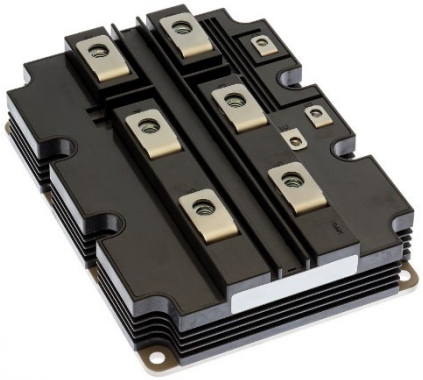
MITSUBISHI ELECTRIC

< High Voltage Insulated Gate Bipolar Transistor: HVIGBT >

CM750HG-130XB

HIGH POWER SWITCHING USE
INSULATED TYPE

CM750HG-130XB

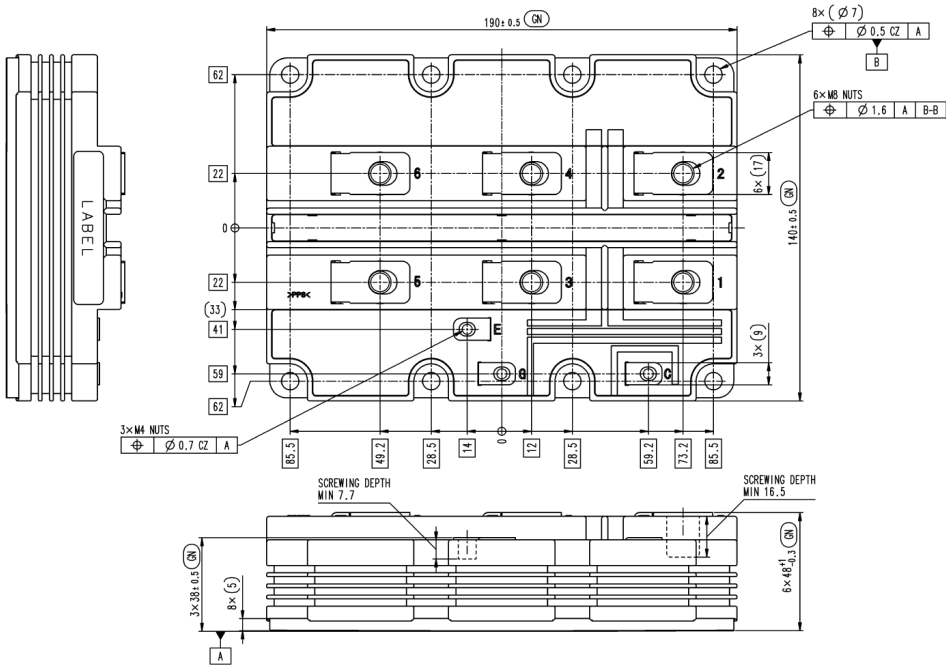


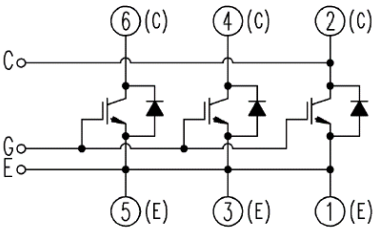
- I_C ..... 750 A
- V_{CES} ..... 6500 V
- 1-elements in a Pack
- High Insulated Type
- CSTBT™(III) / RFC Diode
- Flat Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

