

< 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



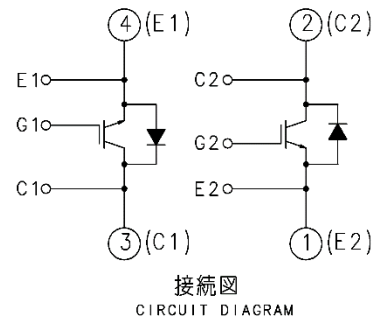
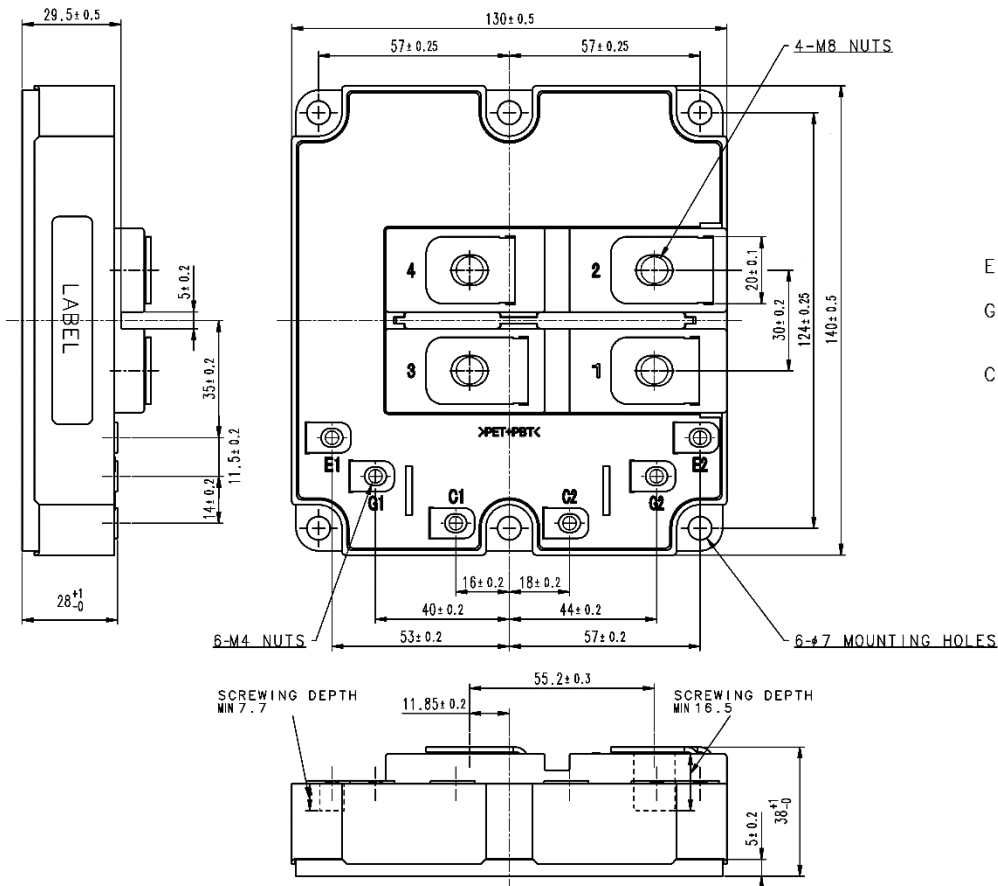
- I_C 1200A
- V_{CES} 1700V
- 2-element in a Pack
- Insulated Type
- CSTBT™(III) / Soft Recovery Diode
- AISiC Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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MAXIMUM RATINGS

Symbol	Item	Conditions	Ratings	Unit
V_{CES}	Collector-emitter voltage	$V_{GE} = 0V$	1700	V
V_{GES}	Gate-emitter voltage	$V_{CE} = 0V, T_j = 25^\circ C$	± 20	V
I_C	Collector current	DC, $T_c = 110^\circ C$	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)	$T_c = 25^\circ C$, IGBT part	6750	W
V_{iso}	Isolation voltage	RMS, sinusoidal, $f = 60Hz, t = 1 \text{ min.}$	4000	V
T_{jop}	Operating junction temperature		$-50 \sim +150$	$^\circ C$
T_{stg}	Storage temperature		$-50 \sim +150$	$^\circ C$
t_{psc}	Short circuit pulse width	$V_{CC} = 1200V, V_{CE} \leq V_{CES}, V_{GE} = 15V, T_j = 150^\circ C$	10	μs

ELECTRICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
I_{CES}	Collector cutoff current	$V_{CE} = V_{CES}, V_{GE} = 0V$	$T_j = 25^\circ C$	—	—	4.0	mA
			$T_j = 125^\circ C$	—	1.5	—	
			$T_j = 150^\circ C$	—	7.0	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE} = 10V, I_C = 120 \text{ mA}, T_j = 25^\circ C$	5.4	6.0	6.6	V	
I_{GES}	Gate leakage current	$V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25^\circ C$	-0.5	—	0.5	μA	
C_{ies}	Input capacitance	$V_{CE} = 10V, V_{GE} = 0V, f = 100 \text{ kHz}$ $T_j = 25^\circ C$	—	216	—	nF	
C_{oes}	Output capacitance		—	8.0	—	nF	
C_{res}	Reverse transfer capacitance		—	1.6	—	nF	
Q_G	Total gate charge	$V_{CC} = 850V, I_C = 1200A, V_{GE} = \pm 15V$	—	12.0	—	μC	
V_{CESat}	Collector-emitter saturation voltage	$I_C = 1200 \text{ A}$ (Note 4) $V_{GE} = 15V$	$T_j = 25^\circ C$	—	1.95	—	V
			$T_j = 125^\circ C$	—	2.25	—	
			$T_j = 150^\circ C$	—	2.30	2.80	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 850V$ $I_C = 1200 \text{ A}$ $V_{GE} = \pm 15V$	$T_j = 25^\circ C$	—	0.60	—	μs
			$T_j = 125^\circ C$	—	0.60	—	
			$T_j = 150^\circ C$	—	0.60	—	
t_r	Turn-on rise time	$V_{CC} = 850V$ $I_C = 1200 \text{ A}$ $V_{GE} = \pm 15V$	$T_j = 25^\circ C$	—	0.16	—	μs
			$T_j = 125^\circ C$	—	0.17	—	
			$T_j = 150^\circ C$	—	0.18	—	
$E_{on(10\%)}$	Turn-on switching energy (Note 5)	$R_{G(on)} = 1.3 \Omega$ $L_s = 70 \text{ nH}$ Inductive load	$T_j = 25^\circ C$	—	260	—	mJ
			$T_j = 125^\circ C$	—	340	—	
			$T_j = 150^\circ C$	—	370	—	
E_{on}	Turn-on switching energy (Note 6)		$T_j = 25^\circ C$	—	300	—	mJ
			$T_j = 125^\circ C$	—	390	—	
			$T_j = 150^\circ C$	—	420	—	

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ELECTRICAL CHARACTERISTICS (continuation)

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 850\text{ V}$ $I_C = 1200\text{ A}$ $V_{GE} = \pm 15\text{ V}$ $R_{G(off)} = 3.3\ \Omega$ $L_s = 70\text{ nH}$ Inductive load	$T_j = 25^\circ\text{C}$	—	1.20	—	μs
			$T_j = 125^\circ\text{C}$	—	1.30	—	
			$T_j = 150^\circ\text{C}$	—	1.32	—	
t_f	Turn-off fall time		$T_j = 25^\circ\text{C}$	—	0.12	—	μs
			$T_j = 125^\circ\text{C}$	—	0.15	—	
			$T_j = 150^\circ\text{C}$	—	0.17	—	
$E_{off(10\%)}$	Turn-off switching energy (Note 5)		$T_j = 25^\circ\text{C}$	—	200	—	mJ
			$T_j = 125^\circ\text{C}$	—	280	—	
			$T_j = 150^\circ\text{C}$	—	310	—	
E_{off}	Turn-off switching energy (Note 6)	$T_j = 25^\circ\text{C}$	—	260	—	mJ	
		$T_j = 125^\circ\text{C}$	—	360	—		
		$T_j = 150^\circ\text{C}$	—	400	—		
V_{EC}	Emitter-collector voltage (Note 2)	$I_E = 1200\text{ A}$ (Note 4) $V_{GE} = 0\text{ V}$	$T_j = 25^\circ\text{C}$	—	2.60	—	V
			$T_j = 125^\circ\text{C}$	—	2.30	—	
			$T_j = 150^\circ\text{C}$	—	2.20	3.00	
t_{rr}	Reverse recovery time (Note 2)	$V_{CC} = 850\text{ V}$ $I_C = 1200\text{ A}$ $V_{GE} = \pm 15\text{ V}$ $R_{G(on)} = 1.3\ \Omega$ $L_s = 70\text{ nH}$ Inductive load	$T_j = 25^\circ\text{C}$	—	0.22	—	μs
			$T_j = 125^\circ\text{C}$	—	0.32	—	
			$T_j = 150^\circ\text{C}$	—	0.38	—	
I_{rr}	Reverse recovery current (Note 2)		$T_j = 25^\circ\text{C}$	—	750	—	A
			$T_j = 125^\circ\text{C}$	—	850	—	
			$T_j = 150^\circ\text{C}$	—	840	—	
Q_{rr}	Reverse recovery charge (Note 2)		$T_j = 25^\circ\text{C}$	—	150	—	μC
			$T_j = 125^\circ\text{C}$	—	340	—	
			$T_j = 150^\circ\text{C}$	—	400	—	
$E_{rec(10\%)}$	Reverse recovery energy (Note 2) (Note 5)	$T_j = 25^\circ\text{C}$	—	70	—	mJ	
		$T_j = 125^\circ\text{C}$	—	170	—		
		$T_j = 150^\circ\text{C}$	—	210	—		
E_{rec}	Reverse recovery energy (Note 2) (Note 6)	$T_j = 25^\circ\text{C}$	—	80	—	mJ	
		$T_j = 125^\circ\text{C}$	—	180	—		
		$T_j = 150^\circ\text{C}$	—	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 $\lambda_{grease} = 1\text{W/m}\cdot\text{k}$, $D_{(c-s)} = 100\mu\text{m}$	—	16.0	—	K/kW

