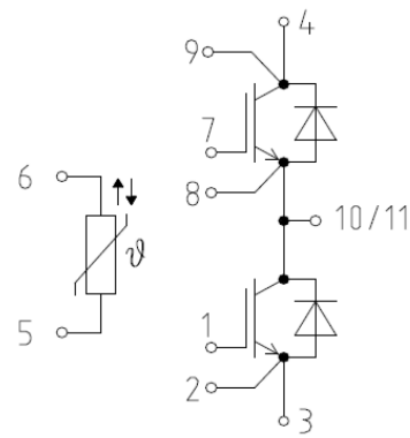
C5 series package: 1200V 900A IGBT module

Datasheet



Equivalent
Circuit Schematic

Features:

- Trenchgate Gen.7 IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High RBSOA capability
- Low static losses: $V_{CE(sat)}$ = 1,55V@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
Implemented Collector Current		I_{Cnom}	900	A
Continuous DC Collector Current	T_C = 45℃, $T_{vj\ max}$ = 175℃	I_C	875	A
Repetitive Peak Collector Current	t_p = 1ms	I_{CRM}	1800	A
Gate-emitter Peak Voltage		V_{GES}	±20	V

Characteristic Values

				min.	typ.	max.	
Collector-emitter Saturation Voltage[1)]	I_C = 900A, V_{GE} = 15V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	V_{CEsat}	-	1.55 1.80 1.86	-	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 = 900A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_{don}	-	197 262 267	-	ns
Rise Time, Inductive Load	I_C = 900A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_r	-	93 107 114	-	ns
Turn-off Delay Time, Inductive Load	I_C = 900A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_{doff}	-	560 582 600	-	ns
Fall Time, Inductive Load	I_C = 900A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_f	-	99 150 198	-	ns
Turn-on Energy Loss per Pulse	I_C = 900A, V_{CE} = 600V, L_σ = 30nH V_{GE} = -8V/15V, R_{GON} = 1Ω di/dt = 6131 (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{on}	-	122 140 162	-	mJ
Turn-off energy Loss per Pulse	I_C = 900A, V_{CE} = 600V, L_σ = 30nH V_{GE} = -8V/15V, R_{GON} = 1Ω du/dt = 4762 (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{off}	-	75 92 112	-	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	R_{thJC}	–	0.028	–	K/W
Thermal Resistance, Case to Heatsink	Per IGBT, λ_{grease} = 1W(m•K)	R_{thCH}	–	0.035	–	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}	900	A
Repetitive Peak Forward Current	t_p = 1ms	I_{FRM}	1800	A

Characteristic Values

				min.	typ.	max.	
Forward Voltage[1)]	I_F = 900A, V_{GE} = 0V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_F	–	1.83 2.12 2.25	–	V
Peak Reverse Recovery Current	I_F = 900A, V_R = 600V $-di_F/dt$ = 5556A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	I_{RM}	–	420 444 476	–	A
Recovery Charge	I_F = 900A, V_R = 600V $-di_F/dt$ = 5556A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	Q_R	–	34 55 71	–	μC
Reverse Recovery Energy	I_F = 900A, V_R = 600V $-di_F/dt$ = 5556A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{rec}	–	7 25 29	–	mJ
Thermal Resistance, Junction to Case	Per FRD		R_{thJC}	–	0.063	–	K/W
Thermal Resistance, Case to Heatsink	Per FRD, λ_{grease} = 1W(m•K)		R_{thCH}	–	0.039	–	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

