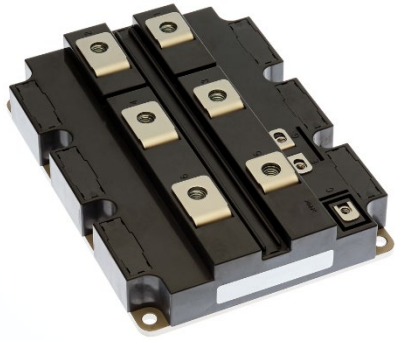
MITSUBISHI ELECTRIC

< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM1200E4C-66X

HIGH POWER SWITCHING USE
INSULATED TYPE

CM1200E4C-66X

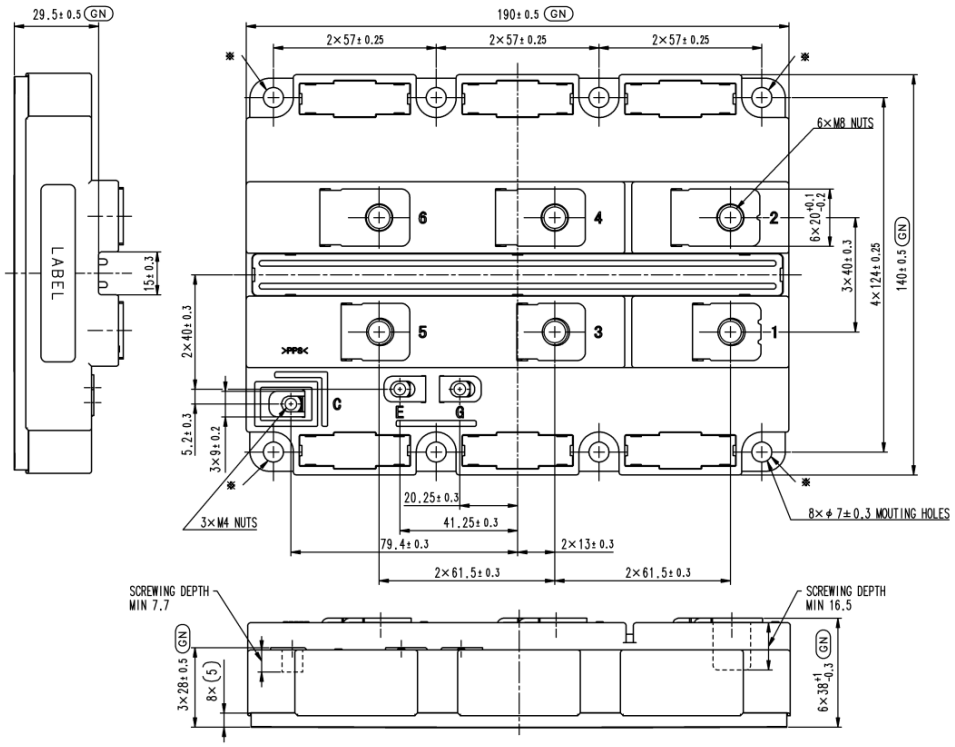


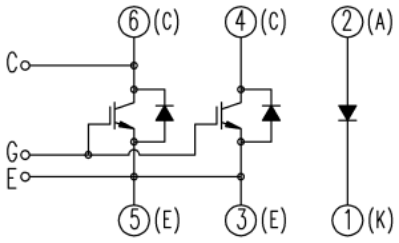
- I_C 1200A
- V_{CES} 3300V
- 2-element in a Pack (for brake chopper)
- Insulated Type
- CSTBT™(III) / RFC Diode
- Flat baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

