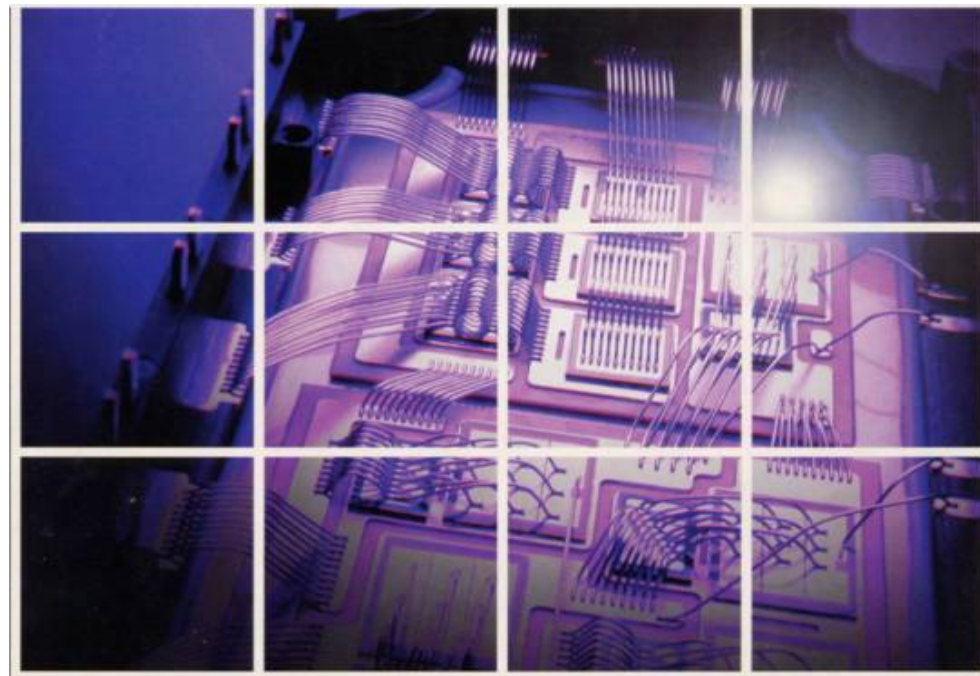


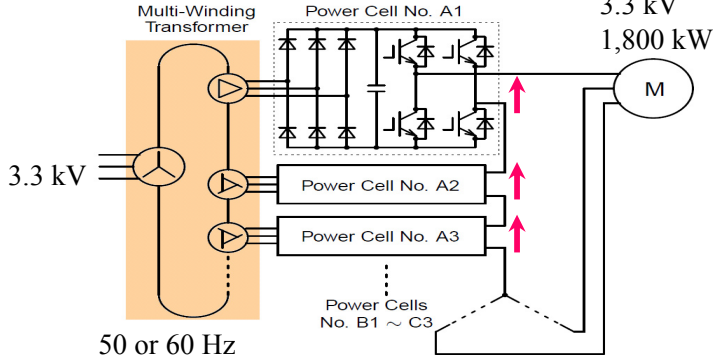
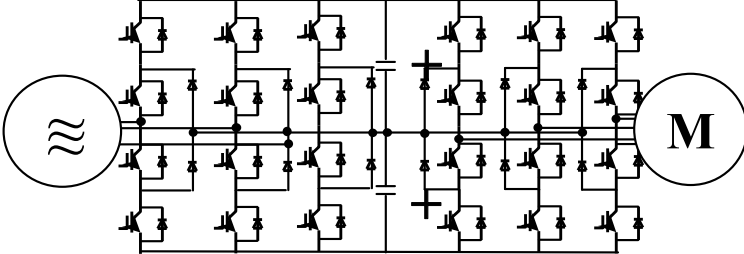
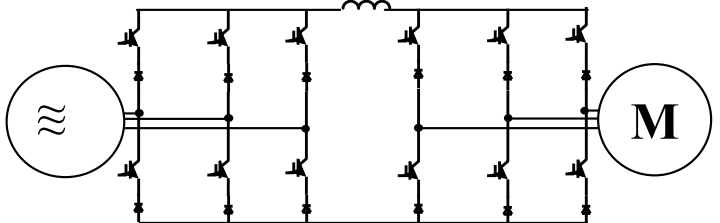
Fuji IGBT modules for MV , SVG inverter



