

General Description

- Latest Trench Power AlphaMOS (αMOS LV) technology
- Very Low RDS(on) at 4.5V_{GS}
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

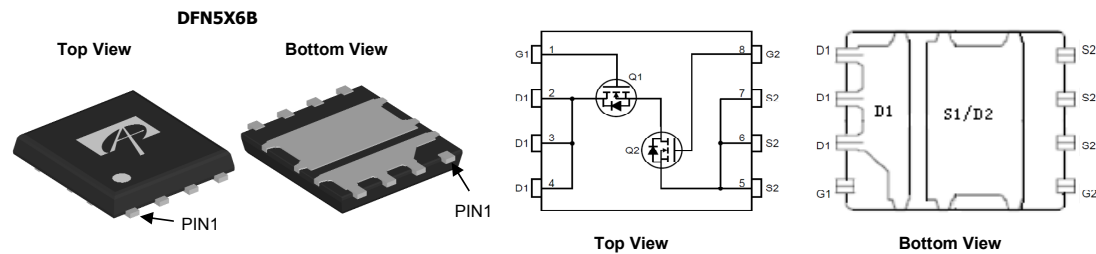
Application

- DC/DC Converters in Computing, Servers, and POL
- Isolated DC/DC Converters in Telecom and Industrial

Product Summary

| | Q1 | Q2 |
|---|--------|--------|
| V _{DS} | 30V | 30V |
| I _D (at V _{GS} =10V) | 28A | 42A |
| R _{DS(ON)} (at V _{GS} =10V) | <5mΩ | <2.5mΩ |
| R _{DS(ON)} (at V _{GS} = 4.5V) | <8.5mΩ | <3.2mΩ |

100% UIS Tested
 100% Rg Tested



Absolute Maximum Ratings T_A=25°C unless otherwise noted

| Parameter | Symbol | Max Q1 | Max Q2 | Units |
|--|-----------------------------------|----------------------|--------|-------|
| Drain-Source Voltage | V _{DS} | 30 | | V |
| Gate-Source Voltage | V _{GS} | ±20 | ±20 | V |
| Continuous Drain Current ^C | I _D | 28 | 42 | A |
| Current ^C | | T _C =25°C | 22 | |
| Pulsed Drain Current ^C | I _{DM} | 112 | 168 | A |
| Continuous Drain Current | I _{DSM} | 22 | 36 | A |
| Current | | T _A =25°C | 17 | |
| Avalanche Current ^C | I _{AS} | 32 | 70 | A |
| Avalanche Energy L=0.05mH ^C | E _{AS} | 26 | 123 | mJ |
| V _{DS} Spike | V _{SPIKE} | 36 | 36 | V |
| Power Dissipation ^B | P _D | 31 | 78 | W |
| | | T _C =25°C | 12 | |
| Power Dissipation ^A | P _{DSM} | 3.6 | 4.3 | W |
| | | T _A =25°C | 2.3 | |
| Junction and Storage Temperature Range | T _J , T _{STG} | -55 to 150 | | °C |

Thermal Characteristics

| Parameter | Symbol | Typ Q1 | Typ Q2 | Max Q1 | Max Q2 | Units |
|--|------------------|---------|--------|--------|--------|-------|
| Maximum Junction-to-Ambient ^A | R _{θJA} | 29 | 24 | 35 | 29 | °C/W |
| Maximum Junction-to-Ambient ^{A,D} | | t ≤ 10s | 56 | 50 | 67 | |
| Maximum Junction-to-Case | R _{θJC} | 3.3 | 1.2 | 4 | 1.6 | °C/W |

Q1 Electrical Characteristics (T_J=25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|--|--|-----|------|--------|-------|
| STATIC PARAMETERS | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | I _D =250μA, V _{GS} =0V | 30 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =30V, V _{GS} =0V T _J =55°C | | | 1 5 | μA |
| I _{GSS} | Gate-Body leakage current | V _{DS} =0V, V _{GS} = ±20V | | | 100 | nA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _D =250μA | 1.4 | 1.8 | 2.2 | V |
| R _{DS(ON)} | Static Drain-Source On-Resistance | V _{GS} =10V, I _D =20A T _J =125°C | | 4.1 | 5 | mΩ |
| | | V _{GS} =4.5V, I _D =20A | | 5.6 | 6.8 | |
| g _{FS} | Forward Transconductance | V _{DS} =5V, I _D =20A | | 91 | | S |
| V _{SD} | Diode Forward Voltage | I _S =1A, V _{GS} =0V | | 0.7 | 1 | V |
| I _S | Maximum Body-Diode Continuous Current ^G | | | | 28 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C _{iss} | Input Capacitance | | | 1037 | | pF |
| C _{oss} | Output Capacitance | V _{GS} =0V, V _{DS} =15V, f=1MHz | | 441 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 61 | | pF |
| R _g | Gate resistance | V _{GS} =0V, V _{DS} =0V, f=1MHz | 0.7 | 1.5 | 2.3 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q _{g(10V)} | Total Gate Charge | V _{GS} =10V, V _{DS} =15V, I _D =20A | | 15.5 | 22 | nC |
| Q _{g(4.5V)} | Total Gate Charge | | | 6.8 | 10 | nC |
| Q _{gs} | Gate Source Charge | | | 3.0 | | nC |
| Q _{gd} | Gate Drain Charge | | | 3.6 | | nC |
| t _{D(on)} | Turn-On DelayTime | V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω | | 5.5 | | ns |
| t _r | Turn-On Rise Time | | | 3.3 | | ns |
| t _{D(off)} | Turn-Off DelayTime | | | 18 | | ns |
| t _f | Turn-Off Fall Time | | | 4.3 | | ns |
| t _{rr} | Body Diode Reverse Recovery Time | I _F =20A, dI/dt=500A/μs | | 12.7 | | ns |
| Q _{rr} | Body Diode Reverse Recovery Charge | I _F =20A, dI/dt=500A/μs | | 17.2 | | nC |

