Gate driver module and Evaluation board that bring out the performance of Infineon Technologies AG SiC Power Module

Supported by Infineon Technologies AG

SUSTAINABLE DEVELOPMENT GOALS

TAMURA
Your One and Only Company

TAM-GDM-00017

Issued on 1st May '22 Unit division HQ Japan

Rev A

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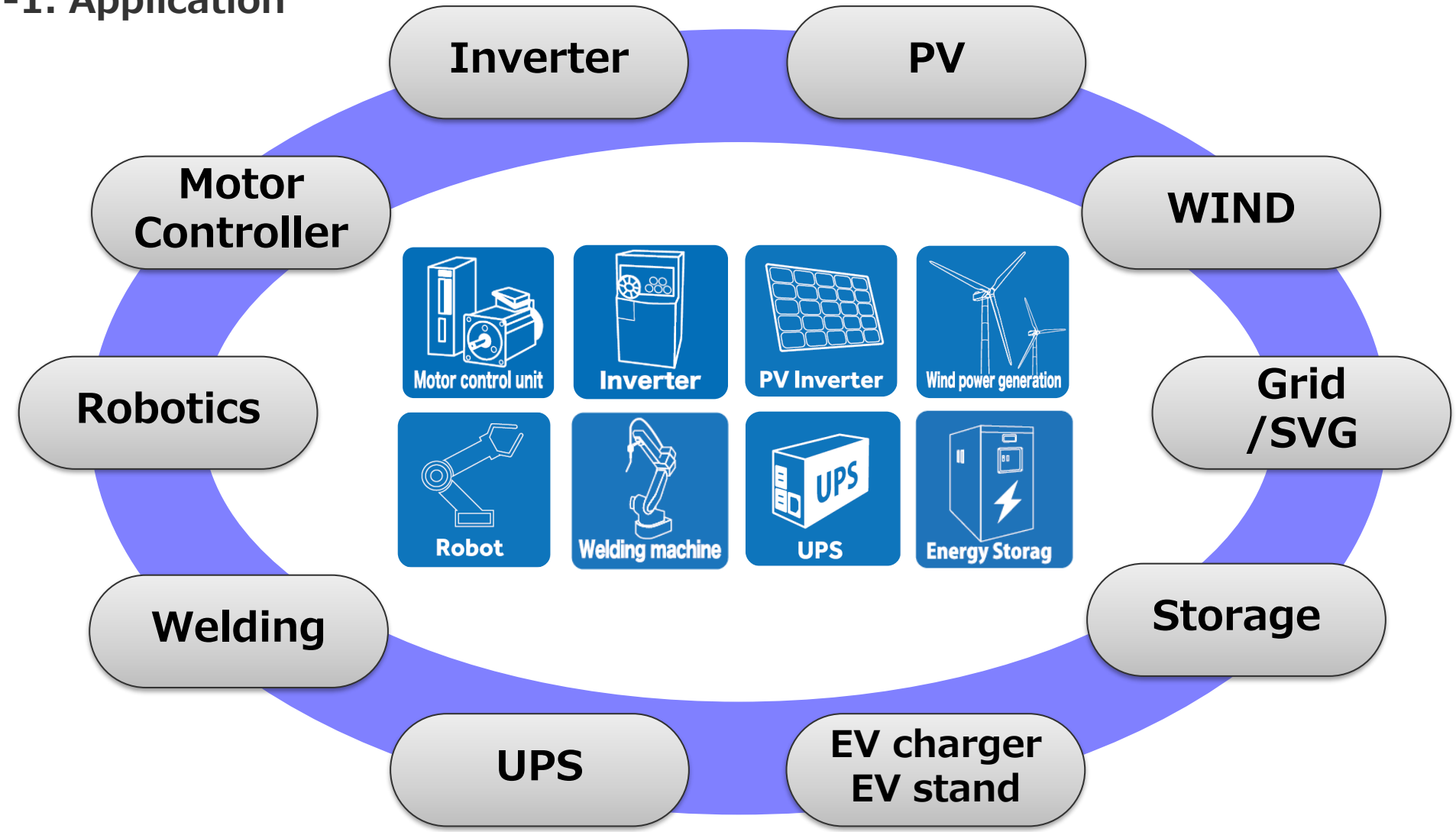
1. Solution Guide for SiC Power Module

1-1. Application



Rev A

1. Solution Guide for SiC Power Module

1-2. Features of Gate driver module.

Features of All-SiC Power Module

Feature①	Short circuit tolerance is lower than Si
Feature②	Low threshold voltage VGS (th)（1V~3V)
Feature③	VGS(+) :On resistance does not decrease at 15V VGS(−) :Low tolerance（Less than −5V)
Feature④	dV/dt can be set high
Feature⑤	High frequency operation is possible

1. Solution Guide for SiC Power Module

1-2. Features of Gate driver module.

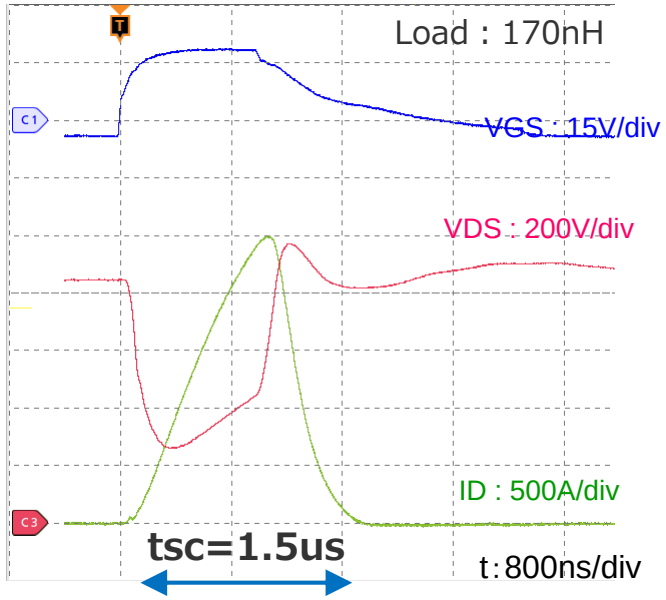
Feature ① Short circuit tolerance is lower than Si

