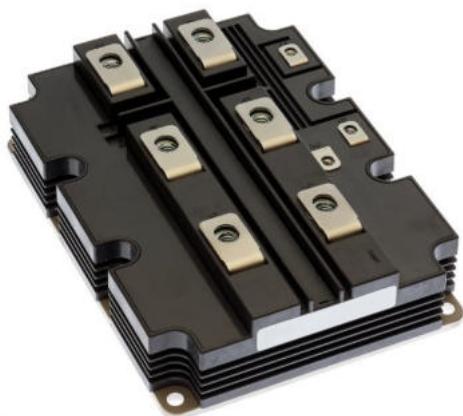


## &lt; High Voltage Insulated Gate Bipolar Transistor: HVIGBT &gt;

**CM1800HG-66X****HIGH POWER SWITCHING USE****INSULATED TYPE**

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

**CM1800HG-66X**

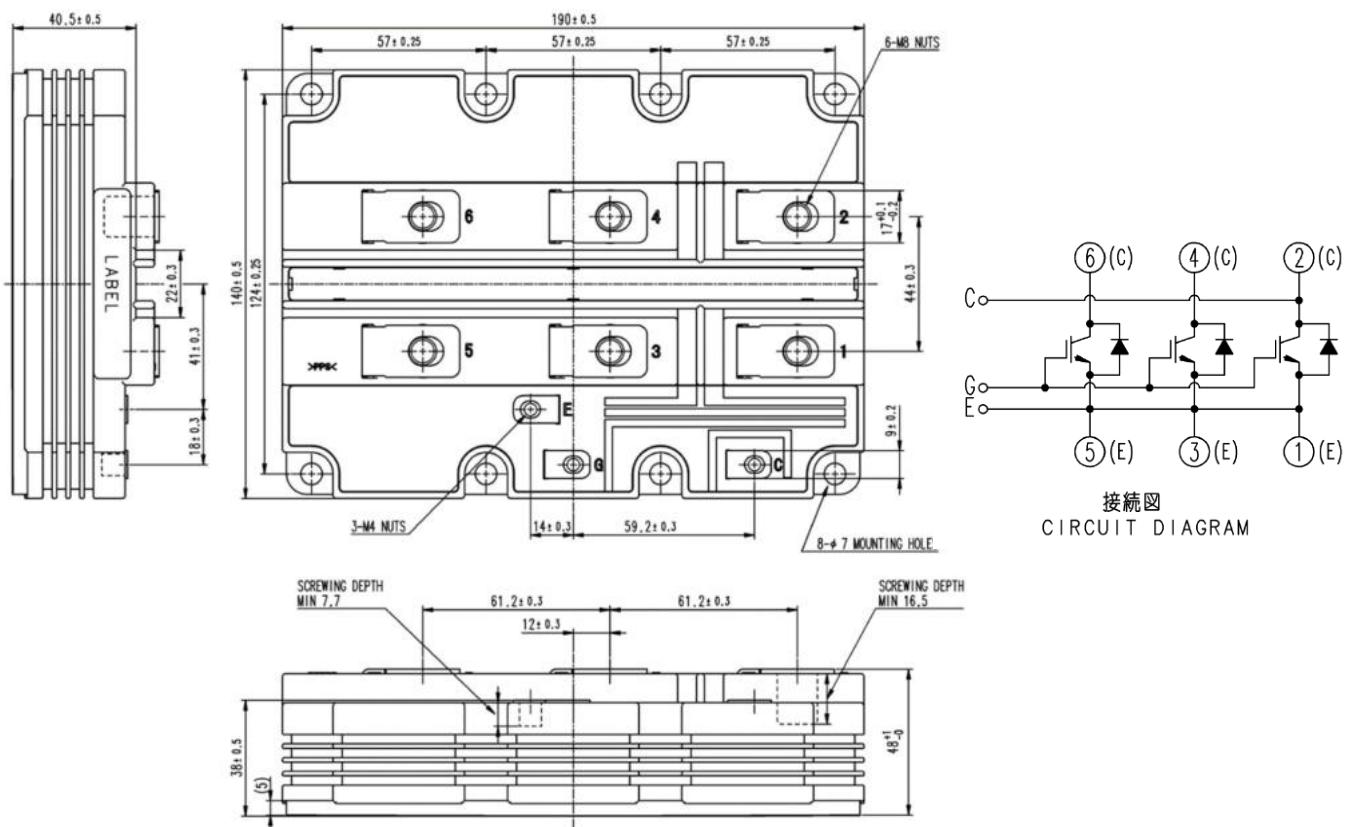
- $I_C$  ..... 1800A
- $V_{CES}$  ..... 3300V
- 1-element in a Pack
- Insulated Type
- CSTBT™(III) / RFC Diode
- AlSiC Baseplate
- UL recognized under UL1557

