

**-40V P-Channel Trench Power MOSFET**

**MAIN CHARACTERISTICS**

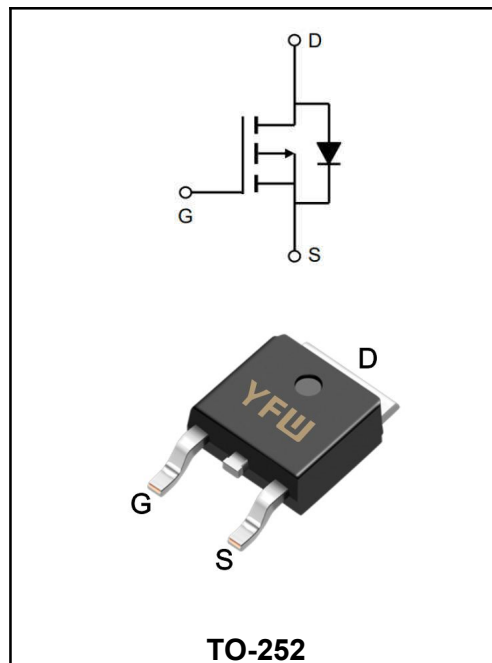
|                                |                             |
|--------------------------------|-----------------------------|
| $I_D$                          | -40A                        |
| $V_{DS}$                       | -40V                        |
| $R_{DS(on)-typ}(@V_{GS}=-10V)$ | $< 10.9m\Omega$ (Typ:8.7mΩ) |

**FEATURES**

- ◆Advanced Trench Technology
- ◆Excellent RDS(ON) and Low Gate Charge

**APPLICATIONS**

- ◆Load Switch
- ◆PWM Application
- ◆Power Management



**Maximum Ratings at Tc=25°C unless otherwise specified**

| Characteristics                         | Symbols         | Value       | Units |
|-----------------------------------------|-----------------|-------------|-------|
| Drain-Source Voltage                    | $V_{DSS}$       | -40         | V     |
| Gate - Source Voltage                   | $V_{GSS}$       | $\pm 20$    | V     |
| Continuous Drain Current                | $I_D$           | -40         | A     |
| Pulsed Drain Current (note1)            | $I_{DM}$        | -160        | A     |
| Single Pulsed Avalanche Energy          | $E_{AS}$        | 144         | mJ    |
| Power Dissipation                       | $P_D$           | 42          | W     |
| Operating Temperature Range             | $T_J$           | 175         | °C    |
| Storage Temperature Range               | $T_{STG}$       | -55 to +175 | °C    |
| Thermal Resistance Junction to Case     | $R_{\theta JC}$ | 3.6         | °C/W  |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 65          | °C/W  |

