

## PRODUCT CHARACTERISTICS

| N-CHANNEL                          |              | P-CHANNEL                           |              |
|------------------------------------|--------------|-------------------------------------|--------------|
| $V_{DSS}$                          | 40V          | $V_{DSS}$                           | -40V         |
| $R_{DS(ON)}$ Typ(@ $V_{GS}=10V$ )  | 23m $\Omega$ | $R_{DS(ON)}$ Typ(@ $V_{GS}=-10V$ )  | 45m $\Omega$ |
| $R_{DS(ON)}$ Typ(@ $V_{GS}=4.5V$ ) | 26m $\Omega$ | $R_{DS(ON)}$ Typ(@ $V_{GS}=-4.5V$ ) | 55m $\Omega$ |
| $I_D$                              | 8A           | $I_D$                               | -6A          |

## APPLICATIONS

- \* Electronic lamp ballasts based on half bridge
- \* Load Switching, Quick/Wireless Charge.
- \* Motor Driving

## FEATURE

- \* Low Gate Charge
- \* Pb-Free Lead Plating



## ORDER INFORMATION

| Order Codes  |          | Package | Packing          |
|--------------|----------|---------|------------------|
| Halogen-Free | Halogen  |         |                  |
| N/A          | MOT4656S | SOP8    | 5000 pieces/Reel |

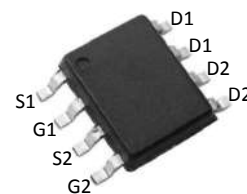
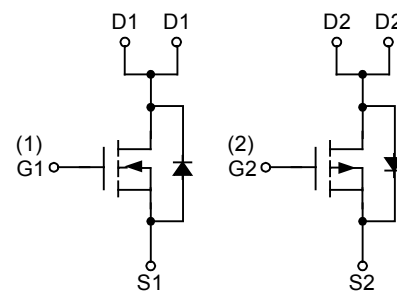
## ABSOLUTE MAXIMUM RATINGS( $T_A=25^{\circ}C$ , unless otherwise specified)

| Parameter                                                         | Symbol    | N-channel | P-channel | Unit        |
|-------------------------------------------------------------------|-----------|-----------|-----------|-------------|
| Drain-Source Voltage                                              | $V_{DSS}$ | 40        | -40       | V           |
| Gate-Source Voltage                                               | $V_{GSS}$ | $\pm 20$  | $\pm 20$  | V           |
| Drain Current Continuous(@ $V_{GS}=10\pm V$ , $T_A=25^{\circ}C$ ) | $I_D$     | 8         | -6        | A           |
| Drain Current Pulsed                                              | $I_{DM}$  | 32        | -24       | A           |
| Avalanche Energy                                                  | $E_{AS}$  | 36        | 42        | mJ          |
| Power Dissipation                                                 | $P_D$     | 3.2       |           | W           |
| Junction Temperature                                              | $T_J$     | +150      |           | $^{\circ}C$ |
| Storage Temperature                                               | $T_{STG}$ | -55~ +150 |           | $^{\circ}C$ |

## THERMAL CHARACTERISTICS

| Parameter           | Symbol     | Typ | Unit          |
|---------------------|------------|-----|---------------|
| Junction to Ambient | $R_{thJA}$ | 39  | $^{\circ}C/W$ |

## Symbol



SOP8

■ N-MOS ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$ , unless otherwise noted)

