



**MAXIMUM RATINGS**

Symbol	Item	Conditions	Ratings	Unit
$V_{CES}$	Collector-emitter voltage	$V_{GE} = 0V$	1700	V
$V_{GES}$	Gate-emitter voltage	$V_{CE} = 0V, T_j = 25^\circ C$	$\pm 20$	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
$I^2t$	Surge current load integral	$T_j = 125^\circ C, V_R = 0V, t_p = 10ms$	—	kA <sup>2</sup> s
$P_{tot}$	Maximum power dissipation (Note 3)	$T_c = 25^\circ C$ , IGBT part	6750	W
$V_{iso}$	Isolation voltage	RMS, sinusoidal, $f = 60Hz, t = 1min.$	4000	V
$T_{jop}$	Operating junction temperature		-50 ~ +150	°C
$T_{stg}$	Storage temperature		-50 ~ +150	°C
$t_{psc}$	Short circuit pulse width	$V_{CC} = 1200V, V_{CE} \leq V_{CES}, V_{GE} = 15V, T_j = 150^\circ C$	10	$\mu s$

**ELECTRICAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
$I_{CES}$	Collector cutoff current	$V_{CE} = V_{CES}, V_{GE} = 0V$	$T_j = 25^\circ C$	—	36	—	mA
			$T_j = 125^\circ C$	—	150	—	
			$T_j = 150^\circ C$	—	180	—	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE} = 10V, I_C = 120mA, T_j = 25^\circ C$	—	6.0	—	V	
$I_{GES}$	Gate leakage current	$V_{GE} = V_{GES}, V_{CE} = 0V, T_j = 25^\circ C$	-0.5	—	0.5	$\mu A$	
$C_{ies}$	Input capacitance	$V_{CE} = 10V, V_{GE} = 0V, f = 100kHz$ $T_j = 25^\circ C$	—	216	—	nF	
$C_{oes}$	Output capacitance		—	8.0	—	nF	
$C_{res}$	Reverse transfer capacitance		—	1.6	—	nF	
$Q_G$	Total gate charge	$V_{CC} = 850V, I_C = 1200A, V_{GE} = 15V$	—	12.0	—	$\mu C$	
$V_{CEsat}$	Collector-emitter saturation voltage	$I_C = 1200A$ $V_{GE} = 15V$ (Note 4)	$T_j = 25^\circ C$	—	1.95	—	V
			$T_j = 125^\circ C$	—	2.25	—	
			$T_j = 150^\circ C$	—	2.30	—	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 850V$ $I_C = 1200A$ $V_{GE} = \pm 15V$	$T_j = 25^\circ C$	—	0.50	—	$\mu s$
			$T_j = 125^\circ C$	—	0.50	—	
			$T_j = 150^\circ C$	—	0.50	—	
$t_r$	Turn-on rise time	$R_{G(on)} = 1.3\ \Omega$ $L_s = 100\ nH$ Inductive load	$T_j = 25^\circ C$	—	0.14	—	$\mu s$
			$T_j = 125^\circ C$	—	0.15	—	
			$T_j = 150^\circ C$	—	0.15	—	
$E_{on(10\%)}$	Turn-on switching energy (Note 6)	$R_{G(off)} = 3.3\ \Omega$ $L_s = 100\ nH$ Inductive load	$T_j = 25^\circ C$	—	110	—	mJ
			$T_j = 125^\circ C$	—	135	—	
			$T_j = 150^\circ C$	—	140	—	
$E_{on}$	Turn-on switching energy (Note 5)		$T_j = 25^\circ C$	—	130	—	mJ
			$T_j = 125^\circ C$	—	155	—	
			$T_j = 150^\circ C$	—	160	—	
$t_{d(off)}$	Turn-off delay time		$T_j = 25^\circ C$	—	1.20	—	$\mu s$
			$T_j = 125^\circ C$	—	1.30	—	
			$T_j = 150^\circ C$	—	1.32	—	
$t_f$	Turn-off fall time	$V_{CC} = 850V$ $I_C = 1200A$ $V_{GE} = \pm 15V$	$T_j = 25^\circ C$	—	0.12	—	$\mu s$
			$T_j = 125^\circ C$	—	0.15	—	
			$T_j = 150^\circ C$	—	0.17	—	
$E_{off(10\%)}$	Turn-off switching energy (Note 6)	$R_{G(off)} = 3.3\ \Omega$ $L_s = 100\ nH$ Inductive load	$T_j = 25^\circ C$	—	200	—	mJ
			$T_j = 125^\circ C$	—	280	—	
			$T_j = 150^\circ C$	—	310	—	
$E_{off}$	Turn-off switching energy (Note 5)		$T_j = 25^\circ C$	—	260	—	mJ
			$T_j = 125^\circ C$	—	360	—	
			$T_j = 150^\circ C$	—	400	—	

