



**ALPHA & OMEGA**  
SEMICONDUCTOR



## AO4620

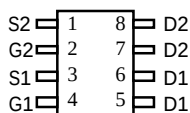
### Complementary Enhancement Mode Field Effect Transistor

#### General Description

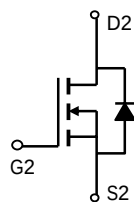
The AO4620 uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used in inverter and other applications. *Standard Product AO4620 is Pb-free (meets ROHS & Sony 259 specifications).*

#### Features

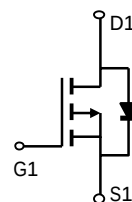
| n-channel                   | p-channel                      |
|-----------------------------|--------------------------------|
| $V_{DS} (V) = 30V$          | -30V                           |
| $I_D = 7.2A (V_{GS}=10V)$   | -5.3A ( $V_{GS} = -10V$ )      |
| $R_{DS(ON)}$                | $R_{DS(ON)}$                   |
| $< 24m\Omega (V_{GS}=10V)$  | $< 38m\Omega (V_{GS} = -10V)$  |
| $< 36m\Omega (V_{GS}=4.5V)$ | $< 60m\Omega (V_{GS} = -4.5V)$ |



SOIC-8



n-channel



p-channel

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

| Parameter                                      | Symbol           | Max n-channel | Max p-channel | Units      |
|------------------------------------------------|------------------|---------------|---------------|------------|
| Drain-Source Voltage                           | $V_{DS}$         | 30            | -30           | V          |
| Gate-Source Voltage                            | $V_{GS}$         | $\pm 20$      | $\pm 20$      | V          |
| Continuous Drain Current <sup>F</sup>          | $T_A=25^\circ C$ | 7.2           | -5.3          | A          |
|                                                | $T_A=70^\circ C$ | 6.2           | -4.5          |            |
| Pulsed Drain Current <sup>B</sup>              | $I_{DM}$         | 30            | -30           | A          |
| Power Dissipation <sup>F</sup>                 | $T_A=25^\circ C$ | 2             | 2             | W          |
|                                                | $T_A=70^\circ C$ | 1.44          | 1.44          |            |
| Avalanche Current <sup>B</sup>                 | $I_{AR}$         | 13            | 17            | A          |
| Repetitive avalanche energy 0.3mH <sup>B</sup> | $E_{AR}$         | 25            | 43            | mJ         |
| Junction and Storage Temperature Range         | $T_J, T_{STG}$   | -55 to 150    | -55 to 150    | $^\circ C$ |

#### Thermal Characteristics: n-channel and p-channel

| Parameter                                | Symbol          | Device | Typ | Max  | Units        |
|------------------------------------------|-----------------|--------|-----|------|--------------|
| Maximum Junction-to-Ambient <sup>A</sup> | $R_{\theta JA}$ | n-ch   | 50  | 62.5 | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | n-ch   | 80  | 100  | $^\circ C/W$ |
| Maximum Junction-to-Lead <sup>C</sup>    | $R_{\theta JL}$ | n-ch   | 32  | 40   | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup> | $R_{\theta JA}$ | p-ch   | 50  | 62.5 | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | p-ch   | 80  | 100  | $^\circ C/W$ |
| Maximum Junction-to-Lead <sup>C</sup>    | $R_{\theta JL}$ | p-ch   | 32  | 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   | 1.6      | 3        | 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> =7.2A<br>T <sub>J</sub> =125°C                       |     | 20<br>26 | 24<br>32 | mΩ    |
|                             |                                       | V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A                                                 |     | 29       | 36       | mΩ    |
|                             |                                       |                                                                                           |     |          |          |       |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =7.2A                                                 |     | 24       |          | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V                                                   |     | 0.77     | 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                                         |     | 660      | 792      | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |                                                                                           |     | 110      |          | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                           |     | 87       |          | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                          |     | 0.8      | 1.5      | 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> =7.2A                          |     | 11.3     | 14.125   | nC    |
| Q <sub>g</sub> (4.5V)       | Total Gate Charge                     |                                                                                           |     | 5.7      |          | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                           |     | 2.1      |          | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                           |     | 3        |          | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =2.1Ω,<br>R <sub>GEN</sub> =3Ω |     | 4.5      |          | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                           |     | 3.1      |          | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                           |     | 15.1     |          | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                           |     | 2.7      |          | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =7.2A, dI/dt=100A/μs                                                       |     | 15.5     | 20       | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =7.2A, dI/dt=100A/μs                                                       |     | 7.1      |          | 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. The current rating is based on the ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

