



Hi-Temp 185°C DC/DC CONVERTER HTPS-15 : 15W POWER

Hi-Temp
Grade

**Single Output
Metallic Case - 1.500 VDC Isolation**

- Designed for drilling applications
- Nominal power up to 15 W
- Wide temperature range : -30°C/+185°C case
- High efficiency (typ. 75%)
- Soft start
- Galvanic isolation 1.500 VDC
- Synchronizable
- Integrated LC EMI filter
- No load to full load operation
- Permanent short circuit protection
- No optocoupler for high reliability



1-General

The HTPS-15 series is a complete line of DC/DC power modules designed for very high temperature systems able to work typically 1000 hrs at 150°C, 400 hrs at 175°C and up to 100 hrs at 185°C in applications such as downhole oil-drilling, gaz extraction, These modules use a fixed swiching technic at 220KHz providing excellent reliability, low noise characteristics and high power density. Standard models are available with standard input voltage range of 150-300 volts. The series include single output voltage choices of 3.3, 5, 9, and 15 volts.

The HTPS-15 series include a synchronization function. This synchronization function allows to synchronize more than one converter to one frequency or an external source frequency. All the modules are designed with LC network filters to minimize reflected input current ripple

and output voltage ripple.

The modules include a soft-start, an input undervoltage and overvoltage lock-out and a permanent short circuit protection to ensure efficient module protections. The soft-start allows current limitation and eliminates inrush current during start-up. The short circuit protection completely protects the modules against short-circuits of any duration by a shut-down and restores to normal when the overload is removed.

The design has been carried out with Polyimide circuit board, very high temperature qualified components. The modules are potted with a protective compound and package in a metallic case to ensure the module's integrity under the highest environmental conditions. 100% products undergo to production screening tests to eliminate infant mortality at high temperature.

