



PRODUCT PREVIEW

FEATURES:

- Wide input +70VDC to +130VDC
- Regulated quad output +5VDC, +3.3VDC, and ±12V; or tri-output +5VDC, and ±12V
- 20 Watts total power
- 85% typical efficiency
- 250kHz fixed frequency input
- Internally synchronized
- Over current protection
- Input under-voltage lockout
- Output enable
- Power good status
- Power Bus Disconnect

APPLICATIONS:

- 100VDC spacecraft power systems
- Radiation Hard Environment
 - 100kRAD (Si) TID
 - 50kRad (Si) ELDRS
 - 86 MeV/(mg/cm²) SEE
- MIL-STD-975 internal de-rating criteria
- Operating Temperature -55°C to 125°C
- Storage Temperature -65°C to 150°C

PRODUCT STATUS

This document contains information on a product under development. Micropac reserves the right to change or discontinue this product without notice.

DESCRIPTION

The 56500 is a radiation compliant isolated DC-DC converter designed for demanding satellite and spacecraft power distribution systems. It is fully characterized for expected radiation environments.

RADIATION CRITERIA

| Test | Conditions | Min | Unit |
|--|---|-----|---------------------------|
| Total Ionization Dose | MIL-STD-883, Method 1019 Operating bias applied during exposure | 100 | kRads (Si) |
| Single Event Effects SEU, SEL, SEGR, SEB | Heavy ions (LET) Operating bias applied during exposure, Full Rated Load, V _{IN} = 70V | 86 | MeV/(mg/cm ²) |
| ELDRS | MIL-STD-883, Method 1019, Condition D | 50 | kRads (Si) |

ABSOLUTE MAXIMUM RATINGS

Maximum Input Voltage (V_{IN}) 140 VDC
 Storage Temperature Range (T_S) -65°C to 150°C
 Operating Case Temperature Range (T_C) -55°C to 125°C
 Lead Temperature 260°C for 10 Sec

ELECTRICAL SPECIFICATIONS T_C = -55°C to 125°C, V_{IN} = 100VDC ±5%; unless otherwise specified.

Micropac Industries cannot assume any responsibility for any circuits shown or represent that they are free from patent infringement. Micropac reserves the right to make changes at any time in order to improve design and to supply the best product possible.

| Parameter | Symbol | Conditions | Min | Max | Unit |
|-------------------------------------|------------------------------|--|--------------|--------------|---------------------|
| Input Bus Voltage | V_{IN} | | 70 | 130 | V |
| Input Under Voltage Protection | V_{UVP} | | | 60 | V |
| Input Over Voltage Protection | V_{OVP} | | 140 | | V |
| Inrush Current | $I_{IN-PEAK}$ | Full Load | | 200 | % |
| Input Ripple Current | I_{RIPPLE} | Full Load | | 100 | mAp-p |
| Output Power (average) | $P_{O(average)}$ | $I_{OUT3.3}$ to 3.4A, $I_{OUT5.0}$ to 0.780A ³ | | 20 | W |
| Average Bus Current | $I_{NOPEN(A)}$ | At Disconnect ¹ | 0.3 | | A |
| Peak Bus Current | $I_{NOPEN(P)}$ | At I Disconnect ² | | 5 | A |
| Control On | V_{CONT} | | 2.5 | | V |
| Control Off | V_{CONT} | | | 0.8 | V |
| Control Reset time | $I_{N_{TIME}}$ | From cold start or from fault | 100 | | msec |
| Input to Output Isolation | $I_{O_{ISO}}$ | Input to Output Breakdown | 1,000 | | V |
| Line Rejection | LR_{dB} | | 60 | | dB |
| Outputs | | | | | |
| +3.3VDC +5VDC | $V_{OUT3.3}$ $V_{out5.0}$ | $I_{OUT3.3} = 3.4A$ $I_{OUT5.0} = 0.780A$ | 3.27 4.95 | 3.34 5.05 | V |
| Output ripple voltage (each output) | V_{RIP} | 50% Load | | ±50 | mV |
| Efficiency | □ | 50% Load for all outputs | 85 | | % |
| Phase Margin (each output) | \emptyset_{Mar} | Dependent on load capacitance ⁵ | 45 | | \emptyset° |
| Power Good | PG | +3.3V,5V, and ±12V | -11 | +11 | % |
| Step load (each output) | Response Recovery | I_{OUT} from 50% to 100% I_{OUT} from 1000% to 50% | | 300 200 | mVpk μS |
| Step line (each output) | Response Recovery | V_{IN} from 70VDC to 130VDC V_{IN} from 130VDC to 70VDC | | 300 200 | mVpk μS |
| | | | | | |
| ±12VDC | V_{+12} , & V_{-12} | I_{OUT} at 100mA | | ±1.5 | % |
| Load Regulation (each output) | V_{LR} | I_{OUT} from 20mA to 200mA | | ±5 | % |
| Ripple ⁴ (each output) | | Full Load | | 50 | mV _{pp} |
| Step Load (each output) | Response Recovery | I_{OUT} from 50% to 100% I_{OUT} from 1000% to 50% | | 500 200 | mVpk μS |
| Step Line (each output) | Response Recovery | V_{IN} from 70VDC to 130VDC V_{IN} from 130VDC to 70VDC | | 100 200 | mVpk μS |

