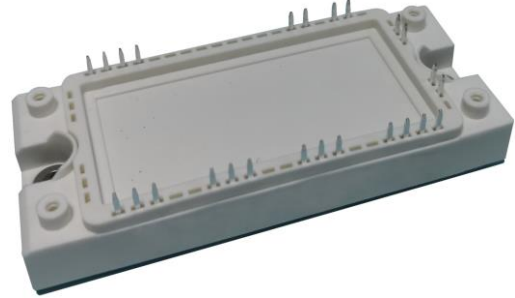


## PRODUCT FEATURES

- Low saturation voltage and positive temperature coefficient
- Fast switching and short tail current
- Free wheeling diodes with fast and soft reverse recovery
- Low switching losses



## APPLICATIONS

- Drive inverters with brake system

### BRAKE-CHOPPER SECTOR

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

| Symbol    | Parameter/Test Conditions         | Values   | Unit |
|-----------|-----------------------------------|--|------|
| $V_{CES}$ | Collector Emitter Voltage         | $T_J=25^\circ\text{C}$                             | V    |
| $V_{GES}$ | Gate Emitter Voltage              |  |      |
| $I_C$     | DC Collector Current              | $T_C=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$ | A    |
|           |                                   | $T_C=95^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$ |      |
| $I_{CM}$  | Repetitive Peak Collector Current | $t_p=1\text{ms}$                                   | 200  |
| $P_{tot}$ | Power Dissipation Per IGBT        | $T_C=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$ | 515  |

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

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

MacMic Science & Technology Co., Ltd.

Add: #18, Hua Shan Zhong Lu, New District, Changzhou City, Jiangsu Province, P. R. of China

Tel.: +86-519-85163708 Fax: +86-519-85162291 Post Code: 213022 Website: www.macmicst.com

