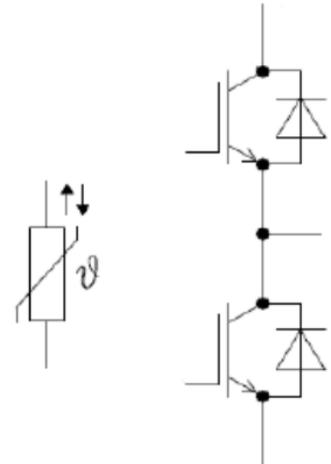


C5 series package: 1200V 600A IGBT module

[Datasheet](#)



Equivalent
Circuit Schematic

Features:

- Trenchgate Gen.7 IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High RBSOA capability
- Low static losses: $V_{CE(sat)} = 1,5V@25^{\circ}C$
- Low dynamic losses

Options:

- Pre-applied TIM (option +M01)
- Adoption for parallel connection (V_f selection)

Typical Applications:

- Motor Drives
- Solar Applications
- UPS Systems
- Energy Storage

**IGBT, Inverter / IGBT
Maximum Rated Values**

Collector-emitter Voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1200	V
Continuous DC Collector Current	$T_C = 25^{\circ}\text{C}, T_{vj\ max} \leq 175^{\circ}\text{C}$	I_{Cnom}	600	A
	$T_C = 100^{\circ}\text{C}, T_{vj\ max} \leq 175^{\circ}\text{C}$	I_C	732	A
Repetitive Peak Collector Current	$t_p = 1\text{ms}$	I_{CRM}	1200	A
Gate-emitter Peak Voltage		V_{GES}	± 20	V

Characteristic Values

		min. typ. max.			
Collector-emitter Saturation Voltage ¹⁾	$I_C = 600\text{A}, V_{GE} = 15\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	V_{CEsat}	1.40 1.50 1.80 1.86	1.70	V
Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 24\text{mA}, T_{vj} = 25^{\circ}\text{C}$	V_{GEth}	5.0	6.0	7.0
Gate Charge	$V_{GE} = 15\text{V}/-8\text{V}, V_{CE} = 600\text{V}$	Q_G	-	5.7	-
Internal Gate Resistor	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}	-	0.43	-
Input Capacitance	$f = 100\text{kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{ies}	-	128	-
Reverse Transfer Capacitance	$f = 100\text{kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{res}	-	0.80	-
Collector-emitter Cutoff Current	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{CES}	-	-	1
Gate-emitter Leakage Current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{GES}	-	-	500
Turn-on Delay Time, Inductive Load	$I_C = 600\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = 15\text{V}/-8\text{V}$ $R_{GON} = 1\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	t_{don}	-	216 222 227 230	-
Rise Time, Inductive Load	$I_C = 600\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = 15\text{V}/-8\text{V}$ $R_{GON} = 1\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	t_r	-	72 85 87 94	-
Turn-off Delay Time, Inductive Load	$I_C = 600\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = 15\text{V}/-8\text{V}$ $R_{Goff} = 1\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	t_{doff}	-	438 478 491 500	-
Fall Time, Inductive Load	$I_C = 600\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = 15\text{V}/-8\text{V}$ $R_{Goff} = 1\Omega$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	t_f	-	116 182 202 230	-
Turn-on Energy Loss per Pulse	$I_C = 600\text{A}, V_{CE} = 600\text{V}, L_{\sigma} = 35\text{nH}$ $V_{GE} = 15\text{V}/-8\text{V}, R_{GON} = 1\Omega$ $di/dt = 6900 (T_{vj} = 175^{\circ}\text{C})$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	E_{on}	-	49.9 75.0 85.0 97.0	-
Turn-off energy Loss per Pulse	$I_C = 600\text{A}, V_{CE} = 600\text{V}, L_{\sigma} = 30\text{nH}$ $V_{GE} = 15\text{V}/-8\text{V}, R_{GON} = 1\Omega$ $du/dt = 6900 (T_{vj} = 175^{\circ}\text{C})$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	E_{off}	-	49.1 55.0 62.0 72.0	-
SC Data	$V_{GE} = 15\text{V}/-8\text{V}$ $V_{CE} = 600\text{V}$ $t_p = 10\mu\text{s}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ $t_p = 10\mu\text{s}, T_{vj} = 175^{\circ}\text{C}$	I_{sc}	-	3400 2700 2200	-

Thermal Resistance, Junction to Case	Per IGBT	R _{thJC}	-	0.051	-	K/W
Thermal Resistance, Case to Heatsink	Per IGBT / IGBT $\lambda_{grease} = 1W/(m \cdot K)$	R _{thCH}	-	0.035	-	K/W
Temperature under Switching Conditions		T _{vj op}	-40		150	°C

