

# FS06P18GPSNA

## General Introduction

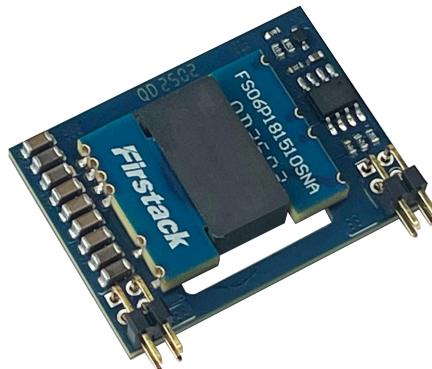
FS06P18GPSNA is a compact DC/DC isolated drive power module independently developed by Firstack. It provides a safe and reliable drive power supply for the gate drive circuits of SiC, MOSFET and IGBT.

### Highlights :

- Primary - secondary insulation: 6.5kV DC
- Total output power: 6W
- Wide - range input voltage: 9 - 18V
- Configurable output drive scheme :  
MOSFET: +15V/-5V; IGBT: +15V/-10V; SiC: +20V/-5V
- Input under-voltage protection; Input over-voltage protection;  
Output over-current protection; Output short-circuit protection;  
Over-temperature protection
- Primary-secondary coupling capacitance: 8pF

### Typical Applications :

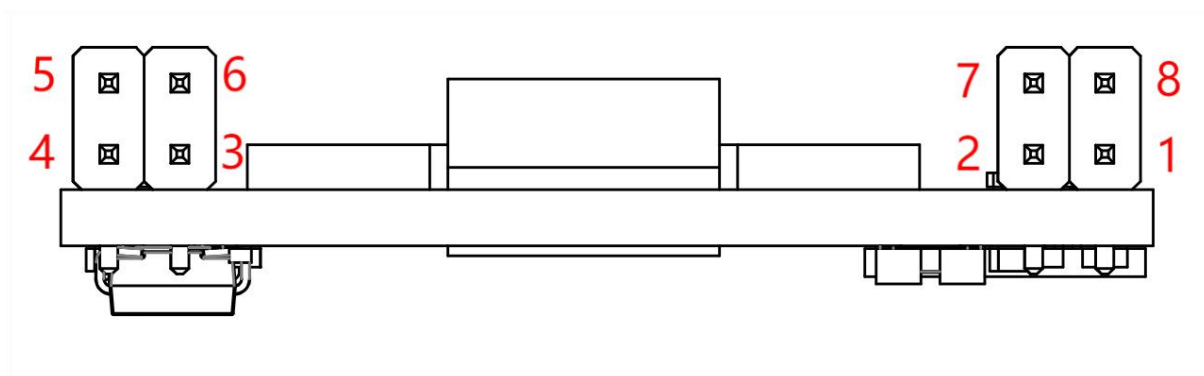
- Energy storage
- Industrial drive
- Photovoltaic system
- Rail Transit



