

## ED-WP-CB Data Sheet

### Abstract

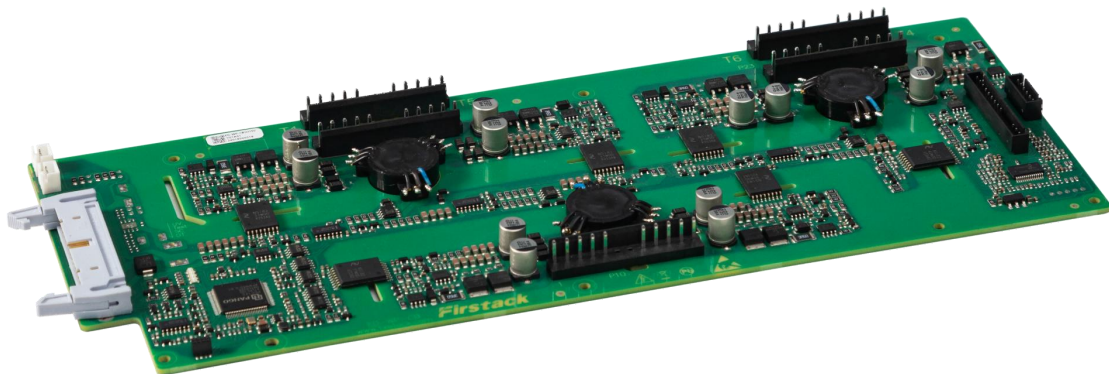
The ED-WP-CB is a high-performance digital gate driver core developed by Firstack for NPC I-type 3-level system. The gate driver adopts CPLD as the digitally controlled core, with complete protection functions and built-in fault management system, which uploads the converter's operating state to the master computer in real time, providing support for "big data management" for the failed converter site. Perfectly solving the two major problems of "turn-off timing sequence" and "large commutation loop turn-off spike" in NPC I-type topology, the reliability of NPC topology can be comparable to 2-level, allowing customers to use NPC I-type 3-level as same as 2-level.

### Highlights:

- Multi-parallel of NPC/ANPC topology
- Rated voltage range: 690-1250V<sub>AC</sub>
- Power range:1MW-10MW

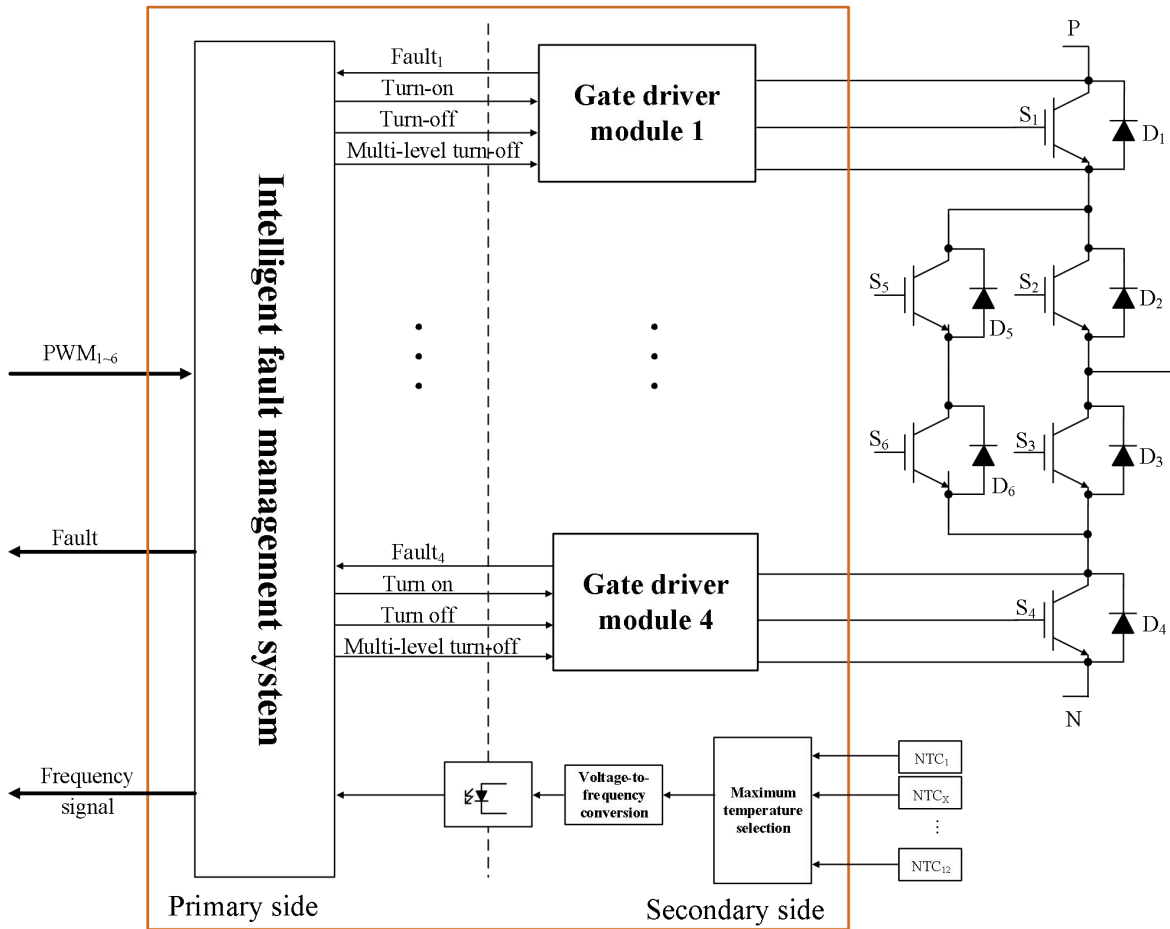
### Applications:

- PV
- Wind
- ESS



**Fig.1** ED-WP-CB

### Functional Block Diagram



**Fig.2** Functional block diagram

## Pin Designation

P1 pin of 15V supply:

Pin	Definition	Function	Pin	Definition	Function
1	NC	Pin1 TO Pin20*	2	V <sub>DC</sub>	+15V supply
3	V <sub>DC</sub>	+15V supply	4	V <sub>DC</sub>	+15V supply
5	GND	Primary side ground	6	SO	Fault summary
7	GND	Primary side ground	8	GND	Primary side ground
9	GND	Primary side ground	10	IN1	T1 IGBT PWM signal
11	GND	Primary side ground	12	PT1-1	External PT1 pin1
13	PT1-2	External PT1 pin2	14	NC	Free
15	GND	Primary side ground	16	IN2	T2 IGBT PWM signal
17	GND	Primary side ground	18	PT2-1	External PT2 pin1
19	PT2-2	External PT2 pin2	20	NC	Pin1 TO Pin20*
21	GND	Primary side ground	22	IN3	T3 IGBT PWM signal
23	GND	Primary side ground	24	IN4	T4 IGBT PWM signal
25	GND	Primary side ground	26	IN5	T5 IGBT PWM signal
27	GND	Primary side ground	28	IN6	T6 IGBT PWM signal
29	GND	Primary side ground	30	FOUT	Frequency output

\*Pin1 and pin20 of P1 are connected for disconnection detection, and can be left free if not used.

P1 pin of 24V supply:

Pin	Definition	Function	Pin	Definition	Function
1	NC	Pin1 TO Pin20*	2	V <sub>DC</sub>	+24V supply
3	V <sub>DC</sub>	+24V supply	4	V <sub>DC</sub>	+24V supply
5	GND	Primary side ground	6	SO	Fault summary
7	GND	Primary side ground	8	GND	Primary side ground
9	GND	Primary side ground	10	IN2	T2 IGBT PWM signal

11	GND	Primary side ground	12	FOUT	Frequency output
13	GND	Primary side ground	14	SO	Fault summary
15	GND	Primary side ground	16	IN1	T1 IGBT PWM signal
17	GND	Primary side ground	18	GND	Primary side ground
19	GND	Primary side ground	20	NC	Pin1 TO Pin20*
21	GND	Primary side ground	22	IN3	T3 IGBT PWM signal
23	GND	Primary side ground	24	IN4	T4 IGBT PWM signal
25	GND	Primary side ground	26	IN5	T5 IGBT PWM signal
27	GND	Primary side ground	28	IN6	T6 IGBT PWM signal
29	PT1-1	External PT1 pin1	30	PT1-2	External PT1 pin2

