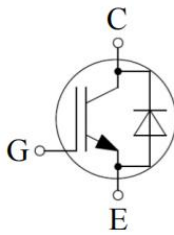


## IGBT Discrete

|                       |      |   |
|-----------------------|------|---|
| $V_{CE}$              | 650  | V |
| $I_C$                 | 10   | A |
| $V_{CE(SAT)} I_C=10A$ | 1.65 | V |

### Circuit



## Applications

- Inverter for motor drive
- Air conditioning
- Uninterruptible power supply

## Features

- High speed smooth switching device for hard & soft switching
- Maximum junction temperature 175°C
- Positive temperature coefficient
- High short circuit capability(5us)
- High ruggedness, temperature stable

## Maximum Ratings

| Parameter                                                                               | Symbol      | Value    | Unit    |
|-----------------------------------------------------------------------------------------|-------------|----------|---------|
| Collector-Emitter Breakdown Voltage                                                     | $V_{CE}$    | 650      | V       |
| DC Collector Current, limited by $T_{jmax}$<br>$T_C=25^{\circ}C$<br>$T_C=100^{\circ}C$  | $I_C$       | 20<br>10 | A       |
| Diode Forward Current, limited by $T_{jmax}$<br>$T_C=25^{\circ}C$<br>$T_C=100^{\circ}C$ | $I_F$       | 20<br>10 | A       |
| Continuous Gate-Emitter Voltage                                                         | $V_{GE}$    | $\pm 20$ | V       |
| Transient Gate-Emitter Voltage<br>( $t_p \leq 10\mu s, D < 0.010$ )                     | $V_{GE}$    | $\pm 30$ | V       |
| Turn off Safe Operating Area $V_{CE} \leq 650V$ ,<br>$T_j \leq 150^{\circ}C$            |             | 30       | A       |
| Pulsed Collector Current, $V_{GE}=15V$ ,<br>$t_p$ limited by $T_{jmax}$                 | $I_{CM}$    | 30       | A       |
| Diode Pulsed Current, $t_p$ limited by $T_{jmax}$                                       | $I_{Fpuls}$ | 30       | A       |
| Short Circuit Withstand Time,<br>$V_{GE}=15V, V_{CC}=400V, V_{CEM} \leq 650V$           | $T_{sc}$    | 5        | $\mu s$ |
| Power Dissipation, $T_j=175^{\circ}C, T_C=25^{\circ}C$                                  | $P_{tot}$   | 115      | W       |



|                                                                          |       |            |    |
|--------------------------------------------------------------------------|-------|------------|----|
| Operating Junction Temperature                                           | $T_j$ | -40...+175 | °C |
| Storage Temperature                                                      | $T_s$ | -55...+150 | °C |
| Soldering Temperature, wave soldering 1.6mm (0.063in.) from case for 10s |       | 260        | °C |

**Electrical Characteristics of the IGBT** ( $T_j = 25^\circ\text{C}$  unless otherwise specified):

| Parameter                            | Symbol        | Conditions                                                                                             | Min. | Typ.                 | Max.      | Unit |
|--------------------------------------|---------------|--------------------------------------------------------------------------------------------------------|------|----------------------|-----------|------|
| <b>Static</b>                        |               |                                                                                                        |      |                      |           |      |
| Collector-Emitter Breakdown Voltage  | $BV_{CES}$    | $V_{GE}=0V, I_C=1mA$                                                                                   | 650  |                      | -         | V    |
| Gate Threshold Voltage               | $V_{GE(th)}$  | $V_{GE}=V_{CE}, I_C=250\mu A$                                                                          | 4.0  | 5.5                  | 6.5       | V    |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=10A$<br>$T_j=25^\circ\text{C},$<br>$T_j=125^\circ\text{C}$<br>$T_j=150^\circ\text{C}$ |      | 1.65<br>1.80<br>1.85 | 2.15      | V    |
| Zero Gate Voltage Collector Current  | $I_{CES}$     | $V_{CE}=650V, V_{GE}=0V$<br>$T_j=25^\circ\text{C},$<br>$T_j=150^\circ\text{C}$                         |      |                      | 0.25<br>5 | mA   |
| Gate-Emitter Leakage Current         | $I_{GES}$     | $V_{CE}=0V, V_{GE}=\pm 20V$                                                                            |      |                      | $\pm 200$ | nA   |

| Parameter                    | Symbol    | Conditions                              | Min. | Typ. | Max. | Unit |
|------------------------------|-----------|-----------------------------------------|------|------|------|------|
| <b>Dynamic</b>               |           |                                         |      |      |      |      |
| Input Capacitance            | $C_{ies}$ | $V_{CE}=25V, V_{GE}=0V,$<br>$f=1MHz$    | -    | 0.56 | -    | nF   |
| Reverse Transfer Capacitance | $C_{res}$ |                                         | -    | 0.01 | -    |      |
| Gate Charge                  | $Q_G$     | $V_{CC}=400V, I_C=10A,$<br>$V_{GE}=15V$ | -    | 0.06 | -    | uC   |

**Electrical Characteristics of the Diode** ( $T_j = 25^\circ\text{C}$  unless otherwise specified):

| Parameter             | Symbol | Conditions                                                                                               | Min. | Typ.                 | Max. | Unit |
|-----------------------|--------|----------------------------------------------------------------------------------------------------------|------|----------------------|------|------|
| <b>Static</b>         |        |                                                                                                          |      |                      |      |      |
| Diode Forward Voltage | $V_F$  | $I_F = 10\text{A}$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ |      | 1.50<br>1.40<br>1.35 | 2.00 | V    |