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

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

E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

F: The power dissipation and current rating are based on the ≤ 10s thermal resistance rating.

Rev 1:Feb 2007

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## N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

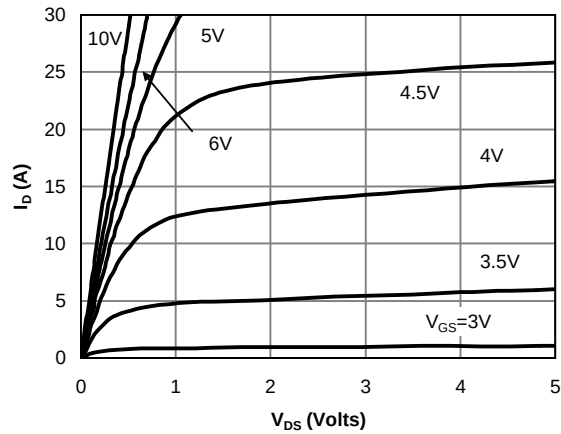


Figure 1: On-Region Characteristics

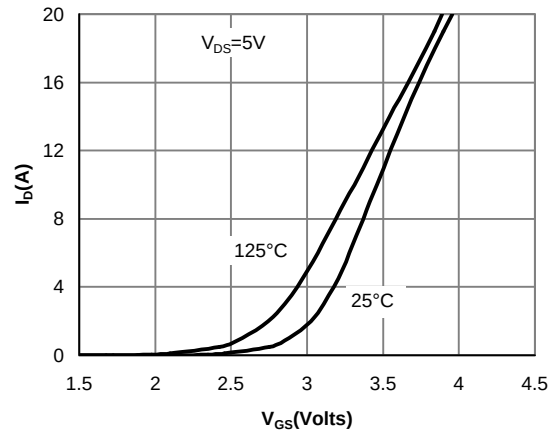


Figure 2: Transfer Characteristics

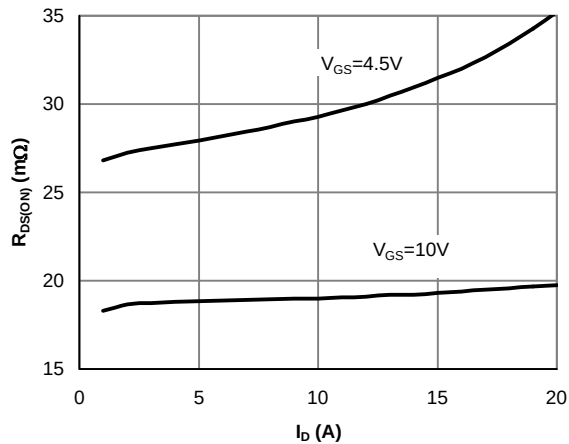


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

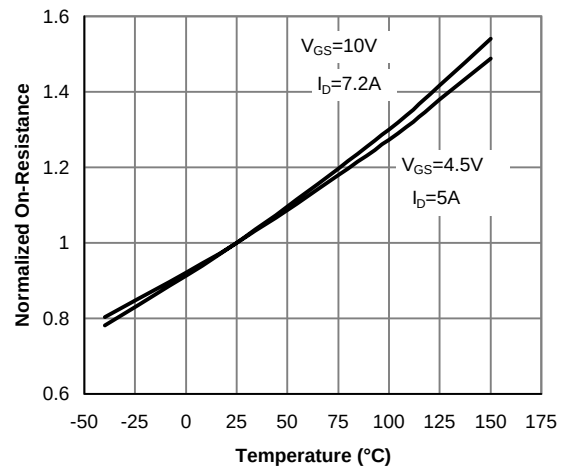


Figure 4: On-Resistance vs. Junction Temperature

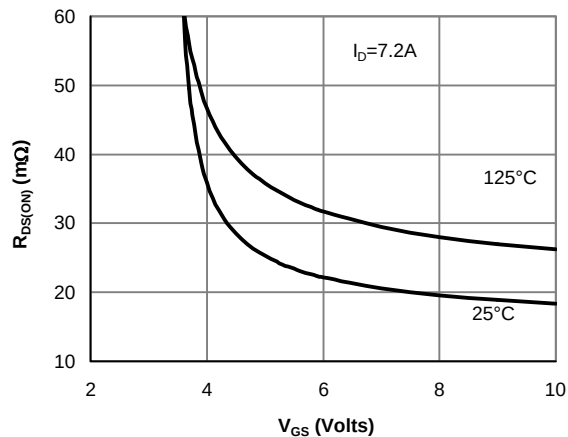


Figure 5: On-Resistance vs. Gate-Source Voltage

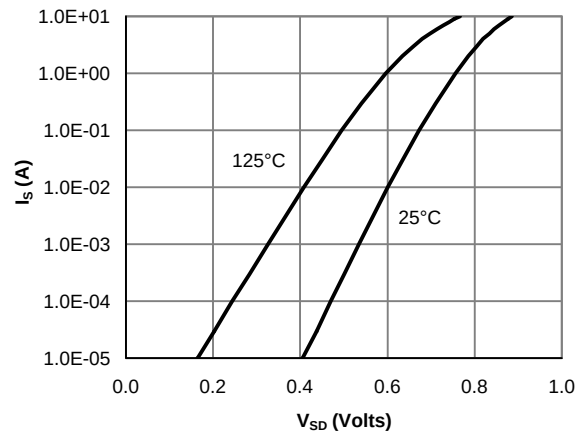


Figure 6: Body-Diode Characteristics

## N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

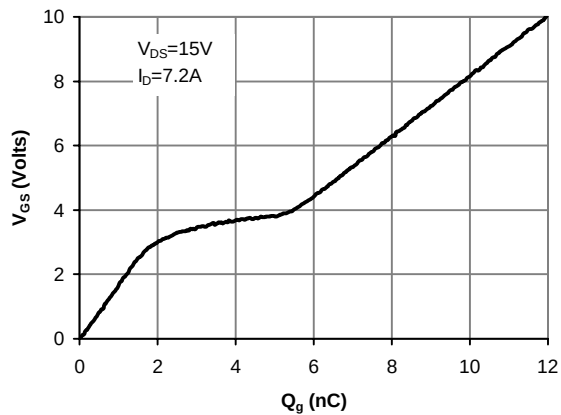


