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*Front- end Switch Mode Power Supply*  
*PTS162M1212*

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This paper is prepared as of December 2016 and subject to change without notice.

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## Safety Precautions

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Be sure to observe the precautions explained below.





1. Be sure to read “Operation Manual” and “Detailed Specifications” before using these products.
2. The products are DC stabilized power supplies with special structures created for mounting on devices. Use only for mounting on devices.
3. Although Sanken strives to improve the quality and the reliability of the products, please implement safety design of the devices under customers' responsibility not to endanger human life, health and property due to malfunction and/or failures of the products when using.
4. Sanken products listed in this publication are NOT intended to use for equipment and applications where extremely high reliability is required such as aerospace equipment, nuclear power-control stations and medical equipment, for which there is enhanced risk that the products could endanger human life or health due to malfunction and/or failures of the products (Classified III or above per GHTF, Global Harmonization Task Force, Medical Equipment Class) Sanken assumes no responsibility for any damage to any customer and/or any third party due to use of Sanken products for the such use.
5. When considering use of the products for the following equipment and applications, for which there is the risk that may heavily endanger human life or affect maintenance of public function, be sure to secure sufficient fail-safe function at customers' devices by means of multiplexing of systems and other method.
  - Electric train and elevator, etc. that may result in personal injury.
  - Vehicles and vessels, etc. that may be affected by oscillation and shock.
  - Traffic system, etc. that may exert an important influence on society and public.
  - Any other applications and equipment similar to those mentioned above.
6. Be sure to observe the items below
  - Do not disassemble, repair or modify these products.
  - Do not touch inside the power supplies because of high voltage.
  - Use the products within designated input voltage, frequency, output voltage and output current ranges.
  - Be sure to observe designated ambient environment conditions such as ambient temperature and humidity.]
  - Each power supply model has a designated method for installation and mounting. Observe installation and mounting directions.

## Appearance and Meaning of Safety Warnings

In this document, the levels of safety warnings are divided into two categories, Hazard and Caution.




 Hazard	Disregarding a Hazard display and incorrectly using the product could result in death and/or serious injury.
 Caution	Disregarding a Caution display and incorrectly using the product could result in personal injury and/or physical damage.

Be sure to observe the safety precautions indicated on the product and in documentation by symbols and text. The general meaning of symbols is as follows:













	Prohibited action
	Strong warning
	Electric shock hazard
	Fire hazard

## Hazard and Caution Safety Warnings

### General Cautionary Notices

 Hazard	
	<ul style="list-style-type: none"> <li>• Shock hazard</li> <li>• Never take off the cover.</li> <li>• There is a high voltage circuit inside and touching it mistakenly could result in death and/or serious injury.</li> </ul>
	<ul style="list-style-type: none"> <li>• Fire hazard</li> <li>• If any abnormal odor or abnormal noise, or smoking or ignition arises in the product, immediately turn off the product and cut the power input to the product by opening an external circuit breaker or other means.</li> <li>• Please contact the vendor from which the product was purchased and/or Sanken.</li> <li>• <u>In case of fire, use a fire extinguisher of a powder/ABC type approved for use on electrical fires.</u></li> </ul> <p><u>Note: Never use water.</u></p>

## Other Precautions

<b>! Caution</b>	
	Each power supply model has a designated input/output range. Be sure to use the products within designated input/output range.
	Be sure that the total power consumption connecting with the load does not exceed the rated output capacity per each power supply. If a power supply is used under an overload condition, it could cause fire.
	Be sure to use thick wire for input/output wiring, and that it is appropriate for the input/output power. If thin wires are used, it could cause fire.
	Be sure not to use and/or store the products in temperature, humidity, and dew condensation conditions beyond the ambient environmental conditions specified in the catalog and/or operation manual, otherwise failure of the products could result.
	When the power supply is operated in dusty conditions, please apply dust proofing measures. The dust could interfere heat dissipation and cause failure and/or fire.
	When the power supply is installed, be sure to use designated screws (paying particular attention to screw length and diameter), otherwise electric shock and/or fire could result.
	The products are not intended for use in equipment that requires high reliability for sustaining human life. Be sure not to use the products for any particular application such as in nuclear reactor and/or power control systems, aerospace applications, special Medical equipment, and so forth.
	When installing the products, be sure to connect each input terminal and output terminal without fail, otherwise malfunction and damage to the products, personal injury, and fire could result.
	Be sure not to apply any external voltage to output terminals of the products, otherwise damage to the internal devices of the products could result.
	Be sure not to use and/or store the products in an environment with corrosive gases such as hydrogen sulfide, sulfur dioxide, and so forth, otherwise damage to the products could result.
	When operating the products in an environment with interference from radio waves, electric fields, or magnetic fields, the products may malfunction, which could lead to failures. Be sure not to use the products under such conditions.
	Although Sanken strives to improve the quality and the reliability of the products, the customer and user are responsible to be sure to apply safe design of their equipment before using the products.

## Introduction to PTS162M1212

### General Description

The Server PSU PTS162M1212 provides high power density and high efficiency, It's a customizable 1600W PSU for servers that exceeds 80 PLUS Platinum with Sanken's innovative design technology.



