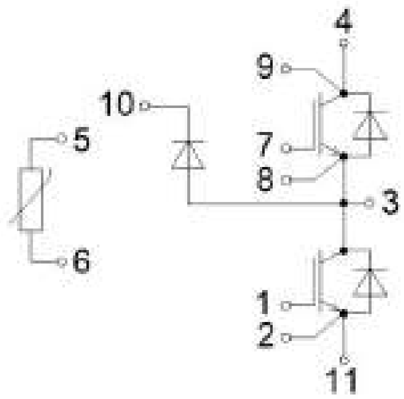
C5 series package: 1200V 450A IGBT module **Datasheet**



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:

- 3L NPC inverters
- Motor drives
- Energy Storage

IGBT, Inverter / IGBT
Maximum Rated Values

Collector-emitter Voltage	T_{vj} = 25℃	V_{CES}	1200	V
Continuous DC Collector Current		I_{Cnom}	450	A
	T_C = 100℃, $T_{vj\,max}$ ≤ 175℃	I_C	500	A
Repetitive Peak Collector Current	t_p $T_{vj\,op}$	I_{CRM}	900	A
Total Power Dissipation	T_C = 25℃, $T_{vj\,max}$ = 175℃	P_{tot}	2344	W
Gate-emitter Peak Voltage		V_{GES}	±20	V

Characteristic Values

				min.	typ.	max.	
Collector-emitter Saturation Voltage[1)]	I_C = 450A, V_{GE} = 15V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_{CEsat}	1.40	1.50 1.76 1.84	1.70	V
Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 24mA, T_{vj} = 25℃		V_{GEth}	5.0	6.0	7.0	V
Gate Charge	V_{GE} = -10V/15V, V_{CE} = 600V		Q_G	-	4.1	-	μC
Internal Gate Resistor	T_{vj} = 25℃		R_{Gint}	-	1.05	-	Ω
Input Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{ies}	-	106	-	nF
Output Capacitance	f = 100kHz, T_{vj} = 25℃, V_{CE} = 25V, V_{GE} = 0V		C_{oes}	-	1.96	-	nF
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}	-	-	100	μA
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} = 0.5Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_{don}	-	186 192 195 217	-	ns
Rise Time, Inductive Load	I_C = 450A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 0.5Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_r	-	54 64 67 85	-	ns
Turn-off Delay Time, Inductive Load	I_C = 450A, V_{CE} = 600V V_{GE} = -8V/15V R_{GON} = 1.0Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_{doff}	-	435 485 492 553	-	ns
Fall Time, Inductive Load	I_C = 450A, V_{CE} = 600V V_{GE} = -8V/15V R_{Goff} = 1Ω	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	t_f	-	123 191 203 210	-	ns
Turn-on Energy Loss per Pulse	I_C = 450A, V_{CE} = 600V, $L_σ$ = 30nH V_{GE} = -8V/15V, R_{gon} = 0.5Ω di/dt = 4200A/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{on}	-	18.4 27.5 31.2 35.0	-	mJ
Turn-off energy Loss per Pulse	I_C = 450A, V_{CE} = 600V, $L_σ$ = 30nH V_{GE} = -8V/15V, R_{goff} = 1.0Ω du/dt = 6300V/μs (T_{vj} = 175℃)	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{off}	-	33.4 46.4 50.4 56.9	-	mJ

SC Data	V_{GE} = -8V/15V V_{CC} = 600V t_p≤10μs, T_{vj} = 25℃ t_p≤10μs, T_{vj} = 150℃ t_p≤10μs, T_{vj} = 175℃	I_{sc}	-	2700 2100 2000	-	A
Thermal Resistance, Junction to Case	Per IGBT / IGBT	R_{thJC}	-	0.064	-	K/W
Thermal Resistance, Case to Heatsink	Per IGBT / IGBT λ_{grease} = 1W/(m·K)	R_{thCH}	-	0.019	-	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}	450	A
Repetitive Peak Forward Current	t_p $T_{vj\ op}$	I_{FRM}	900	A

Characteristic Values

			min.	typ.	max.	
Forward Voltage[1)]	I_F = 450A, V_{GE} = 0V T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_F	1.50	1.95 1.92 1.82	2.40	V
Peak Reverse Recovery Current	I_F = 450A, V_R = 600V $-di_F/dt$ = 5600A/μs (T_{vj} = 175℃) V_{GE} = −8V T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	I_{RM}	-	302 358 374 390	-	A
Recovery Charge	I_F = 450A, V_R = 600V $-di_F/dt$ = 5600A/μs (T_{vj} = 175℃) V_{GE} = −8V T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	Q_R	-	21.3 42.1 50.0 56.0	-	μC
Reverse Recovery Energy	I_F = 450A, V_R = 600V $-di_F/dt$ = 5600A/μs (T_{vj} = 175℃) V_{GE} = −8V T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{rec}	-	11.3 22.5 27.7 33.0	-	mJ
Thermal Resistance, Junction to Case	Per FRD	R_{thJC}	-	0.092	-	K/W
Thermal Resistance, Case to Heatsink	Per FRD λ_{grease} = 1W/(m·K)	R_{thHC}	-	0.021	-	K/W
Temperature under Switching Conditions[2)]		$T_{vj\ op}$	-40	-	175	℃

Diode, 3-Level
Maximum Rated Values

Repetitive Peak Reverse Voltage	T_{vj} = 25℃	V_{RRM}	1200	V
Continuous DC Forward Current		I_{Fnom}	450	A
Repetitive Peak Forward Current	$T_{vj\ op}$	I_{FRM}	900	A

