

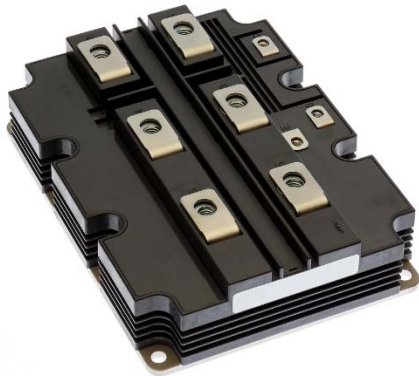
<High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM1000HG-130XA

HIGH POWER SWITCHING USE
INSULATED TYPE

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

CM1000HG-130XA



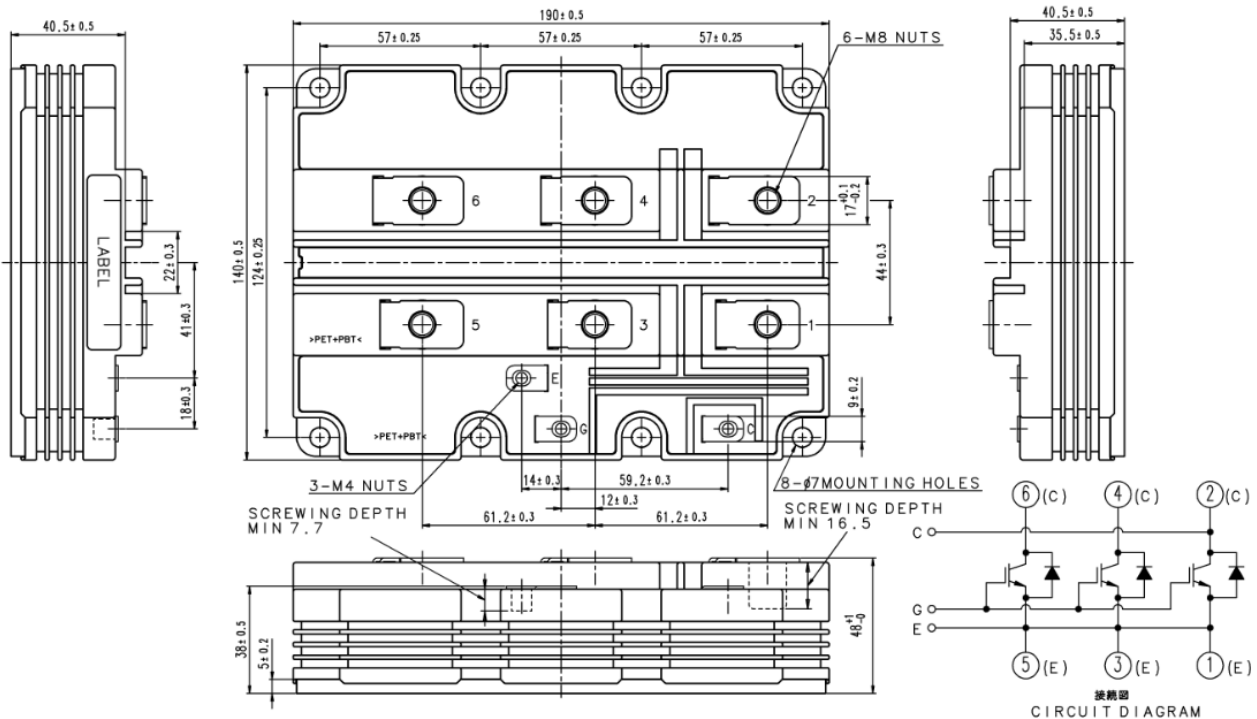
- I_C 1000 A
- V_{CES} 6500 V
- 1-element in Pack
- High Insulated Type
- CSTBT™(III) / RFC Diode
- AISiC Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V _{CES}	Collector-emitter voltage	V _{GE} = 0V, T _j = 150°C	6500	V
		V _{GE} = 0V, T _j = 25°C	6300	
		V _{CE} = 0V, T _j = -50°C	5700	
V _{GES}	Gate-emitter voltage	V _{CE} = 0V, T _j = 25°C	± 20	V
I _C	Collector current	DC, T _C = 110°C	1000	A
I _{CRM}		Pulse (Note 1)	2000	A
I _E	Emitter current (Note 2)	DC, T _C = 95°C	1000	A
I _{ERM}		Pulse (Note 1)	2000	A
P _{tot}	Maximum power dissipation (Note 3)	T _c = 25°C, IGBT part	12500	W
V _{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1min.	10200	V
V _e	Partial discharge extinction voltage	RMS, sinusoidal, f = 60Hz, Q _{PD} ≤ 10pC	5100	V
T _j	Junction temperature		-50 ~ +150	°C
T _{top}	Operating junction temperature		-50 ~ +150	°C
T _{stg}	Storage temperature		-55 ~ +150	°C
t _{psc}	Short circuit pulse width	V _{CC} = 4500V, V _{CE} ≤ V _{CES} , V _{GE} = 15V, 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	—	—	6.0	mA
			T _j = 125°C	—	5.0	—	
			T _j = 150°C	—	90.0	—	
V _{GE(th)}	Gate-emitter threshold voltage	V _{CE} = 10V, I _C = 100mA, T _j = 25°C	6.50	7.00	7.50	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} = 10V, V _{GE} = 0V, f = 100kHz T _j = 25°C	—	152	—	nF	
