

ARC-SGHF2805S* – 19V-39V Input 15W output DC/DC converter Space application

* Preliminary datasheet based on prototype models

Design

ARC-SGHF2800S isolated hybrid DC/DC converter series is a design, based on European components, made to keep robust performance in the harsh space environment.

The design complies with the derating rules specified in ECSS-Q.ST-30-11C (till 85°C, while the converter operates within maximum rating up to 125°C), and the qualification and production is studied to meet the generic procurement requirements for hybrids ECSS-Q-ST-60-05C.

The converter is switching at a fix frequency, in the range 400kHz-450kHz, and take the advantages of a magnetic feedback (no optocoupler used) resulting in high radiation levels tolerance.

The metal sealed package is designed to dissipate the power reducing the temperature stress on junctions of silicon devices. The case is also flanged to achieve robustness against vibrations.

The design documentation is including worst case and part stress analysis and reliability analysis.

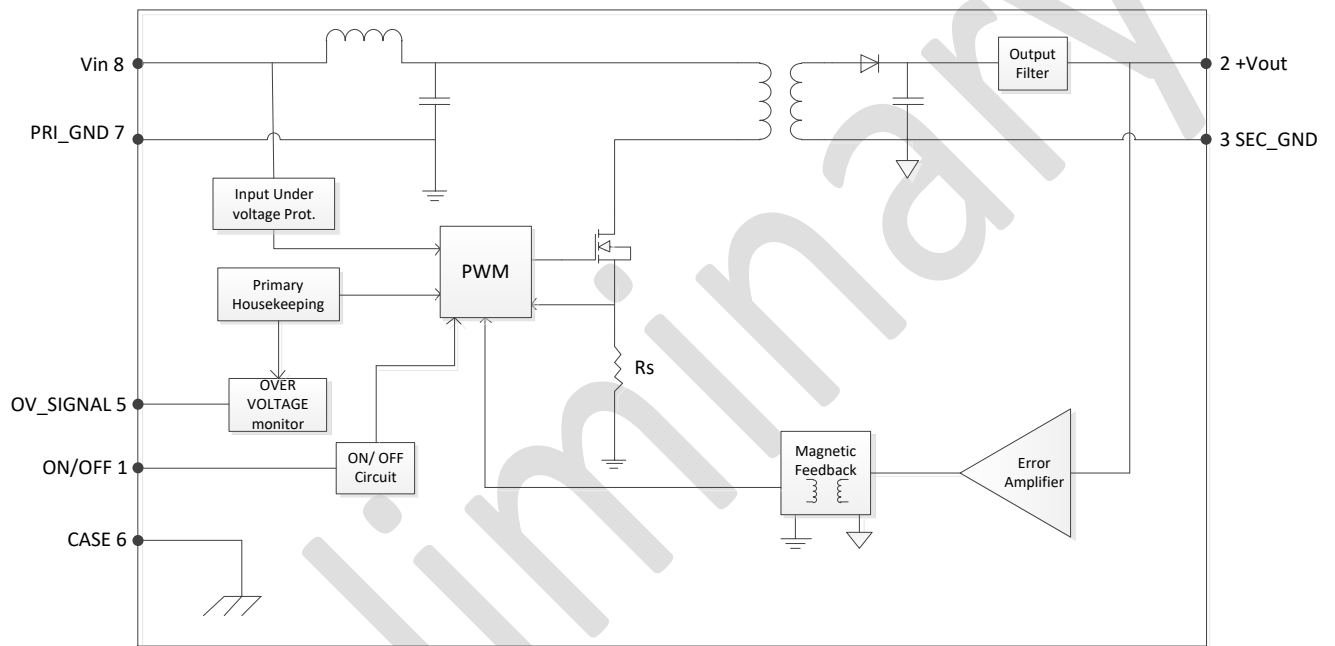


Features

- Input voltage 19V-39V
- Input fault tolerance 50V
- Operating temperature range:
 - -55°C ÷ +125°C (12W @125°C)
 - -55°C ÷ +85°C (15W @85°C, within ECSS-Q.ST-30-11C-recommend T range)
- ON/OFF capability
- Input under-voltage protection with activation hysteresis
- Output over-voltage monitor at primary side (suitable to supply satellites critical loads)
- Overcurrent/short circuit protection
- Radiation tolerance¹:
 - TID: 50Krad and 100Krad versions
 - SEE 85 MeV-cm²/mg
- Magnetic coupled feedback
- Export restriction free

¹ Radiation tolerance based on components screening and unit level analysis. Unit level screening to be performed.

