

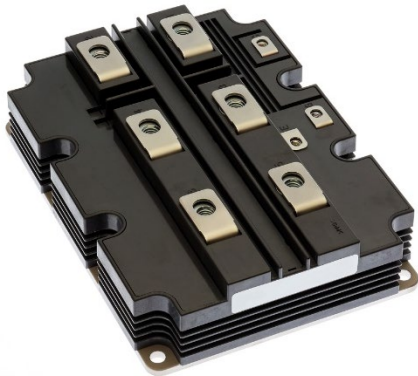
<High Voltage Insulated Gate Bipolar Transistor: HVIGBT >

CM1000HG-130XA

HIGH POWER SWITCHING USE
INSULATED TYPE

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

CM1000HG-130XA



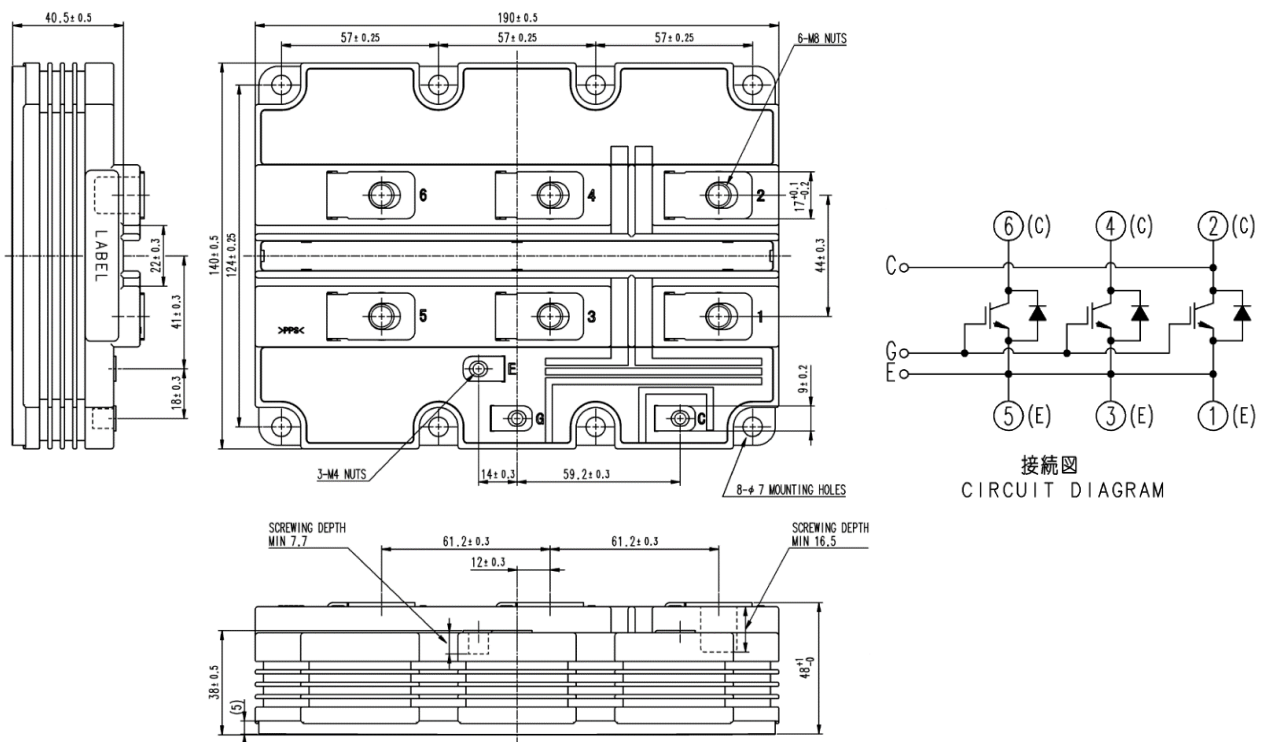
- I_C 1000 A
- V_{CES} 6500 V
- 1-element in Pack
- High Insulated Type
- CSTBT™(III) / RFC Diode
- AlSiC Baseplate
- UL recognized under UL1557

