MITSUBISHI ELECTRIC

<High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM2400HC-34N

HIGH POWER SWITCHING USE
INSULATED TYPE

4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

CM2400HC-34N

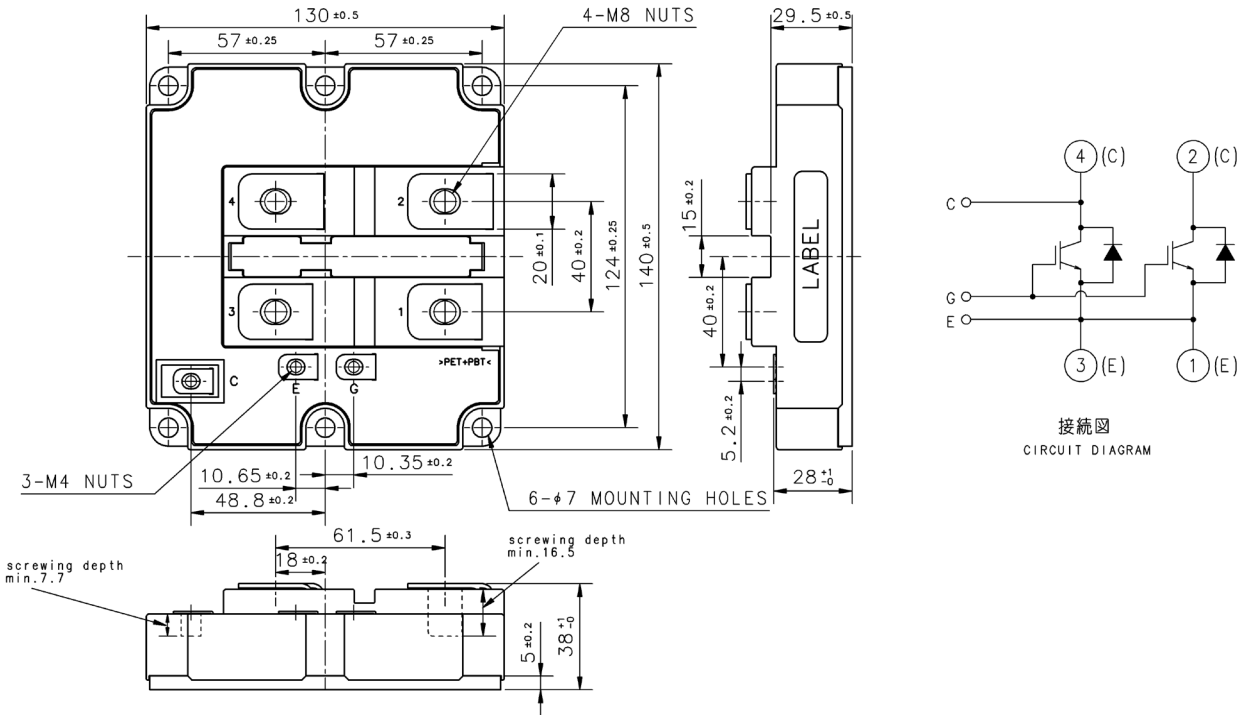
- I_C ..... 2400 A
- V_{CES} ..... 1700 V
- Insulated Type
- 1-element in a Pack
- AlSiC baseplate
- Trench Gate IGBT : CSTBT™
- Soft Reverse Recovery Diode

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



CM2400HC-34N

HIGH POWER SWITHCHING USE
INSULATED TYPE

4th-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 = 25°C	1700	V
V_{GES}	Gate-emitter voltage	V_{CE} = 0V, T_j = 25°C	± 20	V
I_C	Collector current	DC, T_c = 75°C	2400	A
I_{CRM}		Pulse (Note 1)	4800	A
I_E	Emitter current (Note 2)	DC	2400	A
I_{ERM}		Pulse (Note 1)	4800	A
P_{tot}	Maximum power dissipation (Note 3)	T_c = 25°C, IGBT part	13100	W
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1 min.	4000	V
T_j	Junction temperature		−40 ~ +150	°C
T_{jop}	Operating junction temperature		−40 ~ +125	°C
T_{stg}	Storage temperature		−40 ~ +125	°C
t_{psc}	Short circuit pulse width	V_{CC} = 1200V, V_{CE} ≤ V_{CES}, V_{GE} =15V, T_j =125°C	10	μs

