

< High Voltage Insulated Gate Bipolar Transistor: HVIGBT >

CM1500HC-66XB

HIGH POWER SWITCHING USE
INSULATED TYPE

CM1500HC-66XB



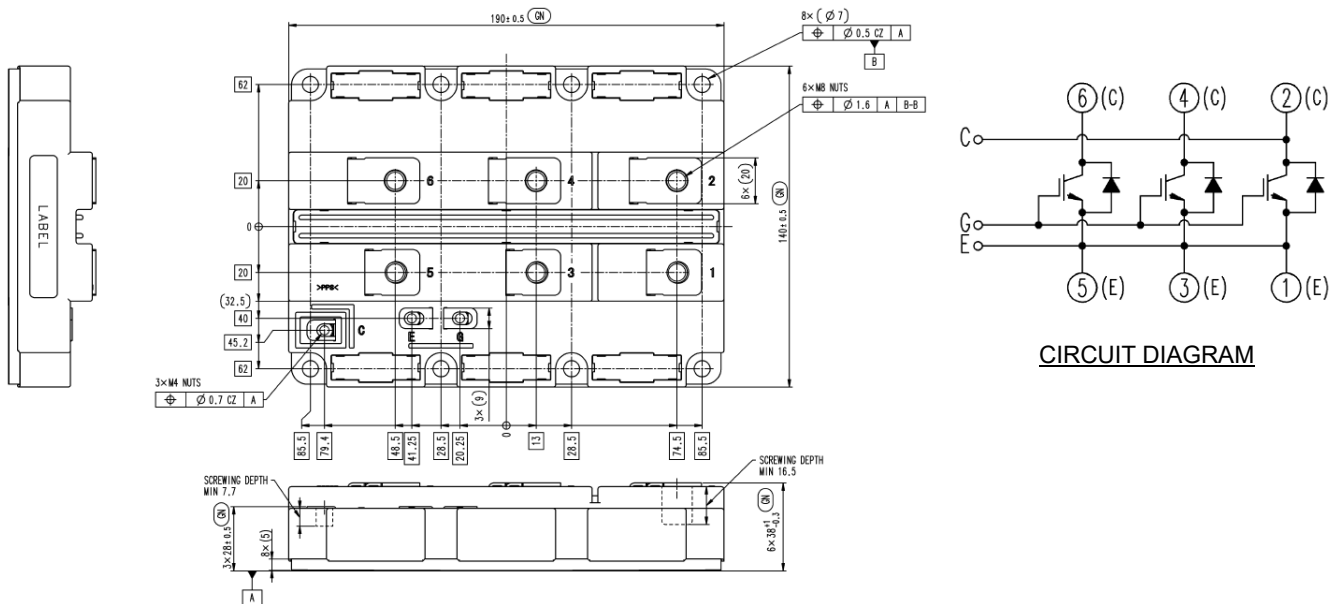
- I_C 1500 A
- V_{CES} 3300 V
- 1-elements in a Pack
- Insulated Type
- CSTBTTM(III) / RFC Diode
- Flat Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



