TECHNICAL REFERENCE NOTE

ARTESYN DS1200DC SERIES

1200 Watts Distributed Power System

PRODUCT DESCRIPTION

Advanced Energy's DS1200DC series bulk front end power supply is the DC-input version of its DS1200 AC-input counterpart. Mechanically identical to the AC-input version, this product allows system operation from a Telco style 48Vdc input. Rated at 1200 watts, the power supply provides a main 12V output and a 3.3V or optional 5.5V standby output. Active current sharing allows this power supply to be paralleled with the AC-input version, for use in battery back-up systems where both AC and DC input capabilities are required. The main 12V output can deliver up to 98A and stays within regulation down to zero load, making it perfect for feeding downstream DC-DC converters in systems that use distributed power architectures (DPA).

SPECIAL FEATURES

- GR-1089-CORE Issue 4 compliant
- 1U X 2U form factor
- No minimum load required
- Internal OR'ing fets
- Active power factor correction
- 21.71W/in^3
- Internal fan speed control
- Inrush current control
- Full digital control
- N+1 redundant
- Hot plug operation
- Active current sharing shares with DS1200 AC unit (20% to 100% load)
- Two years warranty
- Built-in cooling fan (40mm x 28mm)
- I^{2}C communication interface bus
- EEPROM for FRU data
- NEBS compliant
- INTEL, SSI Std. logic timing
- INTEL, SSI Std. FRU data format

SAFETY

- UL/cUL 60950 (UL Recognized)
- NEMKO + CB Report EN 62368
- EN 62368
- CE Mark
- China CCC
- UKCA Mark

TYPICAL APPLICATIONS

- Industrial

AT A GLANCE

Total Power

1200 Watts

Input Voltage

-40 to -72 Vdc

of Outputs

Single Main

PMBus® Power Management. Defined.

RoHS

MODEL NUMBERS

Standard	Output Voltage	Minimum Load	Maximum Load	Stand-by Supply	Air Flow Direction
DS1200DC-3	12.0Vdc	0A	98A	3.3V@6A	Normal (DC Connector to Handle)
DS1200DC-3-001	12.0Vdc	0A	98A	3.3V@6A	Reversed (Handle to DC Connector)
DS1200DC-3-002	12.0Vdc	0A	98A	5.0V@4A	Normal (DC Connector to Handle)
DS1200DC-3-004	12.0Vdc	0A	98A	5.0V@4A	Reversed (Handle to DC Connector)

Options

None

ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

Stress in excess of those listed in the "Absolute Maximum Ratings" may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply's reliability.

Table 1. Absolute Maximum Ratings

Parameter	Models	Symbol	Min	Typ	Max	Unit
Input Voltage						
DC continuous operation	All models	$V_{IN,DC}$	-40	-48	-72	Vdc
Maximum Output Power (Main + Stand-by)	All models	$P_{O,max}$	-	-	1200	W
Isolation Voltage						
Input to outputs	All models		-	-	2120	Vdc
Input to safety ground	All models		-	-	2120	Vdc
Outputs to safety ground	All models		-	-	500	Vdc
Ambient Operating Temperature	All models	T_A	-10	-	55	°C
Storage Temperature	All models	T_{STG}	-40	-	85	°C
Humidity (non-condensing)						
Operating	All models		5	-	90	%
Non-operating	All models		5	-	95	%
Altitude						
Operating	All models		-	-	13000	Feet
Non-operating	All models		-	-	50000	Feet

ELECTRICAL SPECIFICATIONS

Input Specifications

Table 2. Input Specifications

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC	All	$V_{IN,DC}$	-40	-48	-72	Vdc
Maximum Input Current ($I_O = I_{O,max}$, $I_{SB} = I_{SB,Max}$)	$V_{IN,DC}$ = 40V	I_{max}	-	-	36.2	A
Standby Input Current (V_O Off, I_{SB} = 0A)	$V_{IN,DC}$ = 40V $V_{IN,DC}$ = 72V	$I_{standby}$	- -	- -	400 300	mA
No Load Input Current (V_O On, I_O = 0A, I_{SB} = 0A)	$V_{IN,DC}$ = 40V $V_{IN,DC}$ = 72V	I_{no_load}	- -	- -	800 450	mA
Standby Input Power (V_O Off, I_{SB} = 0A)	All	$W_{standby}$	-	-	11	W
Startup Surge Current (Inrush)[1] @ 25°C	$V_{IN,DC}$ = 72V	I	-	-	30	A
Input DC Low Line Start-up Voltage	$I_O = I_{O,max}$	$V_{IN,DC-start}$	42	-	44	Vdc
Input DC Undervoltage Lockout Voltage	$I_O = I_{O,max}$	$V_{IN,DC-stop}$	37	-	39	Vdc
Operating Efficiency @ 25°C	$I_O = I_{O,max}$ $V_{IN,DC}$ = 40V	η	85	-	-	%
System Stability Phase Margin Gain Margin			 45 10	 - -	 - -	 ∅ dB

Note 1 - ETSI EN300 132-2 part 4.7 compliant.

ELECTRICAL SPECIFICATIONS

Output Specifications

Table 3. Output Specifications

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Output Regulation	All models	Inclusive of set-point, temperature change, warm-up drift and dynamic load	V_O	11.4	12.0	12.6	V
	DS1200DC-3 DS1200DC-3-001		V_{SB}	3.13	3.30	3.47	V
	DS1200DC-3-002 DS1200DC-3-004		V_{SB}	4.75	5.00	5.25	V
Output Ripple, pk-pk	All models	Measure with a 0.1µF ceramic capacitor in parallel with a 10µF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	-	120	mV_{PK-PK}
	DS1200DC-3 DS1200DC-3-001 DS1200DC-3-002 DS1200DC-3-004		V_{SB}	-	-	50	mV_{PK-PK}
Output Current	All models	All	I_O	0	-	98	A
	DS1200DC-3 DS1200DC-3-001		I_{SB}	0.5	-	6.0	A
	DS1200DC-3-002 DS1200DC-3-004		I_{SB}	0.5	-	4.0	A
Minimum Current Sharing Loading				10	-	-	$\%I_{O,max}$
Number of Parallel Units[1]		Main output current share connected		4	-	-	Units
Main Output Load Capacitance		Start up	C_O	-	0	-	uF/A
Main Output Dynamic Response[2] Peak Deviation Settling Time		50% load change Slew rate = 1A/us	$\pm\%V_O$ T_s	- -	- -	5 -	% mSec
Main Output Long Term Stability Max change over 24 hours		After thermal equilibrium (30 mins)	$\pm\%V_O$	-	-	0.2	%

Note 1 - V_{SB} output do not use active current sharing. On paralleled units, maximum current on V_{SB} output rail should not exceed the current of one unit.
Note 2 - Recommend to test with 4700uF capacitive load at the V_O output and 470uF at V_{SB} output.

ELECTRICAL SPECIFICATIONS

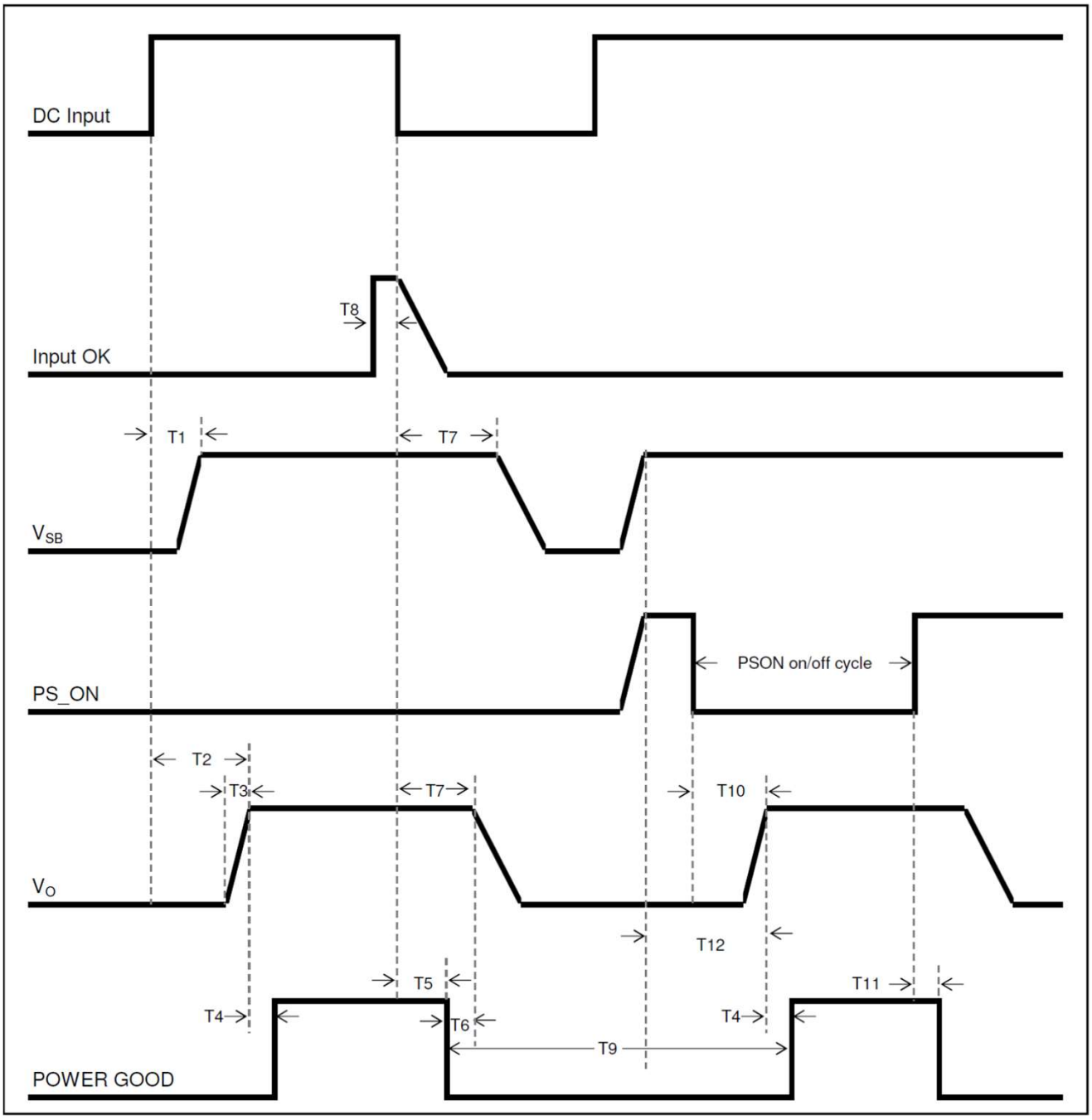
System Timing Specifications

Table 4. System Timing Specifications

Label	Parameter	Min	Typ	Max	Unit
T1	Delay from DC being applied to V_{SB} being within regulation	-	-	1000	mSec
T2	Delay from DC being applied to output voltages being within regulation	-	-	2000	mSec
T3	V_O rise time, 0V to V_O in regulation	5	-	50	mSec
T4	Delay from output voltages within regulation limits to POWER GOOD asserted high	100	-	1000	mSec
T5	Delay from loss of DC to de-assertion of POWER GOOD	1	-	-	mSec
T6	Delay from POWER GOOD de-asserted to output voltages dropping out of regulation limits	0.1			mSec
T7	Hold up time - time all output voltages, including V_{SB}, stay within regulation after loss of DC	1.1	-	-	mSec
T8	Delay from Input OK going to low to loss of DC input	1	-	-	mSec
T9	Duration of POWER GOOD being in the de-asserted state during an off/on cycle using DC	100	-	-	mSec
T10	Delay from PS_ON active to output voltages within regulation limits	10	-	300	mSec
T11	Delay from PS_ON de-active to POWER GOOD de-asserted low	-	-	2	mSec
T12	Delay from the Stand-by output being in regulation to all other output voltages being in regulation at DC turn on	50	-	1000	mSec

ELECTRICAL SPECIFICATIONS

System Timing Diagram



ELECTRICAL SPECIFICATIONS

DS1200DC Performance Curves

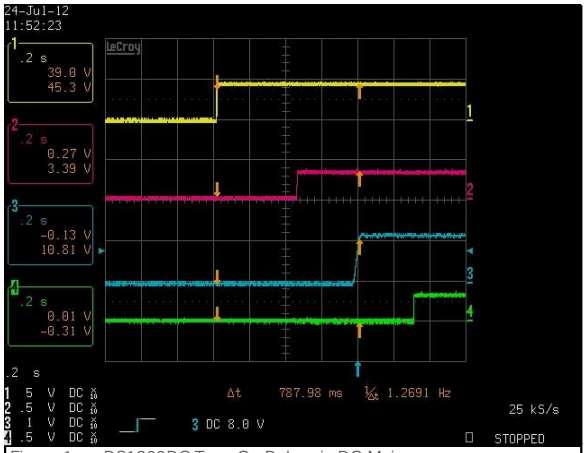


Figure 1: DS1200DC Turn-On Delay via DC Mains
Vin = 43Vdc Load: I_O = 98A I_{SB} = 6A (3.3V)
Ch 1: DC Mains Ch 2: V_{SB} Ch 3: V_O Ch 4: Pwr_GOOD

