



## SOP-8 N+P Dual Enhancement 双沟道增强型 MOS Field Effect Transistor 场效应管

### ■Features 特点

Low on-resistance 低导通电阻

N:  $R_{DS(ON)} = 33m\Omega(\text{Type}) @ V_{GS} = 10V$

$R_{DS(ON)} = 42m\Omega(\text{Type}) @ V_{GS} = 4.5V$

P:  $R_{DS(ON)} = 75m\Omega(\text{Type}) @ V_{GS} = -10V$

$R_{DS(ON)} = 85m\Omega(\text{Type}) @ V_{GS} = -4.5V$

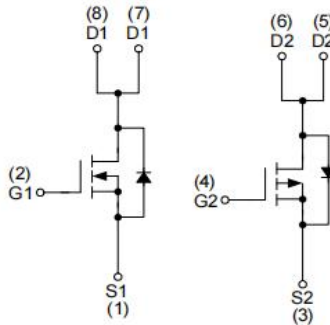
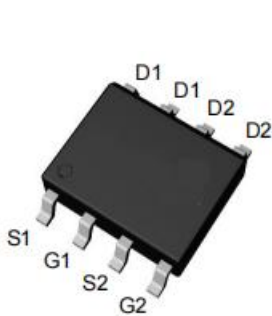
### ■Applications 应用

Motor Control 马达控制

Synchronous Rectification 同步整流

Fan Pre-drive H-bridge 风扇预驱动半桥

### ■Internal Schematic Diagram 内部结构



### ■Absolute Maximum Ratings 最大额定值

| Characteristic 特性参数                    | Symbol 符号                                                   | N          | P            | Unit 单位      |
|----------------------------------------|-------------------------------------------------------------|------------|--------------|--------------|
| Drain-Source Voltage 漏极-源极电压           | $BV_{DSS}$                                                  | 60         | -60          | V            |
| Gate- Source Voltage 栅极-源极电压           | $V_{GS}$                                                    | $\pm 20$   | $\pm 20$     | V            |
| Drain Current (continuous)漏极电流-连续      | $I_D$ (at $T_A = 25^\circ C$<br>at $T_A = 70^\circ C$ )     | 4.5<br>3.6 | -3.2<br>-2.5 | A            |
| Drain Current (pulsed)漏极电流-脉冲          | $I_{DM}$                                                    | 20         | -20          | A            |
| Total Device Dissipation 总耗散功率         | $P_{TOT}$ (at $T_A = 25^\circ C$<br>at $T_A = 70^\circ C$ ) | 2<br>1.3   |              | W            |
| Thermal Resistance Junction-Ambient 热阻 | $R_{\theta JA}$                                             | 62.5       |              | $^\circ C/W$ |
| Avalanche Energy Single Pulse 雪崩能量     | $E_{AS}$                                                    | 25         |              | mJ           |
| Junction/Storage Temperature 结温/储存温度   | $T_J, T_{stg}$                                              | -55~150    |              | $^\circ C$   |



## ■ N Electrical Characteristics 电特性

( $T_A=25^{\circ}\text{C}$  unless otherwise noted 如无特殊说明, 温度为  $25^{\circ}\text{C}$ )

