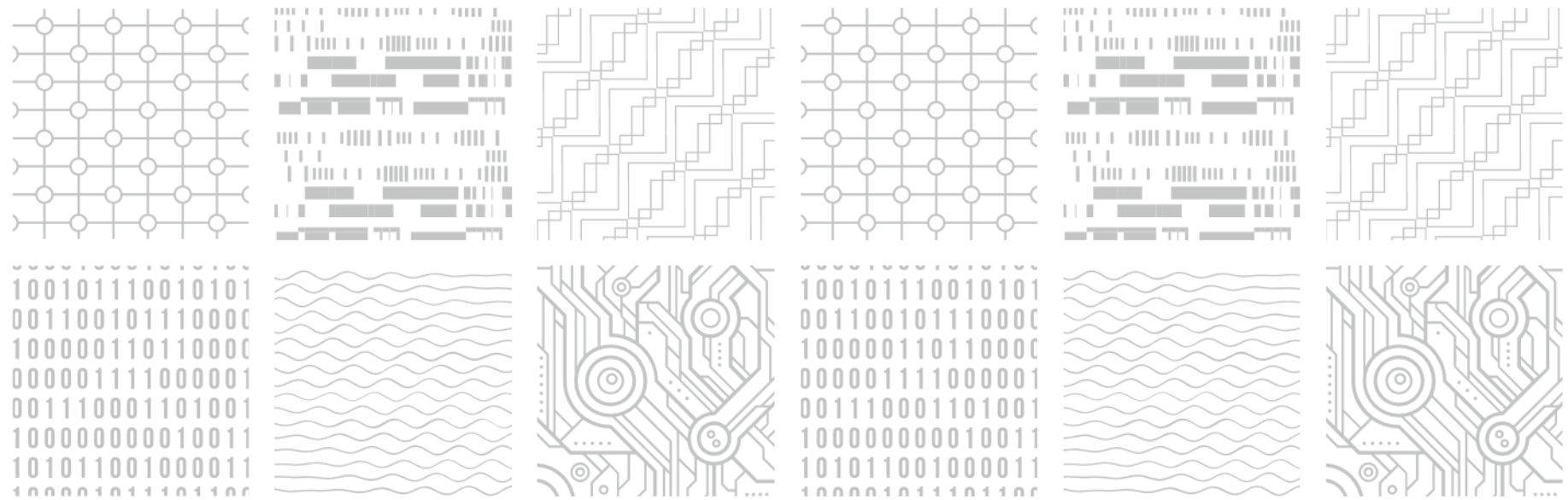


SIMPLIFY YOUR DRIVER

- Introduction for High capacity IGBT-



Issued on 1st Jan '21 Unit division HQ Japan



■ SIMPLIFY YOUR DRIVER

- Introduction for High capacity IGBT-

1. Tamura Products History for Power Electronics

- 1-1. Tamura General History
- 1-2. Tamura Gate Driver History
- 1-3. Future of Tamura Gate Driver

2. Tamura Gate Driver Family Feature

- 2-1. Pro and cons
- 2-2. Diffusion of Power Modules
- 2-3. Market trend of IGBT

3. Introduction of high capacity IGBT compatible Gate Driver

- 3-1. Product features
- 3-2. Gate Driver differences (SiC and IGBT)
- 3-3. Performance comparison of other companies

4. New IGBT power module switching test data

5. Products Line-up

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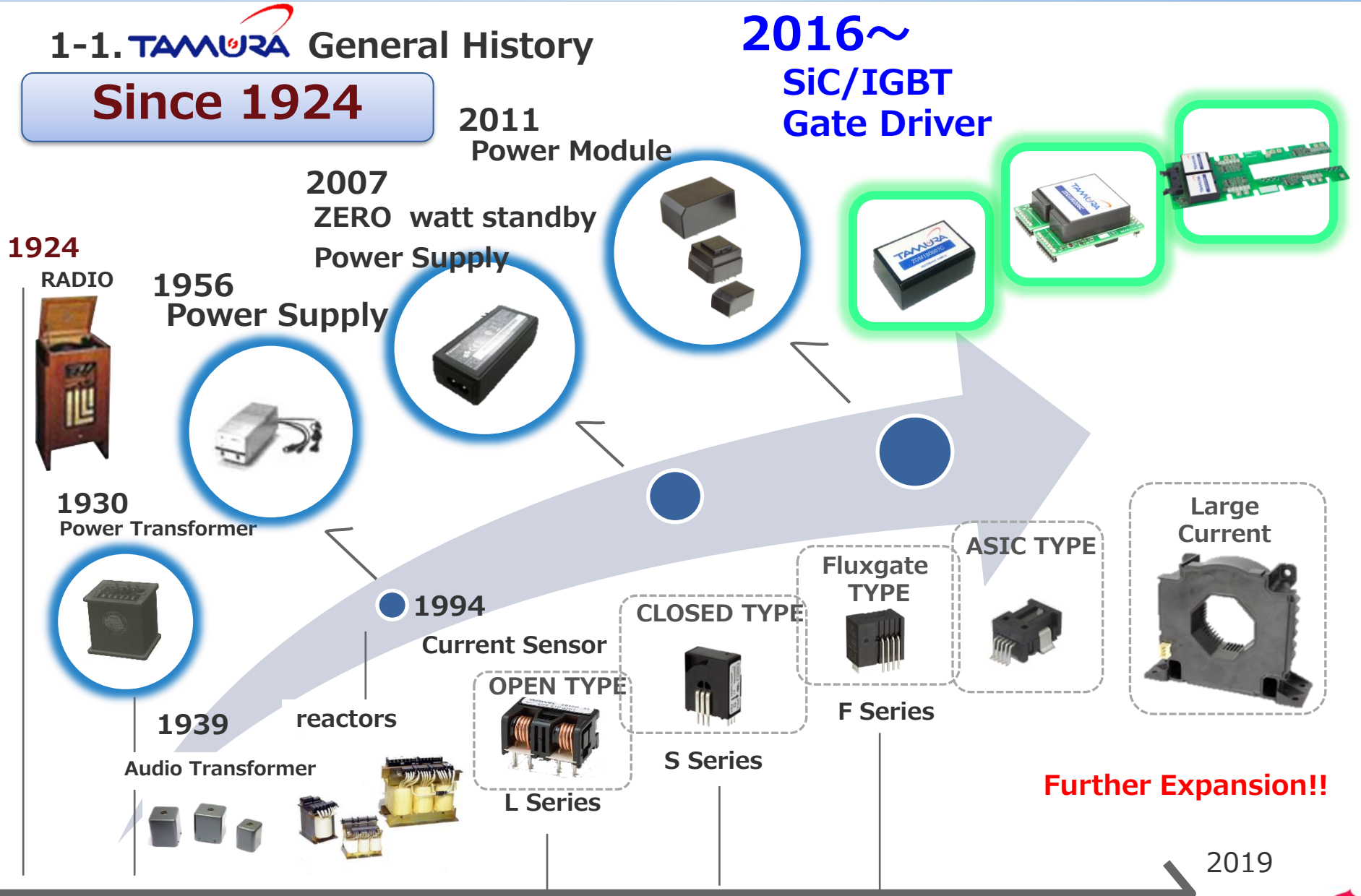
- 3-1. Product features
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4. New IGBT power module switching test data

5. Products Line-up

1-1. TAMURA General History

Since 1924



2DUD-P

2018~

2DUC-E

4DUD

2017

2DMB for SiC/IGBT

2DD of DC-DC convertor

2016

2DM/2DU for SiC

2018

2019

For NPC
For ANPC
For Parallel

High Power solution

Mitsubishi (2in1)

FUJI (2in1)

Infineon (2in1)

FUJI (2in1)

Infineon (2in1)

FUJI (2in1)

Infineon (2in1)

FUJI (4in1)

Mitsubishi (2in1)

FUJI (2in1)

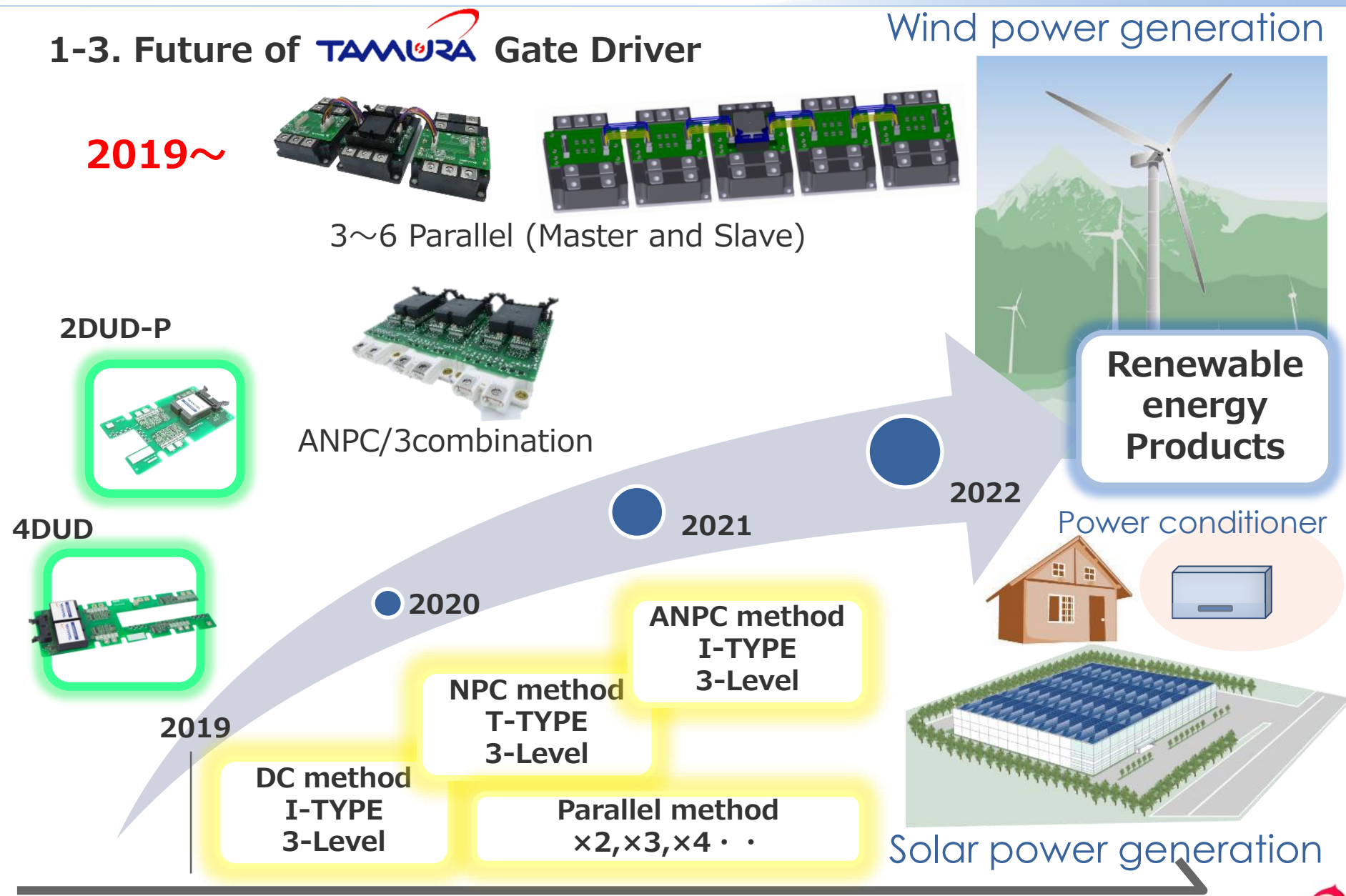
Infineon (2in1)