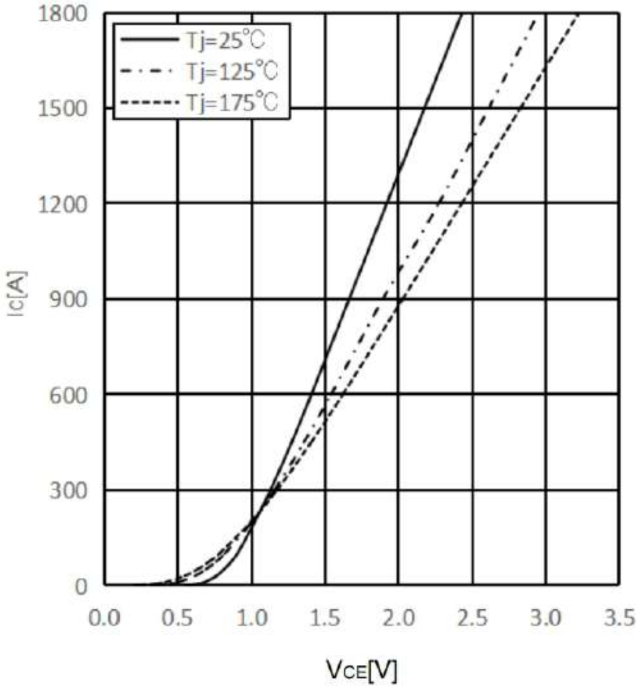
Isolation Test Voltage	RMS, f=50Hz, t=1min	V_{ISOL}	3.0	kV
Material of Module Baseplate			Cu	
Internal Isolation			ZTA	
Creepage Distance	Terminal to heatsink, min Terminal to terminal, min		15.0 13.0	mm
Clearance	Terminal to heatsink, min Terminal to terminal, min		12.5 10.0	mm
Comparative Tracking Index		CTI	200 [2)]	

			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	20	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25℃, Per Switch	$R_{CC'+EE'}$	-	0.8	-	mΩ
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

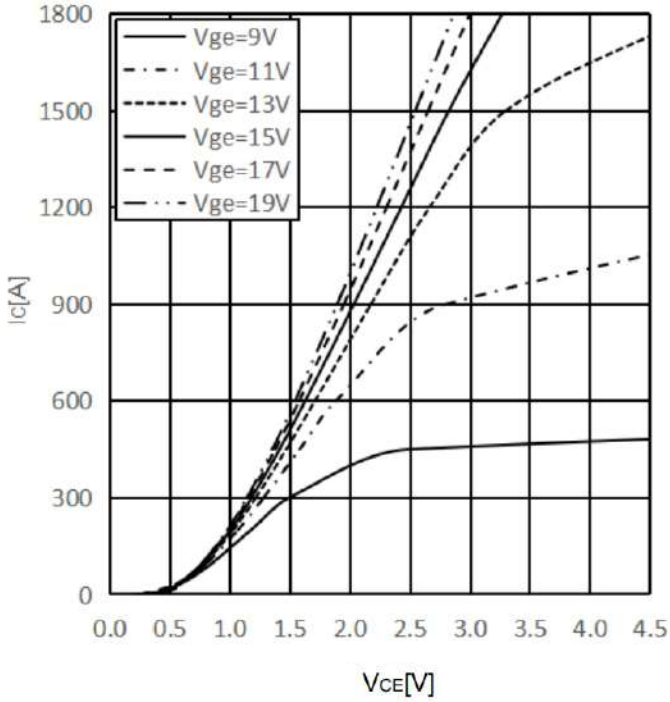
1) Terminal impedance is not included.
2) CTI is about 200.

Circuit Diagram

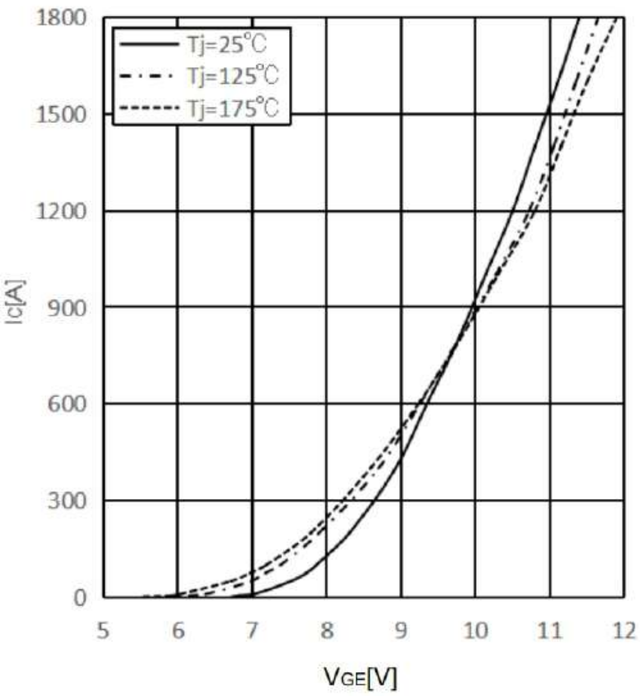
Output characteristic IGBT, Inverter (typical),
Inclusive $R_{CC'+EE'}$ $I_C = f(V_{CE})$, $V_{GE} = 15V$



