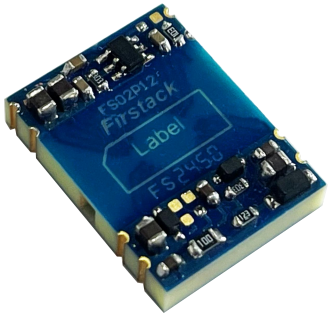


PRODUCT OVERVIEW

The FS02P series is a DC-DC converter specifically designed to drive single IGBT/ SiC&MOSFET or bridge. This series has the ability to output multiple asymmetric voltages, and provide the best driving efficiency for the system. The FS02P series has high insulation withstand voltage, operating temperature, and efficiency, and is suitable for industrial grade motor drives, inverter circuits, and energy storage systems.

FEATURES:

- Output IGBT/SiC&MOSFET bipolar gate driving voltage
- 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 100℃

Application:

- PV and wind power generation systems
- Energy storage systems
- Motor drive
- Inverter
- Railway application

SELECTION GUIDE:

Product Code	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	105	203	6	11	0.2	0.6
FS02P121509MNA	12	15	-9	82	200	5	10	0.1	0.5
FS02P122005MNA	12	20	-5	82	200	6	11	0.1	0.5
FS02P121804MNA	12	18	-4	92	204	5	10	0.5	0.8
FS02P151505MNA	15	15	-5	TBD	TBD	TBD	TBD	TBD	TBD
FS02P151509MNA	15	15	-9	TBD	TBD	TBD	TBD	TBD	TBD
FS02P152005MNA	15	20	-5	TBD	TBD	TBD	TBD	TBD	TBD
FS02P151804MNA	15	18	-4	TBD	TBD	TBD	TBD	TBD	TBD

Technical Parameters

Input Characteristics

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

Output Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Rated power	T_A = -40°C to 100°C			2.0	W
Voltage set point accuracy					
Line regulation	FS02P121505MNA		13		%
	FS02P121509MNA		12		
	FS02P122005MNA		12		
	FS02P121804MNA		12		
	FS02P151505MNA		TBD		
	FS02P151509MNA		TBD		
	FS02P152005MNA		TBD		
	FS02P151804MNA		TBD		

General Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Switching frequency	12V input type		250		kHz
	15V input type		250		kHz

Isolation Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Isolation test voltage	Production tested for 1second	6500			VDC
	Qualification tested for 1 minute	6500			
Resistance	Viso = 1000VDC	50			GΩ
Safety standard	Creepage and clearance		9		mm

Temperature Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Operation	All output types (see derating curves)	-40		100	°C
Storage		-40		125	
Product temperature rise above ambient	Ambient temperature is 25°C		24		
Cooling	Free air convection				

Absolute Maximum Ratings

Short-circuit protection	Continuous
Input voltage, FSD02P12	15V
Input voltage, FSD02P15	18V

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.

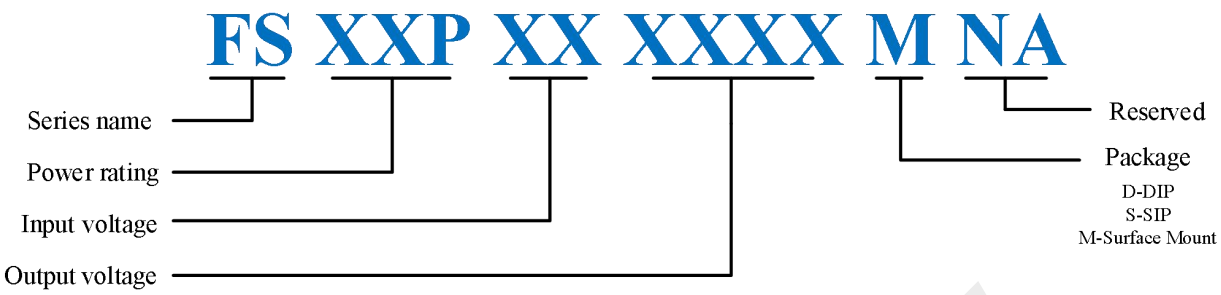
RoHS Compliance, MSL, PSL and soldering information

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
Temperature cycling	JEDEC JESD22-A104	1000 cycles between two temperature extremes set to achieve -40°C and +105°C. 2 full cycles per hour.
Humidity (unbiased)	JEDEC JESD22-A118	130±2°C, 85±5% R.H. for 96 (-0/+2) 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 30 ms 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.

