MITSUBISHI ELECTRIC

< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM1200DC-34S

HIGH POWER SWITCHING USE
INSULATED TYPE

5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

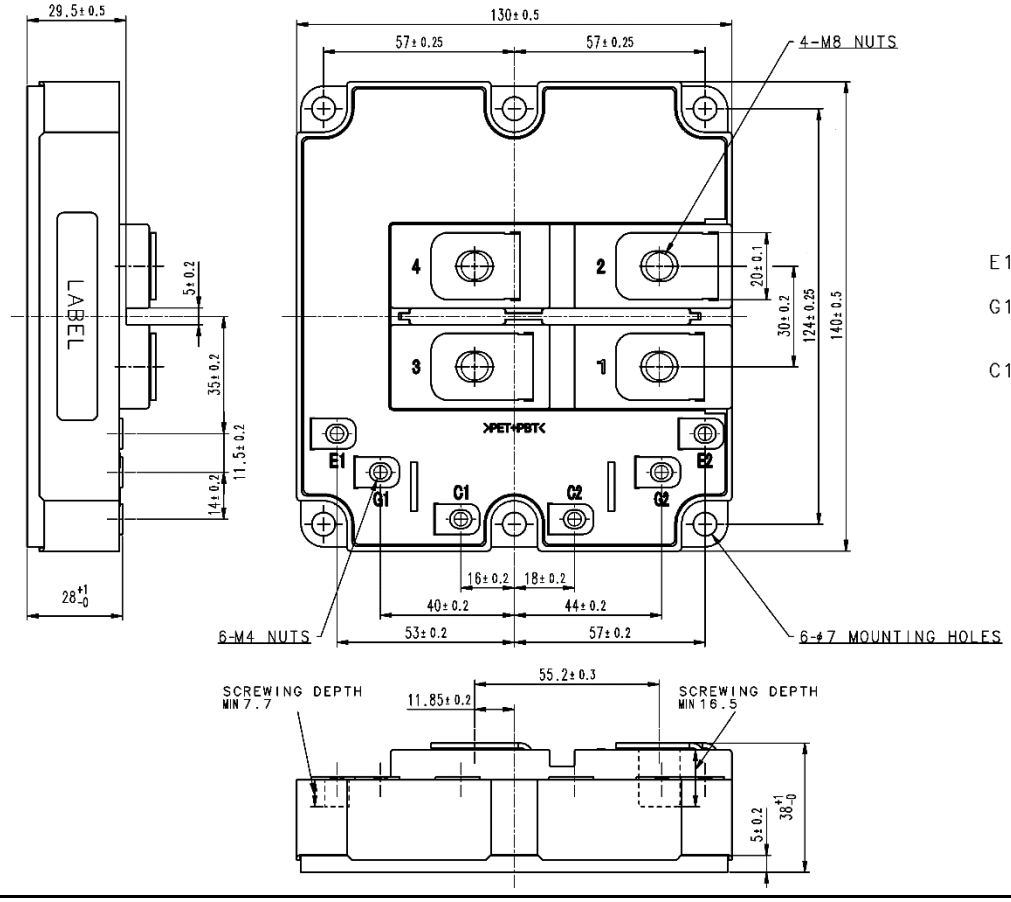
CM1200DC-34S

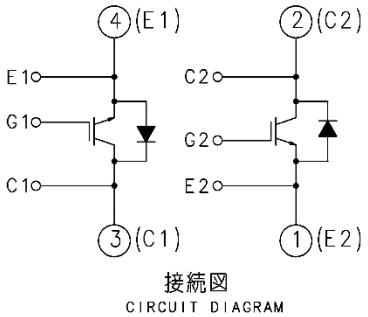
- I_C 1200A
- V_{CES} 1700V
- 2-element in a Pack
- Insulated Type
- CSTBT™(III) / Soft Recovery Diode
- AlSiC Baseplate

