

< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM1200DA-34X

HIGH POWER SWITCHING USE
INSULATED TYPE

6th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

CM1200DA-34X



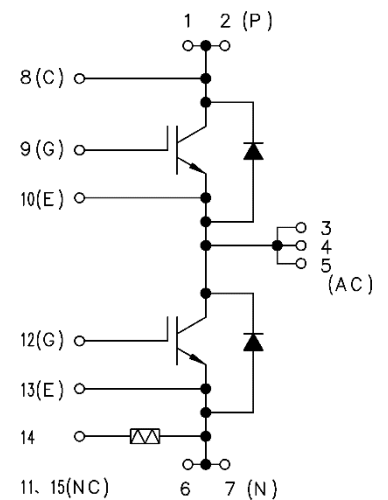
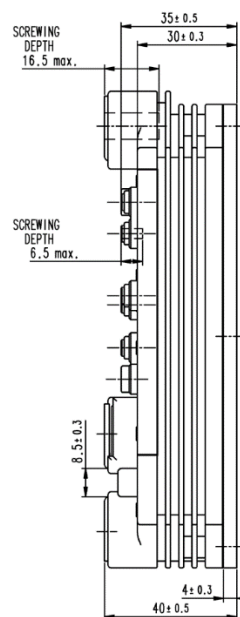
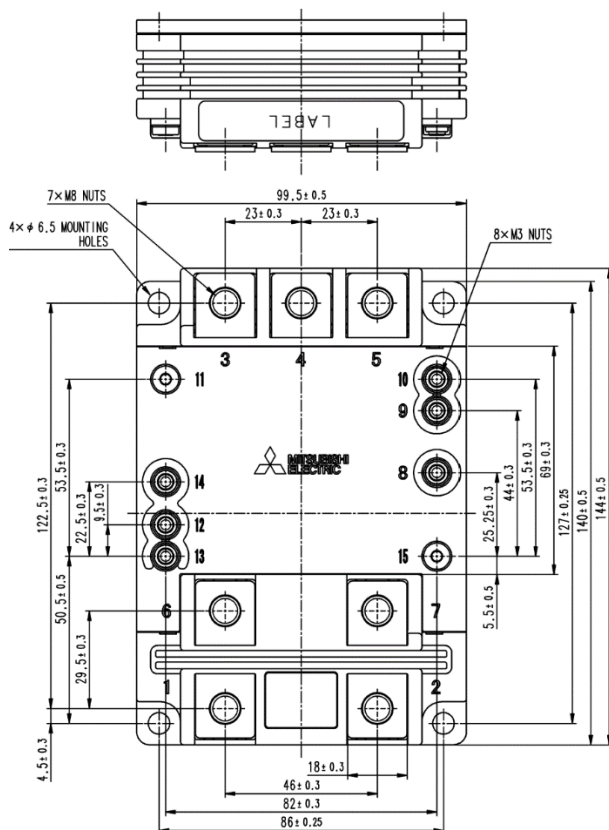
- I_C 1200A
- V_{CES} 1700V
- 2-elements in a Pack
- Insulated Type (Al base type)
- CSTBT™(III) / RFC Diode

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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CIRCUIT DIAGRAM

