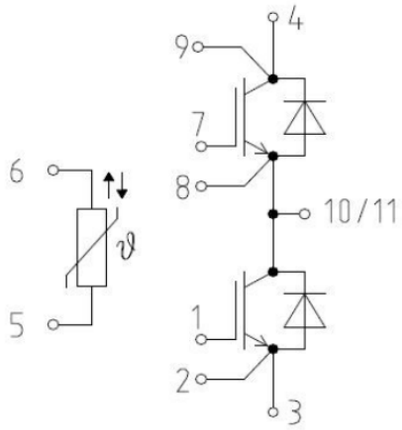
C5 series package: 1200V 950A IGBT module





Equivalent
Circuit Schematic

Features:

- Trenchgate Gen.7 IGBT technology
- VCE(sat) with positive temperature coefficient
- High RBSOA capability
- Low static losses: VCE(sat) = 1,55V@25C
- 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
Implemented Collector Curren		I_{Cnom}	950	A
Repetitive Peak Collector Current	t_p $T_{vj\ op}$	I_{CRM}	1800	A
Gate-emitter Peak Voltage		V_{GES}	±20	V

Characteristic Values

			min.	typ.	max.	
Collector-emitter Saturation Voltage[1)]	I_C = 950A, V_{GE} = 15V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	V_{CEsat}	-	1.57 1.80 1.87	-	V
Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 18mA, T_{vj} = 25℃		V_{GEth}	5.0	6.0	7.0	V
Gate Charge	V_{GE} = -15V/15V, V_{CE} = 600V		Q_G	-	11.2	-	µC
Internal Gate Resistor	T_{vj} = 25℃		R_{Gint}	-	0.2	-	Ω
Input Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{ies}	-	199	-	nF
Reverse Transfer Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{res}	-	0.57	-	nF
Collector-emitter Cutoff Current	V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 25℃		I_{CES}	-	-	0.1	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 = 950A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_{don}	-	162 216 220	-	ns
Rise Time, Inductive Load	I_C = 950A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_r	-	98 113 121	-	ns
Turn-off Delay Time, Inductive Load	I_C = 950A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	tdoff	-	560 582 600	-	ns
Fall Time, Inductive Load	I_C = 950A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_f	-	100 152 200	-	ns
Turn-on Energy Loss per Pulse	I_C = 950A, V_{CE} = 600V, L_σ = 30nH V_{GE} = -8V/15V, R_{GON} = 1Ω di/dt = 6131 A/µs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{on}	-	99 132 152	-	mJ
Turn-off energy Loss per Pulse	I_C = 950A, V_{CE} = 600V, L_σ = 30nH V_{GE} = -8V/15V, R_{Goff} = 1Ω du/dt = 4762 A/µs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{off}	-	72 96 107	-	mJ
SC Data	V_{GE} = -8V/15V V_{CC} = 600V	t_P ≤ 8µs, T_{vj} = 150℃ t_P ≤ 6µs, T_{vj} = 175℃	I_{sc}	-	3200 3100	-	A

Thermal Resistance, Junction to Case	Per IGBT / IGBT	R_{thJC}	-	0.028	-	K/W
Thermal Resistance, Case to Heatsink	Per IGBT / IGBT λ_{grease} = 1W/(m·K)	R_{thCH}	-	0.037	-	K/W
Temperature under Switching Conditions[2)]		$T_{vj\ op}$	-40		175	℃

Diode, Inverter
Maximum Rated Values

Repetitive Peak Reverse Voltage	T_{vj} = 25℃	V_{RRM}	1200	V
Continuous DC Forward Current		I_{Fnom}	950	A
Repetitive Peak Forward Current	t_p = 1ms	I_{FRM}	1900	A

Characteristic Values

			min.	typ.	max.	
Forward Voltage[1)]	I_F = 950A, V_{GE} = 0V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_F	- - -	1.85 2.05 2.12	- - -	V
Peak Reverse Recovery Current	I_F = 950A, V_R = 600V -di_F/dt = 5556 A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	I_{RM}	- - -	443 469 502	- - -	A
Recovery Charge	I_F = 950A, V_R = 600V -di_F/dt = 5556 A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	Q_R	- - -	36 58 75	- - -	µC
Reverse Recovery Energy	I_F = 950A, V_R = 600V -di_F/dt = 5556 A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{rec}	- - - -	7 26 31	- - - -	mJ
Thermal Resistance, Junction to Case	Per FRD		R_{thJC}	-	0.044	-	K/W
Thermal Resistance, Case to Heatsink	Per FRD λ_{grease} = 1W/(m·K)		R_{thCH}	-	0.048	-	K/W
Temperature under Switching Conditions[2)]			$T_{vj\ op}$	-40	-	175	℃