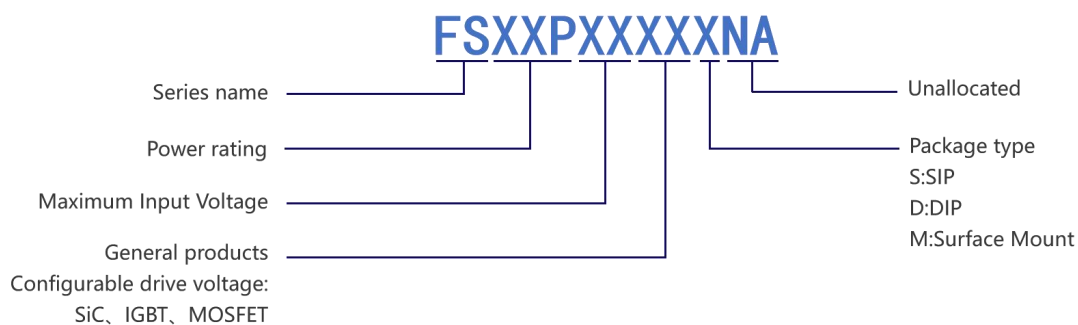
**Fig.1** FS06P18GPSNA

## Pin Information

| Pin | Definition   | Note                                                      |
|-----|--------------|-----------------------------------------------------------|
| 1   | VEN          | It works when floating; enters sleep mode when pulled low |
| 2   | Vin+         | The nominal input is 12V (9 - 18V)                        |
| 3   | 15Vo         | 15V+                                                      |
| 4   | 5Vb_GND      | 5Vb-                                                      |
| 5   | 5Va_GND/5Vb  | 5Va-/5Vb+                                                 |
| 6   | 15Vo_GND/5Va | 15V-/5Va+                                                 |
| 7   | Vin-         | Input ground                                              |
| 8   | Vin-         | Input ground                                              |



## Naming Structure



## Technical Parameters

| Power model  | Input voltage range | Application | Output 1                          |         |                                     | Output 2 |                                   |       |                                     |     |
|--------------|---------------------|-------------|-----------------------------------|---------|-------------------------------------|----------|-----------------------------------|-------|-------------------------------------|-----|
|              |                     |             | Voltage                           | Current | Power                               | Voltage  | Current                           | Power |                                     |     |
| FS06P18GPSNA | V                   | Page 9      | V                                 | mA      | W                                   | V        | mA                                | W     |                                     |     |
|              | 9-18                | IGBT        | +15                               | 240     | 3.6                                 | -10      | 240                               | 2.4   |                                     |     |
|              |                     | SiC         | +20                               | 240     | 4.8                                 | -5       | 240                               | 1.2   |                                     |     |
|              |                     | MOSFET      | +15                               | 300     | 4.5                                 | -5       | 300                               | 1.5   |                                     |     |
|              |                     | Performance | load regulation <sup>1</sup><br>% |         | Ripple& noise <sup>2</sup><br>mVp-p |          | load regulation <sup>1</sup><br>% |       | Ripple& noise <sup>2</sup><br>mVp-p |     |
|              |                     |             | Type                              | Max     | Type                                | Max      | Type                              | Max   | Type                                | Max |
|              |                     | IGBT        | 3                                 | 5       | 110                                 | 150      | 3                                 | 5     | 60                                  | 100 |
|              |                     | SiC         | 3                                 | 5       | 110                                 | 150      | 3                                 | 5     | 60                                  | 100 |
|              |                     | MOSFET      | 3                                 | 5       | 110                                 | 150      | 3                                 | 5     | 60                                  | 100 |

### Note:

- 1.Load regulation from 50% to 100%;
- 2.Refer to the ripple test method with a bandwidth limit of 20 MHz.

## Input Characteristics

| Parameter            | Condition                  | Min | Type | Max | Units |
|----------------------|----------------------------|-----|------|-----|-------|
| Input voltage range  | Recommended                | 9   | 12   | 18  | V     |
| Input ripple current | 100% Load                  |     | 170  |     | mA    |
| VEN <sup>1</sup>     | When VEN pin is pulled low |     | 0.5  |     | mA    |
|                      | Input high level           | 2   |      | 60  | V     |
|                      | Input low level            | -1  | 0    | 0.5 | V     |

### Note:

1. VEN is a high impedance TTL input, use the layout with care to avoid the effects of noise.

**Output Characteristics**

| Parameter             | Condition                                      | Min | Type | Max | Units |
|-----------------------|------------------------------------------------|-----|------|-----|-------|
| Minimum load          | when the module is unloaded<br>15.5V/6.0V      | 1   |      |     | %     |
| Voltage<br>accuracy   | Output 1                                       |     | 1    |     | %     |
|                       | Output 2                                       |     | 4    |     | %     |
| Line regulation       | 9V <sub>in</sub> →18V <sub>in</sub> , 50% Load |     |      | 2   | %     |
| Total regulation      | 1% Load→100% Load                              |     |      | 5   | %     |
| Transient<br>response | Peak deviation for 50%-100% load swing         |     | 3    |     | %     |
|                       | Settling time                                  |     | 0.3  |     | ms    |