4

2-Product Selection

Single output model : HTPS-15- -

Input Voltage Range

Permanent	Transient
R : 150-300 VDC	330 VDC/100 ms

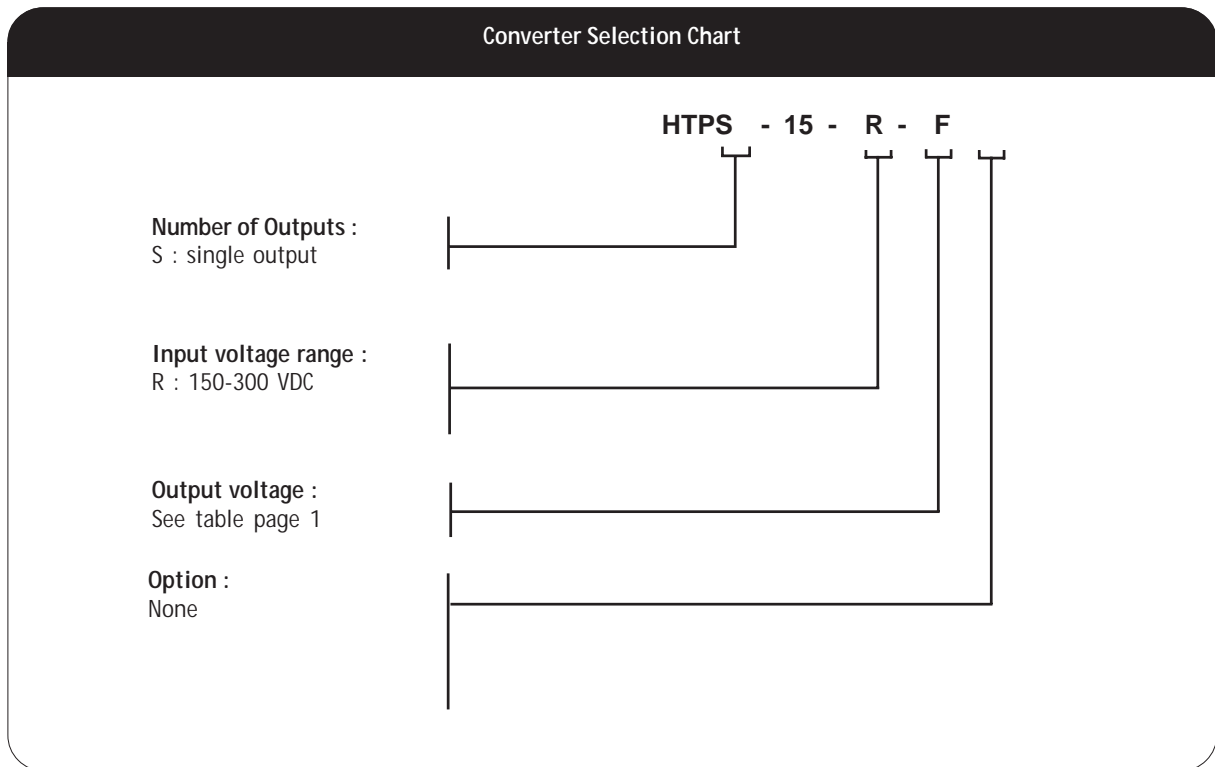
Output

B : 3.3 VDC
C : 5 VDC
9 : 9 VDC
F : 15 VDC

2- Product Selection (continued)

Input range	Output	Current	Reference	Options
150-300 VDC	3,3 VDC	2 A	HTPS-15-R-B	
150-300 VDC	5 VDC	2 A	HTPS-15-R-C	
150-300 VDC	9 VDC	1 A	HTPS-15-R-9	
150-300 VDC	15 VDC	1 A	HTPS-15-R-F	

4



3- Electrical Specifications

Data are valid at +25°C, unless otherwise specified.

Parameter	Conditions	Limit or typical	Units	Single Output HTPS-15
Input				
Nominal input voltage	Full temperature range	Nominal	VDC	200
Permanent input voltage range (Ui)	Full temperature range	Min. - Max.	VDC	150-300
Transient input voltage	Full load (Consult factory)	Maximum	VDC/S	330 / 0,1
Undervoltage lock-out (UVLO)	Turn-on voltage	Nominal	VDC	140
	Turn-off voltage	Nominal	VDC	125
Overvoltage lock-out (OVLO)	Turn-off voltage	Nominal	VDC	315
Start up time	Ui nominal, nominal output Full load : resistive	Maximum	ms	100
Reflected ripple current	Ui nominal, full load at switching freq. BW = 20MHz	Maximum	mApp	5
Input current in short circuit mode (Average)	Ui nominal Short-circuit	Maximum	mA	TBD
No load input current	Ui nominal No load	Maximum	mA	10
Input current in inhibit mode	Ui nominal Inhibit	Maximum	mA	10
Output				
Output voltage	Full temperature range Ui min. to max. 75% load	Nominal	VDC	3,3
		Nominal	VDC	5
		Nominal	VDC	9
		Nominal	VDC	15
Set Point accuracy	Ambient temperature +25°C Ui nominal, 75% load	Maximum	%	+/- 2
Output power	Full temperature range Ui min. to max.	Maximum	W	15
Output current 3,3V, 5V output 9 V output 15V output	Full temperature range Ui min. to max.	Maximum	A	2
		Maximum	A	1
		Maximum	A	1
Ripple output voltage 3,3V and 5V output 9V output 15V output	Ui nominal Full load BW = 20MHz	Maximum	mVpp	50
		Maximum	mVpp	100
		Maximum	mVpp	150
Line regulation	Ui min. to max. Full load	Maximum	%	+/- 1
Load regulation	Ui nominal No load to full load	Maximum	%	+/- 1
Temperature regulation	Ui nominal, full load from -30°C to +185°C	Maximum	%	+/- 4
Output Voltage Trim	As function of output voltage	Minimum	%	- 10
		Maximum	%	+ 5
Efficiency	Ui nominal Full load	Typical	%	75%
Maximum admissible Capacity load 3,3V, 5V output 9V, 15V output	Full input voltage range Full load Per output	Maximum	µF	TBD
		Maximum	µF	TBD