### Features and Benefits

- Exceeds 80 PLUS Platinum with Sanken's innovative designs
  - PFC: CCM with SiC diode to minimize loss
  - DC/DC: Interleaved Resonant Converter and Synchronized Rectifier
  - Protection: N+1 Redundancy, OVC, OCP, low-voltage and thermal protections
  - High Power Density: 2.1 W/cc
- Serial communication function (I2C) is incorporated
  - System commands enable communications between the system (master) and the Power Supply (slave)
- A modular design for quick customization to meet customer's requirements
  - Facilitates a quick re-fitting to meet customer's new design specs
  - Facilitates flexible manufacturing scheduling

PTS162M1212		12V (Main)	12V (Sub)
Output Current	AC230V	132A	2A
	AC115V	66A	2A
Output Power	AC230V	1608W	
	AC115V	816W	
Input Voltage		AC90V ~ AC264V (50 ~ 60 Hz)	
Size & Power Density		265mm x 73.5mm x 40mm (2.1W /cc)	

Parameter		Value			
Input Condition	Rated Input Voltage	100VAC to 120VAC/200VAC to 240VAC			
	Allowable Input Voltage	90VAC to 132VAC/180VAC to 264VAC			
	Rated Frequency	50 / 60 Hz			
	Allowable Frequency Range	47 to 63 Hz			
	Power Factor (typ)	0.99 at 100VAC/ 0.95 at 230VAC			
	Efficiency (typ) at maximum load	90% (VIN = 100V) / 91% (VIN = 230V)			
	Inrush Current (cold start) <sup>1, 2</sup>	25Ao-p or less			
	Leakage Current	0.8 mA (VIN = 264V/60Hz) or less			
Output Conditions	Output	12V	SUB(12V sub)		
	Rated Output Voltage	12.1V	12.1V		
	Allowable Output Current Range	0.5A to 66A(VIN=100V)	0.1A to 2.0A(VIN=100V)		
		0.5A to 132A(VIN=200V)	0.1A to 2.0A(VIN=200V)		
	Constant Voltage Accuracy	±5%	±5%		
	Ripple Noise Voltage <sup>3</sup>	240mVp-p or less	240mVp-p or less		
	Output Holding Time <sup>1</sup>	10ms or more (at 80% load)			
Additional Functions	Over voltage Protection	Detecting value	13.5V to 15.0V	13.5V to 15.0V	
		Output control	Latch 12V output	Latch 12V and 12Vsub	
	Over current Protection	Detecting value 100VAC	73A or more	2.2A or more	
		Detecting value 200VAC	145A or more		
		Output control	Output drooping and latch 12V	Output drooping and Restart	
	Low voltage Protection	Detecting value	11.1V or less	N/A	
		Output control	Latch 12V output		
	Temperature Protection	Detecting value	Detecting point PCB temperature at the detecting point 105°C ± 10%		
		Output control	Latch 12V output		
	FAN anomaly	Detecting value	When the frequency gets lower by more than 30% against command value		
Output control		Latch 12V output			
Environmental Conditions	Operating Temperature Range <sup>4</sup>		0°C to 45°C with Derating		
	Storage Temperature Range		-40°C to 70°C		
	Operating Humidity Range		20% to 80%		
	Storage Humidity Range		5% to 80%		
	Cooling Requirements		Forced air cooling		
	Vibration Resistance	Vibration Frequency		10 to 55 Hz	
		Sweep Time		3 minutes	
		Acceleration		19.6 m / s <sup>2</sup> (2 G)	
		Vibration Directions		x, y, z	
		Vibration Time		One hour in each of three directions	
	Shock Resistance		98 m / s <sup>2</sup> (10 G); conduct this test on an oak board with a flat surface and a thickness of 10 mm or more; lift one edge of the bottom side of the unit 50 mm and drop it on the board; drop 3 times on each of the 4 edges		
Installation Conditions		Install horizontally (output connector is downward) and/or vertically (AC inlet is downward)			