ROHM (SiC)

2016

2017

1-3. Future of Gate Driver



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2. TAMURA Gate Driver Family Feature

2-1. Pro and cons

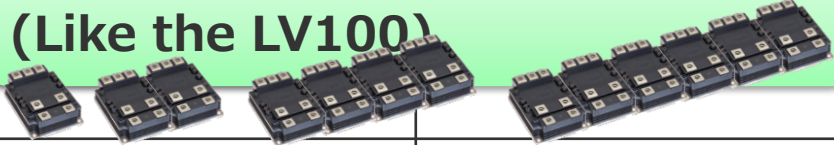
Trans technology

Analog circuit technology

Digital circuit technology

EMC technology

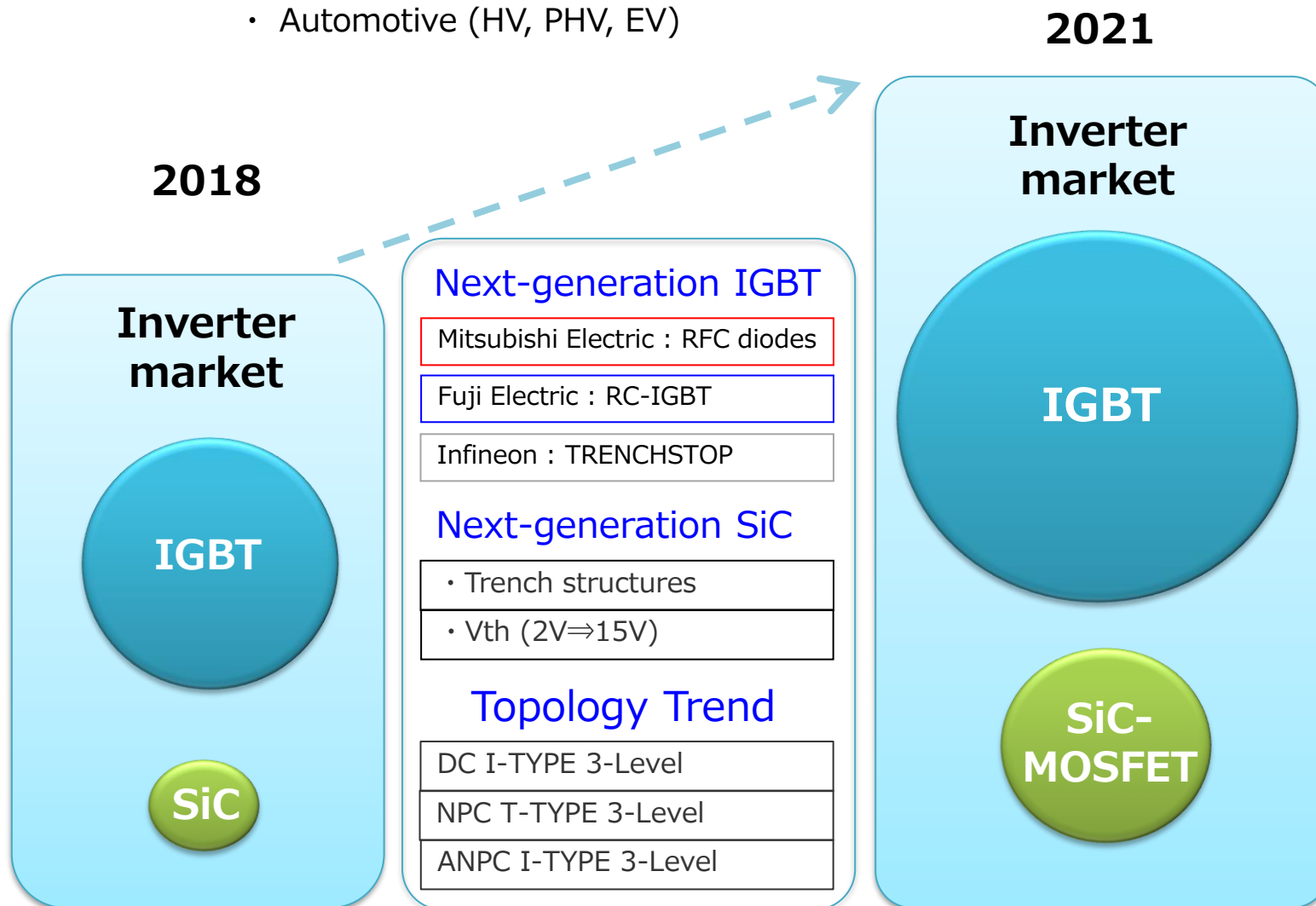
Potting technology

Item	Applied technology	Features	Compared with Competitors
<u>Low stray capacity</u>	   	Low noise at high frequencies	
<u>Wider input voltage</u>	    	Supports 24V system Output high accuracy ⇒ Correspond to SiC	
<u>High Power DC-DC converter</u>	   	High Frequency & Large capacity	
<u>High-speed response & accuracy</u>	   	Parallel drive available (Like the LV100) 	
<u>Various protections</u>	 	Improved reliability	

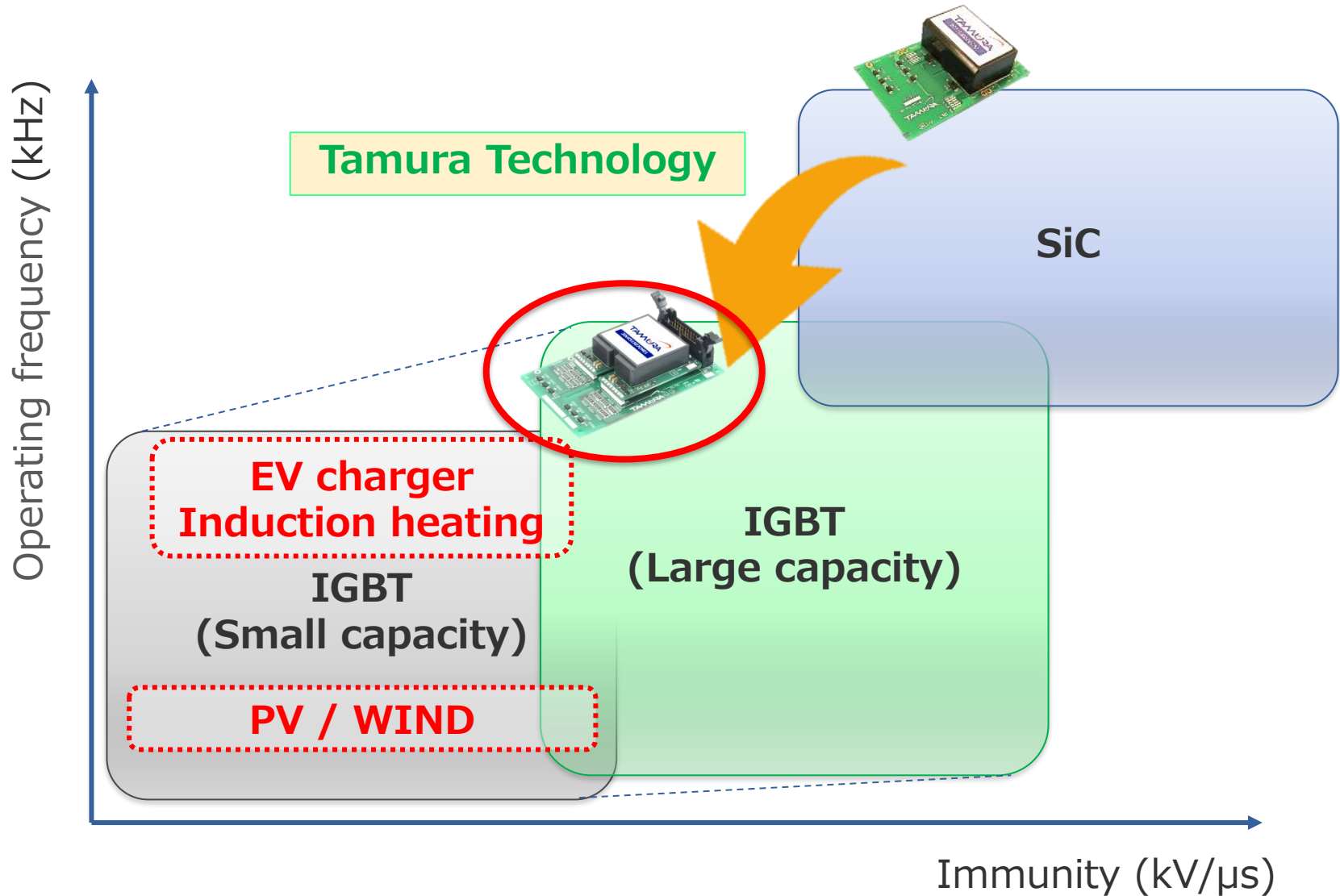


2-2. Diffusion of Power Modules

- Market growth
- PV, and Wind power
 - Motor control inverter (general-purpose inverter)
 - Automotive (HV, PHV, EV)



