

< 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



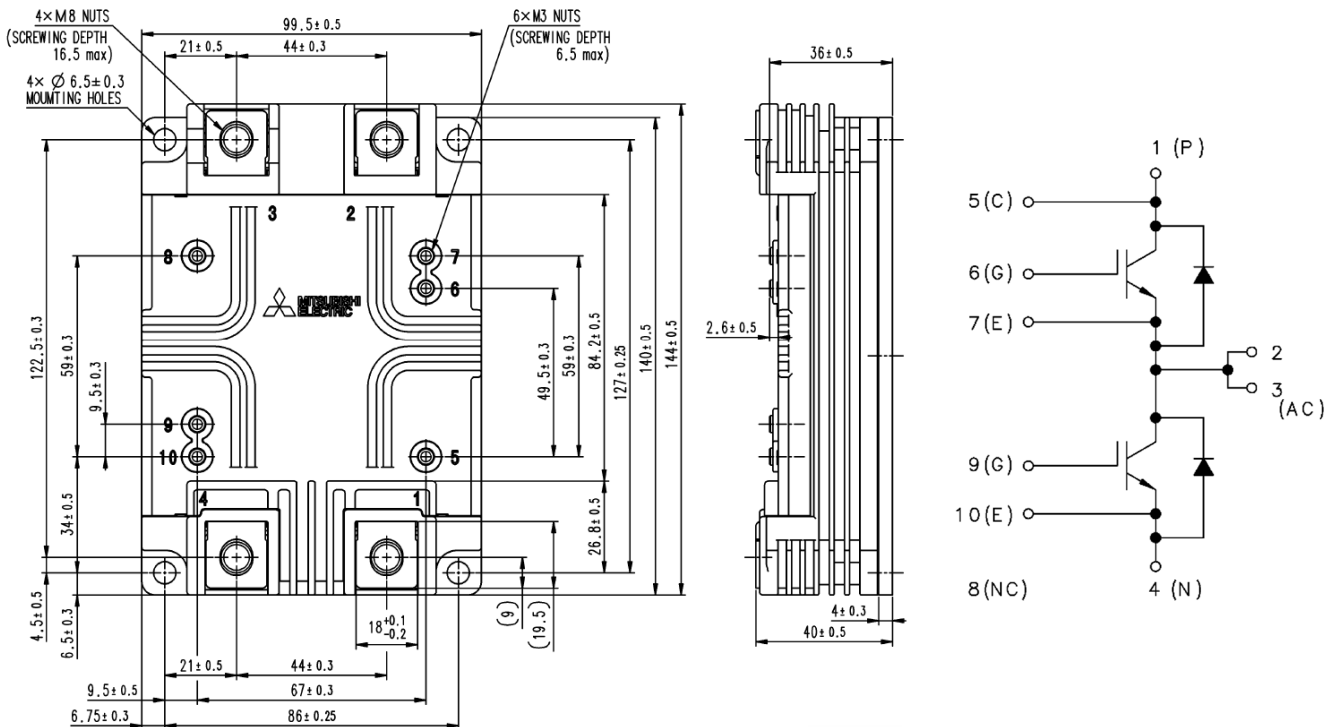
- I_C450 A
- V_{CES}3300 V
- 2-elements in a Pack
- Insulated Type (Al base type)
- CSTBT™(III) / RFC Diode

