New Gate Drivers optimized for Mitsubishi Electric New IGBT Module LV100 series parallel operation

Application reference : Wind Power 2MW 2 level Single phase Power Stack.



SUSTAINABLE DEVELOPMENT GOALS

Supported by Mitsubishi Electric Corporation
Joint Development for Power Stack : NTUT

TAMURA
Your One and Only Company

TAM-GDM-00020

Issued on 1st May '22 Unit division HQ Japan

Rev E

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1) Tamura Gate Driver 7 key points

- Space saving / 100% on the IGBT
- High-speed response & accuracy
- Suitable for parallel drive
- High Power DC-DC converter
- Low stray capacity
- Wider input voltage
- Various protections



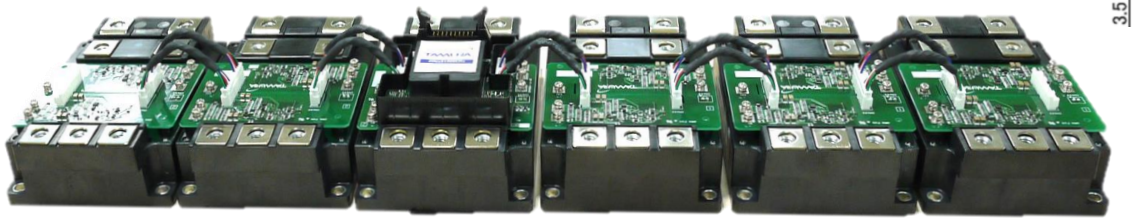


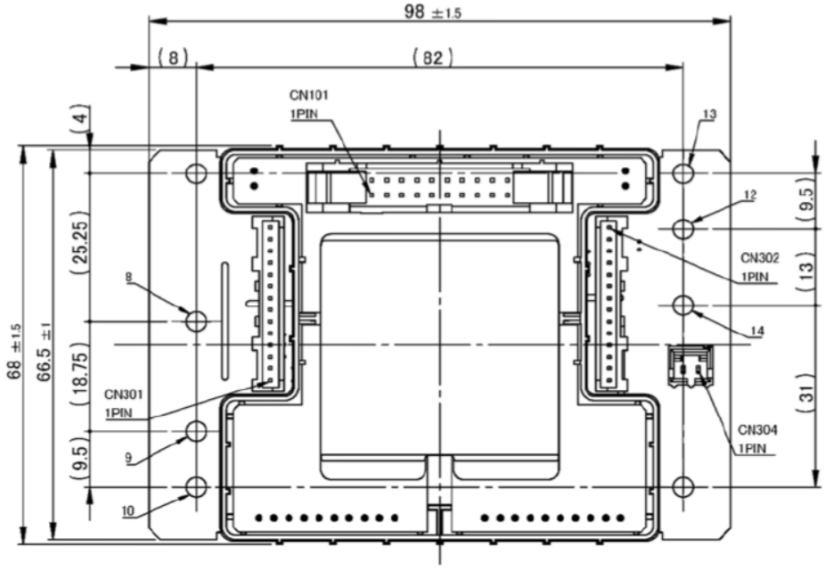
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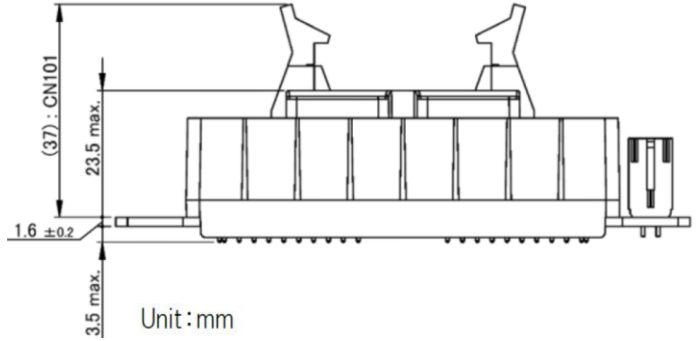
2) Appearance











Unit : mm

Note :1.The dimensional tolerance without directions is ± 0.5mm.

* Specifications may be changed.

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3) Products line-up

*1 Catalog products. Please confirm stock.
*2 Not in stock due to optimization required. Please contact us.

Package	Vce	Ic	Part No	Master /Slave	Model	Frequency (kHz) For Reference	Maximum parallel number
	1200	800	CM800DW-24T	Leader 	2LG02ADxC11M *1 2LG??zyxC11M-?? *2	5.2kHz (max) /units	Contact us
				 Follower	2LG02ADZC11S *1 2LG??zyZC11S-?? *2		
		1200	CM1200DW-24T	Leader 	2LG02ADxC11M *1 2LG??zyxC11M-?? *2	3.0kHz (max) /units	Contact us
				 Follower	2LG02ADZC11S *1 2LG??zyZC11S-?? *2		
	1700	800	CM800DW-34T CM800DW-34TA	Leader 	2LG01ADxC11M *1 2LG??zyxC11M-?? *2	10.2kHz (max) /units	Contact us
				 Follower	2LG01ADZC11S *1 2LG??zyZC11S-?? *2		
		1200	CM1200DW-34T	Leader 	2LG01ADxC11M *1 2LG??zyxC11M-?? *2	7.5kHz (max) /units	Contact us
				 Follower	2LG01ADZC11S *1 2LG??zyZC11S-?? *2		

x: Signal input voltage selectable: "C" => 3.3~15V "D" => 15V
y: Protection circuits: "C"=>Soft turn off / "D"=>Soft turn off + Active clamp
z: Thermistor Isolated Amplifiers: "A"=>Yes / "0"=>None
??: Semi-optimized code

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4) Insulation performance corresponding to each safety standard

■ Compliant Safety Standards

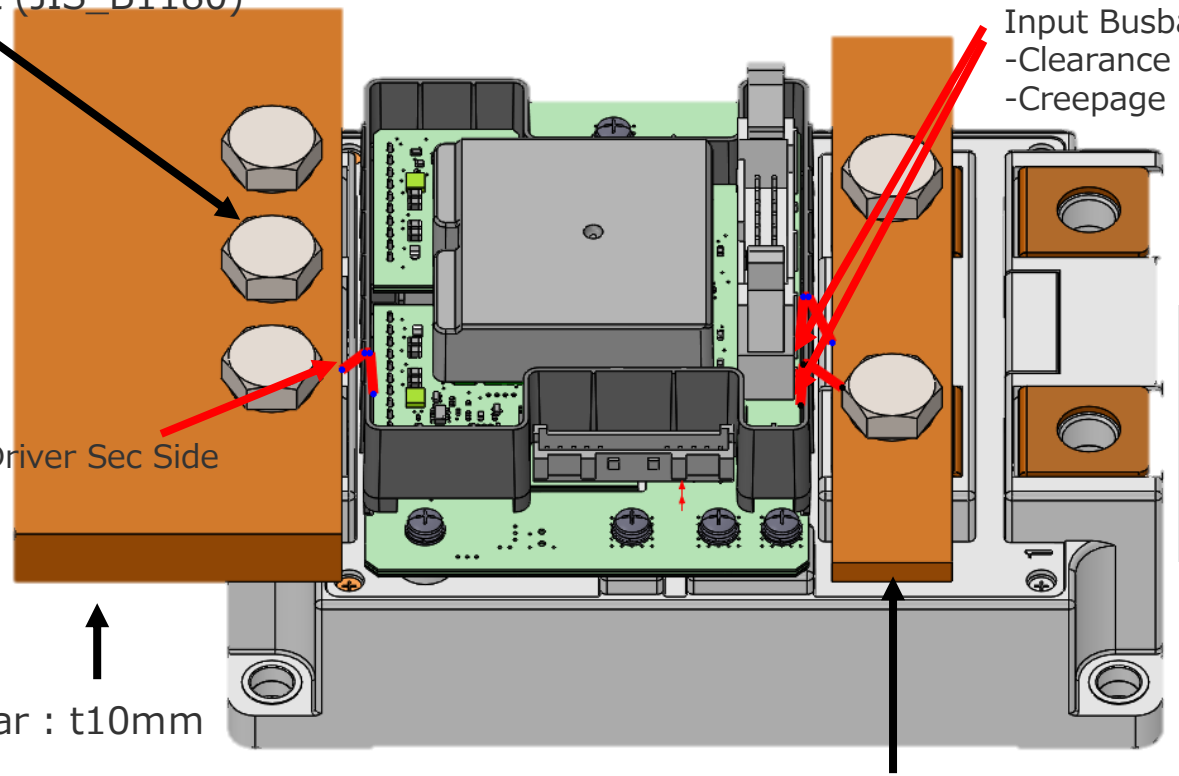
- IEC62109-1 (photovoltaic generation standard)
  and IEC62477-1 (semi-conductor power conversion system/wind power generation standard)

・Basic isolation: Systems voltage ≦1000Vrms (1500Vdc), Operating voltage ≦1600Vrms, OVCIII, PD2, 4000m
・Enhanced isolation: Systems voltage ≦1000Vrms (1500Vdc), Operating voltage ≦1250Vrms, OVCIII, PD2, 2000m

■ Busbar - Gate Driver

M8 Hexagon Bolt (JIS_B1180)