CM1500HC-66XB**HIGH POWER SWITCHING USE
INSULATED TYPE****MAXIMUM RATINGS**

Item	Symbol	Conditions		Ratings	Unit
Collector-emitter voltage	V _{CES}	V _{GE} = 0 V	T _i = -40~+150 °	3300	V
			T _i = -50 °C	3200	V
Gate-emitter voltage	V _{GES}	V _{CE} = 0 V		±20	V
Collector current	I _C	T _c = 100 °C , DC		1500	A
(Repetitive peak) Collector current	I _{CRM}	Pulse ^(Note 1)		3000	A
Emitter current ^(Note 2)	I _E	T _c = 95 °C , DC		1500	A
(Repetitive peak) Emitter current ^(Note 2)	I _{ERM}	Pulse ^(Note 1)		3000	A
Total power dissipation	P _{tot}	T _c = 25 °C , IGBT part ^(Note 3)		14300	W
Isolation voltage	V _{isol}	RMS, sinusoidal, f = 60 Hz, t = 1min. T _c = 25 °C		6000	V _{rms}
Partial discharge charge	Q _{pd}	Charged part to the base-plate V1 = 3500 V _{rms} , V2 = 2600 V _{rms} AC 60 Hz, Tc = 25 °C (acc. to IEC61287-1)		10	pC
Junction temperature	T _j	-		-50 ~ +150	°C
Storage temperature	T _{stg}	-		-55 ~ +150	°C
Operating junction temperature	T _{jop}	-		-50 ~ +150	°C
Short-circuit withstand pulse duration	t _{pSC}	V _{CC} ≤ 2500 V , V _{GE} = ±15.0 V , L _s ≤ 100μH	T _j = T _{jop}	10	μs

ELECTRICAL CHARACTERISTICS

Item	Symbol	Conditions		Limits			Unit
				Min.	Typ.	Max.	
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 3300\text{ V}$, $V_{GE} = 0\text{ V}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	-	3.0	mA
			$T_J = 125\text{ }^{\circ}\text{C}$	-	4.0	-	mA
			$T_J = 150\text{ }^{\circ}\text{C}$	-	26.0	75.0	mA
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 10\text{ V}$, $I_C = 150\text{mA}$	$T_J = 25\text{ }^{\circ}\text{C}$	5.80	6.30	6.80	V
Gate leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$	$T_J = 25\text{ }^{\circ}\text{C}$	-0.5	-	0.5	μA
Gate charge	Q_G	$V_{CC} = 1800\text{ V}$, $I_C = 1500\text{ A}$, $V_{GE} = \pm 15\text{ V}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	8.2	-	μC
Input capacitance	C_{ies}	$V_{CE} = 10\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	164	-	nF
Output capacitance	C_{oes}		$T_J = 25\text{ }^{\circ}\text{C}$	-	11	-	nF
Reverse transfer capacitance	C_{res}		$T_J = 25\text{ }^{\circ}\text{C}$	-	1.4	-	nF
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 1500\text{ A}$ ^(Note 4) , $V_{GE} = 15\text{ V}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	2.60	-	V
			$T_J = 125\text{ }^{\circ}\text{C}$	-	3.20	-	V
			$T_J = 150\text{ }^{\circ}\text{C}$	-	3.30	3.70	V
Emitter-collector voltage ^(Note 2)	V_{EC}	$I_E = 1500\text{ A}$ ^(Note 4) , $V_{GE} = 0\text{ V}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	2.30	-	V
			$T_J = 125\text{ }^{\circ}\text{C}$	-	2.60	-	V
			$T_J = 150\text{ }^{\circ}\text{C}$	-	2.60	3.20	V
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 1800\text{ V}$, $I_C = 1500\text{ A}$,	$T_J = 150\text{ }^{\circ}\text{C}$	-	-	1.40	μs
Rise time	t_r	$V_{GE} = \pm 15\text{ V}$, $L_s = 100\text{ nH}$,	$T_J = 150\text{ }^{\circ}\text{C}$	-	-	0.50	μs
Turn-on switching energy per pulse ^(Note 5)	$E_{on(10\%)}$	$R_{G(on)} = 2.0\text{ }\Omega$, $R_{G(off)} = 27\text{ }\Omega$, Inductive load	$T_J = 25\text{ }^{\circ}\text{C}$	-	1.57	-	J
			$T_J = 125\text{ }^{\circ}\text{C}$	-	2.06	-	J
			$T_J = 150\text{ }^{\circ}\text{C}$	-	2.24	-	J
Turn-on switching energy per pulse	E_{on}		$T_J = 25\text{ }^{\circ}\text{C}$	-	1.66	-	J
			$T_J = 125\text{ }^{\circ}\text{C}$	-	2.20	-	J
			$T_J = 150\text{ }^{\circ}\text{C}$	-	2.40	-	J

