

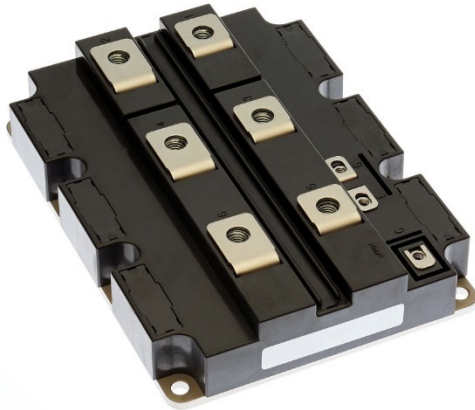
< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

# CM1200HCB-66X

HIGH POWER SWITCHING USE  
INSULATED TYPE

5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

**CM1200HCB-66X**



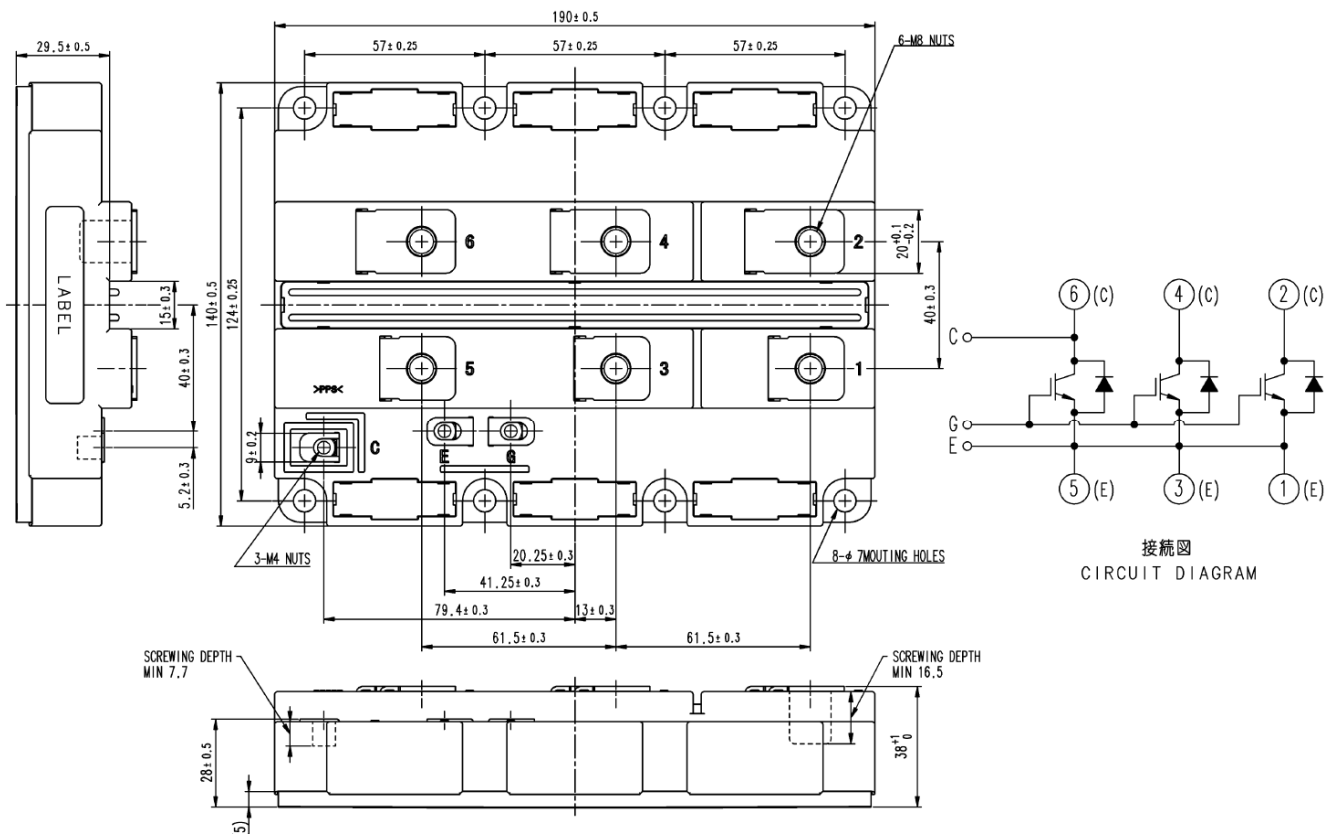
- $I_C$  ..... 1200A
- $V_{CES}$  ..... 3300V
- 1-element in a Pack
- Insulated Type
- CSTBT™(III)
- RFC Diode
- AISiC Baseplate
- UL recognized under UL1557

