

Power Module Report -2020-

Japan Marketing Survey Co., Ltd

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< Subjects of survey >

▼ Power module:

- All IGBT modules including IPM type,
- Any SiC power modules with 600V or greater, but excluding diode modules

< Companies surveyed >

▼ IGBT module company

Infineon, Mitsubishi Electric, Fuji Electric, Semikron, Hitachi Power Semiconductor Device, ABB, Microchip, Vishay, Littelfuse, On Semiconductor, STMicroelectronics, Dynex, Vincotech, Starpower, Macmic, Powersem, Kyocera, Rohm, Sanken, Silvermicro, Silan

▼ Full SiC module company

Infineon, Mitsubishi Electric, Fuji Electric, Semikron, Hitachi Power Semiconductor Device, ABB, Microchip, Vincotech, On Semiconductor, Rohm, Starpower, Silvermicro, Wolfspeed, GE

- * Market Trends and manufacturer trends of IGBT /SiC power modules
 - Classified by module capacity
 - Classified by application
 - Classified by insulating substrate material
 - Classified by package type

- * The updated comparison tables of product lineup situation of major 23 power module companies
 - Classified by module capacity, by type of circuit, by PKG type, by PM / IPM

- * Package technology trends mainly oriented towards xEV drive
 - Double-sided cooling structure, Direct / Indirect cooling
 - Core technologies for high reliability and high heat dissipation of modules

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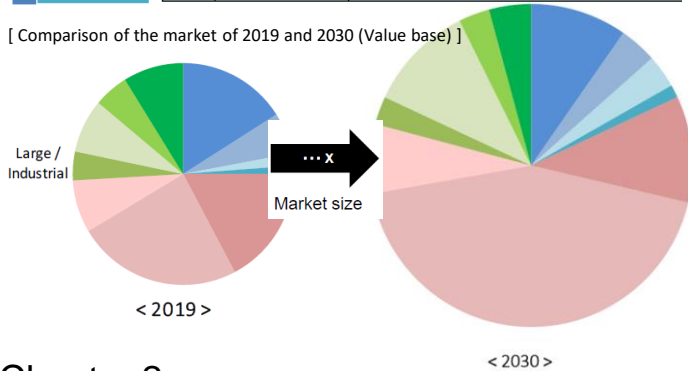
Sample of data -1-

Chapter 1

[Market overview of whole power module and SiC power module]

		2019	2022
Power module market	Volume (M units)
	Value (M USD)	4,990	...
	CAGR	→ ...%	
Full SiC power module market	Volume (K units) *1	... (..%)	... (..%)
	Value (M USD) *1	... (..%)	... (..%)
	CAGR	→ ...%	

[Comparison of the market of 2019 and 2030 (Value base)]



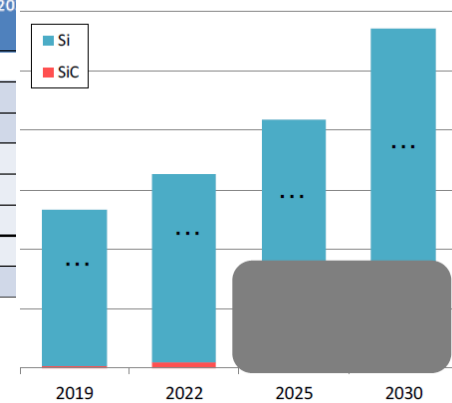
[Small capacity type power module market (volume base)]

		2019	2022	2025	2030
Volume market	Total (K units)	... ,000	100.0%	100.0%	100.0%
by PKG type	TM		..%	..%	..%
	Case		..%	..%	..%
by substrate	Resin		..%	..%	..%

4.3 Trends of power module devices and the packaging for xEV drive

		2019	2022	2030
Max power of motor for xEV	EV	30~450kW		..%
	PHEV			..%
	HEV			..%
PM for EV	Rated voltage value	✓ 650~750V		
Adoption rate of SiC module *1	EV			
	PHEV			
	HEV	0%		
PM PKG type	Ratio of "Case : TM			
PKG material	Insulation circuit substrate			
	Bonding material			
Case type	Encapsulant			
	Circuit connection			
TM type	Ratio of "Single:Do sided cooling			
	Cooling type of dot sided module			