**Note1:** Pulse test: 300  $\mu$ s pulse width, 2 % duty cycle

**Electrical Characteristics (T<sub>J</sub>=25°C, unless otherwise noted)**

| Characteristics                          | Test Condition                                                                                  | Symbols                   | Min | Typ  | Max  | Units     |
|------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------|-----|------|------|-----------|
| Drain-Source Breakdown Voltage           | V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA                                                    | <b>BV<sub>DSS</sub></b>   | -40 | -    | -    | <b>V</b>  |
| Zero Gate Voltage Drain Current          | V <sub>DS</sub> = -40V, V <sub>GS</sub> =0V,                                                    | <b>I<sub>DSS</sub></b>    | -   | -    | -1   | <b>μA</b> |
| Gate to Body Leakage Current             | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V                                                     | <b>I<sub>GSS</sub></b>    | -   | -    | ±100 | <b>nA</b> |
| Gate Threshold Voltage                   | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                      | <b>V<sub>GS(th)</sub></b> | -1  | -    | -2.5 | <b>V</b>  |
| Static Drain-Source on-Resistance        | V <sub>GS</sub> = -10V, I <sub>D</sub> = -20A                                                   | <b>R<sub>DS(ON)</sub></b> | -   | 8.7  | 10.9 | <b>mΩ</b> |
|                                          | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -10A                                                  |                           | -   | 11   | 13.7 | <b>mΩ</b> |
| Input Capacitance                        | V <sub>DS</sub> =-20V<br>V <sub>GS</sub> =0V<br>f=1.0MHz                                        | <b>C<sub>iss</sub></b>    | -   | 3800 | -    | <b>pF</b> |
| Output Capacitance                       |                                                                                                 | <b>C<sub>oss</sub></b>    | -   | 329  | -    |           |
| Reverse Transfer Capacitance             |                                                                                                 | <b>C<sub>rss</sub></b>    | -   | 289  | -    |           |
| Turn-on Delay Time(Note2)                | V <sub>DS</sub> =-20V<br>V <sub>GS</sub> =-10V<br>R <sub>G</sub> =2.4Ω<br>I <sub>D</sub> = -20A | <b>t<sub>d(on)</sub></b>  | -   | 10   | -    | <b>ns</b> |
| Turn-on Rise Time(Note2)                 |                                                                                                 | <b>T<sub>r</sub></b>      | -   | 82   | -    |           |
| Turn-off Delay Time(Note2)               |                                                                                                 | <b>t<sub>d(OFF)</sub></b> | -   | 93   | -    |           |
| Turn-off Fall Time(Note2)                |                                                                                                 | <b>t<sub>f</sub></b>      | -   | 74   | -    |           |
| Total Gate Charge(Note2)                 | V <sub>DS</sub> = -20V<br>V <sub>GS</sub> = -10V<br>I <sub>D</sub> = -20A                       | <b>Q<sub>g</sub></b>      | -   | 68   | -    | <b>nC</b> |
| Gate to Source Charge(Note2)             |                                                                                                 | <b>Q<sub>gs</sub></b>     | -   | 10   | -    |           |
| Gate to Drain Charge(Note2)              |                                                                                                 | <b>Q<sub>gd</sub></b>     | -   | 14   | -    |           |
| Maximun Body-Diode Continuous Current    |                                                                                                 | <b>I<sub>S</sub></b>      | -   | -    | -40  | <b>A</b>  |
| Maximun Body-Diode Pulsed Current(Note2) |                                                                                                 | <b>I<sub>SM</sub></b>     | -   | -    | -160 | <b>A</b>  |
| Drain to Source Diode Forward Voltage    | V <sub>GS</sub> =0V, I <sub>S</sub> = -30A, T <sub>J</sub> =25°C                                | <b>V<sub>SD</sub></b>     | -   | -    | -1.2 | <b>V</b>  |
| Reverse Recovery Time                    | V <sub>GS</sub> =0V, I <sub>S</sub> = -30A,<br>di/dt=100A/μs                                    | <b>t<sub>rr</sub></b>     | -   | 20   | -    | <b>ns</b> |
| Reverse Recovery Charge                  |                                                                                                 | <b>Q<sub>rr</sub></b>     | -   | 13   | -    | <b>nC</b> |