**APPLICATION**

Traction drives, High Reliability Converters / Inverters, DC choppers

**OUTLINE DRAWING & CIRCUIT DIAGRAM**

Dimensions in mm



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## MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V <sub>CES</sub>	Collector-emitter voltage	V <sub>GE</sub> = 0V, T <sub>J</sub> = -40...+150°C	3300	V
		V <sub>GE</sub> = 0V, T <sub>J</sub> = -50°C	3200	
V <sub>GES</sub>	Gate-emitter voltage	V <sub>CE</sub> = 0V, T <sub>J</sub> = 25°C	±20	V
I <sub>C</sub>	Collector current	DC, T <sub>c</sub> = 105°C	1200	A
I <sub>CRM</sub>		Pulse (Note 1)	2400	A
I <sub>E</sub>	Emitter current (Note 2)	DC, T <sub>c</sub> = 90°C	1200	A
I <sub>ERM</sub>		Pulse (Note 1)	2400	A
P <sub>tot</sub>	Maximum power dissipation (Note 3)	T <sub>c</sub> = 25°C, IGBT part	11900	W
V <sub>iso</sub>	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1 min.	6000	V
V <sub>e</sub>	Partial discharge extinction voltage	RMS, sinusoidal, f = 60Hz, Q <sub>PD</sub> ≤ 10 pC	2600	V
T <sub>J</sub>	Junction temperature		-50 ~ +150	°C
T <sub>jop</sub>	Operating junction temperature		-50 ~ +150	°C
T <sub>stg</sub>	Storage temperature		-55 ~ +150	°C
t <sub>psc</sub>	Short circuit pulse width	V <sub>CC</sub> = 2500V, V <sub>CE</sub> ≤ V <sub>CES</sub> , V <sub>GE</sub> = 15V, T <sub>J</sub> = 150°C	10	μs

## ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
I <sub>CES</sub>	Collector cutoff current	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V	T <sub>J</sub> = 25°C	—	—	4.0	mA
			T <sub>J</sub> = 125°C	—	4.0	—	
			T <sub>J</sub> = 150°C	—	24.0	—	
V <sub>GE(th)</sub>	Gate-emitter threshold voltage	V <sub>CE</sub> = 10 V, I <sub>C</sub> = 120 mA, T <sub>J</sub> = 25°C	6.5	7.0	7.5	V	
I <sub>GES</sub>	Gate leakage current	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V, T <sub>J</sub> = 25°C	-0.5	—	0.5	μA	
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> = 10 V, V <sub>GE</sub> = 0 V, f = 100 kHz T <sub>J</sub> = 25°C	—	139	—	nF	
C <sub>oes</sub>	Output capacitance		—	9.3	—		
C <sub>res</sub>	Reverse transfer capacitance		—	1.3	—		
Q <sub>G</sub>	Total gate charge	V <sub>CC</sub> = 1800V, I <sub>C</sub> = 1200A, V <sub>GE</sub> = ±15V	—	9.0	—	μC	
V <sub>CESat</sub>	Collector-emitter saturation voltage	I <sub>C</sub> = 1200A (Note 4) V <sub>GE</sub> = 15V	T <sub>J</sub> = 25°C	—	2.00	—	V
			T <sub>J</sub> = 125°C	—	2.50	—	
			T <sub>J</sub> = 150°C	—	2.60	3.10	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> = 1800V I <sub>C</sub> = 1200A V <sub>GE</sub> = ±15V R <sub>G(on)</sub> = 2.2 Ω L <sub>s</sub> = 150nH Inductive load	T <sub>J</sub> = 150°C	—	—	0.90	μs
t <sub>r</sub>	Turn-on rise time		T <sub>J</sub> = 150°C	—	—	0.50	μs
E <sub>on(10%)</sub>	Turn-on switching energy (per pulse) (Note 7)		T <sub>J</sub> = 25°C	—	1.95	—	J
		T <sub>J</sub> = 125°C	—	2.15	—		
		T <sub>J</sub> = 150°C	—	2.25	—		
E <sub>on</sub>	Turn-on switching energy (per pulse) (Note 5)	T <sub>J</sub> = 25°C	—	2.00	—	J	
		T <sub>J</sub> = 125°C	—	2.25	—		
		T <sub>J</sub> = 150°C	—	2.35	—		
t <sub>d(off)</sub>	Turn-off delay time	T <sub>J</sub> = 25°C	—	2.90	—	μs	
		T <sub>J</sub> = 125°C	—	3.20	—		
		T <sub>J</sub> = 150°C	—	3.20	4.25		
t <sub>f</sub>	Turn-off fall time	V <sub>CC</sub> = 1800V I <sub>C</sub> = 1200A V <sub>GE</sub> = ±15V	T <sub>J</sub> = 25°C	—	0.40	—	μs
		T <sub>J</sub> = 125°C	—	0.45	—		
		T <sub>J</sub> = 150°C	—	0.50	1.00		
E <sub>off(10%)</sub>	Turn-off switching energy (per pulse) (Note 7)	R <sub>G(off)</sub> = 18 Ω L <sub>s</sub> = 150nH Inductive load	T <sub>J</sub> = 25°C	—	1.55	—	J
		T <sub>J</sub> = 125°C	—	2.00	—		
		T <sub>J</sub> = 150°C	—	2.05	—		
E <sub>off</sub>	Turn-off switching energy (per pulse) (Note 5)	T <sub>J</sub> = 25°C	—	1.65	—	J	
		T <sub>J</sub> = 125°C	—	2.10	—		
		T <sub>J</sub> = 150°C	—	2.25	—		