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CM1200DA-34X

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MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V _{CES}	Collector-emitter voltage	V _{GE} = 0V, T _j = 25...+150°C	1700	V
		V _{GE} = 0V, T _j = -50°C	1550	
V _{GES}	Gate-emitter voltage	V _{CE} = 0V, T _j = 25°C	± 20	V
I _C	Collector current	DC, T _C = 98 °C	1200	A
I _{CRM}		Pulse (Note 1)	2400	A
I _E	Emitter current (Note 2)	DC, T _C = 70 °C	1200	A
I _{ERM}		Pulse (Note 1)	2400	A
P _{tot}	Maximum power dissipation (Note 3)	T _C = 25°C, IGBT part	7200	W
V _{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1 min., T _C = 25°C	6000	V
V _e	Partial discharge extinction voltage	RMS, sinusoidal, f = 60Hz, Q _{PD} ≤ 10 pC, T _C = 25°C	2600	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} = 1200V, V _{CE} ≤ V _{CES} , V _{GE} = 15V, T _j = 150°C R _{G(on)} = 1.1Ω, R _{G(off)} = 6.8Ω, C _{GE} = 33nF	6.5	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	—	—	4.0	mA
			T _j = 125°C	—	1.5	—	
			T _j = 150°C	—	9.0	—	
V _{GE(th)}	Gate-emitter threshold voltage	V _{CE} = 10 V, I _C = 120 mA, T _j = 25°C	5.5	6.0	6.5	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	—	330	—	nF	
C _{oes}	Output capacitance		—	7.2	—	nF	
C _{res}	Reverse transfer capacitance		—	2.9	—	nF	
Q _G	Total gate charge	V _{CC} = 900V, I _C = 1200A, V _{GE} = ±15V	—	20.5	—	μC	
V _{CEsat}	Collector-emitter saturation voltage	I _C = 1200 A (Note 4) V _{GE} = 15 V	T _j = 25°C	—	1.80	—	V
			T _j = 125°C	—	2.15	—	
			T _j = 150°C	—	2.20	2.60	
t _{d(on)}	Turn-on delay time	V _{CC} = 900 V I _C = 1200 A V _{GE} = ±15 V R _{G(on)} = 1.1 Ω L _s = 40nH	T _j = 150°C	—	—	1.30	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	—	0.27	—	J
		T _j = 125°C	—	0.38	—		
		T _j = 150°C	—	0.40	—		
E _{on}	Turn-on switching energy per pulse (Note 6)	Inductive load C _{GE} = 33nF	T _j = 25°C	—	0.30	—	J
			T _j = 125°C	—	0.40	—	
			T _j = 150°C	—	0.43	—	
t _{d(off)}	Turn-off delay time	V _{CC} = 900 V I _C = 1200 A V _{GE} = ±15 V R _{G(off)} = 6.8Ω L _s = 40nH Inductive load C _{GE} = 33nF	T _j = 25°C	—	3.10	—	μs
			T _j = 125°C	—	3.20	—	
			T _j = 150°C	—	3.25	5.00	
t _f	Fall time	V _{CC} = 900 V I _C = 1200 A V _{GE} = ±15 V R _{G(off)} = 6.8Ω L _s = 40nH Inductive load C _{GE} = 33nF	T _j = 25°C	—	0.16	—	μs
			T _j = 125°C	—	0.19	—	
			T _j = 150°C	—	0.20	0.50	
E _{off(10%)}	Turn-off switching energy per pulse (Note 5)	Inductive load C _{GE} = 33nF	T _j = 25°C	—	0.30	—	J
			T _j = 125°C	—	0.36	—	
			T _j = 150°C	—	0.39	—	
E _{off}	Turn-off switching energy per pulse (Note 6)	Inductive load C _{GE} = 33nF	T _j = 25°C	—	0.36	—	J
			T _j = 125°C	—	0.48	—	
			T _j = 150°C	—	0.49	—	

CM1200DA-34X

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ELECTRICAL CHARACTERISTICS (continuation)

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
V_{EC}	Emitter-collector voltage (Note 2)	$I_E = 1200\text{ A}$ (Note 4) $V_{GE} = 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	1.80	—	V
			$T_j = 125^\circ\text{C}$	—	1.90	—	
			$T_j = 150^\circ\text{C}$	—	1.90	2.40	
t_{rr}	Reverse recovery time (Note 2)		$T_j = 25^\circ\text{C}$	—	0.35	—	μs
			$T_j = 125^\circ\text{C}$	—	0.50	—	
			$T_j = 150^\circ\text{C}$	—	0.53	—	
I_{rr}	Reverse recovery current (Note 2)		$T_j = 25^\circ\text{C}$	—	830	—	A
			$T_j = 125^\circ\text{C}$	—	860	—	
			$T_j = 150^\circ\text{C}$	—	880	—	
$Q_{rr(10\%)}$	Reverse recovery charge (Note 2) (Note 7)	$V_{CC} = 900\text{ V}$ $I_C = 1200\text{ A}$ $V_{GE} = \pm 15\text{ V}$	$T_j = 25^\circ\text{C}$	—	195	—	μC
			$T_j = 125^\circ\text{C}$	—	310	—	
			$T_j = 150^\circ\text{C}$	—	335	—	
Q_{rr}	Reverse recovery charge (Note 2) (Note 6)	$R_{G(on)} = 1.1\Omega$ $L_s = 40\text{ nH}$ Inductive load $C_{GE} = 33\text{ nF}$	$T_j = 25^\circ\text{C}$	—	205	—	μC
			$T_j = 125^\circ\text{C}$	—	320	—	
			$T_j = 150^\circ\text{C}$	—	350	—	
$E_{rec(10\%)}$	Reverse recovery energy per pulse (Note 2) (Note 5)		$T_j = 25^\circ\text{C}$	—	0.13	—	J
			$T_j = 125^\circ\text{C}$	—	0.17	—	
			$T_j = 150^\circ\text{C}$	—	0.18	—	
E_{rec}	Reverse recovery energy per pulse (Note 2) (Note 6)		$T_j = 25^\circ\text{C}$	—	0.13	—	J
			$T_j = 125^\circ\text{C}$	—	0.21	—	
			$T_j = 150^\circ\text{C}$	—	0.22	—	

