

FH16 Series Multi-output Isolated High-temperature DC-DC Power Converter

Features:

- : Working temperature: Ambient temperature: $-55^{\circ}\text{C} \sim +175^{\circ}\text{C}$, max. shell temperature up to $+185^{\circ}\text{C}$
- : Output power: 16W
- : Dimension: L:52.0×W:27.0×H:11.7mm, **This dimension does not include the size of the mounting base**
- : Multiple outputs up to 4 and at most 4 isolated output ground circuits
(3.3V, 5V, 7V, 9V, 12V, 15V, 18V, 24V, 36V and 48V)
- : Output ripple: Maximum 100mV, typical 50mV
- : Conversion efficiency: Typical 80%
- : Input range: 10V-30V, 16V-48V, 24V-72V, 36V-108V;
70V-210V, 120V-360V
- : Integrated LC EMI filter
- : Sealed metal casting: Impact and moist resistance and electromagnetic radiation protection
- : Synchronous and cutoff function
- : Provide rated power without deduction at 175°C (shell); provide 80% rated power at 185°C (shell) and 50% rated power at 204°C (shell)
- : Isolation voltage between input and output: 1000V, isolation voltage between outputs: 500V
- : Overvoltage and overcurrent fault cutoff delay restart
- : Input undervoltage and overvoltage cutoff protection
- : 100ms soft start function
- : Over-heat protection at 210°C



Description:

FH16 series 16W multi-output isolated high-temperature DC-DC power converter was specially designed for electronic equipment working in the harsh environment. The design and development of this series converter aims to replace the previous FH15 series.

FH15 series power converter has been put into production for 7 years. Although we have accumulated abundant experiences in production and customers' use, FH15 series is outmoded with the continuous progress of latest technology. Our engineers become unsatisfied with its parameters and performance, in this case, we successfully developed FH16 series based on previous FH15 series. In order to make FH16 series completely replace FH15 series, its mechanical installation size is equal to that of FH15 series. To achieve the goal of making FH16 series power converter's EMI three times lower than that of FH15 series, we had to increase its thickness by 1mm. Please pay attention to this when using FH16 series to replace FH15 series. In general situation, the model of power converter only changes FH15 to FH16 and other symbols do not change. FH16 series power converter's electric parameters are superior to that of FH15 series.

FH16 was designed to work for 2,000 hours at shell temperature 150°C , for 750 hours at shell temperature 175°C and for 400 hours at shell temperature 185°C . With features of being resistant to high temperature, impact and humidity, it is particularly suitable for being used as power supply for petroleum prospecting logging tool, petroleum drilling instrument, geophysical detecting instrument, vehicles, telecommunication, network infrastructures, enterprise and high-performance calculation, etc.

FH16 series 16W multi-output isolated high-temperature DC-DC power converter has six alternative input ranges

including 10V~30V, 16V~48V, 24V~72V, 36V~108V, 70V~210V and 120V~360V. The output voltage designed for FH16 series includes 3.3V, 5V, 7V, 9V, 12V, 15V, 18V, 24V, 36V and 48V. The output can be either of them and combinations of any two, three or four voltages. The output can provide at most four isolated ground circuits. During the use, they are allowed to be connected to form output combinations of different types as per requirement.. MOUT represents the main output terminal, and OUT1, OUT2 and OUT3 represent the auxiliary output terminals. It can work with only main output without auxiliary output. If there is auxiliary output, the number of channels of auxiliary output shall not exceed 4. Free isolation and common grounding are allowed between output voltages. If main output has common grounded auxiliary output, there must be one output voltage that is greater than or equal to 5V; if main output has a single ground, main output voltage must be greater than or equal to 5V.