Small chip area

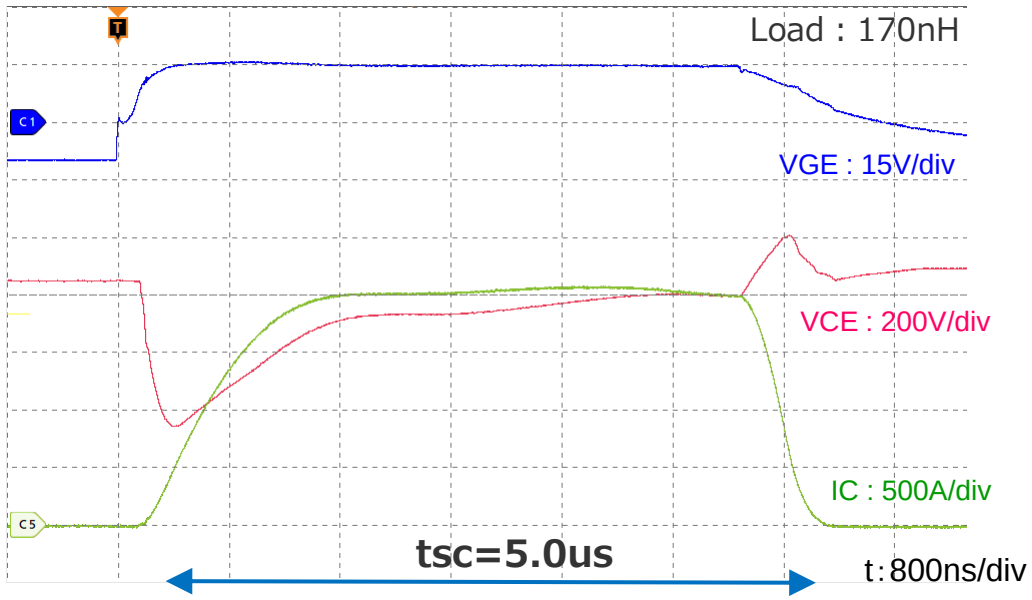
- Wide band gap
- High breakdown voltage
- High temperature operation

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

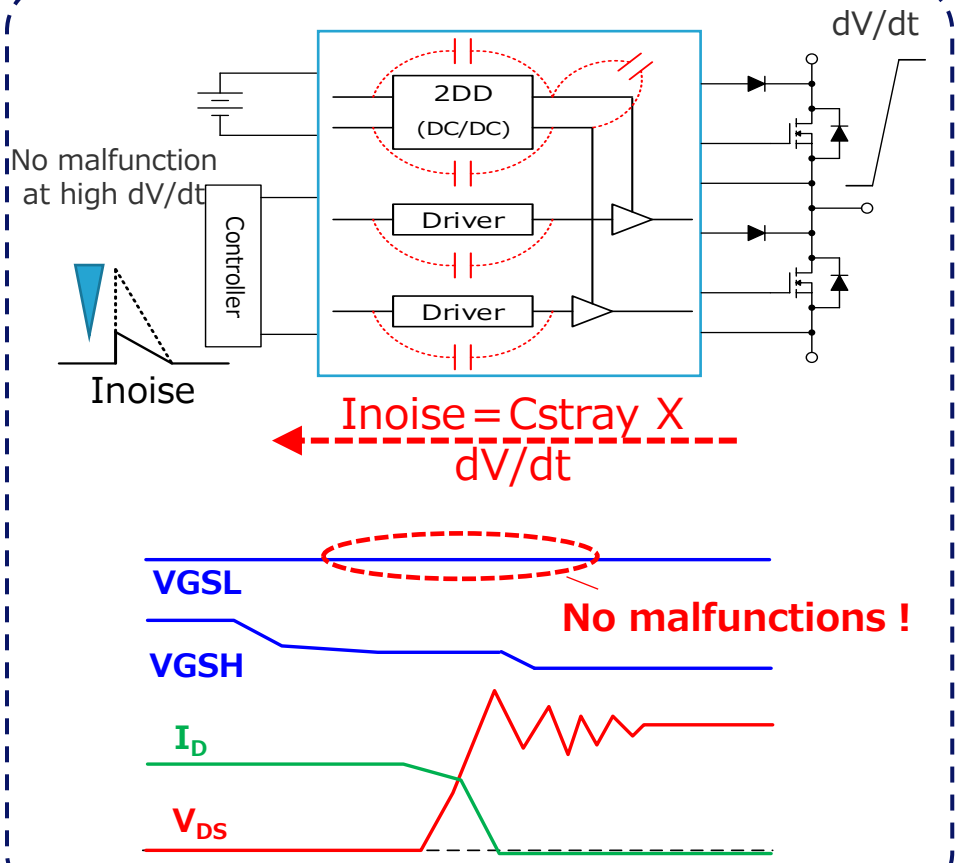
1. Solution Guide for SiC Power Module

1-2. Features of Gate driver module.