**Switching Characteristic, Inductive Load**

| Parameter                           | Symbol              | Conditions                                                                                                                   | Min. | Typ. | Max. | Unit |
|-------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Dynamic , at T <sub>j</sub> = 25°C  |                     |                                                                                                                              |      |      |      |      |
| Turn-on Delay Time                  | t <sub>d(on)</sub>  | T <sub>j</sub> =25°C<br>V <sub>CC</sub> = 400V,<br>I <sub>C</sub> =10A,<br>V <sub>GE</sub> =-5V~15V,<br>R <sub>g</sub> =10Ω  | -    | 7    | -    | ns   |
| Rise Time                           | t <sub>r</sub>      |                                                                                                                              | -    | 17   | -    | ns   |
| Turn-on Energy                      | E <sub>on</sub>     |                                                                                                                              | -    | 0.19 | -    | mJ   |
| Turn-off Delay Time                 | t <sub>d(off)</sub> |                                                                                                                              | -    | 23   | -    | ns   |
| Fall Time                           | t <sub>f</sub>      |                                                                                                                              | -    | 106  | -    | ns   |
| Turn-off Energy                     | E <sub>off</sub>    |                                                                                                                              | -    | 0.17 | -    | mJ   |
| Dynamic , at T <sub>j</sub> = 125°C |                     |                                                                                                                              |      |      |      |      |
| Turn-on Delay Time                  | t <sub>d(on)</sub>  | T <sub>j</sub> =125°C<br>V <sub>CC</sub> = 400V,<br>I <sub>C</sub> =10A,<br>V <sub>GE</sub> =-5V~15V,<br>R <sub>g</sub> =10Ω | -    | 6    | -    | ns   |
| Rise Time                           | t <sub>r</sub>      |                                                                                                                              | -    | 18   | -    | ns   |
| Turn-on Energy                      | E <sub>on</sub>     |                                                                                                                              | -    | 0.21 | -    | mJ   |
| Turn-off Delay Time                 | t <sub>d(off)</sub> |                                                                                                                              | -    | 28   | -    | ns   |
| Fall Time                           | t <sub>f</sub>      |                                                                                                                              | -    | 161  | -    | ns   |
| Turn-off Energy                     | E <sub>off</sub>    |                                                                                                                              | -    | 0.25 | -    | mJ   |
| Dynamic , at T <sub>j</sub> = 150°C |                     |                                                                                                                              |      |      |      |      |
| Turn-on Delay Time                  | t <sub>d(on)</sub>  | T <sub>j</sub> =150°C<br>V <sub>CC</sub> = 400V,<br>I <sub>C</sub> =10A,<br>V <sub>GE</sub> =-5V~15V,<br>R <sub>g</sub> =10Ω | -    | 6    | -    | ns   |
| Rise Time                           | t <sub>r</sub>      |                                                                                                                              | -    | 18   | -    | ns   |
| Turn-on Energy                      | E <sub>on</sub>     |                                                                                                                              | -    | 0.23 | -    | mJ   |
| Turn-off Delay Time                 | t <sub>d(off)</sub> |                                                                                                                              | -    | 31   | -    | ns   |
| Fall Time                           | t <sub>f</sub>      |                                                                                                                              | -    | 189  | -    | ns   |
| Turn-off Energy                     | E <sub>off</sub>    |                                                                                                                              | -    | 0.30 | -    | mJ   |