P8, P22 pin:

Pin	Definition	Function	Pin	Definition	Function
1	Vcesat-T5	T5 sense signal	7	NC	The pin is removed
2	15V-T5	T5_15V	8	Vcesat-T1	T1 sense signal
3	OFF-T5	T5 turn-off signal	9	15V-T1	T1_15V
4	ACOM-T5	T5 ground	10	OFF-T1	T1 turn-off signal
5	ON-T5	T5 turn-on signal	11	ACOM-T1	T1 ground
6	NC	The pin is removed	12	ON-T1	T1 turn-on signal

P10 pin:

Pin	Definition	Function	Pin	Definition	Function
1	Vcesat-T3	T3 sense signal	7	NC	The pin is removed
2	15V-T3	T3_15V	8	Vcesat-T2	T2 sense signal
3	OFF-T3	T3 turn-off signal	9	15V-T2	T2_15V
4	ACOM-T3	T3 ground	10	OFF-T2	T2 turn-off signal

5	ON-T3	T3 turn-on signal	11	ACOM-T2	T2 ground
6	NC	The pin is removed	12	ON-T2	T2 turn-on signal

P12, P23 pin:

Pin	Definition	Function	Pin	Definition	Function
1	Vcesat-T4	T4 sense signal	7	NC	The pin is removed
2	15V-T4	T4_15V	8	Vcesat-T6	T6 sense signal
3	OFF-T4	T4 turn-off signal	9	15V-T6	T6_15V
4	ACOM-T4	T4 ground	10	OFF-T6	T6 turn-off signal
5	ON-T4	T4 turn-on signal	11	ACOM-T6	T6 ground
6	NC	The pin is removed	12	ON-T6	T6 turn-on signal

P16 pin:

Pin	Definition	Function	Pin	Definition	Function
1	-15V-T4	T4 negative voltage	9	NTC9	Module 9 temperature signal
2	GND-T4	T4 ground	10	NC	The pin is removed
3	GND-T4	T4 ground	11	NC	The pin is removed
4	NTC1	Module 1 temperature signal	12	NC	The pin is removed
5	NTC3	Module 3 temperature signal	13	NTC10	Module 10 temperature signal
6	NTC4	Module 4 temperature signal	14	NTC12	Module 12 temperature signal
7	NTC6	Module 6 temperature signal	15	GND-T4	T4 ground
8	NTC7	Module 7 temperature signal			

P18 pin:

Pin	Definition	Function	Pin	Definition	Function
1	15V-T4	T4 15V	4	NTC5	Module 5 temperature signal
2	GND-T4	T4 ground	5	NTC8	Module 8 temperature signal
3	NTC2	Module 2 temperature signal	6	NTC11	Module 11 temperature signal

P20 pin:

Pin	Definition	Function	Pin	Definition	Function
1	PT1-1	External PT1 pin1	2	PT1-2	External PT1 pin2

P21 pin:

Pin	Definition	Function	Pin	Definition	Function
1	PT2-1	External PT2 pin1	2	PT2-2	External PT2 pin2

\*The gate driver samples the temperature signals of 12 modules.

\*NTCx is the temperature signal of module x.

\*The gate driver can be configured with 24V input or 15V input, customers can choose the appropriate input voltage according to their own power supply.

