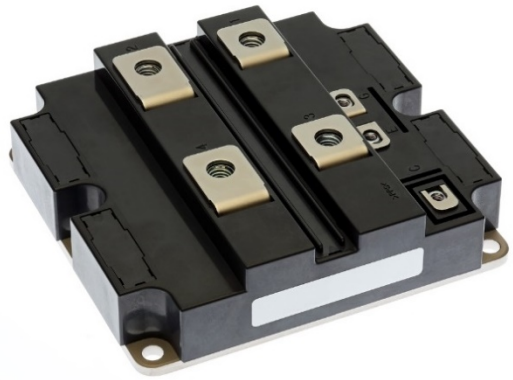
MITSUBISHI ELECTRIC

< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM2400HC-34X

HIGH POWER SWITCHING USE
INSULATED TYPE 6th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

CM2400HC-34X

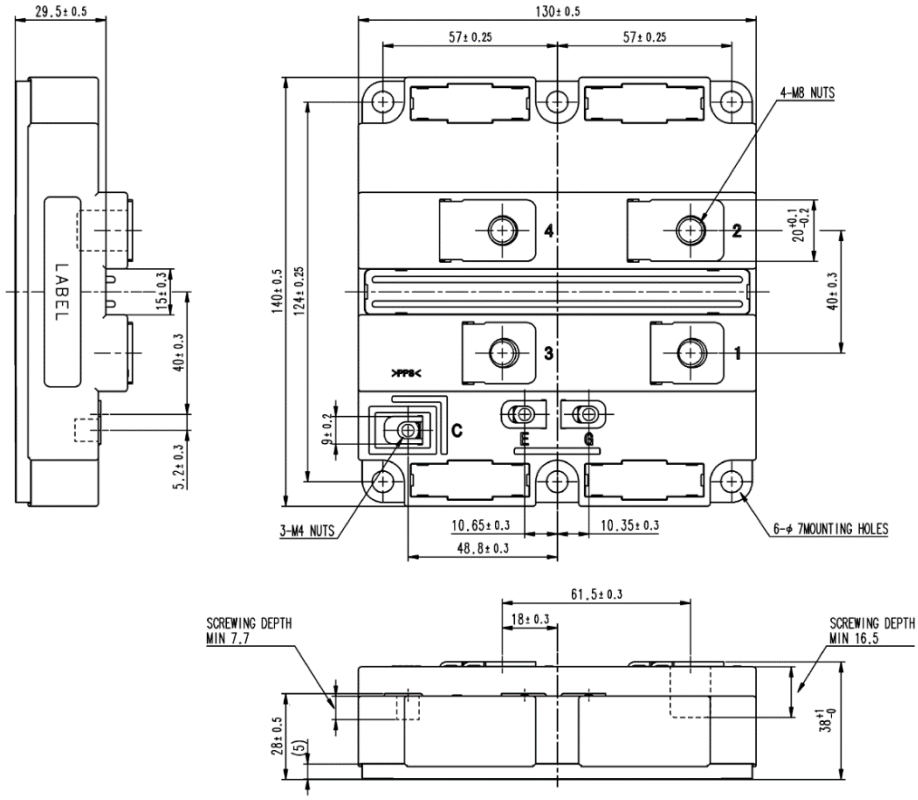


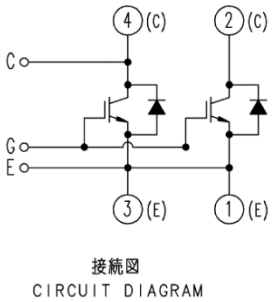
- I_C 2400A
- V_{CES} 1700V
- 1-element in a Pack
- Insulated Type
- CSTBT™(III) / RFC Diode
- AlSiC Baseplate
- UL recognized under UL1557

