

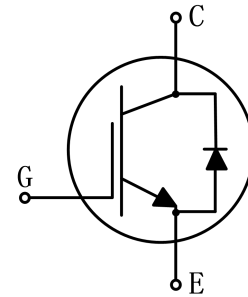
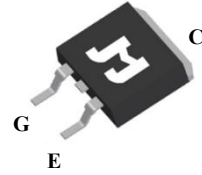
**Key performance:**

- $V_{CE}=650V$
- $I_C=20A@T_C=100^{\circ}C$
- $V_{CE(sat)}=1.6V$

TO-263

**Features:**

- High ruggedness performance.
- 10 $\mu$ s short circuit capability.
- Positive  $V_{CE(sat)}$  temperature coefficient.
- High efficiency for motor control.
- Excellent current sharing in parallel operation.
- RoHS compliant.


**Applications:**

- Home appliances
- Motor drives
- General inverter

**Package parameters**

| Type       | Marking | Package | Packaging method |
|------------|---------|---------|------------------|
| JJT20N65SC | T2065SC | TO-263  | Tape and reel    |

## Maximum ratings

| Symbol    | Parameter  | Values      | Unit |
|-----------|--|-------------|------|
| $V_{CES}$ | Collector-emitter voltage                                    | 650         | V    |
| $V_{GES}$ | Gate-emitter voltage   | ±20         | V    |
| $I_C$     | Continuous collector current ( $T_C=25^\circ\text{C}$ )      | 40          | A    |
|           | Continuous collector current ( $T_C=100^\circ\text{C}$ )     | 20          | A    |
| $I_{CM}$  | Pulsed collector current, $t_p$ limited by $T_{vjmax}$       | 80          | A    |
| $I_F$     | Diode continuous forward current ( $T_C=100^\circ\text{C}$ ) | 20          | A    |
| $I_{FM}$  | Diode maximum current, $t_p$ limited by $T_{vjmax}$          | 80          | A    |
| $t_{sc}$  | Short circuit withstand time                                 | 10          | µs   |
| $P_{tot}$ | Power dissipation ( $T_C=25^\circ\text{C}$ )                 | 150         | W    |
|           | Power dissipation ( $T_C=100^\circ\text{C}$ )                | 75          | W    |
| $T_{vj}$  | Operating junction temperature range                         | -40 to +175 | °C   |
| $T_{stg}$ | Storage temperature range                                    | -55 to +150 | °C   |

## Thermal characteristics

| Symbol        | Parameter                                      | Values |      | Unit |
|---------------|--|--------|------|------|
|               |  | Typ.   | Max. |      |
| $R_{th(j-c)}$ | Thermal resistance, junction to case for IGBT  | -      | 1    | K/ W |
| $R_{th(j-c)}$ | Thermal resistance, junction to case for Diode | -      | 1.8  | K/ W |
| $R_{th(j-a)}$ | Thermal resistance, junction to ambient        | -      | 40   | K/ W |

**Electrical characteristics of IGBT** ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified)

**Static characteristics**

| Symbol        | Parameter                            | Test condition  | Values |      |      | Unit          |
|---------------|--------------------------------------|---|--------|------|------|---------------|
|               |                                      |   | Min.   | Typ. | Max. |               |
| $BV_{CES}$    | Collector-emitter breakdown voltage  | $V_{GE}=0\text{V}, I_C=250\mu\text{A}$                          | 650    | -    | -    | V             |
| $I_{CES}$     | Collector-emitter leakage current    | $V_{CE}=650\text{V}, V_{GE}=0\text{V}$                          | -      | -    | 50   | $\mu\text{A}$ |
| $I_{GES}$     | Gate leakage current, forward        | $V_{GE}=20\text{V}, V_{CE}=0\text{V}$                           | -      | -    | 100  | nA            |
|               | Gate leakage current, reverse        | $V_{GE}=-20\text{V}, V_{CE}=0\text{V}$                          | -      | -    | -100 | nA            |
| $V_{GE(th)}$  | Gate-emitter threshold voltage       | $V_{GE}=V_{CE}, I_C=1\text{mA}$                                 | 5.2    | 5.7  | 6.2  | V             |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE}=15\text{V}, I_C=20\text{A}$                             | -      | 1.6  | -    | V             |
|               |                                      | $V_{GE}=15\text{V}, I_C=20\text{A}, T_{vj}=175^{\circ}\text{C}$ | -      | 1.9  | -    | V             |