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	$V_{GE} = 0V, T_j = 150^\circ C$	6500	V
		$V_{GE} = 0V, T_j = 25^\circ C$	6300	
		$V_{CE} = 0V, T_j = -50^\circ C$	5700	
V_{GES}	Gate-emitter voltage	$V_{CE} = 0V, T_j = 25^\circ C$	± 20	V
I_C	Collector current	DC, $T_c = 111^\circ C$	1000	A
I_{CRM}		Pulse (Note 1)	2000	A
I_E	Emitter current (Note 2)	DC, $T_c = 95^\circ C$	1000	A
I_{ERM}		Pulse (Note 1)	2000	A
P_{tot}	Maximum power dissipation (Note 3)	$T_c = 25^\circ C$, IGBT part	12500	W
V_{iso}	Isolation voltage	RMS, sinusoidal, $f = 60Hz$, $t = 1min.$	10200	V
Q_{PD}	Partial discharge	RMS, sinusoidal, $f = 60Hz$, $V_1 = 6900V, V_2 = 5100V$	10	pC
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	$V_{CC} \leq 4500V, V_{GE} = \pm 15V$, $R_{G(on)} = 4.3\Omega, R_{G(off)} = 39\Omega, T_j = 150^\circ C$	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	—	—	5.0	mA
			T _J = 125°C	—	5.0	—	
			T _J = 150°C	—	—	150.0	
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	—	3.40	3.90	
t _{d(on)}	Turn-on delay time	V _{CC} = 3600V I _C = 1000A V _{GE} = ±15V R _{G(on)} = 4.3Ω L _s = 150nH Inductive load	T _J = 150°C	—	—	1.20	μs
t _r	Rise time		T _J = 150°C	—	—	070	μs
E _{on(10%)}	Turn-on switching energy (per pulse) <div>(Note 5)</div>		T _i = 25°C	—	10.50	—	J
			T _J = 125°C	—	10.50	—	
			T _J = 150°C	—	10.50	—	
E _{on}	Turn-on switching energy (per pulse) <div>(Note 6)</div>		T _J = 25°C	—	11.00	—	J
			T _J = 125°C	—	11.00	—	
			T _J = 150°C	—	11.40	—	
t _{d(off)}	Turn-off delay time		T _J = 25°C	—	7.40	—	μs
			T _J = 125°C	—	7.70	—	
		T _J = 150°C	—	8.00	—		
t _f	Fall time	T _J = 25°C	—	0.50	—	μs	
		T _J = 125°C	—	0.60	—		
		T _J = 150°C	—	0.65	—		
E _{off(10%)}	Turn-off switching energy (per pulse) <div>(Note 5)</div>	T _J = 25°C	—	5.50	—	J	
		T _J = 125°C	—	7.10	—		
		T _J = 150°C	—	7.50	—		
E _{off}	Turn-off switching energy (per pulse) <div>(Note 6)</div>	T _i = 25°C	—	5.90	—	J	
		T _i = 125°C	—	7.50	—		
		T _i = 150°C	—	8.00	—		

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ELECTRICAL CHARACTERISTICS

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)	V _{CC} = 3600V I _C = 1000A V _{GE} = ±15V R _{G(on)} = 4.3Ω L _s = 150nH Inductive load	T _J = 25°C	—	2.70	—	μs
			T _J = 125°C	—	3.30	—	
			T _J = 150°C	—	3.50	—	
I _{rr}	Reverse recovery current (Note 2)		T _J = 25°C	—	1130	—	A
			T _J = 125°C	—	1100	—	
			T _J = 150°C	—	1100	—	
Q _{rr(10%)}	Reverse recovery charge (Note 2, 7)		T _J = 25°C	—	2200	—	μC
			T _J = 125°C	—	2750	—	
			T _J = 150°C	—	3000	—	
Q _{rr}	Reverse recovery charge (Note 2, 6)		T _J = 25°C	—	2250	—	μC
			T _J = 125°C	—	2800	—	
			T _J = 150°C	—	3100	—	
E _{rec(10%)}	Reverse recovery energy (per pulse) (Note 2, 5)		T _J = 25°C	—	3.40	—	J
			T _J = 125°C	—	4.90	—	
			T _J = 150°C	—	5.50	—	
E _{rec}	Reverse recovery energy (per pulse) (Note 2, 6)		T _J = 25°C	—	3.60	—	J
			T _J = 125°C	—	5.10	—	
			T _J = 150°C	—	5.80	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	10.0	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part	—	—	16.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, $\lambda_{grease} = 1W/m^2K$, $D_{(c-s)} = 80\mu m$	—	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_{pCE}	Parasitic stray inductance		—	13.5	—	nH
R_{CC+EE}	Internal lead resistance	$T_C = 25^\circ C$	—	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 ($150^\circ C$).