NOTES:

Micropac Industries cannot assume any responsibility for any circuits shown or represent that they are free from patent infringement. Micropac reserves the right to make changes at any time in order to improve design and to supply the best product possible.

1. Bus Disconnect Current steady state is the maximum average current before the Converter is disconnected from the Bus. Reset is achieved by cycling the Control OFF / then ON.
2. Peak Current allowed from Power In with an I^2t response from no load. Peak value is less when current surges occur from operating currents.
3. No-load operation will not cause excessive over voltage or damage.
4. Output ripple measured as $<1\%$ Peak-Peak of nominal output / frequency domain of 100Hz – 50 MHz.
5. A minimum of 500 μ fd distributed capacity is required for the specified minimum $\varnothing_{Mar} = 45$ degrees.

THEORY OF OPERATION

The 56500 is a radiation compliant by design, dual output, 20W DC-DC converter specifically designed to support demanding spacecraft power requirements. The design topology is a 5V, 3.4A push-pull converter and a 3.3V, 0.76A synchronized buck converter. Either or both of the outputs may be used for a total combined power output up to 20W.

Transformer coupling is used for Power, Feedback, and Synchronization isolation. The Power Good signal is optically isolated. The Inhibit / Shutdown Control allow external control of the converter output. An Over-Current Switch in the input power path provides for a redundant means of Power Bus disconnect in the event of a catastrophic failure in the converter or if the converter detects an overload in the output. The Inhibit / Shutdown Control also provide a means to reset the Over-Current Switch for fault retry and power management. The input steady state protected current is 0.3A (30W input) and an Instant Trip current 5A maximum. The 5V and 3.3V outputs are individually short circuit protected. The Bus Power Disconnect has a power limit of 30W @ 100V in.

