

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.



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



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B) Power Stack application reference

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1) Tamura Gate Driver 7 key points

Space saving / 100% on the IGBT

High-speed response & accuracy

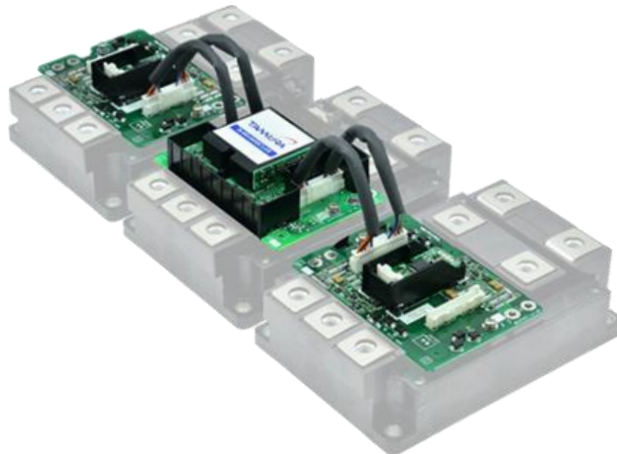
Suitable for parallel drive

High Power DC-DC converter

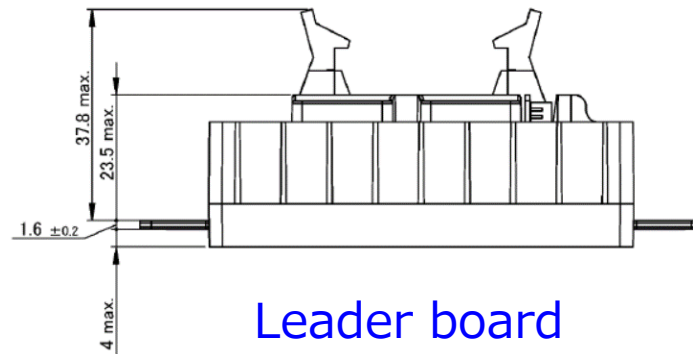
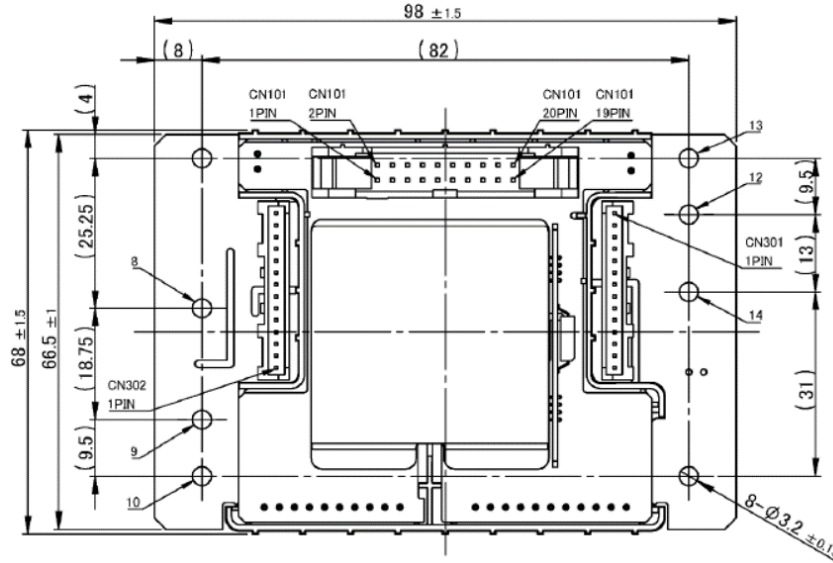
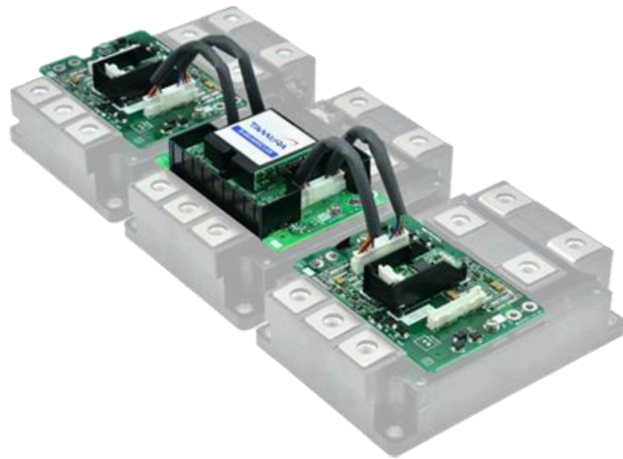
Low stray capacity

Wider input voltage

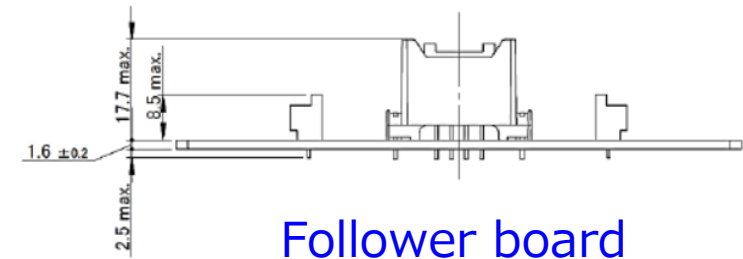
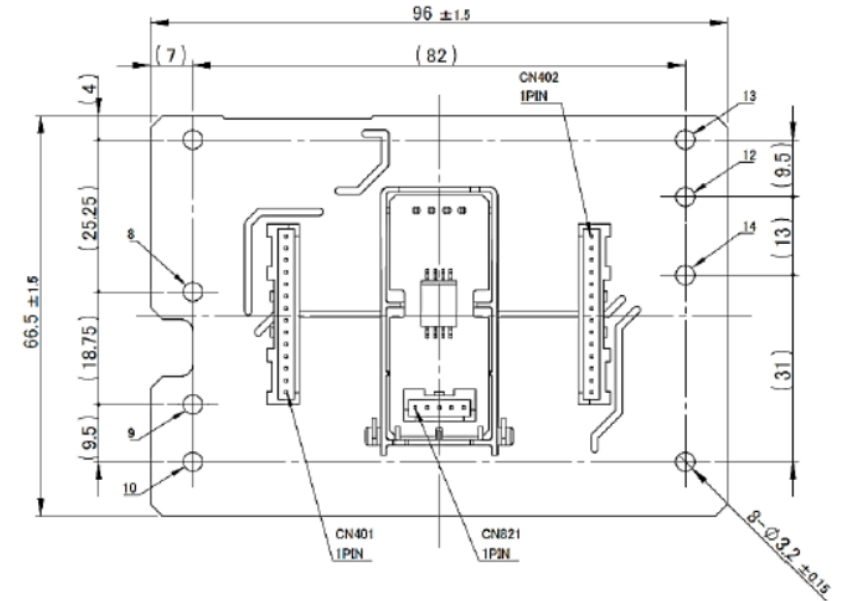
Various protections



2) Appearance



Leader board



Follower board

Unit: mm

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

* Specifications may be changed.

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 	2LG02ACxC11M *1 2LG??zyxC11M-?? *2	5.2kHz (max) /units	Contact us
				Follower 	2LG02ACZC11S *1 2LG??zyZC11S-?? *2		
		1200	CM1200DW-24T	Leader 	2LG02ACxC11M *1 2LG??zyxC11M-?? *2	3.0kHz (max) /units	Contact us
				Follower 	2LG02ACZC11S *1 2LG??zyZC11S-?? *2		
	1700	800	CM800DW-34T CM800DW-34TA	Leader 	2LG01ACxC11M *1 2LG??zyxC11M-?? *2	10.2kHz (max) /units	Contact us
				Follower 	2LG01ACZC11S *1 2LG??zyZC11S-?? *2		
		1200	CM1200DW-34T	Leader 	2LG01ACxC11M *1 2LG??zyxC11M-?? *2	7.5kHz (max) /units	Contact us
				Follower 	2LG01ACZC11S *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