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 $10\%I_E$.

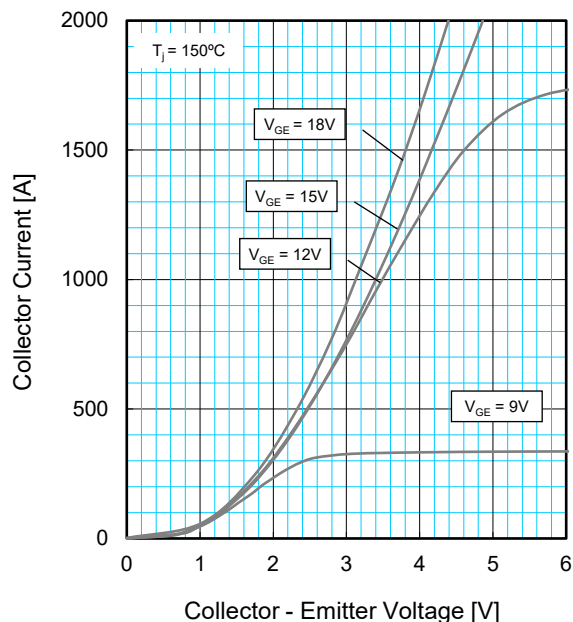
CM1000HG-130XA

HIGH POWER SWITCHING USE
INSULATED TYPE

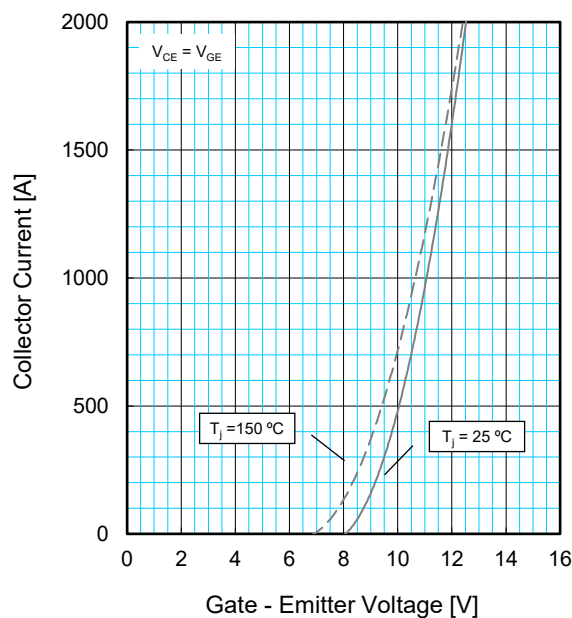
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PERFORMANCE CURVES

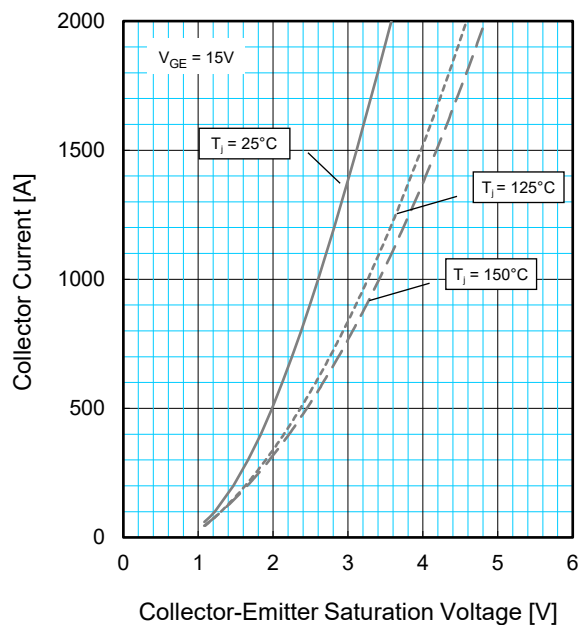
OUTPUT CHARACTERISTICS
(TYPICAL)



