CM1500HC-66R

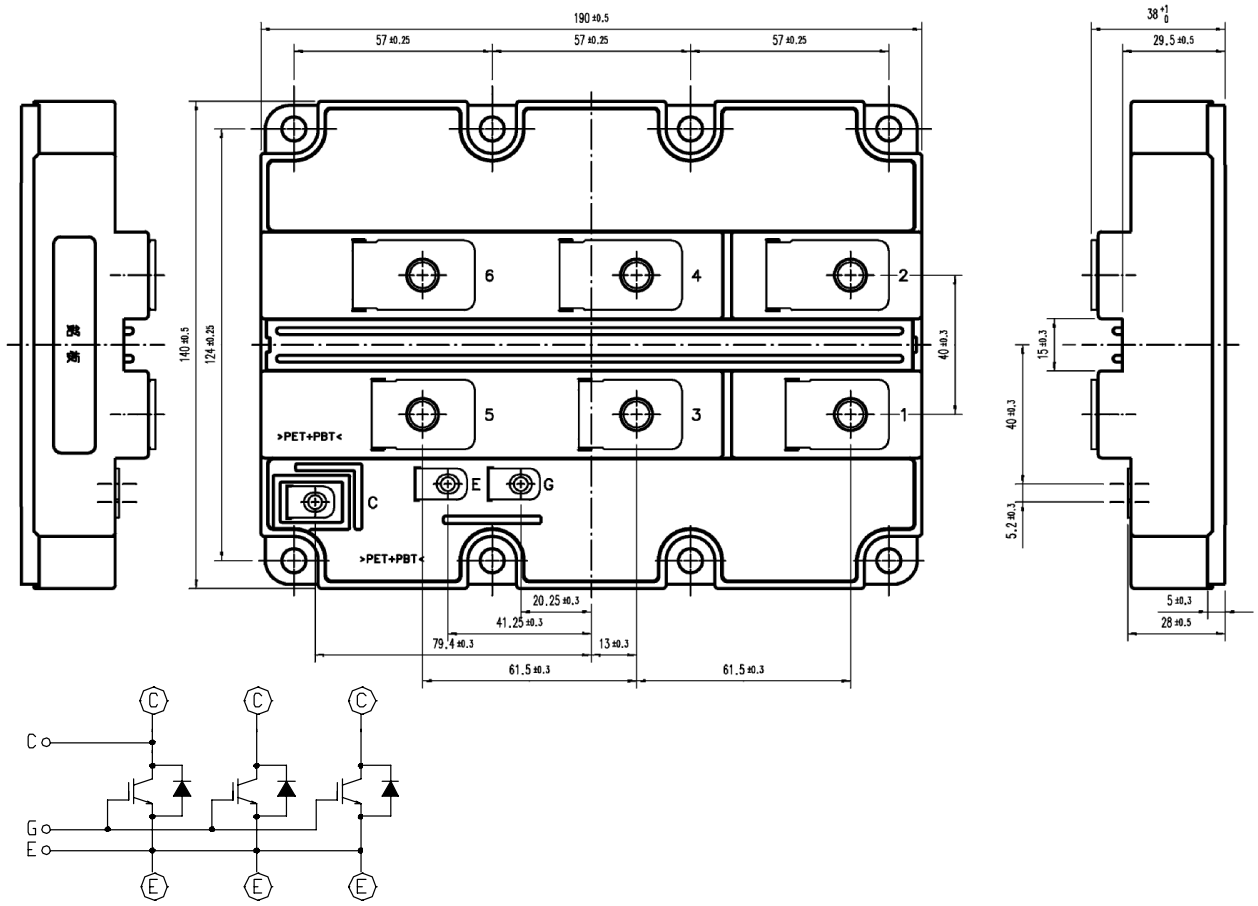
- I_C ..... 1500 A
- V_{CES} ..... 3300 V
- 1-element in a Pack
- Insulated Type
- LPT-IGBT / Soft Recovery Diode
- AlSiC Baseplate

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 = −40…+125°C	3300	V
V_{GES}	Gate-emitter voltage	V_{CE} = 0V, T_j = 25°C	± 20	V
I_C	Collector current	DC, T_c = 100°C	1500	A
I_{CM}		Pulse (Note 1)	3000	A
I_E (Note 2)	Emitter current	DC	1500	A
I_{EM} (Note 2)		Pulse (Note 1)	3000	A
P_c (Note 3)	Maximum power dissipation	T_c = 25°C, IGBT part	15600	W
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1min.	6000	V
T_j	Junction temperature		−40 ~ +150	°C
T_{op}	Operating temperature		−40 ~ +150	°C
T_{stg}	Storage temperature		−55 ~ +150	°C
t_{psc}	Maximum short circuit pulse width	V_{CC} = 2500V, $V_{CE} \leq V_{CES}$, V_{GE} = 15V T_j = 150°C	10	μs

Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{opmax} rating (150°C).
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).

