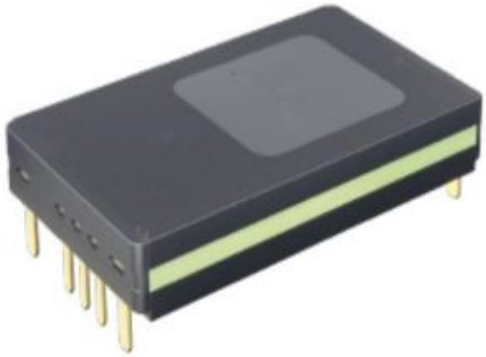
Product Characteristics



- Input voltage range: $9V_{DC}$-$50V_{DC}$
- Output voltage :$28V_{DC}$ (16.8 ~ 30.8V adjustable)
- Efficiency: Up to 91.4%
- Volumetric power density: up to 412W/in3
- Weight Power density: up to 6.6W/g
- Over voltage, over current, under voltage, short circuit and over temperature protection
- 2250VDC insulation withstand voltage
- Supports 8 parallel expansion units
- In-line Chip3623 package :38.72mm×22.8mm×7.21mm
- Working shell temperature :90℃ (full load)

Product Overview

CFJDCM28WBC28X160TX DC/DC power module adopts advanced power topology, control and packaging technology,with high efficiency, ultra-high power density, ultra-small size, ultra-light weight and other advantages; Using MHz softswitching technology, the efficiency is up to 91.4%; With input over and under voltage protection, output over voltage, over current, short circuit protection and over temperature protection and other functions; Product design and manufacturing meet the requirements of SJ20668-1998 "Microcircuit Module General Specification" and product specifications. Especially suitable for aviation, aerospace, ships, weapons and other fields of power, efficiency, volume, weight, height and other extremely strict requirements of highly reliable electronic systems;

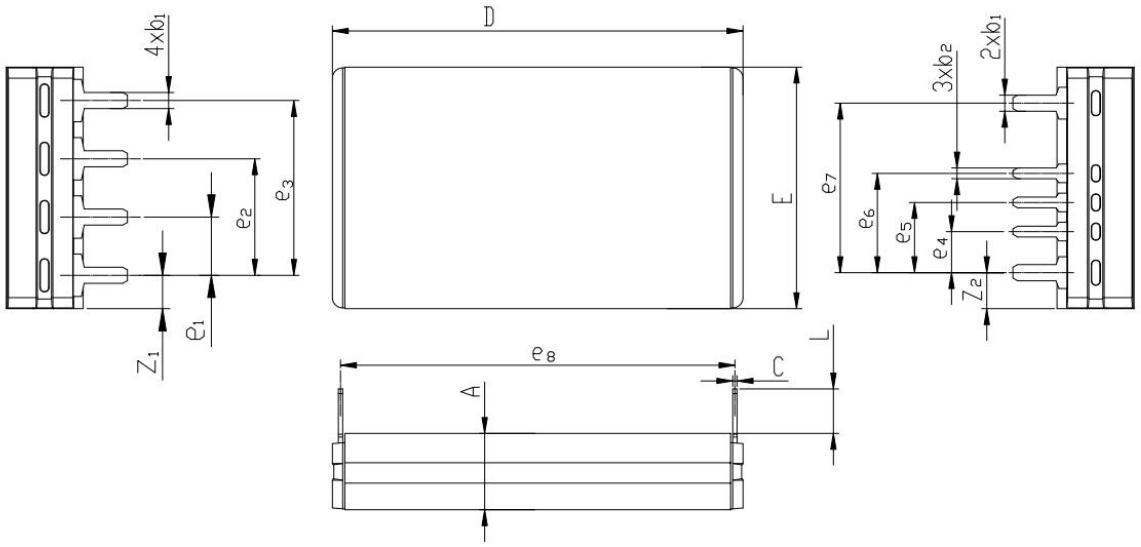
Application Field

- Industrial control system
- Distributed power system
- On-board system
- Missile-borne system
- Unmanned aerial system
- Ship system

