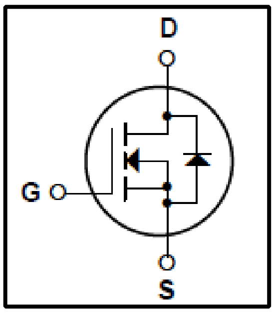
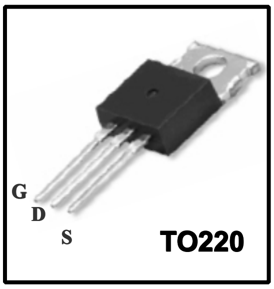
# WFP9N20

## *Silicon N-Channel MOSFET*



### Features

- ■ 9A, 200V, $R_{DS(on)}$(Max 0.4Ω)@$V_{GS}$=10V
- ■ Ultra-low Gate Charge(Typical 43nC)
- ■ Fast Switching Capability
- ■ 100%Avalanche Tested
- ■ Maximum Junction Temperature Range(150℃)



### General Description

This Power MOSFET is produced using Winsemi's advanced planar stripe, DMOS technology. This latest technology has been especially designed to minimize on-state resistance, have a high rugged avalanche characteristics. This devices is specially well suited for low voltage applications such as automotive, high efficiency switching for DC/DC converters, and DC motor control.

### Absolute Maximum Ratings

| Symbol | Parameter | | Value | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain Source Voltage | | 200 | V |
| $I_D$ | Continuous Drain Current(@Tc=25℃) | | 9 | A |
| | Continuous Drain Current(@Tc=100℃) | | 5.7 | A |
| $I_{DM}$ | Drain Current Pulsed | (Note1) | 36 | A |
| $V_{GS}$ | Gate to Source Voltage | | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 160 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy | (Note 1) | 7.2 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 5.5 | V/ns |
| $P_D$ | Total Power Dissipation(@Tc=25℃) | | 72 | W |
| | Derating Factor above 25℃ | | 0.57 | W/℃ |
| $T_J$, $T_{stg}$ | Junction and Storage Temperature | | -55~150 | ℃ |
| $T_L$ | Maximum lead Temperature for soldering purposes | | 300 | ℃ |

### Thermal Characteristics

| Symbol | Parameter | Value | | | Units |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| $R_{QJC}$ | Thermal Resistance, Junction-to-Case | - | - | 1.74 | ℃/W |
| $R_{QCS}$ | Thermal Resistance, Case to Sink | - | 0.5 | - | ℃/W |
| $R_{QJA}$ | Thermal Resistance, Junction-to-Ambient | - | - | 62.5 | ℃/W |

## Electrical Characteristics (Tc = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±30 V, $V_{DS}$ = 0 V | - | - | ±100 | nA |
| Gate−source breakdown voltage | | $V_{(BR)GSS}$ | $I_G$ = ±10 μA, $V_{DS}$ = 0 V | ±30 | - | - | V |
| Drain cut−off current | | $I_{DSS}$ | $V_{DS}$ = 200 V, $V_{GS}$ = 0 V | - | - | 10 | μA |
| Drain−source breakdown voltage | | $V_{(BR)DSS}$ | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 200 | - | - | V |
| Break Voltage Temperature Coefficient | | $\Delta BV_{DSS}/\Delta T_J$ | $I_D$=250μA, Referenced to 25℃ | - | 0.2 | - | V/℃ |
| Gate threshold voltage | | $V_{GS(th)}$ | $V_{DS}$ = 10 V, $I_D$ =250 μA | 2 | - | 4 | V |
| Drain−source ON resistance | | $R_{DS(ON)}$ | $V_{GS}$ = 10 V, $I_D$ = 5.4A | - | - | 0.4 | Ω |
| Forward Transconductance | | gfs | $V_{DS}$ = 50 V, $I_D$ =5.4A | 3.8 | - | - | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = 25 V, | - | 800 | - | pF |
| Reverse transfer capacitance | | $C_{rss}$ | $V_{GS}$ = 0 V, | - | 240 | - | |
| Output capacitance | | $C_{oss}$ | f = 1 MHz | - | 76 | - | |
| Switching time | Rise time | $t_r$ | $V_{DD}$ =100 V, | - | 9.4 | - | ns |
| | Turn−on time | $t_{on}$ | $I_D$ = 5.9 A | - | 28 | - | |
| | Fall time | $t_f$ | $R_G$=12 Ω | - | 39 | - | |
| | Turn−off time | $t_{off}$ | (Note4,5) | - | 20 | - | |
| Total gate charge (gate−source plus gate−drain) | | $Q_g$ | $V_{DD}$ = 160 V, | - | 43 | - | nC |
| Gate−source charge | | $Q_{gs}$ | $V_{GS}$ = 10 V,<br>$I_D$ = 5.9 A | - | 7 | - | |
| Gate−drain (“miller”) Charge | | $Q_{gd}$ | (Note4,5) | - | 23 | - | |