CM1500HC-66XB

HIGH POWER SWITCHING USE

INSULATED TYPE

ELECTRICAL CHARACTERISTICS

Item	Symbol	Conditions		Limits			Unit
				Min.	Typ.	Max.	
Reverse recovery time ^(Note 2)	t _{rr}	V _{CC} = 1800 V , I _E = 1500 A , V _{GE} = ±15 V , L _s = 100 nH , R _{G(on)} = 2.0 Ω , R _{G(off)} = 27 Ω , Inductive load	T _j = 150 °C	-	-	1.20	μs
Reverse recovery current ^(Note 2)	I _{rr}		T _j = 25 °C	-	1580	-	A
			T _j = 125 °C	-	1620	-	A
			T _j = 150 °C	-	1670	-	A
			T _j = 25 °C	-	830	-	μC
Reverse recovery charge ^(Note 2, 6)	Q _{rr(10%)}		T _j = 125 °C	-	1160	-	μC
			T _j = 150 °C	-	1400	-	μC
			T _j = 25 °C	-	880	-	μC
Reverse recovered charge of a reverse-blocking IGBT ^(Note 2)	Q _{rr}		T _j = 125 °C	-	1250	-	μC
			T _j = 150 °C	-	1500	-	μC
			T _j = 25 °C	-	0.95	-	J
Reverse recovery energy per pulse ^(Note 2, 5)	E _{rec(10%)}		T _j = 125 °C	-	1.31	-	J
			T _j = 150 °C	-	1.58	-	J
Reverse recovery energy per pulse ^(Note 2)	E _{rec}		T _j = 25 °C	-	1.05	-	J
			T _j = 125 °C	-	1.48	-	J
			T _j = 150 °C	-	1.79	-	J
Turn-off delay time	t _{d(off)}	V _{CC} = 1800 V , I _C = 1500 A ,	T _j = 150 °C	-	-	6.40	μs
Fall time	t _f	V _{GE} = ±15 V , L _s = 100 nH ,	T _j = 150 °C	-	-	0.70	μs
Turn-off switching energy per pulse ^(Note 5)	E _{off(10%)}	R _{G(on)} = 2.0 Ω , R _{G(off)} = 27 Ω , Inductive load	T _j = 25 °C	-	2.00	-	J
			T _j = 125 °C	-	2.54	-	J
			T _j = 150 °C	-	2.48	-	J
Turn-off (switching) energy per pulse	E _{off}	T _j = 25 °C	-	2.32	-	J	
		T _j = 125 °C	-	2.96	-	J	
		T _j = 150 °C	-	2.87	-	J	

THERMAL CHARACTERISTICS

Item	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermal resistance	$R_{th(j-c)Q}$	Junction to case, IGBT part	-	-	9.0	K/kW
Thermal resistance ^(Note 2)	$R_{th(j-c)D}$	Junction to case, FWDi part	-	-	11.6	K/kW
Contact thermal resistance	$R_{th(c-s)}$	Case to heat sink, $\lambda_{grease} = 1\text{W/m}\cdot\text{K}$, $D_{(c-s)} = 80 \mu\text{m}$	-	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 ^(Note 7)	M_t	Auxiliary terminal screw : M4	1.0	-	3.0	N·m
mass	m	-	-	1.3	-	kg
Comparative tracking index	CTI	-	600	-	-	-
Clearance distance in air	d_a	-	19.5	-	-	mm
Creepage distance along surface	d_s	-	32.0	-	-	mm
Internal inductance	$L_{P(C-E)}$	IGBT part, $T_c=25^\circ\text{C}$	-	8.0	-	nH
Internal lead resistance	$R_{CC+EE'}$	$T_c = 25^\circ\text{C}$	-	0.09	-	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 $I_E=0\text{A}$ to 10% I_E .

Note 7. The maximum specified value is under the condition of using PCB mounted on the power module. In case no PCB is used this maximum torque for M4 screw is 2.0 N·m.