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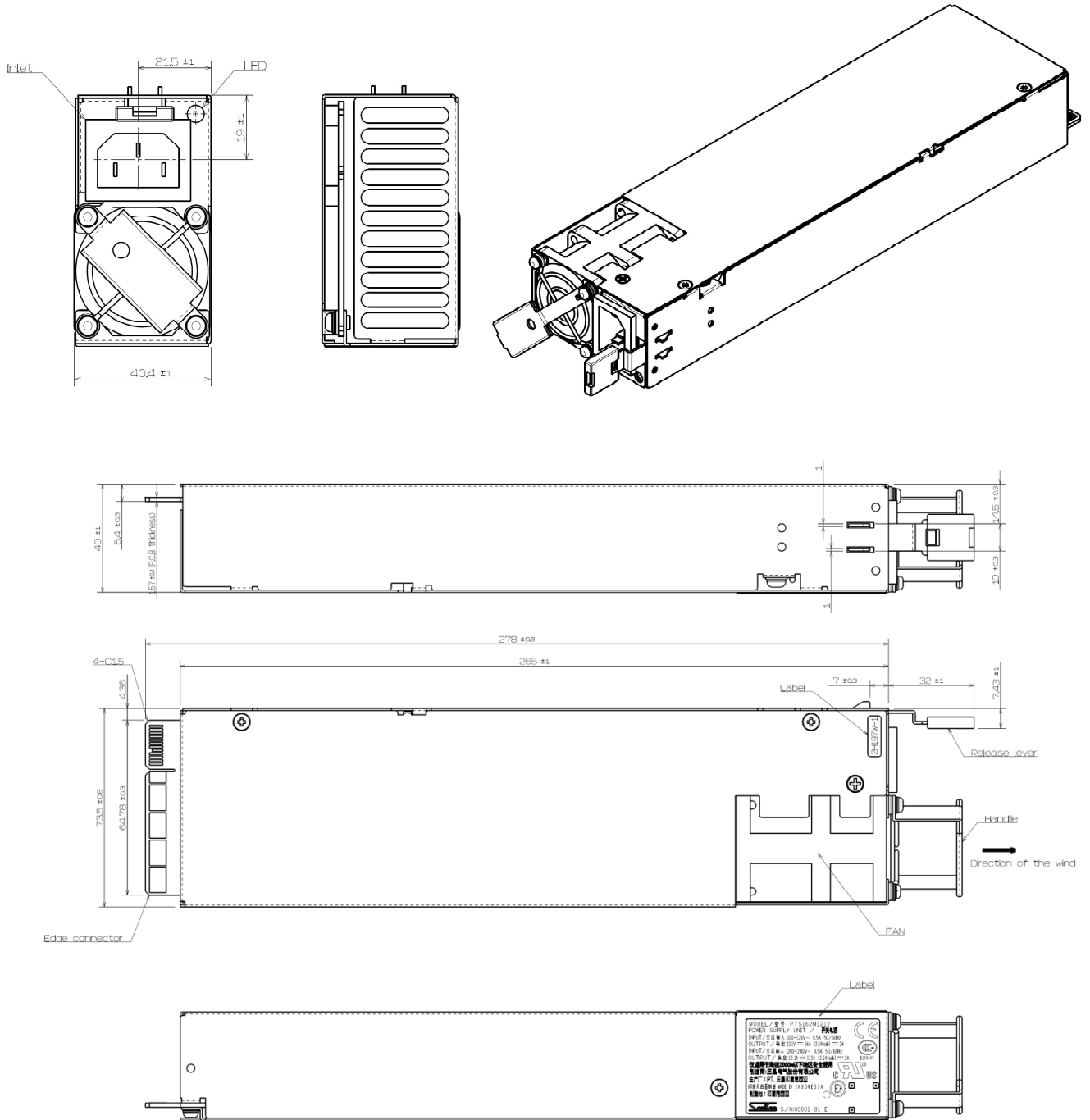
### PTS162M1212

Parameter		Value	
Insulation	Insulation Withstand Voltage 5	Input-Output	3000 VAC one minute (leakage current 10 mA or less)
		Input-FG	1500 VAC one minute (leakage current 10 mA or less)
	Insulation Resistance 5	Input-Output	50 M $\Omega$ (measured with 500 VDC Megger )
		Input-FG	
Applicable Standards	Safety Standards	UL60950-1, CSA60950-1, EN60950-1, CCC	
	Conducted Emissions	Designed to meet EN55022-A, VCCI-A, FCC-A, CISPR22-A	
	EMC	Designed to meet harmonic current IEC61000-3-2	
Structure	Size	73.5(W) x 278(D) x 40(H) mm without projection	
	Weight	1.25kg	

1. Specified under ambient temperature of 25°C.
2. More current above noted values may flow at restart (ambient temperature of 25°C).
3. Ripple noise is measured with a 20 MHz oscilloscope using a 1:1 probe.
4. Refer to Derating data per ambient temperature herein.
5. Insulation conditions are specified under room temperature and normal humidity.