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

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





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CIRCUIT DIAGRAM

CM2400HC-34X

HIGH POWER SWITCHING USE

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

MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V_{CES}	Collector-emitter voltage	V_{GE} = 0V, T_j = -40…+150°C	1700	V
		V_{GE} = 0V, T_j = -50°C	1650	V
V_{GES}	Gate-emitter voltage	V_{CE} = 0V, T_j = 25°C	±20	V
I_C	Collector current	DC, T_c = 95°C	2400	A
I_{CRM}		Pulse (Note 1)	4800	A
I_E	Emitter current (Note 2)	DC, T_c = 75°C	2400	A
I_{ERM}		Pulse (Note 1)	4800	A
P_{tot}	Maximum power dissipation (Note 3)	T_c = 25°C, IGBT part	13800	W
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1min	6000	V
V_e	Partial discharge extinction voltage	RMS, sinusoidal, f = 60Hz, Q_{PD} ≤ 10pC	2600	V
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} ≤ V_{CES}, V_{GE} = 15V, T_j = 150°C	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	—	—	2.0	mA
			T_j = 125°C	—	3.5	—	
			T_j = 150°C	—	20.0	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{CE} = 10V, I_C = 240mA, 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} = 10V, V_{GE} = 0V, f = 100kHz T_j = 25°C		—	817	—	nF
C_{oes}	Output capacitance			—	17.8	—	
C_{res}	Reverse transfer capacitance			—	7.2	—	
Q_G	Total gate charge	V_{CC} = 900V, I_C = 2400A, V_{GE} = ±15V		—	51.0	—	µC
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2400A (Note 4) V_{GE} = 15V	T_j = 25°C	—	1.60	—	V
			T_j = 125°C	—	1.85	—	
			T_j = 150°C	—	1.95	2.45	
$t_{d(on)}$	Turn-on delay time	V_{CC} = 900V I_C = 2400A V_{GE} = ±15V $R_{G(on)}$ = 0.62Ω L_S = 75nH Inductive load	T_j = 150°C	—	—	1.50	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	—	0.40	—	J
			T_j = 125°C	—	0.70	—	
			T_j = 150°C	—	0.75	—	
E_{on}	Turn-on switching energy (per pulse) (Note 6)		T_j = 25°C	—	0.50	—	J
			T_j = 125°C	—	0.75	—	
			T_j = 150°C	—	0.80	—	
$t_{d(off)}$	Turn-off delay time	V_{CC} = 900V I_C = 2400A V_{GE} = ±15V $R_{G(off)}$ = 5.6Ω L_S = 75nH Inductive load	T_j = 25°C	—	6.00	—	µs
			T_j = 125°C	—	6.20	—	
			T_j = 150°C	—	6.35	10.0	
t_f	Fall time		T_j = 25°C	—	0.30	—	µs
			T_j = 125°C	—	0.32	—	
			T_j = 150°C	—	0.34	1.00	
$E_{off(10\%)}$	Turn-off switching energy (per pulse) (Note 5)		T_j = 25°C	—	0.95	—	J
			T_j = 125°C	—	1.10	—	
			T_j = 150°C	—	1.20	—	
E_{off}	Turn-off switching energy (per pulse) (Note 6)		T_j = 25°C	—	1.00	—	J
			T_j = 125°C	—	1.15	—	
			T_j = 150°C	—	1.25	—	