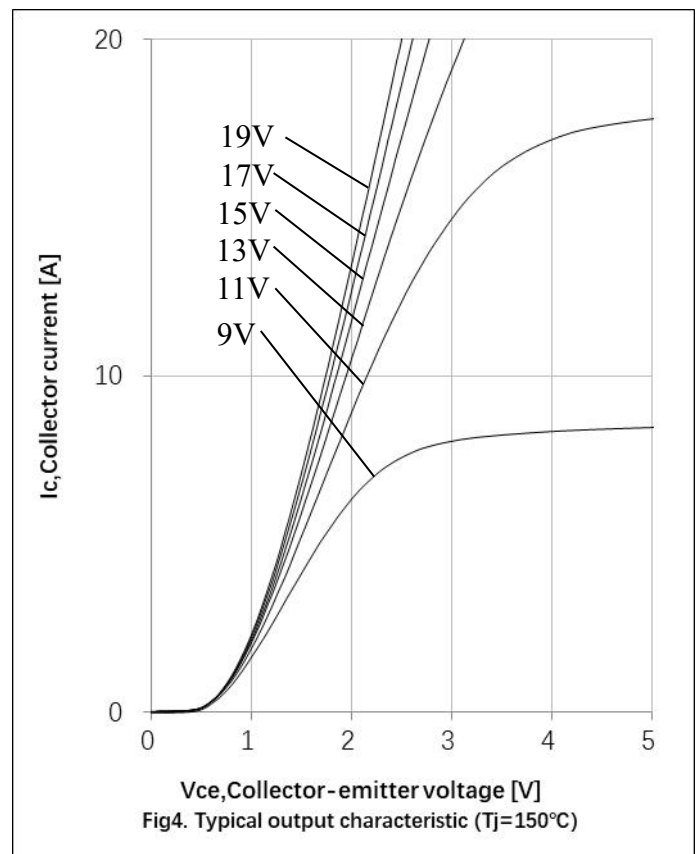
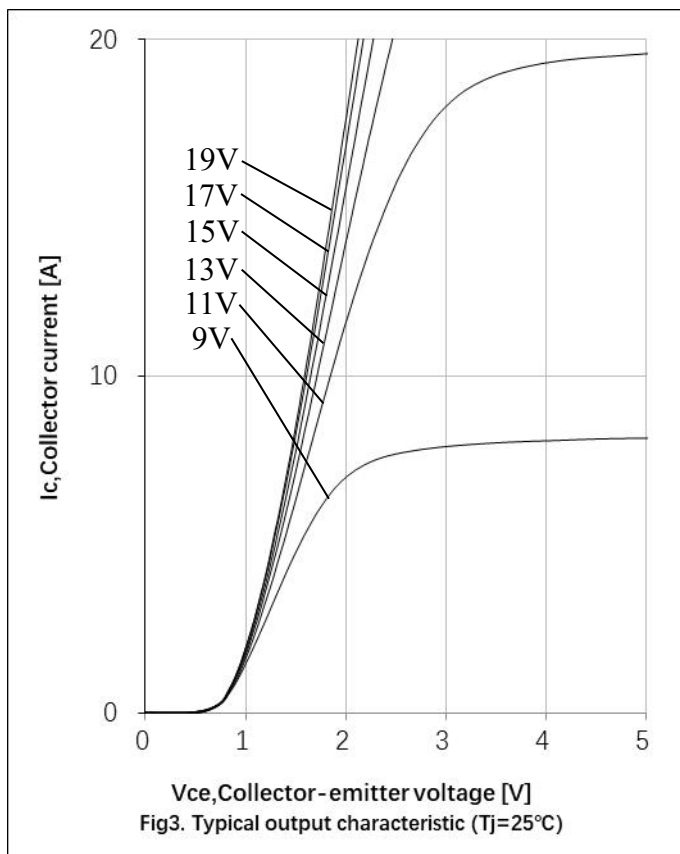
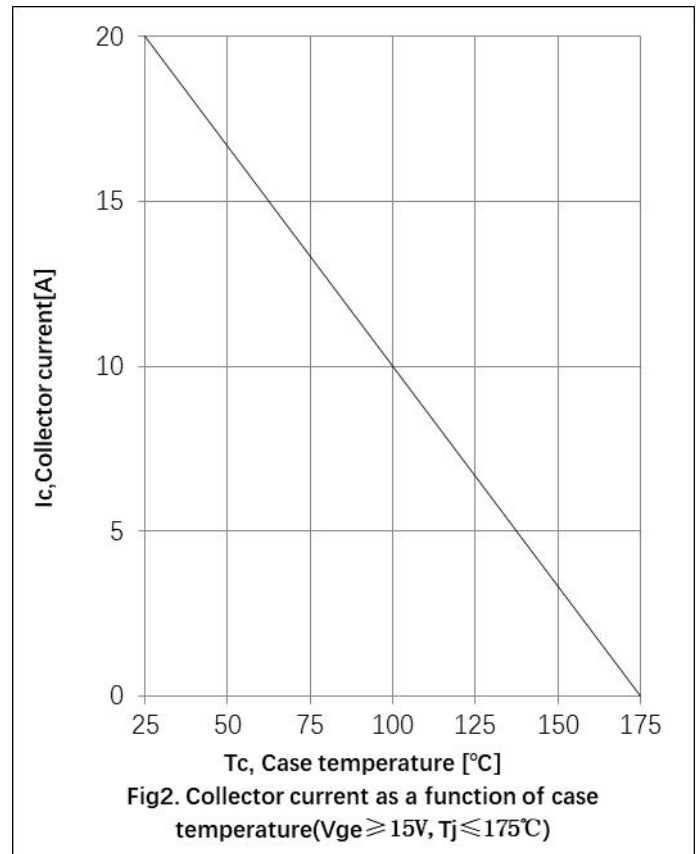
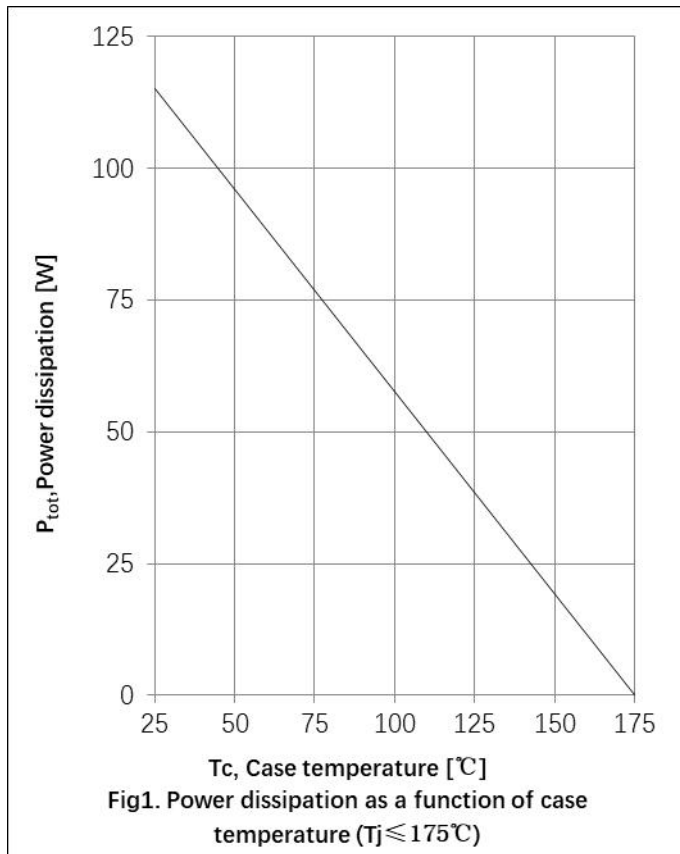