## Names of Product Parts



## Input and Output Terminals, Connector and Pin Assignments

■ Input terminal, Connector

AC inlet: IEC60320 C14

■ Output terminal, connector and Pin Assignments

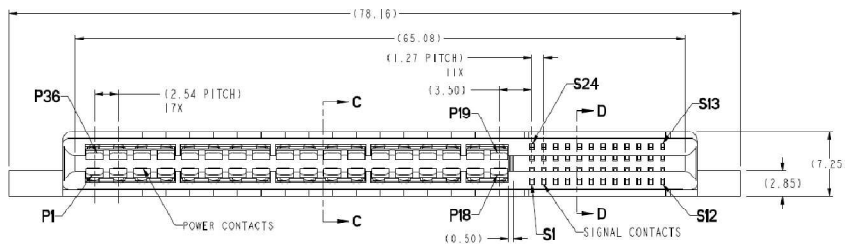
Output: Card-edge

Matching connector: 10107844-001LF FCI

10107844-002LF FCI

10107844-003LF FCI

10107844-004LF FCI



■ Pin Assignments

POWER MODULE		SIGNAL MODULE					
P1~8	12V	S1	0V	S10	SUB	S19	SDA
P29~36	12V	S2	PSON#	S11	SUB	S20	PSKILL
P9~18	RTN 12V	S3	AC_OK#	S12	SUB	S21	SMB_Alert#
P19~28	RTN 12V	S4	PW_OK	S13	SUB	S22	12VLS
S10~14	SUB	S5	PWR_LIMIT-N	S14	SUB	S23	12VRS(-)
S8, 9	RTN SUB	S6	PS_A1	S15	RTN SUB	S24	12VRS(+)
S15, 16, 18	RTN SUB	S7	PS_A0	S16	RTN SUB	---	---
---	---	S8	RTN SUB	S17	SCL	---	---
---	---	S9	RTN SUB	S18	RTN SUB	---	---

No.	Symbol	Description	Remarks
S1	0V	Single Ground	
S2	PSON#	12V ON/OFF signal	LOW:12V ON $V \leq 1.0V$ High:12V OFF $2.0 \leq V \leq 5.25V$
S3	AC_OK#	Input voltage detection signal	High: Normal input voltage LOW: Input voltage anomaly
S4	PW_OK	Normal power output signal	High: Normal power output $2.4 \leq V \leq 5.25V$ LOW: Output voltage anomaly $V \leq 0.4V$
S5	PWR_LIMIT-N	Limit signal to control output power	LOW:800W $V \leq 1.0V$ High:1600W $2.0 \leq V \leq 5.25V$
S6	PS_A1	Signal to set I2C device slave address	
S7	PS_A0	Signal to set I2C device slave address	
S8	RTN SUB	Sub power supply ground	
S9	RTN SUB	Sub power supply ground	
S10	SUB	Sub power supply output	
S11	SUB	Sub power supply output	
S12	SUB	Sub power supply output	
S13	SUB	Sub power supply output	
S14	SUB	Sub power supply output	
S15	RTN SUB	Sub power supply ground	
S16	RTN SUB	Sub power supply ground	
S17	SCL	I2C signal	
S18	RTN SUB	Sub power supply ground	
S19	SDA	I2C signal	
S20	PSKILL	Forced shutdown signal at hot-swap	LOW: Enable PSON# $V \leq 1.0V$ High: Forced shutdown $2.0 \leq V \leq 5.25V$
S21	SMB_Alert#	Power supply anomaly signal	High: normal LOW: anomaly
S22	12VLS	12V current balance signal	
S23	12VRS(-)	12V remote sensing (-)	
S24	12VRS(+)	12V remote sensing (+)	

## Redundancy Operation

Refer to connecting example of redundancy operation as per Chart5-1 below.  
Note that the load sharing wire should be short and with the same length.

