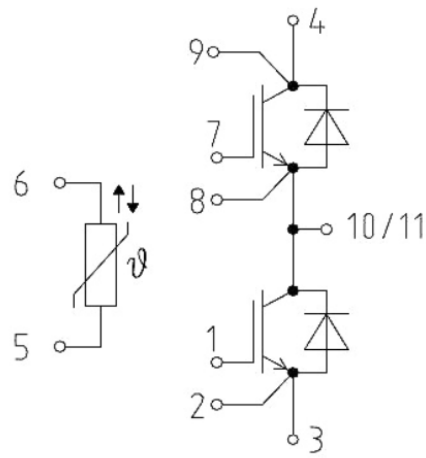
C5 series package: 1200V 300A IGBT module

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 Stores

IGBT, Inverter / IGBT
Maximum Rated Values

Collector-emitter Voltage	T_{vj} = 25℃	V_{CES}	1200	V
Continuous DC Collector Current		I_{Cnom}	300	A
	T_C = 100℃, $T_{vj\ max}$ ≤ 175℃	I_C	358	A
Repetitive Peak Collector Current	t_p = 1ms	I_{CRM}	600	A
Gate-emitter Peak Voltage		V_{GES}	±20	V

Characteristic Values

				min.	typ.	max.	
Collector-emitter Saturation Voltage[1)]	I_C = 300A, V_{GE} = 15V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_{CEsat}	1.40	1.51 1.78 1.87	1.70	V
Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 6mA, T_{vj} = 25℃		V_{GEth}	5.0	6.0	7.0	V
Gate Charge	V_{GE} = 15V/-8V, V_{CE} = 600V		Q_G	-	3.0	-	μC
Internal Gate Resistor	T_{vj} = 25℃		R_{Gint}	-	0.65	-	Ω
Input Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{ies}	-	70.6	-	nF
Reverse Transfer Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{res}	-	0.26	-	nF
Collector-emitter Cutoff Current	V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 25℃		I_{CES}	-	-	1	μA
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 = 300A, V_{CE} = 600V V_{GE} = 15V/-8V R_{GON} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	don	-	186 188 196 198	-	ns
Rise Time, Inductive Load	I_C = 300A, V_{CC} = 600V V_{GE} = 15V/-8V R_{GON} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_r	-	40 50 52 65	-	ns
Turn-off Delay Time, Inductive Load	I_C = 300A, V_{CC} = 600V V_{GE} = -8V/15V R_{GON} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	tdoff	-	351 397 407 428	-	ns
Fall Time, Inductive Load	I_C = 300A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_f	-	119 181 209 210	-	ns
Turn-on Energy Loss per Pulse	I_C = 300A, V_{CC} = 600V, $L_σ$ = 35nH V_{GE} = -8V/15V, R_{GON} = 1.0Ω di/dt = 3600A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{on}	-	11.6 17.0 18.8 21.7	-	mJ
Turn-off energy Loss per Pulse	I_C = 300A, V_{CC} = 600V, $L_σ$ = 35nH V_{GE} = 15V-8V, R_{GON} = 1.0Ω du/dt = 7100V/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{off}	-	20.1 28.6 31.1 36.0	-	mJ
SC Data	V_{CC} = 600V V_{GE} = 15V/-8V	t_p ≤ 10μs, T_{vj} = 150℃ t_p ≤ 8μs, T_{vj} = 175℃	I_{sc}	-	1600 1500	-	A

Thermal Resistance, Junction to Case	Per IGBT	R_{thJC}	-	0.104	-	K/W
Thermal Resistance, Case to Heatsink	Per IGBT λ_{grease} = 1W/(m·K)	R_{thCH}	-	0.023	-	K/W
Temperature under Switching Conditions		$T_{vj\ op}$	-40		175	℃

Diode, Inverter
Maximum Rated Values

Repetitive Peak Reverse Voltage	T_{vj} = 25℃	V_{RRM}	1200	V
Continuous DC Forward Current		I_{Fnom}	300	A
Repetitive Peak Forward Current	t_p = 1ms	I_{FRM}	600	A