Input Busbar - GATE Driver Pri Side
-Clearance > 15.7mm
-Creepage > 27.6mm



Output Busbar - GATE Driver Sec Side
-Clearance > 11.4mm
-Creepage > 13.4mm

Output Busbar : t10mm

Input Busbar : t4mm

	Clearance	Creepage
Pri -Sec	>14mm	>16mm
Sec -Sec	>8mm	>12mm

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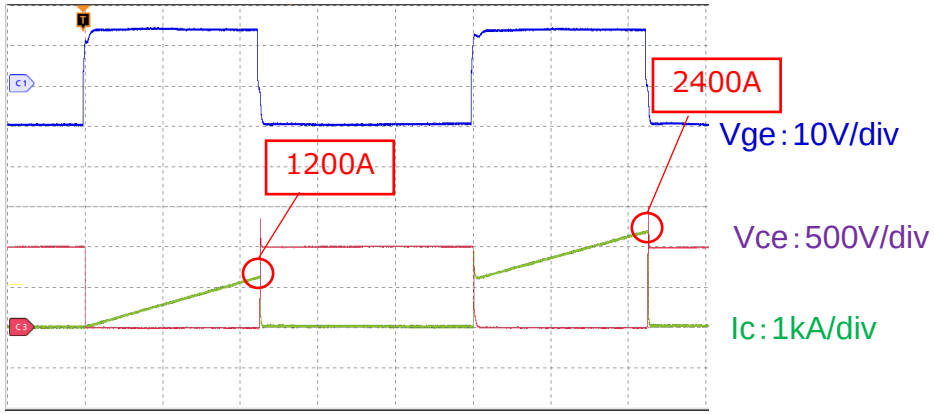
5) Single Operation Matching Data

2 pulse test

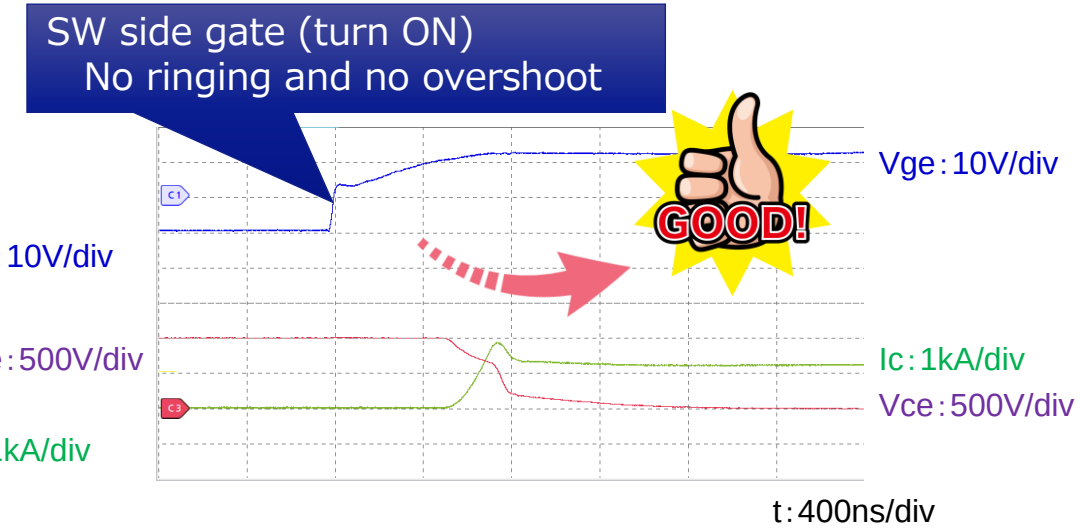
N-side

CM1200DW-34T

Vce,Ic,Vge　Tj=25℃, **Vcc=1000V**



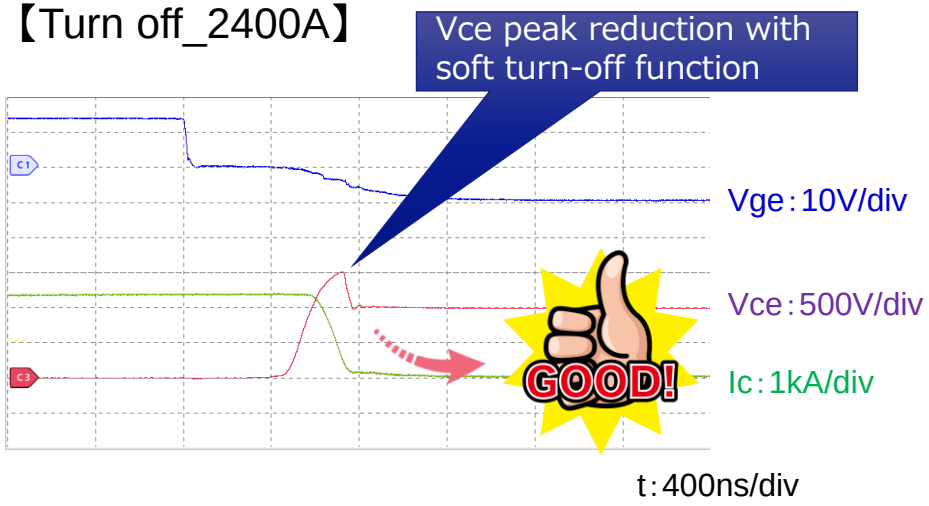
【Turn on_1200A】



【Measured value】

Vce(peak)		1501	V
Turn on _1200A	dV/dt(max)	7	kV/us
	dI/dt(max)	11	kA/us
	Eon	241	mJ
Turn off _2400A	dV/dt(max)	10	kV/us
	dI/dt(max)	16	kA/us
	Eoff	448	mJ

【Turn off_2400A】



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5) Single Operation Matching Data

Short circuit test

N-side

Tj=25℃, Vcc=**1000V**, Load inductance : 170nH

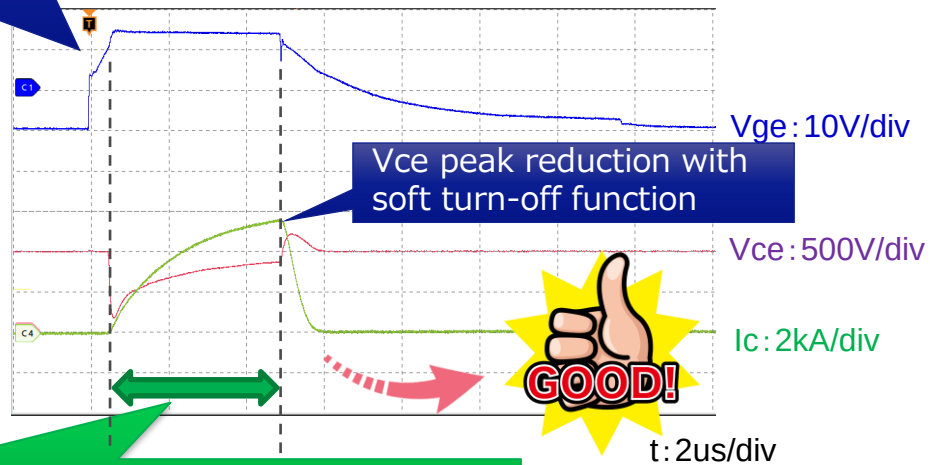
【Measured value】
- Vce(peak) :1213V
- Ic(peak) :5659A
- tw :5.3us

CM1200DW-34T

This driver suppresses the Vce peak voltage in the short circuit by our original circuit technology, and can control the mask time to prevent false short circuit detection.
(Patent pending)

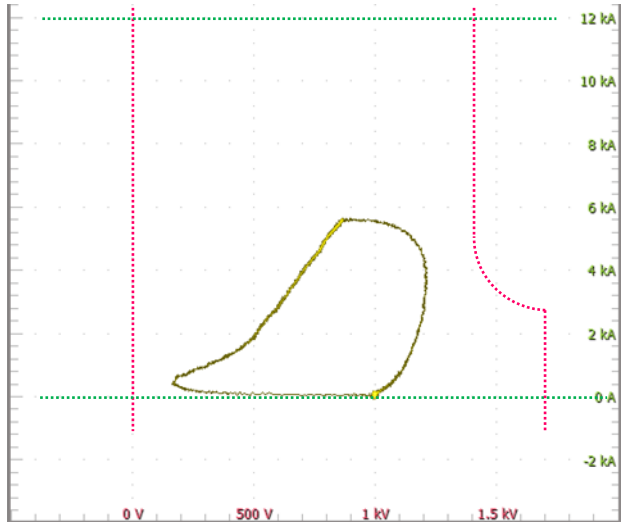
Vce,Ic,Vge

SW side gate (turn ON)
No ringing and no overshoot



Constant control of mask time to prevent false short circuit detection regardless of short circuit conditions

SOA



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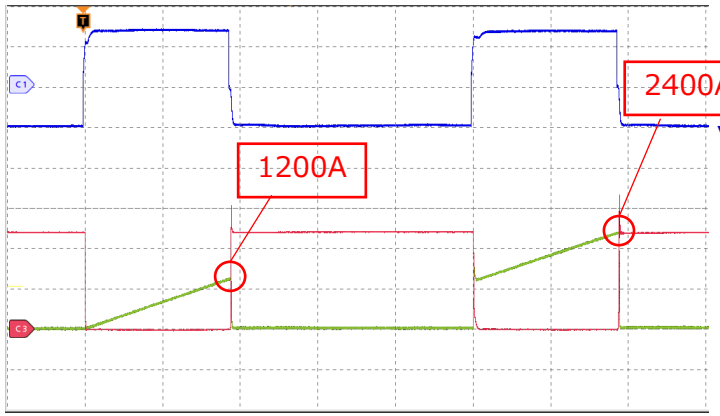
5) Single Operation Matching Data