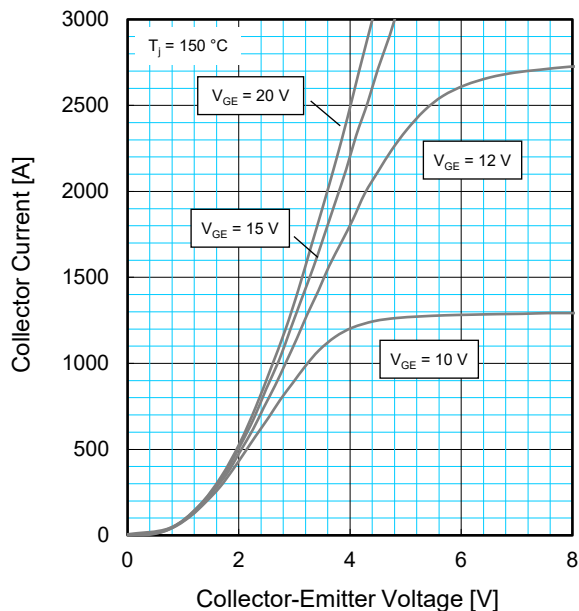
CM1500HC-66XB

HIGH POWER SWITCHING USE

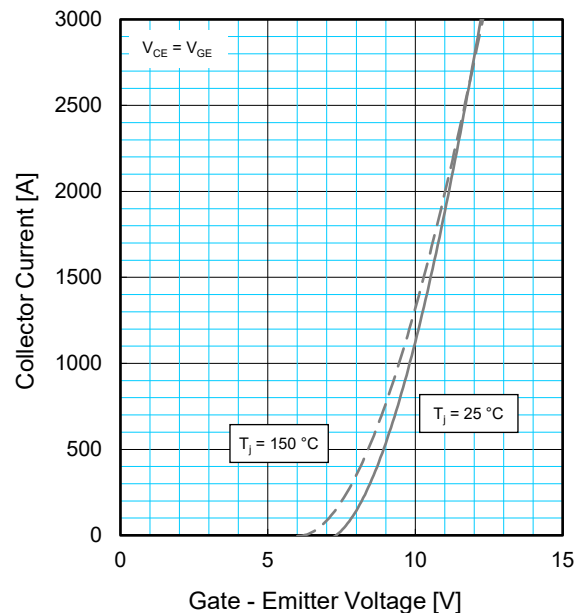
INSULATED TYPE

PERFORMANCE CURVES

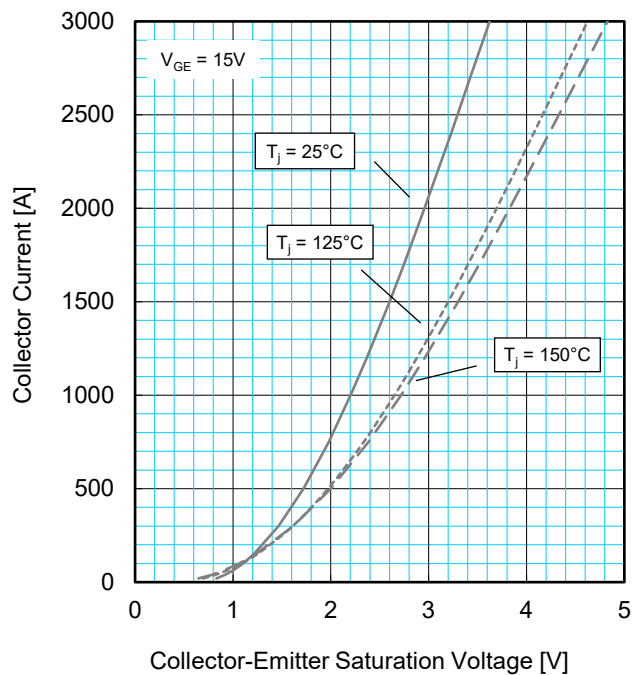
**OUTPUT CHARACTERISTICS
(TYPICAL)**



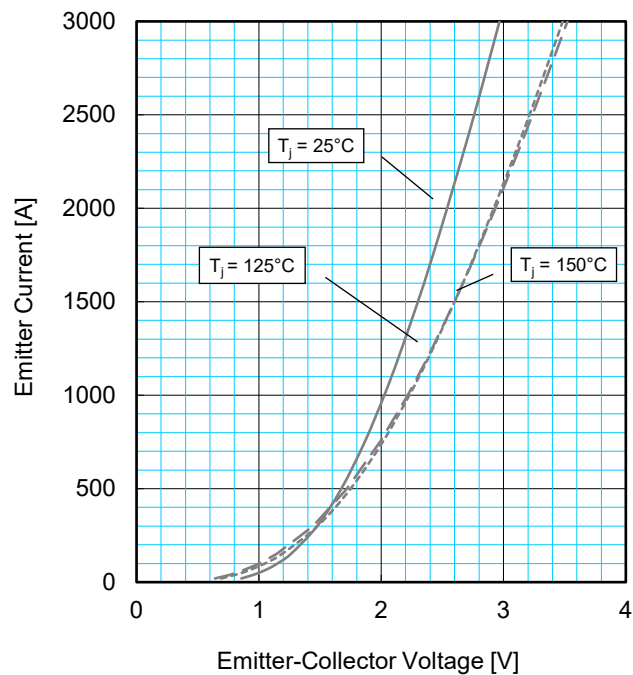
