

## N and P Channel Enhancement Mode Power MOSFET

**Description**

This Product uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

**General Features**

- **NMOS**

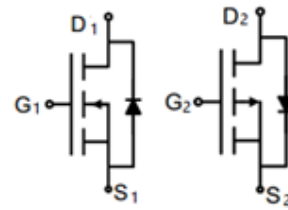
- $V_{DS}$  40V
- $I_D$  (at  $V_{GS} = 10V$ ) 4.5A
- $R_{DS(ON)}$  (at  $V_{GS} = 10V$ ) < 41m $\Omega$
- $R_{DS(ON)}$  (at  $V_{GS} = 4.5V$ ) < 68m $\Omega$

- **PMOS**

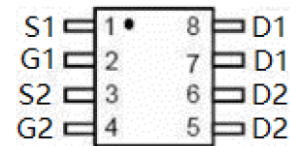
- $V_{DS}$  -40V
- $I_D$  (at  $V_{GS} = -10V$ ) -10A
- $R_{DS(ON)}$  (at  $V_{GS} = -10V$ ) < 37m $\Omega$
- $R_{DS(ON)}$  (at  $V_{GS} = -4.5V$ ) < 54m $\Omega$
- 100% Avalanche Tested
- RoHS Compliant

**Application**

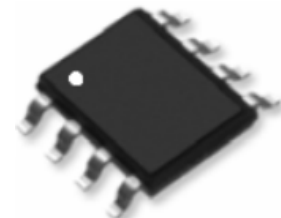
- Power switch
- DC/DC converters



Schematic diagram



Marking and pin assignment



SOP-8

| Device   | Package | Marking | Packaging    |
|----------|---------|---------|--------------|
| G05NP04S | SOP-8双基 | G05NP04 | 4000pcs/Reel |

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

| Parameter                                        | Symbol         | NMOS       | PMOS       | Unit             |
|--------------------------------------------------|----------------|------------|------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$       | 40         | -40        | V                |
| Continuous Drain Current                         | $I_D$          | 4.5        | -10        | A                |
| Pulsed Drain Current (note1)                     | $I_{DM}$       | 18         | -40        | A                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | $\pm 20$   | V                |
| Power Dissipation                                | $P_D$          | 2          | 2          | W                |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | -55 To 150 | -55 To 150 | $^\circ\text{C}$ |

**Thermal Resistance**

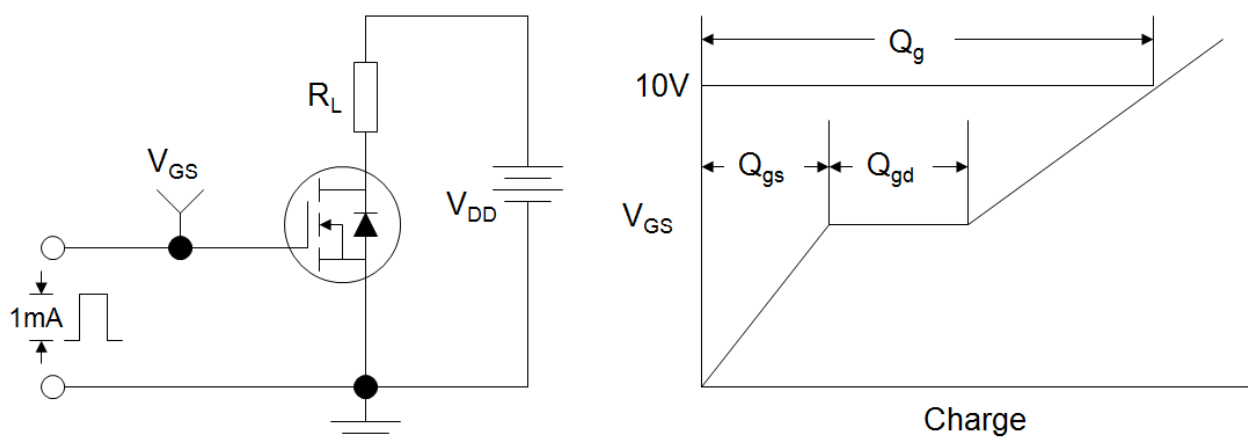
| Parameter                               | Symbol     | NMOS | PMOS | Unit               |
|-----------------------------------------|------------|------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 48   | 62.5 | $^\circ\text{C/W}$ |

