

2.0 Main Applications for Power Modules

Power modules are now commonly used in both converter and inverter circuits. As shown in the application chart in Figure 2.1, the main application of the IGBT is for use as a switching component in inverter circuits which are used in both power supply and motor drive applications. Table 2.1 shows the main markets IGBT modules have been designed to serve, the trends of the application, the requirements of the power device serving the application, and the type of IGBT or Intelligent Power Module (IPM) available to satisfy the trend requirements.

Figure 2.1 Main Applications of the IGBT

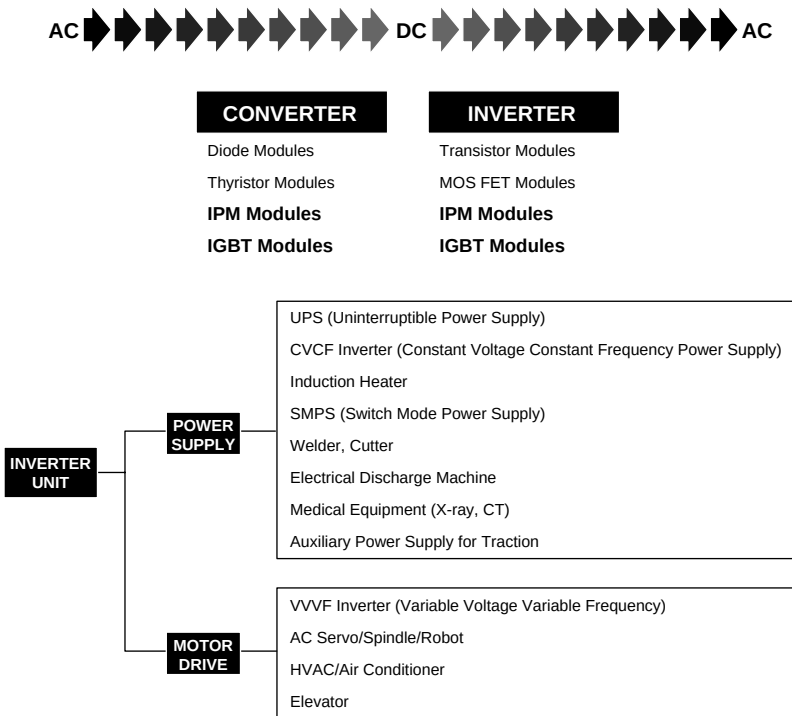
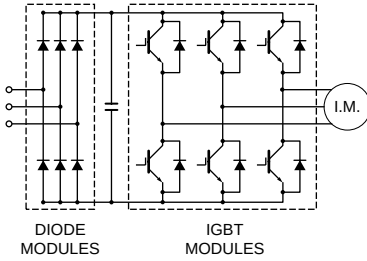


Table 2.1 Market Trend

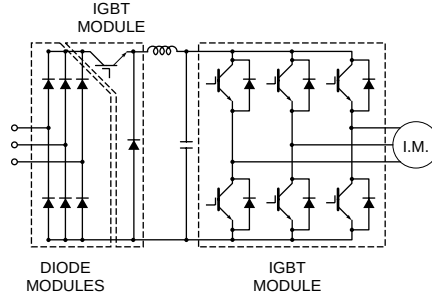
Main Markets	Trend of Application	Requirements to Power Devices	New Power Devices
Inverter	Low Noise Oriented	High Frequency	High Frequency IGBT-MOD
UPS Elevator	Small-Sized	Small Drive-Power	High Frequency Intellimod™
Air Conditioner	Small-Sized Low Cost	Integrated	IPM for Air Conditioner Use High Frequency IGBTMOD
AC Servo	High Accuracy Automatic Assembly	Reduction of Dead-Time	IGBT-MOD (Low $V_{CE(sat)}$) Intellimod™ (Low $V_{CE(sat)}$)

2.1 Basic Circuit Examples of Main Power Module Applications

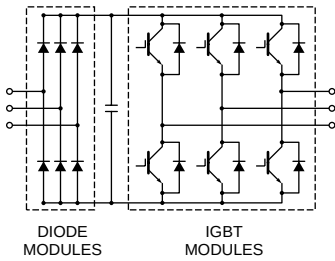
VVVF INVERTER (PWM)