2-3. Market trend of IGBT



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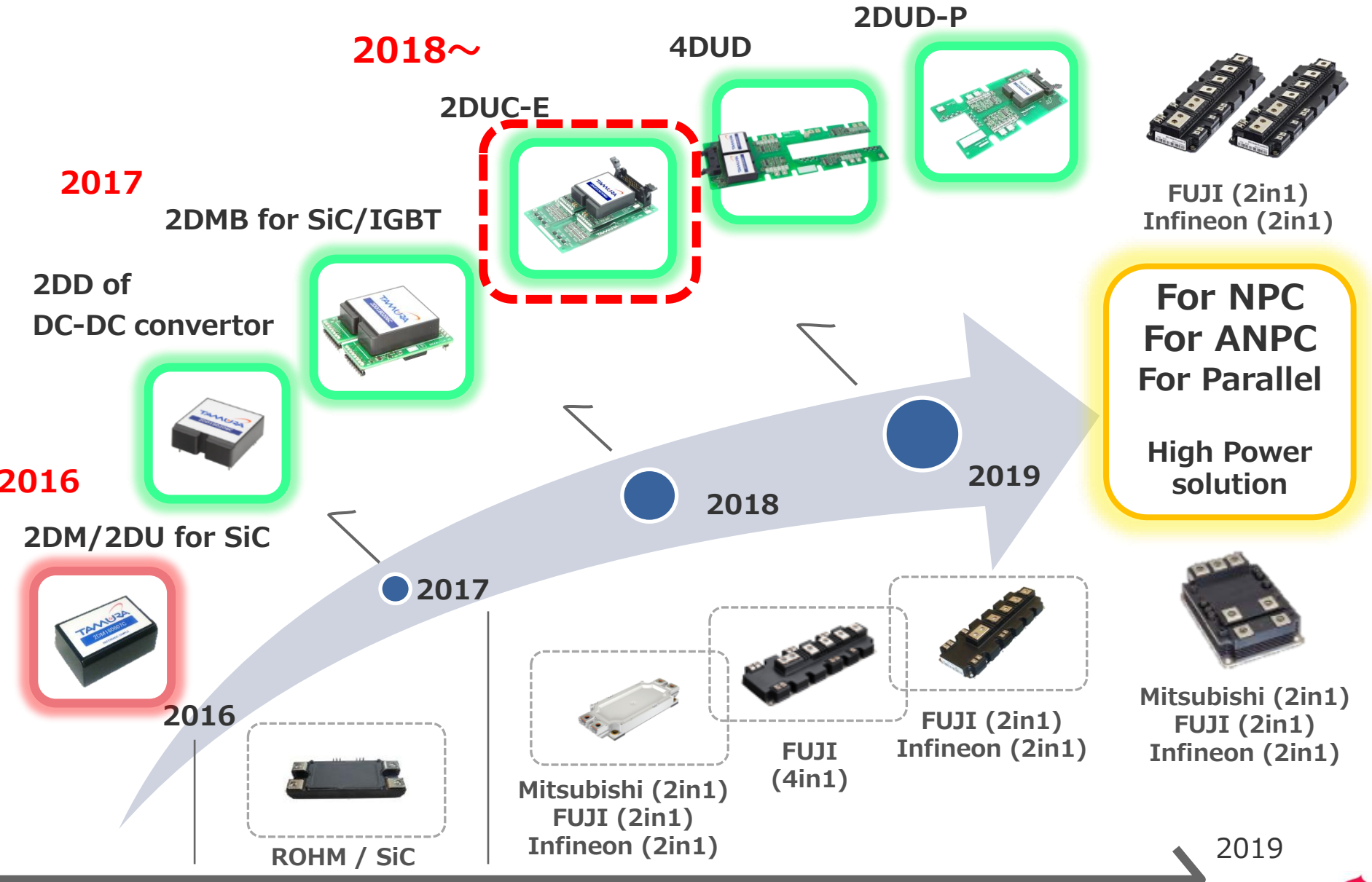
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TAMURA

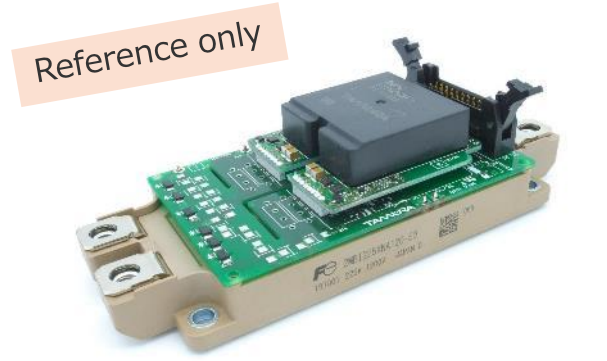


3. Introduction of high capacity IGBT compatible Gate Driver TAMURA

3-1. Product features



Infineon Technologies
/EconoDUAL™



Fuji Electric
/DUAL-XT



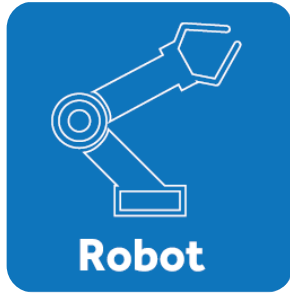
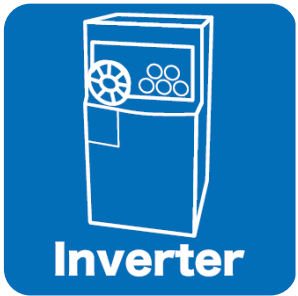
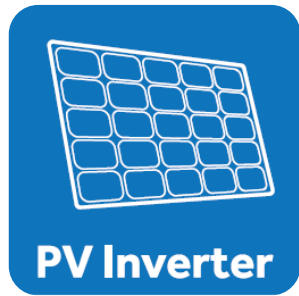
Mitsubishi Electric
/NX-DX

4W per channel

Frequency
200kHz (Max)

Peak Current
43A

Suitable for various applications !

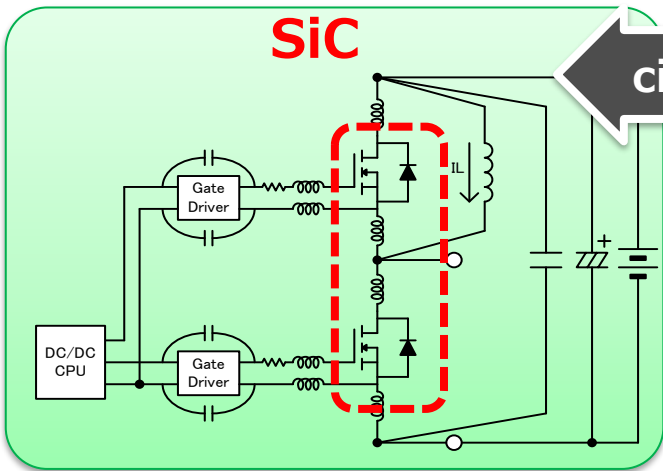


EconoDUAL™ is registered trademark of Infineon Technologies AG, Germany.

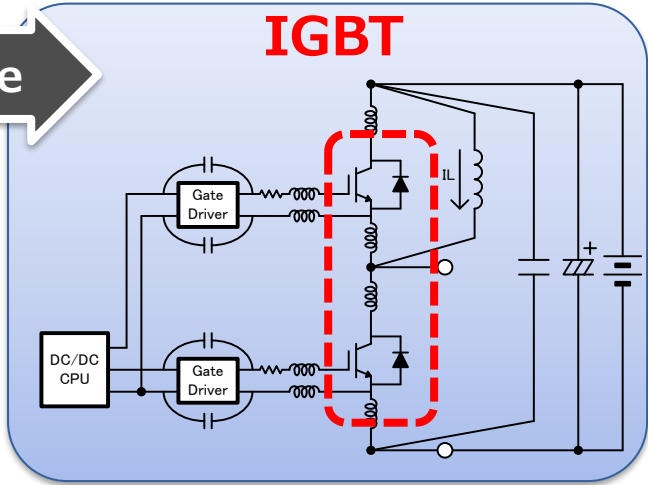
3-2. Gate Driver differences (SiC and IGBT)

Item	Condition (SiC-MOSFET)	Condition (IGBT)
Gate drive circuit	2 (Half bridge)	2 (Half bridge)
Gate voltage (H)/(L)	18V/-5V	15V/-10V
Protection function	DESAT, Miller clamp	DESAT, STO,ACL
Operating frequency	200kHz (MAX)	20kHz (MAX)
Stray capacity	12pF	30-40pF
Response	85nsec (TYP)	350nsec (TYP)

Cover with all items!



circuit is same



If the SiC-MOSFET can be driven, the IGBT can be driven easily!

3. Introduction of high capacity IGBT compatible Gate Driver

TAMURA

3-2. Performance comparison of other companies

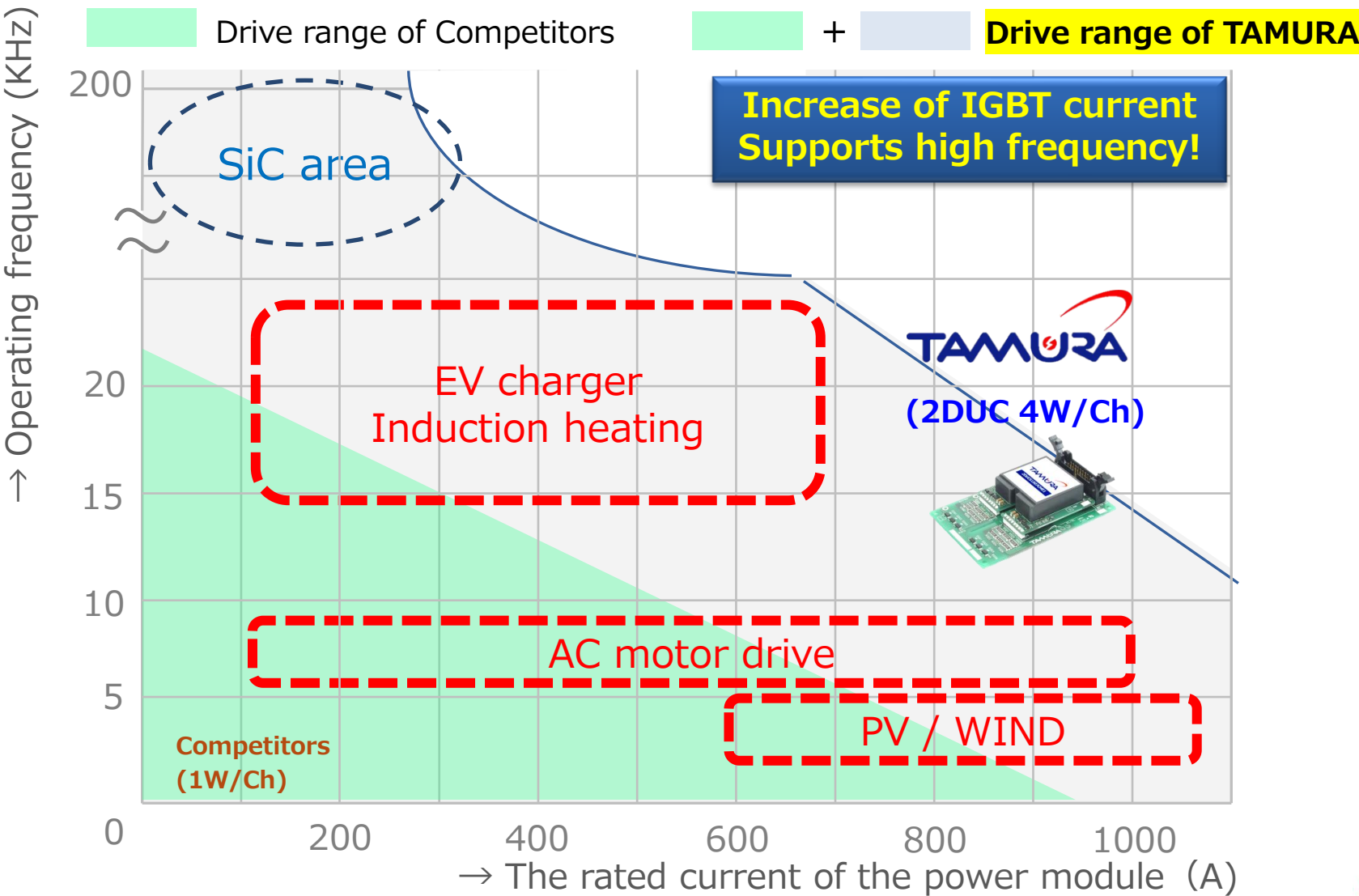


Item	TAMURA	Company A
Power module	SiC-MOSFET/IGBT	IGBT
Input Voltage	13-28V	15V
Output Voltage	15V/-10V	15V/-10V
Output power	○ 4W	1W
Frequency	○ 200kHz (Max)	20kHz (Max)
Output Perk current	○ 43A	15A