Device Application Technology Dept.
Semiconductor Sales Div.
Global Sales Group

- Topology in MV , SVG inverter
- Fuji IGBT modules for MV, SVG inverter
- Fuji solution in Gate Driver Unit (GDU) and Stack structure

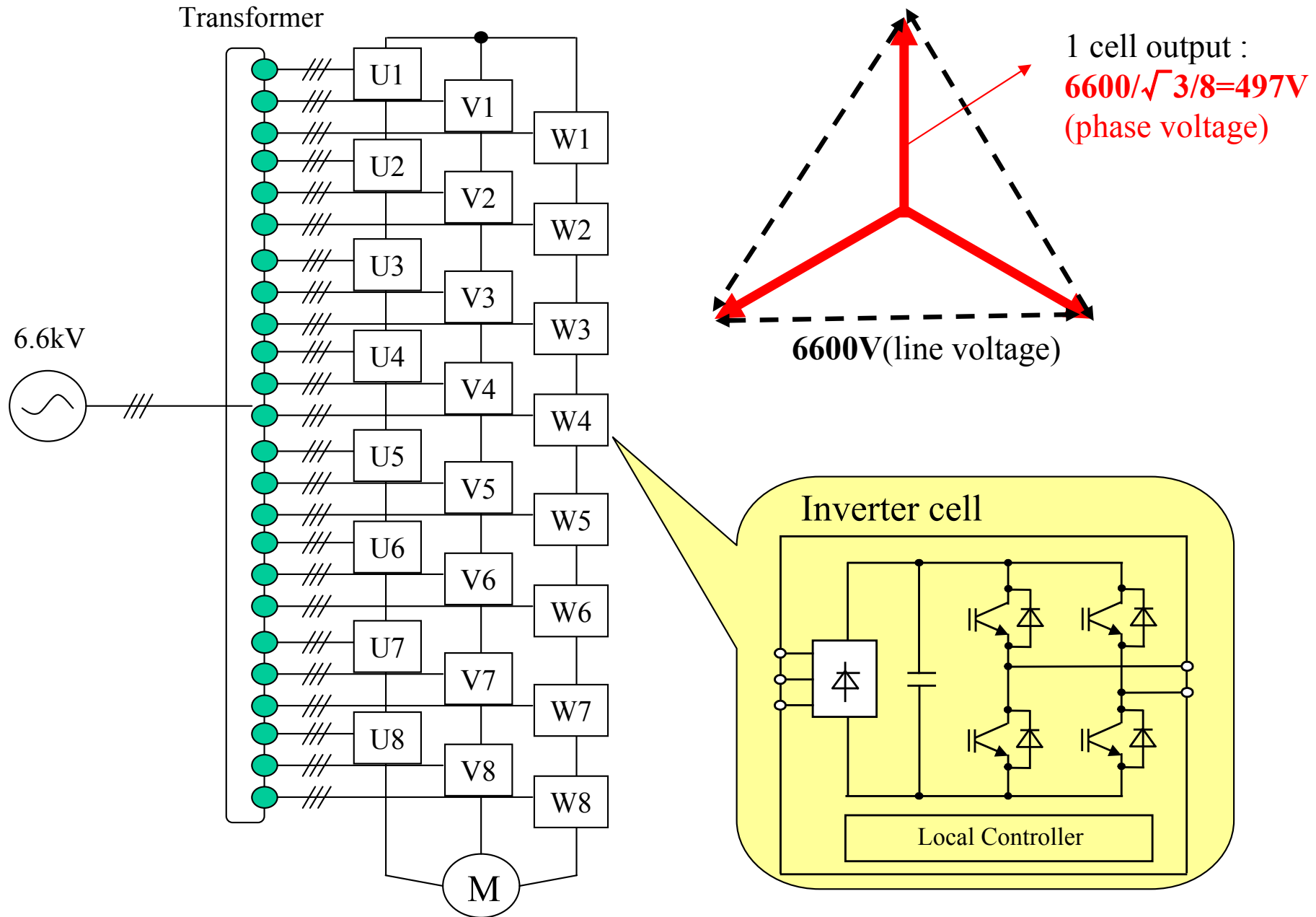
Topology in MV , SVG inverter

	Topology (example)	Feature	Applicable device	Applicable rate
Unit serial multi-level (Robicon type)		<ul style="list-style-type: none"> ▪ Topology is simple, easy maintenance, any output voltage can be obtained by unit cell serials ▪ Input-Transformer is necessary (high cost) 	1700V/100A ~ 1200A Standard Module	60% Around the world (China etc.)
Direct 3 level Inverter		<ul style="list-style-type: none"> ▪ Transformer less ▪ Topology is complicated 	3.3kV/800 ~ 1500A 4.5kV/400A ~ 1500A HPM	30% Europe and America
Current type Inverter		<ul style="list-style-type: none"> ▪ Reverse-blocking diode is necessary (Large loss) 	6.5kV/400A ~ 1500A Press Pack(GCT)	10% Europe and America

Topology in MV , SVG inverter

Field	Application	Topology			Function
		Unit serial multi-level	Direct 3 level	Current type	
Electric	Dust collecting fan	○	○	○	
	Boiler	○	○	○	
	Circulation pump	○	○	○	
Petroleum	Oil transfer pump	○	○	○	
	Ventilation fan	○	○	○	
	Compressor	-	○	○	Regeneration
Steel	Rolling	○	○	○	
	Ventilation fan	○	○	○	
	Pump	○	○	○	
Cement	Cooler dust collector	○	○	○	
	Material mill	○	○	○	
	Fan	○	○	○	
Paper	Pulp mill	-	○	○	Regeneration
Mining	Exhaust fan	○	○	○	
	Ventilation fan	○	○	○	
Transport	Conveyor	-	○	○	Regeneration
