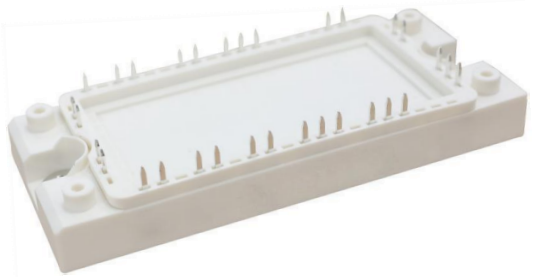
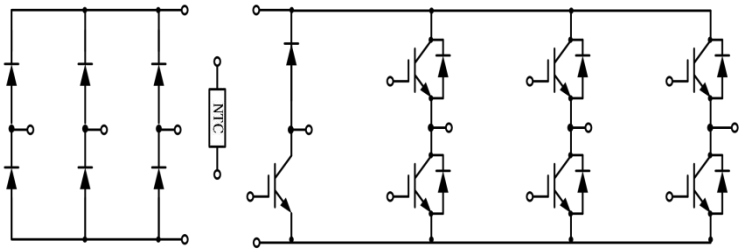
# EconoPIM2 PIM IGBT Module

$V_{CES}$=1200V, $I_C$=75A, $V_{CE(sat)}$=1.75V



## Features

- 1200V Trench Gate/Field Termination Process
- Low Switching Losses
- $V_{CE(Sat)}$ With Positive Temperature Coefficient
- Integrated NTC Temperature Sensor




## Applications

- Power Conversion System
- Windgeneratoren
- Static Var Generator

## IGBT, Inverter

### Maximum Ratings

| Parameter | Symbol | Condition | Value | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | $V_{CES}$ | $T_{vj}$=25℃, $V_{GE}$=0V | 1200 | V |
| Continuous DC collector current | $I_{C\ nom}$ | $T_C$=100℃, $T_{vj\ max}$=175℃ | 75 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_P$=1ms | 150 | A |
| Gate-emitter peak voltage | $V_{GES}$ | $T_{vj}$=25℃ | ±20 | V |

### Characteristics Values

| Parameter | Symbol | Conditions | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$=75A, $V_{GE}$=15V | $T_{vj}$=25℃ | | 1.75 | 2.35 | V |
| | | | $T_{vj}$=125℃ | | 2.06 | | V |
| | | | $T_{vj}$=150℃ | | 2.14 | | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$=2.4mA, $V_{CE}$=$V_{GE}$ | $T_{vj}$=25℃ | 5.35 | 5.85 | 6.35 | V |
| Gate charge | $Q_G$ | $V_{GE}$=-15V...+15V | | | 0.41 | | μC |
| Integrated gate resistor | $R_{G\ int}$ | $T_{vj}$=25℃ | | | None | | Ω |
| Input capacitance | $C_{ies}$ | f=100KHz, $V_{CE}$=25V, $V_{GE}$=0V | $T_{vj}$=25℃ | | 9.72 | | nF |
| Output capacitance | $C_{oes}$ | f=100KHz, $V_{CE}$=25V, $V_{GE}$=0V | $T_{vj}$=25℃ | | 0.86 | | nF |
| Reverse transfer capacitance | $C_{res}$ | f=100KHz, $V_{CE}$=25V, $V_{GE}$=0V | $T_{vj}$=25℃ | | 0.05 | | nF |
| Collector-emitter cut-off current | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V | $T_{vj}$=25℃ | | | 1 | mA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V | $T_{vj}$=25℃ | | | 200 | nA |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Turn-on delay time | $t_{d\ on}$ | $I_C$=75A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=10Ω, Inductive Load | $T_{vj}$=25℃ | | 55 | | ns |
| | | | $T_{vj}$=125℃ | | 53 | | ns |
| | | | $T_{vj}$=150℃ | | 53 | | ns |
| Rise time | $t_r$ | $I_C$=75A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=10Ω, Inductive Load | $T_{vj}$=25℃ | | 30 | | ns |
| | | | $T_{vj}$=125℃ | | 34 | | ns |
| | | | $T_{vj}$=150℃ | | 36 | | ns |
| Turn-off delay time | $t_{d\ off}$ | $I_C$=75A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=10Ω, Inductive Load | $T_{vj}$=25℃ | | 214 | | ns |
| | | | $T_{vj}$=125℃ | | 250 | | ns |
| | | | $T_{vj}$=150℃ | | 259 | | ns |
| Fall time | $t_f$ | $I_C$=75A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=10Ω, Inductive Load | $T_{vj}$=25℃ | | 144 | | ns |
| | | | $T_{vj}$=125℃ | | 228 | | ns |
| | | | $T_{vj}$=150℃ | | 255 | | ns |
| Turn-on energy loss per pulse | $E_{on}$ | $I_C$=75A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=10Ω, di/dt=1700A/μs ($T_{vj}$=150℃) Inductive Load | $T_{vj}$=25℃ | | 5.41 | | mJ |
| | | | $T_{vj}$=125℃ | | 8.84 | | mJ |
| | | | Tvj=150℃ | | 9.87 | | mJ |
| Turn-off energy loss per pulse | $E_{off}$ | $I_C$=75A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=10Ω, du/dt=5800V/μs ($T_{vj}$=150℃) Inductive Load | $T_{vj}$=25℃ | | 3.80 | | mJ |
| | | | $T_{vj}$=125℃ | | 5.53 | | mJ |
| | | | $T_{vj}$=150℃ | | 6.03 | | mJ |
| SC data | $I_{SC}$ | $V_{GE}$≤15V, $V_{CE}$=800V $V_{CEmax}$=$V_{CES}$-$L_{sCE}$*di/dt, $t_P$≤8μs, | Tvj=150℃ | | 350 | | A |
| Thermal resistance, junction to case | $R_{thJC}$ | per IGBT | | | 0.456 | | K/W |
| Temperature under switching conditions | $T_{vj\ op}$ | | | -40 | | 150 | ℃ |

