

## DS450DC-3

### 450 Watts

#### Distributed Power System

**Total Power:** 450 Watts  
**Input Voltage:** 36-75 Vdc  
**# of Outputs:** Single Main

#### Special Features

- 1U X 2U form factor
- 8.4 W / in3 (DS450)
- +12 Vdc Output
- +3.3 Vdc Stand-By
- No Minimum Load Required
- Hot Plug Operation
- N + 1 Redundant
- Internal OR'ing Fets
- Active current sharing
- Built-in Cooling Fans (40 mm x 28 mm)
- I2C Communication Interface Bus
- EERPOM for FRU Data
- Amber LED Status, Fan\_Fail
- Green LED Status, Power Good /
- DC\_OK Status (VIN\_GOOD)
- Internal Fan Speed Control
- Fan Fail Tach Output Signal
- One Year Warranty

#### Safety

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



Connector input shown

## Product Descriptions

The DS450DC-3 power supply features a very wide 36 to 75 Vdc input voltage range, which is ideal for telecom and central office applications operating from 48 V battery plants. The module produce a main +12 Vdc output, together with an auxiliary 'always-on' +3.3 Vdc output for applications that require standby.

The modules is hot pluggable, and incorporate low-loss internal ORing FETs (Field Effect Transistors) on their main 12 V output, for fault-tolerant and N+1 redundancy applications. They have no minimum load requirement, and maintain main output regulation to within  $\pm 5\%$ .

The power module contains a serial EEPROM (electrically erasable programmable read-only memory) that is preprogrammed with data about the unit – including its type, serial number and date of manufacture – to facilitate replacement in the field. A built-in I2C interface, which uses the PMBus™ protocol, enables the data to be read back to the system under power; the interface also allows the system to interrogate the power module to ascertain various operational parameters, including input and output status, fan blocked or running under-speed, and overcurrent and overtemperature flags.

DS450DC-3 dc-input power modules is compact, high efficiency units with a 1U x 2U form factor. It incorporate fan cooling and has an ambient operating temperature range of -10 to +50 degrees Celsius. The module complies with all applicable EMC immunity standards, including EN61000-4-2, -3, -4, -5, -6 and -11. The power supplies carry UL/cUL60950-1 and EN60950-1 VDE safety approvals.

## Model Numbers

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| Standard      | Output Voltage | Minimum Load | Maximum Load | Stand-By Supply | Air Flow Direction                   |
|---------------|----------------|--------------|--------------|-----------------|--------------------------------------|
| DS450DC-3     | 12.0 Vdc       | 0A           | 37.0A        | 3.3V @ 3.0A     | Normal<br>(DC Connector to Handle)   |
| DS450DC-3-002 | 12.0 Vdc       | 0A           | 37.0A        | 3.3V @ 3.0A     | Reversed<br>(Handle to DC Connector) |
| DS450DC-3-401 | 12.0 Vdc       | 0A           | 37.0A        | 3.3V @ 3.0A     | Normal<br>(DC Connector to Handle)   |

## Options

None

## Electrical Specifications

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### 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:<br>AC continuous operation                                                   | All models                             | $V_{IN,AC}$ | 36          | -           | 75                  | Vdc               |
| Maximum Output Power (Main + Stand-by)<br>$V_{IAC} \leq 48Vac$<br>$V_{IAC} > 48Vac$         | All models                             | $P_{O,max}$ | -<br>-      | -<br>-      | 450<br>450          | W<br>W            |
| Isolation Voltage<br>Input to outputs<br>Input to safety ground<br>Outputs to safety ground | All models<br>All models<br>All models |             | -<br>-<br>- | -<br>-<br>- | 2200<br>2200<br>N/A | Vdc<br>Vdc<br>Vdc |
| Ambient Operating Temperature                                                               | All models                             | $T_A$       | -10         | -           | +50                 | °C                |
| Storage Temperature                                                                         | All models                             | $T_{STG}$   | -40         | -           | +70                 | °C                |
| Humidity (non-condensing)<br>Operating<br>Non-operating                                     | All models<br>All models               |             | 20<br>-     | -<br>-      | 90<br>95            | %<br>%            |
| Altitude<br>Operating<br>Non-operating                                                      | All models<br>All models               |             | -<br>-      | -<br>-      | 10,000<br>35,000    | feet<br>feet      |

## Input Specifications

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Table 2. Input Specifications:

| Parameter                                                                | Conditions                                                        | Symbol           | Min      | Typ    | Max        | Unit               |
|--------------------------------------------------------------------------|-------------------------------------------------------------------|------------------|----------|--------|------------|--------------------|
| Operating Input Voltage, DC                                              |                                                                   | $V_{IDC}$        | 36       | 48     | 75         | Vdc <sub>RMS</sub> |
| Maximum Input Current<br>( $I_O = I_{O,max}$ , $I_{VSB} = I_{VSB,Max}$ ) | $V_{IDC} = 40V_{DC}$                                              | $I_{I,max}$      | -<br>-   | -<br>- | 16         | A <sub>RMS</sub>   |
| Standby Input Current<br>( $V_O$ Off, $I_{VSB} = 0A$ )                   | $V_{IDC} = 36V_{DC}$<br>$V_{IDC} = 75V_{DC}$                      | $I_{I,standby}$  | -<br>-   | -<br>- | 600<br>300 | mA <sub>RMS</sub>  |
| No Load Input Current<br>( $V_O$ On, $I_O = 0A$ , $I_{VSB} = 0A$ )       | $V_{IDC} = 36V_{DC}$<br>$V_{IDC} = 75V_{DC}$                      | $I_{I,no\_load}$ | -<br>-   | -<br>- | 400<br>200 | mA <sub>RMS</sub>  |
| Standby Input Power<br>( $V_O$ Off, $I_{VSB} = 0A$ )                     | All Modules                                                       | $W_{W,standby}$  | -        | -      | 20         | W                  |
| Startup Surge Current (Inrush)<br>@ 25°C                                 | $V_{IDC} = 75V_{DC}$                                              |                  | -        | -      | 21         | A <sub>PK</sub>    |
| Input Fuse                                                               | Internal, Blade,<br>19x20mm, 25A, 80V                             |                  | -        | -      | 25         | A                  |
| Isolation – Input to Output                                              |                                                                   |                  | -        | 2200   | -          | Vdc                |
| Isolation – Input to Chassis                                             |                                                                   |                  | -        | 2200   | -          | Vdc                |
| DCDC Switching Frequency                                                 | All Modules                                                       | $f_{SW,DC-DC}$   | 125      | -      | 145        | KHz                |
| Operating Efficiency @ 25°C                                              | $I_O = I_{O,max}$<br>$V_{IDC} = 36V_{DC}$<br>$V_{IDC} = 75V_{DC}$ | $\eta$           | 78       | -      | -          | %                  |
|                                                                          |                                                                   |                  | 84       | -      | -          | %                  |
| System Stability:<br>Phase Margin<br>Gain Margin                         |                                                                   |                  | 45<br>10 | -      | -          | Ø<br>dB            |

## Output Specifications

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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                   |
|                                     | DS450DC-3<br>DS450DC-3-002<br>DS450DC-3-401 |                                                                                                                     | $V_{VSB}$  | 3.13   | 3.30   | 3.47     |                     |
| Output Ripple, pk-pk                | All models                                  | Measure with a 0.1 $\mu$ F ceramic capacitor in parallel with a 10 $\mu$ F tantalum capacitor, 0 to 20MHz bandwidth | $V_O$      | -      | -      | 120      | mV <sub>PK-PK</sub> |
|                                     | DS450DC-3<br>DS450DC-3-002<br>DS450DC-3-401 |                                                                                                                     | $V_{VSB}$  | -      | -      | 60       |                     |
| Output Current                      | All models                                  | all                                                                                                                 | $I_O$      | 0      | -      | 37.0     | A                   |
|                                     | DS450DC-3<br>DS450DC-3-002<br>DS450DC-3-401 |                                                                                                                     | $I_{VSB}$  | 0      | -      | 3.0      |                     |
| $V_O$ Current Share Accuracy        |                                             | 50% to 100% $I_O$<br>10% to 20% $I_O$                                                                               |            | -<br>- | -<br>- | 10<br>20 | % $I_O$             |
| $V_O$ Minimum Current Share Loading |                                             |                                                                                                                     |            | 10     | -      | -        | % $I_{O,max}$       |
| $V_O$ Load Capacitance              |                                             | Start up                                                                                                            | -          | 0      | -      | 100      | $\mu$ F/A           |
| $V_O$ Dynamic Response              | Peak Deviation                              | 25% load change, slew rate = 1A/ $\mu$ s                                                                            | $\pm\%V_O$ | -      | -      | 3        | %                   |
|                                     | Settling Time                               |                                                                                                                     | $T_s$      | -      | -      | 5        | mSec                |

## System Timing Specifications

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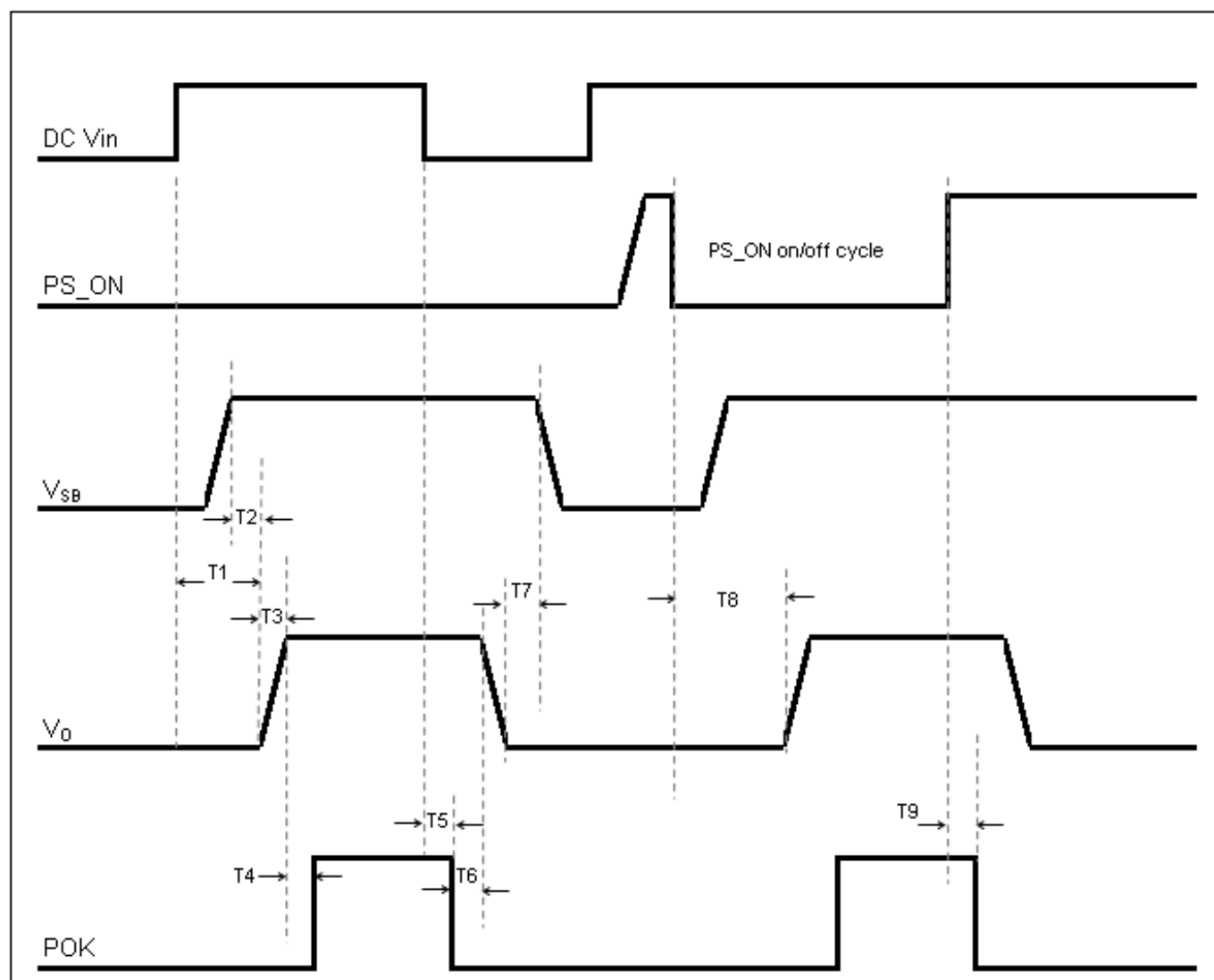
Table 4. System Timing Specifications:

| Label | Parameter                                                                                             | Min | Typ | Max  | Unit |
|-------|-------------------------------------------------------------------------------------------------------|-----|-----|------|------|
| T1    | Delay from DC being applied to $V_O$ being within regulation lower limit.                             | -   | -   | 3000 | mSec |
| T2    | Delay from $V_{SB}$ being within regulation upper limit to $V_O$ being within lower regulation limit. | 5   | -   | -    | mSec |
| T3    | $V_O$ rise time, 0V to $V_O$ in regulation.                                                           | 3   | -   | 300  | mSec |
| T4    | Delay from $V_O$ output voltages within regulation limits to POK asserted high.                       | 100 | -   | 500  | mSec |
| T5    | Delay from loss of DC to de-assertion of POK.                                                         | 1   | -   | -    | mSec |
| T6    | Delay from de-assertion of POK to output voltages within upper regulation limits .                    | 0.1 | -   | 10   | mSec |
| T7    | Delay from $V_O$ out of regulation to $V_{SB}$ output voltages within regulation limits .             | 5   | -   | -    | mSec |
| T8    | Delay from PS_ON active to $V_O$ output voltages within lower regulation limits.                      | -   | -   | 300  | mSec |
| T9    | Delay from PS_ON deactive to POK de-asserted low.                                                     | -   | -   | 50   | mSec |

## System Timing Specifications

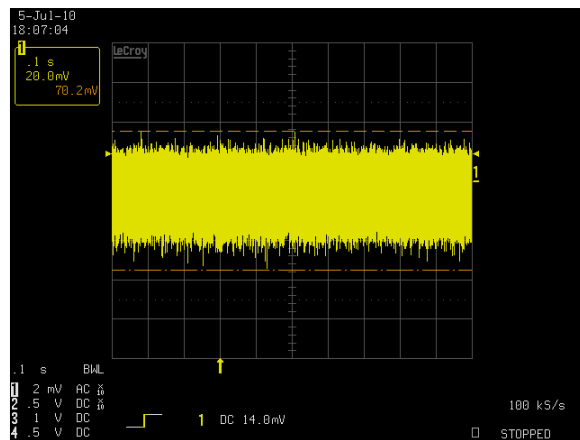
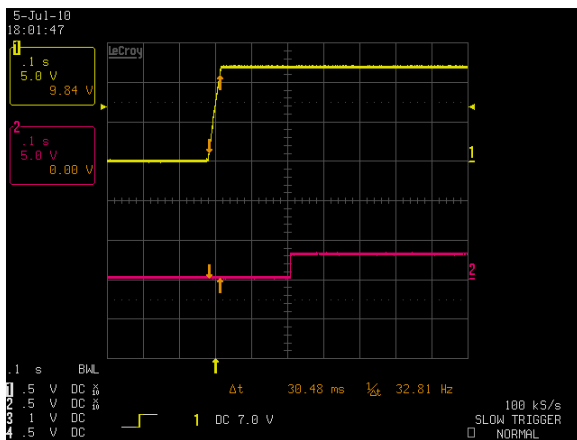
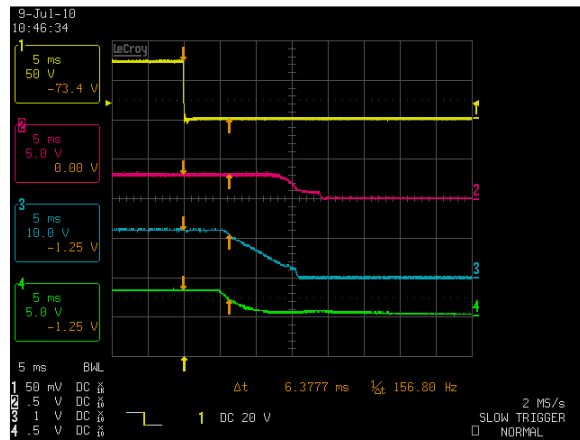
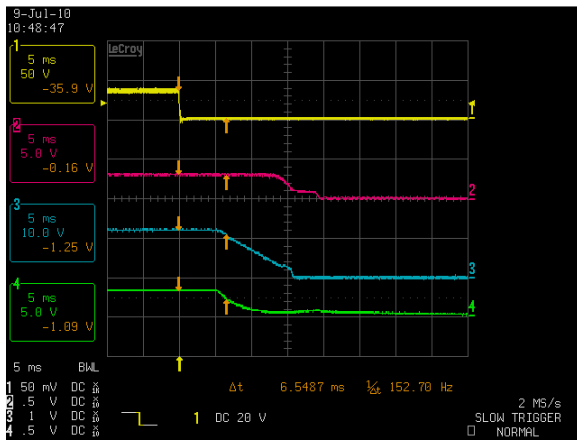
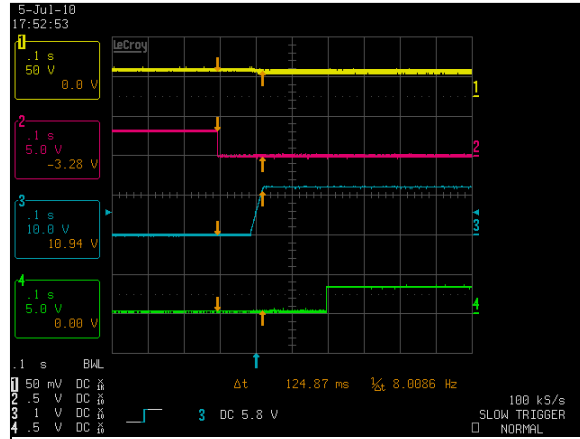
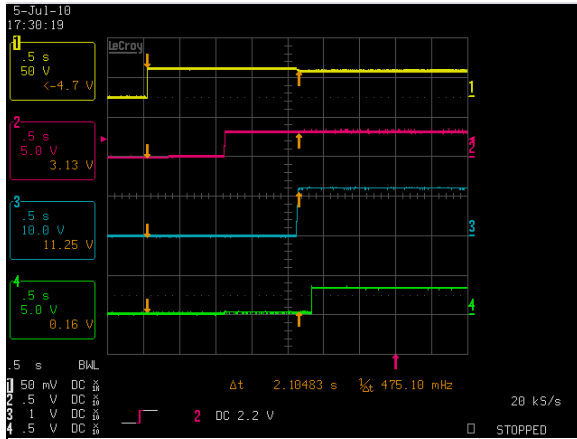
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Figure 1. System Timing Diagram:



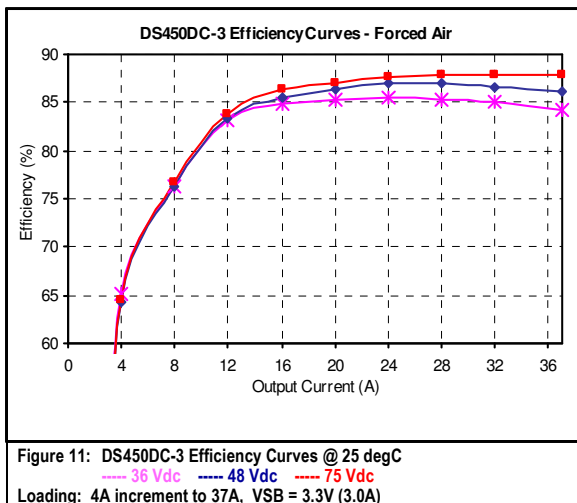
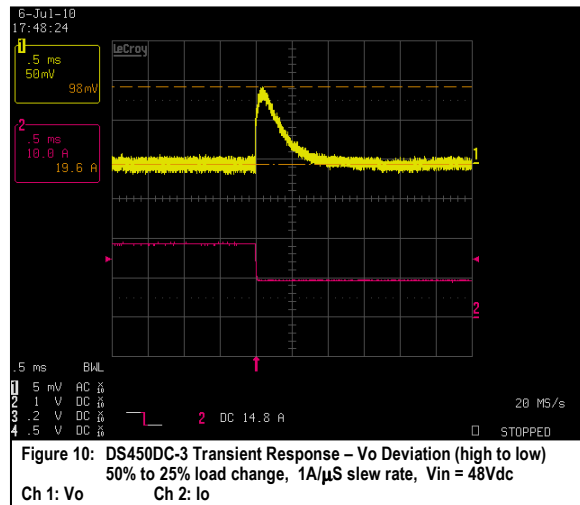
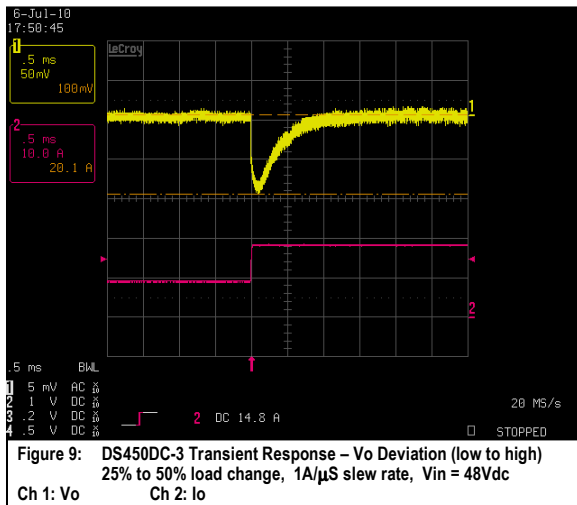
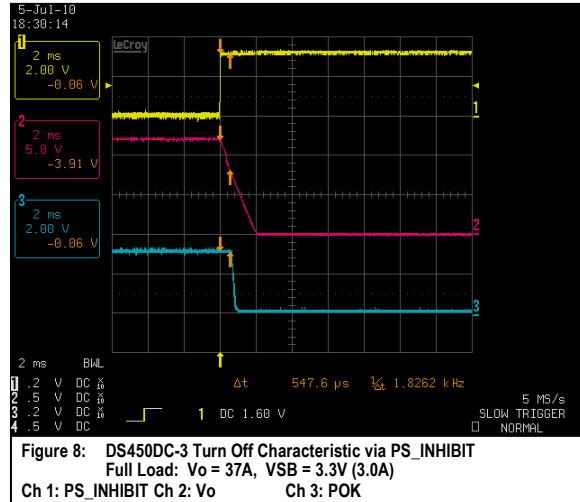
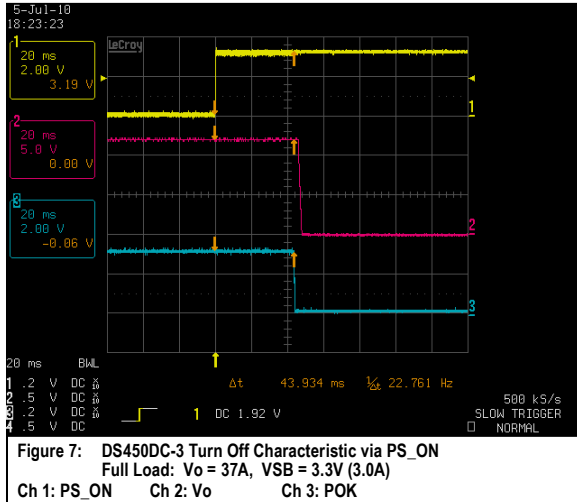
## DS450DC-3 Performance Curves

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## DS450DC-3 Performance Curves

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## **Protection Function Specification**

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### **Input Fusing**

DS450DC-3 series is equipped with an internal primary fuse shall be provided to protect against catastrophic failures. The FKS-80 is an ATO style blade fuse rated at 80V/ 25A for fault protection in series input lines.

### **Over Voltage / Under Voltage Protection (OVP / UVP)**

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

#### **OVP**

| Parameter                              | Min  | Nom | Max  | Unit |
|----------------------------------------|------|-----|------|------|
| V <sub>O</sub> Output Overvoltage      | 13.5 | /   | 15.0 | V    |
| 3.3 V <sub>SB</sub> Output Overvoltage | 3.76 | /   | 4.3  | V    |

#### **UVP**

| Parameter                               | Min  | Nom | Max  | Unit |
|-----------------------------------------|------|-----|------|------|
| V <sub>O</sub> Main Output Undervoltage | 10.5 | /   | 11.0 | V    |
| 3.3 V <sub>SB</sub> Output Undervoltage | 2.77 | /   | 3.0  | V    |

### **Over Current Protection (OCP)**

DS450DC-3 series includes internal current limit circuitry to prevent damage in the event of overload or short circuit. If the overload is > 105% of rated load, the power supply will latch off immediately. Over-current protection shall be activated within 20mS on ALL OUTPUTS. Fault latches can be cleared and restarted by recycling DC power or toggling PS\_ON. When the +3.3VSB is up to 3.2A to 6A, the output may go into "Auto recovery mode."

#### **OCP**

| Parameter                              | Input Voltage | Min  | Nom | Max  | Unit |
|----------------------------------------|---------------|------|-----|------|------|
| V <sub>O</sub> Main Output Overcurrent | 36Vdc         | 39.5 | /   | 44.4 | A    |
|                                        | 75Vdc         | 38.5 | /   | 48.4 | A    |
| 3.3 V <sub>SB</sub> Output Overcurrent | 36Vdc         | 3.2  | /   | 7    | A    |
|                                        | 75Vdc         | 3.2  | /   | 7    | A    |

## **Short Circuit Protection (SCP)**

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A short circuit, which is defined as an impedance of 0.1 ohms or less, applied to any output during start-up or while running will not cause any damage to the power supply such as connectors, components, PCB traces, etc.

When the +3.3VSB is shorted the output may go into "hiccup mode." When the +3.3Vsb attempts to restart the maximum peak current from the output must be less than 10.0A Peak. The maximum average current, taking into account the "hiccup" duty cycle, must be less than 4.9A.

**NOTE: Short circuit current from the output caps cannot be controlled.**

## **Over Temperature Protection (OTP)**

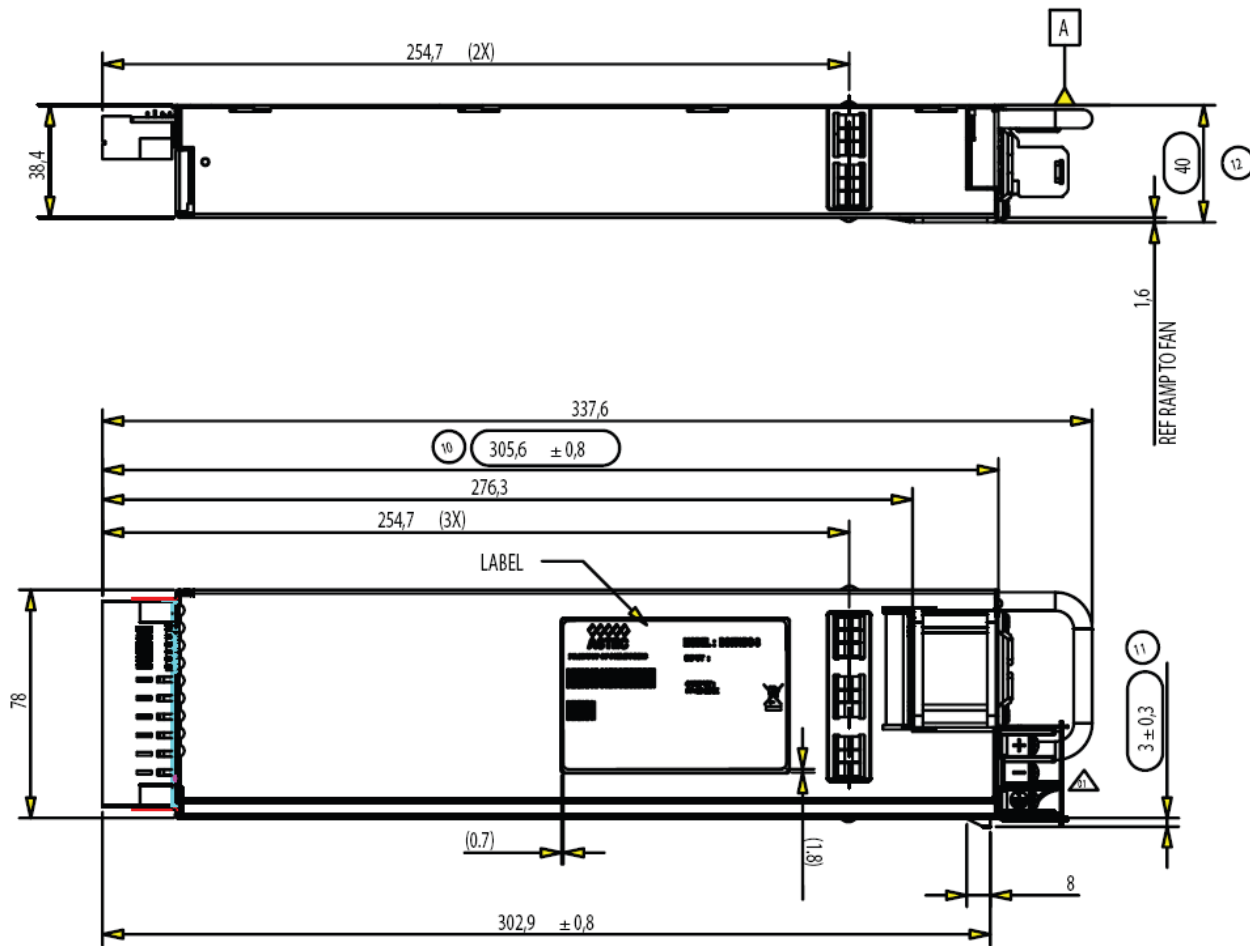
The power supply shall incorporate thermal protection to prevent damage or degradation due to overheating.

The power supply shall be internally protected against over temperature conditions. When the OT circuit is activated, the power supply shall shut-off. OTP is auto-recovery. This unit shall incorporate both fan speed control, and fan fail.

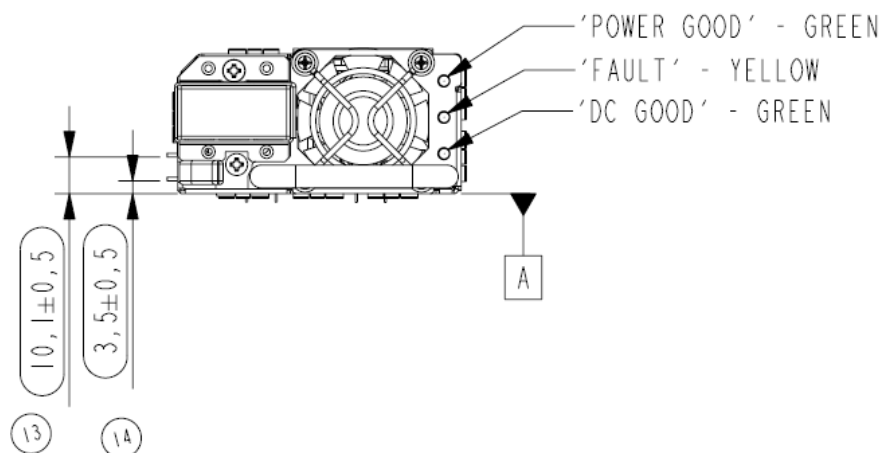
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### Mechanical Outlines(DS450DC-3)