Characteristic Values

				min.	typ.	max.	
Forward Voltage[1)]	I_F = 450A, V_{GE} = 0V	T_{vj} = 25℃ T_{vj} = 150℃ T_{vj} = 175℃	V_F	1.50	1.95 1.92 1.82	2.40	V
Peak Reverse Recovery Current	I_F = 450A, V_R = 600V $-di_F/dt$ = 5600A/μs (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	I_{RM}	-	302 358 374 390	-	A
Recovery Charge	I_F = 450A, V_R = 600V $-di_F/dt$ = 5600A/μs (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	Q_R	-	21.3 42.1 50.0 56.0	-	μC
Reverse Recovery Energy	I_F = 450A, V_R = 600V $-di_F/dt$ = 5600A/μs (T_{vj} = 175℃) V_{GE} = −8V	T_{vj} = 25℃ T_{vj} = 125℃ T_{vj} = 150℃ T_{vj} = 175℃	E_{rec}	-	11.3 22.5 27.7 33.0	-	mJ
Thermal Resistance, Junction to Case	Per FRD		R_{thJC}	-	0.092	-	K/W
Thermal Resistance, Case to Heatsink	Per FRD λ_{grease} = 1W/(m·K)		R_{thHC}	-	0.021	-	K/W
Temperature under Switching Conditions[2)]			$T_{vj\ op}$	-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} = 491Ω	△R/R	-5	-	5	%
Power Dissipation	T_{NTC} = 25℃	P_{25}	-	-	20	mW
B-Value	$R_2 = R_{25}\ exp[B_{25/50}(1/T_2\text{-}1/(298.15K))]$	$B_{25/50}$	-	3375	-	K
	$R_2 = R_{25}\ exp[B_{25/80}(1/T_2\text{-}1/(298.15K))]$	$B_{25/80}$	-	3425	-	K
	$R_2 = R_{25}\ exp[B_{25/100}(1/T_2\text{-}1/(298.15K))]$	$B_{25/100}$	-	3443	-	K

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

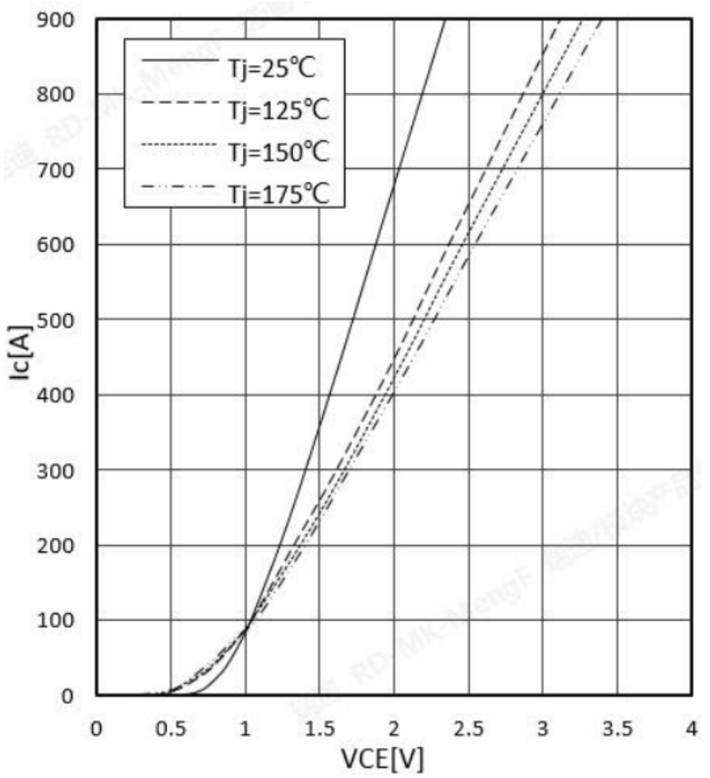
Module

Isolation Test Voltage	RMS, f=50Hz	V_{ISOL}	3.0	kV
Isolation Test Voltage of NTC NTC	RMS, f=50Hz	$V_{ISOL (NTC)}$	3.0	kV
Material of Module Baseplate			Cu	
Internal Isolation			ZTA	
Creepage Distance	Terminal to heatsink, min Terminal to terminal, min		14.7 15.1	mm
Clearance	Terminal to heatsink, min Terminal to terminal, min		9.6 12.5	mm
Comparative Tracking Index		CTI	＞200	

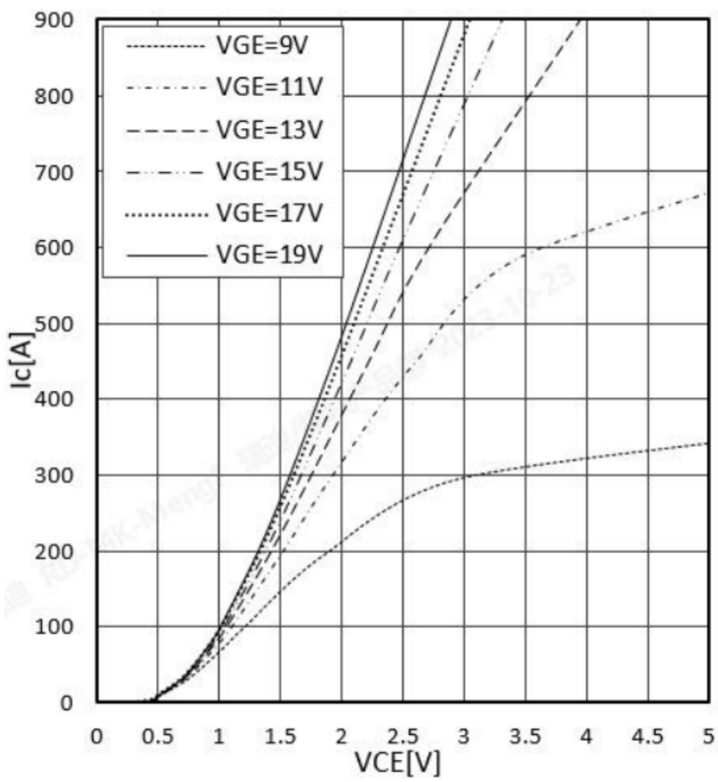
			min.	typ.	max.	
Stray Inductance Module		L_{sCE}	-	20	-	nH
Module Lead Resistance, Terminals-Chip	T_C = 25℃, Per Switch	$R_{CC'+EE'}$	-	0.8	-	mΩ
Storage Temperature		T_{stg}	-40	-	125	℃
Mounting Torque for Module Mounting	Screw M5 / M5	M	4.0	-	6.0	Nm
Mounting Torque for Terminal Mounting	Screw M6 / M6	M	4.0	-	6.0	Nm
Weight		G	-	345	-	g