4- Switching Frequency

Parameter	Conditions	Limit or typical	Specifications
Switching frequency	Full temperature range Ui min. to max. No load to full load	Nominal, fixed	220 KHz

5- Isolation

Parameter	Conditions	Limit or typical	Specifications
Electric strength test voltage	Input to output Input to case Output to case	Minimum Minimum Minimum	1.500 VDC / 1 min 500 VDC / 1 min 1.500 VDC / 1 min
Isolation resistance	500 VDC	Minimum	1 MOhm

6- Protection Functions

Characteristics	Protection Device	Recovery	Limit or typical	Specifications
Input undervoltage lock-out (UVLO)	Turn-on, turn-off circuit with hysteresis cycle	Automatic recovery	Turn-on nominal Turn-off nominal	See section 3
Output short circuit protection (SCP)	Hiccup circuitry with auto-recovery	Automatic recovery	Permanent	See section 11

7- Reliability Data

Characteristics	Conditions	Temperature	Specifications
Mean Time Between Failure (MTBF) According to MIL-HDBK-217F		Case at 40°C Case at 85°C	
		Case at 40°C Case at 85°C	
Mean Time Between Failure (MTBF) According to IEC-62380-TR		/	Consult factory

9- Thermal Characteristics

Characteristics	Conditions	Limit or typical	Performances
Operating ambient temperature range at full load	Ambient temperature *	Minimum Maximum	- 30°C + 185°C
Operating case temperature range at full load	Case temperature	Minimum Maximum	- 30°C + 185°C
Storage temperature range	Non functioning	Minimum Maximum	- 55°C + 185°C
Thermal resistance	Rth case to ambient in free air natural convection	Typical	8°C/W

Note * : The upper temperature range depends on configuration, the user must assure a max. case temperature of + 185°C.

The MGDM-26 series operating **case** temperature must not exceed 185°C. The maximum **ambient** temperature admissible for the DC/DC converter corresponding to the maximum operating case temperature of 185°C depends on the ambient airflow, the mounting/orientation, the cooling features and the power dissipated.

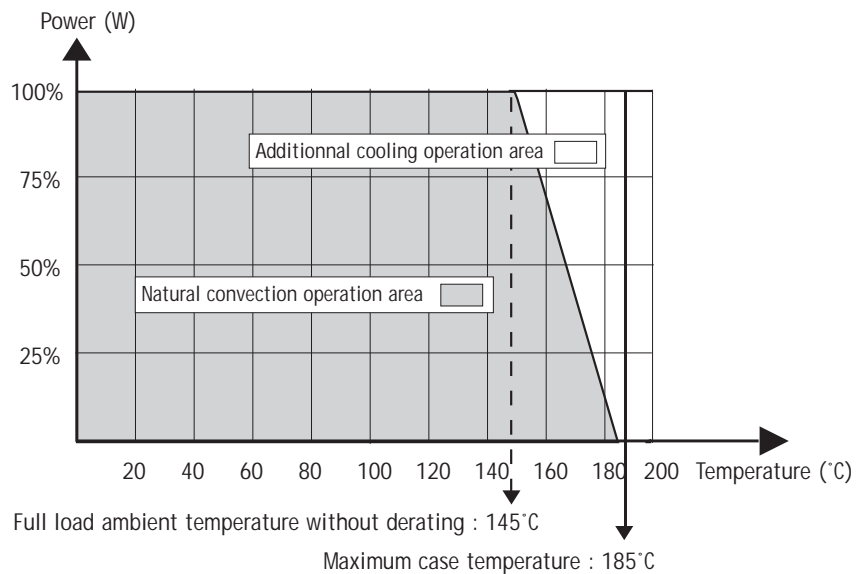
To calculate a maximum admissible ambient temperature the following method can be used. Knowing the maximum case temperature Tcase = 185°C of the module, the power used Pout and the efficiency η :

- determine the power dissipated by the module P_{diss} that should be evacuated :
$$P_{diss} = P_{out} \left(\frac{1}{\eta} - 1 \right)$$
- determine the maximum ambient temperature :
$$T_a = 185^\circ\text{C} - R_{th} \times P_{diss}$$

where **Rth** is the thermal resistance from the case to ambient.