| Parameter                             | Symbol              | Test Conditions                                                                       | Min | Typ  | Max  | Unit |
|---------------------------------------|---------------------|---------------------------------------------------------------------------------------|-----|------|------|------|
| Off characteristics                   |                     |                                                                                       |     |      |      |      |
| Drain to Source Breakdown Voltage     | V <sub>DSS</sub>    | V <sub>GS</sub> =0V,I <sub>D</sub> =250μA                                             | 40  | -    | -    | V    |
| Drain to Source Leakage Current       | I <sub>DSS</sub>    | V <sub>DS</sub> =40V,V <sub>GS</sub> =0V                                              | -   | -    | -1   | μA   |
| Gate to Source Forward Leakage        | I <sub>GSS(F)</sub> | V <sub>GS</sub> =+20V,V <sub>DS</sub> =0V                                             | -   | -    | 100  | nA   |
| Gate to Source Reverse Leakage        | I <sub>GSS(R)</sub> | V <sub>GS</sub> =-20V ,V <sub>DS</sub> =0V                                            | -   | -    | -100 | nA   |
| On characteristics                    |                     |                                                                                       |     |      |      |      |
| Drain to Source On-Resistance         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V,I <sub>D</sub> =5 A                                              | -   | 23   | 30   | mΩ   |
|                                       |                     | V <sub>GS</sub> =4.5V,I <sub>D</sub> =5 A                                             | -   | 26   | 32   | mΩ   |
| Gate Threshold Voltage                | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                               | 1   | 1.4  | 2.5  | V    |
| Dynamic characteristics               |                     |                                                                                       |     |      |      |      |
| Gate Resistance                       | R <sub>g</sub>      | V <sub>GS</sub> =0V,V <sub>DS</sub> =0V ,f=1.0MHz                                     | -   | 3.9  | -    | Ω    |
| Forward Transconductance              | g <sub>fs</sub>     | V <sub>DS</sub> =5V,I <sub>D</sub> =5A                                                | -   | 10   | -    | S    |
| Input Capacitance                     | C <sub>iss</sub>    | V <sub>DS</sub> =20V,V <sub>GS</sub> =0V<br>f=1.0MHz                                  | -   | 790  | -    | pF   |
| Output Capacitance                    | C <sub>oss</sub>    |                                                                                       | -   | 60   | -    | pF   |
| Reverse Transfer Capacitance          | C <sub>rss</sub>    |                                                                                       | -   | 40   | -    | pF   |
| Resistive Switching Characteristics   |                     |                                                                                       |     |      |      |      |
| Turn-on Delay Time                    | t <sub>d(ON)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V,<br>I <sub>D</sub> =8A ,R <sub>G</sub> =3Ω | -   | 4    | -    | ns   |
| Rise Time                             | t <sub>r</sub>      |                                                                                       | -   | 3    | -    | ns   |
| Turn-off Delay Time                   | t <sub>d(OFF)</sub> |                                                                                       | -   | 15   | -    | ns   |
| Fall Time                             | t <sub>f</sub>      |                                                                                       | -   | 2    | -    | ns   |
| Total Gate Charge                     | Q <sub>g</sub>      | I <sub>D</sub> =8 A, V <sub>DS</sub> =20V<br>V <sub>GS</sub> =10V                     | -   | 12   | -    | nC   |
| Gate to Source Charge                 | Q <sub>gs</sub>     |                                                                                       | -   | 3.2  | -    | nC   |
| Gate to Drain("Miller") Charge        | Q <sub>gd</sub>     |                                                                                       | -   | 3.1  | -    | nC   |
| Source-Drain Diode Characteristics    |                     |                                                                                       |     |      |      |      |
| Continuous Source Current(Body Diode) | I <sub>s</sub>      |                                                                                       | -   | -    | 8    | A    |
| Maximum Pulsed Current(Body Diode)    | I <sub>SM</sub>     |                                                                                       | -   | -    | 32   | A    |
| Diode Forward Voltage                 | V <sub>SD</sub>     | I <sub>SD</sub> =1A, V <sub>GS</sub> =0V                                              | -   | 0.76 | 1.2  | V    |
| Reverse Recovery Time                 | t <sub>rr</sub>     | I <sub>SD</sub> =8A, T <sub>J</sub> =25 °C<br>dI/dt=100A/μs                           | -   | 26   | -    | ns   |
| Reverse Recovery Charge               | Q <sub>rr</sub>     |                                                                                       | -   | 15   | -    | nC   |

