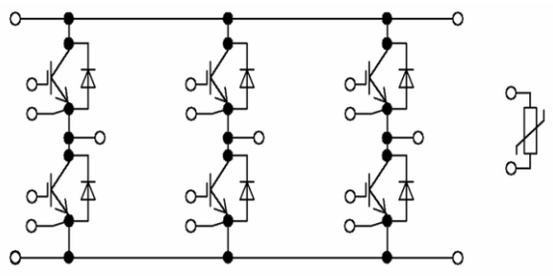
C4 package: 1200V 200A IGBT module



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@25C
- Low dynamic losses

OPTIONS:
*** pre-applied TIM**

Typical Applications:

- Motor drives
- Servo Drives

IGBT, Inverter / IGBT
Maximum Rated Values

Collector-emitter Voltage	T_{vj} = 25℃	V_{CES}	1200	V
Continuous DC collector current		I_{Cnom}	200	A
	T_C = 100℃, T_{vjmax} = 175℃	I_C	230	A
Repetitive Peak Collector Current	I_{CRM} = 2×$I_{C\ nom}$	I_{CRM}	400	A
Gate-emitter Peak Voltage		V_{GES}	±20	V

Characteristic Values

			min.	typ.	max.	
Collector-emitter Saturation Voltage[1)]	I_C = 200A, V_{GE} = 15V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	V_{CEsat}	–	1.50 1.75 1.79	1.70	V
Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 4mA	T_{vj} = 25℃	V_{GEth}	5.5	6.0	7.0	V
Gate charge	V_{GE} = -8V~+15V, V_{CE} = 600V	T_{vj} = 25℃	Q_G	–	1.78	–	μC
Internal Gate Resistor	T_{vj} = 25℃		R_{Gint}	–	3.50	–	Ω
Input Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{ies}	–	42.5	–	nF
Reverse Transfer Capacitance			C_{res}	–	0.12	–	nF
Collector-emitter Cutoff Current	V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 25℃		I_{CES}	–	–	200	mA
Gate-emitter Leakage Current	V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25℃		I_{GES}	–	–	200	nA
Turn-on Delay Time, Inductive Load	I_C = 200A, V_{CE} = 600V V_{GE} = ±15V R_{GON} = 1.5Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_{don}	–	160 190 195	–	ns
Rise Time, Inductive Load	I_C = 200A, V_{CE} = 600V V_{GE} = ±15V R_{GON} = 1.5Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_r	–	50 60 65	–	ns
Turn-off Delay Time, Inductive Load	I_C = 200A, V_{CE} = 600V V_{GE} = ±15V R_{Goff} = 2.5Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	tdoff	–	265 290 310	–	ns
Fall Time, Inductive Load	I_C = 200A, V_{CE} = 600V V_{GE} = ±15V R_{Goff} = 2.5Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	t_f	–	140 220 270	–	ns
Turn-on Energy Loss per Pulse	I_C = 200A, V_{CE} = 600V V_{GE} = ±15V, R_{GON} = 1.5Ω di/dt = 2400 A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{on}	–	12.5 22.0 26.0	–	mJ
Turn-off energy Loss per Pulse	I_C = 200A, V_{CE} = 600V, V_{GE} = ±15V, R_{Goff} = 2.5Ω dv/dt = 7100 A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{off}	–	15.5 21.5 23.5	–	mJ
SC Data	V_{CE} = 800V, V_{GE} = ±15V	t_P ≤ 8μs, T_{vj} = 150℃ t_P ≤ 8μs, T_{vj} = 175℃	I_{sc}	–	610 600	–	A

Thermal Resistance, junction to Case	Per IGBT	R_{thJC}	-	0.135	-	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}	200		A
Repetitive Peak Forward Current	I_{FRM}=2×$I_{F\ nom}$	I_{FRM}	400		A

Characteristic Values

				min.	typ.	max.	
Forward Voltage [1)]	I_F = 200A, V_{GE} = 0V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	V_F	-	2.08 2.20 2.20	2.40	V
Peak Reverse Recovery Current	I_F = 200A, V_R = 600V -di_F/dt = 2380 A/us (T_{vj} = 175℃) V_{GE} = −15V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	I_{RM}	-	145 145 165	-	A
Recovery Charge	I_F = 200A, V_R = 600V -di_F/dt = 2380 A/us (T_{vj} = 175℃) V_{GE} = −15V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	Q_R	-	8.30 12.5 19.5	-	µC
Reverse Recovery Energy	I_F = 200A, V_R = 600V -di_F/dt = 2380 A/us (T_{vj} = 175℃) V_{GE} = −15V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 175℃	E_{rec}	-	2.10 5.50 8.50	-	mJ
Thermal Resistance, junction to Case	PerDiode		R_{thJC}	-	0.194	-	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	T_C = 100℃, R_{100} = 465Ω	△R/R	-7.3	-	7.3	%
Power Dissipation	T_{NTC} = 25℃	P_{25}	-	-	10	mW
B-Value	$R_2 = R_{25}\ exp[B_{25/50}(1/T_2-1/(298.15K))]$	$B_{25/50}$	-	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

