SERIES: PSA-1100 | DESCRIPTION: AC-DC HOT-SWAP POWER SUPPLY

FEATURES

- up to 1100 W continuous power
- high power density - 25.34 W/in^3
- slim line 1U form factor
- PMBus™ communication for monitoring and control
- front to back (-F) and back to front (-B) airflow versions
- power factor correction
- 3.3 Vdc or 5 Vdc standby voltage (2 A) options
- redundant (N+1) operation
- blind mate connections for hot-swap
- DROOP current sharing or forced current sharing (optional)
- remote on/off control, power good signal

MODEL	output voltage (Vdc)	output current max (A)	output power max (W)	ripple and noise[1] max (mVp-p)	efficiency[2] typ (%)
PSA-1100-12-F	12	92	1100	120	93.5
PSA-1100-12-B[3,4,5]	12	92	1100	120	93.5

Notes:
1. Measured at 20 MHz bandwidth at an oscilloscope jack on the output with 0.1 μF ceramic and two 180 μF polymer capacitors at a 2” distance from V1 output connector.
2. At 230 Vac input, 550 W.
3. At 100~240 Vac input, maximum of 1100 W at Ta=29°C.
4. At 100~240 Vac input, maximum of 740 W at Ta=50°C.
5. At 200~240 Vac input, maximum of 1100 W at Ta=48°C.
6. All specifications measured at: Ta=25°C and 220 Vac input voltage unless otherwise specified.

PART NUMBER KEY

PSA-1100 - 12 - X - CXX

- PSA-1100: Base Number
- 12: Output Voltage
- X: Airflow Direction:
  F = AC input connector to DC output connector
  B = DC output connector to AC input connector
- CXX: Reserved for Custom Configurations

INPUT

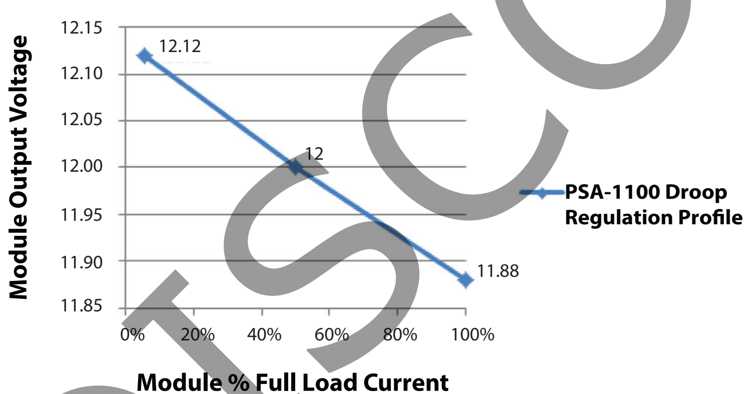
parameter	conditions/description	min	typ	max	units
voltage		90		264	Vac
frequency		47		63	Hz
current	at 90 Vac at 180 Vac			14.4 8.0	Arms Arms
inrush current	at 115 Vac, cold start at 230 Vac, cold start		20 40		A A
leakage current				1.5	mArms
power factor correction	at 115 Vac, full load	0.95			

OUTPUT - V1 (MAIN OUTPUT)

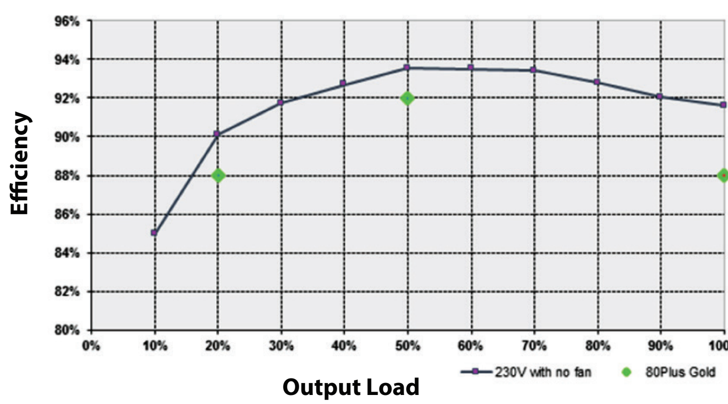
parameter	conditions/description	min	typ	max	units
line regulation			±1.5		%
load regulation			±1.5		%
load capacitance				30,000	μF
transient response	25% step load, 1A/μs slew rate, recovery to 1% within 1 ms			5	%
start-up time				1.5	s
hold-up time	at 230 Vac, full load	12			ms
remote sense	between both output terminals		0.3		V
current share accuracy (Droop)[1]	over 10% to 100% load		±4		A
LED indicator	AC OK: "green" to indicate AC above the lower limit that is required to sustain normal operation				
	DC OK: "green" to indicate module in normal operating condition				