**THERMAL CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit	
			Min	Typ	Max		
$V_{EC}$	Emitter-collector voltage (Note 2)	$I_E = 1200A$ (Note 4) $V_{GE} = 0V$	$T_j = 25^\circ C$	—	1.60	—	V
			$T_j = 125^\circ C$	—	2.20	—	
			$T_j = 150^\circ C$	—	2.30	—	
$Q_C$	Total capacitive charge (Note 2,7)	$V_{CC} = 850V, I_E = 1200 A$ $R_{G(on)} = 1.3\Omega, L_s = 100 nH$	$T_j = 25^\circ C$	—	5.0	—	$\mu C$
			$T_j = 125^\circ C$	—	8.5	—	
			$T_j = 150^\circ C$	—	9.0	—	
$R_{th(j-c)Q}$	Thermal resistance	Junction to Case, IGBT part, 1/2 module	—	—	18.5	K/kW	
$R_{th(j-c)D}$		Junction to Case, FWDi part, 1/2 module	—	—	36.0	K/kW	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, 1/2 module $\lambda_{grease} = 1W/m \cdot k, D_{(c-s)} = 100\mu m$	—	16.0	—	K/kW	

**MECHANICAL CHARACTERISTICS**

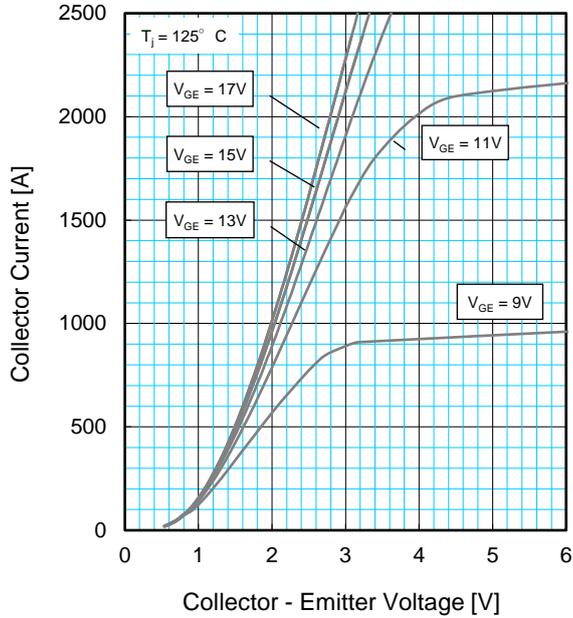
Symbol	Item	Conditions	Limits			Unit
			Min	Typ	Max	
$M_t$	Mounting torque	Main terminals screw	7.0	—	20.0	N·m
$M_s$		Mounting screw	3.0	—	6.0	N·m
$M_t$		Auxiliary terminals screw	1.0	—	3.0	N·m
$m$	Mass		—	0.8	—	kg
CTI	Comparative tracking index		600	—	—	—
$d_a$	Clearance		9.5	—	—	mm
$d_s$	Creepage distance		15.0	—	—	mm
$L_{p,CE}$	Parasitic stray inductance	1/2 module	—	30.0	—	nH
$R_{CC+EE}$	Internal lead resistance	$T_c = 25^\circ C, 1/2$ module	—	0.28	—	m $\Omega$

