MITSUBISHI ELECTRIC

< HVIGBT MODULE >

CMH1200DC-34S

HIGH POWER SWITCHING USE
INSULATED TYPE

SiC Hybrid HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Module

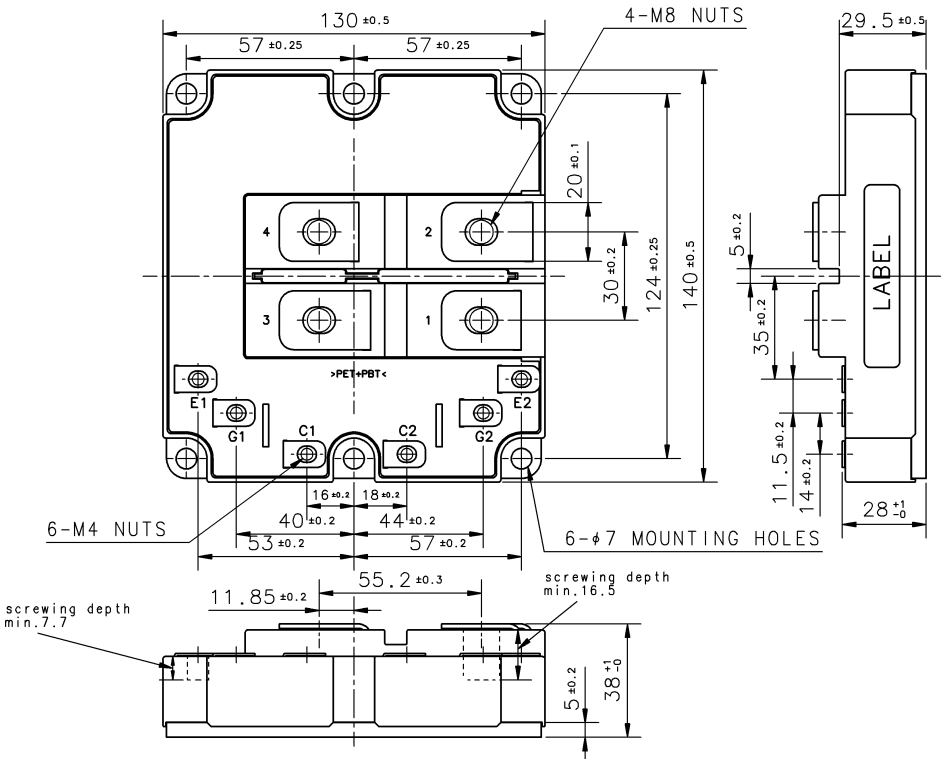
CMH1200DC-34S

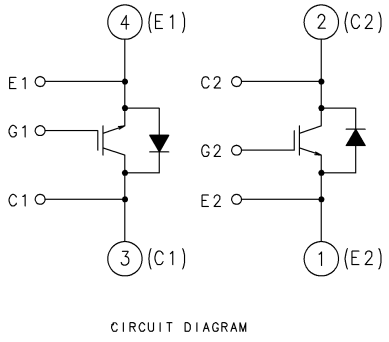
- I_C 1200A
- V_{CES} 1700V
- 2-element in a Pack
- Insulated Type
- CSTBT™
- SiC Schottky-Barrier Diode
- AlSiC Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

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





CIRCUIT DIAGRAM

MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V_{CES}	Collector-emitter voltage	V_{GE} = 0V	1700	V
V_{GES}	Gate-emitter voltage	V_{CE} = 0V, T_j = 25°C	±20	V
I_C	Collector current	DC, T_c = 110°C	1200	A
I_{CRM}		Pulse (Note 1)	2400	A
I_E	Emitter current (Note 2)	DC	1200	A
I_{ERM}		Pulse (Note 1)	2400	A
I^2t	Surge current load integral	T_j = 125°C, V_R = 0V, t_p = 10ms	—	kA^2s
P_{tot}	Maximum power dissipation (Note 3)	T_c = 25°C, IGBT part	6750	W
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1min.	4000	V
T_{jop}	Operating junction temperature		−50 ~ +150	°C
T_{stg}	Storage temperature		−50 ~ +150	°C
t_{psc}	Short circuit pulse width	V_{CC} = 1200 V, $V_{CE} \leq V_{CES}$, V_{GE} = 15V, T_j = 150°C	10	µs

