

## 60V Full-Bridge of MOSFET

### Description

The HM4926 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a H-Bridge, and for a host of other applications.

### General Features

- ◆ **N-channel:**  
 $V_{DS} = 60V, I_D = 5A$   
 $R_{DS(ON)} = 46m\Omega$  (typical) @  $V_{GS} = 4.5V$   
 $R_{DS(ON)} = 34m\Omega$  (typical) @  $V_{GS} = 10V$
- ◆ **P-Channel:**  
 $V_{DS} = -60V, I_D = -5A$   
 $R_{DS(ON)} = 135m\Omega$  (typical) @  $V_{GS} = -4.5V$   
 $R_{DS(ON)} = 85m\Omega$  (typical) @  $V_{GS} = -10V$
- ◆ Excellent gate charge x  $R_{DS(ON)}$  product(FOM)
- ◆ Very low on-resistance  $R_{DS(ON)}$
- ◆ 150 °C operating temperature
- ◆ Pb-free lead plating
- ◆ 100% UIS tested

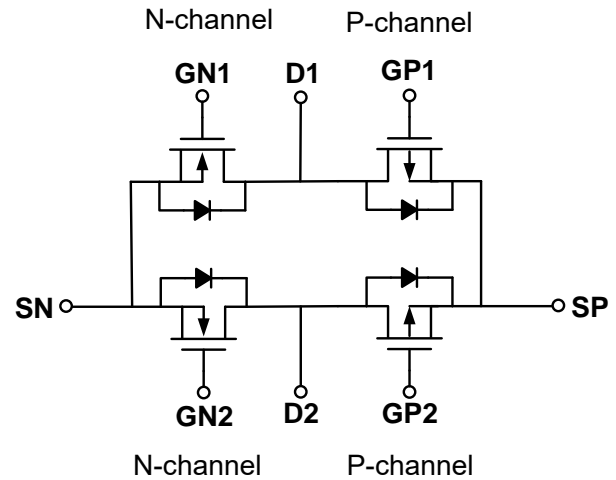
### Application

- ◆ Complementary MOSFET for DC FAN, Motor
- ◆ Wireless Charging

### Package

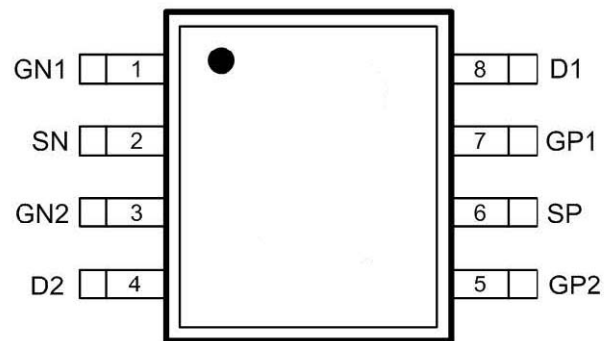
- ◆ SOP-8

### Schematic diagram



### Marking and pin assignment

#### SOP-8 (TOP VIEW)



### Ordering Information

| Part Number | Storage Temperature | Package | Devices Per Reel |
|-------------|---------------------|---------|------------------|
| HM4926SR    | -55°C to +150°C     | SOP-8   | 3000             |
| HM4926SF    | -55°C to +150°C     | SOP-8   | 4000             |

### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| Parameter            | Symbol   | Limit |     | Unit |
|----------------------|----------|-------|-----|------|
|                      |          | N     | P   |      |
| Drain-source voltage | $V_{DS}$ | 60    | -60 | V    |

|   |                          |          |          |    |
|---|--------------------------|----------|----------|----|
| Gate-source voltage                           | $V_{GS}$                 | $\pm 12$ | $\pm 12$ | V  |
| Maximum power dissipation                     | $P_D$                    | 2.0      | 2.0      | W  |
| Operating junction Temperature range          | $T_J$                    | -55—150  | -55—150  | °C |
| Drain Current-Continuous<br>(Silicon Limited) | $T_A=25^{\circ}\text{C}$ | $I_D$    | 5        | A  |
|   | $T_A=75^{\circ}\text{C}$ |          | 3.5      |    |
| Pulsed Drain Current (Package Limited)        | $I_{DM}$                 | 15       | -15      | A  |
| Power Dissipation <sup>B</sup>                | $T_A=25^{\circ}\text{C}$ | $P_D$    | 2        | W  |
|   | $T_A=75^{\circ}\text{C}$ |          | 1.3      |    |
| Junction and Storage Temperature Range        | $T_J, T_{STG}$           | -55—150  |          | °C |

