# ALPHA & OMEGA SEMICONDUCTOR

# AON7440
## 30V N-Channel MOSFET

## General Description

• Trench Power technology
• Low $R_{DS(ON)}$
• High Current Capability
• RoHS and Halogen-Free Compliant

## Applications

• Load switch and Li-ion battery charging/discharging switch

## Product Summary

| | |
|---|---|
| $V_{DS}$ | 30V |
| $I_D$ (at $V_{GS}$=10V) | 50A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 2.8mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$ = 4.5V) | < 3.6mΩ |
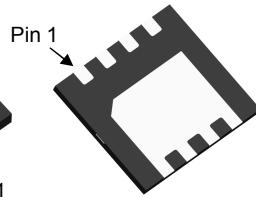
100% UIS Tested
100% $R_g$ Tested

Green Product

**DFN 3.3x3.3 EP**

Top View    Bottom View

Pin 1

Pin 1

**Top View**

| | | | |
|---|---|---|---|
| S | 1 | 8 | D |
| S | 2 | 7 | D |
| S | 3 | 6 | D |
| G | 4 | 5 | D |
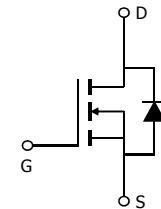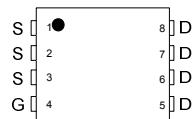
## Absolute Maximum Ratings $T_A$=25°C unless otherwise noted

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current[G] | $T_C$=25°C | $I_D$ | 50 | A |
| | $T_C$=100°C | | 39 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 220 | |
| Continuous Drain Current | $T_A$=25°C | $I_{DSM}$ | 28 | A |
| | $T_A$=70°C | | 23 | |
| Avalanche Current [C] | | $I_{AR}, I_{AS}$ | 50 | A |
| Repetitive avalanche energy L=0.1mH [C] | | $E_{AR}, E_{AS}$ | 125 | mJ |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 42 | W |
| | $T_C$=100°C | | 17 | |
| Power Dissipation [A] | $T_A$=25°C | $P_{DSM}$ | 4.2 | W |
| | $T_A$=70°C | | 2.7 | |
| Junction and Storage Temperature Range | | $T_J, T_{STG}$ | -55 to 150 | °C |

## Thermal Characteristics

| Parameter | | Symbol | Typ | Max | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{\theta JA}$ | 25 | 30 | °C/W |
| Maximum Junction-to-Ambient [A D] | Steady-State | | 50 | 60 | °C/W |
| Maximum Junction-to-Case | Steady-State | $R_{\theta JC}$ | 2.4 | 3 | °C/W |

**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 | 36 | | V |
| I$_{DSS}$ | Zero Gate Voltage Drain Current | V$_{DS}$=30V, V$_{GS}$=0V | | | | 1 | µA |
| | | | T$_J$=55°C | | | 5 | |
| 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 | 1.7 | 2.3 | V |
| R$_{DS(ON)}$ | Static Drain-Source On-Resistance | V$_{GS}$=10V, I$_D$=20A | | | 2.3 | 2.8 | mΩ |
| | | | T$_J$=125°C | | 3.8 | 4.6 | |
| | | V$_{GS}$=4.5V, I$_D$=20A | | | 2.9 | 3.6 | mΩ |
| g$_{FS}$ | Forward Transconductance | V$_{DS}$=5V, I$_D$=20A | | | 100 | | S |
| V$_{SD}$ | Diode Forward Voltage | I$_S$=1A,V$_{GS}$=0V | | | 0.7 | 1 | V |
| I$_S$ | Maximum Body-Diode Continuous Current $^G$ | | | | | 50 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| C$_{iss}$ | Input Capacitance | V$_{GS}$=0V, V$_{DS}$=15V, f=1MHz | | | 2820 | | pF |
| C$_{oss}$ | Output Capacitance | | | | 410 | | pF |
| C$_{rss}$ | Reverse Transfer Capacitance | | | | 280 | | pF |
| R$_g$ | Gate resistance | V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz | | 1.7 | 3.5 | 5 | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| Q$_g$(10V) | Total Gate Charge | V$_{GS}$=10V, V$_{DS}$=15V, I$_D$=20A | | | 54 | 75 | nC |
| Q$_g$(4.5V) | Total Gate Charge | | | | 25 | 35 | nC |
| Q$_{gs}$ | Gate Source Charge | | | | 6.5 | | nC |
| Q$_{gd}$ | Gate Drain Charge | | | | 12.5 | | nC |
| t$_{D(on)}$ | Turn-On DelayTime | V$_{GS}$=10V, V$_{DS}$=15V, R$_L$=0.75Ω, R$_{GEN}$=3Ω | | | 7 | | ns |
| t$_r$ | Turn-On Rise Time | | | | 10 | | ns |
| t$_{D(off)}$ | Turn-Off DelayTime | | | | 58 | | ns |
| t$_f$ | Turn-Off Fall Time | | | | 20 | | ns |
| t$_{rr}$ | Body Diode Reverse Recovery Time | I$_F$=20A, dI/dt=500A/µs | | | 15.5 | | ns |
| Q$_{rr}$ | Body Diode Reverse Recovery Charge | I$_F$=20A, dI/dt=500A/µs | | | 31.5 | | nC |

