

Prepared by S. Iwata Revision: 1.1
 Approved by H. Yamaguchi : Apr. 2009

CM1200HC-90R

HIGH POWER SWITCHING USE
 INSULATED TYPE

4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

CM1200HC-90R

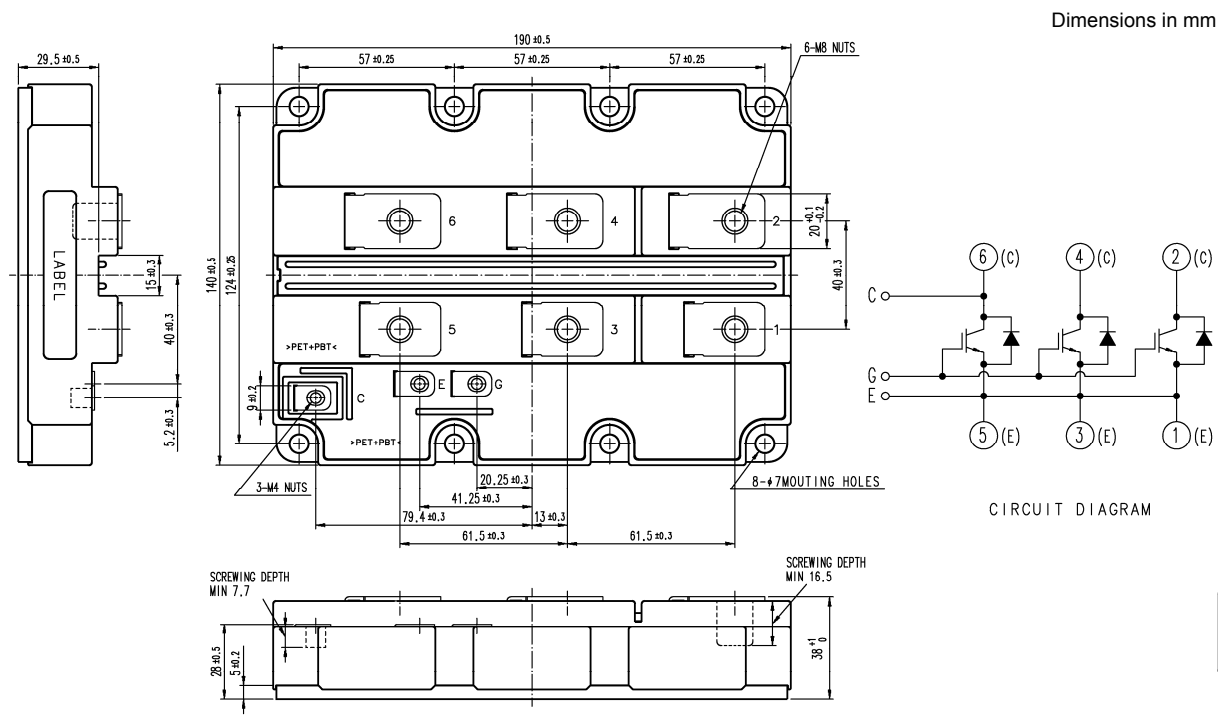


- I_C 1200 A
- V_{CES} 4500 V
- 1-element in a Pack
- Insulated Type
- LPT-IGBT / Soft Recovery Diode
- AISiC Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM



CM1200HC-90R

HIGH POWER SWITCHING USE
INSULATED TYPE

4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V _{CES}	Collector-emitter voltage	V _{GE} = 0V, T _j = -40...+125°C	4500	V
		V _{GE} = 0V, T _j = -50°C	4400	
V _{GES}	Gate-emitter voltage	V _{CE} = 0V, T _j = 25°C	± 20	V
I _C	Collector current	DC, T _c = 85°C	1200	A
I _{CM}		Pulse ^(Note 1)	2400	A
I _E	Emitter current ^(Note 2)	DC	1200	A
I _{EM}		Pulse ^(Note 1)	2400	A
P _c	Maximum power dissipation ^(Note 3)	T _c = 25°C, IGBT part	13100	W
V _{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1 min.	6000	V
V _e	Partial discharge extinction voltage	RMS, sinusoidal, f = 60Hz, Q _{PD} ≤ 10 pC	3500	V
T _j	Junction temperature		-50 ~ +150	°C
T _{op}	Operating temperature		-50 ~ +125	°C
T _{stg}	Storage temperature		-55 ~ +125	°C
t _{psc}	Maximum short circuit pulse width	V _{CC} = 3200V, V _{CE} ≤ V _{CES} , V _{GE} = 15V T _j = 125°C	10	μs

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
I _{CES}	Collector cutoff current	V _{CE} = V _{CES} , V _{GE} = 0V	T _j = 25°C	—	—	12.0	mA
			T _j = 125°C	—	12.0	—	
V _{GE(th)}	Gate-emitter threshold voltage	V _{CE} = 10 V, I _C = 120 mA, T _j = 25°C	5.8	6.3	6.8	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} = 10 V, V _{GE} = 0 V, f = 100 kHz T _j = 25°C	—	175.0	—	nF	
C _{oes}	Output capacitance		—	11.0	—	nF	
C _{res}	Reverse transfer capacitance		—	5.0	—	nF	
Q _g	Total gate charge	V _{CC} = 2800 V, I _C = 1200 A, V _{GE} = ±15 V	—	13.5	—	μC	
V _{CE(sat)}	Collector-emitter saturation voltage	I _C = 1200 A ^(Note 4) V _{GE} = 15 V	T _j = 25°C	—	3.50	—	V
			T _j = 125°C	—	4.40	5.20	
t _{d(on)}	Turn-on delay time	V _{CC} = 2800 V I _C = 1200 A V _{GE} = ±15 V	T _j = 25°C	—	1.00	—	μs
			T _j = 125°C	—	0.95	1.50	
t _r	Turn-on rise time	V _{CC} = 2800 V I _C = 1200 A V _{GE} = ±15 V	T _j = 25°C	—	0.30	—	μs
			T _j = 125°C	—	0.32	0.50	
E _{on(10%)}	Turn-on switching energy ^(Note 5)	R _{G(on)} = 2.7 Ω L _s = 150 nH Inductive load	T _j = 25°C	—	4.25	—	J/P
			T _j = 125°C	—	5.00	—	
E _{on}	Turn-on switching energy ^(Note 6)	Inductive load	T _j = 25°C	—	5.00	—	J/P
			T _j = 125°C	—	5.50	—	

