

Gate drivers that bring out the performance of Mitsubishi Electric **NX SiC industrial Power Modules** (**FMF600DXE-24BN**)



Rev A

TAMURA

TAM-GDM-00072

Supported by Mitsubishi Electric

Issued on 1st Sep '25 Unit division HQ Japan

© TAMURA CORPORATION All Rights Reserved

Index

- 01 Benefit of Mitsubishi Electric – Tamura collaboration
- 02 Application
- 03 Five features obtained by combining NX type SiC industrial Power Modules(FMF600DXE-24BN) and 2EG-B series
- 04 Introduction of Tamura Gate driver
- 05 Matching data (2-pulse / Short circuit)
- 06 Product tree and line-up

Gate drivers that bring out the performance of NX SiC Power Modules

1. Benefit of Mitsubishi Electric – Tamura collaboration

Provide of main components for medium frequency inverter!

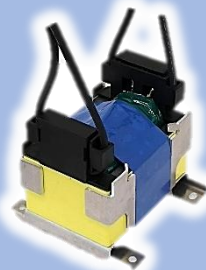


NX type SiC industrial Power Modules
(FMF600DXE-24BN) by Mitsubishi Electric

Power Module



Gate driver



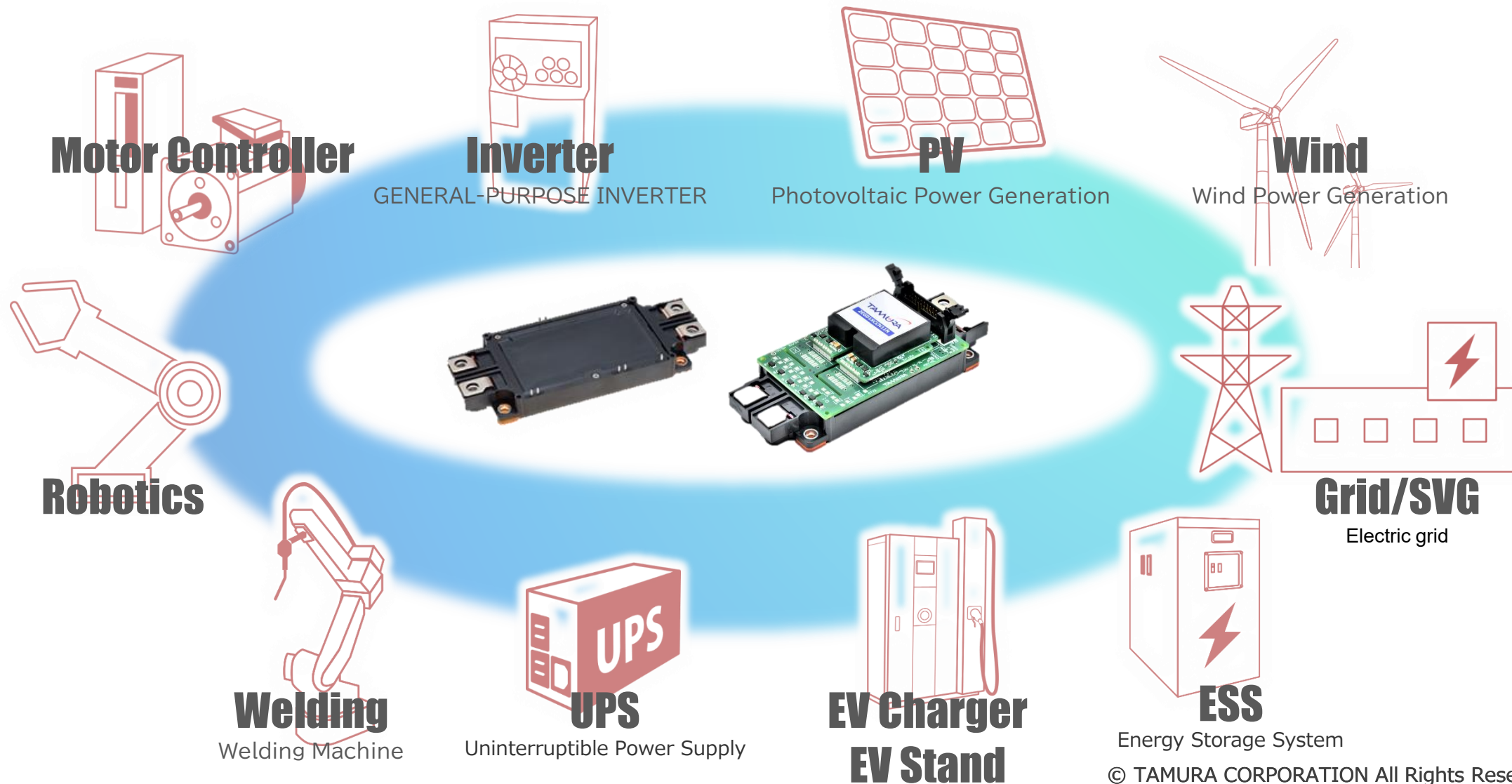
Reactor / Trans



Current sensor

Gate drivers that bring out the performance of NX SiC Power Modules

2. Application



Gate drivers that bring out the performance of NX SiC Power Modules

2. Application

EV fast charger (100kW~)