| Characteristic<br>特性参数                                                                                                                       | Symbol<br>符号 | Min<br>最小值 | Typ<br>典型值 | Max<br>最大值 | Unit<br>单位       |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|------------|------------|------------------|
| Drain-Source Breakdown Voltage<br>漏极-源极击穿电压( $I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$ )                                                     | $BV_{DSS}$   | 60         | —          | —          | V                |
| Gate Threshold Voltage<br>栅极开启电压( $I_D=250\mu\text{A}$ , $V_{GS}=V_{DS}$ )                                                                   | $V_{GS(th)}$ | 1.0        | 1.3        | 2.0        | V                |
| Zero Gate Voltage Drain Current<br>零栅压漏极电流( $V_{GS}=0\text{V}$ , $V_{DS}=60\text{V}$ )                                                       | $I_{DSS}$    | —          | —          | 1          | $\mu\text{A}$    |
| Gate Body Leakage<br>栅极漏电流( $V_{GS}=\pm 20\text{V}$ , $V_{DS}=0\text{V}$ )                                                                   | $I_{GSS}$    | —          | —          | $\pm 100$  | nA               |
| Static Drain-Source On-State Resistance<br>静态漏源导通电阻( $I_D=4.5\text{A}$ , $V_{GS}=10\text{V}$ )<br>( $I_D=3\text{A}$ , $V_{GS}=4.5\text{V}$ ) | $R_{DS(ON)}$ | —          | 33<br>42   | 56<br>65   | $\text{m}\Omega$ |
| Diode Forward Voltage Drop<br>内附二极管正向压降( $I_{SD}=1\text{A}$ , $V_{GS}=0\text{V}$ )                                                           | $V_{SD}$     | —          | 0.74       | 1          | V                |
| Input Capacitance 输入电容<br>( $V_{GS}=0\text{V}$ , $V_{DS}=30\text{V}$ , $f=1\text{MHz}$ )                                                     | $C_{ISS}$    | —          | 450        | —          | pF               |
| Common Source Output Capacitance<br>共源输出电容( $V_{GS}=0\text{V}$ , $V_{DS}=30\text{V}$ , $f=1\text{MHz}$ )                                     | $C_{OSS}$    | —          | 60         | —          | pF               |
| Reverse Transfer Capacitance 反馈电容<br>( $V_{GS}=0\text{V}$ , $V_{DS}=30\text{V}$ , $f=1\text{MHz}$ )                                          | $C_{RSS}$    | —          | 25         | —          | pF               |
| Total Gate Charge 栅极电荷密度<br>( $V_{DS}=30\text{V}$ , $I_D=4.5\text{A}$ , $V_{GS}=10\text{V}$ )                                                | $Q_g$        | —          | 9          | —          | nC               |
| Gate Source Charge 栅源电荷密度<br>( $V_{DS}=30\text{V}$ , $I_D=4.5\text{A}$ , $V_{GS}=10\text{V}$ )                                               | $Q_{gs}$     | —          | 2          | —          | nC               |
| Gate Drain Charge 栅漏电荷密度<br>( $V_{DS}=30\text{V}$ , $I_D=4.5\text{A}$ , $V_{GS}=10\text{V}$ )                                                | $Q_{gd}$     | —          | 2          | —          | nC               |
| Turn-ON Delay Time 开启延迟时间<br>( $V_{DS}=30\text{V}$ $I_D=1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}=10\text{V}$ )                               | $t_{d(on)}$  | —          | 5          | —          | ns               |
| Turn-ON Rise Time 开启上升时间<br>( $V_{DS}=30\text{V}$ $I_D=1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}=10\text{V}$ )                                | $t_r$        | —          | 3          | —          | ns               |
| Turn-OFF Delay Time 关断延迟时间<br>( $V_{DS}=30\text{V}$ $I_D=1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}=10\text{V}$ )                              | $t_{d(off)}$ | —          | 16         | —          | ns               |
| Turn-OFF Fall Time 关断下降时间<br>( $V_{DS}=30\text{V}$ $I_D=1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}=10\text{V}$ )                               | $t_f$        | —          | 2          | —          | ns               |



## ■ P Electrical Characteristics 电特性

( $T_A=25^{\circ}\text{C}$  unless otherwise noted 如无特殊说明, 温度为  $25^{\circ}\text{C}$ )