| 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                            | 40    | --   | --   | V    |
| Zero Gate Voltage Drain Current                                      | I <sub>DSS</sub>     | V <sub>DS</sub> = 40V, 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     | 1.25 | 2.5  | V    |
| Drain-Source On-Resistance                                           | R <sub>DS(on)</sub>  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 1A                              | --    | 27.5 | 41   | mΩ   |
|                                                                      |                      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 1A                             | --    | 35   | 68   |      |
| Forward Transconductance                                             | g <sub>FS</sub>      | V <sub>DS</sub> =5V,I <sub>D</sub> =6A                                  | --    | 27   | --   | S    |
| Dynamic Parameters                                                   |                      |                                                                         |       |      |      |      |
| Input Capacitance                                                    | C <sub>iss</sub>     | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = 20V,<br>f = 1.0MHz           | --    | 516  | --   | pF   |
| Output Capacitance                                                   | C <sub>oss</sub>     |                                                                         | --    | 82   | --   |      |
| Reverse Transfer Capacitance                                         | C <sub>rss</sub>     |                                                                         | --    | 43   | --   |      |
| Total Gate Charge                                                    | Q <sub>g</sub>       | V <sub>DD</sub> = 20V,<br>I <sub>D</sub> = 6A,<br>V <sub>GS</sub> = 10V | --    | 8.9  | --   | nC   |
| Gate-Source Charge                                                   | Q <sub>gs</sub>      |                                                                         | --    | 2.4  | --   |      |
| Gate-Drain Charge                                                    | Q <sub>gd</sub>      |                                                                         | --    | 1.4  | --   |      |
| Turn-on Delay Time                                                   | t <sub>d(on)</sub>   | V <sub>DD</sub> = 20V,<br>I <sub>D</sub> = 6A,<br>R <sub>G</sub> = 3Ω   | --    | 6.4  | --   | ns   |
| Turn-on Rise Time                                                    | t <sub>r</sub>       |                                                                         | --    | 3.6  | --   |      |
| Turn-off Delay Time                                                  | t <sub>d(off)</sub>  |                                                                         | --    | 16.2 | --   |      |
| Turn-off Fall Time                                                   | t <sub>f</sub>       |                                                                         | --    | 6.6  | --   |      |
| Drain-Source Body Diode Characteristics                              |                      |                                                                         |       |      |      |      |
| Continuous Body Diode Current                                        | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                   | --    | --   | 2    | A    |
| Body Diode Voltage                                                   | V <sub>SD</sub>      | T <sub>J</sub> = 25°C, I <sub>SD</sub> = 6A, V <sub>GS</sub> = 0V       | --    | --   | 1.2  | V    |