Characteristic Values

				min.	typ.	max.	
Forward Voltage[1)]	I_F = 300A, V_{GE} = 0V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_F	1.50	1.92 1.94 1.87	2.40	V
Peak Reverse Recovery Current	I_F = 300A, V_{CC} = 600V V_{GE} = −8V $-di_F/dt$ = 3600A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	I_{RM}	-	248 276 284 292	-	A
Recovery Charge	I_F = 300A, V_{CC} = 600V V_{GE} = −8V $-di_F/dt$ = 3600A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	Q_R	-	16.5 28.5 32.6 37.6	-	μC
Reverse Recovery Energy	I_F = 300A, V_{CC} = 600V V_{GE} = −8V $-di_F/dt$ = 3600A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{rec}	-	9.0 16.7 19.0 25.4	-	mJ
Thermal Resistance, Junction to Case	Per FRD		R_{thJC}	-	0.160	-	K/W
Thermal Resistance, Case to Heatsink	Per FRD λ_{grease} = 1W/(m·K)		R_{thHC}	-	0.026	-	K/W
Temperature under Switching Conditions			$T_{vj\ op}$	-40	-	175	℃

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

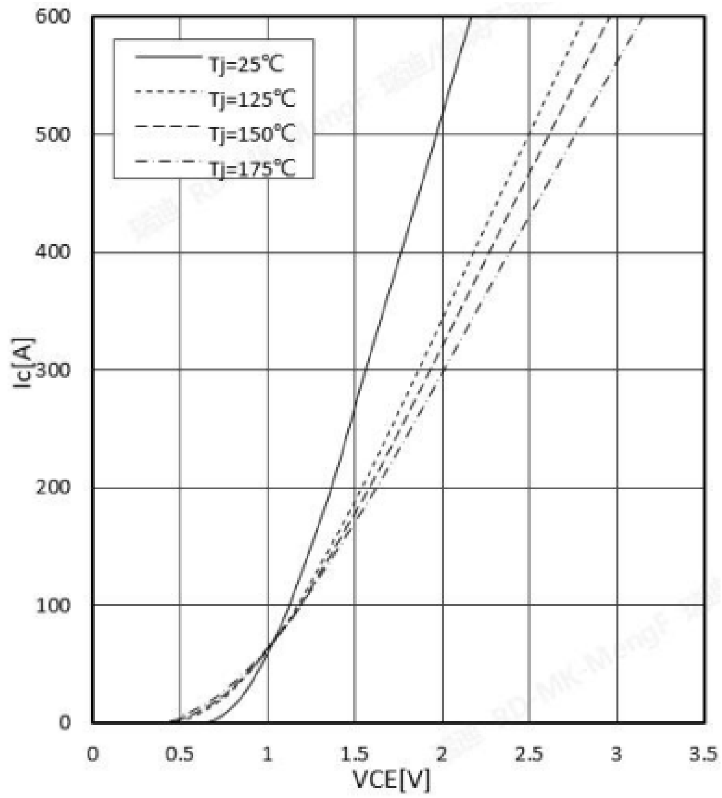
Isolation Test Voltage	RMS, f=50Hz, t = 1min	V_{ISOL}	2.5	kV
Material of Module Baseplate			Cu	
Internal Isolation			Al_2O_3	
Creepage Distance	Terminal to heatsink, min Terminal to terminal, min		15.0 13.0	mm
Clearance	Terminal to heatsink, min Terminal to terminal, min		12.5 10.0	mm
Comparative Tracking Index		CTI	200 2)	

			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	17	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25℃, Per Switch	$R_{CC'+EE'}$	-	0.8	-	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