**Note2:Pulse test: 300 μs pulse width, 2 % duty cycle**

RATINGS AND CHARACTERISTIC CURVES

**Figure 1: Output Characteristics**

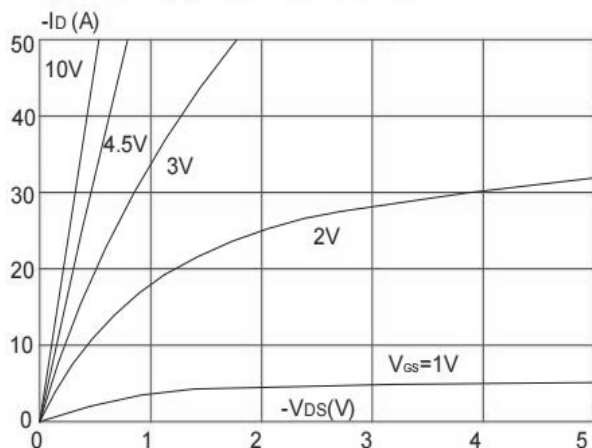


**Figure 2: Typical Transfer Characteristics**

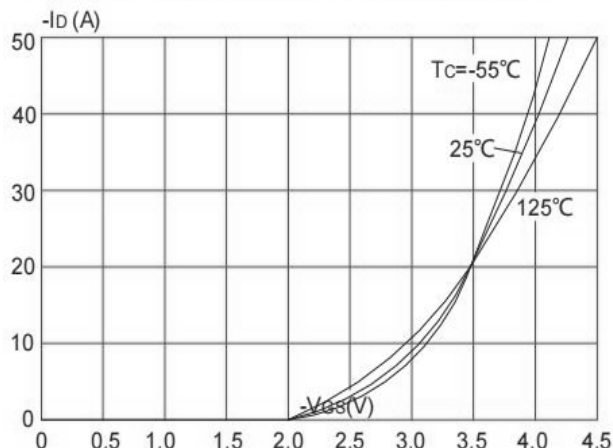


**Figure 3: On-resistance vs. Drain Current**

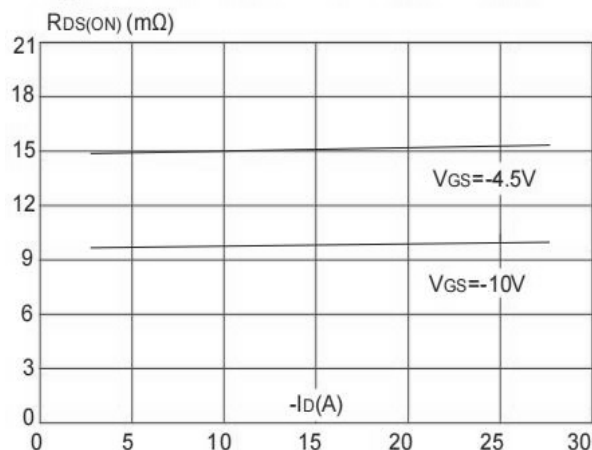


**Figure 4: Body Diode Characteristics**

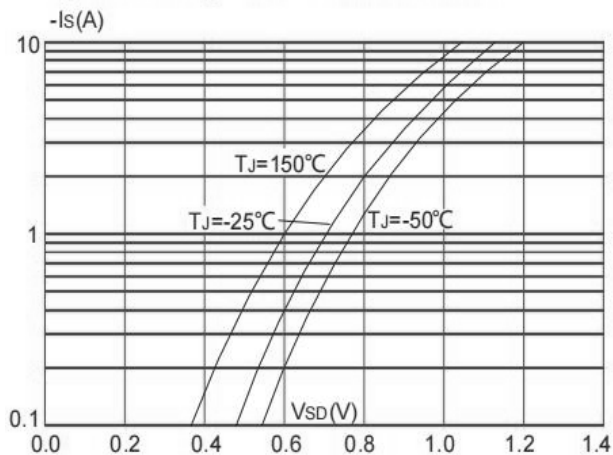


**Figure 5: Gate Charge Characteristics**

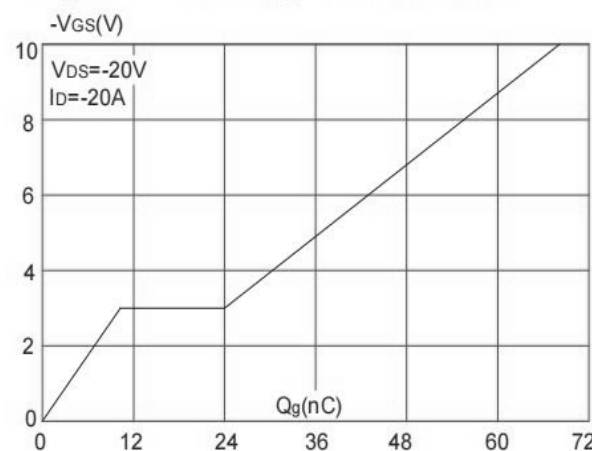
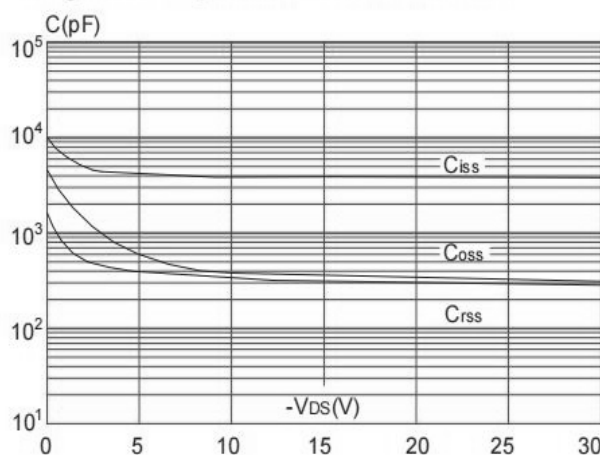