HVIGBT (High Voltage Insulated Gate Bipolar Transistor) MODULES



CM1200HC-90R

HIGH POWER SWITCHING USE
INSULATED TYPE

4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

Symbol	Item	Conditions	Limits			Unit		
			Min	Typ	Max			
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 2800\text{ V}$ $I_C = 1200\text{ A}$ $V_{GE} = \pm 15\text{ V}$ $R_{G(off)} = 22\ \Omega$ $L_s = 150\text{ nH}$ Inductive load	$T_J = 25^\circ\text{C}$	—	6.25	—	μs	
			$T_J = 125^\circ\text{C}$	—	6.60	8.00		
t_f	Turn-off fall time		$T_J = 25^\circ\text{C}$	—	0.40	—	μs	
			$T_J = 125^\circ\text{C}$	—	0.50	1.20		
$E_{off(10\%)}$	Turn-off switching energy (Note 5)		$T_J = 25^\circ\text{C}$	—	3.35	—	J/P	
			$T_J = 125^\circ\text{C}$	—	4.15	—		
E_{off}	Turn-off switching energy (Note 6)		$T_J = 25^\circ\text{C}$	—	3.90	—	J/P	
			$T_J = 125^\circ\text{C}$	—	4.80	—		
V_{EC}	Emitter-collector voltage (Note 2)		$I_E = 1200\text{ A}$ (Note 4) $V_{GE} = 0\text{ V}$	$T_J = 25^\circ\text{C}$	—	2.60	—	V
				$T_J = 125^\circ\text{C}$	—	2.80	3.40	
t_{rr}	Reverse recovery time (Note 2)	$V_{CC} = 2800\text{ V}$ $I_C = 1200\text{ A}$ $V_{GE} = \pm 15\text{ V}$ $R_{G(on)} = 2.7\ \Omega$ $L_s = 150\text{ nH}$ Inductive load	$T_J = 25^\circ\text{C}$	—	0.70	—	μs	
			$T_J = 125^\circ\text{C}$	—	0.90	—		
I_{rr}	Reverse recovery current (Note 2)		$T_J = 25^\circ\text{C}$	—	1200	—	A	
			$T_J = 125^\circ\text{C}$	—	1300	—		
Q_{rr}	Reverse recovery charge (Note 2)		$T_J = 25^\circ\text{C}$	—	1000	—	μC	
			$T_J = 125^\circ\text{C}$	—	1700	—		
$E_{rec(10\%)}$	Reverse recovery energy (Note 2) (Note 5)		$T_J = 25^\circ\text{C}$	—	1.40	—	J/P	
			$T_J = 125^\circ\text{C}$	—	2.30	—		
E_{rec}	Reverse recovery energy (Note 2) (Note 6)		$T_J = 25^\circ\text{C}$	—	1.55	—	J/P	
			$T_J = 125^\circ\text{C}$	—	2.50	—		

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	9.5	K/kW
$R_{th(j-c)R}$	Thermal resistance	Junction to Case, FWDi part	—	—	18.5	K/kW
$R_{th(c-f)}$	Contact thermal resistance	Case to Fin, $\lambda_{grease} = 1\text{ W/m}\cdot\text{K}$, $D_{(c-f)} = 100\ \mu\text{m}$	—	6.0	—	K/kW

CM1200HC-90RHIGH POWER SWITCHING USE
INSULATED TYPE4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules**MECHANICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M_t	Mounting torque	M8: Main terminals screw	7.0	—	22.0	N·m
M_s		M6: Mounting screw	3.0	—	6.0	N·m
M_t		M4: Auxiliary terminals screw	1.0	—	3.0	N·m
m	Mass		—	1.2	—	kg
CTI	Comparative tracking index		600	—	—	—
d_a	Clearance		19.5	—	—	mm
d_s	Creepage distance		32.0	—	—	mm
$L_{P\ CE}$	Parasitic stray inductance		—	11.0	—	nH
R_{CC+EE}	Internal lead resistance	$T_c = 25^\circ\text{C}$	—	0.12	—	m Ω
r_g	Internal gate resistor	$T_c = 25^\circ\text{C}$	—	1.7	—	Ω

Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{opmax} rating (150°C).

Note 2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).

Note 3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).

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

Note 5. $E_{on(10\%)} / E_{off(10\%)} / E_{rec(10\%)}$ are the integral of $0.1V_{CE} \times 0.1I_C \times dt$.

Note 6. The integration range of $E_{on} / E_{off} / E_{rec}$ according to IEC 60747.