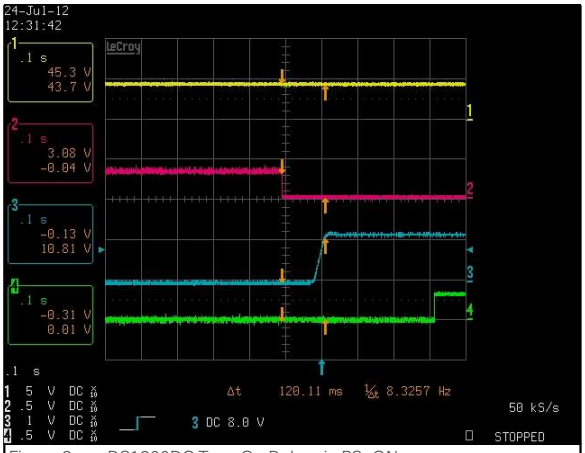


Figure 2: DS1200DC Turn-On Delay via PS_ON
Vin = 43Vdc Load: I_O = 98A I_{SB} = 6A (3.3V)
Ch 1: DC Mains Ch 2: PS_ON Ch 3: V_O Ch 4: Pwr_GOOD

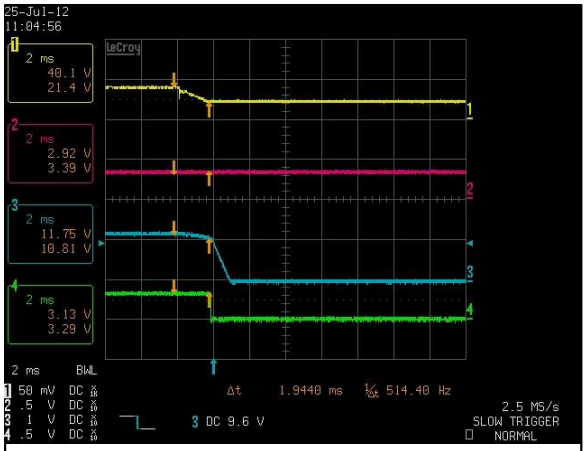


Figure 3: DS1200DC Hold-up Time
Vin = 40Vdc Load: Io = 98A I_{SB} = 6A (3.3V)
Ch 1: DC Mains Ch 2: V_{SB} Ch 3: V_O Ch 4: Pwr_GOOD

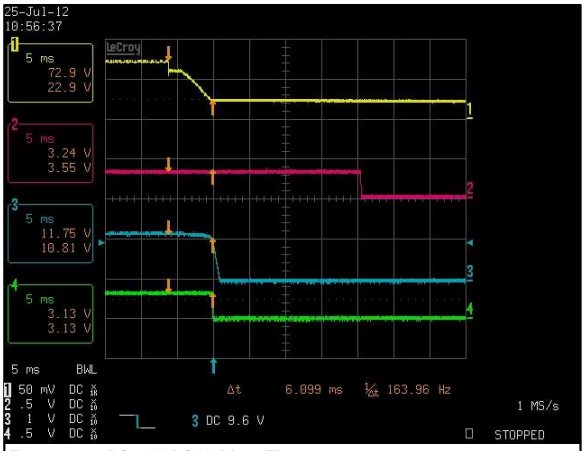


Figure 4: DS1200DC Hold-up Time
Vin = 72Vdc Load: Io = 98A I_{SB} = 6A (3.3V)
Ch 1: DC Mains Ch 2: V_{SB} Ch 3: V_O Ch 4: Pwr_GOOD

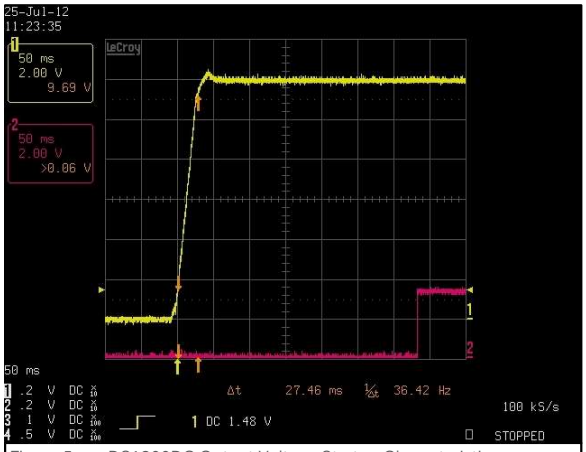


Figure 5: DS1200DC Output Voltage Startup Characteristic
Vin = 40Vdc Load: Io = 98A I_{SB} = 6A (3.3V)
Ch 1: V_O Ch 2: Pwr_GOOD

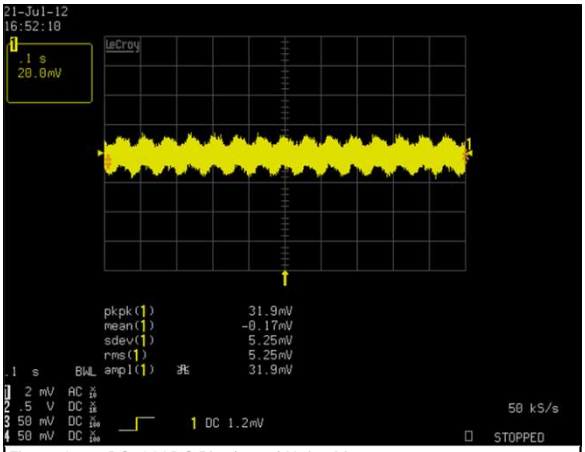


Figure 6: DS1200DC Ripple and Noise Measurement
Vin = 40Vdc Load: Io = 98A I_{SB} = 6A (3.3V)
Ch 1: V_O

ELECTRICAL SPECIFICATIONS

DS1200DC Performance Curves

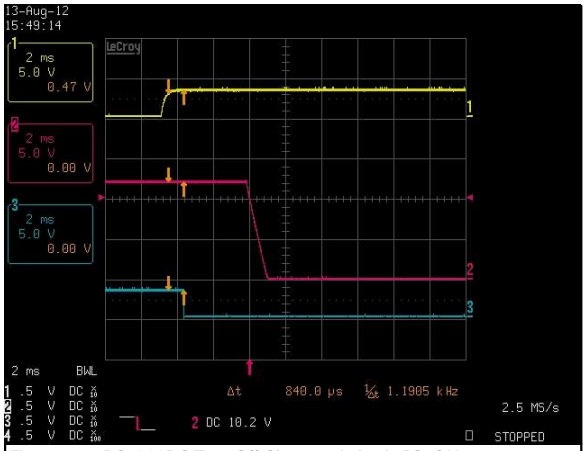


Figure 7: DS1200DC Turn Off Characteristic via PS_ON
Load: I_O = 98A I_{SB} = 6A (3.3V)
Ch 1: PS_ON Ch 2: V_O Ch 3: Pwr_GOOD

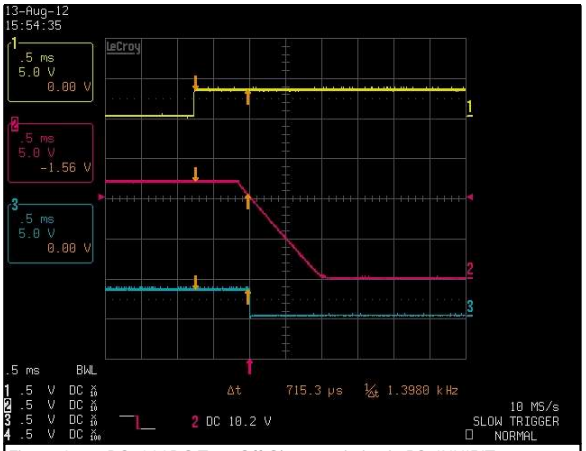


Figure 8: DS1200DC Turn Off Characteristic via PS_INHIBIT
Load: I_O = 98A I_{SB} = 6A (3.3V)
Ch 1: PS_INHIBIT Ch 2: V_O Ch 3: Pwr_GOOD

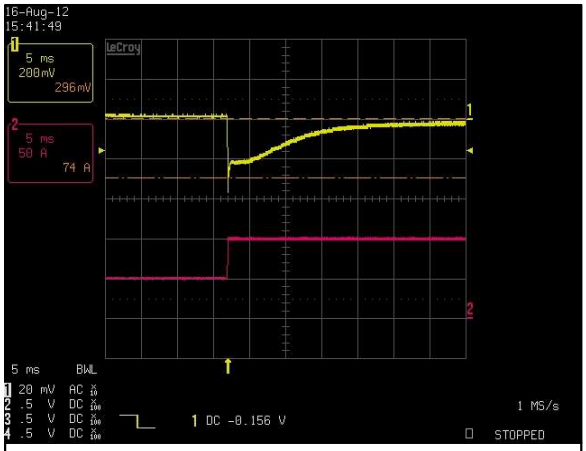


Figure 9: DS1200DC Transient Response - V_O Deviation
50% to 100% load change 1A/uS slew rate Vin = 48Vdc
Ch 1: V_O Ch 2: I_O

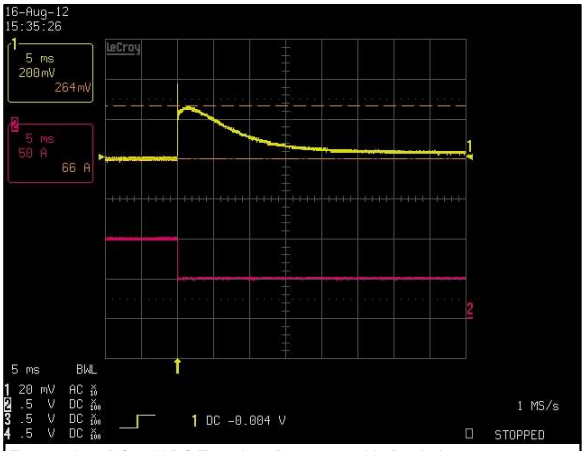


Figure 10: DS1200DC Transient Response - V_O Deviation
100% to 50% load change 1A/uS slew rate Vin = 48Vdc
Ch 1: V_O Ch 2: I_O

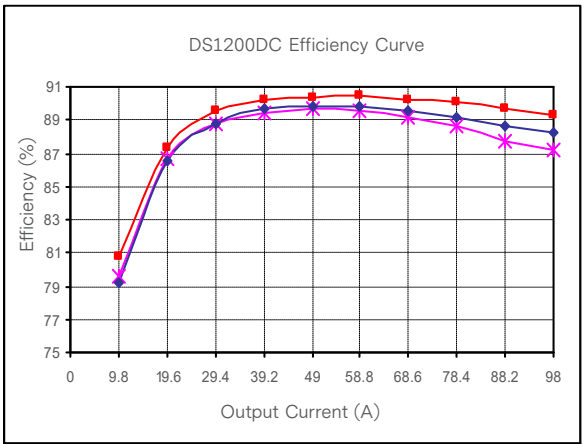


Figure 11: DS1200DC Efficiency Curve @ 25°C
40Vdc 48Vdc 72Vdc
Loading: I_{o_main} = 10%$I_{o,max}$ increment to 98A, I_{SB} = 6A (3.3V)

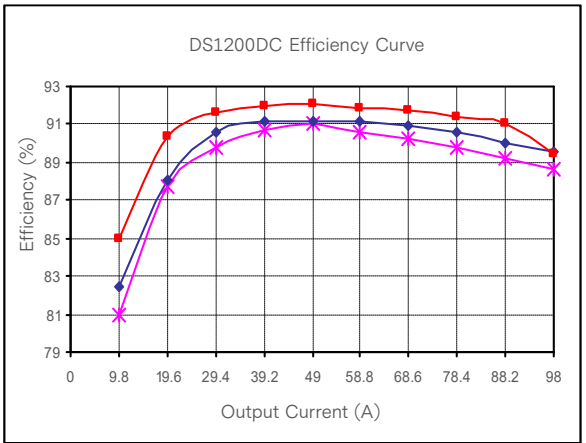


Figure 12: DS1200DC Efficiency Curve @ 25°C
40Vdc 48Vdc 72Vdc
Loading: I_{o_main} = 10%$I_{o,max}$ increment to 98A, I_{SB} = 6A (3.3V)

ELECTRICAL SPECIFICATIONS

Protection Function Specifications

Input Fuse

DS1200DC series power supply is equipped with an internal non user serviceable 70A 170Vdc fuse to IEC 127 for fault protection in the input.

Over Voltage / Under Voltage Protection (OVP / UVP)

The power supply latches off during output overvoltage and undervoltage with the DC line recycled to reset the latch.

OVP

Parameter	Min	Nom	Max	Unit
V_O Output Overvoltage	13.2	/	14.4	V
3.3V V_{SB} Output Overvoltage	3.76	/	4.30	V
5V V_{SB} Output Overvoltage	5.15	/	6.36	V

UVP

Parameter	Min	Nom	Max	Unit
V_O Output Under-voltage	9.0	/	10.8	V

Over Current Protection (OCP)

DS1200DC series power supply includes internal current limit circuitry to prevent damage in the event of overload or short circuit. Recovery must be automatic when the overload is removed, if the overload lasts for 1 second or less, and if it is less than or equal to 150% of rated load. If the overload is > 150% of rated load, the power supply will latch off immediately. In addition, if the overload fault is presented for longer than 1 second, the power supply will also latch off, requiring DC power or PS_ON recycling to restart the power supply.

Parameter	Min	Nom	Max	Unit
V_O Output Overcurrent	107.8	/	147	A
3.3V V_{SB} Output Overvoltage	6.6	/	9	A
5V V_{SB} Output Overvoltage	4.4	/	6.0	A

ELECTRICAL SPECIFICATIONS

Short Circuit Protection (SCP)

The DS1200DC power supply will withstand a continuous short circuit with no permanent damage, applied to its main output during start-up or while running. The main output will latch off immediately requiring DC power / PS_ON recycling to restart the power supply. A short is defined as impedance less than 0.1 ohms.

