



Technologies Int'l

## WFU4N60/WFD4N60

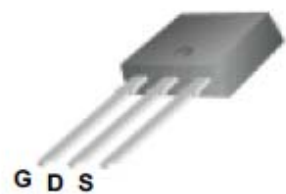
600V N-Channel MOSFET

### Features

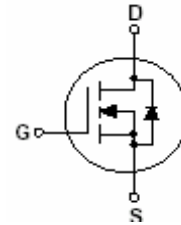
- Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Extended Safe Operating Area
- Unrivalled Gate Charge : 15 nC (Typ.)
- BVDSS=600V, ID=4A
- Lower  $R_{DS(on)}$  : 2.5Ω (Max) @VG=10V
- 100% Avalanche Tested



TO-252



TO-251



G-Gate, D-Drain, S-Source

### Absolute Maximum Ratings $T_c=25^\circ\text{C}$ unless other wise noted

| Symbol         | Parameter  | WFU/D4N60  | Units            |
|----------------|--|------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage   | 600        | V                |
| $I_D$          | Drain Current -continuous ( $T_c=25^\circ\text{C}$ )                         | 4          | A                |
|                | -continuous ( $T_c=100^\circ\text{C}$ )                                      | 1.8        | A                |
| $V_{GS}$       | Gate-Source Voltage  | $\pm 30$   | V                |
| $E_{AS}$       | Single Plused Avanche Energy (Note1)   | 240        | mJ               |
| $I_{AR}$       | Avalanche Current (Note2)  | 4          | A                |
| $P_D$          | Power Dissipation ( $T_c=25^\circ\text{C}$ )                                 | 44         | W                |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                      | -55 ~ +150 | $^\circ\text{C}$ |
| TL             | Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | 300        | $^\circ\text{C}$ |

### Thermal Characteristics

| Symbol          | Parameter                                | Typ. | Max  | Units                     |
|-----------------|--|------|------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case     | --   | 2.56 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta CA}$ | Thermal Resistance, Junction to Ambient* | --   | 50   | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient  | --   | 110  | $^\circ\text{C}/\text{W}$ |

\*When mounted on the minimum pad size recommended (PCB mounted)

