

< High Voltage Insulated Gate Bipolar Transistor:HVIGBT >

CM450DE-66X

HIGH POWER SWITCHING USE
INSULATED TYPE

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

CM450DE-66X



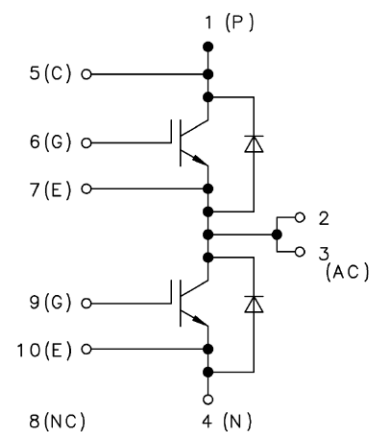
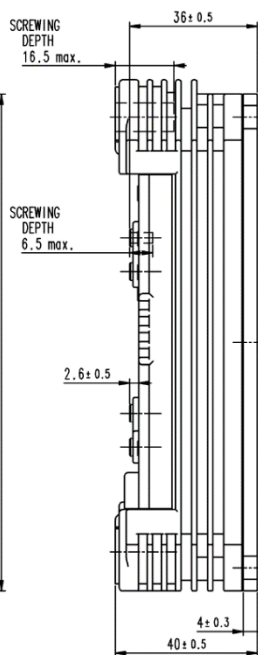
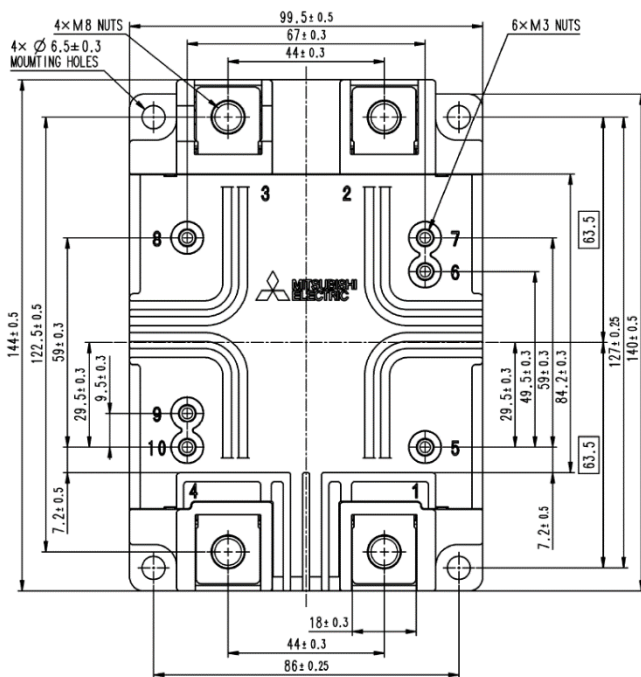
- I_C450A
- V_{CES}3300V
- 2-elements in a Pack
- Insulated Type (Al base type)
- CSTBT™(III) / RFC Diode

