MB18 Series 175℃ 9-36V Input, Dual 5.0V outputs 1/64+ Brick Power Module

Introduction and application:

The MB18 series power supply modules are isolated modules with a wide range of inputs from 9-36V, maximum output power up to 10W and maximum efficiency up to 75%. There are two isolated outputs of the same voltage, which can output two isolated outputs of the same voltage, with each voltage range of +3.3 ~+7.0V and each output power up to 5W. It can also be combined into a single output with a voltage range of +3.3V to +7.0V and a power of up to 10W. It can also be connected in series to form a single output with an output range of +6.6V to +14.0V and output power of 10W. Users can also connect the two isolated outputs into a positive and negative symmetrical dual output, with voltage range of ±3.3 ~ ±7.0 V. Positive and negative outputs total 10W power. Users can freely place the order according to the need.

All internal components are highly reliable and long-life components with a resistance of over 200°C.Under the severe conditions of 175℃ ambient temperature and 185℃ case temperature, the MB18 can work continuously or cumulatively for more than 500 or 1,500 hours (E: 500 hours, T: 1,500 hours) under the condition that the failure rate is guaranteed to be no more than 0.5 per cent. The MS60 features a few protective functions for output over-current, short-circuit and input under-voltage and over-temperature. The environmental performance meets the requirements of GJB150-86, and the electrical performance index is in accordance with GJB-181A-2003 standard. Its elaborate design ensures excellent thermal performance and high stability, and it can meet the requirements of size, weight, power density, environment and other high demands, so that it is widely used in a variety of electronic systems with stringent requirements on environment and quality.

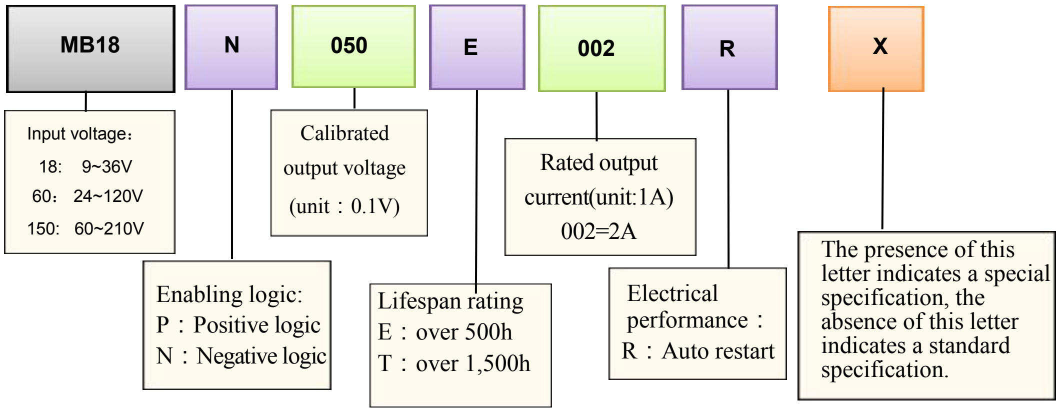
Properties:

- Wide range input voltage:9-36V;
- Wide operating ambient temperature:-55℃ ~ +175℃(case temperature: -55℃ ~ +185℃);
- Two isolated symmetrical output voltage;
- Input and output isolation 1000V. 500V between outputs isolated from each other;
- Output voltage range: 3.3V-7.0V;
- Efficiency up to 75%;
- Short circuit, under-voltage, over-current, and over-temperature protection;
- Excellent thermal performance;

Optional functions:

- Positive and negative switching logic

Naming rules:



Electrical properties:

Typical conditions: T_A=25°C, air flow rate=1.5m/s (300LFM),Vin=18V_{DC}

Parameters	Min. value	Typical value	Max. value	Unit	Description /condition
Maximum absolute rating					
Input voltage					
No working	36		50	V	
Working			36	V	
Surge working voltage			50	V	100ms, square wave
Isolated voltage					
Input to output			1000	VDC	Within 1 minute
Input to base plate			1000	VDC	Within 1 minute
Output to output			500	VDC	Within 1 minute
Output to base plate			500	VDC	Within 1 minute
Efficiency					
100% load		70		%	Output 3.3V
		73			Output 5.0V
		75			Output 7.0V
Working temperature	-55		175	℃	Max. case temperature185℃
Storage temperature	-55		125	℃	
Input characteristics					
Input operating voltage range	9	18	36	V	
No-load input current		25	50	mA	
No-load loss		0.5	0.8	W	
Max. input current			2.86	A	Vin=9V~36V,full load
Standby input current			4	mA	
Input reflected ripple (120Hz)				mA	
Transient shock			0.1	A^2s	
Recommended fuse value			4	A	Fast fuse
Recommended external input capacity		10.0		μF	ESR0.1~0.2Ω
Input undervoltage lockout					
Start-up input voltage threshold	8	10	12	V	
Close input voltage threshold	34	36	38	V	
Output characteristics					

Electrical properties

Typical conditions: T_A =25°C, air flow rate=1.5m/s (300LFM),Vin=18V_{DC}

Parameters	Min. value	Typical value	Max. value	Unit	Description /condition
Output voltage setting value		5.0		V	
Output voltage adjustment range	66		140	%	
Output voltage remote compensation range			10	%	
Deviation of output voltage setting value	-5		+5	%	Full condition range
Maximum output current			2	A	
Maximum output power			10	W	
Dynamic Characteristics					
Peak value deviation		6		%	Load 50%~75%~50%;50%~25%~50%; Rate of change of load current 0.1A/us
Reset time		300		μs	
Output voltage rise time		15		ms	10%~90%VOUT
Output voltage power-up delay time		25		ms	VIN~10% VOUT
Output characteristics					
Output voltage ripple and noise					
Peak-peak value			100	mVp-p	Full load, 20MHz Oscilloscope bandwidth limit
Root mean square (rms) value			50	mVrms	Full load, 20MHz Oscilloscope bandwidth limit
Output overcurrent protection point	5.46	6.06	6.66	A	Two outputs 3.3V
	3.60	4.00	4.40		Two outputs5.0V
	2.56	2.86	3.14		Two outputs7.0V
Capacitive load	47		1000	μF	
Output voltage adjustment rate					
Temperature adjustment rate		0.1		%	Ta = -55°C~175°C
Linear adjustment rate		0.2	0.5	%	Vin=9V~36V, half load
Load adjustment rate		0.2	0.5	%	No load~full load
Temperature limits for derating curves					
Semiconductor junction temperature			205	°C	
Transformer's temperature			205	°C	
Maximum heat dissipating substrate temperature			185	°C	
Printed circuit board temperature			205	°C	
Isolation characteristics					
Isolation voltage (dielectric strength)					Reference maximum absolute rating
Isolation Impedance	10			MΩ	
Isolated capacitance		1000		pF	
General characteristics					
Weight parameters		10		g	Error±2g
Enabling Control					
Positive logic active level	3.5		15	V	
Negative logic active level	-0.7		1.2	V	
Switching frequency	280	300	320		
Mean Time Between Failure (MTBF)		8		10^5 hrs.	Substrate temperature 125°C
Over-temperature protection point		195		°C	Case temperature

Function description

Output voltage adjustment (ADJ)

The voltage regulation pin ADJ is used to regulate the output voltage. Connecting an external resistor R1 between the regulating voltage pin ADJ and the output OUT1 can reduce the output voltage to a value between 3.3V and 5.0V; connecting an external resistor R2 between the regulating voltage pin ADJ and the output GND1 can raise the output voltage to a value between 5.0V and 7.0V. The output voltage can be adjusted from 66% to 140% of its nominal voltage. That is, the output can be adjusted down to 3.3V or up to 7.0V.

1.The formula for the resistance value of the external resistor to reduce the voltage (output voltage 3.3V-5.0V):

VOUT=（5.025+5.119*R1）/(1.518+R1) ①

R1=(1.518*VOUT-5.025)/(5.119-VOUT) ② VOUT is the actual output voltage after adjustment, unit:V;

R1 is an external resistor, unit: kΩ.

Wiring: When ADJ and output OUT1 are short-circuited(R1=0Ω), the dual-output isolated voltage is minimum of 3.3V

When a resistor R1 is connected between ADJ and output OUT1, the dual-output isolated voltage is higher than 3.3V and lower than 5V, refer to the calculation formula above. ①②.

