

自主封測 品質把控 售後保障

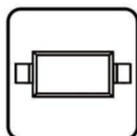
WEB | [WWW.TDSEMIC.COM](http://WWW.TDSEMIC.COM)



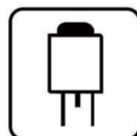
電源管理



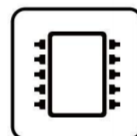
顯示驅動



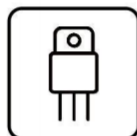
二三極管



LDO穩壓器



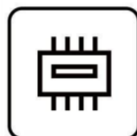
觸摸芯片



MOS管



運算放大器



存儲芯片



MCU



串口通信

## TD4606

產品規格說明書

## TD4606

N-Channel and P-Channel MOSFET

Package · SOP-8

### Description

The TD4606 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

$V_{DS} = 30V$        $I_D = 6.5A$   
 $R_{DS(ON)} < 16m\Omega$       @  $V_{GS}=10V$   
 $V_{DS} = -30V$        $I_D = -5.5A$   
 $R_{DS(ON)} < 29 m\Omega$       @  $V_{GS}=-10V$

### Application

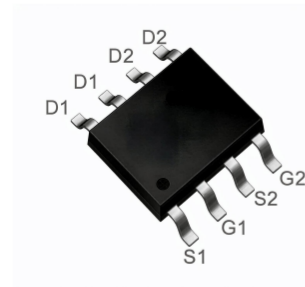
- Wireless charging
- Boost driver
- Brushless motor

### Package Marking and Ordering Information

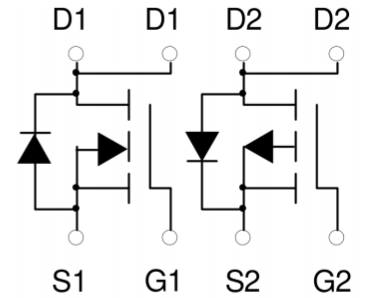
| Product ID | Pack  | Marking   | Qty(PCS) |
|------------|-------|-----------|----------|
| TD4606     | SOP-8 | 4606 XXXX | 3000     |

### Absolute Maximum Ratings ( $T_A=25^\circ C$ unless otherwise noted)

| Symbol               | Parameter                                        | Rating     |            | Units        |
|----------------------|--------------------------------------------------|------------|------------|--------------|
|                      |                                                  | N-Channel  | P-Channel  |              |
| $V_{DS}$             | Drain-Source Voltage                             | 30         | -30        | V            |
| $V_{GS}$             | Gate-Source Voltage                              | $\pm 20$   | $\pm 20$   | V            |
| $I_D@T_A=25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$       | 6.5        | -5.5       | A            |
| $I_D@T_A=70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$       | 5          | -4.3       | A            |
| $I_{DM}$             | Pulsed Drain Current <sup>2</sup>                | 30         | -30        | A            |
| $E_{AS}$             | Single Pulse Avalanche Energy <sup>3</sup>       | 5          | 26         | mJ           |
| $P_D@T_A=25^\circ C$ | Total Power Dissipation <sup>4</sup>             | 2          | 2          | W            |
| $T_{STG}$            | Storage Temperature Range                        | -55 to 150 | -55 to 150 | $^\circ C$   |
| $T_J$                | Operating Junction Temperature Range             | -55 to 150 | -55 to 150 | $^\circ C$   |
| $R\theta_{JA}$       | Thermal Resistance Junction-Ambient <sup>1</sup> | 62.5       |            | $^\circ C/W$ |
| $R\theta_{JC}$       | Thermal Resistance Junction-Case <sup>1</sup>    | 40         |            | $^\circ C/W$ |



SOP-8



N-Channel and P-Channel

Pin Configuration

## N-Channel Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)

| Symbol                                                                              | Parameter                             | Conditions                                                                             | Min | Typ  | Max  | Units   |
|-------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------|-----|------|------|---------|
| <b>STATIC PARAMETERS</b>                                                            |                                       |                                                                                        |     |      |      |         |
| BV <sub>DSS</sub>                                                                   | Drain-Source Breakdown Voltage        | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V                                             | 30  | ---  | ---  | V       |
| I <sub>DSS</sub>                                                                    | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V                                              | --- | ---  | 1    | μA      |
|                                                                                     |                                       | T <sub>J</sub> =55°C                                                                   | --- | ---  | 5    |         |
| I <sub>GSS</sub>                                                                    | Gate-Body leakage current             | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                             | --- | ---  | ±100 | nA      |
| V <sub>GS(th)</sub>                                                                 | Gate Threshold Voltage                | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                               | 1.2 | 1.8  | 2.4  | V       |
| I <sub>D(ON)</sub>                                                                  | On state drain current                | V <sub>GS</sub> =10V, V <sub>DS</sub> =5V                                              | 30  | ---  | ---  | A       |
| R <sub>DS(ON)</sub>                                                                 | Static Drain-Source On-Resistance     | V <sub>GS</sub> =10V, I <sub>D</sub> =6A                                               | --- | 16   | 19   | mΩ      |
|                                                                                     |                                       | T <sub>J</sub> =125°C                                                                  | --- | 26   | 28   |         |
|                                                                                     |                                       | V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A                                              | --- | 24   | 36   |         |
| g <sub>FS</sub>                                                                     | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =6A                                                | --- | 15   | ---  | S       |
| V <sub>SD</sub>                                                                     | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V                                                | --- | 0.76 | 1    | V       |
| I <sub>S</sub>                                                                      | Maximum Body-Diode Continuous Current |                                                                                        | --- | ---  | 2.5  | A       |
| <b>DYNAMIC PARAMETERS</b>                                                           |                                       |                                                                                        |     |      |      |         |
| C <sub>iss</sub>                                                                    | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz                                      | 200 | 255  | 310  | pF      |
| C <sub>oss</sub>                                                                    | Output Capacitance                    |                                                                                        | 30  | 45   | 60   |         |
| C <sub>rss</sub>                                                                    | Reverse Transfer Capacitance          |                                                                                        | 20  | 35   | 50   |         |
| R <sub>g</sub>                                                                      | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                       | 1.6 | 3.25 | 4.9  | Ω       |
| <b>SWITCHING PARAMETERS</b>                                                         |                                       |                                                                                        |     |      |      |         |
| Q <sub>g</sub> (10V)<br>Q <sub>g</sub> (4.5V)<br>Q <sub>gs</sub><br>Q <sub>gd</sub> | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =6A                         | 4   | 5.2  | 6    | nC      |
|                                                                                     | Total Gate Charge                     |                                                                                        | 2   | 2.55 | 3    |         |
|                                                                                     | Gate Source Charge                    |                                                                                        | --- | 0.85 | ---  |         |
|                                                                                     | Gate Drain Charge                     |                                                                                        | --- | 1.3  | ---  |         |
| t <sub>D(on)</sub><br>t <sub>r</sub><br>t <sub>D(off)</sub><br>t <sub>f</sub>       | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =2.5Ω, R <sub>GEN</sub> =3Ω | --- | 4.5  | ---  | ns      |
|                                                                                     | Turn-On Rise Time                     |                                                                                        | --- | 2.5  | ---  |         |
|                                                                                     | Turn-Off DelayTime                    |                                                                                        | --- | 14.5 | ---  |         |
|                                                                                     | Turn-Off Fall Time                    |                                                                                        | --- | 3.5  | ---  |         |
| t <sub>rr</sub><br>Q <sub>rr</sub>                                                  | Body Diode Reverse Recovery Time      | I <sub>F</sub> =6A, dI/dt=100A/μs                                                      | --- | 8.5  | 12   | ns / nC |
|                                                                                     | Body Diode Reverse Recovery Charge    |                                                                                        | --- | 2.2  | 3    |         |

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150°C, using ≤10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25°C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150°C. The SOA curve provides a single pulse rating.