**General Characteristics**

| Parameter              | Condition            | Min | Type | Max | Units |
|------------------------|----------------------|-----|------|-----|-------|
| Switching<br>frequency | 100% Load            |     |      | 360 | kHz   |
| Start-up times         | Output voltage delay |     | 3.5  |     | ms    |

**Isolation Characteristics**

| Parameter                 | Condition                                             | Min  | Type | Max | Units |
|---------------------------|-------------------------------------------------------|------|------|-----|-------|
| Isolation test<br>voltage | Continuous test for 1 minute,<br>leakage current <1mA | 6500 |      |     | VDC   |
| Resistance                | 1kVDC                                                 | 100  |      |     | GΩ    |
| Safety standard           | Creepage and clearance 8mm                            |      |      |     |       |

**Protective Characteristics**

| Parameter                   | Condition             | Min | Type | Max | Units |
|-----------------------------|-----------------------|-----|------|-----|-------|
| Input under-voltage         | Protection thresholds |     | 7.5  |     | V     |
| Input over-voltage          | Protection thresholds |     | 21.5 |     | V     |
| Over-current protection     | Full Voltage 25V      |     | 0.3  |     | A     |
| Over-temperature protection | Protection thresholds |     | 160  |     | °C    |

**Temperature Characteristics**

| Parameter           | Condition                          | Min | Type | Max | Units |
|---------------------|------------------------------------|-----|------|-----|-------|
| Operation           | Reference to the derating curve    | -40 |      | 105 | °C    |
| Storage             |                                    | -50 |      | 125 | °C    |
| Product temperature | 12Vin, 6W full load, 25°C, no wind |     | 40   |     | °C    |

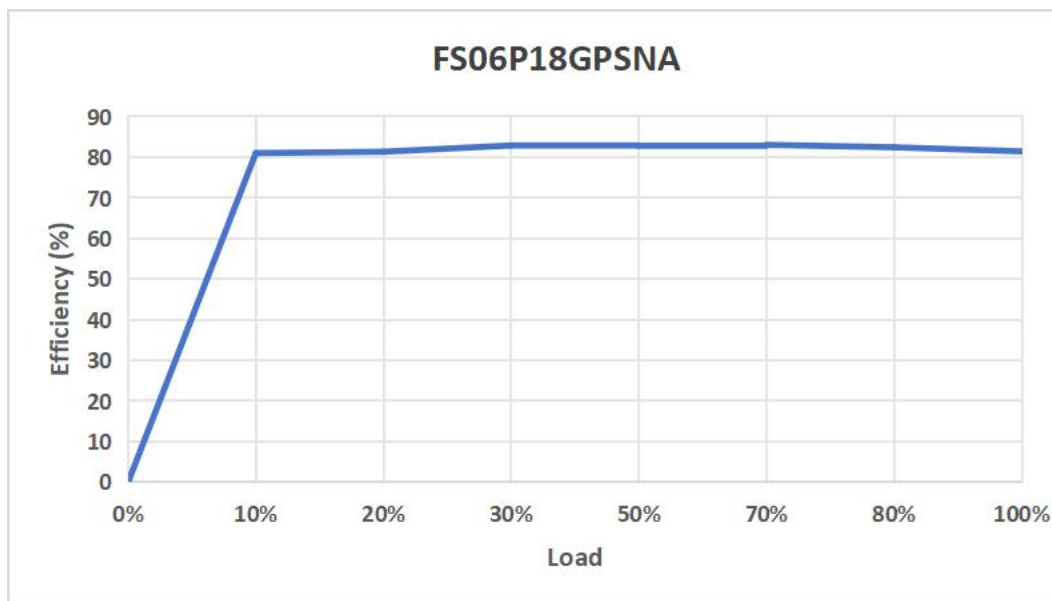
**Absolute maximum rating**

| Parameter          | Condition                                                                | Min  | Type | Max | Units |
|--------------------|--------------------------------------------------------------------------|------|------|-----|-------|
| output capacitance | 20V                                                                      |      |      | 220 | μF    |
|                    | 15V                                                                      |      |      | 330 |       |
|                    | -10V                                                                     |      |      | 330 |       |
|                    | -5V                                                                      |      |      | 490 |       |
| Input voltage      | 21.5V-35V over-voltage protection                                        | -0.3 |      | 35  | V     |
| Wave Solder        | Wave Solder profile not to exceed the profile recommended in IEC 61760-1 |      |      |     |       |