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	1700	V
V_{GES}	Gate-emitter voltage	V_{CE} = 0V, T_j = 25 °C	± 20	V
I_C	Collector current	DC, T_c = 110 °C	1200	A
I_{CRM}		Pulse (Note 1)	2400	A
I_E	Emitter current (Note 2)	DC	1200	A
I_{ERM}		Pulse (Note 1)	2400	A
P_{tot}	Maximum power dissipation (Note 3)	T_c = 25°C, IGBT part	6750	W
V_{iso}	Isolation voltage	RMS, sinusoidal, f = 60Hz, t = 1 min.	4000	V
T_{jop}	Operating junction temperature		−50 ~ +150	°C
T_{stg}	Storage temperature		−50 ~ +150	°C
t_{psc}	Short circuit pulse width	V_{CC} = 1200V, V_{CE} ≤ V_{CES}, V_{GE} =15V, T_j =150°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	T_j = 25°C	—	—	4.0	mA
			T_j = 125°C	—	1.5	—	
			T_j = 150°C	—	7.0	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{CE} = 10 V, I_C = 120 mA, T_j = 25°C		5.4	6.0	6.6	V
I_{GES}	Gate leakage current	V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25°C		−0.5	—	0.5	µA
C_{ies}	Input capacitance	V_{CE} = 10 V, V_{GE} = 0 V, f = 100 kHz T_j = 25°C		—	216	—	nF
C_{oes}	Output capacitance			—	8.0	—	nF
C_{res}	Reverse transfer capacitance			—	1.6	—	nF
Q_G	Total gate charge	V_{CC} = 850V, I_C = 1200A, V_{GE} = ±15V		—	12.0	—	µC
V_{CEsat}	Collector-emitter saturation voltage	I_C = 1200 A (Note 4) V_{GE} = 15 V	T_j = 25°C	—	1.95	—	V
			T_j = 125°C	—	2.25	—	
			T_j = 150°C	—	2.30	2.80	
$t_{d(on)}$	Turn-on delay time	V_{CC} = 850 V I_C = 1200 A V_{GE} = ±15 V $R_{G(on)}$ = 1.3 Ω L_s = 70 nH Inductive load	T_j = 25°C	—	0.60	—	µs
			T_j = 125°C	—	0.60	—	
			T_j = 150°C	—	0.60	—	
t_r	Turn-on rise time		T_j = 25°C	—	0.16	—	µs
			T_j = 125°C	—	0.17	—	
			T_j = 150°C	—	0.18	—	
$E_{on(10\%)}$	Turn-on switching energy (Note 5)		T_j = 25°C	—	260	—	mJ
			T_j = 125°C	—	340	—	
			T_j = 150°C	—	370	—	
E_{on}	Turn-on switching energy (Note 6)		T_j = 25°C	—	300	—	mJ
			T_j = 125°C	—	390	—	
			T_j = 150°C	—	420	—	

ELECTRICAL CHARACTERISTICS (continuation)

Symbol	Item	Conditions		Limits			Unit
				Min	Typ	Max	
$t_{d(off)}$	Turn-off delay time	V_{CC} = 850 V I_C = 1200 A V_{GE} = ±15 V $R_{G(off)}$ = 3.3 Ω L_s = 70 nH Inductive load	T_j = 25°C	—	1.20	—	μs
			T_j = 125°C	—	1.30	—	
			T_j = 150°C	—	1.32	—	
t_f	Turn-off fall time		T_j = 25°C	—	0.12	—	μs
			T_j = 125°C	—	0.15	—	
			T_j = 150°C	—	0.17	—	
$E_{off(10\%)}$	Turn-off switching energy (Note 5)		T_j = 25°C	—	200	—	mJ
			T_j = 125°C	—	280	—	
			T_j = 150°C	—	310	—	
E_{off}	Turn-off switching energy (Note 6)		T_j = 25°C	—	260	—	mJ
			T_j = 125°C	—	360	—	
			T_j = 150°C	—	400	—	
V_{EC}	Emitter-collector voltage (Note 2)	I_E = 1200 A (Note 4) V_{GE} = 0 V	T_j = 25°C	—	2.60	—	V
			T_j = 125°C	—	2.30	—	
			T_j = 150°C	—	2.20	3.00	
t_{rr}	Reverse recovery time (Note 2)	V_{CC} = 850 V I_C = 1200 A V_{GE} = ±15 V $R_{G(on)}$ = 1.3 Ω L_s = 70 nH Inductive load	T_j = 25°C	—	0.22	—	μs
			T_j = 125°C	—	0.32	—	
			T_j = 150°C	—	0.38	—	
I_{rr}	Reverse recovery current (Note 2)		T_j = 25°C	—	750	—	A
			T_j = 125°C	—	850	—	
			T_j = 150°C	—	840	—	
Q_{rr}	Reverse recovery charge (Note 2)		T_j = 25°C	—	150	—	μC
			T_j = 125°C	—	340	—	
			T_j = 150°C	—	400	—	
$E_{rec(10\%)}$	Reverse recovery energy (Note 2) (Note 5)		T_j = 25°C	—	70	—	mJ
			T_j = 125°C	—	170	—	
			T_j = 150°C	—	210	—	
E_{rec}	Reverse recovery energy (Note 2) (Note 6)		T_j = 25°C	—	80	—	mJ
			T_j = 125°C	—	180	—	
			T_j = 150°C	—	230	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part (per 1/2 module)	—	—	18.5	K/kW
$R_{th(j-c)D}$		Junction to Case, FWDi part (per 1/2 module)	—	—	42.0	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, 1/2 module λ_{grease} = 1W/m·k, $D_{(c-s)}$ = 100μm	—	16.0	—	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
M_t	Mounting torque	M8 : Main terminals screw	7.0	—	22.0	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		9.5	—	—	mm
d_s	Creepage distance		15.0	—	—	mm
$L_{P\ CE}$	Parasitic stray inductance	T_C = 25°C, 1/2 module	—	22	—	nH
$R_{CC'+EE'}$	Internal lead resistance	T_C = 25°C, 1/2 module	—	0.16	—	mΩ
r_g	Internal gate resistance	T_C = 25°C, 1/2 module	—	0.94	—	Ω