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

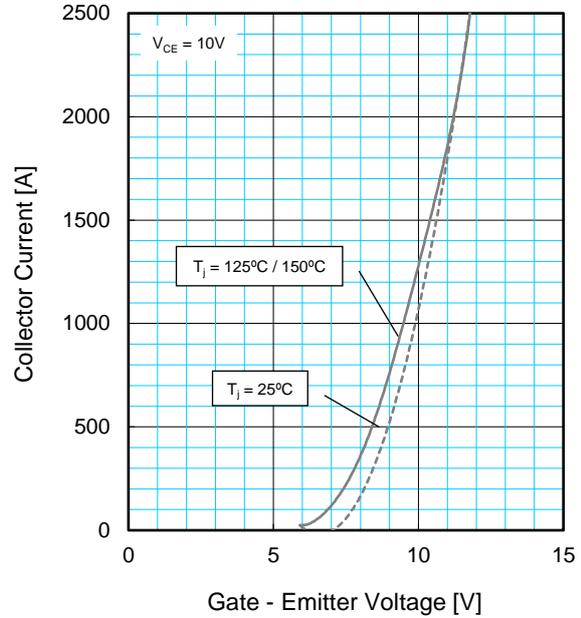
- The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).
- Junction temperature ( $T_j$ ) should not exceed  $T_{jmax}$  rating.
- Pulse width and repetition rate should be such as to cause negligible temperature rise.
- Definition of all items is according to IEC 60747, unless otherwise specified.
- $E_{on(10\%)} / E_{off(10\%)} / E_{rec(10\%)}$  are the integral of  $0.1V_{CE} \times 0.1I_C \times dt$ .
- Capacitive charge during anti-paralleled FWDi's turn-off operation.