| Characteristic<br>特性参数                                                                                                                                 | Symbol<br>符号 | Min<br>最小值 | Typ<br>典型值 | Max<br>最大值 | Unit<br>单位       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|------------|------------|------------------|
| Drain-Source Breakdown Voltage<br>漏极-源极击穿电压( $I_D = -250\mu\text{A}$ , $V_{GS}=0\text{V}$ )                                                            | $BV_{DSS}$   | -60        | —          | —          | V                |
| Gate Threshold Voltage<br>栅极开启电压( $I_D = -250\mu\text{A}$ , $V_{GS} = V_{DS}$ )                                                                        | $V_{GS(th)}$ | -1.0       | -1.65      | -3.0       | V                |
| Zero Gate Voltage Drain Current<br>零栅压漏极电流( $V_{GS}=0\text{V}$ , $V_{DS}= -60\text{V}$ )                                                               | $I_{DSS}$    | —          | —          | -1         | $\mu\text{A}$    |
| Gate Body Leakage<br>栅极漏电流( $V_{GS}=\pm 20\text{V}$ , $V_{DS}=0\text{V}$ )                                                                             | $I_{GSS}$    | —          | —          | $\pm 100$  | nA               |
| Static Drain-Source On-State Resistance<br>静态漏源导通电阻( $I_D= -3.2\text{A}$ , $V_{GS}= -10\text{V}$ )<br>( $I_D= -2.8\text{A}$ , $V_{GS}= -4.5\text{V}$ ) | $R_{DS(ON)}$ | —          | 75<br>85   | 95<br>105  | $\text{m}\Omega$ |
| Diode Forward Voltage Drop<br>内附二极管正向压降( $I_{SD}= -1\text{A}$ , $V_{GS}=0\text{V}$ )                                                                   | $V_{SD}$     | —          | -0.73      | -1.0       | V                |
| Input Capacitance 输入电容<br>( $V_{GS}=0\text{V}$ , $V_{DS}= -30\text{V}$ , $f=1\text{MHz}$ )                                                             | $C_{ISS}$    | —          | 930        | —          | pF               |
| Common Source Output Capacitance<br>共源输出电容( $V_{GS}=0\text{V}$ , $V_{DS}= -30\text{V}$ , $f=1\text{MHz}$ )                                             | $C_{OSS}$    | —          | 85         | —          | pF               |
| Reverse Transfer Capacitance 反馈电容<br>( $V_{GS}=0\text{V}$ , $V_{DS}= -30\text{V}$ , $f=1\text{MHz}$ )                                                  | $C_{RSS}$    | —          | 35         | —          | pF               |
| Total Gate Charge 栅极电荷密度<br>( $V_{DS}= -30\text{V}$ , $I_D= -3.2\text{A}$ , $V_{GS}= -10\text{V}$ )                                                    | $Q_g$        | —          | 16         | —          | nC               |
| Gate Source Charge 栅源电荷密度<br>( $V_{DS}= -30\text{V}$ , $I_D= -3.2\text{A}$ , $V_{GS}= -10\text{V}$ )                                                   | $Q_{gs}$     | —          | 2          | —          | nC               |
| Gate Drain Charge 栅漏电荷密度<br>( $V_{DS}= -30\text{V}$ , $I_D= -3.2\text{A}$ , $V_{GS}= -10\text{V}$ )                                                    | $Q_{gd}$     | —          | 3          | —          | nC               |
| Turn-ON Delay Time 开启延迟时间<br>( $V_{DS}= -30\text{V}$ $I_D= -1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}= -10\text{V}$ )                                   | $t_{d(on)}$  | —          | 8          | —          | ns               |
| Turn-ON Rise Time 开启上升时间<br>( $V_{DS}= -30\text{V}$ $I_D= -1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}= -10\text{V}$ )                                    | $t_r$        | —          | 4          | —          | ns               |
| Turn-OFF Delay Time 关断延迟时间<br>( $V_{DS}= -30\text{V}$ $I_D= -1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}= -10\text{V}$ )                                  | $t_{d(off)}$ | —          | 32         | —          | ns               |
| Turn-OFF Fall Time 关断下降时间<br>( $V_{DS}= -30\text{V}$ $I_D= -1\text{A}$ , $R_{GEN}=3\Omega$ , $V_{GS}= -10\text{V}$ )                                   | $t_f$        | —          | 8          | —          | ns               |

