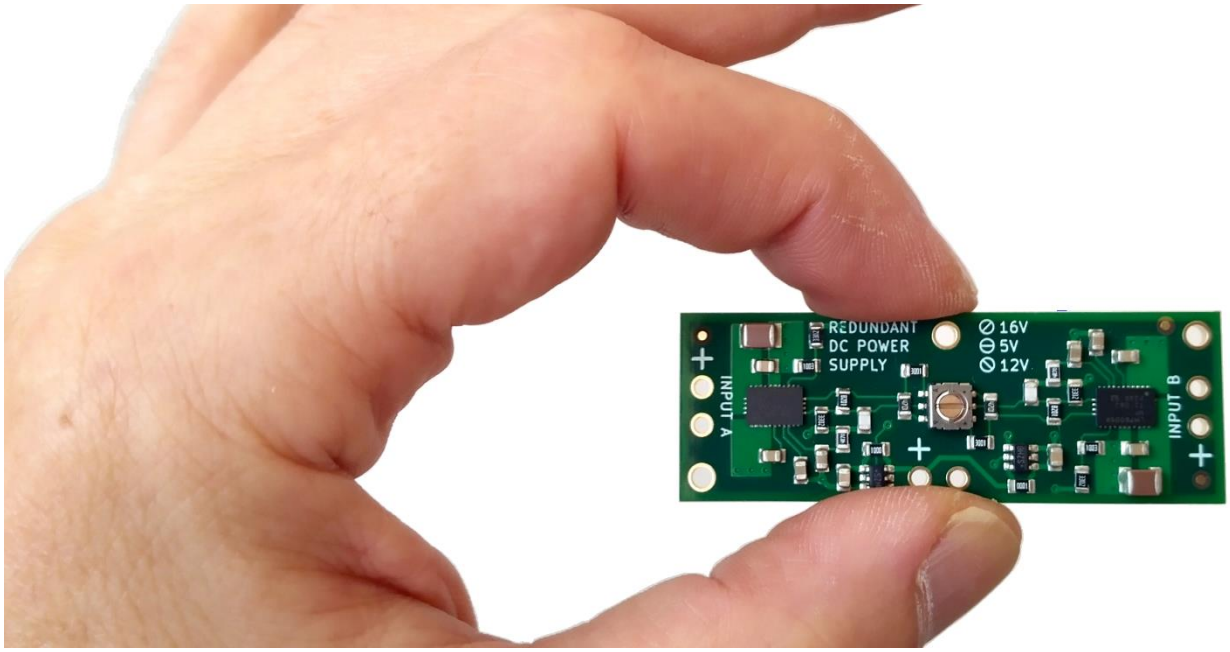
MILLSWOOD
engineering

Redundant DC Power Supply

DATA SHEET

General Description

The Redundant DC Power Supply consists of two identical DC-DC switching converters and a low-loss (ideal diode) power combining stage. It is intended as a high-reliability source of power for mission critical UAV sub-systems.

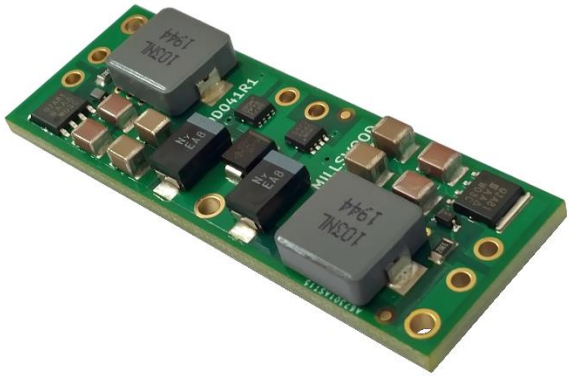


The output voltage may be set to 5, 12 or 16V using the on-board switch and a screwdriver.

Inputs are reverse polarity protected, and the input voltage range extends to +50VDC, allowing direct connection of LiPos up to 12S.

Each DC-DC converter is capable of delivering up to 3 Amps continuously with up to 96% efficiency.

The output tolerates a short-circuit to ground indefinitely.



The Redundant DC Power Supply weighs 13g and is 57 x 20 x 9.2mm.