2 pulse test

N-side

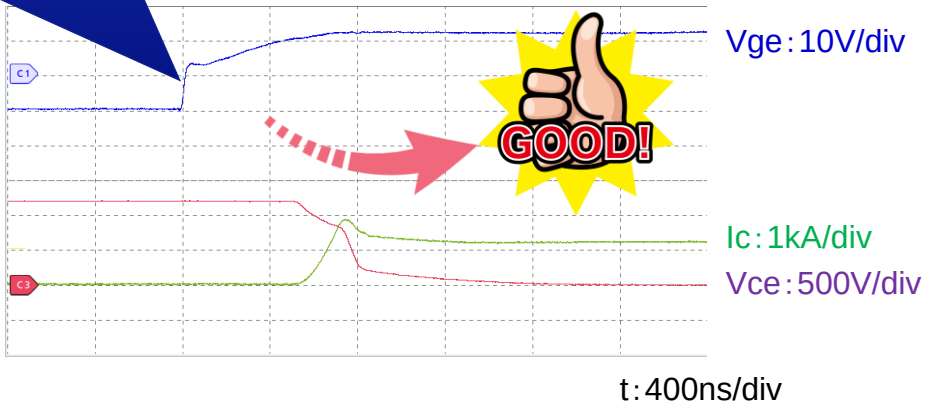
CM1200DW-34T

Vce,Ic,Vge　Tj=25℃, **Vcc=1200V**



【Turn on_1200A】

SW side gate (turn ON)
No ringing and no overshoot

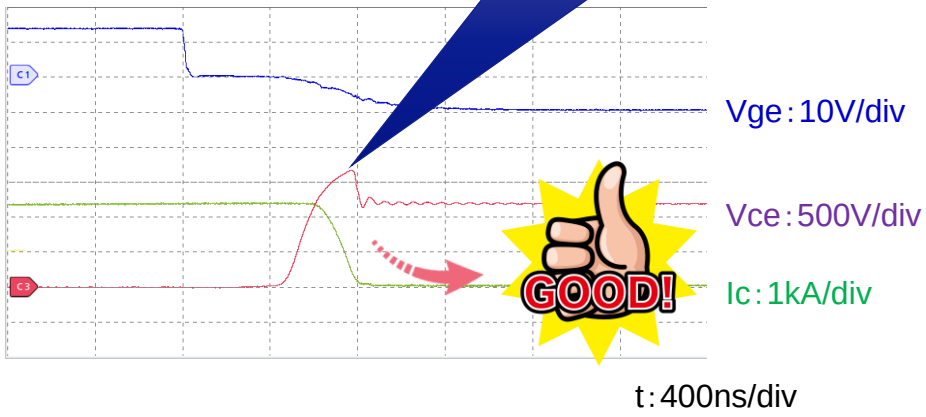


【Measured value】

Vce(peak)		1664	V
Turn on _1200A	dV/dt(max)	8	kV/us
	dI/dt(max)	11	kA/us
	Eon	300	mJ
Turn off _2400A	dV/dt(max)	10	kV/us
	dI/dt(max)	15	kA/us
	Eoff	591	mJ

【Turn off_2400A】

Vce peak reduction with
soft turn-off function



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5) Single Operation Matching Data

Short circuit test

N-side

CM1200DW-34T

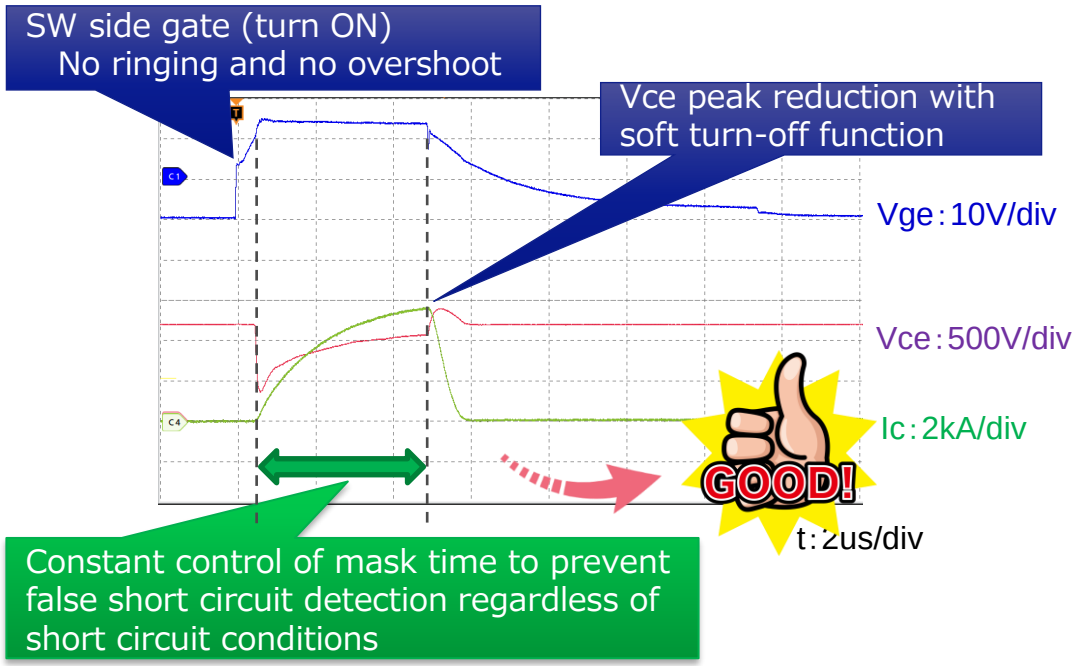
Tj=25℃, Vcc=**1200V**, Load inductance : 170nH

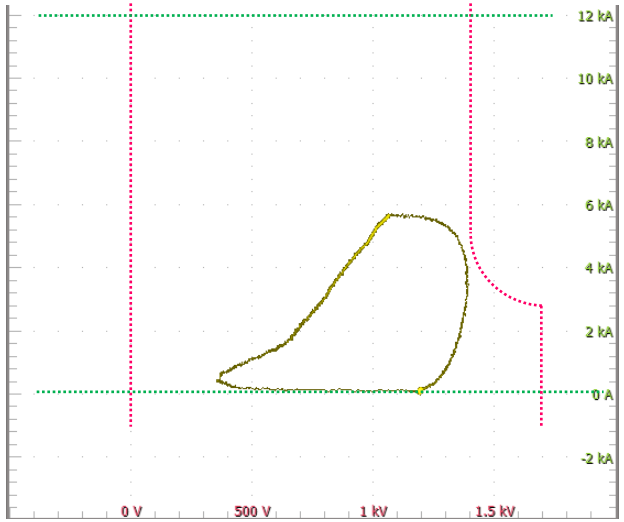
【Measured value】
- Vce(peak) :1395V
- Ic(peak) :5718A
- tw :5.3us

This driver suppresses the Vce peak voltage in the short circuit by our original circuit technology, and can control the mask time to prevent false short circuit detection.
(Patent pending)