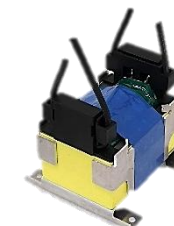
Power semiconductors



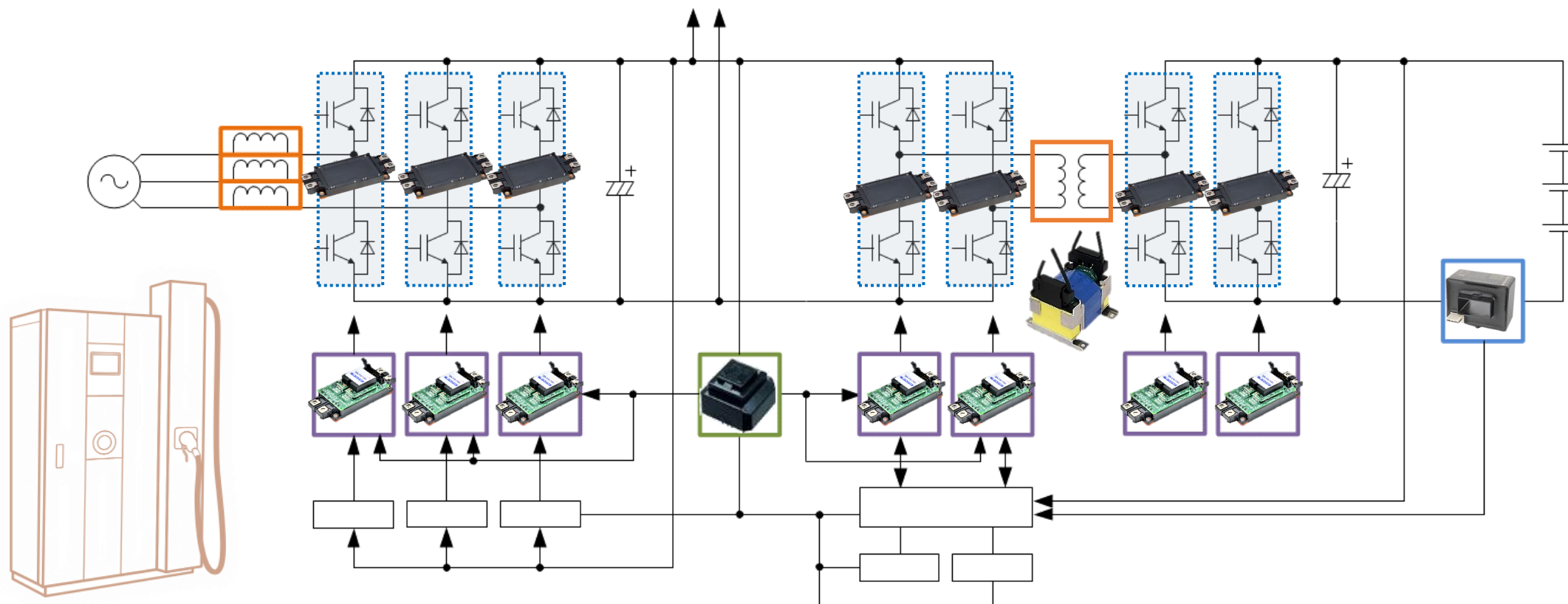
Gate Driver



Current sensor



SW-Trans



Gate drivers that bring out the performance of NX SiC Power Modules

3. Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Features of NX type SiC industrial Power Modules

Feature① Short circuit tolerance is lower than Si

Feature② Low threshold voltage $V_{GS(th)}$ (1.8V~3.2V)

Feature③ $V_{GS(-)}$:Low tolerance(Less than -12V)

Feature④ dV/dt can be set high

Feature⑤ High frequency operation is possible

Gate
Driver
solves all
problems!

Gate drivers that bring out the performance of NX SiC Power Modules

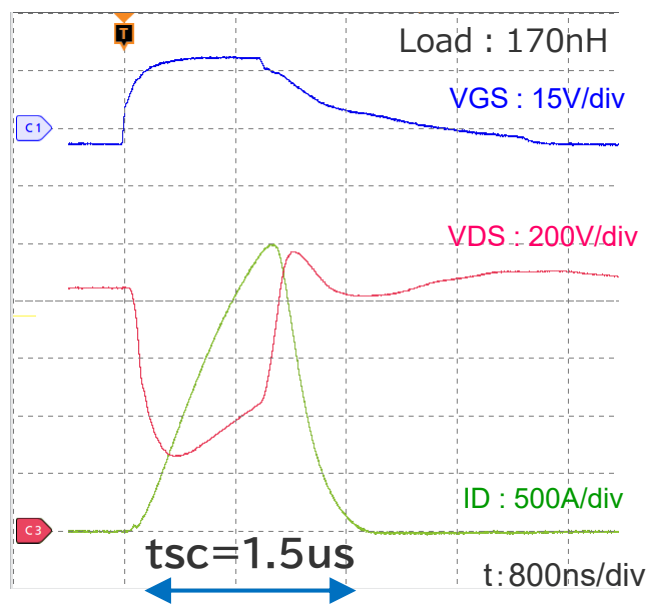
3. Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Feature ① Short circuit tolerance is lower than Si

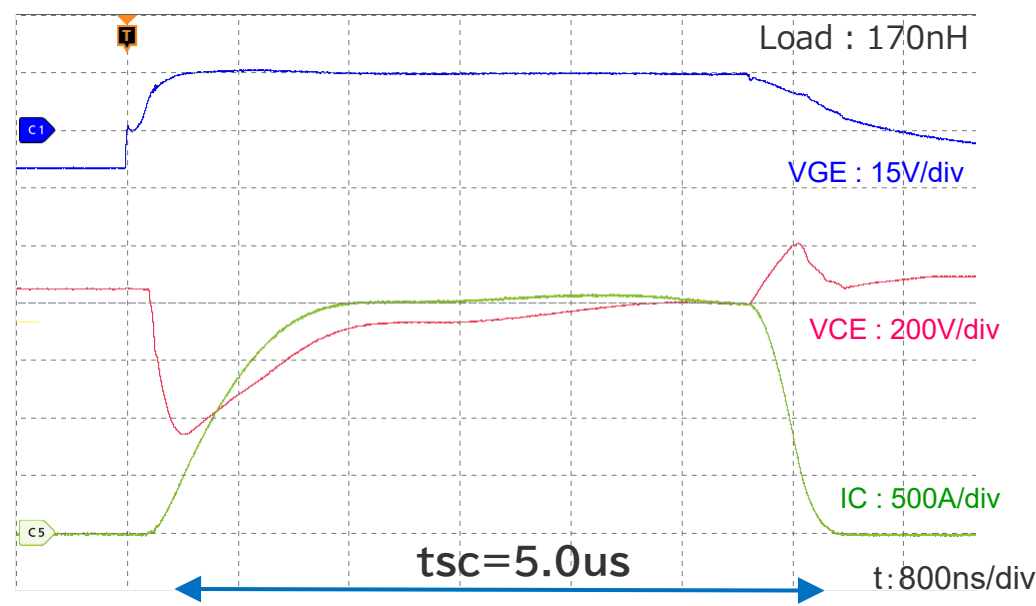
- Small chip area -----
- ·Wide band gap -----
- ·High breakdown voltage -----
- ·High temperature operation -----

