

CM2400HC-34N

HIGH POWER SWITCHING 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	$V_{GE} = 0V, T_j = 25^\circ C$	1700	V
V_{GES}	Gate-emitter voltage	$V_{CE} = 0V, T_j = 25^\circ C$	± 20	V
I_C	Collector current	DC, $T_c = 75^\circ C$	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	13100	W
V_{iso}	Isolation voltage	RMS, sinusoidal, $f = 60Hz, t = 1 \text{ min.}$	4000	V
T_j	Junction temperature		$-40 \sim +150$	$^\circ C$
T_{top}	Operating junction temperature		$-40 \sim +125$	$^\circ C$
T_{stg}	Storage temperature		$-40 \sim +125$	$^\circ C$
t_{psc}	Short circuit pulse width	$V_{CC} = 1200V, V_{CE} \leq V_{CES}, V_{GE} = 15V, T_j = 125^\circ C$	10	μs

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
I_{CES}	Collector cutoff current	$V_{CE} = V_{CES}, V_{GE} = 0V$				mA
		$T_j = 25^\circ C$	—	—	8.0	
						mA
		$T_j = 125^\circ C$	—	6.0	16.0	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE} = 10 V, I_C = 240 \text{ mA}, T_j = 25^\circ C$	6.0	7.0	8.0	V
I_{GES}	Gate leakage current	$V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25^\circ C$	—	—	0.5	μA
C_{ies}	Input capacitance	$V_{CE} = 10 V, V_{GE} = 0 V, f = 100 \text{ kHz}$ $T_j = 25^\circ C$	—	352	—	nF
C_{oes}	Output capacitance		—	19.2	—	nF
C_{res}	Reverse transfer capacitance		—	5.6	—	nF
Q_G	Total gate charge	$V_{CC} = 850V, I_C = 2400A, V_{GE} = \pm 15V, T_j = 25^\circ C$	—	24.5	—	μC
V_{CESat}	Collector-emitter saturation voltage	$I_C = 2400 A$ ^(Note 4) $V_{GE} = 15 V$				V
		$T_j = 25^\circ C$	—	2.15	2.80	
						V
		$T_j = 125^\circ C$	—	2.40	—	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 850 V, I_C = 2400 A, V_{GE} = \pm 15 V$ $R_{G(on)} = 0.7 \Omega, T_j = 125^\circ C, L_s = 100 \text{ nH}$ 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	$V_{CC} = 850 V, I_C = 2400 A, V_{GE} = \pm 15 V$ $R_{G(off)} = 1.6 \Omega, T_j = 125^\circ C, L_s = 100 \text{ nH}$ 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) $V_{GE} = 0 V$				V
		$T_j = 25^\circ C$	—	2.60	3.30	
						V
		$T_j = 125^\circ C$	—	2.30	—	
t_{rr}	Reverse recovery time ^(Note 2)	$V_{CC} = 850 V, I_C = 2400 A, V_{GE} = \pm 15 V$ $R_{G(on)} = 0.7 \Omega, T_j = 125^\circ C, L_s = 100 \text{ nH}$ 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

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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, $\lambda_{grease} = 1W/m \cdot k$, $D_{(c-s)} = 100\mu m$	—	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, $T_C = 25^\circ C$	—	0.14	—	m Ω

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 (FWDi).

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 $0.1V_{CE} \times 0.1I_C \times dt$.

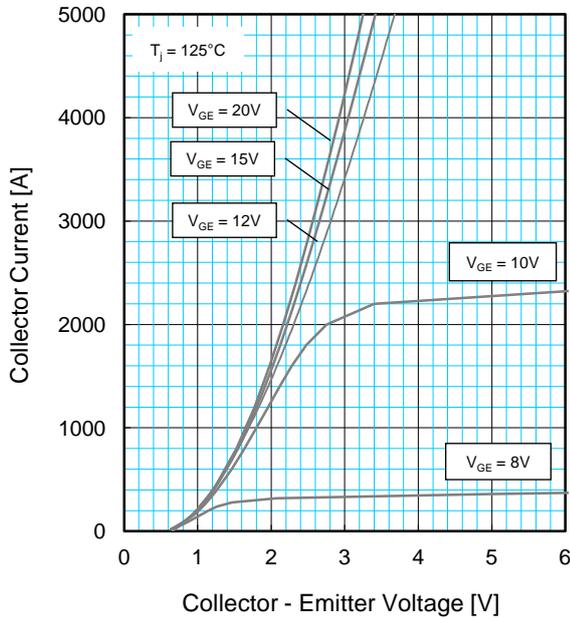
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HIGH POWER SWITCHING USE
INSULATED TYPE