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	—	—	16.5	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part, per 1/2 module	—	—	27.0	
$R_{th(c-s)}$	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

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

CM1200DA-34X

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MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M _i	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	—	1.0	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 °C, 1/2 module	—	0.41	—	mΩ

Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jpmax} rating.

Note 2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD_i).

Note 3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).

Note 4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

Note 5. The integration range of switching energies is from 10%V_{CE} to 10%I_C(10%I_E).

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

Note 7. The integration range of reverse recovery charge is from I_E = 0A to 10%I_E.

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

R₂₅: resistance at 25°C

R₅₀: resistance at 50°C

T₂₅ [K]; T₂₅ = 25[°C] + 273.15 = 298.15[K]

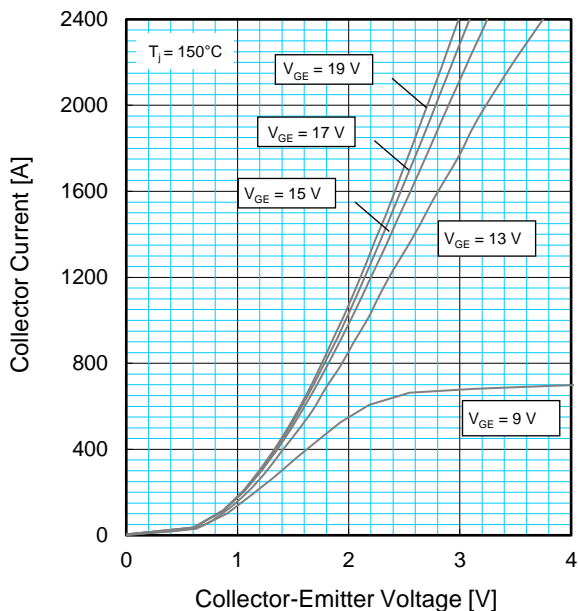
T₅₀ [K]; T₅₀ = 50[°C] + 273.15 = 323.15[K]

CM1200DA-34X

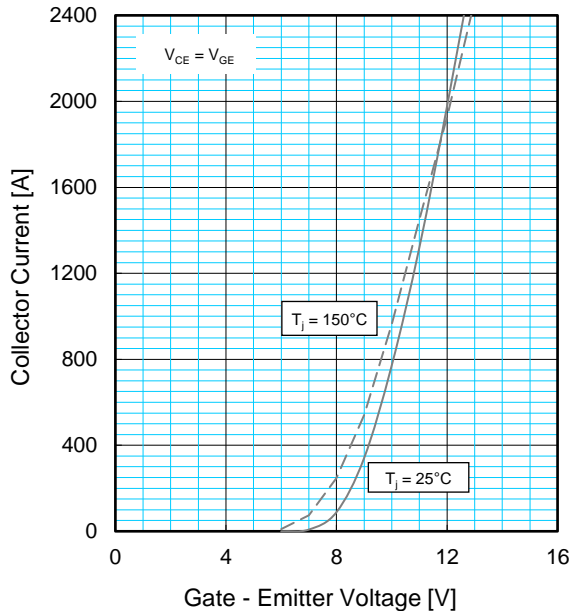
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