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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	$T_C = 25^\circ\text{C}$, 1/2 module	—	22	—	nH
R_{CC+EE}	Internal lead resistance	$T_C = 25^\circ\text{C}$, 1/2 module	—	0.16	—	mΩ
r_g	Internal gate resistance	$T_C = 25^\circ\text{C}$, 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).
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.

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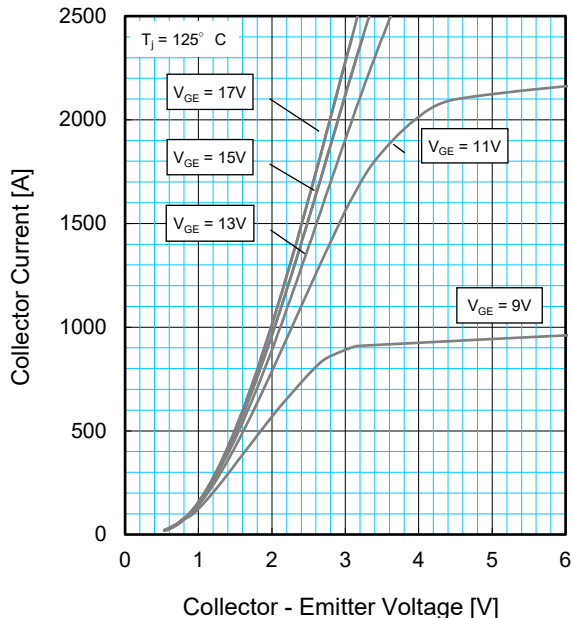
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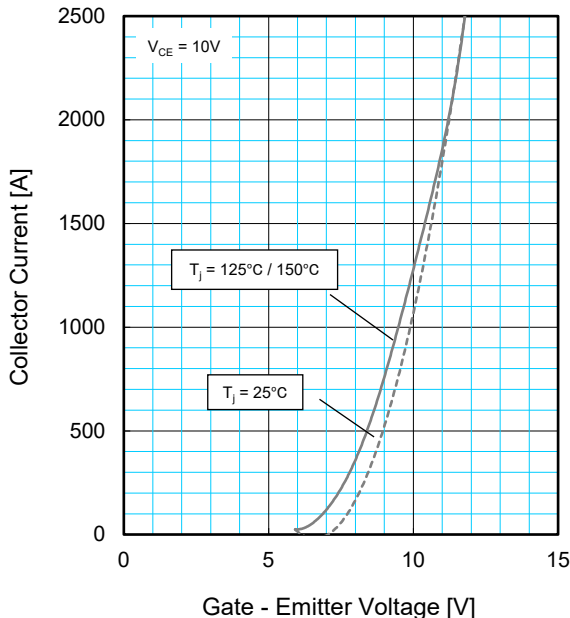
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PERFORMANCE CURVES

