

<High Voltage Insulated Gate Bipolar Transistor: HVIGBT >

CM900HC-90X

HIGH POWER SWITCHING USE
INSULATED TYPE

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

CM900HC-90X



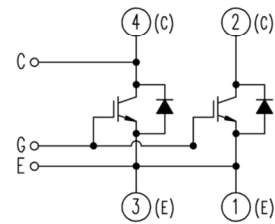
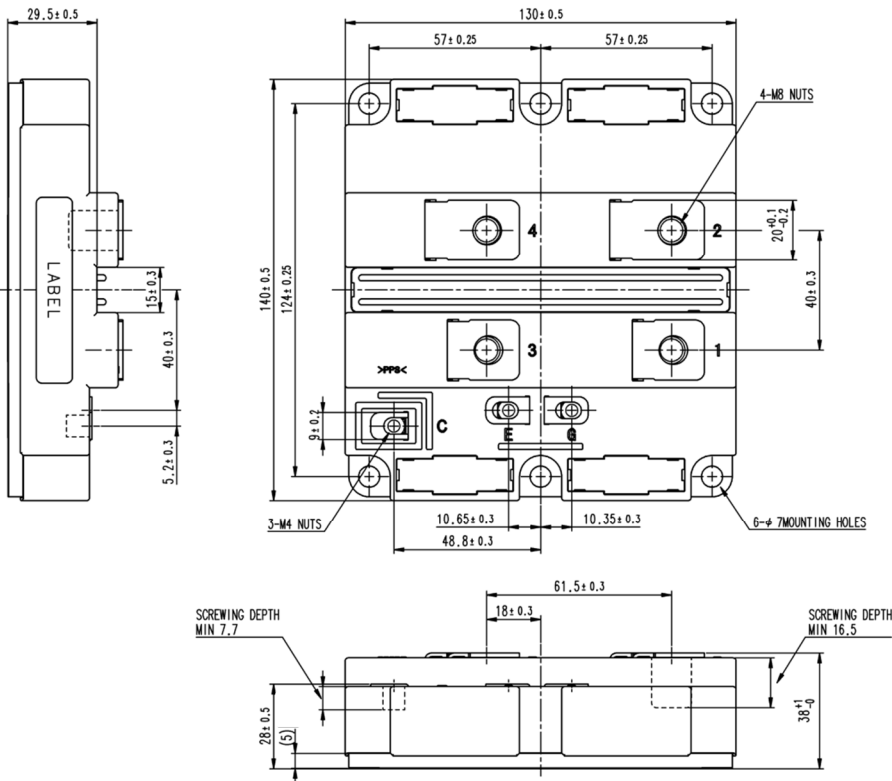
- I_c 900 A
- V_{CES} 4500 V
- 1-element in pack
- High Insulated type
- CSTBT™(III) / RFC Diode
- AISiC baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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CIRCUIT DIAGRAM