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





CIRCUIT DIAGRAM

MAXIMUM RATINGS

Item	Symbol	Conditions	Ratings	Unit
Collector-emitter voltage	V_{CES}	V_{GE}=0V, T_j=-40~ +150℃	3300	V
		V_{GE}=0V, T_j=-50℃	3200	
Gate-emitter voltage	V_{GES}	V_{CE}=0V, T_j=25℃	±20	V
Repetitive peak reverse voltage	V_{RRM}	T_j=-40~+150℃	3300	V
		T_j=-50℃	3200	
Collector current	I_C	Tc=110℃, DC	1200	A
	I_{CRM}	Pulse (Note 1)	2400	A
Emitter current (FWDi forward current)	I_E	Tc=90℃, DC	1200	A
	I_{ERM}	Pulse (Note 1)	2400	A
Forward current	I_F	Tc=90℃, DC	1200	A
	I_{FRM}	Pulse (Note 1)	2400	A
Total power dissipation	P_{tot}	Tc=25℃, IGBT part (Note 2)	11900	W
Isolation voltage	V_{isol}	T_j=25℃, Charged part to the baseplate RMS sinusoidal, 60Hz 1min	6000	V_{rms}
Partial discharge	Q_{pd}	V1=3500V, V2=2600V, Charged part to the baseplate RMS sinusoidal, 60Hz	10	pC
Junction temperature	T_j	Maximum temperature range in off-state or on-state(non-switching)	-50 ~ 150	℃
Storage temperature	T_{stg}	Maximum case temperature range in onstate	-55 ~ 150	℃
Operating junction temperature	T_{jop}	Maximum junction temperature range for switching operation	-50 ~ 150	℃
Maximum turn-off switching current	$I_{C(off)}$	V_{GE}=±15V, V_{CC} ≤ 2500V, L_S ≤ 150nH T_j=Top	2400	A
(Short circuit) Gate pulse width	t_{pSC}	V_{GE}=±15V, L_S ≤ 80nH, V_{CC} ≤ 2500V T_j=Top	10	μs
Maximum reverse recovery instantaneous power (FWDi)	P_{rr}	I_C=2400A, T_j=150℃, V_{CC} ≤ 2500V, L_S ≤ 150nH di_{on}/d_t ≤ 7333A/μs	3.0	MW
Maximum reverse recovery instantaneous power (Clamp-Di)		I_F=2400A, T_j=150℃, V_{CC} ≤ 2500V, L_S ≤ 150nH di_F/d_t ≤ 7333A/μs	3.0	
Surge (non-repetitive) forward current(Clamp-Di)	I_{FSM}	T_j = 150°C start, Half sine wave 50Hz 1cycle、Peak value	10.6	kA
Surge current load integral (Clamp-Di)	I^2t	T_j = 150°C start, Half sine wave 50Hz 1cycle	561	kA^2・s

