

# MITSUBISHI IGBT MODULES

## CM20AD00-12H

MEDIUM POWER SWITCHING USE  
FLAT BASE, INSULATED TYPE

### CM20AD00-12H



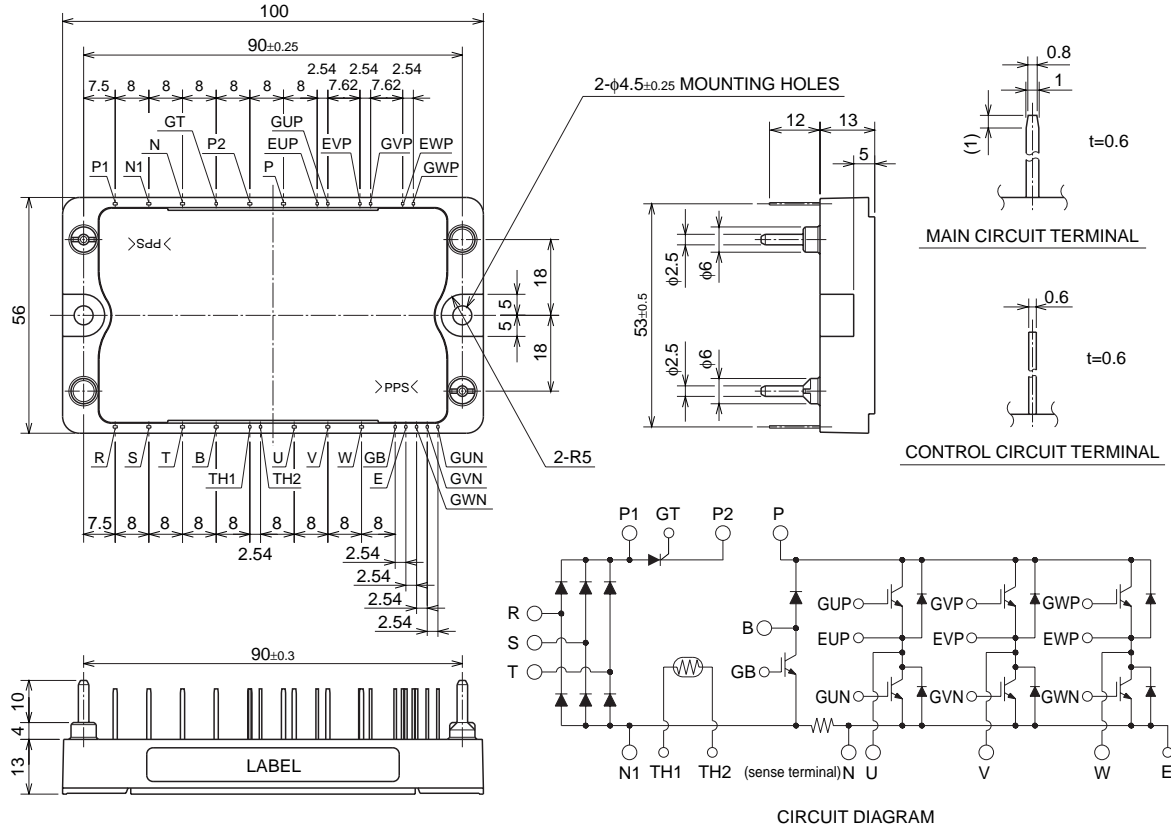
- IC ..... 20A
  - VCES ..... 600V
  - Insulated Type
  - CIB Module
- 3φ Inverter + 3φ Converter + Brake  
Thyristor + Thermistor + Current shunt resistor

### APPLICATION

AC & DC motor controls, General purpose inverters

### OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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**MAXIMUM RATINGS (T<sub>J</sub> = 25°C)**

**INVERTER PART**

Symbol	Parameter	Conditions	Rating	Unit
V <sub>CES</sub>	Collector-emitter voltage	G-E Short	600	V
V <sub>GES</sub>	Gate-emitter voltage	C-E Short	±20	V
I <sub>C</sub>	Collector Current	T <sub>C</sub> = 25°C	20	A
I <sub>CM</sub>		PULSE (Note. 2)	40	A
I <sub>E</sub> (Note.1)	Emitter Current	T <sub>C</sub> = 25°C	20	A
I <sub>EM</sub> (Note.1)		PULSE (Note. 2)	40	A
P <sub>C</sub> (Note.3)	Maximum collector dissipation	T <sub>C</sub> = 25°C	62	W

