

**650V N-Channel Enhancement Mode Power IGBT**

**MAIN CHARACTERISTICS**

|                                |      |
|--------------------------------|------|
| <b>I<sub>c</sub> @TC=100°C</b> | 75A  |
| <b>V<sub>CE</sub></b>          | 650V |
| <b>V<sub>CE(sat)</sub>-typ</b> | 1.8V |

**FEATURES**

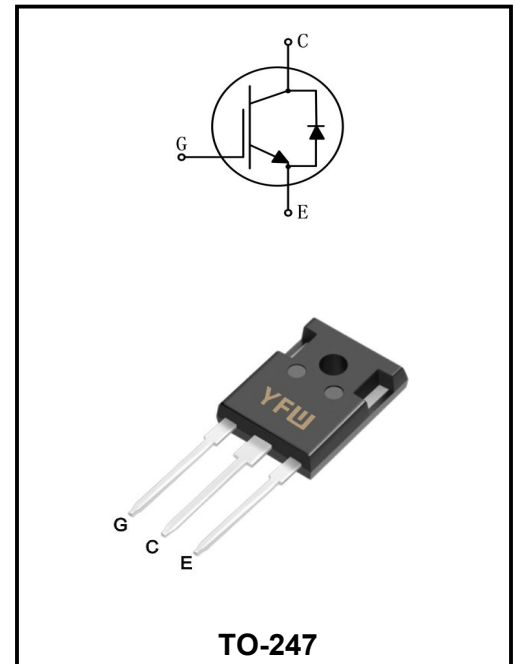
- ◆ Trench and field-stop technology
- ◆ Easy parallel switching capability

**APPLICATIONS**

- ◆ Energy storage
- ◆ Solar string inverter
- ◆ Uninterruptible power supplies

**MECHANICAL DATA**

- ◆ Case: Molded plastic
- ◆ Mounting Position: Any
- ◆ Molded Plastic: UL Flammability Classification Rating 94V-0
- ◆ Lead free in compliance with EU RoHS 2011/65/EU directive
- ◆ Solder bath temperature 275°C maximum,10s per JESD 22-B106



**TO-247**

**Maximum Ratings**

| Characteristics                                | Symbol                 | Value       | Unit      |
|--|------------------------|-------------|-----------|
|  |                        | 247         |           |
| Collector-emitter voltage                      | <b>V<sub>CEs</sub></b> | 650         | <b>V</b>  |
| Gate-emitter voltage                           | <b>V<sub>GES</sub></b> | ±20         | <b>V</b>  |
| Continuous collector current (TC=25°C)         | <b>I<sub>c</sub></b>   | 150         | <b>A</b>  |
| Continuous collector current (TC=100°C)        |                        | 75          | <b>A</b>  |
| Pulsed collector current, tp limited by Tvjmax | <b>I<sub>CM</sub></b>  | 300         | <b>A</b>  |
| Diode continuous forward current (TC=100°C)    | <b>I<sub>F</sub></b>   | 75          | <b>A</b>  |
| Diode maximum current, tp limited by Tvjmax    | <b>I<sub>FM</sub></b>  | 300         | <b>A</b>  |
| Power dissipation (TC=25°C)                    | <b>P<sub>tot</sub></b> | 418         | <b>W</b>  |
| Power dissipation (TC=100°C)                   |                        | 210         | <b>W</b>  |
| Operating junction temperature range           | <b>T<sub>vj</sub></b>  | -40 to +175 | <b>°C</b> |
| Storage temperature range                      | <b>T<sub>stg</sub></b> | -40 to +150 | <b>°C</b> |

**Thermal characteristics**

| Characteristics                                | Symbol        | Values |      | Unit |
|--|---------------|--------|------|------|
|  |               | Typ    | Max. |      |
| Thermal resistance, junction to case for IGBT  | $R_{th(j-c)}$ | -      | 0.35 | K/ W |
| Thermal resistance, junction to case for Diode | $R_{th(j-c)}$ | -      | 0.70 | K/ W |
| Thermal resistance, junction to ambient        | $R_{th(j-a)}$ | -      | 40   | K/ W |