A. The value of R$_{θJA}$ is measured with the device mounted on 1in$^2$ 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 $_{θJA}$ t ≤ 10s value 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 impedence 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 impedence 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 in$^2$ FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25° C.
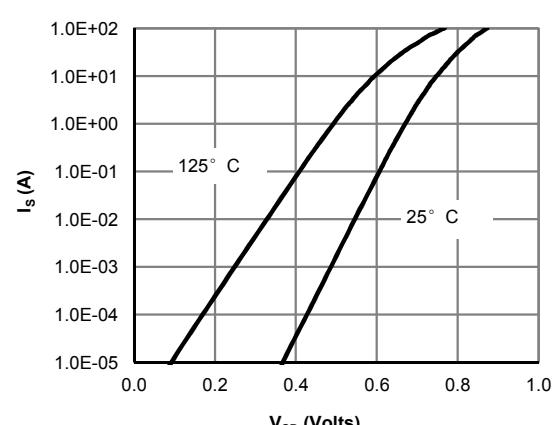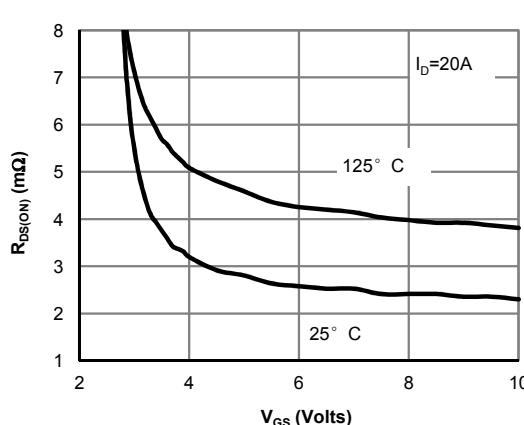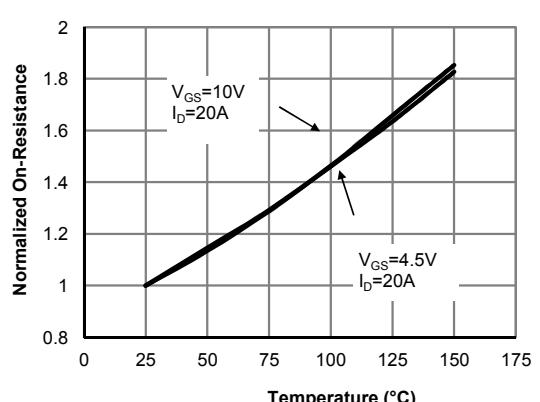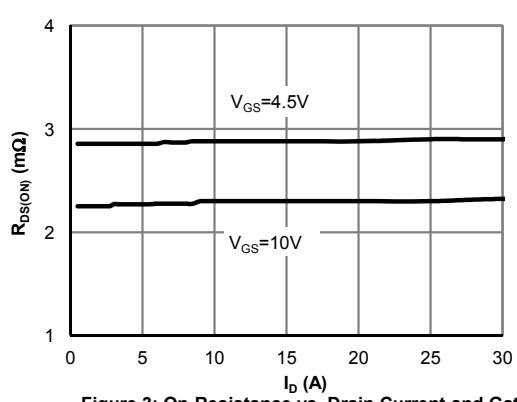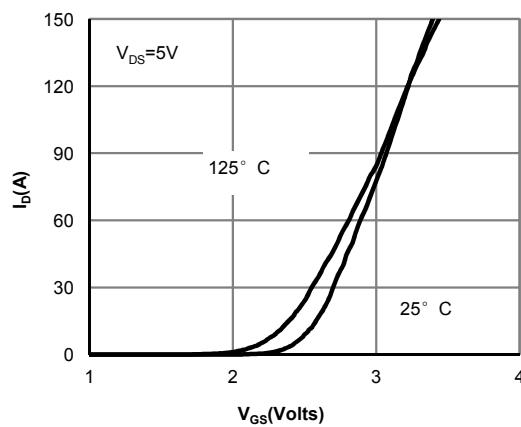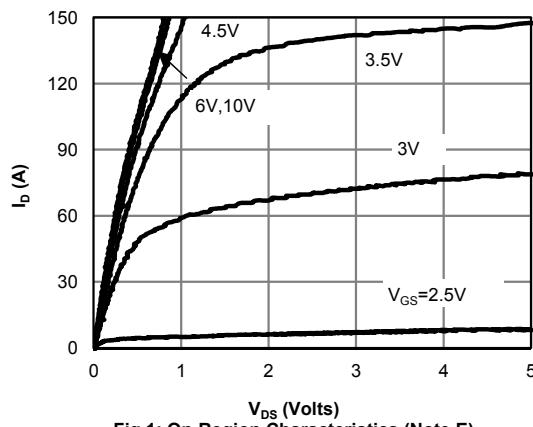