Product Naming

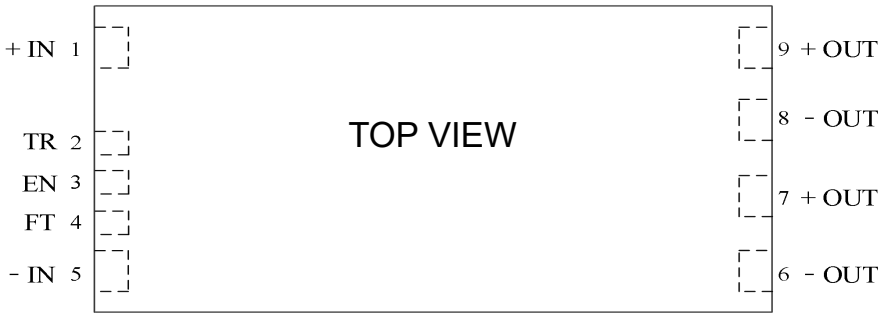
CFJDCM	28W	BC	28	X	160	T	X
Changfeng CFJDCM series microchip power supply	Input voltage 28W:9-50V_{DC}	3623 Dimensions	Output Voltage 28:28V	M : T_C :-55~100℃ T_S :-65~125℃ H: T_C :-40~100℃ T_S :-55~125℃ T: T_C :-40~100℃ T_S :-40~100℃	Output power 160:160W	T: Insert the PIN	S:Single machine operation P:Parallel support	

Packaging size and recommended printing layout



Symbol	Numerical value		
	Minimum	Nominal	Maximum
A	—	7.21	7.31
b_1	—	1.52	—
b_2	—	1.02	—
C	0.31	—	0.51
D	—	38.72	39.10
E	—	22.80	22.93
e_1	—	5.5	—
e_2	—	11	—
e_3	—	16.5	—
e_4	—	3.88	—
e_5	—	6.63	—
e_6	—	9.38	—
e_7	—	16	—
e_8	—	37.2	—
L	3.5	—	—
Z_1	2.75	—	3.55
Z_2	3	—	3.8
Unmarked tolerance dimensions shall be executed according to the tolerance level M specified in Table 1 of GB/T1804-2000;			

Pin definition



Pin	Symbol	Function	Pin	Symbol	Function
1	+IN	Input positive end	6	-OUT	Output negative terminal
2	TR	Voltage regulation pin	7	+OUT	Output positive end
3	EN	Enable pin	8	-OUT	Output negative terminal
4	FT	Fault indicator pin	9	+OUT	Output positive end
5	-IN	Input negative terminal			

Limit Parameter

Project	Minimum value	Typical value	Maximum value	Unit	Remarks/Conditions
+IN → - IN voltage VIN	-0.5		60	V	
TR → - IN voltage VTR	-0.3		3.5	V	
EN → - IN voltage VEN	-0.3		3.5	V	
FT → - IN voltage VFT	-0.3		3.5	V	
+OUT → - OUT voltage	-0.5		39.2	V	
Storage temperature	-55		125	℃	
Lead wire resistance to welding temperature			260	℃	Wave soldering, time less than 5 seconds
			390	℃	Manual welding, time less than 7 seconds

Electrical Characteristics

Project		Minimum value	Typical value	Maximum value	Unit	Remarks/Conditions
Input characteristics						
Input Voltage		9	30	50	V	
Under voltage protect		6.5	7.2	8.5	V	
Over voltage protect		50.1	53.1	60	V	
No-load loss			3.6		W	V_{IN}=30V
Prohibition of wear and tear			0.2		W	
Output characteristic						
Output voltage		27.72	28.00	28.28		V_{IN}=30V, the full load
Voltage regulation			0.1		V	full load
Load Regulation			0.3		V	10%full load--full load (Single machine version)
Temperature coefficient			2		mV/℃	full load
Output Voltage Ripple			300		mV	T_A=25℃,the full load
Current range		0		5.80	A	
Output current limiting protection point		5.9	6.7	8.7	A	
Output current limiting protection restart interval time			1		s	
Output voltage regulating range		16.8		30.8	V	
Output capacitance		1000	2000	10000	μF	
Output Load	Overshoot voltage		1500		mV	Cout=2000uF, 10% full load to 90%
Step response	Recovery time		10		ms	Full load -10% full load, 0.1A/us
Efficiency						
100% load			91.4		%	T_A=25℃,V_{IN}=30V

General characteristics					
Over Temperature Protection		130		℃	Shell temperature
EN enable voltage	2.5			V	Enabling startup above this voltage
EN prohibits voltage			1	V	Enabling shutdown below this voltage
FT pin high voltage	3.0			V	The full load
FT pin current driving capability			3.0	mA	T_A=25℃,the full load
TR prohibits voltage	3.15				TR function disabled above this voltage
Weight		24.2		g	
Shell form	Plastic sealing				

