

## PRODUCT FEATURES

- ☐ High level of integration
- ☐ IGBT CHIP(Trench+Field Stop technology)
- ☐ Low saturation voltage and positive temperature coefficient
- ☐ Fast switching and short tail current
- ☐ Free wheeling diodes with fast and soft reverse recovery
- ☐ Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- ☐ Temperature sense included



**Rectifier+Brake+Inverter**

## APPLICATIONS

- ☐ AC motor control
- ☐ Motion/servo control
- ☐ Inverter and power supplies

## IGBT-inverter

### ABSOLUTE MAXIMUM RATINGS( $T_C=25^{\circ}\text{C}$ unless otherwise specified)

| Symbol    | Parameter/Test Conditions         |                          | Values   | Unit |
|-----------|-----------------------------------|--------------------------|----------|------|
| $V_{CES}$ | Collector Emitter Voltage         | $T_J=25^{\circ}\text{C}$ | 1200     | V    |
| $V_{GES}$ | Gate Emitter Voltage              |                          | $\pm 20$ |      |
| $I_C$     | DC Collector Current              | $T_C=25^{\circ}\text{C}$ | 105      | A    |
|           |                                   | $T_C=80^{\circ}\text{C}$ | 75       |      |
| $I_{CM}$  | Repetitive Peak Collector Current | $t_p=1\text{ms}$         | 150      |      |
| $P_{tot}$ | Power Dissipation Per IGBT        |                          | 415      | W    |

## Diode-inverter

### ABSOLUTE MAXIMUM RATINGS ( $T_C=25^{\circ}\text{C}$ unless otherwise specified)

| Symbol      | Parameter/Test Conditions       |                                                               | Values | Unit                 |
|-------------|---------------------------------|---------------------------------------------------------------|--------|----------------------|
| $V_{RRM}$   | Repetitive Reverse Voltage      | $T_J=25^{\circ}\text{C}$                                      | 1200   | V                    |
| $I_{F(AV)}$ | Average Forward Current         | $T_C=25^{\circ}\text{C}$                                      | 75     | A                    |
| $I_{FRM}$   | Repetitive Peak Forward Current | $t_p=1\text{ms}$                                              | 150    |                      |
| $I^2t$      |                                 | $T_J=125^{\circ}\text{C}$ , $t=10\text{ms}$ , $V_R=0\text{V}$ | 1150   | $\text{A}^2\text{S}$ |

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## IGBT-inverter

ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol               | Parameter/Test Conditions                        |                                                                                                                | Min.                                                                            | Typ. | Max. | Unit |   |
|----------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------|------|------|---|
| V <sub>GE(th)</sub>  | Gate Emitter Threshold Voltage                   | V <sub>CE</sub> =V <sub>GE</sub> , I <sub>C</sub> =3mA                                                         | 5.0                                                                             | 6.0  | 6.5  | V    |   |
| V <sub>CE(sat)</sub> | Collector Emitter Saturation Voltage             | I <sub>C</sub> =75A, V <sub>GE</sub> =15V, T <sub>J</sub> =25℃                                                 |                                                                                 | 1.85 | 2.3  |      |   |
|                      |                                                  | I <sub>C</sub> =75A, V <sub>GE</sub> =15V, T <sub>J</sub> =125℃                                                |                                                                                 | 2.1  |      |      |   |
| I <sub>CES</sub>     | Collector Leakage Current                        | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>J</sub> =25℃                                               |                                                                                 |      | 100  | μA   |   |
|                      |                                                  | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>J</sub> =125℃                                              |                                                                                 |      | 10   | mA   |   |
| I <sub>GES</sub>     | Gate Leakage Current                             | V <sub>CE</sub> =0V, V <sub>GE</sub> =±15V, T <sub>J</sub> =25℃                                                | -400                                                                            |      | 400  | nA   |   |
| R <sub>gint</sub>    | Integrated Gate Resistor                         |                                                                                                                |                                                                                 | 10   |      | Ω    |   |
| Q <sub>g</sub>       | Gate Charge                                      | V <sub>CE</sub> =600V, I <sub>C</sub> =75A , V <sub>GE</sub> =15V                                              |                                                                                 | 0.4  |      | μC   |   |
| C <sub>ies</sub>     | Input Capacitance                                | V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f =1MHz                                                             |                                                                                 | 10   |      | nF   |   |
| C <sub>res</sub>     | Reverse Transfer Capacitance                     |                                                                                                                |                                                                                 | 80   |      | pF   |   |
| t <sub>d(on)</sub>   | Turn on Delay Time                               | V <sub>CC</sub> =600V, I <sub>C</sub> =75A<br>R <sub>G</sub> =15Ω,<br>V <sub>GE</sub> =±15V,<br>Inductive Load | T <sub>J</sub> =25℃                                                             |      | 310  | ns   |   |
|                      |                                                  |                                                                                                                | T <sub>J</sub> =125℃                                                            |      | 340  | ns   |   |
| t <sub>r</sub>       | Rise Time                                        |                                                                                                                | T <sub>J</sub> =25℃                                                             |      | 80   | ns   |   |
|                      |                                                  |                                                                                                                | T <sub>J</sub> =125℃                                                            |      | 100  | ns   |   |
| t <sub>d(off)</sub>  | Turn off Delay Time                              |                                                                                                                | T <sub>J</sub> =25℃                                                             |      | 360  | ns   |   |
|                      |                                                  |                                                                                                                | T <sub>J</sub> =125℃                                                            |      | 400  | ns   |   |
| t <sub>f</sub>       | Fall Time                                        |                                                                                                                | T <sub>J</sub> =25℃                                                             |      | 90   | ns   |   |
|                      |                                                  |                                                                                                                | T <sub>J</sub> =125℃                                                            |      | 120  | ns   |   |
| E <sub>on</sub>      | Turn on Energy                                   | V <sub>CC</sub> =600V, I <sub>C</sub> =75A<br>R <sub>G</sub> =15Ω,<br>V <sub>GE</sub> =±15V,<br>Inductive Load | T <sub>J</sub> =25℃                                                             |      | 9    | mJ   |   |
|                      |                                                  |                                                                                                                | T <sub>J</sub> =125℃                                                            |      | 11.3 | mJ   |   |
| E <sub>off</sub>     | Turn off Energy                                  |                                                                                                                | T <sub>J</sub> =25℃                                                             |      | 5.6  | mJ   |   |
|                      |                                                  |                                                                                                                | T <sub>J</sub> =125℃                                                            |      | 6.8  | mJ   |   |
| I <sub>sc</sub>      | Short Circuit Current                            |                                                                                                                | tpsc≤10μS , V <sub>GE</sub> =15V<br>T <sub>J</sub> =125℃, V <sub>CC</sub> =600V |      | 450  |      | A |
| R <sub>thJC</sub>    | Junction to Case Thermal Resistance （ Per IGBT ） |                                                                                                                |                                                                                 |      | 0.3  | K /W |   |