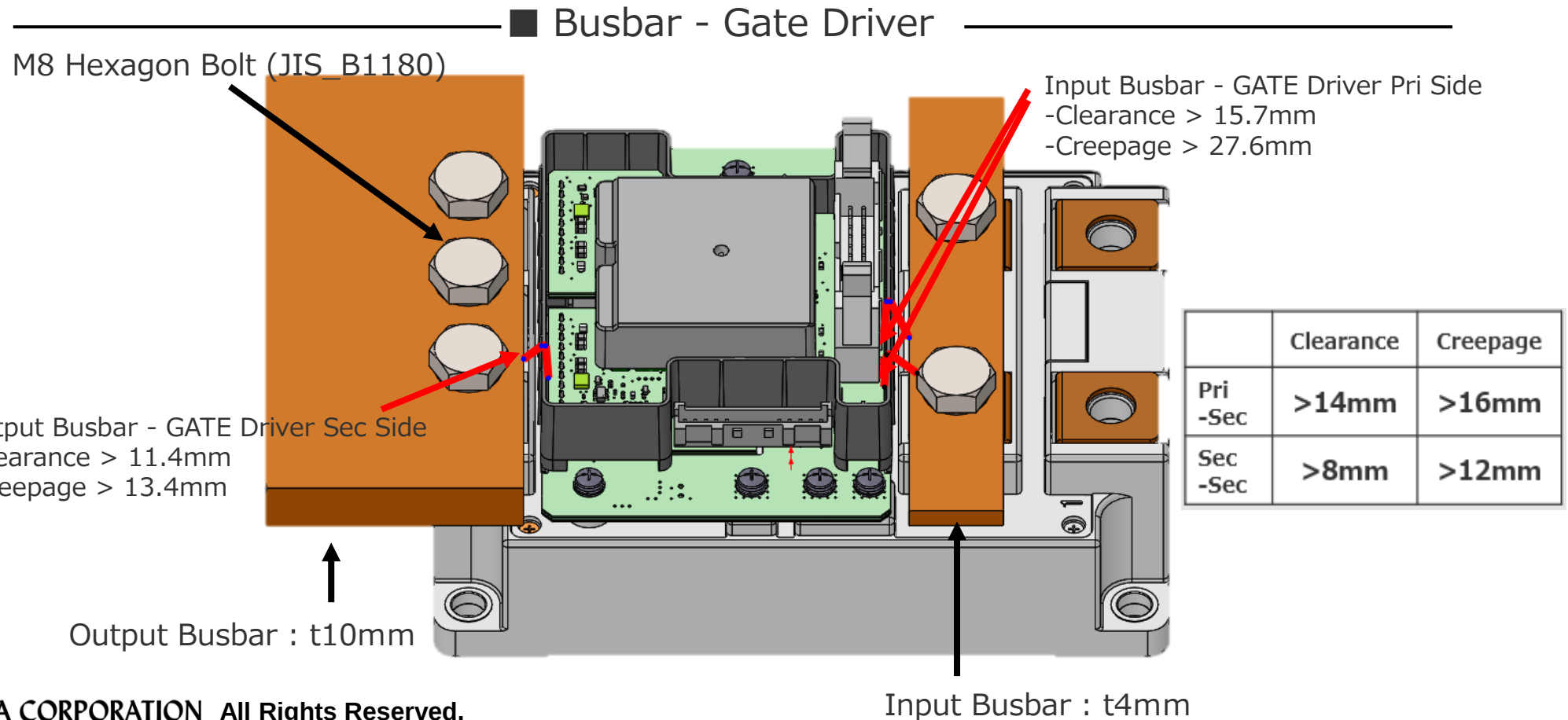
z: Thermistor Isolated Amplifiers: "A"=>Yes / "0"=>None

?: Semi-optimized code

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 $\leq 1000\text{Vrms}$ (1500Vdc), Operating voltage $\leq 1600\text{Vrms}$, OVCI, PD2, 4000m
- Enhanced isolation: Systems voltage $\leq 1000\text{Vrms}$ (1500Vdc), Operating voltage $\leq 1250\text{Vrms}$, OVCI, PD2, 2000m



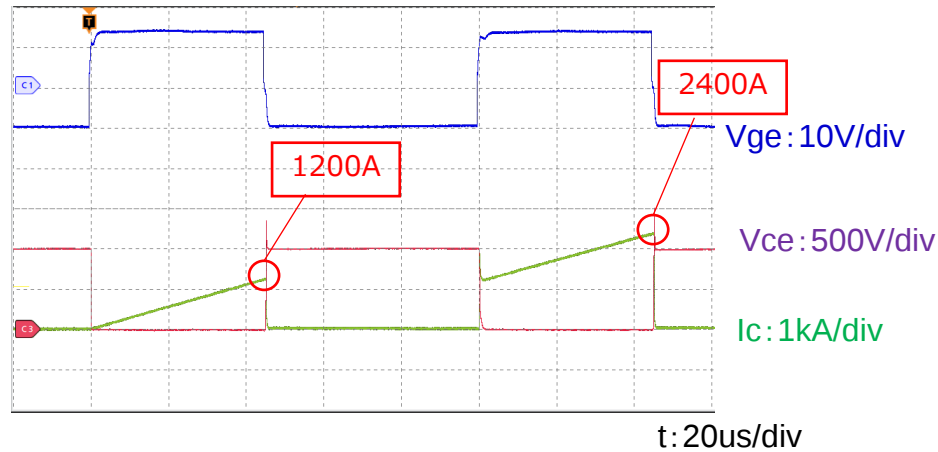
5) Single Operation Matching Data

2 pulse test

N-side

Vce, Ic, Vge

Tj=25°C, Vcc=1000V



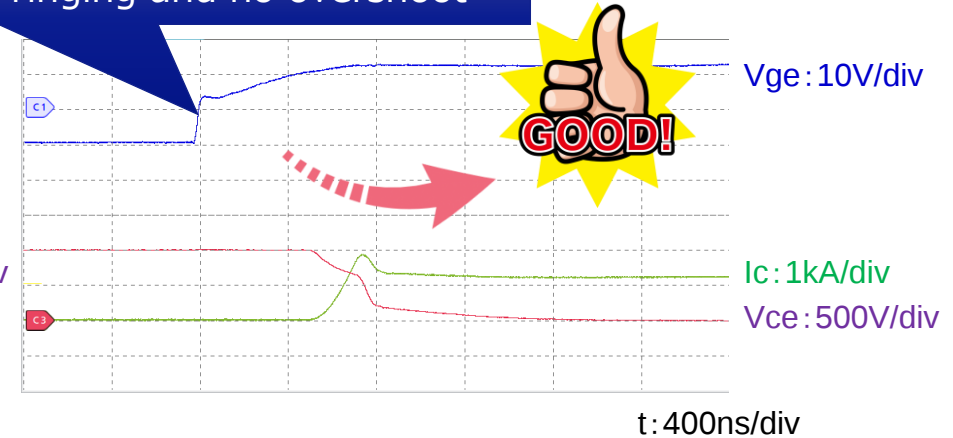
【Measured value】

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 on_1200A】

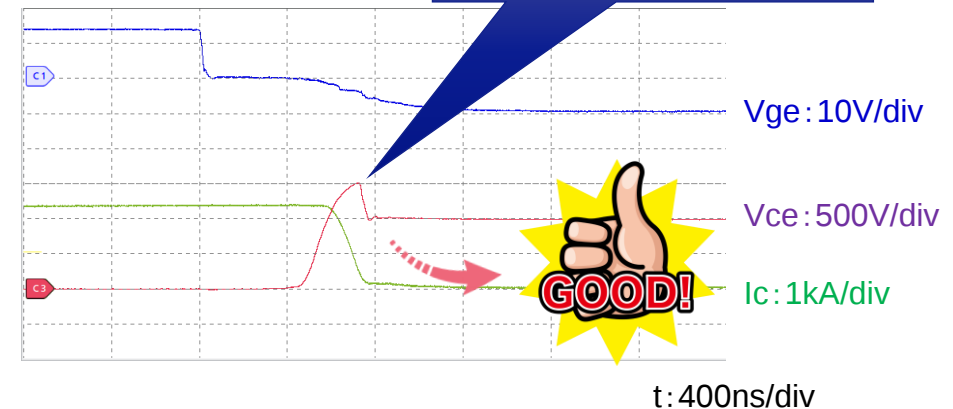
CM1200DW-34T

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



【Turn off_2400A】

Vce peak reduction with
soft turn-off function



5) Single Operation Matching Data

Short circuit test

N-side

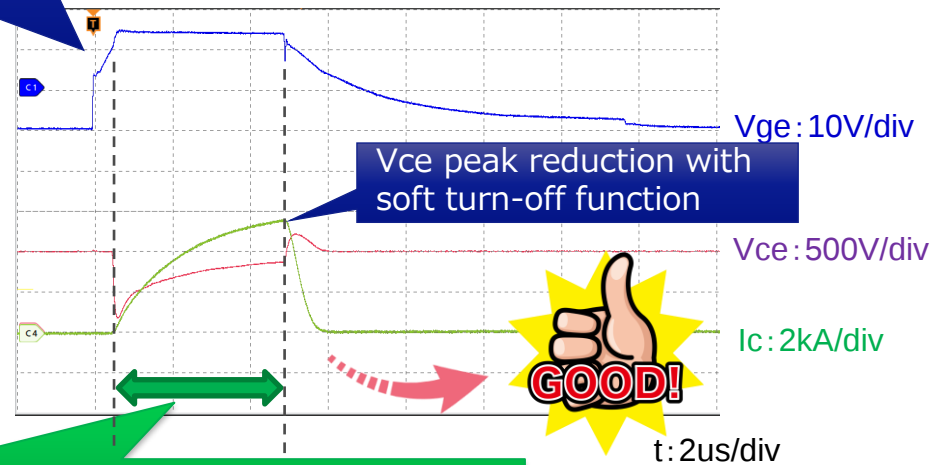
$T_j = 25^\circ\text{C}$, $V_{cc} = 1000\text{V}$, Load inductance : 170nH

