

Patent Protection RoHS



FEATURES

- Wide input voltage range: 9-36V, 14-160V
- Operating ambient temperature range: -40°C to +105°C
- With peripherals, it can be realized: input inrush current suppression, input anti-reverse connection protection, input under-voltage protection

The FS-CXZP(-N) & FS-AXZP(-N) product is a driver module, which can realize input under-voltage protection, input anti-reverse connection protection, and input inrush current suppression functions with the peripheral, which can be applied to the front end of the product, to protect back-end products and improve product reliability.

Selection Guide

Certification	Part No.	Input Voltage (VDC)		Outb logic ^②	Capacitive Load (nF)Max.
		Nominal (Range)	Max. ^①		
--	FS-AXZP	24 (9-36)	40	P	10
	FS-AXZP-N			N	10
	FS-CXZP	110 (14-160)	170	P	10
	FS-CXZP-N			N	10

Notes:

- ① Exceeding the maximum input voltage may cause permanent damage;
② "P" indicates that OUTB is positive logic, and "N" indicates that OUTB is negative logic. For details, see design reference.

Recommended Matching Products

Part No.	Matching test P/N.	Recommended current limiting Wire-wound Resistor	Recommended Mosfet specification
FS-AXZP	URF24_QB-100WR3	Four 12Ω /3W in parallel	Specification:Vds>150V / ID>60A / VGS(th)<5V
FS-AXZP-N	VCF24_EBO-120WR3-N	Four 12Ω /3W in parallel	Specification:Vds>150V / ID>60A / VGS(th)<5V
FS-CXZP	URF1D_HB-250WHR3	Three 51Ω /3W in parallel	Specification:Vds>650V / ID>40A / VGS(th)<5V
FS-CXZP-N	URF1D24QB-50WR3-FD	Three 51Ω /3W in parallel	Specification:Vds>650V / ID>40A / VGS(th)<5V

Notes:

- ① The selection of current limiting resistor can be based on the size of inrush current inhibition. The selection of current limiting resistor should consider whether the transient power consumption of the resistor itself meets the specifications;
② The recommended parameter is the test result of the corresponding switching power module at normal temperature. At high temperature, the temperature rise of the MOSFET should be evaluated and heat dissipation measures should be reasonably increased.

Recommended Parameter Setting

Pin	Function	Description	Min.	Typ.	Max.	Unit	
1	GNDA	The module refers to ground A	--	--	--	VDC	
2	TIMEA	At the positive phase input end of the operational amplifier, set the module drive OUTA2 opening time T OUTA2 opening time T:the delay from start-up to OUTA1 voltage of 5V	10	25	40	ms	
3	UVPA	Set the module drive OUTA2 turn-off voltage	FS-AXZP(-N)	5.5	7	8.5	VDC
			FS-CXZP(-N)	8.5	10	11.5	VDC

9	OUTA1	input anti-reverse function driver	FS-AXZP(-N)	6	8.5	9.5	VDC
			FS-CXZP(-N)	6.5	8.3	9.5	VDC
11	OUTA2	input inrush current suppression function drive	FSAXZP(-N)	5	7.5	9	VDC
			FS-CXZP(-N)	5.5	7.5	9	VDC
14	OUTB	The OUTB action delay of FS-A(C)XZP(-N) is T1	FS-A(C)XZP: Delay time T1 from OUTA2 voltage rising to 5V to OUTB voltage rising to 3.5V	0.001	--	5	ms
			FS-A(C)XZP-N: Delay time T1 from when OUTA2 voltage rises to 5V to when OUTB voltage drops to 1.2V	0.001	--	5	ms
	Controls the Ctrl pin voltage of the power module	FS-A (C) XZP: indicates the OUTB output voltage in the delay time T	0	--	1.2	VDC	
		FS-A (C) XZP-N: indicates the OUTB output voltage in the delay time T	3.5	--	12	VDC	
		FS-A (C) XZP: OUTB output voltage after the delay time T1 ends	3.5	--	12	VDC	
		FS-A (C) XZP-N: indicates the OUTB output voltage after the delay time T1 ends	0	--	1.2	VDC	
16	GNDB	The module refers to ground B		--	--	--	VDC
22	NC	Cannot connect to any external circuit		--	--	--	/
23	VINA	Surge Voltage (1sec. max.)	FS-AXZP(-N)	-0.7	--	50	VDC
			FS-CXZP(-N)	-0.7	--	200	VDC
	Module power supply and input voltage detection	FS-AXZP(-N)	9	--	36	VDC	
		FS-CXZP(-N)	14	--	160	VDC	
	Input Current	FS-CXZP(-N), 110V input voltage	3	6	12	mA	
		FS-AXZP(-N), 24V input voltage	3	6	12	mA	

