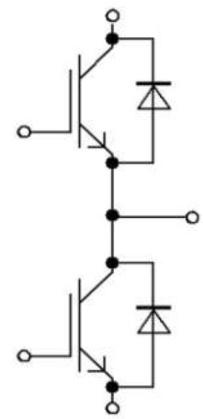
C2 series package: 1200V 600A IGBT module **Datasheet**



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:

- High Power Converters
- Motor Drives
- Uninterrupted Power Supply
- Photovoltaic

IGBT, Inverter / IGBT
Maximum Rated Values

Collector-emitter Voltage	T_{vj} = 25℃	V_{CES}	1200	V
Continuous DC Collector Current		I_{Cnom}	600	A
	T_C = 80℃, $T_{vj\,max}$ = 175℃	I_C	715	A
Repetitive Peak Collector Current	I_{CRM} = 2 x I_{cnom}	I_{CRM}	1200	A
Total Power Dissipation	T_C = 25℃, $T_{vj\,max}$ = 175℃	P_{tot}	2640	W
Gate-emitter Peak Voltage		V_{GES}	±20	V

Characteristic Values

				min.	typ.	max.	
Collector-emitter Saturation Voltage[1)]	I_C = 600A, V_{GE} = 15V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	V_{CEsat}		1.50 1.71 1.87 1.93	1.70	V
Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 22.8mA, T_{vj} = 25℃		V_{GEth}	5.0	6.0	7.0	V
Gate Charge	V_{GE} = -8V/15V, V_{CE} = 600V, T_{vj} = 25℃		Q_G	-	5.6	-	μC
Internal Gate Resistor	T_{vj} = 25℃		R_{Gint}	-	0.85	-	Ω
Input Capacitance	V_{CE} = 25V, V_{GE} = 0V f = 100kHz, T_{vj} = 25℃		C_{ies}	-	143	-	nF
Reverse Transfer Capacitance			C_{res}	-	0.35	-	nF
Collector-emitter Cutoff Current	V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 25℃		I_{CES}	-	-	100	μA
Gate-emitter Leakage Current	V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25℃		I_{GES}	-	-	100	nA
Turn-on Delay Time, Inductive Load	I_C = 600A, V_{CE} = 600V V_{GE} = 15V/-8V R_{gon} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_{don}	-	372 380 380 390	-	ns
Rise Time, Inductive Load	I_C = 600A, V_{CE} = 600V V_{GE} = 15V/-8V R_{gon} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_r	-	78 91 95 100	-	ns
Turn-off Delay Time, Inductive Load	I_C = 600A, V_{CE} = 600V V_{GE} = 15V/-8V R_{Goff} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_{doff}	-	593 635 635 650	-	ns
Fall Time, Inductive Load	I_C = 600A, V_{CE} = 600V V_{GE} = 15V/-8V R_{Goff} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_f	-	89 156 168 190	-	ns
Turn-on Energy Loss per Pulse	I_C = 600A, V_{CE} = 600V, $L_σ$ = 40nH, V_{GE} = 15V/-8V, R_{Gon} = 1.0Ω, di/dt = 4100A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{on}	-	48.2 70.0 74.0 82.0	-	mJ
Turn-off energy Loss per Pulse	I_C = 600A, V_{CE} = 600V, $L_σ$ = 40nH, R_{Goff} = 1.5Ω V_{GE} = 15V/-8V, dv/dt = 4200V/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{off}	-	50.7 68.0 70.0 74.0	-	mJ

SC Data	V_{CE} = 600V, V_{GE} = 15V/-8V; t_p ≤ 8us, T_{vj}=25℃	I_{SC}			3450	A
	t_p ≤ 8us, T_{vj}=150℃				2650	
Thermal Resistance, Junction to Case	Per IGBT / IGBT	R_{thJC}	-	0.056	-	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_F	600	A
Repetitive Peak Forward Current	I_{CRM} = 2 x I_{fnom}	I_{FRM}	1200	A

Characteristic Values

				min.	typ.	max.	
Forward Voltage[1)]	I_F = 600A, V_{GE} = 0V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	V_F		1.90 1.87 1.80 1.72	2.40	V
Peak Reverse Recovery Current	I_F = 600A, V_R = 600V -di_F/dt = 6300A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	I_{RM}	-	300 360 370 385	-	A
Recovery Charge	I_F = 600A, V_R = 600V -di_F/dt = 6300A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	Q_R	-	28.0 56.5 67.5 79.5	-	uC
Reverse Recovery Energy	I_F = 600A, V_R = 600V -di_F/dt = 6300A/us (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{rec}	-	13.0 27.0 33.5 40.0	-	mJ
Thermal Resistance, Junction to Case	Per Doide / Diode		R_{thJC}	-	0.082	-	K/W
Temperature under Switching Conditions[2)]			$T_{vj\ op}$	-40	-	175	℃

