

## N-Channel and P-Channel Enhancement Mode Power MOSFET

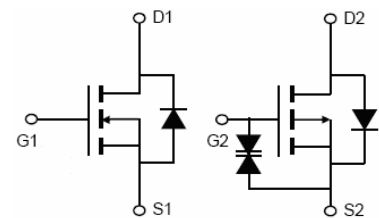
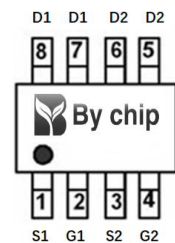
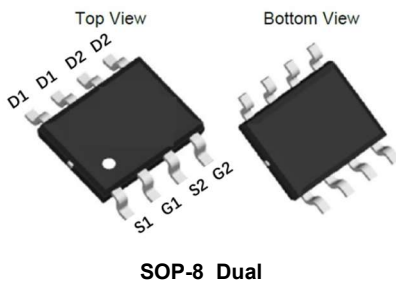
### Features

- N-Channel: 60V, 5A  
 $R_{DS(ON)} < 28 \text{ m}\Omega @ V_{GS} = 10\text{V}$   
 $R_{DS(ON)} < 31 \text{ m}\Omega @ V_{GS} = 4.5\text{V}$
- P-Channel: -60V, -3.1A  
 $R_{DS(ON)} < 62 \text{ m}\Omega @ V_{GS} = -10\text{V}$   
 $R_{DS(ON)} < 72 \text{ m}\Omega @ V_{GS} = -4.5\text{V}$

### General Features

- Advanced Trench Technology
- Provide Excellent  $R_{DS(ON)}$  and Low Gate Charge
- Lead Free and Green Available

*100% UIS TESTED!*  
*100%  $\Delta V_{ds}$  TESTED!*



### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , unless otherwise noted

| Parameter  | Symbol           | NMOS       | PMOS       | Unit             |
|--|------------------|------------|------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$         | 60         | -60        | V                |
| Continuous Drain Current                         | $I_D$            | 5          | -3.1       | A                |
| Pulsed Drain Current                             | $I_{DM}$ (note1) | 20         | -12.4      | A                |
| Gate-Source Voltage                              | $V_{GS}$         | $\pm 20$   | $\pm 20$   | V                |
| Power Dissipation                                | $P_D$            | 2.5        | 1.9        | W                |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$   | -55 To 150 | -55 To 150 | $^\circ\text{C}$ |

### Thermal Resistance

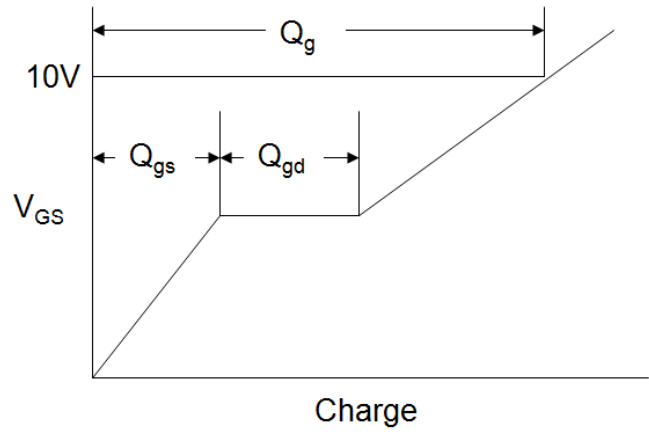
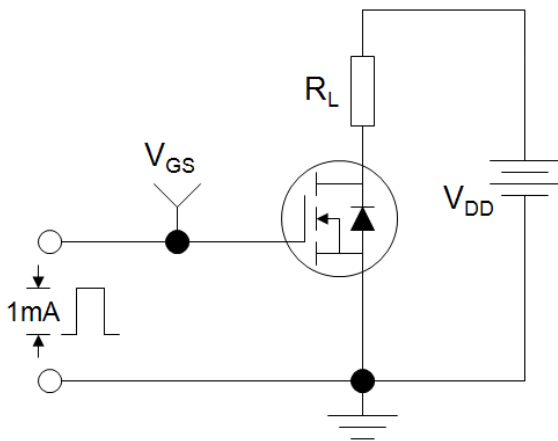
| Parameter                               | Symbol     | NMOS | PMOS | Unit               |
|---|------------|------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 50   | 65   | $^\circ\text{C/W}$ |

