

# TDSEMIC

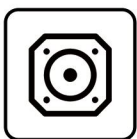
## 拓電半導體

自主封測 品質把控 售後保障

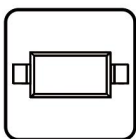
WEB | [WWW.TDSEMIC.COM](http://WWW.TDSEMIC.COM)



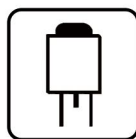
電源管理



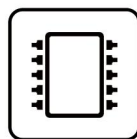
顯示驅動



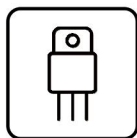
二三極管



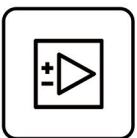
LDO穩壓器



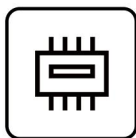
觸摸芯片



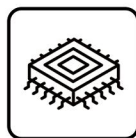
MOS管



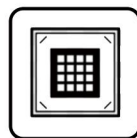
運算放大器



存儲芯片



MCU



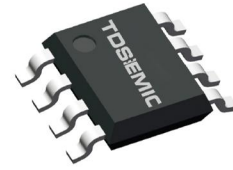
串口通信

# A04606

## 產品規格說明書

### Description

The AO4606 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.



SOP-8

### General Features

$V_{DS} = 30V$   $I_D = 6A$

$R_{DS(ON)} < 30m\Omega$  @  $V_{GS}=10V$

$V_{DS} = -30V$   $I_D = -5.5A$

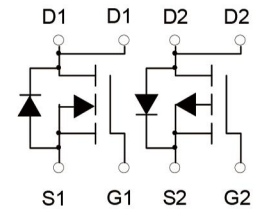
$R_{DS(ON)} < 48 m\Omega$  @  $V_{GS}=-10V$

### Application

Wireless charging

Boost driver

Brushless motor



N-Channel and P-Channel

### Package Marking and Ordering Information

| Product ID | Pack  | Marking   | Qty(PCS) |
|------------|-------|-----------|----------|
| AO4606     | SOP-8 | 4606 XXXX | 3000     |

### Absolute Maximum Ratings ( $T_c=25^\circ C$ 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       | 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         |            | $^\circ C/W$ |

### 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<br>T <sub>J</sub> =55°C                         |     |          | 1<br>5   | μA    |
| 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<br>T <sub>J</sub> =125°C                         |     | 20<br>40 | 30<br>48 | mΩ    |
|                             |                                       | V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A                                                 |     | 33.5     | 42       | mΩ    |
|                             |                                       |                                                                                           |     |          |          |       |
| 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       | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                           | 20  | 35       | 50       | pF    |
| 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)        | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =6A                            | 4   | 5.2      | 6        | nC    |
| Q <sub>g</sub> (4.5V)       | Total Gate Charge                     |                                                                                           | 2   | 2.55     | 3        | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                           |     | 0.85     |          | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                           |     | 1.3      |          | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =2.5Ω,<br>R <sub>GEN</sub> =3Ω |     | 4.5      |          | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                           |     | 2.5      |          | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                           |     | 14.5     |          | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                           |     | 3.5      |          | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =6A, dI/dt=100A/μs                                                         |     | 8.5      | 12       | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =6A, dI/dt=100A/μs                                                         |     | 2.2      | 3        | nC    |

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.

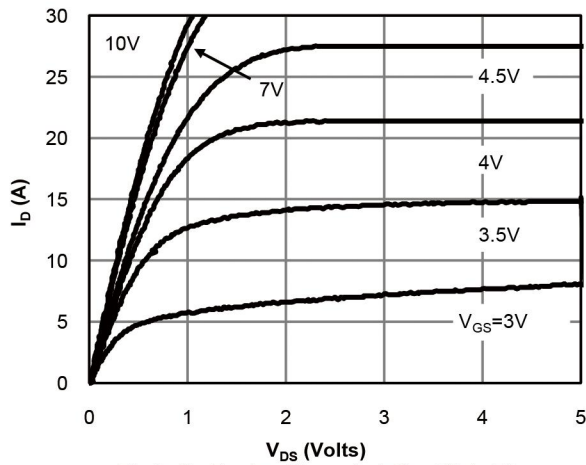


Fig 1: On-Region Characteristics (Note E)

