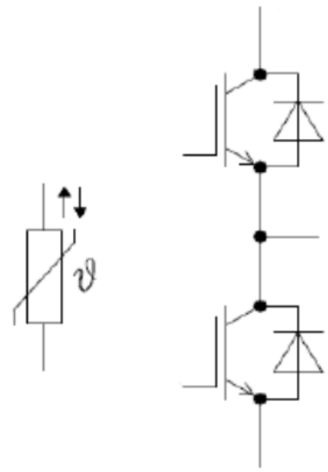
C5 series package: 1200V 600A IGBT module **Datasheet**



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℃
- Low dynamic losses

Options:

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

Typical Applications:

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

IGBT, Inverter / IGBT
Maximum Rated Values

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

Characteristic Values

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

Thermal Resistance, Junction to Case	Per IGBT	R_{thJC}	-	0.051	-	K/W
Thermal Resistance, Case to Heatsink	Per IGBT / IGBT λ_{grease} = 1W/(m·K)	R_{thCH}	-	0.035	-	K/W
Temperature under Switching Conditions		$T_{vj\ op}$	-40		150	℃

Diode, Inverter
Maximum Rated Values

Repetitive Peak Reverse Voltage	T_{vj} = 25℃	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℃ T_{vj} = 150℃ T_{vj} = 175℃	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℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	I_{RM}	-	264 296 304 416	-	A
Recovery Charge	I_F = 600A, V_R = 600V $-di_F/dt$ = 6900A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	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℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	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 λ_{grease} = 1W/(m·K)		R_{thCH}	-	0.039	-	K/W
Temperature under Switching Conditions[2)]			$T_{vj\ op}$	-40	-	150	℃

Per FRD / FRD
λ_{grease} = 1W/(m·K)

NTC-Thermistor / NTC
Maximum Rated Values

			min.	typ.	max.	
Rated Resistance	T_{NTC} = 25℃	R_{25}	-	5	-	KΩ
Deviation of R100 R100	T_{NTC} = 100℃, R_{100} = 465Ω	△R/R	-7.3	-	7.3	%
Power Dissipation	T_{NTC} = 25℃	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

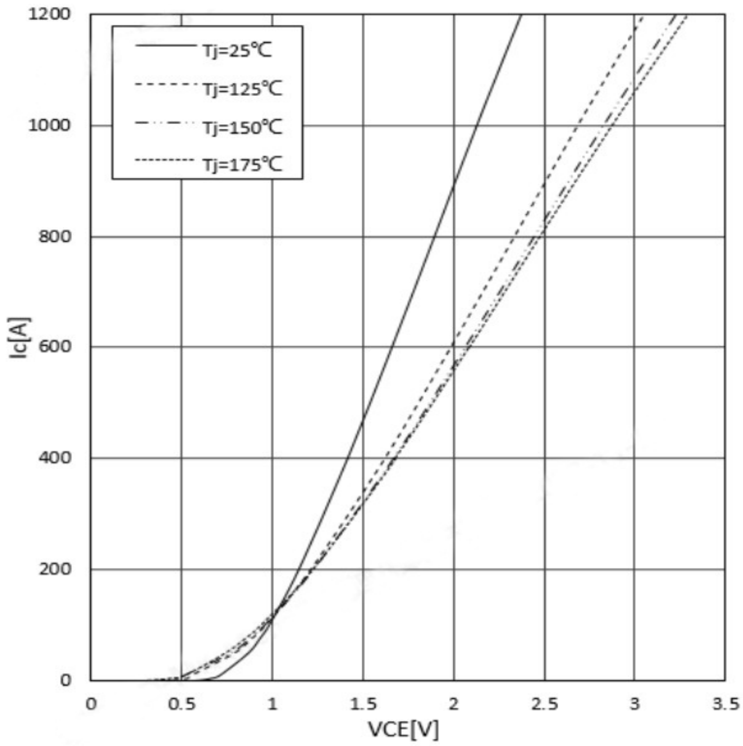
Isolation Test Voltage	RMS, f=50Hz, t=1min	V_{ISOL}	3.0	kV
Material of Module Baseplate			Cu	
Internal Isolation			ZTA	
Creepage Distance	Terminal to heatsink, min Terminal to terminal, min		14.5 13	mm
Clearance	Terminal to heatsink, min Terminal to terminal, min		12.5 10	mm
Comparative Tracking Index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