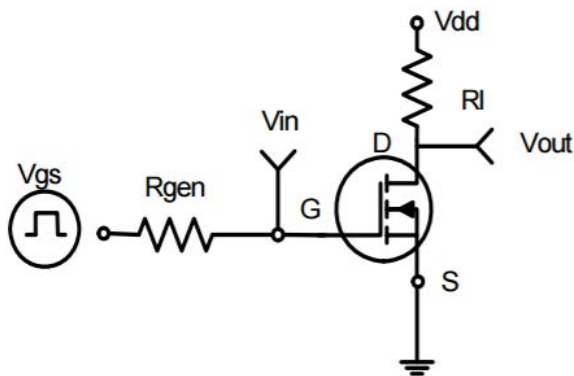
### N-Channel Electrical Characteristics ( $T_J=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                        | Symbol       | Condition  | Min | Typ | Max       | Unit       |
|----------------------------------|--------------|--|-----|-----|-----------|------------|
| <b>OFF Characteristics</b>       |              |  |     |     |           |            |
| Drain-source breakdown voltage   | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$  | 60  | -   | -         | V          |
| Zero gate voltage drain current  | $I_{DSS}$    | $V_{DS}=60V, V_{GS}=0V$  | -   | -   | 1         | $\mu A$    |
| Gate-body leakage                | $I_{GSS}$    | $V_{DS}=0V, V_{GS}=\pm 12V$  | -   | -   | $\pm 100$ | nA         |
| <b>ON Characteristics</b>        |              |  |     |     |           |            |
| Gate threshold voltage           | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$  | 1.0 |     | 2.6       | V          |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=4.5V, I_D=5A$  | -   |     | 46        | m $\Omega$ |
|                                  |              | $V_{GS}=10V, I_D=2.8A$   | -   |     | 34        |            |
| Forward transconductance         | $g_{fs}$     | $V_{GS}=5V, I_D=5A$  | -   | 5   | -         | S          |
| <b>Dynamic Characteristics</b>   |              |  |     |     |           |            |
| Input capacitance                | $C_{ISS}$    | $V_{DS}=10V, V_{GS}=0V$<br>$f=1.0\text{MHz}$                                   | -   | 240 | -         | pF         |
| Output capacitance               | $C_{OSS}$    |  | -   | 45  | -         |            |
| Reverse transfer capacitance     | $C_{RSS}$    |  | -   | 23  | -         |            |
| Gate resistance                  | $R_g$        | $V_{GS}=0V, V_{DS}=0V,$<br>$f=1.0\text{MHz}$                                   | -   | 3.3 | 4.9       | $\Omega$   |
| <b>Switching Characteristics</b> |              |  |     |     |           |            |
| Turn-on delay time               | $t_{D(on)}$  | $V_{DD}=10V$<br>$R_L=3.3\text{ohm}$<br>$V_{GEN}=4.5V$<br>$R_{GEN}=6\text{ohm}$ | -   | 2.3 | -         | ns         |
| Rise time                        | $t_r$        |  | -   | 3.1 | -         |            |
| Turn-off delay time              | $t_{D(off)}$ |  | -   | 21  | -         |            |
| Fall time                        | $t_f$        |  | -   | 2.6 | -         |            |
| Total gate charge                | $Q_g$        | $V_{DS}=10V$<br>$I_D=5A$<br>$V_{GS}=4.5V$                                      | -   | 2.7 | -         | nC         |
| Gate-source charge               | $Q_{gs}$     |  | -   | 0.4 | -         |            |
| Gate-drain charge                | $Q_{gd}$     |  | -   | 0.5 | -         |            |

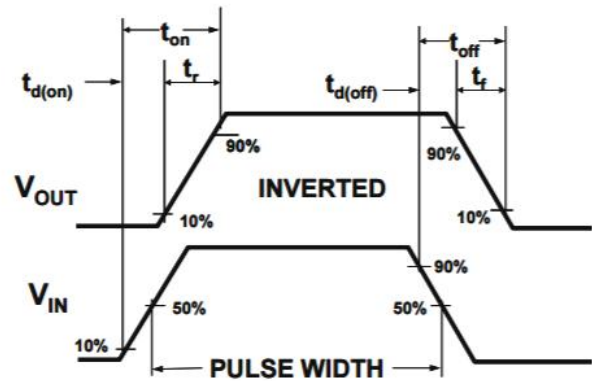
### Thermal Characteristics

|  |             |     |      |
|--|-------------|-----|------|
| Thermal Resistance junction-to ambient | $R_{th JA}$ | 100 | °C/W |
|--|-------------|-----|------|

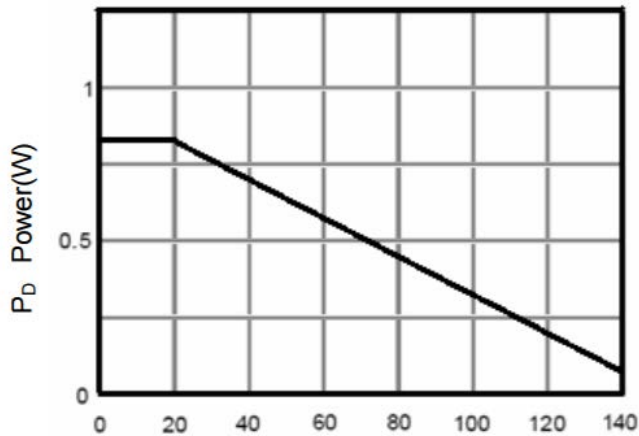
## N-Channel: Typical Electrical And Thermal Characteristics



