Yongsen

# YEGM25BF120L4HZ

## IGBT Power Module

### Features:

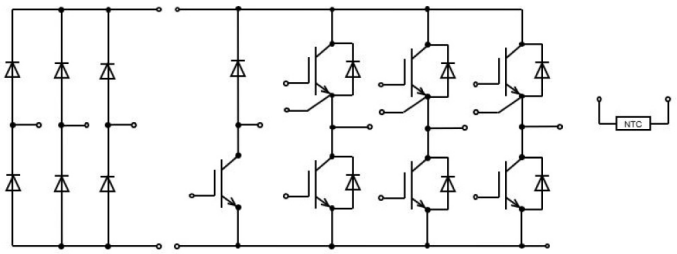
- $V_{CE}$=1200V $I_C$=25A
- Low $V_{CE(sat)}$
- $V_{CEsat}$ with positive temperature coefficient
- Maximum junction temperature 175℃
- Isolation Type Package

### Applications:

- The inverter
- Motor control and drives

### Package Type & Internal Circuit

L4




Internal Circuit

### Maximum Rated Values (IGBT Inverter)

| Symbol | Parameter | Conditions | Ratings | Unit |
|---|---|---|---|---|
| $V_{CES}$ | Collector-emitter voltage | $V_{EC}$=0V,$I_C$=1mA,$T_{vj}$=25℃ | 1200 | V |
| $I_C$ | Continuous Collector Current | $T_C$=100℃ | 25 | A |
| $I_{CRM}$ | Peak Collector Current | $I_{CRM}$=2$I_C$ | 50 | A |
| $V_{GES}$ | Gate-Emitter Voltage | $T_{vj}$=25℃ | ±30 | V |
| $P_{tot}$ | Total Power Dissipation | $T_C$=25℃,$T_{vjmax}$=175℃ | 170 | W |

## Maximum Rated Values (IGBT Inverter)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C$=25 A, $V_{GE}$=15 V, $T_{vj}$=25 ℃ | | 2.01 | | V |
| | | $I_C$=25 A, $V_{GE}$=15 V, $T_{vj}$=150 ℃ | | 2.53 | | V |
| $V_{GE(th)}$ | Gate Threshold Voltage | $I_C$=5.0 mA,$V_{CE}$=$V_{GE}$,$T_{vj}$= 25 ℃ | | 5.8 | | V |
| $I_{CES}$ | Collector-Emitter Cut-off Current | $V_{CE}$=1200 V, $V_{GE}$=0 V, $T_{vj}$=25 ℃ | | | 1.2 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{CE}$=0 V, $V_{GE}$=15 V, $T_{vj}$=25 ℃ | | | 410 | nA |
| $t_{d(on)}$ | Turn-on Delay Time, Inductive Load | $I_C$=25 A,$V_{CE}$=600 V<br>$V_{GE}$=±15 V<br>$R_{Gon}$=20Ω<br>$T_{vj}$=25 ℃ | | 170 | | ns |
| $t_r$ | Rise Time, Inductive Load | | | 160 | | ns |
| $t_{d(off)}$ | Turn-off Delay Time, Inductive Load | | | 170 | | ns |
| $t_f$ | Fall Time, Inductive Load | | | 150 | | ns |
| $E_{on}$ | Turn-on Energy Loss per Pulse | | | 3.7 | | mJ |
| $E_{off}$ | Energy Loss per Pulse | | | 1.4 | | mJ |
| $t_{d(on)}$ | Turn-on Delay Time, Inductive Load | $I_C$=25 A,$V_{CE}$=600 V<br>$V_{GE}$=±15 V<br>$R_{Gon}$=20Ω<br>$T_{vj}$=150 ℃ | | 130 | | ns |
| $t_r$ | Rise Time, Inductive Load | | | 180 | | ns |
| $t_{d(off)}$ | Turn-off Delay Time, Inductive Load | | | 250 | | ns |
| $t_f$ | Fall Time, Inductive Load | | | 180 | | ns |
| $E_{on}$ | Turn-on Energy Loss per Pulse | | | 3.9 | | mJ |
| $E_{off}$ | Energy Loss per Pulse | | | 1.8 | | mJ |
| $R_{thJC}$ | Thermal resistance, junction to case | per IGBT | | | 0.89 | K/W |
| $T_{vj\ op}$ | Temperature under switching conditions | | -40 | | 150 | °C |
| $I_{sc}$ | SC | $V_{GE}$≤15V, $V_{CE}$=600V,<br>tp≤10μS, $T_{vj}$=150℃,<br>$VCE_{max}$=$V_{CES}$-$L_{sCE}$ ·di/dt | | 100 | | A |