**Dynamic characteristics**

| Symbol    | Parameter                    | Test condition  | Values |      |      | Unit |
|-----------|------------------------------|---|--------|------|------|------|
|           |                              |   | Min.   | Typ. | Max. |      |
| $C_{ies}$ | Input capacitance            | $V_{CE}=30\text{V}$<br>$V_{GE}=0\text{V}$<br>$f=1\text{MHz}$    | -      | 1700 | -    | pF   |
| $C_{oes}$ | Output capacitance           |   | -      | 72   | -    | pF   |
| $C_{res}$ | Reverse transfer capacitance |   | -      | 13   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{CC}=520\text{V}$<br>$V_{GE}=15\text{V}$<br>$I_C=20\text{A}$ | -      | 71   | -    | nC   |

### Switching characteristics

| Symbol       | Parameter              | Test condition   | Values |      |      | Unit |
|--------------|------------------------|--|--------|------|------|------|
|              |                        |  | Min.   | Typ. | Max. |      |
| $t_{d(on)}$  | Turn-on delay time     | $V_{CC}=400V$<br>$V_{GE}=0/15V$<br>$I_C=20A$<br>$R_G=10\Omega$<br>Inductive load                         | -      | 21   | -    | ns   |
| $t_r$        | Rise time              |  | -      | 23   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time    |  | -      | 120  | -    | ns   |
| $t_f$        | Fall time              |  | -      | 63   | -    | ns   |
| $E_{on}$     | Turn-on energy         |  | -      | 0.37 | -    | mJ   |
| $E_{off}$    | Turn-off energy        |  | -      | 0.46 | -    | mJ   |
| $E_{ts}$     | Total switching energy |  | -      | 0.83 | -    | mJ   |
| $t_{d(on)}$  | Turn-on delay time     | $V_{CC}=400V$<br>$V_{GE}=0/15V$<br>$I_C=20A$<br>$R_G=10\Omega$<br>Inductive load<br>$T_{vj}=175^\circ C$ | -      | 21   | -    | ns   |
| $t_r$        | Rise time              |  | -      | 23   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time    |  | -      | 141  | -    | ns   |
| $t_f$        | Fall time              |  | -      | 108  | -    | ns   |
| $E_{on}$     | Turn-on energy         |  | -      | 0.59 | -    | mJ   |
| $E_{off}$    | Turn-off energy        |  | -      | 0.67 | -    | mJ   |
| $E_{ts}$     | Total switching energy |  | -      | 1.26 | -    | mJ   |

**Electrical characteristics of Diode** ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol    | Parameter                           | Test condition  | Values |      |      | Unit |
|-----------|-------------------------------------|---|--------|------|------|------|
|           |                                     |   | Min.   | Typ. | Max. |      |
| $V_F$     | Diode forward voltage               | $I_F=20\text{A}$  | -      | 1.5  | -    | V    |
|           |                                     | $I_F=20\text{A}, T_{vj}=175^{\circ}\text{C}$  | -      | 1.2  | -    | V    |
| $t_{rr}$  | Diode reverse recovery time         | $V_R=400\text{V}$<br>$I_F=20\text{A}$<br>$di_F/dt=-500\text{A}/\mu\text{s}$                                 | -      | 62   | -    | ns   |
| $I_{rrm}$ | Diode peak reverse recovery current |   | -      | 12   | -    | A    |
| $Q_{rr}$  | Diode reverse recovery charge       |   | -      | 472  | -    | nC   |
| $t_{rr}$  | Diode reverse recovery time         | $V_R=400\text{V}$<br>$I_F=20\text{A}$<br>$di_F/dt=-500\text{A}/\mu\text{s}$<br>$T_{vj}=175^{\circ}\text{C}$ | -      | 90   | -    | ns   |
| $I_{rrm}$ | Diode peak reverse recovery current |   | -      | 19   | -    | A    |
| $Q_{rr}$  | Diode reverse recovery charge       |   | -      | 1130 | -    | nC   |