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°C	—	—	5.0	mA
		$V_{CE} = V_{CES}$, V_{GE} = 0V, T_j = 125°C	—	5.0	—	
		$V_{CE} = V_{CES}$, V_{GE} = 0V, T_j = 150°C	—	18.0	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{CE} = 10V, I_C = 150mA, T_j = 25°C	5.5	6.0	6.5	V
I_{GES}	Gate leakage current	$V_{GE} = V_{GES}$, V_{CE} = 0V, T_j = 25°C	−0.5	—	0.5	μA
Cies	Input capacitance	V_{CE} = 10V, V_{GE} = 0V, f = 100kHz T_j = 25°C	—	210.0	—	nF
Coes	Output capacitance		—	13.0	—	nF
Cres	Reverse transfer capacitance		—	6.0	—	nF
Qg	Total gate charge	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, T_j = 25°C	—	16.0	—	μC
r_G	Internal gate resistor	T_j = 25°C	—	1.5	—	Ω
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = 1500A (Note 4), V_{GE} = 15V T_j = 25°C	—	2.50	—	V
		I_C = 1500A (Note 4), V_{GE} = 15V T_j = 125°C	—	3.00	—	V
		I_C = 1500A (Note 4), V_{GE} = 15V T_j = 150°C	—	3.10	—	V
V_{EC} (Note 2)	Emitter-collector voltage	I_E = 1500A (Note 4), V_{GE} = 0V T_j = 25°C	—	2.15	—	V
		I_E = 1500A (Note 4), V_{GE} = 0V T_j = 125°C	—	2.30	—	V
		I_E = 1500A (Note 4), V_{GE} = 0V T_j = 150°C	—	2.25	—	V
$t_{d(on)}$	Turn-on delay time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(on)}$ = 1.6Ω T_j = 25°C, L_s = 100nH	—	1.00	—	μs
t_r	Turn-on rise time		—	0.25	—	μs
$E_{on\ (10\%)}$	Turn-on switching energy		—	2.10	—	J/pulse
E_{on}	Turn-on switching energy		—	2.40	—	J/pulse
$t_{d(off)}$	Turn-off delay time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(off)}$ = 5.6Ω T_j = 25°C, L_s = 100nH	—	2.70	—	μs
t_f	Turn-off fall time		—	0.30	—	μs
$E_{off\ (10\%)}$	Turn-off switching energy		—	1.85	—	J/pulse
E_{off}	Turn-off switching energy		—	2.05	—	J/pulse

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
t_{rr}	Reverse recovery time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(on)}$ = 1.6Ω T_j = 25°C, L_s = 100nH	—	0.55	—	µs
I_{rr}	Reverse recovery current		—	1400	—	A
Q_{rr}	Reverse recovery charge		—	1100	—	µC
$E_{rec\ (10\%)}$	Reverse recovery energy		—	1.15	—	J/pulse
E_{rec}	Reverse recovery energy		—	1.25	—	J/pulse
$t_{d(on)}$	Turn-on delay time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(on)}$ = 1.6Ω T_j = 125°C, L_s = 100nH	—	1.00	—	µs
t_r	Turn-on rise time		—	0.26	—	µs
$E_{on\ (10\%)}$	Turn-on switching energy		—	2.80	—	J/pulse
E_{on}	Turn-on switching energy		—	3.10	—	J/pulse
$t_{d(off)}$	Turn-off delay time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(off)}$ = 5.6Ω T_j = 125°C, L_s = 100nH	—	2.80	—	µs
t_f	Turn-off fall time		—	0.35	—	µs
$E_{off\ (10\%)}$	Turn-off switching energy		—	2.40	—	J/pulse
E_{off}	Turn-off switching energy		—	2.70	—	J/pulse
t_{rr}	Reverse recovery time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(on)}$ = 1.6Ω T_j = 125°C, L_s = 100nH	—	0.75	—	µs
I_{rr}	Reverse recovery current		—	1600	—	A
Q_{rr}	Reverse recovery charge		—	1700	—	µC
$E_{rec\ (10\%)}$	Reverse recovery energy		—	1.85	—	J/pulse
E_{rec}	Reverse recovery energy		—	2.00	—	J/pulse
$t_{d(on)}$	Turn-on delay time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(on)}$ = 1.6Ω T_j = 150°C, L_s = 100nH	—	1.00	—	µs
t_r	Turn-on rise time		—	0.26	—	µs
$E_{on\ (10\%)}$	Turn-on switching energy		—	2.90	—	J/pulse
E_{on}	Turn-on switching energy		—	3.50	—	J/pulse
$t_{d(off)}$	Turn-off delay time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(off)}$ = 5.6Ω T_j = 150°C, L_s = 100nH	—	2.90	—	µs
t_f	Turn-off fall time		—	0.40	—	µs
$E_{off\ (10\%)}$	Turn-off switching energy		—	2.65	—	J/pulse
E_{off}	Turn-off switching energy		—	3.00	—	J/pulse

