

The i18 Series Multichannel Isolated Output Extra-High Temperature DC-DC Power Converters

Features:

- : Working temperature: ambient temperature: $-55^{\circ}\text{C} \sim +210^{\circ}\text{C}$ and shell temperature: $+215^{\circ}\text{C}$
- : Output power: 18W
- : Size: $L58.0 \times W33.0 \times H16.3\text{mm}$
- : Multiple output channel and up to four isolated outputs (3.3V, 5V, 7V, 9V, 12V, 15V, 18V, 24V, 36V, 48V)
- : Output ripple: max. 100mV, typical 50mV
- : Conversion efficiency: typical 75%
- : Input range: $10 \sim 30\text{V}$, $16 \sim 48\text{V}$, $24 \sim 72\text{V}$, $36 \sim 108\text{V}$, $70 \sim 210\text{V}$, $120 \sim 360\text{V}$
- : Integrated LC EMI filter
- : Sealed metal casting: Impact and moist resistance and electromagnetic radiation protection
- : Remote shutdown function
- : Provide rated power without deduction at 200°C (shell), provide 80% rated power at 215°C
- : Isolation voltage between input and output: 500V; isolation voltage between outputs: 500V
- : Restart after pressure and over-current shutdown
- : Input undervoltage and overvoltage cut-off protection
- : 100MS soft start
- : 237°C overheat protection



Description

The i series multi-channel isolated output extra-high temperature power converters are specially designed for electronic equipment operating at ambient temperature of 200°C . The purpose of our design of this series is to raise the working environment temperature of FH series to $-55^{\circ}\text{C} \sim +210^{\circ}\text{C}$, and at the same time, improve the electrical performance without increasing the size. i18 corresponds to FH18. Under the temperature of 175°C , two series of products can be electrical interchangeable.

The FH series has been put into mass production for 14 years. The actual use of a large number of products has fed back us a lot of useful data. We have also accumulated a wealth of experience in the production process. At the same time, due to the rapid changes in technology, this series has also continuously adopted new technologies. We also constantly adopt the opinions from clients to improve and upgrade the product.

With the continuous efforts, we successfully developed a full series of high-temperature power converters with a component temperature of 230°C in 2017. In the following three years, we have done a lot of work to improve reliability, reduce cost, improve mass production processes and quality control. Finally, the mass supply was officially launched in August 2020.

The i18 can continuously work for 500 hours at shell temperature 215°C , for 1500 hours at shell temperature 200°C and for 5000hours at shell temperature 185°C . It has passed the reliability verification. It has been verified that the failure rate is

less than 3% for 750 hours at shell temperature 215 °C . With features of being resistant to high temperature, impact and humidity, it is particularly suitable for being used as power supply system for petroleum prospecting logging tool, petroleum drilling instrument, geophysical detecting instrument, vehicles, telecommunication, network infrastructures, enterprise and high-performance calculation, etc.

The i18 series 18W multi-channel isolated output extra-high temperature DC-DC power converters are designed with six input ranges of 10~30V, 16~48V, 24~72V, 36~108V, 70~210V, 120~360V. The output voltages designed include 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 four isolation grounds at the most. When used, they can be connected as needed to form various forms of output combinations for ease of use. MOUT is main output terminal and OUT1, OUT2 and OUT3 are auxiliary output terminals. There can be only main output and no auxiliary output. If there are secondary outputs, the total number of main and auxiliary outputs should not exceed four. Output voltages can be arbitrarily isolated and commonly grounded. If the main output has a common-ground auxiliary output, one of these common-ground outputs must be greater than or equal to 5V. If the main output is single, the main output must be greater than or equal to 5V.

