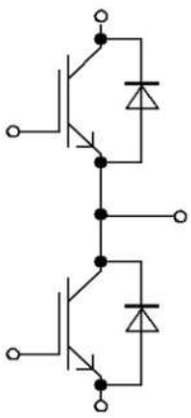
**C2 series package: 1700V 300A IGBT module**

**Datasheet**





Equivalent
Circuit Schematic

# Features:

- Trenchgate Gen.7 IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High RBSOA capability
- Low static losses: $V_{CE(sat)}$ = 1,6V@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℃ | $V_{CES}$ | 1700 | V |
| Continuous DC Collector Current | | $I_{Cnom}$ | 300 | A |
| | $T_C$ = 80℃, $T_{vj\ max}$ = 175℃ | $I_C$ | 385 | A |
| Repetitive Peak Collector Current | $I_{CRM}$ = 2 x $I_{cnom}$ | $I_{CRM}$ | 600 | A |
| Total Power Dissipation | $T_C$ = 25℃, $T_{vj\ max}$ = 175℃ | $P_{tot}$ | 1805 | W |
| Gate-emitter Peak Voltage | | $V_{GES}$ | ±20 | V |

## Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Collector-emitter Saturation Voltage[1)] | $I_C$ = 300A, $V_{GE}$ = 15V | $T_{vj}$ = 25℃<br>$T_{vj}$ = 125℃<br>$T_{vj}$ = 150℃<br>$T_{vj}$ = 175℃ | $V_{CEsat}$ | – | 1.61<br>1.73<br>1.79<br>1.85 | – | V |
| Gate Threshold Voltage | $V_{CE}$ = $V_{GE}$, $I_C$ = 6mA, $T_{vj}$ = 25℃ | | $V_{GEth}$ | 5.5 | 6.10 | 6.70 | V |
| Gate Charge | $V_{GE}$ = -8V/15V, $V_{CE}$ = 900V, $T_{vj}$ = 25℃ | | $Q_G$ | – | 2.33 | – | µC |
| Internal Gate Resistor | $T_{vj}$ = 25℃ | | $R_{Gint}$ | – | 0.75 | – | Ω |
| Input Capacitance | $V_{CE}$ = 25V, $V_{GE}$ = 0V<br>f = 100KHz, $T_{vj}$ = 25℃ | | $C_{ies}$ | – | 68.9 | – | nF |
| Reverse Transfer Capacitance | | | $C_{res}$ | – | 0.19 | – | nF |
| Collector-emitter Cutoff Current | $V_{CE}$ = 1700V, $V_{GE}$ = 0V, $T_{vj}$ = 25℃ | | $I_{CES}$ | – | – | 1 | µA |
| Gate-emitter Leakage Current | $V_{CE}$ = 0V, $V_{GE}$ = 20V, $T_{vj}$ = 25℃ | | $I_{GES}$ | – | – | 200 | nA |
| Turn-on Delay Time, Inductive Load | $I_C$ = 300A, $V_{CE}$ = 900V<br>$V_{GE}$ = ±15V<br>$R_{GON}$ = 2.5Ω | $T_{vj}$ = 25℃<br>$T_{vj}$ = 125℃<br>$T_{vj}$ = 150℃<br>$T_{vj}$ = 175℃ | $t_{don}$ | – | 130<br>132<br>137<br>140 | – | ns |
| Rise Time, Inductive Load | $I_C$ = 300A, $V_{CE}$ = 900V<br>$V_{GE}$ = ±15V<br>$R_{gon}$ = 2.5Ω | $T_{vj}$ = 25℃<br>$T_{vj}$ = 125℃<br>$T_{vj}$ = 150℃<br>$T_{vj}$ = 175℃ | $t_r$ | – | 52<br>57<br>62<br>62 | – | ns |
| Turn-off Delay Time, Inductive Load | $I_C$ = 300A, $V_{CE}$ = 900V<br>$V_{GE}$ = ±15V<br>$R_{goff}$ = 2.5Ω | $T_{vj}$ = 25℃<br>$T_{vj}$ = 125℃<br>$T_{vj}$ = 150℃<br>$T_{vj}$ = 175℃ | $t_{doff}$ | – | 392<br>491<br>500<br>520 | – | ns |
| Fall Time, Inductive Load | $I_C$ = 300A, $V_{CE}$ = 900V<br>$V_{GE}$ = ±15V<br>$R_{Goff}$ = 2.5Ω | $T_{vj}$ = 25℃<br>$T_{vj}$ = 125℃<br>$T_{vj}$ = 150℃<br>$T_{vj}$ = 175℃ | $t_f$ | – | 292<br>599<br>682<br>760 | – | ns |
| Turn-on Energy Loss per Pulse | $I_C$ = 300A, $V_{CE}$ = 900V,<br>$L_\sigma$ = 28nH, $V_{GE}$ = ±15V,<br>$R_{Gon}$ = 2.5Ω, di/dt =<br>3600A/µs ($T_{vj}$ = 175℃) | $T_{vj}$ = 25℃<br>$T_{vj}$ = 125℃<br>$T_{vj}$ = 150℃<br>$T_{vj}$ = 175℃ | $E_{on}$ | – | 65.6<br>81.7<br>86.1<br>93.0 | – | mJ |
| Turn-off energy Loss per Pulse | $I_C$ = 300A, $V_{CE}$ = 900V,<br>$L_\sigma$ = 28nH, $R_{Goff}$ = 2.5Ω<br>$V_{GE}$ = ±15V, dv/dt =<br>3600V/µs ($T_{vj}$ = 175℃) | $T_{vj}$ = 25℃<br>$T_{vj}$ = 125℃<br>$T_{vj}$ = 150℃<br>$T_{vj}$ = 175℃ | $E_{off}$ | – | 51.6<br>92.5<br>102.7<br>110.0 | – | mJ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SC Data | $V_{CE}$ = 1000V, $V_{GE}$ = ±15V | tp ≤ 8us, Tvj = 150℃ | $I_{sc}$ | - | 1300 | - | A |
| | | tp ≤ 6us, Tvj = 175℃ | | | 1250 | | |
| Thermal Resistance, Junction to Case | Per IGBT / IGBT | | $R_{thJC}$ | - | 0.083 | - | K/W |
| Temperature under Switching Conditions [2] | | | $T_{vj\ op}$ | -40 | - | 175 | ℃ |