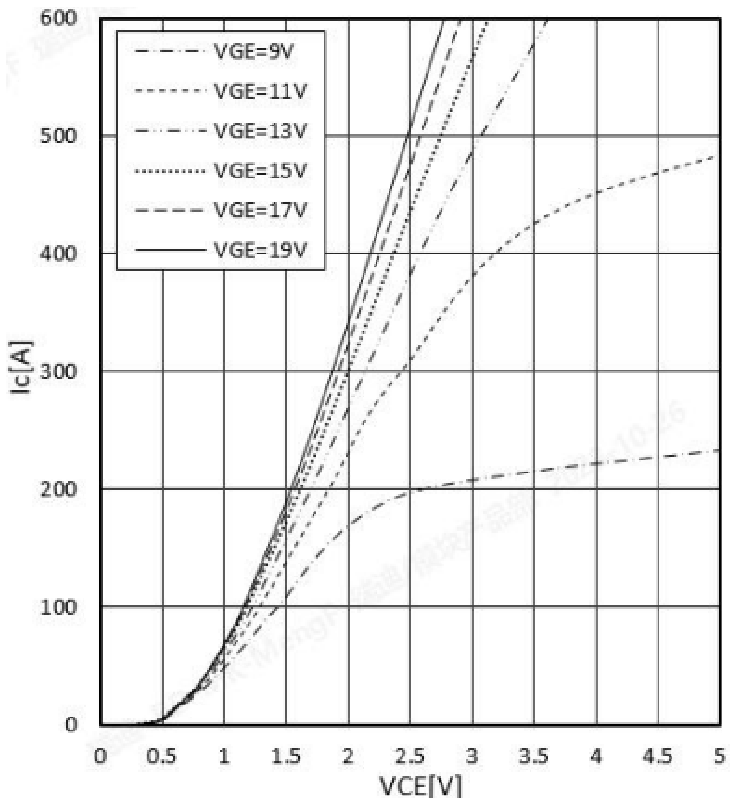
1) Terminal impedance is not included.
2) CTI is about 200.

Circuit Diagram

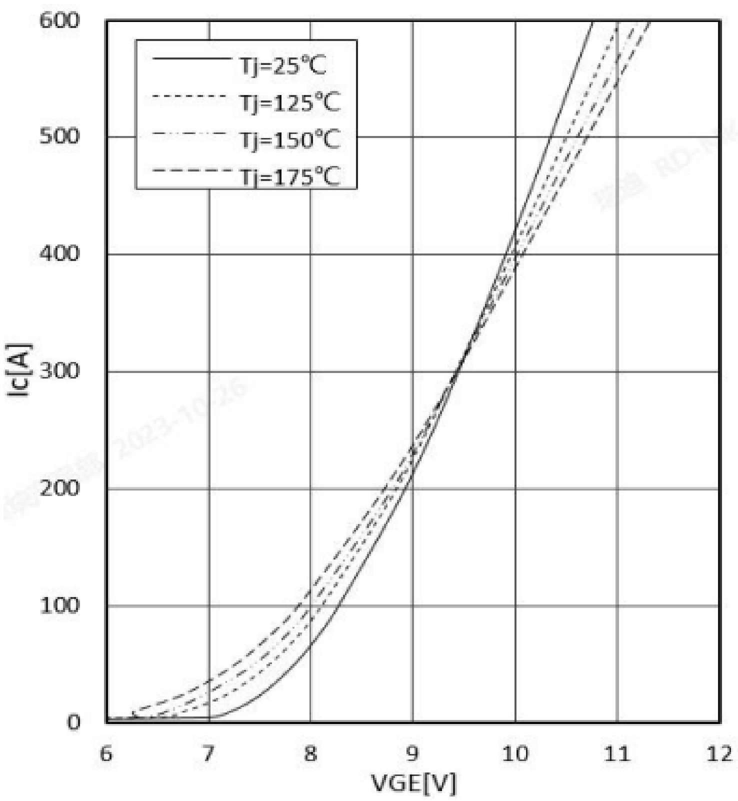
Output characteristic IGBT, Inverter (typical), IGBT
$I_c = f(V_{CE})$, $V_{GE} = 15V$