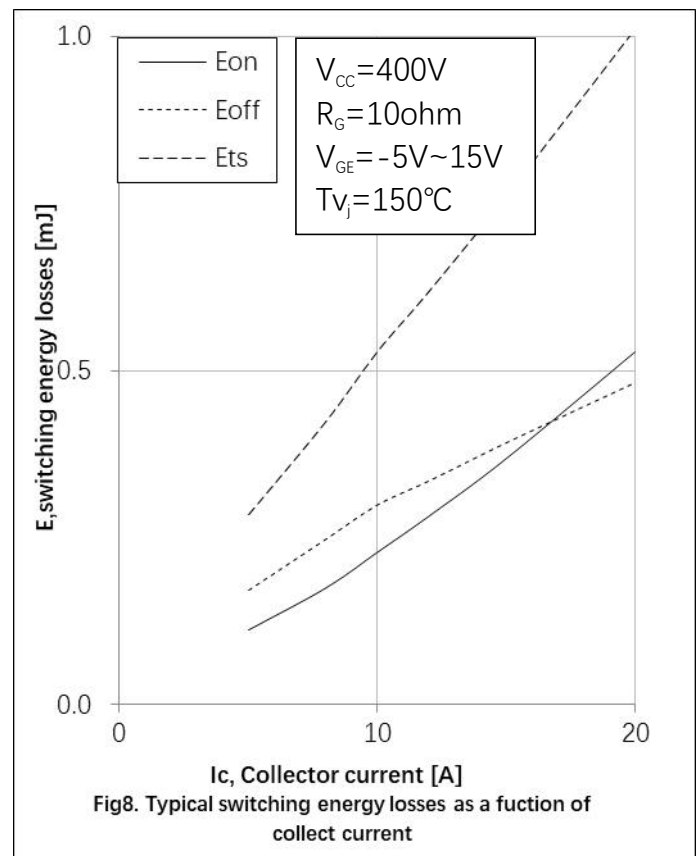
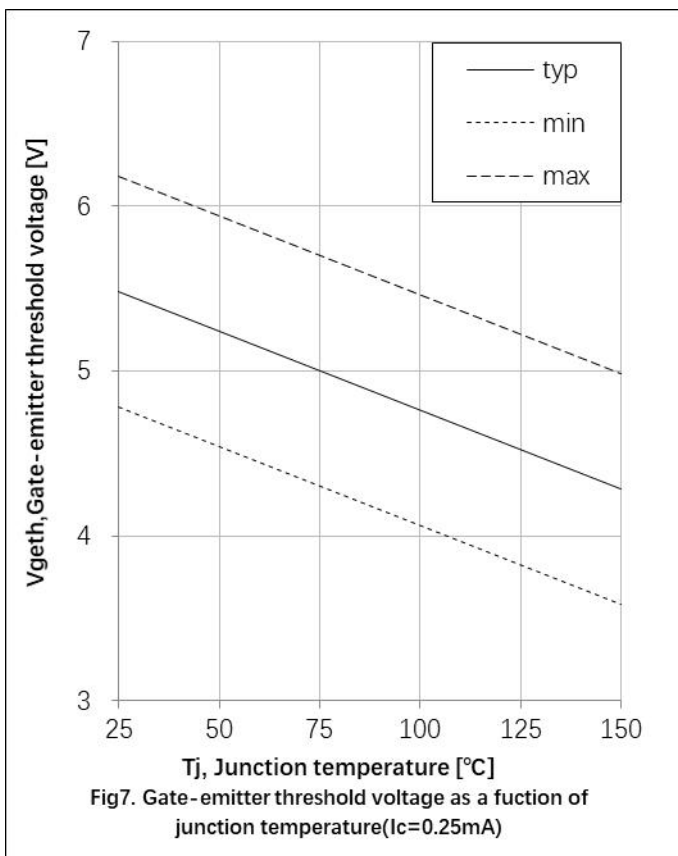
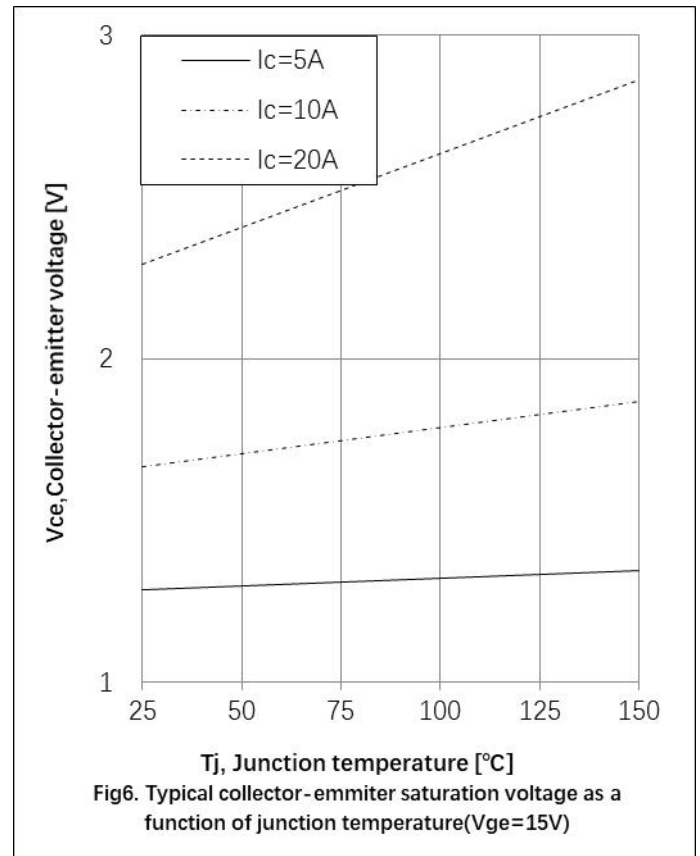
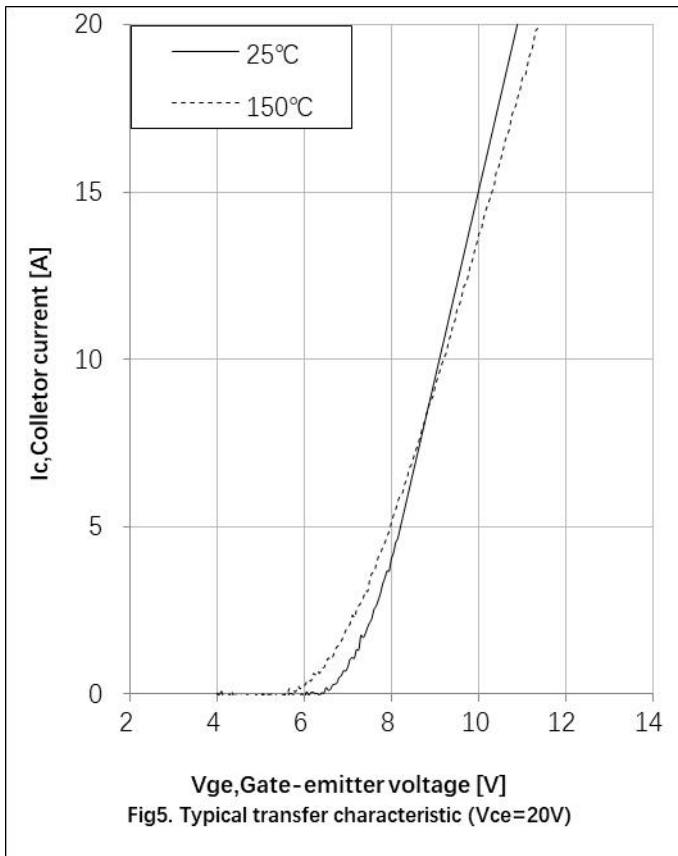
## Electrical Characteristics of the DIODE

