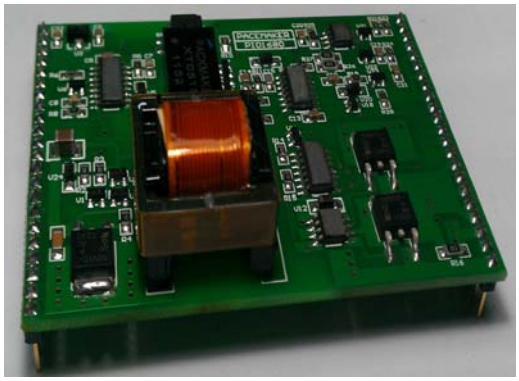
Description and Application Manual for PID1680 Single Channel IGBT driver



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

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

The PID1680 single channel high power IGBT intelligent module driver is pin to pin compatible with 1SD1548.

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
※ Weapon Equipage

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1. Main Features & Technical Specifications

1.1 Main Features

(1) Suitable for driving high power IGBT module
(2) Containing current limit circuit and under-voltage protection
(3) Soft switching
(4) Reliable and durable
(5) High electrical isolation
(6) Switching frequency: 0~150kHz
(7) Duty ratio: 0~100%
(8) Disturbance rejection property: dv/dt >100,000V/us
(9) Integrated internal DC/DC circuit

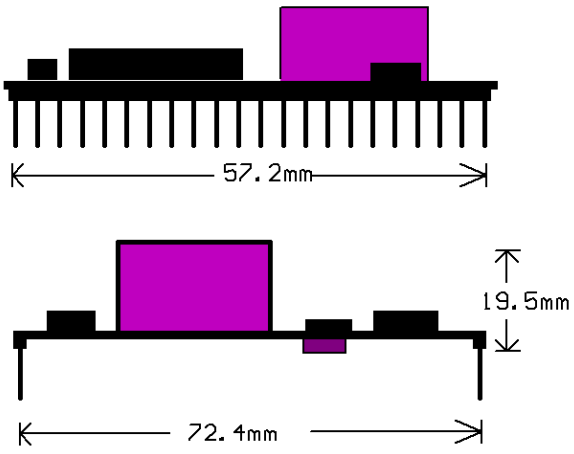
1.2 Technical Specifications

Absolute maximum Ratings				
Symbol	Parameter		Value	Unit
VDD	Primary side power supply		16	V
VDC	Primary side power supply		15.6	V
V_{iH}	Input signal voltage (high)		VS+0.3	V
V_{iL}	Input signal voltage (low)		GND-0.3	V
$Iout_{PEAK}$	Input peak current		80	A
f_{max}	Max switching frequency		150	kHz
V_{CE}	The highest C,E pole monitoring voltage		1700	V
dv/dt	Voltage rise rate		60	kV/us
V_{isolIO}	Input-output Isolation voltage (AC,RMS,10S)		4500	V
V_{isolPD}	Partial discharge extinction Voltage,RMS,Q_{PD}≤10PC		1500	V
R_{Gmin}	Minimum rating for gate		0.2	Ω
T_{op}	Operating temperature	PID1680I	-40℃～+85℃	℃
		PID1680J	-40℃～+105℃	
		PID1680M	-55℃～+125℃	
T_{stg}	Storage temperature	PID1680I	-55℃～+105℃	℃
		PID1680J	-55℃～+125℃	
		PID1680M	-55℃～+130℃	

