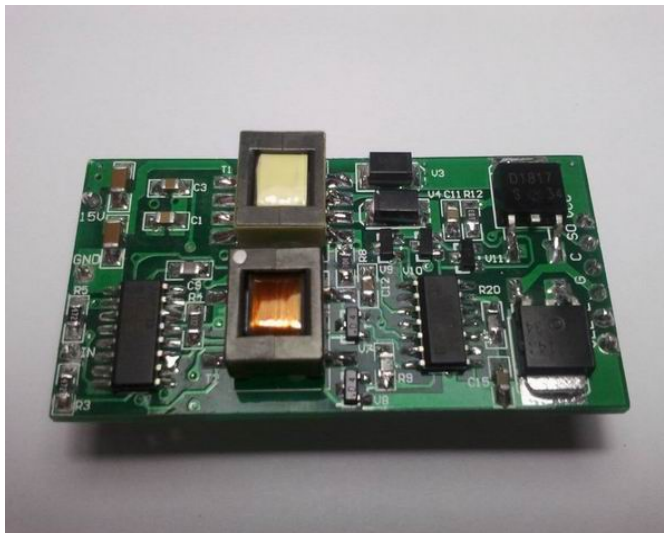


## **Description and Application Manual for PIDS310 standard IGBT driver**

The WEPOWER series high power IGBT intelligent module drivers are designed for high power IGBT module with high reliability and security. The products series have been patented in China.

The high power IGBT intelligent driving module released by WEPOWER is easy to use with intelligent design, high driving power and complete function.

The PIDS310 standard IGBT intelligent module driver is pin compatible to other common products completely and directly in the market.



**The WEPOWER IGBT driver is a winning project of the competition organized by “China National Invention Association” in 2009.**

**The IGBT driver by distinguishing it as the “Bronze Medal” in the “National Exhibition of Inventions” in 2009.**

### **Applications**

- ※ Inverters
- ※ Converters
- ※ Railroad Traction
- ※ Switch Power Supplies
- ※ DC/DC Converters
- ※ Radiology and Laser Technology
- ※ Research
- ※ Motor Drive Technology

**1. Main Features & Technical Specifications****1.1 Main Feature**

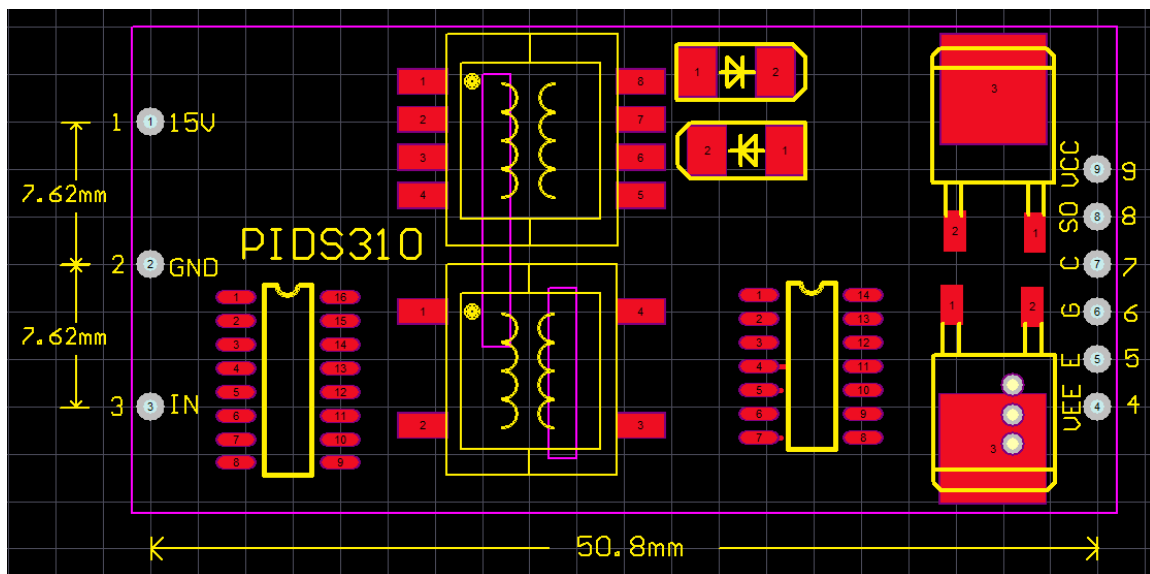
- (1) Adopting transformer modulation isolation technique
- (2) Suitable for driving standard IGBT module
- (3) Short circuit, over current and low-voltage protection.
- (4) Soft switching
- (5) Reliable and durable
- (6) Electrical isolation of 4000V<sub>AC</sub>
- (7) Switching frequency: 0-100kHz
- (8) Duty ratio: 0-100%
- (9) Disturbance rejection property:  $dv/dt > 100,000V/us$
- (10) Integrated internal DC/DC power supply