# CM1200HCB-66X

HIGH POWER SWITCHING USE  
INSULATED TYPE

5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

## ELECTRICAL CHARACTERISTICS (continuation)

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
$V_{EC}$	Emitter-collector voltage (Note 2)	$I_E = 1200\text{ A}$ (Note 4) $V_{GE} = 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.20	—	V
			$T_j = 125^\circ\text{C}$	—	2.40	—	
			$T_j = 150^\circ\text{C}$	—	2.50	3.00	
$t_{rr}$	Reverse recovery time (Note 2)		$T_j = 25^\circ\text{C}$	—	0.95	—	$\mu\text{s}$
			$T_j = 125^\circ\text{C}$	—	1.10	—	
			$T_j = 150^\circ\text{C}$	—	1.15	—	
$I_{rr}$	Reverse recovery current (Note 2)		$T_j = 25^\circ\text{C}$	—	—	—	A
			$T_j = 125^\circ\text{C}$	—	1550	—	
			$T_j = 150^\circ\text{C}$	—	1650	—	
$Q_{rr(10\%)}$	Reverse recovery charge (Note 2,6)	$V_{CC} = 1800\text{ V}$ $I_C = 1200\text{ A}$ $V_{GE} = \pm 15\text{ V}$	$T_j = 25^\circ\text{C}$	—	1050	—	$\mu\text{C}$
			$T_j = 125^\circ\text{C}$	—	1600	—	
			$T_j = 150^\circ\text{C}$	—	1650	—	
$Q_{rr}$	Reverse recovery charge (Note 2,5)	$R_{G(on)} = 2.2\ \Omega$ $L_s = 150\text{ nH}$ Inductive load	$T_j = 25^\circ\text{C}$	—	1200	—	$\mu\text{C}$
			$T_j = 125^\circ\text{C}$	—	1750	—	
			$T_j = 150^\circ\text{C}$	—	1800	—	
$E_{rec(10\%)}$	Reverse recovery energy (per pulse) (Note 2,7)		$T_j = 25^\circ\text{C}$	—	1.15	—	J
			$T_j = 125^\circ\text{C}$	—	1.65	—	
			$T_j = 150^\circ\text{C}$	—	1.85	—	
$E_{rec}$	Reverse recovery energy (per pulse) (Note 2,5)		$T_j = 25^\circ\text{C}$	—	1.25	—	J
			$T_j = 125^\circ\text{C}$	—	1.75	—	
			$T_j = 150^\circ\text{C}$	—	1.95	—	

## THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(f-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	10.5	K/kW
$R_{th(f-c)D}$		Junction to Case, FWDi part	—	—	16.5	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink $\lambda_{grease} = 1\text{ W/m}\cdot\text{k}$ , $D_{(c-s)} = 80\ \mu\text{m}$	—	5.7	—	K/kW

## MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$M_t$	Mounting torque	M8 : Main terminals screw	7.0	—	19.0	N·m
$M_s$	Mounting torque	M6 : Mounting screw	3.0	—	6.0	N·m
$M_t$	Mounting torque (Note 8)	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		—	8.0	—	nH
$R_{CC+EE}$	Internal lead resistance	$T_C = 25^\circ\text{C}$	—	0.09	—	m $\Omega$

Note1. Pulse width and repetition rate should be such that junction temperature ( $T_j$ ) does not exceed  $T_{jopmax}$  rating.

Note2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD).

Note3. Junction temperature ( $T_j$ ) should not exceed  $T_{jmax}$  rating ( $150^\circ\text{C}$ ).

Note4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

Note5. Definition of all items is according to IEC 60747, unless otherwise specified.

Note6. The integration range of reverse recovery charge is from  $I_E = 0\text{ A}$  to  $10\%I_E$ .

Note7. The integration range of switching energies is from  $10\%V_{CE}$  to  $10\%I_C(10\%I_E)$ .

Note8. The maximum specified value is under the condition of using PCB mounted on the power module.

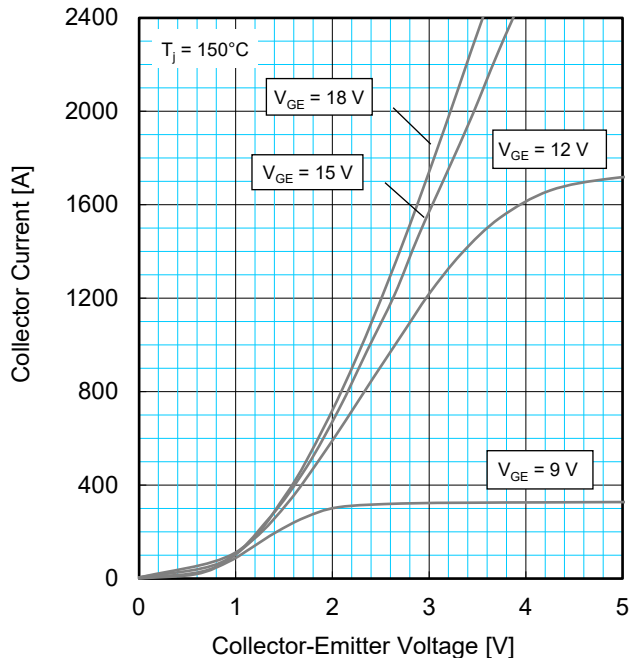
In case no PCB is used this maximum torque for M4 screw is 2.0 N·m.