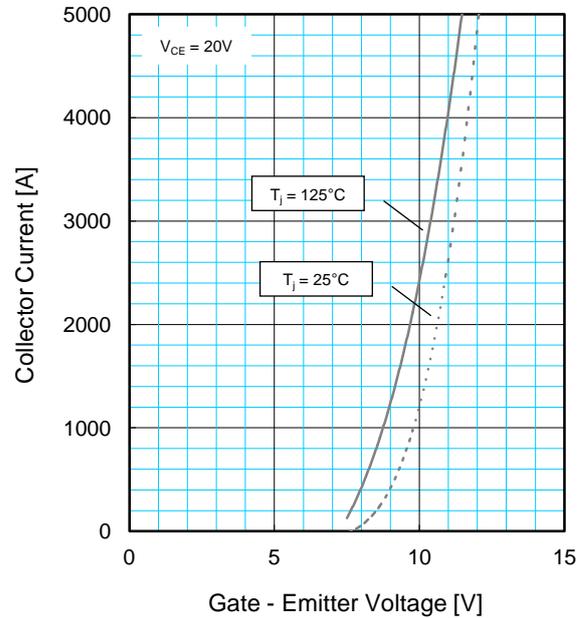
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PERFORMANCE CURVES

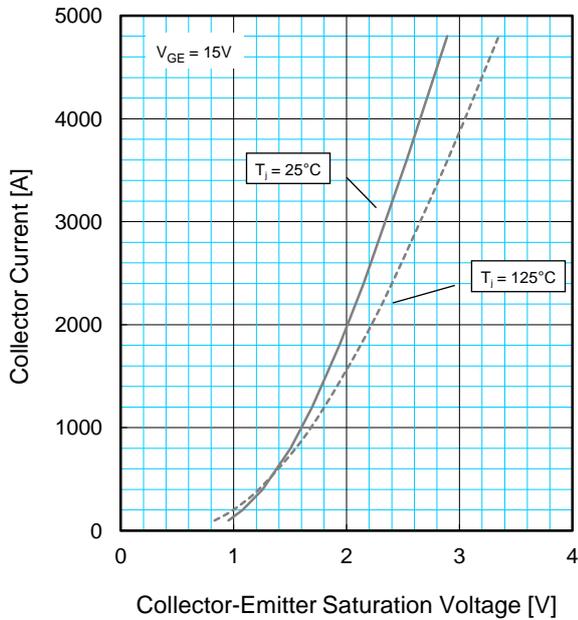
OUTPUT CHARACTERISTICS (TYPICAL)



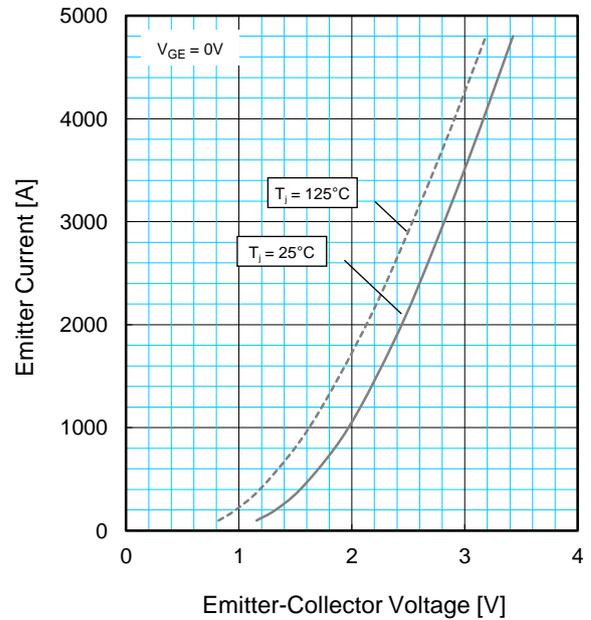
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



