FS02P Series Datasheet

Abstract

The FS02P series are DC-DC converters with embedded transformer dedicated to drive IGBT/SiC MOSFET/Si-MOSFET. With the ability to output a wide range of asymmetrical voltages, the FS02P series provides the best drive efficiency for the system.

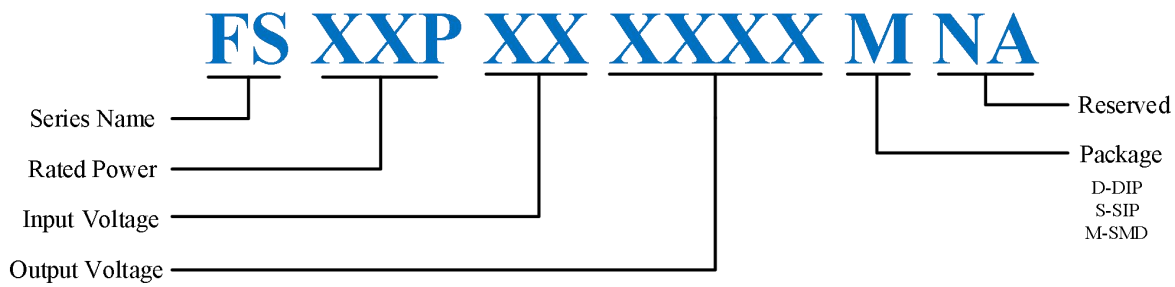
Core Features：

- 6500VDC isolation test voltage 'Hi Pot Test'
- Low isolation capacitance
- Short circuit protection
- Surface mount package
- 12V&15V inputs
- +15V/-9V，+20V/-5V，+15V/-5V & +18V/-4V outputs
- Operation up to 105℃
- Output for IGBT/SiC MOSFET/Si-MOSFET

Typical Application：

- ESS
- Industrial Drives
- PV
- Railway Traction

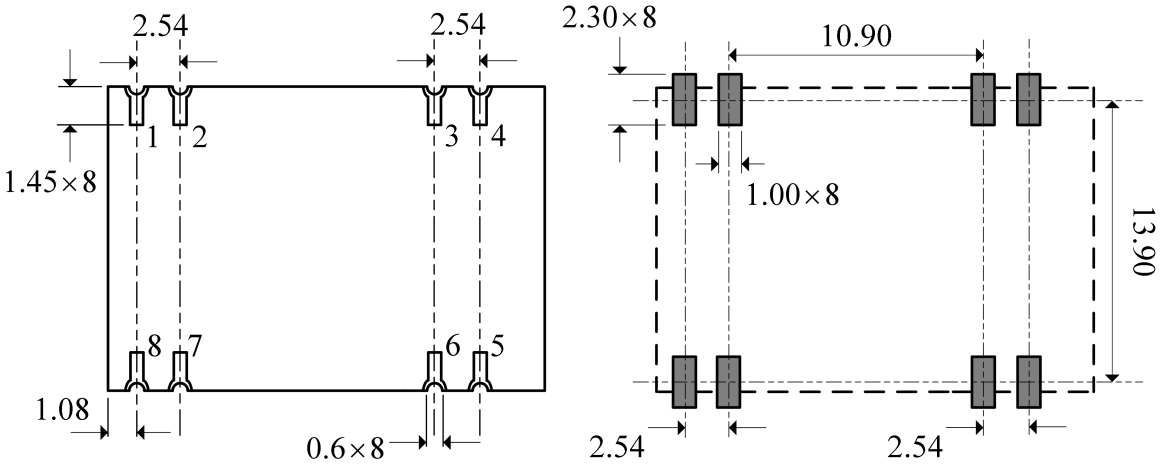
Naming Structure



Package Style

1. Surface Mount

FS02P



Bottom View　　Recommended Footprint

Note：1.All dimensions are in millimeters；
2.All dimensions have a tolerance of ± 0.2mm.

Pin Definition

Pin	Description	Note	Pin	Description	Note
1	VIN-	Power Input Vin-	7	NC	NC
2	NC	NC	8	VIN+	Power Input Vin+
3	VO-	Negative Output			
4	VO-	Negative Output			
5	VO+	Positive Output			
6	0V	Reference Ground			

SELECTION GUIDE:

Part No.	Rated Input Voltage	Output Voltage 1	Output Voltage 2	Output Current @ 2W	Input Current @ 2W	Output 1		Output 2	
						Load Regulation (Typ)	Load Regulation (Max)	Load Regulation (Typ)	Load Regulation (Max)
	V	V	V	mA	mA	%			
FS02P121505MNA	12	15	-5	101	198	4	7	0.4	0.6
FS02P121509MNA	12	15	-9	80	195	5	8	0.3	0.6
FS02P122005MNA	12	20	-5	80	196	4	6	0.2	0.5
FS02P121804MNA	12	18	-4	90	200	4	6	0.5	0.8
FS02P151505MNA	15	15	-5	101	168	4	8	0.2	0.4
FS02P151509MNA	15	15	-9	83	163	5	8	0.1	0.3
FS02P152005MNA	15	20	-5	79	160	3	6	0.2	0.4
FS02P151804MNA	15	18	-4	91	158	4	7	0.4	0.8

SELECTION GUIDE(Continued):

Part No.	Ripple & Noise （Typ）	Efficiency (Typ)	Isolation Capacitance
	mVp-p	%	pF
FS02P121505MNA	80	82	3
FS02P121509MNA	74	83	3
FS02P122005MNA	76	83	3
FS02P121804MNA	78	81	3
FS02P151505MNA	82	80	3
FS02P151509MNA	76	81	3
FS02P152005MNA	78	81	3
FS02P151804MNA	77	80	3

Note: Unless otherwise specified, all typical specifications were tested at T_A=25 °C

Technical Parameters

Input Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Unit
Voltage range	Continuous operation, 12V input	10.8	12	13.2	V
	Continuous operation, 15V input	13.5	15	16.5	