Notes: 1. Droop regulation of ±1.0% for an overall combined regulation allowance of ±1.5%

PSA-1100 Droop Regulation Profile



Efficiency vs. Output Current



OUTPUT - V2 (STANDBY OUTPUT)

parameter	conditions/description	min	typ	max	units
output voltage	selectable		3.3/5		Vdc
output current		0		2	A
ripple and noise[2]				100	mVp-p
line regulation			±2		%

Notes: 2. Measured at 20 MHz bandwidth at an oscilloscope jack on the output with 100 μF low ESR capacitor at 0.5" from V2 output connector.

OUTPUT - V2 (STANDBY OUTPUT CONTINUED)

parameter	conditions/description	min	typ	max	units
load regulation			±2		%
load capacitance				2200	μF
transient response	25% step load, 1A/μs slew rate, recovery to 1% within 1 ms			5	%
start-up time				1.5	s

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over voltage protection	V1: latch off V2: latch off	13.2 110		14.5 120	Vdc %
over current protection	V1: auto recovery V2	101.2		128.8 3	A A
over temperature protection	auto recovery		55		°C

SAFETY & COMPLIANCE

parameter	conditions/description	min	typ	max	units
insulation safety rating / test voltage	input to output, reinforced input to chassis, basic	3,000 1,500			Vrms Vrms
isolation voltage	output to chassis V2 to chassis/ground	100 100			Vrms Vdc
grounding	the output signals are referenced to the A2 and B2 return connection				
safety approvals	EN60950-1:2006+A11+A1+A12, IEC60950-1:2005+Amd 1, CAN/CSA-C22.2 No.60950-1-07+A1:2011, UL 60950-1:2007 R12.11(NRTL Route), EEC/93/68/LVD, 2006/95/EC LVD				
conducted emissions	FCC 15 Sub Part B, EN55022, Class A: tested with resistive load				
radiated emissions	FCC 15 Sub Part B, EN55022, Class A: tested with resistive load				
harmonic compliance	EN/IEC 61000-3-2:2009, Class A Harmonic Limits Compliance Level: 230 Vac line voltage; 100% output load				
flicker	EN/IEC 61000-3-3:2009 limits as specified in the standard: flicker and voltage fluctuations				
electrostatic discharge	EN/IEC 61000-4-2, ±8 kV operational air discharge, ±8 kV contact discharge: all parameters to remain within limits, test set up to be defined				
RF electro-magnetic field. amplitude modulated	EN/IEC 61000-4-3 80~1000 MHz, 10 V/m, 80% AM Modulation (1 kHz): all parameters to remain within limits, test set up to be defined				
immunity to fast transients	EN/IEC 61000-4-4 Power lines: ±2 kV: all parameters to remain within limits, test set up to be defined				
surges (mains)	EN/IEC 61000-4-5 ±1kV line to line, ±2 kV line to earth, Criteria A: all parameters to remain within limits, test set up to be defined				
RF continuous conducted	EN/IEC 61000-4-6 150 kHz~80 MHz 3Vrms 80% AM (1 kHz), Criteria A: all parameters to remain within limits, test set up to be defined				
voltage dips/ interruptions	IEC 61000-4-11 30% reduction for 10 ms, 60% reduction for 100 ms: Reset is permitted must be selfrecovering. Additionally, the PSU shall not latch up during any brownout condition.				
MTBF	as per Telcordia SR-332, Issue 2, Sept 2006 component stress method at Ta=40°C, full load	500,000			hours
RoHS	2011/65/EU				
WEEE	2012/19/EU				

