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

Supported by Mitsubishi Electric

SUSTAINABLE DEVELOPMENT GOALS

TAMURA
Your One and Only Company

TAM-GDM-00072

Issued on 1st Mar '24 Unit division HQ Japan

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

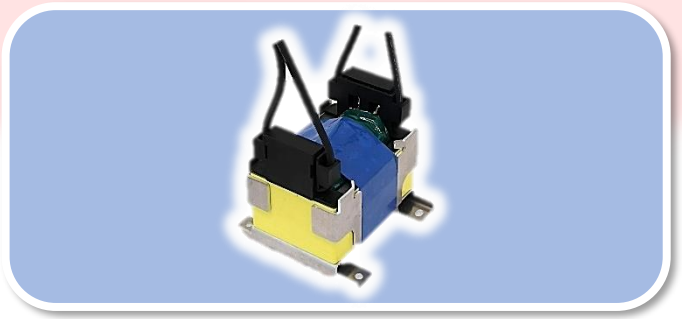
01 Benefit of Mitsubishi Electric – Tamura collaboration

Provide of main components for medium frequency inverter !

NX type SiC industrial Power Modules
by Mitsubishi Electric

Power Module

Gate driver



Reactor / Trans

Current sensor

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

02 Application

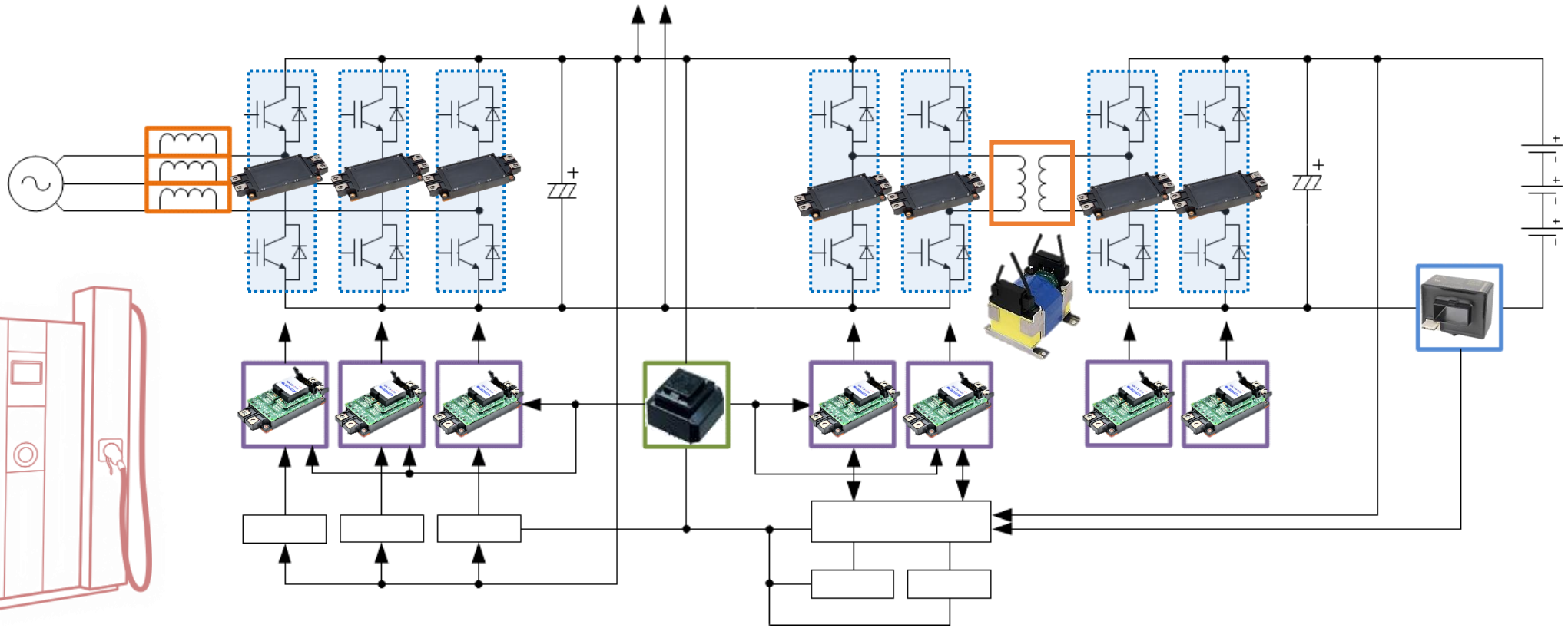
EV fast charger (100kW~)