Vce,Ic,Vge

SOA



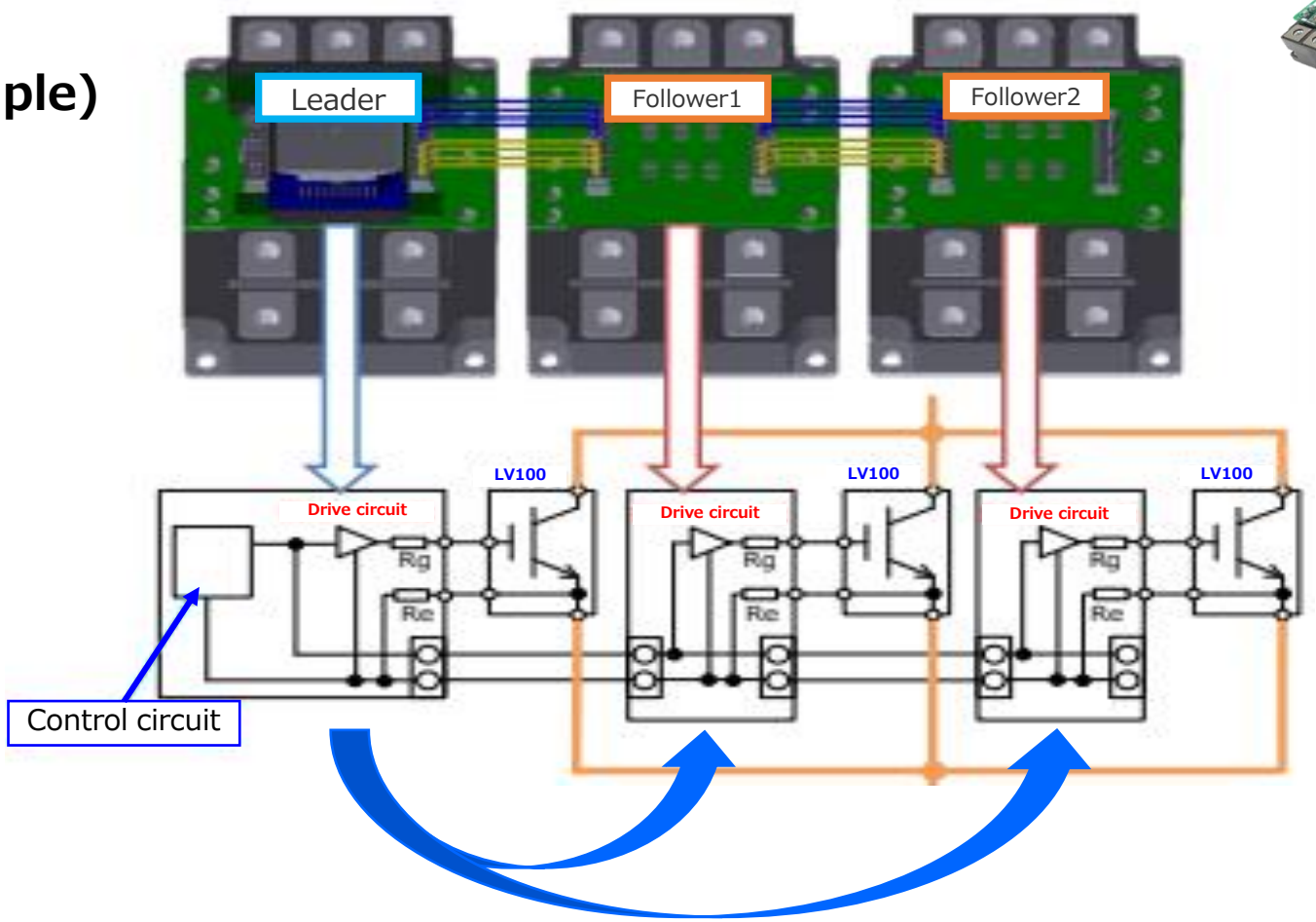


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6) Parallel drive configuration

Leader and Follower Functions

Example)





★Leader board can be placed anywhere!

Please refer to page 21 current balance data.

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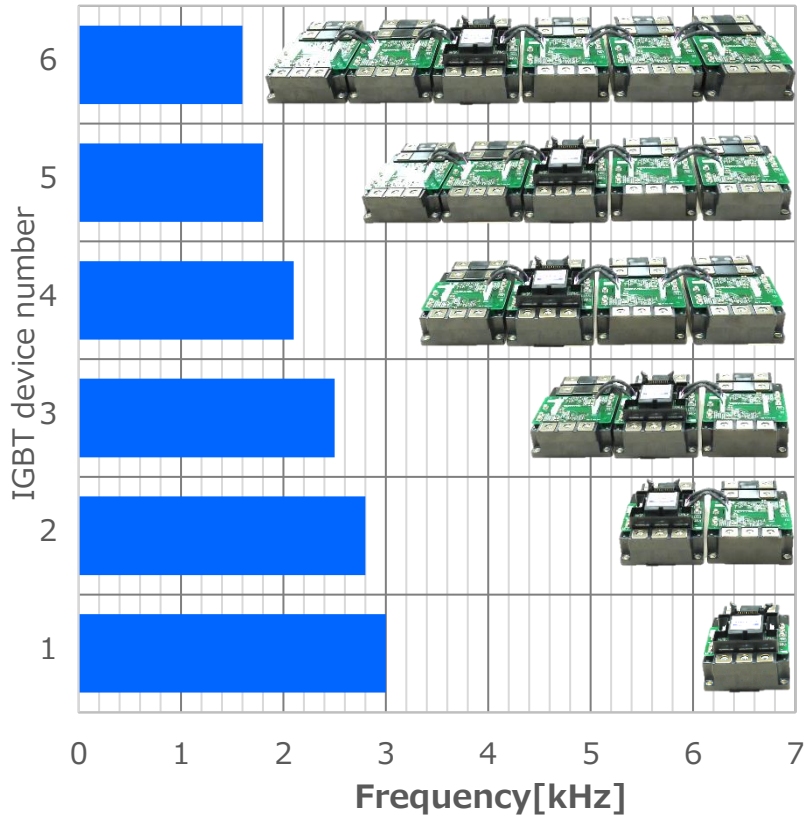
6) Parallel drive configuration (reference only)

1200V

Frequency vs Gate driver parallel number (+15V / -10V)

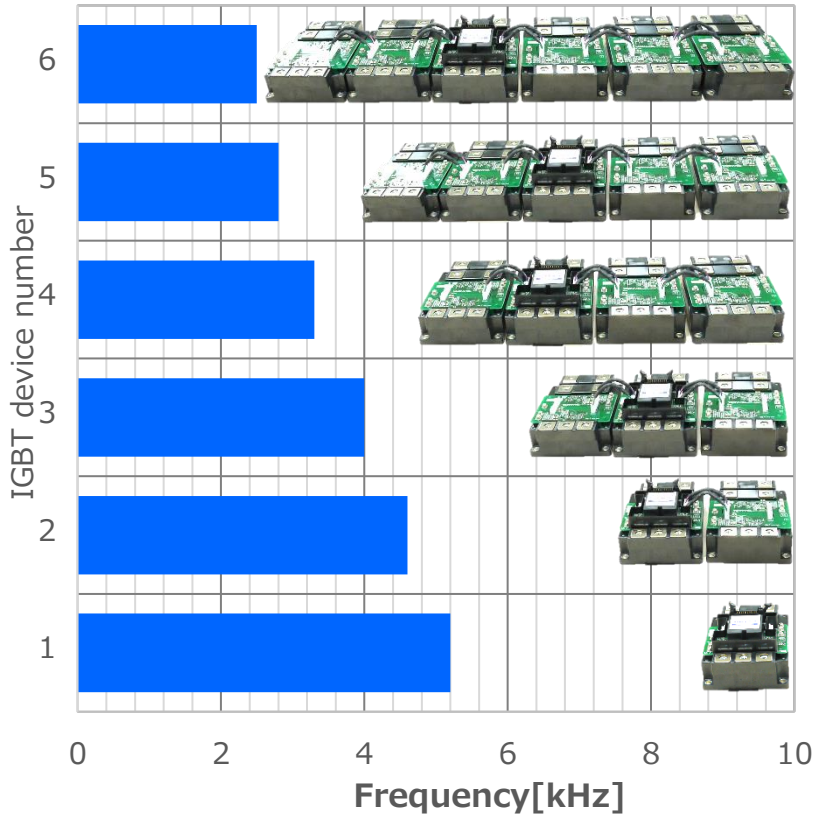
- **CM1200DW-24T**

2LG02xxxx11M/2LG02xxZx11S



- **CM800DW-24T**

2LG02xxxx11M/2LG02xxZx11S



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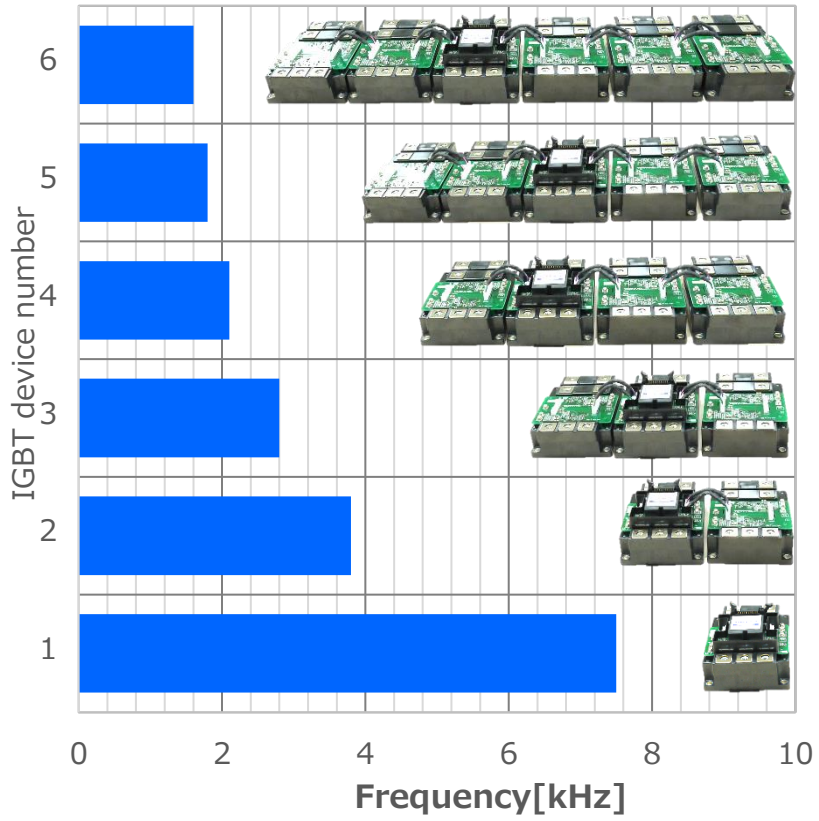
6) Parallel drive configuration (reference only)

Frequency vs Gate driver parallel number (+15V / -10V)

