

< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM450DA-66X

HIGH POWER SWITCHING USE
INSULATED TYPE

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

CM450DA-66X



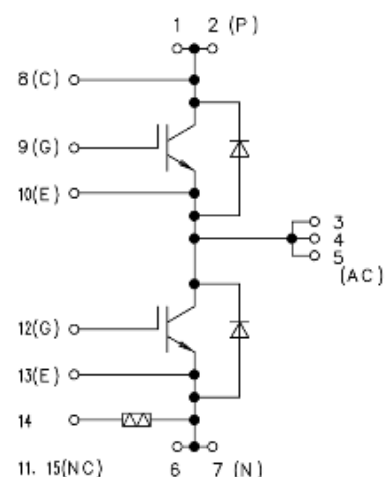
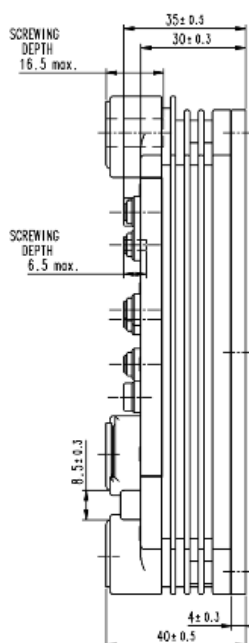
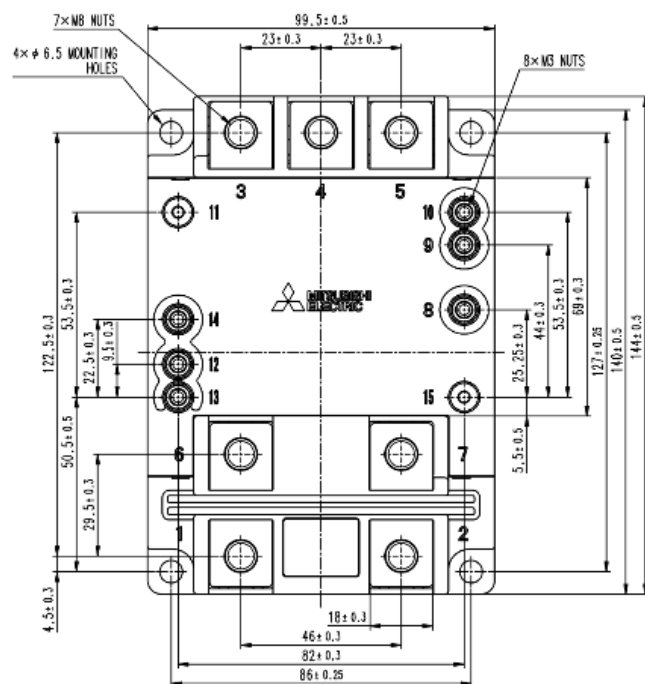
- I_C 450A
- V_{CES} 3300V
- 2-elements in a Pack
- Insulated Type
- Al baseplate
- CSTBT™(III) / RFC Diode