NTC-Thermistor / NTC
Characteristic Values

			min.	typ.	max.	
Rated Resistance	T_{NTC} = 25℃		R_{25}	-	5	-	KΩ
Deviation of R100 R100	T_{NTC} = 100℃, R_{100} = 491Ω		△R/R	-5	-	5	%
Power Dissipation	T_{NTC} = 25℃		P_{25}	-	-	20	mW
B-Value B	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$		$B_{25/50}$	-	3375	-	K
	$R_2 = R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$		$B_{25/80}$	-	3425	-	K
	$R_2 = R_{25} \exp[B_{25/100}(1/T_2-1/(298.15K))]$		$B_{25/100}$	-	3443	-	K

Module

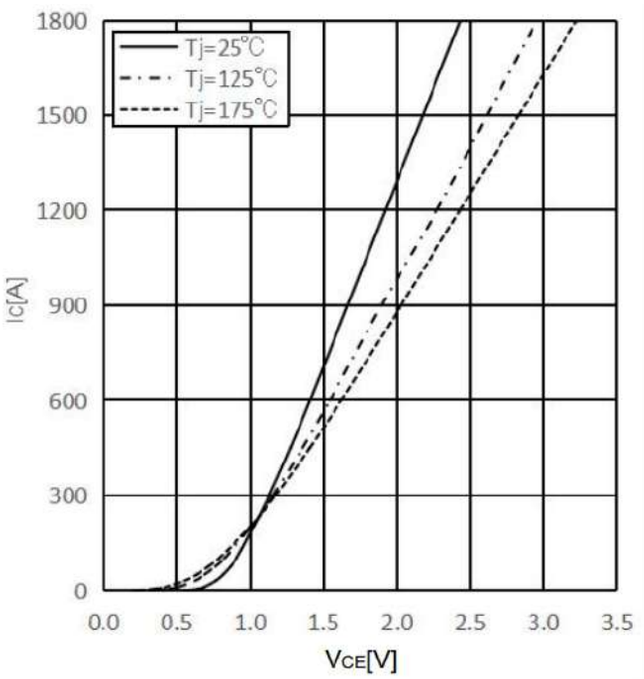
Isolation Test Voltage	RMS, f=50Hz, t=1 min	V_{ISOL}	3	kV
Material of Module Baseplate			Cu	
Internal Isolation			ZTA	
Creepage Distance	Terminal to heatsink, min Terminal to terminal, min		15.0 13.0	mm
Clearance	Terminal to heatsink, min Terminal to terminal, min		12.5 10.0	mm
Comparative Tracking Index		CTI	200	

			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	20	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25°C, Per Switch	$R_{CC'+EE'}$	-	0.8	-	mΩ
Storage Temperature		T_{stg}	-40	-	125	°C
Mounting Torque for Module Mounting	Screw M5 / M5	M	3.0	-	6.0	Nm
Mounting Torque for Module Mounting	Screw M6 / M6	M	3.0	-	6.0	Nm
Weight		G	-	345	-	g

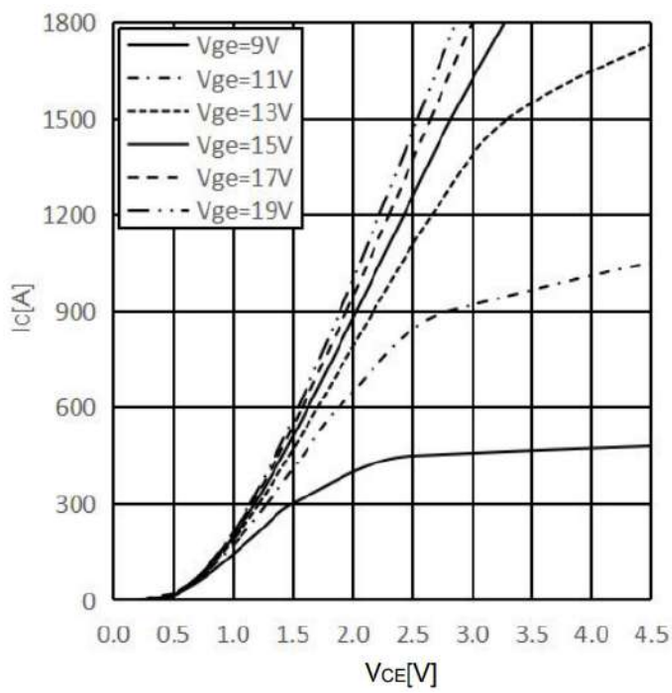
1) Terminal impedance is not included.
2) $T_{vj\ op}$ > 150°C is allowed for operation at overload conditions.