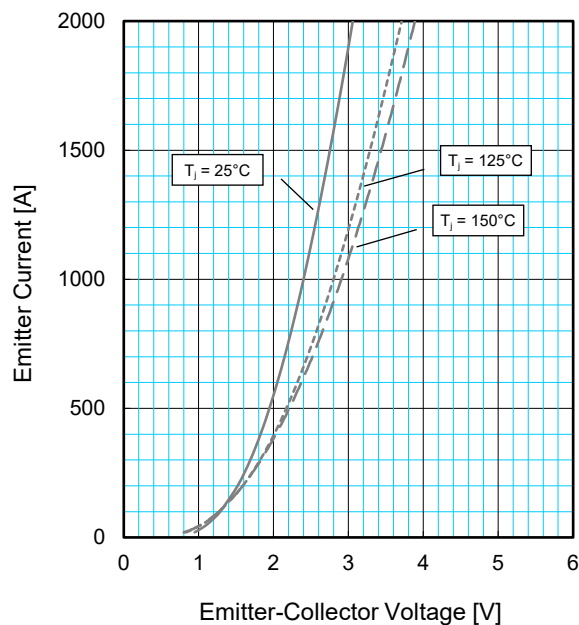
TRANSFER CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS (TYPICAL)

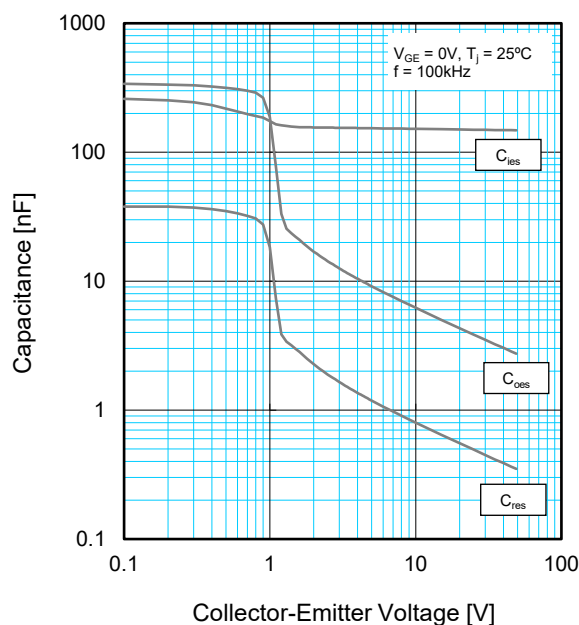