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V _{CES}	Collector-emitter voltage	V _{GE} = 0V, T _J = -50 °C	3200	V
		V _{GE} = 0V, T _J = -40...+150 °C	3300	
V _{GES}	Gate-emitter voltage	V _{CE} = 0V, T _J = 25 °C	± 20	V
I _C	Collector current	DC, T _C = 114 °C	450	A
I _{CRM}		Pulse (Note 1)	900	
I _E	Emitter current (Note 2)	DC, T _C = 98 °C	450	A
I _{ERM}		Pulse (Note 1)	900	
P _{tot}	Maximum power dissipation	T _C = 25 °C, IGBT part (Note 3)	5000	W
V _{iso}	Isolation voltage	Charged part to the base-plate RMS sinusoidal, 60 Hz 1 min., T _C = 25 °C	10200	V
Q _{PD}	Partial discharge	Charged part to the base-plate V1 = 6900 Vrms, V2 = 5100 Vrms AC 60 Hz, T _C = 25 °C (acc. to IEC 61287-1)	10	pC
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} ≤ 2400 V, V _{GE} = ±15 V R _{G(on)} = 2.7 Ω, R _{G(off)} = 62 Ω T _J = T _{Jop} , C _{GE} = 33 nF, L _S = 85 nH	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} = 10 V, I _C = 45 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	
V _{CESat}	Collector-emitter saturation voltage	I _C = 450 A V _{GE} = 15 V (Note 4)	T _J = 25 °C	—	2.20	—	V
			T _J = 125 °C	—	2.65	—	
			T _J = 150 °C	—	2.75	3.15	
C _{ies}	Input capacitance	V _{CE} = 10 V, V _{GE} = 0 V f = 100 kHz, 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} = 1800 V, I _C = 450 A V _{GE} = ±15 V, T _J = 25 °C	—	3.0	—	μC	
t _{d(on)}	Turn-on delay time	V _{CC} = 1800 V I _C = 450 A	T _J = 150 °C	—	—	1.25	μs
t _r	Rise time		T _J = 150 °C	—	—	0.50	
E _{on(10%)}	Turn-on switching energy per pulse (Note 5)	V _{GE} = ±15 V R _{G(on)} = 2.7 Ω C _{GE} = 33 nF L _S = 85 nH	T _J = 25 °C	—	0.74	—	J
			T _J = 125 °C	—	0.89	—	
			T _J = 150 °C	—	0.90	—	
			T _J = 25 °C	—	0.79	—	
E _{on}	Turn-on switching energy per pulse	Inductive load	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} = 1800 V I _C = 450 A	T _J = 25 °C	—	3.40	—	μs
			T _J = 125 °C	—	3.60	—	
			T _J = 150 °C	—	3.65	5.00	
t _f	Fall time	V _{GE} = ±15 V R _{G(off)} = 62 Ω C _{GE} = 33 nF L _S = 85 nH	T _J = 25 °C	—	0.24	—	μs
			T _J = 125 °C	—	0.35	—	
			T _J = 150 °C	—	0.37	1.00	
E _{off(10%)}	Turn-off switching energy per pulse (Note 5)	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	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 = 450 A V _{GE} = 0 V (Note 4)	T _J = 25°C	—	2.00	—	V
			T _J = 125°C	—	2.20	—	
			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} = 1800 V I _C = 450 A V _{GE} = ±15 V R _{G(on)} = 2.7 Ω C _{GE} = 33 nF L _s = 85 nH	T _J = 25°C	—	450	—	μC
			T _J = 125°C	—	555	—	
			T _J = 150°C	—	585	—	
Q _{rr}	Reverse recovery charge (Note 2)	Inductive load	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	—	—	25.0	K/kW
R _{th(j-c)D}		Junction to Case, FWDi part, 1/2 module	—	—	41.0	K/kW
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, 1/2 module λ _{grease} = 1 W/m·K, D _(c-s) = 70 μm	—	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	Between P-side terminal and N-side terminal	—	40	—	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

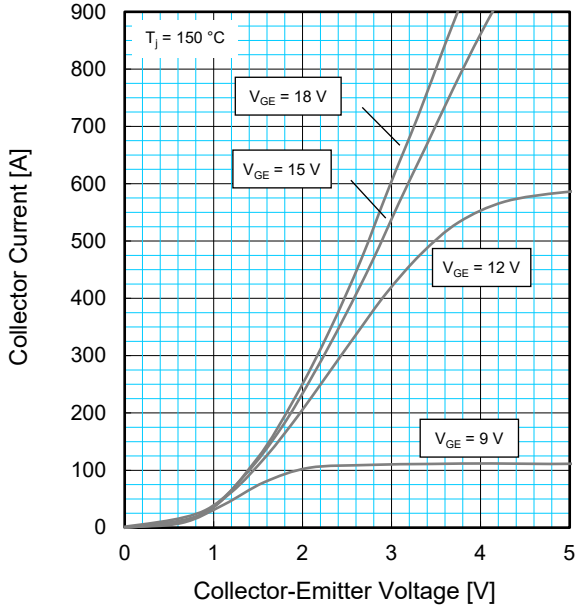
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INSULATED TYPE