Output Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Unit
Rated Power	T_A = -40°C to 105°C			2.0	W
Voltage set point accuracy	Refer to voltage output tolerence curve				
Linear Regulation	12VInput，15V Input		12		%
Load Regulation	12VInput，15V Input		4	8	%
Transient Response Time	50%-100% load		200		us
Switching Frequency	12V Input		250		kHz
	15V Input		250		kHz

Isolation Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Unit
Test Voltage	Production tested for 1sec.	6500			V_{DC}
	Qualification tested for 1 min.	6500			
Insulation Resistor	Test voltage 1000V_{DC}	1T			Ω
Creepage Distance			9		mm
Clearance Distance			9		mm

Temperature Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operation Temperature	All output types (see derating curves)	-40		105	℃

Storage Temperature		-40		125
Product temperature rise above ambient[1]	Ambient temperature 25℃		20	
Cooling	Forced air cooling		/	

Absolute Maximum Ratings

Parameters	Description
Short circuit protection	Continuous
Input voltage，FS02P12	15V
Input voltage，FS02P15	18V

1.The data is the test result of soldering the power module onto the PCB

Technical Notes

1.Isolation voltage

Firstack FS02P series of DC/DC converters are 100% production tested at 6.5kVDC for 1second and have been qualification tested at 6.5kVDC for 1 minute.

2.Repeated high-voltage isolation testing

It is well known that repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage.

Safety Approval

1.EN-50155

The FS02P series DC-DC converter is currently being tested according to the EN-50155 standard.

2.UL 62368-1

The FS02P series DC-DC converter is currently being tested according to the UL 62368-1 standard.

RoHS Compliance, MSL, PSL and soldering information

This series is compatible with Pb-Free soldering systems and is also backward compatible with Sn/Pb soldering systems.The series can be soldered in accordance with J-STD-020. This series have a classification temperature of 260°C and moisture sensitivity level 2. The termination finish on this product is Gold with plating thickness 0.2 microns.

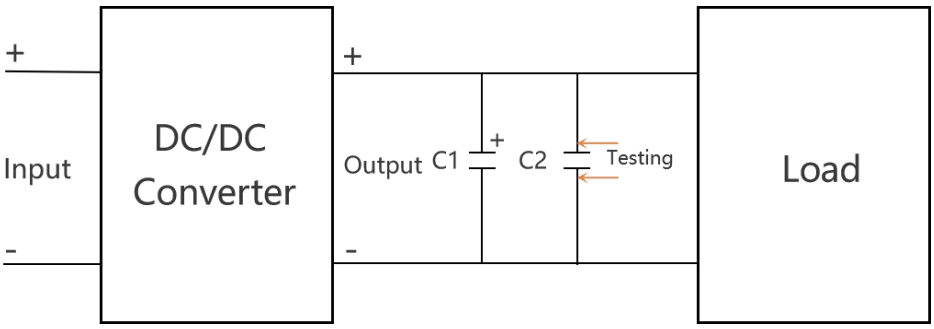
Environmental Validation Testing

Test	Standard	Condition
High temperature operating life	JEDEC JESD22-A108	105±5°C for ≥ 1000 hours
Temperature cycling	JEDEC JESD22-A104	1000 cycles between two temperature extremes set to achieve -40°C and +105°C. 2 full cycles per hour
Temperature humidity bias	JEDEC JESD22-A101D	85±2°C, 85±5% R.H. for 1000 (-24/+168) hours
Storage life	JEDEC JESD22-A103, Condition A	125°C +10/-0°C for ≥ 1000 hours
Vibration	BS EN 61373 with respect to BS EN 60068-2-64,Test Fh Category 1 Class	5-150Hz. Level at each axis–Vertical, Traverse and Longitudinal: 5.72m/s2 rms. 5 hours in each axis. Crest factor: 3 Sigma. Device is secured via the pads.
Shock	BS EN 61373: Category 1, Class B	Test is 30ms duration, 3 shocks in each sense of 3 mutually perpendicular axes (18 shocks total). Level at each axis: Vertical, Traverse and Longitudinal: 50m/s2. Device is secured via the pads.
Solvent cleaning	Resistance to cleaning agents	Solvent-Novec 71IPA & Topklean EL-20A. Pulsed ultrasonic immersion 45°C - 65°C
Solvent resistance	MIL-STD-883 Method 2015	The parts and the bristle portion of the brush are immersed in isopropanol for a minimum of 1 minute. The parts are brushed 3 times, after the third time the parts are blown dry and inspected.

Ripple & Noise Characterization Method

C1	A 10uF electrolytic capacitor with a rated voltage of at least 1.5 times the output voltage of the DC-DC converter, and the ESR of the capacitor needs to be less than 100m at 100kHz.
C2	1uF X7R ceramic capacitor， Rated voltage at least 3 times the output voltage of the module

Ripple & Noise Test Schematic



Note：The bandwidth for ripple testing is 20MHz

Application Note

1. Minimum Load

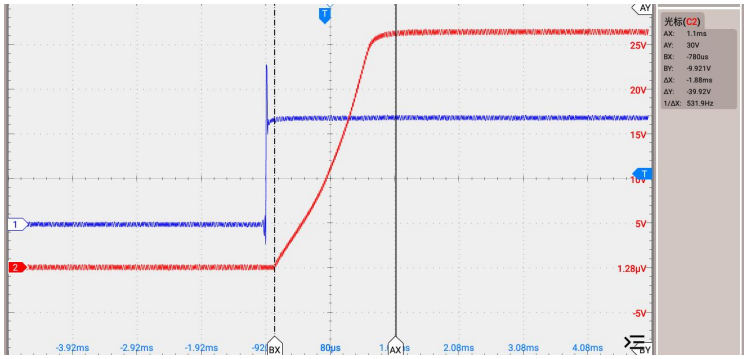
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range.

