DS800SL-3

800 Watts
Distributed Power System

Total Power: 800 Watts
Input Voltage: 90-264 Vac
# of Outputs: Main + Standby

Special Features
- Active power factor correction
- EN61000-3-2 harmonic compliance
- 1U X 54.5mm form factor
- 19.05W / in^3
- +12 Vdc Output
- +5 Vdc stand-by
- Hot plug operation
- N + 1 redundant
- Internal OR'ing diode
- Active current sharing (10 - 100% load)
- I^2C communication interface bus
- PMBus compliant
- EEPROM for FRU data
- Internal fan speed control
- Two years warranty

Safety
UL/cUL 60950 (UL Recognized)
DEMKO + CB Report EN60950
CSA 60950-1
EN60950
China CCC

Product Descriptions

The DS800SL-3 power supply feature a very wide 90 to 264 Vac input voltage range and employ active power factor correction to minimize input harmonic current distortion and to ensure compliance with the international EN61000-3-2 standard – they have a power factor of 0.99 typical.

The power supply has single 12 Vdc output with a 5.0v stand-by aux output. This power supply has a power density of 19.05Watts / cubic inch, and the efficiency shall exceed 2009 Climate Savers targets. The DS800SL-3 can deliver up to 66.7 A from its main +12 Vdc payload output, and up to 4 A from its +5.0Vdc auxiliary output. The form factor is1U by 1.5U (40mmx54.5mm),(1.57"x2.15") and may be used singly or in a redundant configurations. The use of this supply will be as a "Leveraged Platform" for Custom Power, and as a Standard Catalog Product. The supply also will be PMBus™ Compatible.

Model Numbers

Standard	Output Voltage	Minimum Load	Maximum Load	Stand-By Supply	Air Flow Direction
DS800SL-3	12.0Vdc	0.5A	66.7A	5V@4A	Normal (DC Connector to Handle)
DS800SL-3 -001	12.0Vdc	0.5A	66.7A[1]	5V@4A	Reversed (Handle to DC Connector)

Note 1: Total output power will be derated according to the curve shown on page 20.

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	Model	Symbol	Min	Typ	Max	Unit
Input Voltage: AC continuous operation	All models	$V_{IN,AC}$	90	-	264	Vac
Maximum Output Power (Main + Stand-by)	DS800SL-3	$P_{O,max}$	-	-	800	W
Isolation Voltage Input to output Input to safety ground Outputs to safety ground	All models		 - - -	 - - -	 3000 1893 50	 Vac Vdc Vdc
Ambient Operating Temperature	All models	T_A	-10	-	+50	^{O}C
Storage Temperature	All models	T_{STG}	-40	-	+85	^{O}C
Humidity (non-condensing) Operating Non-operating	 All models All models		 5 5	 - -	 95 95	 % %
Altitude Operating Non-operating	 All models All models		 - -	 - -	 10,000 30,000	 ft ft

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, AC		V_{IAC}	90	115/230	264	Vac
Input Vac Source Frequency		f_{IAC}	47	50/60	63	Hz
Maximum Input Current ($I_O = I_{O,max}$, $I_{VSB} = I_{VSB,Max}$)	$V_{IAC} = 100V_{AC}$	$I_{I,max}$	-	-	10	A
Standby Input Current (V_O Off, $I_{VSB} = 0A$)	All	$I_{I,standby}$	-	-	220	mA
No Load Input Current (V_O On, $I_O = 0A$, $I_{VSB} = 0A$)	All	I_{I,no_load}	-	-	250	mA
Harmonic Line Currents	All	THD	Per IEC61000-3-2			
Power Factor	All		-	0.99	-	
Startup Surge Current (Inrush) @ 25°C	$V_{IAC} = 264V_{AC}$	$I_{I,surge}$	-	-	40	A
Input Fuse	Quick Acting 15A, 250V		-	-	15	A
Leakage Current to earth ground	$V_{IAC} = 240V_{AC}$ $f_{IAC} = 50/60$ Hz		-	-	1	mA
PFC Switching Frequency	All	$f_{SW,PFC}$	45	-	55	KHz
DCDC Switching Frequency	All	$f_{SW,DC-DC}$	115	-	125	KHz
Operating Efficiency @ 25°C	$V_{IAC} = 230V_{AC}$ $I_O = 0.5\ I_{O,max}$	η	92	-	-	%
System Stability: Phase Margin Gain Margin			 45 10	 - -	 - -	 Ø dB

Output Specifications

Table 3. Output Specifications:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Output Regulation	All	Inclusive of set-point, temperature change, warm-up drift and dynamic load	V_O	11.4	12.0	12.6	V
			V_{VSB}	4.75	5.0	5.25	
Output Ripple, pk-pk	All	Measure with a 0.1µF ceramic capacitor in parallel with a 10µF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	-	120	mV_{PK-PK}
			V_{VSB}	-	-	100	
Output Current	All	90Vac≤ V_{IAC} ≤ 264Vac	I_O	0	-	66.7	A
			I_{VSB}	0	-	4	
V_O Current Share Accuracy		100% I_O		-	-	5	$\%I_O$
V_O Minimum Current Share Loading				20	-	-	$\%I_{O,max}$
Number of Parallel Units		Main Output Current Share connected		-	-	6	
V_O Load Capacitance		Start up	-	180	-	10000	µF
V_O Dynamic Response	Peak Deviation Settling Time	50% load change, slew rate = 1A/µs	$\pm\%V_O$ T_s	- -	- -	5 250	% uSec
V_O Long Term Stability Max change over 24 hours		After thermal equilibrium (30 mins)	$\pm\%V_O$	-	-	0.2	%

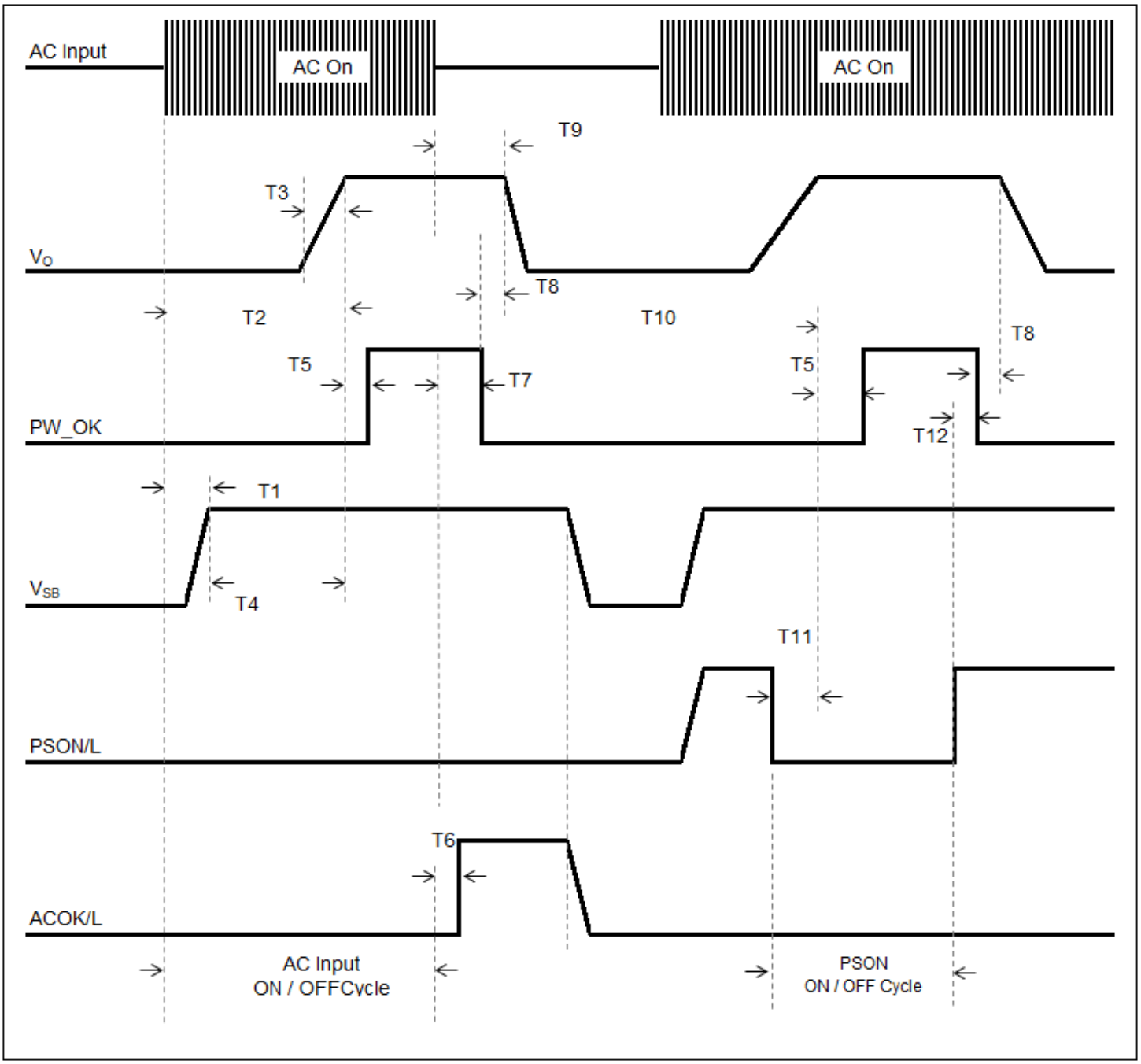
System Timing Specifications

Table 4. System Timing Specifications:

Label	Description	Min	Typ	Max	Unit
T1	Delay from AC being applied to 5Vstandby being within regulatio	1	-	2000	mSec
T2	Delay from AC being applied to all output voltages being within regulation	-	-	4000	mSec
T3	Output voltage rise time from the main output.	10	-	300	mSec
T4	Delay from 5.0Vsb being in regulation to 12Vdc being in regulation at AC turn on.	50	-	1000	mSec
T5	Delay from output voltages within regulation limits to PW_OK asserted at turn on.	100	-	1000	mSec
T6	Delay from loss of AC input to de -assertion of ACOK/L.	10	-	-	mSec
T7	Delay from loss of AC to de-assertion of PW_OK.	5	-	-	mSec
T8	Delay from PW_OK de-asserted to 12V or 5V standby dropping out of regulation limits	1	-	1000	mSec
T9	Time all output voltages, including the 5V standby, stay within regulation after loss of AC.	10	-	-	mSec
T10	Duration of PW_OK being in the de-asserted state during an off/on cycle using AC or the PSON/L signal.	100	-	-	mSec
T11	Delay from PSON/L active to output voltages within regulation limits	50	-	2500	mSec
T12	Delay from PSON/L de-active to PW_OK being de-asserted.	-	-	100	mSec

System Timing Specifications

Figure 1. System Timing Diagram:



DS800SL-3 Performance Curves

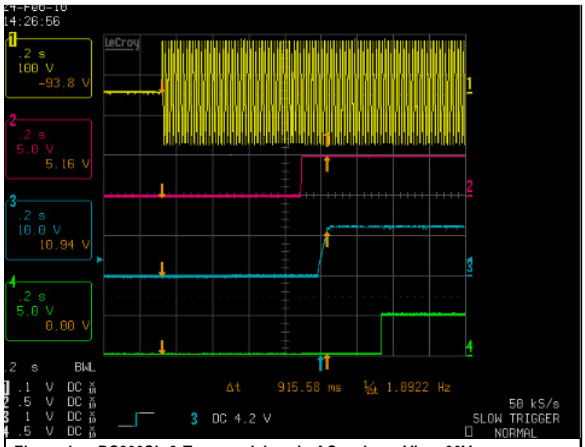


Figure 1: DS800SL-3 Turn-on delay via AC mains – Vin = 90Vac
Full Load: Io=66.7A, Isb=4A
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: PW_OK

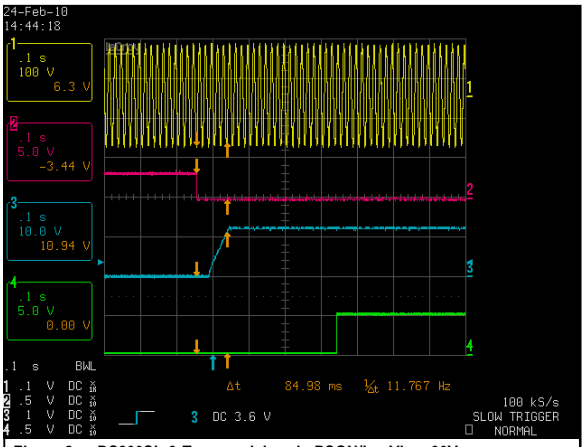


Figure 2: DS800SL-3 Turn-on delay via PSON/L – Vin = 90Vac
Full Load: Io=66.7A, Isb=4A
Ch 1: AC Mains Ch 2: PSON/L Ch 3: Vo Ch 4: PW_OK

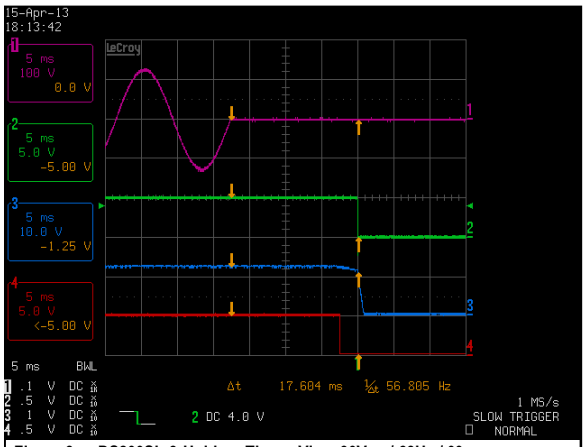


Figure 3: DS800SL-3 Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Io = 66.7A, Isb =4A
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: PW_OK

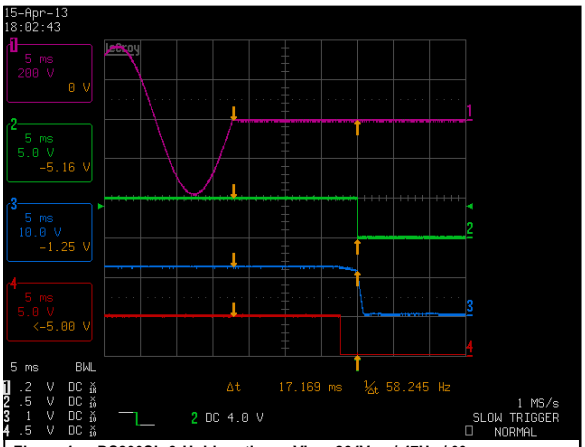


Figure 4: DS800SL-3 Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Io = 66.7A, Isb = 4A
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: PW_OK

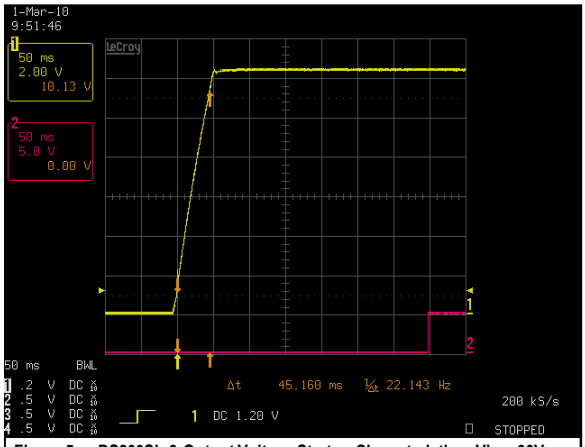


Figure 5: DS800SL-3 Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Io = 66.7A, Isb = 4A
Ch 1: Vo Ch 2: PW_OK

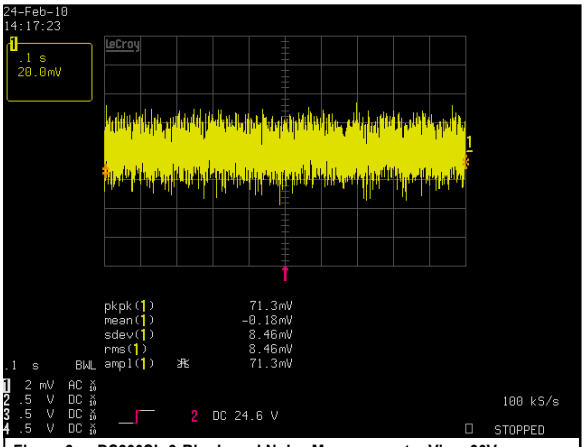


Figure 6: DS800SL-3 Ripple and Noise Measurement – Vin = 90Vac
Full Load: Vo = 66.7A, Isb = 4A
Ch 1: Vo

DS800SL-3 Performance Curves

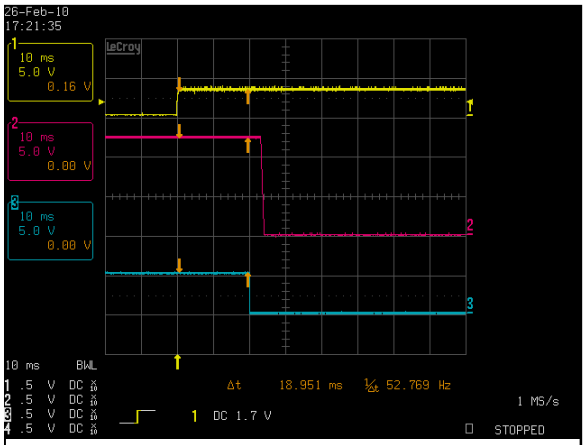


Figure 7: DS800SL-3 Turn Off Characteristic via PSON/L
Full Load: Io = 66.7A Isb = 4A
Ch 1: PSON/L Ch 2: Vo Ch 3: PW_OK

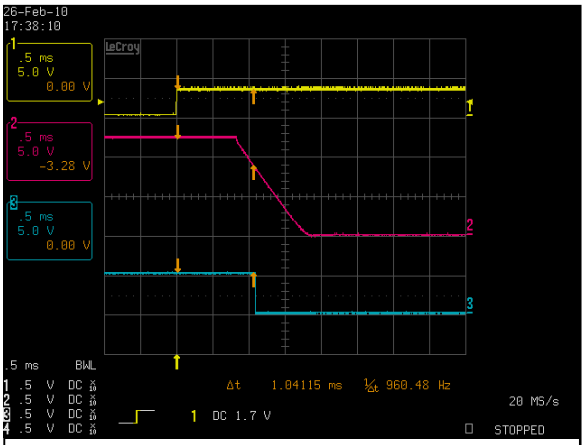


Figure 8: DS800SL-3 Turn Off Characteristic via PSKILL
Full Load: Io = 66.7A, Isb = 4A
Ch 1: PSKILL Ch 2: Vo Ch 3: PW_OK

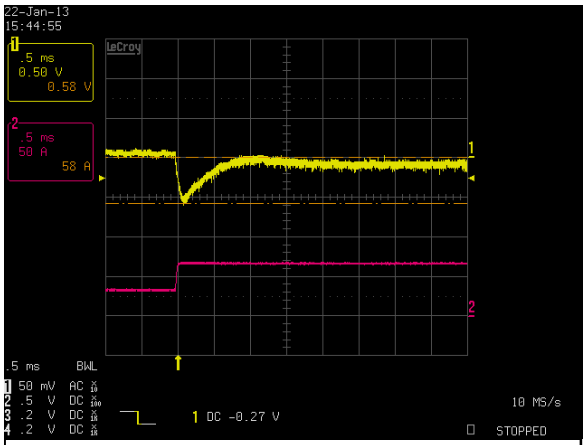


Figure 9: DS800SL-3 Transient Response – Vo Deviation (low to high)
50% to 100% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

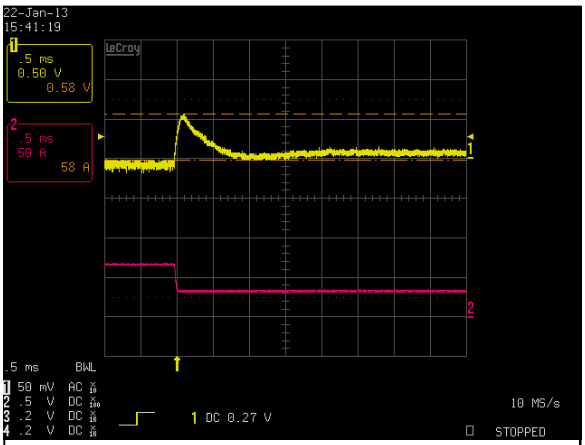


Figure 10: DS800SL-3 Transient Response – Vo Deviation (high to low)
100% to 50% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

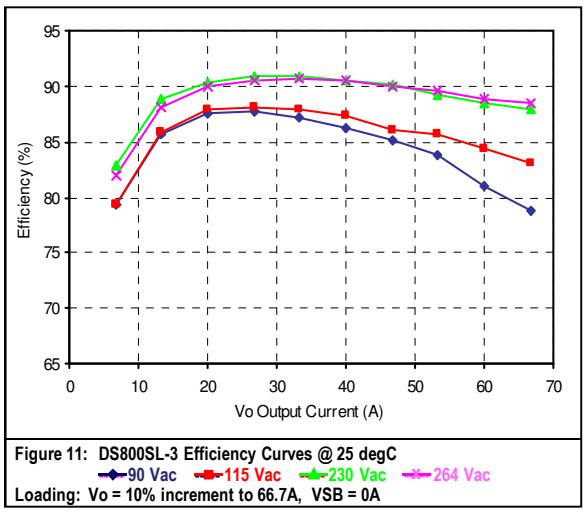


Figure 11: DS800SL-3 Efficiency Curves @ 25 degC
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Vo = 10% increment to 66.7A, VSB = 0A

Protection Function Specification

Input Fusing

The AC line shall be protected by 15A internal fuse fitted in live line.