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions		Limits Min	Limits Typ	Limits Max	Unit
I_{CES}	Collector cutoff current	$V_{CE} = V_{CES}$, V_{GE} = 0V	T_j = 25°C	—	36	—	mA
			T_j = 125°C	—	150	—	
			T_j = 150°C	—	180	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{CE} = 10V, I_C = 120mA, T_j = 25°C		—	6.0	—	V
I_{GES}	Gate leakage current	$V_{GE} = V_{GES}$, V_{CE} = 0V, T_j = 25°C		−0.5	—	0.5	µA
C_{ies}	Input capacitance	V_{CE} = 10V, V_{GE} = 0V, f = 100kHz, T_j = 25°C		—	216	—	nF
C_{oes}	Output capacitance			—	8.0	—	nF
C_{res}	Reverse transfer capacitance			—	1.6	—	nF
Q_G	Total gate charge	V_{CC} = 850V, I_C = 1200A, V_{GE} = 15V		—	12.0	—	µC
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1200 A (Note 4), V_{GE} = 15 V	T_j = 25°C	—	1.95	—	V
			T_j = 125°C	—	2.25	—	
			T_j = 150°C	—	2.30	—	
$t_{d(on)}$	Turn-on delay time	V_{CC} = 850 V, I_C = 1200 A, V_{GE} = ±15 V, $R_{G(on)}$ = 1.3 Ω, L_s = 100 nH, Inductive load	T_j = 25°C	—	0.50	—	µs
			T_j = 125°C	—	0.50	—	
			T_j = 150°C	—	0.50	—	
t_r	Turn-on rise time		T_j = 25°C	—	0.14	—	µs
			T_j = 125°C	—	0.15	—	
			T_j = 150°C	—	0.15	—	
E_{on}	Turn-on switching energy (Note 5)		T_j = 25°C	—	110	—	mJ
			T_j = 125°C	—	135	—	
			T_j = 150°C	—	140	—	
$t_{d(off)}$	Turn-off delay time	V_{CC} = 850 V, I_C = 1200 A, V_{GE} = ±15 V, $R_{G(off)}$ = 3.3 Ω, L_s = 100 nH, Inductive load	T_j = 25°C	—	1.25	—	µs
			T_j = 125°C	—	1.35	—	
			T_j = 150°C		1.35	—	
t_f	Turn-off fall time		T_j = 25°C	—	0.30	—	µs
			T_j = 125°C	—	0.55	—	
			T_j = 150°C	—	0.60	—	
E_{off}	Turn-off switching energy (Note 5)		T_j = 25°C	—	250	—	mJ
			T_j = 125°C	—	370	—	
			T_j = 150°C	—	390	—	
V_{EC}	Emitter-collector voltage (Note 2)	I_E = 1200A (Note 4), V_{GE} = 0V	T_j = 25°C	—	1.60	—	V
			T_j = 125°C	—	2.20	—	
			T_j = 150°C	—	2.30	—	
Q_C	Total capacitive charge (Note 2,6)	V_{CC} = 850V, I_E = 1200 A, $R_{G(on)}$ = 1.3Ω, L_s = 100 nH	T_j = 25°C	—	5.0	—	µC
			T_j = 125°C	—	8.5	—	
			T_j = 150°C	—	9.0	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part, 1/2 module	—	—	18.5	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part, 1/2 module	—	—	36.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, 1/2 module λ_{grease} = 1W/m·k, $D_{(c-s)}$ = 100μm	—	16.0	—	K/kW

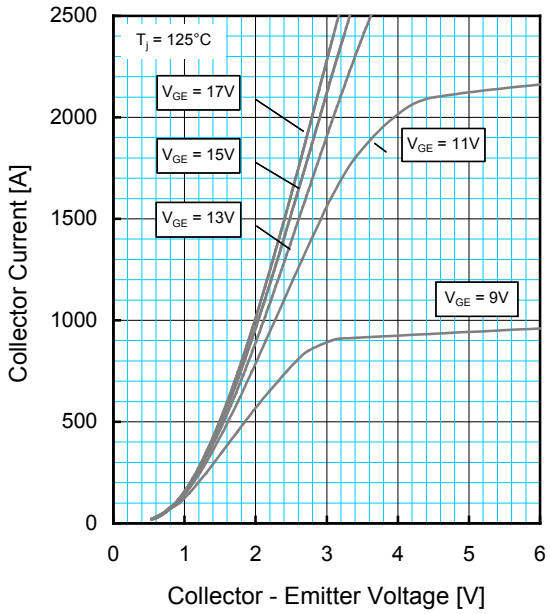
MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M_t	Mounting torque	Main terminals screw	7.0	—	20.0	N·m
M_s		Mounting screw	3.0	—	6.0	N·m
M_t		Auxiliary terminals screw	1.0	—	3.0	N·m
m	Mass		—	0.8	—	kg
CTI	Comparative tracking index		600	—	—	—
d_a	Clearance		9.5	—	—	mm
d_s	Creepage distance		15.0	—	—	mm
$L_{P\ CE}$	Parasitic stray inductance	1/2 module	—	30.0	—	nH
$R_{CC'+EE'}$	Internal lead resistance	T_c = 25°C, 1/2 module	—	0.28	—	mΩ