Part Number Structure

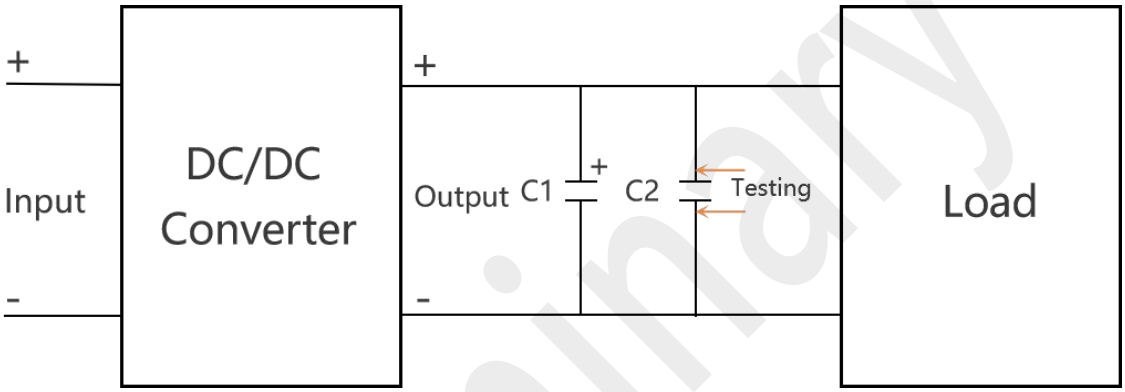


Characterisation Test Methods

Ripple Characterisation 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 chip capacitor, with a rated fixture voltage of at least 3 times the output voltage of the DC-DC converter

Ripple test schematic diagram



Note：The bandwidth for ripple testing is 20MHz

Application Notes

1.Minimum Load

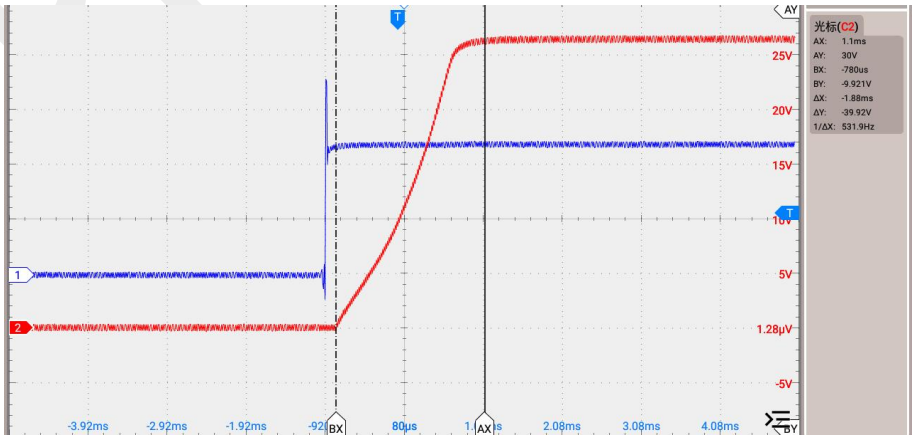
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range.

2. Capacitive loading and start up

Product Code	Start up time (ms)
FS02P121505MNA	1.7
FS02P121509MNA	1.9
FS02P122005MNA	1.9
FS02P121804MNA	1.7
FS02P151505MNA	TBD
FS02P151509MNA	TBD
FS02P152005MNA	TBD
FS02P151804MNA	TBD

Note：The capacitive load is 10μF

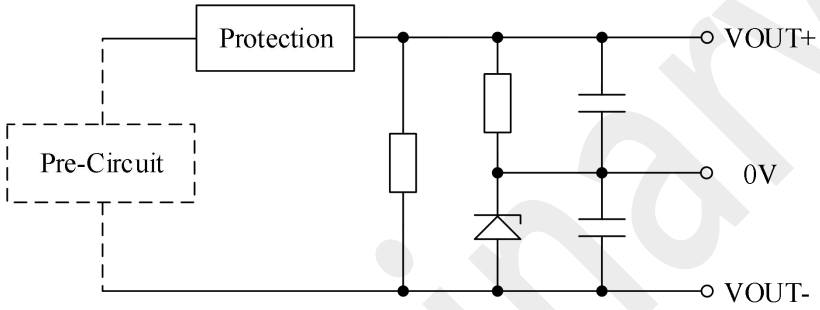
Typical startup waveform:



3.Output configuration

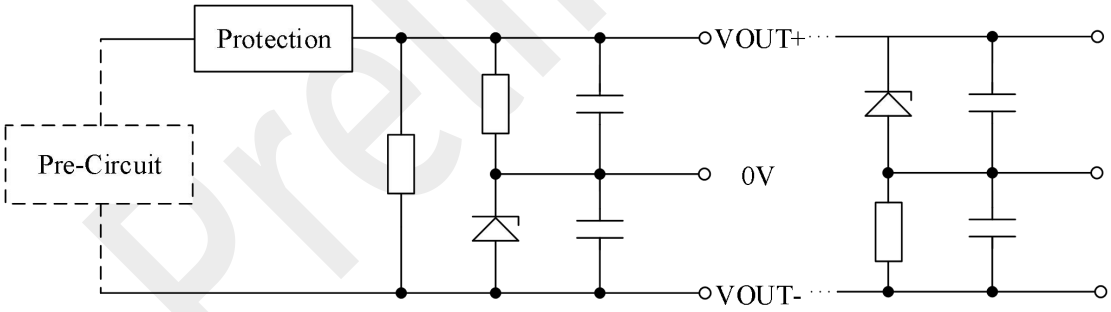
The FS02P series is a dual output DC-DC converter designed specifically for gate drive applications and is not suitable for general-purpose dual output DC-DC converters. However, by loading the load between Vout+ and Vout-, the FS02P series can be used as a universal single output converter.

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.



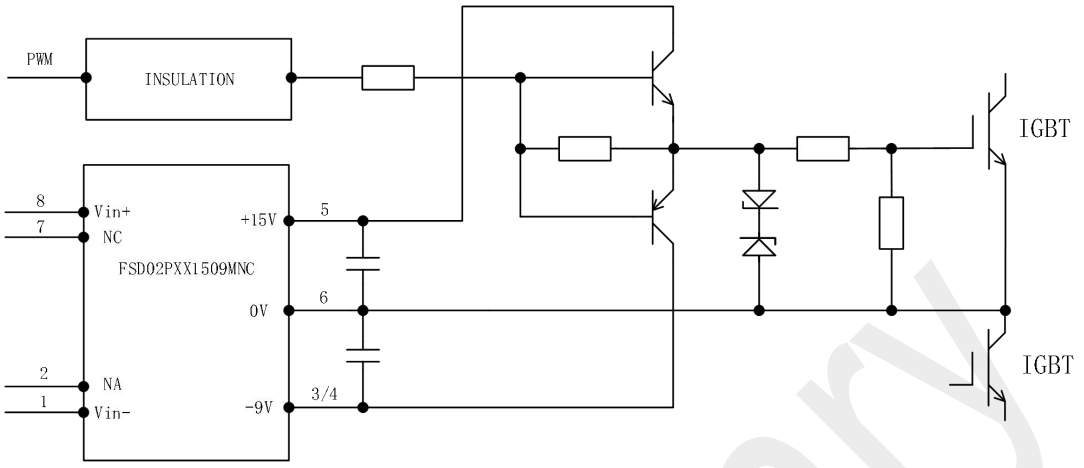
Optional configuration：

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.

