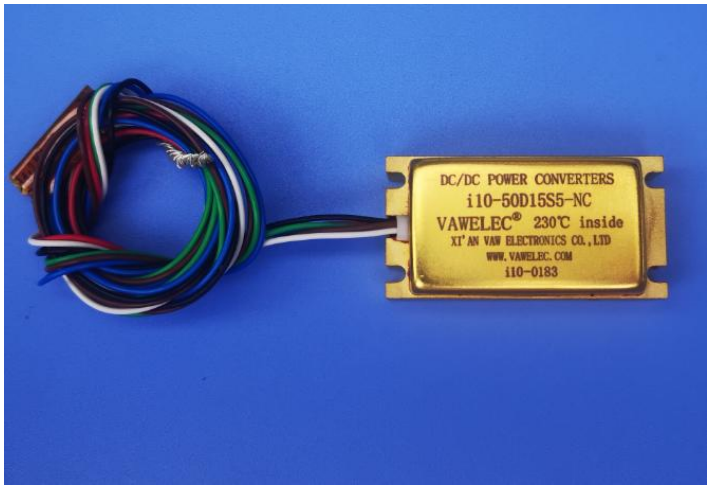
The i10 Series Multichannel Isolated Output Extra-High Temperature DC-DC Power Converters

Features:



- Working temperature: ambient temperature:-55℃～+210℃ and shell temperature: +215℃
- Output power: 5W
- Size: L38.2×W22.2×H10.5mm，**This dimension does not include the size of the mounting base**
- 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 (NC: max. 200mV, typical 100mV)
- Conversion efficiency: typical 75%
- Input range: 10～30V, 16～48V, 24～72V, 36～108V, 70～210V, 120～360V
- 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℃ (shell), provide 80% rated power at 215℃
- Isolation voltage between input and output: 1000V; isolation voltage between outputs: 500V
- Restart after pressure and over-current shutdown
- Input undervoltage and overvoltage cut-off protection
- 100MS soft start
- Overheat protection at 237℃

Description

The i series multi-channel isolated output extra-high temperature power converters are specially designed for electronic equipment operating at an ambient temperature over 200℃. The purpose of our design of this series is to raise the working environment temperature of FH series to -55℃ ~ +210℃, and at the same time, improve the electrical performance without increasing the size.

i10 corresponds to FH10, with the mechanical dimensions unchanged. The installation location holes are same and only the height is increased by 2.5mm. The ambient temperature is increased from -55℃～+175℃ to -55℃～+210℃, and other parameters are not lower than FH10 series.

The FH series has been put into mass production for 15 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℃ 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.

All the electronic components of the i10 series are selected to withstand temperature of +230℃. Each component and process has passed the reliability verification separately, and the whole finished product has also passed the reliability verification and life test.

The i10 series can continuously work for 500 hours at shell temperature 215℃, for 1500 hours at shell temperature 200℃ and for 5000 hours at shell temperature 185℃. It has been verified that the failure rate is less than 3% for 750 hours at shell temperature 215℃. 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 i10 series 10W multi-channel isolation 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 or three voltages. The output can provide two 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 and OUT2 are auxiliary output terminals. There can be only main output and no auxiliary output. If there are auxiliary outputs, the total number of main and auxiliary outputs should not exceed three. 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.

During 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 among the three 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 and OUT2 decreases with the increase of its output power, up to 2%. If the output power of the auxiliary output terminals OUT1 and OUT2 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 i10-150S12S24-S5 outputs three voltages 12V, 24V and 5V, where 12V is from MOUT, 24V from OUT1, and 5V from OUT2. 12V and 24V are in common ground and are isolated from 5V. 12V is the main output, and 24V and 5V are the auxiliary outputs. Thus the module is named as i10-DCINSMOUT-SOUT. "-" means isolation, which may not appear in a model, meaning that the outputs are not isolated. S*** can also be D*** or S***S***! Up to three S*** S in one model. D*** stands for two S***!

In the use of multiple 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.