## Source−Drain Ratings and Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|
| Continuous drain reverse current | $I_{DR}$ | - | - | - | 9 | A |
| Pulse drain reverse current | $I_{DRP}$ | - | - | - | 36 | A |
| Forward voltage (diode) | $V_{DSF}$ | $I_{DR}$ = 9 A, VGS = 0 V | - | 1.4 | 2.0 | V |
| Reverse recovery time | $t_{rr}$ | $I_{DR}$ = 5.9A, VGS = 0 V, | - | 170 | 340 | ns |
| Reverse recovery charge | $Q_{rr}$ | $dI_{DR}$ / dt = 100 A / μs | - | 1.1 | 2.2 | μC |

Note 1.Repeativity rating :pulse width limited by junction temperature
2.L=500uH,$I_{AS}$=9 A,$V_{DD}$=50V,$R_G$=0Ω,Starting $T_J$=25℃
3.$I_{SD}$≤9A,di/dt≤300A/us, $V_{DD}$<$BV_{DSS}$,STARTING TJ=25℃
4.Pulse Test: Pulse Width≤300us,Duty Cycle≤2%
5.Essentially independent of operating temperature.

This transistor is an electrostatic sensitive device
Please handle with caution

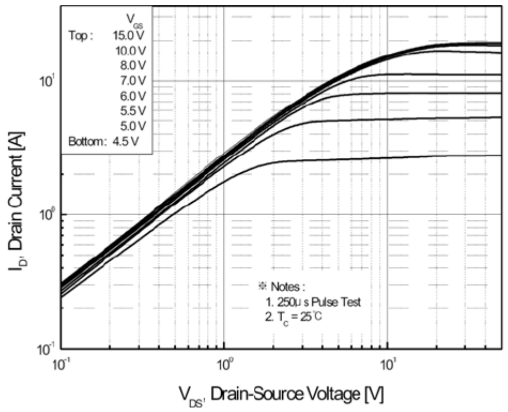


Fig. 1 On-State Characteristics

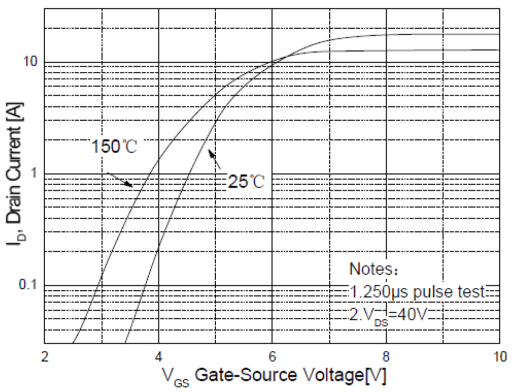


Fig.2 Transfer Characteristics

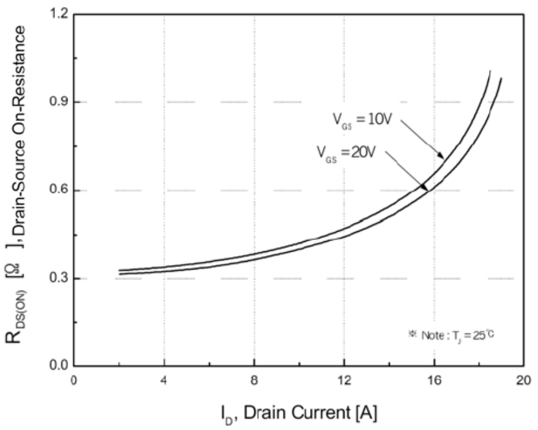


Fig.3 On-Resistance Variation vs Drain Current

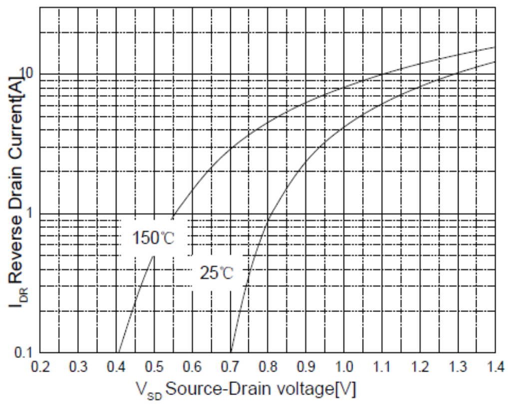


Fig.4 Body Diode Forward Voltage Variation vs. Source Current and Temperature