During the use, the voltage outputted from main output MOUT terminal is most stable. The output power of main output is required to be the largest one among powers of four outputs. The voltage and ripple wave outputted from main output terminal do not vary with the variation of itself and auxiliary output voltage power. In the condition that power outputted from main output terminal is constant, the voltage of auxiliary output terminals OUT1, OUT2 and OUT3 decrease with the rise of its output power, reaching 2% at most. If power outputted from auxiliary output terminals OUT1, OUT2 and OUT3 is constant, their output voltage increases with the increase of power outputted from main output terminal. For this feature, the main and auxiliary output should be specified in using and selecting types. If the model is FH16-150S12-S24-S5, it will output three mutually isolated voltages 12V, 24V, and 5, where, 12V is from MOUT, 24V from OUT1 and 5V from OUT2. That is our model FH16-DCINSMOUT-SOUT1-SOUT2-SOUT3. In this model, "-" means isolation. "-" may not appear in a model, which means that there is no isolation between outputs. S*** can also be represented with D*** or S***S***. There are at most four S*** in a model. D*** represents two S***.

In the course of using multi-output converter, if the output (main or auxiliary) of an output dynamically changes, it will cause the auxiliary output voltage to fluctuate accordingly. If the fluctuation is greater than 50mA, measures must be taken. The voltage fluctuation above 50mA appears when output power varies between the rated power of above 10% and below 70%. The fluctuation increases along with the rise of proportion of high and low output power. The fluctuation frequency is equal to the frequency of power variation. At this time, the secondary filtering is thus considered to be done. If the fluctuation frequency of power is less than 10KHz, there will be trouble in filtering. Then it is necessary to reduce the number of output channels of Main converter and add secondary DC/DC converter to re-convert additional voltage. If the fluctuation frequency of power is greater than 10KHz, the simple filtering is able to remove the fluctuation.

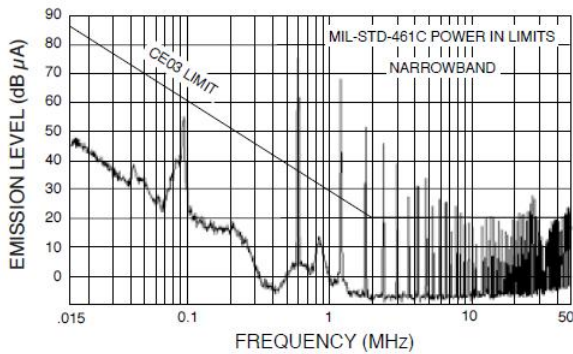
In the course of operation, when an output power (main or auxiliary) varies between the rated power of above 10% and below 70%, its voltage fluctuation generally is less than 50mV. This fluctuation is free from consideration in general.

Within the entire temperature range and conversion between full load and no-load, the output voltage fluctuation is within 2%. The working frequency of FH16 series power converter is up to 300KHz, which provides good filtering condition. In the condition without adding any filtering, its output voltage ripple is less than 100mV. The temperature stability of frequency within the entire range of temperature is $\pm 8\%$.

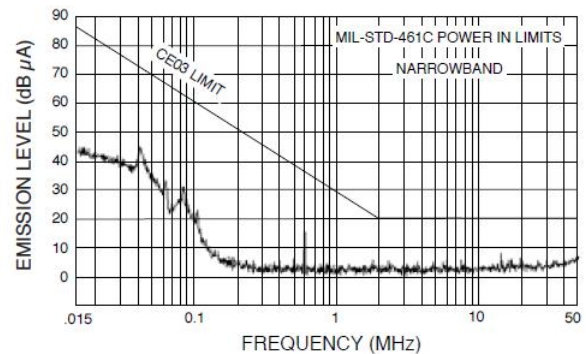
FH16 series power converter provides synchronous function, allowing several converters of the same series to work at same frequency. As a result, switch interference can be effectively reduced. When the power of one converter is inadequate or the output modes are insufficient, it is possible to realize the synchronous operation of several converters. In other word, the synchronous terminals of all converters are bond together to enable the synchronous operation. The converters can automatically distribute the main and auxiliary converters. The converters which are the first to reach steady operation obtain the main control power, and the remaining converters are auxiliary converters which operate by following the frequency of main converters. It is also possible to arrange an external clock at SYNC pin to link up SYNC pins of several converters to realize synchronization. If an external master clock signal is applied, it recommended that the frequency of oscillator should be 250KHZ~350KHZ. If it is not within this range, the converter can work within the range 200KHZ-450KHZ, but working state is not stable. The external master clock signal should have an impulse width greater than 20ns. At this time, all converters 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.