Diode, Inverter Maximum Rated Values

Repetitive Peak Reverse Voltage	T _{vj} = 25°C	V _{RRM}		1200		V
Continuous DC Forward Current		I _{Fnom}		600		A
Repetitive Peak Forward Current	t _p = 1ms	I _{FRM}		1200		A

Characteristic Values

			min. typ. max.				
Forward Voltage ¹⁾	I _F = 600A, V _{GE} = 0V	T _{vj} = 25°C T _{vj} = 150°C T _{vj} = 175°C	V _F	1.50	2.10 2.17 2.05	2.40	V
Peak Reverse Recovery Current	I _F = 600A, V _R = 600V -di _F /dt = 6900A/us (T _{vj} = 175°C) V _{GE} = -8V	T _{vj} = 25°C T _{vj} = 125°C T _{vj} = 150°C T _{vj} = 175°C	I _{RM}	-	264 296 304 416	-	A
Recovery Charge	I _F = 600A, V _R = 600V -di _F /dt = 6900A/us (T _{vj} = 175°C) V _{GE} = -8V	T _{vj} = 25°C T _{vj} = 125°C T _{vj} = 150°C T _{vj} = 175°C	Q _R	-	191 35.8 64.0 87.5	-	μC
Reverse Recovery Energy	I _F = 600A, V _R = 600V -di _F /dt = 6900A/us (T _{vj} = 175°C) V _{GE} = -8V	T _{vj} = 25°C T _{vj} = 125°C T _{vj} = 150°C T _{vj} = 175°C	E _{rec}	-	11.7 20.7 25.4 41.8	-	mJ
Thermal Resistance, Junction to Case	Per FRD		R _{thJC}	-	0.065	-	K/W
Thermal Resistance, Case to Heatsink	Per FRD $\lambda_{grease} = 1W/(m \cdot K)$		R _{thCH}	-	0.039	-	K/W
Temperature under Switching Conditions ²⁾			T _{vj op}	-40	-	150	°C

Per FRD / FRD
 $\lambda_{grease} = 1W/(m \cdot K)$

NTC-Thermistor / NTC Maximum Rated Values

			min. typ. max.				
Rated Resistance	T _{NTC} = 25°C		R ₂₅	-	5	-	KΩ
Deviation of R100 R100	T _{NTC} = 100°C, R ₁₀₀ = 465Ω		ΔR/R	-7.3	-	7.3	%
Power Dissipation	T _{NTC} = 25°C		P ₂₅	-	-	10	mW
B-Value B	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$		B _{25/50}	-	3380	-	K
	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15K))]$		B _{25/80}	-	3470	-	K
	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298.15K))]$		B _{25/100}	-	3520	-	K

Module

Isolation Test Voltage	RMS, f=50Hz, t=1min	ViSOL	3.0	kV
Material of Module Baseplate			Cu	
Internal Isolation			ZTA	
Creepage Distance	Terminal to heatsink, min Terminal to terminal, min		14.5 13	mm
Clearance	Terminal to heatsink, min Terminal to terminal, min		12.5 10	mm
Comparative Tracking Index		CTI	200 ²⁾	

min. typ. max.

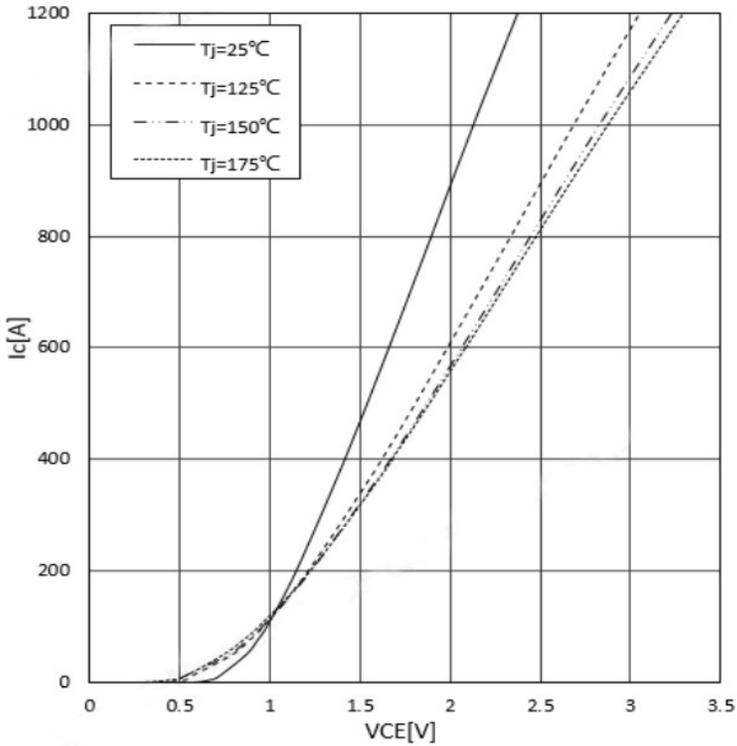
Stray Inductance Module		L _{sCE}	-	20	-	nH
Module Lead Resistance, Terminals-Chip	T _C = 25°C, Per Switch	R _{CC'+EE'}	-	0.83	-	mΩ
Storage Temperature		T _{stg}	-40	-	125	°C
Mounting Torque for Module Mounting	Screw M5 / M5	M	3.0	-	6.0	Nm
Power terminal installation torque	Screw M6 / M6	M	3.0	-	6.0	Nm
Weight		G	-	345	-	g