Power semiconductors


Gate Driver

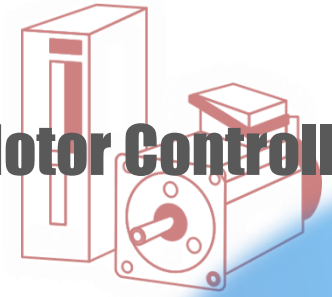

Current sensor


SW-Trans



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

02 Application



Motor Controller

Inverter

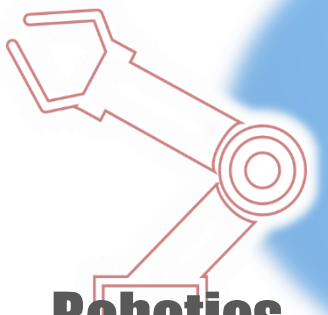
GENERAL-PURPOSE INVERTER

PV

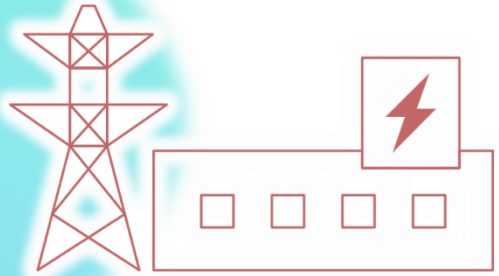
Photovoltaic Power Generation

Wind

Wind Power Generation



Robotics



Grid/SVG

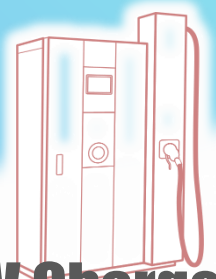
Electric grid

Welding

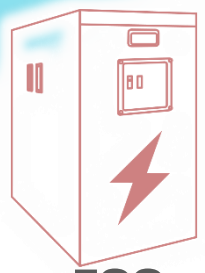
Welding Machine

UPS

Uninterruptible Power Supply



EV Charger
EV Stand



ESS

Energy Storage System

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

03 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

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

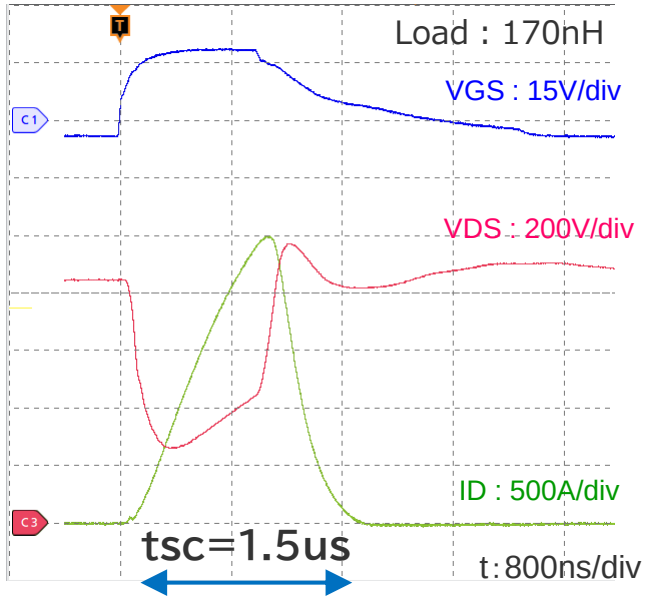
Feature ① Short circuit tolerance is lower than Si