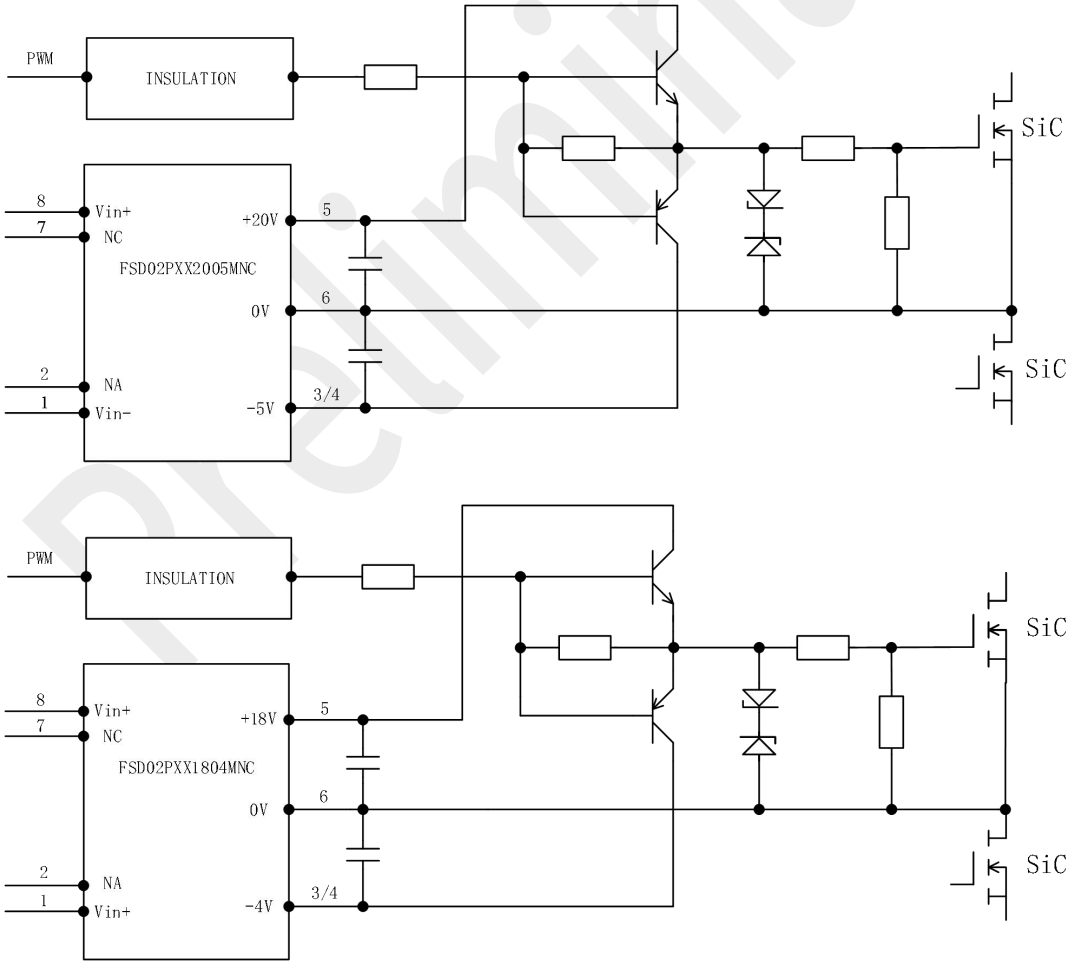


4.Schematic of driving IGBT, SiC & MOSFET

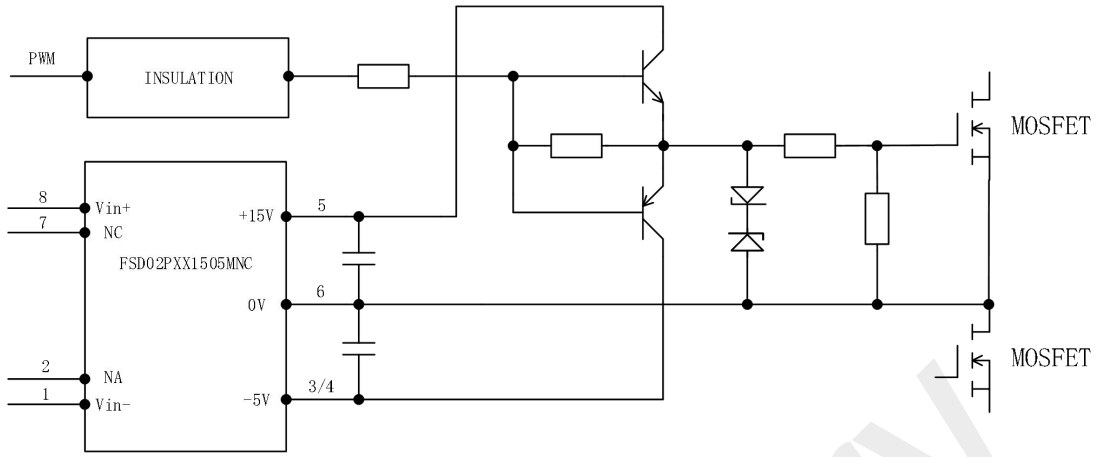
FS02P series for driving IGBT



FS02P series for driving SiC

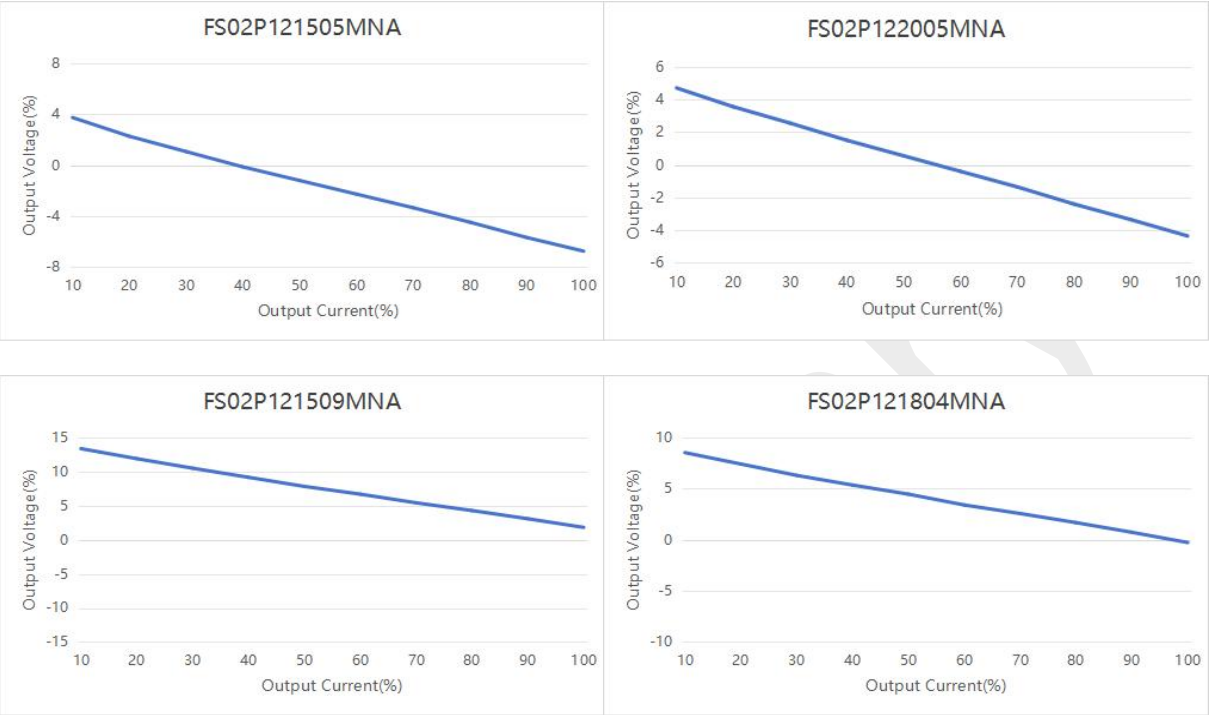


FS02P series for driving MOSFET