Specifications

Electrical:

Input voltage	Operational: V_{OUT}+2.5 to +50 VDC Absolute maximum: -60 to +60 VDC
Output voltage	5, 12 or 16 VDC, user-selectable via 3 position switch
Output current	3 Amps continuous (thermal de-rating applies)
Quiescent current consumption	5mA maximum (per converter) over operational input voltage range

Miscellaneous:

Thermal resistance (device to ambient)	23°C/W (temperature rise per Watt of dissipated power in still air)
Maximum device temperature	+105°C (see Thermal Management section below)
Dimensions (L x W x H)	57 x 20 x 9.2mm
Weight	13g
Mounting	3 x 2.1mm diameter holes (sized for M2 screws), located on 15 x 26mm grid
Connections	3 pairs of 1.65mm diameter through-holes, suitable for direct soldering of wires or fitment of Harwin M80 series right-angle connectors (Harwin part number M80-5000000MC-02-333-00-000)

Thermal Management

All power conversion devices generate heat, and getting rid of this unwanted heat is one of the main factors limiting maximum continuous output current.

For reliable operation in still air with no additional heatsinking measures in place, the output current must be de-rated as shown in graphs 4, 5 and 6 in the Safe Operating Area section. Failure to de-rate adequately may lead to thermal shutdown of a DC-DC converter. Although the converter will cool down and restart after a few seconds, it will produce no output whilst doing so.

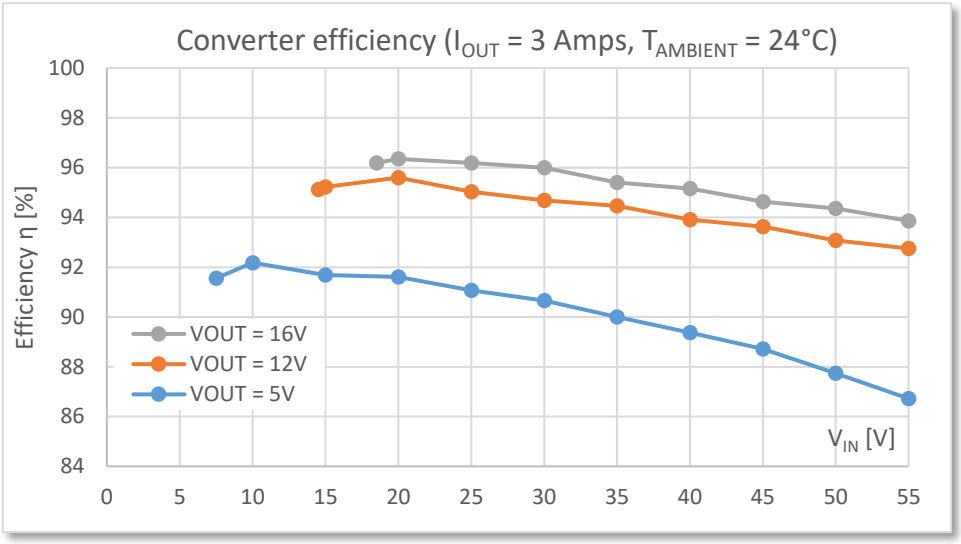
Because this device contains two DC-DC converters operating as a redundant pair, thermal shutdown events may go largely unnoticed and not result in any obvious change in function or performance. However, redundancy should not be relied upon to mitigate against clearly foreseeable events, such as thermal shutdown due to poor thermal management.

Heatsinking the device to a larger thermally conductive surface will significantly improve thermal performance and allow operation over a much wider ambient temperature range. One possible arrangement is to mount the device to a flat metal surface using three M2 screws each passing through a 5mm spacer. A compressible thermal gap filler with a thickness of 1 to 1.5mm (0.04 to 0.06 inches) should be sandwiched between the inductors and the metal surface. Be careful not to bend or stress the board when tightening the screws. Use Loctite to secure any threaded fasteners which compress the board (fibreglass creeps over time).

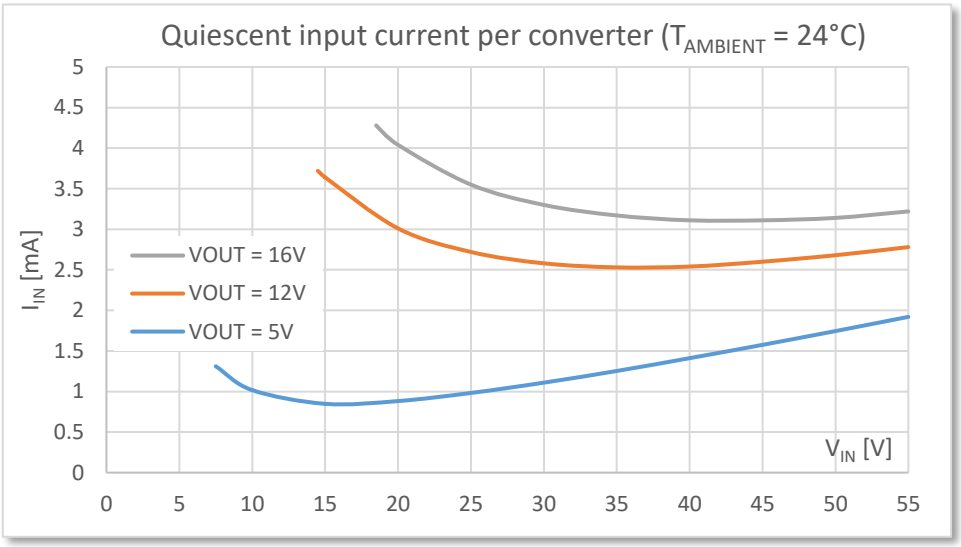
Gluing the inductors directly to a metal surface is another option.