1) Terminal impedance is not included.

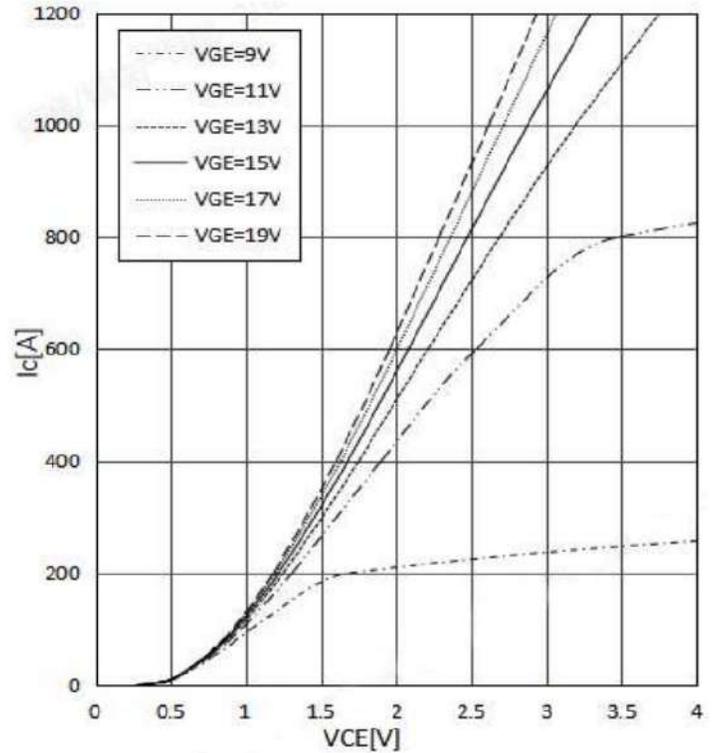
2) CTI is about 200.

Circuit Diagram

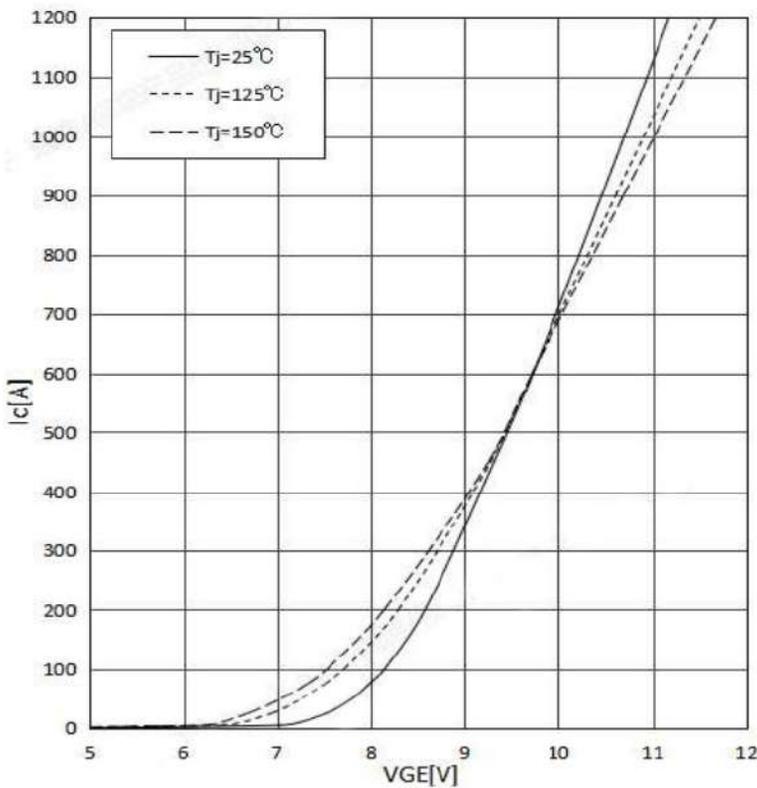
Output characteristic IGBT, Inverter (typical), IGBT
 $I_c = f(V_{CE})$, $V_{GE} = 15V$