Large drive capacity makes it ideal for large capacity IGBTs!

3-2. Performance comparison of other companies

Switching frequency range (image)



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4. New IGBT power module switching test data

5. Products Line-up

IGBT:FF900R12ME7_B11 (Infineon Technologies) 2DUy-E series Switching Test Data 1

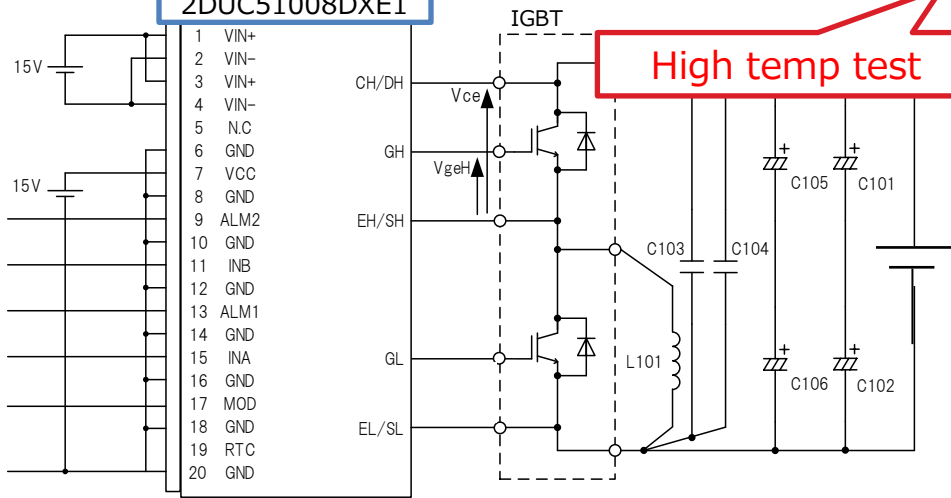


2 Pulse Test

DC Link : 600V, Ron=Roff : 0.51Ω, Upper arm, Tj=150°C

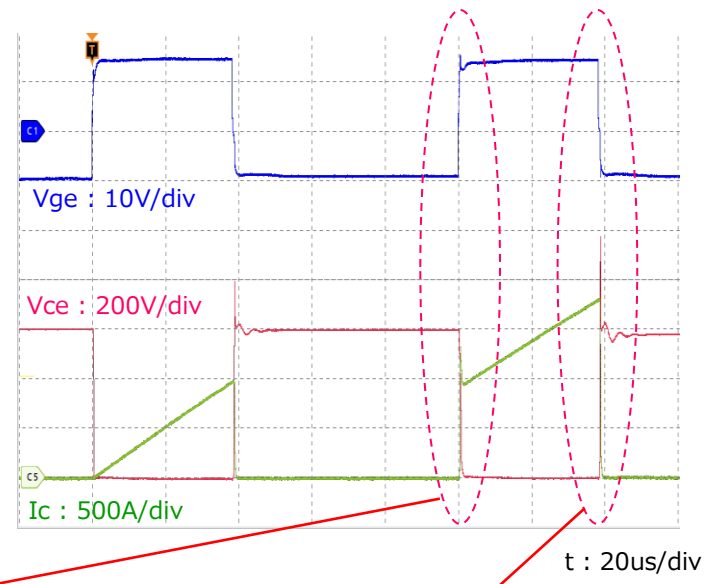
IGBT : FF900R12ME7_B11 (Infineon)

2DUC51008DXE1

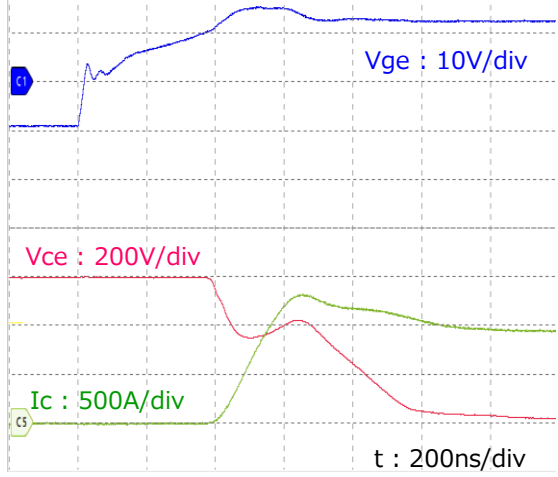


High temp test

IGBT : FF900R12ME7_B11 (Infineon)
C101,102,105,106 : 2700uF (Ls : 20nH)
C103,104: 4.7uF (Ls : 20nH)
L101: 22uH

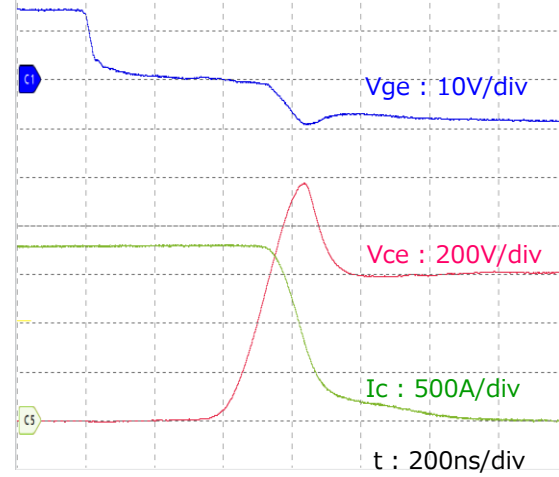


900A turn on



Item	Measurement value	
DC Link	600	V
Ic	900	A
dV/dt	2.7	kV/us
di/dt	7.5	kA/us
td(on)	0.40	us
tr	0.12	us
Eon	172	mJ

1800A turn off

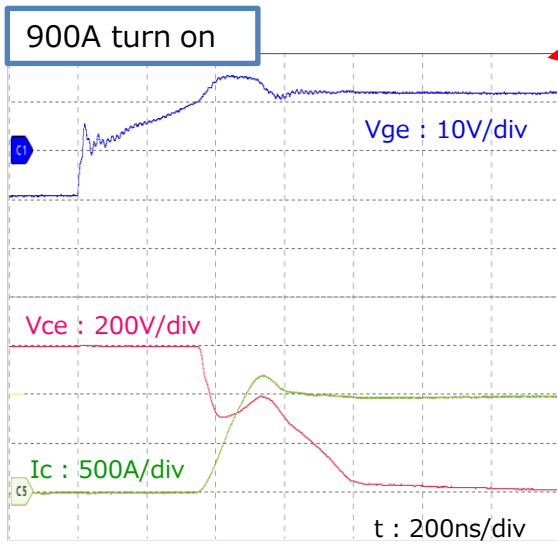
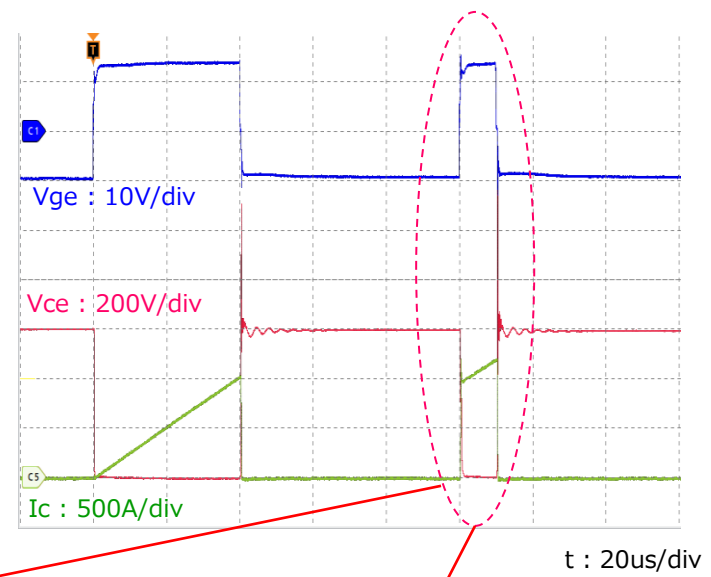
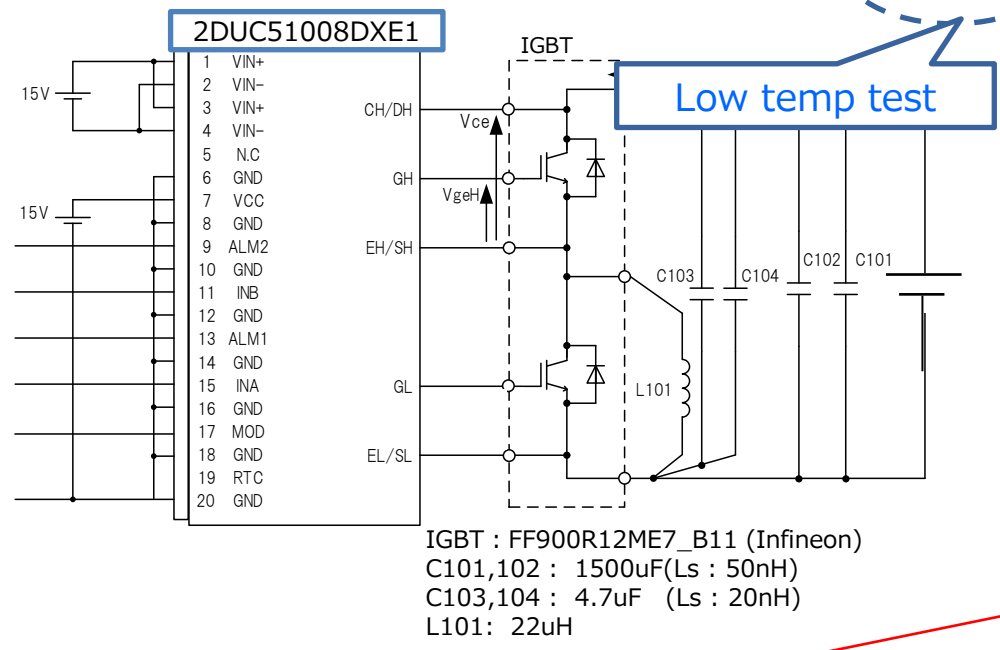