Safety characteristics					
Dielectric Strength	Input and output	2250		V_{DC}	TA=25℃,Leakage current less than 1mA
	Input and Housing	2250		V_{DC}	T_A=25℃,Leakage current less than 1mA
	Output and Housing	707		V_{DC}	T_A=25℃,Leakage current less than 1mA
Insulation resistance	Input and output	200		MΩ	T_A=25℃,500V_{DC}
	Input and Housing	200		MΩ	T_A=25℃,500V_{DC}
	Output and Housing	200		MΩ	T_A=25℃,500V_{DC}

other characteristics			
Sweep frequency vibration	(20-2000-20) Hz20g, 4 times per axial direction, 4 minutes per time		GJB548B-2005 Method 2007 Condition A
Random	2g ²/ Hz, triaxial, 15 minutes each time		GJB360B-2009 Method 214 Condition I
Impact	Half sine wave 1000m/s 26ms, 3 times per axis, a total of 18 times.		GJB360B-2009 Method 213 Condition C
Steady-state acceleration	1000m/s ² Triaxial, 5 minutes each time		GJB360B-2009 Method 212 Condition A
Damp heat steady state	40℃，95%，240 hour		GJB360B-2009 Method 103 Grade A
High temperature storage	125 ℃, insulation for 48 hours, recovery for 2 hours		GJB150.3-86
Low temperature storage	-55 ℃, insulation for 48 hours		GJB150.4A-2009
Temperature cycling	-55℃～125℃,10 times,t1=30min，t2≤1min		GJB548B-2005 Method 1010
Steady-state life	Nominal input voltage, full load, shell temperature of 90 ℃, 1000h		GJB548B-2005 Method 1005.1
Salt mist	NaCl:5±1%;PH:6.5-7.2((35±2)℃)96h		GJB360B-2009 Method 101 Condition A

Note: Unless otherwise specified, the specification parameters are applicable to VIN=28V ± 0.3V, TR pin suspended, and output capacitance of 2000 μ F. -55 ℃ ≤ TC ≤ 90 ℃ Test conditions

Typical Line Connection Diagram

Electrical testing circuit connection diagram (Figure 1)

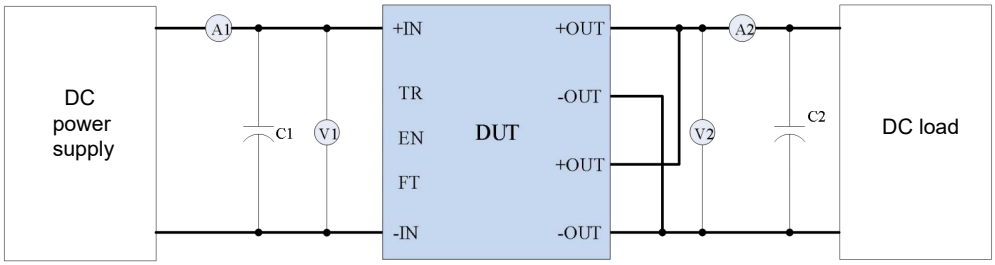


Figure 1 Electrical Test Circuit Connection Diagram

Note::C1=100V/470μF,C2=50V/2000μF

Parallel current sharing (Figure 2)

When the load power is greater than the output power of a single module, multiple modules can be used in parallel to Expand the system capacity; When using multiple modules in parallel, the TR, EN, and FT modules can be connected together to achieve collaborative work among multiple modules and increase output capacity (up to 8 parallel connections are supported)

