



Intelligent Gate Driver Solutions

Hangzhou Firstack Technology Co., Ltd.



Company Profile

Firstack confidential

Est. 2011

over 12 years since it was established

>2 Million

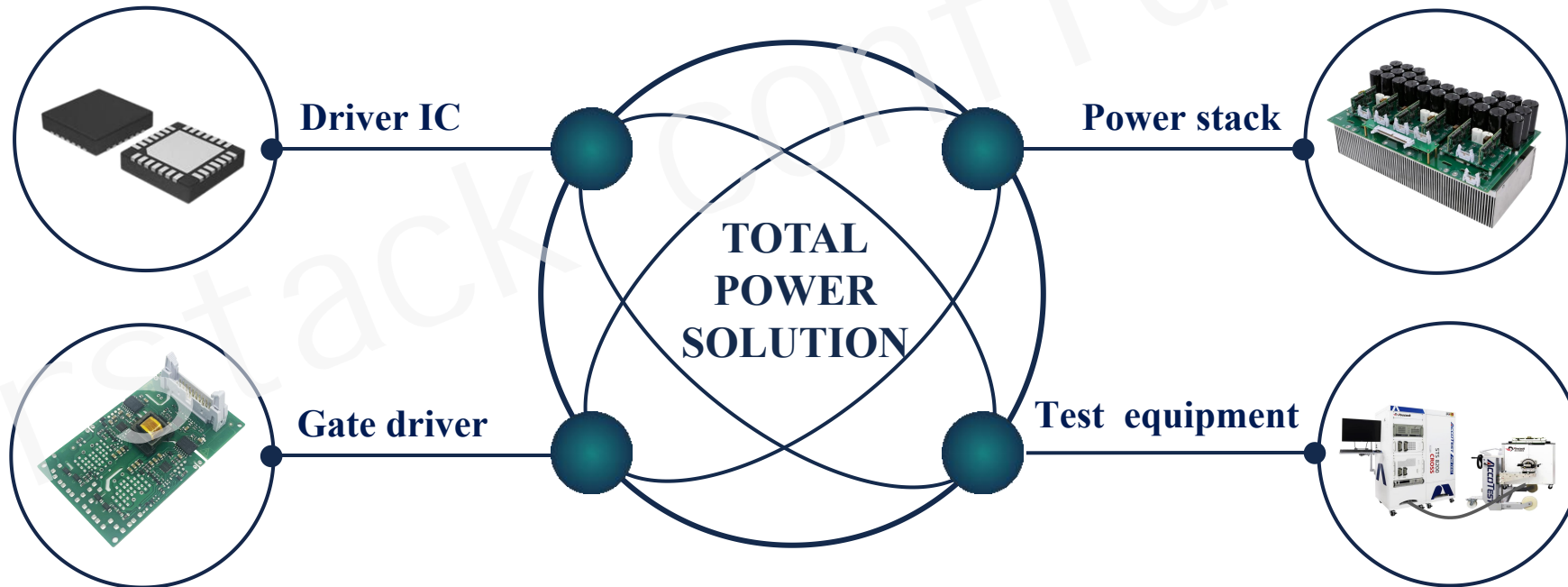
digital drivers shipped

>150 Gigawatt

Renewable energy capacity installed

1000+

Customers



TOTAL POWER SOLUTION

Strategic Partnership with Infineon



2017 PCIM Europe

Infineon and Firststack jointly exhibited two gate drivers, one is designed for 10 XHP power modules in parallel and the other is for PrimePACK™3+ 1200 V, 1800A dual IGBT module which is used in 3 level inverters.



President of Infineon Greater China Hua Su and his delegation visited Firststack



Competing alternatives to our high-voltage ICs for the power-supply market include monolithic and hybrid ICs from companies such as STMicroelectronics, Infineon Technologies and Sanken Electric Company, as well as PWM-controller chips paired with discrete high-voltage silicon or GaN transistors; such controller chips are produced by a large number of vendors, including those listed above as well as such companies as NXP Semiconductors, Diodes Inc., On-Bright Electronics, MediaTek Inc., Southchip Semiconductor and Renesas Electronics. Our gate-driver products compete with alternatives from such companies as Broadcom, Infineon, Mitsubishi Electric, Fuji Electric, Semikron and Hangzhou Firstack Technology Co., as well as driver circuits made up of discrete devices. Our motor-driver ICs compete with power modules from such companies as ON Semiconductor, Infineon, STMicroelectronics, Mitsubishi and Sanken as well as discrete designs from a wide range of other suppliers.

(2022 Annual Report, Power Integrations)

MARKET BENCHMARK ANALYSIS IN CHINA

Gate driver manufacturers



Top board gate driver manufacturers in China: Firstack
(Power Gate Driver; Market and Technology Report 2022, Yole Development)

