CM400HG-66H

HIGH POWER SWITCHING USE
INSULATED TYPE

3rd-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

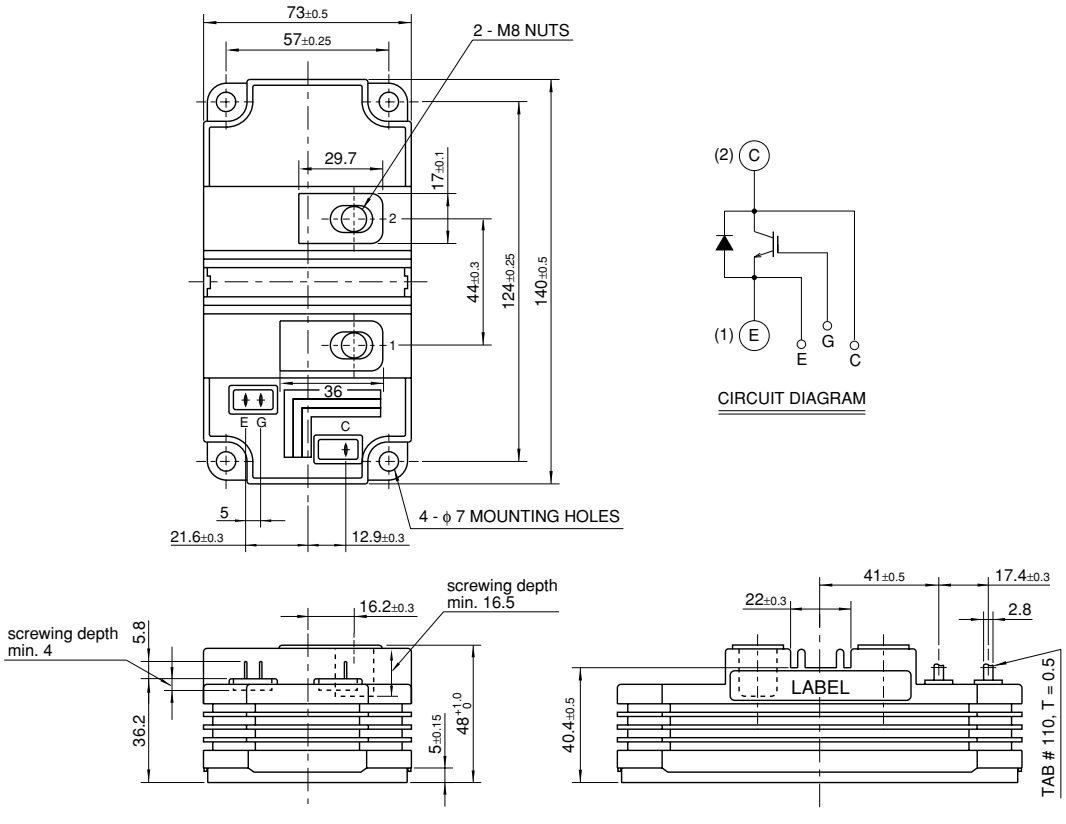
CM400HG-66H

- I_C 400A
- V_{CES} 3300V
- High Insulated Type
- 1-element in a Pack
- AlSiC Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM **Dimensions in mm**



Jul. 2005

MITSUBISHI ELECTRIC

MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V_{CES}	Collector-emitter voltage	V_{GE} = 0V, T_j = 25°C	3300	V
V_{GES}	Gate-emitter voltage	V_{CE} = 0V, T_j = 25°C	±20	V
I_C	Collector current	T_C = 90°C	400	A
I_{CM}		Pulse (Note 1)	800	A
I_E (Note 2)	Emitter current		400	A
I_{EM} (Note 2)		Pulse (Note 1)	800	A
P_C (Note 3)	Maximum power dissipation	T_C = 25°C, IGBT part	4100	W
T_j	Junction temperature		–40 ~ +150	°C
T_{op}	Operating temperature		–40 ~ +125	°C
T_{stg}	Storage temperature		–40 ~ +125	°C
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1min.	10200	V
Q_{pd}	Partial discharge	V1 = 6900V_{rms}, V2 = 5100V_{rms} f = 60Hz (acc. to IEC 1287)	10	pC
t_{psc}	Maximum short circuit pulse width	V_{CC} = 2200V, V_{CES} ≤ 3300V, V_{GE} = 15V T_j = 125°C	10	µs