**APPLICATION**

Traction drives, High Reliability Converters / Inverters, DC choppers

**OUTLINE DRAWING & CIRCUIT DIAGRAM**

Dimensions in mm



**MAXIMUM RATINGS**

Symbol	Item	Conditions	Ratings		Unit
$V_{CES}$	Collector-emitter voltage	$V_{GE} = 0V, T_j = -40...+150^\circ C$	3300		V
		$V_{GE} = 0V, T_j = -50^\circ C$	3200		V
$V_{GES}$	Gate-emitter voltage	$V_{CE} = 0V, T_j = 25^\circ C$	$\pm 20$		V
$I_c$	Collector current	DC, $T_c = 105^\circ C$	1800		A
$I_{CRM}$		Pulse (Note1)	3600		A
$I_E$	Emitter current (Note2)	DC, $T_c = 95^\circ C$	1800		A
$I_{ERM}$		Pulse (Note1)	3600		A
$P_{tot}$	Maximum power dissipation (Note3)	$T_c = 25^\circ C$ , IGBT part	17800		W
$V_{iso}$	Isolation voltage	RMS, sinusoidal, $f = 60Hz, t = 1$ min.	10200		V
$V_e$	Partial discharge extinction voltage	RMS, sinusoidal, $f = 60Hz, Q_{PD} \leq 10$ pC	5100		V
$T_j$	Junction temperature		$-50 \sim +150$		$^\circ C$
$T_{jop}$	Operating junction temperature		$-50 \sim +150$		$^\circ C$
$T_{stg}$	Storage temperature		$-55 \sim +150$		$^\circ C$
$t_{psc}$	Short circuit pulse width	$V_{CC} = 2500V, V_{CE} \leq V_{CES}, V_{GE} = 15V, T_j = 150^\circ C$	10		$\mu s$

**ELECTRICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
$I_{CES}$	Collector cutoff current	$V_{CE} = V_{CES}, V_{GE} = 0V$	$T_j = 25^\circ C$	—	—	6.0	
			$T_j = 125^\circ C$	—	6.0	—	
			$T_j = 150^\circ C$	—	36.0	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE} = 10V, I_c = 180mA, T_j = 25^\circ C$	6.5	7.0	7.5	V	
$I_{GES}$	Gate leakage current	$V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25^\circ C$	-0.5	—	0.5	$\mu A$	
$C_{ies}$	Input capacitance	$V_{CE} = 10V, V_{GE} = 0V, f = 100kHz$ $T_j = 25^\circ C$	—	208	—	nF	
$C_{oes}$	Output capacitance		—	14.0	—		
$C_{res}$	Reverse transfer capacitance		—	1.9	—		
$Q_G$	Total gate charge	$V_{CC} = 1800V, I_c = 1800A, V_{GE} = \pm 15V$	—	13.5	—	$\mu C$	
$V_{CEsat}$	Collector-emitter saturation voltage	$I_c = 1800A$ (Note4) $V_{GE} = 15V$	$T_j = 25^\circ C$	—	2.00	—	
			$T_j = 125^\circ C$	—	2.50	—	
			$T_j = 150^\circ C$	—	2.60	3.10	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 1800V$ $I_c = 1800A$ $V_{GE} = \pm 15V$ $R_{G(on)} = 1.5\Omega$ $L_s = 150nH$ Inductive load	$T_j = 150^\circ C$	—	—	0.90	
$t_r$	Rise time		$T_j = 150^\circ C$	—	—	0.50	
$E_{on(10\%)}$	Turn-on switching energy per pulse (Note 5)		$T_j = 25^\circ C$	—	2.75	—	
			$T_j = 125^\circ C$	—	3.05	—	
			$T_j = 150^\circ C$	—	3.20	—	
$E_{on}$	Turn-on switching energy per pulse (Note 6)		$T_j = 25^\circ C$	—	2.80	—	
			$T_j = 125^\circ C$	—	3.20	—	
			$T_j = 150^\circ C$	—	3.35	—	
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 1800V$ $I_c = 1800A$ $V_{GE} = \pm 15V$ $R_{G(off)} = 12\Omega$ $L_s = 150nH$ Inductive load	$T_j = 25^\circ C$	—	2.90	—	
$t_f$	Fall time		$T_j = 125^\circ C$	—	3.20	—	
			$T_j = 150^\circ C$	—	3.20	4.25	
			$T_j = 25^\circ C$	—	0.40	—	
$E_{off(10\%)}$	Turn-off switching energy per pulse (Note 5)		$T_j = 125^\circ C$	—	0.45	—	
			$T_j = 150^\circ C$	—	0.50	1.00	
			$T_j = 25^\circ C$	—	2.40	—	
$E_{off}$	Turn-off switching energy per pulse (Note 6)		$T_j = 125^\circ C$	—	3.15	—	
			$T_j = 150^\circ C$	—	3.20	—	
			$T_j = 25^\circ C$	—	2.55	—	