# Diode, Inverter

## Maximum Ratings

| Parameter | Symbol | Conditions | | Value | Unit |
|---|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | $T_{vj}$=25℃ | | 1200 | V |
| Continuous forward current | $I_F$ | | | 75 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$= 1ms | | 150 | A |
| $I^2t$-value | $I^2t$ | $t_P$=10ms, sin180° | $T_{vj}$=125℃ | 960 | $A^2s$ |

## Characteristics Values

| Parameter | Symbol | Conditions | | Values | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$=75A, $V_{GE}$=0V | $T_{vj}$=25℃ | | 2.15 | 2.6 | V |
| | | | $T_{vj}$=125℃ | | 1.8 | | V |
| | | | $T_{vj}$=150℃ | | 1.75 | | V |
| Peak reverse recovery current | $I_{rr}$ | $I_F$=75A, $V_R$=600V, $V_{GE}$=-15V, -diF/dt=2600A/μs ($T_{vj}$=150℃) | $T_{vj}$=25℃ | | 93 | | A |
| | | | $T_{vj}$=125℃ | | 127 | | A |
| | | | $T_{vj}$=150℃ | | 135 | | A |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Recovered charge | $Q_{rr}$ | $I_F$=75A, $V_R$=600V, $V_{GE}$=-15V, -diF/dt=2600A/μs ($T_{vj}$=150℃) | $T_{vj}$=25℃ | | 7.9 | | μC |
| | | | $T_{vj}$=125℃ | | 17.8 | | μC |
| | | | $T_{vj}$=150℃ | | 21.2 | | μC |
| Reverse recovery energy | $E_{rec}$ | | $T_{vj}$=25℃ | | 2.84 | | mJ |
| | | | $T_{vj}$=125℃ | | 6.58 | | mJ |
| | | | $T_{vj}$=150℃ | | 7.90 | | mJ |
| Thermal resistance, junction to case | $R_{thJC}$ | per FRD | | | 0.547 | | K/W |
| Temperature under switching conditions | $T_{vj\ op}$ | | | -40 | | 150 | ℃ |

# Diode, Rectifier

## Maximum Ratings

| Parameter | Symbol | Conditions | | Value | Unit |
|---|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | $T_{vj}$=25℃, $I_{RRM}$=0.05mA | | 1600 | V |
| Maximum average forward current | $I_{F(AV)}$ | $T_s$=80℃, $T_{vj}$=25℃ | | 75 | A |
| Surge forward current | $I_{FSM}$ | $t_P$=10ms, sin180° | $T_{vj}$=25℃ | 720 | A |
| $I^2t$-value | $I^2t$ | $t_P$=10ms, sin180° | $T_{vj}$=125℃ | 2590 | $A^2s$ |

## Characteristics Values

| Parameter | Symbol | Conditions | | Values | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$=75A | $T_{vj}$=25℃ | | 1.18 | 1.40 | V |
| Reverse current | $I_R$ | $V_R$=$V_{RRM}$ | $T_{vj}$=25℃ | | | 1 | mA |
| Thermal resistance, junction to case | $R_{thJC}$ | | | | 0.393 | | K/W |
| Temperature under switching conditions | $T_{vj\ op}$ | | | -40 | | 150 | ℃ |

# IGBT, Brake-Chopper

## Maximum Ratings

| Parameter | Symbol | Condition | Value | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | $V_{CES}$ | $T_{vj}$=25°C, $V_{GE}$=0V | 1200 | V |
| Continuous DC collector current | $I_{C\ nom}$ | $T_C$=100° C, $T_{vj\ max}$=175℃ | 40 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_P$=1ms | 80 | A |
| Gate-emitter peak voltage | $V_{GE}$ | $T_{vj}$=25℃ | ±20 | V |

