

**650V N-CHANNEL ENHANCEMENT MODE MOSFET**

**MAIN CHARACTERISTICS**

|                               |                    |
|-------------------------------|--------------------|
| $I_D$                         | 5A                 |
| $V_{DSS}$                     | 650V               |
| $R_{DS(on)-typ}(@V_{GS}=10V)$ | <2.4Ω (Type:2.0 Ω) |

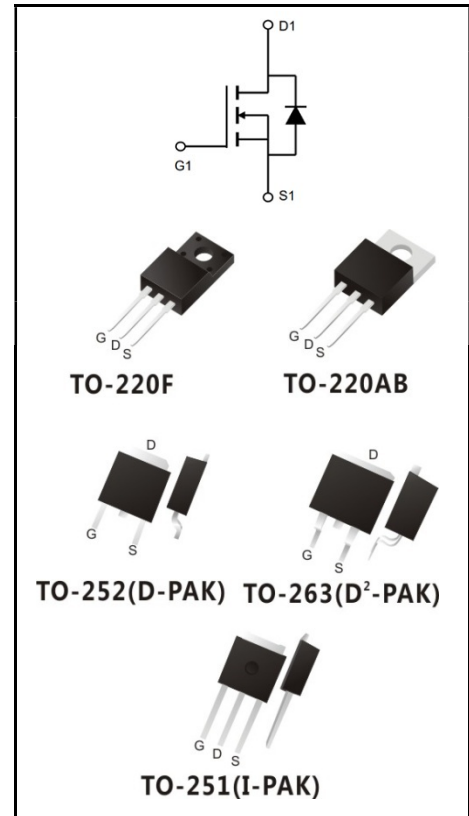


**Features**

- ◆Fast Switching
- ◆Low ON Resistance
- ◆Low Gate Charge
- ◆100% Single Pulse avalanche energy Test
- ◆LeadfreeincomplywithEURoHS2011/65/EUdirectives

**Mechanical Data**

- ◆Case: Molded plastic
- ◆Mounting Position: Any
- ◆Molded Plastic: UL Flammability Classification Rating 94V-0
- ◆Solder bath temperature275°C maximum,10s per JESD22-106



**Product Specification Classification**

| Part Number | Package        | Marking           | Pack         |
|-------------|----------------|-------------------|--------------|
| YFW5N65AT   | TO-220AB       | YFW 5N65AT XXXXX  | 50PCS/Tube   |
| YFW5N65F    | TO-220F(0.5mm) | YFW 5N65AF XXXXX  | 50PCS/Tube   |
| YFW5N65AS   | TO-263         | YFW 5N65AS XXXXX  | 50PCS/Tube   |
| YFW5N65AS-R | TO-263         | YFW 5N65AS XXXXX  | 800PCS/Tape  |
| YFW5N65AMJ  | TO-251         | YFW 5N65AMJ XXXXX | 80PCS/Tube   |
| YFW5N65AD   | TO-252         | YFW 5N65AD XXXXX  | 2500PCS/Tape |

**Maximum Ratings At Tc=25°C Unless Otherwise Specified**

| Characteristics                         | Symbols                | Value       |      |         | Units                |
|---|------------------------|-------------|------|---------|----------------------|
|   |                        | 220AB/263   | 220F | 251/252 |                      |
| Drain-Source Voltage                    | <b>V<sub>DS</sub></b>  | 650         |      |         | <b>V</b>             |
| Gate-Source Voltage                     | <b>V<sub>GS</sub></b>  | ±30         |      |         | <b>V</b>             |
| Continue Drain Current                  | <b>I<sub>D</sub></b>   | 5           |      |         | <b>A</b>             |
| - Continuous(Tc=100°C)                  |                        | 3.1         |      |         |                      |
| Pulsed Drain Current (Note1)            | <b>I<sub>DM</sub></b>  | 20          |      |         | <b>A</b>             |
| Power Dissipation                       | <b>P<sub>D</sub></b>   | 75          | 33   | 63      | <b>W</b>             |
| -Derate above 25°C                      |                        | 0.56        | 0.33 | 0.62    | <b>W/°C</b>          |
| Single Pulse Avalanche Energy (Note2)   | <b>E<sub>AS</sub></b>  | 200         |      |         | <b>m<sub>J</sub></b> |
| Avalanche Current (Note 1)              | <b>I<sub>AR</sub></b>  | 5           |      |         | <b>A</b>             |
| Repetitive Avalanche Energy (Note 1)    | <b>E<sub>AR</sub></b>  | 11.5        |      |         | <b>m<sub>J</sub></b> |
| Operating Temperature Range             | <b>T<sub>J</sub></b>   | 150         |      |         | <b>°C</b>            |
| Storage Temperature Range               | <b>T<sub>STG</sub></b> | -55 to +150 |      |         | <b>°C</b>            |
| Thermal Resistance, Junction to Case    | <b>R<sub>θJC</sub></b> | 1.67        | 3.57 | 2.35    | <b>°C/W</b>          |
| Thermal Resistance, Junction to Ambient | <b>R<sub>θJA</sub></b> | 62.5        | 62.5 | 62.5    | <b>°C/W</b>          |