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





CIRCUIT DIAGRAM

CM750HG-130XB

HIGH POWER SWITCHING USE
INSULATED TYPE

MAXIMUM RATINGS

Item	Symbol	Conditions		Ratings	Unit
Collector-emitter voltage, gate-emitter short-circuited	V_{CES}	V_{GE} = 0 V	T_j = +150 °C	6500	V
			T_j = +25 °C	6300	V
			T_j = -50 °C	5700	V
Gate-emitter voltage, collector-emitter short-circuited	V_{GES}	V_{CE} = 0 V		±20	V
Collector current	I_C	T_c = 99 °C , DC		750	A
(Repetitive peak) Collector current	I_{CRM}	Pulse(Note 1)		1500	A
Emitter current (FWD forward current)	I_E	T_c = 99 °C , DC		750	A
(Repetitive peak) Emitter current (FWD forward current)	I_{ERM}	Pulse(Note 1)		1500	A
Total power dissipation	P_{tot}	T_c = 25 °C , IGBT part(Note 3)		9350	W
Isolation voltage	V_{isol}	Charged part to the baseplate RMS sinusoidal AC 60Hz 1min		10200	V_{rms}
Partial discharge charge	Q_{pd}	V1 = 6900 V_{rms} , V2 = 5100 V_{rms} , Charged part to the baseplate RMS sinusoidal AC 60Hz (IEC61287-1 Ed.3.0:2014)		10	pC
Junction temperature	T_j	-		-50 ~ +150	°C
Storage temperature	T_{stg}	-		-55 ~ +150	°C
Operating junction temperature	T_{jop}	-		-50 ~ +150	°C
Turn-off cllector current	$I_{C(off)}$	$V_{CC} \leq$ 4500 V , V_{GE} = ±15.0 V , $L_s \leq$ 150 nH	$T_j = T_{jop}$	1500	A
Short-circuit withstand pulse duration	t_{pSC}	$V_{CC} \leq$ 4500 V , V_{GE} = ±15.0 V , $L_s \leq$ 150 nH	$T_j = T_{jop}$	10	µs
Reverse recovery power dissipation of a reverse-blocking IGBT	P_{rr}	$V_{CC} \leq$ 4500 V , $L_s \leq$ 150nH, Ic ≤ 1500A, $di_{on}/dt \leq$ 6400A/µs	T_j = 150 °C	4.3	MW

ELECTRICAL CHARACTERISTICS

Item	Symbol	Conditions		Limits			Unit
				Min.	Typ.	Max.	
Collector-emitter cut-off current	I_{CES}	V_{CE} = 6300 V , V_{GE} = 0 V	T_j = 25 °C	-	-	4.5	mA
		V_{CE} = 6500 V , V_{GE} = 0 V	T_j = 125 °C	-	6.0	-	mA
			T_j = 150 °C	-	42.0	100.0	mA
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 10 V , I_C = 75mA	T_j = 25 °C	6.40	6.90	7.40	V
Gate leakage current	I_{GES}	V_{CE} = 0 V , V_{GE} = ±20 V	T_j = 25 °C	-0.5	-	0.5	µA
Gate charge	Q_G	V_{CC} = 3600 V , I_C = 750 A , V_{GE} = ±15 V	T_j = 25 °C	-	5.7	-	µC
Input capacitance	C_{ies}	V_{CE} = 10 V , V_{GE} = 0 V , f = 100 kHz	T_j = 25 °C	-	101	-	nF
Output capacitance	C_{oes}		T_j = 25 °C	-	5	-	nF
Reverse transfer capacitance	C_{res}		T_j = 25 °C	-	0.6	-	nF
Collector-emitter saturation voltage	V_{CEsat}	I_C = 750 A , V_{GE} = 15 V ,Between auxiliary terminals (Note 4)	T_j = 25 °C	-	3.30	-	V
			T_j = 125 °C	-	4.20	-	V
			T_j = 150 °C	-	4.50	5.10	V
Emitter-collector voltage (Note 2)	V_{EC}	I_E = 750 A , V_{GE} = 0 V , Between auxiliary terminals (Note 4)	T_j = 25 °C	-	2.90	-	V
			T_j = 125 °C	-	3.40	-	V
			T_j = 150 °C	-	3.40	4.00	V
Turn-on delay time	$t_{d(on)}$	V_{CC} = 3600 V , I_C = 750 A , V_{GE} = ±15 V , L_s = 150 nH , $R_{G(on)}$ = 2.4 Ω , $R_{G(off)}$ = 39 Ω , Inductive Load	T_j = 150 °C	-	-	0.90	µs
Rise time	t_r		T_j = 150 °C	-	-	0.30	µs
Turn-on switching energy per pulse (Note 5)	$E_{on(10\%)}$		T_j = 25 °C	-	2.50	-	J
			T_j = 125 °C	-	3.20	-	J
			T_j = 150 °C	-	3.50	-	J
Turn-on switching energy per pulse	E_{on}		T_j = 25 °C	-	2.60	-	J
			T_j = 125 °C	-	3.30	-	J
			T_j = 150 °C	-	3.90	-	J