# MMG200H160UX2TC\_W11

## BRAKE-CHOPPER SECTOR

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

| Symbol        | Parameter/Test Conditions                      |   | Min.                    | Typ. | Max. | Unit          |
|---------------|--|---|-------------------------|------|------|---------------|
| $V_{GE(th)}$  | Gate Emitter Threshold Voltage                 | $V_{CE}=V_{GE}, I_C=4\text{mA}$   | 5.0                     | 5.8  | 6.5  | V             |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage           | $I_C=100\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$                                    |                         | 1.8  | 2.25 |               |
|               |  | $I_C=100\text{A}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$                                   |                         | 2.1  |      |               |
|               |  | $I_C=100\text{A}, V_{GE}=15\text{V}, T_J=150^\circ\text{C}$                                   |                         | 2.2  |      |               |
| $I_{CES}$     | Collector Leakage Current                      | $V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$                                 |                         |      | 1    | mA            |
|               |  | $V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_J=150^\circ\text{C}$                                |                         |      | 10   | mA            |
| $I_{GES}$     | Gate Leakage Current                           | $V_{CE}=0\text{V}, V_{GE}=\pm 15\text{V}, T_J=25^\circ\text{C}$                               | -400                    |      | 400  | nA            |
| $R_{gint}$    | Integrated Gate Resistor                       |   |                         | 7    |      | $\Omega$      |
| $Q_g$         | Gate Charge                                    | $V_{CE}=600\text{V}, I_C=100\text{A}, V_{GE}=\pm 15\text{V}$                                  |                         | 0.53 |      | $\mu\text{C}$ |
| $C_{ies}$     | Input Capacitance                              | $V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$  |                         | 7.1  |      | nF            |
| $C_{res}$     | Reverse Transfer Capacitance                   |   |                         |      | 300  |               |
| $t_{d(on)}$   | Turn on Delay Time                             | $V_{CC}=600\text{V}, I_C=100\text{A}$<br>$R_G=5.1\Omega,$                                     | $T_J=25^\circ\text{C}$  |      | 160  | ns            |
|               |  |   | $T_J=125^\circ\text{C}$ |      | 180  | ns            |
|               |  |   | $T_J=150^\circ\text{C}$ |      | 190  | ns            |
| $t_r$         | Rise Time                                      | $V_{GE}=\pm 15\text{V},$<br>Inductive Load  | $T_J=25^\circ\text{C}$  |      | 50   | ns            |
|               |  |   | $T_J=125^\circ\text{C}$ |      | 52   | ns            |
|               |  |   | $T_J=150^\circ\text{C}$ |      | 54   | ns            |
| $t_{d(off)}$  | Turn off Delay Time                            | $V_{CC}=600\text{V}, I_C=100\text{A}$<br>$R_G=5.1\Omega,$                                     | $T_J=25^\circ\text{C}$  |      | 350  | ns            |
|               |  |   | $T_J=125^\circ\text{C}$ |      | 400  | ns            |
|               |  |   | $T_J=150^\circ\text{C}$ |      | 420  | ns            |
| $t_f$         | Fall Time                                      | $V_{GE}=\pm 15\text{V},$<br>Inductive Load  | $T_J=25^\circ\text{C}$  |      | 100  | ns            |
|               |  |   | $T_J=125^\circ\text{C}$ |      | 180  | ns            |
|               |  |   | $T_J=150^\circ\text{C}$ |      | 190  | ns            |
| $E_{on}$      | Turn on Energy                                 | $V_{CC}=600\text{V}, I_C=100\text{A}$<br>$R_G=5.1\Omega,$                                     | $T_J=125^\circ\text{C}$ |      | 15   | mJ            |
|               |  |   | $T_J=150^\circ\text{C}$ |      | 16.5 | mJ            |
| $E_{off}$     | Turn off Energy                                | $V_{GE}=\pm 15\text{V},$<br>Inductive Load  | $T_J=125^\circ\text{C}$ |      | 8    | mJ            |
|               |  |   | $T_J=150^\circ\text{C}$ |      | 8.8  | mJ            |
| $I_{SC}$      | Short Circuit Current                          | $t_{psc}\leq 10\mu\text{s}, V_{GE}=15\text{V}$<br>$T_J=150^\circ\text{C}, V_{CC}=800\text{V}$ |                         | 420  |      | A             |
| $R_{thJC}$    | Junction to Case Thermal Resistance (Per IGBT) |   |                         |      | 0.29 | K/W           |