2. Capacitive loading and start up

Part Number	Start up Time
	ms
FS02P121505MNA	1.7
FS02P121509MNA	1.9
FS02P122005MNA	1.9
FS02P121804MNA	1.7
FS02P151505MNA	1.8
FS02P151509MNA	1.9
FS02P152005MNA	1.9
FS02P151804MNA	1.7

Note：The capacitive load is 10uF

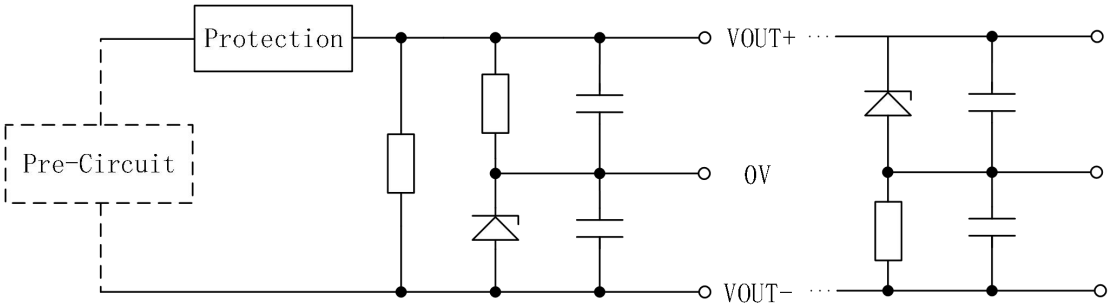
Typical start up curve



2. Output Configuration

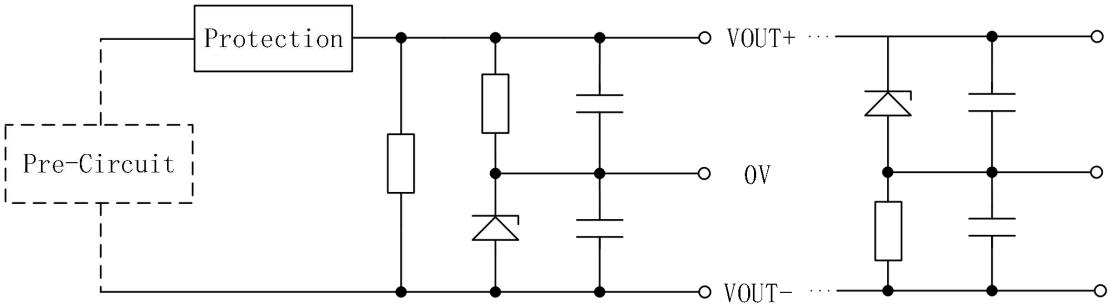
The FS02P series is a dual output DC-DC converter designed specifically for gate drive applications and is not suitable for general-purpose dual output DC-DC converters. However, by loading the load between Vout+and Vout -, the FS02P series can be used as a universal single output converter.

The FS02P series achieves short-circuit protection by controlling the current on the busbar and provides stable negative pressure output through a voltage regulator diode.



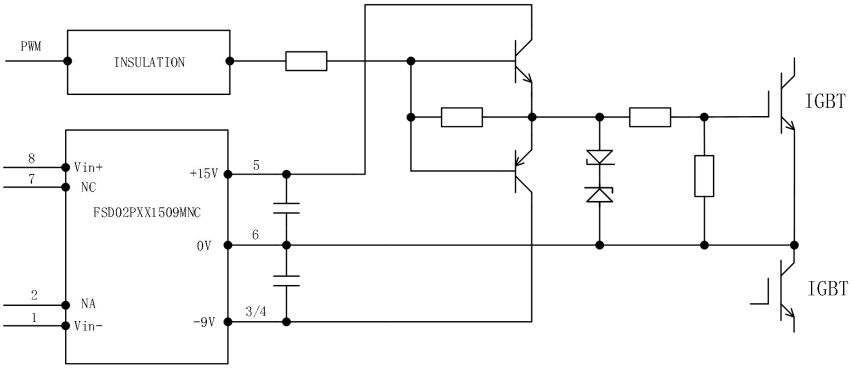
Optional configuration：

For situations where stable positive voltage output is required, an external Zener diode network can be connected between VOUT+and VOUT -, and the external Zener diode network is still protected.