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MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V _{CES}	Collector-emitter voltage	V _{GE} = 0V, T _j = -40...+150°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 = 105°C	900	A
I _{CRM}		Pulse (Note 1)	1800	A
I _E	Emitter current (Note 2)	DC	900	A
I _{ERM}		Pulse (Note 1)	1800	A
P _{tot}	Maximum power dissipation (Note 3)	T _C = 25°C, IGBT part	9800	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 _{jop}	Operating junction temperature		-50 ~ +150	°C
T _{stg}	Storage temperature		-55 ~ +150	°C
t _{psc}	Short circuit pulse width	V _{CC} = 3400V, V _{CE} ≤ V _{CES} , T _j = 150°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	—	—	4.0	mA
			T _j = 125°C	—	4.0	—	
			T _j = 150°C	—	40.0	—	
V _{GE(th)}	Gate-emitter threshold voltage	V _{CE} = 10 V, I _C = 90 mA, T _j = 25°C	6.5	7.0	7.5	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	—	115	—	nF	
C _{oes}	Output capacitance		—	7.5	—	nF	
C _{res}	Reverse transfer capacitance		—	1.0	—	nF	
Q _G	Total gate charge	V _{CC} = 2800V, I _C = 900A, V _{GE} = ±15V	—	8.4	—	μC	
V _{CESat}	Collector-emitter saturation voltage	I _C = 900A (Note 4) V _{GE} = 15 V	T _j = 25°C	—	2.25	—	V
			T _j = 125°C	—	2.90	—	
			T _j = 150°C	—	3.00	3.50	
t _{d(on)}	Turn-on delay time	V _{CC} = 2800 V I _C = 900 A V _{GE} = ±15 V R _{G(on)} = 3.6. Ω L _s = 150 nH Inductive load	T _j = 150°C	—	—	1.00	μs
t _r	Turn-on rise time		T _j = 150°C	—	—	0.50	μs
E _{on(10%)}	Turn-on switching energy per pulse (Note 5)	V _{CC} = 2800 V I _C = 900 A V _{GE} = ±15 V R _{G(on)} = 3.6. Ω L _s = 150 nH Inductive load	T _j = 25°C	—	4.30	—	J
			T _j = 125°C	—	4.60	—	
			T _j = 150°C	—	4.65	—	
E _{on}	Turn-on switching energy per pulse (Note 6)	V _{CC} = 2800 V I _C = 900 A V _{GE} = ±15 V R _{G(on)} = 3.6. Ω L _s = 150 nH Inductive load	T _j = 25°C	—	4.35	—	J
			T _j = 125°C	—	4.85	—	
			T _j = 150°C	—	4.90	—	
t _{d(off)}	Turn-off delay time	V _{CC} = 2800 V I _C = 900 A V _{GE} = ±15 V R _{G(off)} = 45. Ω L _s = 150 nH Inductive load	T _j = 25°C	—	—	—	μs
			T _j = 125°C	—	7.0	—	
			T _j = 150°C	—	7.2	10.0	
t _f	Turn-off fall time	V _{CC} = 2800 V I _C = 900 A V _{GE} = ±15 V R _{G(off)} = 45. Ω L _s = 150 nH Inductive load	T _j = 25°C	—	—	—	μs
			T _j = 125°C	—	0.45	—	
			T _j = 150°C	—	0.45	1.20	
E _{off(10%)}	Turn-off switching energy per pulse (Note 5)	V _{CC} = 2800 V I _C = 900 A V _{GE} = ±15 V R _{G(off)} = 45. Ω L _s = 150 nH Inductive load	T _j = 25°C	—	2.55	—	J
			T _j = 125°C	—	3.50	—	
			T _j = 150°C	—	3.70	—	
E _{off}	Turn-off switching energy per pulse (Note 6)	V _{CC} = 2800 V I _C = 900 A V _{GE} = ±15 V R _{G(off)} = 45. Ω L _s = 150 nH Inductive load	T _j = 25°C	—	2.85	—	J
			T _j = 125°C	—	3.90	—	
			T _j = 150°C	—	4.10	—	

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Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
V_{EC}	Emitter-collector voltage (Note 2)	$I_E = 900\text{ A}$ (Note 4) $V_{GE} = 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.35	—	V
			$T_j = 125^\circ\text{C}$	—	2.90	—	
			$T_j = 150^\circ\text{C}$	—	3.00	3.50	
t_{rr}	Reverse recovery time (Note 2)		$T_j = 25^\circ\text{C}$	—	—	—	μs
			$T_j = 125^\circ\text{C}$	—	1.50	—	
			$T_j = 150^\circ\text{C}$	—	1.70	—	
I_{rr}	Reverse recovery current (Note 2)		$T_j = 25^\circ\text{C}$	—	—	—	A
			$T_j = 125^\circ\text{C}$	—	1300	—	
			$T_j = 150^\circ\text{C}$	—	1300	—	
$Q_{rr(10\%)}$	Reverse recovery charge (Note 2.7)	$V_{CC} = 2800\text{ V}$ $I_C = 900\text{ A}$ $V_{GE} = \pm 15\text{ V}$	$T_j = 25^\circ\text{C}$	—	—	—	μC
			$T_j = 125^\circ\text{C}$	—	1830	—	
			$T_j = 150^\circ\text{C}$	—	1870	—	
Q_{rr}	Reverse recovery charge (Note 2.6)	$R_{G(on)} = 3.6\ \Omega$ $L_S = 150\text{ nH}$ Inductive load	$T_j = 25^\circ\text{C}$	—	—	—	μC
			$T_j = 125^\circ\text{C}$	—	1910	—	
			$T_j = 150^\circ\text{C}$	—	1930	—	
$E_{rec(10\%)}$	Reverse recovery energy per pulse (Note 2.5)		$T_j = 25^\circ\text{C}$	—	2.20	—	J
			$T_j = 125^\circ\text{C}$	—	2.85	—	
			$T_j = 150^\circ\text{C}$	—	2.90	—	
E_{rec}	Reverse recovery energy per pulse (Note 2.6)		$T_j = 25^\circ\text{C}$	—	2.25	—	J
			$T_j = 125^\circ\text{C}$	—	3.05	—	
			$T_j = 150^\circ\text{C}$	—	3.10	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	12.8	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part	—	—	19.5	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, $\lambda_{grease} = 1\text{ W/m}^2\cdot\text{k}$, $D_{(c-s)} = 80\ \mu\text{m}$	—	7.5	—	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		M6 : Mounting screw	3.0	—	6.0	N·m
M_t		M4 : Auxiliary terminals screw (Note 8)	1.0	—	3.0	N·m
m	Mass		—	0.9	—	kg
CTI	Comparative tracking index		600	—	—	—
d_a	Clearance		19.5	—	—	mm
d_s	Creepage distance		32.0	—	—	mm
L_{PCE}	Parasitic stray inductance		—	12.0	—	nH