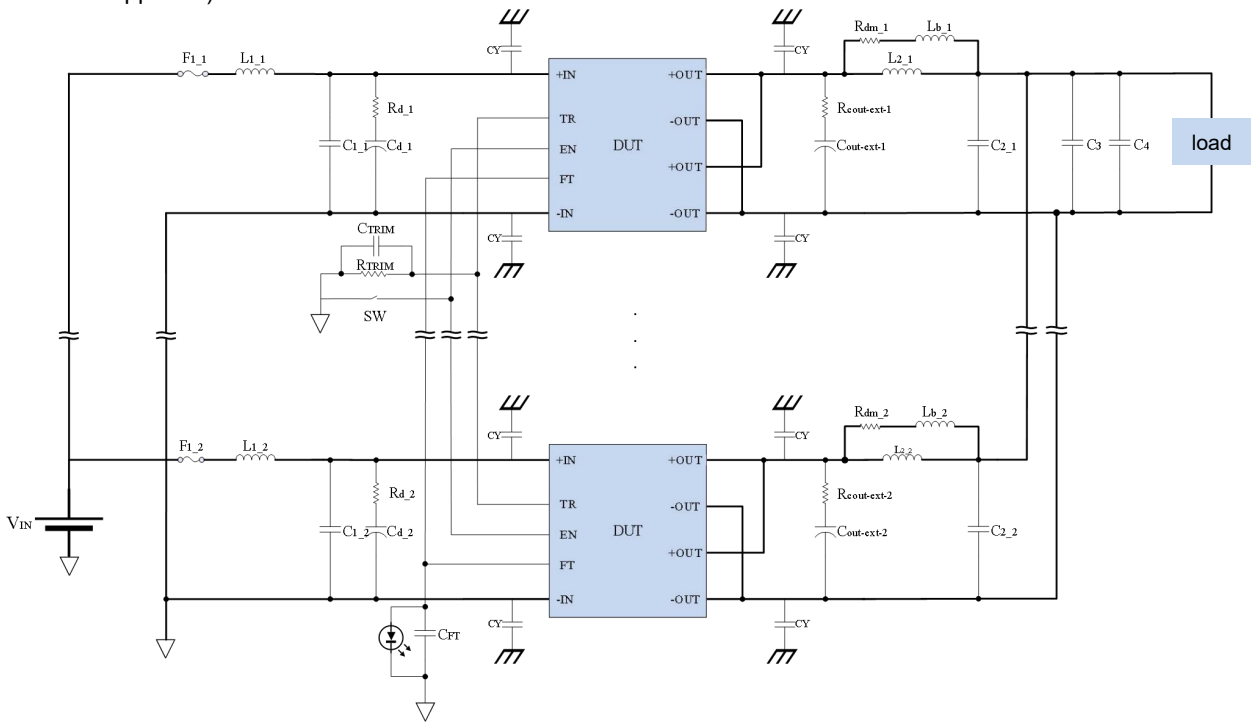


Figure 2 Connection diagram of multi module parallel electrical testing circuit

Pin definition

+IN, -IN

Input power pin, and - IN is the module control signal reference ground. In order to minimize the voltage drop caused by the current on - IN, it is recommended to use Kelvin connection between the external control circuit of the module and - IN;

+OUT, -OUT

Output power pin

EN

The EN pin enables or inhibits module output. When the EN pin level is low, the module prohibits output; When the EN pin level is high, the module enables output. The reference ground for the EN pin level is - IN pin. The EN pin is pulled up to a high level of 3.3V inside the module through a 10k Ω resistor;

Output enable: When the voltage of the EN pin exceeds the module EN enable voltage, the module output is enabled. When the EN pin is suspended, it is pulled up to a high level of 3.3V, and the module output is enabled.

Output prohibition: When the voltage of the EN pin is lower than the EN prohibition voltage, the module output is prohibited.

The EN pin is only the module input pin.

TR

The TR pin is the voltage regulation function pin of the module, which enables the module to work in an enabled state/ disable voltage regulation mode in an enabled state. When the voltage regulation mode is enabled, the output voltage can be adjusted. The TR pin is pulled up to a high level of 3.3V inside the module through a 3.3k Ω resistor.

The module determines whether to enable the voltage regulation mode during the input voltage VIN establishment process and maintains the enable/disable voltage regulation mode state until the module input loses power.

During the process of establishing the input voltage VIN, if the input voltage of the TR pin is greater than the TR inhibit voltage, the module will operate in the inhibit voltage mode and output at the rated output voltage. The module will remain in this operating mode until the input voltage drops and is rebuilt.

During the process of establishing the input voltage VIN, if the input voltage of the TR pin is lower than the TR inhibit voltage, the module will operate in enable voltage regulation mode. The module output voltage can be adjusted in real time through the input voltage of the TR pin. The module will remain in this operating mode until the input voltage drops and is rebuilt. When the module operates at full load and ambient temperature of 25 ℃, the output voltage and TR pin input voltage

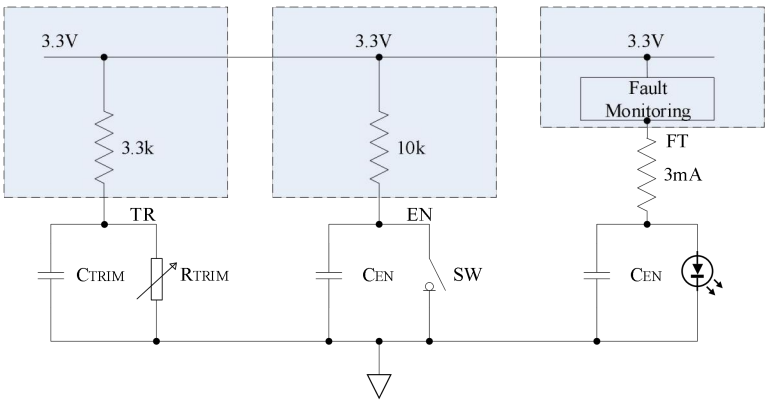
$$V_{out}=12.25+(21.274\cdot V_{TR}/3.3)$$