Notes:
 1)TIMEA pin delay time can be realized by the external capacitor C1 delay time becomes longer, please see the specific design reference;
 2)UVPA pin setting module drive OUTA2 off voltage can be realized through the external resistor to raise the undervoltage point, please see the design reference for details;
 3)Pin 2, 3, 9, 11, 14, 23 do not short circuit to ground (pins 1, 16), pin 2, 3, 9, 11 do not connect the external level, please see the design reference for connection method;
 4)The above conditions are measured under the conditions in Fig 1;
 5)Use the OUTB pin to ensure that the delay from 0V to the back-end power module is greater than 3ms.

General Specifications						
Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Operating Temperature		-40	--	+105	°C	
Storage Temperature		-55	--	+125		
Pin Soldering resistor Temperature	Soldering spot is 1.5mm away from case for 10 seconds	--	--	+300		

Storage Humidity	Non-condensing	5	--	95	%RH
Shock And Vibration		IEC/EN61373 - Category 1, Grade B			
MTBF	MIL-HDBK-217F@25°C	1000	--	--	k hours
ON/OFF frequency	Minimum requirement 5s				
Hot Plug	Unavailable				

Note:
The inrush current suppression module must be in the off state before switching on and off each time. That is, the input voltage of the module is less than the undervoltage point.

Mechanical Specifications

Case Material	Aluminum alloy
Dimensions	32.00 x 20.00 x 10.80 mm
Weight	FS-CXZP(-N) 10.3g(Typ) FS-AXZP(-N) 9.5g(Typ)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

EMI	CE/RE	Test with the corresponding power module and the periphery of the supporting test module, and the specifications are the same as the test specifications of the corresponding power module.			
EMS	ESD	IEC/EN61000-4-2	Contact ±6KV	perf. Criteria A	
	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A	
	EFT	IEC/EN61000-4-4	100KHz ±2KV	perf. Criteria A	
	Surge	IEC/EN61000-4-5	line to line ±2KV	perf. Criteria A	
	CS	IEC/EN61000-4-6	10 Vr.m.s	perf. Criteria A	

Note:
1)When the product is matched for EMS test, the product is tested with the corresponding power module and the periphery of the supporting test module, and the specifications are the same as those of the corresponding power module;
2)When conducting EMC test, the test specification cannot be higher than the EMC index in the table;
3)The judgment result of EMS shall be subject to the output of power module.

Design Reference

1、Recommended circuit for single test:

The recommended connection diagram of FS-AXZP(-N) and FS-CXZP(-N) is as follows:

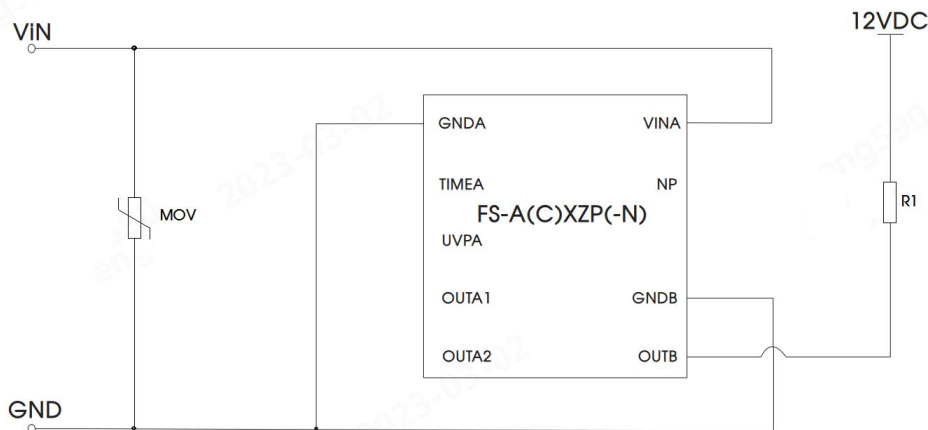


Fig. 1

Table 1: Fig. 1 Recommended device parameters table

Device	Parameter	Parameter description
MOV	FS-CXZP(-N) Selec 20D201K FS-AXZP(-N) Selec 20D470K	/
R1	3.47KΩ 1/2W	/

2、Recommended circuit for application:

The recommended connection diagram of FS-AXZP(-N) and FS-CXZP(-N) is as follows:

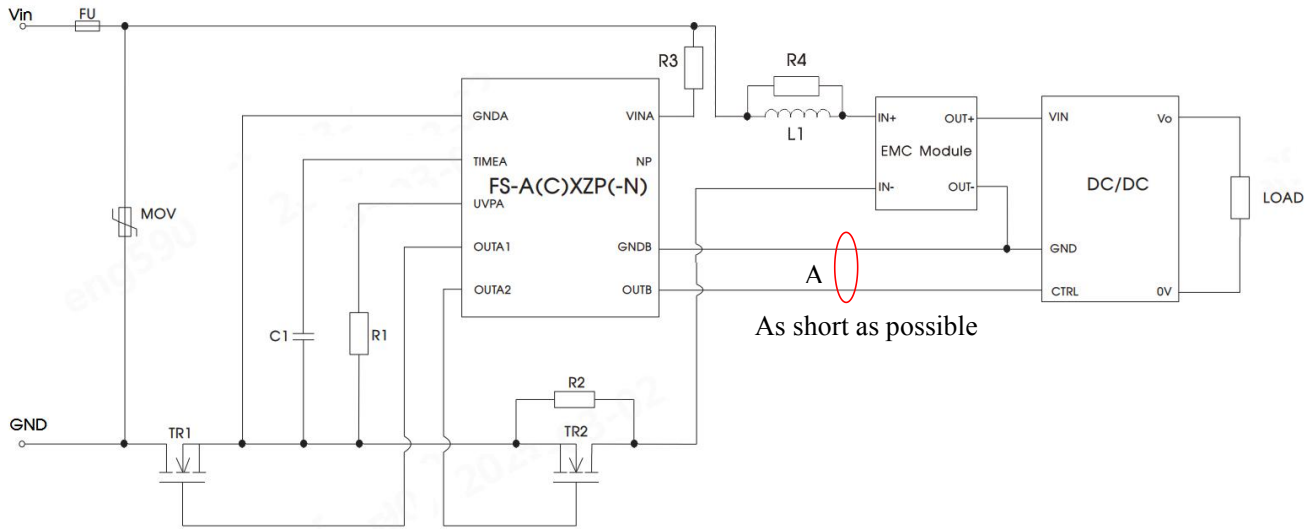


Fig. 2

Table 2: Fig 2 Recommended device parameters

Device	Parameter	Parameter description
MOV	FS-CXZP(-N) Select 2D201K FS-AXZP(-N) Select 20D470K	/
TR1/TR2	See the recommended collocation table above	/
R1	/	See Design Reference 3 Undervoltage Protection Design for instructions
R2	See the recommended collocation table above	/
R3	FS-CXZP(-N) Select 27Ω 1/4W FS-AXZP(-N) Select 8.2Ω 1/4W	/
R4	FS-A(C)XZP(-N) Select 500Ω 5W	/
C1	/	See Design Reference 4 for instructions on how to extend inrush current suppression time
L1	100uH	/

