STARSEA

# MG150P12E2

RoHS COMPLIANT



$V_{CES}$ 1200V
$I_C$ 150A

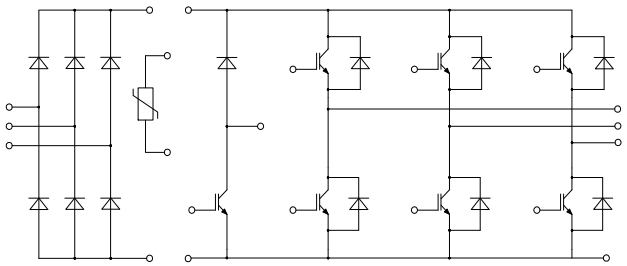
## Applications

- Motor Drivers
- AC and DC servo drive amplifier
- UPS (Uninterruptible Power Supplies)

## Features

- Low switching losses
- Low $V_{CE(sat)}$ with positive temperature coefficient
- Including fast & soft recovery anti-parallel FWD
- Low inductance case
- High short circuit capability(10us)
- Maximum junction temperature 175℃

**Circuit**



IGBT Modules

## ● IGBT- Inverter

Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | $V_{CES}$ | $V_{GE}$=0V, $I_C$=1mA, $T_{vj}$=25℃ | 1200 | V |
| Continuous Collector Current | $I_C$ | $T_C$=100℃, $T_{vjmax}$=175℃ | 150 | A |
| Repetitive Peak Collector Current | $I_{CRM}$ | $t_p$=1ms | 300 | A |
| Gate-Emitter Voltage | $V_{GES}$ | $T_{vj}$=25℃ | ±20 | V |
| Total Power Dissipation | $P_{tot}$ | $T_C$=25℃<br>$T_{vjmax}$=175℃ | 785 | W |

## IGBT- Inverter

Characteristic Values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}=V_{CE}$, $I_C$=5mA,$T_{vj}$=25℃ | 5.0 | 5.8 | 6.6 | V |
| Collector-Emitter Cut-off Current | $I_{CES}$ | $V_{CE}$=1200V,$V_{GE}$=0V, $T_{vj}$=25℃ | | | 1.0 | mA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$=150A,$V_{GE}$=15V, $T_{vj}$=25℃ | | 1.85 | 2.50 | V |
| | | $I_C$=150A,$V_{GE}$=15V, $T_{vj}$=125℃ | | 2.10 | | |
| | | $I_C$=150A,$V_{GE}$=15V, $T_{vj}$=150℃ | | 2.20 | | |
| Gate Charge | $Q_G$ | | | 0.99 | | uC |
| Input Capacitance | $C_{ies}$ | $V_{CE}$=25V,$V_{GE}$=0V, f=1MHz, $T_{vj}$=25℃ | | 14.4 | | nF |
| Reverse Transfer Capacitance | $C_{res}$ | | | 0.48 | | nF |
| Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V,$T_{vj}$=25℃ | | | 400 | nA |
| Turn-on Delay Time | $t_{d(on)}$ | $I_C$=150A $V_{CE}$=600V $V_{GE}$=±15V $R_G$=3.3Ω $T_{vj}$=25℃ | | 160 | | ns |
| Rise Time | $t_r$ | | | 89 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 271 | | ns |
| Fall Time | $t_f$ | | | 217 | | ns |
| Energy Dissipation During Turn-on Time | $E_{on}$ | | | 17.7 | | mJ |
| Energy Dissipation During Turn-off Time | $E_{off}$ | | | 10.3 | | mJ |
| Turn-on Delay Time | $t_{d(on)}$ | $I_C$=150A $V_{CE}$=600V $V_{GE}$=±15V $R_G$=3.3Ω $T_{vj}$=150℃ | | 166 | | ns |
| Rise Time | $t_r$ | | | 95 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 309 | | ns |
| Fall Time | $t_f$ | | | 275 | | ns |
| Energy Dissipation During Turn-on Time | $E_{on}$ | | | 23.9 | | mJ |
| Energy Dissipation During Turn-off Time | $E_{off}$ | | | 13.6 | | mJ |
| SC Data | $I_{sc}$ | $t_p$≤10us,$V_{GE}$=15V,$T_{vj}$=150℃, $V_{CC}$=900V,$V_{CEM}$≤1200V | | 600 | | A |

## Diode-Inverter

Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | $T_{vj}$=25℃ | 1200 | V |
| Continuous DC Forward Current | $I_F$ | | 150 | A |
| Repetitive Peak Forward Current | $I_{FRM}$ | $t_p$=1ms | 300 | A |

Characteristic Values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Forward Voltage | $V_F$ | $I_F$=150A,$T_{vj}$=25℃ | | 2.10 | 2.80 | V |
| | | $I_F$=150A,$T_{vj}$=125℃ | | 1.90 | | |
| | | $I_F$=150A,$T_{vj}$=150℃ | | 1.85 | | |
| Recovered Charge | $Q_{rr}$ | $I_F$=150A<br>$V_R$=600V<br>-$di_F$/dt =1600A/us<br>$T_{vj}$=25℃ | | 8.51 | | uC |
| Peak Reverse Recovery Current | $I_{rr}$ | | | 44 | | A |
| Reverse Recovery Energy | $E_{rec}$ | | | 2.8 | | mJ |
| Recovered Charge | $Q_{rr}$ | $I_F$=150A<br>$V_R$=600V<br>-$di_F$/dt =1600A/us<br>$T_{vj}$=150℃ | | 23.17 | | uC |
| Peak Reverse Recovery Current | $I_{rr}$ | | | 73 | | A |
| Reverse Recovery Energy | $E_{rec}$ | | | 8.2 | | mJ |