2. The formula for the resistance value of the external resistor to raise the voltage (output voltage 5.0V-7.0V):

VOUT=(5.025+5.119*R2）/(0.47+R2) ③

R2=(5.025-0.47*VOUT)/(VOUT-5.119) ④ VOUT is the actual output voltage after adjustment, unit: V;

R2 is an external resistor, unit: kΩ.

Wiring：When a resistor R2 (R2=0.9kΩ) is connected between ADJ and output GND1 , the dual outputs of same isolated voltage is maximum of 7.0V;

When a resistor R2 with its value greater than 0.9kΩ (R2 not lower than 0.9kΩ) is connected between ADJ and output GND1, the dual outputs of the same isolated voltage is higher than 5.0V and lower than 7.0V, refer to formula ③④ above.

3. Note：Dual outputs of the same isolated voltage is 5.0V when ADJ is suspended

The power for the external resistors R1 and R2 requires above 10mW, and the precision is determined according to the accuracy of the VOUT.

When using the function of increasing output voltage or telemetry to make the converter's output voltage higher than the set voltage, please note not to exceed the maximum output power specified in the output specification table.

Enabling control

The converter can be switched on and off by changing the voltage between the ON/OFF pin and Vin(-). The MB series converter allows for a choice of positive logic control or negative logic control for the switching. Regarding negative logic control, the converter is turned on when the ON/OFF pin is at a logic low level, and the converter is turned off when the ON/OFF pin is at a logic high level. For positive logic control, the converter is turned on when the ON/OFF pin is at a logical high level; and the converter is turned off when the ON/OFF pin is at a logical low level. Due to the internal pull-up circuit, connecting a small external switch between the ON/OFF pin and Vin(-) allows you to control the converter.

The logic low-level range is 0V to 1.2V, with a maximum external sourcing current of 1mA. The external switch must be able to maintain the logic low level of the ON/OFF pin while sourcing a current of 1mA; the logic high-level range is 3.5V to 12V. The internal circuit of the converter can generate a maximum voltage on the ON/OFF pin that does not exceed 15V, and when the ON/OFF pin is at a high voltage level, the maximum allowable leakage current is 2mA.

Protective function

Over-voltage protection

The converter starts when the input voltage rises to the startup input voltage threshold; it shuts down when the input voltage falls to the shutdown input voltage threshold. The hysteresis voltage effectively prevents the converter from oscillating between on and off.

Over-temperature protection

The temperature sensor is mounted on the converter circuit board at a location that reflects the temperature of the main components. If an over-temperature condition is detected, the converter will shut down. For self-locking protected modules, the module can start the converter by pressing the ON/OFF switch or inputting voltage. For modules with automatic restart, the module resumes operation on its own after the over-temperature condition disappears.

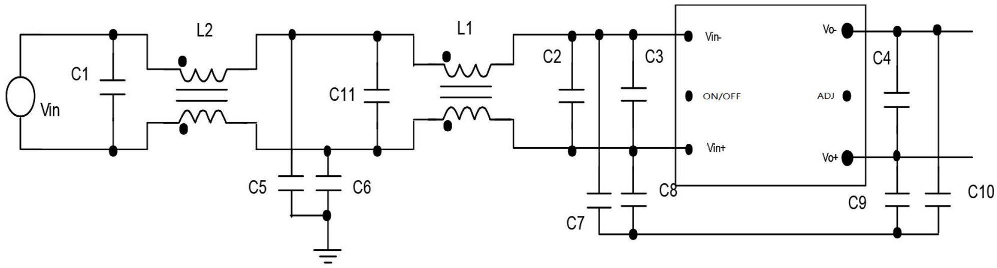
Over-current protection

The converter shuts down when the load current is higher than the overcurrent value. For self-locking protected modules, the module can start the converter by pressing ON/OFF switch or inputting voltage. For modules with automatic restart, the converter shuts down and keep trying to restart when the load current is higher than the overcurrent value. When the overcurrent condition disappears, the module automatically resumes operation.

