

## 650V 6A Trench and Field Stop IGBT

JJT6N65SCD

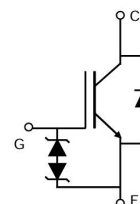
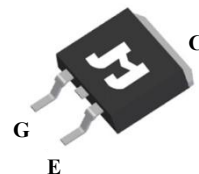
### Key performance:

- $V_{CE}=650V$
- $I_C=6A@T_C=100^{\circ}C$
- $V_{CE(sat)}=1.7V$

TO-263

### Features:

- High ruggedness performance
- Very tight parameter distribution
- Positive  $V_{CE(sat)}$  temperature coefficient
- High efficiency for motor control
- Excellent current sharing in parallel operation
- RoHS compliant
- HBM  $\geq \pm 2000V$
- CDM  $\geq \pm 500V$



### Applications:

- Home appliances
- Motor drives
- Fan, Pumps, Vacuum cleaner

### Package parameters

| Type       | Marking  | Package | Packaging method |
|------------|----------|---------|------------------|
| JJT6N65SCD | T0665SCD | TO-263  | Tape and reel    |

## Maximum ratings

| Symbol    | Parameter                                                    | Values      | Unit             |
|-----------|--------------------------------------------------------------|-------------|------------------|
| $V_{CES}$ | Collector-emitter voltage                                    | 650         | V                |
| $V_{GES}$ | Gate-emitter voltage                                         | $\pm 20$    | V                |
| $I_C$     | Continuous collector current ( $T_C=25^\circ\text{C}$ )      | 12          | A                |
|           | Continuous collector current ( $T_C=100^\circ\text{C}$ )     | 6           | A                |
| $I_{CM}$  | Pulsed collector current, $t_p$ limited by $T_{vjmax}$       | 24          | A                |
| $I_F$     | Diode continuous forward current ( $T_C=100^\circ\text{C}$ ) | 6           | A                |
| $I_{FM}$  | Diode maximum current, $t_p$ limited by $T_{vjmax}$          | 24          | A                |
| $t_{sc}$  | Short circuit withstand time                                 | 8           | $\mu\text{s}$    |
| $P_{tot}$ | Power dissipation ( $T_C=25^\circ\text{C}$ )                 | 88          | W                |
|           | Power dissipation ( $T_C=100^\circ\text{C}$ )                | 44          | W                |
| $T_{vj}$  | Operating junction temperature range                         | -40 to +175 | $^\circ\text{C}$ |
| $T_{stg}$ | Storage temperature range                                    | -55 to +150 | $^\circ\text{C}$ |