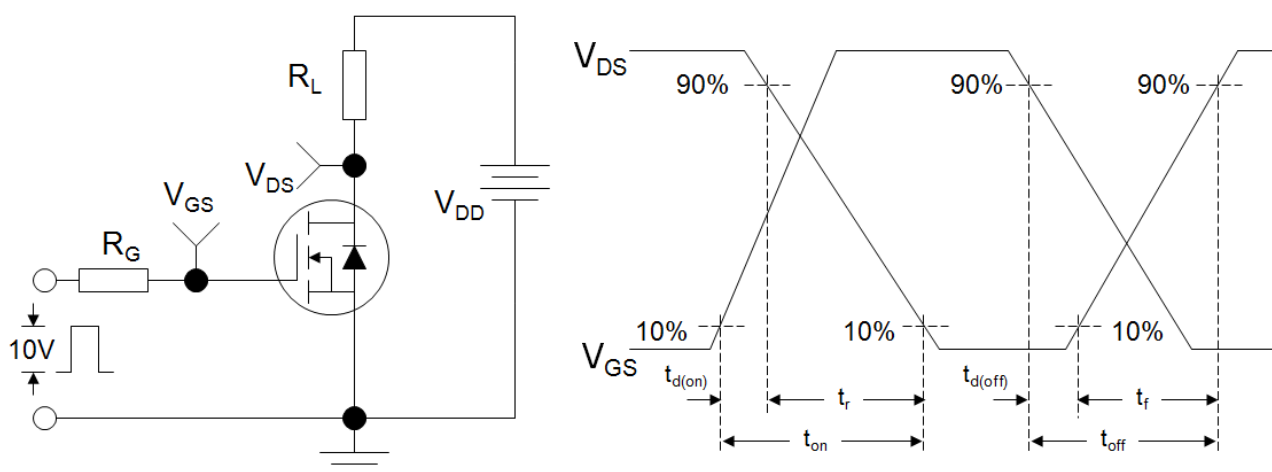
**Notes**

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

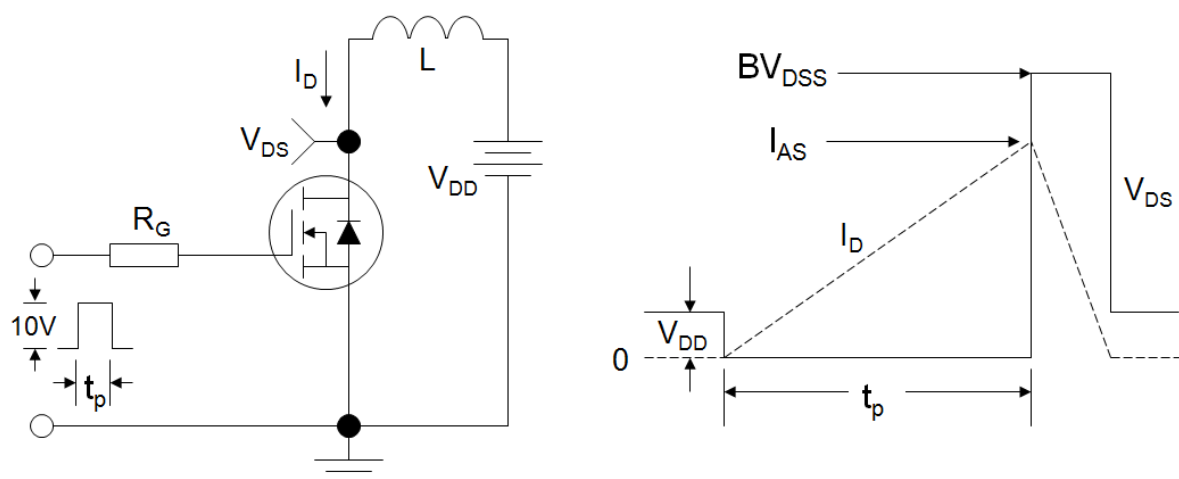
Gate Charge Test Circuit



Switch Time Test Circuit



EAS Test Circuit



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

Figure 1. Output Characteristics

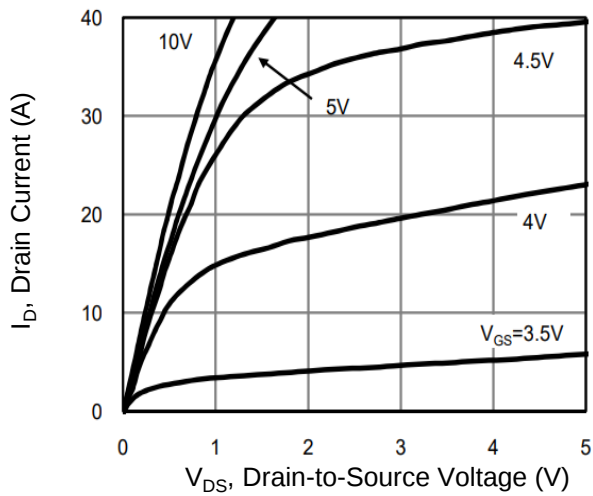


Figure 2. Transfer Characteristics