| <b>Electrical Characteristics</b> $T_c=25^\circ\text{C}$ unless other wise noted |   |   |      |      |      |                           |
|--|---|---|------|------|------|---------------------------|
| Symbol   | Parameter   | Test Condition  | Min. | Typ. | Max  | Units                     |
| <b>Off Characteristics</b>   |   |   |      |      |      |                           |
| $BV_{DSS}$   | Drain-Source Breakdown Voltage  | $I_D=250\ \mu\text{A}, V_{GS}=0$                                    | 600  | --   | --   | V                         |
| $\Delta BV_{DSS}/\Delta T_J$   | Breakdown Voltage Temperature Coefficient   | $I_D=250\ \mu\text{A}$ , Reference to $25^\circ\text{C}$            | --   | 0.6  | --   | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$  | Zero Gate Voltage Drain Current   | $V_{ds}=500\text{V}, V_{gs}=0\text{V}$                              | --   | --   | 1    | $\mu\text{A}$             |
|  |   | $V_{ds}=480\text{V}, T_c=125^\circ\text{C}$                         |      |      | 10   | $\mu\text{A}$             |
| $I_{GSSF}$   | Gate-body leakage Current, Forward  | $V_{gs}=+30\text{V}, V_{ds}=0\text{V}$                              | --   | --   | 100  | nA                        |
| $I_{GSSR}$   | Gate-body leakage Current, Reverse  | $V_{gs}=-30\text{V}, V_{ds}=0\text{V}$                              | --   | --   | -100 | nA                        |
| <b>On Characteristics</b>  |   |   |      |      |      |                           |
| $V_{GS(th)}$   | Gate Threshold Voltage  | $I_D=250\ \mu\text{A}, V_{ds}=V_{gs}$                               | 2    | --   | 4    | V                         |
| $R_{DS(on)}$   | Static Drain-Source On-Resistance   | $I_D=2.0\text{A}, V_{gs}=10\text{V}$                                | --   | --   | 2.5  | $\Omega$                  |
| <b>Dynamic Characteristics</b>   |   |   |      |      |      |                           |
| $C_{iss}$  | Input Capacitance   | $V_{DS}=25\text{V}, V_{GS}=0,$<br>$f=1.0\text{MHz}$                 | --   | 515  | 670  | pF                        |
| $C_{oss}$  | Output Capacitance  |   | --   | 55   | 72   | pF                        |
| $C_{rss}$  | Reverse Transfer Capacitance  |   | --   | 6.5  | 8.5  | pF                        |
| <b>Switching Characteristics</b>   |   |   |      |      |      |                           |
| $T_d(on)$  | Turn-On Delay Time  | $V_{DD}=300\text{V}, I_D=4\text{A},$<br>$R_G=25\ \Omega$ (Note 3,4) | --   | 150  | 30   | nS                        |
| $T_r$  | Turn-On Rise Time   |   | --   | 42   | 90   | nS                        |
| $T_d(off)$   | Turn-Off Delay Time   |   | --   | 38   | 85   | nS                        |
| $T_f$  | Turn-Off Fall Time  |   | --   | 46   | 100  | nS                        |
| $Q_g$  | Total Gate Charge   | $V_{DS}=480, V_{GS}=10\text{V},$<br>$I_D=4\text{A}$ (Note 3,4)      | --   | 15   | 19   | nC                        |
| $Q_{gs}$   | Gate-Source Charge  |   | --   | 2.   | --   | nC                        |
| $Q_{gd}$   | Gate-Drain Charge   |   |      | 6.6  | --   | nC                        |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b>                    |   |   |      |      |      |                           |
| $I_S$  | Maximum Continuous Drain-Source Diode Forward Current   |   | --   | --   | 4    | A                         |
| $I_{SM}$   | Maximum Pulsed Drain-Source Diode Forward Current   |   | --   | --   | 16   | A                         |
| $V_{SD}$   | Drain-Source Diode Forward Voltage  | $I_D=4\text{A}$   | --   | --   | 1.25 | V                         |
| $t_{rr}$   | Reverse Recovery Time   | $I_S=4\text{A}, V_{GS}=0\text{V}$                                   | --   | 300  | --   | nS                        |
| $Q_{rr}$   | Reverse Recovery Charge   | $di_F/dt=100\text{A}/\mu\text{s}$ (Note3)                           | --   | 2.2  | --   | $\mu\text{C}$             |
| *Notes   | 1, $L=27.5\text{mH}, I_{AS}=4\text{A}, V_{DD}=50\text{V}, R_G=25\ \Omega$ , Starting $T_J=25^\circ\text{C}$<br>2, Repetitive Rating : Pulse width limited by maximum junction temperature<br>3, Pulse Test : Pulse Width $\leq 300\ \mu\text{s}$ , Duty Cycle $\leq 2\%$<br>4, Essentially Independent of Operating Temperature |   |      |      |      |                           |