## Maximum Rated Values (Diode Inverter)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | $T_{vj}$= 25 ℃ | | 1200 | | V |
| $I_F$ | Continuous DC Forward Current | $T_C$=100 ℃ | | 25 | | A |
| $I_{FRM}$ | Repetitive Peak Forward Current | $t_P$=1 ms | | 50 | | A |
| $I^2t$ | $I^2t$ Value | $V_R$=0 V, $t_P$=10 ms, $T_{vj}$=150 ℃ | | 100 | | $A^2s$ |

## Characteristic Values (Diode Inverter)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | $I_F$=25A, $V_{CE}$=0 V, $T_{vj}$=25 ℃ | | 1.98 | | V |
| | | $I_F$=25 A, $V_{CE}$=0 V, $T_{vj}$=150 ℃ | | 1.90 | | V |
| $t_{rr}$ | Reverse Recovery time | $I_F$=25 A,$V_R$=600 V<br>-di/dt=250A/us<br>$T_{vj}$=25 ℃ | | 220 | | ns |
| $Q_r$ | Recovered Charge | | | 0.8 | | uC |
| $E_{rec}$ | Reverse Recovery Energy | | | 0.2 | | mJ |
| $t_{rr}$ | Reverse Recovery time | $I_F$=25A,$V_R$=600 V<br>-di/dt=250A/us<br>$T_{vj}$=150 ℃ | | 340 | | ns |
| $Q_r$ | Recovered Charge | | | 1.6 | | uC |
| $E_{rec}$ | Reverse Recovery Energy | | | 0.5 | | mJ |
| $R_{thJC}$ | Thermal resistance, junction to case | $I_F$=25 A, $V_{CE}$=0 V, $T_{vj}$=25 ℃ | | | 1.24 | K/W |
| $T_{vj\ op}$ | Temperature under switching conditions | | -40 | | 150 | °C |

## Maximum Rated Values (Diode Rectifier)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{RRM}$ | Repetitive peak reverse voltage | $T_{vj}$=25 ℃ | | 1600 | | V |
| $I_{FRMSM}$ | Maximum RMS forward current per chip | $T_c$=80 ℃ | | 50 | | A |
| $I_{RMSM}$ | Maximum RMS current at rectifier chip | $T_c$=80 ℃ | | 50 | | A |
| $I_{FSM}$ | Surge forward current | $t_p$=10ms $T_{vj}$=25 ℃ | | 300 | | A |
| $I^2t$ | $I^2t$-value | | | 450 | | $A^2S$ |
| $I_{FSM}$ | Surge forward current | $t_p$=10ms $T_{vj}$=125 ℃ | | 230 | | A |
| $I^2t$ | $I^2t$-value | | | 310 | | $A^2S$ |

## Characteristic Values (Diode Rectifier)

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_F$ | Forward voltage | $T_{vj}$=150 ℃ $I_F$=25A | | 1.1 | | V |
| $I_R$ | Reverse current | $T_{vj}$=150 ℃ $V_R$=1600V | | 1.1 | | mA |
| $R_{thjc}$ | Thermal resistance junction to case | per diode | | | 1.1 | K/W |
| $T_{vjop}$ | Temperature under switching conditions | | -40 | | 150 | ℃ |