Module

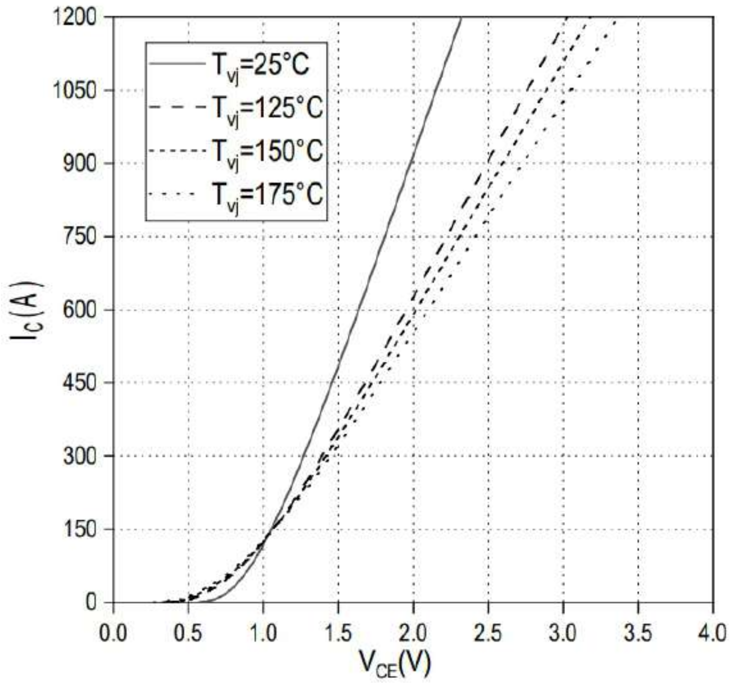
Isolation Test Voltage	RMS, f = 50Hz, t = 1min	V_{ISOL}	3.0	kV
Material of Module Baseplate			Cu	
Internal Isolation	(class 1, IEC 61140) Basic insulation (class 1, IEC 61140)		AL_2O_3	
Creepage Distance	Terminal to heatsink Terminal to terminal		29.0 23.0	mm
Clearance	Terminal to heatsink Terminal to terminal		23.0 11.0	mm
Comparative Tracking Index		CTI	＞200	

			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	20	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25℃, Per Switch	$R_{CC'+EE'}$	-	0.50	-	mΩ
Storage Temperature		T_{stg}	-40	-	125	℃
Modul MountingTorque	M5	M	4.0	-	6.0	Nm
Terminal MountingTorque	M6	M	4.0	-	6.0	Nm
Weight		G	-	320	-	g

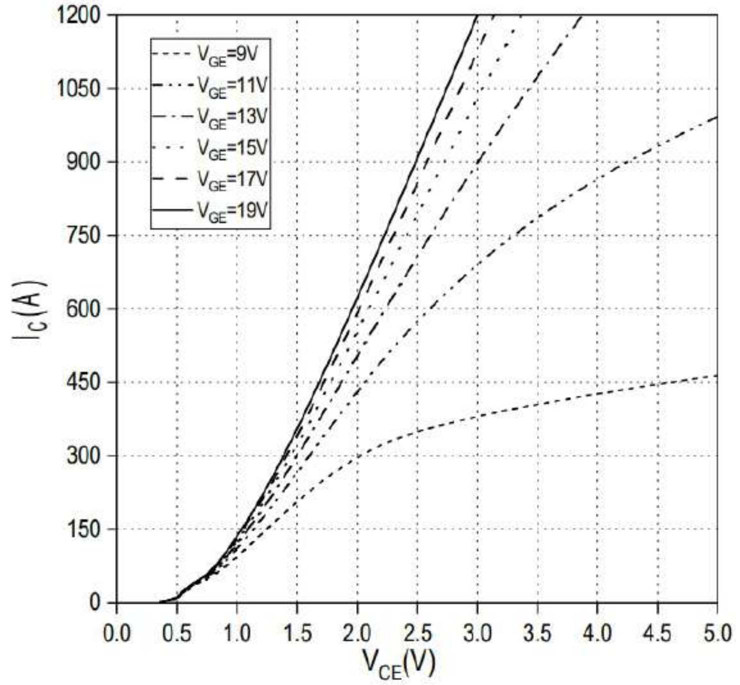
1) Terminal impedance is not included.
2) $T_{vj\ op}$ > 150℃ is allowed for operation at overload conditions.