1700V

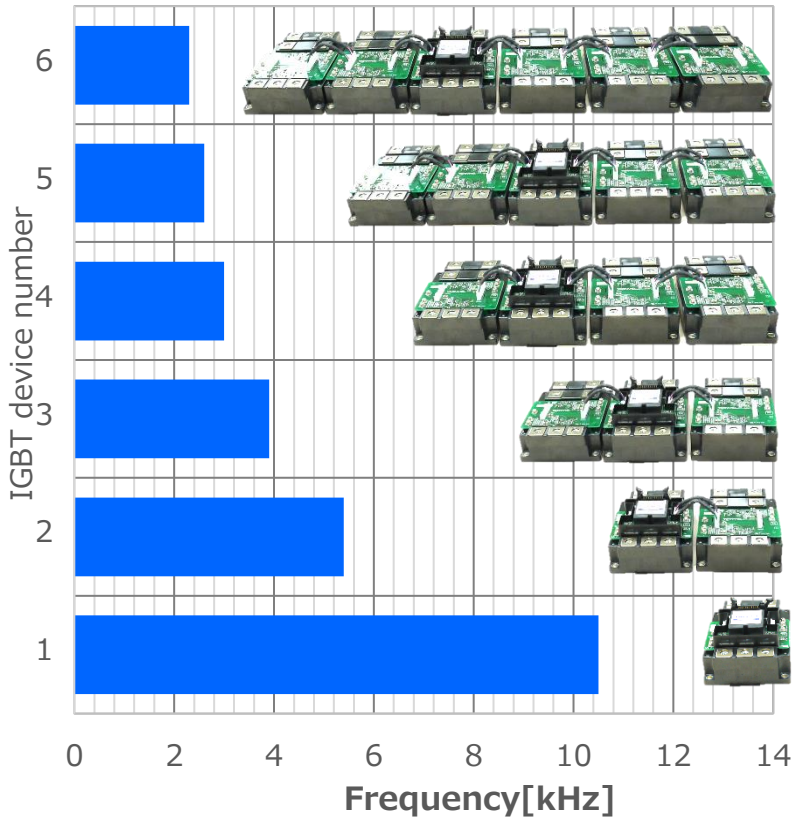
- **CM1200DW-34T**

2LG01xxxx11M/2LG01xxZx11S



- **CM800DW-34T/CM800DW-34TA**

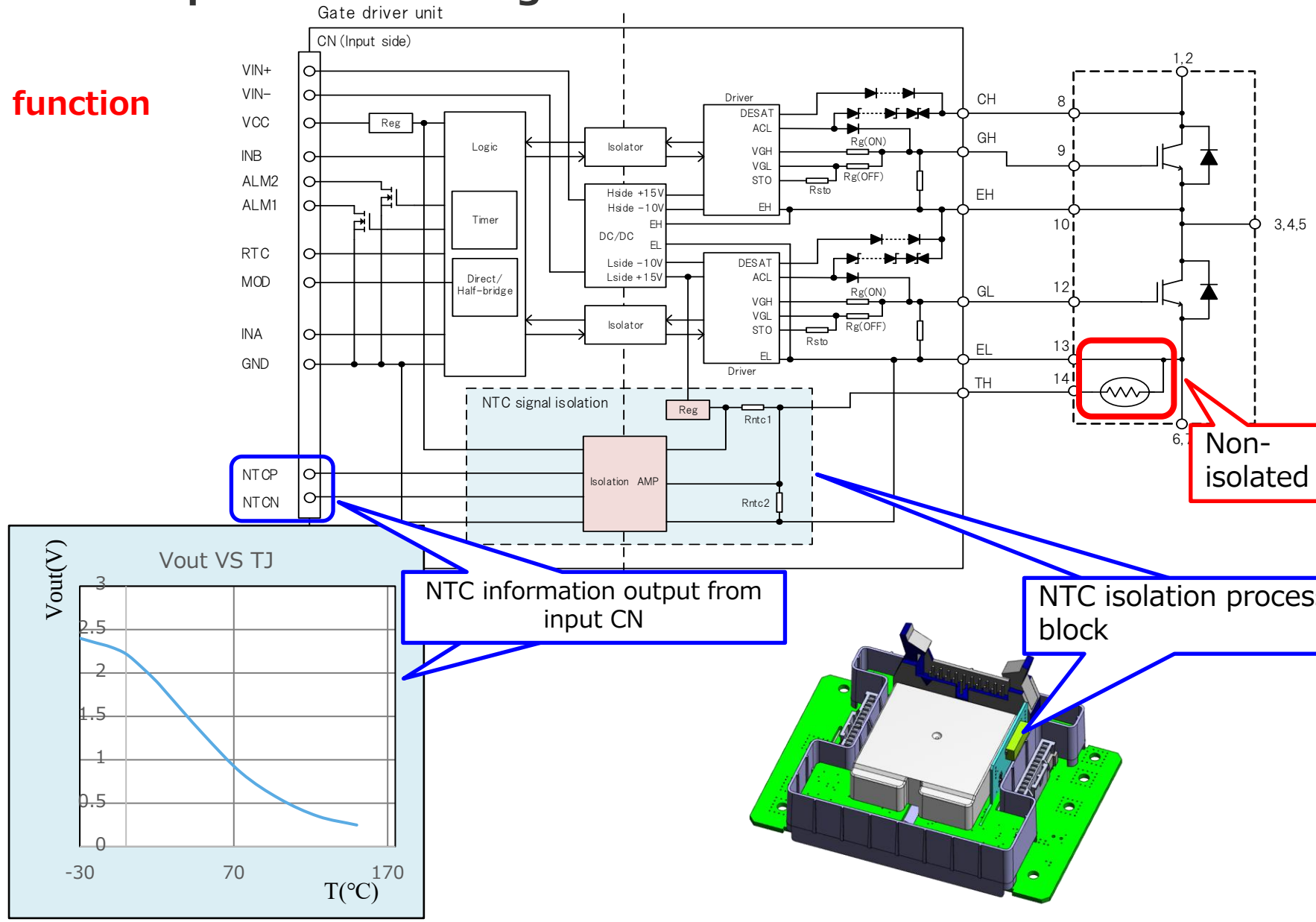
2LG01xxxx11M/2LG01xxZx11S



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7) Isolated temperature sensing

Optional function



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1) Power Stack Information
2) Power Stack specification reference
3) Power Stack operation reference data (2 pulse / Short circuit)

C) Introduction of One Tamura

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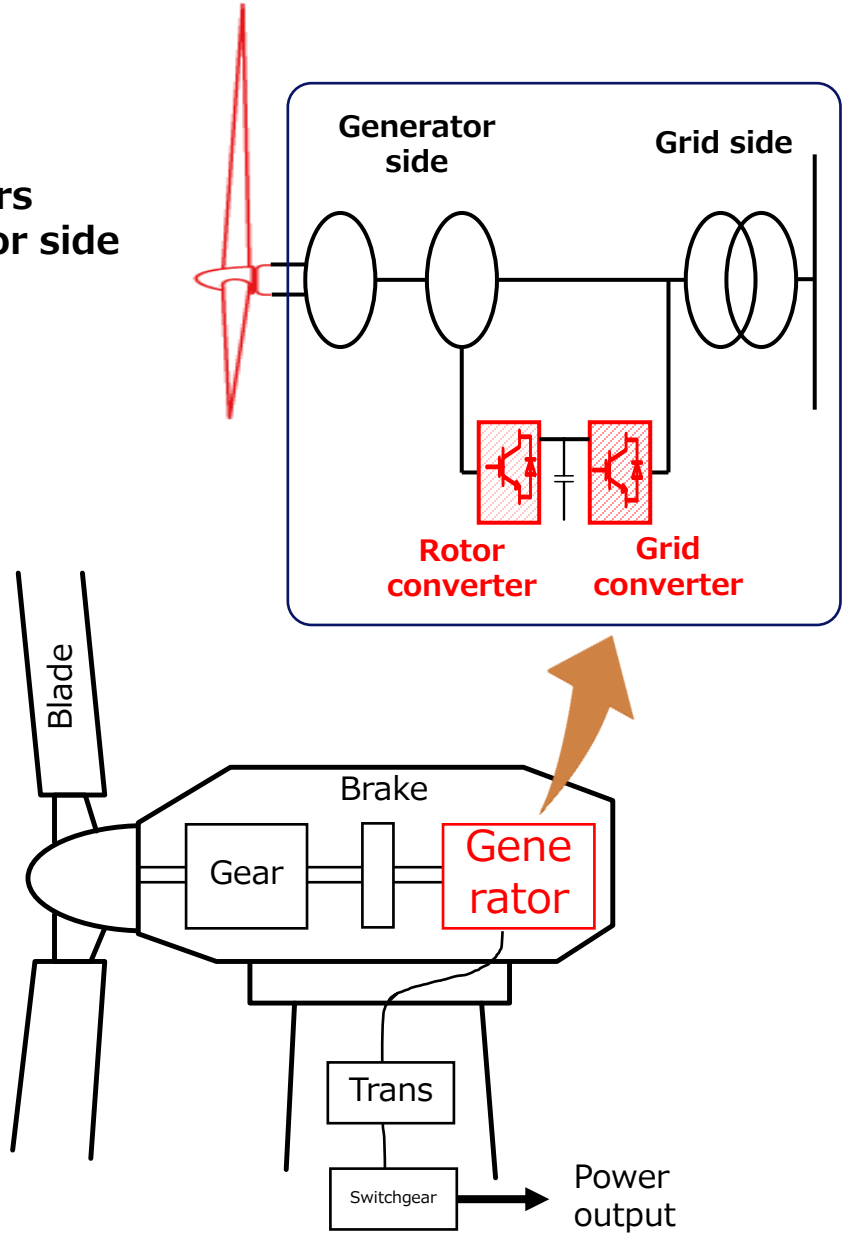
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1) Power Stack Information