ELECTRICAL CHARACTERISTICS

Item	Symbol	Conditions		Limits			Unit
				Min.	Typ.	Max.	
Reverse recovery time (Note 2)	t_{rr}	V_{CC} = 3600 V , I_E = 750 A , V_{GE} = ±15 V ,	T_j = 150 °C	-	-	1.80	μs
Reverse recovery current (Note 2)	I_{rr}	L_s = 150 nH ,$R_{G(on)}$ = 2.4 Ω , $R_{G(off)}$ = 39 Ω , Inductive Load	T_j = 25 °C	-	1150	-	A
			T_j = 125 °C	-	1200	-	A
			T_j = 150 °C	-	1300	-	A
Reverse recovery charge (Note 2,6)	$Q_{rr(10\%)}$		T_j = 25 °C	-	725	-	μC
			T_j = 125 °C	-	1100	-	μC
			T_j = 150 °C	-	1400	-	μC
Reverse recovery charge (Note 2)	Q_{rr}		T_j = 25 °C	-	750	-	μC
			T_j = 125 °C	-	1150	-	μC
			T_j = 150 °C	-	1450	-	μC
Reverse recovery energy per pulse (Note 2,5)	$E_{rec(10\%)}$		T_j = 25 °C	-	1.60	-	J
			T_j = 125 °C	-	2.50	-	J
			T_j = 150 °C	-	3.25	-	J
Reverse recovery energy per pulse (Note 2)	E_{rec}		T_j = 25 °C	-	1.70	-	J
			T_j = 125 °C	-	2.80	-	J
			T_j = 150 °C	-	3.50	-	J
Turn-off delay time	$t_{d(off)}$	V_{CC} = 3600 V , I_C = 750 A , V_{GE} = ±15 V ,	T_j = 150 °C	-	-	7.40	μs
Fall time	t_f	L_s = 150 nH ,$R_{G(on)}$ = 2.4 Ω , $R_{G(off)}$ = 39 Ω , Inductive Load	T_j = 150 °C	-	-	0.70	μs
Turn-off switching energy per pulse (Note 5)	$E_{off(10\%)}$		T_j = 25 °C	-	2.50	-	J
			T_j = 125 °C	-	3.30	-	J
			T_j = 150 °C	-	3.50	-	J
Turn-off switching energy per pulse	E_{off}		T_j = 25 °C	-	2.60	-	J
			T_j = 125 °C	-	3.50	-	J
			T_j = 150 °C	-	3.80	-	J

THERMAL CHARACTERISTICS

Item	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermal resistance	$R_{th(j-c)Q}$	Junction to case, IGBT part	-	-	13.3	K/kW
Thermal resistance (Note 2)	$R_{th(j-c)D}$	Junction to case, FWDi part	-	-	16.8	K/kW
Contact thermal resistance	$R_{th(c-s)}$	Case to heat sink, λ_{grease} = 1W/m·K, $D_{(c-s)}$ = 80 μm	-	5.3	-	K/kW