## ■ N Typical Characteristic Curve 典型特性曲线

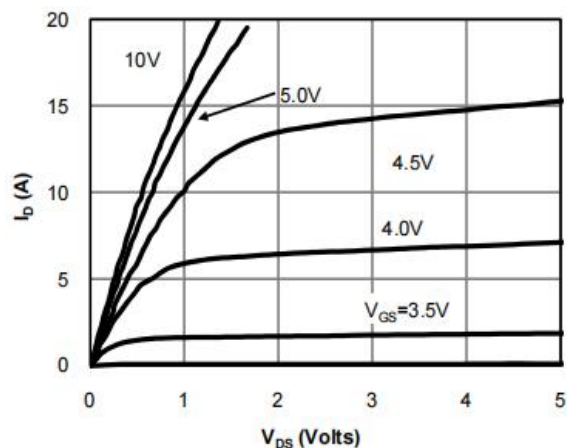


Figure 1: Output Characteristics

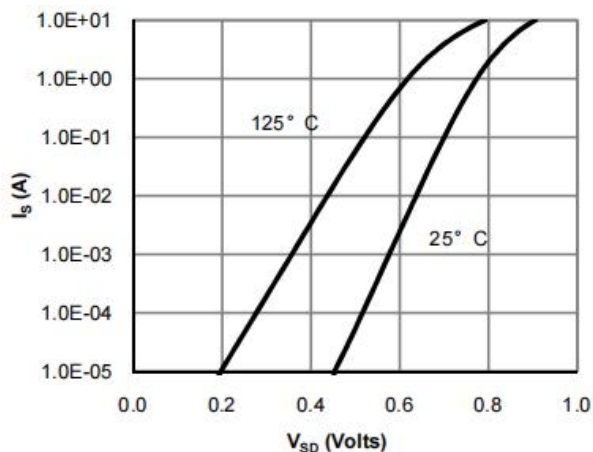


Figure 2: Diode Forward Characteristics

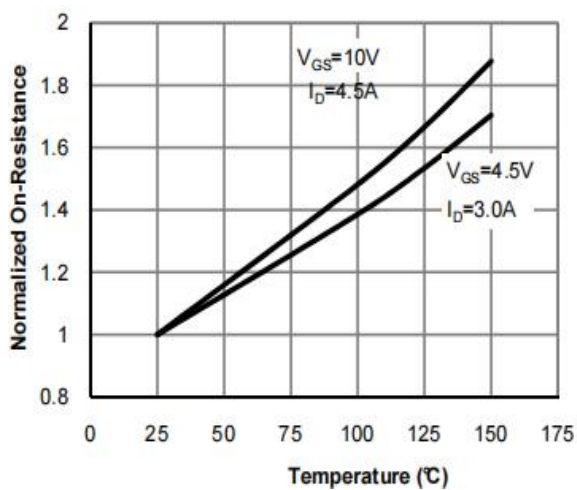


Figure 3: On-Resistance vs.  $T_J$

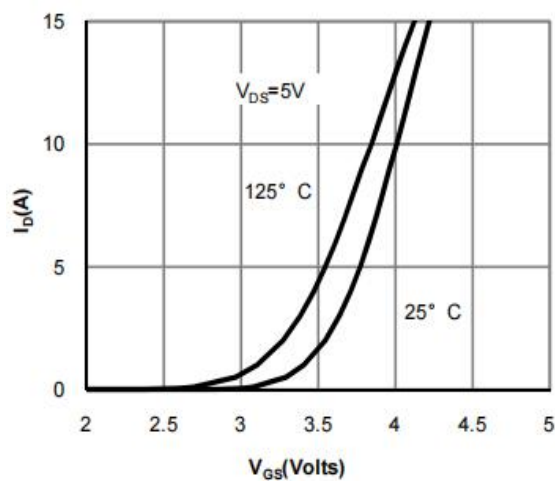


Figure 4: Transfer Characteristics

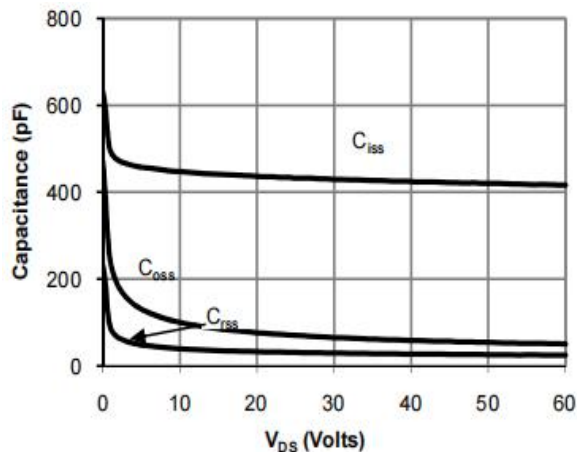


Figure 5: Capacitance Characteristics

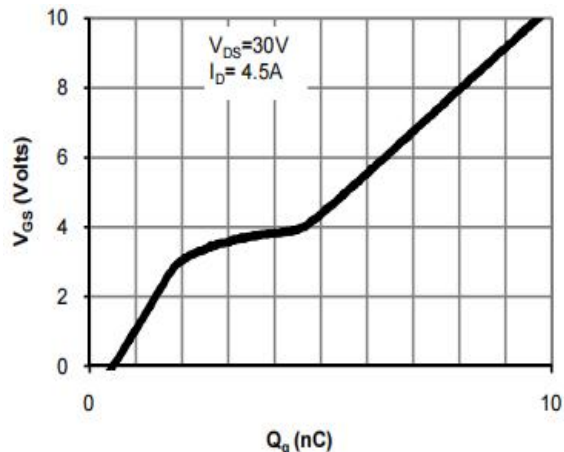


Figure 6: Gate-Charge Characteristics