## Diode, Inverter
## Maximum Rated Values

| | | | | |
|---|---|---|---|---|
| Repetitive Peak Reverse Voltage | $T_{vj}$ = 25℃ | $V_{RRM}$ | 1700 | V |
| Continuous DC Forward Current | | $I_F$ | 300 | A |
| Repetitive Peak Forward Current | $I_{CRM}$ = 2 x $I_{fnom}$ | $I_{FRM}$ | 600 | A |

## Characteristic Values

| | | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|---|
| Forward Voltage [1] | $I_F$ = 300A, $V_{GE}$ = 0V | Tvj = 25℃<br>Tvj = 125℃<br>Tvj = 150℃<br>Tvj = 175℃ | $V_F$ | - | 1.56<br>1.68<br>1.67<br>1.66 | - | V |
| Peak Reverse Recovery Current | $I_F$ = 300A, $V_R$ = 900V<br>-di$_F$/dt = 5500A/us (Tvj = 175℃)<br>$V_{GE}$ = -15V | Tvj = 25℃<br>Tvj = 125℃<br>Tvj = 150℃<br>Tvj = 175℃ | $I_{RM}$ | - | 370<br>400<br>400<br>410 | - | A |
| Recovery Charge | $I_F$ = 300A, $V_R$ = 900V<br>-di$_F$/dt = 5500A/us (Tvj = 175℃)<br>$V_{GE}$ = -15V | Tvj = 25℃<br>Tvj = 125℃<br>Tvj = 150℃<br>Tvj = 175℃ | $Q_R$ | - | 39.0<br>55.0<br>61.0<br>67.0 | - | uC |
| Reverse Recovery Energy | $I_F$ = 300A, $V_R$ = 900V<br>-di$_F$/dt = 5500A/us (Tvj = 175℃)<br>$V_{GE}$ = −15V | Tvj = 25℃<br>Tvj = 125℃<br>Tvj = 150℃<br>Tvj = 175℃ | $E_{rec}$ | - | 21.0<br>43.0<br>47.5<br>49.5 | - | mJ |
| Thermal Resistance, Junction to Case | Per Doide / Diode | | $R_{thJC}$ | - | 0.108 | - | K/W |
| Temperature under Switching Conditions [2] | | | $T_{vj\ op}$ | -40 | - | 175 | ℃ |

## Module

| | | | | | |
|---|---|---|---|---|---|
| Isolation Test Voltage | RMS, f = 50Hz, t = 1min | $V_{ISOL}$ | 4.0 | | kV |
| Material of Module Baseplate | | | Cu | | |
| Internal Isolation | (class 1, IEC 61140)<br>Basic insulation (class 1, IEC 61140) | | $AL_2O_3$ | | |
| Creepage Distance | Terminal to heatsink<br>Terminal to terminal | | 29.0<br>23.0 | | mm |
| Clearance | Terminal to heatsink<br>Terminal to terminal | | 23.0<br>11.0 | | mm |
| Comparative Tracking Index | | CTI | ＞200 | | |