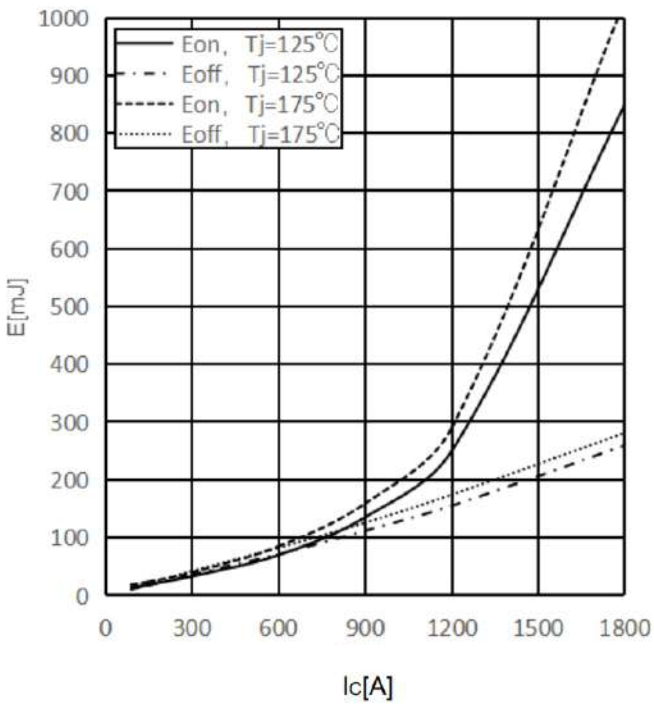
Output characteristic IGBT, Inverter (typical),
Inclusive $R_{CC'+EE'}$ $I_C = f(V_{CE})$, $T_j = 175℃$



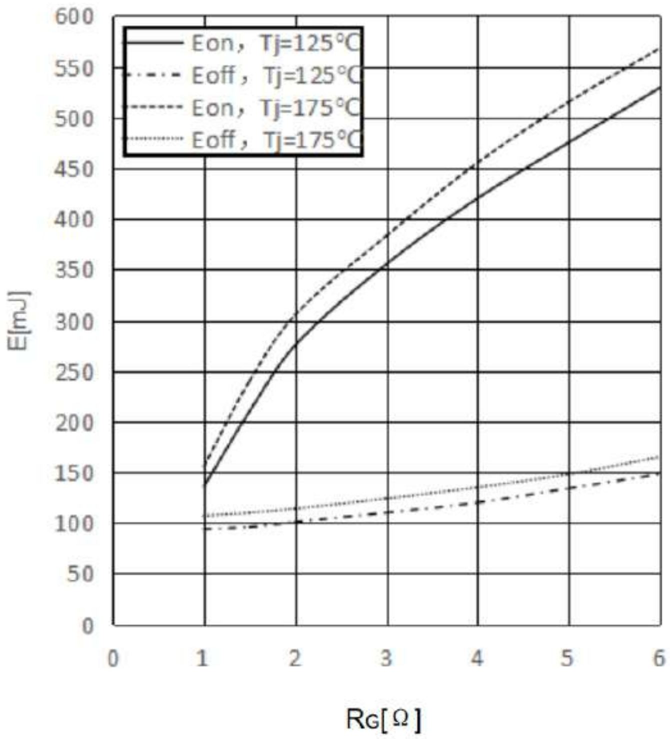
Transfer characteristic IGBT,Inverter(typical),
Inclusive $R_{CC'+EE'}$ $I_C = f(V_{GE})$, $V_{CE} = 20V$



