

< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

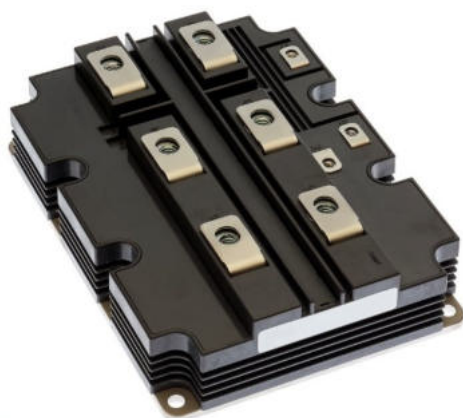
CM1800HG-66X

HIGH POWER SWITCHING USE

INSULATED TYPE

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

CM1800HG-66X



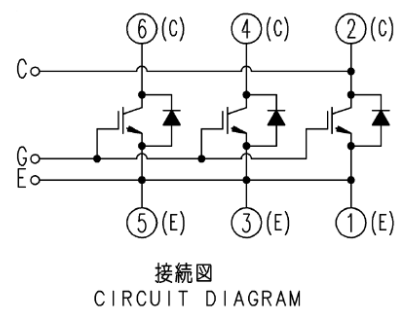
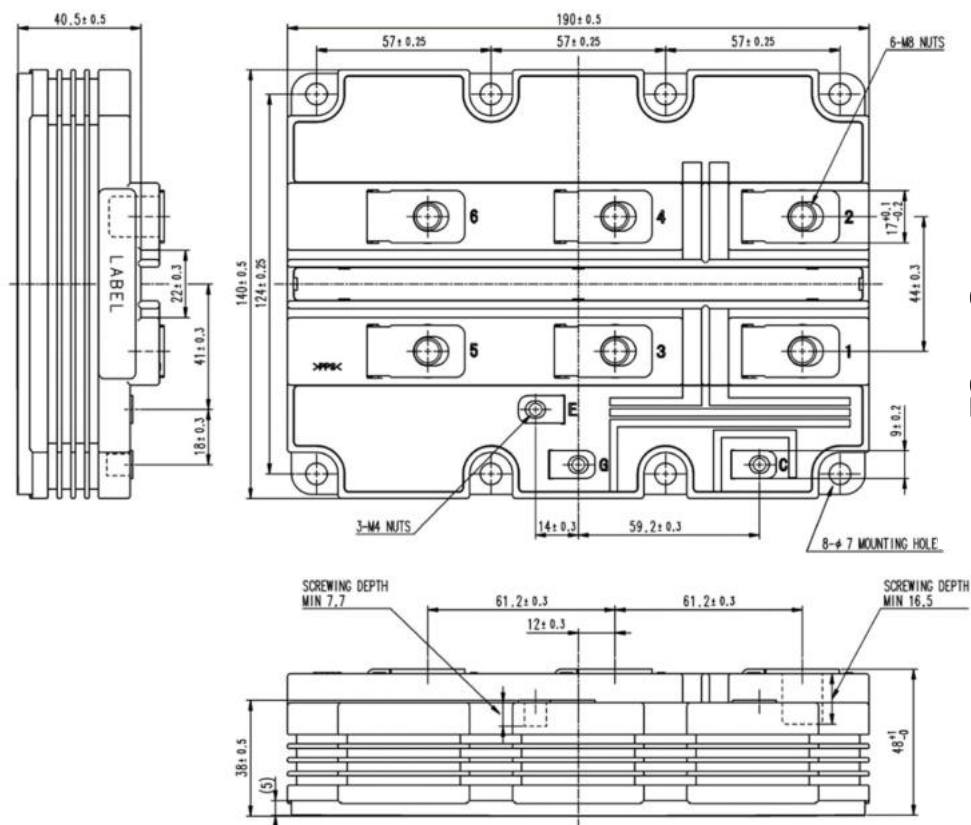
- I_c 1800A
- V_{CES} 3300V
- 1-element in a Pack
- Insulated Type
- CSTBTTM(III) / RFC Diode
- AISiC Baseplate
- UL recognized under UL1557