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions		Limits Min	Limits Typ	Limits Max	Unit
I_{CES}	Collector cutoff current	V_{CE} = V_{CES}, V_{GE} = 0V	T_j = 25°C	—	—	8.0	mA
			T_j = 125°C	—	6.0	16.0	
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{CE} = 10 V, I_C = 240 mA, T_j = 25°C		6.0	7.0	8.0	V
I_{GES}	Gate leakage current	V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25°C		—	—	0.5	μA
C_{ies}	Input capacitance	V_{CE} = 10 V, V_{GE} = 0 V, f = 100 kHz T_j = 25°C		—	352	—	nF
C_{oes}	Output capacitance			—	19.2	—	nF
C_{res}	Reverse transfer capacitance			—	5.6	—	nF
Q_G	Total gate charge	V_{CC} = 850V, I_C = 2400A, V_{GE} = ±15V, T_j = 25°C		—	24.5	—	μC
V_{CEsat}	Collector-emitter saturation voltage	I_C = 2400 A (Note 4) V_{GE} = 15 V	T_j = 25°C	—	2.15	2.80	V
			T_j = 125°C	—	2.40	—	
$t_{d(on)}$	Turn-on delay time	V_{CC} = 850 V, I_C = 2400 A, V_{GE} = ±15 V $R_{G(on)}$ = 0.7 Ω, T_j = 125°C, L_s = 100 nH Inductive load		—	—	1.50	μs
t_r	Turn-on rise time			—	—	0.70	μs
$E_{on(10\%)}$	Turn-on switching energy (Note 5)			—	640	—	mJ
$t_{d(off)}$	Turn-off delay time	V_{CC} = 850 V, I_C = 2400 A, V_{GE} = ±15 V $R_{G(off)}$ = 1.6 Ω, T_j = 125°C, L_s = 100 nH Inductive load		—	—	3.00	μs
t_f	Turn-off fall time			—	—	0.60	μs
$E_{off(10\%)}$	Turn-off switching energy (Note 5)			—	840	—	mJ
V_{EC}	Emitter-collector voltage (Note 2)	I_E = 2400 A (Note 4) V_{GE} = 0 V	T_j = 25°C	—	2.60	3.30	V
			T_j = 125°C	—	2.30	—	
t_{rr}	Reverse recovery time (Note 2)	V_{CC} = 850 V, I_C = 2400 A, V_{GE} = ±15 V $R_{G(on)}$ = 0.7 Ω, T_j = 125°C, L_s = 100 nH Inductive load		—	—	1.50	μs
Q_{rr}	Reverse recovery charge (Note 2)			—	620	—	μC
$E_{rec(10\%)}$	Reverse recovery energy (Note 2), (Note 5)			—	380	—	mJ

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	9.5	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part	—	—	21.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, λ_{grease} = 1W/m・k, $D_{(c-s)}$ = 100μm	—	8.0	—	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M_t	Mounting torque	M8 : Main terminals screw	7.0	—	20.0	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		—	0.8	—	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	IGBT part	—	16	—	nH
$R_{CC'+EE'}$	Internal lead resistance	IGBT part , T_C = 25°C	—	0.14	—	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).

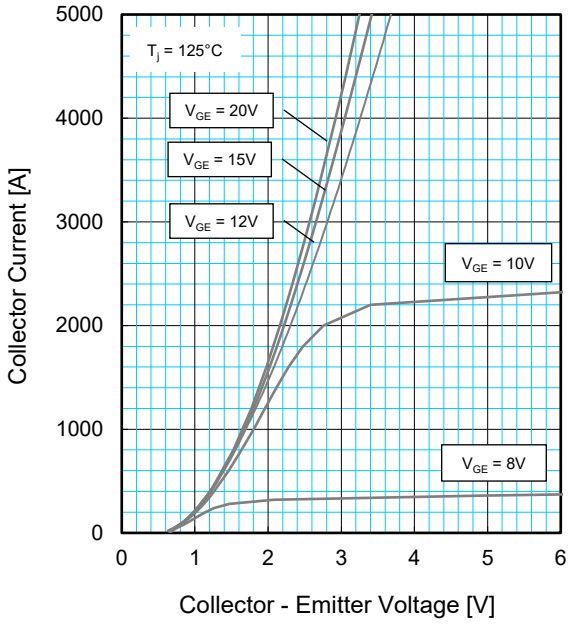
Note 3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).