## Technical parameters

### Absolute Maximum Ratings

Parameter	Remarks	Min	Max	Unit
$V_{DC}$	$V_{DC}$ to GND		15.5	V
Logic input and output voltages	Primary side, to GND	0	15.5	V
SOx	Fault condition		500	mA
Gate peak current			108	A
Output power per channel	$T_A=85^{\circ}C$		4	W
Test voltage (50Hz/1min)	Primary to secondary side	5700		$V_{RMS}$
	Secondary to secondary side	5700		$V_{RMS}$
CMTI		$\pm 100$	$\pm 250$	kV/ $\mu s$
Operating temperature		-40	85	$^{\circ}C$
Gate resistance derating	40%@118 $^{\circ}C$		2W	
Storage temperature		-40	85	$^{\circ}C$

### Recommended Operating Conditions

Parameters	Remarks	Min	Typ	Max	Unit
$V_{DC}$			15 or 24		V
$I_{N_X}$			15		V

### Electrical Characteristics

Power Supply	Note	Min	Typ	Max	Unit
Supply current	15V input, without load, Note 1		0.47		A
	24V input, without load, Note 1		0.32		A
Coupling capacitance	Primary to secondary side, Note 2		12		pF

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## Primary Side Power Monitoring

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Threshold		13	V
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## Logic Input & Output Voltages

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Input impedance		10	kΩ
Turn-on threshold	15V PWM input, high turn on	8.3	V
Turn-off threshold	15V PWM input, high turn on	4.8	V
NTC output		15	V
SOx output	High normal, low fault	15	V

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## Short-circuit Protection

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V <sub>CE</sub> monitoring threshold		11.1	V
	T1, T4, Note 3	6.7	μs
Response time	T2, T3, Note 3	8.0	μs
	T5, T6, Note 3	8.2	μs
Blocking time		90	ms

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## Timing Characteristics

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	T1, T4, Note 4	850	ns
Turn-on delay	T2, T3, Note 4	850	ns
	T5, T6, Note 4	850	ns
	T1, T4, Note 5	850	ns
Turn-off delay	T2, T3, Note 5	850	ns
	T5, T6, Note 5	850	ns
Rise time	T1, T4, Note 6	250	ns
	T2, T3, Note 6	650	ns

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	T5, T6, Note 6	250	ns
	T1, T4, Note 7	500	ns
Fall time	T2, T3, Note 7	700	ns
	T5, T6, Note 7	500	ns

### Output Characteristics

Gate turn-on voltage		15	V
Gate turn-off voltage		-15	V
Gate static impedance	T1, T4, T5, T6	4.7	kΩ
	T2, T3	10	kΩ

### Electrical Isolation

Creepage distance	Primary to secondary side, Note 8	15	mm
Clearance distance	Primary to secondary side	14.5	mm

### NTC Temperature Sampling

NTC temperature sampling range		-40	125	°C
NTC signal output	*Frequency output, refer to NTC sampling function description			

### Fault Output

Fault hold time	High normal, low fault	40	ms
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### Dead Time

(T1&T3) (T2&T4) Dead time	Note 9	4	μs
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### Short Pulse Suppression

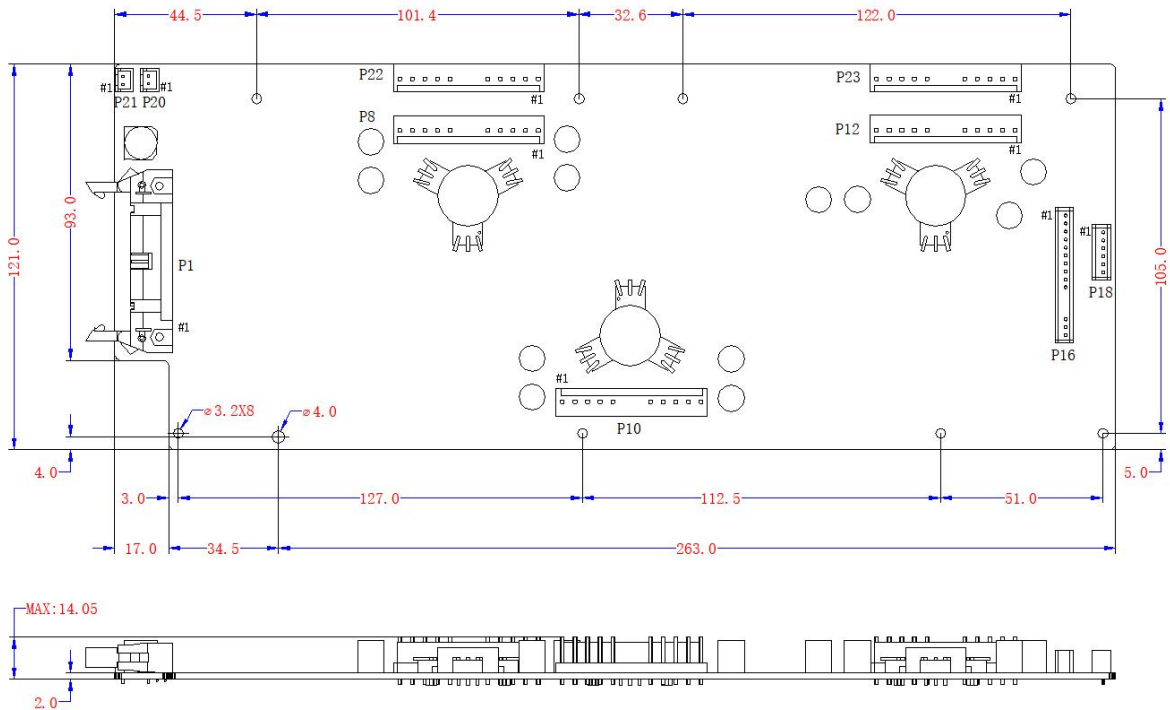
Short pulse filtering time	Note 10	400	ns
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Unless otherwise specified, all data are based on +25°C and  $V_{IN}=15V$ .