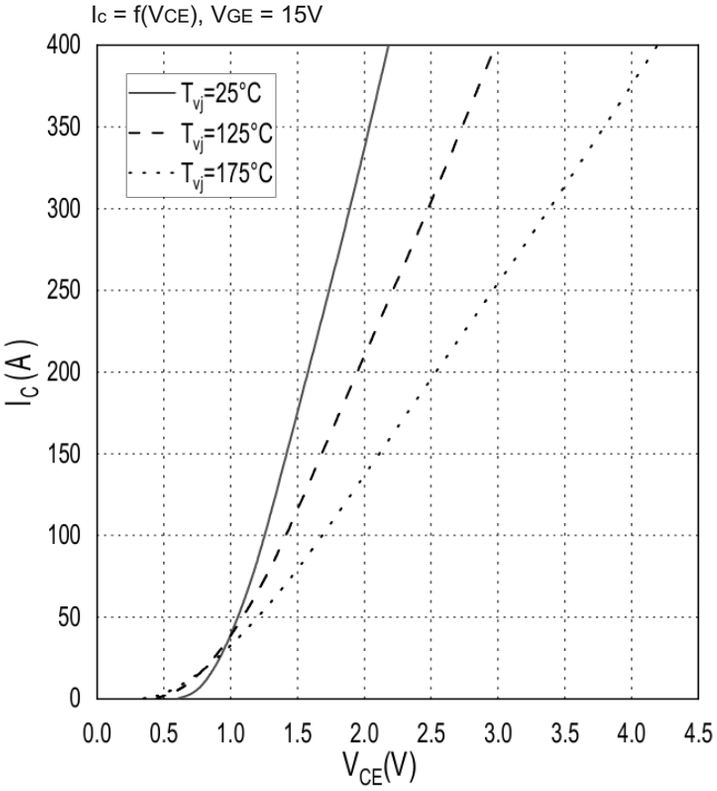
Isolation Test Voltage	RMS, f=50Hz, t=1 min	V_{ISOL}	3.0	kV
Material of Module Baseplate			Cu	
Internal Isolation	Basic insulation (class1,IEC 61140)		Al_3O_4	
Creepage Distance	Terminal to heatsink Terminal to terminal		10.0	mm
Clearance	Terminal to heatsink Terminal to terminal		7.5	mm
Comparative Tracking Index[3)]		CTI	>200	

			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	27	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25°C, Per Switch	$R_{CC'+EE'}$	-	1.5	-	mΩ
Storage Temperature		T_{stg}	-40	-	125	°C
Module Mounting torque	M5	M	1.8	-	2.2	Nm
Weight		G	-	760	-	g

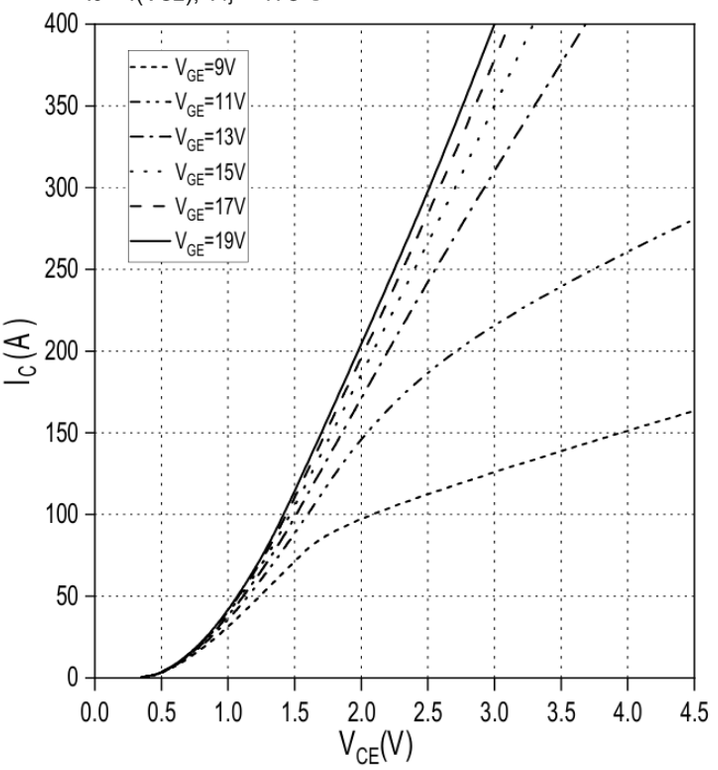
1) Terminal impedance is not included.
2) $T_{vj\ op}$ > 150 °C is only allowed for operation at overload conditions.
3) CTI is about 200