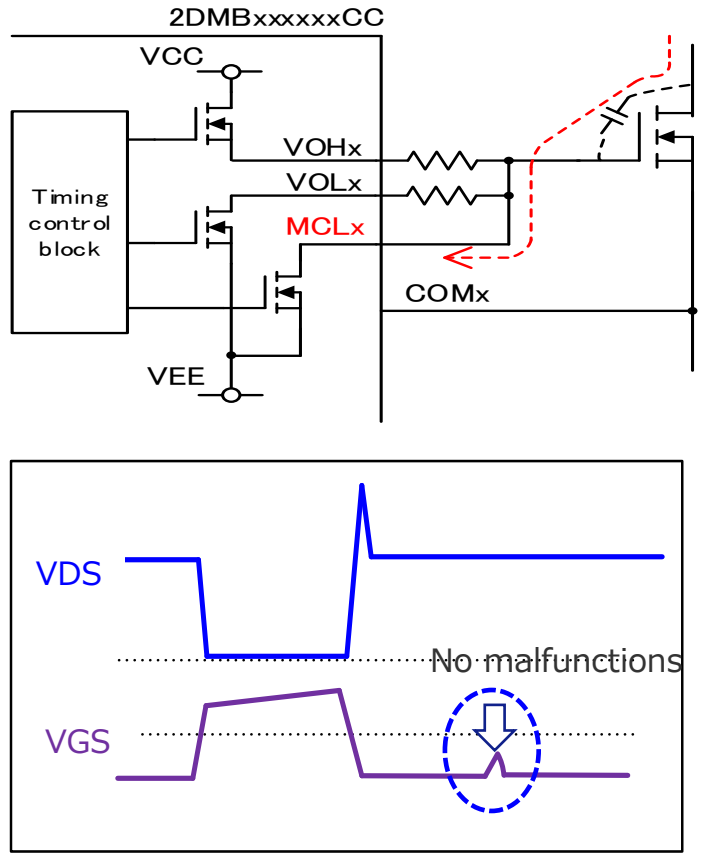
Feature② Low threshold voltage VGS (th) (1V~3V) --- IGBT is 6V~7V --- Beware of malfunctions from IGBT

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

Reduction of parasitic capacitance



Miller clamp circuit



1. Solution Guide for SiC Power Module

1-2. Features of Gate driver module.

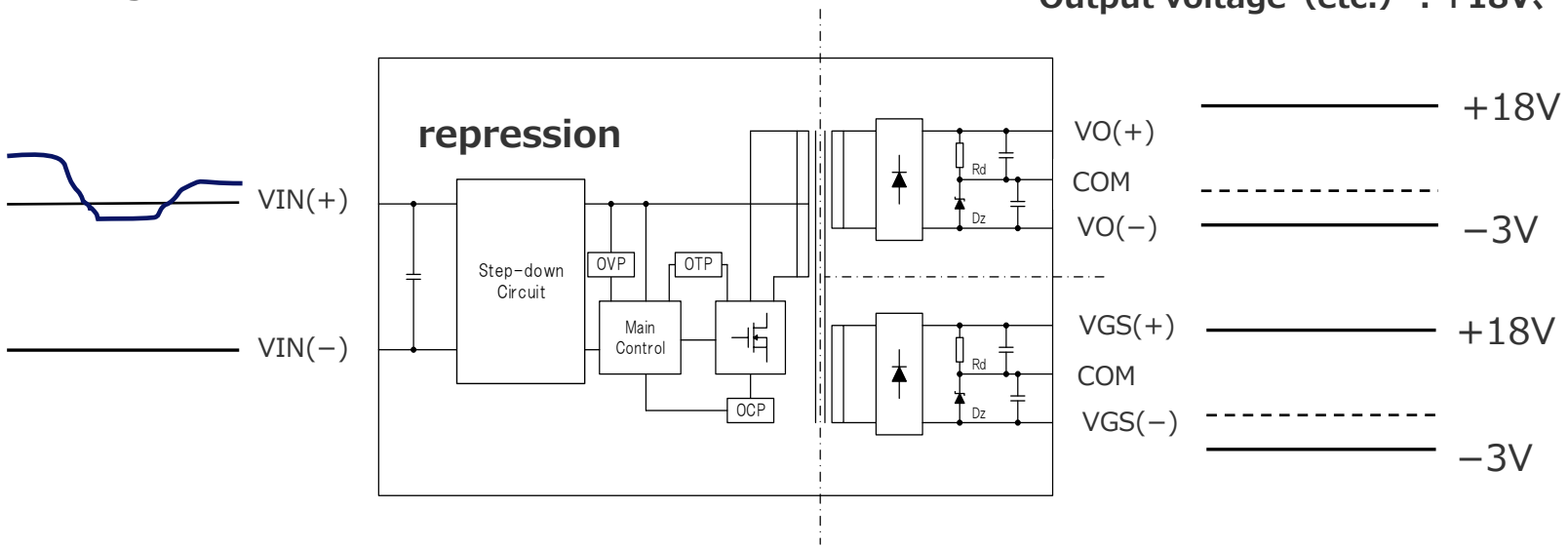
Feature③ VGS(+) :On resistance does not decrease at 15V
VGS(−) :Low tolerance（Less than −5V）

