DATA PATTERNS

DP-PSU-7056

Electrical Power System

KEY FEATURES AND BENEFITS

- Maximum Power Point Tracking based Battery Charge Regulator to extract maximum power from the solar panel
- Battery Charge Regulator suitable for Li-ion and Li-polymer batteries
- Battery depth of discharge control
- Ideal diode for each solar panel input to block reverse current
- Solar panel input power and voltage monitoring
- On board temperature and battery temperature monitoring
- Battery voltage and capacity monitor
- Provision for dead launch operation with two launch separation switches

APPLICATIONS

- Low Earth Orbit(LEO) satellites
- CUBESAT platforms
- Solar power generation platforms

DESCRIPTION

The Electrical Power System (EPS) is a power supply module designed for the Micro/Nano/Cube satellite platforms. The EPS derives its input power from two solar panels and consists of a solar panel interface,battery interface, battery charge/discharge regulator, voltage regulators and distribution electronics.

The EPS generates power by means of solar cells and stores the energy in batteries, regulates the battery voltage and distributes it to the load. The main function of this EPS is to keep the satellite powered during the eclipse period and maintain the battery in charged condition during the sunlight period. It manages the load along with the Power Distribution Module(PDM) by powering ON/OFF the on-board electronic systems to avoid unnecessary power consumption during the satellite's normal operation

BLOCK LEVEL EXPLANATION

SOLAR PANEL INTERFACE

The EPS module is designed to be interfaced to solar panels with Advanced Triple Junction (ATJ)/ Ultra Triple Junction (UTJ) type solar cells. It can receive input from two solar panels and one external supply terminal simultaneously. Ideal diodes are provided in each input to isolate and block the reverse current during failure of any one of the solar panels. The module can accept a maximum input voltage of 14V from each panel and also has a feature to monitor the voltage and current of solar panels.

BATTERY CHARGE AND DISCHARGE REGULATOR

A Maximum Power Point Tracking (MPPT) based Battery Charge Regulator(BCR) is used to track the peak power of solar panel based on the pre programmed voltage point tracking. The BCR charges the battery in constant current mode and constant voltage mode based on the battery charge at an instant of time.

BCR has a hardware programmable option to set the maximum charge rate of battery(C/X). However,depending on available input power and external load conditions,the BCR prioritizes the external load current over the battery charge current.

Li-ion batteries or Li-polymer batteries can be interfaced to the BCR output. Provision to directly charge the battery from external supply is also given, when the system is integrated in the launch vehicle. The module also has a Provision for “dead-launch” operation when it is connected to the launch vehicle, The subsystems of EPS receive power only when it is separated from the launch vehicle.

VOLTAGE REGULATORS AND DISTRIBUTION ELECTRONICS

The voltage regulators and distribution electronics generate the required regulated voltages for the sub systems of the satellite. The unregulated voltage from battery or BCR will vary from 6V to 8.4V. With this voltage as input, regulated voltages of 5V and 3.3V are generated within the module for other sub system requirements. These are filtered out to reduce the ripple current.

The regulated output voltage from EPS is fed to a power distribution module where the supply voltages are switched through the current limited MOSFET switches and made available to the sub systems / sub modules. These switches can also be controlled through an I²C/SPI interface for load management based on battery status.

Note : Power distribution module is an add on card to this EPS module, which has 64 numbers of programmable current limited switches

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SPECIFICATIONS

INPUT SPECIFICATIONS

Solar panel input voltage	: 9VDC to 13VDC
Raw bus input voltage	: 11.5VDC to 13VDC

OUTPUT SPECIFICATIONS

PARAMETER	BATTERY BUS	5V BUS	3.3V BUS
Output Voltage(V) (with line and load regulation)	6.2V to 8.4V	5V ± 2%	3.3V ± 2%
Output Current (A)	Programmable	3A	3A
Ripple	500mV (pk-pk)	100mV(pk-pk)	100mV (pk-pk)

