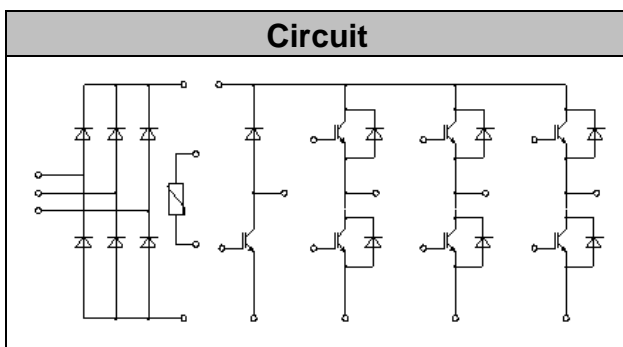


## IGBT Modules

|           |       |
|-----------|-------|
| $V_{CES}$ | 1200V |
| $I_c$     | 15A   |

## 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)
- Isolated heatsink using DBC technology
- Maximum junction temperature 175°C

### ● IGBT- inverter

#### Absolute Maximum Ratings

| Parameter                         | Symbol    | Conditions                                    | Value    | Unit |
|-----------------------------------|-----------|---|----------|------|
| Collector-Emitter Voltage         | $V_{CES}$ | $V_{GE}=0V, I_c = 1mA, T_{vj}=25^{\circ}C$    | 1200     | V    |
| Continuous Collector Current      | $I_c$     | $T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$    | 15       | A    |
| Repetitive Peak Collector Current | $I_{CRM}$ | $t_p=1ms$                                     | 30       | A    |
| Gate-Emitter Voltage              | $V_{GES}$ | $T_{vj}=25^{\circ}C$                          | $\pm 20$ | V    |
| Total Power Dissipation           | $P_{tot}$ | $T_C=25^{\circ}C$<br>$T_{vjmax}=175^{\circ}C$ | 155      | W    |



## ● IGBT- inverter

### Characteristic Values

| Parameter                               | Symbol        | Conditions   | Value   |       |      | Unit |    |
|---|---------------|--|---|-------|------|------|----|
|   |               |  | Min.  | Typ.  | Max. |      |    |
| Gate-Emitter Threshold Voltage          | $V_{GE(th)}$  | $V_{GE}=V_{CE}, I_C=0.5mA, T_{vj}=25^{\circ}C$                                       | 5.2   | 5.9   | 6.5  | V    |    |
| Collector-Emitter Cut-off Current       | $I_{CES}$     | $V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$  |   |       | 1.0  | mA   |    |
| Collector-Emitter Saturation Voltage    | $V_{CE(sat)}$ | $I_C=15A, V_{GE}=15V, T_{vj}=25^{\circ}C$  |   | 1.9   |      | V    |    |
|   |               | $I_C=15A, V_{GE}=15V, T_{vj}=125^{\circ}C$   |   | 2.1   |      |      |    |
|   |               | $I_C=15A, V_{GE}=15V, T_{vj}=150^{\circ}C$   |   | 2.2   |      |      |    |
| Gate Charge                             | $Q_G$         |  |   | 0.15  |      | uC   |    |
| Input Capacitance                       | $C_{ies}$     | $V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$                                  |   | 0.98  |      | nF   |    |
| Reverse Transfer Capacitance            | $C_{res}$     |  |   | 0.034 |      | nF   |    |
| Gate-Emitter leakage current            | $I_{GES}$     | $V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$  |   |       | 400  | nA   |    |
| Turn-on Delay Time                      | $t_{d(on)}$   | $I_C=15A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=25^{\circ}C$             |   | 61    |      | ns   |    |
| Rise Time                               | $t_r$         |  |   | 29    |      | ns   |    |
| Turn-off Delay Time                     | $t_{d(off)}$  |  |   | 89    |      | ns   |    |
| Fall Time                               | $t_f$         |  |   | 311   |      | ns   |    |
| Energy Dissipation During Turn-on Time  | $E_{on}$      |  |   | 1.98  |      | mJ   |    |
| Energy Dissipation During Turn-off Time | $E_{off}$     |  |   | 0.99  |      | mJ   |    |
| Turn-on Delay Time                      | $t_{d(on)}$   |  | $I_C=15A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=150^{\circ}C$ |       | 60   |      | ns |
| Rise Time                               | $t_r$         |  |   |       | 32   |      | ns |
| Turn-off Delay Time                     | $t_{d(off)}$  |  |   |       | 89   |      | ns |
| Fall Time                               | $t_f$         |  |   |       | 319  |      | ns |
| Energy Dissipation During Turn-on Time  | $E_{on}$      |  |   | 2.15  |      | mJ   |    |
| Energy Dissipation During Turn-off Time | $E_{off}$     |  |   | 1.13  |      | mJ   |    |
| SC Data                                 | $I_{sc}$      | $t_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$ |   |       | 55   |      | A  |



## ● Diode-inverter

### Absolute Maximum Ratings

| Parameter                       | Symbol    | Conditions                              | Value | Unit             |
|---------------------------------|-----------|---|-------|------------------|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | $T_{vj}=25^{\circ}C$                    | 1200  | V                |
| Continuous DC Forward Current   | $I_F$     |   | 15    | A                |
| Repetitive Peak Forward Current | $I_{FRM}$ | $t_p=1ms$                               | 30    | A                |
| $I^2t$ -value                   | $I^2t$    | $V_R=0V, t_p=10ms, T_{vj}=125^{\circ}C$ | 16.0  | A <sup>2</sup> s |
|                                 |           | $V_R=0V, t_p=10ms, T_{vj}=150^{\circ}C$ | 14.0  |                  |