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions		Limits			Unit
				Min	Typ	Max	
V_{EC}	Emitter-collector voltage (Note 2)	I_E = 2400A (Note 4), V_{GE} = 0V	T_j = 25°C	—	1.80	—	V
			T_j = 125°C	—	1.95	—	
			T_j = 150°C	—	1.95	2.45	
t_{rr}	Reverse recovery time (Note 2)	V_{CC} = 900V, I_E = 2400A, V_{GE} = ±15V, $R_{G(on)}$ = 0.62Ω, L_S = 75nH, Inductive load	T_j = 25°C	—	0.40	—	μs
			T_j = 125°C	—	0.55	—	
			T_j = 150°C	—	0.60	—	
I_{rr}	Reverse recovery current (Note 2)		T_j = 25°C	—	1790	—	A
			T_j = 125°C	—	1930	—	
			T_j = 150°C	—	1980	—	
$Q_{rr(10\%)}$	Reverse recovery charge (Note 2,7)		T_j = 25°C	—	430	—	μC
			T_j = 125°C	—	720	—	
			T_j = 150°C	—	820	—	
Q_{rr}	Reverse recovery charge (Note 2,6)		T_j = 25°C	—	480	—	μC
			T_j = 125°C	—	785	—	
			T_j = 150°C	—	890	—	
$E_{rec(10\%)}$	Reverse recovery energy (per pulse) (Note 2,5)		T_j = 25°C	—	0.22	—	J
			T_j = 125°C	—	0.40	—	
			T_j = 150°C	—	0.46	—	
E_{rec}	Reverse recovery energy (per pulse) (Note 2,6)		T_j = 25°C	—	0.25	—	J
			T_j = 125°C	—	0.45	—	
			T_j = 150°C	—	0.55	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	9.0	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part	—	—	12.5	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, λ_{grease} = 1W/m·K, $D_{(c-s)}$ = 80μm	—	7.5	—	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M_t	Mounting torque	M8 : Main terminals screw	7.0	—	19.0	N·m
M_s		M6 : Mounting screw	3.0	—	6.0	N·m
M_t		M4 : Auxiliary terminals screw	1.0	—	3.0	N·m
m	Mass		—	0.9	—	kg
CTI	Comparative tracking index		600	—	—	—
d_a	Clearance		19.5	—	—	mm
d_s	Creepage distance		32.0	—	—	mm
$L_{P\ CE}$	Parasitic stray inductance		—	12.0	—	nH
$R_{CC'+EE'}$	Internal lead resistance	T_C = 25°C	—	0.14	—	mΩ

Note1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jopmax} rating.

Note2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD_i).

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.

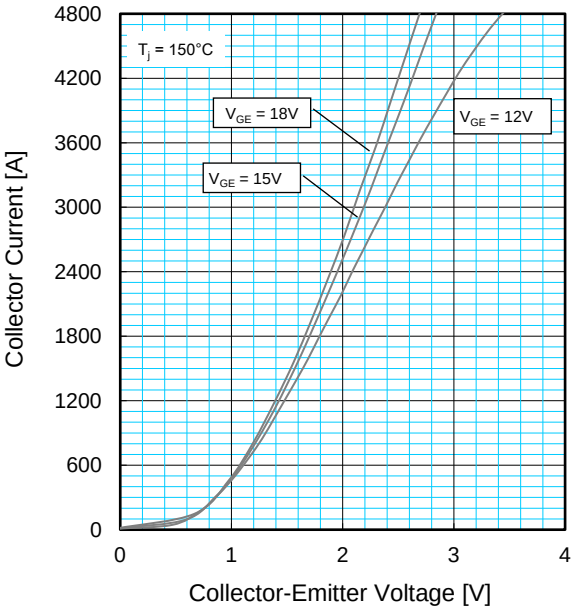
Note5. The integration range of switching energies is from 10%V_{CE} to 10%I_C(10%I_E).

Note6. Definition of all items is according to IEC 60747, unless otherwise specified.

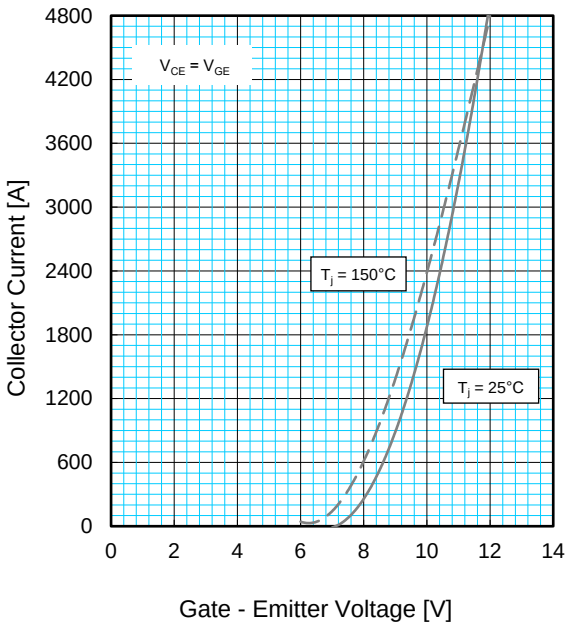
Note7. The integration range of reverse recovery charge is from I_E = 0A to 10%I_E.