Circuit Diagram

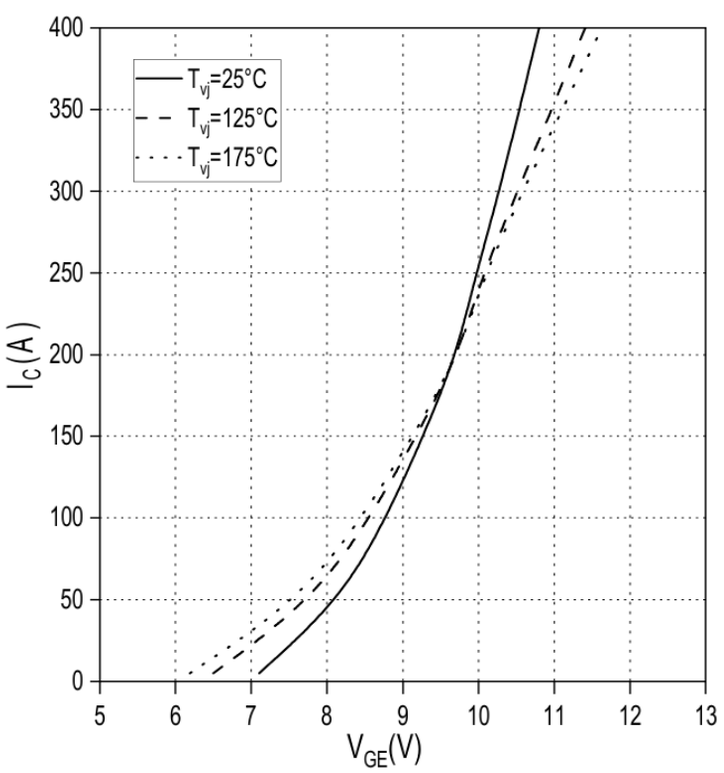
Output characteristic IGBT, Inverter (typical)
$I_C = f(V_{CE})$, V_{GE} = 15V



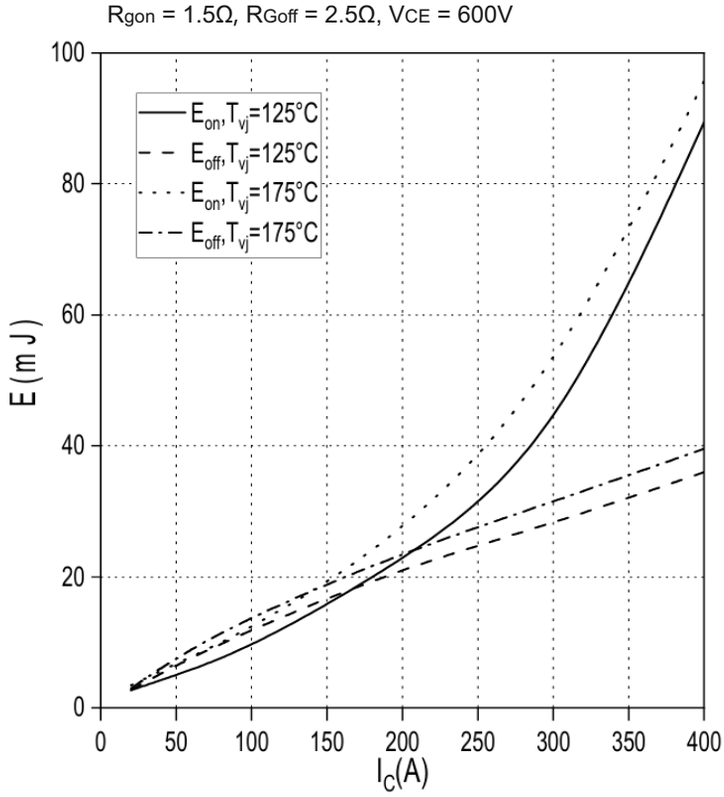
Output characteristic IGBT, Inverter (typical)
$I_C = f(V_{CE})$, T_{vj} = 175°C