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
I_{CES}	Collector cut-off current	V_{CE} = V_{CES}, V_{GE} = 0V, T_j = 25°C	—	—	5	mA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C = 40mA, V_{CE} = 10V, T_j = 25°C	5.0	6.0	7.0	V
I_{GES}	Gate leakage current	V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25°C	—	—	0.5	µA
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = 400A, V_{GE} = 15V, T_j = 25°C (Note 4)	—	3.30	4.20	V
		I_C = 400A, V_{GE} = 15V, T_j = 125°C (Note 4)	—	3.60	—	
C_{ies}	Input capacitance	V_{CE} = 10V, f = 100kHz V_{GE} = 0V, T_j = 25°C	—	60	—	nF
C_{oes}	Output capacitance		—	6.0	—	nF
C_{res}	Reverse transfer capacitance		—	5.4	—	nF
Q_g	Total gate charge	V_{CC} = 1650V, I_C = 400A, V_{GE} = 15V, T_j = 25°C	—	2.8	—	µC
V_{EC} (Note 2)	Emitter-collector voltage	I_E = 400A, V_{GE} = 0V, T_j = 25°C (Note 4)	—	2.80	3.60	V
		I_E = 400A, V_{GE} = 0V, T_j = 125°C (Note 4)	—	2.70	—	
$t_{d(on)}$	Turn-on delay time	V_{CC} = 1650V, I_C = 400A, V_{GE} = ±15V	—	—	1.60	µs
t_r	Turn-on rise time	$R_{G(on)}$ = 5Ω, T_j = 125°C, L_s = 100nH	—	—	1.00	µs
E_{on}	Turn-on switching energy	Inductive load	—	0.64	—	J/pulse
$t_{d(off)}$	Turn-off delay time	V_{CC} = 1650V, I_C = 400A, V_{GE} = ±15V	—	—	2.50	µs
t_f	Turn-off fall time	$R_{G(off)}$ = 5Ω, T_j = 125°C, L_s = 100nH	—	—	1.00	µs
E_{off}	Turn-off switching energy	Inductive load	—	0.52	—	J/pulse
t_{rr} (Note 2)	Reverse recovery time	V_{CC} = 1650V, I_C = 400A, V_{GE} = ±15V	—	—	1.40	µs
Q_{rr} (Note 2)	Reverse recovery charge	$R_{G(on)}$ = 5Ω, T_j = 125°C, L_s = 100nH	—	270	—	µC
E_{rec} (Note 2)	Reverse recovery energy	Inductive load	—	0.30	—	J/pulse

Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{opmax} rating (125°C).
2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).
3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).
4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

THERMAL CHARACTERISTICS

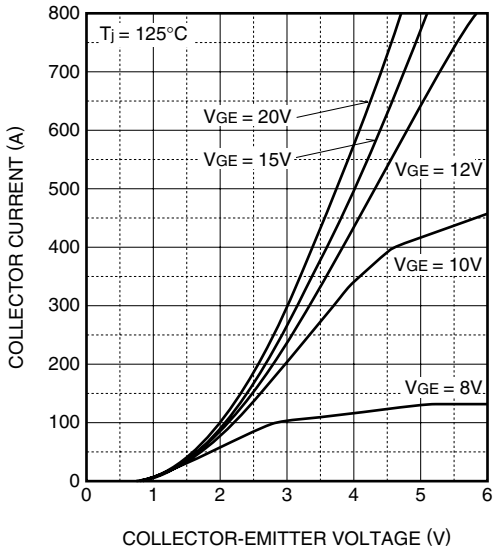
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	30.0	K/kW
$R_{th(j-c)R}$		Junction to Case, FWDi part	—	—	60.0	K/kW
$R_{th(c-f)}$	Contact thermal resistance	Case to Fin, λ_{grease} = 1W/m·K	—	18.0	—	K/kW

