

< High Voltage Insulated Gate Bipolar Transistor: HVIGBT >

CMH600DC-66X

HIGH POWER SWITCHING USE
INSULATED TYPE

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

CMH600DC-66X



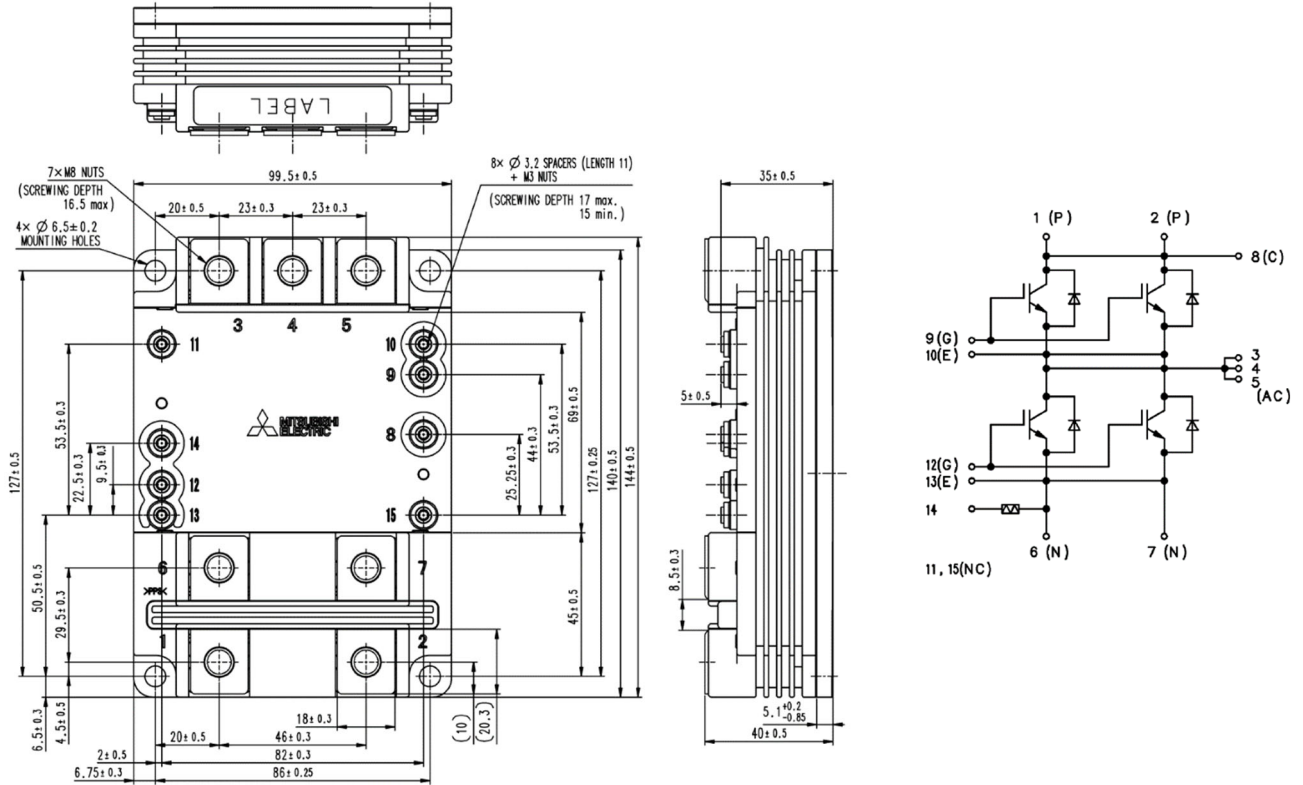
- I_C600A
- V_{CES}3300V
- 2-elements in a Pack
- Insulated Type (AlSiC base type)
- CSTBT™(III)
- SiC Schottky-Barrier Diode

