For systems requiring a regulated 28 to 50 volt power bus a Sequential Switching Shunt Regulator (S3R) module can be provided. The S3R module accommodates eight independent shunt cells. The design is targeted at any types of solar array technology.

The power regulation is based on sequential shunt switching techniques. One module provides eight independent shunt cells, controlled by one common Main Error Amplifier (MEA) control signal.

Each shunt cell has the means to either shunt the section current by a “parallel” switch or to feed the section current to the main bus via two series diodes.

The regulation method is based on sequential switching, that is:

- N cells are continuous off and provide full section current to the bus
- # N+1 cell alternates on/off according to MEA control signal
- Eight – (N+1) are continuous on and the sections are shunted

Modules can be cascaded for increased power capability.

Optionally, an additional protected shunt cell can be accommodated to secure the bus regulation in case one cell fails into permanent off condition.

One cell failure can lead to the loss of one solar array section only.

Each shunt cell is a self contained function deriving its own supply voltage from the main bus. This secures a system always able to recover bus voltage regulation from any unforeseen condition.

References:

- Two modules onboard each of the four Galileo IOV spacecrafts. The first two spacecrafts were launched in October 2011.
Specifications:

Dimensions (L x W x H) 193 x 150 x 24 [mm]
Mass 480 gram
Bus voltage 28 - 50 volt
S3R cells 8
Maximum solar array section current 5 ampere
Maximum solar array section capacitance 0.5 µF
Over-voltage Protection shunt cell (optional) 1
Output power capability 1200 Watt
Maximum power dissipation @ Pout = 1200 W < 33 Watt
Internal consumption < 2.6 Watt
Current TM inaccuracy < 2 %
Shunt cell switch status TM 8 (+1)
Transfer efficiency > 97.8 %
Solar Array Simulator input up to 8 x 5 Ampere

S3R Shunt Regulator Functional Schematic