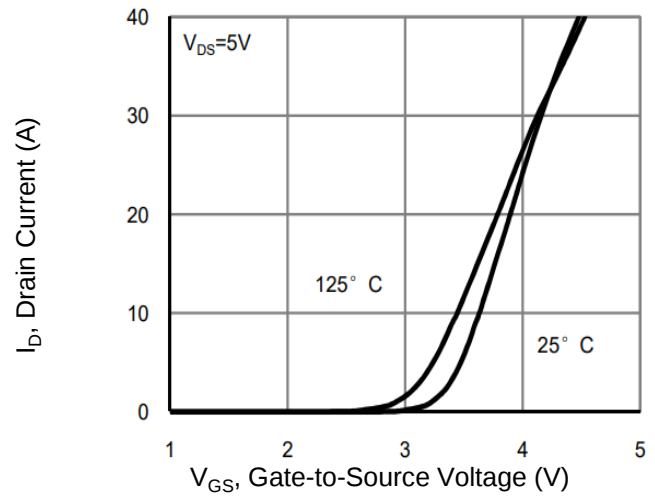


Figure 3. Drain-Source On-Resistance

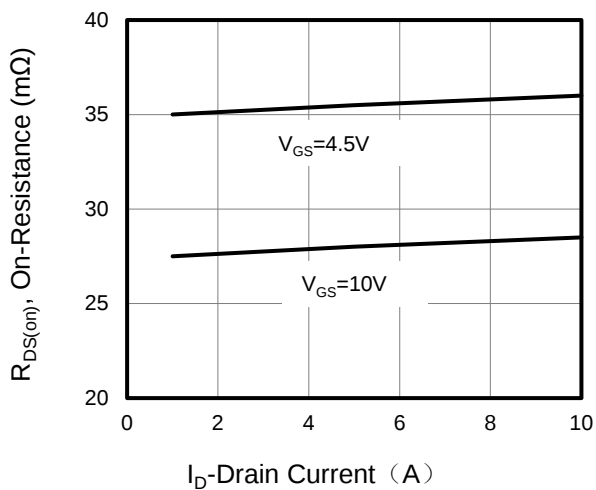


Figure 4. Gate Charge

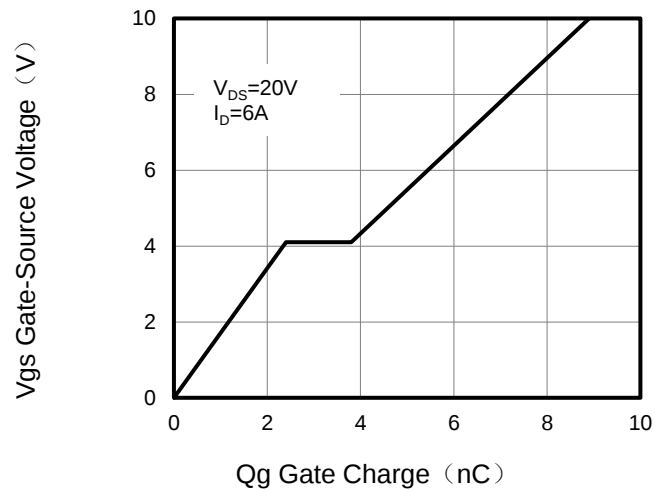


Figure 5. Capacitance

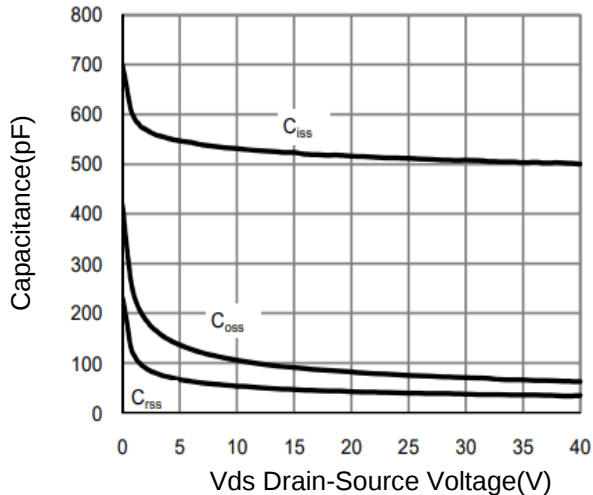
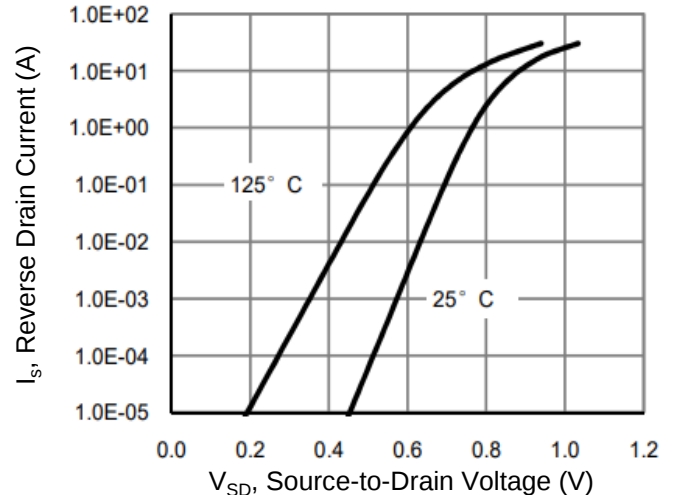
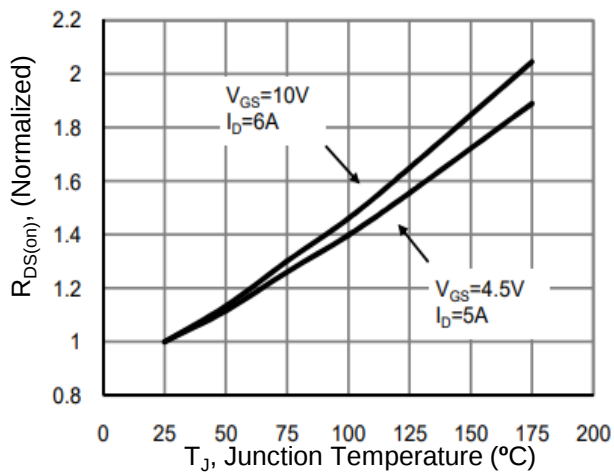
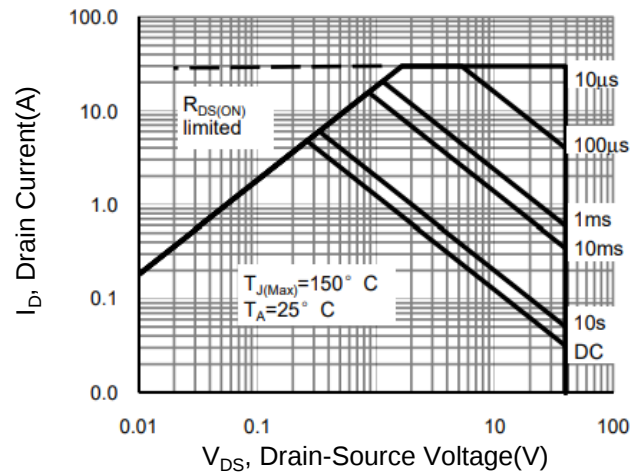
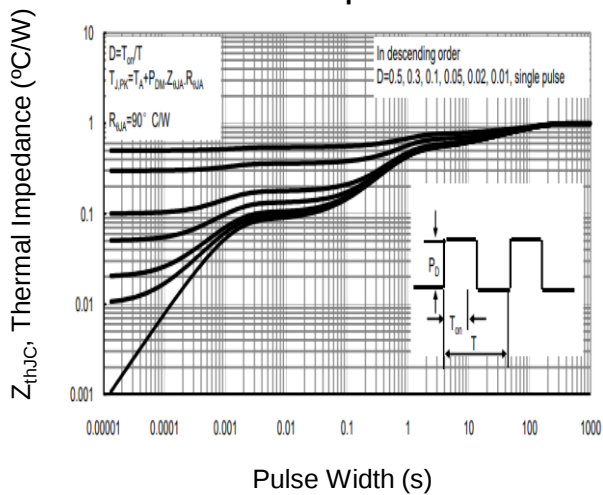