**Maximum Ratings At Tc=25°C Unless Otherwise Specified**

| Characteristics                  | Test Condition  | Symbols                   | Min | Typ | Max  | Units     |
|----------------------------------|---|---------------------------|-----|-----|------|-----------|
| Drain-Source Breakdown Voltage   | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$                                   | <b>BV<sub>DSS</sub></b>   | 650 | -   | -    | <b>V</b>  |
| Drain-Source Leakage Current     | $V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$                                    | <b>I<sub>DSS</sub></b>    | -   | -   | 1    | <b>UA</b> |
|                                  | $V_{DS}=520\text{V}, T_c=125^\circ\text{C}$                                     |                           | -   | -   | 10   |           |
| Gate Leakage Current             | $V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$                                 | <b>I<sub>GSS</sub></b>    | -   | -   | ±100 | <b>nA</b> |
| Gate-Source Threshold Voltage    | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$                                       | <b>V<sub>GS(th)</sub></b> | 2   | -   | 4    | <b>V</b>  |
| Drain-Source On-State Resistance | $V_{GS} = 10\text{ V}, I_D = 2\text{ A}$  | <b>R<sub>DS(on)</sub></b> | -   | 2.0 | 2.4  | <b>Ω</b>  |
| Forward Transconductance         | $V_{DS} = 15\text{ V}, I_D = 2\text{ A}$  | <b>g<sub>fs</sub></b>     | -   | 3.5 | -    | <b>S</b>  |
| Input Capacitance                | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                   | <b>C<sub>iss</sub></b>    | -   | 580 | -    | <b>pF</b> |
| Output Capacitance               |   | <b>C<sub>oss</sub></b>    | -   | 55  | -    |           |
| Reverse Transfer Capacitance     |   | <b>C<sub>rss</sub></b>    | -   | 8.5 | -    |           |
| Turn-on Delay Time               | $I_D = 4\text{ A}, V_{DD} = 325\text{ V}, R_G = 10\ \Omega(\text{Note}3,4)$     | <b>td(ON)</b>             | -   | 8.5 | -    | <b>nS</b> |
| Rise Time                        |   | <b>tr</b>                 | -   | 6.5 | -    |           |
| Turn-Off Delay Time              |   | <b>td(OFF)</b>            | -   | 31  | -    |           |
| Fall Time                        |   | <b>tf</b>                 | -   | 8.5 | -    |           |
| Total Gate Charge                | $I_D = 4\text{ A}, V_{DD} = 480\text{ V}, V_{GS} = 10\text{ V}(\text{Note}3,4)$ | <b>Q<sub>G</sub></b>      | -   | 15  | -    | <b>nC</b> |
| Gate to Source Charge            |   | <b>Q<sub>GS</sub></b>     | -   | 2.8 | -    |           |
| Gate to Drain Charge             |   | <b>Q<sub>GD</sub></b>     | -   | 6.3 | -    |           |