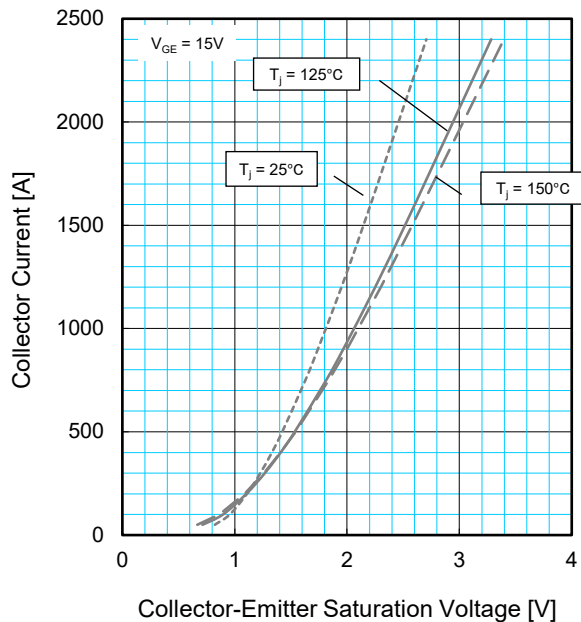
OUTPUT CHARACTERISTICS (TYPICAL)



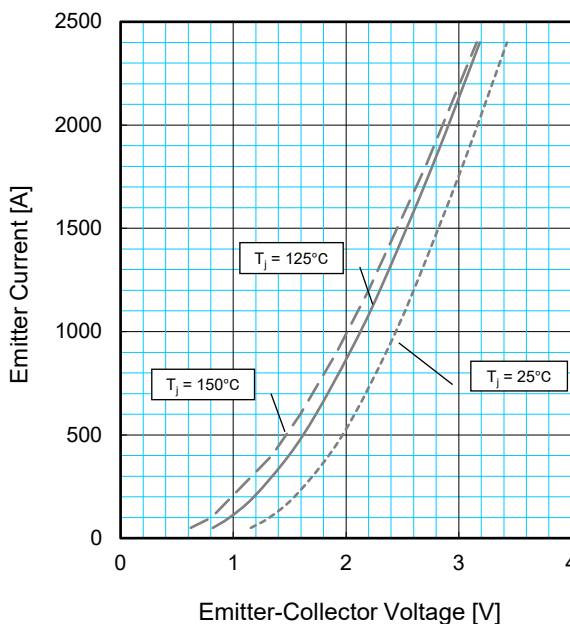
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



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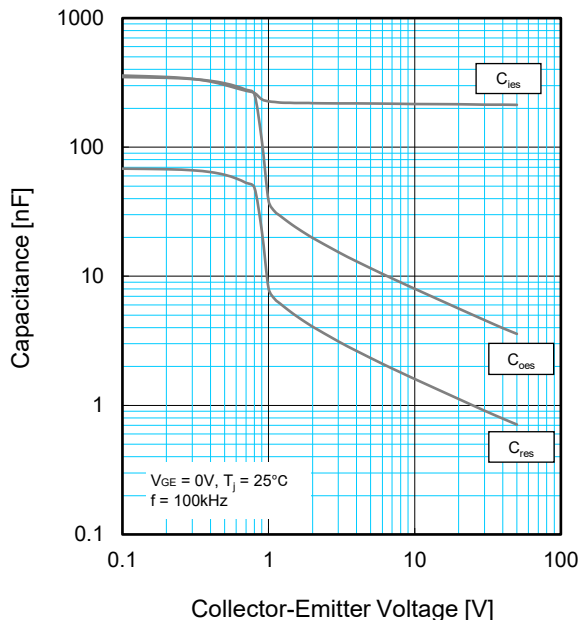
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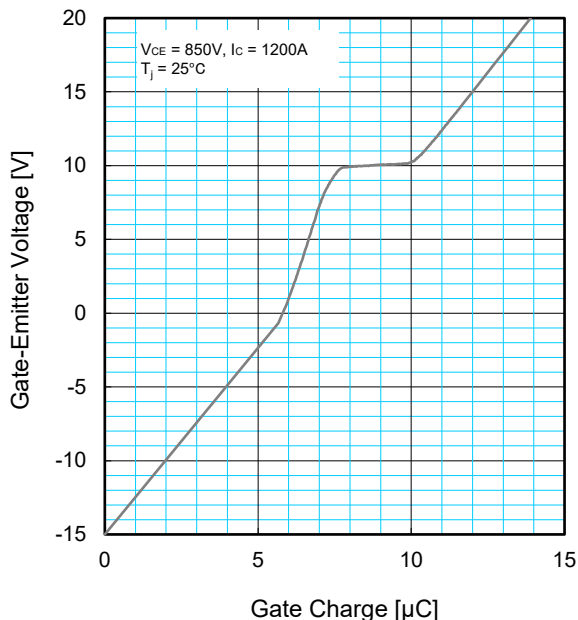
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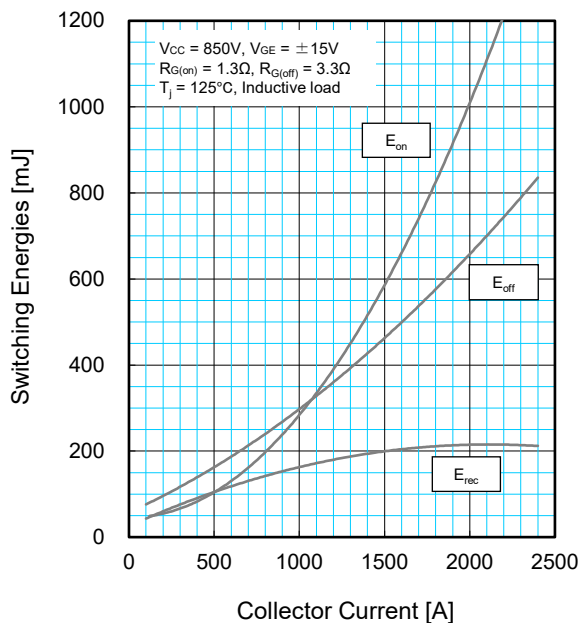
CAPACITANCE CHARACTERISTICS (TYPICAL)