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_{CES}	Collector-emitter voltage	$V_{GE} = 0V, T_J = -40 \dots +150^\circ C$	3300	V
		$V_{GE} = 0V, T_J = -50^\circ C$	3200	V
V_{GES}	Gate-emitter voltage	$V_{CE} = 0V, T_J = 25^\circ C$	± 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, $f = 60Hz$, $t = 1 \text{ min.}$	10200	V
V_e	Partial discharge extinction voltage	RMS, sinusoidal, $f = 60Hz$, $Q_{PD} \leq 10 \text{ pC}$	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	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	—	—	6.0	mA
			T _J = 125 °C	—	6.0	—	
			T _J = 150 °C	—	36.0	—	
V _{GE(th)}	Gate-emitter threshold voltage	V _{CE} = 10 V, I _C = 180 mA, T _J = 25 °C		6.5	7.0	7.5	V
I _{GES}	Gate leakage current	V _{GE} = V _{GES} , V _{CE} = 0 V, 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		—	208	—	nF
C _{oes}	Output capacitance			—	14.0	—	
C _{res}	Reverse transfer capacitance			—	1.9	—	
Q _G	Total gate charge	V _{CC} = 1800 V, I _C = 1800 A, V _{GE} = ±15 V		—	13.5	—	μC
V _{CEsat}	Collector-emitter saturation voltage	I _C = 1800 A ^(Note4) V _{GE} = 15 V	T _J = 25 °C	—	2.00	—	V
			T _J = 125 °C	—	2.50	—	
			T _J = 150 °C	—	2.60	3.10	
t _{d(on)}	Turn-on delay time	V _{CC} = 1800 V I _C = 1800 A V _{GE} = ±15 V R _{G(on)} = 1.5 Ω L _S = 150 nH Inductive load	T _J = 150 °C	—	—	0.90	μs
t _r	Rise time		T _J = 150 °C	—	—	0.50	μs
E _{on(10%)}	Turn-on switching energy per pulse ^(Note 5)		T _J = 25 °C	—	2.75	—	J
			T _J = 125 °C	—	3.05	—	
			T _J = 150 °C	—	3.20	—	
E _{on}	Turn-on switching energy per pulse ^(Note 6)	T _J = 25 °C	—	2.80	—	J	
		T _J = 125 °C	—	3.20	—		
		T _J = 150 °C	—	3.35	—		
t _{d(off)}	Turn-off delay time	V _{CC} = 1800 V I _C = 1800 A V _{GE} = ±15 V R _{G(off)} = 12 Ω L _S = 150 nH Inductive load	T _J = 25 °C	—	2.90	—	μs
			T _J = 125 °C	—	3.20	—	
			T _J = 150 °C	—	3.20	4.25	
t _f	Fall time		T _J = 25 °C	—	0.40	—	μs
			T _J = 125 °C	—	0.45	—	
			T _J = 150 °C	—	0.50	1.00	
E _{off(10%)}	Turn-off switching energy per pulse ^(Note 5)		T _J = 25 °C	—	2.40	—	J
			T _J = 125 °C	—	3.15	—	
			T _J = 150 °C	—	3.20	—	
E _{off}	Turn-off switching energy per pulse ^(Note 6)		T _J = 25 °C	—	2.55	—	J
			T _J = 125 °C	—	3.20	—	
			T _J = 150 °C	—	3.45	—	

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ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{EC}	Emitter-collector voltage (Note2)	$I_E = 1800\text{ A}$ (Note4) $V_{GE} = 0\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$ —	2.20	—	V
			$T_J = 125\text{ }^\circ\text{C}$ —	2.40	—	
			$T_J = 150\text{ }^\circ\text{C}$ —	2.50	3.00	
t_{rr}	Reverse recovery time (Note2)	$V_{CC} = 1800\text{ V}$ $I_E = 1800\text{ A}$ $V_{GE} = \pm 15\text{ V}$ $R_{G(on)} = 1.5\text{ }\Omega$ $L_S = 150\text{ nH}$ Inductive load	$T_J = 25\text{ }^\circ\text{C}$ —	1.20	—	μs
			$T_J = 125\text{ }^\circ\text{C}$ —	1.35	—	
			$T_J = 150\text{ }^\circ\text{C}$ —	1.40	—	
I_{rr}	Reverse recovery current (Note2)		$T_J = 25\text{ }^\circ\text{C}$ —	—	—	A
			$T_J = 125\text{ }^\circ\text{C}$ —	2200	—	
			$T_J = 150\text{ }^\circ\text{C}$ —	2350	—	
$Q_{rr(10\%)}$	Reverse recovery charge (Note2, 7)		$T_J = 25\text{ }^\circ\text{C}$ —	1600	—	μC
			$T_J = 125\text{ }^\circ\text{C}$ —	2400	—	
			$T_J = 150\text{ }^\circ\text{C}$ —	2500	—	
Q_{rr}	Reverse recovery charge (Note 2,6)		$T_J = 25\text{ }^\circ\text{C}$ —	1800	—	μC
			$T_J = 125\text{ }^\circ\text{C}$ —	2600	—	
			$T_J = 150\text{ }^\circ\text{C}$ —	2700	—	
$E_{rec(10\%)}$	Reverse recovery energy per pulse (Note 2, 5)		$T_J = 25\text{ }^\circ\text{C}$ —	1.85	—	J
			$T_J = 125\text{ }^\circ\text{C}$ —	2.65	—	
			$T_J = 150\text{ }^\circ\text{C}$ —	3.00	—	
E_{rec}	Reverse recovery energy per pulse (Note 2,6)		$T_J = 25\text{ }^\circ\text{C}$ —	2.00	—	J
			$T_J = 125\text{ }^\circ\text{C}$ —	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
$R_{th(j-c)D}$		Junction to Case, FWDi 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
M_s		Mounting screw : M6	3.0	—	6.0	N·m
M_t		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	—	m Ω