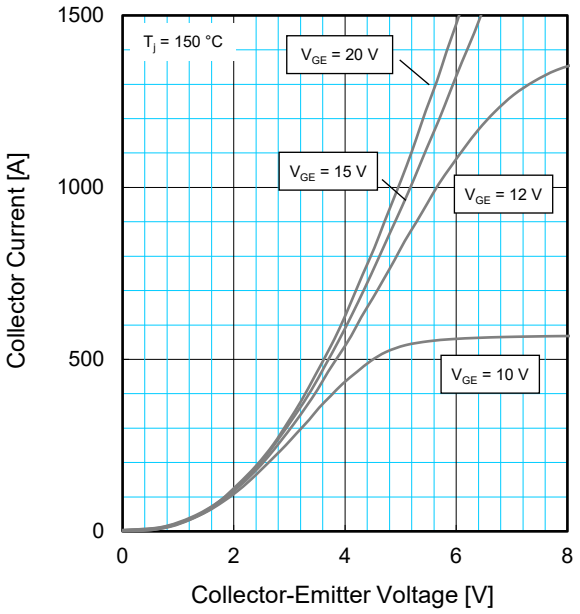
MECHANICAL CHARACTERISTICS

Item	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Mounting torque	M_t	Main terminal screw : M8	7.0	-	19.0	N·m
Mounting torque	M_s	Mounting screw : M6	3.0	-	6.0	N·m
Mounting torque	M_t	Auxiliary terminal screw : M4	1.0	-	3.0	N·m
mass	m	-	-	1.5	-	kg
Comparative tracking index	CTI	-	600	-	-	-
Clearance distance in air	d_a	Between Collector to Emitter	26.0	-	-	mm
Creepage distance	d_s	Between Collector to Emitter	56.0	-	-	mm
Internal inductance	$L_{P(C-E)}$	IGBT part, T_C = 25 °C	-	13.5	-	nH
Internal lead resistance	$R_{CC'+EE'}$	T_C = 25 °C	-	0.12	-	mΩ

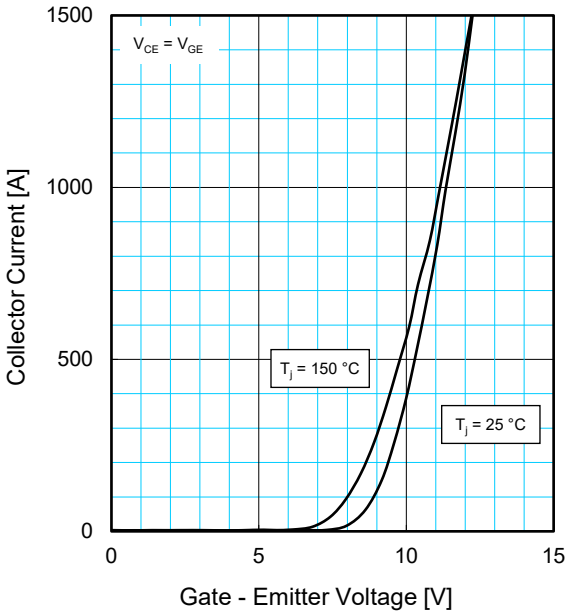
Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed maximum T_{jop} rating.
Note 2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).
Note 3. Junction temperature (T_j) should not exceed T_{j_max} rating.
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(I_E).
Note 6. The integration range of reverse recovery charge is from I_E=0A to 10%I_E.

PERFORMANCE CURVES

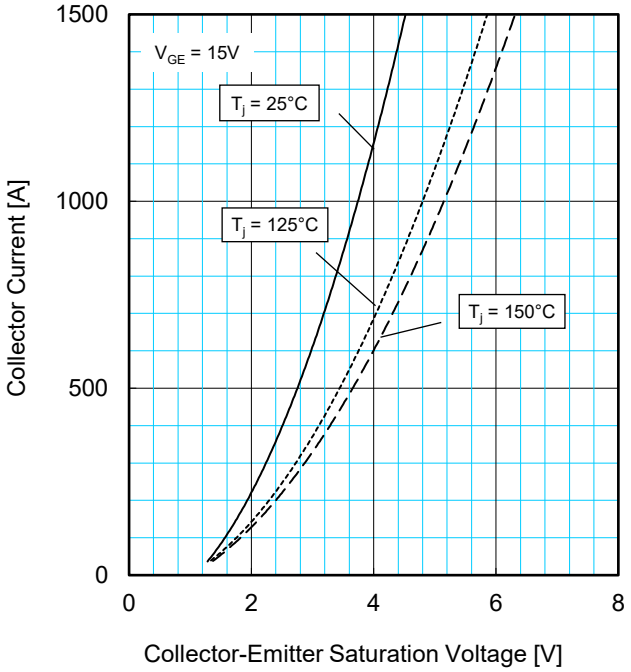
OUTPUT CHARACTERISTICS (TYPICAL)