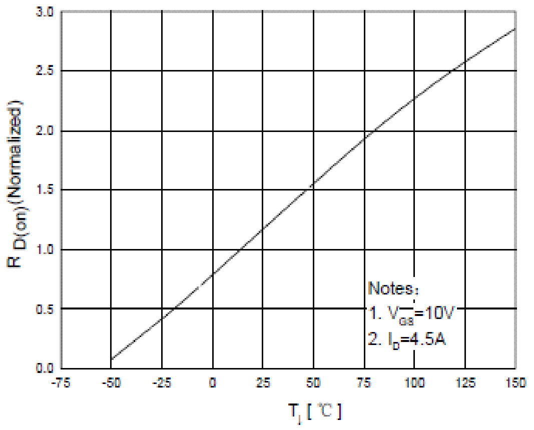


Fig.5 On-Resistance Variation vs Junction Temperature

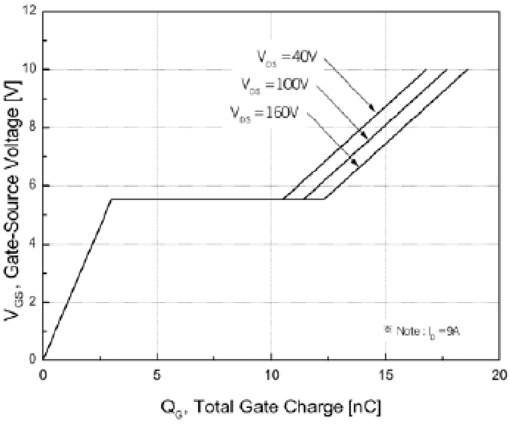


Fig.6 Gate Charge Characteristics

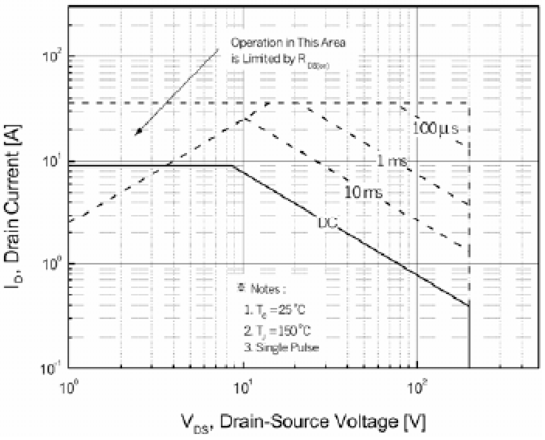


Fig.7 Maximum Safe Operation Area

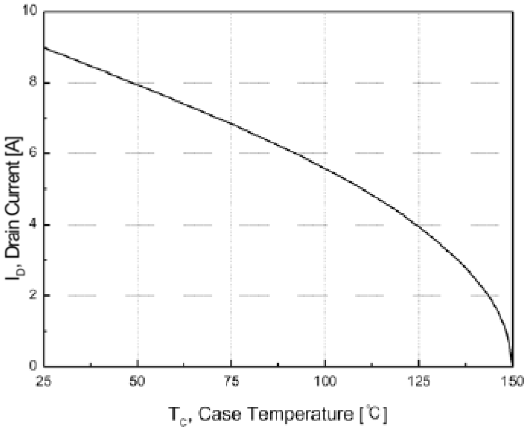


Fig.8 Maximum Drain Current vs Case Temperature

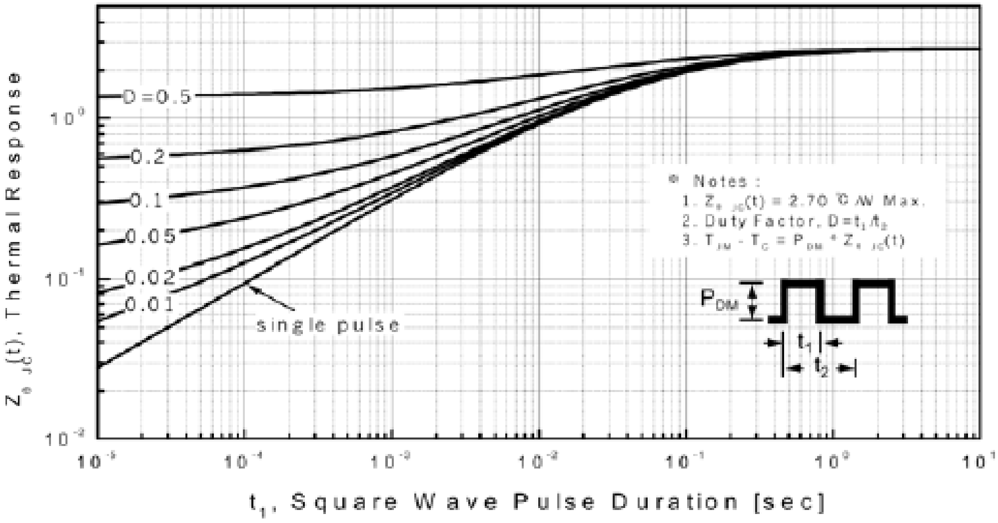


Fig.9 Transient Thermal Response Curve