[Market size by SiC and Si base]



5. A table of market entry trend by module manufacturer, classified by capacity

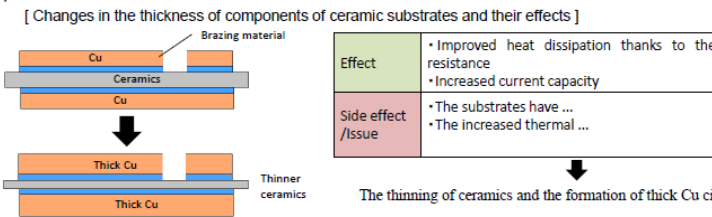
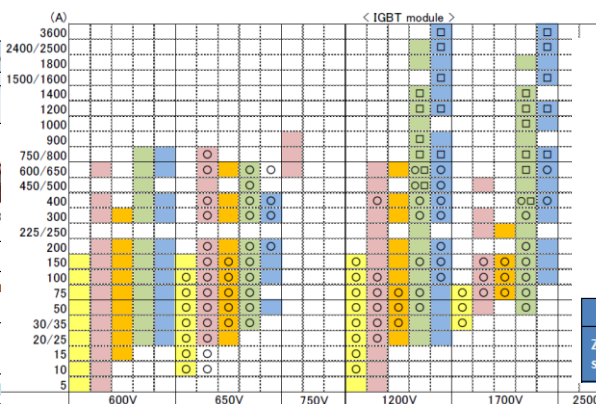
	Small capacity		Middle capacity	Large capacity	
	DIP/SIP/IPM		Module for xEV		High voltage
Fuji Electric					
Hitachi P.S.D					

Chapter 2

3.3.2 Product outline of major power modules

Module type	2 in 1 / TM type	
Product name /Manufacturer	HybridPACK DSC S1 / Infineon	Power card / Der
Image		
RV/RC	700V/400A	1200V/200A
External size	42.4x42x4.7(H)mm	50x58x5.2(H)mm
Cooling side / Shape of Heat sink	Double-sided / Flat	Double-sided
Cooling type	Indirect liquid	Indirect liquid

5.2 Situation classified by capacity and circuit, of companies who entered the IGBT market



[List of Ceramic substrate thickness by material]

	Thickness of ceramics	Thickness of Cu
ZTA/ZDA substrate	0.32	0.127 ~ 0.5

• ZTA/ZDA and Si3N4 substrates, ...

Sample of data -2-

Chapter 3

1.1.1 Classification by module capacity and application

		Application					Total
		Consumer	Industrial	Automotive	New energy	Railway	
Volume (K units)	Small						
	Middle	0					
	Large	0					
	Total						
Amount (K USD)	Small						
	Middle	0					
	Large	0					
	Total						

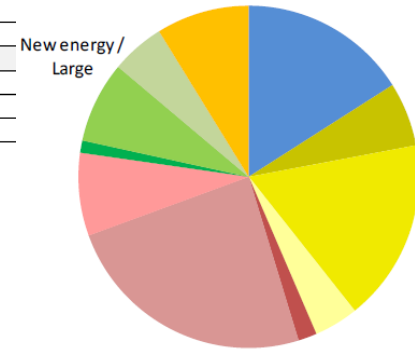
1.2.4 Classification by module capacity and application

Company	Module capacity	Application					Total (K units)	Consumer
		Consumer	Industrial	Automotive	New energy	Railway		
Infineon Technologies	Small							
	Middle	0				0		
	Large	0						
Mitsubishi Electric	Small					0		
	Middle					0		

