



**CM2400HCB-34N**

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<High Voltage Insulated Gate Bipolar Transistor: HVIGBT >

# CM2400HCB-34N

HIGH POWER SWITCHING USE  
INSULATED TYPE

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

## CM2400HCB-34N



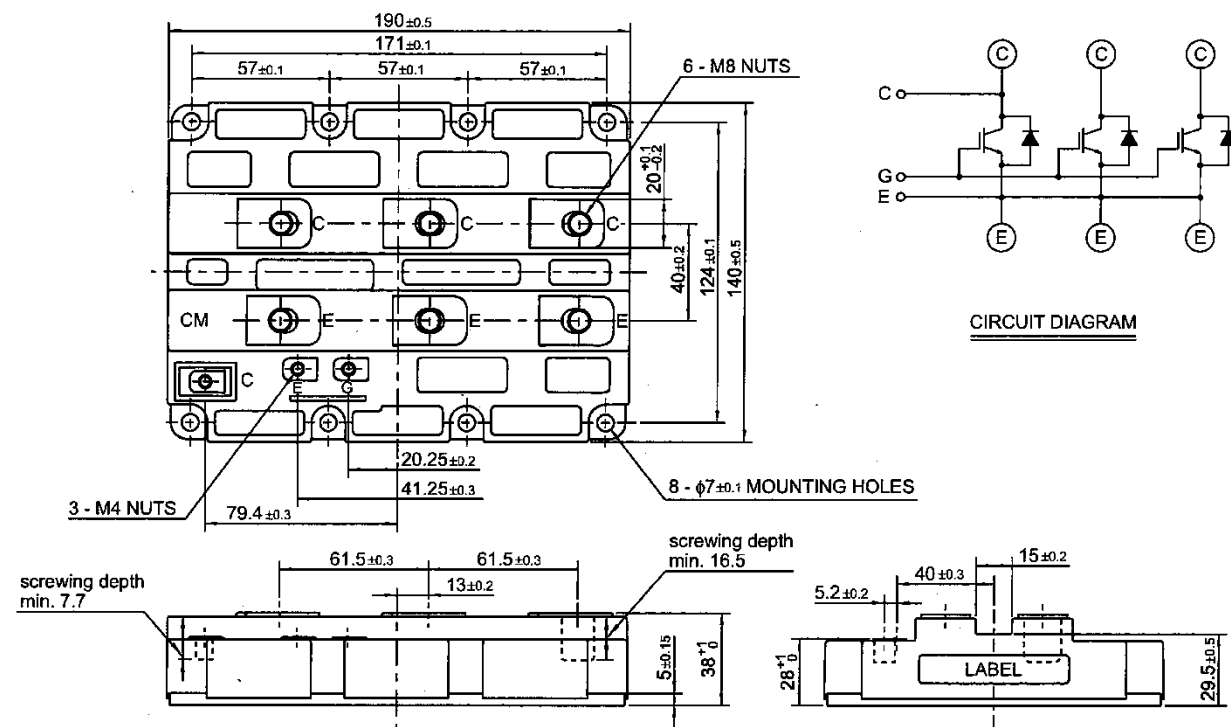
- $I_C$  ..... 2400 A
- $V_{CES}$  ..... 1700 V
- 1-element in pack
- Insulated type
- CSTBT™ / Soft recovery diode
- AlSiC baseplate

## APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

## OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



**MAXIMUM RATINGS**

Symbol	Item	Conditions	Ratings	Unit
$V_{CES}$	Collector-emitter voltage	$V_{GE} = 0V, T_J = 25^\circ C$	1700	V
$V_{GES}$	Gate-emitter voltage	$V_{CE} = 0V, T_J = 25^\circ C$	$\pm 20$	V
$I_C$	Collector current	DC, $T_c = 80^\circ C$	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)	$T_c = 25^\circ C$ , IGBT part	15600	W
$V_{iso}$	Isolation voltage	RMS, sinusoidal, $f = 60Hz, t = 1min.$	4000	V
$T_J$	Junction temperature		$-40 \sim +150$	$^\circ C$
$T_{Jop}$	Operating temperature		$-40 \sim +125$	$^\circ C$
$T_{stg}$	Storage temperature		$-40 \sim +125$	$^\circ C$
$t_{pSC}$	Maximum short circuit pulse width	$V_{CC} = 1000V, V_{CE} \leq V_{CES}, V_{GE} = 15V, T_J = 125^\circ C$	10	$\mu s$

**ELECTRICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$I_{CES}$	Collector cutoff current	$V_{CE} = V_{CES}, V_{GE} = 0V$	$T_J = 25^\circ C$	—	9	mA
			$T_J = 125^\circ C$	7.0	18	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE} = 10V, I_C = 240mA, T_J = 25^\circ C$	5.5	6.5	7.5	V
$I_{GES}$	Gate leakage current	$V_{GE} = V_{GES}, V_{CE} = 0V, T_J = 25^\circ C$	-0.5	—	0.5	$\mu A$
$C_{ies}$	Input capacitance	$V_{CE} = 10V, V_{GE} = 0V, f = 100kHz$ $T_J = 25^\circ C$	—	396	—	nF
$C_{oes}$	Output capacitance		—	21.6	—	nF
$C_{res}$	Reverse transfer capacitance		—	6.3	—	nF
$Q_G$	Total gate charge	$V_{CC} = 900V, I_C = 2400A, V_{GE} = \pm 15V$	—	27.4	—	$\mu C$
$V_{CESat}$	Collector-emitter saturation voltage	$I_C = 2400A$ (Note 4)	$T_J = 25^\circ C$	2.10	2.70	V
		$V_{GE} = 15V$	$T_J = 125^\circ C$	2.35	—	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 900V, I_C = 2400A$	—	0.90	—	$\mu s$
$t_r$	Turn-on rise time	$V_{GE} = \pm 15V, R_{G(on)} = 0.8\Omega$	—	0.30	—	$\mu s$
$E_{on(10\%)}$	Turn-on switching energy (Note 5)	$T_J = 125^\circ C, L_s = 80nH$ Inductive load	—	0.83	—	J
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 900V, I_C = 2400A$	—	1.60	—	$\mu s$
$t_f$	Turn-off fall time	$V_{GE} = \pm 15V, R_{G(off)} = 1.1\Omega$	—	0.25	—	$\mu s$
$E_{off(10\%)}$	Turn-off switching energy (Note 5)	$T_J = 125^\circ C, L_s = 80nH$ Inductive load	—	0.70	—	J
$V_{EC}$	Emitter-collector voltage (Note 2)	$I_E = 2400A$ (Note 4)	$T_J = 25^\circ C$	2.20	3.00	V
		$V_{GE} = 0V$	$T_J = 125^\circ C$	1.85	—	
$t_{rr}$	Reverse recovery time (Note 2)	$V_{CC} = 900V, I_E = 2400A$	—	0.90	—	$\mu s$
$Q_{rr}$	Reverse recovery charge (Note 2)	$V_{GE} = \pm 15V, R_{G(on)} = 0.8\Omega$	—	750	—	$\mu C$
$E_{rec(10\%)}$	Reverse recovery energy (Note 2) (Note 5)	$T_J = 125^\circ C, L_s = 80nH$ Inductive load	—	0.42	—	J

**THERMAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	8.0	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part	—	—	12.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, $\lambda_{grease} = 1W/m^2K, D_{(c-s)} = 100\mu m$	—	6.0	—	K/kW

**MECHANICAL CHARACTERISTICS**

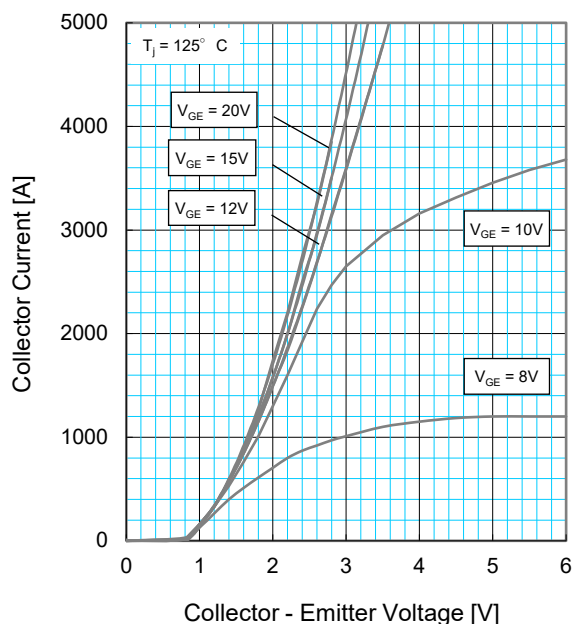
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$M_t$	Mounting torque	M8 : Main terminals screw	7.0	—	13.0	N·m
$M_s$		M6 : Mounting screw	3.0	—	6.0	N·m
$M_t$		M4 : Auxiliary terminals screw	1.0	—	2.0	N·m
$m$	Mass		—	1.5	—	kg
CTI	Comparative tracking index		600	—	—	—
$d_a$	Clearance		19.5	—	—	mm
$d_s$	Creepage distance		32.0	—	—	mm
$L_{PCE}$	Parasitic stray inductance		—	10.0	—	nH
$R_{CC+EE'}$	Internal lead resistance	$T_C = 25\text{ }^{\circ}\text{C}$	—	0.18	—	mΩ