Circuit Diagram

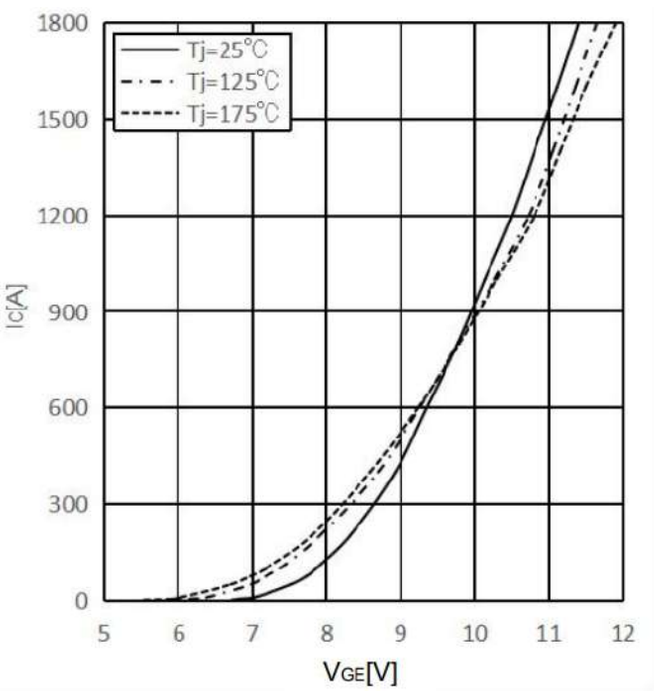
Output characteristic IGBT, Inverter (typical)
Inclusive $R_{CC'+EE'}$
$I_C = f(V_{CE})$, V_{GE} = 15V



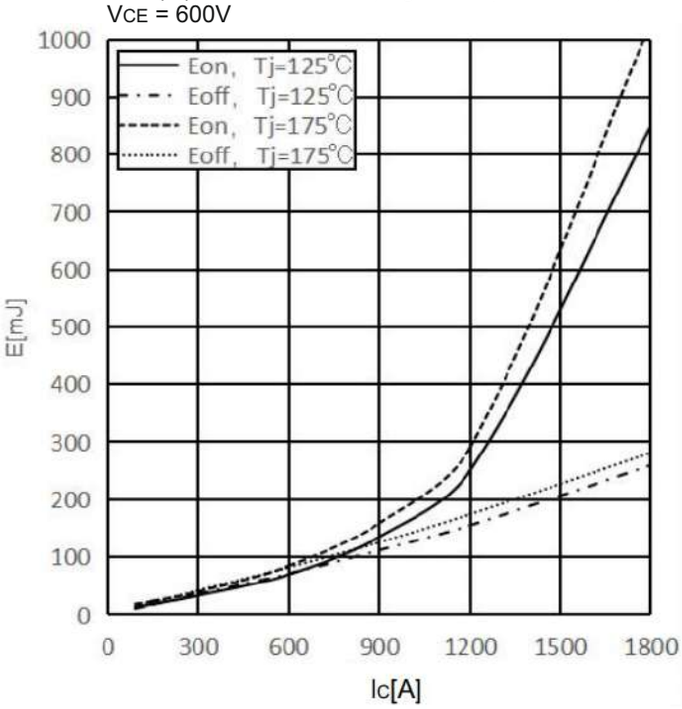
Output characteristic IGBT, Inverter (typical)
Inclusive $R_{CC'+EE'}$
$I_C = f(V_{CE})$, T_j = 175°C