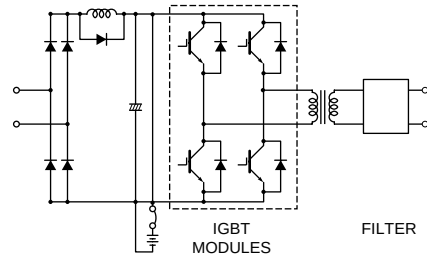
VVVF INVERTER (PAM)



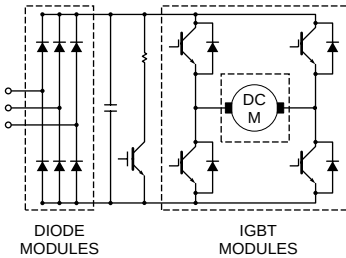
CVCF INVERTER (UPS)



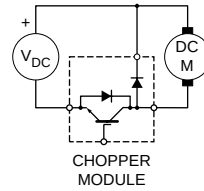
LOW POWER CVCF INVERTER (UPS)



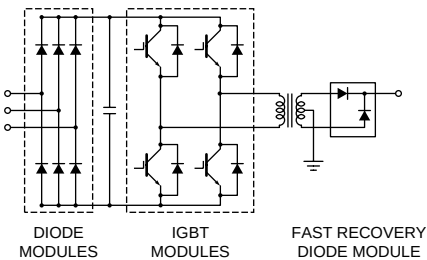
DC SERVO (NC, ROBOTS)



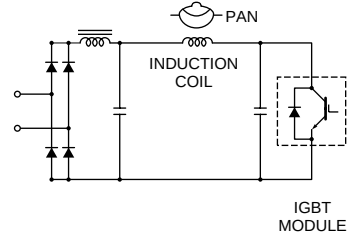
DC CHOPPER



WELDER



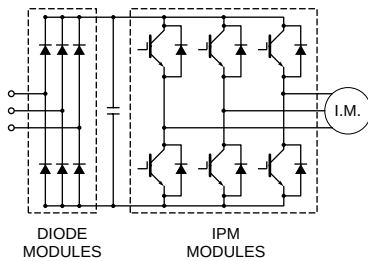
INDUCTION HEATER FOR COOKING



2.2 Applications of IPM Modules to AC Motor Controls (VVVF Inverter, Servo Amps, etc.)

Figure 2.2

VVVF INVERTER (PWM)