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	$V_{GE} = 0V, T_J = -40 \dots +150^\circ C$	3300	V
		$V_{GE} = 0V, T_J = -50^\circ C$	3200	
V_{GES}	Gate-emitter voltage	$V_{CE} = 0V, T_J = 25^\circ C$	± 20	V
I_C	Collector current	DC, $T_c = 114^\circ C$	450	A
I_{CRM}		Pulse (Note 1)	900	A
I_E	Emitter current (Note 2)	DC, $T_c = 98^\circ C$	450	A
I_{ERM}		Pulse (Note 1)	900	A
P_{tot}	Maximum power dissipation (Note 3)	$T_c = 25^\circ C$, IGBT part	5000	W
V_{iso}	Isolation voltage	RMS, sinusoidal, $f = 60Hz, t = 1 \text{ min.}, T_c = 25^\circ C$	6000	V
Q_{PD}	Partial discharge	Charged part to the baseplate $V_1 = 3500 \text{ Vrms}, V_2 = 2600 \text{ Vrms}$ AC 60 Hz, $T_c = 25^\circ C$ (acc. to IEC 61287)	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	$V_{CC} = 2400V, V_{CE} \leq V_{CES}, V_{GE} = 15V, T_J = 150^\circ C$ $R_{g(on)} = 2.7\Omega, R_{g(off)} = 62\Omega, C_{GE} = 33nF$	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} = 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} = 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		—	44.5	—	nF
C _{oes}	Output capacitance			—	3.1	—	nF
C _{res}	Reverse transfer capacitance			—	0.4	—	nF
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 = 450 A ^(Note 4) V _{GE} = 15 V	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} = 1800 V I _C = 450 A V _{GE} = ±15 V R _{G(on)} = 2.7 Ω L _s = 65nH Inductive load C _{GE} = 33nF	T _J = 125°C	—	—	1.25	μs
t _r	Rise time		T _J = 150°C	—	—	1.25	μs
			T _J = 125°C	—	—	0.50	
E _{on(10%)}	Turn-on switching energy per pulse ^(Note 5)		T _J = 150°C	—	—	0.50	J
			T _J = 25°C	—	0.57	—	
			T _J = 125°C	—	0.69	—	
E _{on}	Turn-on switching energy per pulse ^(Note 6)		T _J = 150°C	—	0.70	—	J
			T _J = 25°C	—	0.62	—	
			T _J = 125°C	—	0.74	—	
t _{d(off)}	Turn-off delay time		T _J = 150°C	—	0.75	—	μs
			T _J = 25°C	—	2.75	—	
			T _J = 125°C	—	3.10	5.00	
t _f	Fall time		T _J = 150°C	—	3.20	5.00	μs
		T _J = 25°C	—	0.23	—		
		T _J = 125°C	—	0.33	1.00		
E _{off(10%)}	Turn-off switching energy per pulse ^(Note 5)	T _J = 150°C	—	0.35	1.00	J	
		T _J = 25°C	—	0.50	—		
		T _J = 125°C	—	0.67	—		
E _{off}	Turn-off switching energy per pulse ^(Note 6)	T _J = 150°C	—	0.69	—	J	
		T _J = 25°C	—	0.57	—		
		T _J = 125°C	—	0.76	—		

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ELECTRICAL CHARACTERISTICS (continuation)

Symbol	Item	Conditions		Limits			Unit
				Min	Typ	Max	
V _{EC}	Emitter-collector voltage (Note 2)	I _E = 450 A (Note 4) V _{GE} = 0 V	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)	V _{CC} = 1800 V I _C = 450 A V _{GE} = ±15 V R _{G(on)} = 2.7Ω L _s = 65 nH Inductive load C _{GE} = 33nF	T _J = 25°C	—	0.55	—	μs
			T _J = 125°C	—	0.65	—	
			T _J = 150°C	—	0.70	—	
I _{rr}	Reverse recovery current (Note 2)		T _J = 25°C	—	920	—	A
			T _J = 125°C	—	850	—	
			T _J = 150°C	—	840	—	
Q _{rr(10%)}	Reverse recovery charge (Note 2,7)		T _J = 25°C	—	465	—	μC
			T _J = 125°C	—	555	—	
Q _{rr}	Reverse recovery charge (Note 2,6)		T _J = 150°C	—	580	—	μC
			T _J = 25°C	—	490	—	
E _{rec(10%)}	Reverse recovery energy per pulse (Note 2,5)		T _J = 125°C	—	605	—	J
			T _J = 150°C	—	635	—	
		T _J = 25°C	—	0.50	—		
E _{rec}	Reverse recovery energy per pulse (Note 2,6)	T _J = 125°C	—	0.66	—	J	
		T _J = 150°C	—	0.68	—		
		T _J = 25°C	—	0.56	—		
		T _J = 125°C	—	0.75	—		
		T _J = 150°C	—	0.77	—		

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, per 1/2 module	—	—	41.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, 1/2 module $\lambda_{grease} = 1 \text{ W/m} \cdot \text{K}$, $D_{(c-s)} = 70 \mu\text{m}$	—	16.0	—	K/kW

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NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
R_{25}	Zero-power resistance	$T_c=25^{\circ}\text{C}$	-	5.00	-	k Ω
$B_{(25/50)}$	B-constant (Note 8)	Approximate by equation	-	3375	-	K

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	Between terminals and baseplate	19.5	—	—	mm
d_s	Creepage distance	Between terminals and baseplate	32.0	—	—	mm
L_{P-P-N}	Parasitic stray inductance	Between terminal 1, 2 and terminal 6,7	—	10.0	—	nH
$R_{CC+EE'}$	Internal lead resistance	$T_c = 25^{\circ}\text{C}$, 1/2 module	—	0.46	—	m Ω
r_g	Internal gate resistance	$T_c = 25^{\circ}\text{C}$	—	1.0	—	Ω

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 (FWD).