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} ≤ 10s and the maximum allowed junction temperature of 150° 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° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

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

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case 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-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=150° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is limited by package.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with TA=25° C.

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Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

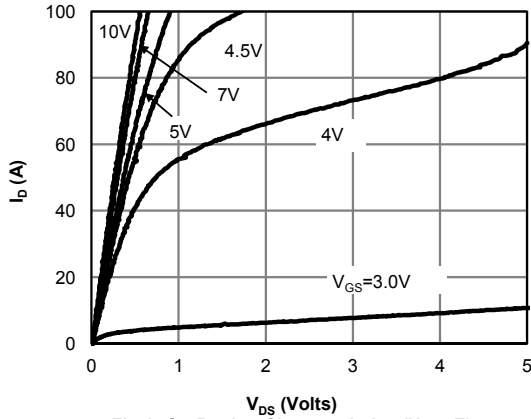


Fig 1: On-Region Characteristics (Note E)

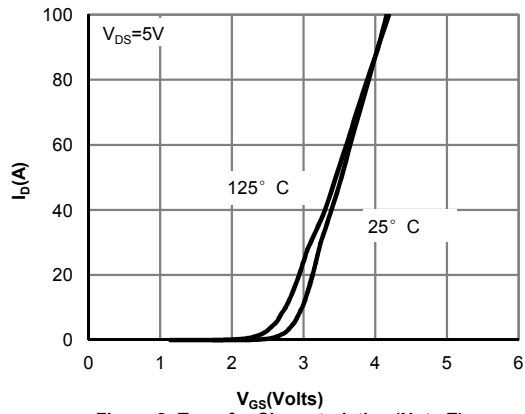


Figure 2: Transfer Characteristics (Note E)

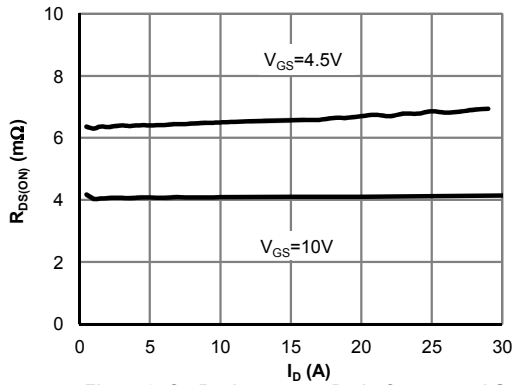


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

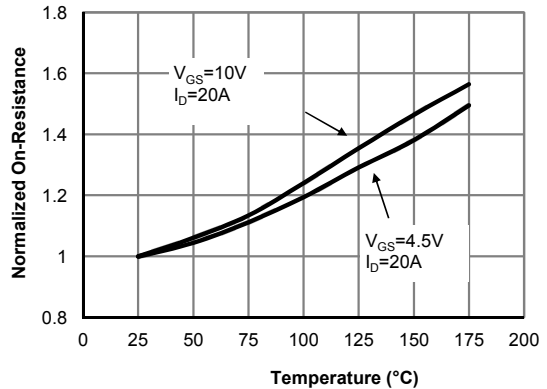


Figure 4: On-Resistance vs. Junction Temperature (Note E)

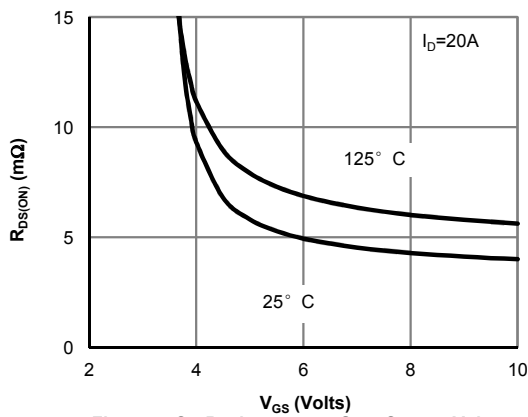


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

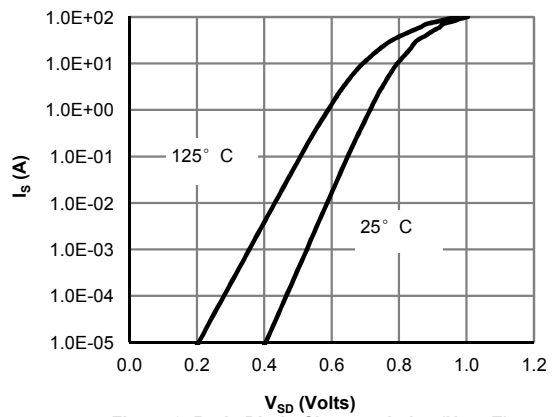


Figure 6: Body-Diode Characteristics (Note E)

Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

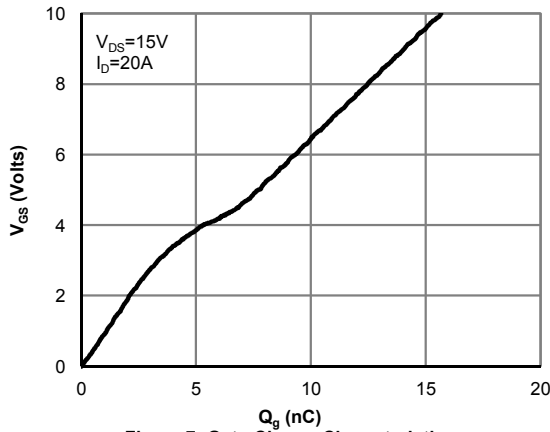


Figure 7: Gate-Charge Characteristics

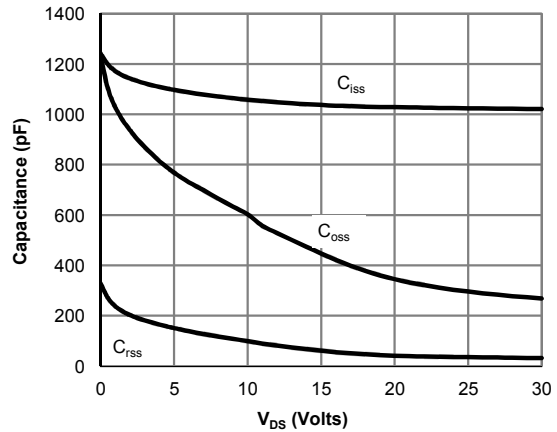


Figure 8: Capacitance Characteristics

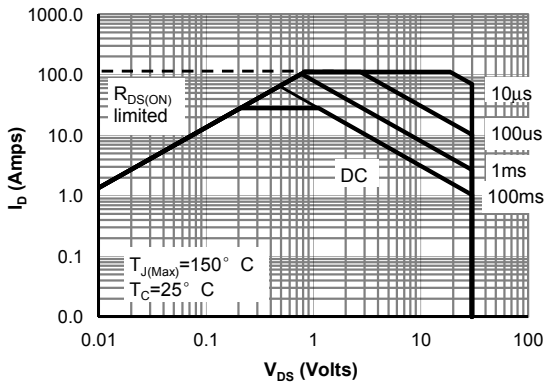


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

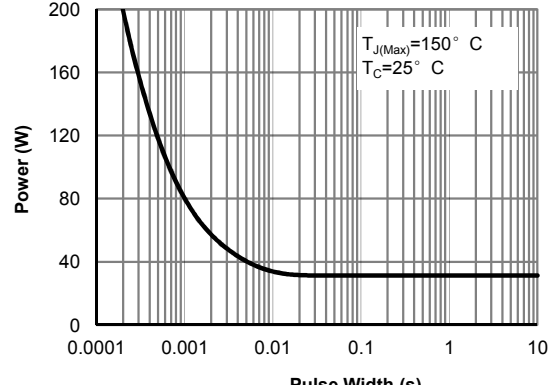


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

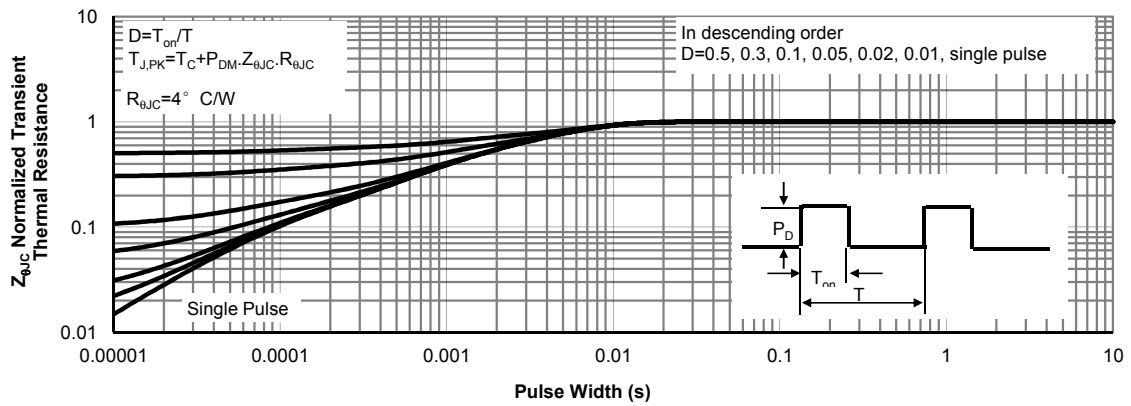


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

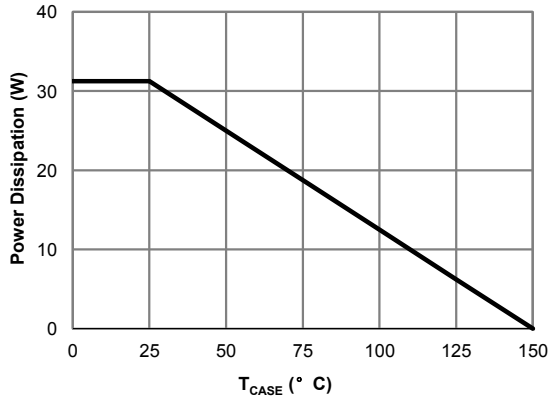


Figure 12: Power De-rating (Note F)

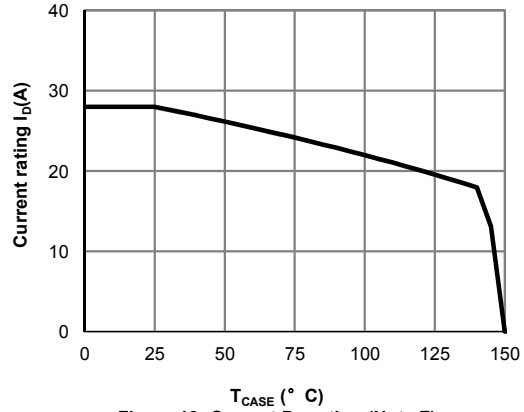


Figure 13: Current De-rating (Note F)