**1.2 Technical Specifications**

Absolute maximum Ratings				
Symbol	Definition		Value	Unit
V <sub>CC</sub>	Power supply voltage		16	V
V <sub>iH</sub>	Input signal voltage (high)		VS+0.3	V
V <sub>iL</sub>	Input signal voltage (low)		GND-0.3	V
I <sub>outPEAK</sub>	Output peak current		10	A
f <sub>max</sub>	Max switching frequency		100	kHz
V <sub>CE</sub>	Collector emitter voltage sense across the IGBT		1700	V
dv/dt	Rate of rise and fall of voltage secondary to primary side		60	kV/us
V <sub>isollO</sub>	Isolation test voltage input-output (AC,RMS,2S)		4000	V
V <sub>isolPD</sub>	Partial discharge extinction voltage, RMS, Q <sub>PD</sub> ≤10PC		2000	V
R <sub>Gmin</sub>	Minimum rating for R <sub>G</sub>		0.5	Ω
T <sub>op</sub>	Operating temperature	PIDS310I	-40℃~+85℃	℃
		PIDS310J	-40℃~+105℃	
		PIDS310M	-55℃~+125℃	
T <sub>stg</sub>	Storage temperature	PIDS310I	-55℃~+125℃	℃
		PIDS310J	-55℃~+125℃	
		PIDS310M	-55℃~+130℃	

Electrical characteristics					
Symbol	Definition	value			unit
		Min.	Typ.	Max	
V <sub>S</sub>	Supply voltage primary side	14.5	15	15.6	V
I <sub>SO</sub>	Supply current primary side (no load )		40		mA
	Supply current primary side (max)			300	mA
V <sub>i</sub>	Input signal voltage on/off		15/0		V
V <sub>IT+</sub>	Input threshold voltage (High)	3.5	-	-	V
V <sub>IT-</sub>	Input threshold voltage (Low)	-	-	2.5	V
V <sub>G(on)</sub>	Turn on gate voltage output		+15		V
V <sub>G(off)</sub>	Turn off gate voltage output		-10		V
t <sub>d(on)</sub>	Turn-on propagation time		0.7		us
t <sub>d(off)</sub>	Turn-off propagation time		0.7		us
t <sub>d(err)</sub>	Error propagation time			0.1	us
C <sub>PS</sub>	Coupling capacitance primary secondary				pF
W	weight		12		g
MTBF	Mean time between failure (Ta=40°C,max load)		1.8		10 <sup>6</sup> h

**2. PIDS310 Mechanical Dimensions**



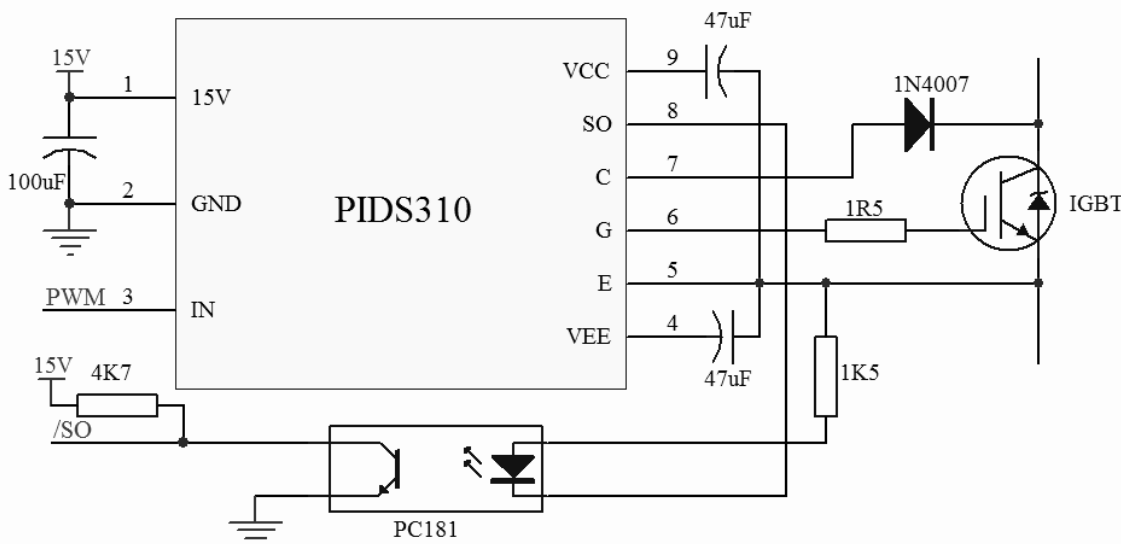
PIDS310 outer dimensions and connector diagram (pin distance: 7.62 & 2.54mm)

**PIDS310 Pin Designation Table**

Pin	Signal	Function
1	VDD	+15V for electronic input side
2	GND	GND for electronic input side
3	IN	PWM Signal input (TTL or COMS)
4	VEE	Blocking Capacitor -10V
5	E	Emitter
6	G	GATE
7	C	Collector sense
8	SO	FAULT OUTPUT
9	VCC	Blocking Capacitor+15V

**3. Application examples**

Reference connection schematic of PIDS310 is shown in the following figure. It shows that WEPOWER series IGBT drive module needs less peripheral device, driving circuits is simple and high integration. In order to improve its reliability, the parameters of the selection of electric level and the protection voltage are pre-set in the module.