Figure 6. Source-Drain Diode Forward



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

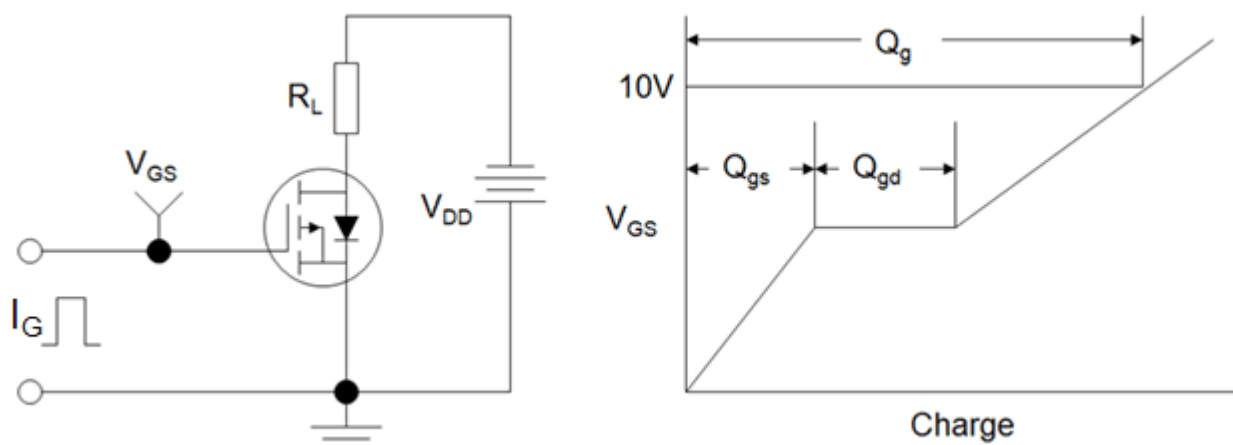
**Figure 7. Drain-Source On-Resistance**

**Figure 10. Safe Operation Area**

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


| PMOS 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                               | -40   | --   | --   | V    |
| Zero Gate Voltage Drain Current                                   | I <sub>DSS</sub>     | V <sub>DS</sub> = -40V, 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    | -1.9 | -2.5 | V    |
| Drain-Source On-Resistance                                        | R <sub>DS(on)</sub>  | V <sub>GS</sub> = -10V, I <sub>D</sub> = -1A                                | --    | 26   | 37   | mΩ   |
|                                                                   |                      | V <sub>GS</sub> = -10V, I <sub>D</sub> = -10A                               | --    | 26   | 37   |      |
|                                                                   |                      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -1A                               | --    | 28   | 54   |      |
|                                                                   |                      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -10A                              | --    | 28   | 54   |      |
| Forward Transconductance                                          | g <sub>FS</sub>      | V <sub>DS</sub> =-5V,I <sub>D</sub> =-8A                                    | 20    | --   | --   | S    |
| Dynamic Parameters                                                |                      |                                                                             |       |      |      |      |
| Input Capacitance                                                 | C <sub>iss</sub>     | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = -20V,<br>f = 1.0MHz              | --    | 520  | --   | pF   |
| Output Capacitance                                                | C <sub>oss</sub>     |                                                                             | --    | 100  | --   |      |
| Reverse Transfer Capacitance                                      | C <sub>rss</sub>     |                                                                             | --    | 65   | --   |      |
| Total Gate Charge                                                 | Q <sub>g</sub>       | V <sub>DD</sub> = -20V,<br>I <sub>D</sub> = -10A,<br>V <sub>GS</sub> = -10V | --    | 13   | --   | nC   |
| Gate-Source Charge                                                | Q <sub>gs</sub>      |                                                                             | --    | 3.8  | --   |      |
| Gate-Drain Charge                                                 | Q <sub>gd</sub>      |                                                                             | --    | 3.1  | --   |      |
| Turn-on Delay Time                                                | t <sub>d(on)</sub>   | V <sub>DD</sub> = -20V,<br>I <sub>D</sub> = -10A,<br>R <sub>G</sub> = 6Ω    | --    | 7.5  | --   | ns   |
| Turn-on Rise Time                                                 | t <sub>r</sub>       |                                                                             | --    | 5.5  | --   |      |
| Turn-off Delay Time                                               | t <sub>d(off)</sub>  |                                                                             | --    | 19   | --   |      |
| Turn-off Fall Time                                                | t <sub>f</sub>       |                                                                             | --    | 7    | --   |      |
| Drain-Source Body Diode Characteristics                           |                      |                                                                             |       |      |      |      |
| Continuous Body Diode Current                                     | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                       | --    | --   | -10  | A    |
| Body Diode Voltage                                                | V <sub>SD</sub>      | T <sub>J</sub> = 25°C, I <sub>SD</sub> = -10A, V <sub>GS</sub> = 0V         | --    | --   | -1.2 | V    |