When the module is operating in the enable voltage regulation mode, the typical interval time for the module to adjust the output voltage based on the input voltage of the TR pin is 30ms. When the output voltage of the module is adjusted to exceed the rated output voltage, the output current limiting protection point of the module will be lowered accordingly;

FT

The FT pin is the module fault indicator pin. When there is no fault, the FT pin is at a low level; When the module malfunctions, the FT pin is at a high level of 3.3V;

Typical peripheral circuits



Protection mode description

Input undervoltage protection (UVLO)

The module has input undervoltage protection function; When the module is in the enable disable state, if the input voltage is lower than the input undervoltage protection point, the module will not be able to be enabled to start until the input voltage is greater than the input undervoltage recovery point. When the module is in operation if the input voltage is lower than the input undervoltageprotection point, the module will enter the protection state, power flow transmission will stop, and the output voltage will drop

If the input voltage transiently drops and then climbs, the time below the input undervoltage protection point is less than 600 μ s. The module will not enter a protected state;

After the module enters the protection state, the power flow transmission stops, and the protection state will continue until the input voltage climbs above the input undervoltage recovery point; If the module is in the enabled state after the protection status is released, it will start normally

Input overvoltage protection (OVLO)

The module has input overvoltage protection function; When the module is in an enabled and disabled state, if the input voltage is higher than the input overvoltage protection point, the module will not be able to be enabled to start until the input voltage is lower than the input overvoltage recovery point; When the module is in operation, if the input voltage is higher than the input overvoltage protection point, the module will enter the protection state, power flow transmission will stop, and the output voltage will drop;

If the input voltage transiently rises and then falls, and the time above the input overvoltage protection point is less than 240 seconds, the module will not enter the protection state;

After the module enters the protection state, the power flow transmission stops, and the protection state will continue until the input voltage drops below the input overvoltage recovery point; If the module is in the enabled state after the protection status is released, it will start normally;

Output undervoltage protection (UVP)

The module determines the output overload and short circuit status by detecting the sampling point voltage corresponding to the output voltage of the primary and secondary sides and the output voltage of the internal error amplifier; Normally, when the module is in operation, if it detects that the voltage at the primary sampling point drops below the output undervoltage protection point, the module will enter a short circuit protection state; After the module enters the short-circuit protection state, the power flow transmission stops and the output voltage will drop; The short circuit protection state will last for 1 second. After the protection state is released, if the module is in the enabled state, it will start normally;

Over temperature protection (OTP)

The module has an over temperature protection function; When the internal temperature is detected to be higher than the over temperature protection point, the module will enter an over temperature protection state, the power flow transmission will stop, the output voltage will drop, and the over temperature protection state will last for a minimum of 6ms. When the internal temperature is detected to be lower than the over temperature protection point, the protection state will be released. If the module is in an enabled state, it will start normally;

Output overvoltage protection (OVP)

The module realizes the output overvoltage protection function by detecting the sampling points corresponding to the output voltage of the primary and secondary sides; If the voltage at the original sampling point is detected to be higher than the output overvoltage protection point, the module will enter an overvoltage protection state; After the module enters the overvoltage protection state, the power flow transmission stops and the output voltage will drop:

The output overvoltage protection of the module is a lock up protection, and the module cannot restart until the lock up state is released. There are two methods to release the lock up state: disabling the module through the EN pin; Reduce the input voltage of the module below the input undervoltage protection point;

The module realizes the output overvoltage protection function by detecting the sampling points corresponding to the output voltage of the primary and secondary sides; If the voltage at the original sampling point is detected to be higher than the output overvoltage protection point, the module will enter an overvoltage protection state; After the module enters the overvoltage protection state, the power flow transmission stops and the output voltage will drop:

The output overvoltage protection of the module is a lock up protection, and the module cannot restart until the lock up state is released. There are two methods to release the lock up state: disabling the module through the EN pin; Reduce the input voltage of the module below the input undervoltage protection point;

Typical Curve (output capacitance 2000 μ F/50V, TA=25 ℃)