PERFORMANCE CURVES

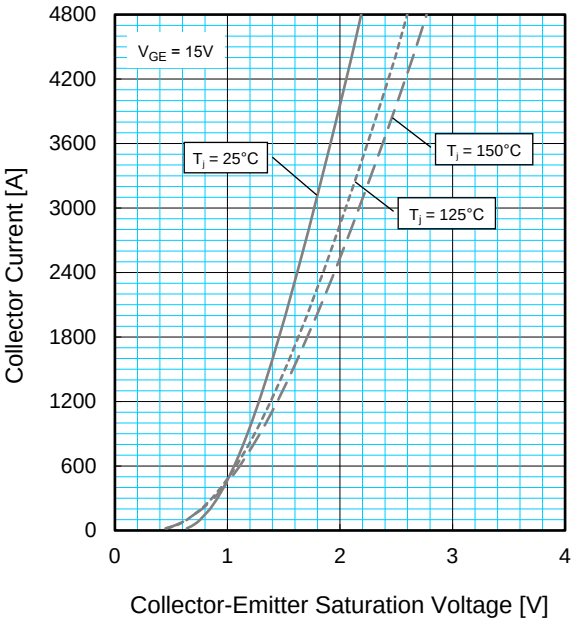
OUTPUT CHARACTERISTICS (TYPICAL)



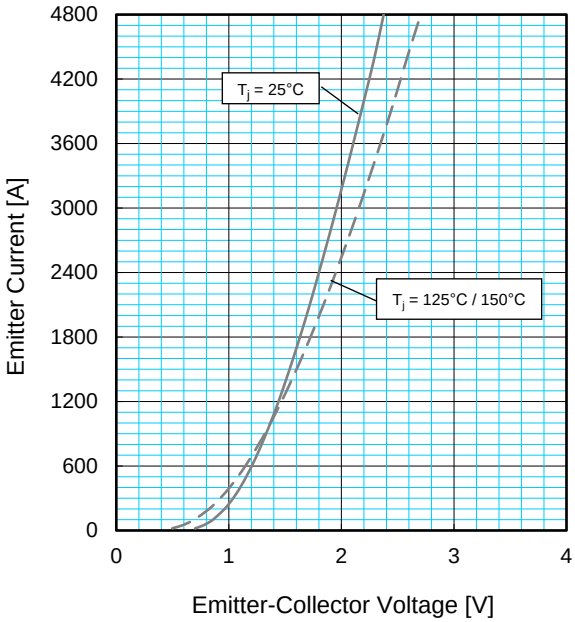
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