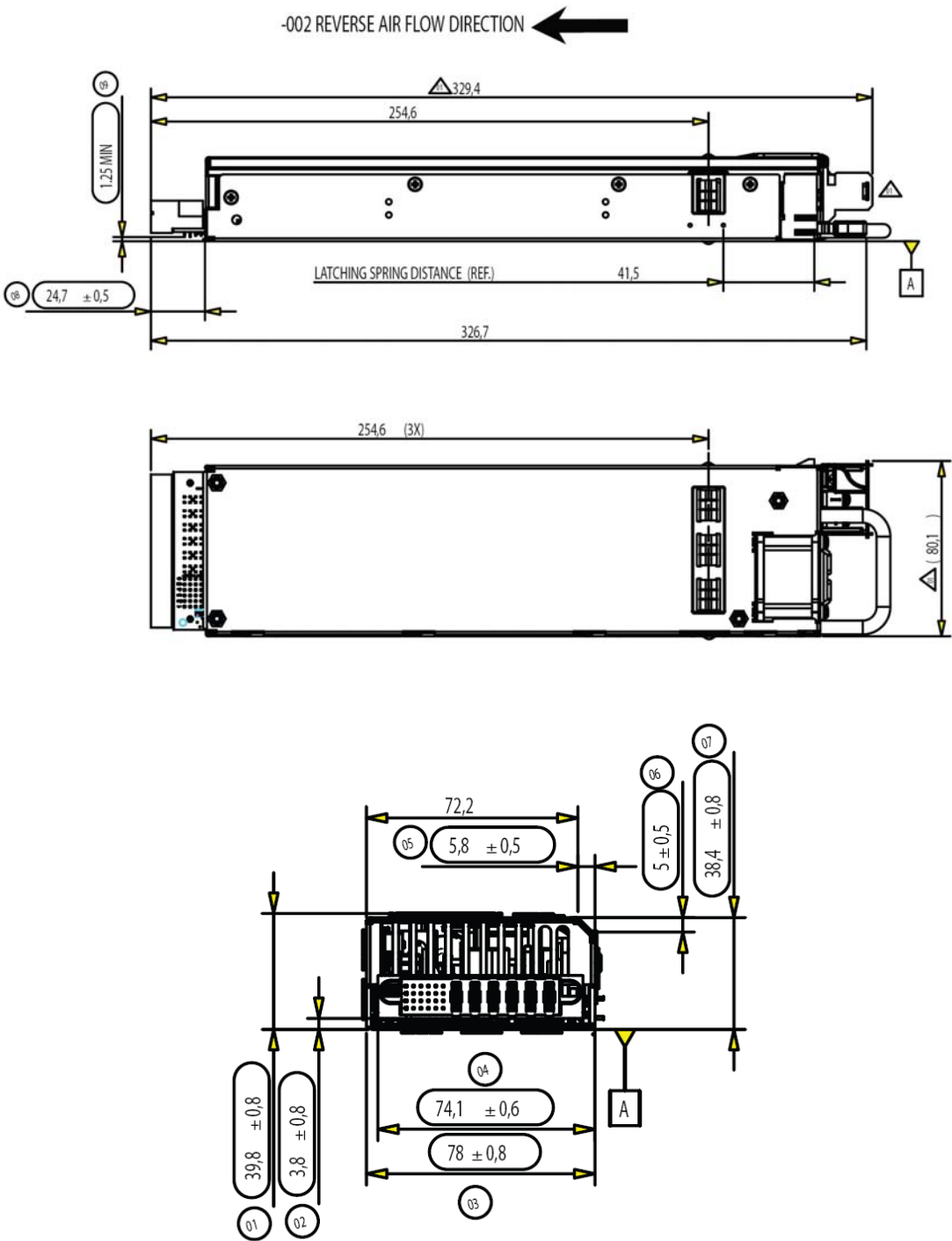


STANDARD AIR FLOW DIRECTION →



# Mechanical Specifications

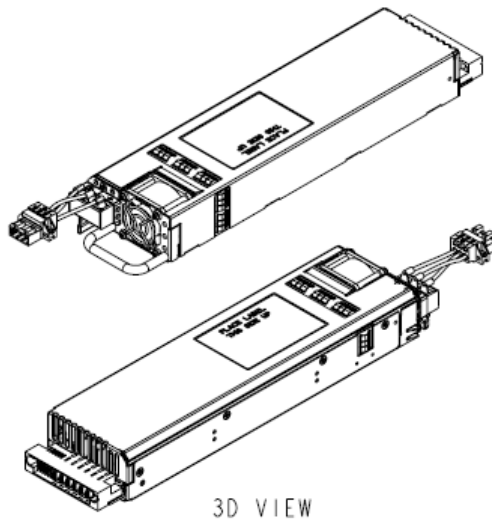
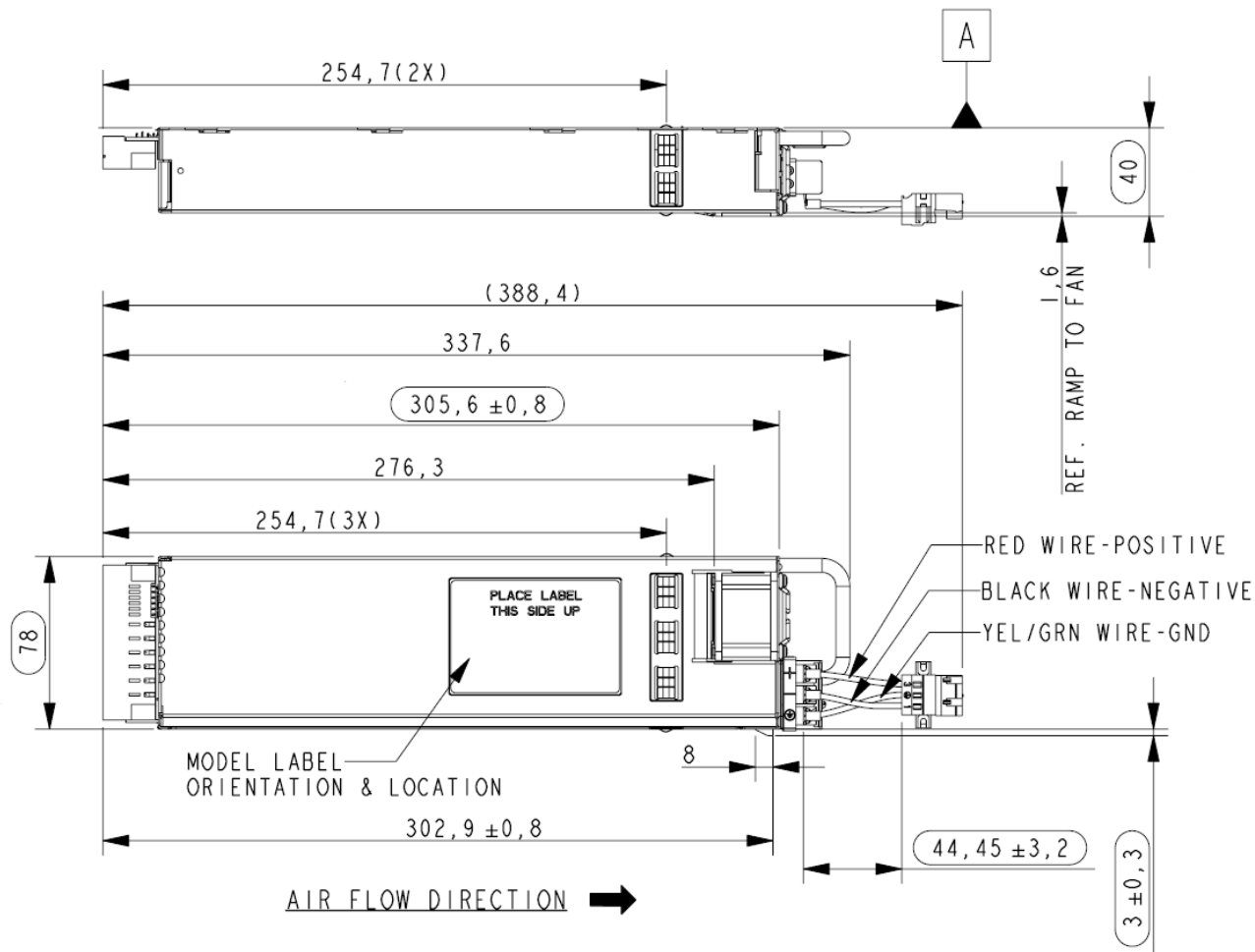
## Mechanical Outlines(DS450DC-3-002)



## Mechanical Specifications

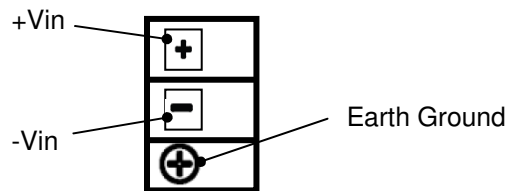
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### Mechanical Outlines(DS450DC-3-401)

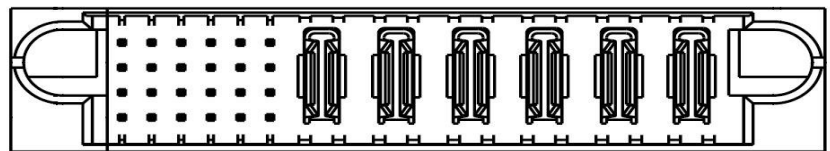


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|       |   |              |
|-------|---|--------------|
| Pin 1 | - | +Vin         |
| Pin 2 | - | -Vin         |
| Pin 3 | - | Earth Ground |



|     |   |                         |
|-----|---|-------------------------|
| 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

|    |   |                                 |
|----|---|---------------------------------|
| A1 | – | PS_KILL                         |
| A2 | – | +12V_Current Share              |
| A3 | – | Return                          |
| A4 | – | Write Protect                   |
| A5 | – | PS A0(I2C Address BIT 0 Signal) |
| A6 | – | +3.3V SB                        |
| B1 | – | Return                          |
| B2 | – | +12V RTN Sense                  |
| B3 | – | Return                          |
| B4 | – | +3.3V SB                        |
| B5 | – | SDA(I2C Data Signal)            |
| B6 | – | -PS_ON/L                        |
| C1 | – | Return                          |
| C2 | – | Tach_1                          |
| C3 | – | Return                          |
| C4 | – | +3.3V SB                        |
| C5 | – | SCL(I2C Clock Signal)           |
| C6 | – | VIN_GOOD/H                      |
| D1 | – | -Present/L                      |
| D2 | – | +12V_Sense                      |
| D3 | – | Return                          |
| D4 | – | +3.3V SB                        |
| D5 | – | Alert/L(S_INT)                  |
| D6 | – | POK/H(PWROK/H)                  |

|    |    |    |    |    |    |     |     |     |     |     |     |
|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| 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 |     |     |     |     |     |     |

## **Power / Signal Mating Connectors and Pin Types**

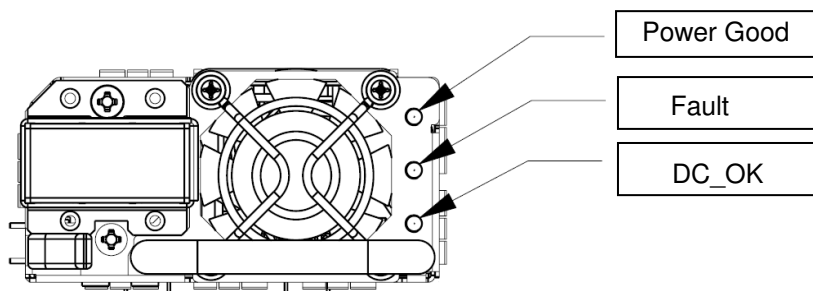
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Table 7. Mating Connectors for DS450DC-3 series

| Reference                         | On Power Supply                                                                                                                 | Mating Connector or Equivalent                          |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| DC Input Connector(DS450DC-3)     | DINKLE DT-4C-B02W-03<br>Center Spacing: 9.5 mm<br>Screw Size: Steel, M3.5, Nickel plated<br>Distance Between Barriers: (8.2 mm) | Wire Range: #12-22 AWG CU                               |
| DC Input Connector(DS450DC-3-401) | WAGO 721-603/019-042<br>No. of Pole: 3<br>Pin Spacing: 5.0 mm / 0.197 in                                                        | WAGO 721-103/026-000 or or 721-103/037-000              |
| Output Connector                  | FCI Power Blade<br>51721-10002406AA<br>or<br>Molex Power Connector<br>87667-7002                                                | FCI Power Blade<br>51741-10002406CC<br>Strait Pins      |
|                                   |                                                                                                                                 | FCI Power Blade<br>51761-10002406AA<br>Right Angle Pins |

## LED indicator Definition

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Three LED at the power supply front provides status signal. The status LED conditions is shown on the below table.

| Condition                                                 | LED Status                                |
|-----------------------------------------------------------|-------------------------------------------|
| $V_{SB} = \text{ON}$ , $V_O = \text{OFF}$ , AC Input = ON | DC_OK Solid Green                         |
| $V_{SB} = \text{ON}$ , $V_O = \text{ON}$                  | Power Good Solid Green, DC_OK Solid Green |
| $V_O = \text{OCP} / \text{UVP} / \text{OVP}$              | Solid Amber                               |
| FAN_FAULT / OTP / $V_{SB} = \text{OCP/UVP}$               | Solid Amber                               |



## **Weight**

The DS450DC-3 series weight is 2.6 lbs. maximum.

## Environmental Specifications

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### **EMC Immunity**

DS450DC-3 series power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications:

| Document                                                            | Description                                                                                                                                                                                                               |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC Docket No. 20780 Part 15<br>Subpart J Class A/ EN55022, Level A | Conducted and Radiated EMI Limits                                                                                                                                                                                         |
| 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 80 – 1000 MHz, 10V/m, AM 80% (1KHz), 900MHz, 10V/M, PM 100% (200Hz), Criteria A. |
| 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. |
| EN55024:1998                                                        | Information Technology Equipment-Immunity Characteristics, Limits and Method of Measurements                                                                                                                              |

## **Safety Certifications**

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The DS450DC-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 5. Safety Certifications for DS450DC-3 series power supply system

| Document                  | File #           | Description                                                                                                      |
|---------------------------|------------------|------------------------------------------------------------------------------------------------------------------|
| UL 60950 No.              | E186249          | US and Canada Requirements                                                                                       |
| CSA 22.2 No. 60950        |                  | Information Technology Equipment - Safety - Part 1: General Requirements (Bi-National standard, with UL 60950-1) |
| EN60950                   |                  | European Requirements                                                                                            |
| EN60950 Deviations        |                  | International Requirements                                                                                       |
| CB Certificate and Report | 46478            | (All CENELEC Countries)                                                                                          |
| CE Mark                   | P08208864        | LVD                                                                                                              |
| CHINA CCC Approval        | 2008010907302876 | China Requirements                                                                                               |

## EMI Emissions

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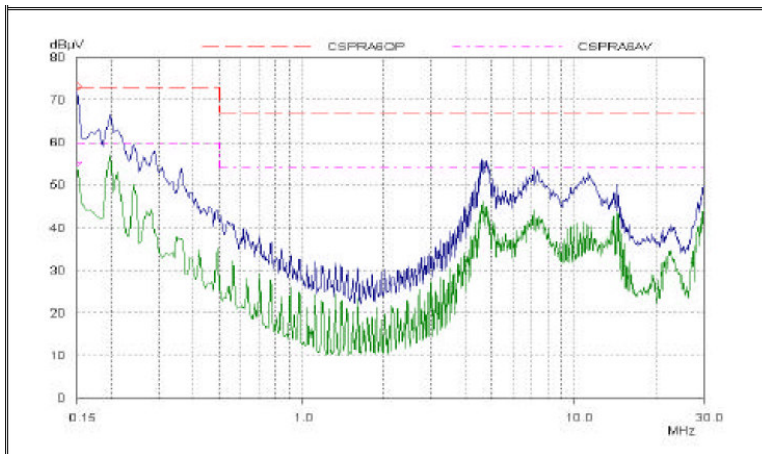
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The DS450DC-3 series has been designed to comply with the Class A limits of EMI requirements of EN55022 (FCC Part 15) and CISPR 22 (EN55022) for emissions and relevant sections of EN61000 (IEC 61000) for immunity. The unit is enclosed inside a metal box, tested at 4500W 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 DS450DC-3 power supplies have internal EMI filters ensure the converters' conducted EMI levels comply with EN55022 (FCC Part 15) Class A and EN55022 (CISPR 22) Class A limits. The EMI measurements are performed with resistive loads at maximum rated loading.

Sample of EN55022 Conducted EMI Measurement at 48Vdc input

Note: Red Line refers to Emerson Quasi Peak margin, which is 6dB below the CISPR international limit. Blue 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 DS450DC-3 series

| Parameter                  | Model | Symbol | Min | Typ | Max | Unit |
|----------------------------|-------|--------|-----|-----|-----|------|
| FCC Part 15, class A       | All   | Margin | -   | -   | 6   | dB   |
| CISPR 22 (EN55022) class A | All   | Margin | -   | -   | 6   | dB   |

## **Radiated Emissions**

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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 dc-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 dc-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.



## **Operating Temperature**

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The DS450DC-3 series power supplies will start and operate within stated specifications at an ambient temperature from - 10 ° C to 50 ° C under all load conditions with internal fan.

## **Forced Air Cooling**

The fan (s) will be included as part of the power supply assembly and provide forced air-cooling of desired CFM to maintain or control temperature of devices and ambient temperature in the power supply to appropriate levels. The standard direction of airflow shall be from the DC connector end to the DC end of the power supply. It can be reverse the airflow direction.

## **Storage and Shipping Temperature / Humidity**

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The DS450DC-3 series power supplies can be stored or shipped at temperatures between  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and relative humidity up to 95% non-condensing.

## **Altitude**

The DS450DC-3 series will operate within specifications at altitudes up to 10,000 feet above sea level. The power supply shall not be damaged when stored at altitudes of up to 35,000 feet above sea level.

## **Humidity**

The DS450DC-3 series will operate within specifications when subjected to a relative humidity from 20% to 90% non-condensing. The DS450DC-3 series can be stored in a relative humidity up to 95% non-condensing.

## **Vibration**

The DS450DC-3 power supply will pass the following vibration specifications:

### **Non-Operating Random Vibration**

|                 |                                         |                                                                                                                                             |
|-----------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Acceleration    | 2.5                                     | gRMS                                                                                                                                        |
| Frequency Range | 10-2000                                 | Hz                                                                                                                                          |
| Duration        | 20                                      | mins                                                                                                                                        |
| Direction       | 3 mutually perpendicular axis           |                                                                                                                                             |
| PSD Profile     | <b>FREQ</b><br>10-200 Hz<br>200-2000 Hz | <b>SLOPE</b><br><b>dB/oct</b><br>---<br>---<br><b>PSD</b><br><b>g<sup>2</sup>/Hz</b><br>0.01 g <sup>2</sup> /Hz<br>0.003 g <sup>2</sup> /Hz |

### **Operating Random Vibration**

|                 |                               |                                                                                                          |
|-----------------|-------------------------------|----------------------------------------------------------------------------------------------------------|
| Acceleration    | 1.0                           | gRMS                                                                                                     |
| Frequency Range | 10-2000                       | Hz                                                                                                       |
| Duration        | 20                            | mins                                                                                                     |
| Direction       | 3 mutually perpendicular axis |                                                                                                          |
| PSD Profile     | <b>FREQ</b><br>10-2000 Hz     | <b>SLOPE</b><br><b>dB/oct</b><br>---<br><b>PSD</b><br><b>g<sup>2</sup>/Hz</b><br>0.02 g <sup>2</sup> /Hz |

## **Shock**

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The DS450DC-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

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### **DC Input Connector**

This connector supplies the AC Mains to the DS450DC-3 power supply.