ENVIRONMENTAL

parameter	conditions/description	min	typ	max	units
operating temperature[1]		0		50	°C
storage temperature	non-condensing	-40		70	°C
operating humidity	non-condensing	10		90	%
storage humidity		5		90	%
acoustic	ISO 7779-1999			60	dB LpAm
cold[2]	IEC 68 Part 2 – 1: at -10°C minimum for 4 hours				
dry heat	IEC 68 Part 2 – 2: at 50°C minimum for 4 hours				
damp heat, cyclic	IEC 68 Part 2 – 30: at 20~45°C, 30~95 %RH				
low air pressure (operating)	IEC 68 Part 2 – 13: at 10,000 feet, 697 mbar				
vibration (sinusoidal)	IEC 68 Part 2 – 6: at 10~58 Hz, 0.075 mm; 58~500 Hz, 10 m/s^2, 1 octave/minute, 10 cycles/ main axis		1		G
shock	IEC 68 Part 2 – 27: at 300 m/s^2, 11 ms, half sine wave 3 shocks/main axis		30		G
bump	IEC 68 Part 2 – 29: at 150 m/s^2, 6 ms, half sine wave 900 bumps/main axis		15		G

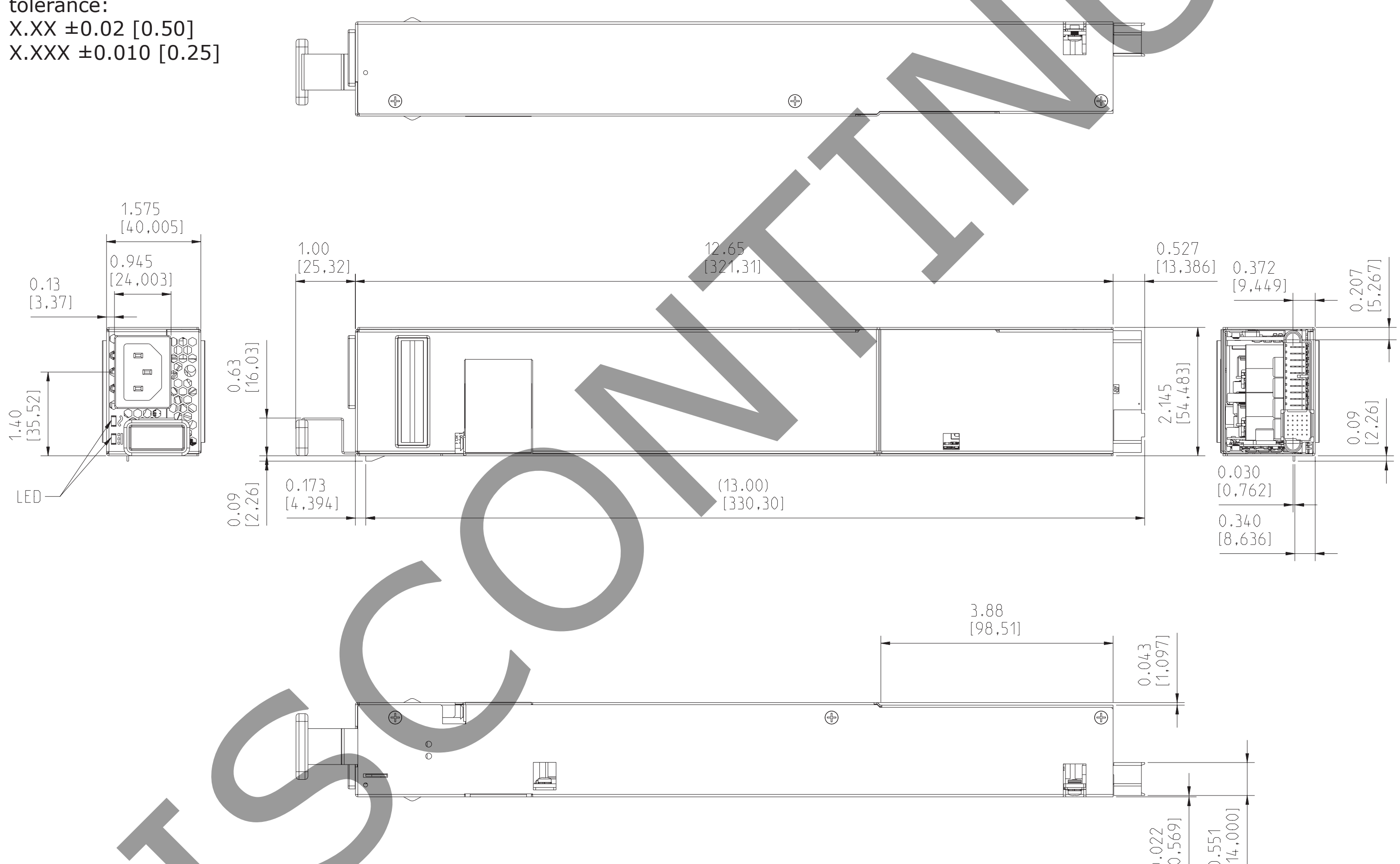
Notes:
1. PSA-1100-12-B: At 100~240 Vac input, maximum of 1100 W at Ta=29°C. At 100~240 Vac input, maximum of 740 W at Ta=50°C. At 200~240 Vac input, maximum of 1100 W at Ta=48°C.
2. The module shall start up at -10°C, however it is not required that the full specification is achieved until the operational internal temperature has risen to 0°C.

MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	12.65 x 2.145 x 1.575 (321.3 x 54.5 x 40.0 mm)				inches
weight			1.1		kg
cooling / airflow	integral fan				
material flammability	UL 94V-0				
AC input	IEC320/C14				
DC output	Tyco Electronics P/N 2-1926734-2 mates with Tyco Electronics P/N 2-1926739-5				

MECHANICAL DRAWING

units: inches [mm]
tolerance:
X.XX ±0.02 [0.50]
X.XXX ±0.010 [0.25]



DC OUTPUT PIN ASSIGNMENTS

PIN		FUNCTION	DESCRIPTION		HIGH / LOW LEVEL	Imax
1,2,3,4,5		12 V output return	V1 (-VE) main output return			
6,7,8,9,10		12 V output	V1 (+VE) main output			
signal pin row "A"	A1	Vstandby +VE	positive output of standby (V2)			
	A2	signal/logic return	common with V1 & V2 returns			
	A3	I²C address select	analog I²C address selection			
	A4	SCL	communications clock line			
	A5	PSKILL_H	disables power on extraction (recessed pin)			
			pin status	module		
			open circuit	"off"		
			logic "1"	"off"		
			logic "0"	"on"		
signal pin row "B"	B1	Vstandby +VE	positive output of standby (V2)			
	B2	signal/logic return	common with V1 & V2 Returns			
	B3	not use	reserved			
	B4	PS_ON_L (remote_ON_L)	internally pulled up to 3.3 V via 3.01 kΩ if PSKILL_H is connected to return			
			open to A2/B2	short to A2/B2		
			"off"	"on"		1.05 mA
	B5	Ishare (optional)	active current sharing bus (recessed pin)			
signal pin row "C"	C1	Vstandby +VE	positive output of standby (V2)			
	C2	not use	reserved			
	C3	SDA	communications data			
	C4	SMB_ALERT_L	SMBus interrupt line			
			logic "1"	"good"	>2.1 V	
			logic "0"	"fault"	<0.4 A	-5 mA
	C5	DC_OK_H	DC OK Signal (recessed pin)			
			logic "1"	"good"	>2.1 V	
			logic "0"	"fault"	<0.4 A	-5 mA
signal pin row "D"	D1	Vstandby +VE	positive output of standby (V2)			
	D2	not use	reserved			
	D3	V1 Vsense (-VE)	V1 negative sense line			
	D4	not use	reserved			
	D5	Vstandby_select (V2)	selects the voltage of V2 recessed pin			
			open circuit	short circuit		
			3.3 V	5 V		
signal pin row "E"	E1	Vstandby +VE	positive output of standby (V2)			
	E2	not use	reserved			
	E3	V1 Vsense (+VE)	V1 positive sense line			
	E4	AC_OK_H	AC incoming source alarm			
			logic "1"	"good"	> 2.1 V	
			logic "0"	"fault"	< 0.4 A	-5 mA
	E5	PS_present	active low, recessed pin, passive signal to detect presence of module, host to provide pull up resistor connected to V2 to source maximum of 5 mA when module is inserted			

APPLICATION NOTES

Digital Interface

The PSA-1100 is provided with a digital communications interface that is based upon a subset of the SMBus™ & PMBus™ Protocols.
The communication interface is a Two Wire Interface (TWI) using devices hardware compatible with I^2C.
The interface is based upon the I^2C Protocol developed by Philips Semiconductors (now NXP). Reference to the "I^2C Bus Specification and User Manual" UM10204 Rev.03 – 19 June 2007 is recommended.