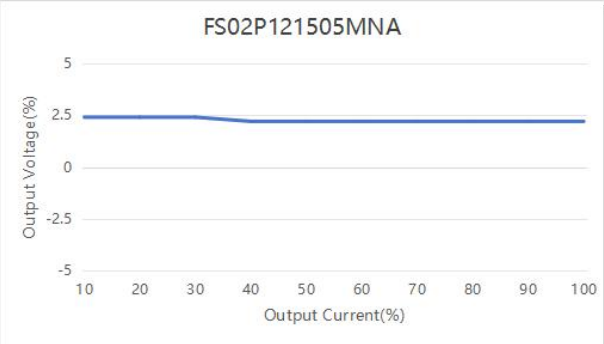
Positive output voltage curve

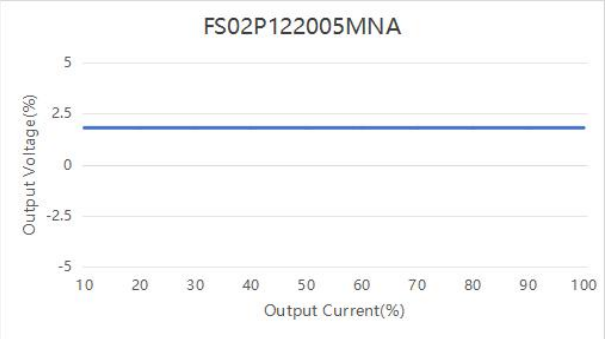
The output voltage curve demonstrates the typical output voltage accuracy and load regulation characteristics caused by load changes.