## Characteristics Values

| Parameter | Symbol | Conditions | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$=40A, $V_{GE}$=15V | $T_{vj}$=25℃ | | 1.78 | 2.4 | V |
| | | | $T_{vj}$=125℃ | | 2.09 | | V |
| | | | $T_{vj}$=150℃ | | 2.16 | | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$=1.5mA, $V_{CE}$=$V_{GE}$ | $T_{vj}$=25℃ | 5.1 | 5.7 | 6.3 | V |
| Gate charge | $Q_G$ | $V_{GE}$=-15V...+15V | | | 0.33 | | μC |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Integrated gate resistor | $R_{G\ int}$ | | | | None | | Ω |
| Input capacitance | $C_{ies}$ | f=100KHz, $V_{CE}$=25V, $V_{GE}$=0V | $T_{vj}$=25℃ | | 2.8 | | nF |
| Output capacitance | $C_{oes}$ | f=100KHz, $V_{CE}$=25V, $V_{GE}$=0V | $T_{vj}$=25℃ | | 0.45 | | nF |
| Reverse transfer capacitance | $C_{res}$ | f=100KHz, $V_{CE}$=25V, $V_{GE}$=0V | $T_{vj}$=25℃ | | 0.13 | | nF |
| Collector-emitter cut-off current | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V | $T_{vj}$=25℃ | | | 1 | mA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V | $T_{vj}$=25℃ | | | 200 | nA |
| Turn-on delay time | $t_{d\ on}$ | $I_C$=40A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=20Ω, Inductive Load | $T_{vj}$=25℃ | | 47 | | ns |
| | | | $T_{vj}$=125℃ | | 39 | | ns |
| | | | $T_{vj}$=150℃ | | 39 | | ns |
| Rise time | $t_r$ | $I_C$=40A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=20Ω, Inductive Load | $T_{vj}$=25℃ | | 45 | | ns |
| | | | $T_{vj}$=125℃ | | 47 | | ns |
| | | | $T_{vj}$=150℃ | | 48 | | ns |
| Turn-off delay time | $t_{d\ off}$ | $I_C$=40A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=20Ω, Inductive Load | $T_{vj}$=25℃ | | 258 | | ns |
| | | | $T_{vj}$=125℃ | | 315 | | ns |
| | | | $T_{vj}$=150℃ | | 331 | | ns |
| Fall time | $t_f$ | $I_C$=40A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=20Ω, Inductive Load | $T_{vj}$=25℃ | | 155 | | ns |
| | | | $T_{vj}$=125℃ | | 250 | | ns |
| | | | $T_{vj}$=150℃ | | 260 | | ns |
| Turn-on energy loss per pulse | $E_{on}$ | $I_C$=40A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=20Ω, di/dt=2100A/μs ($T_{vj}$=150℃) Inductive Load | $T_{vj}$=25℃ | | 4.57 | | mJ |
| | | | $T_{vj}$=125℃ | | 6.50 | | mJ |
| | | | Tvj=150℃ | | 7.19 | | mJ |
| Turn-off energy loss per pulse | $E_{off}$ | $I_C$=40A, $V_{CE}$=600V, $V_{GE}$=-15V/+15V,$R_G$=20Ω, du/dt=4200V/μs ($T_{vj}$=150℃) Inductive Load | $T_{vj}$=25℃ | | 2.15 | | mJ |
| | | | $T_{vj}$=125℃ | | 3.32 | | mJ |
| | | | $T_{vj}$=150℃ | | 3.64 | | mJ |
| SC data | $I_{SC}$ | $V_{GE}$≤15V, $V_{CE}$=800V $V_{CEmax}$=$V_{CES}$-$L_{sCE}$*di/dt, $t_P$≤8μs, | $T_{vj}$=150℃ | | 220 | | A |
| Thermal resistance, junction to case | $R_{thJC}$ | | | | 0.509 | | K/W |
| Temperature under switching conditions | $T_{vj\ op}$ | | | -40 | | 150 | ℃ |

## Diode, Brake-Chopper
### Maximum Ratings

| Parameter | Symbol | Conditions | | Value | Unit |
|---|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | $T_{vj}$=25℃ | | 1200 | V |
| Continuous forward current | $I_{FN}$ | | | 40 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$= 1ms | | 80 | A |
| $I^2t$-value | $I^2t$ | $t_P$=10ms, sin180° | $T_{vj}$=125℃ | 310 | $A^2s$ |

### Characteristics Values

| Parameter | Symbol | Conditions | | Value | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$=40A, $V_{GE}$=0V | $T_{vj}$=25℃ | | 1.95 | 2.5 | V |
| | | | $T_{vj}$=125℃ | | 1.71 | | V |
| | | | $T_{vj}$=150℃ | | 1.65 | | V |
| Peak reverse recovery current | $I_{rr}$ | $I_F$=40A, $V_R$=600V, $V_{GE}$=-15V, -diF/dt=800A/μs ($T_{vj}$=150℃) | $T_{vj}$=25℃ | | 27 | | A |
| | | | $T_{vj}$=125℃ | | 40 | | A |
| | | | $T_{vj}$=150℃ | | 44 | | A |
| Recovered charge | $Q_{rr}$ | | $T_{vj}$=25℃ | | 3.6 | | μC |
| | | | $T_{vj}$=125℃ | | 8.4 | | μC |
| | | | $T_{vj}$=150℃ | | 10.2 | | μC |
| Reverse recovery energy | $E_{rec}$ | | $T_{vj}$=25℃ | | 1.18 | | mJ |
| | | | $T_{vj}$=125℃ | | 2.16 | | mJ |
| | | | $T_{vj}$=150℃ | | 2.55 | | mJ |
| Thermal resistance, junction to case | $R_{thJC}$ | | | | 0.836 | | K/W |
| Temperature under switching conditions | $T_{vj\ op}$ | | | -40 | | 150 | ℃ |

## NTC-Thermistor
### Characteristics Values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Rated resistance | $R_{25}$ | $T_C$=25℃, ±5% | | 5.0 | | kΩ |
| △R/R | | | -5 | | -5 | % |
| B-value | $B_{25/50}$ | ±3% | | 3375 | | K |
| B-value | $B_{25/100}$ | ±3% | | 3433 | | K |