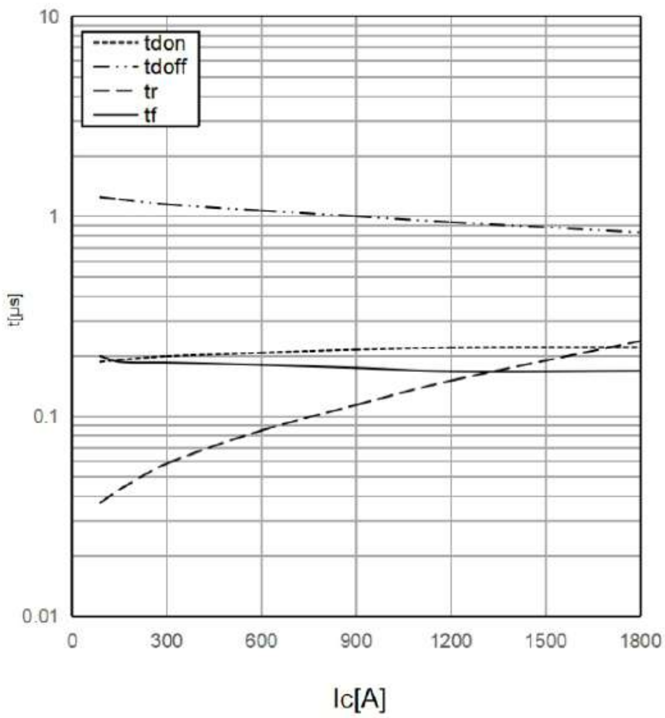
Switching losses IGBT, Inverter (Typical),
Inclusive $R_{CC'+EE'}$
$E = f(I_C)$, $V_{GE} = +15V/-8V$, $R_{Gon} = 1\Omega$,
$R_{Goff} = 3\Omega$, $V_{CC} = 600V$



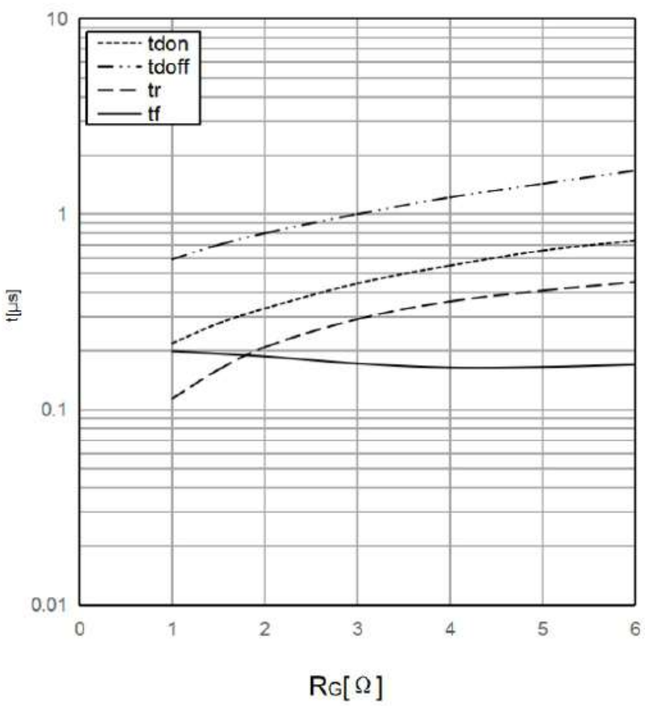
Switching losses IGBT, Inverter (Typical)
Inclusive $R_{CC'+EE'}$
E = f(R_G), V_{GE} = +15V/-8V, I_C = 900A, V_{CE} = 600V



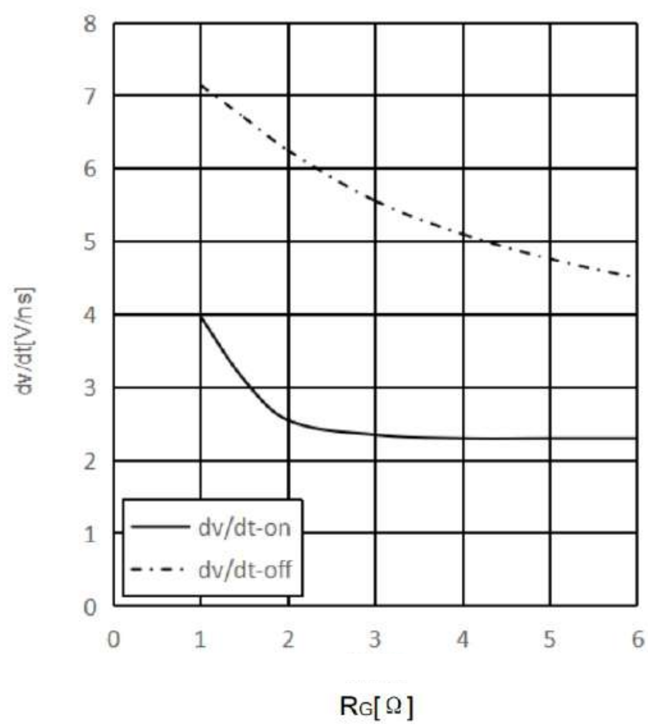
Switching times IGBT, Inverter (Typical)
t_{don} = f(I_C), t_r = f(I_C),V_{GE} = +15V/-8V,
R_{Gon} = 1Ω, R_{Goff} = 1Ω, V_{CE} = 600V, T_{vj} = 175℃



