PDC-2200WC PSU

Technical Manual

Issue   1.0

Date   2018-11-20

About This Document

Purpose

This document describes the PDC-2200WC power supply unit (PSU), including its features, electrical specifications, applications, and communication.

The figures provided in this document are for reference only.

Intended Audience

This document is intended for:

- Hardware engineers
- Software engineers
- System engineers
- Technical support engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.
⚠ WANRNING	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. **NOTICE** is used to address practices not related to personal injury.
📖 NOTE	Calls attention to important information, best practices and tips. **NOTE** is used to address information not related to personal injury, equipment damage, or environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

Issue 1.0 (2018-11-20)

This issue is the first official release.

Contents

1 Product Overview

Features

- Input voltage range: -38 V to -72 V, output power: 2200 W
- Efficiency: 94% (V_{in} = -53.5 V, 40% load)
- Depth x Width x Height: 485.0 mm x 106.5 mm x 41.0 mm (19.094 in. x 4.193 in. x 1.614 in.)
- Weight: ≤ 3.0 kg
- Hold up time: 8 ms
- Hot-swappable
- With speed-controllable fan
- Support input undervoltage, reverse polarity protection
- Support output overvoltage, current limiting, short circuit, fault isolation protection
- Support overtemperature protection, fan fault protection
- CAN communication interface for controlling, programming and monitoring
- TUV, UL, CE certification and CB report
- Meet IEC 62368-1, RoHS6 requirement

PDC-2200WC is a high efficiency PSU that convert DC input into DC output, which has a wide application range. The PSU has an DC input range of -38 V to -72 V, provides the rated output of 53.5 V. It provides CAN communication ports, communicates with and sends the electronic serial numbers to the host to facilitate the monitoring and management. It also supports N+1, N+N redundancy (N≥2). Up to 32 PSUs can be paralleled for redundancy use.

Model Naming Convention

<u>P</u>	_	<u>DC</u>	<u>2200W</u>	<u>C</u>
1		2	3	4

1 - Embedded Power

2 - Direct current input

3 - Output power: 2200 W

4 - Version number

Applications

- Routers/Switches
- Servers/Storages
- Telecommunications equipment

2 Electrical Specifications

2.1 Environmental

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Ambient temperature (T_A)	– 5	-	55	°C	The ambient temperature refers to the temperature at the air intake vent of the PSU.
Storage temperature	– 40	-	85	°C	-
Relative humidity	5	-	95	% RH	Non-condensing
Altitude	– 60	-	5000	m	If the altitude is between 1800 m and 5000 m, the operating temperature decrease by 1°C (1.8°F) for each additional 220 m.
Atmospheric pressure	76	-	106	kPa	-
Acoustic noise	-	-	61	dBA	V_{in} = -48 V; T_A = 27°C (80.6°F); 100% load

2.2 Input

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Input continuous voltage	-	-	-80	V	-
Input transient voltage (100 ms)	-	-	-100	V	-
Input voltage range	-72	-48/-60	-38	V	-
Input current	-	-	63	A	V_{in} = -40 V, P_{out} = 2200 W
Input voltage detected precision	-	-	±1	V	V_{in} = -38 to -72 V
Input power detected precision	-	-	-	-	$P_{in} \leq 200$ W No detection precision requirements

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
	-	-	±10	%	$200\ W < P_{in} < 500\ W$
	-	-	±5	%	$P_{in} \geq 500\ W$
Input inrush current	-	-	60	A	V_{in} = -53.5 V; Meet ETSI300132-2

2.3 Output

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Output voltage set point	53.3	53.5	53.7	V	V_{in} = -53.5 V; 50% load
Nominal output voltage	-	53.5	-	V	-
Output power	-	-	2200	W	V_{in} = -38 to -72 V
Output current range	0	-	42	A	-
Output power detected precision	-	-	-	-	$P_{in} \leq 200\ W$ No detection precision requirements
	-	-	±5	%	$P_{out} > 200\ W$
Output voltage detected precision	-	-	±0.5	V	V_{out} = 47 - 60 V
Output current detected precision	-	-	±1	A	I_{out} = 0 - 70 A
Voltage regulation	-	-	±3	%	100% load
Load regulation	-	-	±3	%	V_{in} = -53.5 V
Regulated voltage precision	-	-	±3	%	The whole range of Vin and load
Dynamic response recovery time	-	-	200	μs	di/dt ≤ 1 A/μs; T = 2 ms; load: 25% – 50% – 25%; 50% – 75% – 50%
Dynamic response overshoot	-	-	±2.5	V DC	di/dt ≤ 1 A/μs; T = 2 ms; load: 25% – 50% – 25%; 50% – 75% – 50%
Dynamic response overshoot	-	-	±5.0	V DC	di/dt ≤ 1 A/μs; T = 2 ms; load: 0% – 50% – 0%; 50% – 100% – 50%
Current share unbalance	-	-	±5	%	50% load to 100% load
Overshoot at turn on/turn off	-	-	±5	%	-

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Temperature coefficient	-	-	±0.02	%/°C	-
Standby power consumption	-	-	10	W	V_{in} = -53.5 V, T_A = 25°C, hibernation state
No-load loss	-	-	30	W	V_{in} = -53.5 V, T_A = 25°C
Output voltage delay time	-	-	8	s	From Vin connection to 10%V_{out}
Output voltage rise time	-	-	1	s	From 10%V_{out} to 90%V_{out}
Hold up time	8	-	-	ms	V_{in} = -53.5 V; 50% load; T_A = 25°C From input voltage failure to output voltage dropping to 43 V
	4	-	-	ms	V_{in} = -53.5 V; 100% load; T_A = 25°C From input voltage failure to output voltage dropping to 43 V
Output ripple and noise (peak to peak)	-	-	500	mV	Oscilloscope bandwidth: 20 MHz; 0.1 µF ceramic capacitor and 10 µF electrolytic capacitor
External capacitance	-	-	20000	µF	Aluminum electrolytic capacitor; CR mode

2.4 Efficiency

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
100% load	93.0	-	-	%	V_{in} = -53.5 V, T_A=25°C
40% load	94.0	-	-	%	V_{in} = -53.5 V, T_A=25°C
20% load to 100% load	93.0	-	-	%	V_{in} = -40 V to -60 V, T_A=25°C