Slave Addresses

The device is selected by setting the Slave Address (Pin A3) either by an external resistor network or by direct connection to logic "high" or "low". Either method interfaced to the appropriate I/O port of the internal I^2C device. Therefore the device can be set to respond to all addresses in the range from binary 1011 0000 to 1011 0110 (where the last bit is for read/write that is always set at "0" for initial addressing).

- Connection of Pin A3 to a logic "low" will provide an address of B0 (1011 0000)
- Connection of Pin A3 to a logic "high" (or leaving open circuit) will provide an address of B6 (1011 0110)

To achieve the full range of four potential address combinations Pin A3 requires to be connected to an external resistor that will create an internal analogue voltage that is interpreted by the internal I^2C device to derive the following address combinations:

Possible Module Slave Address Combinations									
External Resistor Value (Ohms)	Fixed Address				Variable Address Bits			R/W	HEX
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
820	1	0	1	1	0	0	0	0	B0
2700	1	0	1	1	0	0	1	0	B2
5600	1	0	1	1	0	1	0	0	B4
8200	1	0	1	1	0	1	1	0	B6

APPLICATION NOTES (CONTINUED)

General Information

Refer to the PMBus™/SMBus specification for details on read/write operations when dealing with Byte, Word or Block process calls. Packet Error Correction (PEC) and Address Resolution Protocol (ARP) are not supported. If the PMBus™ master tries to read more bytes than the length of the data selected by the command code, the additional bytes will be sent as 0xFF. The PMBus™ slave device may apply clock stretching by holding the clock line (SCL) low after a command to indicate that it is busy processing data. A master device on the PMBus™ may attempt to continue with the communications but must first wait until the clock line is released. Clock stretching times will vary depending on the data being processed and/or if there are any higher priority events during the response but shall not exceed 25 ms.

PMBus™ COMMAND SUBSET

The following is subset of commands (extracted from the "PMBus Power System Management Protocol Specification; Part II Command Language; Rev 1.2, 6 September 2010") and apply on a per module basis, (although certain commands could be applied "globally"). For a full definition of the individual command refer to the above referenced PMBus™ specification.

Note: Hex Command 88h, 89h, 8Bh, 8Ch divide decimal value by 100.

Command (HEX)	Command Name	No. of Bytes	Read / Write	Command Description
01h	OPERATION	1	W	The OPERATION command is used to turn the unit on & off in conjunction with the CONTROL (short; last make, first make pin). The unit remains in the commanded mode until the command is toggled or the unit removed from its slot; in which case the CONTROL pin is de-asserted and overrules the OPERATION command.
03h	CLEAR_FAULTS	0	W	Clear fault data
78h	STATUS_BYTE	1	R	Lower byte returned from the STATUS_WORD
79h	STATUS_WORD	2	R	The command returns two bytes of data relating to the unit fault condition. CUI may elect to provide a subset of information.
88h	READ_VIN	2	R	Provides the measured input voltage of the power module in volts.
89h	READ_IIN	2	R	Provides the measured input current of the power module in Amps.
8Bh	READ_VOUT	2	R	Provides the measured output voltage of the power module in volts.
8Ch	READ_IOUT	2	R	Provides the measured output current of the power module in Amps.
8Dh	READ_TEMPERATURE_1	2	R	This command shall return a select component temperature used by the power module, in degrees Celsius.
8Eh	READ_TEMPERATURE_2	2	R	This command shall return the prevailing internal ambient of the power module, in degrees Celsius.
90h	READ_FAN_SPEED_1	2	R	Provides the measured fan speed in the power module in RPM.
96h	READ_POUT	2	R	This command shall return the calculated output being delivered by the power module, in Watts.
97h	READ_PIN	2	R	This command shall return the calculated input being drawn by the power module, in Watts.
98h	PMBUS_REVISION	1	R	PMBus™ Revision
99h	MFR_ID	8	R	The command returns the ASCII string for manufacturer's ID.
9Ah	MFR_MODEL	12	R	The command returns the ASCII string manufacturer's model.
9Bh	MFR_REVISION	2	R	The command returns the ASCII string manufacturer's revision (example case "01").
9Dh	MFR_DATE	4	R	The command returns the ASCII string manufacturer's date code (example case "0913").
9Eh	MFR_SERIAL	8	R	The command returns manufacturers serial number.