The output voltage fluctuates within 4% over the whole operating temperature range and under the condition of full load and no load transformation. The i10 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 ±4% over the whole temperature range.

The i10 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 R$S certification test system certified by EMI in the industry. We used it to design the input-output LC network contained in i10, making the input current fluctuation and output voltage fluctuation and interference ratio as same as FH series.

The i10 contains 100MS soft start circuit, which can slowly increase the input current after the module startup and elimination of fault, facilitating external large capacity of output filter capacitance and reducing start shock.

The i10 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 i10, is high level and effective. When the voltage is 3.2~5.3V, the module enters the SLEEP state and cuts 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.

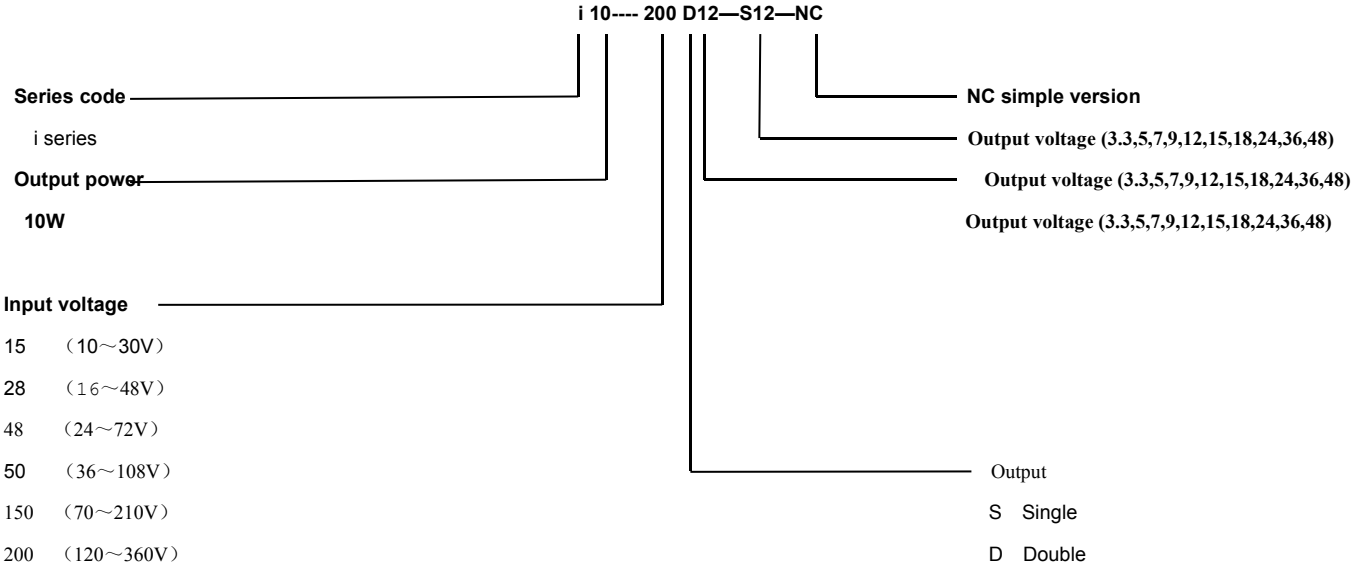
The i10 series power converters contain the output short circuit and overload automatic cut-off circuit. When the output lasts for 0.1s and exceeds 150% of the rated output power, the converters will cut off all outputs. After the over-current fault is eliminated, it will automatically resume the output voltage. If the overload duration of output is less than 01s, the converter will not act.

Considering the cost and economic benefits, i10 provides a simple version - NC, which minimizes the amount of 230℃ filter capacitance in the power supply. This increases the maximum ripple of the overall power supply to 200Mv. If the ripple does not meet the requirements in use, each circuit can be externally connected with a 10UF 200℃ capacitor to achieve the requirement of no more than 100Mv. This can greatly reduce the use cost, because the 230℃ filter capacitor needed inside the power supply is 10 to 100 times higher than the 200℃ filter capacitor needed outside the power supply. Using NC version, the use cost can be reduced by about half.