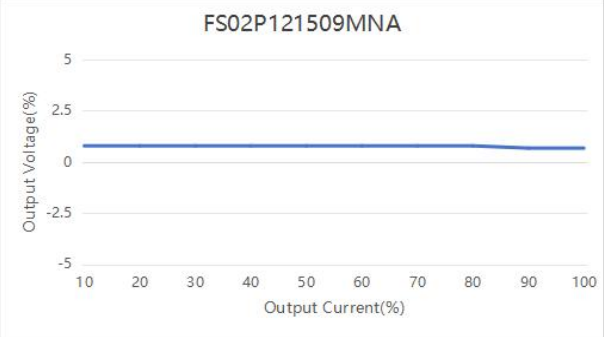


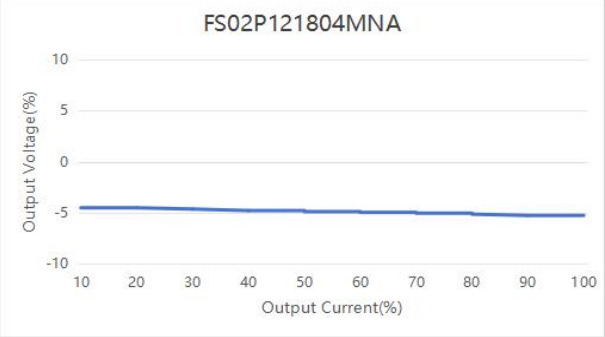
Negative output voltage curve

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

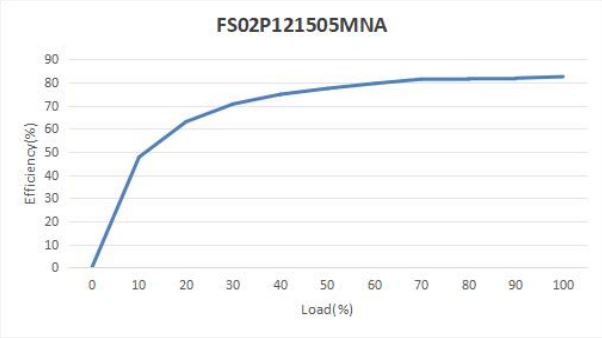


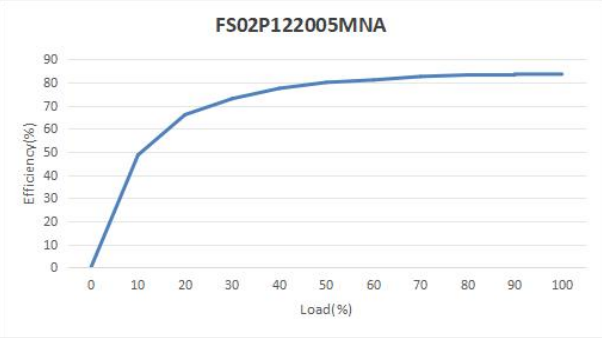


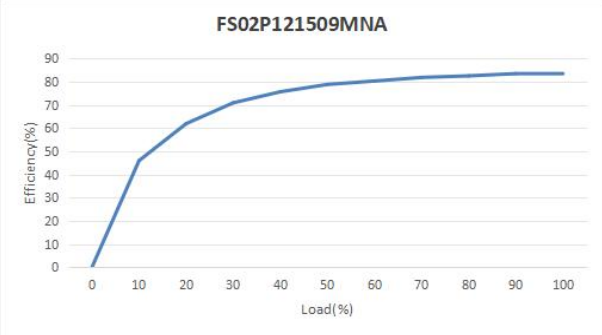


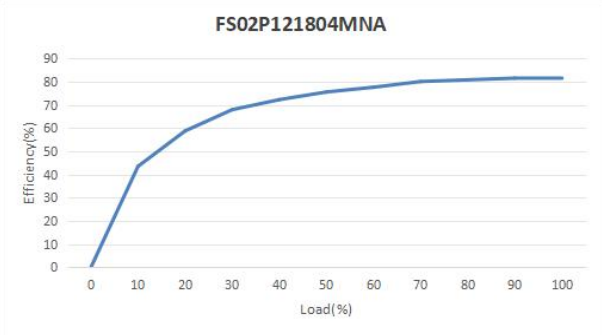


Efficiency VS Load

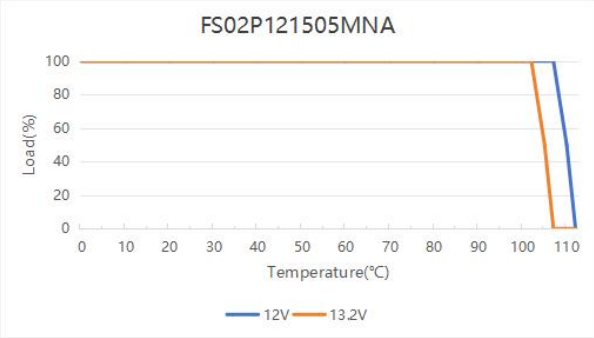


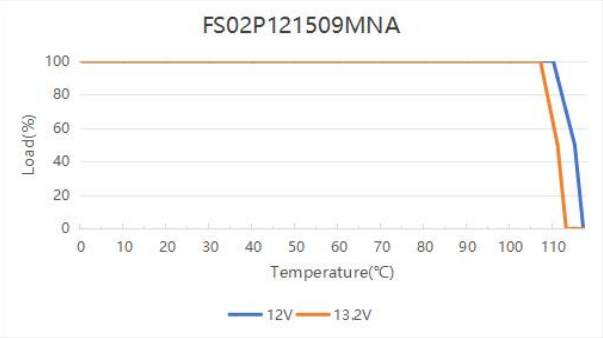