When in use, the output voltage of the main output terminal MOUT is the most stable. The output power of the main output is required to be the largest of the four output channels. The output voltage and ripple of the main output do not vary with the power variation of the main output voltage and the auxiliary output voltage. In the case that the output power of the main output terminal MOUT is constant, the voltage of the auxiliary output terminals OUT1, OUT2 and OUT3 decreases with the increase of its output power, up to 2%. If the output power of the auxiliary output terminals OUT1, OUT2 and OUT3 are constant, their output voltage will increase with the output power of the main output MOUT. Because of this feature, the main output and auxiliary output must be clearly defined when selecting models. For example, the module i18-150S12-S24-S5 outputs three mutually isolated voltages 12V, 24V and 5V, where 12V from MOUT, 24V from OUT1, and 5V from OUT2. Thus the module is named as i18-DCINSMOUT-SOUT1-SOUT2-SOUT3. “-“ means isolation, which may not appear in a model, it means that the outputs are not isolated. S*** can also be D*** or S***S***! Up to four S*** S in one model. D*** stands for two S***!

In the use of multi-output mode, if the power of an output (main or auxiliary) 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 below 10% and above 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. 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 ways 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.

During use, 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 and this fluctuation can be neglected in general.

The output voltage fluctuates within 2% over the whole operating temperature range and under the condition of full load and no load transformation. The i18 series operates at frequencies up to 300KHZ, providing good filtering conditions. Without any filtering, its output voltage ripple is less than 100MV. The temperature stability of the frequency is $\pm 8\%$ over the whole temperature range.

The i18 series contain LC network, which can effectively reduce input current fluctuation and output voltage fluctuation. When we developed this series, we had established the most authoritative RSS certification test system certified by EMI in the industry. We used it to design the input-output LC network contained in i18, making the input current fluctuation and output voltage fluctuation and interference ratio as same as FH series.

The i18 contains 100MS soft start circuit, which can slowly increase the input current after module startup and elimination of fault, facilitating external large capacity of output filter capacitance and reducing start shock.

The i18 contains undervoltage and overvoltage shutoff, which makes the module stop working when it exceeds the input voltage range and protects the module. Undervoltage overvoltage shutoff voltage is within 5V of rated voltage epitaxy. For example, with an input range rated from 24 to 72V, its undervoltage shutoff voltage is 21 to 23.9V, and its overvoltage shutoff voltage is 72.1 to 77V.

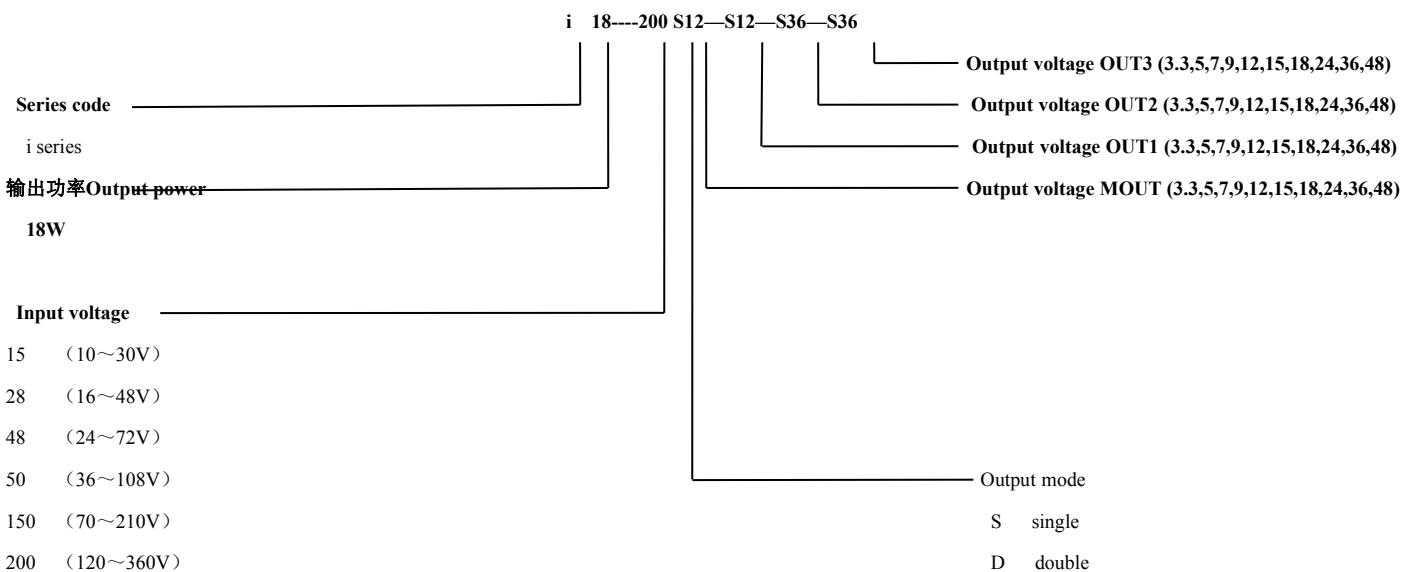
The SLEEP, off terminal of the i18, is high level and effective. When the voltage is 3.2~5.3V, the module will enter the SLEEP state and cut off all outputs with the input current less than 1mA. When the voltage is 0~ 2.5V or suspended, the module works normally. The input voltage at the SLEEP terminal should not exceed 12.0V.