## Maximum Rated Values (IGBT Brake-Chopper)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CES}$ | Collector-emitter voltage | $T_{vj}$=25℃ | | 1200 | | V |
| $I_C$ | Continuous Collector Current | $T_C$ = 100 ℃, $T_{vj\ max}$ = 175 ℃ | | 15 | | A |
| $I_{CRM}$ | Peak Collector Current | $I_{CRM}$=2$I_C$ | | 30 | | A |
| $V_{GES}$ | Gate-Emitter Voltage | $T_{vj}$=25℃ | -20 | | 20 | V |

## Characteristic Values (IGBT Brake-Chopper)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C$=15 A, $V_{GE}$=15 V, $T_{vj}$=25 ℃ | | 2.31 | | V |
| | | $I_C$=15 A, $V_{GE}$=15 V, $T_{vj}$=150 ℃ | | 2.52 | | V |
| $V_{GE(th)}$ | Gate Threshold Voltage | $I_C$=5.0 mA,$V_{CE}$=$V_{GE}$,$T_{vj}$= 25 ℃ | | 5.8 | | V |
| $I_{CES}$ | Collector-Emitter Cut-off Current | $V_{CE}$=1200 V, $V_{GE}$=0 V, $T_{vj}$=25 ℃ | | | 1.2 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{CE}$=0 V, $V_{GE}$=15 V, $T_{vj}$=25 ℃ | | | 410 | nA |
| $t_{d(on)}$ | Turn-on Delay Time, Inductive Load | $I_C$=15 A,$V_{CE}$=600 V<br>$V_{GE}$=±15 V<br>$R_{Gon}$=50Ω<br>$T_{vj}$=25 ℃ | | 200 | | ns |
| $t_r$ | Rise Time, Inductive Load | | | 120 | | ns |
| $t_{d(off)}$ | Turn-off Delay Time, Inductive Load | | | 290 | | ns |
| $t_f$ | Fall Time, Inductive Load | | | 200 | | ns |
| $E_{on}$ | Turn-on Energy Loss per Pulse | | | 2.8 | | mJ |
| $E_{off}$ | Energy Loss per Pulse | | | 0.8 | | mJ |
| $t_{d(on)}$ | Turn-on Delay Time, Inductive Load | $I_C$=15 A,$V_{CE}$=600 V<br>$V_{GE}$=±15 V<br>$R_{Gon}$=50Ω<br>$T_{vj}$=150 ℃ | | 200 | | ns |
| $t_r$ | Rise Time, Inductive Load | | | 240 | | ns |
| $t_{d(off)}$ | Turn-off Delay Time, Inductive Load | | | 320 | | ns |
| $t_f$ | Fall Time, Inductive Load | | | 290 | | ns |
| $E_{on}$ | Turn-on Energy Loss per Pulse | | | 3.2 | | mJ |
| $E_{off}$ | Energy Loss per Pulse | | | 1.1 | | mJ |
| $R_{thJC}$ | Thermal resistance, junction to case | pro IGBT / per IGBT | | | 1.1 | K/W |
| $T_{vj\ op}$ | Temperature under switching conditions | | -40 | | 150 | °C |

## Maximum Rated Values (Diode Brake-Chopper)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | $T_{vj}$= 25 ℃ | | 1200 | | V |
| $I_F$ | Continuous DC Forward Current | $T_C$=100 ℃ | | 15 | | A |
| $I_{FRM}$ | Repetitive Peak Forward Current | $t_P$=1 ms | | 30 | | A |
| $I^2t$ | $I^2t$ Value | $V_R$=0 V, $t_P$=10 ms, $T_{vj}$=150 ℃ | | 15 | | $A^2s$ |