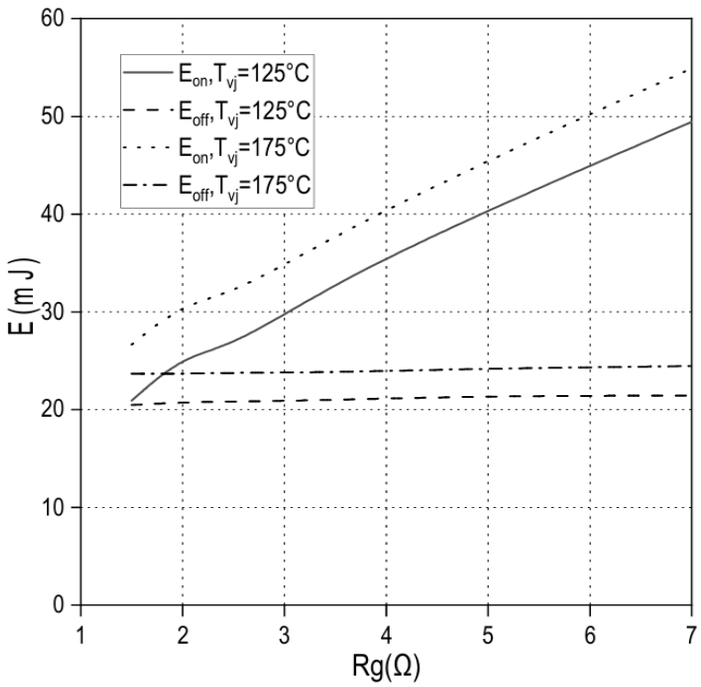
Transfer characteristic IGBT, Inverter(typical),
$I_C = f(V_{GE})$,V_{CE} = 20V



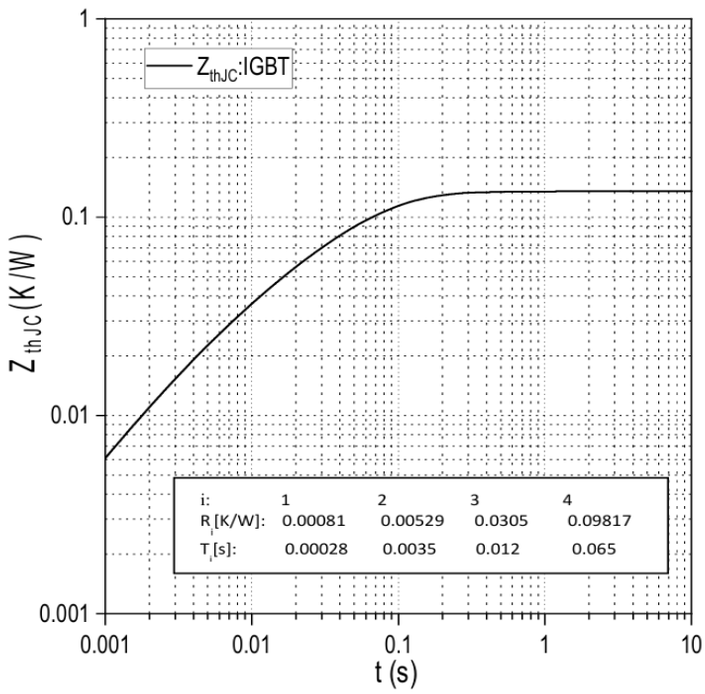
Switching losses IGBT, Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$, V_{GE} = ±15V,
R_{gon} = 1.5Ω, R_{Goff} = 2.5Ω, V_{CE} = 600V



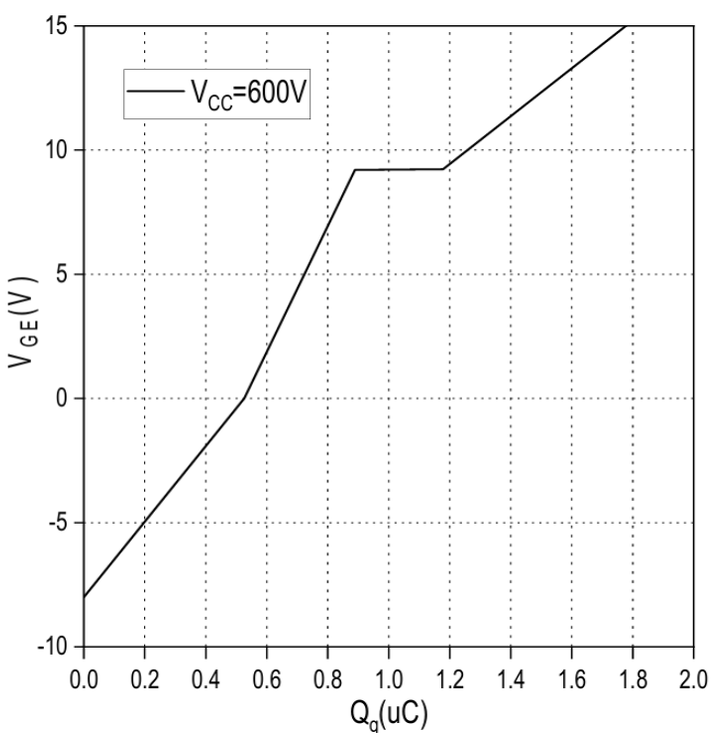
Switching losses IGBT, Inverter(typical)
E = f(R_G), V_{GE} = ±15V, I_C = 200A, V_{CE} = 600V



