

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

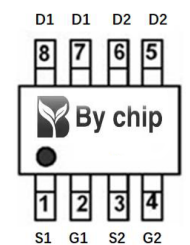
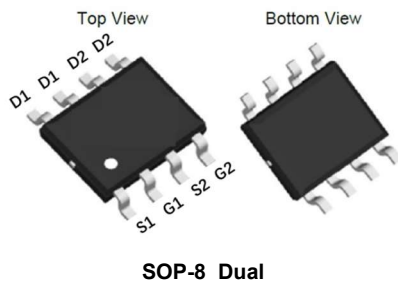
### Features

- 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  
 $R_{DS(ON)} < 62 \text{ m}\Omega @ V_{GS} = -10\text{V}$   
 $R_{DS(ON)} < 72 \text{ m}\Omega @ V_{GS} = -4.5\text{V}$

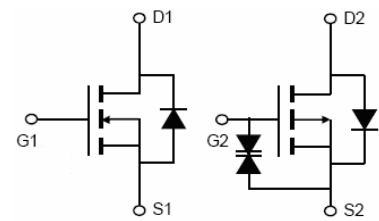
### General Features

- 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!**



**Pin Assignment**



**Schematic diagram**

### 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 (note1)                     | $I_{DM}$       | 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

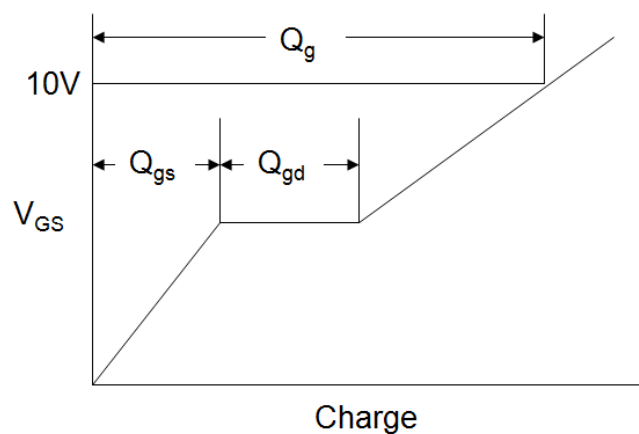
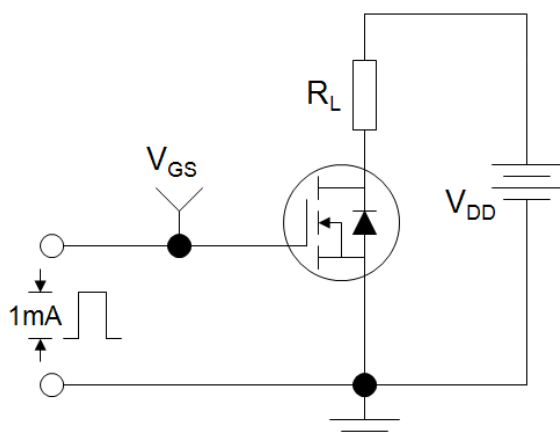
| Parameter                               | Symbol     | NMOS | PMOS | Unit               |
|-----------------------------------------|------------|------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 50   | 65   | $^\circ\text{C/W}$ |