Circuit Diagram

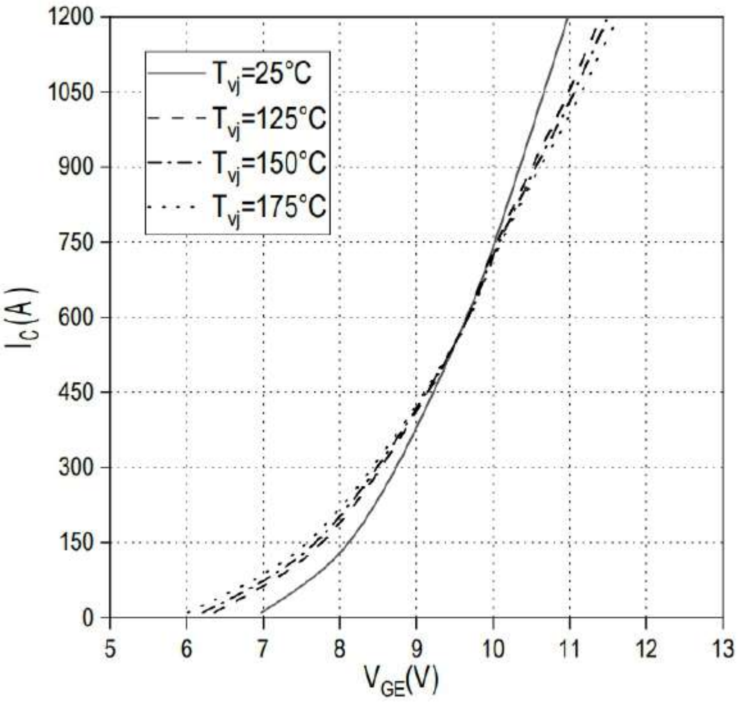
Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $V_{GE} = 15V$



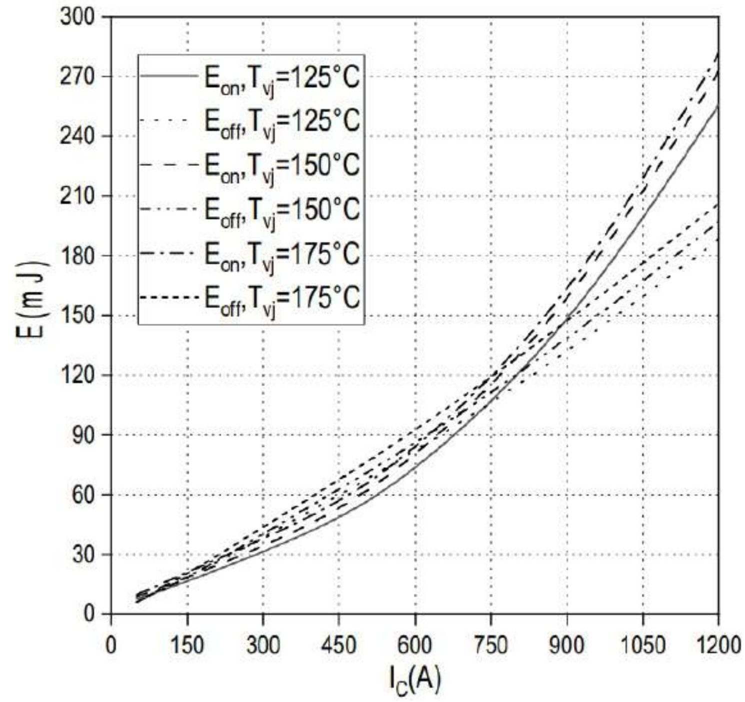
Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $T_{vj} = 175°C$



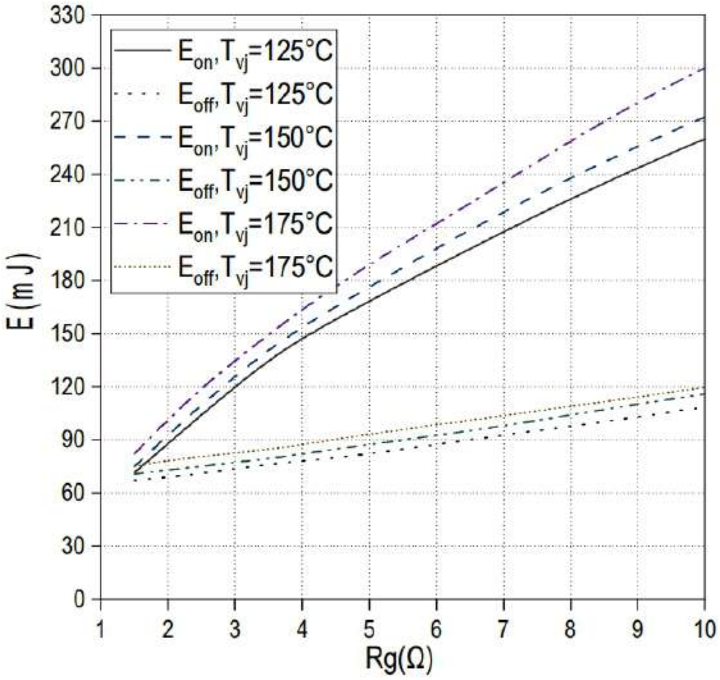
Transfer characteristic IGBT,Inverter(typical), IGBT
$I_C = f(V_{GE})$, $V_{CE} = 20V$