The previous thermal calculation shows two areas of operation :

- a normal operation area in a free natural ambient convection (grey area in this following graph),
- an area with cooling features (air flow or heatsink) ensuring a maximum case temperature below the maximum operating case temperature of 185°C (white area in the following graph).



10- Environmental Qualifications

The modules have been subjected to the following environmental qualifications.

Characteristics	Conditions	Severity
Climatic Qualifications		
Life at high temperature	Duration Temperature / status of unit	1.000 hrs @ 150°C case, unit operating 400 hrs @ 175°C case unit operating 100 hrs @ 185°C case unit operating
Temperature survival	Test duration Temperature Status of unit	96 hrs 200°C unit not operating / unit operating 10 min. every 24 hrs@ full load
Humidity steady	Damp heat Temperature Duration Status of unit	93 % relative humidity 40°C 56 days unit not operating
Salt atmosphere	Temperature Concentration NaCl Duration Status of unit	35°C 5 % 48 hrs unit not operating
Temperature cycling	Number of cycles Temperature change Transfert time Steady state time Status of unit	50 -30°C / +185°C case 3°C to 5°C/min. 2 hours. unit operating
Mechanical Qualifications		
Vibration (Sinusoidal) according to IEC-68-2-6	Number of cycles Frequency / amplitude Frequency / acceleration Duration Status of unit	10 cycles in each axis 5 to 31 Hz / 1.5 mm 5 to 500 Hz / 20 g rms 1h per axis unit operating
Shock (Half sinus) according to IEC-68-2-27	Number of shocks Peak acceleration Duration Shock form Status of unit	20 shocks in each x & Y axis, 40 shocks in z axis 40 g 11 ms 1/2 sinusoidal unit operating

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11- Production Screening

All the modules in production are subjected to the following environmental production screening. Any module failed in one of the screening is rejected.

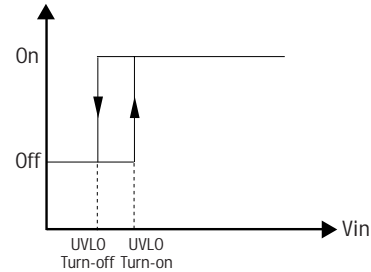
Characteristics	Conditions	Severity
Production Screening		
Step 1	Temperature cycle : -30°C/+150°C	Number of cycles : 12 Temperature change : -30°C/+150°C Transfert rate : 5°C/min. Steady state time : 15 min unit operating : input 200 Vdc, full load
Step 2	Life at high temperature +185°C	Number of cycles : 8 Temperature change : +25°C/+185°C Transfert rate : 5°C/min. Steady state time : 1h @ 185°C Steady state time : 15 min. @ +25°C unit operating : input 200 Vdc, full load

12- Description of Protections

12-1 Input Undervoltage Lockout (UVLO) and Overvoltage Lockout (OVLO)

12-1-1 Undervoltage Lockout (UVLO)

An undervoltage protection is implemented to lock off the converter as long as the input voltage has not reached the UVLO turn-on threshold (see section 3 for value) which is the minimum input voltage required to operate without damaging the converter.

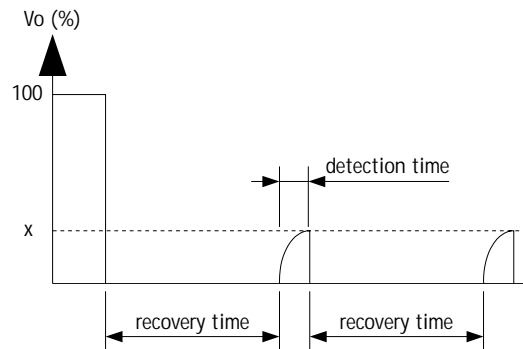


12-1-2 Overvoltage Lockout (OVLO)

An overvoltage protection will inhibit the module when input voltage reaches the overvoltage lockout turn-off threshold (see section 3 for value) and restores to normal operation automatically when the input voltage drops below the overvoltage Lockout turn on threshold.