| NMOS Specifications   T <sub>J</sub> = 25°C, unless otherwise noted |                      |                                                                         |       |      |      |      |
|---------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------|-------|------|------|------|
| Parameter                                                           | Symbol               | Test Conditions                                                         | Value |      |      | Unit |
|                                                                     |                      |                                                                         | Min.  | Typ. | Max. |      |
| Static Parameters                                                   |                      |                                                                         |       |      |      |      |
| Drain-Source Breakdown Voltage                                      | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                            | 60    | --   | --   | V    |
| Zero Gate Voltage Drain Current                                     | I <sub>DSS</sub>     | V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C      | --    | --   | 1    | μA   |
| Gate-Source Leakage                                                 | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20V                                                  | --    | --   | ±100 | nA   |
| Gate-Source Threshold Voltage                                       | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA              | 1.0   |      | 2.5  | V    |
| Drain-Source On-Resistance                                          | R <sub>DS(on)</sub>  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 4.3A                            | --    |      | 28   | mΩ   |
|                                                                     |                      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 3.9A                           | --    |      | 31   |      |
| Forward Transconductance                                            | g <sub>FS</sub>      | V <sub>DS</sub> =5V,I <sub>D</sub> =4.3A                                | --    | 9.6  | --   | S    |
| Dynamic Parameters                                                  |                      |                                                                         |       |      |      |      |
| Input Capacitance                                                   | C <sub>iss</sub>     | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = 30V,<br>f = 1.0MHz           | --    | 1336 | --   | pF   |
| Output Capacitance                                                  | C <sub>oss</sub>     |                                                                         | --    | 56   | --   |      |
| Reverse Transfer Capacitance                                        | C <sub>rss</sub>     |                                                                         | --    | 52   | --   |      |
| Total Gate Charge                                                   | Q <sub>g</sub>       | V <sub>DS</sub> = 30V,<br>I <sub>D</sub> = 5A,<br>V <sub>GS</sub> = 10V | --    | 22   | --   | nC   |
| Gate-Source Charge                                                  | Q <sub>gs</sub>      |                                                                         | --    | 3.3  | --   |      |
| Gate-Drain Charge                                                   | Q <sub>gd</sub>      |                                                                         | --    | 5.2  | --   |      |
| Turn-on Delay Time                                                  | t <sub>d(on)</sub>   | V <sub>DD</sub> = 30V,<br>I <sub>D</sub> = 5A,<br>R <sub>G</sub> = 3Ω   | --    | 5.2  | --   | ns   |
| Turn-on Rise Time                                                   | t <sub>r</sub>       |                                                                         | --    | 3    | --   |      |
| Turn-off Delay Time                                                 | t <sub>d(off)</sub>  |                                                                         | --    | 17   | --   |      |
| Turn-off Fall Time                                                  | t <sub>f</sub>       |                                                                         | --    | 2.5  | --   |      |
| Drain-Source Body Diode Characteristics                             |                      |                                                                         |       |      |      |      |
| Body Diode Voltage                                                  | V <sub>SD</sub>      | T <sub>J</sub> = 25°C, I <sub>SD</sub> = 1.7A, V <sub>GS</sub> = 0V     | --    | --   | 1.2  | V    |
| Continuous Body Diode Current                                       | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                   | --    | --   | 5    | A    |

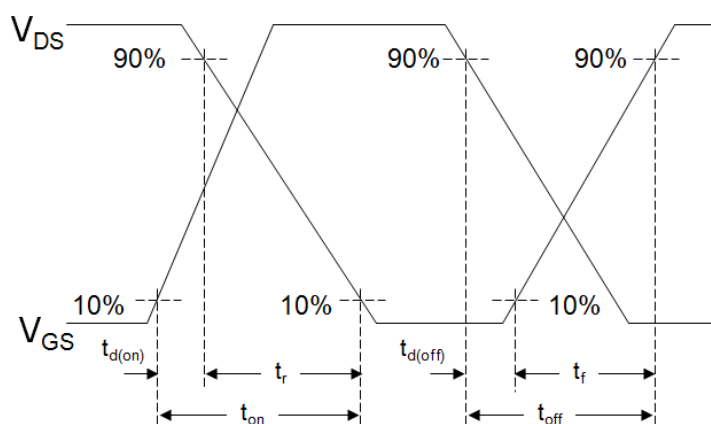
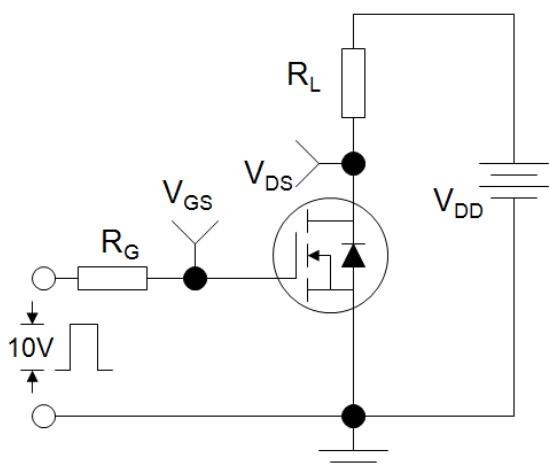
#### Notes