■ P-MOS ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$ , unless otherwise noted)

| Parameter                             | Symbol              | Test Conditions                                                                          | Min | Typ   | Max  | Unit |
|---------------------------------------|---------------------|------------------------------------------------------------------------------------------|-----|-------|------|------|
| Off characteristics                   |                     |                                                                                          |     |       |      |      |
| Drain to Source Breakdown Voltage     | V <sub>DSS</sub>    | V <sub>GS</sub> =0V,I <sub>D</sub> =-250μA                                               | -40 | -     | -    | V    |
| Drain to Source Leakage Current       | I <sub>DSS</sub>    | V <sub>DS</sub> =-40V,V <sub>GS</sub> =0V                                                | -   | -     | -1   | μA   |
| Gate to Source Forward Leakage        | I <sub>GSS(F)</sub> | V <sub>GS</sub> =+20V,V <sub>DS</sub> =0V                                                | -   | -     | 100  | nA   |
| Gate to Source Reverse Leakage        | I <sub>GSS(R)</sub> | V <sub>GS</sub> =-20V ,V <sub>DS</sub> =0V                                               | -   | -     | -100 | nA   |
| On characteristics                    |                     |                                                                                          |     |       |      |      |
| Drain to Source On-Resistance         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-10V,I <sub>D</sub> =-5A                                                | -   | 45    | 51   | mΩ   |
|                                       |                     | V <sub>GS</sub> =-4.5V,I <sub>D</sub> =-5A                                               | -   | 55    | 60   | mΩ   |
| Gate Threshold Voltage                | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =-250μA                                 | -1  | -1.6  | -2.5 | V    |
| Dynamic characteristics               |                     |                                                                                          |     |       |      |      |
| Gate Resistance                       | R <sub>g</sub>      | V <sub>GS</sub> =0V,V <sub>DS</sub> =0V ,f=1.0MHz                                        | -   | 10    | -    | Ω    |
| Forward Transconductance              | g <sub>fs</sub>     | V <sub>DS</sub> =-5V,I <sub>D</sub> =-5A                                                 | -   | 10    | -    | S    |
| Input Capacitance                     | C <sub>iss</sub>    | V <sub>DS</sub> =-20V,V <sub>GS</sub> =0V<br>f=1.0MHz                                    | -   | 775   | -    | pF   |
| Output Capacitance                    | C <sub>oss</sub>    |                                                                                          | -   | 60    | -    | pF   |
| Reverse Transfer Capacitance          | C <sub>rss</sub>    |                                                                                          | -   | 50    | -    | pF   |
| Resistive Switching Characteristics   |                     |                                                                                          |     |       |      |      |
| Turn-on Delay Time                    | t <sub>d(ON)</sub>  | V <sub>GS</sub> =-10V,V <sub>DS</sub> =-20V,<br>I <sub>D</sub> =-6 A,R <sub>G</sub> =6 Ω | -   | 7.5   | -    | ns   |
| Rise Time                             | t <sub>r</sub>      |                                                                                          | -   | 5.5   | -    | ns   |
| Turn-off Delay Time                   | t <sub>d(OFF)</sub> |                                                                                          | -   | 19    | -    | ns   |
| Fall Time                             | t <sub>f</sub>      |                                                                                          | -   | 7     | -    | ns   |
| Total Gate Charge                     | Q <sub>g</sub>      | I <sub>D</sub> =-6 A, V <sub>DS</sub> =-20V<br>V <sub>GS</sub> =-10V                     | -   | 13    | -    | nC   |
| Gate to Source Charge                 | Q <sub>gs</sub>     |                                                                                          | -   | 3.8   | -    | nC   |
| Gate to Drain("Miller") Charge        | Q <sub>gd</sub>     |                                                                                          | -   | 3.1   | -    | nC   |
| Source-Drain Diode Characteristics    |                     |                                                                                          |     |       |      |      |
| Continuous Source Current(Body Diode) | I <sub>s</sub>      |                                                                                          | -   | -     | -6   | A    |
| Maximum Pulsed Current(Body Diode)    | I <sub>SM</sub>     |                                                                                          | -   | -     | - 24 | A    |
| Diode Forward Voltage                 | V <sub>SD</sub>     | I <sub>SD</sub> =-1A, V <sub>GS</sub> =0V                                                | -   | -0.76 | -1.2 | V    |
| Reverse Recovery Time                 | t <sub>rr</sub>     | I <sub>SD</sub> =-6 A, T <sub>J</sub> =25 °C<br>dI/dt=100A/μs                            | -   | 18    | -    | ns   |
| Reverse Recovery Charge               | Q <sub>rr</sub>     |                                                                                          | -   | 10    | -    | nC   |

