Technical datasheet

# 1. Product Features

## 1.1 Electrical features

- $V_{CES}$=1200V
- $I_{C\ nom}$=25A / $I_{CRM}$=50A
- Low switching losses
- Low inductance
- Fast switching and short tail current
- Integrated NTC temperature sensor
- High power and thermal cycling capability

**Figure1 IGBT Module**

## 1.2 Mechanical features

- Integrated NTC temperature sensor
- High power and thermal cycling capability
- $Al_2O_3$ substrate with low thermal resistance

# 2. Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- power supply

# 3. Description

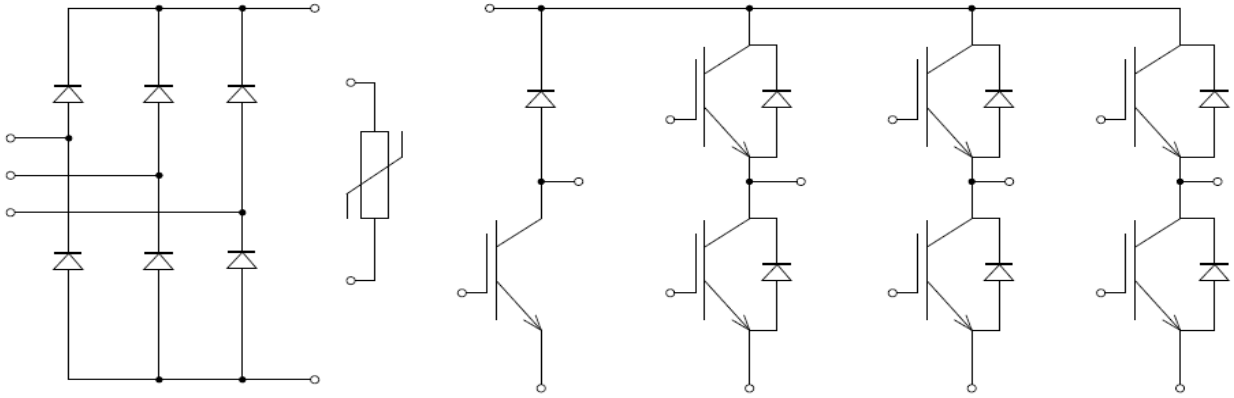


**Figure 2 3 Phase Bridge +Rectifier+Brake**

# 4. IGBT, Inverter

## 4.1 Maximum Rated Values

| Parameter | Note or test condition | Symbol | Values | Unit |
|---|---|---|---|---|
| Collector-emitter voltage<br>集电极—发射极间电压 | $T_{vj}$ = 25°C | $V_{CES}$ | 1200 | V |
| Continuous DC collector current<br>连续集电极电流 | $T_C$ = 100°C, $T_{vj,max}$ = 150°C | $I_{C\ nom}$ | 25 | A |
| Repetitive peak collector current<br>集电极峰值电流 | $t_P$ = 1 ms | $I_{CRM}$ | 50 | A |
| Total power dissipation<br>总功率损耗 | $T_C$ = 25°C, $T_{vj,max}$ = 175 °C | $P_{tot}$ | 110 | W |
| Gate-emitter peak voltage<br>栅极－发射极峰值电压 | | $V_{GES}$ | +/- 20 | V |

## 4.2 Characteristic value

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage<br>集电极－发射极饱和电压 | $I_C$ = 25 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_{CE,sat}$ | | 1.75<br>2.02<br>2.08 | | V<br>V<br>V |
| Gate threshold voltage<br>栅极阈值电压 | $I_C$ = 0.25mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25°C | | $V_{GE,th}$ | 4.5 | 5.5 | 6.5 | V |
| Gate charge<br>栅极电荷 | $V_{GE}$ = -15 V ... +15 V | | $Q_G$ | | 0.155 | | µC |
| Input capacitance<br>输入电容 | f=1MHz, $T_{vj}$=25°C, $V_{CE}$=25V, $V_{GE}$=0V | | $C_{ies}$ | | 3.60 | | nF |
| Reverse transfer capacitance<br>反向传输电容 | f=1MHz, $T_{vj}$=25°C, $V_{CE}$=25V, $V_{GE}$=0V | | $C_{res}$ | | 0.05 | | nF |
| Collector-emitter cut-off current<br>集电极-发射极截止电流 | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 V, $T_{vj}$ = 25°C | | $I_{CES}$ | | | 1 | mA |
| Gate-emitter leakage current<br>栅极-发射极漏电流 | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V, $T_{vj}$ = 25°C | | $I_{GES}$ | | | 100 | nA |
| Turn-on delay time, inductive load<br>开通延迟时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,on}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d,on}$ | | 0.036<br>0.036<br>0.035 | | us<br>us<br>us |
| Rise time, inductive load<br>上升时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,on}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_r$ | | 0.025<br>0.027<br>0.026 | | us<br>us<br>us |