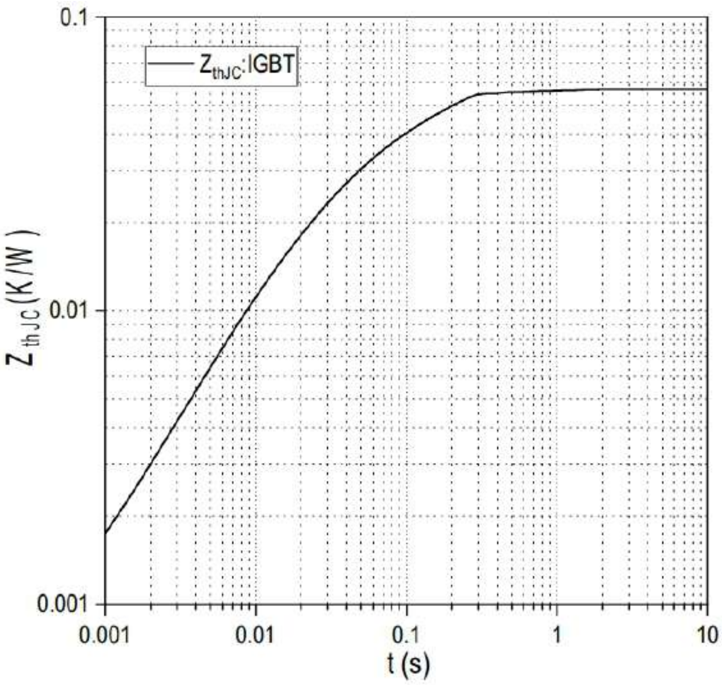
Switching losses IGBT, Inverter (Typical), IGBT
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} =15V/-8V, R_{Gon} = 1.5Ω, R_{Goff} = 4.7Ω, V_{CE} = 600V



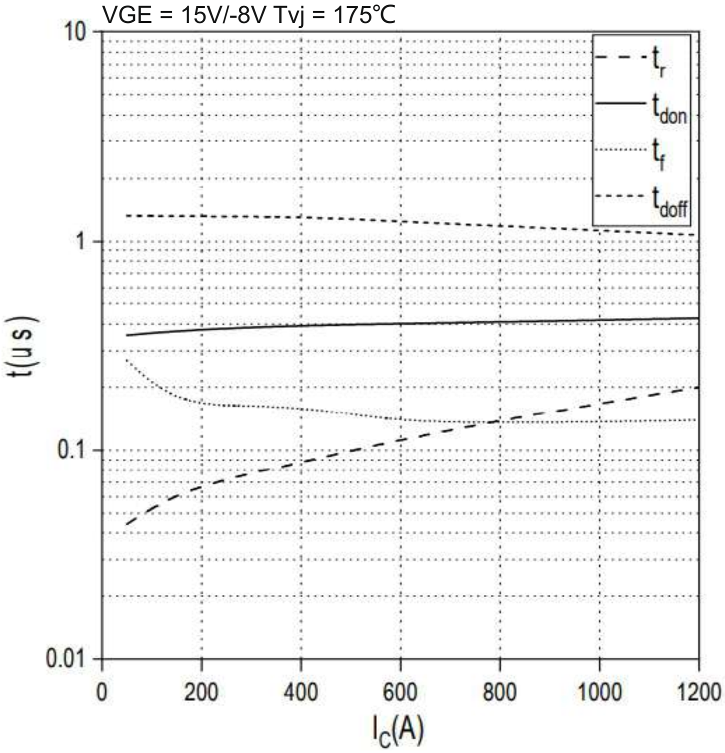
Switching losses IGBT, Inverter (typical), IGBT
V_{GE} =15V/-8V, I_C = 600A, V_{CE} = 600V