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 (FWDi).

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% I_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 .

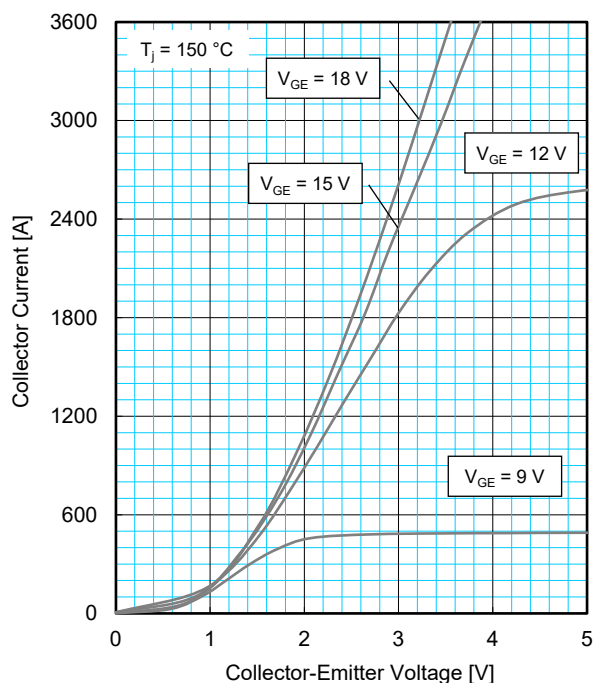
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HIGH POWER SWITCHING USE
INSULATED TYPE

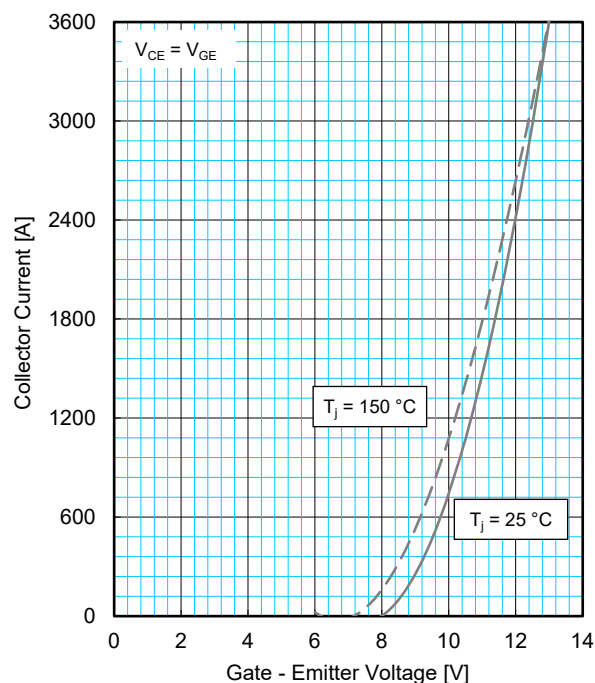
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