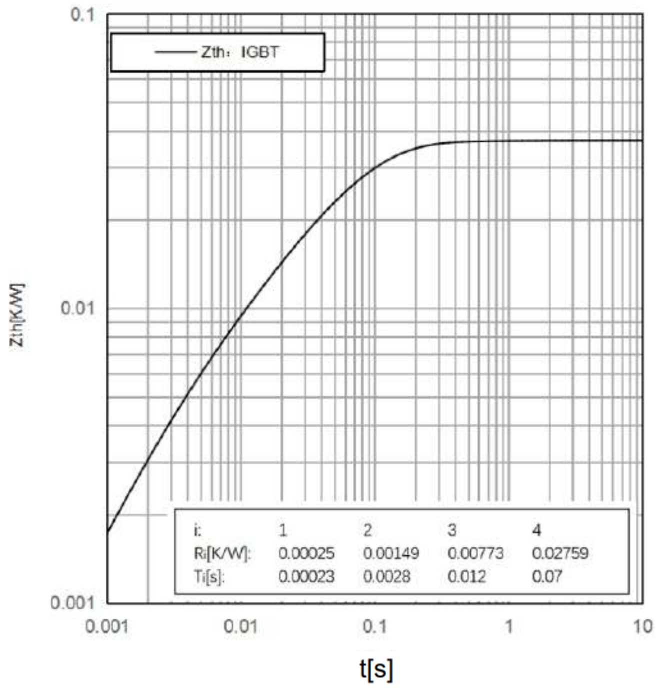
Switching times IGBT, Inverter (Typical)
t_{don} = f(R_G), t_r = f(R_G), V_{GE} = +15V/-8V,
I_C = 900A, V_{CE} = 600V, T_{vj} = 175℃