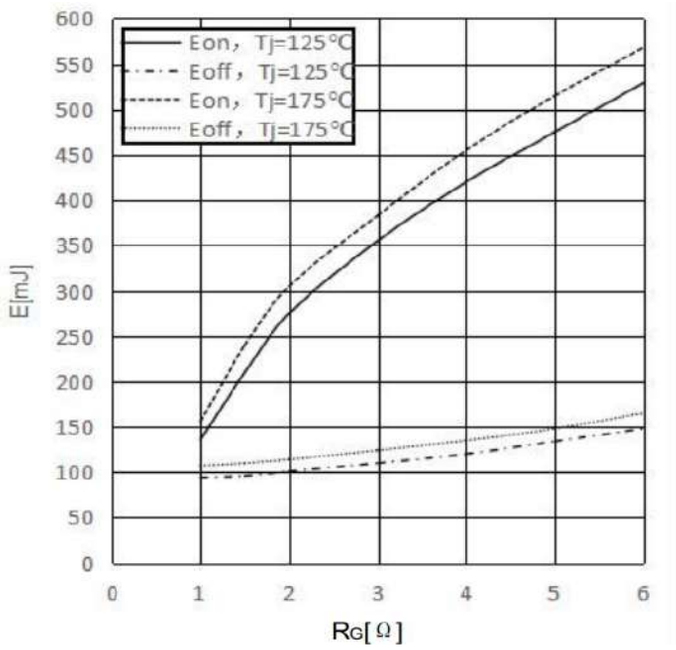
Transfer characteristic IGBT, Inverter(typical),
Inclusive $R_{CC'+EE'}$
$I_C = f(V_{GE})$, V_{CE} = 20V



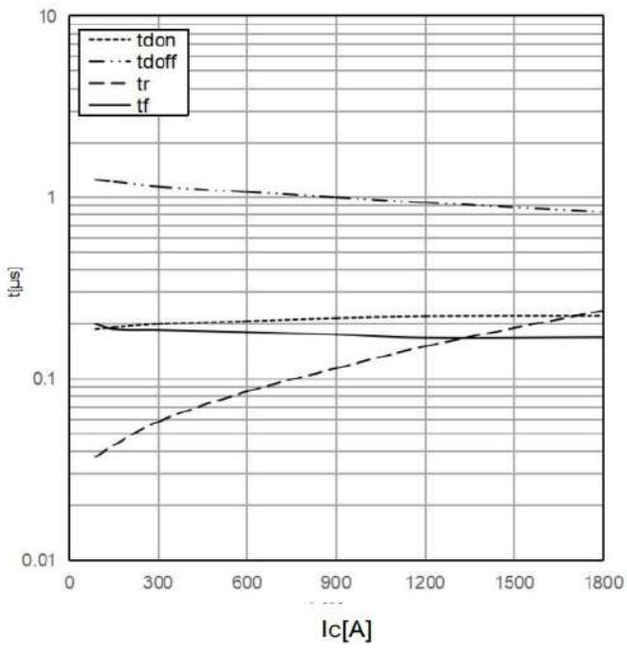
Switching losses IGBT, Inverter (typical)
Inclusive $R_{CC'+EE'}$
$E = f(I_C)$, V_{GE} = +15V/-8V, R_{gon} = 1Ω, R_{Goff} = 1Ω,
V_{CE} = 600V



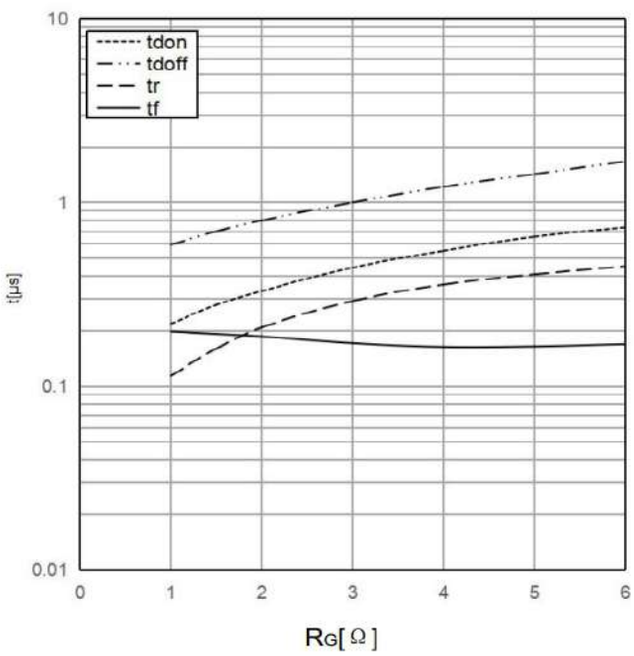
Switching losses IGBT, Inverter(typical)
Inclusive $R_{CC'+EE'}$
$E = f(R_G)$, V_{GE} = +15V/-8V, I_C = 900A, V_{CE} = 600V