## Typical performance characteristics

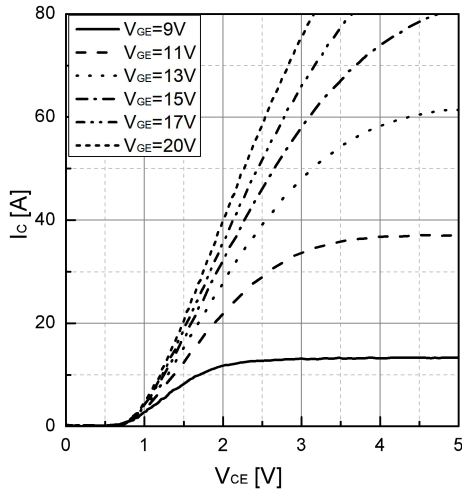


Fig 1. Typical output characteristic ( $T_{vj}=25^{\circ}\text{C}$ )

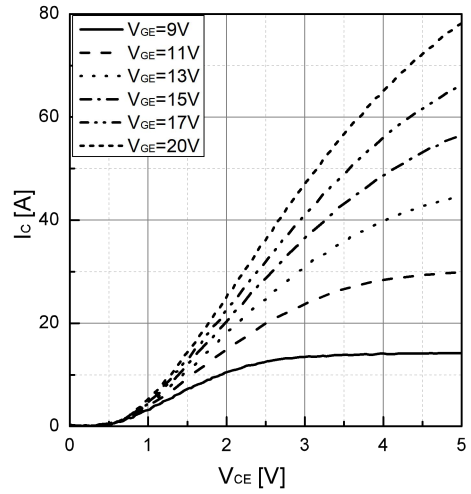


Fig 2. Typical output characteristic ( $T_{vj}=175^{\circ}\text{C}$ )

