

## FHL100 Series High-temperature DC-DC Modules

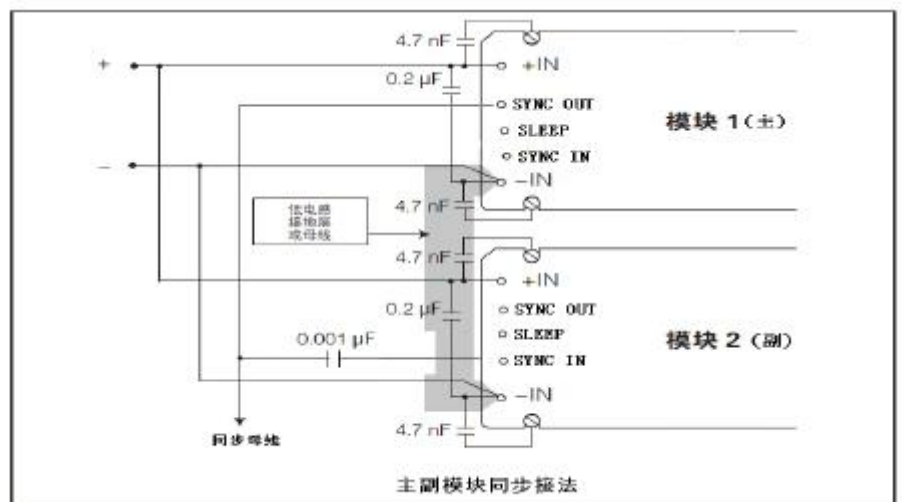
### Feature:

- : High operating temperature (ambient temperature:-55℃ ~+175℃ and max. shell temperature: +185℃)
- : Output modes up to two modes
- : Output voltage  $\pm 25\%$  adjustable
- : High operating frequency (500KHZ)
- : ZVS-ZCS soft switch topology structure (zero voltage-zero current soft switch)
- : Synchronization and shutoff function
- : N+1 parallel connection power extension (max. up to 650W)
- : High conversion efficiency (typical 85% ~91%)
- : Sealed metal casting (impact and moist resistance and electromagnetic radiation protection)
- : Wide input range (10~30V, 16~48V, 24~72V, 36~108V, 70~210V, 120~360V)
- : Multi-output approach (up to triple-route: 3.3V, 5V,  $\pm 5V$ ,  $\pm 9V$ ,  $\pm 12V$  and  $\pm 15$ , etc.)
- : Integrated LC EMI filter
- : Providing rated power without deduction at 175℃ (shell); providing 50% rated power at 185℃ (shell)
- : Over-heat protection at 210℃
- : Over-voltage and over-current failure switch-off delay restart
- : Input under-voltage and overvoltage turn-off protection
- : 100MS soft-start function
- : Small size (16~48V, 24~72V, 36~108V)



### Description:

The FHL100 series 100W high-temperature DC-DC power module is designed for the electronic equipments working in the harsh environment and can work for 2000 hours at 150 °C shell temperature, 750 hours at 175 °C shell temperature and 400 hours at 185 °C shell temperature. With features of being resistant to high temperature, impact and humidity, it is a power supply system especially applicable to petroleum survey logging tool, petroleum drilling instrument, geophysical detecting instrument, vehicles, telecommunication, network infrastructures, enterprise and high-performance calculation. It has three optional input ranges: 24V~72V, 36~108V and can provide fixed-voltage output in the mode of single-way, double-way and three-way. Within the entire operating temperature range and under the condition that full-load and no-load change alternatively, the output voltage fluctuation is less than 0.3V and the output precision of 3.3V voltage is even less than 0.15V. The operating frequency of the FHL100 series is up to 500KHZ and it uses ZVS-ZGS soft switch topology structure (zero voltage-zero current soft switch) developed by VAW. It effectively removes peak burrs of ordinary power switch. Its output voltage ripple is less than 100MV in the condition of no wave filtering. Within the entire



temperature range, the temperature stability of frequency is  $\pm 8\%$ .