--- IGBT's Gate driver cannot be used

Support with a gate driver ･･･Constant voltage control of VGS

Input voltage : 13V~28V

Output voltage（etc.）: +18V、−3V



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

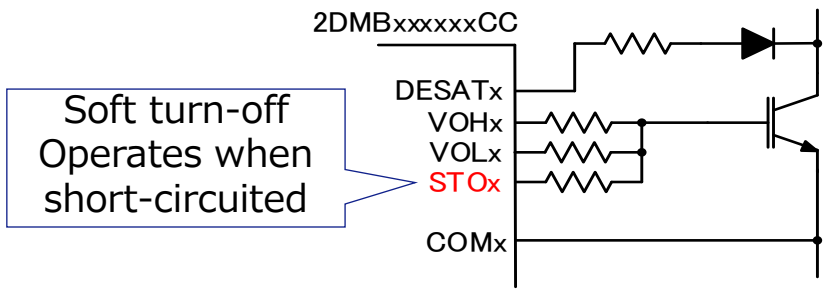
1. Solution Guide for SiC Power Module

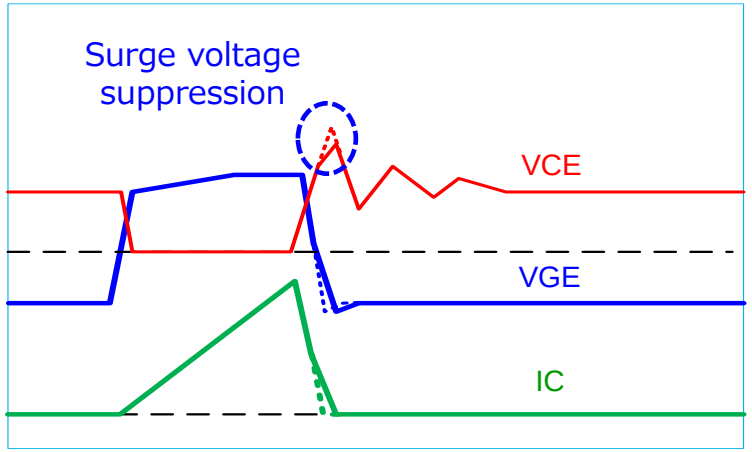
1-2. Features of Gate driver module.

Feature④　dV/dt can be set high ----- Turn-on: Recovery current is small
Turn-off: No tail current

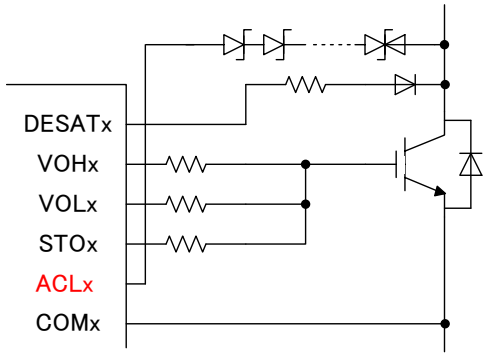
Support with a gate driver ・・・Ability to suppress surge voltage with high dV/dt
(Soft turn-off, Active clamp)

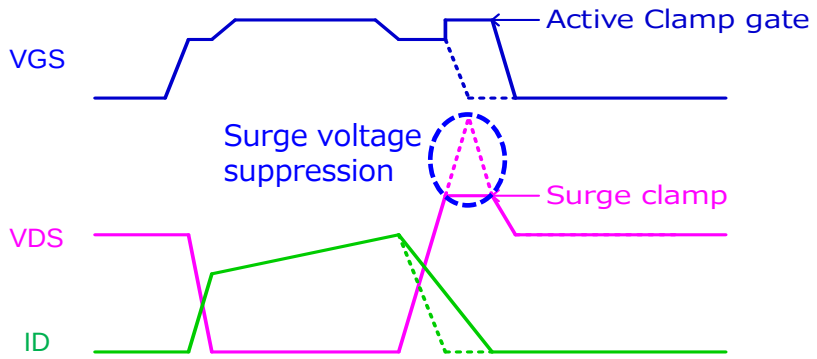
Soft turn-off





Active clamp (Option)





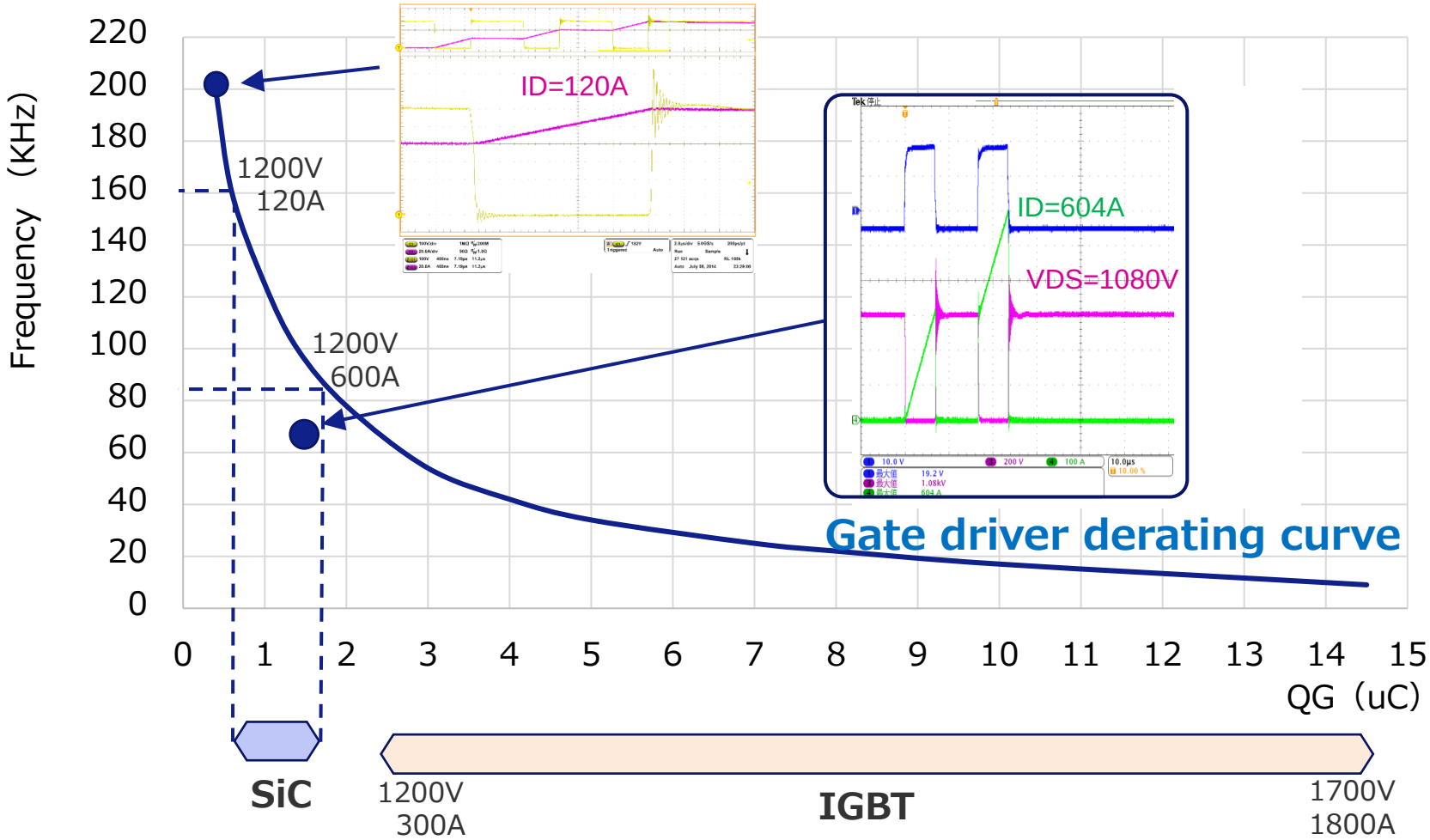
1. Solution Guide for SiC Power Module

1-2. Features of Gate driver module.