Small chip area

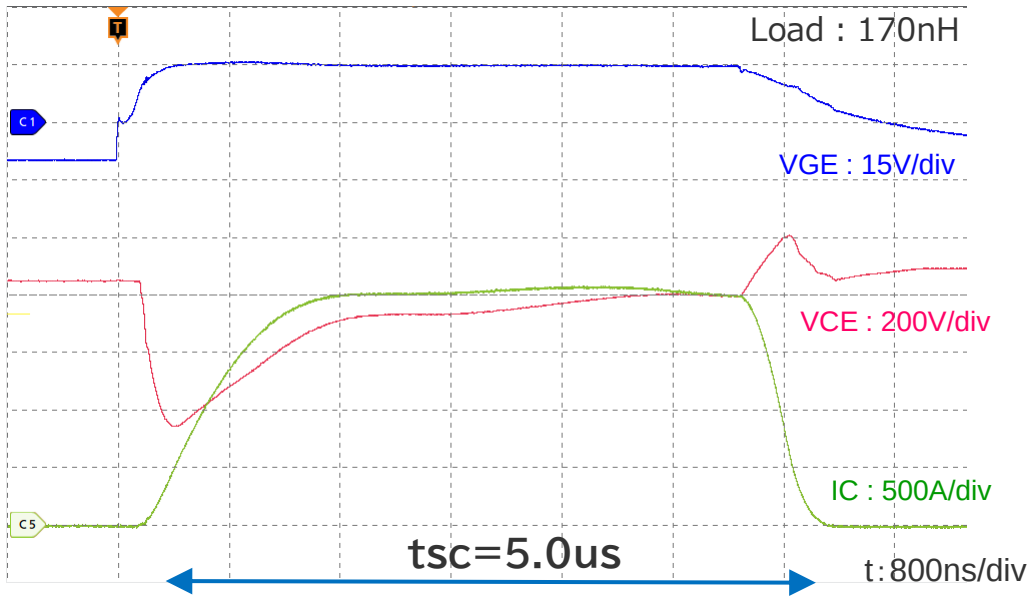
- Wide band gap
- High breakdown voltage
- High temperature operation

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

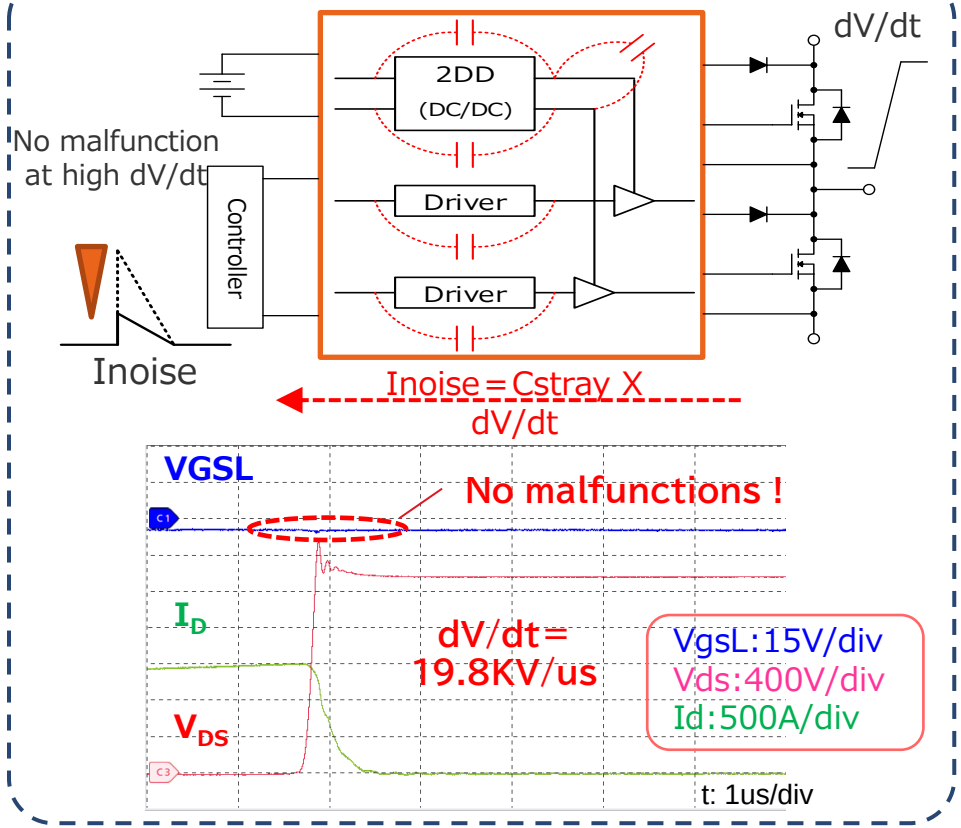
03 Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Feature② Low threshold voltage VGS (th)
(1.8V~3.2V)