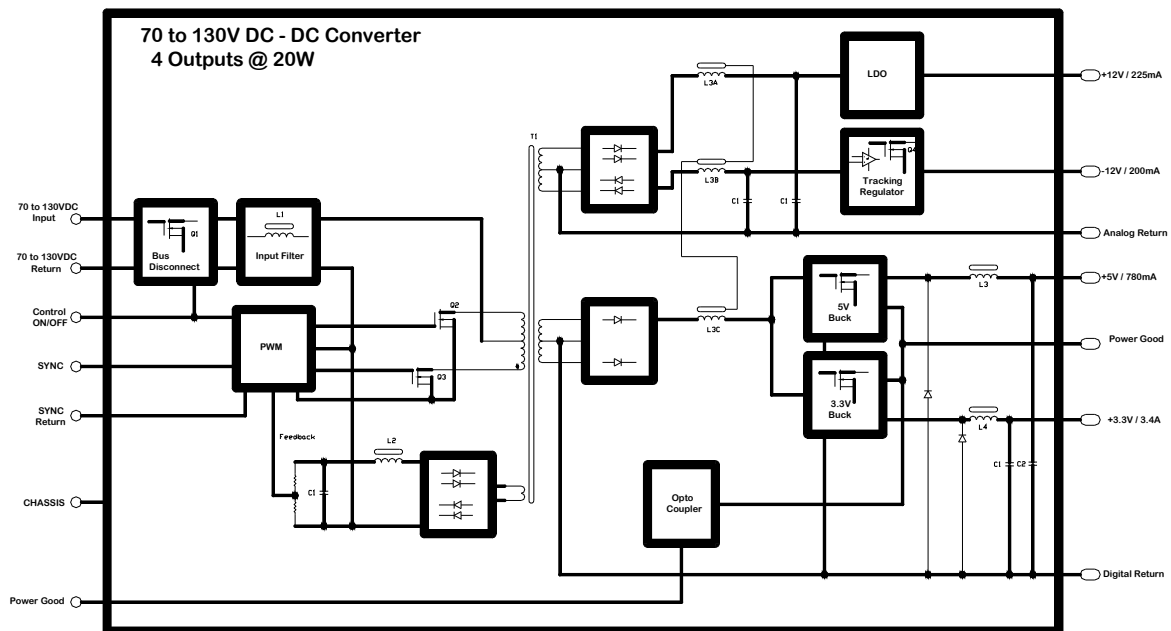


Figure 1: Isolated DC/DC Converter Functional Block Diagram

Micropac Industries cannot assume any responsibility for any circuits shown or represent that they are free from patent infringement. **Micropac** reserves the right to make changes at any time in order to improve design and to supply the best product possible.

DESIGN TOPOLOGY

The DC-DC Converter consists of a Push-Pull isolated converter feeding an internal 3.3V and 5.0V synchronized buck regulators, and ± 12 VDC linear regulators. The combined operating output power for the 3.3VDC, 5VDC, and ± 12 VDC converters is limited to a total rated power of 20 watts. Galvanic isolation is provided between Power Bus, base plate and the regulated outputs using magnetic and optical networks.

I²t FAULT BUS PROTECTION

The I²t fault bus protection circuit provides converter over-current protection and bus protection in the event of converter failure. The I²t fault bus protection provides the 0.3A input to the converter steady state.

INPUT FILTER PWM BIAS

The input filter design provides EMI suppression. Also within this functional block is the PWM bias supply consisting of a bus supplied start voltage and a power transformer supplied run voltage.

PWM CONTROLLER

The PWM controller is push-pull current mode with integrated MOSFET drivers.

POWER GOOD

Power Good is reported in real time on the isolated 5VDC, 3.3VDC, and ± 12 VDC side and opto-coupled to the power input side of the converter as a means of managing out of tolerance voltage conditions.

5V ISOLATED FEEDBACK

The Boost Voltage Supply is used to determine the input PWM operating point to provide +12VDC input for the 5.0VDC and the 3.3VDC isolated Buck Regulators and a (+) and (-) for the ± 12 VDC Linear Regulators. No other regulation is required from output to input.

MODULE INPUT INTERFACE

- +DC Bus Voltage Input
- +DC Bus Voltage Return
- Control Logic Input
- Logic Return
- Sync Input control, –Master / Slave.
- Sync clock input
- Chassis Ground

MODULE OUTPUT INTERFACE

- +12.0VDC
- ± 12.0 VDC Analog return
- -12.0VDC
- +3.3VDC
- +5.0VDC
- +3.3VDC & 5.0VDC Digital return
- Power Good

Micropac Industries cannot assume any responsibility for any circuits shown or represent that they are free from patent infringement. **Micropac** reserves the right to make changes at any time in order to improve design and to supply the best product possible.

MECHANICAL FEATURES

- Mass: Estimated, 100gm (3.5oz)
- Estimated Cavity Dimensions: 1.9in x 1.9in x 0.400in. Dimensions may change in final layout & package design.
- Final dimensions and pin-out to be determined.