## Diode-inverter

ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol             | Parameter/Test Conditions                          |                                                                                                    | Min. | Typ. | Max. | Unit |
|--------------------|----------------------------------------------------|----------------------------------------------------------------------------------------------------|------|------|------|------|
| V <sub>F</sub>     | Forward Voltage                                    | I <sub>F</sub> =75A , V <sub>GE</sub> =0V, T <sub>J</sub> =25℃                                     |      | 1.65 | 2.15 | V    |
|                    |                                                    | I <sub>F</sub> =75A , V <sub>GE</sub> =0V, T <sub>J</sub> =125℃                                    |      | 1.65 |      |      |
| t <sub>rr</sub>    | Reverse Recovery Time                              | I <sub>F</sub> =75A , V <sub>R</sub> =600V<br>di <sub>F</sub> /dt=-800A/μs<br>T <sub>J</sub> =125℃ |      | 500  |      | ns   |
| I <sub>RRM</sub>   | Max. Reverse Recovery Current                      |                                                                                                    |      | 55   |      | A    |
| Q <sub>RR</sub>    | Reverse Recovery Charge                            |                                                                                                    |      | 14   |      | μC   |
| E <sub>rec</sub>   | Reverse Recovery Energy                            |                                                                                                    |      | 4.9  |      | mJ   |
| R <sub>thJCD</sub> | Junction to Case Thermal Resistance   （ Per Diode） |                                                                                                    |      |      | 0.56 | K /W |

**Diode-RECTIFIER****ABSOLUTE MAXIMUM RATINGS** ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol     | Parameter/Test Conditions            |                                                    | Values | Unit                 |
|------------|--------------------------------------|----------------------------------------------------|--------|----------------------|
| $V_{RRM}$  | Repetitive Reverse Voltage           | $T_J=25^{\circ}\text{C}$                           | 1600   | V                    |
| $I_{FRMS}$ | R.M.S. Forward Current Per Diode     | $T_C=80^{\circ}\text{C}$                           | 80     | A                    |
| $I_{RMS}$  | R.M.S. Current at rectifier output   |                                                    | 110    |                      |
| $I_{FSM}$  | Non Repetitive Surge Forward Current | $T_J=45^{\circ}\text{C}$ , $t=10\text{ms}$ , 50Hz  | 500    |                      |
|            |                                      | $T_J=45^{\circ}\text{C}$ , $t=8.3\text{ms}$ , 60Hz | 550    |                      |
| $I^2t$     |                                      | $T_J=45^{\circ}\text{C}$ , $t=10\text{ms}$ , 50Hz  | 1250   | $\text{A}^2\text{S}$ |
|            |                                      | $T_J=45^{\circ}\text{C}$ , $t=8.3\text{ms}$ , 60Hz | 1255   |                      |

**Diode-RECTIFIER****ELECTRICAL CHARACTERISTICS** ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol      | Parameter/Test Conditions                         |                                                | Min. | Typ. | Max. | Unit          |
|-------------|---------------------------------------------------|------------------------------------------------|------|------|------|---------------|
| $V_F$       | Forward Voltage                                   | $I_F=75\text{A}$ , $T_J=25^{\circ}\text{C}$    |      | 1.1  | 1.35 | V             |
|             |                                                   | $I_F=75\text{A}$ , $T_J=125^{\circ}\text{C}$   |      | 1.05 |      | V             |
| $I_R$       | Reverse Leakage Current                           | $V_R=1600\text{V}$ , $T_J=25^{\circ}\text{C}$  |      |      | 50   | $\mu\text{A}$ |
|             |                                                   | $V_R=1600\text{V}$ , $T_J=125^{\circ}\text{C}$ |      |      | 1    | mA            |
| $R_{thJCD}$ | Junction to Case Thermal Resistance ( Per Diode ) |                                                |      |      | 0.6  | K /W          |