Note :

1. Power supply current: gate driver core connected to IGBT, no PWM input;
2. Coupling capacitance: the values of coupling capacitance are within the range of values given in the table;
3. Response time: the time from the occurrence of the fault to the start of soft shut down;
4. Turn-on delay: the time required to transmit the rising edge of the PWM signal input from the primary side to the rising edge of the gate driver of the secondary side when the IGBT is not connected;
5. Turn-off delay: the time required to transmit the falling edge of the PWM signal input from the primary side to the falling edge of the gate driver of the secondary side when the IGBT is not connected;
6. Rise time: the amount of time from 10% of the gate turn-off voltage(-15V) to 90% of the gate turn-on voltage(+15V);
7. Fall time: the amount of time from 90% of the gate turn-on voltage(+15V) to the gate turn-off voltage(-10V);
8. Creepage distance: refer to IEC61800-5-1-2007;
9. Dead time: when the time set by the control board has no deadband or is less than 3us, the driver board itself will have a 3us deadband; when the time set by the control board is more than 3us, it will be executed according to the control board time;
10. Short pulse filtering time: the maximum narrow pulse that can be filtered out is 400ns, which may be less than this value in practice.

## Mechanical Dimensions



**Fig. 4** Mechanical dimensions(unit: mm)

Note: 1. Plate thickness tolerance  $\pm 10\%$ ;

2. Other dimensional tolerances refer to GB/T1804-m;

3. All mounting holes in the diagram must be used as a fixing, otherwise the connector is likely to cause damage to the gate driver due to excessive insertion and extraction stress. At the same time, the **mounting holes** must be fixed with **plastic studs or other insulating material studs**, otherwise there is a risk of safety issue.

### Connector Manufacturer and Part Number

Number	Bit Number	Manufacturer	Part Number	Recommended Matching Terminals
1	P1	Nextron	Z-230011830209	FC-30P
2	P8, P10, P12, P22, P23	WCON	WF3963-WSH12B02	WF3963-H12B01
3	P16	WCON	WF2501A-WSH15B02	WF2501A-H15B01
4	P18	WCON	WF2501A-WSH06B05	WF2501A-H06B01
5	P20, P21	JST	B2B-XH-A	XHP-2

## Ordering Information

The ED-WP-CB supports different models of modules from multiple manufacturers. If you have a purchase request, please contact us, and we can provide the gate driver 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

This manual gives a detailed introduction about the product, but cannot promise to provide specific parameters. No warranty or guarantee, express or implied, is given herein as to the delivery, performance or applicability of the product.

Firstack reserves the right to modify technical data and product specifications at any time without prior notice. Firstack's general payment terms and conditions apply.

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