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

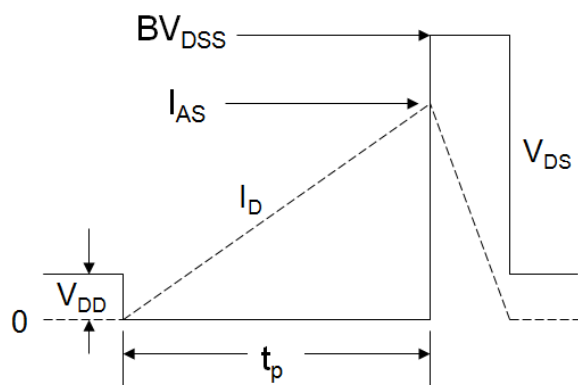
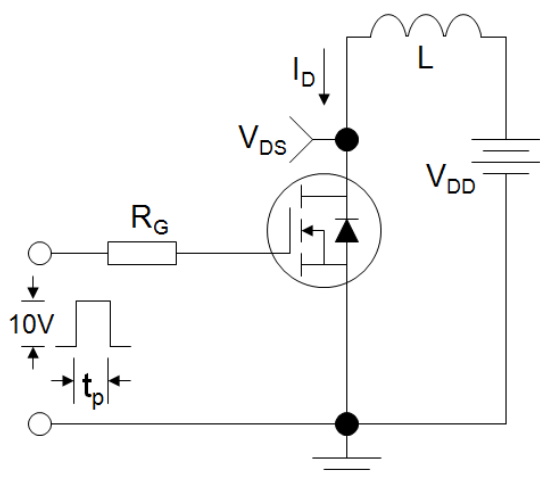
### Gate Charge Test Circuit



