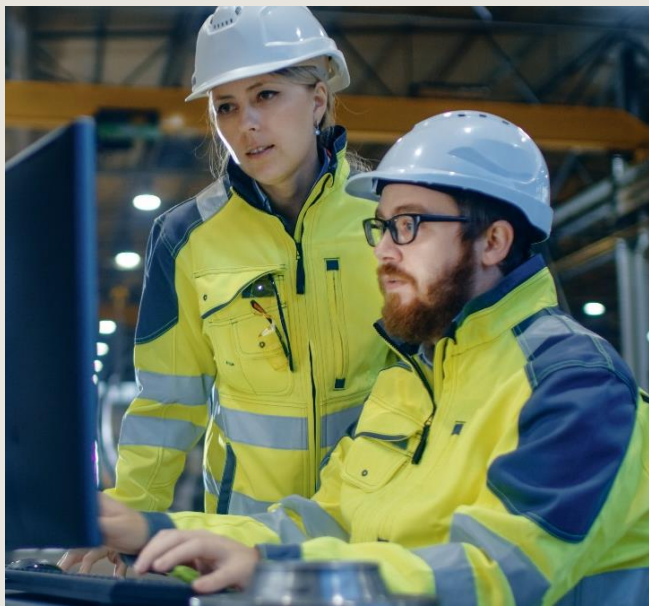


## X-Series: High-Voltage IGBT Modules

### Industry-Leading Power and Operating Temperature Range

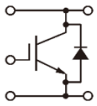





High-voltage modules are essential for power systems that require large capacity, high reliability and maximum efficiency. Mitsubishi Electric's first HVIGBT module, which was commercialized in 1997, enabled the development of larger capacity and smaller sized high-voltage converter systems. The X Series HVIGBT modules feature 7<sup>th</sup>-generation Insulated Gate Bipolar Transistors (IGBT) and Relaxed Field of Cathode (RFC) diodes.



Besides state-of-the-art chip technology, the new X Series std. type offers three package footprints. A small 73 mm x 140 mm and a medium 130 mm x 140 mm package allowing compact converter designs while a 190 mm x 140mm package achieves higher output currents up to 2400 A. As key technologies the X Series provides a 1.5-times higher current rating than H Series and, as world's first for the 6.5 kV class, 150°C maximal operational junction temperature.

#### Product Advantages

- ❑ Power loss reduced by incorporating 7<sup>th</sup>-generation IGBT and RFC diode
- ❑ Current rating increased by 50 % compared to conventional package
- ❑ Latest package technology enhances power cycle lifetime
- ❑ Package compatible to previous H and R series for simplified design and easy replacement
- ❑ High robustness and 150 °C maximal operation temperature

Circuit	Circuit Diagram	Package	1700 V	3300 V	4500 V	6500 V
1-in-1		 $V_{iso} = 6kV$	CM2400HC-34X 2400 A	CM1800HC-66X 1800 A CM1500HC-66XB 1500 A CM1200HC-66X 1200 A	CM1500HC-90XA 1500 A CM1350HC-90X 1350 A CM1200HC-90XB* 1200 A	
		 $V_{iso} = 6kV$	CM2400HC-34X 2400 A	CM1200HC-66X 1200 A	CM900HC-90X 900 A	
		 $V_{iso} = 10.2kV$		CM1800HG-66X 1800 A	CM1500HG-90X 1500 A CM1350HG-90X 1350 A CM1200HG-90XB* 1200 A	CM1000HG-130XA 1000 A CM900HG-130X 900 A CM750HG-130XB* 750A
		 $V_{iso} = 10.2kV$			CM1000HG-90X 1000 A CM900HG-90X 900 A	CM600HG-130X 600 A
		 $V_{iso} = 10.2kV$		CM400HG-66X 400 A		

\* Under development



Power  
Transmission



Railway

## Chip Technology

The 7<sup>th</sup>-generation trench-gate IGBT with carrier-store effect (CSTBT™) and RFC diode reduce the power loss by about 20 %. This leads to either a higher output power or a more compact converter through higher switching frequency. Moreover, the optimized edge termination structure LNFLR (Linearly-Narrowed Field Limiting Ring) allows an increased active chip area of 28 % compared to previous product. Furthermore, as first in the world, Mitsubishi Electric has achieved 150 °C operational junction temperature for the 6.5 kV class.



Compared to previous product\*, active chip area is increased 28% by optimizing edge termination.

\* CM750HG-130R

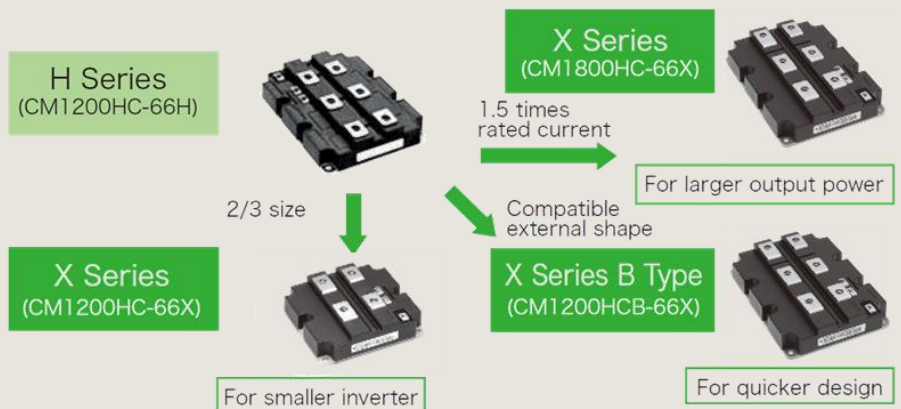
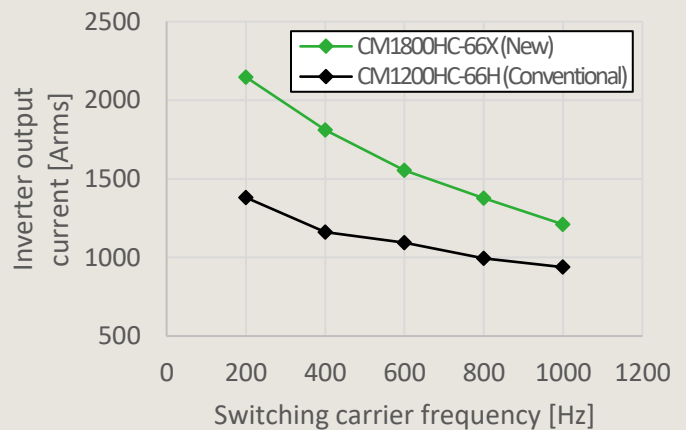
## Package Technology

The newly developed X Series achieves 50 % higher output current regarding same footprint compared to the former H Series. This is achieved by improved chip development as well as by enhanced package technology. Thus, the thermal resistance of the module is reduced by 28 %\*\*. At the same time, the improved package technology, which includes optimized wire bonding and material approach, increases power cycling lifetime.

The X Series offers a large line-up in two different footprints, a smaller 130 mm x 140 mm and a larger 190 mm x 140 mm package. As stated above, the large package offers 50 % higher output current compared to H Series.

The same current rating as the H Series' large package is now provided in the X Series' smaller package. This allows engineers design of more compact and more cost-effective converters. Additionally, the X Series provides a large package with same current rating as H Series for perfect compatibility and faster design ("X Series B Type").

Condition: T<sub>j</sub>=125°C, V<sub>cc</sub>=1800V, P.F.=0.85, f<sub>o</sub>=50Hz, T<sub>f</sub>=80°C



\*\* CM1000HG-130XA vs. CM600HG-130H

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