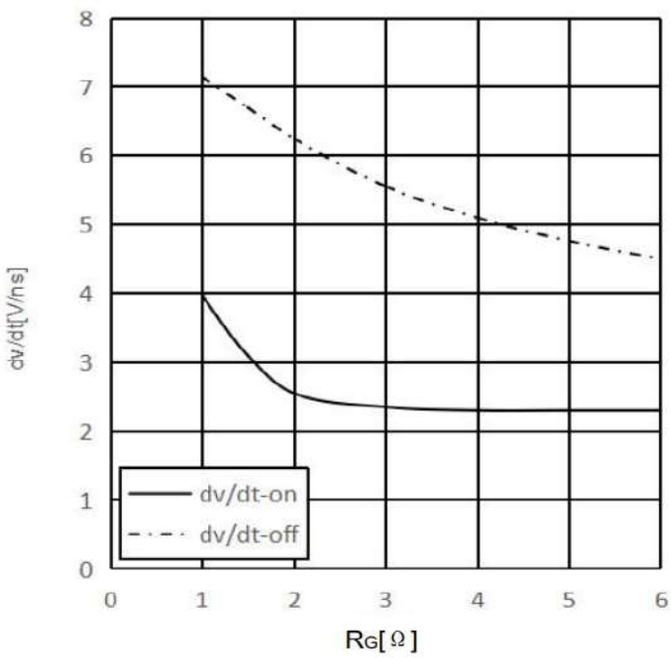
Switching times IGBT, Inverter(typical)
$t_{don} = f(I_C)$, $t_r = f(I_C)$, VGE = +15V/-8V
R_{gon} = 1Ω, R_{Goff} = 1Ω, V_{CE} = 600V, T_{vj} = 175°C



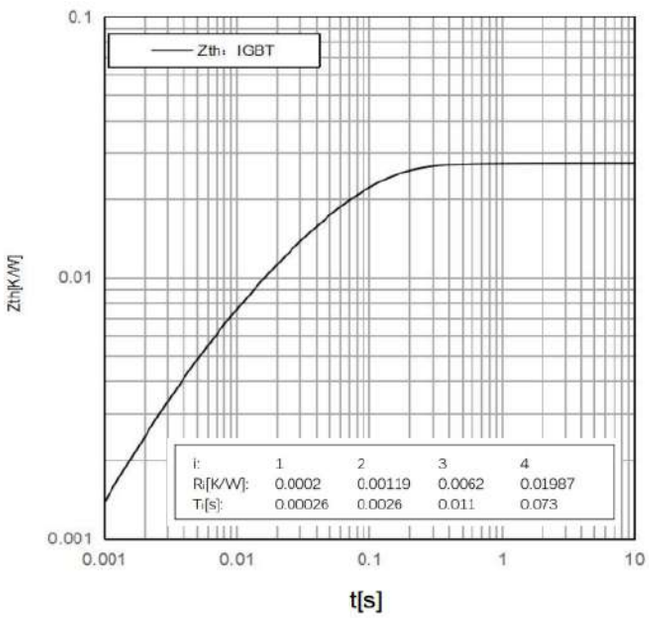
Switching times IGBT, Inverter (typical)
$t_{don} = f(R_G)$, $t_r = f(R_G)$, V_{GE} = +15V/-8V,
I_C = 900A, V_{CE} = 600V, T_{vj} = 175°C



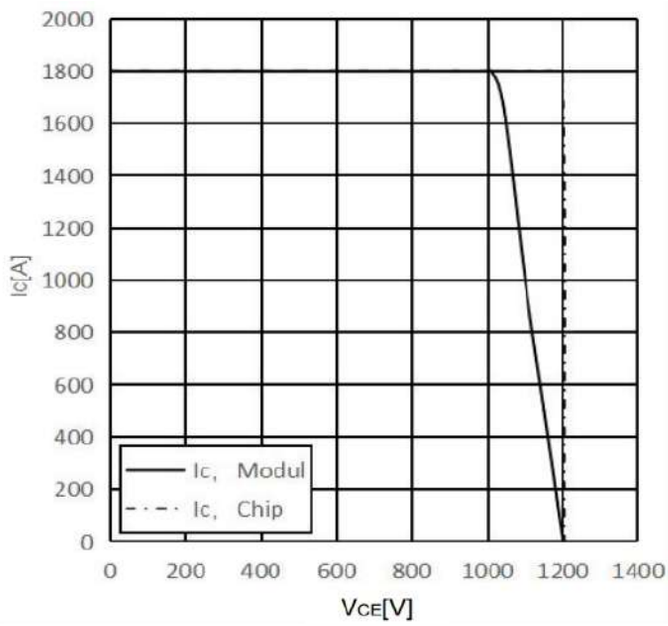
IGBT, Inverter (typical)
dv/dt = f(R_G), V_{GE} = +15V/-8V,
I_C = 900A, V_{CE} = 600V, T_j = 125°C