### Switch Time Test Circuit

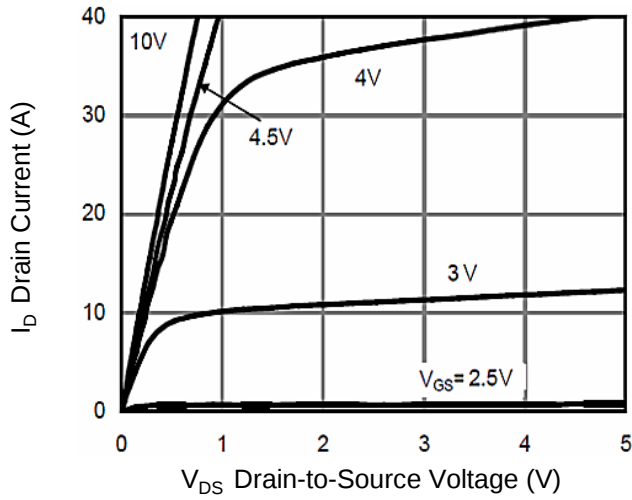


### EAS Test Circuit

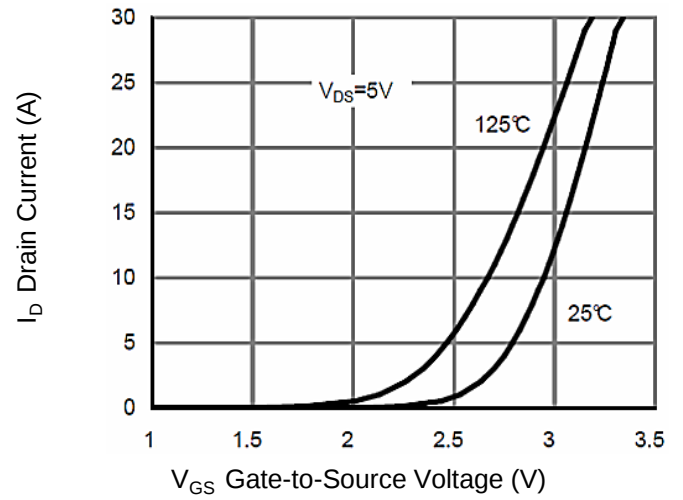


**NMOS Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

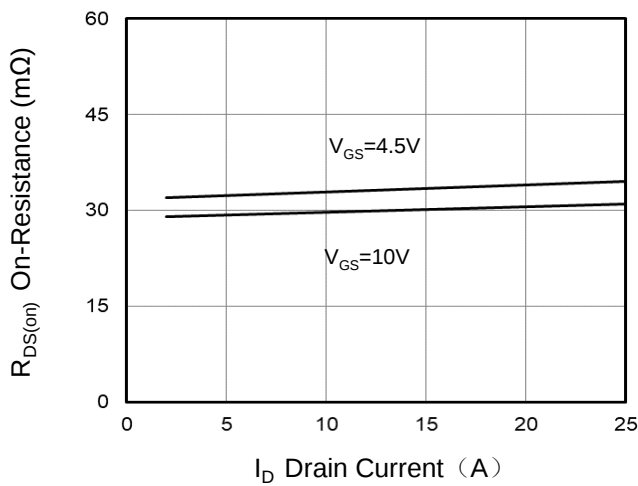
**Figure 1. Output Characteristics**



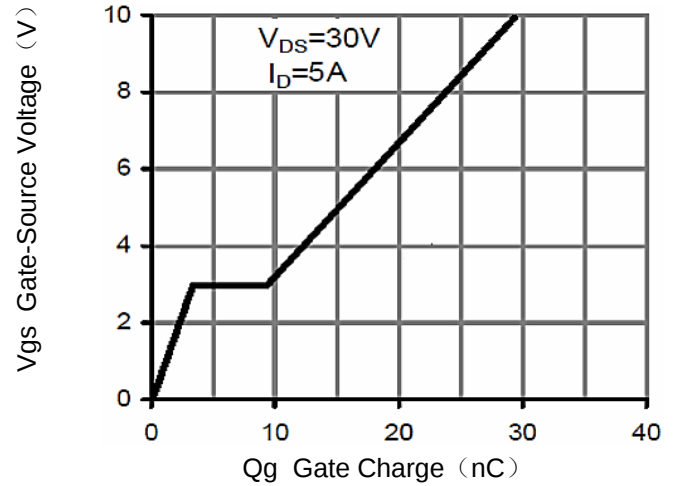
**Figure 2. Transfer Characteristics**



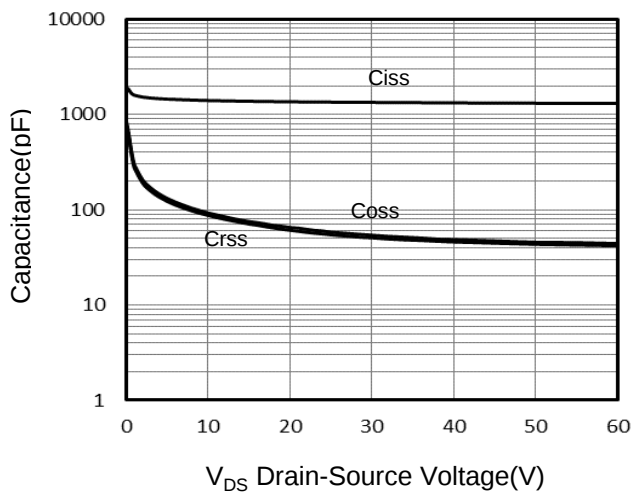
**Figure 3. Drain-Source On-Resistance**