**IGBT-Brake chopper****ABSOLUTE MAXIMUM RATINGS** ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol    | Parameter/Test Conditions         |                          | Values   | Unit |
|-----------|-----------------------------------|--------------------------|----------|------|
| $V_{CES}$ | Collector Emitter Voltage         | $T_J=25^{\circ}\text{C}$ | 1200     | V    |
| $V_{GES}$ | Gate Emitter Voltage              |                          | $\pm 20$ |      |
| $I_C$     | DC Collector Current              | $T_C=25^{\circ}\text{C}$ | 105      | A    |
|           |                                   | $T_C=80^{\circ}\text{C}$ | 75       |      |
| $I_{CM}$  | Repetitive Peak Collector Current | $t_p=1\text{ms}$         | 150      |      |
| $P_{tot}$ | Power Dissipation Per IGBT        |                          | 415      | W    |

**Diode-Brake chopper****ABSOLUTE MAXIMUM RATINGS** ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol      | Parameter/Test Conditions       |                                                               | Values | Unit                 |
|-------------|---------------------------------|---------------------------------------------------------------|--------|----------------------|
| $V_{RRM}$   | Repetitive Reverse Voltage      | $T_J=25^{\circ}\text{C}$                                      | 1200   | V                    |
| $I_{F(AV)}$ | Average Forward Current         | $T_C=25^{\circ}\text{C}$                                      | 25     | A                    |
| $I_{FRM}$   | Repetitive Peak Forward Current | $t_p=1\text{ms}$                                              | 50     |                      |
| $I^2t$      |                                 | $T_J=125^{\circ}\text{C}$ , $t=10\text{ms}$ , $V_R=0\text{V}$ | 200    | $\text{A}^2\text{S}$ |

## IGBT-Brake chopper

ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol               | Parameter/Test Conditions                      |                                                                                                                | Min.                                                                             | Typ. | Max. | Unit |   |
|----------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------|------|------|---|
| V <sub>GE(th)</sub>  | Gate Emitter Threshold Voltage                 | V <sub>CE</sub> =V <sub>GE</sub> , I <sub>C</sub> =3mA                                                         | 5.0                                                                              | 6.0  | 6.5  | V    |   |
| V <sub>CE(sat)</sub> | Collector Emitter Saturation Voltage           | I <sub>C</sub> =75A, V <sub>GE</sub> =15V, T <sub>J</sub> =25°C                                                |                                                                                  | 1.85 | 2.3  |      |   |
|                      |                                                | I <sub>C</sub> =75A, V <sub>GE</sub> =15V, T <sub>J</sub> =125°C                                               |                                                                                  | 2.1  |      |      |   |
| I <sub>CES</sub>     | Collector Leakage Current                      | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>J</sub> =25°C                                              |                                                                                  |      | 100  | μA   |   |
|                      |                                                | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>J</sub> =125°C                                             |                                                                                  |      | 10   | mA   |   |
| I <sub>GES</sub>     | Gate Leakage Current                           | V <sub>CE</sub> =0V, V <sub>GE</sub> =±15V, T <sub>J</sub> =25°C                                               | -400                                                                             |      | 400  | nA   |   |
| R <sub>gint</sub>    | Integrated Gate Resistor                       |                                                                                                                |                                                                                  | 10   |      | Ω    |   |
| Q <sub>g</sub>       | Gate Charge                                    | V <sub>CE</sub> =600V, I <sub>C</sub> =75A , V <sub>GE</sub> =15V                                              |                                                                                  | 0.4  |      | μC   |   |
| C <sub>ies</sub>     | Input Capacitance                              | V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f =1MHz                                                             |                                                                                  | 10   |      | nF   |   |
| C <sub>res</sub>     | Reverse Transfer Capacitance                   |                                                                                                                |                                                                                  | 80   |      | pF   |   |
| t <sub>d(on)</sub>   | Turn on Delay Time                             | V <sub>CC</sub> =600V, I <sub>C</sub> =75A<br>R <sub>G</sub> =15Ω,<br>V <sub>GE</sub> =±15V,<br>Inductive Load | T <sub>J</sub> =25°C                                                             |      | 310  | ns   |   |
|                      |                                                |                                                                                                                | T <sub>J</sub> =125°C                                                            |      | 340  | ns   |   |
| t <sub>r</sub>       | Rise Time                                      |                                                                                                                | T <sub>J</sub> =25°C                                                             |      | 80   | ns   |   |
|                      |                                                |                                                                                                                | T <sub>J</sub> =125°C                                                            |      | 100  | ns   |   |
| t <sub>d(off)</sub>  | Turn off Delay Time                            |                                                                                                                | T <sub>J</sub> =25°C                                                             |      | 360  | ns   |   |
|                      |                                                |                                                                                                                | T <sub>J</sub> =125°C                                                            |      | 400  | ns   |   |
| t <sub>f</sub>       | Fall Time                                      |                                                                                                                | T <sub>J</sub> =25°C                                                             |      | 90   | ns   |   |
|                      |                                                |                                                                                                                | T <sub>J</sub> =125°C                                                            |      | 120  | ns   |   |
| E <sub>on</sub>      | Turn on Energy                                 | V <sub>CC</sub> =600V, I <sub>C</sub> =75A<br>R <sub>G</sub> =15Ω,<br>V <sub>GE</sub> =±15V,<br>Inductive Load | T <sub>J</sub> =25°C                                                             |      | 8    | mJ   |   |
|                      |                                                |                                                                                                                | T <sub>J</sub> =125°C                                                            |      | 10.5 | mJ   |   |
| E <sub>off</sub>     | Turn off Energy                                |                                                                                                                | T <sub>J</sub> =25°C                                                             |      | 5.6  | mJ   |   |
|                      |                                                |                                                                                                                | T <sub>J</sub> =125°C                                                            |      | 6.8  | mJ   |   |
| I <sub>sc</sub>      | Short Circuit Current                          |                                                                                                                | tpsc≤10μS , V <sub>GE</sub> =15V<br>T <sub>J</sub> =125°C, V <sub>CC</sub> =600V |      | 450  |      | A |
| R <sub>thJC</sub>    | Junction to Case Thermal Resistance （Per IGBT） |                                                                                                                |                                                                                  |      | 0.3  | K /W |   |

