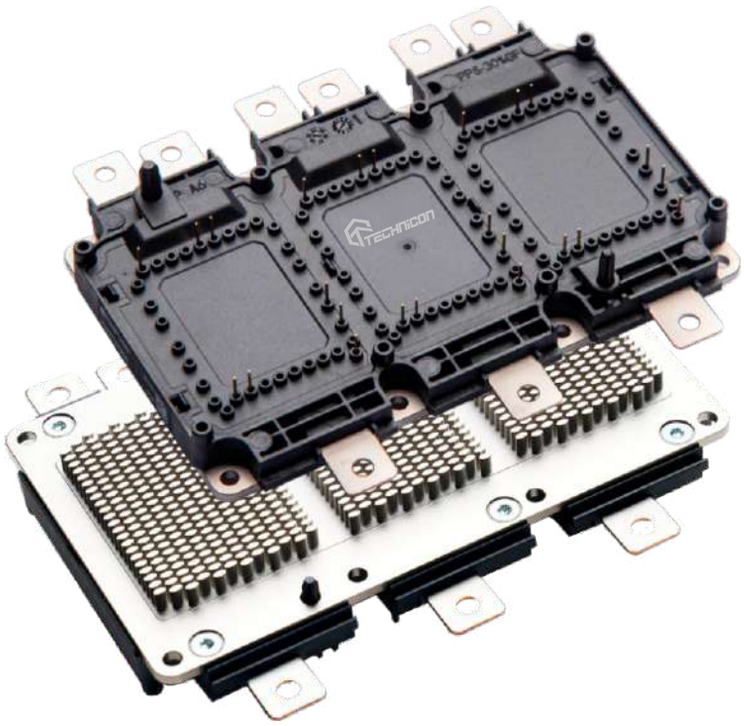
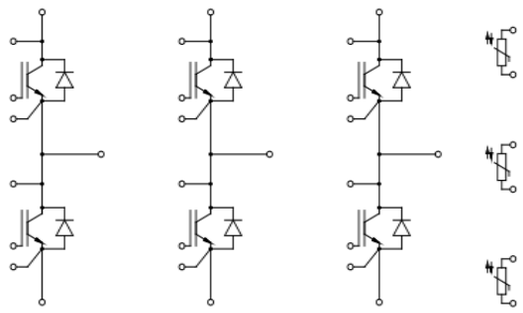
C6 series package: 1200V 450A IGBT module





Equivalent
Circuit Schematic

Features:

- Trenchgate Gen.7 IGBT technology
- VCE(sat) with positive temperature coefficient
- High RBSOA capability
- Low static losses: $V_{CE(sat)}$ = 1,53V@25C
- Low dynamic losses
- 6 us short circuit capability
- Fast and soft reverse-recovery FWD
- Si_3N_4 DBC substrate for high thermocycling capability

TECHNICON IGBT Power Modules in C6 (HPD) case provides ultra low conduction loss as well as short circuit ruggedness. They are designed for e-transport applications such as hybrid and electric vehicle.

Typical Applications:

- Hybrid and electric vehicles
- Motor drives

IGBT, Inverter / IGBT
Maximum Rated Values

Collector-emitter Voltage	T_{vj} = 25℃	V_{CES}	1200	V
Implemented Collector Curren		I_{Cnom}	450	A
Continuous DC collector current	T_F = 25℃, T_{vjmax} = 175℃	I_C	475 [1)]	A
Repetitive Peak Collector Current	t_p = 1ms	I_{CRM}	900 [1)]	A
Gate-emitter Peak Voltage		V_{GES}	±20	V

