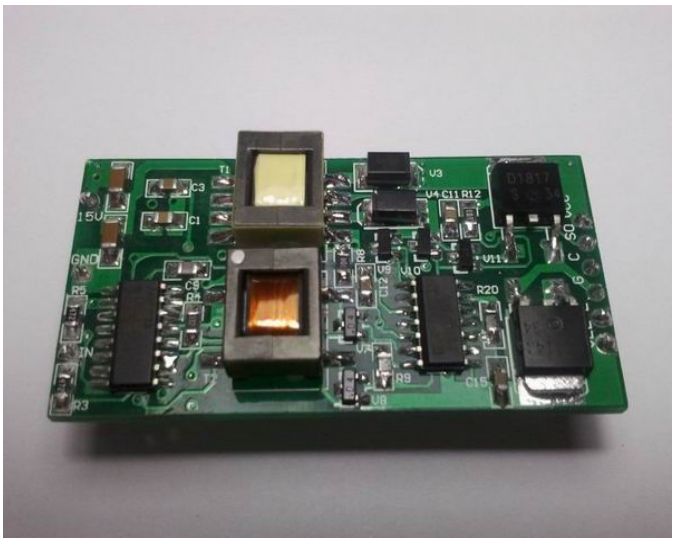
Description and Application Manual for PIDS310 high power IGBT driver



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

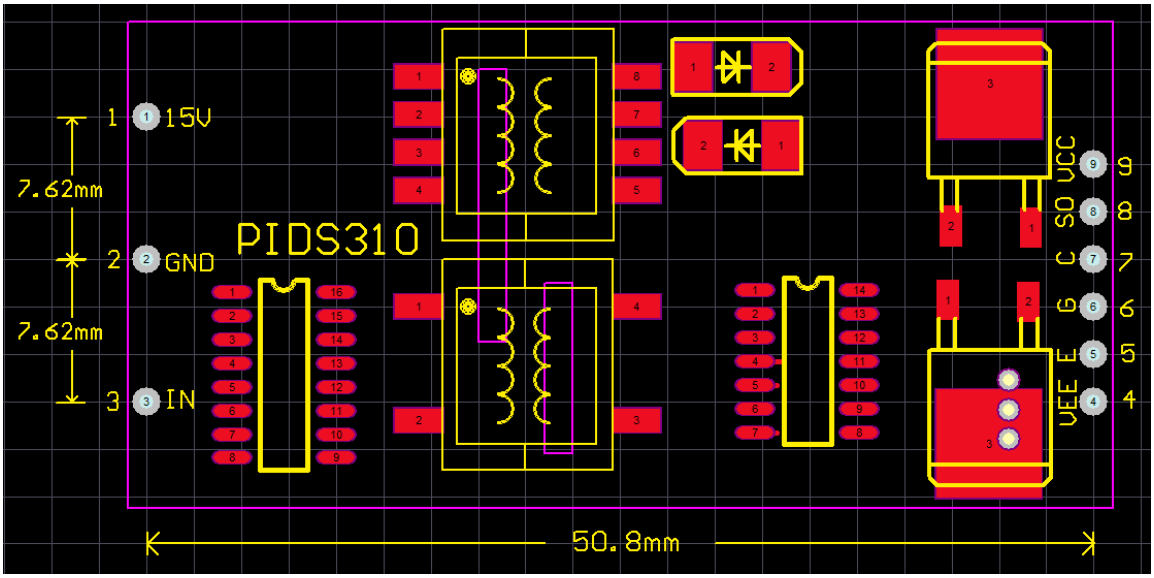
(1) Adopting transformer modulation isolation technique
(2)Suitable for driving standard IGBT module
(3)Short circuit, over current and low-voltage protection.
(4)Soft switching
(5)Reliable and durable
(6)Electrical isolation of 4000V_{AC}
(7)Switching frequency: 0-100kHz
(8)Duty ratio: 0-100%
(9)Disturbance 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
VCC	Power supply voltage		16	V
V_{iH}	Input signal voltage (high)		VS+0.3	V
V_{iL}	Input signal voltage (low)		GND-0.3	V
$Iout_{PEAK}$	Output peak current		10	A
f_{max}	Max switching frequency		100	kHz
V_{CE}	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_{isolIO}	Isolation test voltage input-output (AC,RMS,2S)		4000	V
V_{isolPD}	Partial discharge extinction voltage，RMS, Q_{PD}≤10PC		2000	V
R_{Gmin}	Minimum rating for R_G		0.5	Ω
T_{op}	Operating temperature	PIDS310I	-40℃～+85℃	℃
		PIDS310J	-40℃～+105℃	
		PIDS310M	-55℃～+125℃	
T_{stg}	Storage temperature	PIDS310I	-55℃～+125℃	℃
		PIDS310J	-55℃～+125℃	
		PIDS310M	-55℃～+130℃	