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 (150°C).

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

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

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

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

8. 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 $1.9\text{ N}\cdot\text{m}$.

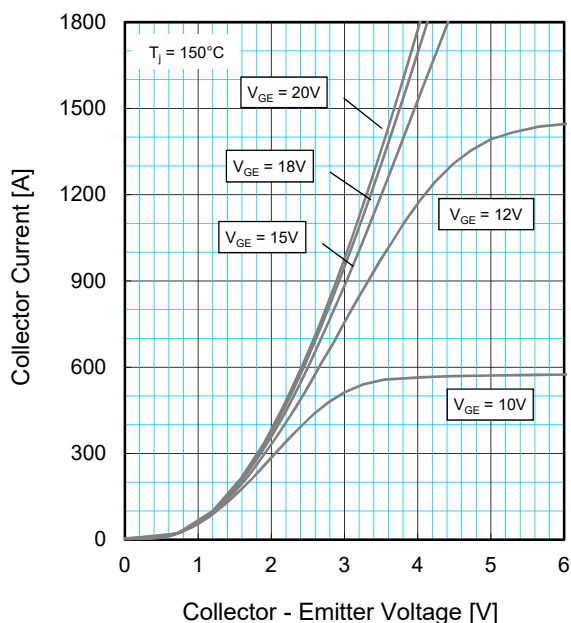
CM900HC-90X

HIGH POWER SWITCHING USE
INSULATED TYPE

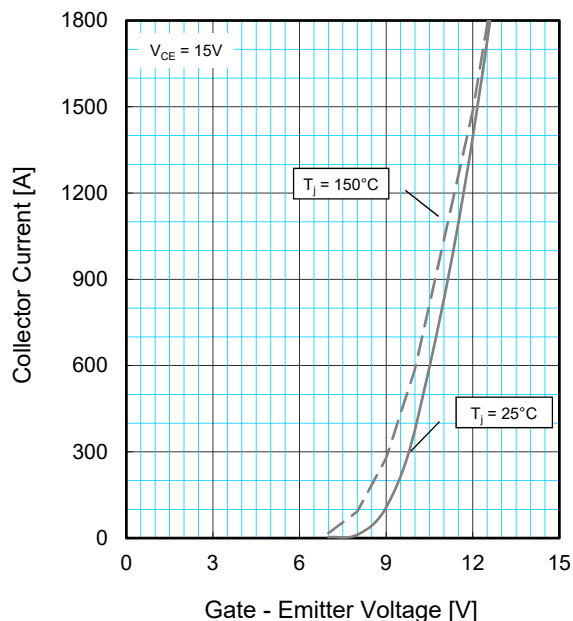
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

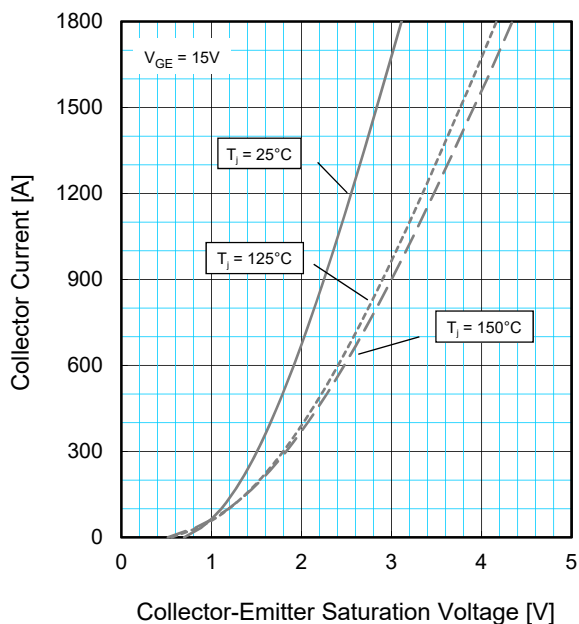
OUTPUT CHARACTERISTICS (TYPICAL)