Feature⑤ High frequency operation is possible

Drive power needs to be increased

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



1. Solution Guide for SiC Power Module

1-3. Waveform of Tamura gate driver (2 Pulse test)

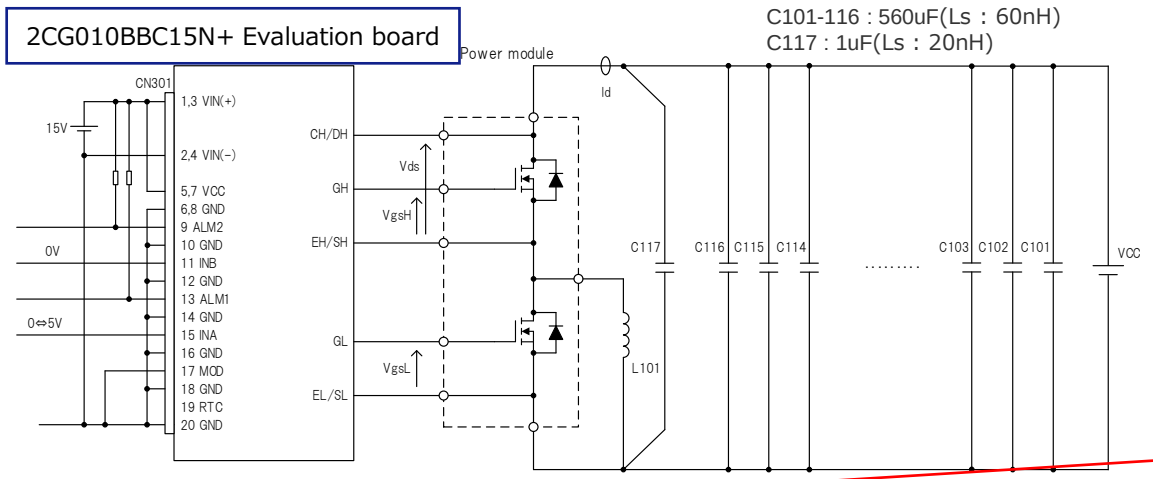
SiC MOSFET : FF3MR12KM1

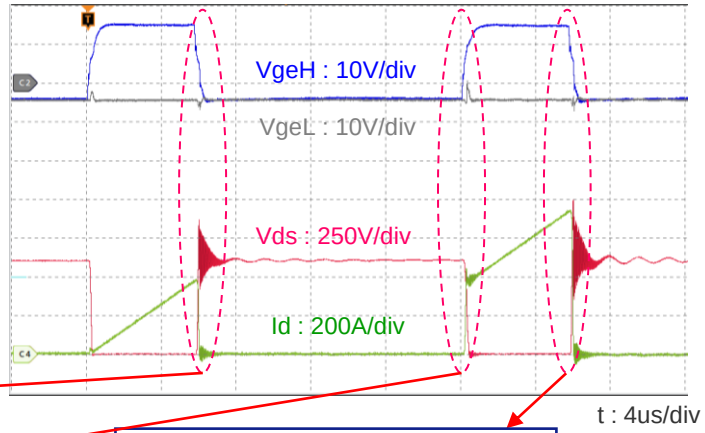
Rev A

DC Link : 600V,　Ron : 4.3Ω, Roff : 3.6Ω,　Upper arm,　Tj=25℃

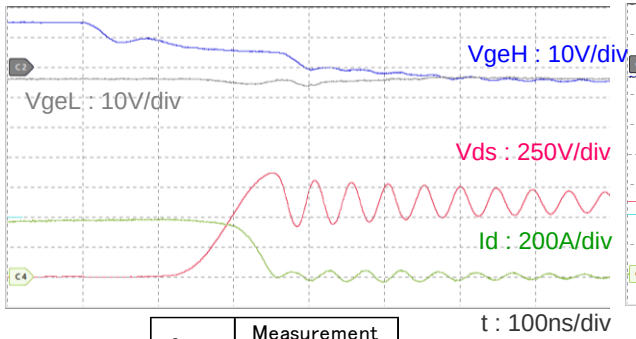
2CG010BBC15N+ Evaluation board

Highly stable gate drive with proprietary drive circuit and miller clamp circuit (patent pending)