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. The integration range of switching energies is from $10\%V_{CE}$ to $10\%I_C(10\%I_E)$.

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

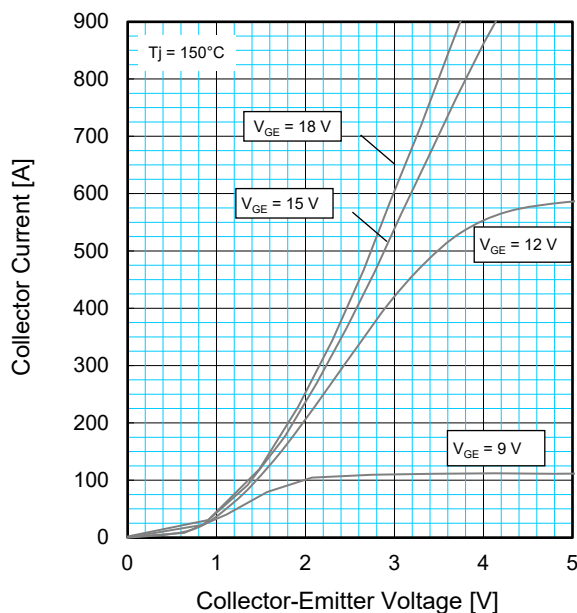
7. The integration range of reverse recovery charge is from $I_E = 0\text{A}$ to $10\%I_E$.

$$8. B_{(25/50)} = \ln \left(\frac{R_{25}}{R_{50}} \right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}} \right)$$

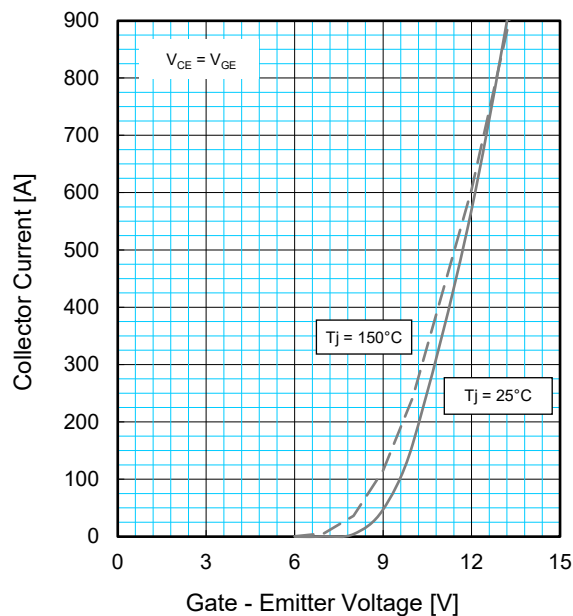
 R_{25} : resistance at absolute temperature T_{25} [K]; $T_{25} = 25[^{\circ}\text{C}] + 273.15 = 298.15[\text{K}]$ R_{50} : resistance at absolute temperature T_{50} [K]; $T_{50} = 50[^{\circ}\text{C}] + 273.15 = 323.15[\text{K}]$

PERFORMANCE CURVES

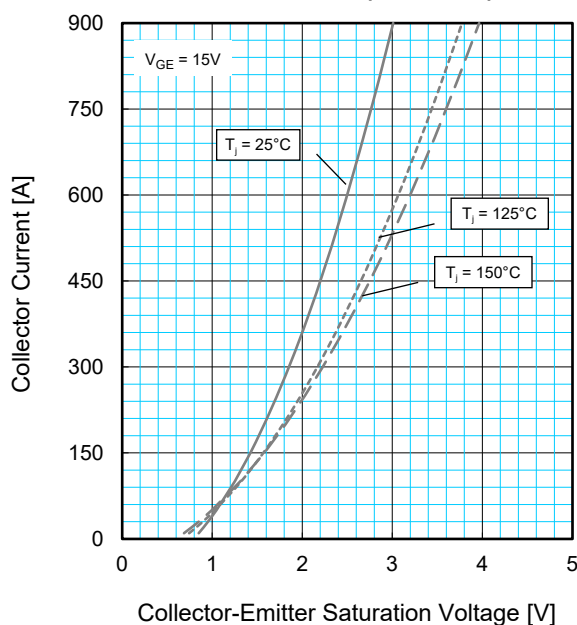
OUTPUT CHARACTERISTICS
(TYPICAL)