## IGBT-Brake-Chopper

Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | $V_{CES}$ | $V_{GE}$=0V, $I_C$ =1mA, $T_{vj}$=25℃ | 1200 | V |
| Continuous Collector Current | $I_C$ | $T_C$=100℃, $T_{vjmax}$=175℃ | 100 | A |
| Repetitive Peak Collector Current | $I_{CRM}$ | $t_p$=1ms | 200 | A |
| Gate-Emitter Voltage | $V_{GES}$ | $T_{vj}$=25℃ | ±20 | V |
| Total Power Dissipation | $P_{tot}$ | $T_C$=25℃<br>$T_{vjmax}$=175℃ | 515 | W |

Characteristic Values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}$=$V_{CE}$, $I_C$=3.3mA,$T_{vj}$=25℃ | 5.0 | 5.7 | 6.5 | V |
| Collector-Emitter Cut-off Current | $I_{CES}$ | $V_{CE}$=1200V,$V_{GE}$=0V, $T_{vj}$=25℃ | | | 1.0 | mA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$=100A,$V_{GE}$=15V, $T_{vj}$=25℃ | | 1.85 | | V |
| | | $I_C$=100A,$V_{GE}$=15V, $T_{vj}$=125℃ | | 2.15 | | |
| | | $I_C$=100A,$V_{GE}$=15V, $T_{vj}$=150℃ | | 2.25 | | |
| Gate Charge | $Q_G$ | | | 0.68 | | uC |
| Input Capacitance | $C_{ies}$ | $V_{CE}$=25V,$V_{GE}$=0V, f=1MHz, $T_{vj}$=25℃ | | 8.9 | | nF |
| Reverse Transfer Capacitance | $C_{res}$ | | | 0.27 | | nF |
| Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=20V,$T_{vj}$=25℃ | | | 400 | nA |
| Turn-on Delay Time | $t_{d(on)}$ | $I_C$=100A<br>$V_{CE}$=600V<br>$V_{GE}$=±15V<br>$R_G$ =5.6Ω<br>$T_{vj}$=25℃ | | 160 | | ns |
| Rise Time | $t_r$ | | | 45 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 215 | | ns |
| Fall Time | $t_f$ | | | 54 | | ns |
| Energy Dissipation During Turn-on Time | $E_{on}$ | | | 9.2 | | mJ |
| Energy Dissipation During Turn-off Time | $E_{off}$ | | | 5.8 | | mJ |

| | | | | | | |
|---|---|---|---|---|---|---|
| Turn-on Delay Time | $t_{d(on)}$ | $I_C$=100A<br>$V_{CE}$=600V<br>$V_{GE}$=±15V<br>$R_G$ =5.6Ω<br>$T_{vj}$=150℃ | | 180 | | ns |
| Rise Time | $t_r$ | | | 52 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 360 | | ns |
| Fall Time | $t_f$ | | | 63 | | ns |
| Energy Dissipation During Turn-on Time | $E_{on}$ | | | 13.3 | | mJ |
| Energy Dissipation During Turn-off Time | $E_{off}$ | | | 9.5 | | mJ |
| SC Data | $I_{sc}$ | $t_p$≤10us,$V_{GE}$=15V,$T_{vj}$=150℃,<br>$V_{CC}$=900V,$V_{CEM}$≤1200V | | 400 | | A |

## ● Diode-Brake-Chopper

Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | $T_{vj}$=25℃ | 1200 | V |
| Continuous DC Forward Current | $I_F$ | | 60 | A |
| Repetitive Peak Forward Current | $I_{FRM}$ | $t_p$=1ms | 120 | A |

Characteristic Values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Forward Voltage | $V_F$ | $I_F$=60A,$T_{vj}$=25℃ | | 1.95 | 2.80 | V |
| | | $I_F$=60A,$T_{vj}$=125℃ | | 1.70 | | |
| | | $I_F$=60A,$T_{vj}$=150℃ | | 1.65 | | |
| Recovered Charge | $Q_{rr}$ | $I_F$=60A<br>$V_R$=600V<br>-di$_F$/dt =1500A/us<br>$T_{vj}$=25℃ | | 5.8 | | uC |
| Peak Reverse Recovery Current | $I_{rr}$ | | | 56 | | A |
| Reverse Recovery Energy | $E_{rec}$ | | | 1.85 | | mJ |
| Recovered Charge | $Q_{rr}$ | $I_F$=60A<br>$V_R$=600V<br>-di$_F$/dt =1500A/us<br>$T_{vj}$=150℃ | | 9.1 | | uC |
| Peak Reverse Recovery Current | $I_{rr}$ | | | 58 | | A |
| Reverse Recovery Energy | $E_{rec}$ | | | 3.35 | | mJ |

## Diode-Rectifier

Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | $T_{vj}$=25℃ | 1600 | V |
| Average output Current 50/60Hz, sine wave | $I_{F(AV)}$ | $T_C$=100℃ | 150 | A |
| Maximum RMS Current at Rectifier Output | $I_{RMSM}$ | $T_C$=100℃ | 150 | A |
| Surge Forward Current | $I_{FSM}$ | $V_R$=0V,$t_p$=10ms,$T_{vj}$=25℃ | 1500 | A |
| $I^2t$-value | $I^2t$ | $V_R$=0V,$t_p$=10ms,$T_{vj}$=25℃ | 11200 | $A^2s$ |

Characteristic Values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Diode Forward Voltage | $V_F$ | $I_F$=150A,$T_{vj}$=150℃ | | 1.15 | | V |
| Reverse Current | $I_R$ | $T_{vj}$=150℃,$V_R$=1600V | | | 2.0 | mA |