Circuit Diagram

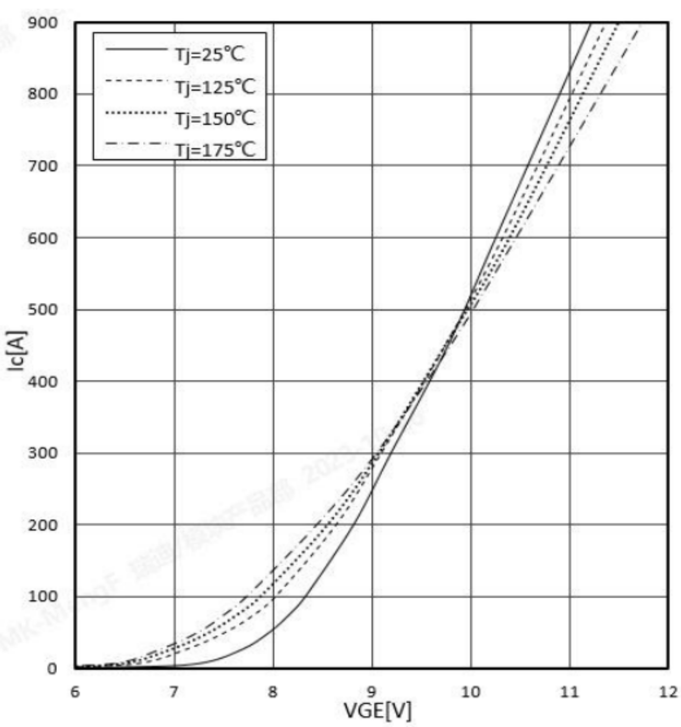
Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $V_{GE} = 15V$



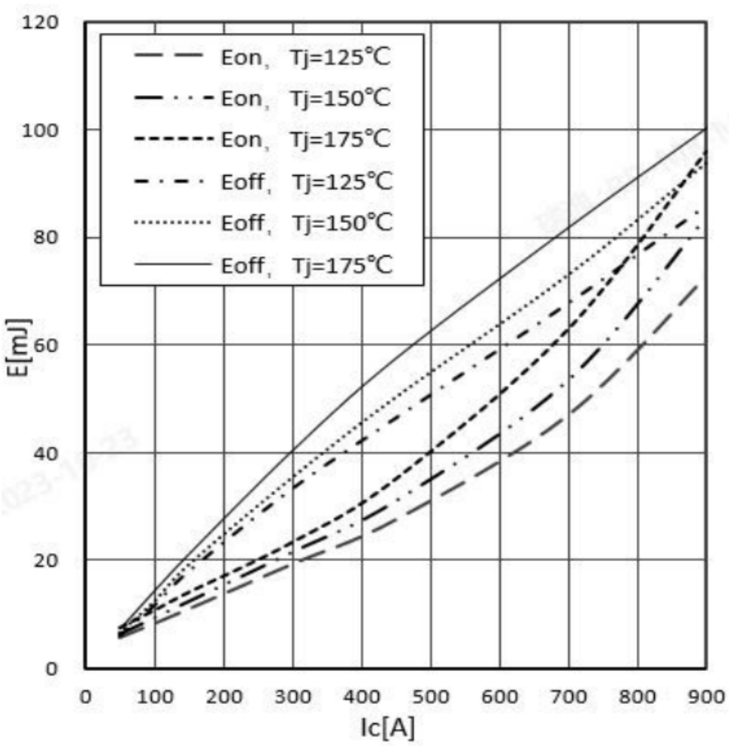
Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $T_{vj} = 175°C$



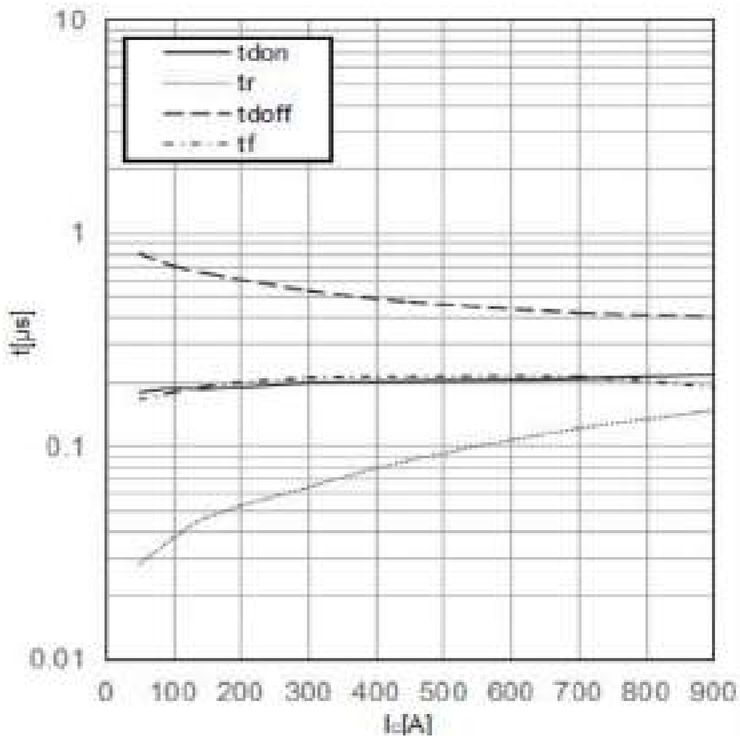
Transfer characteristic IGBT,Inverter(typical), IGBT
$I_C = f(V_{GE})$, $V_{CE} = 20V$