ELECTRICAL CHARACTERISTICS

Item	Symbol	Conditions		Lmits			Unit
				Min.	Typ,	Max.	
Collector-emitter cut-off current	I_{CES}	V_{CE}=3300V V_{GE}=0V	T_j=25℃	-	-	4.0	mA
			T_j=125℃	-	4.0	-	
			T_j=150℃	-	24.0	48.0	
Repetitive reverse current (Clamp-Di)	I_{RRM}	V_R=3300V	T_j=25℃	-	-	2.0	mA
			T_j=125℃	-	2.0	-	
			T_j=150℃	-	12.0	24.0	
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE}=10V, Ic=120mA	T_j=25℃	6.50	7.00	7.50	V
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	T_j=25℃	0.0	-	0.5	μA
		V_{CE}=0V, V_{GE}=-20V		-0.5	-	0.0	
Gate charge	Q_G	V_{CC}=1800V, I_C=12000A V_{GE}=±15V	T_j=25℃	-	9.0	-	μC
Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=100kHz	T_j=25℃	-	139	-	nF
Output capacitance	C_{oes}		T_j=25℃	-	9.3	-	nF
Reverse transfer capacitance	C_{res}		T_j=25℃	-	1.3	-	nF
Collector-emitter saturation voltage	V_{CEsat}	I_C=1200A V_{GE}=15V (Excluding package drop) (Note 3)	T_j=25℃	-	2.00	-	V
			T_j=125℃	-	2.50	-	
			T_j=150℃	-	2.60	3.10	
Emitter-collector voltage	V_{EC}	I_E=1200A V_{GE}=0V (Excluding package drop) (Note 3)	T_j=25℃	-	2.20	-	V
			T_j=125℃	-	2.40	-	
			T_j=150℃	-	2.50	3.00	
Forward voltage(Clamp-Di)	V_{FM}	I_F=1200A (Excluding package drop) (Note 3)	T_j=25℃	-	2.20	-	V
			T_j=125℃	-	2.40	-	
			T_j=150℃	-	2.50	3.00	
Turn-on delay time	$t_{d(on)}$	V_{CC}=1800V, I_C=1200A V_{GE}=±15V $R_{G(on)}$=2.2Ω, $R_{G(off)}$=18Ω L_S=150nH Inductive load	T_j=150℃	-	-	0.90	μs
Rise time	t_r		T_j=150℃	-	-	0.50	μs
Turn-on switching energy per pulse(Note 4)	$E_{on(10\%)}$		T_j=25℃	-	1.95	-	J
			T_j=125℃	-	2.15	-	
			T_j=150℃	-	2.25	-	
Turn-on switching energy per pulse	Eon		T_j=25℃	-	2.00	-	J
			T_j=125℃	-	2.25	-	
			T_j=150℃	-	2.35	-	
Turn-off delay time	$t_{d(off)}$	V_{CC}=1800V, I_C=1200A V_{GE}=±15V $R_{G(on)}$=2.2Ω, $R_{G(off)}$=18Ω L_S=150nH Inductive load	T_j=150℃	-	-	4.25	μs
Fall time	t_f		T_j=150℃	-	-	0.80	μs
Turn-off switching energy per pulse(Note 4)	$E_{off(10\%)}$		T_j=25℃	-	1.55	-	J
			T_j=125℃	-	2.00	-	
			T_j=150℃	-	2.05	-	
Turn-off switching energy per pulse	Eoff		T_j=25℃	-	1.65	-	J
			T_j=125℃	-	2.10	-	
			T_j=150℃	-	2.25	-	

ELECTRICAL CHARACTERISTICS (continuation)

Item	Symbol	Conditions		Lmits			Unit
				Min.	Typ,	Max.	
Reverse recovery time (FWDi)	t_{rr}	V_{CC}=1800V, I_C=1200A V_{GE}=±15V $R_{G(on)}$=2.2Ω L_S=150nH Inductive load	T_j=150℃	-	1.15	-	μs
Reverse recovery current (FWDi)	I_{rr}		T_j=25℃	-	-	-	A
			T_j=125℃	-	1550	-	
			T_j=150℃	-	1650	-	
Reverse recovery current (FWDi)(Note 5)	$Q_{rr(10\%)}$		T_j=25℃	-	-	-	μC
			T_j=125℃	-	1600	-	
			T_j=150℃	-	1650	-	
Reverse recovery current (FWDi)	Qrr		T_j=25℃	-	-	-	μC
			T_j=125℃	-	1750	-	
			T_j=150℃	-	1800	-	
Reverse recovery energy per pulse (FWDi)(Note 4)	$E_{rec(10\%)}$		T_j=25℃	-	1.15	-	J
			T_j=125℃	-	1.65	-	
			T_j=150℃	-	1.85	-	
Reverse recovery energy per pulse (FWDi)	Erec		T_j=25℃	-	1.25	-	J
			T_j=125℃	-	1.75	-	
			T_j=150℃	-	1.95	-	
Reverse recovery time (Clamp-Di)	t_{rr}		T_j=150℃	-	1.15	-	μs
Reverse recovery current (Clamp-Di)	I_{rr}		T_j=25℃	-	-	-	A
			T_j=125℃	-	1550	-	
			T_j=150℃	-	1650	-	
Reverse recovery current (Clamp-Di)(Note 5)	$Q_{rr(10\%)}$		T_j=25℃	-	-	-	μC
			T_j=125℃	-	1600	-	
			T_j=150℃	-	1650	-	
Reverse recovery current (Clamp-Di)	Qrr		T_j=25℃	-	-	-	μC
			T_j=125℃	-	1750	-	
			T_j=150℃	-	1800	-	
Reverse recovery energy per pulse (Clamp-Di)(Note 4)	$E_{rec(10\%)}$		T_j=25℃	-	1.15	-	J
			T_j=125℃	-	1.65	-	
			T_j=150℃	-	1.85	-	
Reverse recovery energy per pulse (Clamp-Di)	Erec		T_j=25℃	-	1.25	-	J
			T_j=125℃	-	1.75	-	
			T_j=150℃	-	1.95	-	