**Figure 1: Switching Test Circuit**

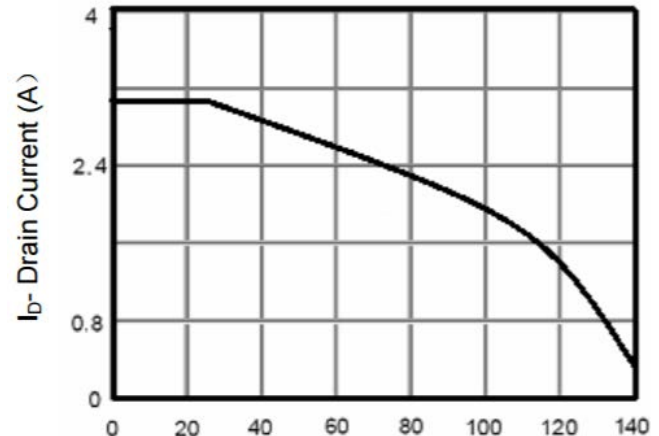


**Figure 2: Switching Waveforms**



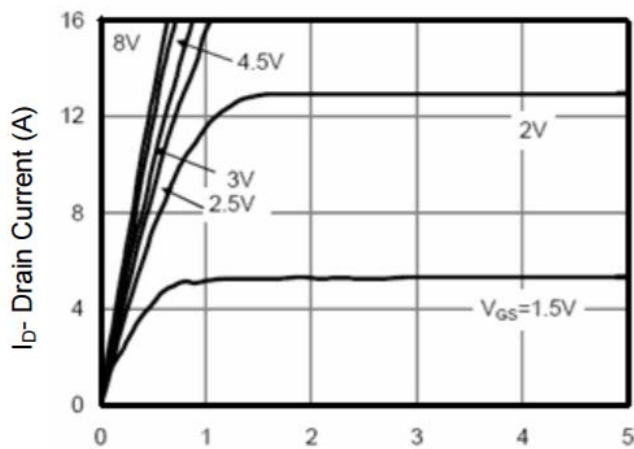
T<sub>J</sub>-Junction Temperature(°C)

**Figure 3 Power Dissipation**



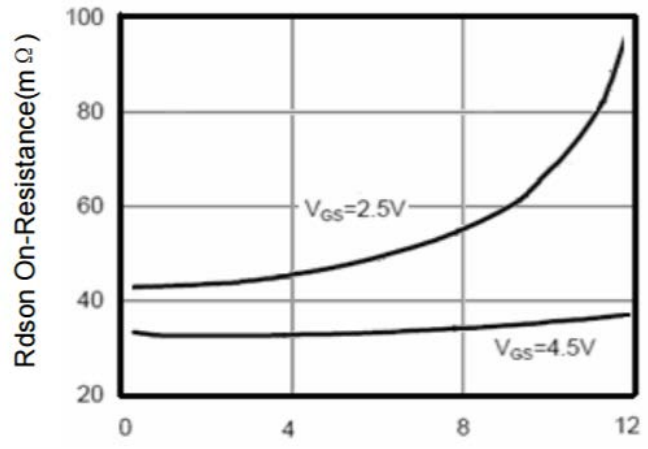
T<sub>J</sub>-Junction Temperature(°C)

**Figure 4 Drain Current**



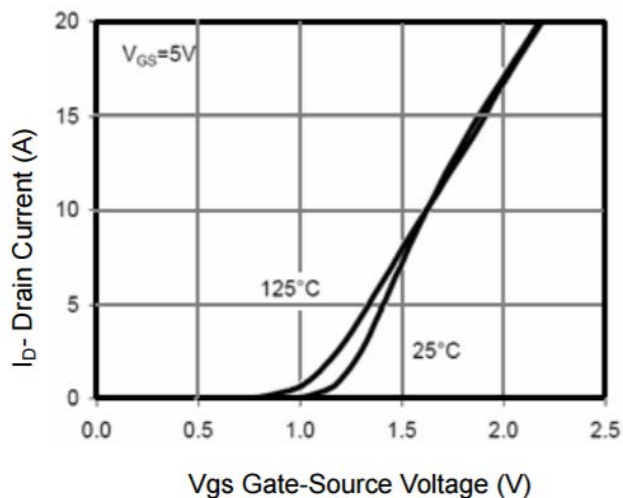
V<sub>DS</sub> Drain-Source Voltage (V)

**Figure 5 Output Characteristics**

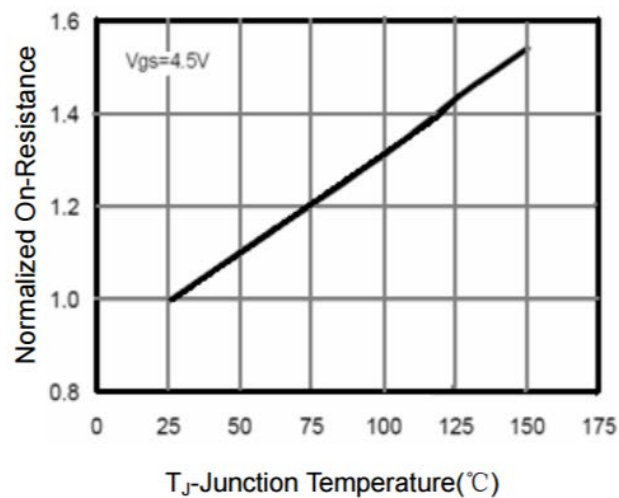


I<sub>D</sub>- Drain Current (A)