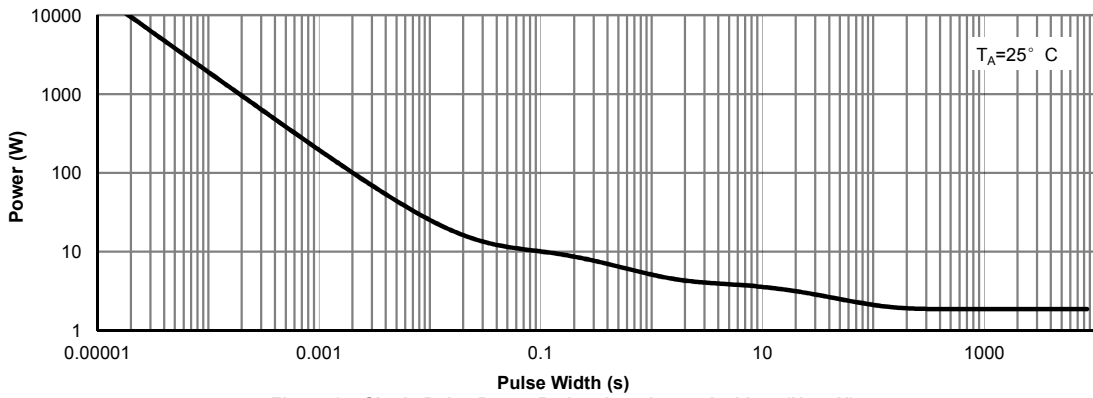


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

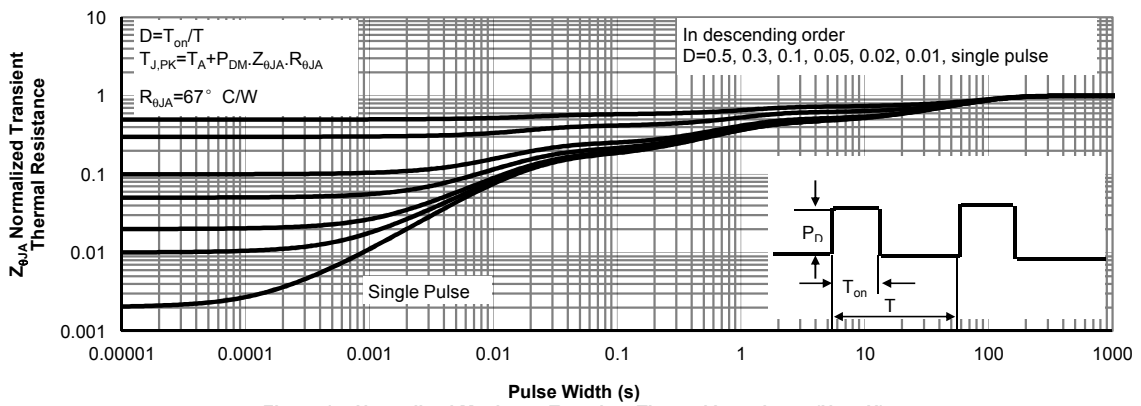


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

Q2 Electrical Characteristics (T_J=25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|--|--|-----|------|--------|-------|
| STATIC PARAMETERS | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | I _D =10mA, V _{GS} =0V | 30 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =30V, V _{GS} =0V T _J =55°C | | | 1 5 | μA |
| I _{GSS} | Gate-Body leakage current | V _{DS} =0V, V _{GS} = ±20V | | | 100 | nA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _D =250μA | 1.1 | 1.5 | 1.9 | V |
| R _{DS(ON)} | Static Drain-Source On-Resistance | V _{GS} =10V, I _D =20A T _J =125°C | | 1.8 | 2.5 | mΩ |
| | | V _{GS} =4.5V, I _D =20A | | 2.3 | 3.2 | mΩ |
| g _{FS} | Forward Transconductance | V _{DS} =5V, I _D =20A | | 85 | | S |
| V _{SD} | Diode Forward Voltage | I _S =1A, V _{GS} =0V | | 0.7 | 1 | V |
| I _S | Maximum Body-Diode Continuous Current ^G | | | | 42 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C _{iss} | Input Capacitance | | | 3430 | | pF |
| C _{oss} | Output Capacitance | V _{GS} =0V, V _{DS} =15V, f=1MHz | | 1327 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 175 | | pF |
| R _g | Gate resistance | V _{GS} =0V, V _{DS} =0V, f=1MHz | 0.3 | 0.7 | 1.1 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q _g (10V) | Total Gate Charge | V _{GS} =10V, V _{DS} =15V, I _D =20A | | 53 | 64 | nC |