## MMG200H160UX2TC\_W11

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

| Symbol               | Parameter/Test Conditions                       | Min.   | Typ. | Max. | Unit          |   |
|----------------------|---|--|------|------|---------------|---|
| <b>Diode-Serial</b>  |   |  |      |      |               |   |
| $V_F$                | Forward Voltage                                 | $I_F=50\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=25^\circ\text{C}$   |      | 1.8  | 2.3           | V |
|                      |   | $I_F=50\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=125^\circ\text{C}$  |      | 1.55 |               |   |
|                      |   | $I_F=50\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=150^\circ\text{C}$  |      | 1.5  |               |   |
| $t_{rr}$             | Reverse Recovery Time                           |  | 450  |      | ns            |   |
| $I_{RRM}$            | Max. Reverse Recovery Current                   | $I_F=50\text{A}$ , $V_R=600\text{V}$<br>$di_F/dt=-1500\text{A}/\mu\text{s}$<br>$T_J=150^\circ\text{C}$ | 80   |      | A             |   |
| $Q_{RR}$             | Reverse Recovery Charge                         |  | 14.5 |      | $\mu\text{C}$ |   |
| $E_{rec}$            | Reverse Recovery Energy                         |  | 5.5  |      | mJ            |   |
| $R_{thJCD}$          | Junction to Case Thermal Resistance (Per Diode) |  |      | 0.81 | K/W           |   |
| <b>Diode-Reverse</b> |   |  |      |      |               |   |
| $V_F$                | Forward Voltage                                 | $I_F=15\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=25^\circ\text{C}$   |      | 2.1  | 2.3           | V |
|                      |   | $I_F=15\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=125^\circ\text{C}$  |      | 1.75 |               |   |
|                      |   | $I_F=15\text{A}$ , $V_{GE}=0\text{V}$ , $T_J=150^\circ\text{C}$  |      | 1.7  |               |   |
| $I_{RRM}$            | Max. Reverse Recovery Current                   | $I_F=15\text{A}$ , $V_R=600\text{V}$   |      | 16   | A             |   |
| $Q_{RR}$             | Reverse Recovery Charge                         | $di_F/dt=-400\text{A}/\mu\text{s}$ , $T_J=150^\circ\text{C}$   |      | 2.5  | $\mu\text{C}$ |   |
| $R_{thJCD}$          | Junction to Case Thermal Resistance (Per Diode) |  |      | 2.3  | 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<br>$T_J=25^\circ\text{C}$                   | 1600   | V     |      |
| $I_D$     | Output Current(D.C.)<br>Three phase, half wave, $T_c=80^\circ\text{C}$ | 200  | A     |      |
| $I_{FSM}$ | Non Repetitive Surge Forward Current                                   | $T_J=45^\circ\text{C}$ , $t=10\text{ms}$ , 50Hz  |       | 1800 |
|           |  | $T_J=45^\circ\text{C}$ , $t=8.3\text{ms}$ , 60Hz |       | 2000 |
| $I^2t$    |  | $T_J=45^\circ\text{C}$ , $t=10\text{ms}$ , 50Hz  | 16200 |      |
|           |  | $T_J=45^\circ\text{C}$ , $t=8.3\text{ms}$ , 60Hz | 16600 |      |

### 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                                 | $I_F=200\text{A}$ , $T_J=25^\circ\text{C}$   |      | 1.15 | 1.45 | V             |
|             |   | $I_F=200\text{A}$ , $T_J=125^\circ\text{C}$  |      | 1.12 |      | V             |
|             |   | $I_F=200\text{A}$ , $T_J=150^\circ\text{C}$  |      | 1.1  |      | V             |
| $I_R$       | Reverse Leakage Current                         | $V_R=1600\text{V}$ , $T_J=25^\circ\text{C}$  |      |      | 50   | $\mu\text{A}$ |
|             |   | $V_R=1600\text{V}$ , $T_J=150^\circ\text{C}$ |      |      | 1    | mA            |
| $R_{thJCD}$ | Junction to Case Thermal Resistance (Per Diode) |  |      | 0.33 | K/W  |               |

## MMG200H160UX2TC\_W11

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

| Symbol     | Parameter/Test Conditions   |                            | Values  | Unit |
|------------|-----------------------------|----------------------------|---------|------|
| $T_{Jmax}$ | Max. Junction Temperature   |                            | 175     | °C   |
| $T_{Jop}$  | Operating Temperature       |                            | -40~150 |      |
| $T_{stg}$  | Storage Temperature         |                            | -40~150 |      |
| $V_{isol}$ | Isolation Breakdown Voltage | AC, 50Hz(R.M.S), t=1minute | 3000    | V    |
| Md         | Mounting Torque             | Recommended (M5)           | 2.5~5   | Nm   |
| Weight     |                             |                            | 180     | g    |