## Module
### Characteristics Values

| Parameter | Symbol | Conditions | Value | | | Units |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Isolation test voltage | $V_{ISOL}$ | RMS, f=50Hz, t=1min | | 2.5 | | kV |
| Internal isolation | - | | | $Al_2O_3$ | | - |
| Storage temperature | $T_{stg}$ | | -40 | | 125 | ℃ |
| Mounting torque for module mounting | M | | 3 | - | 6 | N·m |
| Weight | G | | | 180 | | g |

## Typical Characteristics

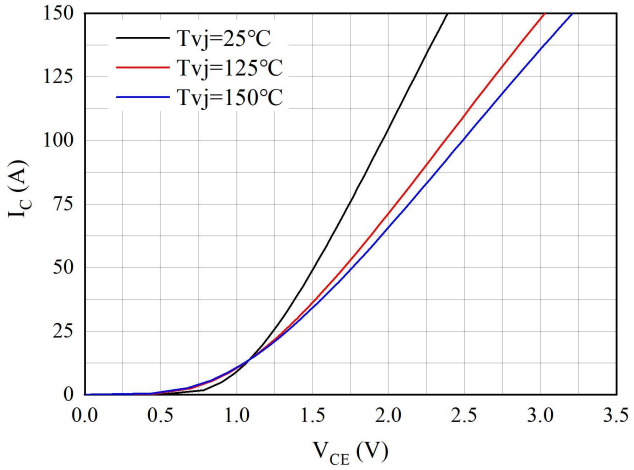



Fig 1. Typical output characteristics ($V_{GE}$=15V)

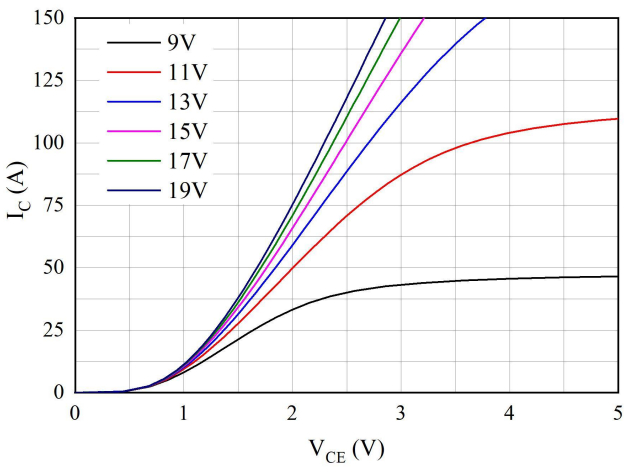



Fig 2. Typical output characteristics ($T_{vj}$=150℃)

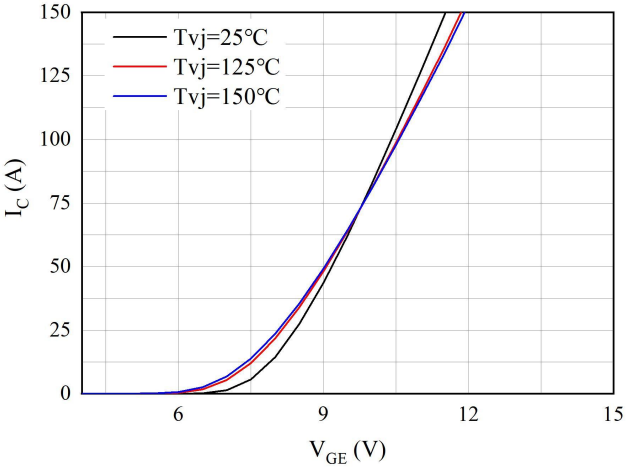



Fig 3. Typical transfer characteristics ($V_{CE}$=20V)

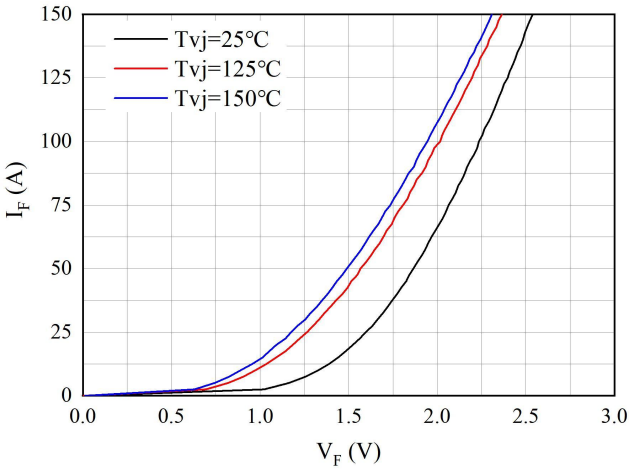



Fig4. Forward characteristics of Diode

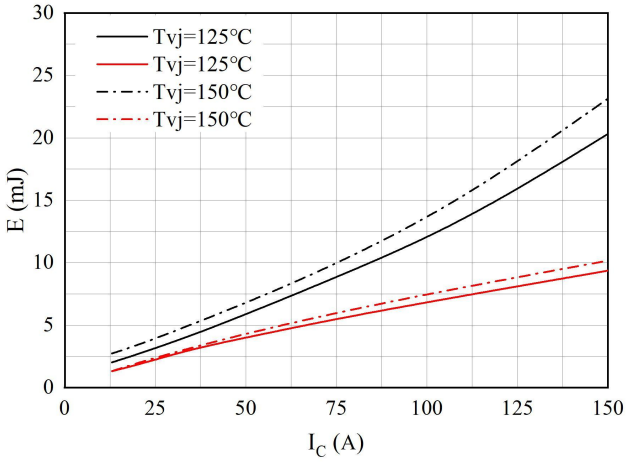



Fig 5. Switching losses of IGBT, Inverter
$V_{GE}$=±15V, $R_{Gon}$=$R_{Goff}$=10Ω, $V_{CE}$=600V