1.2.7 Classification by insulating substrate material and module capacity

Company	Insulating material	Module capacity			(Sub) Total (K units)
		Small	Middle	Large	
Infineon Technologies	Resin				0
	Al ₂ O ₃				
	Si ₃ N ₄	0			
	AlN	0			
Mitsubishi Electric	Resin				
	Al ₂ O ₃				
	Si ₃ N ₄				
	AlN				

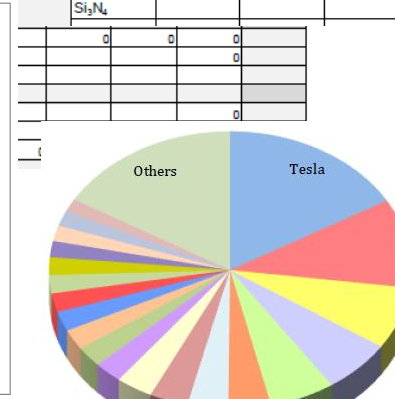
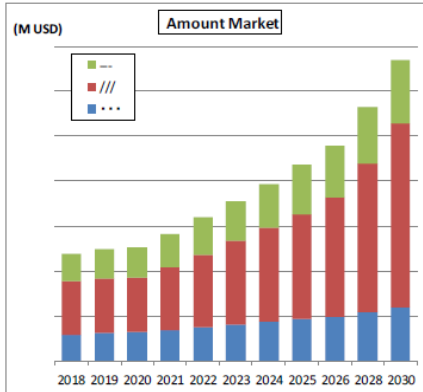
[Market ratio of power module by module capacity (primary) and application (secondary) in 2019]



1.3.3 Classification by module capacity and application

		2018	2019	2020	2021
Small	Consumer				
	Industrial				
	Automotive				
	New energy				
	Railway	0	0	0	
Middle	Consumer	0	0	0	
	Industrial				
	Automotive				
	New energy				
	Railway	0	0	0	
Large	Consumer	0	0	0	
	Industrial	229			
	Automotive				
	New energy				

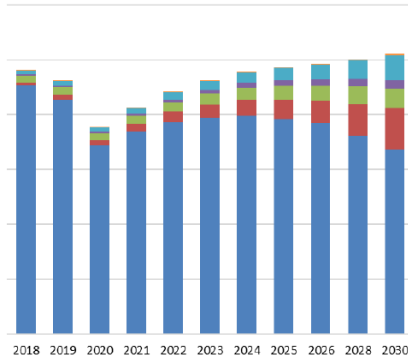
[Market forecast of whole power module by module capacity (volume and value bases)]



[Worldwide sales volume and market share of EV/PHEV by OEM in 2019]

Chapter 4

< Total automotive market >

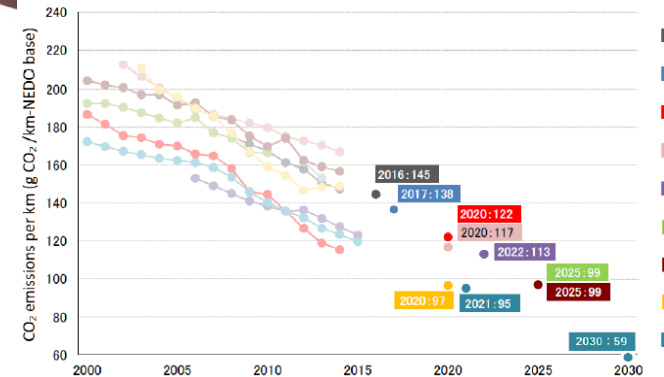


Engine Car ■ Mild HEV ■ Strong HEV ■ PHEV ■ EV ■ FCV

1.1.2 Comparison of power train by type

		MHEV	HEV	PHEV	EV
Having an engine				Yes	
Driving only by motor				Yes	
	Driving range			20~150km	
Capacity of the battery				7~20kWh	
Power generation *1	Engine driving			-/Yes	
	Other method			-	
Motor *2	Number of mounted unit			1~3	
	Max output *3			50~300kW	
	Torque *3			160~400N·m	

1.2.1 Target values of fuel economy regulations in each country



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