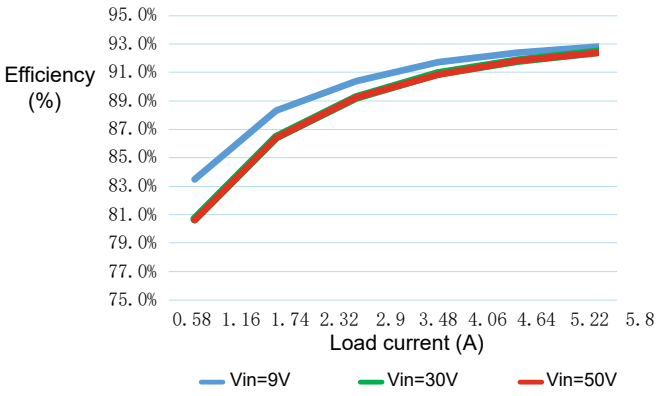


Figure 1 Efficiency curve

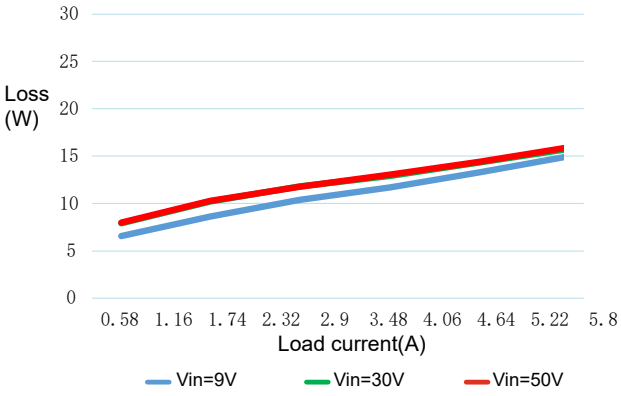


Figure 2 Loss Curve

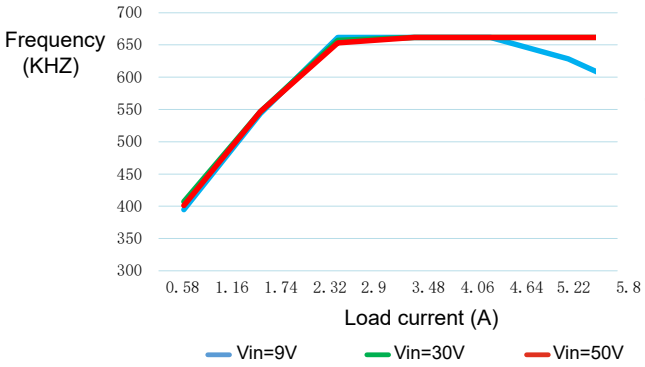


Figure 3 Frequency Curve

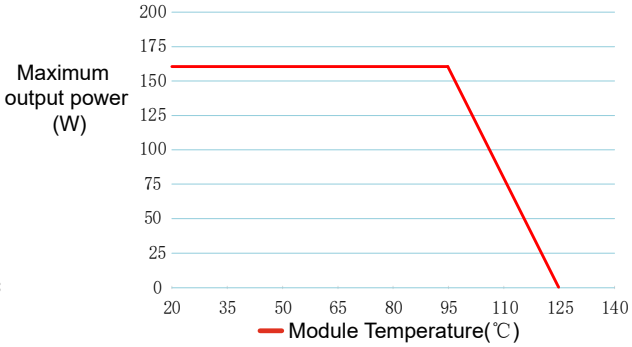


Figure 4 Temperature Derating Curve

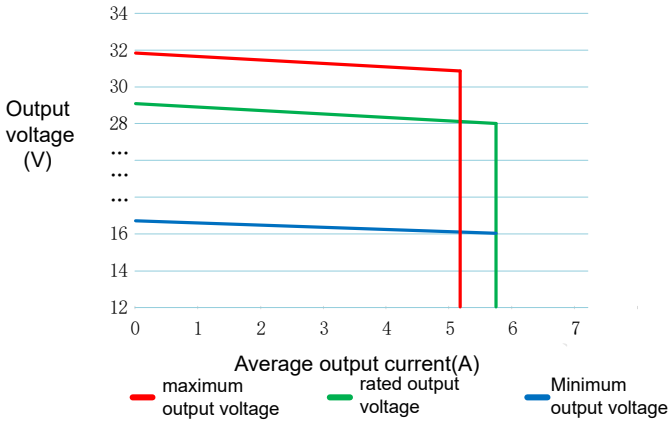


Figure 5 Safe Work Area

Typical Waveform (output capacitance 2000 μ F/50V, TA=25 ℃)