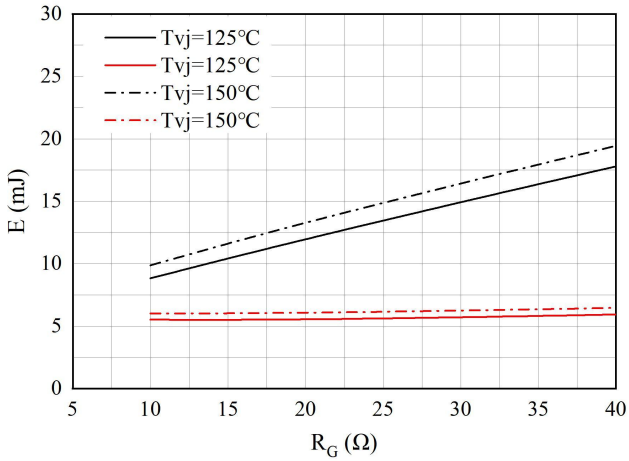



Fig 6. Switching losses of IGBT, Inverter
$V_{GE}$=±15V, $I_C$=75A, $V_{CE}$=600V

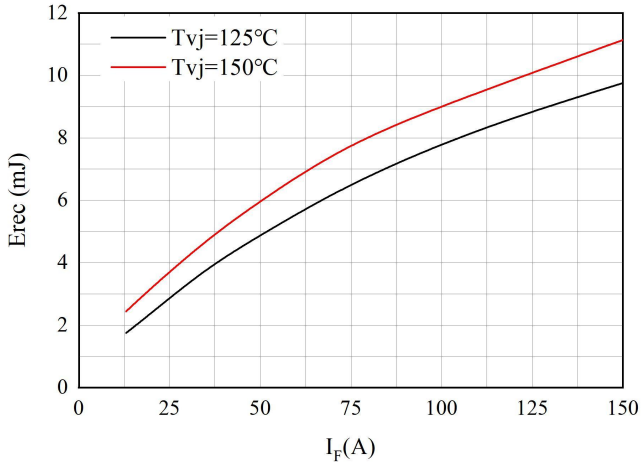



Fig 7. Switching losses of Diode
$R_{Gon}$=$R_{Goff}$=10Ω, $V_{CE}$=600V

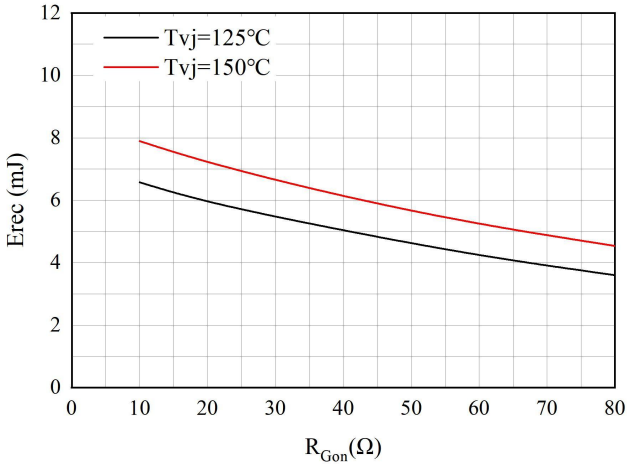



Fig 8. Switching losses of Diode
$I_F$=75A, $V_{CE}$=600V

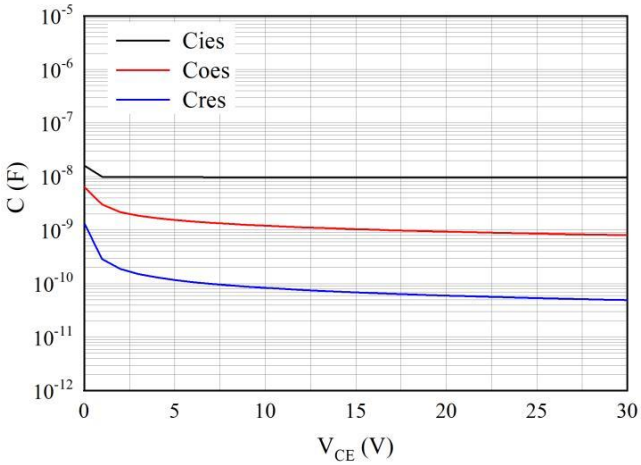



Fig 9. Capacitance characteristics

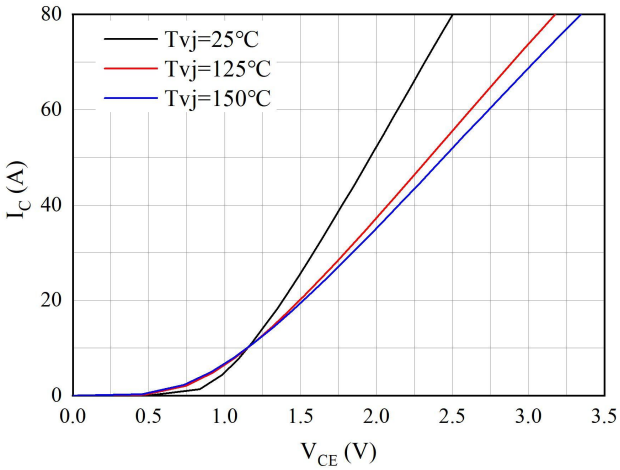



Fig 10. Typical output characteristics ($V_{GE}$=15V),
Brake-Chopper