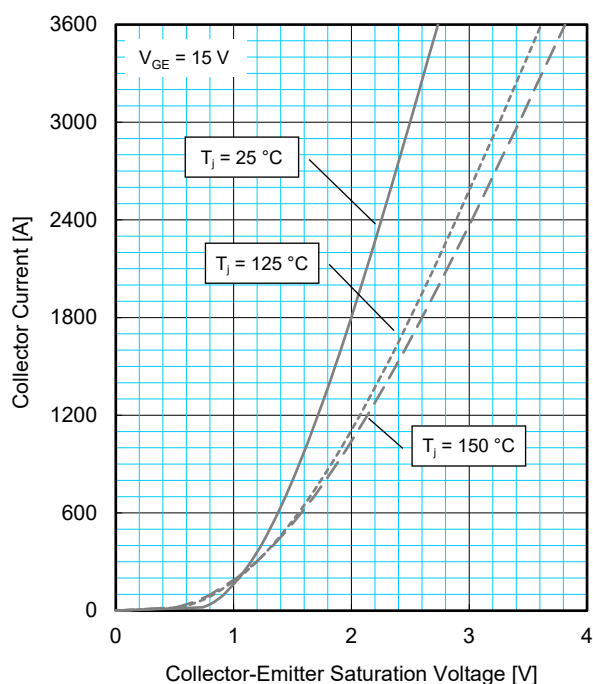
OUTPUT CHARACTERISTICS
(TYPICAL)



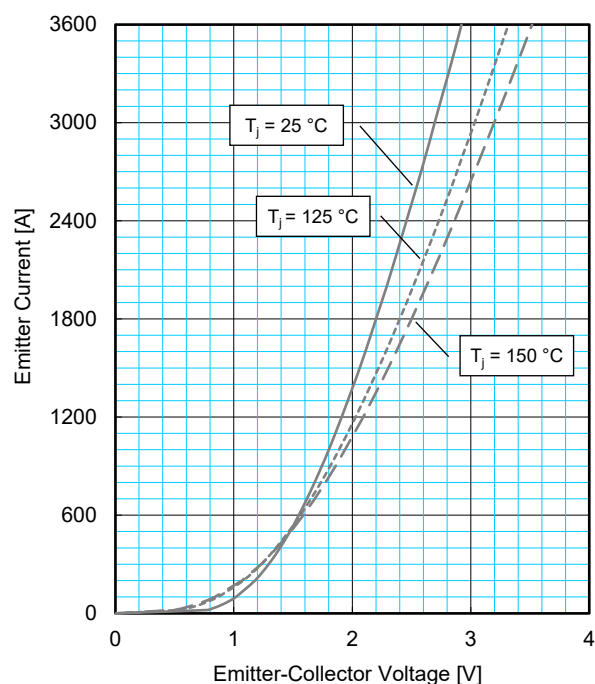
TRANSFER CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD
CHARACTERISTICS (TYPICAL)



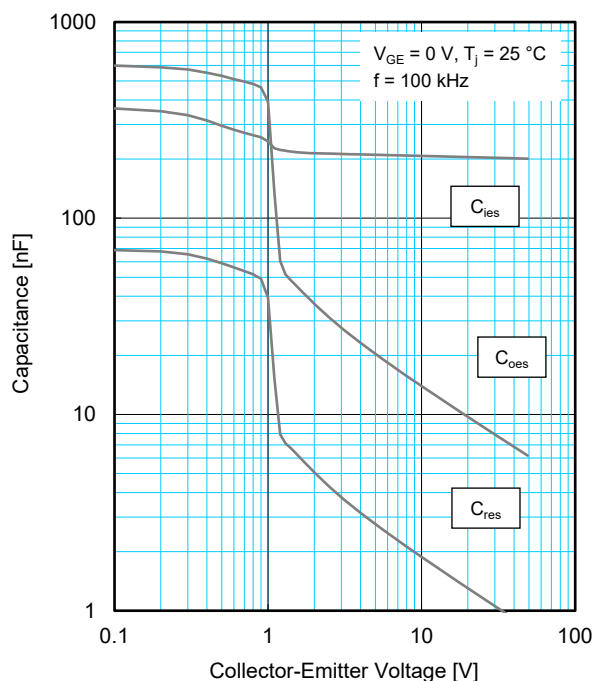
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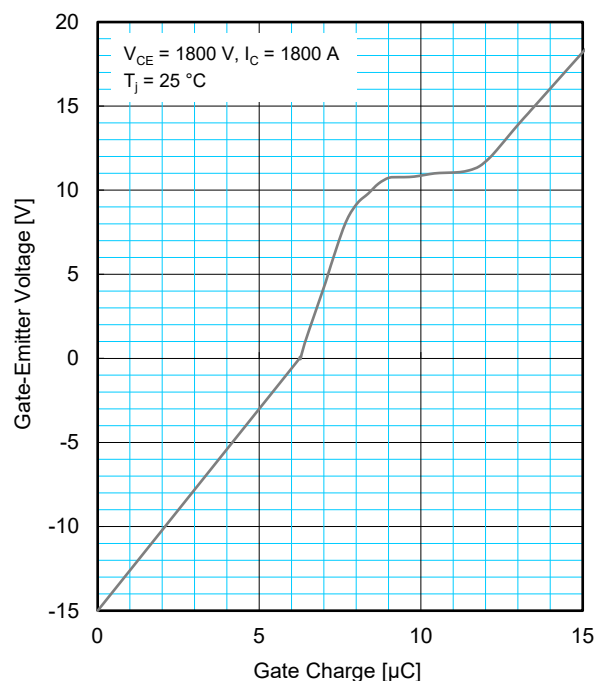
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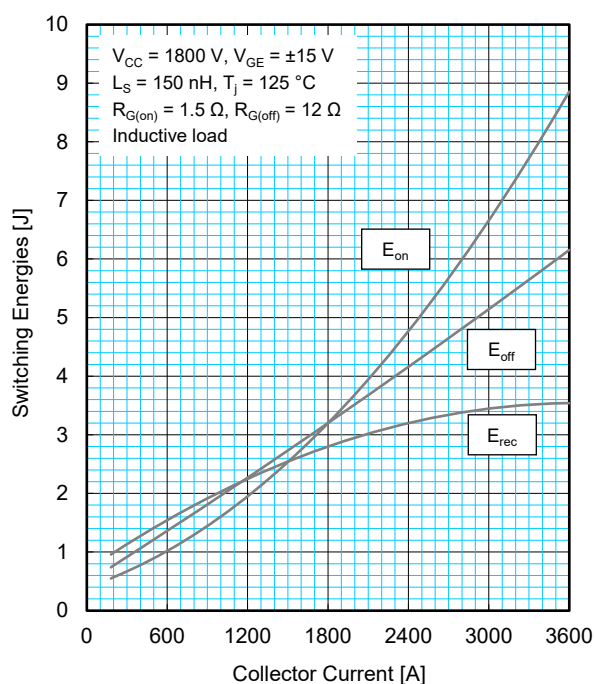
**CAPACITANCE CHARACTERISTICS
(TYPICAL)**