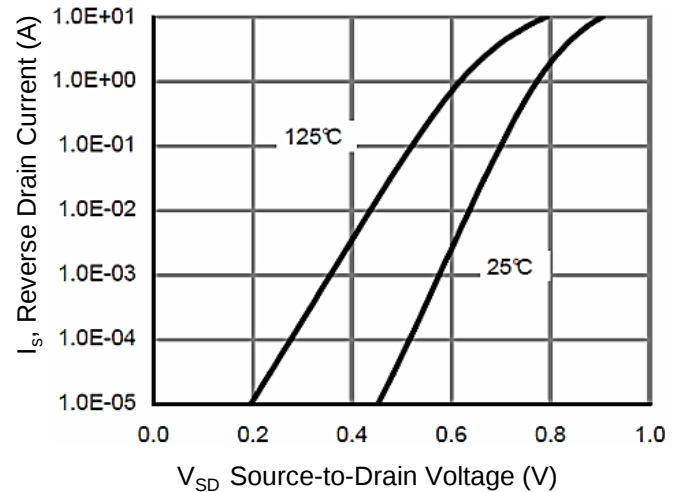
**Figure 4. Gate Charge**



**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

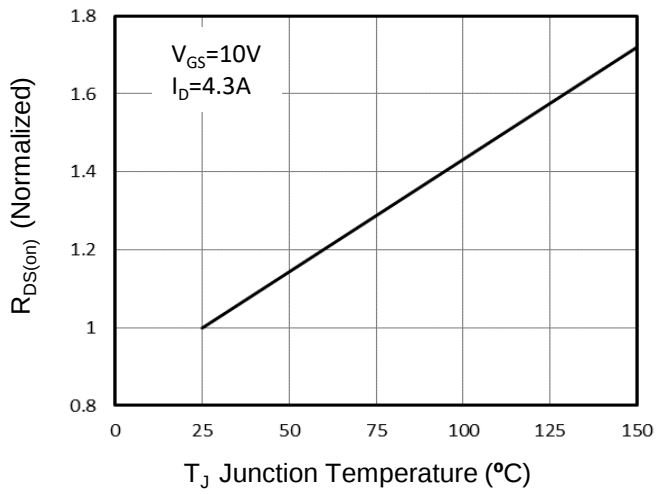


Figure 8. Safe Operation Area

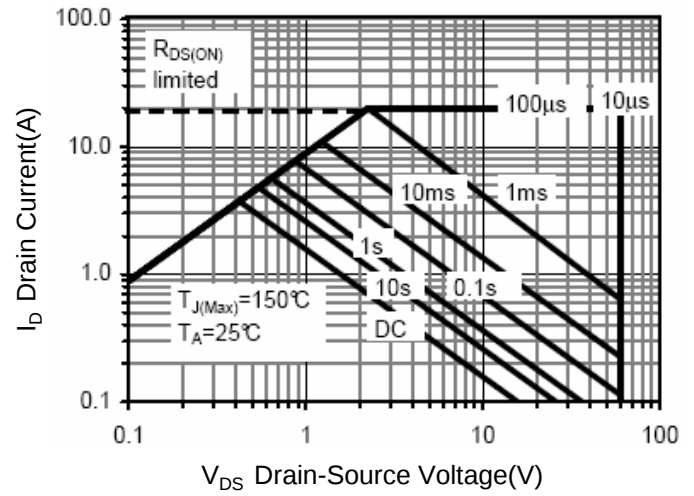
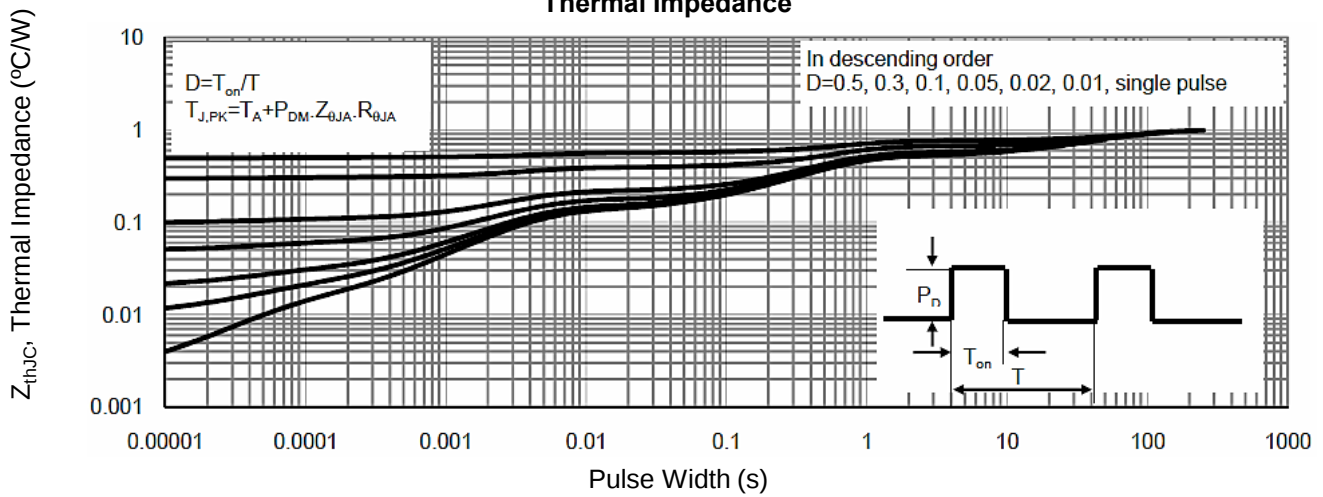


Figure 9. Normalized Maximum Transient Thermal Impedance



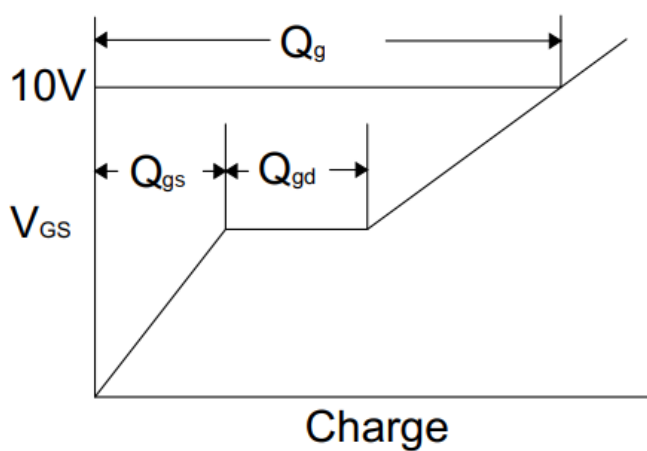
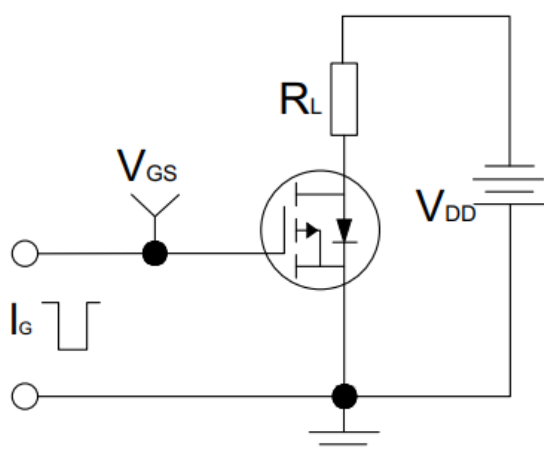
**PMOS Specifications**  $T_J = 25^{\circ}\text{C}$ , unless otherwise noted