			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	20	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25℃, Per Switch	$R_{CC'+EE'}$	-	0.83	-	mΩ
Thermal Resistance, Case to Heatsink	including thermal coupling, Ts underneath module (λgrease=0.81 W/(m*K))	R_{thCH}	-	0.014	-	K/W
Storage Temperature		T_{stg}	-40	-	125	℃
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

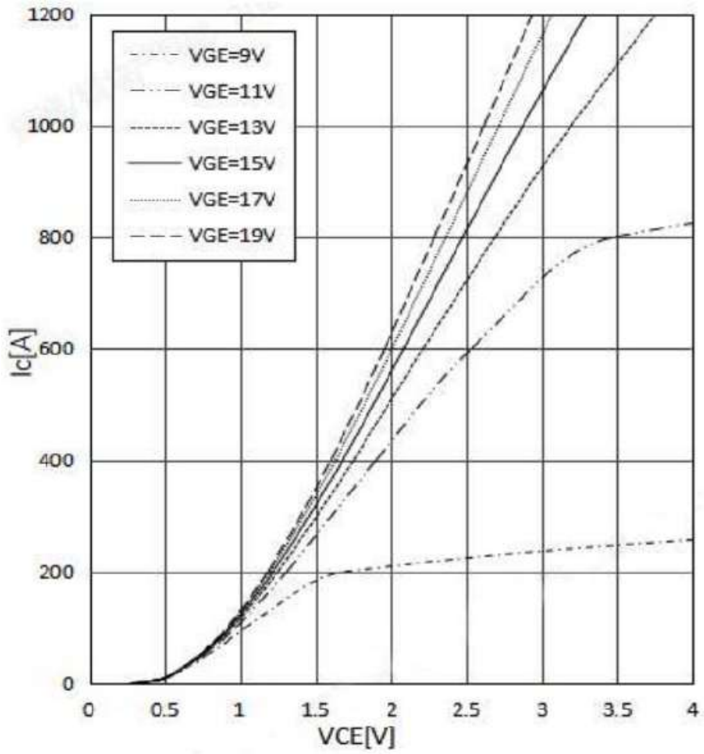
1) Terminal impedance is not included.
2) CTI is about 200.

Circuit Diagram

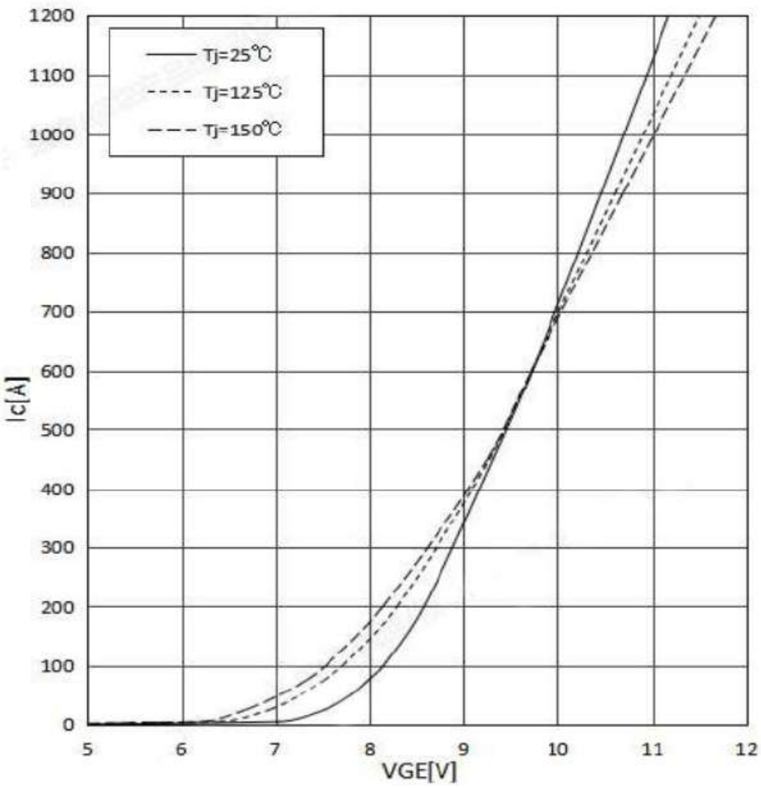
Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $V_{GE} = 15V$