**Note1: Pulse test: 300  $\mu$ s pulse width, 2 % duty cycle**
**Electrical characteristics of IGBT at  $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified**

| Characteristics                      | Test Condition   | Symbol   | Min          | Typ  | Max       | Unit    |    |
|--------------------------------------|--|--|--------------|------|-----------|---------|----|
| Collector-emitter breakdown voltage  | $V_{GE}=0V, I_c=250\mu A$  | $B_{V_{CES}}$  | 650          | -    | -         | V       |    |
| Collector-emitter leakage current    | $V_{CE}=650V, V_{GE}=0V$   | $I_{CES}$  | -            | -    | 50        | $\mu A$ |    |
| Gate leakage current, forward        | $V_{GE}=\pm 20V, V_{CE}=0V$  | $I_{GES}$  | -            | -    | $\pm 100$ | nA      |    |
| Gate-emitter threshold voltage       | $V_{GE}=V_{CE}, I_c=1mA$   | $V_{GE(th)}$   | 4.7          | 5    | 5.3       | V       |    |
| Collector-emitter saturation voltage | $V_{GE}=15V, I_c=75A$  | $V_{CE(sat)}$  | -            | 1.8  | -         | V       |    |
|                                      | $V_{GE}=15V, I_c=75A, T_{vj}=175^{\circ}\text{C}$                              |  | -            | 2.5  | -         | V       |    |
| Input capacitance                    | $V_{CE}=30V$<br>$V_{GE}=0V$<br>$f=1MHz$  | $C_{ies}$  | -            | 4260 | -         | pF      |    |
| Output capacitance                   |  | $C_{oes}$  | -            | 205  | -         | pF      |    |
| Reverse transfer capacitance         |  | $C_{res}$  | -            | 31   | -         | pF      |    |
| Total gate charge                    | $V_{cc}=520V, V_{GE}=15V, I_c=75A$   | $Q_g$  | -            | 130  | -         | nC      |    |
| Turn-on delay time                   | $V_{cc}=400V$<br>$V_{GE}=15V$<br>$I_c=75A$<br>$R_G=10\Omega$<br>Inductive load | $t_{d(on)}$  | -            | 53   | -         | ns      |    |
| Rise time                            |  | $t_r$  | -            | 132  | -         | ns      |    |
| Turn-off delay time                  |  | $t_{d(off)}$   | -            | 162  | -         | ns      |    |
| Fall time                            |  | $t_f$  | -            | 95   | -         | ns      |    |
| Turn-on energy                       |  | $E_{on}$   | -            | 3.3  | -         | mJ      |    |
| Turn-off energy                      |  | $E_{off}$  | -            | 2.2  | -         | mJ      |    |
| Total switching energy               |  | $E_{ts}$   | -            | 5.5  | -         | mJ      |    |
| Turn-on delay time                   |  | $V_{cc}=400V$<br>$V_{GE}=15V$<br>$I_c=75A$<br>$R_G=10\Omega$<br>Inductive load<br>$T_{vj}=175^{\circ}\text{C}$ | $t_{d(on)}$  | -    | 53        | -       | ns |
| Rise time                            |  |  | $t_r$        | -    | 128       | -       | ns |
| Turn-off delay time                  |  |  | $t_{d(off)}$ | -    | 183       | -       | ns |
| Fall time                            | $t_f$  |  | -            | 107  | -         | ns      |    |
| Turn-on energy                       | $E_{on}$   |  | -            | 4.8  | -         | mJ      |    |
| Turn-off energy                      | $E_{off}$  |  | -            | 2.7  | -         | mJ      |    |
| Total switching energy               | $E_{ts}$   |  | -            | 7.5  | -         | mJ      |    |
| Diode forward voltage                | $I_F=75A$  |  | $V_F$        | -    | 1.8       | -       | V  |
|                                      | $I_F=75A, T_{vj}=175^{\circ}\text{C}$  | -  |              | 1.4  | -         | V       |    |
| Diode reverse recovery time          | $V_R=400V$<br>$I_F=75A$<br>$diF/dt=-450A/\mu s$                                | $t_{rr}$   | -            | 129  | -         | ns      |    |
| Diode peak reverse recovery current  |  | $I_{rrm}$  | -            | 14   | -         | A       |    |
| Diode reverse recovery charge        |  | $Q_{rr}$   | -            | 778  | -         | nC      |    |
| Diode reverse recovery time          |  | $t_{rr}$   | -            | 172  | -         | ns      |    |
| Diode peak reverse recovery current  | $V_R=400V$<br>$I_F=75A$<br>$diF/dt=-450A/\mu s, T_{vj}=175^{\circ}\text{C}$    | $I_{rrm}$  | -            | 22   | -         | A       |    |
| Diode reverse recovery charge        |  | $Q_{rr}$   | -            | 2200 | -         | nC      |    |