【Measured value】

- $V_{ce}(\text{peak})$: 1213V
- $I_c(\text{peak})$: 5659A
- t_w : 5.3 μs

V_{ce}, I_c, V_{ge}

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

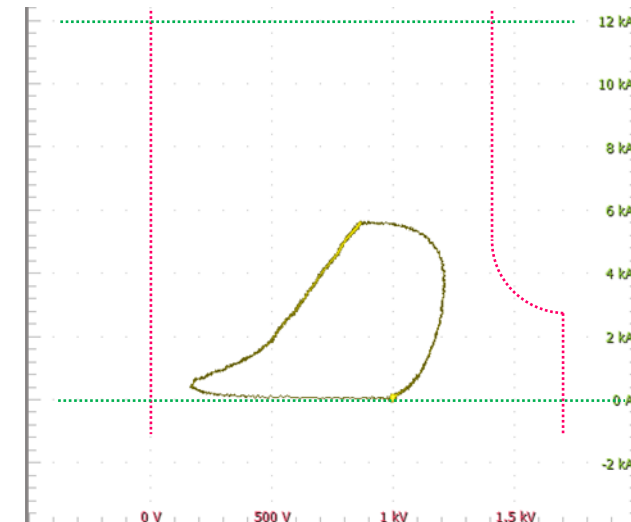


Constant control of mask time to prevent false short circuit detection regardless of short circuit conditions

CM1200DW-34T

This driver suppresses the V_{ce} 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)

SOA



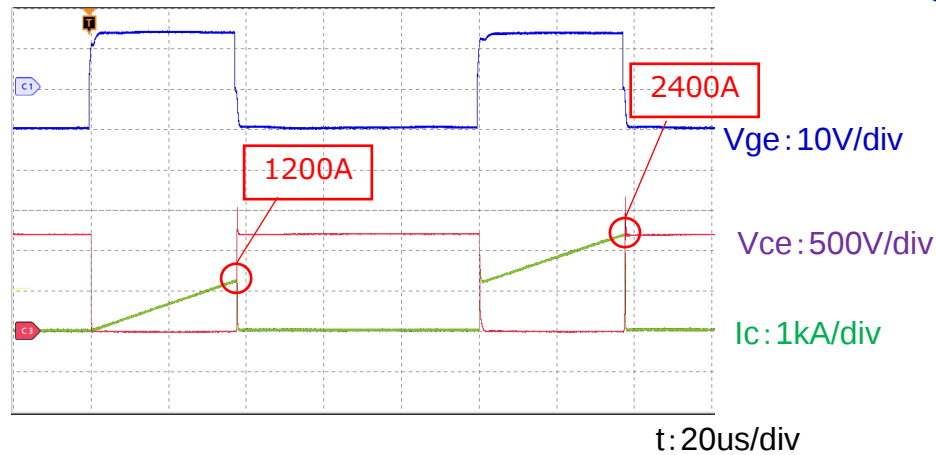
5) Single Operation Matching Data

2 pulse test

N-side

Vce, Ic, Vge

Tj=25°C, Vcc=1200V



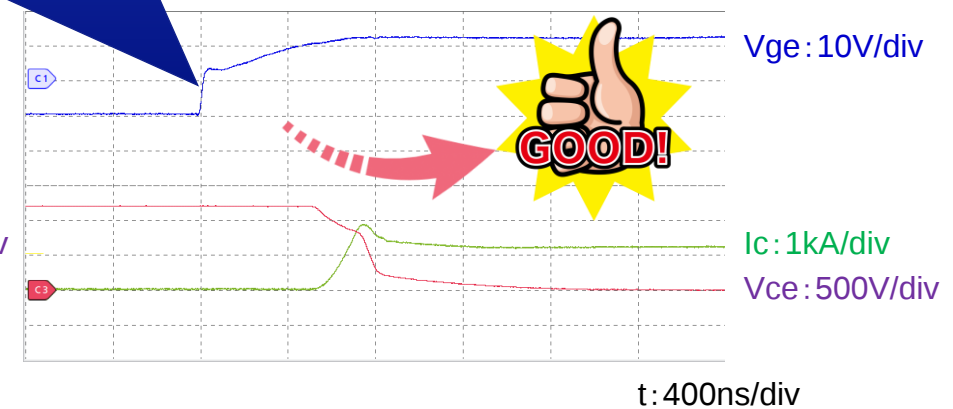
【Measured value】

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

CM1200DW-34T

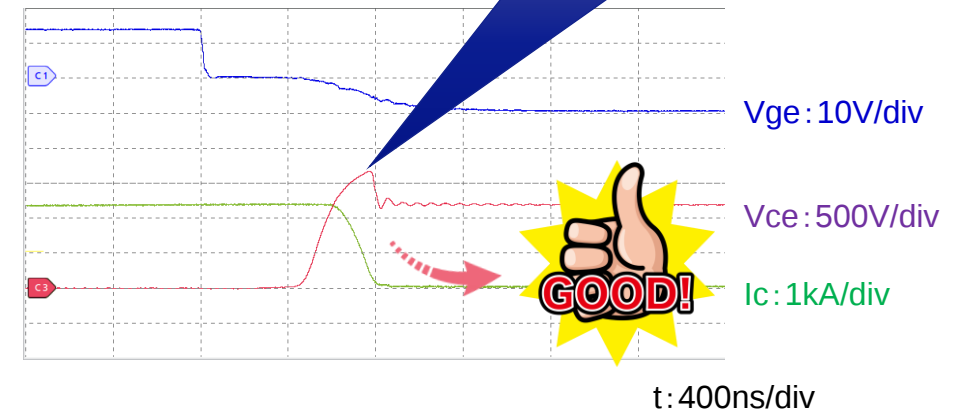
【Turn on_1200A】

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



【Turn off_2400A】

Vce peak reduction with
soft turn-off function



5) Single Operation Matching Data

Short circuit test

N-side

$T_j = 25^\circ\text{C}$, $V_{cc} = 1200\text{V}$, Load inductance : 170nH

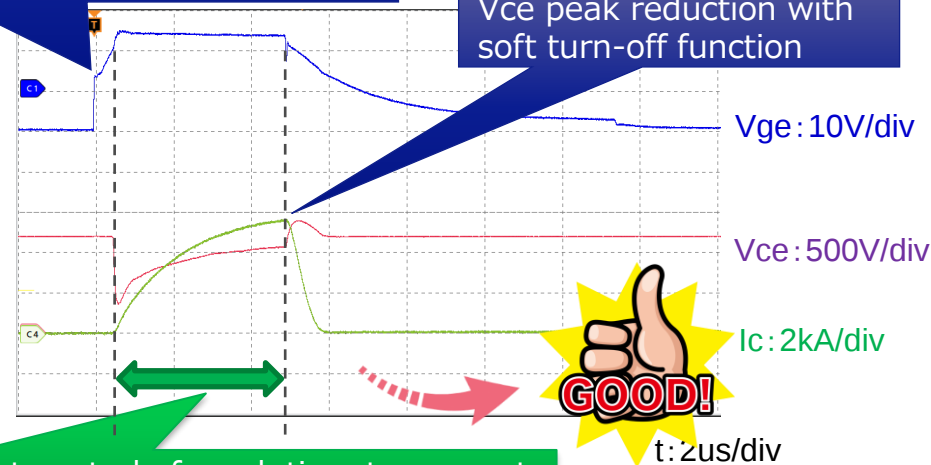
【Measured value】

- $V_{ce}(\text{peak})$: 1395V
- $I_c(\text{peak})$: 5718A
- t_w : 5.3 μs

V_{ce}, I_c, V_{ge}

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

V_{ce} peak reduction with
soft turn-off function

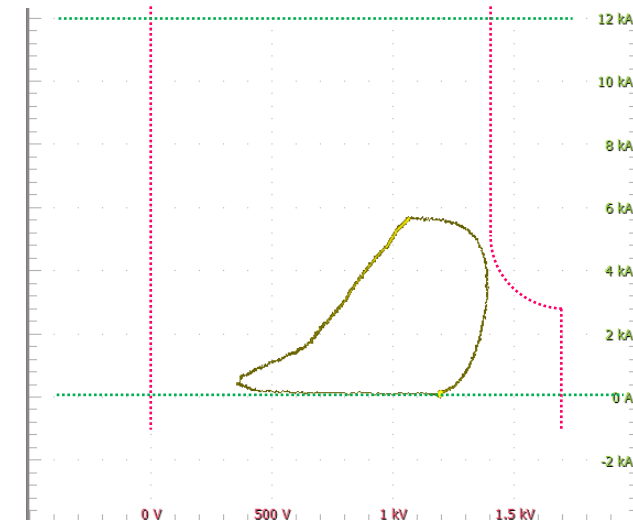


Constant control of mask time to prevent
false short circuit detection regardless of
short circuit conditions

CM1200DW-34T

This driver suppresses the V_{ce} 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)