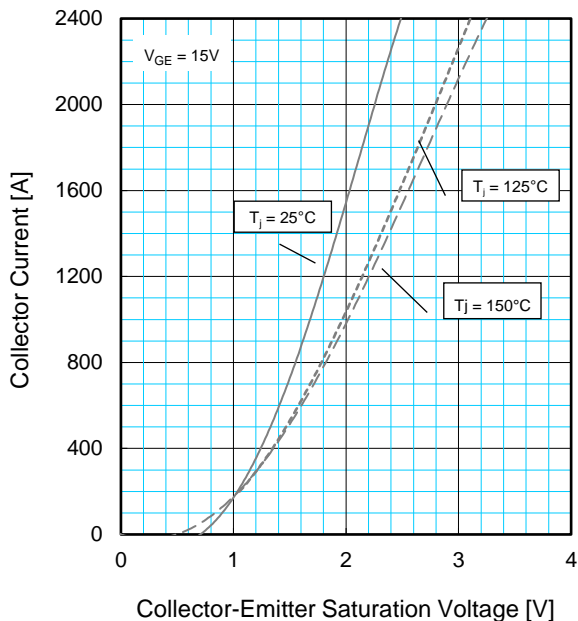
OUTPUT CHARACTERISTICS (TYPICAL)



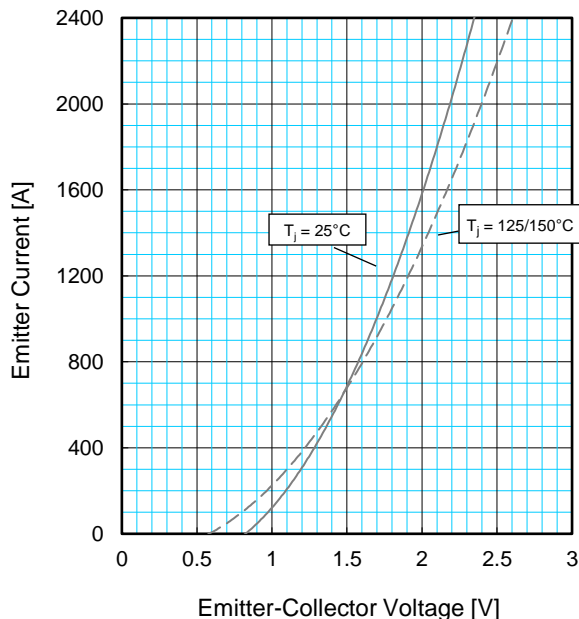
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



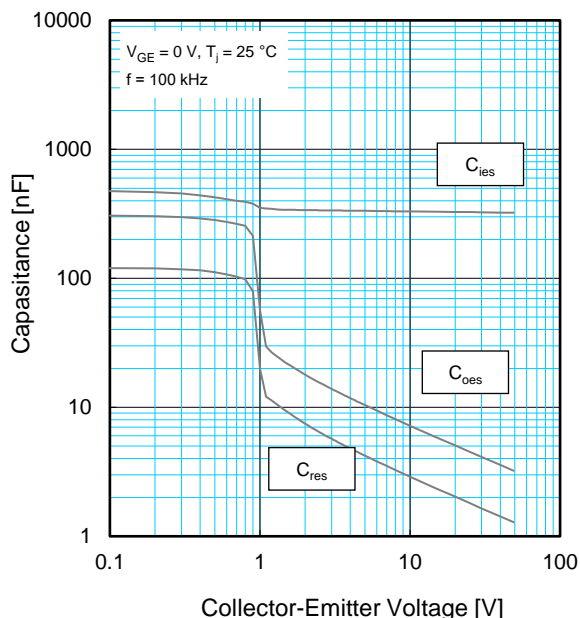
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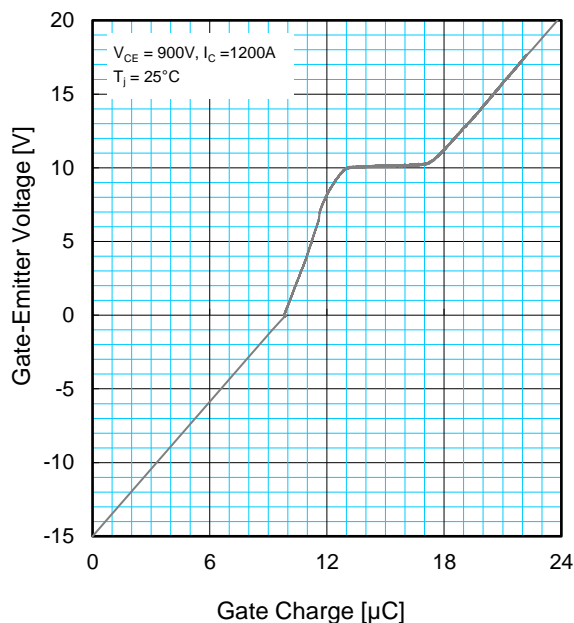
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PERFORMANCE CURVES