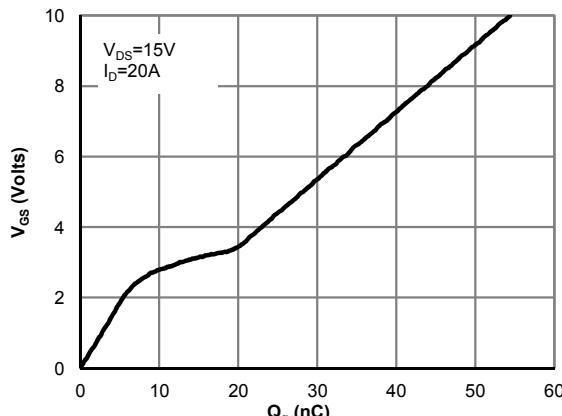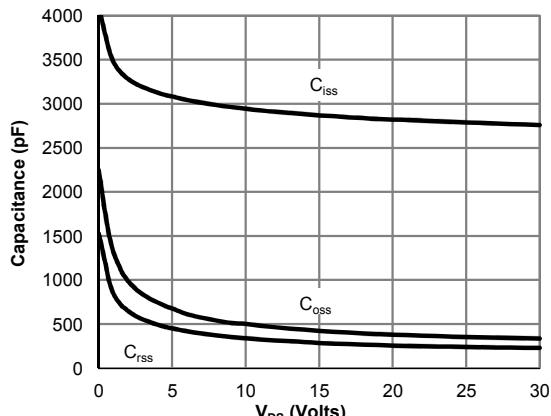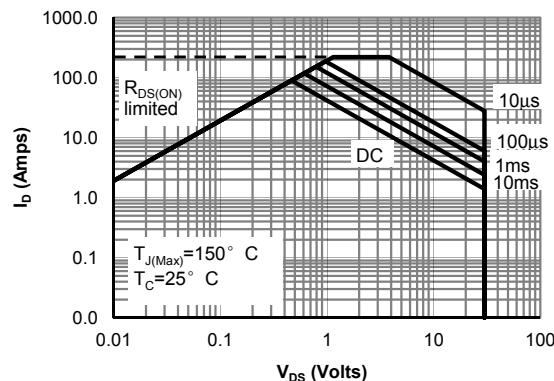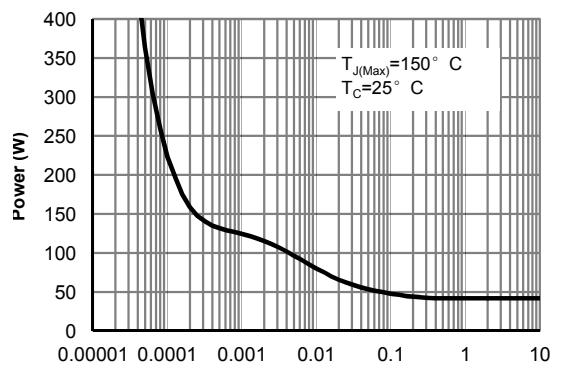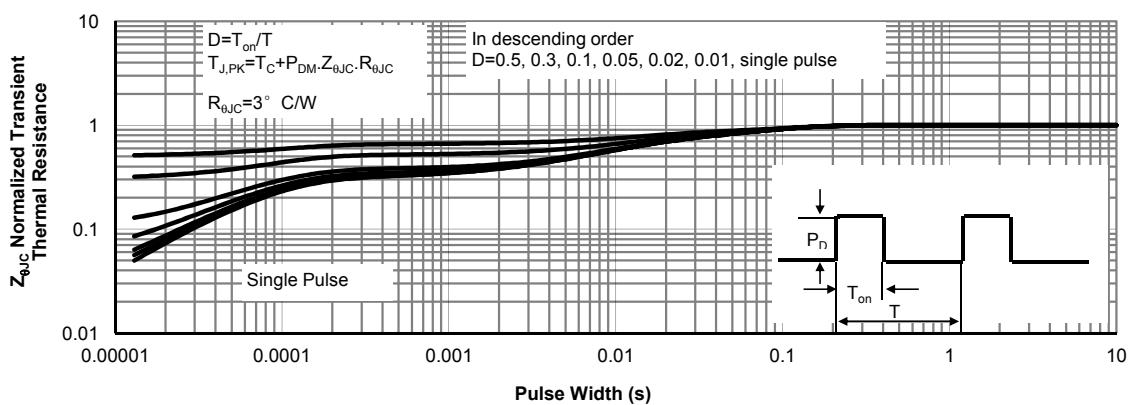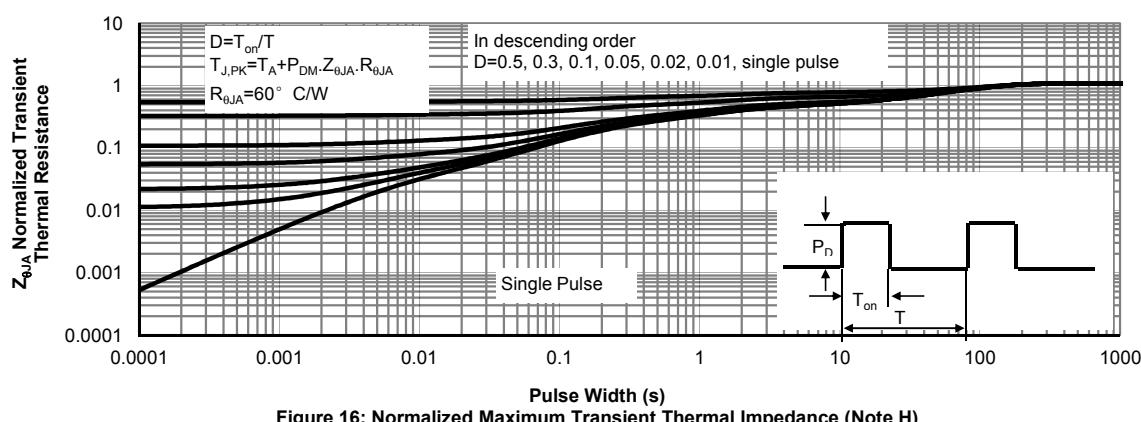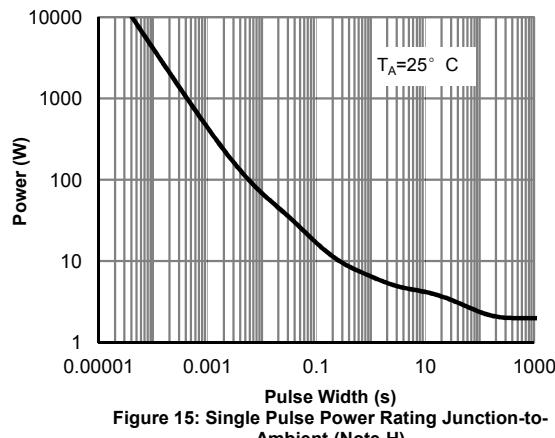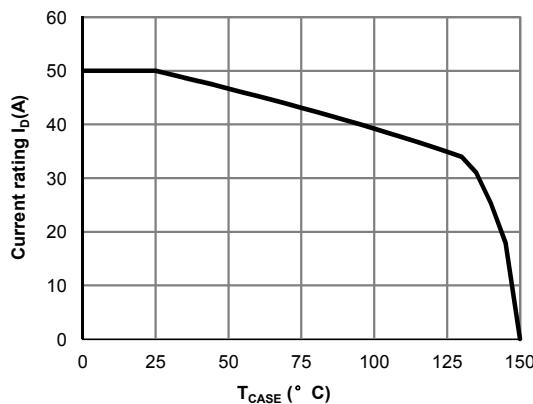