| Q _g (4.5V) | Total Gate Charge | | | 25 | 30 | nC |
| Q _{gs} | Gate Source Charge | | | 7.8 | | nC |
| Q _{gd} | Gate Drain Charge | | | 10.3 | | nC |
| t _{D(on)} | Turn-On DelayTime | V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω | | 7.5 | | ns |
| t _r | Turn-On Rise Time | | | 5.0 | | ns |
| t _{D(off)} | Turn-Off DelayTime | | | 33.8 | | ns |
| t _f | Turn-Off Fall Time | | | 9.8 | | ns |
| t _{rr} | Body Diode Reverse Recovery Time | I _F =20A, dI/dt=500A/μs | | 22 | | ns |
| Q _{rr} | Body Diode Reverse Recovery Charge | I _F =20A, dI/dt=500A/μs | | 58 | | nC |

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} ≤ 10s and the maximum allowed junction temperature of 150° 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° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

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

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Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

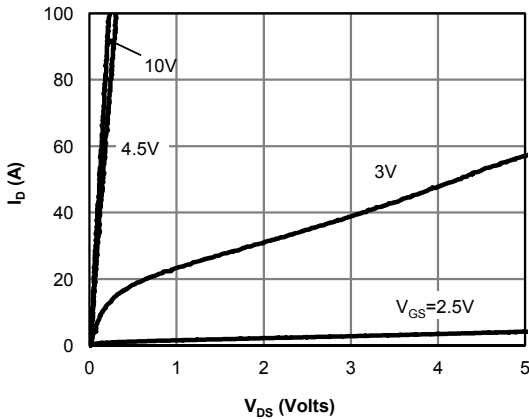


Fig 1: On-Region Characteristics (Note E)

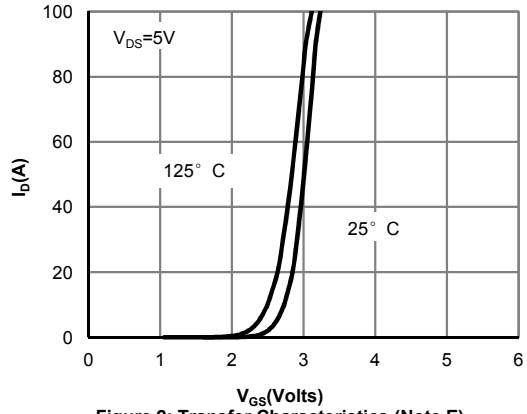


Figure 2: Transfer Characteristics (Note E)

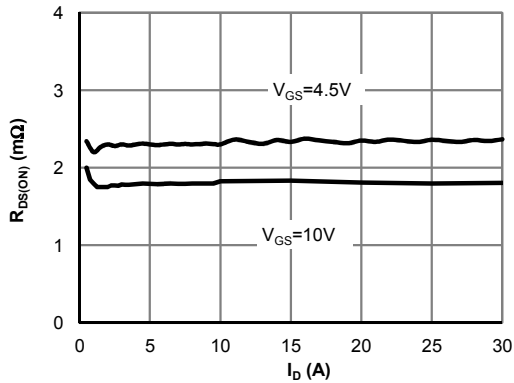


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

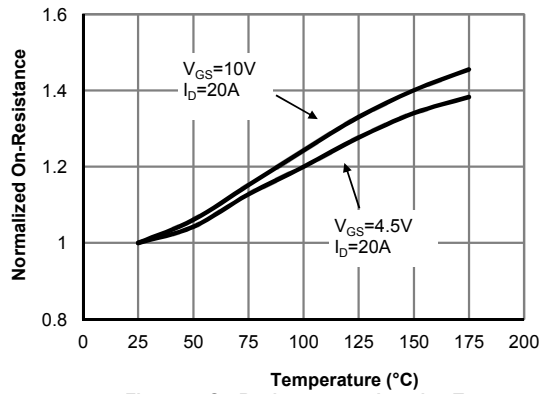


Figure 4: On-Resistance vs. Junction Temperature (Note E)