EMI

When the power module is in operation, it will generate two types of electromagnetic interference noise: radiation and conduction. Radiation noise mainly originates from the rapid changes in voltage and current in the module, and the rapid changes in voltage and current are due to the turning on and off of power switching devices. At the same time, the mechanical structure of the module also has a certain impact on the radiation noise. In the design of general modules, a snubber is adopted to reduce the high-frequency oscillation generated by the rapid changes in voltage and current during the switching of power devices. When selecting a metal substrate, grounding the metal substrate or connecting it to a relatively stable potential point can achieve a certain shielding effect. Conductive noise can be further divided into differential mode noise and common mode noise. Differential mode noise appears between the positive and negative pins of the input and output, mainly at the input end. The pulse width modulation (PWM) of the power switching devices in the power supply module is the source of such noise. Modules usually contain input differential mode L-C filters. Common-mode noise appears between the input and output pins and the ground, and its strength is related to many internal and external factors. The module also contains common-mode filtering capacitors. To further reduce noise interference, external differential mode and common mode filters are generally required in the application. Electromagnetic interference is a system problem affected by many factors other than modules, such as cabinet design, wiring design of the circuit board using the module, etc. Therefore, the structure of the filter and the parameters of the filter components may vary to some extent due to different systems.

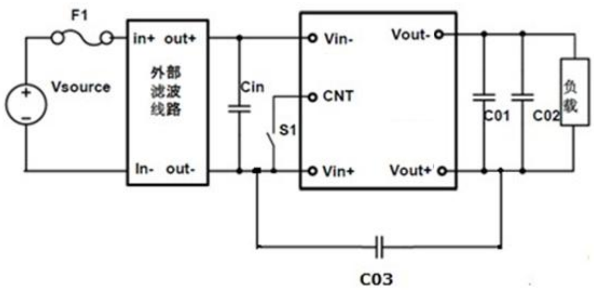
Recommended configuration parameters for EMC:



C1, C2, C3, and C4 are differential mode filtering capacitors. Among them, C2 should be a capacitor with a large capacity and a low equivalent series resistance (ESR), such as an electrolytic capacitor. Generally, C1, C3, and C4 are ceramic capacitors with very small equivalent series resistance (ESR) and equivalent series inductance (ESL), providing a low-impedance loop for high-frequency noise currents. Regarding the selection of C2 capacitance, for modules with a minimum input voltage of 120V, it is recommended to use 22-47uF per 100 watts of input power. For modules with a minimum input voltage of 30V, it is recommended to use 50-100uF per 100 watts of input power. For a module with a minimum input voltage of 18V, it is recommended to use 200-400uF per 100 watts of input power. The voltage rating of the capacitor should be greater than the maximum input voltage. Additionally, C2 must have a sufficient current rating to meet the needs of long-term operation under high temperatures and heavy loads. The main function of C2 is to prevent the output impedance of the power supply at the input end of the module from being too high, ensuring stable operation of the module under various practical conditions. If the output impedance of the power supply is relatively low and the distance to the module is short, the capacity of C2 can also be appropriately reduced. While ensuring stability, C2 also provides a path for the input ripple current generated by the module. Capacitors C7-C10 are common-mode high-frequency decoupling capacitors, with capacitance values typically ranging from 10nF to 0.1uF. Depending on the grounding method of input and output, some of these capacitors must be high-voltage capacitors. In most applications, increasing the output capacitor C4 can improve the output dynamic response and reduce voltage oscillations caused by output lead inductance. Generally, these output capacitors should also be capacitors with low equivalent series resistance (such as ceramic capacitors). The selection of L1 and L2 needs to be based on the actual input current and the system's actual EMC requirements, typically ranging from tens of uH to hundreds of uH.

Guide to application

Typical application circuit



F1: 4A fuse (fast fusing)

Cin: 33uF/75V high frequency low ESR electrolytic capacitors is recommended, plus a 1uF/100V ceramic capacitor connected in parallel;

C01: 1uF ceramic capacitor is recommended;

C02: 47uF electrolytic capacitor is recommended;

C03: 1nF /3000Vdc ceramic capacitors are recommended. C03 cannot be used in most cases.

Installation and welding precautions

Module installation

Modules can be installed in different positions, but it must be ensured that the air duct is unobstructed. Generally, power devices are placed at the end of the air duct or have a separate air duct. This installation can ensure the cooling of the power supply module and increase the service life of the device.