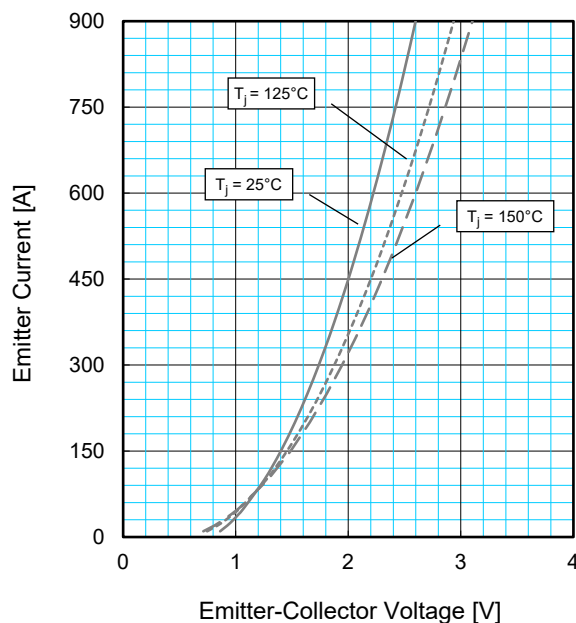
TRANSFER CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD
CHARACTERISTICS (TYPICAL)



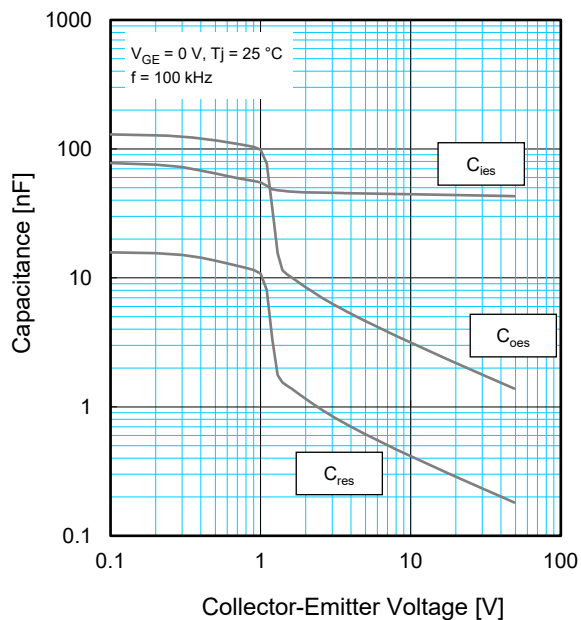
CM450DA-66X

HIGH POWER SWITCHING USE
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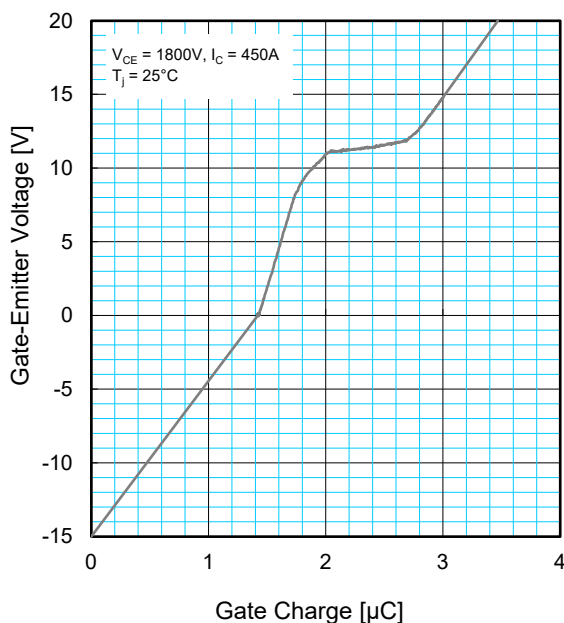
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