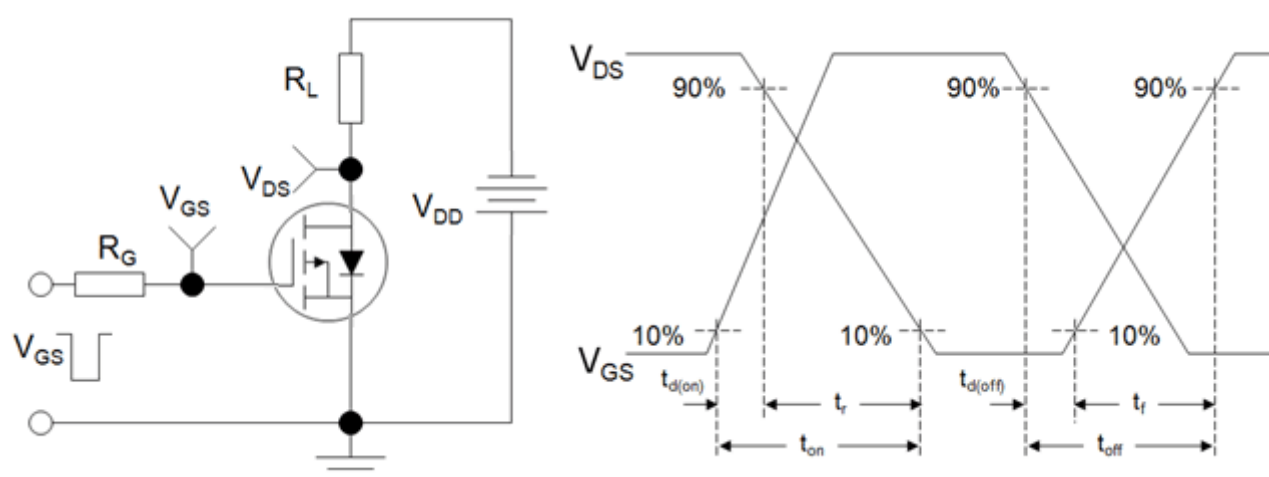
**Notes**

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

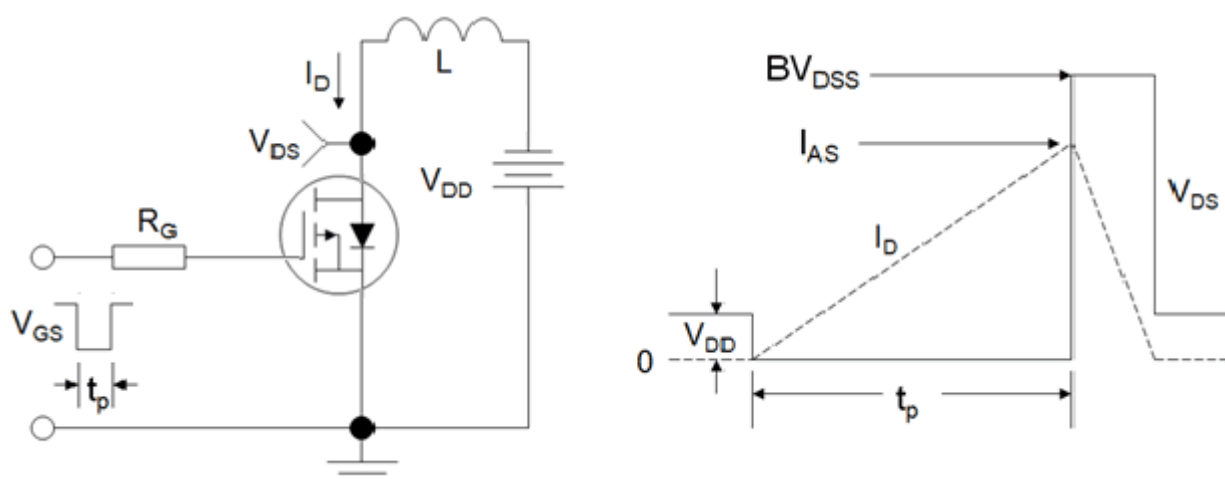
Gate Charge Test Circuit



Switch Time Test Circuit

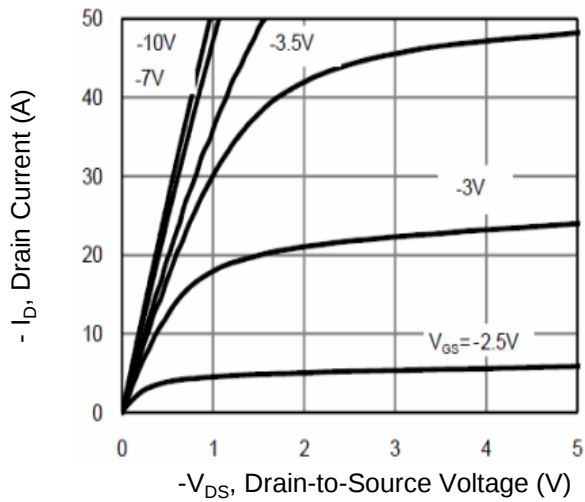


EAS Test Circuit

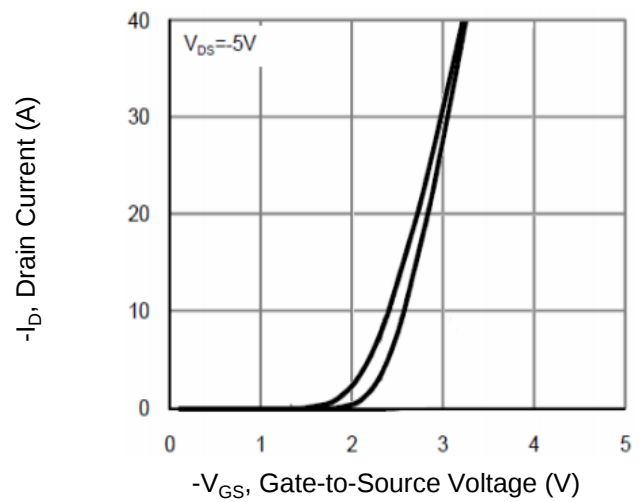