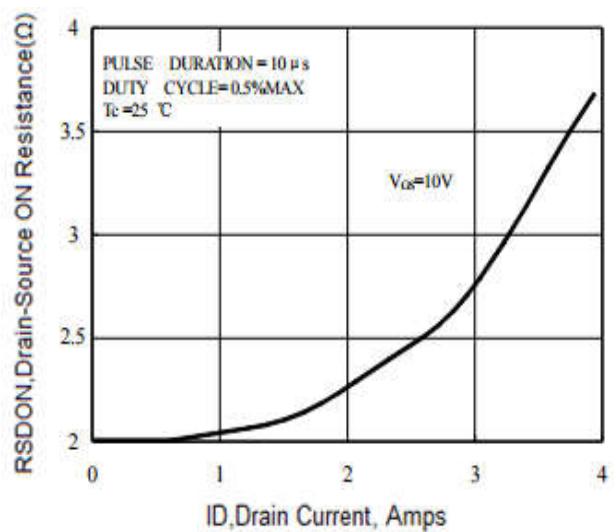
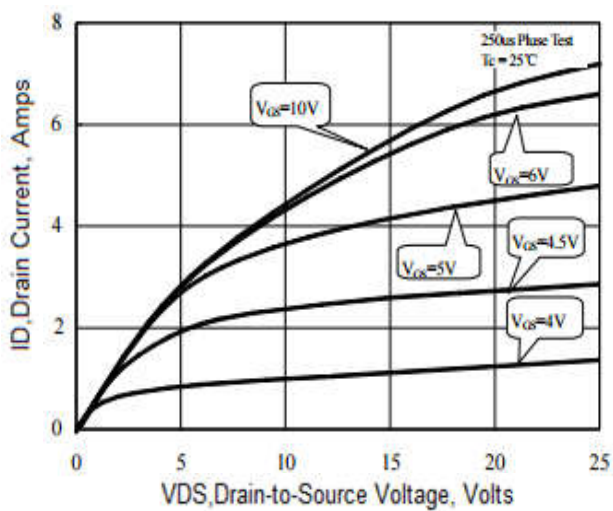
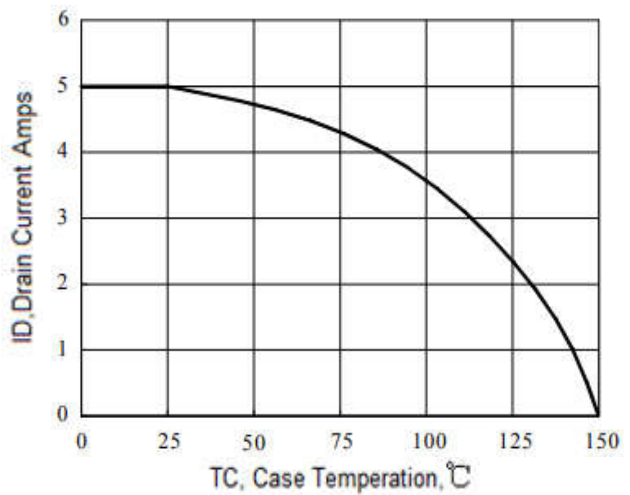
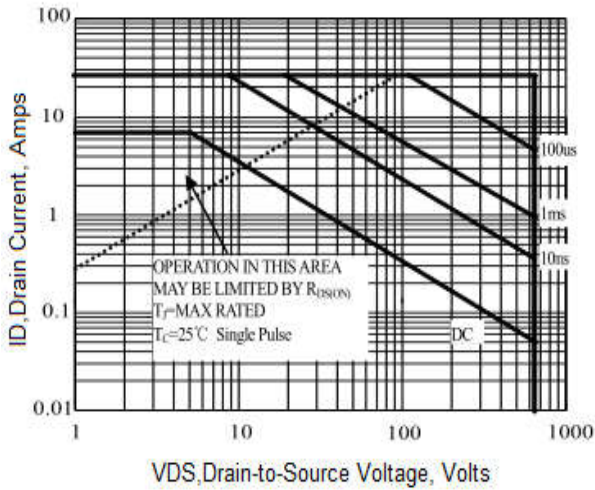
Source-Drain Diode Characteristics at Ta=25°C unless otherwise specified

| Characteristics                          | Test Condition  | Symbols  | Min | Typ  | Max | Units |
|--|---|----------|-----|------|-----|-------|
| Maximun Body-Diode Continuous Current    |   | $I_S$    | -   | -    | 5   | A     |
| Maximun Body-Diode Pulsed Current(Note2) |   | $I_{SM}$ | -   | -    | 20  | A     |
| Drain-Source Diode Forward Voltage       | $I_{SD} = 4 A$  | $V_{SD}$ | -   | -    | 1.5 | V     |
| Reverse Recovery Time                    | $I_{SD} = 4 A, V_{GS} = 0 V, di_F / dt = 100 A/\mu s$ | $trr$    | -   | 430  | -   | nS    |
| Reverse Recovery Charge                  |   | $Q_{rr}$ | -   | 1.27 | -   | uC    |