## NTC-Thermistor

Characteristic values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Rated Resistance | $R_{25}$ | | | 5.0 | | kΩ |
| Deviation of R100 | ΔR/R | $T_C$=100,$R_{100}$=493.3Ω | -5 | | 5 | % |
| Power Dissipation | $P_{25}$ | | | | 20.0 | mW |
| B-value | $B_{25/50}$ | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\ K))]$ | | 3375 | | K |

## Module Characteristics

$T_C$=25°C unless otherwise specified

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Isolation Voltage | $V_{isol}$ | t=1min,f=50Hz | 2500 | | | V |
| Maximum Junction Temperature | $T_{jmax}$ | | | | 175 | ℃ |
| Operating Junction Temperature | $T_{vj\ op}$ | | -40 | | 150 | ℃ |
| Storage Temperature | $T_{stg}$ | | -40 | | 125 | ℃ |
| Stray-inductance-module | $L_{SCE}$ | | | 60 | | nH |
| Module Lead Resistance, Terminals-chip | $R_{CC'+EE'}$ | $T_C$=25℃, per switch | | 4.0 | | mΩ |
| | $R_{AA'+CC'}$ | | | 3.0 | | |
| Thermal Resistance Junction to Case | $R_{\theta JC}$ | per IGBT-inverter | | | 0.19 | K/W |
| | | per Diode-inverter | | | 0.35 | |
| | | per IGBT-brake-copper | | | 0.29 | |
| | | per Diode-chopper | | | 0.85 | |
| | | per Diode-rectifier | | | 0.45 | |
| Thermal Resistance Case to Sink | $R_{\theta CS}$ | per IGBT-inverter | | 0.12 | | K/W |
| | | per Diode-inverter | | 0.20 | | |
| | | per IGBT-brake-copper | | 0.18 | | |
| | | per Diode-chopper | | 0.45 | | |
| | | per Diode-rectifier | | 0.17 | | |
| | | per Module | | 0.009 | | |
| Module-to-Sink Torque | Ms | | 3.0 | | 6.0 | N·m |
| Weight of Module | G | | | 300 | | g |