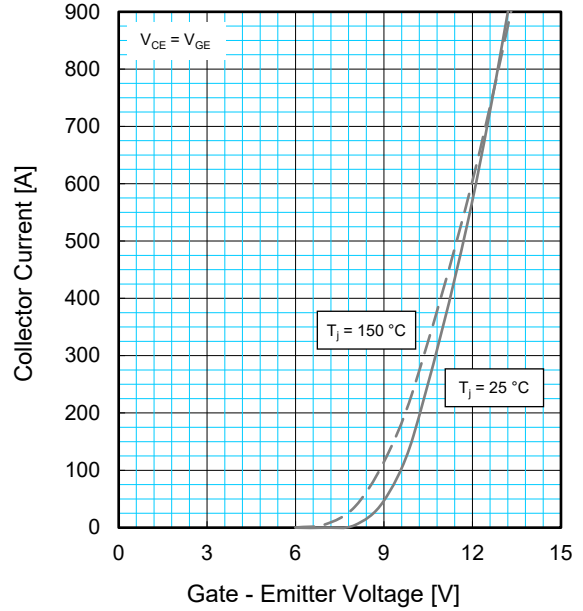
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

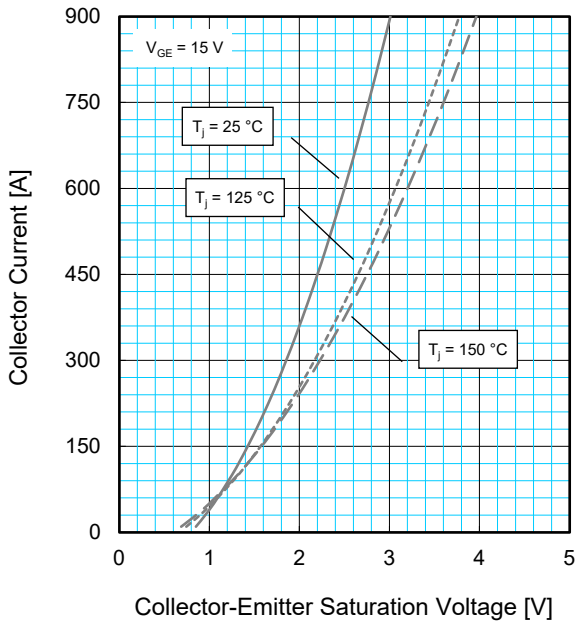
OUTPUT CHARACTERISTICS (TYPICAL)



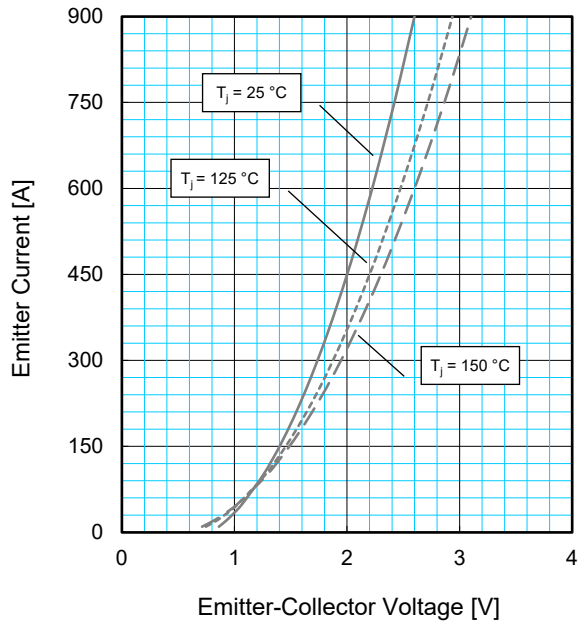
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