MECHANICAL CHARACTERISTICS

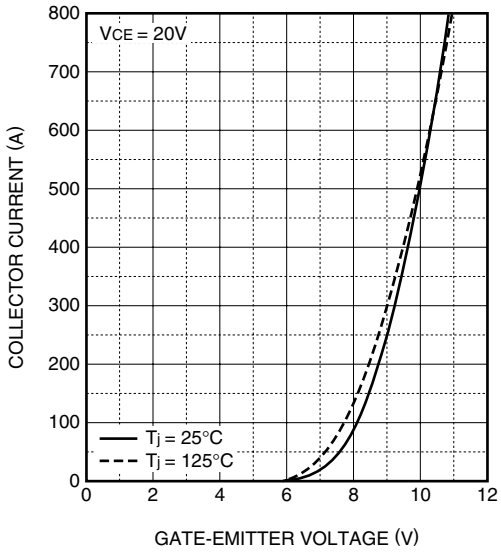
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M	Mounting torque	M8 : Main terminals screw	7.0	—	15.0	N·m
		M6 : Mounting screw	3.0	—	6.0	
		M4 : Auxiliary terminals screw	1.0	—	3.0	
—	Mass		—	0.52	—	kg
CTI	Comparative tracking index		600	—	—	—
d_a	Clearance distance in air		26.0	—	—	mm
d_s	Creepage distance along surface		56.0	—	—	mm

PERFORMANCE CURVES

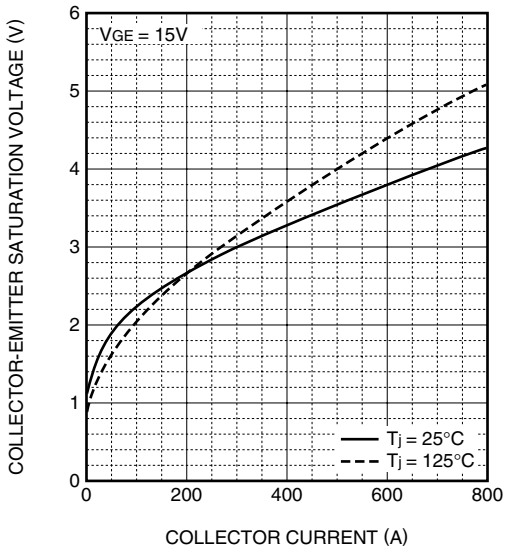
OUTPUT CHARACTERISTICS (TYPICAL)



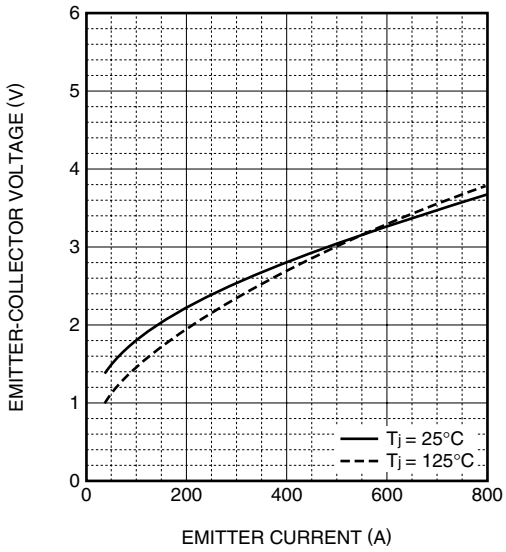
TRANSFER CHARACTERISTICS (TYPICAL)



