

## Logic N-Channel MOSFET

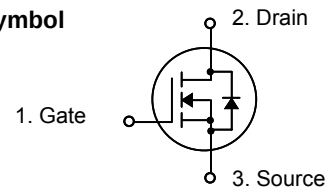
### Features

- Low  $R_{DS(on)}$  ( $0.0135\Omega$ )@ $V_{GS}=10V$
- Low Gate Charge (Typical 21.5nC)
- Low  $C_{rss}$  (Typical 130pF)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Maximum Junction Temperature Range (175°C)

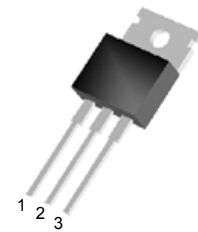
### General Description

This Power MOSFET is produced using SemiWell's advanced planar stripe, DMOS technology. This latest technology has been especially designed to minimize on-state resistance, have a low gate charge with superior switching performance, and rugged avalanche characteristics. This Power MOSFET is well suited for synchronous DC-DC Converters and Power Management in portable and battery operated products.

#### Symbol



#### TO-220



### Absolute Maximum Ratings

| Symbol         | Parameter                                                                    | Value      | Units         |
|----------------|------------------------------------------------------------------------------|------------|---------------|
| $V_{DSS}$      | Drain to Source Voltage                                                      | 30         | V             |
| $I_D$          | Continuous Drain Current(@ $T_C = 25^\circ C$ )                              | 60         | A             |
|                | Continuous Drain Current(@ $T_C = 100^\circ C$ )                             | 43         | A             |
| $I_{DM}$       | Drain Current Pulsed (Note 1)                                                | 240        | A             |
| $V_{GS}$       | Gate to Source Voltage                                                       | $\pm 20$   | V             |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                      | 270        | mJ            |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)                                           | 7.0        | V/ns          |
| $P_D$          | Total Power Dissipation(@ $T_C = 25^\circ C$ )                               | 100        | W             |
|                | Derating Factor above $25^\circ C$                                           | 0.67       | W/ $^\circ C$ |
| $T_{STG}, T_J$ | Operating Junction Temperature & Storage Temperature                         | - 55 ~ 175 | $^\circ C$    |
| $T_L$          | Maximum Lead Temperature for soldering purpose, 1/8 from Case for 5 seconds. | 300        | $^\circ C$    |

### Thermal Characteristics

| Symbol          | Parameter                               | Value |      |      | Units        |
|-----------------|-----------------------------------------|-------|------|------|--------------|
|                 |                                         | Min.  | Typ. | Max. |              |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | -     | -    | 1.50 | $^\circ C/W$ |
| $R_{\theta CS}$ | Thermal Resistance, Case to Sink        | -     | 0.5  | -    | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -     | -    | 62.5 | $^\circ C/W$ |