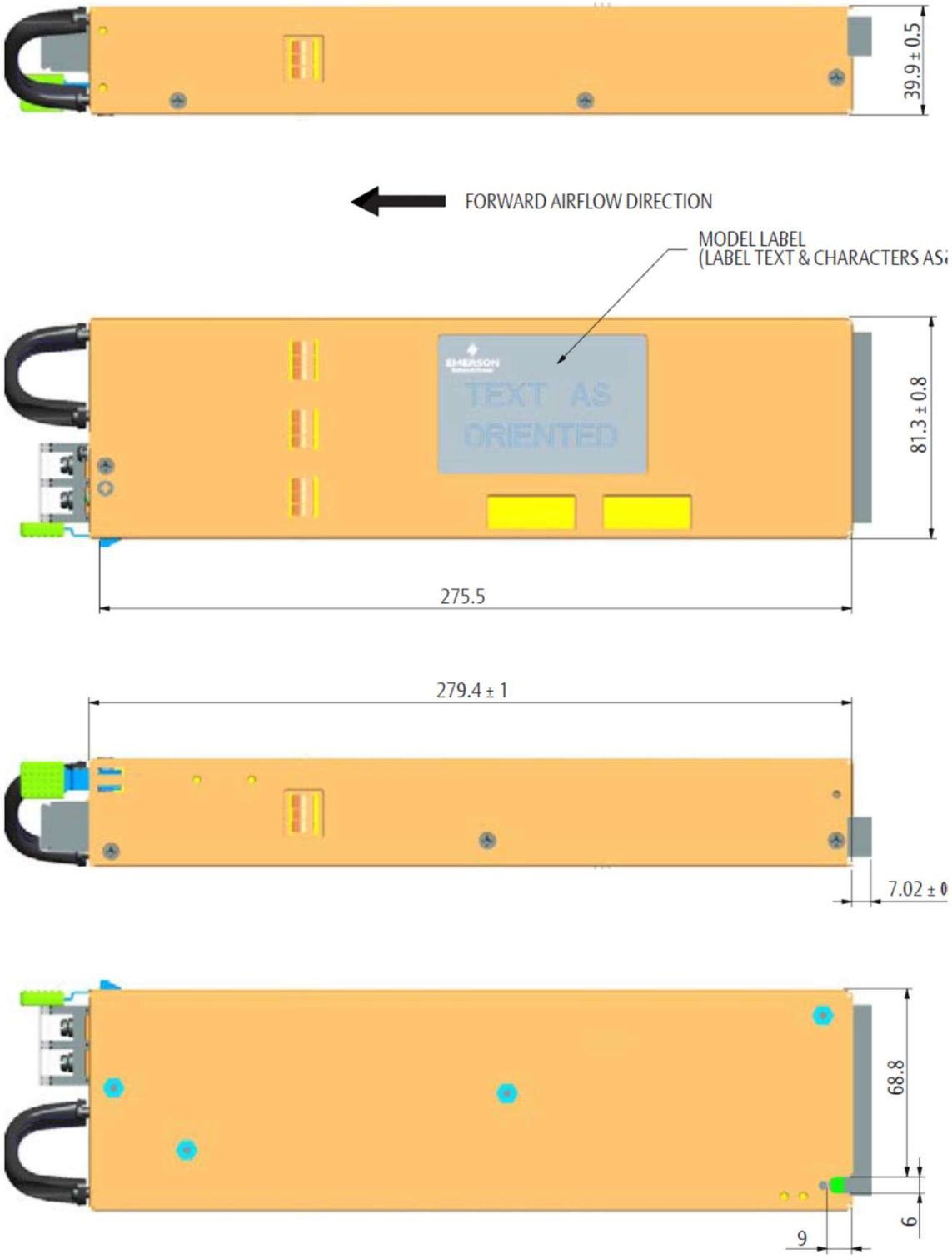
When the standby output V_{SB} is shorted the output will go into “hiccup mode”. When the V_{SB} attempts to restart, the maximum peak current from the V_{SB} output will be less than 9.0A peak (3.3V) or 6.6A (5.0V). The maximum average current, taking into account the “hiccup” duty cycle, is less than 4.9A.

Over Temperature Protection (OTP)

The power supply is internally protected against over temperature conditions. When the OT circuit is activated, the power supply will latch off, requiring DC power or PS_ON recycling to restart the power supply.

MECHANICAL SPECIFICATIONS

Mechanical Outlines (unit: mm)



MECHANICAL SPECIFICATIONS

Mechanical Outlines (unit: mm)

MECHANICAL SPECIFICATIONS

Connector Definitions

DC Input Connector (IEC320 C-16)

T1 – RTN

T2 – -48V

N/A – Earth Ground

Output Connector - Power Blades

PB1 – Main Output Return

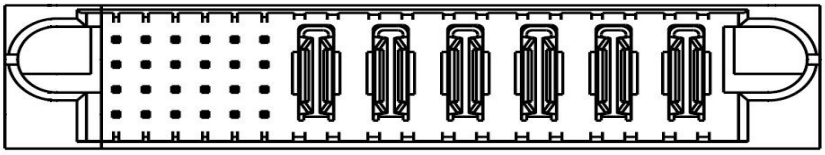
PB2 – Main Output Return

PB3 – Main Output Return

PB4 – Main Output (V_O)

PB5 – Main Output (V_O)

PB5 – Main Output (V_O)



D1	D2	D3	D4	D5	D6	PB1	PB2	PB3	PB4	PB5	PB6
C1	C2	C3	C4	C5	C6						
B1	B2	B3	B4	B5	B6						
A1	A2	A3	A4	A5	A6						

Output Connector - Control Signals

A1 – PS_ON

A2 – Main Output Remote Sense Return

A3 – Spare

A4 – PS_SEATED

A5 – Standby Output

A6 – Standby Output Return

B1 – Input OK

B2 – Main Output Remote Sense

B3 – Main Output Current Share

B4 – PS_INHIBIT

B5 – Standby Output

B6 – Standby Output Return

C1 – SDA (I^2C Data Signal)

C2 – SCL (I^2C Clock Signal)

C3 – POWER GOOD

C4 – Spare

C5 – Standby Output

C6 – Standby Output Return

D1 – A0 (I^2C Address BIT 0 Signal)

D2 – A1 (I^2C Address BIT 1 Signal)

D3 – S_INT (Alarm)

D4 – Standby Remote Sense

D5 – Standby Output

D6 – Standby Output Return

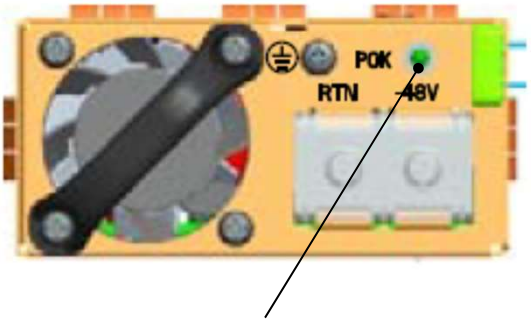
MECHANICAL SPECIFICATIONS

Power / Signal Mating Connectors and Pin Types

Table 5. Mating Connectors for DS1200DC Series		
Reference	On Power Supply	Mating Connector or Equivalent
DC Input Connector	DT-7C-B14W	Ring Lug, #10 screw
Output Connector	FCI Power Blade 51721-10002406AA or Molex Power Connector 87667-7002	FCI Power Blade 51741-10002406CC Straight Pins
		FCI Power Blade 51761-10002406AALF Right Angle Pins

MECHANICAL SPECIFICATIONS

LED Indicator Definitions



Status LED

One bi-color (green/amber) LED at the power supply front provides the status signal. The status LED conditions are shown on the below table.

Conditions	LED Status
V_{SB} = ON, V_O = OFF, DC Input = ON	Blinking Amber
V_{SB} = ON, V_O = ON	Solid Green
V_O = OCP / UVP / OVP	Blinking Amber
FAN_FAULT / OTP / V_{SB} = OCP/UVP	Solid Amber

MECHANICAL SPECIFICATIONS

Weight

The DS1200DC series power supply weight is 1.26kg/2.78lbs maximum.

ENVIRONMENTAL SPECIFICATIONS

EMC Immunity

DS1200DC series power supply is designed to meet the following EMC immunity specifications.

Table 6. Environmental Specifications

Document	Description
CFR47, Part 15 Subpart B Class B / EN55032, Level B	Conducted and Radiated EMI Limits
EN61000-3-2	Harmonics
EN61000-3-3	Voltage Fluctuations
IEC/EN61000-4-2, Edition 1.2, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Electrostatic discharge immunity test: +/-15KV air, +/-8KV contact discharge. Performance - Criteria B
IEC/EN61000-4-3, 2002, Amendment 1, 2002-08	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.
IEC/EN61000-4-4, 1995, Amendment 2, 2001-07	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Electrical fast transient/burst immunity test: 2KV for input power port. Performance - Criteria B 1KV for DC ports, I/O and signal ports. Performance - Criteria B
IEC/EN61000-4-5, Edition 1.1, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Surge test: 2KV common mode and 1KV differential mode for input ports and 0.5KV differential mode for DC power, I/O and signal ports. Performance - Criteria B
IEC/EN61000-4-11, Edition 1.1, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Voltage dips and interruptions: Criteria B: >95% reduction for 10mS; Criteria C: >30% reduction for 500mS, or Criteria C: >95% reduction for 500mS.
EN55024:1998	Information Technology Equipment - Immunity Characteristics, Limits and Method of Measurements

ENVIRONMENTAL SPECIFICATIONS

Safety Certifications

The DS1200DC-3 series power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 7. Safety Certifications for DS1200DC Series Power Supply

Agency	File #	Description
UL62368		US and Canada Requirements
CSA 22.2 No. 60950-01-03		Information Technology Equipment - Safety - Part 1: General Requirements (Bi-National standard, with UL60950-1)
EN62368-1		European Requirements
EN62368-1 Deviations		International Requirements
CB Certificate and Report		(All CENELEC Countries)
CHINA CCC Approval	2010010907430442	China Requirements
Argentina IRAM/S-mark		
CE Mark	P10212734/A2	China
UKCA Mark		UK Requirements

ENVIRONMENTAL SPECIFICATIONS

EMI Emissions

The DS1200DC-3 series has been designed to comply with the Class B limits of EMI requirements of EN55032 (FCC Part 15) and CISPR 22 (EN55032) for emissions and relevant sections of EN61000 (IEC61000) for immunity. The unit is enclosed inside a metal box, tested at 1200W using resistive load with cooling fan.

Conducted Emissions

Table 8. Conducted EMI Emission Specifications of The DS1200DC Series Power Supply

Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, class B	All	Margin	-	-	6	dB
CISPR 22 (EN55032) class B	All	Margin	-	-	6	dB

Radiated Emissions

Unlike conducted EMI, radiated EMI performance in a system environment may differ drastically from that in a stand-alone power supply. The shielding effect provided by the system enclosure may bring the EMI level from Class A to Class B. It is thus recommended that radiated EMI be evaluated in a system environment. The applicable standard is EN55032 Class A (FCC Part 15). Testing AC-DC convertors as a stand-alone component to the exact requirements of EN55032 can be difficult, because the standard calls for 1m leads to be attached to the input and outputs and aligned such as to maximize the disturbance. In such a set-up, it is possible to form a perfect dipole antenna that very few AC-DC convertors could pass. However, the standard also states that an attempt should be made to maximize the disturbance consistent with the typical application by varying the configuration of the test sample.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature

The DS1200DC series power supplies will start and operate within stated specifications at an ambient temperature from -10°C to 55°C under all load conditions with internal fan.

DS1200DC-3-001 and DS1200DC-3-401 can operate up to 55°C with derated power (Reverse airflow).

Ambient (°C)	Iout (+12V) (Amps)	Iout (Standby) (Amps)	12V Pout (Watts)	Standby Pout (Watts)	Pout Total (Watts)
25	98	6	1176	20	1196
30	98	6	1176	20	1196
35	98	6	1176	20	1196
40	98	6	1176	20	1196
45	88.33	6	1059.96	20	1079.96
50	78.33	6	939.96	20	959.96
55	68.33	6	819.96	20	839.96

Forced Air Cooling

The DS1200DC series power supplies included internal cooling fans as part of the power supply assembly to provide forced air-cooling to maintain and control temperature of devices and ambient temperature in the power supply to appropriate levels. The standard direction of airflow is from the DC output connector end to the DC input connector end of the power supply.

Determined by the temperature sensed, load current range and user configuration, fan speed is controlled by secondary controller. As the default configuration, there is a minimum speed running under light load and without temperature warning/protection. It will always achieve maximum speed under full load condition whether there is any temperature warning/protection or not.

INPUT (Vdc)	Output Loading (A)		Specification
	12V	3.3V V_{SB} 5V V_{SB}	FAN Speed (RPM)
48	98	6 4	>15000
48	0	0 0	>3000 and <10000 (Under room temperature

POWER AND CONTROL SIGNAL DESCRIPTIONS

DC Input Connector

This connector supplies the DC to the DS1200DC-3 power supply.

T1 – RTN
T2 – -48V
T3 – Earth Ground

Output Connector – Power Blades

These pins provide the main output for the DS1200DC-3 series power supply. The main output (V_O) and the main output return pins are the positive and negative rails, respectively, of the V_O main output of the DS1200DC-3 series power supply. The main output (V_O) is electrically isolated from the power supply chassis.