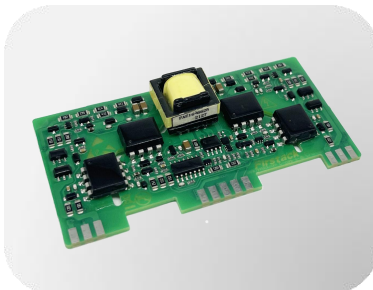


Product Portfolio

Firstack confidential

Max Breakdown Voltage $\leq 1700V$

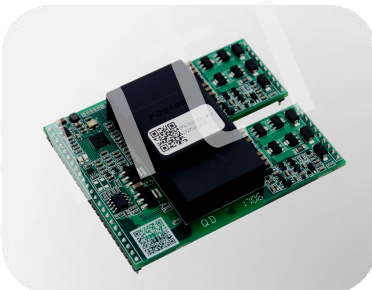
Gate Driver Core



2FSC0210
2W/10A
1700V

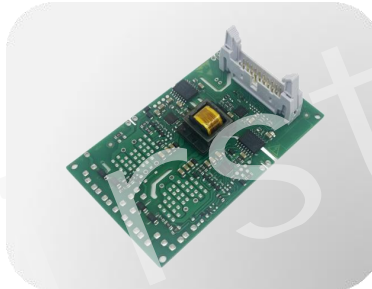


2FSC0435
4W/35A
1700V

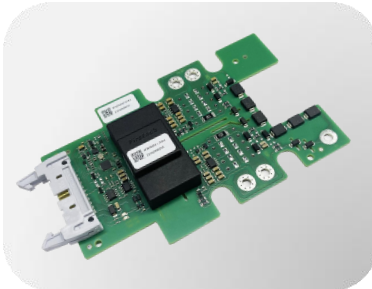


2FSC300C17
5W/30A
1700V

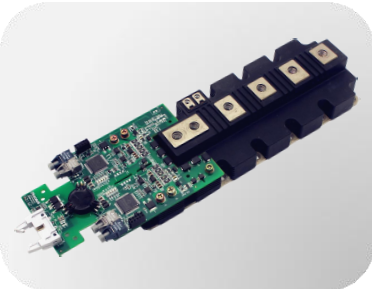
Plug-and-play Gate Driver



2FHD0115
1.2W/20A
1700V
EconoDUAL™3

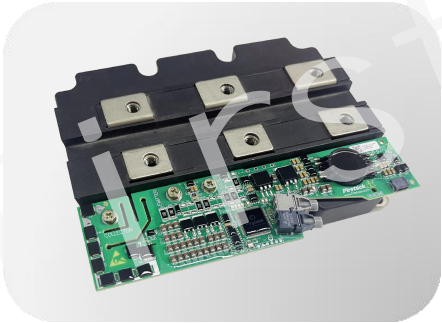
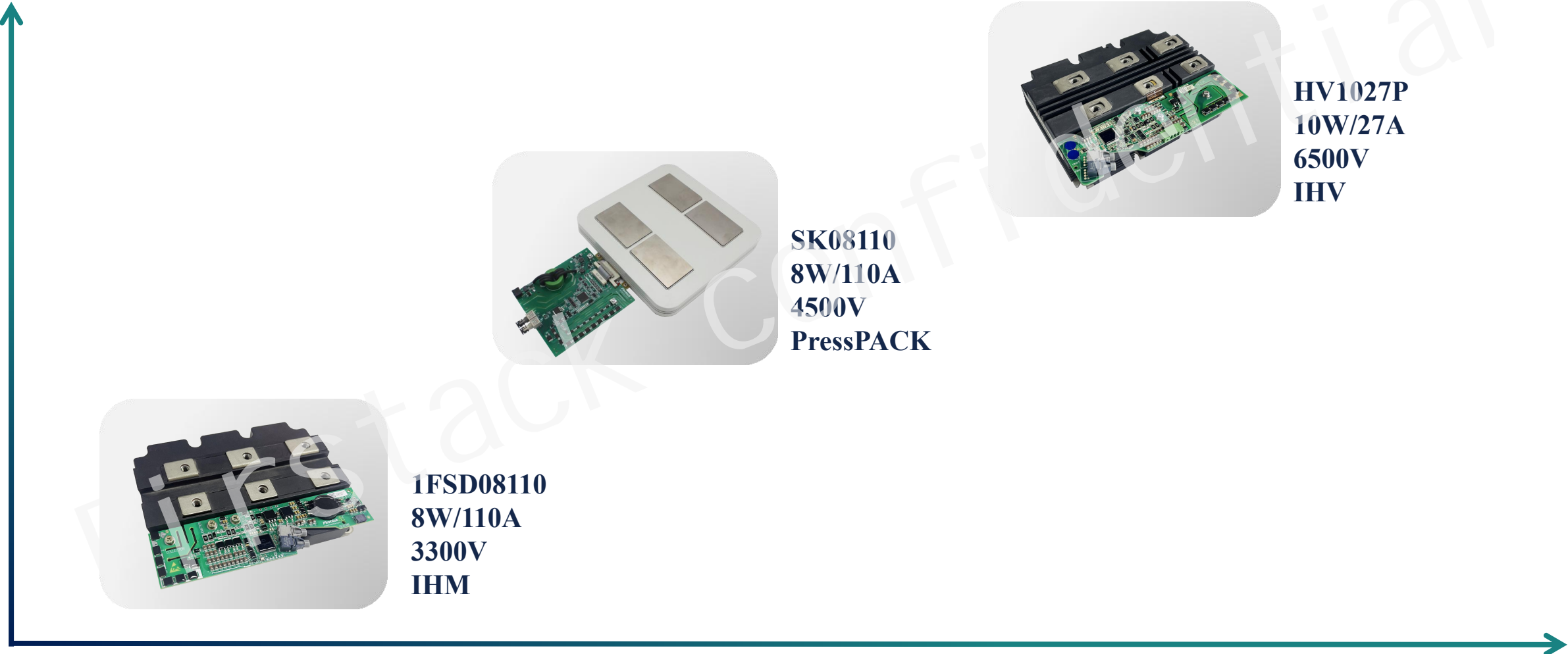