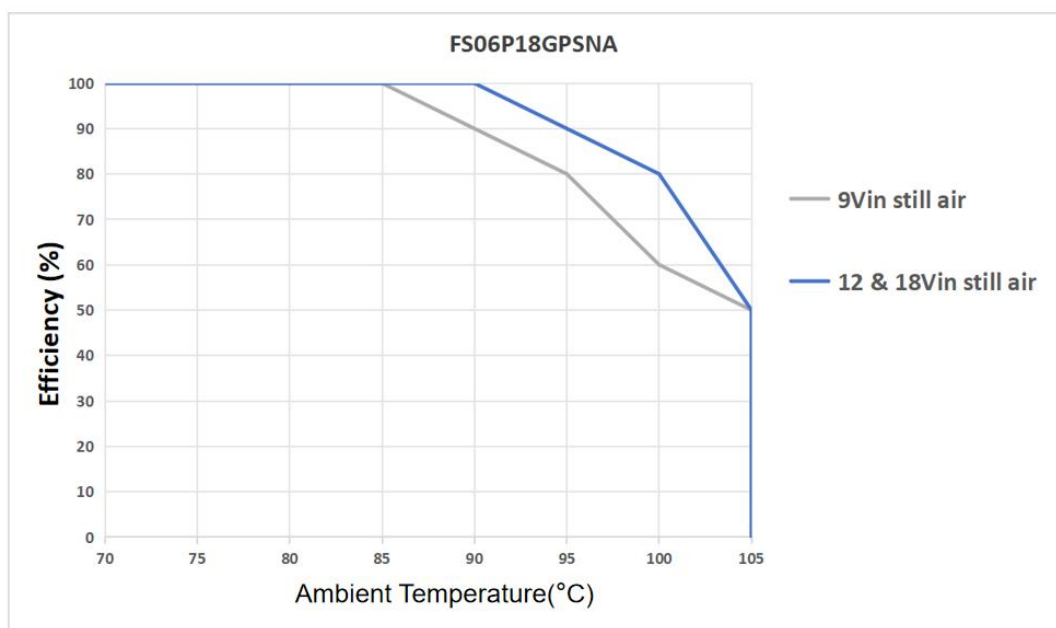
**Note:**

Unless otherwise specified, the above characteristics are based on 12V input and 25°C ring temperature.