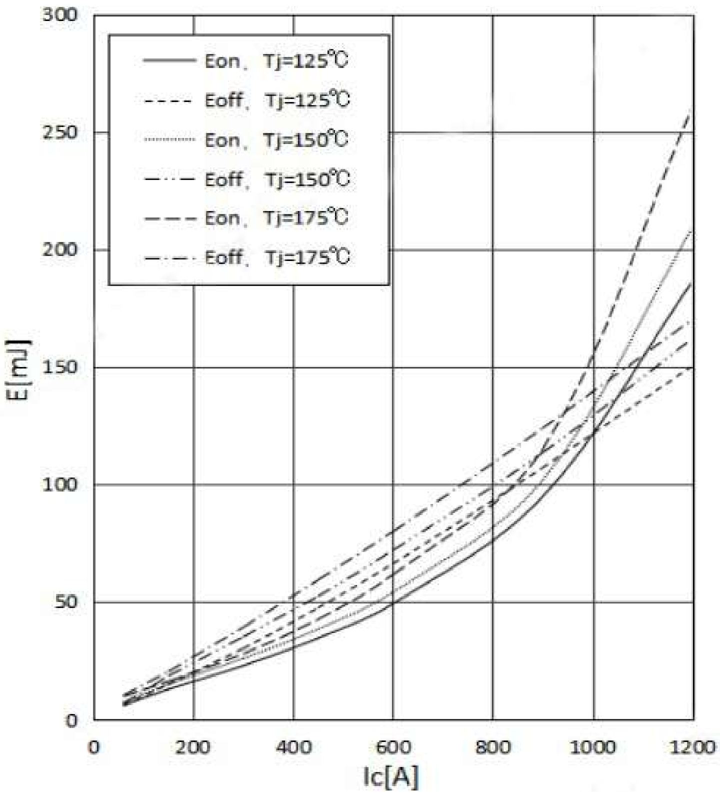
Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $T_{vj} = 175$℃



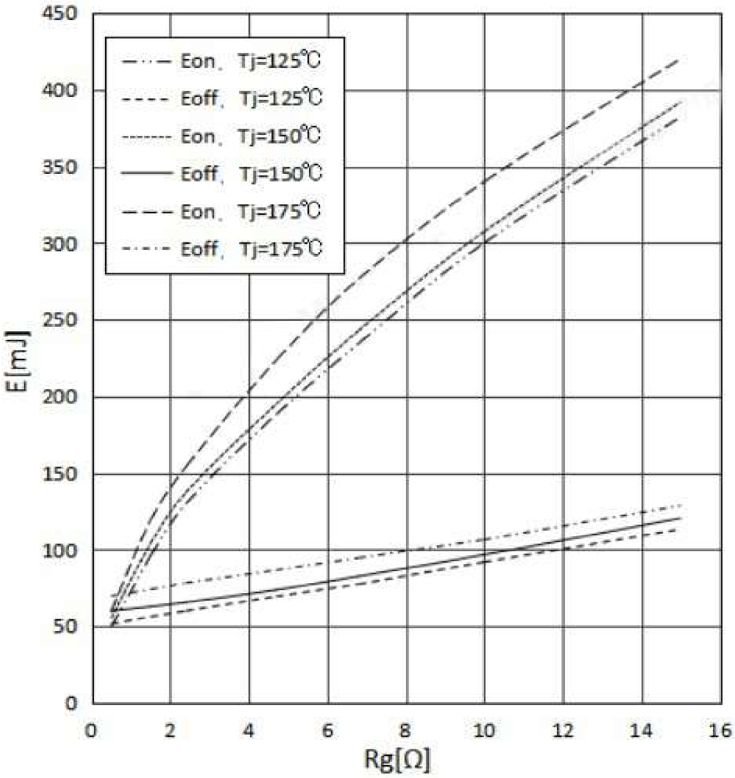
Transfer characteristic IGBT,Inverter(typical), IGBT
$I_C = f(V_{GE})$, $V_{CE} = 20V$