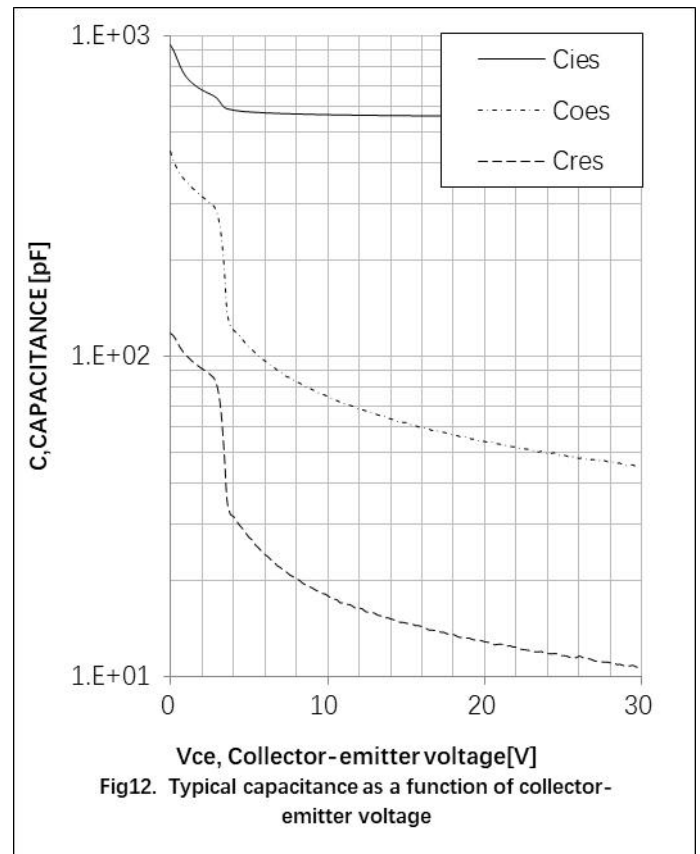
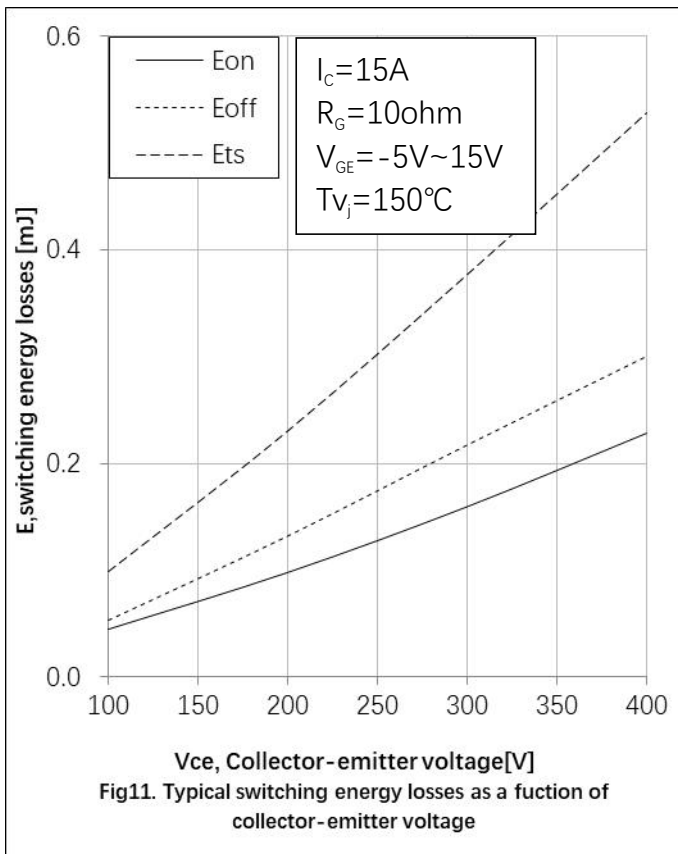
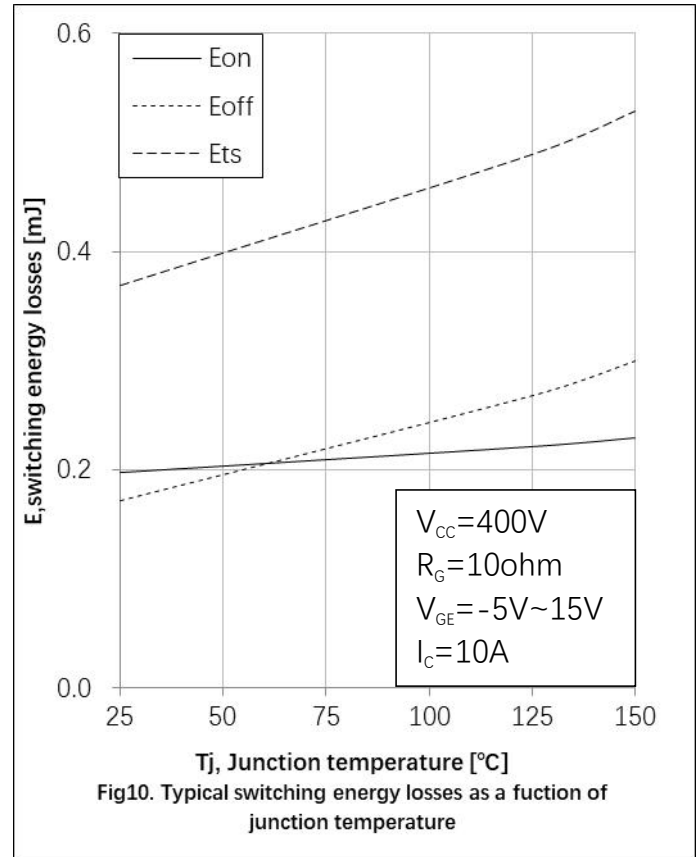
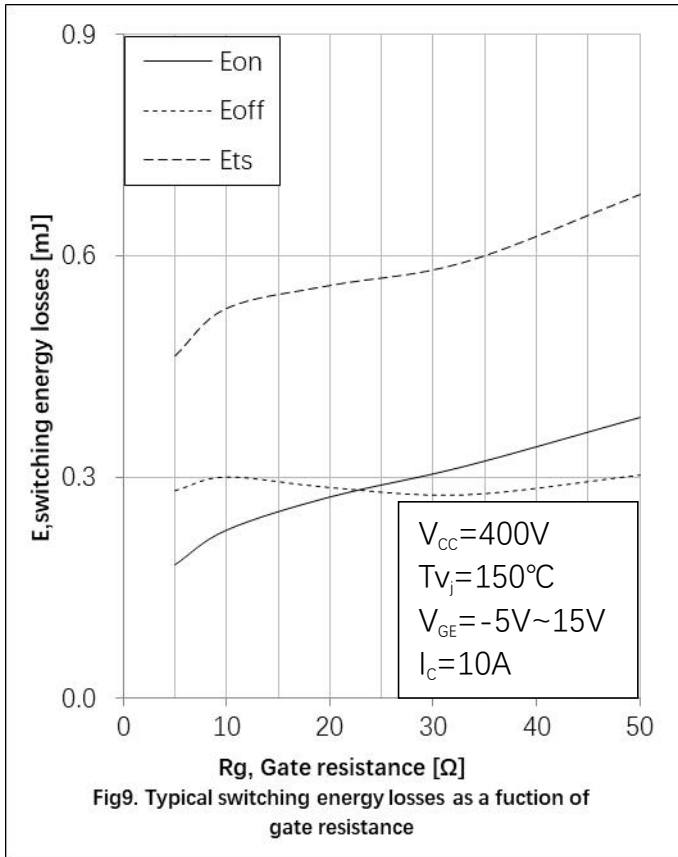
| Parameter                           | Symbol           | Conditions                                                        | Min. | Typ. | Max. | Unit |
|-------------------------------------|------------------|-------------------------------------------------------------------|------|------|------|------|
| Dynamic , at T <sub>j</sub> = 25°C  |                  |                                                                   |      |      |      |      |
| Reverse Recovery Current            | I <sub>rr</sub>  | I <sub>F</sub> =10A,<br>V <sub>R</sub> =400V,<br>-di/dt= 320A/μs, | -    | 9    | -    | A    |
| Diode reverse recovery time         | trr              |                                                                   | -    | 81   | -    | ns   |
| Reverse Recovery Charge             | Q <sub>rr</sub>  |                                                                   | -    | 0.33 | -    | uC   |
| Reverse Recovery Energy             | E <sub>rec</sub> |                                                                   | -    | 0.06 | -    | mJ   |
| Dynamic , at T <sub>j</sub> = 125°C |                  |                                                                   |      |      |      |      |
| Reverse Recovery Current            | I <sub>rr</sub>  | I <sub>F</sub> =10A,<br>V <sub>R</sub> =400V,<br>-di/dt= 320A/μs, | -    | 11   | -    | A    |
| Diode reverse recovery time         | trr              |                                                                   | -    | 99   | -    | ns   |
| Reverse Recovery Charge             | Q <sub>rr</sub>  |                                                                   | -    | 0.52 | -    | uC   |
| Reverse Recovery Energy             | E <sub>rec</sub> |                                                                   | -    | 0.14 | -    | mJ   |
| Dynamic , at T <sub>j</sub> = 150°C |                  |                                                                   |      |      |      |      |
| Reverse Recovery Current            | I <sub>rr</sub>  | I <sub>F</sub> =10A,<br>V <sub>R</sub> =400V,<br>-di/dt= 320A/μs, | -    | 12   | -    | A    |
| Diode reverse recovery time         | trr              |                                                                   | -    | 106  | -    | ns   |
| Reverse Recovery Charge             | Q <sub>rr</sub>  |                                                                   | -    | 0.77 | -    | uC   |
| Reverse Recovery Energy             | E <sub>rec</sub> |                                                                   | -    | 0.17 | -    | mJ   |