## Efficiency vs. Load



## Derating Curve

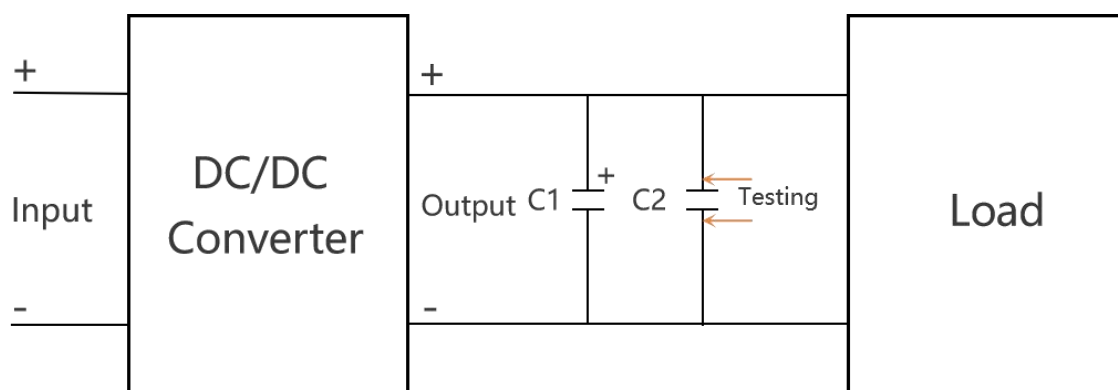


**Environmental Validation Testing**

| Test                          | Standard                        | Condition                                                                                                                                                                                                   |
|-------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature cycling           | MIL-STD 883                     | 10 cycles between two chambers set to achieve -55°C and +125°C. The dwell time shall not be less than 10min and the load shall reach the specified temperature in 15min.                                    |
| HAST(Unbiased)                | JEDEC JESD22-A118               | 96Hrs +2/-0Hrs at 130°C ± 2°C, 85% ± 5% R.H.                                                                                                                                                                |
| Vibration                     | BS EN 61373<br>BS EN 60068-2-64 | 5–150Hz. Level at each axis–Vertical, Traverse and Longitudinal: 5.72m/s <sup>2</sup> rms. 5 hours in each axis. Crest factor: 3 Sigma. Device is secured via pins.                                         |
| Shock                         | BS EN 61373                     | Test is 30ms duration, 3 shocks in each sense of 3 mutually perpendicular axis (18 shocks total). Level at each axis: Vertical, Traverse and Longitudinal: 50m/s <sup>2</sup> . Device is secured via pins. |
| Solvent Resistance            | MIL-STD 883                     | 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.            |
| Solder heat                   | JEDEC JESD22-B106               | The test sample is subjected to a molten solder bath at 260 ± 5°C for 10 +2/-0 seconds (96SC tin/silver/copper). The leads are dipped in the solder bath to within 1mm of the device body.                  |
| Lead Integrity (Adhesion)     | MIL-STD 883                     | Leads are bent through 90° until a fracture occurs.                                                                                                                                                         |
| Lead Integrity (Fatigue)      | MIL-STD 883                     | The leads are bent to an angle of 15°. Each lead is subjected to 3 cycles.                                                                                                                                  |
| Solder ability                | IPC/ECA J-STD-002D              | Parts are baked for 4 hours at a temperature of 155°C within 72 hours they are dipped in flux for 10 seconds. Followed by dipping in a solder pot at 255°C ± 5°C for 5 seconds (96SC tin/silver/copper)     |
| High Temperature Storage life | JEDEC JESD22-A103               | 125°C +10/-0°C for ≥1000 hours                                                                                                                                                                              |
| Solvent cleaning              | /                               | Solvent–Novec 71IPA & Topklean EL-20A. Pulsed ultrasonic immersion 45°C- 65°C                                                                                                                               |

**Ripple & Noise Characterisation Method**

| Test | Standard                                                                                     |
|------|----------------------------------------------------------------------------------------------|
| C1   | 10 $\mu$ F electrolytic capacitor rated at least 1.5 times the output voltage of the module. |
| C2   | 1 $\mu$ F X7R ceramic capacitor rated at least 3 times the module output voltage.            |

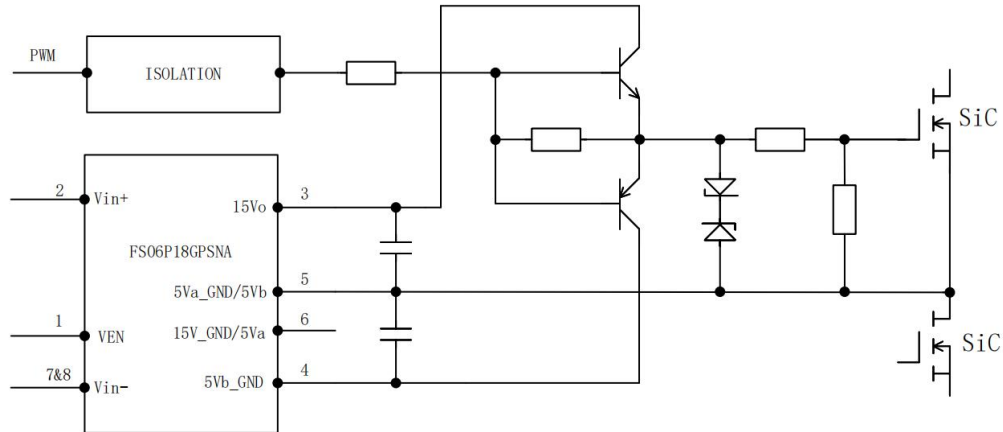
**Differential Mode Noise Test Schematic**