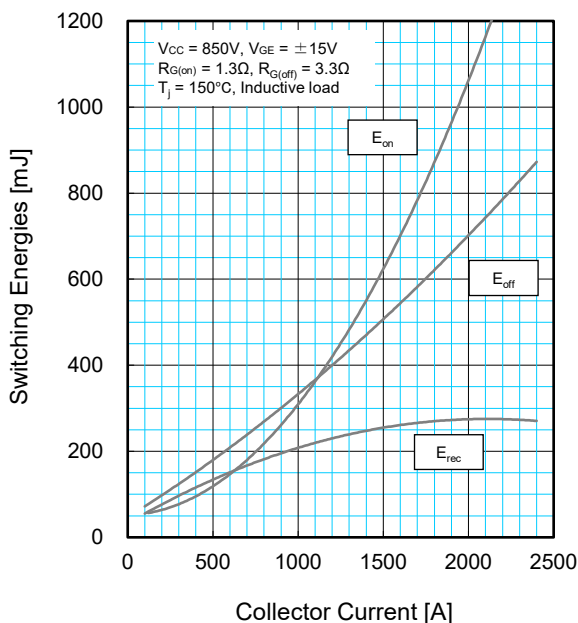
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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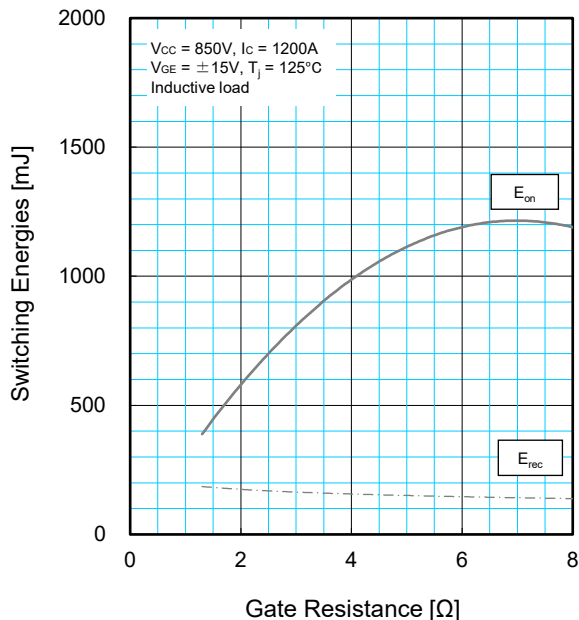
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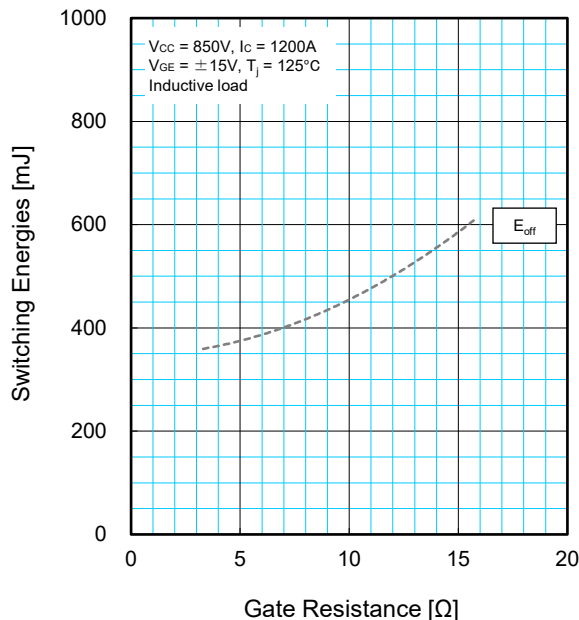
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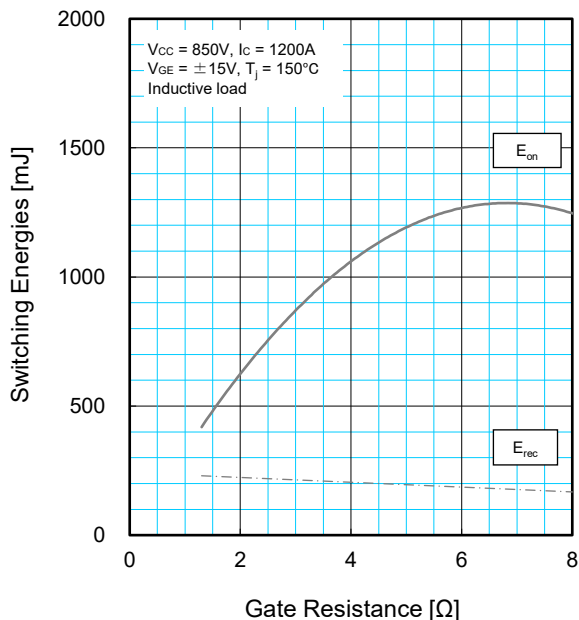
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