The i18 series power converters contain the output short circuit and overload automatic cut-off circuit. When the output lasts for 0.1s and exceeds 120% of the rated output power, the converters will cut off all outputs. After the over-current fault is eliminated, it will automatically resume the output voltage. If the overload duration of output is less than 01s, the converter will not act.

Key components used for the i18 series power converters completely pass the in-factory test in accordance with the national military product quality standard, including live aging for 72 hours under the temperature of +230°C. All finished products have experienced full-load operation for 6 hours under the temperature of +210°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

i18-DCINSMOUT-SOUT1-SOUT2-SOUT3



Note: “—” in the above model means isolation, that is input is always isolated from output, so the first “—” is required. The following three “—” may not appear or just only appear one to three “—”, which means no isolation or there is isolation between outputs. S*** can also be D*** or S***S***. There are four S*** at most in a model. D*** means two S***.

Model example: In i18-150D15S5, MOUT outputs +15V, OUT1 outputs -15V and OUT2 outputs +5V. The outputs are commonly grounded.

In i18-50S15S3.3-S5, MOUT outputs +15V, OUT1 outputs +3.3V, and OUT 2 outputs 5V. MOUT and OUT1 are commonly grounded and isolation from OUT2.

In i18-50S15-S3.3-S5-S24, the outputs are isolated from each other. MOUT outputs 15V, OUT1 outputs +3.3V, OUT 2 outputs 5V, and OUT 3 outputs 24V

Technical Parameters

- (1) Working temperature: $-55^{\circ}\text{C} \sim +210^{\circ}\text{C}$, Max. shell temperature: $+215^{\circ}\text{C}$.
- (2) Input voltage: 10~30V, 16~48V, 24~72V, 36~108V, 70~210V, 120~360V
- (3) Multiple output channel and up to four isolated outputs 3.3V, 5V, 7V, 9V, 12V, 15V, 18V, 24V, 36V, 48V
- (4) Output ripple: 100mVp-p, typical 50mVp-p
- (5) Output power: 18W
- (6) Output precision: less than 4%
- (7) Load regulation: less than 4%
- (8) Temperature stability: Less than $\pm 2.5\%$, typical $\pm 1\%$
- (9) Line regulation: $\pm 0.1\%$ (10% linear variation)
- (10) Shock resistance: 25G, 0 ~ 300Hz
- (11) Conversion efficiency: 75%
- (12) Static power consumption: 0.8WMax.
- (13) Isolation voltage between input and output or between outputs: 500V
- (14) 100MS soft start
- (15) Dimension: L58.0×W33.0×H16.3mm
- (16) Voltage output type: high-temperature lead

Service Requirement

As the power converter has nearly 4W 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 215°C .

Module shell is isolated from input and output. In the use of the module, it is generally installed directly on the framework of the instrument or equipment. The framework is used as a radiator. At the time, if the ripple cannot continue to be filtered by the electricity capacity or LC network, then the ripple that cannot be filtered is EMI interference. EMI filtering module should be added to the input and output terminals of i18. As we have added EMI network to input and output terminals inside converter, so long as the shell is suspended, it will function. To make internal EMI function, 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. 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, it is needed to externally connect input or output EMI filter outside the shell. The input and output of the module shall have a maximum of four ground wires. If any of them need to be connected together, they must be connected at a place less than 1CM from the outgoing module. The shorter the line of the connection point from the module, the less interference.