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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	3300	V
		V _{GE} = 0V, T _J = -50°C	3200	
V _{GES}	Gate-emitter voltage	V _{CE} = 0V, T _J = 25°C	± 20	V
I _c	Collector current	DC, T _c = 110°C	450	A
I _{CRM}		Pulse (Note 1)	900	
I _E	Emitter current (Note 2)	DC	450	A
I _{ERM}		Pulse (Note 1)	900	
P _{tot}	Maximum power dissipation (Note 3)	T _c = 25°C, IGBT part	4500	W
V _{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1 min., T _c = 25°C	10200	V
V _e	Partial discharge extinction voltage	RMS, sinusoidal, f = 60Hz, Q _{PD} ≤ 10 pC., T _c = 25°C	5100	V
T _j	Junction temperature		-50 ~ +150	°C
T _{jop}	Operating junction temperature		-50 ~ +150	°C
T _{stg}	Storage temperature		-55 ~ +125	°C
t _{psc}	Short circuit pulse width	V _{CC} = 2400V, V _{CE} ≤ V _{CEs} , V _{GE} = 15V, T _J = 150°C R _{G(on)} = 2.7Ω, R _{G(off)} = 62Ω, C _{GE} = 33nF	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	—	—	1.5	mA
			T _J = 125°C	—	1.5	—	
			T _J = 150°C	—	15.0	—	
V _{GE(th)}	Gate-emitter threshold voltage	V _{CE} = 10V, I _c = 45mA, 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} = 10V, V _{GE} = 0V, f = 100kHz T _J = 25°C	—	44.5	—	nF	
C _{oes}	Output capacitance		—	3.1	—		
C _{res}	Reverse transfer capacitance		—	0.4	—		
Q _G	Total gate charge	V _{CC} = 1800V, I _c = 450A, V _{GE} = ±15V	—	3.0	—	μC	
V _{CEsat}	Collector-emitter saturation voltage	I _c = 450A (Note 4) V _{GE} = 15V	T _J = 25°C	—	2.20	—	V
			T _J = 125°C	—	2.65	3.05	
			T _J = 150°C	—	2.75	3.15	
t _{d(on)}	Turn-on delay time	V _{CC} = 1800V I _c = 450A V _{GE} = ±15V R _{G(on)} = 2.7Ω C _{GE} = 33nF L _s = 85nH Inductive load	T _J = 150°C	—	—	1.25	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	—	0.74	—	J
		T _J = 125°C	—	0.89	—		
		T _J = 150°C	—	0.90	—		
E _{on}	Turn-on switching energy per pulse	T _J = 25°C	—	0.79	—	J	
		T _J = 125°C	—	0.95	—		
		T _J = 150°C	—	0.96	—		
t _{d(off)}	Turn-off delay time	V _{CC} = 1800V I _c = 450A V _{GE} = ±15V R _{G(off)} = 62Ω C _{GE} = 33nF L _s = 85nH Inductive load	T _J = 25°C	—	3.40	—	μs
			T _J = 125°C	—	3.60	5.00	
			T _J = 150°C	—	3.65	5.00	
t _f	Fall time	V _{CC} = 1800V I _c = 450A V _{GE} = ±15V R _{G(off)} = 62Ω C _{GE} = 33nF L _s = 85nH Inductive load	T _J = 25°C	—	0.24	—	μs
			T _J = 125°C	—	0.35	1.00	
			T _J = 150°C	—	0.37	1.00	
E _{off(10%)}	Turn-off switching energy per pulse (Note 5)	V _{CC} = 1800V I _c = 450A V _{GE} = ±15V R _{G(off)} = 62Ω C _{GE} = 33nF L _s = 85nH Inductive load	T _J = 25°C	—	0.55	—	J
			T _J = 125°C	—	0.74	—	
			T _J = 150°C	—	0.75	—	
E _{off}	Turn-off switching energy per pulse	V _{CC} = 1800V I _c = 450A V _{GE} = ±15V R _{G(off)} = 62Ω C _{GE} = 33nF L _s = 85nH Inductive load	T _J = 25°C	—	0.62	—	J
			T _J = 125°C	—	0.84	—	
			T _J = 150°C	—	0.85	—	

