< 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

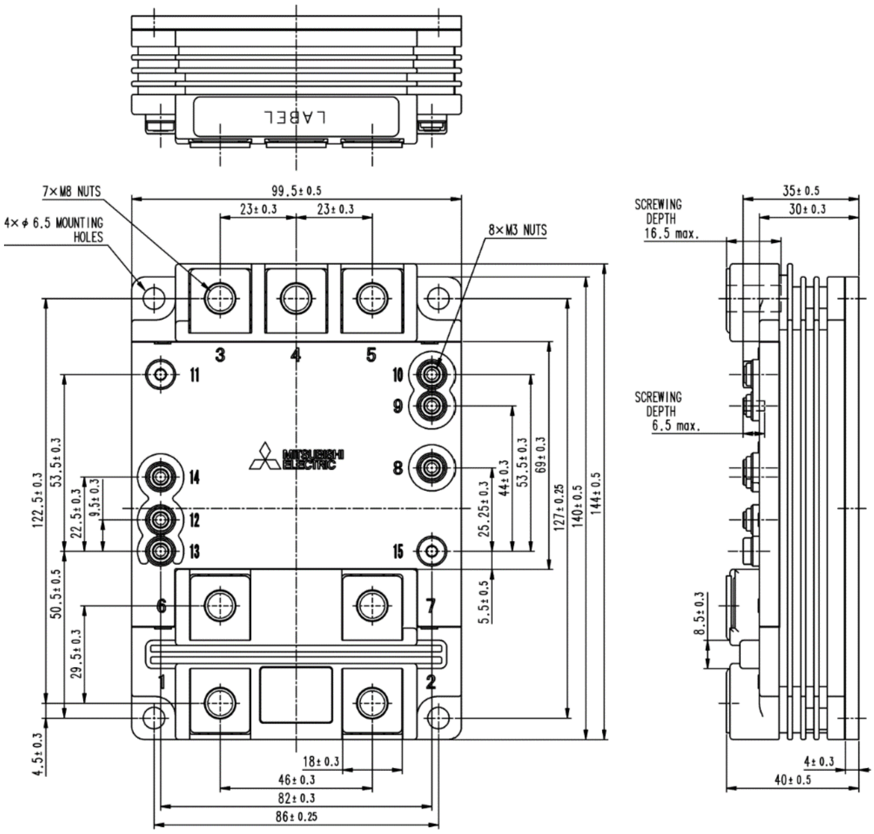
CM1200DA-34X

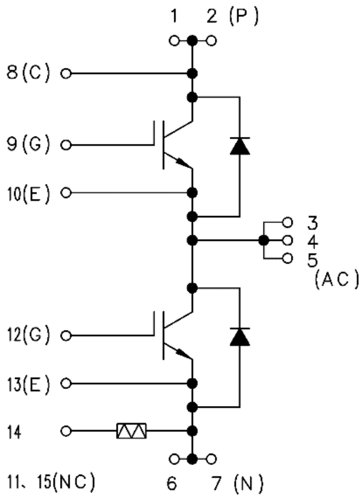
- I_C 1200A
- V_{CES} 1700V
- 2-elements in a Pack
- Insulated Type (Al base type)
- CSTBT^{TM}(III) / RFC Diode

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM **Dimensions in mm**





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CIRCUIT DIAGRAM

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	7500	W
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1 min., T_C = 25°C	6000	V
Q_{PD}	Partial discharge	Charged part to the baseplate V1 = 3500 Vrms, V2 = 2600 Vrms AC 60 Hz, T_c = 25 °C (acc. to IEC 61287)	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} = 1200V, $V_{CE} \le V_{CES}$, 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 Inductive load C_{GE} = 33nF	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)		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		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)		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)		T_j = 25°C	—	0.36	—	J
			T_j = 125°C	—	0.48	—	
			T_j = 150°C	—	0.49	—	

ELECTRICAL CHARACTERISTICS (continuation)

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

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits Min	Typ	Max	Unit
$R_{th(j-c)Q}$	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	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