**Fig 1: On-Region Characteristics (Note E)**

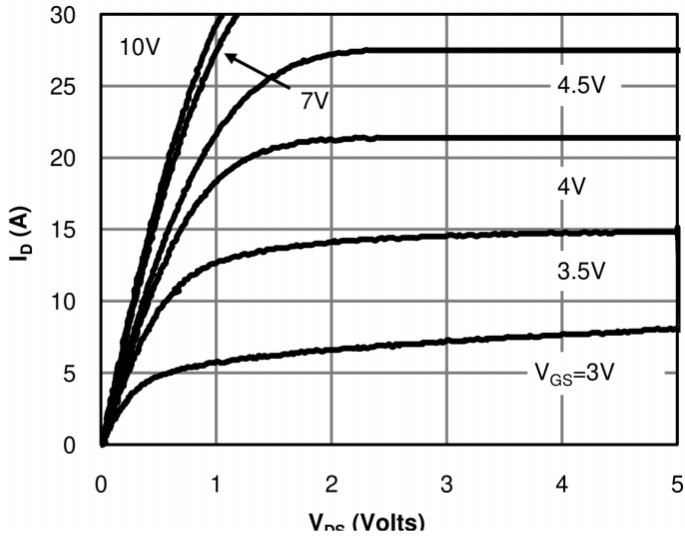


**Figure 2: Transfer Characteristics (Note E)**

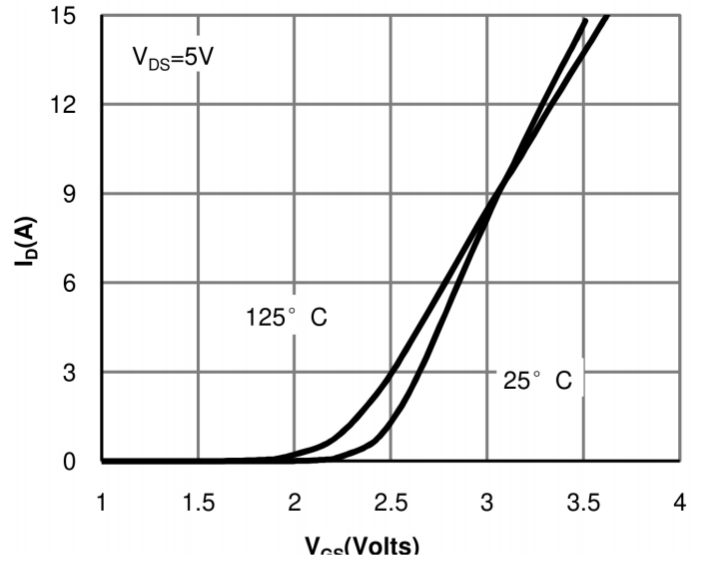


**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**

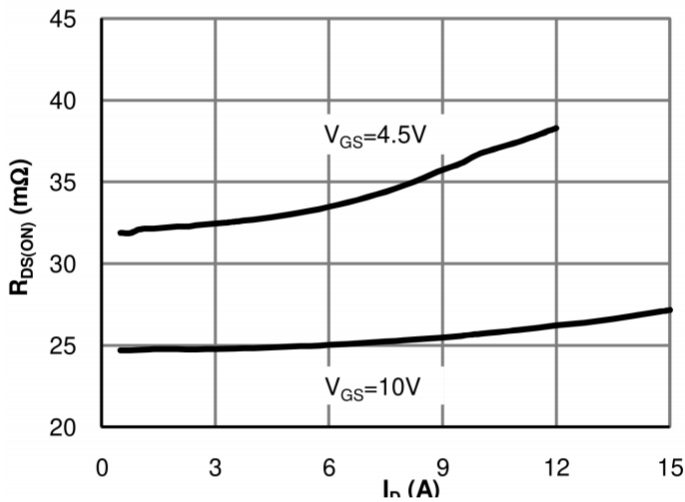


**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

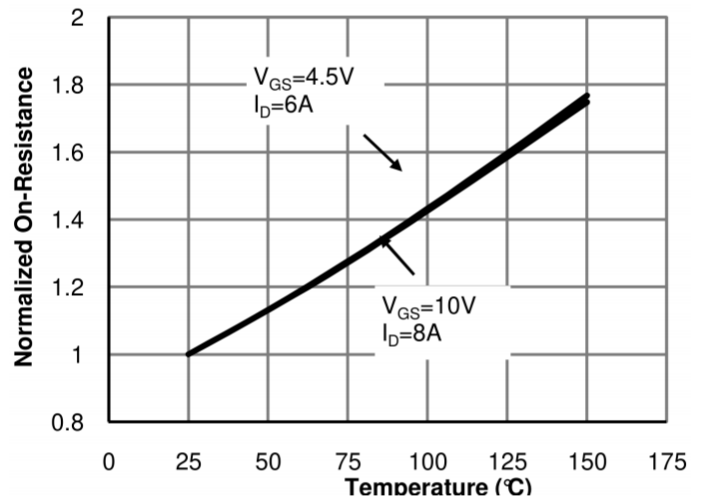


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

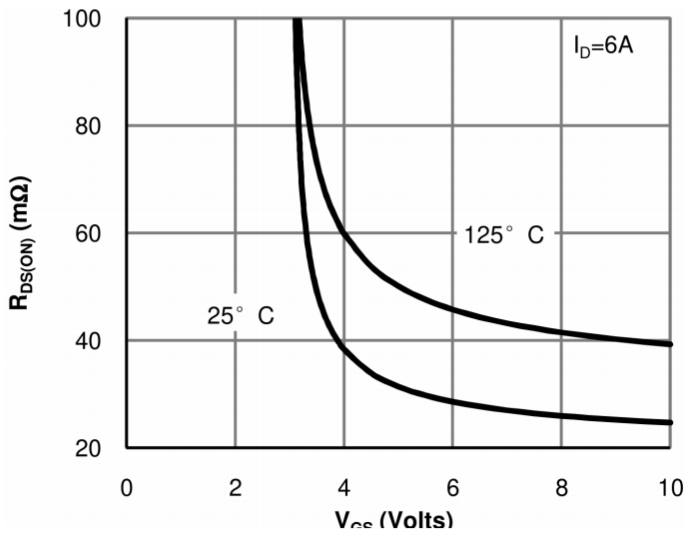