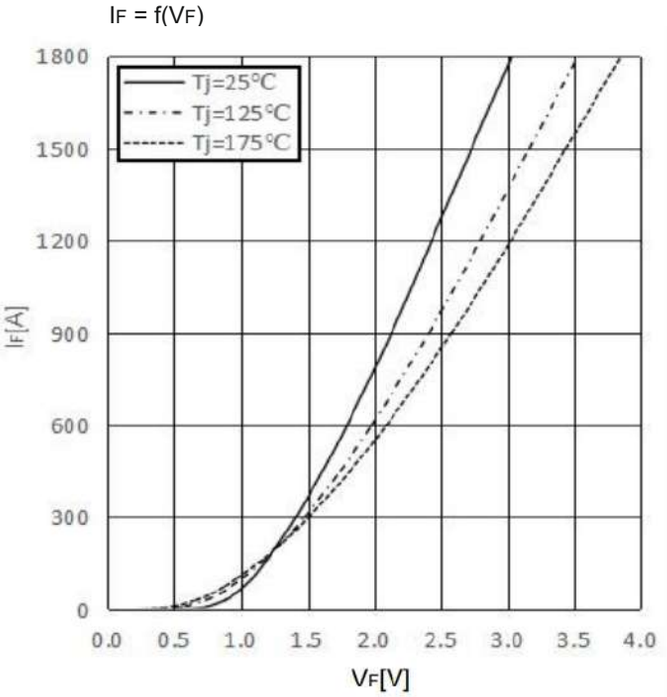
Transient thermal impedance IGBT, Inverter
$Z_{thJC}=f(t)$



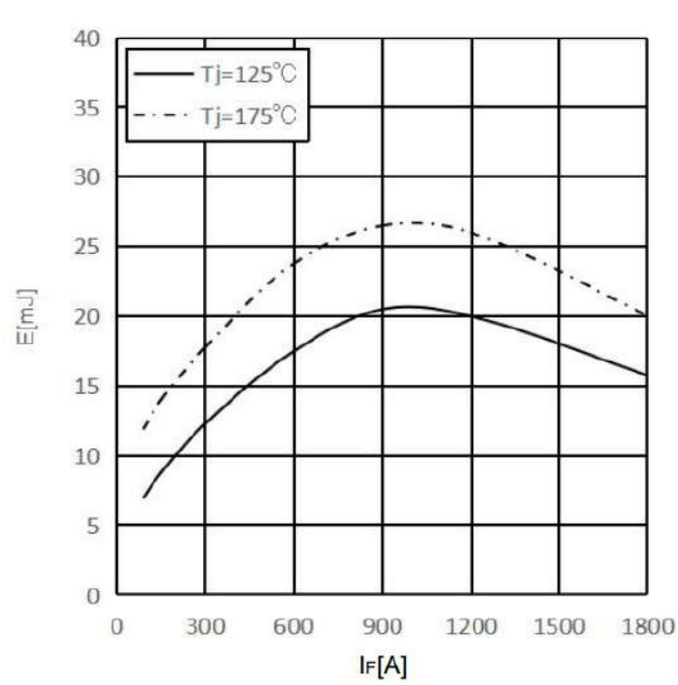
Reverse bias safe operating area IGBT, Inverter(RBSOA)
$I_C = f(V_{CE}), V_{GE}$ = +15V/-8V, R_{Goff} = 1Ω, T_j = 175°C