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

| Symbol                                    | Parameter                                      | Test Conditions                                                                                  | Min | Typ   | Max    | Units |
|-------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------|-----|-------|--------|-------|
| Off Characteristics                       |                                                |                                                                                                  |     |       |        |       |
| BV <sub>DSS</sub>                         | Drain-Source Breakdown Voltage                 | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250uA                                                     | 30  | -     | -      | V     |
| Δ BV <sub>DSS</sub> /<br>Δ T <sub>J</sub> | Breakdown Voltage Temperature coef-<br>ficient | I <sub>D</sub> = 250uA, referenced to 25 °C                                                      | -   | 0.02  | -      | V/°C  |
| I <sub>DSS</sub>                          | Drain-Source Leakage Current                   | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V                                                      | -   | -     | 1      | uA    |
|                                           |                                                | V <sub>DS</sub> = 24V, T <sub>C</sub> = 150 °C                                                   | -   | -     | 10     | uA    |
| I <sub>GSS</sub>                          | Gate-Source Leakage, Forward                   | V <sub>GS</sub> = 20V, V <sub>DS</sub> = 0V                                                      |     |       | 100    | nA    |
|                                           | Gate-Source Leakage, Reverse                   | V <sub>GS</sub> = -20V, V <sub>DS</sub> = 0V                                                     | -   | -     | -100   | nA    |
| On Characteristics                        |                                                |                                                                                                  |     |       |        |       |
| V <sub>GS(th)</sub>                       | Gate Threshold Voltage                         | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250uA                                       | 1.0 | -     | 3.0    | V     |
| R <sub>DS(ON)</sub>                       | Static Drain-Source On-state Resis-<br>tance   | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30A                                                     | -   | 0.011 | 0.0135 | Ω     |
|                                           |                                                | V <sub>GS</sub> = 5 V, I <sub>D</sub> = 30A                                                      | -   | 0.015 | 0.019  |       |
| Dynamic Characteristics                   |                                                |                                                                                                  |     |       |        |       |
| C <sub>iss</sub>                          | Input Capacitance                              | V <sub>GS</sub> = 0 V, V <sub>DS</sub> =25V, f = 1MHz                                            | -   | 1010  | 1320   | pF    |
| C <sub>oss</sub>                          | Output Capacitance                             |                                                                                                  | -   | 450   | 585    |       |
| C <sub>rss</sub>                          | Reverse Transfer Capacitance                   |                                                                                                  | -   | 130   | 170    |       |
| Dynamic Characteristics                   |                                                |                                                                                                  |     |       |        |       |
| t <sub>d(on)</sub>                        | Turn-on Delay Time                             | V <sub>DD</sub> =15V, I <sub>D</sub> =30A, R <sub>G</sub> =50Ω<br><br>✱ see fig. 13. (Note 4, 5) | -   | 20    | 50     | ns    |
| t <sub>r</sub>                            | Rise Time                                      |                                                                                                  | -   | 55    | 120    |       |
| t <sub>d(off)</sub>                       | Turn-off Delay Time                            |                                                                                                  | -   | 53    | 116    |       |
| t <sub>f</sub>                            | Fall Time                                      |                                                                                                  | -   | 75    | 160    |       |
| Q <sub>g</sub>                            | Total Gate Charge                              | V <sub>DS</sub> =24V, V <sub>GS</sub> =5V, I <sub>D</sub> =60A<br><br>✱ see fig. 12. (Note 4, 5) | -   | 21.5  | 28     | nC    |
| Q <sub>gs</sub>                           | Gate-Source Charge                             |                                                                                                  | -   | 3.6   | -      |       |
| Q <sub>gd</sub>                           | Gate-Drain Charge(Miller Charge)               |                                                                                                  | -   | 10.7  | -      |       |

## Source-Drain Diode Ratings and Characteristics

| Symbol          | Parameter                 | Test Conditions                                                           | Min. | Typ. | Max. | Unit. |
|-----------------|---------------------------|---------------------------------------------------------------------------|------|------|------|-------|
| I <sub>S</sub>  | Continuous Source Current | Integral Reverse p-n Junction Diode in the MOSFET                         | -    | -    | 60   | A     |
| I <sub>SM</sub> | Pulsed Source Current     |                                                                           | -    | -    | 240  |       |
| V <sub>SD</sub> | Diode Forward Voltage     | I <sub>S</sub> = 60A, V <sub>GS</sub> = 0V                                | -    | -    | 1.5  | V     |
| t <sub>rr</sub> | Reverse Recovery Time     | I <sub>S</sub> = 60A, V <sub>GS</sub> = 0V, dI <sub>F</sub> /dt = 100A/us | -    | 40   | -    | ns    |
| Q <sub>rr</sub> | Reverse Recovery Charge   |                                                                           | -    | 35   | -    | nC    |

### \* NOTES

1. Repeativity rating : pulse width limited by junction temperature
2. L = 75uH, I<sub>AS</sub> = 60A, V<sub>DD</sub> = 15V, R<sub>G</sub> = 0Ω, Starting T<sub>J</sub> = 25°C
3. ISD ≤ 60A, di/dt ≤ 300A/us, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test : Pulse Width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially independent of operating temperature.