If the module is used in a closed space without air ducts, a metal heat sink is required to dissipate the heat from the module. The MB module does not have a heat dissipation substrate, and the internal heat is transmitted to its metal case, with a maximum of 3W of heat. During installation, it is necessary to dissipate the heat from the case. The general practice is to install the module on the back of the PCB, use the PCB to press the module onto the metal bracket, and place an elastic thermal conductive pad with a thickness of 0.5MM to 1.0MM between the top of the module and the metal bracket to maintain good thermal conductivity between the module and the metal bracket. The metal bracket of the instrument or equipment is used as a heat sink to dissipate the heat of 3W. When used in a strong vibration environment, the four claws around the module shell should be welded onto the PCB to fix the module, rather than using the pins. This is done to increase the module's shock resistance and protect it.

Notice:

It must be ensured that there are no electrical connections between the module's substrate and safety ground, or between the base plate and other pins.

Module welding:

The module meets the standard wave soldering technology. During wave soldering, the module's pins must be preheated at 110℃ for 20 to 30 seconds, and the wave soldering should be done at 235℃ for less than 10 seconds. During manual soldering, the soldering iron should be set at 425℃, and it is necessary to ensure that the direct contact time with the pins does not exceed 3 seconds. Long-term high-temperature soldering can cause internal damage to the module. The module's solder joints can be cleaned using IPA or an appropriate solvent.

Special notes:

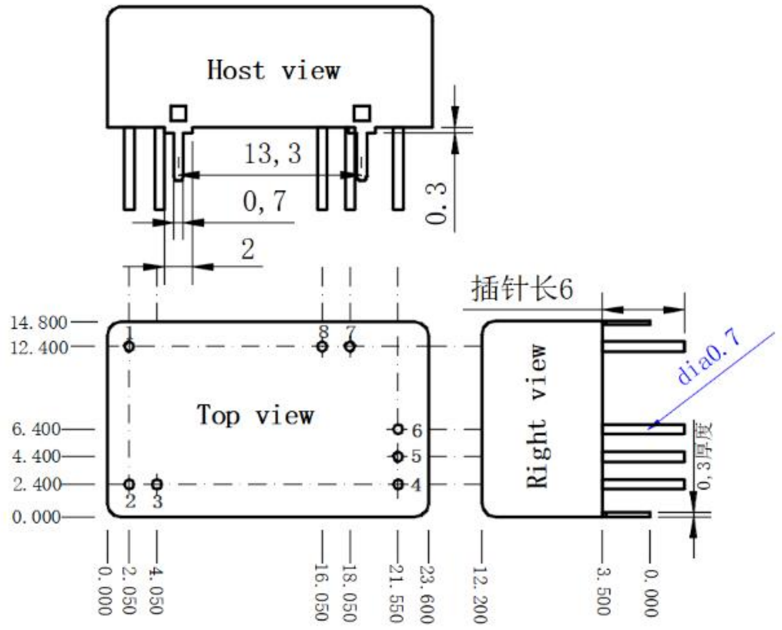
1. If the input voltage is repeatedly restarted several times quickly, the restart of the power supply module will cause the failure of the slow start circuit, which may lead to the damage of the module. The recommended restart interval for the input voltage should be greater than 1 second;

2. If the control voltage on the enable pin (ON/OFF) is repeatedly restarted quickly, the power supply module will cause the slow start circuit to fail when restarted, which may cause damage to the module. The recommended restart interval for the control voltage on the enable pin (ON/OFF) should be more than 1 second.

3. The voltage of each pin of the power supply module is not allowed to exceed the maximum voltage indicated in the specification, especially the input positive pin, otherwise the module will be damaged;

4. The power module requires an additional input capacitor for use. The specific input capacitance value can be recommended by the manufacturer, but if the input capacitance is too small or not available, it will cause the power module to oscillate, which will most likely lead to module failure.

Module’s dimension



注：1. 插针及针距间尺寸公差为±0. 1mm;
2. 外形尺寸公差为±0. 2mm;

Notes: 1. The tolerance of pin spacing and installation hole’s dimension is ± 0.1mm.

2. The tolerance of dimension is ± 0.2mm.

Definition of wire leads:

Pin No.	Definition	Function
1	Vin-	Input -
2	Vin+	Input +
3	ON/OFF	Remote control terminal
4	GND2	Second output -
5	OUT2	Second output +
6	GND1	First output -
7	OUT1	First output +
8	ADJ	Output voltage regulation

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

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