| Parameter                               | Symbol        | Test Conditions                                     | Value |      |           | Unit       |
|-----------------------------------------|---------------|-----------------------------------------------------|-------|------|-----------|------------|
|                                         |               |                                                     | Min.  | Typ. | Max.      |            |
| Static Parameters                       |               |                                                     |       |      |           |            |
| Drain-Source Breakdown Voltage          | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -250\mu A$                      | -60   | --   | --        | V          |
| Zero Gate Voltage Drain Current         | $I_{DSS}$     | $V_{DS} = -60V, V_{GS} = 0V, T_J = 25^{\circ}C$     | --    | --   | -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              | $R_{DS(on)}$  | $V_{GS} = -10V, I_D = -3.1A$                        | --    |      | 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          |
| Dynamic Parameters                      |               |                                                     |       |      |           |            |
| Input Capacitance                       | $C_{iss}$     | $V_{GS} = 0V,$<br>$V_{DS} = -30V,$<br>$f = 1.0MHz$  | --    | 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    | --        |            |
| Drain-Source Body Diode Characteristics |               |                                                     |       |      |           |            |
| Continuous Body Diode Current           | $I_S$         | $T_C = 25^{\circ}C$                                 | --    | --   | -3.1      | A          |
| Body Diode Voltage                      | $V_{SD}$      | $T_J = 25^{\circ}C, I_{SD} = -2A, V_{GS} = 0V$      | --    | --   | -1.2      | V          |

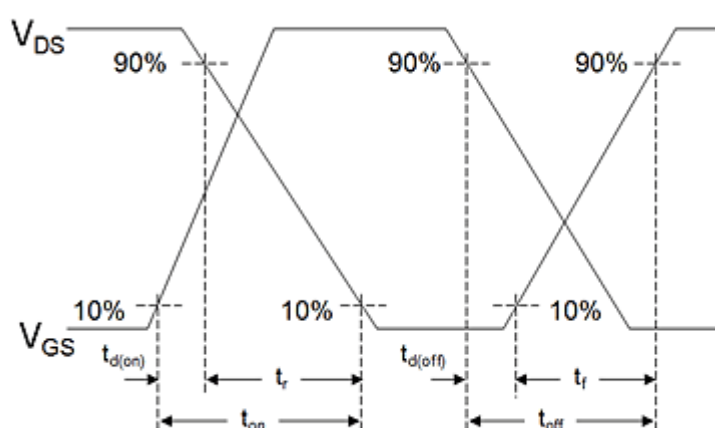
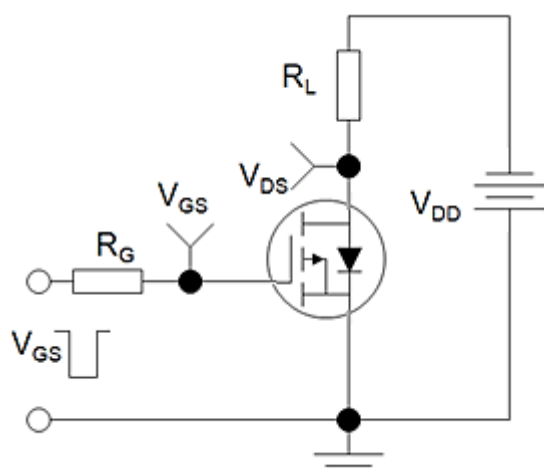
**Notes**