PB1 – Main Output Return
PB2 – Main Output Return
PB3 – Main Output Return
PB4 – Main Output (V_O)
PB5 – Main Output (V_O)
PB6 – Main Output (V_O)

Output Connector – Control Signals

The DS1200DC-3 series power supply contains a 24 pins control signal header providing an analogue control interface, standby power and I^2C interface signal connections.

PS_ON - (Pin A1)

This signal input pin controls the normal turning ON and Off of the main output of the DS1200DC power supply. The power supply main output (V_O) will be enabled when this signal is pulled low, below 0.8V. The power supply output (except V_{SB} output) will be disabled when this input is driven higher than 2.4V, or left open circuited.

Main Output Remote Sense Return, Main Output Remote Sense - (Pins A2, B2)

The main output of the DS1200DC-3 is equipped with a remote sensing capability that will compensate for a power path drop around the entire loop of 1 volt. This feature is implemented by connecting the main output remote sense (pin B2) and the main output remote sense return (pin A2) to the positive and negative rails of the main output, respectively, at a location that is near to the load. Care should be taken in the routing of the sense lines as any noise sources or additional filtering components introduced into the voltage rail may affect the stability of the power supply. The DS1200DC-3 will operate appropriately without the sense lines connected; however it is recommended that the sense lines be connected directly to the main output terminals if remote sensing is not required. This remote sense circuit will not raise the power supply's output voltage to the OVP trip level.

Main output remote sense has no effect on the standby output (V_{SB}).

PS_SEATED - (Pin A4)

TTL logic LOW indicates power supply inserted and seated into the mid-plane bulk power supply connector. This signal pin is grounded in the power supply. A Logic HIGH indicated the removal of the bulk power supply.

POWER AND CONTROL SIGNAL DESCRIPTIONS

StandBy Output, StandBy Output Return - (Pins A5, A6, B5, B6, C5, C6, D5, D6)

The DS1200DC-3 provides a regulated 3.3 volt 6 amp (or 5.0 volt 4 amp) auxiliary output voltage to power critical circuitry that must remain active regardless of the on/off status of the power supply's main output. The standby output (V_{SB}) voltage is available whenever a valid DC input voltage is applied to the unit. The standby output is independently short circuit protected and is referenced to the standby output return pins (A6, B6, C6, D6).

Input OK - (Pin B1)

The Input OK signal is a normally LOW level TTL logic signal when the input voltage is within the allowable limits. A TTL logic HIGH level, with a 1mS early warning will be sent before the main DC output loses regulation. Open collector (or open drain). Pull up in power supply.

Main Output Current Share - (Pin B3)

The DS1200DC-3 supports active current sharing through a single wire connection between the power supplies. This input/output signal pin allows two or more power supplies to share the main output load current to increase the overall power capability or to operate the units in a N+1 configuration for redundancy purposes.

The voltage of this signal will be a linear slope from no load to full load. At ½ load, the output of the main output current share pin will be between 3.75 and 4.25V.

When two or more power supplies are connected and operating in parallel and each is delivering 40-100% of its rated output to the load, the power supplies will current share within 5% accuracy. When supplying light loads between 10% and 40% of its rated load, the power supplies will share within 20% accuracy. (Below 10% load, there is no guarantee of output current sharing). If any power supply is hot swapped, no glitch will occur that violates the regulation limits of the power supply defined in this specification.

PS_INHIBIT - (Pin B4)

This signal pin should be grounded in the system. If left open, power supply operation will be inhibited (standby V_{SB} output will remain on). When the power supply is inserted into the system, this pin will be pull low by the system and turn the power supply ON only after all other power supply pins have seated. This will minimize arching damage to the power pins. This function will also be supported by the I^2C where the unit can be turned on and off via I^2C.

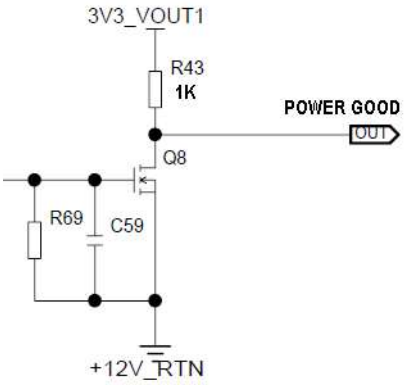
SDA, SCL and S_INT - (Pins C1, C2, D3)

Please refer to "Communication Bus Descriptions" section.

POWER AND CONTROL SIGNAL DESCRIPTIONS

POWER GOOD - (Pin C3)

The POWER GOOD is an output signal driven high, by the power supply to indicate that all outputs are valid. If any of the power supply outputs fails below its regulation limits, this output will be driven low. The output signal is an open drain output internally pulled up in the power supply to internal standby supply (anode side of standby output or'ing circuit) via a 1Kohm resistor. It is capable of driving the output below 0.4V with a load of 4mA.



A0, A1 - (Pins D1, D2)

Please refer to "Communication Bus Descriptions" section.

StandBy Remote Sense - (Pin D4)

The standby output of the DS1200DC is also equipped with a remote sensing capability that will compensate up to 50mV of voltage drop for the positive rail. The standby output remote sense pin should be connected as close to the load as possible, or connected to the standby output pins at the base of the output connector if not used. If left open, the remote sense might not work properly and the voltage level of standby output can be lower than the guaranteed spec.

COMMUNICATION BUS DESCRIPTIONS

I²C Bus Signals

The DS1200DC-3 series power supply contains enhanced monitor and control functions implemented via the I²C bus. The DS1200DC-3 series I²C functionality (PMBus™ and FRU data) can be accessed via the output connector control signals. The communication bus is powered either by the internal 3.3V (or 5V) supply or from an external power source connected to the standby output (i.e. accessing an unpowered power supply as long as the standby output of another power supply connected in parallel is on).

If units are connected in parallel or in redundant mode, the standby outputs must be connected together in the system. Otherwise, the I²C bus will not work properly when a unit is inserted into the system without the DC source connected.

Note: PMBus™ functionality can be accessed only when the PSU is powered up. Guaranteed communication I²C speed is 100KHz.

SDA, SCL (I²C Data and Clock Signals) - (Pins C1, C2)

I²C serial data and clock bus - these pins are internally pulled up to internal 3.3V (or 5V) supply with a 39K resistor. These pins must be pulled-up in the system by an 1Kohm resistor to the standby output.

If these pins are pulled up to the stand-by output created from the main output using a step-down, non-isolated DC/DC provided within the end system, the ground of the stand-by output and main output must be connected together.

S_INT (Alarm) - (Pin D3)

S_INT is used to send a signal to the system that a fault in the power supply occurred. The pin is normally low it goes high when a change occurs. If the power supply address is read or the PSU returns to its previous state, it returns to low.

A0, A1 (I²C Address BIT 0, BIT1 Signals) - (Pins D1, D2)

These two input pins are the address lines A0 and A1 to indicate the slot position the power supply occupies in the power bay and define the power supply addresses for FRU data and PMBus™ data communication. This allows the system to assign different addresses for each power supply. During I²C communication between system and power supplies, the system will be the master and power supplies will be slave.

They are internally pulled up to internal 3.3V (or 5V) supply with a 1K resistor.

I²C Bus Communication Interval

The interval between two consecutive I²C communications to the power supply must be at least 50ms to ensure proper monitoring functionality.

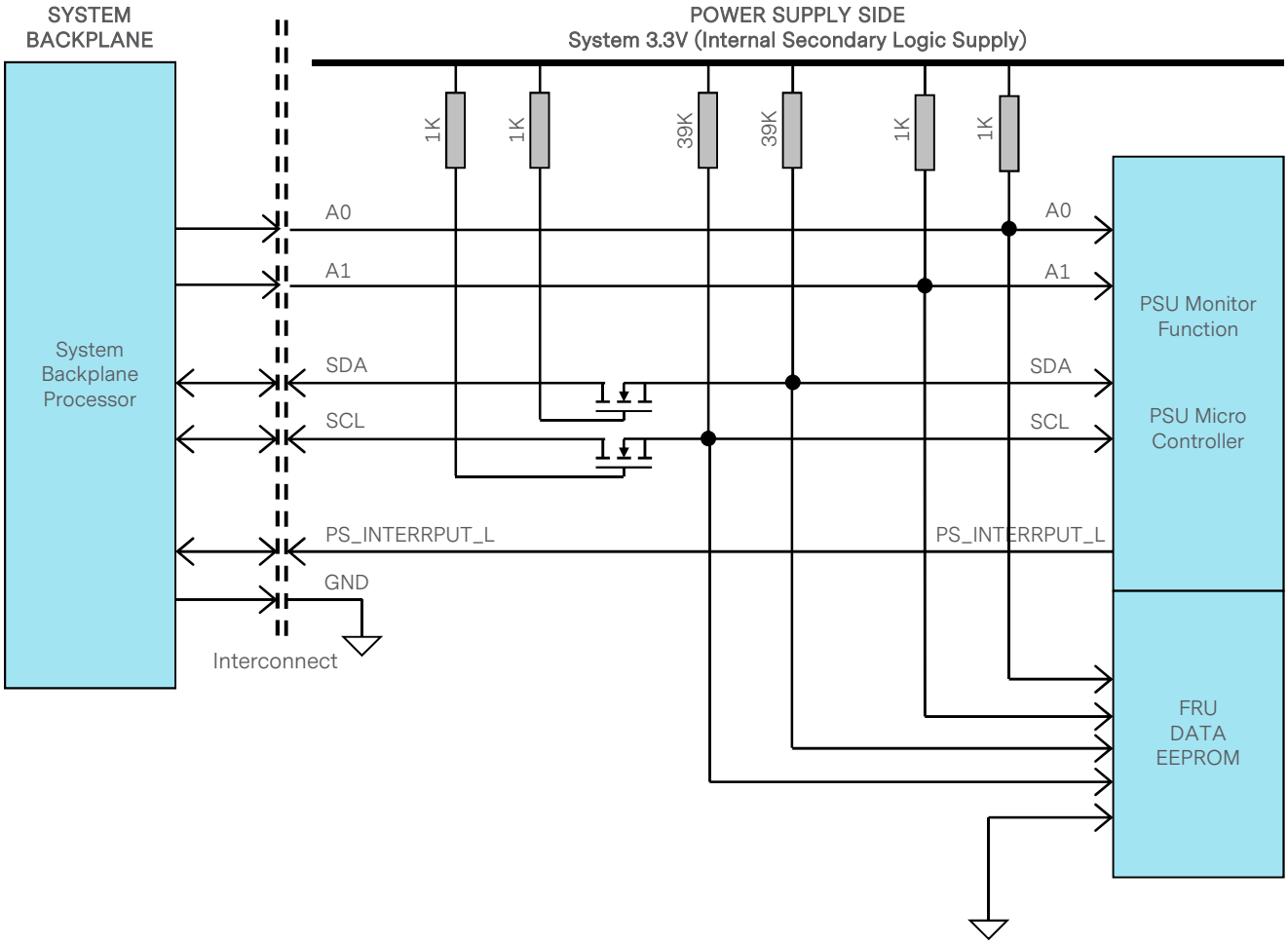
I²C Bus Signal Integrity

The noise on the I²C bus (SDA, SCL lines) due to the power supply will be less than 500mV peak-to-peak. This noise measurement should be made with an oscilloscope bandwidth limited to 100MHz. Measurements must be made at the power supply output connector with 3.2Kohm resistors pulled up to standby output and 20pF ceramic capacitors to standby output return.

The noise on the address lines A0 and A1 will be less than 100mV peak-to-peak. This noise measurement should be made at the power supply output connector.

COMMUNICATION BUS DESCRIPTIONS

I²C Bus Internal Implementation, Pull-ups and Bus Capacitances



I²C Bus - Recommended external pull-ups

Electrical and interface specifications of I²C signals (referenced to standby output return pin, unless otherwise indicated):

Parameter	Condition	Symbol	Min	Type	Max	Unit
SDA, SCL Internal Pull-up Resistor		R_{int}	-	39	-	Kohm
SDA, SCL internal bus capacitance		C_{int}	-	0	-	pF
Recommended External Pull-up Resistor	1 PSU	R_{ext}	-	1.0	-	Kohm
	4 PSU	R_{ext}	-	0.25	-	Kohm

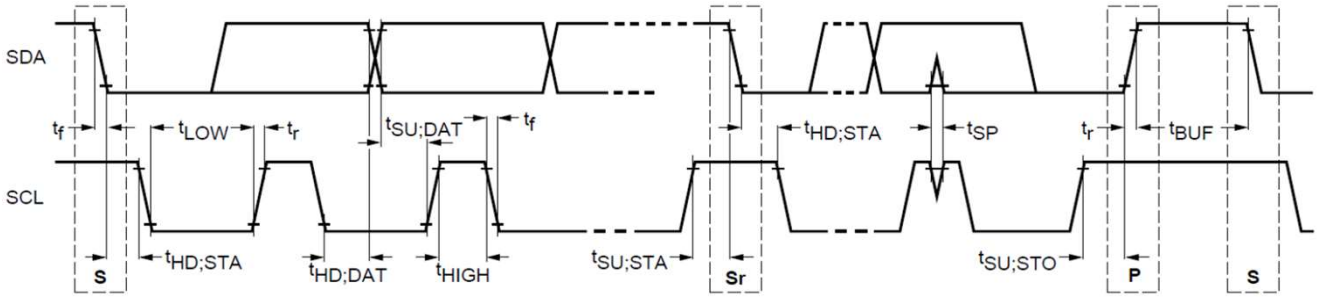
COMMUNICATION BUS DESCRIPTIONS

Logic Levels

DS1200DC series power supply I²C communication bus will respond to logic levels as per below:

Logic High: 5.0V nominal (Spec is 2.1V to 5.0V)**
Logic Low: 500mV nominal (Spec is 800mV max)**

Timings



Parameter	Symbol	Standard-Mode Specs		Actual Measured		Unit
		Min	Max			
SCL clock frequency	f_{SCL}	0	100	99		KHz
Hold time (repeated) START condition	$t_{HD;STA}$	4.0	-	4.2		uS
LOW period of SCL clock	t_{LOW}	4.7	-	14.0		uS
HIGH period of SCL clock	t_{HIGH}	4.0	50	3.4		uS
Setup time for repeated START condition	$t_{SU;STA}$	4.7	-	3.9		uS
Data hold time	$t_{HD;DAT}$	0	3.45	1.0		uS
Data setup time	$t_{SU;DAT}$	250	-	344		nS
Rise time	t_r	-	1000	SCL = 950	SDA = 990	nS
Fall time	t_f	-	300	SCL = 130	SDA = 300	nS
Setup time for STOP condition	$t_{SU;STO}$	4.0	-	7.3		uS
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	60msec***		mS

*** Note - Philips™ I²C adapter and bundled software (USB-to-I²C) was used.

COMMUNICATION BUS DESCRIPTIONS

Device Addressing

The DS1200DC-3 series will respond to supported commands on the I²C bus that are addressed according to pins A1 and A0 pins of output connector.