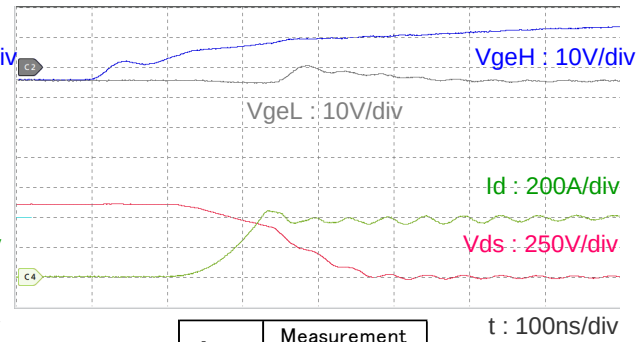


Turn OFF / Ic =375A



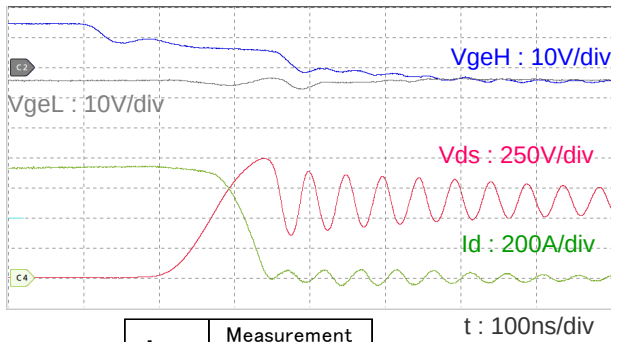
Item	Measurement value	
Vdsp	866	V
dV/dt	8.8	kV/us
di/dt	6.2	kA/us
Eoff	13	mJ

Turn ON / Ic =375A



Item	Measurement value	
dV/dt	4.6	kV/us
di/dt	5.0	kA/us
Eon	19	mJ

Turn OFF / Ic =750A



Item	Measurement value	
Vdsp	992	V
dV/dt	9.2	kV/us
di/dt	10.3	kA/us
Eoff	33	mJ

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1. Solution Guide for SiC Power Module

1-3. 2 Pulse test (Enlarged waveform)

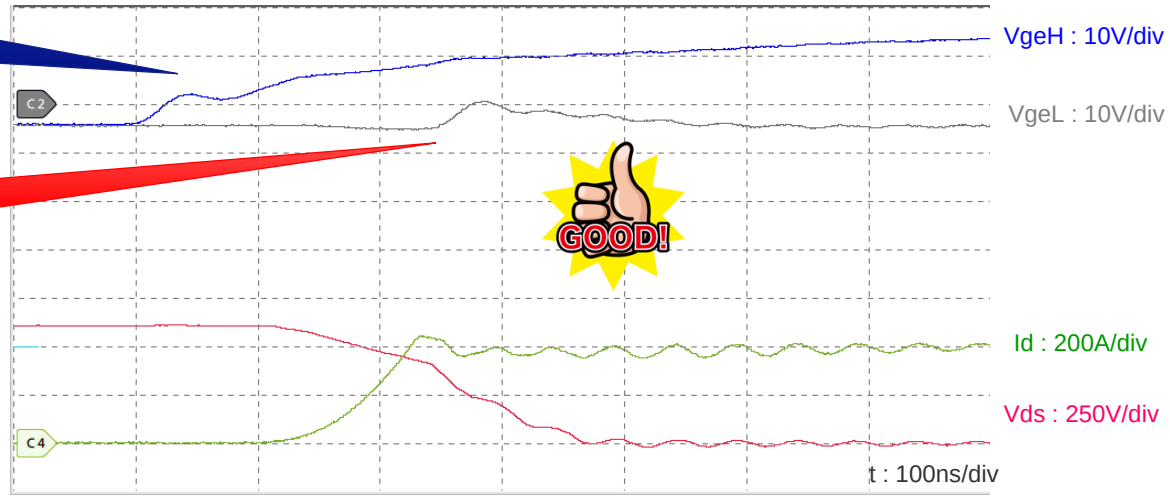
Rev A

SiC MOSFET : FF3MR12KM1

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

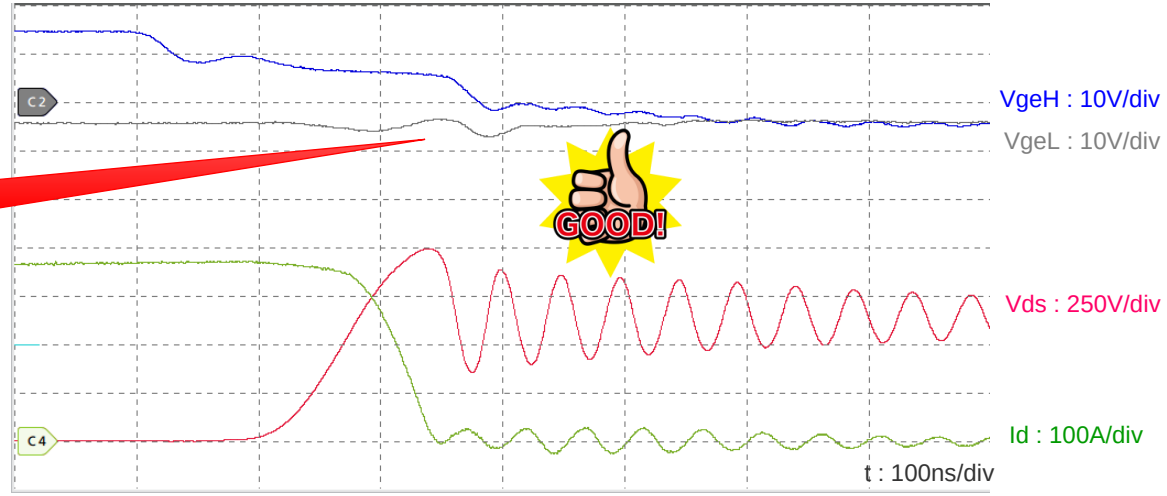
OFF side gate
Stable L state without malfunction