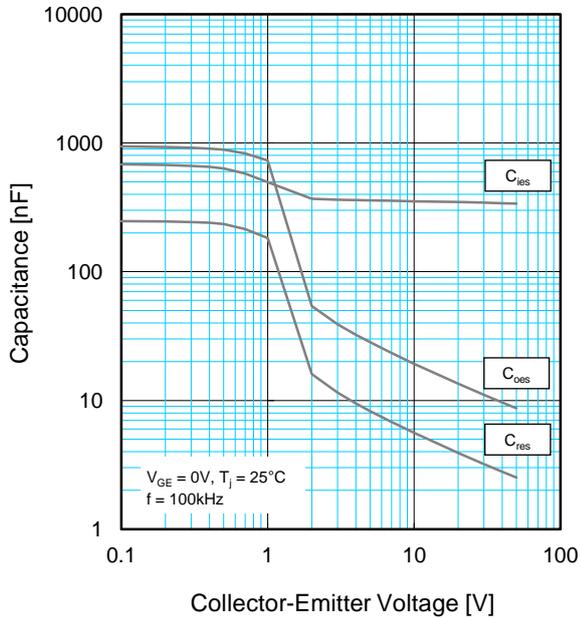
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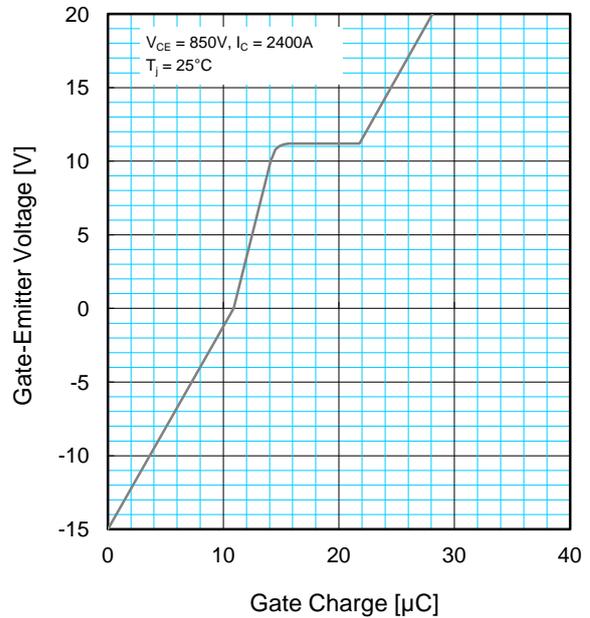
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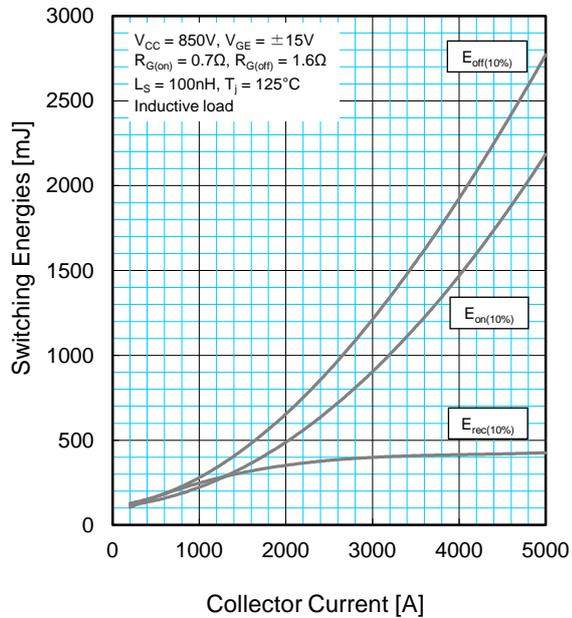
CAPACITANCE CHARACTERISTICS (TYPICAL)