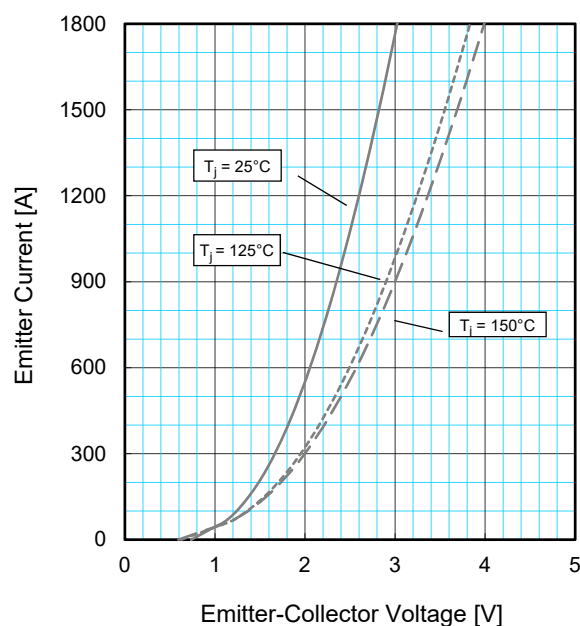
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



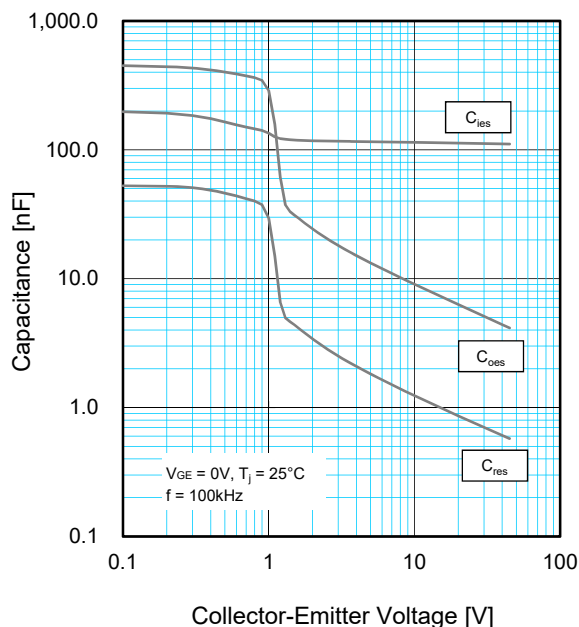
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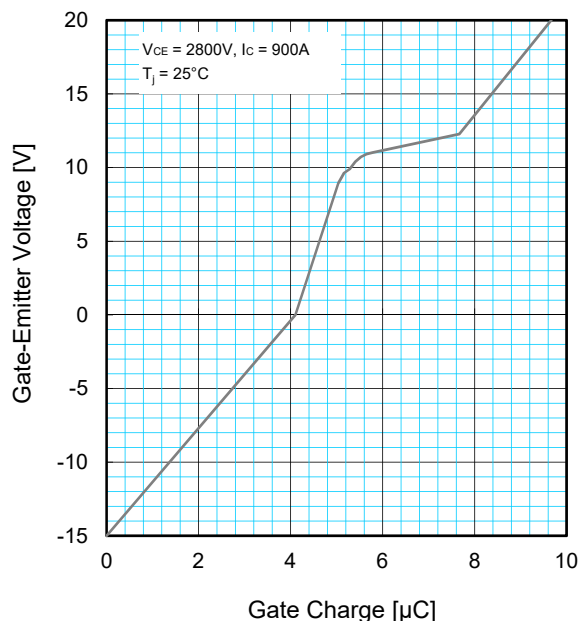
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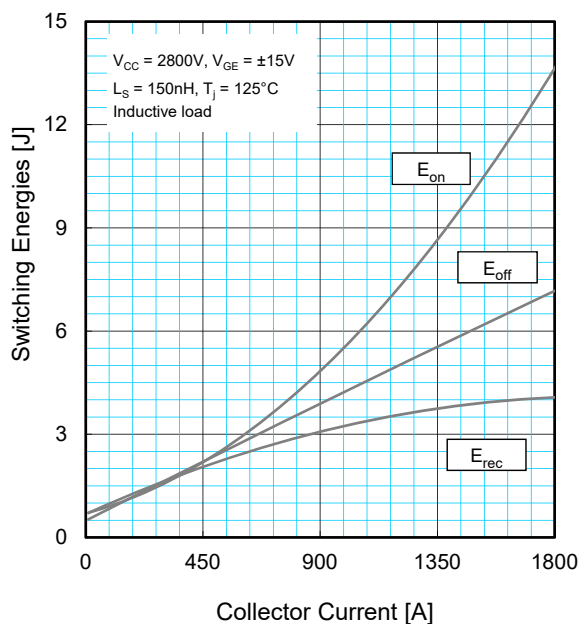
CAPACITANCE CHARACTERISTICS (TYPICAL)