Item	Measurement value	
DC Link	600	V
Ic	1800	A
Vcep	973	V
dV/dt	5.2	kV/us
di/dt	12.4	kA/us
td(off)	0.56	us
tf	0.28	us
Eoff	240	mJ

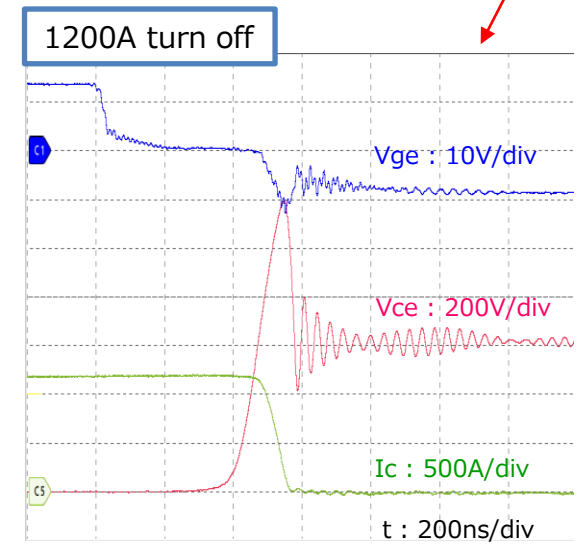
2 Pulse Test

DC Link : 600V, Ron=Roff : 0.51Ω, Upper arm, Tj=-40℃

IGBT : FF900R12ME7_B11 (Infineon)



Item	Measurement value	
DC Link	600	V
Ic	900	A
dV/dt	4.2	kV/us
di/dt	9.2	kA/us
td(on)	0.36	us
tr	0.10	us
Eon	108	mJ

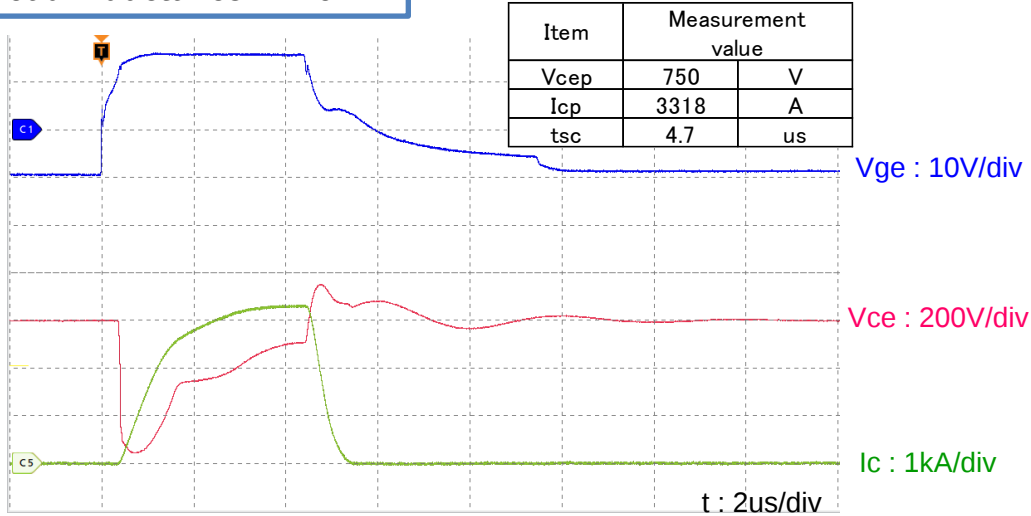


Item	Measurement value	
DC Link	600	V
Ic	1200	A
Vcep	1197	V
dV/dt	8.0	kV/us
di/dt	16.3	kA/us
td(off)	0.47	us
tf	0.07	us
Eoff	82	mJ

Desaturation Protection

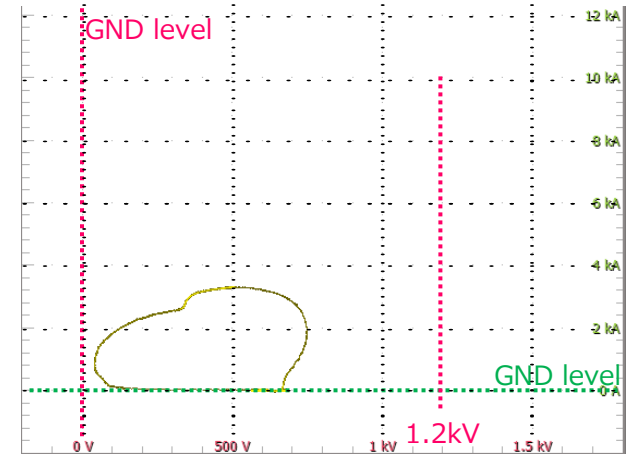
DC Link : 600V, Ron=Roff : 0.51Ω, Upper arm, Tj=150℃

Load inductance : 170nH

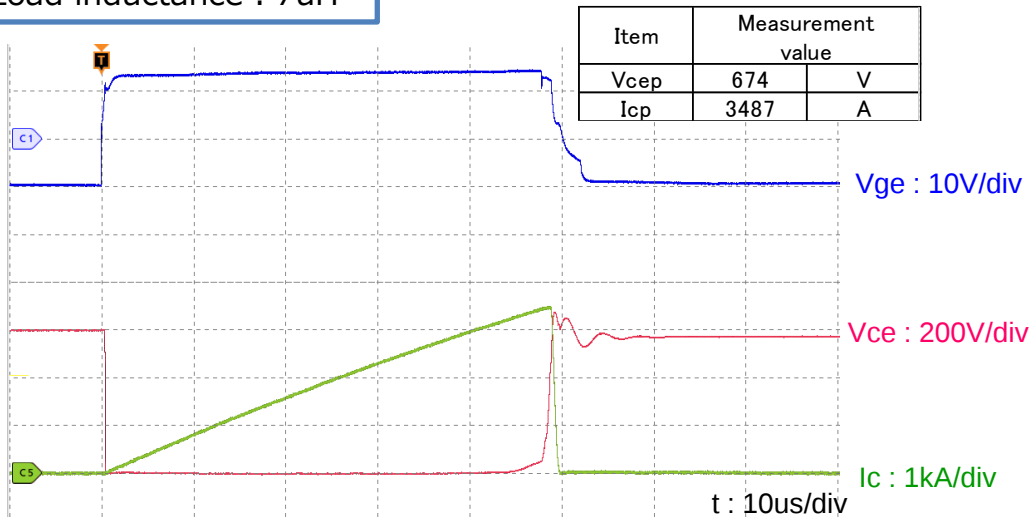


IGBT : FF900R12ME7_B11 (Infineon)

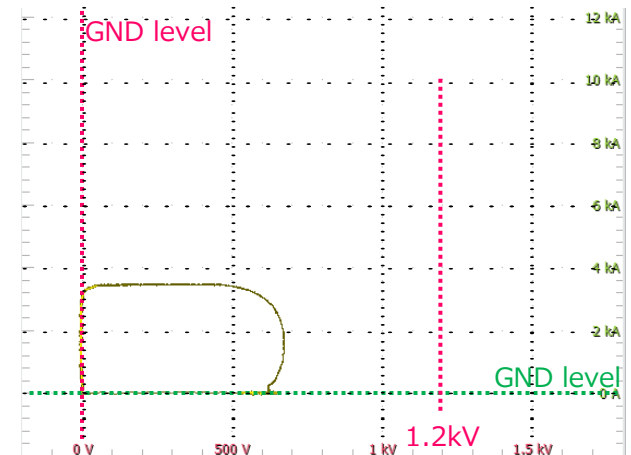
SOA



Load inductance : 7uH



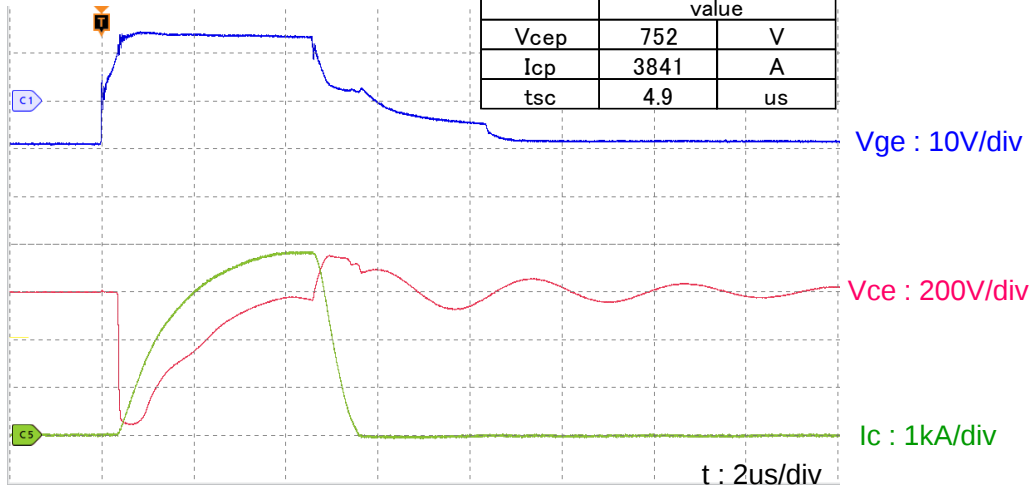
SOA



Desaturation Protection

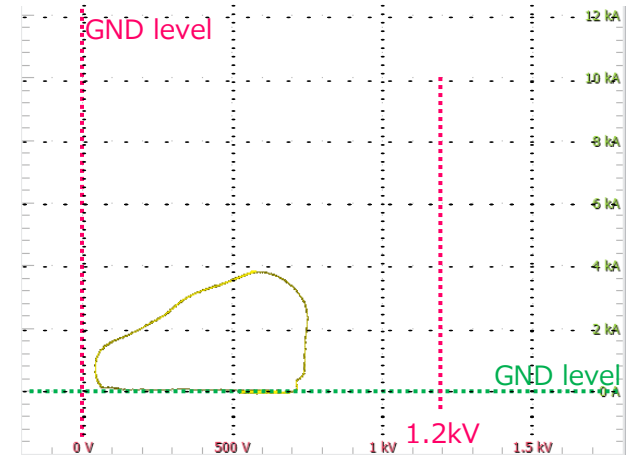
DC Link : 600V, Ron=Roff : 0.51Ω, Upper arm, Tj=-40℃