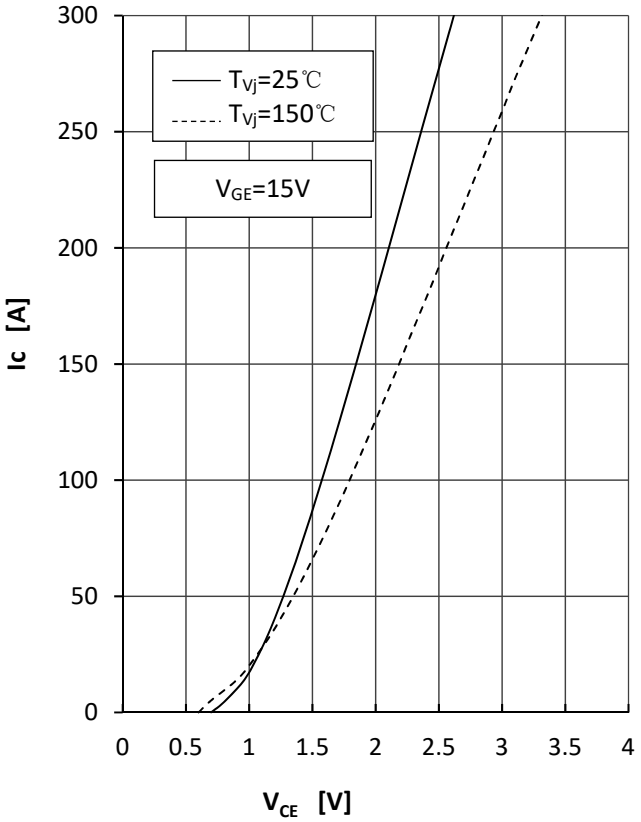



Fig1.IGBT Output Characteristics

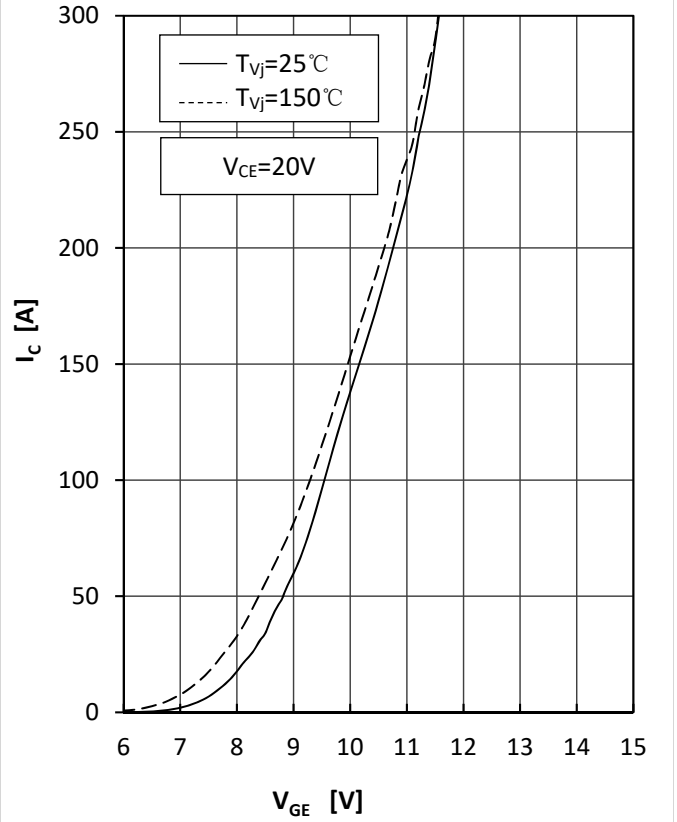



Fig2.IGBT Transfer Characteristics

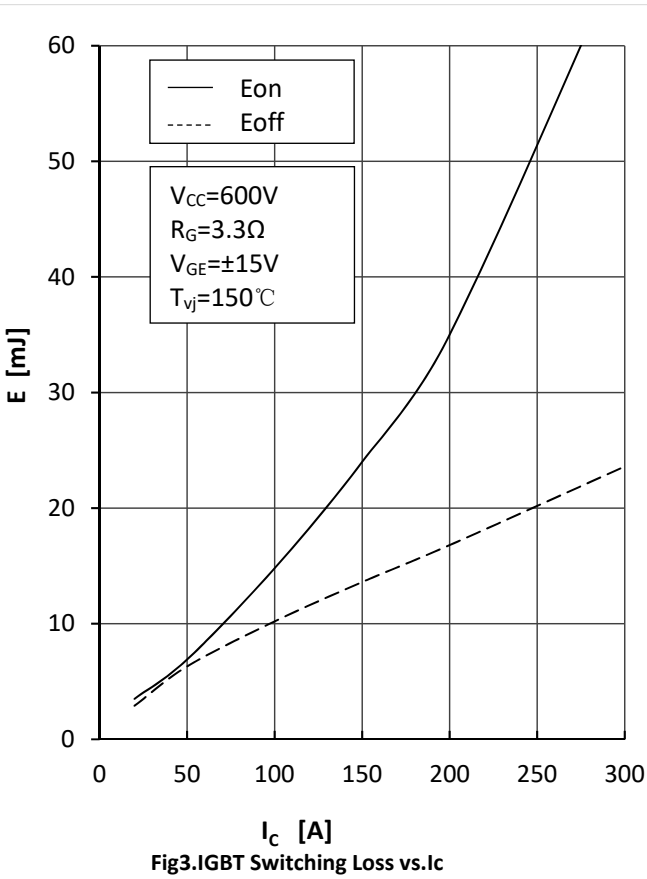



Fig3.IGBT Switching Loss vs.Ic

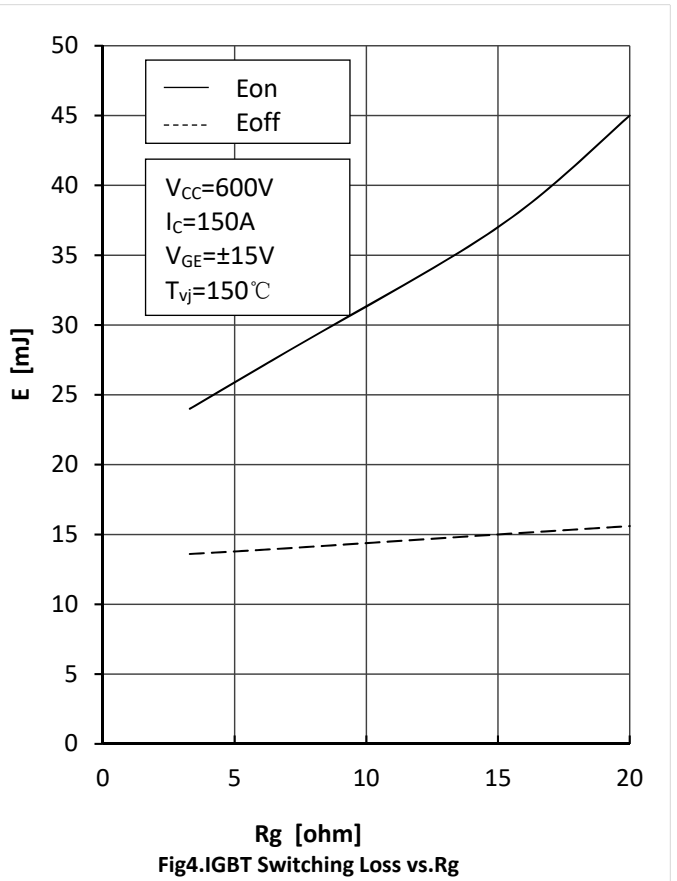