Output characteristic IGBT, Inverter (typical), IGBT
 $I_c = f(V_{CE})$, $T_{vj} = 175^\circ C$

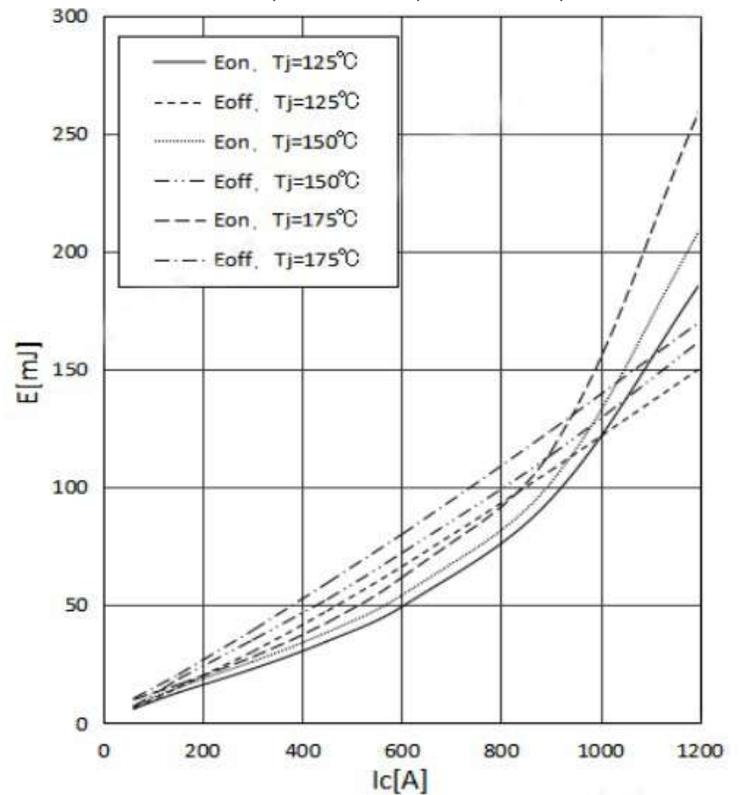


Transfer characteristic IGBT, Inverter (typical), IGBT
 $I_c = f(V_{GE})$, $V_{CE} = 20V$