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

2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWD_i).

3. Junction temperature (T_j) should not exceed T_{jopmax} rating .

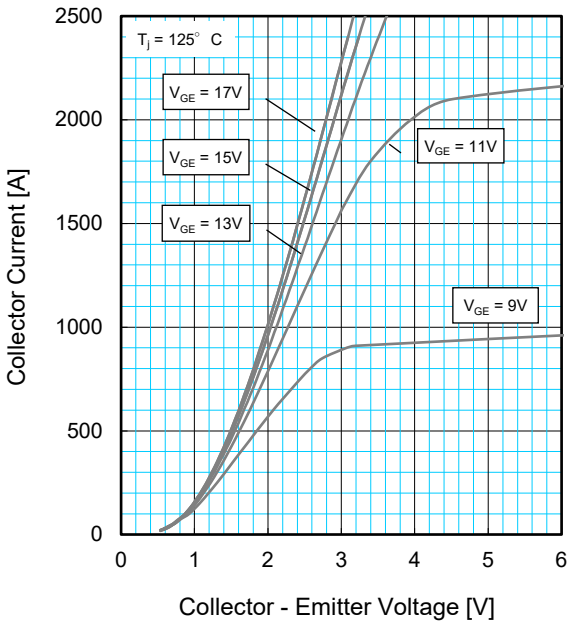
4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

5. $E_{on(10\%)}$ / $E_{off(10\%)}$ / $E_{rec(10\%)}$ are the integral of $0.1V_{CE} \times 0.1I_C \times dt$.

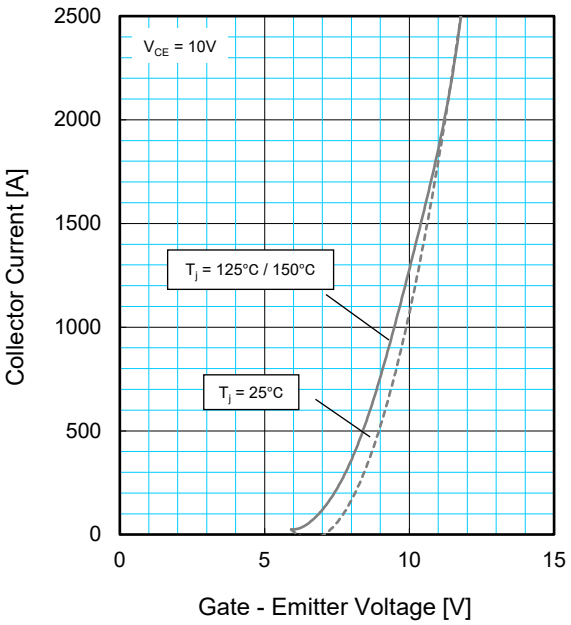
6. Definition of all items is according to IEC 60747, unless otherwise specified.