Fig4.IGBT Switching Loss vs.Rg

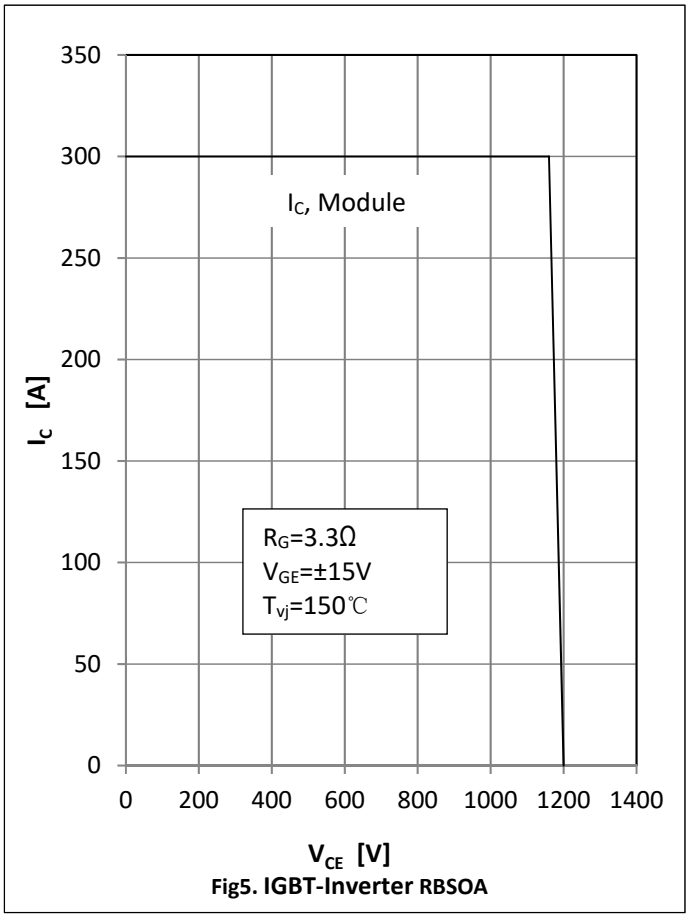


Fig5. IGBT-Inverter RBSOA

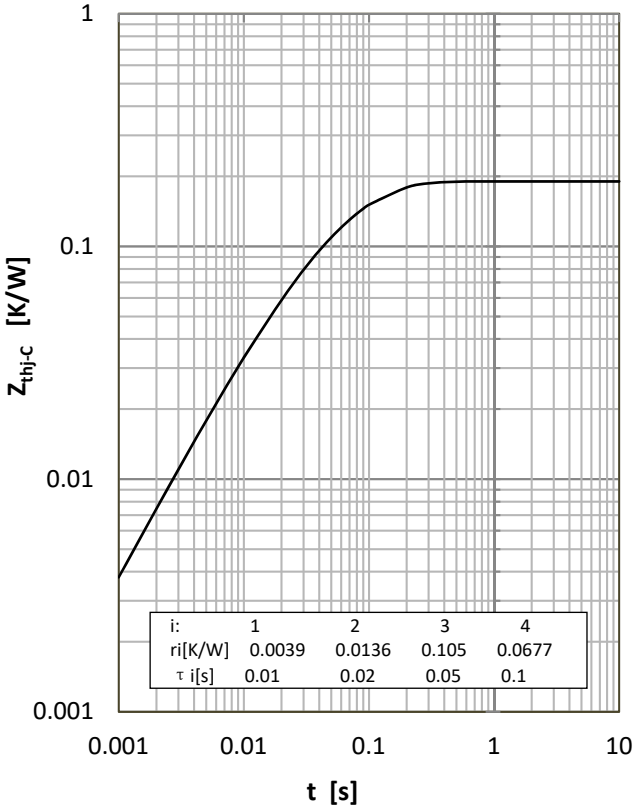


Fig 6. IGBT-Inverter Transient Thermal Impedance

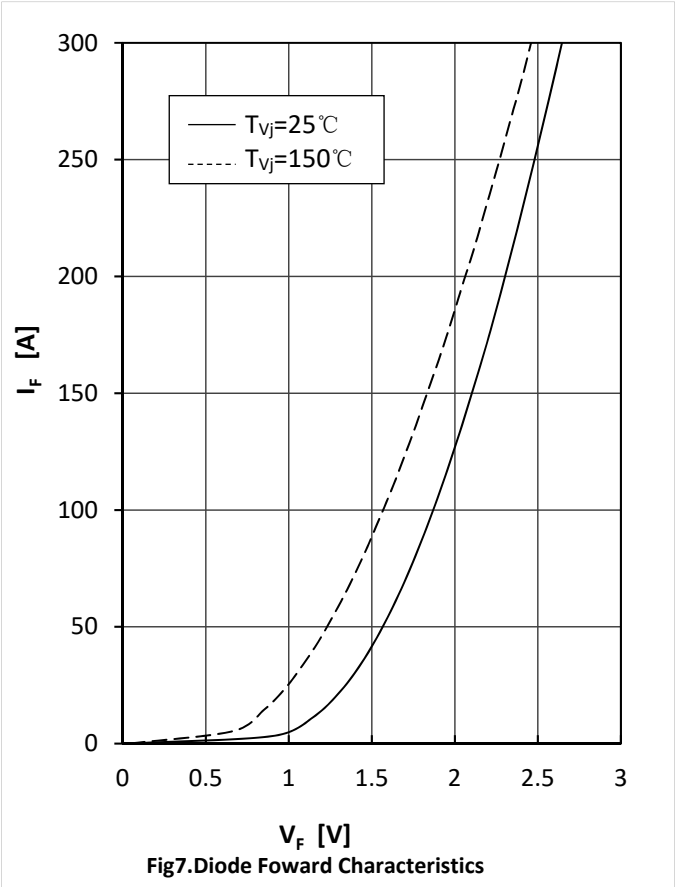


Fig7.Diode Foward Characteristics