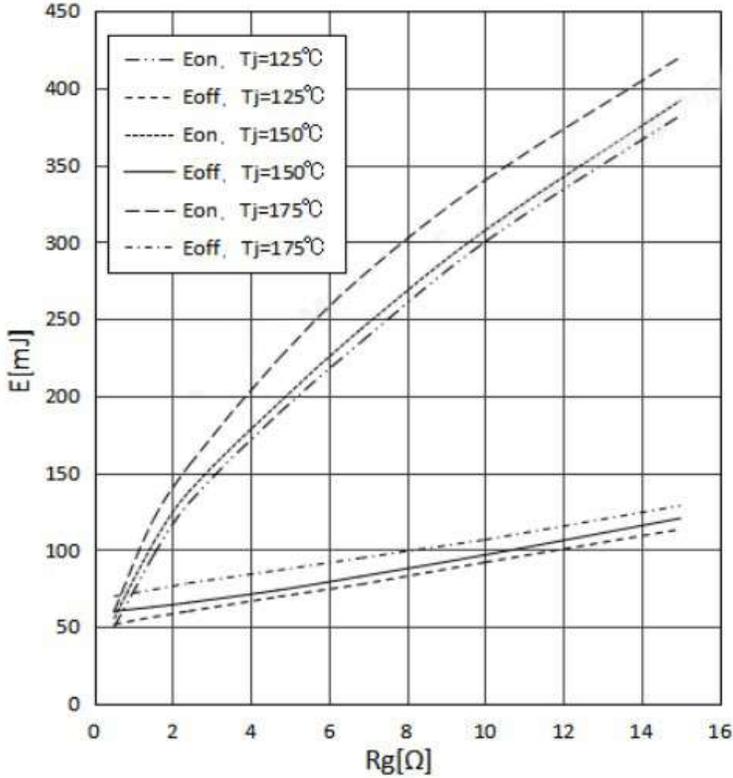


Switching losses IGBT, Inverter (Typical), IGBT

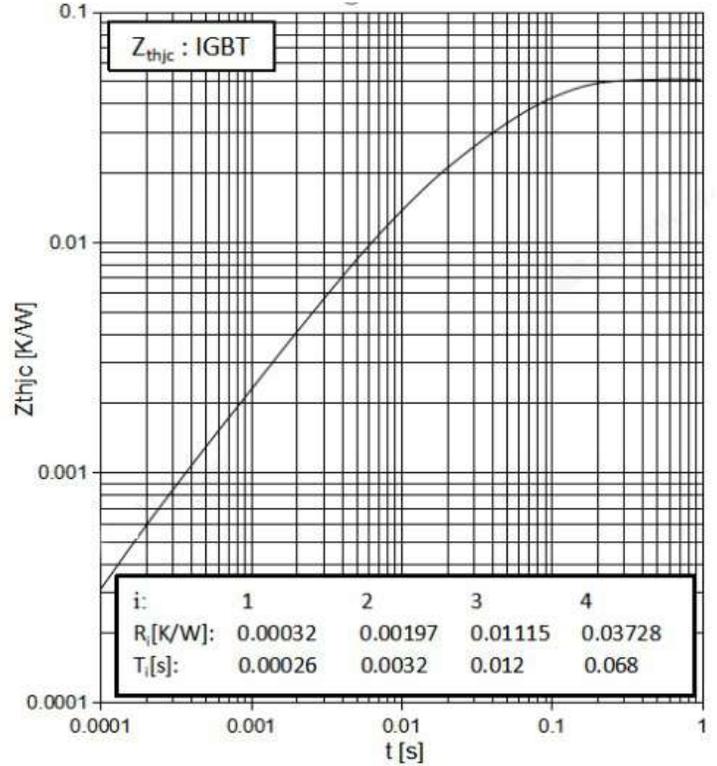
$E_{on} = f(I_c)$, $E_{off} = f(I_c)$
 $V_{GE} = +15V/-8V$, $R_{Gon} = 0.5\Omega$, $R_{Goff} = 3.3\Omega$, $V_{CC} = 600V$



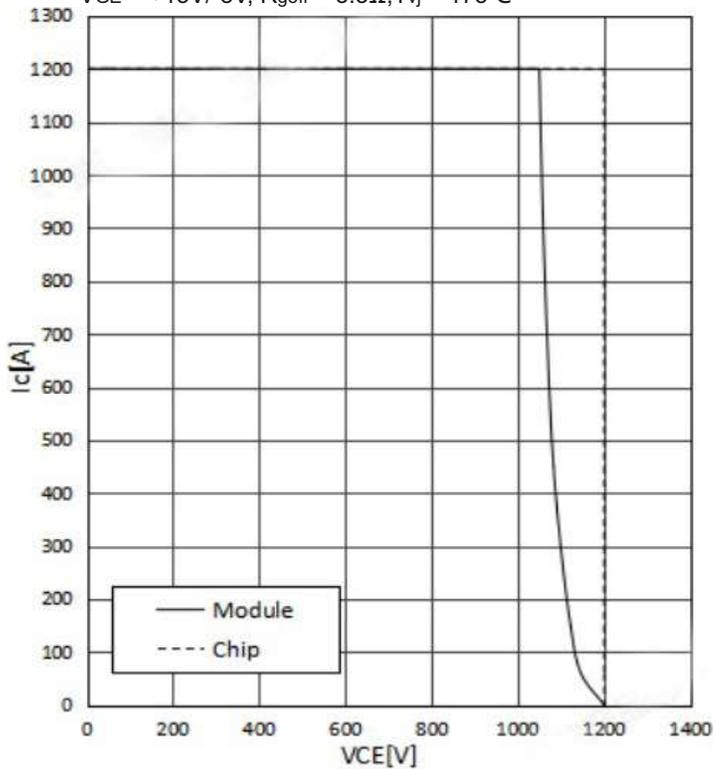
Switching losses IGBT, Inverter (Typical), IGBT
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = +15V/-8V$, $I_c = 600A$, $V_{CE} = 600V$



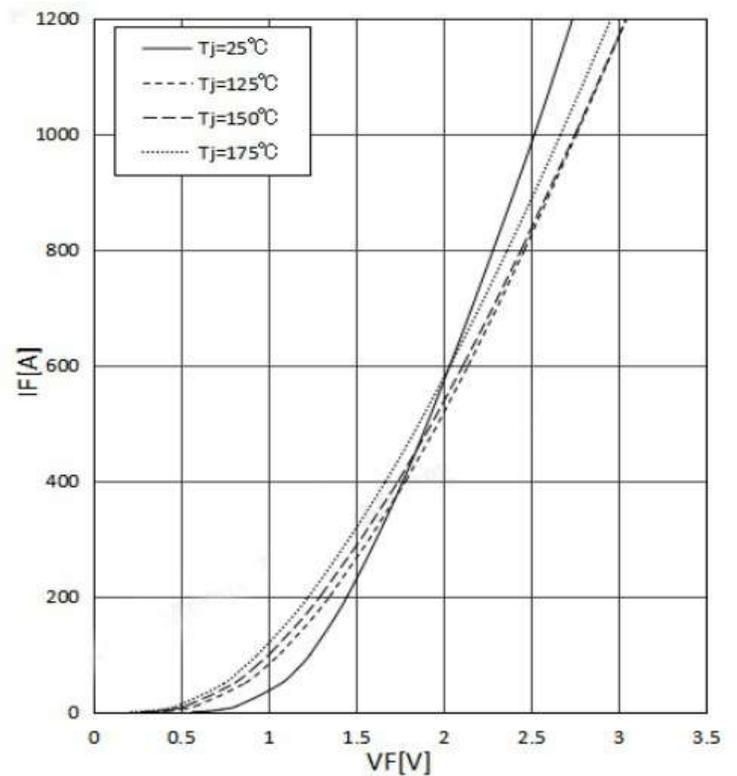
Transient thermal impedance IGBT, Inverter
 $Z_{thJC} = f(t)$