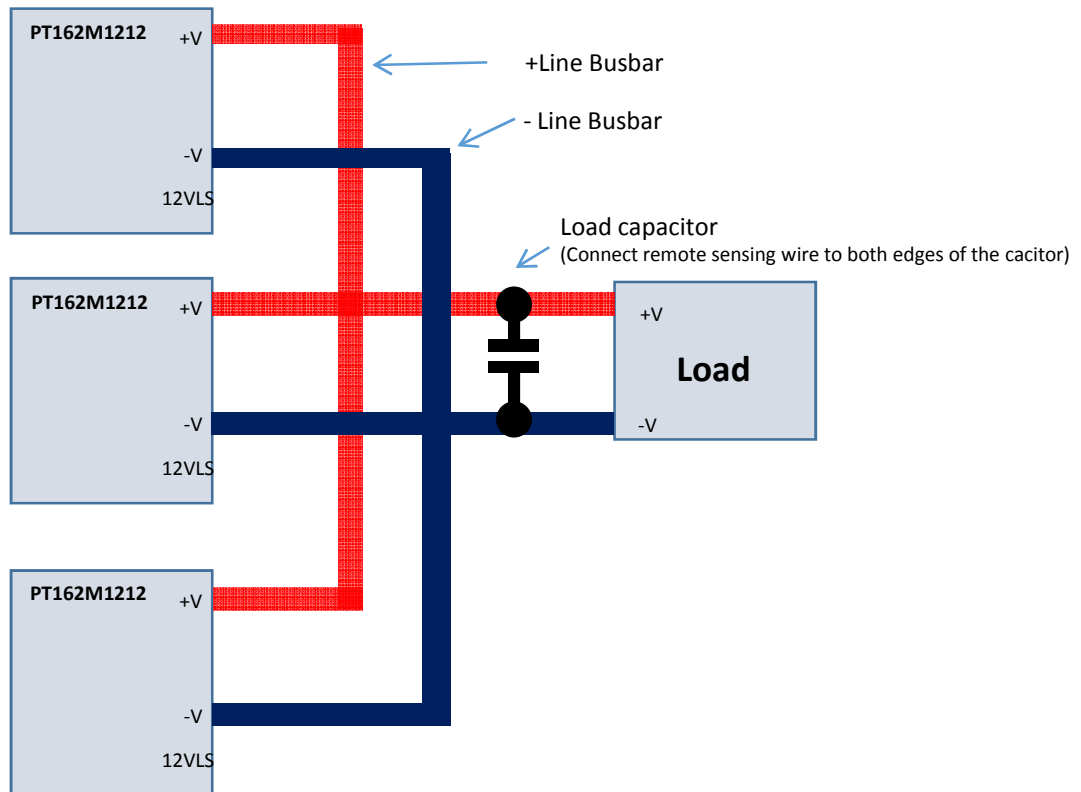


Chart 5-1

- Enable to connect 4 power supplies with identical rate at maximum.
  - Backflow prevention diode for redundancy operation is incorporated at the output.
  - Output current is balanced by connecting load sharing terminal (12VLS)
- Be sure to conduct thorough evaluation before use because of unbalanced current due to the impedance of wiring and load.

Table 5-1 Load spec at redundancy operation

		12V	12Vsub
Redundancy operation (Hot-swappable)		Yes	N/A
Maximum allowable connection		4 power supplies	N/A
Maximum allowable output current	For 100VAC	66× (N-1) [A] 1	N/A
	For 200VAC	132× (N-1) [A] 1	N/A

1. N: Connecting power supplies, 2 to 4 power supplies

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## Functional Description

### Input Voltage Range, Harmonic Current and Inrush Current

#### ■Input voltage range

The input voltage range of power supply is 90 to 132VAC or 180 to 264VAC. If other than specified input voltages are applied, it could cause the products to fail to operate within the specifications and/or cause permanent failures of the products.

#### ■Harmonic current

A harmonic current suppression circuit (active filter) is incorporated in to power supply and harmonic current is suppressed in all load conditions from no load to full load. The input voltage range at which the harmonic current suppression circuit activates is between 90 and 132VAC or 180 and 264VAC.

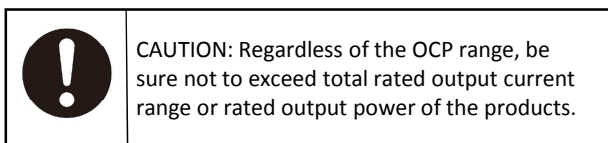
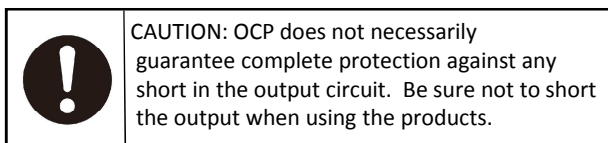
#### ■Inrush current

If a switch is used for controlling input, be sure to select a switch that can withstand the expected inrush current. If the AC is reapplied, be sure to wait until the supply is being switched off and the internal cooling fan has stopped moving, and then reapply AC, otherwise a large current could flow after release of the inrush preventive circuit.

### Protection Functions

#### ■Over current protection (OCP)

Once over current protection activates, the power supply shuts down. The OCP activates at 110% and more of the rated current. If output is stopped due to an over current condition, be sure to evaluate the load condition and remove the causes of over current before reapply AC either by changing PSON# signal from HIGH to LOW or by input of the power supply.



#### ■Overvoltage protection (OVP)

12V overvoltage protection circuit is incorporated into power supply. When OVP is activated, it shuts down 12V output. If output is stopped due to an overvoltage condition, be sure to evaluate the load condition and remove the causes of overvoltage before reapply AC either by changing PSON# signal from HIGH to LOW or by input of the power supply.

#### ■Under voltage protection (UVP)

12V under voltage protection circuit is incorporated into power supply. When UVP is activated, it shuts down 12V output. If output is stopped due to an under voltage condition, be sure to evaluate the load condition and remove the causes of under voltage before reapply AC either by changing PSON# signal from HIGH to LOW or by input of the power supply.

#### ■Thermal shutdown protection

Thermal shutdown protection circuit is incorporated into power supply. The circuit is activated when the following abnormalities occur:

- When the airflow volume of the internal fan is lowered and/or stopped, the internal temperature rises.
- When the power supply is used for a long time in conditions exceeding the total rated power.
- When the power supply is used in an ambient temperature exceeding specified temperature in the specifications.

When thermal shutdown is activated, it shuts down 12V output. Be sure to shut off the AC supply and remove the causes of the overheating, as well as delay long enough for the products to cool to normal temperatures, before reapplying the AC supply. If the application requires that the product be used continuously, be sure to apply thorough investigation of the causes and countermeasures for overheating before using the product.

## Alarm Functions

### ■AC\_OK# signal

Input voltage monitoring signal and open collector output.

When PWR\_LIMIT-N is at LOW level, the power supply gets OFF at the input voltage below 90VAC and ON at input voltage more than 90VAC. When PWR\_LIMIT-N is at HIGH level, the power supply gets OFF at the input voltage below 180VAC and ON at input voltage more than 180VAC

### ■PW\_OK signal

Normal power output signal. When the main output starts up normally, HIGH level signal is output.