**PMOS Typical Characteristics**  $T_j = 25^\circ\text{C}$ , unless otherwise noted

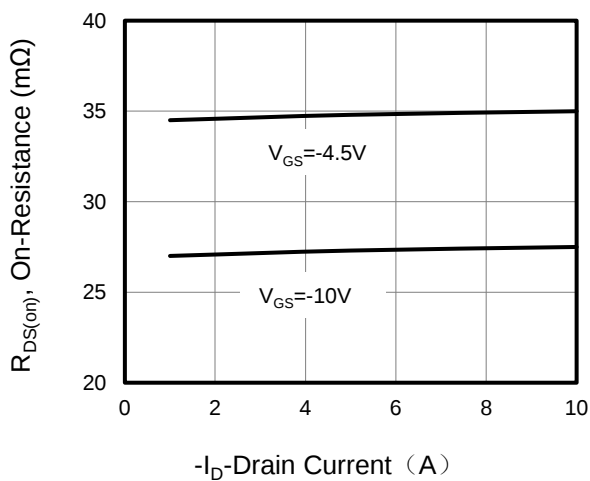
**Figure 1. Output Characteristics**



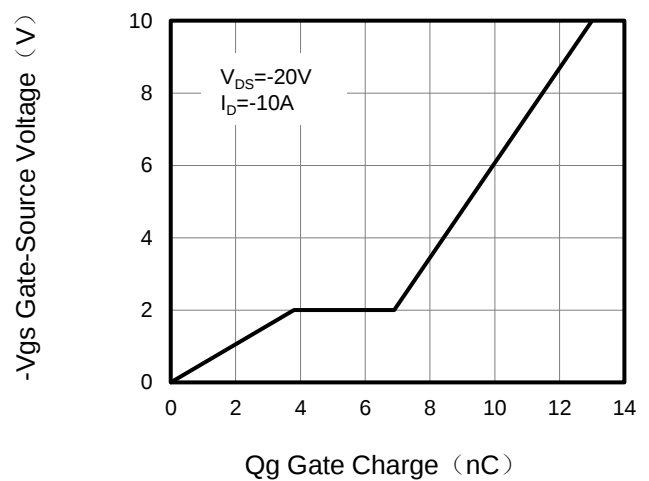
**Figure 2. Transfer Characteristics**



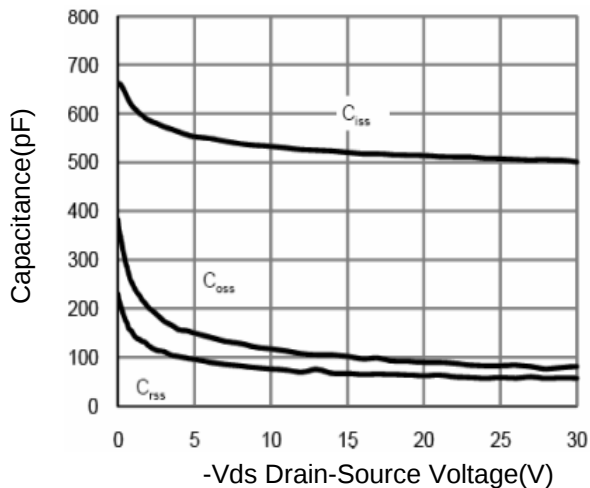
**Figure 3.  $R_{DS(on)}$ -Drain Current**