APPLICATION NOTES (CONTINUED)

PMBus™ Non-Standard Extended Command Subset

Command (HEX)	Command Name	No. of Bytes	Read / Write	Command Description
16h	SOFTWARE VERSION	4	R	Read vendor specific firmware revision (ASCII string). Example case "A100"

Remote On/Off (PMBus™ Operation Command 0x01)

This command can be used to turn the unit on and off via the PMBus™ interface.

If B4 (REMOTE_ENABLE) is HIGH (enabled) then the PMBus™ Remote On/Off function can turn the unit off and on. If B4 (REMOTE_ENABLE) is LOW (disabled) then the PMBus™ Remote On/Off function cannot turn the unit on or off and can be ignored.

The bit encoding of the data byte of the command is as follows.

Bits [7:6]	Bits [5:4]	Bits [3:2]	Bits [1:0]	Unit State
00	XX	XX	XX	Off
01	XX	XX	XX	Off
10	00	XX	XX	On
10	01	01	XX	On
10	01	10	XX	On
10	10	01	XX	On
10	10	10	XX	On

If any other bit pattern is received take no action.

If the power supply is turned off by this command then set the OFF bit (6 of the low byte) of the status word to 1. Otherwise set it to 0.

APPLICATION NOTES (CONTINUED)

Status Word

This command is a two byte structure (High and Low bytes). The PMBus™ specification (Table 15) details the structure and content of the word. Note that unsupported bits shall be set to “0”

Status Word (79h); Low Byte

Byte	Bit #	PMBus™ Bit Name	Definition
Low	Bit 7	BUSY	Not Supported
	Bit 6	OFF	Pulse Width Modulator enable status: 1 = PWM disabled 0 = PWM enabled
	Bit 5	VOUT_OV	Output over voltage fault 1 = OVP has occurred 0 = OVP has not occurred
	Bit 4	IOUT_OC	OCP; the unit has entered overload protection. 1= OCP has occurred 0= OCP has not occurred
	Bit 3	VIN_UV	Incoming AC under voltage: 1 = AC is not OK 0 = AC is OK
	Bit 2	TEMPERATURE	Over Temperature fault 1 = OTP has occurred 0 = OTP has not occurred
	Bit 1	CML	Not Supported
	Bit 0	NONE OF THE ABOVE	Not Supported