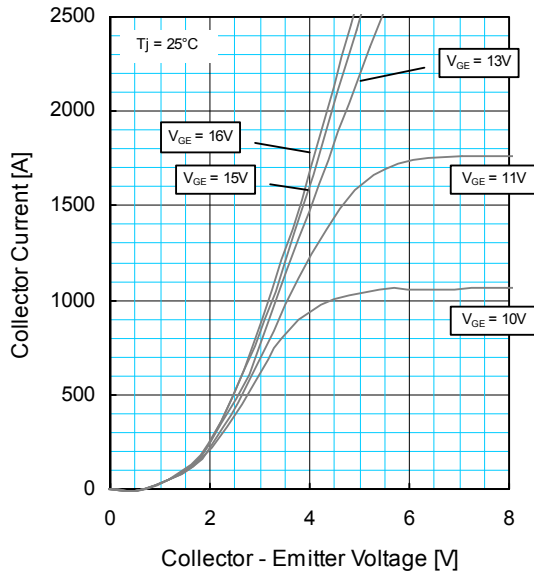
CM1200HC-90R

HIGH POWER SWITCHING USE
INSULATED TYPE

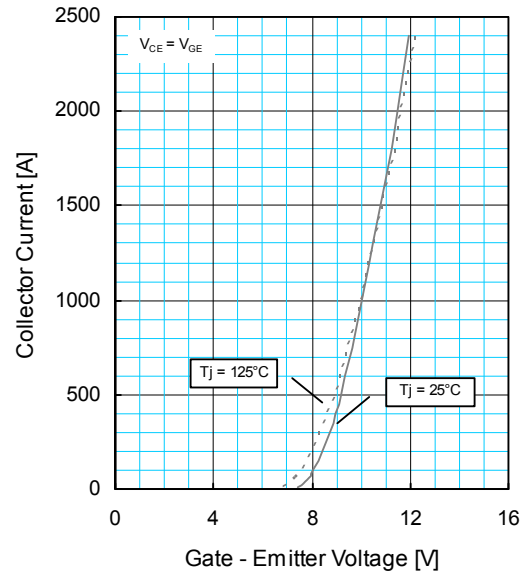
4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

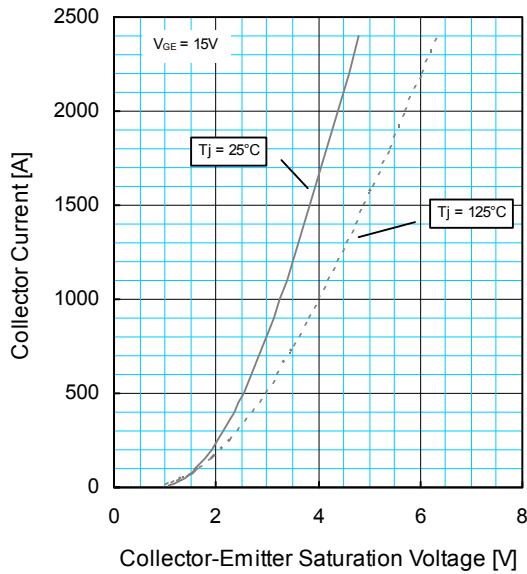
OUTPUT CHARACTERISTICS (TYPICAL)



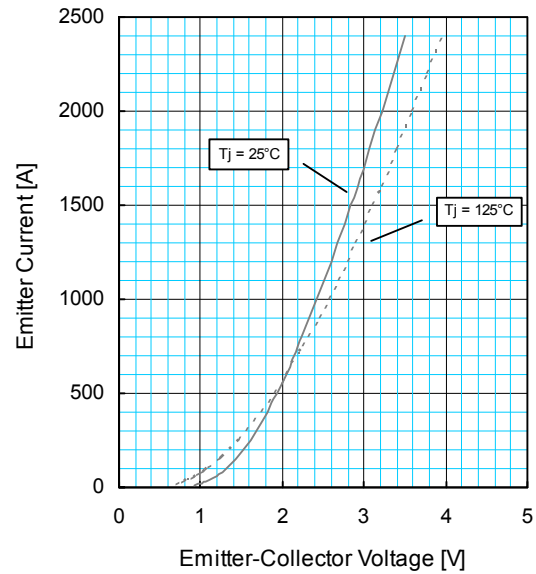
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