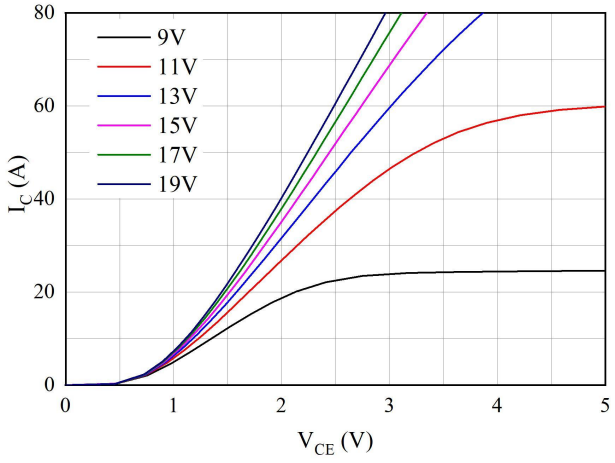



Fig 11. Typical output characteristics ($T_{vj}$=150℃)
Brake-Chopper

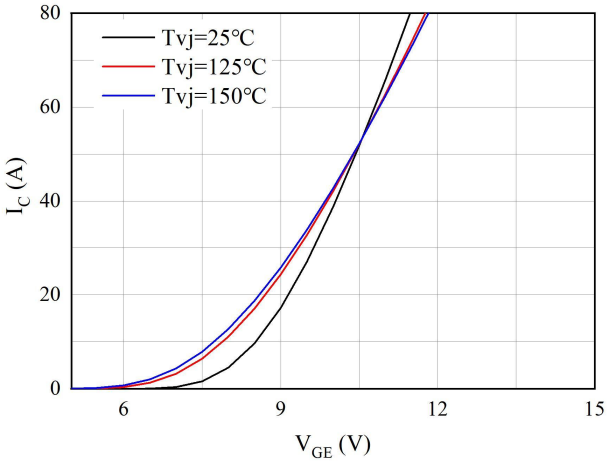



Fig 12. Typical transfer characteristics ($V_{CE}$=20V)
Brake-Chopper

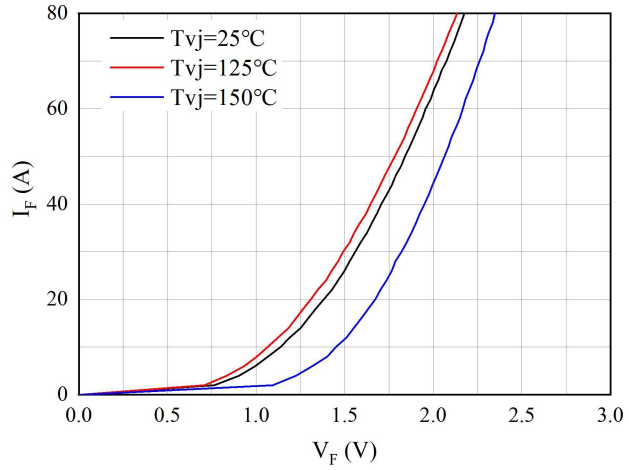



Fig 13.Forward characteristic of Diode, Brake-Chopper

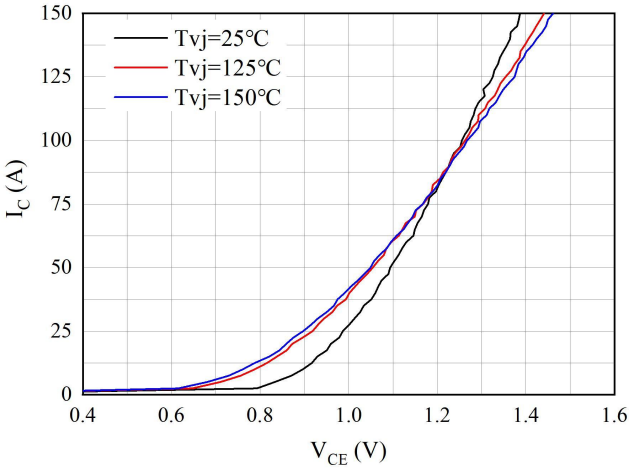



Fig 14.Forward characteristic of Diode, Rectifier

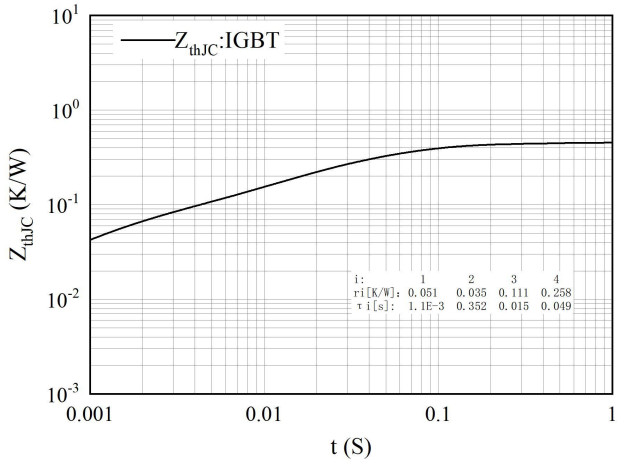



Fig 15. Transient thermal impedance IGBT, Inverter $Z_{thJC}$=f(t)