## IGBT-Brake chopper

ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol      | Parameter/Test Conditions                       |                                                             | Min. | Typ. | Max. | Unit         |
|-------------|-------------------------------------------------|-------------------------------------------------------------|------|------|------|--------------|
| $V_F$       | Forward Voltage                                 | $I_F=25\text{A}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$  |      | 1.55 | 2.0  | V            |
|             |                                                 | $I_F=25\text{A}, V_{GE}=0\text{V}, T_J=125^{\circ}\text{C}$ |      | 1.54 |      |              |
| $t_{rr}$    | Reverse Recovery Time                           | $I_F=25\text{A}, V_R=600\text{V}$                           |      | 200  |      | $\text{ns}$  |
| $I_{RRM}$   | Max. Reverse Recovery Current                   | $di_F/dt=-400\text{A}/\mu\text{s}$                          |      | 20   |      | A            |
| $E_{rec}$   | Reverse Recovery Energy                         | $T_J=125^{\circ}\text{C}$                                   |      | 1.5  |      | $\text{mJ}$  |
| $R_{thJCD}$ | Junction to Case Thermal Resistance (Per Diode) |                                                             |      |      | 1.22 | $\text{K/W}$ |

**NTC CHARACTERISTICS** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

| Symbol      | Parameter/Test Conditions                                     |                        | Min. | Typ. | Max. | Unit             |
|-------------|---------------------------------------------------------------|------------------------|------|------|------|------------------|
| $R_{25}$    | Resistance                                                    | $T_C=25^\circ\text{C}$ |      | 5    |      | $\text{K}\Omega$ |
| $B_{25/50}$ | $R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15 \text{ K}))]$ |                        |      | 3375 |      | K                |

**MODULE CHARACTERISTICS** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

| Symbol      | Parameter/Test Conditions   |                            | Values  | Unit             |
|-------------|-----------------------------|----------------------------|---------|------------------|
| $T_{J\max}$ | Max. Junction Temperature   |                            | 150     | $^\circ\text{C}$ |
| $T_{Jop}$   | Operating Temperature       |                            | -40~125 |                  |
| $T_{stg}$   | Storage Temperature         |                            | -40~125 |                  |
| $V_{isol}$  | Isolation Breakdown Voltage | AC, 50Hz(R.M.S), t=1minute | 3000    | V                |
| CTI         | Comparative Tracking Index  |                            | >200    |                  |
| Md          | Mounting Torque             | Recommended (M5)           | 2.5~5   | Nm               |
| Weight      |                             |                            | 300     | g                |