### Characteristic Values

| Parameter                     | Symbol    | Conditions                            | Value |      |      | Unit    |
|-------------------------------|-----------|---------------------------------------|-------|------|------|---------|
|                               |           |                                       | Min.  | Typ. | Max. |         |
| Forward Voltage               | $V_F$     | $I_F=15A, T_{vj}=25^{\circ}C$         |       | 2.00 |      | V       |
|                               |           | $I_F=15A, T_{vj}=125^{\circ}C$        |       | 1.80 |      |         |
|                               |           | $I_F=15A, T_{vj}=150^{\circ}C$        |       | 1.75 |      |         |
| Recovered Charge              | $Q_{rr}$  | $I_F=15A$                             |       | 0.45 |      | $\mu C$ |
| Peak Reverse Recovery Current | $I_{rr}$  | $V_R=600V$<br>$-di_F/dt = 600A/\mu s$ |       | 13   |      | A       |
| Reverse Recovery Energy       | $E_{rec}$ | $T_{vj}=25^{\circ}C$                  |       | 0.49 |      | mJ      |
| Recovered Charge              | $Q_{rr}$  | $I_F=15A$                             |       | 0.54 |      | $\mu C$ |
| Peak Reverse Recovery Current | $I_{rr}$  | $V_R=600V$<br>$-di_F/dt = 600A/\mu s$ |       | 14   |      | A       |
| Reverse Recovery Energy       | $E_{rec}$ | $T_{vj}=150^{\circ}C$                 |       | 0.68 |      | mJ      |



● **IGBT-brake-chopper**  
**Absolute Maximum Ratings**

| Parameter                         | Symbol    | Conditions                                 | Value    | Unit |
|-----------------------------------|-----------|--|----------|------|
| Collector-Emitter Voltage         | $V_{CES}$ | $V_{GE}=0V, I_C=1mA, T_{vj}=25^{\circ}C$   | 1200     | V    |
| Continuous Collector Current      | $I_C$     | $T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$ | 15       | A    |
| Repetitive Peak Collector Current | $I_{CRM}$ | $t_p=1ms$                                  | 30       | A    |
| Gate-Emitter Voltage              | $V_{GES}$ | $T_{vj}=25^{\circ}C$                       | $\pm 20$ | V    |
| Total Power Dissipation           | $P_{tot}$ | $T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$  | 155      | W    |

**Characteristic Values**

| Parameter                               | Symbol        | Conditions   | Value |       |      | Unit |    |
|---|---------------|--|-------|-------|------|------|----|
|   |               |  | Min.  | Typ.  | Max. |      |    |
| Gate-emitter Threshold Voltage          | $V_{GE(th)}$  | $V_{GE}=V_{CE}, I_C=0.5mA, T_{vj}=25^{\circ}C$                           | 5.2   | 5.9   | 6.5  | V    |    |
| Collector-Emitter Cut-off Current       | $I_{CES}$     | $V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$                            |       |       | 1.0  | mA   |    |
| Collector-Emitter Saturation Voltage    | $V_{CE(sat)}$ | $I_C=15A, V_{GE}=15V, T_{vj}=25^{\circ}C$                                |       | 1.9   |      | V    |    |
|   |               | $I_C=15A, V_{GE}=15V, T_{vj}=125^{\circ}C$                               |       | 2.1   |      |      |    |
|   |               | $I_C=15A, V_{GE}=15V, T_{vj}=150^{\circ}C$                               |       | 2.2   |      |      |    |
| Gate Charge                             | $Q_G$         |  |       | 0.09  |      | uC   |    |
| Input Capacitance                       | $C_{ies}$     | $V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$                      |       | 0.98  |      | nF   |    |
| Reverse Transfer Capacitance            | $C_{res}$     |  |       | 0.034 |      | nF   |    |
| Gate-Emitter leakage current            | $I_{GES}$     | $V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$                              |       |       | 400  | nA   |    |
| Turn-on Delay Time                      | $t_{d(on)}$   | $I_C=15A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=25^{\circ}C$ |       | 61    |      | ns   |    |
| Rise Time                               | $t_r$         |  |       | 29    |      | ns   |    |
| Turn-off Delay Time                     | $t_{d(off)}$  |  |       | 89    |      | ns   |    |
| Fall Time                               | $t_f$         |  |       | 311   |      | ns   |    |
| Energy Dissipation During Turn-on Time  | $E_{on}$      |  |       |       | 1.98 |      | mJ |
| Energy Dissipation During Turn-off Time | $E_{off}$     |  |       |       | 0.99 |      | mJ |



|   |              |  |  |    |
|---|--------------|--|--|----|
| Turn-on Delay Time                      | $t_{d(on)}$  | $I_C=15A$<br>$V_{CE}=600V$<br>$V_{GE}=\pm 15V$<br>$R_G=39\Omega$<br>$T_{vj}=150^\circ C$ | 60   | ns |
| Rise Time                               | $t_r$        |  | 32   | ns |
| Turn-off Delay Time                     | $t_{d(off)}$ |  | 89   | ns |
| Fall Time                               | $t_f$        |  | 319  | ns |
| Energy Dissipation During Turn-on Time  | $E_{on}$     |  | 2.15   | mJ |
| Energy Dissipation During Turn-off Time | $E_{off}$    |  | 1.13   | mJ |
| SC Data                                 | $I_{SC}$     |  | $t_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^\circ C,$<br>$V_{CC}=900V, V_{CEM} \leq 1200V$ | 55 |

## ● Diode-brake-chopper

### Absolute Maximum Ratings

| Parameter                       | Symbol    | Conditions                             | Value | Unit             |
|---------------------------------|-----------|--|-------|------------------|
| Repetitive Peak Reverse Voltage | $V_{RRM}$ | $T_{vj}=25^\circ C$                    | 1200  | V                |
| Continuous DC Forward Current   | $I_F$     |  | 10    | A                |
| Repetitive Peak Forward Current | $I_{FRM}$ | $t_p=1ms$                              | 20    | A                |
| I <sup>2</sup> t-value          | $I^2t$    | $V_R=0V, t_p=10ms, T_{vj}=125^\circ C$ | 16.0  | A <sup>2</sup> s |
|                                 |           | $V_R=0V, t_p=10ms, T_{vj}=150^\circ C$ | 14.0  |                  |