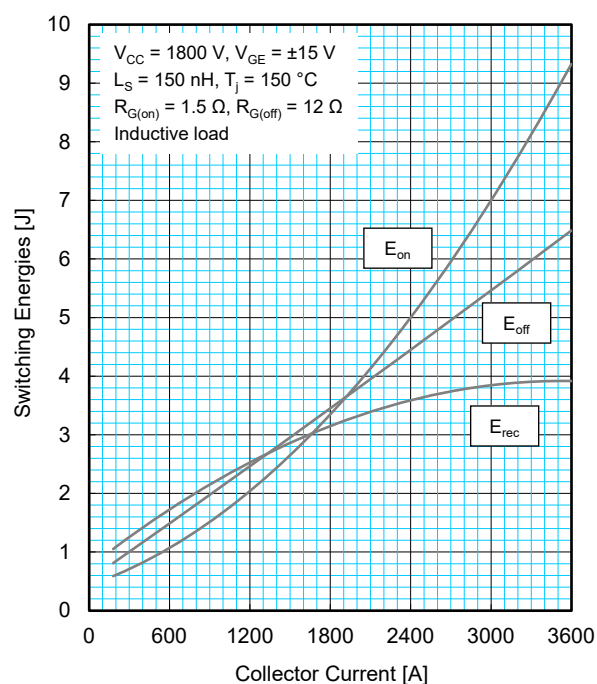
**GATE CHARGE CHARACTERISTICS
(TYPICAL)**