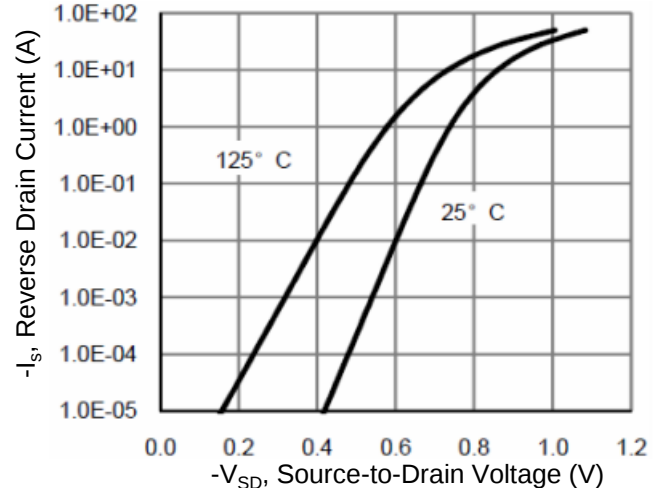
**Figure 4. Gate Charge**



**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

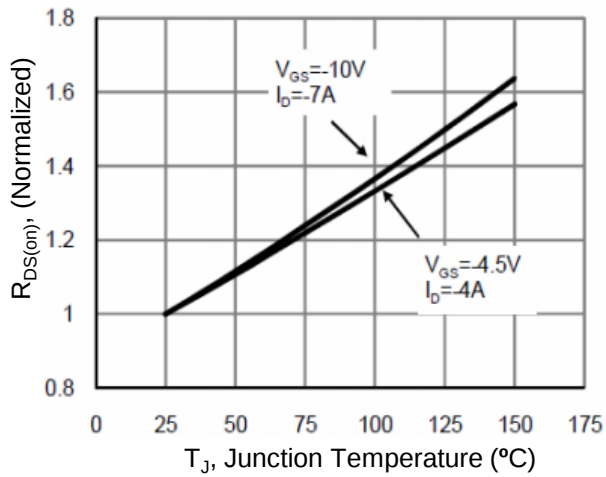


Figure 8. Safe Operation Area

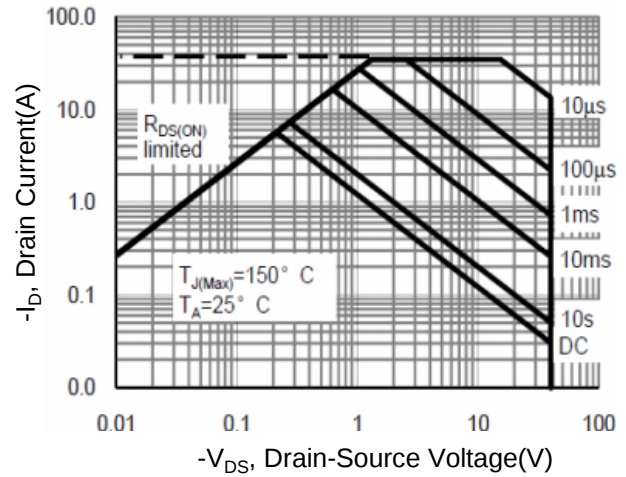
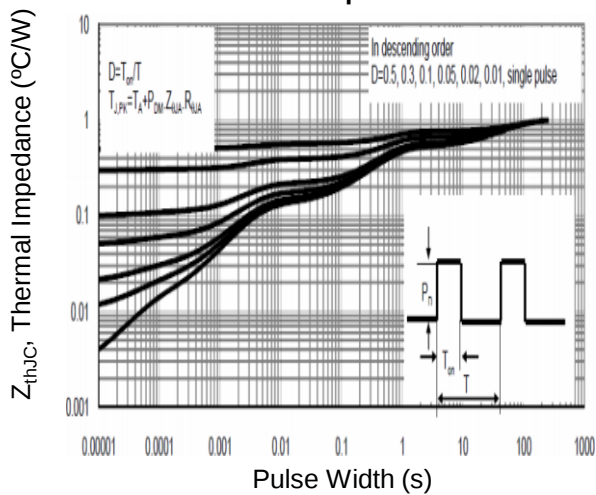
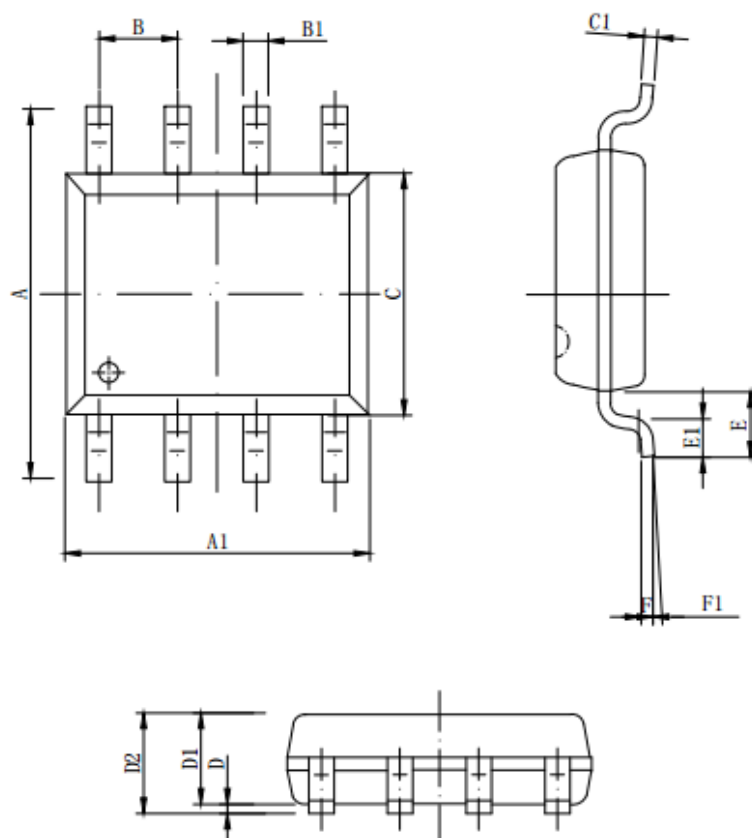


Figure 9. Normalized Maximum Transient Thermal Impedance



## SOP-8 Package Information



| Symbol | Dimensions in Millimeters |                    |                    |
|--------|---------------------------|--------------------|--------------------|
|        | MIN.                      | NOM.               | MAX.               |
| A      | 5.800                     | 6.000              | 6.200              |
| A1     | 4.800                     | 4.900              | 5.000              |
| B      | 1.270BSC                  |                    |                    |
| B1     | 0.35 <sup>8x</sup>        | 0.40 <sup>8x</sup> | 0.45 <sup>8x</sup> |
| C      | 3.780                     | 3.880              | 3.980              |
| C1     | --                        | 0.203              | 0.253              |
| D      | 0.050                     | 0.150              | 0.250              |
| D1     | 1.350                     | 1.450              | 1.550              |
| D2     | 1.500                     | 1.600              | 1.700              |
| D2     | 1.500                     | 1.600              | 1.700              |
| E      | 1.060REF                  |                    |                    |
| E1     | 0.400                     | 0.700              | 0.100              |
| F      | 0.250BSC                  |                    |                    |
| F1     | 2°                        | 4°                 | 6°                 |