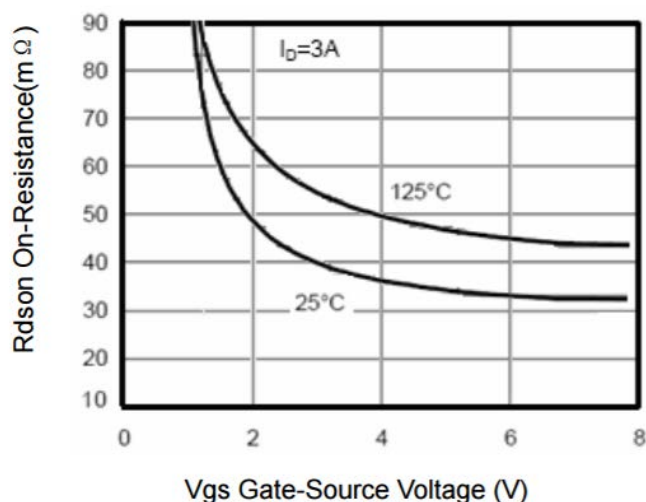
**Figure 6 Drain-Source On-Resistance**



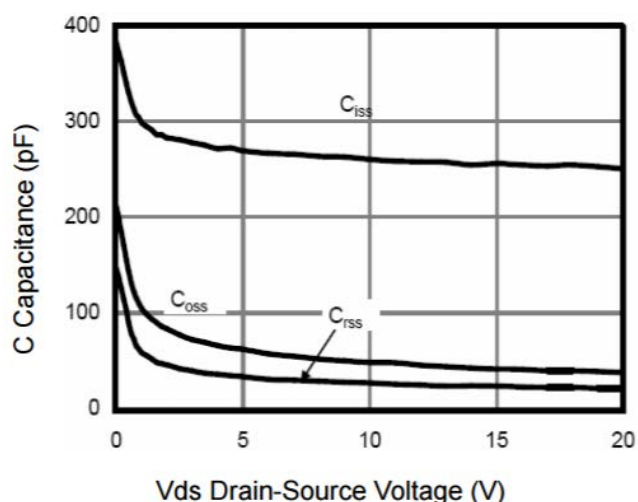
**Figure 7 Transfer Characteristics**



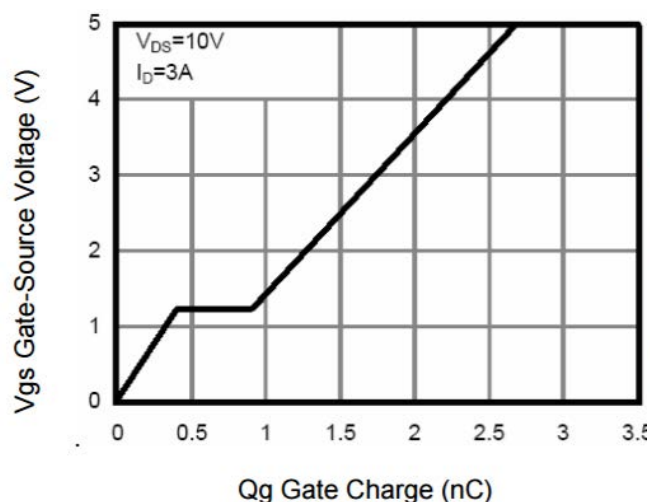
**Figure 8 Drain-Source On-Resistance**



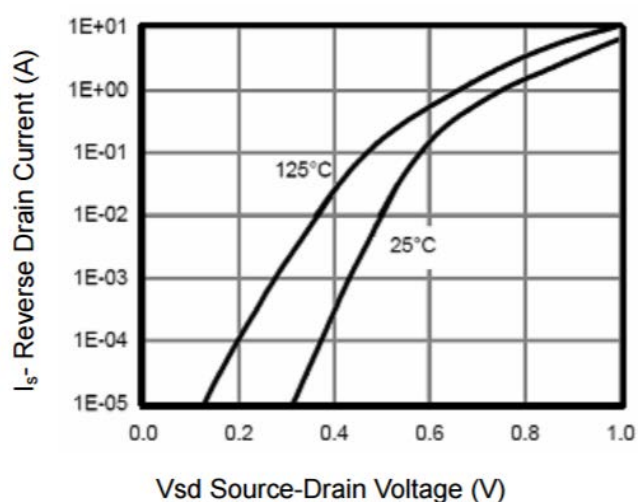
**Figure 9 Rdson vs Vgs**



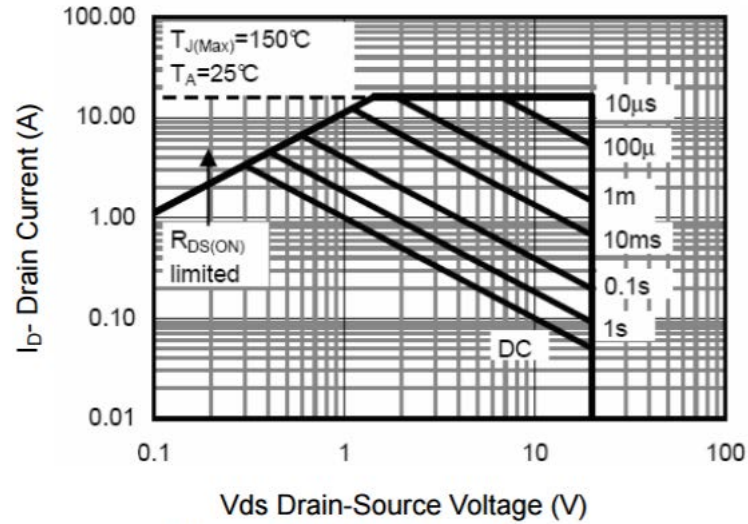
**Figure 10 Capacitance vs Vds**



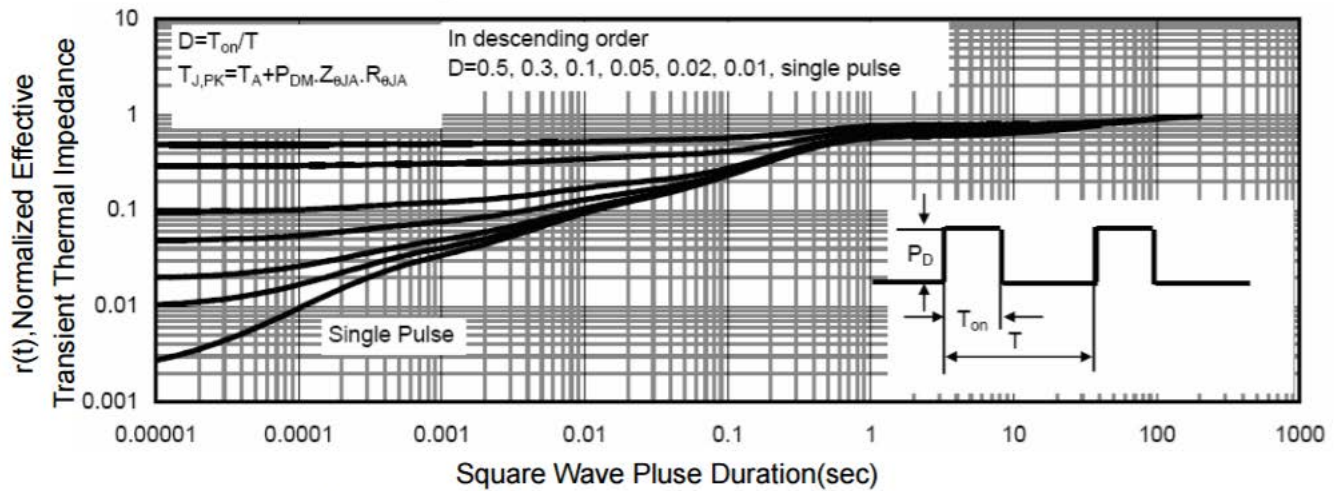
**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**



**Figure 13 Safe Operation Area**



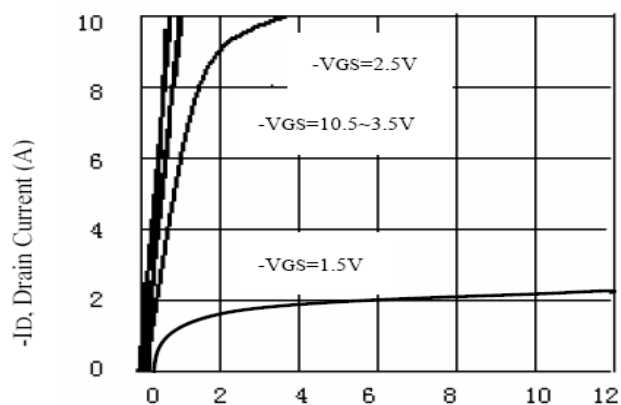
**Figure 14 Normalized Maximum Transient Thermal Impedance**

**P-Channel Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  unless otherwise noted)

| Parameter                        | Symbol              | Condition  | Min  | Typ  | Max  | Unit |
|----------------------------------|---------------------|--|------|------|------|------|
| OFF Characteristics              |                     |  |      |      |      |      |
| Drain-source breakdown voltage   | BV <sub>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   | -    | -    | -1   | μA   |
| Gate-body leakage                | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±12V   | -    | -    | ±100 | nA   |
| ON Characteristics               |                     |  |      |      |      |      |
| Gate threshold voltage           | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA  | -1.0 |      | -3.0 | V    |
| Drain-source on-state resistance | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-2.8A  | -    |      | 135  | mΩ   |