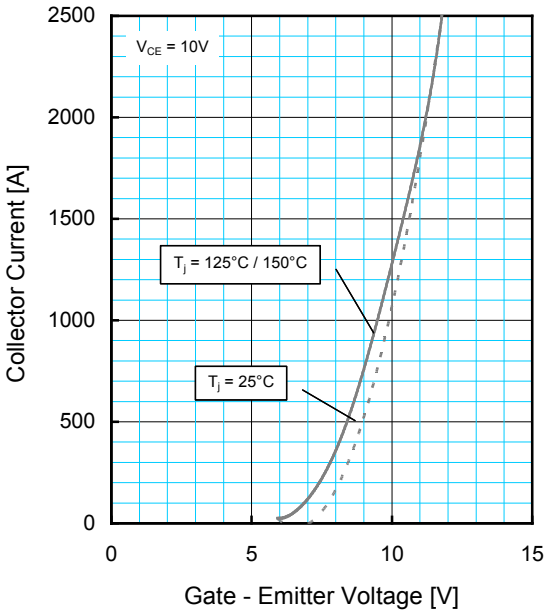
Note1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jopmax} rating.
2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).
3. Junction temperature (T_j) should not exceed T_{jmax} rating.
4. Pulse width and repetition rate should be such as to cause negligible temperature rise.
5. Definition of all items is according to IEC 60747, unless otherwise specified.
6. Capacitive charge during anti-paralleled FWDi's turn-off operation.

PERFORMANCE CURVES

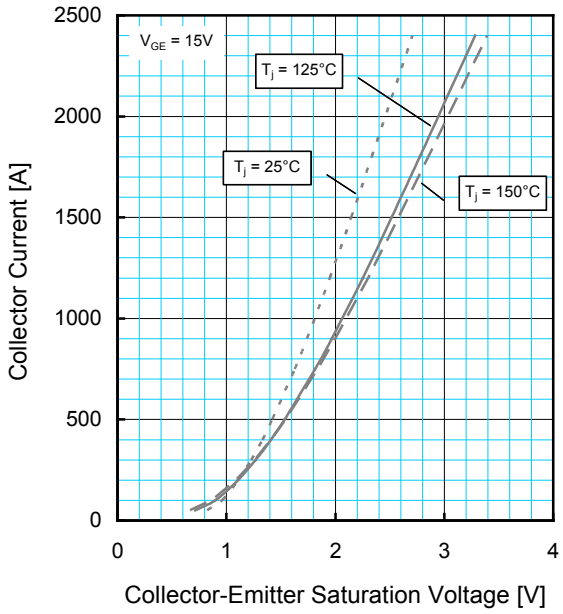
OUTPUT CHARACTERISTICS (TYPICAL)



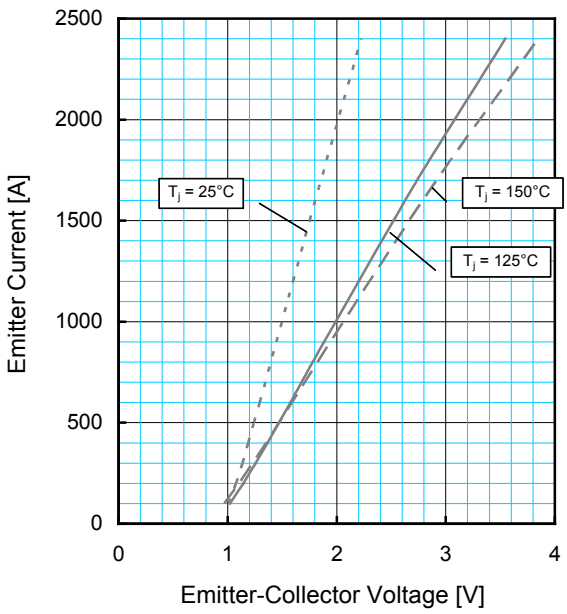
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