Reference information

Reference application : Wind Power converters for Grid side and Rotor side
Install type : Onshore
Circuit solution : 2 Level



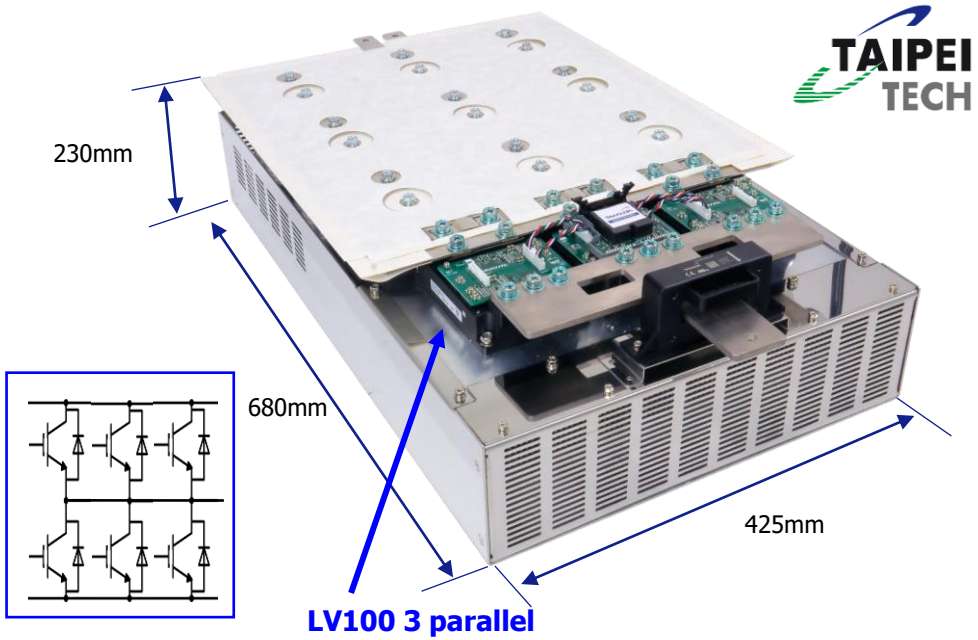


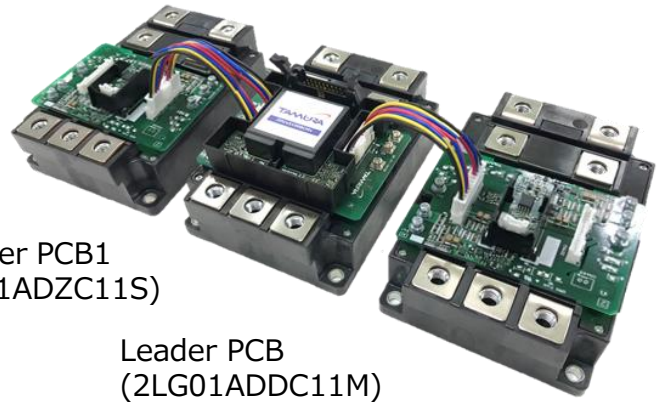
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2) Power Stack specification reference

Joint Development of National TAIPEI University of Technology - Tamura

Cooperated by Mitsubishi Electric





Specification

- **The half-bridge 3-parallel**
- **Max Power 2.0MW**
- **Rated Current 1900Arms***
- **Bus-bar stray inductance 10nH**

*** Vdc-link 1050V Vac = 690Vrms**

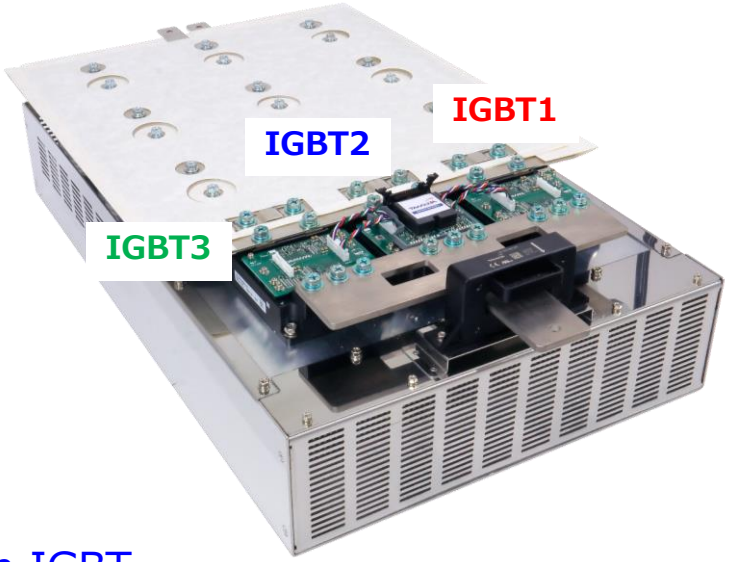
Power Module	**"CM1200DW-34T" (Mitsubishi Electric)**
	Rated current 1200A
	Rated voltage 1700V
Gate Driver	**"2LG01ADDC11M" (TAMURA)**
	"2LG01ADZC11S" (TAMURA)
Current Sensor	**"L51S2T5D15" (TAMURA)**

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3) Power Stack operation reference data

2 pulse test (reference only)

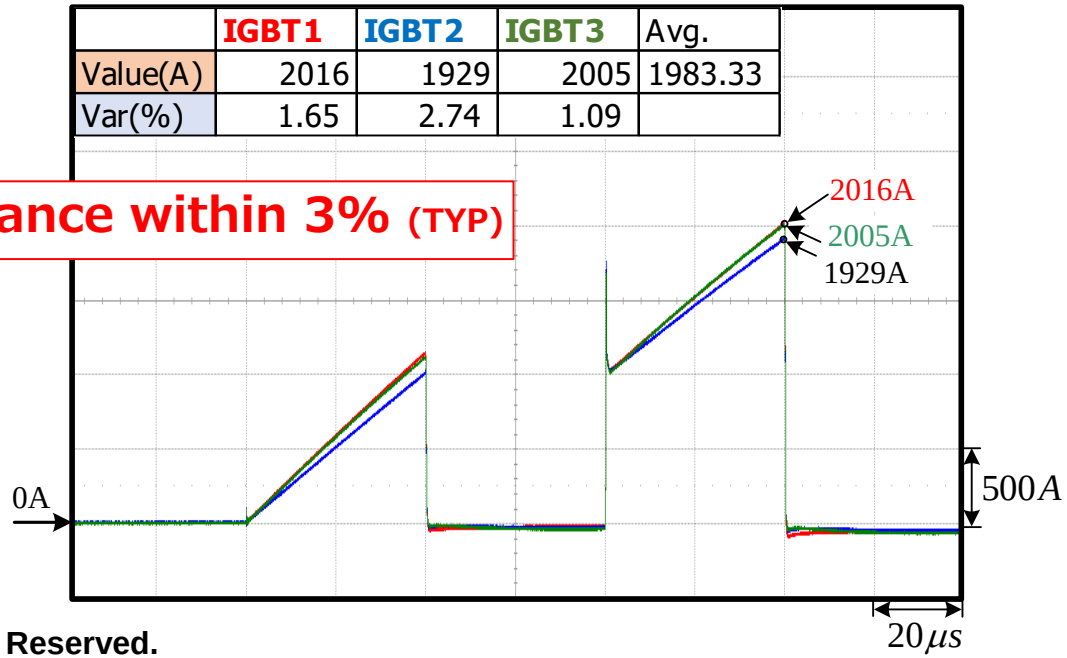
Item	Description
IGBT device	CM1200DW-34T
Gate driver	2LG01ADDC11M
Gate voltage	+15V/-10V
Gate resistor	+0.47Ω/−0.47Ω
DC-link voltage (VCC)	1000V
Load inductance	11uH
Junction temperature	25℃



Current waveform of each IGBT

	IGBT1	IGBT2	IGBT3	Avg.
Value(A)	2016	1929	2005	1983.33
Var(%)	1.65	2.74	1.09	

Current balance within 3% (TYP)