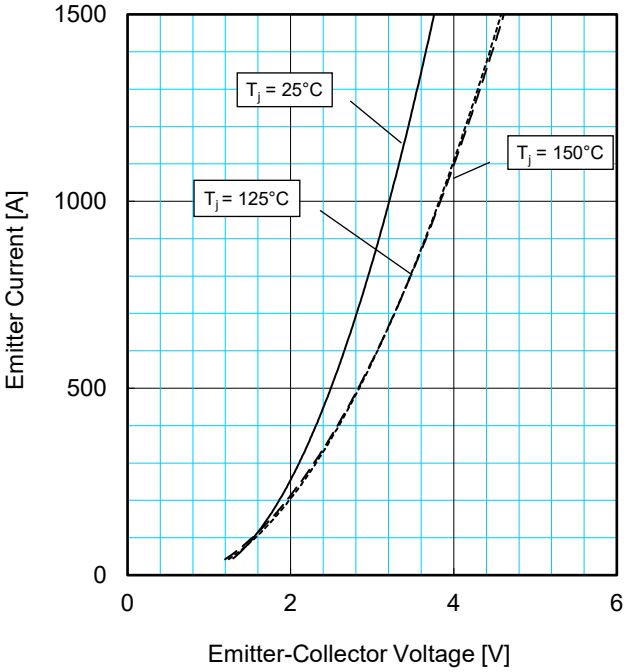
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