## Characteristics (Diode Brake-Chopper)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | $I_F$=15 A, $V_{CE}$=0 V, $T_{vj}$=25 ℃ | | 1.98 | | V |
| | | $I_F$=15 A, $V_{CE}$=0 V, $T_{vj}$=150 ℃ | | 1.90 | | V |
| $t_{rr}$ | Reverse Recovery time | $I_F$=15 A,$V_R$=600 V<br>-di/dt=300A/us<br>$T_{vj}$=25 ℃ | | 340 | | ns |
| $Q_r$ | Recovered Charge | | | 0.8 | | uC |
| $E_{rec}$ | Reverse Recovery Energy | | | 0.2 | | mJ |
| $t_{rr}$ | Reverse Recovery time | $I_F$=15A,$V_R$=600 V<br>-di/dt=300A/us<br>$T_{vj}$=150 ℃ | | 400 | | ns |
| $Q_r$ | Recovered Charge | | | 1.6 | | uC |
| $E_{rec}$ | Reverse Recovery Energy | | | 0.4 | | mJ |
| $R_{thJC}$ | Thermal resistance, junction to case | $I_F$=15 A, $V_{CE}$=0 V, $T_{vj}$=25 ℃ | | | 1.75 | K/W |
| $T_{vj\ op}$ | Temperature under switching conditions | | -40 | | 150 | °C |

## NTC-Thermistor (Characteristic Values)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $R_{25}$ | Rated resistance | $T_c$=25 ℃ | | 5 | | KΩ |
| ΔR/R | Deviation of R100 | $T_c$=100 ℃ | -5 | | 5 | % |
| $P_{25}$ | Power dissipation | $T_c$=25 ℃ | | 20 | | mW |
| $B_{25/50}$ | B-value | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$ | | 3380 | | K |
| $B_{25/100}$ | B-value | $R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298,15K))]$ | | 3450 | | K |

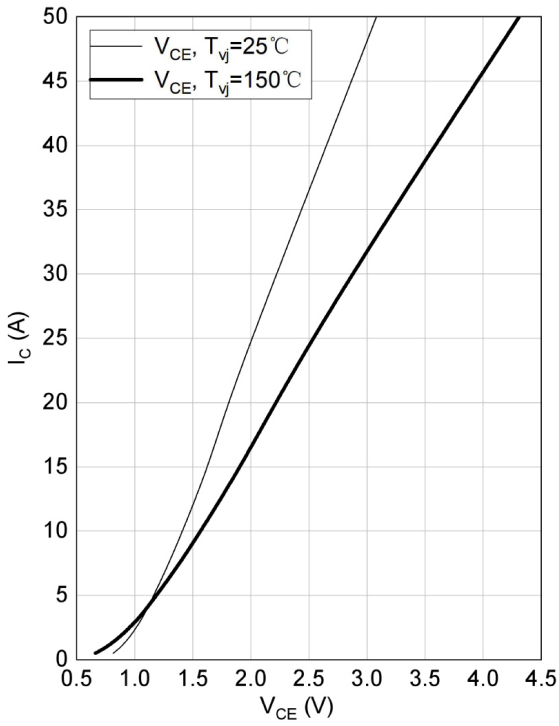
## Module Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{isol}$ | Isolation voltage | t=1min,f=50Hz | 2500 | | | V |
| $T_{stg}$ | Storage Temperature | | -40 | | 150 | ℃ |
| $M_s$ | Module-to-Sink Torque | Recommended(M5) | 3.0 | | 6.0 | N·m |
| G | Weight of Module | | | 180 | | g |

Output characteristic of IGBT,Inverter (typical)