2.5 Protection

Input Protection

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Input undervoltage protection threshold	-37	-35	-33	V	Self-recovery
Input undervoltage recovery threshold	-38	-37	-34	V	
Input undervoltage protection hysteresis	1.5	-	-	V	-
Input reverse polarity protection	-	-	-	-	When the input polarities are reversed, the PSU is not damaged

Output Protection

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Output overvoltage protection	57	-	60	V	Latch off
Output current limiting protection	45	-	50	A	Self-recovery, constant current
Output short circuit protection	-	-	-	-	The PSU is not damaged by a long-time short-circuit; Self-recovery
Overtemperature protection	65	-	-	°C	Self-recovery; Hysteresis ≥ 5°C
Output fault isolation protection	-	-	-	-	The PSU is hot-swappable
Fan fault protection	-	-	-	-	If a fan becomes faulty, it reports a fault signal and shuts down

# 3 Characteristic Curves

Efficiency and Power Dissipation Curves

Conditions: $T_A = 25°C$ unless otherwise specified
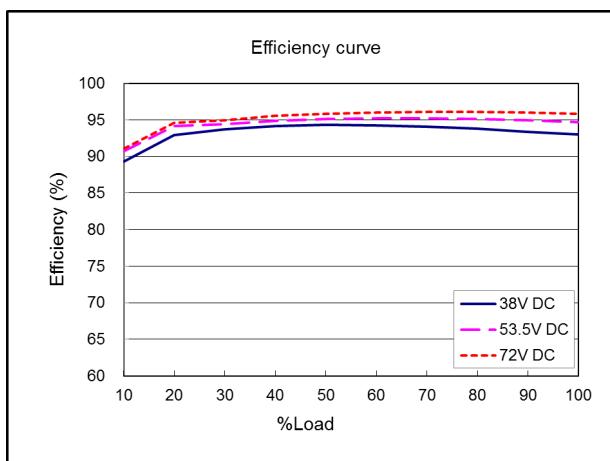
Efficiency curve
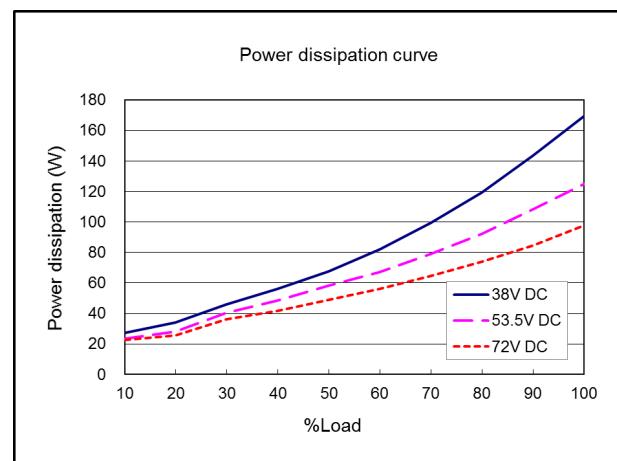
Power dissipation curve

4 Typical Waveforms

4.1 Power-on/Power-off

Startup by power-on
($T_A = 25°C$; $V_{in} = -53.5$ V; 100% load)

Shutdown by power-off
($T_A = 25°C$; $V_{in} = -53.5$ V; 100% load)
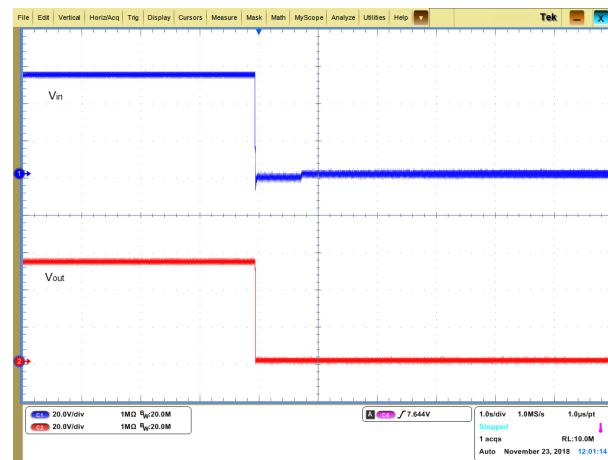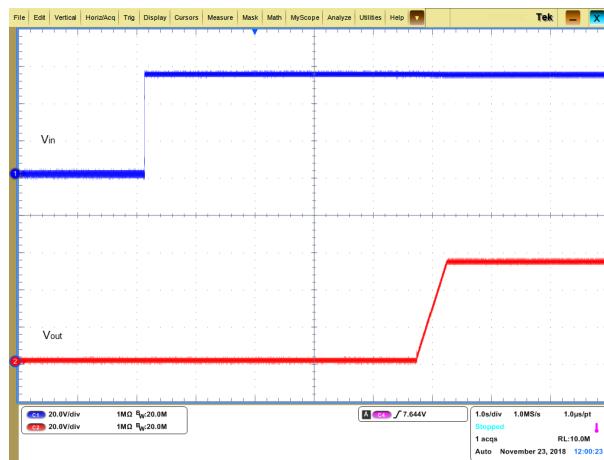
4.2 Turn-on/Turn-off
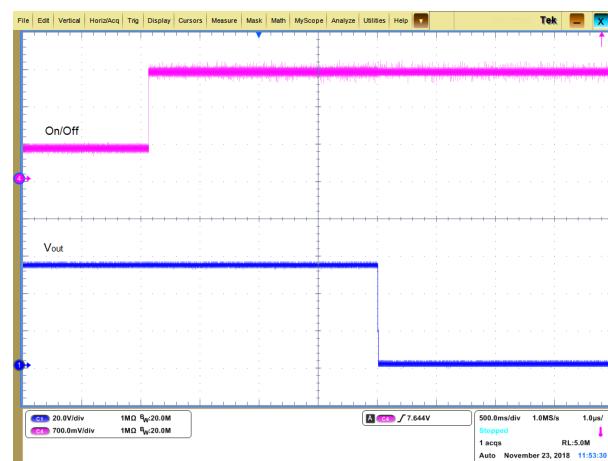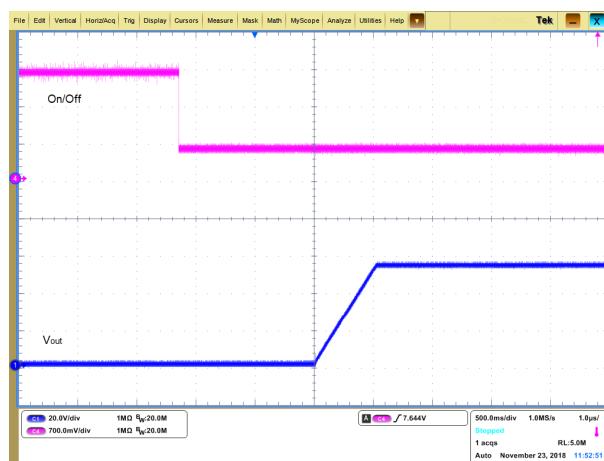
Startup from On/Off
(T_A = 25°C; V_{in} = -53.5 V; 100% load)