C _{oes}	Output capacitance		—	6.2	—	nF	
C _{res}	Reverse transfer capacitance		—	0.8	—	nF	
Q _G	Total gate charge	V _{CC} = 3600V, I _C = 1000A, V _{GE} = ±15V	—	9.9	—	μC	
V _{CESat}	Collector-emitter saturation voltage	I _C = 1000A (Note 4) V _{GE} = 15V	T _j = 25°C	—	2.60	—	V
			T _j = 125°C	—	3.25	—	
			T _j = 150°C	—	3.45	3.95	
t _{d(on)}	Turn-on delay time	V _{CC} = 3600V I _C = 1000A V _{GE} = ±15V	T _j = 25°C	—	—	—	μs
			T _j = 125°C	—	—	1.20	
			T _j = 150°C	—	—	1.20	
t _r	Rise time	V _{CC} = 3600V I _C = 1000A V _{GE} = ±15V	T _j = 25°C	—	—	—	μs
			T _j = 125°C	—	0.30	—	
			T _j = 150°C	—	0.30	0.60	
E _{on(10%)}	Turn-on switching energy (per pulse) (Note 5)	R _{G(on)} = 4.3Ω L _s = 150nH Inductive load	T _j = 25°C	—	—	—	J
			T _j = 125°C	—	7.85	—	
			T _j = 150°C	—	8.40	—	
E _{on}	Turn-on switching energy (per pulse) (Note 6)	R _{G(on)} = 4.3Ω L _s = 150 nH Inductive load	T _j = 25°C	—	—	—	J
			T _j = 125°C	—	8.30	—	
			T _j = 150°C	—	8.85	—	
t _{d(off)}	Turn-off delay time	V _{CC} = 3600V I _C = 1000A V _{GE} = ±15V	T _j = 25°C	—	—	—	μs
			T _j = 125°C	—	10.0	—	
			T _j = 150°C	—	10.0	15.0	
t _f	Fall time	V _{CC} = 3600V I _C = 1000A V _{GE} = ±15V	T _j = 25°C	—	—	—	μs
			T _j = 125°C	—	0.60	—	
			T _j = 150°C	—	0.70	1.40	
E _{off(10%)}	Turn-off switching energy (per pulse) (Note 5)	R _{G(off)} = 39Ω L _s = 150 nH Inductive load	T _j = 25°C	—	—	—	J
			T _j = 125°C	—	6.70	—	
			T _j = 150°C	—	7.10	—	
E _{off}	Turn-off switching energy (per pulse) (Note 6)	R _{G(off)} = 39Ω L _s = 150 nH Inductive load	T _j = 25°C	—	—	—	J
			T _j = 125°C	—	7.10	—	
			T _j = 150°C	—	7.60	—	