### Characteristic Values

| Parameter                     | Symbol    | Conditions                            | Value |      |      | Unit |
|-------------------------------|-----------|---------------------------------------|-------|------|------|------|
|                               |           |                                       | Min.  | Typ. | Max. |      |
| Forward Voltage               | $V_F$     | $I_F=10A, T_{vj}=25^\circ C$          |       | 2.00 |      | V    |
|                               |           | $I_F=10A, T_{vj}=125^\circ C$         |       | 1.85 |      |      |
|                               |           | $I_F=10A, T_{vj}=150^\circ C$         |       | 1.80 |      |      |
| Recovered Charge              | $Q_{rr}$  | $I_F=10A$                             |       | 0.26 |      | uC   |
| Peak Reverse Recovery Current | $I_{rr}$  | $V_R=600V$<br>$-di_F/dt = 500A/\mu s$ |       | 11   |      | A    |
| Reverse Recovery Energy       | $E_{rec}$ | $T_{vj}=25^\circ C$                   |       | 0.25 |      | mJ   |
| Recovered Charge              | $Q_{rr}$  | $I_F=10A$                             |       | 0.49 |      | uC   |
| Peak Reverse Recovery Current | $I_{rr}$  | $V_R=600V$<br>$-di_F/dt = 500A/\mu s$ |       | 13   |      | A    |
| Reverse Recovery Energy       | $E_{rec}$ | $T_{vj}=150^\circ C$                  |       | 0.50 |      | mJ   |



## ● Diode-rectifier

### Absolute Maximum Ratings

| Parameter                                    | Symbol           | Conditions                              | Value | Unit             |
|--|------------------|---|-------|------------------|
| Repetitive Peak Reverse Voltage              | $V_{RRM}$        | $T_{vj}=25^{\circ}C$                    | 1600  | V                |
| Average output Current<br>50/60Hz, sine wave | $I_{F(AV)}$      | $T_C=100^{\circ}C$                      | 20    | A                |
| Maximum RMS Current at<br>Rectifier Output   | $I_{RMSM}$       | $T_C=100^{\circ}C$                      | 40    | A                |
| Surge Forward Current                        | $I_{FSM}$        | $V_R=0V, t_p=10ms, T_{vj}=25^{\circ}C$  | 330   | A                |
|  |                  | $V_R=0V, t_p=10ms, T_{vj}=150^{\circ}C$ | 280   | A                |
| I <sup>2</sup> t-value                       | I <sup>2</sup> t | $V_R=0V, t_p=10ms, T_{vj}=25^{\circ}C$  | 520   | A <sup>2</sup> s |
|  |                  | $V_R=0V, t_p=10ms, T_{vj}=150^{\circ}C$ | 390   | A <sup>2</sup> s |

### Characteristic Values

| Parameter             | Symbol | Conditions                       | Value |      |      | Unit |
|-----------------------|--------|----------------------------------|-------|------|------|------|
|                       |        |                                  | Min.  | Typ. | Max. |      |
| Diode Forward Voltage | $V_F$  | $I_F=15A, T_{vj}=150^{\circ}C$   |       | 0.96 |      | V    |
| Reverse Current       | $I_R$  | $T_{vj}=150^{\circ}C, V_R=1600V$ |       |      | 1.0  | mA   |