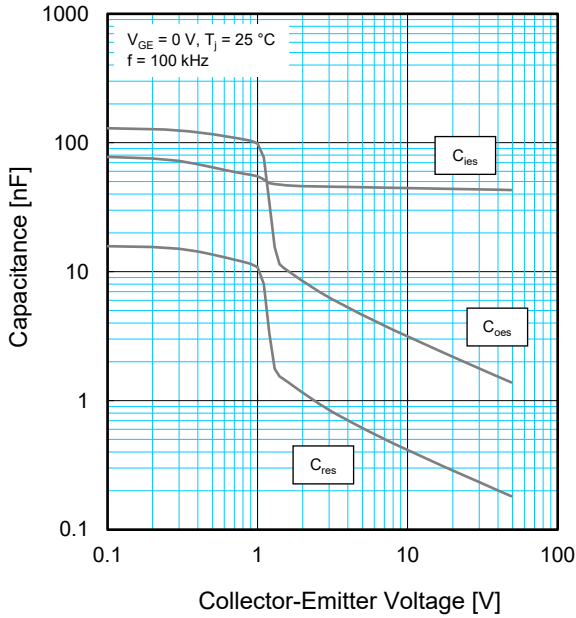
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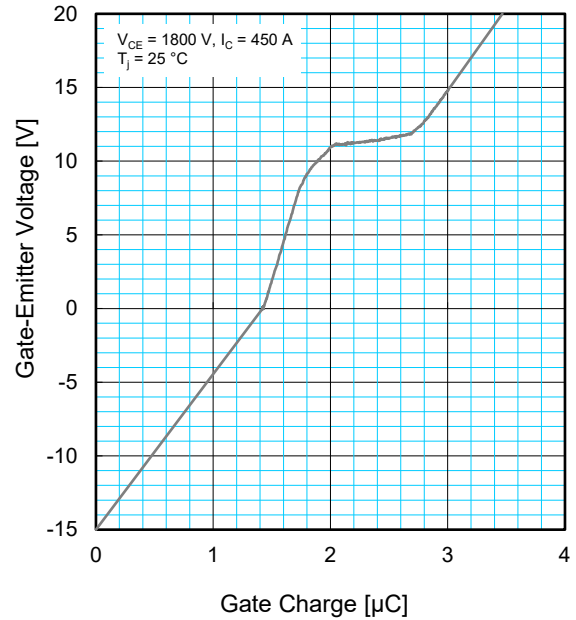
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PERFORMANCE CURVES

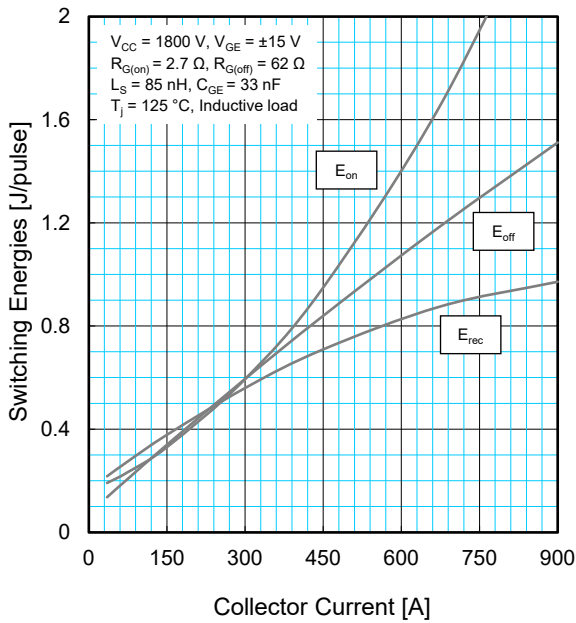
CAPACITANCE CHARACTERISTICS (TYPICAL)