Note 4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
t_{rr}	Reverse recovery time	V_{CC} = 1800V, I_C = 1500A V_{GE} = ±15V, $R_{G(on)}$ = 1.6Ω T_j = 150°C, L_s = 100nH	—	0.80	—	μs
I_{rr}	Reverse recovery current		—	1600	—	A
Q_{rr}	Reverse recovery charge		—	2000	—	μC
$E_{rec\ (10\%)}$	Reverse recovery energy		—	2.20	—	J/pulse
E_{rec}	Reverse recovery energy		—	2.40	—	J/pulse

THERMAL CHARACTERISTICS

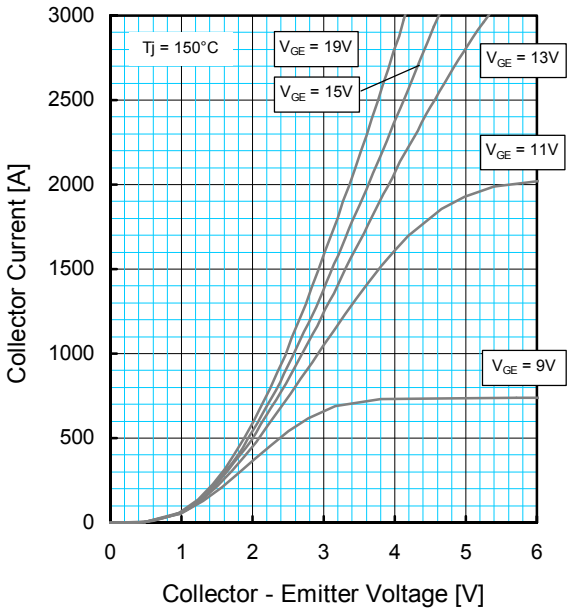
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part	—	—	8.0	K/kW
$R_{th(j-c)R}$	Thermal resistance	Junction to Case, FWDi part	—	—	15.0	K/kW
$R_{th(c-f)}$	Contact thermal resistance	Case to Fin, λ_{grease} = 1W/m·K	—	6.0	—	K/kW

MECHANICAL CHARACTERISTICS

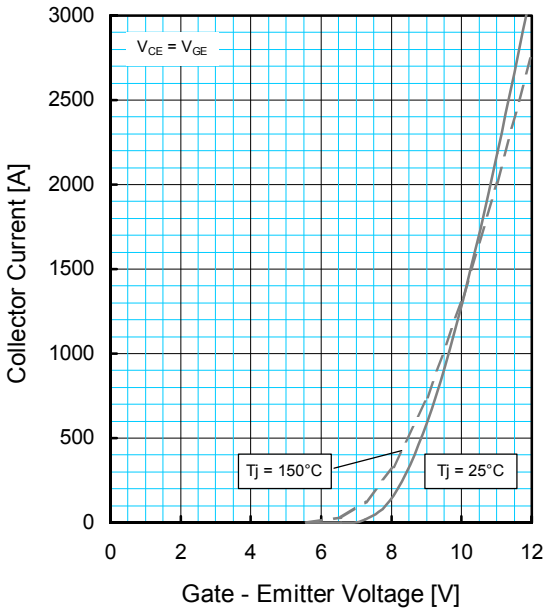
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M	Mounting torque	M8: Main terminals screw	7.0	—	22.0	N·m
		M6: Mounting screw	3.0	—	6.0	N·m
		M4: Auxiliary terminals screw	1.0	—	3.0	N·m
—	Mass		—	1.2	—	kg
CTI	Comparative tracking index		600	—	—	—
D_{cl}	Clearance		19.5	—	—	mm
D_{cr}	Creepage distance		32.0	—	—	mm
$L_{C-E(int)}$	Internal inductance		—	11.0	—	nH
$R_{C-E(int)}$	Internal lead resistance	Tc = 25°C	—	0.12	—	mΩ