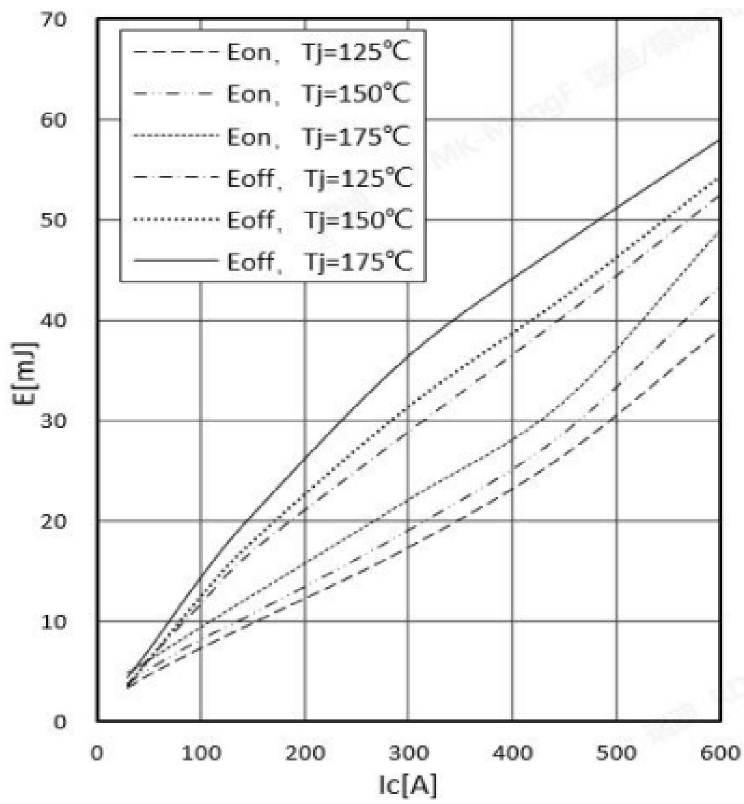
Output characteristic IGBT, Inverter (typical), IGBT
$I_c = f(V_{CE})$, $T_{vj} = 175℃$



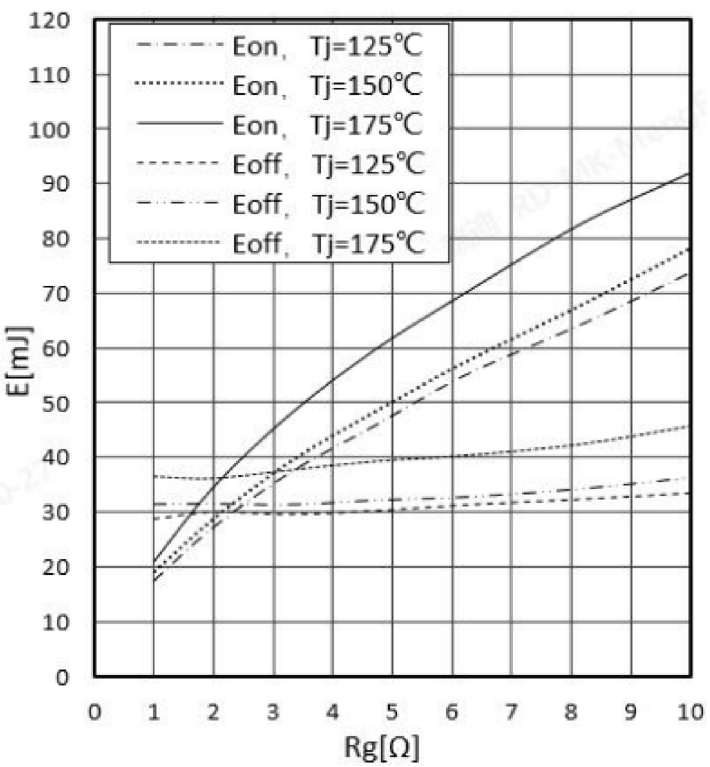
Transfer characteristic IGBT, Inverter(typical), IGBT
$I_c = f(V_{GE})$, $V_{CE} = 20V$