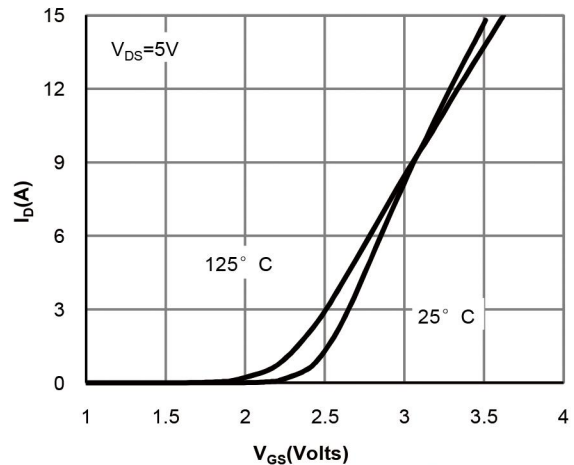


Figure 2: Transfer Characteristics (Note E)

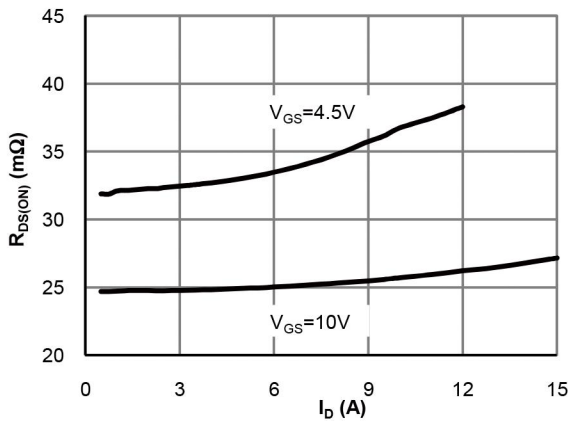


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

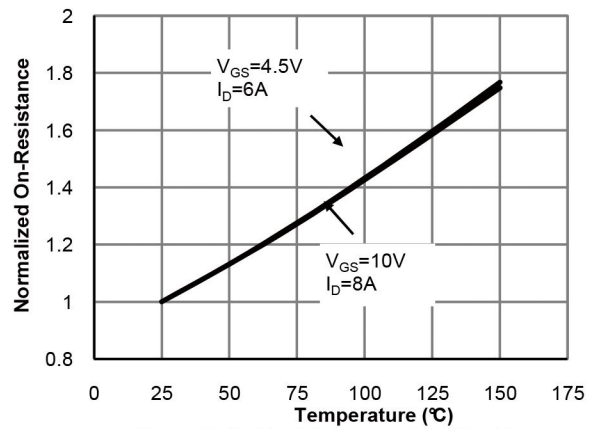


Figure 4: On-Resistance vs. Junction Temperature (Note E)