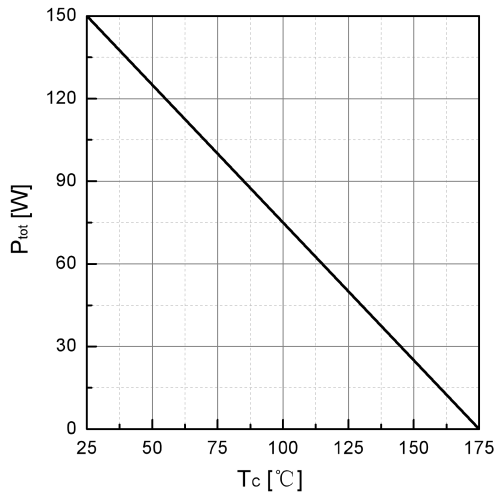


Fig 3. Power dissipation as a function of  $T_c$

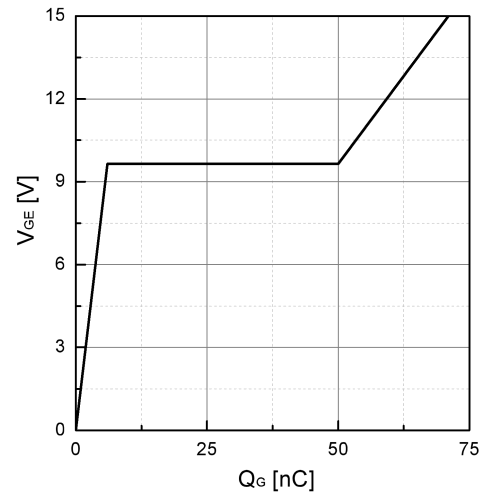


Fig 4. Typical Gate charge

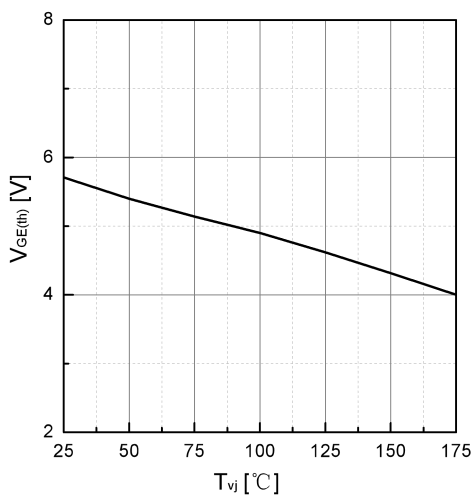


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_C=1\text{mA}$ )