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

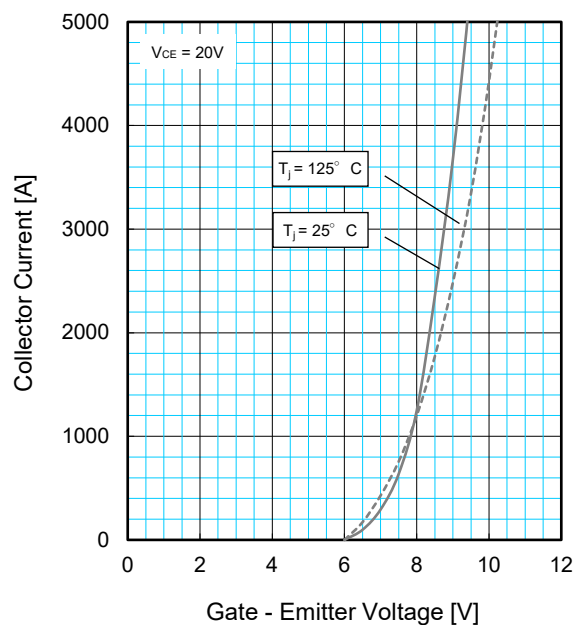
- The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD).
- Junction temperature ( $T_j$ ) should not exceed  $T_{jmax}$  rating ( $150^{\circ}\text{C}$ ).
- Pulse width and repetition rate should be such as to cause negligible temperature rise.
- $E_{on(10\%)} / E_{off(10\%)} / E_{rec(10\%)}$  are the integral of  $0.1V_{CE} \times 0.1I_C \times dt$ .

PERFORMANCE CURVES

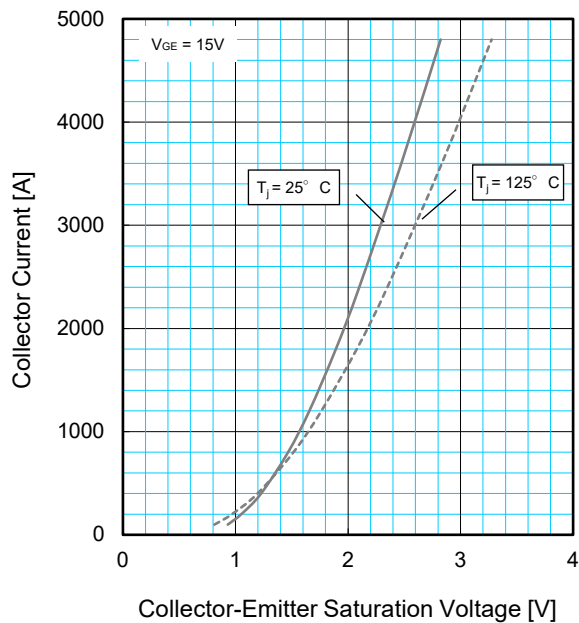
**OUTPUT CHARACTERISTICS  
(TYPICAL)**



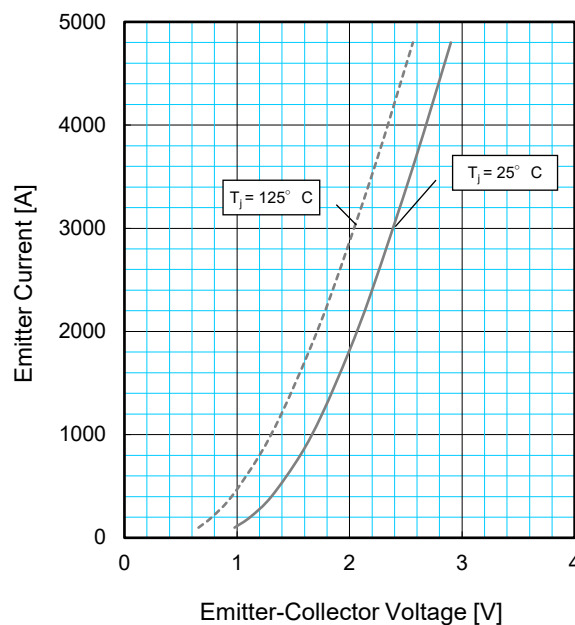
**TRANSFER CHARACTERISTICS  
(TYPICAL)**