**(table continues...)** 待续

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Turn-off delay time, inductive load<br>关断延迟时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,off}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d,off}$ | | 0.062<br>0.161<br>0.167 | | us<br>us<br>us |
| Fall time, inductive load<br>下降时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,off}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_f$ | | 0.166<br>0.319<br>0.330 | | us<br>us<br>us |
| Turn-on energy loss per pulse<br>开通损耗能量 | $I_C$ = 25A, $V_{CE}$ = 600V, $L_s$=30nH<br>$V_{GE}$ = +15/-15V, di/dt =810A/μs<br>$R_{G,on}$ = 15Ω ($T_{vj}$ = 150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{on}$ | | 2.23<br>3.43<br>3.72 | | mJ<br>mJ<br>mJ |
| Turn-off energy loss per pulse<br>关断损耗能量 | $I_C$ = 25A, $V_{CE}$ = 600V, $L_s$=30nH<br>$V_{GE}$ = +15/-15V, dv/dt =7260V/μs<br>$R_{G,off}$ = 15Ω ($T_{vj}$ = 150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{off}$ | | 1.09<br>1.92<br>2.11 | | mJ<br>mJ<br>mJ |
| SC data<br>短路数据 | $V_{GE}$ ≤15V, $V_{CC}$=600 V, $t_P$ ≤ 8 μs, $T_{vj}$ = 150°C ,<br>$C_{GE}$ = 0.0uF , $V_{CEmax}$ = $V_{CES}$ -$L_{sCE}$ · di/dt | | $I_{SC}$ | | 170 | | A |
| Thermal resistance, junction to case<br>结－外壳热阻 | Per IGBT | | $R_{th,JH}$ | | | 1.15 | K/W |

# 5. Diode, Inverter

## 5.1 Maximum Rated Values

| Parameter | Note or test condition | Symbol | Values | Unit |
|---|---|---|---|---|
| Repetitive peak reverse voltage<br>反向重复峰值电压 | $T_{vj}$ = 25°C | $V_{RRM}$ | 1200 | V |
| Continuous DC forward current<br>连续正向直流电流 | | $I_F$ | 25 | A |
| Repetitive peak forward current<br>正向重复峰值电流 | $t_P$ = 1 ms | $I_{FRM}$ | 50 | A |

## 5.2 Characteristic value

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage<br>正向电压 | $I_F$ = 25 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_F$ | | 2.05<br>1.65<br>1.60 | | V<br>V<br>V |

(table continues...) 待续

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Peak reverse recovery current<br>反向恢复峰值电流 | $I_F$ = 25A, $V_R$ = 600V<br>$V_{GE}$ = -15V , - $di_F/dt$ = 315 A/µs<br>($T_{vj}$=150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $I_{RM}$ | | 38<br>78<br>80 | | A<br>A<br>A |
| Recovered charge<br>恢复电荷 | $I_F$ = 25A, $V_R$ = 600V<br>$V_{GE}$ = -15V , - $di_F/dt$ = 315 A/µs<br>($T_{vj}$=150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $Q_r$ | | 2.80<br>7.04<br>7.86 | | µC<br>µC<br>µC |
| Reverse recovery energy<br>反向恢复损耗（每脉冲） | $I_F$ = 25A, $V_R$ = 600V<br>$V_{GE}$ = -15V , - $di_F/dt$ = 315 A/µs<br>($T_{vj}$=150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{rec}$ | | 0.77<br>2.16<br>2.68 | | mJ<br>mJ<br>mJ |
| Thermal resistance, junction to case<br>结－外壳热阻 | Per diode | | $R_{th,JH}$ | | | 1.5 | K/W |

# 6. Diode, Rectifier

## 6.1 Maximum Rated Values

| Parameter | Note or test condition | Symbol | Values | Unit |
|---|---|---|---|---|
| Repetitive peak reverse voltage<br>反向重复峰值电压 | $T_{vj}$ = 25°C | $V_{RRM}$ | 1600 | V |
| Average Rectified Output current<br>整流器输出均方根电流 | $V_F$ = 1.2, $T_{vj}$ = 150°C | $I_F$ | 25 | A |
| Surge forward current<br>正向浪涌电流 | $t_p$ = 10 ms, $T_{vj}$ = 150°C | $I_{FSM}$ | 270 | A |
| $I^2t$ - value<br>$I^2t$-值 | $t_p$ = 10 ms, $T_{vj}$ = 150°C | $I^2t$ | 729 | $A^2s$ |

## 6.2 Characteristic value

| Parameter | Note or test condition | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Forward voltage<br>正向电压 | $T_{vj}$ = 150°C, $I_F$ = 25 A | $V_F$ | | 1.0 | | V |
| Reverse current<br>反向电流 | $T_{vj}$ = 150°C, $V_R$ = 1600 V | $I_R$ | | 1 | | mA |
| Thermal resistance, junction to case<br>结－外壳热阻 | Per diode | $R_{thJH}$ | | | 1.32 | K/W |

# 7. IGBT, Brake-Chopper

## 7.1 Maximum Rated Values

| Parameter | Note or test condition | Symbol | Values | Unit |
|---|---|---|---|---|
| Collector-emitter voltage<br>集电极—发射极间电压 | $T_{vj}$ = 25°C | $V_{CES}$ | 1200 | V |
| Continuous DC collector current<br>连续集电极电流 | $T_C$ = 100°C, $T_{vj}$ max = 150°C | $I_{C\ nom}$ | 25 | A |
| Repetitive peak collector current<br>集电极峰值电流 | $t_P$ = 1 ms | $I_{CRM}$ | 50 | A |
| Gate-emitter peak voltage<br>栅极－发射极峰值电压 | | $V_{GES}$ | +/- 20 | V |