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

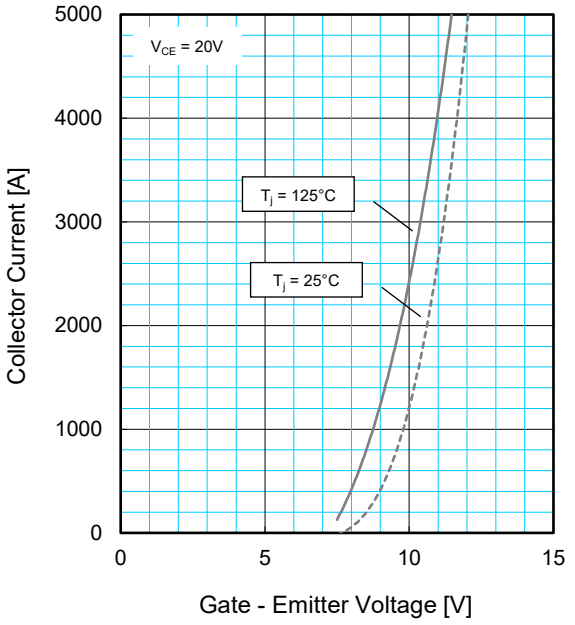
Note 5. $E_{on(10\%)}$ / $E_{off(10\%)}$ / $E_{rec(10\%)}$ are the integral of $0.1V_{CE} \times 0.1I_C \times dt$.

PERFORMANCE CURVES

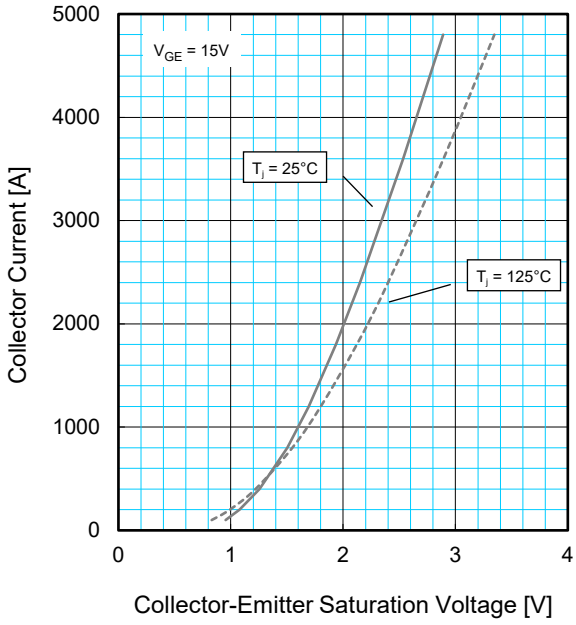
OUTPUT CHARACTERISTICS (TYPICAL)



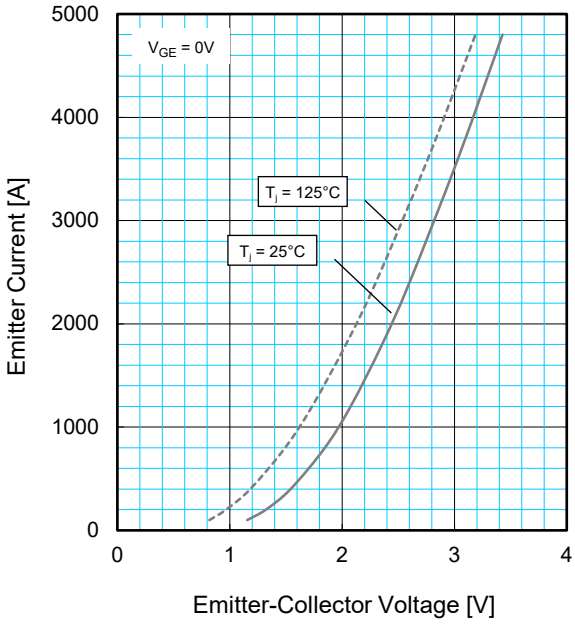
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