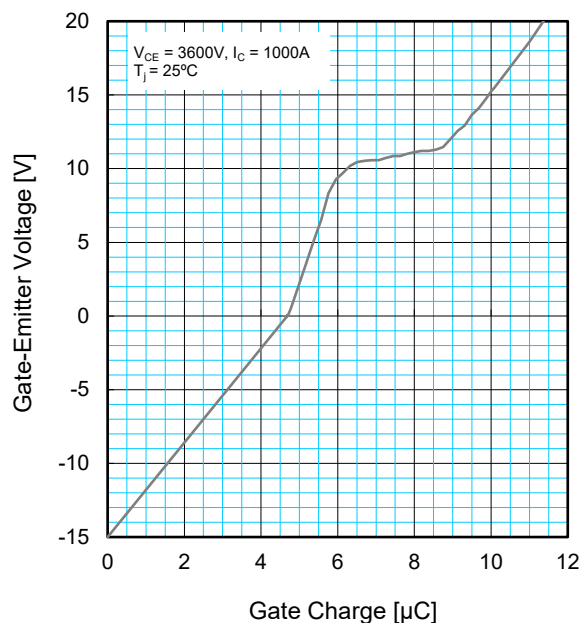
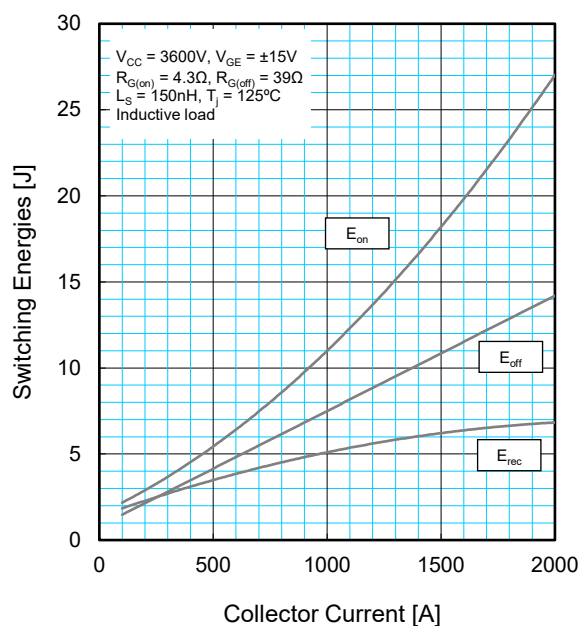
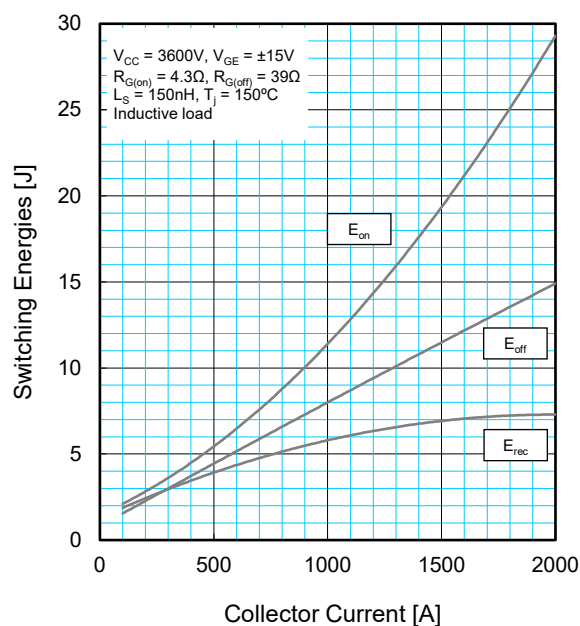


FREE-WHEEL DIODE FORWARD
CHARACTERISTICS (TYPICAL)