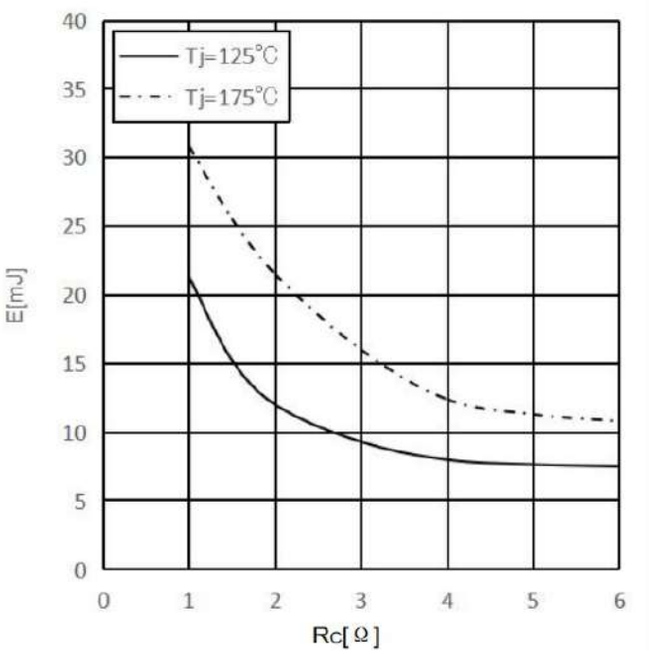
Forward characteristic FRD, Inverter(typical), Inclusiver $R_{CC'+EE'}$
$I_F = f(V_F)$



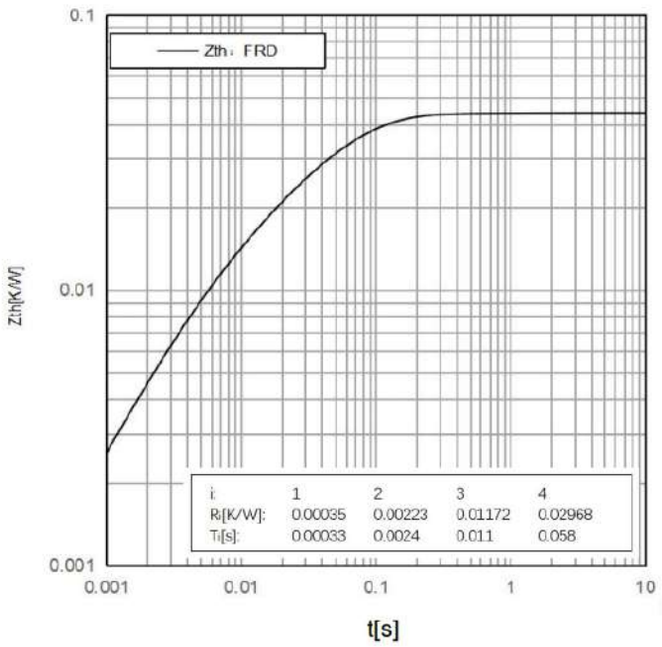
Swiching Losses FRD, Inverter (typical), Inclusive $R_{CC'+EE'}$
$E_{rec} = f(I_F)$, R_{Gon} = 1Ω, V_{CE} = 600V



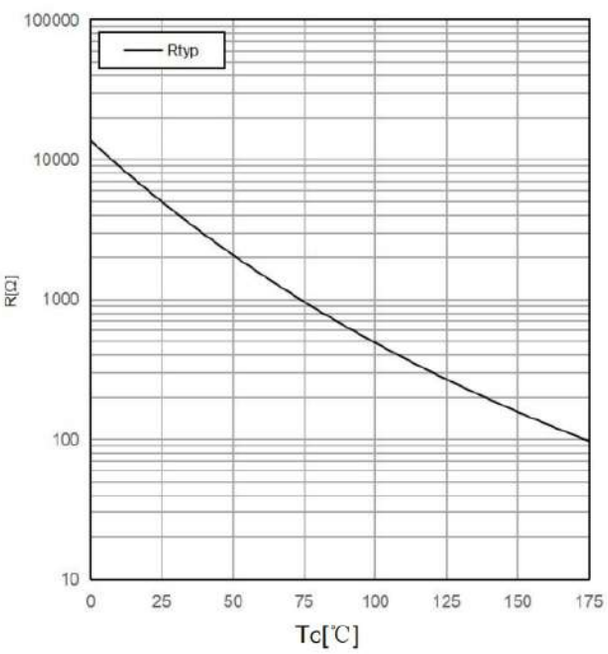
Swiching Losses FRD, Inverter (typical),
Inclusive $R_{CC'+EE'}$
$E_{rec} = f(R_g)$, I_C = 600A, V_{CE} = 900V