Product working principle:

Taking FS-A(C)XZP as an example, according to the connection method in Fig 2, after the input power supply turns on the switch, the voltage of the FS-A(C)XZP module rises, and OUTA1 outputs a high level to drive the anti-reverse connection Mosfet to make it conduct, the input voltage charges the large capacitor in the switching power supply module and the capacitor in the EMC module through the resistor R2. During this process, the OUTB pin outputs a low level and pulls down the CTRL pin of the switching power supply, so that even if the switching power supply reaches the starting voltage, it will not start to work, after the charging delay of the capacitor T junction, OUTA2 outputs high level, the Mosfet at both ends of the current limiting resistor are turned on, and after a delay T1, the OUTB pin outputs high level, and the switching power supply starts to work. The working principle of FS-A(C)XZP-N is basically the same, only the logic of OUTB pin is opposite.

Notes:

- 1)The definition of delay T and T1 can be seen in the recommended parameter setting table;
- 2)OUTA1, OUTA2, OUTB output level range can be seen in the recommended parameter setting table;
- 3)When the trace at A in the recommended circuit is long, it is recommended to connect an inductor with an inductance of 2mH in series in the two traces respectively, and to connect a decoupling capacitor in parallel between CTRL and GND of the switching power supply.

3、Undervoltage protection design:

As shown in Fig. 1, UVPA pin drives OUTA2 turn-off voltage V1 through external resistor R1 to GND setting module, and this voltage is the undervoltage point of VINA pin. When the voltage is lower than turn-off voltage V1, OUTA2 pin voltage drops below 0.7V.

$$V1 = \frac{12410R1 + 1130791}{1220R1 + 6222} \quad \text{Formula 1}$$

$$V1 = \frac{1096R1 + 120045}{157R1 + 3140} \quad \text{Formula 2}$$

Notes:

- 1)Module drive OUTA2 turn-off voltage V1, unit is V;
- 2)R1 is the external resistor, expressed in k Ω ;
- 3)Formula 1 applies to model FS-CXZP (-N), and Formula 2 applies to model FS-AXZP (-N);
- 4)When the UVPA pin is suspended, the voltage of V1 is shown in the undervoltage point of VINA in the parameter specification;
- 5)You are advised to set this voltage to the lower limit of the actual working voltage of the power module.

4、Extend inrush current suppression time:

In the connection method shown in Fig 1, the TIMEA pin sets the delay time T of 5V output voltage of the module from startup to OUTA2 through the external capacitor C1 to GNDA.

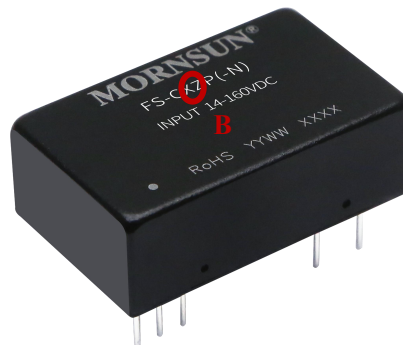
$$T = 50(0.5 + C1)$$

Notes:

- 1)Module driver OUTA2 starts time T (unit: ms);
- 2)C1 is the external capacitor, expressed in uF;
- 3)When the TIMEA pin is suspended, see the opening time of driver OUTA2 in parameter specifications for T time;
- 4)It is recommended to set this time to be greater than the input inrush current time;
- 5)Due to the capacitance deviation, the actual test time at normal temperature will be deviated by $\pm 10\%$, and the capacitance value of the capacitor will change at high and low temperatures. Affected by the temperature characteristics of the selected capacitor, it is recommended to use a capacitor with good temperature characteristics.