Load inductance : 170nH

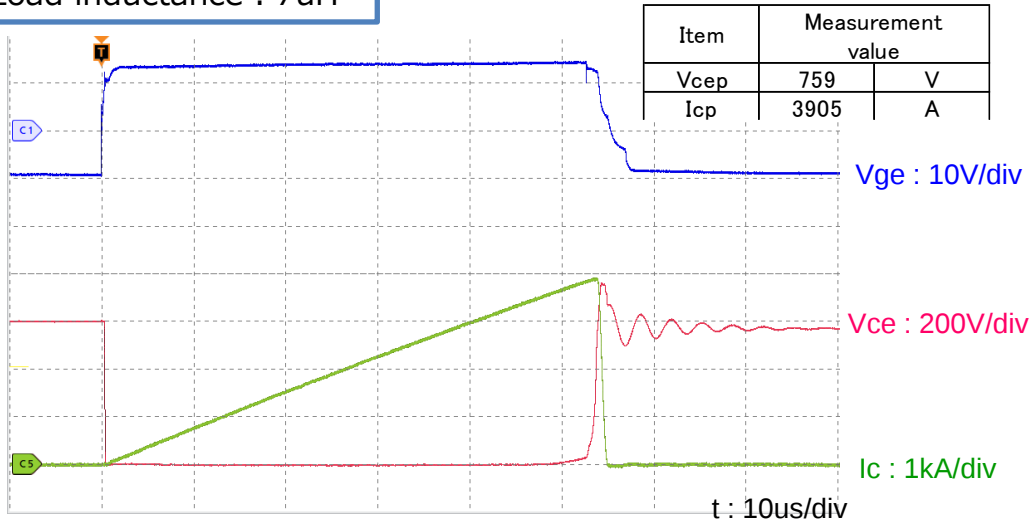


IGBT : FF900R12ME7_B11 (Infineon)

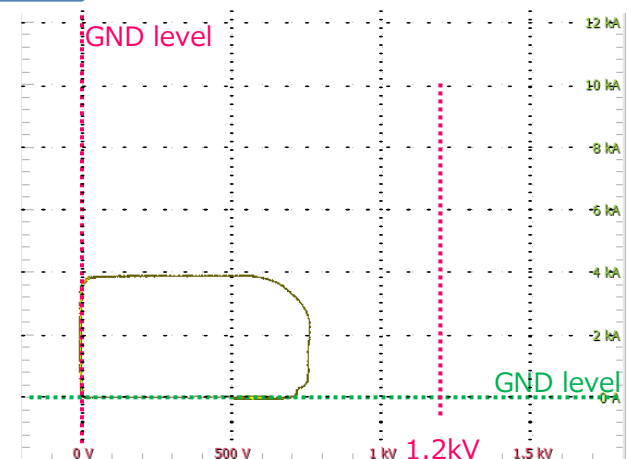
SOA



Load inductance : 7uH



SOA

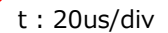


IGBT:CM800DX-24T1 (Mitsubishi Electric)

2DUy-E series Switching Test Data 1



IGBT : CM800DX-24T1 (Mitsubishi)



V_{ge} : 10V/div

t : 200ns/div

V_{ge} : 10V/div

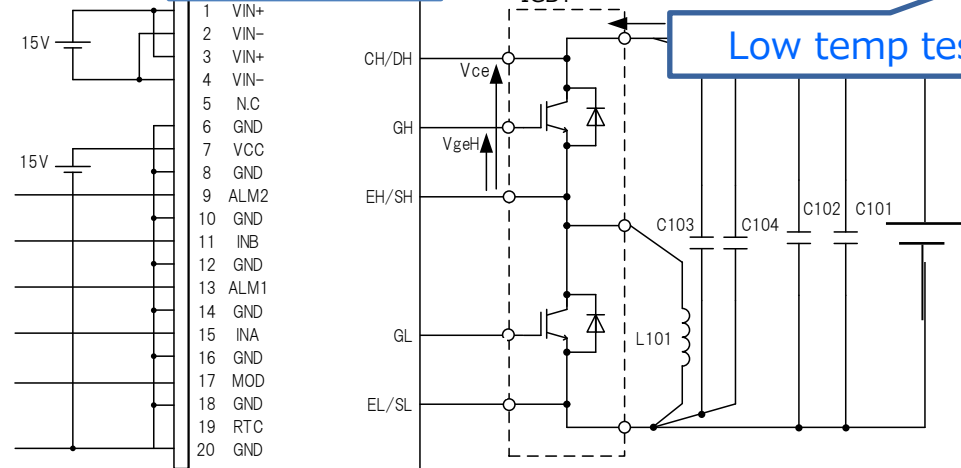
t : 500ns/div

2 Pulse Test

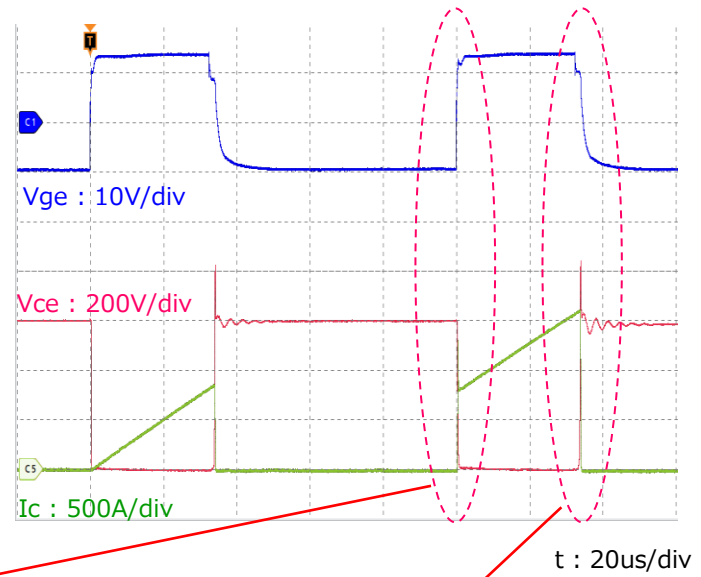
DC Link : 600V, Ron : 1Ω, Roff : 10Ω, Upper arm, Tj=-40℃

IGBT : CM800DX-24T1 (Mitsubishi)

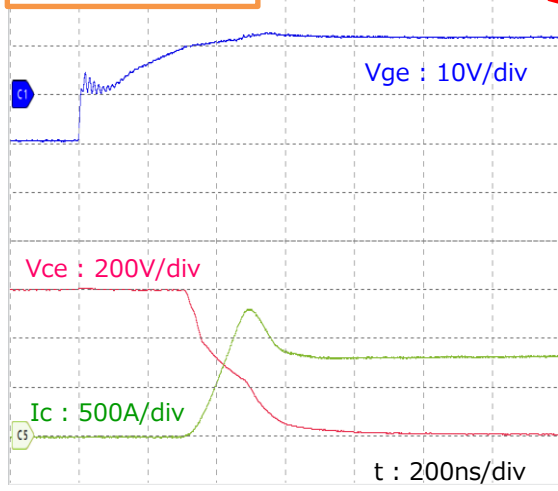
2DUC51008DXE1



IGBT : CM800DX-24T1 (Mitsubishi)
C101,102 : 1500uF (Ls : 50nH)
C103,104 : 4.7uF (Ls : 20nH)
L101: 22uH

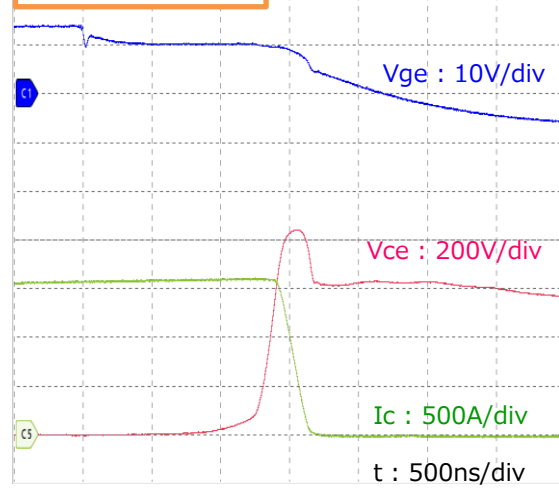


800A turn on



Item	Measurement value	
DC Link	600	V
Ic	800	A
dV/dt	3.2	kV/us
di/dt	8.9	kA/us
td(on)	0.33	us
tr	0.08	us
Eon	46	mJ

1600A turn off



Item	Measurement value	
DC Link	600	V
Ic	1600	A
Vcep	840	V
dV/dt	4.3	kV/us
di/dt	8.0	kA/us
td(off)	1.45	us
tf	0.18	us
Eoff	236	mJ

Desaturation Protection

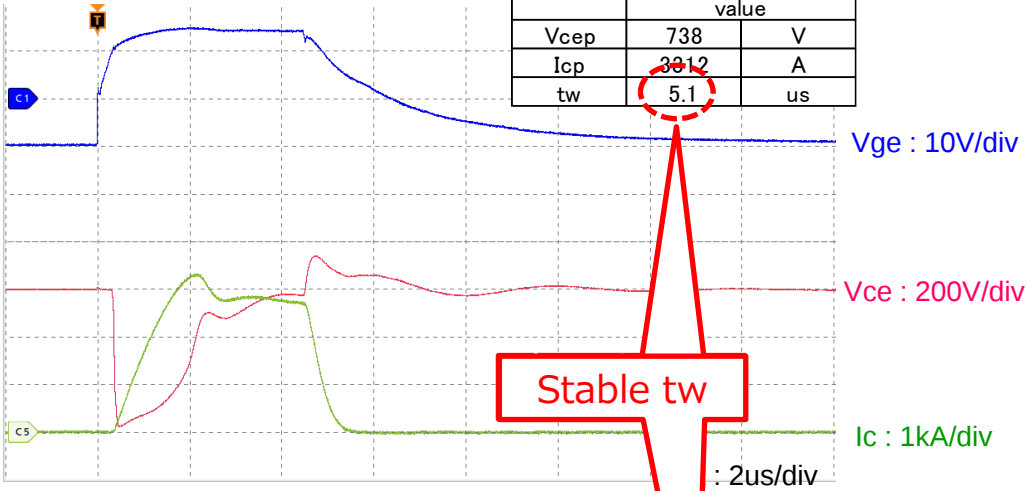
DC Link : 600V, Ron : 1Ω, Roff : 10Ω, Upper arm, Tj=150℃