Figure 7: Gate-Charge Characteristics

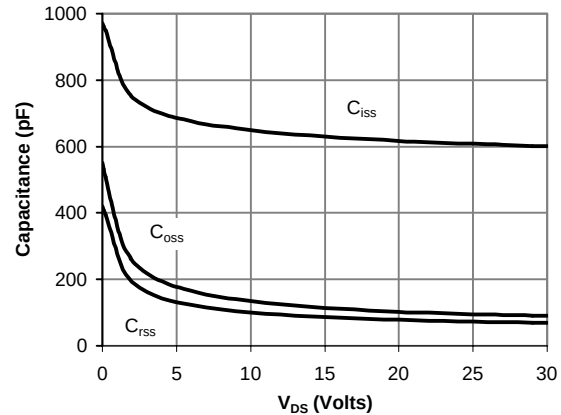


Figure 8: Capacitance Characteristics

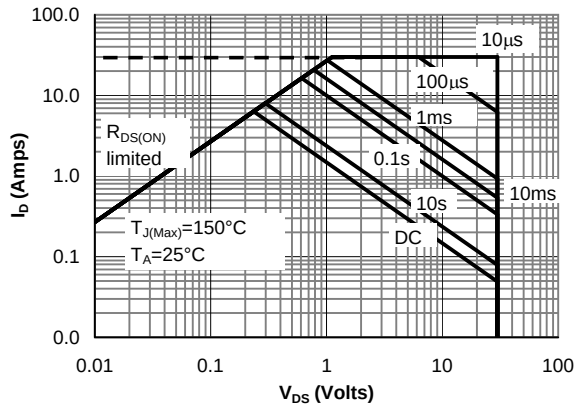


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

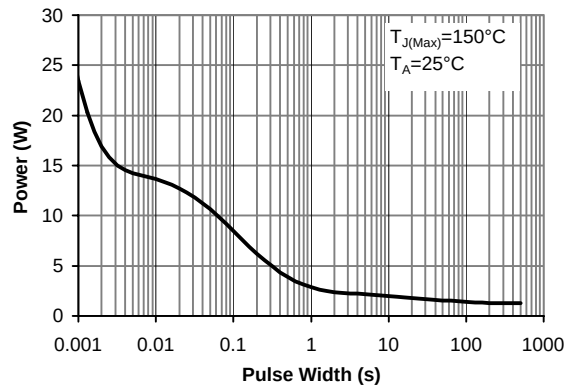


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

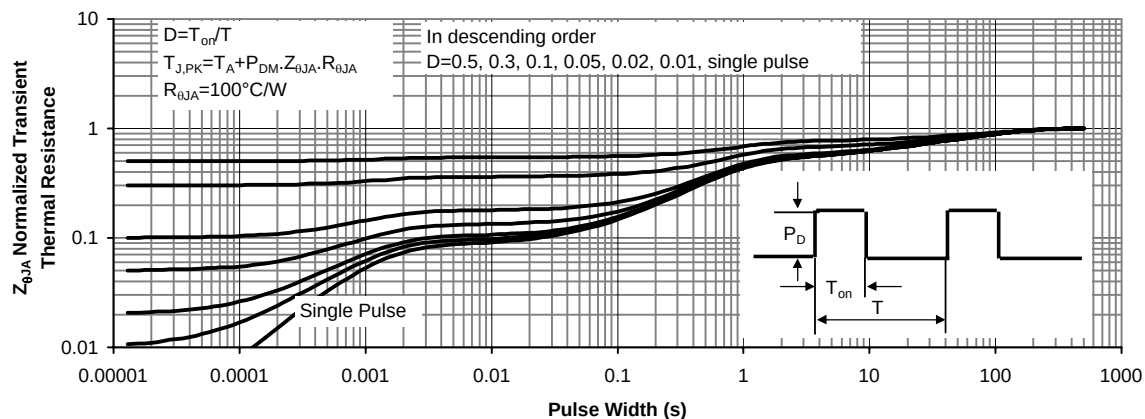


Figure 11: Normalized Maximum Transient Thermal Impedance

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  | -2       | -3       | 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> =-5.3A<br>T <sub>J</sub> =125°C                       |     | 31<br>42 | 38       | mΩ    |
|                             |                                       | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4.5A                                               |     | 48       | 60       |       |