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Fig 1. On-State Characteristics

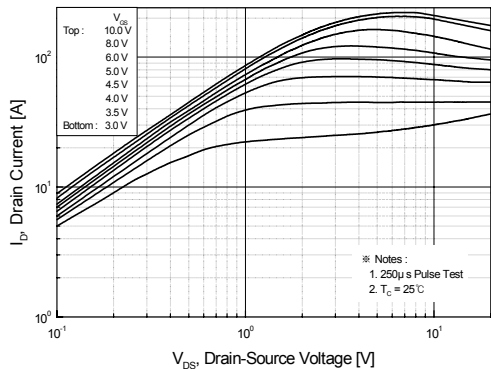


Fig 2. Transfer Characteristics

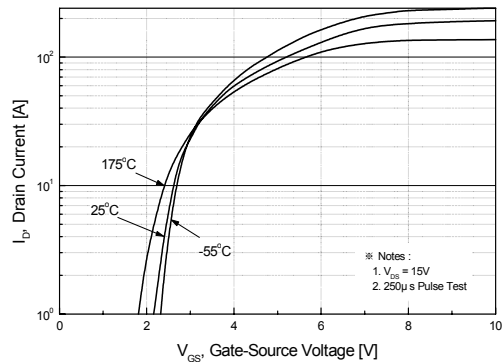


Fig 3. On Resistance Variation vs. Drain Current and Gate Voltage

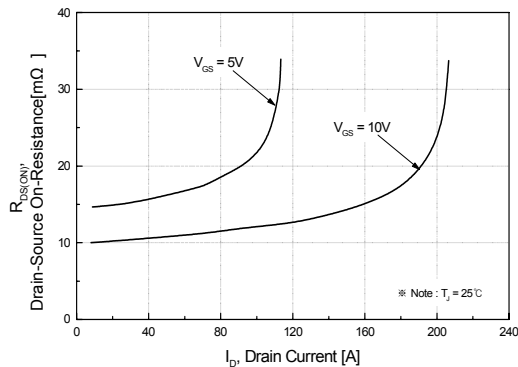


Fig 4. On State Current vs. Allowable Case Temperature

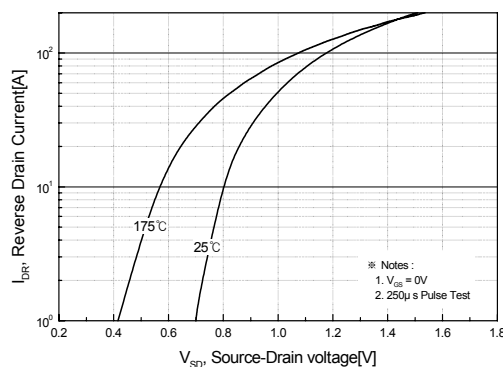


Fig 5. Capacitance Characteristics (Non-Repetitive)

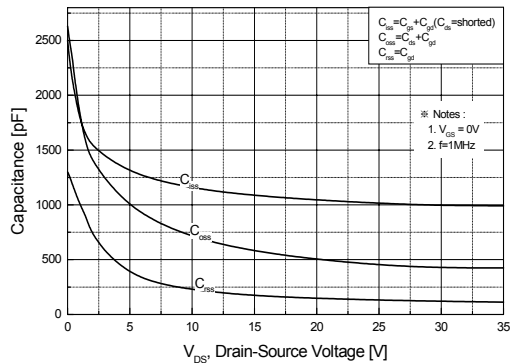
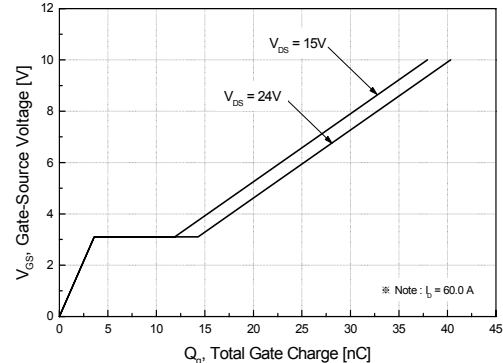