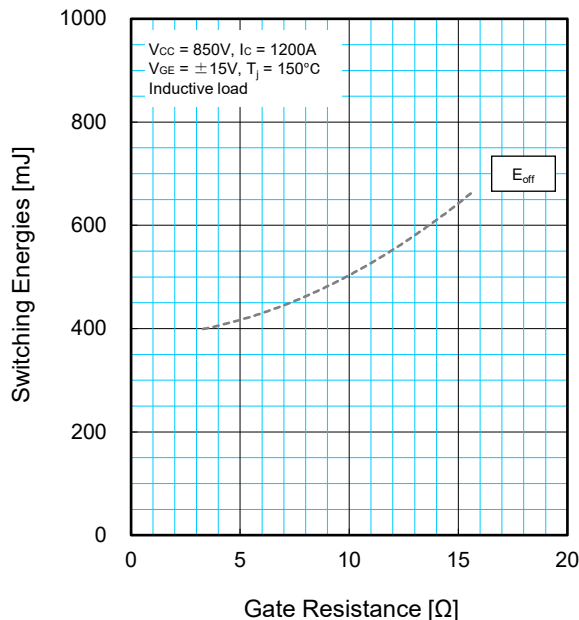
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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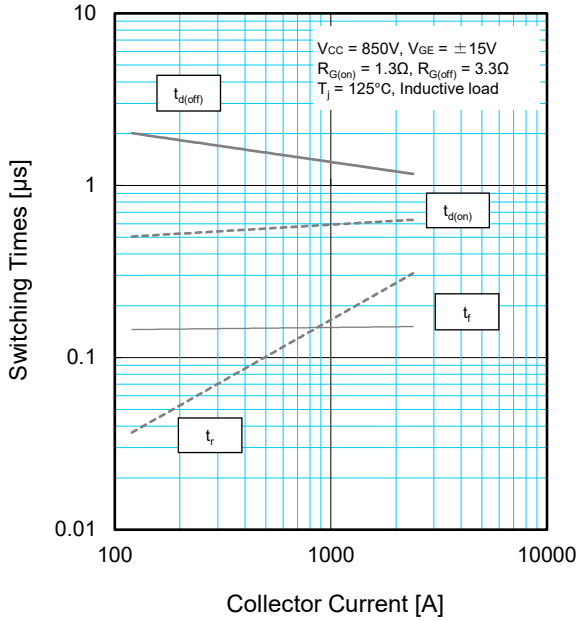
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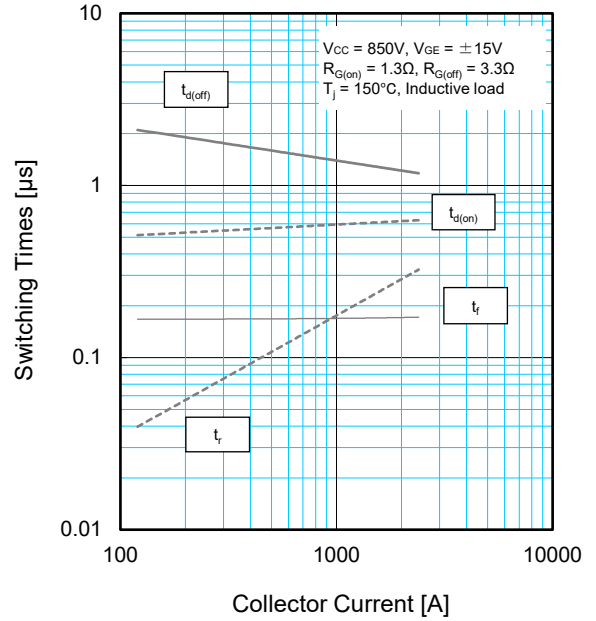
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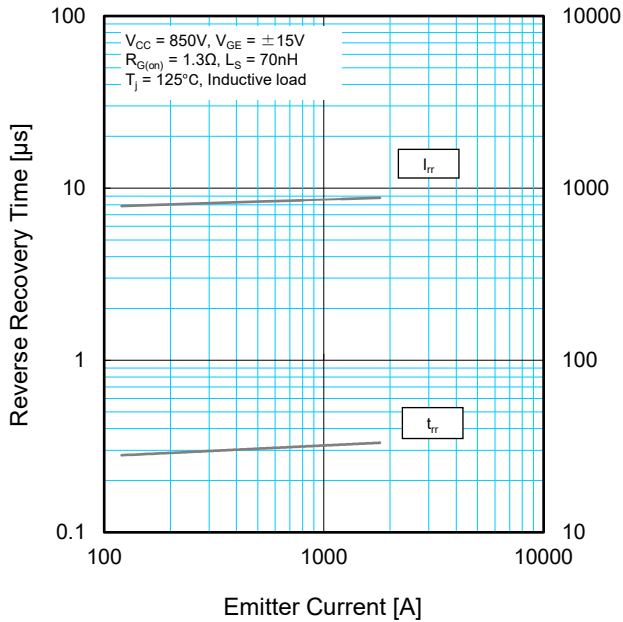
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