## ■ N-MOS TYPICAL CHARACTERISTICS

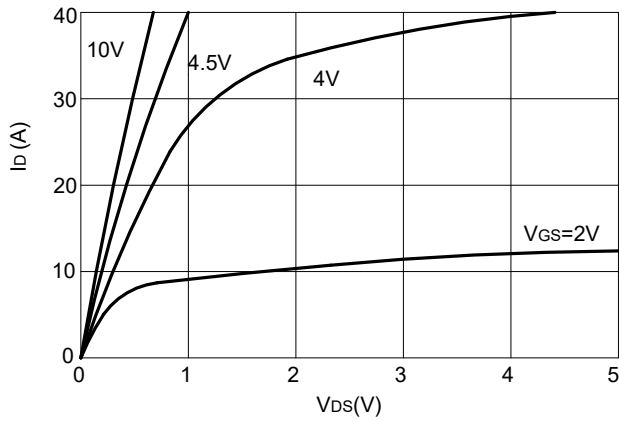


Figure 1: Output Characteristics

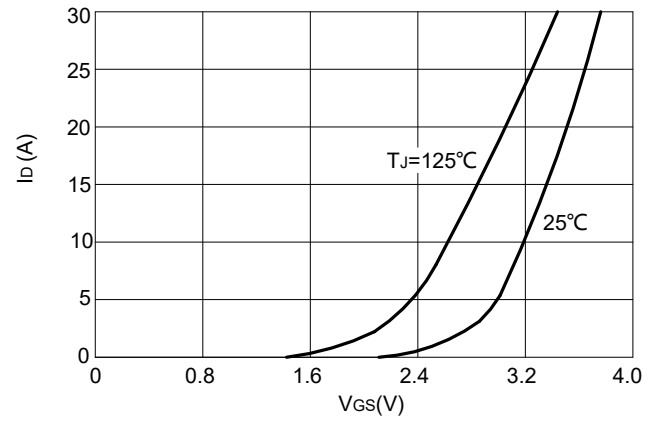


Figure 2: Typical Transfer Characteristics

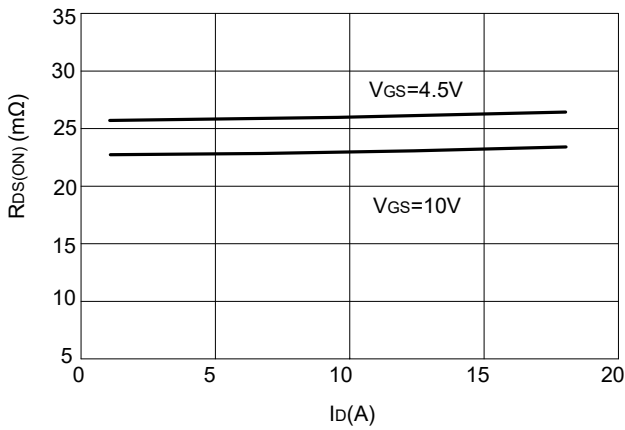


Figure 3: On-resistance vs. Drain Current