**Figure 6: Body-Diode Characteristics (Note E)**

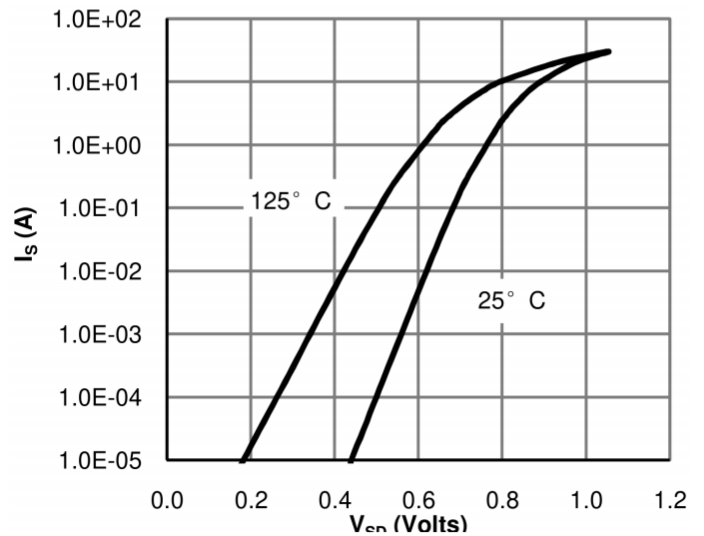


Figure 7: Gate-Charge Characteristics

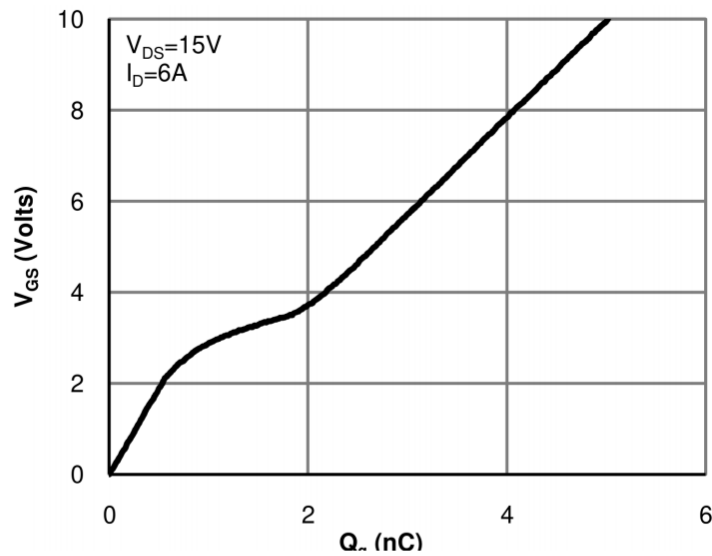


Figure 8: Capacitance Characteristics

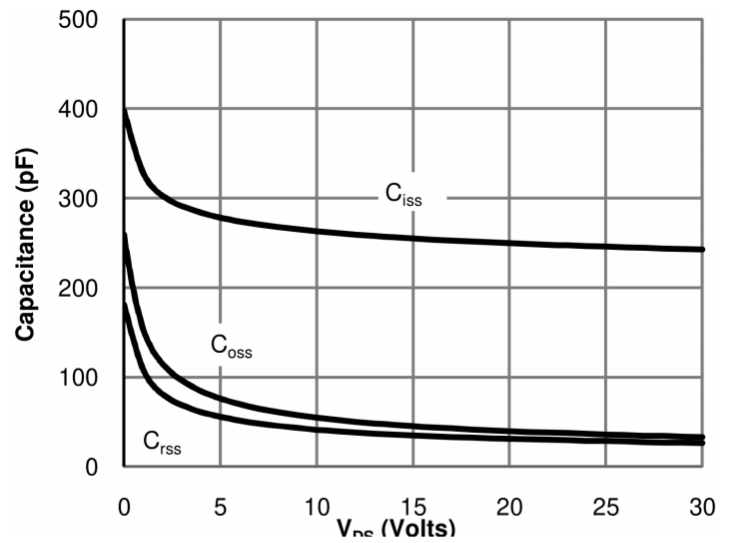


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

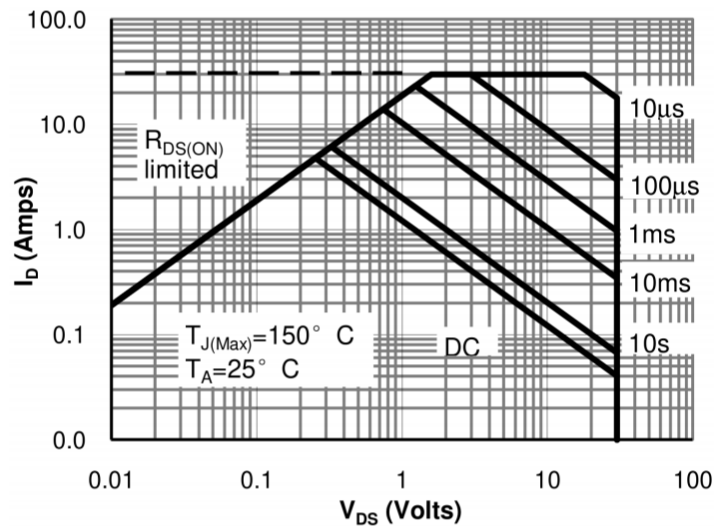


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

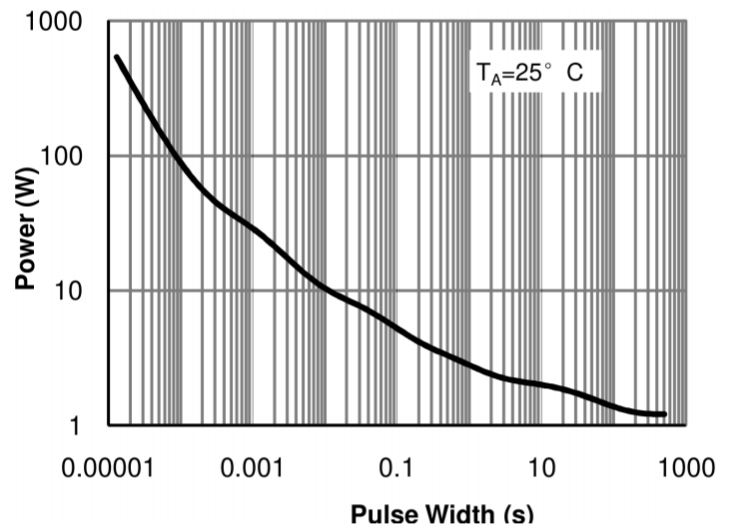
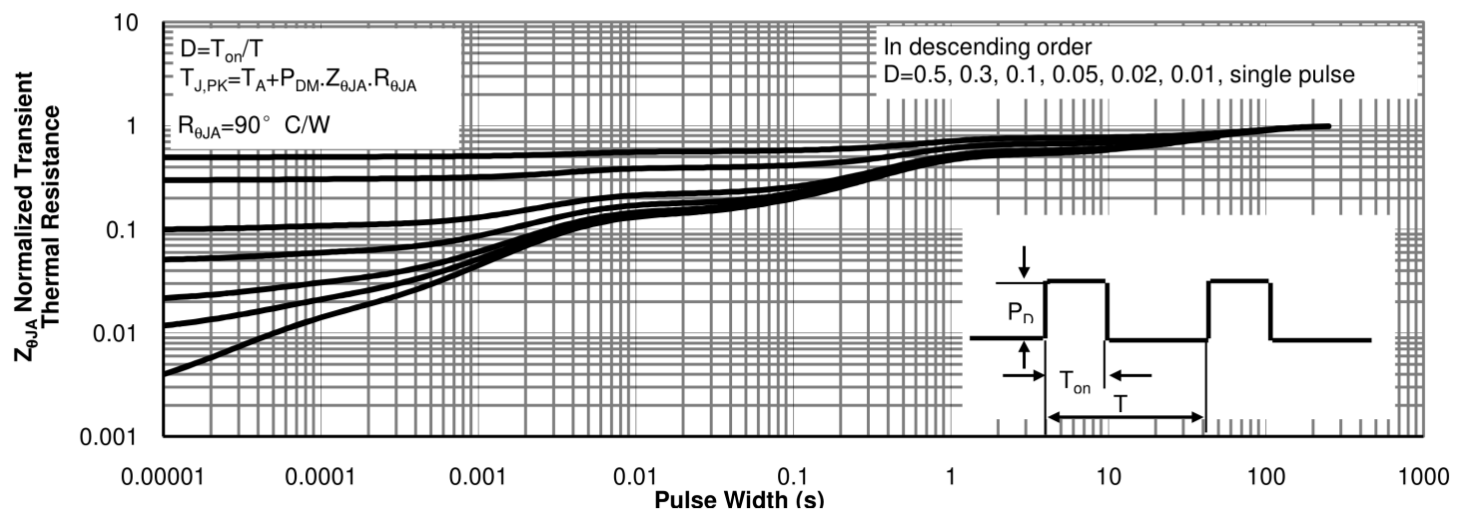