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



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



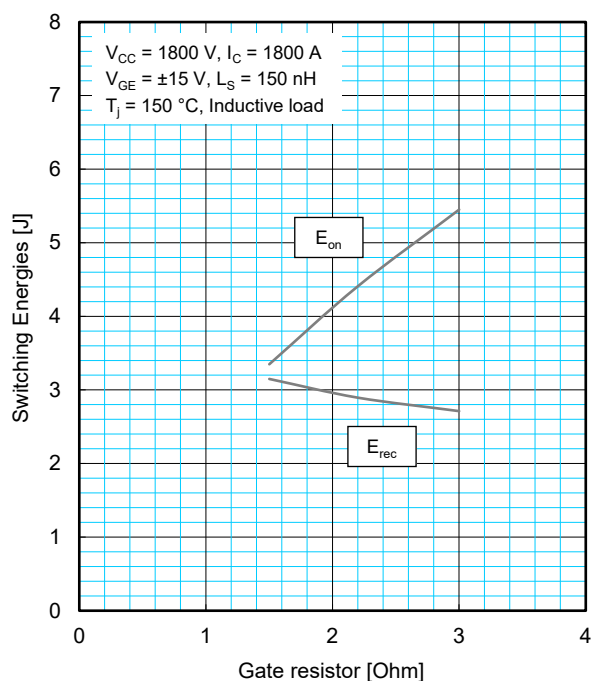
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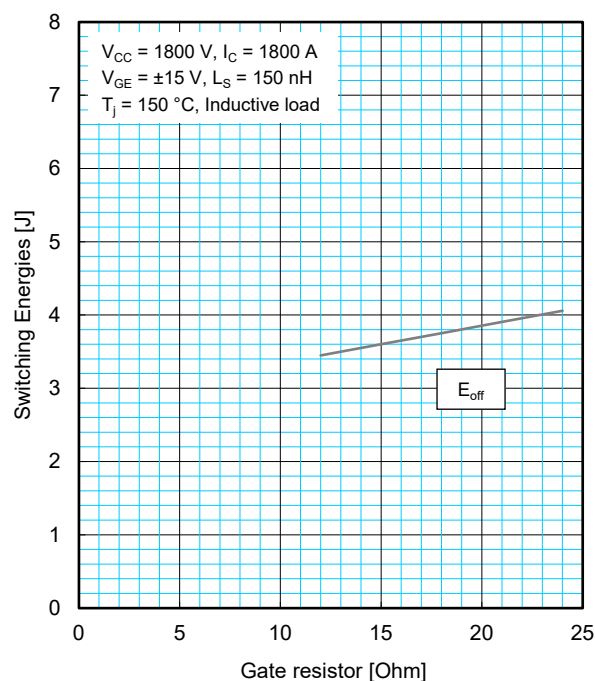
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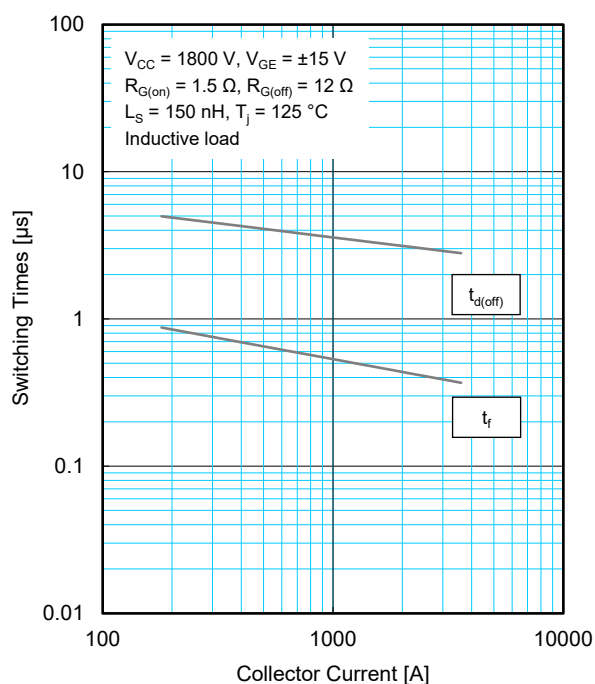
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



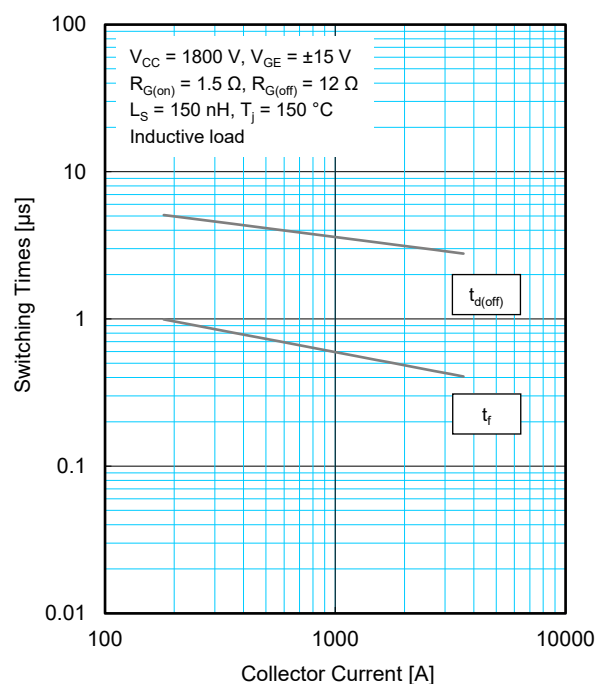
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