Support with a gate driver ... Short-circuit mask time (tsc) adjustment function

SiC power module(1200V 300A)
Waveform with shorted load



IGBT power module (1200V 300A)
Waveform with shorted load



Adjustable with external capacitor capacity

Optimal value of SiC: 1.0~3.0us

Optimal value of IGBT: 3.0~7.0us

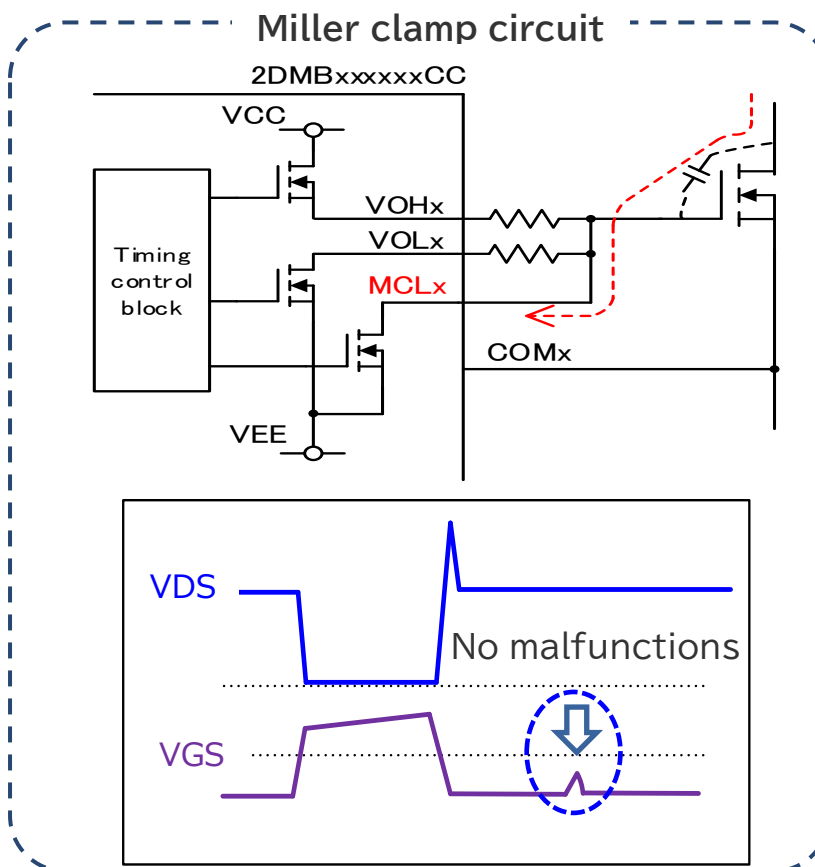
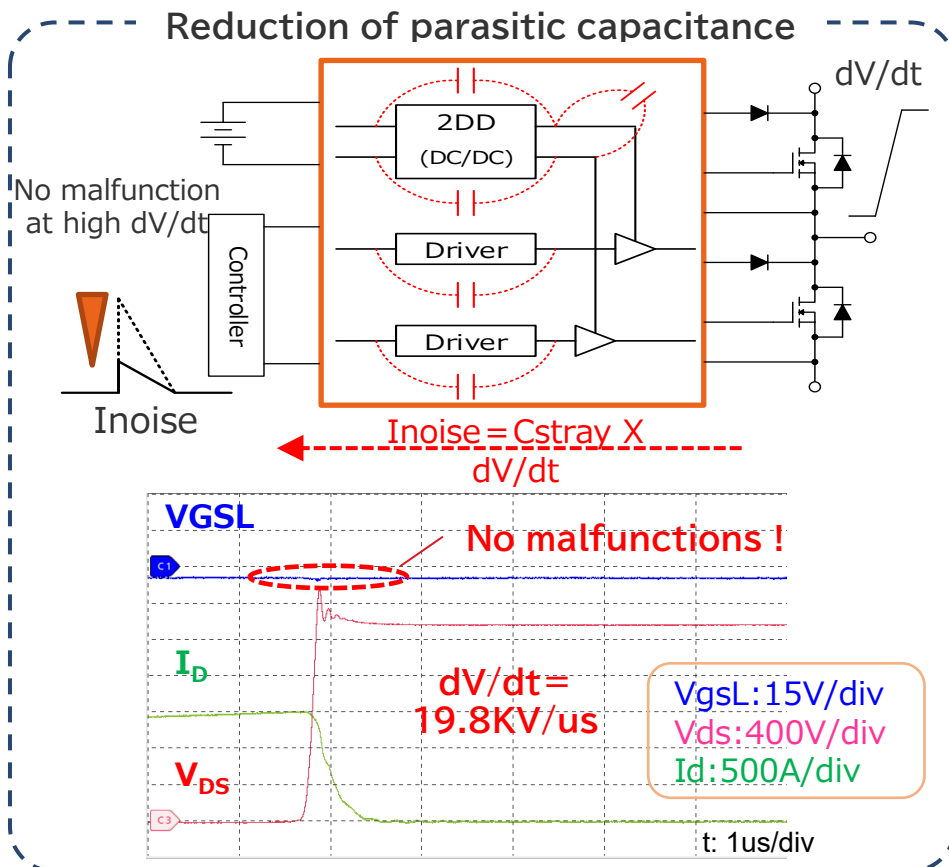
Gate drivers that bring out the performance of NX SiC Power Modules

3. Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Feature② Low threshold voltage V_{GS} (th) (1.8V~3.2V)