Block diagram



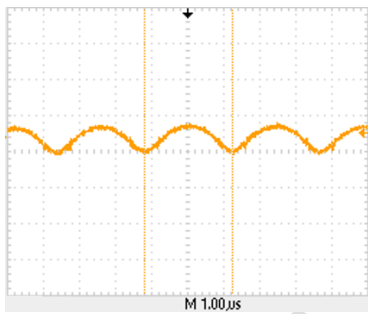
Electrical characteristics and performances

Performances in the range $-55^{\circ}\text{C} \div +85^{\circ}\text{C}$, input voltage 28V, full load; unless otherwise specified.

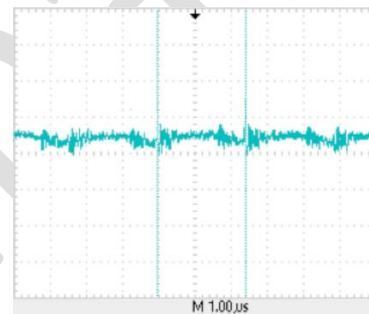
ARC-SGHF2805S					
Parameter	Description	Min	Typ	Max	Unit
Input Section					
Operating input voltage	ECSS-Q-ST-30-11C compliant	19	28	39	V
Fault input voltage tolerance	Continuous	-	-	50	V
Under voltage lockout	ON threshold	16.8	-	17.2	V
	OFF threshold	15.6	-	16.0	V
Ripple current	20Hz to 10Mhz	-	35	100	mApp
No load current	On condition no load connected	-	35	-	mA
OFF condition current		-	3	4	mA
Output Section					
Voltage	$-55^{\circ}\text{C} \div +85^{\circ}\text{C}$	4.92	5.00	5.08	V
Power	$-55^{\circ}\text{C} \div +85^{\circ}\text{C}$ (ECSS-Q-ST-30-11C compliant)	0	-	15	W
	125°C	0	-	12	W
Current	$-55^{\circ}\text{C} \div +85^{\circ}\text{C}$ (ECSS-Q-ST-30-11C compliant)	0	-	3	A
	125°C	0	-	2.4	A
Ripple voltage	Switching frequency	-	15	30	mVpp
Spikes	High frequency	-	-	100	mVpp
Line regulation	19V to 39V input	-	1	5	mV
Load regulation	0A to 3A load	-	10	20	mV
Load step	Half to full load	-	80	100	mV
	Recovery time	-	300	400	μsec
Start up overshoot	0V to 28V	-	-	100	mV
Start up rise time	0V to nominal output voltage	-	-	15	msec
Load fault power dissipation	Overload	-	-	8	W
Functions					
Inhibit	ON (High impedance at PIN1)	Open collector or unconnected			-
	OFF (PIN 1 grounded to PRI_GND)	0	-	0.5	V
Overvoltage Monitor	Activation above nominal output voltage ²	120	-	135	%
	Not active signal	0	-	0.3	V
	Active signal	4.5	-	-	V