PERFORMANCE CURVES

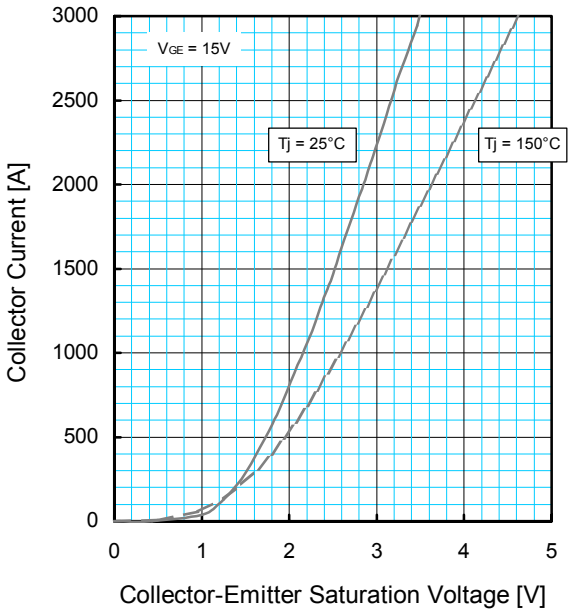
OUTPUT CHARACTERISTICS (TYPICAL)



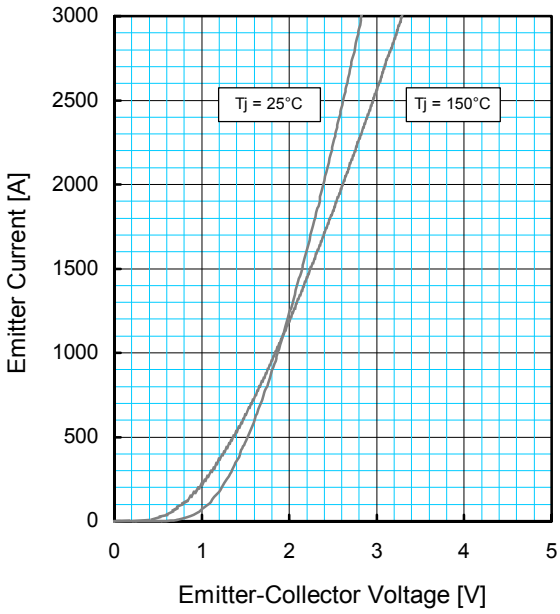
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