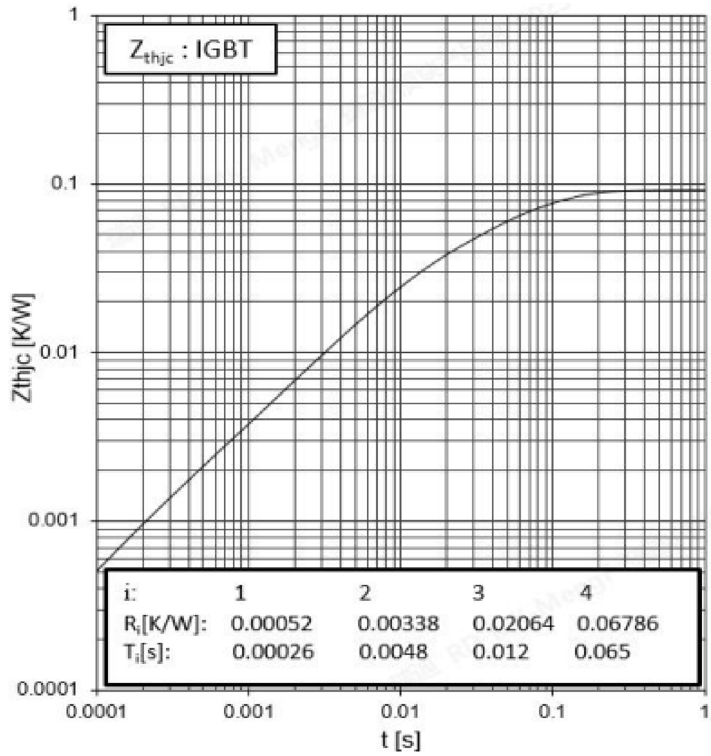
Switching losses IGBT, Inverter (Typical), IGBT
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE} = +15V/-8V$, $R_{Gon} = 1Ω$, $R_{Goff} = 1Ω$, $V_{CC} = 600V$



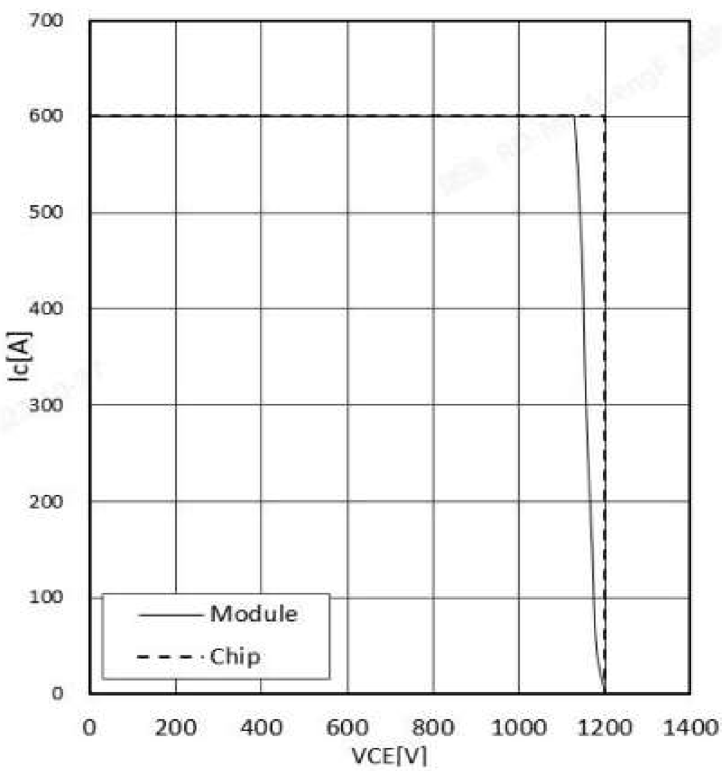
Switching losses IGBT, Inverter (Typical), IGBT
E_{on} = f(R_G)1Ω, E_{off} = f(R_G),
V_{GE} = +15V/-8V, I_C = 300A, V_{CC} = 600V



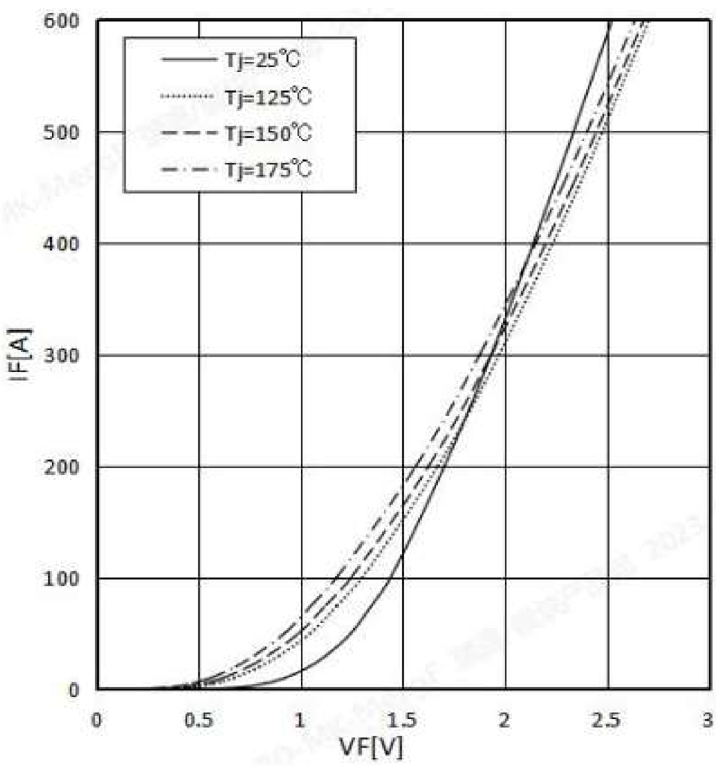
Transient thermal impedance IGBT, Inverter
Z_{thJC} = f(t)