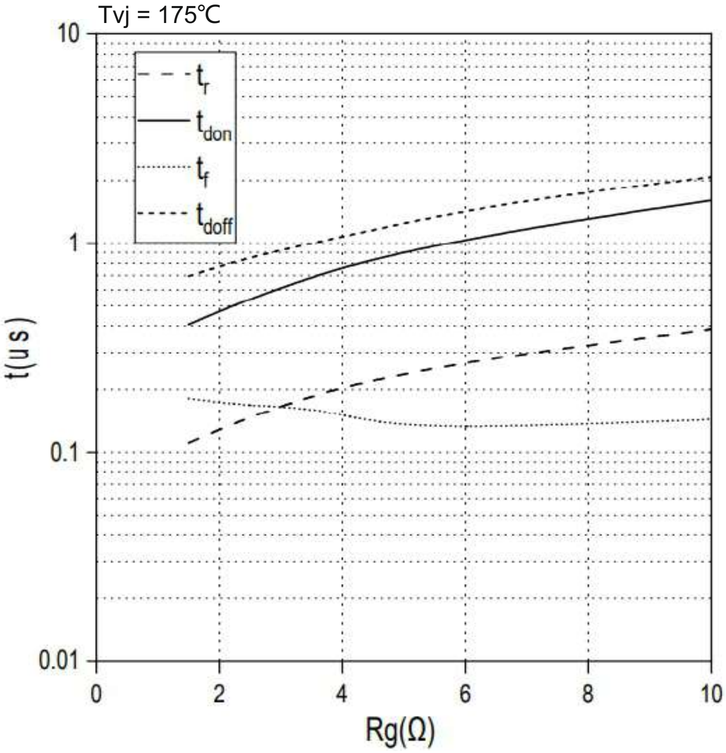
Transient thermal impedance IGBT, Inverter
Z_{thJC} = f(t)



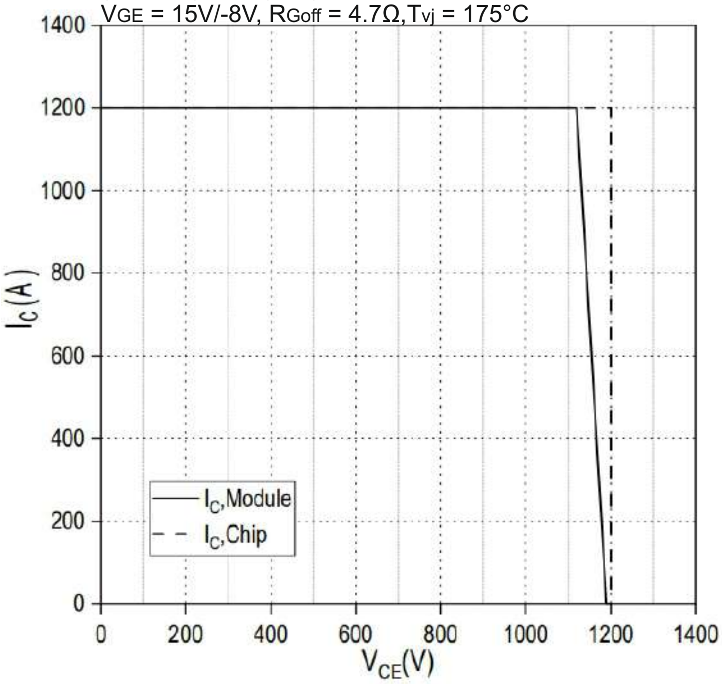
Switching time IGBT, Inverter (typical), IGBT
t = f(I_C)
R_{goff} = 4.7Ω R_{gon} = 1.5Ω V_{CE} = 600V
VGE = 15V/-8V Tvj = 175℃



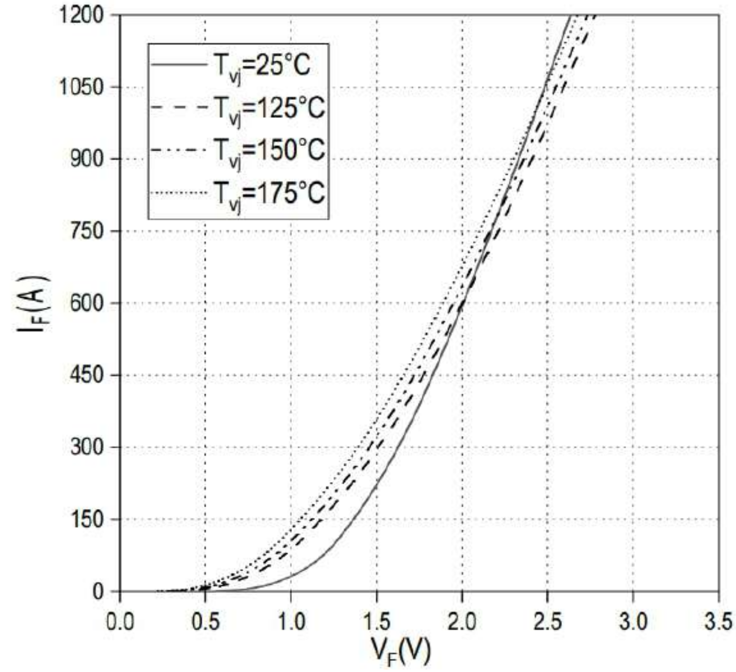
Switching time IGBT, Inverter (typical), IGBT
t = f(R_G)
I_C = 600A,V_{CE} = 600V, V_{GE} = 15V/-8V
Tvj = 175℃