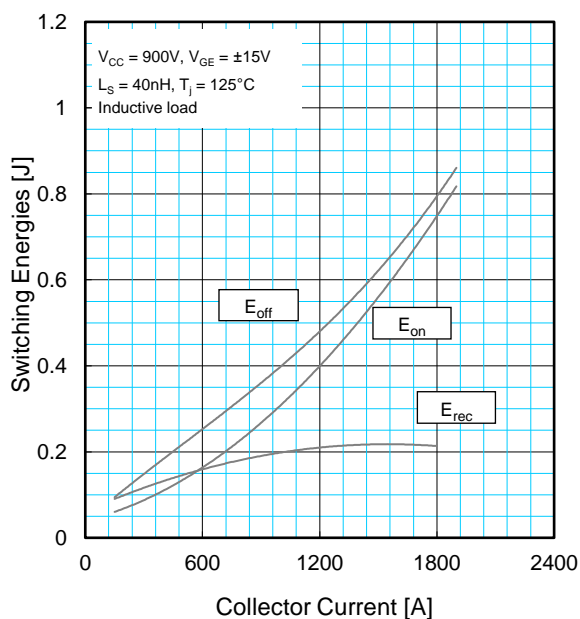
CAPACITANCE CHARACTERISTICS (TYPICAL)



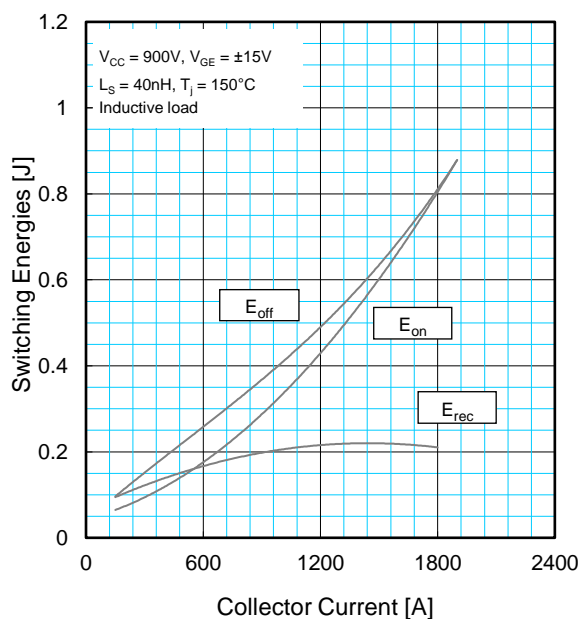
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