Characteristic Values

			min.	typ.	max.	
Collector-emitter Saturation Voltage[2)]	I_C = 450A, V_{GE} = 15V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_{CEsat}	–	1.53 1.78 1.87	1.70	V
Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 18mA	T_{vj} = 25℃ T_{vj} = 175℃	V_{GEth}	5.0	6.0 4.0	7.0	V
Internal Gate Resistor	T_{vj} = 25℃		R_{Gint}	–	0.7	–	Ω
Input Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{ies}	–	106	–	nF
Gate charge	V_{GE} = -8V~+15V, V_{CE} = 600V		Q_G	–	4.28	–	µC
Reverse Transfer Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{res}	–	0.28	–	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 = 450A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 1Ω	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	t_{don}	–	134 152 156	–	ns
Rise Time, Inductive Load	I_C = 450A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 1Ω	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	t_r	–	46 54 58	–	ns
Turn-off Delay Time, Inductive Load	I_C = 450A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	tdoff	–	484 551 560	–	ns
Fall Time, Inductive Load	I_C = 450A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	t_f	–	126 226 246	–	ns
Turn-on Energy Loss per Pulse	I_C = 450A, V_{CE} = 600V, Lσ = 30nH V_{GE} = -8V/15V, R_{GON} = 1Ω di/dt = 6760 A/µs (T_{vj} = 25℃) di/dt = 5450 A/µs (T_{vj} = 150℃)	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{on}	–	19.3 30.3 33.0	–	mJ
Turn-off energy Loss per Pulse	I_C = 450A, V_{CE} = 600V, Lσ = 30nH V_{GE} = -8V/15V, R_{Goff} = 1Ω dv/dt = 8500 A/µs (T_{vj} = 25℃) dv/dt = 6500 A/µs (T_{vj} = 150℃)	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{off}	–	35.4 50.7 54.0	–	mJ
SC Data	V_{GE} = 15V/-8V V_{CC} = 800V V_{CEmax} ≤ 1200V	t_P ≤ 8µs, T_{vj} = 25℃ t_P ≤ 6µs, T_{vj} = 175℃	I_{sc}	–	3400 2500	–	A

1) Calculated values.
2) Terminal impedance is not included.

Thermal Resistance, junction to cooling fluid	Per IGBT, $\Delta V/\Delta t$ = 10dm³/min, T_F=65℃	R_{thJC}	-	0.105	-	K/W
Temperature under Switching Conditions	t_{op} continuous for 10s within a period of 30s, occurrence maximum 3000 times over lifetime	$T_{vj\ op}$	-40 150		150 175	℃

Diode, Inverter
Maximum Rated Values

Repetitive Peak Reverse Voltage	T_{vj} = 25℃	V_{RRM}	1200	V
Implemented forward current		I_{Fnom}	450	A
Repetitive Peak Forward Current	t_p = 1ms	I_{FRM}	900[1)]	A

Characteristic Values

			min.	typ.	max.	
Forward Voltage[2)]	I_F = 450A, V_{GE} = 0V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_F	- - -	1.97 1.93 1.88	2.40 - -	V
Peak Reverse Recovery Current	I_F = 450A, V_R = 600V -di_F/dt = 6600 A/us (T_{vj} = 150℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	I_{RM}	-	345 420 435	-	A
Recovery Charge	I_F = 450A, V_R = 600V -di_F/dt = 6600 A/us (T_{vj} = 150℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	Q_R	-	20 43 49	-	µC
Reverse Recovery Energy	I_F = 450A, V_R = 600V -di_F/dt = 6600 A/us (T_{vj} = 150℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{rec}	-	7.2 20.2 23.0	-	mJ
Thermal Resistance, junction to cooling fluid	Per FRD, $\Delta V/\Delta t$ = 10dm³/min, T_F=65℃		R_{thJC}	-	0.138	-	K/W
Temperature under Switching Conditions	t_{op} continuous for 10s within a period of 30s, occurrence maximum 3000 times over lifetime		$T_{vj\ op}$	-40 150	-	150 175	℃

NTC-Thermistor / NTC
Characteristic Values

			min.	typ.	max.	
Rated Resistance	T_C = 25℃	R_{25}	-	5.00	-	KΩ
Deviation of R100	T_C = 100℃, R_{100} = 493.3Ω	△R/R	-5	-	5	%
Power Dissipation	T_C = 25℃	P_{25}	-	-	20	mW
B-Value	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$	$B_{25/50}$	-	3375	-	K
	$R_2 = R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$	$B_{25/80}$	-	3414	-	K
	$R_2 = R_{25} \exp[B_{25/100}(1/T_2-1/(298.15K))]$	$B_{25/100}$	-	3436	-	K

1) Calculated values.
2) Terminal impedance is not included.