2FSD0320
4W/35A
1700V
PrimePACK™3

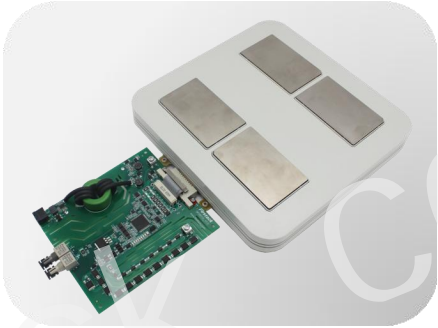


PM0538
5W/38A
1700V
PrimePACK™3

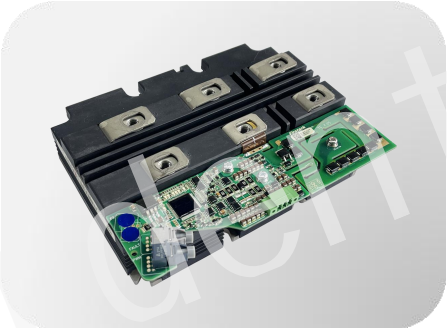
Max Breakdown Voltage > 1700V



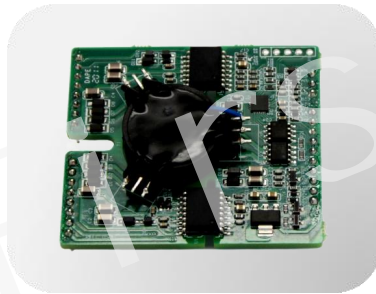
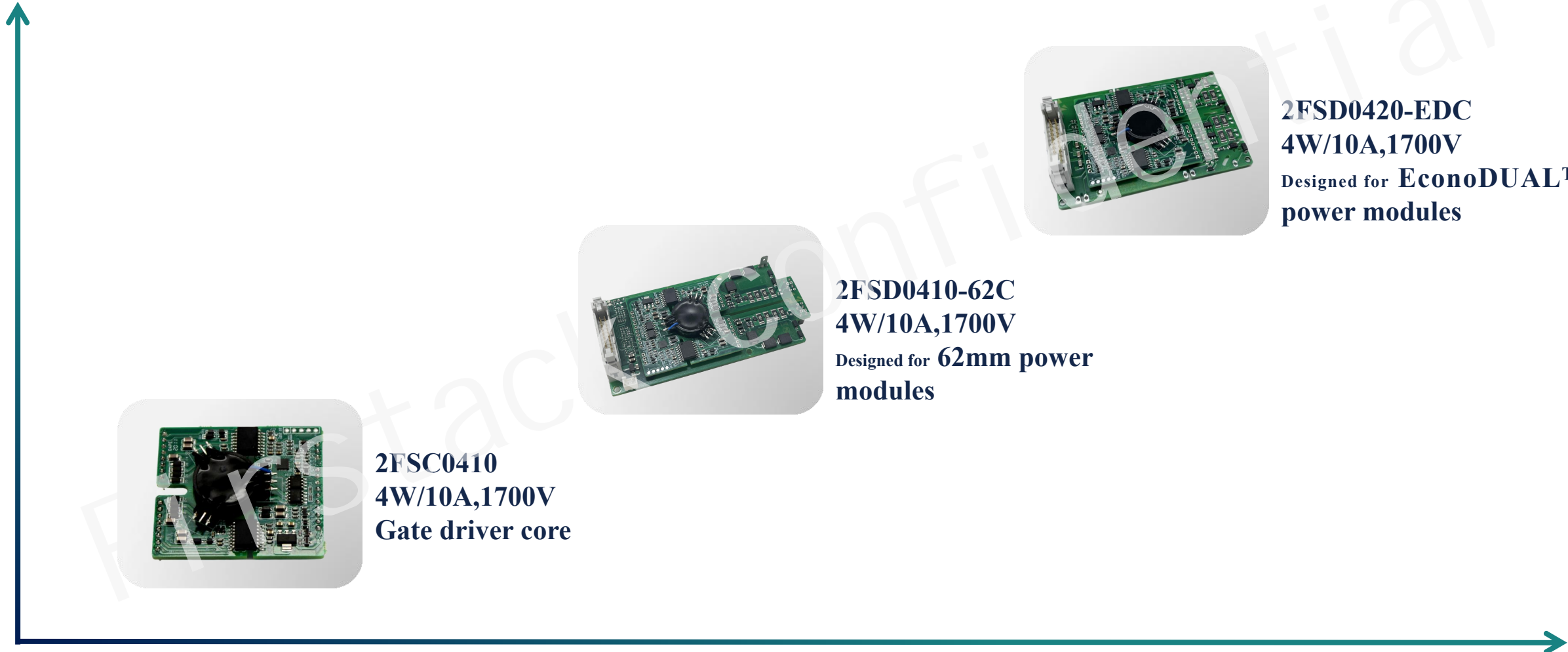
1FSD08110
8W/110A
3300V
IHM