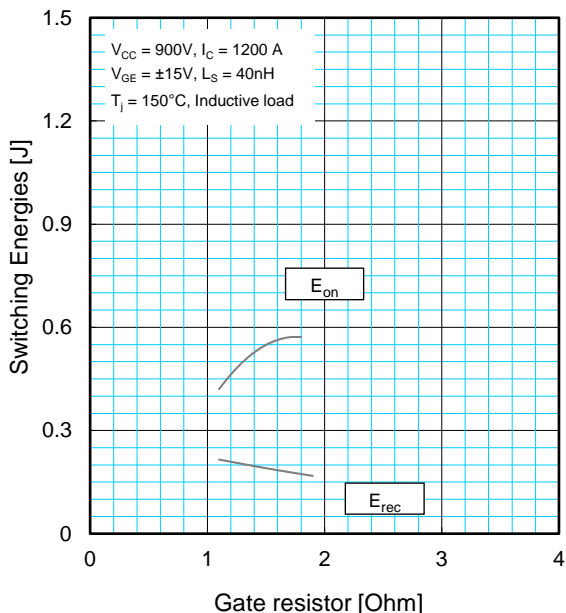
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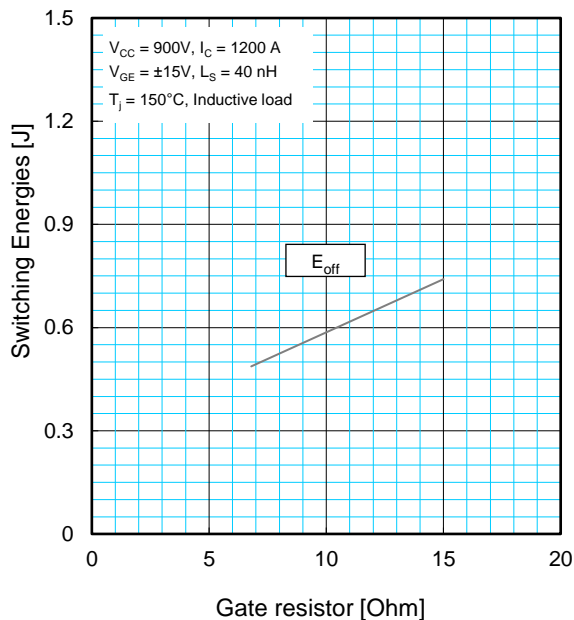
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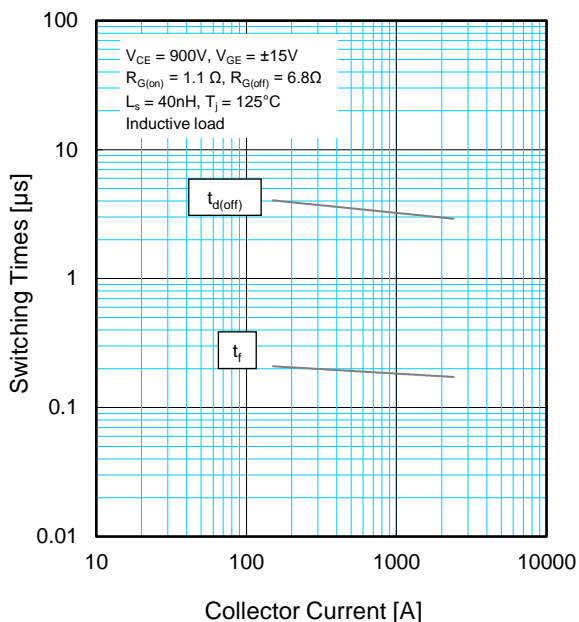
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



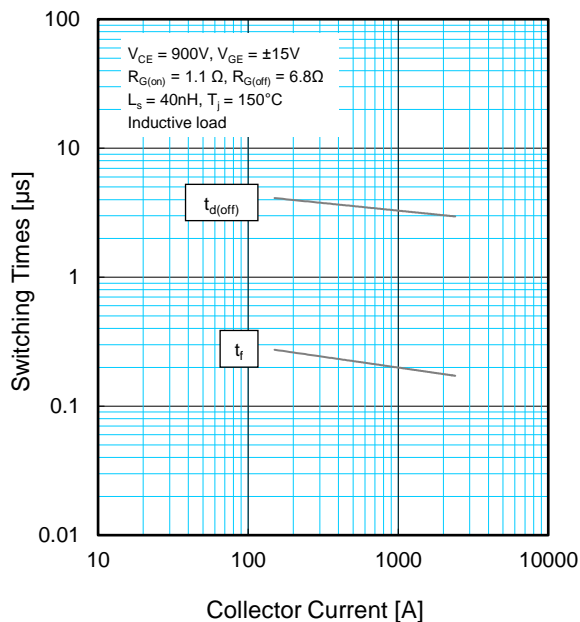
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