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

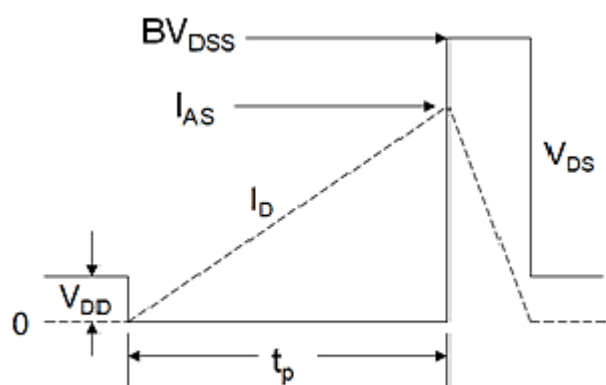
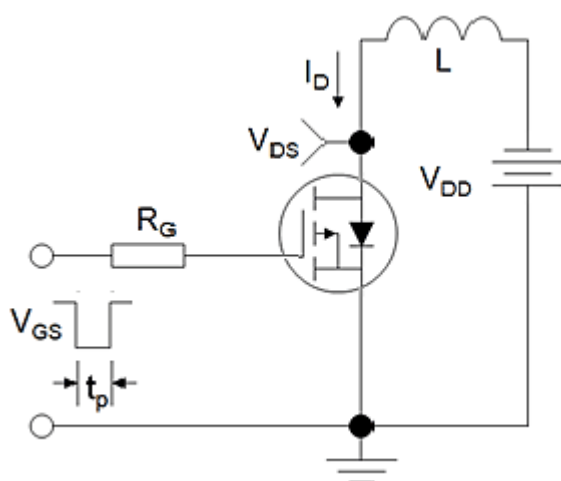
Gate Charge Test Circuit