# Typical Characteristics

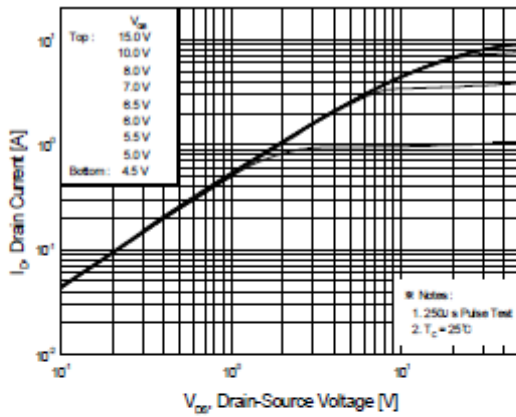


Figure 1. On-Region Characteristics

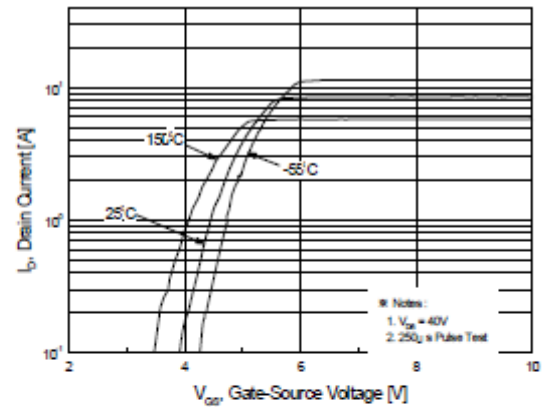


Figure 2. Transfer Characteristics

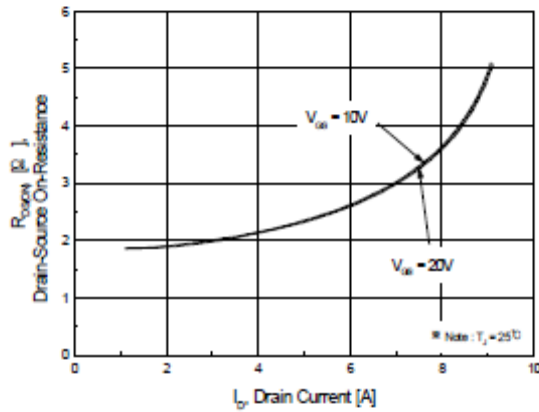


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

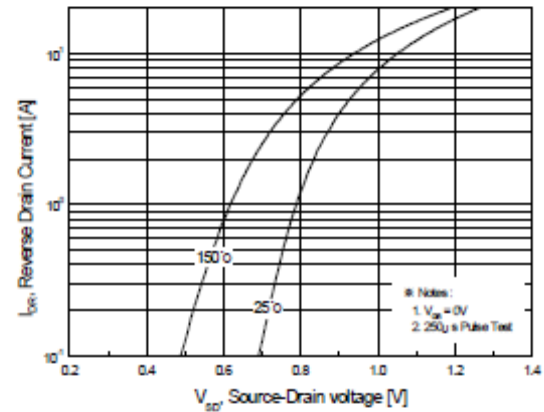


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

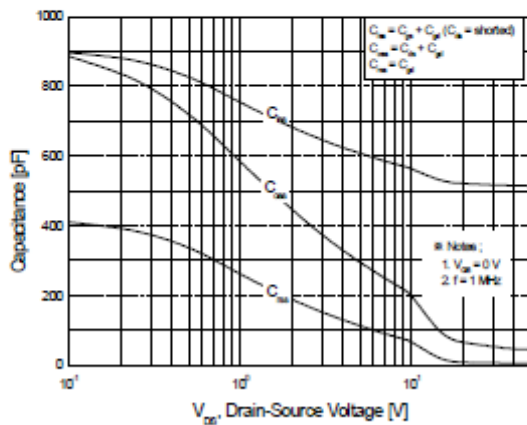


Figure 5. Capacitance Characteristics

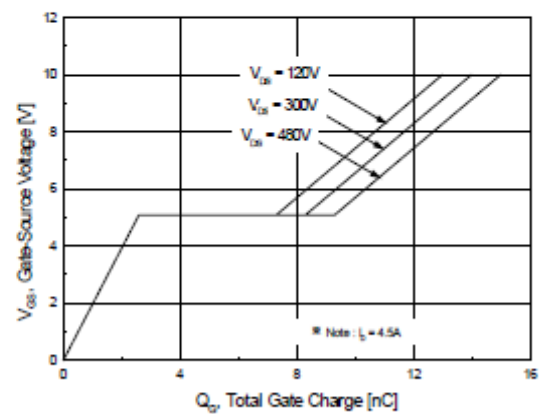
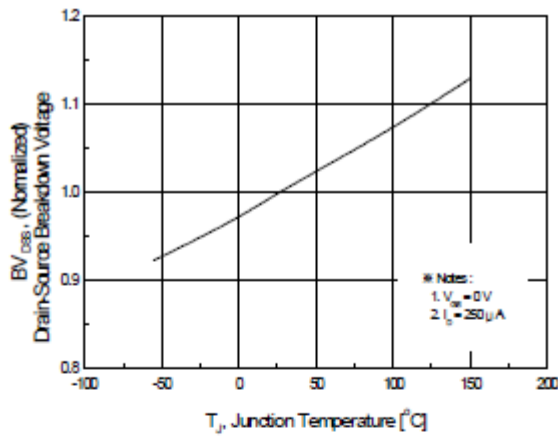
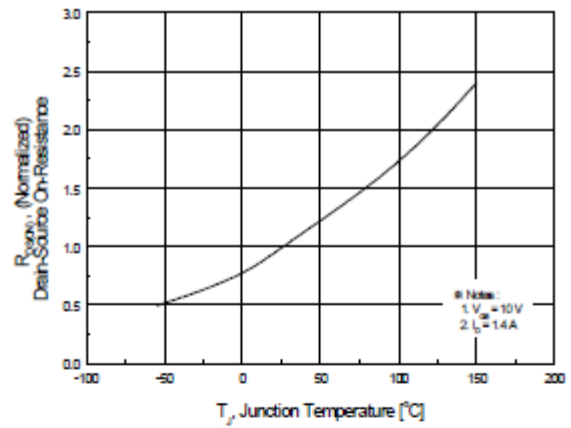