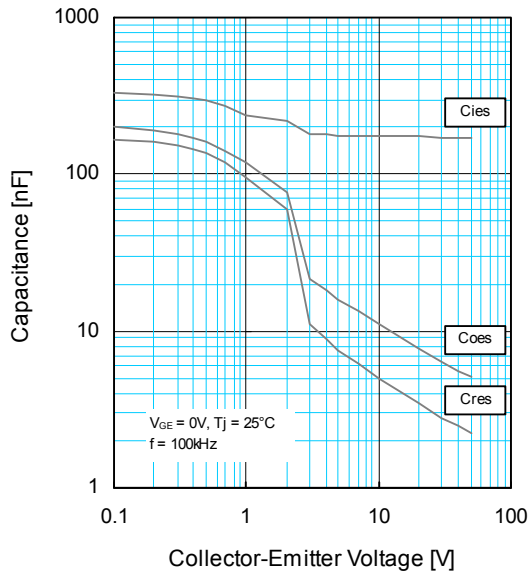
CM1200HC-90R

HIGH POWER SWITCHING USE
INSULATED TYPE

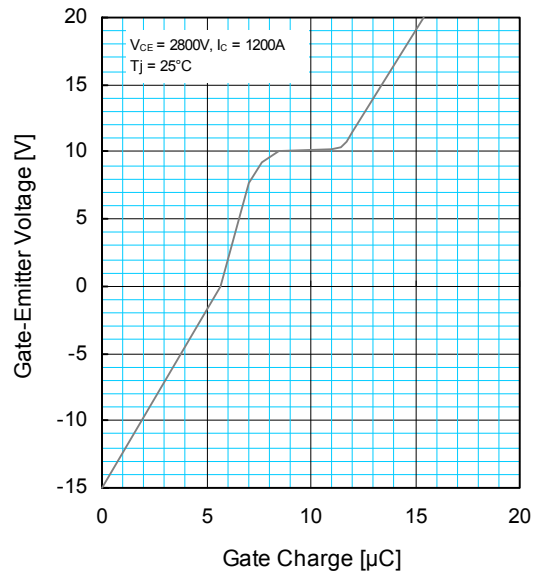
4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

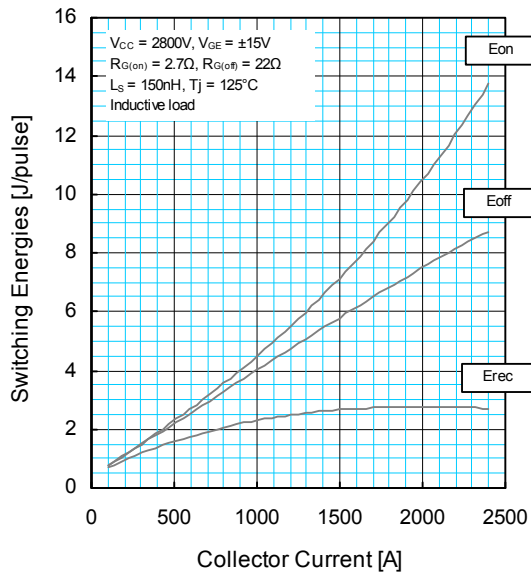
CAPACITANCE CHARACTERISTICS (TYPICAL)



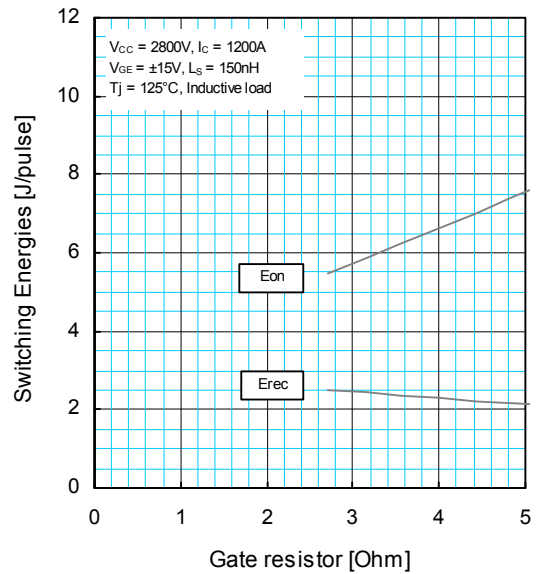
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HVIGBT (High Voltage Insulated Gate Bipolar Transistor) MODULES