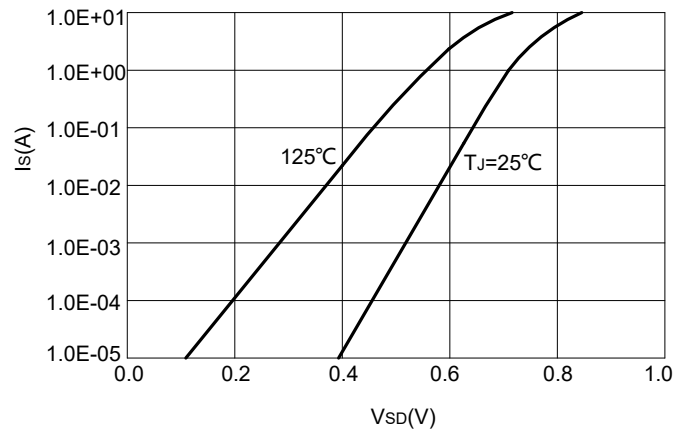


Figure 4: Body Diode Characteristics

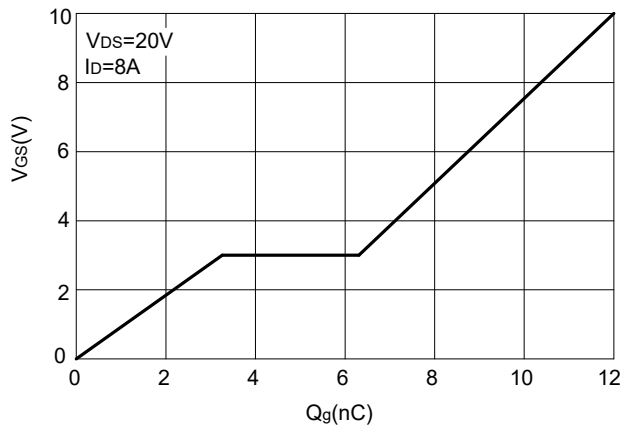


Figure 5: Gate Charge Characteristics

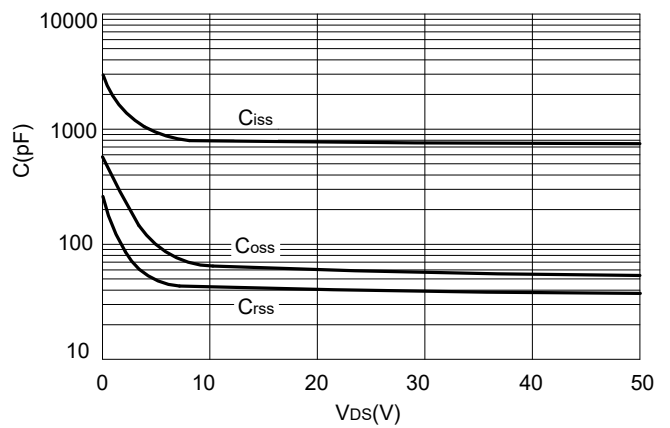


Figure 6: Capacitance Characteristics

■ N-MOS TYPICAL CHARACTERISTICS(Cont.)