**Ratings and Characteristic Curves**

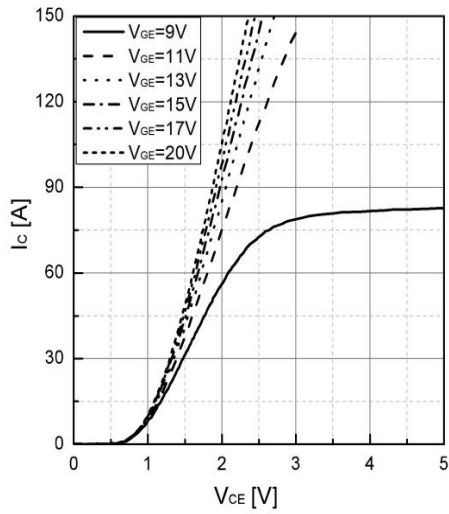


Fig 1. Typical output characteristic ( $T_{vj}=25^{\circ}\text{C}$ )

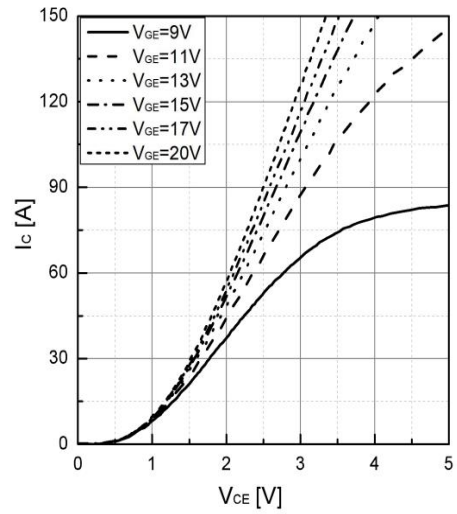


Fig 2. Typical output characteristic ( $T_{vj}=175^{\circ}\text{C}$ )