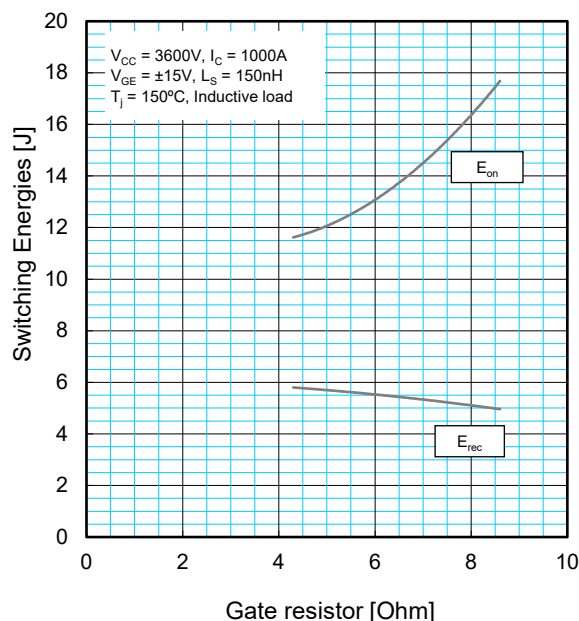
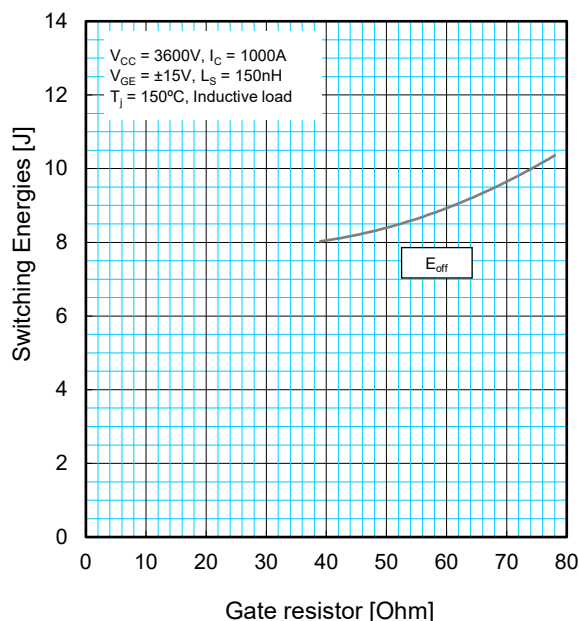
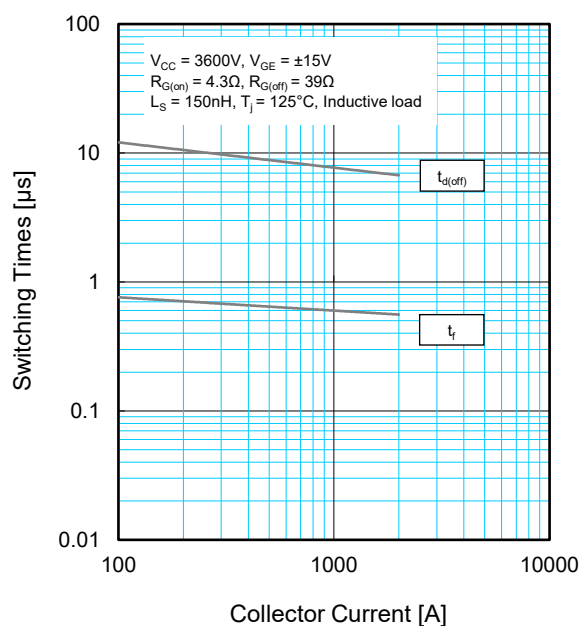
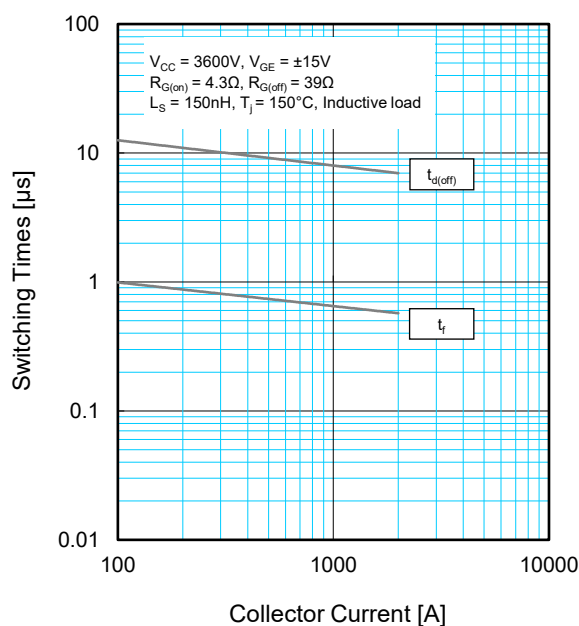
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PERFORMANCE CURVES**CAPACITANCE CHARACTERISTICS
(TYPICAL)****GATE CHARGE CHARACTERISTICS
(TYPICAL)****HALF-BRIDGE SWITCHING ENERGY
CHARACTERISTICS (TYPICAL)****HALF-BRIDGE SWITCHING ENERGY
CHARACTERISTICS (TYPICAL)**