## 7.2 Characteristic value

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage<br>集电极－发射极饱和电压 | $I_C$ = 25 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_{CE,sat}$ | | 1.75<br>2.02<br>2.08 | | V<br>V<br>V |
| Gate threshold voltage<br>栅极阈值电压 | $I_C$ = 0.25mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25°C | | $V_{GE,th}$ | 4.5 | 5.5 | 6.5 | V |
| Gate charge<br>栅极电荷 | $V_{GE}$ = -15 V ... +15 V | | $Q_G$ | | 0.155 | | µC |
| Input capacitance<br>输入电容 | f=1MHz, $T_{vj}$=25°C, $V_{CE}$=25V, $V_{GE}$=0V | | $C_{ies}$ | | 3.60 | | nF |
| Reverse transfer capacitance<br>反向传输电容 | f=1MHz, $T_{vj}$=25°C, $V_{CE}$=25V, $V_{GE}$=0V | | $C_{res}$ | | 0.05 | | nF |
| Collector-emitter cut-off current<br>集电极-发射极截止电流 | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 V, $T_{vj}$ = 25°C | | $I_{CES}$ | | | 1 | mA |
| Gate-emitter leakage current<br>栅极-发射极漏电流 | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V, $T_{vj}$ = 25°C | | $I_{GES}$ | | | 100 | nA |
| Turn-on delay time, inductive load<br>开通延迟时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,on}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d,on}$ | | 0.100<br>0.124<br>0.130 | | us<br>us<br>us |
| Rise time, inductive load<br>上升时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,on}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_r$ | | 0.025<br>0.026<br>0.026 | | us<br>us<br>us |

(table continues...) 待续

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Turn-off delay time, inductive load<br>关断延迟时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,off}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d,off}$ | | 0.121<br>0.144<br>0.149 | | us<br>us<br>us |
| Fall time, inductive load<br>下降时间 | $I_C$ = 25A, $V_{CE}$ = 600V<br>$V_{GE}$ = +15/-15V<br>$R_{G,off}$ = 15Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_f$ | | 0.159<br>0.230<br>0.248 | | us<br>us<br>us |
| Turn-on energy loss per pulse<br>开通损耗能量 | $I_C$ = 25A, $V_{CE}$ = 600V, $L_s$=30nH<br>$V_{GE}$ = +15/-15V, di/dt =780A/μs<br>$R_{G,on}$ = 15Ω ($T_{vj}$ = 150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{on}$ | | 2.29<br>3.56<br>3.88 | | mJ<br>mJ<br>mJ |
| Turn-off energy loss per pulse<br>关断损耗能量 | $I_C$ = 25A, $V_{CE}$ = 600V, $L_s$=30nH<br>$V_{GE}$ = +15/-15V, dv/dt =7380V/μs<br>$R_{G,off}$ = 15Ω ($T_{vj}$ = 150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{off}$ | | 1.16<br>1.57<br>1.66 | | mJ<br>mJ<br>mJ |
| SC data<br>短路数据 | $V_{GE}$ ≤15V, $V_{CC}$ =600 V, $t_P$ ≤ 8 μs, $T_{vj}$ = 150°C ,<br>$C_{GE}$ = 0.0uF , $V_{CEmax}$ = $V_{CES}$ - $L_{sCE}$ · di/dt | | $I_{SC}$ | | 170 | | A |
| Thermal resistance, junction to case<br>结－外壳热阻 | Per IGBT | | $R_{th,JH}$ | | | 0.92 | K/W |

# 8. Diode, Brake-Chopper

## 8.1 Maximum Rated Values

| Parameter | Note or test condition | Symbol | Values | Unit |
|---|---|---|---|---|
| Repetitive peak reverse voltage<br>反向重复峰值电压 | $T_{vj}$ = 25°C | $V_{RRM}$ | 1200 | V |
| Continuous DC forward current<br>连续正向直流电流 | | $I_F$ | 25 | A |
| Repetitive peak forward current<br>正向重复峰值电流 | $t_P$ = 1 ms | $I_{FRM}$ | 50 | A |

## 8.2 Characteristic value

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage<br>正向电压 | $I_F$ = 25 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_F$ | | 2.05<br>1.70<br>1.60 | | V<br>V<br>V |

(table continues...) 待续

| Parameter | Note or test condition | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Peak reverse recovery current<br>反向恢复峰值电流 | $I_F$ = 25A, $V_R$ = 600V<br>$V_{GE}$ = -15V , - $di_F/dt$ = 110 A/μs<br>($T_{vj}$=150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $I_{RM}$ | | 20.3<br>29.5<br>31.2 | | A<br>A<br>A |
| Recovered charge<br>恢复电荷 | $I_F$ = 25A, $V_R$ = 600V<br>$V_{GE}$ = -15V , - $di_F/dt$ = 110 A/μs<br>($T_{vj}$=150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $Q_r$ | | 2.76<br>6.22<br>7.14 | | μC<br>μC<br>μC |
| Reverse recovery energy<br>反向恢复损耗（每脉冲） | $I_F$ = 25A, $V_R$ = 600V<br>$V_{GE}$ = -15V , - $di_F/dt$ = 110 A/μs<br>($T_{vj}$=150°C) | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{rec}$ | | 0.89<br>2.12<br>2.43 | | mJ<br>mJ<br>mJ |
| Thermal resistance, junction to case<br>结－外壳热阻 | Per diode | | $R_{th,JH}$ | | | 1.10 | K/W |