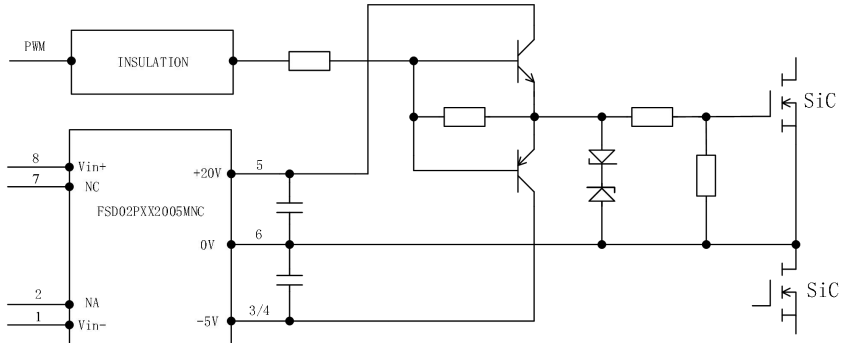


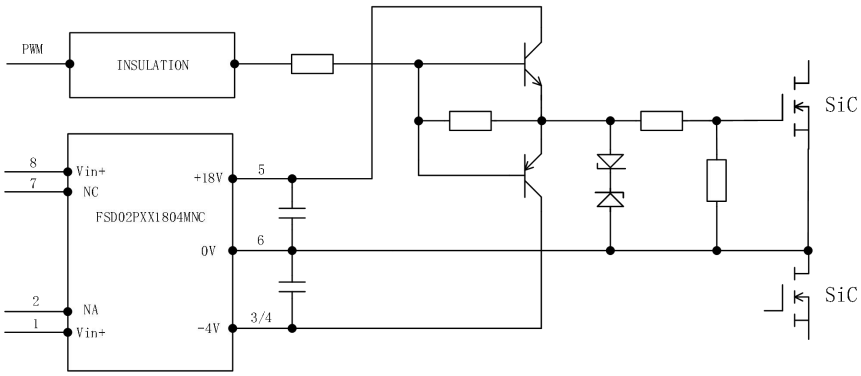
Output Settings

FS02P series for driving IGBT

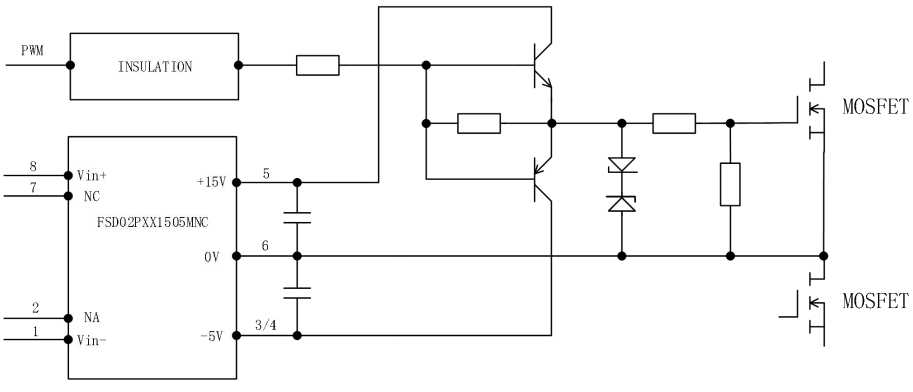


FS02P series for driving SiC



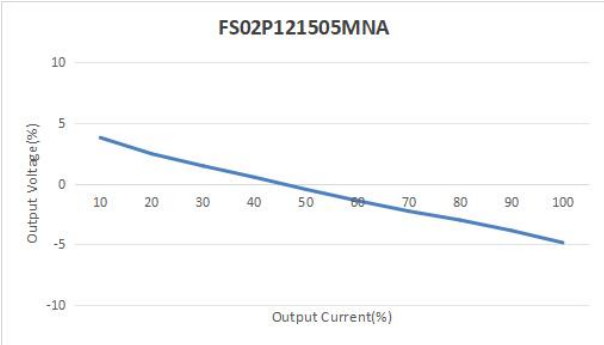


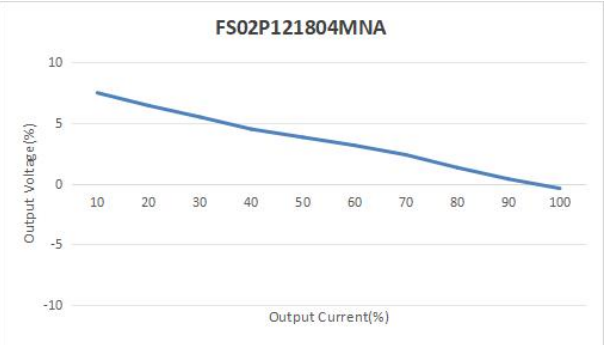
FS02P series for driving MOSFET

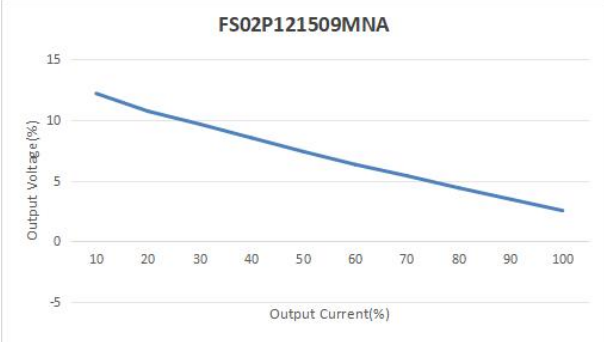


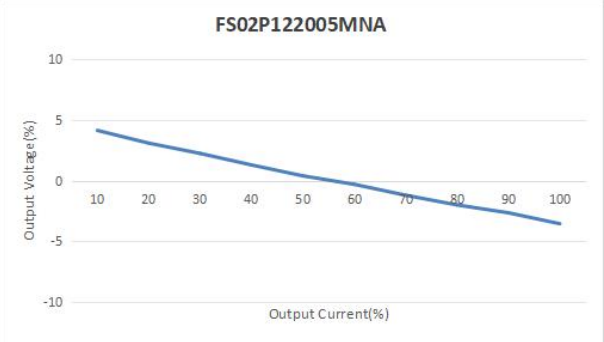
Positive output voltage tolerance

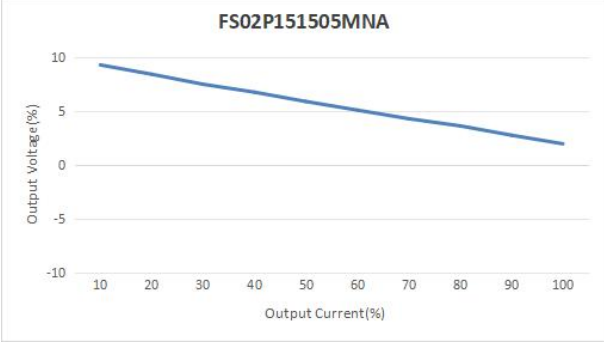
The output voltage curve demonstrates the typical output voltage accuracy and load regulation characteristics caused by load changes.