**Output Configurations for Power Switches**

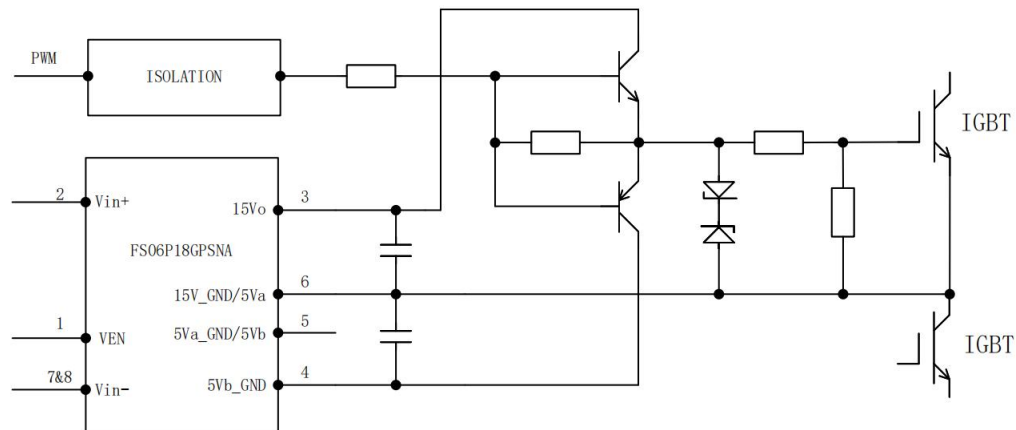
| Ports       | Pin | IGBT          | SiC           | MOSFET       |
|-------------|-----|---------------|---------------|--------------|
| 15Vo        | 3   | +15V<br>0.24A | +20V<br>0.24A | +15V<br>0.3A |
| 15V_GND/5Va | 6   | 0V            | Floating      | 0V           |
| 5Va_GND/5Vb | 5   | Floating      | 0V            | -5V<br>0.3A  |
| 5Vb_GND     | 4   | -10V<br>0.24A | -5V<br>0.24A  | Floating     |

## Application Schematic

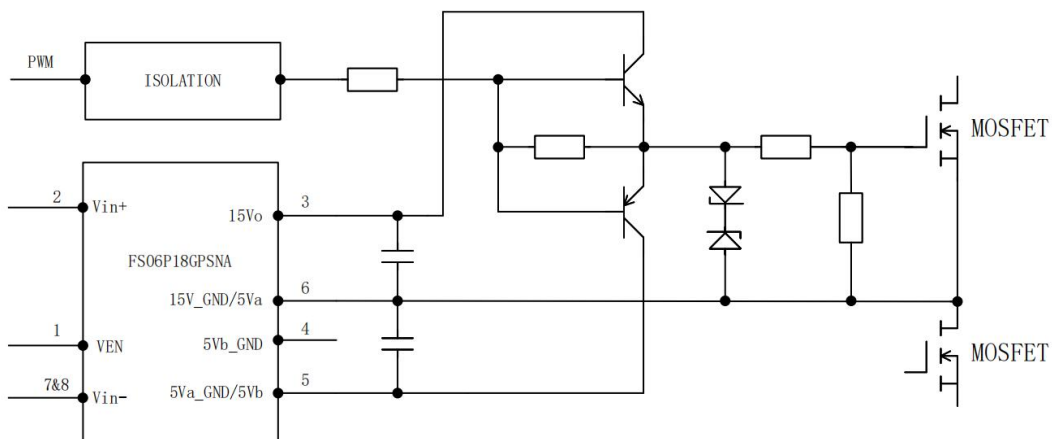
Output configuration for driving SiC (+20V, -5V)