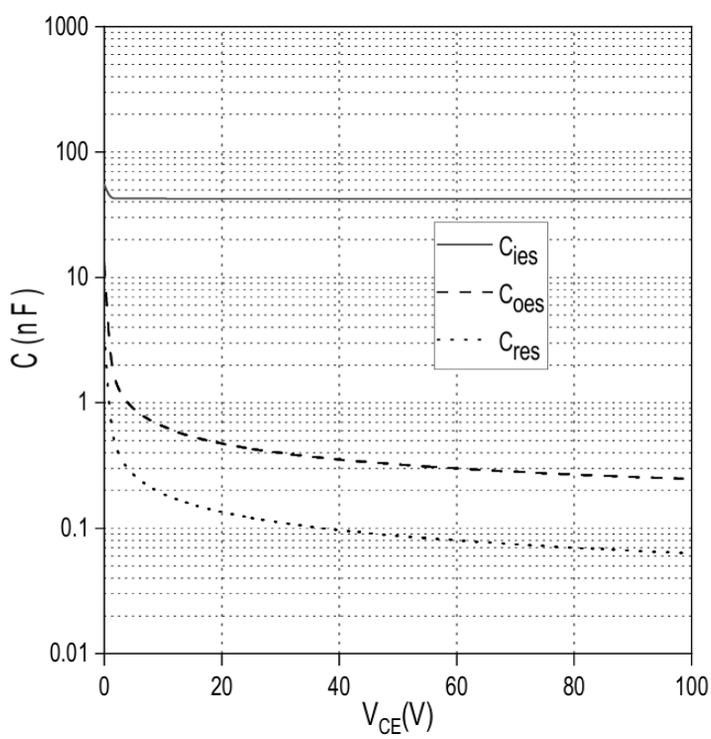
Transient thermal impedance IGBT, Inverter
Z_{thJC} = f(t)



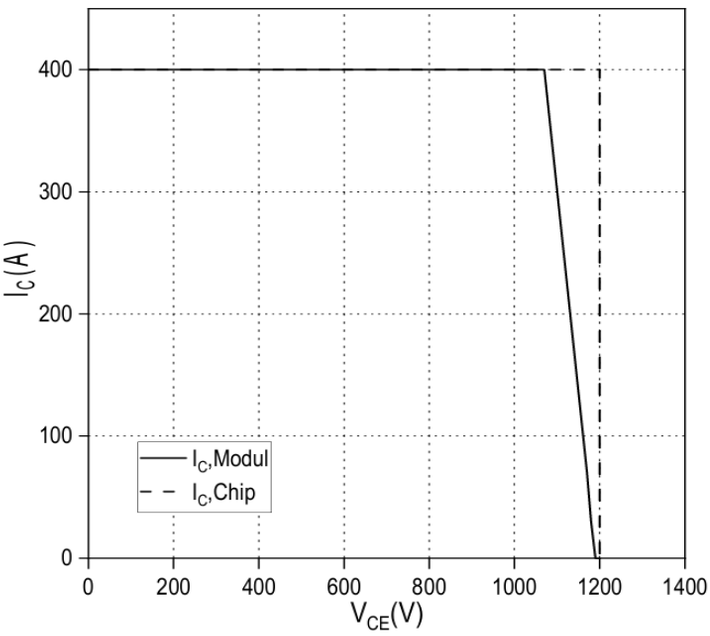
Gate charge characteristic, IGBT, Inverter (typical)
V_{GE} = f(Q_G)
I_C = 200 A, T_{vj} = 25 °C



Capacity characteristic, IGBT, Inverter (typical)
C = f(VCE)
f = 100 kHz, V_{GE} = 0 V, T_{vj} = 25 °C