Load inductance : 170nH

High temp test

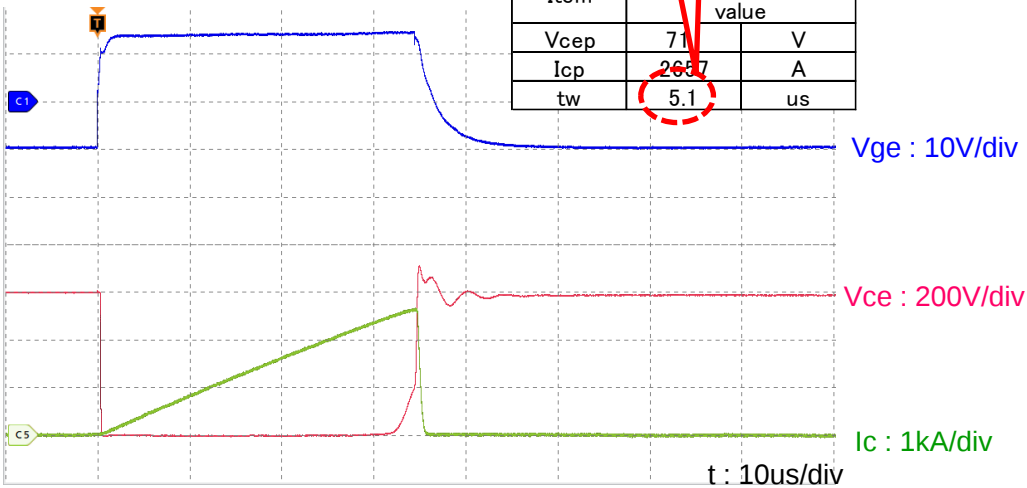
Item	value	
Vcep	738	V
Icp	3012	A
tw	5.1	us

Stable tw



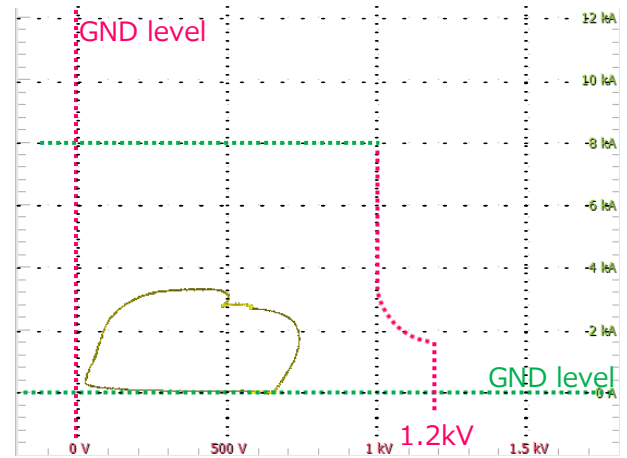
Load inductance : 7uH

Item	Measurement value	
Vcep	71	V
Icp	2657	A
tw	5.1	us

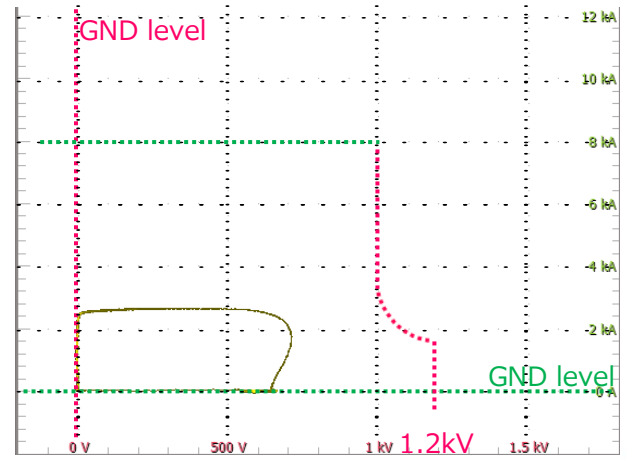


IGBT : CM800DX-24T1 (Mitsubishi)

SOA



SOA



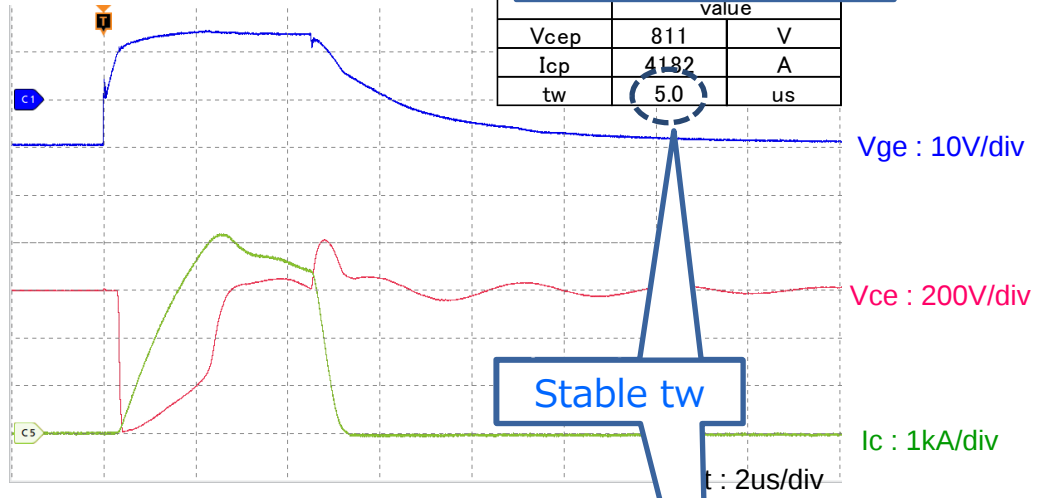
Desaturation Protection

DC Link : 600V, Ron : 1Ω, Roff : 10Ω, Upper arm, Tj=-40℃

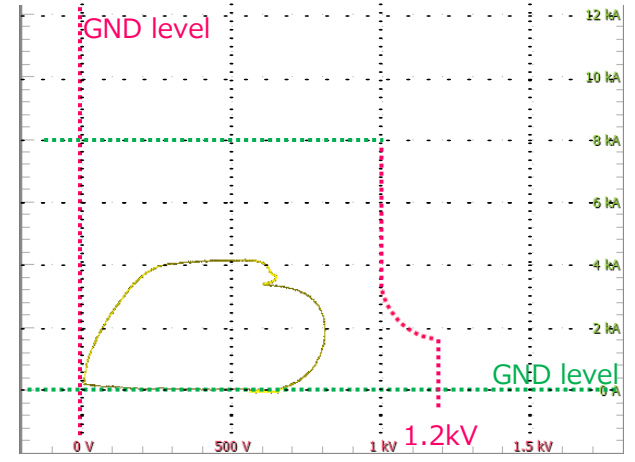
IGBT : CM800DX-24T1 (Mitsubishi)

Load inductance : 170nH

Low temp test

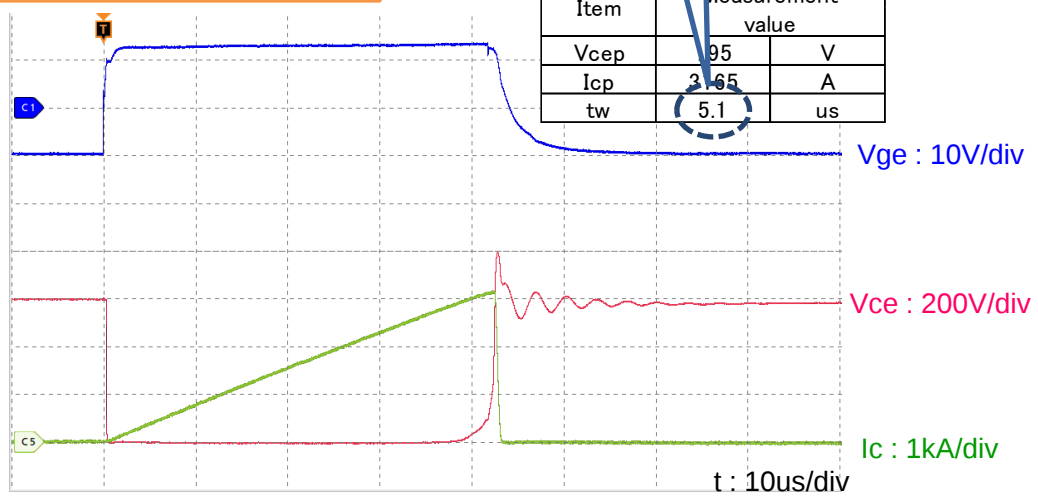


SOA

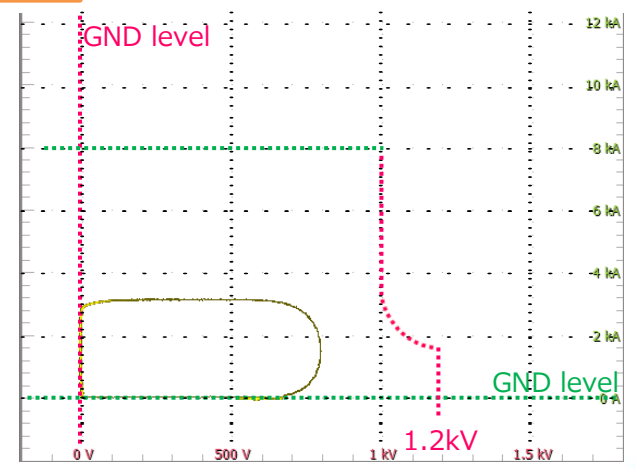


Load inductance : 7uH

Stable tw



SOA



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5. Products Line-up

5. Products Line-up

5-1. Product line-up for Infineon Technologies EconoDUAL™ 2in1 Type

Package	Output power (Ref.)	Ic	Part No	TAMURA Driver			
				2DUy-E *1	2DMB	2DD	
				Vce = 1200V			
	20kW	150	FF150R12MS4G		2DUy51008xXE1		
	30kW	225	FF225R12ME4		2DUy51008xXE1		
			FF225R12MS4		2DUy51008xNE4 *1		
	50kW	300	FF300R12ME4		2DUy51008xXE1		
			FF300R12MS4		2DUy51008xNE3 *1		
	100kW	450	FF450R12ME4		2DUy51008xXE1		
	125kW	600	FF600R12ME4		2DUy51008xNE2 *1		
					2DUy51008xNE1 *1		
	150kW	900	FF900R12ME7				
		Vce = 1700V					
	TBC	225	FF225R17ME4		2DUy51008xXE1		
		300	FF300R17ME4		2DUy51008xXE1		
		450	FF450R17ME4		2DUy51008xNE7 *1		
					2DUy51008xNE6 *1		
		600	FF600R17ME4		2DUy51008xXE1		
					2DUy51008xNE5 *1		