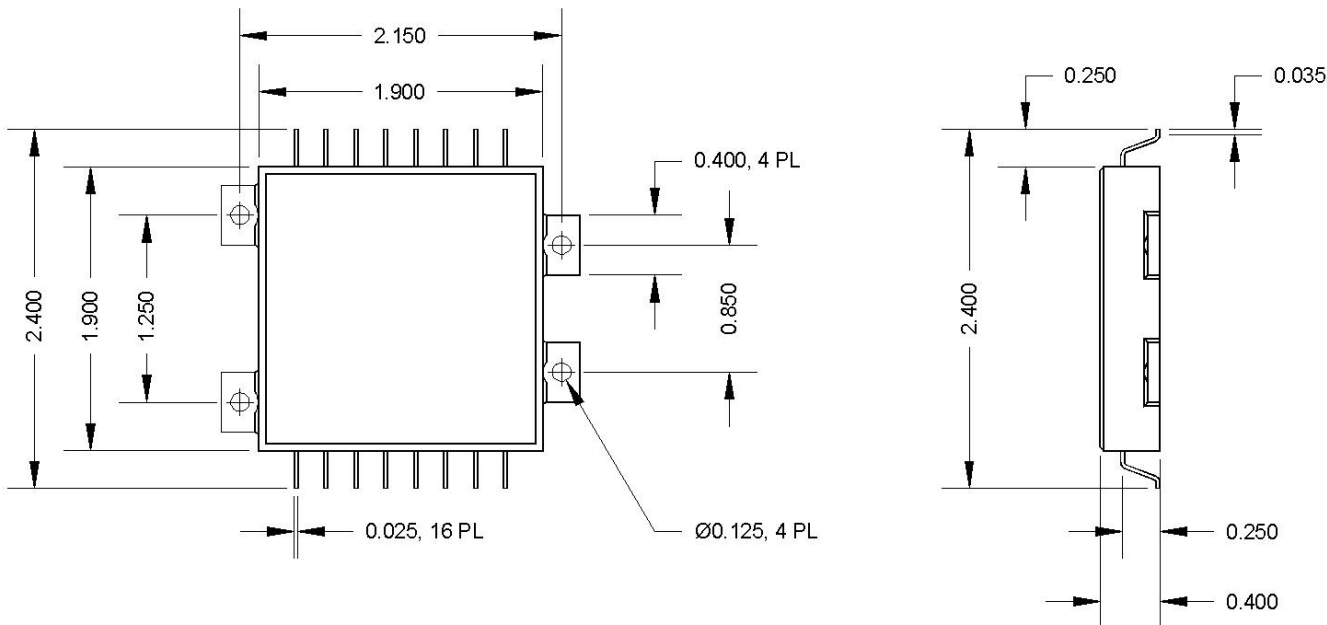


Figure 2: Case Outline (For Reference Only.)

ORDERING INFORMATION

| Part Number | Description |
|--------------------------|--|
| 56500-100-5-3R3-12 PROTO | 100V _{IN} ; 3.3V _{OUT} ; 5V _{OUT} ; ±12V _{OUT} ; 20W; For Engineering Evaluation |
| 56500-100-5-3R3-12FLT | 100V _{IN} ; 3.3V _{OUT} ; 5V _{OUT} ; ±12V _{OUT} ; 20W; MIL-PRF-38534 Table C-XI screened to Class K |
| 56500-100-5-12-PROTO | 100V _{IN} ; 5V _{OUT} ; ±12V _{OUT} ; 20W; For Engineering Evaluation |
| 56500-100-5-12-FLT | 100V _{IN} ; 5V _{OUT} ; ±12V _{OUT} ; 20W; MIL-PRF-38534 Table C-XI screened to Class K |

EXPORT CLASSIFICATION

An export license has not yet been obtained. Contact the factory for further information.

Micropac Industries cannot assume any responsibility for any circuits shown or represent that they are free from patent infringement. Micropac reserves the right to make changes at any time in order to improve design and to supply the best product possible.