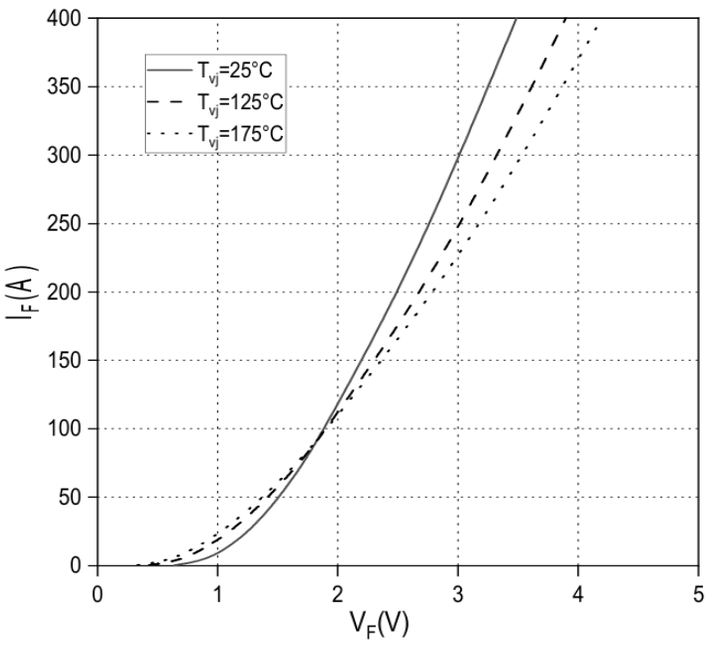


Reverse bias safe operating area IGBT, Inverter
(RBSOA) $I_C = f(V_{CE})$,
$V_{GE} = \pm 15V, R_{Goff} = 2.5\Omega, T_{vj} = 175°C$

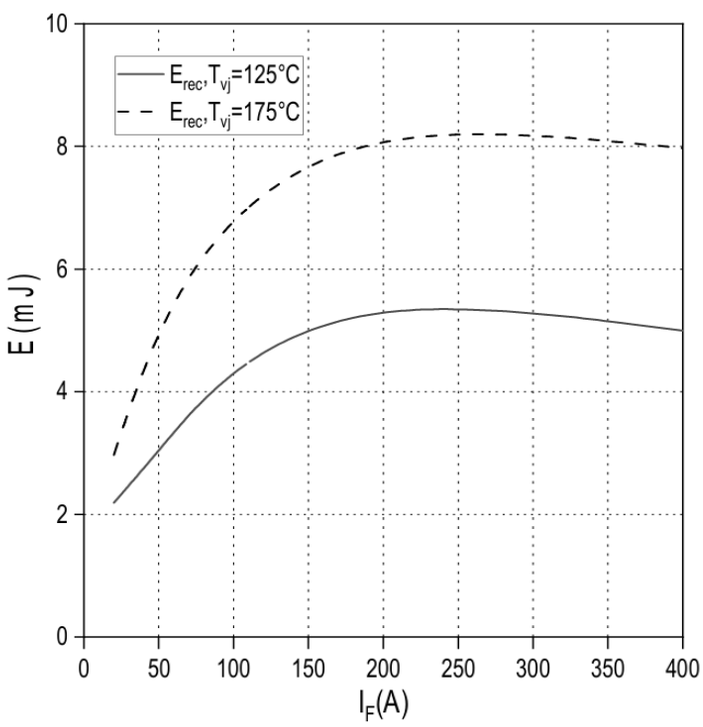


Forward characteristic of Diode, Inverter (typical)