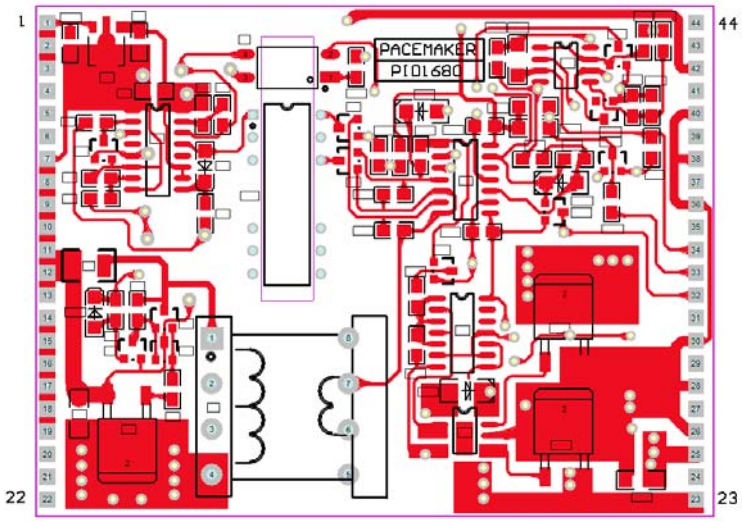
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Electrical characteristics					
Simbol	Parameter	value			Unit
		Min.	Typ.	Max.	
V_S	Supply voltage primary side	14.5	15	15.6	V
I_{SO}	Supply current primary side (no load)		80		mA
	Supply current primary side (max)		1100		mA
V_i	Input signal voltage on/off		15/0		V
V_{iT+}	Input threshold voltage (High)	3.0	-	-	V
V_{iT-}	Input threshold voltage (Low)	-	-	1.8	V
$V_{G(on)}$	Turn on gate voltage output		+15		V
$V_{G(off)}$	Turn off gate voltage output		-15		V
$t_{d(on)}$	Turn-on propagation time		1.8		us
$t_{d(off)}$	Turn-off propagation time		0.9		us
$t_{d(err)}$	Error propagation time			2.5	us
$T_{ERRRESET}$	Error Reset Time	3	5		us
C_{PS}	Coupling capacitance primary secondary		18		pF
W	Weight		36		g
MTBF	Mean time between failure (Ta=40℃,max load)		1.6		10^6h

2. PID1680 Block Diagram



PID1548 Dimensional Diagram (Pin Distance: 2.54mm)