**PIDS3102 Connection Schematic**

**4. Overview of WEPOWER series High Power IGBT intelligent module driver**

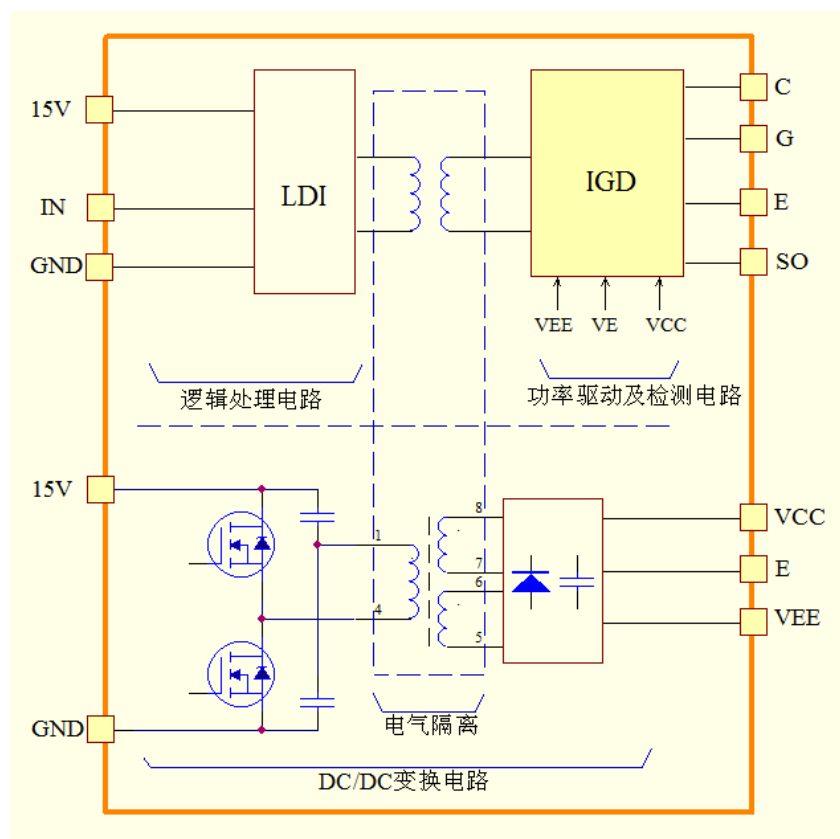
(1)More reliable operation (Gate bipolar power supply with +15V/-10V is suitable for IGBT of any manufacturer. The gate is driven by negative voltage which increases capacity of anti-interference and more Parallel IGBTs can be driven.)

(2)True electrical isolation (The non-core transformer isolation technology is used for each channel of drivers to reach better insulation properties and lower coupling capacitance.)

**5. Operation Principle**

**5.1 Block diagram**

PIDS310 IGBT intelligent driving module mainly consists of internal DC / DC converting circuit and IGBT Intelligent driving circuit which is formed by a logic processing circuit, a power drive and detection circuits. The block diagram is shown below.



**PIDS310 Block diagram**

LDI is a logic signal processing circuit. IGD is an intelligent gate driver and power expansion circuit. The non-core pulse transformer is used to transmit signals and feedback the signal between LDI and IGD.

### IGD intelligent gate driver circuit

For each driving channel, there is an intelligent gate driver circuit IGD in which all function circuits such as intelligent drive, overload and short circuit protection, temporal logic blocking the signal, state identification, power supply and output monitoring circuits are integrated.