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} = 0 V, T _J = -40...+150 °C	3300	V
		V _{GE} = 0 V, T _J = -50 °C	3200	
V _{GES}	Gate-emitter voltage	V _{CE} = 0 V, T _J = 25 °C	± 20	V
I _C	Collector current	DC, T _c = 90 °C	600	A
I _{CRM}		Pulse (Note 1)	1200	A
I _E	Emitter current (Note 2)	DC	600	A
I _{ERM}		Pulse (Note 1)	1200	A
P _{tot}	Maximum power dissipation (Note 3)	T _c = 25 °C, IGBT part	4100	W
V _{iso}	Isolation voltage	RMS, sinusoidal, f = 60 Hz, t = 1 min	6000	V
Q _{PD}	Partial discharge	Charged part to the base-plate V ₁ = 3500 V _{rms} , V ₂ = 2600 V _{rms} AC 60 Hz, T _c = 25 °C (acc. to IEC 61287-1)	10	pC
T _J	Junction temperature	—	-50 ~ +150	°C
T _{Jop}	Operating junction temperature	—	-50 ~ +150	°C
T _{stg}	Storage temperature	—	-55 ~ +150	°C
t _{psc}	Short circuit pulse width	V _{CC} ≤ 2400 V, V _{GE} = ±15 V R _{G(on)} = 2.2 Ω, R _{G(off)} = 51 Ω T _J = 150 °C, C _{GE} = 33 nH, L _S = 65 nH	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	—	—	2.0	mA
			T _J = 125 °C	—	2.0	—	
			T _J = 150 °C	—	20.0	—	
V _{GE(th)}	Gate-emitter threshold voltage	V _{CE} = 10 V, I _C = 60 mA, T _J = 25 °C	6.5	7.0	7.5	V	
I _{GES}	Gate leakage current	V _{GE} = V _{GES} , V _{CE} = 0 V, T _J = 25 °C	-0.5	—	0.5	μA	
V _{CESat}	Collector-emitter saturation voltage	I _C = 600 A (Note 4) V _{GE} = 15 V	T _J = 25 °C	—	2.30	—	V
			T _J = 125 °C	—	2.80	—	
			T _J = 150 °C	—	2.90	3.30	
C _{ies}	Input capacitance	V _{CE} = 10 V, V _{GE} = 0 V, f = 100 kHz T _J = 25 °C	—	53.4	—	nF	
C _{oes}	Output capacitance		—	3.8	—	nF	
C _{res}	Reverse transfer capacitance		—	0.48	—	nF	
Q _G	Total gate charge	V _{CC} = 1800 V, I _C = 600 A, V _{GE} = ±15 V	—	3.6	—	μC	
t _{d(on)}	Turn-on delay time	V _{CC} = 1800 V I _{C/E} = 600 A V _{GE} = ±15 V R _{G(on)} = 2.2 Ω, C _{GE} = 33 nF L _S = 65 nH	T _J = 150 °C	—	—	1.25	μs
t _r	Rise time		T _J = 150 °C	—	—	0.50	μs
E _{on(10%)}	Turn-on switching energy per pulse (Note 5)		T _J = 25 °C	—	0.27	—	J
			T _J = 125 °C	—	0.29	—	
			T _J = 150 °C	—	0.30	—	
E _{on}	Turn-on switching energy per pulse		T _J = 25 °C	—	0.29	—	J
			T _J = 125 °C	—	0.34	—	
			T _J = 150 °C	—	0.35	—	
E _{off_diode(10%)}	Diode-off switching energy per pulse (Note 2, 5)		T _J = 25 °C	—	0.01	—	J
			T _J = 125 °C	—	0.01	—	
		T _J = 150 °C	—	0.01	—		
Q _{C(10%)}	Total capacitive charge (Note 2, 6)	Inductive load	T _J = 25 °C	—	8.55	—	μC
			T _J = 125 °C	—	9.25	—	
			T _J = 150 °C	—	10.0	—	

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Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
V _{EC}	Emitter-collector voltage (Note 2)	I _E = 600 A (Note 4) V _{GE} = 0 V	T _J = 25 °C	—	2.25	—	V
			T _J = 125 °C	—	3.55	—	
			T _J = 150 °C	—	4.55	7.00	
t _{d(off)}	Turn-off delay time	V _{CC} = 1800 V I _C = 600 A V _{GE} = ±15 V R _{G(off)} = 51 Ω C _{GE} = 33 nF L _S = 65 nH	T _J = 150 °C	—	—	5.00	μs
t _f	Fall time		T _J = 150 °C	—	—	1.00	μs
E _{off(10%)}	Turn-off switching energy per pulse (Note 5)		T _J = 25 °C	—	0.68	—	J
		T _J = 125 °C	—	0.91	—		
		T _J = 150 °C	—	0.92	—		
E _{off}	Turn-off switching energy per pulse	Inductive load	T _J = 25 °C	—	0.75	—	J
			T _J = 125 °C	—	1.03	—	
			T _J = 150 °C	—	1.04	—	

THERMAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R _{th(j-c)Q}	Thermal resistance	Junction to Case, IGBT part, 1/2 module	—	—	30.0	K/kW
R _{th(j-c)D}		Junction to Case, FWDi part, 1/2 module	—	—	45.0	K/kW
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, 1/2 module λ _{grease} = 1 W/m·K, D _(c-s) = 70 μm	—	16.0	—	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M _t	Mounting torque	Main terminals screw M8 (Note 7)	7.0	—	14.0	N·m
M _s		Mounting screw M6	3.0	—	6.0	N·m
M _t		Auxiliary terminals screw M3	0.4	—	0.8	N·m
m	Mass	—	—	0.80	—	Kg
CTI	Comparative tracking index	—	600	—	—	—
d _a	Clearance	Between terminals and baseplate	19.5	—	—	Mm
d _s	Creepage distance	—	32.0	—	—	Mm
L _{P(P-N)}	Parasitic stray inductance	Between terminal 1, 2 and terminal 6, 7	—	14.0	—	nH
R _{CC+EE'}	Internal lead resistance	T _c = 25 °C, 1/2 module	—	0.33	—	mΩ

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NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R ₂₅	Zero-power resistance	T _c = 25 °C	—	5.00	—	kΩ
B _(25/50)	B-constant (Note 8)	Approximate by equation	—	3375	—	K

Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jop,max} rating.

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

Note 3. Junction temperature (T_j) should not exceed T_{L,max} rating (150°C).

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 total capacitive charge is from I_E=0A to 10%I_E.

Note 7 This is the case when installing the product on the bus bar.

Note 8. $B_{(25/50)} = \ln \left(\frac{R_{25}}{R_{50}} \right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}} \right)$

R₂₅: resistance at 25 °C

R₅₀: resistance at 50 °C

T₂₅ [K]: T₂₅ = 25 [°C] + 273.15 = 298.15 [K]

T₅₀ [K]: T₅₀ = 50 [°C] + 273.15 = 323.15 [K]

R₂₅: resistance at absolute temperature T₂₅ [K]; T₂₅ = 25 [°C] + 273.15 = 298.15 [K]

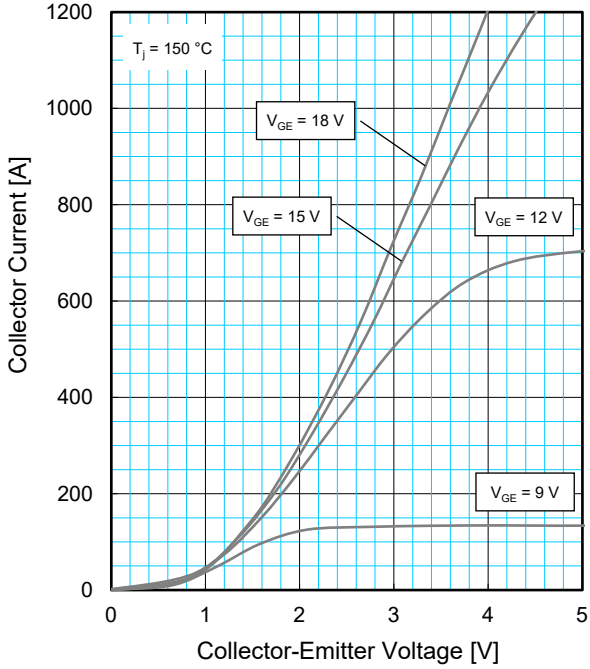
R₅₀: resistance at absolute temperature T₅₀ [K]; T₅₀ = 50 [°C] + 273.15 = 323.15 [K]