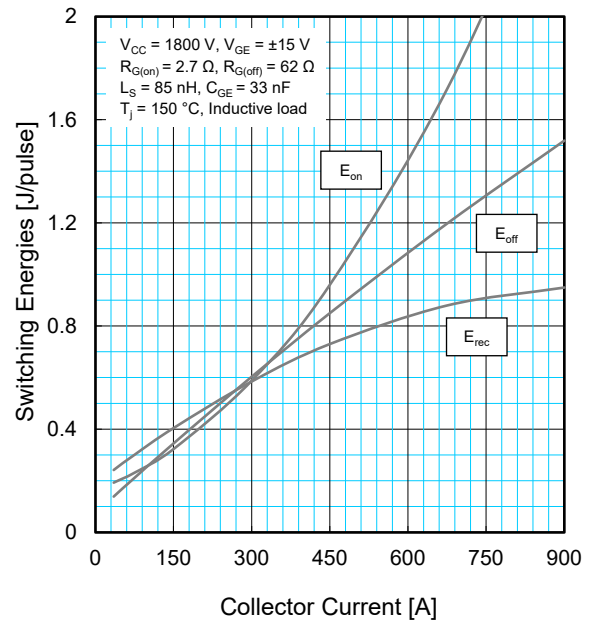
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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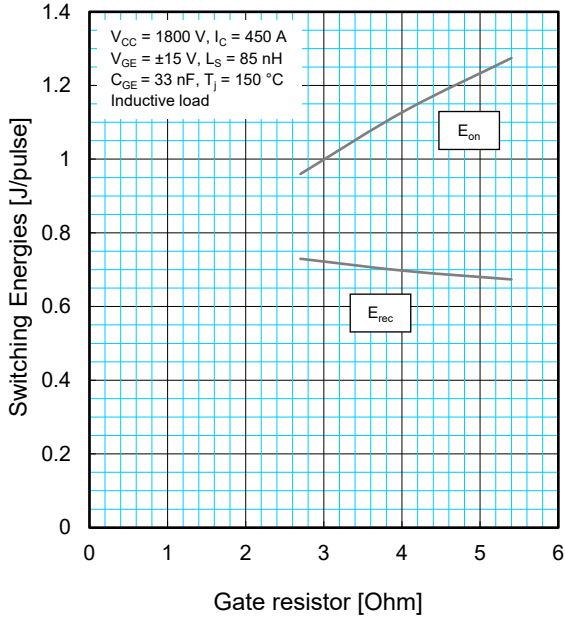
HIGH POWER SWITCHING USE

INSULATED TYPE

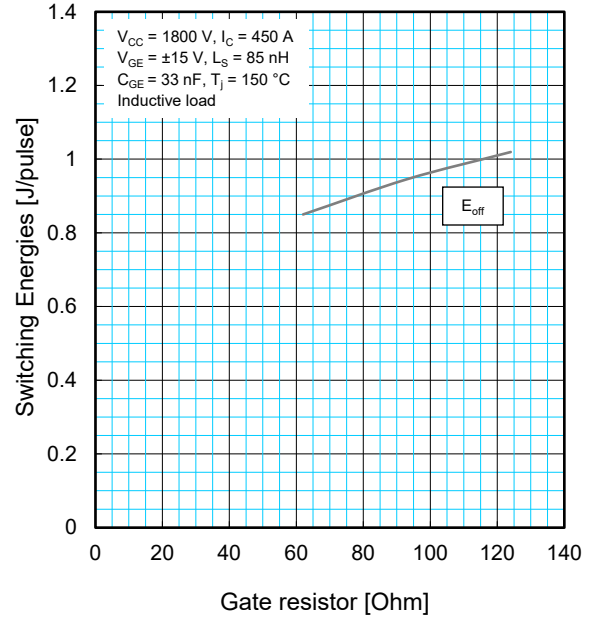
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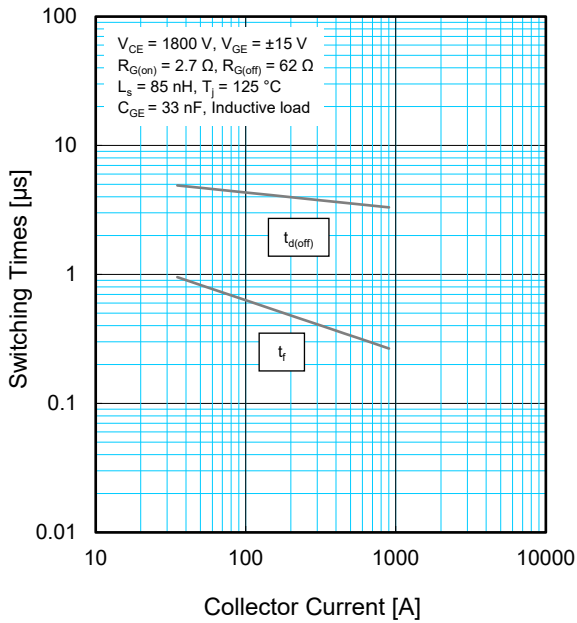
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