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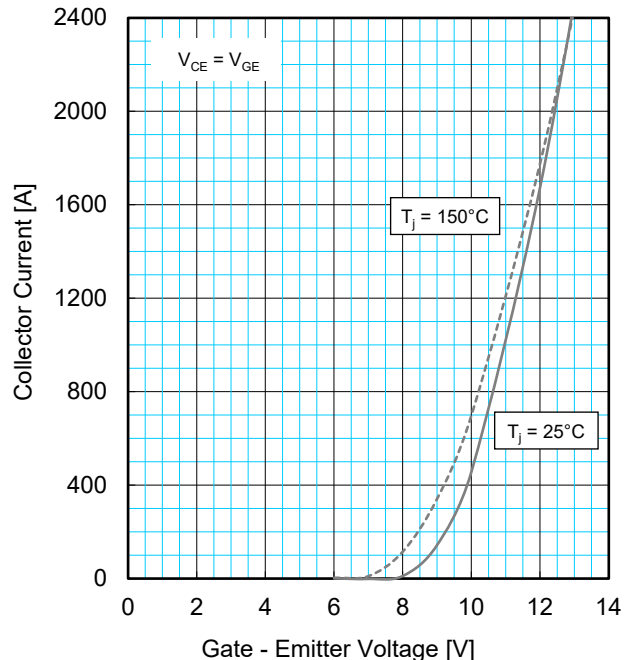
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