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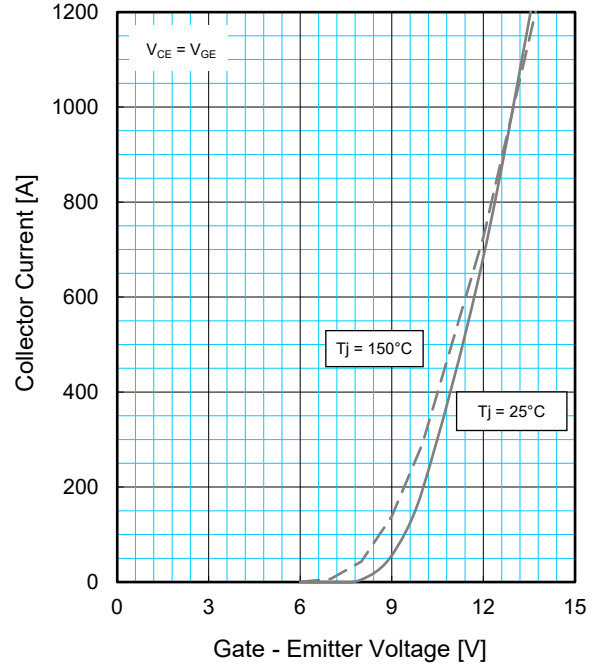
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

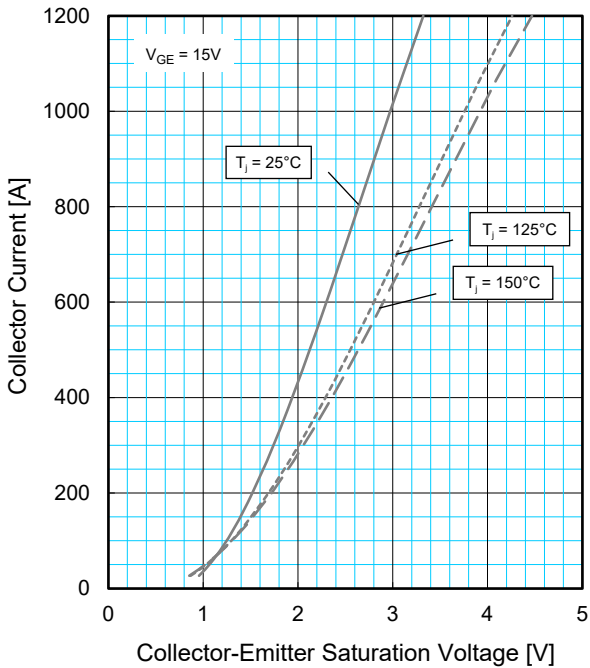
OUTPUT CHARACTERISTICS (TYPICAL)



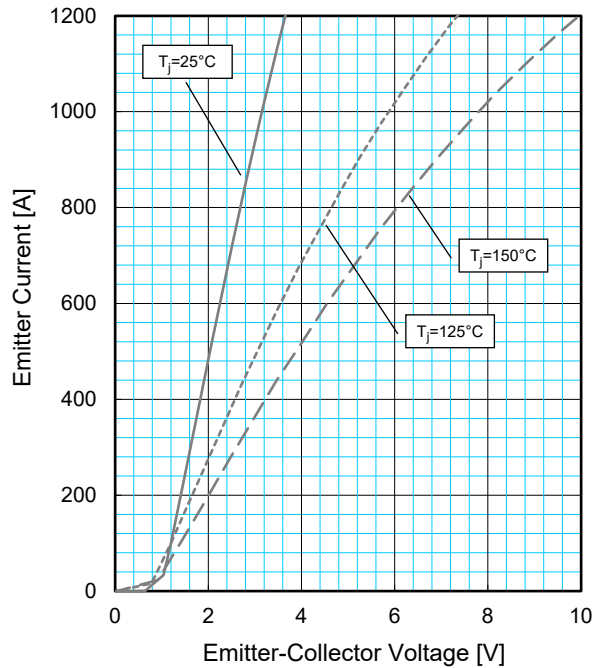
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



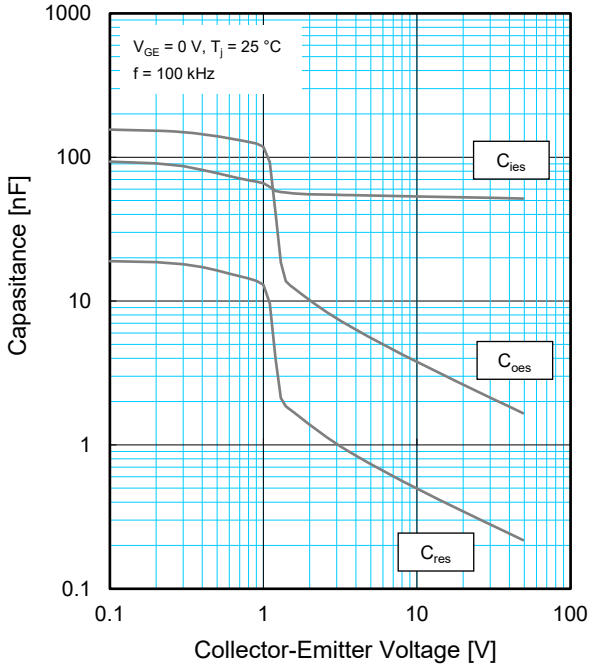
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HIGH POWER SWITCHING USE
INSULATED TYPE