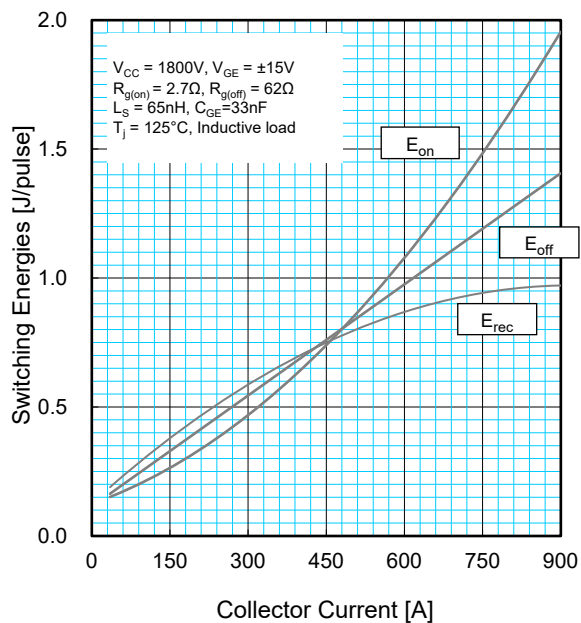
**CAPACITANCE CHARACTERISTICS
(TYPICAL)**



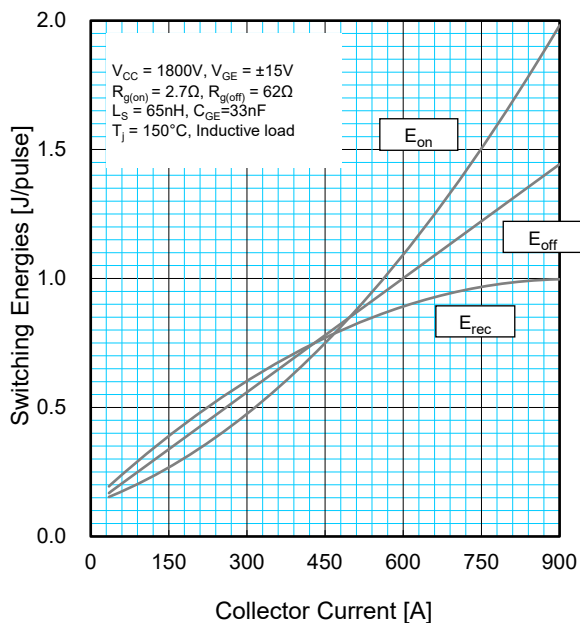
**GATE CHARGE CHARACTERISTICS
(TYPICAL)**



**HALF-BRIDGE SWITCHING ENERGY
CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING ENERGY
CHARACTERISTICS (TYPICAL)**