PID1680 Pin Diagram

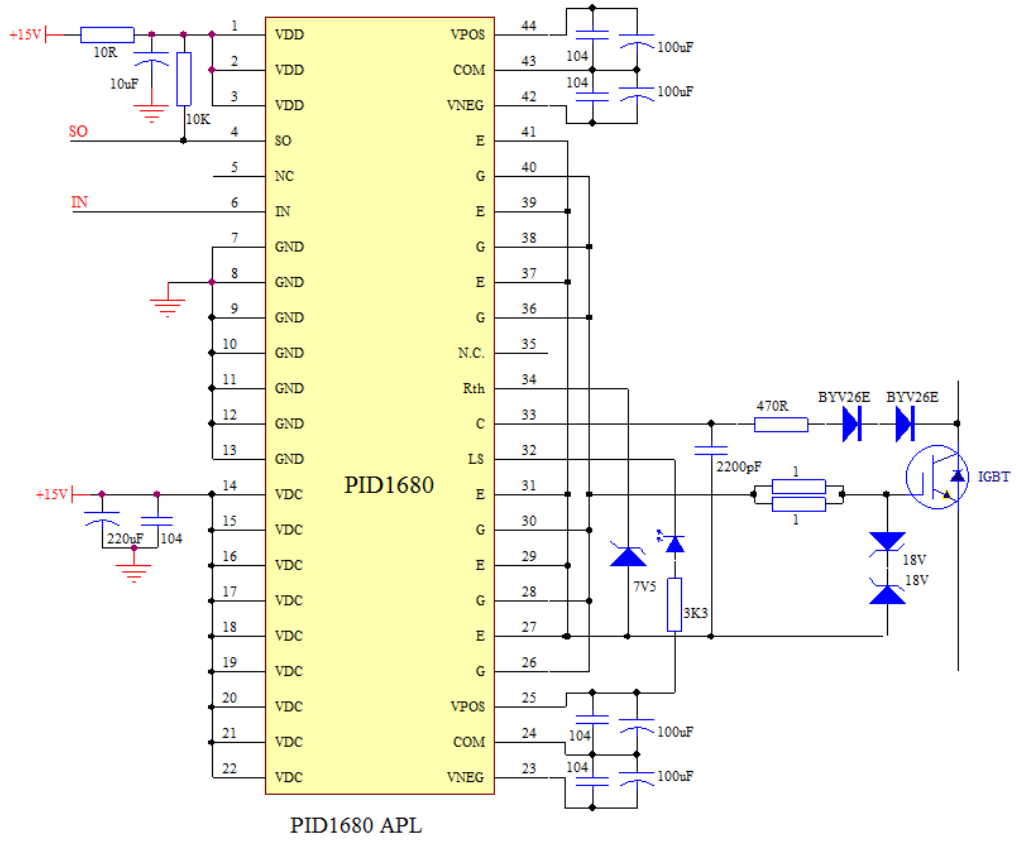
PID1680 Pin Designation

Pin	Signal	Definition	Explaination
1	VDD	Logic circuit +15V power supply	
2	VDD	Logic circuit +15V power supply	
3	VDD	Logic circuit +15V power supply	
4	SO	Error signal output	Error Output I_{MAX}=50mA;
5	reserved	reserved	
6	IN	Signal input terminal	High level is effective, pull down internal
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	GND	Ground	
12	GND	Ground	
13	GND	Ground	
14	VDC	Internal DC/DC+15V power supply	
15	VDC	Internal DC/DC+15V power supply	
16	VDC	Internal DC/DC+15V power supply	
17	VDC	Internal DC/DC+15V power supply	
18	VDC	Internal DC/DC+15V power supply	
19	VDC	Internal DC/DC+15V power supply	
20	reserved	reserved	
21	VDC	Internal DC/DC+15V power supply	
22	VDC	Internal DC/DC+15V power supply	

23	VNEG	DC/DC output side -10V	Filter capacitor can be added to improve driving effect
24	COM	DC/DC output side COM	
25	VPOS	DC/DC output side +15V	Filter capacitor can be added to improve driving effect
26	G	Wiring terminal G of IGBT	
27	E	Wiring terminal E of IGBT	
28	G	Wiring terminal G of IGBT	
29	E	Wiring terminal E of IGBT	
30	G	Wiring terminal G of IGBT	
31	E	Wiring terminal E of IGBT	
32	LS	High voltage error output	Low for error
33	C	Over-current monitoring terminal	Over-current protection monitoring terminal output of IGBT
34	Rth	Over-current protection threshold setting	External zener connection is recommended to setting
35	reserved	reserved	
36	G	Wiring terminal G of IGBT	
37	E	Wiring terminal E of IGBT	
38	G	Wiring terminal G of IGBT	
39	E	Wiring terminal E of IGBT	
40	G	Wiring terminal G of IGBT	
41	E	Wiring terminal E of IGBT	
42	VNEG	DC/DC output side -15V	Filter capacitor can be added to improve driving effect
43	COM	DC/DC output side COM	
44	VPOS	DC/DC output side +15V	Filter capacitor can be added to improve driving effect

3. Application example

Reference connection schematic of PID1680 is shown in the following figure. It shows that WEPOWER series of high-power IGBT drive module needs less peripheral device, driving circuits is simple, high integration.



PID1680 APL

PID1680 connection schematic

4. Overview of WEPOWER series High Power IGBT intelligent drive Module

(1) More reliable operation (Gate bipolar power supply with +15V/-15V 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 transformer isolation technology is used for each channel of drivers to reach better insulation properties and lower coupling capacitance.)

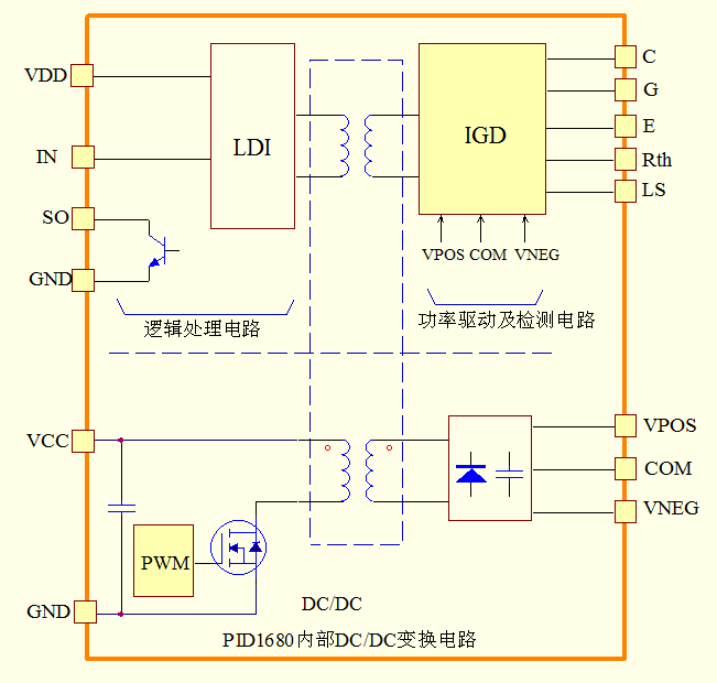
(3) Minimum pulse width limitation. The module has function of minimum pulse width limitation. Interference pulse less than 500ns will be shielded.