Electrical characteristics					
Symbol	Definition	value			unit
		Min.	Typ.	Max.	
V_S	Supply voltage primary side	14.5	15	15.6	V
I_{SO}	Supply current primary side (no load)		40		mA
	Supply current primary side (max)			300	mA
V_i	Input signal voltage on/off		15/0		V
V_{iT+}	Input threshold voltage (High)	3.5	-	-	V
V_{iT-}	Input threshold voltage (Low)	-	-	2.5	V
$V_{G(on)}$	Turn on gate voltage output		+15		V
$V_{G(off)}$	Turn off gate voltage output		-10		V
$t_{d(on)}$	Turn-on propagation time		0.7		us
$t_{d(off)}$	Turn-off propagation time		0.7		us
$t_{d(err)}$	Error propagation time			0.1	us
C_{PS}	Coupling capacitance primary secondary				pF
W	weight		12		g
MTBF	Mean time between failure (Ta=40℃,max load)		1.8		10^6h

2. PIDS310 Mechanical Dimensions



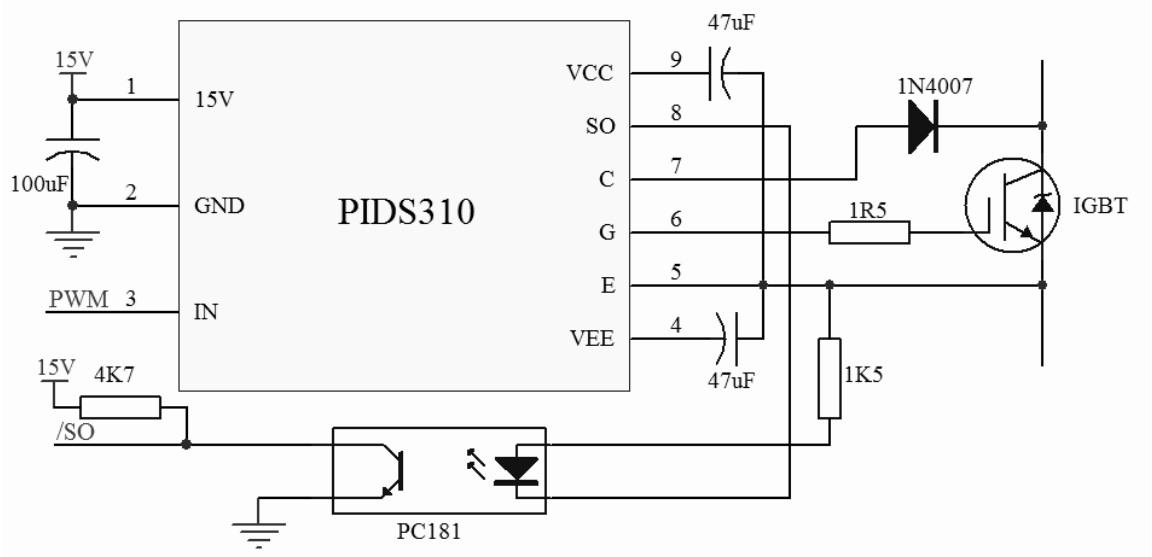
PIDS310 outer dimensions and connector diagram (pin distance: 7.62 & 2.54mm)

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.



PIDS310 Connection Schematic

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

(1)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 IGBT can be driven.)