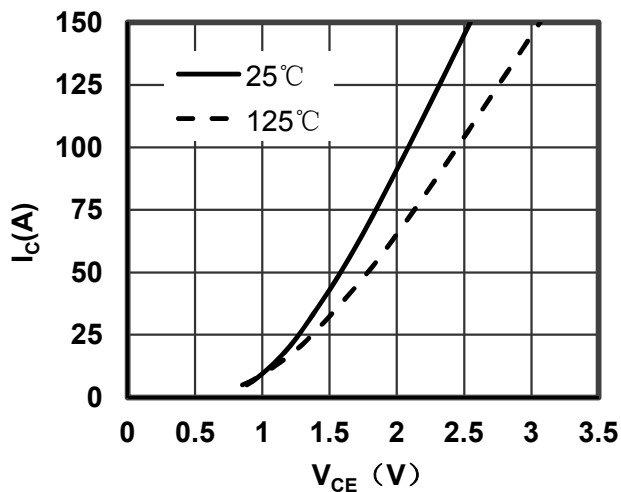


Figure 1. Typical Output Characteristics  
IGBT-inverter

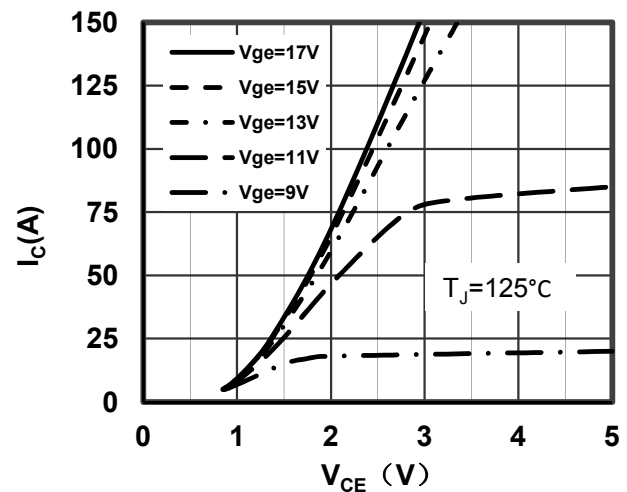
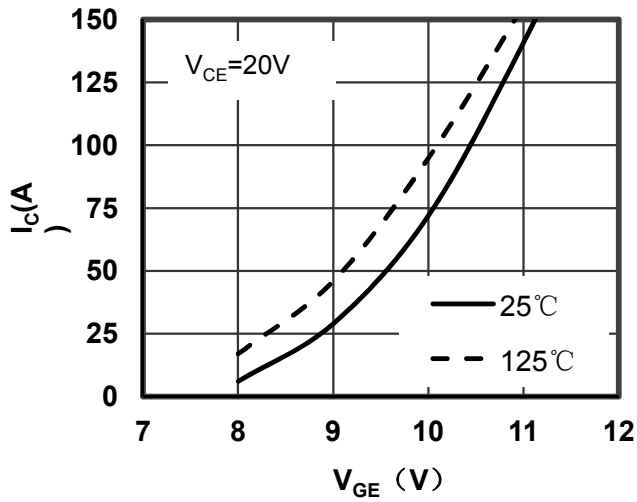
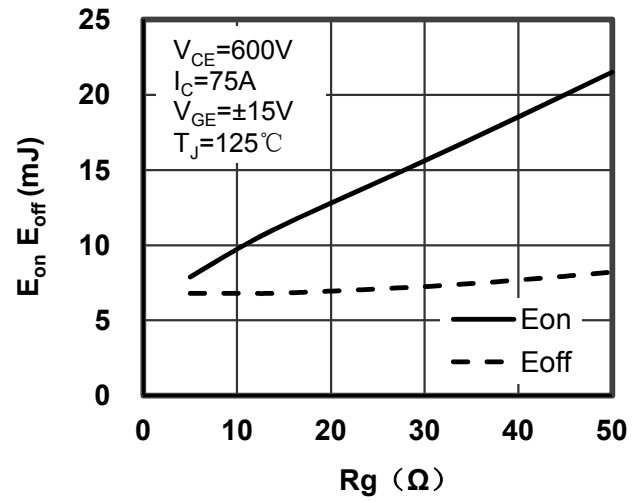


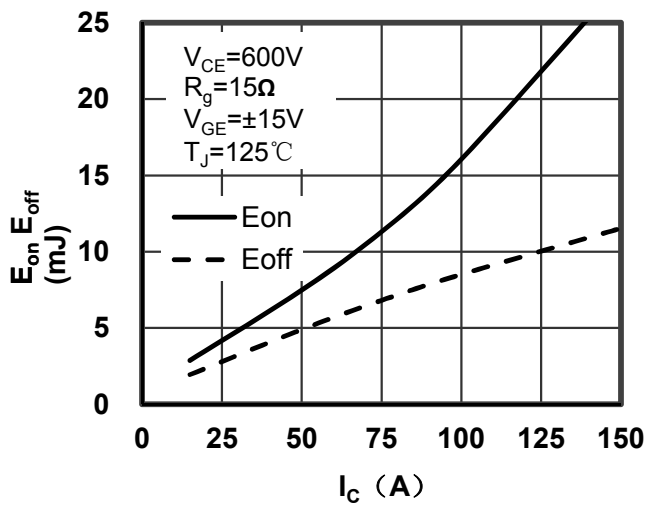
Figure 2. Typical Output Characteristics  
IGBT-inverter



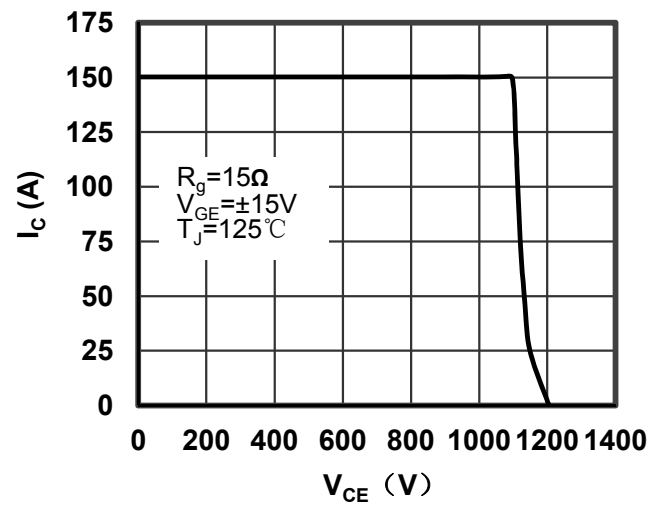
**Figure 3. Typical Transfer Characteristics IGBT-inverter**



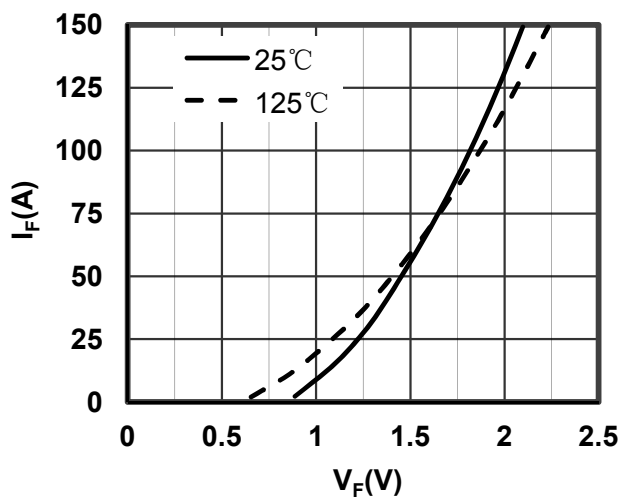
**Figure 4. Switching Energy vs Gate Resistor IGBT-inverter**