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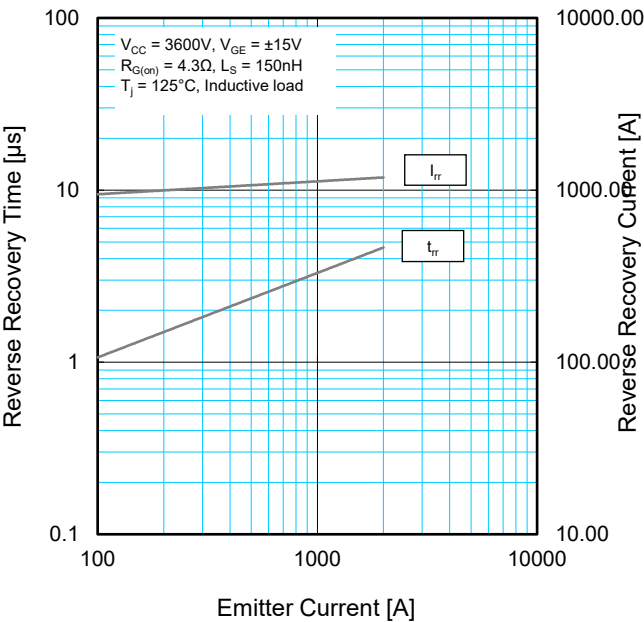
PERFORMANCE CURVES**HALF-BRIDGE SWITCHING ENERGY
CHARACTERISTICS (TYPICAL)****HALF-BRIDGE SWITCHING ENERGY
CHARACTERISTICS (TYPICAL)****HALF-BRIDGE SWITCHING TIME
CHARACTERISTICS (TYPICAL)****HALF-BRIDGE SWITCHING TIME
CHARACTERISTICS (TYPICAL)**

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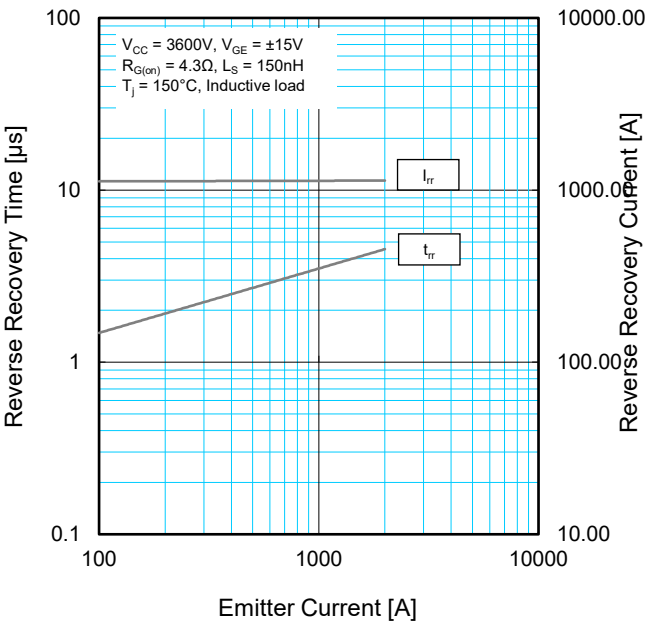
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PERFORMANCE CURVES

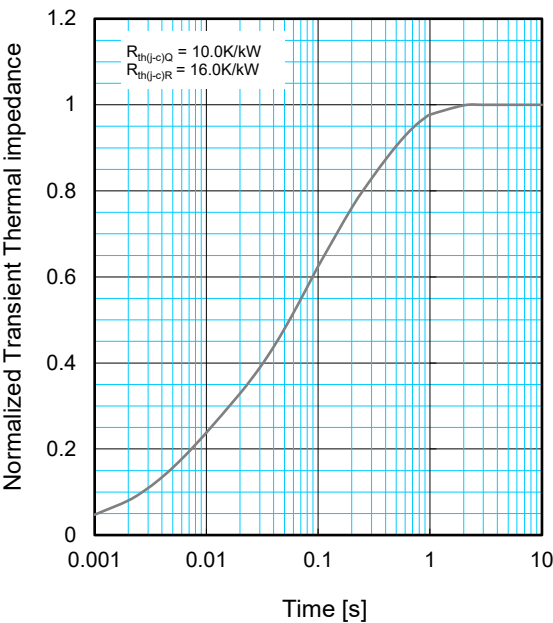
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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