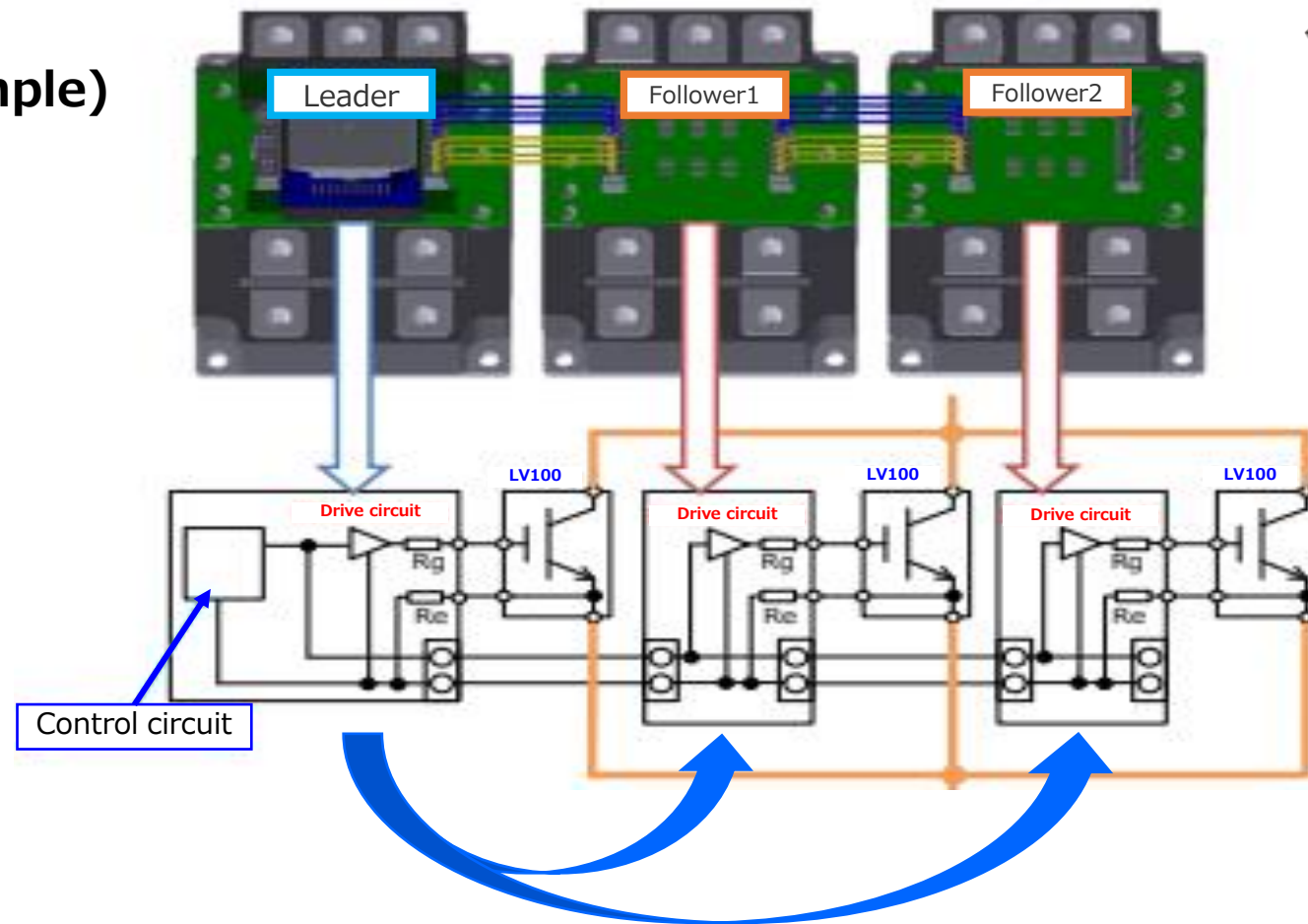
SOA



6) Parallel drive configuration

Leader and Follower Functions

Example)



★ Leader board can be placed anywhere!

Please refer to page 21 current balance data.

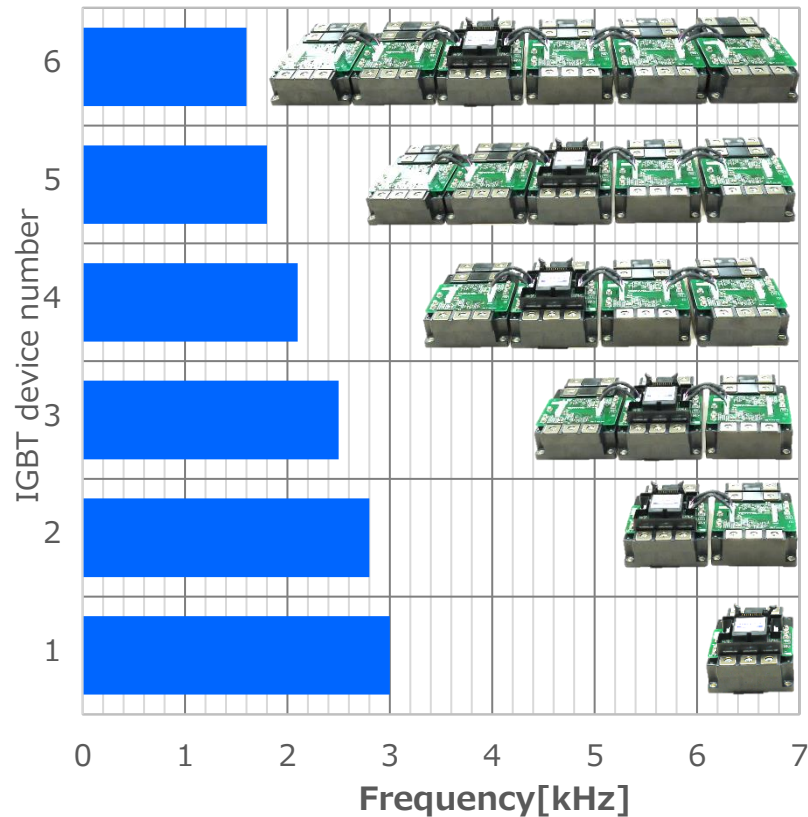
6) Parallel drive configuration (reference only)