PERFORMANCE CURVES

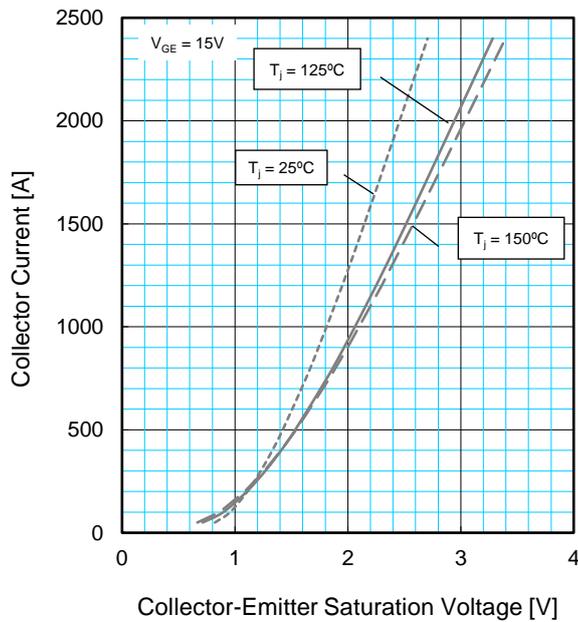
**OUTPUT CHARACTERISTICS (TYPICAL)**



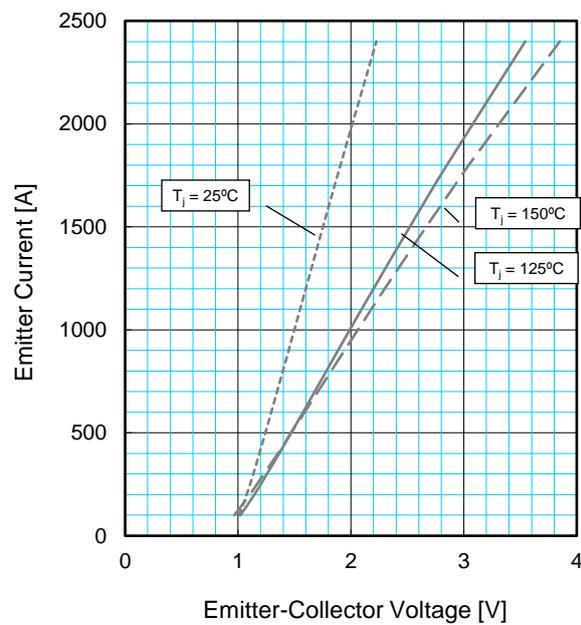
**TRANSFER CHARACTERISTICS (TYPICAL)**



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



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



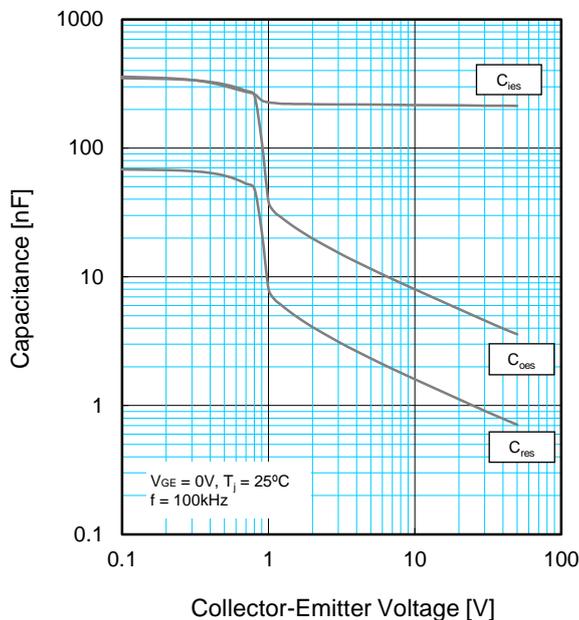
# CMH1200DC-34S

HIGH POWER SWITCHING USE  
INSULATED TYPE

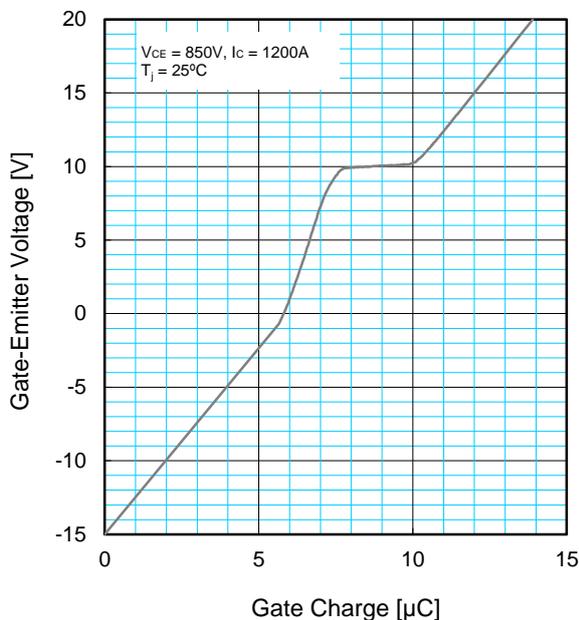
SiC Hybrid HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Module

## PERFORMANCE CURVES

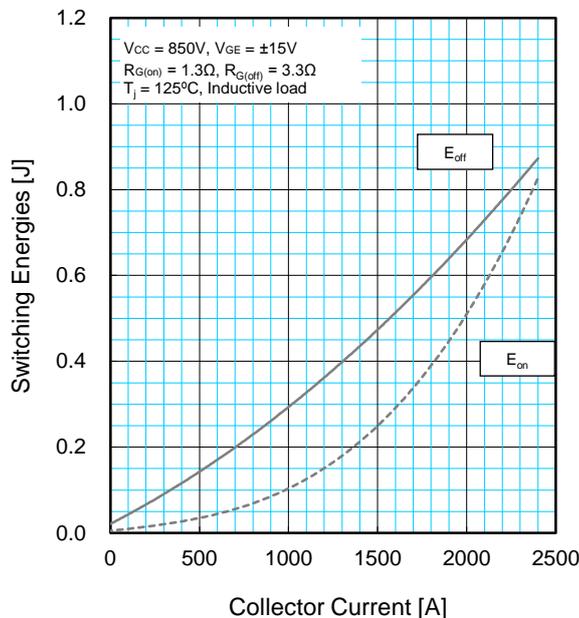
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