THERMAL CHARACTERISTICS

Item	Symbol	Conditions	Lmits			Unit
			Min.	Typ,	Max.	
Thermal resistance	$R_{th(j-c)Q}$	Junction to case IGBT part	-	-	10.5	K/kW
	$R_{th(j-c)D}$	Junction to case FWDi part, FWDi part	-	-	16.5	
		Junction to case FWDi part, Clamp-Di part	-	-	16.5	
Contact thermal resistance	$R_{th(c-s)}$	Case to heat sink, Composite of IGBT part and FWDi part λ_{grease}=1W/m・K, $D_{(c-s)}$=80μm	-	7.5	-	
		Case to heat sink, Clamp-Di part, λ_{grease}=1W/m ・K $D_{(c-s)}$=80μm	-	15.0	-	

MECHANICAL CHARACTERISTICS

Item	Symbol	Conditions	Lmits			Unit
			Min.	Typ,	Max.	
Mounting torque	M_t	Main terminal screw: M8	7.0	-	19.0	N・m
	M_s	Mounting screw: M6	3.0	-	6.0	N・m
	M_t	Auxiliary terminal screw: M4 (Note 6)	1.0	-	2.0	N・m
Mass, Weight	m	-	-	1.2	-	kg
Comparative tracking index	CTI	-	600	-	-	—
Clearance	d_a	Between C-E(G) Between Each terminal to Baseplate	19.5	-	-	mm
Creepage distance	d_s	Between C-E(G) Between Each terminal to Baseplate	32.0	-	-	mm
Parasitic stray inductance	$L_{P(C-E)}$	IGBT part	-	12.0	-	nH
Internal lead resistance (IGBT・FWDi part)	$R_{CC'+EE'}$	Tc=25℃	-	0.14	-	mΩ
Internal lead resistance (Clamp-Di part)	$R_{AA'+KK'}$	Tc=25℃	-	0.27	-	

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

Note2. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).

Note3. Pulse width and repetition rate should be such as to cause negligible temperature rise.

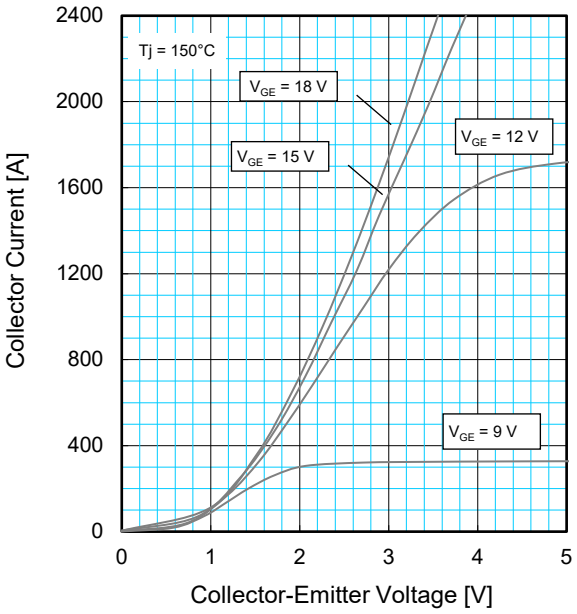
Note4. The integration range of switching energies is from 10%V_{CE} to 10%I_C(10%I_E).

Note5. The integration range of reverse recovery charge is from I_E = 0A to 10%I_E.