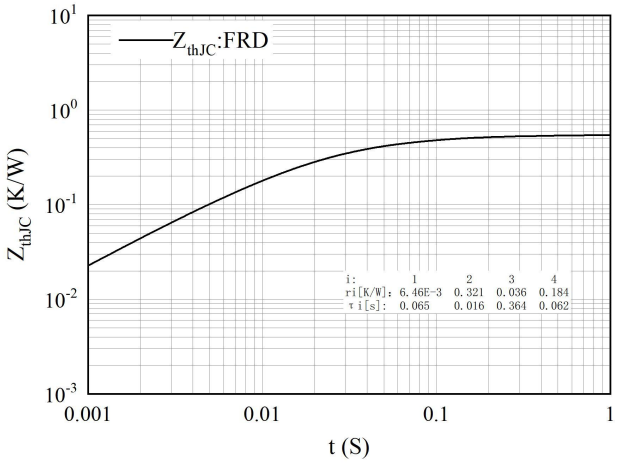



Fig 16. Transient thermal impedance FRD, Inverter $Z_{thJC}$=f(t)

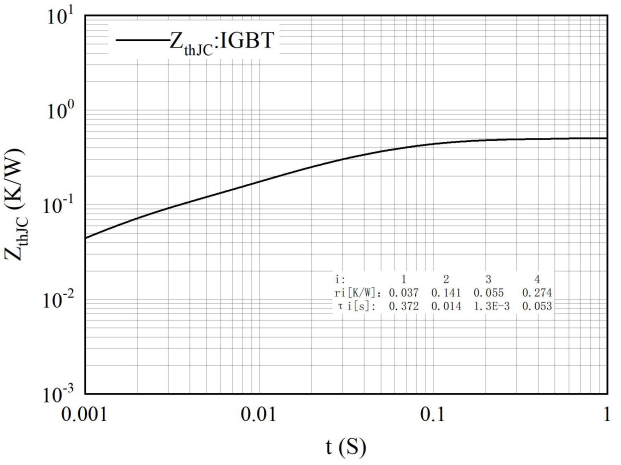



Fig 17. Transient thermal impedance IGBT, Inverter $Z_{thJC}$=f(t), Brake-Chopper

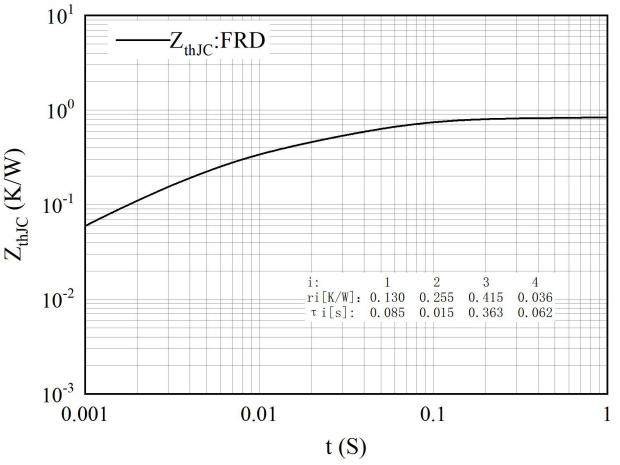



Fig 18. Transient thermal impedance FRD, Inverter $Z_{thJC}$=f(t), Brake-Chopper

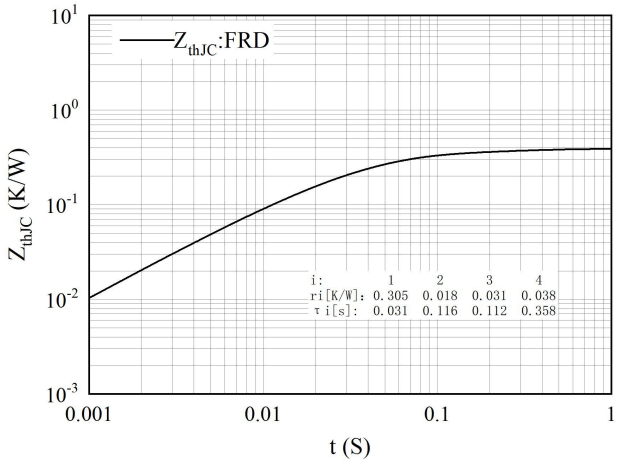



Fig 19.Transient thermal impedance Diode, $Z_{thJC}$= f(t)