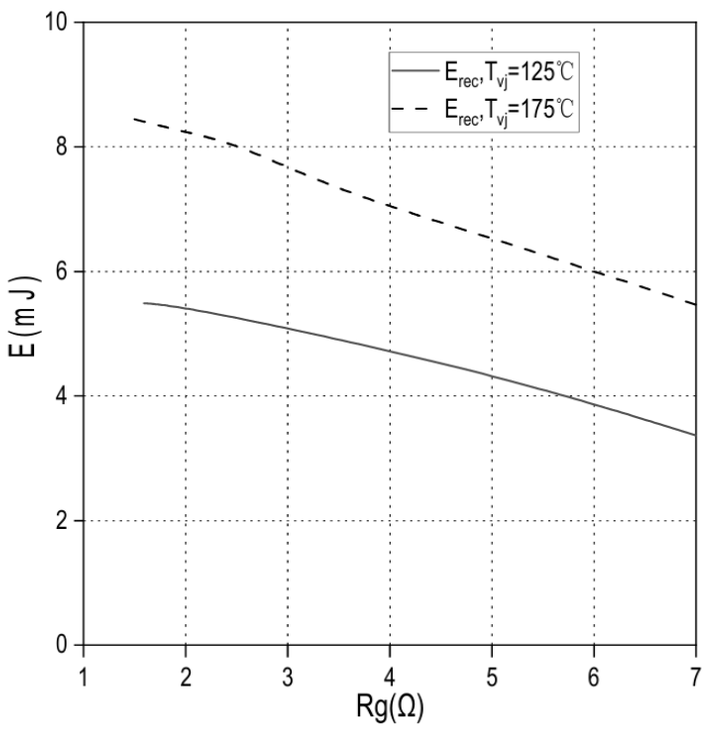
$I_F = f(V_F)$



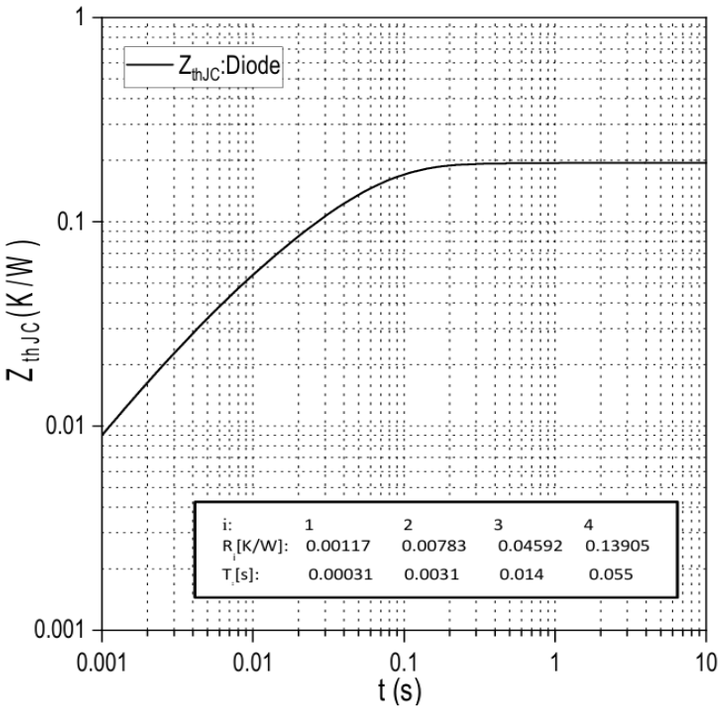
Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 1.5\Omega, V_{CE} = 600V$



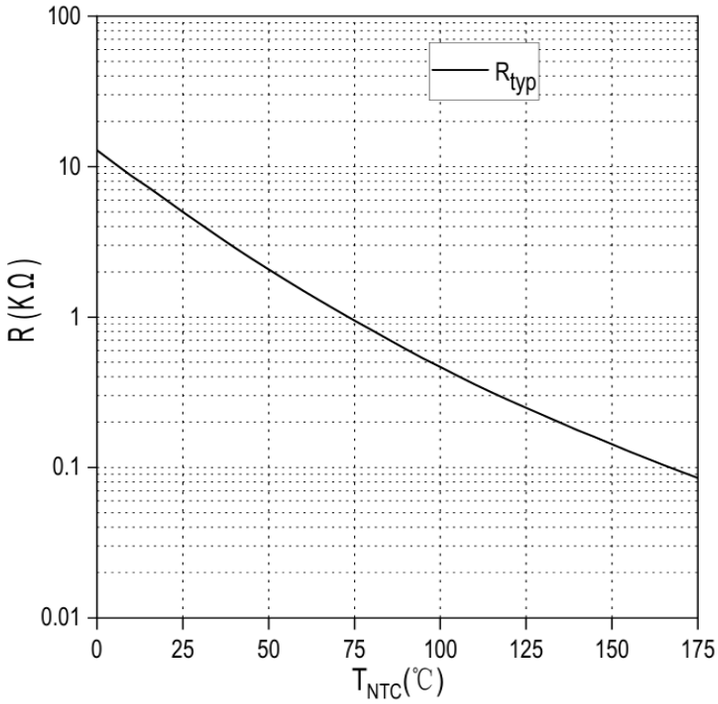
Switching losses Diode, Inverter (typical)
$E_{rec} = f(Rg)$
$I_F = 200A, V_{CE} = 600V$