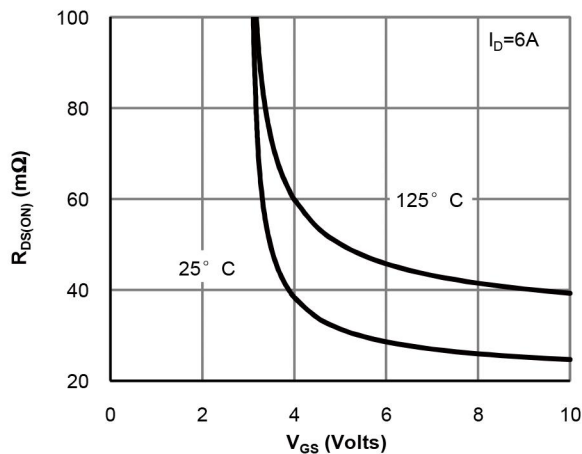


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

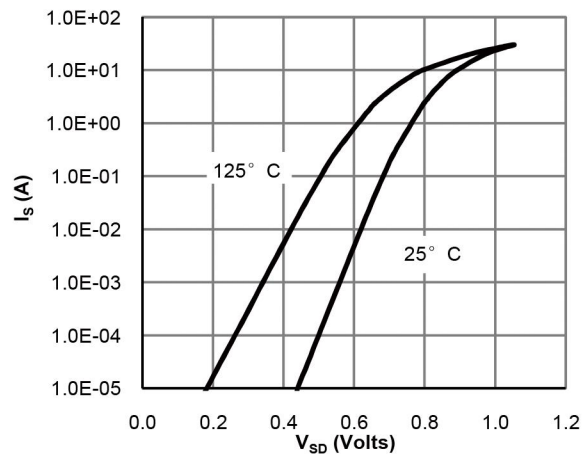
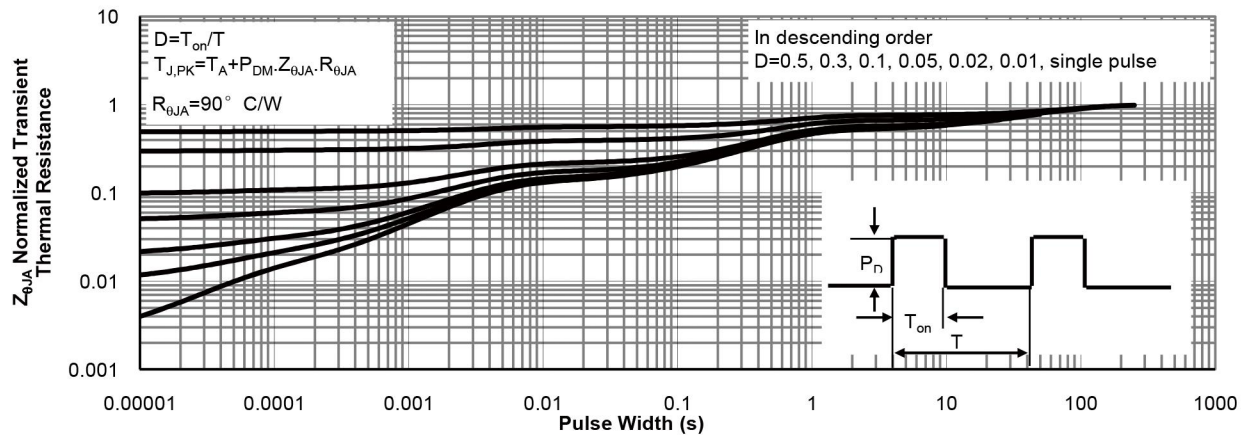
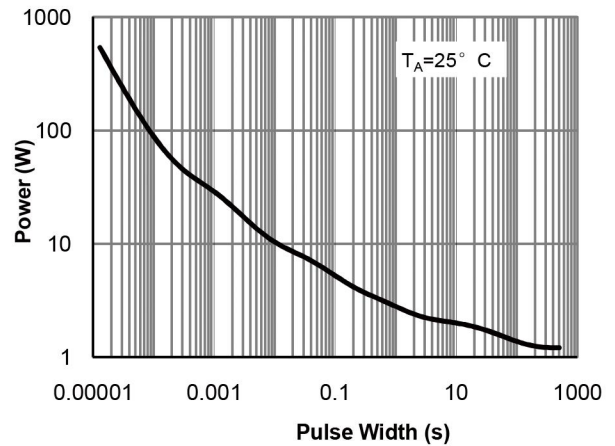
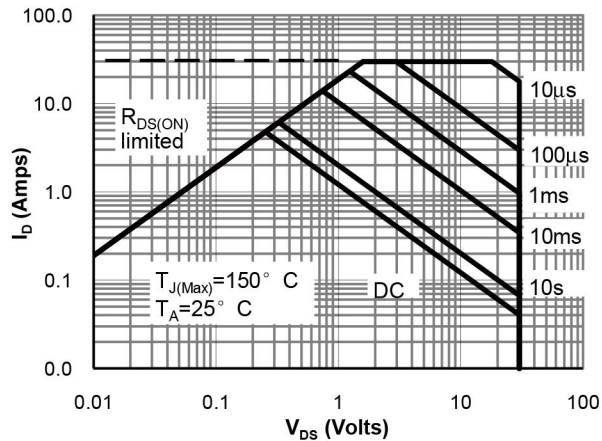
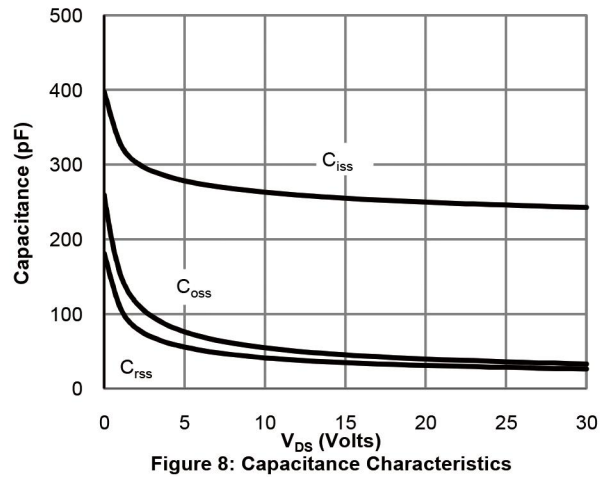
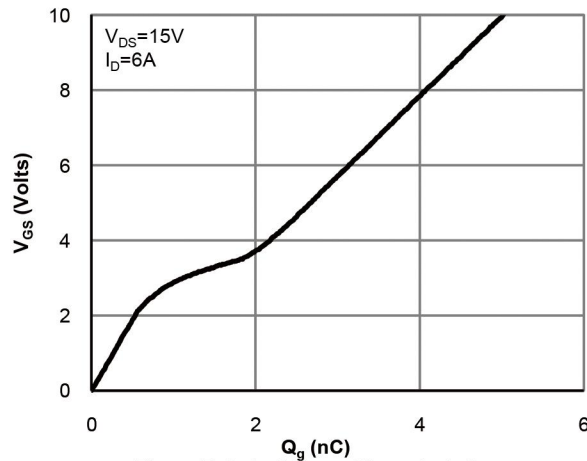
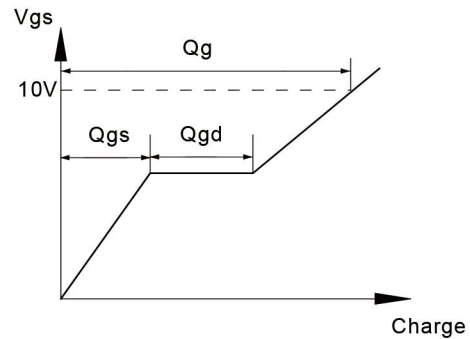
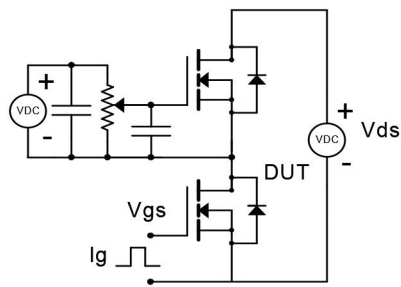


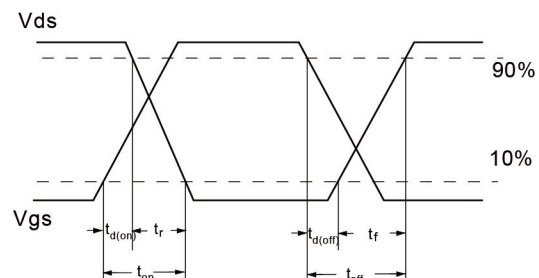
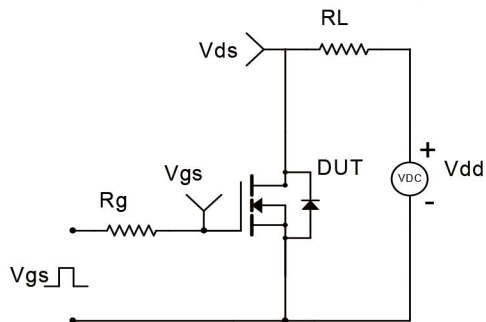
Figure 6: Body-Diode Characteristics (Note E)



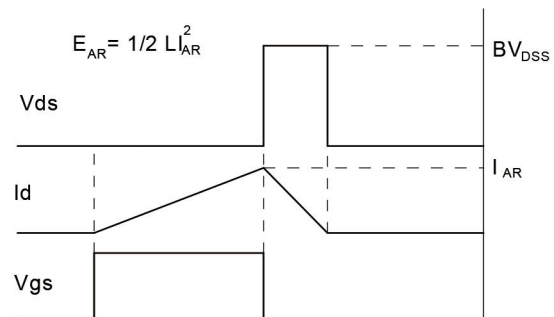
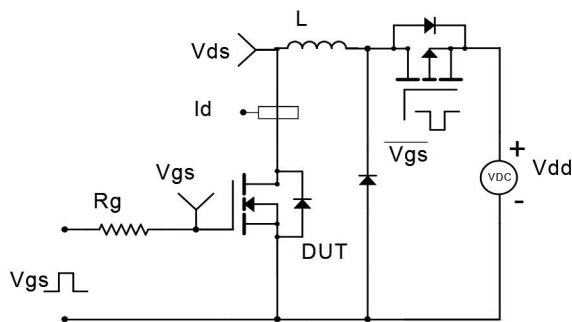
Gate Charge Test Circuit & Waveform



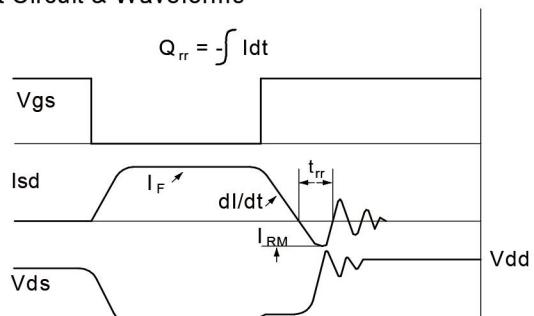
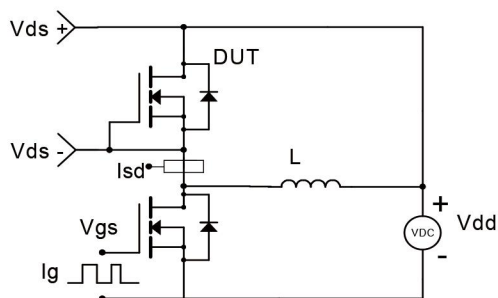
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



### P-Channel Electrical Characteristics (T<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<br>T <sub>J</sub> =55°C                         |      |          | -1<br>-5 | μA    |
| 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                                    | -1.3 | -1.85    | -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> =-6.5A<br>T <sub>J</sub> =125°C                      |      | 40<br>32 | 48<br>40 | mΩ    |
|                             |                                       | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A                                                |      | 34       | 44       | mΩ    |
|                             |                                       |                                                                                            |      |          |          |       |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =-5V, I <sub>D</sub> =-6.5A                                                |      | 18       |          | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =-1A, V <sub>GS</sub> =0V                                                   |      | -0.8     | -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                                         |      | 760      |          | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |                                                                                            |      | 140      |          | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                            |      | 95       |          | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                           | 1.5  | 3.2      | 5        | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                            |      |          |          |       |
| Q <sub>g</sub> (10V)        | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-6.5A                         |      | 13.6     | 16       | nC    |
| Q <sub>g</sub> (4.5V)       | Total Gate Charge                     |                                                                                            |      | 6.7      | 8        | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                            |      | 2.5      |          | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                            |      | 3.2      |          | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =2.3Ω,<br>R <sub>GEN</sub> =3Ω |      | 8        |          | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                            |      | 6        |          | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                            |      | 17       |          | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                            |      | 5        |          | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =-6.5A, dI/dt=100A/μs                                                       |      | 15       |          | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =-6.5A, dI/dt=100A/μs                                                       |      | 9.7      |          | nC    |

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.

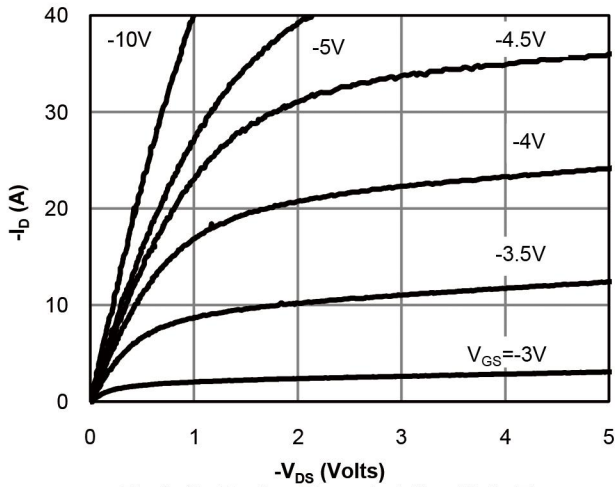


Fig 1: On-Region Characteristics (Note E)

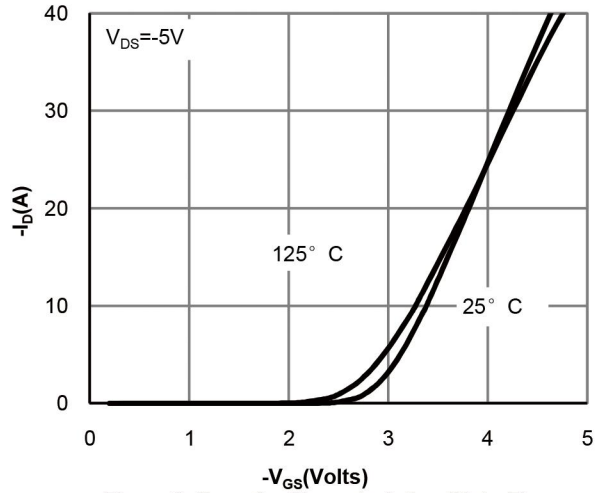


Figure 2: Transfer Characteristics (Note E)

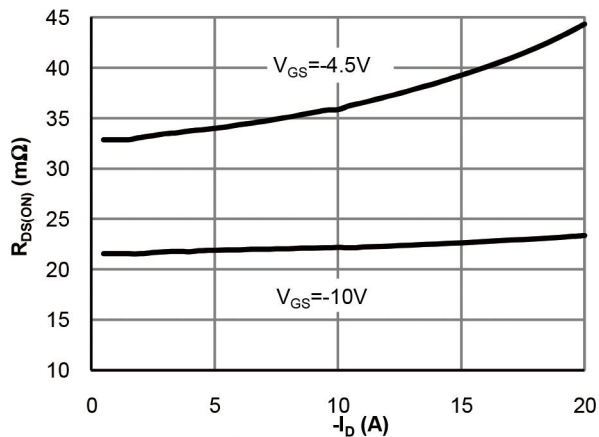


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

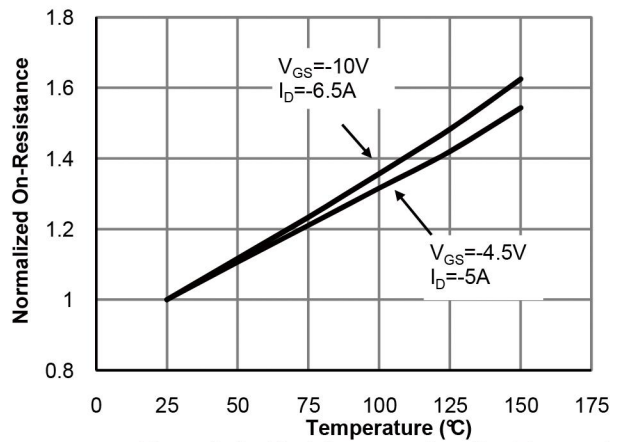


Figure 4: On-Resistance vs. Junction Temperature (Note E)

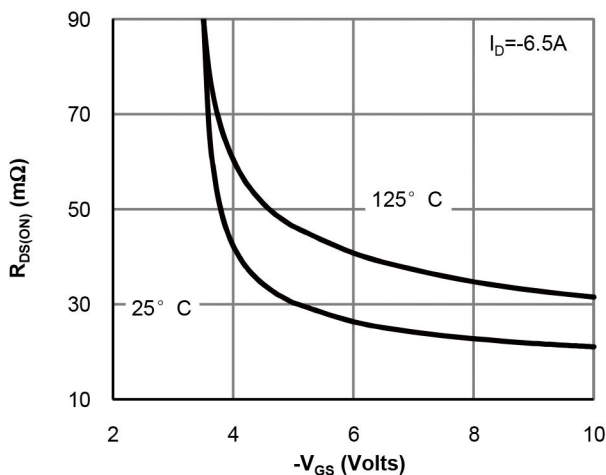


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

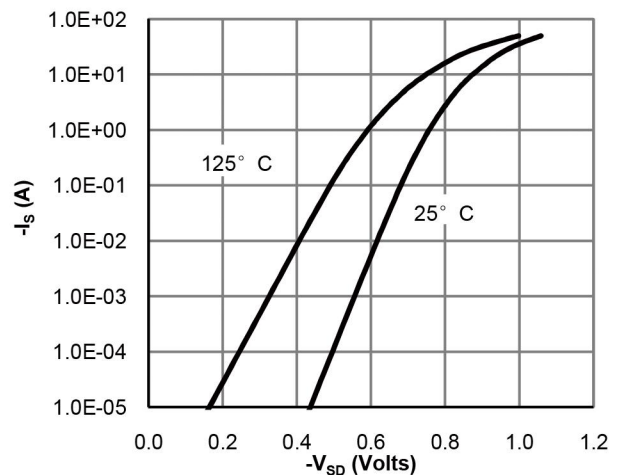


Figure 6: Body-Diode Characteristics (Note E)

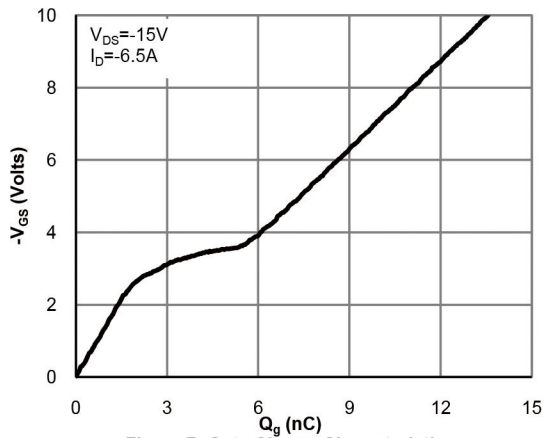


Figure 7: Gate-Charge Characteristics

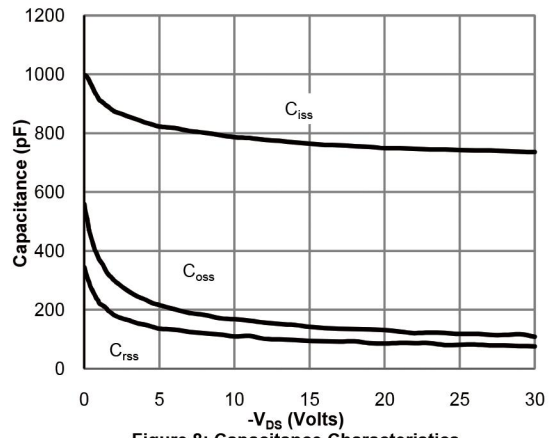


Figure 8: Capacitance Characteristics

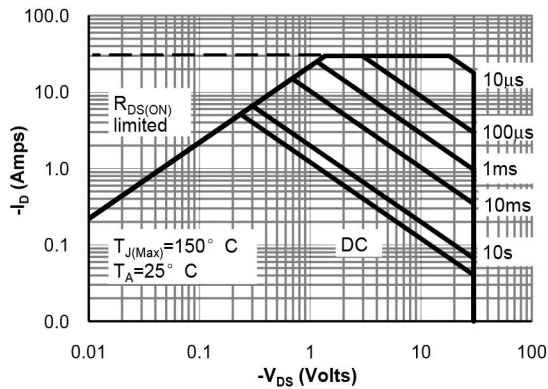


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

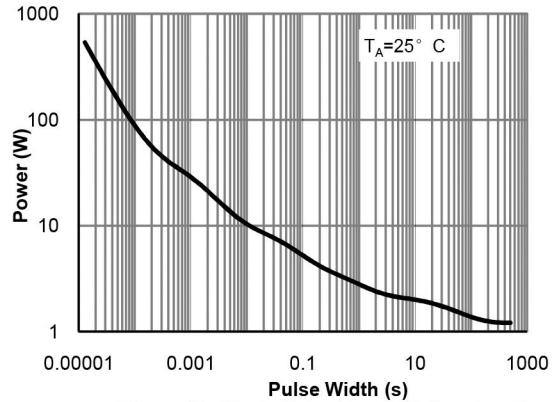


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

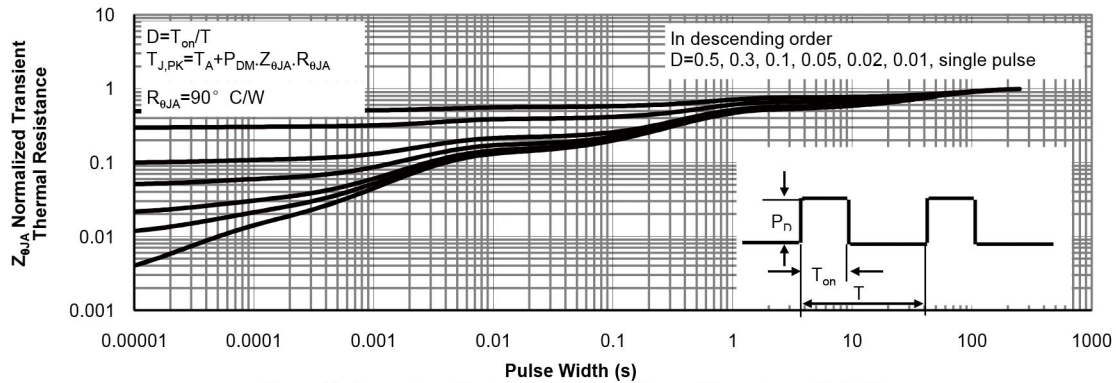
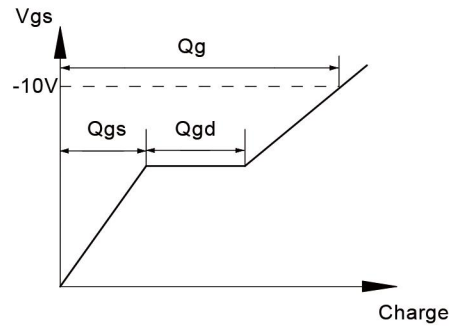
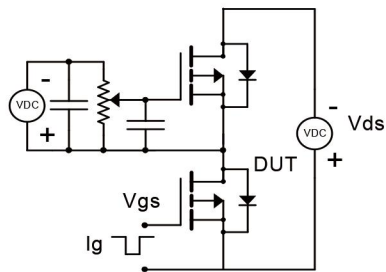
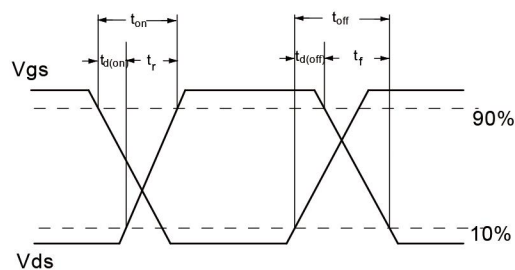
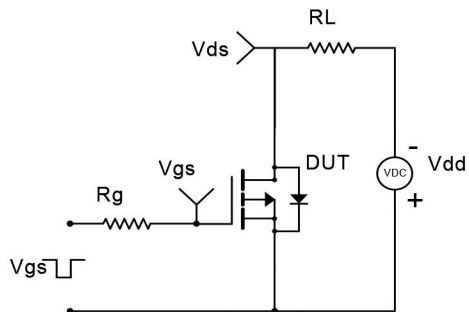