	Crane	-	○	○	Regeneration

Topology - Unit serial multi-level circuit (6.6kV output)



- Topology in MV , SVG inverter
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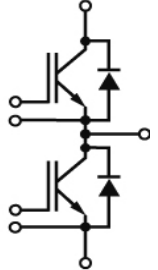

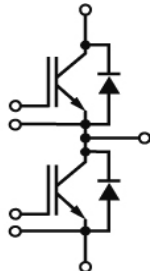
Fuji IGBT module for MV , SVG inverter

AC output voltage	Inverter capacity (kVA)	Serial	VCES	Ic rating	IGBT P/N
3.3 kV	350	4	1700V	100A	2MBI100VA-170-50
	500	4	1700V	150A	2MBI150VH-170-50
	700	4	1700V	200A	2MBI200VH-170-50
	1050	4	1700V	300A	2MBI300VN-170-50
	1350	4	1700V	400A	2MBI450VN-170-50
	1600	4	1700V	300A x2	2MBI300VN-170-50
6.6 kV	720	8	1700V	100A	2MBI100VA-170-50
	1090	8	1700V	150A	2MBI150VH-170-50
	1450	8	1700V	200A	2MBI200VH-170-50
	2180	8	1700V	300A	2MBI300VN-170-50
	2900	8	1700V	400A	2MBI450VN-170-50
	3490	8	1700V	300A x2	2MBI300VN-170-50
10 kV	1200	12	1700V	100A	2MBI100VA-170-50
	1800	12	1700V	150A	2MBI150VH-170-50
	2400	12	1700V	200A	2MBI200VH-170-50
	3600	12	1700V	300A	2MBI300VN-170-50
	4800	12	1700V	400A	2MBI450VN-170-50
	5800	12	1700V	300A x2	2MBI300VN-170-50

Fuji IGBT module for MV , SVG inverter - Standard 2in1

Feature


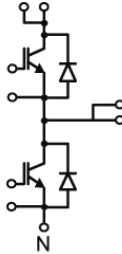

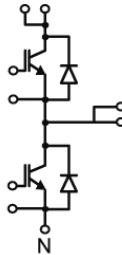
- ✓Low power dissipation with V-silicon chipset
- ✓Extra thermal design ($T_{jmax} = 175^{\circ}\text{C}$ repetitive guarantee)
- ✓Improved thermal cycling capability with new solder
- ✓Long-term reliability (CTI > 600, High Tc capability)
- ✓M6 mounting hole for all PKG (except 45mm PKG;M5)

