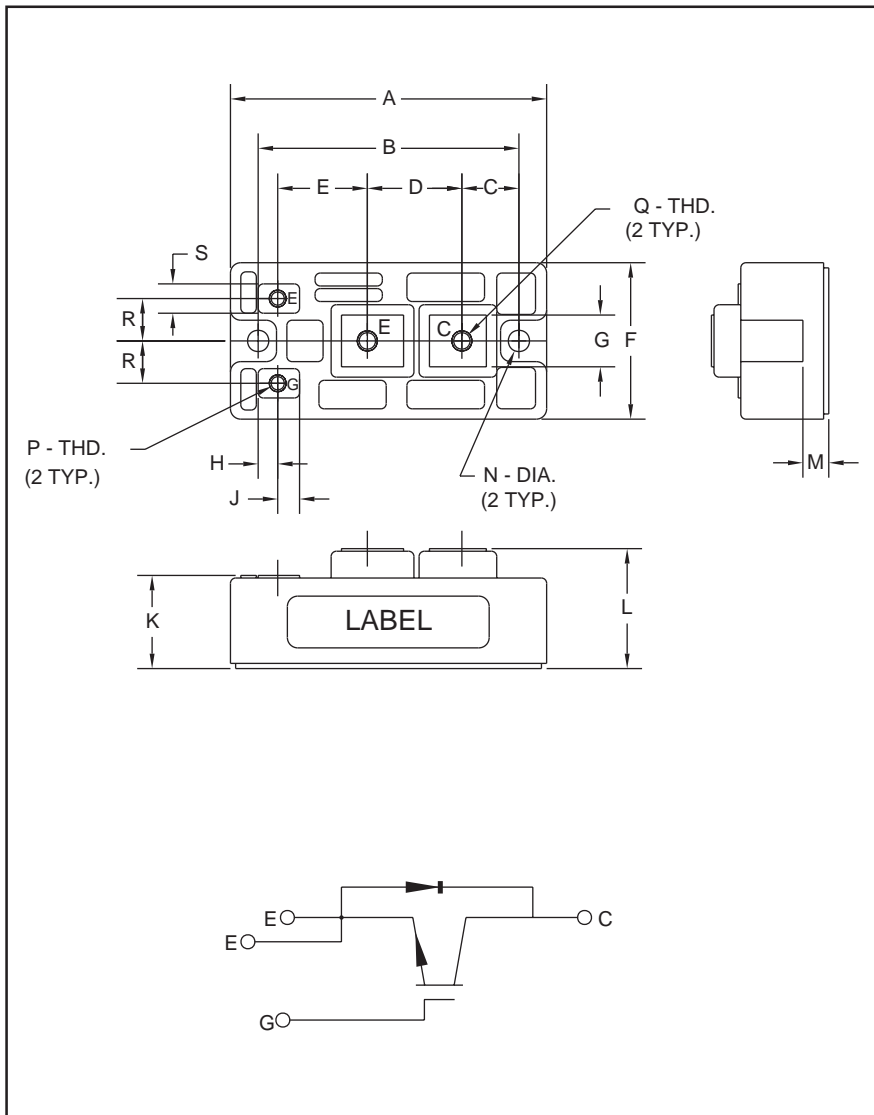


MITSUBISHI IGBT MODULES  
**CM450HA-5F**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE



Outline Drawing and Circuit Diagram



**Description:**

Mitsubishi IGBT Modules are designed for use in switching applications. Each module consists of one IGBT in a single configuration, with a reverse connected super-fast recovery free-wheel diode. All components and interconnects are isolated from the heat sinking baseplate, offering simplified system assembly and thermal management.

**Features:**

- Low Drive Power
- Low  $V_{CE(sat)}$
- Discrete Super-Fast Recovery Free-Wheel Diodes
- High Frequency Operation
- Isolated Baseplate for Easy Heat Sinking

**Applications:**

- UPS
- Forklift

**Ordering Information:**

Example: Select the complete nine digit module part number you desire from the table below - i.e. CM450HA-5F is a 250V ( $V_{CES}$ ), 450 Ampere Single IGBT Module.