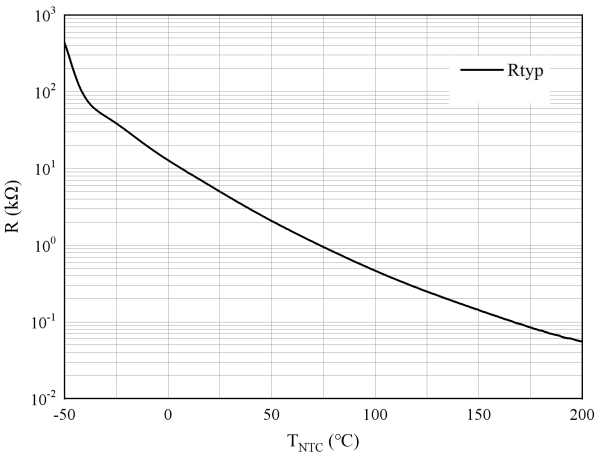
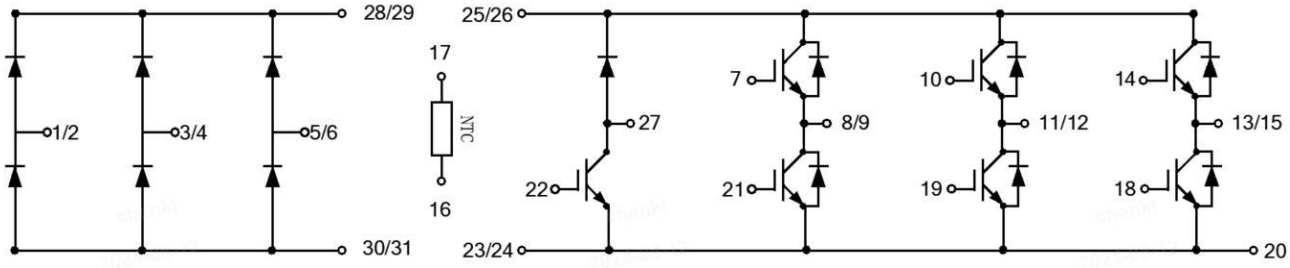
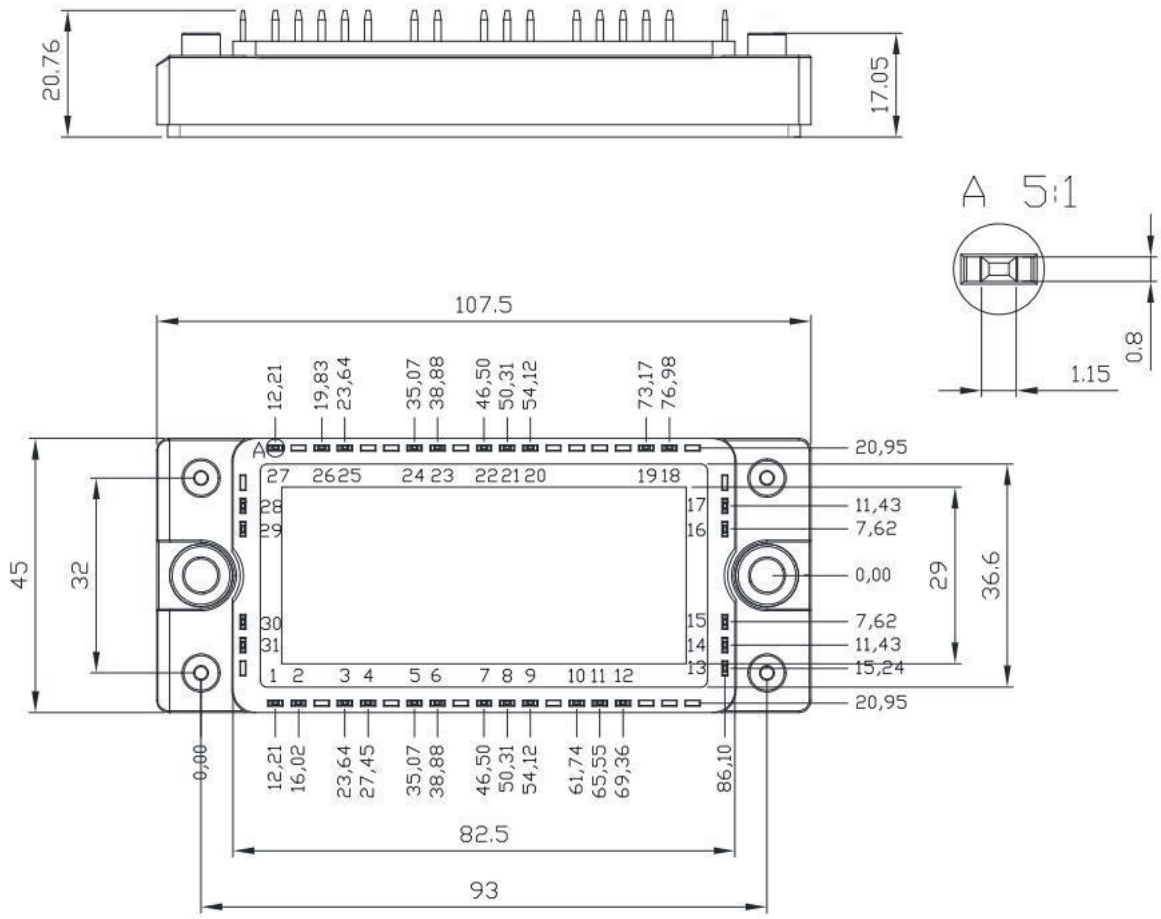



Fig 20.NTC-Themistor-temperature characteristic

## Circuit Diagram



## Package Outlines (Unit:mm)

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