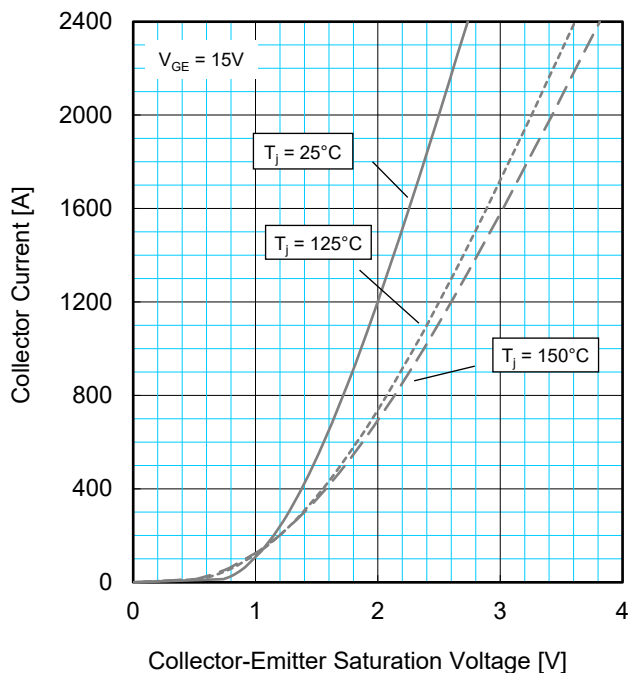
**OUTPUT CHARACTERISTICS (TYPICAL)**



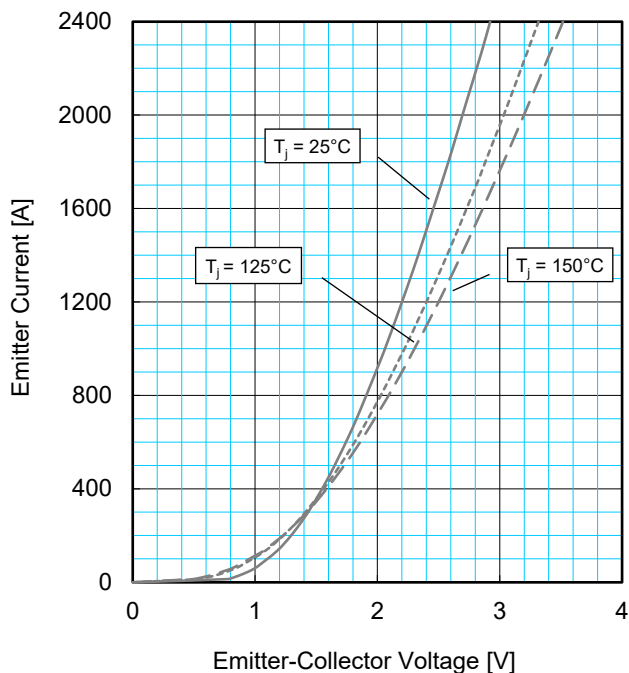
**TRANSFER CHARACTERISTICS (TYPICAL)**



**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



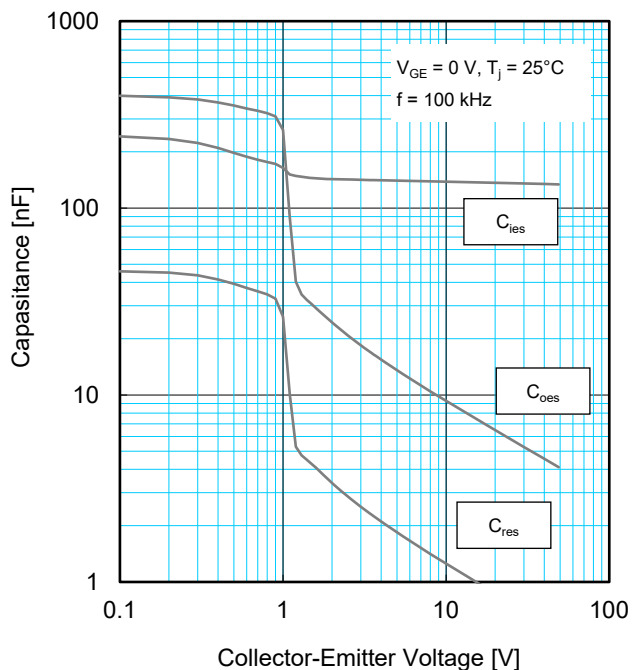
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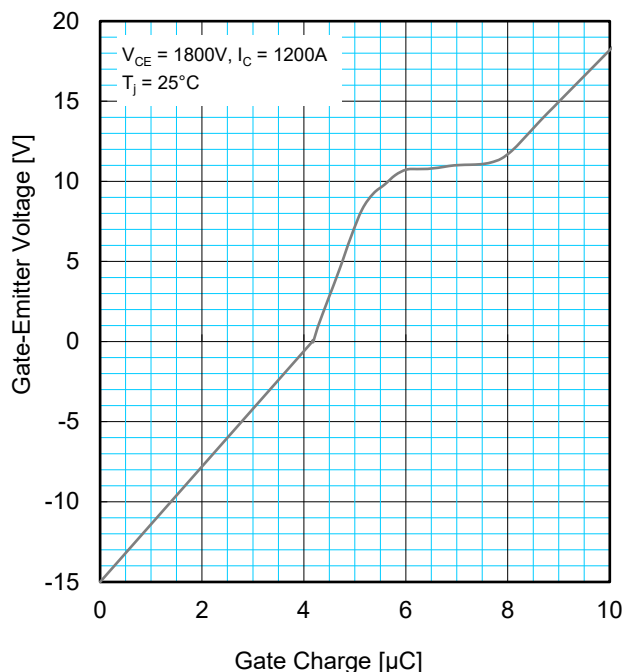
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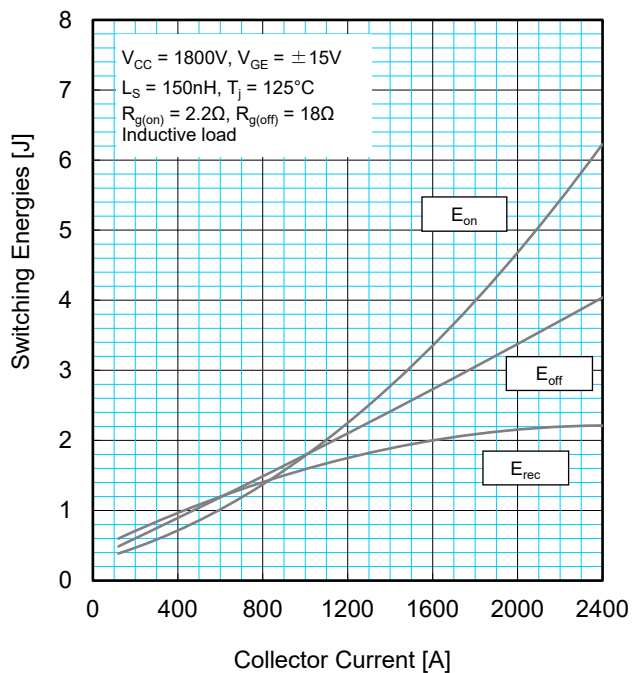
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