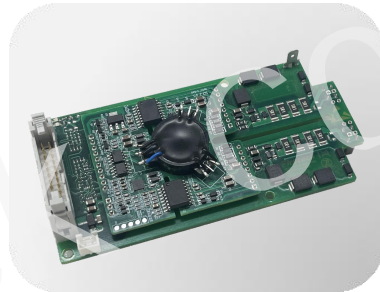
SK08110
8W/110A
4500V
PressPACK



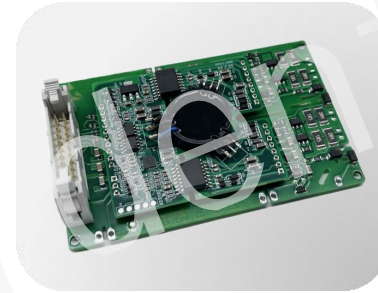
HV1027P
10W/27A
6500V
IHV



2FSC0410
4W/10A,1700V
Gate driver core

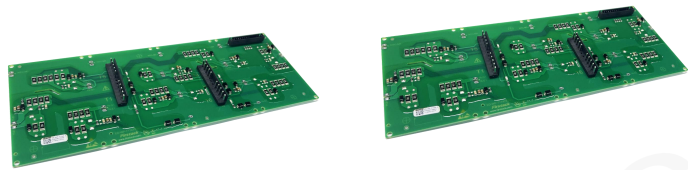


2FSD0410-62C
4W/10A,1700V
Designed for **62mm power modules**

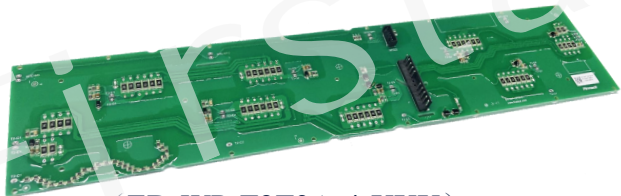


2FSD0420-EDC
4W/10A,1700V
Designed for **EconoDUAL™3 power modules**

ED-WP-CA Series



(ED-WP-T1T4A-2-XXX) + (ED-WP-T1T4A-2-XXX)



(ED-WP-T2T3A-4-XXX)

ED module ANPC topology 4 in parallel gate driver core + adapter board (main model)

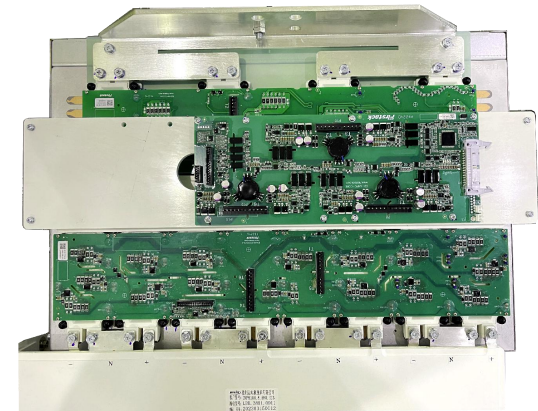
01 Introduction

NPC-type three-level/ANPC multi-parallel cost-effective intelligent gate driver solution for 1700V or 1200V mainstream half-bridge IGBT modules(eg.62mm or EconoDUAL™3 or PrimePack™3, etc.)

02 Voltage / Power range

- Rated voltage range: 690-1250V_{ac}
- Power range: 1MW-10MW

03 EconoDUAL™3 connection diagram





IGBT Gate Driver Core Technology

Most driver damage is power supply related

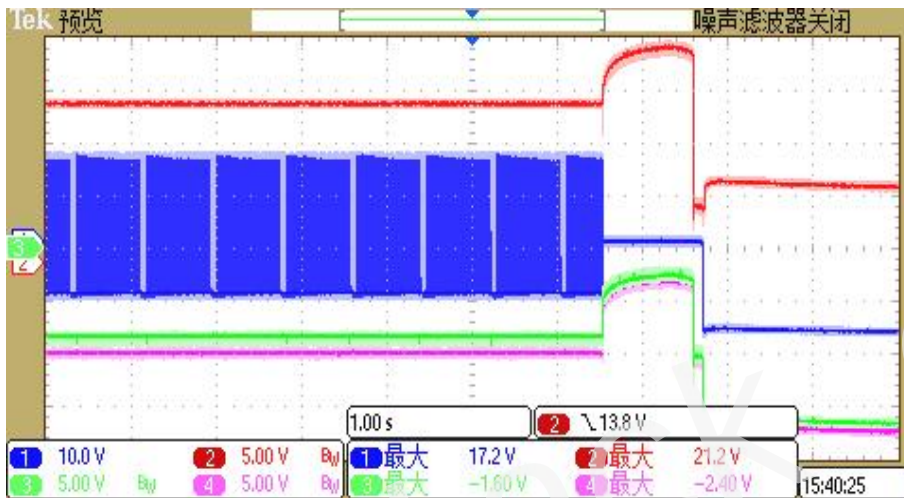
- ✘ IGBT failure causes gate driver power supply damage
- ✘ Secondary side overload
- ✘ Improper operation, e.g. reversing the polarity of the power supply

The DC/DC power supply is the weakest link in a gate driver, which means designing a robust and reliable power supply is critical to the reliability of a gate driver.