**Figure 6: Capacitance Characteristics**



**RATINGS AND CHARACTERISTIC CURVES**

**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**

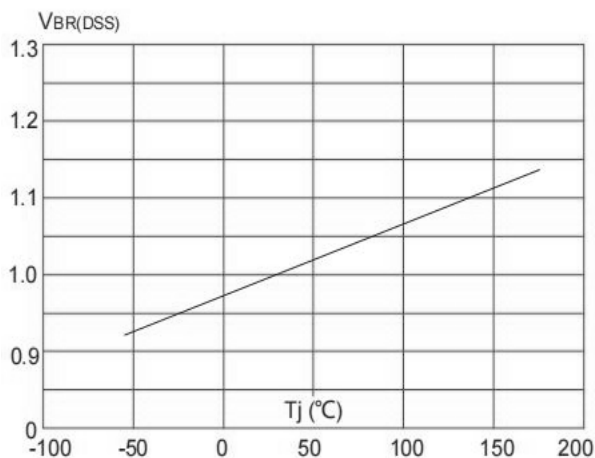


**Figure 8: Normalized on Resistance vs. Junction Temperature**

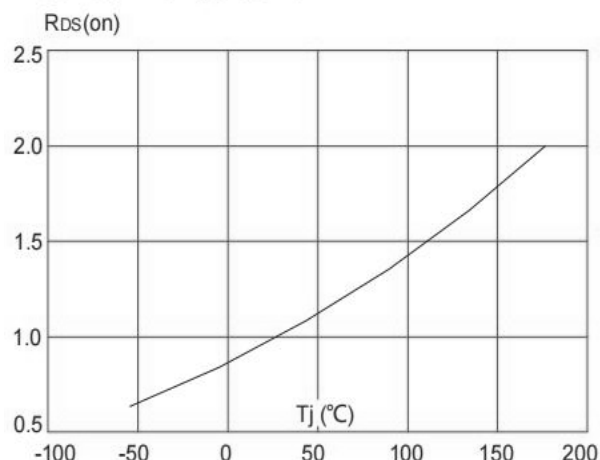


**Figure 9: Maximum Safe Operating Area**

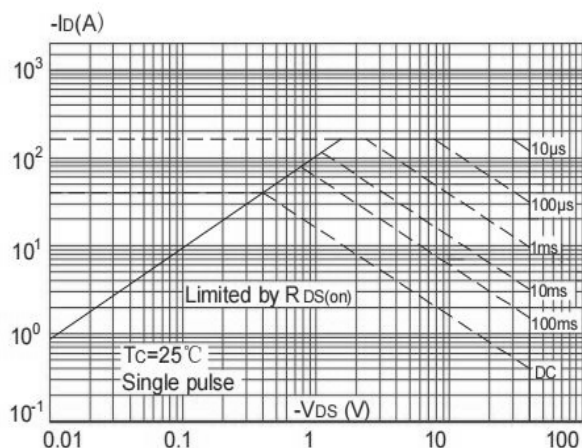


**Figure 10: Maximum Continuous Drain Current vs. Case Temperature**

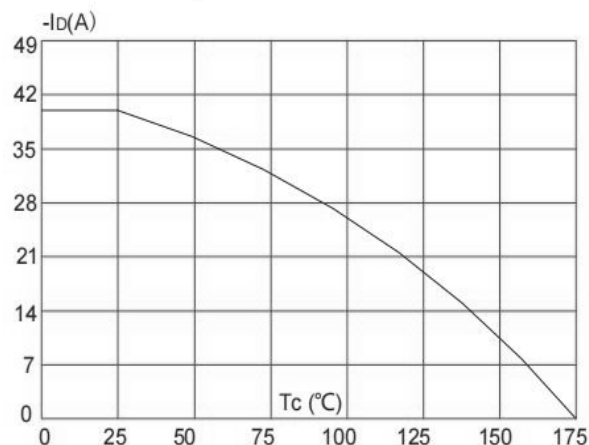
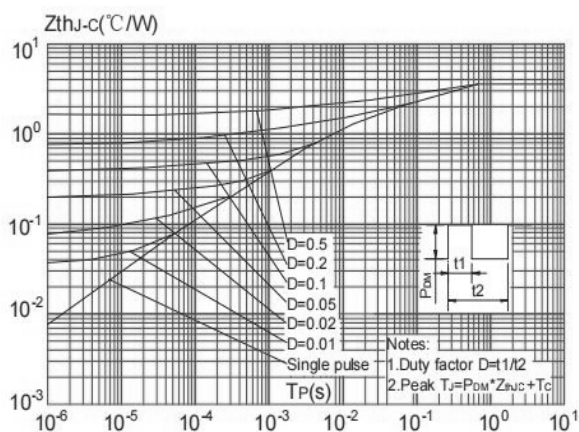
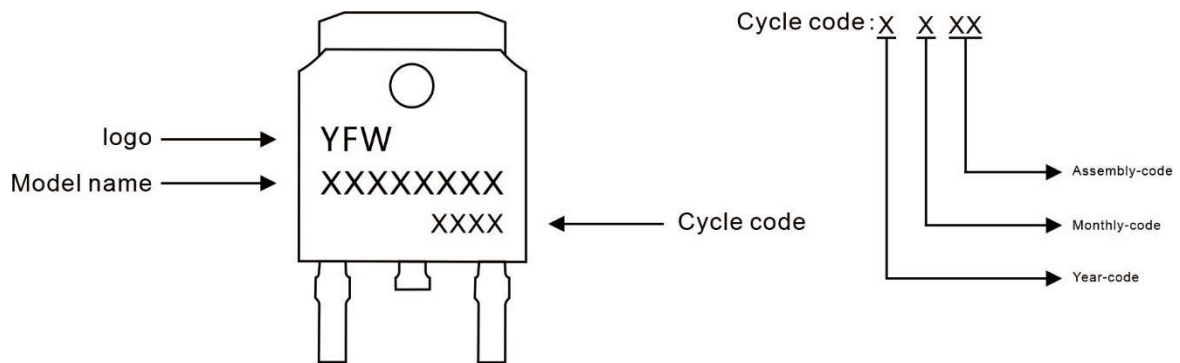


**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case**



## Marking Diagram



## Ordering information

| Model name | Package | Unit Weight    | Base Quantity | Packing Quantity            |
|------------|---------|----------------|---------------|-----------------------------|
| YFW40P04AD | TO-252  | 0.011oz(0.32g) | 2500pcs/reel  | 5000pcs/box 25000pcs/Carton |