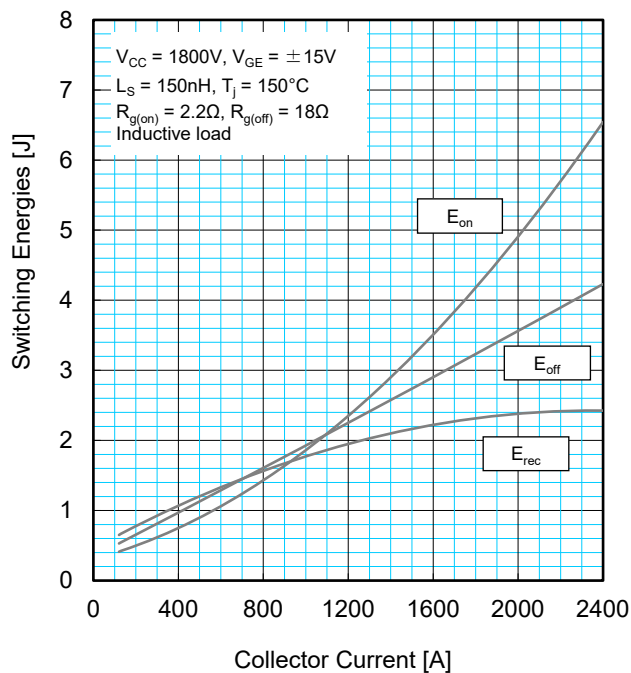
**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



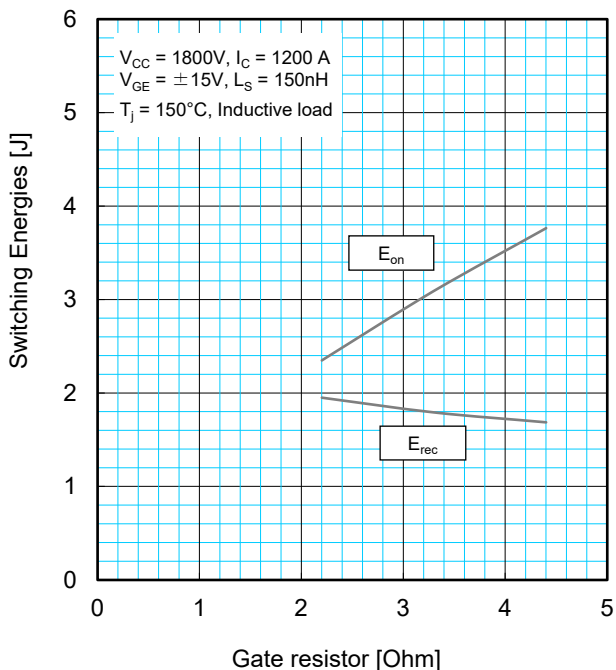
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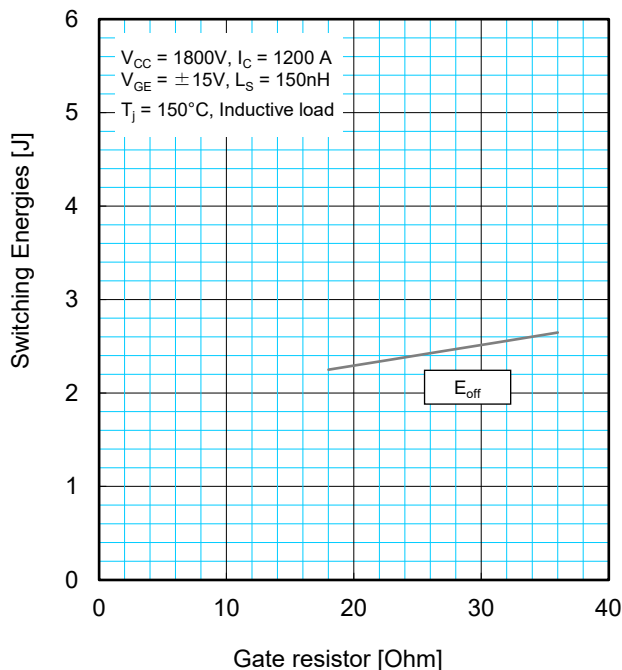
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## PERFORMANCE CURVES

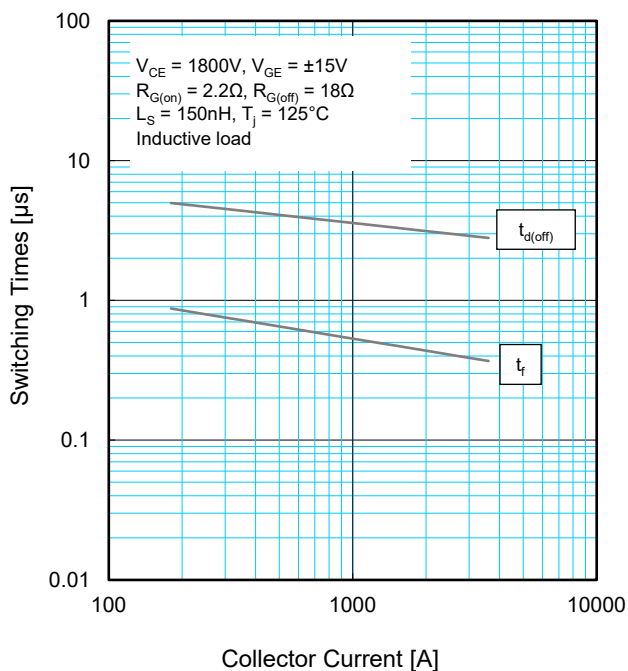
**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