FHL100 series provide the synchronization, allowing several modules in a same series to work at the same frequency. As a result, switch interference can be effectively reduced. When the power of one module is inadequate or the routes of output are insufficient, it is possible to realize the synchronous operation of several modules. To realize synchronous operation of several modules, firstly select the module with max. load as the primary module and set SYNC OUT as synchronous bus, and SYNC IN of other auxiliary modules passes 0.001 UF capacitor and connected to the synchronous bus. In this case, the starting time of all modules synchronizes with that of primary module and the shutoff time is independently decided by the feedback circuit of each module. It is also possible to arrange an external clock at SYNC pin to link up SYNC pins of several modules to realize synchronization. If an external master clock signal is applied, it recommended that the frequency of oscillator should be 450KHZ~550KHZ. If it is not within this range, the in-service condition may not be the optimal, even if the module can still operate within the wide range of 400KHZ ~ 600KHZ. In some load and input voltage condition, it is not in ZVS-ACS state. The impulse width (Larger than 20ns) of external master clock signal should be made available. At this time, all modules can operate by following the external sync frequency. The level received by SYNC pin should be TTL5V. At the time of application, if the external sync clock signal is not TTL level, it is necessary to convert by adding the level. In synchronous working state, as each module passes a 0.001UF capacitor connected to synchronous bus. If the auxiliary module fails, other modules can continue to work normally; if the primary module fails, the auxiliary module will exit from synchronous working state to continue working separately with their own frequency.

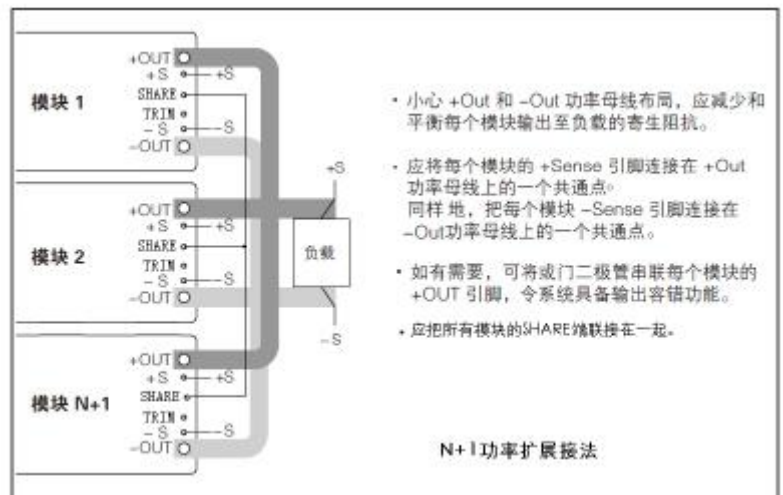
The single output type of FHL100 newly comes with remote current diagnosis end. In application, if the load is far away from module, the voltage drop on output line will be large, making voltage on the load lower than rated output voltage of module. In order to compensate this voltage drop, it needs to respectively connect +S and -S ends of module to the positive and negative ends of the load via a separate wire. In this way the voltage between connecting points +S and -S on the load will remain constant on the rated output of module despite of voltage drop. If +S and -S suspend, module thus cannot realize the compensation of voltage drop.

The single output type of FHL 100 comes with unique N+1 power extension function up to 100W. +OUTs and -OUT of modules can be connected by merely connecting SHARE ends of module to be connected in parallel way. With several modules being connected in this way, the total output power will increase by several times. In normal work, the output current of modules differs within  $\pm 10\%$ . Provided a module fails, the current undertaken by this module will be evenly distributed to other modules. The parallel connection of modules must be the modules of the same type.

FHL100 contains an in-built LC network, which can effectively reduce the fluctuations of the input current and the output voltage.

FHL100 contains a 100MS soft-start circuit, which can slowly increase the input current when the module is activated and after the failure is removed so as to facilitate external connection of a large-capacity output filtering capacitor and reduce the impact from starting.

FHL100 series has over-voltage and under-voltage turnoff functions, which can enable the module to stop working beyond the range of the input voltage to protect the module. The under-voltage and over-voltage turn-off voltage is within 5V of extension of VAC. If the input range is rated at 36~108V, its under-voltage turn-off voltage will be 31~35.9VV and over-voltage turn-off



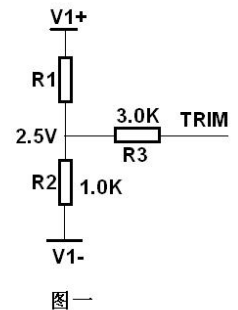
voltage will be 110~115V.