Module

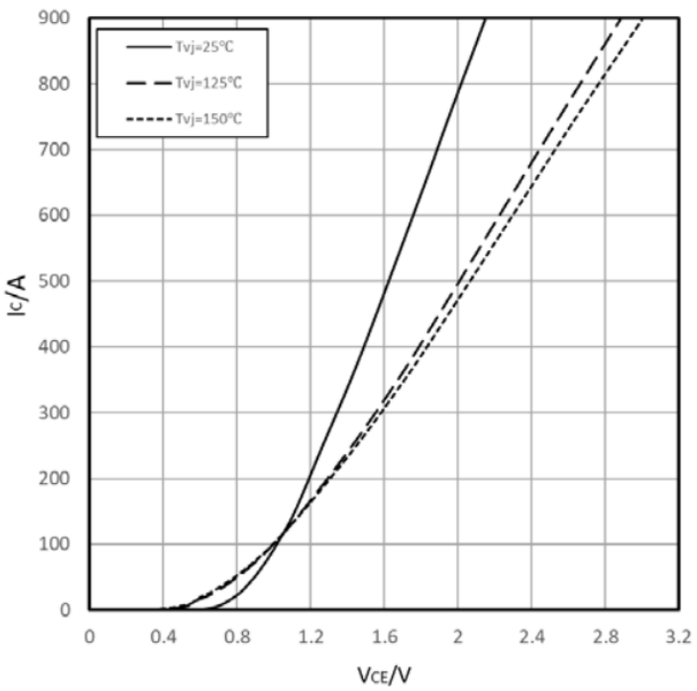
Isolation Test Voltage	RMS, f=50Hz, t=1 min	V_{ISOL}	3	kV
Material of Module Baseplate			Cu+Ni[1)]	
Internal Isolation			ZTA	
Creepage Distance	Terminal to heatsink Terminal to terminal		9.0 9.0	mm
Clearance	Terminal to heatsink Terminal to terminal		4.5 4.5	mm
Comparative Tracking Index		CTI	200[2)]	

			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	9.5	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25°C, Per Switch	$R_{CC'+EE'}$	-	0.75	-	mΩ
Storage Temperature		T_{stg}	-40	-	125	°C
Mounting Torque for Module mounting	Baseplate to heatsink, Screw M4	M	1.8	-	2.2	Nm
	Terminal connection, Screw M5	M	3.6	-	4.4	Nm
	PCB to frame		0.5		0.6	Nm
Weight		G	-	760	-	g

1) Nickel plated copper.
2) CTI ≈ 200.