FH16 series power converter contains an in-built LC network, which can effectively reduce the fluctuations of the input current and the output voltage. In the course of developing this series power converter, we established EMI authoritative R&S certification test system. We rationally and scientifically designed input LC network and output EMI filtering contained in FH16, which makes FH16 effectively reduce current and voltage fluctuation and interference. The below picture on the left shows the result tested with this system and the picture on the right shows the result after using FMP filter. When working separately, it is clear that is slightly above CE03 standard and meets the CE03 standard after using FMP.



FH16



FH16+FMP

FH16 contains 100MS soft start circuit, able to slowly increase input current after converter is started and fault is removed for externally connecting large capacity output filtering capacitance and reducing start impact.

FH16 series power converter contains over-voltage and under-voltage cut-off functions, which enables the converter to stop working beyond the range of the input voltage to protect the converter. The under-voltage and over-voltage cut-off voltage is within 5V of extension of rated voltage. If the input range is rated at 24-72V, its under-voltage cut-off voltage will be 21-23.9V and over-voltage cut-off voltage will be 72.1~77V.

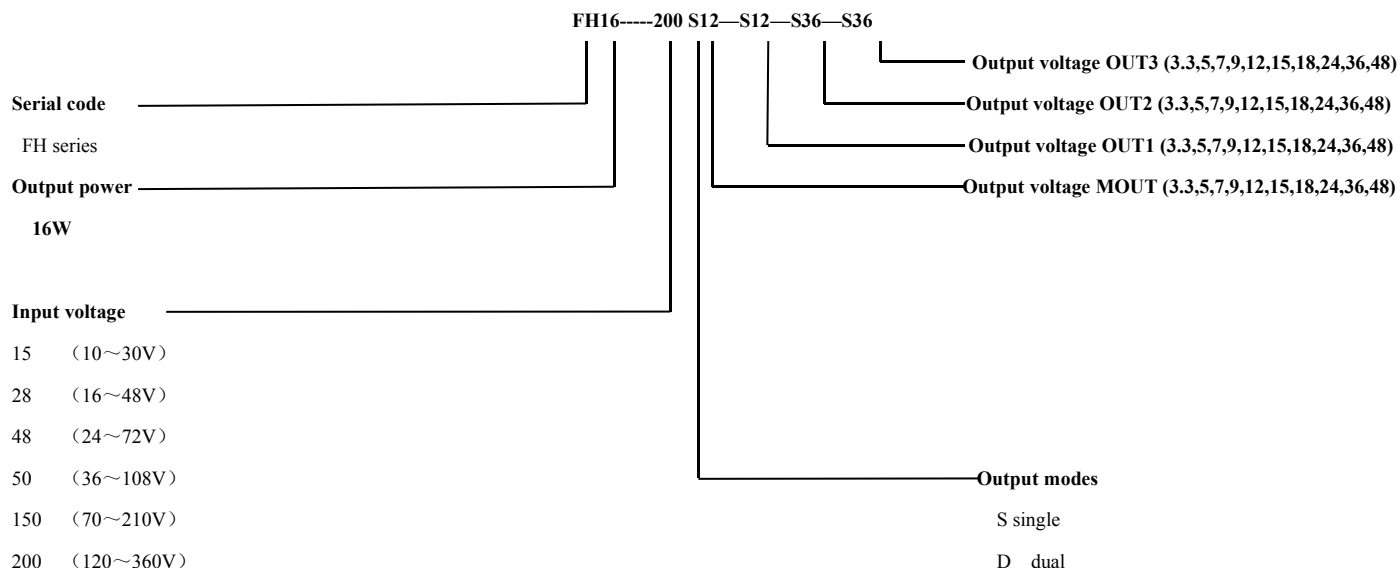
FH16 power converter's cut-off terminal SLEEP is high-level effective. When the voltage is 3.2~5.3V, the converter enters the resting state, all outputs are cut off, and the input current is less than 1mA. If multiple converters work synchronously, after cutting off main converter, auxiliary converter shall re-produce a main converter. The auxiliary converter shall follow the working frequency of main converter. If auxiliary converter is cut off, converters not cut off shall not be affected and shall follow the working frequency of main converter. When the voltage is 0~ 2.5V, or suspended, the converter operates properly. The input voltage of SLEEP terminal shall not exceed 5.5V.