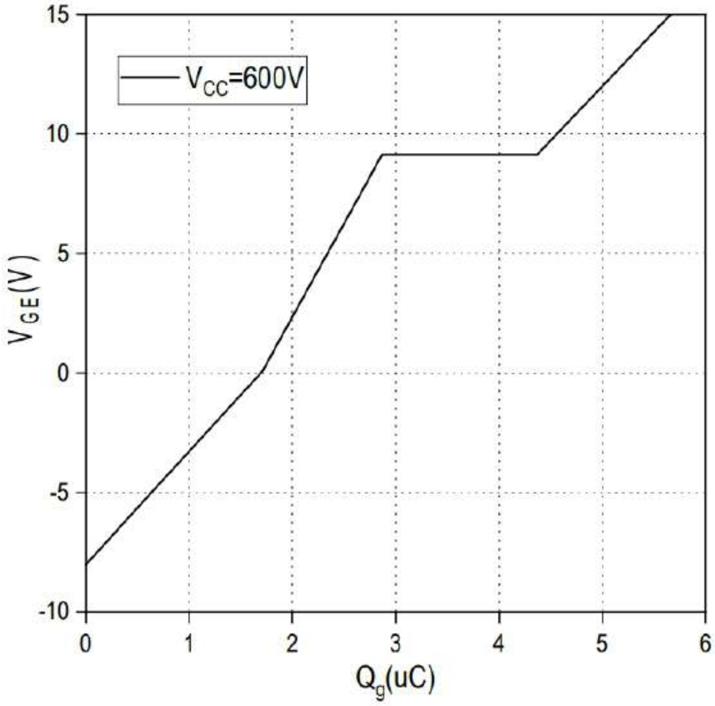
Reverse bias safe operating area IGBT, Inverter
(RBSOA) $I_C = f(V_{CE})$,
V_{GE} = 15V/-8V, R_{Goff} = 4.7Ω, T_{vj} = 175°C



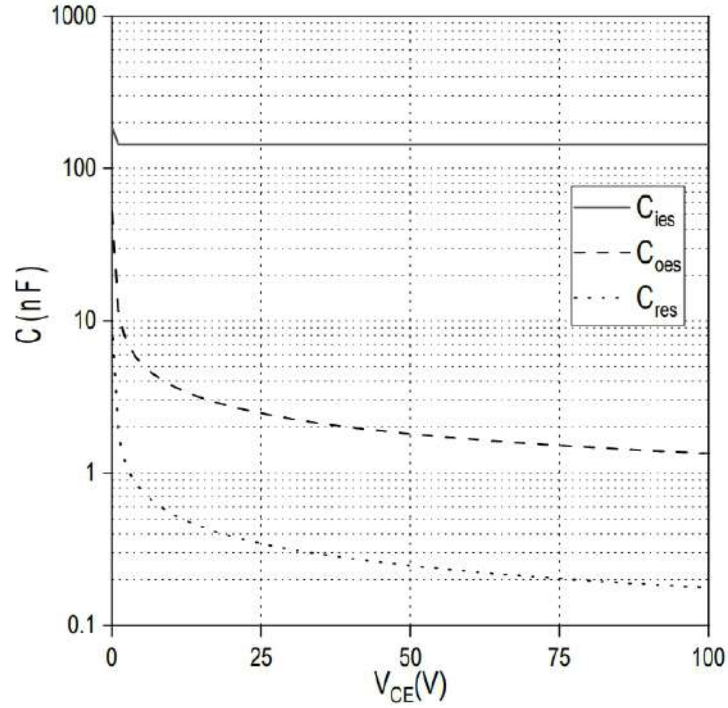
Forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