$I_c = f(V_{CE})$

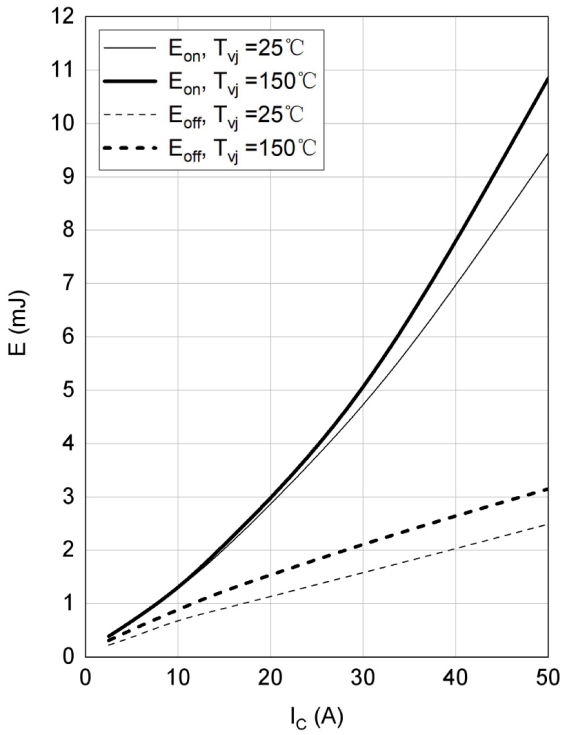
$V_{GE} = 15V$




Switching losses of IGBT,Inverter (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$

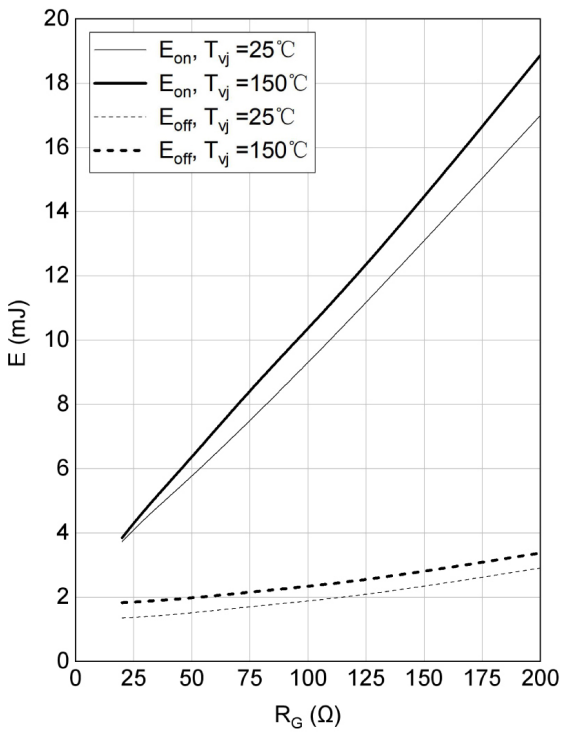
$V_{GE} = \pm 15V$, $R_{Gon} = 20\Omega$, $V_{CE} = 600V$




switching losses of IGBT,Inverter (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$

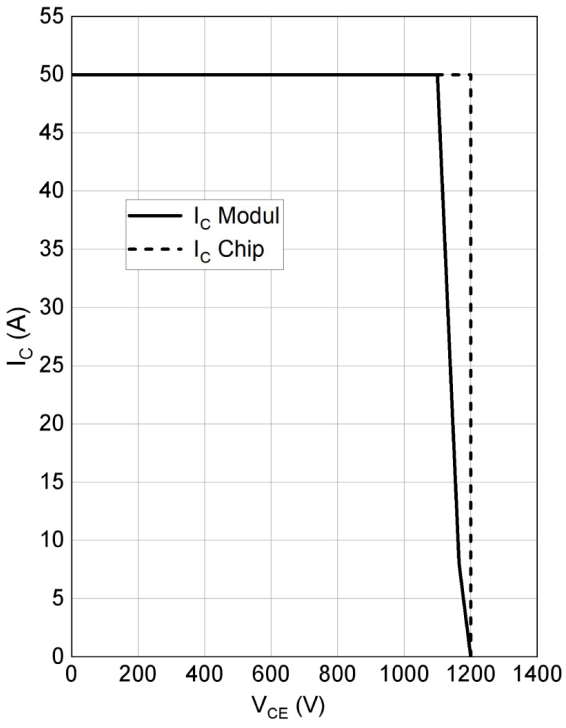
$V_{GE} = \pm 15V$, $I_C = 25A$, $V_{CE} = 600V$




