DS1050

1050 Watts

Distributed Power System

Total Power: 1050 Watts
Input Voltage: 90-264 Vac
# of Outputs: Main + Standby

Special Features

- Active power factor correction
- EN61000-3-2 harmonic compliance
- AC inrush control
- 1U X 2U form factor
- 19 W / in^3
- +12 Vdc Output
- +3.3 Vdc stand-by and +5.0V version available
- No minimum load required
- Hot plug operation
- N + 1 redundant
- Internal OR'ing fets
- Active current sharing (10 - 100% load)
- Built in cooling fan (40mmx80mm)
- I^2C communication interface bus
- PMBus compliant
- EEPROM for FRU data
- Internal fan speed control
- Fan Fail Tach Output Signal
- INTEL, SSI Std. logic timing
- INTEL, SSI Std. FRU data format
- Full digital control
- One year warranty

Safety

UL/cUL 60950 (UL Recognized)
NEMKO+ CB Report EN60950
EN60950
CE Mark
China CCC

Product Descriptions

The DS1050 series is Emerson's bulk front end ac-dc power supply that meets the Climate Savers Computing gold standard for efficiency. The new power supply has a power density of 19 W per cubic inch and can achieve a high typical conversion efficiency of 92 percent at 50 percent full load.

DS1050-3 generates a main payload output of 12 Vdc and an auxiliary output of 3.3 Vdc, or 5.0 Vdc as an option, for powering standby circuitry. It features a wide 90 to 264 Vac input voltage range and employs active power factor correction to minimize input harmonic current distortion and ensure compliance with the international EN61000-3-2 standard, with a power factor of 0.99 typical. To simplify incorporating the new power supply in equipment designs, it accepts the widely available IEC C14 ac input power connector.

DS1050-3 is equipped with an I^2C interface available with industry-standard PMBus™ communications protocol. It also contains a memory device (EEPROM) that is preprogrammed with data about the unit – including its type, serial number and date of manufacture – to facilitate replacement in the field.

ARTESYN™
EMBEDDED TECHNOLOGIES

Model Numbers

Standard	Output Voltage	Minimum Load	Maximum Load	Stand-By Supply[1]	Air Flow Direction
DS1050-3	12.0Vdc	0A	87A	3.3V@4A	Normal (DC Connector to Handle)
DS1050-3-001	12.0Vdc	0A	87A	3.3V@4A	Reversed (Handle to DC Connector)
DS1050-3-002	12.0Vdc	0A	87A	5V@2.5A	Normal (DC Connector to Handle)
DS1050-3-003	12.0Vdc	0A	87A	5V@2.5A	Reversed (Handle to DC Connector)

Note 1: Maximum efficiency for 3.3V stand-by up to 4A and 5V stand-by up to 2.5A. Stand-by supply available up to 20W with derated efficiency.

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)	All models	$P_{O,max}$	-	-	1050	W
Isolation Voltage						
Input to outputs	All models		-	-	2500	Vdc
Input to safety ground	All models		-	-	2500	Vdc
Outputs to safety ground	All models		-	-	50	Vdc
Ambient Operating Temperature	All models	T_A	-10	-	+70[1]	°C
Storage Temperature	All models	T_{STG}	-40	-	+85	°C
Humidity (non-condensing)						
Operating	All models		20	-	90	%
Non-operating	All models		10	-	95	%
Altitude						
Operating	All models		-	-	13,000	feet
Non-operating	All models		-	-	30,000	feet

Note 1: With power derating (see page 23 power derating curve)

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, AC		$V_{IN,AC}$	90	115/230	264	Vac
Input Vac Source Frequency		$f_{IN,AC}$	47	50/60	63	Hz
Maximum Input Current ($I_O = I_{O,max}$, $I_{SB} = I_{SB,Max}$)	$V_{IN,AC}$ = 90Vac	$I_{IN,max}$	- -	- -	14.5	A_{RMS}
Standby Input Current (V_O =Off, I_{VSB} = 0A)	All	$I_{IN,standby}$	-	-	350	mA_{RMS}
No Load Input Current (V_O =On, I_O = 0A, I_{VSB} = 0A)	All	I_{IN,no_load}	-	-	400	mA_{RMS}
Harmonic Line Currents	All	THD	Per IEC1000-3-2			
Power Factor	$V_{IN,AC}$ = 115/230Vac, 100% load		-	0.99	-	
Startup Surge Current (Inrush) @ 25°C	Cold start at $V_{IN,AC}$ = 264Vac		-	-	40	A_{PK}
Input Fuse	Internal, L and N 5x20mm, Quick Acting 16A, 250V		-	-	16	A
Leakage Current to earth ground	$V_{IN,AC}$ = 240Vac $f_{IN,AC}$ = 50/60 Hz		-	-	1.6	mA
PFC Switching Frequency	All	$f_{SW,PFC}$	75		85	KHz
Operating Efficiency @ 25°C	I_O = 50%$I_{O,max}$ $V_{IN,AC}$ = 230Vac	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 models	Inclusive of set-point, temperature change, warm-up drift and dynamic load	V_O	11.4	12.0	12.6	V
	DS1050-3 DS1050-3-001		V_{SB}	3.13	3.30	3.47	
	DS1050-3-002 DS1050-3-003		V_{SB}	4.75	5.00	5.25	
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}
	DS1050-3 DS1050-3-001		V_{SB}	-	-	50	
	DS1050-3-002 DS1050-3-003		V_{SB}	-	-	50	
Output Current	All models		I_O	0	-	87	A
	DS1050-3 DS1050-3-001		I_{SB}	0.5	-	6	
	DS1050-3-002 DS1050-3-003		I_{SB}	0.5	-	4	
Ripple Switching Frequency		All	$f_{SW,DC-DC}$	105	-	115	KHz
V_O Minimum Current Share Loading				10	-	-	$\%I_{O,max}$
Number of Parallel Units[1]		Main Output Current Share connected		-	-	4	
V_O Load Capacitance		Start up	V_O	0	-	4700	µF
			V_{SB}	0	-	470	
V_O Dynamic Response Peak Deviation Settling Time		50% load change, slew rate = 1A/µs	$\pm\%V_O$ T_s	- -	- -	5 -	% mSec
V_O 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 will not exceed the current of one unit. Consult factory if more than 4 units in parallel is needed.

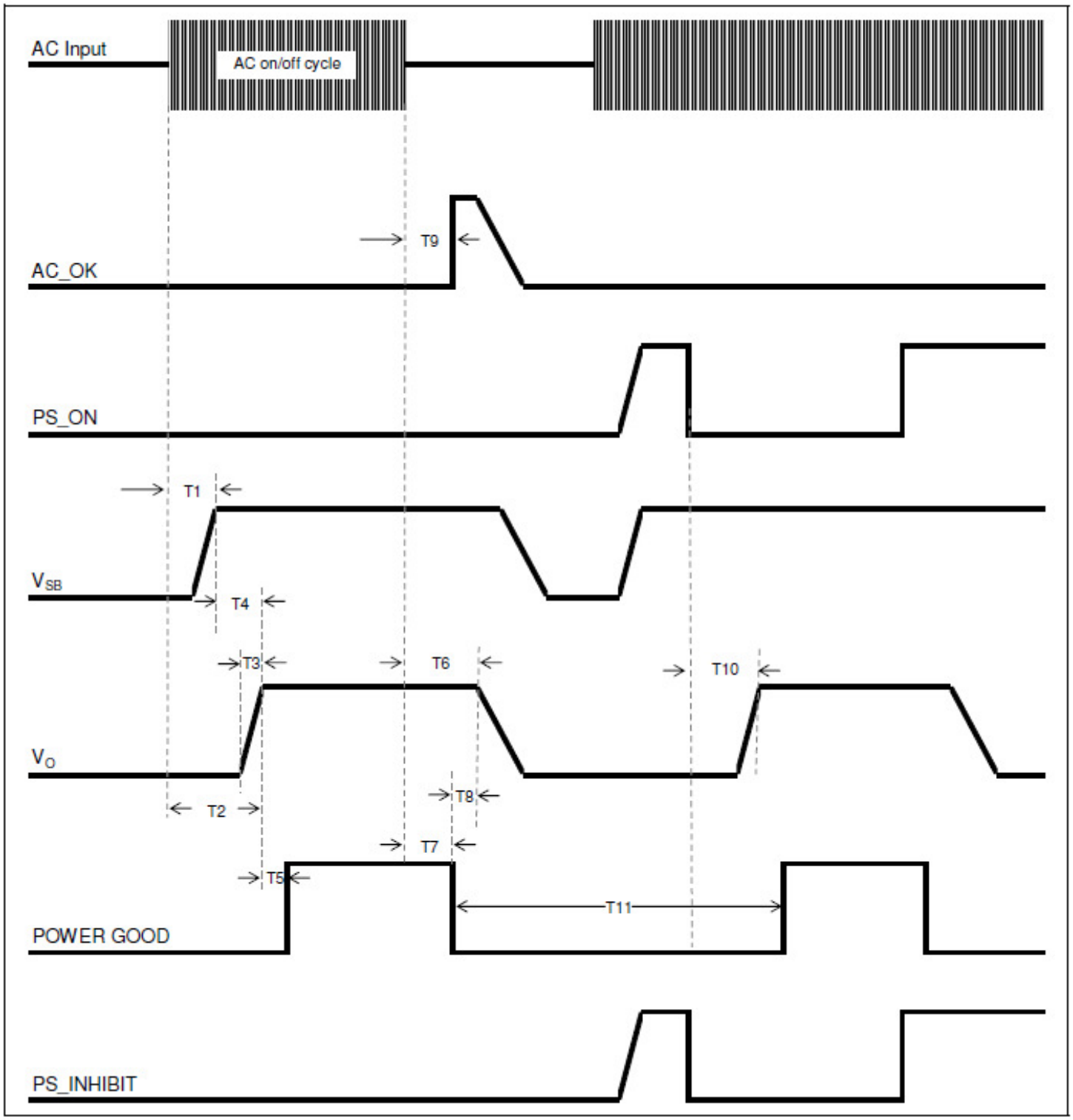
System Timing Specifications

Table 4. System Timing Specifications:

Label	Parameter	Min	Typ	Max	Unit
T1	Delay from AC being applied to V_{SB} being within regulation	-	-	1500	mSec
T2	Delay from AC being applied to output voltages being within regulation with PS_ON asserted low.	-	-	2000	mSec
T3	V_O rise time, 10%V_O to V_O in regulation.	5	-	50	mSec
T4	Delay from +3V3SB (+5VSB) being in regulation to all other output voltages being in regulation at AC turn on.	50	-	1000	mSec
T5	Delay from output voltages within regulation limits to POWER GOOD asserted high.	100	-	1000	mSec
T6	Hold up time - time all output voltages, including V_{SB}, stay within regulation after loss of AC.	12	-	-	mSec
T7	Delay from loss of AC to de-assertion of POWER GOOD.	11	-		mSec
T8	Delay from POWER GOOD de-asserted to output voltages dropping out of regulation limits.	1	-	-	mSec
T9	Delay from loss of AC input to AC_OK going to high.	7	-	12	mSec
T10	Delay from PSON# active to output voltages within regulation limits.	10	-	300	mSec
T11	Duration of PWOK being in the de-asserted state during an off/on cycle using AC or the PSON# signal.	100	-	-	mSec

System Timing Specifications

Figure 1. System Timing Diagram:



DS1050-3 Performance Curves

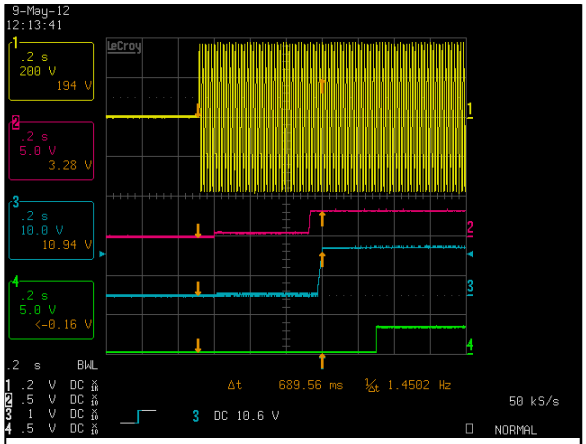


Figure 1: DS1050-3 Turn-on delay via AC mains – Vin = 90Vac
Full Load: Io = 87A, ISB = 4A (3.3V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

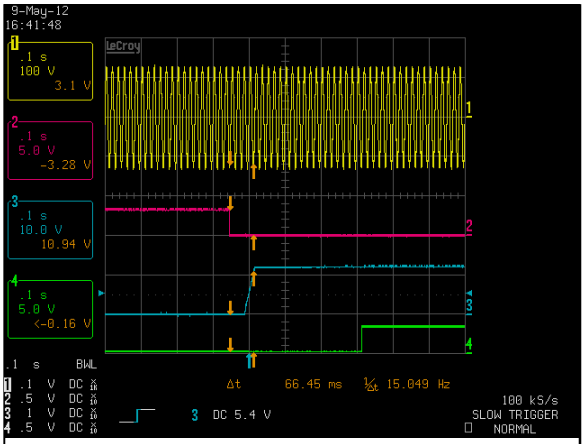


Figure 2: DS1050-3 Turn-on delay via PS_ON – Vin = 90Vac
Full Load: Io = 87A, ISB = 4A (3.3V)
Ch 1: AC Mains Ch 2: PS_ON Ch 3: Vo Ch 4: POWER GOOD

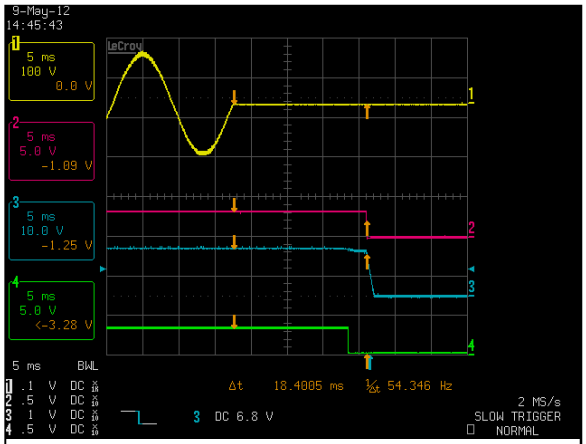


Figure 3: DS1050-3 Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Io = 87A, ISB = 4A (3.3V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

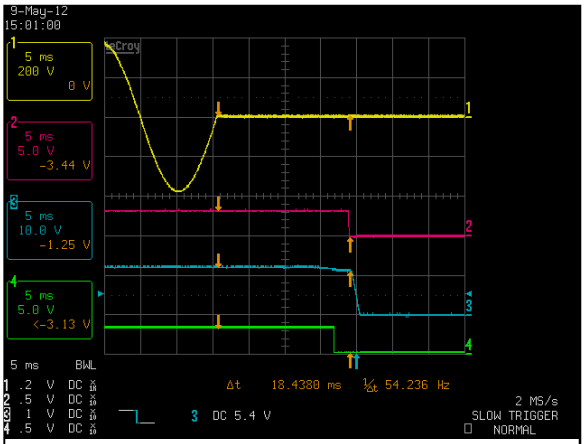


Figure 4: DS1050-3 Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Io = 87A, ISB = 4A (3.3V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

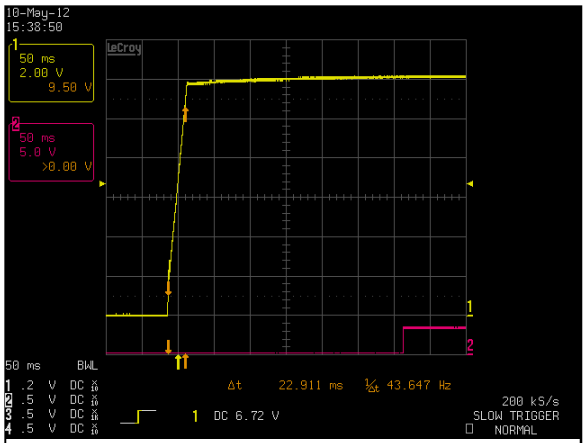


Figure 5: DS1050-3 Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Vo = 87A, VSB = 4A (3.3V)
Ch 1: Vo Ch 2: POWER GOOD

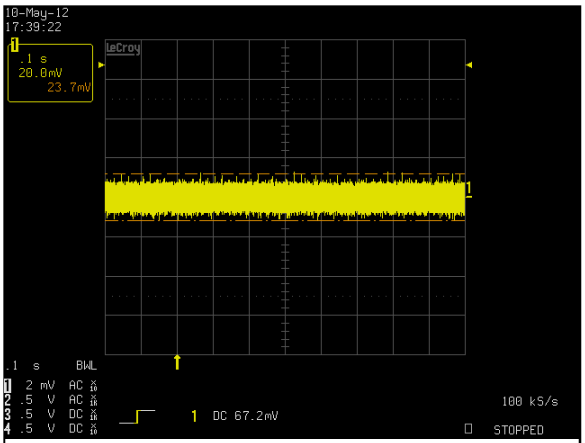


Figure 6: DS1050-3 Ripple and Noise Measurement – Vin = 90Vac
Full Load: Vo = 87A, VSB = 4A (3.3V)
Ch 1: Vo

DS1050-3 Performance Curves

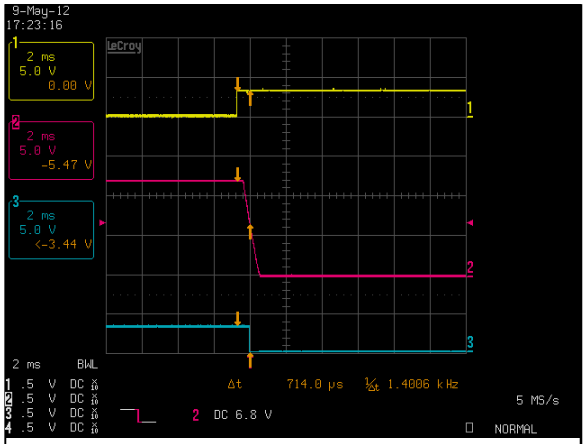


Figure 7: DS1050-3 Turn Off Characteristic via PS_ON
Full Load: Io = 87A, VSB = 4A (3.3V)
Ch 1: PS_ON Ch 2: Vo Ch 3: POWER GOOD

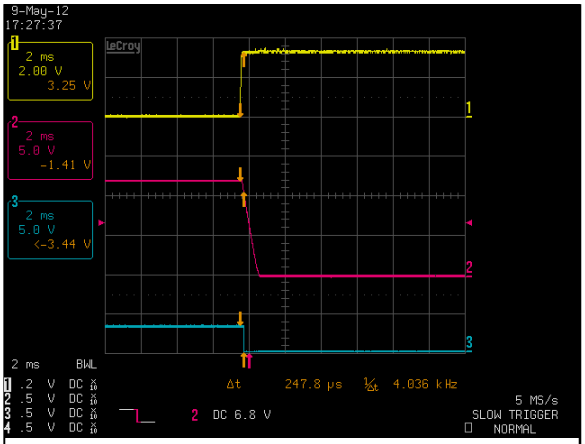


Figure 8: DS1050-3 Turn Off Characteristic via PS_INHIBIT
Full Load: Io = 87A, VSB = 4A (3.3V)
Ch 1: PS_INHIBIT Ch 2: Vo Ch 3: POWER GOOD

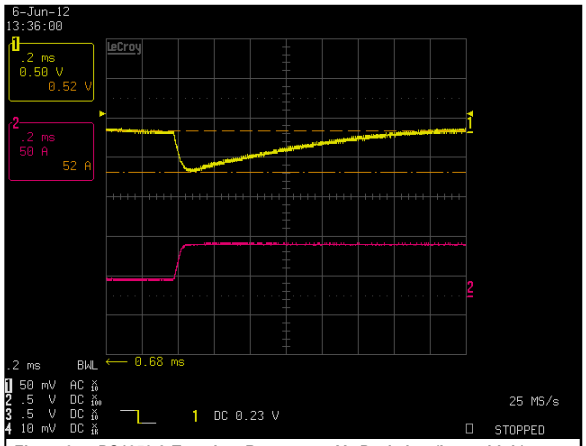


Figure 9: DS1050-3 Transient Response – Vo Deviation (low to high)
25% to 75% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

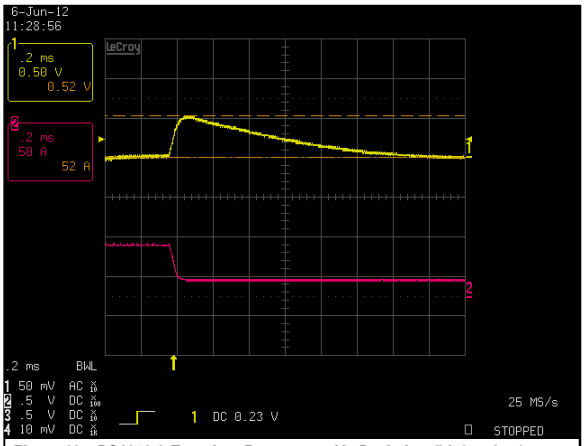


Figure 10: DS1050-3 Transient Response – Vo Deviation (high to low)
75% to 25% load change, 1A/µS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

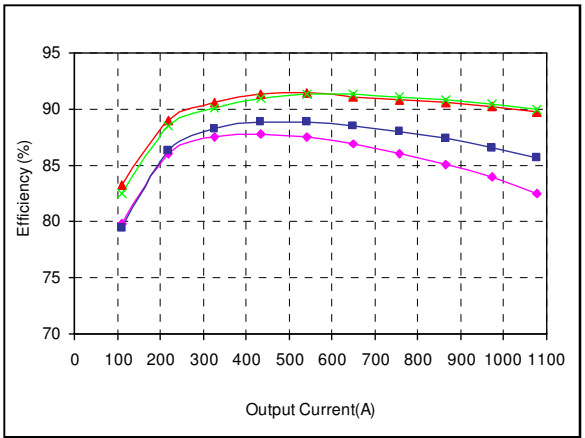


Figure 11: DS1050-3-001 Efficiency Curves @ 25 degC
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Io = 10% increment to 87A, VSB = 6A (3.3V)

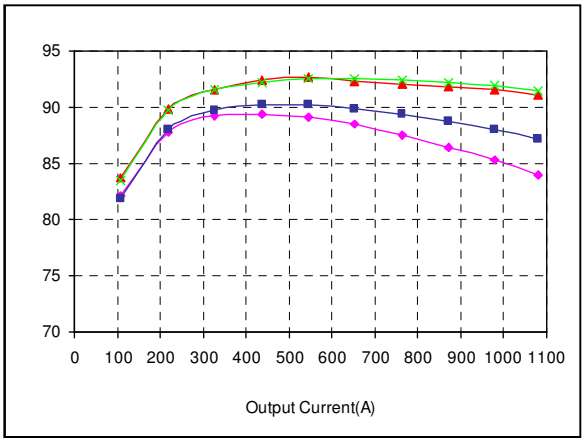


Figure 12: DS1050-3-002 Efficiency Curves @ 25 degC
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Io = 10% increment to 87A, VSB = 4A (5V)

Protection Function Specification

Input Fusing

DS1050-3 series is equipped with an internal non user serviceable 16A High Rupturing Capacity (HRC) 250 Vac fuse to IEC 127 for fault protection in both the L1 and L2 lines input.

Over Voltage / Under Voltage Protection (OVP / UVP)

The power supply latches off during output overvoltage and under voltage with the AC line or PS_ON recycled to reset the latch.