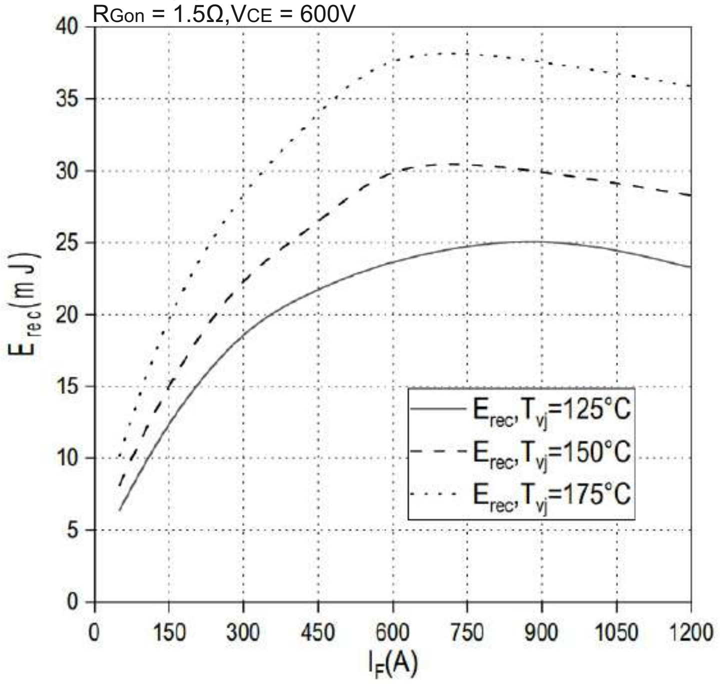
Gate charge characteristic, IGBT, Inverter (typical)
$V_{GE} = f(Q_g)$
IC = 600A, T_{vj} = 25°C



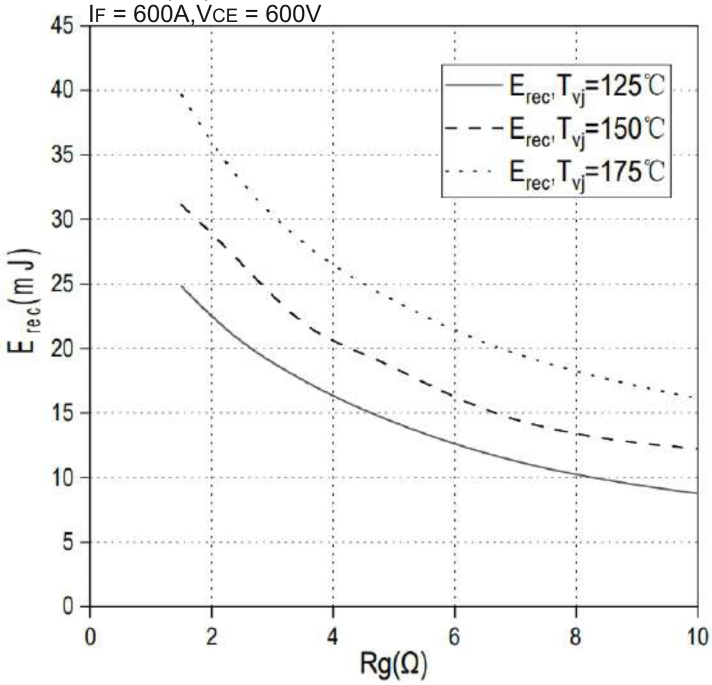
Capacity characteristic, IGBT, Inverter (typical)
$C = f(V_{CE})$
f = 100kHz, V_{GE} = 0 V, T_{vj} = 25°C



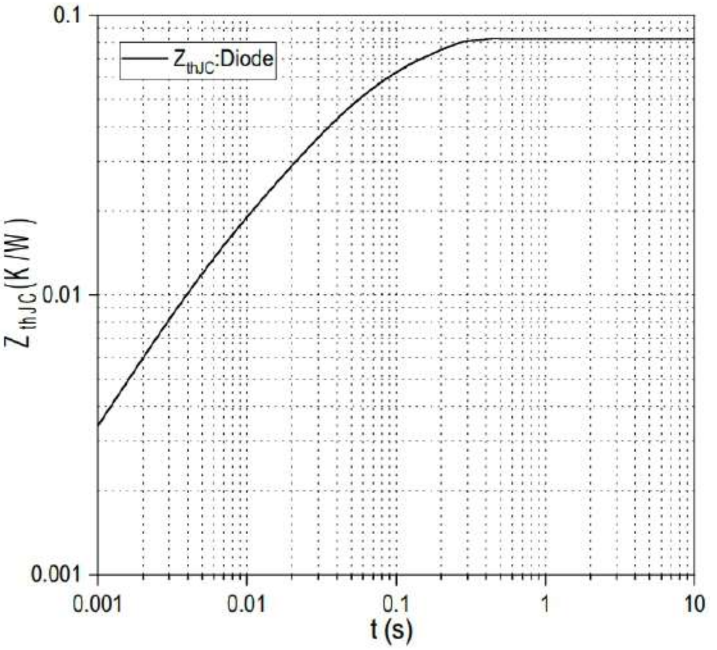
Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 1.5\Omega, V_{CE} = 600V$