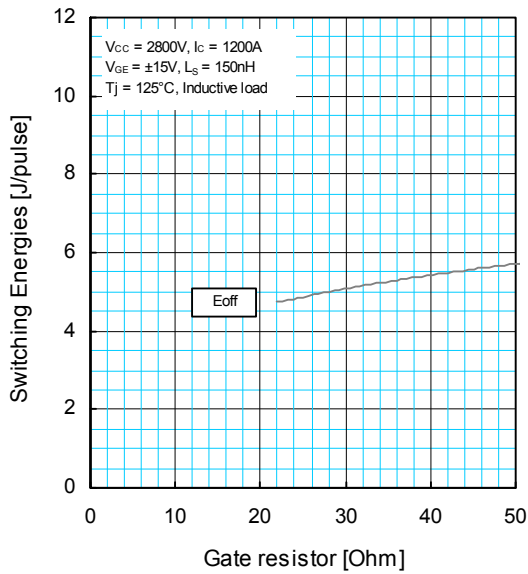
CM1200HC-90R

HIGH POWER SWITCHING USE
INSULATED TYPE

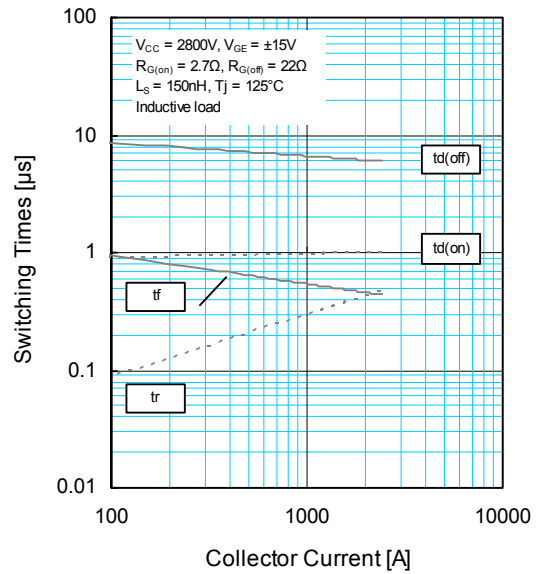
4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

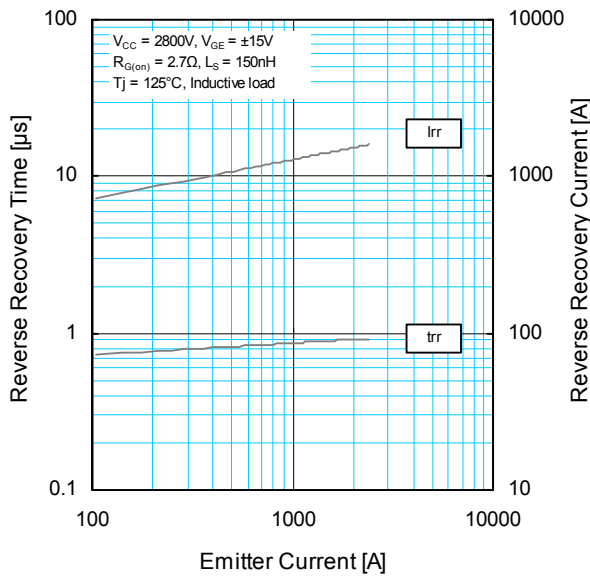
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



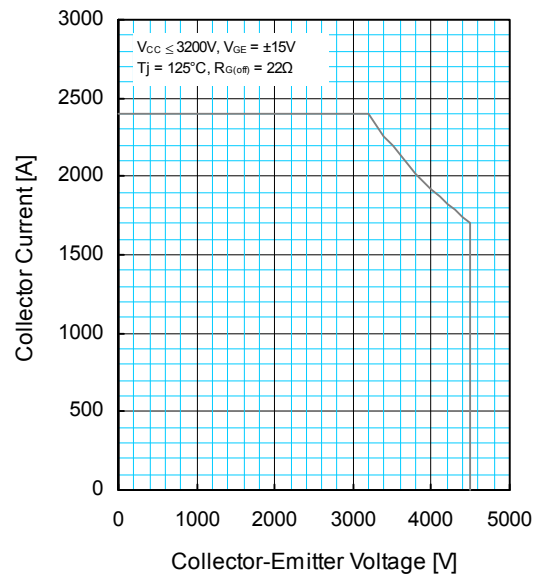
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