PERFORMANCE CURVES

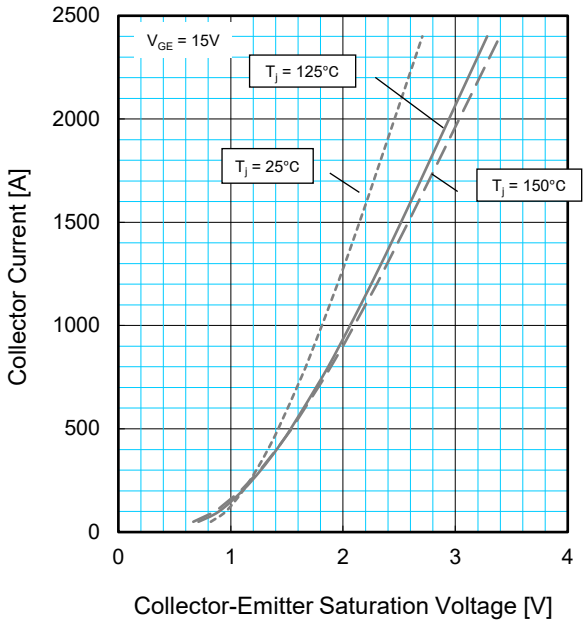
OUTPUT CHARACTERISTICS (TYPICAL)



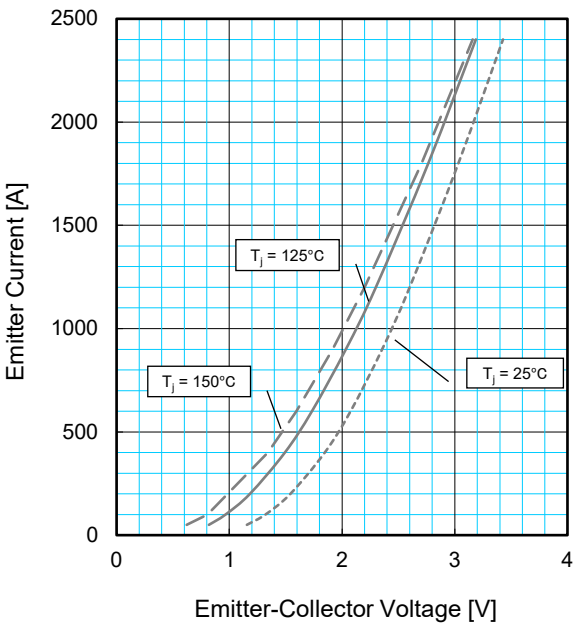
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