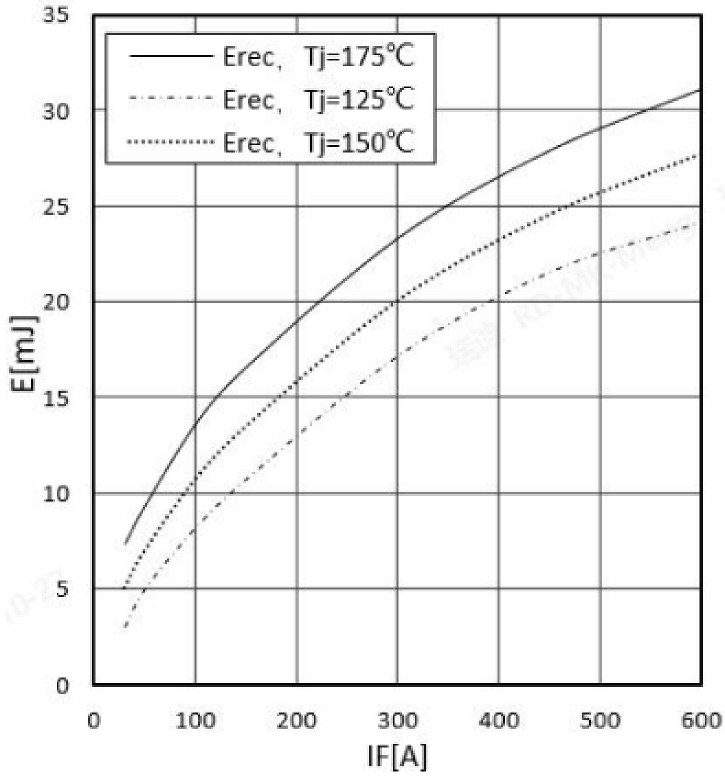
Reverse bias safe operating area IGBT, Inverter (RBSOA)
I_C = f(V_{CE})
GE = +15V/-8V, Rgoff = 1Ω, Tvj = 175℃



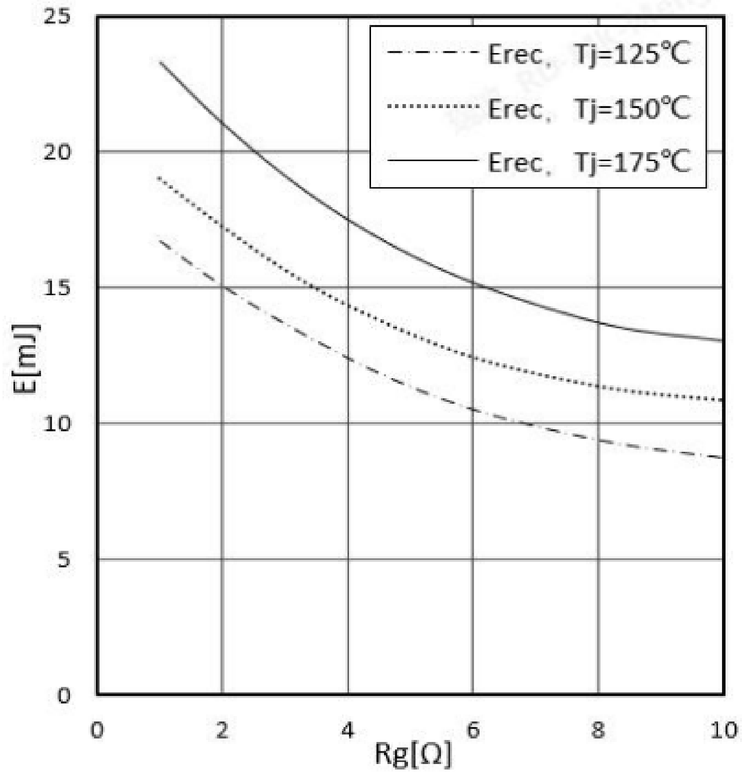
Forward characteristic of Diode, Inverter (typical)
I_F = f(V_F)