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Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
V _{EC}	Emitter-collector voltage (Note 2)	I _E = 450A (Note 4) V _{GE} = 0V	T _J = 25°C	—	2.00	—	V
			T _J = 125°C	—	2.20	2.70	
			T _J = 150°C	—	2.30	2.80	
t _{rr}	Reverse recovery time (Note 2)		T _J = 25°C	—	0.65	—	μs
			T _J = 125°C	—	0.80	—	
			T _J = 150°C	—	0.85	—	
I _{rr}	Reverse recovery current (Note 2)		T _J = 25°C	—	720	—	A
			T _J = 125°C	—	690	—	
			T _J = 150°C	—	680	—	
Q _{rr(10%)}	Reverse recovery charge (Note 2,6)	V _{CC} = 1800V I _C = 450A V _{GE} = ±15V R _{G(on)} = 2.7Ω C _{GE} = 33nF L _s = 85nH Inductive load	T _J = 25°C	—	450	—	μC
			T _J = 125°C	—	555	—	
			T _J = 150°C	—	585	—	
Q _{rr}	Reverse recovery charge (Note 2)		T _J = 25°C	—	490	—	μC
			T _J = 125°C	—	605	—	
			T _J = 150°C	—	635	—	
E _{rec(10%)}	Reverse recovery energy per pulse (Note 2,5)		T _J = 25°C	—	0.46	—	J
			T _J = 125°C	—	0.62	—	
			T _J = 150°C	—	0.64	—	
E _{rec}	Reverse recovery energy per pulse (Note 2)		T _J = 25°C	—	0.53	—	J
			T _J = 125°C	—	0.71	—	
			T _J = 150°C	—	0.73	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
R _{th(j-c)Q}	Thermal resistance	Junction to Case, IGBT part, 1/2 module	—	—	27.5	K/kW
R _{th(j-c)D}		Junction to Case, FWDi part, 1/2 module	—	—	44.0	K/kW
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, 1/2 module λ _{grease} = 1W/m·k, D _(c-s) = 70μm	—	16.0	—	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M _t	Mounting torque	Main terminals screw M8	7.0	—	14.0	N·m
M _s		Mounting screw M6	3.0	—	6.0	N·m
M _t		Auxiliary terminals screw M3	0.4	—	0.8	N·m
m	Mass		—	0.75	—	kg
CTI	Comparative tracking index		600	—	—	—
d _a	Clearance		26.0	—	—	mm
d _s	Creepage distance		56.0	—	—	mm
L _{P-P-N}	Parasitic stray inductance		—	40.0	—	nH
R _{CC+EE'}	Internal lead resistance	T _c = 25°C, 1/2 module	—	0.59	—	mΩ

Note1. Pulse width and repetition rate should be such that junction temperature (T_J) does not exceed maximum T_{Jop} rating (150°C).

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(I_E).

Note6. The integration range of reverse recovery charge is from I_E=0A to 10%I_E

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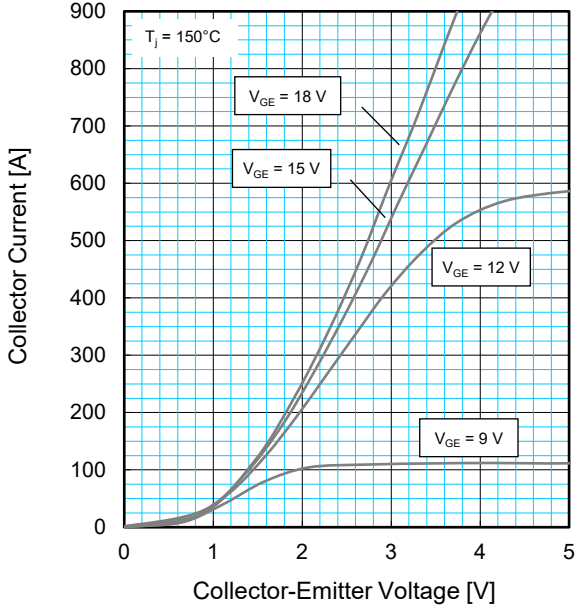
HIGH POWER SWITCHING USE

INSULATED TYPE

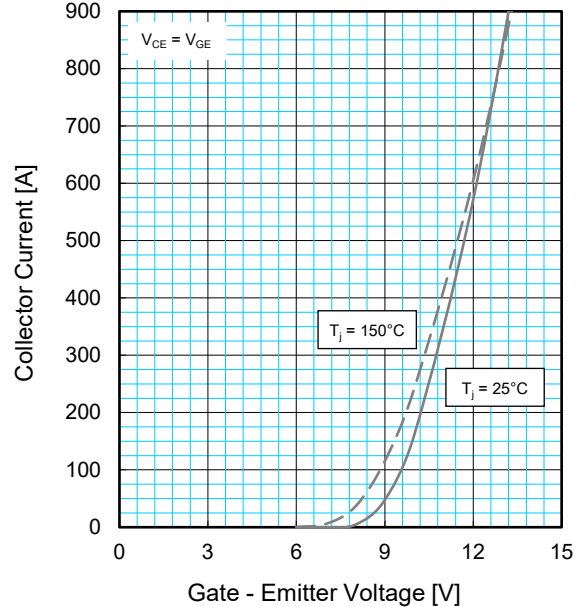
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