RBSOA IGBT,Inverter (typical)

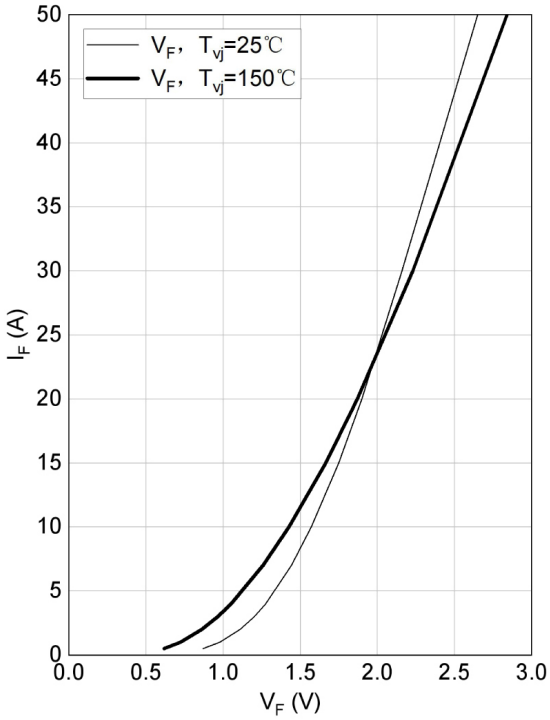
$I_C = f(V_{CE})$

$V_{GE} = \pm 15V$, $R_{Goff} = 20\Omega$, $T_{vj} = 150\ ℃$



forward characteristic of Diode,Inverter (typical)

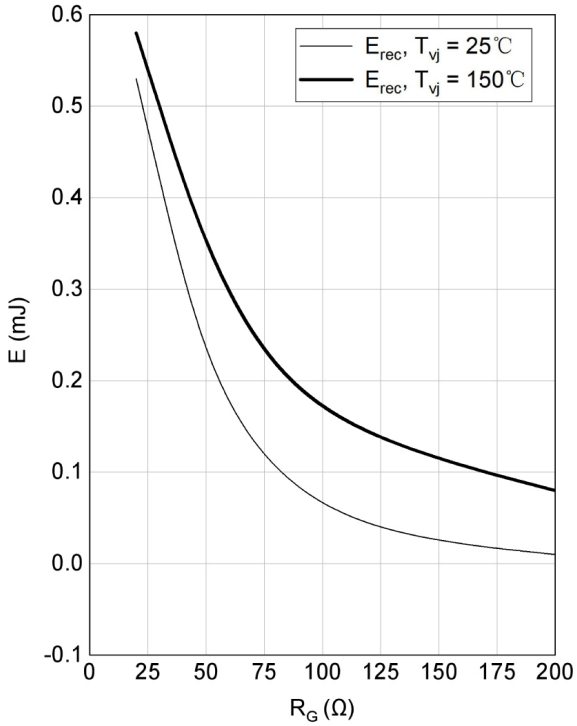
$I_F = f(V_F)$




switching losses of Diode, Inverter (typical)