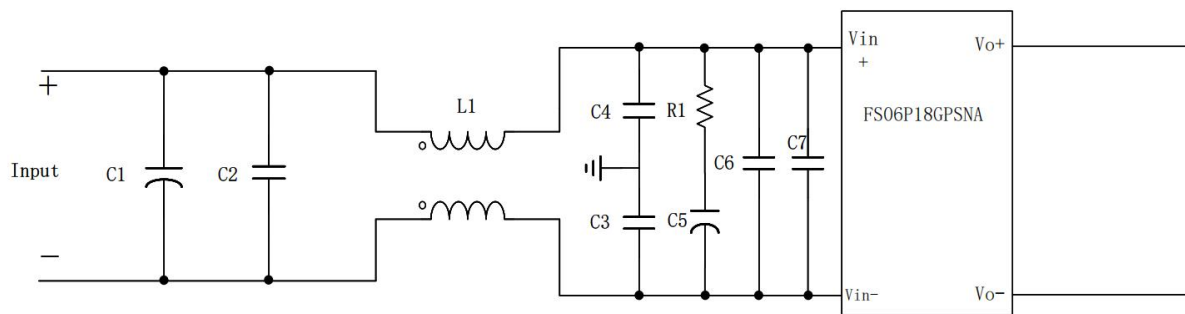
Output configuration for driving IGBT (+15V, -10V)



Output configuration for driving MOSFET (+15V, -5V)