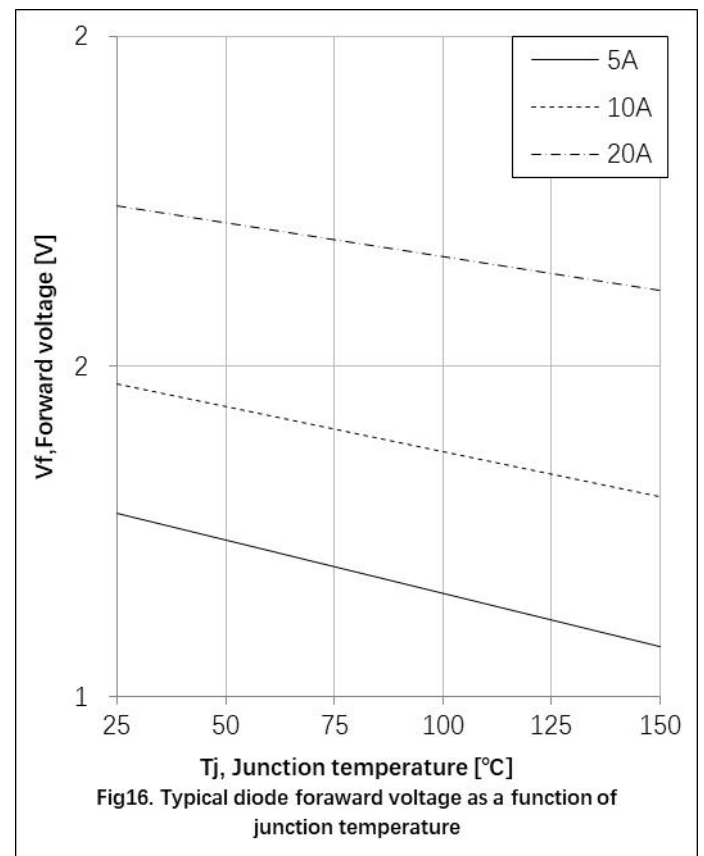
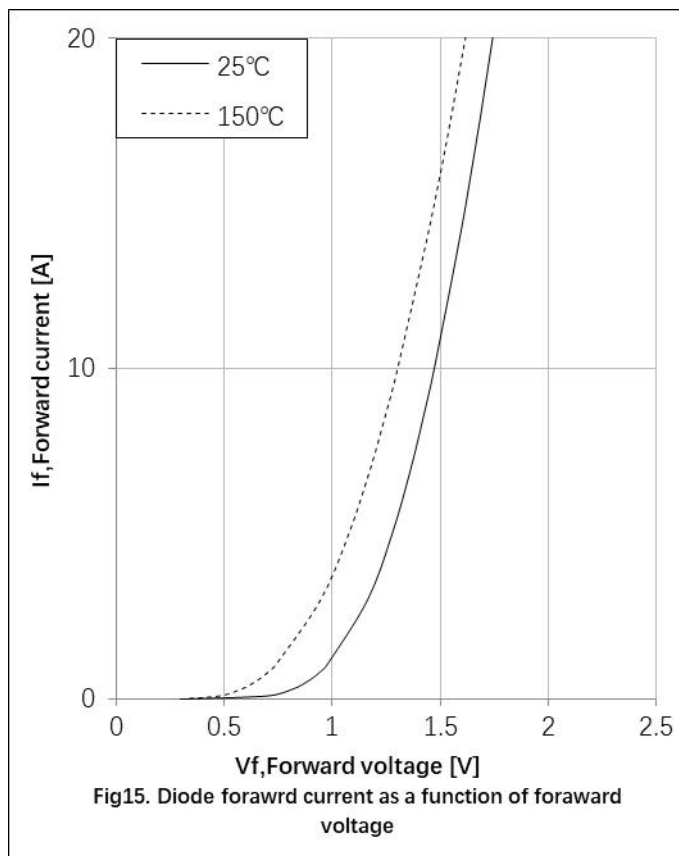
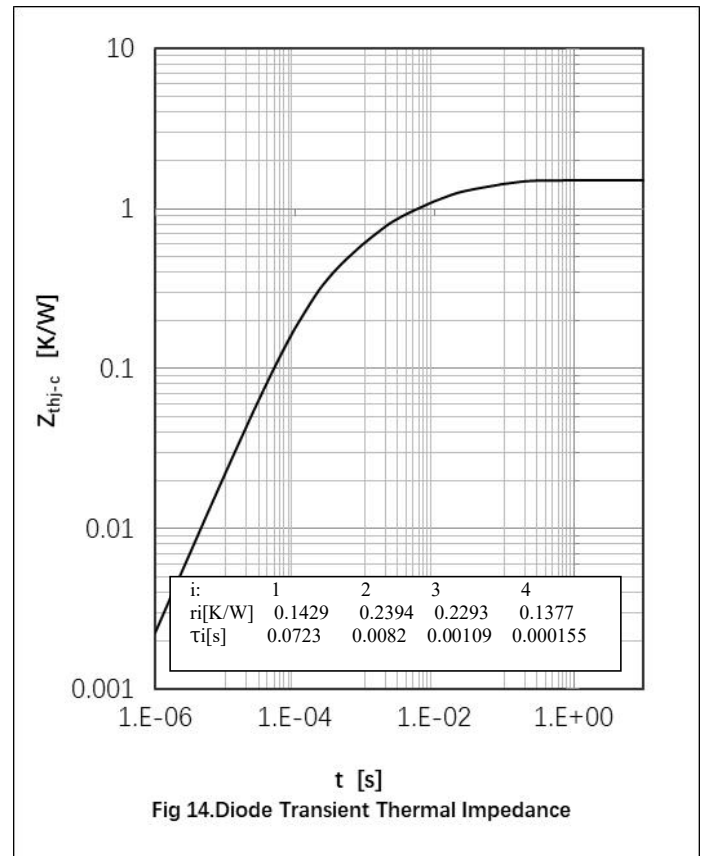
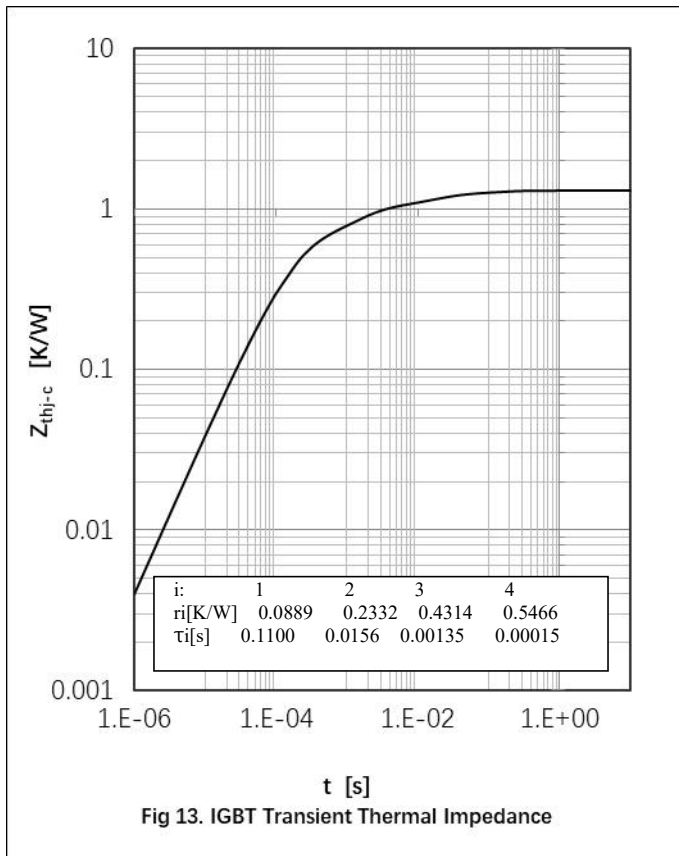
## Thermal Resistance