|                                  |                     | V <sub>GS</sub> =-10V, I <sub>D</sub> =-2.8A   | -    |      | 85   |      |
| Forward transconductance         | g <sub>fs</sub>     | V <sub>GS</sub> =-5V, I <sub>D</sub> =-5A  | -    | 5    | -    | S    |
| Dynamic Characteristics          |                     |  |      |      |      |      |
| Input capacitance                | C <sub>ISS</sub>    | V <sub>DS</sub> =-10V ,V <sub>GS</sub> =0V<br>f=1.0MHz   | -    | 561  | -    | pF   |
| Output capacitance               | C <sub>OSS</sub>    |  | -    | 61   | -    |      |
| Reverse transfer capacitance     | C <sub>RSS</sub>    |  | -    | 52   | -    |      |
| Switching Characteristics        |                     |  |      |      |      |      |
| Turn-on delay time               | t <sub>D(ON)</sub>  | V <sub>DD</sub> =-10V<br>I <sub>D</sub> =-2.8A<br>V <sub>GEN</sub> =-4.5V<br>R <sub>L</sub> =10ohm<br>R <sub>GEN</sub> =-60ohm | -    | 12.5 | -    | ns   |
| Rise time                        | t <sub>r</sub>      |  | -    | 6.6  | -    |      |
| Turn-off delay time              | t <sub>D(OFF)</sub> |  | -    | 113  | -    |      |
| Fall time                        | t <sub>f</sub>      |  | -    | 46.6 | -    |      |
| Total gate charge                | Q <sub>g</sub>      | V <sub>DS</sub> =-10V,I <sub>D</sub> =-5A<br>V <sub>GS</sub> =-4.5V  | -    | 6.1  | -    | nC   |
| Gate-source charge               | Q <sub>gs</sub>     |  | -    | 1.7  | -    |      |
| Gate-drain charge                | Q <sub>gd</sub>     |  | -    | 1.2  | -    |      |