Fig 6. Gate Charge Characteristics



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Fig 7. Breakdown Voltage Variation vs. Junction Temperature

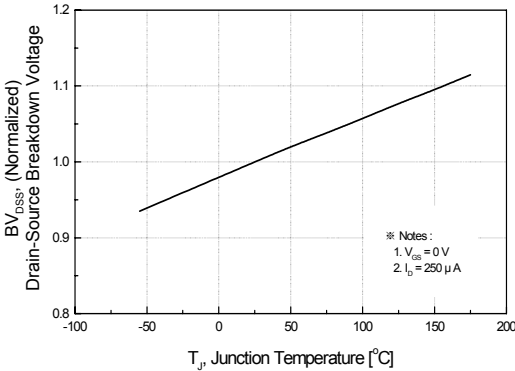


Fig 8. On-Resistance Variation vs. Junction Temperature

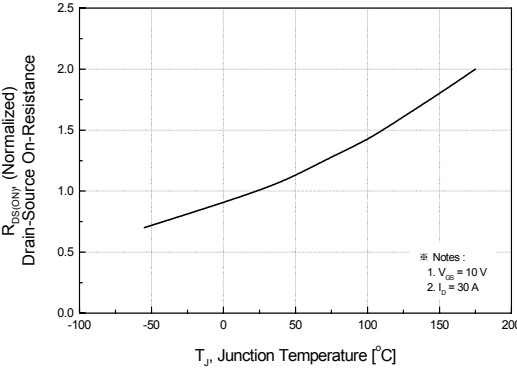


Fig 9. Maximum Safe Operating Area

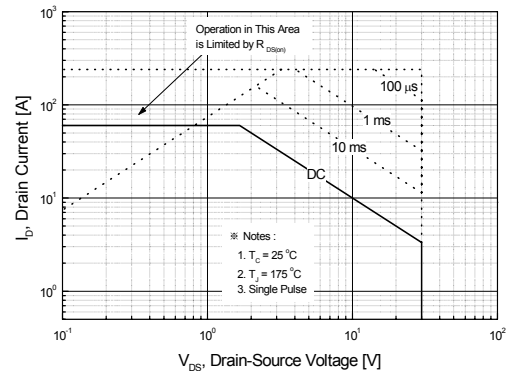


Fig 10. Maximum Drain Current vs. Case Temperature

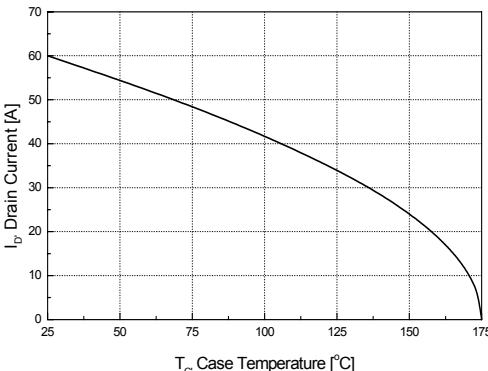
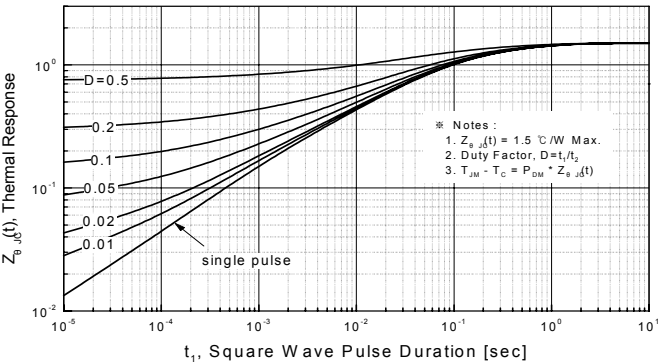


Fig 11. Transient Thermal Response Curve



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Fig. 12. Gate Charge Test Circuit & Waveforms

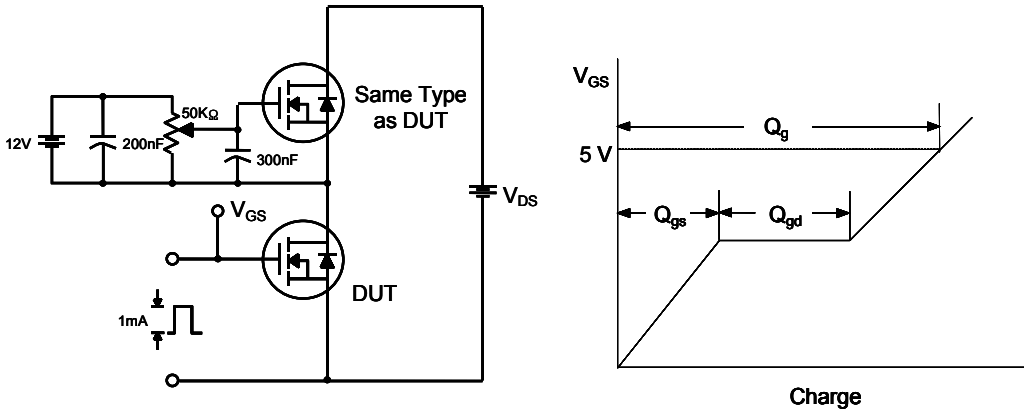


Fig. 13. Switching Time Test Circuit & Waveforms

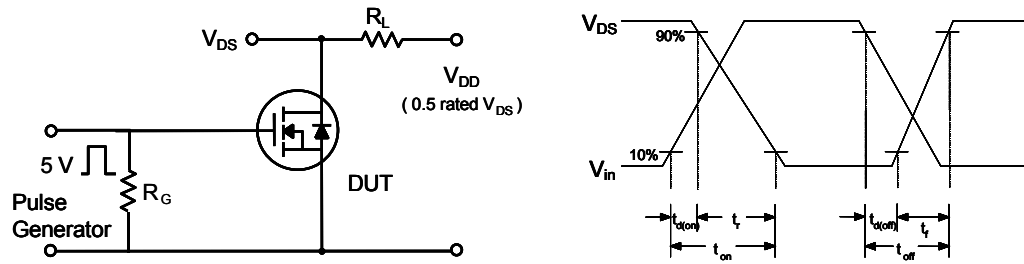
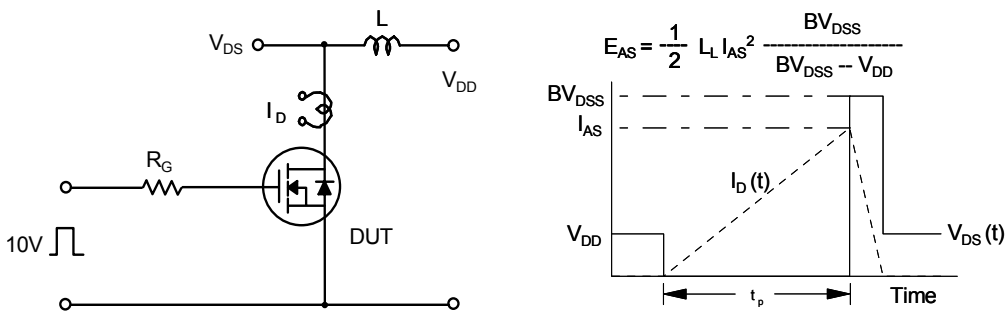
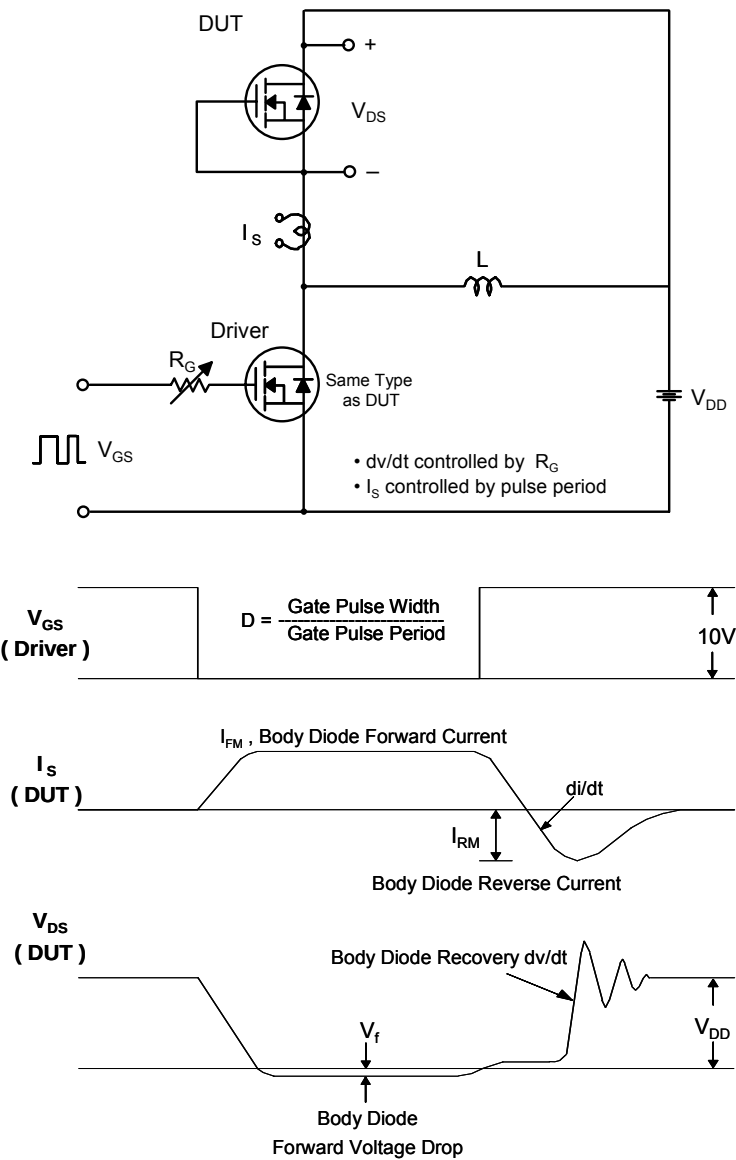


Fig. 14. Unclamped Inductive Switching Test Circuit & Waveforms



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Fig. 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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## TO-220 Package Dimension

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| Dim. | mm   |      |      | Inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | Min. | Typ. | Max. | Min.  | Typ.  | Max.  |
| A    | 9.7  |      | 10.1 | 0.382 |       | 0.398 |
| B    | 6.3  |      | 6.7  | 0.248 |       | 0.264 |
| C    | 9.0  |      | 9.47 | 0.354 |       | 0.373 |
| D    | 12.8 |      | 13.3 | 0.504 |       | 0.524 |
| E    | 1.2  |      | 1.4  | 0.047 |       | 0.055 |
| F    |      | 1.7  |      |       | 0.067 |       |
| G    |      | 2.5  |      |       | 0.098 |       |
| H    | 3.0  |      | 3.4  | 0.118 |       | 0.134 |
| I    | 1.25 |      | 1.4  | 0.049 |       | 0.055 |
| J    | 2.4  |      | 2.7  | 0.094 |       | 0.106 |
| K    | 5.0  |      | 5.15 | 0.197 |       | 0.203 |
| L    | 2.2  |      | 2.6  | 0.087 |       | 0.102 |
| M    | 1.25 |      | 1.55 | 0.049 |       | 0.061 |
| N    | 0.45 |      | 0.6  | 0.018 |       | 0.024 |
| O    | 0.6  |      | 1.0  | 0.024 |       | 0.039 |
| Ø    |      | 3.6  |      |       | 0.142 |       |