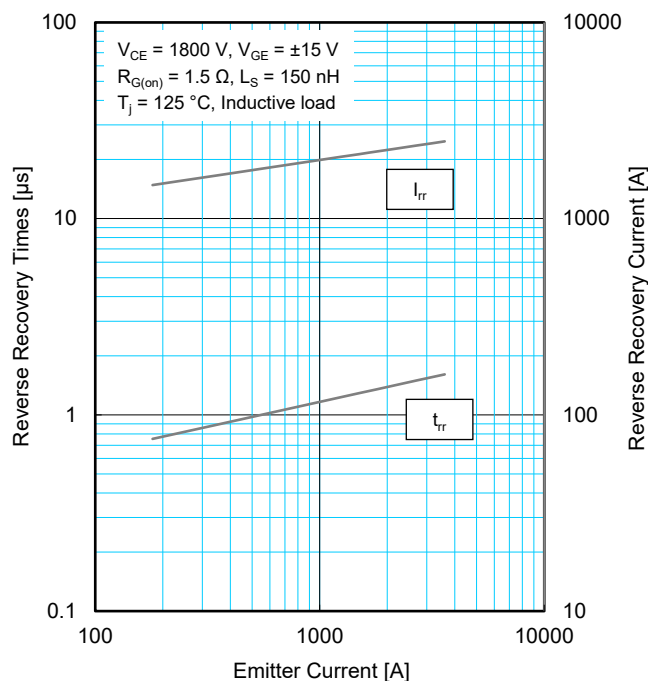
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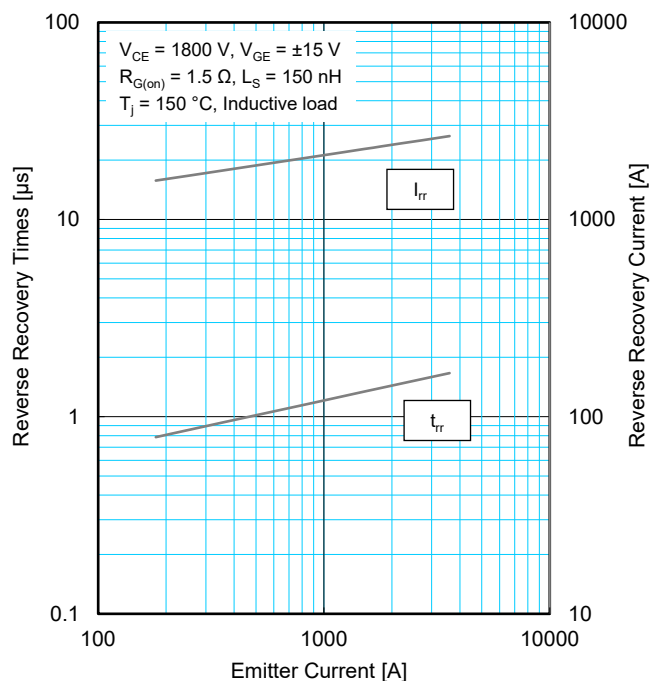
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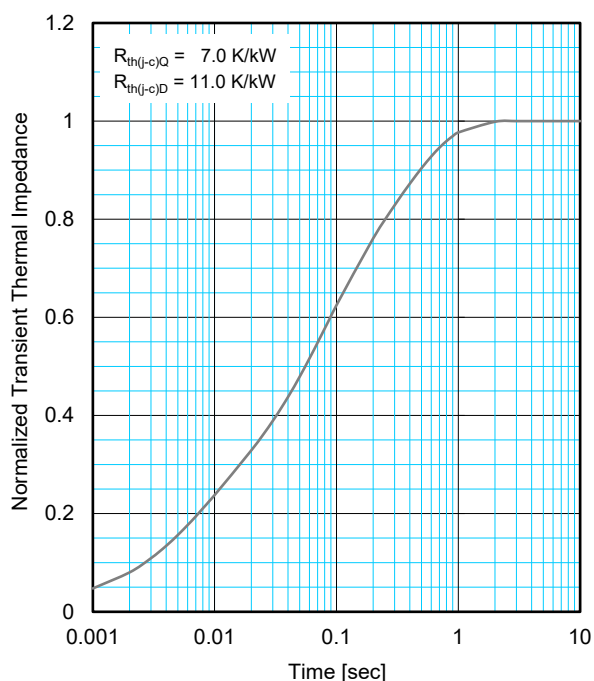
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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 / R_{th}	0.0096	0.1893	0.4044	0.3967
τ_i [sec]	0.0001	0.0058	0.0602	0.3512