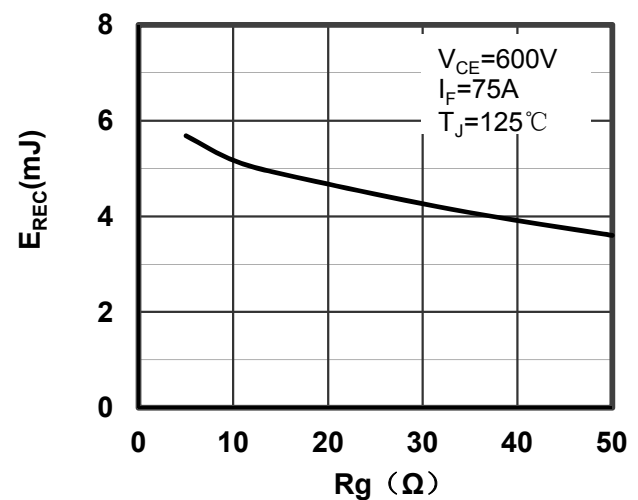
**Figure 5. Switching Energy vs Collector Current IGBT-inverter**



**Figure 6. Reverse Biased Safe Operating Area IGBT-inverter**



**Figure 7. Diode Forward Characteristics Diode-inverter**



**Figure 8. Switching Energy vs Gate Resistor Diode-inverter**

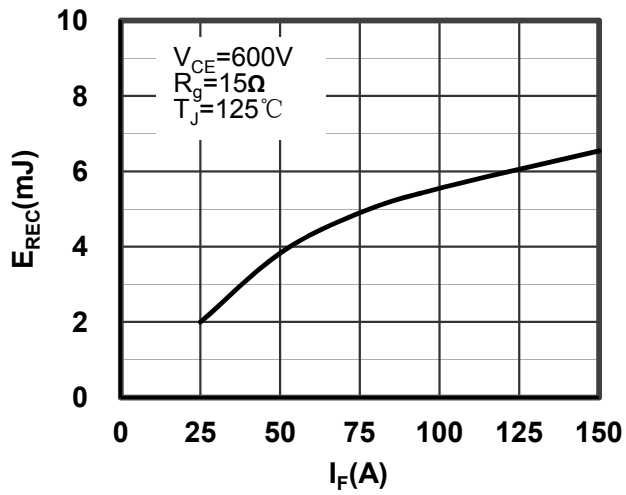


Figure 9. Switching Energy vs Forward Current  
Diode-inverter

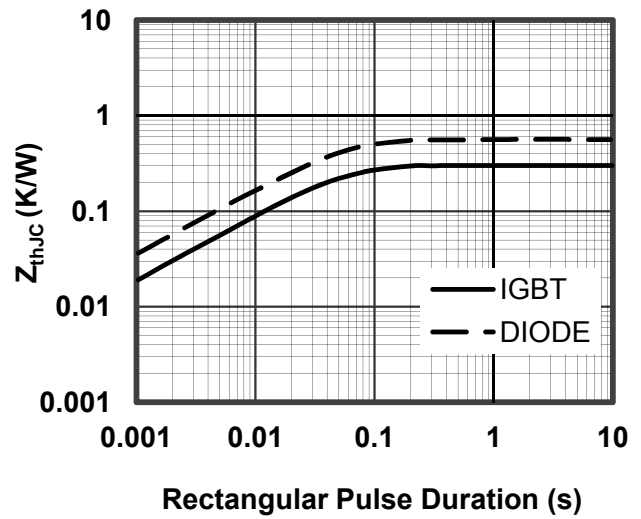