**CM1800HG-66X****HIGH POWER SWITCHING USE****INSULATED TYPE****5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules****ELECTRICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{EC}$	Emitter-collector voltage <sup>(Note2)</sup>	$I_E = 1800 \text{ A}$ <sup>(Note4)</sup> $V_{GE} = 0 \text{ V}$	$T_j = 25 \text{ }^\circ\text{C}$	—	2.20	—
			$T_j = 125 \text{ }^\circ\text{C}$	—	2.40	—
			$T_j = 150 \text{ }^\circ\text{C}$	—	2.50	3.00
$t_{rr}$	Reverse recovery time <sup>(Note2)</sup>		$T_j = 25 \text{ }^\circ\text{C}$	—	1.20	—
			$T_j = 125 \text{ }^\circ\text{C}$	—	1.35	—
			$T_j = 150 \text{ }^\circ\text{C}$	—	1.40	—
$I_{rr}$	Reverse recovery current <sup>(Note2)</sup>		$T_j = 25 \text{ }^\circ\text{C}$	—	—	—
			$T_j = 125 \text{ }^\circ\text{C}$	—	2200	—
			$T_j = 150 \text{ }^\circ\text{C}$	—	2350	—
$Q_{rr(10\%)}$	Reverse recovery charge <sup>(Note2, 7)</sup>	$V_{CC} = 1800 \text{ V}$ $I_E = 1800 \text{ A}$ $V_{GE} = \pm 15 \text{ V}$ $R_{G(on)} = 1.5 \text{ }\Omega$ $L_S = 150 \text{ nH}$ Inductive load	$T_j = 25 \text{ }^\circ\text{C}$	—	1600	—
			$T_j = 125 \text{ }^\circ\text{C}$	—	2400	—
			$T_j = 150 \text{ }^\circ\text{C}$	—	2500	—
$Q_{rr}$	Reverse recovery charge <sup>(Note 2,6)</sup>		$T_j = 25 \text{ }^\circ\text{C}$	—	1800	—
			$T_j = 125 \text{ }^\circ\text{C}$	—	2600	—
			$T_j = 150 \text{ }^\circ\text{C}$	—	2700	—
$E_{rec(10\%)}$	Reverse recovery energy per pulse <sup>(Note 2, 5)</sup>		$T_j = 25 \text{ }^\circ\text{C}$	—	1.85	—
			$T_j = 125 \text{ }^\circ\text{C}$	—	2.65	—
			$T_j = 150 \text{ }^\circ\text{C}$	—	3.00	—
$E_{rec}$	Reverse recovery energy per pulse <sup>(Note 2,6)</sup>		$T_j = 25 \text{ }^\circ\text{C}$	—	2.00	—
			$T_j = 125 \text{ }^\circ\text{C}$	—	2.80	—
			$T_j = 150 \text{ }^\circ\text{C}$	—	3.15	—

**THERMAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	7.0	K/kW
		Junction to Case, FWD <sub>i</sub> part	—	—	11.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink $\lambda_{grease} = 1 \text{ W/m}\cdot\text{k}$ , $D_{(c-s)} = 80 \mu\text{m}$	—	5.0	—	K/kW

**MECHANICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$M_t$	Mounting torque	Main terminals screw : M8	7.0	—	19.0	N·m
		Mounting screw : M6	3.0	—	6.0	N·m
		Auxiliary terminals screw : M4	1.0	—	3.0	N·m
$m$	Mass		—	1.5	—	kg
CTI	Comparative tracking index		600	—	—	—
$d_a$	Clearance		26.0	—	—	mm
$d_s$	Creepage distance		56.0	—	—	mm
$L_{P CE}$	Parasitic stray inductance		—	13.5	—	nH
$R_{CC+EE'}$	Internal lead resistance	$T_c = 25 \text{ }^\circ\text{C}$	—	0.12	—	$\text{m}\Omega$

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<sub>i</sub>).Note3. Junction temperature ( $T_j$ ) should not exceed  $T_{jmax}$  rating (150°C).

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

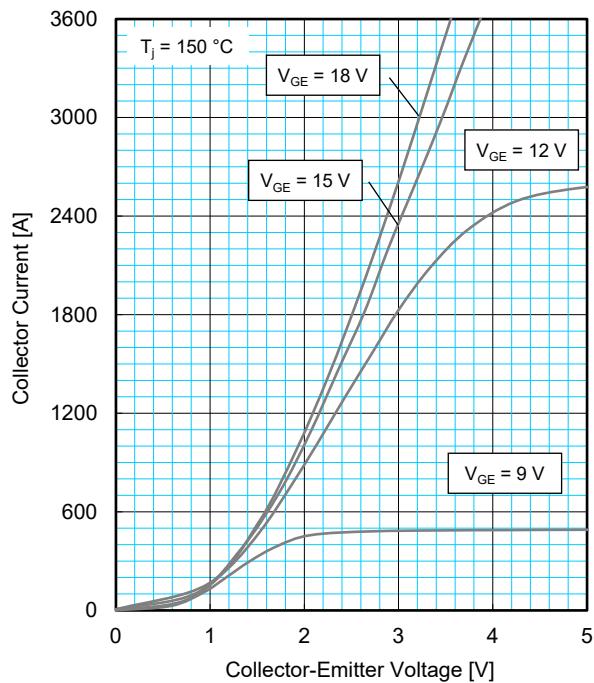
Note5. The integration range of switching energies is from 10% $V_{CE}$  to 10% $I_C(10\%)_E$ .