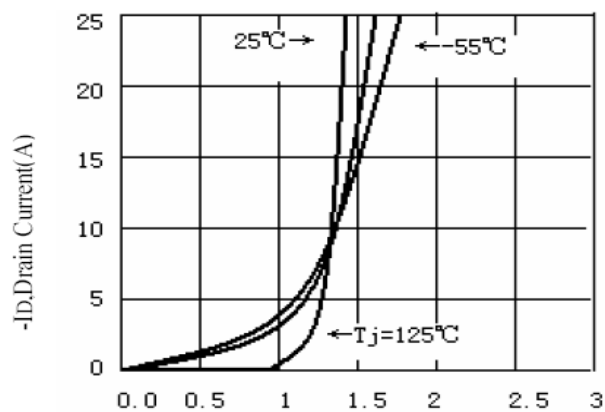


## P-Channel: Typical Electrical And Thermal Characteristics



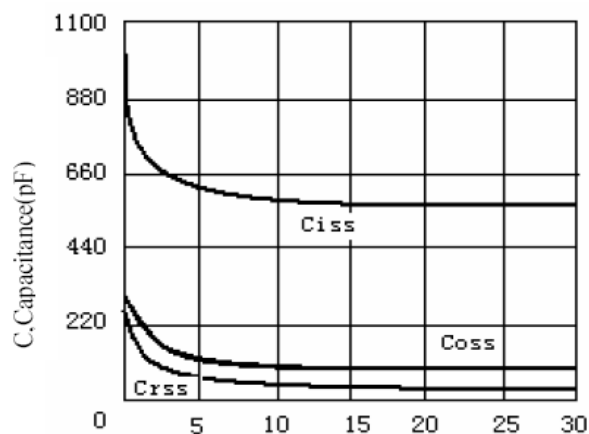
- VDS, Drain-to-Source Voltage (V)

Figure 1. Output Characteristics



-VGS, Gate-to-source Voltage (V)

Figure 2. Transfer Characteristics



- VGS, Drain-to Source Voltage

Figure3. Capacitance

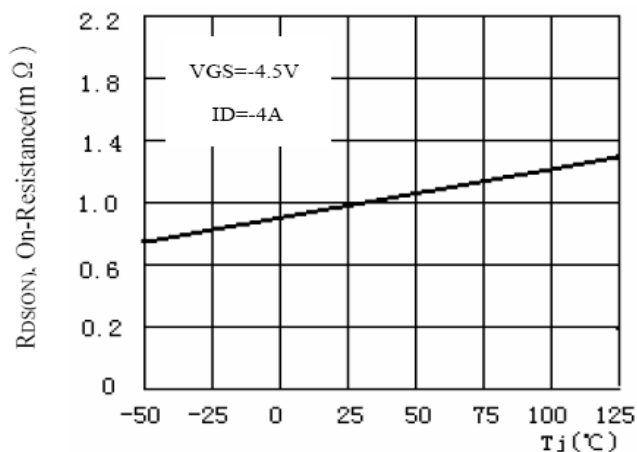


Figure4. On-Resistance Variation with Temperature

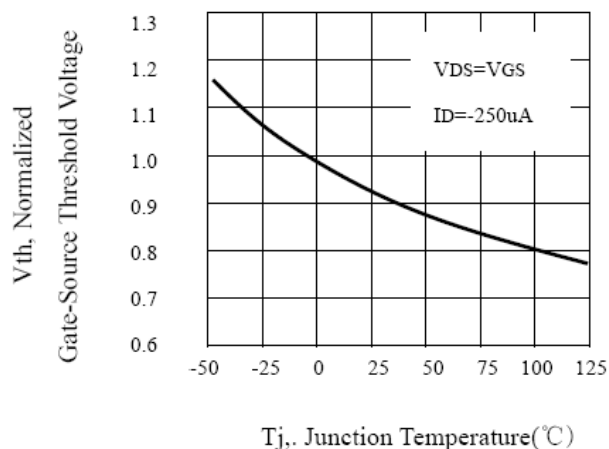


Figure5. Gate Threshold Variation With Temperature

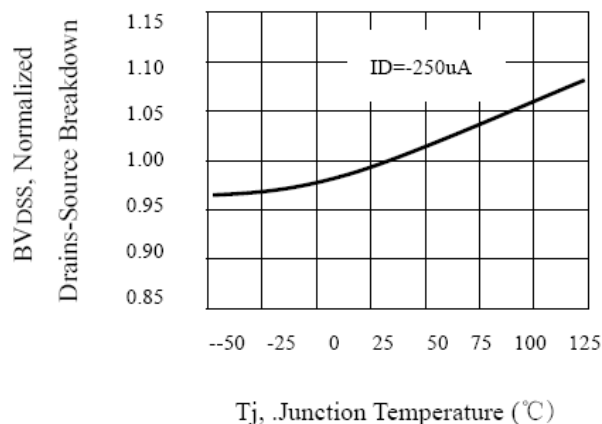
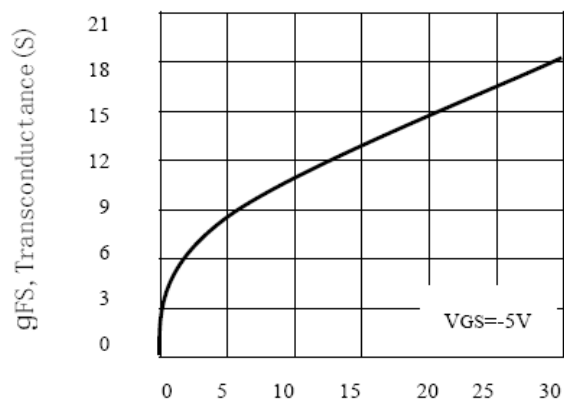
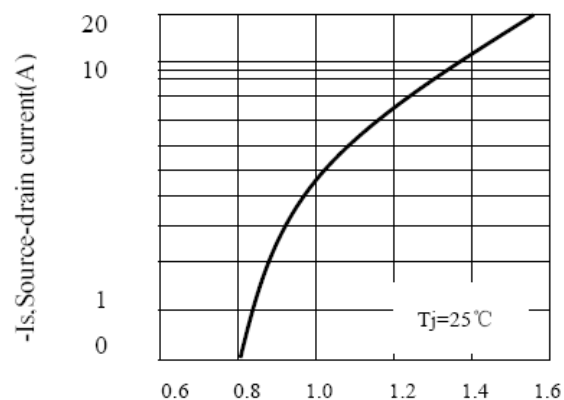