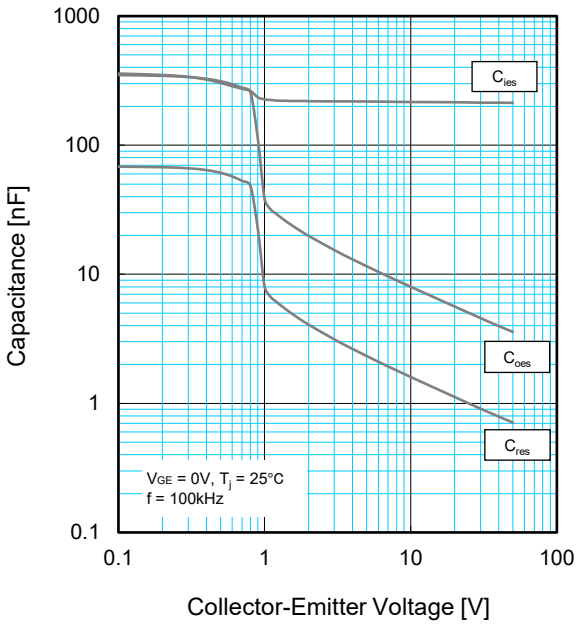


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

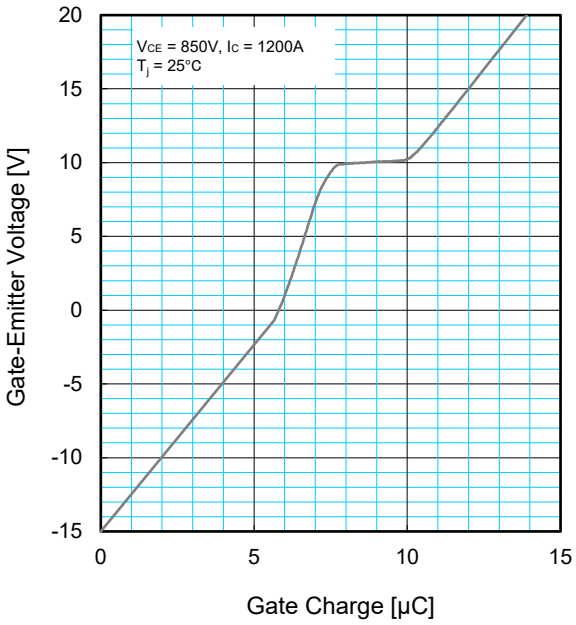


PERFORMANCE CURVES

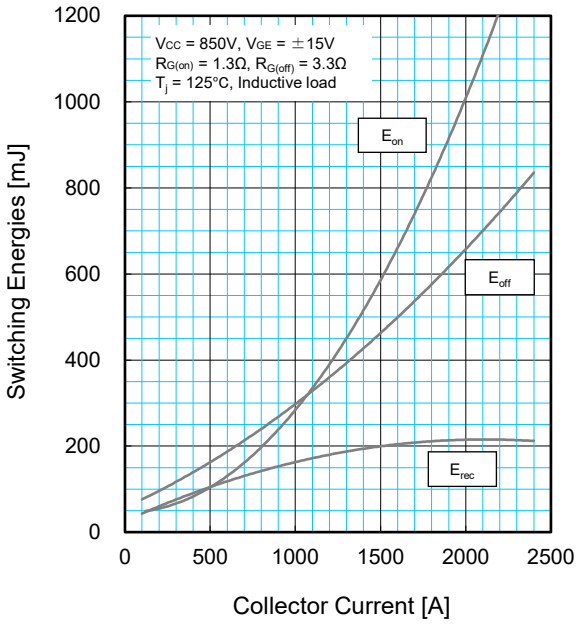
CAPACITANCE CHARACTERISTICS (TYPICAL)



GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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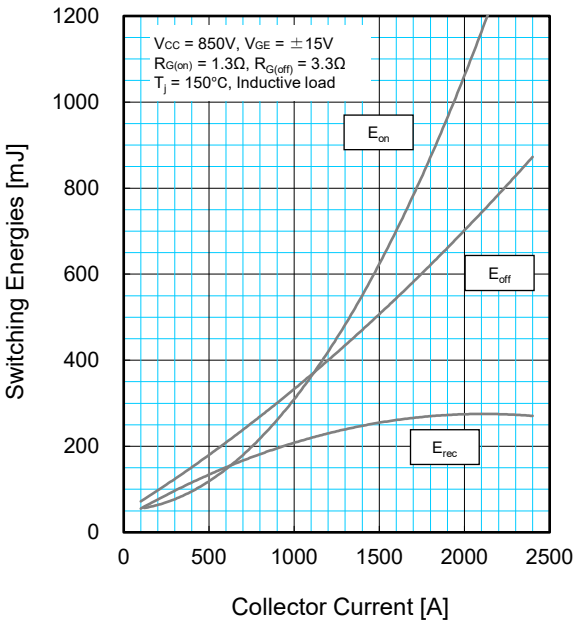

PERFORMANCE CURVES

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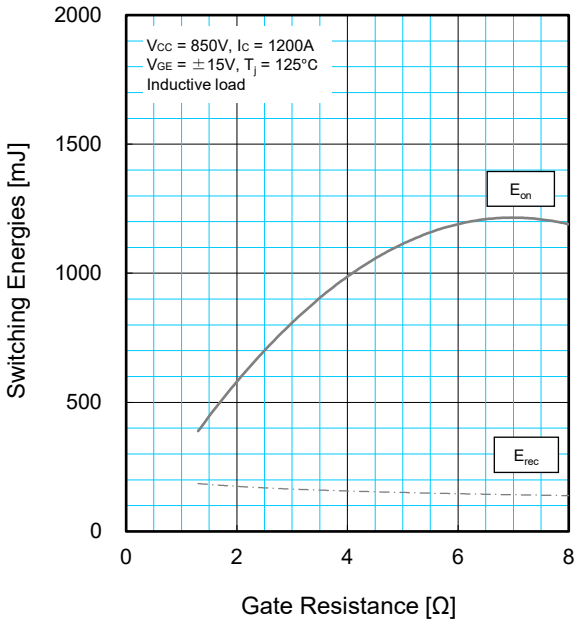

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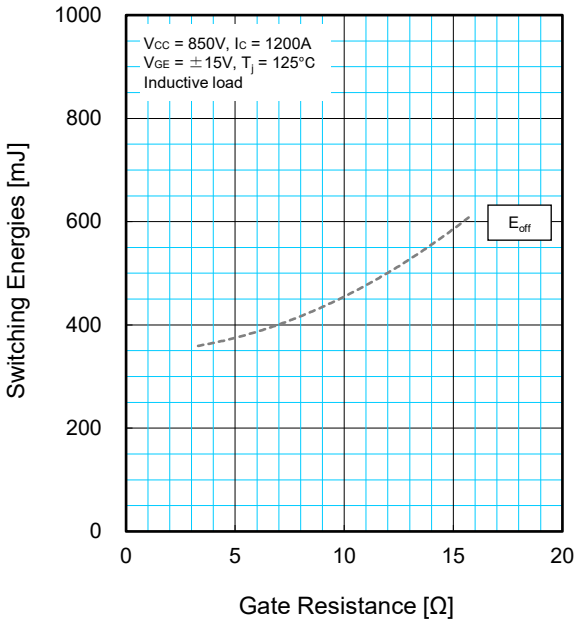