SLEEP, the turn-off terminal of FHL100, is high-level effective. When the voltage is 2.0~5.3V, the module enters into the resting state, all outputs are cut off, and the input current is less than 2MA. If a multiple of modules operate in synchronous manner, the auxiliary module shall generate a main module after the main modules is turned off. At this moment, the original auxiliary modules will operate by following the frequency of new main modules. If the auxiliary module is turned off, the unturned-off modules shall not be affected, and shall still operate by following the frequency of main modules. When the voltage is 0~ 1.5V, or hangs in the air, the module operates properly. The input voltage of SLEEP terminal shall not exceed 5.5V.

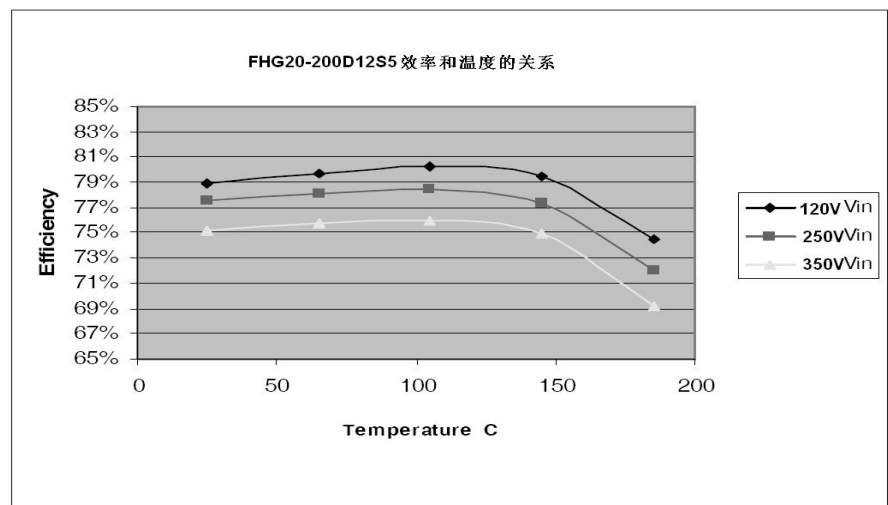
FHL100 includes the output short circuit and overload automatic turn-off circuit. When the output lasts 0.1s and exceeds 120% of the rated output power, the module cuts off all outputs. After the over-current fault is eliminated, it automatically enters into soft-start mode and restores the output voltage. If the overload duration of output is less than 01s, the module will not act.

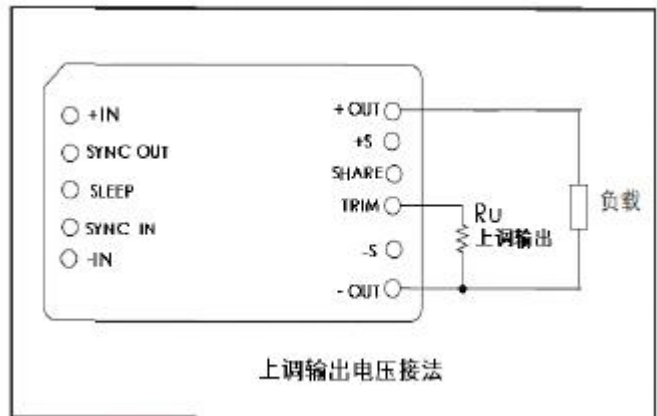
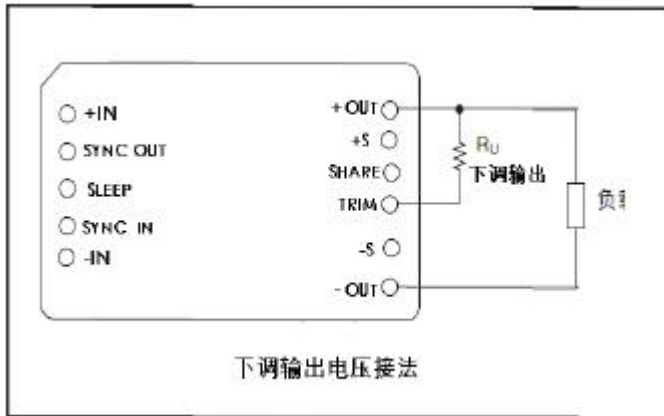
The operating frequency of FHL100 series is up to 500KHZ, which provides a good filtering condition. Its output voltage ripple is less than 100MV without any additional filtering.