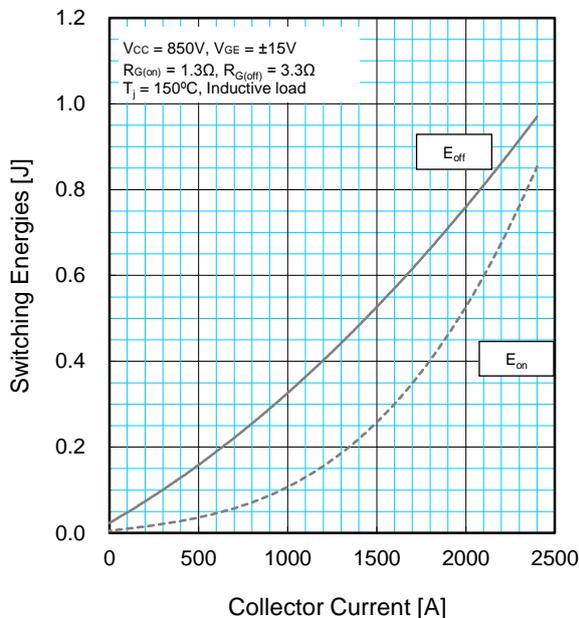
**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**

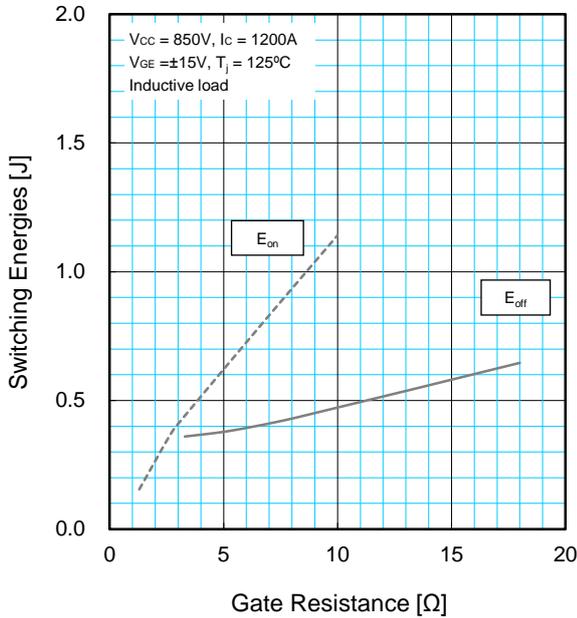


**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**

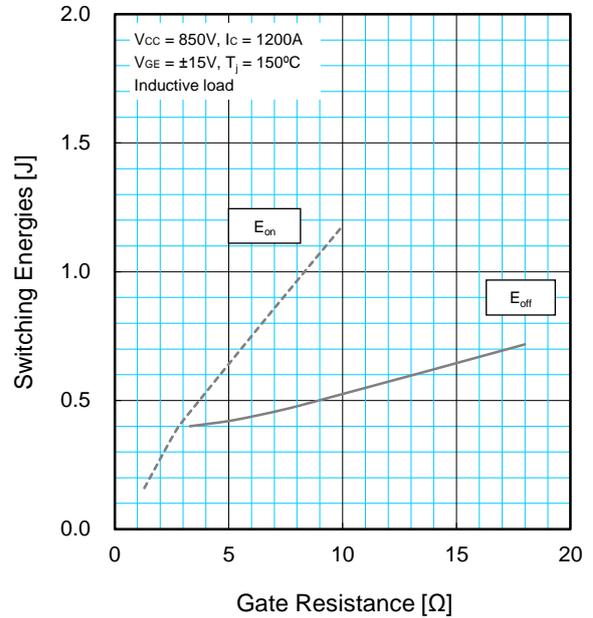


PERFORMANCE CURVES

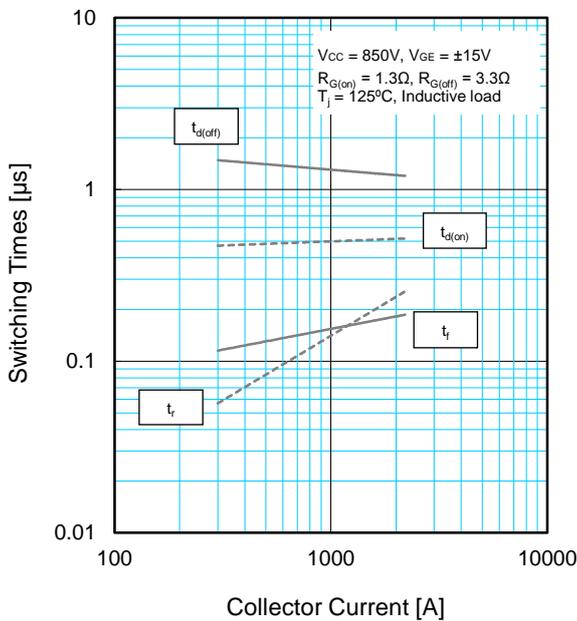
**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