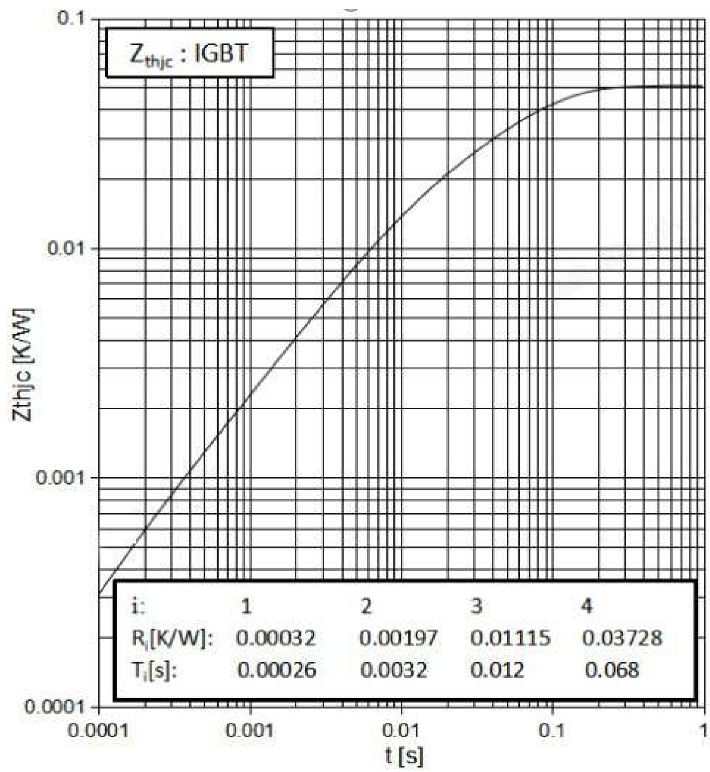
Switching losses IGBT, Inverter (Typical), IGBT
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE} = +15V/-8V$, $R_{Gon} = 0.5\Omega$, $R_{Goff} = 3.3\Omega$, $V_{CC} = 600V$



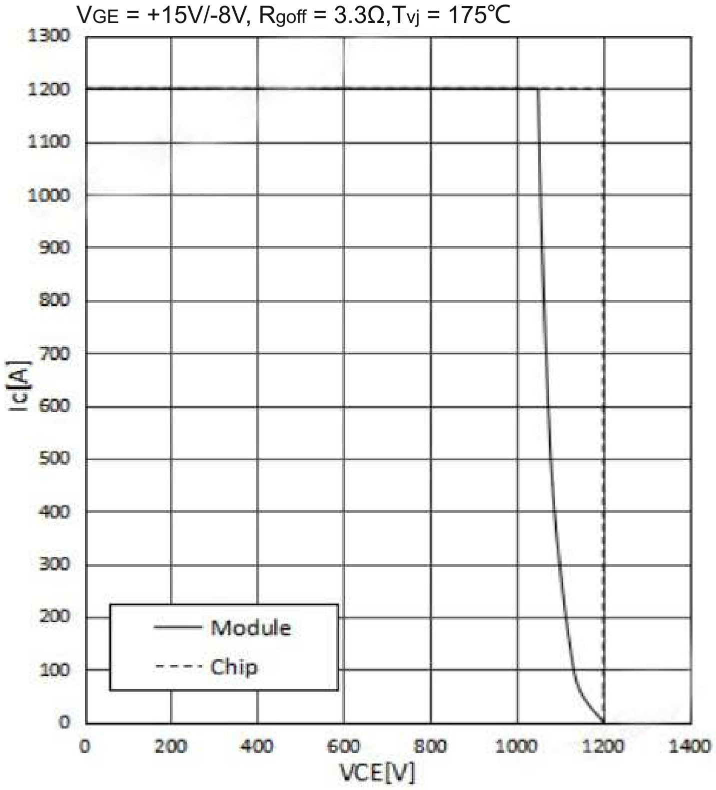
Switching losses IGBT, Inverter (Typical), IGBT
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = +15V/-8V, I_C = 600A, V_{CE} = 600V