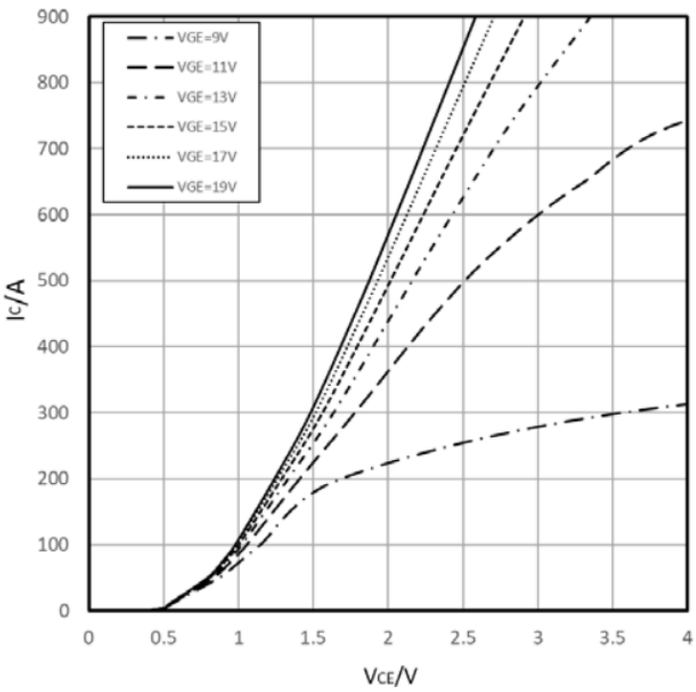
Circuit Diagram

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



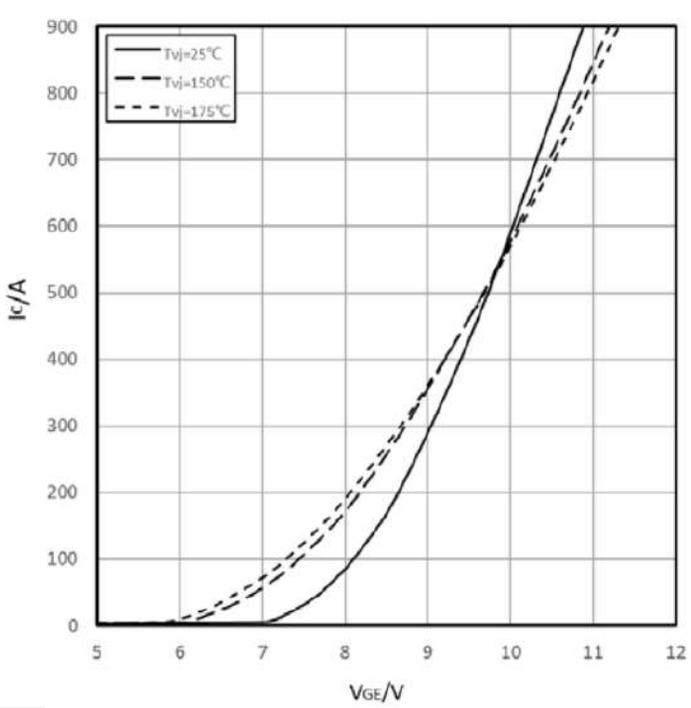
Output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$, T_j = 150℃



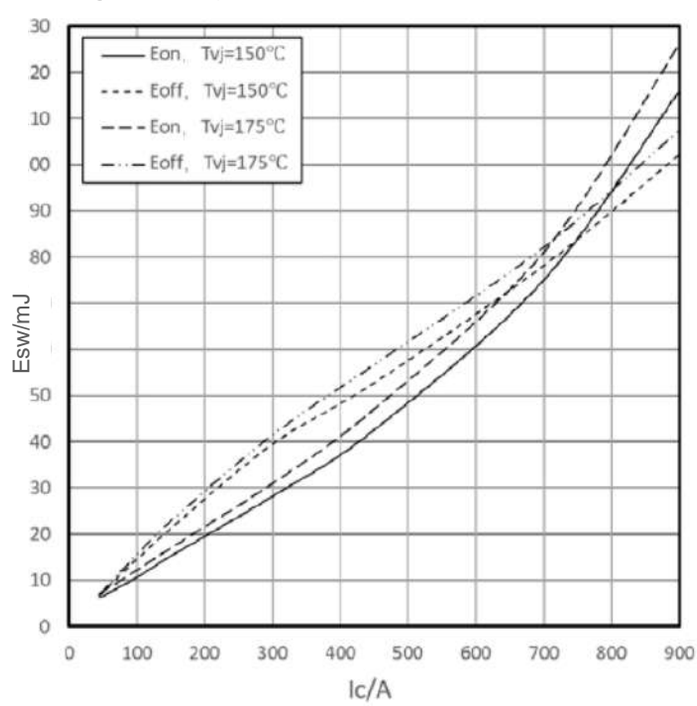
Transfer characteristic IGBT, Inverter(typical),

$I_C = f(V_{GE})$,V_{CE} = 20V



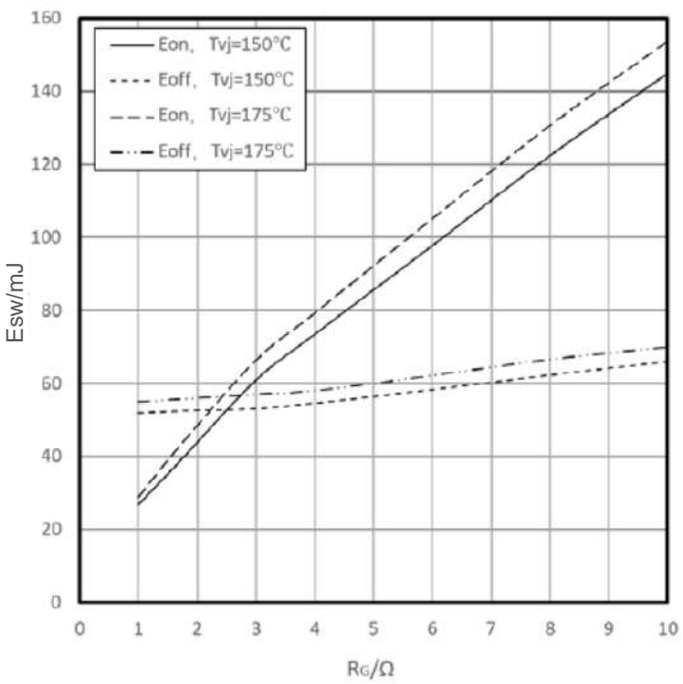
Switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$, V_{GE} = +15V/-8V,
R_{gon} = 1.43Ω, R_{Goff} = 2.5Ω, V_{CE} = 600V