--- IGBT is 6V~7V --- Beware of malfunctions from IGBT

Support with a gate driver ...Reduction of parasitic capacitance and Miller clamp circuit



Gate drivers that bring out the performance of NX SiC Power Modules

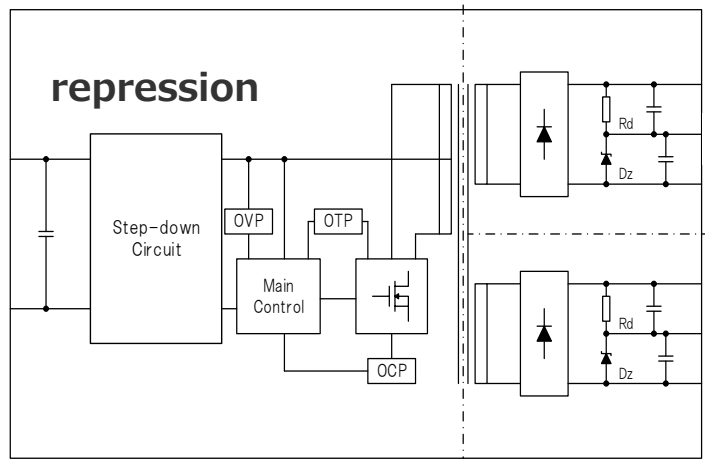
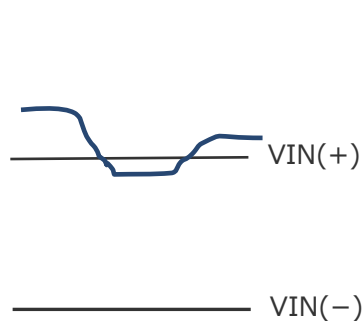
3. Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Feature③ $V_{GS}(-)$:Low tolerance(Less than $-12V$)

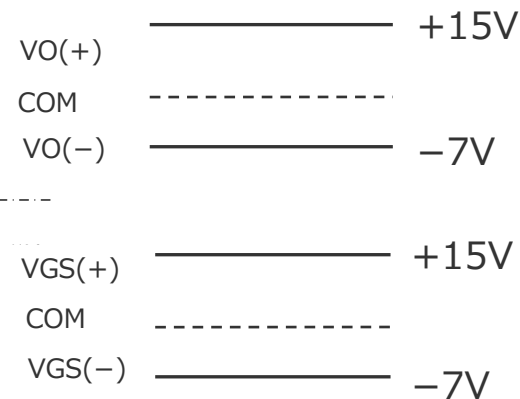
--- IGBT's Gate driver cannot be used

Support with a gate driver ...Constant voltage control of V_{GS}

Input voltage:13V~28V



Output voltage(etc.):+15V、-7V



Controls the gate voltage to be constant even for input fluctuations
 The gate voltage is constant even for output fluctuations (SW frequency, QG of power module)
 } Improved SiC reliability
 Low loss operation

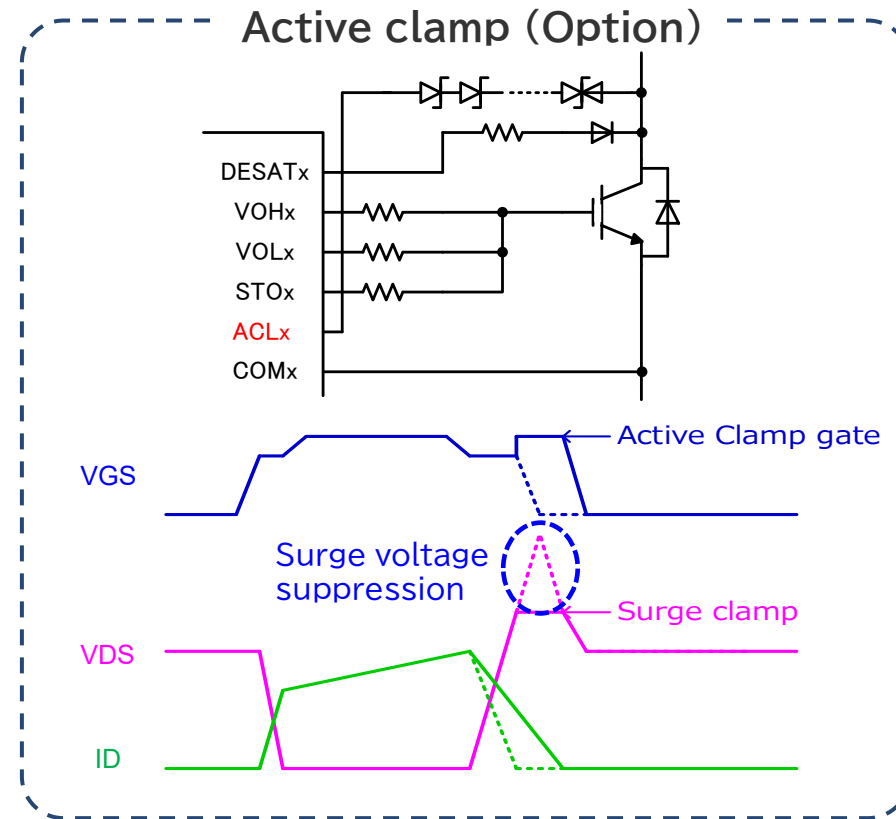
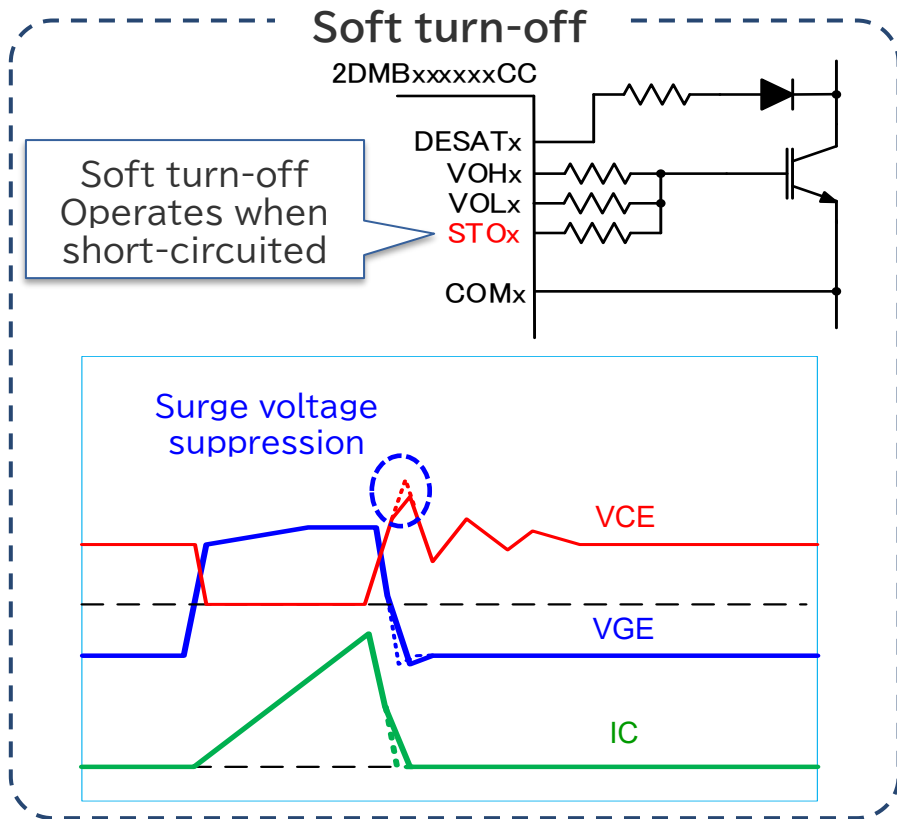
Gate drivers that bring out the performance of NX SiC Power Modules

3. Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Feature④ dV/dt can be set high

----- Turn-on: Recovery current is small
Turn-off: No tail current

Support with a gate driver ... Ability to suppress surge voltage with high dV/dt (Soft turn-off, Active clamp)



Gate drivers that bring out the performance of NX SiC Power Modules

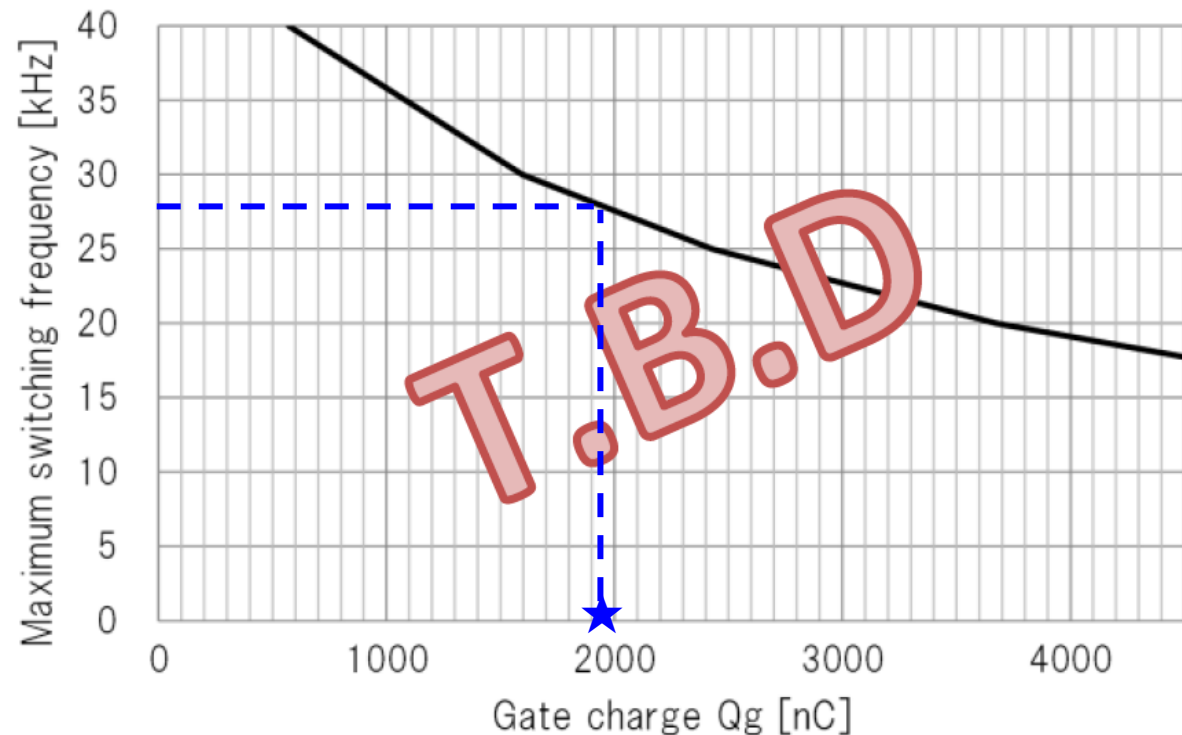
3. Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Feature⑤ High frequency operation is possible

----- Drive power needs to be increased

Support with a gate driver ... Output capacity considering SiC power module

Total gate charge (Qg) vs permissible frequency curve



— 10~+85°C / $V_{IN} = 13.5 \sim 18V$
 — 10~+75°C / $V_{IN} = 18 \sim 26.4V$

★ FMF600DXE-24BN : 1950nC

* About 28kHz Max

*Since it is under development, specifications may change.