BATTERY SPECIFICATION (HARDWARE PROGRAMMABLE)

Battery voltage	: 6.2VDC to 8.4VDC
Charge current	: ≤ C/5
Discharge current	: ≤C/2

COMMUNICATION

I²C channel (1) - Battery voltage, battery current data communication using I2C

I²C channel (2) - On board temperature, solar panel current and voltage data communication using I2C

CONNECTORS

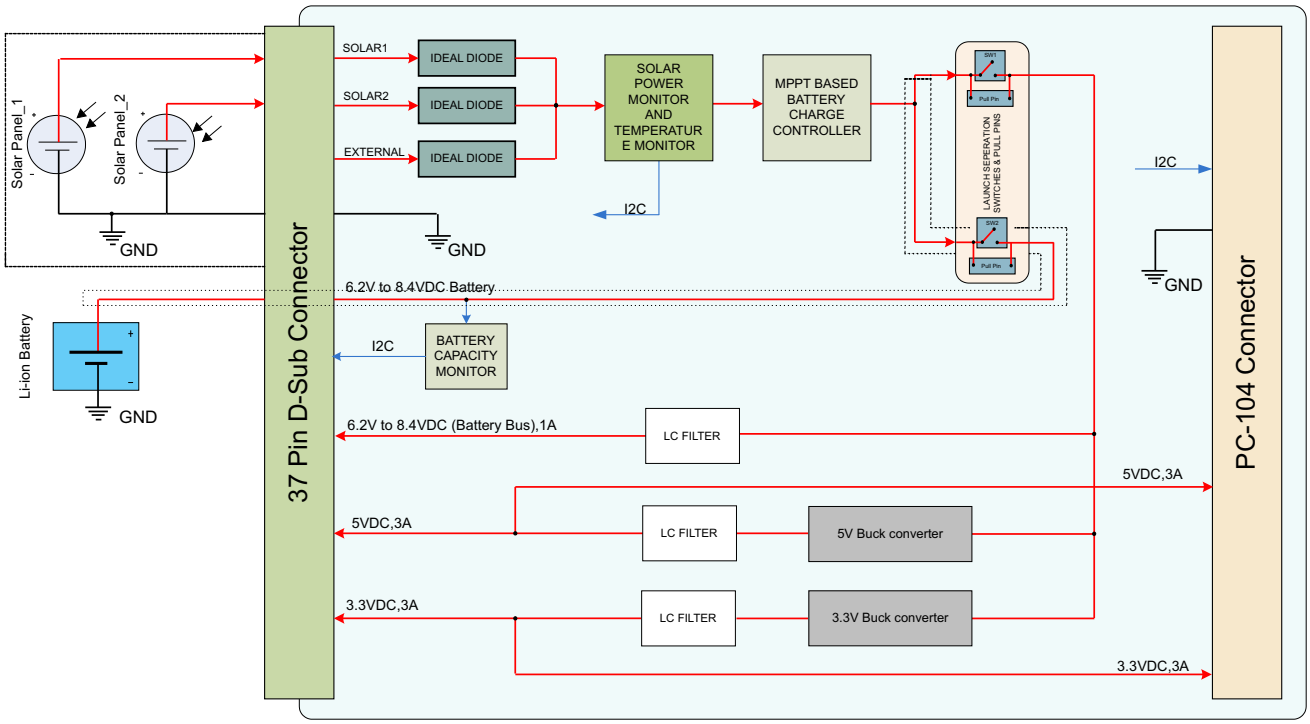
37 Pin D-connector – for solar panel input and bus power interface

PC104 connector – for power bus interface (Optional mount)

MECHANICAL

Form factor	: Standard cubesat module (Pc104 Form factor)
Dimension in mm	: 96(L) x 90(B) x 16(H)
Operating temperature	: -20°C to 70°C
Weight in gram	: <90

BLOCK DIAGRAM OF DP-PSU-7056



Note :

- - - - - - - - Solar panel interface and Battery charge and discharge regulator