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Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
V _{EC}	Emitter-collector voltage (Note 2)	I _E = 1000A (Note 4) V _{GE} = 0V	T _J = 25°C	—	2.40	—	V
			T _J = 125°C	—	2.80	—	
			T _J = 150°C	—	2.90	3.40	
t _{rr}	Reverse recovery time (Note 2)		T _J = 25°C	—	—	—	μs
			T _J = 125°C	—	2.10	—	
			T _J = 150°C	—	2.20	—	
I _{rr}	Reverse recovery current (Note 2)		T _J = 25°C	—	—	—	A
			T _J = 125°C	—	1250	—	
			T _J = 150°C	—	1200	—	
Q _{rr(10%)}	Reverse recovery charge (Note 2, 7)	V _{CC} = 3600V I _C = 1000A V _{GE} = ±15V	T _J = 25°C	—	—	—	μC
			T _J = 125°C	—	2300	—	
			T _J = 150°C	—	2400	—	
Q _{rr}	Reverse recovery charge (Note 2, 6)	R _{G(on)} = 4.3Ω L _s = 150nH Inductive load	T _J = 25°C	—	—	—	μC
			T _J = 125°C	—	2400	—	
			T _J = 150°C	—	2500	—	
E _{rec(10%)}	Reverse recovery energy (per pulse) (Note 2, 5)		T _J = 25°C	—	—	—	J
			T _J = 125°C	—	4.45	—	
			T _J = 150°C	—	4.70	—	
E _{rec}	Reverse recovery energy (per pulse) (Note 2, 6)		T _J = 25°C	—	—	—	J
			T _J = 125°C	—	4.75	—	
			T _J = 150°C	—	5.10	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
R _{th(f-c)Q}	Thermal resistance	Junction to Case, IGBT part	—	—	10.0	K/kW
R _{th(f-c)D}		Junction to Case, FWDi part	—	—	16.0	K/kW
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, λ _{grease} = 1W/m·k, D _(c-s) = 80μm	—	5.0	—	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	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 _{PE}	Parasitic stray inductance		—	13.5	—	nH
R _{CC+EE}	Internal lead resistance	T _C = 25°C	—	0.12	—	mΩ

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°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).

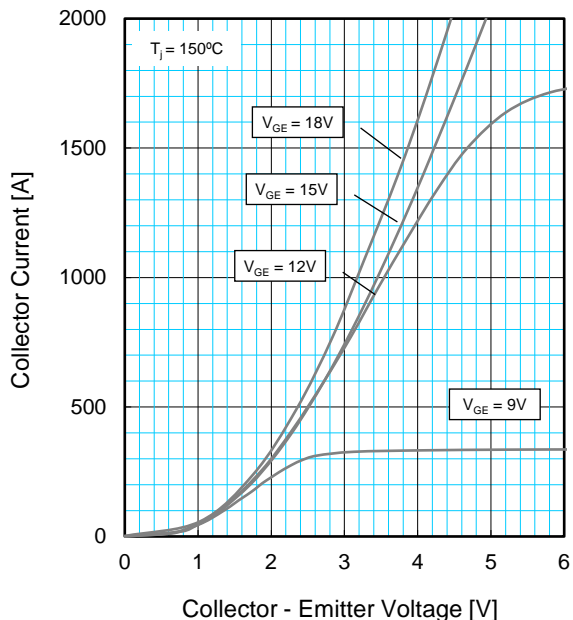
Note6. Definition of all items is according to IEC 60747, unless otherwise specified.

Note7. The integration range of reverse recovery charge is from I_E = 0A to 10%I_E.

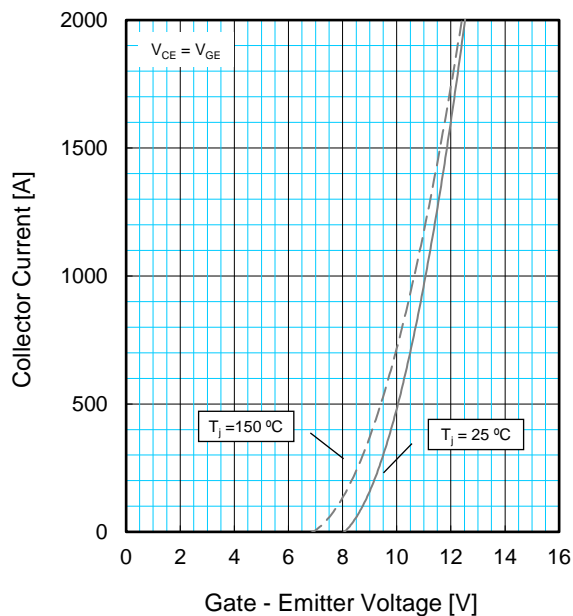
CM1000HG-130XA
 HIGH POWER SWITCHING USE
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PERFORMANCE CURVES