Type	Current Rating Amperes	$V_{CES}$ Volts (x 50)
CM	450	5

Dimensions	Inches	Millimeters
A	3.82	97.0
B	3.15	80.0
C	0.69	17.5
D	1.14	29.0
E	1.04	26.5
F	1.89	48.0
G	0.63	16.0
H	0.24	6.0
J	0.26	6.7

Dimensions	Inches	Millimeters
K	1.14	29.0 <sup>+1.0</sup> <sub>-0.5</sub>
L	1.42	36.0 <sup>+1.0</sup> <sub>-0.5</sub>
M	0.28	7.0
N	0.26 Dia.	Dia. 6.5
P	M4 Metric	M4
Q	M6 Metric	M6
R	0.51	13.0
S	0.35	9.0

# CM450HA-5F

HIGH POWER SWITCHING USE  
INSULATED TYPE

## Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

	Symbol	Ratings	Units
Junction Temperature	$T_j$	-40 to 150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$	-40 to 125	$^\circ\text{C}$
Collector-Emitter Voltage (G-E Short)	$V_{\text{CES}}$	250	Volts
Gate-Emitter Voltage (C-E Short)	$V_{\text{GES}}$	$\pm 20$	Volts
Collector Current ( $T_C = 25^\circ\text{C}$ )	$I_C$	450	Amperes
Peak Collector Current ( $T_j \leq 150^\circ\text{C}$ )	$I_{\text{CM}}$	900*	Amperes
Emitter Current** ( $T_C = 25^\circ\text{C}$ )	$I_E$	450	Amperes
Peak Emitter Current**	$I_{\text{EM}}$	900*	Amperes
Maximum Collector Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_C$	735	Watts
Mounting Torque, M6 Main Terminal	—	1.96 ~ 2.94	N · m
Mounting Torque, M6 Mounting	—	1.96 ~ 2.94	N · m
Mounting Torque, M4 Terminal	—	0.98 ~ 1.47	N · m
Weight	—	270	Grams
Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)	$V_{\text{iso}}$	2500	$V_{\text{rms}}$

\*Pulse width and repetition rate should be such that the device junction temperature ( $T_j$ ) does not exceed  $T_{j(\text{max})}$  rating.

\*\*Represents characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).

## Static Electrical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Cutoff Current	$I_{\text{CES}}$	$V_{\text{CE}} = V_{\text{CES}}, V_{\text{GE}} = 0\text{V}$	—	—	1.0	mA
Gate Leakage Current	$I_{\text{GES}}$	$V_{\text{GE}} = V_{\text{GES}}, V_{\text{CE}} = 0\text{V}$	—	—	0.5	$\mu\text{A}$
Gate-Emitter Threshold Voltage	$V_{\text{GE(th)}}$	$I_C = 45\text{mA}, V_{\text{CE}} = 10\text{V}$	3.0	4.0	5.0	Volts
Collector-Emitter Saturation Voltage	$V_{\text{CE(sat)}}$	$I_C = 450\text{A}, V_{\text{GE}} = 10\text{V},$	—	1.2	1.7**	Volts
		$I_C = 450\text{A}, V_{\text{GE}} = 10\text{V}, T_j = 150^\circ\text{C}$	—	1.1	—	Volts
Total Gate Charge	$Q_G$	$V_{\text{CC}} = 100\text{V}, I_C = 450\text{A}, V_{\text{GE}} = 10\text{V}$	—	1760	—	nC
Emitter-Collector Voltage	$V_{\text{EC}}$	$I_E = 450\text{A}, V_{\text{GE}} = 0\text{V}$	—	—	2.0	Volts

\*\* Pulse width and repetition rate should be such that device junction temperature rise is negligible.