Figure6. Breakdown Voltage Variation With Temperature



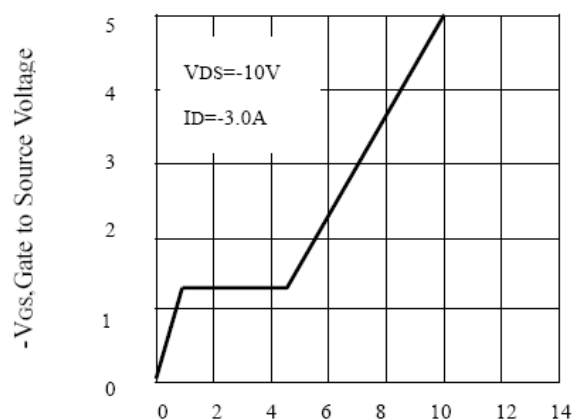
-IDS, Drain-Source Current (A)

Figure7. Transconductance Variation  
With Drain Current



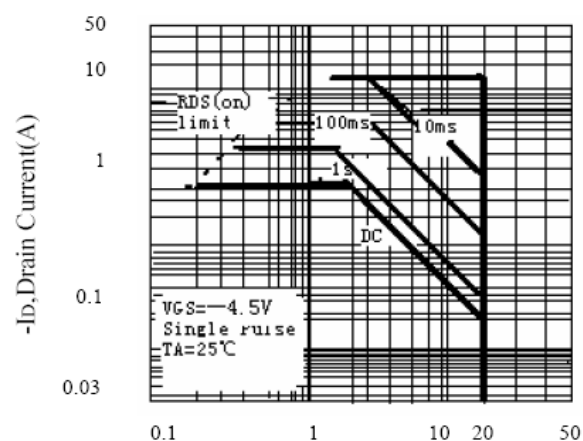
-VSD, Body Diode Forward Voltage

Figure8. Body Diode Forward Voltage  
Variation with Source Current



Qg, Total Gate Charge (nC)

Figure9. Gate Charge

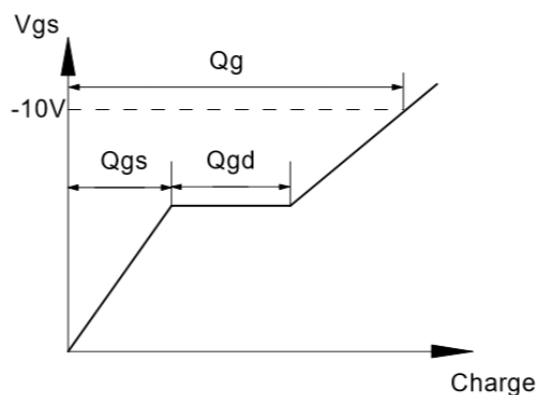
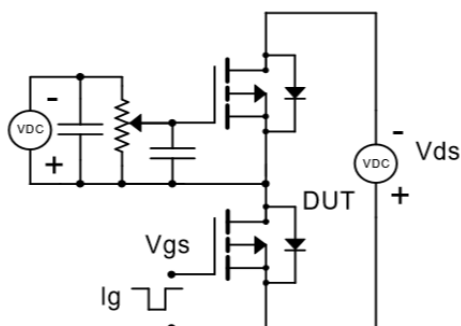


-VDS, Drain-Source Voltage(V)

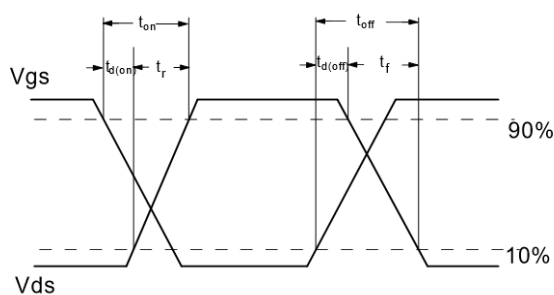
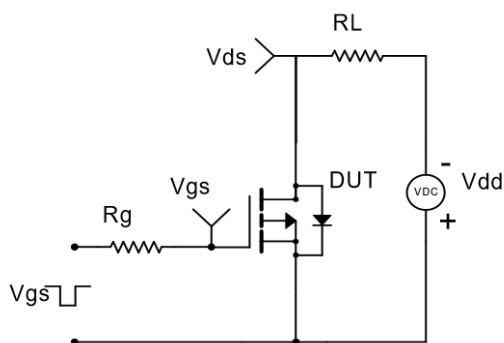
Figure10. Maximum Safe Operating Area