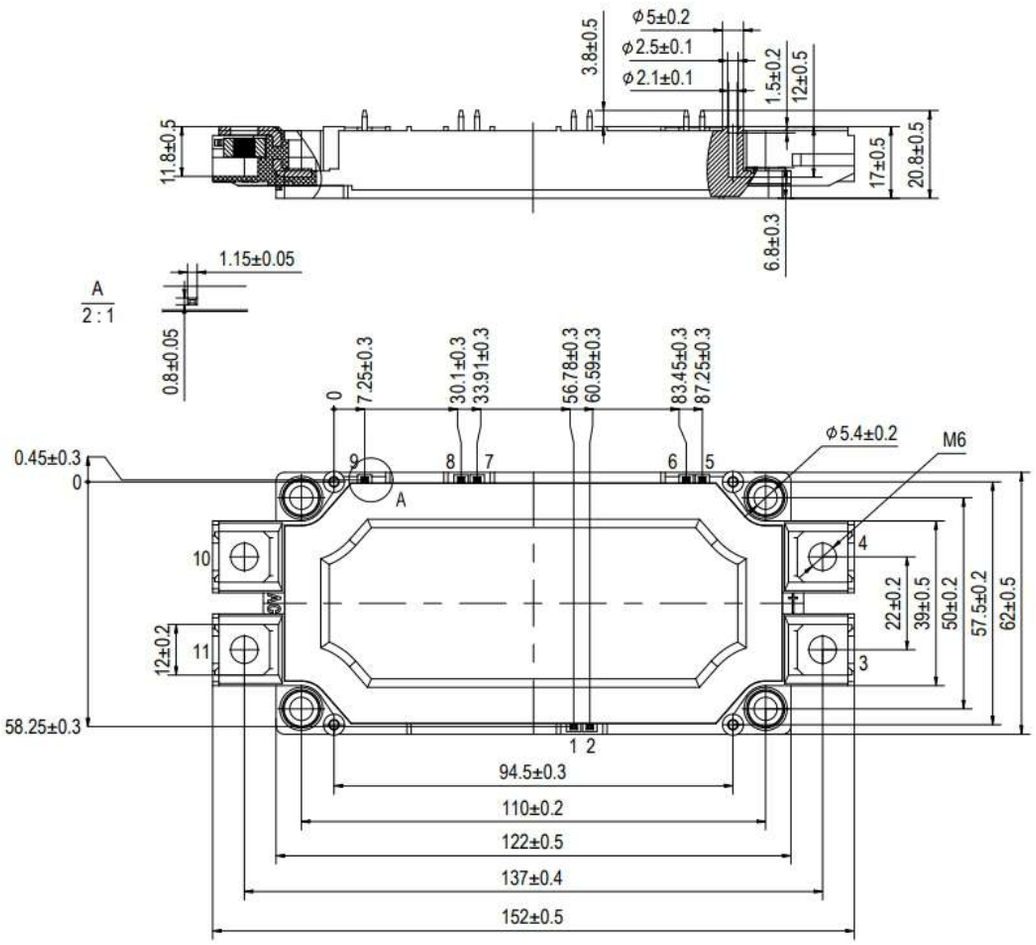
Transient thermal impedance FRD, Inverter
FRD
$Z_{thJC} = f(t)$



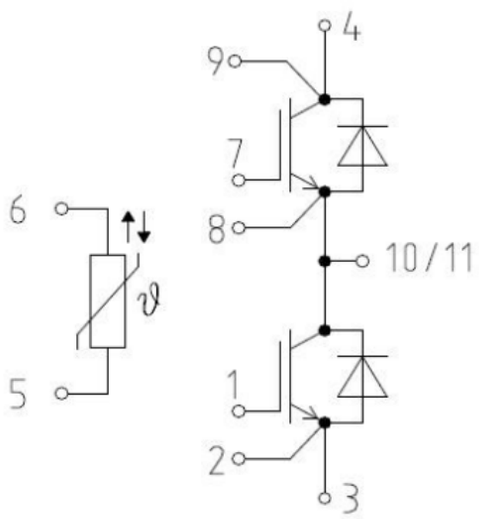
NTC Thermistor temperature characteristic
(typical)
R = f(T)



Package Dimension/
Dimensions in Millimeters



Internal Circuit



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