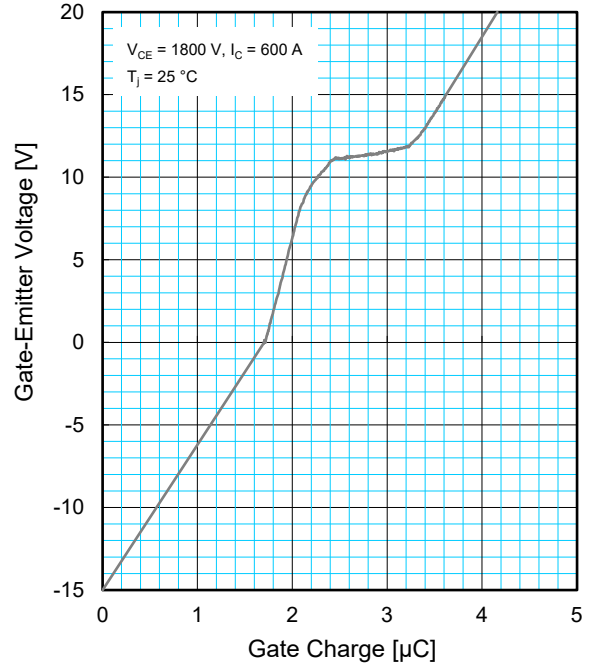
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PERFORMANCE CURVES

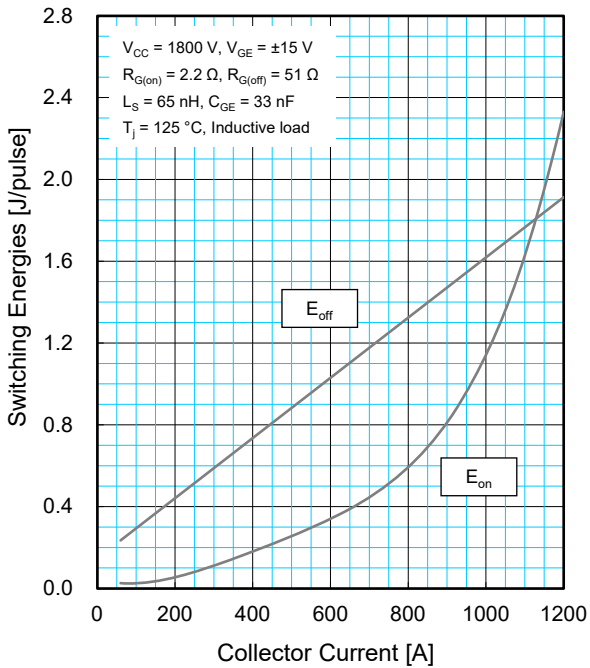
CAPACITANCE CHARACTERISTICS (TYPICAL)



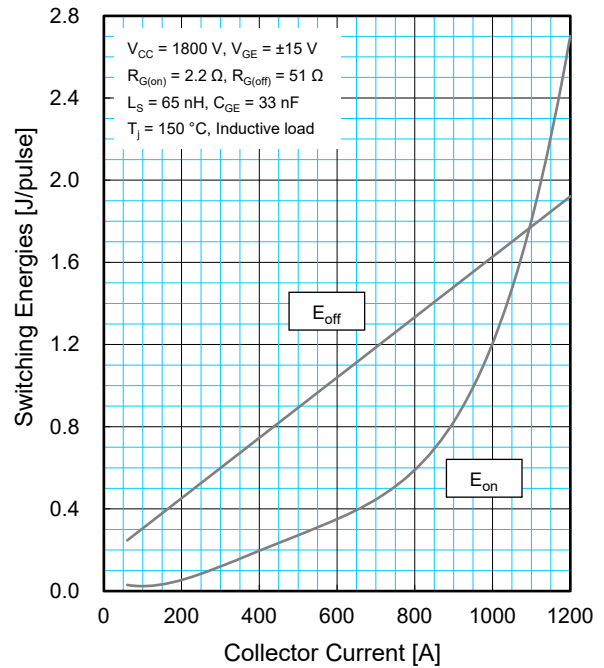
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