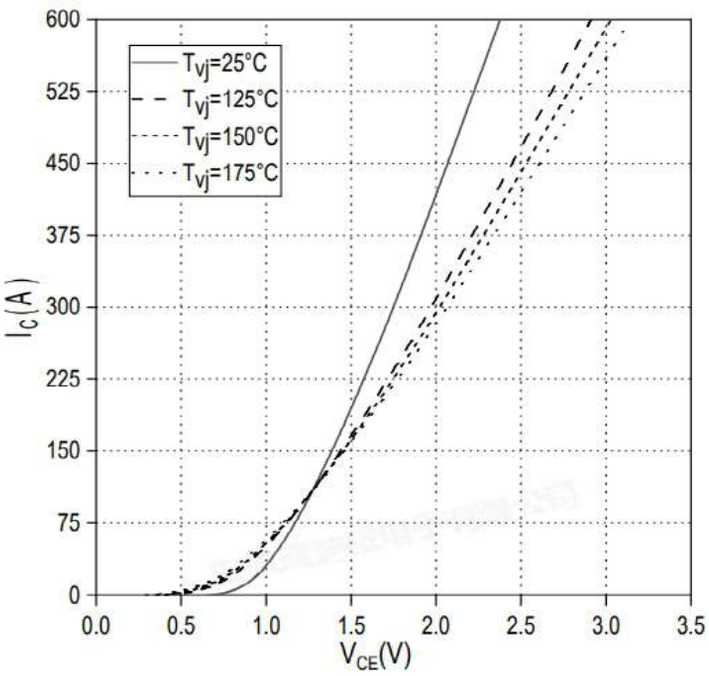
| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Stray Inductance Module | | $L_{sCE}$ | - | 20 | - | nH |
| Module Lead Resistance, Terminals-Chip | $T_C$ = 25℃, Per Switch | $R_{CC'+EE'}$ | - | 0.41 | - | mΩ |
| Storage Temperature | | $T_{stg}$ | -40 | - | 125 | ℃ |
| Modul MountingTorque | M6 | M | 3.0 | - | 6.0 | Nm |
| Terminal MountingTorque | M6 | M | 3.0 | - | 6.0 | Nm |
| Weight | | G | - | 320 | - | g |

1) Terminal impedance is not included.

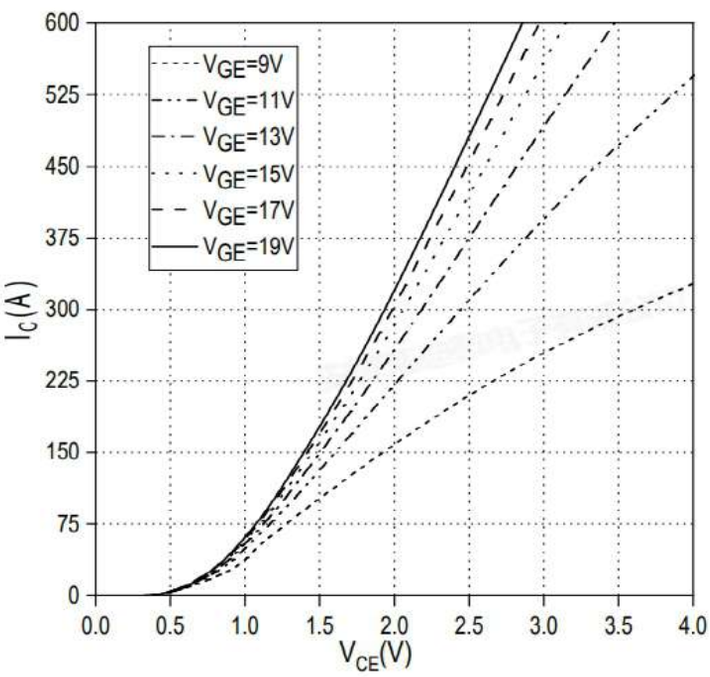
2) $T_{vj\ op}$ > 150°C is only allowed for operation at overload conditions.

## Circuit Diagram

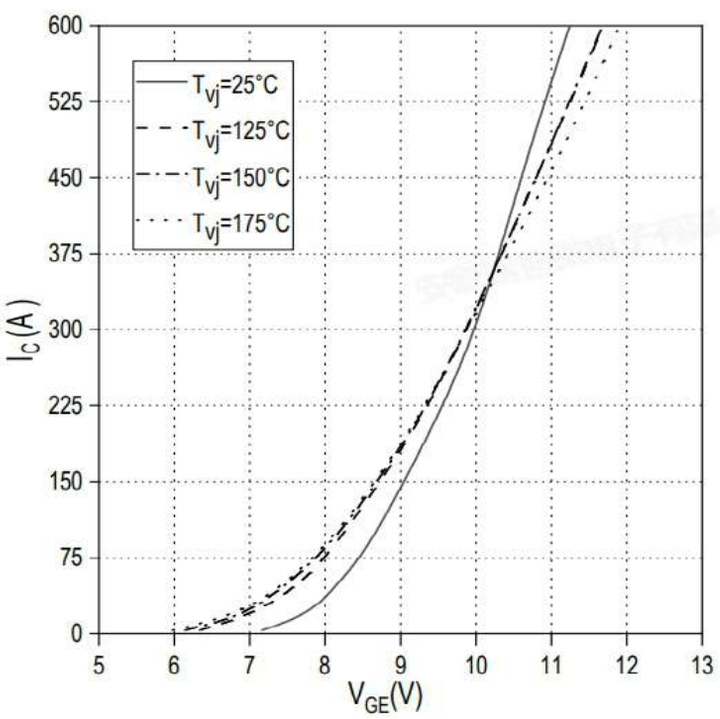
Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $V_{GE}$ = 15V