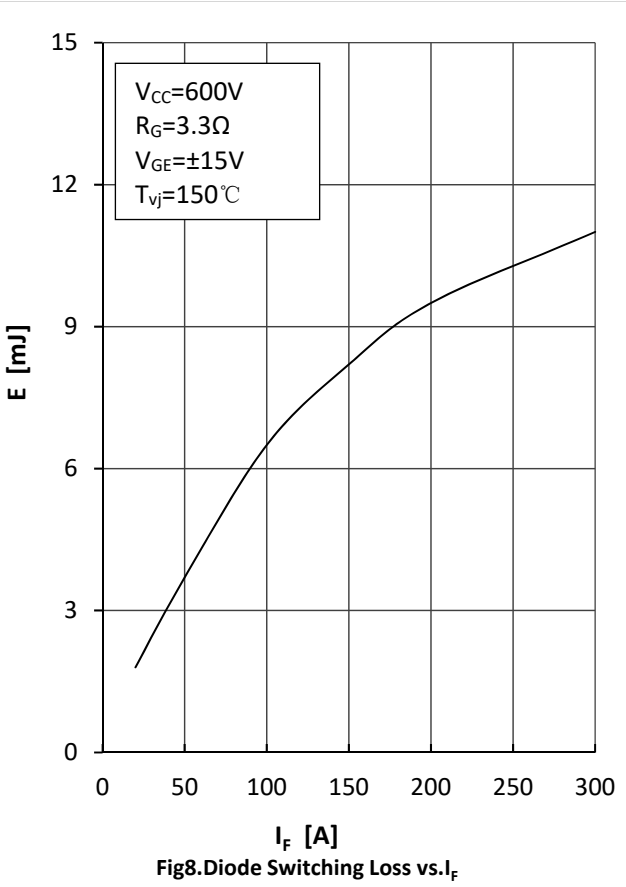


Fig8.Diode Switching Loss vs.$I_F$

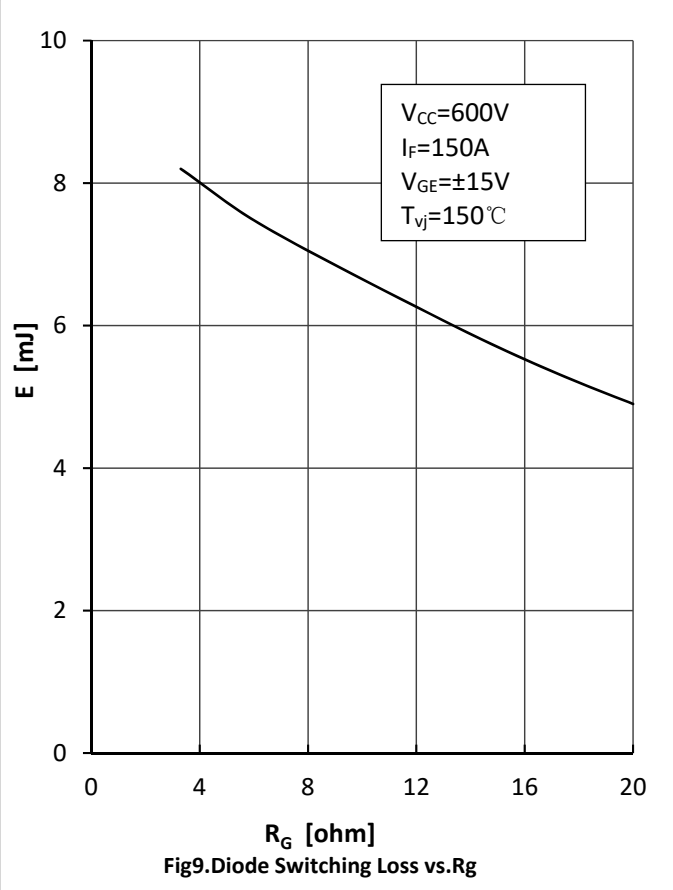



Fig9.Diode Switching Loss vs.Rg

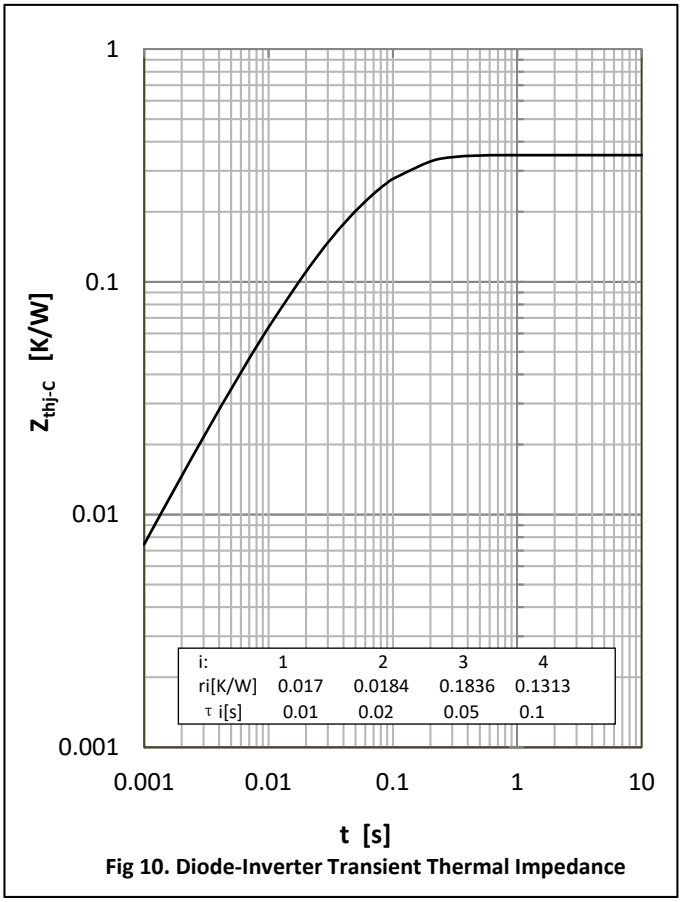



Fig 10. Diode-Inverter Transient Thermal Impedance