(2)Transformer Isolation technology (the driver using transformer isolation technology with better performance of insulation and fast respond speed)

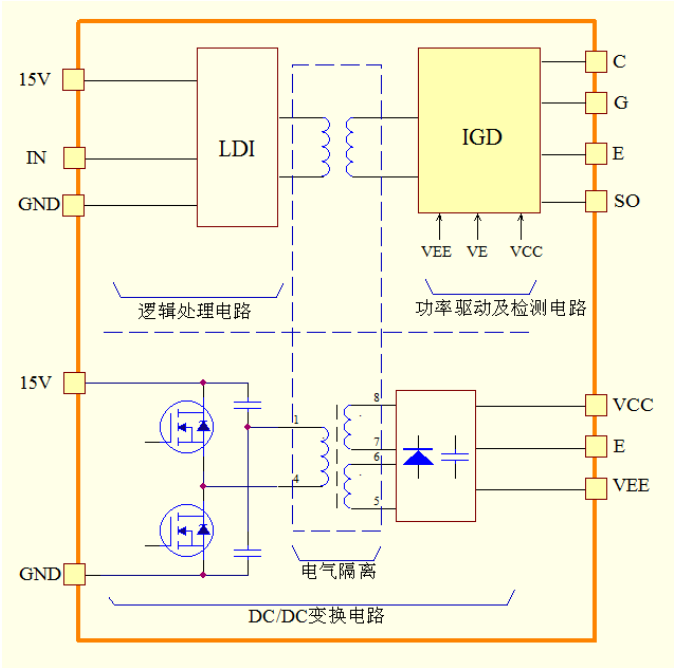
(3)Pulse suppression technology (the driver using the special technology of pulse suppression interference, all interference pulse which width is less than 350ns will be ignored)

(4)Soft turn off technology is used to avoid broken of over voltage for IGBTs when over-current occurs.

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.

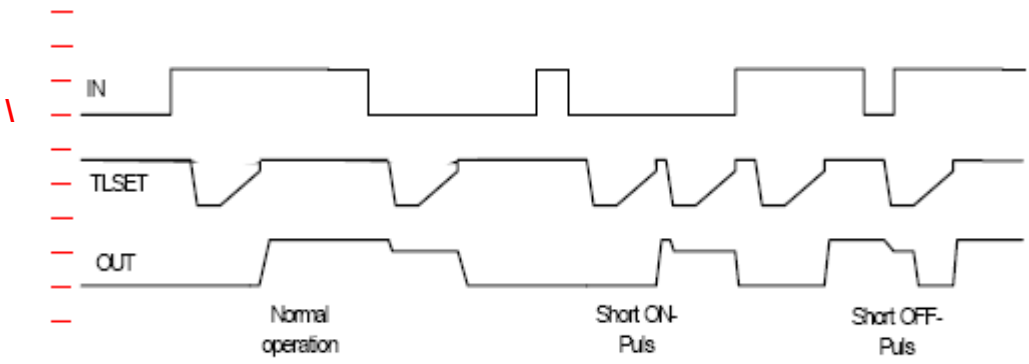
Integrated DC / DC power supply

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 Low Power Side

Pin 15V：primary internal DC/DC and Logic circuit +15V input power supply

Pin GND： primary internal DC/DC and Logic ground power supply

Pin IN：primary signal input, compatible with TTL&COMS electrical level

5.3.2 The High Power Side

The grid drive voltage for WEPOWER series high power MOSFET driver module is +15V/-5V, and the negative voltage is caused inside the module. The max driving power for PMD310 is 10A.

Pin VEE
Pin VEE is the -10V output power supply of high power side. Filtering capacitor can be added between VEE and E when using.

Pin E
Pin E is the ground of high power side. It will be connected to "E" of the IGBTs.

Pin G
Pin G is the output of high power side. It will be connected to the Gate of the IGBT.

Pin C
Pin C is the voltage detection terminal for "C" of IGBTs of high power side. It will be connected to "C" gate of IGBTs and used to check max Leakage current and collector voltage when shut-off with high voltage diode which could be remain 40% voltage margin and standard diode is enough, no need fast diode.

Pin SO
Pin SO is the fault output terminal of high power side. It outputs low electric level when fault occurs. The fault signals will be transmitted to control circuit through optocoupler.

Pin VCC
Pin VCC is the +15V output power supply of high power side. Filtering capacitor can be added between VCC and VE when using.

5.4 Layout and wiring

Drivers should be placed as close as possible to the power semiconductors and the lead wire length of gate is less than 10 cm. It is better to use twisted wire to connect. It is recommended to connect 2 piece of zener diode back to back between power gate and emit gate to stabilize gate voltage

6. Calculation of driving power

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

$P=f*Cin*\triangle V^2$ OR $P=f*Q*\triangle V$

Gate charge $Q=\int idt=C*\triangle V$

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

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