$E_{rec} = f(R_G)$,

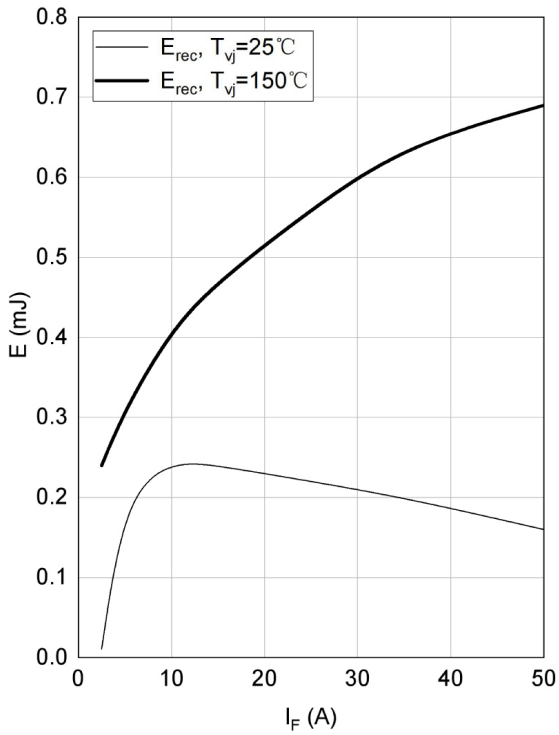
$I_F$ = 25A，$V_{CE}$ = 600V




switching losses of Diode, Inverter (typical)

$E_{rec} = f(I_F)$,

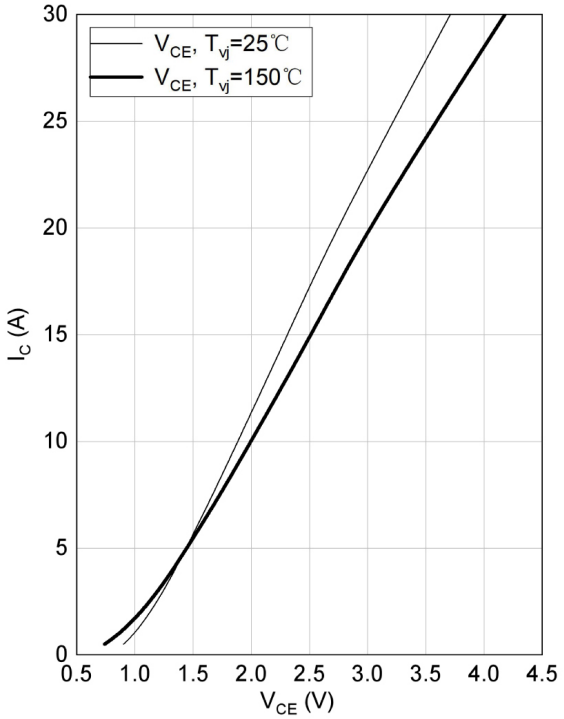
$R_{Gon}$ = 20Ω，$V_{CE}$ = 600V




output characteristic of IGBT,Brake-Chopper, (typical)