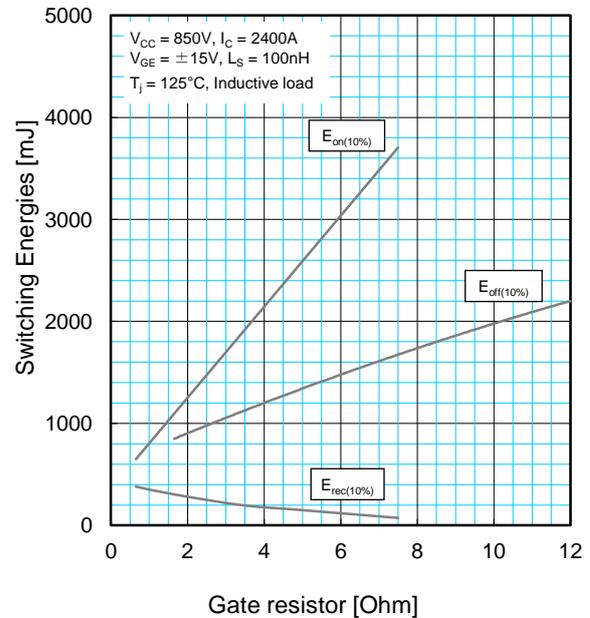
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



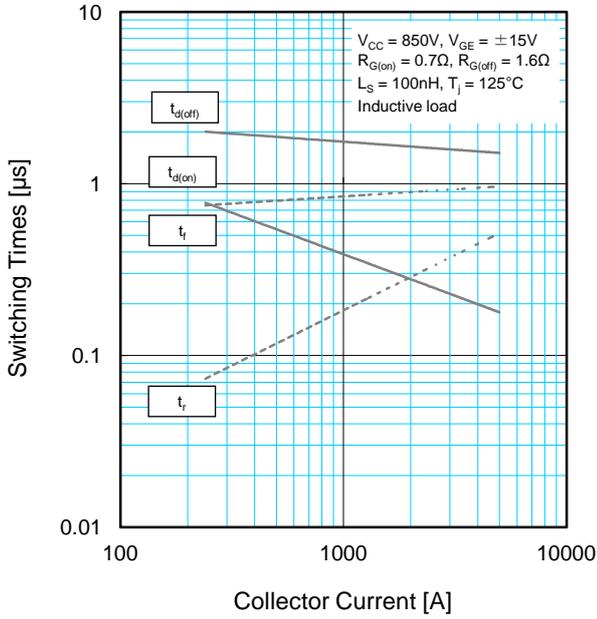
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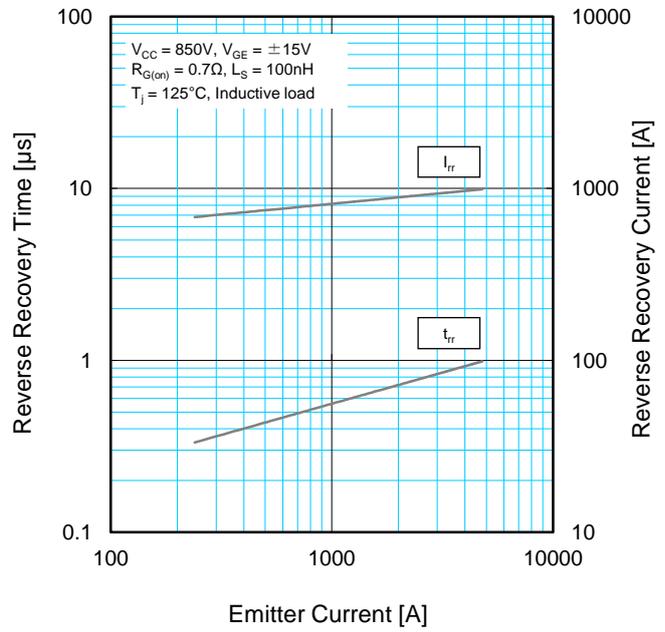
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PERFORMANCE CURVES

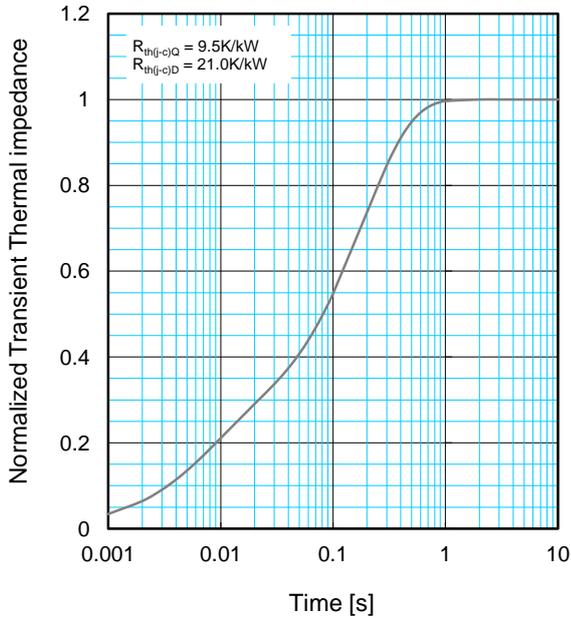
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