**TRANSFER CHARACTERISTICS
(TYPICAL)**



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



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

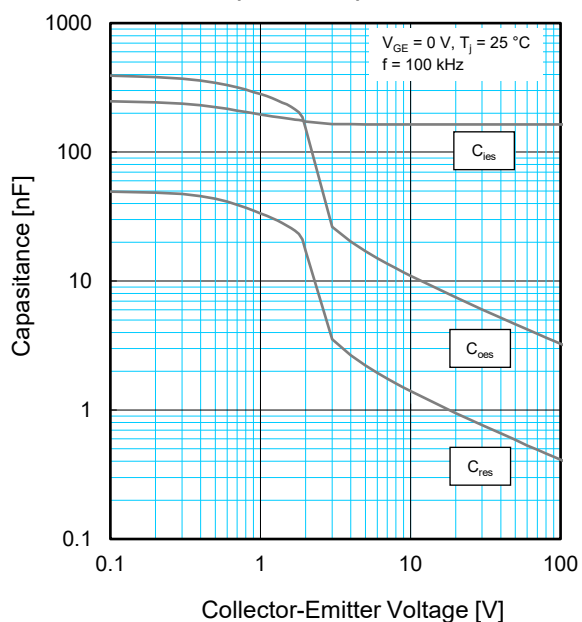


CM1500HC-66XB

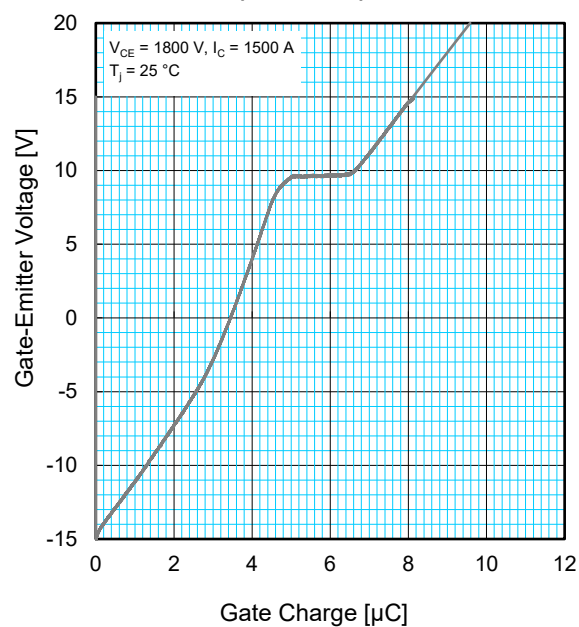
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