REVERSE BIAS SAFE OPERATING AREA (RBSOA)



HVIGBT (High Voltage Insulated Gate Bipolar Transistor) MODULES



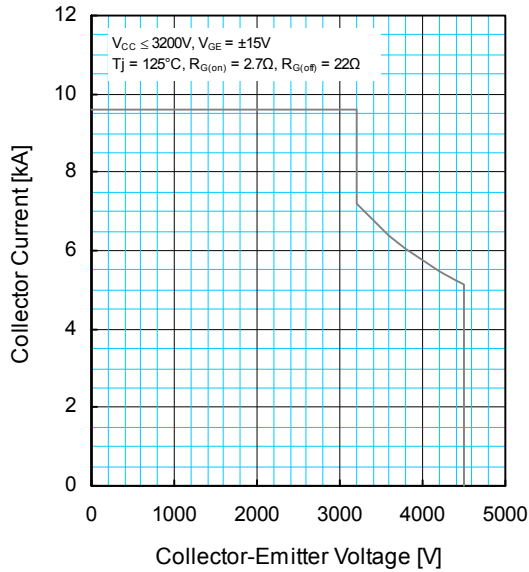
CM1200HC-90R

HIGH POWER SWITCHING USE
INSULATED TYPE

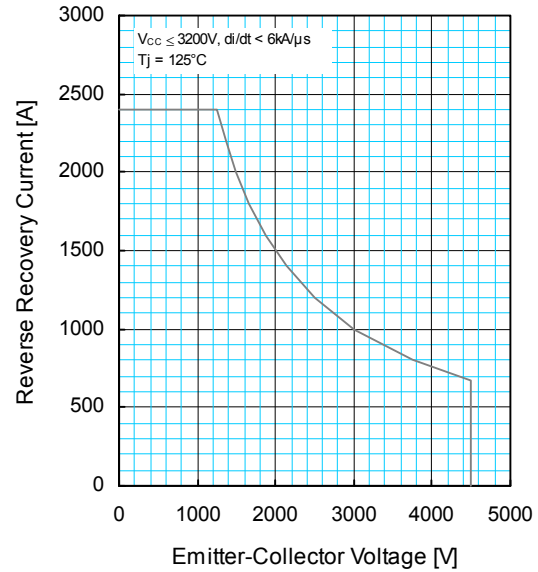
4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

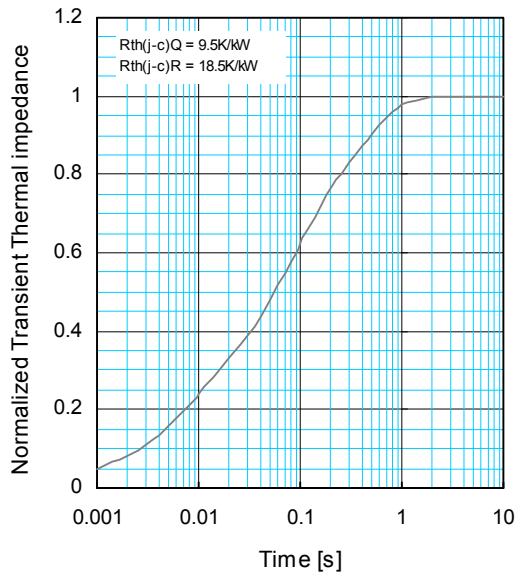
**SHORT CIRCUIT
SAFE OPERATING AREA (SCSOA)**



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



**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
τ_i [sec] :	0.0001	0.0058	0.0602	0.3512

HVIGBT (High Voltage Insulated Gate Bipolar Transistor) MODULES