Note6. Definition of all items is according to IEC 60747, unless otherwise specified.

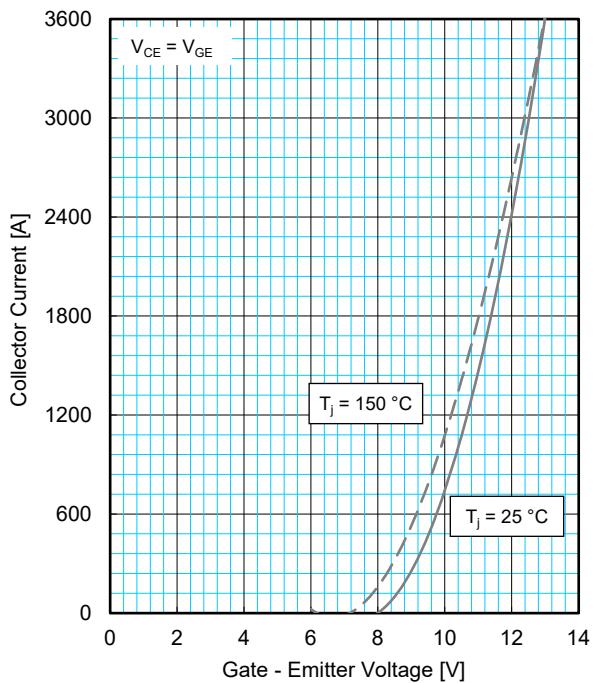
Note7. The integration range of reverse recovery charge is from  $I_E = 0 \text{ A}$  to 10% $I_E$ .

**PERFORMANCE CURVES**

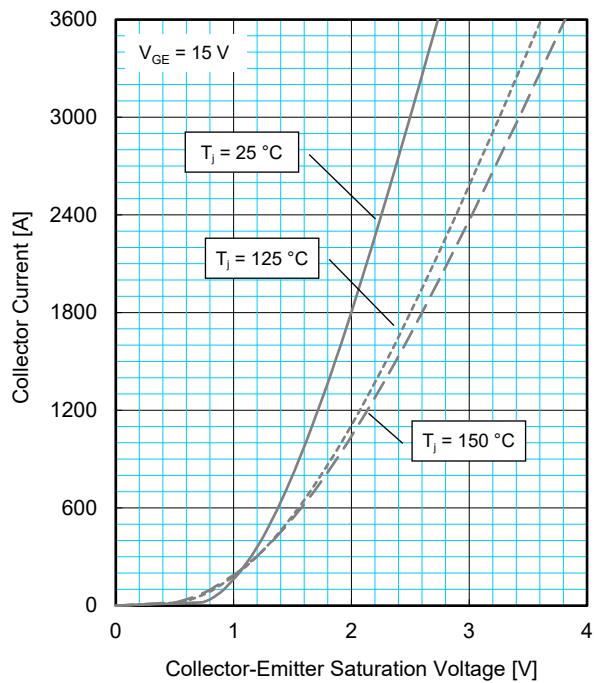
**OUTPUT CHARACTERISTICS  
(TYPICAL)**



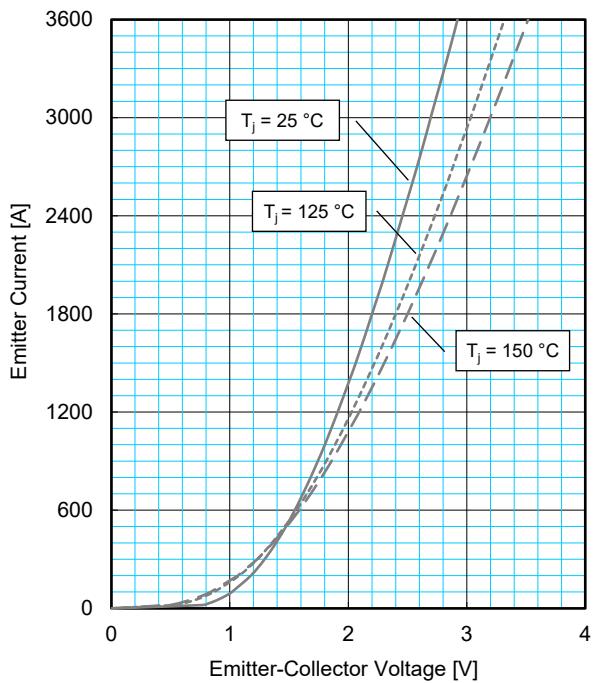
**TRANSFER CHARACTERISTICS  
(TYPICAL)**