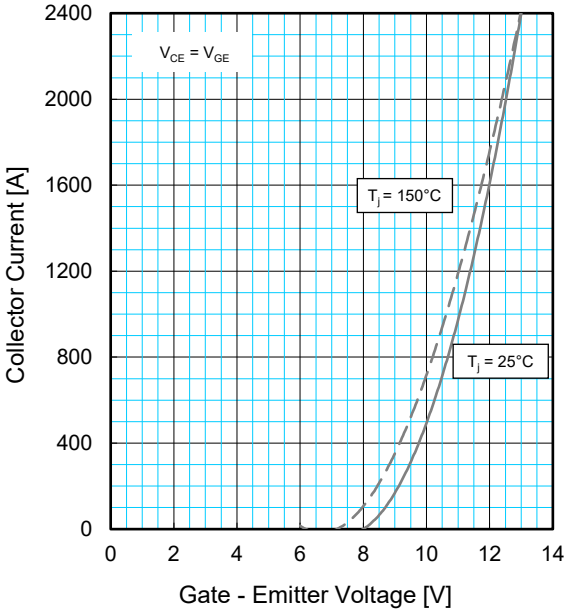
Note6. The maximum specified value is 3.0Nm under the condition of using PCB mounted on the power module.

PERFORMANCE CURVES

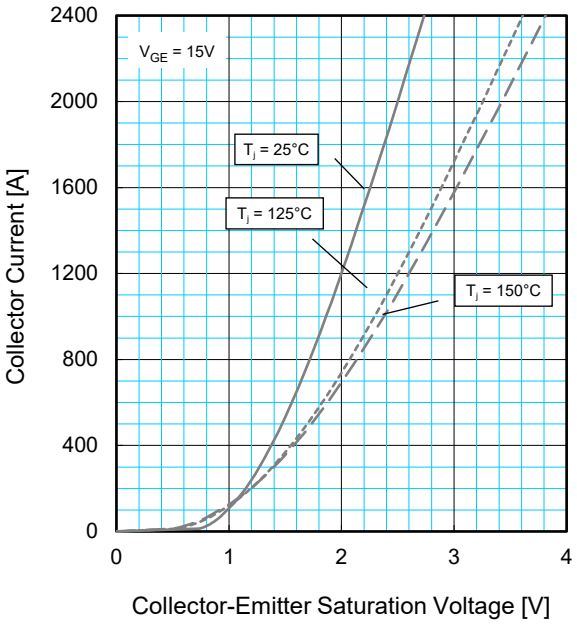
OUTPUT CHARACTERISTICS (TYPICAL)



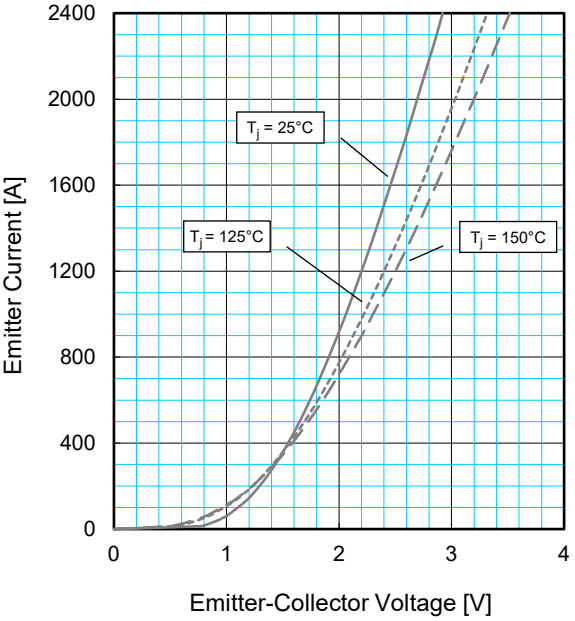
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