² Between 15% load to full load

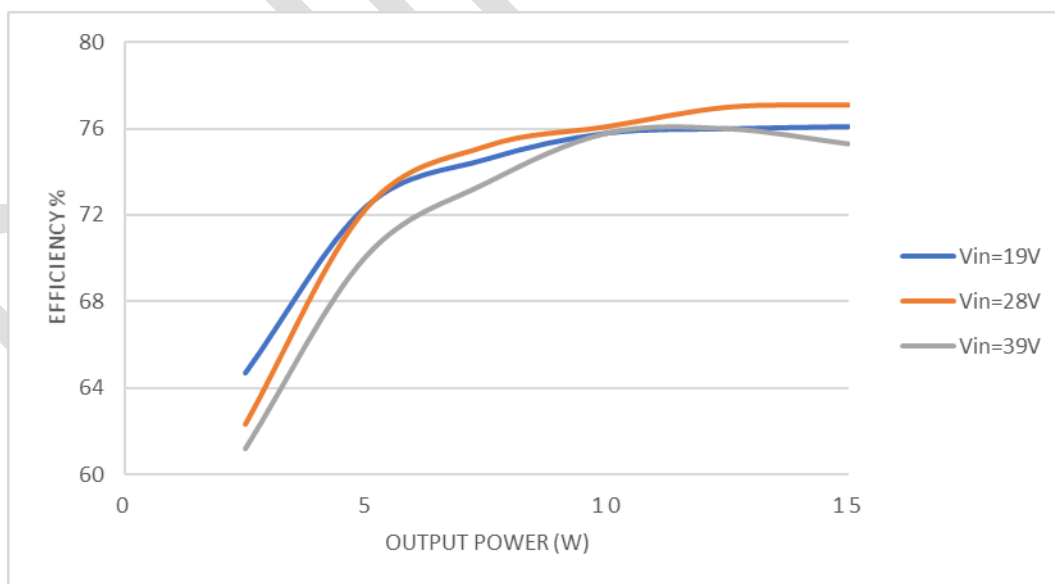
ARC-SGHF2805S					
Parameter	Description	Min	Typ	Max	Unit
Other data					
Efficiency	@25°C	-	77	-	%
Capacitive load		-	-	350	μF
Switching frequency	Fix frequency	400	-	450	kHz
Isolation	500V DC, case temperature 25 °C	100	-	-	MΩ
Storage temperature		-65	-	155	°C
Soldering temperature		-	-	300	°C
Weight		-	-	35	g



Typical input ripple current
@ switching frequency; 28V In; 3A Out (50mA/div)



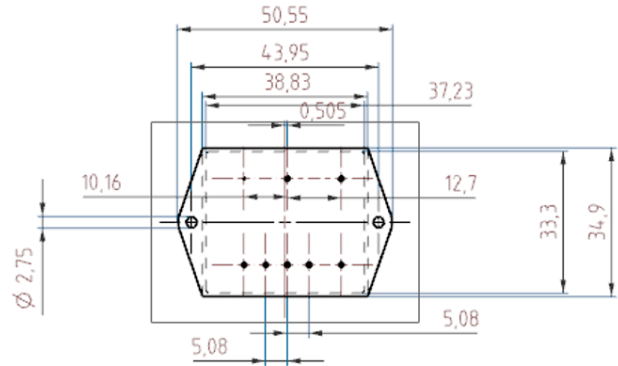
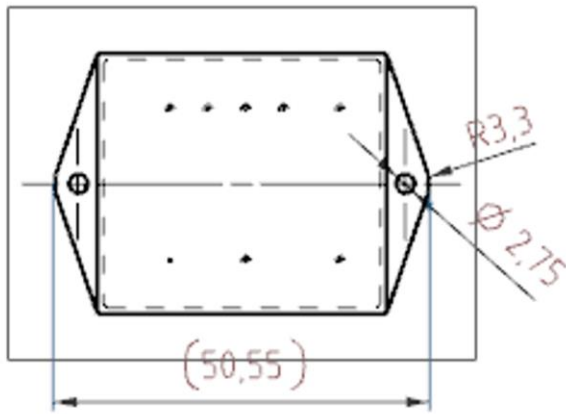
Typical output ripple voltage
@ switching frequency; 28V In; 3A Out (50mV/div)



Efficiency @ 25°C

Case and pin out

All dimensions in mm.



Case Dimension

Tolerance: +/-0.13 for three decimal places; +/-0.3 for two decimal places

Soldering

Heat from may damage the device. Solder pins individually with heat application not exceeding 300°C for 10 seconds.

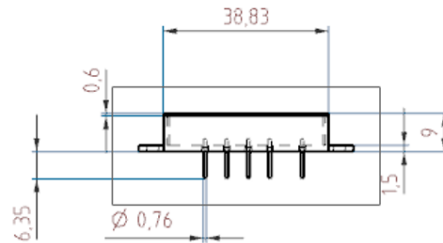
Materials:

Header: Steel/Nickel/Gold

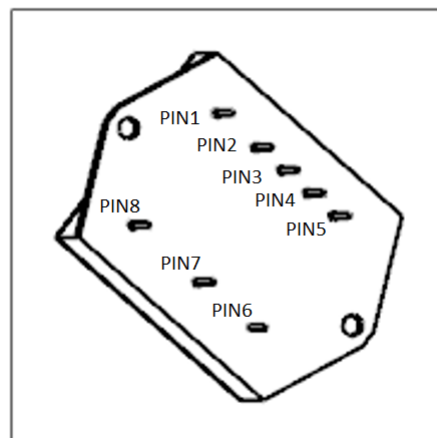
Cover: Steel/Nickel/Gold

Pins: Iron-Nickel Alloy 52/Gold compression glass seal; Gold Plating of 1.27-3.81 µm included in pin diameter