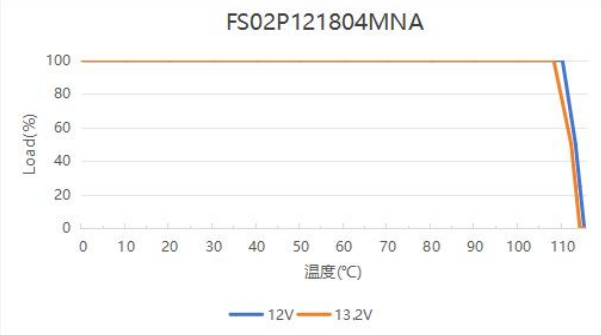


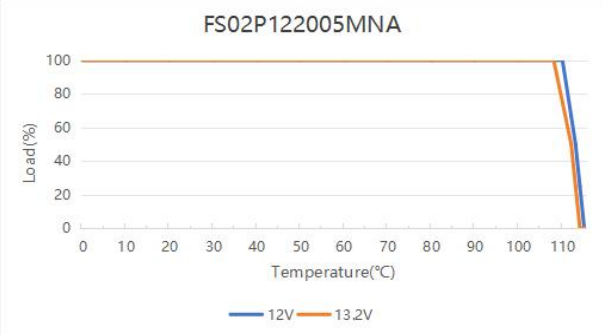


Derating Graphs



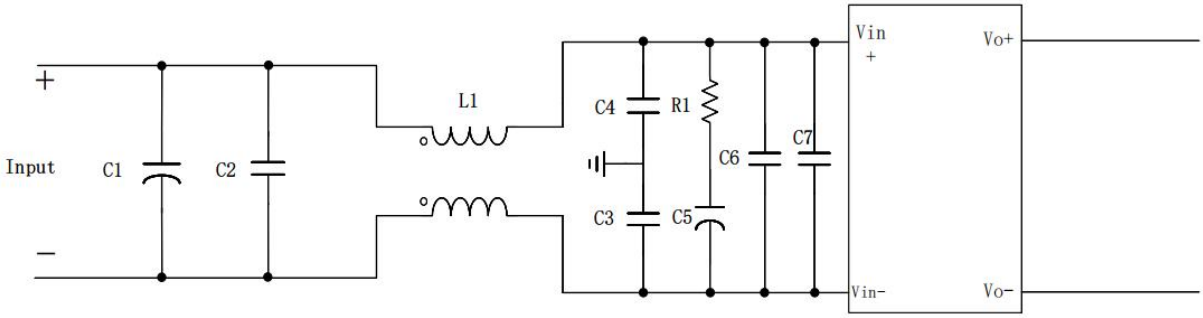




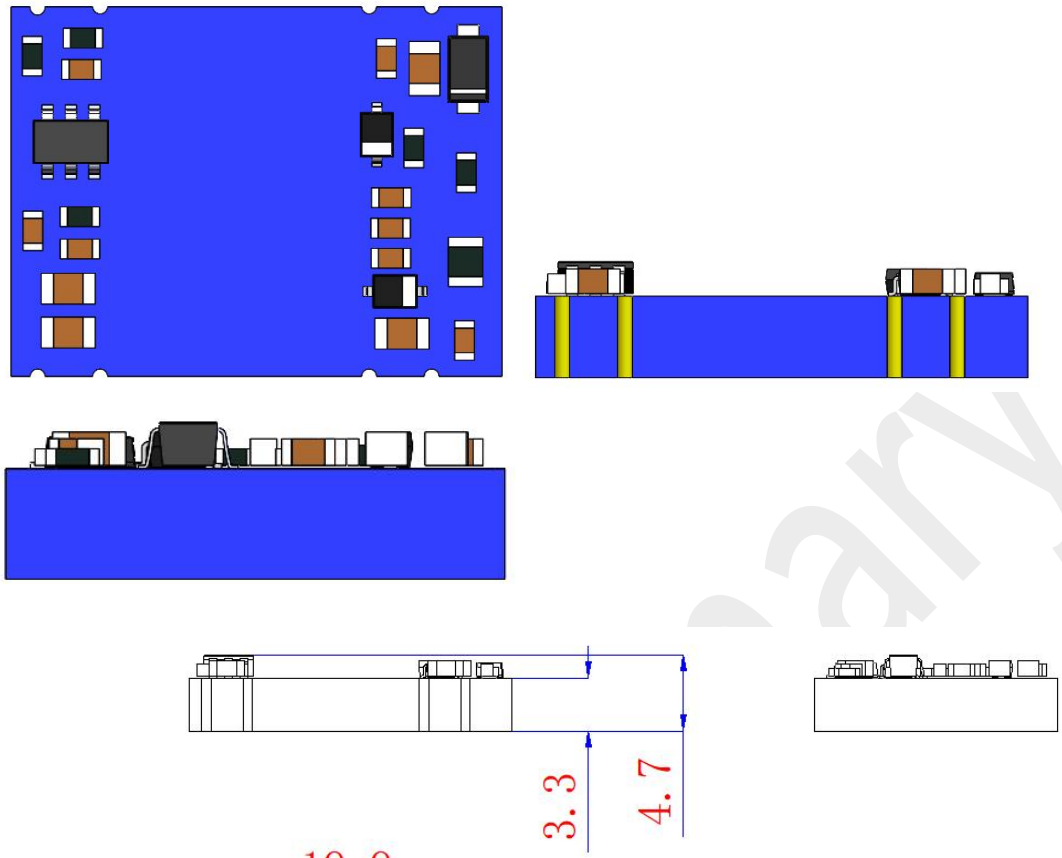


EMC Test (During testing)

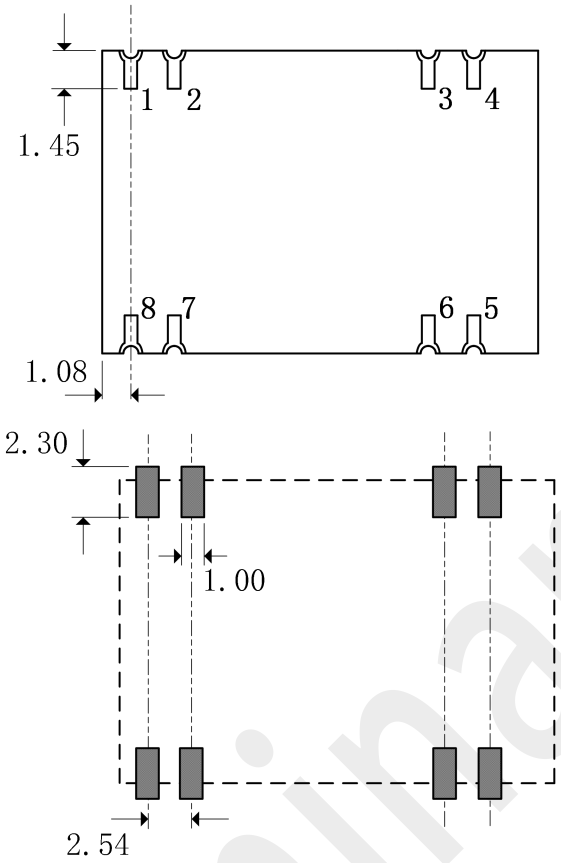
The following filter circuit and filter table shows the input filters typically required to meet EN55022 Quasi-PeakCurve A or B.



Package Specifications



Unit: mm



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

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

Pin Function

Pin	Function
1	VIN-
2	NC
3	VO-
4	VO-
5	VO+
6	0V
7	NC
8	VIN+

Ordering Information

The FS02P series is a DC-DC converter. If you have a purchase request, please contact us, and we can provide the gate driver that best meets your requirements.

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.

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