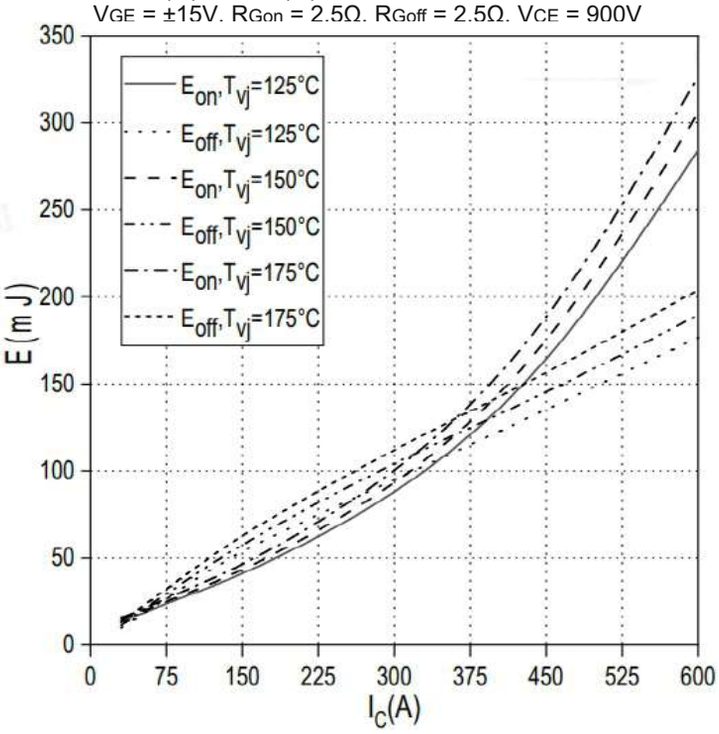

Output characteristic IGBT, Inverter (typical), IGBT
$I_C = f(V_{CE})$, $T_{vj}$ = 175°C




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

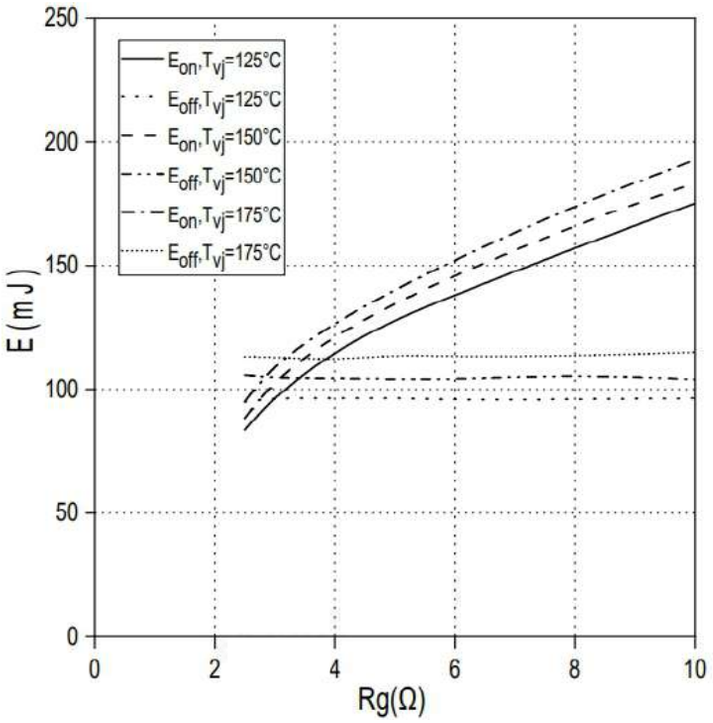



Switching losses IGBT, Inverter (Typical), IGBT
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE}$ = ±15V, $R_{Gon}$ = 2.5Ω, $R_{Goff}$ = 2.5Ω, $V_{CE}$ = 900V



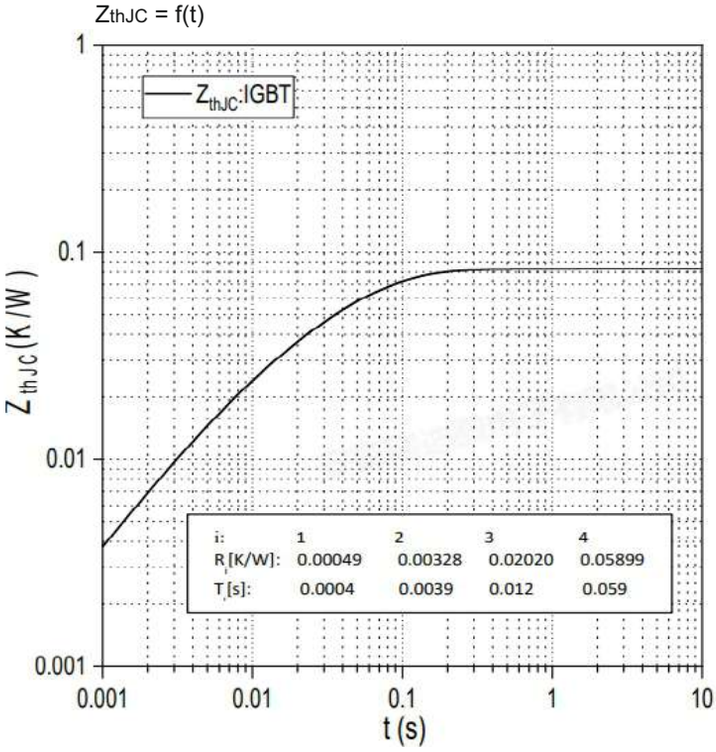
Switching losses IGBT, Inverter (typical)