HIGH: Normal output voltage  $2.4 \leq V \leq 5.25V$  LOW: Abnormal output voltage  $V \leq 0.4V$

### ■SMB Alert# signal

Power failure notice signal and open collector output.

OFF: Normal power ON: Abnormal power

Alarm	Conditions	
AC_OK# (Open collector)	Good	35Vmax
	Bad	LOW (0.8V and less, 8mA and less)
PW_OK	Good	$2.4 \leq V \leq 5.25V$
	Bad	$V \leq 0.4V$
SMB Alert# (Open collector)	Good	35Vmax
	Bad	Low (0.8V and less, 20mA and less)

Table6-1 Alarm specification

### ■LED Display (Display status of power supply)

Status of power supply	12V ○: With output x: No output	12Vsub ○: With output x: No output	LED Green/Orange
Normal operation (AC is applied and 12V is output)	○	○	Green light
Normal operation (Stand-by and only 12Vsub is out)	x	○	Green blink
Abnormal operation (Due to any cases of OCP, OTP, OVP, UVP and fan stop)	x	x	No light
Abnormal operation (Due to any cases of OCP, OTP, OVP, UVP and fan stop)	x	○	Orange light
Stop AC input for all power supplies	x	x	No light

Table6-2 LED Display

## Remote sensing

### ■Remote sensing

Be sure to connect remote sensing wire when using power supply. Remote sensing functions allow the system to compensate for voltage reduction due to output wiring. The compensated voltage is 0.2V or less.

When using remote sensing, be sure to conduct a thorough evaluation and adjustment of the application system, based on the remote sensing connection example shown in the Chart 6-1.

Be sure to pay attention to following notes when using the remote sensing function:

- Pay attention to wiring connection not to make contact failure such as loosened screw of the load wire, otherwise load current may flow into the remote sensing wire, which may cause the damage to the power supply due to the heat.
- Be sure to use thick wire, with a sufficient current capacity margin above the maximum output current for wiring from power supply to the load. Set the line drop to the compensated voltage or below.
- Oscillating waveforms and/or fluctuations of output voltage could arise due to wiring and load impedance. Be sure to apply a thorough evaluation before using the products.

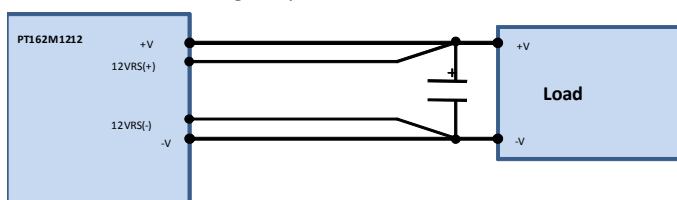


Chart 6-1 Remote sensing connection example

## I2C Specification

■ **Communication speed**

Correspond to up to 100kHz

■ **Error check**

Apply PEC protocol against all commands corresponded. CRC-8 is applied to PEC.

■ **Inapplicable commands and PEC error**

NACK is responded to the inapplicable commands and communication error bit of STATUS\_CML is set.

In the case of no PEC and/or PEC error, relevant bit of STATUS\_CML is set after invalidation of the relevant commands.

■ **Address assignation**

The address is determined by 2 terminals (2 bits) of PS\_A0 and PS\_1

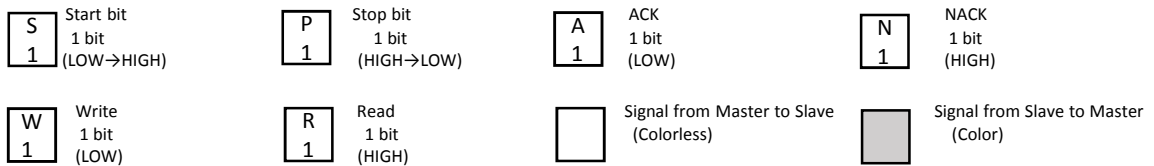
Address(A1) / Address(A0)		0/0	0/1	1/0	1/1
Power Supply I2C Device Address	Write	B0h	B2h	B4h	B6h
	Read	B1h	B3h	B5h	B7h

Reference: B0h    1011 0000    (bit0= 0 represents Write)  
               B1h    1011 0001    (bit0= 1 represents Read)

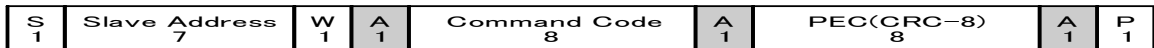
■ **Communication protocol**

Communication protocol used for power supply is as follows:

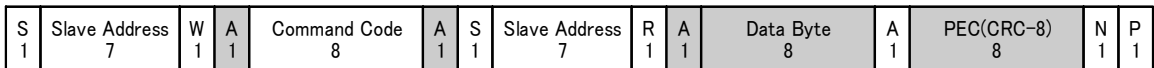
- Send Byte with PEC protocol
- READ with PRC protocol (Byte/Word/Block)