| NMOS Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted |               |  |       |      |           |            |
|---|---------------|--|-------|------|-----------|------------|
| Parameter   | Symbol        | Test Conditions  | Value |      |           | Unit       |
|   |               |  | Min.  | Typ. | Max.      |            |
| <b>Static Parameters</b>  |               |  |       |      |           |            |
| Drain-Source Breakdown Voltage  | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$                            | 60    | --   | --        | V          |
| Zero Gate Voltage Drain Current                                       | $I_{DSS}$     | $V_{DS} = 60V, V_{GS} = 0V, T_J = 25^\circ\text{C}$      | --    | --   | 1         | $\mu A$    |
| Gate-Source Leakage   | $I_{GSS}$     | $V_{GS} = \pm 20V$                                       | --    | --   | $\pm 100$ | nA         |
| Gate-Source Threshold Voltage   | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu A$                        | 1.0   |      | 2.5       | V          |
| Drain-Source On-Resistance  | $R_{DS(on)}$  | $V_{GS} = 10V, I_D = 4.3A$                               | --    |      | 28        | m $\Omega$ |
|   |               | $V_{GS} = 4.5V, I_D = 3.9A$                              | --    |      | 31        |            |
| Forward Transconductance  | $g_{FS}$      | $V_{DS}=5V, I_D=4.3A$                                    | --    | 9.6  | --        | S          |
| <b>Dynamic Parameters</b>   |               |  |       |      |           |            |
| Input Capacitance   | $C_{iss}$     | $V_{GS} = 0V,$<br>$V_{DS} = 30V,$<br>$f = 1.0\text{MHz}$ | --    | 1336 | --        | pF         |
| Output Capacitance  | $C_{oss}$     |  | --    | 56   | --        |            |
| Reverse Transfer Capacitance  | $C_{rss}$     |  | --    | 52   | --        |            |
| Total Gate Charge   | $Q_g$         | $V_{DS} = 30V,$<br>$I_D = 5A,$<br>$V_{GS} = 10V$         | --    | 22   | --        | nC         |
| Gate-Source Charge  | $Q_{gs}$      |  | --    | 3.3  | --        |            |
| Gate-Drain Charge   | $Q_{gd}$      |  | --    | 5.2  | --        |            |
| Turn-on Delay Time  | $t_{d(on)}$   | $V_{DD} = 30V,$<br>$I_D = 5A,$<br>$R_G = 3\Omega$        | --    | 5.2  | --        | ns         |
| Turn-on Rise Time   | $t_r$         |  | --    | 3    | --        |            |
| Turn-off Delay Time   | $t_{d(off)}$  |  | --    | 17   | --        |            |
| Turn-off Fall Time  | $t_f$         |  | --    | 2.5  | --        |            |
| <b>Drain-Source Body Diode Characteristics</b>                        |               |  |       |      |           |            |
| Body Diode Voltage  | $V_{SD}$      | $T_J = 25^\circ\text{C}, I_{SD} = 1.7A, V_{GS} = 0V$     | --    | --   | 1.2       | V          |
| Continuous Body Diode Current   | $I_S$         | $T_C = 25^\circ\text{C}$                                 | --    | --   | 5         | A          |

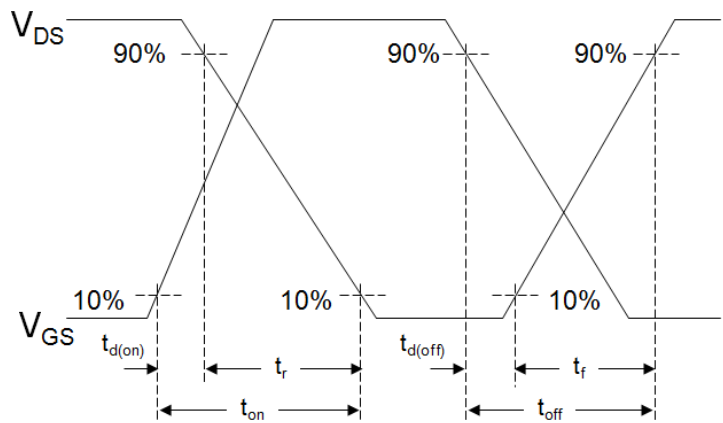
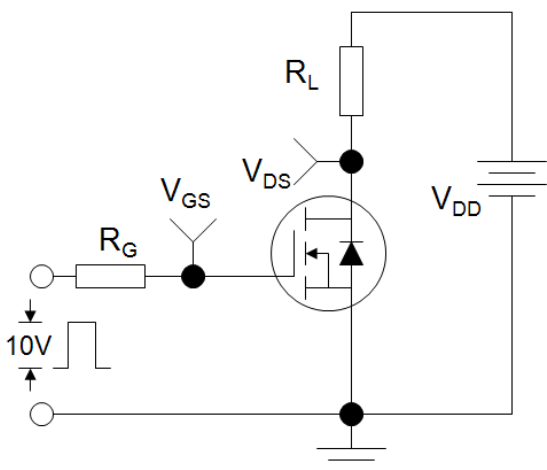
**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. Identical low side and high side switch with identical  $R_G$