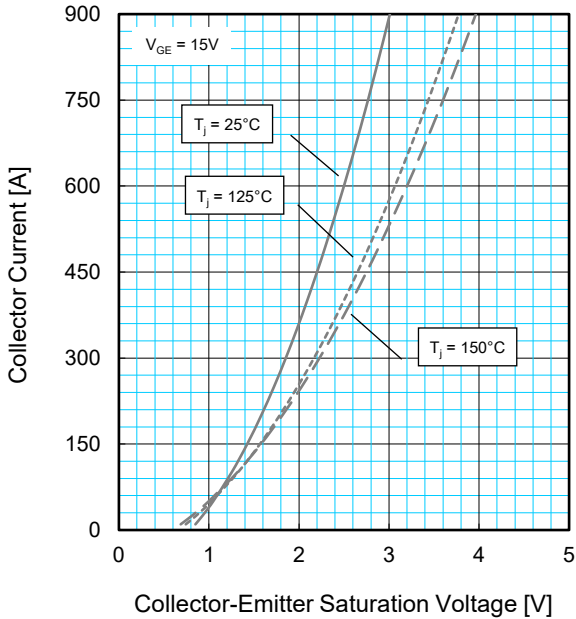
OUTPUT CHARACTERISTICS (TYPICAL)



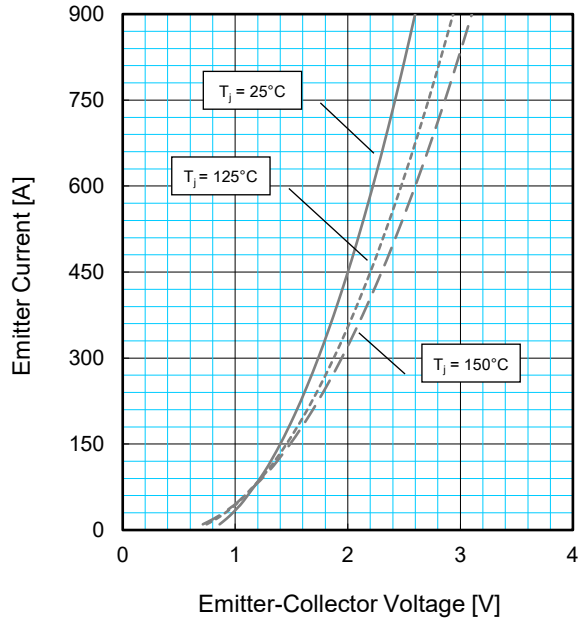
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