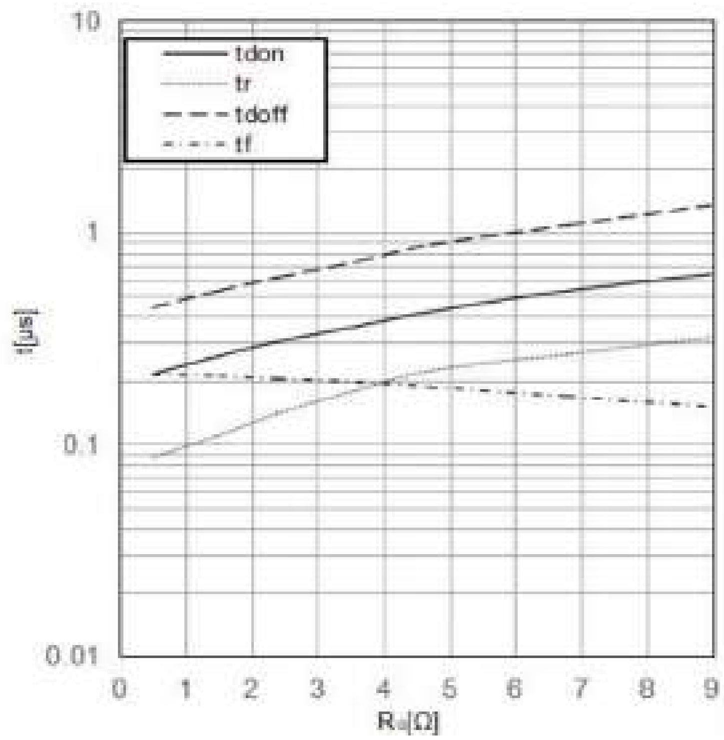
Switching losses IGBT, Inverter (Typical), IGBT
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE} = +15V/-8V$, $R_{Gon} = 0.5\Omega$, $R_{Goff} = 1\Omega$, $V_{CC} = 600V$



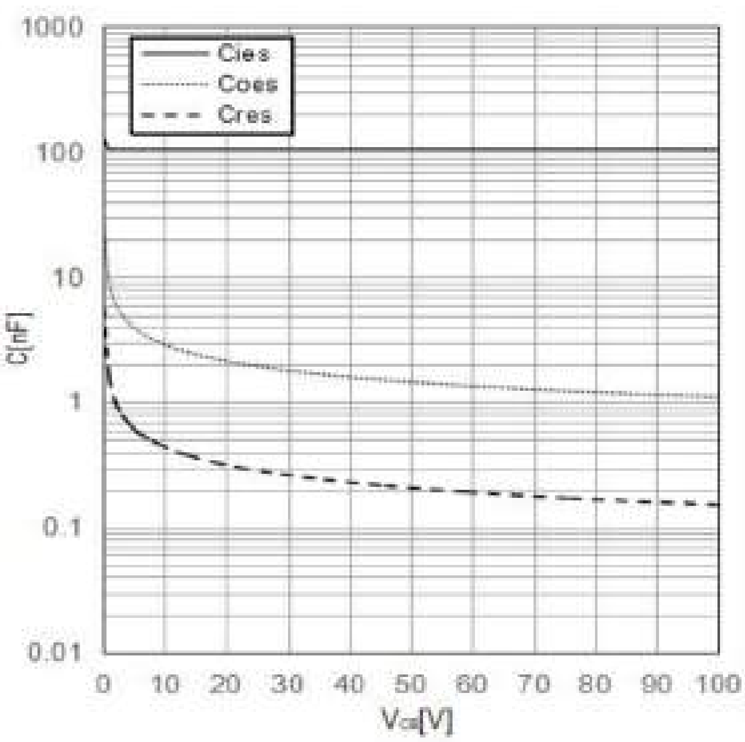
Switching time IGBT,Inverter (typical), IGBT
t = f(I_C)
R_{Goff} = 1Ω, R_{gon} = 0.5Ω, V_{GE} = +15V/-8V, V_{CE} = 600V, T_{vj} = 175℃



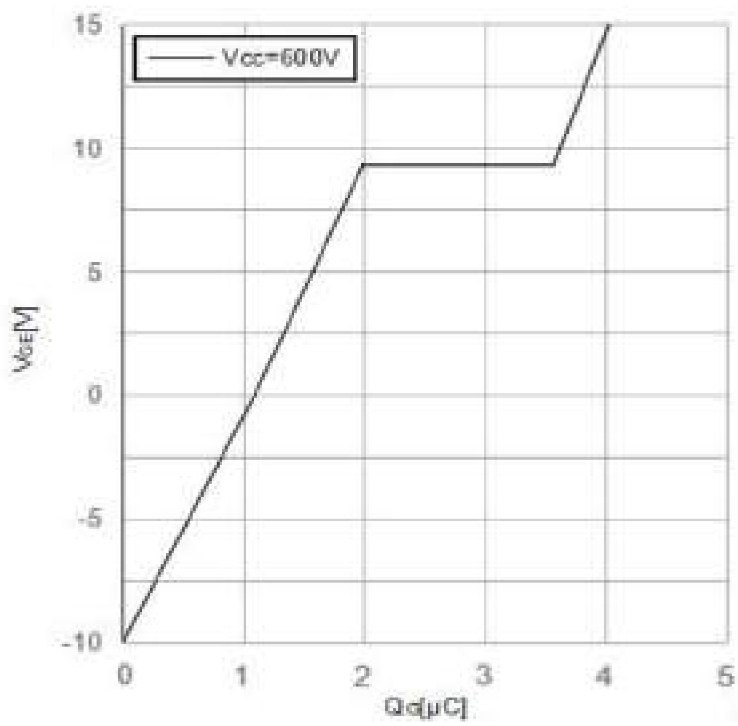
Switching time IGBT,Inverter (typical), IGBT
t = f(R_G)
V_{GE} = +15V/-8V, I_C = 450A, V_{CE} = 600V, T_{vj} = 175℃