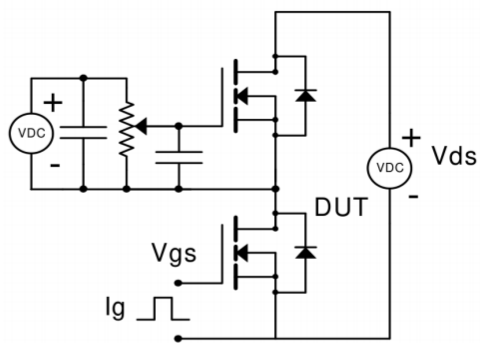
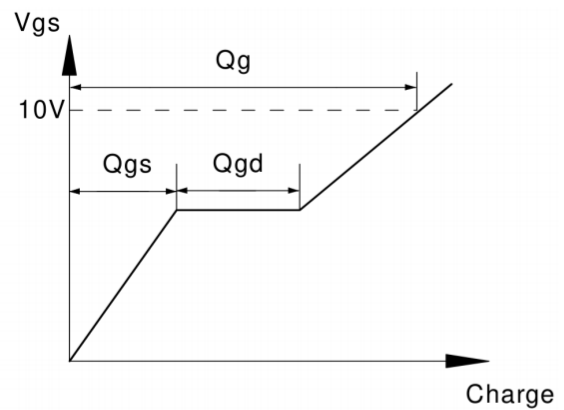


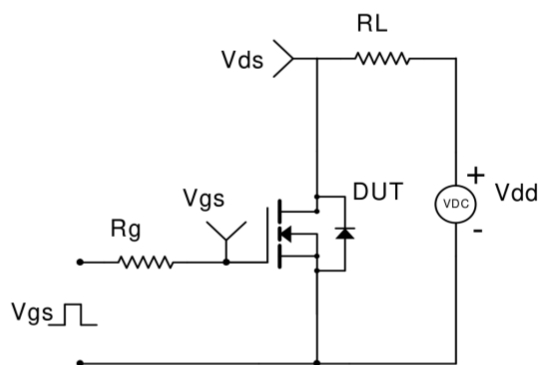
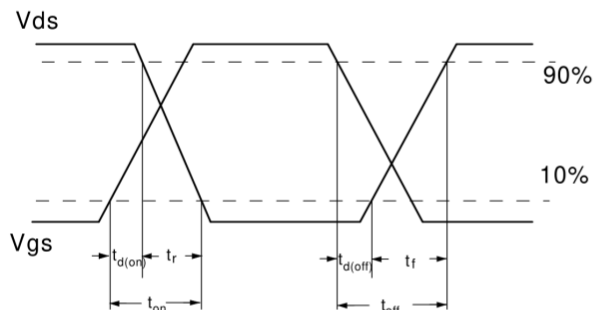
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)



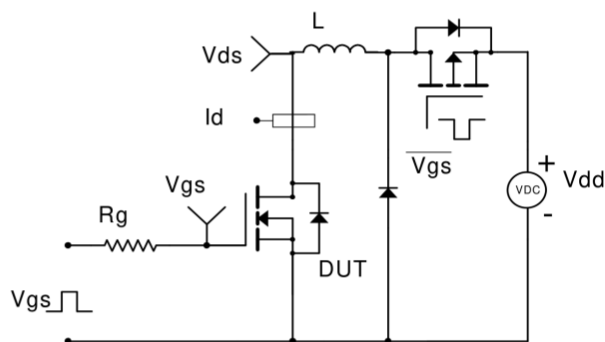
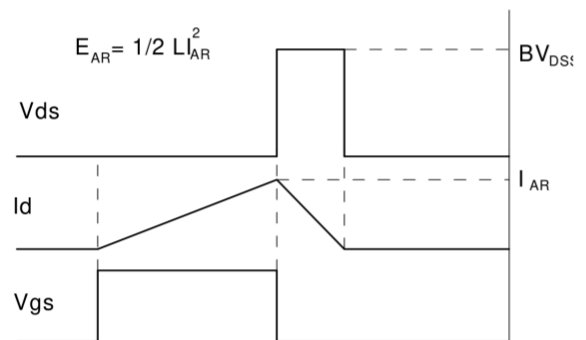
## Gate Charge Test Circuit & Waveform



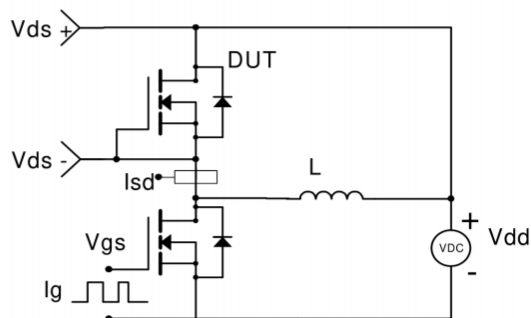
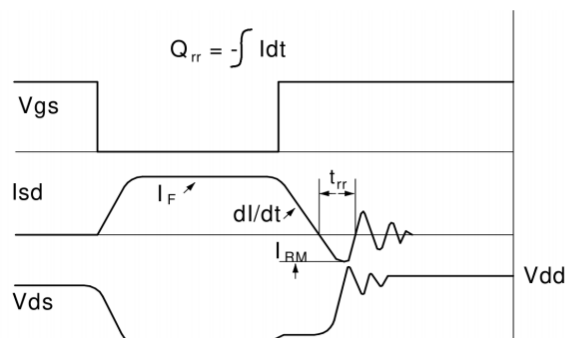
## Resistive Switching Test Circuit & Waveforms



## Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



## Diode Recovery Test Circuit & Waveforms



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

| Symbol                                              | Parameter                             | Conditions                                                                       | Min  | Typ   | Max       | Units         |
|-----------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------|------|-------|-----------|---------------|
| <b>STATIC PARAMETERS</b>                            |                                       |                                                                                  |      |       |           |               |
| $BV_{DSS}$                                          | Drain-Source Breakdown Voltage        | $I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$                                       | -30  | ---   | ---       | V             |
| $I_{DSS}$                                           | Zero Gate Voltage Drain Current       | $V_{DS}=-30\text{V}$ , $V_{GS}=0\text{V}$                                        | ---  | ---   | -1        | $\mu\text{A}$ |
|                                                     |                                       | $T_J=55^{\circ}\text{C}$                                                         | ---  | ---   | -5        |               |
| $I_{GSS}$                                           | Gate-Body leakage current             | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$                                     | ---  | ---   | $\pm 100$ | nA            |
| $V_{GS(th)}$                                        | Gate Threshold Voltage                | $V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$                                          | -1.3 | -1.85 | -2.4      | V             |
| $I_{D(ON)}$                                         | On state drain current                | $V_{GS}=-10\text{V}$ , $V_{DS}=-5\text{V}$                                       | -30  | ---   | ---       | A             |
| $R_{DS(ON)}$                                        | Static Drain-Source On-Resistance     | $V_{GS}=-10\text{V}$ , $I_D=-6.5\text{A}$                                        | ---  | 36    | 45        | m $\Omega$    |
|                                                     |                                       | $T_J=125^{\circ}\text{C}$                                                        | ---  | 32    | 40        |               |
|                                                     |                                       | $V_{GS}=-4.5\text{V}$ , $I_D=-5\text{A}$                                         | ---  | 68    | 77        |               |
| $g_{FS}$                                            | Forward Transconductance              | $V_{DS}=-5\text{V}$ , $I_D=-6.5\text{A}$                                         | ---  | 18    | ---       | S             |
| $V_{SD}$                                            | Diode Forward Voltage                 | $I_S=-1\text{A}$ , $V_{GS}=0\text{V}$                                            | ---  | -0.8  | -1        | V             |
| $I_S$                                               | Maximum Body-Diode Continuous Current |                                                                                  | ---  | ---   | -2.5      | A             |
| <b>DYNAMIC PARAMETERS</b>                           |                                       |                                                                                  |      |       |           |               |
| $C_{iss}$                                           | Input Capacitance                     | $V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$                      | ---  | 760   | ---       | pF            |
| $C_{oss}$                                           | Output Capacitance                    |                                                                                  | ---  | 140   | ---       |               |
| $C_{rss}$                                           | Reverse Transfer Capacitance          |                                                                                  | ---  | 95    | ---       |               |
| $R_g$                                               | Gate resistance                       | $V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$                        | 1.5  | 3.2   | 5         | $\Omega$      |
| <b>SWITCHING PARAMETERS</b>                         |                                       |                                                                                  |      |       |           |               |
| $Q_g$ (10V)<br>$Q_g$ (4.5V)<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge                     | $V_{GS}=10\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-6.5\text{A}$                  | ---  | 13.6  | 16        | nC            |
|                                                     | Total Gate Charge                     |                                                                                  | ---  | 6.7   | 8         |               |
|                                                     | Gate Source Charge                    |                                                                                  | ---  | 2.5   | ---       |               |
|                                                     | Gate Drain Charge                     |                                                                                  | ---  | 3.2   | ---       |               |
| $t_{D(on)}$<br>$t_r$<br>$t_{D(off)}$<br>$t_f$       | Turn-On DelayTime                     | $V_{GS}=10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=2.3\Omega$ , $R_{GEN}=3\Omega$ | ---  | 8     | ---       | ns            |
|                                                     | Turn-On Rise Time                     |                                                                                  | ---  | 6     | ---       |               |
|                                                     | Turn-Off DelayTime                    |                                                                                  | ---  | 17    | ---       |               |
|                                                     | Turn-Off Fall Time                    |                                                                                  | ---  | 5     | ---       |               |
| $t_{rr}$<br>$Q_{rr}$                                | Body Diode Reverse Recovery Time      | $I_F=-6.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                             | ---  | 15    | ---       | ns / nC       |
|                                                     | Body Diode Reverse Recovery Charge    |                                                                                  | ---  | 9.7   | ---       |               |

A. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^{\circ}\text{C}$ . The value in any given application depends on the user's specific board design.

B. The power dissipation  $P_D$  is based on  $T_{J(MAX)}=150^{\circ}\text{C}$ , using  $\leq 10\text{s}$  junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=150^{\circ}\text{C}$ . Ratings are based on low frequency and duty cycles to keep initial  $T_J=25^{\circ}\text{C}$ .

D. The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using  $<300\mu\text{s}$  pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of  $T_{J(MAX)}=150^{\circ}\text{C}$ . The SOA curve provides a single pulse rating.