## Thermal characteristics

| Symbol        | Parameter                                      | Values |      | Unit |
|---------------|------------------------------------------------|--------|------|------|
|               |                                                | Typ.   | Max. |      |
| $R_{th(j-c)}$ | Thermal resistance, junction to case for IGBT  | -      | 1.7  | K/ W |
| $R_{th(j-c)}$ | Thermal resistance, junction to case for Diode | -      | 2.6  | K/ W |
| $R_{th(j-a)}$ | Thermal resistance, junction to ambient        | -      | 50   | 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    | $V_{CE}=650\text{V}, V_{GE}=0\text{V}$                         | -      | -    | 10   | $\mu\text{A}$ |
| $I_{GES}$     | Gate leakage current, forward        | $V_{GE}=20\text{V}, V_{CE}=0\text{V}$                          | -      | -    | 100  | $\mu\text{A}$ |
|               | Gate leakage current, reverse        | $V_{GE}=-20\text{V}, V_{CE}=0\text{V}$                         | -      | -    | -100 | $\mu\text{A}$ |
| $V_{GE(th)}$  | Gate-emitter threshold voltage       | $V_{GE}=V_{CE}, I_C=1\text{mA}$                                | 5.3    | 6.3  | 7.3  | V             |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE}=15\text{V}, I_C=6\text{A}$                             | -      | 1.7  | -    | V             |
|               |                                      | $V_{GE}=15\text{V}, I_C=6\text{A}, T_{vj}=175^{\circ}\text{C}$ | -      | 2.2  | -    | 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>$f=1\text{MHz}$   | -      | 355  | -    | pF   |
| $C_{oes}$ | Output capacitance           |                                                                | -      | 25   | -    | pF   |
| $C_{res}$ | Reverse transfer capacitance |                                                                | -      | 8    | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{CC}=520\text{V}$<br>$V_{GE}=15\text{V}$<br>$I_C=6\text{A}$ | -      | 19   | -    | 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>$I_C=6A$<br>$R_G=10\Omega$<br>Inductive load                          | -      | 9    | -    | ns   |
| $t_r$        | Rise time              |                                                                                                          | -      | 18   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time    |                                                                                                          | -      | 24   | -    | ns   |
| $t_f$        | Fall time              |                                                                                                          | -      | 91   | -    | ns   |
| $E_{on}$     | Turn-on energy         |                                                                                                          | -      | 0.18 | -    | mJ   |
| $E_{off}$    | Turn-off energy        |                                                                                                          | -      | 0.09 | -    | mJ   |
| $E_{ts}$     | Total switching energy |                                                                                                          | -      | 0.27 | -    | mJ   |
| $t_{d(on)}$  | Turn-on delay time     | $V_{CC}=400V$<br>$V_{GE}=0/15V$<br>$I_C=6A$<br>$R_G=10\Omega$<br>Inductive Load<br>$T_{vj}=175^{\circ}C$ | -      | 8    | -    | ns   |
| $t_r$        | Rise time              |                                                                                                          | -      | 20   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time    |                                                                                                          | -      | 33   | -    | ns   |
| $t_f$        | Fall time              |                                                                                                          | -      | 118  | -    | ns   |
| $E_{on}$     | Turn-on energy         |                                                                                                          | -      | 0.23 | -    | mJ   |
| $E_{off}$    | Turn-off energy        |                                                                                                          | -      | 0.15 | -    | mJ   |
| $E_{ts}$     | Total switching energy |                                                                                                          | -      | 0.38 | -    | 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               | $I_F=6\text{A}$                                                                                            | -      | 1.4  | -    | V    |
|           |                                     | $I_F=6\text{A}, T_{vj}=175^{\circ}\text{C}$                                                                | -      | 1.2  | -    | V    |
| $t_{rr}$  | Diode reverse recovery time         | $V_R=400\text{V}$<br>$I_F=6\text{A}$<br>$di_F/dt=-500\text{A}/\mu\text{s}$                                 | -      | 55   | -    | ns   |
| $I_{rrm}$ | Diode peak reverse recovery current |                                                                                                            | -      | 10   | -    | A    |
| $Q_{rr}$  | Diode reverse recovery charge       |                                                                                                            | -      | 306  | -    | nC   |
| $t_{rr}$  | Diode reverse recovery time         | $V_R=400\text{V}$<br>$I_F=6\text{A}$<br>$di_F/dt=-500\text{A}/\mu\text{s}$<br>$T_{vj}=175^{\circ}\text{C}$ | -      | 98   | -    | ns   |
| $I_{rrm}$ | Diode peak reverse recovery current |                                                                                                            | -      | 12   | -    | A    |
| $Q_{rr}$  | Diode reverse recovery charge       |                                                                                                            | -      | 529  | -    | nC   |

## Typical performance characteristics

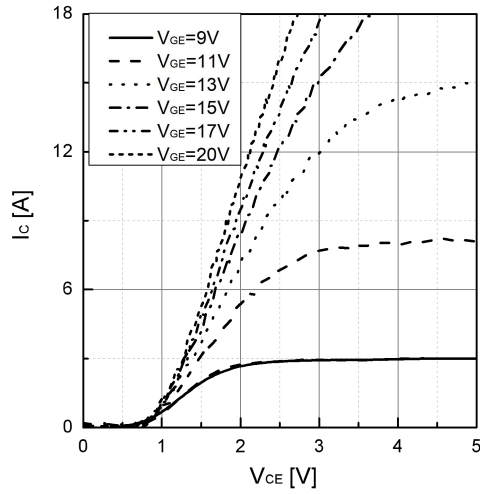


Fig 1. Typical output characteristic ( $T_{vj}=25^\circ\text{C}$ )