# 9. NTC-Thermistor

## 9.1 Characteristic value

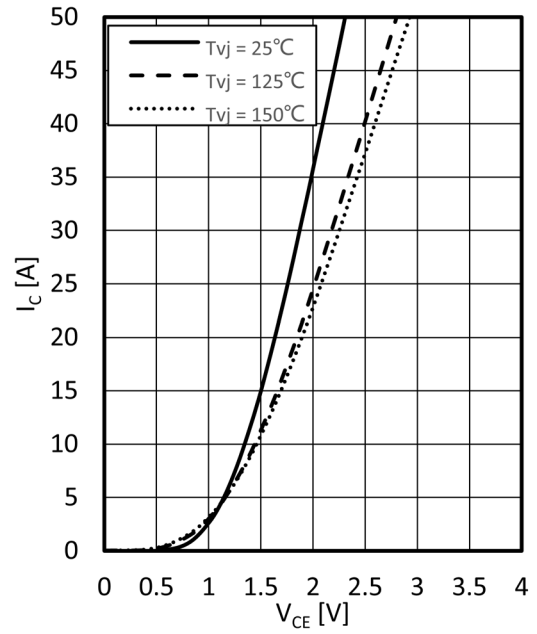
| Parameter | Note or test condition | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Rated resistance<br>额定电阻值 | Tc = 25°C | $R_{25}$ | | 5.00 | | KΩ |
| Power dissipation<br>耗散功耗 | Tc = 25°C | $P_{25}$ | | | 20 | mW |
| B-value<br>B-Z 值 | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298, 15K))]$ | $B_{25}/B_{50}$ | | 3400 | | K |
| B-value<br>B-Z 值 | $R_2=R_{25}\exp[B_{25/75}(1/T_2-1/(298, 15K))]$ | $B_{25}/B_{75}$ | | 3430 | | K |
| B-value<br>B-Z 值 | $R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298, 15K))]$ | $B_{25}/B_{100}$ | | 3445 | | K |

# 10. Module

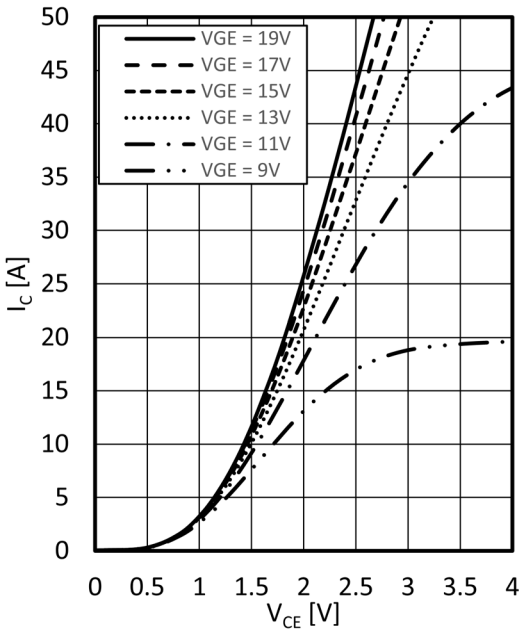
## 10.1 Characteristic value

| Parameter | Note or test condition | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Isolation Voltage<br>隔离电压 | RMS, f=50HZ,1min | $V_{ISOL}$ | | | 2500 | V |
| Stray inductance module<br>杂散电感 | | $L_{sCE}$ | | 30 | | nH |
| Operation Junction Temperature<br>结温 | | $T_{jop}$ | -40 | | 150 | ˚C |
| Storage Temperature Range<br>存储温度范围 | | $T_{stg}$ | -40 | | 125 | ˚C |
| Mounting Torque<br>安装扭矩 | Screw M4 | M | 2 | | 2.3 | N.m |
| Weight of Module<br>重量 | | G | | 42 | | g |