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

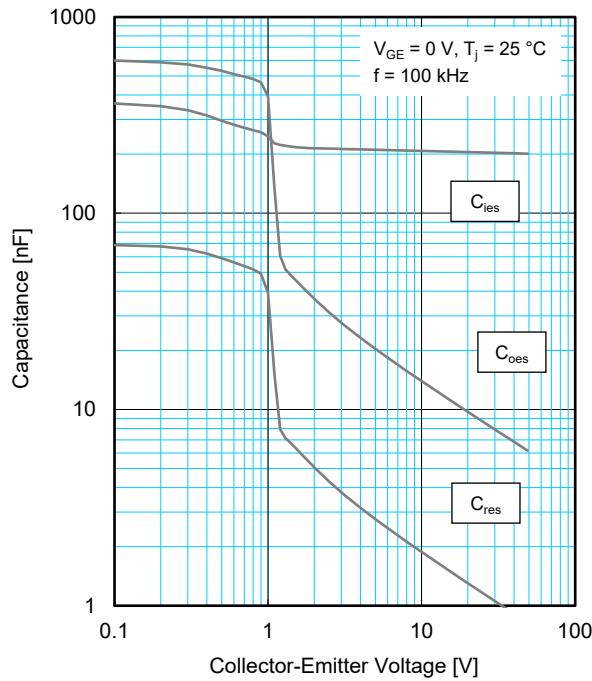
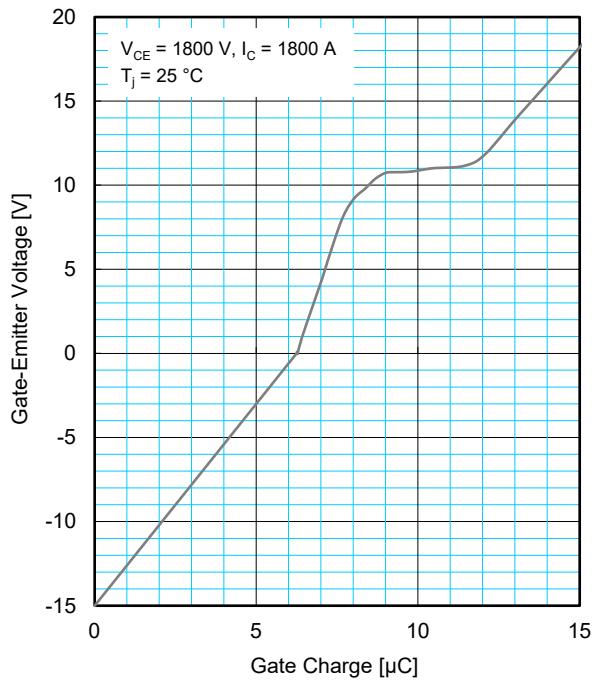
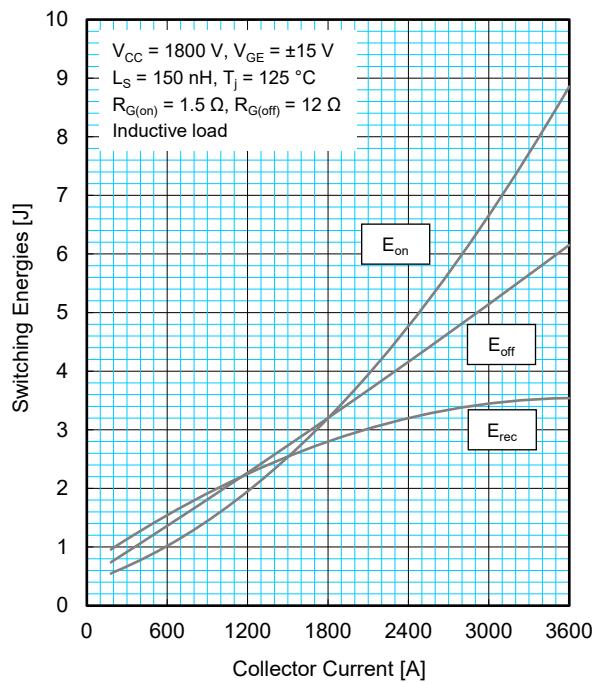
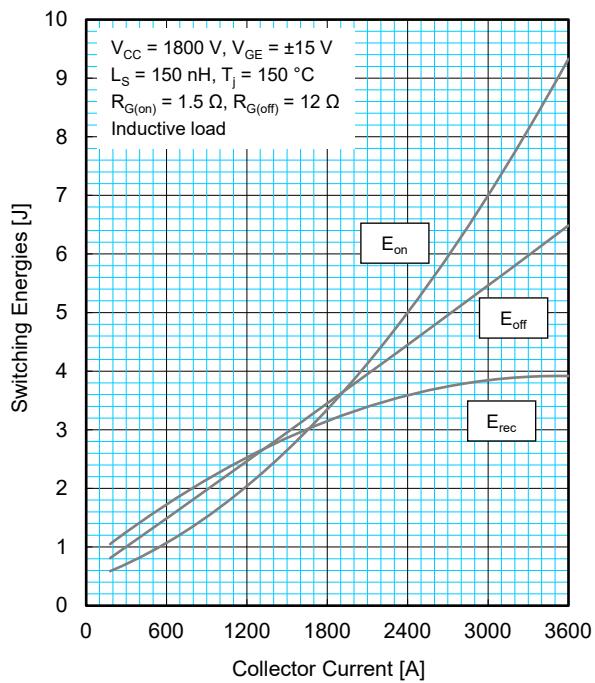