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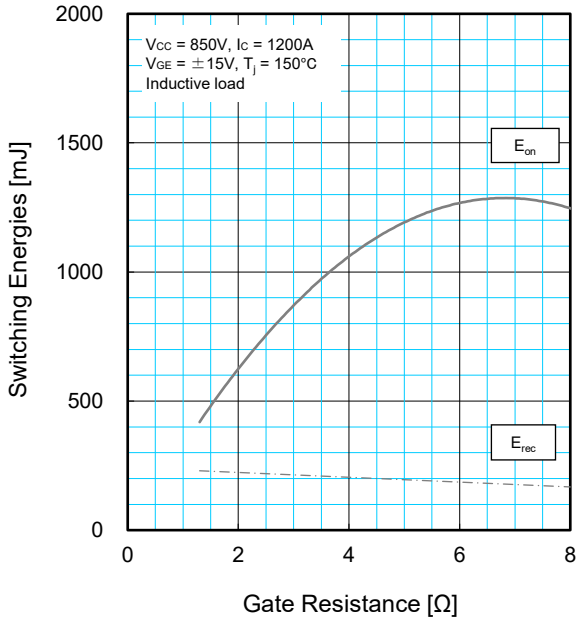

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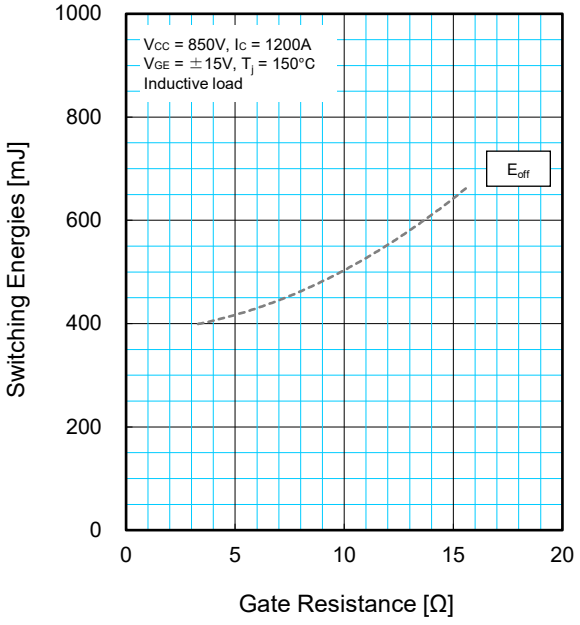
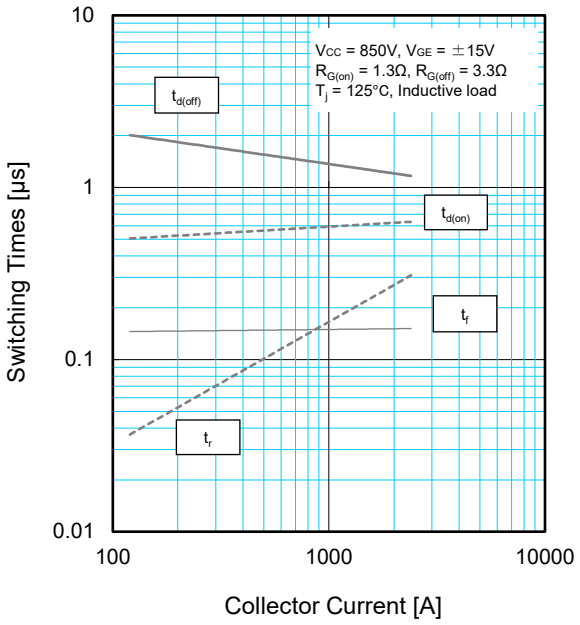
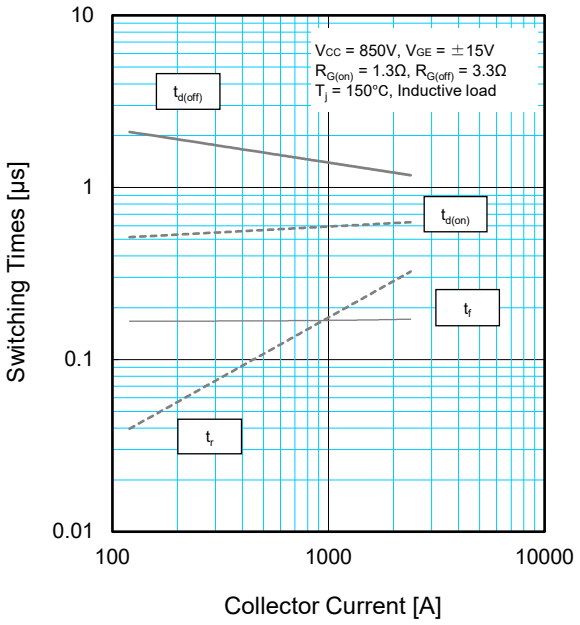