## ■N Typical Characteristic Curve 典型特性曲线

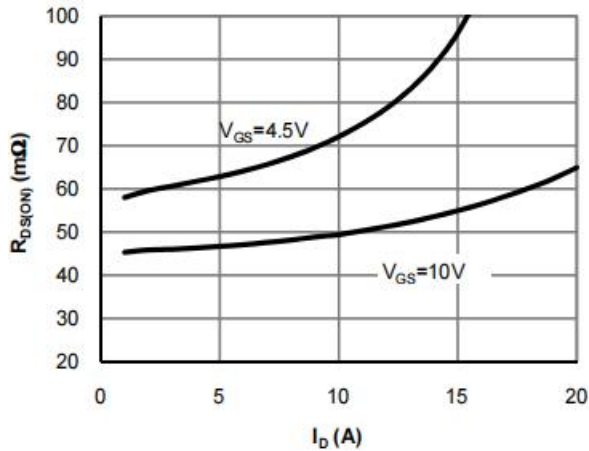


Figure 7: On-Resistance vs. Drain Current

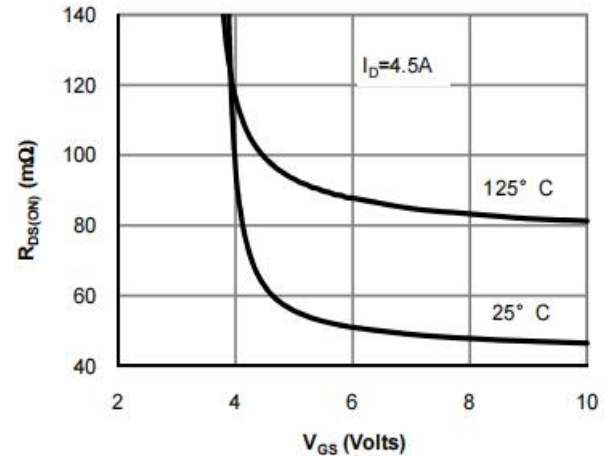


Figure 8: On-Resistance vs.  $V_{GS}$

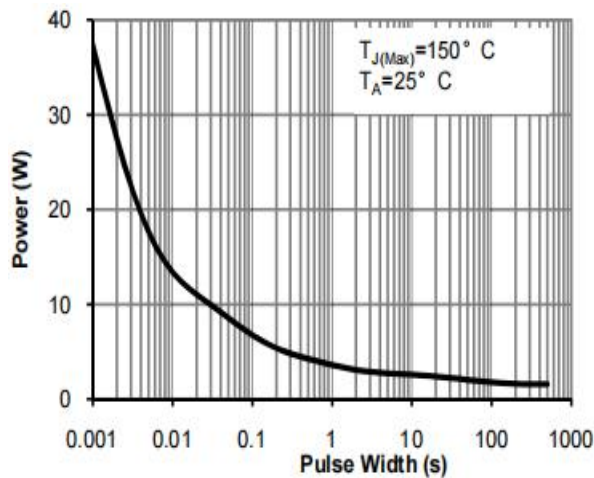


Figure 9: Power Rating Curve

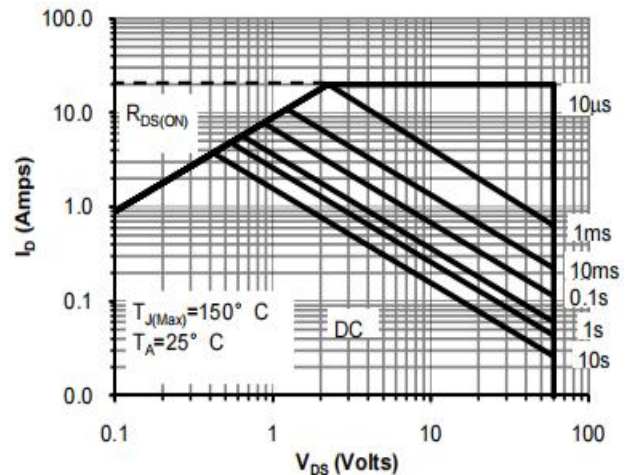


Figure 10: Safe Operating Area

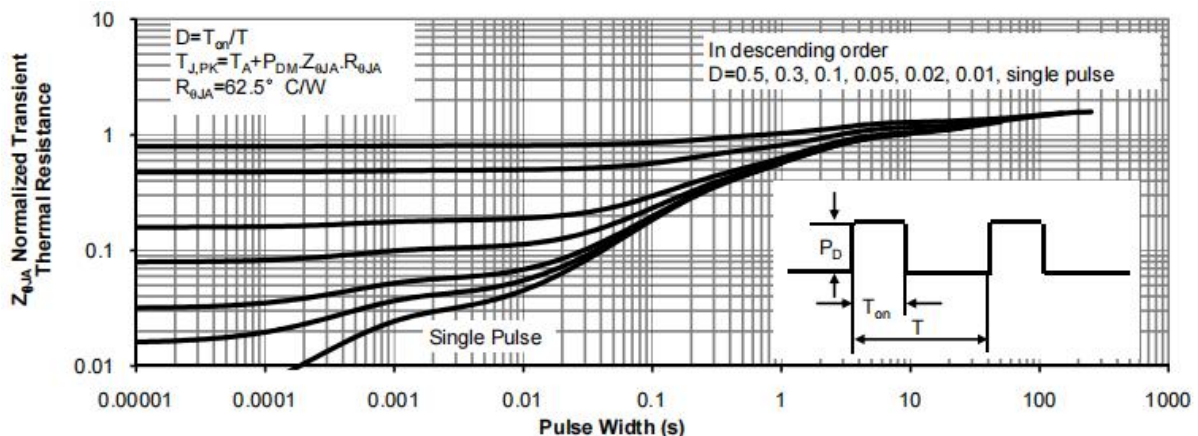


Figure 11: Transient Thermal Response Curve

## ■ P Typical Characteristic Curve 典型特性曲线

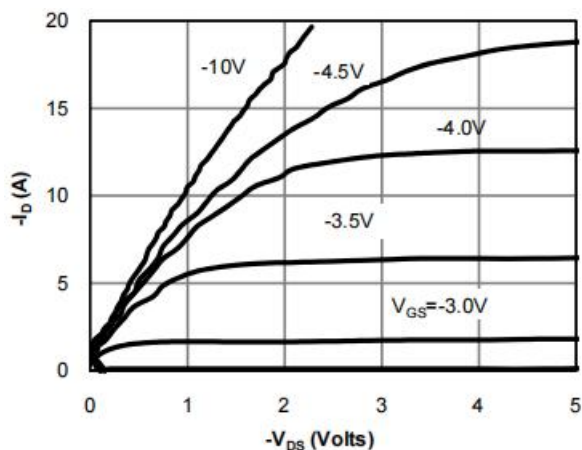


Figure 1: Output Characteristics