Status Word; High Byte

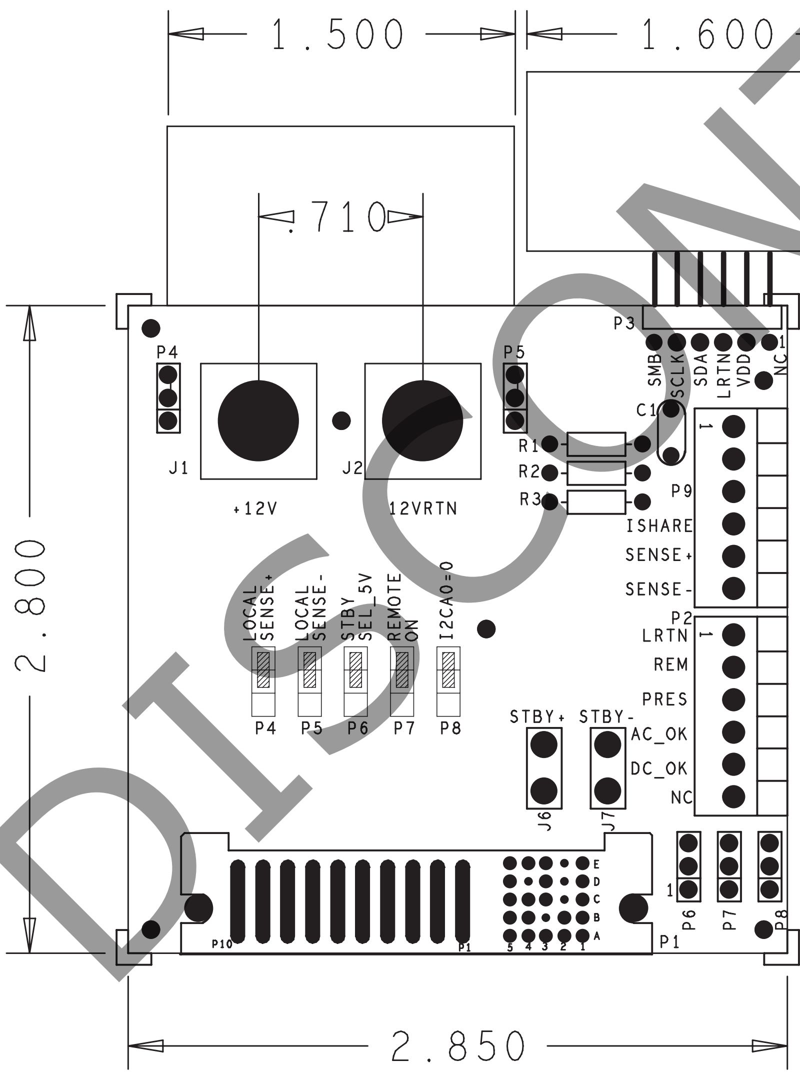
Byte	Bit #	PMBus™ Bit Name	Definition
High	Bit 7	VOUT	Voltage Fault or Warning uVP fault only
	Bit 6	IOUT/POUT	Not Supported
	Bit 5	INPUT	Not Supported
	Bit 4	MFR	Auxiliary Specific Failure
	Bit 3	POWER_GOOD#	Not Supported
	Bit 2	FAN	Fan Failure 1 = Fan has failed 0 = Fan has not failed
	Bit 1	OTHER	Not Supported
	Bit 0	UNKNOWN	Not Supported

DEMO BOARD

Accessories		
Description	**CUI Part Number**	**Vendor/Part Number**
Demo Board[1]	01T-156801-1	
DC Output Mating Connector	22P-S00065-4	TEConn 2-1926739-5
I²C dongle[2]		Microchip DV164122
AC power cord[3]		Qualtek 312019-01

Notes:
1. This demo board is intended for user connection to evaluate the power supply in the laboratory by qualified personnel. Please take necessary safety precautions during product evaluation.
2. The PICkit Serial Analyzer is an USB-based tool used to direct communication between a PC and an external serial device. The kit comes complete with hardware (supporting I2C™, SMBus, SPI and USART protocols), an easy-to-use GUI (to configure and display communications) and a target demonstration board for out-of-the-box functionality. http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en028600
3. For North American use only

Demo Board Power Connections	
J1	+12V Output
J2	12V Return
J6	+ Standby Output
J7	Standby Output Return



Demo Board Connections/Settings	
P1	DC Output Mating Connector
P2	Control & Status Signals
1	Logical Return
2	Remote ON (override by P7)
3	Present
4	AC_OK
5	DC_OK
6	NC
P3	I²C Dongle Connection
1	SMB
2	SCL
3	SDA
4	Logical Return
5	VDD
6	NC
P4	Jumper to Local Sense+, remove jumper for remote sense
P5	Jumper to Local Sense-, remove jumper for remote sense
P6	Jumper to Select 5V Standby, remove jumper to set 3.3V Standby
P7	Jumper to ON, remove jumper for Remote ON/OFF
P8	Jumper to set I²C A0 = 0, remove jumper to set address by host
P9	Control & Status Signals
1	NC
2	NC
3	NC
4	ISHARE (optional force sharing)
5	SENSE+ (override by P4)
6	SENSE- (override by P5)

REVISION HISTORY

rev.	description	date
1.0	initial release	05/07/2015
1.01	updated datasheet	07/15/2015
1.02	added efficiency curve	06/03/2016

The revision history provided is for informational purposes only and is believed to be accurate.

CUI INC®

Headquarters
20050 SW 112th Ave.
Tualatin, OR 97062
800.275.4899

Fax 503.612.2383
cui.com
techsupport@cui.com