**Fig 1: On-Region Characteristics (Note E)**

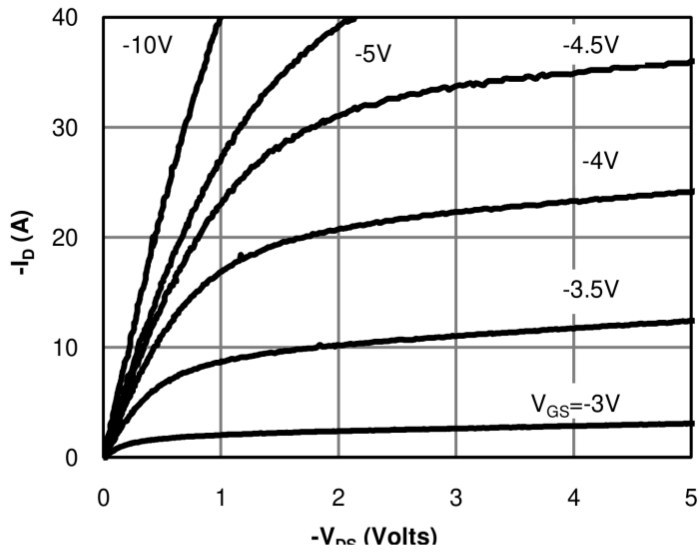


**Figure 2: Transfer Characteristics (Note E)**

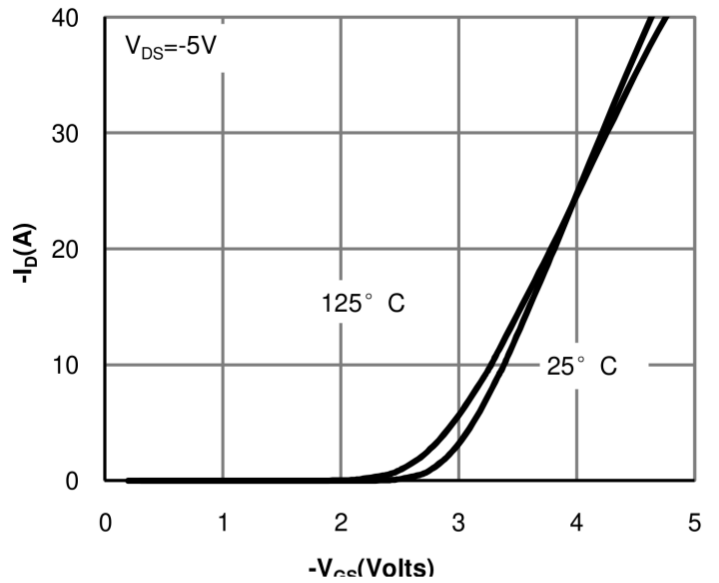


**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**

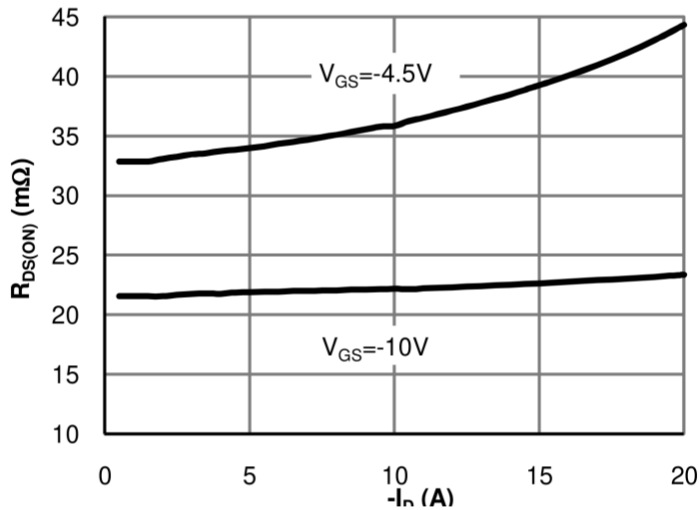


**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

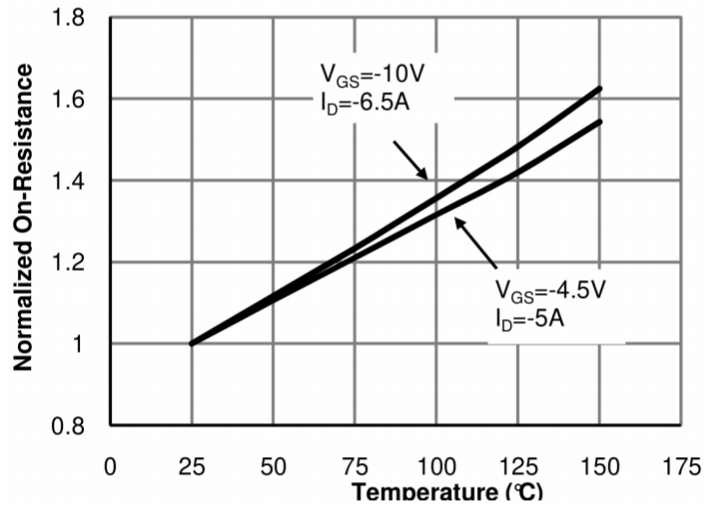


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

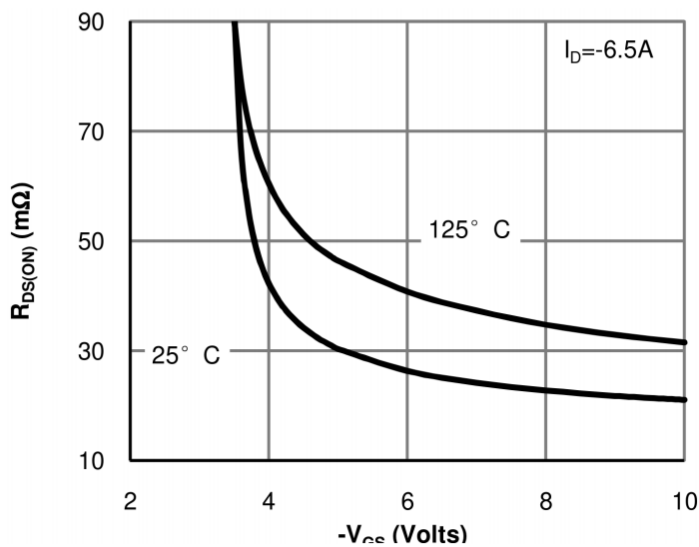


**Figure 6: Body-Diode Characteristics (Note E)**

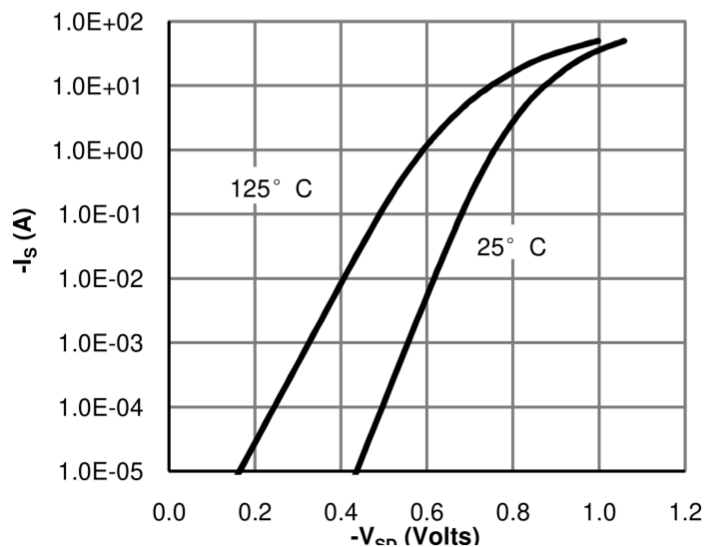