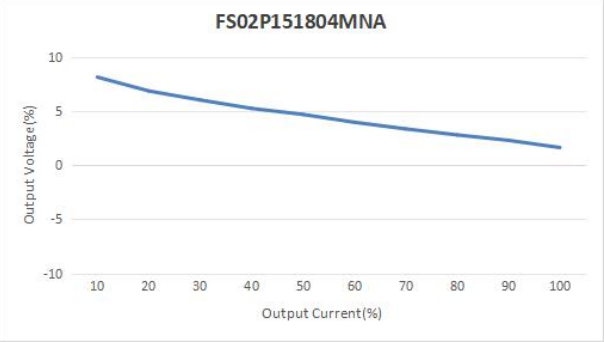


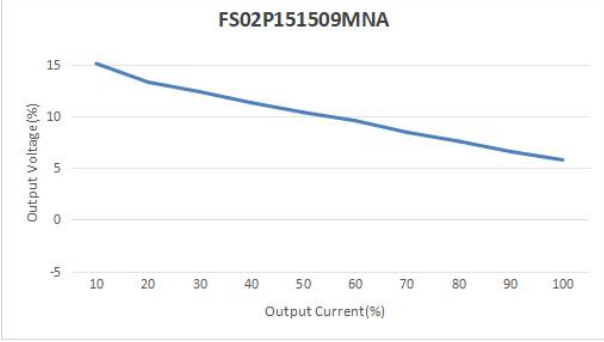


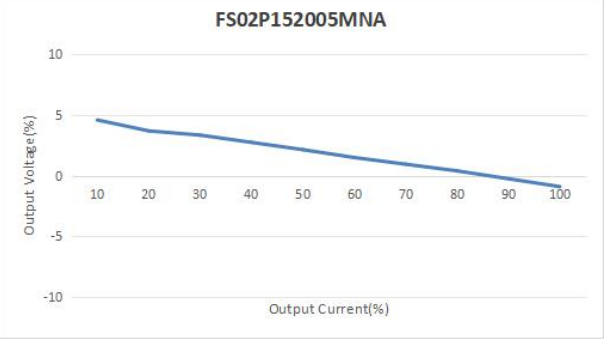






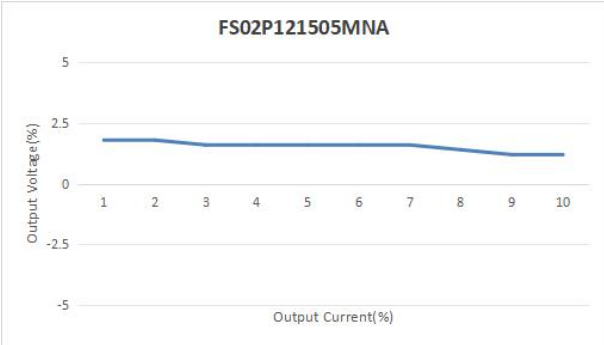


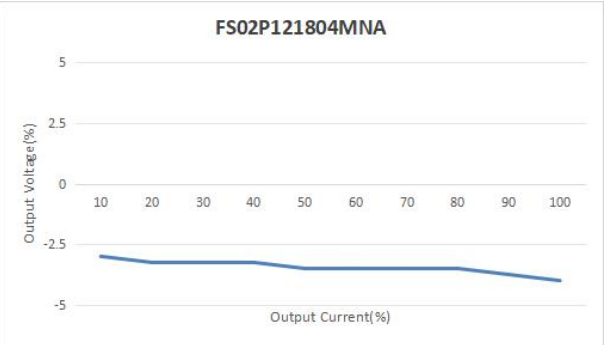


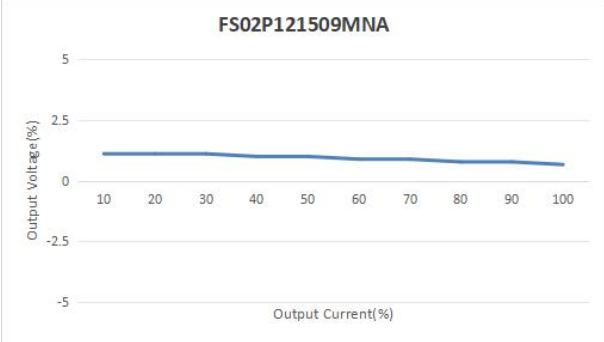


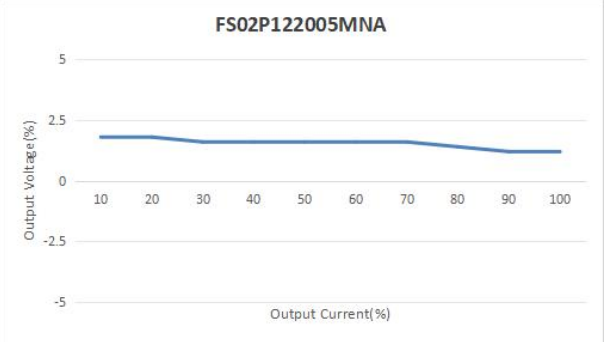
Negative output voltage tolerance

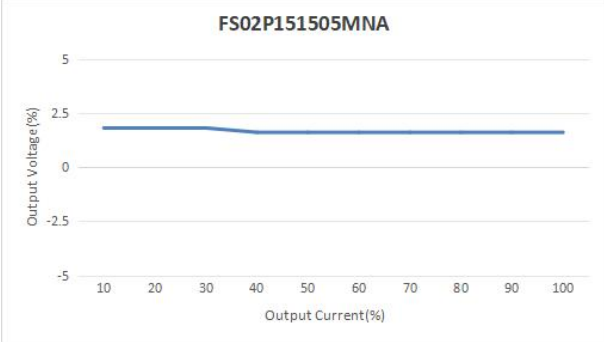
The output voltage curve demonstrates the typical output voltage accuracy and load regulation characteristics caused by load changes.