Gate drivers that bring out the performance of NX SiC Power Modules

4. Introduction of Tamura Gate driver 2EG-B series

Product

DC/DC Converter

Gate Driver Module

Gate Driver Unit

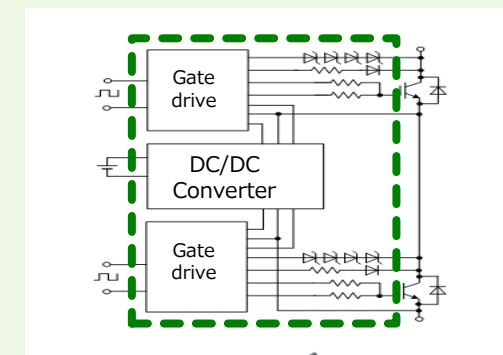
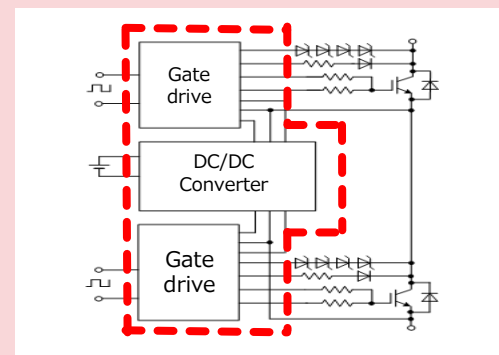
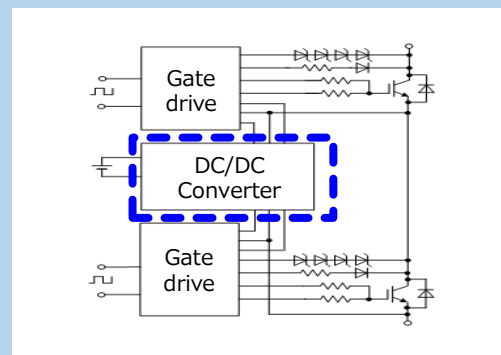
Function

**2in1 PM designated
DC/DC Converter**

**DC/DC Converter
+ Gate drive**

**Gate Driver Module
+ Gate resistors
Protective function**

Block diagram



Appearance



2DD series



2CG-B/D series



2EG-B series

Gate drivers that bring out the performance of NX SiC Power Modules

4. Introduction of Tamura Gate driver 2EG-B series

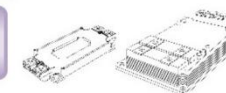
GDM Leading sector For **Mitsubishi Electric**

Gate Driver Family Selection Guide

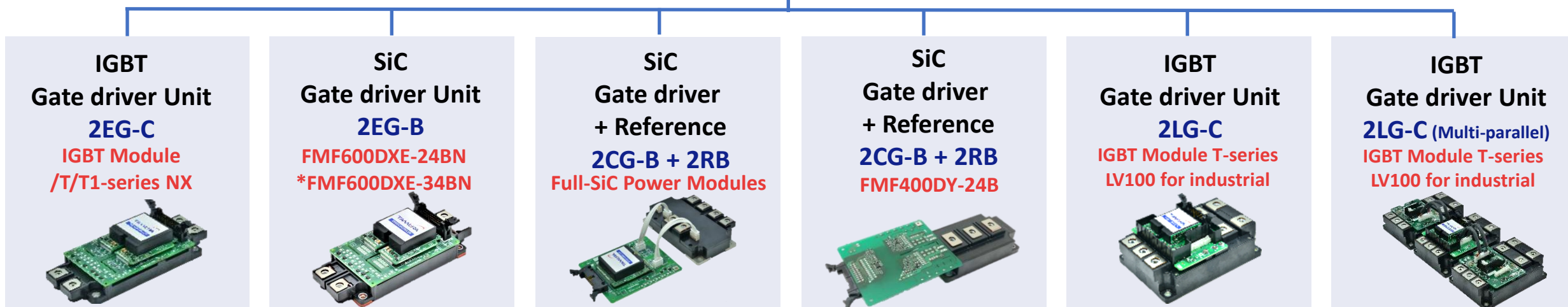
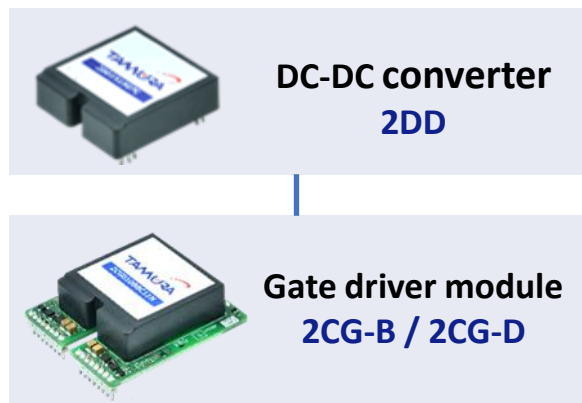
Products Selection Guide

Click here to search applicable power modules!

[Go to selection guide !](#)



Click here !



* Please contact us on gate drivers for FMF600DXE-34BN

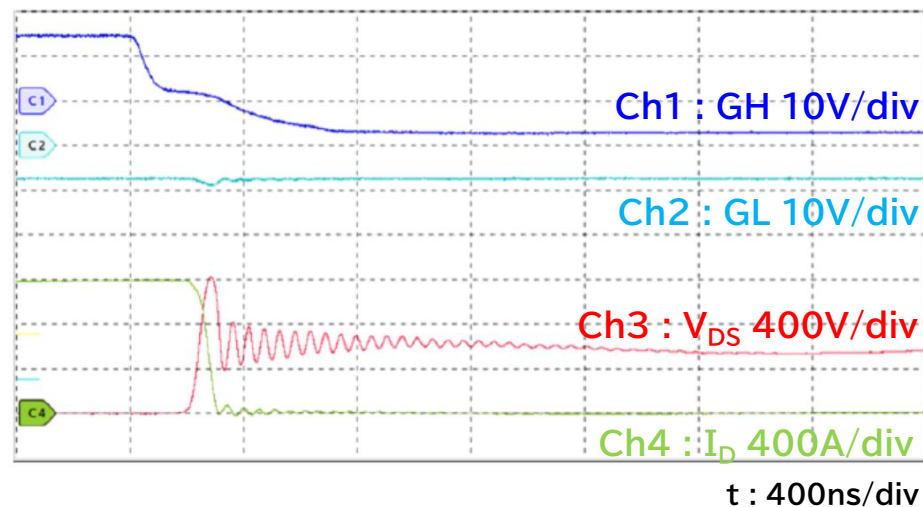
Gate drivers that bring out the performance of NX SiC Power Modules