Reverse bias safe operating area IGBT, Inverter (RBSOA)
 $I_c = f(V_{CE})$
 $V_{GE} = +15V/-8V$, $R_{goff} = 3.3\Omega$, $T_{vj} = 175^\circ C$

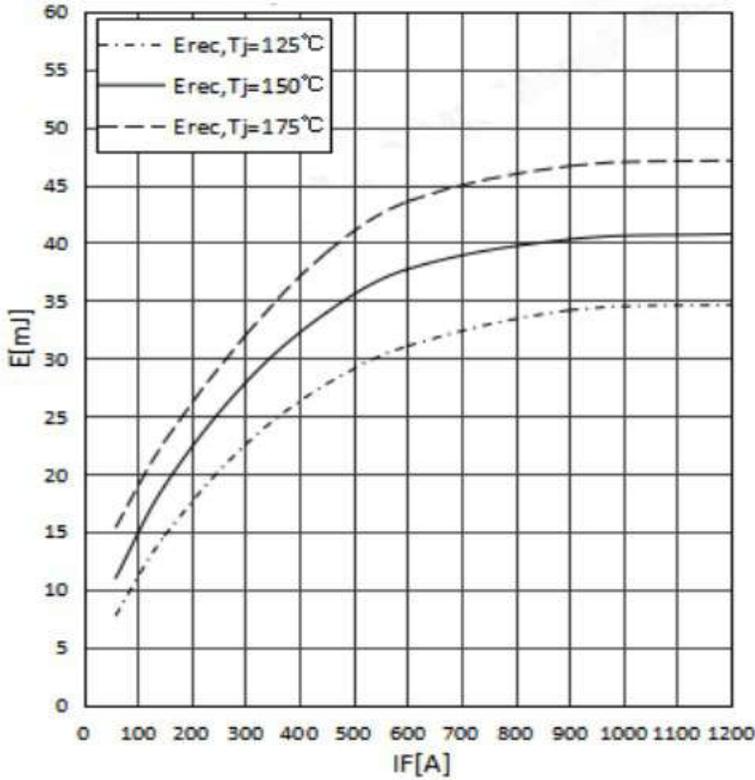


Forward characteristic of Diode, Inverter (typical)
 $I_F = f(V_F)$



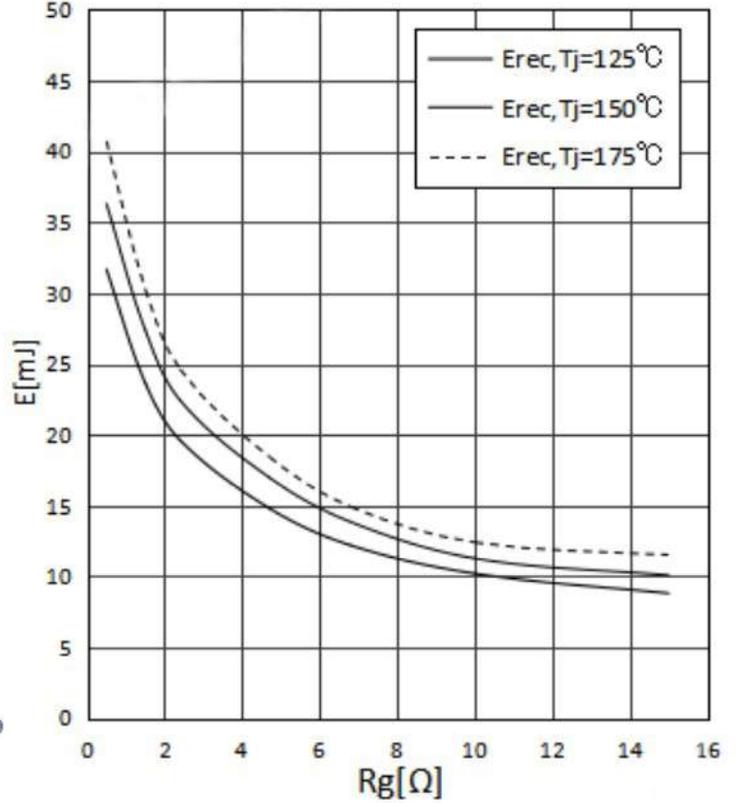
Switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$,
 $R_{aon} = 1.5\Omega, V_{CE} = 600V$