$V_{GE}$ = ±15V, $I_C$ = 300A, $V_{CE}$ = 900V

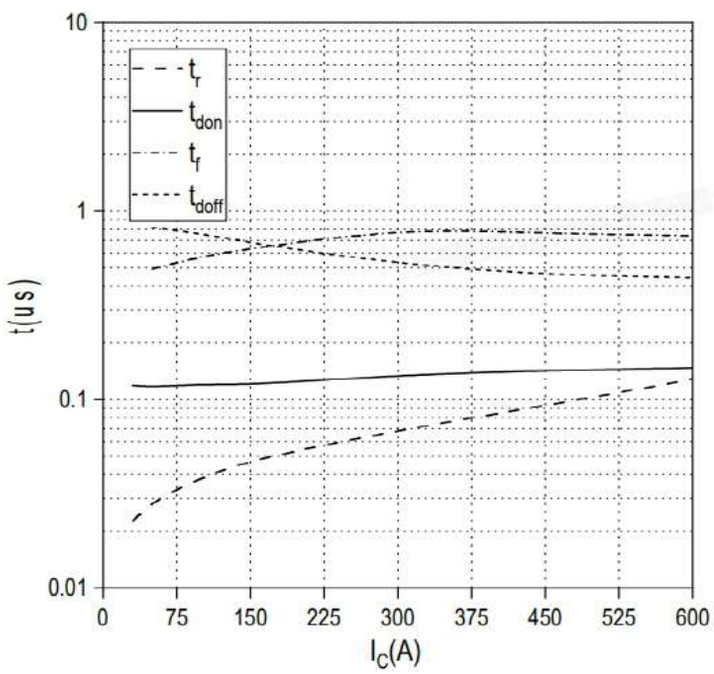



Transient thermal impedance IGBT, Inverter

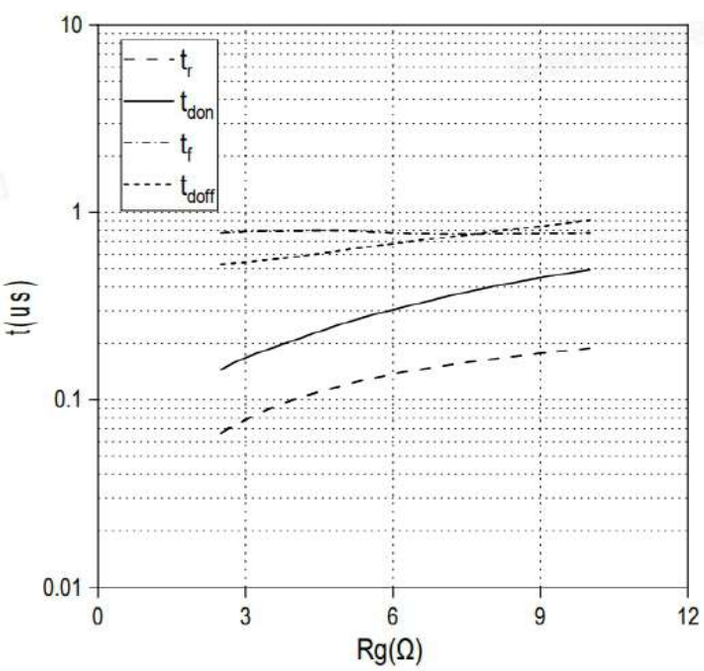
$Z_{thJC}$ = f(t)



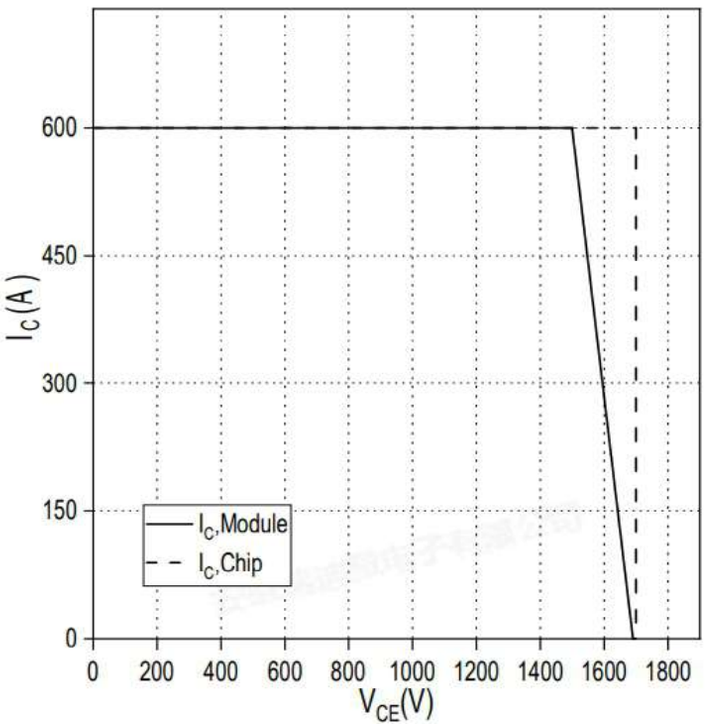

Switching time IGBT, Inverter (typical)
t = f(Ic)
$R_{goff}$ = 2.5Ω $R_{Gon}$ = 2.5Ω VCE = 900V
$V_{GE}$ = ±15V, $T_{vj}$ = 175°C