V_{GE} short-circuit test

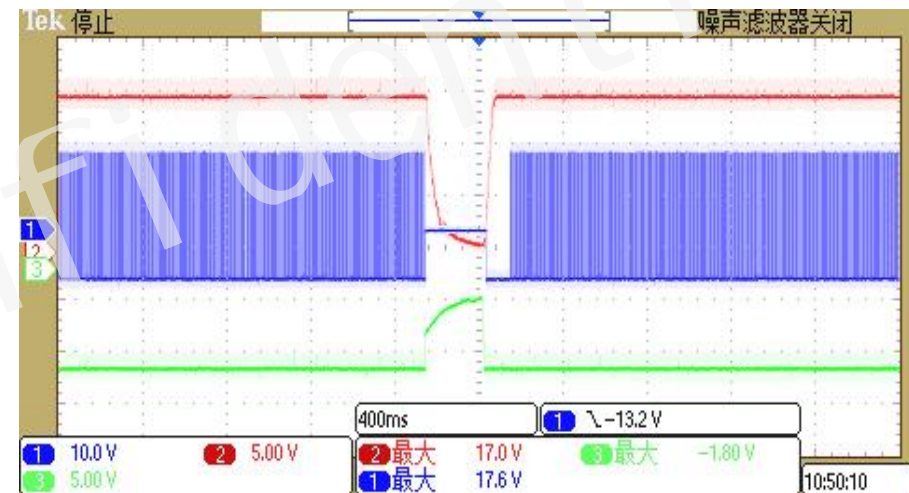
CH1: V_{GE}
CH2: +15V
CH3: -10V

Competitor company product



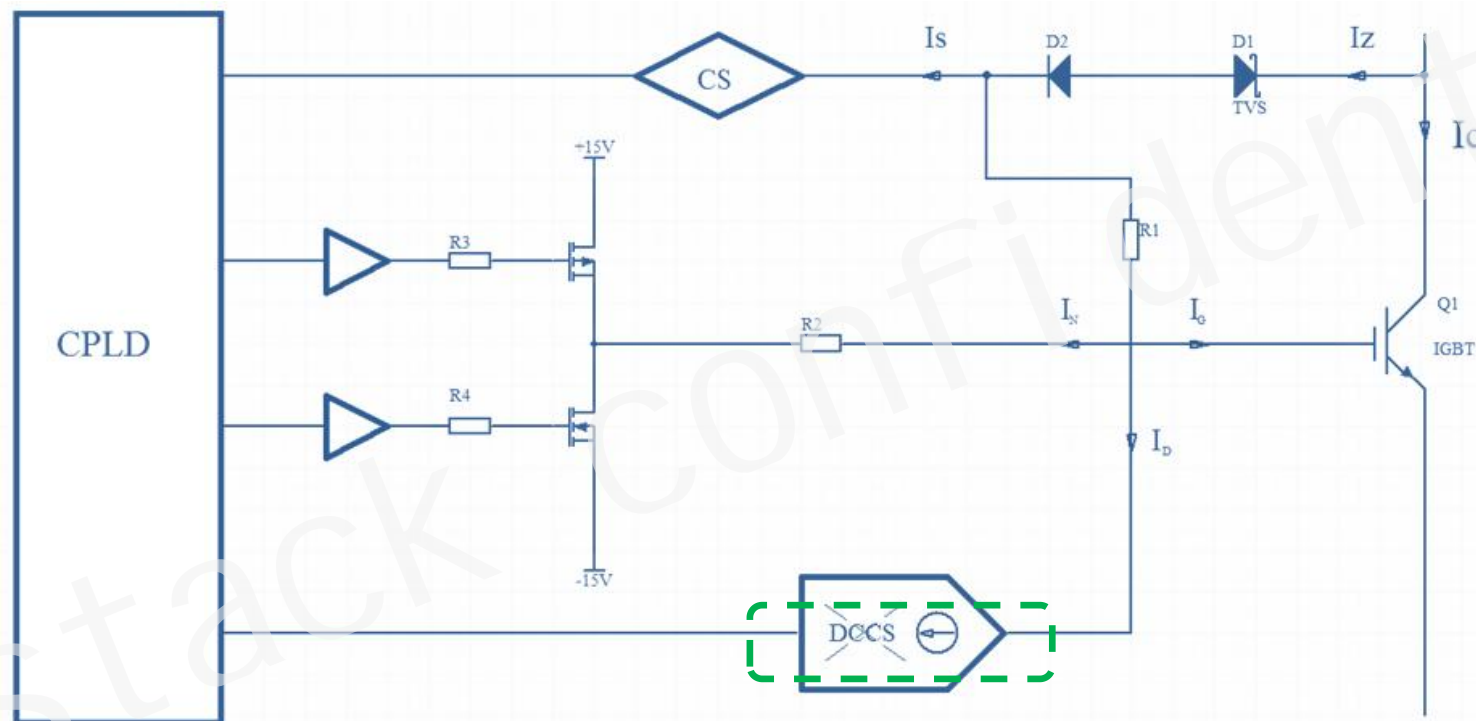
- ✓ Blocking pulses, reporting "undervoltage" fault
- ! Withstands short-circuit for approx. 1s, over 1s SCALE-2 damages
- ! +15V→21.2V, -10V→-2V