Address pins are held HIGH by default via pulled up to internal 3.3V (5V) supply with a 1K resistor. To set the address as “0”, the corresponding address line should be pulled down to logic ground level. Below tables show the address of the power supply with A0 and A1 pins set to either “0” or “1”:

PSU Slot	Slot ID Bits		PMBus™ Address	EEPROM (FRU) Address
	A1	A0		
1	0	0	0x78	0xA9
2	0	1	0x7A	0xAB
3	1	0	0x7C	0xAD
4	1	1	0x7E*	0xAF*

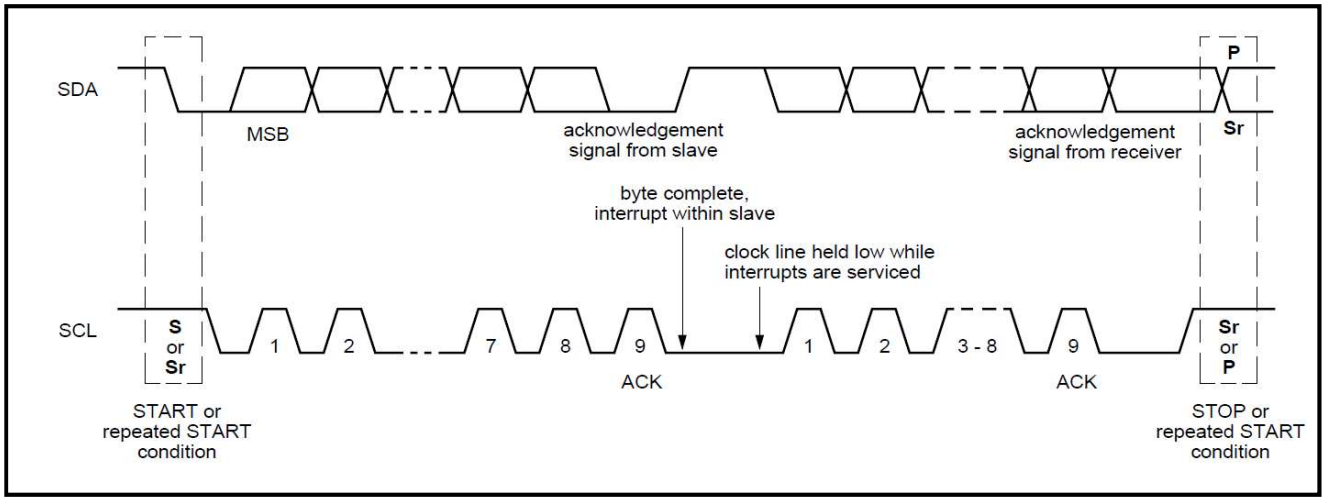
*Note - Default address when A0 and A1 are left open.

COMMUNICATION BUS DESCRIPTIONS

I²C Clock Synchronization

The DS1200DC-3 series power supply applies clock stretching. An addressed slave power supply holds the clock line (SCL) low after receiving (or sending) a byte, indicating that it is not yet ready to process more data. The system master that is communicating with the power supply will attempt to raise the clock to transfer the next bit but must verify that the clock line was actually raised. If the power supply is clock stretching, the clock line will still be low (because the connections are open-drain).

The maximum time-out condition for clock stretching for DS1200DC-3 series is 100 milliseconds.



COMMUNICATION BUS DESCRIPTIONS

Power Supply Status Register, PMBus™ Register 0xEFh

Power supply status monitoring can be done via the PMBus™ register 0xEFh or as I/O expander. Detailed explanation of functions is given below:

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
OCP	UVP	OVP	FAN_OK	Input_OK	TEMP_OK	V_{SB} OK	V_O OK

- OCP
  - Output Current Protection
  - This bit will be set when the power supply outputs have been disabled due to an over current event.
- UVP
  - Under Voltage Protection
  - This bit will be set when the power supply outputs have been disabled due to an under voltage event.
- OVP
  - Over Voltage Protection
  - This bit will be set when the power supply outputs have been disabled due to an over voltage event.
- FAN_OK
  - Fan Status
  - This bit will be set high when fault has been triggered on manufacturer defined fault.
- Input_OK
  - AC Line Voltage Status
  - This bit is an image of the AC_OK signal coming out the power supply to the system. A logic HIGH, if the input voltage is within allowable limits. This bit will be cleared when the power supply line voltage is past the trip limit.
- TEMP_OK
  - Over temperature status
  - A logic HIGH, when the power supply operating within allowable temperature range. This bit will be cleared when the power supply temperature is past the trip limit.
- V_{SB} OK
  - Standby Output (V_{SB}) status
  - This bit is set when the Standby Output (V_{SB}) is within regulation limits. This bit will be cleared when the V_{SB} voltage is out of regulation.
- V_O OK
  - Main Output (V_O) status
  - This bit is set when the Main Output (V_O) is within regulation limits. This bit will be cleared when the V_O voltage is out of regulation.

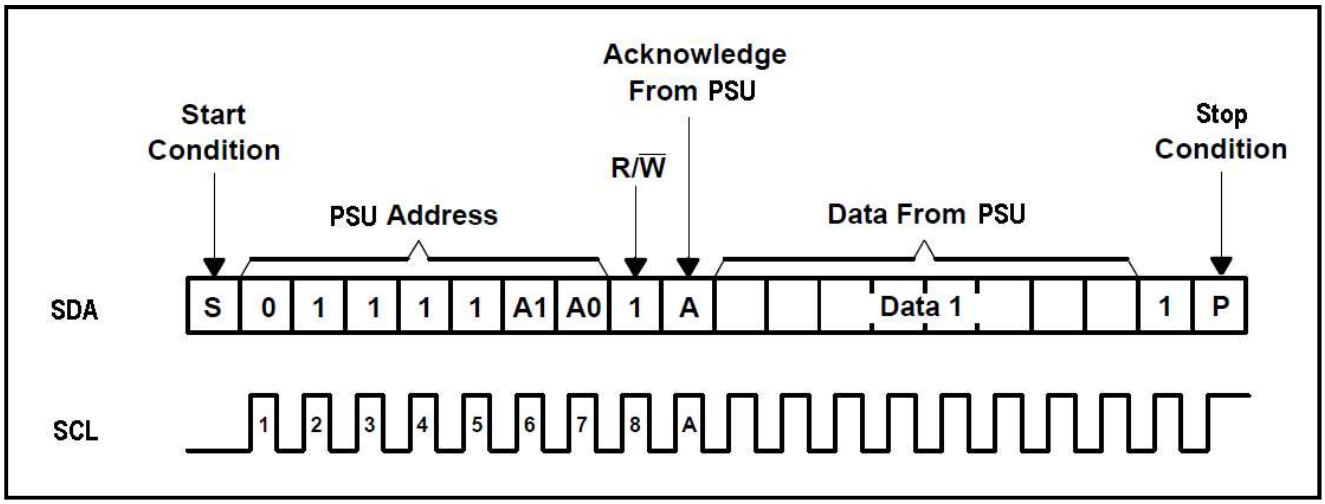
Status Register Code		
Signal Name	**Code (Binary)**	**Code (Hex)**
Normal / 12V ON	00011111	1F
Normal / 12V OFF	00011110	1E
OCP	10011111	9E
UVP	01011110	5E
OVP	00111110	3E
Fan Fault	00001110	0E
Low Input / No DC	00010100	14
Over Temp Fault	00011010	1A

COMMUNICATION BUS DESCRIPTIONS

Reading the Status Register

Reading the status register data from the power supply using PMBus™ commend 0xEFh, see PMBus™ Description - Commend list for details.

The status register can also be read as an IO expander (shown in diagram below), the slave address will is (01111A1A0).



COMMUNICATION BUS DESCRIPTIONS

FRU (EEPROM) Data

The FRU (Field Replaceable Unit) data format is compliant with the Intel IPMI v1.0 specification. The DS1200DC-3 uses 1 page of EEPROM for FRU purpose. The one page of EEPROM contains up to 256 byte-sized data locations.

Where: OFFSET -The OFFSET denotes the address in decimal format of a particular data byte within DS1200DC-3 EEPROM.

VALUE -The VALUE details data written to a particular memory location of the EEPROM.

DEFINITION -The contents DEFINITION refers to the definition of a particular data byte.

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
COMMON HEADER, 8 BYTES				
0	00	**FORMAT VERSION NUMBER** (Common Header) 7:4 - Reserved, write as 0000b 3:0 - Format Version Number = 1h for this specification	1	01
1	01	**INTERNAL USE AREA OFFSET**	27	1B
2	02	**CHASSIS INFO AREA OFFSET**	1	01
3	03	**BOARD INFO AREA OFFSET**	0	00
4	04	**PRODUCT INFO AREA OFFSET**	5	05
5	05	**MULTI RECORD AREA OFFSET**	13	0D
6	06	**PAD** (reserved) Default value is 0.	0	00
7	07	**ZERO CHECK SUM** (256 - (Sum of bytes 0 to 6))	209	D1
CHASSIS INFO AREA (32 BYTES) This area will be filled by the Mfg. Diag. or by the OS if used				
8	08	**FORMAT VERSION NUMBER** 7:4 - Reserved, write as 0000b 3:0 - Format Version Number = 1h for this specification	1	01
9	09	**CHASSIS INFO AREA LENGTH** in multiple of 8 bytes	4	04
10	0A	**CHASSIS TYPE** (Default value is 0.)	0	00
11	0B	**CHASSIS PART NUMBER** Type/Length CAh (if used) Type = “ASCII+LATIN1” = (11)b length = 8 bytes = (001010)b	202	CA
12 13 14 15 16 17 18 19 20 21	0C 0D 0E 0F 10 11 12 13 14 15	**CHASSIS PART NUMBER BYTES** (Default value is 0.)	0 0 0 0 0 0 0 0 0 0	00 00 00 00 00 00 00 00 00 00
22	16	**CHASSIS SERIAL NUMBER Type/Length** CFH (if used) Type = “ASCII+LATIN1” = (11)b length = 15 bytes = (001111)b	207	CF
23 24 25 26 27 28 29 30 31	17 18 19 1A 1B 1C 1D 1E 1F	**CHASSIS SERIAL NUMBER BYTES,** default value is 0.	0 0 0 0 0 0 0 0 0	00 00 00 00 00 00 00 00 00

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
32	20	**CHASSIS SERIAL NUMBER BYTES,** default value is 0.	0	00
33	21		0	00
34	22		0	00
35	23		0	00
36	24		0	00
37	25		0	00
38	26	**End Tag** (0C1h if used)	193	C1
39	27	**CHKSUM** (Zero CHKSUM if used) (256 - (Sum of bytes 8 to 38)	161	A1
		PRODUCT INFORMATION AREA, 64 BYTES		
40	28	**FORMAT VERSION NUMBER** (Product Info Area) 7:4 - Reserved, write as 0000b 3:0 - Format Version Number = 1h for this specification	1	01
41	29	**PRODUCT INFO AREA LENGTH** (In multiples of 8 bytes)	8	08
42	2A	**Language (English)**	25	19
43	2B	**MANUFACTURER NAME TYPE / LENGTH** (0C5H) Type “ASCII+LATIN1” 5 bytes.	197	C5
		MANUFACTURER'S NAME 5 bytes sequence		
44	2C	“E” = 45h	69	45
45	2D	“M”= 4Dh	77	4D
46	2E	“R” = 52h	82	52
47	2F	“S” = 53h	83	53
48	30	“N” = 4Eh	78	4E
49	31	**PRODUCT NAME** Type/Length (D0H) Type = “ASCII+LATIN1” = (11)b length = 12 bytes = (010000)b	208	D0
50	32	**Product Name,** 10 bytes sequence	68	44
51	33	**“DS1200DC-3 ”**	83	53
52	34	In Decimal = 68, 83, 49, 50, 48, 48, 68, 67, 45, 51, 32, 32, 32, 32, 32, 32	49	31
53	35	In Hex = 44H, 53H, 31H, 32H, 30H, 30H, 44H, 43H, 2DH, 33H, 20H, 20H,	50	32
54	36	20H, 20H, 20H, 20H	48	30
55	37		48	30
56	38		68	44
57	39		67	43
58	3A		45	2D
59	3B		51	33
60	3C		32	20
61	3D		32	20
62	3E		32	20
63	3F		32	20
64	40		32	20
65	41		32	20
66	42	**PRODUCT PART/MODEL NUMBER** Type/Length (D0H) Type = “ASCII+LATIN1” = (11)b length = 16 bytes = (010000)b	208	D0
67	43	**Part / Model Number**	68	44
68	44	**“DS1200DC-3 ”**	83	53
69	45	In Decimal = 68, 83, 49, 50, 48, 48, 68, 67, 45, 51, 32, 32, 32, 32, 32, 32	49	31
70	46	In Hex = 44H, 53H, 31H, 32H, 30H, 30H, 44H, 43h, 2DH, 33H, 20H, 20H,	50	32
71	47	20H, 20H,20H, 20H	48	30
72	48		48	30
73	49		68	44
74	4A		67	43
75	4B		45	2D
76	4C		51	33
77	4D		32	20
78	4E		32	20
79	4F		32	20
80	50		32	20