1200V

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

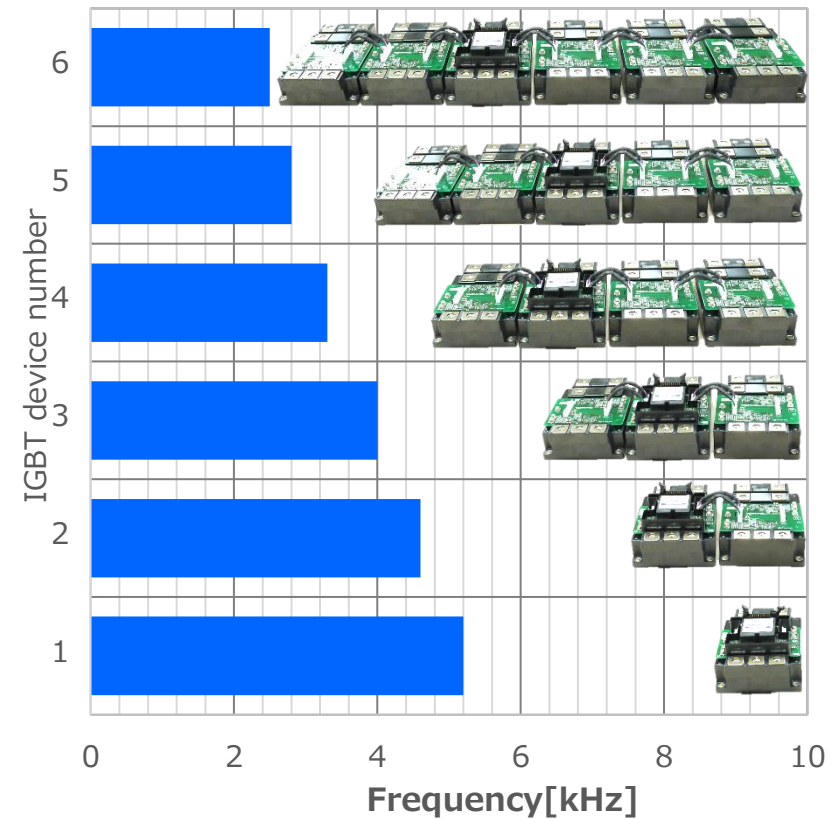
• CM1200DW-24T

2LG02xxxx11M/2LG02xxZx11S



• CM800DW-24T

2LG02xxxx11M/2LG02xxZx11S



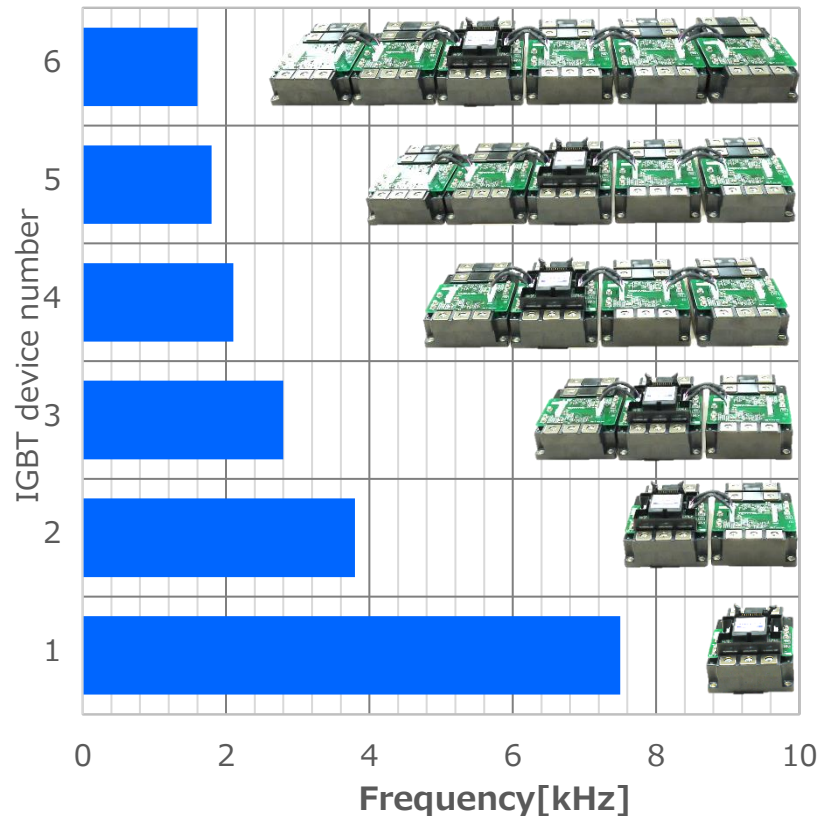
6) Parallel drive configuration (reference only)

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

1700V

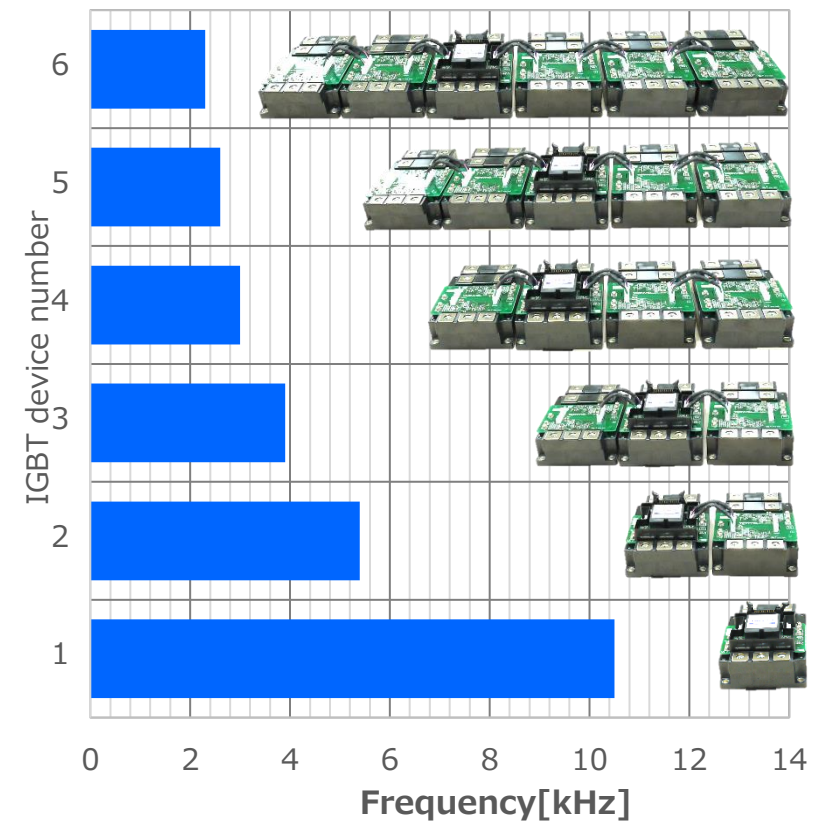
• CM1200DW-34T

2LG01xxxx11M/2LG01xxZx11S



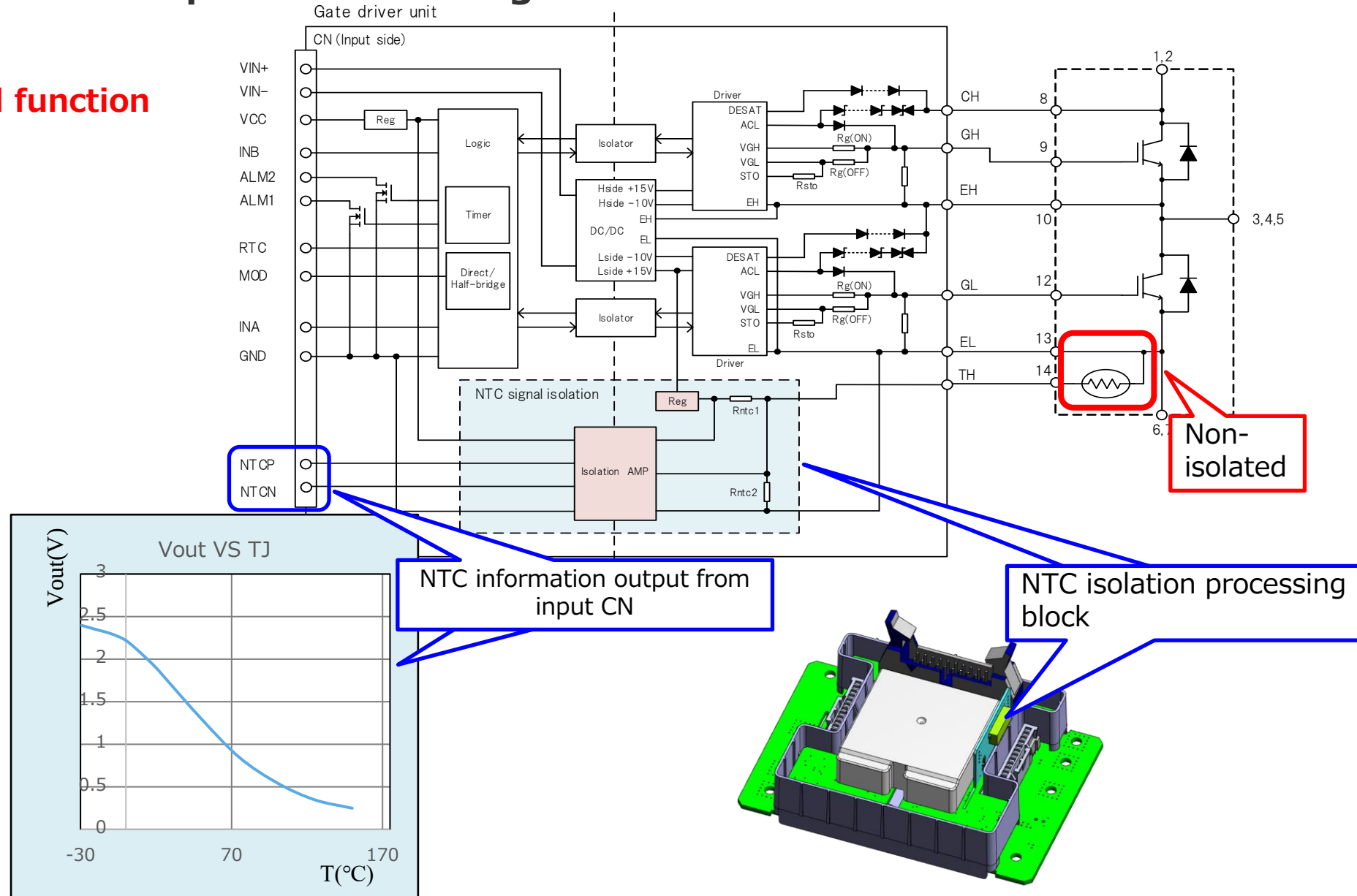
• CM800DW-34T/CM800DW-34TA

2LG01xxxx11M/2LG01xxZx11S



7) Isolated temperature sensing

Optional function



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- 3) Power Stack operation reference data (2 pulse / Short circuit)