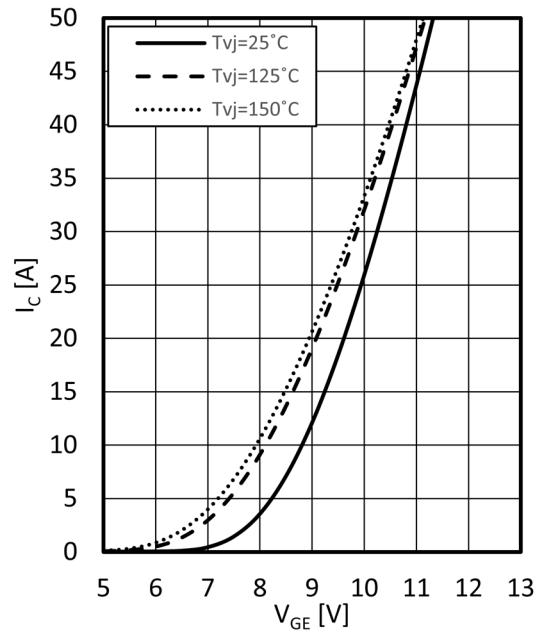
## 11. Characteristics diagrams



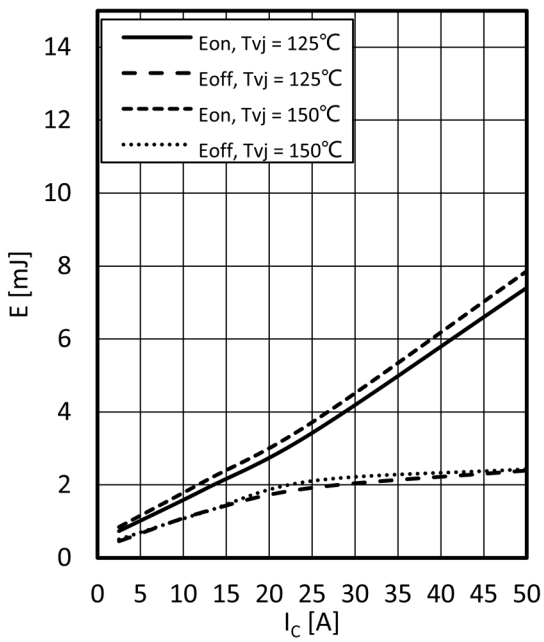

**Output characteristic IGBT, Inverter (typical)**
$I_C = f(V_{CE})$ $V_{GE} = 15V$



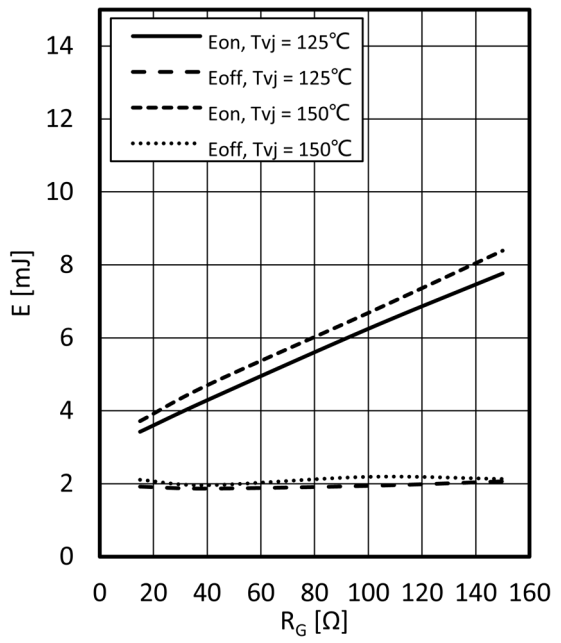

**Output characteristic IGBT, Inverter (typical)**
$I_C = f(V_{CE})$ $T_{vj} = 150°C$



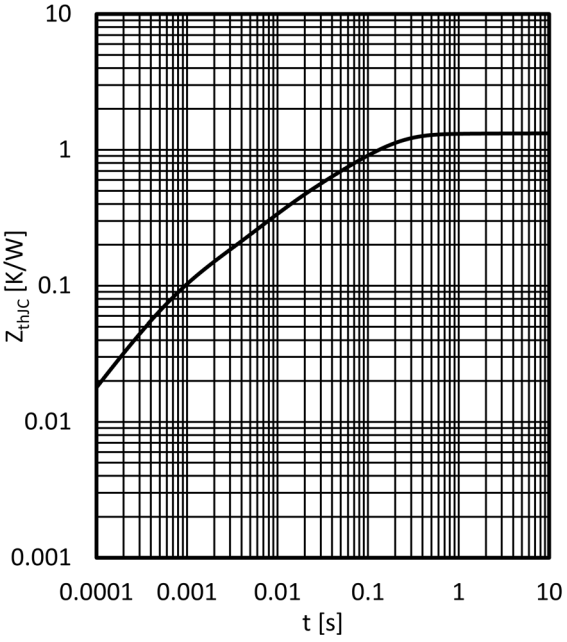

**Transfer characteristic IGBT, Inverter (typical)**
$I_C = f(V_{GE})$ $V_{CE} = 20V$



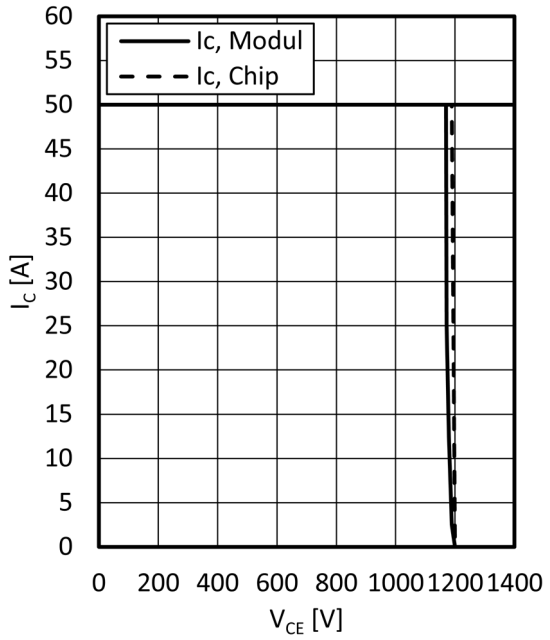

**Switching losses IGBT, Inverter (typical)**
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$ $V_{GE} = \pm 15V$, $R_{Gon} = 15\ \Omega$ $R_{Goff} = 15\ \Omega$, $V_{CE} = 600V$