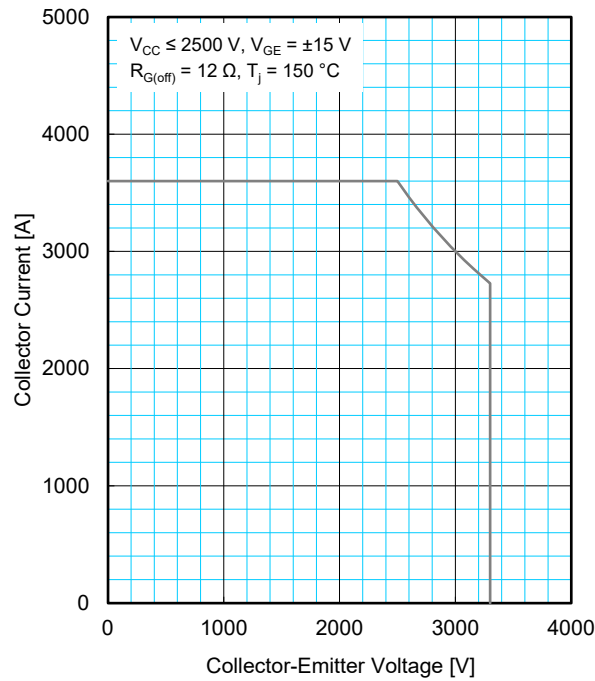
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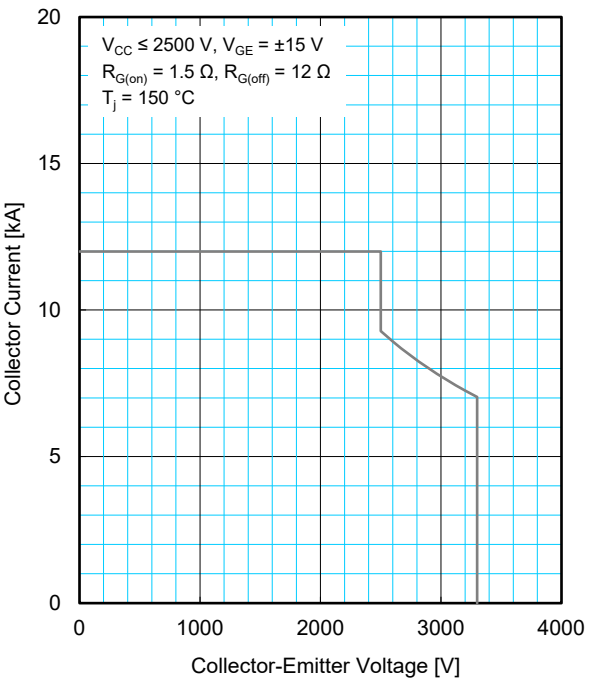
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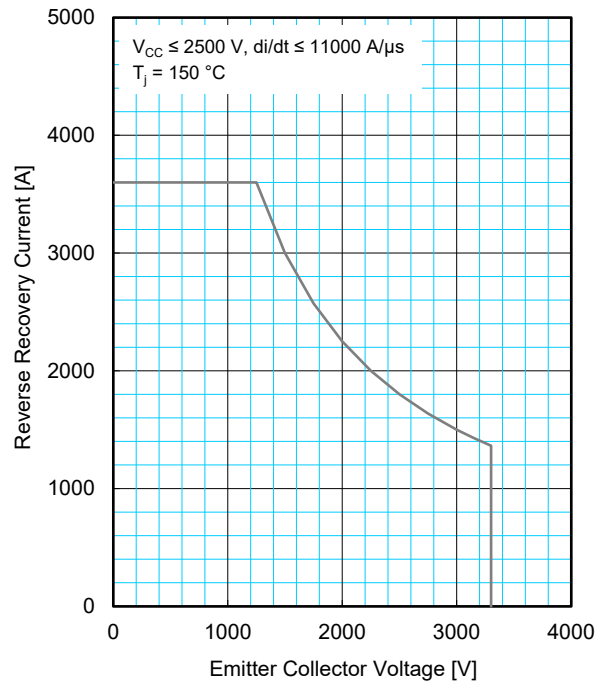
REVERSE BIAS
SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT
SAFE OPERATING AREA (SCSOA)



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



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