**FREE-WHEEL DIODE FORWARD  
CHARACTERISTICS (TYPICAL)**



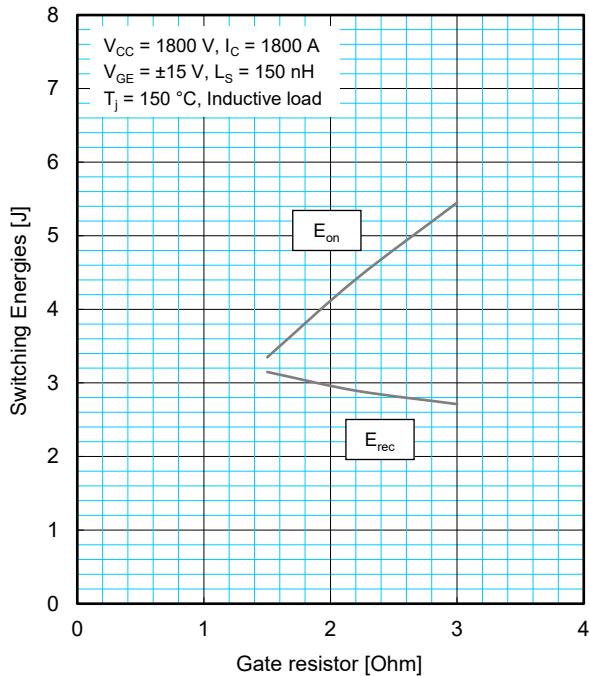
**CM1800HG-66X**HIGH POWER SWITCHING USE  
INSULATED TYPE

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

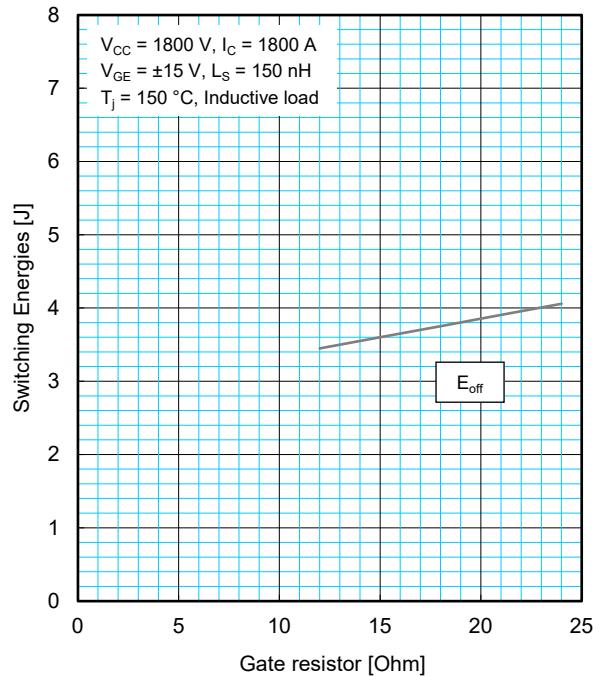
**PERFORMANCE CURVES****CAPACITANCE CHARACTERISTICS  
(TYPICAL)****GATE CHARGE CHARACTERISTICS  
(TYPICAL)****HALF-BRIDGE SWITCHING ENERGY  
CHARACTERISTICS (TYPICAL)****HALF-BRIDGE SWITCHING ENERGY  
CHARACTERISTICS (TYPICAL)**

**PERFORMANCE CURVES**

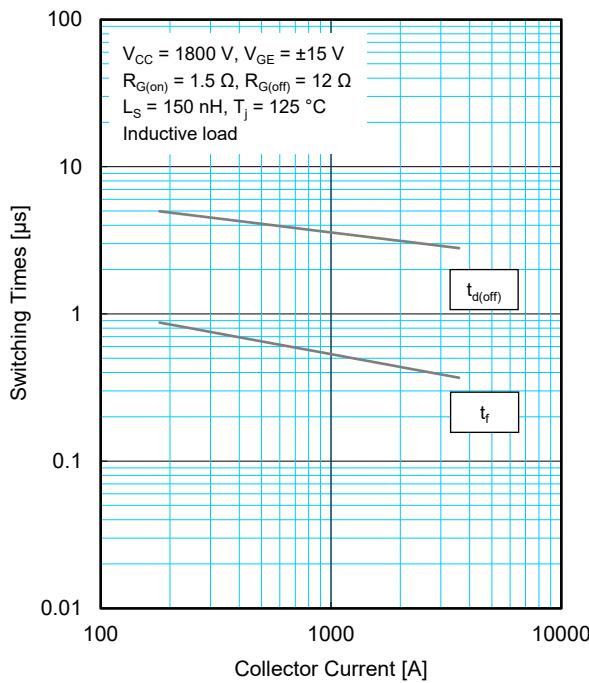
**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