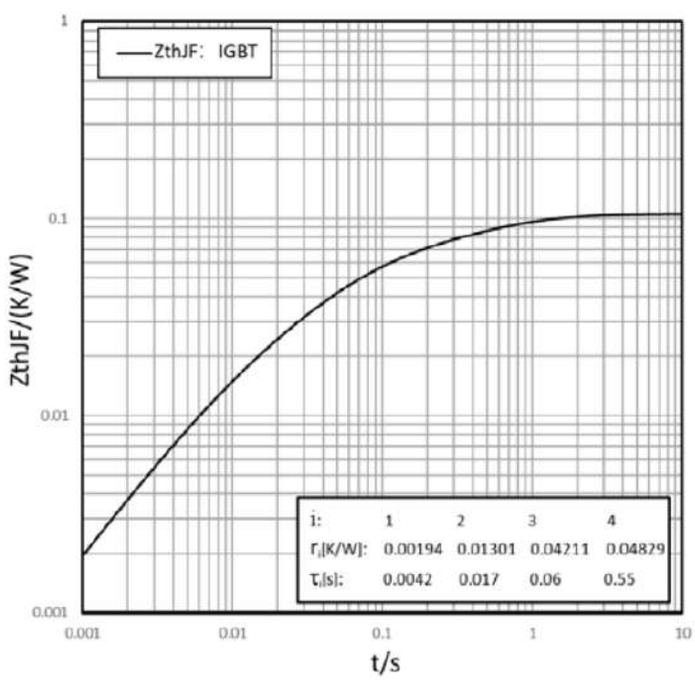
Switching losses IGBT, Inverter(typical)