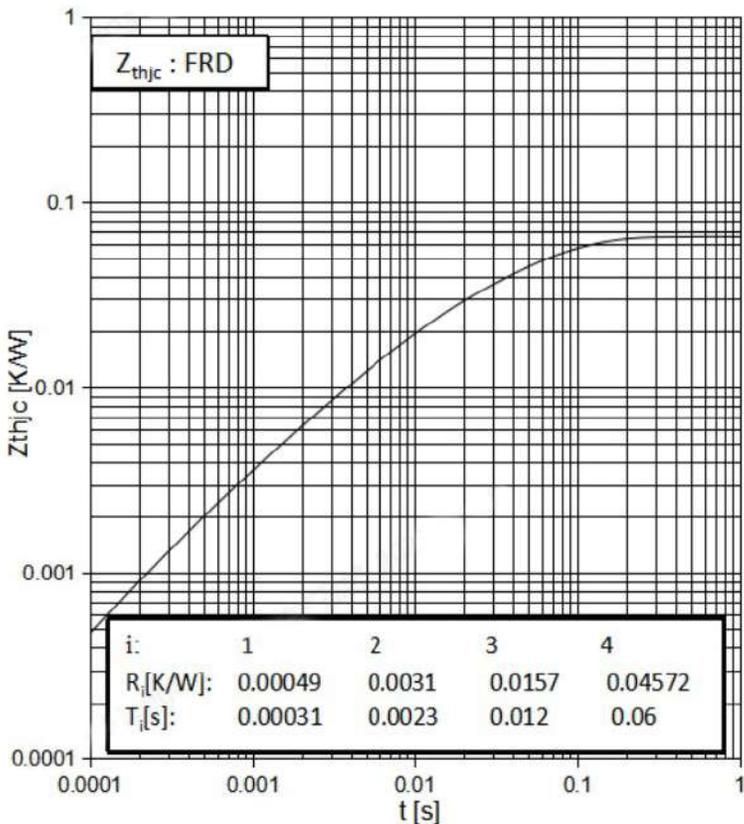
Switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$,
 $I_F = 600A, V_{CE} = 600V$



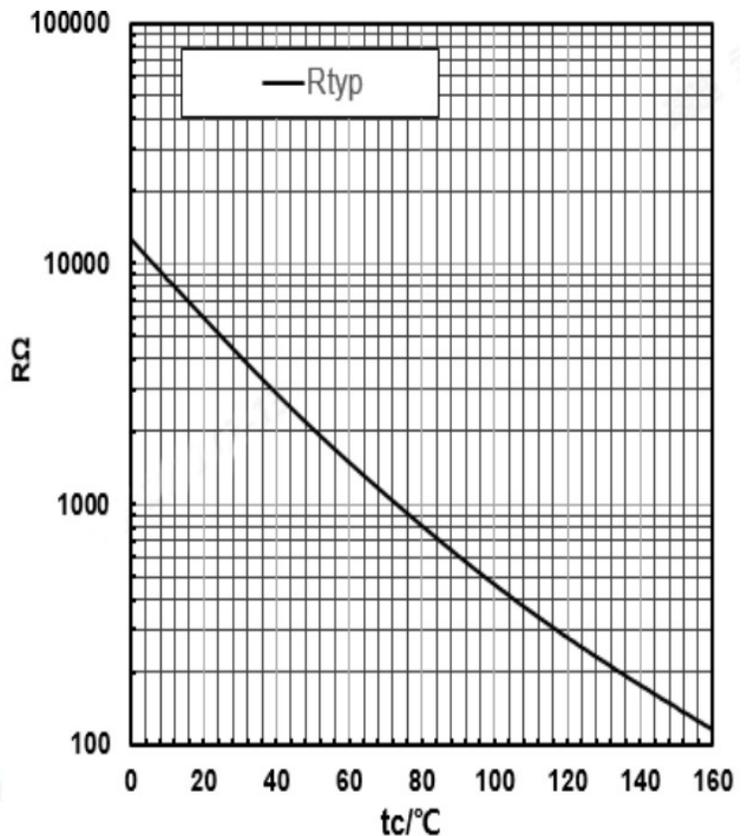
Transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