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
τ_i [sec]	0.0001	0.0058	0.0602	0.3512

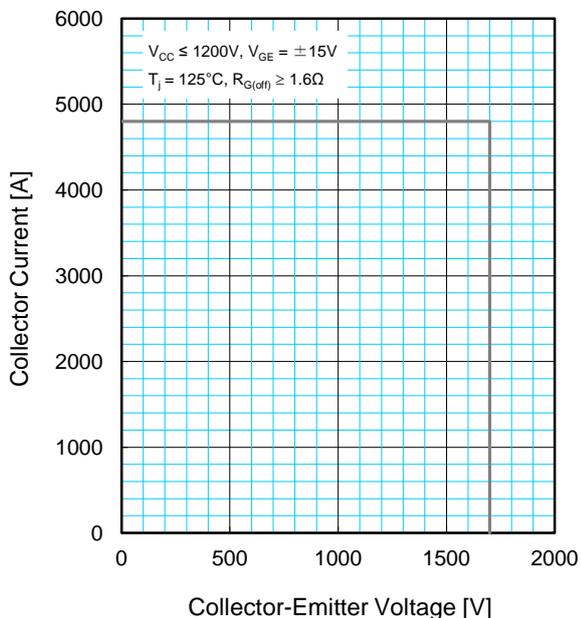
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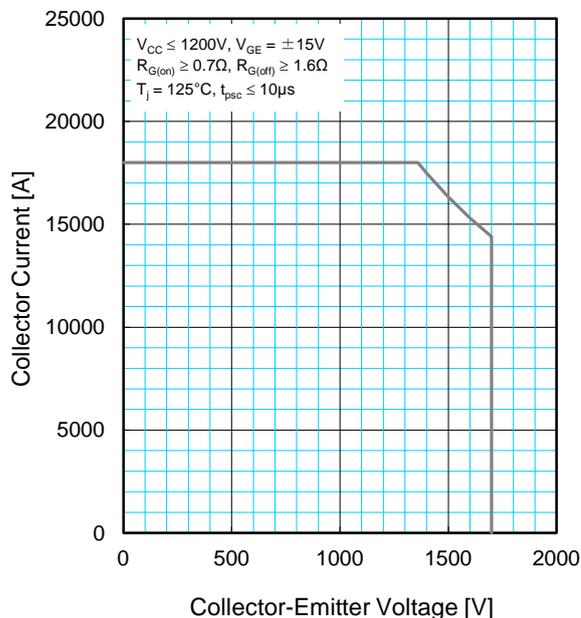
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PERFORMANCE CURVES

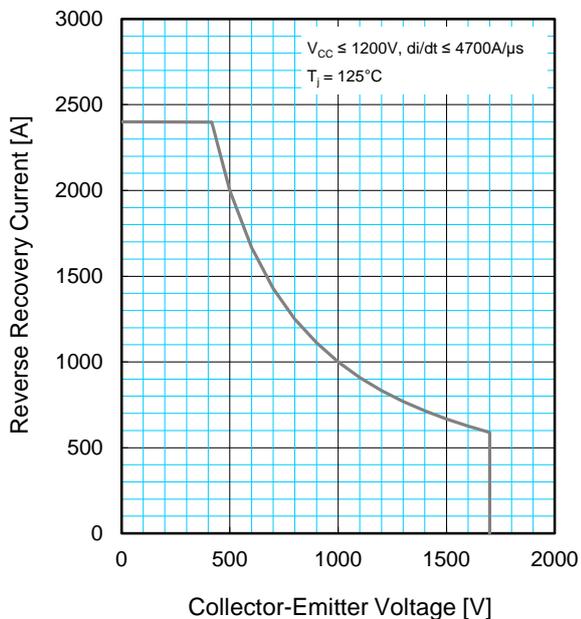
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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