## ● NTC-thermistor

### Characteristic Values

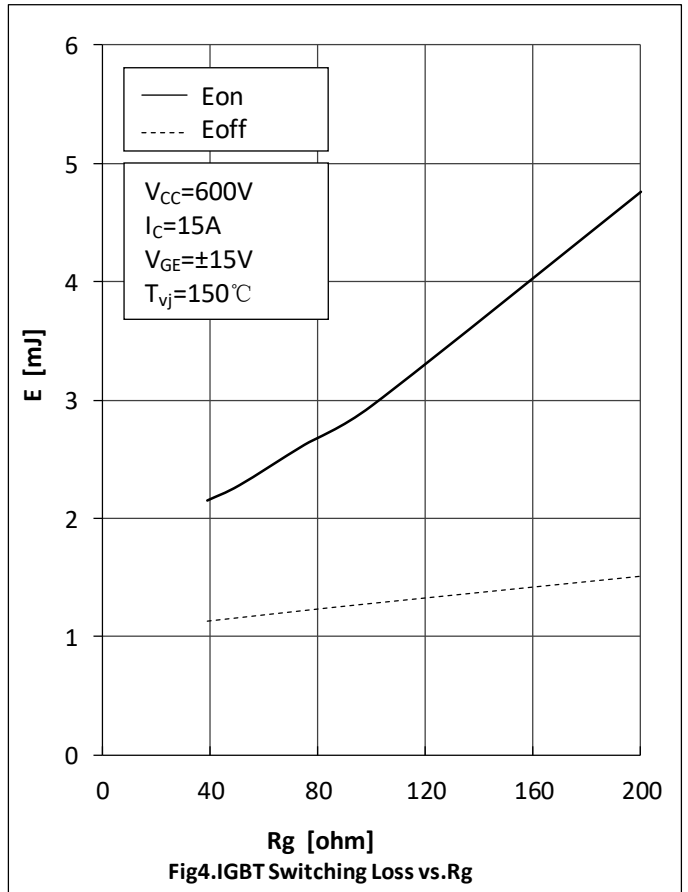
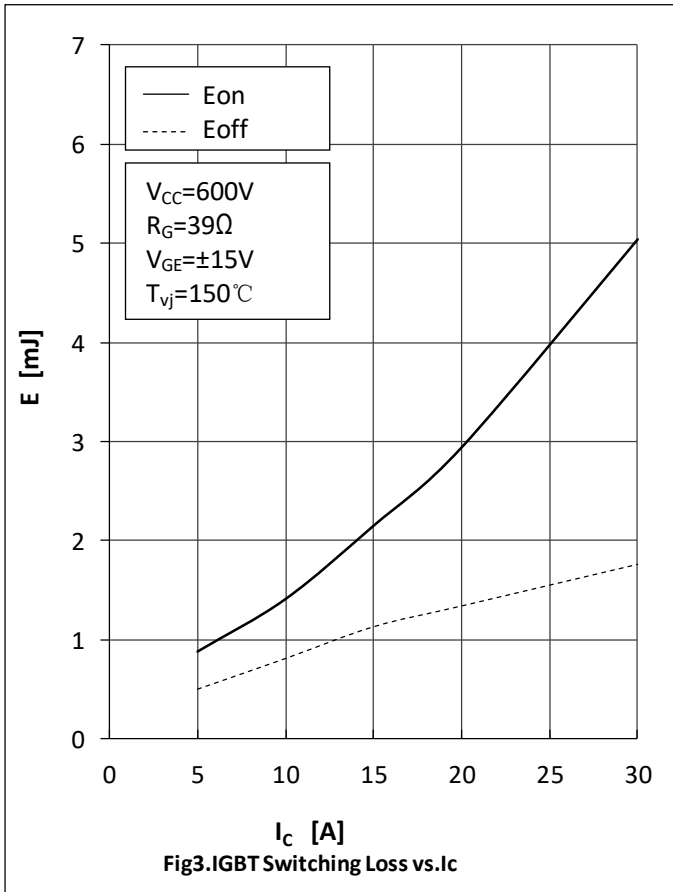
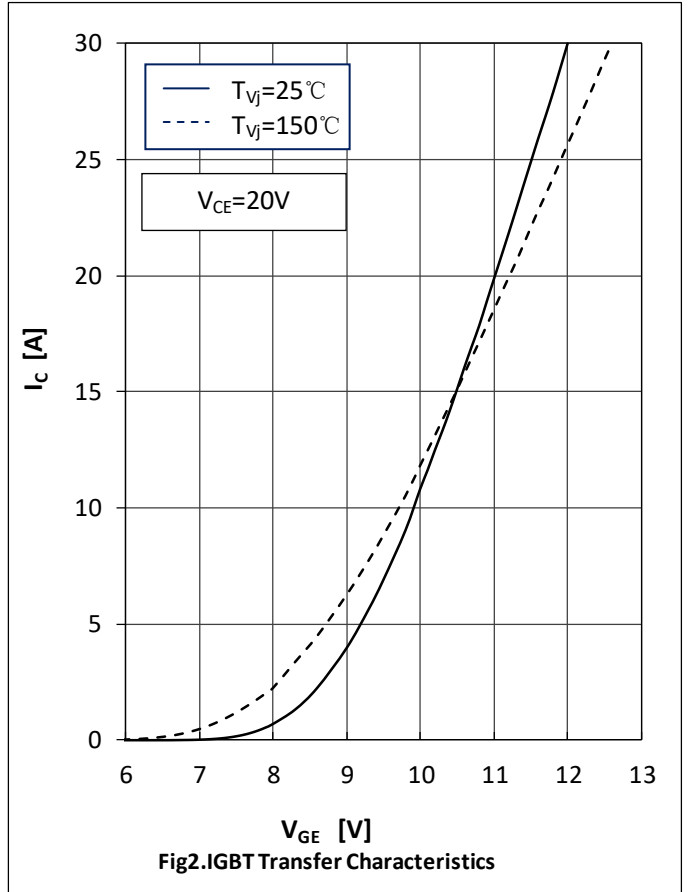
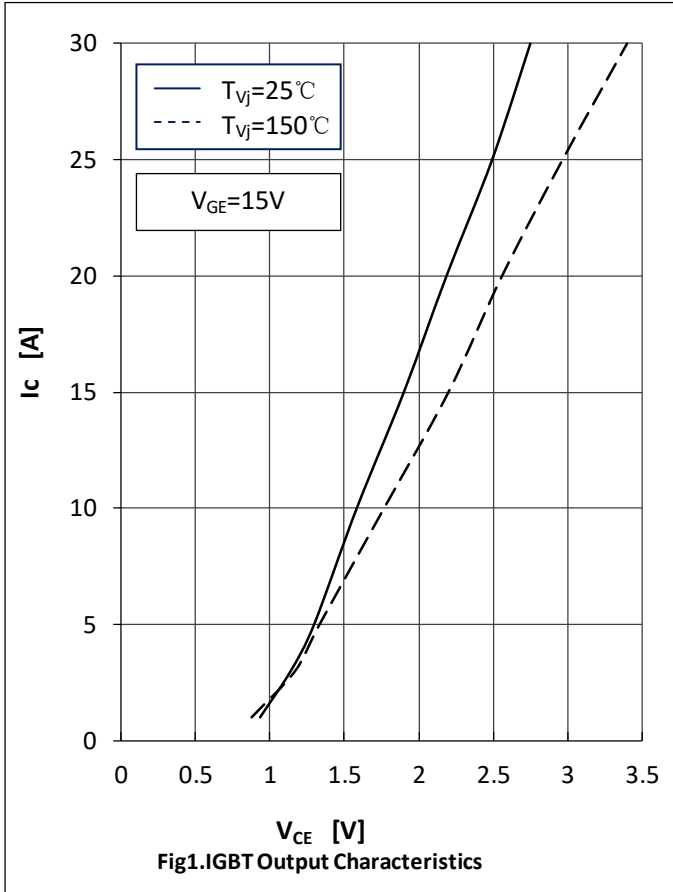
| Parameter         | Symbol       | Conditions                                      | Value |      |      | Unit       |
|-------------------|--------------|---|-------|------|------|------------|
|                   |              |   | Min.  | Typ. | Max. |            |
| Rated Resistance  | $R_{25}$     |   |       | 5.0  |      | k $\Omega$ |
| Deviation of R100 | $\Delta R/R$ | $T_C=100^{\circ}C, R_{100}=493.3\Omega$         | -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          |