**BRAKE PART**

Symbol	Parameter	Conditions	Rating	Unit
V <sub>CES</sub>	Collector-emitter voltage	G-E Short	600	V
V <sub>GES</sub>	Gate-emitter voltage	C-E Short	±20	V
I <sub>C</sub>	Collector Current	T <sub>C</sub> = 25°C	20	A
I <sub>CM</sub>		PULSE (Note. 2)	40	A
P <sub>C</sub> (Note.3)	Maximum collector dissipation	T <sub>C</sub> = 25°C	59	W
V <sub>RRM</sub>	Repetitive peak reverse voltage	Clamp diode part	600	V
I <sub>FM</sub> (Note.3)	Forward current	Clamp diode part	20	A

**CONVERTER PART**

Symbol	Parameter	Conditions	Rating	Unit
V <sub>RRM</sub>	Repetitive peak reverse voltage		800	V
E <sub>a</sub>	Recommended AC input voltage		220	V
I <sub>O</sub>	DC output current	3φ rectifying circuit	20	A
I <sub>FSM</sub>	Surge (non-repetitive) forward current	1/2 cycle at 60Hz, peak value, Non-repetitive	200	A
I <sup>2</sup> t	I <sup>2</sup> t for fusing	Value for one cycle of surge current	165	A <sup>2</sup> s

**THYRISTOR PART**

Symbol	Parameter	Conditions	Rating	Unit
V <sub>DRM</sub>	Repetitive peak off-state voltage		800	V
V <sub>RRM</sub>	Repetitive peak reverse voltage		800	V
I <sub>T(AV)</sub>	Average on-state current	Single-phase, half-wave 180° conduction	20	A
I <sub>TSM</sub>	Surge (non-repetitive) on-state current	1/2 cycle at 60Hz, peak value Non-repetitive	200	A
P <sub>GM</sub>	Peak gate power dissipation		10	W
P <sub>G(AV)</sub>	Average gate power dissipation		1	W
I <sub>FGM</sub>	Peak gate forward current		3	A
V <sub>FGM</sub>	Peak gate forward voltage		10	V
V <sub>RGM</sub>	Peak gate reverse voltage		5	V
di/dt	Critical rate of rise of on-state Current	I <sub>G</sub> =100mA, V <sub>D</sub> =400V, dI <sub>G</sub> /dt=1A/μs	100	A/μs

**COMMON RATING**

Symbol	Parameter	Conditions	Rating	Unit
T <sub>J</sub>	Junction temperature	Inverter, brake, converter part	-40 ~ +150	°C
T <sub>J</sub>	Junction temperature	Thyristor part	-40 ~ +125	°C
T <sub>stg</sub>	Storage temperature		-40 ~ +125	°C
V <sub>iso</sub>	Isolation voltage	AC 1 min.	2500	V
—	Mounting torque	Mounting M4 screw	1.47 ~ 1.96	N·m
—	Weight	Typical value	120	g

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**ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25°C)  
INVERTER PART**

Symbol	Parameter	Test conditions	Limits			Unit		
			Min.	Typ.	Max.			
ICES	Collector cutoff current	VCE = VCES, VGE = 0V	—	—	1	mA		
VGE(th)	Gate-emitter threshold voltage	IC = 2.0mA, VCE = 10V	4.5	6	7.5	V		
IGES	Gate-emitter cutoff current	VGE = VGES, VCE = 0V	—	—	0.5	μA		
VCE(sat)	Collector-emitter saturation voltage	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C	IC = 20A, VGE = 15V	(Note.4)	—	2.1	2.8	V
					—	2.15	—	
Cies	Input capacitance	VCE = 10V VGE = 0V	—	—	2.0	nF		
Coes	Output capacitance		—	—	1.5	nF		
Cres	Reverse transfer capacitance		—	—	0.4	nF		
QG	Total gate charge	VCC = 300V, IC = 20A, VGE = 15V	—	60	—	nC		
td(on)	Turn-on delay time	VCC = 300V, IC = 20A	—	—	120	ns		
tr	Turn-on rise time	VGE1 = VGE2 = 15V	—	—	300	ns		
td(off)	Turn-off delay time	RG = 31Ω	—	—	200	ns		
tf	Turn-off fall time	Resistive load	—	—	300	ns		
VEC(Note.1)	Emitter-collector voltage	IE = 20A, VGE = 0V	—	—	2.8	V		
trr (Note.1)	Reverse recovery time	IE = 20A, VGE = 0V	—	—	110	ns		
Qrr (Note.1)	Reverse recovery charge	diE / dt = - 40A / μs	—	0.05	—	μC		
Rth(j-c)Q	Thermal resistance	IGBT part, Per 1/6 module	—	—	2.0	°C/W		
Rth(j-c)R		FWDi part, Per 1/6 module	—	—	3.1	°C/W		