	IGBT P/N	Current	Voltage	Package	Equivalent circuit	Base plate	Isolation
Standard 2in1	2MBI75VA-170-50	75A	1700V	M263:94 x 34 x 30mm 		Copper (Cu)	Al_3O_2 Viso=4.0kV/60s
	2MBI100VA-170-50	100A	1700V				
	2MBI150VH-170-50	150A	1700V	M276:108 x 62 x 30.5mm 		Copper (Cu)	Al_3O_2 Viso=4.0kV/60s
	2MBI200VH-170-50	200A	1700V				
	2MBI300VH-170-50	300A	1700V				

Fuji IGBT module for MV , SVG inverter - Dual XT

Feature


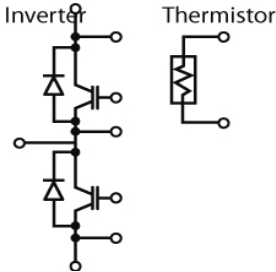

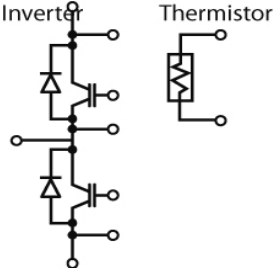
- ✓Low power dissipation with V-silicon chipset
- ✓Extra thermal design ($T_{jmax} = 175^{\circ}\text{C}$ repetitive guarantee)
- ✓Low inductance and good current balance package
- ✓Long-term reliability (CTI > 600, High Tc capability)
- ✓M6 mounting hole for all PKG (except 45mm PKG;M5)

	IGBT P/N	Current	Voltage	Package	Equivalent circuit	Base plate	Isolation
Dual XT	2MBI300VN-170-50	300A	1700V	M254:150 x 62 x 17mm 		Copper (Cu)	Al_3O_2 Viso=4.0kV/60s
	2MBI450VN-170-50	450A	1700V				
	2MBI550VN-170-50	550A	1700V				
	2MBI550VJ-170-50	550A	1700V	M260:150 x 62 x 17mm 		Copper (Cu)	Al_3O_2 Viso=4.0kV/60s

Fuji IGBT module for MV , SVG inverter - PrimePACK™

Feature

- ✓ Low power dissipation with V-silicon chipset
- ✓ Extra thermal design ($T_{jmax}=175^{\circ}\text{C}$ repetitive guarantee)
- ✓ Low inductance and good current balance package
- ✓ Long-term reliability (CTI > 600, High Tc capability)


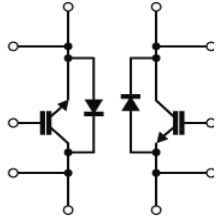

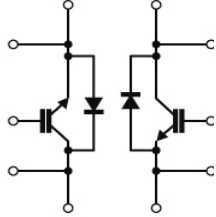
	IGBT part No.	Current	Voltage	Package	Equivalent circuit	Base plate	Isolation
PrimePACK™	2MBI650VXA-170E-50	650A	1700V	M271:172 x 89 x 38mm 		Copper (Cu)	Al_3O_2 Viso=4.0kV/60s
	2MBI1000VXB-170E-50	1000A	1700V	M272:250 x 89 x 38mm 		Copper (Cu)	Al_3O_2 Viso=4.0kV/60s
	2MBI1400VXB-170E-50	1400A	1700V				
	2MBI1400VXB-170P-50	1400A	1700V				

Note: PrimePACK™ are registered trademarks of Infineon Technology AG, Germany.

Fuji IGBT module for MV , SVG inverter - HPM (2in1)

Feature


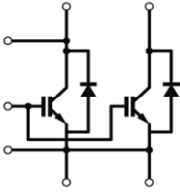

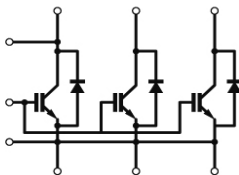
- ✓Low power dissipation with V-silicon chipset
- ✓Extra thermal design ($T_{jmax}=175^{\circ}\text{C}$), AlSiC base plate
- ✓Low inductance and good current balance package
- ✓Long-term reliability (CTI > 600, High Tc capability)

	IGBT part No.	Current	Voltage	Package	Equivalent circuit	Base plate	Isolation
2in1	2MBI600VG-170E	600A	1700V	M256:130 x 140 x 38mm 		Copper (Cu)	Si_3N_4 Viso=4.0kV/60s
	2MBI800VG-170E	800A	1700V				
	2MBI1200VG-170E	1200A	1700V				
	2MBI600VT-170E	600A	1700V	M278130 x 140 x 38mm 		AlSiC	AlN Viso=4.0kV/60s
	2MBI800VT-170E	800A	1700V				
	2MBI1200VT-170E	1200A	1700V				