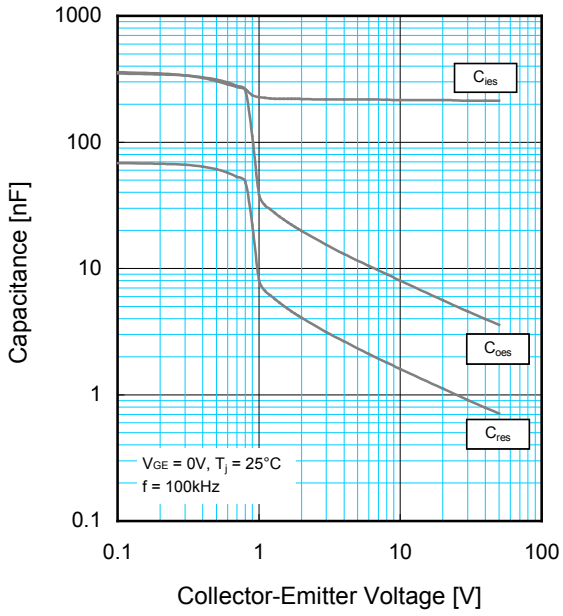


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

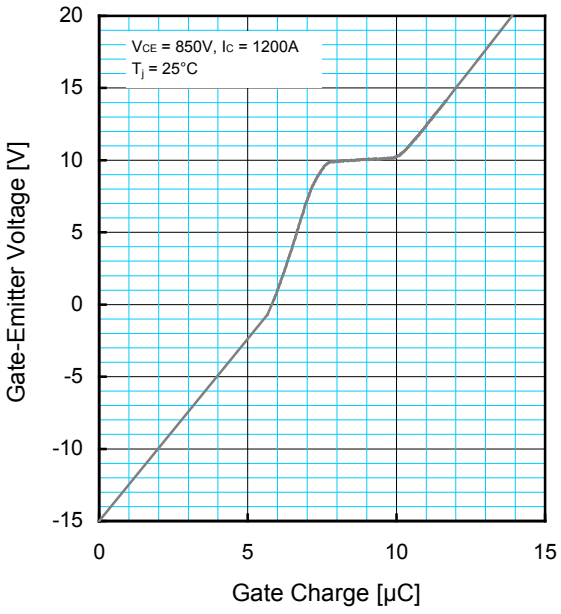


PERFORMANCE CURVES

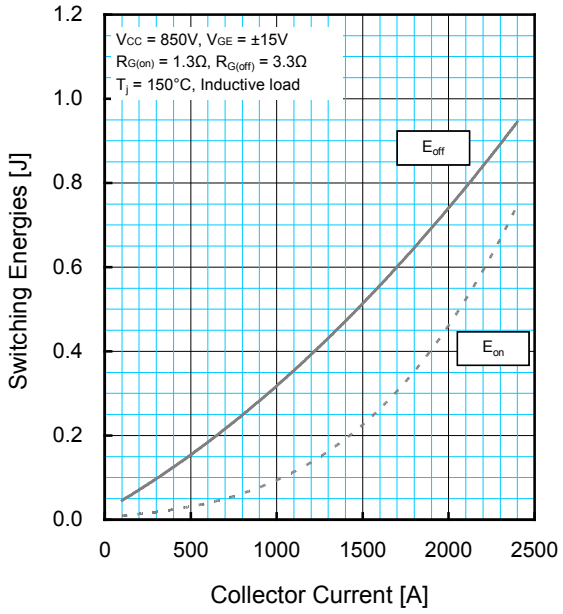
CAPACITANCE CHARACTERISTICS (TYPICAL)