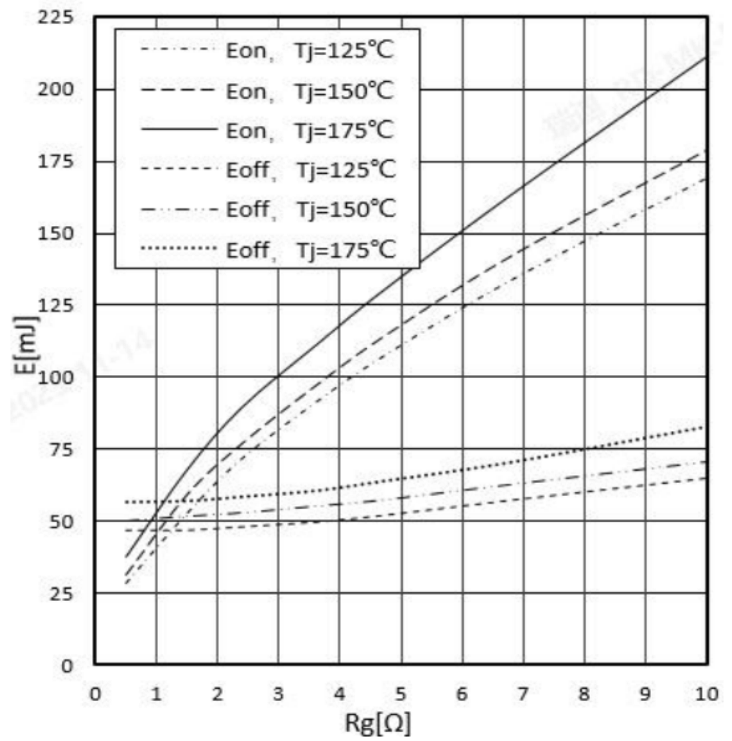
Capacitance characteristic IGBT, Inverter, IGBT
C = f(V_{CE})
f = 100kHz, V_{GE} = 0V, T_{vj} = 25℃



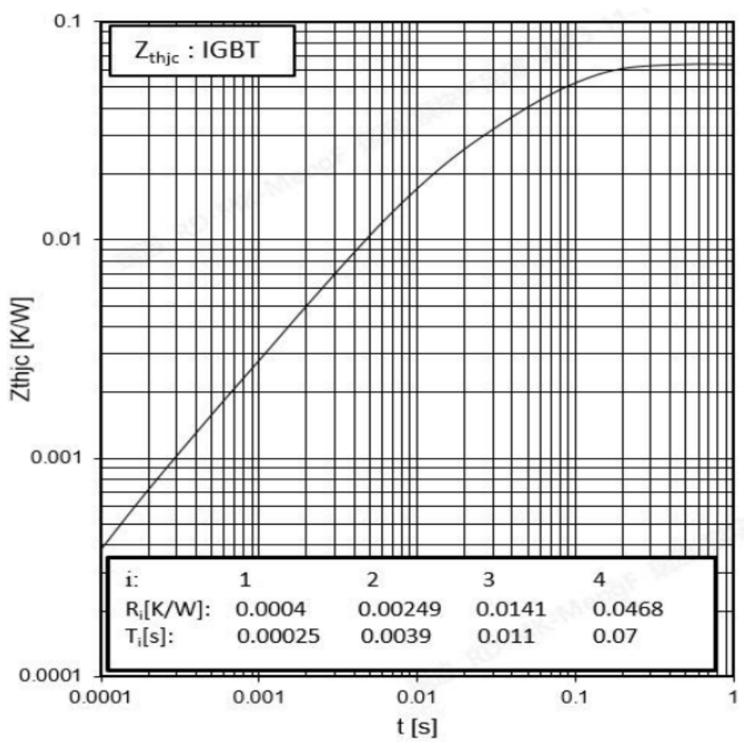
Gate Charge characteristic IGBT, Inverter, IGBT
V_{GE} = f(Q_G)
I_C = 450A, T_{vj} = 25℃



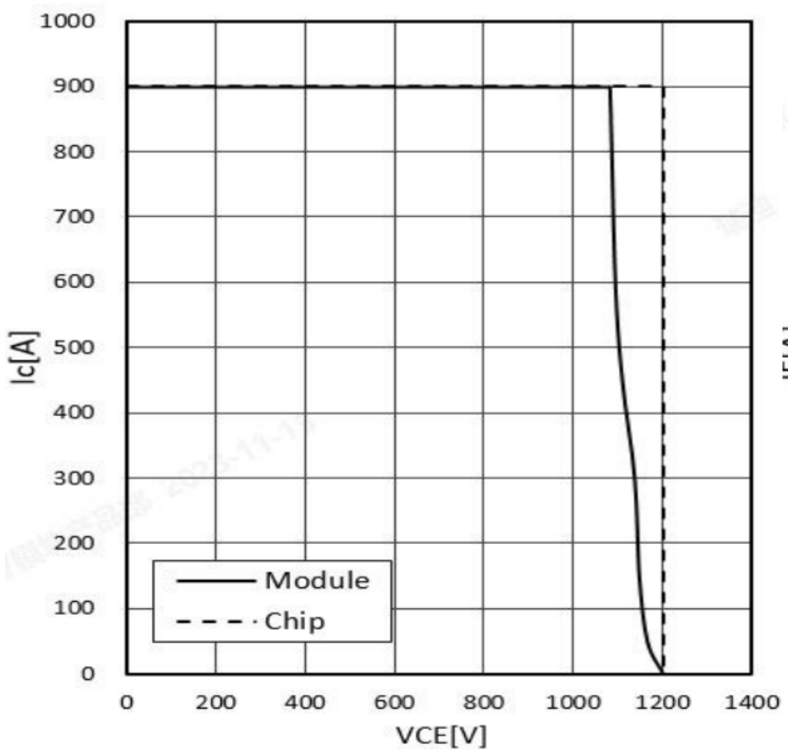
Switching losses IGBT, Inverter (Typical), IGBT
E_{on} = f(R_G)1Ω, E_{off} = f(R_G),
V_{GE} = +15V/-8V, I_C = 450A, V_{CE} = 600V