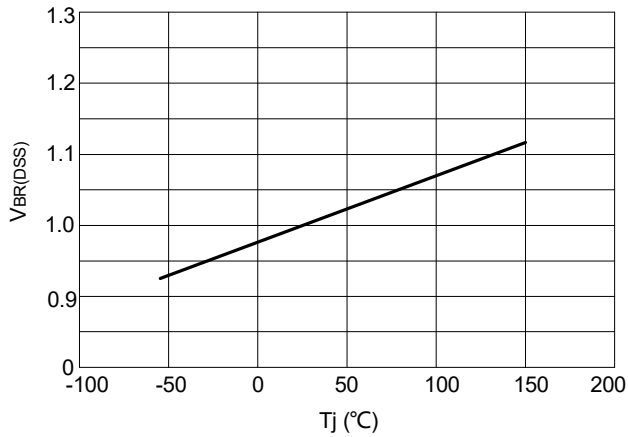


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

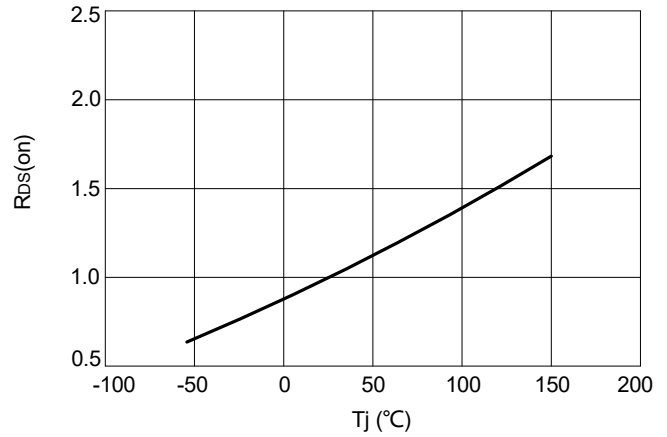


Figure 8: Normalized on Resistance vs. Junction Temperature

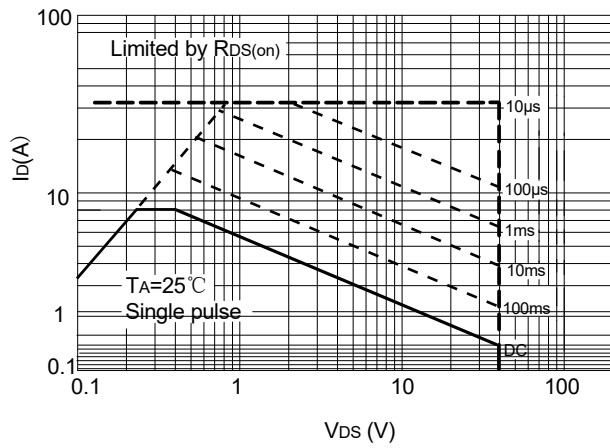


Figure 9: Maximum Safe Operating Area

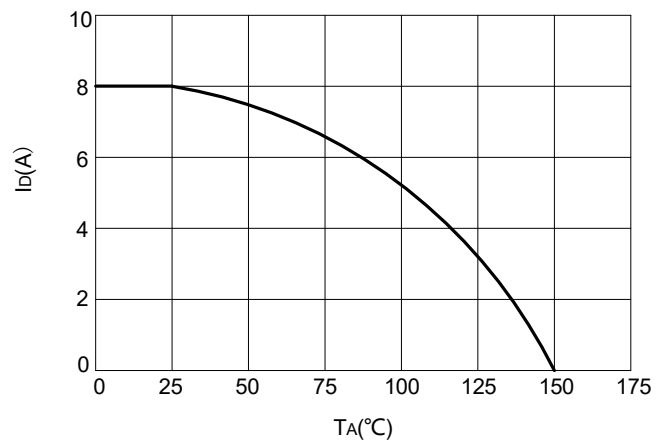


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

■ P-MOS TYPICAL CHARACTERISTICS

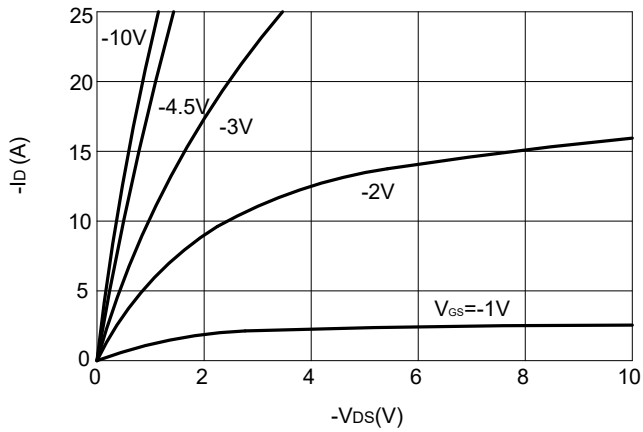