| Parameter                                 | Symbol               | Max. Value | Unit |
|-------------------------------------------|----------------------|------------|------|
| IGBT Thermal Resistance, Junction - Case  | R <sub>th(j-c)</sub> | 1.3        | K/W  |
| Diode Thermal Resistance, Junction - Case | R <sub>th(j-c)</sub> | 1.5        | K/W  |
| Thermal Resistance, Junction - Ambient    | R <sub>th(j-a)</sub> | 40         | K/W  |



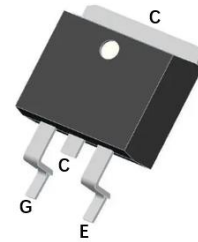
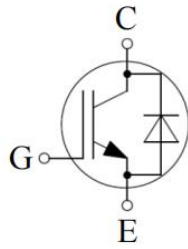






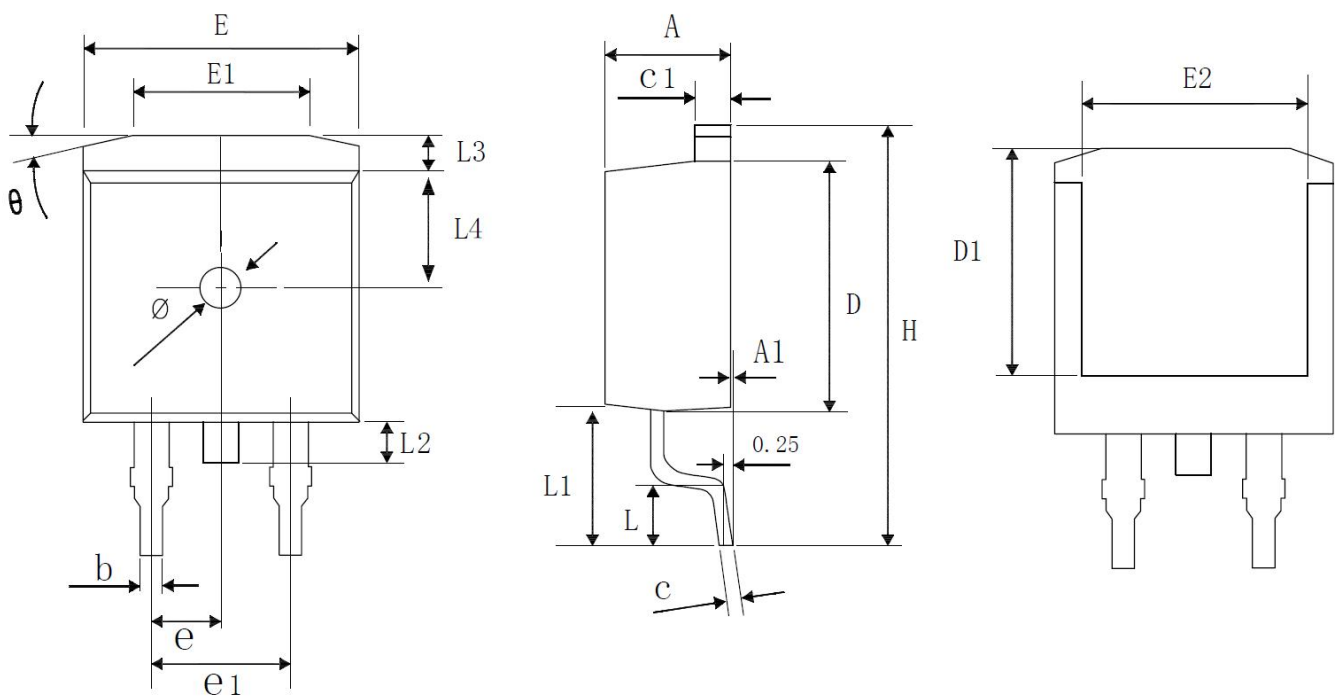


## ● Circuit Diagram



## ● Package Outline Information

**CASE: TO 263**



| TO-263(mm) |      |      |     |      |      |     |          |      |
|------------|------|------|-----|------|------|-----|----------|------|
| Dim        | Min  | Max  | Dim | Min  | Max  | Dim | Min      | Max  |
| A          | 4.3  | 4.7  | H   | 14.9 | 15.5 | L2  | 1.3      | 1.7  |
| A1         | 0    | 0.25 | E   | 9.8  | 10.2 | L3  | 1.15     | 1.35 |
| b          | 0.7  | 0.9  | E1  | 6.3  | 6.5  | L4  | 4.5      | 4.6  |
| c          | 0.4  | 0.6  | E2  | 7.9  | 8.1  | Ø   | 1.5 REF  |      |
| c1         | 1.25 | 1.35 | e1  | 4.93 | 5.23 | e   | 2.54 BSC |      |
| D          | 9    | 9.2  | L   | 1.85 | 2.45 | θ   | 13° TYP  |      |
| D1         | 8    | 8.2  | L1  | 4.45 | 4.85 |     |          |      |



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IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.

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