### EMC Filtering and Spectra (To be determined)

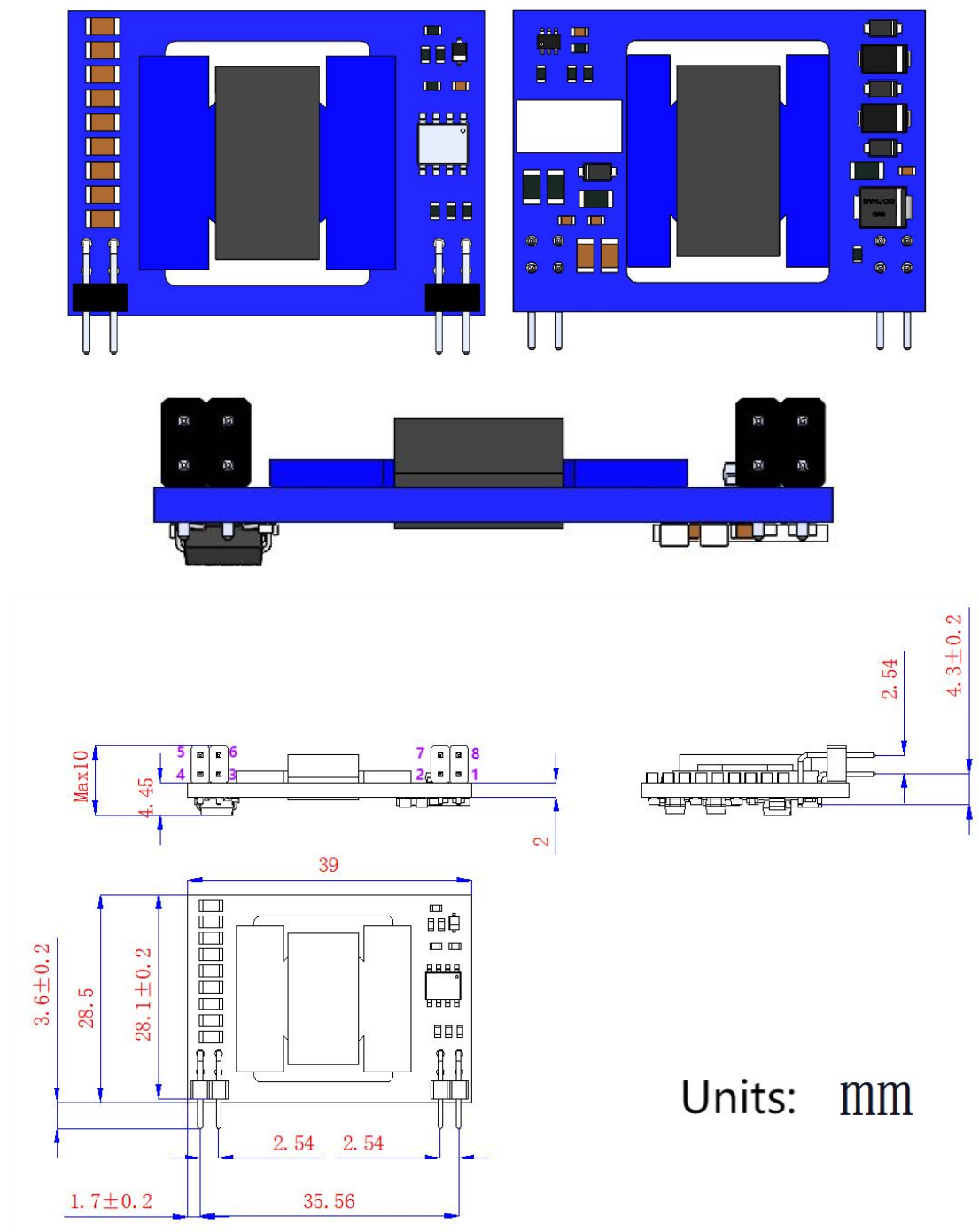


**Note:**

EN50155, UL 62368-1 relevant characteristics are being tested.

The above diagram shows the EMC test application schematic diagram for reference only.

### 3D and Mechanical Dimension

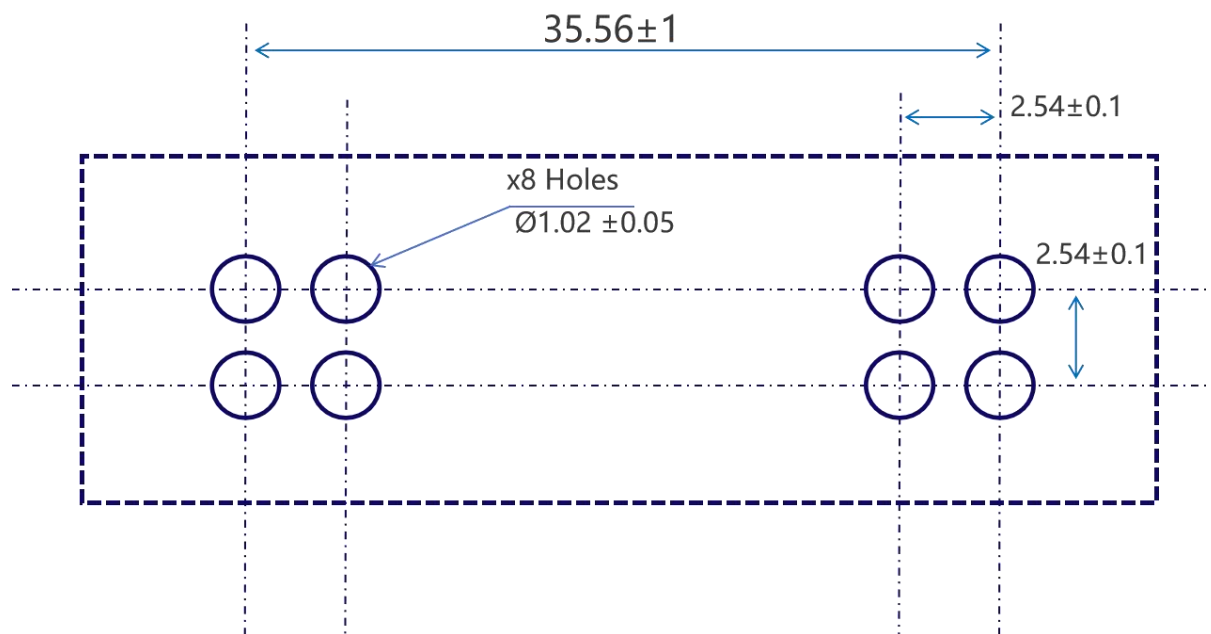


3D and mechanical dimension

**Note:**

1. Tolerance of plate thickness  $\pm 10\%$ ;
2. The rest of the dimensional tolerances refer to GB/T1804-m.

## Recommended PCB Layout



PCB Layout

## **Ordering Information**

The FS06P18GPSNA is a SiC, MOSFET and IGBT compact drive power supply product that can support multiple drive voltage configurations. Please contact our staff for the power supply module that best meets your needs.

## **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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