Figure 1: Output Characteristics

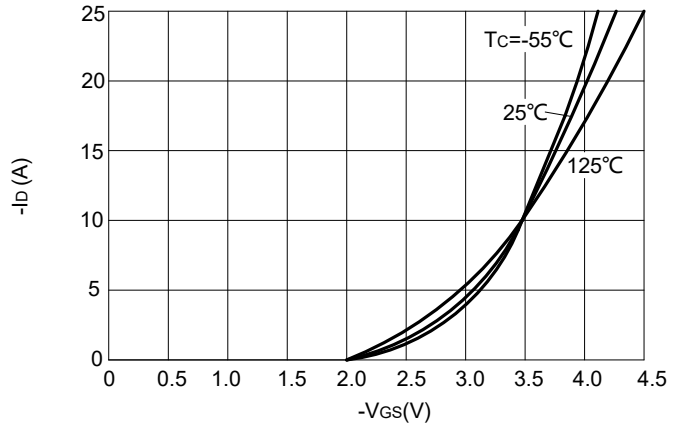


Figure 2: Typical Transfer Characteristics

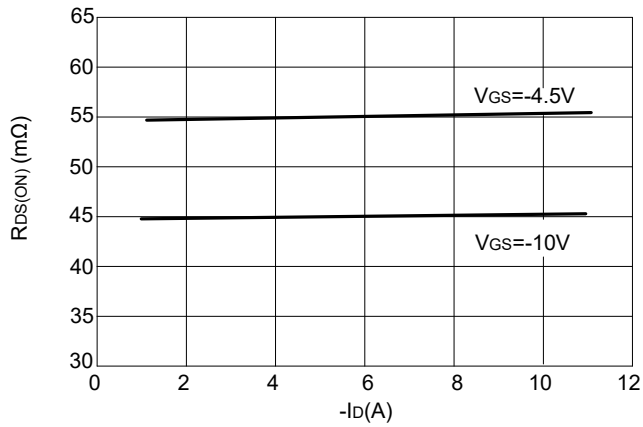


Figure 3: On-resistance vs. Drain Current

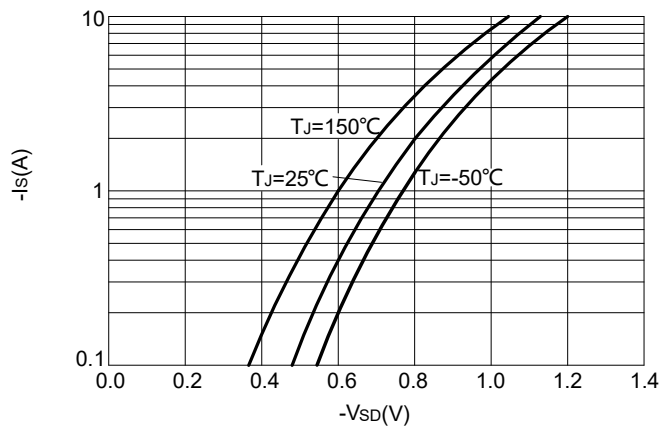


Figure 4: Body Diode Characteristics

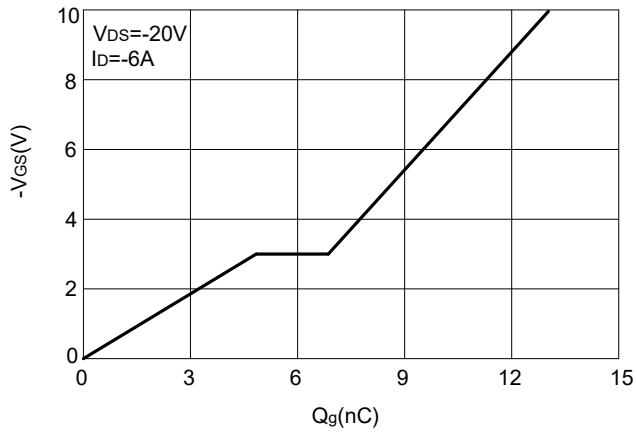


Figure 5: Gate Charge Characteristics

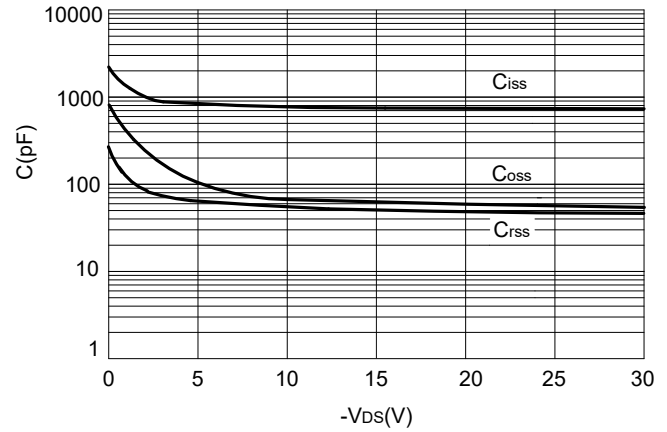


Figure 6: Capacitance Characteristics

■ P-MOS TYPICAL CHARACTERISTICS(Cont.)