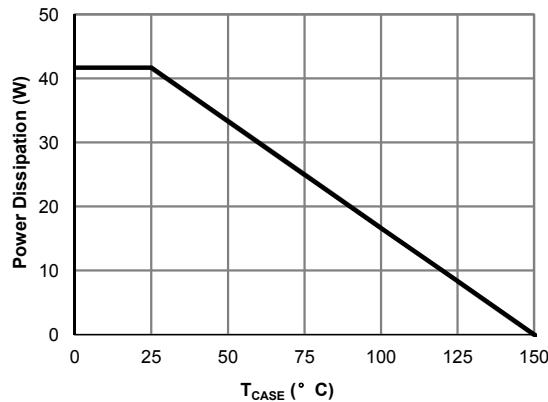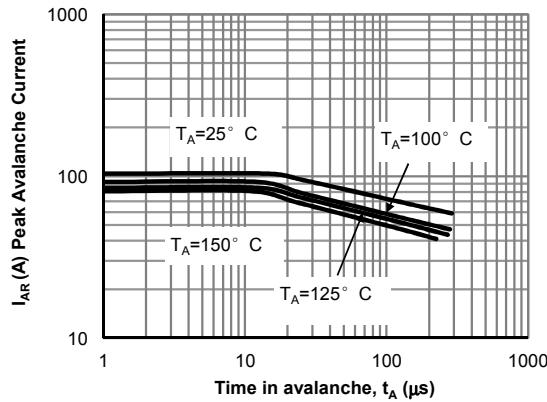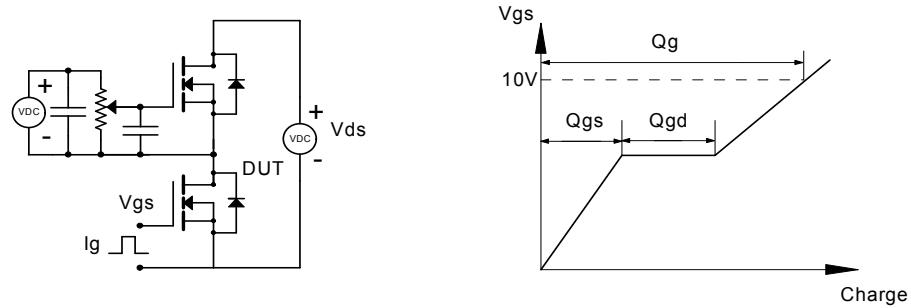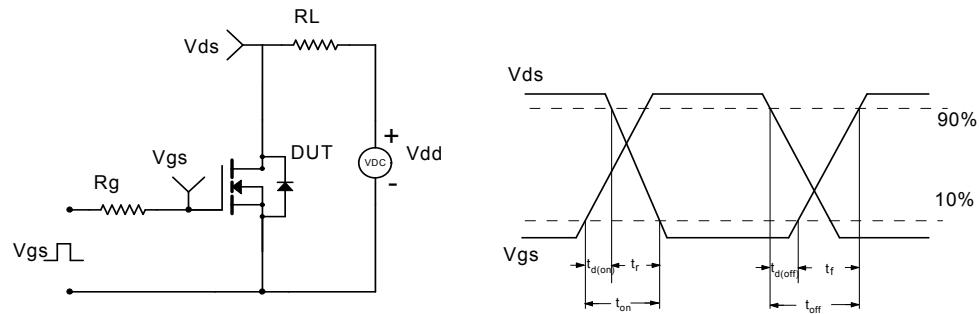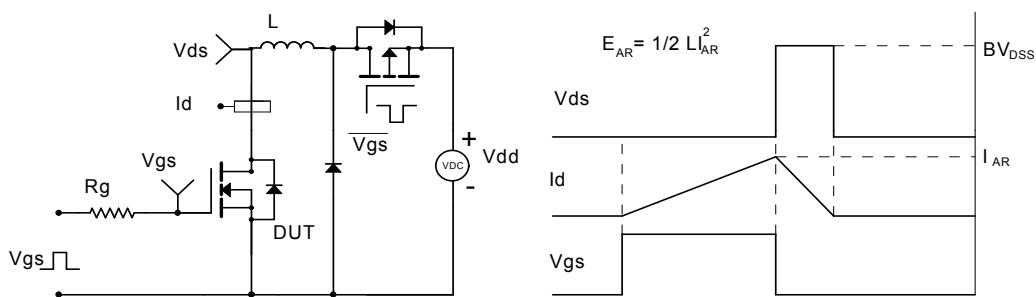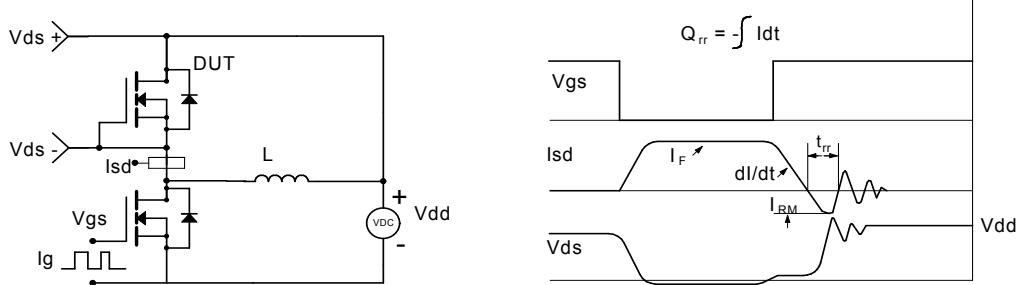
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