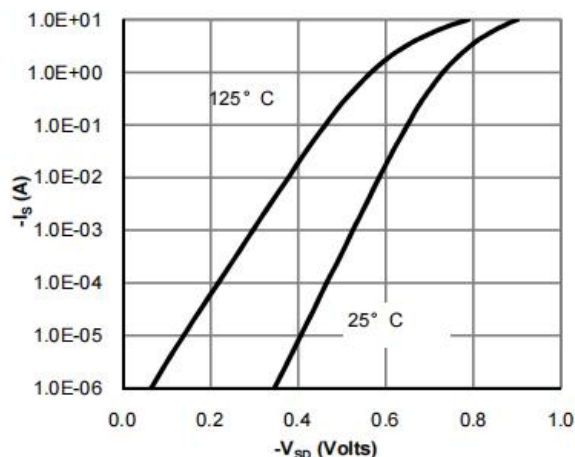


Figure 2: Diode Forward Characteristics

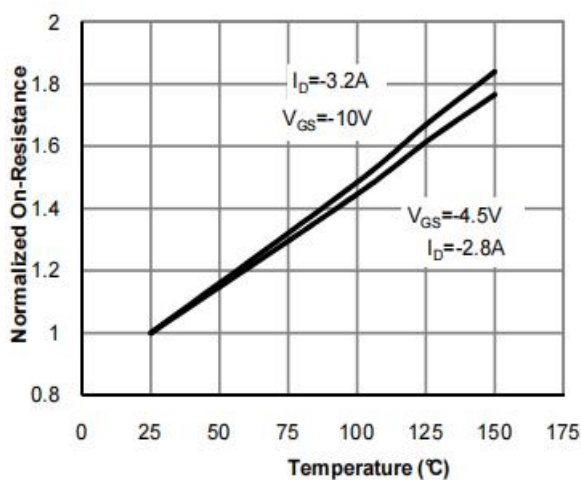


Figure 3: On-Resistance vs.  $T_J$

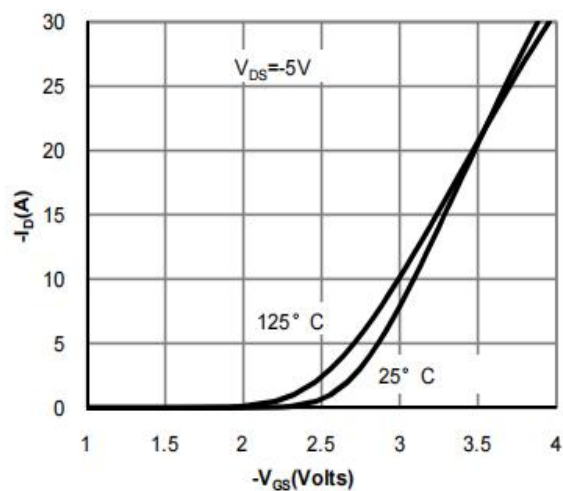


Figure 4: Transfer Characteristics

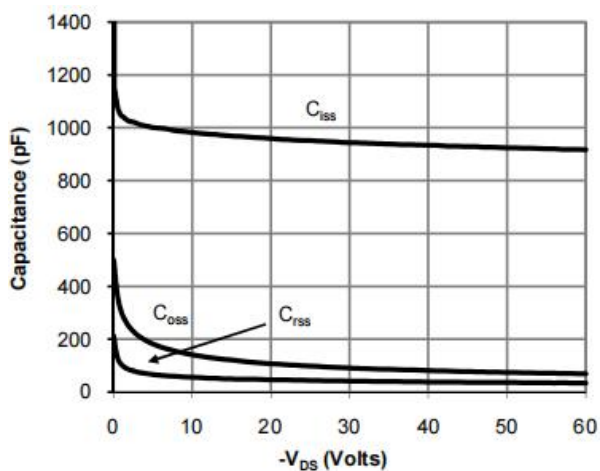


Figure 5: Capacitance Characteristics

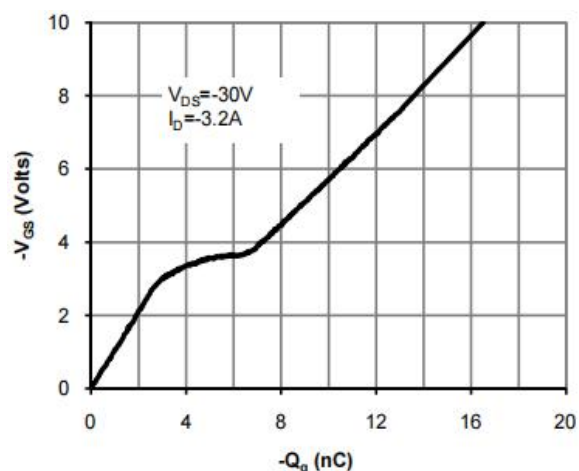


Figure 6: Gate-Charge Characteristics



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FS4612

## ■ P Typical Characteristic Curve 典型特性曲线

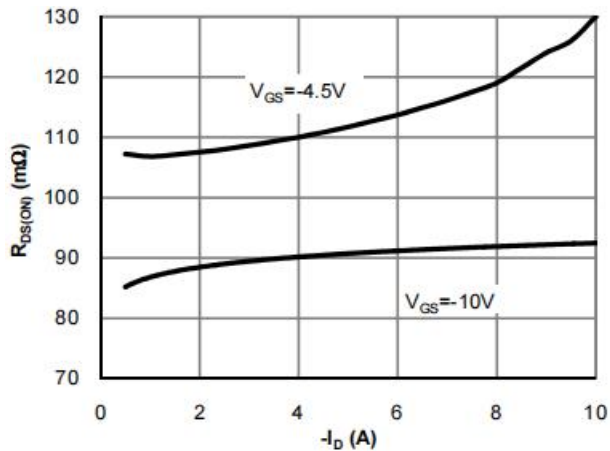