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

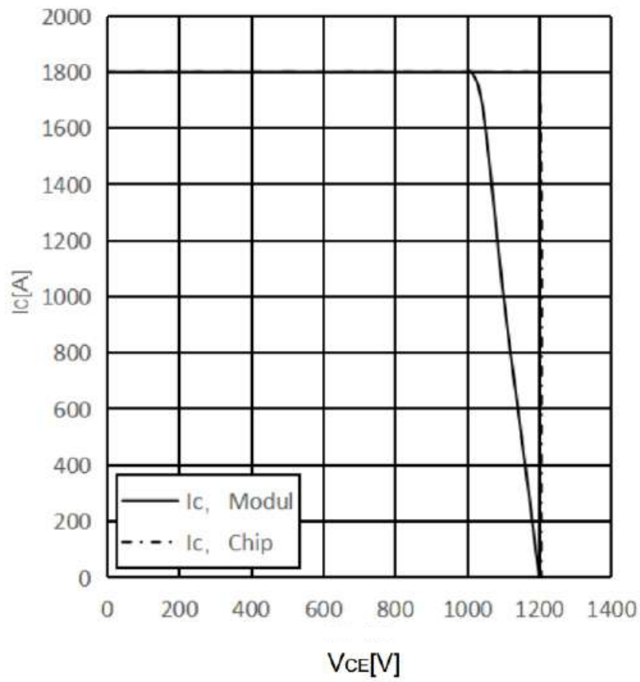


Transient thermal impedance IGBT,Inerter
$Z_{thJC} = f(t)$

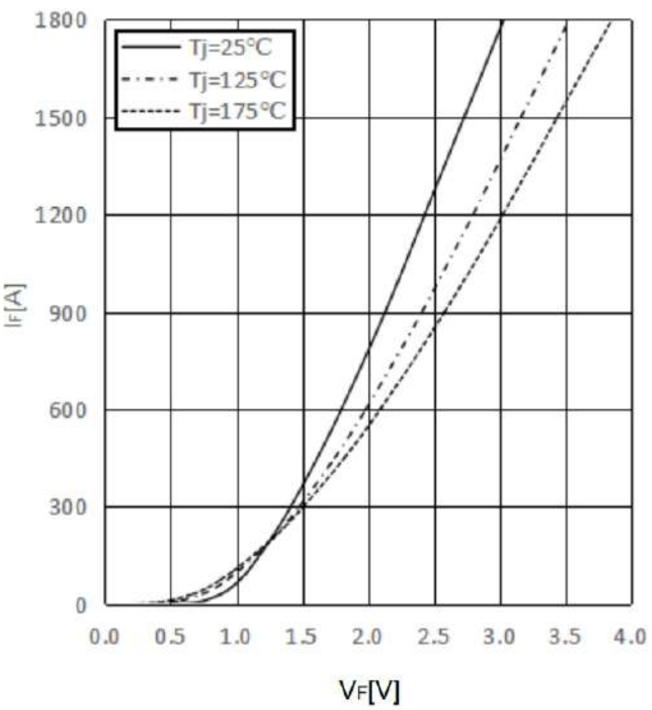


i:	1	2	3	4
Ri[K/W]:	0.00025	0.00149	0.00773	0.02759
Ti[s]:	0.00023	0.0028	0.012	0.07

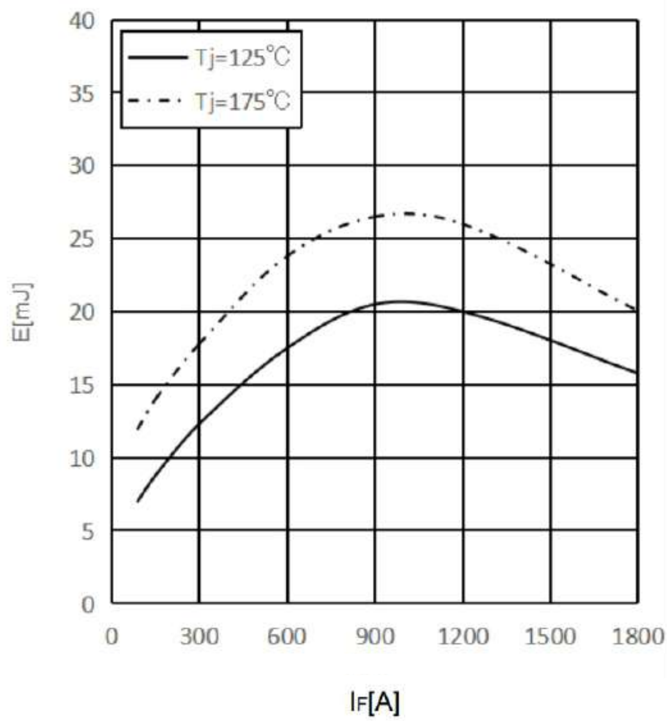
Reverse bias safe operating area IGBT, Inverter(RBSOA)
$I_C = f(V_{CE})$
V_{GE} = +15V/-8V, R_{Goff} = 3Ω,T_j = 175℃



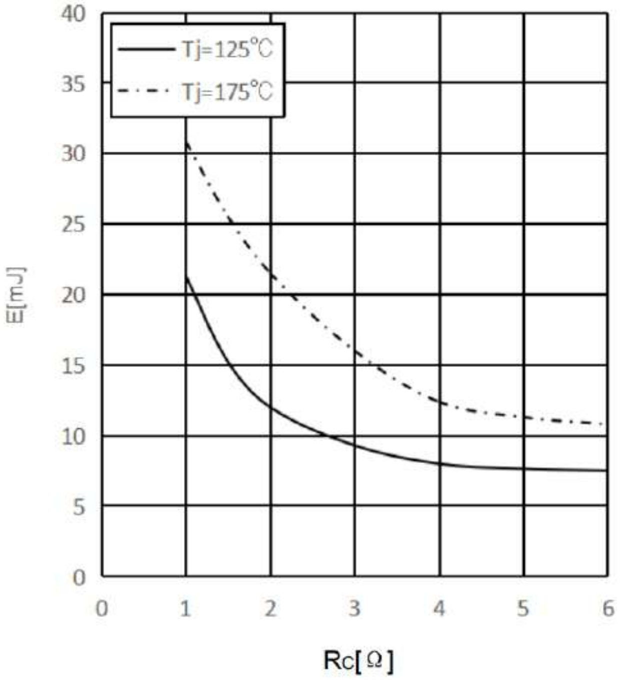
Forward characteristic FRD, Inverter (typical)
Inclusive $R_{CC'+EE'}$
$I_F = f(V_F)$