NTC THERMISTOR PART

Symbol	Item	Conditions	Limits Min	Typ	Max	Unit
R_{25}	Zero-power resistance	T_c=25°C	-	5.00	-	kΩ
$B_{(25/50)}$	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	—	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
$L_{P\ P\text{-}N}$	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

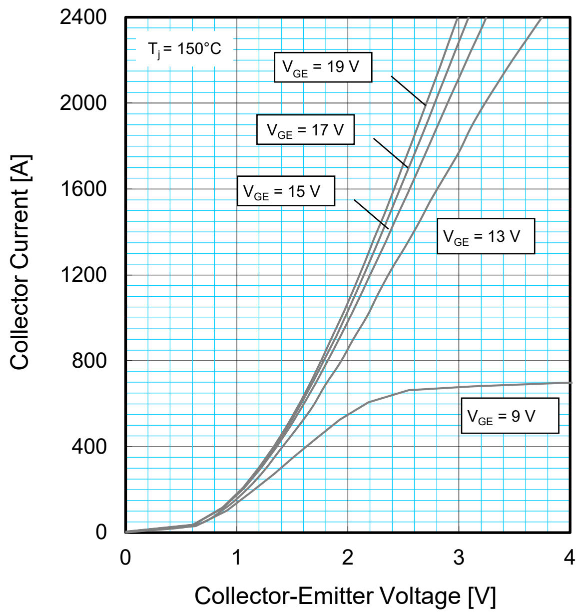
Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jopmax} rating.
Note 2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD_i).
Note 3. Junction temperature (T_j) should not exceed T_{jmax} rating (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. $B_{(25/_{50})} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$

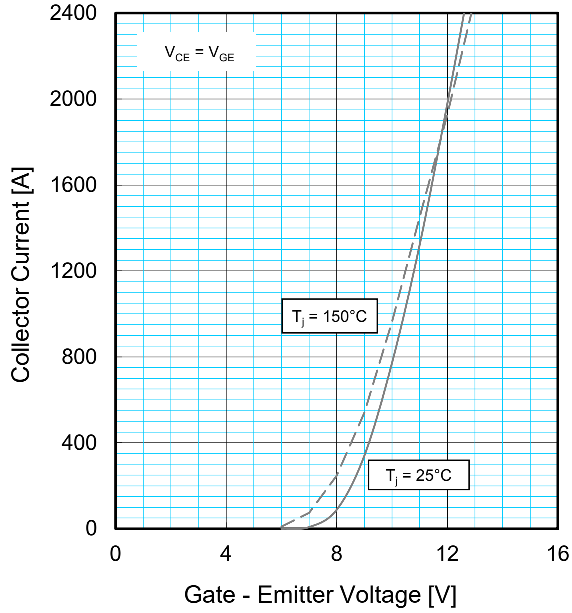
R_{25}: resistance at 25ºC
R_{50}: resistance at 50ºC
T_{25} [K]; T_{25} = 25[ºC] + 273.15 = 298.15[K]
T_{50} [K]; T_{50} = 50[ºC] + 273.15 = 323.15[K]

PERFORMANCE CURVES

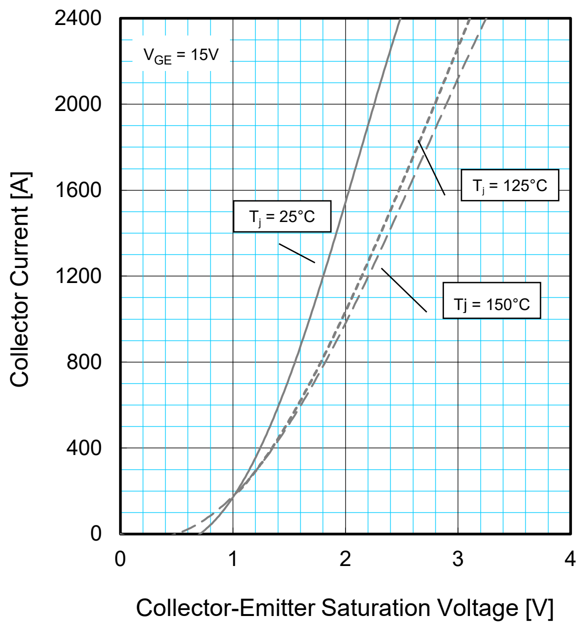
OUTPUT CHARACTERISTICS (TYPICAL)