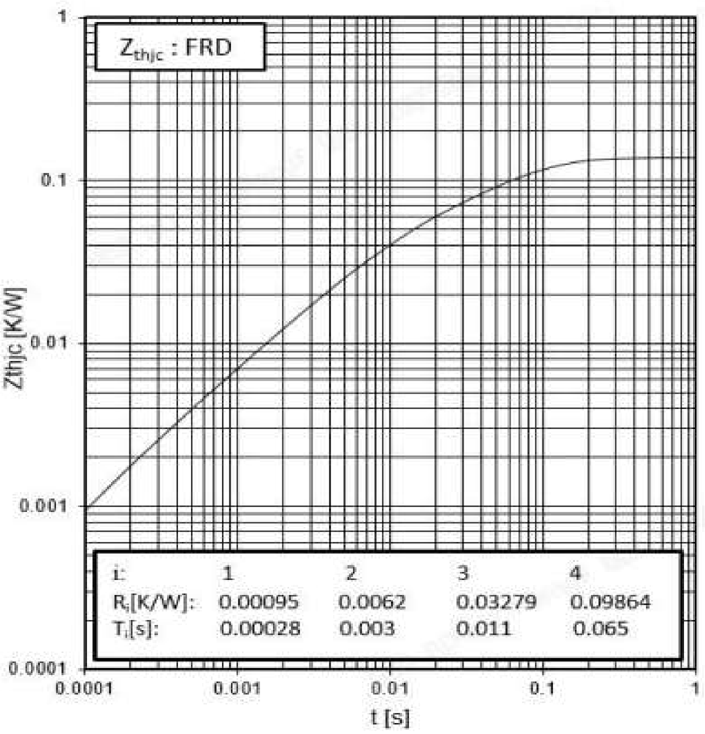
Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$, $R_{gon} = 0.5\Omega$, $V_{CE} = 600V$



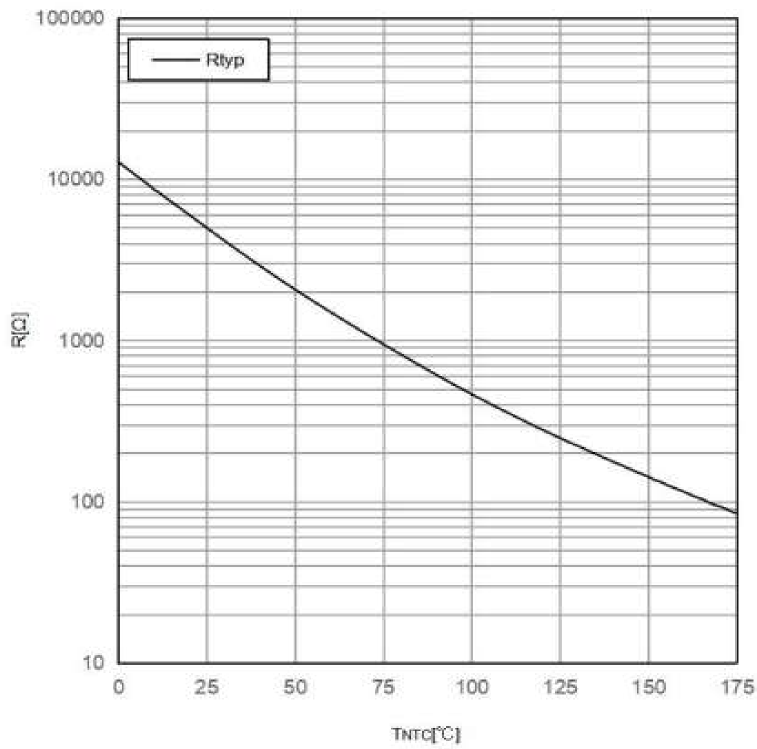
Switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$, $I_F = 450A$, $V_{CE} = 600V$