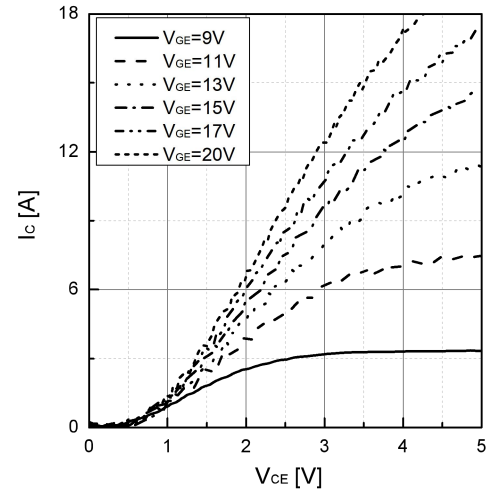


Fig 2. Typical output characteristic ( $T_{vj}=175^\circ\text{C}$ )

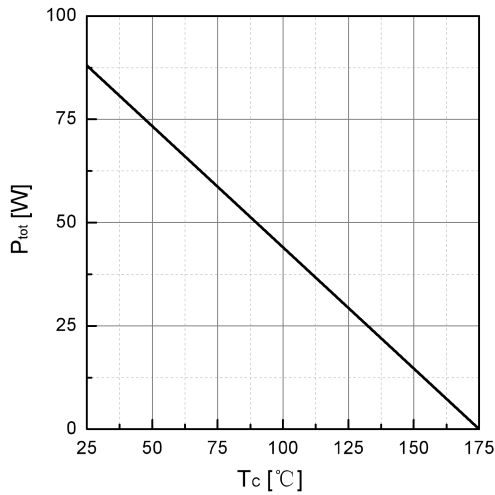


Fig 3. Power dissipation as a function of  $T_c$

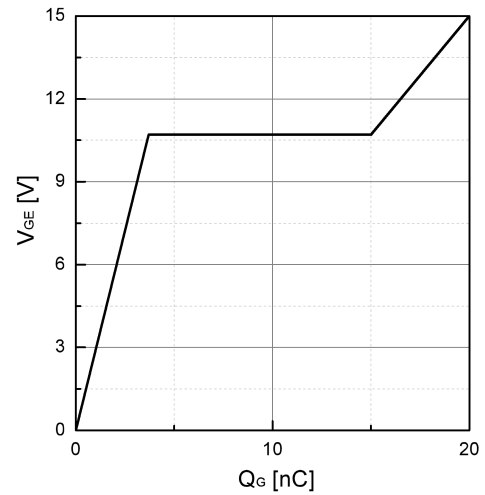


Fig 4. Typical Gate charge

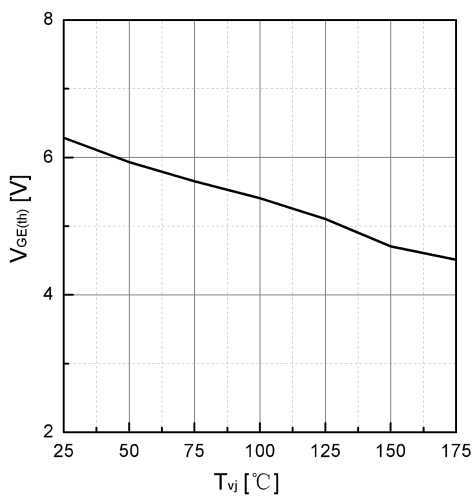


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_c=1\text{mA}$ )