OVP

Parameter	Min	Nom	Max	Unit
V_O Output Overvoltage	13.2	/	14.4	V
3.3V Standby Overvoltage	3.76	/	4.30	V
5V Standby Overvoltage	5.75	/	6.50	V

UVP

Parameter	Min	Nom	Max	Unit
V_O Output Undervoltage	9.0	/	10.8	V

Over Current Protection (OCP)

DS1050-3 series includes internal current limit circuitry to prevent damage in the event of overload or short circuit. Recovery is 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 AC power or PS_ON recycling to restart the power supply.

Any over-current on the stand-by output will not cause any latch protection. The unit will always auto recover once the over-current fault is removed.

Parameter	Min	Nom	Max	Unit
V_O Output Overcurrent	103	/	111.7	A
3.3V Standby Overcurrent	7	/	9.5	A
5V Standby Overcurrent	4.6	/	6.7	A

Short Circuit Protection (SCP)

The DS1050 power supply will withstand a continuous short circuit with no permanent damage, applied to its main output during start-up or while running.. A short is defined as impedance less than 0.05 ohms.

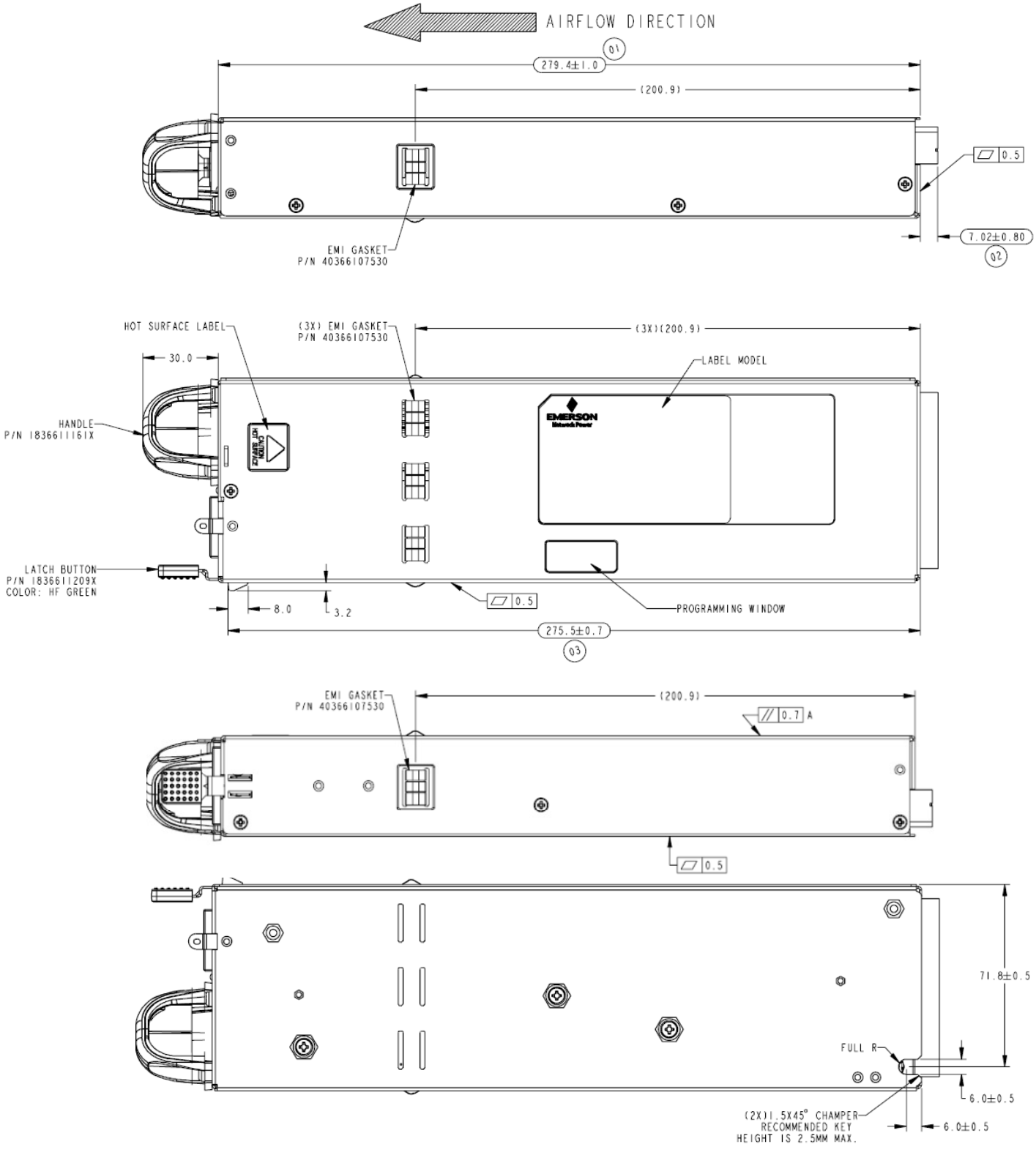
When the standby output V_{SB} is shorted the output will turn off. When the V_{SB} attempts to restart, the maximum peak current from the V_{SB} output will be less than 9.0A peak (3.3V) or 6.6A (5.0V).

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 AC power or PS_ON recycling to restart the power supply.

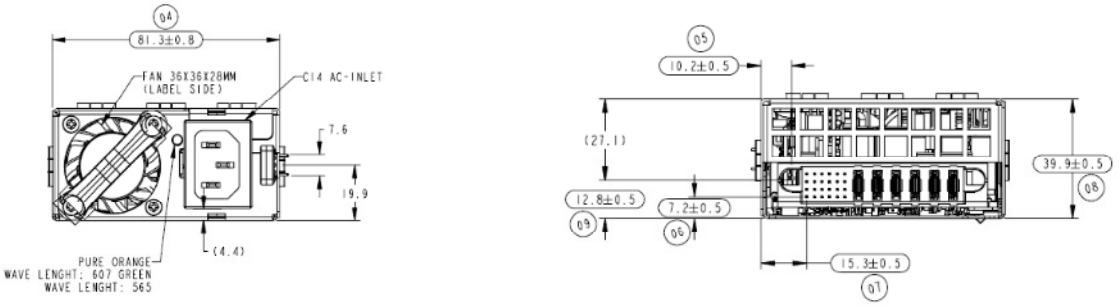
Mechanical Specifications

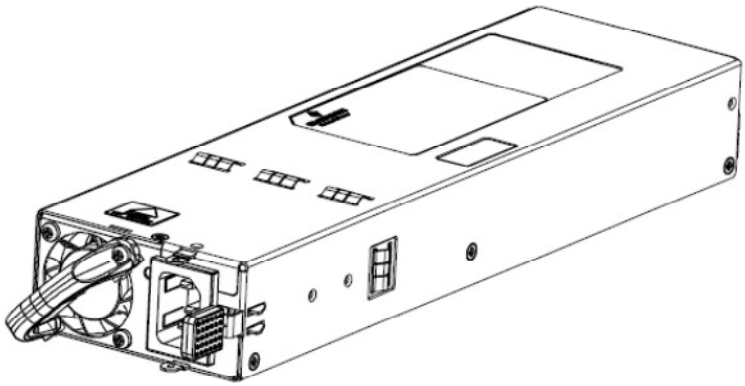
Mechanical Outlines

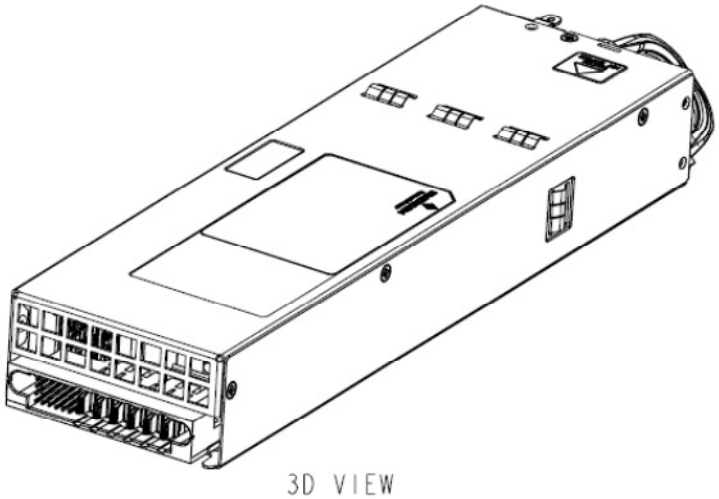


Mechanical Specifications

Mechanical Outlines





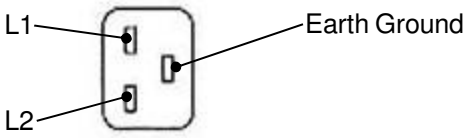


3D VIEW

Connector Definitions

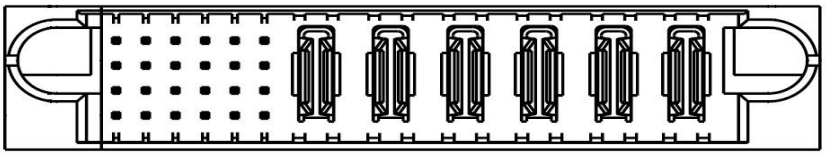
AC Input Connector

Pin 1 – L1
Pin 2 – L2
Pin 3 – 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)
PB6 – + Main Output (V_O)



View from power supply output connector end

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

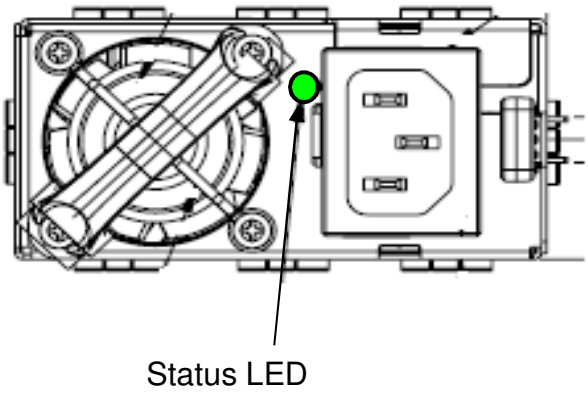
A1 – PS_ON
A2 – Main Output Remote Sense Return
A3 – Spare
A4 – PS_SEATED
A5 – StandBy Output
A6 – StandBy Output Return
B1 – AC_OK(AC Input Present)
B2 – Main Output Remote Sense
B3 – Main Output Current Share
B4 – PS_INHIBIT/PS_Kill
B5 – StandBy Output
B6 – StandBy Output Return
C1 – SDA (I^2C Data 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

Power / Signal Mating Connectors and Pin Types

Table 5. Mating Connectors for DS1050-3 series

Reference	On Power Supply	Mating Connector or Equivalent
AC Input Connector	IEC320-C13	IEC320-C14
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

LED indicator Definition



One bi-color (Green/Amber) LED at the power supply front provides status signal. The status LED conditions is shown on the below table.

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

Weight

The DS1050-3 series weight is 2.857 lbs / 1.296kg (1kg=2.2046lbs) maximum.