Power Line Transient Protection

The PSU shall be protected from high voltage transients by a Metal Oxide Varistor (MOV) directly placed after the input fuse. In addition, switch or AC input plug bounce shall not cause any PSU components to fail or exceed their respective ratings.

AC Under Voltage Tolerance

The PSU shall not be damaged and shall either operate properly or shutdown (latching or non-latching)

when the input voltage is less than the minimum operating voltage.

Protection Circuits

Protection circuits inside the PSU shall cause only the PSU main output +12V to shutdown. The +5Vsb shall remain powered if the failure does not involve this output. When a protection circuit shuts down the +12V output, an AMBER LED on the front panel shall be activated. If the PSU latches off due to a circuit protection tripping, an AC cycle OFF for a maximum of 15sec must be able to reset the PSU.

Over Voltage / Under Voltage Protection (OVP)

The PSU overvoltage protection shall be locally sensed. The PSU shall shutdown in latched mode after an over voltage condition. This latch can be cleared by an AC power interruption.

Parameter	Min	Nom	Max	Unit
V_O Output Overvoltage	13.2	/	14.4	V
5V Standby Output Overvoltage	5.50	/	6.25	V

Over Current / Short Circuit Protection (OCP / SCP)

The Main / Stand-by output shall be internally protected against output overload or short circuit applied to its output. 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%. If the overload is > 150%, the power supply shall latch off immediately. In addition, if the overload fault is present for longer than 1 second, the power supply will latch off, requiring AC power / PS_ON recycling to restart the power supply. No damage shall result to the supply as the result of either short term or long term overloads of the outputs. To be measured under all line and load conditions.

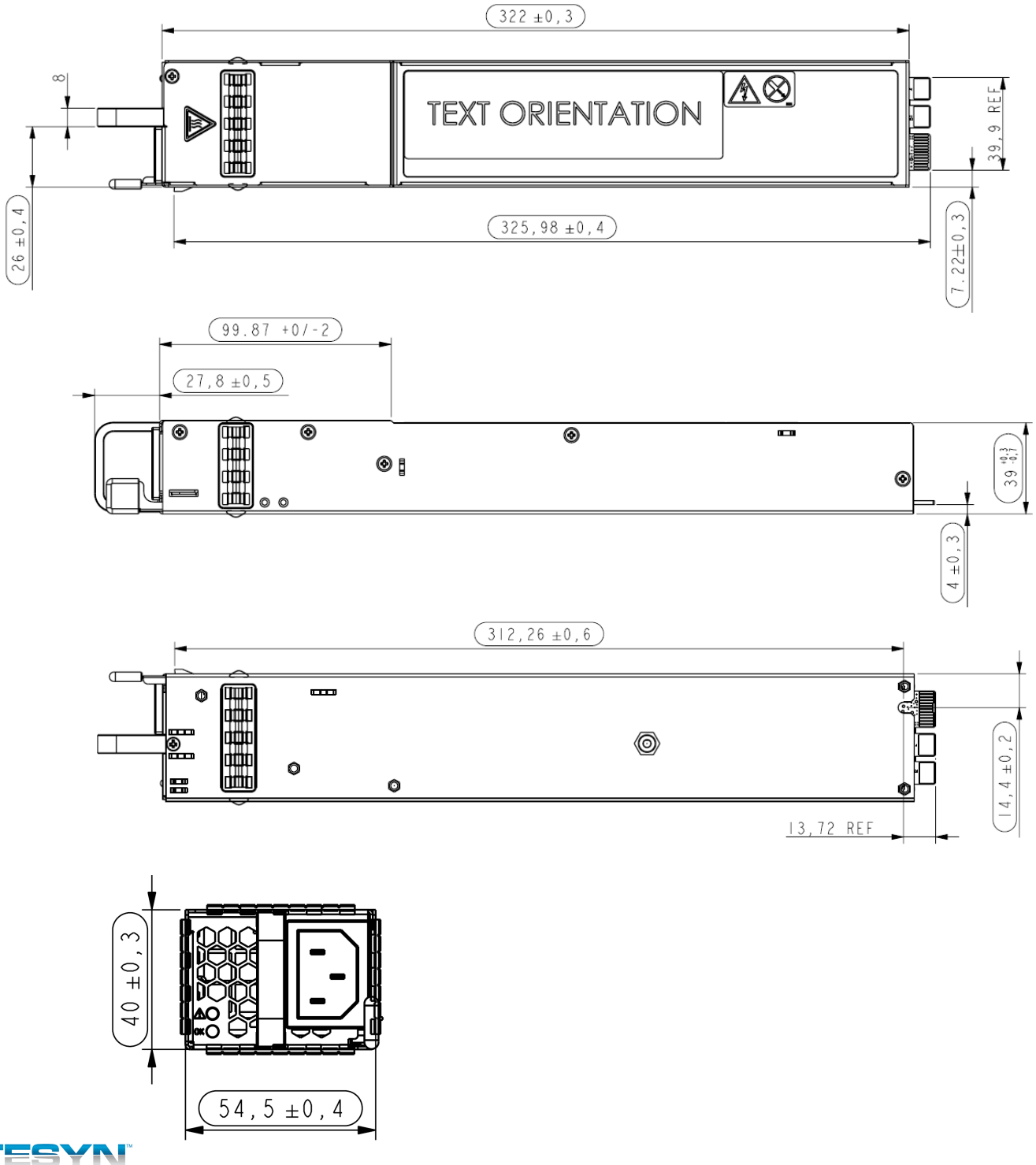
Parameter	Min	Nom	Max	Unit
V_O Output Overcurrent	80.0	/	86.7	A
5V Standby Output Overcurrent	4.8	/	6.8	A

Over Temperature Protection (OTP)

The PSU shall be protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature. In OTP condition, the PSU shall be shutdown with the exception of the +5Vsb output. When the PSU temperature drops to within the specified limits, the PSU shall restore the +12V output automatically. Hysteresis must be provided to prevent PSU turning ON and OFF near the OTP limit. Input ambient OTP should be 10 degC above the operating limit, (applicable only Reverse fan version). Forward fan version OTP is base on heatsink temperatures.

Mechanical Specifications

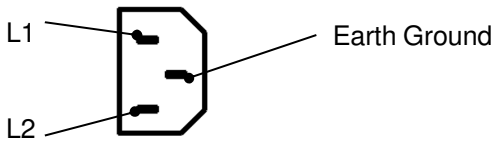
Mechanical Outlines



Connector Definitions

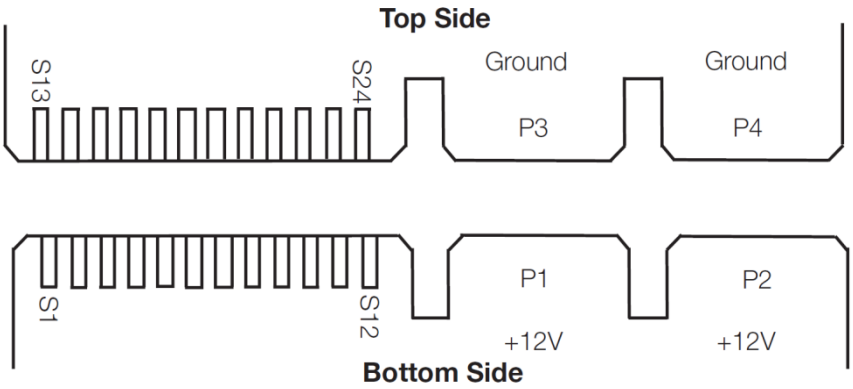
AC Input Connector

Pin 1 – L1
Pin 2 – L2
Pin 3 – Earth Ground



Output Connector – Power Blades

P1 – +12V
P2 – +12V
P3 – Ground
P4 – Ground



Output Connector – Control Signals

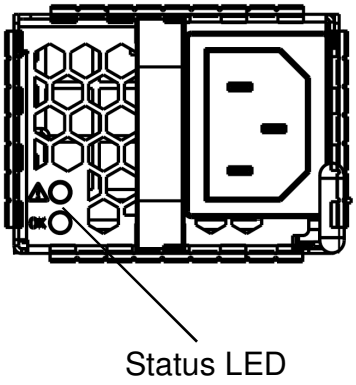
S1 – +12V Sense
S2 – +12V RTN Sense
S3 – +12V Current Share
S4 – SMB_ALERT/L
S5 – SDA
S6 – SCL
S7 – PSKILL
S8 – PSON/L
S9 – PW_OK
S10 – PS_A1
S11 – +5.0V_STBY
S12 – +5.0V_STBY
S13 – Reserved
S14 – PRESENT/L
S15 – PS_A0
S16 – Reserved
S17 – Reserved for factory use
S18 – EEPROM_WP
S19 – ACOK/L
S20 – Not used
S21 – PS_A2
S22 – V_STBY Remote Sense
S23 – +5.0V_STBY
S24 – +5.0V_STBY

Power / Signal Mating Connectors and Pin Types

Table 5. Mating Connectors for DS800SL-3 series

Reference	On Power Supply	Mating Connector or Equivalent
AC Input Connector	IEC60320-C14	IEC60320-C13
Output Connector	Card-edge	MOLEX P/N 45984-4343

LED indicator Definition



Two LEDs will be provided on the PSU at the input side to indicate the status of the PSU. Green (POWER) LED will indicate the status of the output voltages. Amber (FAULT) will indicate that the PSU has failed and must be replaced. These faults include UVP, OVP, OTP or Fan Fail except OCP. Amber LED can be reset by PSON/L or AC input recycle greater than 1 second. Amber LED should not be enabled if PSON/L is de-asserted (logic high).

Condition	LED Status	
	POWER LED (Green)	FAULT LED (Amber)
No AC power to PSU	OFF	OFF
AC present / Standby Mode	Blinking	OFF
Main and Standby Output OK	ON	OFF
PSU fault except OCP	OFF	ON
Current Limit (OCP)	ON	Blinking

Weight

The DS800SL-3 series weight is 2.25 lbs/1.027kg maximum.

Environmental Specifications

EMC Immunity

DS800SL-3 series power supply is designed to meet the following EMC immunity specifications:

Table 6. Environmental Specifications:

Document	Description
FCC 47CFR15 and/or EN 55022	PSU shall meet conducted and radiated EMI limits specified in FCC 47CFR15 and/or EN 55022. Radiated Emissions EN 55022 30M -1GHz Class B 6dB Margin CFR 47, Part 15, Subpart B 30M-1GHz>1GHz Class B
EN 55022	PSU shall meet conducted and radiated EMI limits specified in FCC 47CFR15 and/or EN 55022 with a t least 6dB margin below the limit
EN 61000-3-2	Harmonics
EN 61000-3-3	Voltage Fluctuations
EN 61000-4-2	Electrostatic discharge immunity test. ±15kV air, ±8kV contact discharge, performance criteria B
EN 61000-4-4	Electrical Fast Transient/Burst Immunity Test, 2kV for AC power port, 1.0kV for DC power, I/O and signal ports, performance criteria B
EN 61000-4-5	Surge Immunity Test. 2kV common mode and 1kV differential mode for AC power ports and 0.5kV differential mode for DC power, I/O and signal ports, performance criteria B
EN 61000-4-11	Voltage Dips and Interruptions. 30% reduction for 500ms – criteria B, >95% reduction for 10ms – criteria A, >95% reduction for 5000ms – criteria C
EN 55024	Information Technology Equipment – Immunity Characteristics, Limits and Method of Measurement.