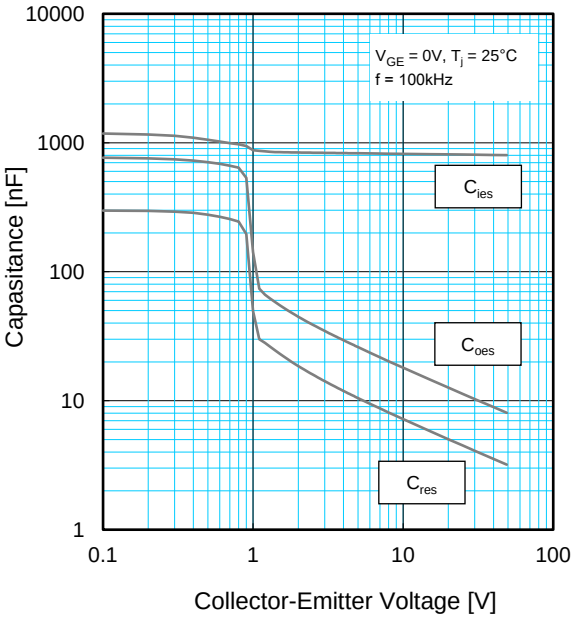


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

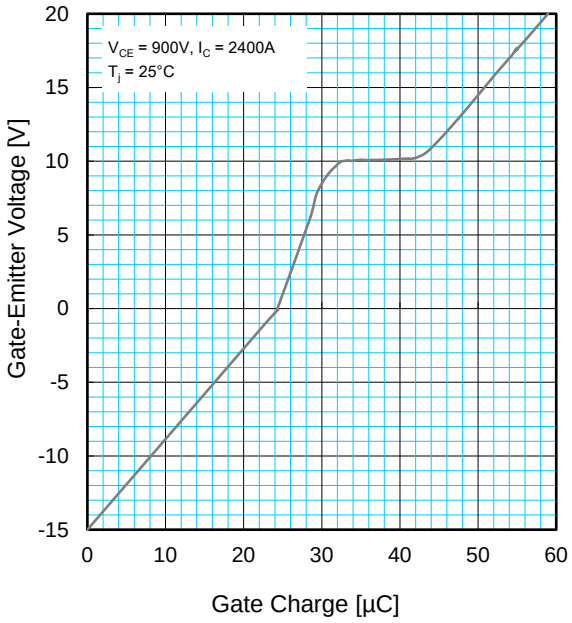


PERFORMANCE CURVES

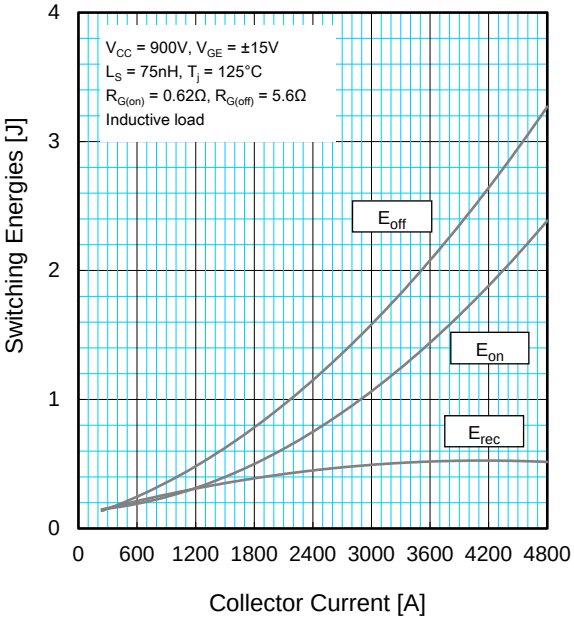
CAPACITANCE CHARACTERISTICS (TYPICAL)



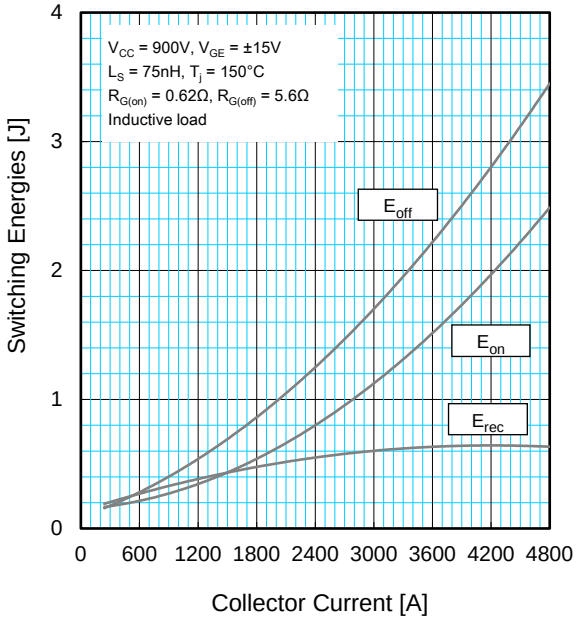
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