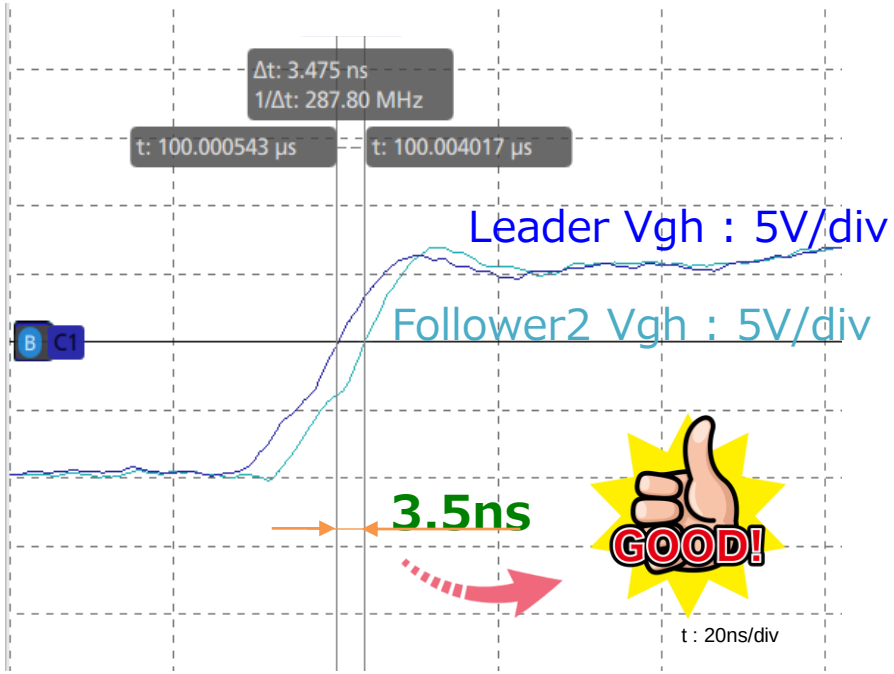
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3) Power Stack operation reference data

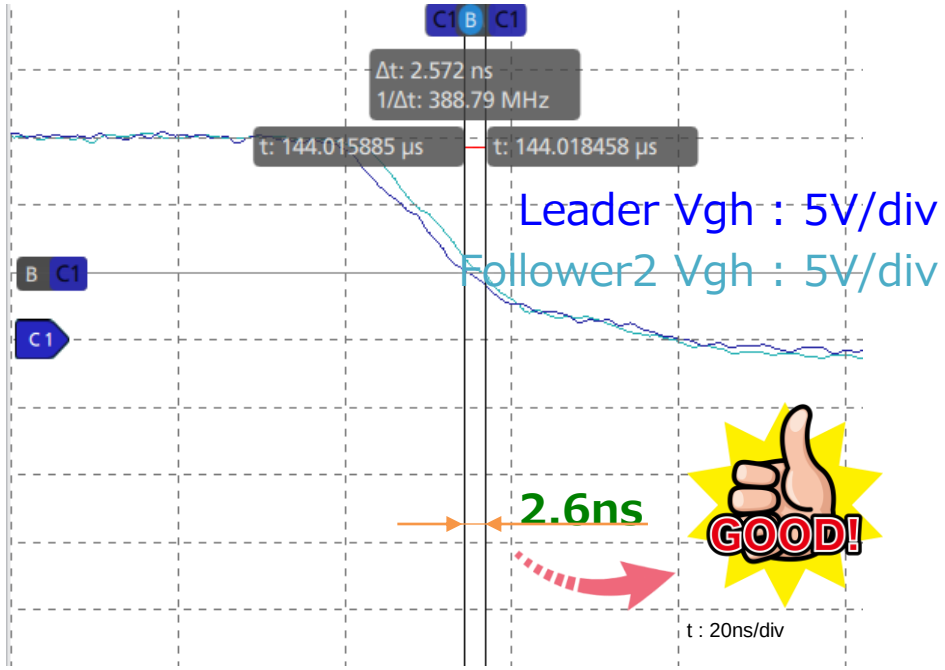
Gate signal balance

@V_{DC}1kV

Turn ON



Turn OFF

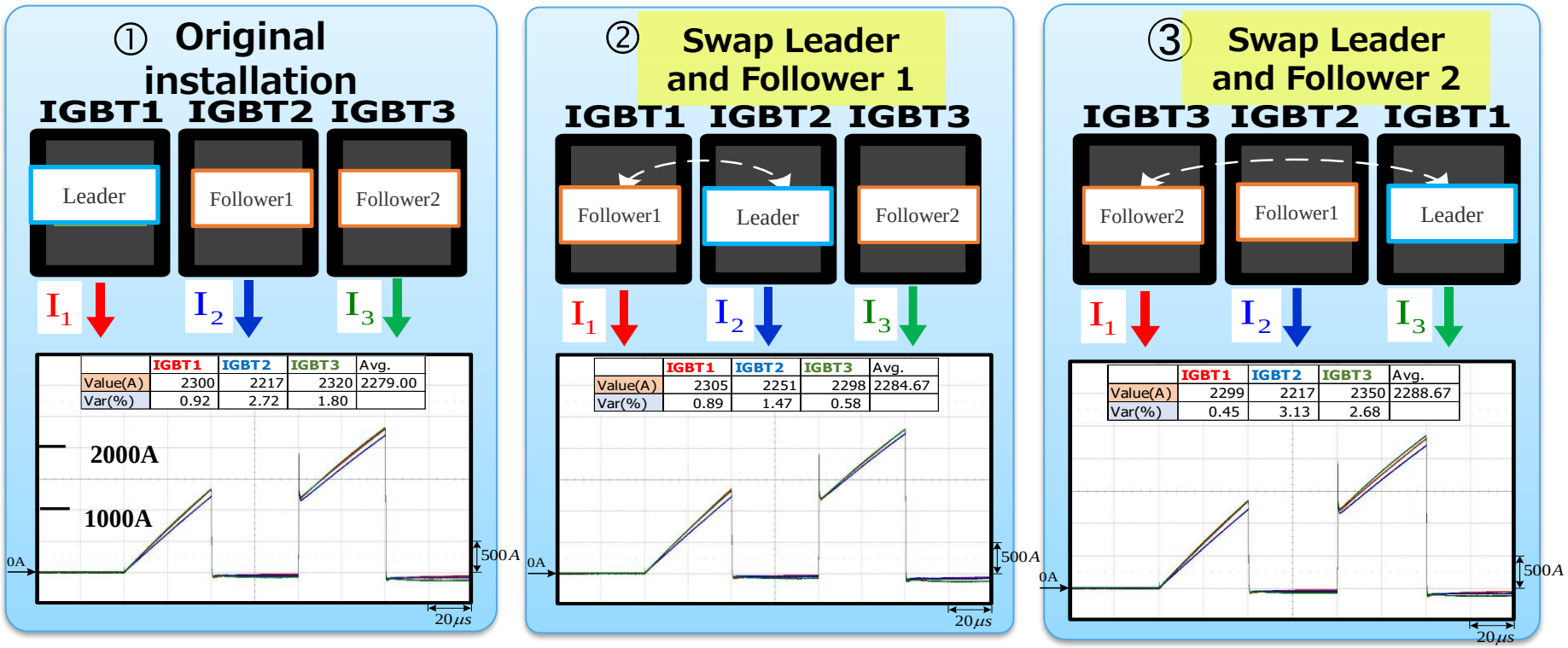


Follower drive signal delay is very small.

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3) Power Stack operation reference data

Current balance



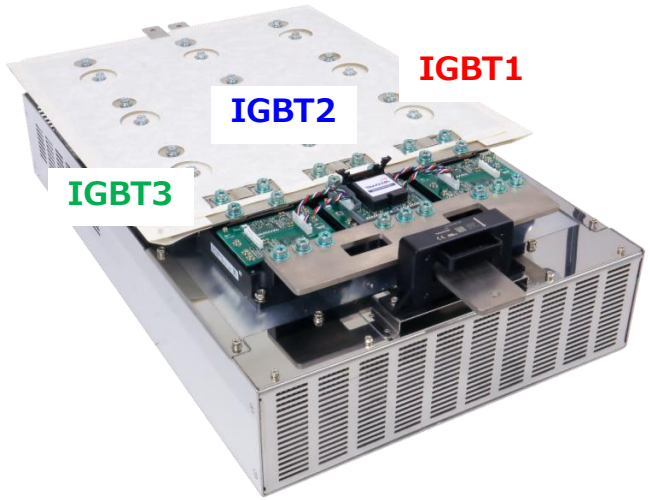
The current balance does not change even when the position of the gate driver is changed.
= Do not worsen the current balance in the gate driver