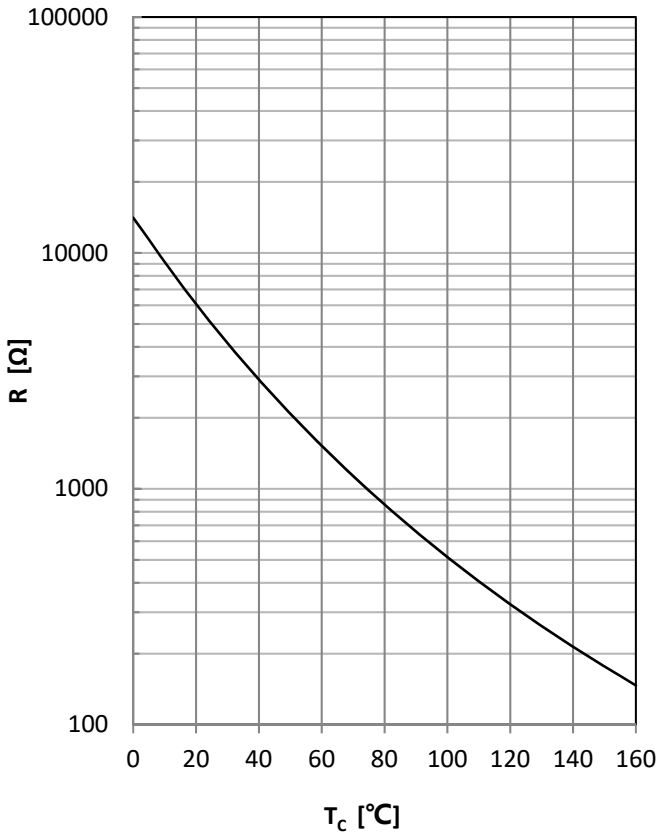



Fig 11. NTC Temperature Characteristic

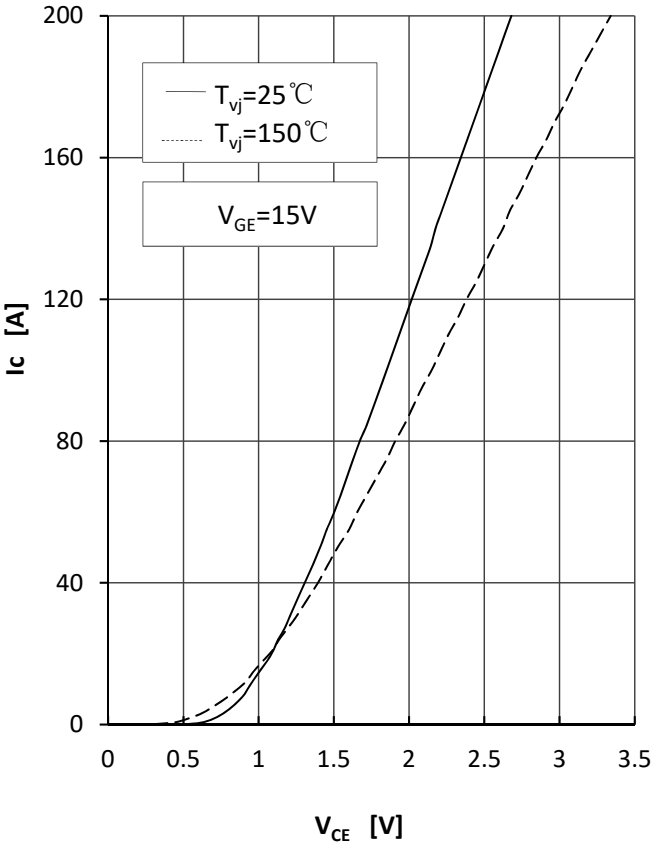



Fig12. IGBT-Brake-Chopper output Characteristics

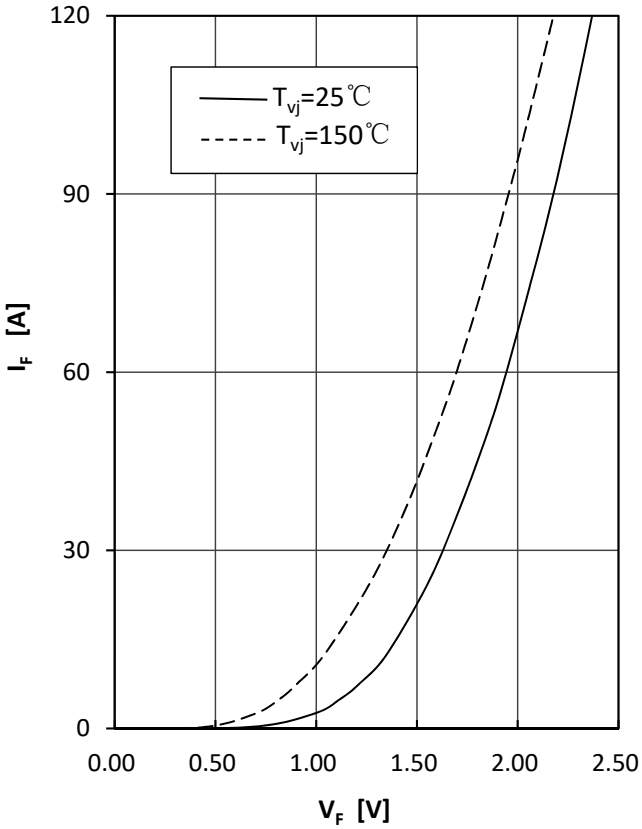



Fig13.Diode-Brake-Chopper Foward Characteristics