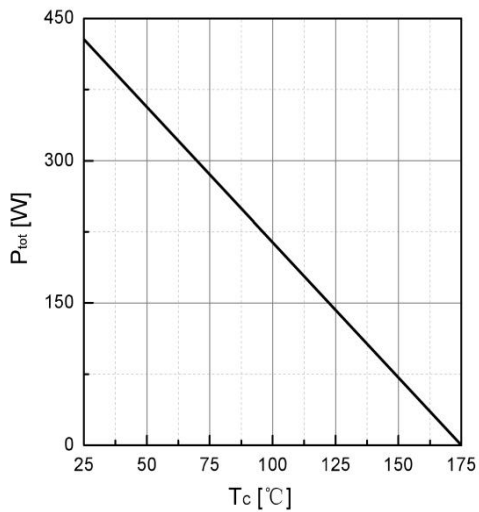


Fig 3. Power dissipation as a function of  $T_c$

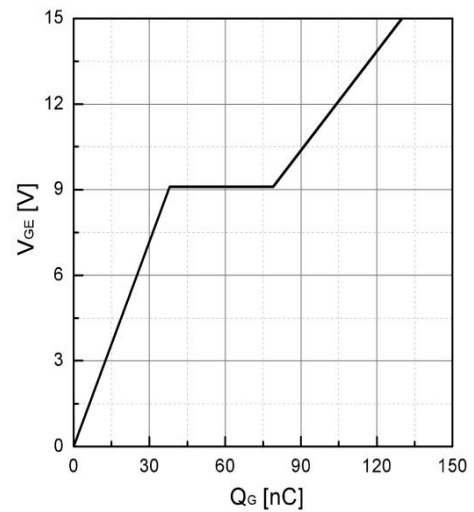


Fig 4. Typical Gate charge

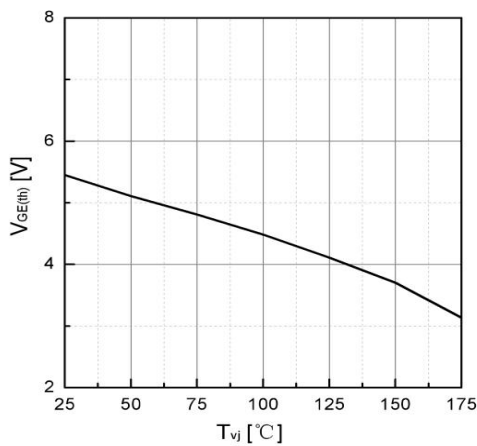


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_c=1\text{mA}$ )