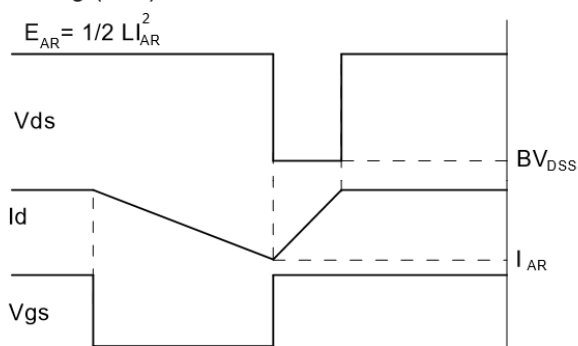
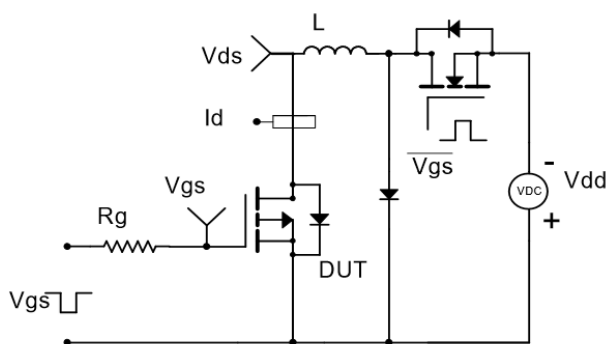
Gate Charge Test Circuit & Waveform



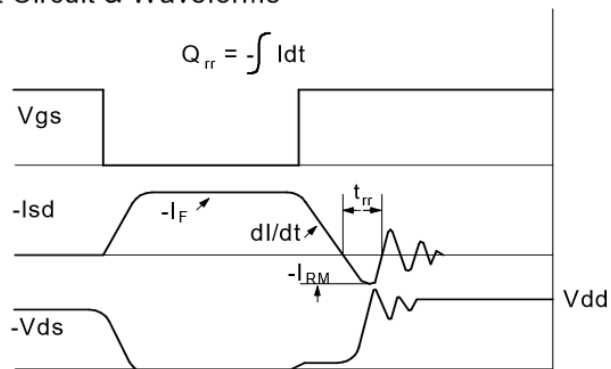
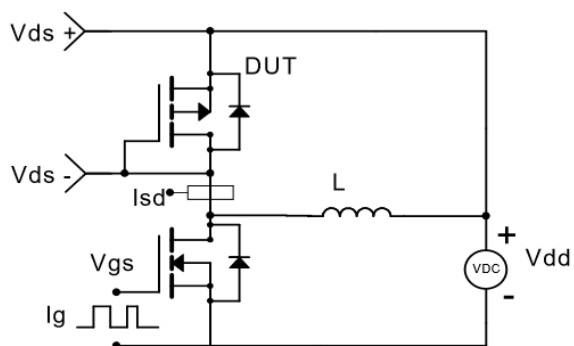
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

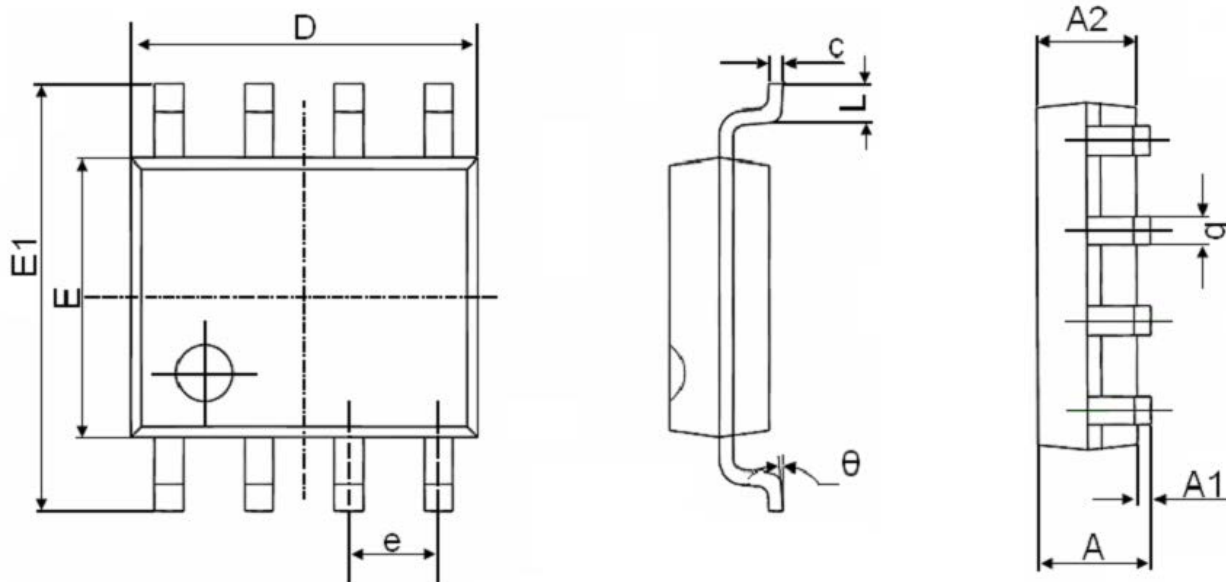


Diode Recovery Test Circuit & Waveforms



## Package Information

- SOP-8



| 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°    |