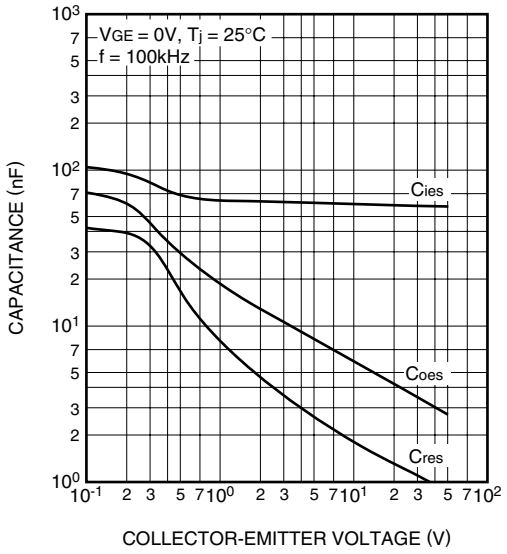
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



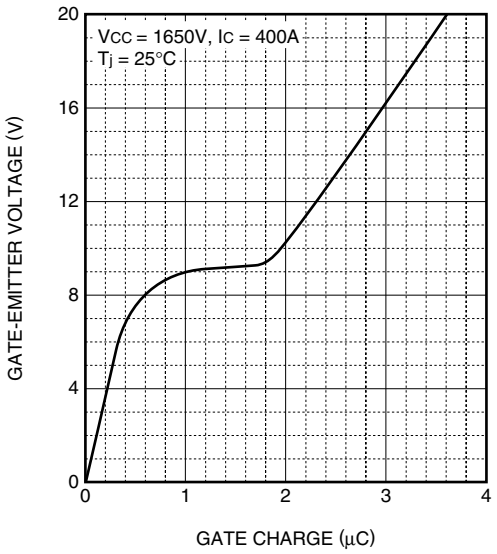
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



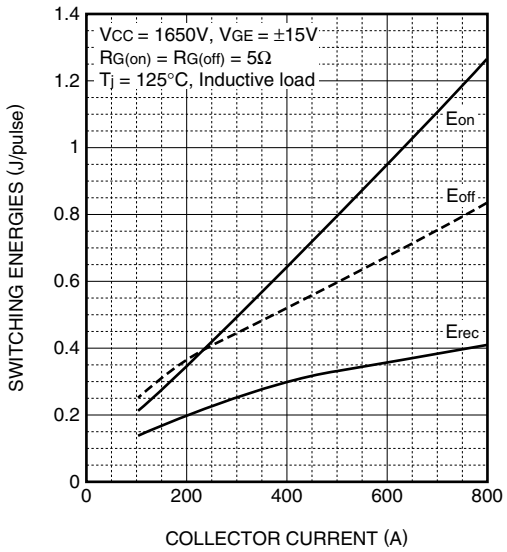
CAPACITANCE CHARACTERISTICS (TYPICAL)



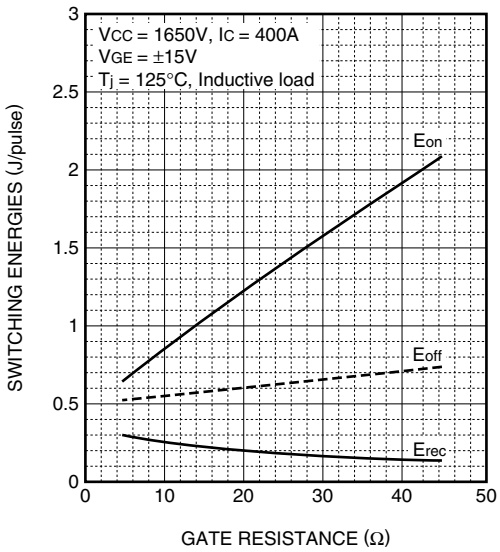
GATE CHARGE CHARACTERISTICS (TYPICAL)