Safety Certifications

The DS800SL-3 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 DS800SL-3 series power supply system

Document	Description
UL 60950-1	US and Canada Requirements. The PSU must be recognized to UL69050 and so labeled. The recognition shall be without D3 deviations and shall include stalled fan tests. Apply for CuLR to cover CSA requirements.
CSA C22.2 No 60950-1-07	The PSU must be certified to CSA 22.2 No. 60950 Level 5. Refer to UL.
EN60950	European Requirements. The PSU must be certified and licensed to EN60950 Class 1 SELV and so labeled. Shall be designed to meet all EN60950 Nordic Deviations. CB report from UL.
China CCC	CHINA CCC Apply for latest edition China CCC certifications.

EMI Emissions

The DS800SL-3 series has been designed to comply with the Class B limits of EMI requirements of EN55022 (FCC Part 15) and CISPR 22 (EN55022) for emissions and relevant sections of EN61000 (IEC 61000) for immunity.

Conducted Emissions

The power supply shall meet the conducted EMI limits specified in FCC 47CFR15 and/or EN 55022 and the limits specified in EN55022, Level "B", with 6dB margin, and GR1089.

Table 8. Conducted EMI emission specifications of the DS800SL-3 series

Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, class B	All	Margin	-	-	6	dB
VCCI Class II	All	Margin	-	-	6	dB
EN 60601-1-2: 2001	All	Margin	-	-	6	dB
CISPR 22 (EN55022) class B	All	Margin	-	-	6	dB

Radiated Emissions

The power supply shall meet the compliance to the radiated EMI limits specified in FCC Docket No. 20780 Part 15 Subpart J Class B and the limits specified in EN55022, Level "B" with a minimum of 6dB margin under the limits.

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 EN55022 Class A (FCC Part 15). Testing ac-dc convertors as a stand-alone component to the exact requirements of EN55022 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'.

Electromagnetic Compatibility/Input Transients

EN61000-3-2 Harmonics

EN61000-3-3 Voltage fluctuations

EN61000-4-2 ESD: +/-15KV air, +/-8kV contact discharge, performance Criteria A

EN61000-4-3 Radiated Susceptibility: 80 – 1000 MHz, 10V/m, AM 80% (1KHz), 900MHz, 10V/M, PM 100% (200Hz), Criteria A

EN61000-4-3 Conducted Susceptibility: 0.15 - 80 MHz, 10V/m, AM 80% (1KHz), Criteria A

EN61000-4-4 Fast Transient: 2KV for AC power port, 1.0 KV for DC power, I/O and signal ports, performance Criteria A.

EN61000-4-5 Surges: 2KV common mode and 1KV differential mode for AC power ports and 0.5 KV differential mode for DC power, I/O and signal ports, performance criteria A.

EN61000-4-11 Voltage Dips and Interruptions: 30% reduction for 500 mS – Criteria B, >95% reduction for 10 mS, Criteria A, >95% reduction for 5000 mS, Criteria C.

EN55024: Information Technology Equipment – Immunity Characteristics, Limits and Method of Measurement.

Operating Temperature

The DS800SL-3 series power supplies will start and operate within stated specifications at an ambient temperature from -10 ºC to 50 ºC under all load conditions with internal fan.

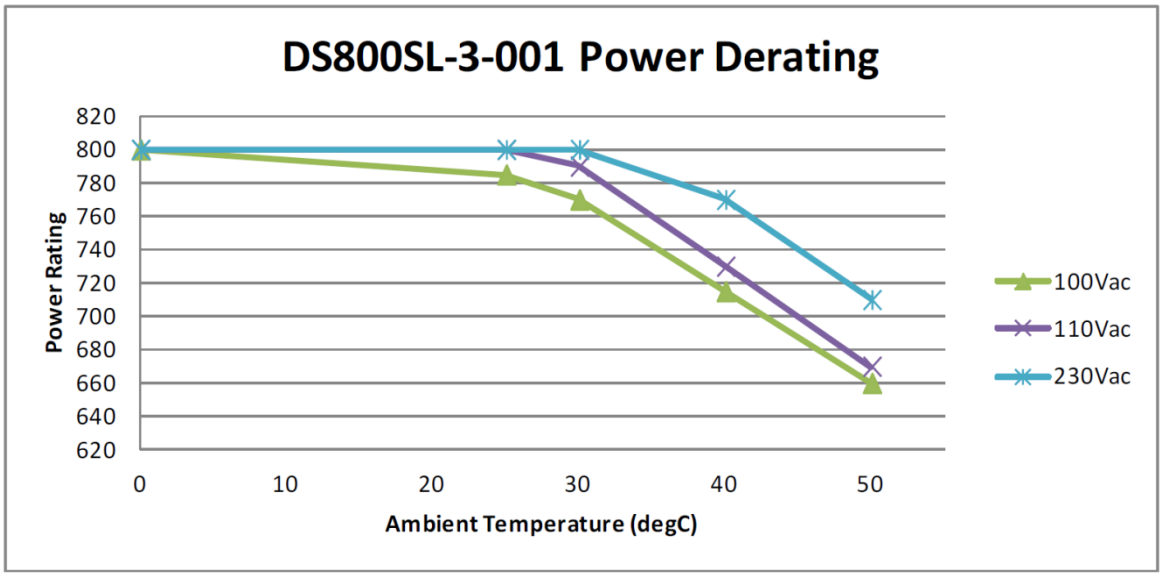
Forced Air Cooling

The DS800SL-3 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 connector end to the AC connector end of the power supply.

The cooling fan is a variable speed fan. In standby mode power supply fan will operate at minimum speed to maintain component reliability at all load, line and ambient conditions. When 12V output is enabled, power supply fan will operate at minimum achievable fan speed. Power supply will contain fan speed control circuits to vary the speed so that the critical component temperatures do not exceed safe operating levels. Fans will be powered from voltage source inside the power supply and from system side voltage source.

Power Derating Curves

DS800SL-3-001 total output power will be derated according to the curve shown below



Storage and Shipping Temperature / Humidity

The DS800SL-3 series power supplies can be stored or shipped at temperatures between -40 ^{O}C to +85 ^{O}C and relative humidity from 5% to 95% non-condensing.

Altitude

Operating: Up to 10,000 feet above sea level

Non-Operating: Up to 30,000 feet above sea level

Humidity

Operating: Power supply shall be designed to operate with no degradation of performance while operating in range of 5% RH to 95%RH @ 45 ^{O}C.

Non-Operating: Power supply shall be designed to operate with no degradation of performance while operating in range of 5-95% non-condensing

Vibration

The PSU shall be subjected to a non-operational 5G sine sweep from 5Hz to 500Hz, dwelling at resonant frequencies for 1 hour each. All components within the PSU shall be appropriately secured to prevent failure resulting from this test. At the conclusion of any of the above referenced shock/vibration tests listed in this section of this document, the PSU shall be powered up under maximum rated load and shall perform within specification.

Non-Operating Random Vibration

Acceleration	5.0	gRMS
Frequency Range	5-500	Hz
Duration	60	mins
Direction	3 mutually perpendicular axis	

Acoustic Noise Emissions

55 (dbA) Max at full Load 25 ^{O}C and 230Vac ,<45(dbA) at 50% Load, 25C ambient temperature, and 110Vac/230Vac(Fan speed shall be controlled by internal temperature)

Power and Control Signal Descriptions

AC Input Connector

This connector supplies the AC Mains to the DS800SL-3 power supply.

Pin 1 - L1
Pin 2 - L2
Pin 3 - Earth Ground

Output Connector – Power Blades

These pins provide the main output for the DS800SL-3.

P1 - +12V
P2 - +12V
P3 - Ground
P4 - Ground

Output Connector - Control Signals

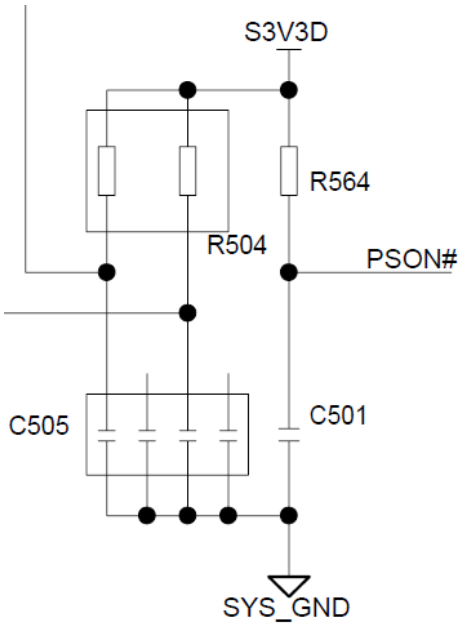
The DS800SL-3 series contains control signal header providing analogy control interface, standby power and I^2C interface. These are Control signals which are directly connected from the System to the Power Supply.

PSON/L – (S8)

The PSON/L signal is required to remotely turn on/off the power supply. PSON/L is an active low signal that turns on the +12VDC power rail. When this signal is not pulled low by the system, or left open, the +12VDC output turns off. The 5.0Vsb output remains on. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply. The power supply fan(s) shall operate at the lowest speed.

Signal Type	Accepts an open collector/drain input from the system. Pulled-up to the 5.0Vsb located in power supply.	
PSON /L= Low	ON	
PSON/L = Open	OFF	
	MIN	MAX
Logic level low (power supply ON)	0V	0.8V
Logic level high (power supply OFF)	2.0V	4.12V
Source current, Vpson = low		4mA
Power up delay: $T_{pson\_on\_delay}$	5msec	400msec

PSON/L Schematic

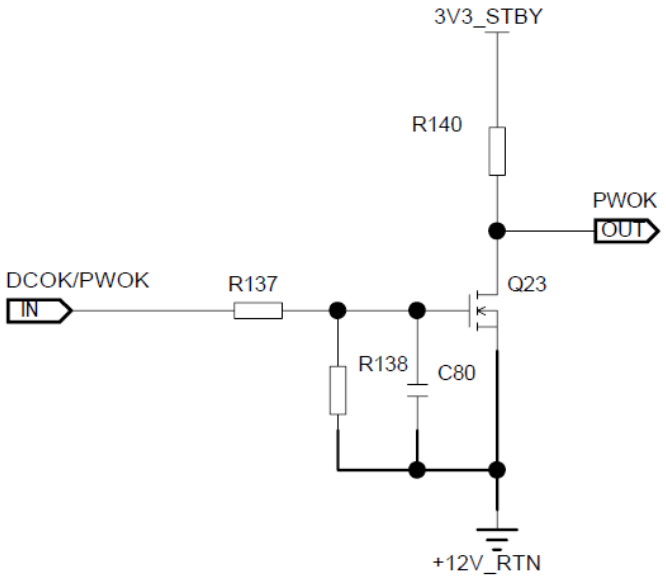


PW_OK – (S9)

PW_OK signal will be pulled high by the power supply to indicate that both the outputs are above the regulation limits of the power supply. When any output voltage falls below/above regulation limits or when AC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, PW_OK will be de-asserted to low state. The start of the PW_OK delay time shall be as long as +12VDC output is in current limit or 5.0Vsb output is below the regulation limit.

Signal Type	Open collector/drain output from power supply. Pull-up to 5.0vsb external to the power supply.	
PW_OK = High	Power Good	
PW_OK = Low	Power Not Good	
	MIN	MAX
Logic level low voltage, Isink=4mA	0V	0.8V
Logic level high voltage, Isource=200μA	2.0V	4.125V
Sink current, PW_OK = low		4mA
Source current, PW_OK = high		2mA
PW_OK delay: Tpwok_on	100ms	1000ms
PW_OK rise and fall time		100us
Power down delay: T pwok_off	1ms	1000ms

PW_OK schematic

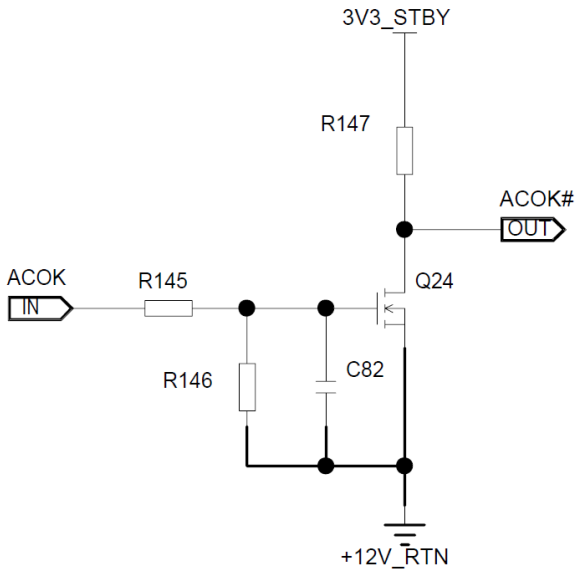


Power Supply Present Indicator (PRESENT/L) – (S14)

The PRESENT/L signal is primarily used to provide a mechanism by which the host system can sense the number of power supplies physically present (operational or not). This pin is connected to ground in the power supply.

AC INPUT Present Indicator (ACOK/L) – (S19)

The AC OK# signal is used to indicate presence of AC input to the power supply. This signal shall be connected to standby through a resistor on the host system side. A logic "Low" level on this signal shall indicate AC input to the power supply is present. A Logic "High" on this signal shall indicate a loss of AC input to the power supply.

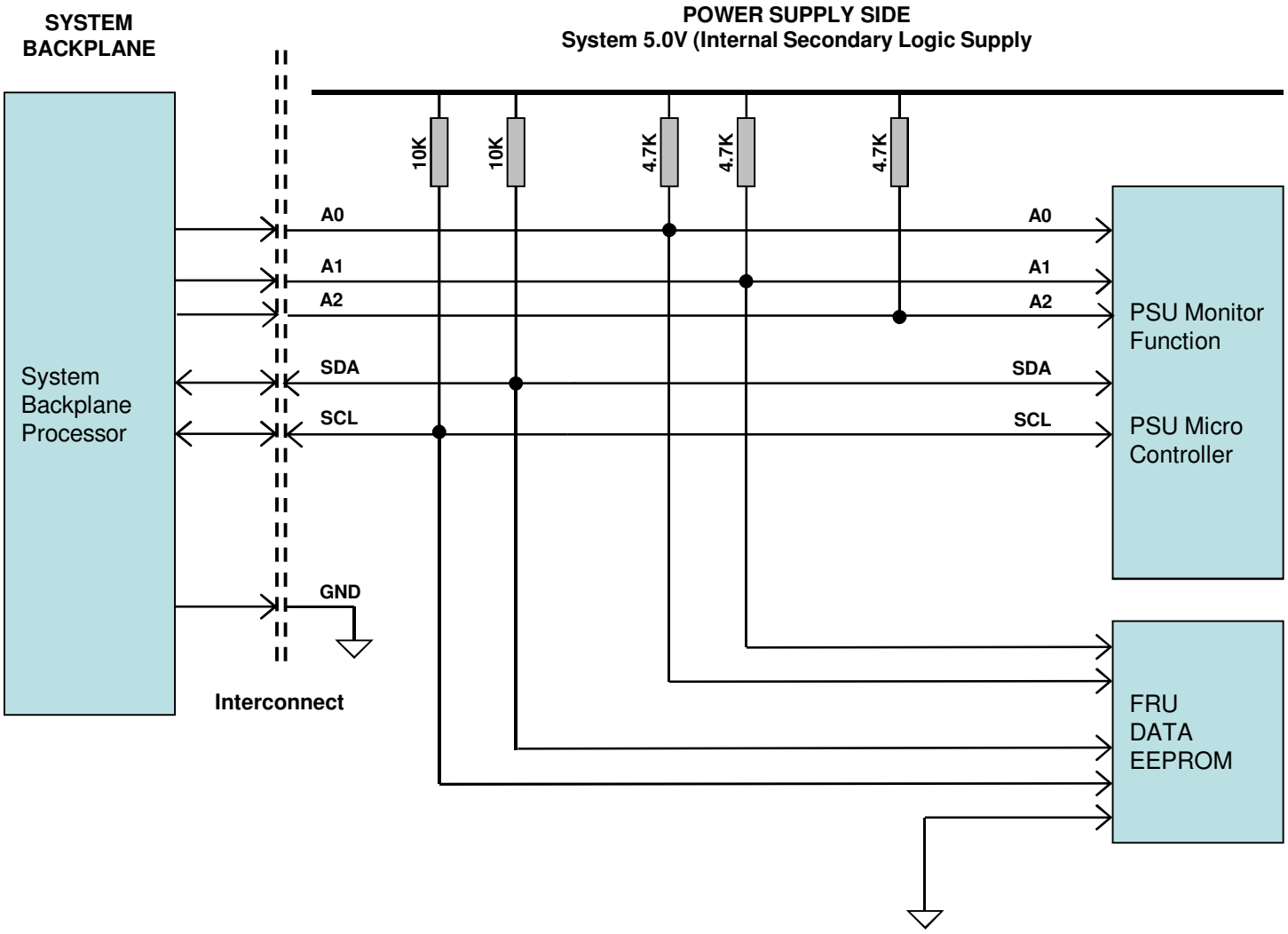


Signal Type	Pull-up to 5.0Vsb through a resistor in the host system.	
ACOK/L = Low	Present	
ACOK/L = High	Not Present	
	MIN	MAX
Logic level low voltage, Isink=4mA	0V	0.8V
Logic level high voltage, Isink=50μA	2.0V	5.2V
Sink current, ACOK/L = low		4mA
Sink current, ACOK/L = high		50μA

Communication Bus Descriptions

I2C Interface Signals

These signals are directly connected from the Power Supply (s) to System or each of the Power Supplies within system.



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	Typ	Max	Unit
SDA, SCL internal pull-up resistor		R_{int}	-	10	-	Kohm
SDA, SCL internal bus capacitance		C_{int}	-	20	-	pF

The noise on the address lines A0, A1 and A2 will be less than 200mVpp. This noise measurement shall be made at the address lines of the EEPROM chip and the GND pin of the EEPROM chip. Measure with 100MHz bandwidth setting.

The I2C must disconnect and go to a High Impedance State when the supply is dead.

I²C Bus Signals

The DS800SL-3 power supply contains enhanced monitoring and control functions implemented via the I²C bus. The DS800SL-3 I²C functionality (PMBus™ and FRU data) can be accessed via the output connector control signals. The communication bus is powered either by the internal5.0V supply or from an external power source connected to the StandBy Output (ie: 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 AC source connected.

Note: PMBus™ functionality can be accessed only when the PSU is powered-up.

Guaranteed communication I²C speed is 100KHz.

SCL – (S6)

I2C serial clock line for System Controller. Open drain serial bus clock. Requires 10K ohm (tbd) pull up resistor in the system. An optional R/C filter will be provided in the psu to this signal, footprints should be available for the provision of a series 47R resistor and a 47pf decoupling capacitor to ground.

SDA – (S5)

Digital I/O serial data line for I2C devices. Open drain I/O. Requires 10K ohm (tbd) pull up resistor in the system. An optional R/C filter will be provided in the psu to this signal, footprints should be available for the provision of a series 47R resistor and a 47pf decoupling capacitor to ground.

SMB_Alert/L – (S4)

Interrupt signal indicating system should check the power supply status and warnings. This will be an open collector/open drain output from the power supply with the pull-up located on the system side to 5.0V STBY.

PS_A0, PS_A1 – (S15, S10)

I2C device address bits will be brought out to the output connector to allow the supplies to be identified through the power distribution board. Internal pull-up 10k resistors will be to 5.0V Standby.

EEPROM_WP – (S18)

This signal will be pulled up to 5.0 STBY by a 4.7k resistor in the PSU to prevent data in the whole of the EEPROM from being over-written. If this signal is pulled down by the system write cycles to the EEPROM are permitted.

I²C Bus Communication Interval

The interval between two consecutive I²C communications to the power supply should 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 should be make at the power supply output connector with 10K ohm 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.

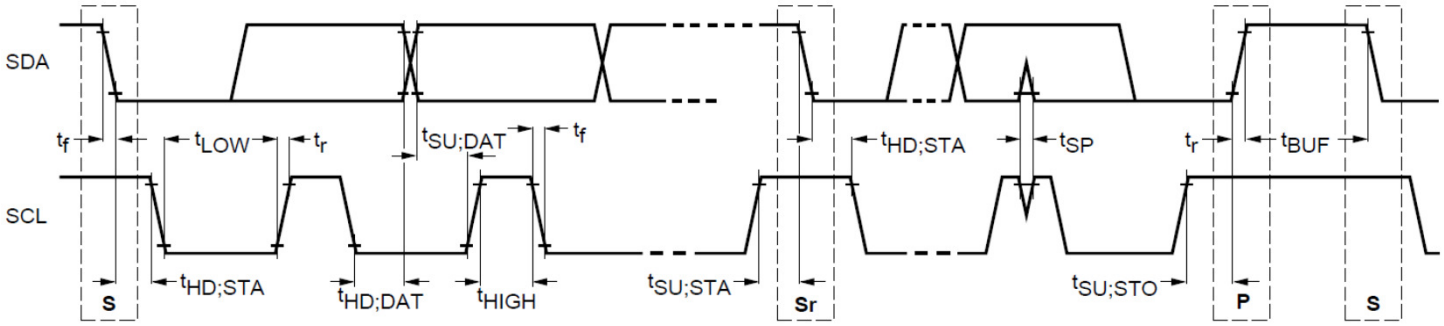
Logic Levels

DS800SL-3 series power supply I²C Communication Bus will respond to logic levels as per below:

Logic High: 5.0 Nominal (Specs is 2.1V to 5.5V)**
Logic Low: 500mV nominal (Specs is 800mV max)**

** Note: Emerson 73-769-001 I²C adapter was used.

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	-	4.724		µS
LOW period of SCL clock	t_{LOW}	4.7	-	4.904		µS
HIGH period of SCL clock	t_{HIGH}	4.0	-	4.064		µS
Setup time for repeated START condition	$t_{SU;STA}$	4.7	-	5.0		µS
Data hold time	$t_{HD;DAT}$	0	3.45	1.108		µS
Data setup time	$t_{SU;DAT}$	250	-	8624		nS
Rise time	t_r	-	1000	SCL = 792	SDA = 800	nS
Fall time	t_f	-	300	SCL = 12	SDA = 208	nS
Setup time for STOP condition	$t_{SU;STO}$	4.0	-	4.492		µS
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	60 msec***		µS

*** Note Emerson 73-769-001 I²C adapter (USB-to-I²C) and Universal PMBus™ GUI software was used

Device Addressing

The PSU can be used singly or in n+1 (n=1,2, or 3) configuration. The PSU addressing refers to the address of each PSU if it is used in n+1 configuration. This will allow the system to assign different addresses for each PSU. During I2C communication between system and PSU, the system will be the master and the PSU will be slave.

PSU Slot	Slot ID Bits			PMBusTM Address	EEPROM (FRU) Read Address
	A2	A1	A0		
1	0	0	0	0xB0	0xA0
2	0	0	1	0xB2	0xA2
3	0	1	0	0xB4	0xA4
4	0	1	1	0xB6*	0xA6*
5	1	0	0	0xB8	0xA8
6	1	0	1	0xBA	0xAA
7	1	1	0	0xBC	0xAC
8	1	1	1	0xBE**	0xAE**

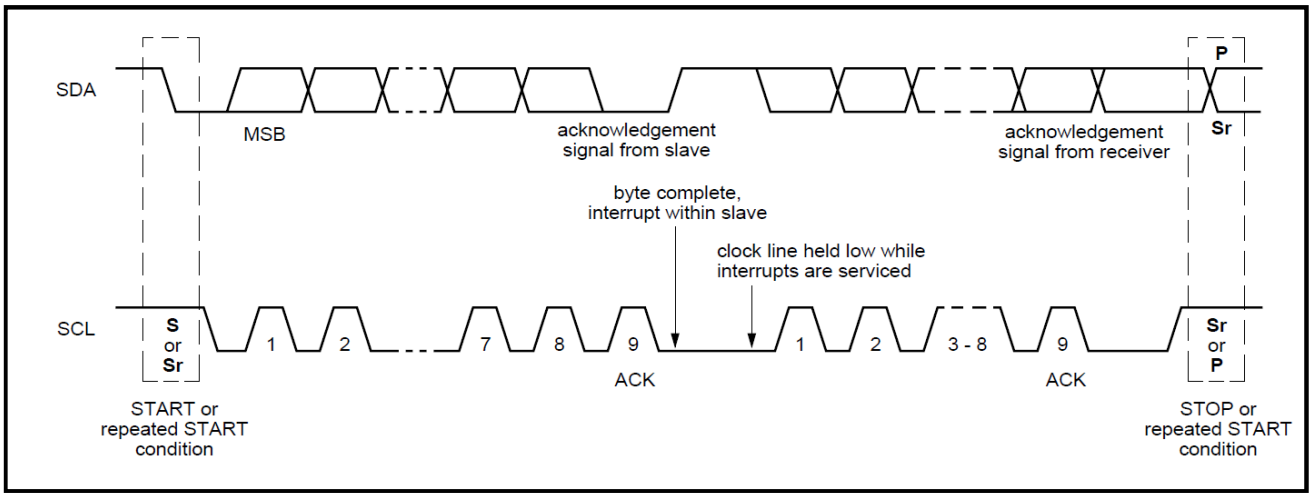
Note: ** Default, if all address pins are left open

* Default, if A2 is connected to ground, and the rest open.

I²C Clock Synchronization

The DS800SL-3 power supply might apply clock stretching. An addressed slave power supply may hold 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 DS800SL-3 is 100 microseconds.



FRU (EEPROM) Data

The FRU (Field Replaceable Unit) data format compliant with the Intel IPMI V1.0 specification.

The DS800SL-3 uses 1 page of EEPROM for FRU purpose. A 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 DS800SL-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.

DS800SL-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		COMMON HEADER, 8 BYTES		
0	00	**FORMAT VERSION NUMBER** (Common Header)	1	01
1	01	**INTERNAL USE AREA OFFSET** (In multiples of 8 Bytes)	27	1B
2	02	**CHASSIS INFO AREA OFFSET** (In multiples of 8 Bytes)	1	01
3	03	**BOARD INFO AREA OFFSET** (Not Used)	0	00
4	04	**PRODUCT INFO AREA OFFSET** (In multiples of 8 Bytes)	5	05
5	05	**MULTI RECORD AREA OFFSET** (In multiples of 8 Bytes)	13	0D
6	06	**PAD** (reserved – always 00H)	0	00
7	07	**ZERO CHECK SUM** (256 – (Sum of bytes 000d to 006d))	209	D1
		CHASSIS INFO AREA(32 BYTES)		
8	08	**FORMAT VERSION NUMBER** (Default value is 1.)	1	01
9	09	**CHASSIS INFO AREA LENGTH** (Default value is 0.)	4	04
10	0A	**CHASSIS TYPE** (Default value is 0.)	0	00
11	0B	**CHASSIS PART NUMBER Type/Length 10 byte allocation** 0CAH (if used) (Default value is 0.)	202	CA
12	0C	**CHASSIS PART NUMBER BYTES** (Default value is 0.)	0	00
13	0D		0	00
14	0E		0	00
15	0F		0	00
16	10		0	00
17	11		0	00
18	12		0	00
19	13		0	00
20	14		0	00
21	15		0	00
22	16	**CHASSIS SERIAL NUMBER Type/Length 15 byte allocation** 0CFH (if used) (Default value is 0.)	207	CF
23	17	**CHASSIS SERIAL NUMBER** (Default value is 0.)	0	00
24	18		0	00
25	19		0	00
26	1A		0	00
27	1B		0	00
28	1C		0	00
29	1D		0	00
30	1E		0	00
31	1F		0	00
32	20		0	00

DS800SL-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
33	20		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)	161	A1
		PRODUCT INFORMATION AREA, 80 BYTES		
40	28	**FORMAT VERSION NUMBER**	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** (0C7H) 7-6: (11)b, 8-Bit ASCII+LATIN1, 5-0: (000111)b, 7-Byte Allocation	199	C7
		MANUFACTURER NAME		
44	2C	“E”= 45H	69	45
45	2D	“M”= 4DH	77	4D
46	2E	“E”= 45H	69	45
47	2F	“R”= 52H	82	52
48	30	“S”= 53H	83	53
49	31	“O”= 4FH	79	4F
50	32	“N”= 4EH	78	4E
51	33	**PRODUCT NAME Type/Length** (0CEH) Type = “ASCII+LATIN1” = (11)b Length = 15 Bytes = (001111)b	207	CF
		Product Name		
52	34	“D”= 44H	68	44
53	35	“S”= 53H	83	53
54	36	“8”= 38H	56	38
55	37	“0”= 30H	48	30
56	38	“0”= 30H	48	30
57	39	“S”= 53H	83	53
58	3A	“L”= 4CH	76	4C
59	3B	“ -“= 2DH	45	2D
60	3C	“3”= 33H	51	33
61	3D		32	20
62	3E		32	20
63	3F		32	20
64	40		32	20
65	41		32	20
66	42		32	20
67	43	**PRODUCT PART/MODEL NUMBER** Type/Length (CFH)	207	CF

DS800SL-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		PRODUCT PART/MODEL NUMBER BYTES		
68	44	"D" = 44H	68	44
69	45	"S" = 53H	83	53
70	46	"8" = 38H	56	38
71	47	"0" = 30H	48	30
72	48	"0" = 30H	48	30
73	49	"S" = 53H	83	53
74	4A	"L" = 4CH	76	4C
75	4B	"-" = 2DH	45	2D
76	4C	"3" = 33H	51	33
77	4D		32	20
78	4E		32	20
79	4F		32	20
80	50		32	20
81	51		32	20
82	52		32	20
83	53	**PRODUCT VERSION NUMBER** Type/Length (0C2H)	194	C2
		PRODUCT VERSION NUMBER BYTES Refer to Section 1.2 Product Revision History in latest IPS		
84	54	"0" = 30H	48	30
85	55	"D" = 44H	68	34
86	56	**PRODUCT SERIAL NUMBER** Type/Length Type = "ASCII+LATIN1" = (11)b Length = 13 bytes = (001101)b	205	CD
		PRODUCT SERIAL NUMBER BYTES Model ID=I081		
87	57	"1" = 49H	73	49
88	58	"0" = 40H	48	30
89	59	"8" = 38H	56	38
90	5A	"0" = 31H	49	31
		MANUFACTURING YEAR AND WEEK CODE		
91	5B	"W" = 57h (Per Unit)	72	48
92	5C	"W" = 57h (Per Unit)	69	45
		UNIQUE SERIAL NUMBER "SSSS"		
93	5D	"S" = 53 (Per Unit)	48	30
94	5E	"S" = 53 (Per Unit)	48	30
95	5F	"S" = 53 (Per Unit)	48	30
96	60	"S" = 53 (Per Unit)	49	31
		MODEL REVISION, Astec Model Rev, See Latest Model Rev in IPS Sec 1.2		
97	61	"0" = 30H	48	30
98	62	"D" = 44H	68	44
99	63	**MANUFACTURING LOCATION** "P" In Decimal = 080 In Hex = 50H	80	50
100	64	**Eng Tag**	193	C1
101	65	PAD (reserved), Default value is 0.	00	00
102	66		00	00
103	67	**ZERO CHECK SUM (256 – (Sum of bytes 40 to 102))** Per Unit Zero Check Sum :Should follow check sum calculation as per IPMI v1.1 specs	204	CC

DS800SL-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		Multi Record Area, 88 Bytes		
		Power Supply Record Header		
104	68	Record type = 00 for Power supply	00	00
105	69	End of List /Record Format Version Number	02	02
106	6A	Record Length of Power Supply Record	24	18
107	6B	Record CHECKSUM of Power Supply Record (Zero CHECKSUM) (256-(sum of bytes 109 to 132)	121	79
108	6C	Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM) (256-(sum of bytes 104 to 107)	109	6D
		Power Supply Record		
		Overall Capacity of the Power Supply		
109	6D	2 Bytes Sequence	32	20
110	6E	800W = 0320H	3	03
		Peak VA, 889W = 0379H 2 Bytes Sequence		
111	6F	In Decimal = 121, 003	121	79
112	70	In Hex = 79H, 03H	3	30
		Inrush Current, 40A In Decimal = 040		
113	71	In Hex = 28H	40	28
		Inrush Interval, 50mS In Decimal = 050		
114	72	In Hex = 32H	50	32
		Low End Input Voltage Range 1(10mV), (90V / 10mV) 9000 = 2328H 2 Bytes Sequence		
115	73	In Decimal = 040, 035	40	28
116	74	In Hex = 28H, 23H	35	23
		High End Input Voltage Range 1(10mV), (264V/10mV) 26400= 6720H 2 Bytes Sequence		
117	75	In Decimal = 032, 103	32	20
118	76	In Hex = 20H, 67H	103	67
		Low End Input Voltage Range 2(10mV)		
119	77	Not Applicable	00	00
120	78	(Autoswitch)	00	00
		High End Input Voltage Range 2(10mV)		
121	79	Not Applicable	00	00
122	7A	(Autoswitch)	00	00
123	7B	**Low End Input Frequency Range,** 47Hz = 2FH	47	2F
124	7C	**Low End Input Frequency Range,** 63Hz = 3FH	63	3F
125	7D	**AC Dropout Tolerance in ms,** 10mS= 0AH	10	0A
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 = 1 Bit 3: Hot Swap / Redundancy Support BIT = 1 Bit 2: Auto switch Support BIT = 1 Bit 1: Power Factor Correction Support BIT = 1 Bit 0: Predictive Fail Support BIT = 0	30	1E

DS800SL-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		Peak Wattage Capacity and Holdup Time		
127	7F	800W = 0320H	32	20
128	80	12second = 0CH	159	C3
		Combined Wattage,		
129	81	Byte1: 0010 0000, Byte2 and Byte3:00H,00H	32	20
130	82	800W=0320H	32	20
131	83	3 Bytes sequence	3	03
		Predictive Fail Tachometer Lower Threshold, Not Applicable.		
132	84	Predictive failure is not supported.	0	00
		12V DC OUTPUT RECORD HEADER		
		Record type=01 for DC Output Record		
133	85	End of List /Record Format Version Number for 12V DC Output Record	1	01
134	86	Record Length of 12V DC Output Record	2	02
135	87	Record CHECKSUM of 12V DC Output Record (Zero CHECKSUM) (256-(sum of bytes 138 to 150)	13	0D
136	88	Header CHECKSUM of 12V DC Output Record Header (Zero CHECKSUM)	67	43
137	89	(256-(sum of bytes 1313to 136)	173	AD
		12V OUTPUT RECORD		
		Output Information, 001 = 01H		
138	8A	Bit 7: standby information=0B Bits 6-4: Reserved, write as 000B Bits 3-0: Output Number 1=001b	1	01
		Nominal Voltage (10mV), (12V / 10mV) 1200 = 04B0H		
		2 Bytes Sequence		
139	8B	In Decimal: 176, 004	176	B0
140	8C	In Hex: B0H, 04H	4	04
		Maximum Negative Voltage Deviation (10mV), 1140 = 0474H		
		2 Bytes Sequence		
141	8D	In Decimal: 140, 004	116	74
142	8E	In Hex: 8CH, 04H	4	04
		Maximum Positive Voltage Deviation (10mV), 1260 =04ECH		
		2 Bytes Sequence		
143	8F	In Decimal: 212, 00411-0	120	78
144	90	In Hex: D4H, 04H	0	00
		Ripple and Noise pk-pk (mV), 120 = 78H		
		2 Bytes Sequence		
145	91	In Decimal: 120, 000	002	02
146	92	In Hex: 78H, 00H	00	00
		Minimum Current Draw (10mA), 0000 = 0000H		
		2 Bytes Sequence		
147	93	In Decimal: 000, 000	00	00
148	94	In Hex: 00H, 00H	00	00
		Maximum Current Draw (10mA),		
149	95	6670mA = 1A0EH	14	0E
150	96		26	1A

DS800SL-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		VSB OUTPUT RECORD HEADER		
151	97	Record type = 01 for DC Output Record	1	01
152	98	End of List /Record Format Version Number for 5V0SB Output Record	2	02
153	99	Record Length of 5V0SB Output Record	13	0D
154	9A	Record CHECKSUM of 5V0SB Output Record (Zero CHECKSUM) (256-(sum of bytes 156 to 168)	169	A9
155	9B	Header CHECKSUM of 5V0SB Output Record Header (Zero CHECKSUM) (256-(sum of bytes 151 to 154)	71	47
		SB 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
		Nominal Voltage (10mV), 2 Bytes Sequence		
157	9D	(5.0V/10mV)	244	F4
158	9E	500 = 01F4H	1	01
		Maximum Negative Voltage Deviation (10mV), 2 Bytes Sequence		
159	9F	(4.75/10mV)	219	DB
160	A0	475 = 01DBH	1	01
		Maximum Positive Voltage Deviation (10mV), 2 Bytes Sequence		
161	A1	(5.25/10mV)	13	0D
162	A2	525 = 020DH	2	02
		Ripple and Noise pk-pk (mV), 100 = 0064H 2 Bytes Sequence		
163	A3	In Decimal: 050, 000	100	64
164	A4	In Hex: 32H, 00H	0	00
		Minimum Current Draw (10mA), (0A / 10mA) 50 = 0000H 2 Bytes Sequence		
165	A5	In Decimal: 000, 000	0	00
166	A6	In Hex: 00H, 00H	0	00
		Maximum Current Draw (4A), (4.0A / 10mA) 400 = 0190H 2 Bytes Sequence		
167	A7	In Decimal: 144, 001	144	90
168	A8	In Hex: 90H, 01H	1	01
169	A9	Record type = C0H for OEM Record	192	C0
170	AA	End of List /Record Format Version Number for 5.0sb output Record	130	82
171	AB	Record Length of OEM Record	42	2A
172	AC	Record CHECKSUM of OEM Record (Zero CHECKSUM)	0	00
173	AD	Header CHECKSUM of OEM Record Header (Zero CHECKSUM) (256-(sum of bytes 169to 172)	148	94

DS800SL-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		OEM RECORD		
174	AE		0	00
175	AF		0	00
176	B0		0	00
177	B1		0	00
178	B2		0	00
179	B3		0	00
180	B4		0	00
181	B5		0	00
182	B6		0	00
183	B7		0	00
184	B8		0	00
185	B9		0	00
186	BA		0	00
187	BB		0	00
188	BC		0	00
189	BD		0	00
190	BE		0	00
191	BF		0	00
192	C0		0	00
193	C1		0	00
194	C2		0	00
195	C3		0	00
196	C4		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
		INTERNAL USE AREA, 40 BYTES		
216	D8		0	00
217	D9		0	00
218	DA		0	00
219	DB		0	00
216	D8		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

DS800SL-3 FRU (EEPROM) Data:

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

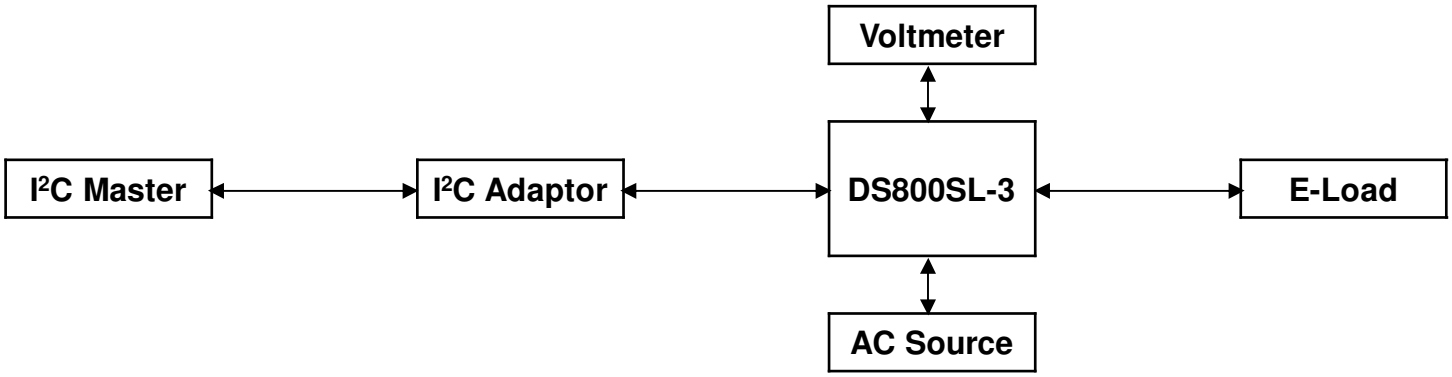
PMBus™ Interface Support

The DS800SL-3 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

DS800SL-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.

DS800SL-3 Series Support PMBus™ Command List

The DS800SL-3 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the i²C interface port.

DS800SL-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		Used to Turn the unit ON/OFF in conjunction with the input CONTROL pin. It is also used to set output to upper or lower Margin Voltages.
	b7:6	10b				00 – Immediate Turn OFF (No Sequencing) 01 – Soft Turn OFF (With Sequencing) 10 – PSU ON
	b5:4	00b				01 – Margin Low 10 – Margin High 00 – No Margin
	b3:2	00b				01 – Ignore Fault 10 – Act On Fault
	b1:0	00b				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 PSON/L 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 – COMMAND_HOST_CONFIG	1				0 –Disregards CONTROL pin, to accept ON/OFF of OPERATION command. 1 – Unit requires both CONTROL pin and ON/OFF of OPERATION command be asserted, to start the unit. Requires CONTROL pin be asserted, to accept OPERATION command. Note: On/OFF default is ON.
	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	FF	W	1		Clear all fault bits in all status registers that had been set. If does not cause any restarts for latched units.
10h	WRITE_PROTECT	1C	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.
11h	STORE_DEFAULT_ALL	-	S	0		Copies the Value of the Operating memory table to the matching DEFAULT non-volatile memory.