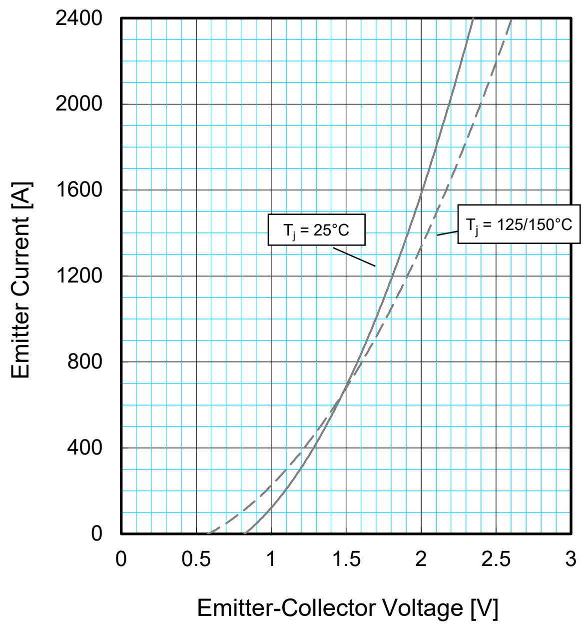
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

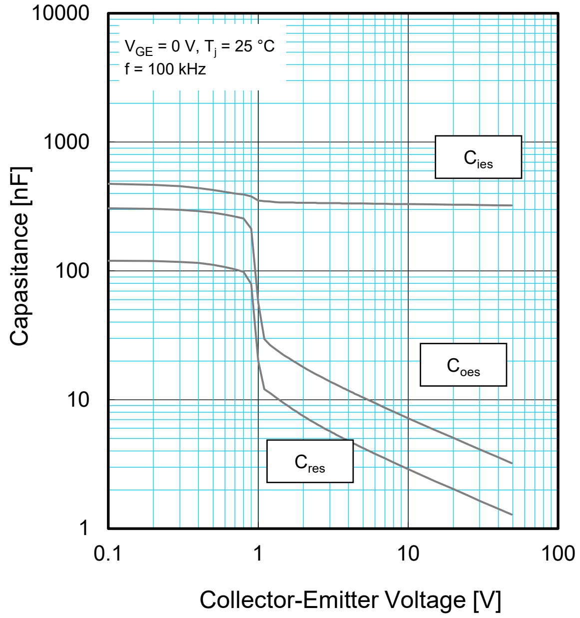


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

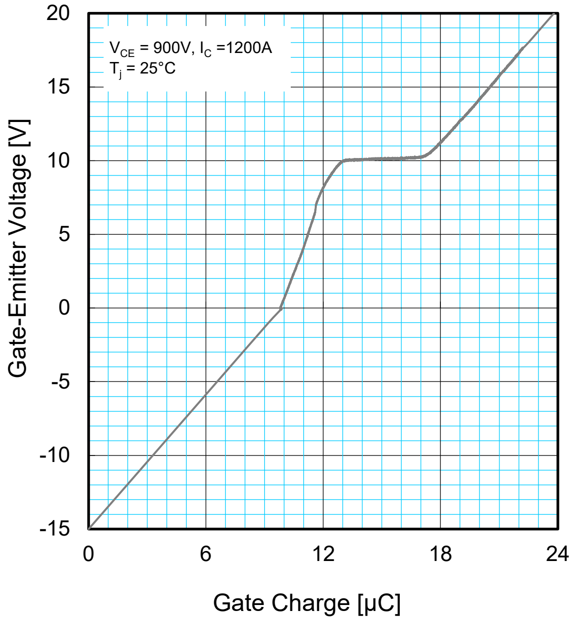


PERFORMANCE CURVES

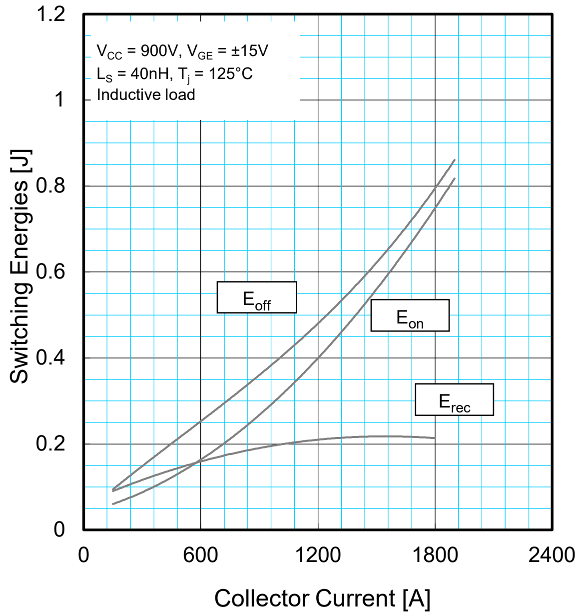
CAPACITANCE CHARACTERISTICS (TYPICAL)



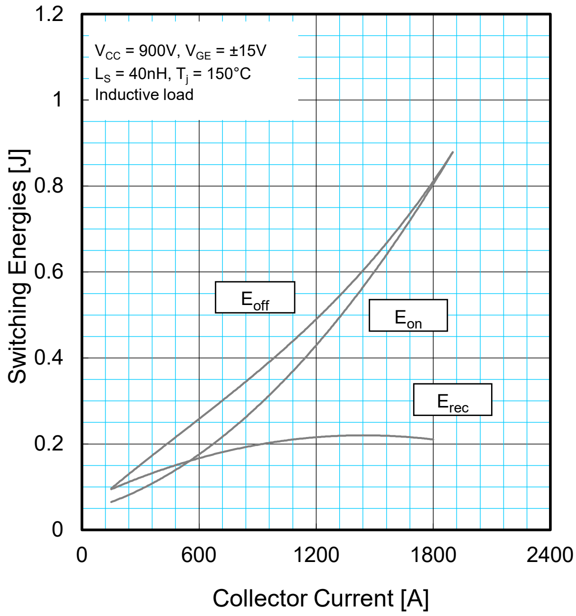
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