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

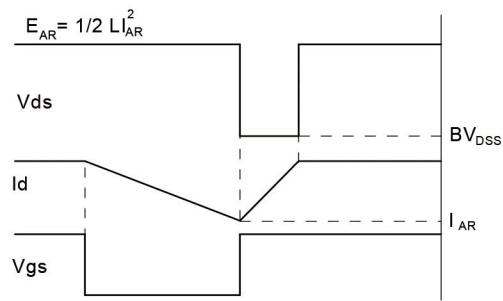
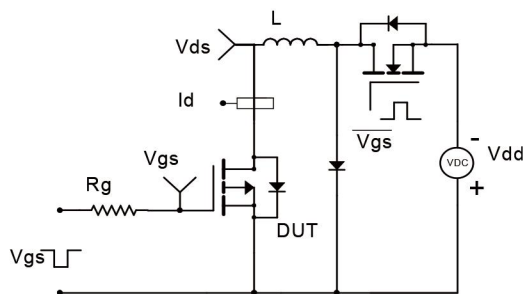
Gate Charge Test Circuit & Waveform



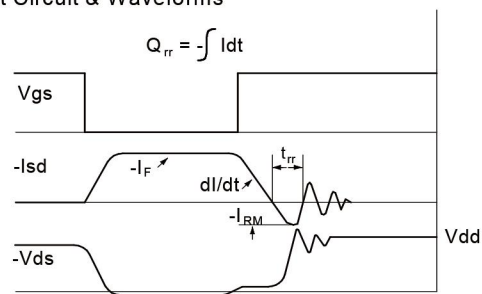
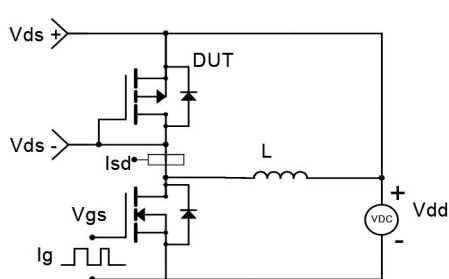
Resistive Switching Test Circuit & Waveforms



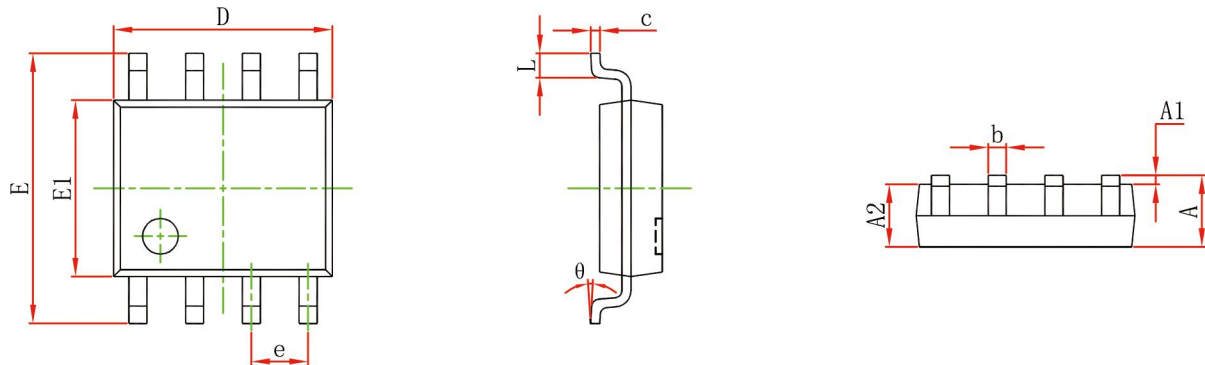
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



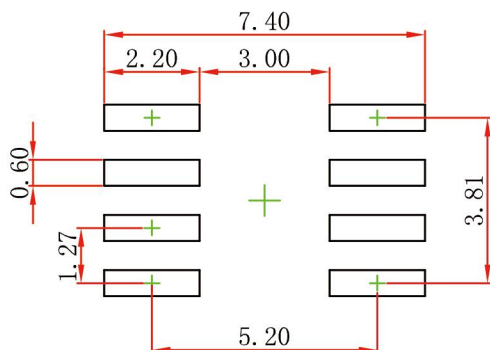
Diode Recovery Test Circuit & Waveforms



### 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:  $\pm 0.05\text{mm}$ .
3. The pad layout is for reference purposes only.