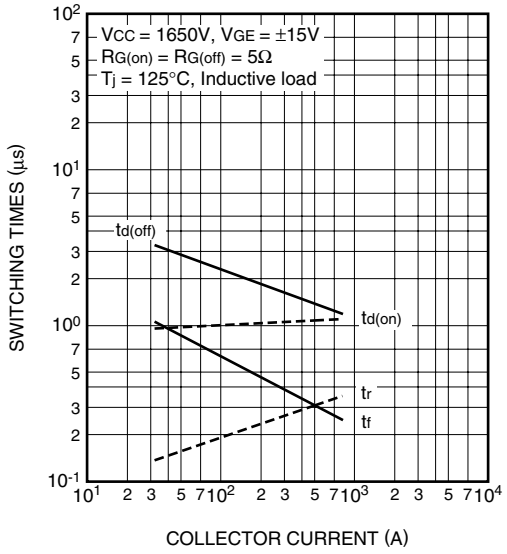
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



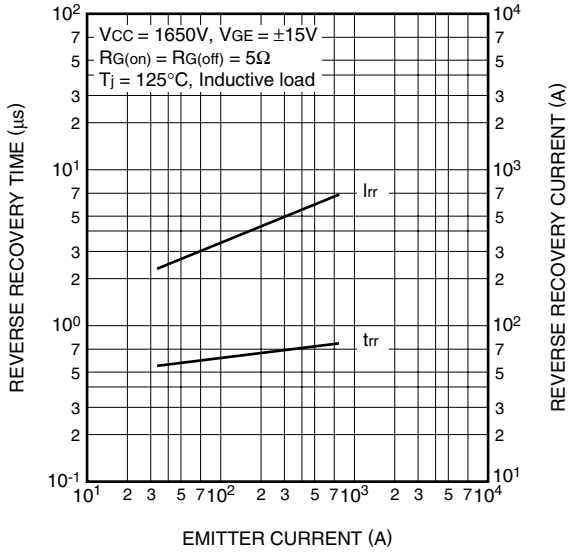
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



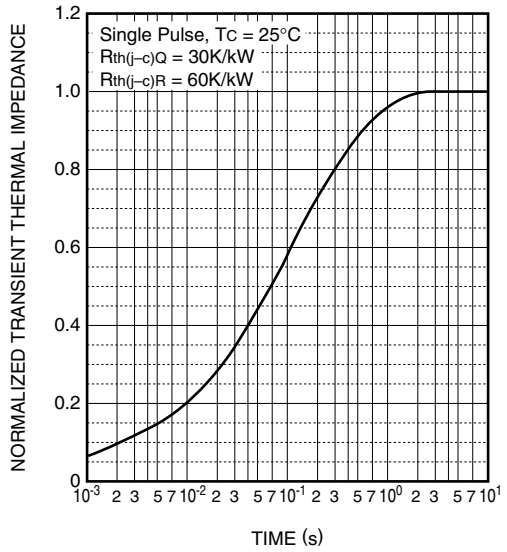
HALF-BRIDGE
SWITCHING TIME CHARACTERISTICS
(TYPICAL)



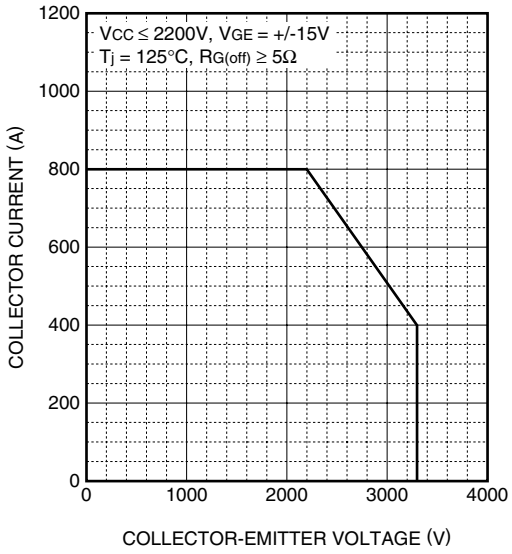
FREE-WHEEL DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS



REVERSE BIAS SAFE OPERATING AREA (RBSOA)



FREE-WHEEL DIODE REVERSE RECOVERY SAFE OPERATING AREA (RRSOA)