Seal Hole: 2 ±0.05 glass

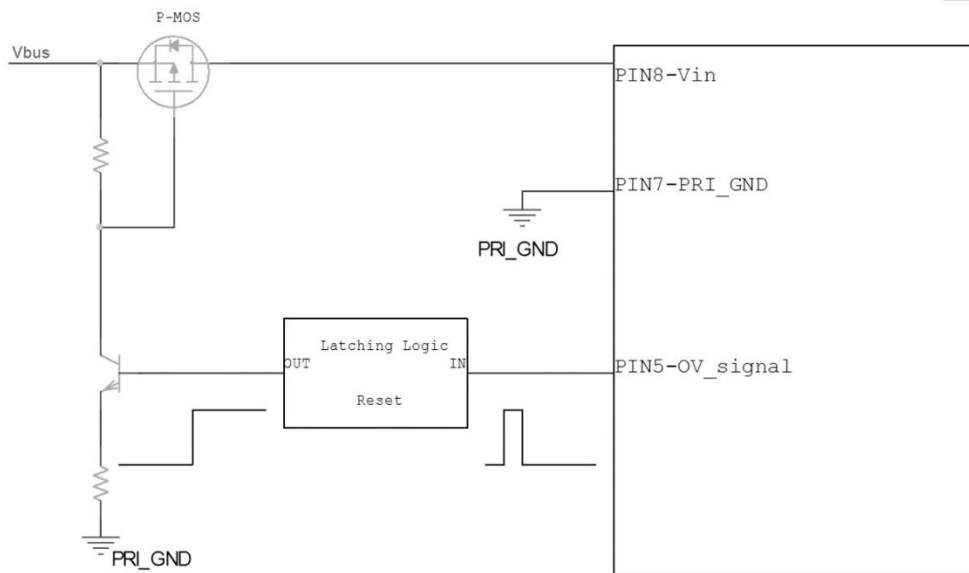


PIN number	Function
1	ON/OFF
2	+Vout
3	SEC_GND
4	-Vout (or NC is case of single output)
5	OV_SIGNAL
6	CASE
7	PRI_GND
8	Vin



Overvoltage monitor and protection

PIN 5 provides an overvoltage signal: 0V in normal operation and 5V in case of output overvoltage; the protection and its reset capability must be implemented by adding components outside the hybrid. The protection circuit must be latching, being the overvoltage signal going again to 0V when the converter is switched off.



Preliminary

Preliminary

Other ARC-SGHF2800S family DC DC converters– single output

Parameter	Description	ARC-SGHF283V3S			ARC-SGHF2812S			ARC-SGHF2815S			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Section											
Operating input voltage	ECSS-Q-ST-30-11C compliant	19	28	39	19	28	39	19	28	39	V
Fault input voltage tolerance	Continuous	-	-	50	-	-	50	-	-	50	V
Under voltage lockout	ON threshold	16.8	-	17.2	16.8	-	17.2	16.8	-	17.2	V
	OFF threshold	15.6	-	16.0	15.6	-	16.0	15.6	-	16.0	V
Ripple current	20Hz to 10Mhz	-	35	100	-	35	100	-	35	100	mApp
No load current	On condition no load connected	-	35	-	-	35	-	-	35	-	mA
OFF condition current		-	3	4	-	3	4	-	3	4	mA
Output Section											
Voltage	-55°C ÷ +85°C	3.20	3.30	3.40	11.75	12.00	12.25	14.70	15.00	15.30	V
Power	-55°C ÷ +85°C (ECSS-Q-ST-30-11C compliant)	0	-	10	0	-	15	0	-	15	W
Current	-55°C ÷ +85°C (ECSS-Q-ST-30-11C compliant)	0	-	3	0	-	1.25	0	-	1	A
Ripple voltage	Switching frequency	-	15	30	-	20	40	-	20	40	mVpp
Spikes	High frequency	-	-	100	-	-	100	-	-	100	mVpp
Line regulation	19V to 39V input	-	1	5	-	1	5	-	1	5	mV
Load regulation	0A to 3A load	-	10	20	-	10	20	-	10	20	mV
Load step	Half to full load	-	80	100	-	80	100	-	80	100	mV
	Recovery time	-	300	400	-	300	400	-	300	400	µsec
Start up overshoot	0V to 28V	-	-	100	-	-	100	-	-	100	mV