- Pin 1 - +Vin
- Pin 2 - -Vin
- Pin 3 - Earth Ground

### **Output Connector – Power Blades**

These pins provide the main output for the DS450DC-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 DS450DC-3 power supply. The Main Output ( $V_O$ ) is electrically isolated from the power supply chassis.

- PB1 - +12V Main Output Return
- PB2 - +12V Main Output Return
- PB3 - +12V Main Output Return
- PB4 - +12V Main Output ( $V_O$ )
- PB5 - +12V Main Output ( $V_O$ )
- PB6 - +12V Main Output ( $V_O$ )

### **Output Connector - Control Signals**

The DS450DC-3 series contains a 24 pins control signal header providing analogy control interface, standby power and i<sup>2</sup>C interface signal connections.

#### **PS\_KILL – (pin A1)**

The PS\_KILL input is separate from the PS\_ON input and is connected directly and only to the system cover interlocks. The DC 12V output will be disabled only when the input is driven higher than 2.4V, or open circuited. PS\_KILL will cause the PSU to latch off the main 12V-output rail. Recycling PS\_ON or recycling the DC supply can clear this latch. There shall be a pull up resistor (10K-Ref) located within the PSU to +3V3SBY or internal housekeeping supply. When hot plugging or hot unplugging the power supply, the PS\_KILL signal shall not cause the power supply to FAULT or LATCH-OFF.

#### **+12V\_Current Share – (pin A2)**

The DS450DC-3 supports active current sharing through a single wire force current share shall be employed on the +12v output. When one or more power supplies are connected and operating in parallel and each is delivering 50% or more of its rated output to the load, the power supplies shall current share within 10% accuracy, between 50% – 100% load. When supplying light loads between 10% and 20% of its rated load, the power supplies shall share within 20% accuracy. If any power supply is hot swapped, no glitch shall occur that violates the regulation limits of the power supply defined in this specification. Recommend the use of the ADM1041 IC.

Compute Current Share voltage using formula below:

I Share bus voltage = (output current \* 8.0V)/12V full load current.

#### **+3.3V SB, StandBy Output Return – (pins A3, A6, B1, B3, B4, C1, C3, C4, D3, D4)**

The DS450DC-3 provides a regulated 3.3 volt amp (or 5.0 volt 2 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 (VSB) voltage is available whenever a valid DC input voltage is applied to the unit. The StandBy Output is independently short circuit protected and is referenced to the StandBy Output Return pins (A3, B1, B3, C1, C3, D3).

## Write Protect - (pin A4)

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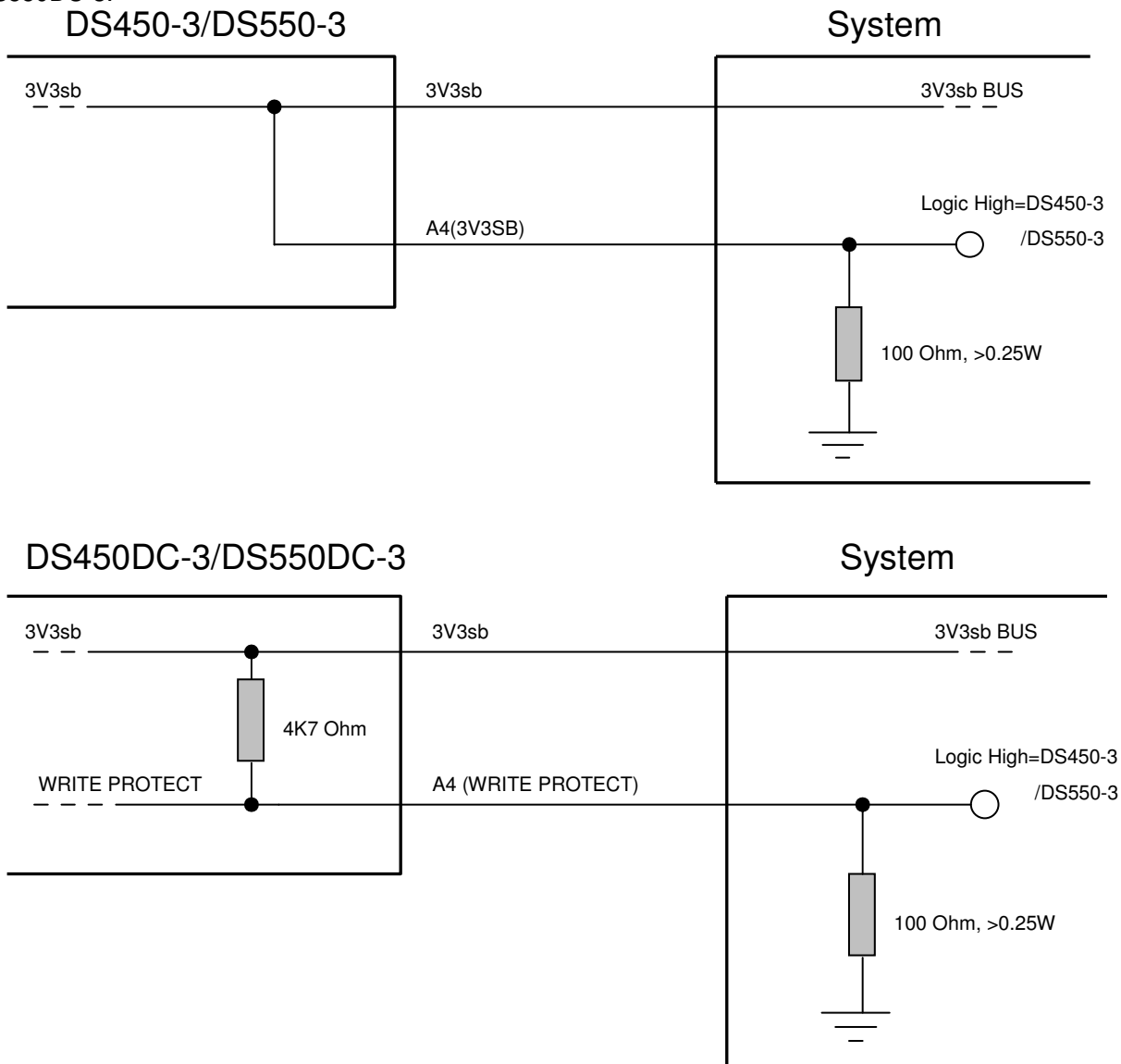
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The Write Protect pin allows or denies write access to the whole of the EEPROM memory array. Attempts to write to the EEPROM when the write protection is active will be acknowledged by the EEPROM but ignored.

To protect the EEPROM memory this pin is may be left open or pulled to +3V3SBY by the system and shall have an internal pull-up or 4K7ohms or higher to the shared +3V3SBY in the power supply.

To allow write to the EEPROM memory the signal has to be pulled low. As physically compatible power supplies exist that connect the same connector pin (A4) to 3V3SBY inside the power supply it is recommended that a 100 ohm 0.25W minimum resistor is used to pull the signal to 0V to allow for these parts to be fitted accidentally.

To accommodate both DS450-3/DS550-3 and DS450DC-3/DS550DC-3, system can be configured as below. In such case, A4 pin can be used to detect PSU type where "Logic High" indicate DS450-3/DS550-3 and "Logic Low" indicate DS450DC-3/DS550DC-3.



## **PS A0 – (pins A5)**

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Please refer to “Communication Bus Descriptions” section.

## **+12V RTN Sense, +12V\_Sense – (pins B2, D2)**

The main output of the DS450DC-3 is equipped with a Remote Sensing capability that will compensate for a power path drop around the entire loop of 0.2 volt. This feature is implemented by connecting the +12V\_Sense (pin D2) and the +12V RTN Sense (pin B2) to the positive and negative rails of the main output, respectively, at a location that is near to the load. The DS450DC-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 (VSB).

## **SDA, SCL and S\_INT – (pin B5, C5, D5)**

Please refer to “Communication Bus Descriptions” section.

## **-PS\_ON/L – (pin B6)**

This signal input pin controls the normal turning ON and Off of the Main Output of the DS450DC-3 power supply. The power supply 12V DC output will be enabled when this signal is pulled low, below 0.8V. In the low state the input will not source more than 1mA of current. The 12VDC output will be disabled when the input is driven higher than 2.4V, or open circuited.

PS\_ON is an active LOW signal controlled by the system (via I2C bus) and pulled up internal to PSU +3V3SBY rail or internal house keeping supply.

HIGH = Output V1 OFF (disabled)

LOW = Output V1 ON (enabled)

## **Tach\_1 – (pin C2)**

This signal is generated from the fan. The signal should generate 2 pulses per revolution. The logic in the system will be operating at 3.3V. The TACH output is open collector and will have an internal pull-up resistor to +3V3SBY or internal housekeeping supply. There must also be a provision for pull up resistor to be taken from either 3V3 / 5V at system side.

## **VIN\_GOOD/H – (pin C6)**

Active High signal asserted when the input voltage rises above the min input voltage specified. This signal is internally pulled up through 4.7 K ohms to the 3.3 V housekeeping voltage.

The hold up requirement shall be met at –36 VDC input. High = OK, Low = Supply out of range. The output will be an open collector/drain. It will be capable of driving the output below 0.4V with a load of 4mA.

## **-Present/L – (pin D1)**

This signal is used to detect the presence of a PSU by the system. The signal is pulled up within the system and connected direct to the PSU Logic GND.

HIGH = PSU not Present, LOW = PSU Present

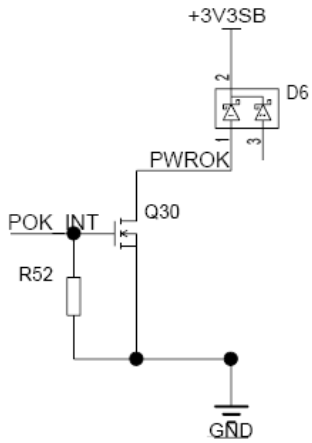
## POK/H(PWROK/H)– (pin D6)

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The POK 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 diode. It is capable of driving the output below 0.4V with a load of 4mA.



## **I<sup>2</sup>C Bus Signals**

The DS450DC-3 power supply contains monitor functions implemented via the I<sup>2</sup>C bus. The DS450DC-3 I<sup>2</sup>C functionality (EEPROM for 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 I<sup>2</sup>C bus will not work properly when a unit is inserted into the system without the AC source connected.

Note: I<sup>2</sup>C functionality can be accessed only when the PSU is powered-up.

Guaranteed communication I<sup>2</sup>C speed is 100KHz.

### **SDA, SCL (I<sup>2</sup>C Data and Clock Signals) – (pin B5, C5)**

I<sup>2</sup>C serial data and clock bus - these pins are internally pulled up to internal 3.3V supply with a 10K resistor. and located within the PSU, and de-coupled with 100pF and 100R maximum series resistor to the system.

### **S\_INT (Alarm) – (pin D5)**

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) - (1) recycle input DC power, (2) toggle PSON signal and (3) issuance of a CLEAR\_FAULTS PMBus™ command.

### **PS A0 (I<sup>2</sup>C Address BIT 0) – (pin A5)**

The input pins is the address lines A0 to indicate the slot position the power supply occupies in the power bay and define the power supply addresses for FRU data communication. This allows the system to assign different addresses for each power supply. During I<sup>2</sup>C 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 4.7K resistor.

### **I<sup>2</sup>C Bus Communication Interval**

The interval between two consecutive I<sup>2</sup>C communications to the power supply should be at least 50ms to ensure proper monitoring functionality.

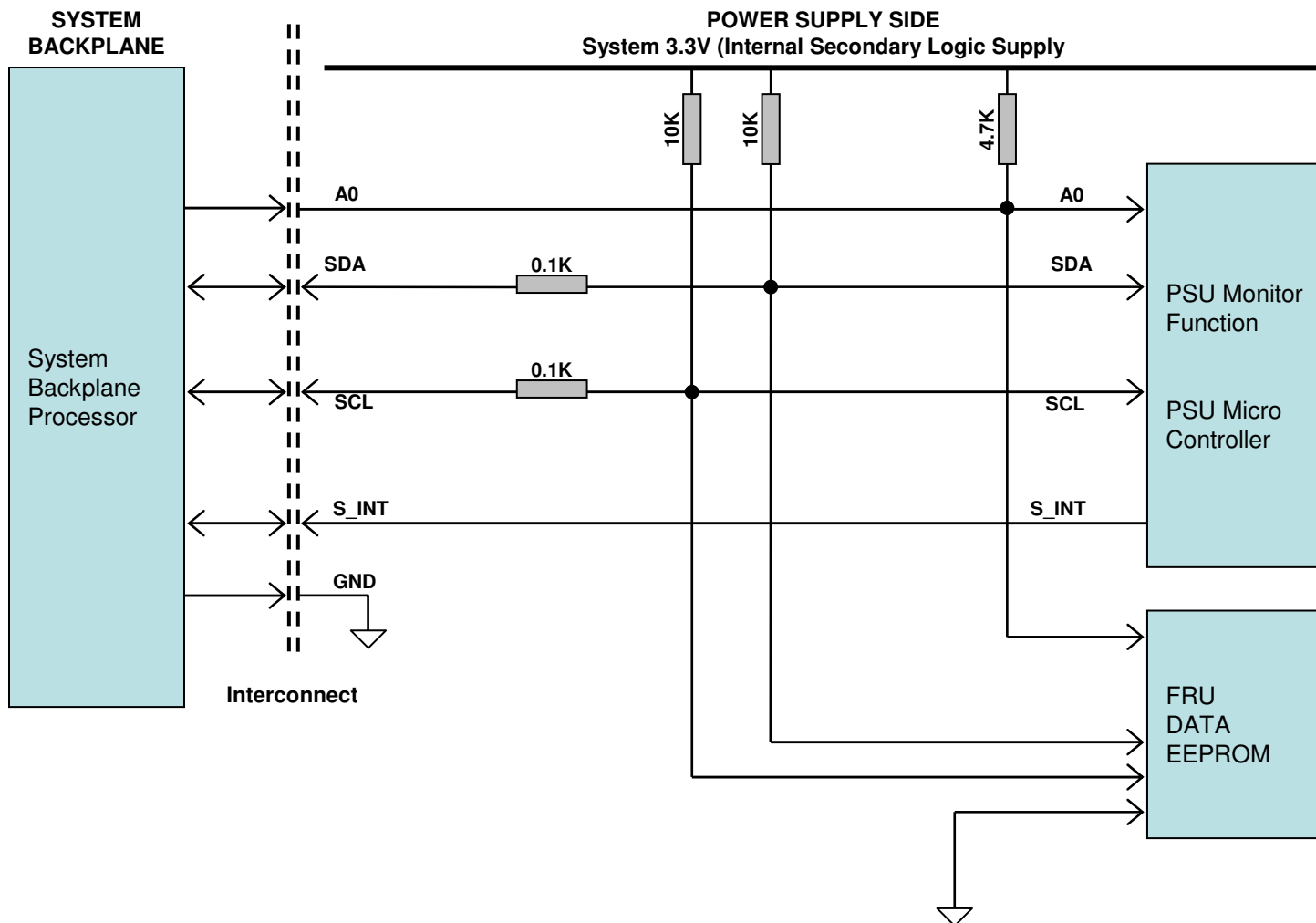
### **I<sup>2</sup>C Bus Signal Integrity**

The noise on the I<sup>2</sup>C 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 made 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 will be less than 100mV peak-to-peak. This noise measurement should be made at the power supply output connector.

## I<sup>2</sup>C Bus Internal Implementation, Pull-ups and Bus Capacitances

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## I<sup>2</sup>C Bus - Recommended external pull-ups:

Electrical and Interface specifications of I<sup>2</sup>C 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              |           | $C_{int}$ | -   | 100 | -   | pF   |
| Recommended external pull-up resistor<br>1 PSU | 1 PSU     | $R_{ext}$ | -   | -   | -   | Kohm |
|                                                | 2 PSU     |           | -   | -   | -   | Kohm |

## Logic Levels

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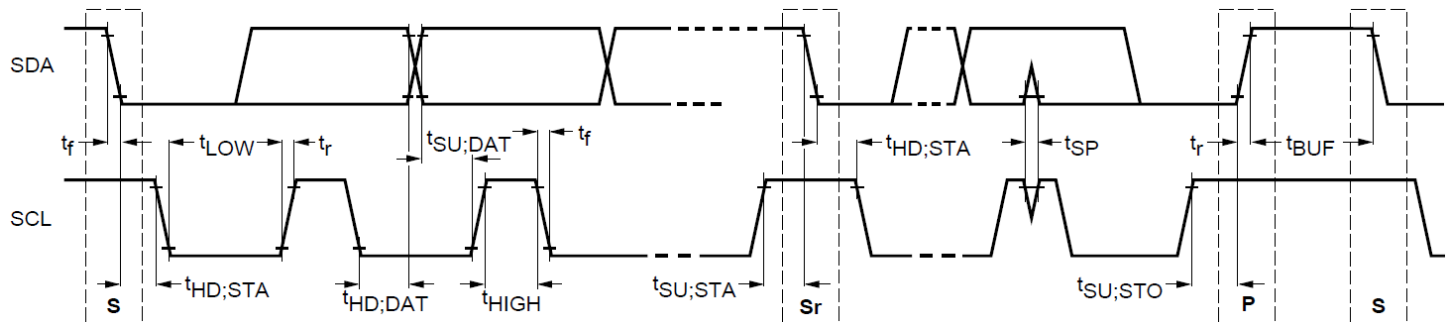
DS450DC-3 series power supply I<sup>2</sup>C Communication Bus will respond to logic levels as per below:

Logic High: 3.3V Nominal (Specs is 2.1V to 5.5V)\*\*

Logic Low: 500mV nominal (Specs is 800mV max)\*\*

\*\* Note: Win I2CNT adapter was used.