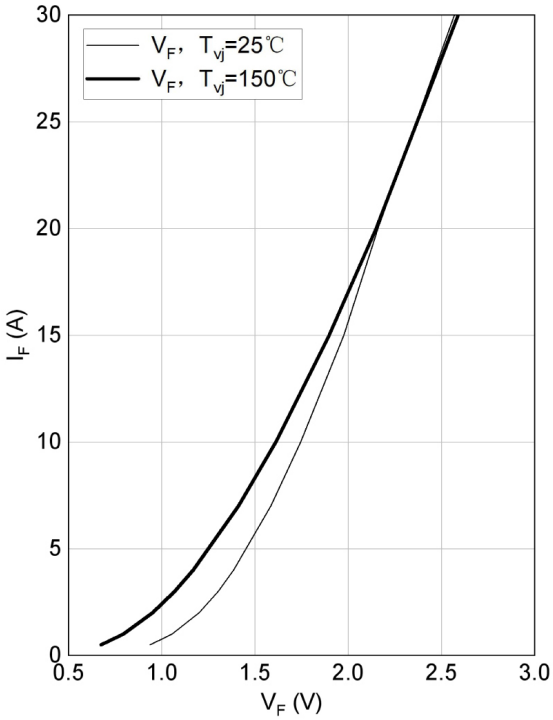
$I_c = f(V_{CE})$

$V_{GE}$ = 15V



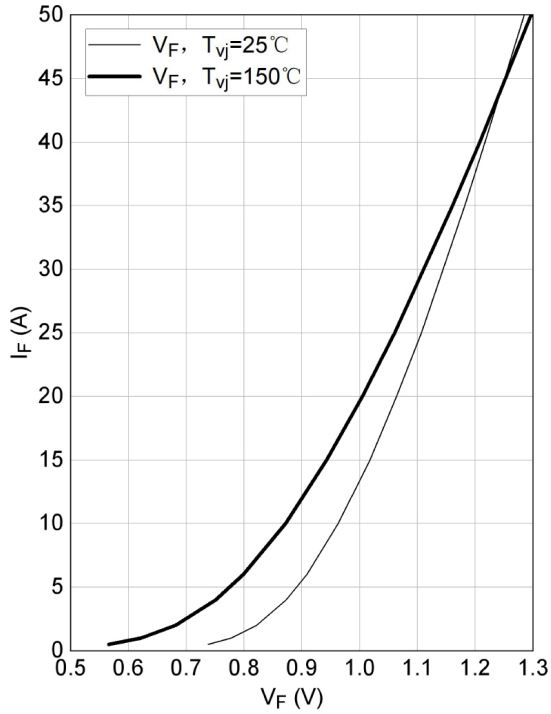
forward characteristic of Diode,Brake-Chopper (typical)

$I_F = f(V_F)$



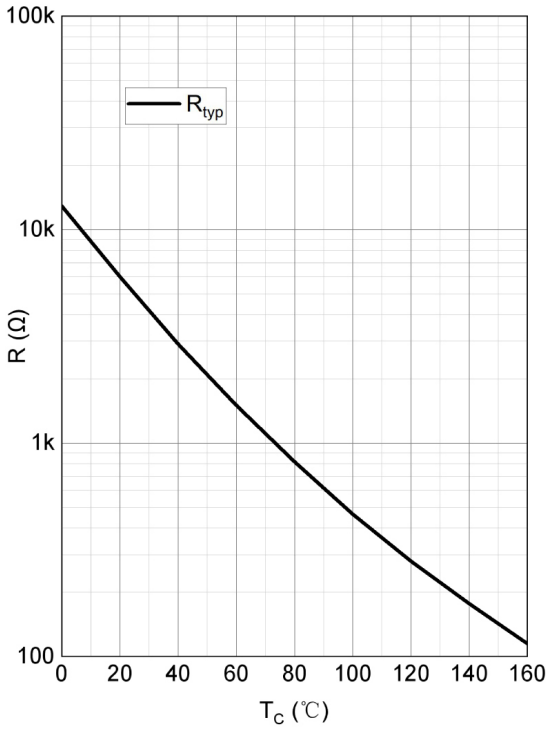

forward characteristic of Diode, Rectifier(typical)

$I_F = f(V_F)$

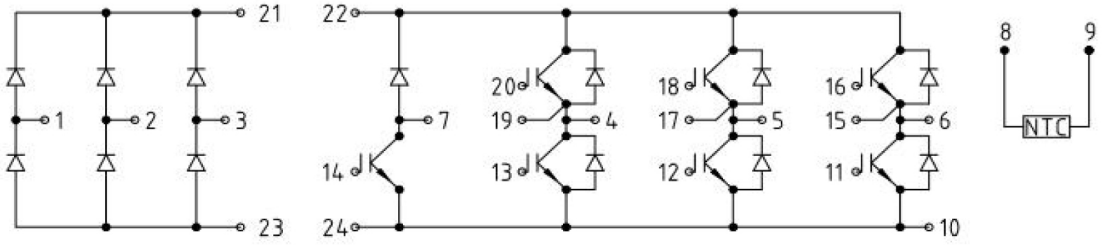



NTC-thermistor-temperature characteristic (typical)

$R = f(T_{NTC})$,



## Circuit Diagram




## Package Dimensions

(Dimensions in Millimeters)