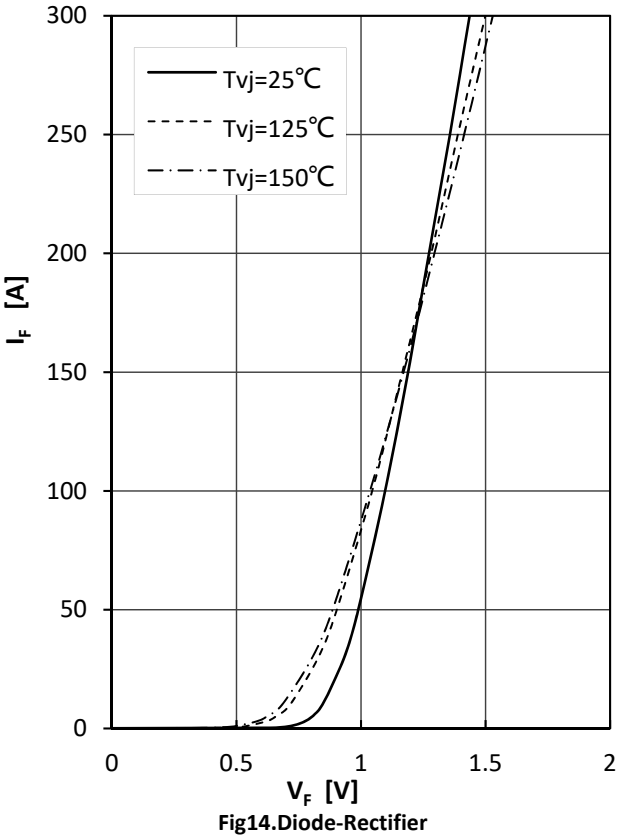
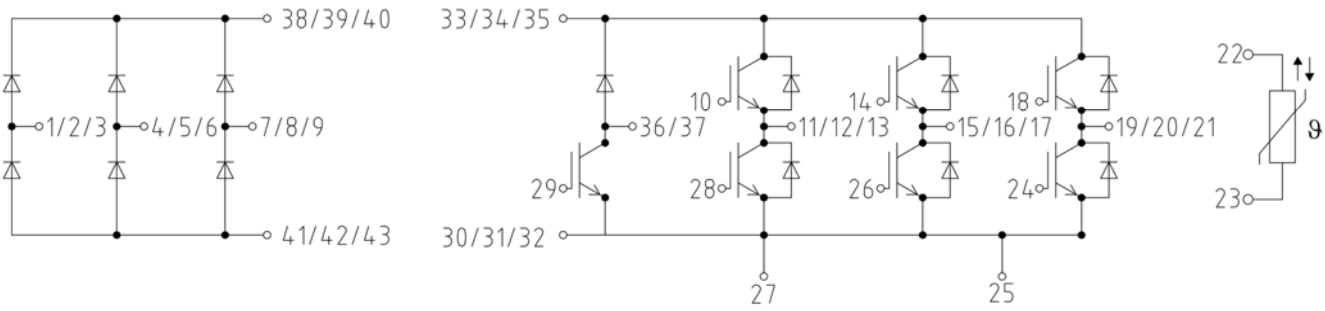
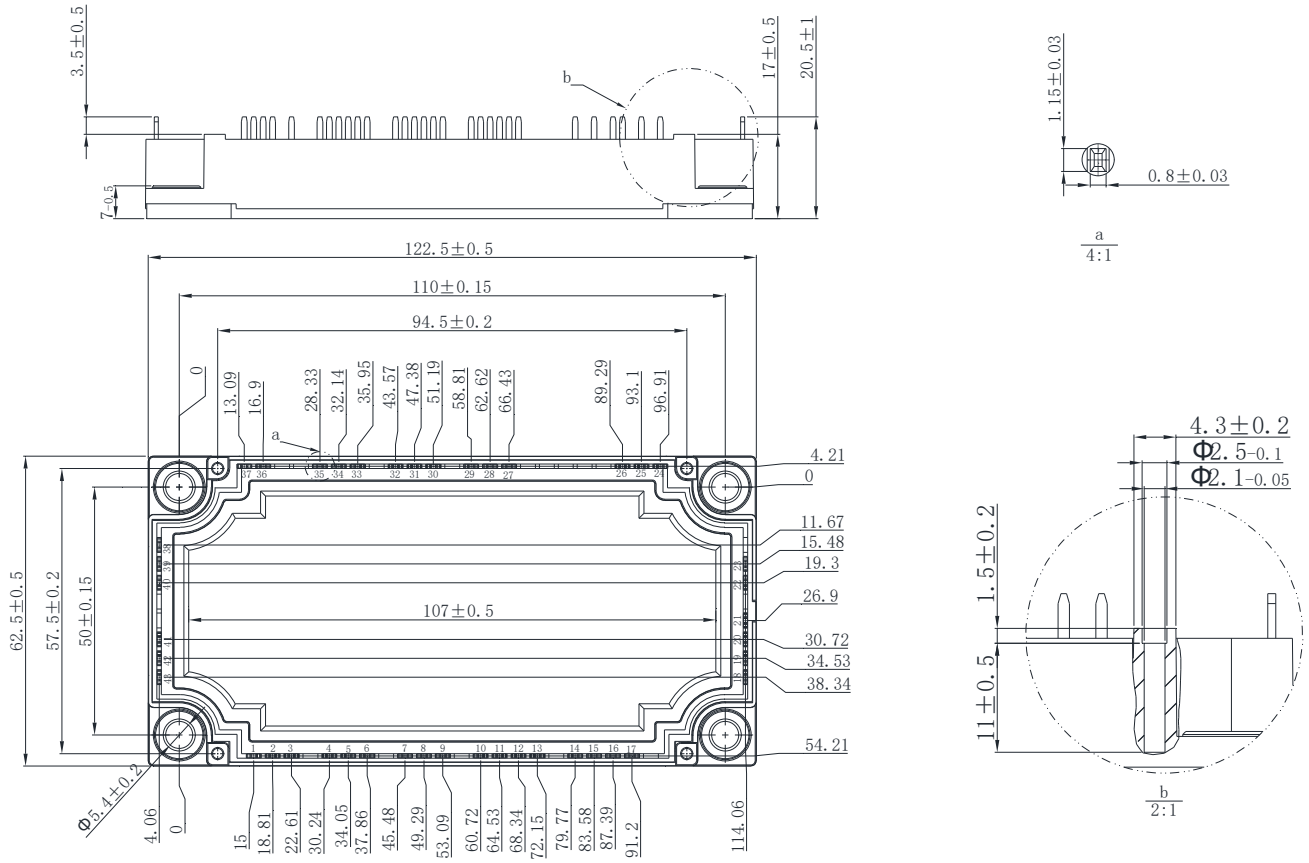



Fig14.Diode-Rectifier Foward Characteristics

- Circuit Diagram




- **Package Outline Information**



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