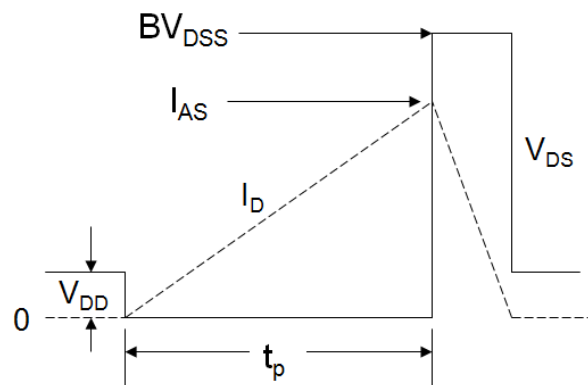
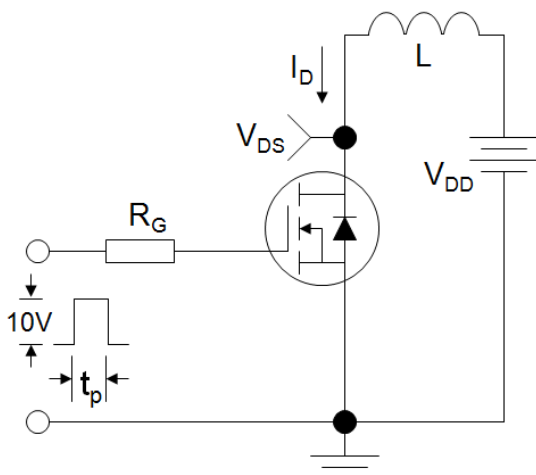
Gate Charge Test Circuit



Switch Time Test Circuit



EAS Test Circuit



NMOS Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 1. Output Characteristics