The output voltage of FHL100 series can be regulated within the range of  $\pm 25\%$  to facilitate the application and type selection of customers. Figure 1 is the internal adjustment circuit. During the adjustment, it is necessary to always ensure that the voltage at the junction between R1 and R2 should be 2.5V. TRIM is directly connected to V-, and the output is maximum; TRIM is directly connected to V+, and the output is the minimum. During the actual adjustment, R3 is required to connect appropriate resistance, and then connect with V1+ or V1-.



It can be found in the adjustment diagram that adjustment of output voltage can break the limit of  $\pm 25\%$ . However, we do not recommend this kind of application for the reason that the module efficiency decreases along the reliability as long as this limit is exceeded. For the single output module, V1+ is positive output, and V1- is negative output (output ground). For the double output module, V1+ is positive output, and V1- is negative output. The control circuit controls the voltage difference of positive and negative output. Since v1+ is symmetrical with v- in the internal circuit, we can thus conclude that the output voltage should also be the same as long as the output current is the same. If the output current is not the same, the output voltage is high for small current while the output voltage is low for large current. However, the difference should be within 0.3V. No matter how the output current will be, the voltage difference of positive and negative output under the internal control should remain unchanged.





FHL100 components completely pass the in-factory test in strict accordance with the enterprise standards and GJB, which includes 24 ~ 72-hour live aging and screening at +175°C. All finished products have experienced 8-hour full-load operation at +175 °C before delivery so as to fully expose the damage to the components during the production process and hence ensure the reliability of products.

**Type selection:**

<b>FHL100--28D12</b>	
<b>Family code</b> _____	<b>Output voltage</b>
FHL Series	5
<b>Output power</b> _____	12
100W	15
	18
	24
<b>Input voltage</b> _____	<b>Output channel</b>
48 (24~72V)	S Single
50 (36~108V)	D Dual