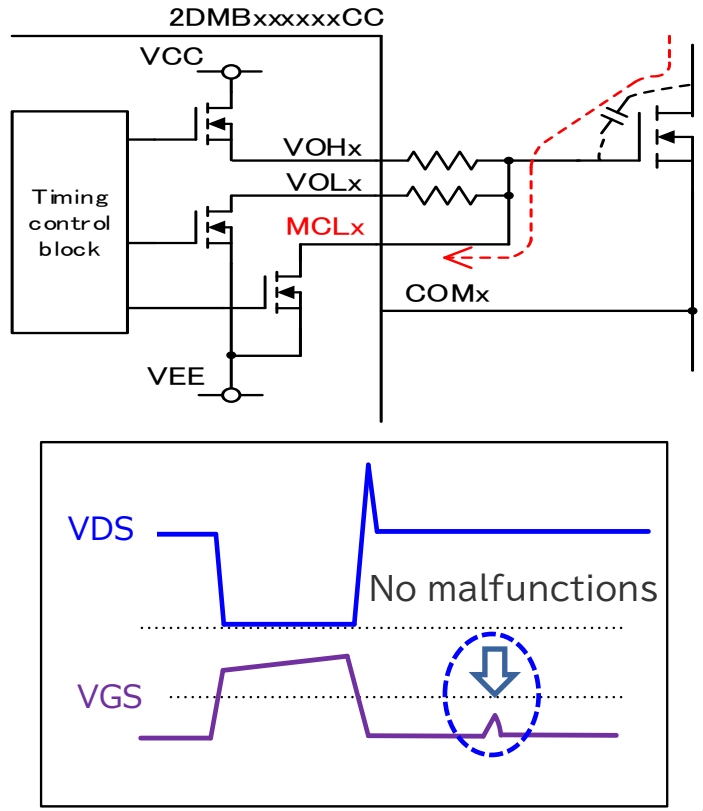
--- IGBT is 6V~7V --- Beware of malfunctions from IGBT