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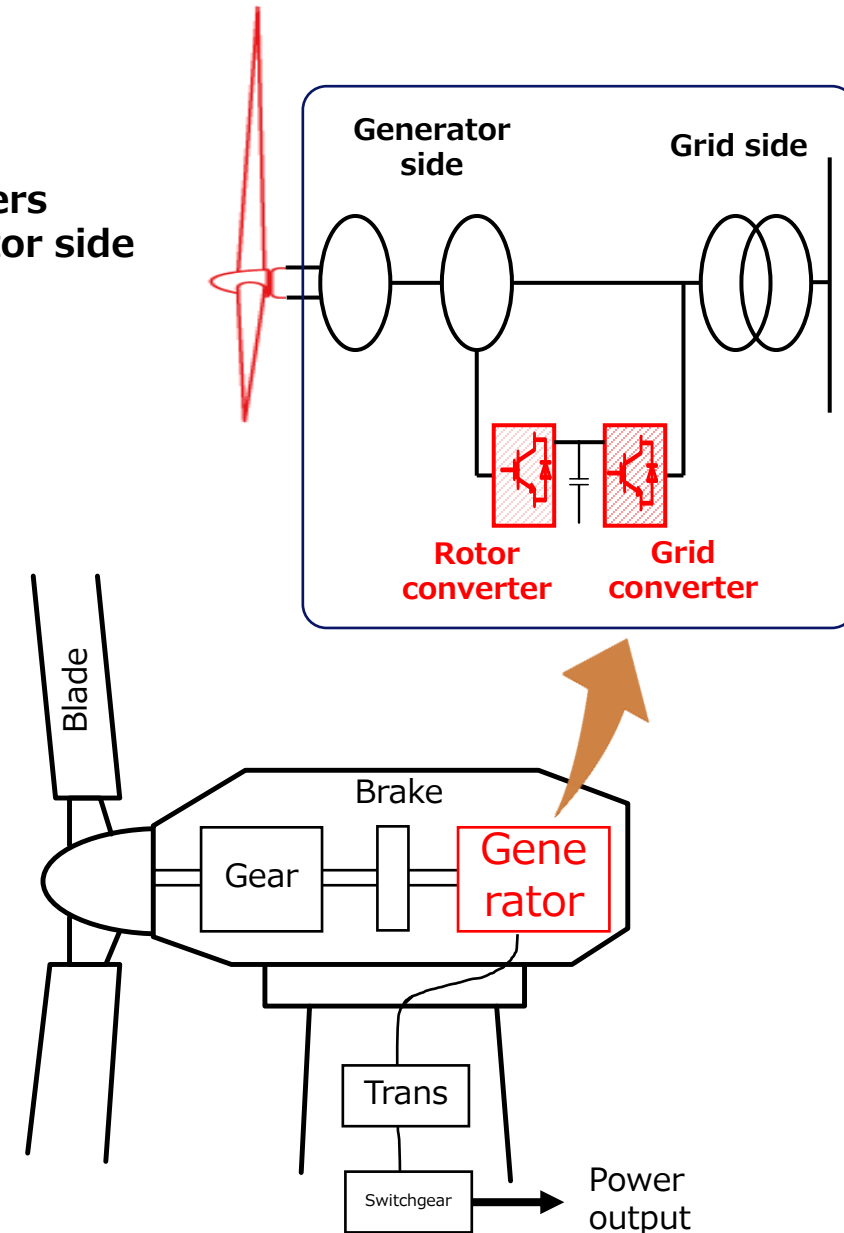
1) Power Stack Information

Reference information

Reference application : Wind Power converters
for Grid side and Rotor side

Install type : Onshore

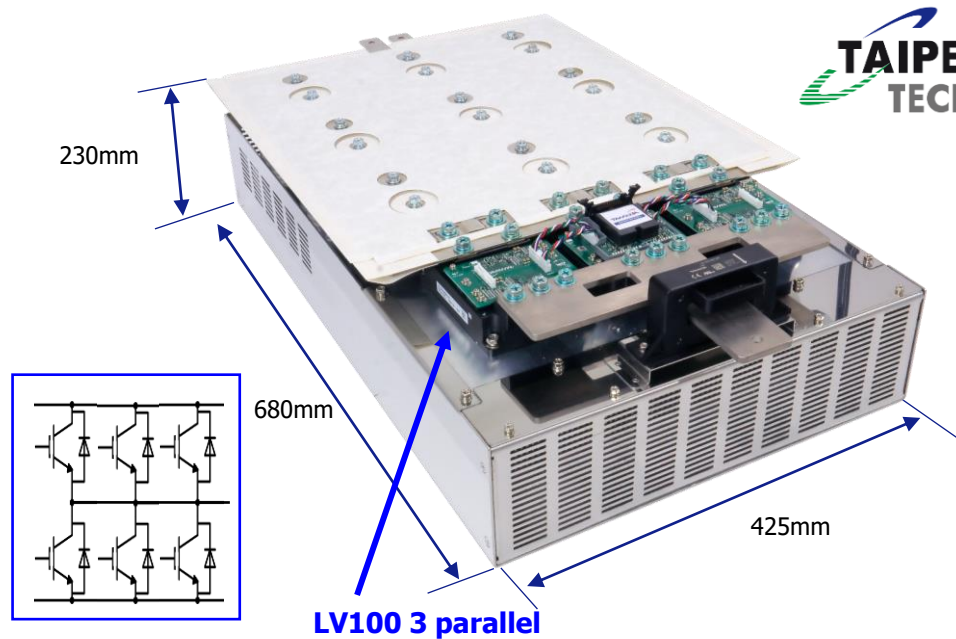
Circuit solution : 2 Level



2) Power Stack specification reference

Joint Development of National TAIPEI University of Technology - Tamura

Cooperated by Mitsubishi Electric



TAIPEI
TECH



Follower PCB1
(2LG01ADZC11S)

Leader PCB
(2LG01ADDC11M)

Follower PCB2
(2LG01ADZC11S)

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

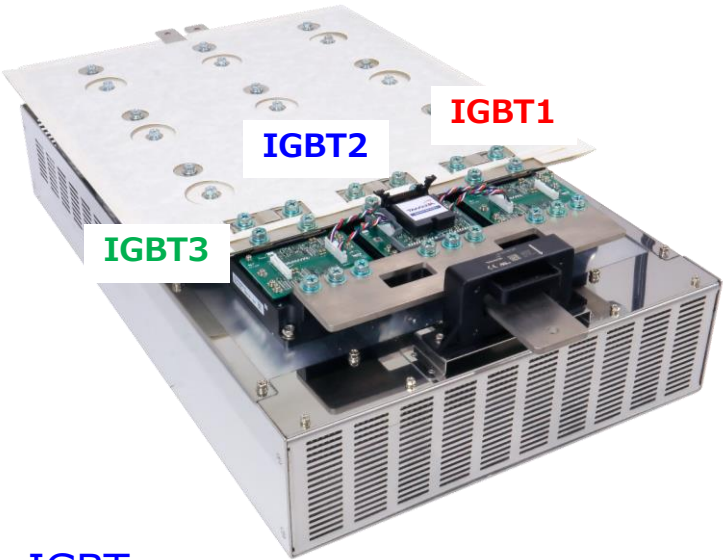
Gate Driver "2LG01ADDC11M" (TAMURA)
 "2LG01ADZC11S" (TAMURA)

Current Sensor "L51S2T5D15" (TAMURA)

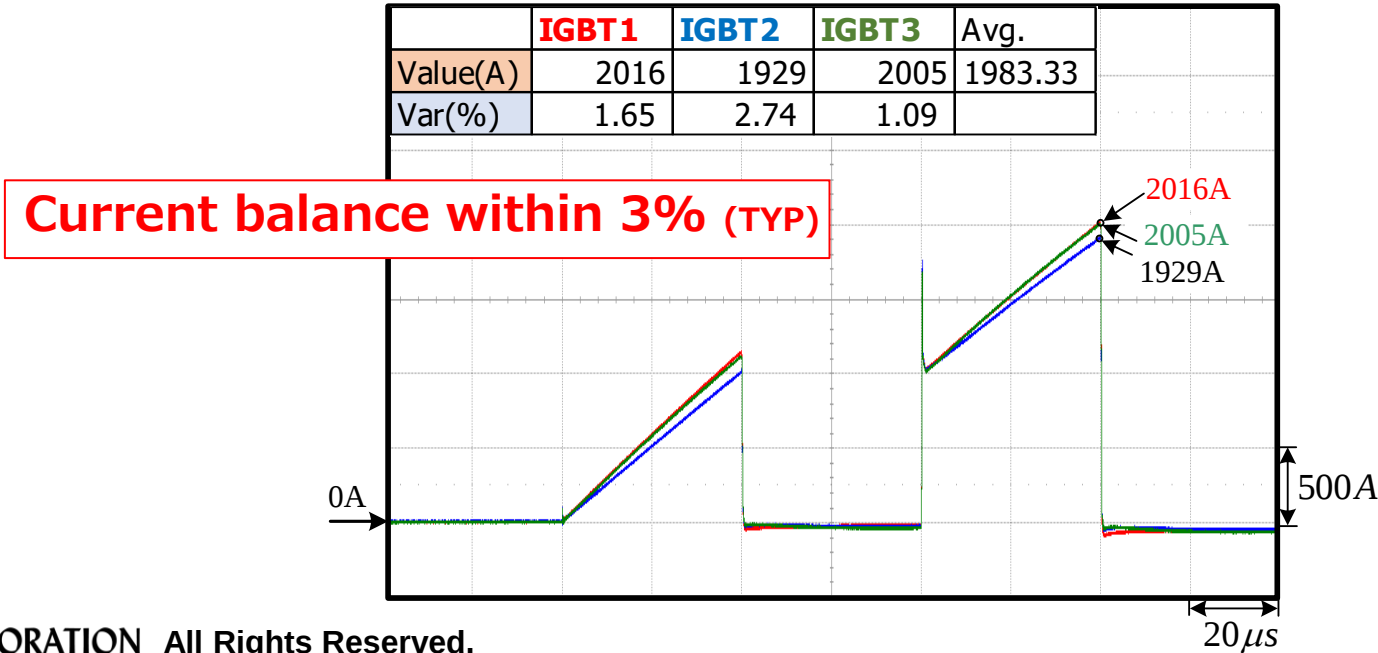
3) Power Stack operation reference data

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	11μH
Junction temperature	25℃