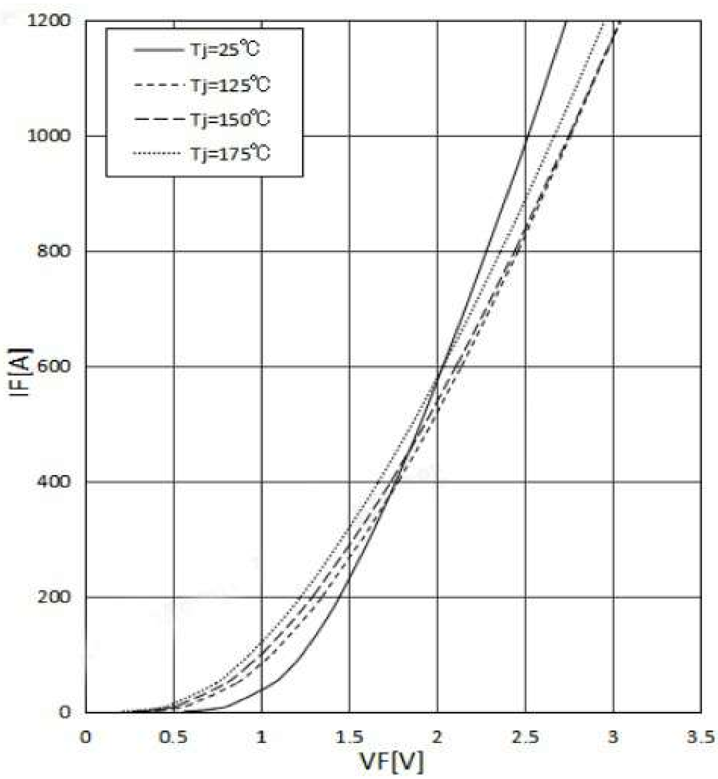
Transient thermal impedance IGBT,Inerter
$Z_{thJC} = f(t)$



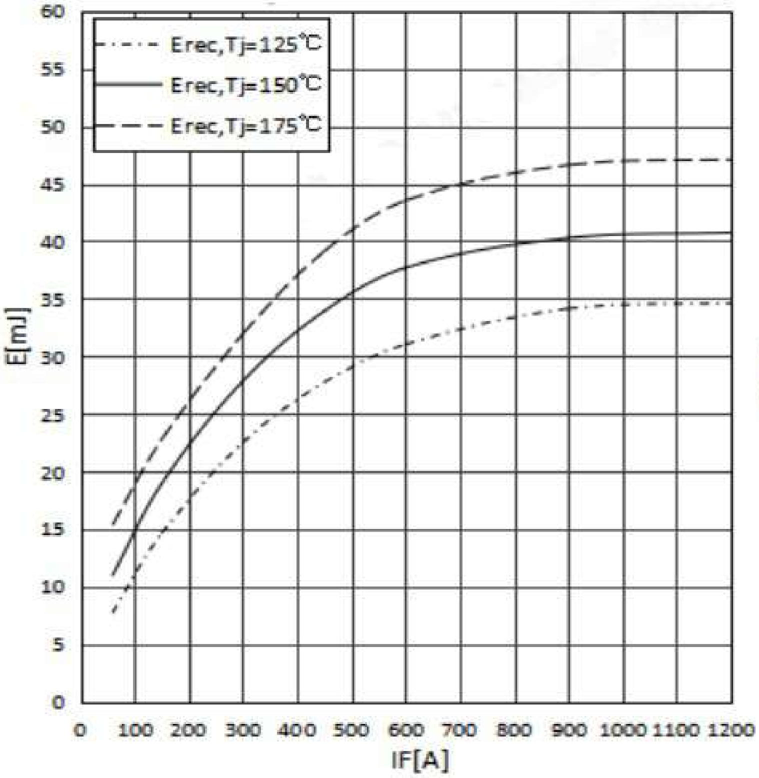
Reverse bias safe operating area IGBT,Inverter(RBSOA)
$I_C = f(V_{CE})$
V_{GE} = +15V/-8V, R_{goff} = 3.3Ω,T_{vj} = 175℃