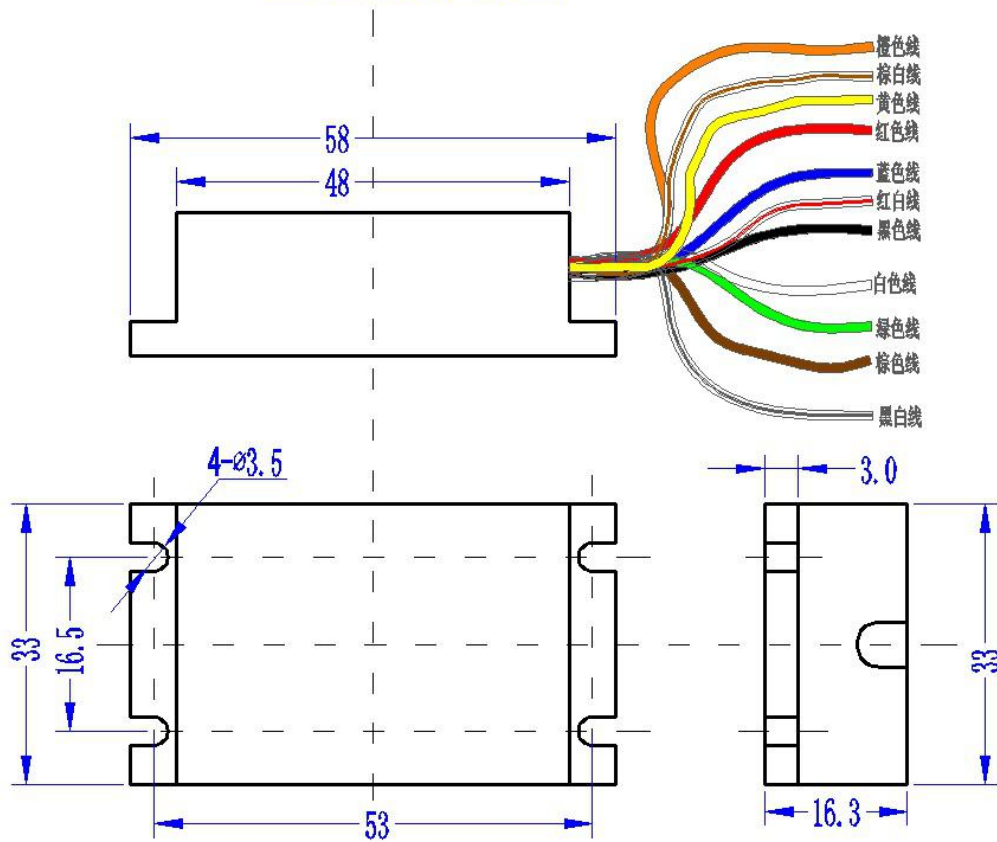
If the input and output need to be isolated, there is no need for isolation between outputs, but the module output has chosen the isolated type, the connection between the output and output places is optional, there is no requirement.

The no-load current of the module is 12MA, and the current after shutdown is 2MA. The operating frequency is 300 ± 20 KHZ at $+25^{\circ}\text{C}$ and 310 ± 20 KHZ at $+215^{\circ}\text{C}$.

In actual operation, if the load is less than 4W, the shell temperature can reach 225°C .

Outline Diagram

I18外观示意图



Definition of Lead Wires

- | | | |
|--|---------------|------------------------|
| Red: input + | Black: input- | Yellow: shutoff |
| White: MOUT (positive end of symmetric output of positive and negative) | | Blue: MGND |
| Brown: +OUT1 (negative end of symmetric output of positive and negative) | | White and black: -OUT1 |
| Green: auxiliary output +OUT2 (it is MOUT when symmetric output of positive and negative is auxiliary) | | Orange: -OUT2 |
| White and red: +OUT3 | | White and brown: -OUT3 |

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