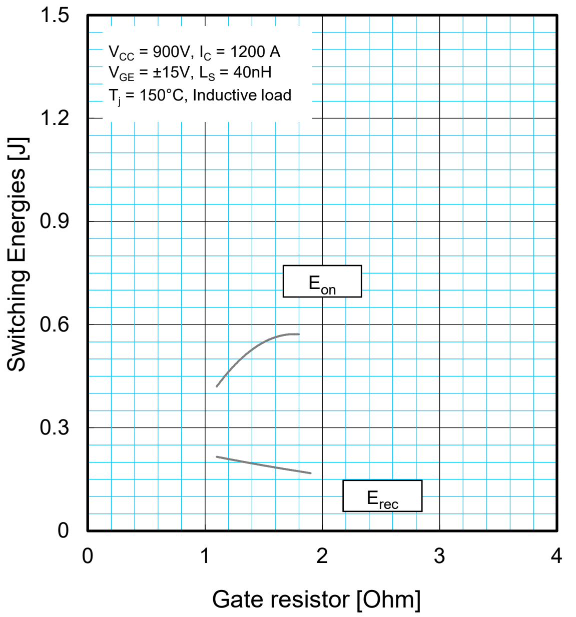


HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

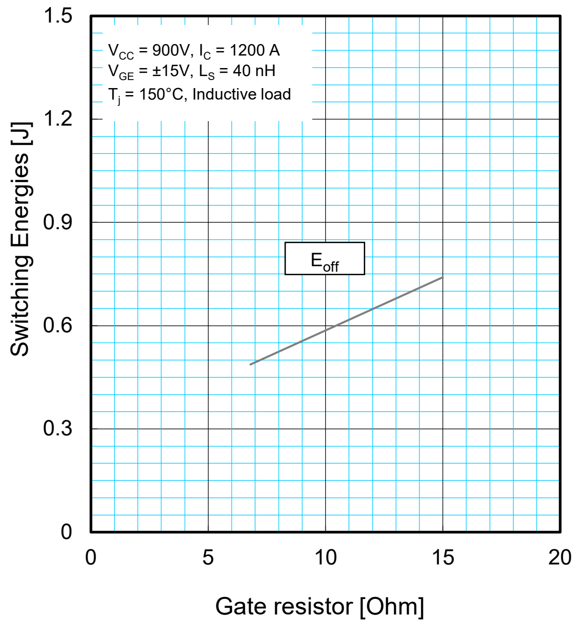


PERFORMANCE CURVES

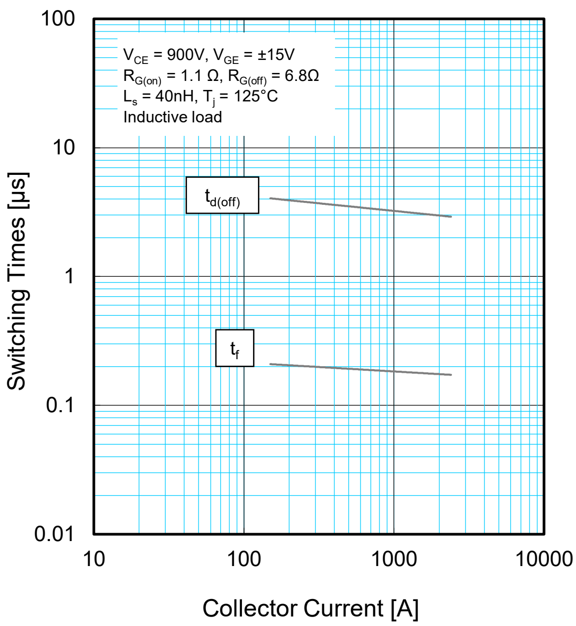