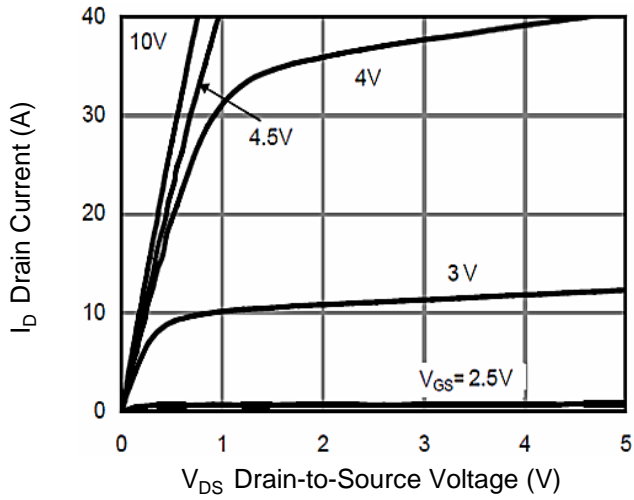


Figure 2. Transfer Characteristics

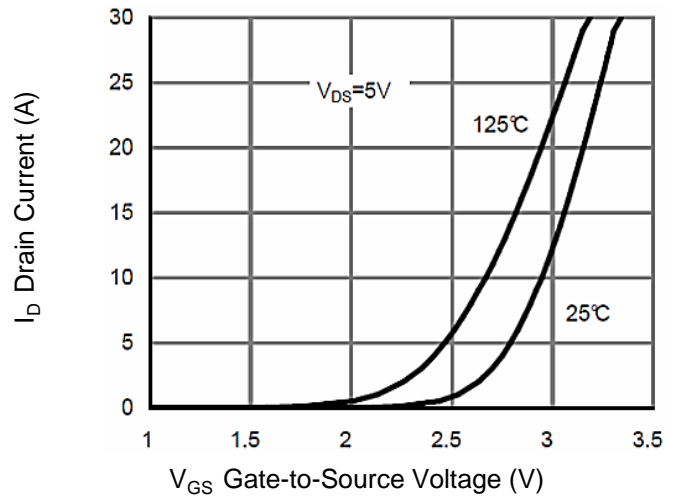


Figure 3. Drain-Source On-Resistance

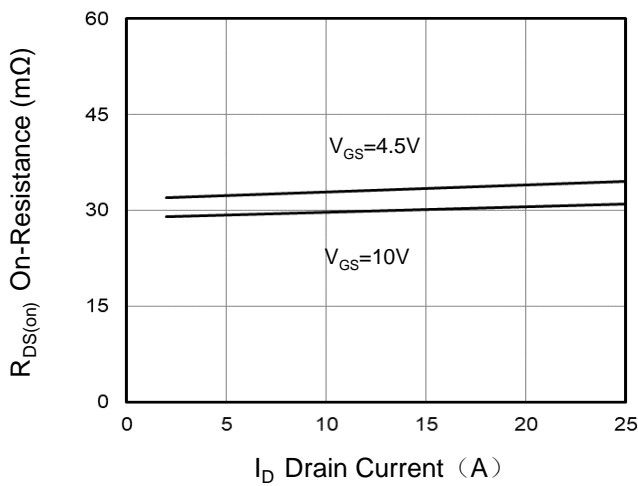


Figure 4. Gate Charge

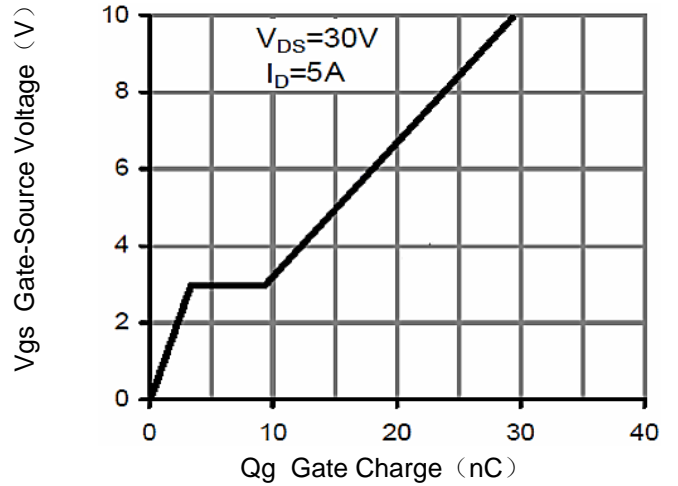


Figure 5. Capacitance

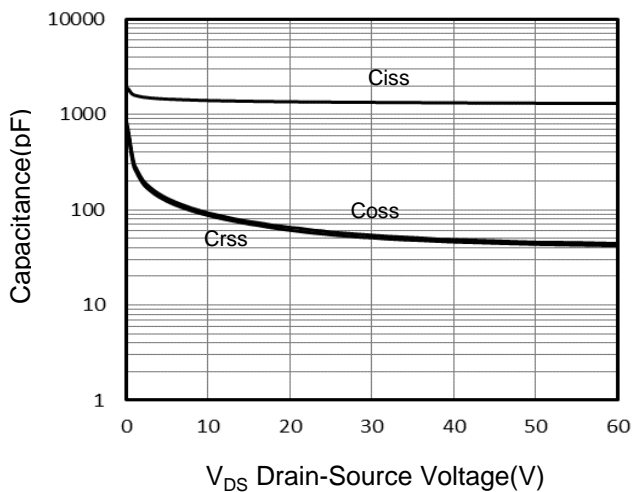
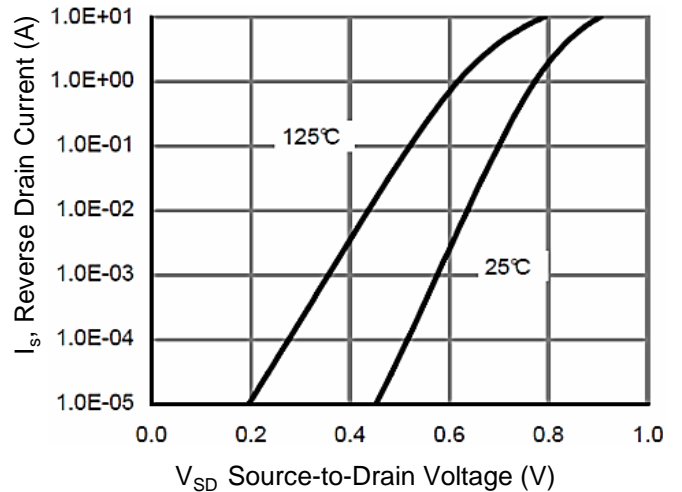
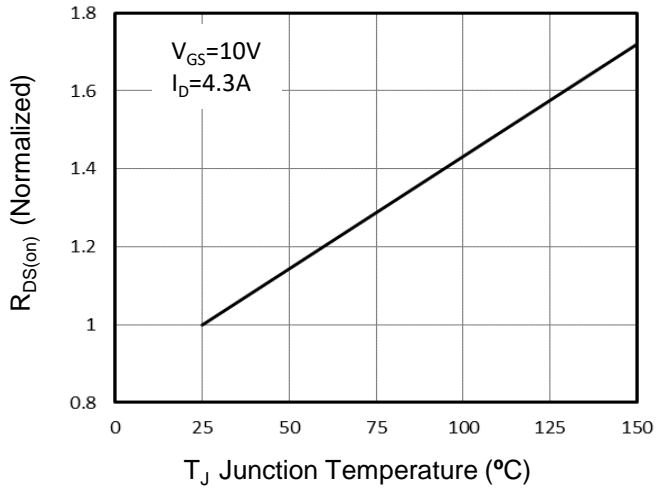