$E_{on} = E_{off} = f(R_G)$, V_{GE} = +15V/-8V, I_C = 450A, V_{CE} = 600V

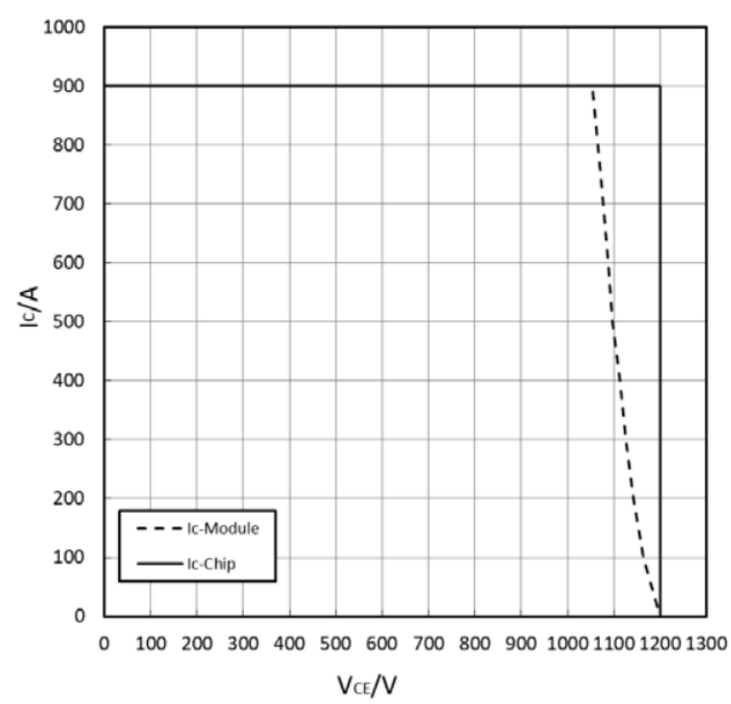


Transient thermal impedance IGBT, Inverter

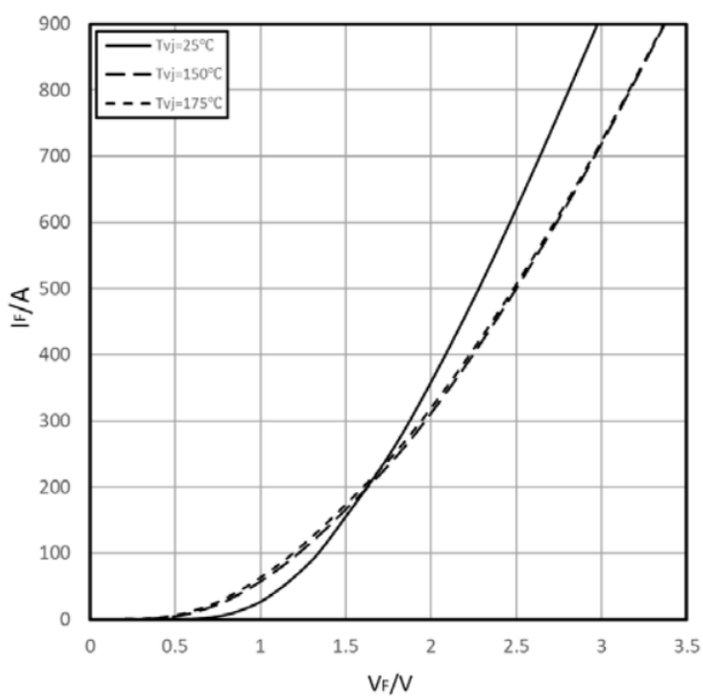
$Z_{thJF} = f(t)$, $\Delta V/\Delta t$ = 10dm³/min, T_F=65℃,
50% water / 50% ethylenglycol



Reverse bias safe operating area IGBT,
Inverter(RBSOA)
$I_C = f(V_{CE})$,V_{GE} = +15V/-8V, R_{Goff} = 5.0Ω, T_{vj} = 150°C

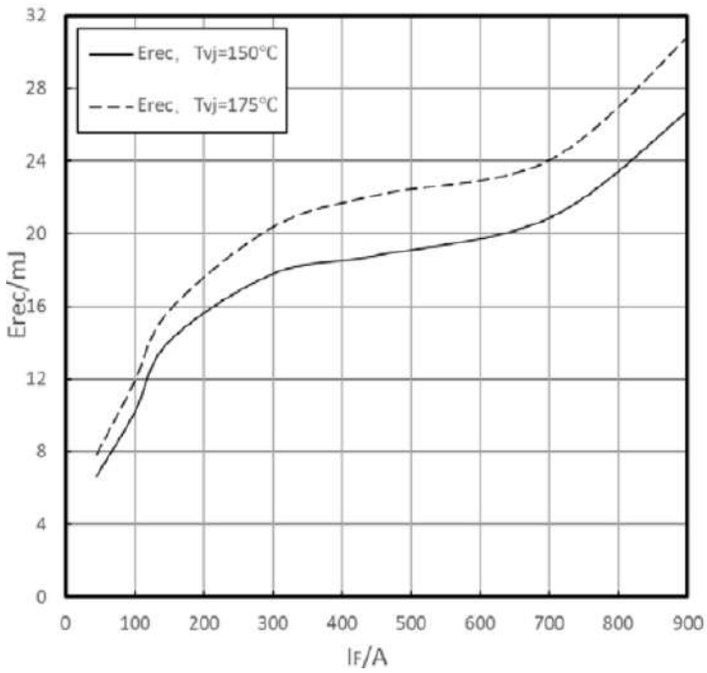


Forward characteristic, Inverter FRD (typical),
Inclusiver $R_{CC'+EE'}$
$I_F = f(V_F)$



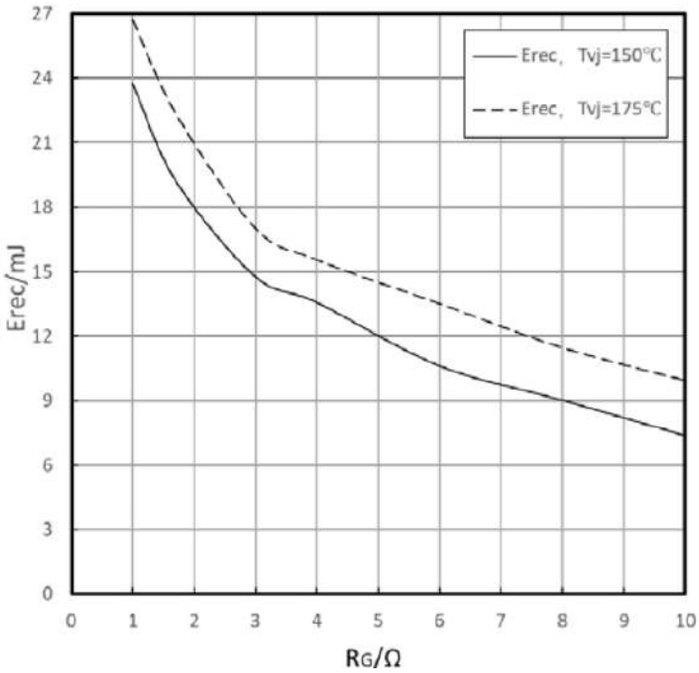
Swiching Losses, Inverter IGBT (typical),