5. Matching data (2-pulse / Short circuit)

2 pulse test of upper arm

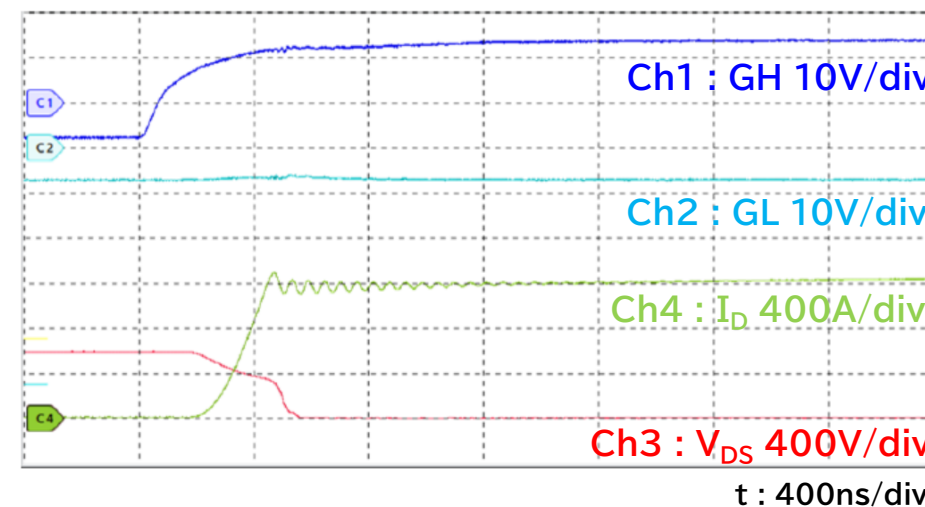
Turn off / $I_D=1200A$

【 $R_{off}:1.8\Omega$ 】 DC-link:600V



Turn on / $I_D=1200A$

【 $R_{on}:1.6\Omega$ 】 R_{on} min /DC-link:600V



Gate drivers that bring out the performance of NX SiC Power Modules

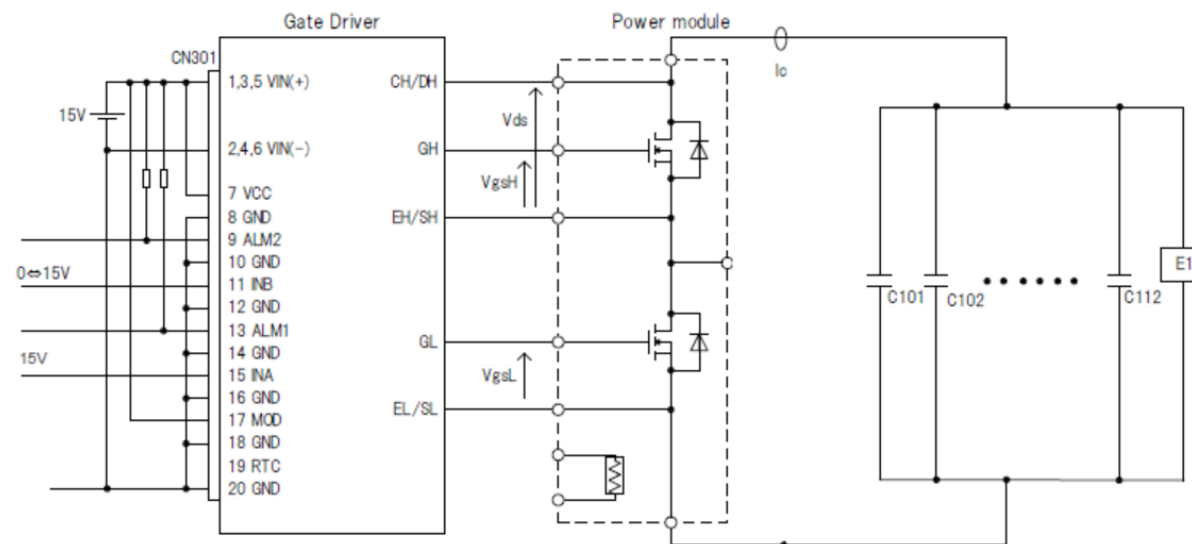
5. Matching data (2-pulse / Short circuit)

Short circuit test of upper arm

Test condition

Items	Description
Device	FMF600DXE-24BN (Mitsubishi Electric)
Gate driver	Master: 2EG01XBDN18N
Gate voltage	+15V/-7V
Gate resistor	Ron: 1.6Ω, Roff: 1.8Ω
DC-link voltage (VCC)	600V
Main circuit current	1200A
Load inductance	28.5uH
Junction temperature	25°C

Test Circuit for Upper arm



Load : 28.5uH
 C101,102 : 560uF (Ls:60nH)
 C103-110 : OPEN
 C111,112 : 2.5uF (Ls:30nH or less/snubber)
 Circuit inductance : about 40nH