Firststack HV1027P



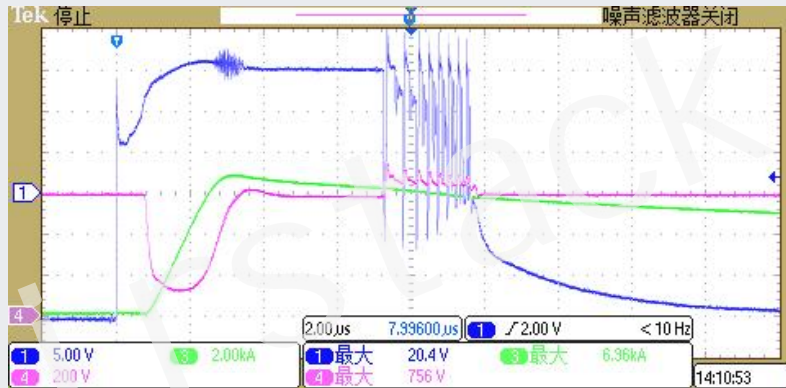
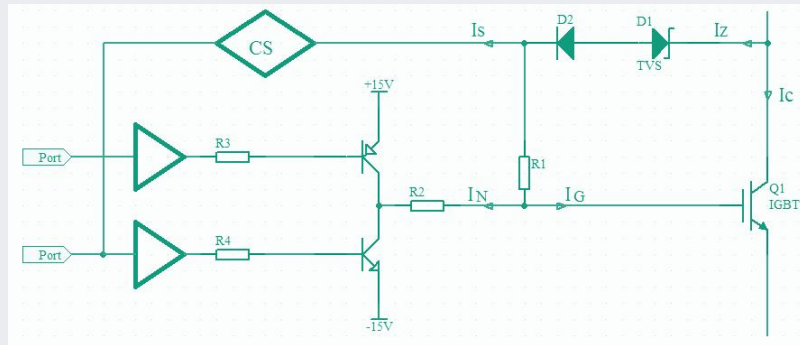
- ✓ Blocking pulses, reporting "undervoltage" fault
- ✓ Withstands short-circuit for any length of time
- ✓ Normal operation after clearing short-circuit

VS



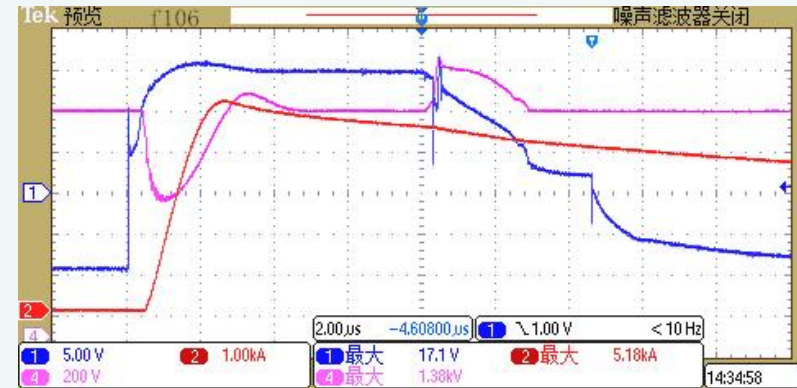
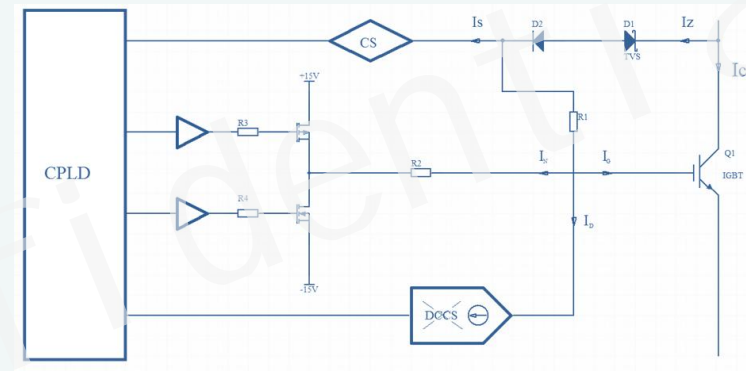
- TVS is broken down, CPLD immediately turns off the N-transistor, $I_N=0$, $I_Z=I_G+I_D$
- Rely on DCCS (Digitally Controlled Current Source) for precise control of I_Z

Advanced Active Clamping(AAC)



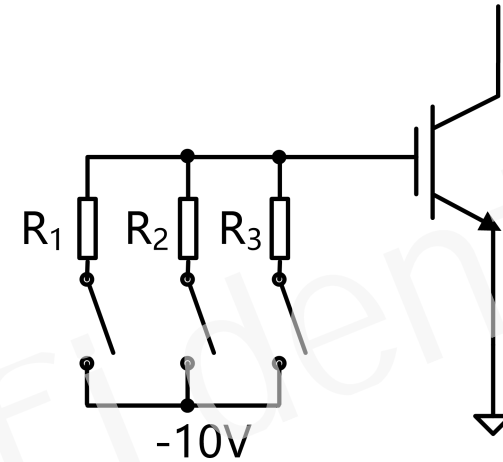
Internal electric field changes suddenly, which damages the power module.