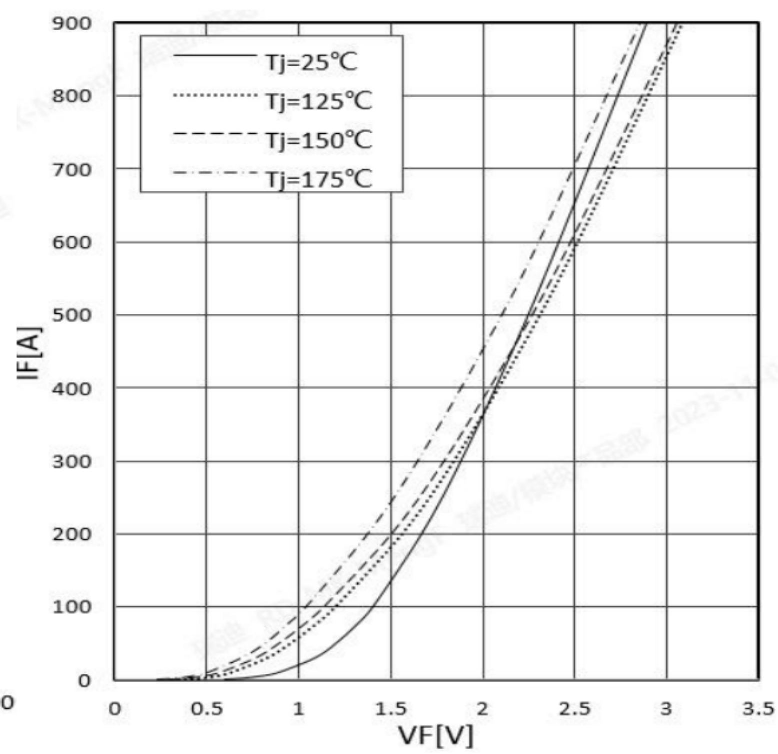
Transient thermal impedance IGBT, Inerter, IGBT
E_{thJC} = f(t)



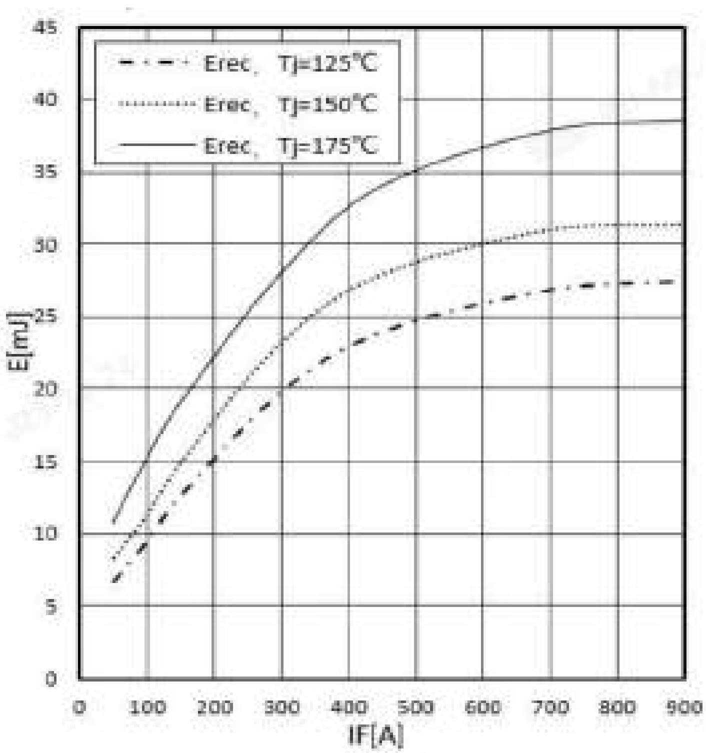
Reverse bias safe operating area IGBT, Inverter (RBSOA)
IGBT (RBSOA)
I_C = f(V_{CE})
GE = +15V/-8V, Rgoff = 1Ω, Tvj = 175℃