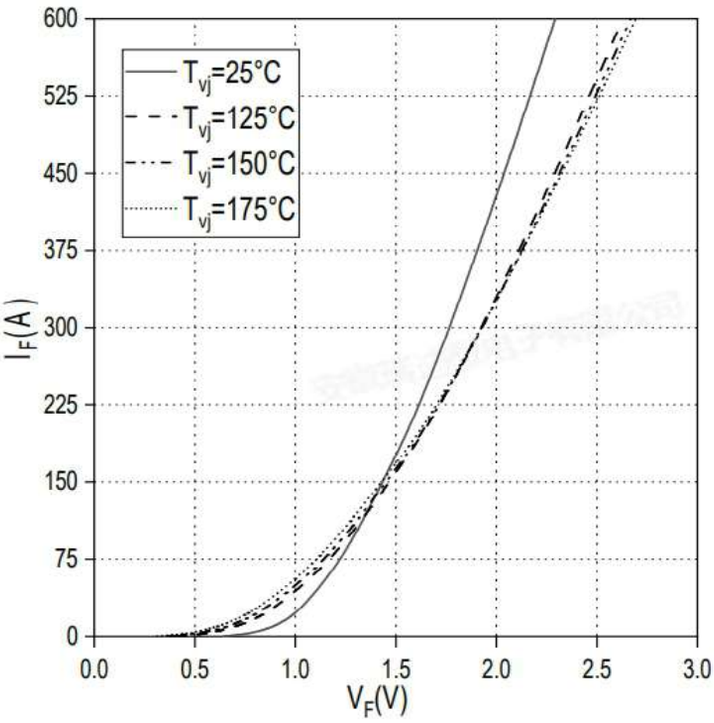

Switching time IGBT, Inverter (typical)
t = f(RG)
$I_C$ = 300A,$V_{CE}$ = 900V $V_{GE}$ = ±15V
$T_{vj}$ = 175°C



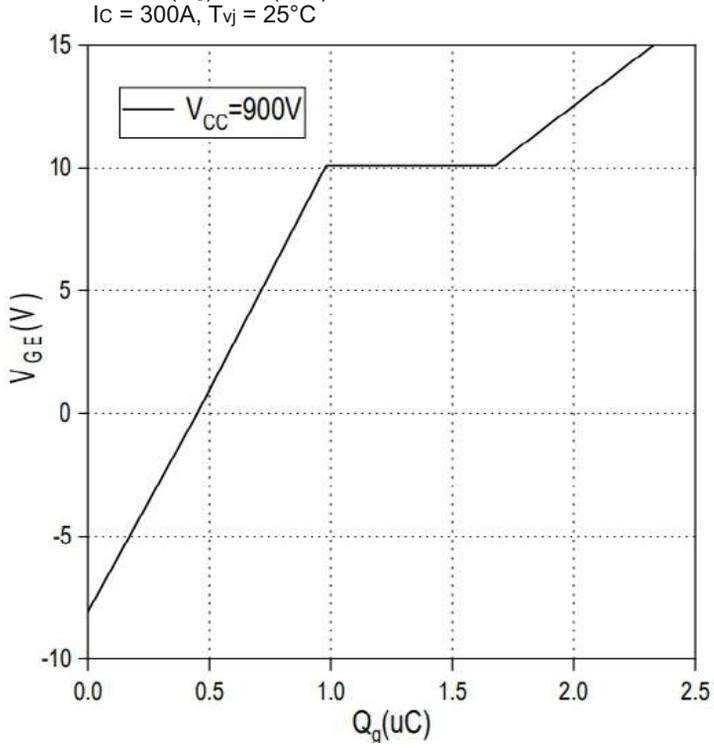
Reverse bias safe operating area IGBT, Inverter (RBSOA) $I_C = f(V_{CE})$,
$V_{GE} = \pm 15V$ , $R_{Goff} = 2.5\Omega, T_{vj} = 175°C$