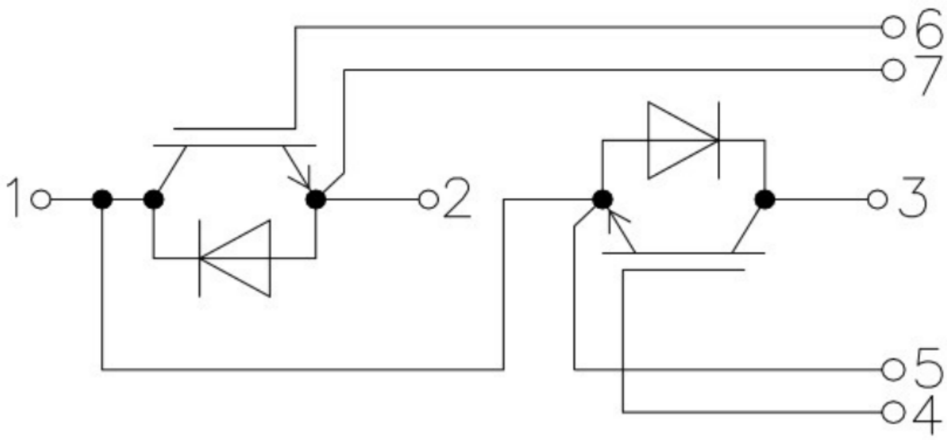
Switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 600A, V_{CE} = 600V$



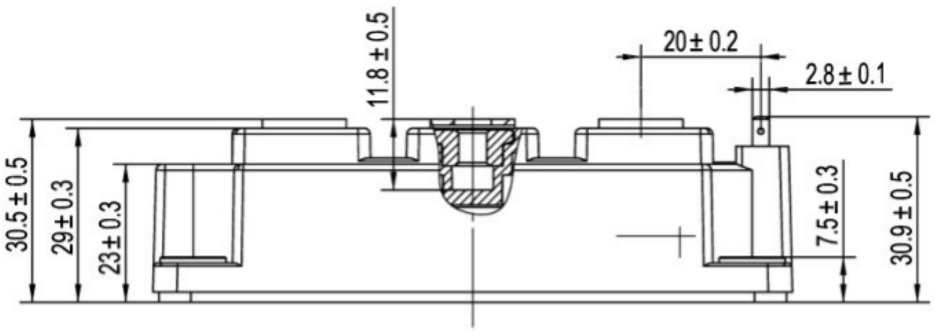
Transient thermal impedance Diode , Inverter
$Z_{thJC} = f(t)$

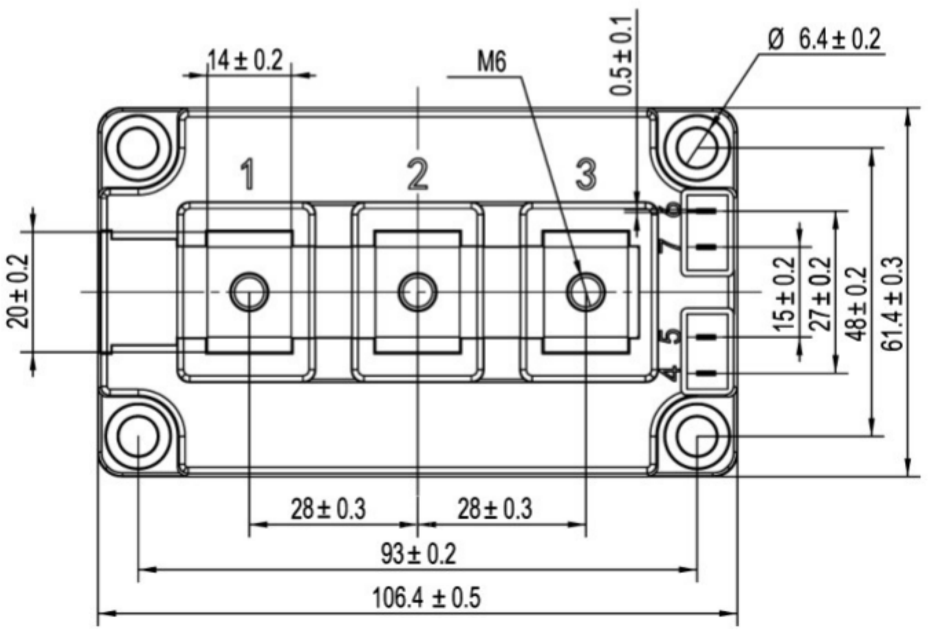


Internal Circuit



Package Dimension
Dimensions in Millimeters





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