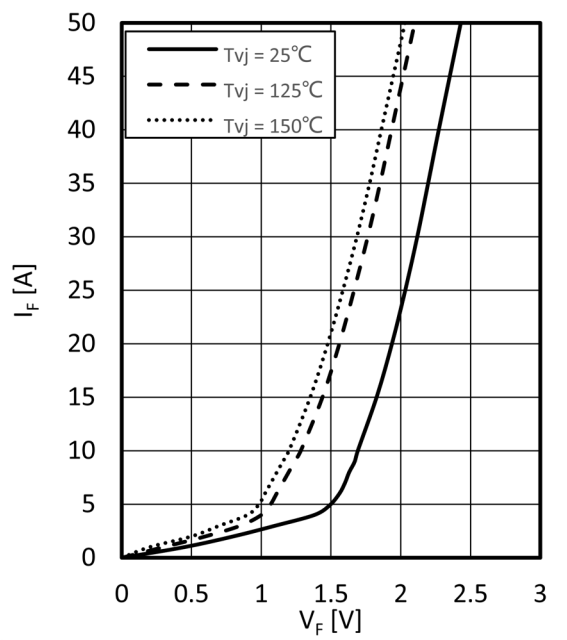

**Switching losses IGBT, Inverter (typical)**
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$ $V_{GE} = \pm 15V$, $I_C = 25A$, $V_{CE} = 600V$



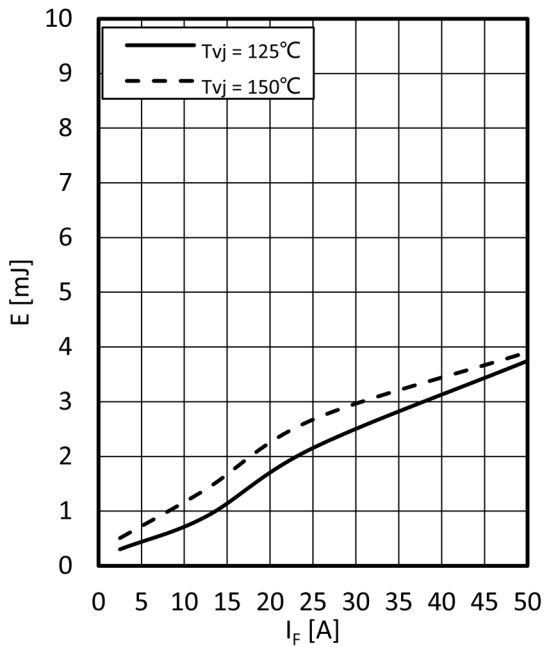

**Transient thermal impedance IGBT, Inverter**
$Z_{thJC} = f(t)$




**Reverse bias safe operating area IGBT, Inverter (RBSOA)**
$I_C = f(V_{CE})$ $V_{GE} = \pm 15V$ $R_{Goff} = 15\Omega$, $T_{vj} = 150°C$