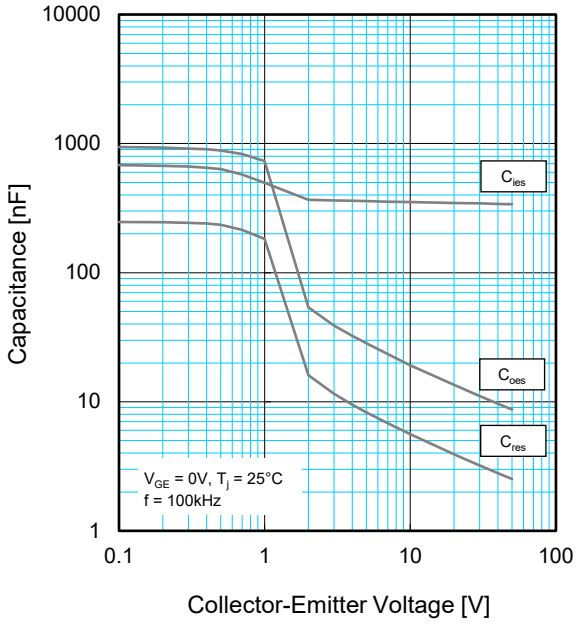


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

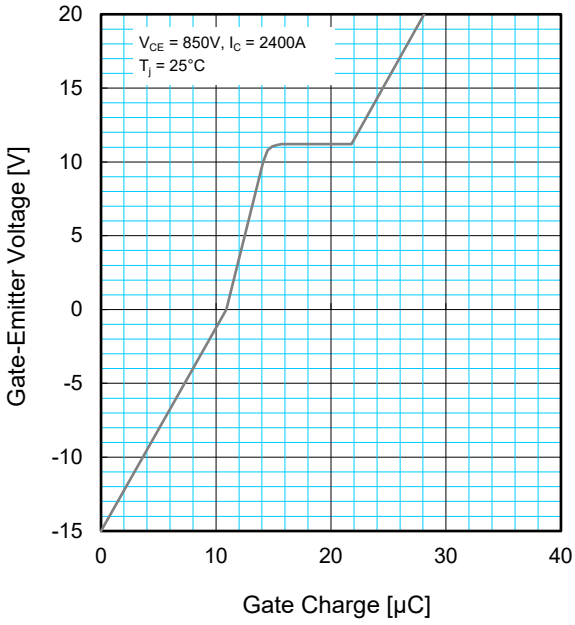


PERFORMANCE CURVES

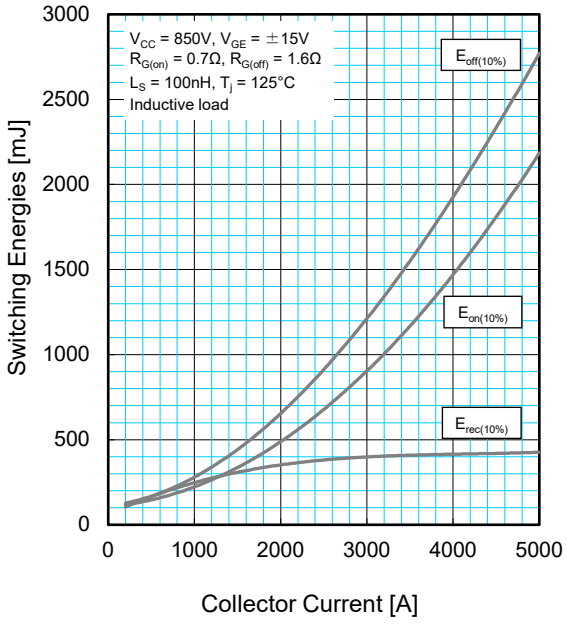
CAPACITANCE CHARACTERISTICS (TYPICAL)