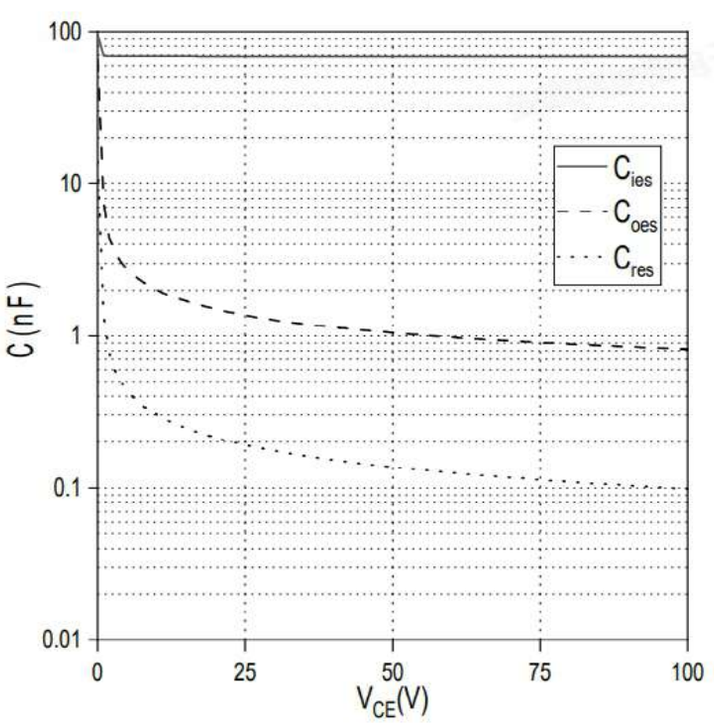

Forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



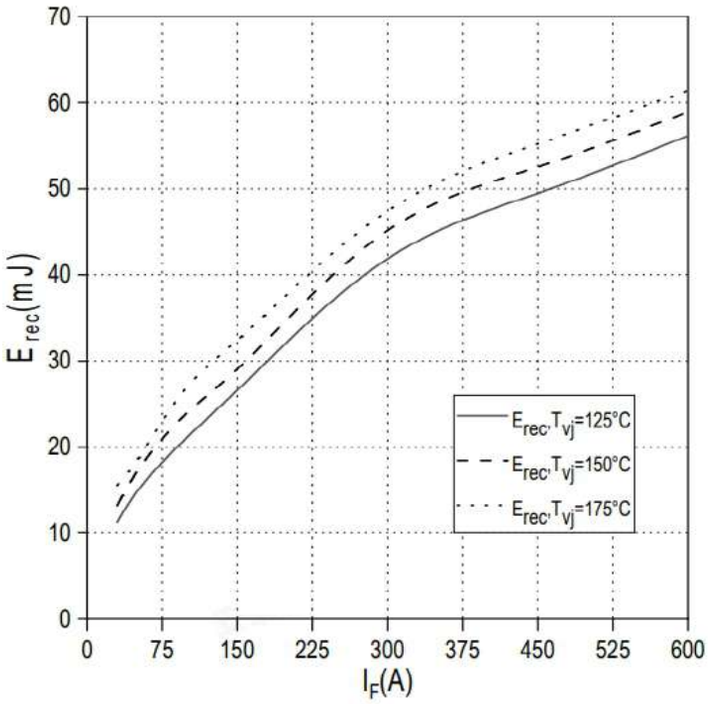

Gate charge characteristic, IGBT, Inverter (typical)
$V_{GE} = f(Q_g)$ $C = f(V_{CE})$
$I_C = 300A$, $T_{vj} = 25°C$



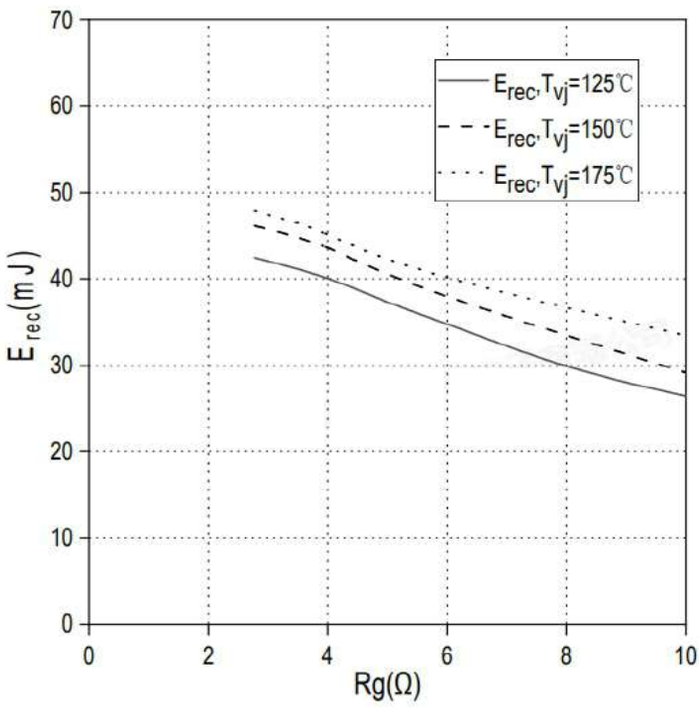

Capacity characteristic, IGBT, Inverter (typical)
f = 100kHz, $V_{GE} = 0$ V, $T_{vj} = 25°C$