The graphs shown in the Safe Operating Area section apply to the worst case situation of the device mounted horizontally in still air. Measurements have shown that the converters shut down when the inductor temperature reaches approximately 112°C. If the inductors are maintained well below this temperature, then the graphs in the Safe Operating Area section do not apply and rated current may be drawn across a much wider range of ambient temperatures.

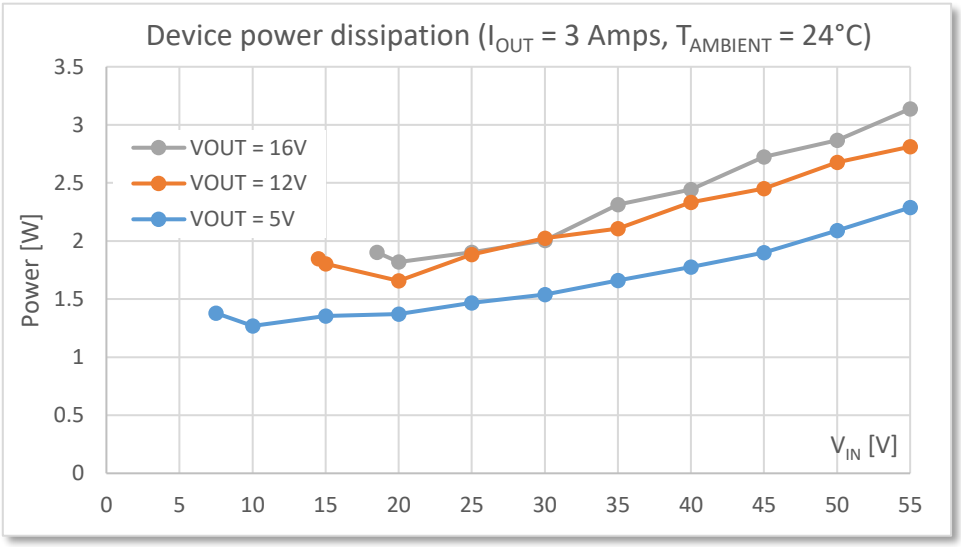
Typical Characteristics



Graph 1 – Typical converter efficiency at rated current

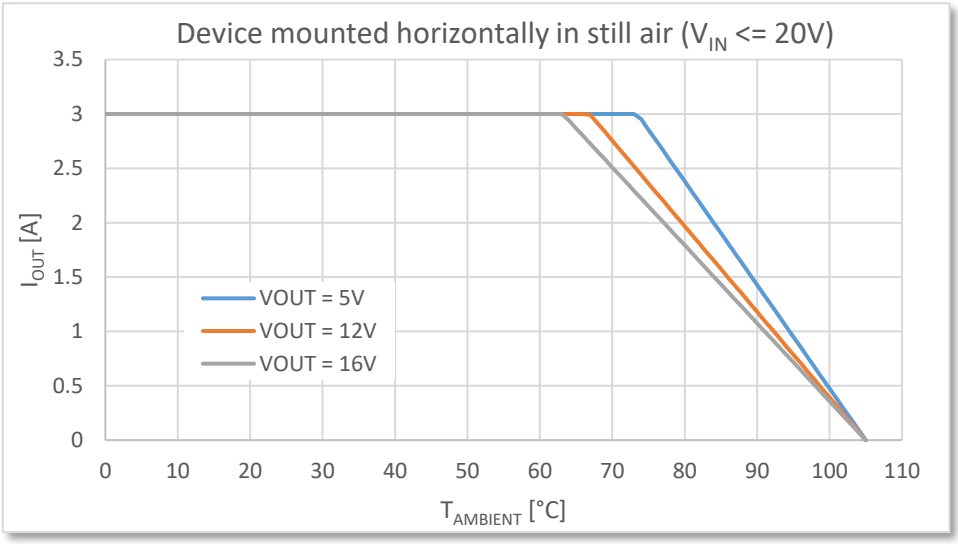


Graph 2 – Typical quiescent input current per converter

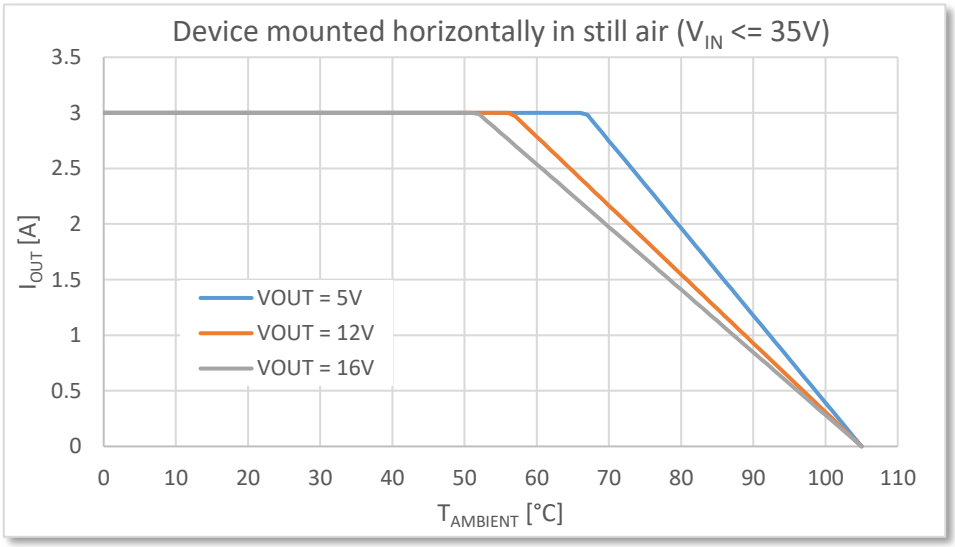


Graph 3 – Typical device power dissipation at rated current

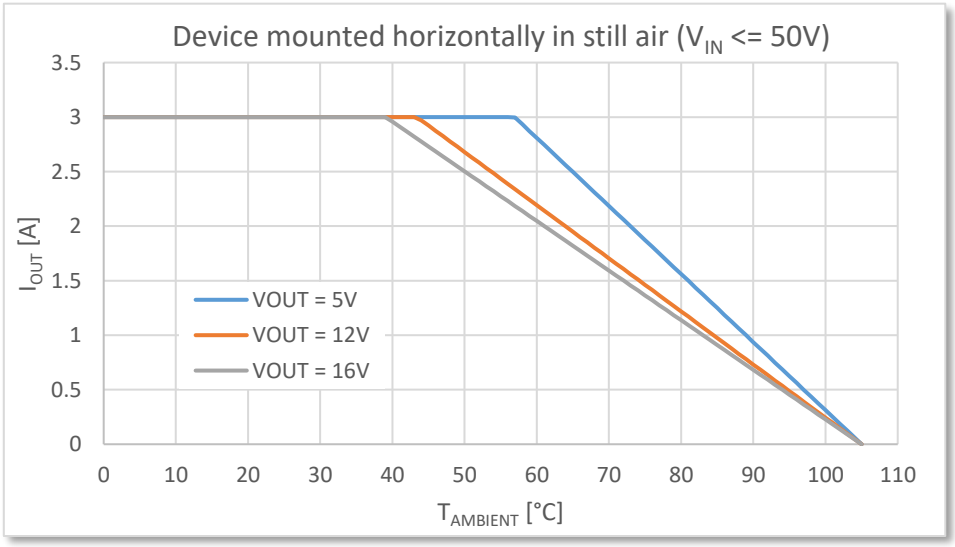
Safe Operating Area



Graph 4 – Maximum continuous output current for input voltages up to 20V



Graph 5 – Maximum continuous output current for input voltages up to 35V



Graph 6 – Maximum continuous output current for input voltages up to 50V

Additional notes

- Input voltages do not need to be the same. As long as both input voltages meet the input voltage requirements, then normal redundant operation will occur.
- Inputs may be shorted together if only a single power source is available.
- Converters do not necessarily share load current, and it is not predictable which converter will supply load current at any given time.
- Switchover from one converter to the other is smooth and does not exhibit any transient loss of output voltage.
- Ground inputs and mounting holes are all connected together internally.
- And finally, ***don't ignore thermal management***. Because this device is very small, power dissipation can cause its temperature to rise rapidly, with potentially catastrophic consequences. Use a heatsink if at all possible. If in doubt, measure.