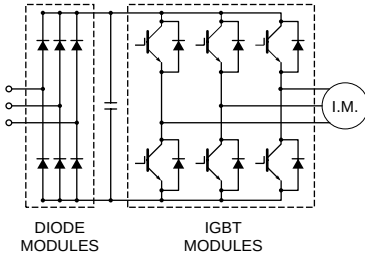
Motor Rating (VAC)	HP	IPM Module	Diode Module	Gate Driver	Power Supply	Snubber Diode (If Required)
240	0.5	PM10CSJ060	*RM10TN-H	Included	M57120L, M57140-01	NA
240	1.0	PM10CSJ060	*RM10TN-H	Included	M57120L, M57140-01	NA
240	1.5	PM15CSJ060	*RM10TN-H	Included	M57120L, M57140-01	NA
240	2.0	PM20CSJ060	*RM10TN-H	Included	M57120L, M57140-01	NA
240	3.0	PM30CSJ060	*RM20TN-H	Included	M57120L, M57140-01	NA
240	5.0	PM50RVA060	*RM20TPM-H	Included	M57120L, M57140-01	RM50HG-12S
240	7.5	PM75RVA060	*RM30TPM-H	Included	M57120L, M57140-01	RM50HG-12S
240	10.0	PM100CVA060	*RM75TPM-H	Included	M57120L, M57140-01	RM50HG-12S
240	15.0	PM150CVA060	*RM75TPM-H	Included	M57120L, M57140-01	RM50HG-12S
240	20.0	PM200CVA060	*RM75TPM-H	Included	M57120L, M57140-01	RM50HG-12S
240	25.0	PM200CVA060	*RM75TPM-H	Included	M57120L, M57140-01	RM50HG-12S
240	30.0	PM300CVA060	ME600815	Included	M57120L, M57140-01	RM50HG-12S
240	40.0	PM400DVA060 x 3	CD510825 x 3	Included	M57120L, M57140-01	RM50HG-12S
240	60.0	PM600DVA060 x 3	CD510825 x 3	Included	M57120L, M57140-01	RM50HG-12S
240	80.0	PM800HSA060 x 6	CD510825 x 3	Included	M57120L, M57140-01	RM50HG-12S
460	0.5	PM10CZF120	*RM10TN-2H	Included	NA	NA
460	1.0	PM10CZF120	*RM10TN-2H	Included	NA	NA
460	1.5	PM10CZF120	*RM10TN-2H	Included	NA	NA
460	2.0	PM10CZF120	*RM10TN-2H	Included	NA	NA
460	3.0	PM15CZF120	*RM10TN-2H	Included	NA	NA
460	5.0	PM25RSK120	RM25TN-2H	Included	NA	NA
460	7.5	PM25RSK120	RM25TN-2H	Included	NA	NA
460	10.0	PM50RVA120	*RM20TPM-2H	Included	NA	RM25HG-24S
460	15.0	PM75CVA120	*RM75TPM-2H	Included	NA	RM25HG-24S
460	20.0	PM100CVA120	*RM75TPM-2H	Included	NA	RM25HG-24S
460	25.0	PM100CVA120	*RM75TPM-2H	Included	NA	RM25HG-24S
460	30.0	PM150CVA120	ME501606	Included	NA	RM25HG-24S
460	40.0	PM150CVA120	ME501610	Included	NA	RM25HG-24S
460	50.0	PM200DVA120 x 3	ME501610	Included	NA	RM25HG-24S
460	60.0	PM300DVA120 x 3	ME601615	Included	NA	RM25HG-24S
460	75.0	PM300DVA120 x 3	ME601615	Included	NA	RM25HG-24S
460	100.0	PM400HSA120 x 6	CD511625 x 3	Included	NA	RM25HG-24S
460	125.0	PM600HSA120 x 6	CD511625 x 3	Included	NA	RM25HG-24S
460	150.0	PM600HSA120 x 6	CD511625 x 3	Included	NA	RM25HG-24S
460	200.0	PM800HSA120 x 6	LD411660 x 3	Included	NA	RM25HG-24S
460	250.0	PM800HSA120 x 6	LD411660 x 3	Included	NA	RM25HG-24S

* - Same height as IPM

2.3 Applications of IGBT Modules to AC Motor Control (VVVF Inverter, Servo Amps, etc.)

Figure 2.3

VVVF INVERTER (PWM)