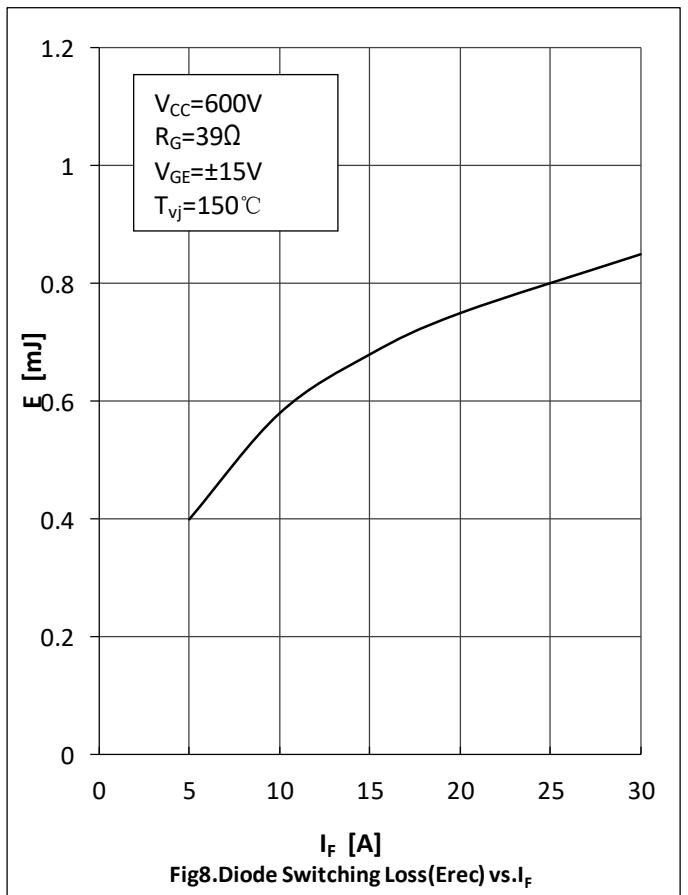
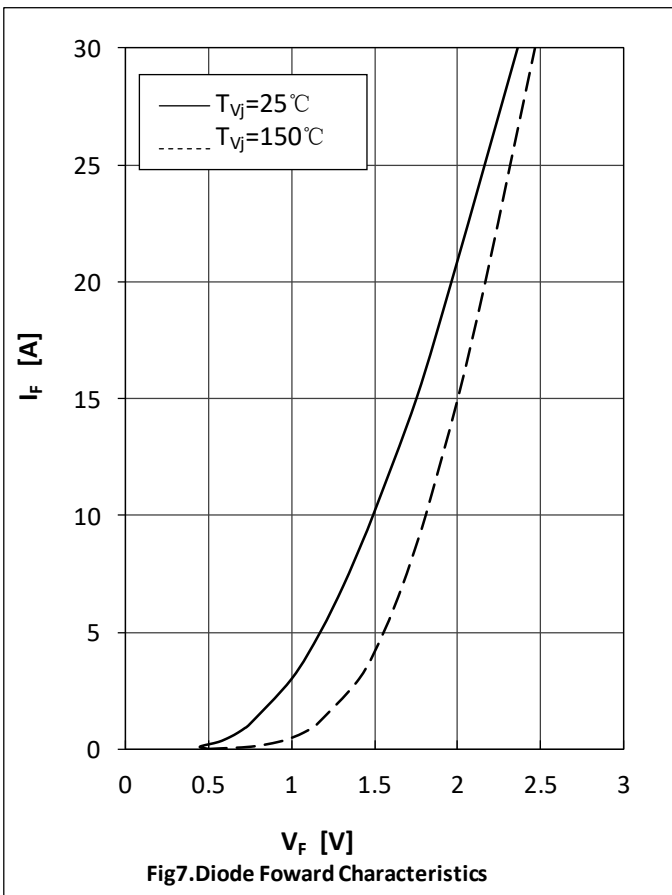
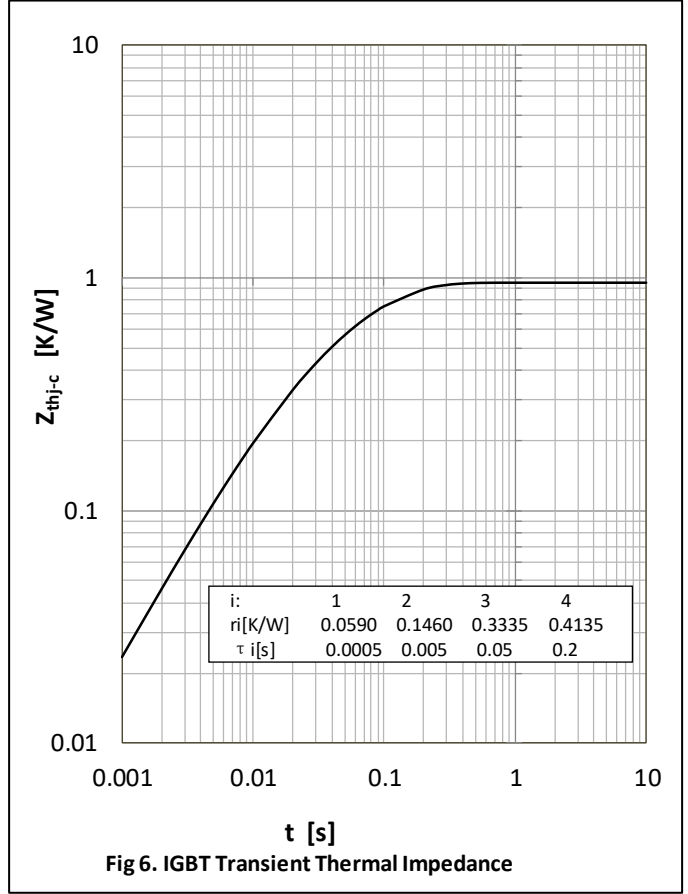
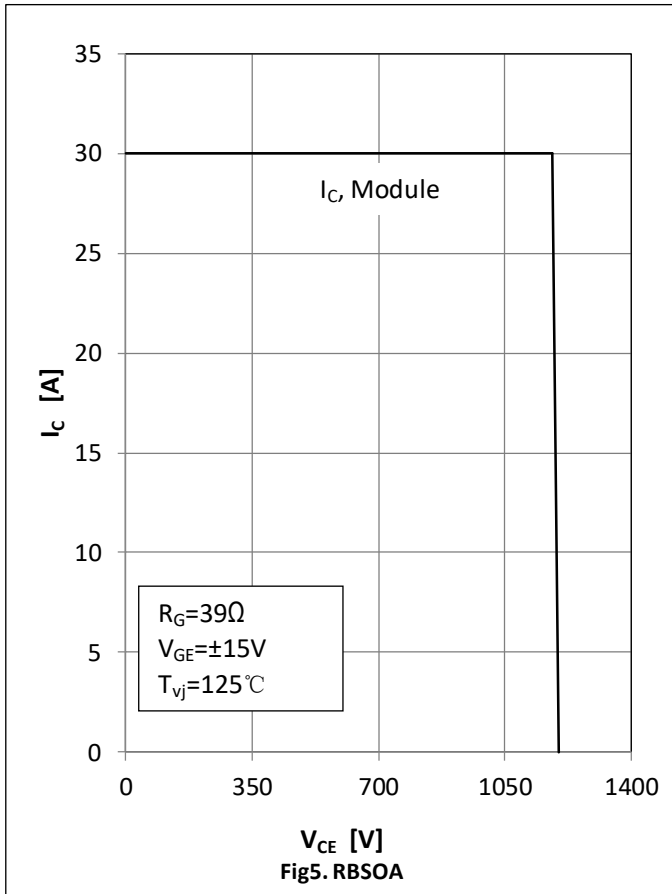