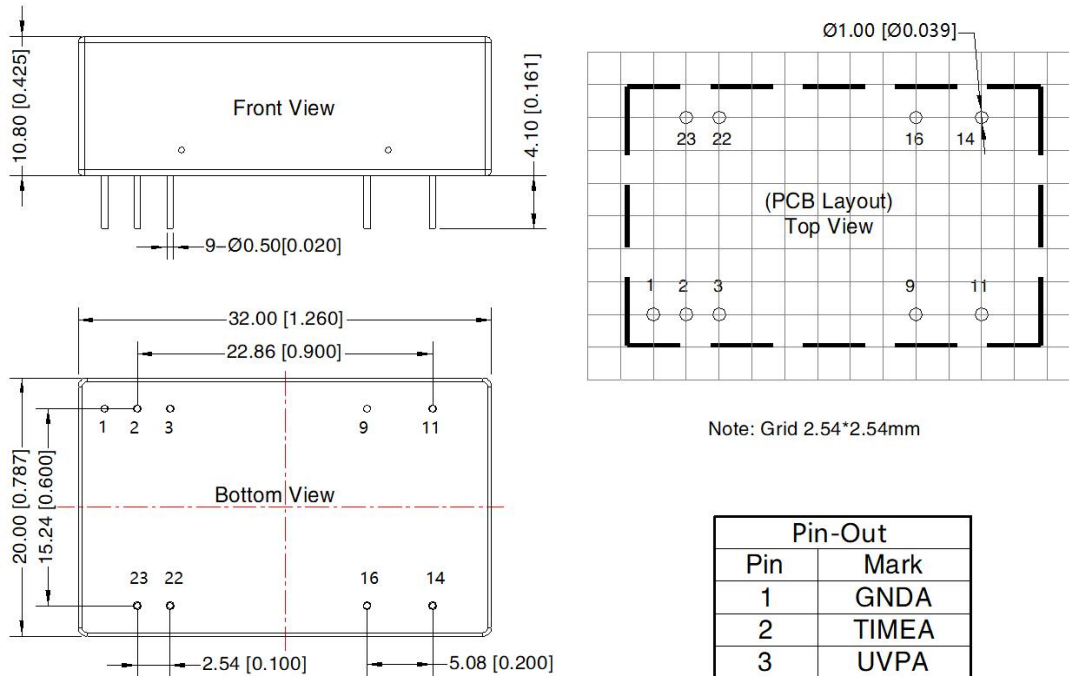
5、Recommended solution of thermal test

In the process of application, product thermal design can be evaluated by combining product temperature derating curve, or determine the stable working interval of the product by the temperature at point B in the following test figure. When the temperature at point B is lower than 115 $^{\circ}\text{C}$, it is the stable working interval of the product.



Dimensions and Recommended Layout

THIRD ANGLE PROJECTION 



Note: Grid 2.54*2.54mm

Note:
Unit: mm[inch]
PIN1/2/3/9/11/14/16/22/23: ϕ 0.5mm
Pin diameter tolerances: $\pm 0.10[\pm 0.004]$
General tolerances: $\pm 0.50[\pm 0.020]$

Pin-Out	
Pin	Mark
1	GND A
2	TIME A
3	UVPA
9	OUT A1
11	OUT A2
14	OUT B
16	GND B
22	NC
23	VINA

NC: Pin to be isolated from circuit

Notes:

- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58210008;
- The maximum capacitive load offered were tested at input voltage range and full load;
- Unless otherwise specified, parameters in this datasheet were measured under the conditions of $T_a=25^\circ\text{C}$, humidity<75%RH with nominal input voltage and rated output load;
- All index testing methods in this datasheet are based on company corporate standards; We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see "Features" and "EMC";
- Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

Mornsun Guangzhou Science & Technology Co., Ltd.

Address: No. 5, Kehui St. 1, Kehui Development Center, Science Ave., Guangzhou Science City, Huangpu District, Guangzhou, P. R. China
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: info@mornsun.cn www.mornsun-power.com