|                             |                                       |                                                                                             |     |          |          | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =-5V, I <sub>D</sub> =-5.3A                                                 |     | 15       |          | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =-1A, V <sub>GS</sub> =0V                                                    |     | -0.77    | -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                                          |     | 980      | 1225     | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |                                                                                             |     | 150      |          | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                             |     | 115      |          | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                            |     | 2.2      | 3.3      | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                             |     |          |          |       |
| Q <sub>g</sub> (10V)        | Total Gate Charge (10V)               | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-5.3A                         |     | 18.7     | 24       | nC    |
| Q <sub>g</sub> (4.5V)       | Total Gate Charge (4.5V)              |                                                                                             |     | 9.6      |          | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                             |     | 3.2      |          | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                             |     | 4.8      |          | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =2.8Ω,<br>R <sub>GEN</sub> =3Ω |     | 7.7      |          | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                             |     | 6        |          | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                             |     | 20       |          | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                             |     | 7        |          | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =-5.3A, dI/dt=100A/μs                                                        |     | 21       | 26       | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =-5.3A, dI/dt=100A/μs                                                        |     | 13       |          | 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. The current rating is based on the ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

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

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

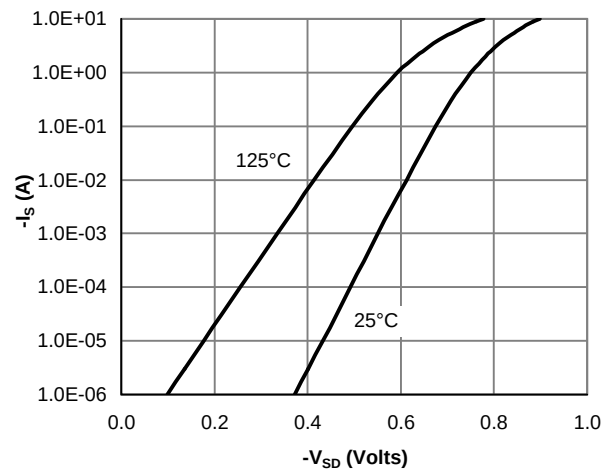
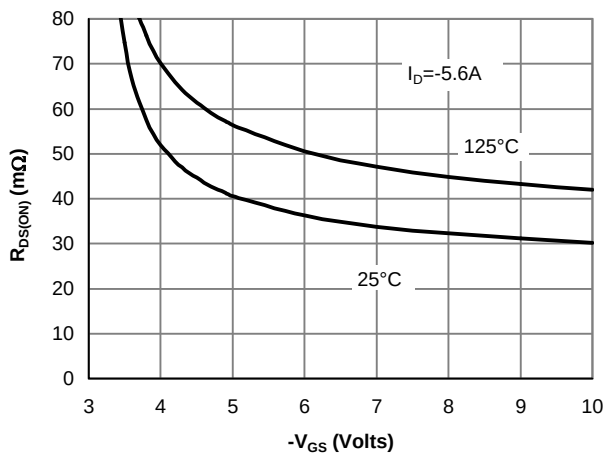
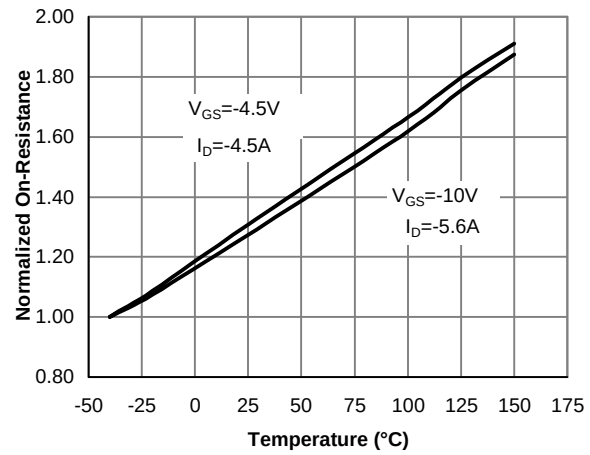
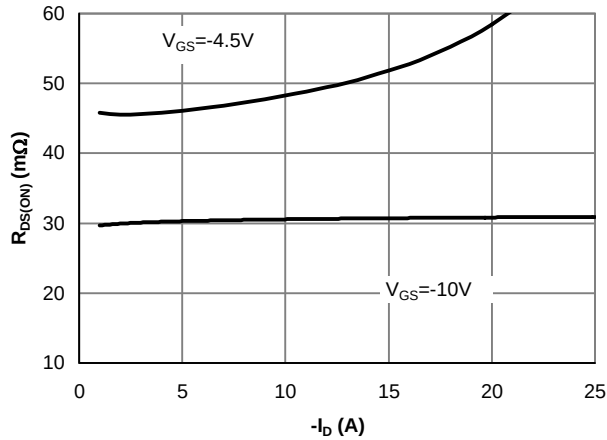
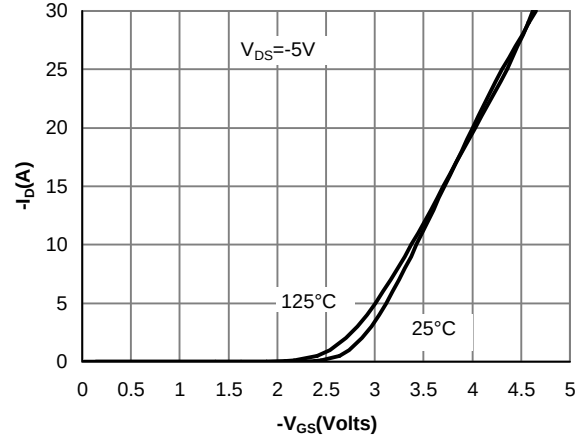
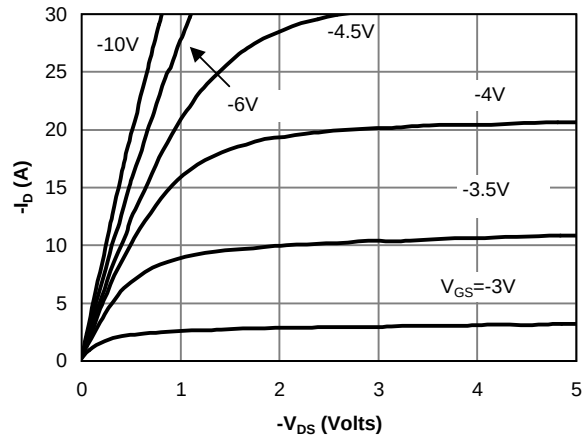
E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