Motor Rating (VAC)	HP	IGBT Module	Diode Module	Gate Driver	Power Supply	Snubber Diode (If Required)
240	0.5	CM15ADXX-12H	Included	M63993FP	NA	NA
240	1.0	CM15ADXX-12H	Included	M63993FP	NA	NA
240	1.5	CM15ADXX-12H	Included	M63993FP	NA	NA
240	2.0	CM20ADXX-12H	Included	M63993FP	NA	NA
240	3.0	CM30ADXX-12H	Included	M63993FP	NA	NA
240	5.0	CM50ADXX-12H	Included	M63993FP	NA	NA
240	7.5	CM75TU-12F	ME700803	M57160AL-01	M57145L-01	RM50HG-12S
240	10.0	CM100TU-12F	MEB00806	M57160AL-01	M57145L-01	RM50HG-12S
240	15.0	CM150TU-12F	MEB00806	M57160AL-01	M57145L-01	RM50HG-12S
240	20.0	CM200TU-12F	ME500810	M57160AL-01	M57145L-01	RM50HG-12S
240	25.0	CM200TU-12F	ME500810	M57160AL-01	M57145L-01	RM50HG-12S
240	30.0	CM300DU-12F x 3	ME600815	M57160AL-01	M57145L-01	RM50HG-12S
240	40.0	CM400DU-12F x 3	CD510825 x 3	M57160AL-01	M57145L-01	RM50HG-12S
240	60.0	CM600HU-12F x 6	CD510825 x 3	M57160AL-01	M57145L-01	RM50HG-12S
460	0.5	CM15ADXX-24H	Included	M57159L-01	M57145L-01	NA
460	1.0	CM15ADXX-24H	Included	M57159L-01	M57145L-01	NA
460	1.5	CM15ADXX-24H	Included	M57159L-01	M57145L-01	NA
460	2.0	CM15ADXX-24H	Included	M57159L-01	M57145L-01	NA
460	3.0	CM15ADXX-24H	Included	M57159L-01	M57145L-01	NA
460	5.0	CM25ADXX-24H	Included	M57159L-01	M57145L-01	NA
460	7.5	CM25ADXX-24H	Included	M57159L-01	M57145L-01	NA
460	10.0	CM50TU-24F	ME701602	M57160AL-01	M57145L-01	RM25HG-24S
460	15.0	CM75TU-24F	ME701603	M57160AL-01	M57145L-01	RM25HG-24S
460	20.0	CM100TU-24F	ME501606	M57160AL-01	M57145L-01	RM25HG-24S
460	25.0	CM100TU-24F	ME501606	M57160AL-01	M57145L-01	RM25HG-24S
460	30.0	CM150DU-24F x 3	ME501606	M57160AL-01	M57145L-01	RM25HG-24S
460	40.0	CM150DU-24F x 3	ME501610	M57160AL-01	M57145L-01	RM25HG-24S
460	50.0	CM200DU-24F x 3	ME501610	M57160AL-01	M57145L-01	RM25HG-24S
460	60.0	CM300DU-24F x 3	ME601615	M57160AL-01	M57145L-01	RM25HG-24S
460	75.0	CM300DU-24F x 3	ME601615	M57160AL-01	M57145L-01	RM25HG-24S
460	100.0	CM400HU-24F x 6	CD511625 x 3	M57160AL-01	M57145L-01	RM25HG-24S
460	125.0	CM600HU-24F x 6	CD511625 x 3	M57160AL-01	M57145L-01	RM25HG-24S
460	150.0	CM600HU-24F x 6	CD511625 x 3	M57160AL-01	M57145L-01	RM25HG-24S
460	200.0	CM1000HA-24H x 6	LD411660 x 3	M57958L, M57962L	M57145L-01	RM25HG-24S
460	250.0	CM1000HA-24H x 6	LD411660 x 3	M57958L, M57962L	M57145L-01	RM25HG-24S
460	300.0	CM1000HA-24H x 6	LD411660 x 3	M57958L, M57962L	M57145L-01	RM25HG-24S

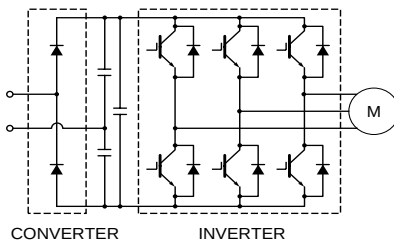
2.3 Applications of IGBT Modules to AC Motor Control (VVVF Inverter, Servo Amps, etc.) (Continued)

Motor Rating (VAC)	HP	IGBT Module	Diode Module	Gate Driver	Power Supply	Snubber Diode (If Required)
575	10.0	CM50TF-28H	ME701602	M57159L-01	M57145L-01	RM35HG-34S
575	15.0	CM75TF-28H	ME701603	M57957L, M57959L	M57145L-01	RM35HG-34S
575	20.0	CM100TF-28H	ME501606	M57957L, M57959L	M57145L-01	RM35HG-34S
575	25.0	CM100TF-28H	ME501606	M57957L, M57959L	M57145L-01	RM35HG-34S
575	30.0	CM100TF-28H	ME501606	M57958L, M57962L	M57145L-01	RM35HG-34S
575	40.0	CM200DY-28H x 3	ME501610	M57958L, M57962L	M57145L-01	RM35HG-34S
575	50.0	CM200DY-28H x 3	ME501610	M57958L, M57962L	M57145L-01	RM35HG-34S
575	60.0	CM300DY-28H x 3	ME601615	M57958L, M57962L	M57145L-01	RM35HG-34S
575	75.0	CM300DY-28H x 3	ME601615	M57958L, M57962L	M57145L-01	RM35HG-34S
575	100.0	CM400HA-28H x 6	CD511625 x 3	M57958L, M57962L	M57145L-01	RM35HG-34S
575	125.0	CM600HA-28H x 6	CD511625 x 3	M57958L, M57962L	M57145L-01	RM35HG-34S
575	150.0	CM600HA-28H x 6	CD511625 x 3	M57958L, M57962L	M57145L-01	RM35HG-34S
575	200.0	CM1000HA-28H x 6	LD411660 x 3	M57958L, M57962L	M57145L-01	RM35HG-34S
575	250.0	CM1000HA-28H x 6	LD411660 x 3	M57958L, M57962L	M57145L-01	RM35HG-34S
575	300.0	CM1000HA-28H x 6	LD411660 x 3	M57958L, M57962L	M57145L-01	RM35HG-34S