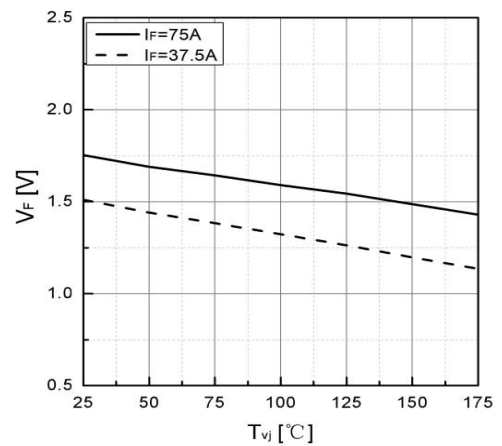


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

**Ratings and Characteristic Curves**

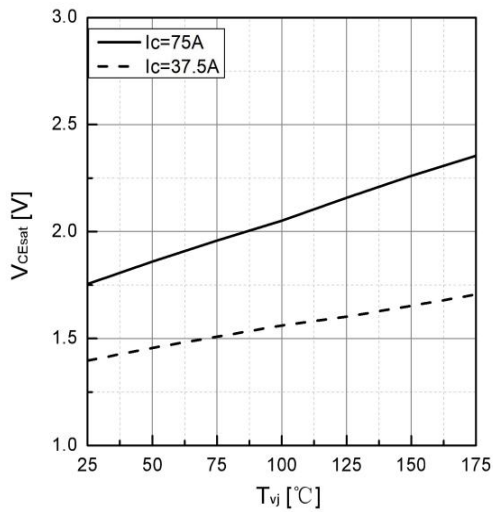


Fig 7. Typical  $V_{CEsat}$  as a function of  $T_{vj}$

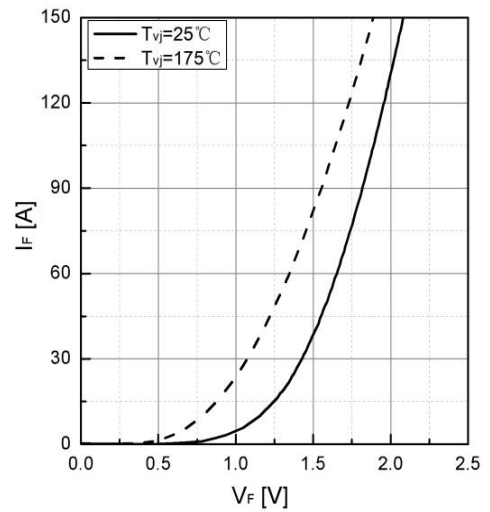


Fig 8. Typical  $I_F$  as a function of  $V_F$

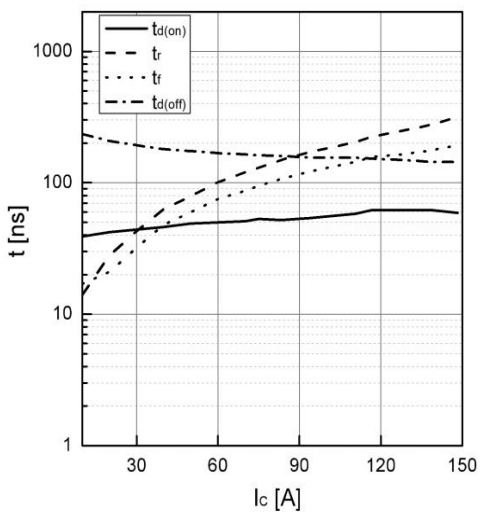


Fig 9. Typical switching time as a function of  $I_c$

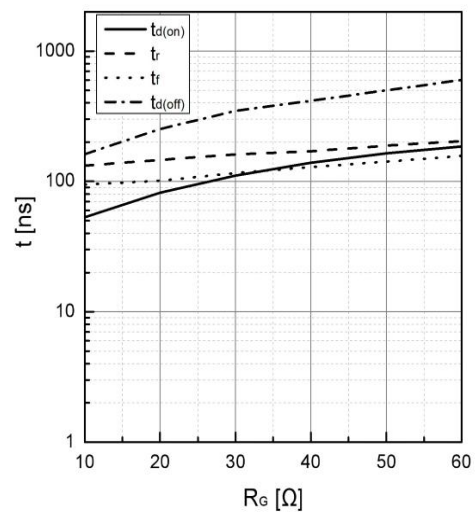


Fig 10. Typical switching times as a function of  $R_G$

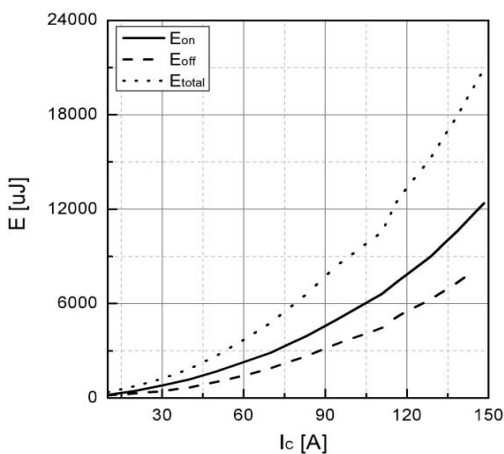


Fig 11. Typical switching energy losses as a function of  $I_c$

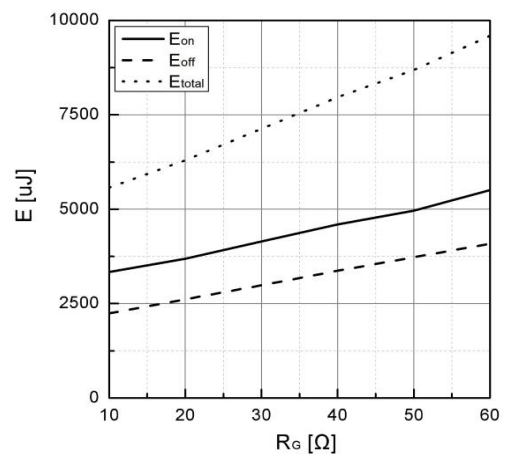


Fig 12. Typical switching energy losses as a function of  $R_G$

Package Outline Dimensions Millimeters

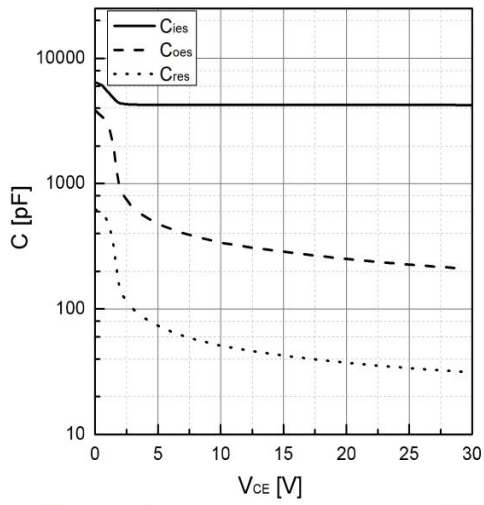


Fig 13. Typical capacitance as a function of  $V_{CE}$   
( $f=1\text{Mhz}$ ,  $V_{GE}=0\text{V}$ )