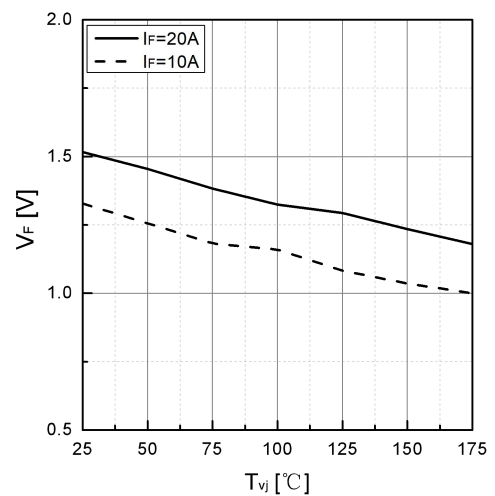


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

### Typical performance characteristics

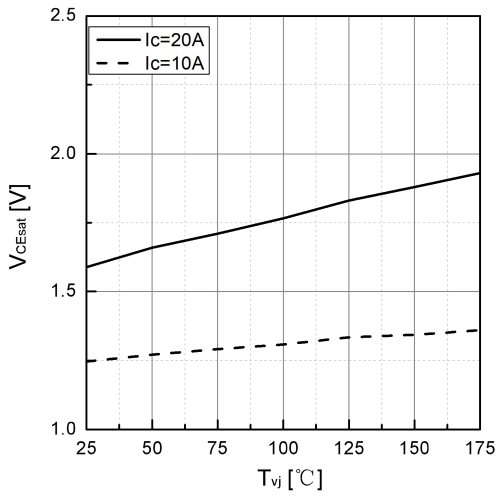


Fig 7. Typical  $V_{CEsat}$  as a function of  $T_{vj}$

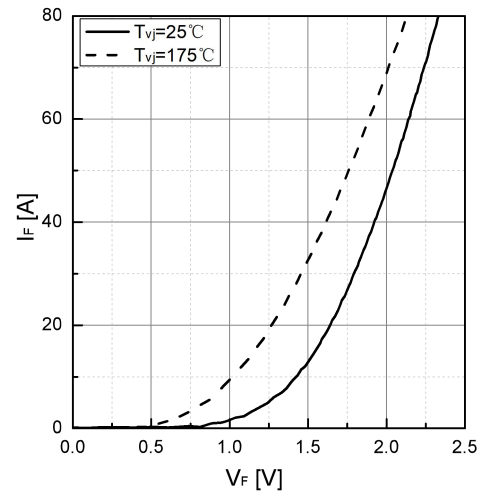


Fig 8. Typical  $I_F$  as a function of  $V_F$

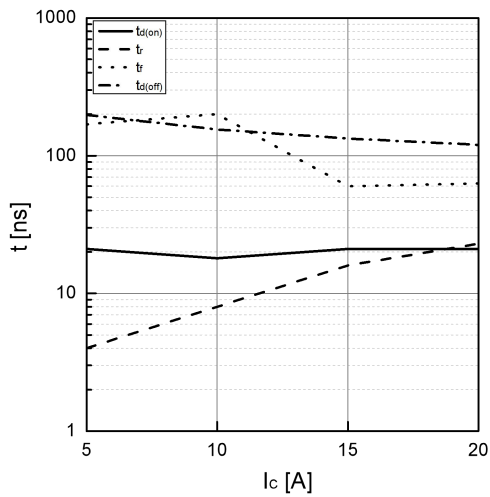


Fig 9. Typical switching time as a function of  $I_c$

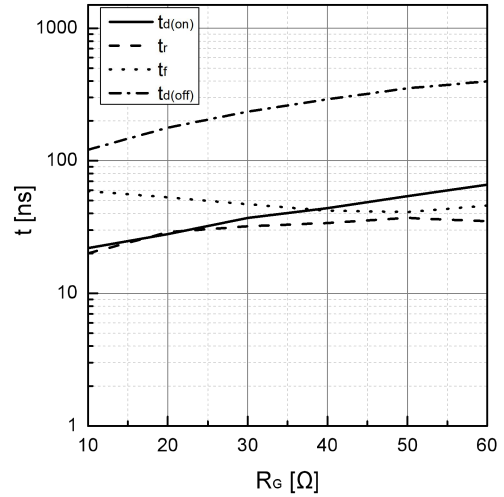


Fig 10. Typical switching times as a function of  $R_G$

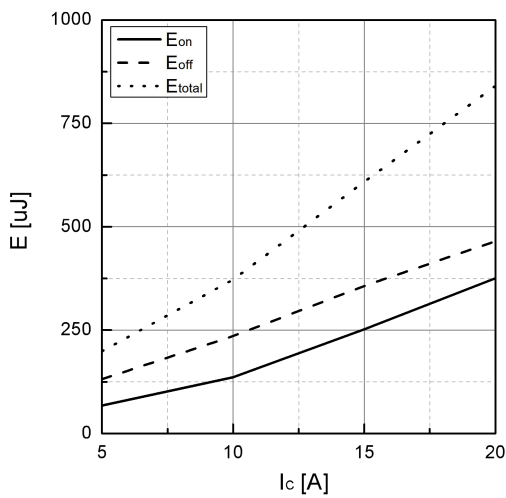


Fig 11. Typical switching energy losses as a function of  $I_c$

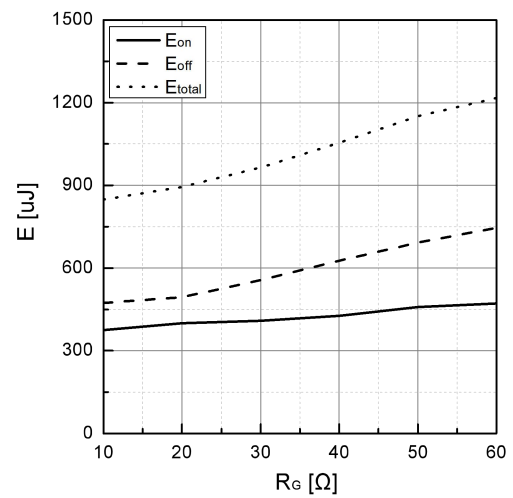


Fig 12. Typical switching energy losses as a function of  $R_G$

### Typical performance characteristics

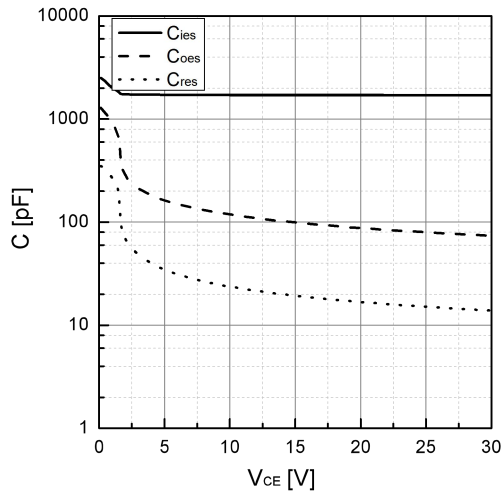
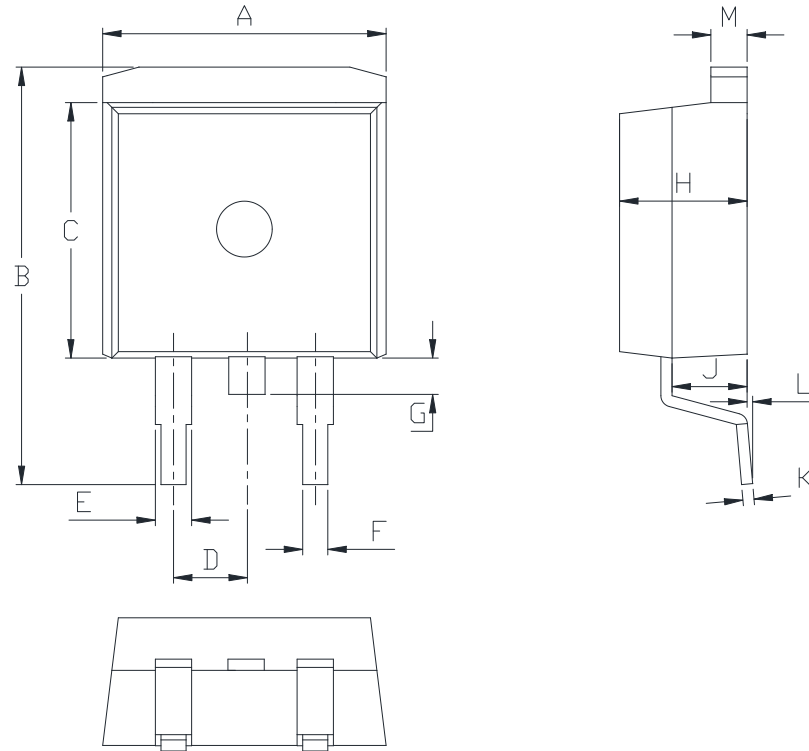


Fig 13. Typical capacitance as a function of  $V_{CE}$   
( $f=1\text{Mhz}$ ,  $V_{GE}=0\text{V}$ )



**Package dimension**

TO-263



| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    | 9.90        | -    | 10.20 | 0.390  | -     | 0.402 |
| B    | 14.70       | -    | 15.80 | 0.579  | -     | 0.622 |
| C    | 9.4         | -    | 9.6   | 0.37   | -     | 0.378 |
| D    | -           | 2.54 | -     | -      | 0.100 | -     |
| E    | 1.20        | -    | 1.40  | 0.047  | -     | 0.055 |
| F    | 0.75        | -    | 0.85  | 0.029  | -     | 0.033 |
| G    | -           | -    | 1.75  | -      | -     | 0.069 |
| H    | 4.40        | -    | 4.70  | 0.173  | -     | 0.185 |
| J    | 2.30        | -    | 2.70  | 0.091  | -     | 0.106 |
| K    | 0.38        | -    | 0.55  | 0.015  | -     | 0.022 |
| L    | 0           | 0.10 | 0.25  | 0      | 0.004 | 0.010 |
| M    | 1.25        | -    | 1.35  | 0.049  | -     | 0.053 |

## Revision history

| Date       | Revision | Changes                   |
|------------|----------|---------------------------|
| 2023-12-05 | Rev 1.0  | Release of the datasheet. |
| 2024-05-20 | Rev 1.1  | Update                    |
| 2024-06-21 | Rev 1.2  | Update                    |

## Disclaimer

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