Shutdown from On/Off
(T_A = 25°C; V_{in} = -53.5 V; 100% load)

4.3 Enable-on/Enable-off

Enable-on
(T_A = 25°C; V_{in} = -53.5 V; 100% load)

Enable-off
(T_A = 25°C; V_{in} = -53.5 V; 100% load)
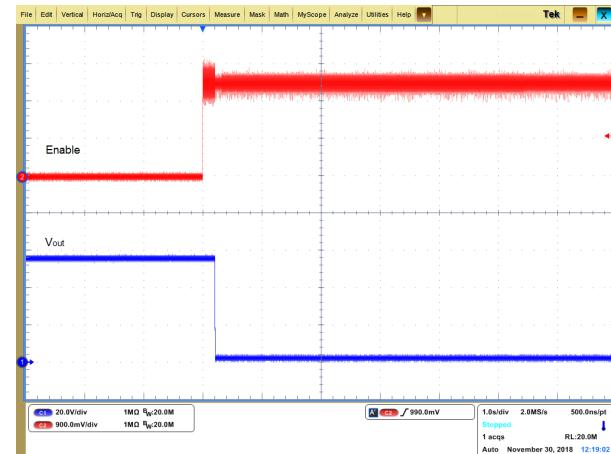
4.4 Output Voltage Dynamic Response

Output voltage dynamic response
(T_A = 25°C; V_{in} = -53.5 V; 25% – 50% – 25%; di/dt = 1 A/μs)

Output voltage dynamic response
(T_A = 25°C; V_{in} = -53.5 V; 50% – 75% – 50%; di/dt = 1 A/μs)
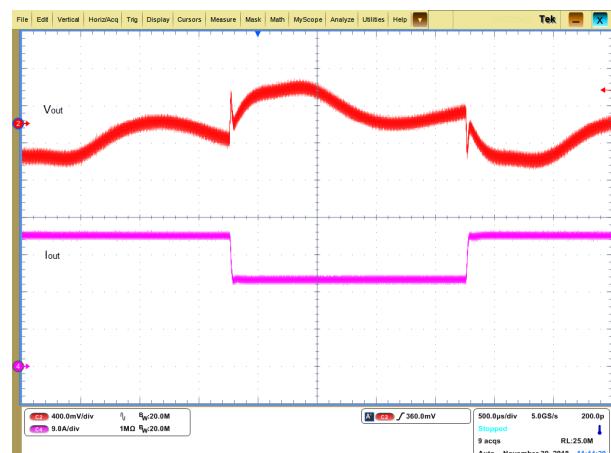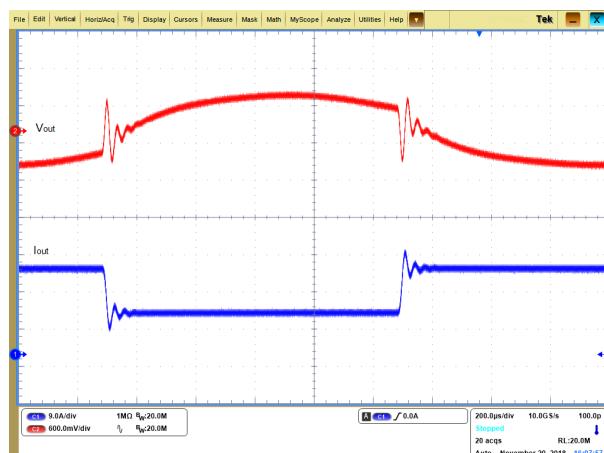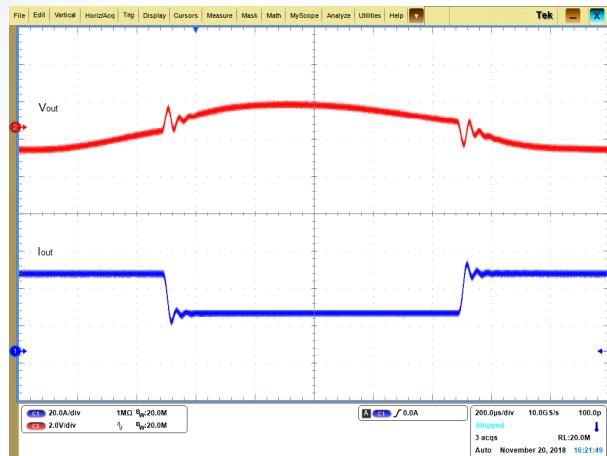
Output voltage dynamic response

(T_A = 25°C; V_{in} = -53.5 V; 50% – 100% – 50%; di/dt = 1 A/µs)
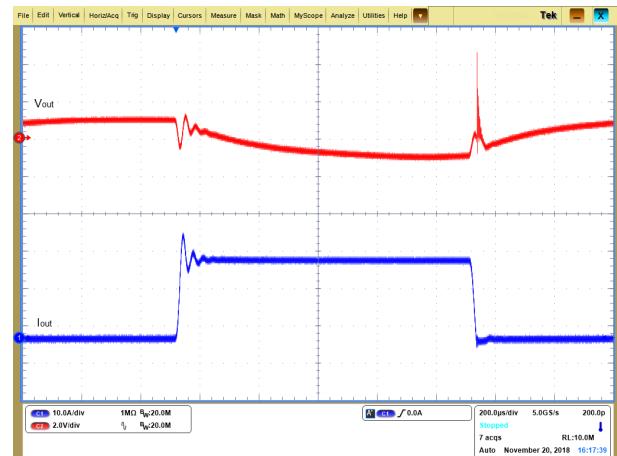
Output voltage dynamic response

(T_A = 25°C; V_{in} = -53.5 V; 0% – 50% – 0%; di/dt = 1 A/µs)

4.5 Output Voltage Ripple
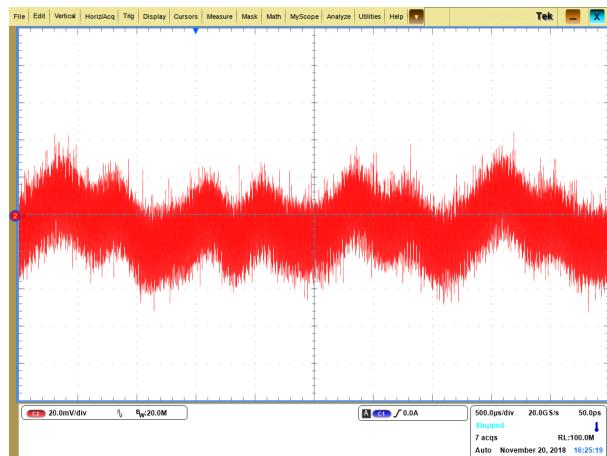
(T_A = 25°C; V_{in} = -53.5 V; V_{out} = 53.5 V)

5 Control Functions

5.1 Enable

The analog signal Enable is an input signal to enable/disable the 53.5 V output. The logic of Enable is as following:

Table 5-1 Logic of Enable

Enable	53.5 V Output
High level	Off
Low level	On

Figure 5-1 Configuration diagram of Enable
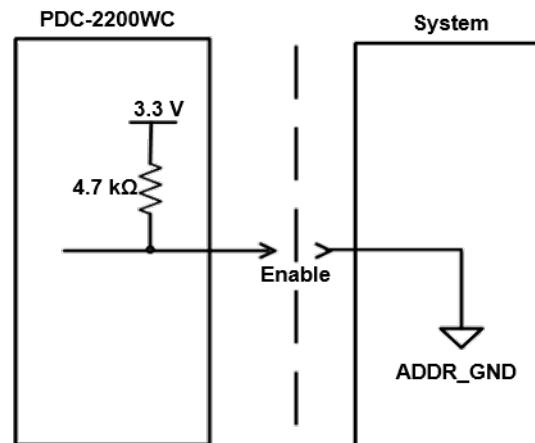
5.2 Present

This signal indicates that the PSU is in position. It connects to the GND inside the PSU and has a impedance equal to 4.7 kΩ to the 3.3 V. The logic of Present is as following:

Table 5-2 Logic of Present

Present	Connect to the system
Low level	Yes

Present	Connect to the system
High level	No

Figure 5-2 Configuration diagram of Present
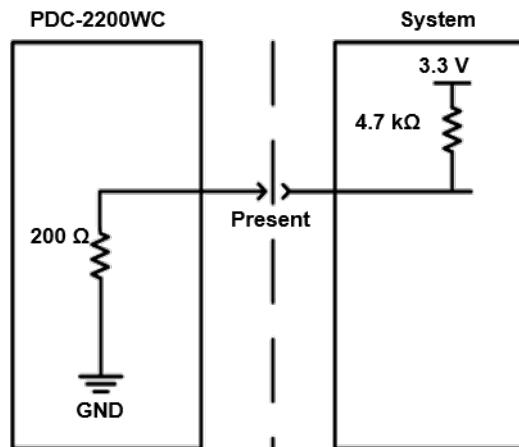
5.3 On/Off Control

On/Off 0, On/Off 1

The low active signal On/Off 0 and On/Off 1 are input signal to enable/disable the 53.5 V output. On/Off 0 and On/Off 1 can control the PSU output in separate or combined mode with connecting to a mechanical switch.

The logic of On/Off 0 and On/Off 1 are as following:

Table 5-3 Logic of On/Off 0 and On/Off 1

On/Off 0, On/Off 1	53.5 V Output
Low level	On
High level	Off

Figure 5-3 Configuration diagram of On/Off (common ground mode) signal
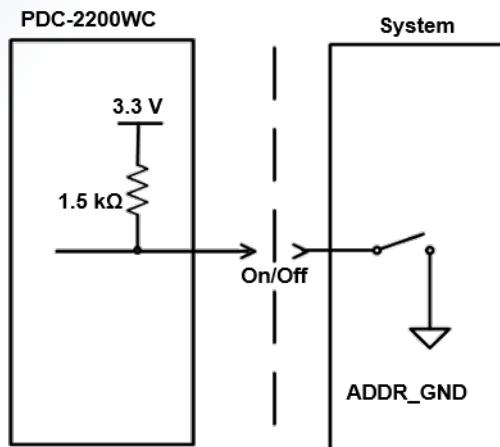
Table 5-4 On/Off 0 and On/Off 1 combination methods and control results

On/Off 0 level	On/Off 1 level	Output voltage
Low level	Low level	On
Low level	High level	On
High level	Low level	On
High level	High level	Off

On/Off 2, On/Off 3

The low active signal On/Off 2 and On/Off 3 are input signal to enable/disable the 53.5 V output. On/Off 2 and On/Off 3 can control the PSU output in separate or combined mode with connecting to a mechanical switch.

The logic of On/Off 2 and On/Off 3 are as following:

Table 5-5 Logic of On/Off 0 and On/Off 1

On/Off 2, On/Off 3	53.5 V Output
Low level	On
High level	Off

Figure 5-4 Configuration diagram of On/Off (common ground mode) signal
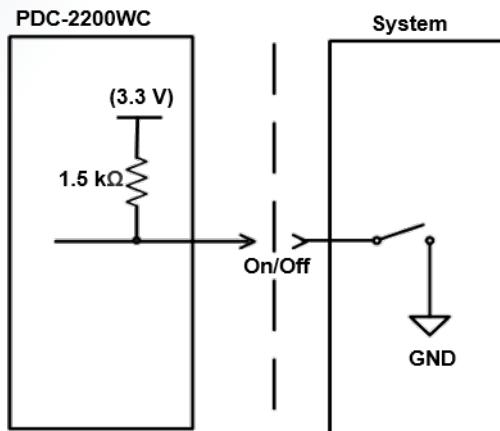
Table 5-6 On/Off 0 and On/Off 1 combination methods and control results

On/Off 2 level	On/Off 3 level	Output voltage
Low level	Low level	On
Low level	High level	On
High level	Low level	On
High level	High level	Off

Turn on/Turn off Timing

Figure 5-5 Turn on/turn off timing
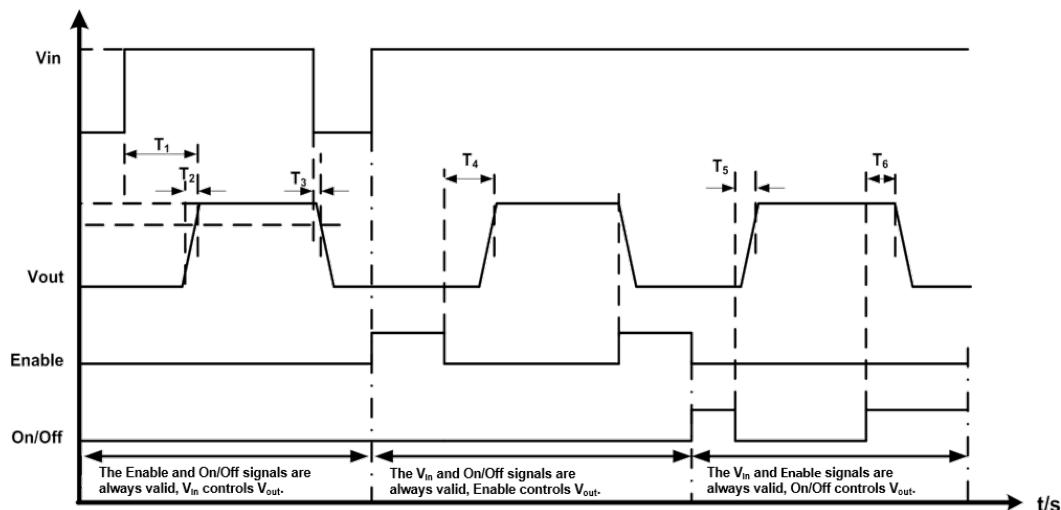
Table 5-7 Turn on/turn off timing

Label	Description	Min.	Typ.	Max.	Unit
T1	Output voltage delay time, from Vin connection to 90% V_{out}	-	-	8	s
T2	Output voltage rise time, from 10%Vout to 90%Vout	-	-	1	s
T3	Duration from input voltage failure to output voltage dropping to 43 V **NOTE** ● T3 ≥ 8 ms (V_{in} = -53.5 V; 50% load; T_A = 25°C) ● T3 ≥ 4 ms (V_{in} = -53.5 V; 100% load; T_A = 25°C)	4	-	-	ms
T4	Delay of startup output triggered by the Enable signal	-	-	4	s
T5	Delay of startup output triggered by the On/Off signal	-	-	2	s
T6	Delay of shutdown triggered by the On/Off signal	-	2	-	s

6 Protection Characteristic

- **Input Undervoltage Protection**

  The PSU will shut down after the input voltage drops below the undervoltage protection threshold for shutdown. The PSU will start to work again after the input voltage reaches the input undervoltage recovery threshold for startup.

- **Input Reverse Polarity Protection**

  When the input polarities are reversed, the PSU is not damaged.

- **Output Overvoltage Protection**

  The protection mode is locked with the protection range of 57 - 60 V, and the bus with overvoltage does not lock out. If the voltage for output overvoltage protection exceeds 60 V, ensure that the voltage is within 64 V DC and the exceeding duration is 50 ms at most.

- **Output Short Circuit Protection**

  The PSU is not damaged even with long-term short circuits and can recover automatically. The internal short circuit in the PSU does not affect the bus voltage.

- **Overtemperature Protection**

  The power supply is protected against over temperature conditions caused by overload, loss of fan cooling or excessively high ambient temperature. When the ambient temperature exceeds 65°C, the overtemperature protection is triggered and the PSU output is derating. When the ambient temperature returns to normal, the PSU automatically recovers.

- **Output Fault Isolation Protection**

  A single module is automatically isolated once it becomes faulty, which does not affect the system operation.

7 Parallel Operation

Current Share

Up to 32 PDC-2200WCs can be paralleled for redundant configurations. The current sharing is implemented over CAN communication.

Safety Precautions

You are advised to provide two power inputs for the system. Power configuration in N+N mode is preferred. The following figure shows the power configuration in 3+3 mode.

- Configure a circuit breaker (with a rated current is 63 A) for each PSU.
- The rated current of the upstream circuit breaker for each power input is recommended to be not less than 500 A.
- The PSU should be properly grounded. Otherwise, it will be damaged due to a lightning strike.

Figure 7-1 Application configuration in system
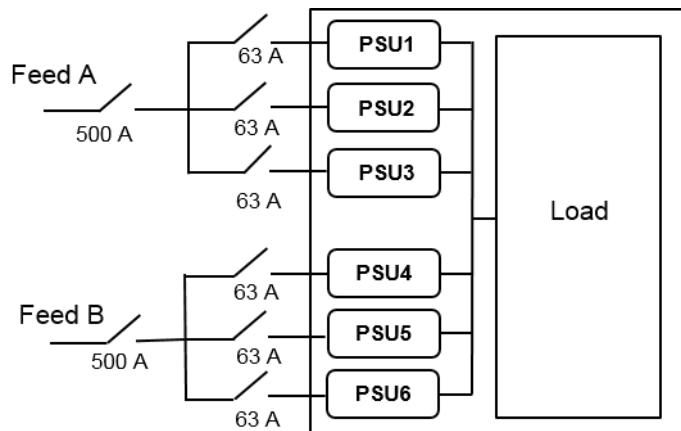
8 Internal Cooling Fan

The PSU uses a fan to dissipate heat. The fan draws air in from the front and exhausts air out of the rear for cooling, and adjusts its speed based on temperature control.

Figure 8-1 Wind tunnel

9 Product Structure

Dimensions

Unit of measurement: mm (in.)

All dimensional tolerance refers to: x.x ± 0.5 mm [x.xx ± 0.02 in.], x.xx ± 0.25 mm [x.xxx ± 0.010 in.]
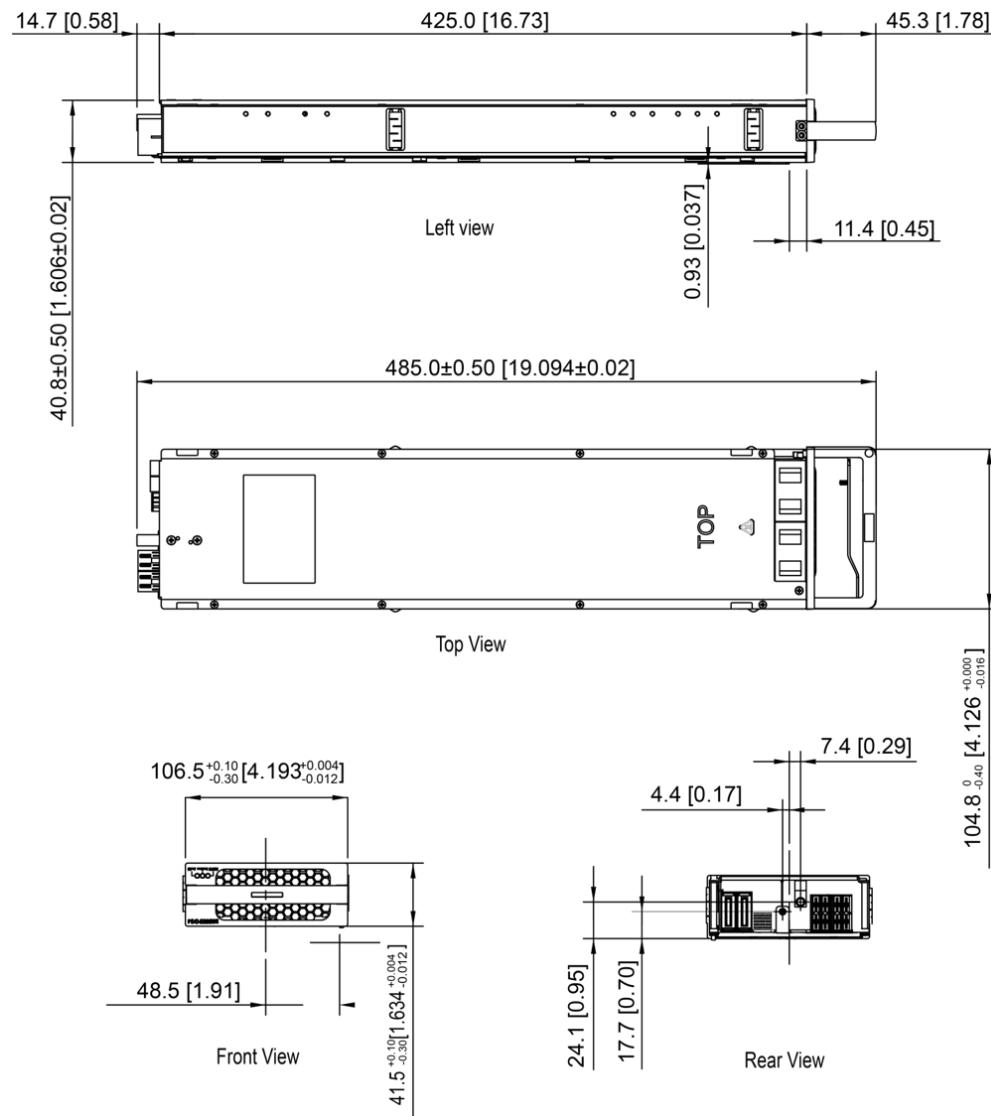
9.1 Connectors

The output connector connects the power as well as the signal to the system or the power backplane board.

Figure 9-1 Rear panel
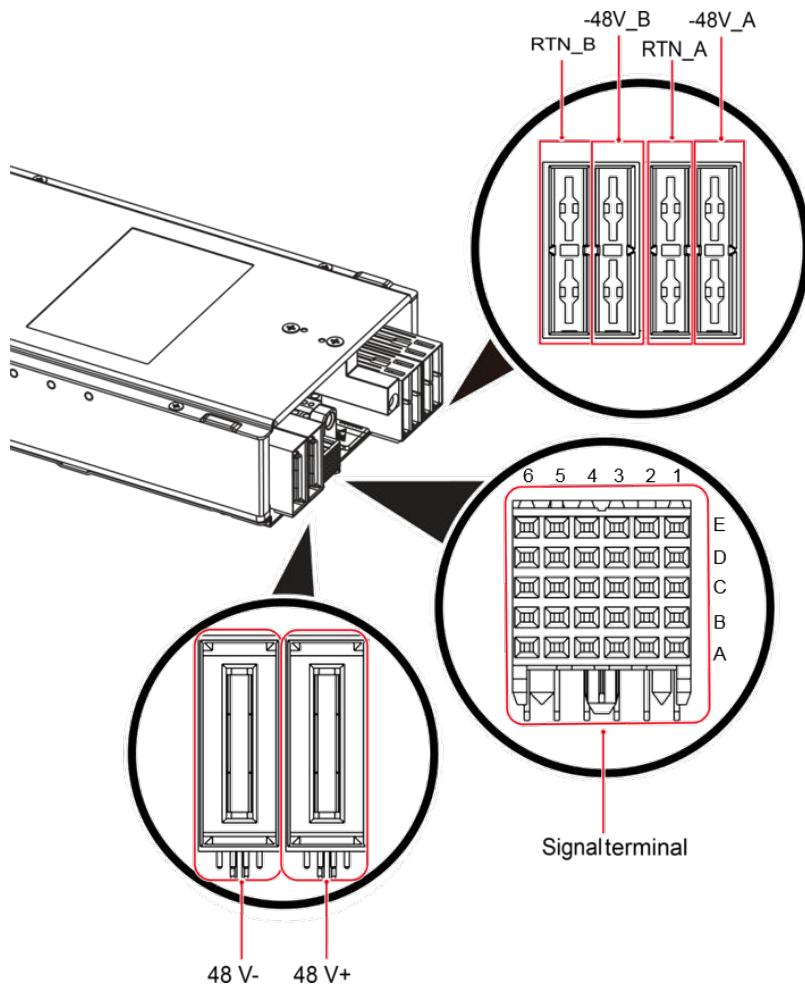
Table 9-1 Terminal definition

Terminal Type			Manufacturer	Part Number
Input terminal	-48 V_A	RTN_A	OUPIIN ELECTRONIC(KUNSHAN) CO., LTD.	9113-D0000-004
	-48 V_B	RTN_B		
Output terminal	48 V+ (RTN)	48 V- (-48 V)	Tyco Electronics CO., LTD.	6450830_P7

Terminal Type		Manufacturer	Part Number
Signal terminal	-	HON HAI PRECISION IND.CO., LTD TAIPEI.TAIWAN.R.O.C.	343-0000-1066

Table 9-2 Signal terminal

Pin	Definition	Function
A1	ON/OFF3	PSU mechanical switch control signal 3
A2	ON/OFF2	PSU mechanical switch control signal 2
A4	Ishare+	Current sharing signal+
A5	Ishare-	Current sharing signal-
A6	ADDR3	PSU address 3
B1	Present	In-position signal
B2	GND	Signal isolation GND
B4	ON/OFF1	PSU mechanical switch control signal 1
B5	ON/OFF0	PSU mechanical switch control signal 0
B6	ADDR2	PSU address 2
C5	ADDR5	PSU address 5
C6	ADDR1	PSU address 1
D1	CAN_L_1	Low level CAN channel 1
D3	CAN_L_0	Low level CAN channel 0
D5	ADDR4	PSU address 4
D6	ADDR0	PSU address 0
E1	CAN_H_1	High level CAN channel 1
E3	CAN_H_0	High level CAN channel 0
E5	ENABLE	Output enabled singnal
E6	ADDR_GND	Address GND

9.2 LED Indicators

Table 9-3 LED indicators

Indicator	Color	Status	Description
Input indicator	Green LED	Steady On	The input voltage does not reach the undervoltage or overvoltage protection threshold
		Steady Off	Indicates the failure of double power inputs (reverse connections or disconnections of the two inputs)
		Blinking at 0.5 Hz	The input voltage has reached the undervoltage and the auxiliary power supply works properly, or the input voltage has reached the overvoltage protection threshold
Output indicator	Green LED	Steady On	Indicates that the output voltage is equal to or greater than 43 V (tolerance ±1 V)
		Steady Off	Indicates that the PSU has no output or its output voltage is lower than 43 V (tolerance ±1 V)
Alarm indicator	Red LED	Steady On	Reports alarms for fan failure, internal communication faults, overtemperature protection, output overvoltage protection, output overcurrent, short circuit, abnormal boost bus voltage, and severe current imbalance
		Steady Off	Indicates that the module works normally or is in standby status, or that the software loading fails (In addition to: the communication between the primary and secondary sides is faulty due to the loading interruption)

10 Communication

Dual CAN communication is adopted. The dual CAN buses are isolated from the main output. The baud rate is 1000 K bps, and the dual CAN buses provide mutual backup. A faulty CAN bus has no impact on the other one.

10.1 Communication Functions

The PDC-2200WC PSU supports monitoring and alarming functions.

Monitoring

- System runtime (0x030E)
- All runtime (0x032F)
- DC input current (0x0372)
- DC input power (0x0373)
- Measured DC output voltage (0x0375)
- Actual output current limit (0x0376)
- DC input voltage (0x0378)
- PCB temperature (0x037F)
- Ambient temperature at the air intake vent (0x0380)
- Actual output current (0x0381)
- Displayed output current (0x0382)
- Current alarm/status (0x0383)

Fault Detection and Alarming

- Input undervoltage
- Output overvoltage/undervoltage
- Overtemperature
- PSU fault
- PSU protection
- Fan fault
- PSU EEPROM fault
- Serious PSU current imbalance
- PSU communication abnormality
- PSU input power failure

10.2 Data Format

Definition

Table 10-1 Frame format

4 bytes	8 bytes
CAN ID	Data field

Table 10-2 CAN ID definition

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command ID and message ID (8 bits)								M/S	Slot number (hardware address)						CNT

28	27	26	25	24	23	22	21	20	19	18	17	16
Protocol type number (6 bits)						Slave node address (7 bits)						

📖**NOTE**

CNT: The value 1 indicates data except the last frame for batch processing and 0 indicates the last frame of data for batch processing.

Slot number (hardware address): 0–31, depends on the slot; used for the communication between the PSU and the host.

M/S: The value 1 indicates a query or configuration message from the master and 0 indicates a reply from the slave.

Command ID and message ID:

- 0x80 - Byte-based control command with customized content
- 0x81 - Byte-based configuration command with customized content
- 0x82 - Byte-based query command with customized content
- 0x40 - Command for querying PSU inherent information
- 0x50 - Command for querying batch inherent information

Slave node address (software address): used during PSU loading for current share and ID information interaction between PSUs.

Table 10-3 Data field definition

4 bits	12 bits	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Error type	Signal ID	Signal content					

📖**NOTE**

Error type:

- 0000 - No error, normal response
- 0001 - Incorrect parameters
- 0010 - Invalid command
- 0011 - Address identification in progress
- 0100 - E-label not written
- 0101 - Hardware fault in E-label reading

For details about the signal ID and signal content, see **10.3 Communication Commands**.

Report Format with the Page Signal

Table 10-4 Format for transmitting a single 4-byte signal

Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Page	-	4 Byte variable			

Table 10-5 Format for transmitting dual 2-byte composite signals

Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Page	-	2 Byte variable		2 Byte variable	

Table 10-6 Format for transmitting 1-byte composite signal

Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Page	-	0			1 Byte variable

Report Format without the Page Signal

Table 10-7 Format for transmitting a single 4-byte signal

Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0		4 Byte variable			

Table 10-8 Format for transmitting a single signal combining 2 bytes and 4 bytes

Byte2	Byte3	Byte 4	Byte 5	Byte 6	Byte 7
2 Byte variable		4 Byte variable			

Table 10-9 Format for transmitting a single 1-byte signal

Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0					1 Byte variable

Table 10-10 Format for transmitting triple 2-byte composite signals

Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
2 Byte variable		2 Byte variable		2 Byte variable	

10.3 Communication Commands

Hex	Transaction Type	Data Format	Description
0x0001	Read word	III	PSU types characteristic data
0x0002	Read/Write word	IV	Serial number
0x0003	Read/Write word	IV	Bar code 1
0x0004	Read/Write word	IV	Bar code 2
0x0005	Read word	VII	Hardware version number
		VII	Primary software version number
		VII	DCDC software version number
0x0006	Read word	VII	PSU hardware address
0x0008	Read/Write word	III	Host-allocated time
0x0301	Read word	V	Default voltage **NOTE** Default output voltage. The default voltage is 53.5 V.
0x0304	Read word	I	Default current limit **NOTE** Default current limiting. The default current is 46 A.
0x0306	Read word	V	Default power limit **NOTE** Default power limit. When the power reaches the level with full load, the default power is 2200 W.
0x0307	Read word	V	Internal overtemperature point **NOTE** Internal overtemperature point. When the overtemperature point reaches 70ºC - 150ºC, the default temperature is 115ºC.
0x030A	Read word	V	Primary output voltage setting
0x030E	Read word	II	Total system runtime
0X032F	Read word	II	Total PSU runtime

Hex	Transaction Type	Data Format	Description
0x0331	Write word	V	Emergency shutdown control **NOTE** Emergency shutdown control. Command 0 indicates startup restoration. Command 1 indicates emergency shutdown. The default value is 0 (startup).
0x0332	Write word	V	Startup/shutdown by communication command, all shutdown **NOTE** Command 0 indicates startup restoration. Command 1 indicates emergency shutdown. The default value is 0 (startup).
0x0337	Write word	V	CAN PSU initialization control **NOTE** PSU CAN initialization control. Command 0 indicates disable, and command 1 indicates reset. The default value is 0 (disable).
0x0370	Read word	I	DC input power
0x0372	Read word	I	DC input current
0x0373	Read word	I	DC output power
0x0374	Read word	I	Real-time efficiency
0x0375	Read word	I	Output voltage measurements
0x0376	Read word	V	Actual output current limit
0x0377	Read word	I	Actual output power limit
0x0378	Read word	I	Input voltage
0x037E	Read word	V	Secondary overtemperature protection point temperature
0x037F	Read word	I	PCB temperature
0x0380	Read word	I	Air inlet ambient temperature
0x0381	Read word	I	Actual output current
0x0382	Read word	I	Displayed output current
0x0383	Read word	III	Alarm/status
0x0385	Read word	I	Output overvoltage protection
0x0387	Read word	V	Fan speed
0x0388	Read word	III	Power outage recording
0x0389	Read word	V	Boost output voltage
0x0398	Read word	II	Dual input status

📖**NOTE**

Data type description:

- I: 4-byte fixed point number
- II: 4-byte integer
- III: 4-byte value defined by bit
- IV: 6-byte value defined by bit
- V: 1-byte integer
- VI: 2-byte fixed point number
- VII: 2-byte integer

Definition of Alarm/Status (0x0383)

Table 10-11 Definition of alarm/status

Bit	Fault	Constitute conditions	Clear conditions
Bit0	Overvoltage	PSU output voltage exceeds 56.5 V	PSU installation, removal, and soft unlocking
Bit1	Overtemperature	One of the four temperature detection points in the PSU exceeds the overtemperature point.	All of the four temperature detection points in the PSU are below the overtemperature protection recovery point
Bit2	PSU fault	Generated by resetting one of bit0/4/26/28/23/20	Removed by clearing all of bit0/4/26/28/23/20
Bit3	PSU protection	Generated by resetting one of bit17/22/1 and boost output over/undervoltage	Generated by clearing all of bit17/22/1 and boost output over/undervoltage
Bit4	Fan fault	The fan rotation speed at normal high temperatures is below 50% of the configured rotation speed	The fan rotation speed at normal high temperatures is above 50% of the configured rotation speed
Bit5	PSU EEPROM fault	EEPROM read-write failure	EEPROM read-write ok
Bit9	PSU startup/shutdown	PSU in on state	PSU in off state
Bit10	Full fan speed	Full fan speed (16000)	Not full fan speed
Bit13	PSU identification	The PSU detects an address of slots 0 - 32	The PSU detects an illegal address
Bit15	PSU CAN error state	An alarm is generated if CAN communication has been interrupted for 60s or more and one of channels has failed in communication for 20 min	Generation condition and clearance condition

Bit	Fault	Constitute conditions	Clear conditions
Bit17	PSU input undervoltage alarm	Input voltage is less than 35 V	Input voltage is higher than 38 V
Bit18	PSU output undervoltage alarm	Input voltage is less than 40 V	Input voltage is higher than 42 V
Bit19	Dual inputs for the PSU, one or more inputs drop	Dual inputs for PSU, one or more inputs drop	Dual power inputs for the PSU are normal
Bit20	Serious not current sharing PSU	Serious not current sharing PSU	PSU current sharing
Bit21	Duplicate PSU ID	Duplicate PSU ID	PSU ID unique
Bit23	PSU upper-level failure	The boost input for the PSU does not experience undervoltage, but the output experiences undervoltage. The boost input for the PSU does not experience overvoltage, but the output experiences overvoltage	Generation condition and clearance condition
Bit26	PSU internal communication abnormal alarm	PSU communication abnormality	PSU communication normality
Bit28	PSU limiting state	Output current limiting	Non current limiting status
Bit29	PSU input power failure alarm	Dual power outputs fail	One or more input supplies power

A Safety

Reliability Requirements

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Mean time between failures (MTBF)	-	300,000	-	Hours	Rated input, 100% load; T_A = 25°C

Isolation Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Primary voltage to secondary isolation	-	-	1500	V	Withstand voltage: 1 min Leakage current $\leq$ 10 mA No breakdown or arcing
Primary to enclosure isolation	-	-	1002	V	
Secondary to enclosure isolation	-	-	707	V	
Isolation resistance	10	-	-	MΩ	$<$ 90%RH Normal atmospheric pressure Non-condensing The test voltage is 500 V DC

EMC Requirements

Parameter	Conditions	Criterion
Conducted Emission (CE)	6 dB	EN55032 Class A
Radiated Emission (RE)	6 dB	EN55032 Class A
Conducted susceptibility (CS)	V_{in} = -53.5 V; rated load	IEC61000-4-6 level 3 Perform, criterion A
Radiated susceptibility (RS)	V_{in} = -53.5 V; rated load	IEC61000-4-3 level 3 Perform, criterion A
Electrostatic Discharge (ESD)	Contact: ±6 kV, air: ±8 kV Contact: ±8 kV, air: ±15 kV	IEC61000-4-2 Perform, criterion B

Parameter	Conditions	Criterion
Surge	Differential mode (line to line): ± 2 kV Common mode (line to earth): ± 4 kV	IEC61000-4-5 Perform, criterion B
Electrical fast transient	± 2 kV	IEC61000-4-4 level 3 Perform, criterion B
DIP	Voltage dip. The input voltage drop to 40%, 70%. Hold up time: 1 ms, 3 ms, 10 ms, 30 ms, 100 ms, 300 ms, 1s	IEC61000-4-29 Perform, criterion B
	Voltage dip. The input voltage drop to 0%. Hold up time: 1 ms, 3 ms, 10 ms, 30 ms, 100 ms, 300 ms, 1s, 5s	IEC61000-4-29 Perform, criterion B
	Change of voltage.100% Vin to 80% Vin or 120% Vin. Hold up time: 1 ms, 3 ms, 10 ms, 30 ms, 100 ms, 300 ms, 1s, 10s	IEC61000-4-29 Perform, criterion A

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