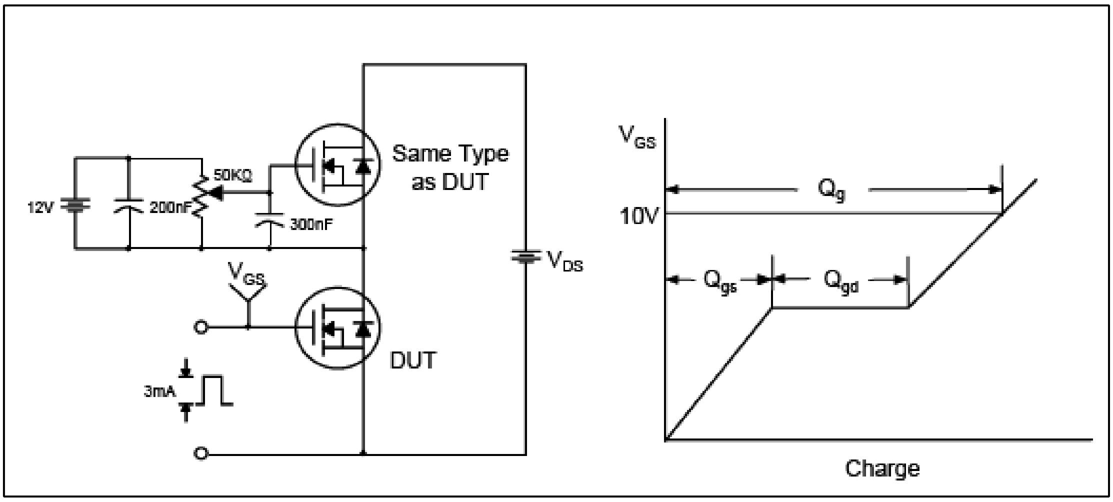


Fig.10 Gate Test Circuit & Waveform

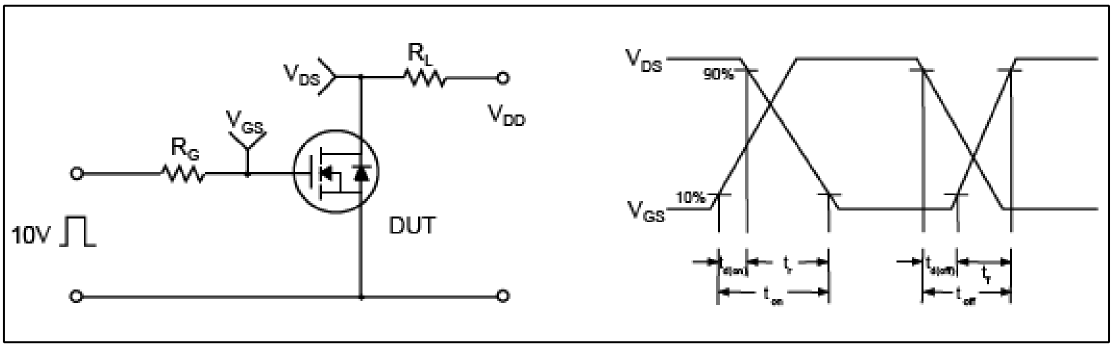


Fig.11 Resistive Switching Test Circuit & Waveform

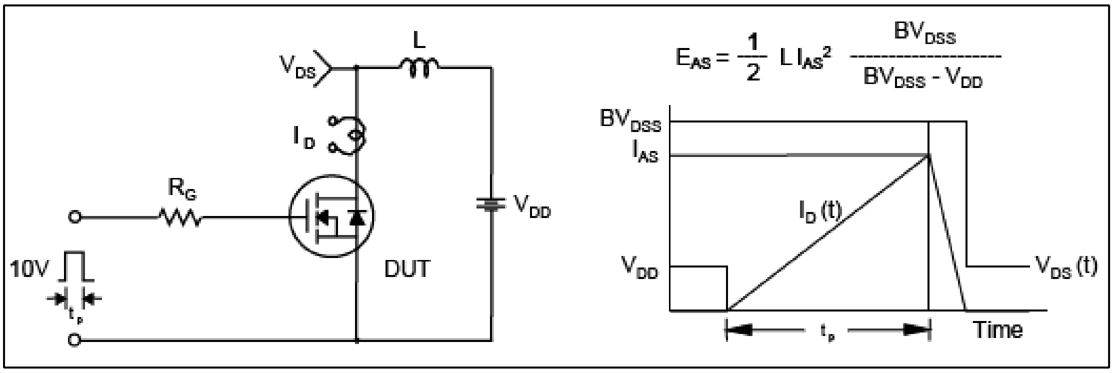


Fig.12 Unclamped Inductive Switching Test Circuit & Waveform

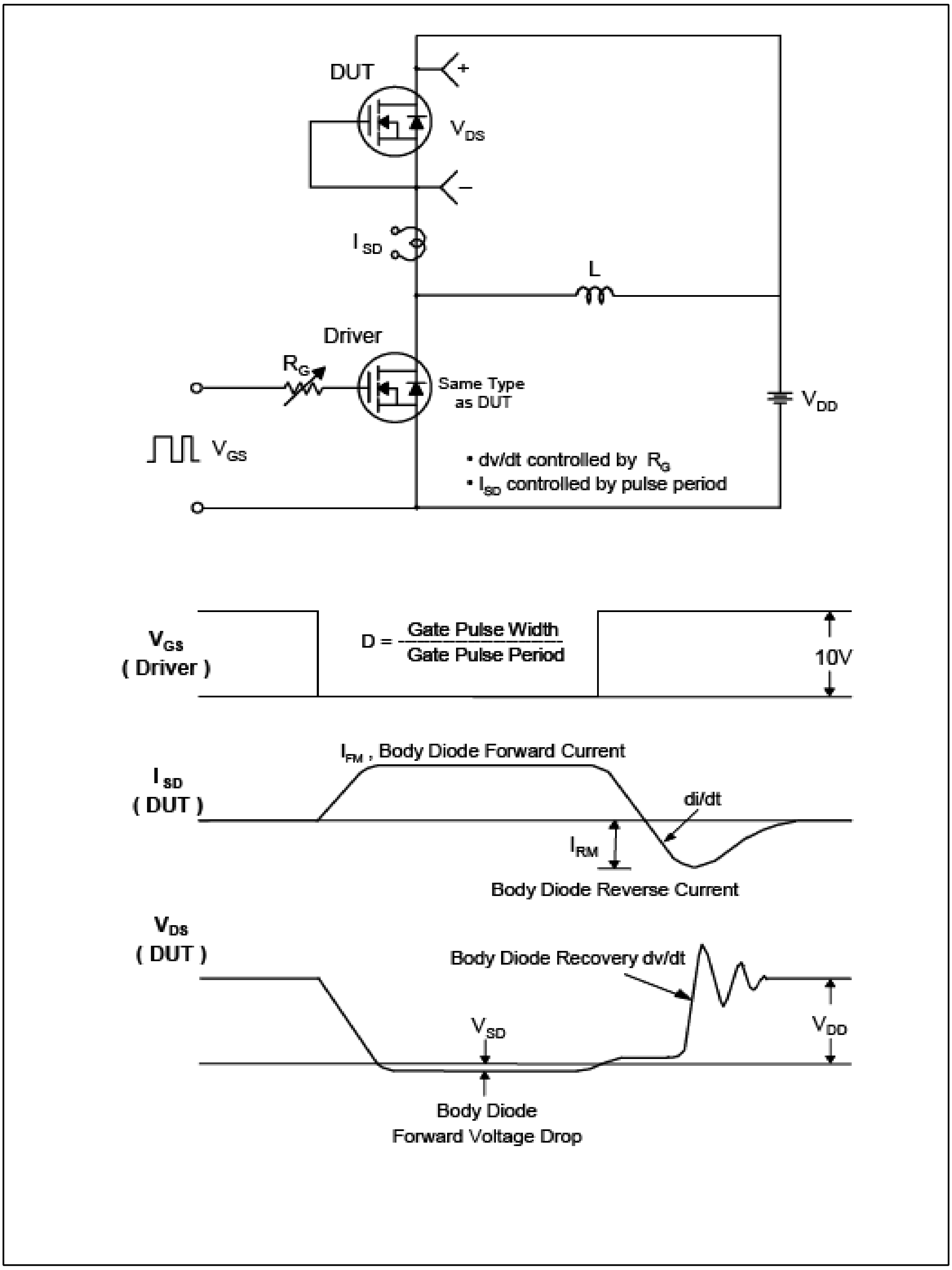


**Fig.13 Peak Diode Recovery dv/dt Test Circuit & Waveform**

## TO-220 Package Dimension

Unit: mm