Figure 10. Transient Thermal Impedance of  
Diode and IGBT-inverter

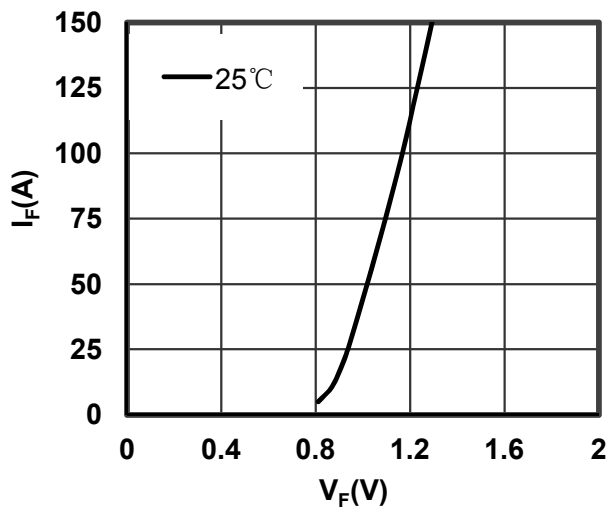


Figure 11. Diode Forward Characteristics  
Diode- rectifier

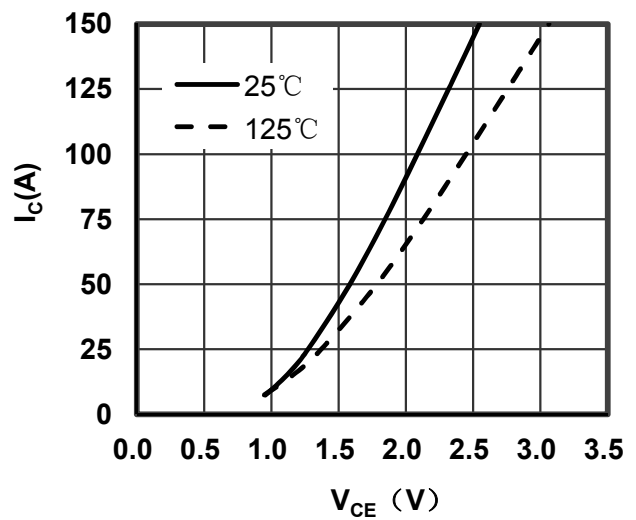


Figure 12. Typical Output Characteristics  
IGBT- brake chopper

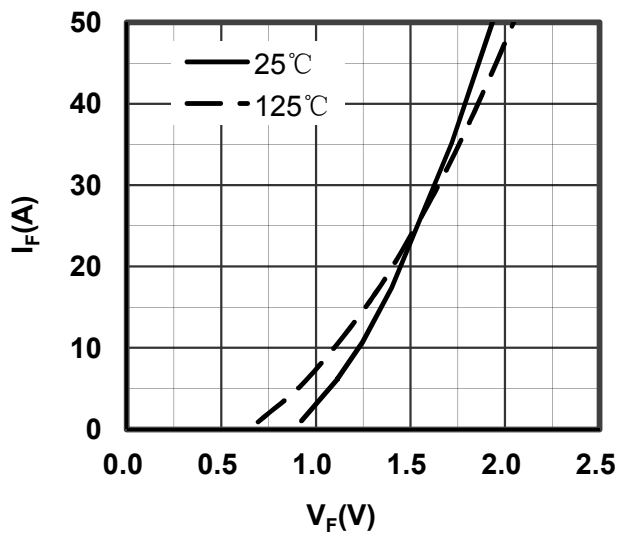


Figure 13. Diode Forward Characteristics  
Diode - brake chopper

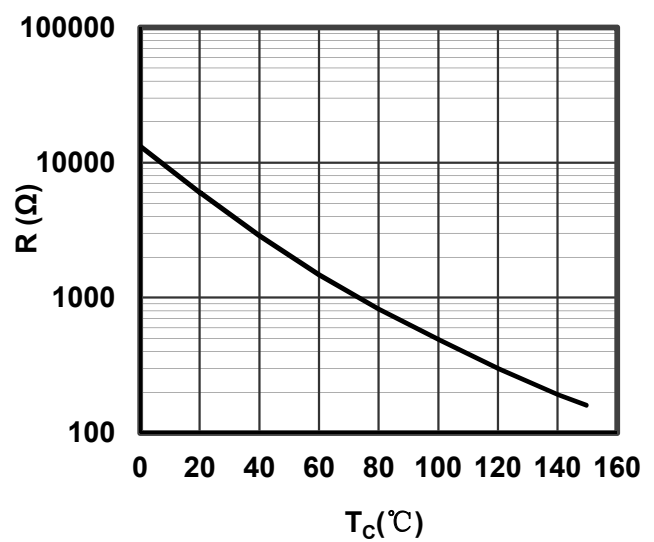