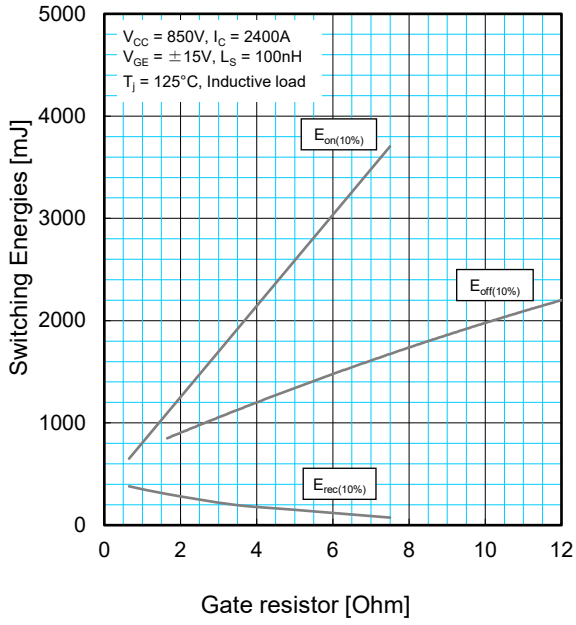
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

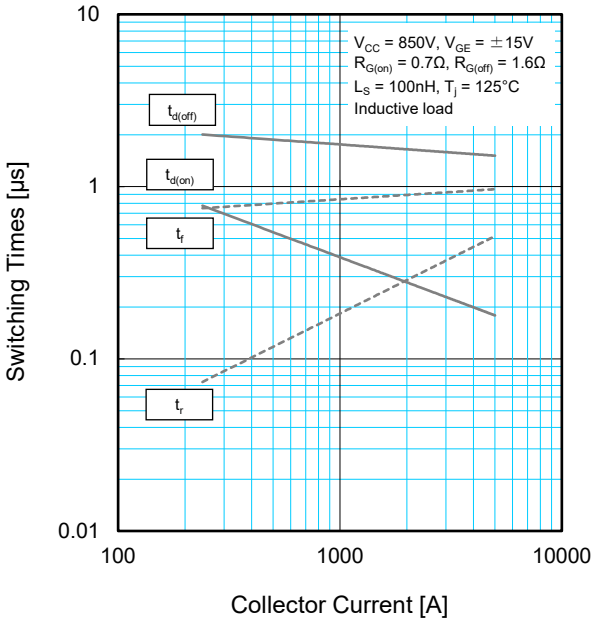


HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

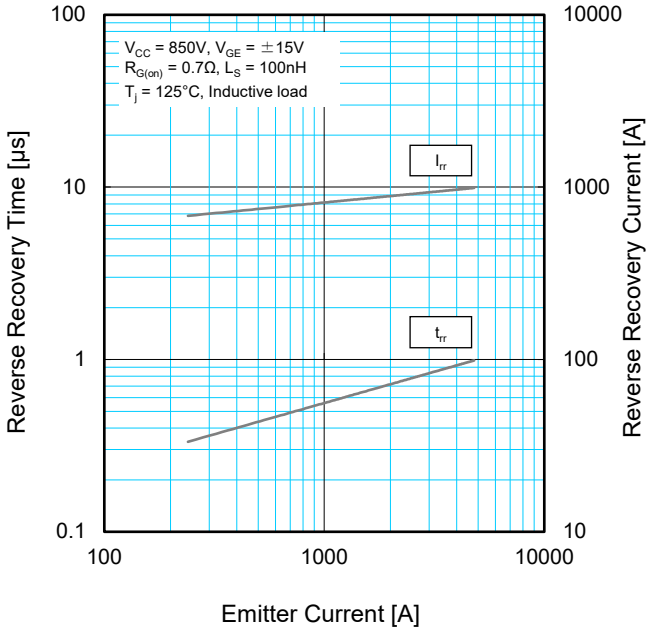


PERFORMANCE CURVES

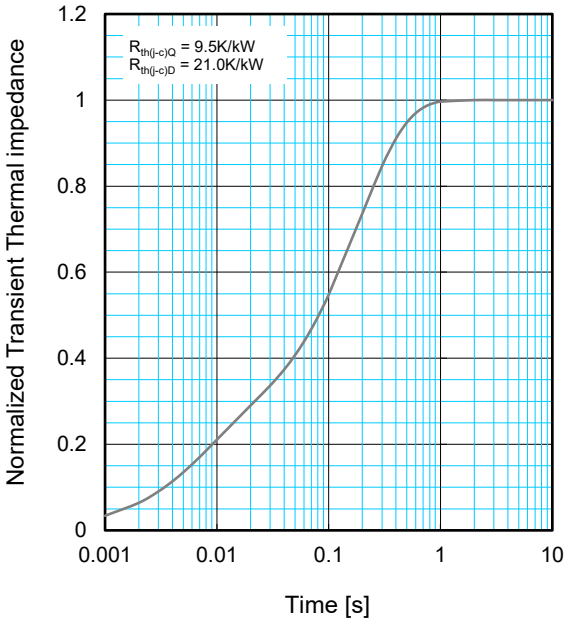
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS

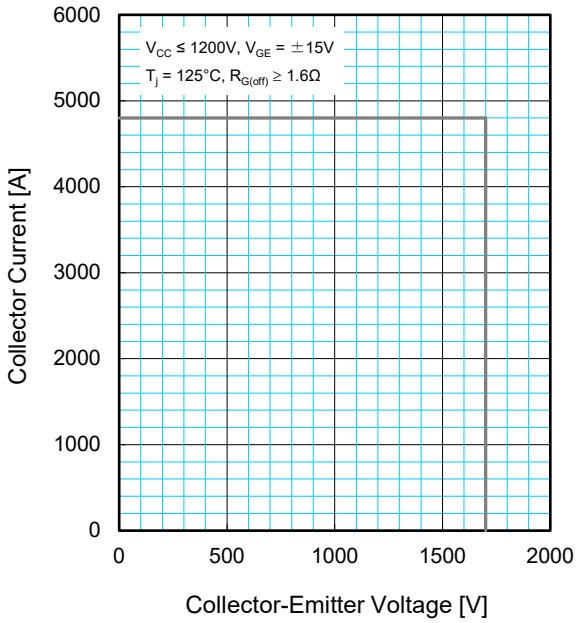


$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - exp\left(-\frac{t}{\tau_i} \right) \right\}$$

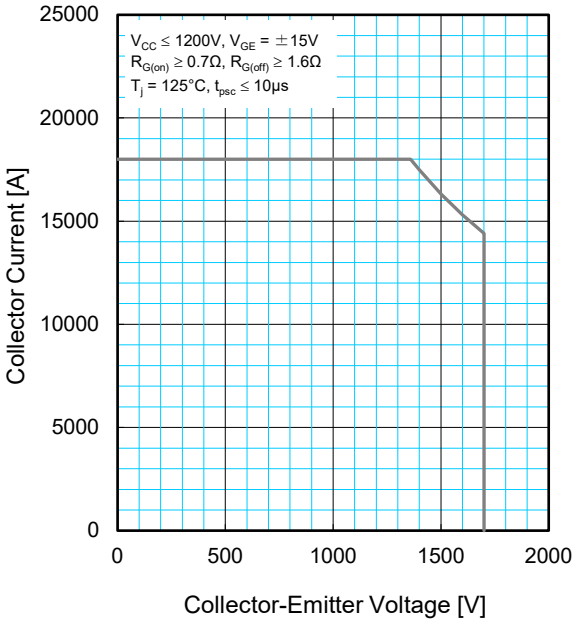
	1	2	3	4
R_i [K/kW]	0.0096	0.1893	0.4044	0.3967
t_i [sec]	0.0001	0.0058	0.0602	0.3512

PERFORMANCE CURVES

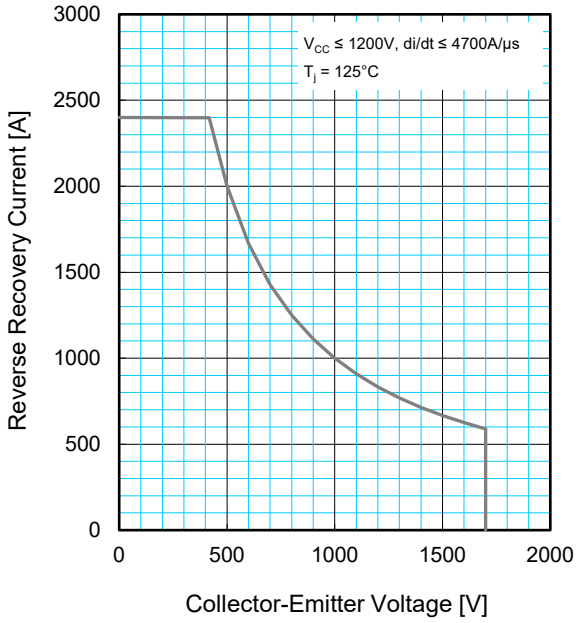
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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