Turn ON / Ic =375A



OFF side gate
Stable L state without malfunction

Turn OFF / Ic =750A



1. Solution Guide for SiC Power Module

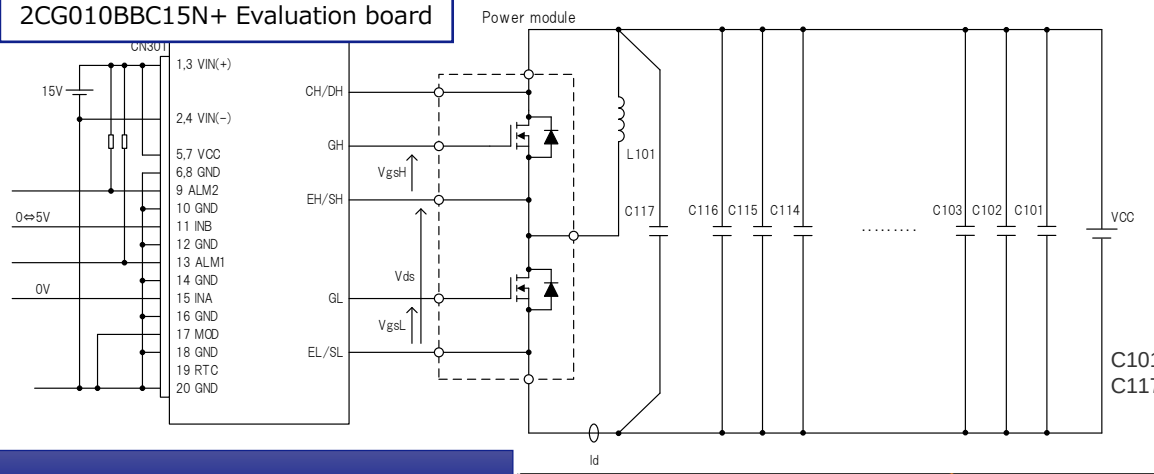
1-3 Waveform of Tamura gate driver (Short circuit test)

Rev A

SiC MOSFET : FF3MR12KM1

DC Link : 600V, Ron : 4.3Ω, Roff : 3.6Ω, Lower arm, Tj=25℃

2CG010BBC15N+ Evaluation board



C101-116 : 560uF(Ls : 60nH)
C117 : 1uF(Ls : 20nH)

Item	Measurement value	
Vdsp	806	V
Idp	4124	A
tsc	2.28	us

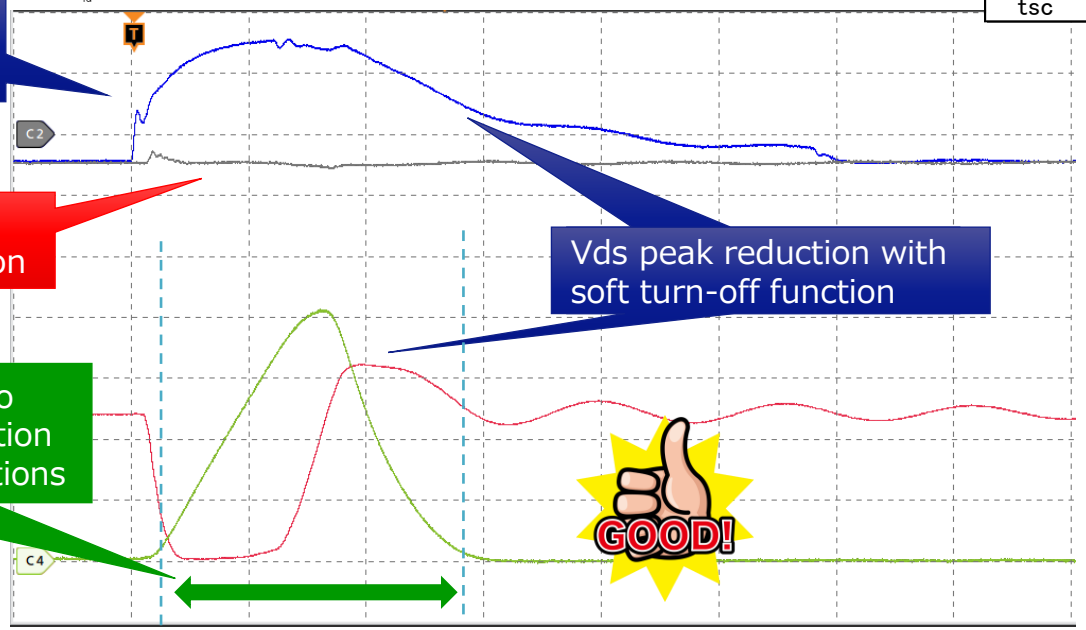
This driver suppresses the Vds peak voltage in the short circuit by our original circuit technology, and can control the mask time to prevent false short circuit detection. (Patent pending)

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

OFF side gate
Stable L state without malfunction

Vds peak reduction with soft turn-off function

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



VgeL : 10V/div
VgeH : 10V/div
Vds : 250V/div
Id : 1kA/div
t : 1us/div

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1. Solution Guide for SiC Power Module

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1-4. Product Line-up

Gate Driver Module 2CG-B series

		MODEL				
		2CG010BBC11N	2CG010BBC12N	2CG010BBC13N	2CG010BBC14N	2CG010BBC15N *
Output	Output voltage(+)	+15V	+15V	+18V	+18V	+15V
	Output voltage(-)	-10V	-15V	-4V	-2V	-4V
	Output power/1ch	3.8W	3.3W	3.5W	3.2W	3.0W
	Number of output	2				
	Peak output current	±43A				
Input	Input voltage	DC13~28V				
	Logic input voltage	DC3.3~5V				
Insulation	Withstand voltage	Primary to secondary AC5KV / Secondary to secondary AC4KV				
	Partial discharge extinction voltage	1768V peak				
Function	Mode select	Direct mode / Half bridge mode				
	DESAT protection	Yes				
	Soft turn off	Yes				
	Active clamp	No				
	Miller clamp	Yes				