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
81 82	51 52		32 32	20 20
83	53	**PRODUCT VERSION NUMBER** Type/Length (C2h) Type = "ASCII+LATIN1" = (11)b length = 2 bytes = (000010)b	194	C2
84 85	54 55	Refer to Section 1.2 Product Revision History (Model Revision) in latest IPS Eg. "0A" In Decimal = 48, 65 In Hex = 30H, 41H	XX XX	XX XX
86	56	**PRODUCT SERIAL NUMBER** Type/Length Type = "ASCII+LATIN1" = (11)b length = 13 bytes = (001101)b	205	CD
87 88 89 90	57 58 59 5A	**Model ID** "J049" for DS1200DC-3 In Decimal = 74, 48, 52, 57 In Hex = 4AH, 30H, 34H, 39H	74 48 52 57	4A 30 34 39
91 92	5B 5C	**MANUFACTURING YEAR AND WEEK CODE** "WW" In Decimal = 087, 087 In Hex = 57H, 57H	87 87	57 57
93 94 95 96	5D 5E 5F 60	**Unique Serial Number** "SSSS" In Decimal = 083, 083, 083, 083 In Hex = 53H, 53H, 53H, 53H	83 83 83 83	53 53 53 53
97 98	61 62	**MODEL REVISION** Astec Model Rev, see latest model rev in IPS sec 1.2 Eg. "0A" In Decimal = 048, 065 In Hex = 30H, 41H	XX XX	XX XX
99	63	**Manufacturing Location** "F" for FUYONG In Decimal = 070 In Hex = 46H	70	46
100	64	**End Tag** In Decimal: 193 In Hex: 0C1H	193	C1
101 102	65 66	**PAD (reserved), default value is 0.**	0 0	00 00
103	67	**ZERO CHECK SUM (256 - (Sum of bytes 40 to 102))** Zero Check Sum: should follow check sum calculation as per IPMI v1.1 specs	XX	XX
MULTI RECORD AREA, 88 BYTES				
104 105 106 107 108	68 69 6A 6B 6C	**Power Supply Record Header** Record type = 00 for power supply End of List / Record Format Version Number Record Length of Power Supply Record Record CHECKSUM of Power Supply Record (Zero CHECKSUM) (256 - (sum of bytes 109 to 132) Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM) (256 - (sum of bytes 104 to 107)	0 2 24 XX XX	00 02 18 XX XX
POWER SUPPLY RECORD				
109 110	6D 6E	**Overall Capacity of the Power Supply**, 1200W = 04B0H 2 bytes sequence In Decimal = 176, 004 In Hex = B0H, 04H	176 4	B0 04
111 112	6F 70	**Peak VA,** 1348W = 0544H 2 bytes sequence In Decimal = 068, 005 In Hex = 44H, 05H	68 5	44 05

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
113	71	**Inrush Current**, 30A In Decimal = 030 In Hex = 1EH	30	1E
114	72	**Inrush Interval**, 10mS In Decimal = 010 In Hex = 0AH	10	0A
115 116	73 74	**Low End Input Voltage Range 1(10mV),** (40V / 10mV) 4000 = 1130H 2 bytes sequence In Decimal = 015, 160 In Hex = 0FH, A0H	15 160	0F A0
117 118	75 76	**High End Input Voltage Range 1(10mV),** (72V / 10mV) 4000 = 1C20H 2 bytes sequence In Decimal = 028, 032 In Hex = 1CH, 20H	28 32	1C 20
119 120	77 78	**Low End Input Voltage Range 2(10mV)** Not Applicable (Autoswitch)	0 0	00 00
121 122	79 7A	**High End Input Voltage Range 2(10mV)** Not Applicable (Autoswitch)	0 0	00 00
123	7B	**Low End Input Frequency Range**, 00Hz = 00H	0	00
124	7C	**Low End Input Frequency Range**, 00Hz = 00H	0	00
125	7D	**DC input Dropout Tolerance in ms,** 1mS= 01H	1	01
126	7E	**Binary Flags**, 1 indicates function supported and a 0 indicates function not supported. Bits 7-5: RESERVED, write as 000B Bit 4: Tachometer Pulses Per Rotation / Predictive Fail Polarity BIT = 0 Bit 3: Hot Swap / Redundancy Support BIT = 1 Bit 2: Auto Switch Support BIT = 1 Bit 1: Power Factor Correction Support BIT = 0 Bit 0: Predictive Fail Support BIT = 0	12	0C
127 128	7F 80	**Peak Wattage Capacity and Holdup Time**, 1800W = 708H 1 Second = 01H Bits 15-12: Holdup Time in Seconds, 1 = 01H Bits 11- 0: Peak Capacity in Watts, 1800 = 708H 2 bytes sequence: In Decimal: 008, 023 In Hex: 08H, 17H	8 23	08 17
129 130 131	81 82 83	**Combined Wattage,** not applicable Byte 1 000B = 00H = 0d Bits 7-4: 0000B Bits 3-0: 0000B Byte 2 and Byte 3: 00h,00h 3 bytes sequence In Decimal = 0, 0, 0 In Hex = 30H, B0H, 04H	0 0 0	00 00 00
132	84	**Predictive Fail Tachometer Lower Threshold, not applicable.** Predictive failure is not supported.	0	00

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
12V DC OUTPUT RECORD HEADER				
133	85	Record Type = 01 for DC Output Record	1	01
134	86	End of List / Record Format Version Number for 12V DC Output Record	2	02
135	87	Record Length of 12V DC Output Record	13	0D
136	88	Record CHECKSUM of 12V DC Output Record (Zero CHECKSUM) (256-(sum of bytes 138 to 150)	XX XX	XX XX
137	89	Header CHECKSUM of 12V DC Output Record Header (Zero CHECKSUM) (256-(sum of bytes 133 to 136)		
12V OUTPUT RECORD				
138	8A	**Output Information, 001 = 01H** Bit 7: Standby Information = 0B Bits 6-4: Reserved, write as 000B Bits 3-0: Output Number 1 = 001B	1	01
139	8B	**Nominal Voltage (10mV), (12V/10mV) 1200 = 04B0H** 2 bytes sequence In Decimal: 176, 004	176	B0
140	8C	In Hex: B0H, 04H	4	04
141	8D	**Maximum Negative Voltage Deviation (10mV), 1140 = 0474H** 2 bytes sequence In Decimal: 116, 004	116	74
142	8E	In Hex: 74H, 04H	4	04
143	8F	**Maximum Positive Voltage Deviation (10mV), 1260 = 04ECH** 2 bytes sequence In Decimal: 236, 004	236	EC
144	90	In Hex: ECH, 04H	4	04
145	91	**Ripple and Noise pk-pk (mV), 120 = 78H** 2 bytes sequence In Decimal: 120, 000	120	78
146	92	In Hex: 78H, 00H	0	00
147	93	**Minimum Current Draw (10mA),** 0000 = 0000H 2 bytes sequence In Decimal: 000, 000	0	00
148	94	In Hex: 00H, 00H	0	00
149	95	**Maximum Current Draw (10mA), 98.0A** 9800 = 2648H, 2 bytes sequence, In Decimal: 072, 048	72	48
150	96	In Hex: 38H, 26H	38	26
3V3VSB OUTPUT RECORD HEADER				
151	97	Record Type = 01 for DC Output Record	1	01
152	98	End of List / Record Format Version Number for 3V3SB Output Record	2	02
153	99	Record Length of 3V3SB Output Record	13	0D
154	9A	Record CHECKSUM of 3V3SB Output Record (Zero CHECKSUM) (256-(sum of bytes 156 to 168)	XX	XX
155	9B	Header CHECKSUM of 3V3SB Output Record Header (Zero CHECKSUM) (256-(sum of bytes 151 to 154)	XX	XX
3V3VSB OUTPUT RECORD				
156	9C	**Output Information,** 002 = 02H Bit 7: Standby Information = 1B Bits 6-4: Reserved, Write as 000B Bits 3-0: Output Number 2 = 010B	130	82

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		Nominal Voltage (10mV), (3.3V / 10mV) 330 = 014AH 2 bytes sequence		
157 158	9D 9E	In Decimal: 074, 001 In Hex: 4AH, 01H	74 1	4A 01
		Maximum Negative Voltage Deviation (10mV), (3.14V/10mV) 314 = 013AH 2 bytes sequence		
159 160	9F A0	In Decimal: 058, 001 In Hex: 3AH, 01H	58 1	3A 01
		Maximum Positive Voltage Deviation (10mV), (3.46V/ 10mV) 346 = 015AH 2 bytes sequence		
161 162	A1 A2	In Decimal: 090, 001 In Hex: 5AH, 01H	90 1	5A 01
		Ripple and Noise pk-pk (mV), 50 = 0032H 2 bytes sequence		
163 164	A3 A4	In Decimal: 050, 000 In Hex: 32H, 00H	50 0	32 00
		Minimum Current Draw (10mA), (0.5A / 10mA) 50 = 0032H 2 bytes sequence		
165 166	A5 A6	In Decimal: 050, 000 In Hex: 32H, 00H	50 0	32 00
		Maximum Current Draw (10mA), (6.0A / 10mA) 600 = 0258H 2 bytes sequence		
167 168	A7 A8	In Decimal: 88, 002 In Hex: 58H, 02H	88 2	58 02
169 170	A9 AA	Record Type = C0H for OEM Record End of List / Record Format Version Number for $3.3V_{SB}$ Output Record	192 130	C0 82
		OEM RECORD HEADER		
171 172 173	AB AV AD	Record Length of OEM Record Record CHECKSUM of OEM Record (Zero CHECKSUM) Header CHECKSUM of OEM Record Header (Zero CHECKSUM) (256-(sum of bytes 169 to 172)	42 0 148	2A 00 94
		OEM RECORD		
174 175 176	AE AF B0	**Manufacturer ID** (3 bytes, default is 0)	0 0 0	00 00 00
177 178 179 180 181 182 183 184 185 186	B1 B2 B3 B4 B5 B6 B7 B8 B9 BA	RESERVED RESERVED RESERVED RESERVED RESERVED RESERVED RESERVED RESERVED RESERVED RESERVED	0 0 0 0 0 0 0 0 0 0	00 00 00 00 00 00 00 00 00 00
187 188 189 190 191 192 193 194 195	BB BC BD BE BF C0 C1 C2 C3	PAD (reserved), Default value is 0.	0 0 0 0 0 0 0 0 0	00 00 00 00 00 00 00 00 00

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
196	C4	PAD (reserved), Default value is 0.	0	00
197	C5		0	00
198	C6		0	00
199	C7		0	00
200	C8		0	00
201	C9		0	00
202	CA		0	00
203	CB		0	00
204	CC		0	00
205	CD		0	00
206	CE		0	00
207	CF		0	00
208	D0		0	00
209	D1		0	00
210	D2		0	00
211	D3		0	00
212	D4		0	00
213	D5		0	00
214	D6		0	00
215	D7		0	00
216	D8	RESERVED, default value is 0.	0	00
217	D9		0	00
218	DA		0	00
219	DB		0	00
220	DC		0	00
221	DD		0	00
222	DE		0	00
223	DF		0	00
224	E0		0	00
225	E1		0	00
226	E2		0	00
227	E3		0	00
228	E4		0	00
229	E5		0	00
230	E6		0	00
231	E7		0	00
232	E8		0	00
233	E9		0	00
234	EA		0	00
235	EB		0	00
236	EC		0	00
237	ED		0	00
238	EE		0	00
239	EF		0	00
240	F0		0	00
241	F1		0	00
242	F2		0	00
243	F3		0	00
244	F4		0	00
245	F5		0	00
246	F6		0	00
247	F7		0	00
248	F8		0	00
249	F9		0	00
250	FA		0	00
251	FB		0	00
252	FC		0	00
253	FD		0	00
254	FE		0	00

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
255	FF	Zero CHECKSUM of Internal Use Area (if used). Default Value=0	0	00