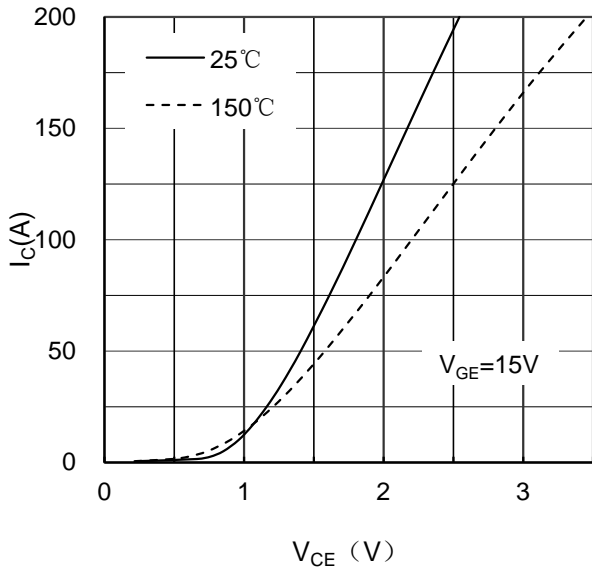


Figure 1. Typical Output Characteristics IGBT-inverter

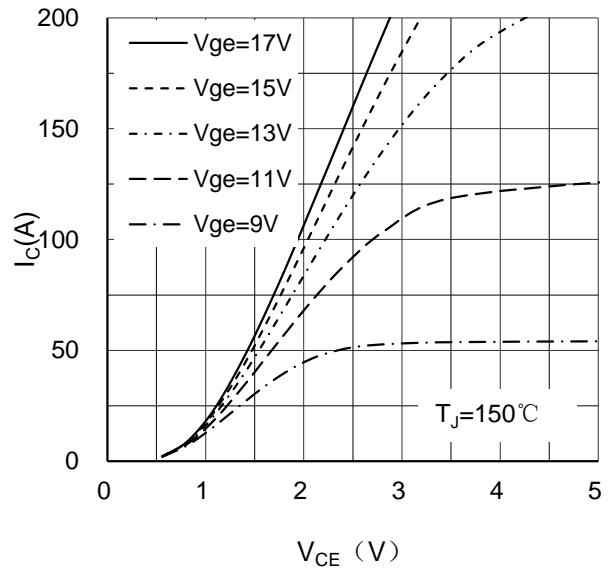


Figure 2. Typical Output Characteristics IGBT-inverter

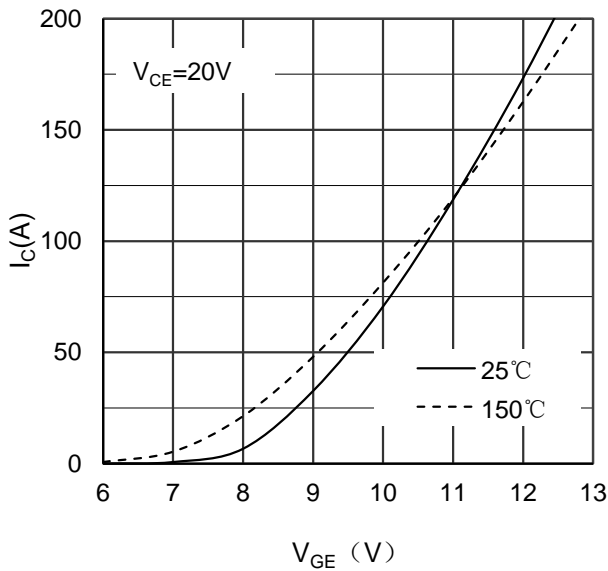


Figure 3. Typical Transfer characteristics IGBT-inverter