PERFORMANCE CURVES

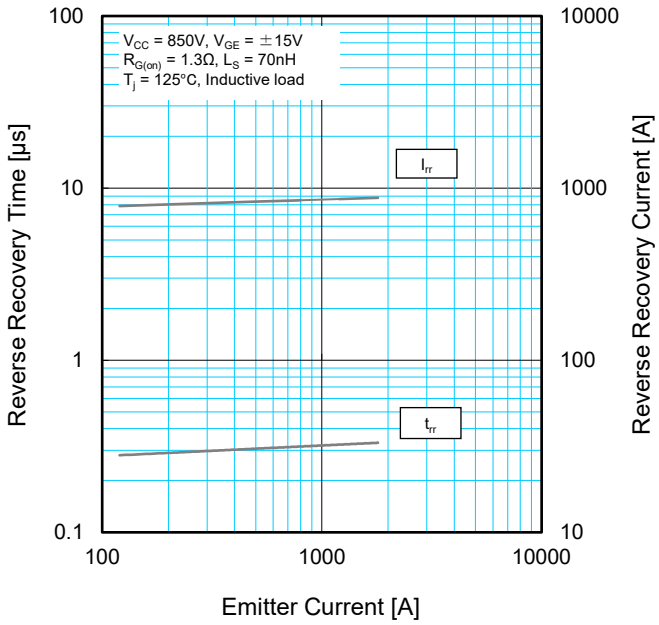
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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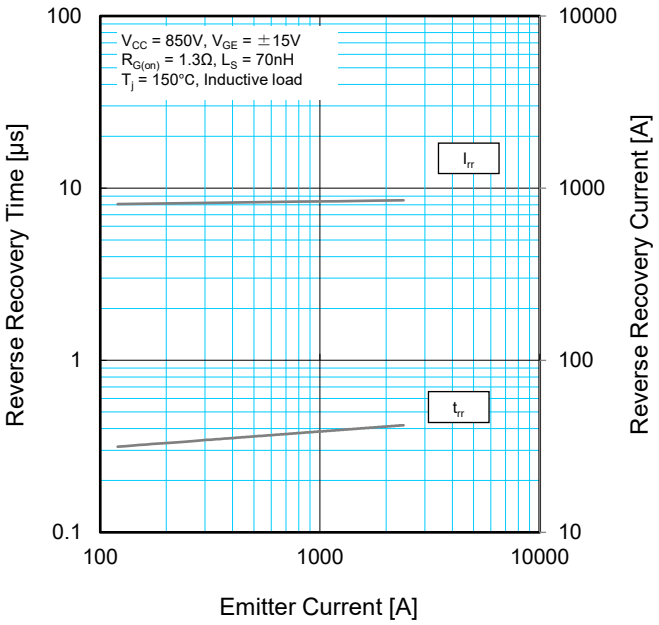
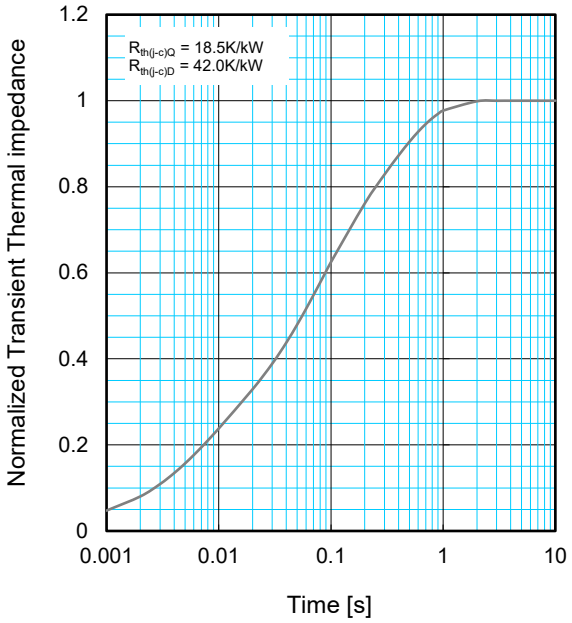