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3-001 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
CHASSIS INFO AREA (32 BYTES) This area will be filled by the Mfg. Diag. or by the OS if used				
11	0B	**CHASSIS PART NUMBER** Type/Length C8h (if used) Type = "ASCII+LATIN1" = (11)b length = 10 bytes = (001000)b	200	C8
20	16	**CHASSIS SERIAL NUMBER Type/Length** D1H (if used) Type = "ASCII+LATIN1" = (11)b length = 17 bytes = (010001)b	209	D1
PRODUCT INFORMATION AREA, 56 BYTES				
50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65	32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 40 41	**Product Name,** 16 bytes sequence **"DS1200DC-3-001"** In Decimal = 68, 83, 49, 50, 48, 48, 68, 67, 45, 51, 45, 48, 48, 49, 32, 32 In Hex = 44H, 53H, 31H, 32H, 30H, 30H, 44H, 43H, 2DH, 33H, 2DH, 30H, 30H, 31H, 20H, 20H	68 83 49 50 48 48 68 67 45 51 45 48 48 49 32 32	44 53 31 32 30 30 44 43 2D 33 2D 30 30 31 20 20
87 88 89 90	57 58 59 5A	**Model ID** "J049" for DS1200DC-3-001 In Decimal = 74, 48, 52, 57 In Hex = 4AH, 30H, 34H, 39H	74 52 52 49	4A 34 34 39

COMMUNICATION BUS DESCRIPTIONS

DS1200DC-3-002 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
CHASSIS INFO AREA (32 BYTES) This area will be filled by the Mfg. Diag. or by the OS if used				
11	0B	**CHASSIS PART NUMBER** Type/Length C8h (if used) Type = "ASCII+LATIN1" = (11)b length = 10 bytes = (001000)b	200	C8
20	16	**CHASSIS SERIAL NUMBER Type/Length** D1H (if used) Type = "ASCII+LATIN1" = (11)b length = 17 bytes = (010001)b	209	D1
PRODUCT INFORMATION AREA, 56 BYTES				
50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65	32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 40 41	**Product Name,** 16 bytes sequence **"DS1200DC-3-002"** In Decimal = 68, 83, 49, 50, 48, 48, 68, 67, 45, 51, 45, 48, 48, 50, 32, 32 In Hex = 44H, 53H, 31H, 32H, 30H, 30H, 44H, 43H, 2DH, 33H, 2DH, 30H, 30H, 31H, 20H, 20H	68 83 49 50 48 48 68 67 45 51 45 48 48 50 32 32	44 53 31 32 30 30 44 43 2D 33 2D 30 30 32 20 20
87 88 89 90	57 58 59 5A	**Model ID** "J442" for DS1200DC-3-002 In Decimal = 74, 52, 52, 50 In Hex = 4AH, 34H, 34H, 32H	74 52 52 50	4A 34 34 32
5VSB OUTPUT RECORD				
157 158	9D 9E	**Nominal Voltage (10mV),** (5V/10mV) 500 = 01F4H 2 bytes sequence In Decimal: 244, 01 In Hex: F4, 01	244 01	F4 01
159 160	9F A0	**Maximum Negative Voltage Deviation (10mV),** (4.75V/10mV) 475 = 01DBH 2 bytes sequence In Decimal: 219, 01 In Hex: DB, 01	219 01	DB 01
161 162	A1 A2	**Maximum Positive Voltage Deviation (10mV),** (3.46V/10mV) 346 = 015AH 2 bytes sequence In Decimal: 13, 02 In Hex: 0D, 02	13 02	0D 02
167 168	A7 A8	**Maximum Current Draw (10mA),** (4.0A/10mA) 400 = 0190H 2 bytes sequence In Decimal: 144, 01 In Hex: 90, 01	144 01	90 01

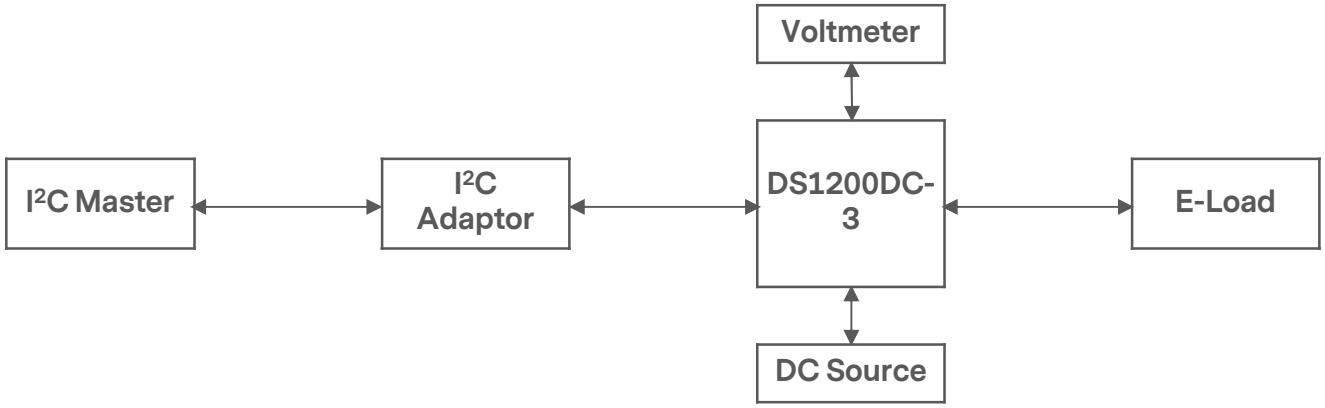
PMBus™ SPECIFICATIONS

The DS1200DC-3 series is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

DS1200DC-3 Series PMBus™ General Instructions

Equipment Setup

The following is typical I²C communication setup:



PMBus™ Writing Instructions

When writing to any PMBus™ R/W registers, always do the following:

Disable write protect (command 10h) by writing any of the following accordingly:

Levels: 00h - Enable writing to all writeable commends

20h - Disables write except 10h, 01h, 00h, 02h and 21h commands

40h - Disables write except 10h, 01h, and 00h commends

80h - Disable write except 0x00h

To save changes on the USER PMBus™ Table:

Use send byte command: 15h STORE_USER_ALL

To save changes on the DEFAULT PMBus™ Table:

Use send byte command: 11h STORE_DEFAULT_ALL

Wait for 5 seconds, turn off the PSU, wait for another 5 seconds before turning it on.

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
01h	OPERATION	80	R/W	1	Bitmapped	Used to turn the unit ON/OFF in conjunction with the input PS_ON pin. It is also used to set output to upper or lower margin voltages.
	b7:6	10				00 - Immediate Turn OFF (no sequencing) 01 - Soft Turn OFF (with sequencing) 10 - PSU ON
	b5:2	0000				
	b1:0	00				Reserved
02h	ON_OFF_CONFIG	1C	R/W	1		Configures the combination of CONTROL pin and serial communication commands needed to turn the unit ON/OFF.
	b7:5	000				Reserved
	b4 - Enable CONTROL pin and serial communication control.	1				0 - Unit powers up any time power is present regardless of the state of CONTROL pin. 1 - Unit powers up as dictated by CONTROL pin and OPERATION command (b3:0).
	b3 - Serial communication control	1				0 - Unit ignores ON/OFF portion of the OPERATION command. 1 - Enables serial communication ON/OFF portion of OPERATION command. Requires CONTROL pin to be asserted for the unit to start and energize the output.
	b2 - Sets how the unit responds to CONTROL pin	1				0 - Unit ignores CONTROL pin. (ON/OFF controlled by OPERATION command). 1 - Unit requires CONTROL pin to be asserted to start the unit.
	b1 - CONTROL pin polarity	0				0 - Active low (Pull low to start the unit) 1 - Active high (Pull high to start the unit)
	b0 - CONTROL pin action	0				0 - Use programmed turn ON/OFF delay. 1 - Turn OFF the output and stop transferring energy to the output as fast as possible.
03h	CLEAR_FAULTS	0	S			
10h	WRITE_PROTECT	00	R/W	1		Used to control writing to the PMBus™ device. 80h - Disables write except 10h 40h - Disables write except 10h, 01h, 00h 20h - Disables write except 10h, 01h, 00h, 02h and 21h commands. 00 - Enables write to all writeable commands.

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
11h	STORE_DEFAULT_ALL	-	S	0		Copies the value of the operating memory table to the matching DEFAULT non-volatile memory.
12h	RESTORE_DEFAULT_ALL	-	S	0		Copies the entire contents of the DEFAULT non-volatile memory to the operating memory table.
15h	STORE_USER_ALL	-	S	0		Copies the operating memory table to the matching USER non-volatile memory.
16h	RESTORE_USER_ALL	-	S	0		Copies the entire USER non-volatile memory to the operating memory table.
19h	CAPABILITY	00	R	1		Provides a way for the hosts system to determine some key capabilities of a PMBus™ device.
	b7 - Packet Error Checking	0				0 - PEC not supported 1 - PEC supported
	b6 - Maximum Bus Speed	0				0 - Maximum supported bus speed, 100KHz 1 - Maximum supported bus speed, 400KHz
	b5 - SMBALERT	0				0 - SMBus Alert Pin not supported. 1 - SMBus Alert Pin supported.
	b4:0	00000				Reserved
20h	VOUT_MODE	40	R	1		Specifies the mode and parameters of output voltage related data formats.
21h	VOUT_COMMAND	04B0	R/W	2	Direct	Sets the output voltage reference. Vout command sends discreet value to change or trim output voltage. The value acts as digital reference of the power supply after additional operations are performed (to make the representation compatible). Affects OVP_WARNING and FAULT LIMIT, as well as POWER_GOOD_ON/OFF level.
22h	VOUT_TRIM	0000	R/W	2		0
23h	VOUT_CAL_OFFSET	xxxx	R/W	2		Variable. Used by factory to trim Vout default before trimming.
24h	VOUT_MAX	0564	R	2	Direct	Sets the max adjustable output voltage limit. 13.8V
30h	COEFFICIENTS	FFFF	R	6		Use to retrieve the m, b and R coefficients, needed for DIRECT data format.
	byte 5					R byte
	byte 4:3					b low byte, b high byte
	byte 2:1					m low byte, m high byte
31h	POUT_MAX	A258	R	2	Linear	Sets the operating power limit condition. 1550W

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
35h	VIN_ON	E954	R	2	Linear	Sets the value of input, in volts, at which the unit should start.
36h	VIN_OFF	E932	R	2	Linear	Sets the value of input, in volts, at which the unit should stop power conversion.
38h	IOUT_CAL_GAIN	FFFF	R	2		The ratio of voltage across the current sense to actual current.
39h	IOUT_CAL_OFFSET	F226	R	2		Used to null any offsets in the current sensing circuit. Normally used in conjunction with the IOUT_SCALE to minimize current sensing error.
3Ah	FAN_ CONFIG_1_2	90	R	1		Used to configure up to 2 fans associated with one PMBus device.
	b7	1				1 - Fan is installed in position 1. 0 - No fan is installed in position 1.
	b6	0				1 - Fan is commanded in RPM. 0 - Fan is commanded in DC.
	b5:4	01				00 - 1 pulse per revolution 01 - 2 pulses per revolution 10 - 3 pulses per revolution 11 - 4 pulses per revolution
	b3	0				1 - Fan is installed in position 2. 0 - No fan is installed in position 2.
	b2	0				1 - Fan is commanded in RPM. 0 - Fan is commanded in DC.
	b1:0	00				00 - 1 pulse per revolution 01 - 2 pulses per revolution 10 - 3 pulses per revolution 11 - 4 pulses per revolution
3Bh	FAN_COMMAND_1	0064	R/W	2	Direct	Adjusts the operation of the fans. The device may override the command, if it requires higher value to maintain proper device temperature. RPM control - Commands speeds from 0-65535 RPM. Duty cycle Control - Commands speeds from 0 to 100%
40h	VOUT_OV_FAULT_LIMIT	0564	R/W	2	Direct	Sets output over voltage threshold. (13.8V)
41h	VOUT_OV_FAULT_RESPONSE	80	R	1		Unit latches OFF. Resets on PSON or CONTROL pin recycle or DC recycle.
42h	VOUT_OV_WARN_LIMIT	0514	R/W	2	Direct	Sets over-voltage warning threshold. (13.0V)
43h	VOUT_UV_WARN_LIMIT	044C	R/W	2	Direct	Sets under-voltage warning threshold. (11.0V)
44h	VOUT_UV_FAULT_LIMIT	03FC	R/W	2	Direct	Sets under-voltage fault threshold. (10.2V)
45h	VOUT_UV_FAULT_RESPONSE	80	R	1		Turn PSU OFF

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
46h	IOUT_OC_FAULT_LIMIT	2E2C	R	2	Direct	Sets the over current threshold in Amps.
47h	IOUT_OC_FAULT_RESPONSE	C0	R	1		OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT	2A48	R	2	Direct	Sets the over current warning threshold in Amps.
4Fh	OT_FAULT_LIMIT	16A8	R/W	2	Direct	Secondary ambient temperature fault threshold, in degree C. (58degC)
50h	OT_FAULT_RESPONSE	B8	R	1	Linear	Turn PSU OFF and will retry indefinitely.
51h	OT_WARN_LIMIT	E370	R	2	Direct	Secondary ambient temperature warning threshold, in degree C. Operating limit. refer to section 3.1. (55degC)
55h	VIN_OV_FAULT_LIMIT	F892	R	2	Linear	Sets input over-voltage threshold.
56h	VIN_OV_FAULT_RESPONSE	00	R	1		No interruption.
57h	VIN_OV_WARN_LIMIT	F892	R	2	Linear	Sets the threshold of input voltage that triggers high voltage warning. (?Vdc)
58h	VIN_UV_WARN_LIMIT	E938	R	2	Linear	(?Vdc)
59h	VIN_UV_FAULT_LIMIT	E92C	R	2	Linear	(?Vdc)
5Ah	VIN_UV_FAULT_RESPONSE	00	R	1		
5Bh	IIN_OC_FAULT_LIMIT	D780	R	2	Linear	Sets the threshold for input current that causes over-current fault within 100ms. (13A)
5Ch	IIN-OC-FAULT_RESPONSE	00	R	1		Turn PSU OFF. Cleared upon DC recycle.
5Eh	POWER_GOOD_ON	0498	R	2	Direct	Sets the threshold by which the Power Good signal is asserted. (11.76V)
5Fh	POWER_GOOD_OFF	03FC	R	2	Direct	Sets the threshold by which the power good signal is de-asserted. (10.2V)
60h	TON_DELAY	00C3	R	2	Direct	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (2sec)
61h	TON_RISE	1388	R	2	Direct	Sets the time (ms), for the output rises from 0 to regulation. (50ms)
64h	TOFF_DELAY	0064	R	2	Direct	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF). (23ms)
78h	STATUS_BYTE	-	R	1		Returns the summary of critical faults.
	b7 - BUSY	-				A fault was declared because the device was busy and unable to respond.
	b6 - OFF	-				Unit is OFF.
	b5 - VOUT_OV	-				Output over-voltage fault has occurred.
	b4 - IOUT_OC	-				Output over-current fault has occurred.