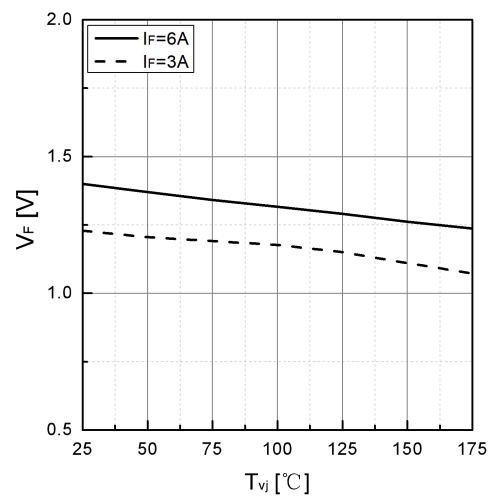


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

## Typical performance characteristics

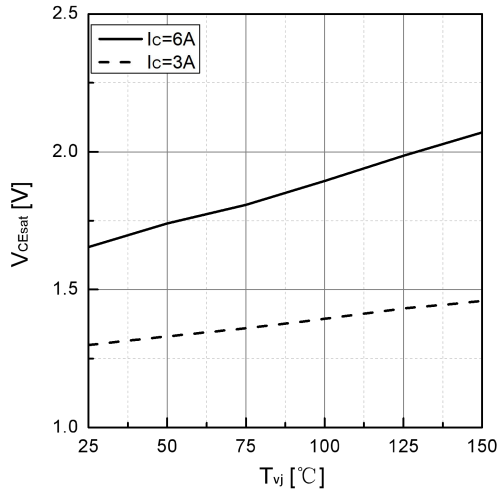


Fig 7. Typical  $V_{CEsat}$  as a function of  $T_{vj}$

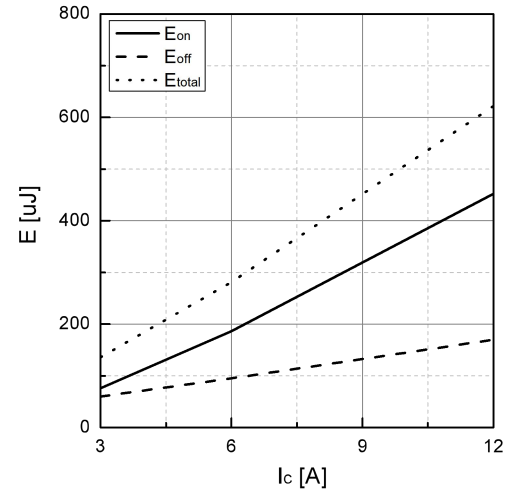


Fig 8. Typical switching time as a function of  $I_C$

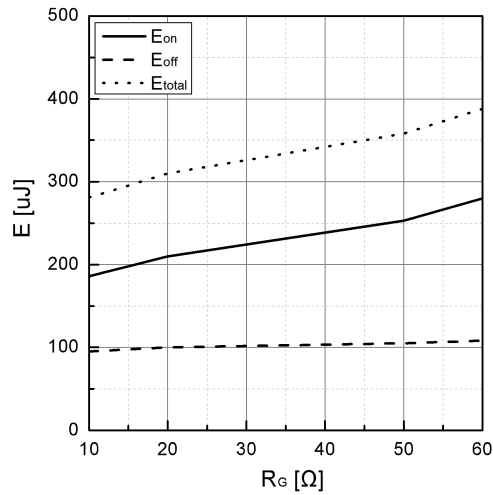


Fig 9. Typical switching times as a function of  $R_G$

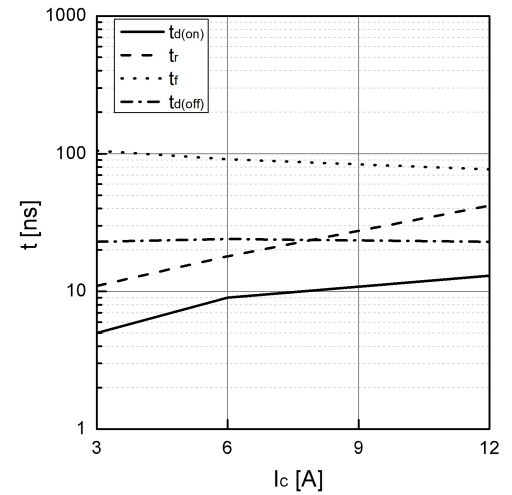


Fig 10. Typical switching energy losses as a function of  $I_C$

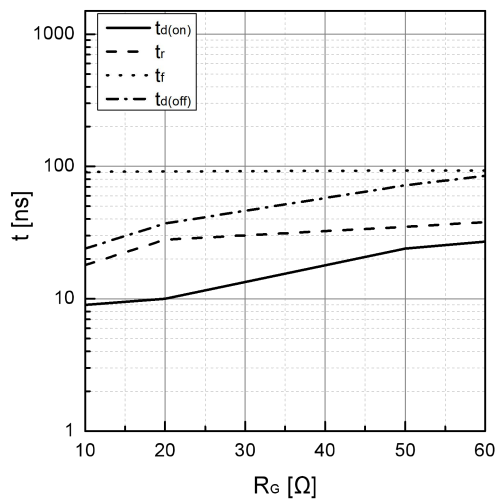


Fig 11. Typical switching energy losses as a function of  $R_G$

