Output</i>		
6, 7, 8, 9, 10	V1	+12 VDC main output
1, 2, 3, 4, 5	PGND	Power ground (return)
<i>Control Pins</i>		
A1	VSB	Standby positive output (+3.3/5 V)
B1	VSB	Standby positive output (+3.3/5 V)
C1	VSB	Standby positive output (+3.3/5 V)
D1	VSB	Standby positive output (+3.3/5 V)
E1	VSB	Standby positive output (+3.3/5 V)
A2	SGND	Signal ground (return)
B2	SGND	Signal ground (return)
C2	HOTSTANDBYEN	Hot standby enable signal



PIN	NAME	DESCRIPTION
D2	VSB_SENSE_R	Standby output negative sense
E2	VSB_SENSE	Standby output positive sense
A3	APS	I <sup>2</sup> C address and protocol selection (select by a pull down resistor)
B3	nc	Reserved
C3	SDA	I <sup>2</sup> C data signal line
D3	V1_SENSE_R	Main output negative sense
E3	V1_SENSE	Main output positive sense
A4	SCL	I <sup>2</sup> C clock signal line
B4	PSON	Power supply on input (connect to A2/B2 to turn unit on)
C4	SMB_ALERT	SMB Alert signal output
D4	nc	Reserved
E4	INOK	DC input OK signal
A5	PSKILL	Power supply kill (lagging pin)
B5	ISHARE	Current share bus (lagging pin)
C5	PWOK	Power OK signal output (lagging pin)
D5	VSB_SEL	Standby voltage selection (lagging pin)
E5	PRESENT_L	Power supply present (lagging pin)

## 9 ACCESSORIES

ITEM	DESCRIPTION	ORDERING PART NUMBER	SOURCE
	<b>Power-One I<sup>2</sup>C Utility</b> Windows XP/Vista/7 compatible GUI to program, control and monitor PFE Front-Ends (and other I <sup>2</sup> C units)	N/A	<a href="http://www.power-one.com">www.power-one.com</a>
	<b>USB to I<sup>2</sup>C Converter</b> Master I <sup>2</sup> C device to program, control and monitor I <sup>2</sup> C units in conjunction with the <i>Power-One I<sup>2</sup>C Utility</i>	ZM-00056	Power-One
	<b>Dual Connector Board</b> Connector board to operate 2 PFE units in parallel. Includes an on-board USB to I <sup>2</sup> C converter (use <i>Power-One I<sup>2</sup>C Utility</i> as desktop software).	SNP-OP-BOARD-01	Power-One

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