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



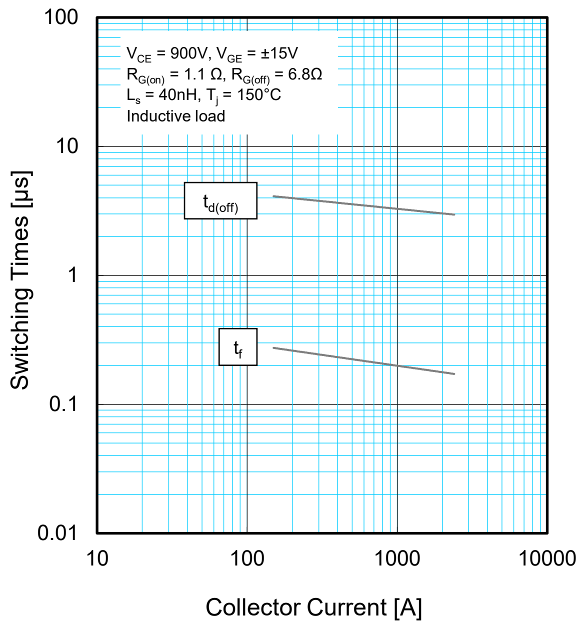
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)

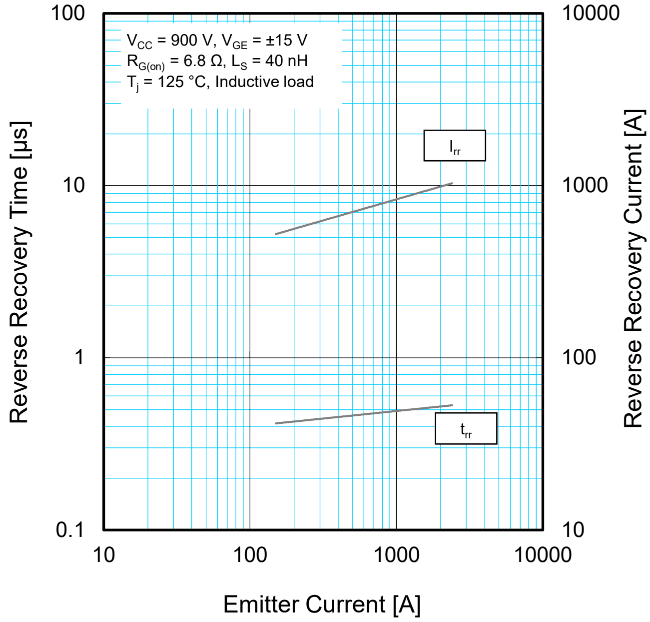


HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)