Figure 7: On-Resistance vs. Drain Current

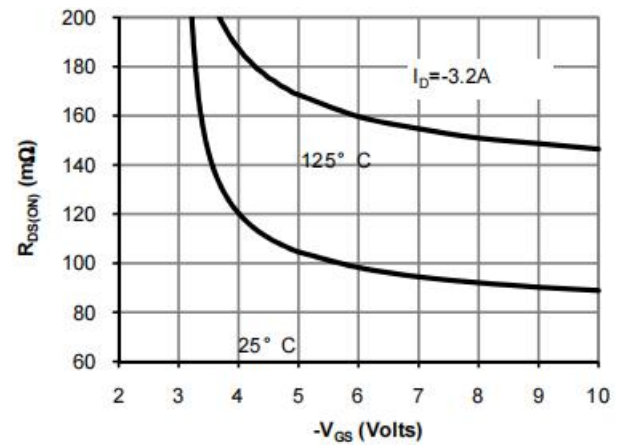


Figure 8: On-Resistance vs.  $V_{GS}$

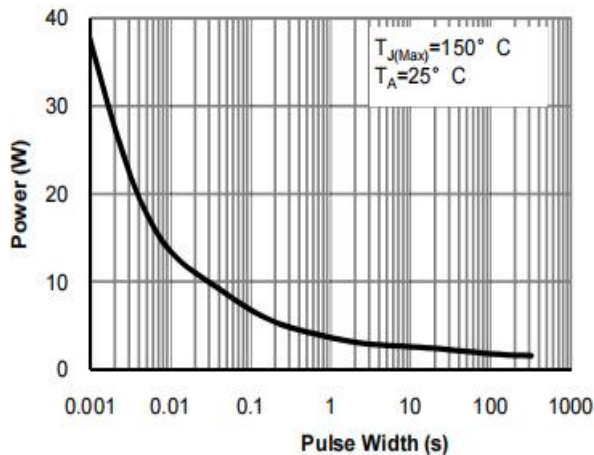


Figure 9: Power Rating Curve

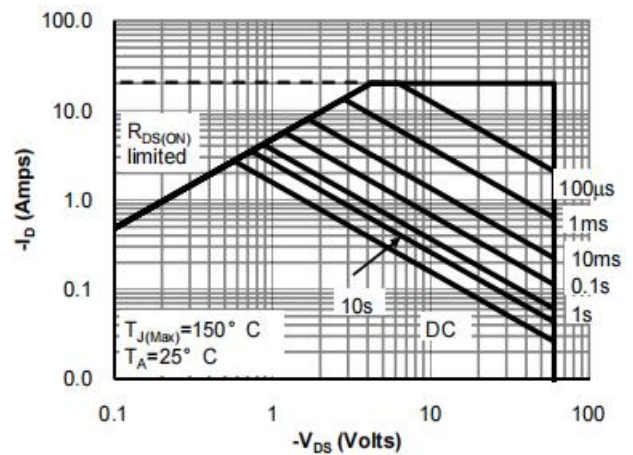


Figure 10: Safe Operating Area

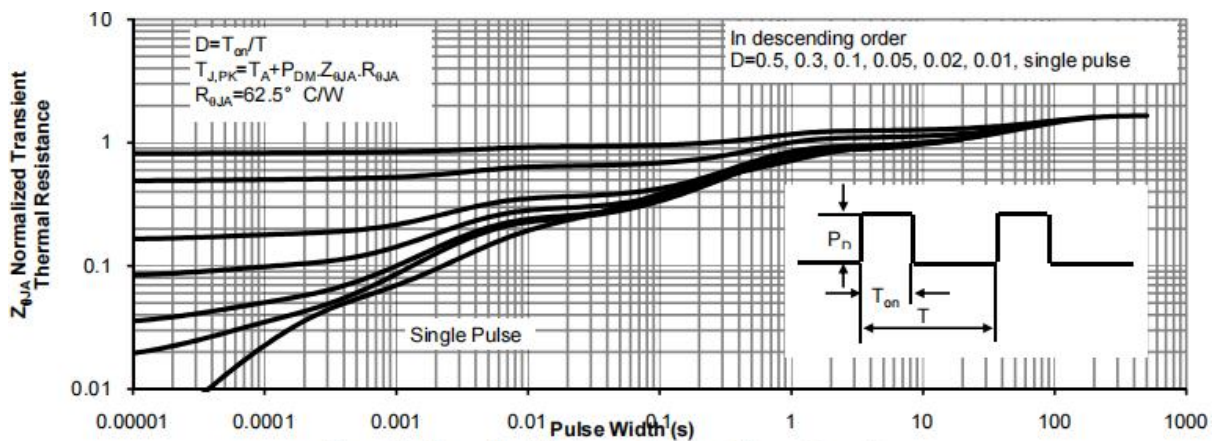
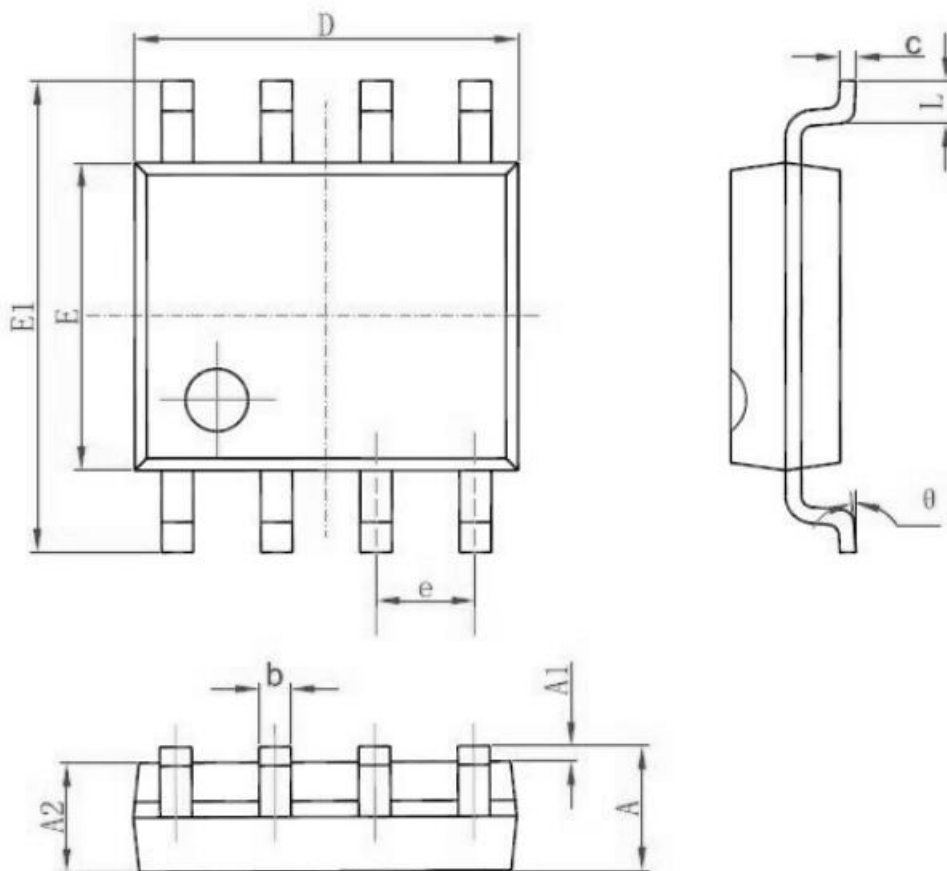


Figure 11: Transient Thermal Response Curve

## ■ Dimension 外形封装尺寸



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1     | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2     | 1.350                     | 1.550 | 0.053                | 0.061 |
| b      | 0.330                     | 0.510 | 0.013                | 0.020 |
| c      | 0.170                     | 0.250 | 0.006                | 0.010 |
| D      | 4.700                     | 5.100 | 0.185                | 0.200 |
| E      | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1     | 5.800                     | 6.200 | 0.228                | 0.244 |
| e      | 1.270 (BSC)               |       | 0.050 (BSC)          |       |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |