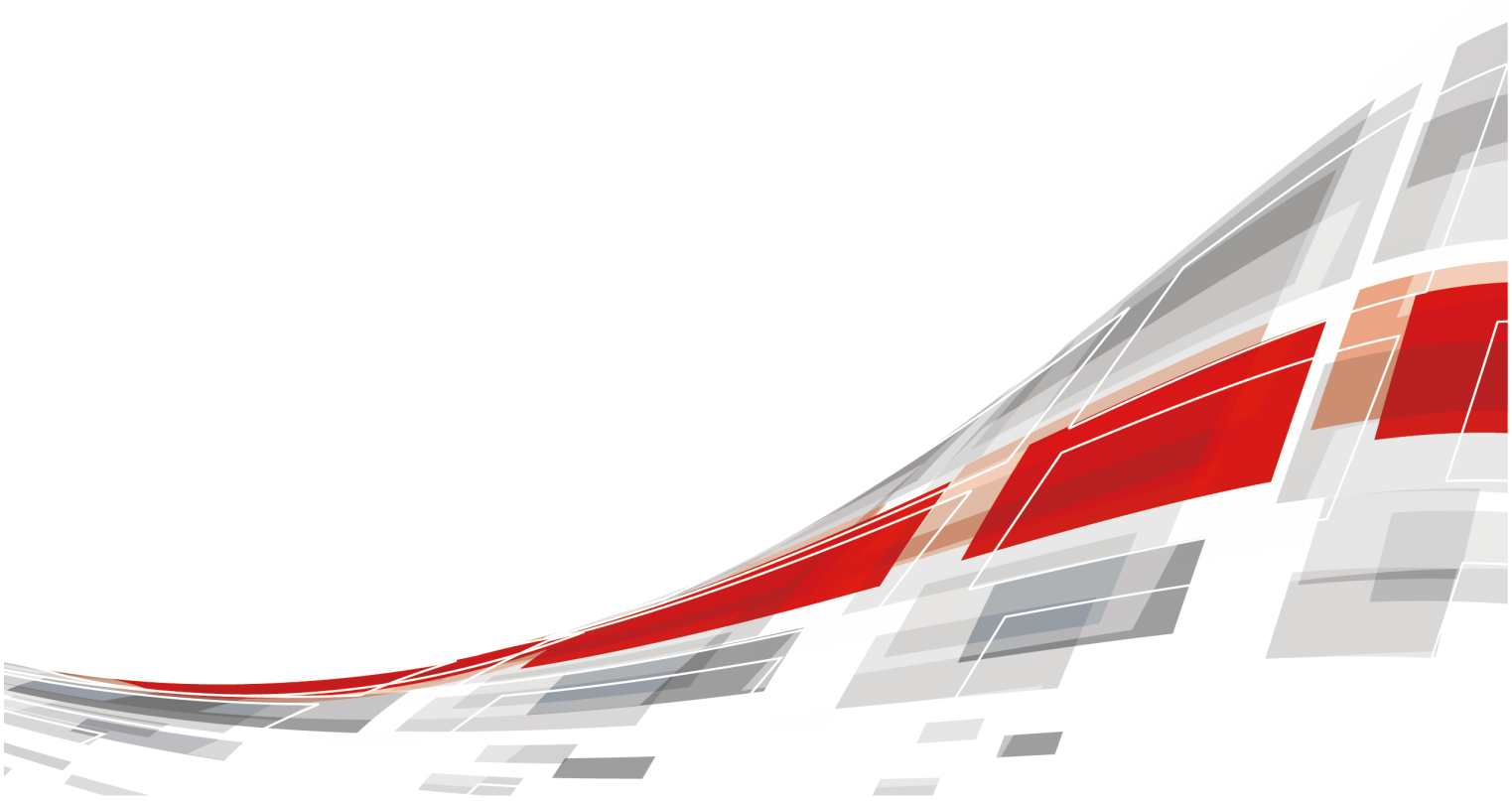
PDC1200S12-CF PSU

Technical Manual

Issue 02

Date 2026-01-20



XFUSION INTERNATIONAL PTE. LTD.

Copyright © XFUSION INTERNATIONAL PTE. LTD. 2026. All rights reserved.

No part of this document may be reproduced or transmitted in any form or by any means without prior written consent of XFUSION INTERNATIONAL PTE. LTD.

Trademarks and Permissions

XFUSION and other xFusion trademarks are trademarks of XFUSION INTERNATIONAL PTE. LTD. All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between xFusion and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

XFUSION INTERNATIONAL PTE. LTD.

Website: https://www.xfusion.com

About This Document

Purpose

This document describes the PDC1200S12-CF power supply units (PSUs), including the functions and applications of their pins, as well as their heat dissipation and storage requirements.

The figures provided in this document are for reference only.

Intended Audience

This document is intended for pre-sales engineers.

Symbol Conventions

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

Symbol	Description
DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could 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	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Contents

About This Document ii

1 Safety Precautions 1

1.1 General Safety 1

1.2 Personnel Requirements 2

1.3 Electrical Safety 3

2 Product Overview 4

3 Product Structure Overview 6

3.1 Structural Dimensions 6

3.2 External Ports 7

4 Electrical Specifications 9

4.1 Environmental Characteristics 9

4.2 Input Characteristics 10

4.3 Output Characteristics 11

4.4 Efficiency Characteristics 14

4.5 Protection Characteristics 15

5 Parallel Operation 20

6 Hot Swap Requirements 21

7 Energy Saving Feature 22

7.1 Active/Standby (Hot Standby) Power Supply 22

7.2 Deep Sleep Function 23

7.3 Cold Standby Energy Saving Function 24

8 Feature Curves 26

9 Typical Waveforms 28

9.1 Turn-on/Turn-off 28

9.2 Output Voltage Dynamic Response 29

9.3 Output Voltage Ripple and Noise 32

10 Control Signals 33

10.1 PSU Timing Diagram 34

10.2 ORing-FET 35

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

10.3 PSON12V#..... 35
10.4 PRESENT#..... 36
10.5 INSTALLED#..... 37
10.6 OPOK..... 37
10.7 IPOK..... 39
10.8 IPOK LINK..... 40
10.9 IP PRESENT..... 41
10.10 CYC_PWR#..... 41
10.11 I-MON..... 42
10.12 PS_INTERRUPT..... 42
10.13 SCL and SDA..... 43
10.14 ADD, 0ADD1, and ADD2..... 43
10.15 EFUSEV..... 44
10.16 SMART_ON..... 44
11 Communication..... 46
11.1 Input power precision..... 46
11.2 Online Upgrade, Prewarning, and Black Box..... 46
11.3 PSU Reverse Power Supply..... 47
11.4 External EEPROM..... 47
12 Heat Dissipation Requirements and Fan Control..... 48
13 Indicator on the Panel..... 50
14 Product Storage, and Transportation..... 52
A Appendix..... 53
A.1 EMC Requirements..... 53
A.2 Product Safety Testing..... 54
A.3 Reliability..... 55

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

1 Safety Precautions

1.1 General Safety

1.2 Personnel Requirements

1.3 Electrical Safety

1.1 General Safety

Statement

Before installing, operating, and maintaining the device, read this document and observe all the safety instructions on the device and in this document.

The "NOTICE", "CAUTION", "WARNING", and "DANGER" statements in this document do not cover all the safety instructions. They are only supplements to the safety instructions. xFusion will not be liable for any consequence caused by the violation of general safety requirements or design, production, and usage safety standards.

Ensure that the PSU is used in environments that meet its design specifications. Otherwise, the PSU may become faulty, and the resulting malfunction, component damage, personal injuries, or property damage are not covered by the warranty.

Follow local laws and regulations when installing, operating, and maintaining the PSU. The safety instructions in this document are only supplements to local laws and regulations.

xFusion will not be liable for any consequences of the following circumstances:

- Although the device has passed security and compatibility tests, the radio frequency and magnetic fields emitted from the device may have a negative impact on the operation of other electronic devices. The device may affect normal operation of implanted medical appliances or personal medical appliances, such as pacemakers, cochlear implants, and hearing aids. If such appliances are used, consult the appliance manufacturer about the restrictions for using this device.
- Operation beyond the conditions specified in this document.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

- Installation or use in environments which are not specified in relevant international or national standards.
- Unauthorized modifications to the product or software code or removal of the product.
- Failure to follow the operation instructions and safety precautions on the product and in this document.
- Equipment damage due to force majeure, such as earthquakes, fire, and storms.
- Damage caused during transportation by the customer.
- Storage conditions that do not meet the requirements specified in this document.
- Do not drop, squeeze, or pierce the PSU. Protect the PSU from external high pressure to prevent internal short circuits and overheating.
- Do not disassemble, refit, or insert foreign objects into the PSU, or expose the PSU to water or other liquids, so as to avoid short circuits, overheating, fire, or electric shocks.
- Use the PSU at a temperature ranging from 5°C to 55°C (41°F to 131°F) and store the PSU at a temperature ranging from –40°C to +85°C (-40°F to +185°F).
- Do not expose the PSU to heat sources such as direct sunlight, radiators, microwave ovens, ovens, or water heaters.
- If the PSU is damaged, cracked, or wet, stop using it. Continuing to use it in such conditions may lead to electric shocks, short circuits, or fire.
- Dispose of the PSU in accordance with local regulations. Do not dispose of it as normal household waste. Follow local regulations on disposal of the PSU and its accessories, and support proper collection and recycling.
- Keep the PSU dry. Do not use the PSU in a dusty or damp place. Otherwise, the PSU may be faulty. Do not splash water on the PSU. Keep the PSU far away from fire sources. Do not ignite the PSU.

WARNING

In a household scenario, operation of this device may cause wireless interference.

Personal Safety

- Do not alter, disassemble, or remove the shell of the PSU.
- If there is a probability of personal injury or PSU damage during operations on the PSU, immediately stop the operations, report the case to the supervisor, and take feasible protective measures.
- Before the installation is completed or confirmed by professionals, do not power on the PSU.

1.2 Personnel Requirements

- Personnel who plan to install, operate or maintain the PSU must receive thorough training, understand all necessary safety precautions, and be able to correctly perform all operations.
- During the installation, operation, and maintenance of the PSU, no collision or drop is allowed.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

- During the secondary assembly of the PSU, do not introduce conductive foreign objects.

1.3 Electrical Safety

Operation Requirements

WARNING

Failure to follow the operating procedures may cause personal injury or even death.

- Only qualified personnel are allowed to perform operations to prevent electric shocks.
- Before installing or removing the PSU, disconnect the upstream power supply to the PSU.
- Before powering on the PSU, ensure that the PSU cables are correctly connected.
- Before making electrical connections, disconnect the upstream power supply to the PSU if people may contact energized components.
- Do not open, alter, or repair the product as the voltage inside the product is high.
- To ensure safety, connect the shell ground and the device ground reliably. When installing the device, install the PGND cable first. When uninstalling the device, remove the PGND cable last.
- Do not operate the PSU with wet hands. Otherwise, electric shocks may occur.
- The voltage between the L or N terminal of the PSU and the PE terminal cannot exceed 318 V AC.
- If any damage or fault occurs during installation or operation, power off the PSU immediately and return it to the manufacturer for inspection or repair.
- In case of emergency, remove the power plug from the power outlet to completely cut off the power supply.
- If the PSU has multiple inputs, disconnect all the inputs to completely power it off before operating the PSU.

ESD

- When installing, operating, and maintaining the PSU, comply with the ESD protection regulations and wear the ESD clothing, gloves, and wrist strap.
- When holding the PSU, hold its edge without touching any components. Do not touch the components with your bare hands.
- Package the removed PSU with ESD packaging materials before storing or transporting it.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

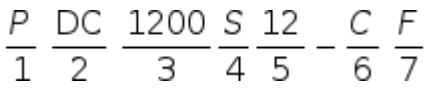
2 Product Overview

The PDC1200S12-CF supports DC input of –38.4 V to –72 V. The PSU provides one output and can work in three modes (MV12, SV12, and MV6). The rated output power is 1200 W.

The hot swappable PSU supports current sharing, 1+1/2+2/3+3 parallel usage.

The PSU provides an I2C communication function for reporting the vendor, model, version and other information. It provides a black box and supports online upgrade. The PSU is designed according to the safety requirements and complies with the information technology equipment safety standards.

Model Naming Convention



No.	Description	No.	Description
1	Embedded power	2	DC input
3	Output power: 1200 W	4	Single output
5	Output voltage: 12 V DC	6	Heat dissipation through hot air extraction
7	Serial number	-	-

Features

- Efficiency: ≥ 92.5% (T_A = 25°C or 77°F; V_{in} = 48 V DC; without a fan).
- Depth x Width x Height: 183.0mm × 68.0mm × 40.3mm (7.20in. × 2.68in. × 1.59in.)
- Weight: < 2 kg
- Supports input protection for overvoltage and undervoltage. Supports output protection for overvoltage, overcurrent, short circuit, and overtemperature.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

- I2C communication for control, online upgrade, and monitoring.
- TUV, CE, UL, BIS, CCC and CB certification available.
- IEC 60950-1, EN 60950-1, UL 60950-1, IEC 62368-1, EN62368-1, UL62368-1, GB 4943.1
- RoHS6 compliant.
- 2002/95/EC compliant.

Application Scenario

Servers

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

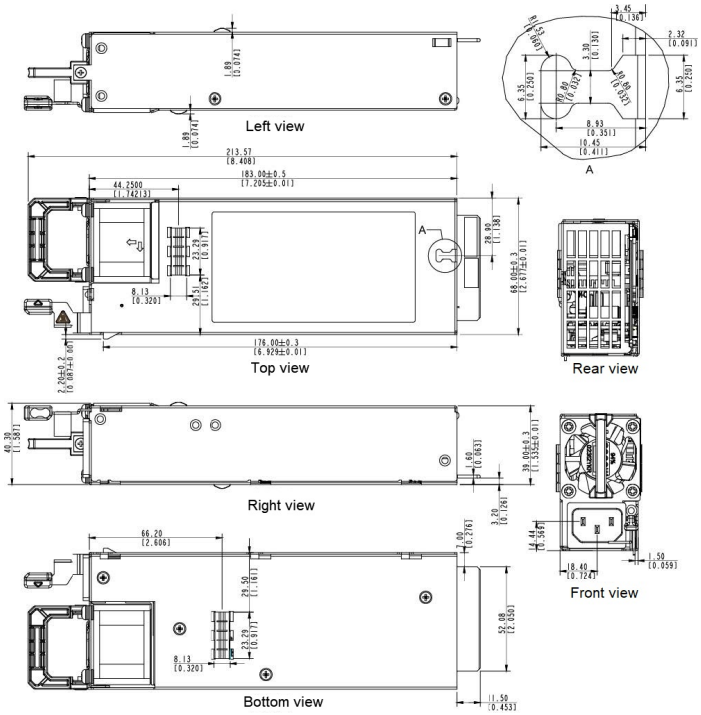
3 Product Structure Overview

3.1 Structural Dimensions

3.2 External Ports

3.1 Structural Dimensions

Depth x Width x Height: 183.0 mm × 68.0 mm × 40.3 mm (7.20 in. × 2.68 in. × 1.59 in.)



 Copyright © XFUSION INTERNATIONAL PTE. LTD.

3.2 External Ports

Figure 3-1 Output port (top view)

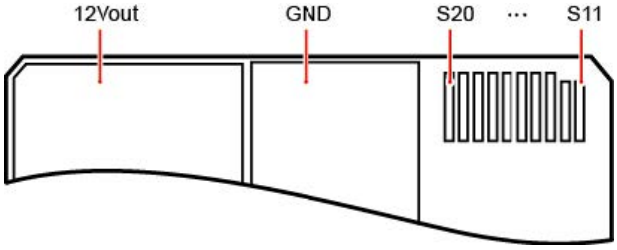
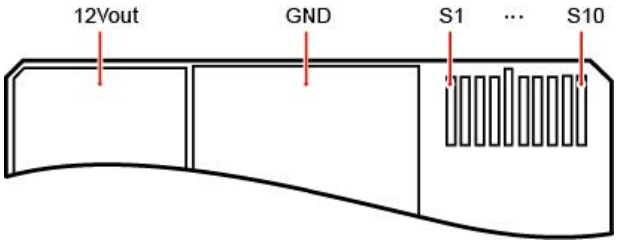


Figure 3-2 Output port (bottom view)



Pin	Name	Description
P1-P6, P21-P28	V12	PSU 12 V main output
P7-P20	RTN	PSU output GND
S20	OPOK	Signal for indicating whether the main output is normal
S19	IPOK	Signal for indicating whether the input is normal
S18	IPOK Link	Signal for indicating whether the input of the redundant PSU is normal
S17	SMART_ON	Signal for waking up the cold standby power mode
S16	SHLFBB_SF1	Reserved
S15	INSTALLED54#	Reserved
S14	IP PRESENT	SV12 control signal
S13	PSON12V#	MV12 remote on/off control signal

Copyright © XFUSION INTERNATIONAL PTE. LTD.

Pin	Name	Description
S12	INSTALLED#	PSU installation signal
S11	PRESENT#	PSU presence signal
S10	I-MON	Current sharing signal
S9	EFUSEV	System E-Fuse voltage
S8	CYC_PWR#	Power supply cycle power signal
S7	PS_INTERRUPT#	PSU alarm interruption signal
S6	SDA	I2C data cable
S5	I2C Sig GND	I2C signal ground
S4	SCL	I2C Serial Clock Line
S3	ADD2	Address cable 2
S2	ADD1	Address cable 1
S1	ADD0	Address cable 0

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

4 Electrical Specifications

4.1 Environmental Characteristics
4.2 Input Characteristics
4.3 Output Characteristics
4.4 Efficiency Characteristics
4.5 Protection Characteristics

4.1 Environmental Characteristics

Parameter	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Operating temperature (T_A)	5	25	55	°C	The PSU is able to start at –10°C (14°F), but there is no requirements on the PSU performance.
Storage temperature	–40	25	85	°C	-
Relative humidity	5	-	95	%RH	Non-condensing. The PSU can work properly.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Altitude	–60	-	5000	m	● 5000 m (16,404 ft) in CCC certification. When the PSU is not working, it can be placed at an altitude of 15,000 m (49,212 ft). ● When the altitude ranges from 1800 m to 4000 m (5905.51 ft to 13,123.36 ft), the highest operating temperature decreases by 1°C (1.8°F) for every increase of 220 m (721.78 ft).
Atmospheric pressure	61	-	106	kPa	● Chassis specification decomposition. The PSU can run normally with the atmospheric pressure at an altitude of 4000 m (13,123.36 ft). ● Low atmospheric pressure test at an altitude of 4000 m (13,123.36 ft).

4.2 Input Characteristics

Parameter	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Input voltage range	38.4	48/60	72	V	-
Maximum DC input current	-	-	40	A	V_{in} = –38.4 V DC, rated load output.
Input inrush current	-	-	-	A	ETSI300132-2 compliant.
Standby power consumption	-	-	5	W	V_{in} = –53.5 V DC. The fan, output and PFC are shut down (in parallel mode).
	-	-	25	W	V_{in} = –53.5 V DC. In MV6 output mode, the fan works at the lowest rotational speed, and the output is 0 A.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
	-	-	25	W	V_{in} = –53.5 V DC. In MV12 output mode, the fan works at the lowest rotational speed, and the output is 0 A.

4.3 Output Characteristics

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Number of outputs	-	-	-	Single route	-	There is a single output. The output mode can be MV12 (V_{out} = 12.3 V) and MV6 (V_{out} = 7.6 V). ● PSON12V# at high level: MV6 output mode. ● PSON12V# at low level: MV12 output mode.
Output power	MV12	-	-	1200	W	-
	SV12	-	-	90	W	-
	MV6	-	-	120	W	-
Output voltage setpoint	MV12	12.2	12.3	12.4	V DC	T_A = 25°C (77°F), rated input, 30 A load.
	MV6	7.8	7.9	8.0	V DC	T_A = 25°C (77°F), rated input, 1 A load.
Output voltage	MV12	11.97	12.3	12.6	V DC	The voltage of each channel should be within the static voltage range during the cross adjustment. The output voltage should be tested when the load is higher than the minimum value.
	SV12	11.97	12.3	12.6	V DC	
	MV6	7.65	7.9	8.2	V DC	

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Output current	MV12	1	-	97.6	A	-
	SV12	1	-	7.3	A	-
	MV6	1	-	15.2	A	-
Source regulation rate	-	–1	-	1	%	-
Ripple and noise (peak to peak)	MV12	-	-	120	mV	During the test, the output port of the PSU is added with a ceramic capacitor of 0.47 μF, two tantalum capacitors of 33 μF, and a solid capacitor of 780 μF, and the oscilloscope bandwidth is set to 20 MHz. The test is carried out with the current over 1 A in MV12/MV6 mode under full range of temperature and full input voltage.
	MV6	-	-	120	mV	
Dynamic	MV12	11.6	-	12.6	V	Load: 25%-50%-25%, 50%-75%-50%, or 50%-100%-50%, Current change rate: 0.5 A/μs, T = 10 ms (5 ms of CCDHT 1 and 5 ms of CCDHT 2); Tested with the minimum capacitive load of 540 uF.
	MV6	6.0	-	8.2	V	Load change: 0.5 A to 10 A. Current change rate: 0.5 A/μs, T = 10 ms (5 ms of CCDHT 1 and 5 ms of CCDHT 2); Tested with the minimum capacitive load of 270 uF.
Transient impact power overshoot	MV12/SV12	11.5	-	12.6	V	Load: 65%-130%-65%, T = 1 s-10 ms-1 s, current change rate: 0.5 A/μs.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Overshoot at power-on/off	-	–5	-	5	%	The power-on and power-off waveforms are monotonic without ringback or oscillation.
Temperature coefficient	-	–0.02	-	0.02	%/°C	Rated output voltage, rated output current and full range of T_A.
Current share error	-	–5	-	5	%	In the range from 50% to 100% of the rated output current of the active PSU in MV12 mode, the imbalance value of the PSU evenly allocated load should not exceed ±5% of the rated DC output current of a single PSU.
		-	-	-	%	In MV6 mode, the output of a single PSU needs to meet the system power consumption. The current sharing is not required.
Current share bus voltage	-	1.60	1.728	1.85	V	$V_{share} = 0.0177 \times I_{out}$ ● V_{share}: current share bus voltage (Unit: V) ● I_{out}: output current (Unit: A) ● 0.0177: coefficient of proportionality
Current share bus linearity	-	–5	-	5	%	-
Capacitive load	MV12	540	-	22000	μF	Full voltage, full load and full range of temperature.
	MV6	270	-	1000	μF	

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Hot swap	MV12	11.6	-	12.6	V	When the swap speed is from 0.5 m/s to 1 m/s, the backplane voltage cannot exceed the dynamic specifications of the PSU during the swap. The time when the bus voltage is lower than 11.6 V during the 12 V swap is less than 200 μs, but the bus voltage should not be lower than 11.4 V.
	MV6	6.0	-	8.2	V	

4.4 Efficiency Characteristics

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Efficiency	MV12	83	-	-	%	T_A = 25°C (77°F), V_{in} = 48 V DC, I_{out} = 10 A, without a fan.
		89	-	-	%	T_A = 25°C (77°F), V_{in} = 48 V DC, I_{out} = 20 A, without a fan.
		92.5	-	-	%	T_A = 25°C (77°F), V_{in} = 48 V DC, I_{out} = 50 A, without a fan.
		92	-	-	%	T_A = 25°C (77°F), V_{in} = 48 V DC, I_{out} = 97.6 A, without a fan.
	MV6	70	-	-	%	T_A = 25°C (77°F), V_{in} = 48 V DC, I_{out} = 6 A, without a fan.
		80	-	-	%	T_A = 25°C (77°F), V_{in} = 48 V DC, I_{out} = 12 A, without a fan.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

4.5 Protection Characteristics

Table 4-1 Input Protection Characteristics

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
AC input overvoltage protection threshold	-	78	-	-	V	Self-recovery.
AC input overvoltage recovery threshold	-	76	-	-	V	Hysteresis > 2 V.
AC input undervoltage protection threshold	-	-	-	36	V	Self-recovery.
AC input undervoltage recovery threshold	-	-	-	38.4	V	Hysteresis > 1 V.
AC input overcurrent or short circuit protection	-	-	-	-	-	Use a fast-blow fuse.
Input anti-reverse connection protection	-	-	-	-	-	Do not damage the positive and negative reverse connection modules of the input voltage or affect the input system.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Table 4-2 Output protection characteristics

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Output overvoltage protection	MV12	13	-	15	V DC	Latch off.
	SV12	13	-	15	V DC	Latch off.
	MV6	13	-	15	V DC	Latch off.
Output overcurrent protection	MV12	105	-	130	A	Latch off, T = 100ms-200ms. Within the response time, the output voltage remains in the steady state in the range from 11.5 V to 12.6 V.
		130	-	150	A	Latch off. Response time is greater than or equal to 4 ms. The steady state precision of output voltage within the response time is not required.
	SV12	45	-	150	A	● The PSU outputs in MV12 mode (without receiving a signal from the system). ● Response time: 100 ms to 200 ms. ● The PSU can enter SV12 mode only after the PSON12V# signal changes from low level to high level, and then from high level back to low level.
	MV6	25	-	35	A	● The PSU outputs in MV12 mode (without receiving a signal from the system). ● Response time: 400 ms to 600 ms ● The PSU can enter MV6 mode only after the PSON12V# signal changes from high level to low level, and then from low level back to high level.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Output shortcircuit protection	MV12	150	-	-	A	Latch off. Response time is less than to 500 μs.The steady state precision of output voltage within the response time is not required.
	SV12	150	-	-	A	Latch off. Response time is less than to 500 μs. The steady state precision of output voltage within the response time is not required.
	MV6	150	-	-	A	Latch off. Response time is less than to 500 μs. The steady state precision of output voltage within the response time is not required.
		35	-	-	A	Latch off. Response time is greater than to 500 ms, The steady state precision of output voltage within the response time is not required.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
Overtemperature protection	-	60	-	-	°C	● The PSU can be protected against overtemperature and shut down only when the ambient temperature is higher than 60°C (140°F). The PSU operation should be restored automatically when the ambient temperature is below 55°C (131°F). The hysteresis for restoration must be greater than 5°C (9°F). ● The temperature protection threshold of the PSU air intake vent should be set to a value over 65°C (149°F). ● If the PSU experiences overtemperature in MV12 mode, it will output in MV6 mode (although the PSON12# signal is at low level). When the temperature of the components inside the PSU drops to a normal value, the PSU restores the output in MV12 mode (although the PSON12V# signal is at low level). An MV6 output delay greater than 5s indicates that the overtemperature is lasting, and the output should be shut down. ● If the PSU experiences overtemperature in MV6 mode, it will shut down output. ● When the temperature of the components inside the PSU restores to normal, the PSU restores to MV6 mode first (even if PSON12V# is still at low level), and then restores to MV12 mode if the PSON12V# signal is at low level. The hysteresis for restoration must be greater than 5°C (41°F).

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Output	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
						● The preceding criteria apply to high ambient temperature and component temperature.

NOTE

- Conversion slope requirements for MV12 and MV6 when the PSU output protection is triggered: When the PSU changes from MV6 to MV12 mode (OCP and OTP), the voltage slope should be slower than 2 V/s (in a single PSU test).
- In a parallel system, if one PSU experiences output overvoltage or overcurrent, disconnect the DC input, wait for 2 s, and then connect the DC input to unlock the PSU.
- After the PSU triggers fault protection, the MCU and I2C in the PSU can work properly.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

5 Parallel Operation

Current Share Design Requirements

- The PSU is hot-swappable, supports 1+1 and 2+2 backup, and maximum support 3+3.
- The 12 V main current share imbalance is ±5% (with a load rate of 50% to 100%).
- The total load at startup in parallel operation scenarios should be less than the rated load of a single PSU.
- When PSUs work in 1+1, 2+2 or 3+3 mode, if one of the PSUs works in MV6 mode and other PSUs work in MV12 mode, the PSUs should work properly without affecting each other.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

6 Hot Swap Requirements

Hot swapping is the process of inserting the PSU to and extracting another PSU from a power system. The PSU should meet hot-swapping specifications.

The PSU can be hot swapped by the following methods:

- PSU hot swap without DC power applied (The PSU does not work before the insertion or extraction.)
  - Extraction: The DC power is disconnected from the PSU before the PSU is extracted from the system.
  - Insertion: The PSU is inserted into the system without power applied. Then, power is applied after the insertion.
- PSU hot swap through the system processor
  - Extraction: The system processor removes the PSU by turning off the PSON12V# signal.
  - Insertion: After a PSU is inserted into the system, the system processor queries the system status and turns on the PSON12V# signal to enable the PSU to work in main route operation mode.
- PSU hot swap with DC power applied (The DC is valid before being removed and inserted.)
  - Extraction: The PSU is removed from the system with power on.
  - Insertion: The PSU starts to work immediately after it is inserted into the system.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

7 Energy Saving Feature

7.1 Active/Standby (Hot Standby) Power Supply

7.2 Deep Sleep Function

7.3 Cold Standby Energy Saving Function

7.1 Active/Standby (Hot Standby) Power Supply

If PSUs work in parallel, the system sets the bit 7 of the **CEh (PS_CONTROL)** to **1**, and the output voltage of the standby PSU is set to hot standby mode through the **VOUT_COMMAND (21h)** command. The PSU with an output setting voltage of 12.3 V is the active PSU, and the PSU whose output is set to hot standby mode is the standby PSU.

Table 7-1 Active/Standby power supply characteristics

Parameter	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
12 V output voltage of the standby PSU	12	-	-	V	T_A = 25°C (77°F), The output voltage of the standby PSU is less than that of the active PSU.
No-load power consumption of the standby PSU	-	-	25	W	1+1 power supply scenario: For the active/standby power supply with rated input of 48 V (DC+DC), the input power consumption of each standby PSU is lower less than 25 W.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Minimum Value	Typical Value	Maximum Value	Unit	Remarks
	-	-	25	W	2+2 power supply scenario: For the active/standby power supply with rated input of 48 V (DC+DC), the input power consumption of each standby PSU is lower less than 25 W. **NOTE** The total output load is less than 70% of the rated load of a single PSU.
Busbar voltage in fault mode	11.4	-	-	V	In 1+1 active/standby power supply scenarios (DC+DC), if one of the PSUs experiences power failure or other faults (such as input undervoltage, input overvoltage, fan fault, overtemperature, or output overvoltage), or the PSU is removed in the power-on status, the busbar 12 V voltage cannot be lower than 11.4 V (the voltage of the 12 V short circuit before the ORing-FET output is 11 V). **NOTE** In a parallel scenario, the 12 V output is connected with a 540 μF capacitor.
	11.4	-	-	V	In 2+2 active/standby power supply scenario (DC+DC): ● One power input fails (2+2 backup, one power input for two PSUs). ● One of the PSUs experienced a fault (such as input undervoltage, input overvoltage, fan fault, overtemperature, output overvoltage, or hot swap). The actual voltage of the busbar 12 V output cannot be lower than 11.4 V (the voltage of the 12 V short circuit before the ORing-FET output is 11 V). **NOTE** In a parallel scenario, the 12 V output is connected with a 540 μF capacitor.

7.2 Deep Sleep Function

The PSU enters deep sleep mode if bit B of **PS_CONTROL (CEh)** is set to 1.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

- Requirement: In deep sleep mode, the PSU input power is less than 1 W.
- Acceptance criteria:
  - The main power is shut down and the bus of 12 V has no output power.
  - The fan obtains power from the 12 V bus.
  - The power control function can be obtained through the 12 V bus.
  - The output of all converters can be controlled online and restored to normal.

In a parallel system, the PSU is not allowed to enter deep sleep mode unless all of the following occur:

- The system sets the deep sleep control register to 1.
- EFUSEV is less than or equal to 0.8 V.

The PSU must be able to restore output of converters when any of the following occurs:

- The bus voltage is less than 5.7 V.
- The deep sleep control register is set to 0.
- EFUSEV is greater than 1.0 V.

The deep sleep function is available in both MV12 and MV6 modes.

NOTE

- When PSUs work in parallel, if one PSU enters deep sleep mode, the system communicates with it, and the PSU's primary information including input voltage, current, and power is reported as 0; the secondary information is reported as the actual value (the output voltage and current are reported as 0).
- When the voltage is lower than 5.7 V, the bus voltage should be restored to a value above 11.5 V within 5 s.

7.3 Cold Standby Energy Saving Function

In a 1+1/2+2 redundancy system, the cold standby mode is supported when the output mode is MV12.

The PSU can enter cold standby mode if all of the following conditions are met

- The load is less than rated load of a single PSU.
- The system sends a D0h 0x01 command to set one of the PSUs as the active PSU (SMART_ON changes to high level).
- The system sends D0h 0x02 to the other PSU and detects that SMART_ON is high.

The cold standby PSU exits cold standby mode if any of the following conditions is met

- The system sends the D0h 0x00 command.
- The single-chip microcomputer of the PSU restarts.
- The I2C communication of the PSU is abnormal.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

- The 12V output of the active PSU encounters a fault, such as input power failure, input overvoltage/ undervoltage, output overvoltage/overcurrent/ undervoltage (< 11.8 V), overtemperature, and fan fault, which causes SMART_ON to change to low level.
- The PSON12V# signal changes from low level to high level, and the INSTALLED# signal changes from low level to high level.

The active PSU exits cold standby mode if any of the following conditions is met

- The system sends the D0h 0x00 command.
- The single-chip microcomputer of the PSU restarts.
- The I2C communication of the PSU is abnormal.
- The 12 V output of the active PSU encounters a fault, such as input power failure, input overvoltage/ undervoltage, output overvoltage/overcurrent/ undervoltage (< 11.8 V), overtemperature, and fan fault.

  The SMART_ON signal changes to low level due to the fault.
- The PSON12V# signal changes from low level to high level, and the INSTALLED# signal changes from low level to high level.
- The load power is greater than the maximum power supported by the cold standby mode.

Table 7-2 Power consumption of standby PSU in cold standby mode

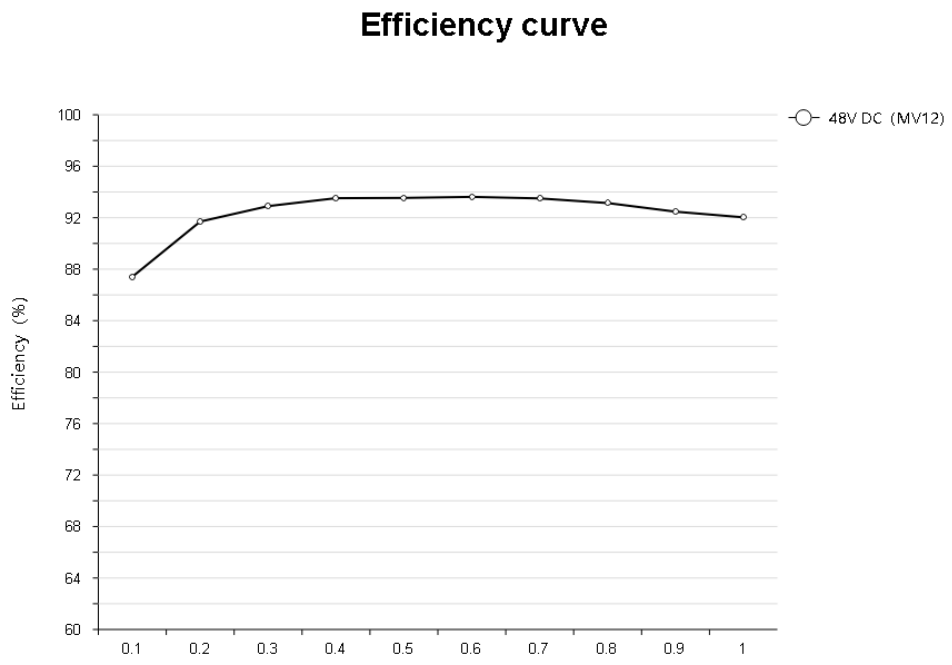
Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Busbar voltage in fault mode	11.4	-	-	V	In 1+1 active/standby power supply scenarios (DC+DC), if one of the PSUs experiences power failure or other faults (excluding the short circuit inside the ORing-FET and the removal of a PSU in the power-on status), the actual voltage of the busbar 12 V output cannot be lower than 11.4 V (within the full-load range). **NOTE** In a parallel scenario, the 12 V output is connected with a 540 μF capacitor.
Power consumption of standby PSU	-	-	25	W	Rated input.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

8 Feature Curves

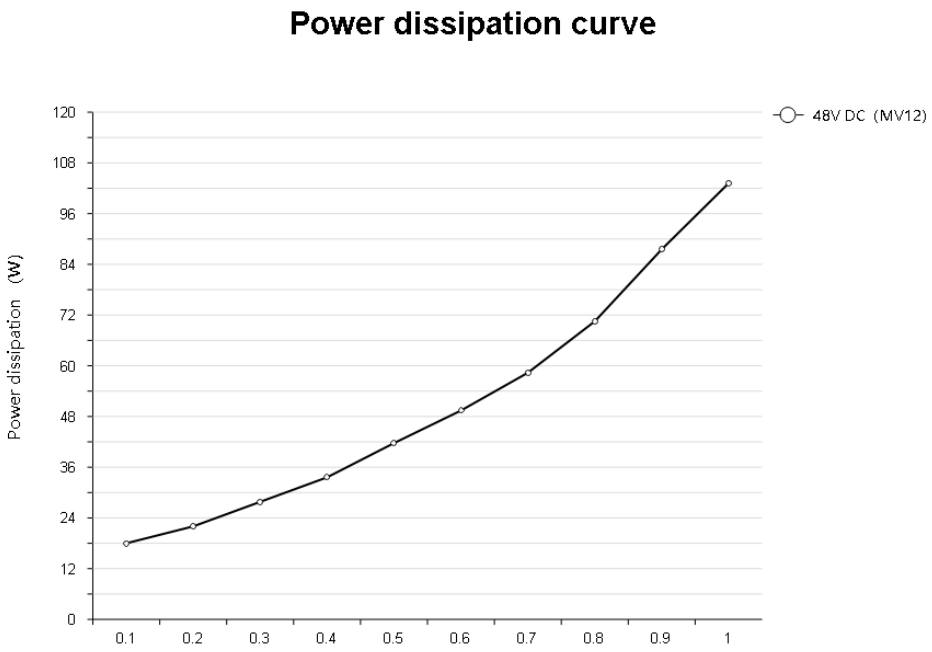
Conditions: T_A = 25°C (77°F) unless otherwise specified.

Figure 8-1 Efficiency curve



 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 8-2 Power dissipation curve



 Copyright © XFUSION INTERNATIONAL PTE. LTD.

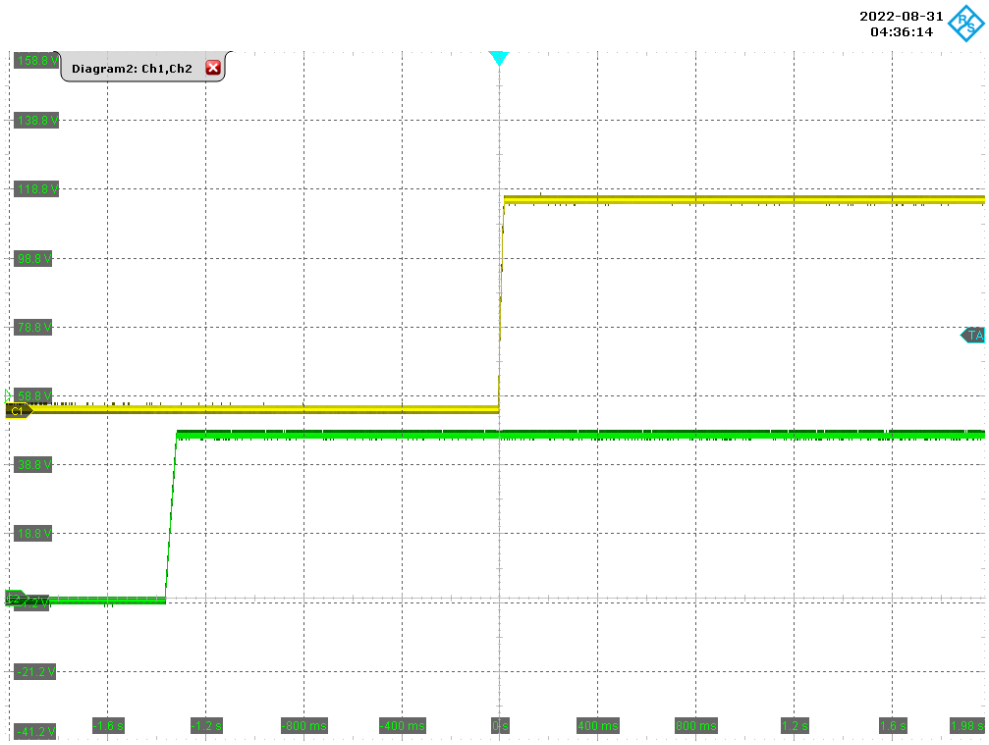
9 Typical Waveforms

9.1 Turn-on/Turn-off
9.2 Output Voltage Dynamic Response
9.3 Output Voltage Ripple and Noise

9.1 Turn-on/Turn-off

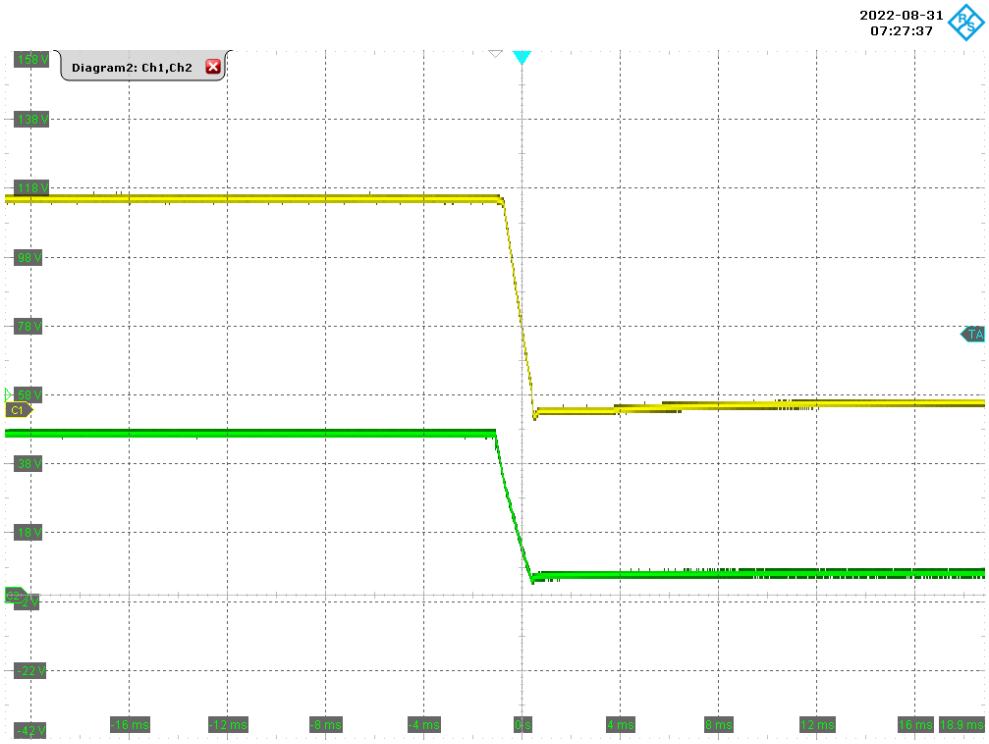
Conditions: T_A = 25°C (77°F) unless otherwise specified.

Figure 9-1 Turn-on (V_{in} = 48 V DC)



 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 9-2 Turn-off (V_{in} = 48 V DC)



9.2 Output Voltage Dynamic Response

Conditions: T_A = 25°C (77°F) unless otherwise specified.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 9-3 Output voltage dynamic response (V_{in} = 48 V DC, 25%-50%-25%, T = 10ms)

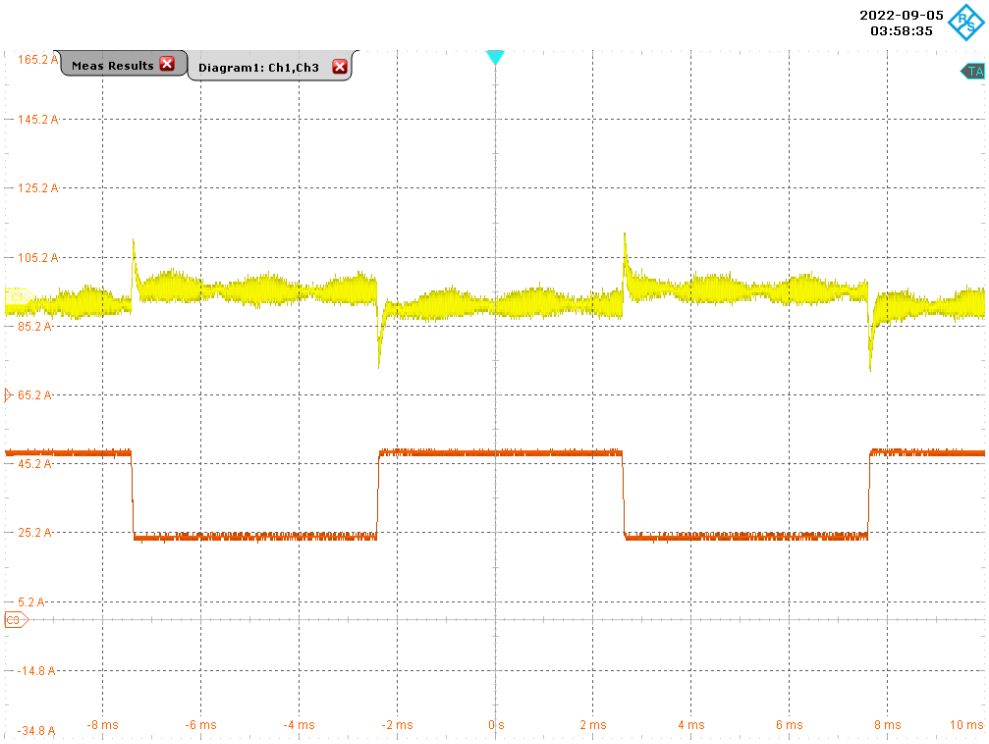
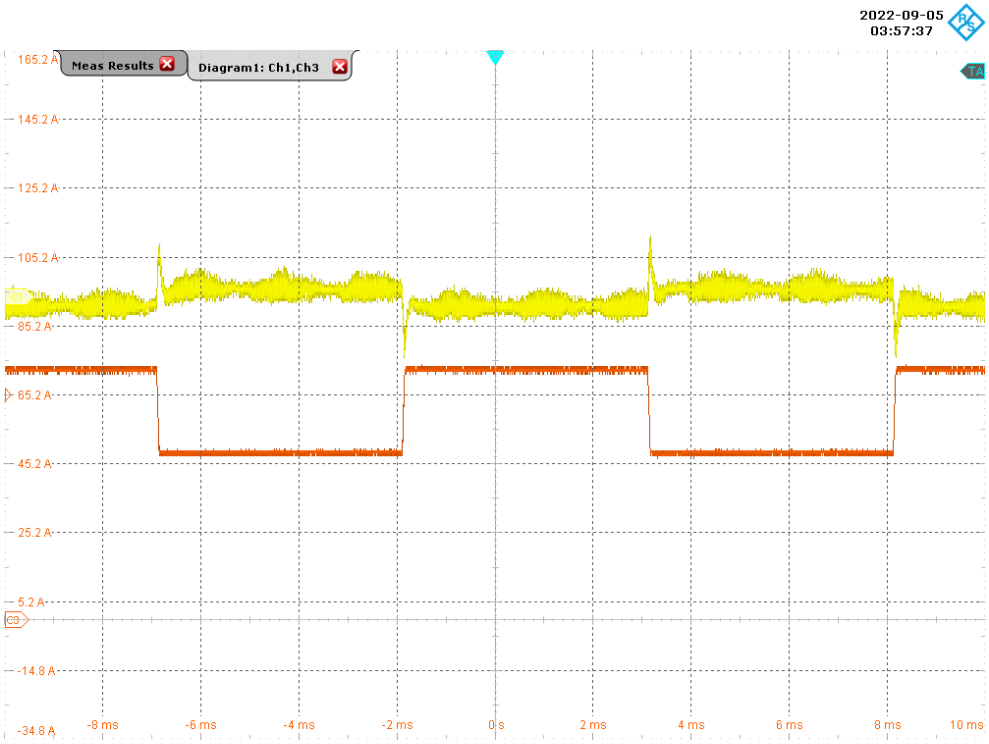


Figure 9-4 Output voltage dynamic response (V_{in} = 48 V DC, 50%-75%-50%, T = 10ms)



 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 9-5 Output voltage dynamic response (V_{in} = 48 V DC, 50%-100%-50%, T = 10ms)

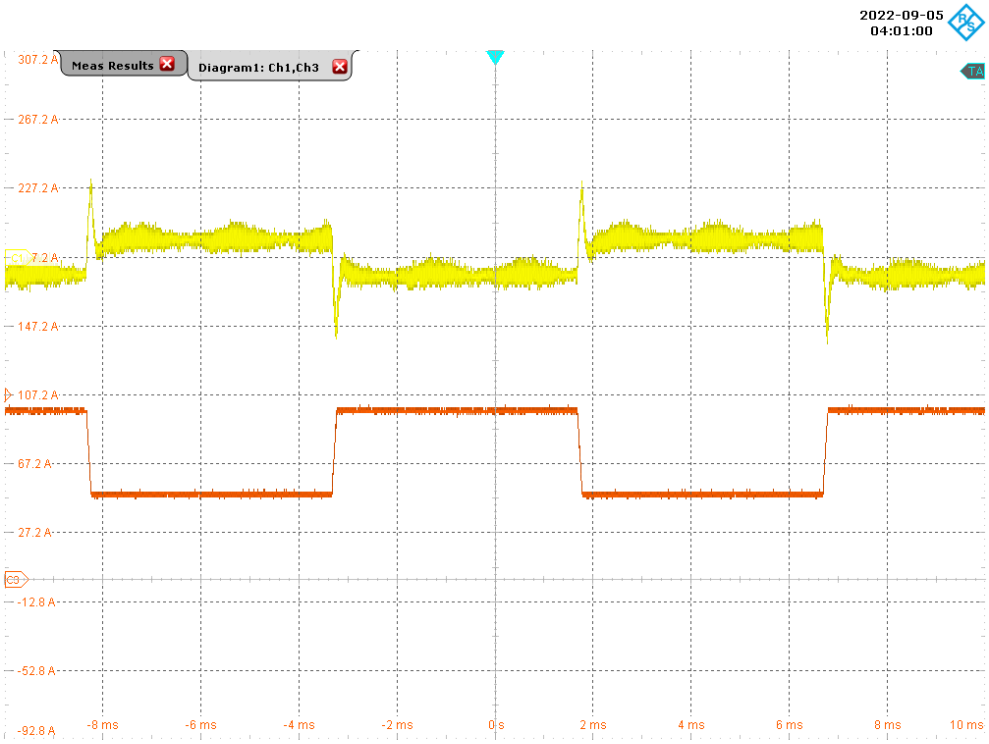
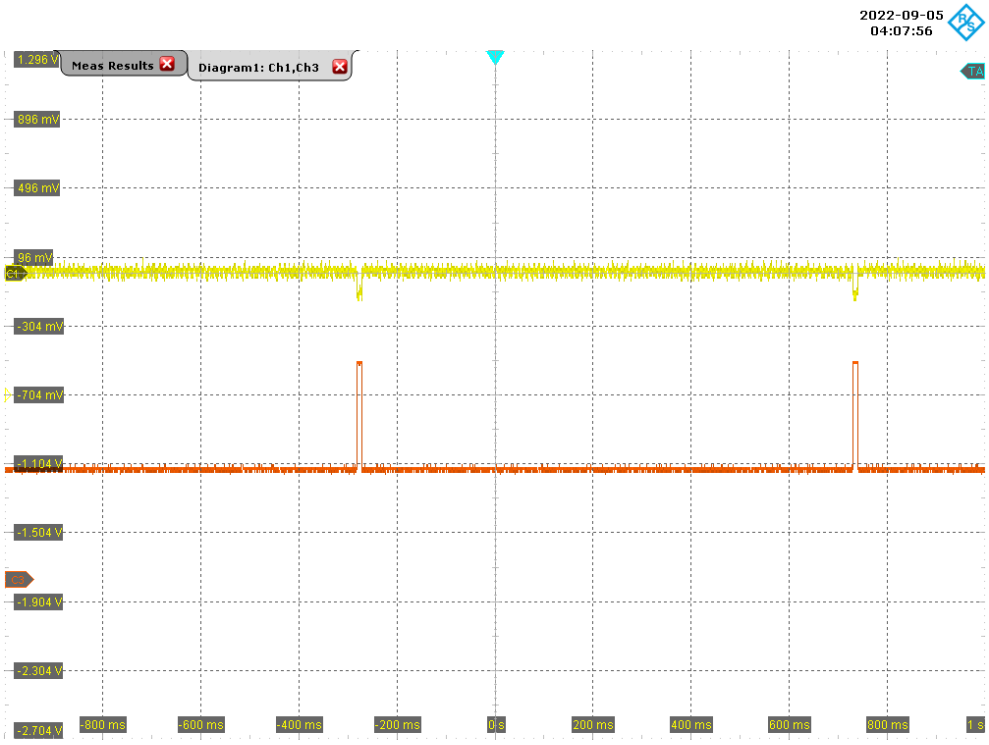


Figure 9-6 Output voltage dynamic response (V_{in} = 48 V DC, 65%-130%-65%, T = 10ms)

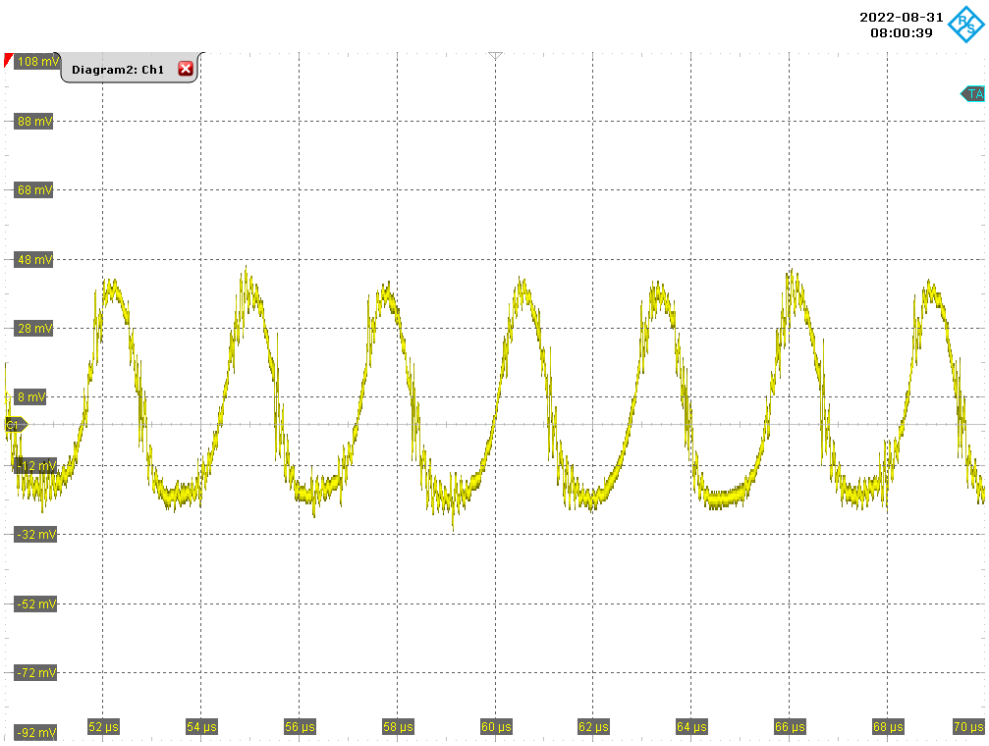


 Copyright © XFUSION INTERNATIONAL PTE. LTD.

9.3 Output Voltage Ripple and Noise

Conditions: T_A = 25°C (77°F) unless otherwise specified.

Figure 9-7 Output voltage ripple and noise (V_{in} = 48 V DC, 100% load)



 Copyright © XFUSION INTERNATIONAL PTE. LTD.

10 Control Signals

Signal noise (golden finger output connector): The peak voltage is less than 250 mV (20 MHz bandwidth).

10.1 PSU Timing Diagram

10.2 ORing-FET

10.3 PSON12V#

10.4 PRESENT#

10.5 INSTALLED#

10.6 OPOK

10.7 IPOK

10.8 IPOK LINK

10.9 IP PRESENT

10.10 CYC_PWR#

10.11 I-MON

10.12 PS_INTERRUPT

10.13 SCL and SDA

10.14 ADD, 0ADD1, and ADD2

10.15 EFUSEV

10.16 SMART_ON

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

10.1 PSU Timing Diagram

Table 10-1 Output PSU timing requirements

Mark	Description	Min.	Max.	Unit
T1	Time from DC input to when IPOK is at high level.	1000	1500	ms
T2	Time for MV6/MV12 to increase to 10% when the IPOK signal changes from low level to high level. (The PSU is started after the DC is disconnected for over 5 s.)	-	100	ms
T3	Time for MV6 output to increase from 10% to 90%.	6	12	ms
	Time for MV12 output to increase from 10% to 90%.	12	24	ms
T4	Delay time for the OPOK to take effect (when MV12/MV6 increases to 90% to when OPOK is at high level).	50	100	ms
T5	IPOK failure delay time (from input outage to low IPOK signal, circuit breaker disconnection not considered).	-	4	ms
T6	Time from when the DC input power fails to when MV12 output drops to 11.0 V.	-	-	ms
T7	Time from DC power failure to low OPOK signal, 100% load.	-	-	ms
	Time from DC power failure to low OPOK signal, 50% load.	-	-	ms
	Time from DC power failure to low OPOK signal, 25% load.	-	-	ms
	Time from DC power failure to low OPOK signal, 12.5% load.	-	-	ms
T8	Time for MV12 output to drop from 11.0 V to 5.7 V (5 W load).	-	-	μs
T10	Time for MV12 to increase. (The PSON12V# signal changes from high level to low level of and from MV6 to 11.1 V.)	80	120	ms
	Time for MV12 to increase. (MV6 OCP and OTP recover, and MV6 increases to 11.1 V.)	2.1	3.3	s
T11	Time for the PSON12# signal to change from high level to MV12 output to drop to 90%.	-	-	ms
T12	Time for MV12 to drop to MV6 mode (5 W load)	-	120	ms
T15	Interval time between MV12 output lower than 5.7 V and MV12 output greater than 5.9 V	-	-	ms

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

NOTE

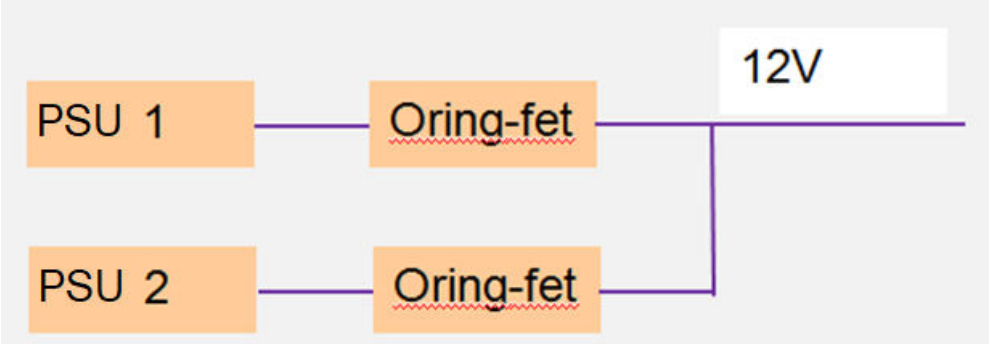
- In case of input power failure, the PSU needs 10 ms to 120 ms to set IIC alarm position to 1 at more than half load, and the system needs 20 ms to 120 ms to set IIC alarm position to 1 at below half load (including half load).
- Only the steady startup is constrained by T1 and T2. The transient voltage drop, overshoot out of specification, and slow increase of voltage are not constrained by T1 and T2.
- The start voltage of the input power failure is the power input undervoltage threshold 35 V.

10.2 ORing-FET

PSU side:

An ORing-FET failure isolation circuit needs to be added inside the PSU 12 V output. In the practical application scenario (1+1 and 2+2 redundancy), if one PSU experiences an internal fault, it should exit automatically to prevent the bus voltage output from being abnormal.

Figure 10-1 ORing-FET circuit



System side:

- Capacitance at the MV12 input side: The equivalent capacitance should be greater than the PSU's minimum capacitive load 540 μF multiplied by N (N is the number of PSUs configured in the system) and less than the PSU's maximum capacitive load 22000 μF.
- The 12 V load should be greater than the minimum PSU load 1 A and less than the rated load of the PSU.

10.3 PSON12V#

The PSON12V# signal is an on/off signal that controls the PSU 12 V output remotely. If the PSON12V# signal is at low level and takes effect, the PSU 12 V enters MV12 output mode. If the PSON12V# is at high level or left open, the PSU enters MV6 output mode.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 10-2 Interconnect diagram of the PSON12V# signal

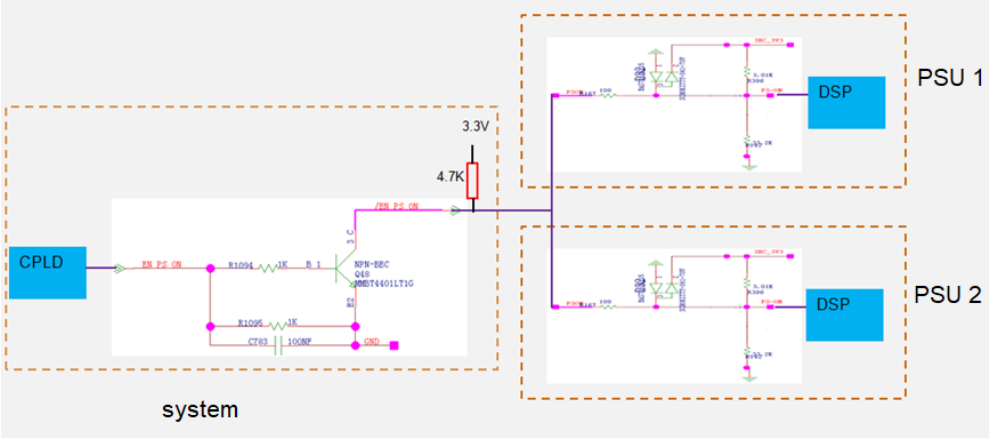


Table 10-2 PSON12V# signal characteristics

Signal Characteristics	
Signal type	PSU side: This signal is pulled up to the 3.3 V auxiliary power source inside the PSU by a 4.7-kilohm resistor. System side: This signal is output by CPLD over the drive circuit and pulled up to 3.3 V by a 4.7-kilohm resistor.
PSON12V# = Low	MV12 output mode.
PSON12V# = High/Open	MV6 output mode.

Table 10-3 PSON12V# output

PSON12V# Output	Minimum Value	Maximum Value
Low level voltage (main output enabled)	0 V	0.8 V
High level voltage (main output disabled)	2.0 V	3.465 V
Source current, and PSON12V# = Low	-	1 mA
Signal rise and fall time	-	1000 μs

10.4 PRESENT#

The PRESENT# signal is used by the system to detect whether the PSU is present. The signal pin is required to be shorter than other pins on the PSU. The pin is grounded inside the PSU.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Table 10-4 PRESENT# signal characteristics

Signal Characteristics	
Signal type	PSU side: The pin is directly grounded inside the PSU. System side: This signal is pulled up to 3.3 V by a 4.7-kilohm resistor and output to the system CPLD over a series resistor.

10.5 INSTALLED#

The INSTALLED# signal is used by the PSU to determine whether it has been inserted into the system. The signal pin is required to be shorter than other pins on the PSU. High level indicates that the PSU is not inserted into the system. Low level indicates that the PSU is inserted into the system. When the signal is left open, the PSU has no output. The PSU enables the main output mode when the PSU is inserted into the system.

Table 10-5 INSTALLED# signal characteristics

Signal Characteristics	
Signal type	PSU side: This signal is pulled up to the 3.3 V auxiliary power source inside the PSU by a 4.7-kilohm resistor. System side: This pin is grounded directly.
INSTALLED# = Low	PSU is inserted into the system.
INSTALLED# = High	PSU is not inserted into the system.

Table 10-6 INSATLLED# output

INSATLLED# Output	Minimum Value	Maximum Value
Low level voltage	0 V	0.6 V
High level voltage	2.0 V	3.465 V
Sink current, and INSATLLED# = Low	1 mA	-
Signal rise and fall time	-	1000 μs

10.6 OPOK

The OPOK signal indicates whether the main output is normal. High level indicates that the main output is normal. Low level indicates that the main output is abnormal.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 10-3 Interconnect diagram of the OPOK signal

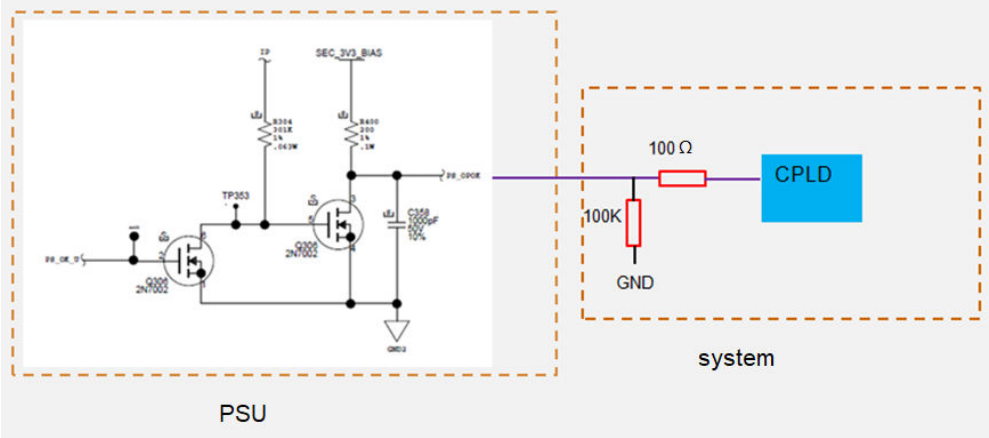


Table 10-7 OPOK signal characteristics

Signal Characteristics	
Signal type	PSU side: This signal is output over the drive circuit and pulled up to 3.3 V by a 200-ohm resistor. System side: Pulled down to GND by a 100-kilohm resistor and connected to the system CPLD over a 100-ohm series resistor.
OPOK = High	The main output is normal.
OPOK = Low	The main output is abnormal.

Table 10-8 OPOK output

OPOK Output	Min.	Max.
Low level voltage	0 V	0.6 V
High level voltage	2.0 V	3.465 V
Sink current, OPOK = Low	-	1 mA
Source current, OPOK = High	-	1 mA
Signal rise and fall time	-	200 µs

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

NOTE

- If the INSTALLED# signal is at high level, then the OPOK signal is at low level.
- In MV12 mode:
  - If the output voltage is higher than 11.5 V, OPOK is at high level.
  - If the output voltage is lower than 11.4 V, OPOK is at low level.
- In MV6 mode:
  - If the output voltage is higher than 5.9 V, OPOK is at high level.
  - If the output voltage is lower than 5.8 V, OPOK is at low level.

10.7 IPOK

The IPOK signal is used to detect whether the PSU input is normal. High level indicates that the PSU input is normal. Low level indicates that the PSU input is abnormal.

Figure 10-4 Interconnect diagram of the IPOK signal

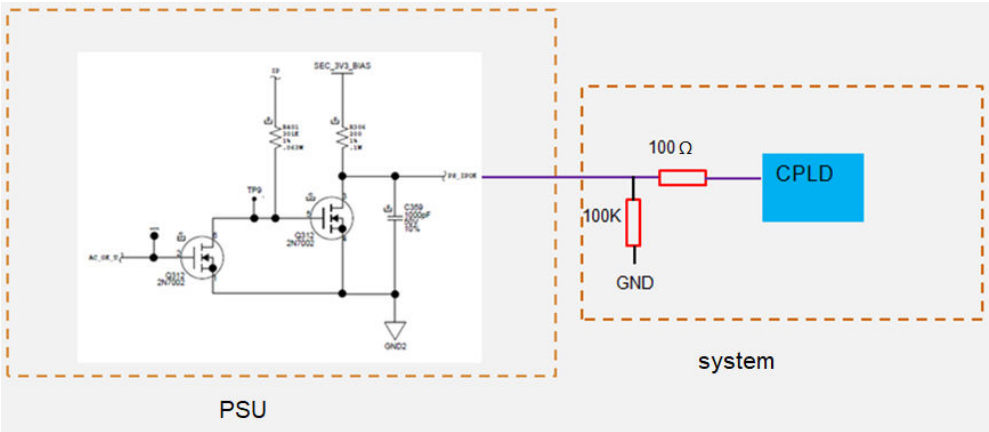


Table 10-9 IPOK signal characteristics

Signal Characteristics	
Signal type	PSU side: This signal is output over the drive circuit and pulled up to 3.3 V by a 200-ohm resistor. System side: Pulled down to GND by a 100-kilohm resistor and connected to the system CPLD over a 100-ohm series resistor.
IPOK = High	The input is normal.
IPOK = Low	The input is abnormal.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Table 10-10 IPOK output

IPOK Output	Min.	Max.
Low level voltage	0 V	0.6 V
High level voltage	2.0 V	3.465 V
Sink current, IPOK = Low	-	1 mA
Source current, IPOK = High	-	1 mA
Signal rise and fall time	-	200 μs

10.8 IPOK LINK

The IPOK LINK signal is sent by the system to the PSU. It indicates that at least one PSU is present in the system and its input is normal. High level indicates that the standby PSU input of the system is normal. Low level indicates that the standby PSU input of the system is abnormal.

Table 10-11 IPOK LINK signal characteristics

Signal Characteristics	
Signal type (PSU output signal)	PSU side: This signal is pulled up to the 3.3 V auxiliary power source inside the PSU by a 2.49-kilohm resistor. System side: This signal is output by CPLD over the drive circuit and pulled up to 3.3 V by a 4.7-kilohm resistor.
IPOK LINK = High	The standby power supply input is normal.
IPOK LINK = Low	The standby power supply input is abnormal.

Table 10-12 IPOK LINK output

IPOK LINK Output	Min.	Max.
Low level voltage	0 V	0.6 V
High level voltage	2.0 V	3.465 V
Sink current, IPOK LINK = Low	-	1 mA
Source current, IPOK LINK = High	-	1 mA
Signal rise and fall time	-	1000 μs

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

10.9 IP PRESENT

The IP PRESENT signal is the received signal of the PSU. The signal is directly connected to the I/O port of the microcontroller unit of the PSU for function expansion.

Table 10-13 IP PRESENT# signal characteristics

Signal Characteristics	
Signal type	PSU side: This signal is pulled up to the 3.3 V auxiliary power source inside the PSU by a 2.49-kilohm resistor. System side: This signal is output by CPLD over the drive circuit and pulled up to 3.3 V by a 4.7-kilohm resistor.
IP PRESENT# = High	TBD
IP PRESENT# = Low	TBD

Table 10-14 IP PRESENT output

IP PRESENT Output	Min.	Max.
Low level voltage	0 V	0.6 V
High level voltage	2.0 V	3.465 V
Sink current, IP PRESENT = Low	-	1 mA
Source current, IP PRESENT = High	-	1 mA
Signal rise and fall time	-	1000 µs

10.10 CYC_PWR#

The CYC_PWR# signal is sent to PSUs by the system to shut down or restore the MV12 main output of the PSU.

- The signal is valid if the CYC_PWR# signal is at low level for 100–150 ms. The PSU shuts down after the delay time (configurable) and then starts after the restart time (configurable).
- The CYC_PWR# signal is invalid if both the OPOK and CYC_PWR# signals are low level.
- The signal is invalid if the CYC_PWR# signal is at low level for less than 100 ms.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

- The CYC_PWR# signal is invalid when a PSU is during delay shutdown or restarting. The CYC_PWR# signal is valid after the OPOK signal becomes high level.

Table 10-15 CYC_PWR# signal characteristics

Signal Characteristics	
Signal type	PSU side: This signal is pulled up to the 3.3 V auxiliary power source inside the PSU by a 2.49-kilohm resistor. System side: This signal is output by CPLD over the drive circuit and pulled up to 3.3 V by resistor greater than 4.7 kilohm.
CYC_PWR# = High	The PSU does not act.
CYC_PWR# = Low	The PSU enters power supply cycle power mode.

Table 10-16 CYC_PWR# output

CYC_PWR# Output	Min.	Max.
Low level voltage	0 V	0.6 V
High level voltage	2.0 V	3.465 V
Sink current, CYC_PWR# = Low	-	1 mA
Source current, CYC_PWR# = High	-	1 mA
Signal rise and fall time	-	1000 µs

10.11 I-MON

This signal is a 12 V current sharing signal and is connected to the system backplane.

PSU side: Internal current sharing bus

System side: The backplane directly connects the I-MON signals of all PSUs together.

10.12 PS_INTERRUPT

The PS_INTERRUPT# signal indicates PSU I2C alarm interruption. High level indicates that the PSU is normal. Low level indicates that the PSU generates an alarm. PSU exceptions include input undervoltage/overvoltage, output overvoltage/overcurrent, PSU overtemperature, and fan faults.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 10-5 Interconnect diagram of the PS_INTREEUPT signal

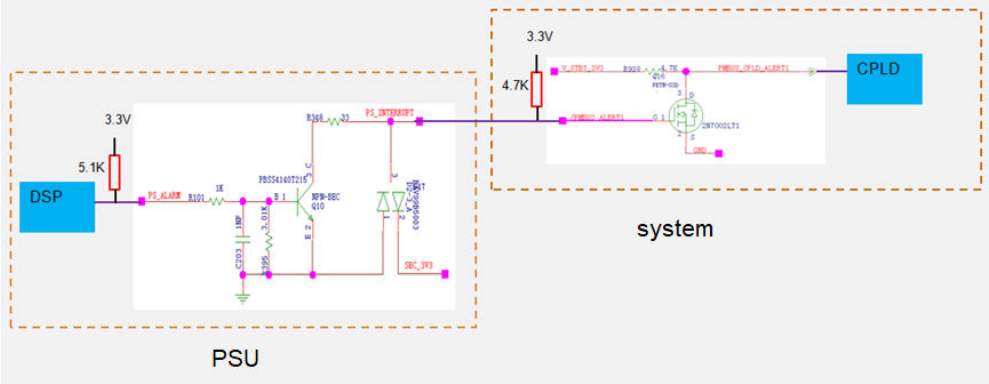


Table 10-17 PS_INTERRUPT# signal characteristics

Signal Characteristics	
Signal type	PSU side: The signal is output over a driver and there is no pull-up on the PSU side. System side: Pulled up to 3.3 V level and then reversely sent to the system over the MOS transistor.

10.13 SCL and SDA

The I2C serial clock line (SCL) and the serial data line (SDA) occupy two signal pins of the output connector.

PSU side:

- Interconnection in the PSU: SCL and SDA must be pulled up to 3.3 V by a 20-kilohm (reference value) resistor.
- The supply voltage source for the secondary-side MCU must be generated from the auxiliary power source and 12 V at the system side at the same time.
- When power is supplied from the system side, the fuse or overcurrent/short-circuit protection circuit must be used.
- The capacitance on the SCL and SDA in the PSU cannot exceed 66 pF.

System side: SCL and SDA are pulled up to 3.3 V by an equivalent resistor of 3 kilohm to 10 kilohm.

10.14 ADD, 0ADD1, and ADD2

Address bits A2, A1, and A0 are used to allocated to the PSU.

PSU side:

- Interconnection in the PSU: A2, A1, and A0 must be pulled up to the internal voltage source by a 10-kilohm (reference value) resistor. The supply voltage source must be the voltage source that supplies power to the secondary-side

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

MCU. The voltage source is supplied by the internal auxiliary power source, which is generated by the PSU and the system-side 12 V bus at the same time.

- When power is supplied from the system side, the fuse or overcurrent/short-circuit protection circuit must be used.

System side: If this signal is connected to SGND through a 300-ohm resistor, the address bit is 0. If this signal is left open, the address bit is 1.

10.15 EFUSEV

The system samples the input current of the main service load branch (12 V), converts the current to a linear voltage analog signal, and sends the signal to the EFUSEV pin of the PSU. If the value of EFUSEV is greater than 1.0 V, the main service of the system is working. In this case, the PSU cannot enable deep sleep. If the value of EFUSEV is less than 0.8 V, the main service of the system is powered off or does not work. In this case, the PSU can enable deep sleep.

Table 10-18 EFUSEV signal characteristics

Signal Characteristics	
Signal type	PSU side: Send to the PSU DSP by a 100-ohm series resistor. System side: ● If this function is enabled, the system sends the voltage analog signal of the main service circuit to the PSU, or CPLD outputs this signal over the drive circuit and this signal is pulled up to 3.3 V level by a 4.7-kilohm resistor. ● If this function is disabled, this signal is pulled up to 3.3 V level by a 4.7-kilohm resistor.
EFUSEV = High	Disable deep sleep.
EFUSEV = Low	Enable deep sleep.

Table 10-19 EFUSEV output

EFUSEV Output	**Min.**	**Max.**
Low level voltage	0 V	0.8 V
High level voltage	1.0 V	3.465 V

10.16 SMART_ON

The SMART_ON signal is used to wake up a cold-standby PSU (low level by default).

The system sets one of the PSUs as the active PSU by sending the **D0h 0x01** command. The active PSU sets the SMART_ON signal to high level. The system

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

sends a standby PSU command **(D0h 0x02h/0x03h/0x04h)**. Then the standby PSU disconnects the DC. (Two conditions must be met before the standby PSU disconnects the DC input: 1. The SMART_ON signal is at high level. 2. The system sends the **D0h 0x02/0x03/0x04** command.) If the active PSU is faulty and the SMART_ON# signal changes to low level, the standby PSU starts working.

Table 10-20 SMART_ON signal characteristics

Signal Characteristics	
Signal type	System side: The SMART_ON signals of all PSU backplanes are connected together through the cables.
SMART_ON = High	The PSU enters cold standby mode.
SMART_ON = Low	The PSU exits from cold standby mode.

Table 10-21 SMART_ON output

SMART_ON Output	**Min.**	**Max.**
Low level voltage	0 V	0.8 V
High level voltage	2.1 V	3.6 V

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

11 Communication

11.1 Input power precision

11.2 Online Upgrade, Prewarning, and Black Box

11.3 PSU Reverse Power Supply

11.4 External EEPROM

11.1 Input power precision

Table 11-1 Input power precision

Condition	Voltage	Input Power ≤ 20 W	20 W < Input Power ≤ 160 W	Input Power > 160 W
25-35°C (77-95°F)	48V DC	20 W is reported.	±5 W	±3%

NOTE

- The actual power is reported in the cold standby (standby) mode and hot standby (standby) mode; 0 W is reported in deep sleep mode and in the reverse power supply mode.
- If the input power is less than 20 W when the PSU is operating, 20 W is reported (the report is related only to the input power but not to the output load).

11.2 Online Upgrade, Prewarning, and Black Box

The power board and the MCU of power brick support the online upgrade (not in the undervoltage state), prewarning, and black box functions.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

11.3 PSU Reverse Power Supply

In case of parallel PSUs, if the system works normally and there is no input from a single PSU, the system must be able to communicate with the PSU normally.

11.4 External EEPROM

The circuit for the external EEPROM is reserved. Soldering the BOM is optional.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

12 Heat Dissipation Requirements and Fan Control

The PSU supports forcible air cooling with built-in fan modules. The PSU uses 40 mm (1.57 in.) (W) x 40 mm (1.57 in.) (H) fans. The fans draw air in from the rear panel (at the output port) and blow air out from the front panel (at the input port).

Heat Dissipation Requirements

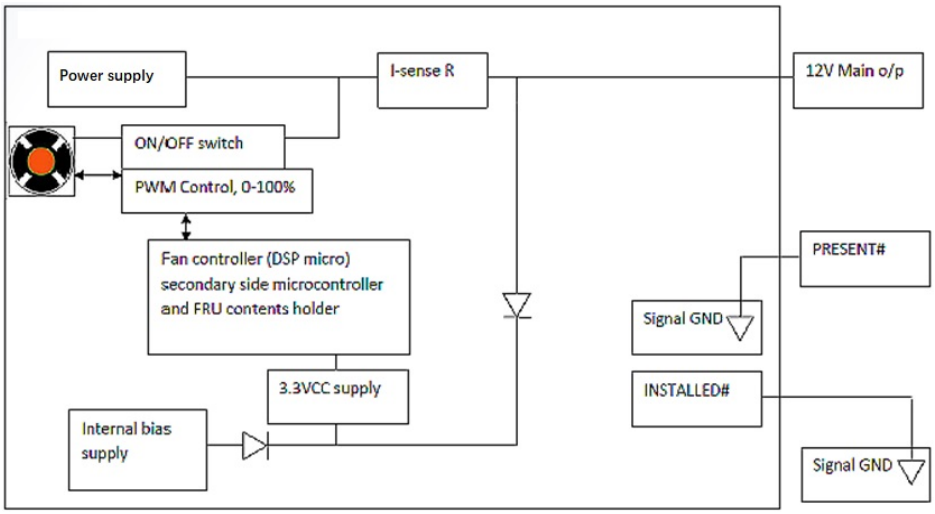
- Four temperature detection positions should be set inside the PSU: primary side, secondary side, air intake vent, and air exhaust vent.
- In MV6 mode, the PSU will not trigger overtemperature protection when the fan works at the lowest speed.
- In MV12 mode, the PSU will not trigger overtemperature protection when the fan works at the preset speed.
- When the PSUs work in redundancy, the PSU backplane has a voltage of 12 V. If one of the PSUs has no DC input, the fan of the PSU works at the lowest speed (the typical value is 20% of the highest speed) to prevent the high speed from taking the hot air to the PSU.
- When the temperature of the air intake vent exceeds 55 ± 5°C (131 ± 9°F), the system must linearly increase the fan speed to ensure the reliability of device or prolong overtemperature protection. The temperature hysteresis of the air intake vent when the fan speed adjustment is disabled is ±5°C (9°F). Before overtemperature protection is enabled, the fan must run at full speed.

Fan Power Supply Mode

- Fans obtain power from the output bus. PSU swap, fan turn-on/-off, and fan fault will not cause the system bus to drop out of the regulated voltage precision.
- The fan should be isolated if a fault occurs.
- In a fan, there is a switch circuit that is used to control the 12 V power supply to the fan.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Figure 12-1 Fan power supply circuit



Noise Requirements

Air Intake Vent Temperature	Load	Maximum Value	Test Method
25°C	Half load	50 dB (sound pressure level)	The test should be conducted at 1 m away from the PSU. The noise sensor should face the air exhaust vent of the fan.
25°C	Full load	65 dB (sound pressure level)	The test should be conducted at 1 m away from the PSU. The noise sensor should face the air exhaust vent of the fan.

Fan Protection

- If PSUs are connected in parallel and one of the fans or the power supply circuit is short-circuited or open-circuited, the 12 V and 6 V routes of the system backplane should not exceed the normal dynamic change voltage restriction specifications. The system operation should not be affected.
- The fan fault detection circuit can report a fault only when it detects a fan or fan circuit fault and the fault lasts for over 10 s.

NOTE

Long-time fan operation ages the internal bearing, which prolongs fan startup time. The fan is considered to be faulty only when it does not reach the specified rotational speed after more than 10 s.

- When the fan is faulty, the main output is disconnected. After the faulty fan restores, the main output restores.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

13 Indicator on the Panel

The power supply of the PSU indicator is the same as that of the secondary MCU.

Table 13-1 Indicator on the panel

Indicator	Status	Description
Power status indicator	Steady green	The input and mains MV12 output are normal.
	Blinking green at 1 Hz	● The input is normal, and the PSU shuts down MV12 output due to the INSTALLED# signal. ● The input is normal. The PSU enters MV6 mode because the PSON12V# signal is at high level. ● Input undervoltage occurs. ● The standby PSU is in cold standby mode. ● The PSU enters deep sleep mode. ● The input is normal, and the PSU enters SV12 mode because the IP PRESENT signal is at low level. ● After the PSU shuts down due to overtemperature protection in MV12 mode, the voltage restores to increase (excluding the case that the voltage restores to increase after the PSU enters MV6 mode due to the overtemperature protection triggered in MV12 mode). ● The overcurrent protection is triggered in MV6 mode and climbs to the output voltage in MV12 mode. ● The PSU enters MV12 mode after overcurrent occurs in SV12 mode.
	Steady orange	The input is normal. There is no output due to overtemperature protection, output overcurrent/short circuit, output overvoltage, short-circuit protection, or component failure (excluding failure of all components).
	Off	No input.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Indicator	Status	Description
	Blinking green at 4 Hz	Online upgrade is in progress. **NOTE** The orange indicator is on for 10 minutes after the upgrade fails.

Table 13-2 Panel indicator luminance

Indicator	Meaning	Luminance Range
Green	Normal	36-206 cd/m2
Orange	Normal	36-206 cd/m2

NOTE

- For normal startup, the green indicator should be on and should not blink. For normal poweroff, the power indicator should be off and should not be steady red or blinking red.
- The LED indicator is visible from the shell of the PSU. The position of the LED indicator should meet the ESD requirements.
- An I2C communication fault is not indicated by the indicator status.
- When the indicator is controlled by the main control unit, the indicator status depends on the main control unit command.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

14 Product Storage, and Transportation

Storage Requirements

The product must be stored in a dry and well-ventilated warehouse where the temperature ranges from –40°C to +85°C (-40°F to +185°F), the relative humidity is not greater than 80%, and no corrosive gas exists.

Transportation Requirements

During transportation, the product must be securely placed in a packing case. The packing case must comply with related international standards and be printed with marks such as "Handle with care" and "Keep dry". The packing case containing the product can be transported by any means. The packing case must be protected against rains, snows, and mechanical impact during transportation.

Enclosure Protection

Table 14-1 Enclosure protection level

Item	Requirement
Enclosure protection level	IP20 (normal maintenance surface)

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

A Appendix

A.1 EMC Requirements

Parameter	Conditions	Criterion
Conducted emission (CE)	6 dB	EN 55032, class A
Radiated emission (RE)	6 dB	EN 55032, class A
	6 dB, 30 MHz–1 GHz	FCC Part15, class A
Electrostatic discharge (ESD)	Contact: 6 kV, air: 8 kV	IEC 61000-4-2, criterion B
	Contact: 8 kV, air: 15 kV	IEC 61000-4-2, criterion C
Electrical fast transient (EFT)	±2 kV	IEC 61000-4-4, criterion B
Radiated susceptibility (RS)	10 V/m, 80 MHz-6 GHz	IEC 61000-4-3, criterion A
Conducted susceptibility (CS)	10 V, 150 kHz-80 MHz	IEC 61000-4-6, criterion A

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Parameter	Conditions	Criterion
Power magnetic susceptibility (PMS)	30 A/m	IEC 61000-4-8: 2001, criterion A
Surge	HVDC input port: ● Differential mode: ±1 kV for P to N ● Common mode: ±2 kV for P to PE, N to PE, and P and N to PE	IEC 61000-4-5, criterion B
Voltage fluctuation and flicker	Voltage fluctuation and flicker limit of class A products	IEC 61000-3-3
Current harmonics emission	Harmonic current limit of class A products	IEC 61000-3-2
Dip (HVDC)	Dip to 40% UT, hold-up time: 1 ms/3 ms/10 ms/30 ms/100 ms/300 ms/1000 ms	IEC 61000-4-11, criterion C
	Dip to 70% UT, hold-up time: 1 ms/3 ms/10 ms/30 ms/100 ms/300 ms/1000 ms	IEC 61000-4-11, criterion C
	Dip to 0% UT, hold-up time: 1 ms/3 ms/10 ms/30 ms/100 ms/300 ms/1000 ms	IEC 61000-4-11, criterion C
	Dip to 80% UT, hold-up time: 100 ms/300 ms/1000 ms/ 3,000 ms/10,000 ms	IEC 61000-4-11, criterion A
	Dip to 120% UT, hold-up time: 100 ms/300 ms/1000 ms/ 3,000 ms/10,000 ms	IEC 61000-4-11, criterion A

A.2 Product Safety Testing

Dielectric Strength Testing

Test Item	Min. Test Voltage	Test Time	Leakage Current	Arching Determination
Input and PE	2500 V DC	1 min	≤ 10 mA	No breakdown or arcing.

 Copyright © XFUSION INTERNATIONAL PTE. LTD.

Test Item	Min. Test Voltage	Test Time	Leakage Current	Arching Determination
	1500 V AC	1 min	≤ 10 mA	No breakdown or arcing.
Input to output	4242 V DC	1 min	≤ 10 mA	No breakdown or arcing.
Output and PE	GND of the 12 V output and the PE are short-circuited inside the PSU.			

NOTE

Input to output must meet the reinforced insulation requirements after the output ground is disconnected from the PE.

Ground Continuity Testing

Test Item	Maximum Test Voltage	Test Current	Maximum Resistance	Test Duration
PE input and shell	12 V	25 A	0.1 ohm	Until the readings are stable.

NOTE

This test item is applicable only to power supply devices with metal shells or L-shaped supports that are connected to the PE.

A.3 Reliability

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Mean time between failures (MTBF)	-	500,000	-	Hours	Telcordia SR332, V_{in} = 230 V AC/ 240 V DC; rated load, T_A = 25ºC

 Copyright © XFUSION INTERNATIONAL PTE. LTD.