* Under development

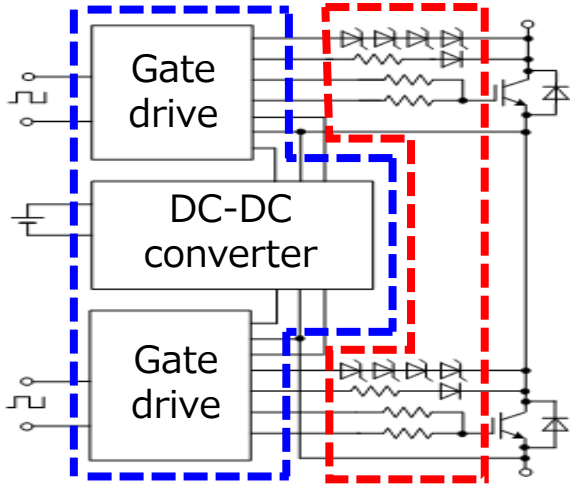
1. Solution Guide for SiC Power Module

1-4. Evaluation board (2RB020BB)

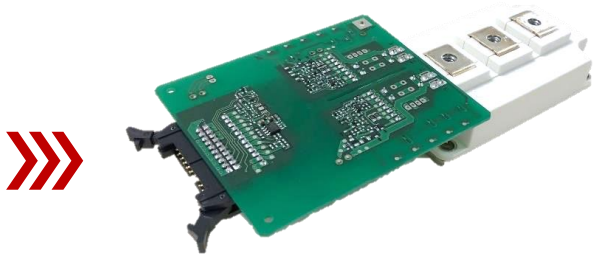
Rev A

Help your evaluation !

Gate Driver Module



Evaluation board



Can be connected directly !

Package	I_D	Part No	TAMURA Driver			
			Evaluation board		2CG-B	2DD
	V_{D-S} = 1200V					
	250	FF6MR12KM1		2RB020BB	2CG010BBC15N * (+15/-4V) 	2DD15xxxxC * (+15V/-4V) 
		FF6MR12KM1P				
	375	FF3MR12KM1				
		FF3MR12KM1P				
	500	FF2MR12KM1				
		FF2MR12KM1P				

* Under development

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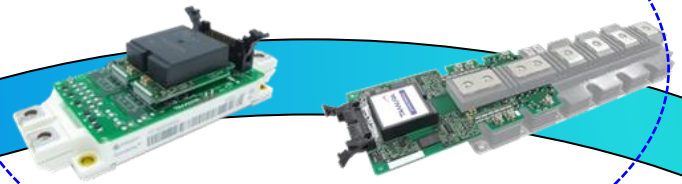
2) Introduction of One Tamura (General application)

Rev A

Power electronics technology and main products

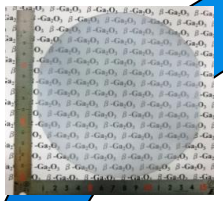
Gate driver
Circuit technology



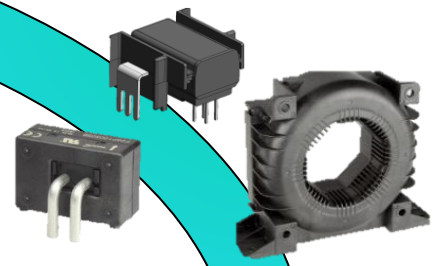
Gate Driver Unit

Device technology
Novel Crystal Technology, Inc.

Ga_2O_3

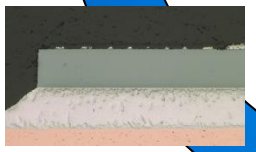


Module technology
Current sensor



Power electronics technology and main products

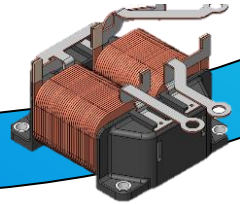
Soldering technology



Electric Chemicals
Soldering material
Die attach material
TIM material

Reflow soldering system

Automotive reactor



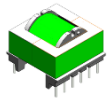
Reactor for PF
(2 in 1)

Passive components

Reactor
Trans
Coil

Large reactor/ transformer

Toroidal coil



SW-Trans

Appendix) Information & Contact

Rev A

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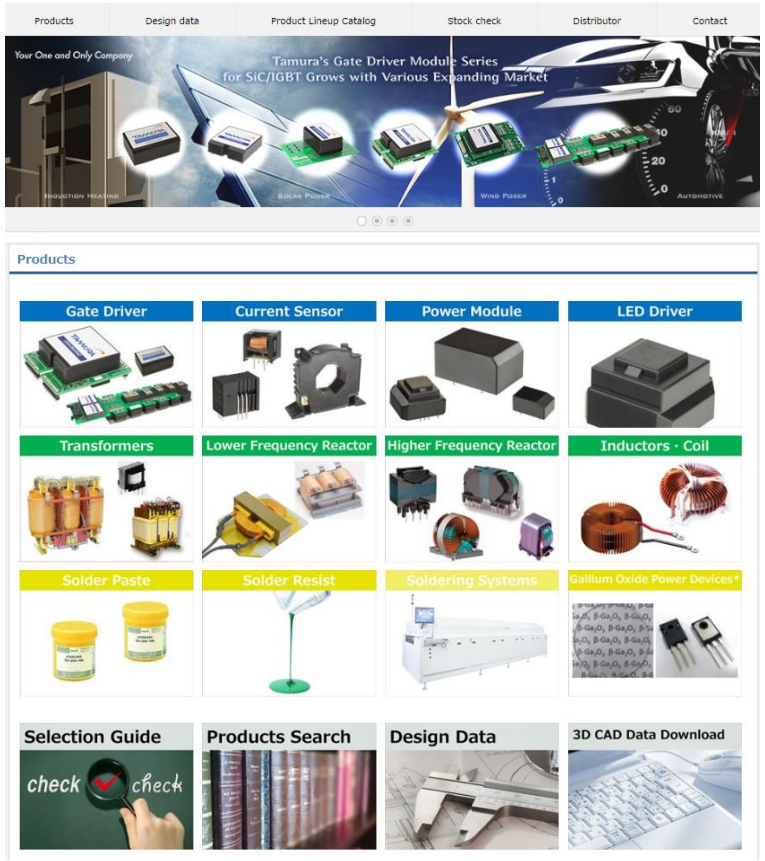

WEB

Tamura Gate Driver

- 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!

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