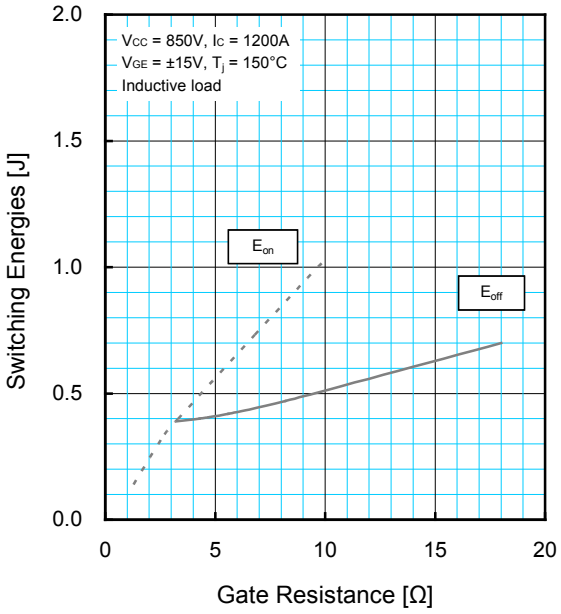
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

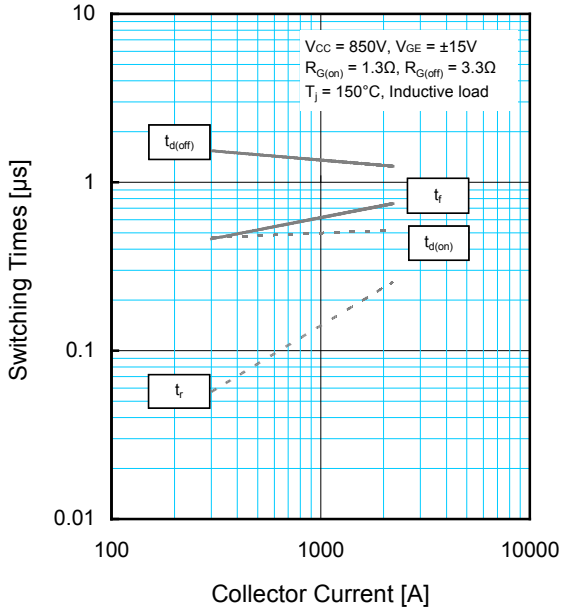


HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

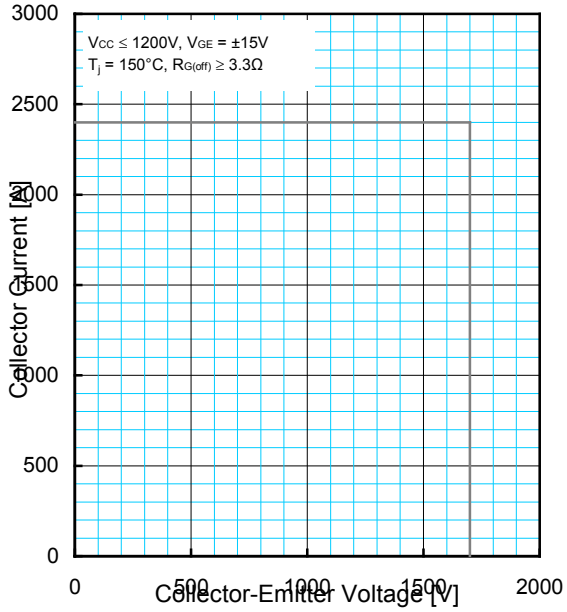


PERFORMANCE CURVES

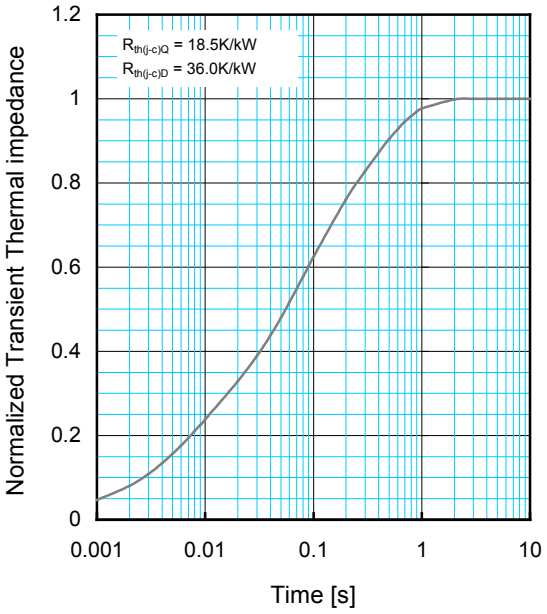
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



REVERSE BIAS SAFE OPERATING AREA (RBSOA)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - exp\left(\frac{-t}{\tau_i} \right) \right\}$$

	1	2	3	4
R_i [K/kW]	0.0096	0.1893	0.4044	0.3967
t_i [sec]	0.0001	0.0058	0.0602	0.3512

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