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

Reduction of parasitic capacitance



Miller clamp circuit

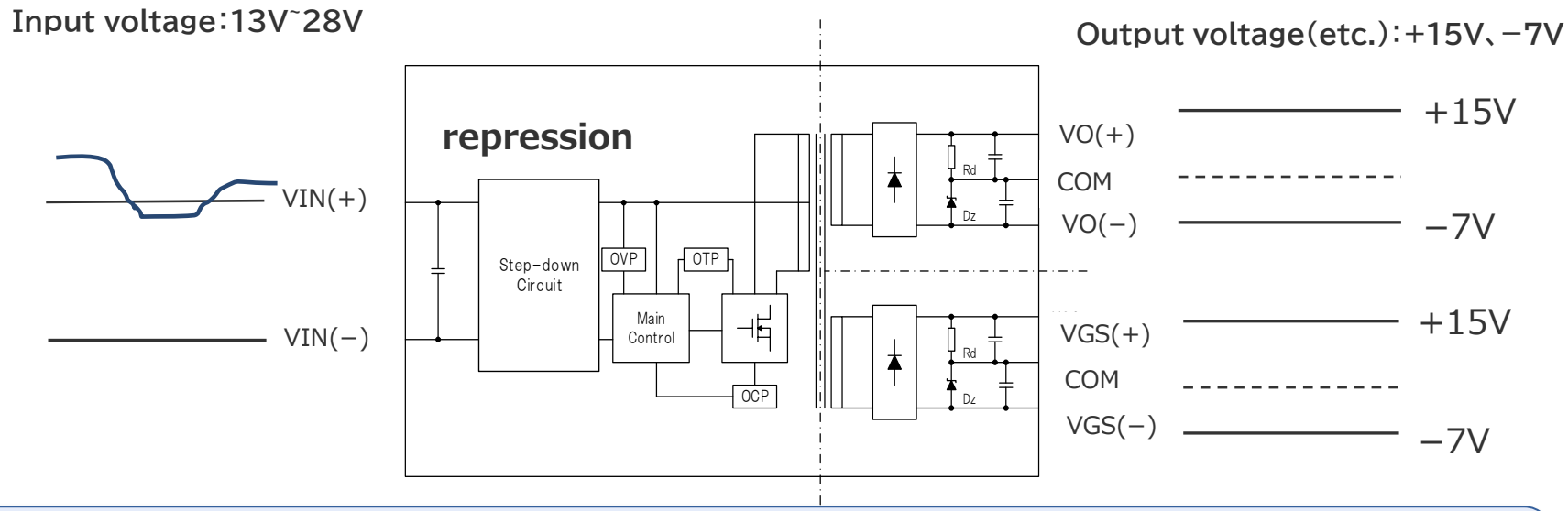


Gate drivers that bring out the performance of NX SiC Power Modules

03 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}



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

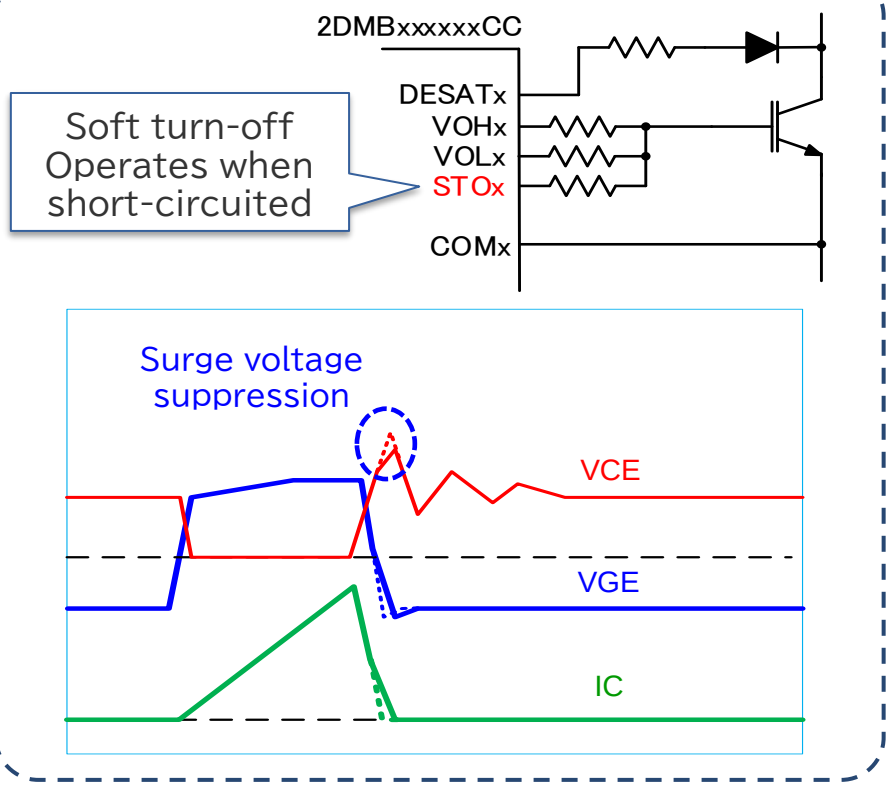
03 Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

Feature④ dV/dt can be set high

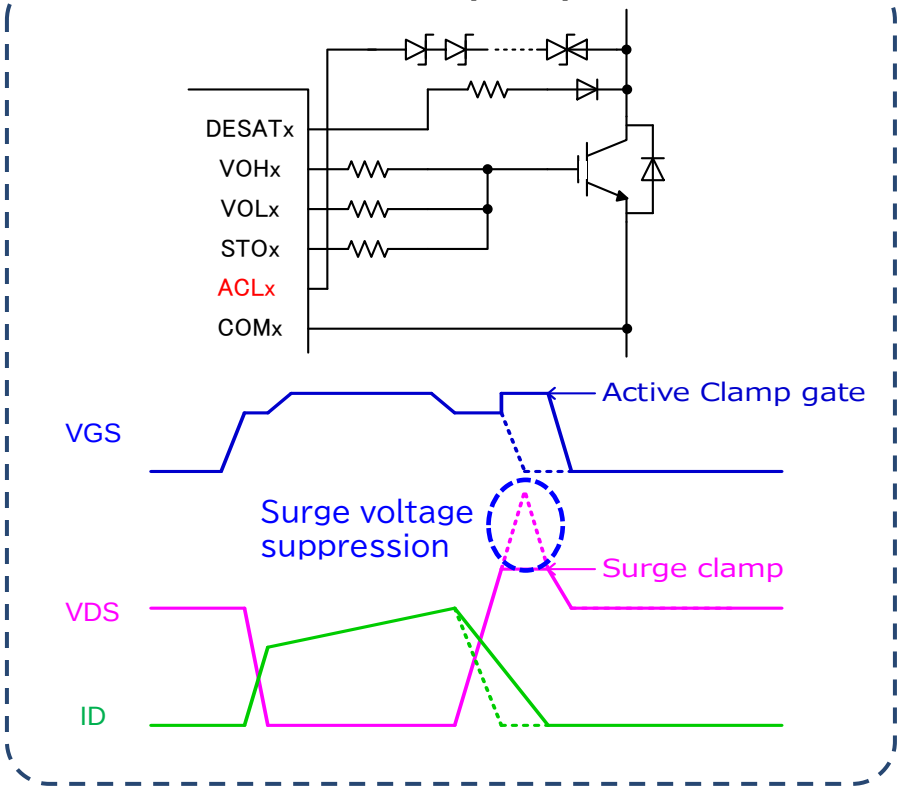
Turn-on: Recovery current is small
Turn-off: No tail current