5. Operation Principle

5.1 Block diagram

PID1680 high-power 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.



PID1680 Block diagram

LDI is a logic signal processing circuit. IGD is an intelligent gate driver and power expansion circuit.

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 high-power 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 PID1680 is 16W.

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 (about 12V) is detected, 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 feedback to the LDI, the status is output through the pin SO. So the driver will not accept any driving signal until the "blocking" time has elapsed.

5.3 The Pin Designation

5.3.1 The Low Power Side

Pin GND
Pin GND is the internal DC/DC and logic circuit ground

Pin VDD
Pin VDD is the internal logic circuit +15V power supply input terminal

Pin VDC
Pin VDC is the internal DC/DC circuit +15V power supply input terminal

Pin IN
Pin IN is the signal input terminal, high level is effective and compatible with TTL and COMS level and internal has been pull down.

Pin SO
Pin SO is the error output terminal. SO output is a open collector transistor. If SO access through a pull-up resistor on the +15 V power supply, once the drive channel is detected with error, then the transistor turns on, SO be pulled down. The output drive capacity is 50mA.

5.3.2 The High Power Side

Pin VPOS
Pin VPOS is the +15V output of high power side. External filter capacitor can be connected between VPOS and COM.
Pin COM
Pin COM is the common terminal of high power side.

Pin VNEG
Pin VNEG is the -15V output terminal of high power side. External filter

capacitor can be connected between VNEG and COM.

Pin G

Pin G is the output terminal of Gate

The output of PID1680 adopts a field-effect circuit and its max drive current reaches ±80A/±15V.

Pin E

Pin E the output terminal of Emitter

It connects to the E pole of IGBT and it is also the COM terminal of the high power side of drive module.

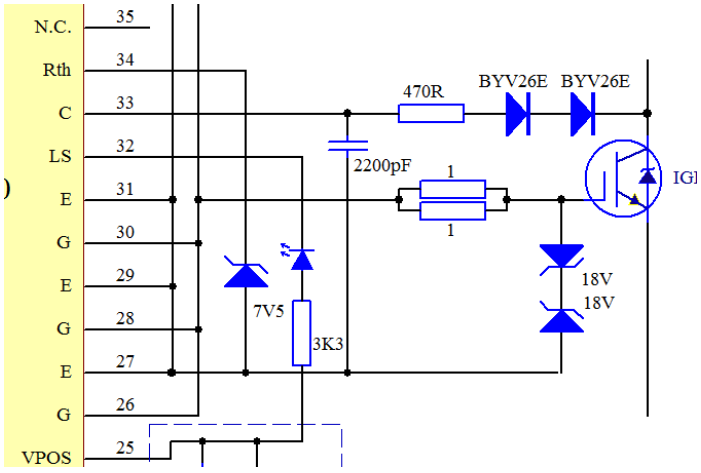
Pin C

Pin C is the monitoring terminal of VCE. This Pin is used to measure the conduction voltage drop to protect short circuit and over-load. It can't be connected to the G of IGBT directly.

To use high voltage diode to detect large leakage current and collector voltage when shut-off. For 1200V and 1700V modules, two or three pieces of BYV26E diodes in series connection are recommended. The diodes remain 40% margin pressure when selection.

Pin Rth

Pin Rth is the setting of threshold voltage over-current protection. To set the value of threshold voltage by connection zener diode or resistor with Pin E. By external connection of zener diode setting is recommended and the threshold voltage will be more stable.



When set the value of threshold voltage through external connection of resistor, Vth ≈15*Rth/(2+ Rth), Rth:KΩ.

Pin LS

Pin LS is the error output terminal of high power side. The pin output is low

when error occurs. LED diodes can be connected to display error signal.

5.4 Layout and wiring

Drivers should as a rule to 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 more than 10 cm must be avoided.
It is recommended to place two zener diodes connected in counter-series immediately between the gate and emitter of the IGBT to get more stable threshold 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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