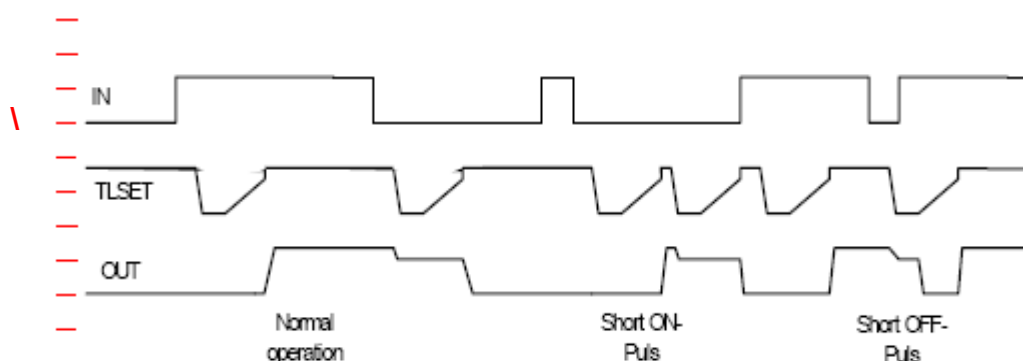
### Integrated DC / DC power supply

All of the standard series of WEPOWER series IGBT intelligent drive module includes a DC / DC converter for each channel to provide drive voltage. Therefore, drivers need only a stable 15V DC power supply. As for different application, especially the different switching frequency and power valve gate charge, WEPOWER offers different driving power. Internal DC/DC drive power of PIDS310 is 3W.

## 5.2 Protection Features

The IGBT  $V_{CE}$  detection circuit is set in each channel of WEPOWER intelligent driver. Once the fault of Over current or low-voltage is detected (the value is 9V), shutdown signal will generated by the module. The drive board begins to turn off the power device (With soft switch-off function), and it does not receive drive signals, the "failure" message will be output through the pin /FAUL. So the driver will not accept any driving signal until the "blocking" time has elapsed.

The timing diagram of WEPOWER intelligent driver beginning to turn off the power device in two stages when IGBT is over current or short circuit is shown below.



The timing diagram with Short circuit and over current protection

### 5.3 The Pin Designation

#### 5.3.1 The Input Side

##### Pin VDD (voltage supply electronics input side)

A stabilized voltage supply of +15V with respect to GND is connected to terminal VDD

##### Pin GND

Pin GND is connected to the ground of the electronic power supply, if several GNDs are present, all GNDs should be connected to ground.

##### Pin IN (signal input)

The signal input has a TLL or COMS positive logic: a Hi level switches the power semiconductor on ,a Lo level means a switch-off state. The signal input has been pulled to GND via a pull-down resistor in the driver internal.

#### 5.3.2 The Power Side

##### Pin E (emitter terminal)

This terminal should be connected to the emitter of IGBT. The connected must be as short as possible and be run directly to emitter of IGBT. And the terminal is also the VE terminal of the power side.

##### VEE and VCC Pin: external support capacitor

The PIDS310 has blocking capacitors on the secondary side of the DC/DC converter .At gate charges of IGBT ,external blocking capacitors are required between VEE—VE and VE—VCC .It is important for the capacitor to be suitable for switched-mode power supply applications. They must be connected as closely as possible to the drive' s terminal pins with minimum inductance.

The anode of capacitor is connected to Vcc (VE), its cathode to VE (VEE).

##### PIN SO (Fault output)

The PIN SO is pulled to VCC if an error has been detected .The PIN /FAUL is pulled to GND when no error is present.

##### Pin G (gate terminal)

The output OUT is the output for the gate drive. When the WEPOWER driver is supplied with 15V, the gate is with +15V/-10V, the negative gate voltage is generated internally. The maximum permissible gate current is 10A

##### Pin C (collector sense)

This terminal is used to measure the voltage drop across the turned-on power transistor in order to ensure protection from short circuit and overload. It should be noted that it must never be connected directly to the drain or collector of the power

transistor. A circuit with a high-blocking diode must be included to protect the measuring terminal from the high drain or collector voltage of the turned-off power element. For 1200V and 1700V modules, a circuit made up of two or three diodes of type 1N4007 connected in series has proved its worth in place of exotic higher-blocking elements. It is recommended that the voltage of these diodes be over dimensioned by at least 40%. Fast diodes are not required here. Standard line diodes are quite sufficient.

#### 5.4 Layout and wiring

Drivers should as a rule be placed as close as possible to the power semiconductors so that the leads from the driver to the transistors are as short as possible. Lead lengths of gate are less than 10 cm. When the power semiconductors are connected by stranded wires, it is recommended always to twist the three associated leads  $G_x$ ,  $C_x$  and  $E_x$  of the IGBT.

It is also recommended to place two zener diodes connected in counter-series immediately between the gate and emitter of the IGBT. It is possible that the two zener diodes are 15V zener diodes.

#### 6. Calculation of driving power

Gate input capacitance ( $C_{in}$ ) can be found in the data sheet. The total power need to drive IGBT can be calculated by the following simple formula:

$$P=f \cdot C_{in} \cdot \Delta V^2 \quad \text{OR} \quad P=f \cdot Q \cdot \Delta V$$

$$\text{Gate charge } Q = \int i dt = C \cdot \Delta V$$

(Note: P represents the real driving power not including the losses in drive channel and drive power supply.)



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