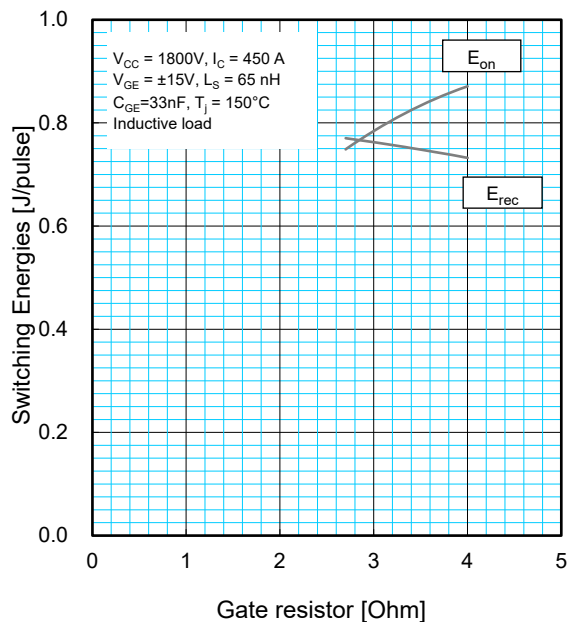
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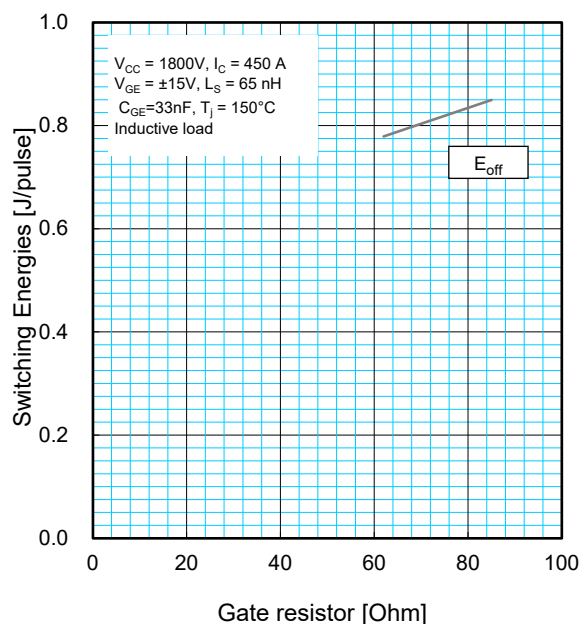
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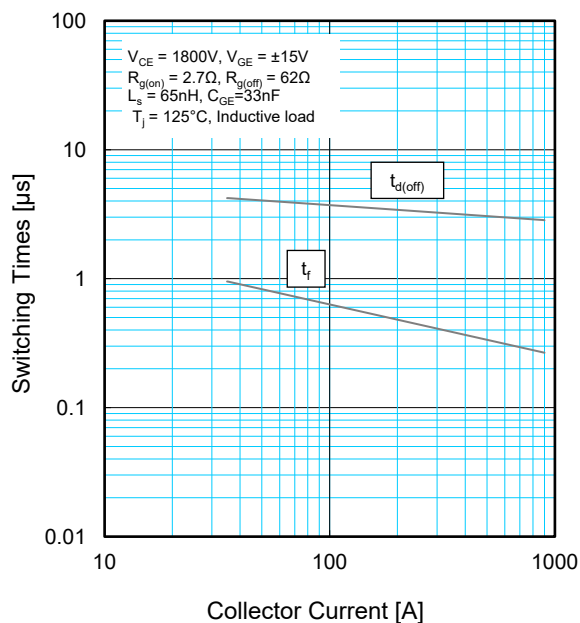
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