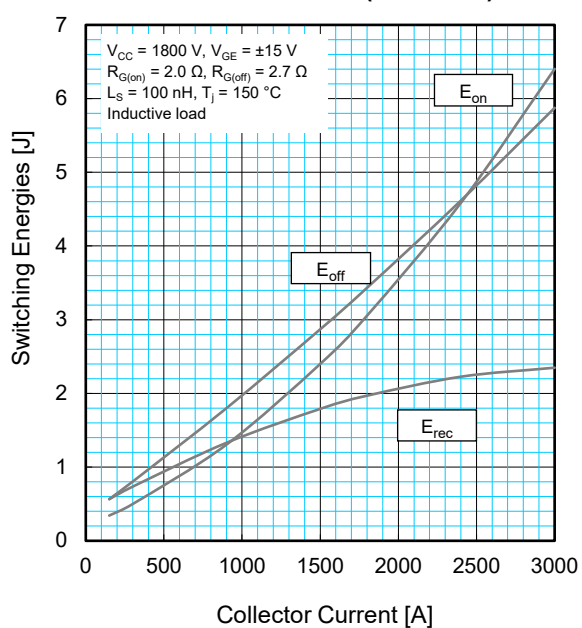
CAPACITANCE CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)



HALF-BRIDGE SWITCHING ENERGY
CHARACTERISTICS (TYPICAL)

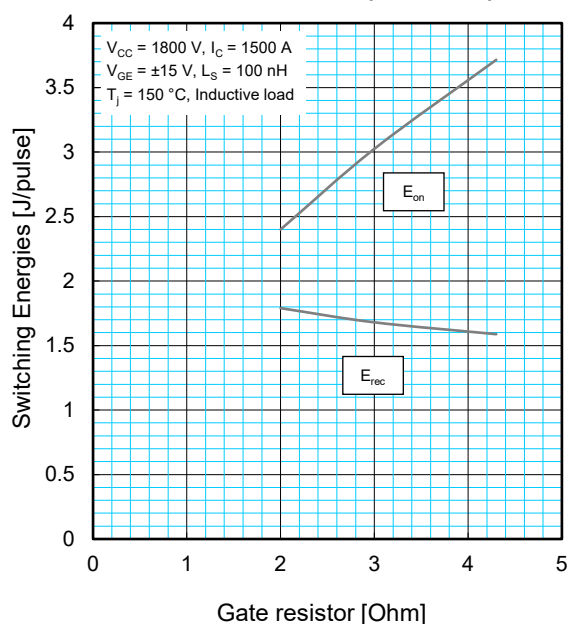


CM1500HC-66XB

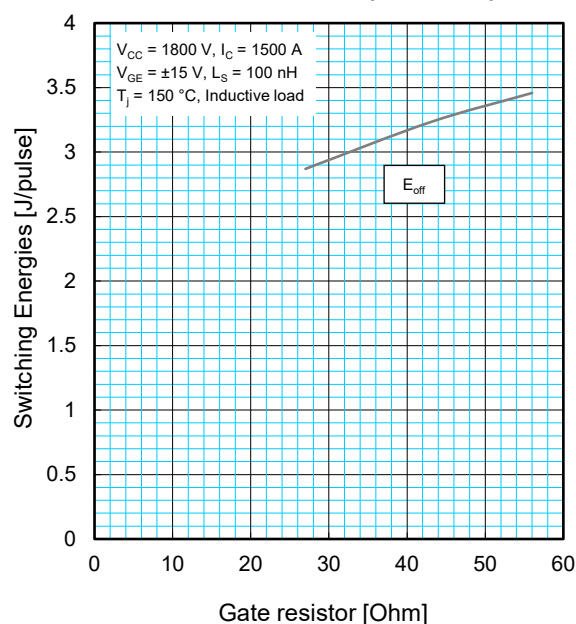
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