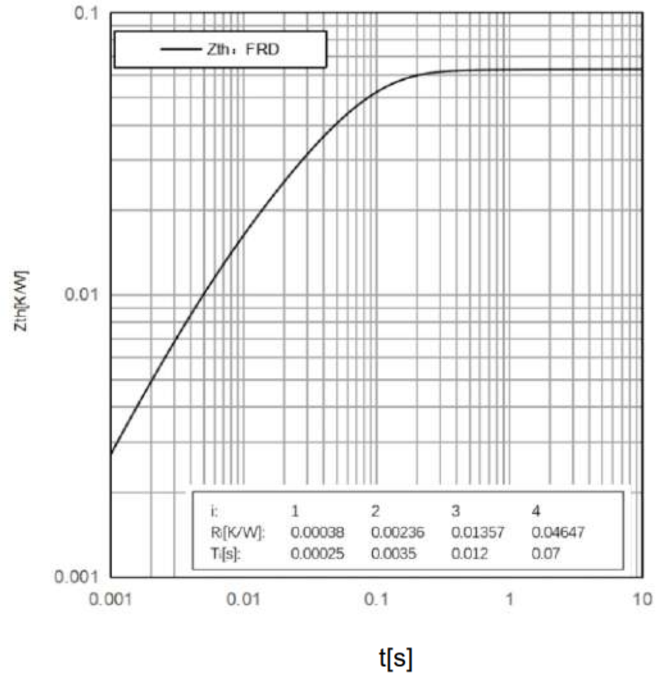
Switching losses FRD, Inverter (typical)
Inclusive $R_{CC'+EE'}$
$E_{rec} = f(I_F)$, R_{Gon} = 1Ω, V_{CE} = 400V



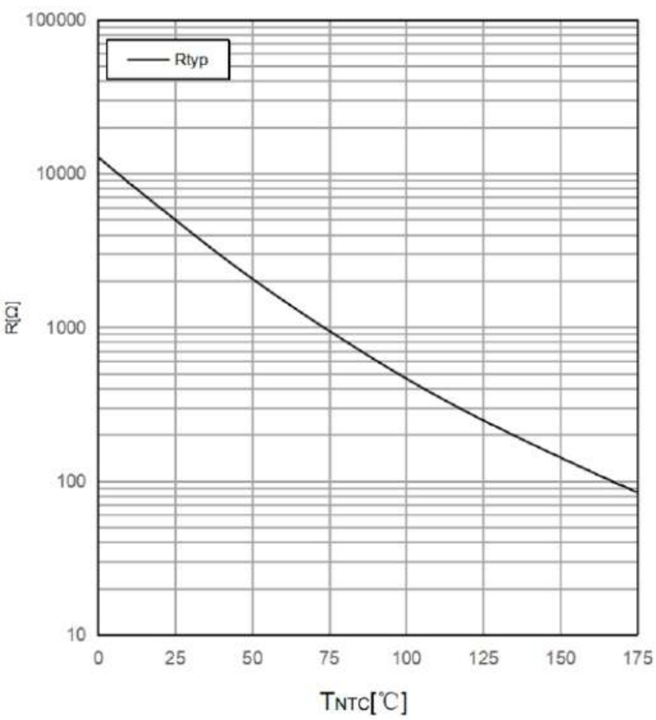
Switching losses FRD, Inverter (typical)
Inclusive $R_{CC'+EE'}$
$E_{rec} = f(R_G)$



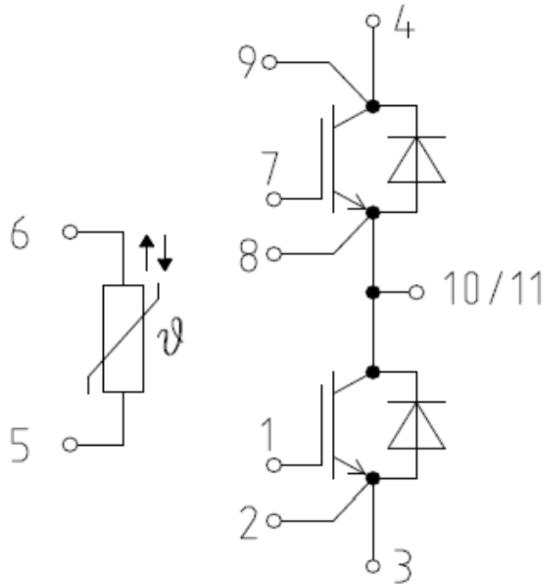
Transient thermal impedance FRD, Inverter
$Z_{thJC} = f(t)$