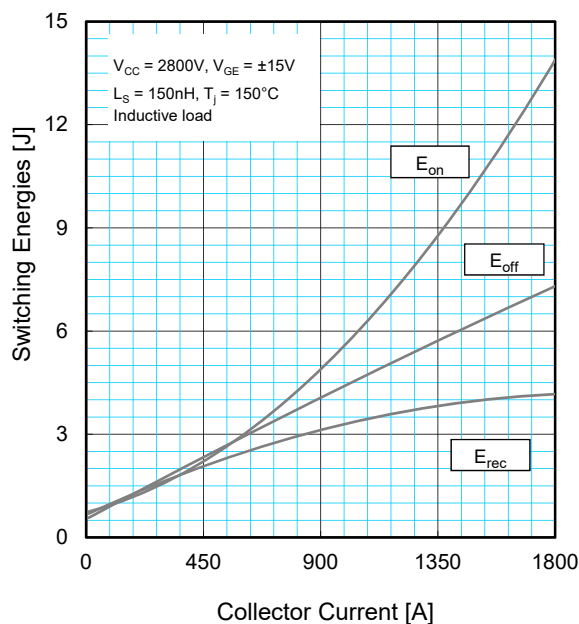
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



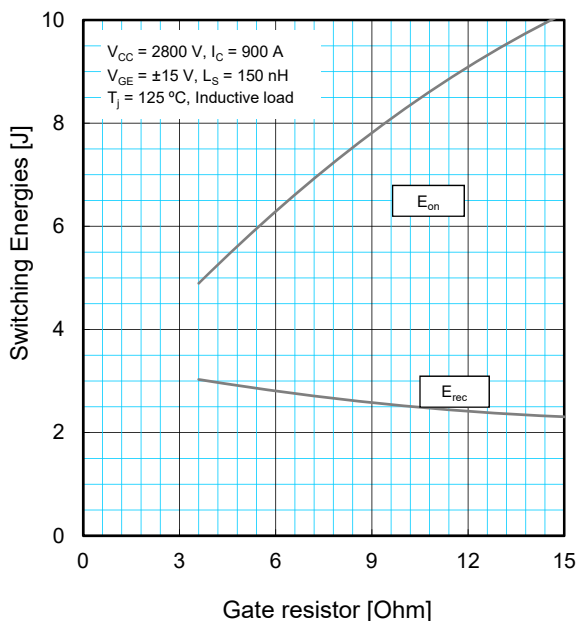
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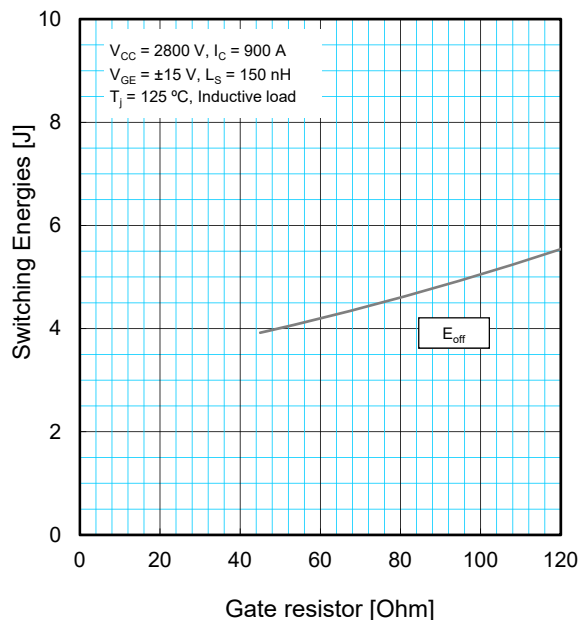
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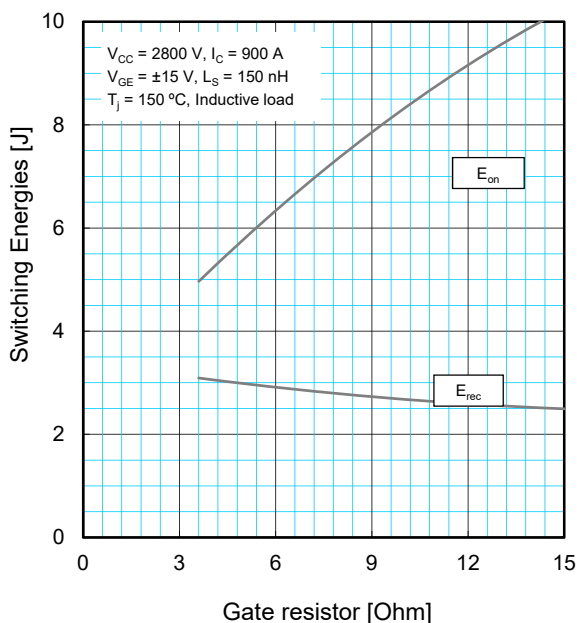
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