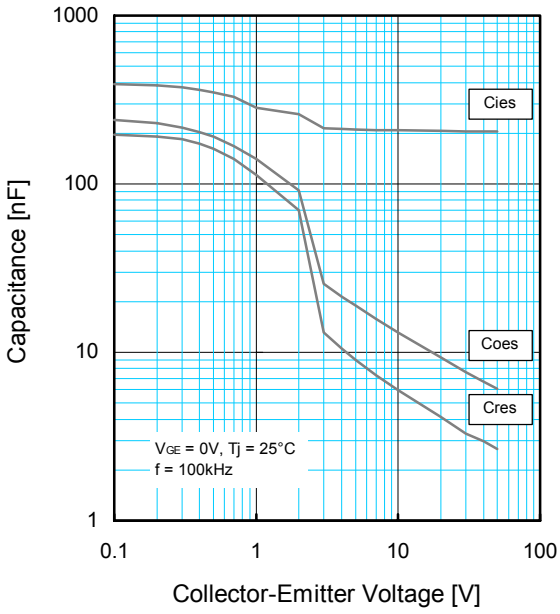


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

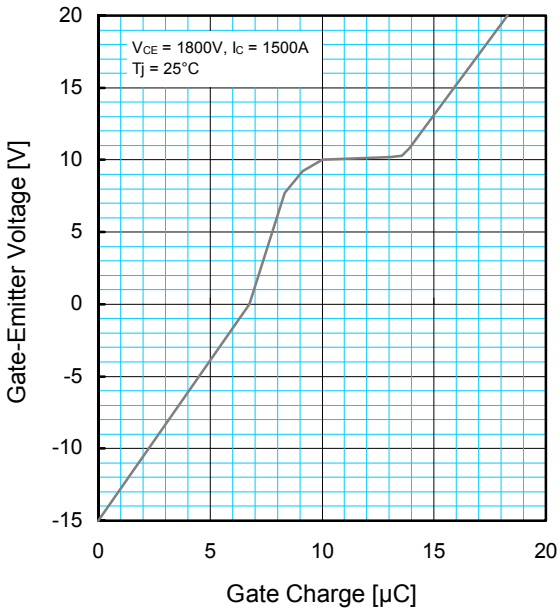


PERFORMANCE CURVES

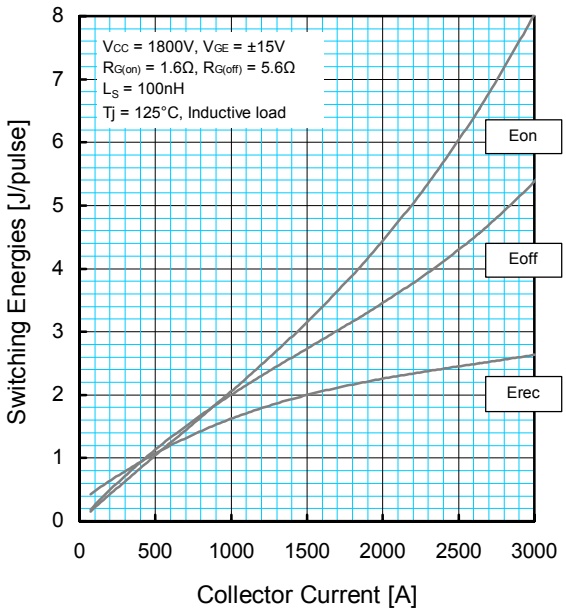
CAPACITANCE CHARACTERISTICS (TYPICAL)



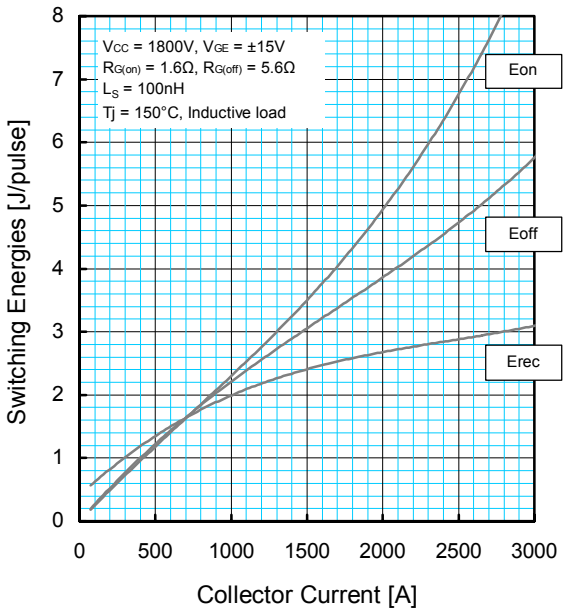
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

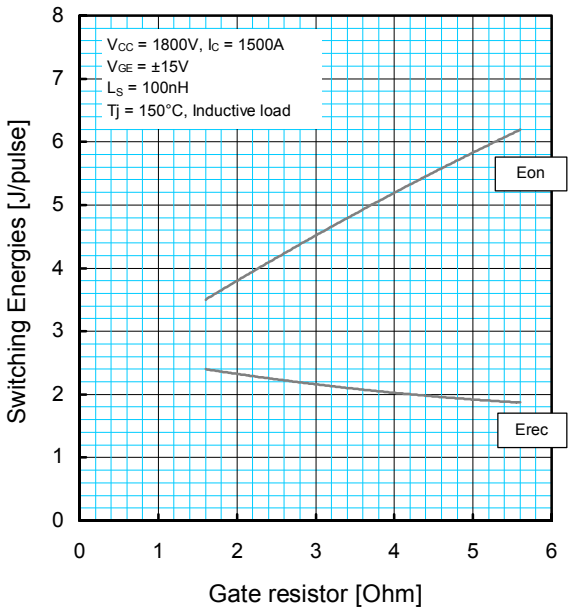


HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)