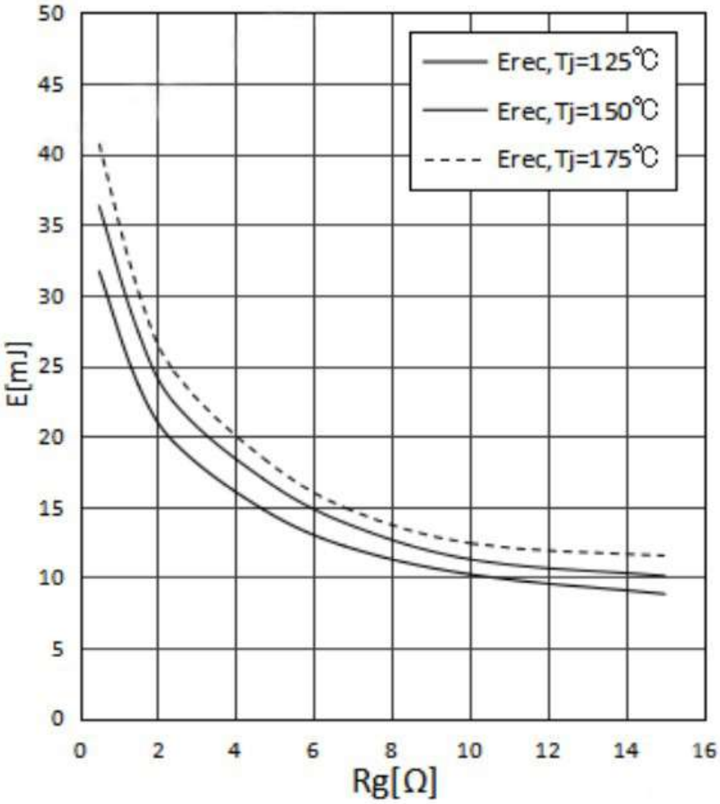
Forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



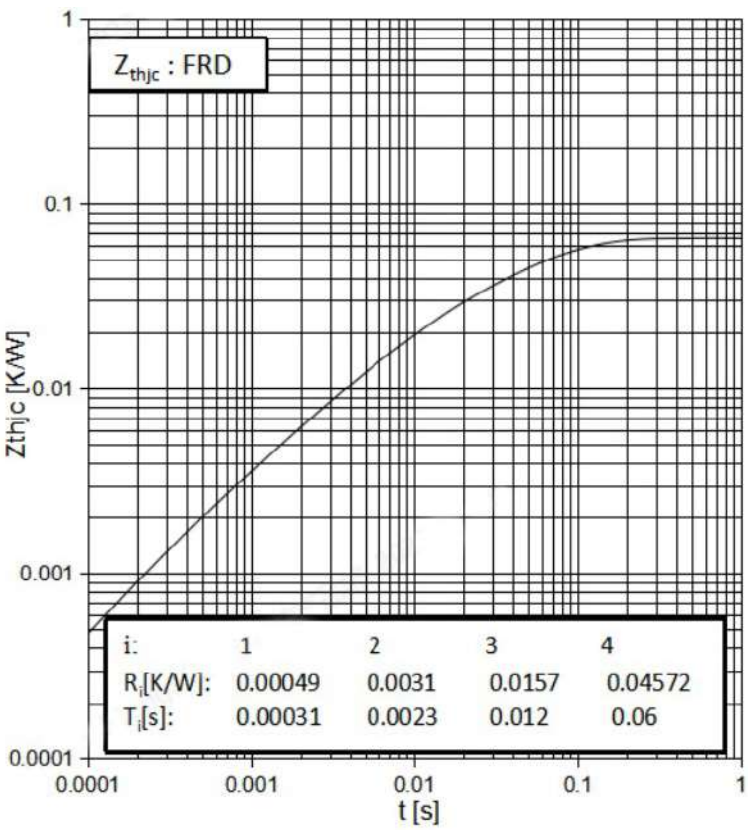
Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$,
$R_{Gon} = 1.5\Omega$.$V_{CE} = 600V$