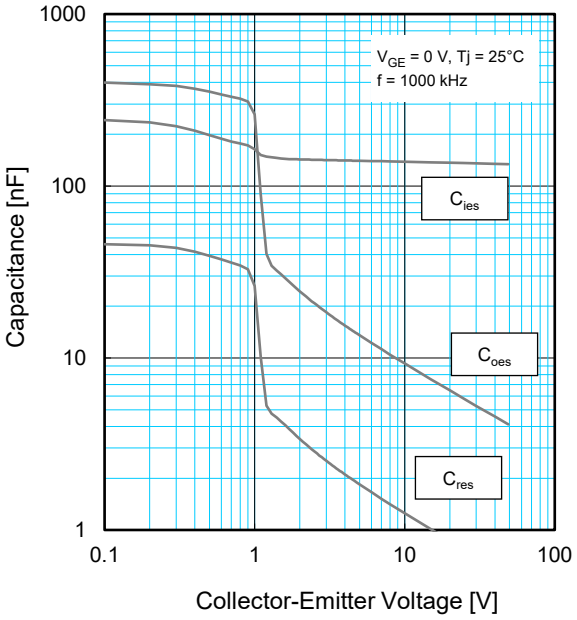


DIODE FORWARD CHARACTERISTICS (TYPICAL)

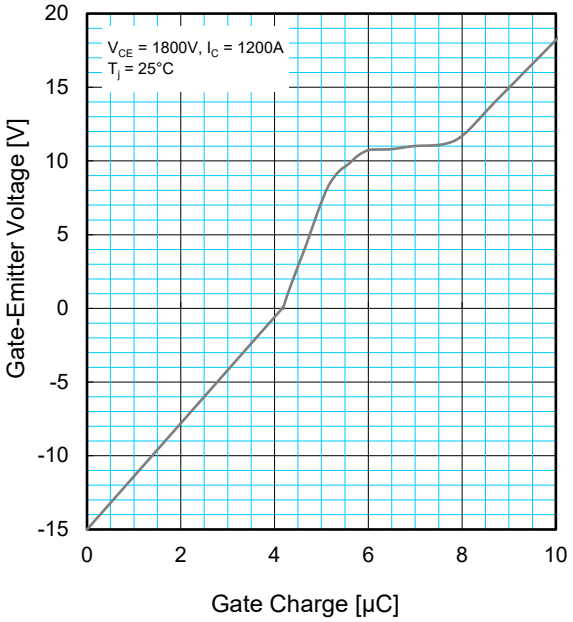


PERFORMANCE CURVES

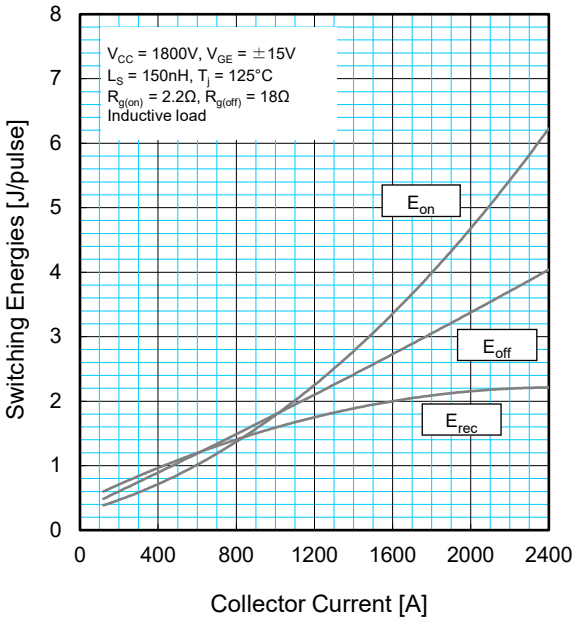
CAPACITANCE CHARACTERISTICS (TYPICAL)



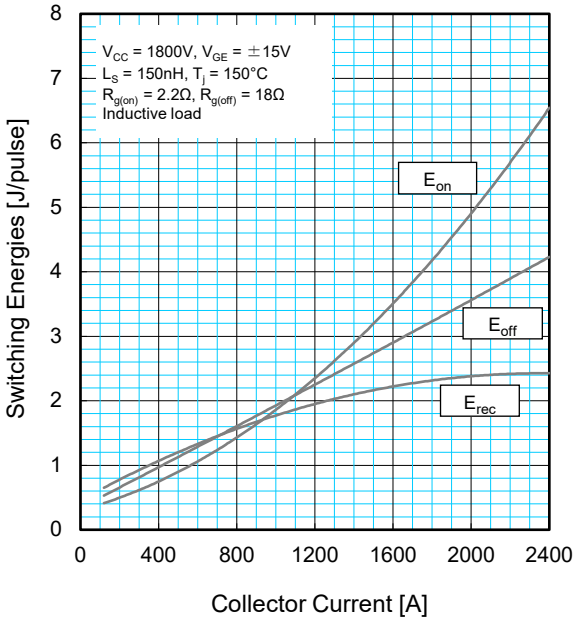
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