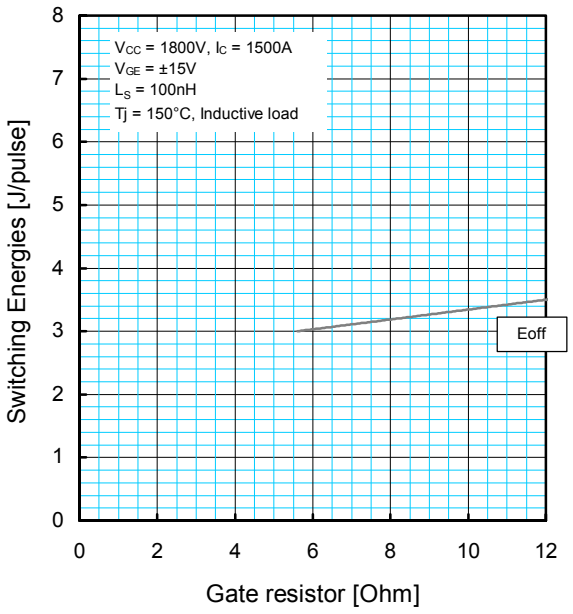


PERFORMANCE CURVES

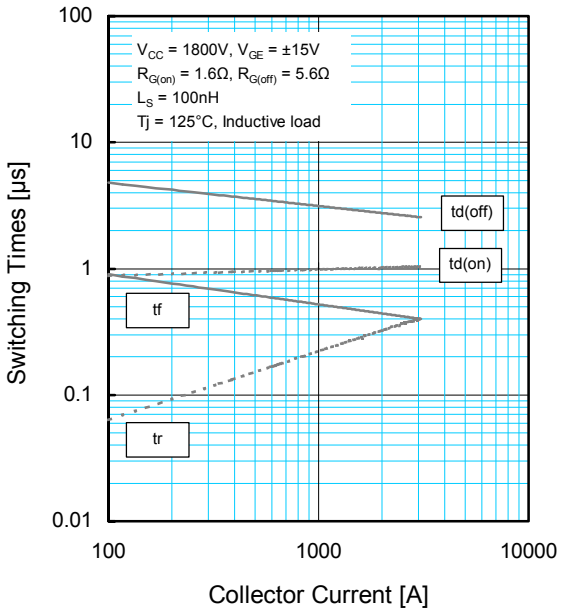
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



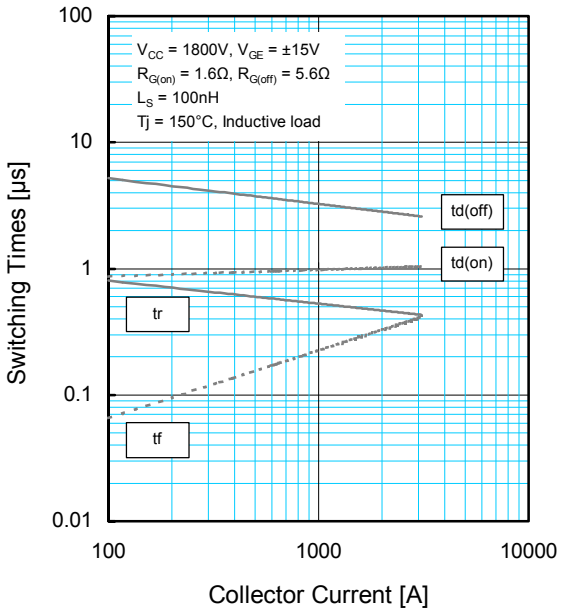
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)

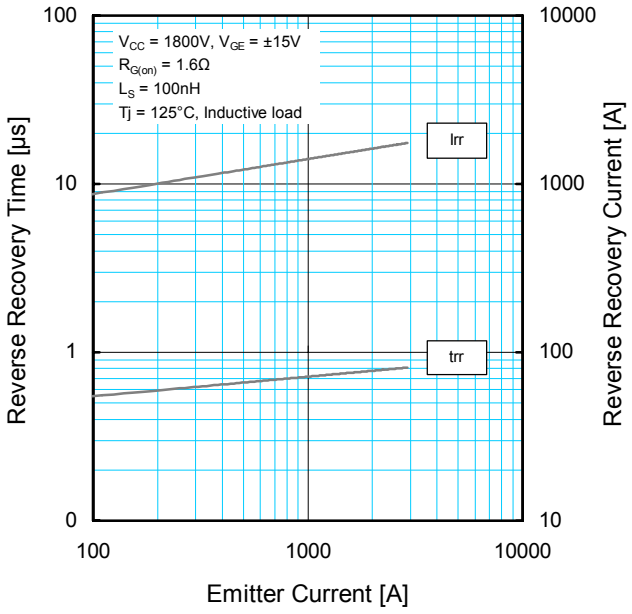


HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)