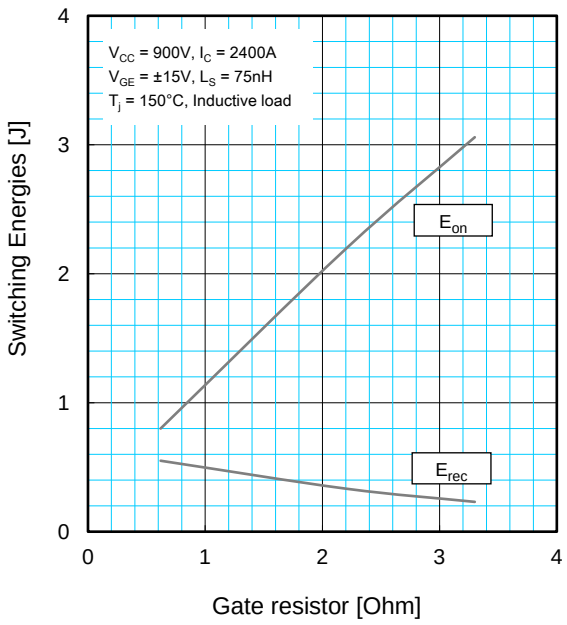


HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

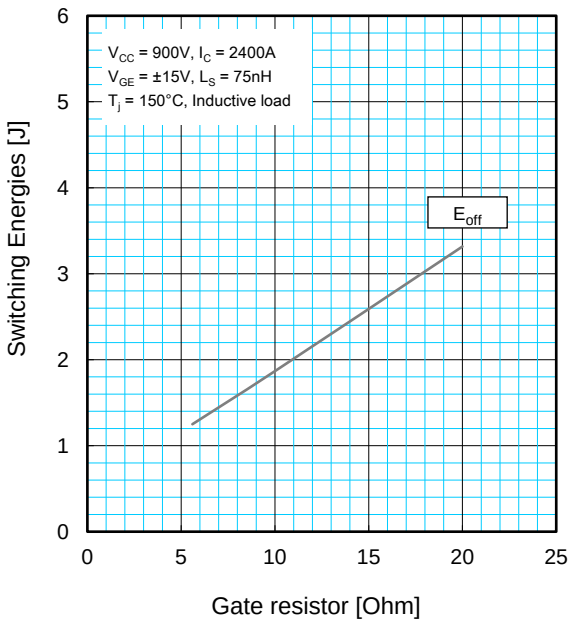


PERFORMANCE CURVES

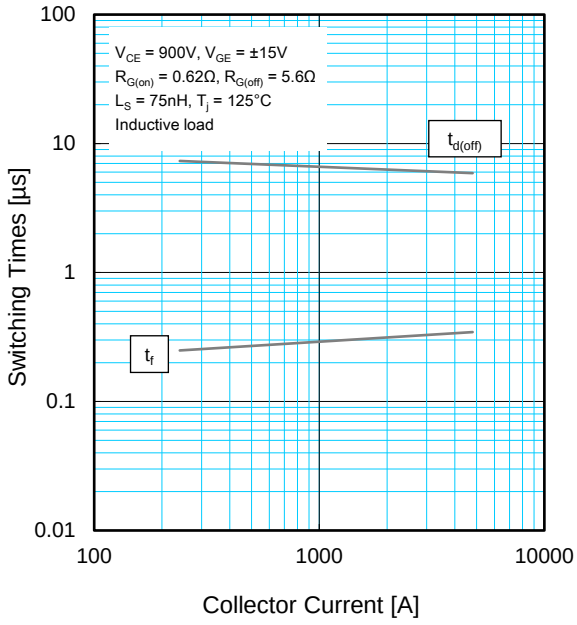
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



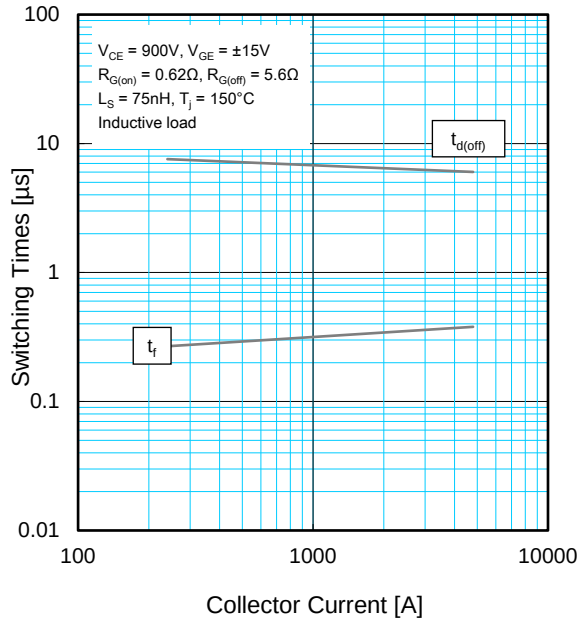
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)