Figure 6. Gate Charge Characteristics

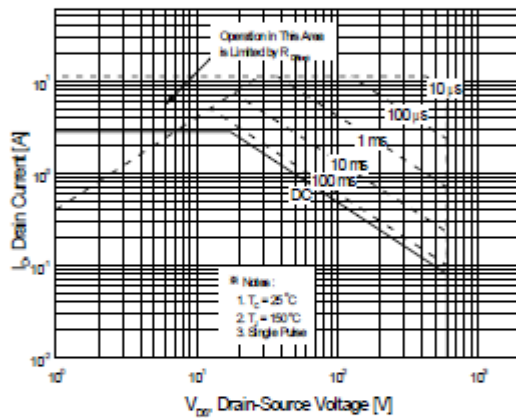
**Typical Characteristics (Continued)**



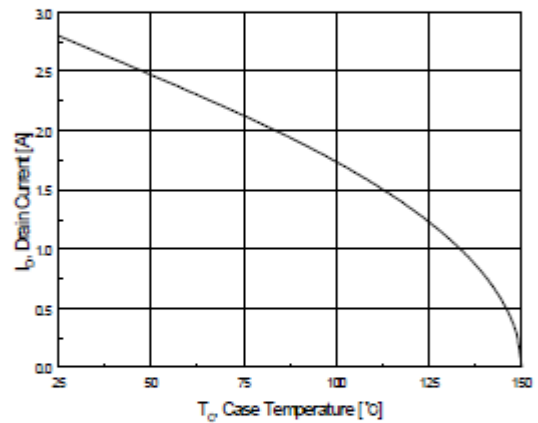
**Figure 7. Breakdown Voltage Variation vs Temperature**



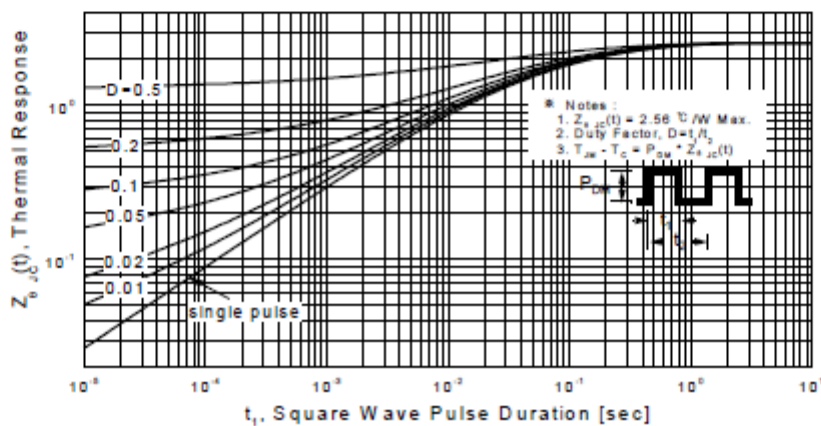
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9. Maximum Safe Operating Area**