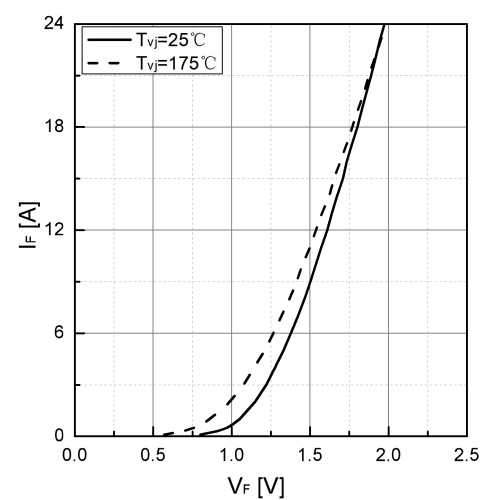


Fig 12. Typical  $I_F$  as a function of  $V_F$

## Typical performance characteristics

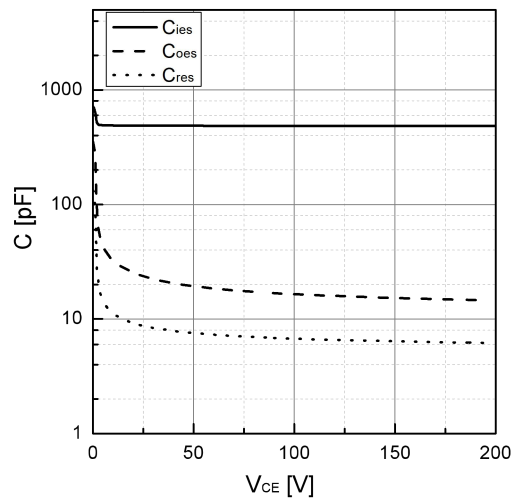
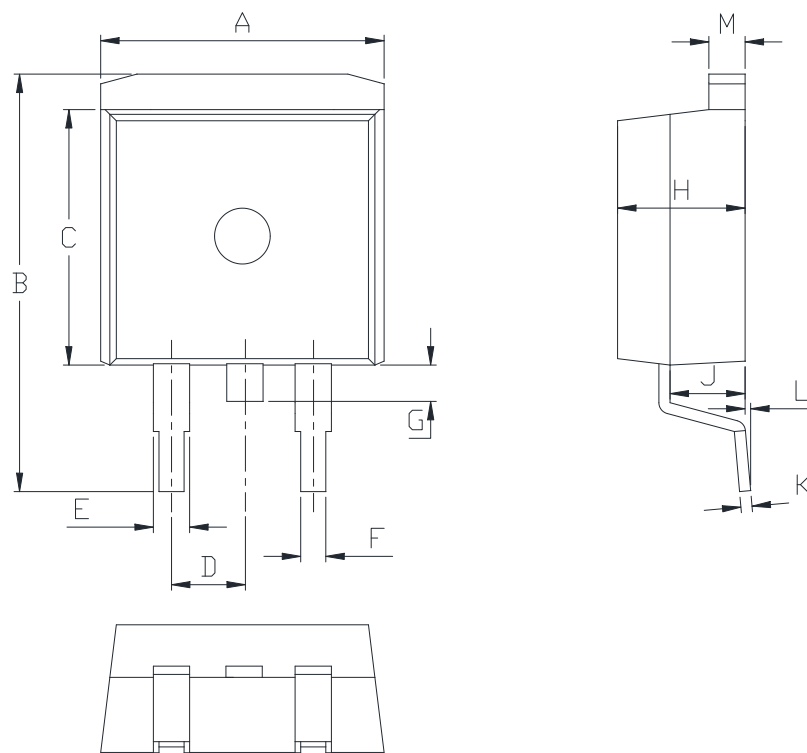


Fig 13. Typical capacitance as a function of  $V_{CE}$   
( $f=1\text{MHz}$ ,  $V_{GE}=0\text{V}$ )

## 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                  |
|------------|----------|--------------------------|
| 2025-03-19 | Rev 1.0  | Release of the datasheet |
|            |          |                          |
|            |          |                          |

## Disclaimer

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