		ARC-SGHF283V3S			ARC-SGHF2812S			ARC-SGHF2815S			
Parameter	Description	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
Start up rise time	0V to nominal output voltage	-	-	15	-	-	15	-	-	15	msec
Load fault power dissipation	Overload	-	-	8	-	-	8	-	-	8	W
Functions											
Inhibit	ON (High impedance at PIN1)	Open collector or unconnected			Open collector or unconnected			Open collector or unconnected			
	OFF (PIN 1 grounded to PRI_GND)	0	-	0.5	0	-	0.5	0	-	0.5	V
Other data											
Efficiency	@25°C	-	72	-	-	80	-	-	80	-	%
Capacitive load		-	-	350	-	-	150	-	-	150	μF
Switching frequency	Fix frequency	400	-	450	400	-	450	400	-	450	kHz
Isolation	500V DC, case temperature 25 °C	100	-	-	100	-	-	100	-	-	MΩ
Storage temperature		-65	-	155	-65	-	155	-65	-	155	°C
Soldering temperature		-	-	300	-	-	300	-	-	300	°C
Weight		-	-	35	-	-	35	-	-	35	g

ARC-SGHF2800D family DC DC converters – dual output (in development)

Parameter	Description	ARC-SGHF2805D			ARC-SGHF2812D			ARC-SGHF2815D			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Section											
Operating input voltage	ECSS-Q-ST-30-11C compliant	19	28	39	19	28	39	19	28	39	V
Fault input voltage tolerance	Continuous	-	-	50	-	-	50	-	-	50	V
Under voltage lockout	ON threshold	16.8	-	17.2	16.8	-	17.2	16.8	-	17.2	V
	OFF threshold	15.6	-	16.0	15.6	-	16.0	15.6	-	16.0	V
Ripple current	20Hz to 10Mhz	-	35	100	-	35	100	-	35	100	mApp
No load current	On condition no load connected	-	35	-	-	35	-	-	35	-	mA
OFF condition current		-	3	4	-	3	4	-	3	4	mA
Output Section											
Positive Voltage	-55°C ÷ +85°C	4.92	5.00	5.08	11.75	12.00	12.25	14.70	15.00	15.30	V
Negative Voltage (cross regulated-load 70%30% and 30%-70%)	-55°C ÷ +85°C	4.55	-	5.45	11.40	-	12.60	14.40	-	15.60	V
Power	-55°C ÷ +85°C (ECSS-Q-ST-30-11C compliant)	0	-	15	0	-	15	0	-	15	W
Total current (70% either output)	-55°C ÷ +85°C (ECSS-Q-ST-30-11C compliant)	0	-	3	0	-	1.25	0	-	1	A
Ripple voltage	Switching frequency	-	140	180	-	100	180	-	100	180	mVpp
Spikes	High frequency	-	-	100	-	-	100	-	-	100	mVpp
Line regulation	19V to 39V input	-	1	5	-	1	5	-	1	5	mV
Load regulation positive out	0A to 3A load	-	10	20	-	10	20	-	10	20	mV

		ARC-SGHF2805D			ARC-SGHF2812D			ARC-SGHF2815D			
Parameter	Description	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
Load fault power dissipation	Overload	-	-	8	-	-	8	-	-	8	W
Functions											
Inhibit	ON (High impedance at PIN1)	Open collector or unconnected			Open collector or unconnected			Open collector or unconnected			
	OFF (PIN 1 grounded to PRI_GND)	0	-	0.5	0	-	0.5	0	-	0.5	V
Other data											
Efficiency	@25°C	-	78	-	-	82	-	-	82	-	%
Capacitive load		-	-	350	-	-	150	-	-	150	μF
Switching frequency	Fix frequency	400	-	450	400	-	450	400	-	450	kHz
Isolation	500V DC, case temperature 25 °C	100	-	-	100	-	-	100	-	-	MΩ
Storage temperature		-65	-	155	-65	-	155	-65	-	155	°C
Soldering temperature		-	-	300	-	-	300	-	-	300	°C
Weight		-	-	35	-	-	35	-	-	35	g

Future developments

Arc Power is also developing the 28V, 5W series and 100V bus input, 15W output series.

All the Arc Power products are intended for space application.