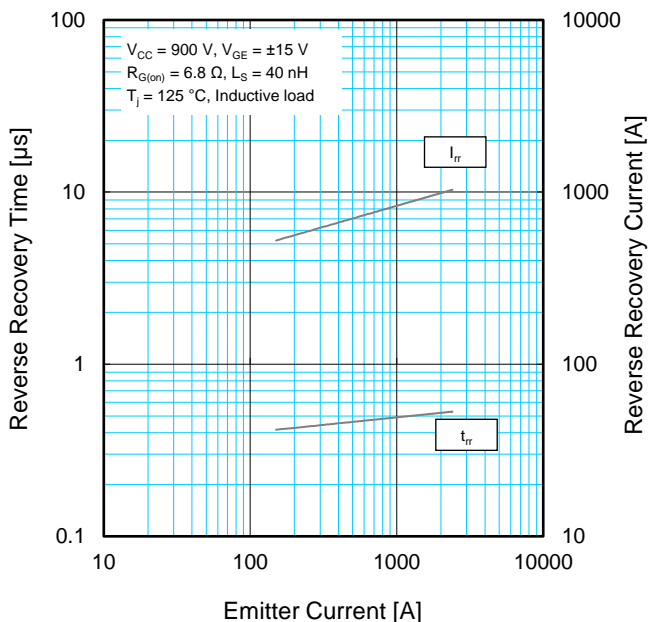
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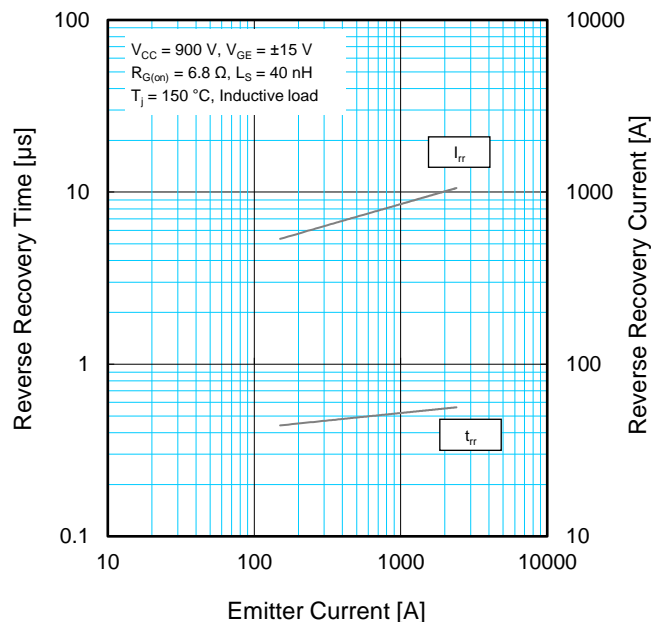
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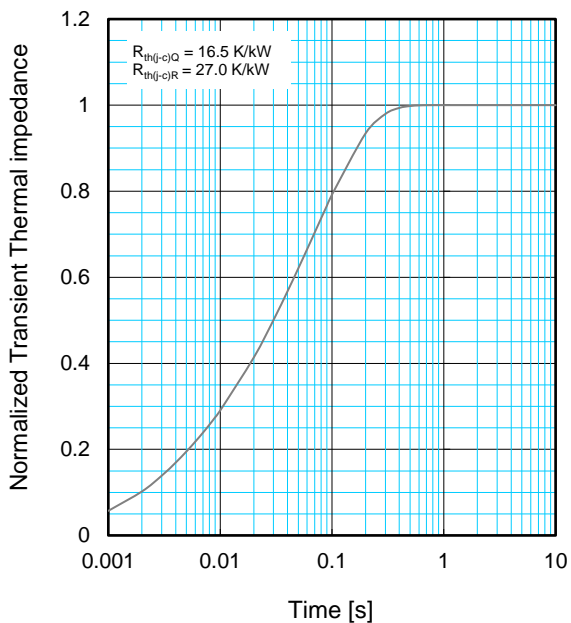
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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 [sec.] :	0.0025	0.0027	0.0155	0.0865