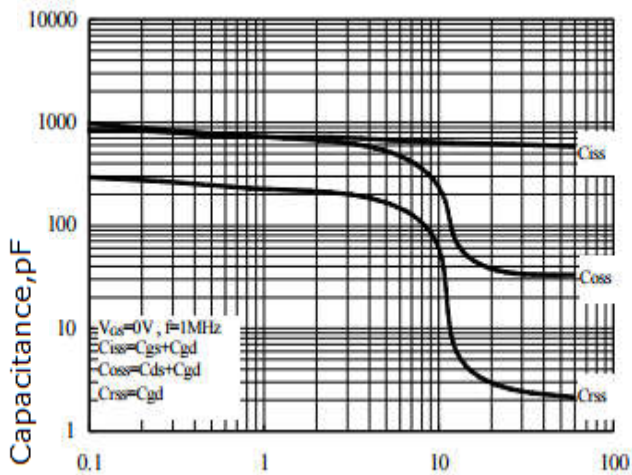
Note:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. IAS = 5 A, VDD = 50 V, L = 16.5mH, RG = 25Ω, starting TJ = 25°C.
3. ulse test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
4. Essentially Independent of Operating Temperature.

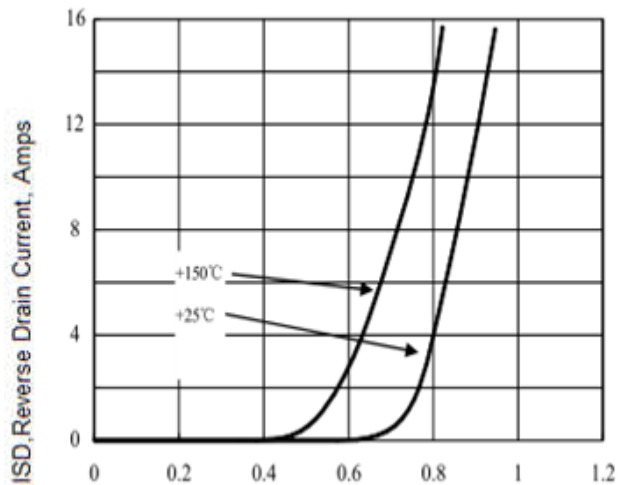
Ratings and Characteristic Curves



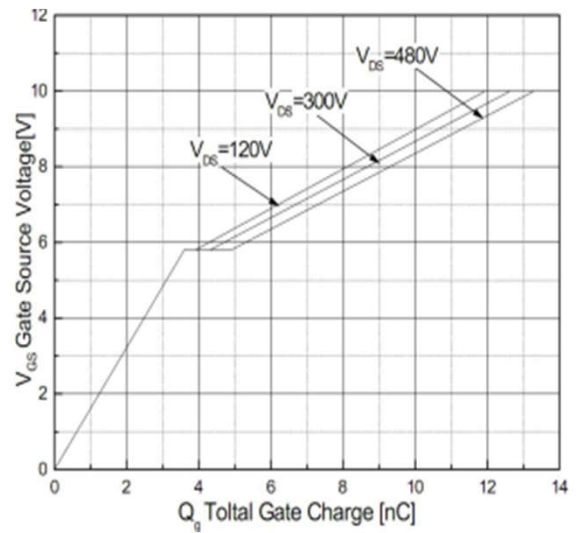
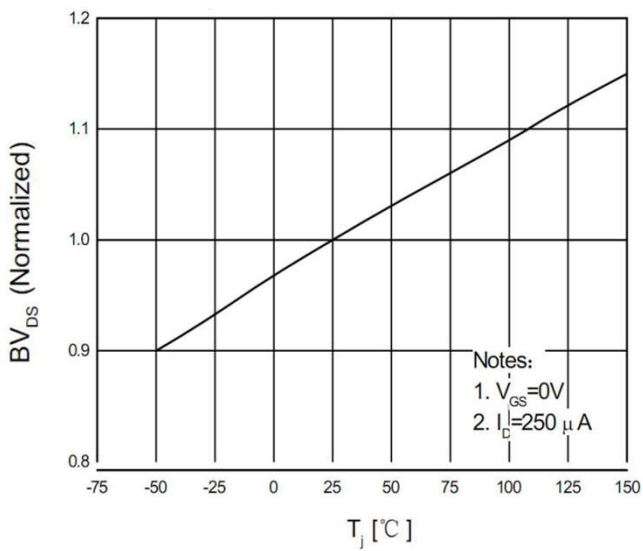
Ratings and Characteristic Curves