Switch Time Test Circuit

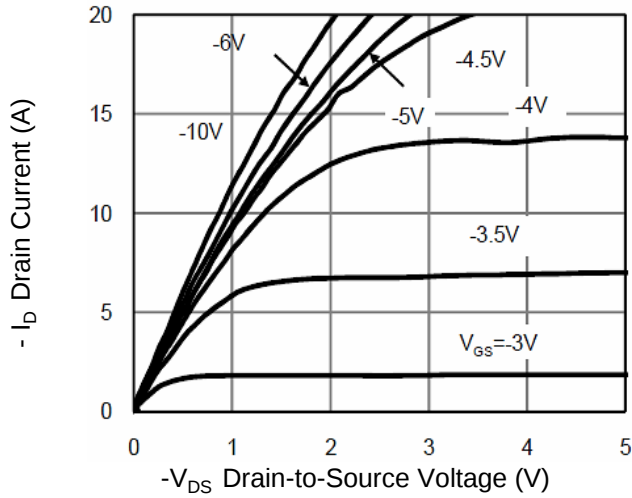


EAS Test Circuit

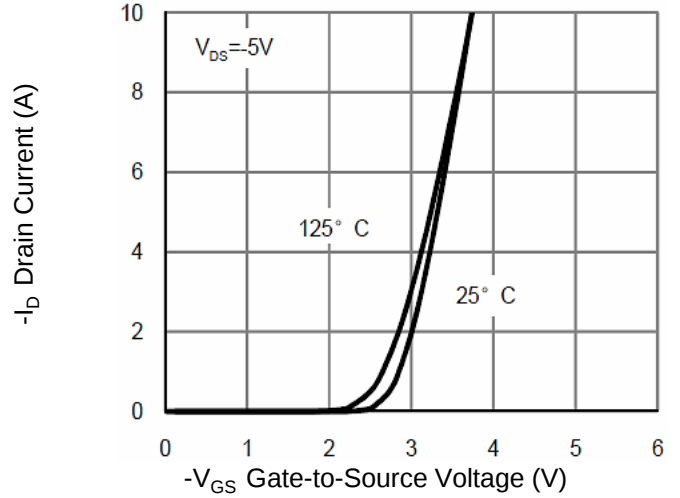


**PMOS Typical Characteristics**  $T_j = 25^\circ\text{C}$ , unless otherwise noted

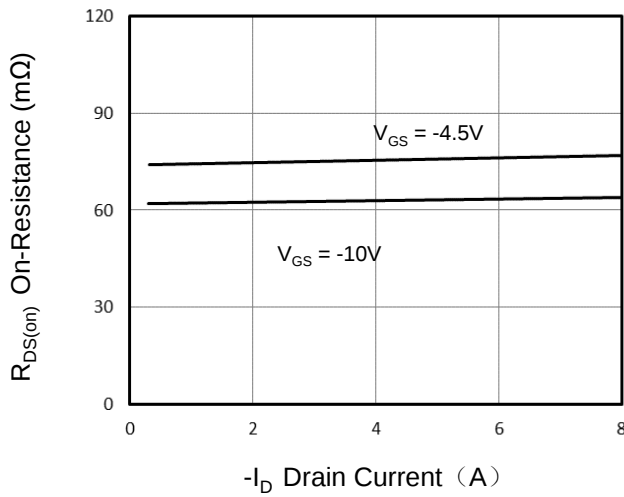
**Figure 1. Output Characteristics**



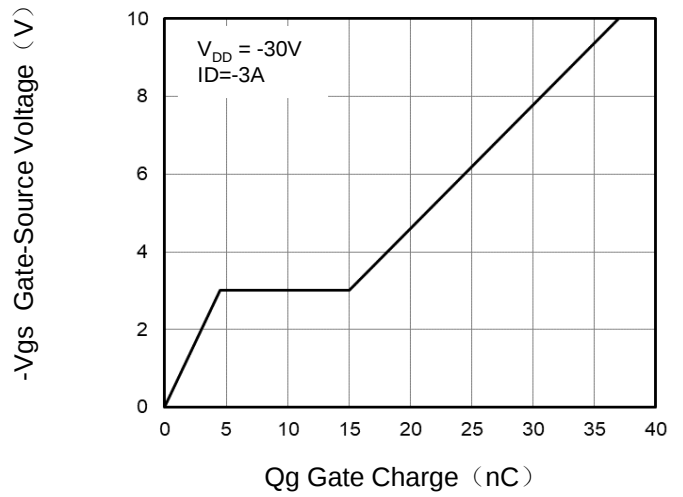
**Figure 2. Transfer Characteristics**



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



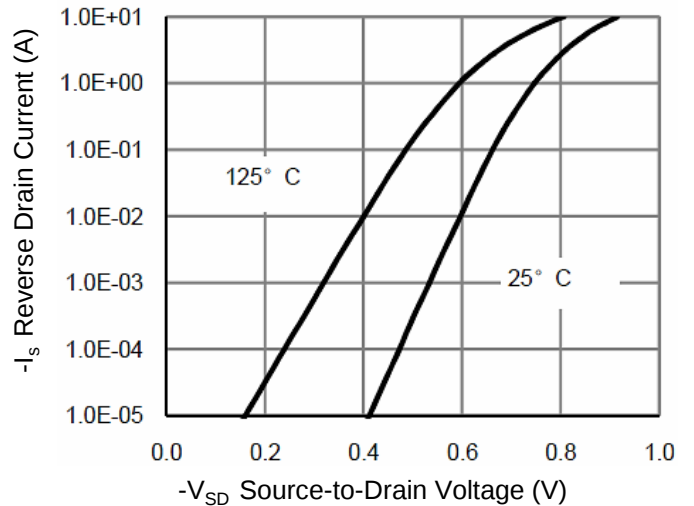
**Figure 4. Gate Charge**



**Figure 5. Capacitance**

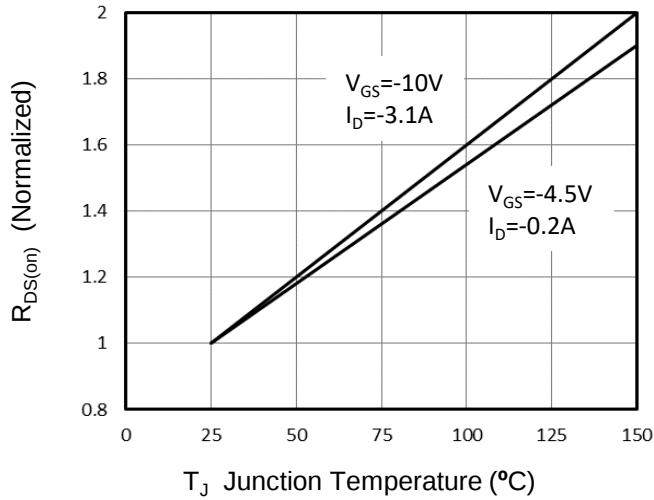


**Figure 6. Source-Drain Diode Forward**

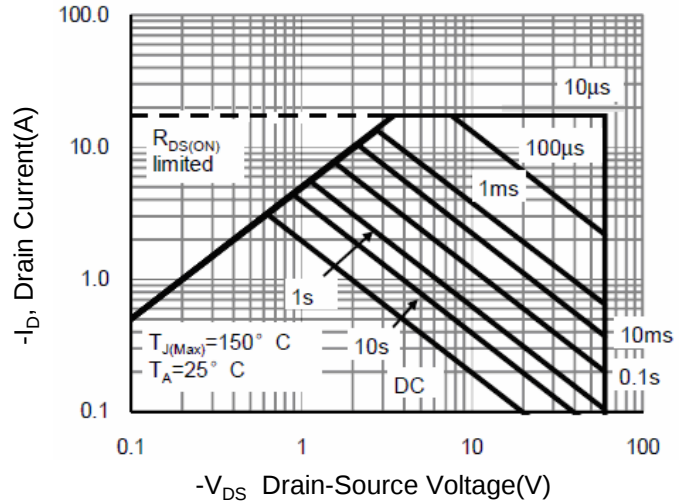


**PMOS Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

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



**Figure 8. Safe Operation Area**



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