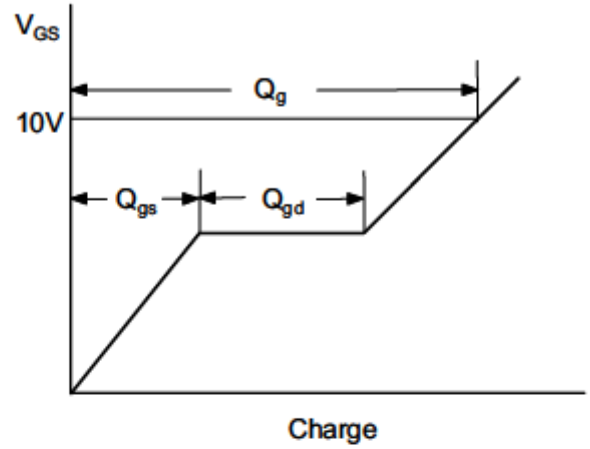
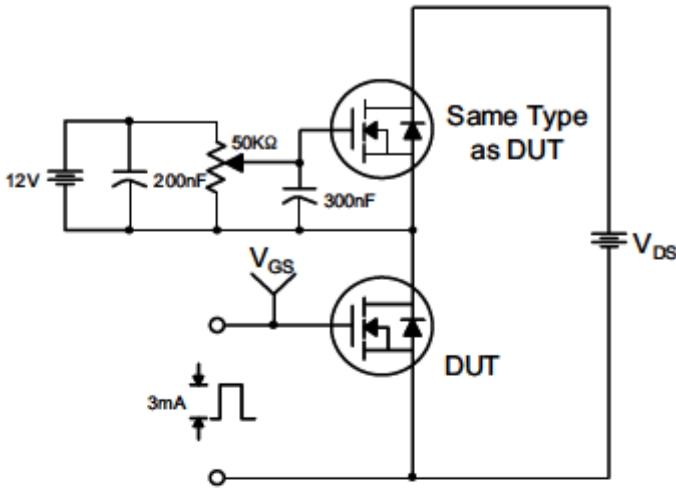


**Figure 10. Maximum Drain Current vs Case Temperature**

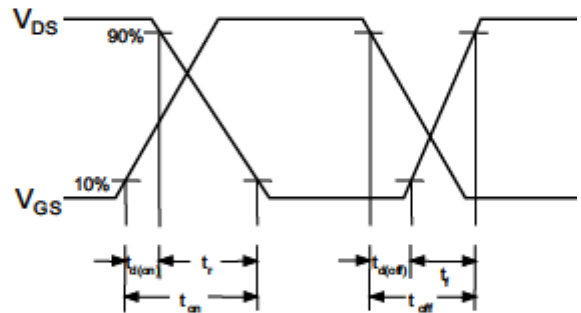
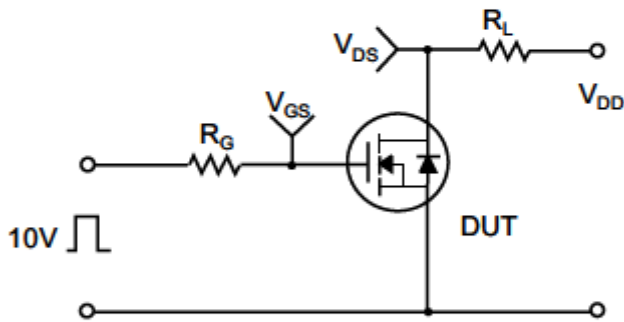


**Figure 11. Transient Thermal Response Curve**

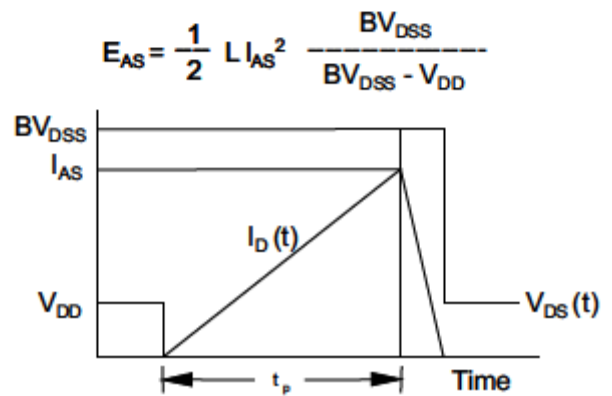
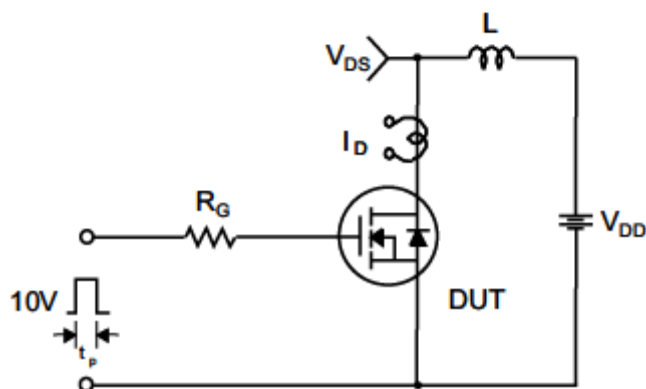
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**



Peak Diode Recovery dv/dt Test Circuit & Waveforms