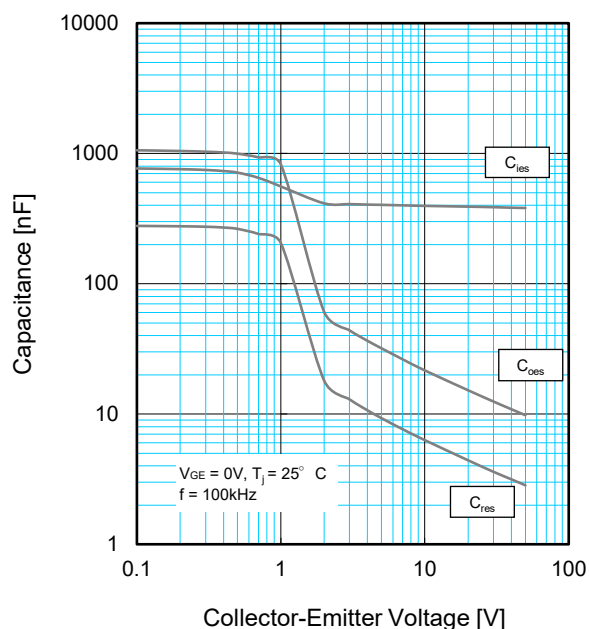
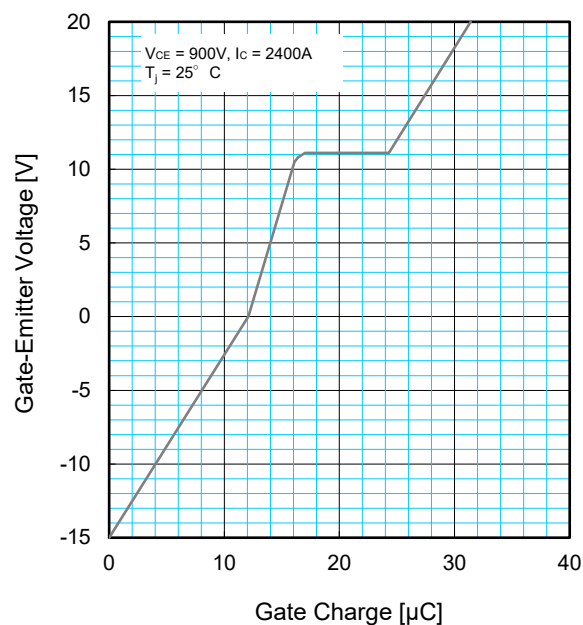
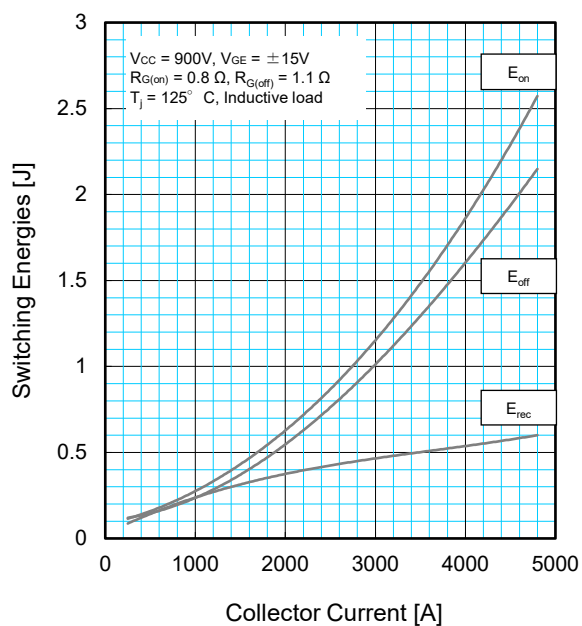
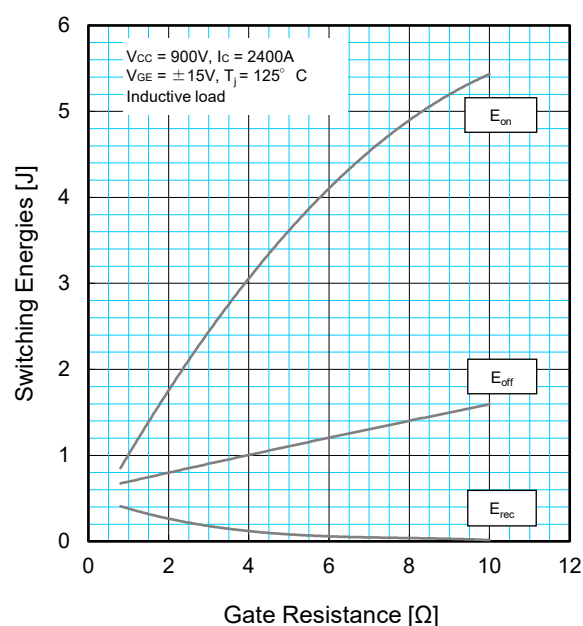
**COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS (TYPICAL)**