## Dynamic Electrical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Input Capacitance	$C_{\text{ies}}$		—	—	132	nF
Output Capacitance	$C_{\text{oes}}$	$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = 10\text{V}$	—	—	6	nF
Reverse Transfer Capacitance	$C_{\text{res}}$		—	—	4.5	nF
Resistive	Turn-on Delay Time	$t_{\text{d(on)}}$	—	—	1200	ns
	Rise Time	$t_r$	—	—	2700	ns
Switching	Turn-off Delay Time	$t_{\text{d(off)}}$	—	—	900	ns
	Fall Time	$t_f$	—	—	500	ns
Diode Reverse Recovery Time	$t_{\text{rr}}$	$I_E = 450\text{A}, di_E/dt = -900\text{A}/\mu\text{s}$	—	—	300	ns
Diode Reverse Recovery Charge	$Q_{\text{rr}}$	$I_E = 450\text{A}, di_E/dt = -900\text{A}/\mu\text{s}$	—	7.6	—	$\mu\text{C}$

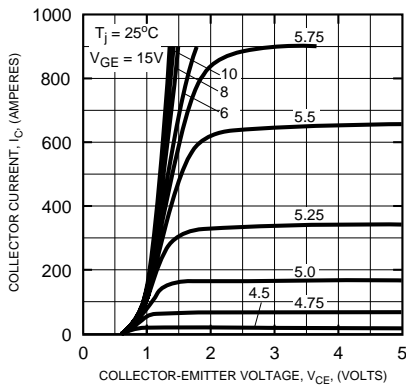
## Thermal and Mechanical Electrical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case	$R_{\text{th(j-c)}}$	Per IGBT	—	—	0.17	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\text{th(j-c)}}$	Per Free Wheel Diode	—	—	0.23	$^\circ\text{C}/\text{W}$
Contact Thermal Resistance	$R_{\text{th(c-f)}}$	Per Module, Thermal Grease Applied	—	—	0.090	$^\circ\text{C}/\text{W}$

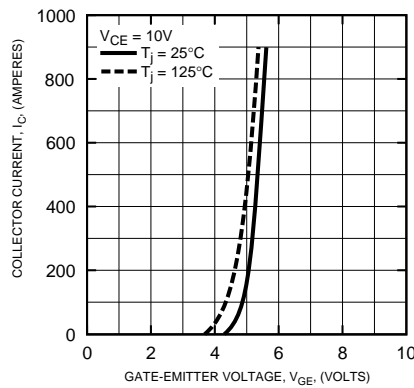
# CM450HA-5F

HIGH POWER SWITCHING USE  
INSULATED TYPE

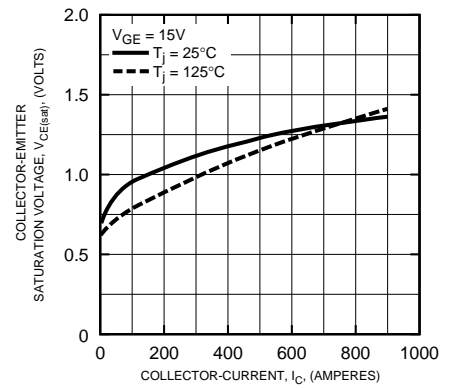
OUTPUT CHARACTERISTICS  
(TYPICAL)



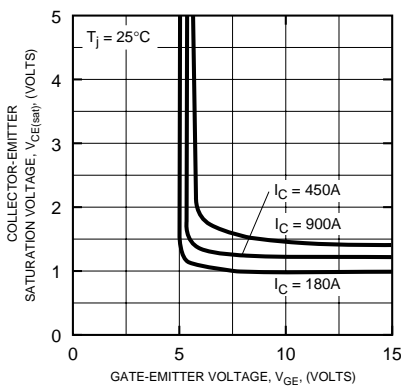
TRANSFER CHARACTERISTICS  
(TYPICAL)



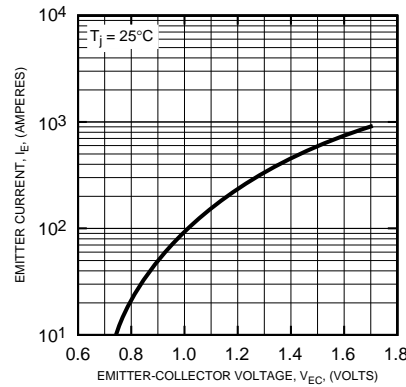
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS  
(TYPICAL)