Figure 6. Source-Drain Diode Forward

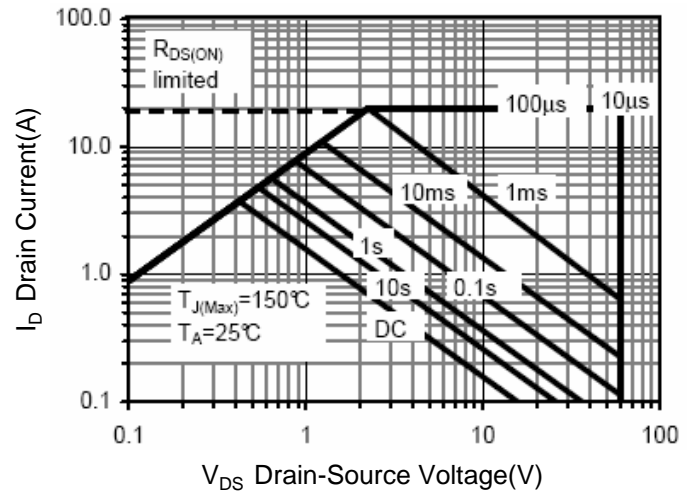


**NMOS Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

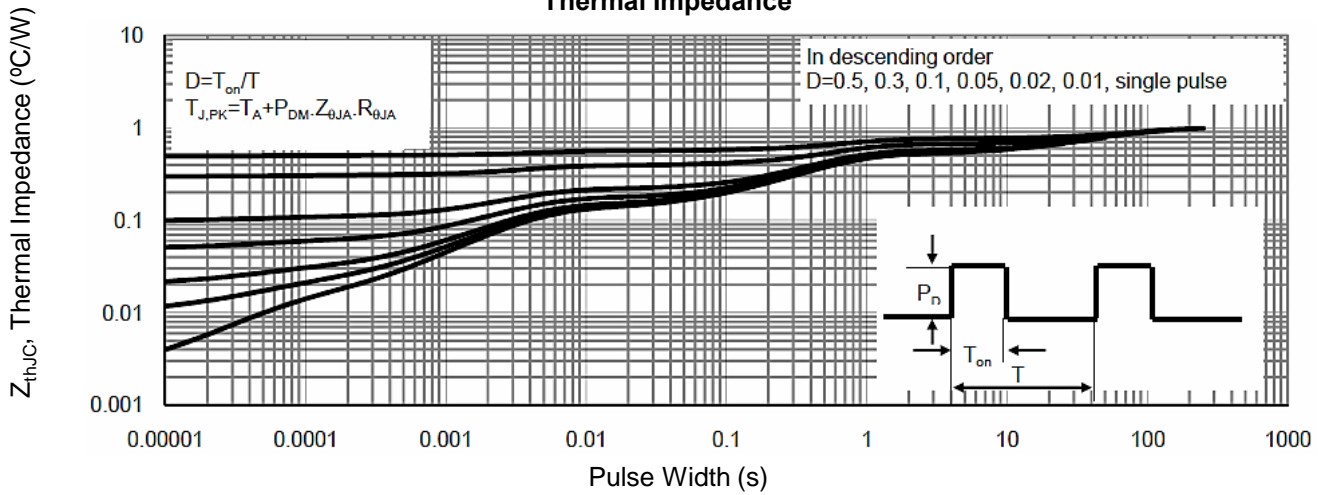
**Figure 7. Drain-Source On-Resistance**



**Figure 8. Safe Operation Area**



**Figure 9. Normalized Maximum Transient Thermal Impedance**

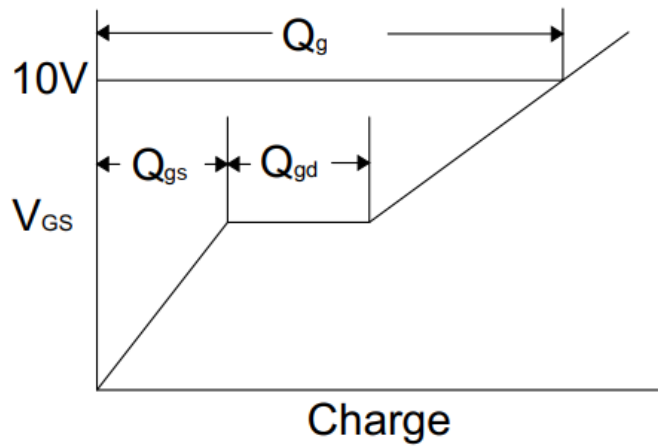
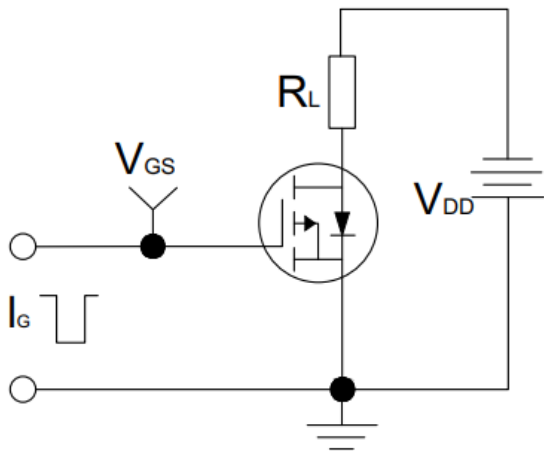