DS800SL-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
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	80	R	1		Provides a way for the hosts system to determine some key capabilities of a PMBus™ device.
	b7 - Packet Error Checking	1				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	17	R/W	1		Specifies the mode and parameters of Output Voltage related Data Formats
21h	VOUT_COMMAND	1800	R/W	2	Linear	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. The value is computed in this manner. Vref = Vdiv * 32768 / 5.0V Vdiv is your Vsense divider network 32768 is ADC max Ie. If your Vdiv @ 12.05V is 2.5V then Vref = 24824 Affects OVP_WARNING and FAULT LIMIT, as well as POWER_GOOD_ON/OFF level.
24h	VOUT_MAX	1933	R/W	2	Linear	Sets the max adjustable output voltage limit.
31h	POUT_MAX	FFFF	R/W	2	Linear	Sets the operating power limit condition.
3Ah	FAN_ CONFIG_1_2	90	R/W	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

DS800SL-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
3Bh	FAN_COMMAND_1 (used in both Fan1 and 2)	0000	R/W	2	Linear	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	1B00	R/W	2	Linear	Sets Output Over voltage threshold.
41h	VOUT_OV_FAULT_RESPONSE	80	R/W	1		Unit Latches OFF. Resets on PSON/L or CONTROL pin recycle or AC recycle.
42h	VOUT_OV_WARN_LIMIT	1999	R/W	2	Linear	Sets Over-voltage Warning threshold.
43h	VOUT_UV_WARN_LIMIT	1666	R/W	2	Linear	Sets Under-voltage Warning threshold.
44h	VOUT_UV_FAULT_LIMIT	1599	R/W	2	Linear	Sets Under-voltage Fault threshold.
45h	VOUT_UV_FAULT_RESPONSE	80	R/W	1		Turn PSU OFF
46h	IOUT_OC_FAULT_LIMIT	EA64	R/W	2	Linear	Sets the Over current threshold in Amps.
47h	IOUT_OC_FAULT_RESPONSE	C0	R/W	1		OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT	EA50	R/W	2	Linear	Sets the Over Current Warning threshold in Amps.
4Fh	OT_FAULT_LIMIT	EBC0	R/W	2	Linear	Secondary ambient temperature Fault threshold, in degree C.
50h	OT_FAULT_RESPONSE	F8	R/W	1		Turn PSU OFF and retry once Over temp Fault is removed.
51h	OT_WARN_LIMIT	EB70	R/W	2	Linear	Secondary ambient temperature warning threshold, in degree C.
5Eh	POWER_GOOD_ON	1766	R/W	2	Linear	Sets the threshold by which the PW_OK signal is asserted.
5Fh	POWER_GOOD_OFF	16CC	R/W	2	Linear	Sets the threshold by which the PW_OK signal is de-asserted.
60h	TON_DELAY	0BE8	R/W	2	Linear	Sets the time (ms), from start condition (Power ON) until the output starts to rise. Default value is 0ms
61h	TON_RISE	DBC0	R/W	2	Linear	Sets the time (ms), for the output rises from 0 to regulation. Default value is 0ms
64h	TOFF_DELAY	C280	R/W	2	Linear	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF). Default value is 0ms
6A	POUT_OP_WARN_LIMIT	03C0	R/W	2	Linear	
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
	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.

DS800SL-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
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	-	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
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					
	b1					
	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					IOUT Over-current Warning
	b4					IOUT Under-current Fault
	b3					Current Share Fault Set if Ishare level is much greater or lower than the actual output current.
	b2					Power Limit
	b1					
	b0					

DS800SL-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Ch	STATUS_INPUT	-	R	1		Input related faults and warnings
	b7					VIN Overvoltage Fault
	b6					VIN Overvoltge Warning
	b5					
	b4					
	b3					Unit is OFF for insufficient Input Voltage
	b2					IIN Overcurrent Fault
	b1					IIN Overcurrent Warning
	b0					
7Dh	STATUS_TEMPERATURE	-	R	1		Temperature related faults and warnings
	b7					Overtemperature Fault
	b6					Overtemperature Warning
	b5					Undertemperature Warning
	b4					Undertemperature 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					Reserved
	b1					
	b0					
80h	STATUS_MFR_SPECIFIC	-	R	1		Manufacturer Status codes
	b7					Bulk OK, 1- Bulk is within range and is ready for use
	b6					BulkUV, 1-Bulk is below operating range
	b5					BulkOV, 1-Bulk voltage reached OVP limit
	b4					Primary_OTP2, Heatsink OTP
	b3					Primary_OTP2, Ambient OTP
	b2					Reserved
	b1					Reserved
	b0					PSON/L, CONTROL Pin Status 1 – asserted, 0 - deasserted
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					

DS800SL-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
88h	READ_VIN	-	R	2	Linear	Returns input Voltage in Volts ac.
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	Linear	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Linear	Returns the output current in amperes.
8Dh	READ_TEMPERATURE_1	-	R	2	Linear	Secondary Ambient Temperature
8Eh	READ_TEMPERATURE_2	-	R	2	Linear	Primary Heat-sink Temperature
8Fh	READ_TEMPERATURE_3	-	R	2	Linear	Primary Ambient Temperature
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	5F11	R	1	Linear	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/W	3		Deleted from PMBus Provided in FRU Data
9Ah	MFR_MODEL	“DS800SL-3”	BR/W	6		Deleted from PMBus Provided in FRU Data
9Bh	MFR_REVISION	“1.0”	BR/W	2		Deleted from PMBus Provided in FRU Data
9Ch	MFR_LOCATION	“xxx”	BR/W	3		Deleted from PMBus Provided in FRU Data
9Dh	MFR_DATE	“xxxxxx”	BR/W	6		Deleted from PMBus Provided in FRU Data
9Eh	MFR_SERIAL	“xxxxxxxxxxxxxxx”	BR/W	16		Deleted from PMBus Provided in FRU Data
A0h	MFR_VIN_MIN	EAD0	R	2	Linear	Minimum Input Voltage
A1h	MFR_VIN_MAX	FA10	R	2	Linear	Maximum Input Voltage
A2h	MFR_IIN_MAX	D280	R	2	Linear	Maximum Input Current
A3h	MFR_PIN_MAX	03E8	R	2	Linear	Maximum Input Power
A4h	MFR_VOUT_MIN	16CC	R	2	Linear	Minimum Output Voltage Regulation Window.
A5h	MFR_VOUT_MAX	1933	R	2	Linear	Maximum Output Voltage. Regulation Window.
A6h	MFR_IOUT_MAX	EA15	R	2	Linear	Maximum Output Current
A7h	MFR_POUT_MAX	0320	R	2	Linear	Maximum Output Power
A8h	MFR_TAMBIENT_MAX	E320	R	2	Linear	Maximum Operating Ambient Temperature (Secondary Ambient)
A9h	MFR_TAMBIENT_MIN	00	R	2	Linear	Minimum Operating Ambient Temperature (Secondary Ambient)
D2h	Min Fan Speed	FFFF	R/W	2	Linear	Standby Fan Speed
D3h	Max Fan Speed	FFFF	R/W	2	Linear	Normal operation Fan Speed

Application Notes

Forced Load Sharing

The 12V output shall have active load sharing. Single wire force current share shall be employed in this power supply. When two or more power supplies are connected and operating in parallel and each is delivering 40-50% of its rated output to the load, the power supplies shall current share within 5% accuracy. When supplying light loads between 10% and 30% of its rated load, the power supplies shall share within 20% accuracy. (Below 10% load, there is no guarantee of output current sharing) If any power supply is hot swapped, no glitch shall occur that violates the regulation limits of the power supply defined in this specification. All current sharing functions are implemented internal to the PSU by making use of the 12V Ishare signal. The system connects the 12V Ishare lines between power supplies. The supplies must be able to share with up to 4 PSU in parallel and operate in a hot swap/redundant n+1 configuration where n=1,2,3,4,5,6.

Load Sharing Control

If the load sharing is disabled by shorting the 12V Ishare bus to ground, the PSU must continue to operate within regulation limits for loads less than or equal to the load of one (1) PSU. The failure of a PSU should not affect the load sharing or output voltages of the other PSU still operating. 12V Ishare voltage level at full load shall be 6.0VDC, and 3.0VDC at half load. The slope shall be 6V/Ioutmax.

12V Ishare must be able to sink up to 2.5mA and can source at least 4.0mA.

Delay from output voltages in regulation to load sharing active with maximum load of one PSU and two PSU in parallel is 100ms.

Standby Load Sharing

Each +5Vsb output in the system will deliver current up to the current limit point. When the load at the +5Vsb exceeds the maximum load or shorted, output may go into “hiccup” mode. Output shall return to normal when the fault is removed. Sharing will be passive.

Redundancy/Fault Tolerance

The DS800SL series power supplies can be connected in the following to provide redundancy/fault tolerance operation.

PSU can be extracted and inserted in an operating power system. During this process, the output voltage shall remain within the limits specified with the capacitive load. The hot swap test shall be conducted when the system is operating under both static and dynamic conditions. The PSU can be hot swapped using the following methods:

1. Up to 6 PSU may be on a single AC line.

Extraction: The AC power will be disconnected from the PSU as it is being extracted from the system. This could occur in standby mode or powered mode.

Insertion: The AC power will be connected to PSU as it is inserted into the system and the PSU will power on into standby mode or powered mode.

2. Server management turning on the hot swapped power supply.

Extraction: Server management turns off one of the PSU via PSON/L signal, then the PSU is removed from the system.

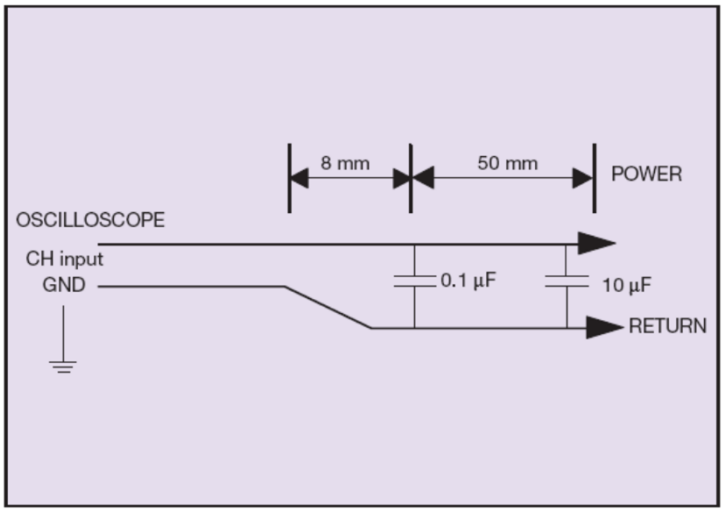
Insertion: PSU is inserted into the system, server management looks for the PSU, depending upon the state of the system (on or off), the system the turns on the PSU via PSON/L signal or goes to standby mode operation.

Many variations of the above is possible. Supplies need to be compatible with these different variations. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good PSU, however, hot swap needs to work with the operational as well as failed PSU. The newly inserted PSU may get turned on by insertion (AC is at the internal face) by plugging AC into the external face, or by system management recognizing an inserted supply and explicitly turning it on.

Hot Plug Sequence - The PSU shall be designed to allow connection into and removal from the system without removing power. During any phase of insertion, start-up, shutdown, or removal, the PSU shall not cause any other like module in the system to exceed their specifications. Upon application of AC Power, the Auxiliary supply shall turn on providing bias power internal to the supply +5Vsb output.

Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the DS800SL-3 Series. When measuring output ripple and noise, a scope jack in parallel with a 0.1uF ceramic chip capacitor, and a 10 uF aluminum electrolytic capacitor should be used. Oscilloscope should be set to 20 MHz bandwidth for this measurement.



Record of Revision and Changes

Issue	Date	Description	Originators
1.1	04.14.2015	First Issue	S. Dong
1.2	11.07.2016	Updated the PW_OK description	K. Wang
1.3	09.21.2016	Update Command list	S. Dong
1.4	11.05.2018	Update connector to card-edge	K. Wang

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