V<sub>DS</sub>, Drain-to-Source Voltage, Volts



V<sub>SD</sub>, Source to Drain Voltage, Volts



Package Outline Dimensions Millimeters

**TO-220AB**

| Dim.                         | Min.     | Max.  |
|------------------------------|----------|-------|
| A                            | 10.15    | 10.35 |
| B                            | 2.65     | 2.95  |
| C                            | 3.70     | 3.90  |
| D                            | 28.5     | 29.5  |
| E                            | 1.30     | 1.45  |
| F                            | 6.35     | 6.55  |
| G                            | 2.9      | 3.3   |
| H                            | 15.0     | 16.0  |
| I                            | 0.38     | 0.42  |
| J                            | 4.45     | 4.55  |
| K                            | 1.25     | 1.35  |
| L                            | Typ 5.08 |       |
| M                            | Typ 2.54 |       |
| N                            | 3.1      | 3.3   |
| O                            | 0.76     | 0.84  |
| All Dimensions in millimeter |          |       |

**TO-220F**

| Dim.                         | Min.     | Max.  |
|------------------------------|----------|-------|
| A                            | 9.95     | 10.25 |
| B                            | 2.95     | 3.25  |
| C                            | 1.25     | 1.45  |
| D                            | 12.95    | 13.25 |
| E                            | 0.50     | 0.65  |
| F                            | 3.1      | 3.3   |
| G                            | 1.30     | 1.45  |
| H                            | Typ 2.54 |       |
| I                            | Typ 5.08 |       |
| J                            | 4.60     | 4.75  |
| K                            | 2.50     | 2.65  |
| L                            | 6.35     | 6.55  |
| M                            | 15.4     | 16.0  |
| N                            | 2.75     | 3.05  |
| O                            | 0.48     | 0.52  |
| P                            | 0.76     | 0.84  |
| All Dimensions in millimeter |          |       |

Package Outline Dimensions Millimeters

**TO-263**

|                              |      |         |      |
|------------------------------|------|---------|------|
|                              | Dim. | Min.    | Max. |
|                              | A    | 10.1    | 10.2 |
|                              | B    | 7.4     | 7.6  |
|                              | C    | 1.3     | 1.5  |
|                              | D    | 0.55    | 0.75 |
|                              | E    | 5.0     | 6.0  |
|                              | F    | 1.4     | 1.6  |
|                              | G    | 0.78    | 0.86 |
|                              | H    | 1.2     | 1.3  |
|                              | I    | Typ2.54 |      |
|                              | J    | 8.4     | 8.6  |
|                              | K    | 4.45    | 4.55 |
|                              | L    | 1.25    | 1.35 |
| M                            | 0.02 | 0.1     |      |
| N                            | 2.4  | 2.8     |      |
| O                            | 0.36 | 0.40    |      |
| All Dimensions in millimeter |      |         |      |

**TO-252**

|                              |      |         |      |       |
|------------------------------|------|---------|------|-------|
|                              | Dim. | Min.    | Typ. | Max.  |
|                              | A    | 2.10    | -    | 2.50  |
|                              | A2   | 0       | -    | 0.10  |
|                              | B    | 0.66    | -    | 0.86  |
|                              | B2   | 5.18    | -    | 5.48  |
|                              | C    | 0.40    | -    | 0.60  |
|                              | C2   | 0.44    | -    | 0.58  |
|                              | D    | 5.90    | -    | 6.30  |
|                              | D1   | 5.30REF |      |       |
|                              | E    | 6.40    | -    | 6.80  |
|                              | E1   | 4.63    | -    | -     |
|                              | G    | 4.47    | -    | 4.67  |
|                              | H    | 9.50    | -    | 10.70 |
|                              | L    | 1.09    | -    | 1.21  |
|                              | L2   | 1.35    | -    | 1.65  |
| V1                           | -    | 7°      | -    |       |
| V2                           | 0°   | -       | 6°   |       |
| All Dimensions in millimeter |      |         |      |       |

Package Outline Dimensions Millimeters

TO-251

|                              |      |         |      |
|------------------------------|------|---------|------|
|                              | Dim. | Min.    | Max. |
|                              | A    | 2.2     | 2.4  |
|                              | A2   | 0.95    | 1.15 |
|                              | A3   | 0.45    | 0.65 |
|                              | b    | 0.65    | 0.85 |
|                              | c    | 0.45    | 0.55 |
|                              | D    | 6.45    | 6.75 |
|                              | D2   | 5.2     | 5.4  |
|                              | E    | 5.8     | 6    |
|                              | E2   | 0.95    | 1.25 |
|                              | e    | Typ 2.3 |      |
|                              | e1   | Typ 4.6 |      |
|                              | L    | 4       | 4.2  |
|                              | L1   | 1.2     | 1.5  |
| All Dimensions in millimeter |      |         |      |