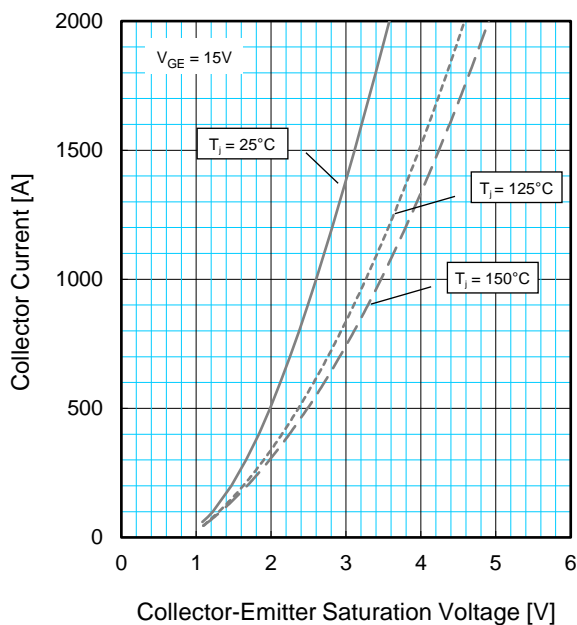
OUTPUT CHARACTERISTICS (TYPICAL)



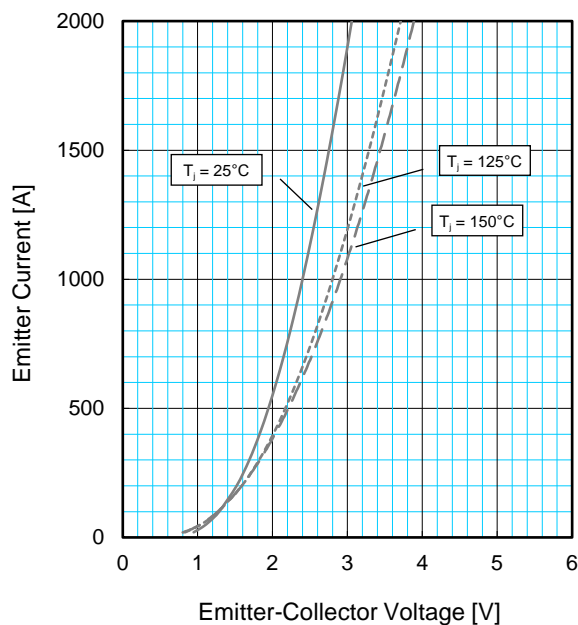
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



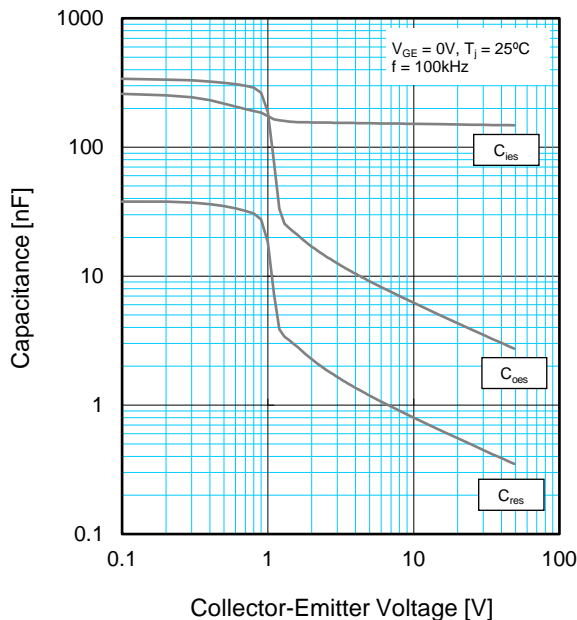
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HIGH POWER SWITCHING USE
INSULATED TYPE

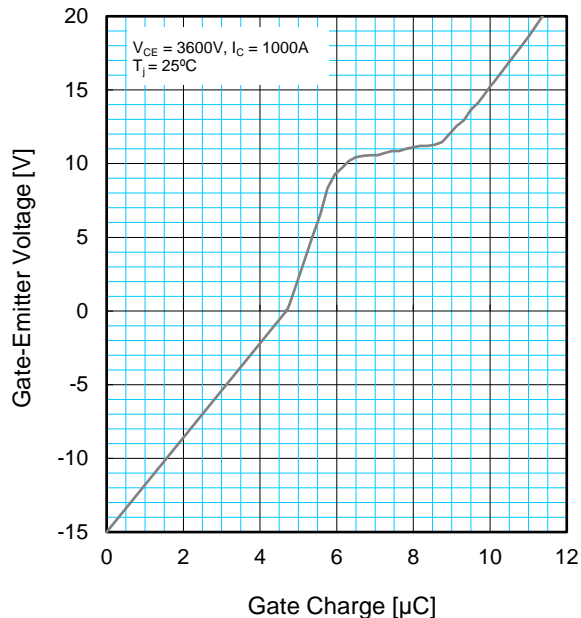
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

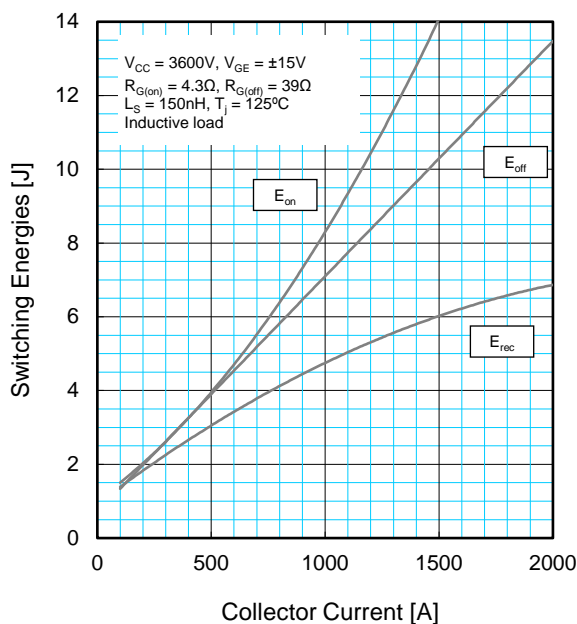
CAPACITANCE CHARACTERISTICS (TYPICAL)



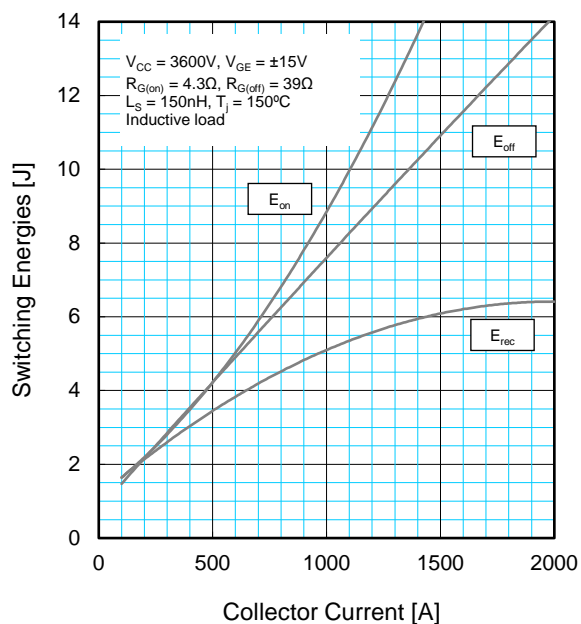
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



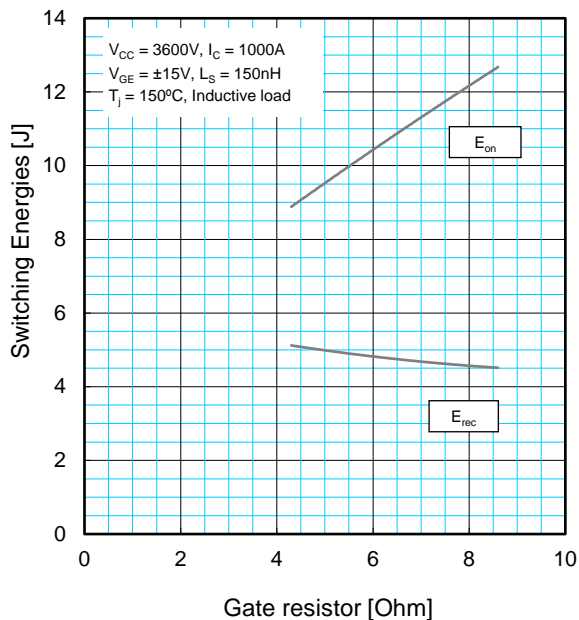
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



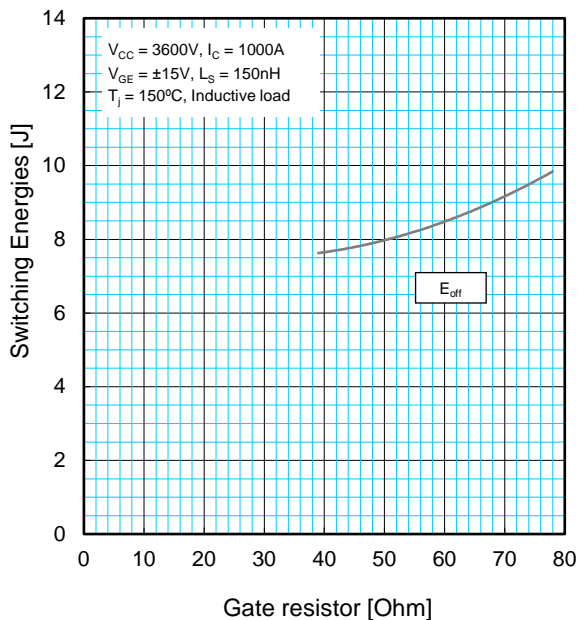
CM1000HG-130XA
 HIGH POWER SWITCHING USE
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PERFORMANCE CURVES

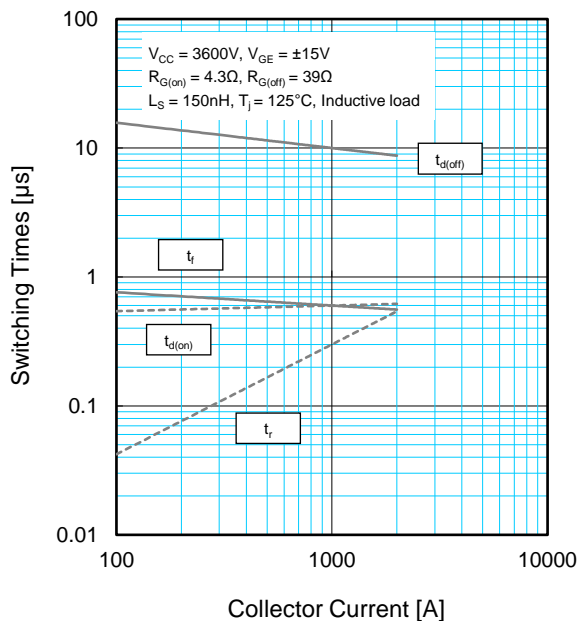
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



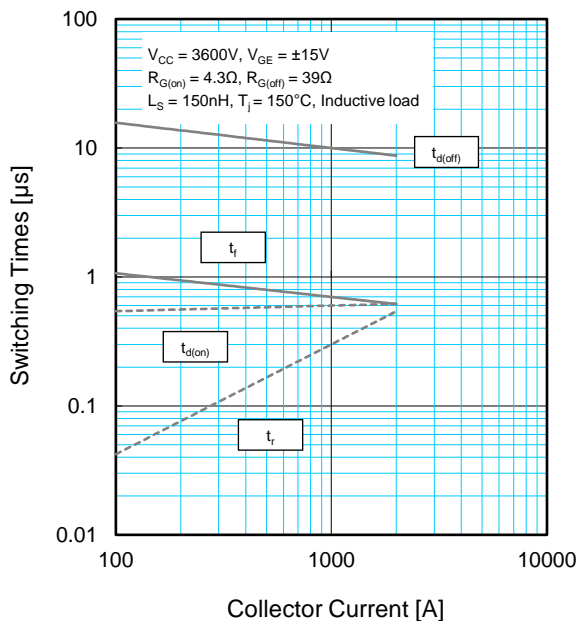
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



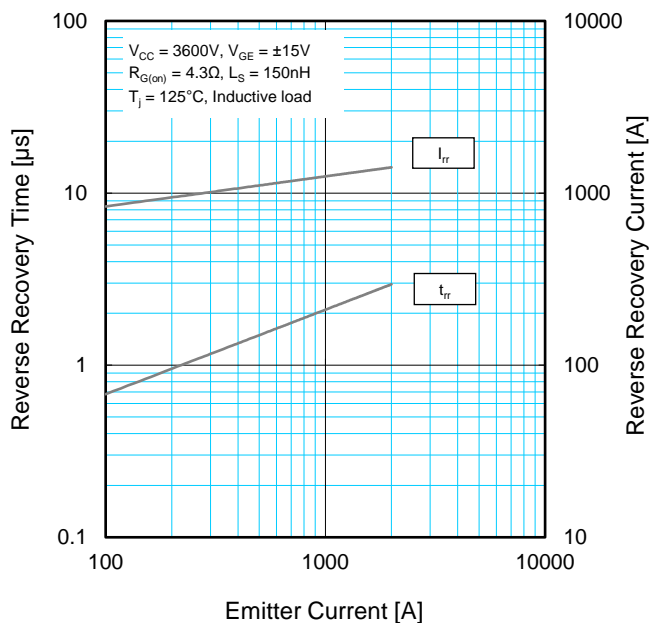
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



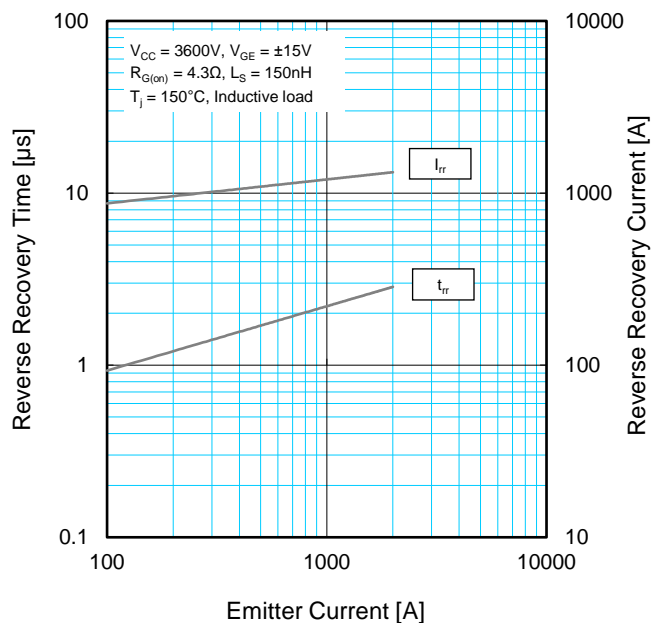
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PERFORMANCE CURVES

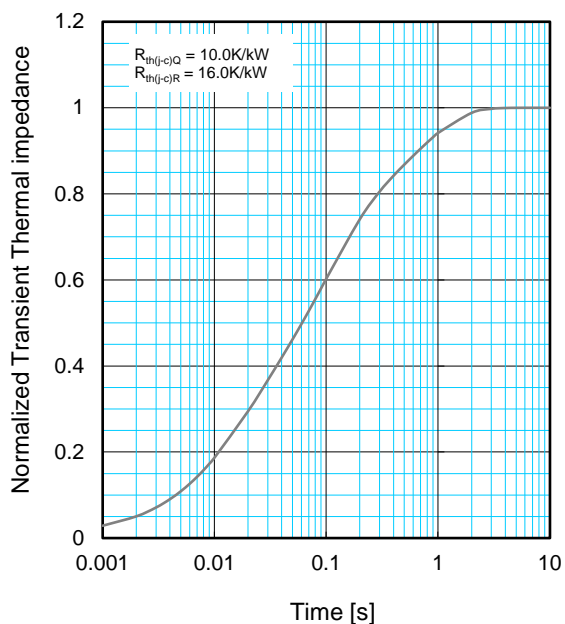
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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