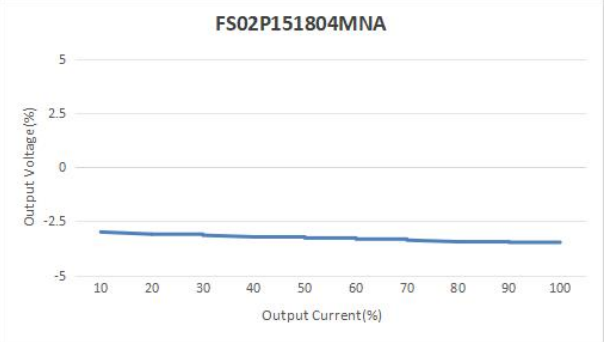


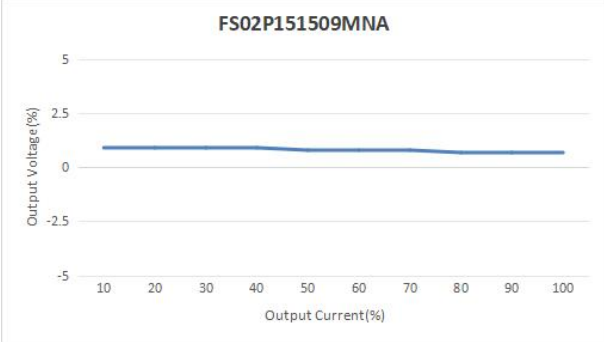


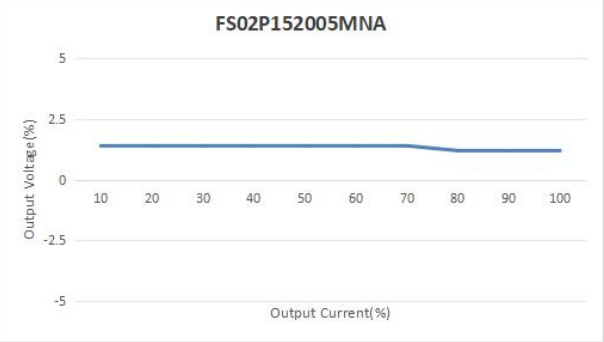




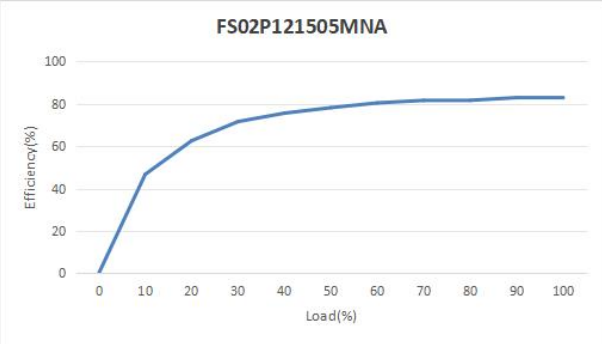


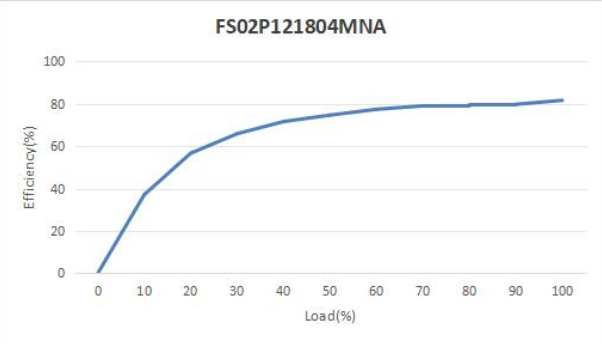


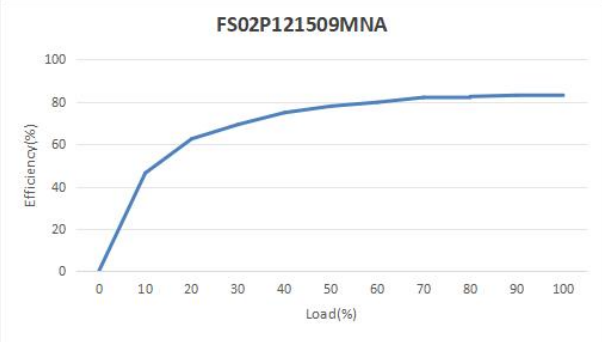


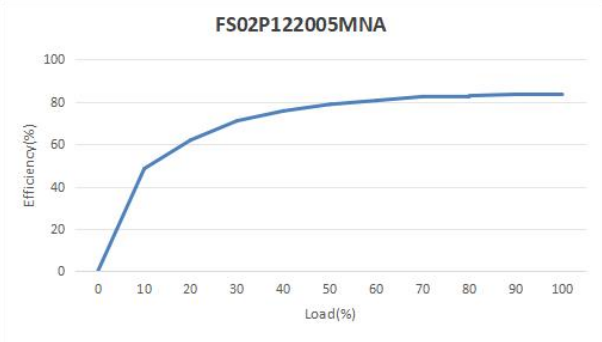


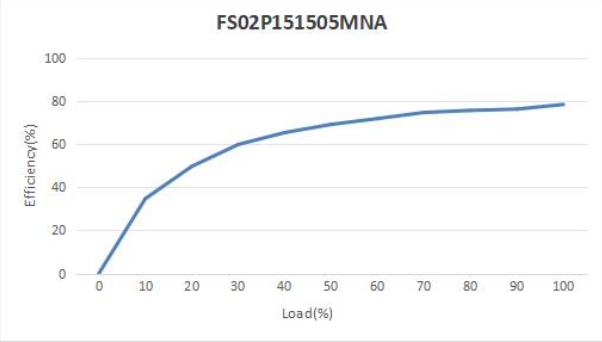
Efficiency VS Load

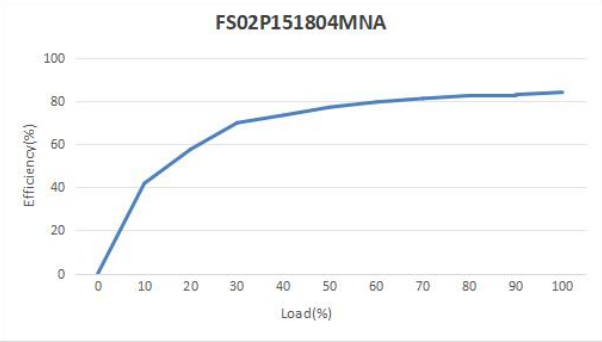


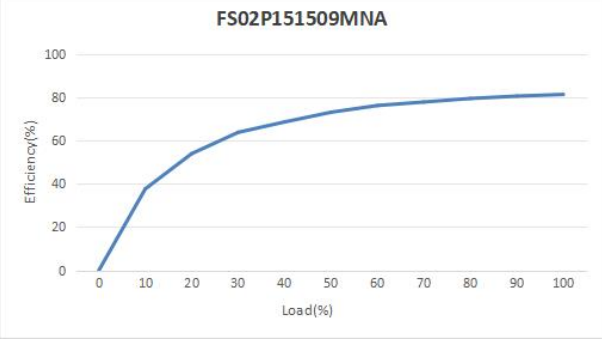


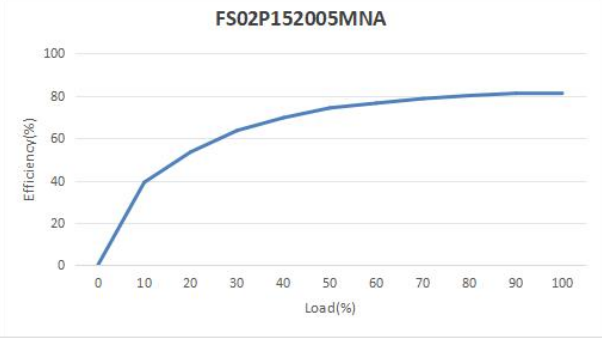




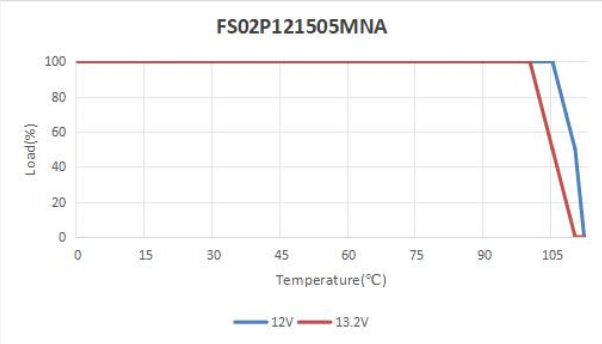


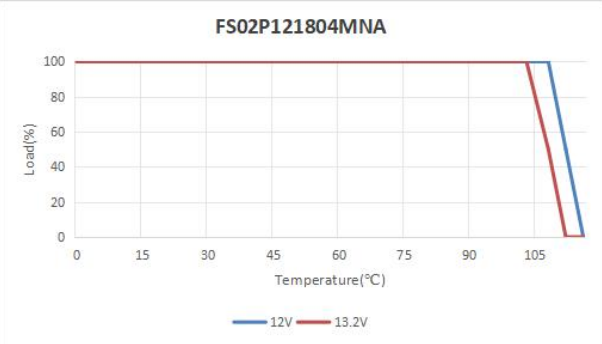


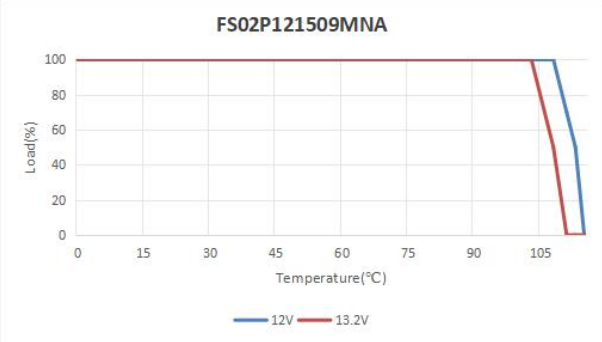


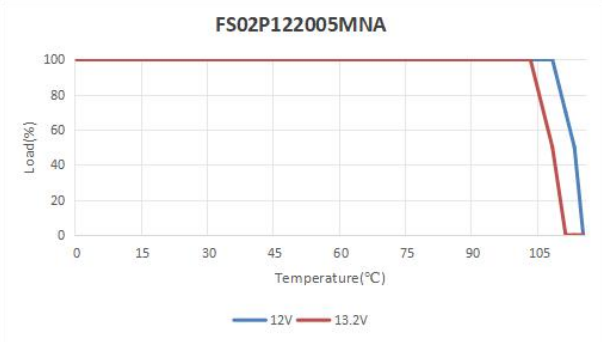


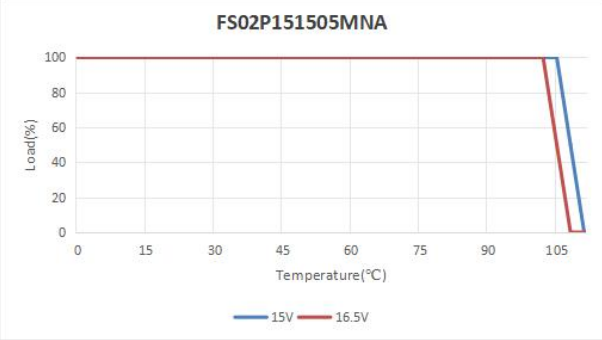
Temperature Derating Curve

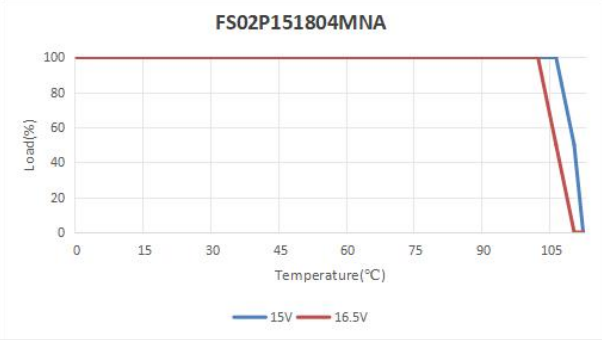


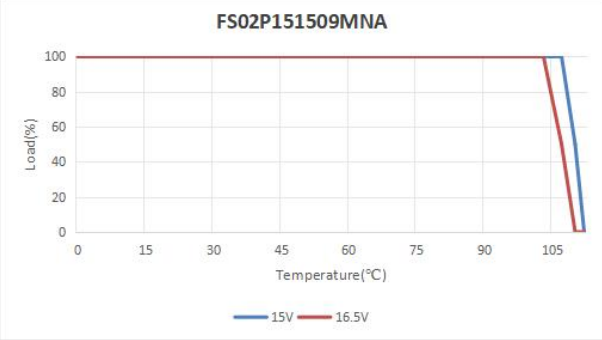


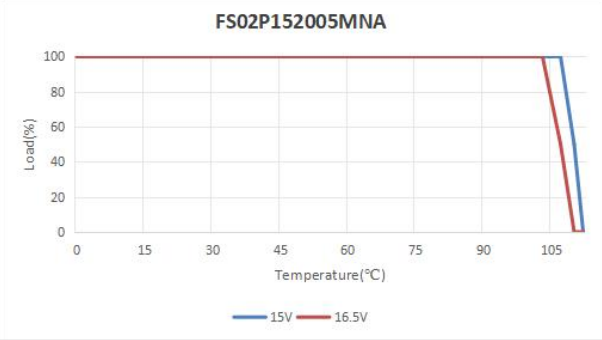