DCAC(Patented technology)



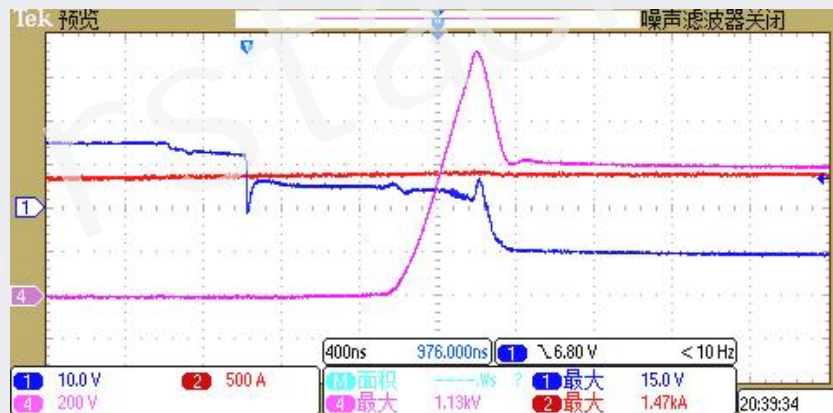
Turn-off without voltage oscillation.

Voltage spike reduced
by 30% at turn-off.

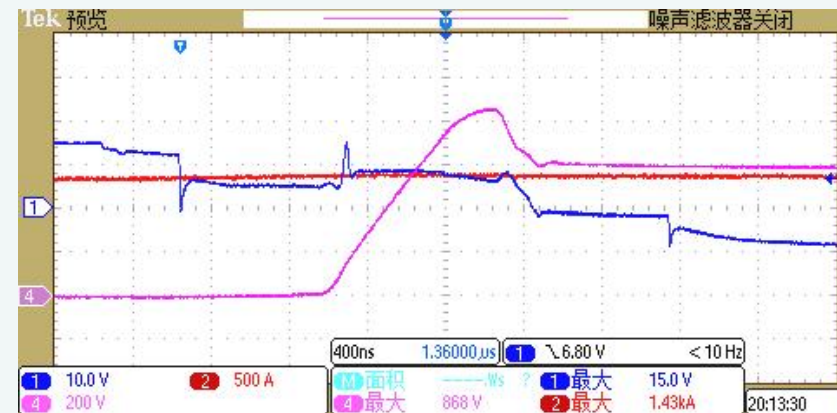


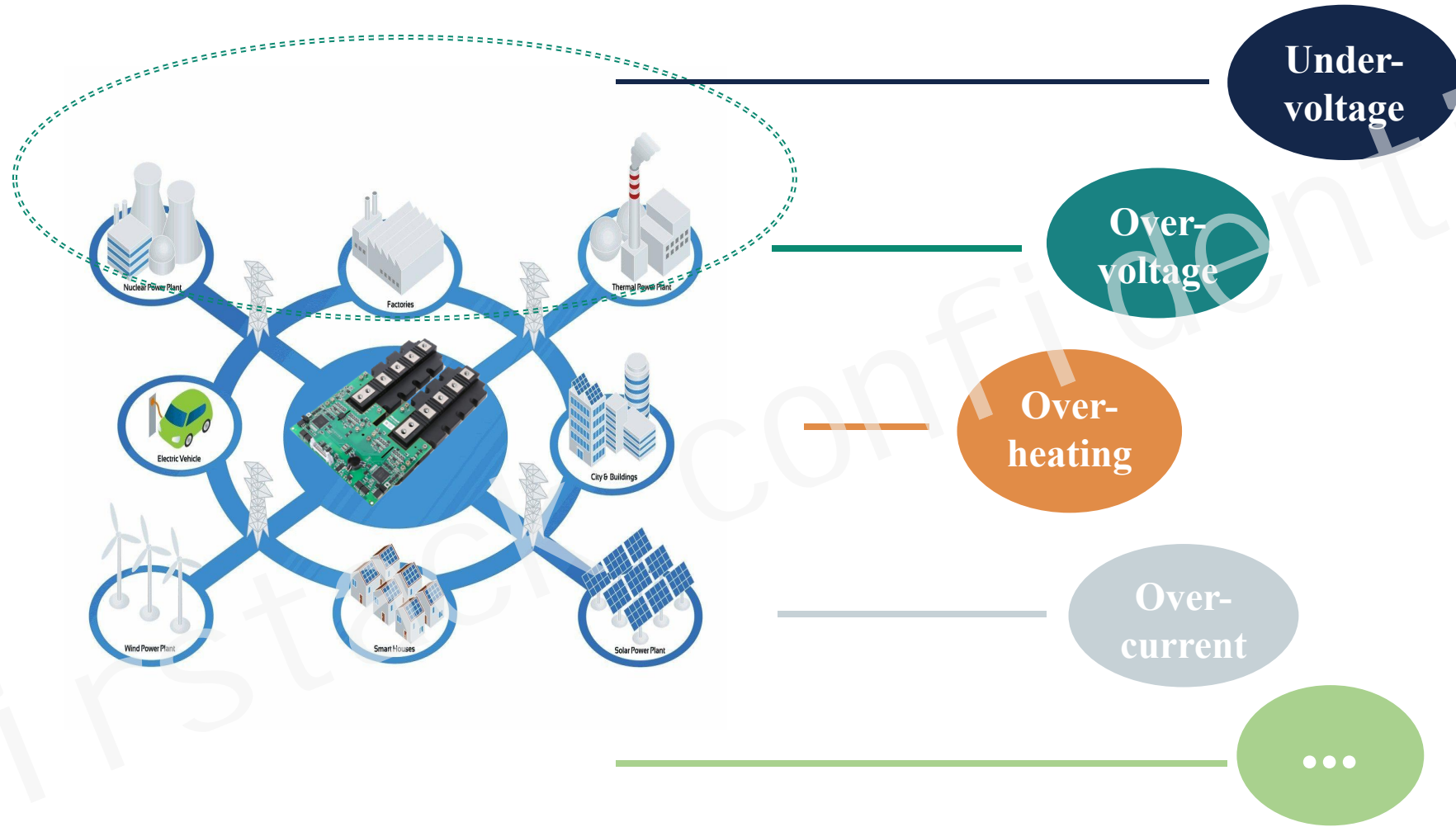
$V_{DC}=1200V$ 、 $I_C=1400A$ 、FF1400R12IP4、 S_3