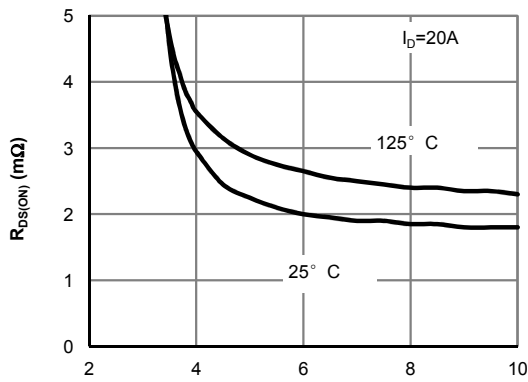


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

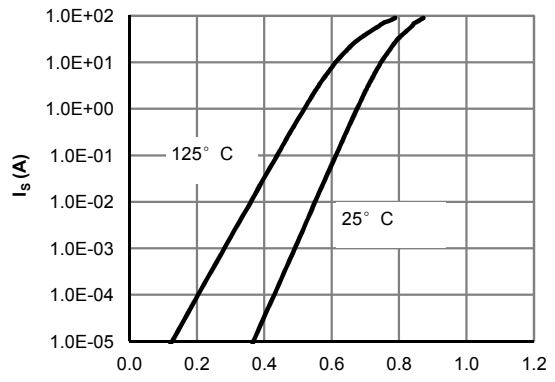


Figure 6: Body-Diode Characteristics (Note E)

Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

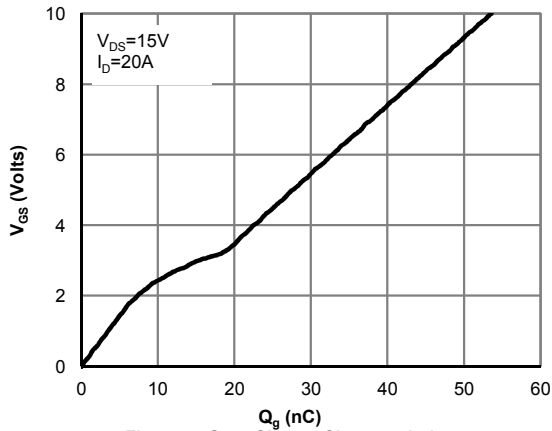


Figure 7: Gate-Charge Characteristics

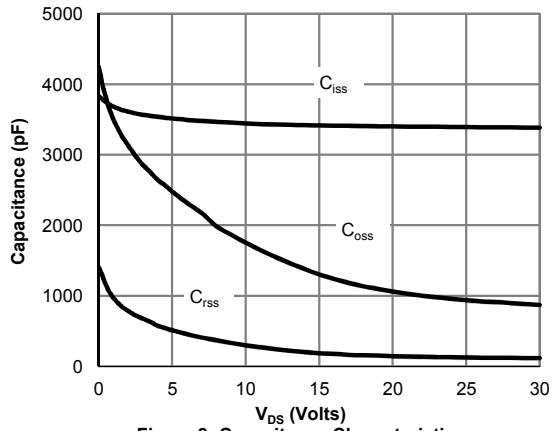


Figure 8: Capacitance Characteristics

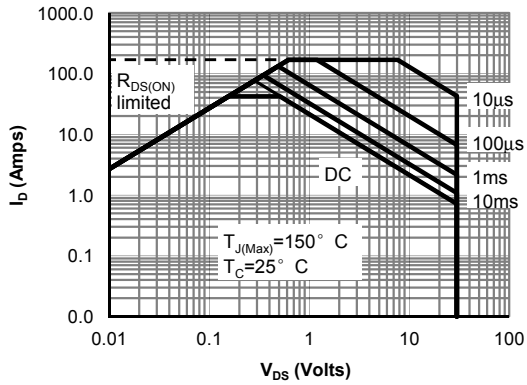


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

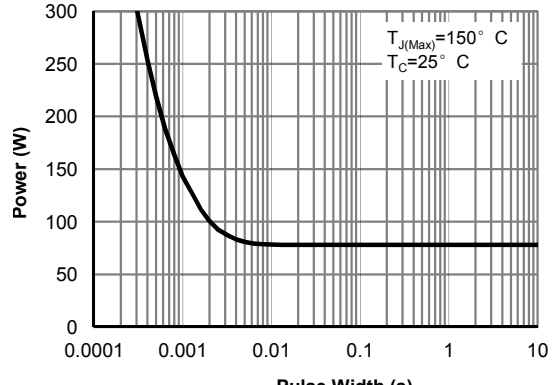


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

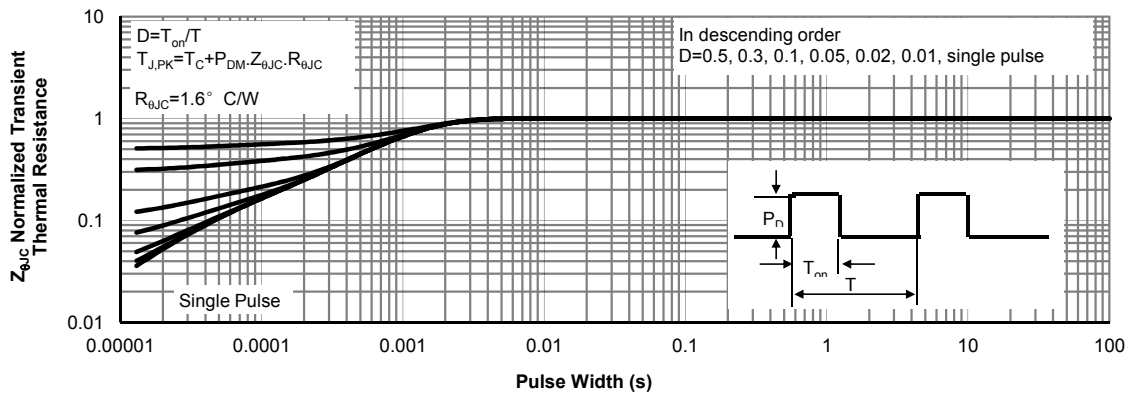


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

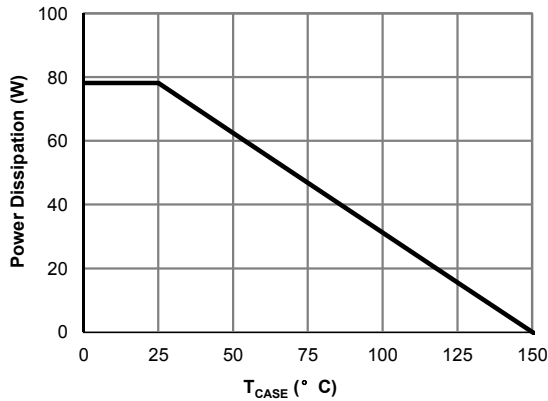


Figure 12: Power De-rating (Note F)

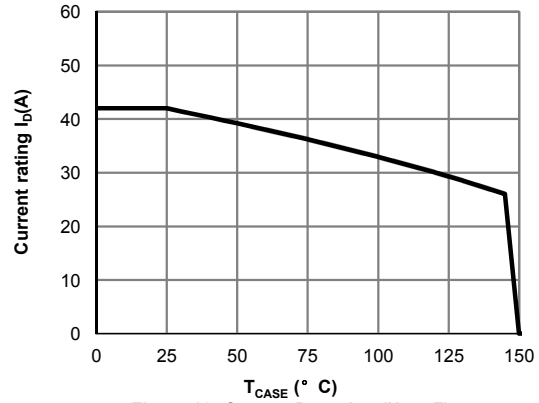


Figure 13: Current De-rating (Note F)