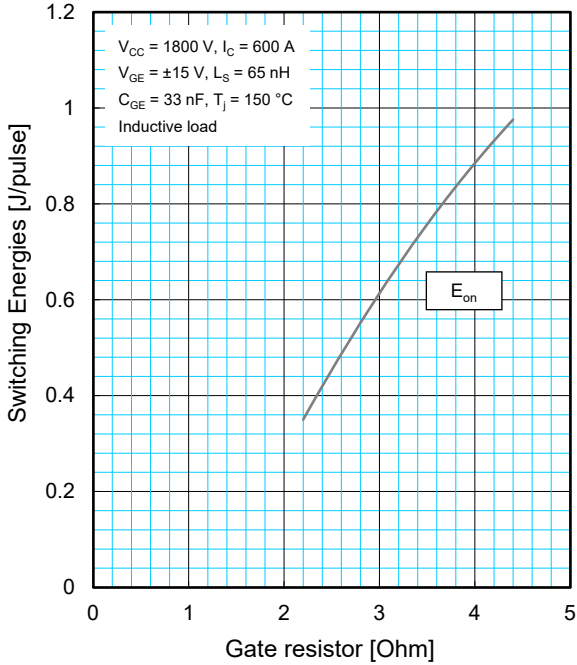
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INSULATED TYPE

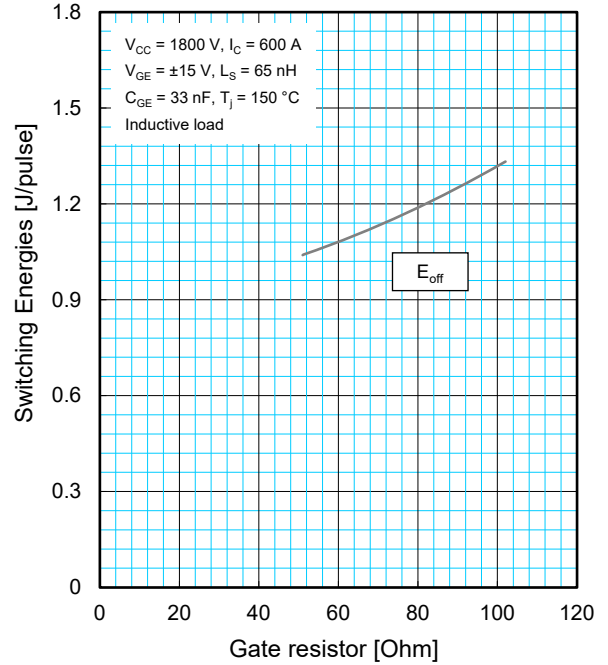
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PERFORMANCE CURVES

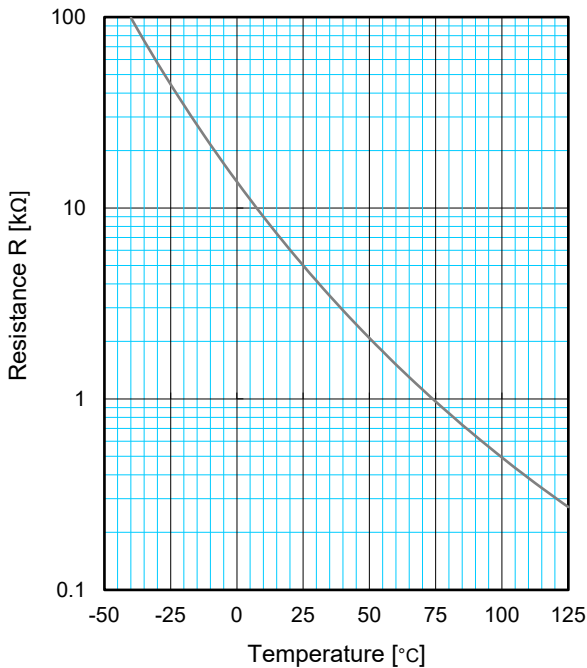
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