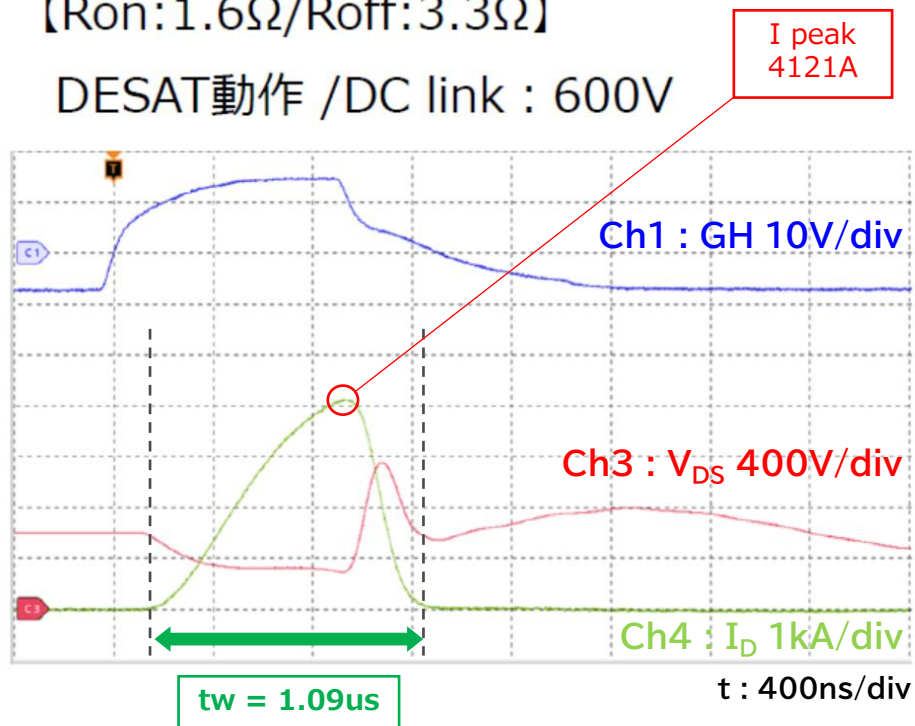
Gate drivers that bring out the performance of NX SiC Power Modules

5. Matching data (2-pulse / Short circuit)

Short circuit test of upper arm

【Ron:1.6Ω/Roff:3.3Ω】

DESAT動作 / DC link : 600V

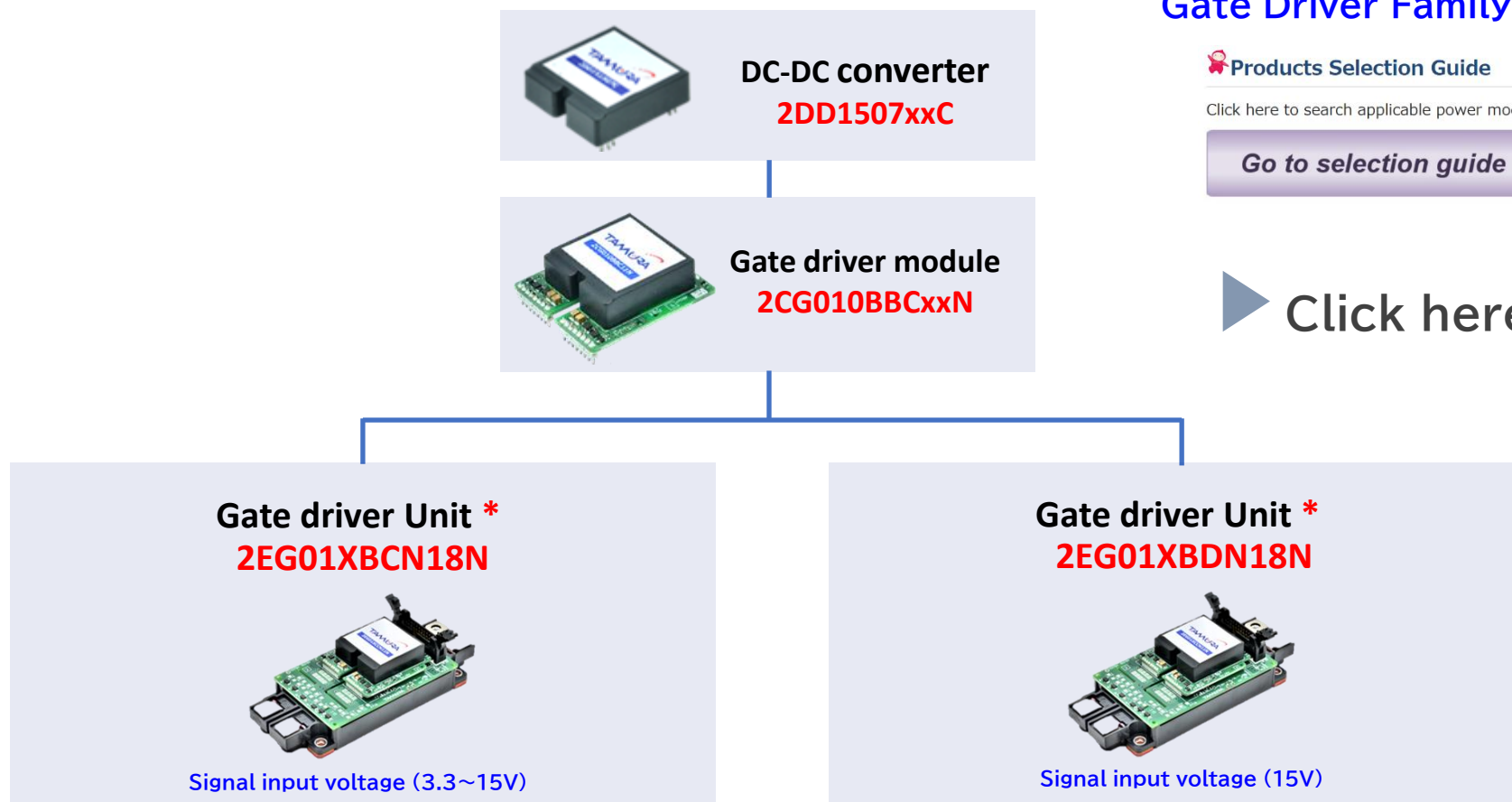


Item	Value	Unit
V_{DS} peak	1150	V
I peak	4121	A
Loss	1.004	J
tw	1.09	us

Gate drivers that bring out the performance of NX SiC Power Modules

6. Product tree and line-up

GDM Leading sector For **FMF600DXE-24BN**

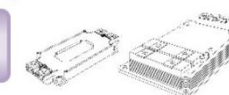


Gate Driver Family Selection Guide

Products Selection Guide

Click here to search applicable power modules!

[Go to selection guide !](#)



Click here !



* Gate resistance is not assembled. They must be assembled by the user before operation.
 * Please contact us on gate drivers for FMF600DXE-34BN

Please visit our website!



Home



Contact



Catalog



Linkedin



Digi-Key



Mouser



CORPORATE GOVERNANCE REPORT

Tamura's mascot "Quenu"