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
78h	b3 - VIN_UV	-				An input under-voltage fault has occurred.
	b2 - TEMPERATURE	-				A temperature fault or warning has occurred.
	b1 - CML	-				A communication, memory or logic fault has occurred.
	b0 - NONE OF THE ABOVE	-				A fault warning not listed in bits[7:1] has occurred.
79h	STATUS_WORD	-	R	2		Summary of units fault and warning status.
	b15 - VOUT					An output voltage fault or warning has occurred.
	b14 - IOUT/POUT					An output current or power fault or warning has occurred.
	b13 - INPUT					An input voltage, current or power fault or warning as occurred.
	b12 - MFR					A manufacturer specific fault or warning has occurred.
	b11 - POWER_GOOD#					The POWER_GOOD signal is de-asserted.
	b10 - FANS					A fan or airflow fault or warning has occurred.
	b9 - OTHER					A bit in STATUS_OTHER is set.
	b8 - UKNOWN					A fault type not given in bits [15:1] of the STATUS_WORD has been detected.
	b7 - BUSY					A fault was declared because the device was busy and unable to respond.
	b6 - OFF					Unit is OFF.
	b5 - VOUT_OV					Output over-voltage fault has occurred.
	b4 - IOUT_OC					Output over-current fault has occurred.
	b3 - VIN_UV					An input under-voltage fault has occurred.
	b2 - TEMPERATURE					A temperature fault or warning has occurred.
	b1 - CML					A communication, memory or logic fault has occurred.
	b0 - NONE_OF_THE_ABOVE					A fault or warning not listed in bits[7:1] of this byte has occurred.
7Ah	STATUS_VOUT	00	R	1		Output voltage related faults and warnings
	b7					VOUT over-voltage fault
	b6					VOUT over-voltage warning
	b5					VOUT under-voltage warning
	b4					VOUT under-voltage fault

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Ah	b3					VOUT_MAX warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					Reserved
7Bh	STATUS_IOUT	-	R	1		Output current related faults and warnings.
	b7					IOUT Over Current Fault
	b6					IOUT Over Current and Low Voltage Shutdown Fault
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					POUT Overpower Warning
7Ch	STATUS_INPUT	-	R	1		Input related faults and warnings.
	b7					VIN Overvoltage Fault
	b6					VIN Overvoltage Warning
	b5					VIN Under-voltage Warning
	b4					VIN Under-voltage Fault
	b3					Unit is OFF for insufficient input voltage.
	b2					IIN Over Current Fault
	b1					IIN over current warning
	b0					PIN overpower warning
7Dh	STATUS_TEMPERATURE	-	R	1		Temperature related faults and warnings.
	b7					Over-temperature Fault
	b6					Over-temperature Warning
	b5					Under-temperature Warning
	b4					Under-temperature Fault
	b3:0					Reserved
7Eh	STATUS_CML	-	R	1		Communications, logic and memory
	b7					Invalid or unsupported command received.
	b6					
	b5					Packet Error Check Failed
	b4					Memory Fault Detect, CRC Error
	b3					
	b2					
	b1					
	b0					

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
80h	STATUS_MFR_SPECIFIC	-	R	1		Manufacturer Status Codes
	b7					Bulk OK, 1 - Bulk is within range and is ready for use.
	b6					Not Used
	b5					Not Used
	b4					Not Used
	b3					Not Uesd
	b2					Not Uesd
	b1					Standby Fault, 1 if there's a standby fault.
	b0					PSON, CONTROL Pin Status 1 - asserted, 0 - de-asserted
81h	STATUS_FANS_1_2		R	1		
	b7					Fan 1 Fault
	b6					Fan 2 Fault
	b5					Fan 1 Warning
	b4					Fan 2 Warning
	b3					Fan_1 Speed Overridden
	b2					Fan_2 Speed Overridden
	b1					
	b0					
88h	READ_VIN	-	R	2	Linear	Returns input voltage in Volts.
89h	READ_IIN	-	R	2	Linear	Returns input current in Amperes
8Ah	READ_VCAP	-	R	2	Linear	Returns bulk capacitor voltage in Volts
8Bh	READ_VOUT	-	R	2	Direct	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Direct	Returns the output current in amperes.
8Eh	READ_TEMPERATURE_2	-	R	2	Direct	PSU air inlet temp (inside PSU)
90h	READ_FAN_SPEED_1	-	R	2	Linear	Speed of Fan 1
96h	READ_POUT	-	R	2	Linear	Returns the output power, in Watts.
97h	READ_PIN	-	R	2	Linear	Returns the input power, in Watts.
98h	PMBUS_REVISION	11	R	1		Reads the PMBus revision number
	b7:5	0001				Part 1 Revision 0000 - Revision 1.0 0001 - Revision 1.1
	b4:0	0001				Part 2 Revision 0000 - Revision 1.0 0001 - Revision 1.1
99h	MFR_ID	"ALL"	BR, ASCII	4		Abbrev or symbol of manufacturers name.
9Ah	MFR_MODEL	"DS1200DC-3"	BR, ASCII	8		Manufacturers model number, ASCII format
9Bh	MFR_REVISION	"1.0"	BR, ASCII	3		Manufacturers, revision number, ASCII format

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
9Ch	MFR_LOCATION	"xxxx"	BR, ASCII	4		Manufacturers facility, ASCII format
9Dh	MFR_LOCATION	"xxxxxxx"	BR	7		Manufacture date, ASCII format structure: YYMMDD
9Eh	MFR_DATE	"xxxxxxxxxxxxxxxx"	BR	16		Unit serial number, ASCII format.
A0h	MFR_VIN_MIN	F8E4	R	2	Linear	Minimum Input Voltage (40Vdc)
A1h	MFR_VIN_MAX	F890	R	2	Linear	Maximum Input Voltage (72Vdc)
A2h	MFR_IIN_MAX	F844	R	2	Linear	Maximum Input Current (12A)
A3h	MFR_PIN_MAX	0AA2			Linear	Maximum Input Power (1348W)
A4h	MFR_VOUT_MIN	0474	R	2	Direct	Minimum Output Voltage Regulation Window (11.4V)
A5h	MFR_VOUT_MAX	04EC	R	2	Direct	Maximum Output Voltage. Regulation Window (12.6V)
A6h	MFR_IOUT_MAX	2670	R	2	Direct	Maximum Output Current (98A)
A7h	MFR_POUT_MAX	0A58	R	2	Linear	Maximum Output Power (1200W)
A8h	MFR_TAMBIENT_MAX	1388	R	2	Direct	Maximum Operating Ambient Temperature (Secondary Ambient) (50degC)
A9h	MFR_TAMBIENT_MIN	0000	R	2	Direct	Minimum Operating Ambient Temperature (Secondary Ambient) (0degC)
D1h	STBY_UV	0AF0	R	2	Direct	Standby Under-voltage Level (2.5V, for conversion decimal value should be multiplied by 10, eg. 2.5V x 10 = 25V = 09C4hex)
D2h	Min Fan Speed	1B39	R	2	L	Standby Fan Speed, (13200rpm / 20% Duty Cycle)
D3h	Max Fan Speed	2A52	R	2	L	Normal Operation Fan Speed (38400rpm / 100% Duty Cycle)
E2h	Ishare Offset		R/W	2		Variable. Used by factory to trim ishare voltage offset. Default before tirmming, 0000
E3h	Ishare Slope		R/W	2		Variable. Used by factory to trim ishare voltage slope. Default before tirmming, FF7F
EAh	ENTER_BOOTLOAD		W	2		
EEh	FIRMWARE_VERSION		BR	11	ASCII	
EFh	I/O_EXPANDER		R	1		See Section 5.24.6 - Power Supply Status Register
F0h	MFR_PASSWORD		W	2		
F1h	MFR_DATE_WRITE		BW	6	-	
F2h	MFR_SERIAL_WRITE		BW	13	-	

PMBus™ SPECIFICATIONS

The DS1200DC-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
D0h	Fault Register		R	2		Summary of units fault and warning status.
	b15 - 12Vout_sckt					An output short circuit fault has occurred.
	b14 - 12Vout_ocw					+12V Over Current Warning Flag
	b13 - 12Vout_ocp2					+12V Fast OCP (High Level OCP) fault occurred (1ms)
	b12 - 12Vout_ocp					+12V Normal OCP fault occurred (1sec).
	b11 - 12Vout_ovp2					+12V Second level OVP fault occurred.
	b10 - 12Vout_ovp					+12V OVP fault occurred.
	b9 - 12Vout_uvp					+12V UVP fault occurred.
	b8 - NA					Not Used
	b7 - NA					Not Used
	b6 - Ocp_ride_through_flag					PSU is in 1second ride-through because +12V OCP level is reached.
	b5 - Stby_uvp					Standby UVP fault occurred.
	b4 - Fanfail					A fan or airflow fault or warning has occurred.
	b3 - Otp_Secondary					Secondary OTP (Ambient) fault occurred.
	b2 - Otp_Primary					Primary OTP fault occurred.
	b1 - PwrLimit_Enabled.					PSU is on derated output power
	b0 - Save Last Known State IFF "1" - default "0"					Saves last known fault that occurred. Under development
F7h	Calibration Register		R	1		PSU is calibrated and passed all functional tests.
	b7 - PSU Calibrated and Tested					Bit is set if PSU calibrated and has passed all functional tests. This is to ensure that all PSUs exiting the factory have been calibrated.
	b6 - NA					Not Used
	b5 - NA					Not Used
	b4 - NA					Not Used
	b3 - NA					Not Used
	b2 - NA					Not Used
	b1 - NA					Not Used
	b0 - NA					Not Used

APPLICATION NOTES

Current Sharing

The DS1200DC-3 series' main output V_O is equipped with current sharing capability. This will allow up to 4 power supplies to be connected in parallel for higher power application. Current share accuracy is typically 5% of full load. When supplying light loads between 10% and 40% of its rated load, the power supplies will share within 20% accuracy. Below 10% total loading, there is no guarantee of output current sharing.

Redundancy / Fault Tolerance

The DS1200DC-3 series power supplies will allow up to 4 power supplies to be connected in a N+1 redundant load.

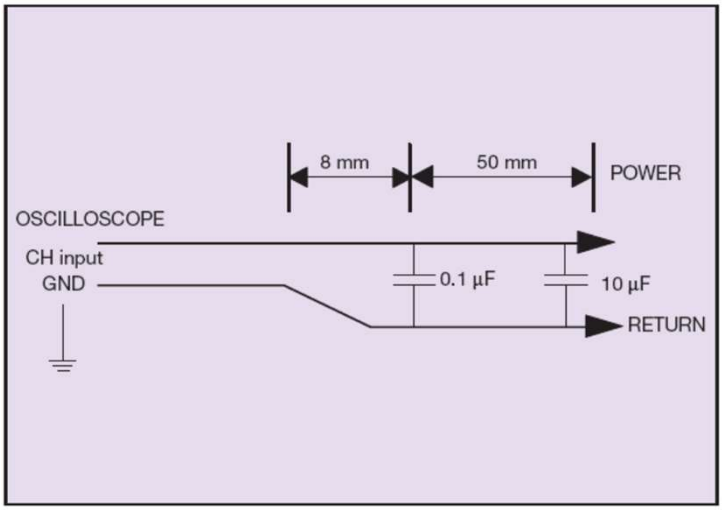
Any failure of one power supply in parallel as well as hot swapping shall not cause more than a 5% change in any output. The failure of one or more supplies will not cause the remaining supplies to violate any of the input or output specifications noted in this specification including all status signals.

The latch of the DS1200DC-3 power supply is designed to prevent the latch from depressed if the DC cord is attached to the power supply. In order to remove the power supply from system chassis, the DC cord must be removed first so the power supply will always be in the powered off state during the removal from system chassis.

APPLICATION NOTES

Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the DS1200DC-3 series. When measuring output ripple and noise, a scope jack in parallel with a 0.1uF ceramic chip capacitor, and a 10uF tantalum capacitor will be used. Oscilloscope can be set to 20MHz bandwidth for this measurement.



RECORD OF REVISION AND CHANGES

Issue	Date	Description	Originators
1.0	03.11.2014	First issue	K. Wang
1.2	07.13.2014	Update the dynamic response minimum load	K. Wang
1.3	07.03.2018	Add the low voltage start up information	K. Wang
1.4	03.03.2021	Update cover and back cover	C. Liu
1.5	04.19.2022	Add UKCA mark	C. Liu

ABOUT ADVANCED ENERGY

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Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

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For international contact information,
visit advancedenergy.com.

powersales@aei.com (Sales Support)
productsupport.ep@aei.com (Technical Support)
+1 888 412 7832

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