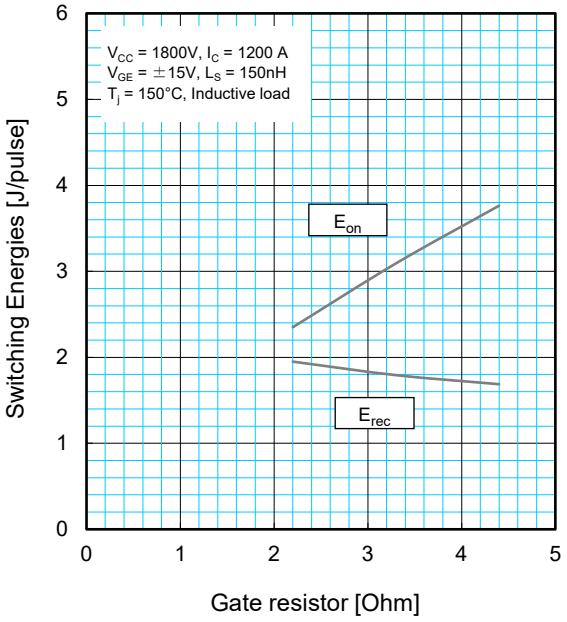


HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

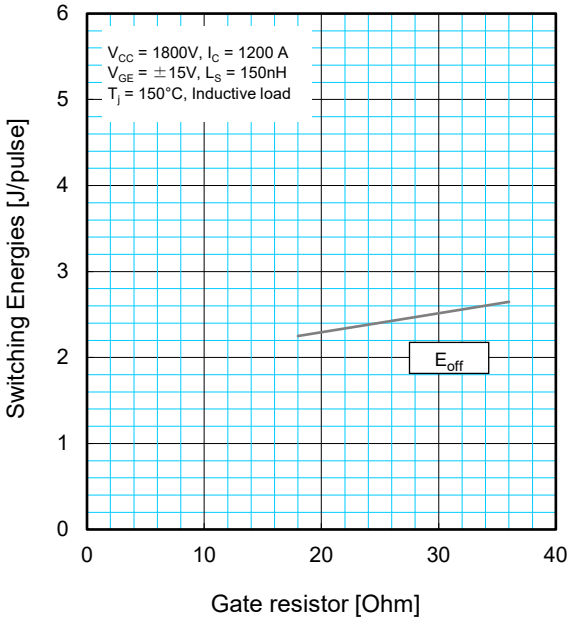


PERFORMANCE CURVES

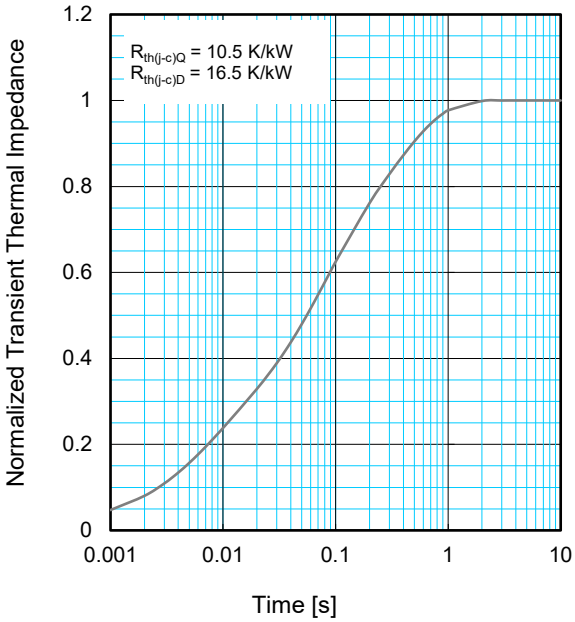
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS

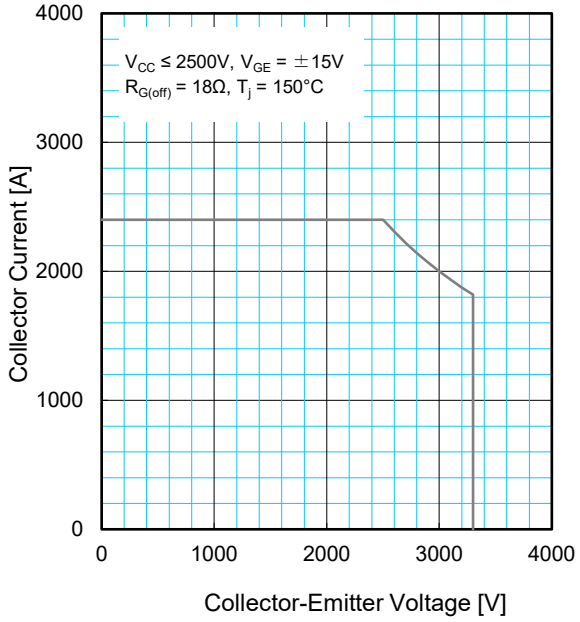


$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i} \right) \right\}$$

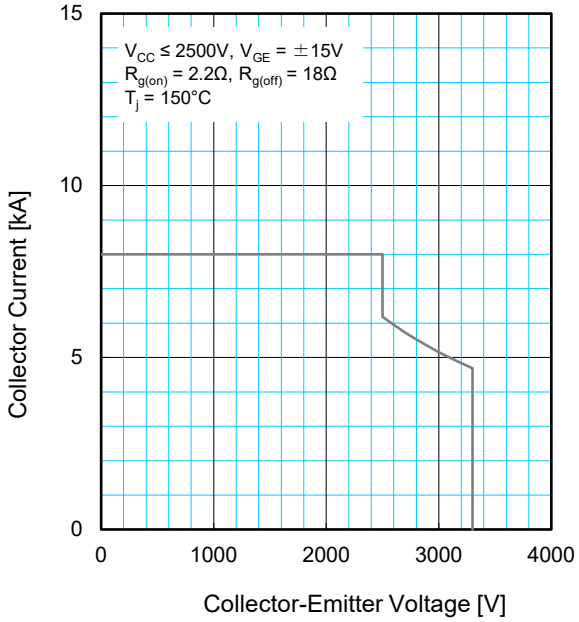
	1	2	3	4
R_i [K/kW] :	0.0096	0.1893	0.4044	0.3967
τ_i [sec] :	0.0001	0.0058	0.0602	0.3512

PERFORMANCE CURVES

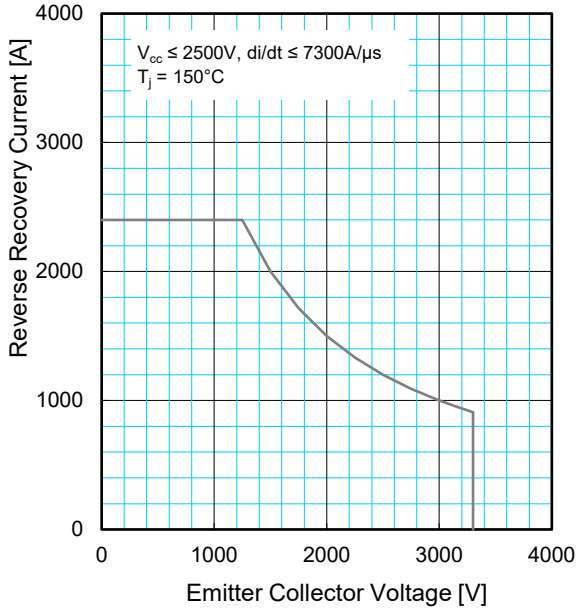
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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



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