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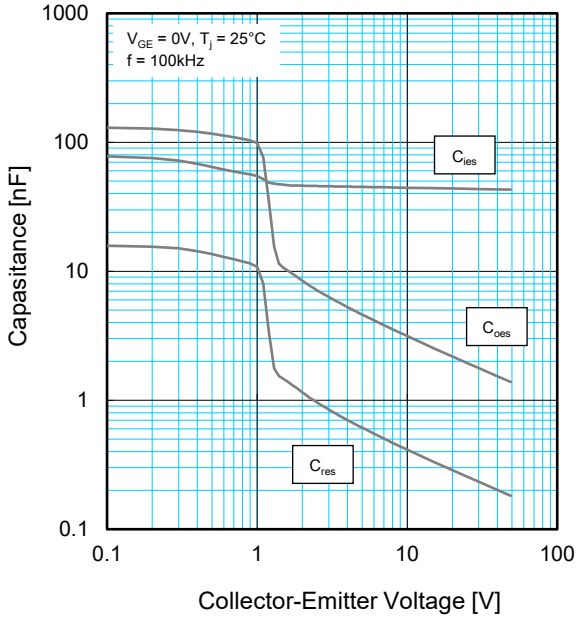
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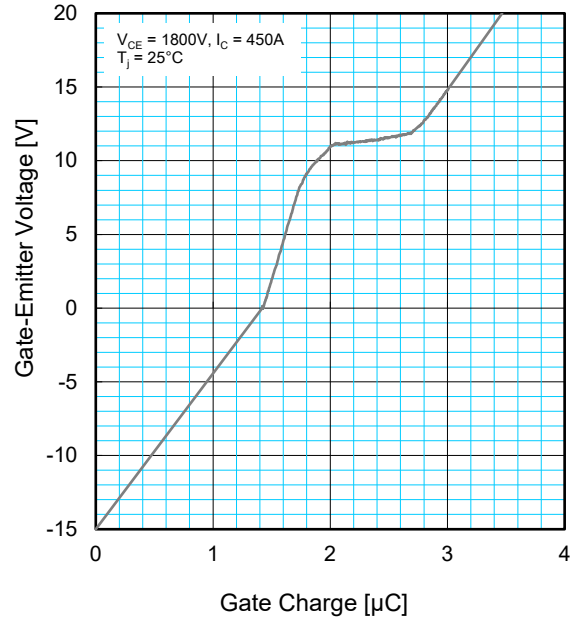
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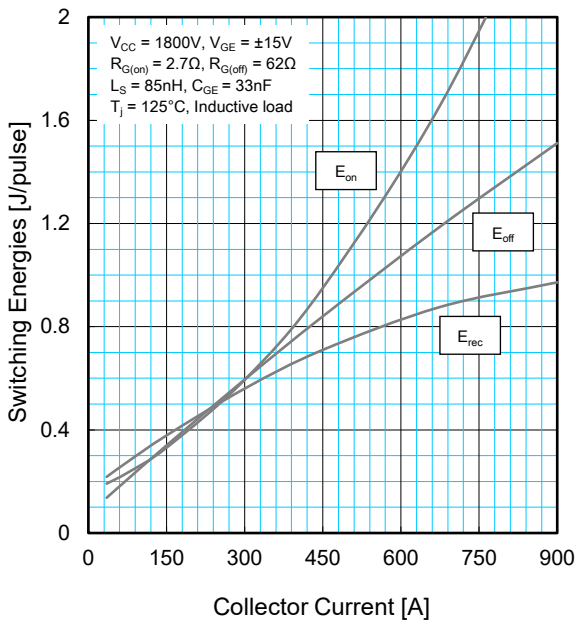
CAPACITANCE CHARACTERISTICS (TYPICAL)