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

Soft turn-off



Active clamp (Option)



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

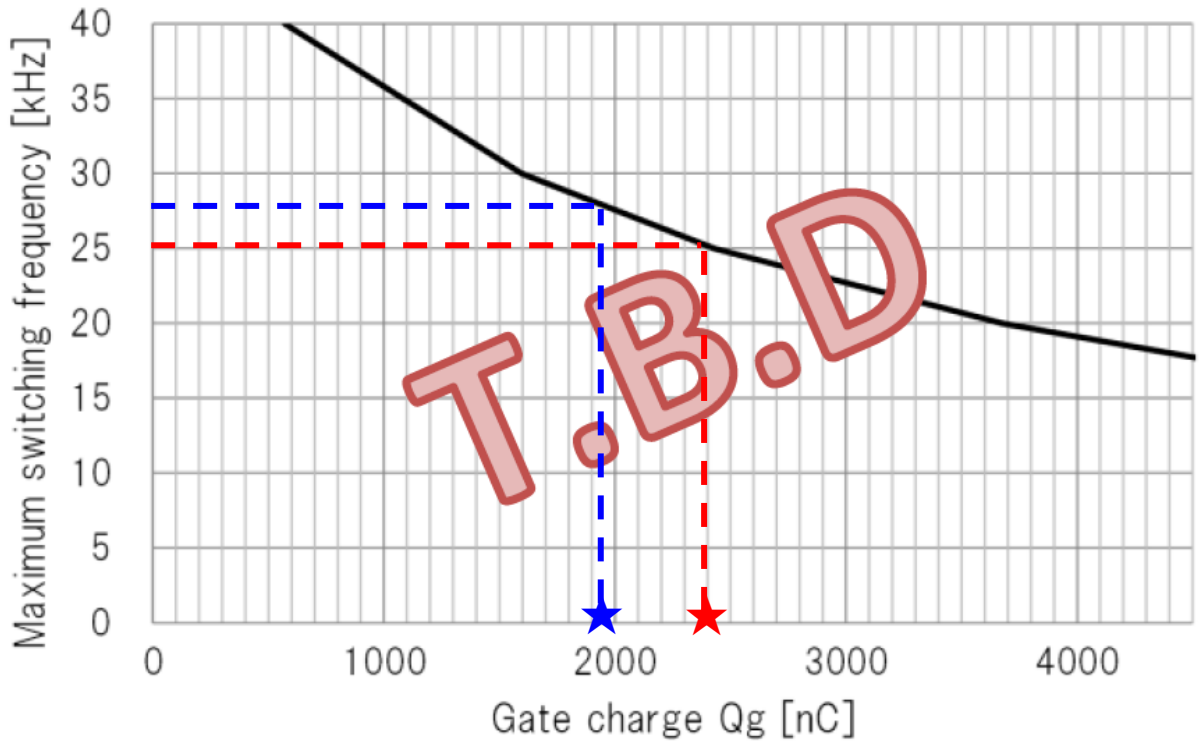
03 Five features obtained by combining NX type SiC industrial Power Modules and 2EG-B series