2.4 Applications of IGBT Modules to HVAC Air Conditioner

Figure 2.4 Example of a Main Circuit of an Air Conditioner

MAIN CIRCUIT OF AIR CONDITIONER



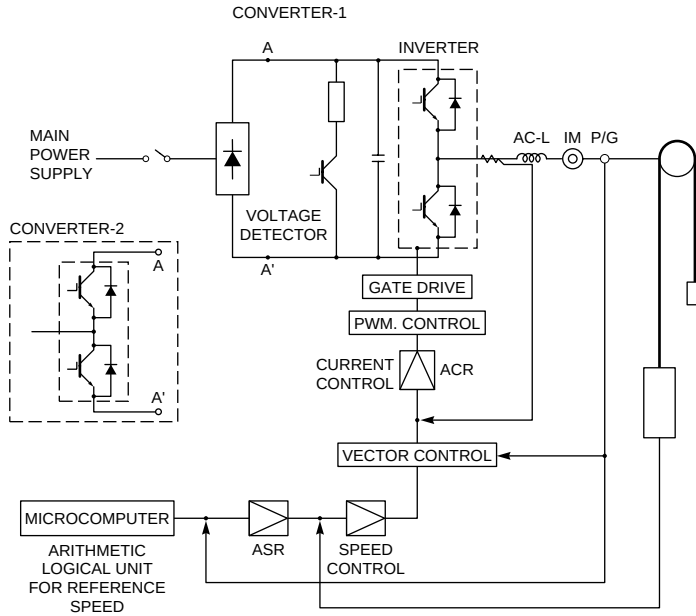
IGBT Module List for Inverter Air Conditioner

Capacity	Recommended IGBT Type	Recommended IPM Type	Specifications	
			I _C (A)	V _{CE} (V)
0.7HP	CM15ADXX-12H	PM15CSJ060	15	600
1~1.2HP	CM15ADXX-12H	PM15CSJ060	15	600
1.2~1.5HP	CM20ADXX-12H	PM20CSJ060	20	600
2HP	CM30ADXX-12H	PM30CSJ060	30	600
3HP	CM50ADXX-12H	PM50RSK060	50	600
5HP	CM75TU-12F	PM75RSA060	75	600
5HP	CM75TU-12F	PM75RSK060	75	600
5HP	CM75TU-12F	PM75RVA060	75	600
7.5HP	CM100TU-12F	PM100CSA060	100	600
7.5HP	CM100TU-12F	PM100CVA060	100	600
10HP	CM150TU-12F	PM150CSA060	150	600
10HP	CM150TU-12F	PM150CVA060	150	600

*If you plan to design an ACTIVE FILTER for the converter section for low harmonic and high power factor, please use the same IGBT as used in the INVERTER section.

2.5 Applications of IGBT Module to Elevator System

Figure 2.5 Example of an Elevator Circuit



Input Voltage	Inverter Ratings	Converter - 1 Rectific/SCR	Converter - 2 Re-generation	Inverter	Gate Drive Hybrid IC
AC230V	7.5kVA	MEB00806	—	CM100DU-12F x 3	M57160AL-01
	10kVA	ME500810	—	CM150DU-12F x 3	M57160AL-01
	15kVA	CDD10810 x 3	—	CM200DU-12F x 3	M57160AL-01
	25kVA	CDD10810 x 3	—	CM300DU-12F x 3	M57160AL-01
AC460V	35kVA	CM531613 x 3	CM300DU-24F x 3	CM300DU-24F x 3	M57160AL-01
AC480V	60kVA	CM531620 x 6	CM400HU-24F x 6	CM400HU-24F x 6	M57160AL-01
	75kVA	CSD3160H x 6	CM600HU-24F x 6	CM600HU-24F x 6	M57160AL-01