## Timings



| Parameter                                        | Symbol       | Standard-Mode Specs |      | Actual Measured |           | Unit    |
|--------------------------------------------------|--------------|---------------------|------|-----------------|-----------|---------|
|                                                  |              | Min                 | Max  |                 |           |         |
| SCL Clock Frequency                              | $f_{SCL}$    | 0                   | 100  | 99.8            |           | KHz     |
| Hold time (repeated) START condition             | $t_{HD;STA}$ | 4.0                 | -    | 13.8            |           | $\mu S$ |
| LOW period of SCL clock                          | $t_{LOW}$    | 4.7                 | -    | 25.8            |           | $\mu S$ |
| HIGH period of SCL clock                         | $t_{HIGH}$   | 4.0                 | -    | 8.1             |           | $\mu S$ |
| Setup time for repeated START condition          | $t_{SU;STA}$ | 4.7                 | -    | 14.3            |           | $\mu S$ |
| Data hold time                                   | $t_{HD;DAT}$ | 0                   | 3.45 | 1.59            |           | $\mu S$ |
| Data setup time                                  | $t_{SU;DAT}$ | 250                 | -    | 9763            |           | nS      |
| Rise time                                        | $t_r$        | -                   | 1000 | SCL = 845       | SDA = 983 | nS      |
| Fall time                                        | $t_f$        | -                   | 300  | SCL = 95        | SDA = 97  | nS      |
| Setup time for STOP condition                    | $t_{SU;STO}$ | 4.0                 | -    | 10.1            |           | $\mu S$ |
| Bus free time between a STOP and START condition | $t_{BUF}$    | 4.7                 | -    | 58.5            |           | $\mu S$ |

\*\*\* Note Win-I2CNT adapter (Parallel port-to-I<sup>2</sup>C) and Win-I2CNT GUI software was used

## Device Addressing

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The DS450DC-3 series will respond to supported commands on the I<sup>2</sup>C™ bus that are addressed according to A0 pin of output connector.

Address pins are held HIGH by default via pulled up to internal 3.3V supply with a 10K resistor. To set the address as “0”, the corresponding address line should be pulled down to logic ground level. Below tables show the address of the power supply with A0 pin set to either “0” or “1”:

| PSU Slot | Slot ID Bits | uC Read Address | EEPROM(FRU) Read Address |
|----------|--------------|-----------------|--------------------------|
|          | A0           |                 |                          |
| 1        | 0            | 0x7D            | 0xAD                     |
| 2        | 1            | 0x7F            | 0xAF                     |

\* Default I2C address when A0 is left open

## Power Supply Status Register 0x7Eh

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Power supply status monitoring can be done via the Status register 0x7Eh or as I/O expander. Detailed explanation of functions is given below:

| BIT 7      | BIT 6      | BIT 5  | BIT 4    | BIT 3   | BIT 2   | BIT 1      | BIT 0   |
|------------|------------|--------|----------|---------|---------|------------|---------|
| -DC PRFAIL | -PS STATUS | P_Good | Vin_Good | -OV 12V | -UV 12V | -Fan Fault | -OC 12V |

- **DC\_PRFAIL** - Power Drop Detection
  - the bit is high except when the power supply turns the main outputs, not +3.3VSB, off due to a DC failure the supply is turned off due to PS\_ON, PS\_KILL, or a fault, then P7 remains high.
- **PS\_STATUS** -Power Supply status.
  - A logic low, when the power supply is off, either due to PS\_ON,PS\_KILL or a fault, the bit is high
- **P\_Good** -Main Output (VO) status.
  - This bit is set when the Main Output (VO) is within regulation limits. This bit will be cleared when the VO voltage is out of regulation.
- **Vin\_Good** -DC line voltage status
  - This bit is an image of the DC\_OK signal coming out the power supply to the system. A logic HIGH, if the input voltage is within allowable limits.
- **OV +12V** -Over Voltage Protection
  - This bit will be low set when the power supply outputs have been disabled due to an over voltage event.
- **UV +12V** -Under Voltage Protection
  - This bit will be set low when the power supply outputs have been disabled due to an under voltage event.
- **Fan Fault** -Fan Status
  - Any abnormalities on the fan will clear this bit. Normal fan operation, this is set to high.
- **OC +12V** -Over Current Protection
  - This bit will be set when the power supply outputs have been disabled due to an over current event.

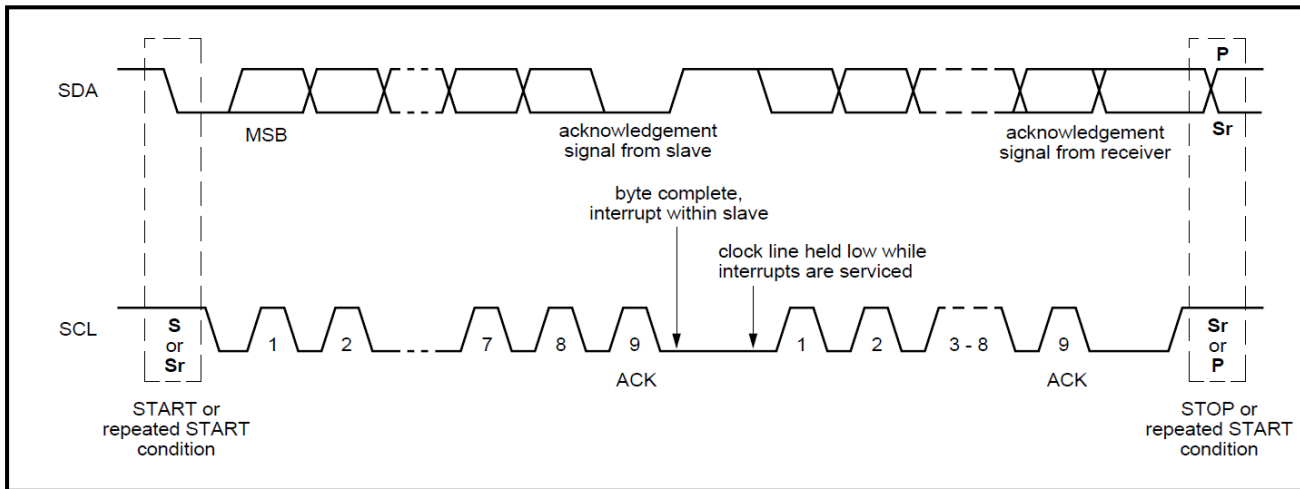
| Status Register Code |                   |            |
|----------------------|-------------------|------------|
| Signal Name          | Code (Binary)     | Code (Hex) |
| Normal / 12V ON      | 10111111          | BF         |
| Normal / 12V OFF     | 11011111          | DF         |
| OCP                  | 11011110/11011010 | DE/DA      |
| UVP                  | 11001111          | CF         |
| NO DC                | 11001111          | CF         |
| DC PRFAIL            | 01011111/01001111 | 5F/4F      |

## I<sup>2</sup>C Clock Synchronization

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The DS450DC-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 DS450DC-3 is 100 microseconds.



## FRU (EEPROM) Data

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

The DS450DC-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 DS450DC-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.

### DS450DC-3 FRU (EEPROM) Data:

| OFFSET                                                          |       | DEFINITION                                                                                                                                | SPEC VALUE |       |
|-----------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                                                           | (HEX) | (REMARKS)                                                                                                                                 | (DEC)      | (HEX) |
| <b>COMMON HEADER, 8 BYTES</b>                                   |       |                                                                                                                                           |            |       |
| 0                                                               | 00    | <b>FORMAT VERSION NUMBER</b> (Common Header)<br>7:4 - Reserved, write as 0000b<br>3:0 - Format Version Number = 1H for this specification | 1          | 01    |
| 1                                                               | 01    | <b>INTERNAL USE AREA OFFSET</b>                                                                                                           | 24         | 18    |
| 2                                                               | 02    | <b>CHASSIS INFO AREA OFFSET</b>                                                                                                           | 1          | 01    |
| 3                                                               | 03    | <b>BOARD INFO AREA OFFSET</b>                                                                                                             | 0          | 00    |
| 4                                                               | 04    | <b>PRODUCT INFO AREA OFFSET</b>                                                                                                           | 5          | 05    |
| 5                                                               | 05    | <b>MULTI RECORD AREA OFFSET</b>                                                                                                           | 15         | 0F    |
| 6                                                               | 06    | <b>PAD</b> (reserved) Default value is 0.                                                                                                 | 0          | 00    |
| 7                                                               | 07    | <b>ZERO CHECK SUM</b> (256 – (Sum of bytes 0 to 6))                                                                                       | 210        | D2    |
| <b>CHASSIS INFO AREA( 32 BYTES)</b>                             |       |                                                                                                                                           |            |       |
| This area will be filled by the Mfg. Diag. or by the OS if used |       |                                                                                                                                           |            |       |
| 8                                                               | 08    | <b>FORMAT VERSION NUMBER</b><br>7:4 - Reserved, write as 0000b<br>3:0 - Format Version Number = 1H for this specification                 | 1          | 01    |
| 9                                                               | 09    | <b>CHASSIS INFO AREA LENGTH</b> in multiple of 8 bytes                                                                                    | 0          | 00    |
| 10                                                              | 0A    | <b>CHASSIS TYPE</b> (Default value is 0.)                                                                                                 | 0          | 00    |
| 11                                                              | 0B    | <b>CHASSIS PART NUMBER</b> Type/Length 10-Byte Allocation<br>Type = "ASCII+LATIN1" = (11)b Length = 10 Bytes = (001010)b                  | 0          | 00    |
| 12                                                              | 0C    | <b>CHASSIS PART NUMBER BYTES</b> (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    | <b>CHASSIS SERIAL NUMBER</b> Type/Length 15-Byte Allocation                                                                               | 0          | 00    |
| 23                                                              | 17    | <b>CHASSIS SERIAL NUMBER BYTES</b> , 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    |

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| OFFSET                                    |       | DEFINITION                                                                                                                                                                                                              | SPEC VALUE |       |
|-------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                                     | (HEX) | (REMARKS)                                                                                                                                                                                                               | (DEC)      | (HEX) |
| 33                                        | 21    | <b>CHASSIS SERIAL NUMBER BYTES</b> , Default value is 0.                                                                                                                                                                | 0          | 00    |
| 34                                        | 22    |                                                                                                                                                                                                                         | 0          | 00    |
| 35                                        | 23    |                                                                                                                                                                                                                         | 0          | 00    |
| 36                                        | 24    |                                                                                                                                                                                                                         | 0          | 00    |
| 37                                        | 25    |                                                                                                                                                                                                                         | 0          | 00    |
| 38                                        | 26    | <b>End TAG</b>                                                                                                                                                                                                          | 0          | 00    |
| 39                                        | 27    | <b>ZERO CHECK SUM</b> (100H-((Sum of byte 08h-26h) and FFH)                                                                                                                                                             | 255        | FF    |
| <b>PRODUCT INFORMATION AREA, 80 BYTES</b> |       |                                                                                                                                                                                                                         |            |       |
| 40                                        | 28    | <b>FORMAT VERSION NUMBER</b> (Product Info Area)<br>7:4 - Reserved, write as 0000b<br>3:0 - Format Version Number = 1H for this specification                                                                           | 1          | 01    |
| 41                                        | 29    | <b>PRODUCT INFO AREA LENGTH</b> (In multiples of 8 bytes)                                                                                                                                                               | 10         | 0A    |
| 42                                        | 2A    | <b>LANGUAGE CODE (English)</b>                                                                                                                                                                                          | 25         | 19    |
| 43                                        | 2B    | <b>MANUFACTURER NAME TYPE / LENGTH</b> (0C5H)<br>7-6: (11)b, 8-Bit ASCII + Latin 1,<br>5-0: (000101)b, 5-Byte Allocation                                                                                                | 197        | C5    |
| 44                                        | 2C    | <b>MANUFACTURER'S NAME</b><br>"A" = 41h<br>"S" = 53h<br>"T" = 54h<br>"E" = 45h<br>"C" = 43h                                                                                                                             | 65         | 41    |
| 45                                        | 2D    |                                                                                                                                                                                                                         | 83         | 53    |
| 46                                        | 2E    |                                                                                                                                                                                                                         | 84         | 54    |
| 47                                        | 2F    |                                                                                                                                                                                                                         | 69         | 45    |
| 48                                        | 30    |                                                                                                                                                                                                                         | 67         | 43    |
| 49                                        | 31    | <b>PRODUCT NAME</b> Type/Length (0CEH)<br>7-6: (11)b, 8-Bit ASCII + Latin 1, 5-0: (001110)b, 14-Byte Allocation                                                                                                         | 206        | CE    |
| 50                                        | 32    | <b>PRODUCT NAME,</b><br>"D" = 44H<br>"S" = 53H<br>"4" = 34H<br>"5" = 35H<br>"0" = 30H<br>"D" = 44H<br>"S" = 43H<br>"_" = 2DH<br>"3" = 33H<br>" " = 20H<br>" " = 20H<br>" " = 20H<br>" " = 20H<br>" " = 20H<br>" " = 20H | 68         | 44    |
| 51                                        | 33    |                                                                                                                                                                                                                         | 83         | 53    |
| 52                                        | 34    |                                                                                                                                                                                                                         | 52         | 34    |
| 53                                        | 35    |                                                                                                                                                                                                                         | 53         | 35    |
| 54                                        | 36    |                                                                                                                                                                                                                         | 48         | 30    |
| 55                                        | 37    |                                                                                                                                                                                                                         | 68         | 44    |
| 56                                        | 38    |                                                                                                                                                                                                                         | 67         | 43    |
| 57                                        | 39    |                                                                                                                                                                                                                         | 45         | 2D    |
| 58                                        | 3A    |                                                                                                                                                                                                                         | 51         | 33    |
| 59                                        | 3B    |                                                                                                                                                                                                                         | 32         | 20    |
| 60                                        | 3C    |                                                                                                                                                                                                                         | 32         | 20    |
| 61                                        | 3D    |                                                                                                                                                                                                                         | 32         | 20    |
| 62                                        | 3E    |                                                                                                                                                                                                                         | 32         | 20    |
| 63                                        | 3F    |                                                                                                                                                                                                                         | 32         | 20    |
| 64                                        | 40    | <b>PRODUCT PART/MODEL NUMBER</b> Type/Length (0CAH)<br>7-6: (11)b, 8-Bit ASCII + Latin 1, 5-0: (001010)b, 10-Byte Allocation                                                                                            | 202        | CA    |
| 65                                        | 41    | <b>POWER SUPPLY SPARE KIT NUMBER</b><br>Power Supply Spare Kit Number 192201-001<br>Not Applicable                                                                                                                      | 00         | 00    |
| 66                                        | 42    |                                                                                                                                                                                                                         | 00         | 00    |
| 67                                        | 43    |                                                                                                                                                                                                                         | 00         | 00    |
| 68                                        | 44    |                                                                                                                                                                                                                         | 00         | 00    |
| 69                                        | 45    |                                                                                                                                                                                                                         | 00         | 00    |
| 70                                        | 46    |                                                                                                                                                                                                                         | 00         | 00    |
| 71                                        | 47    |                                                                                                                                                                                                                         | 00         | 00    |
| 72                                        | 48    |                                                                                                                                                                                                                         | 00         | 00    |
| 73                                        | 49    |                                                                                                                                                                                                                         | 00         | 00    |
| 74                                        | 4A    |                                                                                                                                                                                                                         | 00         | 00    |
| 75                                        | 4B    | <b>PRODUCT VERSION NUMBER</b> Type/Length (0C2h)<br>Type = "ASCII+LATIN1" = (11)b Length = 2 bytes = (000010)b                                                                                                          | 194        | C2    |
| 76                                        | 4C    | <b>Product Version Number/Auto Rev</b><br>"0" = 30H<br>"1" = 41H, SHOULD TRACK MODULE REVISION indicated on IPS                                                                                                         | 48         | 30    |
| 77                                        | 4D    |                                                                                                                                                                                                                         | 49         | 41    |