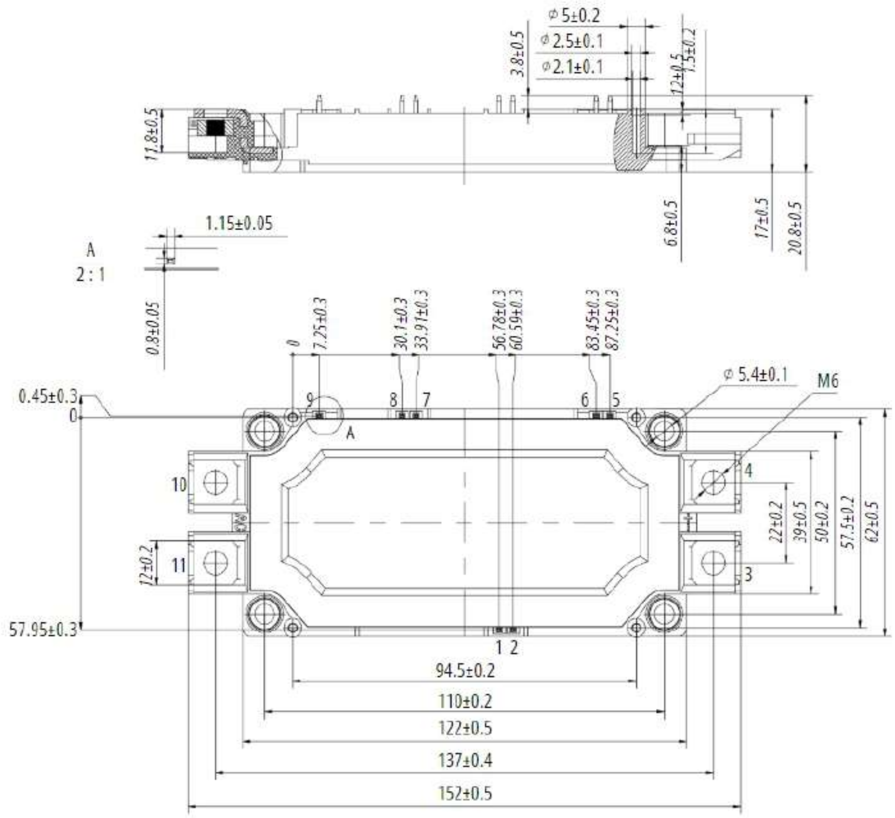
Transient thermal impedance IGBT, Inverter
$Z_{thJC} = f(t)$



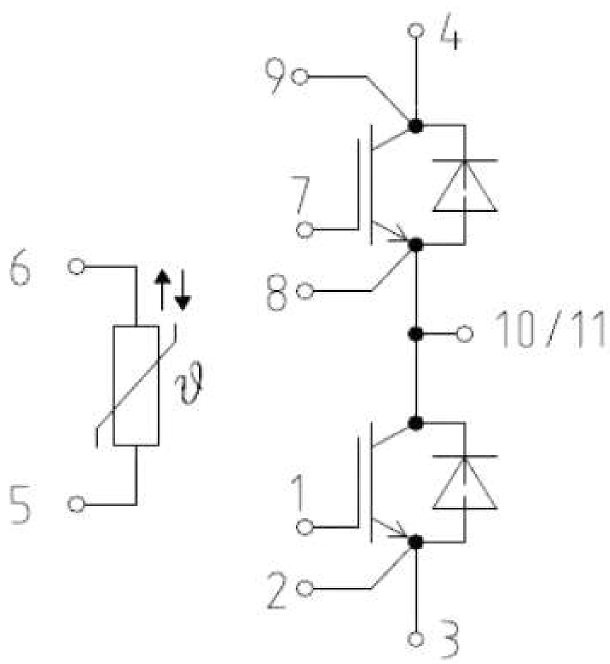
NTC-Thermistor-temperature characteristic (typical)
R = f(t)



Package Dimension
Dimensions in Millimeters



Internal Circuit



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