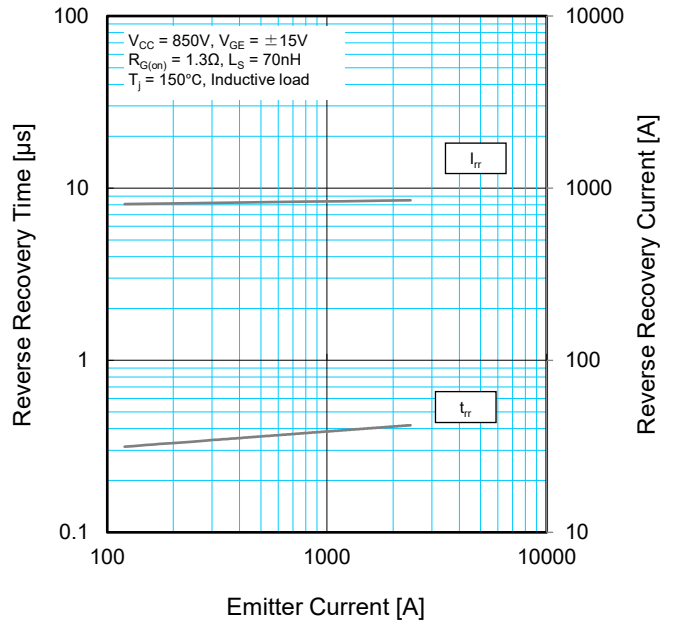
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