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



＊ About 28kHz Max

＊ About 25kHz Max

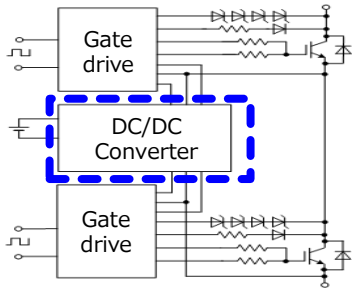
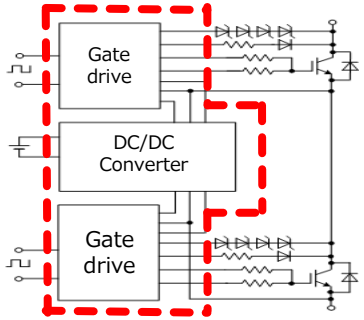
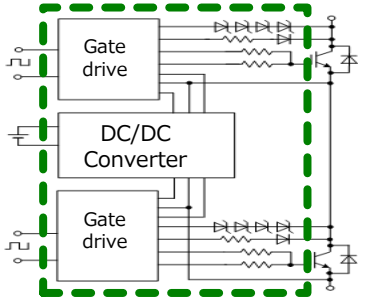
— 0～+85℃ / V_{IN} = 13.5～18V
0～+75℃ / V_{IN} = 18～26.4V

★ FMF600DXE-34BN : 2400nC
★ FMF600DXE-24BN : 1950nC

＊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

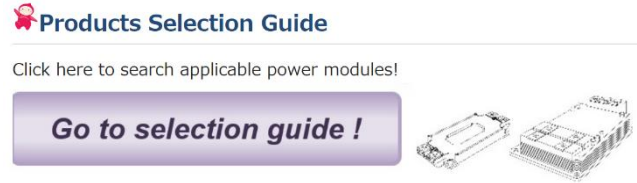
	DC/DC Converter	Gate Driver Module	Gate Driver Unit
Function	2in1 PM designated DC/DC Converter	DC/DC Converter + Gate drive	Gate Driver Module + Gate resistors Protective function
Block diagram			
Appearance	 2DD series	 2CG-B/D series	 2EG-B series

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



Click here !

DC-DC converter
2DD

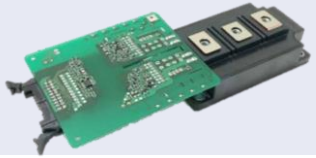
Gate driver module
2CG-B / 2CG-D

IGBT
Gate driver Unit
2EG-C
IGBT Module
/T/T1-series NX

SiC
Gate driver Unit
2EG-B
FMF600DXE-24BN
FMF600DXE-34BN

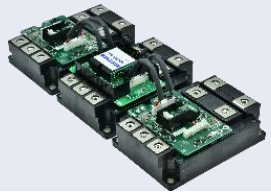
SiC
Gate driver
+ Reference
2CG-B + 2RB
Full-SiC Power Modules

SiC
Gate driver
+ Reference
2CG-B + 2RB
FMF400DY-24B



IGBT
Gate driver Unit
2LG-C
IGBT Module T-series
LV100 for industrial

IGBT
Gate driver Unit
2LG-C (Multi-parallel)
IGBT Module T-series
LV100 for industrial



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

4 Introduction of Tamura Gate driver 2EG-B series

Mass production board is available

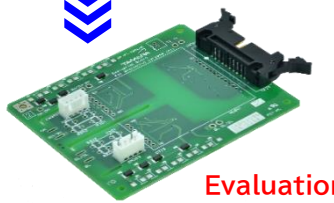
Output Voltage +15V / -7V

Can be mounted directly !

Model: 2EG01XBxN18NP

Evaluation board is available

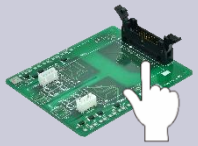
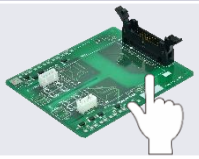
Model: 2CG010BBC15N
(+15V / -4V)



Evaluation board : 2RB020BB

Available for evaluation now !

Product line-up

Power module Part No	Series			
	2EG-B	2RB *	2CG-B	2DD
FMF600DXE-24BN	V_{DS} = 1200V			
	2EG01XBCN18NP（Signal 3.3~15V）		2CG010BBC**N (+15/-7V) 	2DD1507**C (+15V/-7V) 
	2EG01XBDN18NP（Signal 15V）			
FMF600DXE-34BN	V_{DS} = 1700V			
	2EG01XBCN18NP（Signal 3.3~15V）		2CG010BBC**N (+15/-7V) 	2DD1507**C (+15V/-7V) 
	2EG01XBDN18NP（Signal 15V）			

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CORPORATE GOVERNANCE REPORT

Tamura's mascot "Quenu"