NTC THERMISTOR TEMPERATURE CHARACTERISTICS (TYPICAL)



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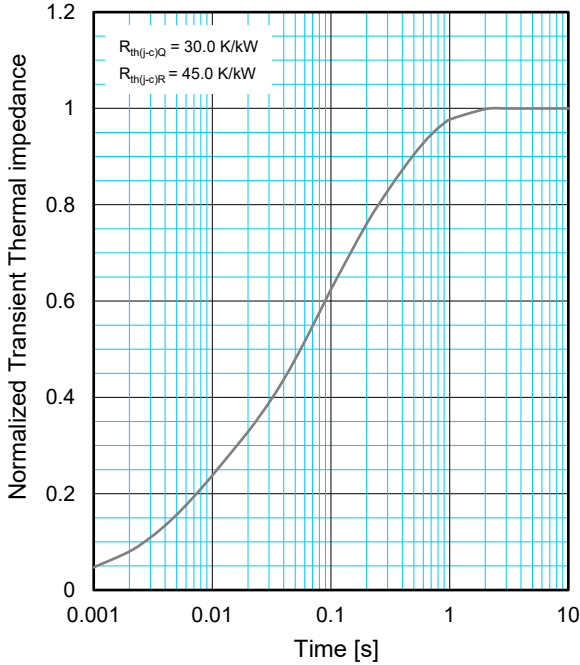
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PERFORMANCE CURVES

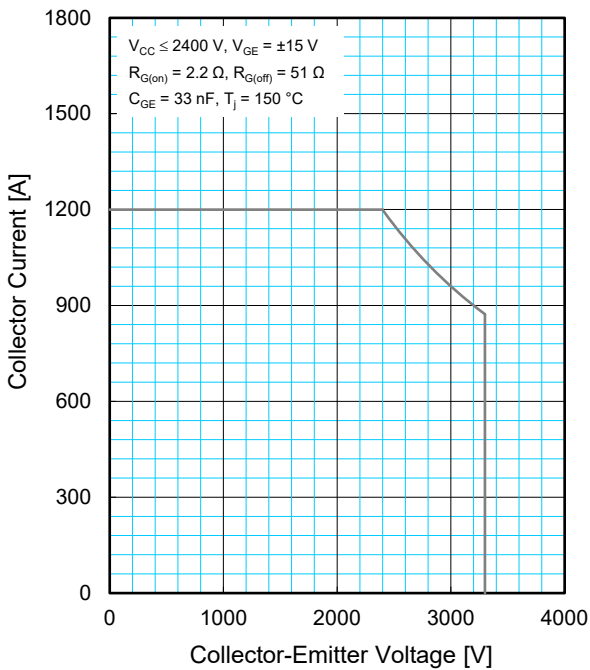
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



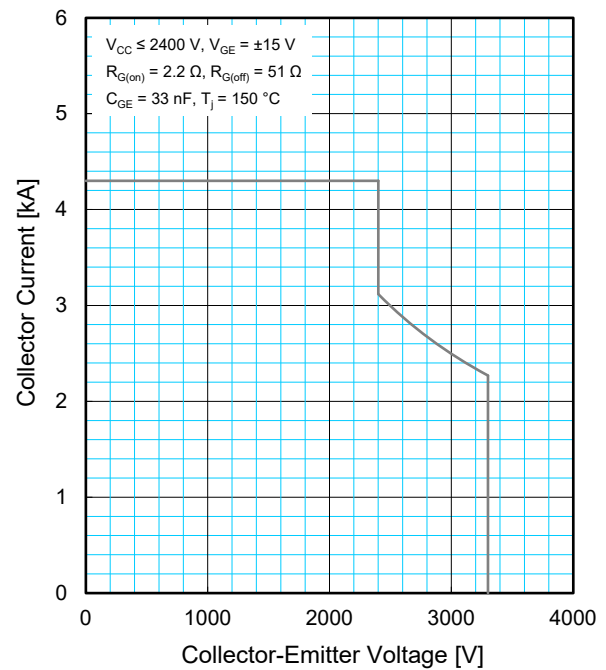
$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i}\right) \right\}$$

	1	2	3	4
$R_i / R_{th(j-c)}$	0.0096	0.1893	0.4044	0.3967
τ_i [s]	0.0001	0.0058	0.0602	0.3512

REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



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