Fuji IGBT module for MV , SVG inverter - HPM (1in1)

Feature


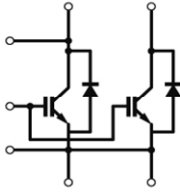

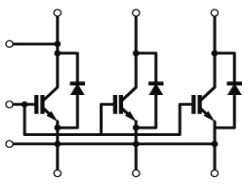
- ✓ Low power dissipation with V-silicon chipset
- ✓ Extra thermal design ($T_{jmax}=175^{\circ}\text{C}$), SiN-DCB
- ✓ Low inductance and good current balance package
- ✓ Long-term reliability (CTI > 600, High Tc capability)
- ✓ 1700V-3600A max rating

	IGBT part No.	Current	Voltage	Package	Equivalent circuit	Base plate	Isolation
1in1	1MBI1200VC-170E	1200A	1700V	M151:130 x 140 x 38mm 		Copper (Cu)	Si_3N_4 Viso=4.0kV/60s
	1MBI1600VC-170E	1600A	1700V				
	1MBI2400VC-170E	2400A	1700V				
	1MBI2400VD-170E	2400A	1700V	M152:190 x 140 x 38mm 		Copper (Cu)	Si_3N_4 Viso=4.0kV/60s
	1MBI3600VD-170E	3600A	1700V				

Fuji IGBT module for MV , SVG inverter - HPM (1in1)

Feature

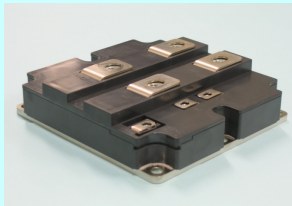
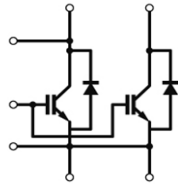
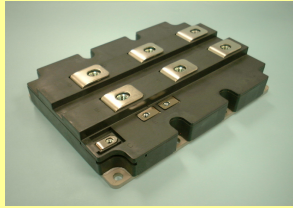
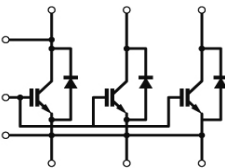
- ✓Low power dissipation with V-silicon chipset
- ✓Extra thermal design ($T_{jmax}=175^{\circ}\text{C}$), AlSiC base plate
- ✓Low inductance and good current balance package
- ✓Long-term reliability (CTI > 600, High Tc capability)
- ✓1700V-3600A max rating

	IGBT part No.	Current	Voltage	Package	Equivalent circuit	Base plate	Isolation
1in1	1MBI1200VR-170E	1200A	1700V	M155:130 x 140 x 38mm 		AlSiC	AlN Viso=4.0kV/60s
	1MBI1600VR-170E	1600A	1700V				
	1MBI2400VR-170E	2400A	1700V				
	1MBI2400VS-170E	2400A	1700V	M156:190 x 140 x 38mm 		AlSiC	AlN Viso=4.0kV/60s
	1MBI3600VS-170E	3600A	1700V				

Fuji IGBT module for MV , SVG inverter - 3.3kV module

Feature

- ✓Trench gate structure for reducing $V_{ce(sat)}$
- ✓FS (field-stop) structure for fast switching and low $V_{ce(sat)}$
- ✓High ruggedness even at $T_j = 150^{\circ}\text{C}$ operation
- ✓High tracking (CTI > 600) special resin for high Viso guarantee
- ✓High thermal cycling life time with AlSiC base plate

	IGBT part No.	Current	Voltage	Package	Equivalent circuit	Base plate	Isolation
1in1	1MBI800UG-330	800A	3300V	M155:130 x 140 x 38mm 		AlSiC	AlN Viso=6.0kV/60s
	1MBI1000UG-330	1000A	3300V				
	1MBI1200UE-330	1200A	3300V	M156:190 x 140 x 38mm 		AlSiC	AlN Viso=6.0kV/60s
	1MBI1500UE-330	1500A	3300V				

- Topology in MV , SVG inverter
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- **Fuji solution in Gate Driver Unit (GDU) and Stack structure**