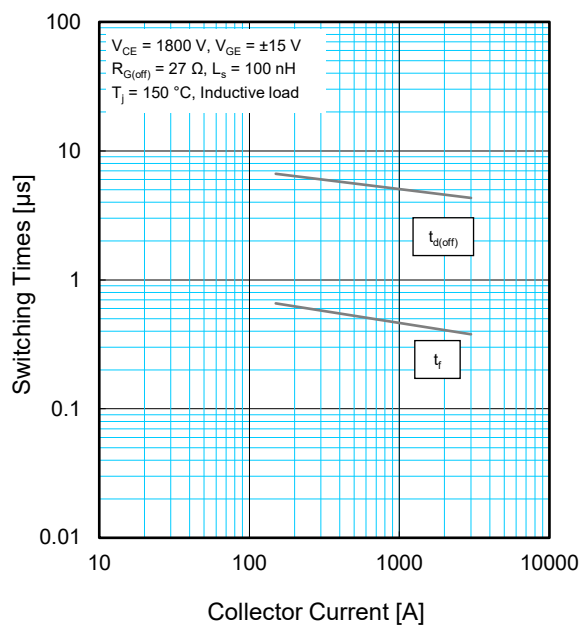
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



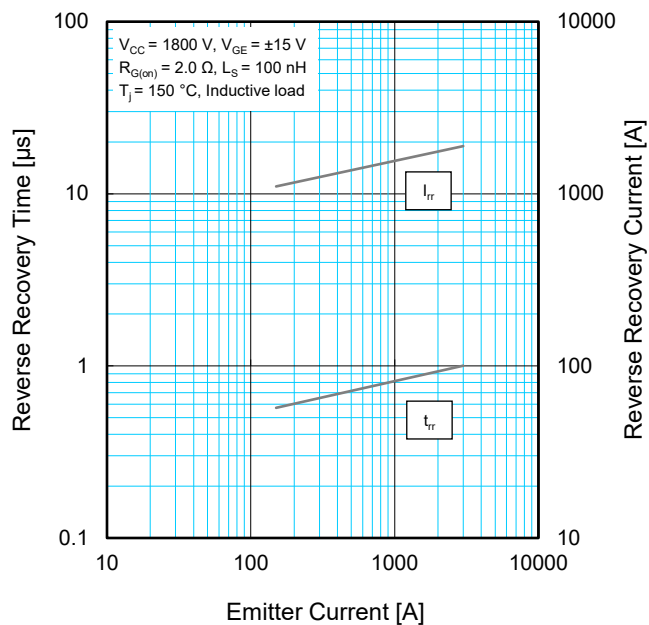
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