Figure 7: Gate-Charge Characteristics

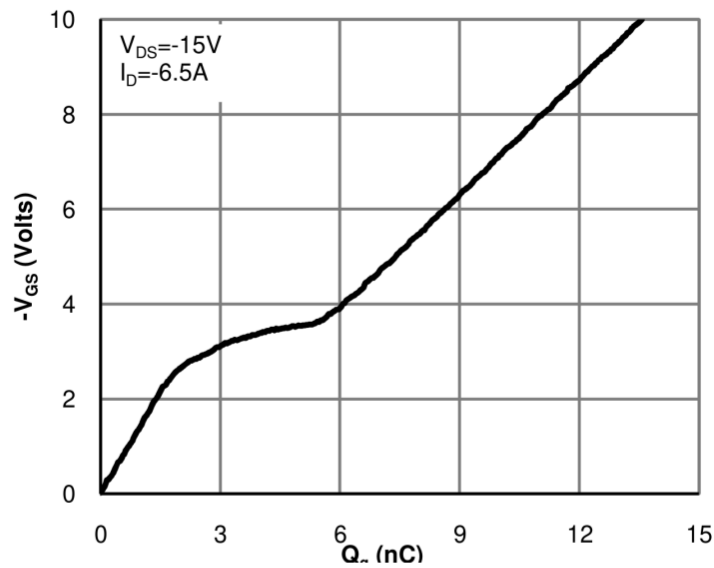


Figure 8: Capacitance Characteristics

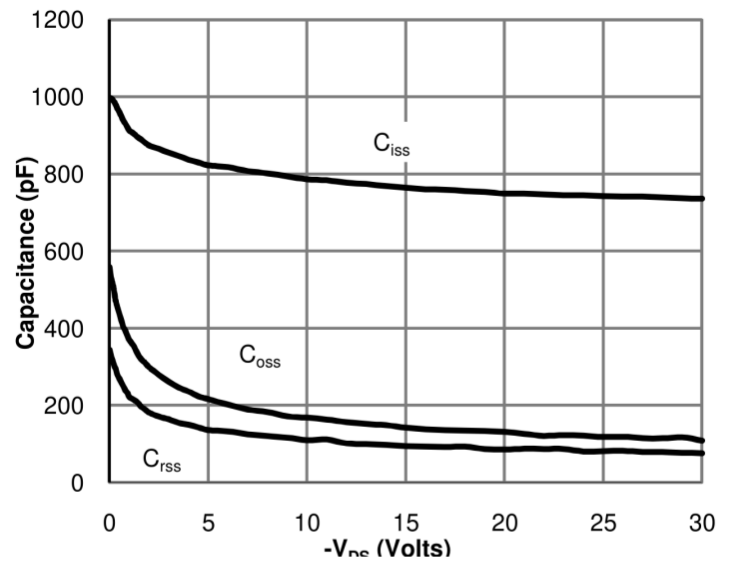


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

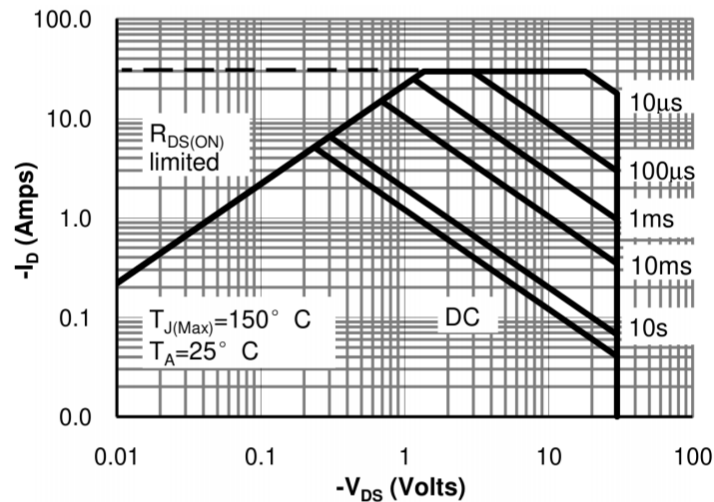


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

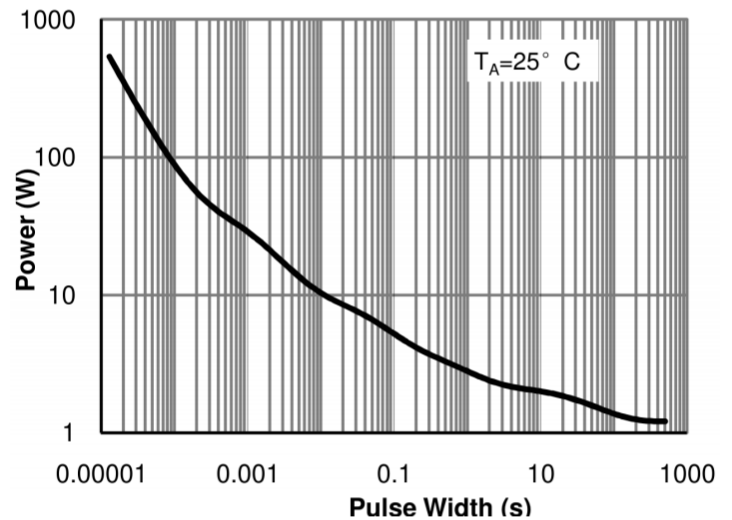
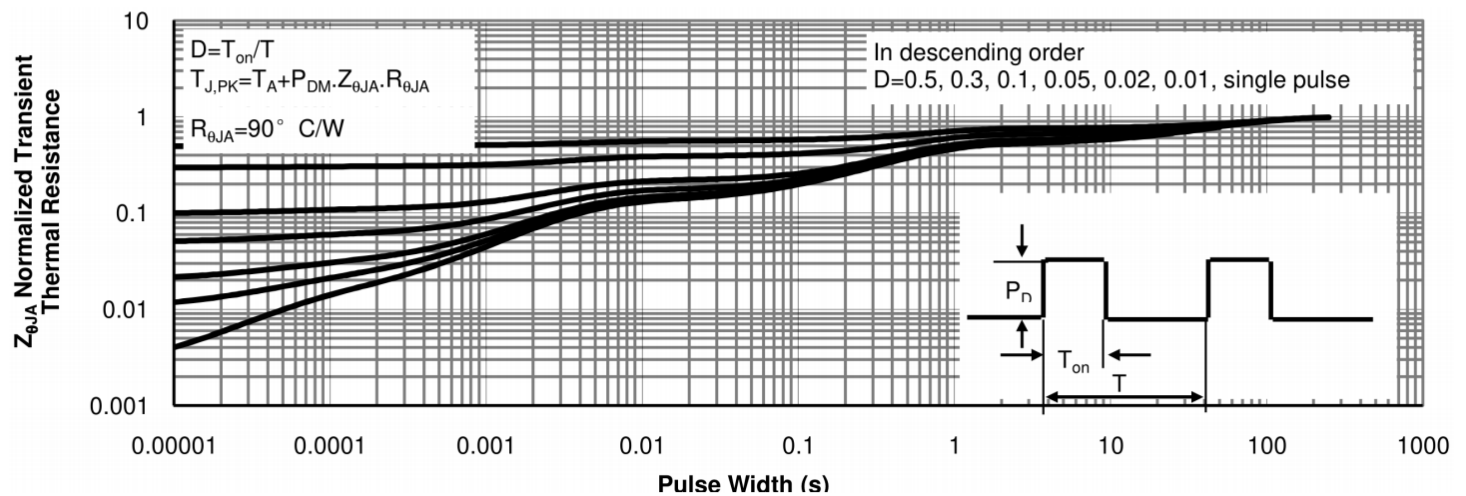
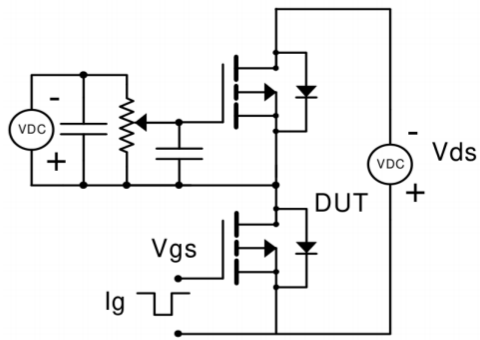
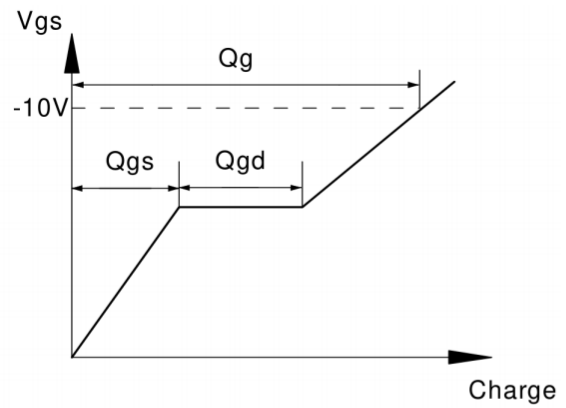