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| OFFSET |       | DEFINITION                                                                                                                                                                                                | SPEC VALUE                                   |       |
|--------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------|
| (DEC)  | (HEX) | (REMARKS)                                                                                                                                                                                                 | (DEC)                                        | (HEX) |
| 78     | 4E    | <b>PRODUCT SERIAL NUMBER</b> Type/Length<br>*PRODUCT SERIAL NUMBER IS BASED ON ASTEC SERIAL NUMBER<br>FORMAT P/N: 417-00201000<br>7-6: (11)b, 8-Bit ASCII + Latin1,<br>5-0: (001101)b, 13-Byte Allocation | 205                                          | CD    |
| 79     | 4F    | <b>PRODUCT SERIAL NUMBER Model ID</b><br>"G" =47H                                                                                                                                                         | 71                                           | 47    |
| 80     | 50    | "2" =32H                                                                                                                                                                                                  | 50                                           | 32    |
| 81     | 51    | "6" =36H                                                                                                                                                                                                  | 54                                           | 36    |
| 82     | 52    | "8" =38H                                                                                                                                                                                                  | 56                                           | 38    |
| 83     | 53    | <b>MANUFACTURING YEAR AND WEEK CODE</b>                                                                                                                                                                   | PER UNIT<br>PER UNIT                         |       |
| 84     | 54    | REFER TO 417-00201000 FOR DETAILS                                                                                                                                                                         |                                              |       |
| 85     | 55    | <b>UNIQUE SERIAL NUMBER</b>                                                                                                                                                                               | PER UNIT<br>PER UNIT<br>PER UNIT<br>PER UNIT |       |
| 86     | 56    | REFER TO 417-00201000 FOR DETAILS                                                                                                                                                                         |                                              |       |
| 87     | 57    |                                                                                                                                                                                                           |                                              |       |
| 88     | 58    |                                                                                                                                                                                                           |                                              |       |
| 89     | 59    | <b>MODEL REVISION</b><br>"0" =30H                                                                                                                                                                         | 48                                           | 30    |
| 90     | 5A    | "1" =41H                                                                                                                                                                                                  | 49                                           | 41    |
| 91     | 5B    | <b>MANUFACTURING LOCATION</b><br>"P" = 50H                                                                                                                                                                | 80                                           | 50    |
| 92     | 5C    | <b>ASSET TAG(0C8H)</b><br>7-6: (11)b, 8-Bit ASCII + Latin 1,<br>5-0: (001000)b, 8-Byte Allocation                                                                                                         | 200                                          | C8    |
| 93     | 5D    | NO ASSET TAG                                                                                                                                                                                              | 0                                            | 00    |
| 94     | 5E    |                                                                                                                                                                                                           | 0                                            | 00    |
| 95     | 5F    |                                                                                                                                                                                                           | 0                                            | 00    |
| 96     | 60    |                                                                                                                                                                                                           | 0                                            | 00    |
| 97     | 61    |                                                                                                                                                                                                           | 0                                            | 00    |
| 98     | 62    |                                                                                                                                                                                                           | 0                                            | 00    |
| 99     | 63    |                                                                                                                                                                                                           | 0                                            | 00    |
| 100    | 64    |                                                                                                                                                                                                           | 0                                            | 00    |
| 101    | 65    | <b>FRU FILE(0CFH)</b><br>7-6: (11)b, 8-Bit ASCII + Latin 1,<br>5-0: (001111)b, 15-Byte Allocation                                                                                                         | 207                                          | CF    |
| 102    | 60    | "D" =44H                                                                                                                                                                                                  | 68                                           | 44    |
| 103    | 61    | "S" =53H                                                                                                                                                                                                  | 83                                           | 53    |
| 104    | 62    | "4" =34H                                                                                                                                                                                                  | 52                                           | 34    |
| 105    | 63    | "5" =35H                                                                                                                                                                                                  | 53                                           | 35    |
| 106    | 64    | "0" =30H                                                                                                                                                                                                  | 48                                           | 30    |
| 107    | 65    | "D" =44H                                                                                                                                                                                                  | 68                                           | 44    |
| 108    | 66    | "C" =43H                                                                                                                                                                                                  | 67                                           | 43    |
| 109    | 67    | "_" =2DH                                                                                                                                                                                                  | 45                                           | 2D    |
| 110    | 68    | "3" =33H                                                                                                                                                                                                  | 51                                           | 33    |
| 111    | 69    | " " =5FH                                                                                                                                                                                                  | 95                                           | 5F    |
| 112    | 70    | "R" =52H                                                                                                                                                                                                  | 82                                           | 52    |
| 113    | 71    | "E" =45H                                                                                                                                                                                                  | 69                                           | 45    |
| 114    | 72    | "V" =56H                                                                                                                                                                                                  | 86                                           | 56    |
| 115    | 73    | "0" =30H                                                                                                                                                                                                  | 48                                           | 30    |
| 116    | 74    | "1" =41H                                                                                                                                                                                                  | 49                                           | 41    |
| 117    | 75    | <b>END OF FIELDS MARKER(0C1H)</b>                                                                                                                                                                         | 193                                          | C1    |
| 118    | 76    | <b>RESERVED</b>                                                                                                                                                                                           | 00                                           | 00    |
| 119    | 77    | <b>ZERO CHECK SUM</b> [100H-((SUM OF BYTES 28H-76H) AND FFH)]                                                                                                                                             | PER                                          | UNIT  |

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| OFFSET                      |       | DEFINITION                                                                                           | SPEC VALUE |       |
|-----------------------------|-------|------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                       | (HEX) | (REMARKS)                                                                                            | (DEC)      | (HEX) |
| Multi Record Area, 72 Bytes |       |                                                                                                      |            |       |
|                             |       | Power Supply Record Header                                                                           |            |       |
| 120                         | 78    | RECORD TYPE (0X00=Power Supply Information)                                                          | 00         | 00    |
| 121                         | 79    | 7:7 - End Of List, (0)b<br>6:4 - Reserved, Write As (000)b<br>3:0 - Record Format Version (0010)b=2H | 02         | 02    |
| 122                         | 7A    | RECORD LENGTH (24 Bytes)                                                                             | 24         | 18    |
| 123                         | 7B    | RECORD CHECKSUM (Zero Checksum from 7DH-94H)                                                         | 136        | 88    |
| 124                         | 7C    | HEADER CHECKSUM (Zero Checksum from 78H-7BH)                                                         | 94         | 5E    |
| Power Supply Record         |       |                                                                                                      |            |       |
| 125                         | 7D    | Overall Capacity of the Power Supply                                                                 | 176        | C2    |
| 126                         | 7E    | 15-12: (0000)b, Reserved<br>11-0: (001000100110)b, 450W=01C2H<br>Stored with LSB first then MSB      | 4          | 01    |
| 127                         | 7F    | Peak VA                                                                                              | 00         | 00    |
| 128                         | 80    | 15-12: (0000)b, Reserved<br>11-0: NO PEAK VA RATING<br>Stored with LSB first then MSB                | 00         | 00    |
| 129                         | 81    | Inrush Current (Amps) 21.0A=15H                                                                      | 21         | 15    |
| 130                         | 82    | Inrush Interval (ms), 00ms=00H                                                                       | 00         | 00    |
| 131                         | 83    | Low End Input Voltage Range 1(10mV)                                                                  | 16         | 10    |
| 132                         | 84    | 36V =3600(*10mV)=0E10H<br>Stored with LSB first then MSB                                             | 14         | 0E    |
| 133                         | 85    | High End Input Voltage Range 1(10mV)                                                                 | 76         | 4C    |
| 134                         | 86    | 75V =7500(*10mV)=1D4CH<br>Stored with LSB first then MSB                                             | 29         | 1D    |
| 135                         | 87    | Low End Input Voltage Range 2(10mV)                                                                  | 00         | 00    |
| 136                         | 88    | (Only one input range)<br>Stored with LSB first then MSB                                             | 00         | 00    |
| 137                         | 89    | High End Input Voltage Range 2(10mV)                                                                 | 00         | 00    |
| 138                         | 8A    | (Only one input range)<br>Stored with LSB first then MSB                                             | 00         | 00    |
| 139                         | 8B    | Low End Input Frequency Range, 00Hz= 00H                                                             | 00         | 00    |
| 140                         | 8C    | High End Input Frequency Range, 00Hz= 00H                                                            | 00         | 00    |
| 141                         | 8D    | D/C DROPOUT Tolerance (ms), 1ms= 01H                                                                 | 01         | 01    |

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| OFFSET                             |       | DEFINITION                                                                                                                                                                                                                                                                                                                                                                                                                                             | SPEC VALUE |       |
|------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                              | (HEX) | (REMARKS)                                                                                                                                                                                                                                                                                                                                                                                                                                              | (DEC)      | (HEX) |
| 142                                | 8E    | <b>Binary Flags</b><br>Bits 7-5: RESERVED<br>Bit 4: (1)b, Tachometer Pulses Per Rotation / Predictive Fail Polarity<br>[2 Pulses per Rotation = 1; 1 Pulse per rotation = 0] or<br>[Signal Asserted (1) Indicates Failure = 0, Signal De-asserted (0) Indicates Failure = 1]<br>Bit 3: (1)b, Hot Swap / Redundancy Support<br>Bit 2: (0)b, Auto switch Support<br>Bit 1: (0)b, Power Factor Correction Support<br>Bit 0: (0)b, Predictive Fail Support | 24         | 18    |
| 143                                | 8F    | <b>Peak Wattage Capacity and Holdup Time</b>                                                                                                                                                                                                                                                                                                                                                                                                           | 0          | 00    |
| 144                                | 90    | Bits 15-12: Holdup Time in Seconds = 00H<br>Bits 11- 0: (000000000000)b, Peak Capacity in Watts = 00H                                                                                                                                                                                                                                                                                                                                                  | 0          | 00    |
| 145                                | 91    | <b>Combined Wattage,</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | 0          | 00    |
| 146                                | 92    | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0          | 00    |
| 147                                | 93    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0          | 00    |
| 148                                | 94    | <b>Predictive Fail Tachometer Lower Threshold,</b> Not Applicable.                                                                                                                                                                                                                                                                                                                                                                                     | 0          | 00    |
| <b>12V DC OUTPUT RECORD HEADER</b> |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |       |
| 149                                | 95    | <b>Record type ID</b> (0x01= DC Output)                                                                                                                                                                                                                                                                                                                                                                                                                | 01         | 01    |
| 150                                | 96    | <b>End of List /Record Format Version Number</b><br>7:7 - End of List, (0)b<br>6:4 - Reserved, write as (000)b<br>3:0 – Record Format Version, (0010)b = 2H                                                                                                                                                                                                                                                                                            | 02         | 02    |
| 151                                | 97    | <b>RECORD LENGTH</b> (13 Bytes)                                                                                                                                                                                                                                                                                                                                                                                                                        | 13         | 0D    |
| 152                                | 98    | <b>RECORD CHECKSUM</b> (Zero Checksum from 9AH to A6H)                                                                                                                                                                                                                                                                                                                                                                                                 | 233        | E9    |
| 153                                | 99    | <b>HEADER CHECKSUM</b> (Zero Checksum from 95H to 98H)                                                                                                                                                                                                                                                                                                                                                                                                 | 07         | 07    |
| <b>12V OUTPUT RECORD</b>           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |       |
| 154                                | 9A    | <b>+12V Output Information</b><br>Bit 7: Standby, (0)b<br>Bits 6-4: Reserved, Write as (000)b<br>Bits 3-0: Output Number, (0001)b = 1H                                                                                                                                                                                                                                                                                                                 | 1          | 01    |
| 155                                | 9B    | <b>Nominal Voltage</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 | 176        | B0    |
| 156                                | 9C    | 12.00V = 1200 (x10mV) = 04B0H<br><br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                                                    | 4          | 04    |
| 157                                | 9B    | <b>Maximum Negative Voltage Deviation</b>                                                                                                                                                                                                                                                                                                                                                                                                              | 140        | 8C    |
| 158                                | 9C    | 11.64V = 1164 (x10mV) = 048CH<br><br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                                                    | 4          | 04    |
| 159                                | 9F    | <b>Maximum Positive Voltage Deviation</b>                                                                                                                                                                                                                                                                                                                                                                                                              | 212        | D4    |
| 160                                | A0    | 12.36V = 1236 (x10mV) = 04D4H<br><br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                                                    | 04         | 04    |
| 161                                | A1    | <b>Ripple and Noise pk-pk 10Hz-30MHz(mV)</b>                                                                                                                                                                                                                                                                                                                                                                                                           | 120        | 78    |
| 162                                | A2    | 120mV = 0078H<br><br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                                                                    | 00         | 00    |
| 163                                | A3    | <b>Minimum Current Draw (10mA)</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 00         | 00    |
| 164                                | A4    | 0.00A = 0000 (x10mA) = 0000H<br><br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                                                     | 00         | 00    |

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| OFFSET                            |          | DEFINITION                                                                                                                                                  | SPEC VALUE |          |
|-----------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|
| (DEC)                             | (HEX)    | (REMARKS)                                                                                                                                                   | (DEC)      | (HEX)    |
| 165<br>166                        | A5<br>A6 | <b>Maximum Current Draw (10mA)</b><br>37.00A = 3700 (x10mA) = E74H<br><br>Stored with LSB first then MSB                                                    | 116<br>014 | 74<br>0E |
| <b>3V3SB OUTPUT RECORD HEADER</b> |          |                                                                                                                                                             |            |          |
| 167                               | A7       | <b>RECORD TYPE ID</b> (0x01 = DC Output)                                                                                                                    | 01         | 01       |
| 168                               | A8       | <b>End of List /Record Format Version Number</b><br>7:7 – End of list, (0)b<br>6:4 – Reserved, write as (000)b<br>3:0 – Record Format Version, (0010)b = 2H | 02         | 02       |
| 169                               | A9       | <b>Record Length</b> (20 Bytes)                                                                                                                             | 20         | 14       |
| 170                               | AA       | <b>Record CHECKSUM</b> (Zero Checksum from ACH to BFH)                                                                                                      | 12         | 0C       |
| 171                               | AB       | <b>Header CHECKSUM</b> (Zero Checksum from A7H to AAH)                                                                                                      | 221        | DD       |
| <b>3V3SB DC OUTPUT RECORD</b>     |          |                                                                                                                                                             |            |          |
| 172                               | AC       | <b>3V3SB Output Information</b> , 002 = 02H<br>7:7 – Standby, (1)b<br>6:4 – Reserved, write as (000)b<br>3:0 – Output Number, (0010)b = 2H                  | 130        | 82       |
| 173<br>174                        | AD<br>AE | <b>Nominal Voltage</b><br>3.30V = 330 (x10mV) = 014AHIn<br><br>Stored with LSB first then MSB                                                               | 74<br>1    | 4A<br>01 |
| 175<br>176                        | AF<br>B0 | <b>Maximum Negative Voltage Deviation (10mV)</b><br>3.20V = 320 (x10mV) = 0140HIn<br><br>Stored with LSB first then MSB                                     | 64<br>1    | 40<br>01 |
| 177<br>178                        | B1<br>B2 | <b>Maximum Positive Voltage Deviation</b><br>3.40V = 340 (x10mV) = 0154HIn<br><br>Stored with LSB first then MSB                                            | 84<br>1    | 54<br>01 |
| 179<br>180                        | B3<br>B4 | <b>Ripple and Noise pk-pk 10Hz-30MHz(mV)</b><br>100mV = 0064H<br><br>Stored with LSB first then MSB                                                         | 100<br>0   | 64<br>00 |
| 181<br>182                        | B5<br>B6 | <b>Minimum Current Draw (10mA)</b><br>0.00A = 0000 (x10mA) = 0000H<br><br>Stored with LSB first then MSB                                                    | 0<br>0     | 00<br>00 |
| 183<br>184                        | 87<br>B8 | <b>Maximum Current Draw (10mA)</b><br>3.00A = 300 (x10mA) = 012CH<br><br>Stored with LSB first then MSB                                                     | 44<br>1    | 2C<br>01 |
| 185                               | B9       | Reserved                                                                                                                                                    | 0          | 00       |
| 186                               | BA       | Reserved                                                                                                                                                    | 0          | 00       |
| 187                               | BB       | Reserved                                                                                                                                                    | 0          | 00       |
| 188                               | BC       | Reserved                                                                                                                                                    | 0          | 00       |
| 189                               | BD       | Reserved                                                                                                                                                    | 0          | 00       |
| 190                               | BE       | Reserved                                                                                                                                                    | 0          | 00       |
| 191                               | BF       | Reserved                                                                                                                                                    | 0          | 00       |

## DS450DC-3 FRU (EEPROM) Data:

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| OFFSET                       |       | DEFINITION                                                                                                                                    | SPEC VALUE |       |
|------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                        | (HEX) | (REMARKS)                                                                                                                                     | (DEC)      | (HEX) |
| INTERNAL USE AREA (64 bytes) |       |                                                                                                                                               |            |       |
| 192                          | C0    | <b>FORMAT VERSION NUMBER</b> (Internal Use Area)<br>7:4 – Reserved, write as 0000b<br>3:0 – Format Version Number = 1H for this specification | 1          | 01    |
| 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    |
| 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    |

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| OFFSET |       | DEFINITION                                                              | SPEC VALUE |       |
|--------|-------|-------------------------------------------------------------------------|------------|-------|
| (DEC)  | (HEX) | (REMARKS)                                                               | (DEC)      | (HEX) |
| 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 Check Sum (Chassis Info) [100H – ((Sum of bytes C0H-FEH) AND FFH)] | 255        | FF    |

## FRU (EEPROM) Data

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

The DS450DC-3-401 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 DS450DC-3-401 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.