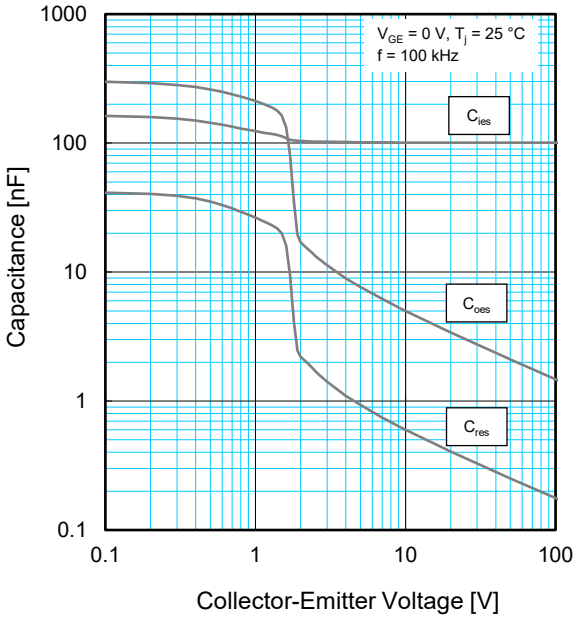


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

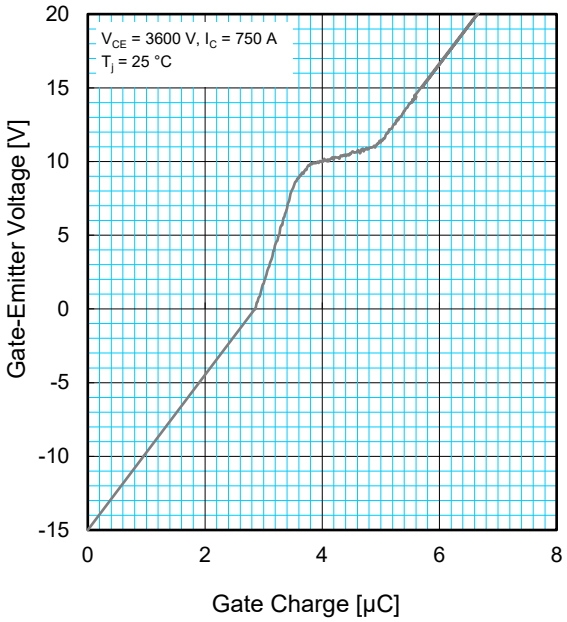


PERFORMANCE CURVES

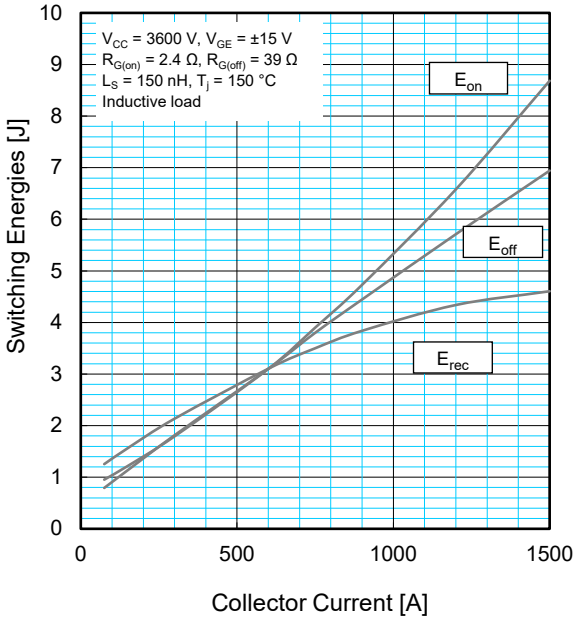
CAPACITANCE CHARACTERISTICS (TYPICAL)



GATE CHARGE CHARACTERISTICS (TYPICAL)

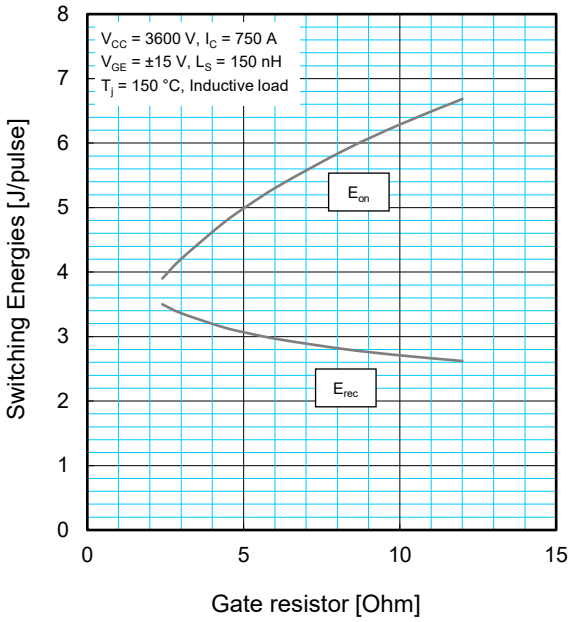


HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

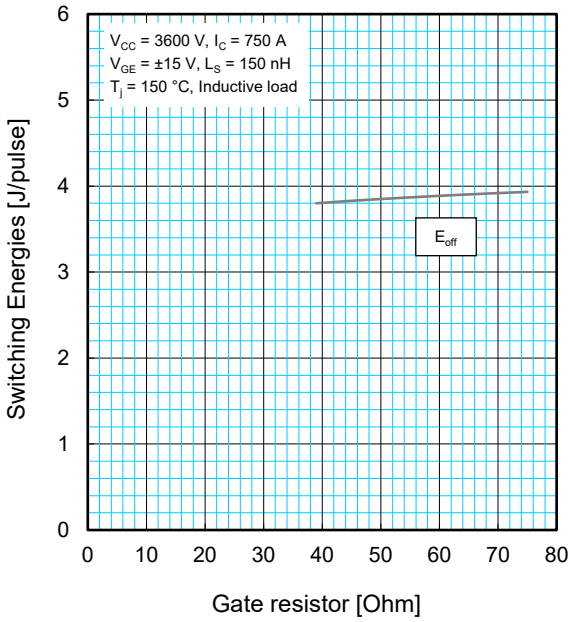


PERFORMANCE CURVES

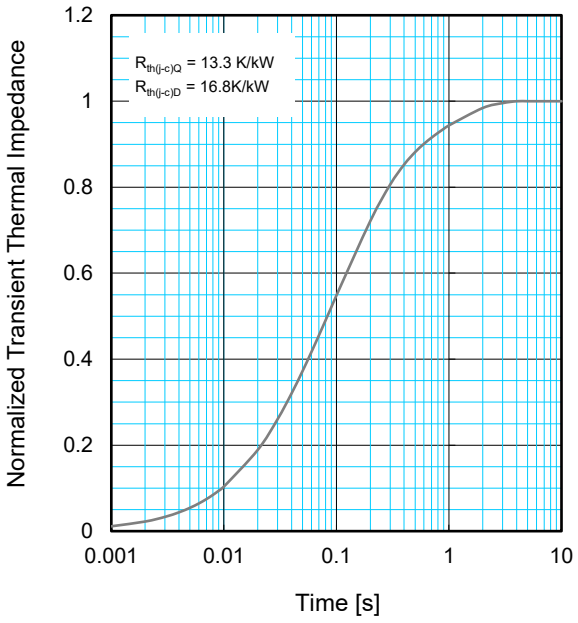
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS

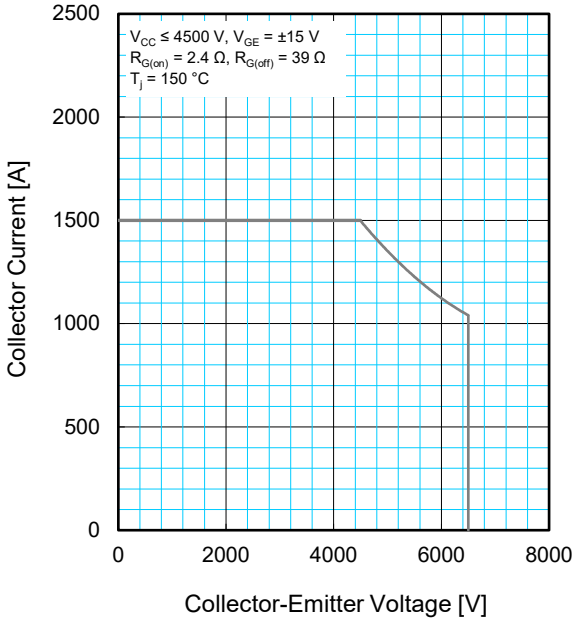


$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i} \right) \right\}$$

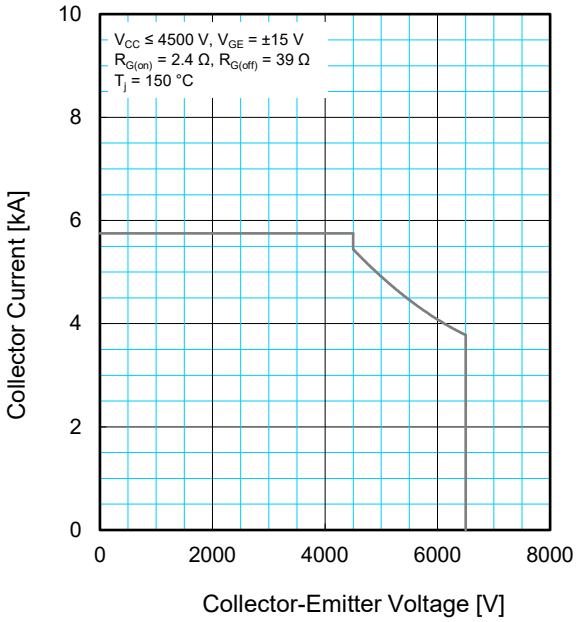
	1	2	3	4
R_i / R_{th} :	0.0000	0.2002	0.2401	0.5596
τ_i [sec.] :	0.0001	0.7842	0.0347	0.1319

PERFORMANCE CURVES

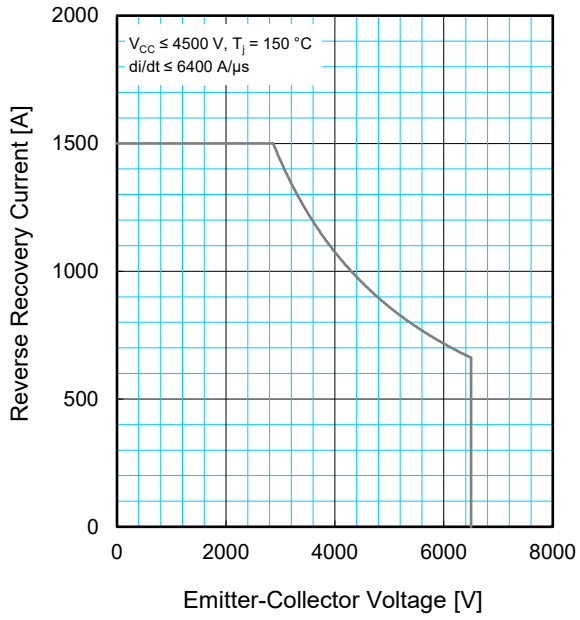
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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