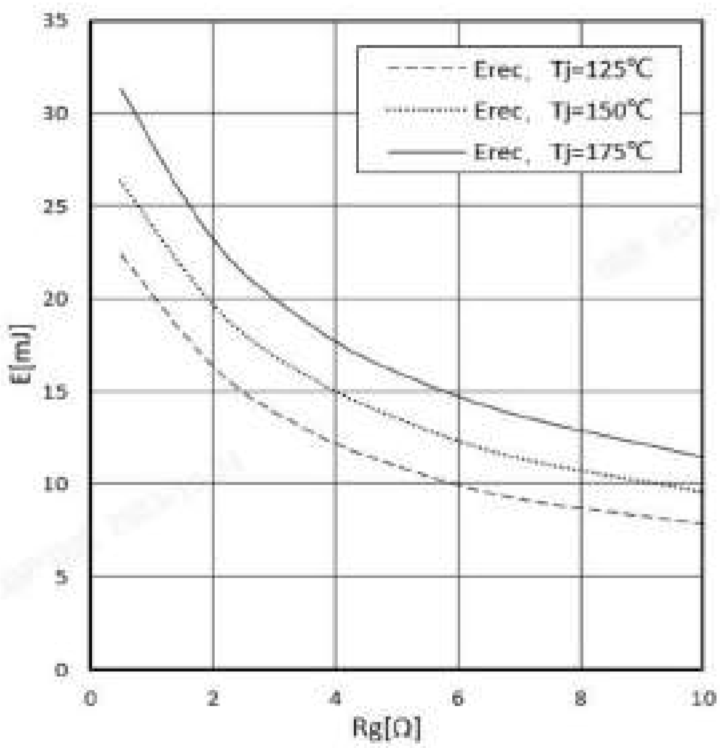
Forward characteristic of Diode, Inverter (typical)
I_F = f(V_F)



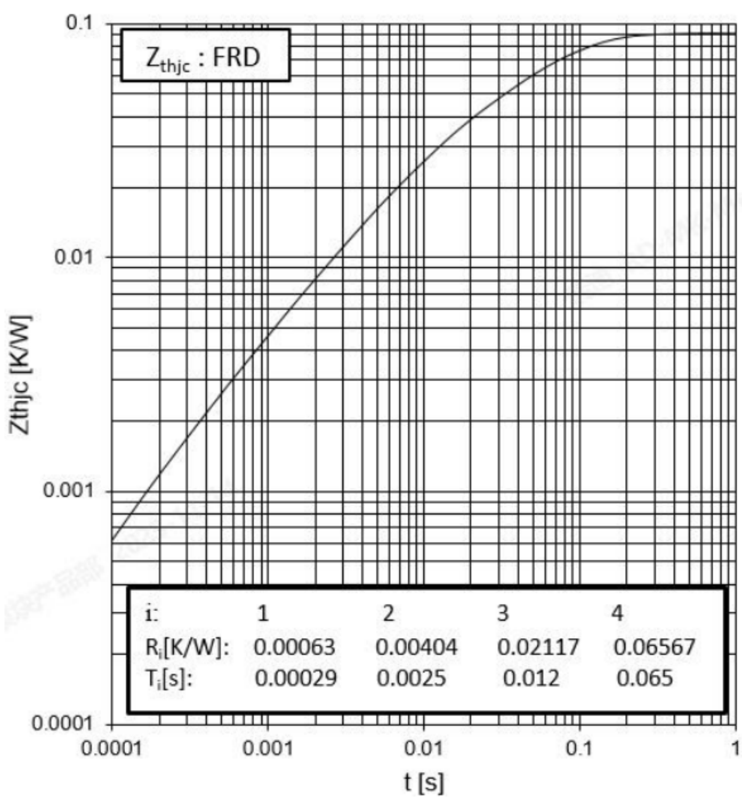
Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$, $R_{gon} = 0.5\Omega$, $V_{CE} = 600V$



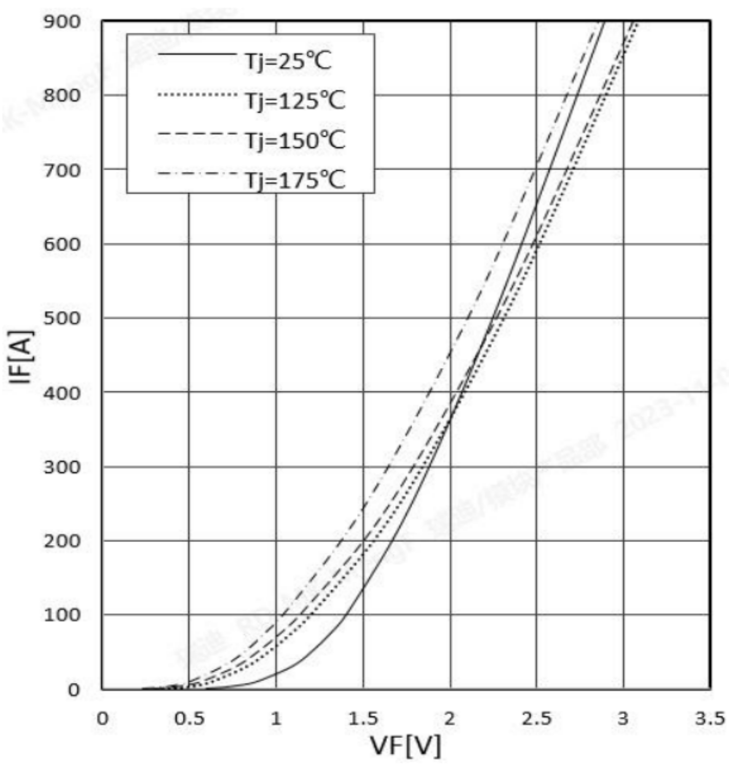
Switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$, $I_F = 450A$, $V_{CE} = 600V$