| PMOS Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted |               |   |       |      |           |               |
|---|---------------|---|-------|------|-----------|---------------|
| Parameter   | Symbol        | Test Conditions   | Value |      |           | Unit          |
|   |               |   | Min.  | Typ. | Max.      |               |
| <b>Static Parameters</b>  |               |   |       |      |           |               |
| Drain-Source Breakdown Voltage  | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -250\mu\text{A}$                      | -60   | --   | --        | V             |
| Zero Gate Voltage Drain Current                                       | $I_{DSS}$     | $V_{DS} = -60V, V_{GS} = 0V, T_J = 25^\circ\text{C}$      | --    | --   | -1        | $\mu\text{A}$ |
| Gate-Source Leakage   | $I_{GSS}$     | $V_{GS} = \pm 20V$  | --    | --   | $\pm 100$ | nA            |
| Gate-Source Threshold Voltage   | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = -250\mu\text{A}$                  | -1.0  |      | -2.5      | V             |
| Drain-Source On-Resistance  | $R_{DS(on)}$  | $V_{GS} = -10V, I_D = -3.1A$                              | --    |      | 62        | m $\Omega$    |
|   |               | $V_{GS} = -4.5V, I_D = -0.2A$                             | --    |      | 72        |               |
| Forward Transconductance  | $g_{FS}$      | $V_{DS} = -5V, I_D = -3.1A$                               | --    | 6.6  | --        | S             |
| <b>Dynamic Parameters</b>   |               |   |       |      |           |               |
| Input Capacitance   | $C_{iss}$     | $V_{GS} = 0V,$<br>$V_{DS} = -30V,$<br>$f = 1.0\text{MHz}$ | --    | 1454 | --        | pF            |
| Output Capacitance  | $C_{oss}$     |   | --    | 62   | --        |               |
| Reverse Transfer Capacitance  | $C_{rss}$     |   | --    | 58   | --        |               |
| Total Gate Charge   | $Q_g$         | $V_{DD} = -30V,$<br>$I_D = -3A,$<br>$V_{GS} = -10V$       | --    | 37   | --        | nC            |
| Gate-Source Charge  | $Q_{gs}$      |   | --    | 4.5  | --        |               |
| Gate-Drain Charge   | $Q_{gd}$      |   | --    | 10.5 | --        |               |
| Turn-on Delay Time  | $t_{d(on)}$   | $V_{DD} = -30V,$<br>$I_D = -3A,$<br>$R_G = 3\Omega$       | --    | 8    | --        | ns            |
| Turn-on Rise Time   | $t_r$         |   | --    | 4    | --        |               |
| Turn-off Delay Time   | $t_{d(off)}$  |   | --    | 32   | --        |               |
| Turn-off Fall Time  | $t_f$         |   | --    | 7    | --        |               |
| <b>Drain-Source Body Diode Characteristics</b>                        |               |   |       |      |           |               |
| Continuous Body Diode Current   | $I_S$         | $T_C = 25^\circ\text{C}$                                  | --    | --   | -3.1      | A             |
| Body Diode Voltage  | $V_{SD}$      | $T_J = 25^\circ\text{C}, I_{SD} = -2A, V_{GS} = 0V$       | --    | --   | -1.2      | V             |

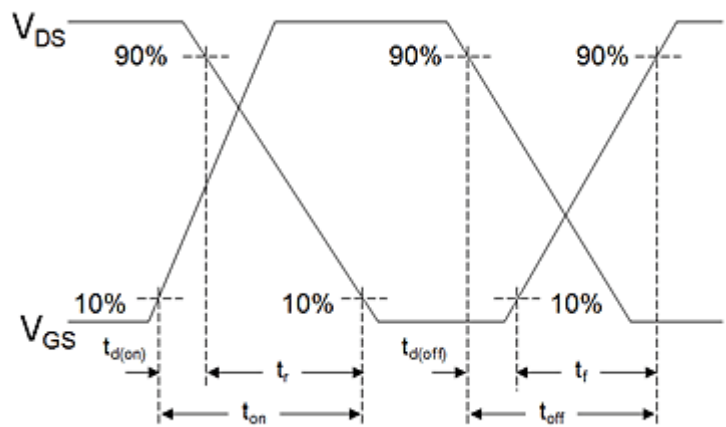
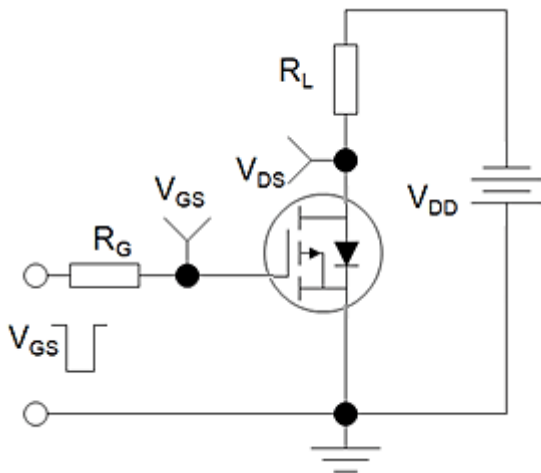
**Notes**

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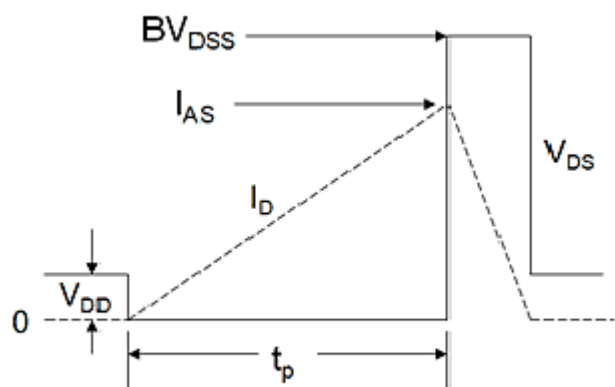
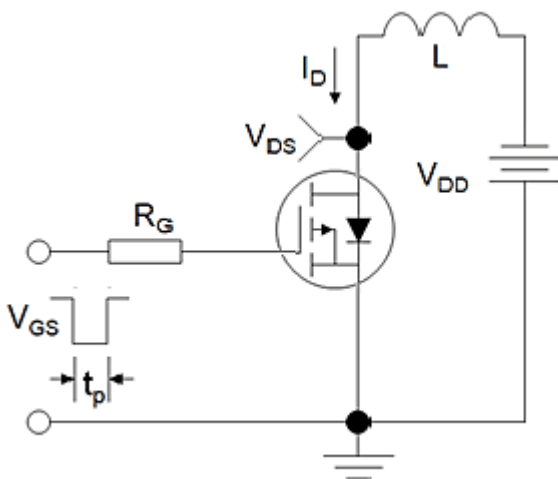
Gate Charge Test Circuit