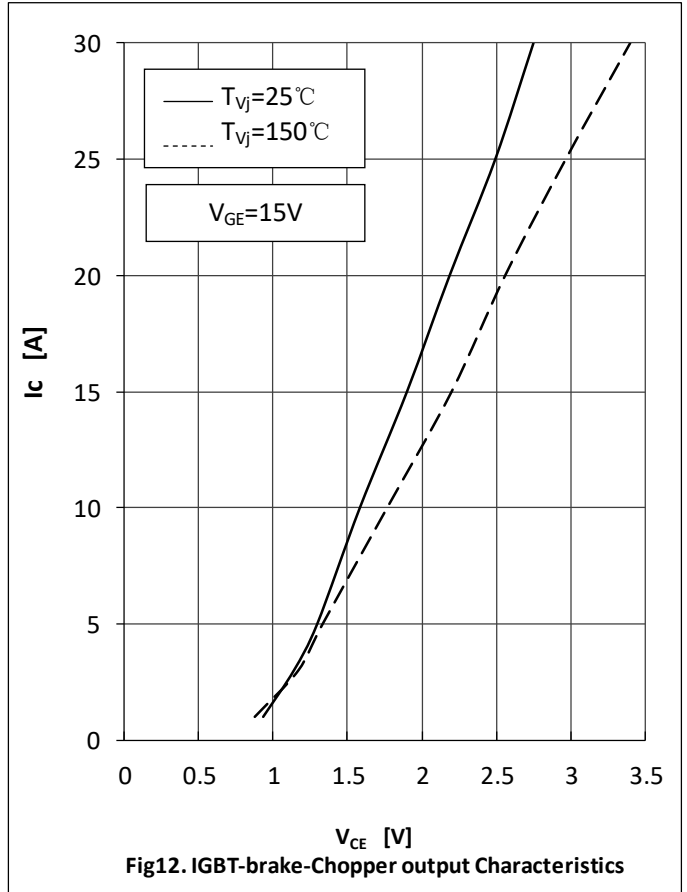
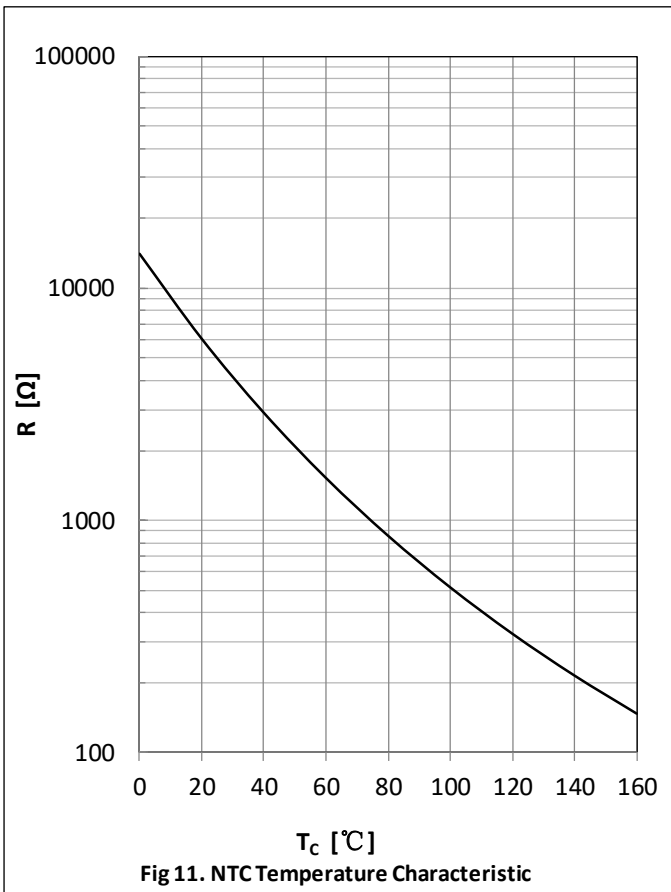
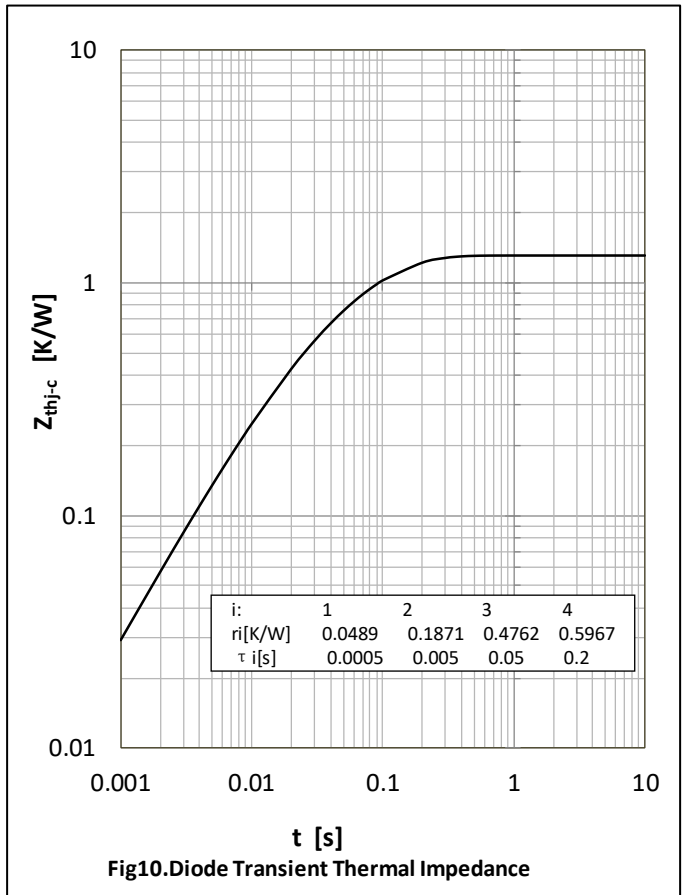
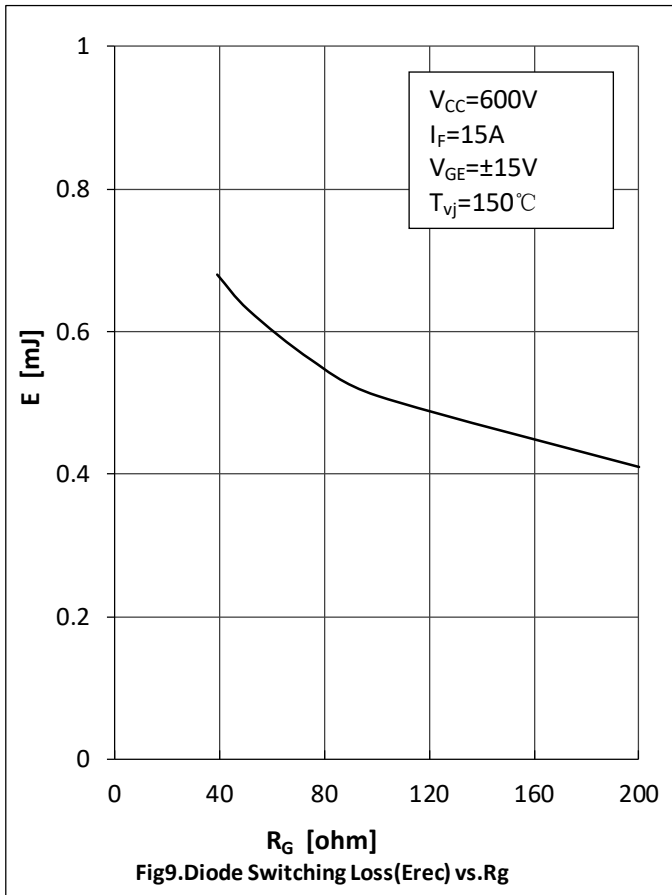
## ● Module Characteristics