### DS450DC-3-401 FRU (EEPROM) Data:

| OFFSET                              |       | DEFINITION                                                                                                                                    | SPEC VALUE |       |
|-------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                               | (HEX) | (REMARKS)                                                                                                                                     | (DEC)      | (HEX) |
| <b>COMMON HEADER, 8 BYTES</b>       |       |                                                                                                                                               |            |       |
| 0                                   | 00    | <b>FORMAT VERSION NUMBER</b> (Common Header)<br>7:4 - Reserved, write as 0000b<br>3:0 - Format Version Number = 1H for this specification     | 0          | 00    |
| 1                                   | 01    | <b>INTERNAL USE AREA OFFSET</b> (In multiples of 8 bytes)                                                                                     | 1          | 01    |
| 2                                   | 02    | <b>CHASSIS INFO AREA OFFSET</b> (In multiples of 8 bytes)                                                                                     | 2          | 02    |
| 3                                   | 03    | <b>BOARD INFO AREA OFFSET</b> (In multiples of 8 bytes)                                                                                       | 3          | 03    |
| 4                                   | 04    | <b>PRODUCT INFO AREA OFFSET</b> (In multiples of 8 bytes)                                                                                     | 4          | 04    |
| 5                                   | 05    | <b>MULTI RECORD AREA OFFSET</b> (In multiples of 8 bytes)                                                                                     | 5          | 05    |
| 6                                   | 06    | <b>PAD</b> write as 00h                                                                                                                       | 6          | 06    |
| 7                                   | 07    | <b>ZERO CHECK SUM</b> [100H – ((Sum of bytes 00H-06H) AND FFH)]                                                                               | 7          | 07    |
| <b>CHASSIS INFO AREA( 32 BYTES)</b> |       |                                                                                                                                               |            |       |
| 8                                   | 08    | <b>FORMAT VERSION NUMBER</b> (Chassis Info Area)<br>7:4 - Reserved, write as 0000b<br>3:0 - Format Version Number = 1H for this specification | 1          | 01    |
| 9                                   | 09    | <b>CHASSIS INFO AREA LENGTH</b> (in multiple of 8 bytes)                                                                                      | 4          | 04    |
| 10                                  | 0A    | <b>CHASSIS TYPE</b>                                                                                                                           | 0          | 00    |
| 11                                  | 0B    | <b>CHASSIS PART NUMBER</b> Type/Length 10-Byte Allocation<br>Type = "ASCII+LATIN1" = (11)b Length = 10 Bytes = (001010)b                      | 202        | CA    |
| 12                                  | 0C    | <b>CHASSIS PART NUMBER BYTES</b> (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    | <b>CHASSIS SERIAL NUMBER</b> Type/Length 15-Byte Allocation                                                                                   | 207        | CF    |
| <b>CHASSIS SERIAL NUMBER BYTES</b>  |       |                                                                                                                                               |            |       |
| 23                                  | 17    | "D" = 44H                                                                                                                                     | 68         | 44    |
| 24                                  | 18    | "S" = 53H                                                                                                                                     | 83         | 53    |
| 25                                  | 19    | "4" = 34H                                                                                                                                     | 52         | 34    |
| 26                                  | 1A    | "5" = 35H                                                                                                                                     | 53         | 35    |
| 27                                  | 1B    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 28                                  | 1C    | "-" = 2DH                                                                                                                                     | 68         | 44    |
| 29                                  | 1D    | "3" = 33H                                                                                                                                     | 67         | 43    |
| 30                                  | 1E    | "_" = 2DH                                                                                                                                     | 45         | 2D    |
| 31                                  | 1F    | "4" = 34H                                                                                                                                     | 51         | 33    |
| 32                                  | 20    | "_" = 2DH                                                                                                                                     | 45         | 2D    |

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| OFFSET                                    |       | DEFINITION                                                                                                                                    | SPEC VALUE |       |
|-------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                                     | (HEX) | (REMARKS)                                                                                                                                     | (DEC)      | (HEX) |
| 33                                        | 21    | "4" = 34H                                                                                                                                     | 52         | 34    |
| 34                                        | 22    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 35                                        | 23    | "1" = 31H                                                                                                                                     | 49         | 31    |
| 36                                        | 24    | "R" = 52H                                                                                                                                     | 82         | 52    |
| 37                                        | 25    | "1" = 31H                                                                                                                                     | 49         | 31    |
| 38                                        | 26    | <b>End TAG</b>                                                                                                                                | 193        | C1    |
| 39                                        | 27    | <b>ZERO CHECK SUM</b> (100H-((Sum of byte 08h-26h) and FFH)                                                                                   | 69         | 45    |
| <b>PRODUCT INFORMATION AREA, 80 BYTES</b> |       |                                                                                                                                               |            |       |
| 40                                        | 28    | <b>FORMAT VERSION NUMBER</b> (Product Info Area)<br>7:4 - Reserved, write as 0000b<br>3:0 - Format Version Number = 1H for this specification | 1          | 01    |
| 41                                        | 29    | <b>PRODUCT INFO AREA LENGTH</b> (In multiples of 8 bytes)                                                                                     | 10         | 0A    |
| 42                                        | 2A    | <b>LANGUAGE CODE (English=19H)</b>                                                                                                            | 25         | 19    |
| 43                                        | 2B    | <b>MANUFACTURER NAME TYPE / LENGTH</b> (0C5H)<br>7-6: (11)b, 8-Bit ASCII + Latin 1, 5-0: (000101)b, 5-Byte Allocation                         | 197        | C5    |
| 44                                        | 2C    | <b>MANUFACTURER'S NAME</b><br>"A" = 41h                                                                                                       | 65         | 41    |
| 45                                        | 2D    | "S" = 53h                                                                                                                                     | 83         | 53    |
| 46                                        | 2E    | "T" = 54h                                                                                                                                     | 84         | 54    |
| 47                                        | 2F    | "E" = 45h                                                                                                                                     | 69         | 45    |
| 48                                        | 30    | "C" = 43h                                                                                                                                     | 67         | 43    |
| 49                                        | 31    | <b>PRODUCT NAME</b> Type/Length (0CAH)<br>7-6: (11)b, 8-Bit ASCII + Latin 1, 5-0: (001110)b, 14-Byte Allocation                               | 202        | CA    |
| 50                                        | 32    | <b>PRODUCT NAME,</b><br>"D" = 44H                                                                                                             | 68         | 44    |
| 51                                        | 33    | "S" = 53H                                                                                                                                     | 83         | 53    |
| 52                                        | 34    | "4" = 34H                                                                                                                                     | 52         | 34    |
| 53                                        | 35    | "5" = 35H                                                                                                                                     | 53         | 35    |
| 54                                        | 36    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 55                                        | 37    | "D" = 44H                                                                                                                                     | 68         | 44    |
| 56                                        | 38    | "S" = 43H                                                                                                                                     | 67         | 43    |
| 57                                        | 39    | "_" = 2DH                                                                                                                                     | 45         | 2D    |
| 58                                        | 3A    | "3" = 33H                                                                                                                                     | 51         | 33    |
| 59                                        | 3B    | " " = 20H                                                                                                                                     | 32         | 20    |
| 60                                        | 3C    | <b>PRODUCT PART/MODEL NUMBER</b> Type/Length (0CEH)<br>7-6: (11)b, 8-Bit ASCII + Latin 1, 5-0: (001010)b, 10-Byte Allocation                  | 206        | CE    |
| 61                                        | 3D    | <b>POWER SUPPLY CUSTOMER NUMBER</b><br>"B" = 42H                                                                                              | 66         | 42    |
| 62                                        | 3E    | "G" = 47H                                                                                                                                     | 71         | 47    |
| 63                                        | 3F    | "R" = 52H                                                                                                                                     | 82         | 52    |
| 64                                        | 40    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 65                                        | 41    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 66                                        | 42    | "3" = 33H                                                                                                                                     | 51         | 33    |
| 67                                        | 43    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 68                                        | 44    | "3" = 33H                                                                                                                                     | 51         | 33    |
| 69                                        | 45    | " " = 20H                                                                                                                                     | 32         | 20    |
| 70                                        | 46    | "R" = 52H                                                                                                                                     | 82         | 52    |
| 71                                        | 47    | "A" = 41H                                                                                                                                     | 65         | 41    |
| 72                                        | 48    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 73                                        | 49    | "0" = 30H                                                                                                                                     | 48         | 30    |
| 74                                        | 4A    | " " = 20H                                                                                                                                     | 32         | 20    |
| 75                                        | 4B    | <b>PRODUCT VERSION NUMBER</b> Type/Length (0C2h)<br>Type = "ASCII+LATIN1" = (11)b Length = 2 bytes = (000010)b                                | 194        | C2    |
| 76                                        | 4C    | <b>Product Version Number/Auto Rev</b><br>"0" = 30H                                                                                           | 48         | 30    |
| 77                                        | 4D    | "1" = 31H, SHOULD TRACK MODULE REVISION indicated on IPS                                                                                      | 49         | 31    |

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| OFFSET |       | DEFINITION                                                                                                                                                                                                | SPEC VALUE                                   |       |
|--------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------|
| (DEC)  | (HEX) | (REMARKS)                                                                                                                                                                                                 | (DEC)                                        | (HEX) |
| 78     | 4E    | <b>PRODUCT SERIAL NUMBER</b> Type/Length<br>*PRODUCT SERIAL NUMBER IS BASED ON ASTEC SERIAL NUMBER<br>FORMAT P/N: 417-00201000<br>7-6: (11)b, 8-Bit ASCII + Latin1,<br>5-0: (001101)b, 13-Byte Allocation | 205                                          | CD    |
| 79     | 4F    | <b>PRODUCT SERIAL NUMBER Model ID</b><br>"I" = 49H                                                                                                                                                        | 73                                           | 49    |
| 80     | 50    | "6" = 36H                                                                                                                                                                                                 | 54                                           | 36    |
| 81     | 51    | "1" = 31H                                                                                                                                                                                                 | 49                                           | 31    |
| 82     | 52    | "5" = 35H                                                                                                                                                                                                 | 53                                           | 35    |
| 83     | 53    | <b>MANUFACTURING YEAR AND WEEK CODE</b>                                                                                                                                                                   | PER UNIT<br>PER UNIT                         |       |
| 84     | 54    | REFER TO 417-00201000 FOR DETAILS                                                                                                                                                                         |                                              |       |
| 85     | 55    | <b>UNIQUE SERIAL NUMBER</b>                                                                                                                                                                               | PER UNIT<br>PER UNIT<br>PER UNIT<br>PER UNIT |       |
| 86     | 56    | REFER TO 417-00201000 FOR DETAILS                                                                                                                                                                         |                                              |       |
| 87     | 57    |                                                                                                                                                                                                           |                                              |       |
| 88     | 58    |                                                                                                                                                                                                           |                                              |       |
| 89     | 59    | <b>PRODUCT SERIAL NUMBER: MODEL REVISION</b><br>"0" = 30H                                                                                                                                                 | 48                                           | 30    |
| 90     | 5A    | "1" = 31H *SHOULD TRACK MODEL REVISION indicated on IPS                                                                                                                                                   | 49                                           | 31    |
| 91     | 5B    | <b>PRODUCT SERIAL NUMBER: MANUFACTURING LOCATION</b><br>"P" = 50H (P for Laguna, Philippines)                                                                                                             | 80                                           | 50    |
| 92     | 5C    | <b>ASSET TAG(0C8H)</b><br>7-6: (11)b, 8-Bit ASCII + Latin 1,<br>5-0: (001000)b, 8-Byte Allocation                                                                                                         | 200                                          | C8    |
| 93     | 5D    | NO ASSET TAG                                                                                                                                                                                              | 0                                            | 00    |
| 94     | 5E    |                                                                                                                                                                                                           | 0                                            | 00    |
| 95     | 5F    |                                                                                                                                                                                                           | 0                                            | 00    |
| 96     | 60    |                                                                                                                                                                                                           | 0                                            | 00    |
| 97     | 61    |                                                                                                                                                                                                           | 0                                            | 00    |
| 98     | 62    |                                                                                                                                                                                                           | 0                                            | 00    |
| 99     | 63    |                                                                                                                                                                                                           | 0                                            | 00    |
| 100    | 64    |                                                                                                                                                                                                           | 0                                            | 00    |
| 101    | 65    | <b>FRU FILE(0CFH)</b><br>7-6: (11)b, 8-Bit ASCII + Latin 1,<br>5-0: (001111)b, 15-Byte Allocation                                                                                                         | 207                                          | CF    |
| 102    | 60    | "D" =44H                                                                                                                                                                                                  | 68                                           | 44    |
| 103    | 61    | "S" =53H                                                                                                                                                                                                  | 83                                           | 53    |
| 104    | 62    | "4" =34H                                                                                                                                                                                                  | 52                                           | 34    |
| 105    | 63    | "5" =35H                                                                                                                                                                                                  | 53                                           | 35    |
| 106    | 64    | "0" =30H                                                                                                                                                                                                  | 48                                           | 30    |
| 107    | 65    | "D" =44H                                                                                                                                                                                                  | 68                                           | 44    |
| 108    | 66    | "C" =43H                                                                                                                                                                                                  | 67                                           | 43    |
| 109    | 67    | "_" =2DH                                                                                                                                                                                                  | 45                                           | 2D    |
| 110    | 68    | "3" =33H                                                                                                                                                                                                  | 51                                           | 33    |
| 111    | 69    | "_" =5FH                                                                                                                                                                                                  | 95                                           | 5F    |
| 112    | 70    | "R" =52H                                                                                                                                                                                                  | 82                                           | 52    |
| 113    | 71    | "E" =45H                                                                                                                                                                                                  | 69                                           | 45    |
| 114    | 72    | "V" =56H                                                                                                                                                                                                  | 86                                           | 56    |
| 115    | 73    | "0" =30H                                                                                                                                                                                                  | 48                                           | 30    |
| 116    | 74    | "1" =31H                                                                                                                                                                                                  | 49                                           | 31    |
| 117    | 75    | END OF FIELDS MARKER(0C1H)                                                                                                                                                                                | 193                                          | C1    |
| 118    | 76    | RESERVED                                                                                                                                                                                                  | 00                                           | 00    |
| 119    | 77    | ZERO CHECK SUM[100H-((SUM OF BYTES 28H-76H) AND FFH)]                                                                                                                                                     | PER                                          | UNIT  |

DS450DC-3-401 FRU (EEPROM) Data:

| OFFSET                      |       | DEFINITION                                                                                           | SPEC VALUE |       |
|-----------------------------|-------|------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                       | (HEX) | (REMARKS)                                                                                            | (DEC)      | (HEX) |
| Multi Record Area, 72 Bytes |       |                                                                                                      |            |       |
|                             |       | <b>Power Supply Record Header</b>                                                                    |            |       |
| 120                         | 78    | RECORD TYPE (0X00=Power Supply Information)                                                          | 00         | 00    |
| 121                         | 79    | 7:7 - End Of List, (0)b<br>6:4 - Reserved, Write As (000)b<br>3:0 - Record Format Version (0010)b=2H | 02         | 02    |
| 122                         | 7A    | RECORD LENGTH (24 Bytes)                                                                             | 24         | 18    |
| 123                         | 7B    | RECORD CHECKSUM (Zero Checksum from 7DH-94H)                                                         | 136        | 88    |
| 124                         | 7C    | HEADER CHECKSUM (Zero Checksum from 78H-7BH)                                                         | 94         | 5E    |
| <b>Power Supply Record</b>  |       |                                                                                                      |            |       |
| 125                         | 7D    | <b>Overall Capacity of the Power Supply (Watts)</b><br>15-12: (0000)b, Reserved                      | 194        | C2    |
| 126                         | 7E    | 11-0: (001000100110)b, 450W=01C2H<br>Stored with LSB first then MSB                                  | 1          | 01    |
| 127                         | 7F    | <b>Peak VA</b><br>15-12: (0000)b, Reserved                                                           | 00         | 00    |
| 128                         | 80    | 11-0: NO PEAK VA RATING<br>Stored with LSB first then MSB                                            | 00         | 00    |
| 129                         | 81    | <b>Inrush Current (Amps)</b> 21.0A=15H                                                               | 21         | 15    |
| 130                         | 82    | <b>Inrush Interval (ms)</b> , 00ms=00H                                                               | 00         | 00    |
| 131                         | 83    | <b>Low End Input Voltage Range 1(10mV)</b><br>36V =3600(*10mV)=0E10H                                 | 16         | 10    |
| 132                         | 84    | Stored with LSB first then MSB                                                                       | 14         | 0E    |
| 133                         | 85    | <b>High End Input Voltage Range 1(10mV)</b><br>75V =7500(*10mV)=1D4CH                                | 76         | 4C    |
| 134                         | 86    | Stored with LSB first then MSB                                                                       | 29         | 1D    |
| 135                         | 87    | <b>Low End Input Voltage Range 2(10mV)</b><br>(Only one input range)                                 | 00         | 00    |
| 136                         | 88    | Stored with LSB first then MSB                                                                       | 00         | 00    |
| 137                         | 89    | <b>High End Input Voltage Range 2(10mV)</b><br>(Only one input range)                                | 00         | 00    |
| 138                         | 8A    | Stored with LSB first then MSB                                                                       | 00         | 00    |
| 139                         | 8B    | <b>Low End Input Frequency Range</b> , 00Hz= 00H                                                     | 00         | 00    |
| 140                         | 8C    | <b>High End Input Frequency Range</b> , 00Hz= 00H                                                    | 00         | 00    |
| 141                         | 8D    | <b>D/C DROPOUT Tolerance (ms)</b> , 1ms= 01H                                                         | 01         | 01    |