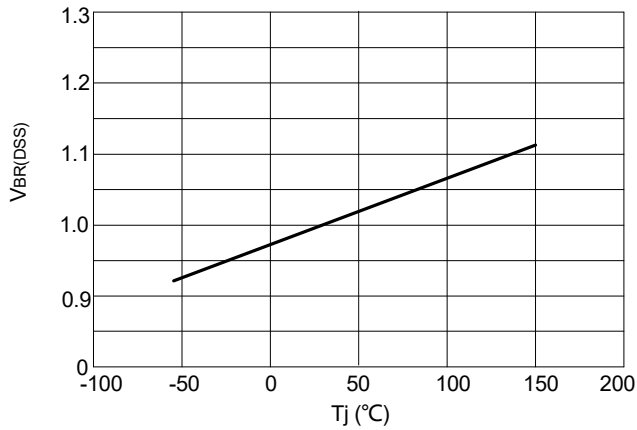


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

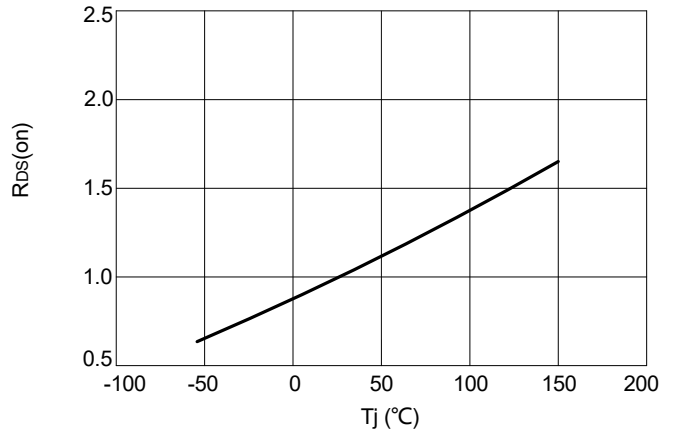


Figure 8: Normalized on Resistance vs. Junction Temperature

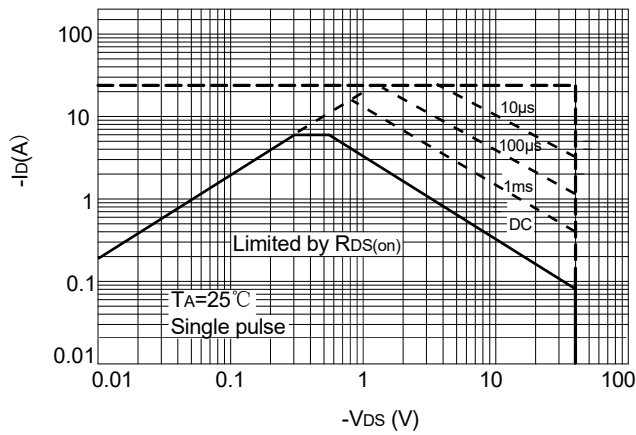


Figure 9: Maximum Safe Operating Area

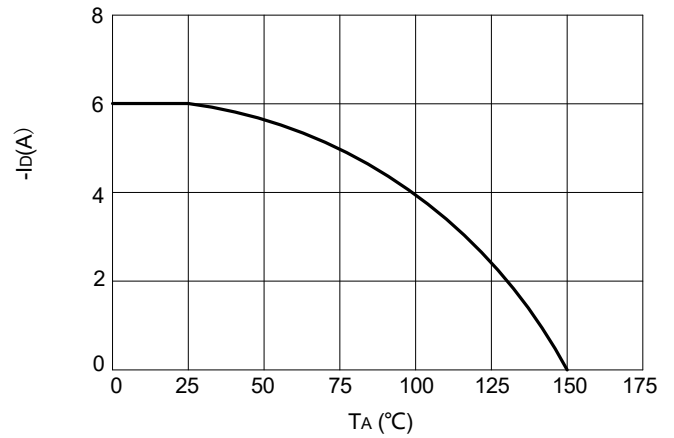


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

■ SOP8 PACKAGE OUTLINE DIMENSIONS