Fuji solution in GDU



<http://igbt-driver.com/>

Ic rating	IGBT P/N (example)	Driver type (example)
100A	2MBI100VA-170-50	2SP0115T2Ax
150A	2MBI150VH-170-50	2SP0115T2Ax
200A	2MBI200VH-170-50	2SP0115T2Ax
300A	2MBI300VN-170-50	2SP0115T2Ax
450A	2MBI450VN-170-50	2SP0115T2Ax
550A	2MBI550VN-170-50	2SP0115T2Ax

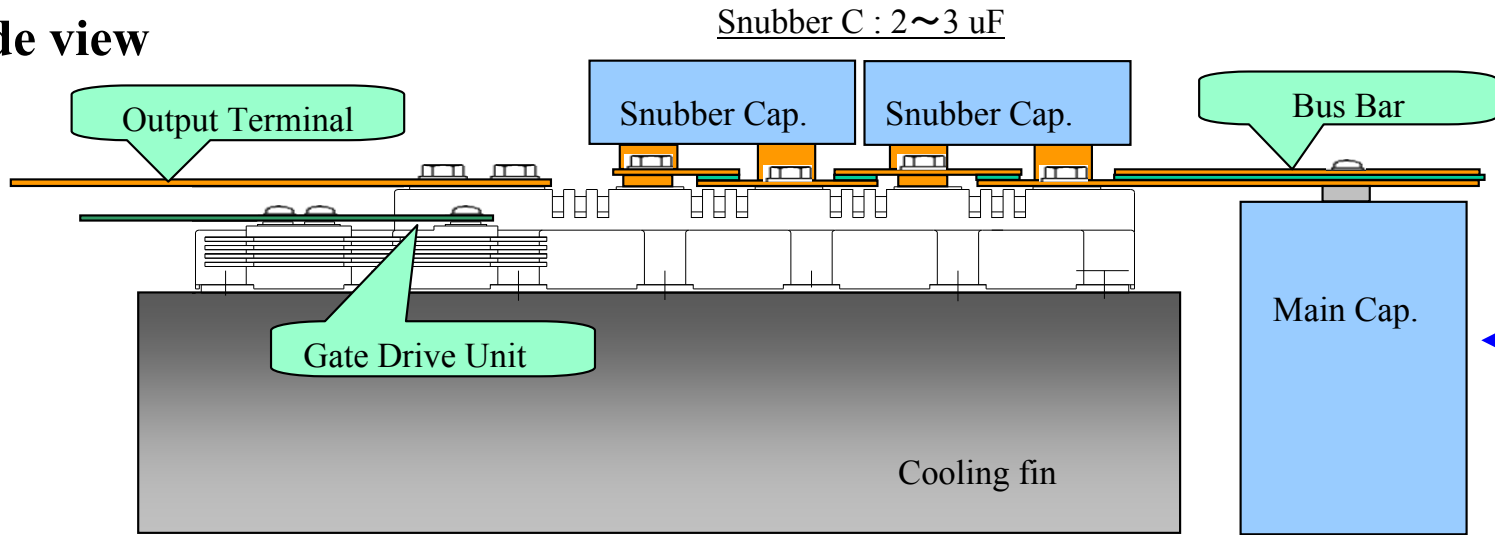


<http://www.idc-com.co.jp/>

Ic rating	IGBT P/N (example)	Driver type (example)
75A	2MBI75VA-170-50	VLA546**
100A	2MBI100VA-170-50	VLA546**
150A	2MBI150VH-170-50	VLA546**
200A	2MBI200VH-170-50	VLA546**
300A	2MBI300VN-170-50	VLA546**
450A	2MBI450VN-170-50	VLA500K