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)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**


$V_{DS}=15V$
$I_D=20A$
Figure 7: Gate-Charge Characteristics


$C_{iss}$
$C_{oss}$
$C_{rss}$
Figure 8: Capacitance Characteristics


$R_{DS(ON)}$ limited
10µs
100µs
DC
1ms
10ms
$T_{J(Max)}=150°C$
$T_C=25°C$
Figure 9: Maximum Forward Biased Safe
Operating Area (Note F)


$T_{J(Max)}=150°C$
$T_C=25°C$
Figure 10: Single Pulse Power Rating Junction-to-
Case (Note F)


$D=T_{on}/T$
$T_{J,PK}=T_C+P_{DM} \cdot Z_{\theta JC} \cdot R_{\theta JC}$
$R_{\theta JC}=3°C/W$
In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse
Single Pulse
$P_D$
$T_{on}$
T
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 12: Single Pulse Avalanche capability (Note C)

Figure 13: Power De-rating (Note F)

Figure 14: Current De-rating (Note F)

Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

$D=T_{on}/T$
$T_{J,PK}=T_A+P_{DM}\cdot Z_{\theta JA}\cdot R_{\theta JA}$
$R_{\theta JA}=60°$ C/W

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

Single Pulse

Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

## Gate Charge Test Circuit & Waveform



## Resistive Switching Test Circuit & Waveforms



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

$$E_{AR} = 1/2 \ LI_{AR}^2$$



## Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = \int Idt$$

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