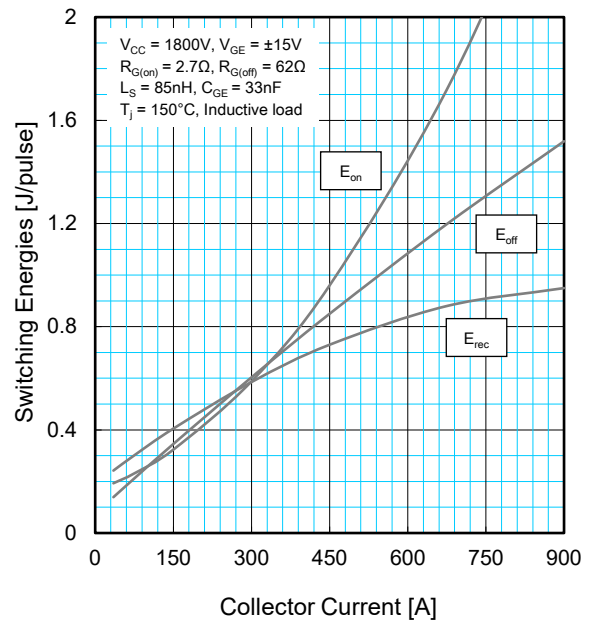
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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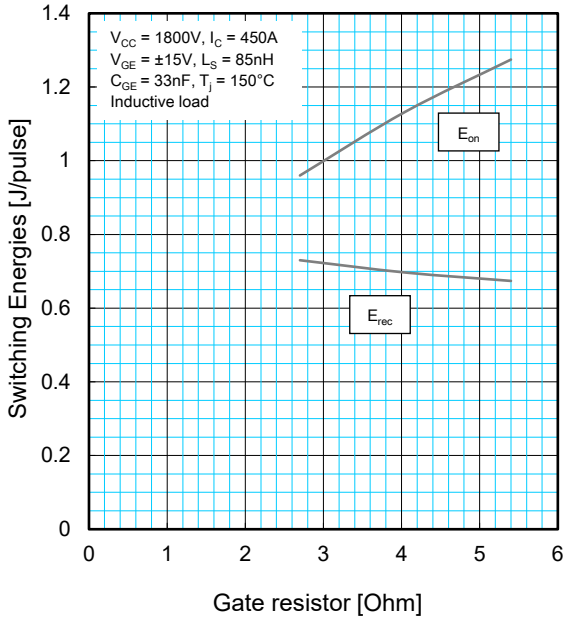
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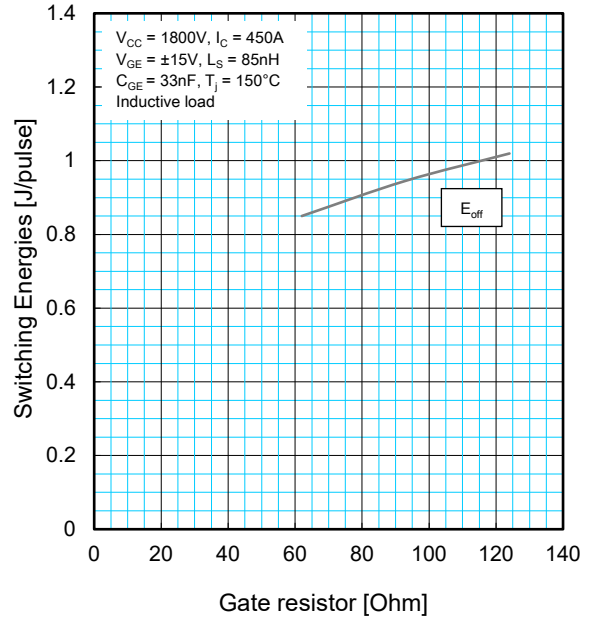
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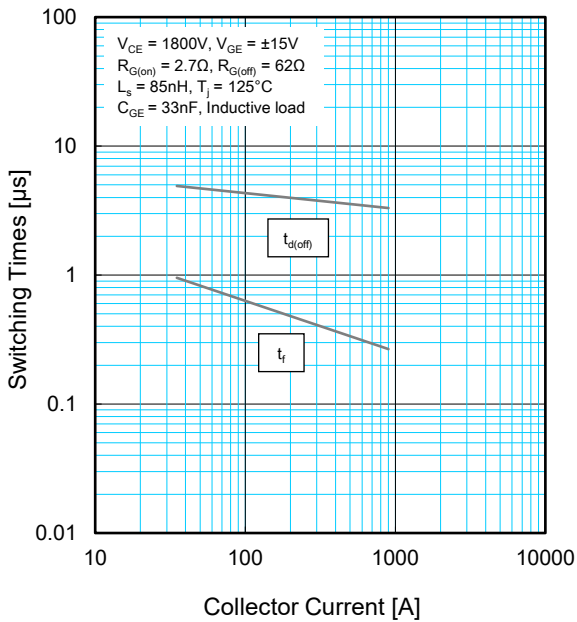
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



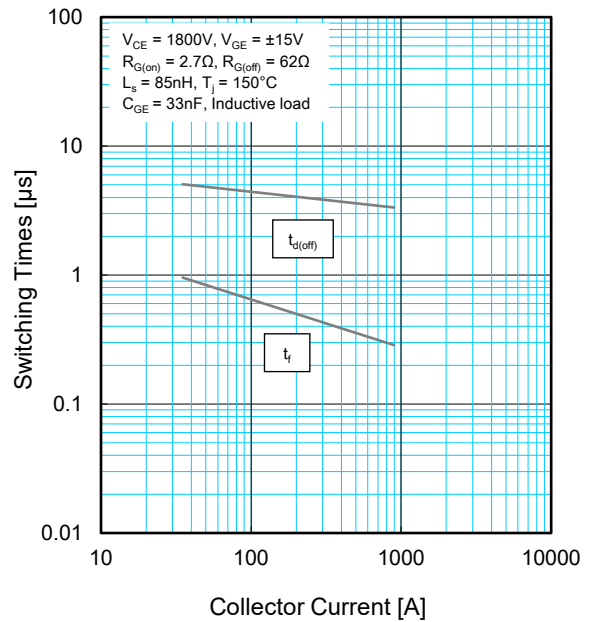
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