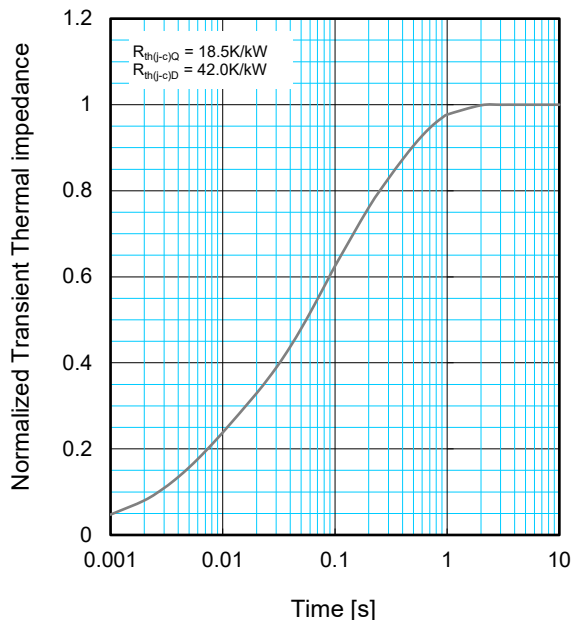
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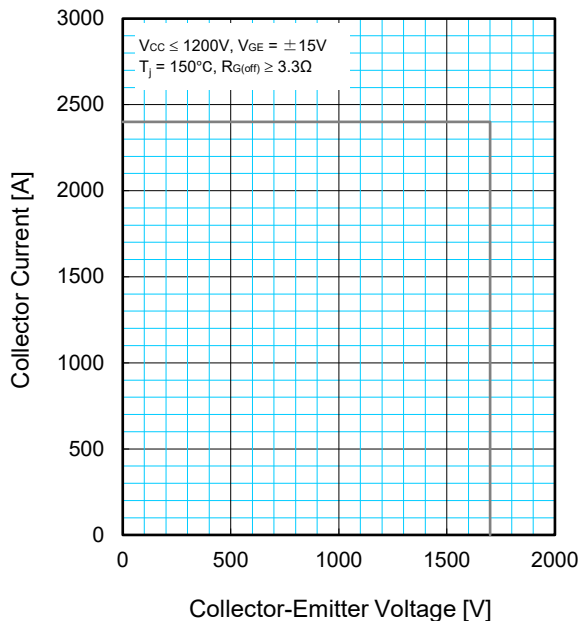
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



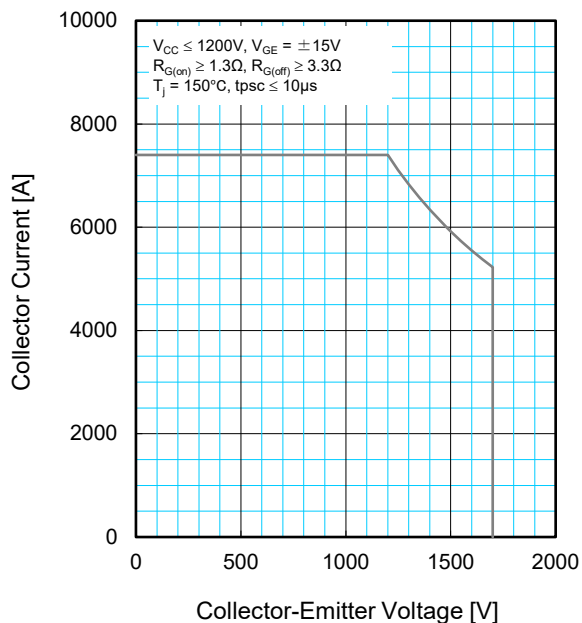
$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i}\right) \right\}$$

	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)



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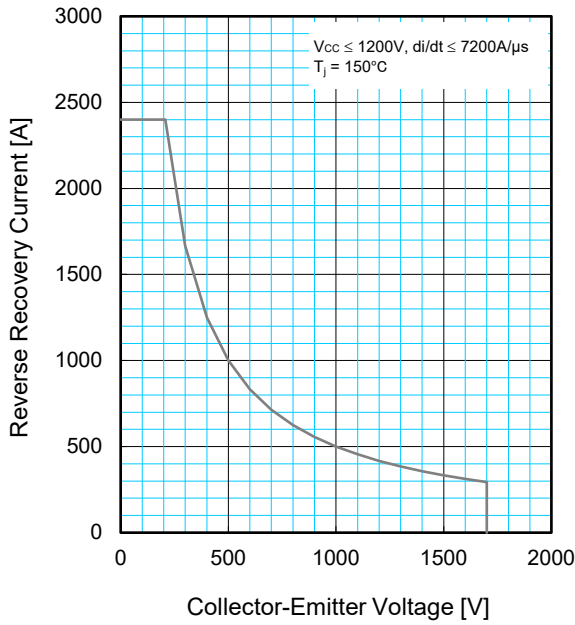
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PERFORMANCE CURVES

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



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