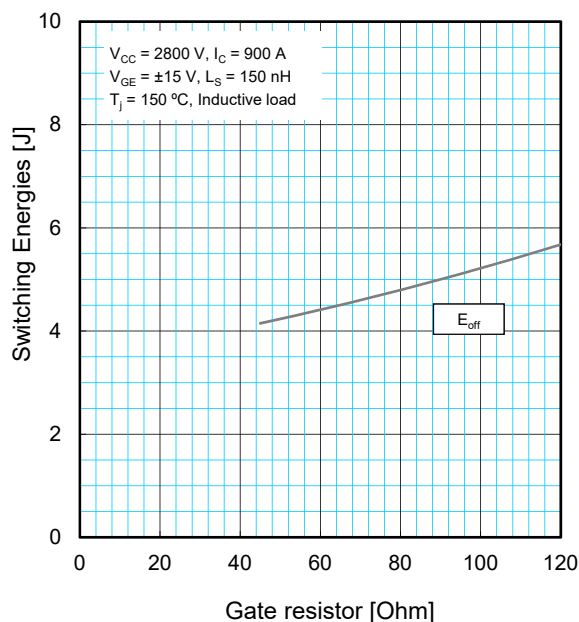
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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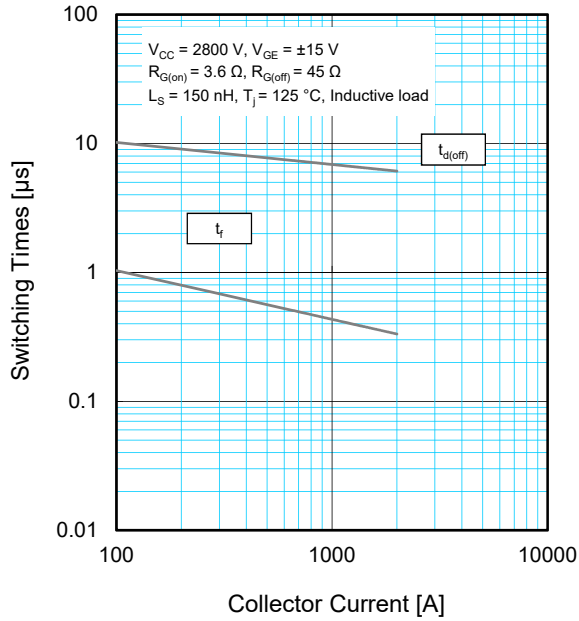
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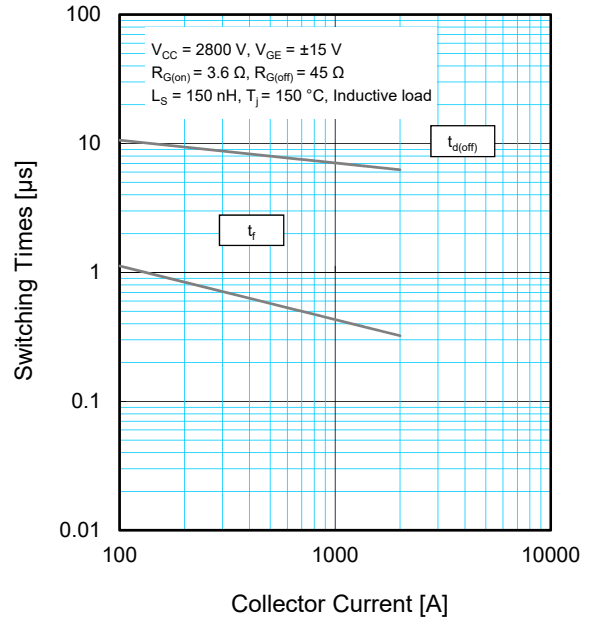
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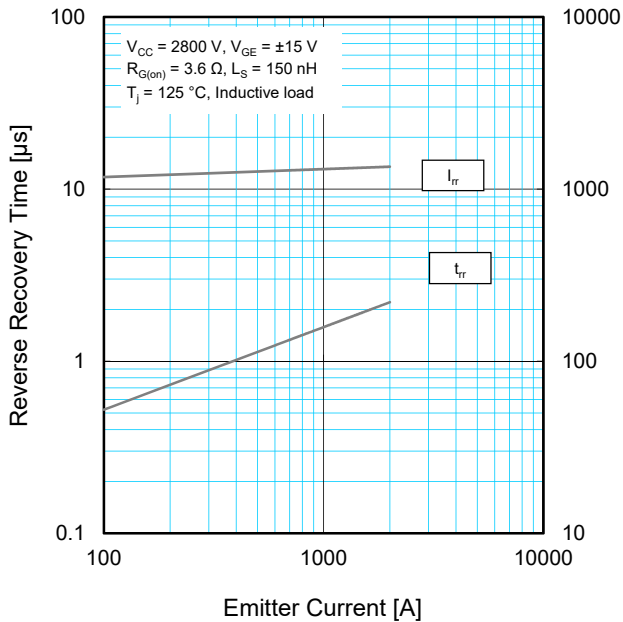
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