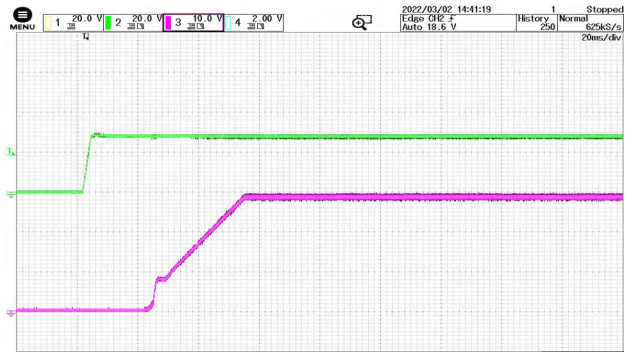


Figure 6 Start waveform @ VIN=30V CH2: VIN CH3: Vout

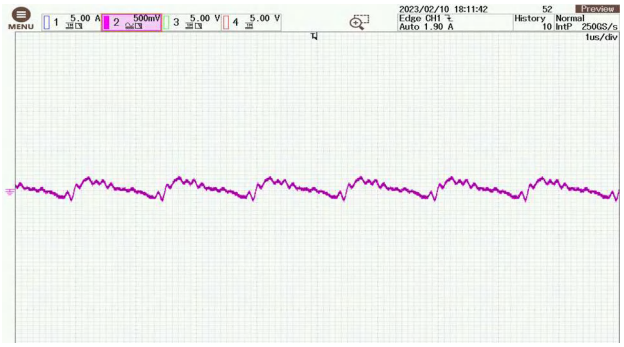


Figure 7 Output voltage ripple @ VIN=30V at full load

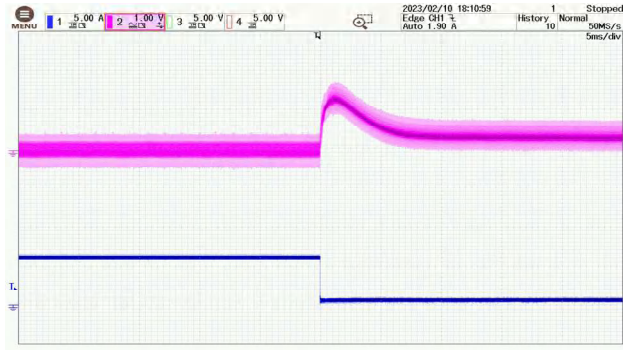


Figure 8 90% load -10% load jump @ VIN=30V CH2: V_{out} CH1: I_o

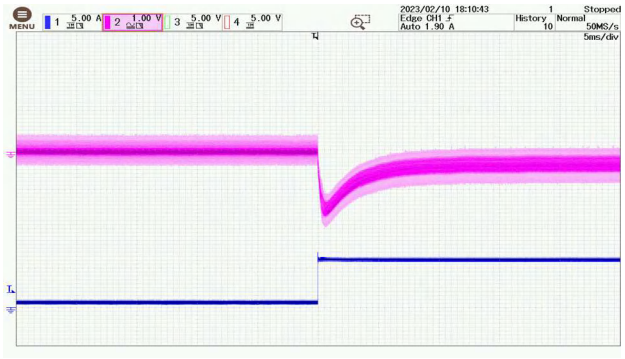


Figure 9 10% load -90% load jump @ VIN=30V CH2: V_{out} CH1: I_o

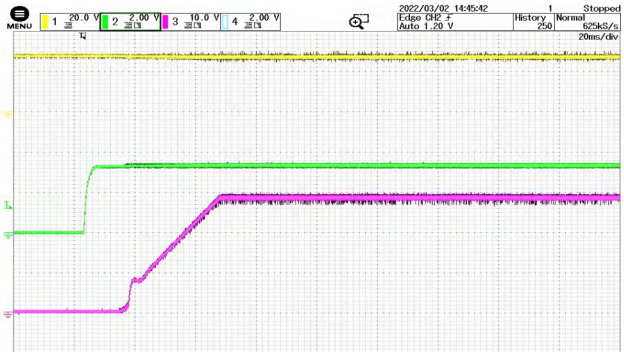


Figure 10 Start waveform (enabled) @ VIN=30V CH1:V_{IN} CH2: EN CH3:V_{out}

Figure 11 Overcurrent protection @ VIN=30V CH2:V_{out}

User Notice

Input transients and surges

The voltage applied to the input terminal of the module should not exceed the limit values listed in the data table. To prevent rapid transient damage to the module, protective devices (such as Z ener diodes or varistors) should be used;