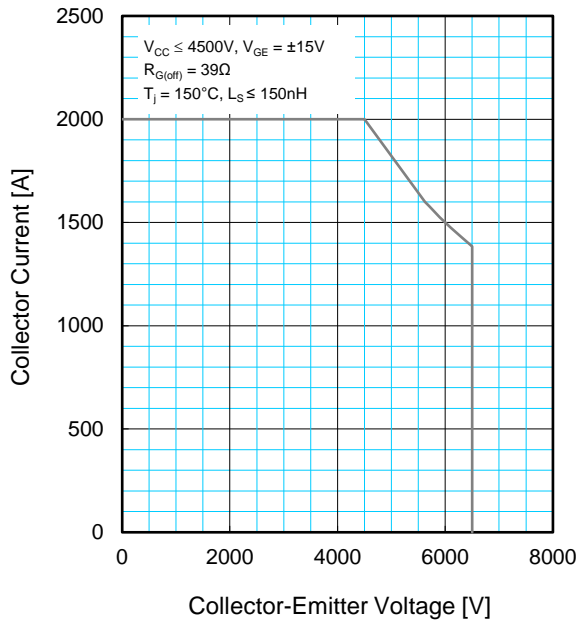
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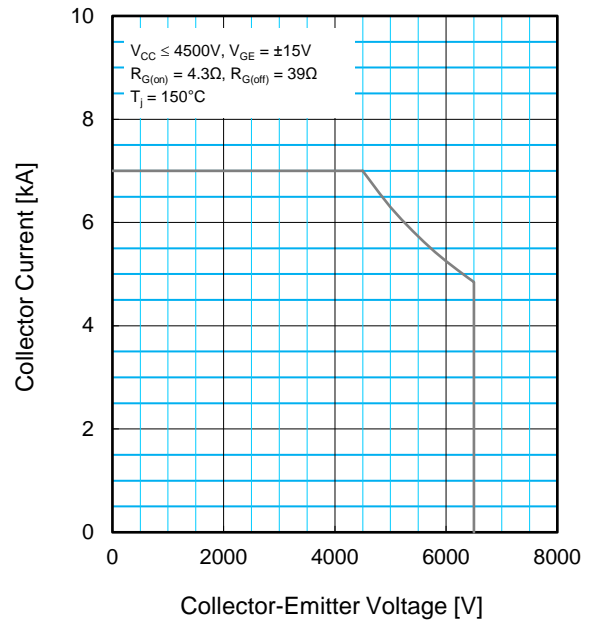
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

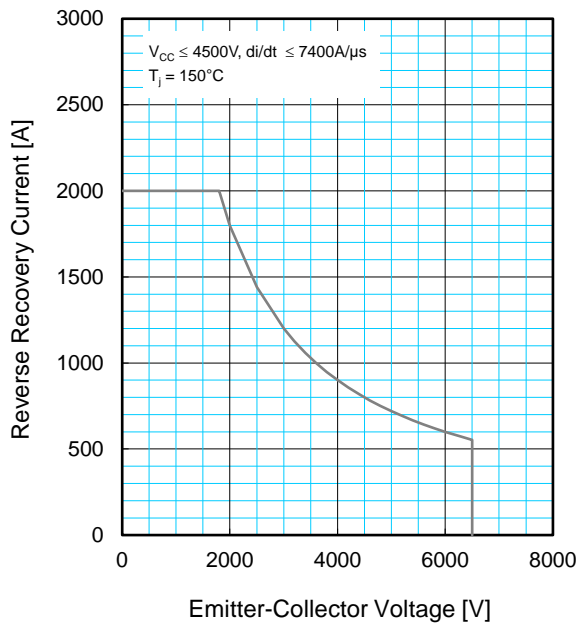
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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