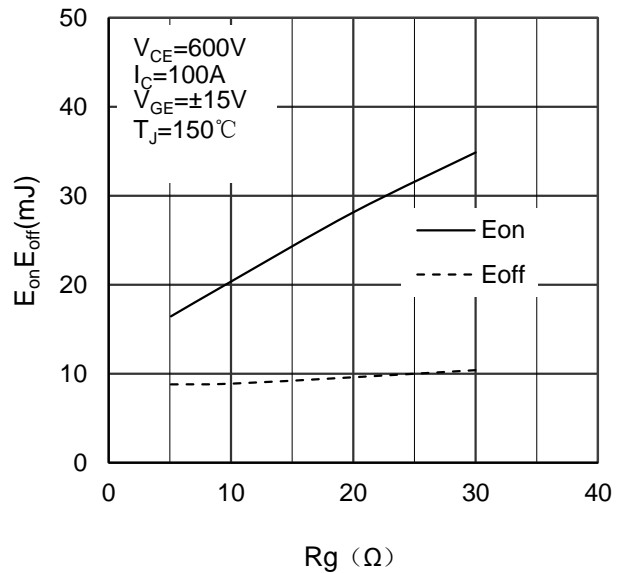


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

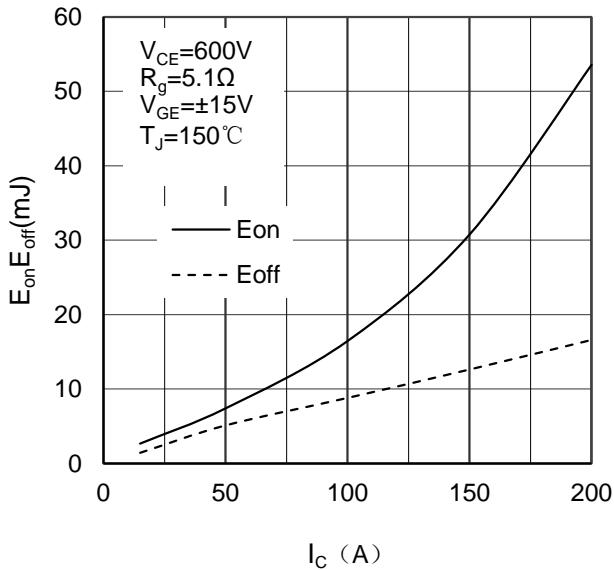


Figure 5. Switching Energy vs Collector Current IGBT-inverter

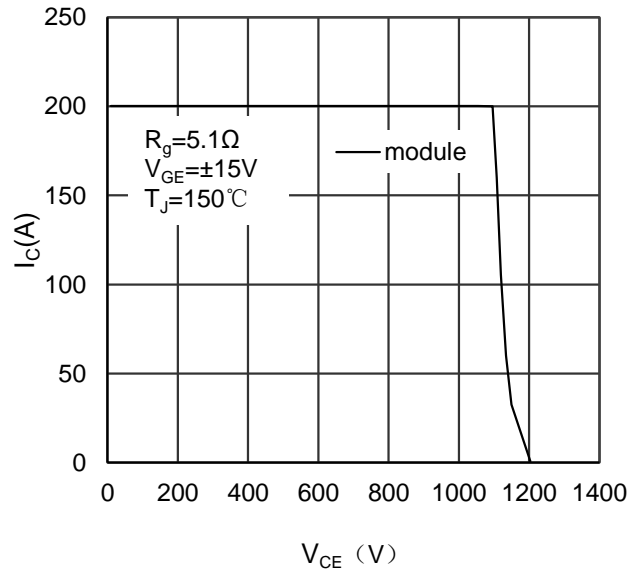


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

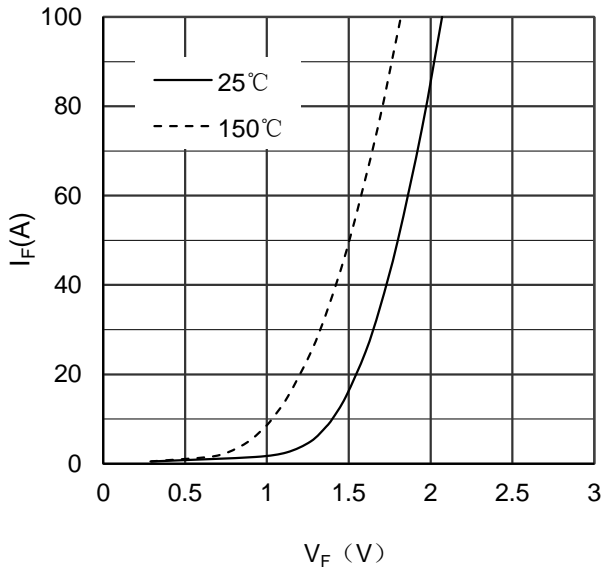


Figure 7. Diode Forward Characteristics Diode-Serial

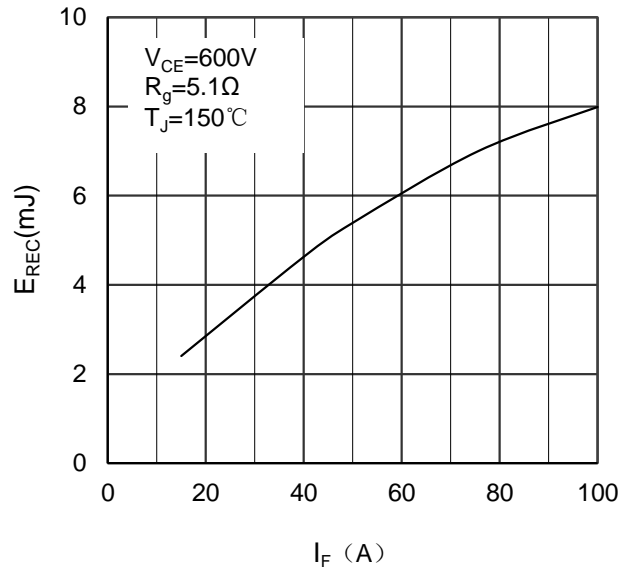


Figure 8. Switching Energy vs Forward Current Diode-Serial

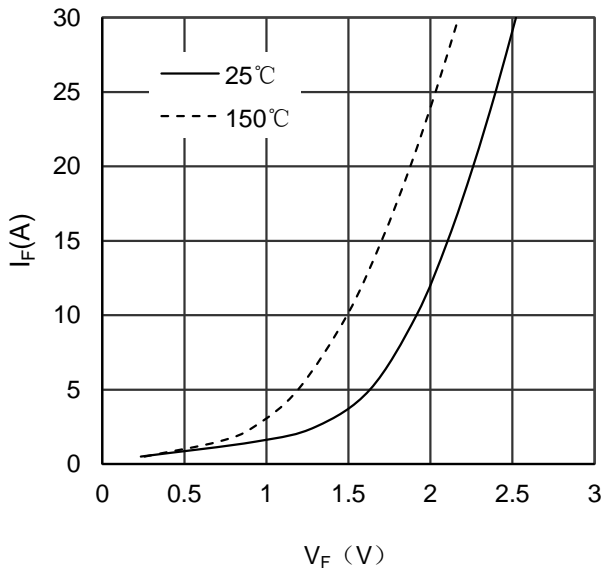


Figure 9. Diode Forward Characteristics Reverse-Diode

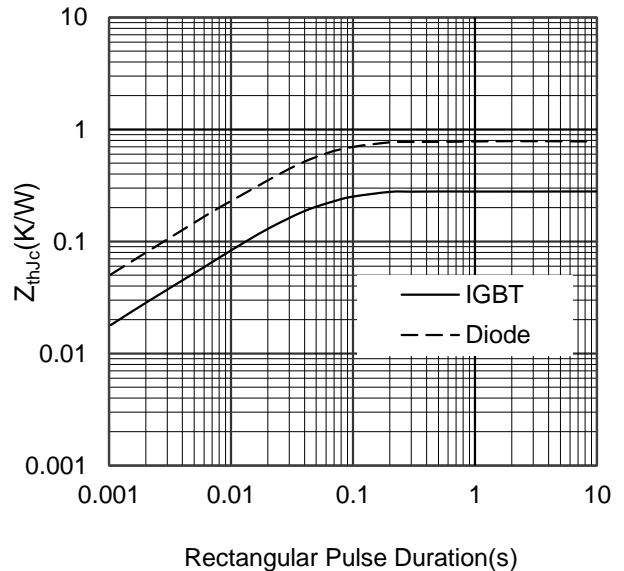