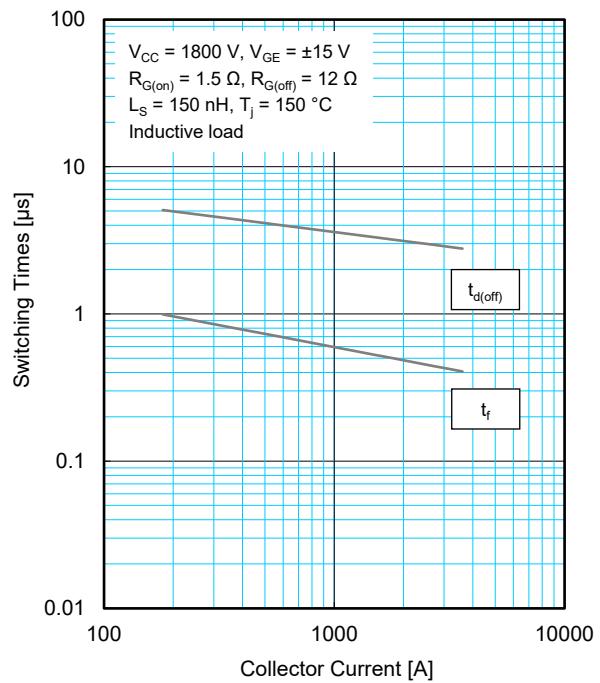
**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



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

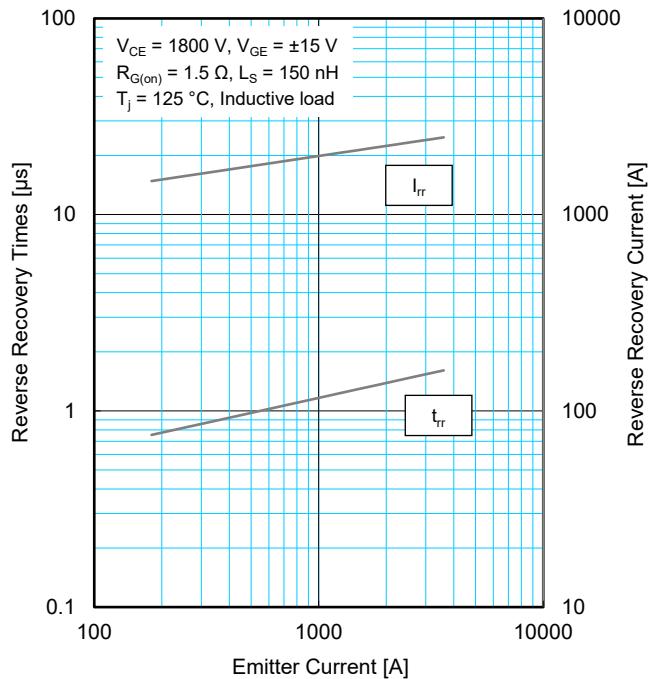
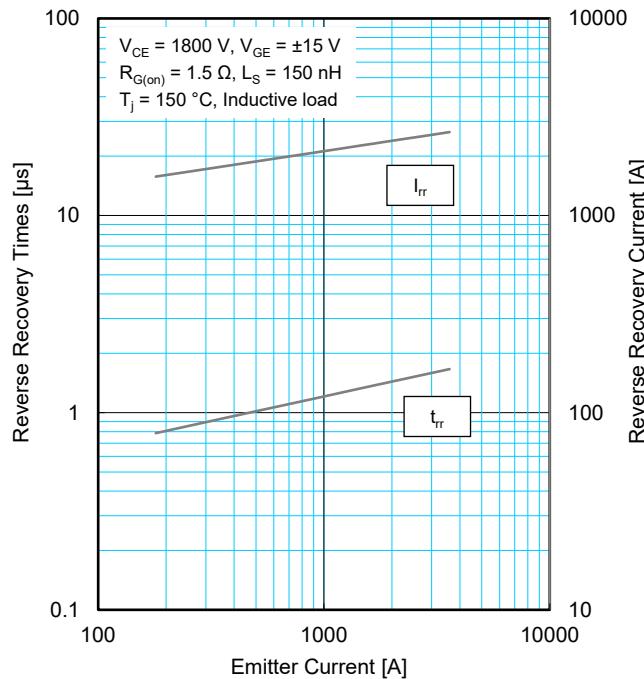
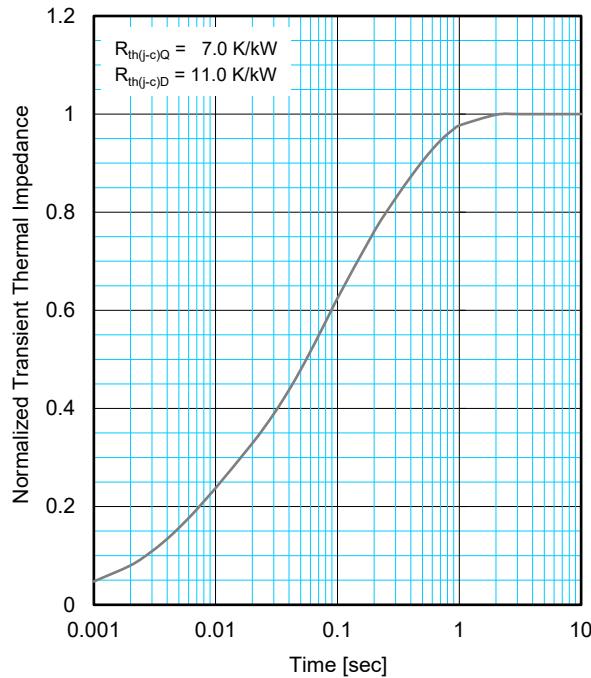


**HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)**



**CM1800HG-66X**HIGH POWER SWITCHING USE  
INSULATED TYPE

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

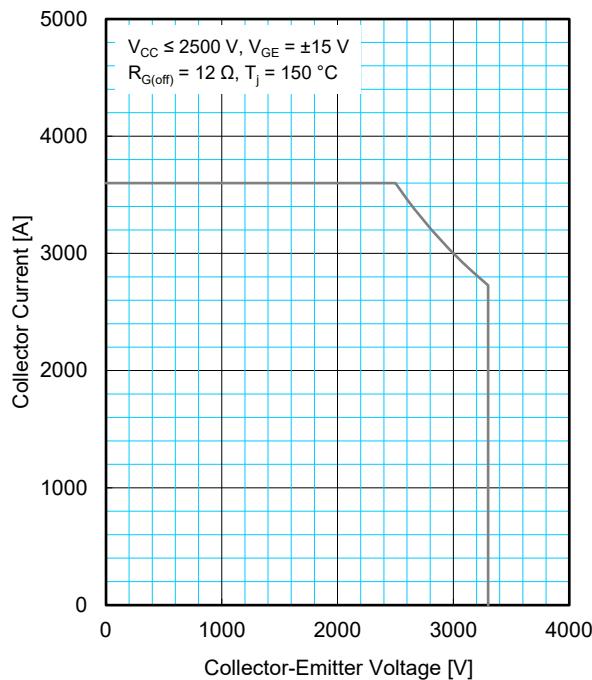
**PERFORMANCE CURVES****FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)****FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)****TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS**

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

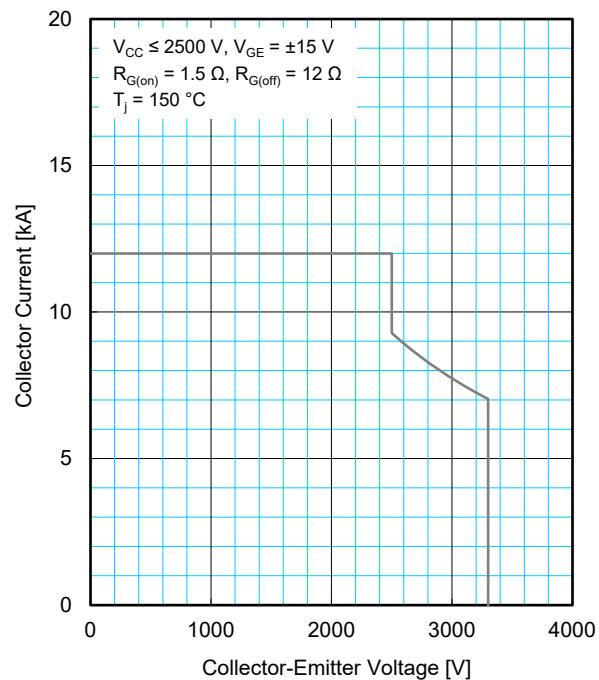
	1	2	3	4
$R_i / R_{th}$	0.0096	0.1893	0.4044	0.3967
$\tau_i \text{ [sec]}$	0.0001	0.0058	0.0602	0.3512

**PERFORMANCE CURVES**

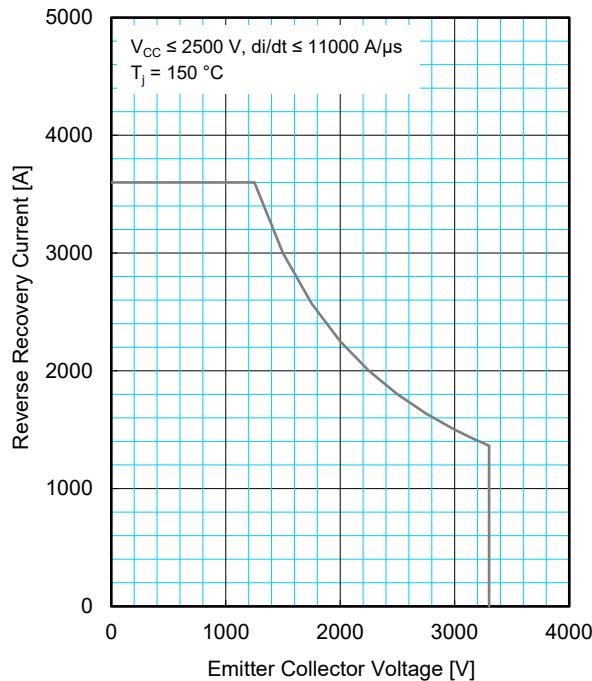
**REVERSE BIAS  
SAFE OPERATING AREA (RBSOA)**



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



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



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