**BRAKE PART**

Symbol	Parameter	Test conditions	Limits			Unit		
			Min.	Typ.	Max.			
ICES	Collector cutoff current	VCE = VCES, VGE = 0V	—	—	1	mA		
VGE(th)	Gate-emitter threshold voltage	IC = 2.0mA, VCE = 10V	4.5	6	7.5	V		
IGES	Gate-emitter cutoff current	VGE = VGES, VCE = 0V	—	—	0.5	μA		
VCE(sat)	Collector-emitter saturation voltage	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C	IC = 20A, VGE = 15V	(Note.4)	—	2.1	2.8	V
					—	2.15	—	
Cies	Input capacitance	VCE = 10V VGE = 0V	—	—	2.0	nF		
Coes	Output capacitance		—	—	1.5	nF		
Cres	Reverse transfer capacitance		—	—	0.4	nF		
QG	Total gate charge	VCC = 300V, IC = 20A, VGE = 15V	—	60	—	nC		
VFM	Forward voltage drop	IF = 20A, Clamp diode part	—	—	2.8	V		
Rth(j-c)Q	Thermal resistance	IGBT part	—	—	2.1	°C/W		
Rth(j-c)R		Clamp diode part	—	—	3.2	°C/W		

**CONVERTER PART**

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
IRRM	Repetitive reverse current	VR = VRRM, T <sub>j</sub> = 150°C	—	—	8	mA
VFM	Forward voltage drop	IF = 20A	—	—	1.5	V
Rth(j-c)	Thermal resistance	Per 1/6 module	—	—	3.1	°C/W

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## THYRISTOR PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
IDRM	Repetitive peak off-state current	V <sub>D</sub> =800V	—	—	1	mA
IRRM	Repetitive peak reverse current	V <sub>R</sub> =800V	—	—	1	mA
ITM	On-state voltage	I <sub>T</sub> =20A, instantaneous means	—	—	1.55	V
IGT	Gate trigger current	V <sub>D</sub> =6V, I <sub>T</sub> =1A	—	—	50	mA
VGT	Gate trigger voltage	V <sub>D</sub> =6V, I <sub>T</sub> =1A	—	—	3	V
dv/dt	Critical rate of rise of off-state Voltage	T <sub>j</sub> =125°C, V <sub>D</sub> =540V, exp. waveform	500	—	—	V/μs
I <sub>H</sub>	Holding current		—	50	—	mA
R <sub>th(j-c)</sub>	Thermal resistance		—	—	1.75	°C/W

## THERMISTOR PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
R <sub>TH</sub>	Resistance	T <sub>c</sub> = 25°C	—	100	—	kΩ
B	B Constant	Resistance at 25°C, 50°C (Note.5)	—	4000	—	K

## RESISTOR PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
R	Resistance	Measured between N-N1	—	3.4	—	mΩ
—	Temperature coefficient		—	0.079	—	%/°C

## COMMON RATING

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
R <sub>th(c-f)</sub>	Contact thermal resistance	Case to fin, Thermal compound applied*1 (1 module)	—	0.05	—	°C/W

Note. 1 I<sub>E</sub>, V<sub>EC</sub>, t<sub>rr</sub>, Q<sub>rr</sub>, diE/dt represent characteristics of the anti-parallel, emitter to collector free-wheel diode.

2 Pulse width and repetition rate should be such that the device junction temp. (T<sub>j</sub>) does not exceed T<sub>jmax</sub> rating.

3 Junction temperature (T<sub>j</sub>) should not increase beyond 150°C.

4 Pulse width and repetition rate should be such as to cause negligible temperature rise.

5  $B = (\ln R_1 - \ln R_2) / (1/T_1 - 1/T_2)$       R<sub>1</sub>: Resistance at T<sub>1</sub>(K)

R<sub>2</sub>: Resistance at T<sub>2</sub>(K)

\*1 : Typical value is measured by using Shin-etsu Silicone "G-746".