Switch Time Test Circuit



EAS Test Circuit



PMOS Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 1. Output Characteristics

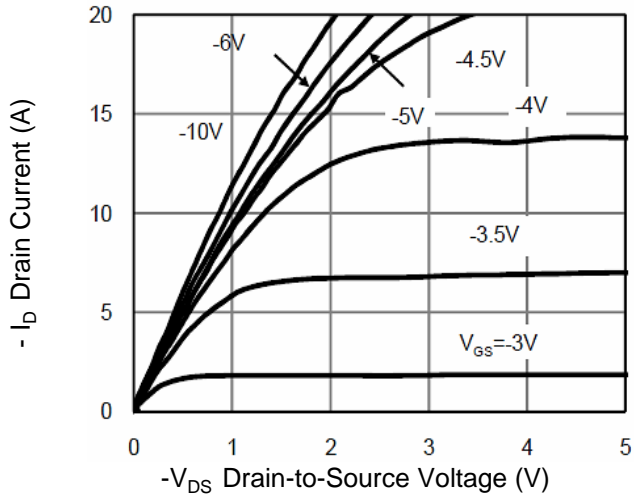


Figure 2. Transfer Characteristics

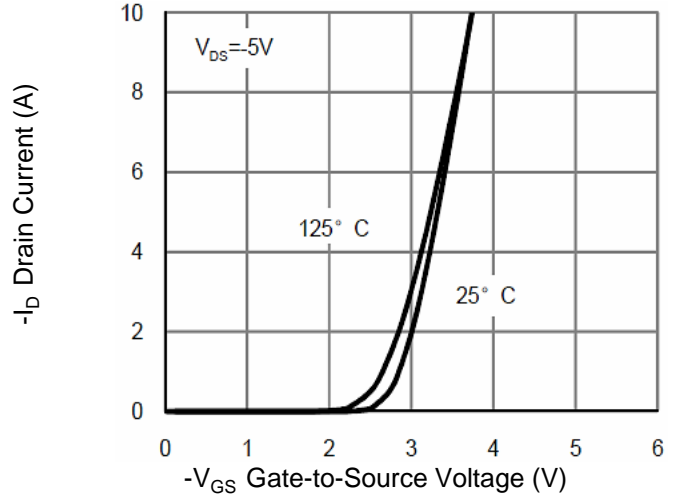


Figure 3.  $R_{DS(on)}$ -Drain Current

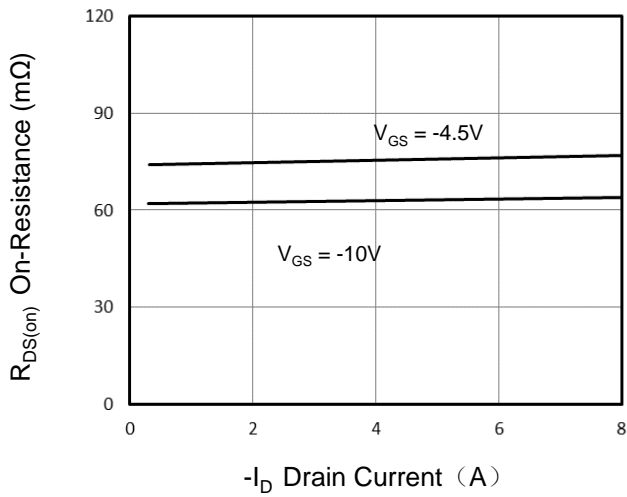


Figure 4. Gate Charge

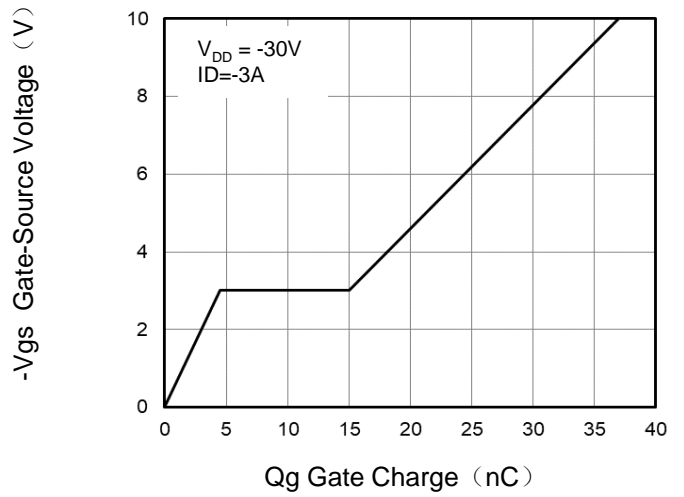