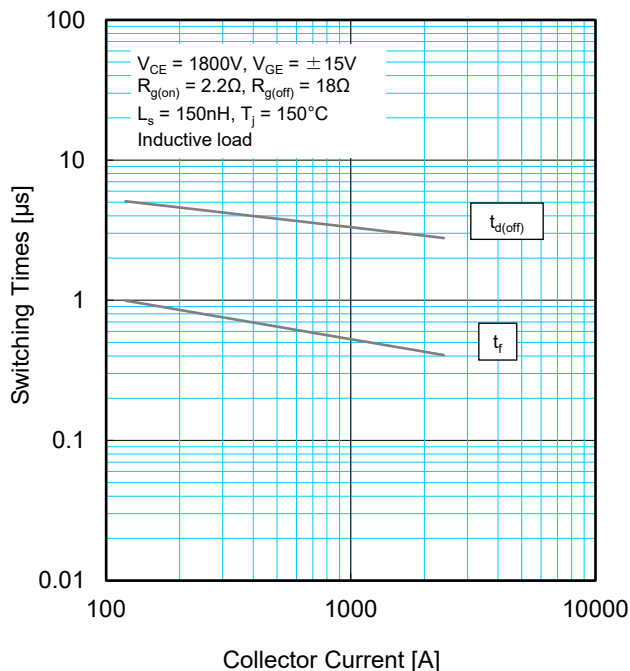
**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)**



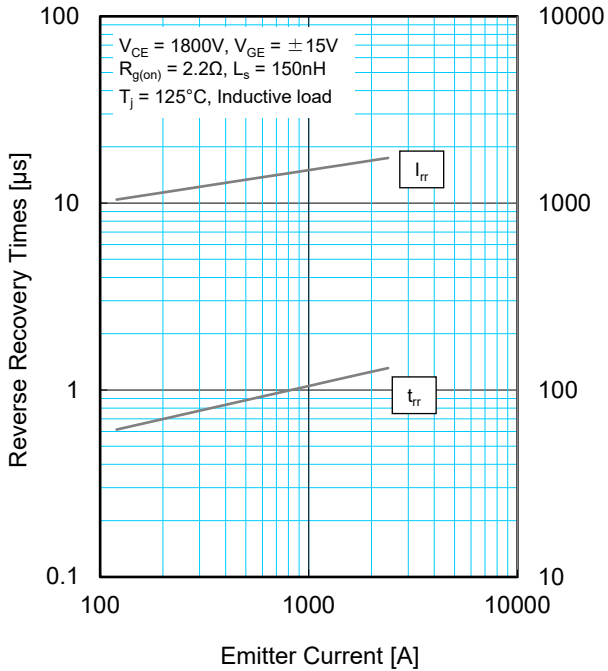
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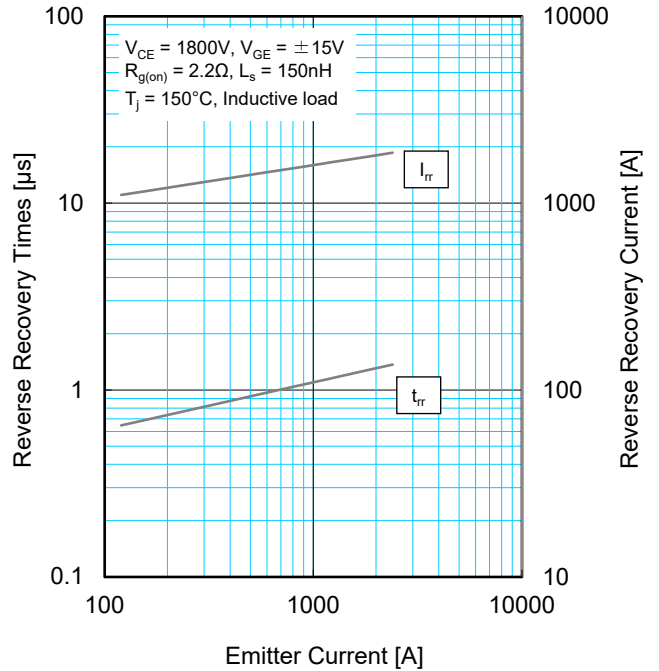
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

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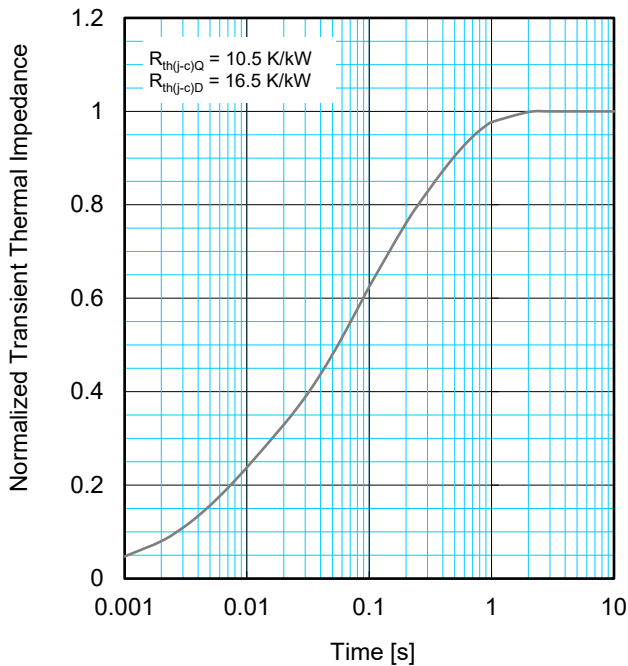
**FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**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
$\tau_i$ [sec] :	0.0001	0.0058	0.0602	0.3512