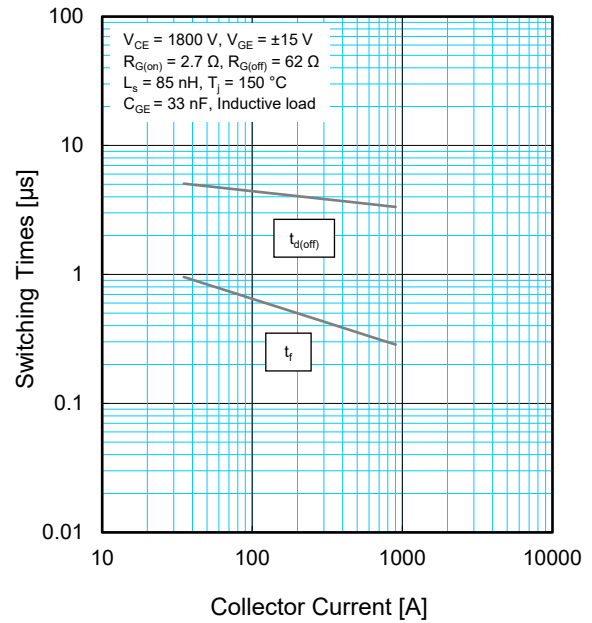
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



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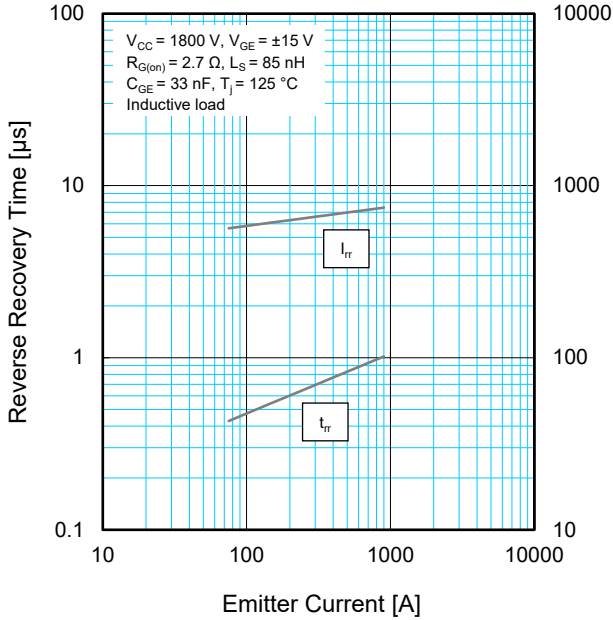
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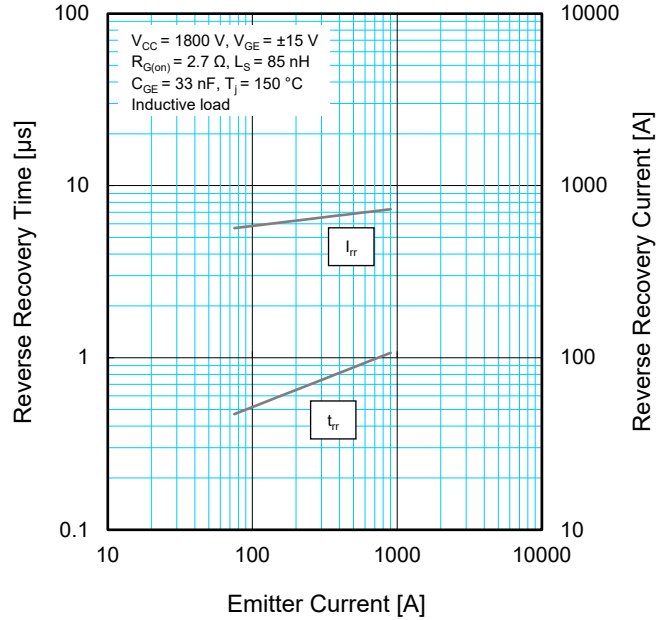
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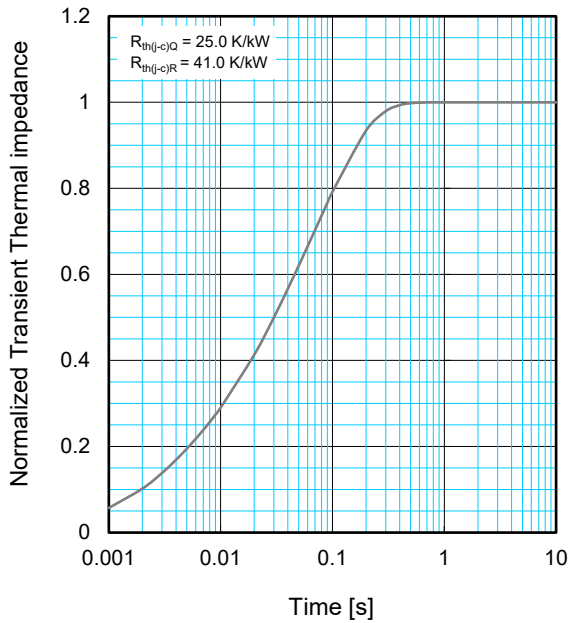
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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
$R_i / R_{th(j-c)}$	0.0292	0.0832	0.2277	0.6599
τ_i [s]	0.0025	0.0027	0.0155	0.0865