FH16 series power converter contains the output short circuit and overload automatic turn-off circuit. When the output lasts for 0.1s and exceeds 120% of the rated output power, the converter cuts off all outputs. After the over-current fault is eliminated, it automatically resumes the output voltage. If the overload duration of output is less than 01s, the converter will not act.

Key components used for FH16 series power converter are purchased in military level and completely pass the in-factory test in strict accordance with the national military product quality standard. The factory test includes 24~72-hour live aging and screening under the temperature of +175°C. All finished products have experienced 8-hour full-load operation under the temperature of +185 °C before delivery so as to fully check the damage to the components during the production process and hence ensure the reliability of products.

Model Naming Rules:

FH16-DCIN^SMOUT-SOUT1-SOUT2-SOUT3



NOTE: “—” in model refers to the meaning of isolation. It is always isolated between input and output. For this reason, the first “-” is necessary. The later three “-” may not appear. S*** can also be represented with D*** or S***S***. There are at most four S*** in a model. D*** represents two S***.

Model example: FH16-150D15-S5, where MOUT outputs +15V, OUT1 outputs -15V and OUT2 outputs +5V. It is commonly grounded between outputs

FH16-50S15S3.3-S5, where MOUT outputs +15V, OUT1 outputs +3.3V and OUT2 outputs +5V.

FH16-50S15-S3.3-S5-S24 is mutually isolated between outputs 15V, 3.3V, 5V, 24V. MOUT outputs +15V, OUT1 outputs +3.3V, OUT2 outputs +5V and OUT3 outputs 24V

Technical Parameters:

- (1) Operating temperature: -55℃ ~ +175℃, Max. shell temperature: +185℃.
- (2) Input voltage: 10~30V, 16~48V, 24~72V, 36~108V, 70~210V, 120~360V
- (3) Output voltage: multiple outputs up to 4 and at most 4 isolated output ground circuits: 3.3V, 5V, 7V, 9V, 12V, 15V, 18V, 24V, 36V and 48V
- (4) Output ripple: Less than 100mV_{p-p}, typical 50mV_{p-p}
- (5) Output power: 16W
- (6) Output accuracy: Less than 4%
- (7) Load regulation: Less than 4%
- (8) Temperature stability: Less than ±2.5%, typical ±1%
- (9) Linear regulation: ±1% (10% linear change)
- (10) Shock resistance: 25G, 0 ~ 300Hz
- (11) Conversion efficiency: Typical 80%
- (12) Static power consumption: 0.8W Max.
- (13) Isolation voltage between input and output: 1000V, isolation voltage between outputs: 500V
- (14) 100MS soft start function
- (15) Overheat cutoff at 210℃

- (16) Dimension: L:52.0×W:27.0×H:11.7mm, **This dimension does not include the size of the mounting base**
- (17) Output form of voltage: high-temperature lead wire

Service Requirement:

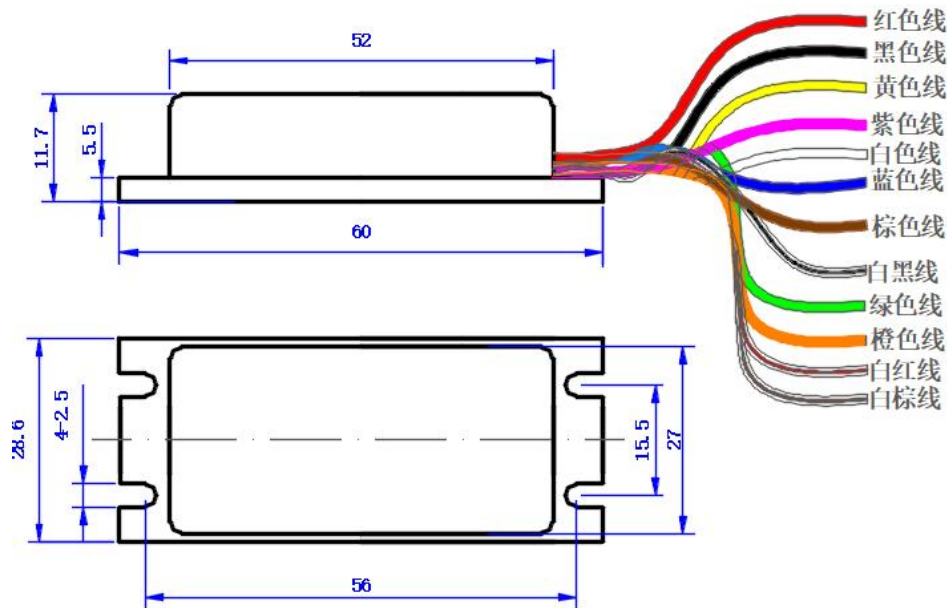
As the power converter has nearly 2W power consumption under the condition of full-load operation and its size are small, good medium is necessary to be added between the shell of the power converter and the radiator so as to ensure the temperature of the converter shell to be less than 185°C.

The shell of the converter is isolated from the input and output. During the use, the converter is usually mounted on instrument or its framework with the framework as a radiator. If the ripple cannot be filtered with capacitance or LC network, then this ripple is electro-magnetic interference (EMI). Thus, an EMI filtering converter is necessary to be added to input and output terminals of FH16. To function properly, the shell of filtering converter should be suspended not to connect with radiator, input and output ground wires. If it is connected to either of them, EMI filtering converter will not function properly. As we have added EMI network to input and output terminals inside converter, so long as the shell is suspended, it will function. If the ripple is still large, it is needed to externally connect input or output EMI filter outside the shell. To suspend shell, it usually puts heat-conducting pad, ceramics backing or silicon rubber pad between the shell and radiator. If the ripple is still large after the internal EMI functions, it is necessary to connect input or output EMI filtering outside the converter. Input and output of the converter at most have four ground circuits and if they are needed to be connected together, connection should be done at the point less than 1cm where the lead wires go out of the converter. The closer that wire at connection point is to the converter, the less the intervention will be.

If isolation is needed between output and input, and not needed between outputs, but isolated type converter is selected, there is no requirement on connection between output grounds.

The no-load current of converter is 12mA and the current after cutoff is 2mA. The working frequency is 300±20 KHZ at +25°C and 310±20KHZ at +175°C.

Outline Diagram:



- Note: 1、 Mounting hole and mounting hole spacing dimension tolerance is $\pm 0.1\text{mm}$
2、 The tolerance of external dimension is $\pm 0.2\text{mm}$

Definition of Lead Wires:

Red wire: Input + Black wire: Input - Yellow wire: Cutoff Purple wire: Synchronous
White wire: MOUT (positive terminal of "+" and "-" symmetric output) Blue wire: MGND
Brown wire: +OUT1 (negative terminal of "+" and "-" symmetric output) White and black wire: -OUT1
Green wire: +OUT2 (MOUT when "+" and "-" symmetric output is auxiliary) Orange wire: -OUT2
White and red wire: +OUT3 White and brown wire: -OUT3

Product performance, reliability and information are subject to change without prior notice.
June 11,2022