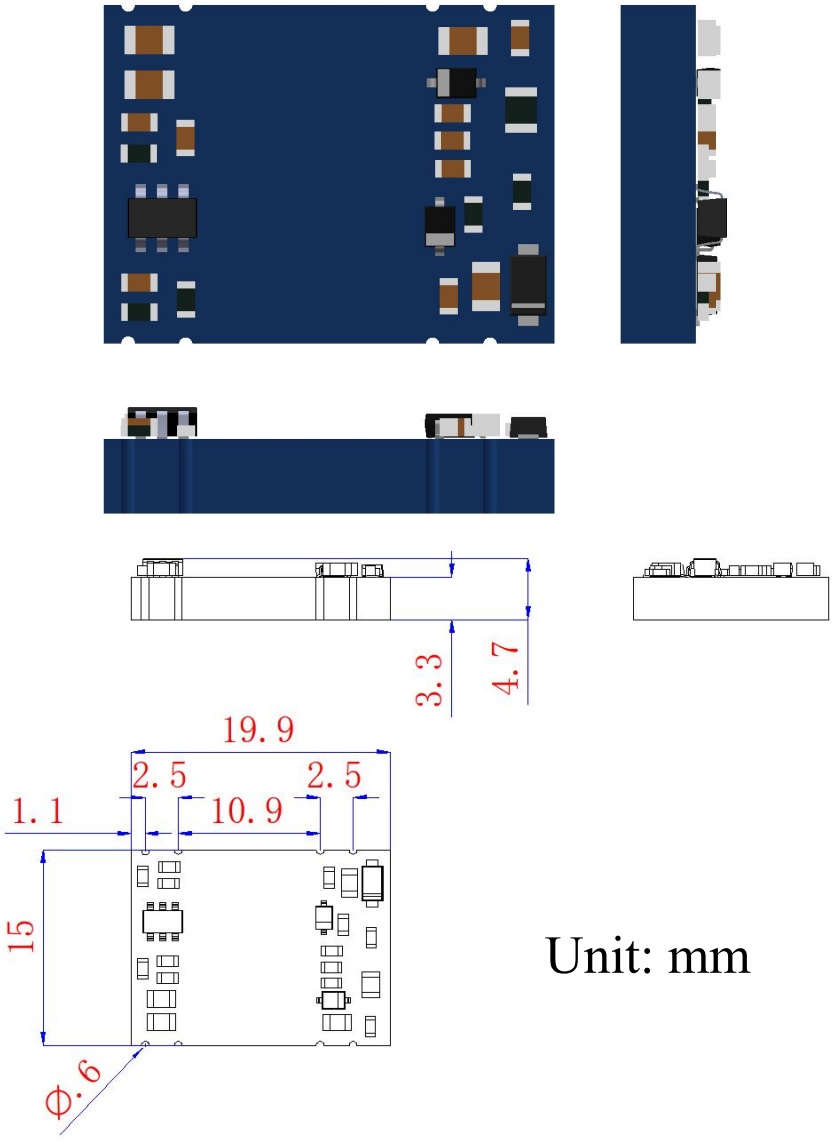






Note：The temperature derating curve is the test result of the power module soldered onto PCB.

3D and Mechanical Dimensions



Note：1. PCB board thickness tolerance ± 10%;

2. For other dimensional tolerances, refer to GB/T1804-m.

Update History

Date	Description	Version
2025.06.13	Preliminary	V0.1
2025.7.14	Update insulation resistance, isolation capacitance, load adjustment rate test data, and reliability test items	V0.2

Ordering Information

The FS02P series are SiC MOSFET, Si-MOSFET and IGBT compact drive power products that can support a variety of drive voltage configurations. If you have a purchase request, please contact our staff and we will provide the power supply module that best meets your needs.

Part Number	Input Voltage（V）	Output Voltage（V）
FS02P121505MNA	12	15/-5
FS02P121509MNA	12	15/-9
FS02P122005MNA	12	20/-5
FS02P121804MNA	12	18/-4
FS02P151505MNA	15	15/-5
FS02P151509MNA	15	15/-9
FS02P152005MNA	15	20/-5
FS02P151804MNA	15	18/-4

Technical Support

Firstack's professional team will provide you with business consultation and technical support. Please contact the Firstack technical sales team if you require the application manual for further information of the technical application.

Legal Disclaimer

The instruction manual provides a detailed description of the product but does not commit to providing specific parameters regarding the delivery, performance, or applicability of the product. This document does not offer any express or implied warranties or guarantees.

Firstack reserves the right to modify technical data and product specifications at any time without prior notice. The general delivery terms and conditions of Firstack apply.

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