Key components of the i10 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℃. All finished products have experienced full-load operation for 6 hours under the temperature of +210℃ 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

Model named i10-DCINSMOUT-SOUT1-NC



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

Model example: In i10-150D15S5, MOUT outputs + **15V, OUT1** outputs -15**V and OUT2** outputs +5**V. The outputs are commonly grounded.**

In i10-50S15S3.3-S5, MOUT outputs **+15V** , **OUT1 outputs +3.3V, and OUT 2** outputs **5V. MOUT and OUT1 are commonly grounded and isolated from OUT2.**

Technical Parameters

(1) Working temperature: -55℃～+210 ℃, Max. shell temperature: +215 ℃.
(2) Input voltage: 10～30V, 16～48V, 24～72V, 36～108V, 70～210V, 120～360V
(3) Multiple outputs up to three outputs and up to two isolated output GND 3.3V, 5V, 7V, 9V, 12V, 15V, 18V, 24V, 36V, 48V
(4) Output ripple: 100mVp-p, typical 50mVp-p (NC: max. 200mV, typical 100mV)
(5) Output power: 10W
(6) Output precision: less than 4%
(7) Load regulation: less than 4%
(8) Temperature stability: Less than ±4% , typical ±2%
(9) Line regulation: ±0.1%(10% linear variation)
(10) Shock resistance: 25G, 0 ~ 300Hz
(11) Conversion efficiency: 75%
(12) Static power consumption: 0. 8W Max.
(13) Isolation voltage between input and output :1000V，Isolation voltage between outputs: 500V
(14) 100MS soft start
(15) Overheat cutoff at 237℃

(16) Dimension: L38.2×W22.2×H10.5m，**This dimension does not include the size of the mounting base**

(17) Voltage output type: high-temperature lead

Service Requirement:

As the power converter has nearly 2.5W 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℃.

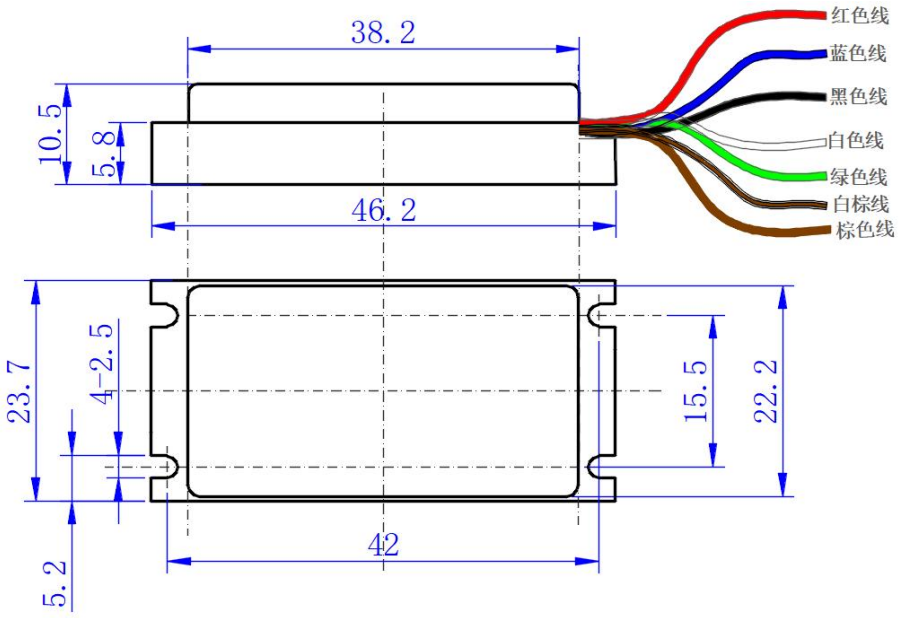
Module shell is isolated from input and output. During use, it is generally installed directly on the framework of the instrument or equipment. The framework is used as a radiator. At the time, if the ripple cannot continue to be filtered by the electricity capacity or LC network, then the ripple that cannot be filtered is EMI interference. EMI filtering module should be added to the input and output terminals of i10. 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℃ and 310±20KHZ at +215℃.