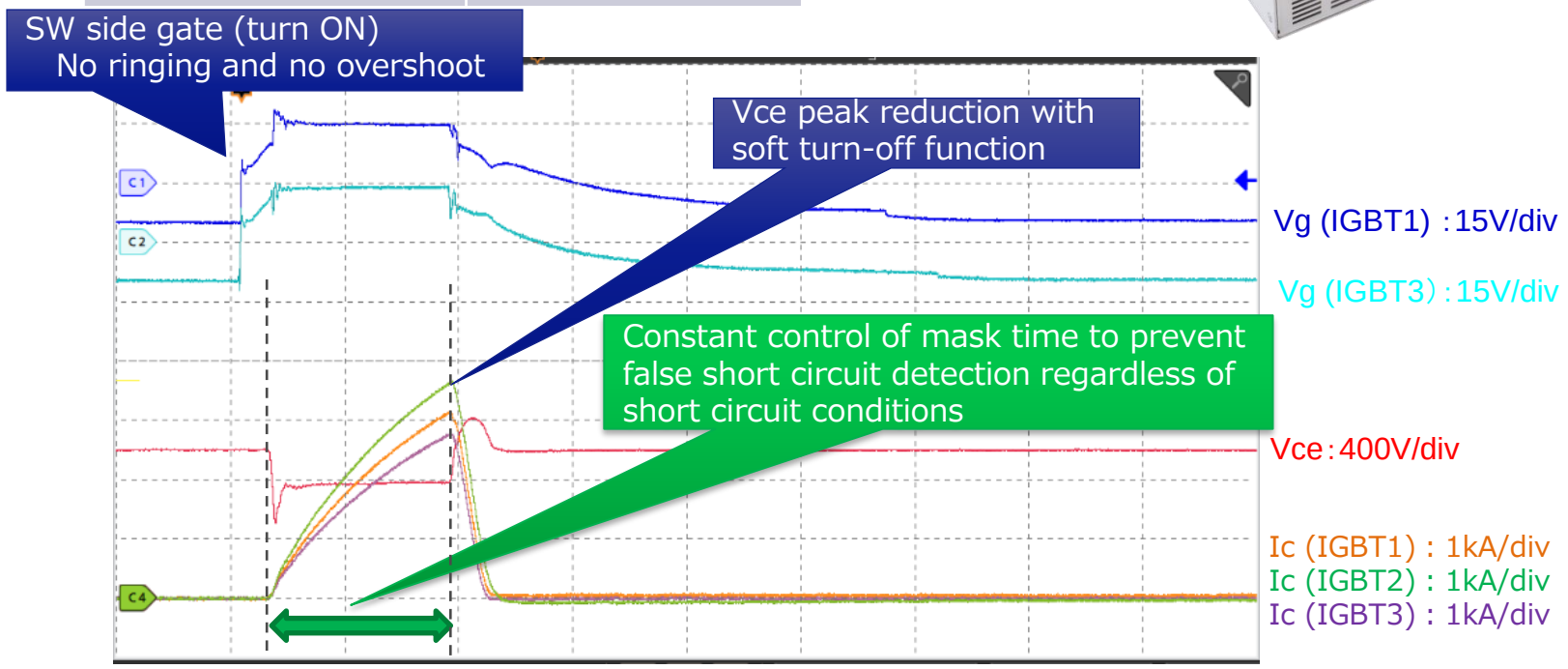
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3) Power Stack operation reference data

Short circuit test (Load short / reference only)

Item	Description
IGBT device	CM1200DW-34T
Gate driver	2LG01ADDC11M
Gate voltage	+15V/-10V
Gate resistor	+0.47Ω/−0.47Ω
DC-link voltage (VCC)	1000V
Load inductance	170nH (L101, 102, 103)
Junction temperature	25℃





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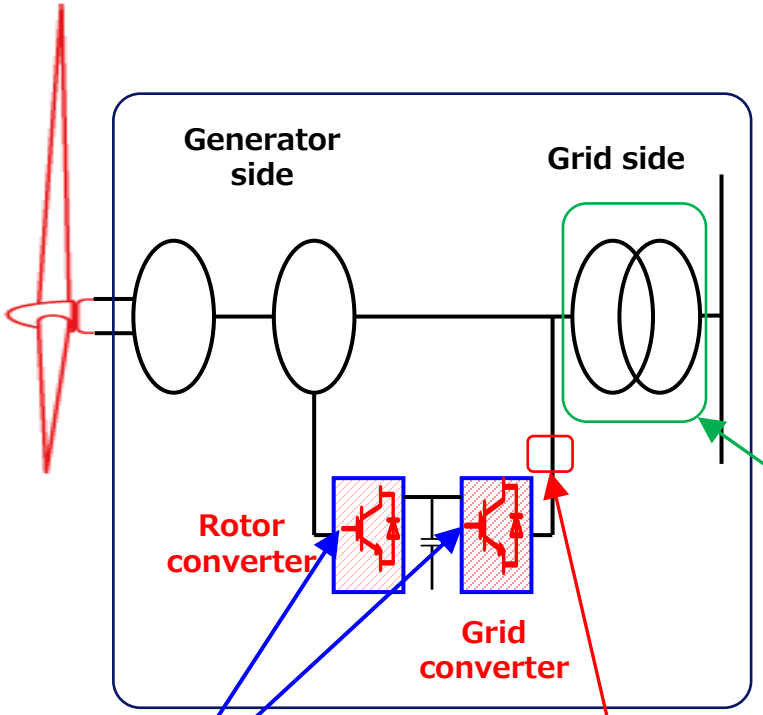
1) Power Stack Information
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C) Introduction of One Tamura

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C) Introduction of One Tamura (Wind Power converters)







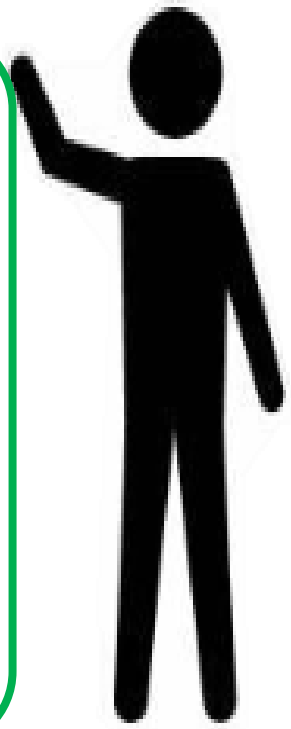
Gate Driver Unit



Current sensor



Reactor

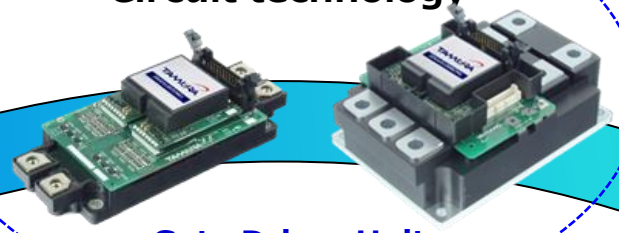


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C) Introduction of One Tamura (General application)

Power electronics technology and main products

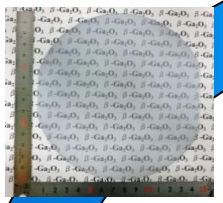
Gate driver
Circuit technology



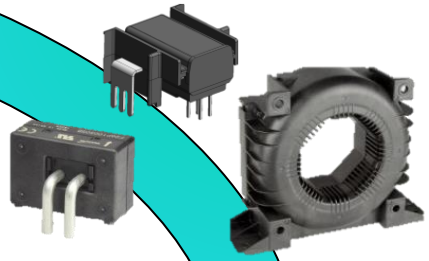
Gate Driver Unit

Device technology
Novel Crystal Technology, Inc.

Ga_2O_3



Module technology
Current sensor



Power electronics technology and main products

Soldering technology

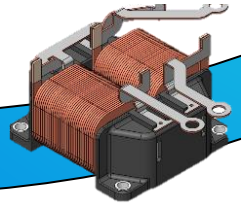


Electric Chemicals
Soldering material
Die attach material
TIM material

Reflow soldering system



Automotive reactor



Reactor for PF
(2 in 1)

Passive components

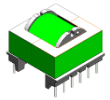


Reactor
Trans
Coil

Large reactor/ transformer



Toroidal coil

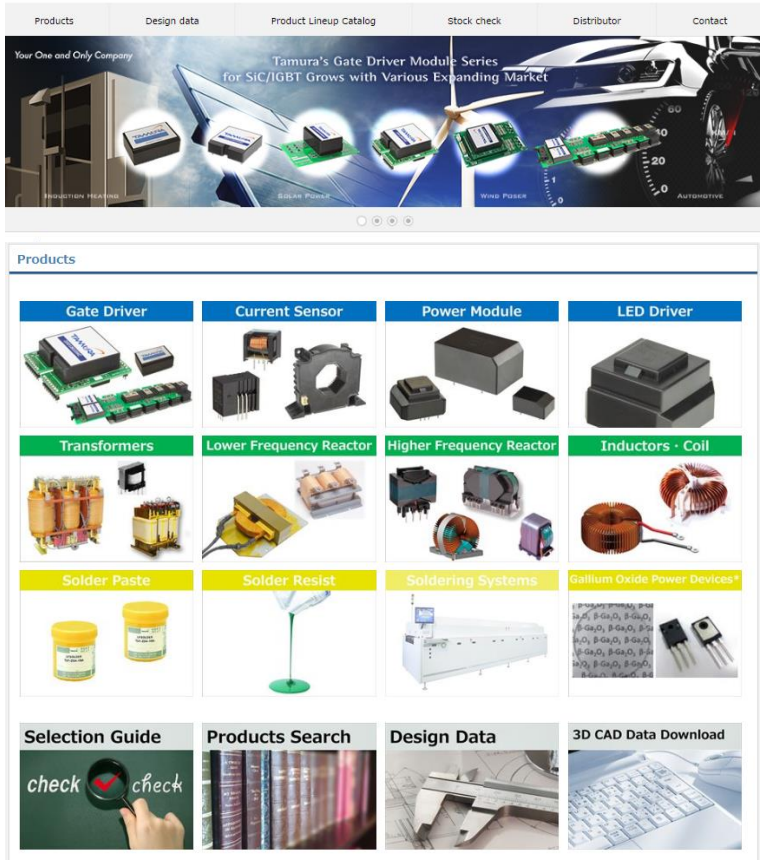


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Appendix) Information & Contact

Please visit our website!



WEB

Tamura Gate Driver

- Let's know more TAMURA products
  - Special movie
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  - Matching data with power module
  - 3D data to design!
- One-click to purchase
  - from the check stock!

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