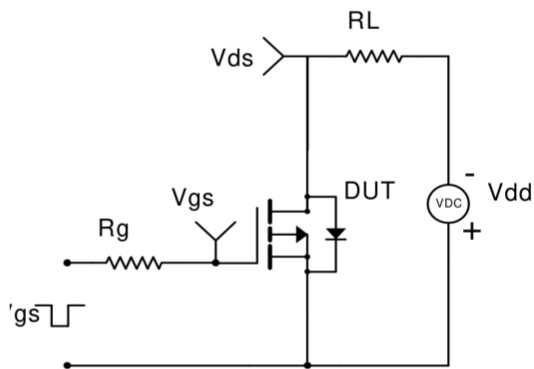
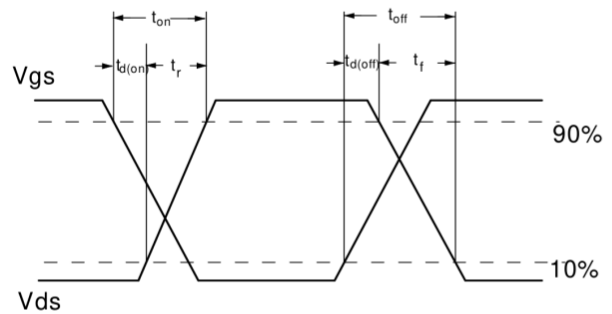
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)



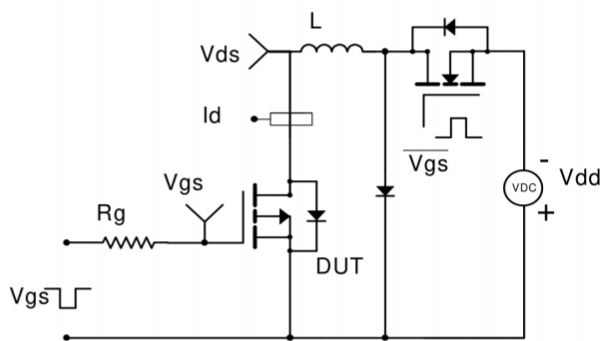
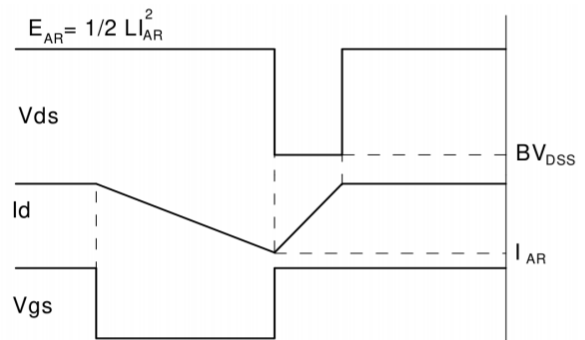
Gate Charge Test Circuit & Waveform



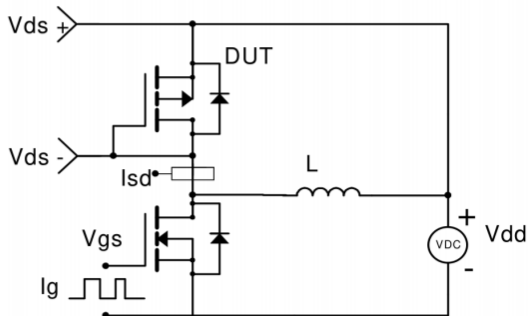
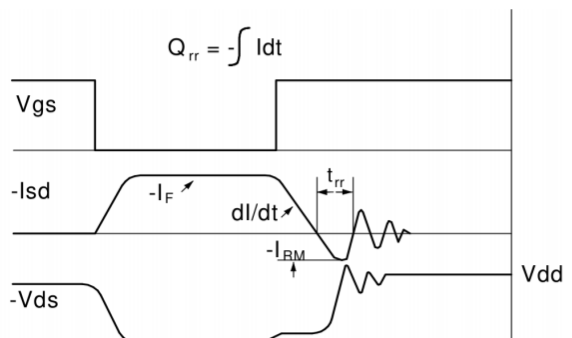
Resistive Switching Test Circuit & Waveforms



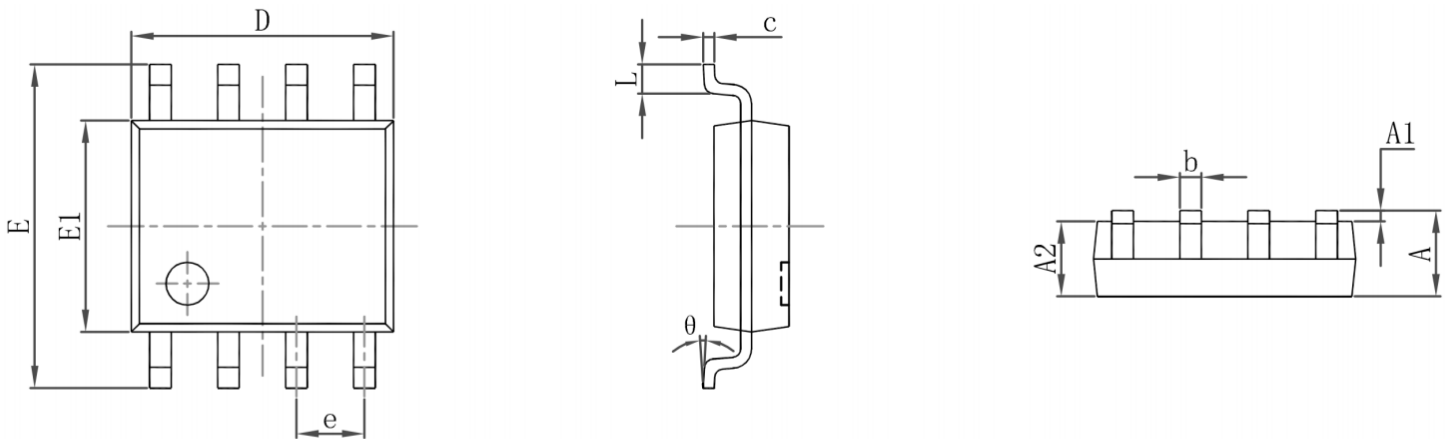
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



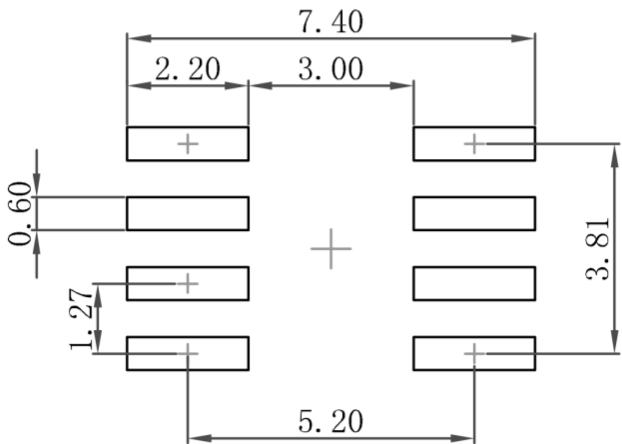
Diode Recovery Test Circuit & Waveforms



SOP-8 Package Outline Dimensions



| 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 | 0.007                | 0.010 |
| D      | 4.800                     | 5.000 | 0.189                | 0.197 |
| e      | 1.270 (BSC)               |       | 0.050 (BSC)          |       |
| E      | 5.800                     | 6.200 | 0.228                | 0.244 |
| E1     | 3.800                     | 4.000 | 0.150                | 0.157 |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |



Note:  
1.Controlling dimension:in millimeters.  
2.General tolerance:± 0.05mm.  
3.The pad layout is for reference purposes only.