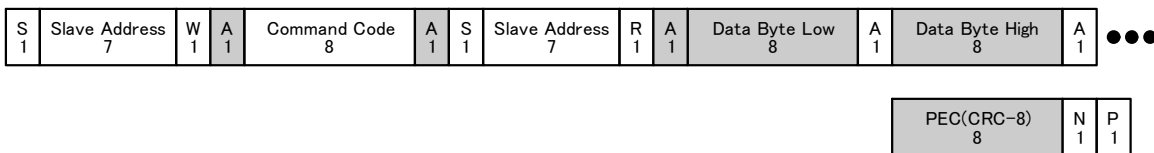
Send Byte with PEC Protocol



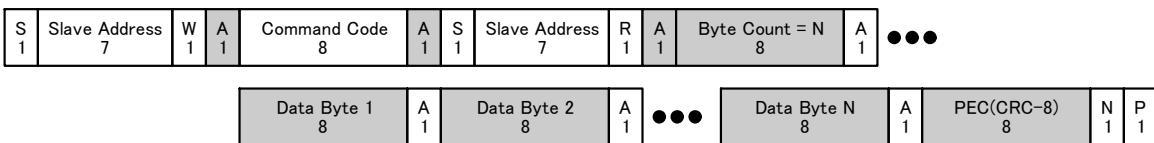
Read Byte with PEC Protocol



Read Word with PEC Protocol



Block read with PEC Protocol



### ■Corresponding commands

The following commands are corresponding to power supply and no other commands are applicable to power supply.

Command Code	Command Name	Type: Write Data	Type: Read Data	er of	Description
0x03	CLEAR FAULTS	Send Byte	N/A	0	Command to clear "STATUS" information.
0x19	CAPABILITY	N/A	Read Byte	1	Command to inform main performance of power supply to host Transmit fixed data mentioned below. 0b10010000 [bit7] PacketErrorChecking embeded : 1 [bit6-5]MaximumBusSpeed 100kHz : 00 [bit4] SMBALERT embeded : 1 [bit3-0]RESERVED 0000
0x20	VOUT_MODE	N/A	Read Byte	1	Command to format Output Voltage and other relative parameters. LINEAR mode is applied to power supply and index is fixed as -9. Tranmit fixed data mentioned below. 0b00010111 bit[7-5] 000b = Linear mode bit[4-0] 10111 = -9
0x79	STATUS_WORD	N/A	Read Word	2	Command to communicate brief abnormal status of power supply. Transimit intelligence data mentioned below. Low[bit7] Not used Low[bit6] OFF Low[bit5] VOUT_OV Low[bit4] Not used Low[bit3] VIN_UV Low[bit2] TEMPERATURE Low[bit1] CML Low[bit0] NONE OF THE ABOVE High[bit7] VOUT High[bit6] IOUT High[bit5] INPUT High[bit4] Not Used High[bit3] POWER_GOOD# High[bit2] FANS High[bit1] Not used High[bit0] UNKNOWN
0x7A	STATUS_VOUT	N/A	Read Byte	1	Command to communicate abnormal status of output voltage. Transmit intelligence data mentioned below. [bit7] VOUT Overvoltage Fault [bit6] Not Used [bit5] Not Used [bit4] VOUT Undervoltage Fault [bit3] Not Used [bit2] Not Used [bit1] Not Used [bit0] Not Used
0x7B	STATUS_IOUT	N/A	Read Byte	1	Command to communicate abnormal status of iutput current and output power. Transmit intelligence data mentioned below. [bit7] Not Used [bit6] Not Used [bit5] Not Used [bit4] Not Used [bit3] Not Used [bit2] Not Used [bit1] Not Used [bit0] Not Used

0x7C	STATUS_INPUT	N/A	Read Byte	1	Command to communicate abnormal status of input. Transmit intelligence data mentioned below. [bit7] Not Used [bit6] Not Used [bit5] Not Used [bit4] VIN Undervoltage Fault [bit3] Unit Is Off For Insufficient Input Voltage [bit2] Not Used [bit1] Not Used [bit0] Not Used
0x7D	STATUS_TEMPERAT	N/A	Read Byte	1	Command to communicate abnormal status of temperature. Transmit intelligence data mentioned below. [bit7] Overtemperature Fault [bit6] Not Used [bit5] Not Used [bit4] Not Used [bit3] Not Used [bit2] Not Used [bit1] Not Used [bit0] Not Used
0x7E	STATUS_CML	N/A	Read Byte	1	Command to communicate abnormal status of communication. Transmit intelligence data mentioned below. [bit7] Invalid Or Unsupported Command Receive [bit6] Invalid Or Unsupported Data Receive [bit5] Packed Error Check Failed [bit4] Not Used [bit3] Not Used [bit2] Not Used [bit1] Not Used [bit0] Other Memory Or Logic Fault has occurred
0x81	STATUS_FANS_1_2	N/A	Read Byte	1	Command to communicate abnormal status of Fan. Transmit intelligence data mentioned below. [bit7] Fan1 Fault [bit6] Fan2 Fault [bit5] Not Used [bit4] Not Used [bit3] Not Used [bit2] Not Used [bit1] Not Used [bit0] Not Used
0x88	READ_VIN	N/A	Read Word	2	Command to communicate input voltage value. Use Linear Data Format. Unit is [Vrms].
0x89	READ_IIN	N/A	Read Word	2	Command to communicate input current value. Use Linear Data Format. Unit is [Arms].
0x8B	READ_VOUT	N/A	Read Word	2	Command to communicate output voltage value. Use Linear Data Format designated by VOUT_MODE command. (VOUT_MODE command is Linear Mode and fixed as index -9. Unit is [V].
0x8C	READ_IOUT	N/A	Read Word	2	Command to communicate output current value. Use Linear Data Format. Unit is [A].
0x8D	READ_TEMPERATUR E_1	N/A	Read Word	2	Command to communicate temperature value of intake part. Use Linear Data Format. Unit is [°C].



0x8E	READ_TEMPERATURE_2	N/A	Read Word	2	Command to communicate temperature value of the highest part. Use Linear Data Format. Unit is [°C].
0x90	READ_FAN_SPEED_1	N/A	Read Word	2	Command to communicate frequency of FAN1. Use Linear Data Format. Unit is [rpm].
0x91	READ_FAN_SPEED_2	N/A	Read Word	2	Command to communicate frequency of FAN2. Use Linear Data Format. Unit is [rpm].
0x96	READ_POUT	N/A	Read Word	2	Command to communicate output voltage value. Use Linear Data Format. Unit is [W].
0x97	READ_PIN	N/A	Read Word	2	Command to communicate input power value. Use Linear Data Format. Unit is [W].
0x98	PMBUS_REVISION	N/A	Read Byte	1	Command to communicate REVISION of I2C. Transmit fixed data mentioned below. 0b00010001 [bit7-4] 0010 Revision of Part1 is 1.2. [bit3-0] 0010 Revision of Part2 is 1.2.
0x99	MFR_ID	N/A	Block Read	15	Command to communicate manufacturer ID (Manufacturing name). Use Block Read Protocol. Use ASCII code for data. Transmit 1 byte of Byte Count followed by 15 bytes. Transmit fixed data mentioned below. Byte Count=15, "SANKEN ELECTRIC"
0x9A	MFR_MODEL	N/A	Block Read	6	Command to communicate model name. Use Block Read Protocol. Use ASCII code for data. Transmit 1 byte of Byte Count followed by 6 bytes. Transmit fixed data mentioned below. Byte Count=6, "2H197W"
0xD0 ~ 0xFD	MFR_SPECIFIC_00 ~ MFR_SPECIFIC_45	N/A	N/A		Field to be used by Sanken exclusively. The value is inconstant when doing READ.

■ Accuracy of Power information

	Unit	Accuracy
READ_VIN	Vrms	±5%
READ_IIN	Arms	±5% or ±0.3Arms
READ_VOUT	V	±5%
READ_IOUT	A	±5% or ±3A
READ_TEMPERATURE_1, 2	°C	±3°C
READ_POUT	W	±10% or ±30W
READ_PIN	W	±10% or ±30W

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## Derating and life cycle

### ■ Derating per ambient temperatures

The derating characteristic of the products at various ambient temperatures is shown in the chart below. Be sure the power supplies are used within specification, considering this derating characteristic.

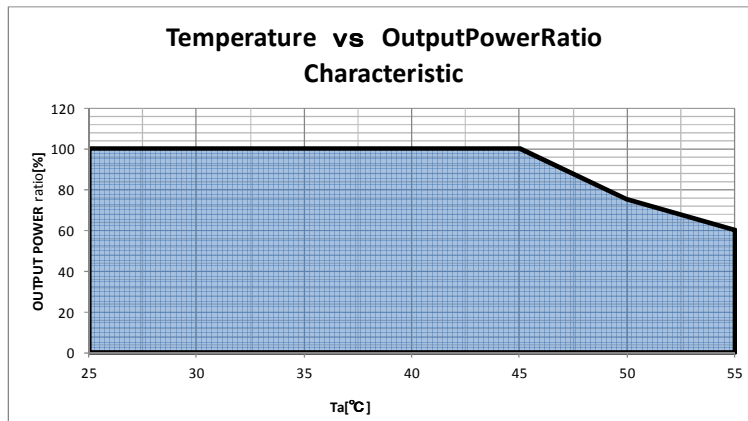


Chart 8-1 Derating characteristic per ambient temperatures

### ■ Life cycle

Life cycle expectation: 6 years @ 35°C, Load 66A (12V)

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When using the products described herein, the applicability and suitability of such products for the intended purpose shall be reviewed at the users' responsibility.

Although Sanken undertakes to enhance the quality and reliability of its products, the occurrence of failure and defect of semiconductor products at a certain rate is inevitable.

Users of Sanken products are requested to take, at their own risk, preventative measures including safety design of the equipment or systems against any possible injury, death, fires or damages to society due to device failure or malfunction.

Sanken products listed in this publication are designed and intended for use as components in general-purpose electronic equipment or apparatus (home appliances, office equipment, telecommunication equipment, measuring equipment, etc.). Their use in any application requiring radiation hardness assurance (e.g., aerospace equipment) is not supported.

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