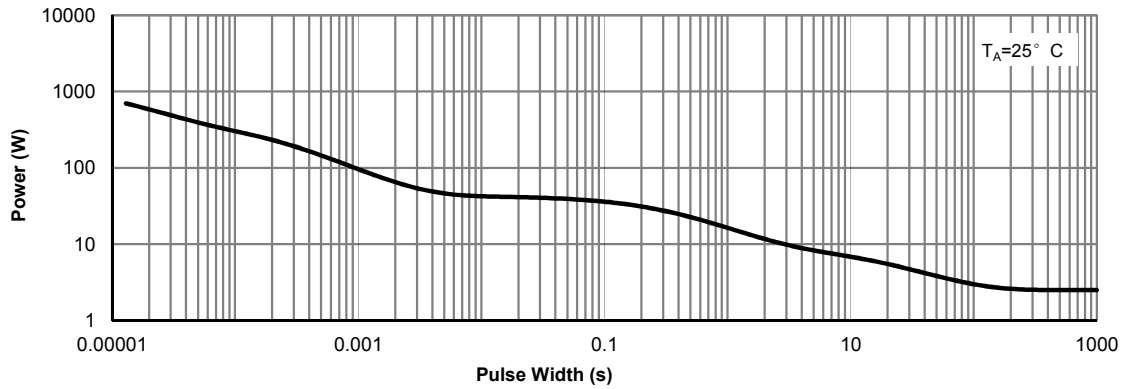


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

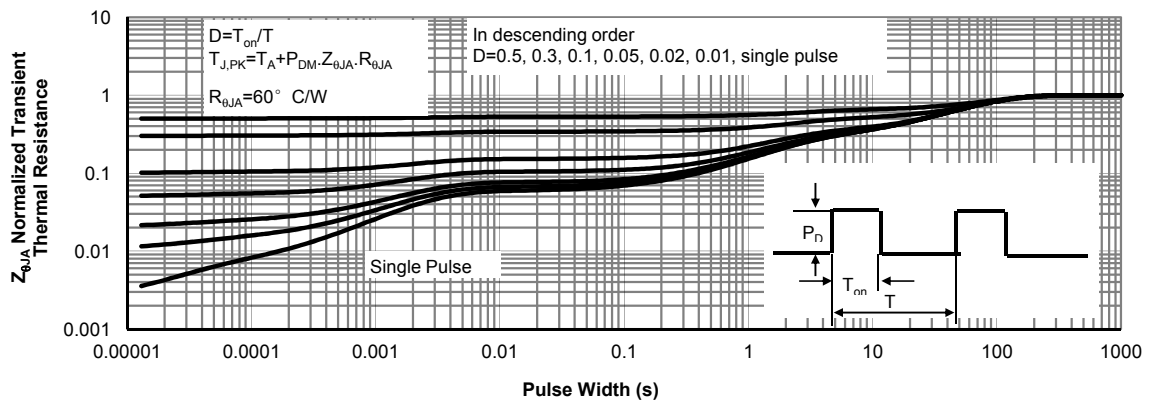
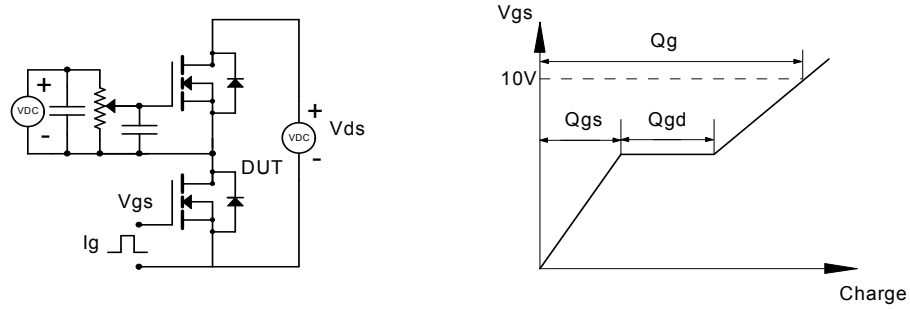
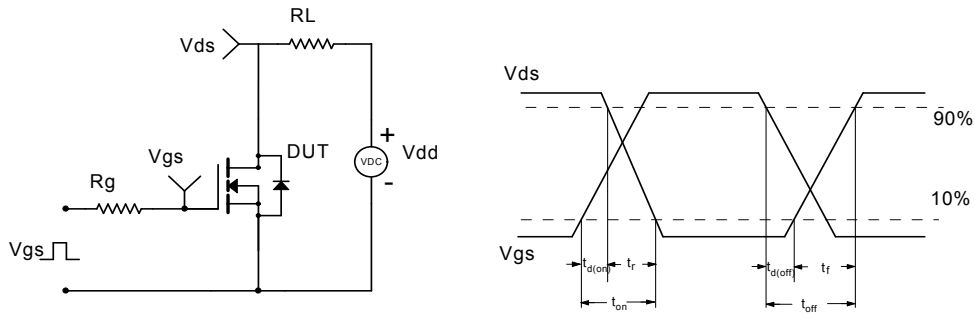


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

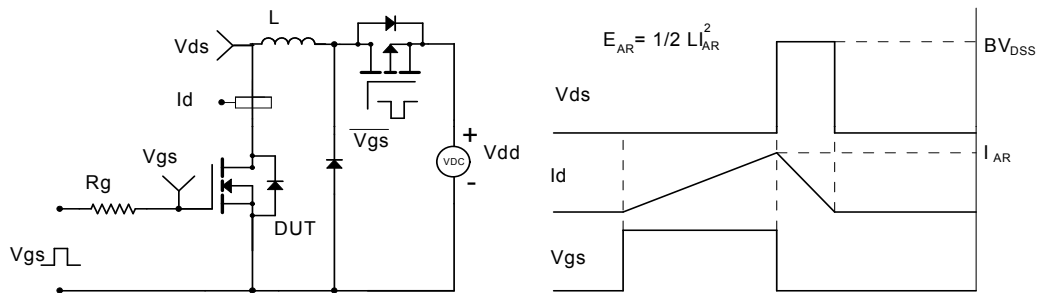
Gate Charge Test Circuit & Waveform



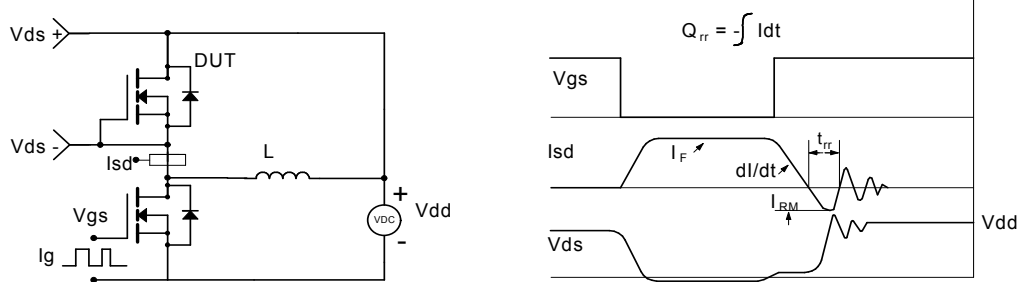
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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