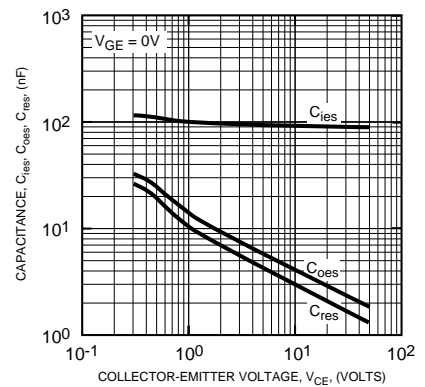
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS  
(TYPICAL)



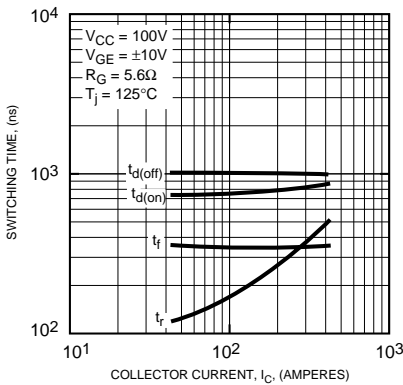
FREE-WHEEL DIODE FORWARD CHARACTERISTICS  
(TYPICAL)



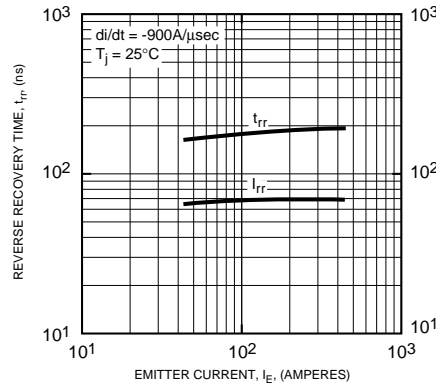
CAPACITANCE VS.  $V_{CE}$   
(TYPICAL)



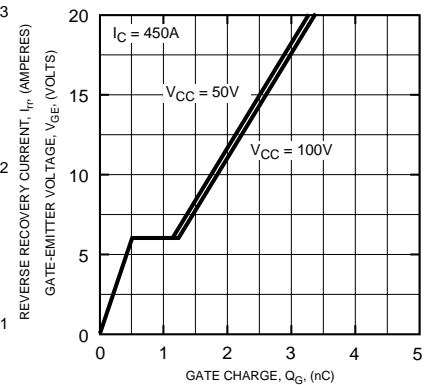
HALF-BRIDGE SWITCHING CHARACTERISTICS  
(TYPICAL)



REVERSE RECOVERY CHARACTERISTICS  
(TYPICAL)



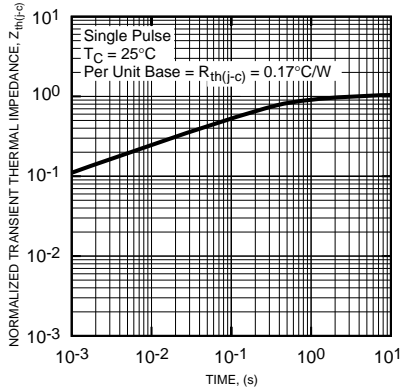
GATE CHARGE,  $V_{GE}$



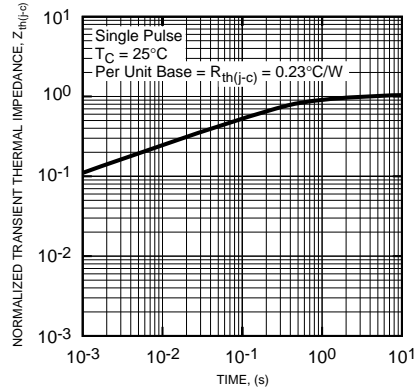
# CM450HA-5F

HIGH POWER SWITCHING USE  
INSULATED TYPE

TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT)



TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(FWD)



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