$E_{rec} = f(I_F)$, $R_{Gon} = 1.43\Omega$, $V_{CE} = 600V$



Swiching Losses, Inverter FRD (typical),

$E_{rec} = f(R_G)$, $I_F = 450A$, $V_{CE} = 400V$

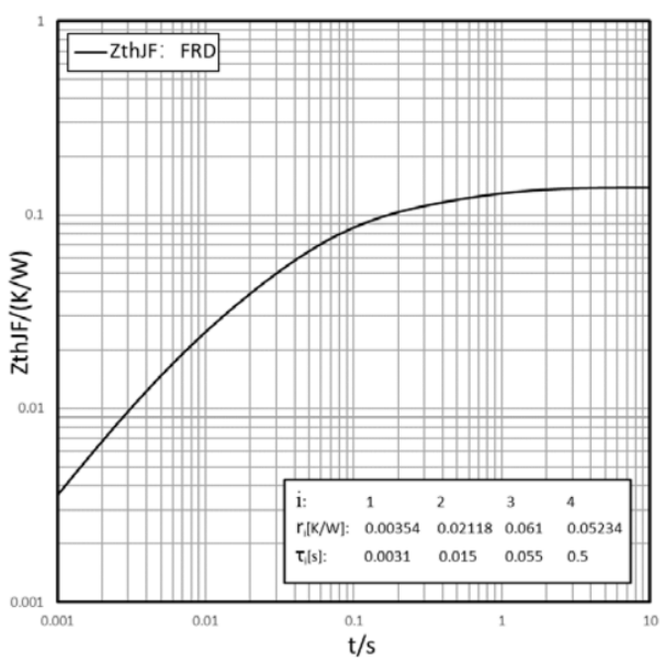


Transient thermal impedance FRD, Inverter

$Z_{thJF}=f(t)$

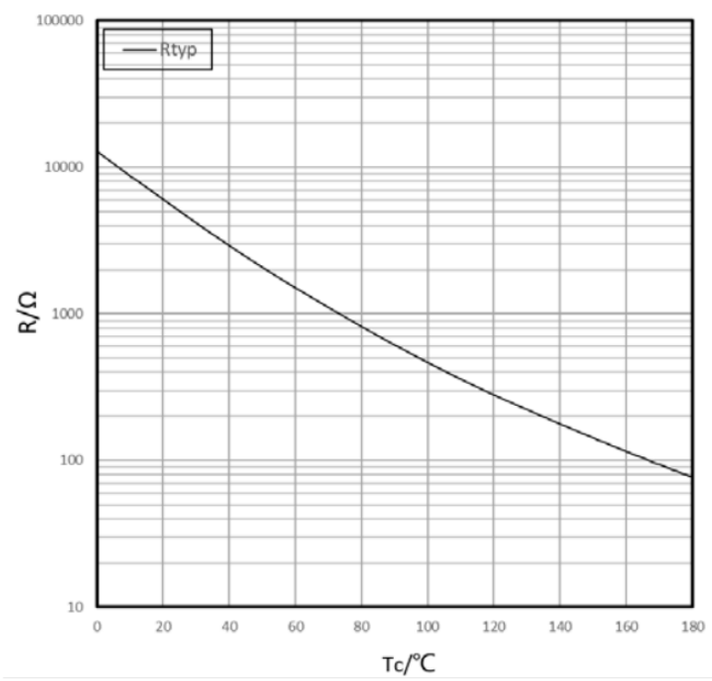
$\Delta V/\Delta t = 10dm^3/min$, $T_F=65℃$,