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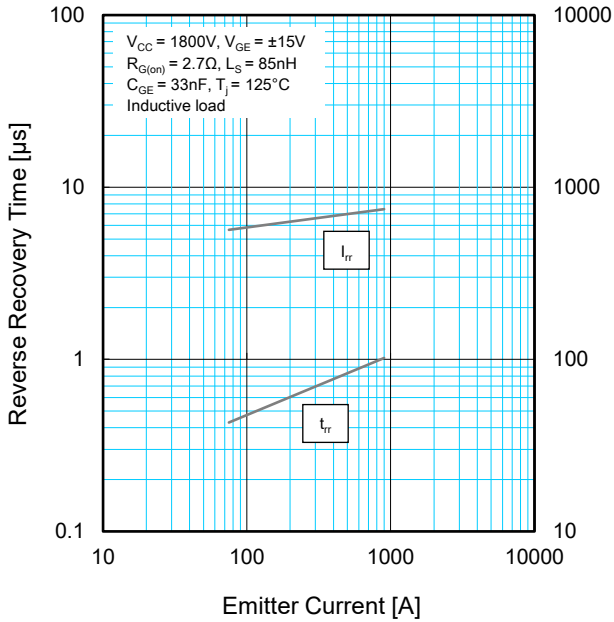
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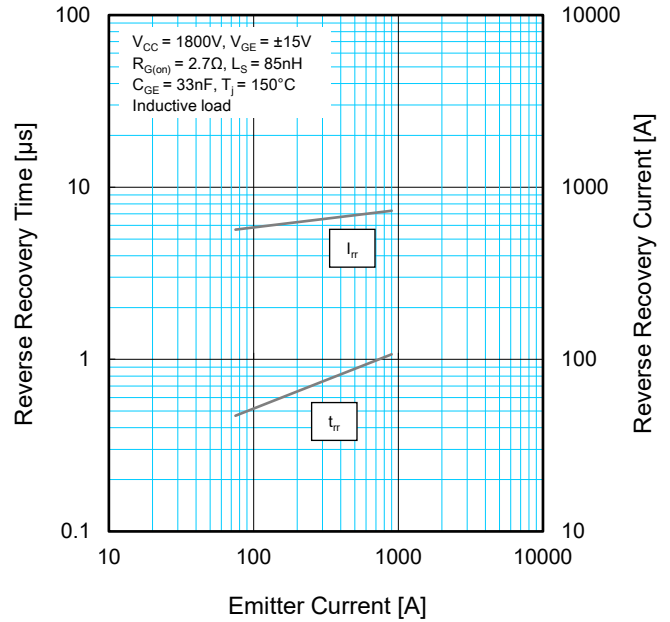
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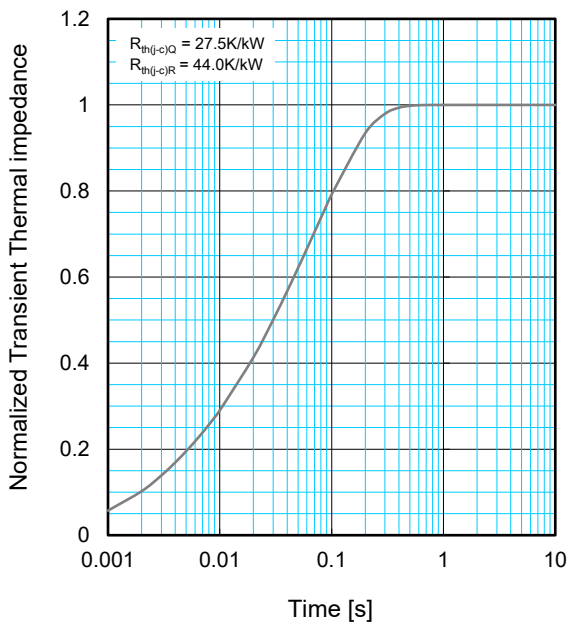
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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} :	0.0292	0.0832	0.2277	0.6599
τ _i [sec.] :	0.0025	0.0027	0.0155	0.0865