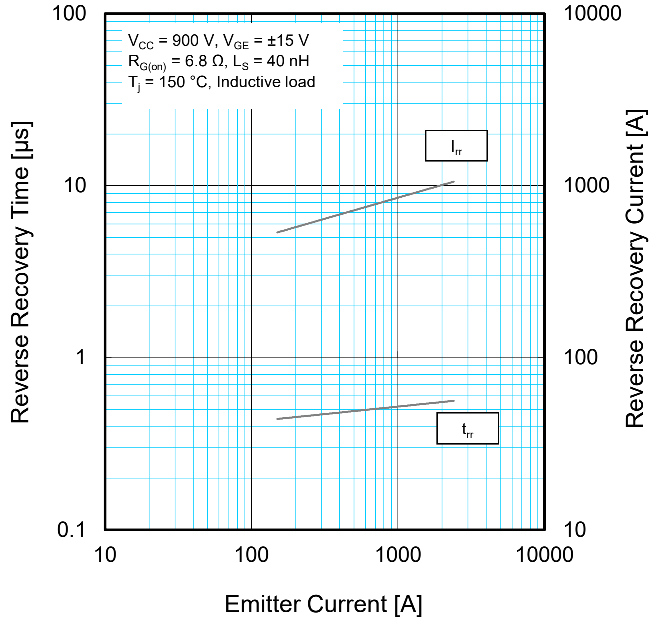


PERFORMANCE CURVES

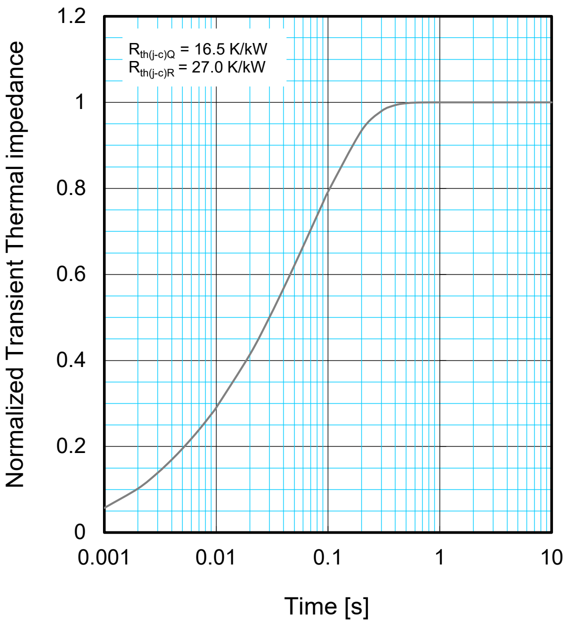
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS

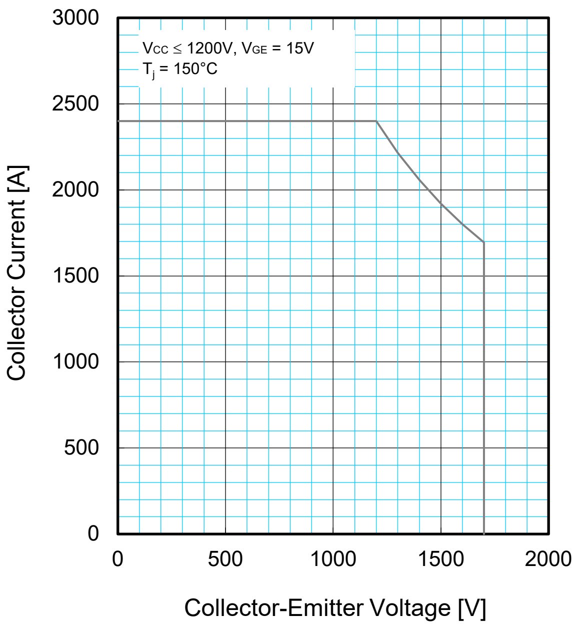


$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i} \right) \right\}$$

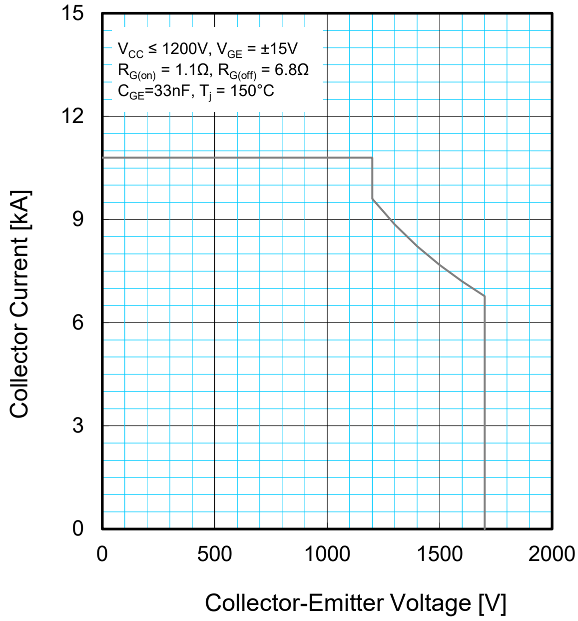
	1	2	3	4
R_i / $R_{th(j-c)}$:	0.0292	0.0832	0.2277	0.6599
τ_i [sec.] :	0.0025	0.0027	0.0155	0.0865

PERFORMANCE CURVES

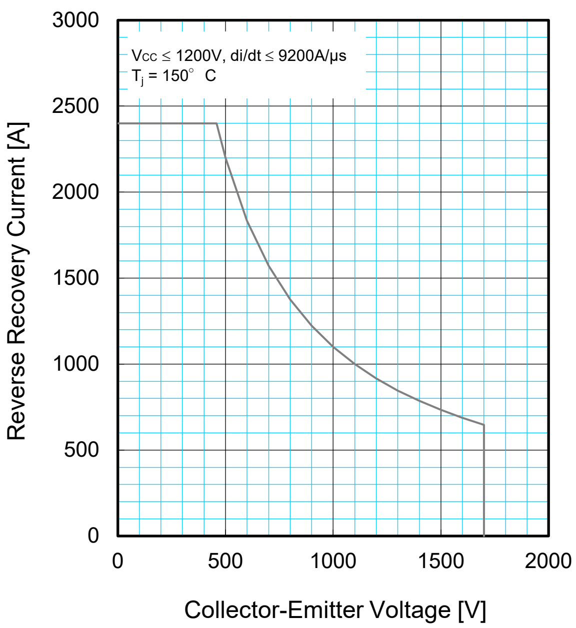
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



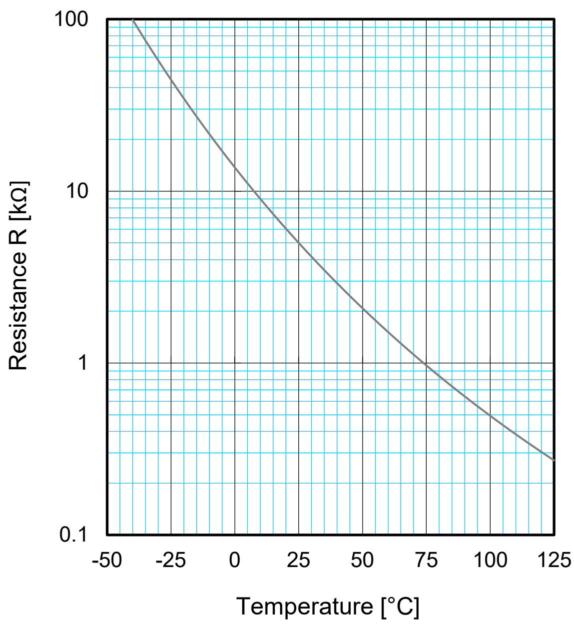
SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



NTC THERMISTOR TEMPERATURE CHARACTERISTICS (TYPICAL)



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