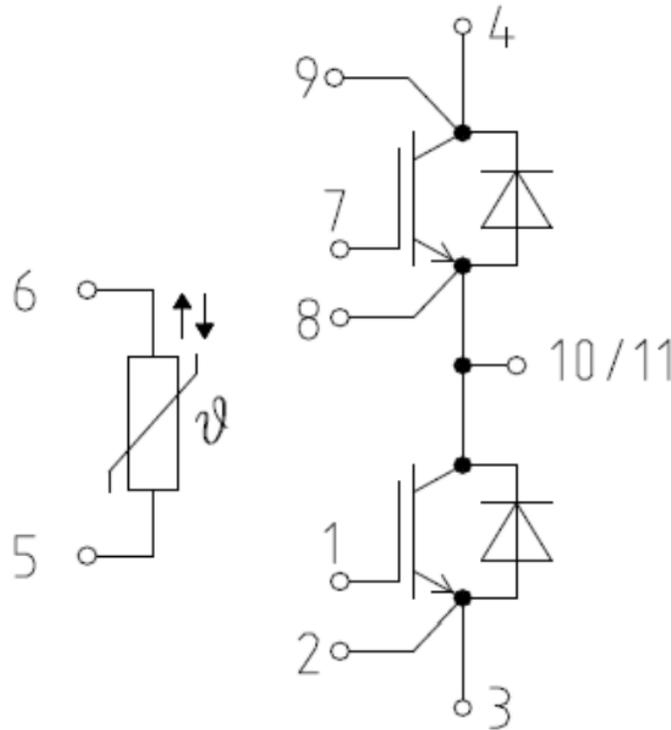


NTC-Thermistor-temperature characteristic (typical)

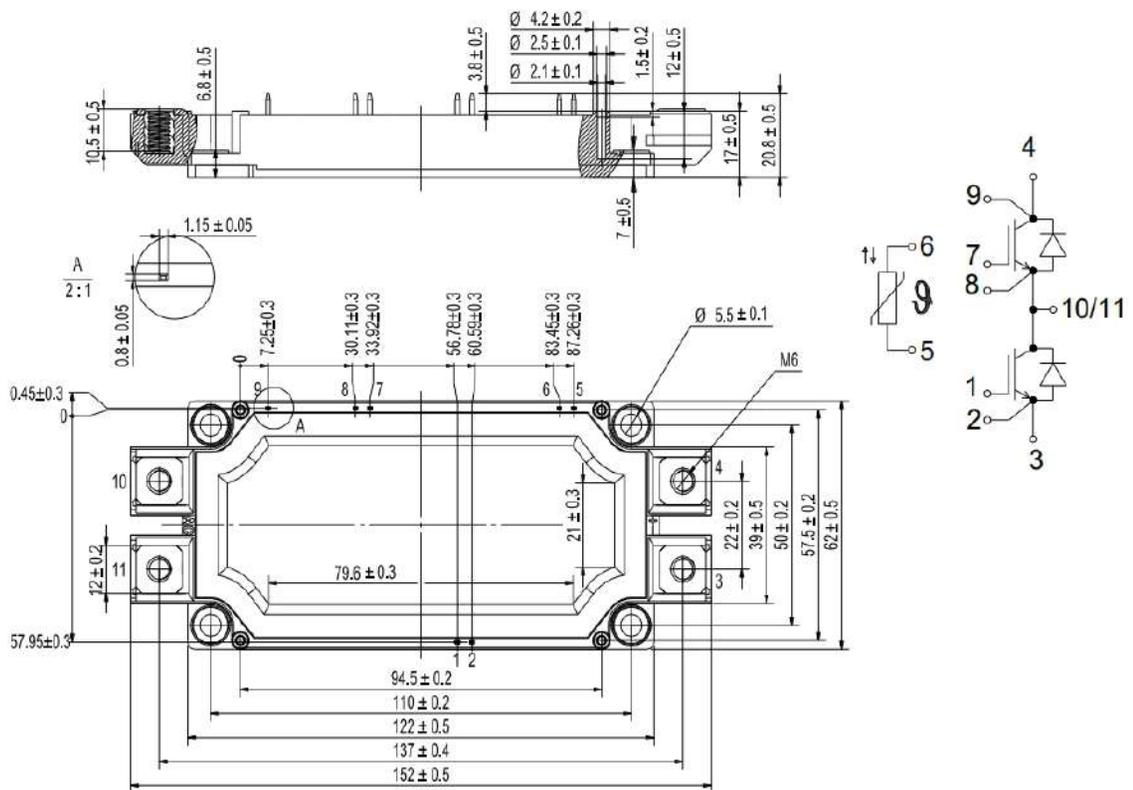
$R = f(T)$



Circuit diagram



Package outlines
Dimensions in Millimeters



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