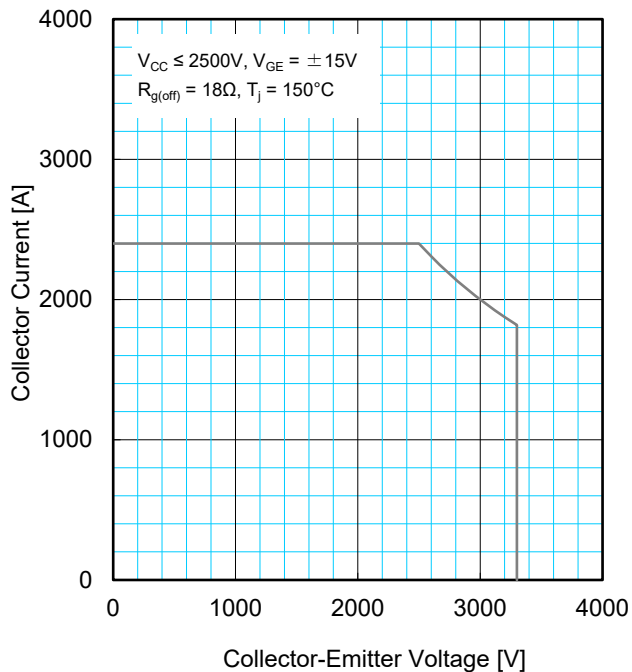
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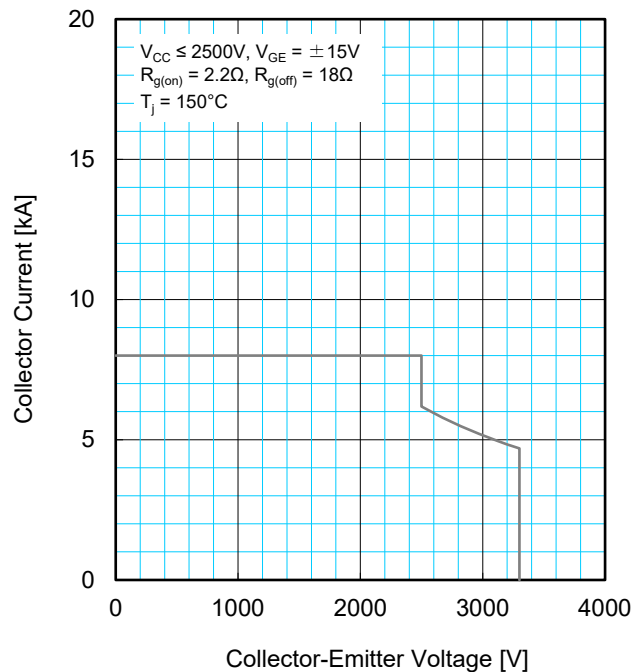
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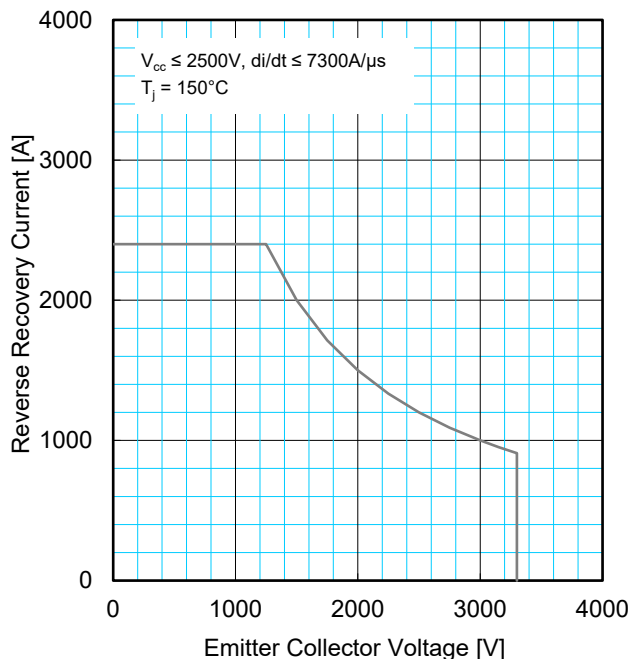
**REVERSE BIAS SAFE OPERATING AREA (RBSOA)**



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



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





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