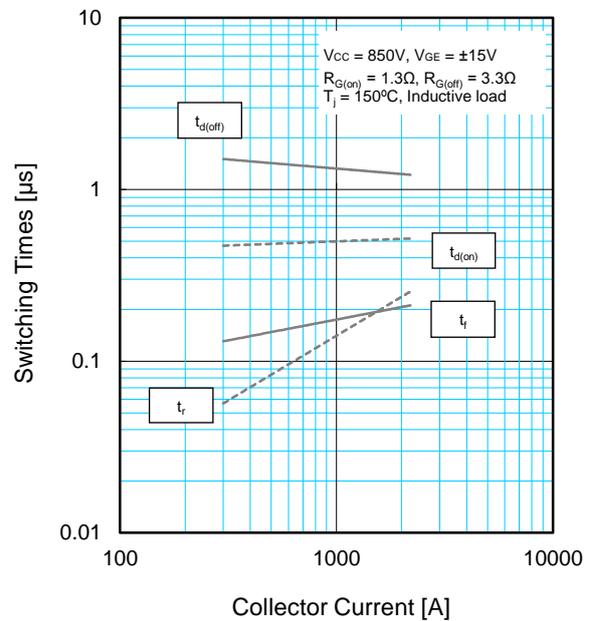
**HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)**

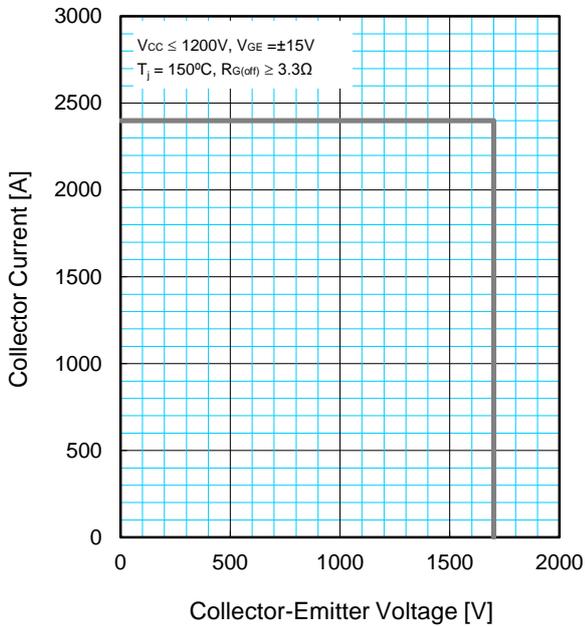


**HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)**

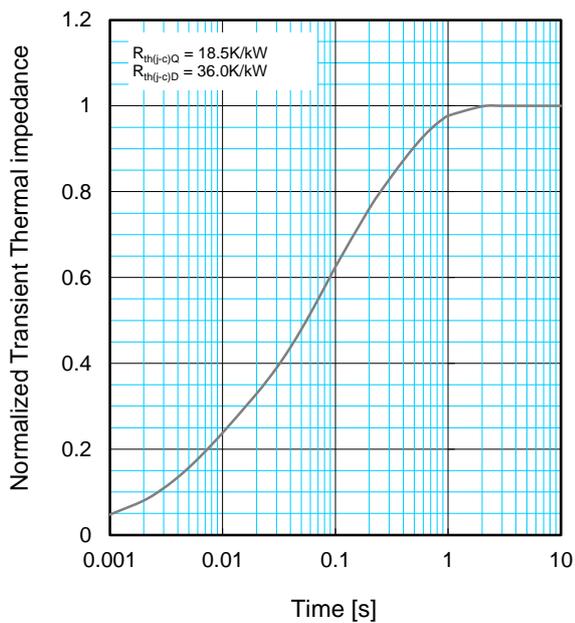


PERFORMANCE CURVES

**REVERSE BIAS  
SAFE OPERATING AREA (RBSOA)**



**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
$\tau_i$ [sec]	0.0001	0.0058	0.0602	0.3512

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