Figure 14. NTC Characteristics

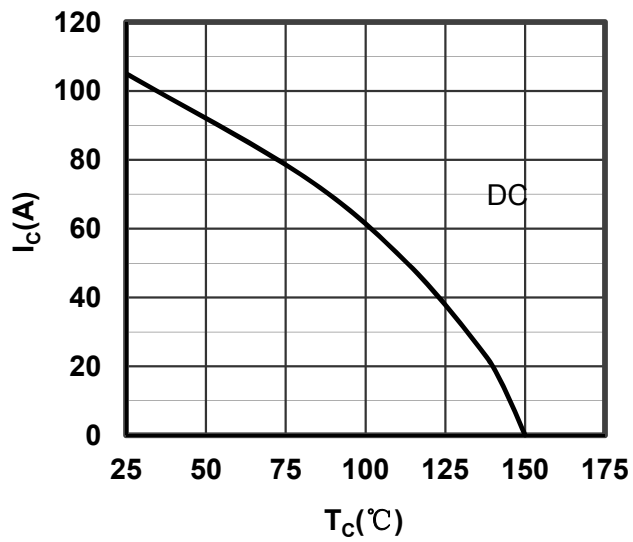


Figure 15. Collector Current vs Case temperature  
IGBT -inverter

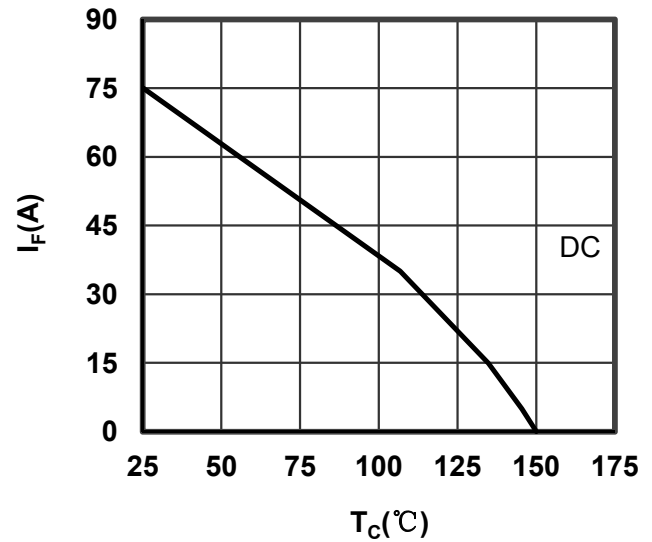


Figure 16. Forward current vs Case temperature  
Diode -inverter

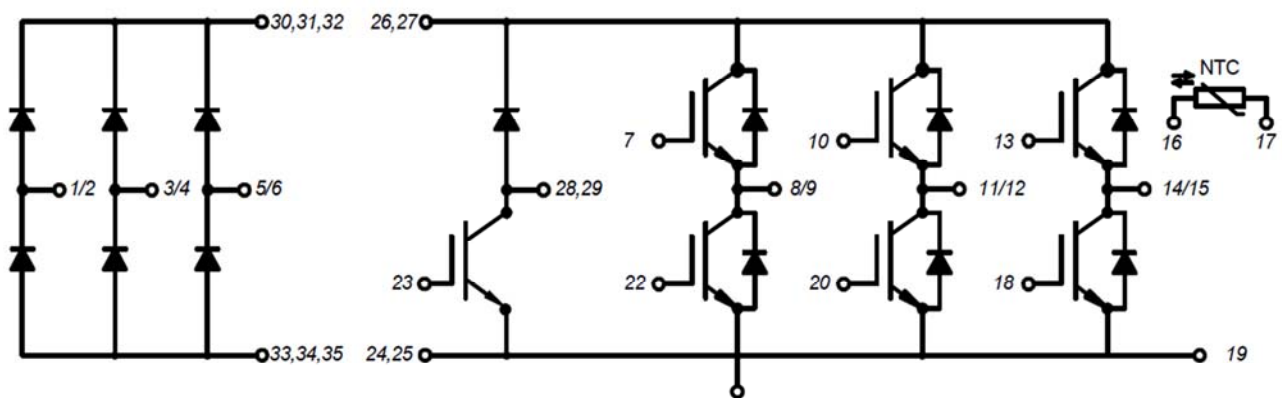
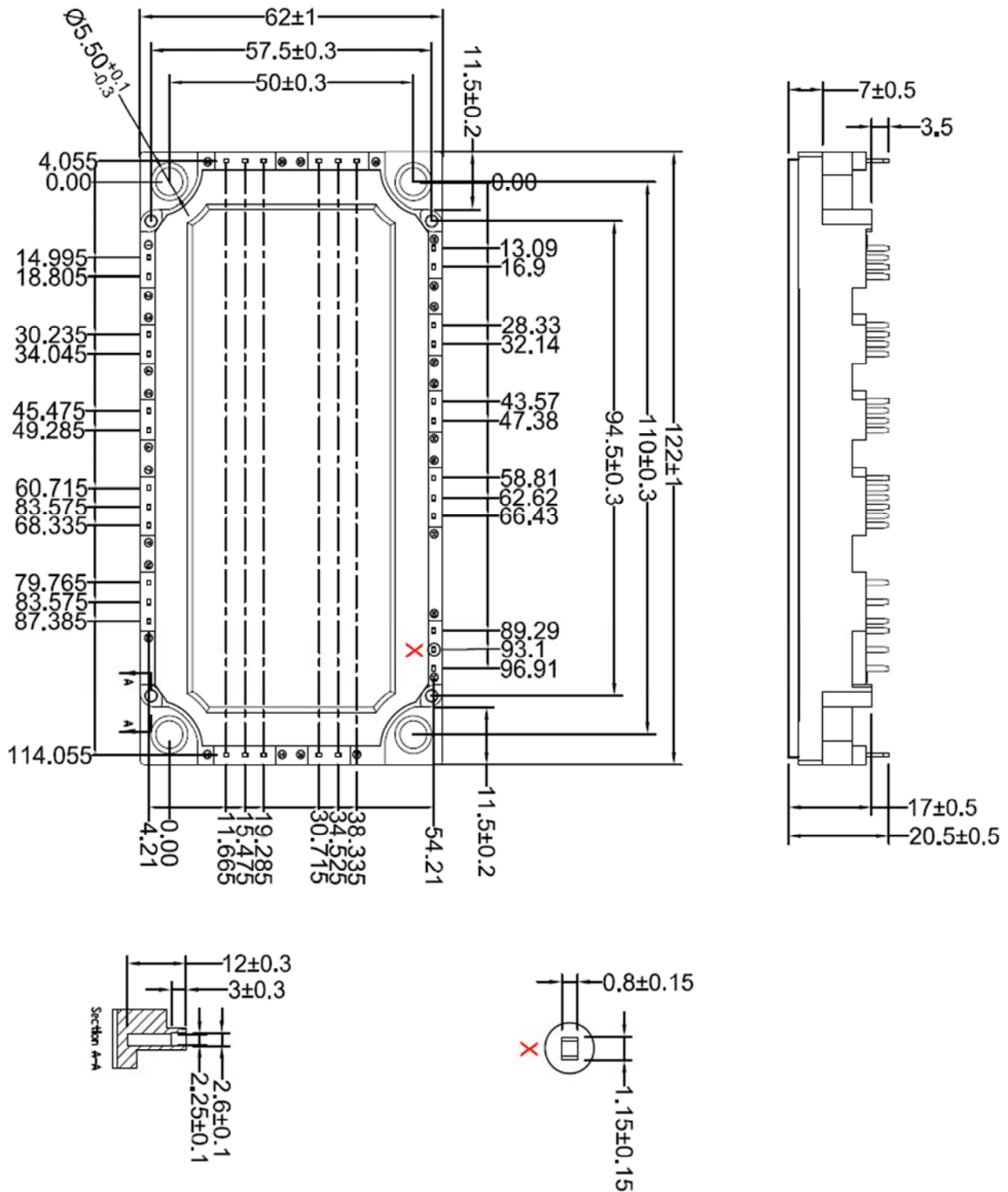


Figure 17. Circuit Diagram





Dimensions in (mm)  
Figure 18. Package Outline