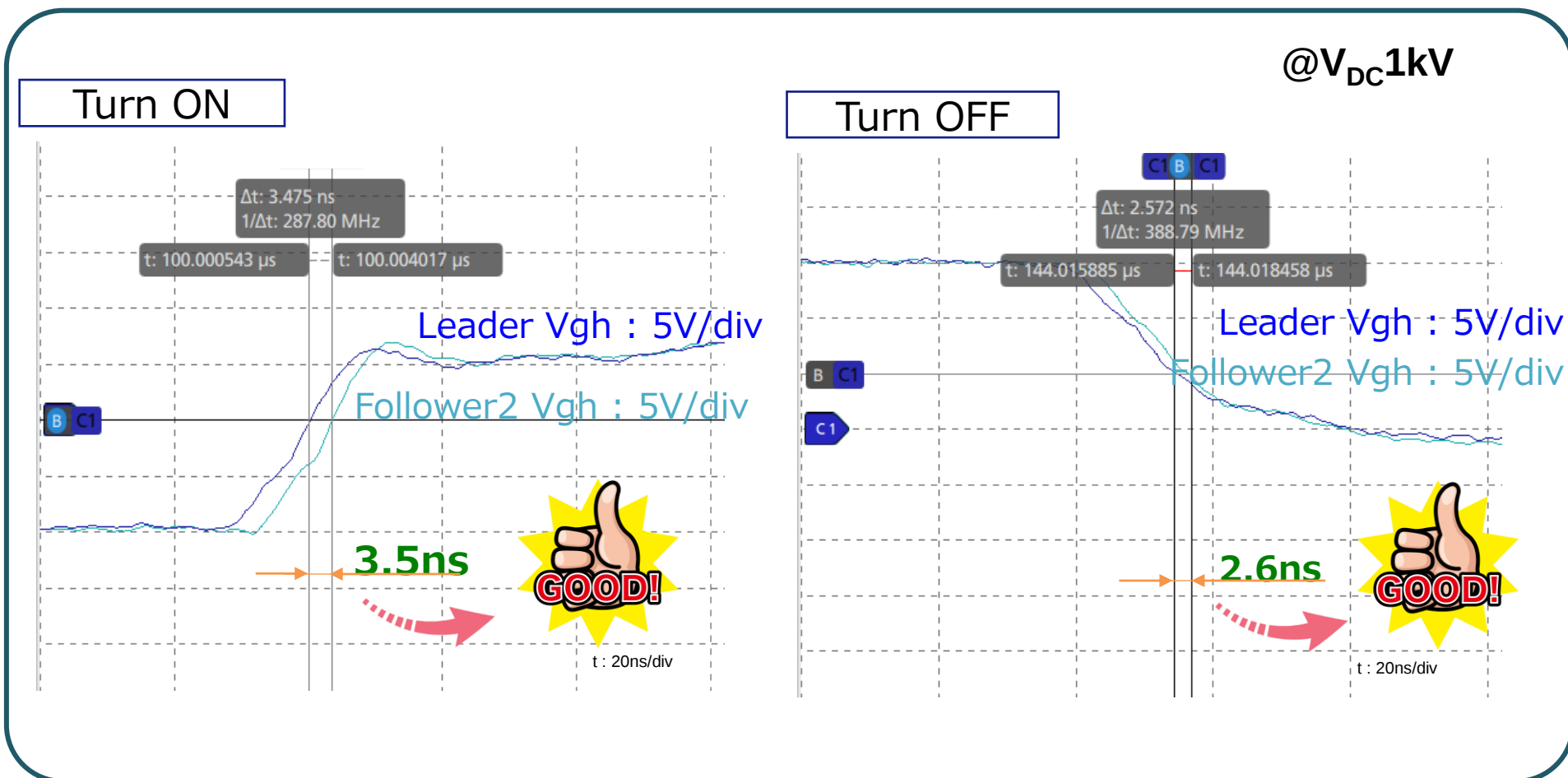


Current waveform of each IGBT



3) Power Stack operation reference data

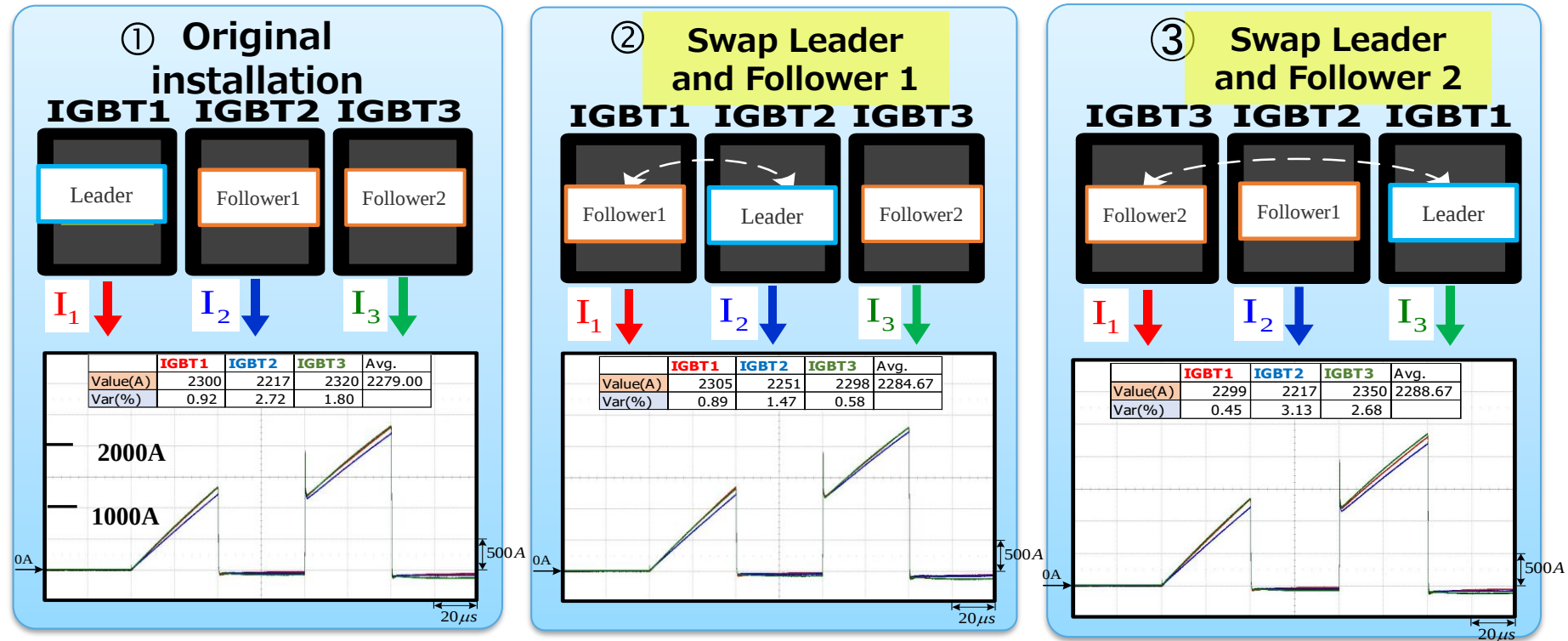
Gate signal balance



Follower drive signal delay is very small.