Environmental Specifications

EMC Immunity

DS1050-3 series power supply is designed to meet the following EMC immunity specifications:

Table 6. Environmental Specifications:

Document	Description
FCC Docket No. 20780 Part 15 Subpart J Class B/ EN55022, Level B	Conducted and Radiated EMI Limits
EN61000-3-2	Harmonics
EN61000-3-3	Voltage Fluctuations
IEC/EN 61000-4-2, 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/EN 61000-4-3, 2002, Amendment 1, 2002-08	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Radiated, radio-frequency, electromagnetic field immunity test
IEC/EN 61000-4-4, 1995, Amendment 2, 2001-07	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Electrical Fast Transient/Burst Immunity Test. 2KV for AC power port, 1.0KV for DC ports, I/O and signal ports performance Criteria B
IEC/EN 61000-4-5, Edition 1.1, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques – 2KV common mode and 1KV differential mode for AC ports and 0.5kV differential mode for DC power, I/O and signal ports, performance criteria B.
IEC/EN 61000-4-11, Edition 1.1, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques : Voltage Dips and Interruptions: 30% reduction for 500ms- Criteria B>95% reduction for 10mS, Criteria A, >95% reduction for 5000mS, Criteria C
EN55024:1998	Information Technology Equipment-Immunity Characteristics, Limits and Method of Measurements

Safety Certifications

The DS1050-3 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 DS1050-3 series power supply system

Document	File #	Description
UL 60950 No.	151494-02	US and Canada Requirements
CSA 22.2 No. 60950		Information Technology Equipment - Safety - Part 1: General Requirements (Bi-National standard, with UL 60950-1)
IEC60950-1:2005 2nd		International Requirements
EN60950 Deviations		International Requirements
CB Certificate and Report	E186249-A133-CB-1	(All CENELEC Countries)
CHINA CCC Approval	2010010907443010	China Requirements

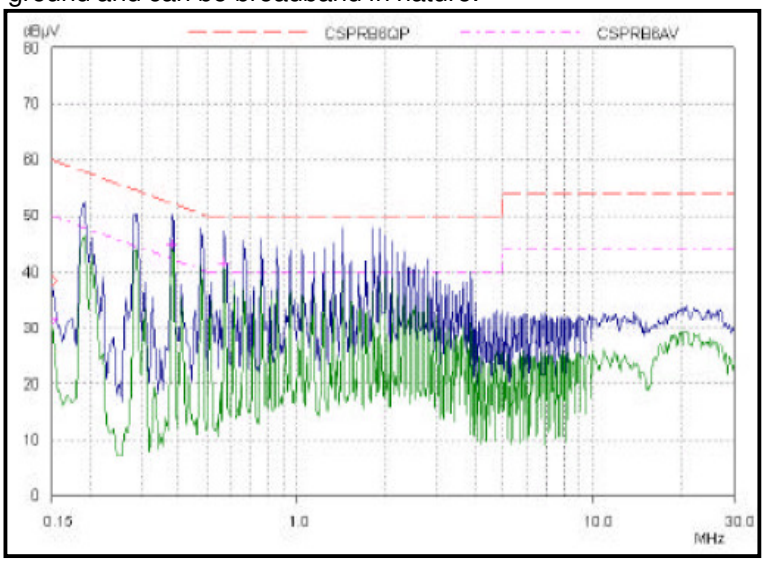
EMI Emissions

The DS1050 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.

The unit is enclosed inside a metal box, tested at 1050W using resistive load with cooling fan.

Conducted Emissions

The applicable standard for conducted emissions is EN55022 (FCC Part 15). Conducted noise can appear as both differential mode and common mode noise currents. Differential mode noise is measured between the two input lines, with the major components occurring at the supply fundamental switching frequency and its harmonics. Common mode noise, a contributor to both radiated emissions and input conducted emissions, is measured between the input lines and system ground and can be broadband in nature.



The DS1050-3 power supplies have internal EMI filters to ensure the convertors' conducted EMI levels comply with EN55022 (FCC Part 15) Class B and EN55022 (CISPR 22) Class B limits. The EMI measurements are performed with resistive loads at maximum rated loading.

Sample of EN55022 Conducted EMI Measurement at 100Vac input

Note: Red Line refers to Emerson Quasi Peak margin, which is 6dB below the CISPR international limit. Pink Line refers to the Emerson Average margin, which is 6dB below the CISPR international limit.

Conducted Emissions

Table 6. Conducted EMI emission specifications of the DS1050-3 series

Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, class B	All	Margin	-	-	6	dB
CISPR 22 (EN55022) 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 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 will be made to maximize the disturbance consistent with the typical application by varying the configuration of the test sample.

Operating Temperature

The DS1050-3 series power supplies will start and operate within stated specifications at an ambient temperature from -10^{O}C to 25^{O}C under all load conditions with internal fan, they can operate up to 70^{O}C with derated power.

Forced Air Cooling

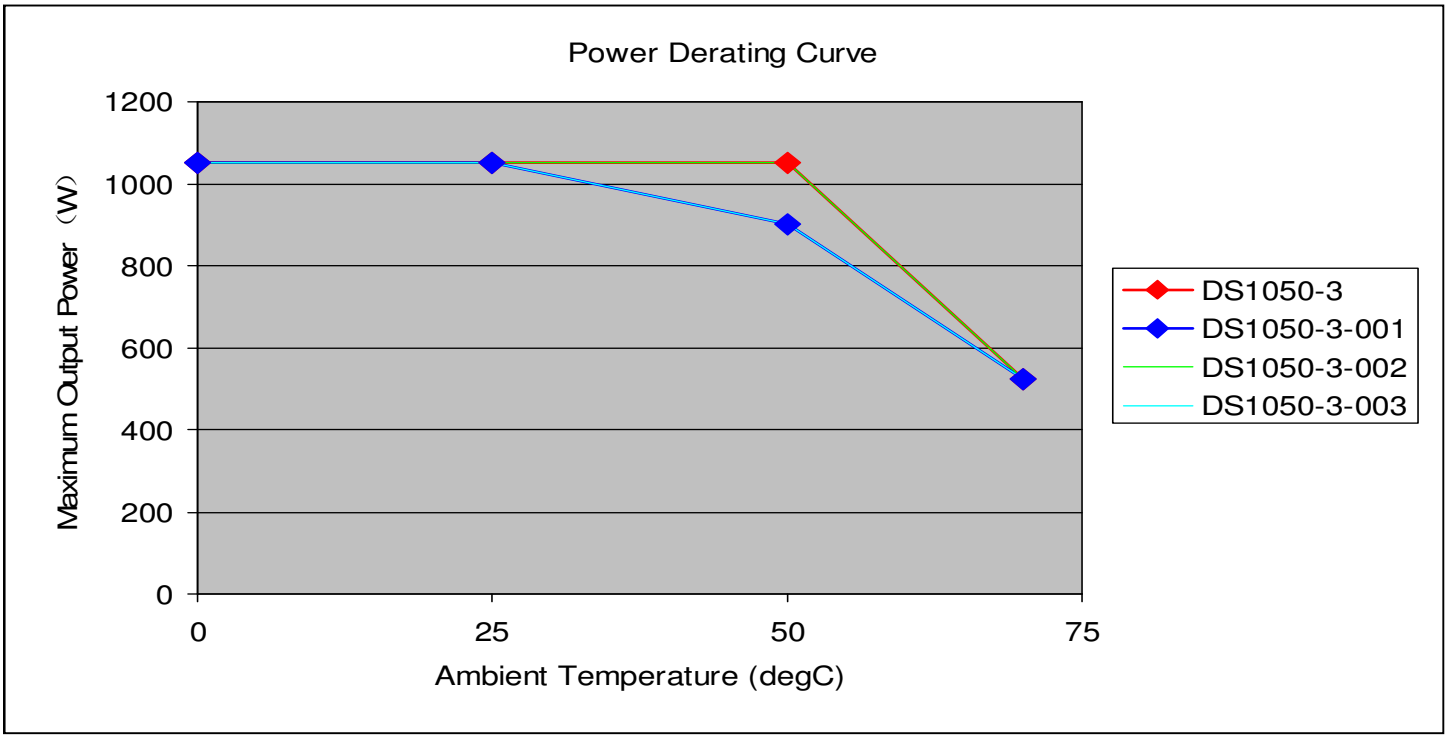
The DS1050-3 series power supplies included internal cooling fans as part of the power supply assembly to provide forced air-cooling to maintain and control temperature of devices and ambient temperature in the power supply to appropriate levels. The standard direction of airflow is from the DC connector end to the AC connector end of the power supply.

Power Derating Curves

The DS1050-3 series can operate up to a maximum ambient temperature of 70 ^{O}C with 50% derating. See tables below for derated output current and combined output power.

Model	-10 ^{O}C to 25 ^{O}C	50 ^{O}C	26 ^{O}C - 50 ^{O}C	70 ^{O}C	51 ^{O}C - 70 ^{O}C
DS1050-3	1050 W	1050 W	0 W / ^{O}C	525 W	- 26.25 W / ^{O}C
DS1050-3-001	1050 W	900 W	- 6 W / ^{O}C	525 W	- 18.75 W / ^{O}C
DS1050-3-002	1050 W	1050 W	0 W / ^{O}C	525 W	- 26.25 W / ^{O}C
DS1050-3-003	1050 W	900 W	- 6 W / ^{O}C	525 W	-18.75 W / ^{O}C

Power Derating Curve



Storage and Shipping Temperature / Humidity

The DS1050-3 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

The DS1050-3 series will operate within specifications at altitudes up to 13,000 feet above sea level. The power supply shall not be damaged when stored at altitudes of up to 30,000 feet above sea level.

Humidity

The DS1050-3 series will operate within specifications when subjected to a relative humidity from 20% to 90% non-condensing. The DS1050-3 series can be stored in a relative humidity from 10% to 95% non-condensing.

Vibration

The DS1050-3 power supply will pass the following vibration specifications:

Non-Operating Random Vibration

Acceleration	2.7		gRMS
Frequency Range	10-2000		Hz
Duration	20		mins
Direction	3 mutually perpendicular axis		
PSD Profile	**FREQ** 10-190 Hz 190-210 Hz 210-2000 Hz	**SLOPE** **dB/oct** --- -31.213dB/oct ---	**PSD** **g^2/Hz** 0.01 g^2/Hz --- 0.003 g^2/Hz

Operating Random Vibration

Acceleration	1.0		gRMS
Frequency Range	10-500		Hz
Duration	20		mins
Direction	3 mutually perpendicular axis		
PSD Profile	**FREQ** 10-500 Hz	**SLOPE** **dB/oct** ---	**PSD** **g^2/Hz** 0.002 g^2/Hz

Shock

The DS1050-3 power supply will pass the following vibration specifications:

Non-Operating Half-Sine Shock

Acceleration	30	G
Duration	18	msec
Pulse	Half-Sine	
No. of Shock	3 shock on each of 6 faces	

Operating Half-Sine Shock

Acceleration	4	G
Duration	22	msec
Pulse	Half-Sine	
No. of Shock	3 shock on each of 6 faces	

Power and Control Signal Descriptions

AC Input Connector

This connector supplies the AC Mains to the DS1050-3 power supply.

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

Output Connector – Power Blades

These pins provide the main output for the DS1050-3. 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 DS1050-3 power supply. The Main Output (V_O) is electrically isolated from the power supply chassis.

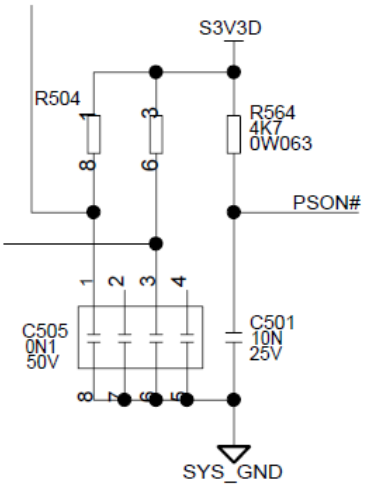
PB1 - Main Output Return
PB2 - Main Output Return
PB3 - Main Output Return
PB4 - + Main Output (V_O)
PB5 - + Main Output (V_O)
PB6 - + Main Output (V_O)

Output Connector - Control Signals

The DS1050-3 series 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 DS1050-3 power supply. The power supply main output (V_O) will be enabled when this signal is pulled low, below 0.8 V. The Power supply output (except V_{SB} output) will be disabled when this input is driven higher than 2.4V, or left open circuited.