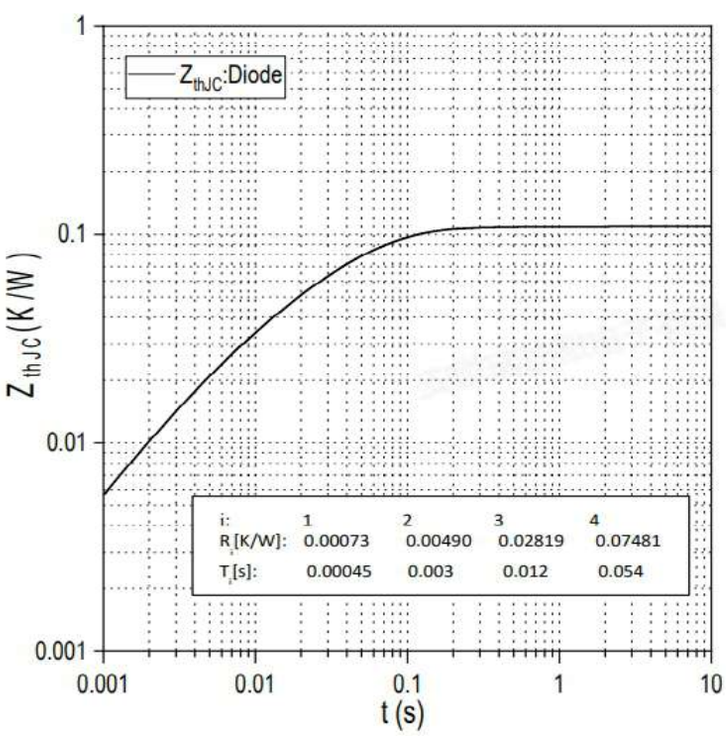
Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$, $R_{gon} = 2.5\Omega$, $V_{CE} = 900V$



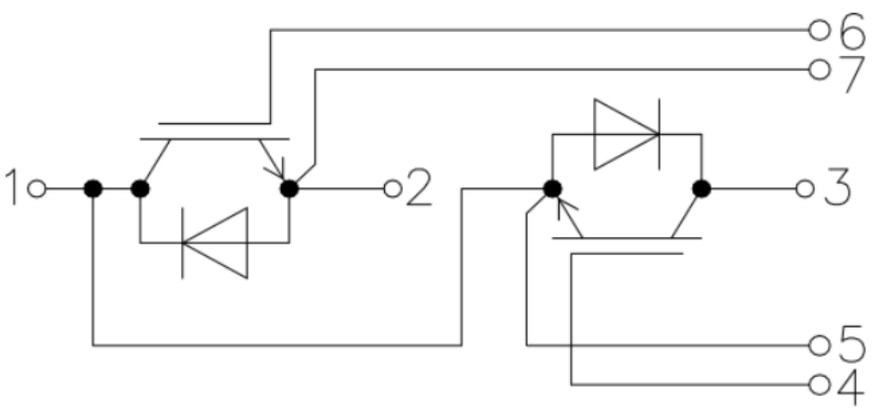

Switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$, $I_F = 300A$, $V_{CE} = 900V$



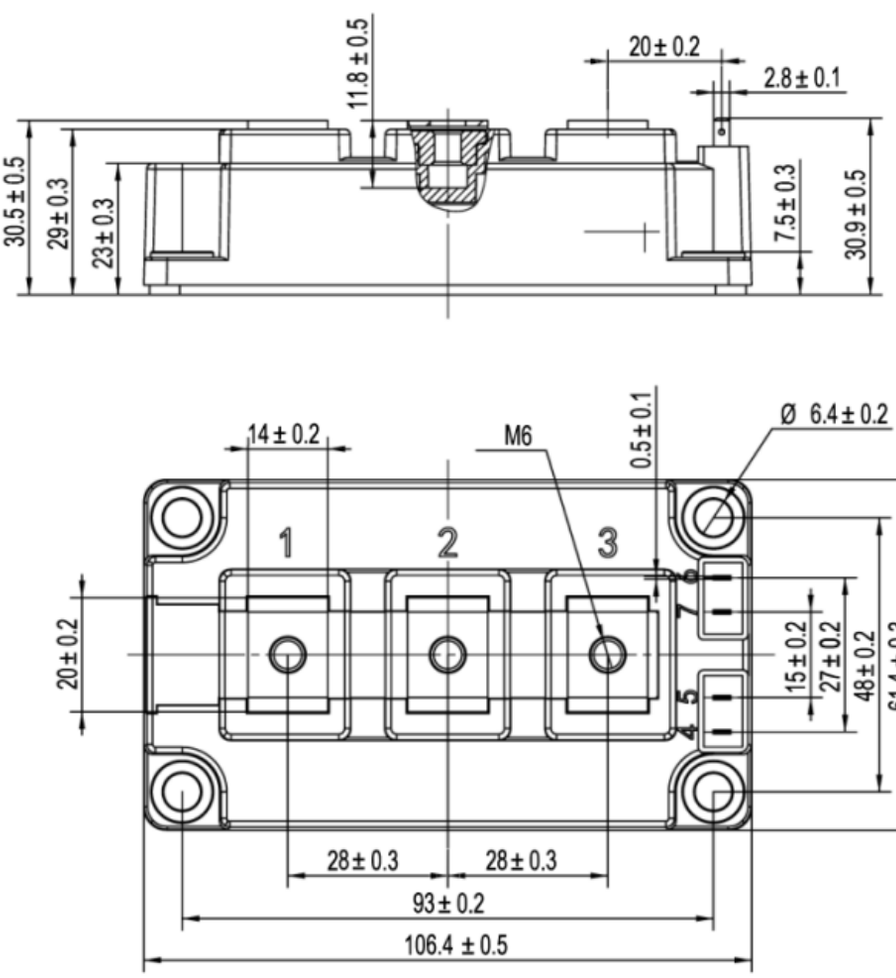

Transient thermal impedance Diode , Inverter
$Z_{thJC} = f(t)$



## Internal Circuit




## Package Dimension
## Dimensions in Millimeters



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