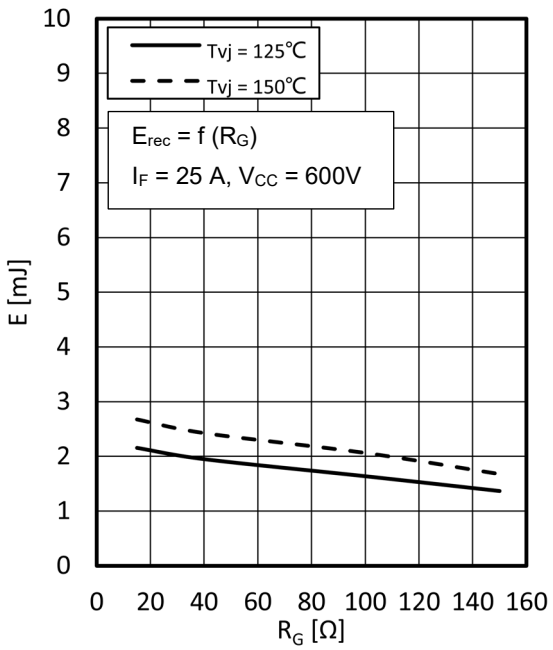



**Forward characteristic of Diode, Inverter (typical)**
$I_F = f(V_F)$



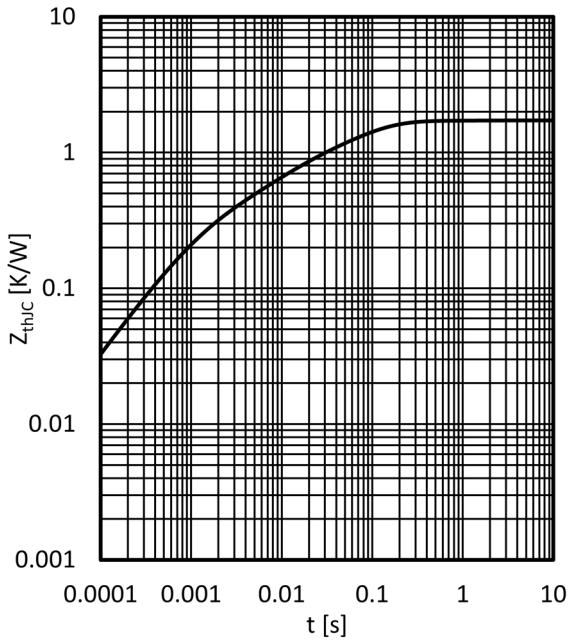

**Switching losses Diode, Inverter (typical)**

$E_{rec} = f(I_F)$ $R_{Gon}$ = 15 Ω, $V_{CC}$ = 600V



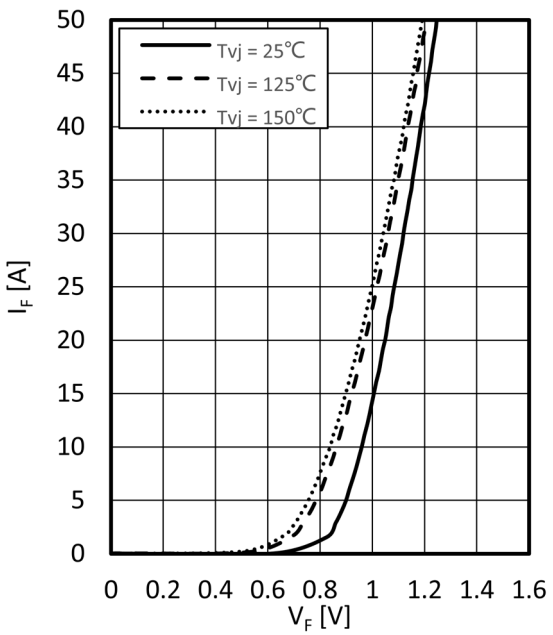

**Switching losses Diode, Inverter (typical)**

$E_{rec} = f(R_G)$ $I_F$ = 25 A, $V_{CC}$ = 600V



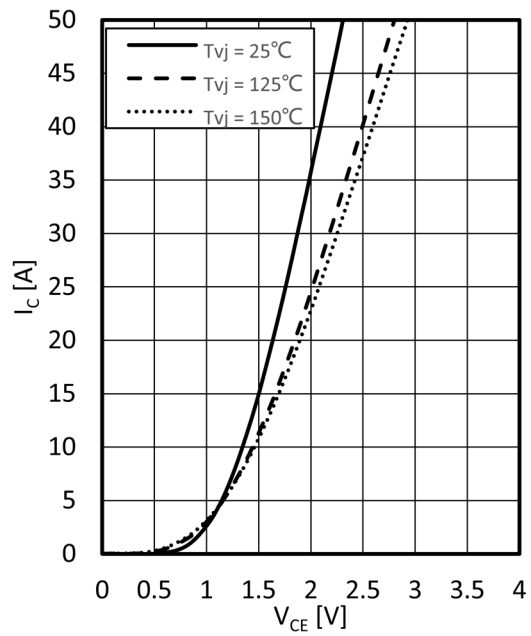

**Transient thermal impedance Diode Inverter**

$Z_{thJC} = f(t)$

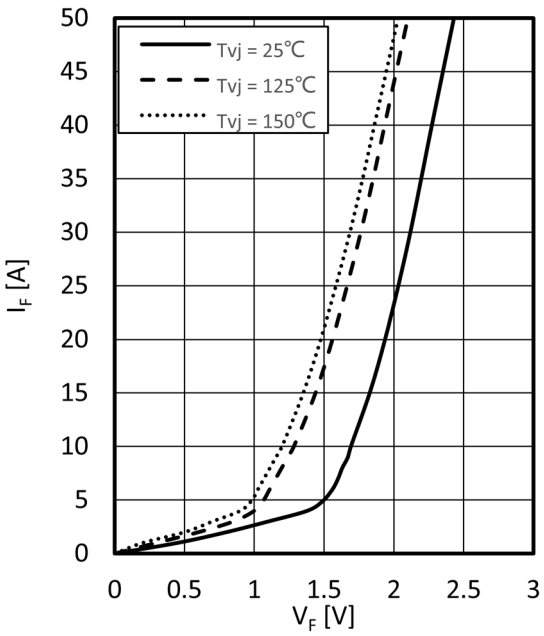



**Forward characteristic of Diode, Rectifier (typical)**

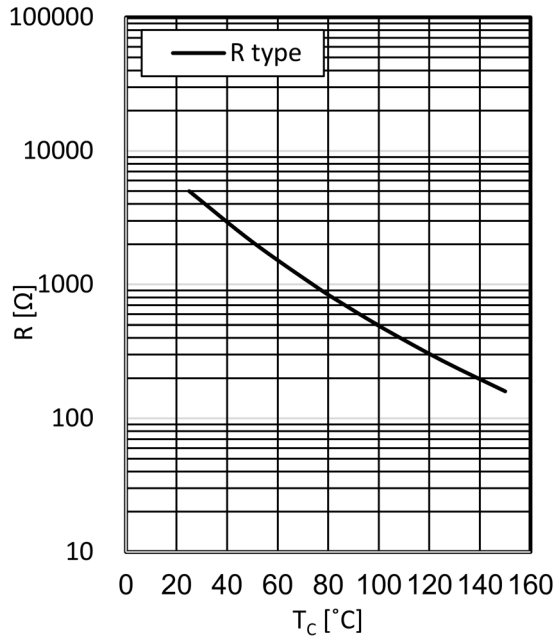
$I_F = f(V_F)$




Output characteristic IGBT, Brake-Chopper (typical)