## Package Dimensions

### TO-252

| Dim | Millimeter |       | Inches |       |
|-----|------------|-------|--------|-------|
|     | Min.       | Max.  | Min.   | Max.  |
| A   | 2.20       | 2.50  | 0.087  | 0.098 |
| A1  | 0.00       | 0.12  | 0.000  | 0.005 |
| A2  | 2.20       | 2.40  | 0.087  | 0.094 |
| B   | 0.95       | 1.55  | 0.037  | 0.061 |
| b   | 0.50       | 0.80  | 0.020  | 0.031 |
| b1  | 0.60       | 0.90  | 0.024  | 0.035 |
| c   | 0.40       | 0.60  | 0.016  | 0.024 |
| c1  | 0.40       | 0.60  | 0.016  | 0.024 |
| D   | 6.35       | 6.65  | 0.250  | 0.262 |
| D1  | 5.20       | 5.40  | 0.205  | 0.213 |
| E   | 5.80       | 6.40  | 0.228  | 0.252 |
| e   | 2.20       | 2.40  | 0.087  | 0.094 |
| e1  | 4.40       | 4.80  | 0.173  | 0.189 |
| L   | 10.00      | 11.00 | 0.393  | 0.433 |
| L1  | 2.70       | 3.50  | 0.106  | 0.138 |
| L2  | 1.40       | 1.80  | 0.055  | 0.071 |
| L3  | 0.90       | 1.50  | 0.035  | 0.059 |

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