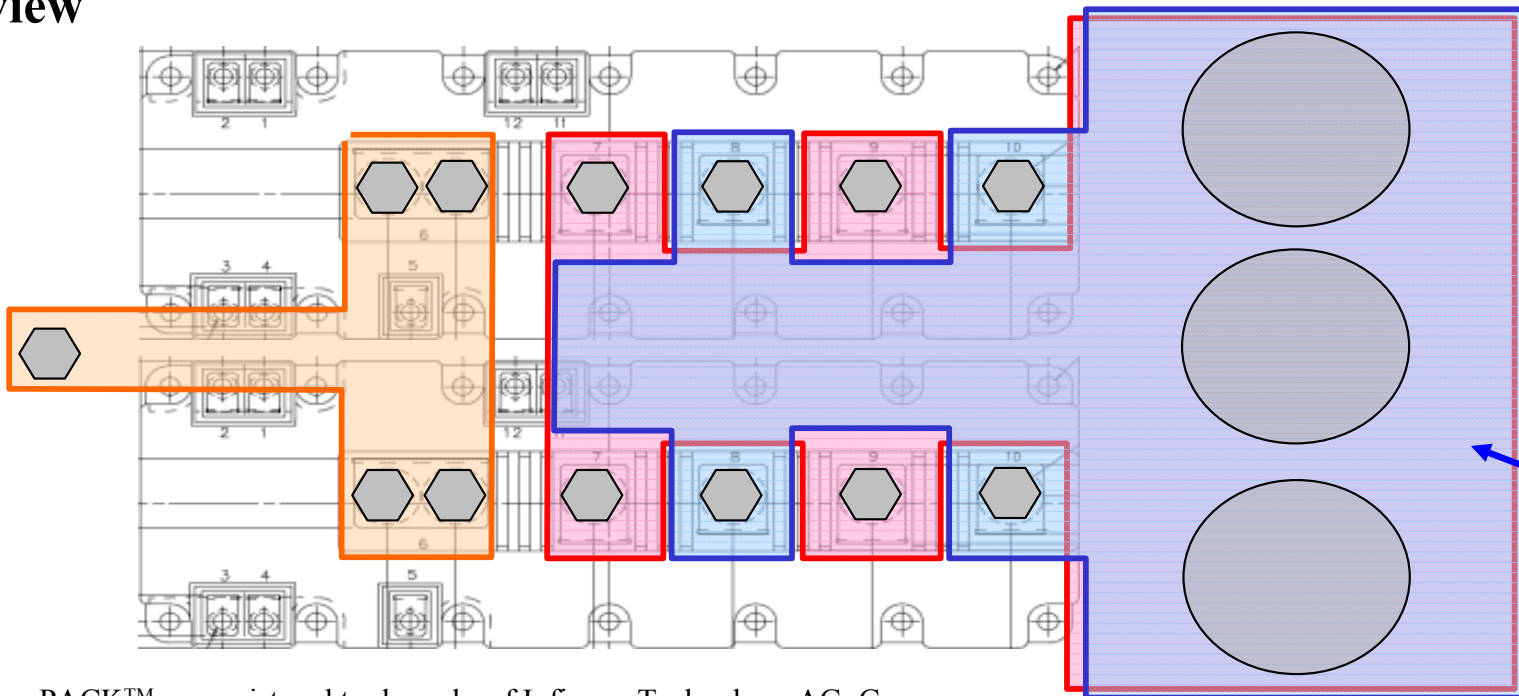
PrimePACK™ 2 parallel

Side view



PrimePACK™ can easily construct inverter circuit . This figure shows the example.

Top view



Laminate bus bar to realize low leakage inductance.

Note: PrimePACK™ are registered trademarks of Infineon Technology AG, Germany.

Snubber capacitors

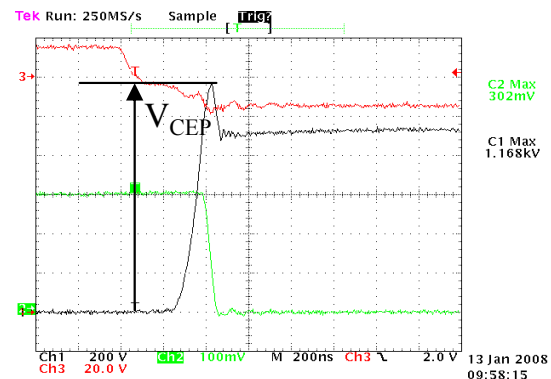
$$C_S = \frac{L * I_o^2}{(V_{CEP} - Ed)^2}$$

L: Main circuit wiring parasitic inductance

I_o: Collector current at IGBT turn-off

V_{CEP}: Snubber capacitor peak voltage

Ed: DC supply voltage



Module rating		DC line inductance	snubber capacitance
Vces	Ic		
1200V/1700V	100A	0.2 μH	0.47 μF
	300A	0.1 μH	3.3 μF
	450A	0.08 μH	4.7 μF
	1000A	0.07 μH	6.8 μF
	1400A	0.06 μH	12 μF