Figure 5. Capacitance

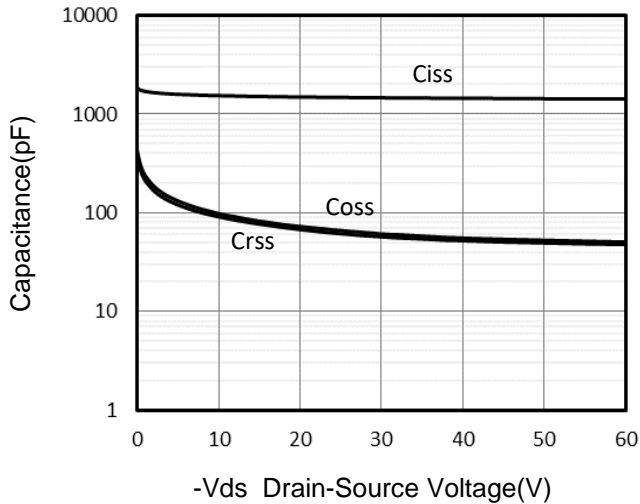
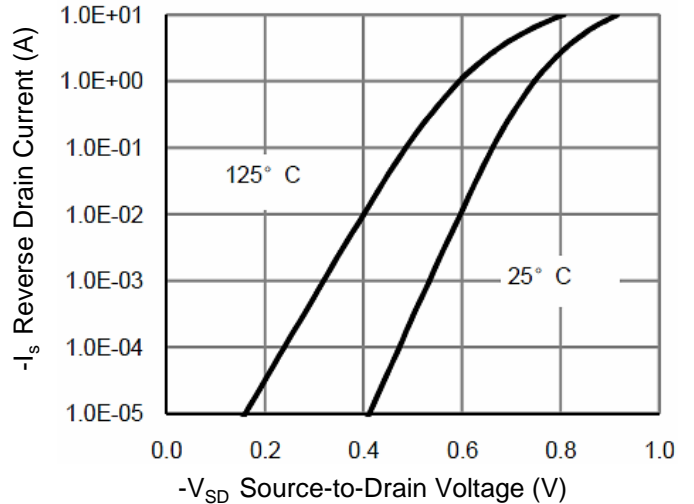


Figure 6. Source-Drain Diode Forward





PMOS Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 7. Drain-Source On-Resistance

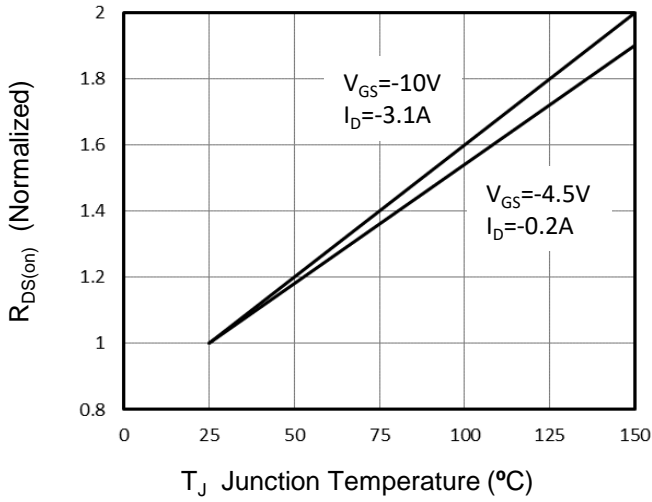


Figure 8. Safe Operation Area

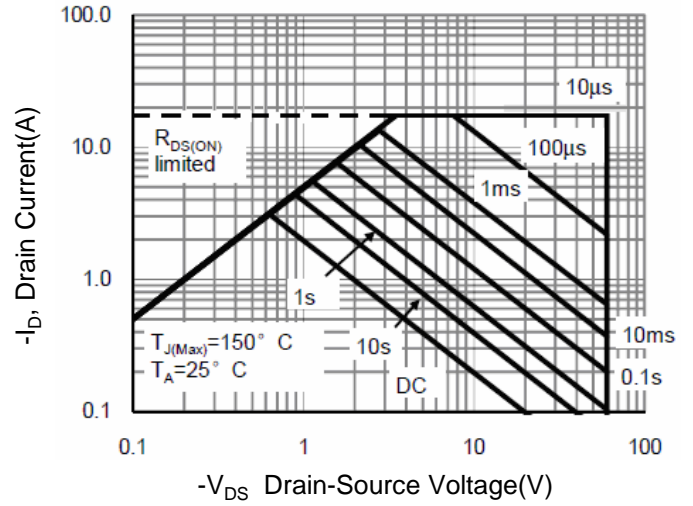


Figure 9. Normalized Maximum Transient Thermal Impedance