DS450DC-3-401 FRU (EEPROM) Data:

| OFFSET                             |       | DEFINITION                                                                                                                                                                                                                                                                                                                                                                                                                                             | SPEC VALUE |       |
|------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                              | (HEX) | (REMARKS)                                                                                                                                                                                                                                                                                                                                                                                                                                              | (DEC)      | (HEX) |
| 142                                | 8E    | <b>Binary Flags</b><br>Bits 7-5: RESERVED<br>Bit 4: (1)b, Tachometer Pulses Per Rotation / Predictive Fail Polarity<br>[2 Pulses per Rotation = 1; 1 Pulse per rotation = 0] or<br>[Signal Asserted (1) Indicates Failure = 0, Signal De-asserted (0) Indicates Failure = 1]<br>Bit 3: (1)b, Hot Swap / Redundancy Support<br>Bit 2: (0)b, Auto switch Support<br>Bit 1: (0)b, Power Factor Correction Support<br>Bit 0: (0)b, Predictive Fail Support | 24         | 18    |
| 143                                | 8F    | <b>Peak Wattage Capacity and Holdup Time</b>                                                                                                                                                                                                                                                                                                                                                                                                           | 0          | 00    |
| 144                                | 90    | Bits 15-12: Holdup Time in Seconds = 00H<br>Bits 11- 0: (000000000000)b, Peak Capacity in Watts = 00H                                                                                                                                                                                                                                                                                                                                                  | 0          | 00    |
| 145                                | 91    | <b>Combined Wattage,</b><br>Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                             | 0          | 00    |
| 146                                | 92    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0          | 00    |
| 147                                | 93    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0          | 00    |
| 148                                | 94    | <b>Predictive Fail Tachometer Lower Threshold</b> , Not Applicable.                                                                                                                                                                                                                                                                                                                                                                                    | 0          | 00    |
| <b>12V DC OUTPUT RECORD HEADER</b> |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |       |
| 149                                | 95    | <b>Record type ID</b> (0x01= DC Output)                                                                                                                                                                                                                                                                                                                                                                                                                | 01         | 01    |
| 150                                | 96    | <b>End of List /Record Format Version Number</b><br>7:7 - End of List, (0)b<br>6:4 - Reserved, write as (000)b<br>3:0 – Record Format Version, (0010)b = 2H                                                                                                                                                                                                                                                                                            | 02         | 02    |
| 151                                | 97    | <b>RECORD LENGTH</b> (13 Bytes)                                                                                                                                                                                                                                                                                                                                                                                                                        | 13         | 0D    |
| 152                                | 98    | <b>RECORD CHECKSUM</b> (Zero Checksum from 9AH to A6H)                                                                                                                                                                                                                                                                                                                                                                                                 | 233        | E9    |
| 153                                | 99    | <b>HEADER CHECKSUM</b> (Zero Checksum from 95H to 98H)                                                                                                                                                                                                                                                                                                                                                                                                 | 07         | 07    |
| <b>12V OUTPUT RECORD</b>           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |       |
| 154                                | 9A    | <b>+12V Output Information</b><br>Bit 7: Standby, (0)b<br>Bits 6-4: Reserved, Write as (000)b<br>Bits 3-0: Output Number, (0001)b = 1H                                                                                                                                                                                                                                                                                                                 | 1          | 01    |
| 155                                | 9B    | <b>Nominal Voltage</b><br>12.00V = 1200 (x10mV) = 04B0H<br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                              | 176        | B0    |
| 156                                | 9C    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4          | 04    |
| 157                                | 9B    | <b>Maximum Negative Voltage Deviation</b><br>11.64V = 1164 (x10mV) = 048CH<br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                           | 140        | 8C    |
| 158                                | 9C    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4          | 04    |
| 159                                | 9F    | <b>Maximum Positive Voltage Deviation</b><br>12.36V = 1236 (x10mV) = 04D4H<br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                           | 212        | D4    |
| 160                                | A0    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 04         | 04    |
| 161                                | A1    | <b>Ripple and Noise pk-pk 10Hz-30MHz(mV)</b><br>120mV = 0078H<br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                        | 120        | 78    |
| 162                                | A2    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 00         | 00    |
| 163                                | A3    | <b>Minimum Current Draw (10mA)</b><br>0.00A = 0000 (x10mA) = 0000H<br>Stored with LSB first then MSB                                                                                                                                                                                                                                                                                                                                                   | 00         | 00    |
| 164                                | A4    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 00         | 00    |

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| OFFSET                               |          | DEFINITION                                                                                                                                                  | SPEC VALUE |          |
|--------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|
| (DEC)                                | (HEX)    | (REMARKS)                                                                                                                                                   | (DEC)      | (HEX)    |
| 165<br>166                           | A5<br>A6 | <b>Maximum Current Draw (10mA)</b><br>37.00A = 3700 (x10mA) = E74H<br><br>Stored with LSB first then MSB                                                    | 116<br>014 | 74<br>0E |
| <b>3V3SB OUTPUT RECORD HEADER</b>    |          |                                                                                                                                                             |            |          |
| 167                                  | A7       | <b>RECORD TYPE ID</b> (0x01 = DC Output)                                                                                                                    | 01         | 01       |
| 168                                  | A8       | <b>End of List /Record Format Version Number</b><br>7:7 – End of list, (0)b<br>6:4 – Reserved, write as (000)b<br>3:0 – Record Format Version, (0010)b = 2H | 02         | 02       |
| 169                                  | A9       | <b>Record Length</b> (20 Bytes)                                                                                                                             | 20         | 14       |
| 170                                  | AA       | <b>Record CHECKSUM</b> (Zero Checksum from ACH to BFH)                                                                                                      | 12         | 0C       |
| 171                                  | AB       | <b>Header CHECKSUM</b> (Zero Checksum from A7H to AAH)                                                                                                      | 221        | DD       |
| <b>3V3SB DC OUTPUT RECORD HEADER</b> |          |                                                                                                                                                             |            |          |
| 172                                  | AC       | <b>3V3SB Output Information</b><br>7:7 – Standby, (1)b<br>6:4 – Reserved, write as (000)b<br>3:0 – Output Number, (0010)b = 2H                              | 130        | 82       |
| 173<br>174                           | AD<br>AE | <b>Nominal Voltage</b><br>3.30V = 330 (x10mV) = 014AHIn<br><br>Stored with LSB first then MSB                                                               | 74<br>1    | 4A<br>01 |
| 175<br>176                           | AF<br>B0 | <b>Maximum Negative Voltage Deviation (10mV)</b><br>3.20V = 320 (x10mV) = 0140HIn<br><br>Stored with LSB first then MSB                                     | 64<br>1    | 40<br>01 |
| 177<br>178                           | B1<br>B2 | <b>Maximum Positive Voltage Deviation</b><br>3.40V = 340 (x10mV) = 0154HIn<br><br>Stored with LSB first then MSB                                            | 84<br>1    | 54<br>01 |
| 179<br>180                           | B3<br>B4 | <b>Ripple and Noise pk-pk 10Hz-30MHz(mV)</b><br>100mV = 0064H<br><br>Stored with LSB first then MSB                                                         | 100<br>0   | 64<br>00 |
| 181<br>182                           | B5<br>B6 | <b>Minimum Current Draw (10mA)</b><br>0.00A = 0000 (x10mA) = 0000H<br><br>Stored with LSB first then MSB                                                    | 0<br>0     | 00<br>00 |
| 183<br>184                           | B7<br>B8 | <b>Maximum Current Draw (10mA)</b><br>3.00A = 300 (x10mA) = 012CH<br><br>Stored with LSB first then MSB                                                     | 44<br>1    | 2C<br>01 |
| 185                                  | B9       | Reserved                                                                                                                                                    | 0          | 00       |
| 186                                  | BA       | Reserved                                                                                                                                                    | 0          | 00       |
| 187                                  | BB       | Reserved                                                                                                                                                    | 0          | 00       |
| 188                                  | BC       | Reserved                                                                                                                                                    | 0          | 00       |
| 189                                  | BD       | Reserved                                                                                                                                                    | 0          | 00       |
| 190                                  | BE       | Reserved                                                                                                                                                    | 0          | 00       |
| 191                                  | BF       | Reserved                                                                                                                                                    | 0          | 00       |

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| OFFSET                       |       | DEFINITION                                                                                                                                    | SPEC VALUE |       |
|------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|
| (DEC)                        | (HEX) | (REMARKS)                                                                                                                                     | (DEC)      | (HEX) |
| INTERNAL USE AREA (64 bytes) |       |                                                                                                                                               |            |       |
| 192                          | C0    | <b>FORMAT VERSION NUMBER</b> (Internal Use Area)<br>7:4 – Reserved, write as 0000b<br>3:0 – Format Version Number = 1H for this specification | 1          | 01    |
| 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    |
| 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    |

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| OFFSET |       | DEFINITION                                                              | SPEC VALUE |       |
|--------|-------|-------------------------------------------------------------------------|------------|-------|
| (DEC)  | (HEX) | (REMARKS)                                                               | (DEC)      | (HEX) |
| 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 Check Sum (Chassis Info) [100H – ((Sum of bytes C0H-FEH) AND FFH)] | 255        | FF    |

## I2C Interface Support

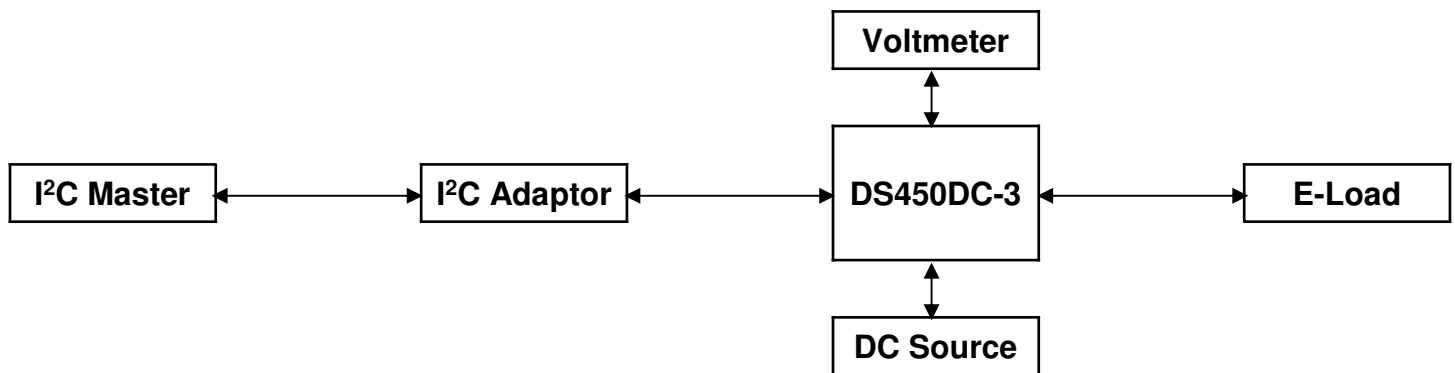
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The DS450DC-3 is compliant with the industry standard I2C protocol for monitoring and control of the power supply via the I2C interface port.

### DS450DC-3 Series I2C General Instructions

#### Equipment Setup

The following is typical I2C communication setup:



### **Current Sharing**

The DS450DC-3 series' main output V1 is equipped with current sharing capability. This will allow up to 4 power supplies to be connected in parallel for higher power application. Current share accuracy is typically 10% of full load. When supplying light loads between 10% and 20% 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 shall occur that violates the regulation limits of the power supply defined in this specification.

Compute Current Share voltage using formula below:

$I_{Share} \text{ bus voltage} = (\text{output current} * 8.0V) / 12V \text{ full load current.}$

Current share voltages computed by using above formula may not be accurate below 20-25% load due to non-linearity at lighter loads.

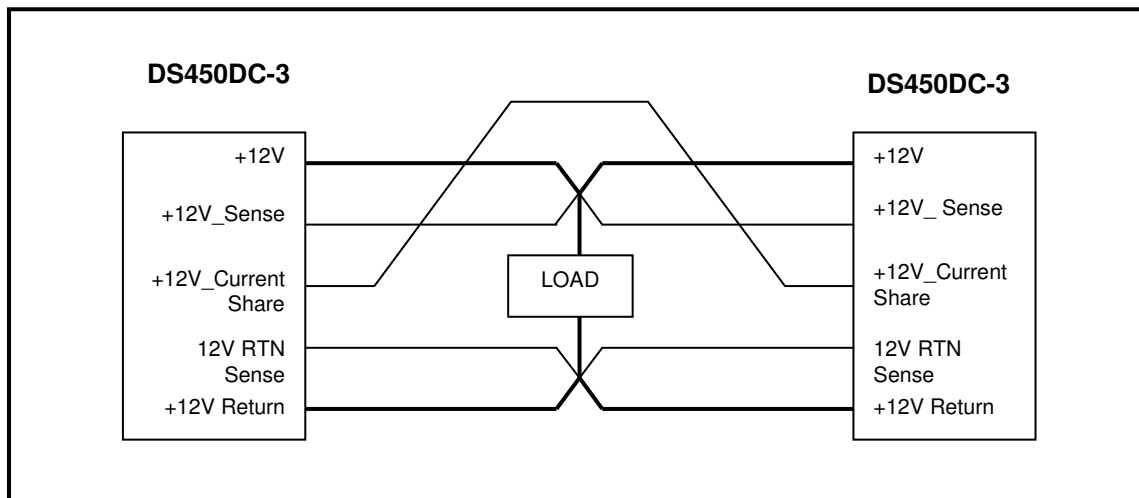
## Redundancy/Fault Tolerance

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The DS450DC-3 series power supplies can be connected in the following to provide redundancy/fault tolerance operation:

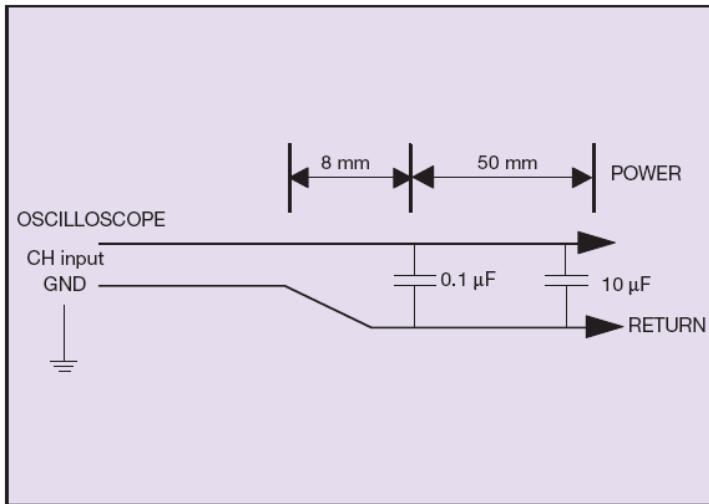


This will allow up to N\* power supplies to be connected in an N+1 redundant load. Any failure of one power supply in parallel as well as hot swapping shall not cause more than a 5%(which ever is greater) change in any output. Current share accuracy is typically 10% of full load. The Failure of one or 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

## **Output Ripple and Noise Measurement**

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The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the DS450DC-3 Series. When measuring output ripple and noise, a scope jack in parallel with a 0.1  $\mu\text{F}$  ceramic chip capacitor, and a 10  $\mu\text{F}$  aluminum electrolytic capacitor should be used. Oscilloscope should be set to 20 MHz bandwidth for this measurement.



### **Americas**

5810 Van Allen Way  
Carlsbad, CA 92008  
USA  
Telephone: +1 (760) 930 4600  
Facsimile: +1 (760) 930 0698

### **Europe (UK)**

Waterfront Business Park  
Merry Hill, Dudley  
West Midlands, DY5 1LX  
United Kingdom  
Telephone: +44 (0) 1384 842 211  
Facsimile: +44 (0) 1384 843 355

### **Asia (HK)**

14/F, Lu Plaza  
2 Wing Yip Street  
Kwun Tong, Kowloon  
Hong Kong  
Telephone: +852 2176 3333  
Facsimile: +852 2176 3888

For global contact, visit:

**[www.powerconversion.com](http://www.powerconversion.com)**  
**[techsupport.embeddedpower@emerson.com](mailto:techsupport.embeddedpower@emerson.com)**

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