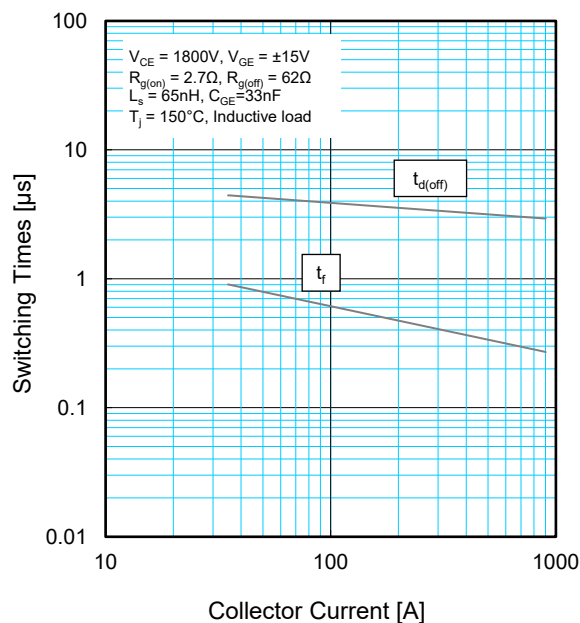
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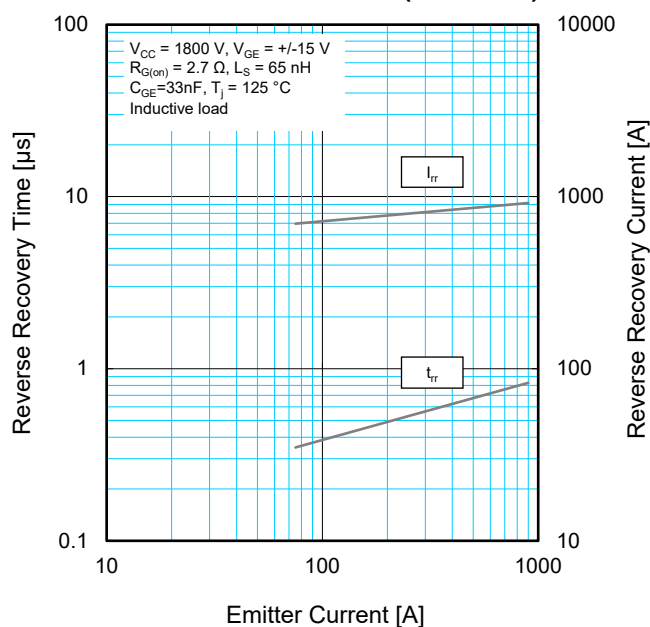
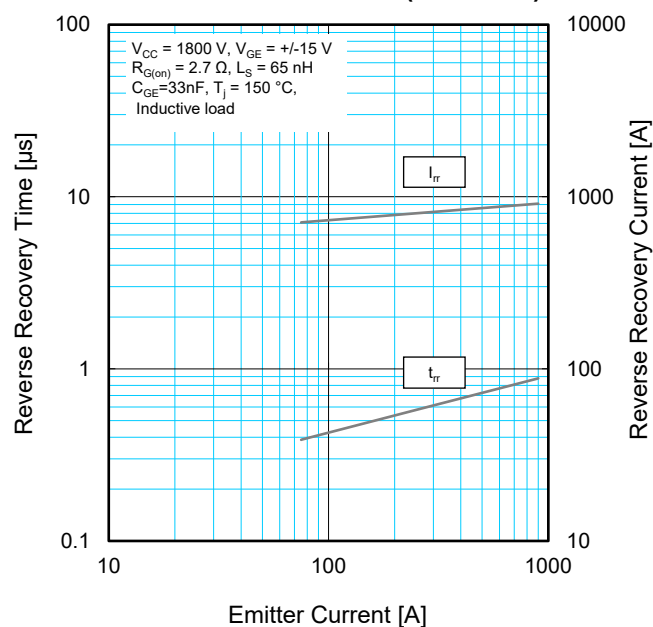
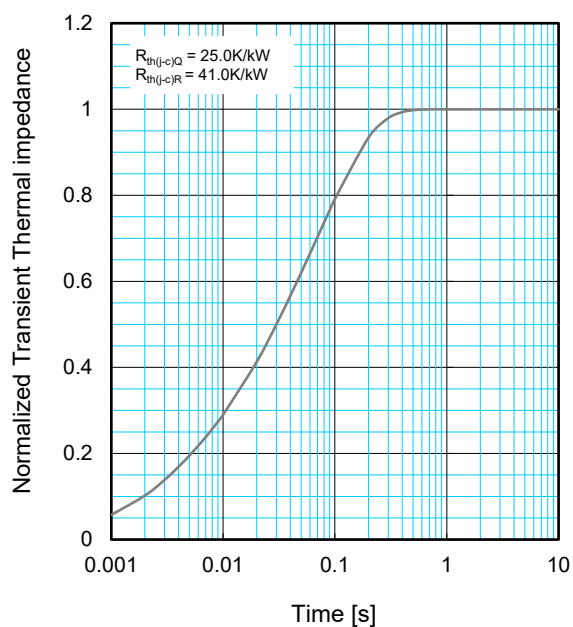


HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



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

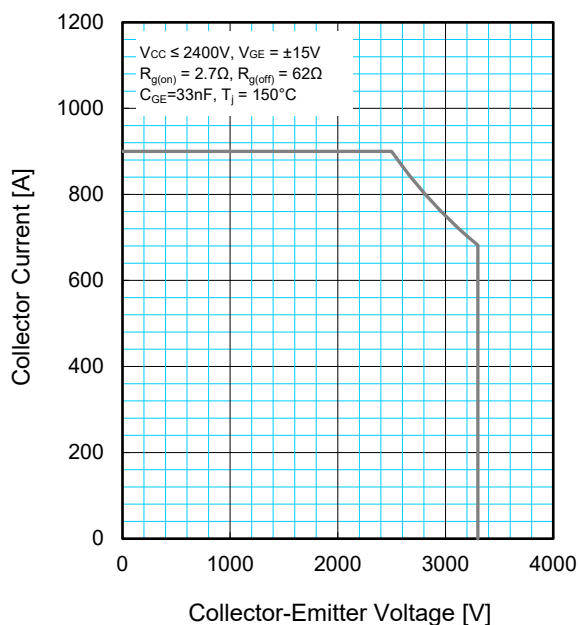
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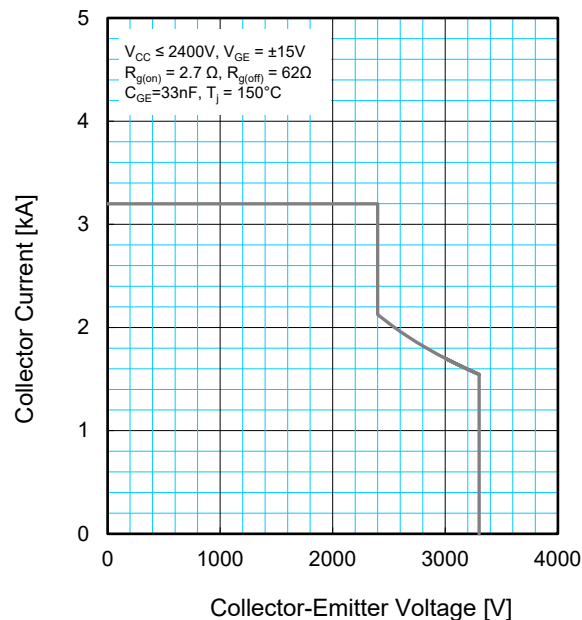
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PERFORMANCE CURVES

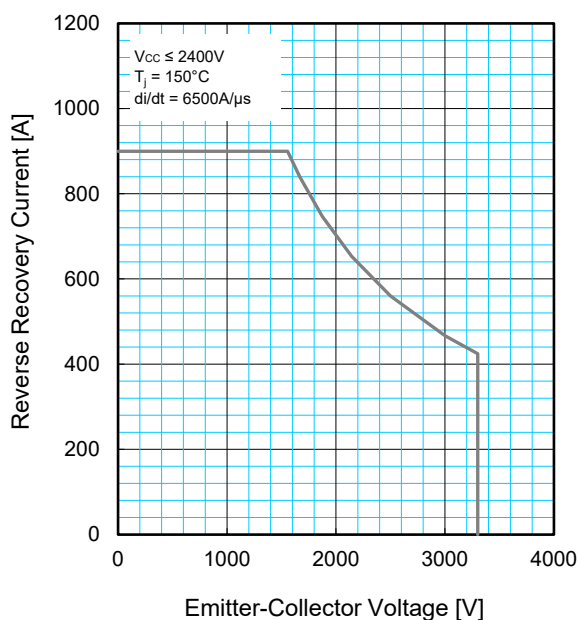
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



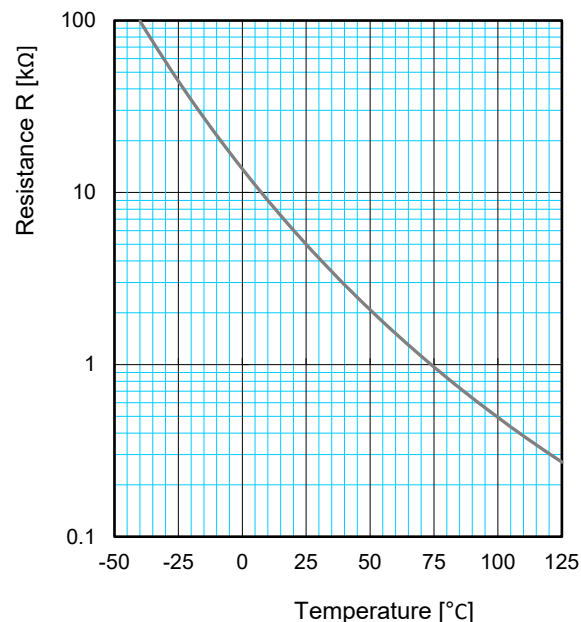
SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



NTC THERMISTOR TEMPERATURE CHARACTERISTICS (TYPICAL)



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