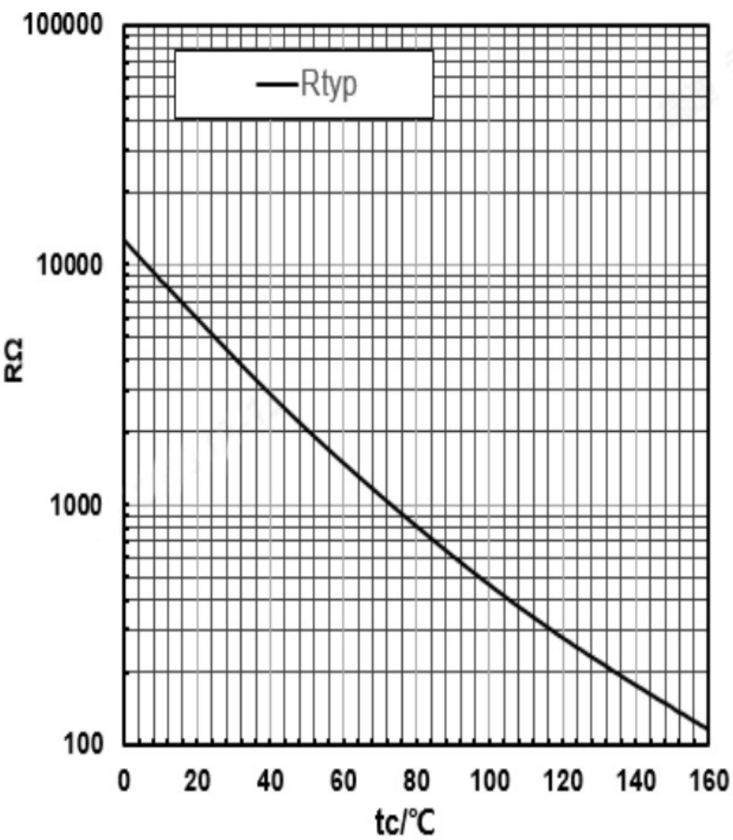
Switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$,
$I_F = 600A$.$V_{CE} = 600V$



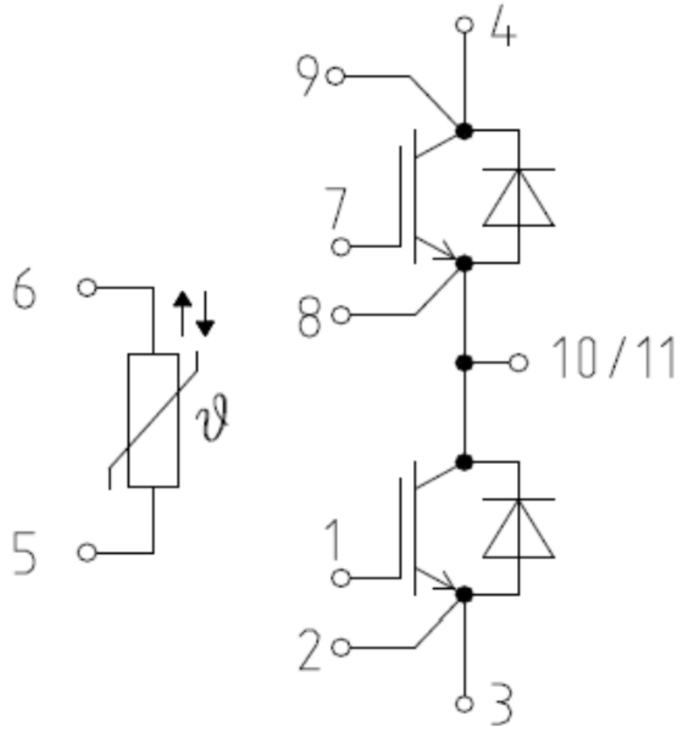
Transient thermal impedance Diode, Inverter
$Z_{thJC} = f(t)$