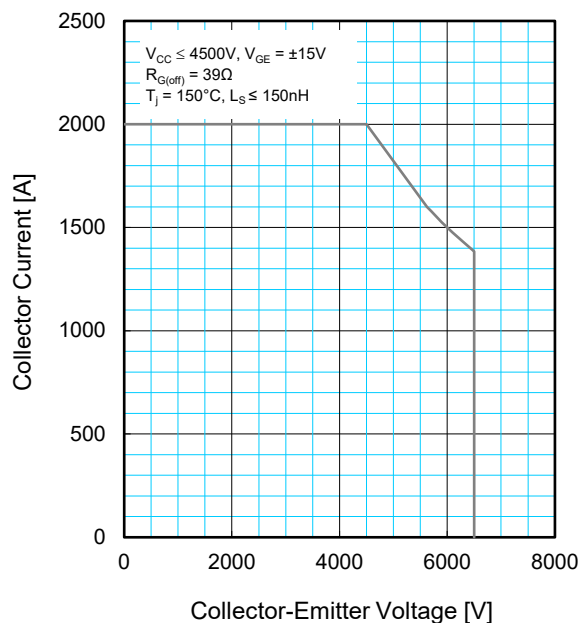
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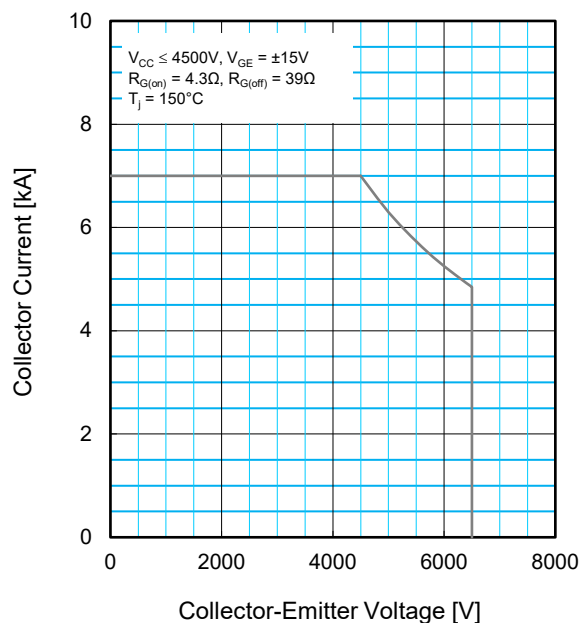
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PERFORMANCE CURVES

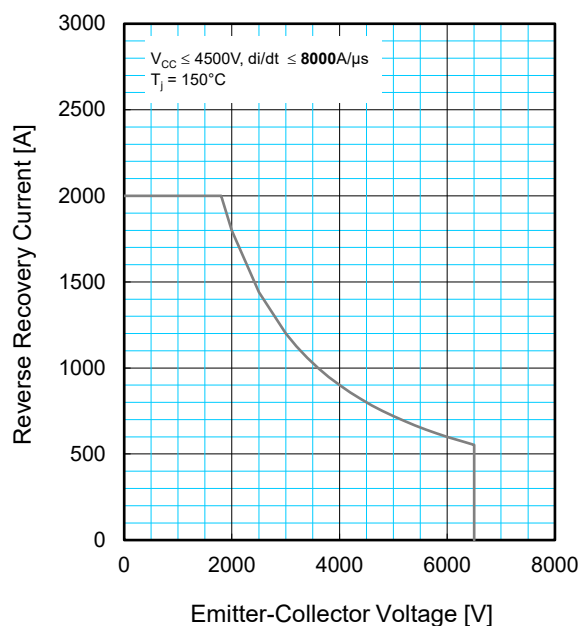
REVERSE BIAS SAFE OPERATING AREA
(RBSOA)



SHORT CIRCUIT
SAFE OPERATING AREA (SCSOA)



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



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