12-2 Output Short Circuit Protection (SCP)

The short circuit protection device protects the module against short circuit of any duration and restores the module to normal operation when the short circuit is removed. It operates in «hiccup» mode by testing periodically if an overload is applied (typically every 0.8s recovery time). The overload detection threshold is typically 200% of maximum current with a detection time lower than 50ms.



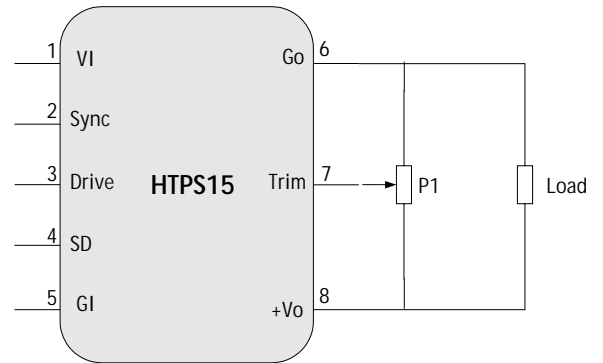
13- Description of Functions

13-1 Trim Function

The primary output voltage V_o may be trimmed at -10%/+5% via a single external trimpot or fixed resistor. The trimpot should be connected as shown in figure hereafter. Value of the trim resistance is given in the following table.

V_o	P1 Value
3,3 V	KOhm
5 V	KOhm
9 V	KOhm
15 V	KOhm

For other V_o1 Output value consult Factory

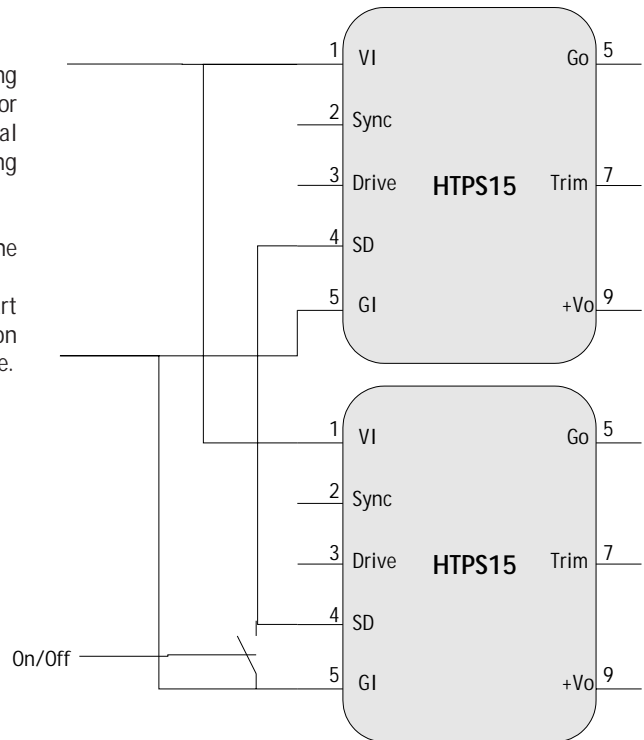


13-2 On/Off Function

The control pin 4 (On/Off) can be used for applications requiring On/Off operation. This may be done with an open collector transistor, a switch, a relay or an optocoupler. Several converters may be disabled with a single switch by connecting all On/Off pins together.

- The converter is disabled by pulling low the pin 4.
- No connection or high impedance on pin 4 enables the converter.

By releasing the On/Off function, the converter will restart within the start up time specifications given in table section 4. For further details please consult "Logic On/Off" application note.



4

13-3 Synchronization Function

The HTPS-15 series provide a synchronization function through connection 2 (Sync) to enable automatic synchronization between several converters. The converters lock into the highest switching frequency if more than one converter is used or on an external clock for a frequency in the range between 210% and 230% of the converter's free frequency.