In actual operation, if the load is less than 1W, the shell temperature can reach 225℃.

Outline Diagram



Note: 1、Mounting hole and mounting hole spacing dimension tolerance is ±0.1mm
2、The tolerance of external dimension is ±0.2mm

Definition of lead wires

Lead color / Output category (model)	Red	Black	White	Blue	Brown	Green	White & brown	Yellow (if any)	Purple (if any)	Remark
	Input+	Input-	Input+							
Single output (e.g. i10-28S5)	IN+	IN-	MOUT main output	MGND	/	/	/	on/off lead	sync lead	1 main output
Single output shares the ground (e.g. i10-28S5S12)	IN+	IN-	The first output MOUT main output	The first and second outputs share the ground MGND	/	The second output+OUT2 auxiliary output	/	on/off lead	sync lead	1 main and 1 auxiliary outputs
Single output isolates (e.g. i10-28S5-S12)	IN+	IN-	The first output MOUT main output	The first output MGND	The second output GND2	/	The second output +OUT2 auxiliary output	on/off lead	sync lead	1 main and 1 auxiliary outputs
Positive and negative symmetric output (e.g. i10-28D5)	IN+	IN-	The first output MOUT main output	The first and second outputs share the ground MGND	The second output-OUT2 auxiliary output or main output	/	/	on/off lead	sync lead	2 main output and 1 main and 1 auxiliary outputs
Three single outputs share the ground (e.g. i10-28S5S12S15)	IN+	IN-	The first output MOUT main output	Three outputs share the ground MGND	The second output+OUT2 auxiliary output	The third output +OUT3 auxiliary output	/	on/off lead	sync lead	1 main and 2 auxiliary outputs
2 single outputs share the ground+1 isolated single output (e.g. i10-28S5S12-S15)	IN+	IN-	The first output MOUT main output	The first and the second outputs share the ground MGND	The second output+OUT2 auxiliary output	The third output +OUT3 auxiliary output	The third output GND3	on/off lead	sync lead	1 main and 2 auxiliary outputs
1 isolated single output+2 single outputs share the ground (e.g. i10-28S5-S12S15)	IN+	IN-	The second output+OUT2 auxiliary output	The first output MGND	The second and the third outputs share the ground GND2	The first output MOUT main output	The third output +OUT3 auxiliary output	on/off lead	sync lead	1 main and 2 auxiliary outputs
2 positive and negative symmetric outputs share the ground+1 isolated single output (e.g. i10-28D5-S12)	IN+	IN-	The first output MOUT main output	The first and the second outputs share the ground MGND	The second output-OUT2 auxiliary output or main output	The third output +OUT3 auxiliary output	The third output GND3	on/off lead	sync lead	1 main and 2 auxiliary outputs and 2 main and 1 auxiliary outputs
2 positive and negative symmetric outputs share the ground+1 single	IN+	IN-	The first output MOUT main output	Three outputs share the ground MGND	The second output-OUT2 auxiliary output or	The third output +OUT3 auxiliary output	/	on/off lead	sync lead	1 main and 2 auxiliary outputs and 2 main and 1

output shares the ground (e.g. i10-28D5S12)					main output					auxiliary output
1 single output+2 positive and negative symmetric outputs share the ground (e.g. i10-28S5-D12)	IN+	IN-	The second output+OUT2 auxiliary output	The first output MGND	The third output OUT3 auxiliary output	The first output MOUT main output	The second and the third outputs share the ground GND2	on/off lead	sync lead	1 main and 2 auxiliary outputs
1 single output+2 positive and symmetric outputs share the ground (e.g. i10-28S5D12)	IN+	IN-	The second output+OUT2 auxiliary output	Three outputs share the ground MGND	The third output OUT3 auxiliary outputs	The first output MOUT main output	/	on/off lead	sync lead	1 main and 2 auxiliary outputs

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

June 09, 2026