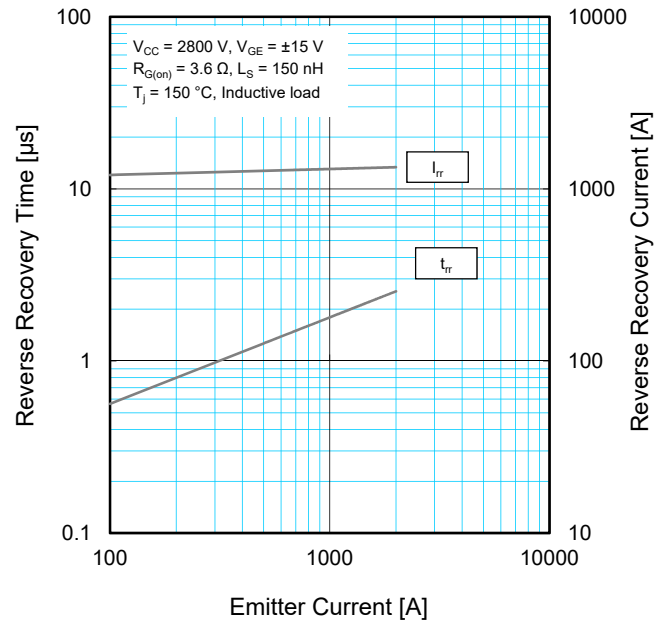
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