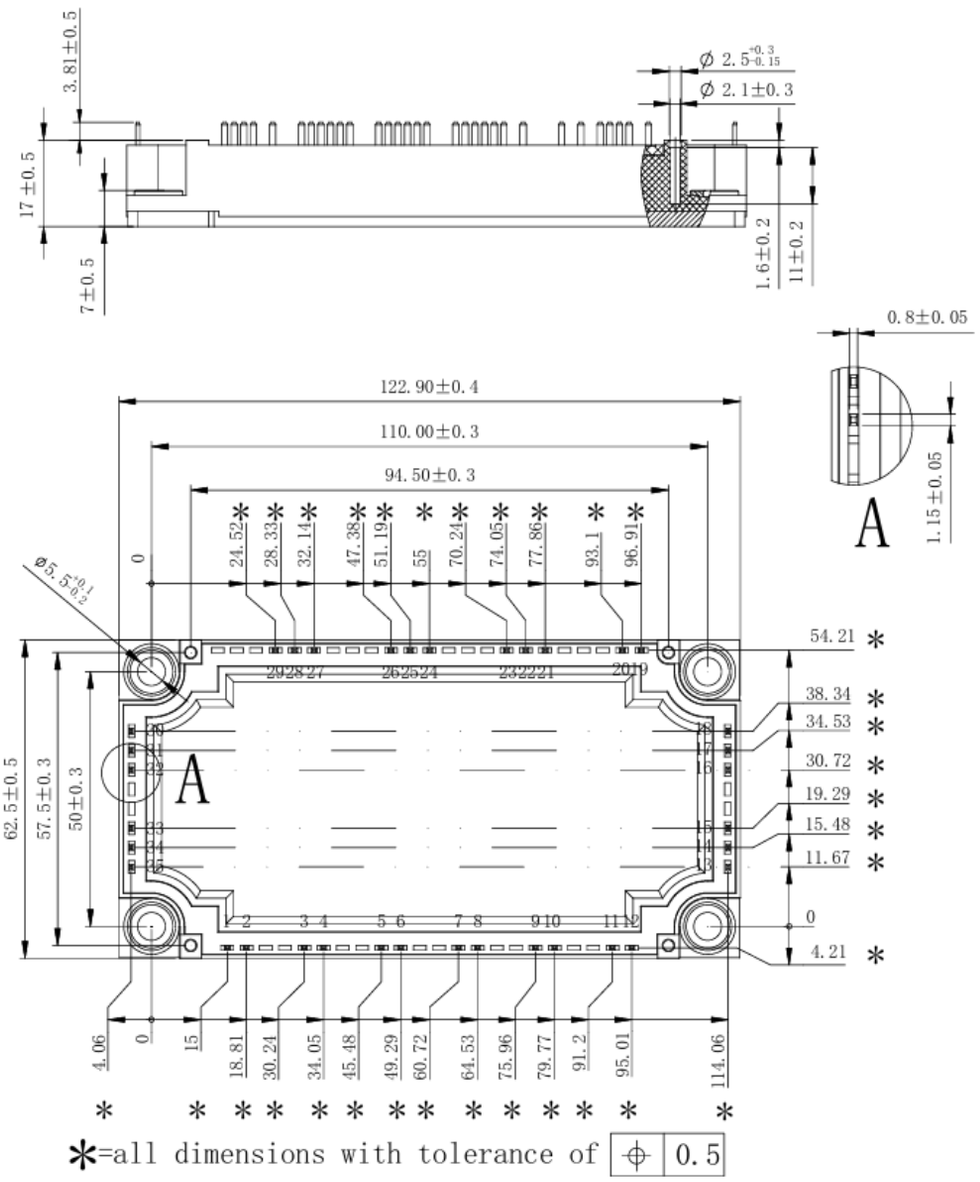
Transient thermal impedance Diode , Inverter
$Z_{thJC} = f(t)$



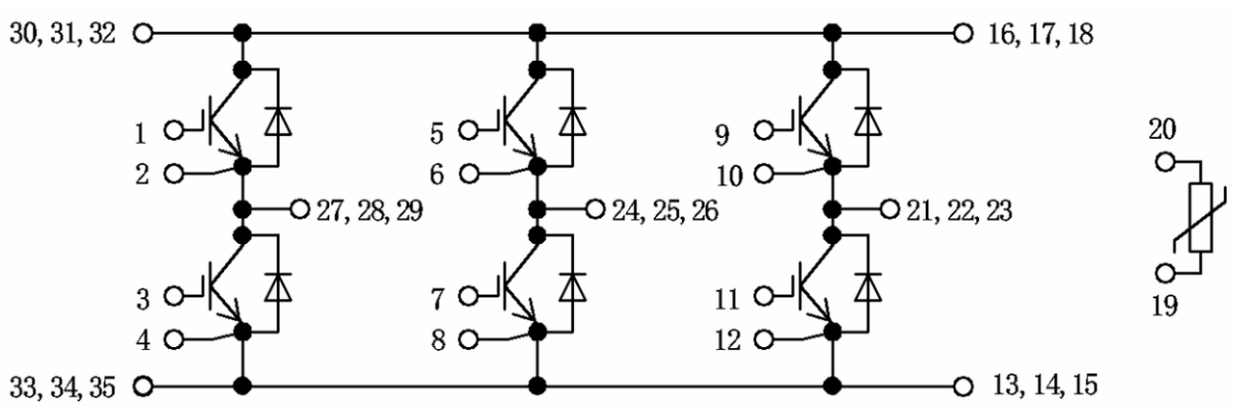
NTC-Thermistor-temperature characteristic
$R = f(T_{NTC})$



Package Dimension/
Dimensions in Millimeters



Internal Circuit



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