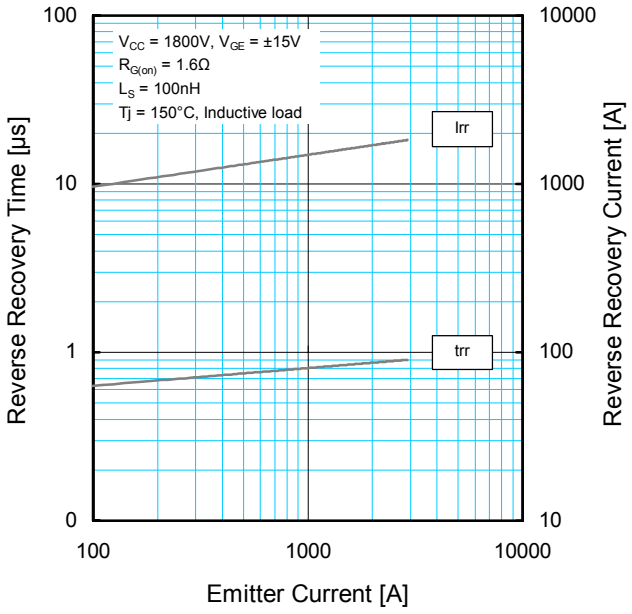


PERFORMANCE CURVES

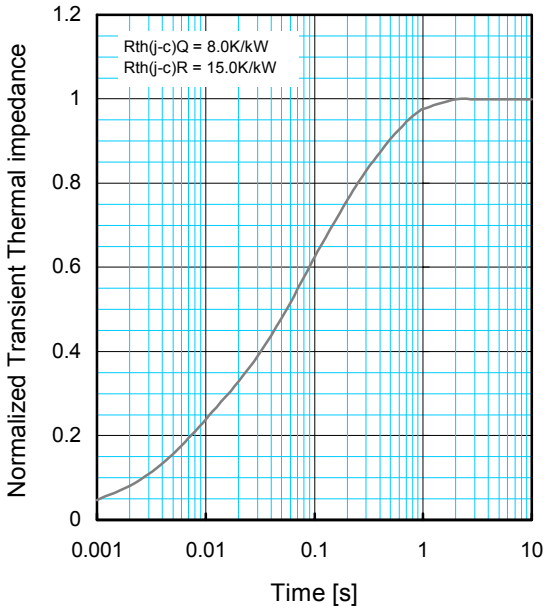
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS

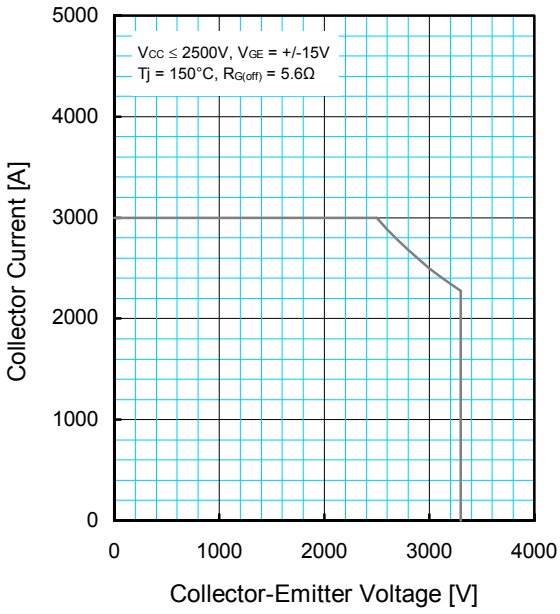


$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - exp\left(-\frac{t}{\tau_i} \right) \right\}$$

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

PERFORMANCE CURVES

REVERSE BIAS SAFE OPERATING AREA (RBSOA)



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