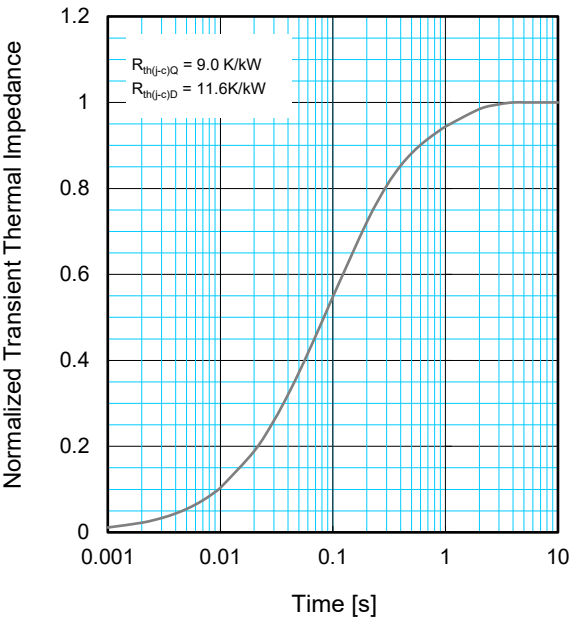


CM1500HC-66XB

HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

TRANSIENT THERMAL IMPEDANCE
CHARACTERISTICS



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

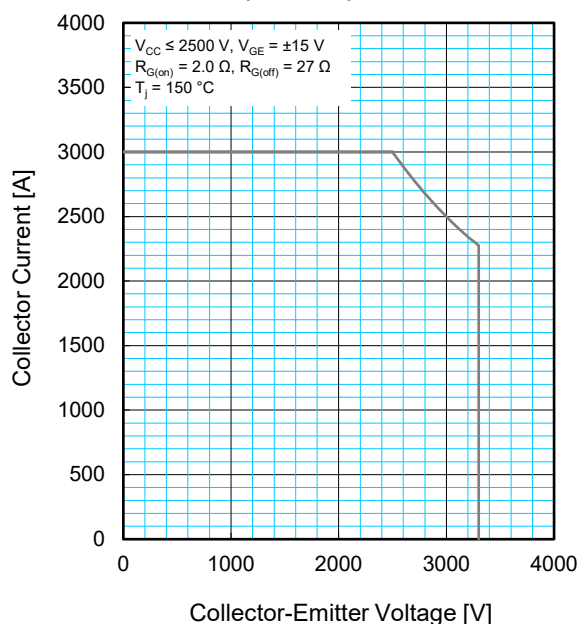
	1	2	3	4
R_i / R_{th} :	0.0000	0.2002	0.2401	0.5596
τ_i [sec.] :	0.0001	0.7842	0.0347	0.1319

CM1500HC-66XB

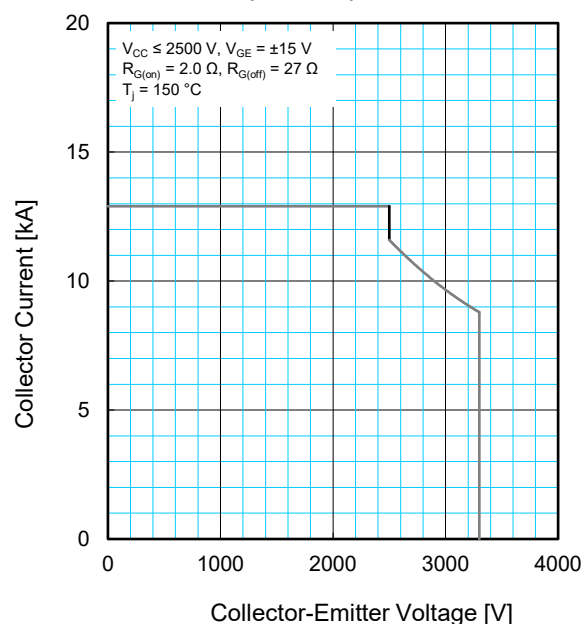
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

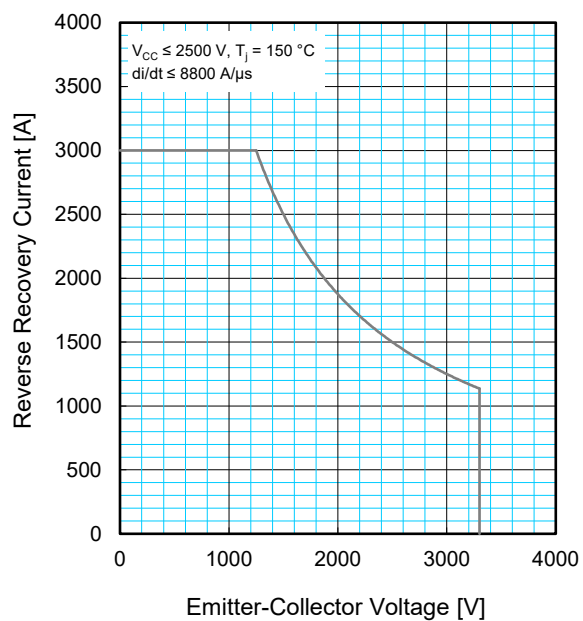
REVERSE BIAS SAFE OPERATING AREA
(RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA
(SCSOA)



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



CM1500HC-66XB

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CM1500HC-66XB

HIGH POWER SWITCHING USE
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