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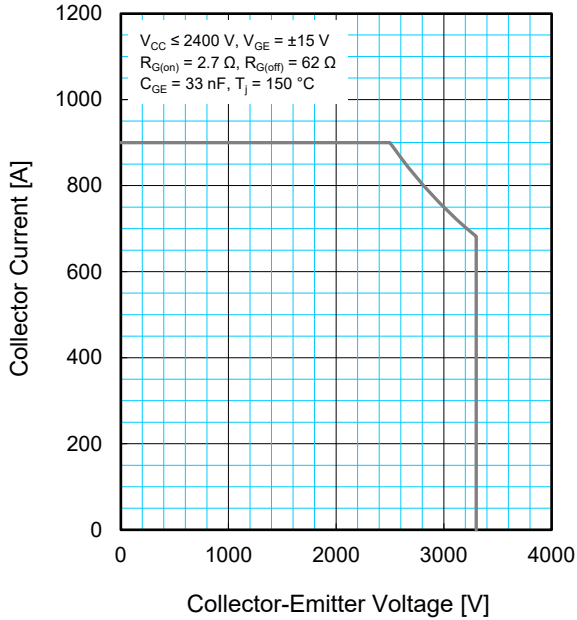
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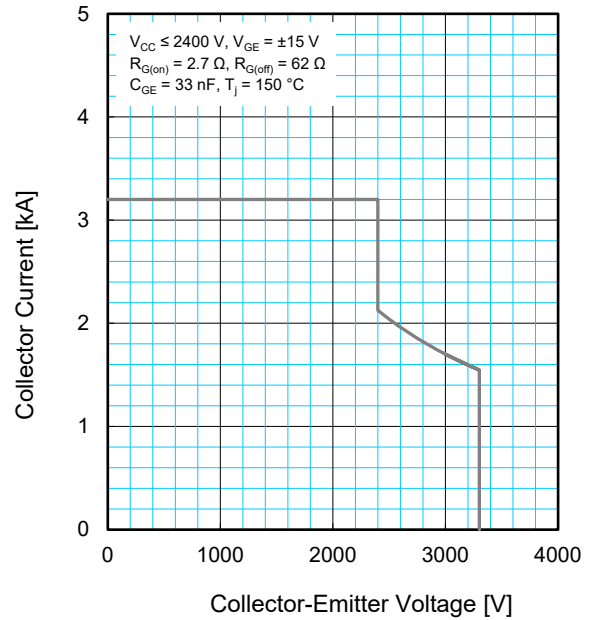
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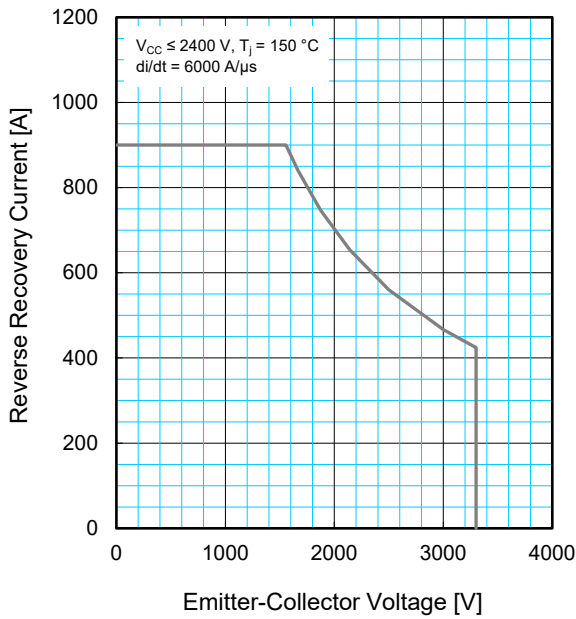
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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