Forward characteristic of Diode, Brake-Chopper (typical)




NTC-Thermistor-temperature characteristic (typical)

## 12. Circuit Diagram

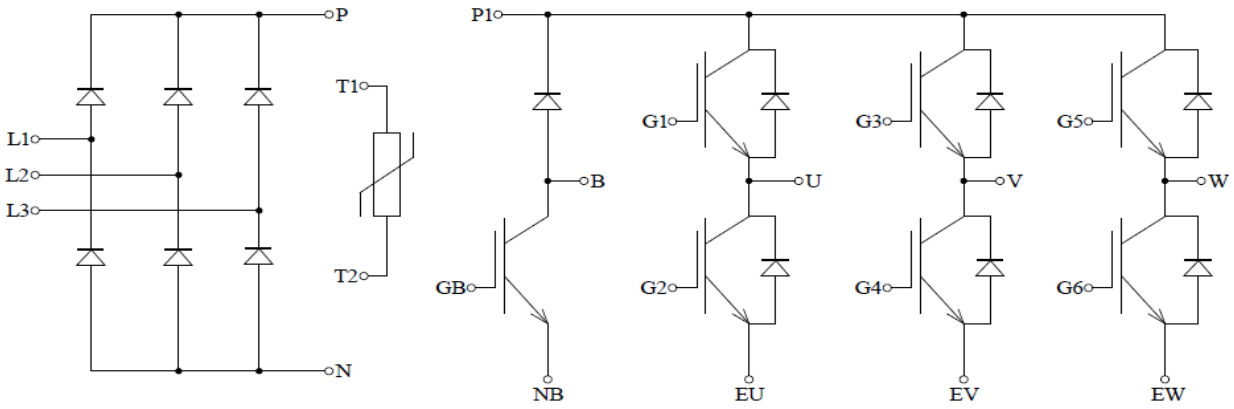



**Figure 3**

## 13. Package Outlines

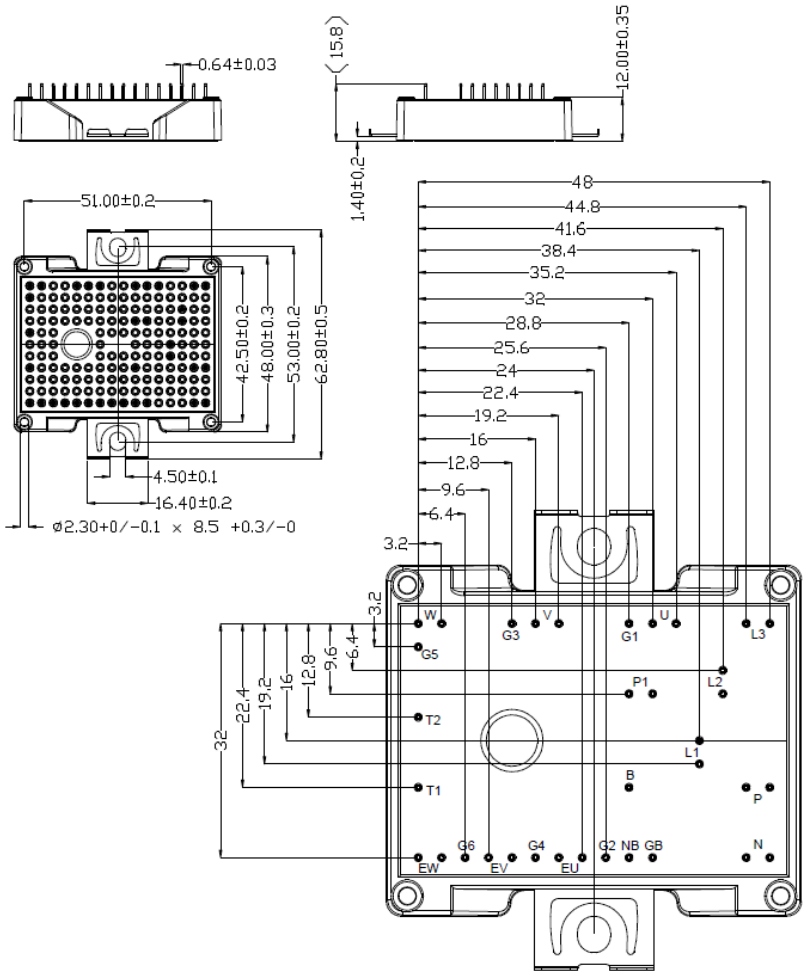



**Figure 4**