**FREE-WHEEL DIODE FORWARD  
CHARACTERISTICS (TYPICAL)**

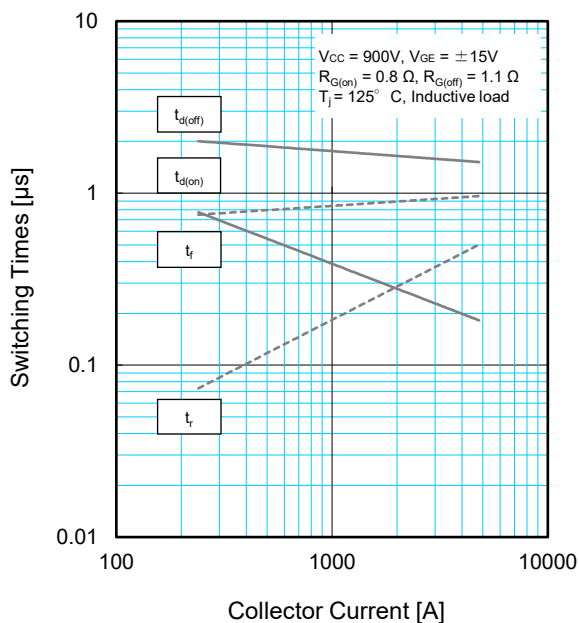


## PERFORMANCE CURVES

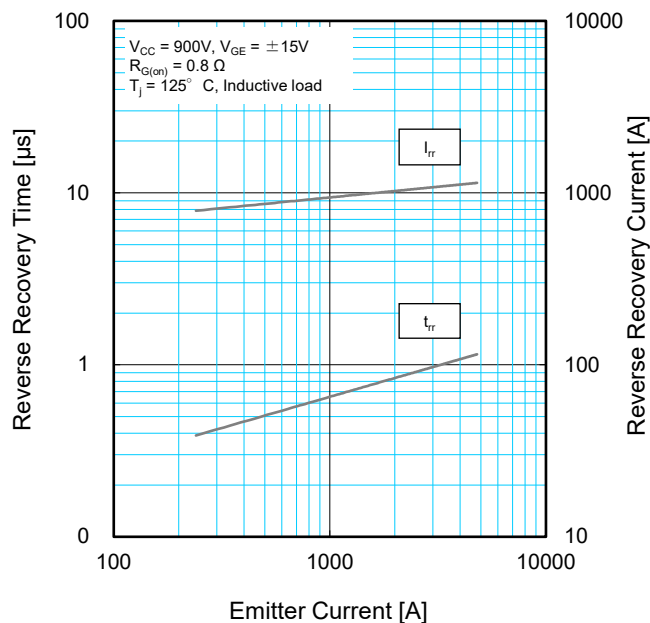
**CAPACITANCE CHARACTERISTICS (TYPICAL)****GATE CHARGE CHARACTERISTICS (TYPICAL)****HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)****HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**

PERFORMANCE CURVES

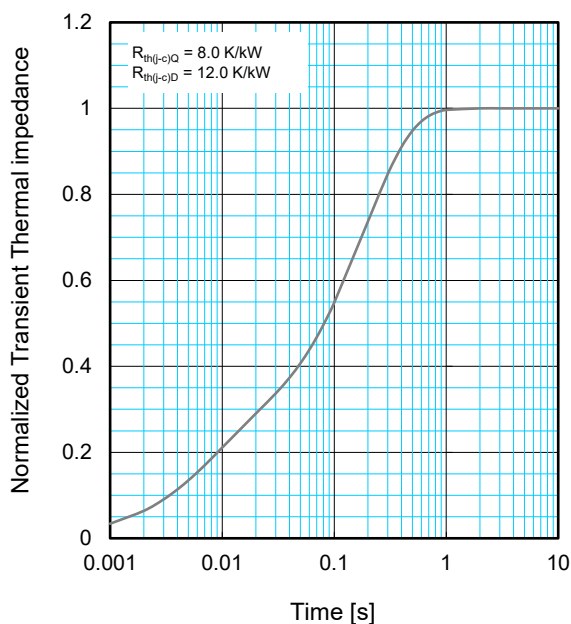
**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



**FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



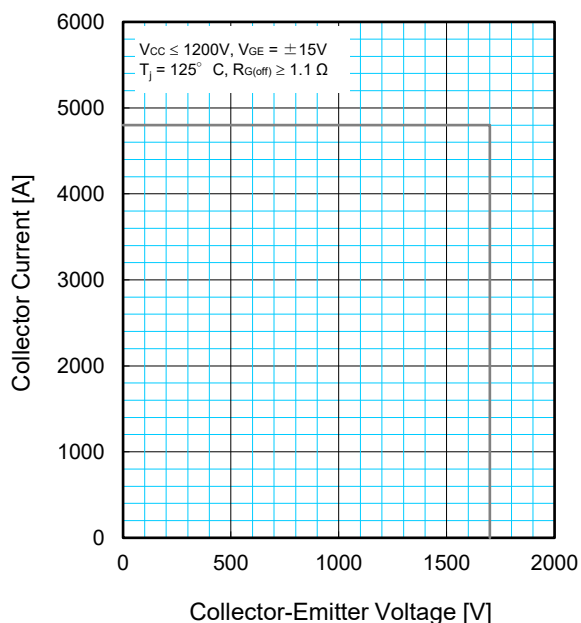
**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS**



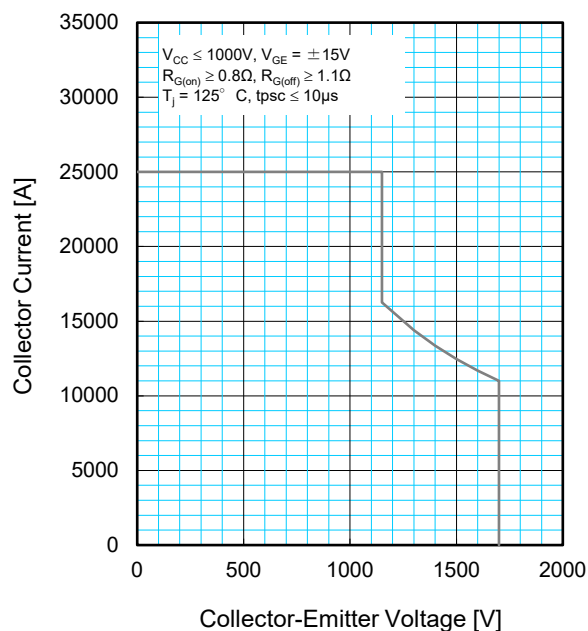
$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i}\right) \right\}$$

PERFORMANCE CURVES

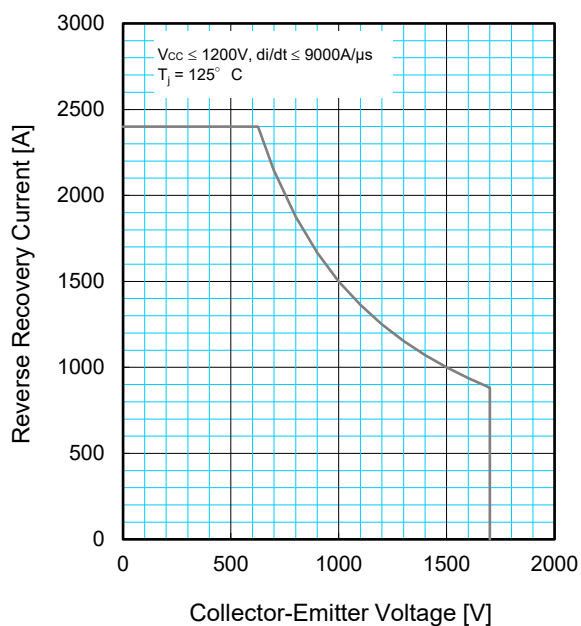
**REVERSE BIAS SAFE OPERATING AREA (RBSOA)**



**SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)**



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





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