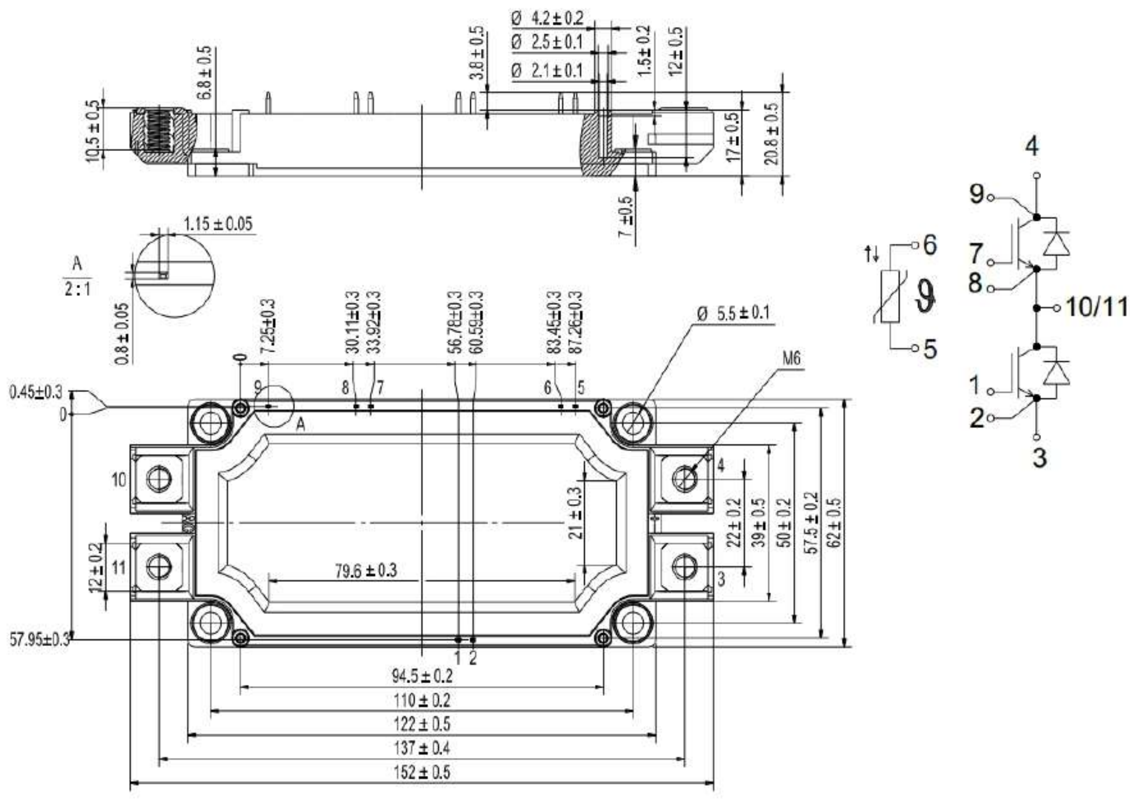
NTC-Thermistor-temperature characteristic(typical)
R = f(T)



Circuit diagram



Package outlines
Dimensions in Millimeters



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