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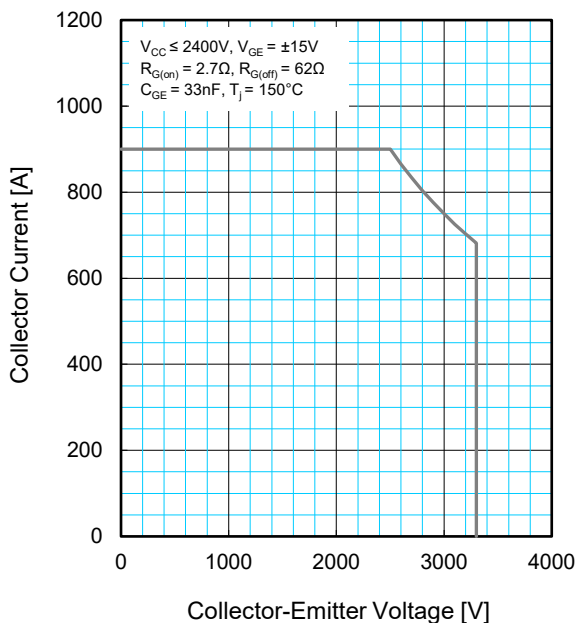
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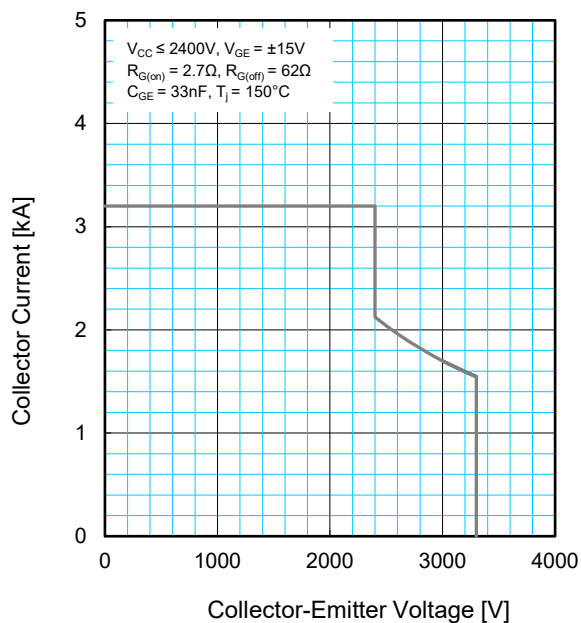
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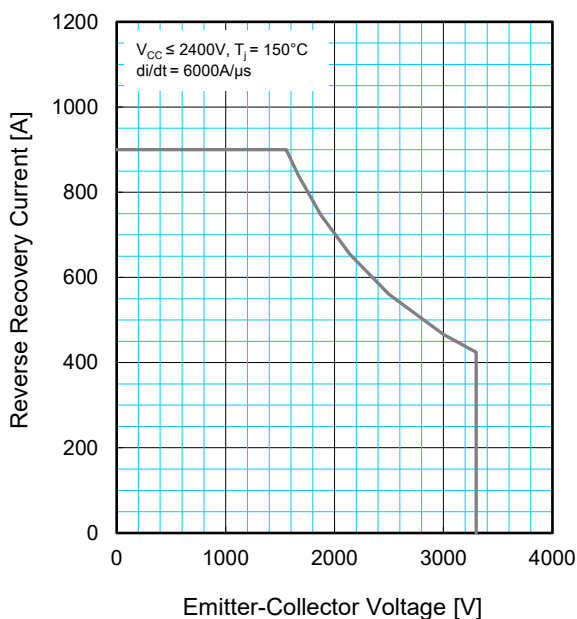
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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