50% water / 50% ethylenglycol

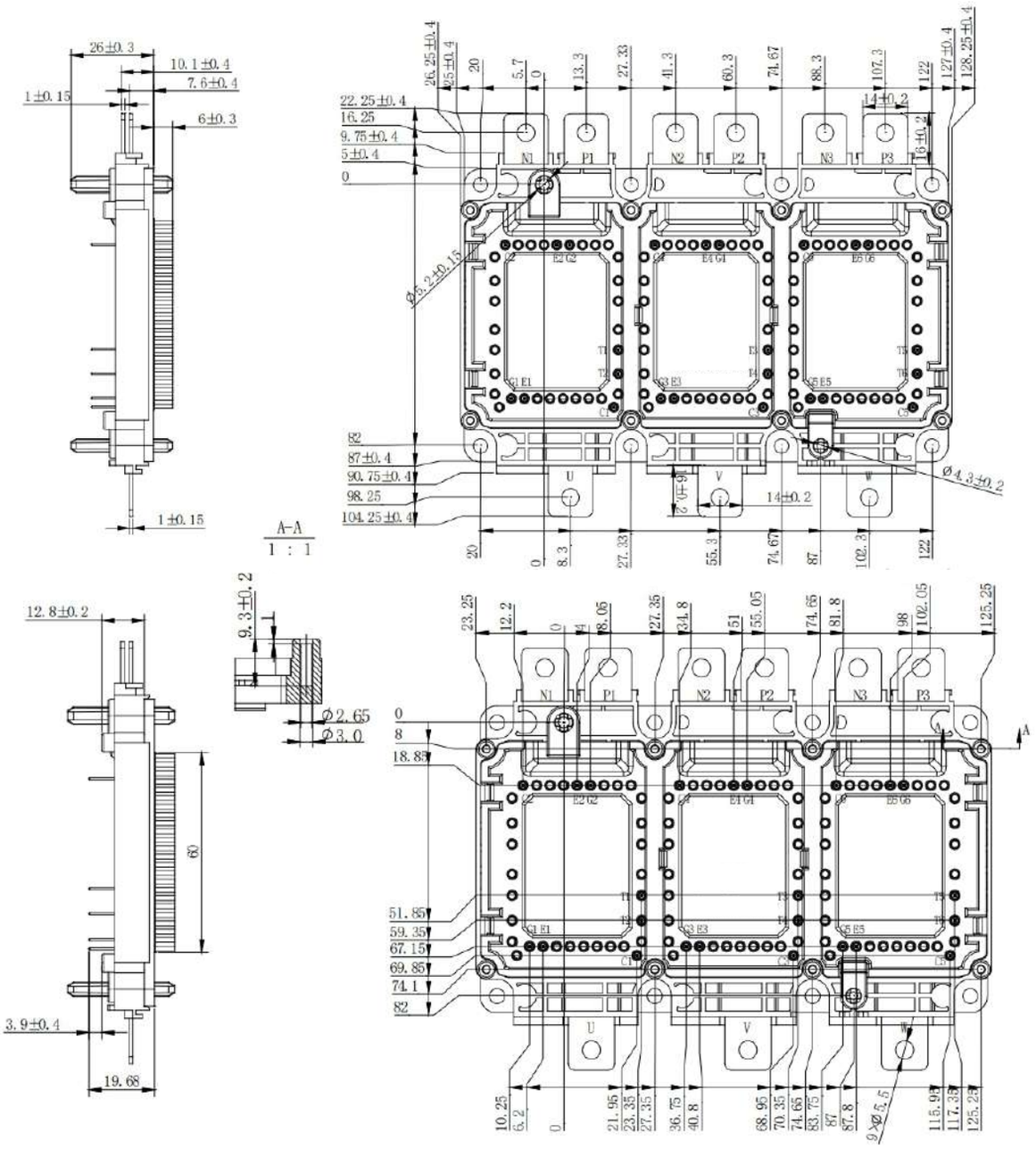


NTC-Thermistor-temperature characteristic

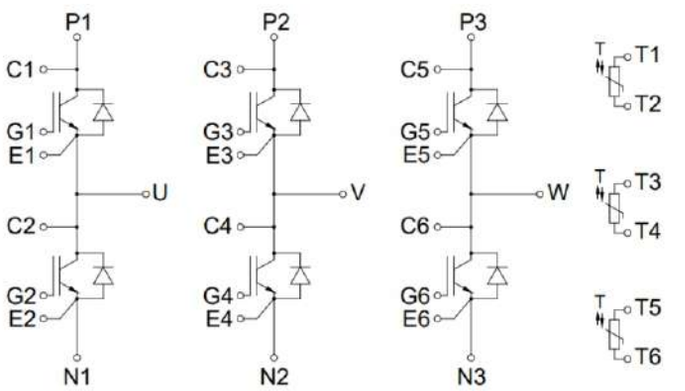
R = f(T)



Package Dimension/
Dimensions in Millimeters



Internal Circuit



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