PERFORMANCE CURVES

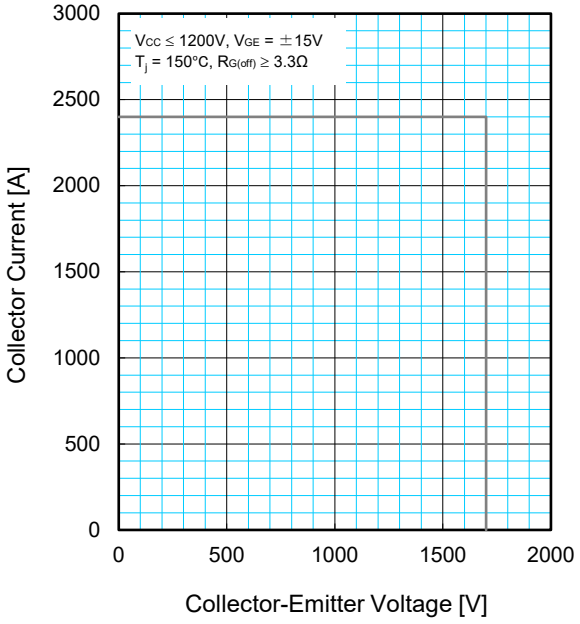
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



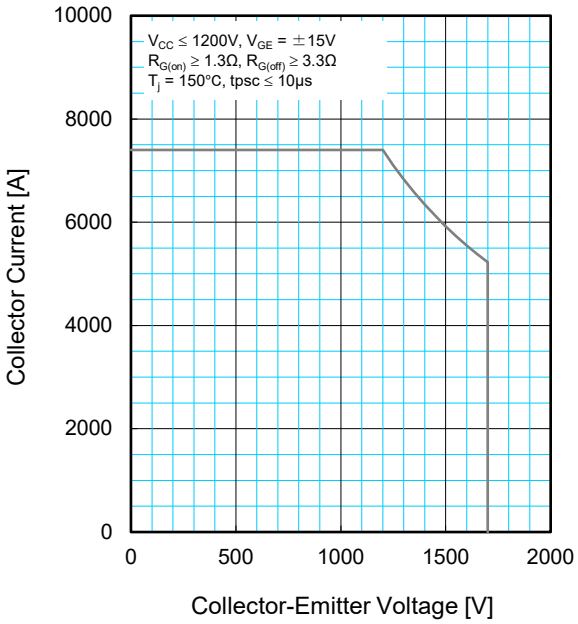
$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i} \right) \right\}$$

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

REVERSE BIAS SAFE OPERATING AREA (RBSOA)

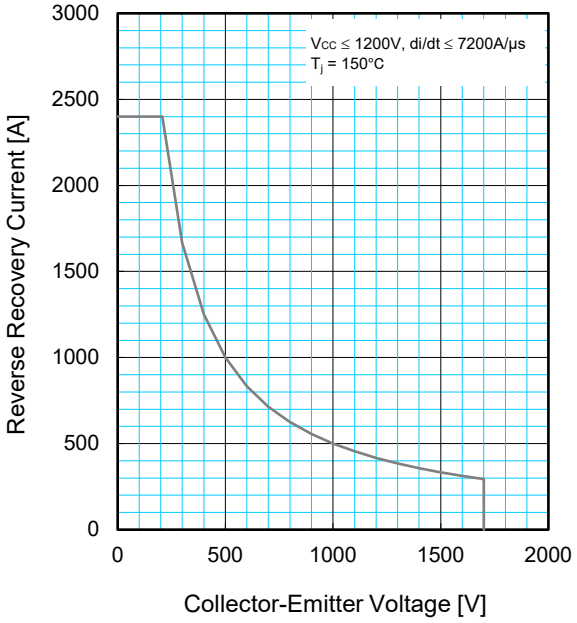


SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



PERFORMANCE CURVES

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



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