Without graded shutdown, $V_{ce_max}=1130V$



With graded shutdown, $V_{ce_max}=868V$





Intelligent fault management: fault type, first fault report

Intelligent Fault Management Application——Status Monitoring

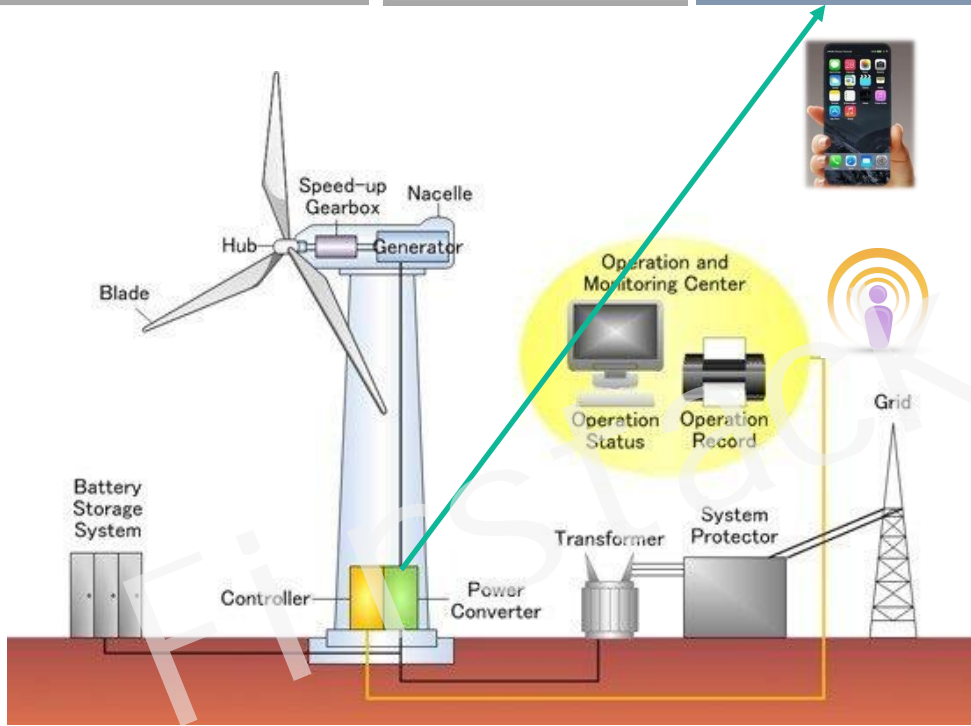


Envision Smart Wind Farm
Wind OS management
platform

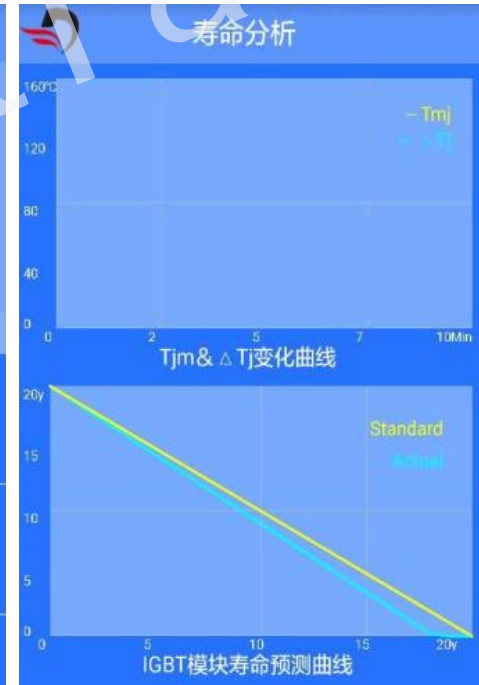


Envision EN-136/4.2
Offshore Smart Wind
Turbine

Firststack inside
Module status data:
 - Voltage
 - Current
 - Temperature



Future trend: maintenance-free



Firststack intelligent driver remote monitoring APP



Manufacturing Facilities



Gate driver PCB assembly lines annual capacity **1 million pieces**

line equipments are the latest models of top brands domestic and international

SMDs show **high precision, high efficiency and stable quality**



Gate driver annual capacity 5 million pieces
Power stack annual capacity 50 thousand sets



Hangzhou Firststack Technology Co., Ltd Semiconductor Power Devices Headquarters

Location: Linping District, subway entrance
Plot size: 30 acres (first phase 30 acres, later 20 acres)
Planning architecture: R&D headquarters, operation building,
digital intelligent workshop, restaurant, apartment



Certified:

- ISO9001
- IATF16949
- ISO14001
- ESD S20.20

Certification application in progress:

- 3C certification
- CE certification



THANKS

Vision: Global Professional Total Power Solution

Mission: Greener, More Reliable Engery

Value: Customer achievement, Integrity, Growth