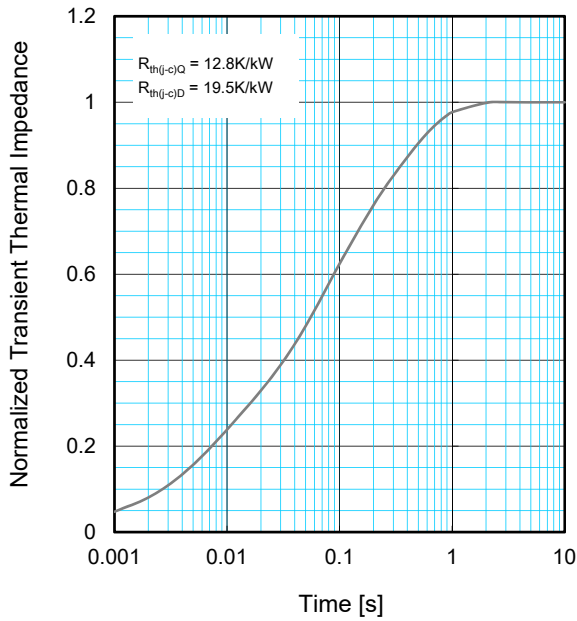


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PERFORMANCE CURVES

TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



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

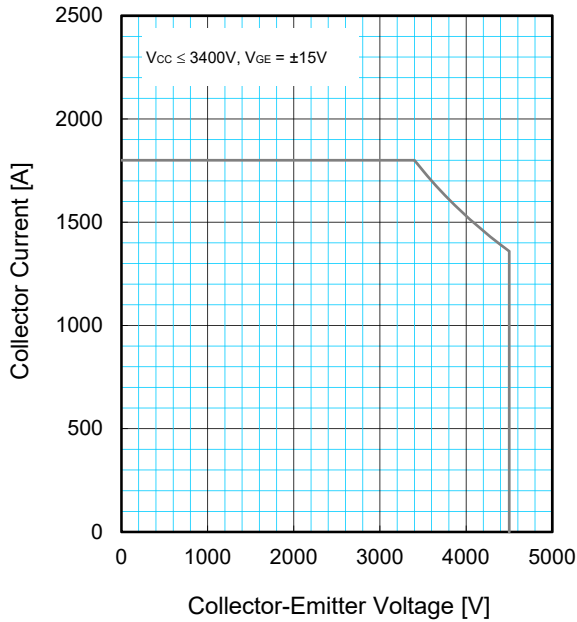
	1	2	3	4
$R_i / R_{th(j-c)}$:	0.0096	0.1893	0.4044	0.3967
τ_i [sec] :	0.0001	0.0058	0.0602	0.3512

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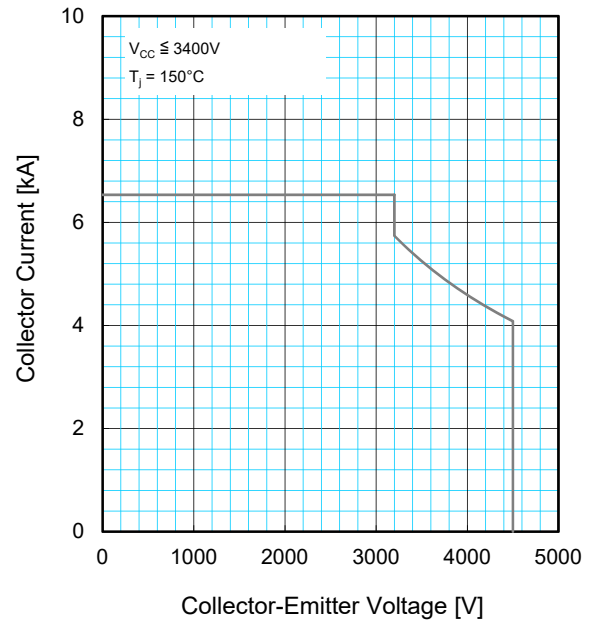
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

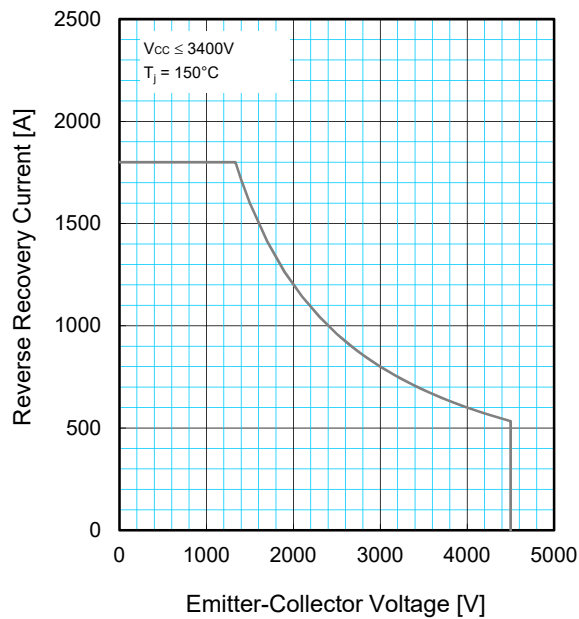
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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