Figure 10. Transient Thermal Impedance of Diode-Serial and IGBT-inverter

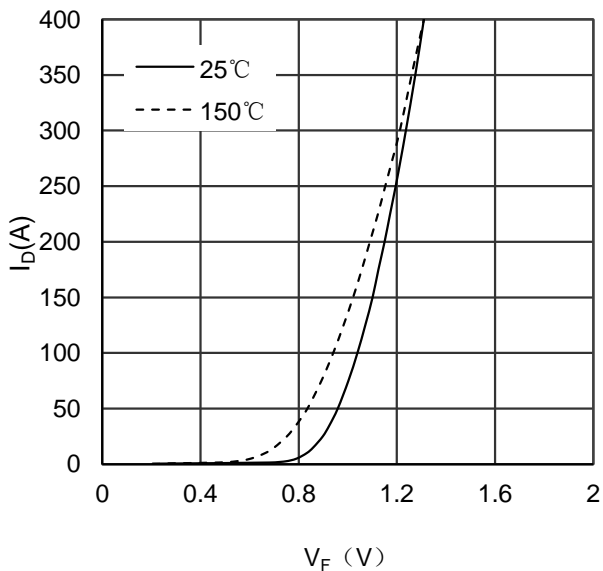


Figure 11. Forward Voltage Drop vs Output Current

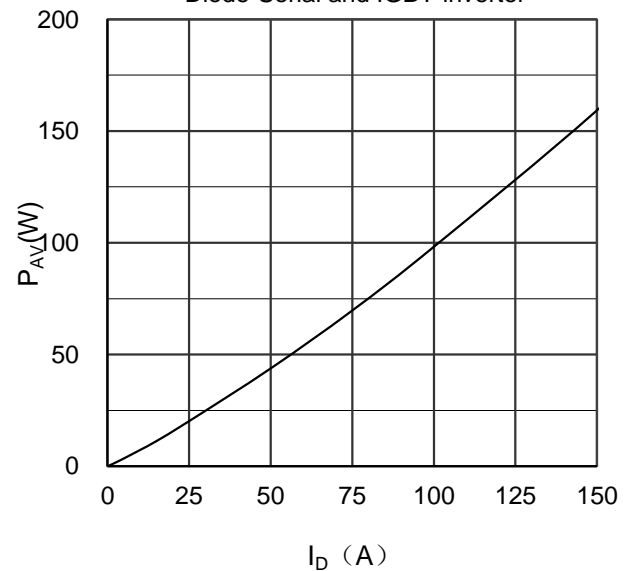


Figure 12. Power dissipation vs Output Current

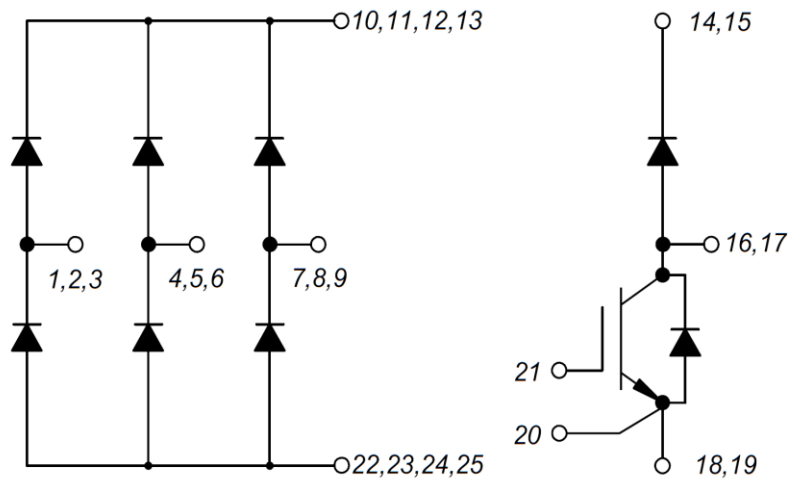


Figure 13. Circuit Diagram