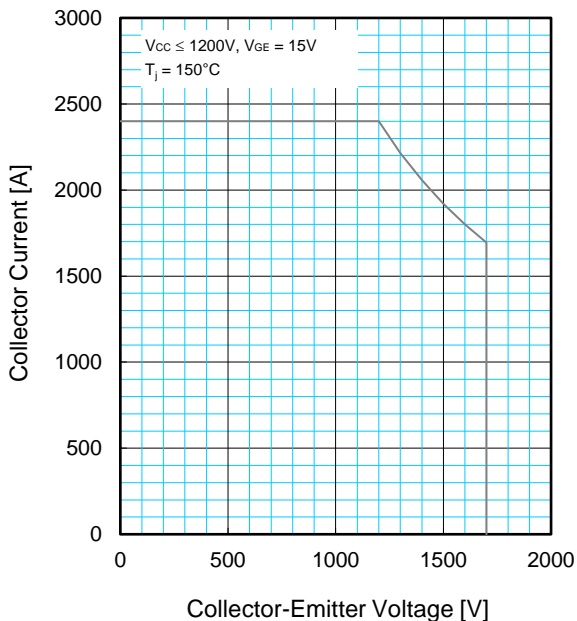
CM1200DA-34X

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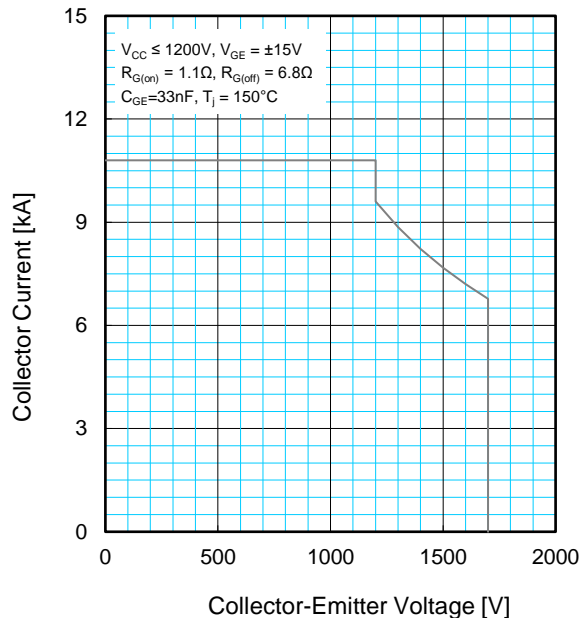
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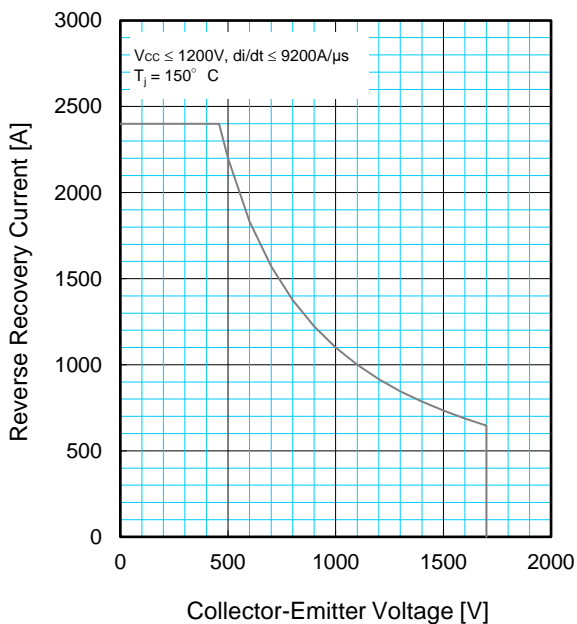
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



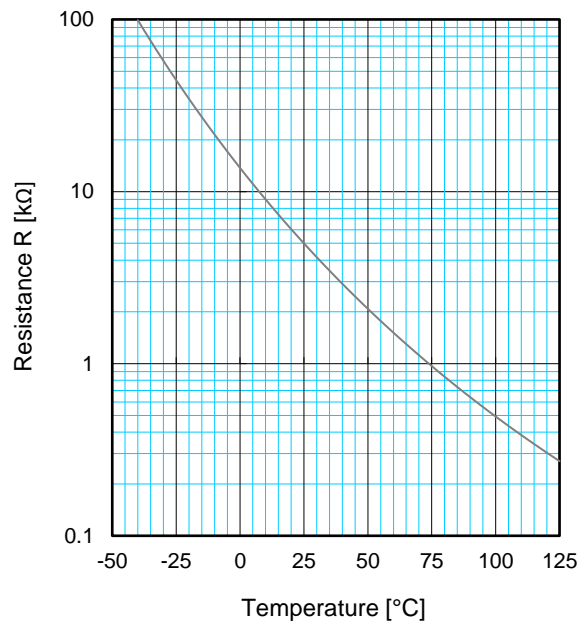
SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



NTC THERMISTOR TEMPERATURE CHARACTERISTICS (TYPICAL)



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