3) Power Stack operation reference data

Current balance

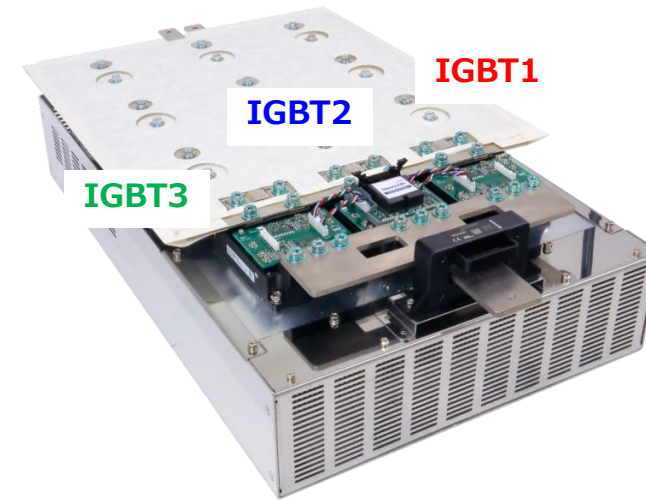


The current balance does not change even when the position of the gate driver is changed.
 = Do not worsen the current balance in the gate driver

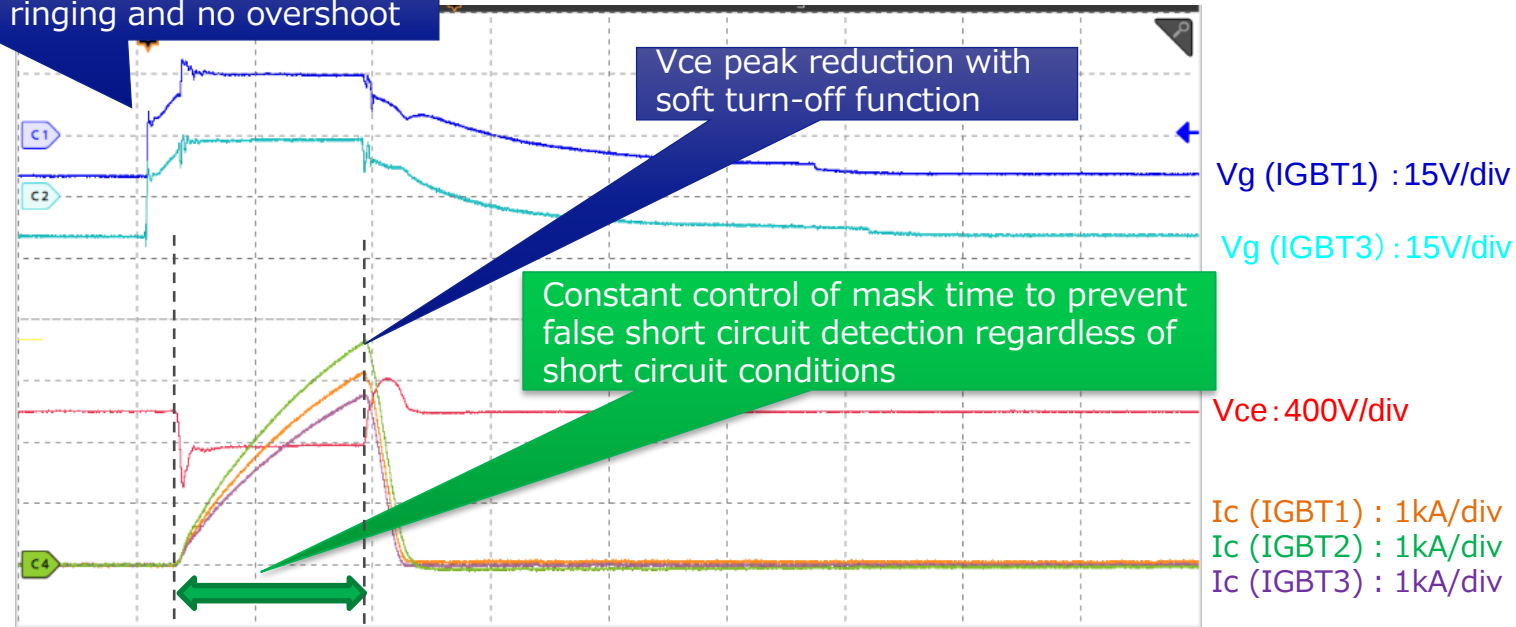
3) Power Stack operation reference data

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°C



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



t: 2μs/div

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- 7) Isolated temperature sensing

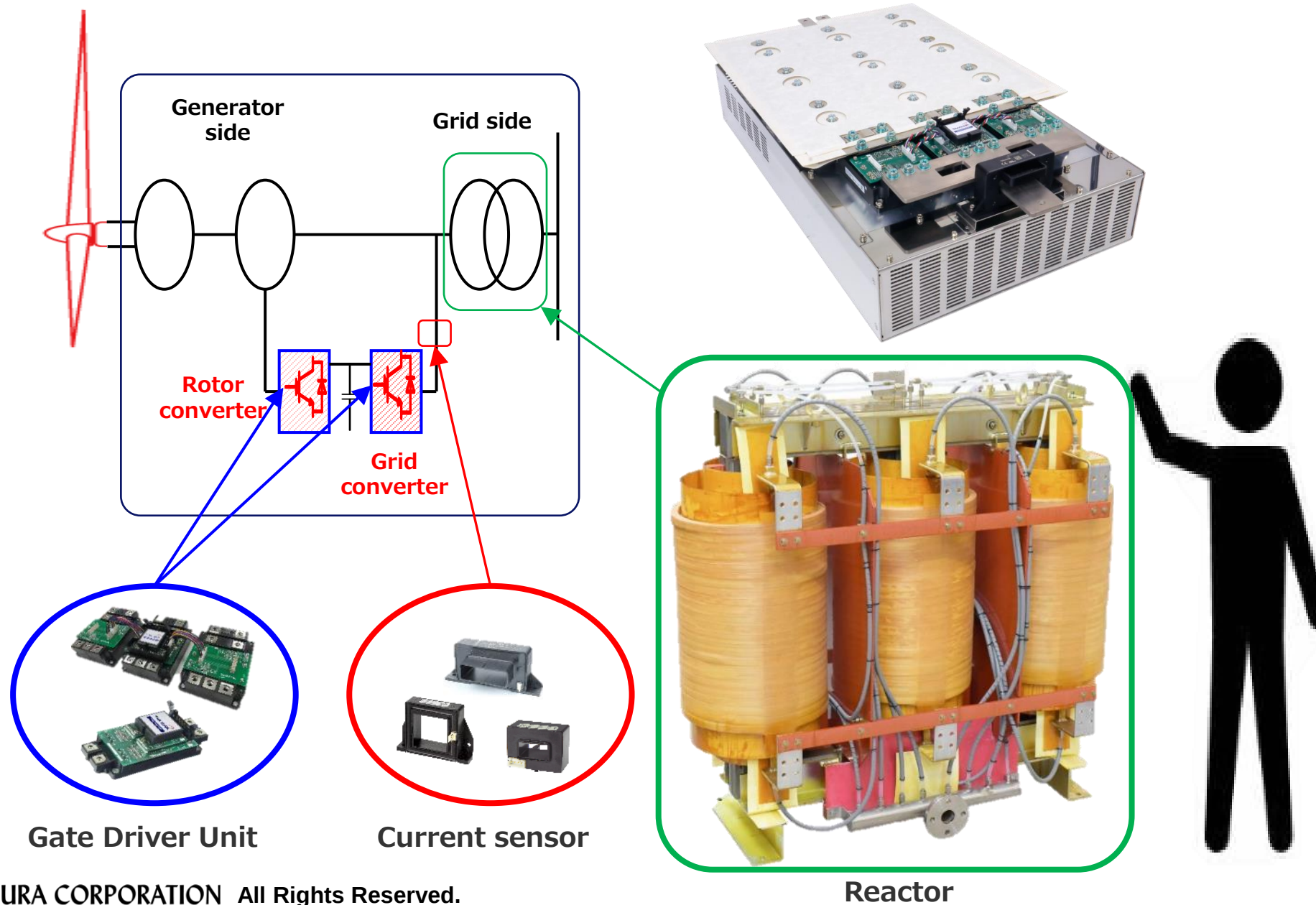
B) Power Stack application reference

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C) Introduction of One Tamura

Appendix) Contact person

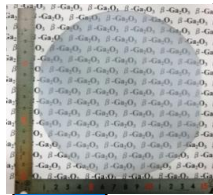
C) Introduction of One Tamura (Wind Power converters)



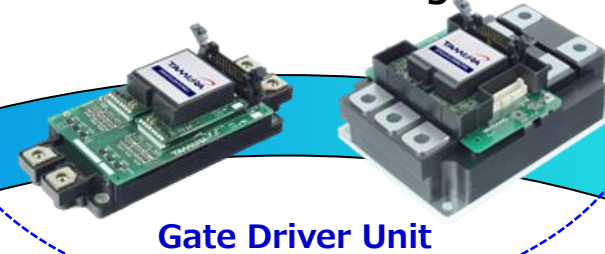
C) Introduction of One Tamura (General application)

Power electronics technology and main products

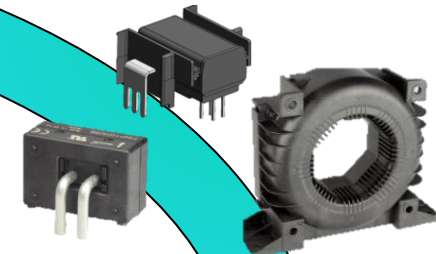
Device technology
Novel Crystal Technology, Inc.
 Ga_2O_3



Gate driver
Circuit technology



Module technology
Current sensor



Soldering technology



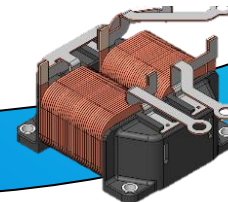
Electric Chemicals
Soldering material
Die attach material
TIM material

Power electronics technology and main products

Reflow soldering system



Automotive reactor

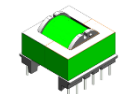


Passive components



Reactor
Trans
Coil

Large reactor/ transformer



Appendix) Information & Contact

Please visit our website!



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

Feel free to inquire! ↓

<https://www.tamuracorp.com/electronics/en/contact/>