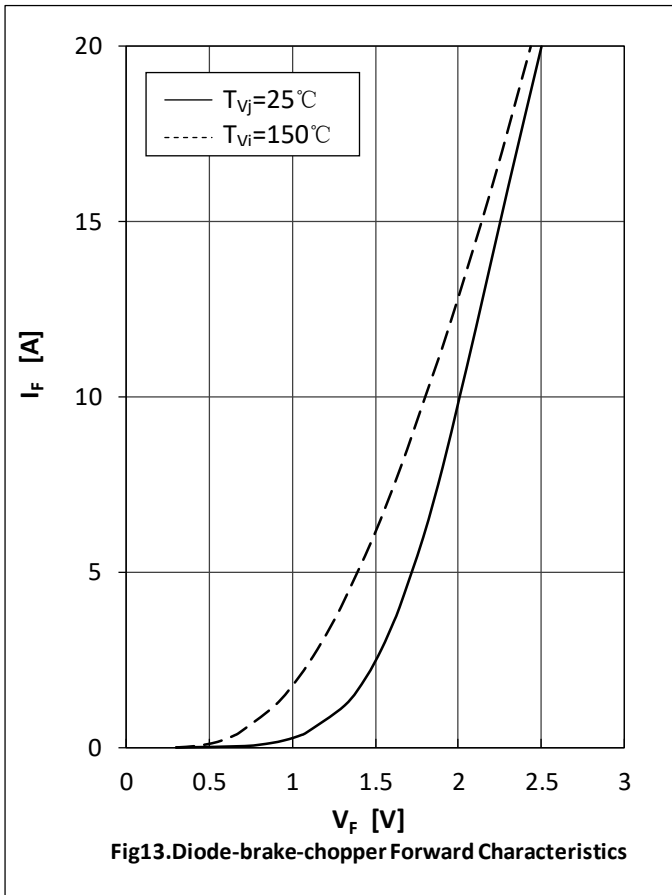
$T_c=25^{\circ}\text{C}$  unless otherwise specified

| Parameter                                 | Symbol                      | Conditions                            | Value |       |      | Unit               |
|---|-----------------------------|---------------------------------------|-------|-------|------|--------------------|
|   |                             |                                       | Min.  | Typ.  | Max. |                    |
| Isolation Voltage                         | $V_{\text{isol}}$           | $t=1\text{min}, f=50\text{Hz}$        | 2500  |       |      | V                  |
| Maximum Junction Temperature              | $T_{\text{jmax}}$           |                                       |       |       | 175  | $^{\circ}\text{C}$ |
| Operating Junction Temperature            | $T_{\text{vj op}}$          |                                       | -40   |       | 150  | $^{\circ}\text{C}$ |
| Storage Temperature                       | $T_{\text{stg}}$            |                                       | -40   |       | 125  | $^{\circ}\text{C}$ |
| Stray-inductance-module                   | $L_{\text{SCE}}$            |                                       |       | 30    |      | nH                 |
| Module lead resistance,<br>terminals-chip | $R_{\text{CC}'+\text{EE}}$  | $T_c=25^{\circ}\text{C}$ , per switch |       | 8.00  |      | m $\Omega$         |
|   | $R_{\text{AA}'+\text{CC}'}$ |                                       |       | 6.00  |      |                    |
| Thermal Resistance<br>Junction-to Case    | $R_{\theta\text{JC}}$       | per IGBT-inverter                     |       | 0.95  | 1.05 | K/W                |
|   |                             | per Diode-inverter                    |       | 1.30  | 1.45 |                    |
|   |                             | per IGBT-brake-chopper                |       | 0.95  | 1.05 |                    |
|   |                             | per Diode-chopper                     |       | 1.75  | 1.90 |                    |
|   |                             | per Diode-rectifier                   |       | 1.03  | 1.13 |                    |
| Thermal Resistance<br>Case-to Sink        | $R_{\theta\text{CS}}$       | per IGBT-inverter                     |       | 0.95  |      | K/W                |
|   |                             | per Diode-inverter                    |       | 1.05  |      |                    |
|   |                             | per IGBT-brake-chopper                |       | 0.95  |      |                    |
|   |                             | per Diode-chopper                     |       | 1.30  |      |                    |
|   |                             | per Diode-rectifier                   |       | 1.17  |      |                    |
|   |                             | per Module                            |       | 0.058 |      |                    |
| Mounting Force Per Clamp                  | F                           |                                       | 20    |       | 50   | N                  |
| Weight of Module                          | G                           |                                       |       | 25    |      | g                  |