Safety considerations

The power components of converters with heat and voltage hazards should be protected by an outer shell; The DC/DC converter operates efficiently within the rated substrate temperature, and direct contact may cause injury; The voltage and current (energy hazard) on the module pin s and any circuits connected to them, such as direct contact or the formation of parasitic current paths, may pose a safety hazard; Module pins are used for installation on printed circuit boards and can be soldered onto the board using wave soldering; In addition, modules that have been s oldered onto printed circuit boards should not be removed for reuse;

Referenced standards:

◆ SJ20668-1998	General specification for microcircuit modules
◆ GJB150A-2009	Environmental testing methods for military equipment laboratories
◆ GJB360B-2009	Test methods for electronic and electrical components
◆ GJB548B-2005	Test methods and procedures for microelectronic devices

Warning::

- ◆ When the product is powered on, please keep your hands and face away from the product to avoid accidental injury.
- ◆ Please do not modify or disassemble the product, otherwise it may cause electric shock. If the user processes or modifies it, our company will not be responsible for the consequences;
- ◆ During product operation, internal components may output high voltage or high temperature, which may cause electric shock or burns when touched;
- ◆ When the product is powered on, please do not touch the product casing to avoid burns;

Welding and precautions

- Due to various factors affecting welding time, it is very difficult to list the actual welding time. Simply put, it is necessary to chec kwhether the welding points are of high quality after welding. If necessary, the parameters can be changed to ensure process s tability. The following are some specific suggestions:
- The module pins are plug-in pins, and it is recommended to use wave soldering or selective wave soldering, which can be don e manually;
- The module can withstand a maximum shell temperature of 225 ℃, up to three times; The MSL processing time is considered c umulative, and the total time exposed to environmental conditions, including the time between welding, should not exceed the l imit of MSL5. If exposed to environmental conditions for more than 48 hours, it is necessary to re bake at 125 ℃ for 48 hours to remove internal moisture from the module;
- During the use of wave soldering or selective wave soldering, it is recommended that the maximum temperature of the module body should not exceed 205 ℃, and the maximum temperature of the pins should not exceed 215 ℃; The spray method shall be adopted for flux spraying, and the flux shall overflow the surface of the components of the metallized hole; When the printed circuit board assembly passes through the preheating zone, it should be uniformly heated. The module body temperature shoul d be preheated to around 135 ℃, and the appropriate transfer speed and soldering depth should be adjusted to control the app ropriate soldering time, which is conducive to forming reliable solder joints;
- When using soldering iron for welding, the temperature of the soldering iron head should not exceed 400 ℃, otherwise it may in crease the risk of burning out the solder pads, printed wires, printed circuit boards, and even power modules. When welding, pl ace the soldering iron on one side of the pins and solder pads, and inject the solder on the other side to allow heat to flow out fr om the pins and solder pads, melting the solder: Do not directly contact the soldering iron head with the solder, and then transf er it to the pins and solder pads; Do not use a soldering iron tip to squeeze the pins;
- The welding time should not be too long, as it may damage the module;
- Before welding, ensure that the solder pads, through-holes, and pins are clean;
- When the solder is cooling, do not shake the module and circuit board to avoid forming gaps in the pins or cracking at the solde r joints;
- It is not recommended to use a hot air gun to weld modules;
- It is not recommended to trim the pins of the module;
- It is recommended to use solder containing rosin type low corrosive flux to ensure that there is no corrosive residue around or a t the bottom of the module; If necessary, appropriate cleaning methods can be selected for cleaning; If water-soluble solder is u sed, the board can be washed with deionized water; Non cleaning solder can be cleaned, but it will leave residue on the surface of the board; If cleaning is required, isopropanol or anhydrous ethanol can be used; Suggest drying the product after cleaning,
- Dismantling welded modules may increase the mechanical and thermal stress that the module bears during the dismantling pro cess, which may damage the module. Therefore, the power module cannot be reused after removal;

Storage requirements

- The product should be placed in packaging bags that meet the MSL5 level when not in use, with an ambient temperature of 20 ± 10 ℃ and a relative humidity of 40% -80% in the warehouse. It should be dry, ventilated, and free of corrosive gases;
- The packaging should be more than 20cm away from the ground, and at least 50cm away from walls, heat sources, ventilation openings, and windows;
- Under the conditions of this regulation, the storage period of the module is 2 years, and it should be re inspected after exceedin g 2 years;

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