**Technical parameters:**

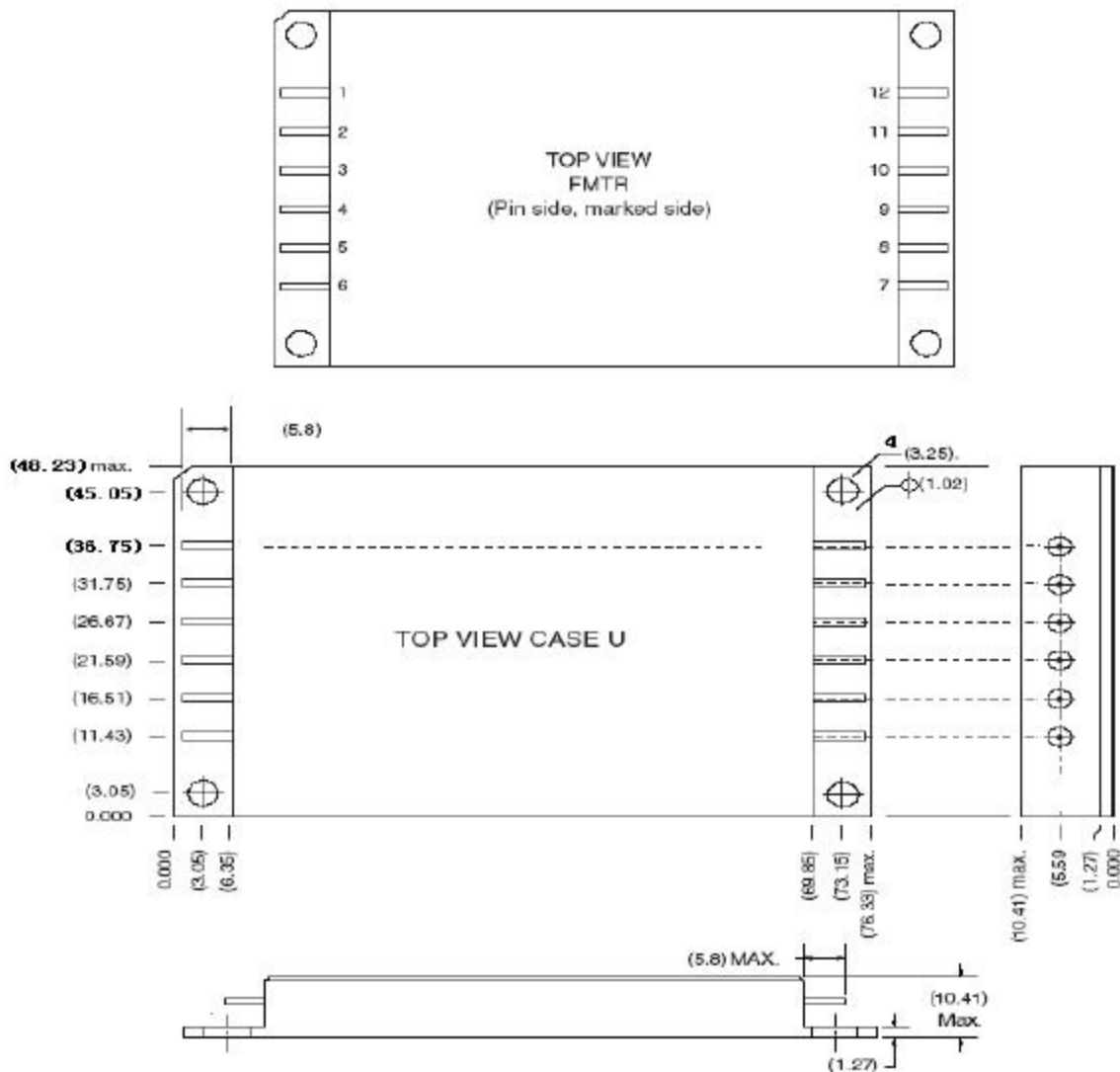
- (1) Operating temperature: -55 °C ~ +175 °C Maximum shell temperature: +185 °C.
- (2) Input voltage: 24V~72V, 36~108V
- (3) Output voltage: ±5V, ±12V, ±15V, +5V, +12V, +15V, +18V, +24V
- (4) Output ripple: 100mVp-p (typical 30mVp-p)
- (5) Output power: 100W (up to 1000W by parallel connection)
- (6) Output accuracy: less than 4%
- (7) Load regulation: less than 4%.
- (8) Temperature stability: less than ±2.5% (typical ±1%)
- (9) Line regulation: ±0.1% (10% linear change).
- (10) Shock resistance: 25G, 0 ~ 300Hz
- (11) Conversion efficiency: 87% ~ 92%
- (12) Static power consumption: 1.0W Maximum
- (13) Isolation voltage between input and output or between the outputs: 1000V

(14) Mechanical size: L\*W\*H: 76.33MM\*48.23MM\*10.41MM

**Service Requirements:**

As the modules have nearly 2W of power consumption under the condition of full-load operation and their sizes are small, good medium need to be added between the shell of the power supply and the radiator so as to ensure the temperature of the module case to be less than 204 °C. In some applications, it requires that input and output have common ground and it must use the shortest and roughest wire to make input and output ground wire short circuit as soon as it comes out the module. The shorter the connection distance is, the less the interference is. The shell of the module is isolated from the input and output and withstand voltage is 1000V. During use, in order to reduce electro-magnetic interference, it requires to connect a 4700PF /1000V capacitor respectively at positive and negative end. If it requires not isolate shell from input or output, directly connect input or output ground wire in shortest distance.

**Outline diagram:**



**Definition of pinouts**

	Definition of single power	Definition of dual power
1	Positive input (+IN)	Positive input (+IN)
2	Negative input (-IN)	Negative input (-IN)

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	Case connection(CASE)	Case connection(CASE)
3		
4	(SLEEP)	(SLEEP)
5	SYNC OUT	SYNC OUT
6	(SYNC IN)	(SYNC IN)
7	(+OUT)	(+OUT)
8	(GND)	(GND)
9	(-S)	(-OUT)
10	(+S)	NC
11	TRIM	TRIM
12	SHARE	NC

(Product performance, reliability and information are subject to change without prior notice.)

February 8, 2010