Power and Control Signal Descriptions

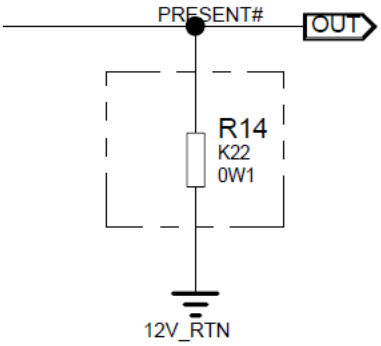
Main Output Remote Sense Return, Main Output Remote Sense – (pins A2, B2)

The main output of the DS1050-3 is equipped with a Remote Sensing capability that will compensate for a power path drop around the entire loop of 300 millivolt. 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 will 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 DS1050-3 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)

This signal pin is connected to Main Output Return inside the power supply via a 220 ohm resistor. This pin is to be pull high on the system side by a resistor of 4.7K or higher. A TTL logic LOW indicates the power supply is inserted and seated into the system power supply connector. A Logic HIGH indicated the removal of the power supply.

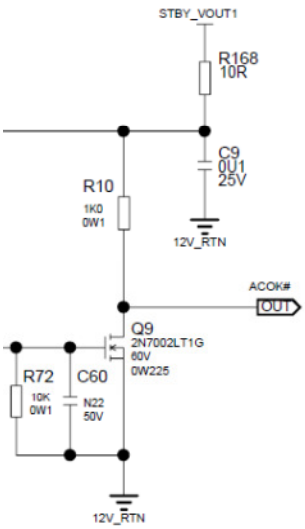


StandBy Output, StandBy Output Return – (pins A5, A6, B5, B6, C5, C6, D5, D6)

The DS1050-3 provides a regulated 3.3 volt 4 amp (or 5.0 volt 2.5 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 AC 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).

AC_OK – (pin B1)

The AC_OK signal is a normally LOW level TTL logic signal when the AC input voltage is within the allowable limits. A TTL logic HIGH level, with a 7-12 mS early warning will be sent before the main output loses regulation. This signal is an open drain output internally pulled up in the power supply to StandBy Output via a 1K ohm resistor. It is capable of driving the output below 0.4V with a load of 4mA.



Main Output Current Share – (pin B3)

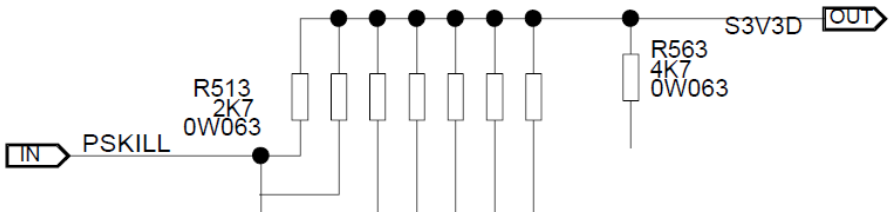
The DS1050-3 supports active current sharing through a single wire connection between the power supplies. This input/output signal pin allows two or more power supplies to share the main output load current to increase the overall power capability or to operate the units in a N+1 configuration for redundancy purposes.

The voltage of this signal will be a linear slope from no load to full load. At 43.5A, the output of the Main Output Current Share pin will be between 2.90 V and 3.10V. At 87A output when two supplies are running in parallel must be between 2.90 and 3.10V.

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 will current share within 5% accuracy. When supplying light loads between 10% and 30% 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 will 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 pulled 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 I2C where the unit can be turned on and off via I2C.

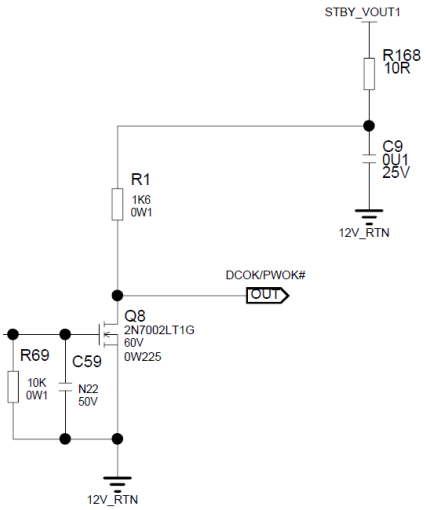


SDA, SCL and S_INT – (pin C1, C2, D3)

Please refer to “Communication Bus Descriptions” section.

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 1.6K ohm 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 DS1050-3 is also equipped with a Remote Sensing capability that will compensate upto 50mV of voltage drop for the positive rail. The StandBy Output Remote Sense pin will 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 DS1050-3 power supply contains enhanced monitoring and control functions implemented via the I²C bus. The DS1050-3 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 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.

SDA, SCL (I²C Data and Clock Signals) – (pin C1, C2)

I²C serial data and clock bus - these pins are internally pulled up to internal 3.3V supply with a 10K resistor. These pins must be pulled-up in the system by an 2.2K ohm resistor.

S_INT (Alarm) – (pin D3)

S_INT is used to send a signal to the system that a fault in the power supply occurred. This signal is normally logic level HIGH. It will go to a LOW logic level when a fault bit has been set in the power supply's status register. To reset the S_INT signal back to normal (logic HIGH level), perform one of the following actions - (1) recycle input AC power, (2) toggle PSON signal and (3) issuance of a CLEAR_FAULTS PMBus™ command.

A0, A1 (I²C Address BIT 0, BIT1 Signals) – (pin 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 supply with a 1K resistor.

I²C Bus Communication Interval

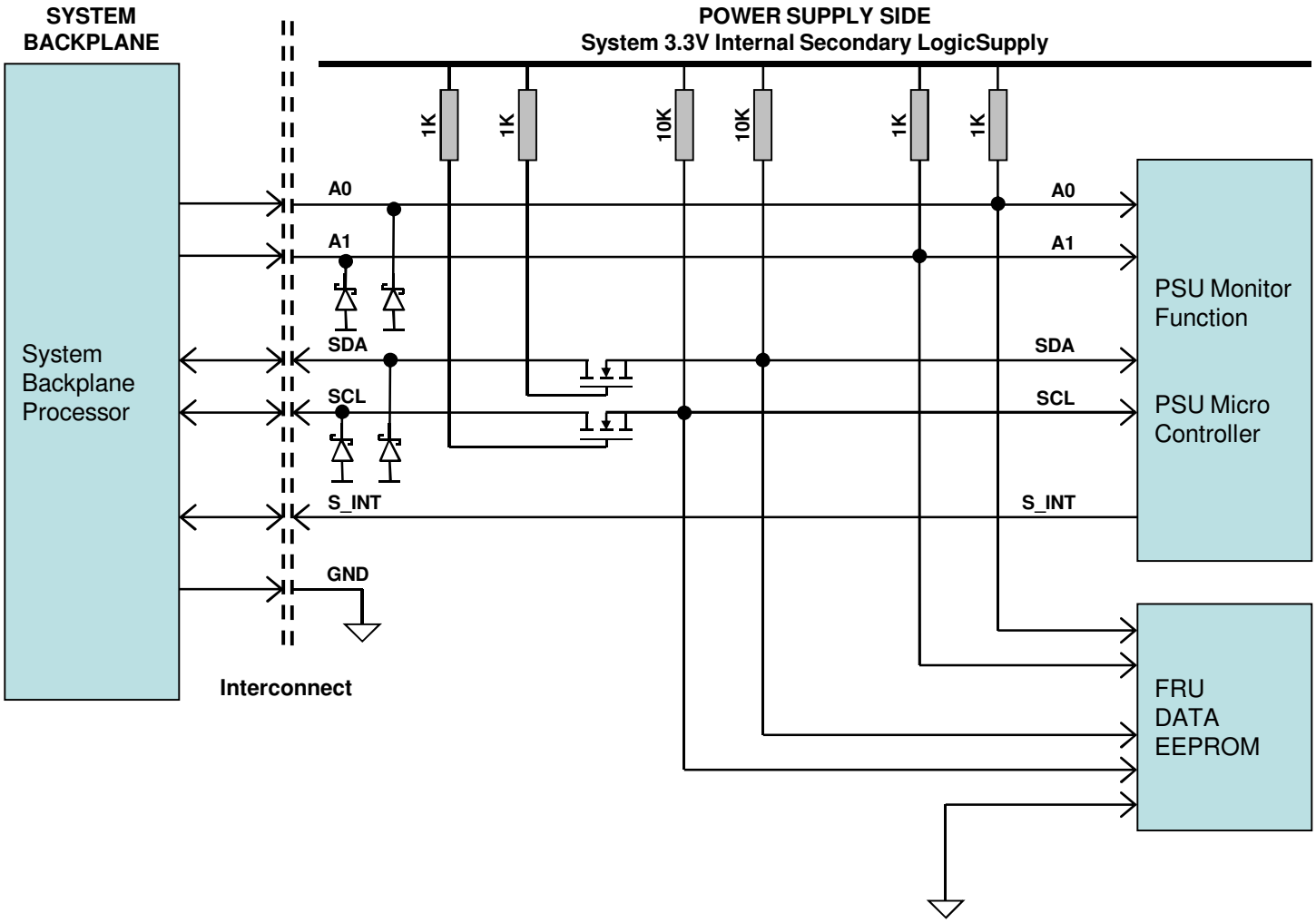
The interval between two consecutive I²C communications to the power supply will be at least 50ms to ensure proper monitoring functionality.

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 will be made with an oscilloscope bandwidth limited to 100MHz. Measurements will be make at the power supply output connector with 3.2K 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 will be made at the power supply output connector.

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	Typ	Max	Unit
SDA, SCL internal pull-up resistor		R_{int}	-	10	-	Kohm
SDA, SCL internal bus capacitance		C_{int}	-	0	-	pF
Recommended external pull-up resistor	1 PSU	R_{ext}	-	2.2	-	Kohm
	4 PSU		-	0.55	-	Kohm

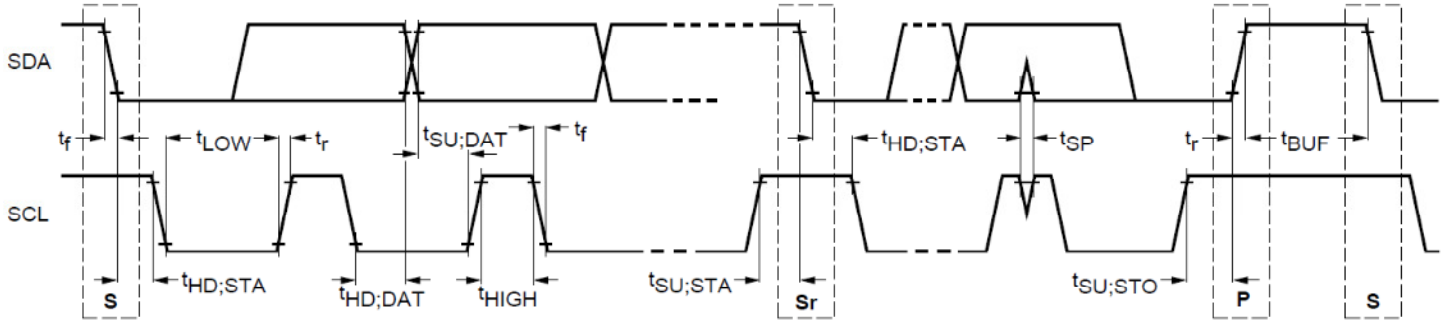
Logic Levels

DS1050-3 series power supply I²C Communication Bus will respond to logic levels as per below:

Logic High: 3.3V 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	101		KHz
Hold time (repeated) START condition	$t_{HD;STA}$	4.0	-	4.4		µS
LOW period of SCL clock	t_{LOW}	4.7	-	14.5		µS
HIGH period of SCL clock	t_{HIGH}	4.0	-	4.0		µS
Setup time for repeated START condition	$t_{SU;STA}$	4.7	-	5.4		µS
Data hold time	$t_{HD;DAT}$	0	3.45	1.66		µS
Data setup time	$t_{SU;DAT}$	250	-	5576		nS
Rise time	t_r	-	1000	SCL = 804	SDA = 800	nS
Fall time	t_f	-	300	SCL = 136	SDA = 132	nS
Setup time for STOP condition	$t_{SU;STO}$	4.0	-	7.08		µS
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	100		µS

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

Device Addressing

The DS1050-3 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 supply with a 1K resistor. To set the address as "0", the corresponding address line will 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) Read Address
	A1	A0		
1	0	0	0xB8	0xA8
2	0	1	0xBA	0xAA
3	1	0	0xBC	0xAC
4	1	1	0xBE*	0xAE*

* Default PMBus™ address when A0 and A1 are left open, EEPROM Read address = EEPROM Write Address + 1

Power Supply Status Register, PMBus™ Register 0x79h

Power supply status monitoring can be done via the PMBus™ register 0x79h or as I/O expander Detailed explanation of functions is given below:

Upper Byte

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
Vout	Iout/Pout	Input	MFR	Power_Good	Fan	Other	Unknown

Lower Byte

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
Busy	OFF	OV	OC	UV	Temp	CML	None

- Vout - This bit will be set high when fault has been triggered on main output.
- Iout/Pout - This bit will be set high when fault has been triggered on Iout/Pout.
- Input - This bit will be set high when fault has been triggered on Input voltage.
- MFR - This bit will be set high when fault has been triggered on Manufacturer defined fault.
- Power_Good - This bit will be set high when fault has been triggered on Manufacturer defined
- Fan - This bit will be set high when fault has been triggered on Fan control.
- Other - Not used
- Unknown - Note used
- Busy - This bit will be set high when the receiving device is too busy to respond on the communication on the bus.
- Off - Not used.
- OV - This bit will be set high when fault has been triggered on main output.
- OC - This bit will be set high when fault has been triggered on output load.
- UV - This bit will be set high when Input Under-voltage occur.
- Temp - This bit will be set high when OTP is triggered.
- CML - This bit will be set high when memory or logic fault has occurred.
- None - This bit will be set high when a fault triggered is not listed avobe

Power Supply Status Register, PMBus™ Register 0x79h

STATUS_VOUT	
7	VOUT OV Fault
6	VOUT OV Warning
5	VOUT UV Warning
4	VOUT UV Fault
3	VOUT_MAX Warning
2	TON MAX Warning
1	TOFF MAX Warning
0	Power On Tracking Error

STATUS_WORD	
7	VOUT
6	IOUT/POUT
5	INPUT
4	MFR
3	POWER_GOOD#
2	FANS
1	OTHER
0	UNKNOWN

STATUS_INPUT	
7	VIN OV Fault
6	VIN OV Warning
5	VIN UV Warning
4	VIN UV Fault
3	Unit Off For Low Input Voltage
2	VIN OC Fault
1	VIN OC Warning
0	PIN OP Warning

STATUS_IOUT	
7	IOUT OC Fault
6	OC Fault/LV Shutdown
5	IOUT OC Warning
4	IOUT UC Fault
3	Current Share Fault
2	In Power Limiting Mode
1	POUT OP Fault
0	POUT OP warning

STATUS_BYTE	
7	BUSY
6	OFF
5	VOUT_OV
4	VOUT_OC
3	VIN_UV
2	TEMPERATURE
1	CML
0	NONE OF ABOVE

STATUS_MFR_SPECIFIC	
7	Manufacturer Defined
6	Manufacturer Defined
5	Manufacturer Defined
4	Manufacturer Defined
3	Manufacturer Defined
2	Manufacturer Defined
1	Manufacturer Defined
0	Manufacturer Defined

STATUS_TEMPERATURE	
7	OT Fault
6	OT Warning
5	UT Warning
4	UT Fault
3	Reserved
2	Reserved
1	Reserved
0	Reserved

STATUS_FAN_1_2	
7	Fan 1 Fault
6	Fan 2 Fault
5	Fan 1 Warning
4	Fan 2 Warning
3	Fan 1 Speed Override
2	Fan 2 Speed Override
1	Air Flow Fault
0	Air Flow Warning

STATUS_CML	
7	Invalid/Unsupported Command
6	Invalid/Unsupported Date
5	Packed Error Check Failed
4	Memory Fault Detected
3	Processor Fault Detected
2	Reversed
1	Other Communication Fault
0	Other Memory or Logic Fault

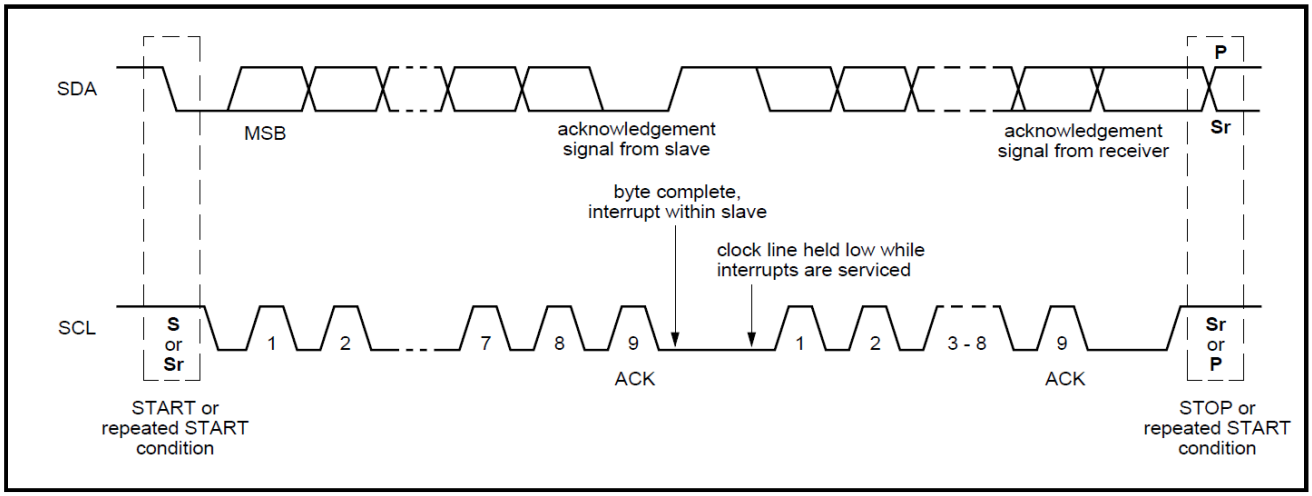
STATUS_OTHER	
7	Reserved
6	Reserved
5	Input A Fuse/Breaker Fault
4	Input B Fuse/Breaker Fault
3	Input A Oring Device Fault
2	Input B Oring Device Fault
1	Output Oring Device Fault
0	Reserved

STATUS_VOUT	
7	Fan 3 Fault
6	Fan 4 Fault
5	Fan 3 Warning
4	Fan 4 Warning
3	Fan 3 Speed Override
2	Fan 4 Speed Override
1	Reserved
0	Reserved

I²C Clock Synchronization

The DS1050-3 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 DS1050-3 is 100 microseconds.



FRU (EEPROM) Data

The FRU (Field Replaceable Unit) data format is compliant with the Intel IPMI v1.0 specification.

The DS1050-3 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 DS1050-3 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.

DS1050-3 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 = 10 Bytes = (001010)b	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** CFH (if used) Type = “ASCII+LATIN1” = (11)b Length = 15 Bytes = (001111)b	207	CF
23	17	**CHASSIS SERIAL NUMBER BYTES,** 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

DS1050-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
33	20	CHASSIS SERIAL NUMBER BYTES, Default value is 0.	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, 56 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.	199	C7
		MANUFACTURER'S NAME 5 byte sequence		
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”= 43h	83	53
49	31	“O”= 4Fh	79	4F
50	32	“N”= 4Eh	78	4E
51	33	**PRODUCT NAME** Type/Length (CCH) Type = “ASCII+LATIN1” = (11)b Length = 12 Bytes = (001100)b	207	CF
52	34	**Product Name,** 15 Byte sequence	68	44
53	35	**“DS1050-3 ”**	83	53
54	36		49	31
55	37		48	30
56	38		53	35
57	39		48	30
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		32	20
67	43	**PRODUCT PART/MODEL NUMBER** Type/Length (CCH) Type = “ASCII+LATIN1” = (11)b Length = 12 Bytes = (001100)b	207	CF
68	44	**Part / Model Number**	68	44
69	45	“DS1050-3 ”	83	53
70	46	In Decimal = 068, 083, 049, 050, 048, 048, 045, 051, 032, 032, 032, 032,	49	31
71	47	In Hex = 44H, 53H, 31H, 32H, 30H, 30H, 2DH, 33H, 20H, 20H, 20H, 20H,	48	30
72	48		53	35
73	49		48	30
74	4A		45	2D
75	4B		51	33
76	4C		32	20
77	4D		32	20
78	4E		32	20
79	4F		32	20
80	50		32	20
81	51		32	20
82	52		32	20

DS1050-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
83	53	**PRODUCT VERSION NUMBER** Type/Length (C2h) 194 d C2 h Type = "ASCII+LATIN1" = (11)b Length = 2 bytes = (000010)b	194	C2
84 85	54 55	**PRODUCT VERSION NUMBER BYTES** Refer to Section 1.2 Product Revision History in latest IPS	48 69	30 45
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** DS1050-3=I096	73 48 57 54	49 30 39 36
91 92	5B 5C	**MANUFACTURING YEAR AND WEEK CODE** "WW"	XX XX	XX XX
93 94 95 96	5D 5E 5F 60	**Unique Serial Number (Per Unit)**	XX XX XX XX	XX XX XX XX
97 98	61 62	**MODEL REVISION**	48 69	30 45
99 100	63 64	**MANUFACTURING LOCATION** "P" In Decimal = 080 In Hex = 50H	80	50
		End Tag	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 94))** Zero Check Sum :will follow check sum calculation as per IPMI v1.1 specs	228	E4
		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 Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM)	 0 2 24 155 75	 00 02 18 9B 4B
		Power Supply Record		
109 110	6D 6E	**Overall Capacity of the Power Supply**, 1300W = 04B0H 2 Bytes Sequence	26 4	1A 04
111 112	6F 70	**Peak VA,** 1300W = 0544H 2 Bytes Sequence	20 5	14 05
113	71	**Inrush Current**, 40A	40	28
114	72	**Inrush Interval**, 50mS	50	32
115 116	73 74	**Low End Input Voltage Range 1(10mV),** (90V / 10mV) 9000 = 2328H 2 Bytes Sequence	40 35	28 23
117 118	75 76	**High End Input Voltage Range 1(10mV),** (264V/10mV) 26400= 6720H 2 Bytes Sequence	32 103	20 67
119 120	77 78	**Low End Input Voltage Range 2(10mV),** 2 Bytes Sequence No application	 0 0	 00 00
121 122	79 7A	**High End Input Voltage Range 2(10mV),** 2 Bytes Sequence No application	 0 0	 00 00

DS1050-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
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 = 0 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	14	0E
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:	26 20	1A 14
129 130 131	81 82 83	**Combined Wattage,** Not Applicable Byte 1 00110000B =30H=48d Byte 2 and Byte 3: 1050W =041AH 3 Bytes Sequence	48 26 4	30 1A 04
132	84	**Predictive Fail Tachometer Lower Threshold,** Not Applicable. Predictive Failure is not Supported.	0	00
		12V DC OUTPUT RECORD HEADER		
133 134 135 136 137	85 86 87 88 89	Record type = 01 for DC Output Record End of List /Record Format Version Number for 12V DC Output Record Record Length of 12V DC Output Record Record CHECKSUM of 12V DC Output Record (Zero CHECKSUM) (256-(sum of bytes 138 to 150) Header CHECKSUM of 12V DC Output Record Header (Zero CHECKSUM)	1 2 13 78 162	01 02 0D 4E A2
		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
139 140	8B 8C	**Nominal Voltage (10mV), (12V / 10mV)** 1200 = 04B0H 2 Bytes Sequence In Decimal: 176, 004 In Hex: B0H, 04H	176 4	B0 04
141 142	8D 8E	**Maximum Negative Voltage Deviation (10mV),** 1140 = 0474H 2 Bytes Sequence In Decimal: 116, 004 In Hex: 74H, 04H	116 4	74 04
143 144	8F 90	**Maximum Positive Voltage Deviation (10mV),** 1260 =04ECH 2 Bytes Sequence In Decimal: 236, 004 In Hex: ECH, 04H	236 4	EC 04
145 146	91 92	**Ripple and Noise pk-pk (mV),** 120 = 78H 2 Bytes Sequence In Decimal: 120, 000 In Hex: 78H, 00H	120 0	78 00
147 148	93 94	**Minimum Current Draw (10mA),** 0000 = 0000H 2 Bytes Sequence In Decimal: 000, 000 In Hex: 00H, 00H	0 0	00 00

DS1050-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		Maximum Current Draw (10mA), 8700 = 21FCH		
149	95	2 Bytes Sequence	252	FC
150	96		33	21
		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 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)	223	DF
155	9B	(256-(sum of bytes 156 to 168)		
		Header CHECKSUM of 3V3SB Output Record Header (Zero CHECKSUM)	17	11
		(256-(sum of bytes 151 to 154)		
		VSB OUTPUT RECORD		
		Output Information, 002 = 02H		
		Bit 7: Standby Information = 1B		
		Bits 6-4: Reserved, Write as 000B		
156	9C	Bits 3-0: Output Number 2 = 010B	130	82
		Nominal Voltage (10mV), (3.3V / 10mV) 330 = 014AH		
157	9D	2 Bytes Sequence	74	4A
158	9E		1	01
159	9F	**Maximum Negative Voltage Deviation (10mV),** (3.14V/10mV) 314= 013AH	58	3A
160	A0	2 Bytes Sequence	1	01
		Maximum Positive Voltage Deviation (10mV), (3.46V/ 10mV) 346 =015AH		
161	A1	2 Bytes Sequence	90	5A
162	A2		01	01
163	A3	**Ripple and Noise pk-pk (mV),** 50 = 0032H	50	32
164	A4	2 Bytes Sequence	0	00
165	A5	**Minimum Current Draw (10mA),** (0.5A / 10mA) 50 = 0032H	50	32
166	A6	2 Bytes Sequence	0	00
		Maximum Current Draw (10mA), (6.0A / 10mA) 600 = 0258H		
167	A7	2 Bytes Sequence	88	58
168	A8		02	02
		OEM RECORD		
169	A9	Record type = C0H for OEM Record	192	C0
170	AA	End of List /Record Format Version Number for 3.3Vsb 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)	148	94
		(256-(sum of bytes 169to 172)		
		OEM RECORD		
174	AE	Manufacturer ID (3 bytes, Default is 0)		
175	AF	RESERVED		
176	B0	RESERVED		
177	B1	RESERVED		
178	B2	RESERVED		
179	B3	RESERVED		
180	B4	RESERVED		
181	B5	RESERVED		
182	B6	RESERVED		
183	B7	RESERVED		
184	B8	RESERVED		
185	B9	RESERVED		
186	BA	RESERVED		
187	BB	PAD (reserved), Default value is 0.		

DS1050-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
179	B3	PAD (reserved), Default value is 0.	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
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
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

DS1050-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		INTERNAL USE AREA, 40 BYTES		
239	EF	RESERVED, Default value is 0.	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
255	FF	Zero CHECKSUM of Internal Use Area (if used). Default Value=0	0	00

DS1050-3-001 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
52	34	**Product Name,** 15 Byte sequence	68	44
53	35	"**DS1050-3-001** "	83	53
54	36		49	31
55	37		48	30
56	38		53	35
57	39		48	30
58	3A		45	2D
59	3B		51	33
60	3C		45	2D
61	3D		48	30
62	3E		48	30
63	3F		49	31
64	40		32	20
65	41		32	20
66	42		32	20
68	44	**Part / Model Number**	68	44
69	45	"DS1050-3-001 "	83	53
70	46		49	31
71	47		48	30
72	48		53	35
73	49		48	30
74	4A		45	2D
75	4B		51	33
76	4C		45	2D
77	4D		48	30
78	4E		48	30
79	4F		49	31
80	50		32	20
81	51		32	20
82	52		32	20
87	57	**Model ID**	73	49
88	58	Ds1050-3-001=I306	51	33
89	59		48	30
90	5A		54	36
104	68	**Power Supply Record Header**		
105	69	Record type = 00 for Power supply	0	00
106	6A	End of List /Record Format Version Number	2	02
107	6B	Record Length of Power Supply Record	24	18
108	6C	Record CHECKSUM of Power Supply Record	155	9B
		Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM)	75	4B
129	81	**Combined Wattage,** Not Applicable	48	30
130	82	Byte 1 00110000B =30H=48d	26	1A
131	83	Byte 2 and Byte 3: 1050W =041AH	4	04
		3 Bytes Sequence		
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 5VSB Output Record	2	02
153	99	Record Length of 3V3SB Output Record	13	0D
154	9A	Record CHECKSUM of 5VSB Output Record (Zero CHECKSUM)	223	DF
155	9B	(256-(sum of bytes 156 to 168)		
		Header CHECKSUM of 5VSB Output Record Header (Zero CHECKSUM)	17	11
		(256-(sum of bytes 151 to 154)		

DS1050-3-001 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		VSB OUTPUT RECORD		
157 158	9D 9E	**Nominal Voltage (10mV),** (3.3V / 10mV) 330 = 014AH 2 Bytes Sequence	74 1	4A 01
159 160	9F A0	**Maximum Negative Voltage Deviation (10mV),** (3.14V/10mV) 314= 013AH 2 Bytes Sequence	58 1	3A 01
161 162	A1 A2	**Maximum Positive Voltage Deviation (10mV),** (3.46V/ 10mV) 346 =015AH 2 Bytes Sequence	90 0	5A 01
167 168	A7 A8	**Maximum Current Draw (10mA),** (6.0A / 10mA) 600 = 0258H 2 Bytes Sequence	88 02	58 02

DS1050-3-002 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
52	34	**Product Name,** 15 Byte sequence	68	44
53	35	"**DS1050-3-002** "	83	53
54	36		49	31
55	37		48	30
56	38		53	35
57	39		48	30
58	3A		45	2D
59	3B		51	33
60	3C		45	2D
61	3D		48	30
62	3E		48	30
63	3F		50	32
64	40		32	20
65	41		32	20
66	42		32	20
68	44	**Part / Model Number**	68	44
69	45	"DS1050-3-002 "	83	53
70	46		49	31
71	47		48	30
72	48		53	35
73	49		48	30
74	4A		45	2D
75	4B		51	33
76	4C		45	2D
77	4D		48	30
78	4E		48	30
79	4F		50	32
80	50		32	20
81	51		32	20
82	52		32	20
87	57	**Model ID**	73	49
88	58	Ds1050-3-002=I168	48	31
89	59		54	36
90	5A		56	38
104	68	**Power Supply Record Header**		
105	69	Record type = 00 for Power supply	0	00
106	6A	End of List /Record Format Version Number	2	02
107	6B	Record Length of Power Supply Record	24	18
108	6C	Record CHECKSUM of Power Supply Record	171	AB
		Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM)	59	3B
129	81	**Combined Wattage,** Not Applicable	32	20
130	82	Byte 1 00100000B =20H=32d	26	1A
131	83	Byte 2 and Byte 3: 1050W =041AH	4	04
		3 Bytes Sequence		
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 5VSB Output Record	2	02
153	99	Record Length of 5VSB Output Record	13	0D
154	9A	Record CHECKSUM of 5VSB Output Record (Zero CHECKSUM)	169	A9
155	9B	(256-(sum of bytes 156 to 168)		
		Header CHECKSUM of 5VSB Output Record Header (Zero CHECKSUM)	71	47
		(256-(sum of bytes 151 to 154)		

DS1050-3-002 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		VSB OUTPUT RECORD		
157 158	9D 9E	**Nominal Voltage (10mV),** (3.3V / 10mV) 500 = 01F4H 2 Bytes Sequence	244 1	F4 01
159 160	9F A0	**Maximum Negative Voltage Deviation (10mV),** (4.75V/10mV) 475= 01DBH 2 Bytes Sequence	219 1	DB 01
161 162	A1 A2	**Maximum Positive Voltage Deviation (10mV),** (5.25V/ 10mV) 525 =020DH 2 Bytes Sequence	13 2	0D 02
167 168	A7 A8	**Maximum Current Draw (10mA),** (4.0A / 10mA) 400 = 0190H 2 Bytes Sequence	144 1	90 01

DS1050-3-003 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
52	34	**Product Name,** 15 Byte sequence	68	44
53	35	"**DS1050-3-003** "	83	53
54	36		49	31
55	37		48	30
56	38		53	35
57	39		48	30
58	3A		45	2D
59	3B		51	33
60	3C		45	2D
61	3D		48	30
62	3E		48	30
63	3F		51	33
64	40		32	20
65	41		32	20
66	42		32	20
68	44	**Part / Model Number**	68	44
69	45	"DS1050-3-003 "	83	53
70	46		49	31
71	47		48	30
72	48		53	35
73	49		48	30
74	4A		45	2D
75	4B		51	33
76	4C		45	2D
77	4D		48	30
78	4E		48	30
79	4F		51	33
80	50		32	20
81	51		32	20
82	52		32	20
87	57	**Model ID**	73	49
88	58	Ds1050-3-003=I737	55	37
89	59		51	33
90	5A		55	37
104	68	**Power Supply Record Header**		
105	69	Record type = 00 for Power supply	0	00
106	6A	End of List /Record Format Version Number	2	02
107	6B	Record Length of Power Supply Record	24	18
108	6C	Record CHECKSUM of Power Supply Record	171	AB
		Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM)	59	3B
129	81	**Combined Wattage,**	32	20
130	82	Byte 1 00100000B =20H=32d	26	1A
131	83	Byte 2 and Byte 3: 1050W =041AH	4	04
		3 Bytes Sequence		
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 5VSB Output Record	2	02
153	99	Record Length of 5VSB Output Record	13	0D
154	9A	Record CHECKSUM of 5VSB Output Record (Zero CHECKSUM)	169	A9
155	9B	(256-(sum of bytes 156 to 168)		
		Header CHECKSUM of 5VSB Output Record Header (Zero CHECKSUM)	71	47
		(256-(sum of bytes 151 to 154)		

DS1050-3-003 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		VSB OUTPUT RECORD		
157 158	9D 9E	**Nominal Voltage (10mV),** (3.3V / 10mV) 500 = 01F4H 2 Bytes Sequence	244 1	F4 01
159 160	9F A0	**Maximum Negative Voltage Deviation (10mV),** (4.75V/10mV) 475= 01DBH 2 Bytes Sequence	219 1	DB 01
161 162	A1 A2	**Maximum Positive Voltage Deviation (10mV),** (5.25V/ 10mV) 525 =020DH 2 Bytes Sequence	13 2	0D 02
167 168	A7 A8	**Maximum Current Draw (10mA),** (4.0A / 10mA) 400 = 0190H 2 Bytes Sequence	144 1	90 01

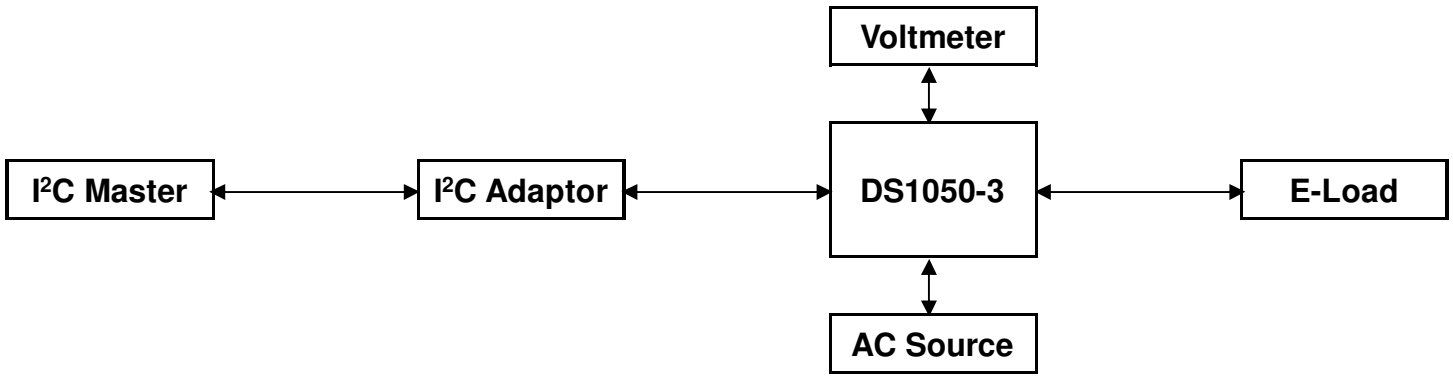
PMBus™ Interface Support

The DS1050-3 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

DS1050-3 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 commands

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.

DS1050-3 Series Support PMBus™ Command List

The DS1050-3 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the i²C interface port.

DS1050-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
00h	PAGE	00	R/W	1	HEX	
01h	OPERATION	80	R/W	1	bitmapped	Used to turn the unit ON/OFF in conjunction with the input PS_ON pin.
	b7:6	10b				00 – Immediate Turn OFF (No Sequencing)
02h	ON_OFF_CONFIG	1C	R	1	bitmapped	Configures the combination of PS_ON pin and serial communication commands needed to turn the unit ON/OFF.
	b7:5	000				Reserved
	b4 – Enable PS_ON pin and Serial communication control.	1				0 – Unit powers up any time power is present regardless of the state of PS_ON pin. 1 – Unit powers up as dictated by PS_ON 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 PS_ON pin to be asserted for the unit to start and energize the output.
	b2 – Sets how the unit responds to PS_ON pin	1				0 – Unit ignores PS_ON pin. (ON/OFF controlled by OPERATION command). 1 – Unit requires PS_ON pin to be asserted to start the unit.
	b1 – PS_ON pin polarity	0				0 – Active Low (Pull Low to start the unit). 1 – Active high (Pull high to start the unit).
	b0 – PS_ONL 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	80	R/W	1	bitmapped	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.
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	-	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	1				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

DS1050-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
1A	QUERY		BW-BRPC	1/1	bitmapped	
20h	VOUT_MODE	17	R	1		Specifies the mode and parameters of Output Voltage related Data Formats
21h	VOUT_COMMAND	17C7	R/W	2	Linear	Sets 11.88v Output Voltage Reference
24h	VOUT_MAX	1933	R	2	Linear	Sets the max output voltage limit. 12.6V.
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	00	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. (13.5V)
41h	VOUT_OV_FAULT_RESPONSE	80	R	1		Unit Latches OFF. Resets on PSON or CONTROL pin recycle or AC recycle.
42h	VOUT_OV_WARN_LIMIT	1999	R/W	2	Linear	Sets Over-voltage Warning threshold. (12.8V)
43h	VOUT_UV_WARN_LIMIT	1666	R/W	2	Linear	Sets Under-voltage Warning threshold. (11.2V)
44h	VOUT_UV_FAULT_LIMIT	1599	R/W	2	Linear	Sets Under-voltage Fault threshold. (10.8V)
45h	VOUT_UV_FAULT_RESPONSE	80	R	1	Linear	Turn PSU OFF
46h	IOUT_OC_FAULT_LIMIT	EB60	R	2	Linear	Sets the Over current threshold in Amps. (108A)
47h	IOUT_OC_FAULT_RESPONSE	EC0	R	1	Linear	OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT	EAD0	R	2	Linear	Sets the Over Current Warning threshold in Amps. (90A)
4Fh	OT_FAULT_LIMIT	EBC0	R	2	Linear	Secondary ambient temperature Fault threshold, in degree C. (120degC)
50h	OT_FAULT_RESPONSE	12F8	R	1	Linear	Turn PSU OFF and will retry indefinitely
51h	OT_WARN_LIMIT	EB98	R	2	Linear	Secondary ambient temperature warning threshold, in degree C. Operating limit. refer to section 3.1. (115 degC)

DS1050-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
5Eh	POWER_GOOD_ON	1766	R	2	Linear	Sets the threshold by which the Power Good signal is asserted. (11.76V)
5Fh	POWER_GOOD_OFF	16CC	R	2	Linear	Sets the threshold by which the Power Good signal is de-asserted. (11.4V)
60h	TON_DELAY	828F	R	2	Linear	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (2sec)
61h	TON_RISE	8BD7	R	2	Linear	Sets the time (ms), for the output rises from 0 to regulation. (50ms)
64h	TOFF_DELAY	8A8F	R	2	Linear	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF).(23ms)
78h	STATUS_BYTE	-	R	1	bitmapped	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.
79h	STATUS_WORD	-	R	2	bitmapped	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.

DS1050-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Ah	STATUS_VOUT	-	R	1	bitmapped	Output voltage related faults and warnings
	b7					VOUT OV Fault
	b6					VOUT OV Warning
	b5					VOUT UV Warning
	b4					VOUT UV Fault
	b3					VOUT_MAX Warning
	b2					TON MAX Warning
	b1					TOFF MAX Warning
	b0					Power On Tracking Error
7Bh	STATUS_IOUT	-	R	1	bitmapped	Output Current related faults and warnings
	b7					IOUT OC Fault
	b6					OC Fault/LV Shutdown
	b5					IOUT OC Warning
	b4					IOUT UC Fault
	b3					Current Share Fault
	b2					In Power Limiting Mode
	b1					POUT OP Fault
	b0					POUT OP warning
7Ch	STATUS_INPUT	-	R	1	bitmapped	Input related faults and warnings
	b7					VIN OV Fault
	b6					VIN OV Warning
	b5					VIN UV Warning
	b4					VIN UV Fault
	b3					Unit Off For Low Input Voltage
	b2					VIN OC Fault
	b1					VIN OC Warning
	b0					PIN OP Warning
7Dh	STATUS_TEMPERATURE	-	R	1	bitmapped	Temperature related faults and warnings
	b7					OT Fault
	b6					OT Warning
	b5					UT Warning
	b4					UT Fault
	b3					Reserved
	b2					Reserved
	b1					Reserved
	b0					Reserved

DS1050-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Eh	STATUS_CML	-	R	1	bitmapped	Communications, Logic and Memory
	b7					Invalid/Unsupported Command
	b6					Invalid/Unsupported Date
	b5					Packed Error Check Failed
	b4					Memory Fault Detected
	b3					Processor Fault Detected
	b2					Reversed
	b1					Other Communication Fault
	b0					Other Memory or Logic Fault
80h	STATUS_MFR_SPECIFIC	-	R	1	bitmapped	Manufacturer Status codes
	b7					Manufacturer Defined
	b6					Manufacturer Defined
	b5					Manufacturer Defined
	b4					Manufacturer Defined
	b3					Manufacturer Defined
	b2					Manufacturer Defined
	b1					Manufacturer Defined
	b0					Manufacturer Defined
81h	STATUS_FANS_1_2	-	R	1	bitmapped	
	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					Air Flow Fault
	b0					Air Flow Warning
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	PSU Air inlet temp (inside PSU)
8Eh	READ_TEMPERATURE_2	-	R	2	Linear	
8Fh	READ_TEMPERATURE_3	-	R	2	Linear	
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	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 Revision0000 – Revision 1.00001 – Revision 1.1

DS1050-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
99h	MFR_ID	45,4D,45,7	BR, ASCII	4	ASCII	Abbrev or symbol of manufacturers name. “EME”
9Ah	MFR_MODEL	2D,30,35,30,31,53,44,C	BR, ASCII	8	ASCII	Manufacturers Model number, ASCII format “DS1050-3”
9Bh	MFR_REVISION	31,30,2	BR, ASCII	3	ASCII	Manufacturers, revision number, ASCII format 10
9Ch	MFR_LOCATION	69,68,50,B	BR, ASCII	4	ASCII	Manufacturers facility, ASCII format
A0h	MFR_VIN_MIN	EAD0	R	2	Linear	Minimum Input Voltage (90Vac)
A1h	MFR_VIN_MAX	FA10	R	2	Linear	Maximum Input Voltage (264Vac)
A2h	MFR_IIN_MAX	D3A0	R	2	Linear	Maximum Input Current (14.5A)
A3	MFR_PIN_MAX	0AA3			Linear	Maximum Input Power (1350W)
A4h	MFR_VOUT_MIN	16CC	R	2	Linear	Minimum Output Voltage Regulation Window. (11.4V)
A5h	MFR_VOUT_MAX	1933	R	2	Linear	Maximum Output Voltage. Regulation Window (12.6V)
A6h	MFR_IOUT_MAX	EA98	R	2	Linear	Maximum Output Current (83A)
A7h	MFR_POUT_MAX	03E8	R	2	Linear	Maximum Output Power (1000W)
A8h	MFR_TAMBIENT_MAX	EA30	R	2	Linear	Maximum Operating Ambient Temperature (Secondary Ambient) (50 degC)
A9h	MFR_TAMBIENT_MIN	00			Linear	
AA	MFR_EFFICIENCY_LL		Block	14	Linear	
AB	MFR_EFFICIENCY_HL		Block	14	Linear	

Redundancy / Fault Tolerance

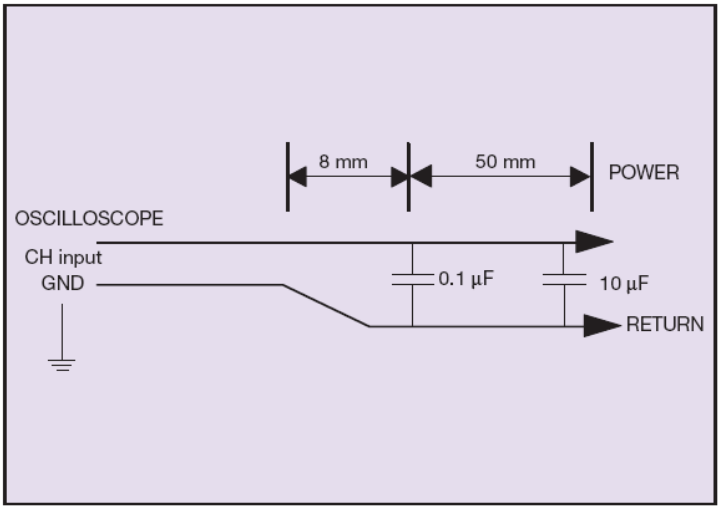
The DS1050-3 series power supplies will allow up to 4 power supplies to be connected in an N+1 redundant load.

Any failure of one power supply in parallel as well as hot swapping shall not cause more than a 5% change in any output. Current share accuracy is typically 5% of full load. 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 DS1050-3 power supply is designed to prevent the latch from depressed if the AC cord is attached to the power supply. In order to remove the power supply from system chassis, the AC cord must be removed first so the power supply will always be in the powered off state during the removal from system chassis.

Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the DS1050-3 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 will be used. Oscilloscope will be set to 20 MHz bandwidth for this measurement.



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Record of Revision and Changes

Issue	Date	Description	Originators
1.0	11.27.2012	First Issue	B. Wang
1.1	08.12.2015	Update I2C part, pull up resistor	B. Wang
1.2	07.21.2015	Delete the 9D,9E command list	K. Wang

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