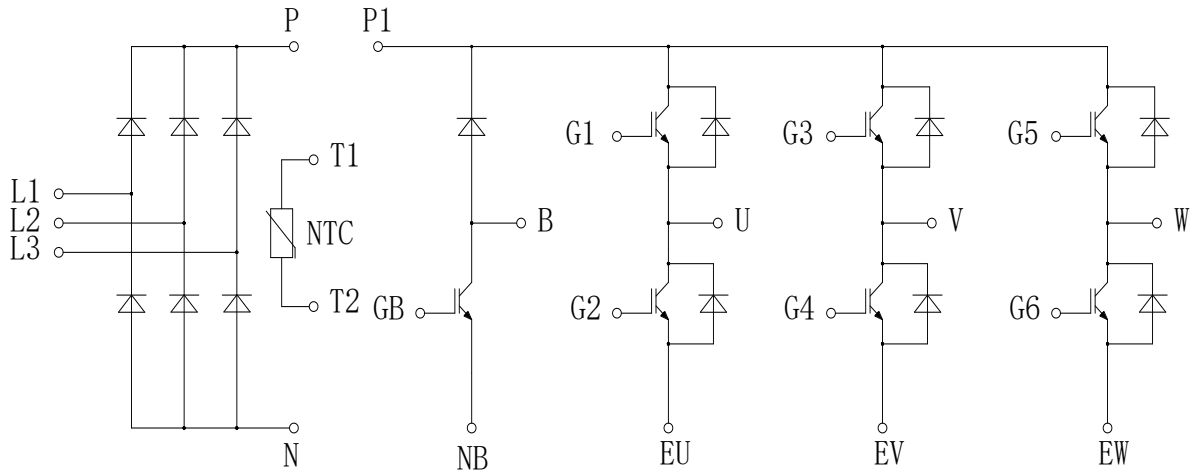




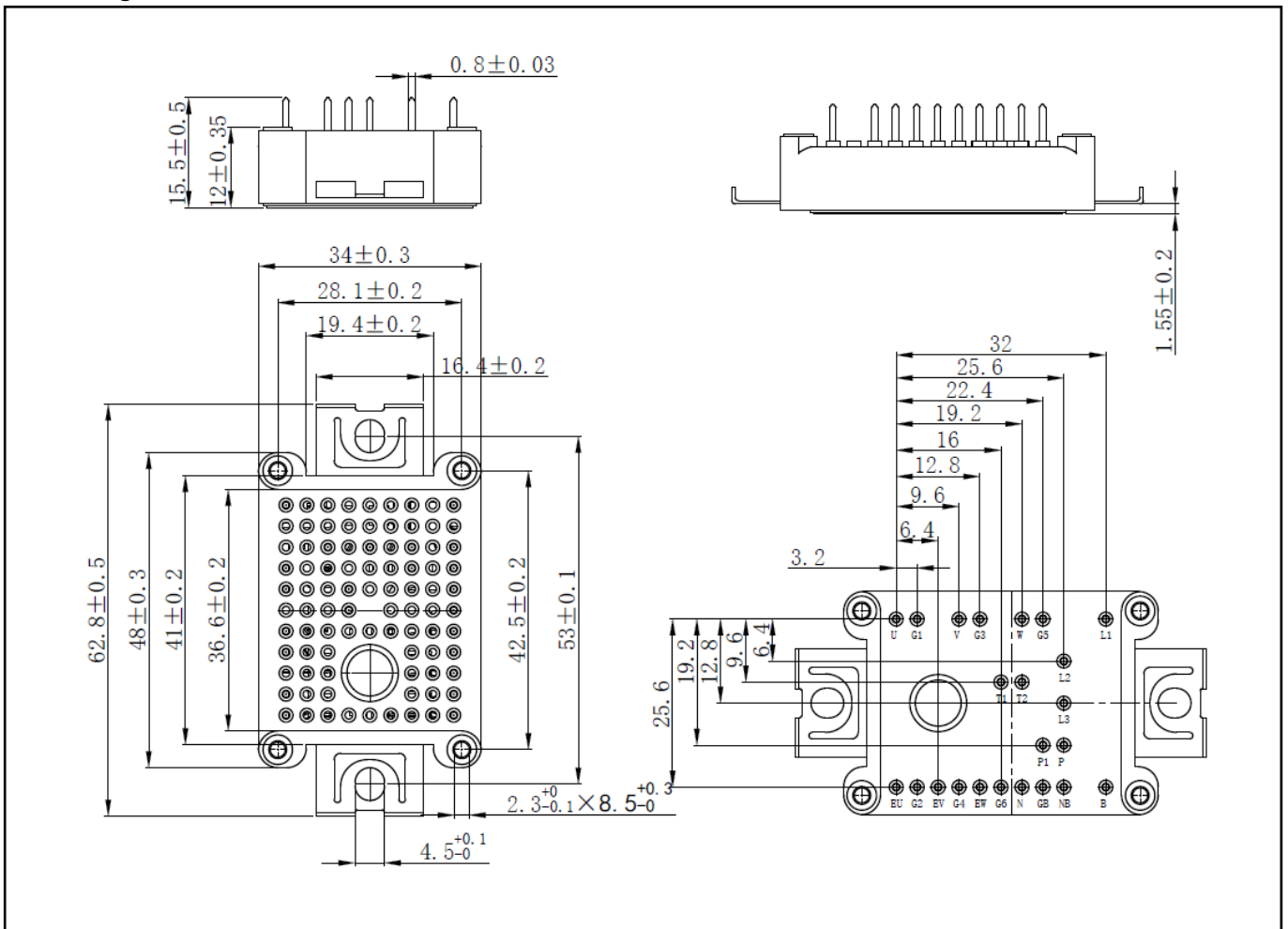




## Circuit Diagram



## Package Dimensions





## Disclaimer

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