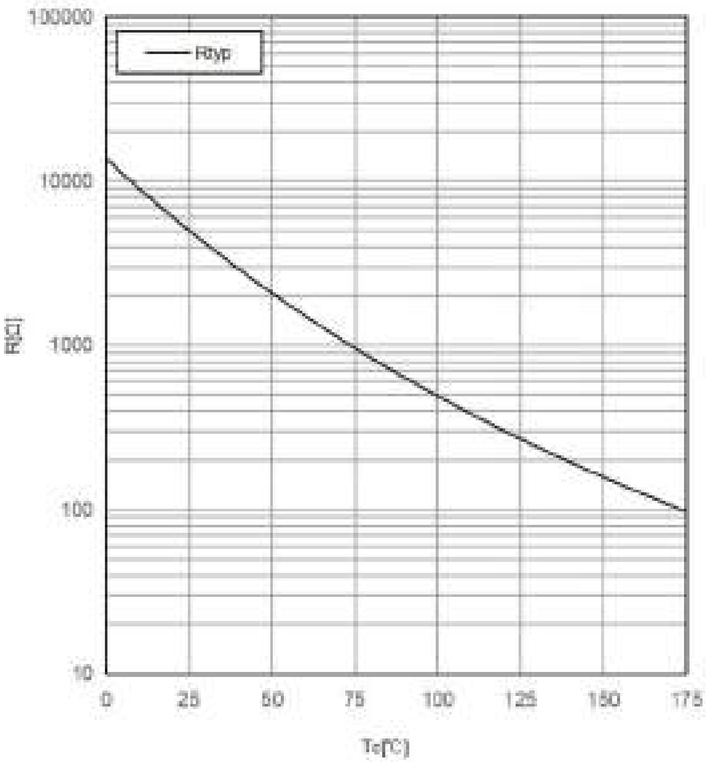
Transient thermal impedance Diode,Inerter
$Z_{thJC} = f(t)$



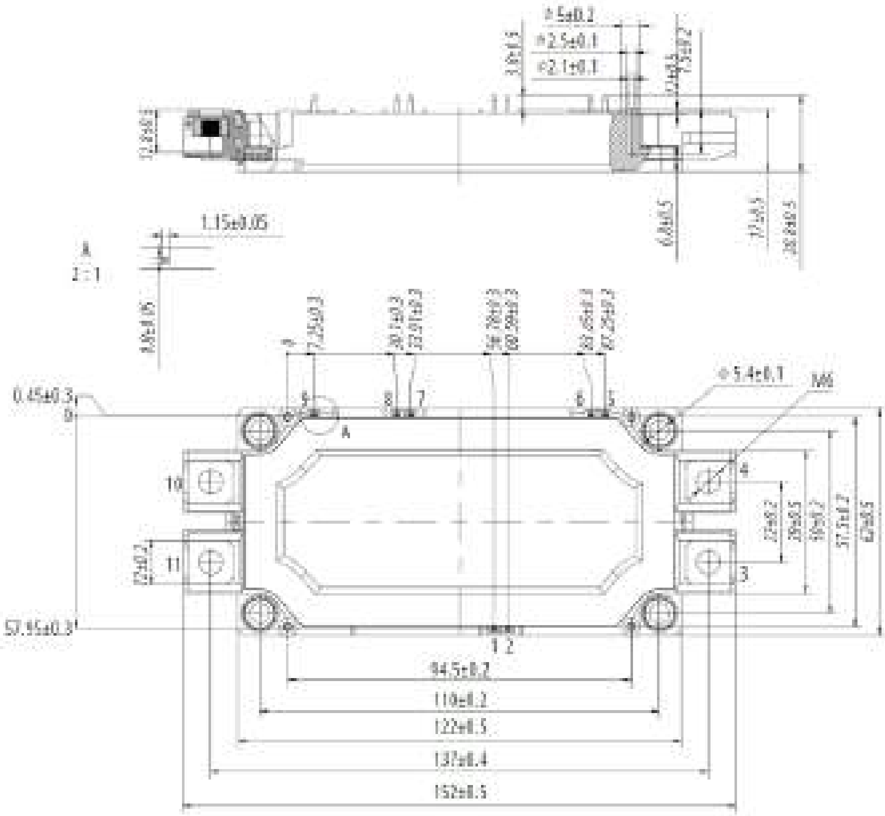
Forward characteristic of Diode,3-Level (typical)
$I_F = f(V_f)$



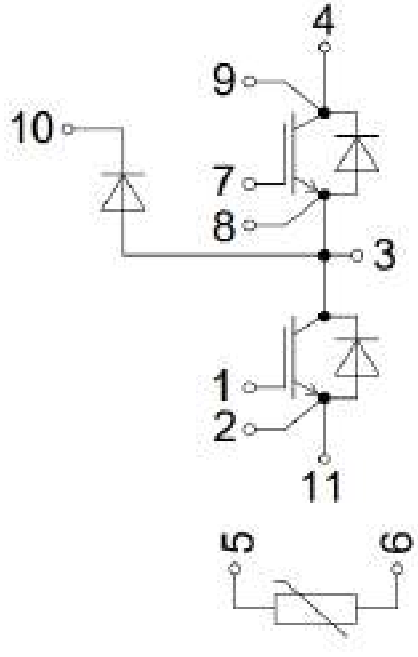
NTC-Thermistor-temperature characteristic (typical)
R = f(t)



Package Dimension
Dimensions in Millimeters



Internal Circuit



Terms and Conditions of Usage of Technicon products

The data contained in this product datasheet is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application. This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant to the terms and conditions of the supply agreement. Therefore, products must be tested for the respective application in advance. Application adjustments may be necessary.

The user of Technicon products is responsible for the safety of their applications embedding Technicon products and must take adequate safety measures to prevent the applications from causing physical injury, fire, or other problems if any of Technicon products become faulty. The user is responsible for ensuring that the application design is compliant with all applicable laws, regulations, norms, and standards.

Except as otherwise explicitly approved by Technicon in a written document signed by authorized representatives of Technicon, Technicon products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

No representation or warranty is given and no liability is assumed with respect to the accuracy, completeness and/or use of any information herein, including without limitation, warranties of non-infringement of intellectual property rights of any third party. Technicon does not assume any liability arising out of the applications or use of any product; neither does it convey any license under its patent rights, copyrights, trade secrets, or other intellectual property rights, nor the rights of others.

Technicon makes no representation or warranty of non-infringement or alleged non-infringement of intellectual property rights of any third party which may arise from applications. This document supersedes and replaces all information previously supplied and may be superseded by updates. Technicon reserves the right to make changes.

For any questions or suggestions, please contact us at info@technicon.asia .