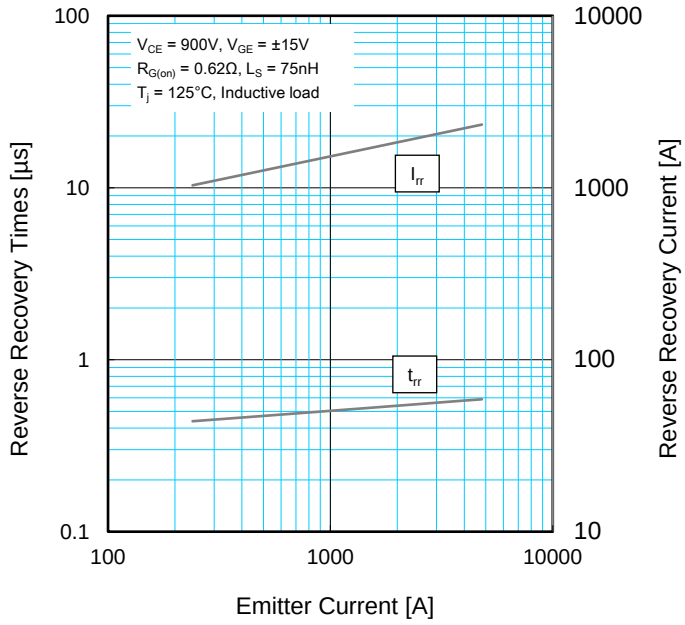


HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)

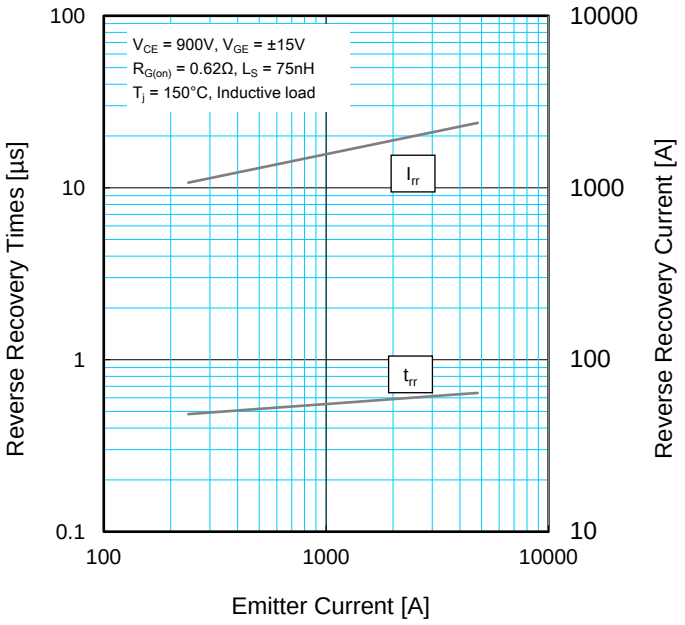


PERFORMANCE CURVES

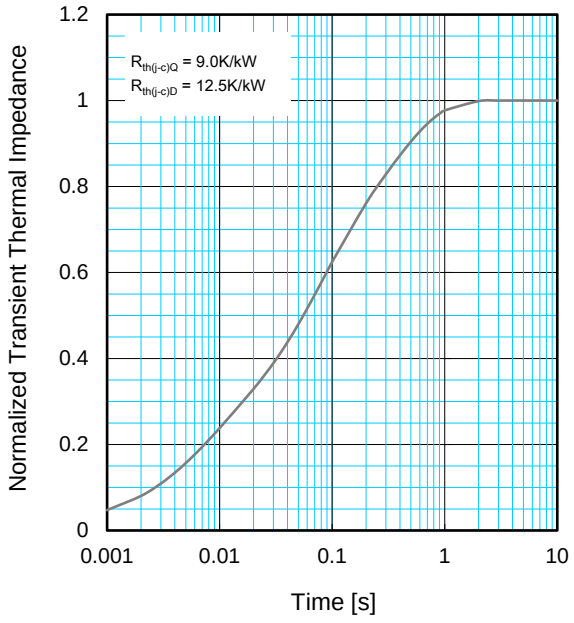
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS

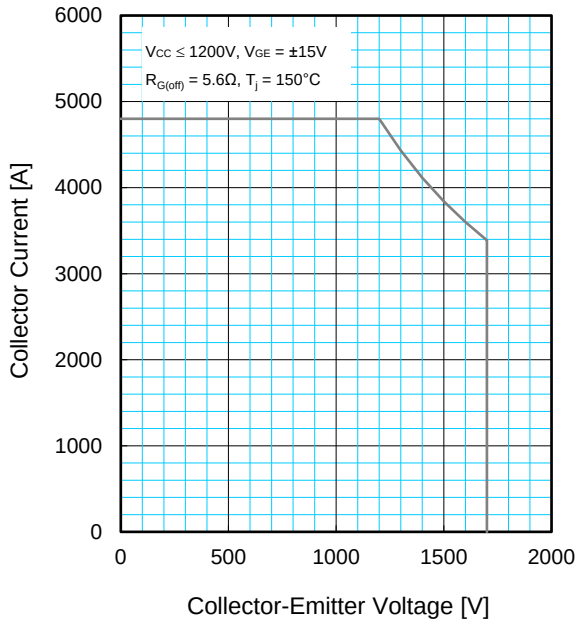


$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i} \right) \right\}$$

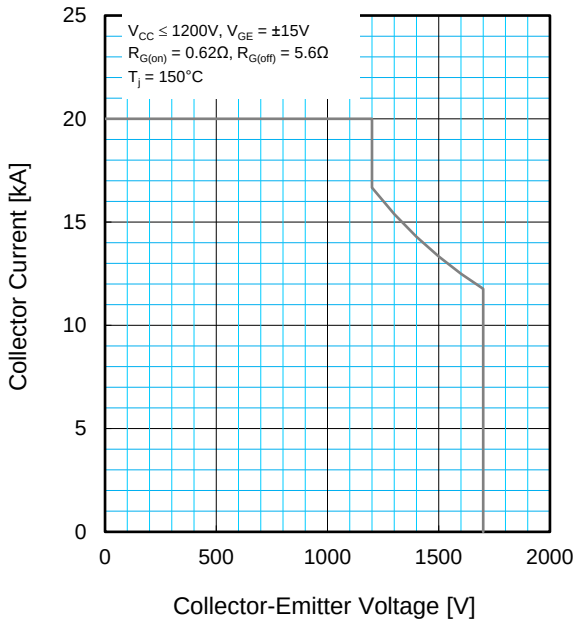
	1	2	3	4
R_i / $R_{th(j-c)}$:	0.0096	0.1893	0.4044	0.3967
τ_i [sec] :	0.0001	0.0058	0.0602	0.3512

PERFORMANCE CURVES

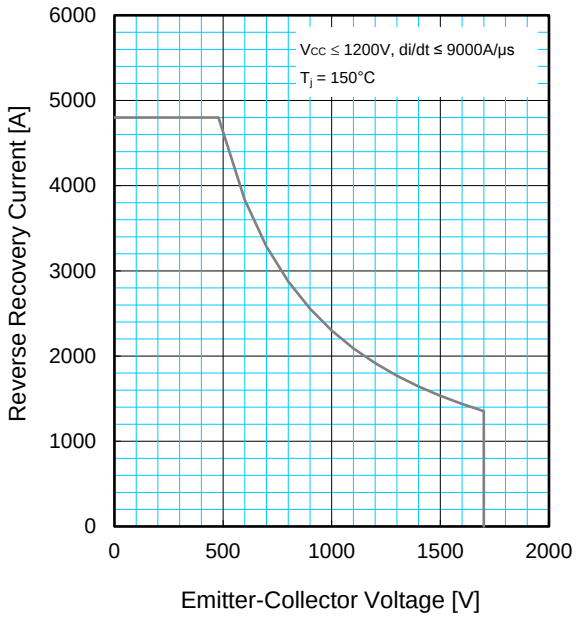
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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