*1 Not standard product
Consider evaluation on customer's request.

x: Signal input voltage selectable "E" => 3.3~15V "F" => 15V
y: Protection circuits "C"=>Soft turn off / "D"=>Soft turn off + Active clamp

EconoDUAL™ is registered trademark of Infineon Technologies AG, Germany

5. Products Line-up

5-2. Product line-up for Mitsubishi Electric NX 2in1 Type

Package	Output power (Ref.)	Ic	Part No	TAMURA Driver					
				2DUy-E	2DMB	2DD			
	Vce = 1200V								
	30kW	225	CM225DX-24T1		2DUy51008xXE1		2DD151008C (+15V/-10V)		
			CM225DX-24T						
	50kW	300	CM300DX-24T1		2DUy51008xXE1				
			CM300DX-24T		2DUy51008xME3 *1				
	100kW	450	CM450DX-24T1		2DUy51008xXE1				
			CM450DX-24T		2DUy51008xME2 *1				
	125kW	600	CM600DX-24T1		2DUy51008xXE1 2DUy51008xME1 *1				
			CM600DX-24T						
	150kW	900	CM800DX-24T1						
	Vce = 1700V								
	TBC	225	CM225DX-34T		2DUy51008xXE1		2DD151008C (+15V/-10V)		
		300	CM300DX-34T		2DUy51008xXE1 2DUy51008xME6 *1				
		450	CM450DX-34T		2DUy51008xXE1 2DUy51008xME5 *1				
		600	CM600DX-34T		2DUy51008xXE1 2DUy51008xME4 *1				

*1 Not standard product
Consider evaluation on customer's request.

x: Signal input voltage selectable "E" => 3.3~15V "F" => 15V
y: Protection circuits "C"=>Soft turn off / "D"=>Soft turn off + Active clamp

5. Products Line-up

5-3. Product line-up for Fuji Electric Dual XT 2in1 Type

Package	Output power (Ref.)	Ic	Part No	TAMURA Driver						
				2DUy-E	2DMB	2DD				
			Vce = 1200V							
	30kW	225	2MBI225XNA120-50		2DUy51008xXE1					
	50kW	300	2MBI300XNA120-50		2DUy51008xXE1 2DUy51008xFE5 *1					
			2MSI300VAN-120-53 2MSI300VWAN-120-53		2DUy51008xXE1					
			100kW		450			2MBI450XNA120-50	2DUy51008xXE1 2DUy51008xFE4 *1	
	2MSI450VAN-120-53	2DUy51008xXE1								
	125kW	600	2MBI600XNG120-50		2DUy51008xXE1 2DUy51008xFE3 *1					
			2MBI600XNE120-50		2DUy51008xXE1					
			2MSI600VAN-120-53		2DUy51008xXE1 2DUy51008xFE2 *1					
	150kW	800	2MBI800XNE120-50		2DUy51008xXE1 2DUy51008xFE2 *1					
		1000	2MBI1000XRNE120-50		2DUy51008xXE1 2DUy51008xFE1 *1					
			Vce = 1700V							
	TBC	225	2MBI225XNA170-50					2DUy51008xXE1		
		300	2MBI300XNA170-50	2DUy51008xXE1 2DUy51008xFE8 *1						
		450	2MBI450XNA170-50	2DUy51008xXE1 2DUy51008xFE7 *1						
		550	2MSI550VAN-170-53	2DUy51008xXE1						
		600	2MBI600XNG170-50	2DUy51008xXE1 2DUy51008xFE6 *1						
2MBI600XNE170-50										

*1 Not standard product

Consider evaluation on customer's request.

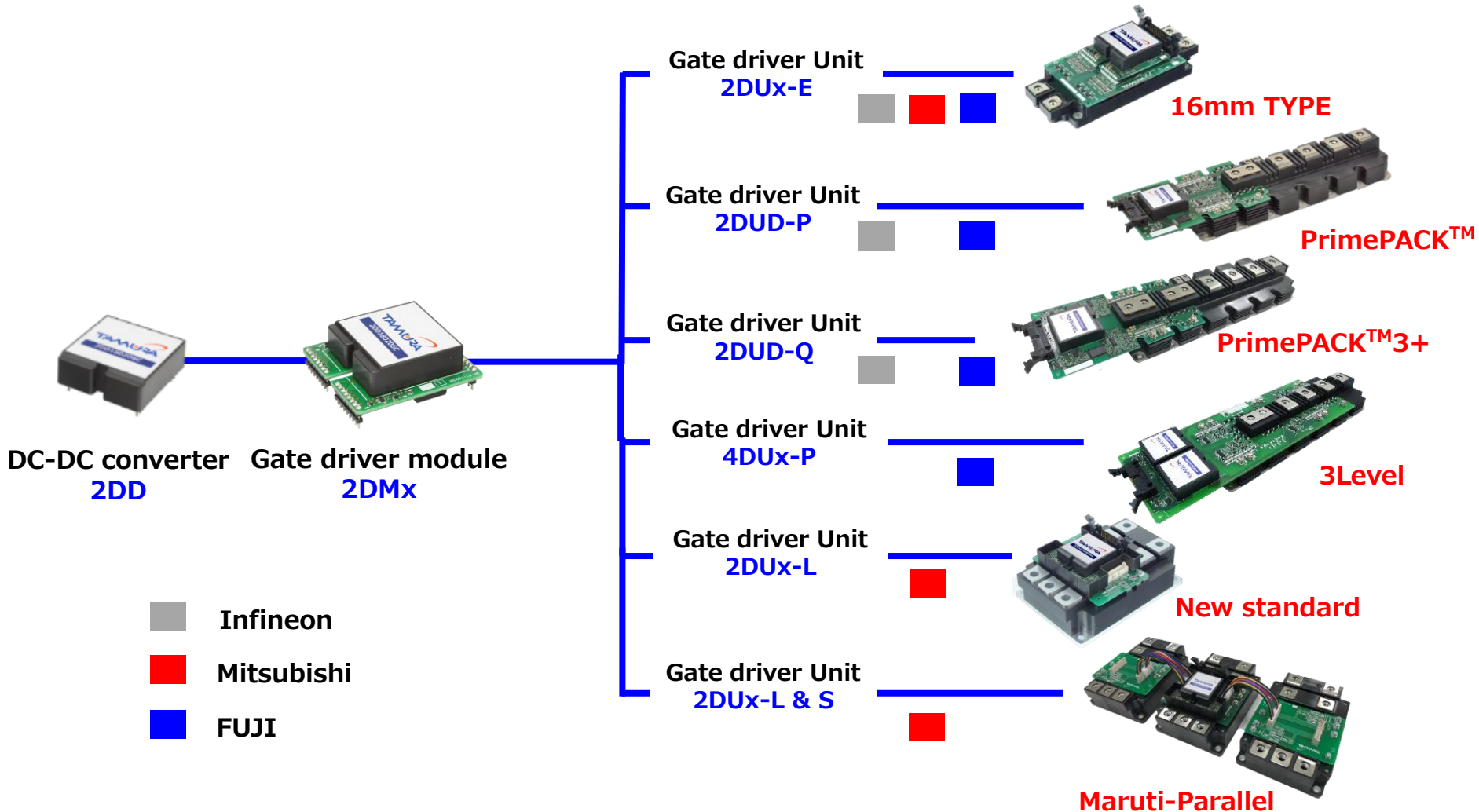
x: Signal input voltage selectable "E" => 3.3~15V "F" => 15V

y: Protection circuits "C"=>Soft turn off / "D"=>Soft turn off + Active clamp



5. Products Line-up

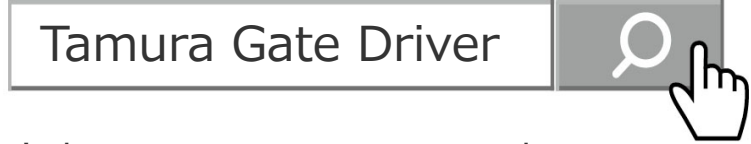
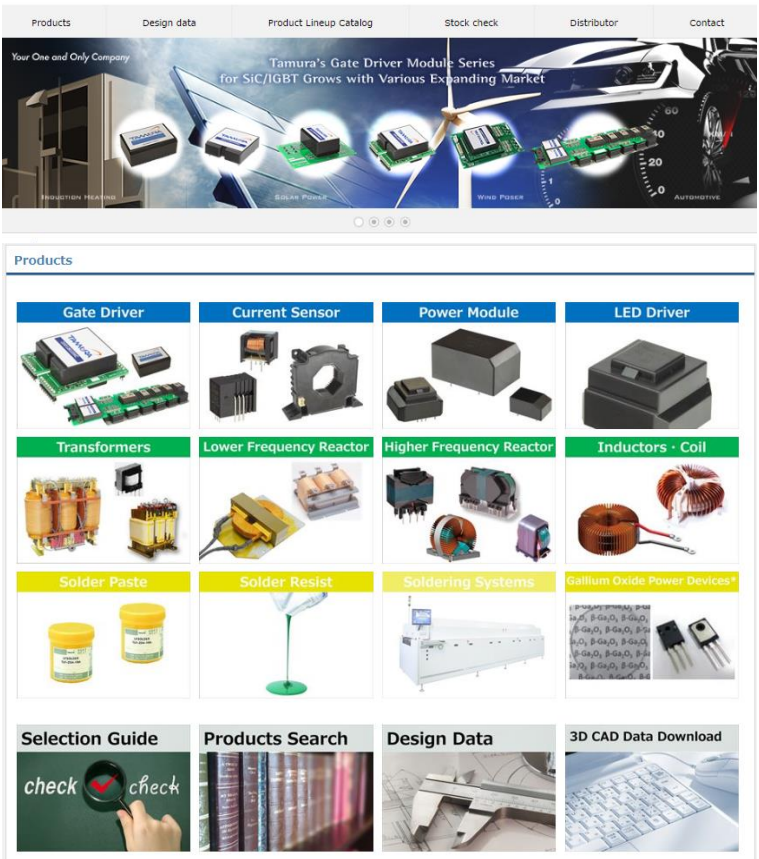
Gate Drivers Family Selection guide (All products)



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