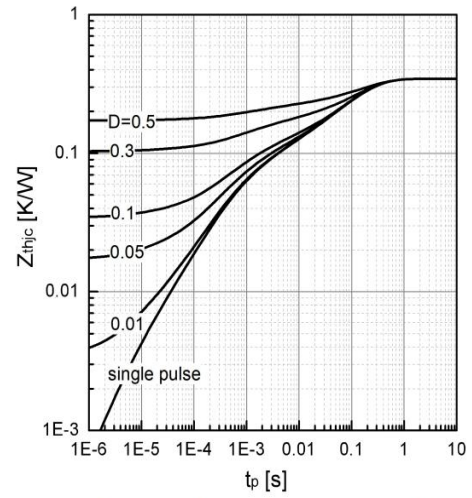
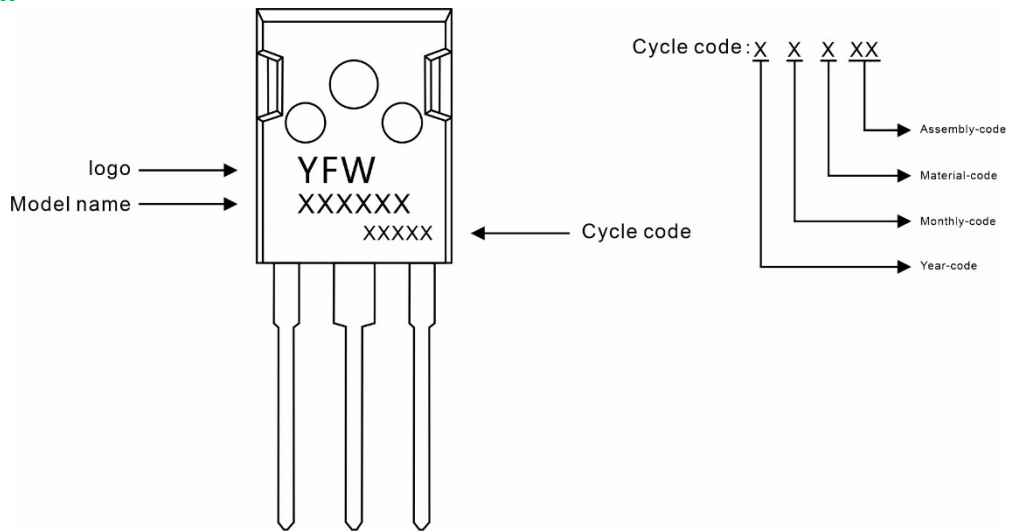


Fig 14. Transient thermal impedance of IGBT

**Marking Diagram**



**Ordering information**

| Model name  | Package | Unit Weight    | Base Quantity | Packing Quantity          |
|-------------|---------|----------------|---------------|---------------------------|
| YFWG75T65AP | TO-247  | 0.209oz(5.93g) | 30pcs/tube    | 600PCS/Box 2400PCS/Carton |

**Package Dimensions**

**TO-247**

| Symbol | Dimensions in mm |       | Dimensions in Inch |       |
|--------|------------------|-------|--------------------|-------|
|        | Min.             | Max.  | Min.               | Max.  |
| A      | 4.90             | 5.10  | 0.193              | 0.201 |
| A1     | 1.90             | 2.10  | 0.075              | 0.083 |
| A2     | 2.29             | 2.54  | 0.090              | 0.100 |
| b      | 1.00             | 1.40  | 0.039              | 0.055 |
| b1     | 2.00             | 2.20  | 0.079              | 0.087 |
| b2     | 3.00             | 3.20  | 0.118              | 0.126 |
| c      | 0.50             | 0.70  | 0.020              | 0.028 |
| D      | 15.75            | 16.05 | 0.620              | 0.632 |
| E      | 20.20            | 20.80 | 0.795              | 0.819 |
| e      | 5.45 (BSC)       |       | 0.215 (BSC)        |       |
| e1     | 10.90 (BSC)      |       | 0.429 (BSC)        |       |
| F      | 6.05             | 6.25  | 0.238              | 0.246 |
| F1     | 5.80             | 6.00  | 0.228              | 0.236 |
| L      | 20.10            | 20.40 | 0.791              | 0.803 |
| L1     | 4.05             | 4.35  | 0.159              | 0.171 |
| Φ      | 3.50             | 3.70  | 0.138              | 0.146 |

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