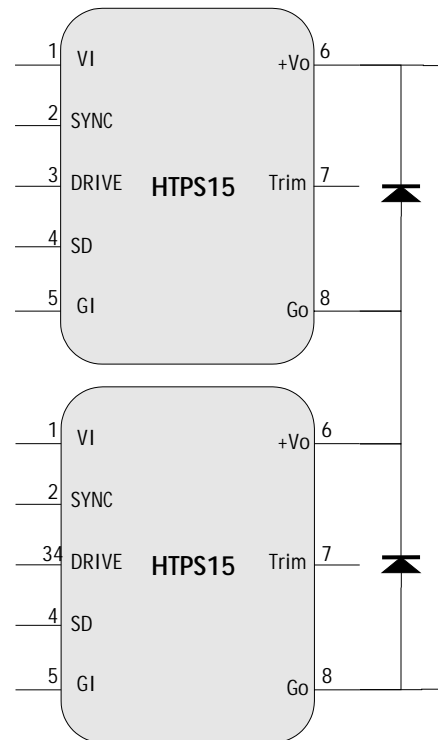
14- Application Notes

14-1 Connection of Modules in Series

The output of single output units can be connected in series without any precautions to provide higher output voltage level.

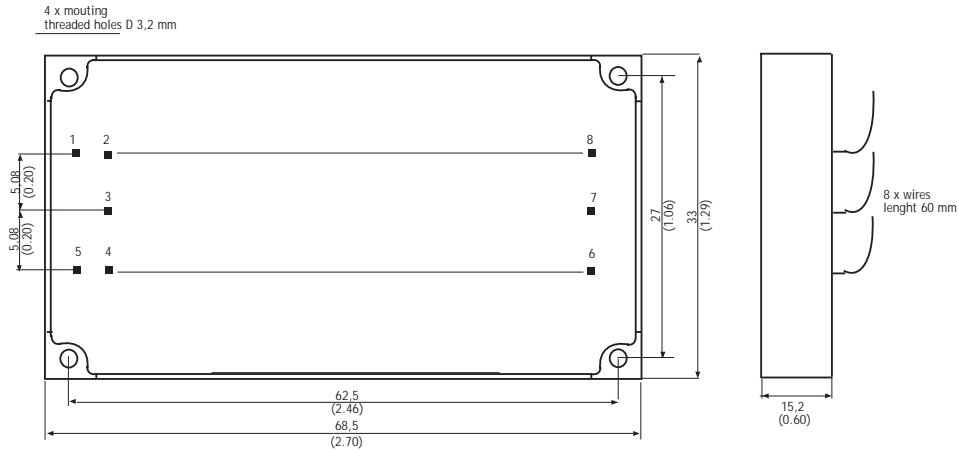
Nevertheless, GAIA Converter recommends to protect each individual output by a low power shottky diode rated with the maximum current of the converter to avoid reverse polarity at any output.

Reverse polarity may occur at start up if the output voltages do not rise at the same time.



15- Dimensions

Dimension are given in mm (inches). Tolerance : +/- 0,2 mm (+/- 0.01 ") unless otherwise indicated.
 Weight : 65 grams (2.3 Ozs) max.



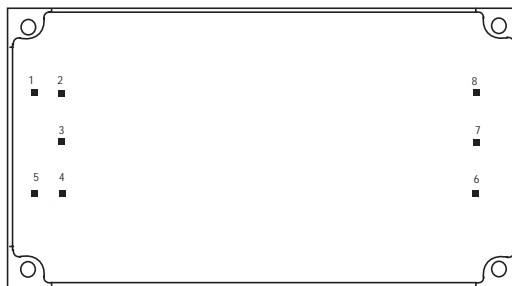
Terminations : 22AWG PTFE insulated wires

Metallic case alodined coating solder plated pin.

16- Product Marking

Side face : Company logo, location of manufacturing, module reference, option, date code : year and week of manufacturing.

17- Connections



Bottom view

Pin	Single Output	
1	Red	+ Input (Vi)
2	White	Synchro (Sync)-
3	Yellow	Drive (Drive)
4	Orange	On/Off (SD)
5	Black	Input (Gi)
6	Black	- Output (Go)
7	Yellow	Trim (Trim)
8	Red	+ Ouput (VO)



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