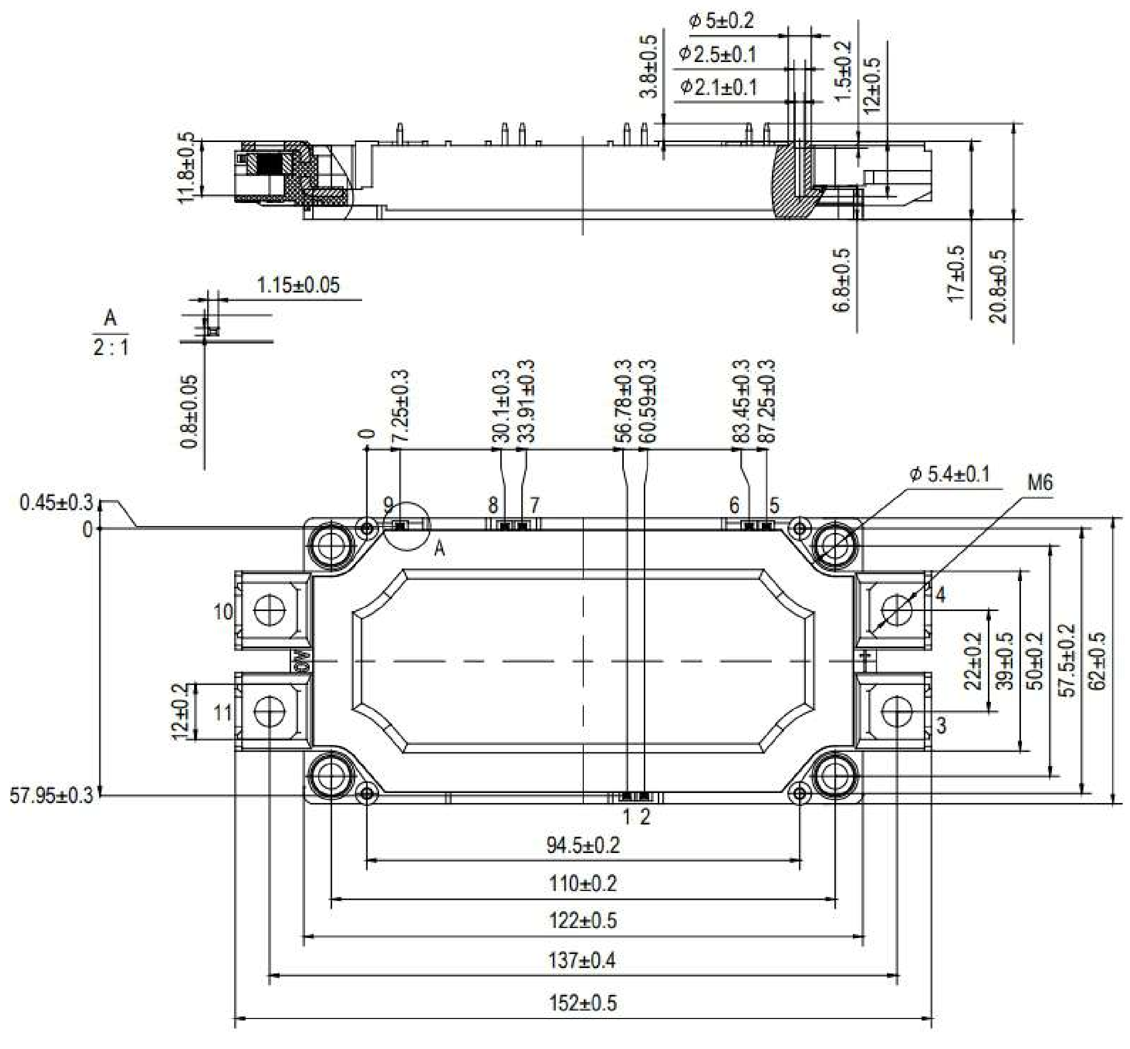
NTC Thermistor temperature characteristic (typical)
R = f(T)



Internal Circuit



Package Dimension
Dimensions in Millimeters



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