F: The power dissipation and current rating are based on the ≤ 10s thermal resistance rating.

Rev1:Feb 2007

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P-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



## P-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

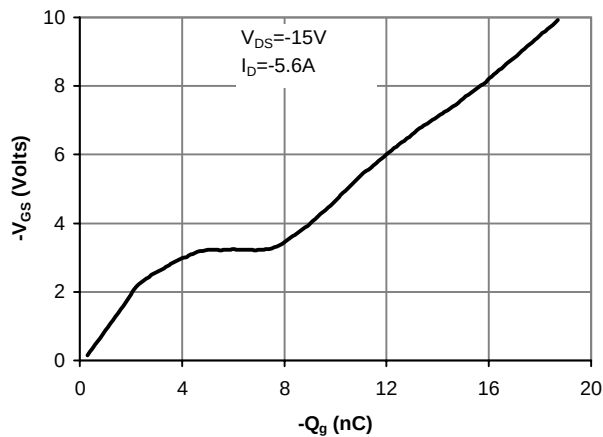


Figure 7: Gate-Charge Characteristics

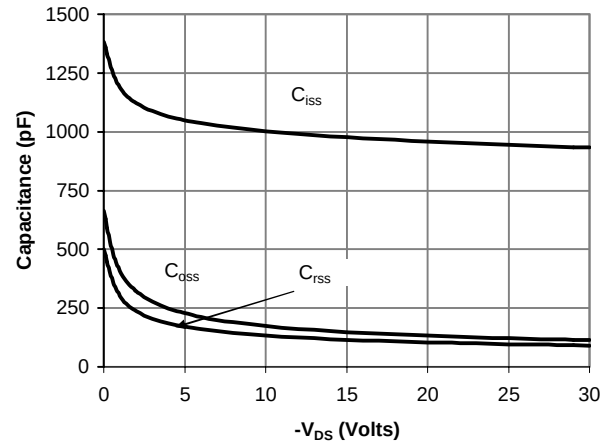


Figure 8: Capacitance Characteristics

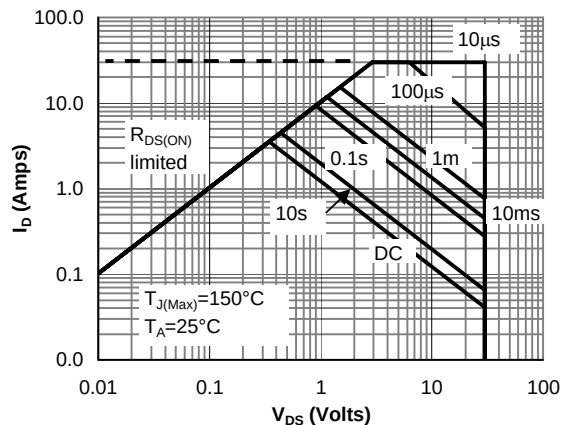


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

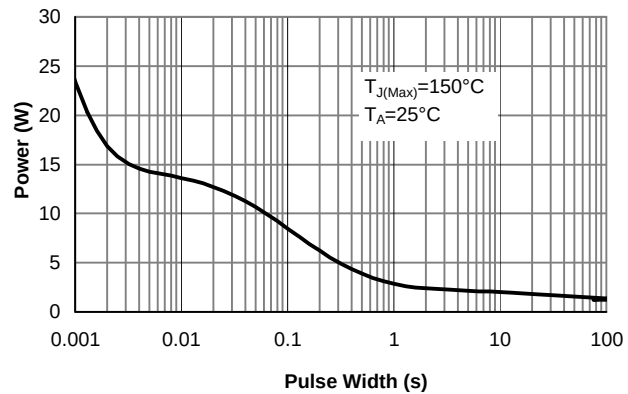


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

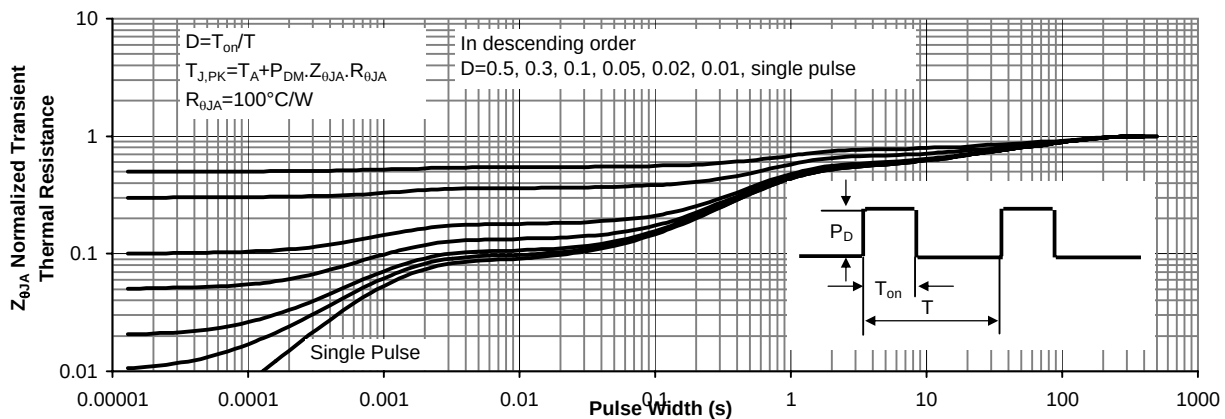


Figure 11: Normalized Maximum Transient Thermal Impedance