ALPHA & OMEGA SEMICONDUCTOR

# AOT240L/AOB240L/AOTF240L

## 40V N-Channel MOSFET

### General Description

The AOT240L & AOB240L & AOTF240L uses Trench MOSFET technology that is uniquely optimized to provide the most efficient high frequency switching performance. Power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Crss.

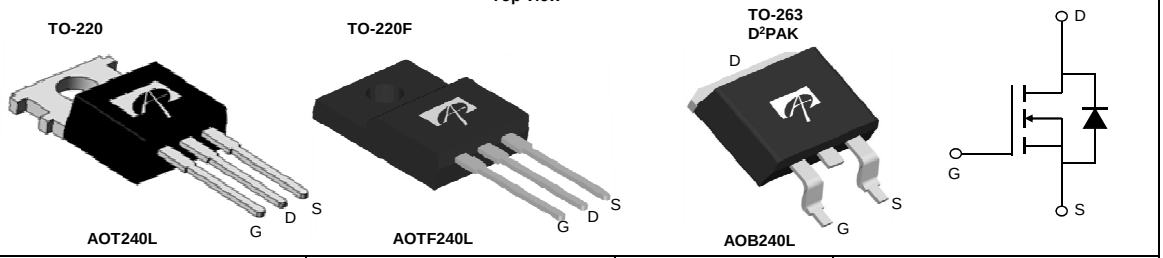
### Product Summary

| | |
|---|---|
| $V_{DS}$ | 40V |
| $I_D$ (at $V_{GS}$=10V) | 105A/85A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 2.9mΩ (< 2.6mΩ*) |
| $R_{DS(ON)}$ (at $V_{GS}$=4.5V) | < 3.7mΩ (< 3.5mΩ*) |

100% UIS Tested
100% $R_g$ Tested

Green Product

Top View




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AOT240L | TO-220 | Tube | 1000 |
| AOB240L | TO-263 | Tape & Reel | 800 |
| AOTF240L | TO-220F | Tube | 1000 |

**Absolute Maximum Ratings $T_A$=25°C unless otherwise noted**

| Parameter | | Symbol | AOT240L/AOB240L | AOTF240L | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 40 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | | V |
| Continuous Drain Current [G] | $T_C$=25°C | $I_D$ | 105 | 85 | A |
| | $T_C$=100°C | | 82 | 60 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 400 | | A |
| Continuous Drain Current | $T_A$=25°C | $I_{DSM}$ | 20 | | A |
| | $T_A$=70°C | | 16 | | |
| Avalanche Current [C] | | $I_{AS}$ | 68 | | A |
| Avalanche energy L=0.1mH [C] | | $E_{AS}$ | 231 | | mJ |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 176 | 41 | W |
| | $T_C$=100°C | | 88 | 20 | |
| Power Dissipation [A] | $T_A$=25°C | $P_{DSM}$ | 1.9 | | W |
| | $T_A$=70°C | | 1.2 | | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 175 | | °C |

**Thermal Characteristics**

| Parameter | | Symbol | AOT240L/AOB240L | AOTF240L | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{\theta JA}$ | 15 | 15 | °C/W |
| Maximum Junction-to-Ambient [A D] | Steady-State | | 65 | 65 | °C/W |
| Maximum Junction-to-Case | Steady-State | $R_{\theta JC}$ | 0.85 | 3.6 | °C/W |

* Surface mount package TO263

**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 | 40 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=40V, $V_{GS}$=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 | 1.7 | 2.2 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=10V, $V_{DS}$=5V | 400 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=20A | | 2.4 | 2.9 | mΩ |
| | | TO220/TO220F, $T_J$=125°C | | 3.7 | 4.7 | |
| | | $V_{GS}$=4.5V, $I_D$=20A TO220/TO220F | | 3 | 3.7 | mΩ |
| | | $V_{GS}$=10V, $I_D$=20A TO263 | | 2.1 | 2.6 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=20A TO263 | | 2.7 | 3.5 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=20A | | 78 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | 0.65 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current [G] | | | | 105 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=20V, f=1MHz | | 3510 | | pF |
| $C_{oss}$ | Output Capacitance | | | 1070 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 68 | | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | 0.5 | 1 | 1.5 | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$(10V) | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=20V, $I_D$=20A | | 49 | 72 | nC |
| $Q_g$(4.5V) | Total Gate Charge | | | 22 | 32 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 9 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 7 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=20V, $R_L$=1Ω, $R_{GEN}$=3Ω | | 11 | | ns |
| $t_r$ | Turn-On Rise Time | | | 10 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 38 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 11 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=20A, dI/dt=500A/µs | | 21 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=20A, dI/dt=500A/µs | | 58 | | nC |

A. The value of $R_{\theta JA}$ 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 $R_{\theta JA}$ and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.

B. The power dissipation $P_D$ is based on $T_{J(MAX)}$=175° 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 $T_{J(MAX)}$=175° C. Ratings are based on low frequency and duty cycles to keep initial $T_J$ =25° C.

D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ 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 $T_{J(MAX)}$=175° C. The SOA curve provides a single pulse rating.

G. The maximum current 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 $T_A$=25° C.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

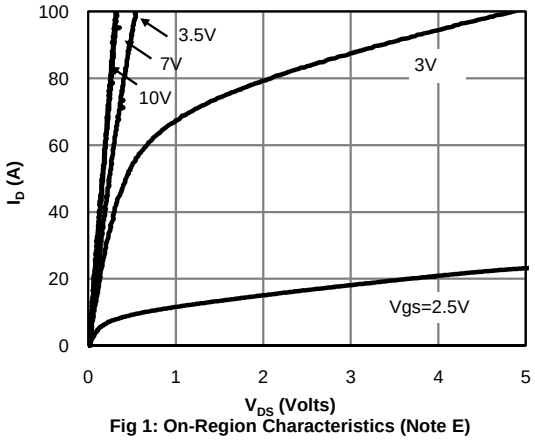



Fig 1: On-Region Characteristics (Note E)

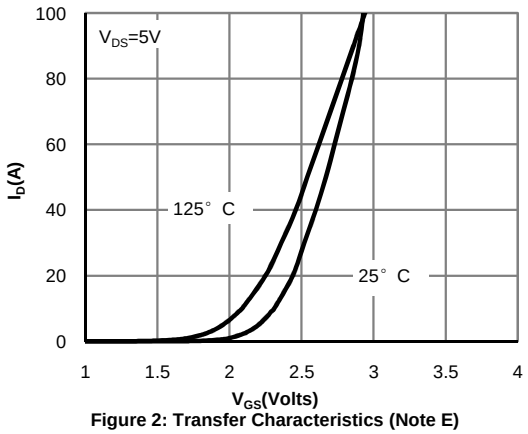



Figure 2: Transfer Characteristics (Note E)

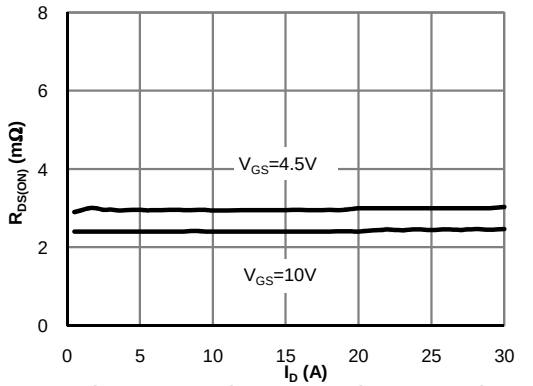



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

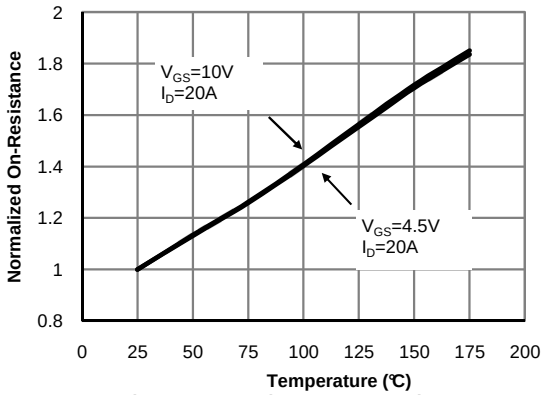



Figure 4: On-Resistance vs. Junction Temperature (Note E)

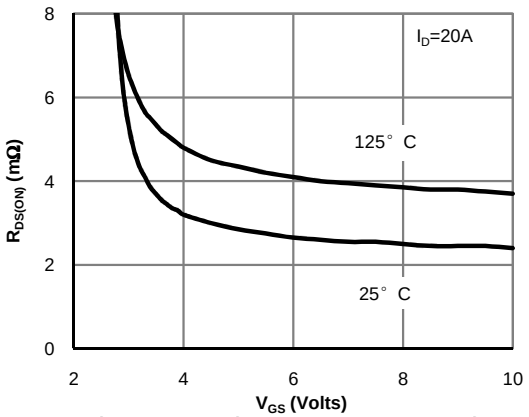



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

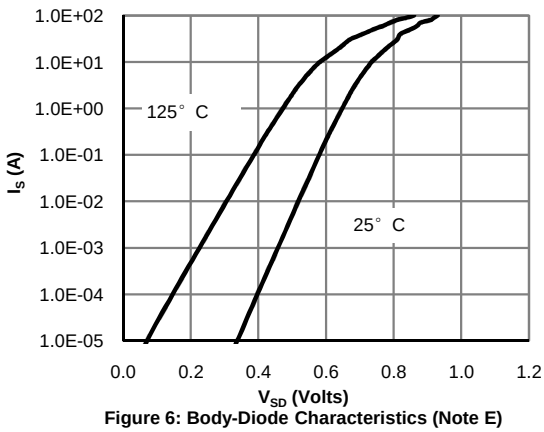



Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

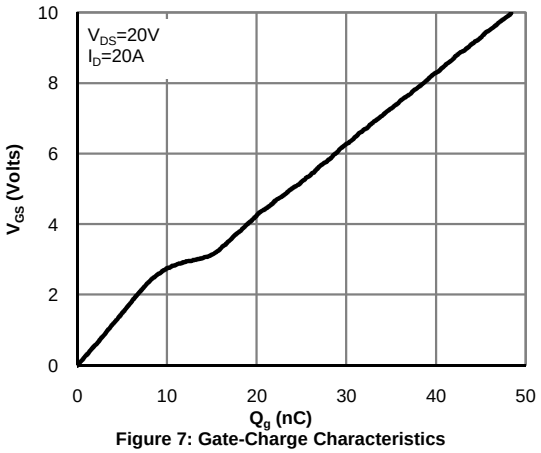



**Figure 7: Gate-Charge Characteristics**

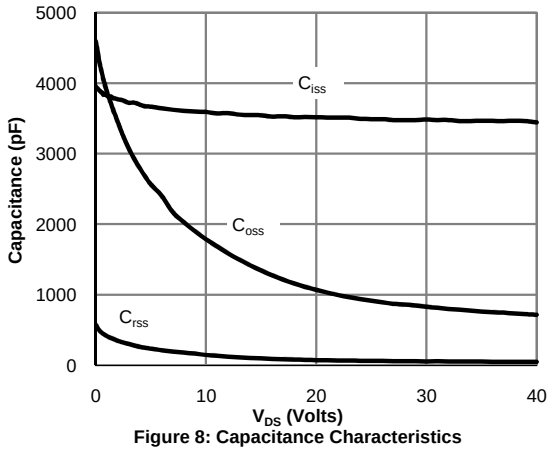



**Figure 8: Capacitance Characteristics**

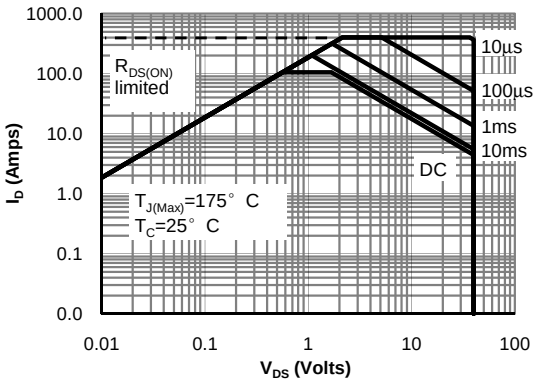



**Figure 9: Maximum Forward Biased Safe Operating Area for AOT240L and AOB240L (Note F)**

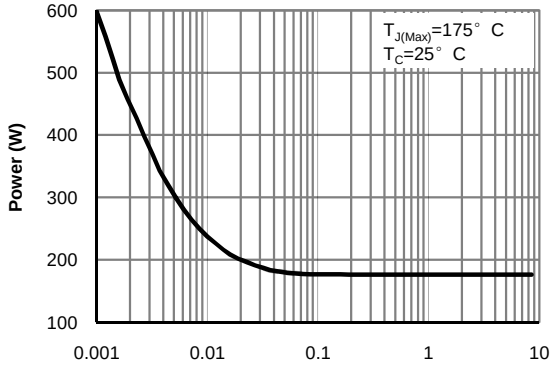



**Figure 10: Single Pulse Power Rating Junction-to-Case for AOT240L and AOB240L (Note F)**

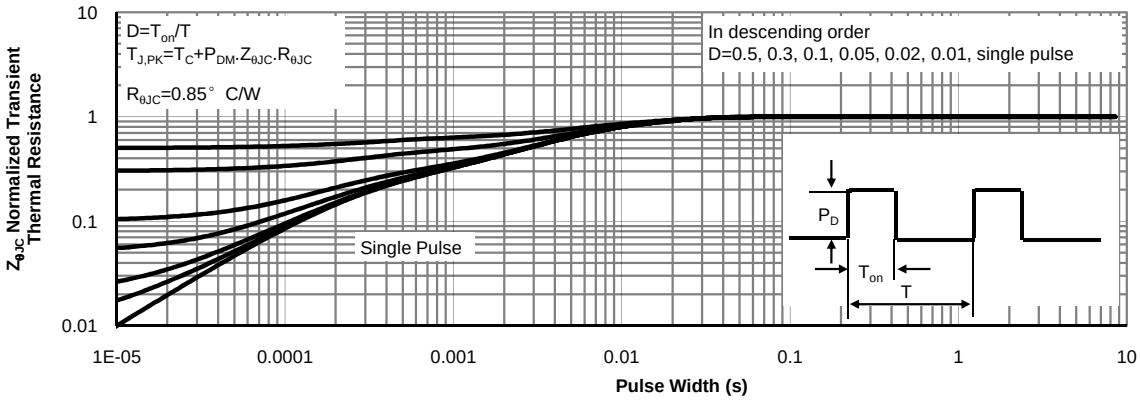



**Figure 11: Normalized Maximum Transient Thermal Impedance for AOT240L and AOB240L (Note F)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

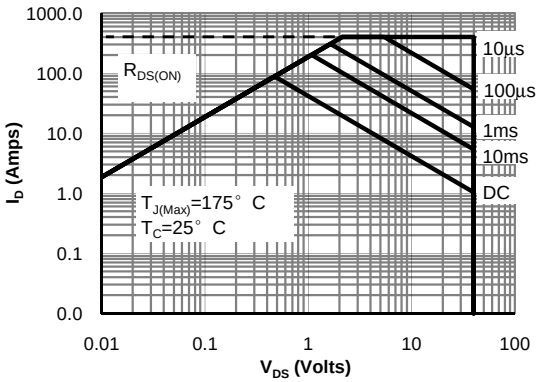



**Figure 12: Maximum Forward Biased Safe Operating Area for AOTF240L**

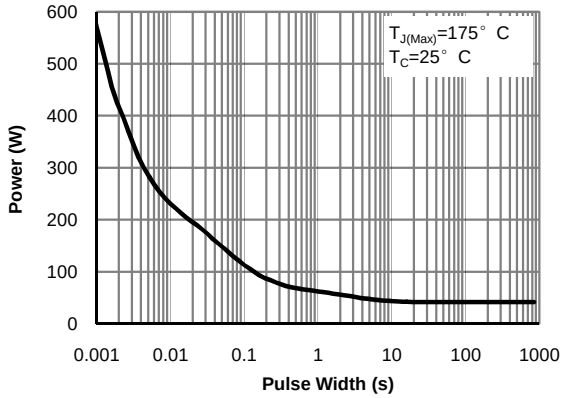



**Figure 13: Single Pulse Power Rating Junction-to-Case for AOTF240L (Note F)**

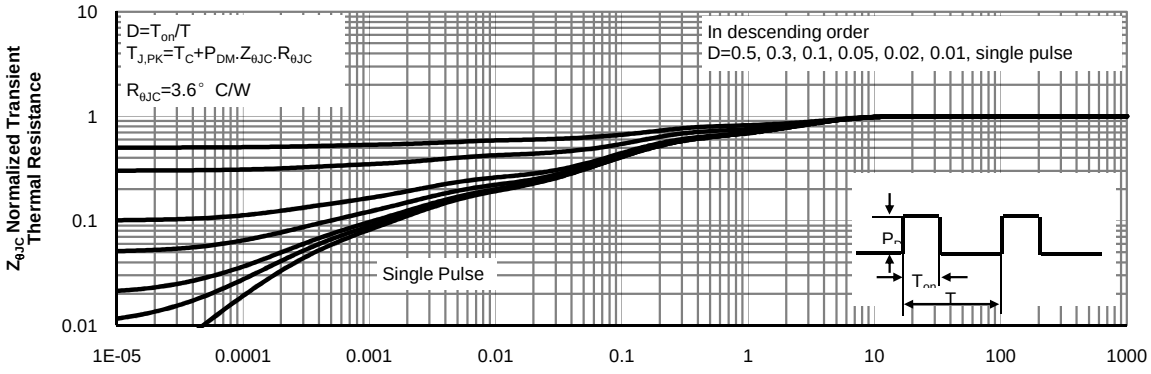



**Figure 14: Normalized Maximum Transient Thermal Impedance for AOTF240L (Note F)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

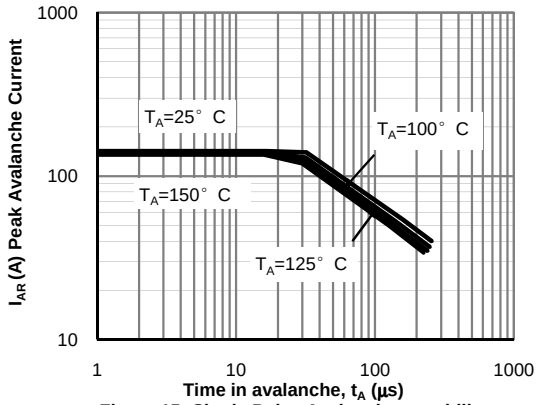



**Figure 15: Single Pulse Avalanche capability (Note C)**

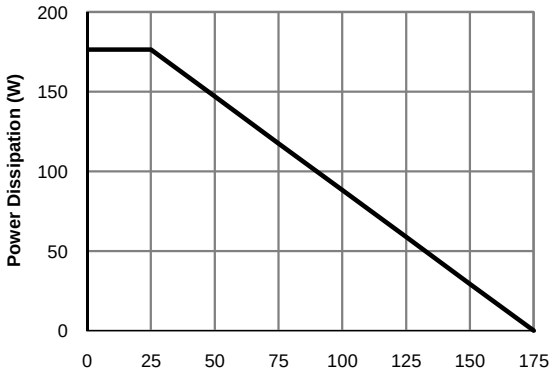



**Figure 16: Power De-rating (Note F)**

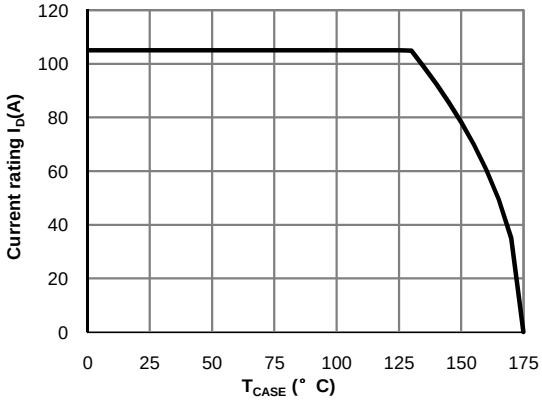



**Figure 17: Current De-rating (Note F)**

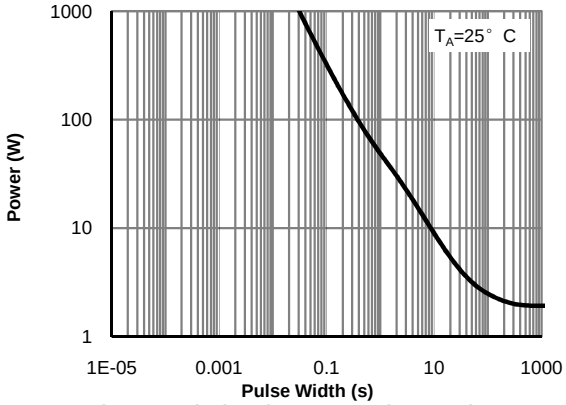



**Figure 18: Single Pulse Power Rating Junction-to-Ambient (Note H)**

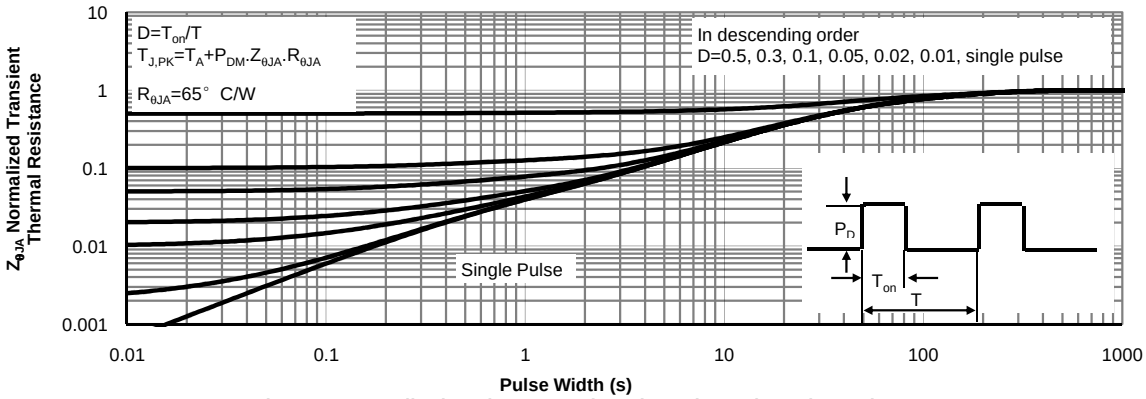
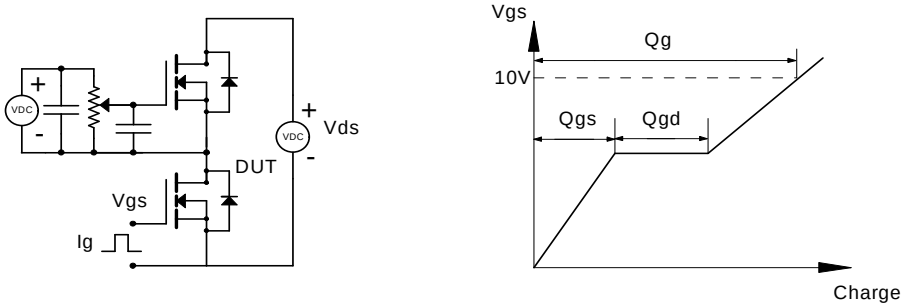
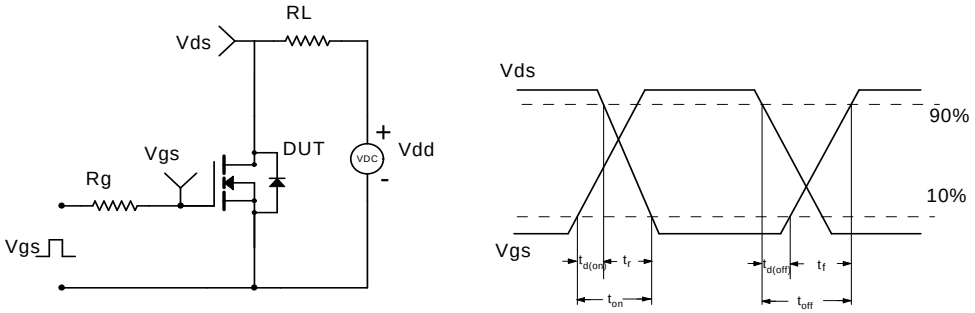



**Figure 19: Normalized Maximum Transient Thermal Impedance (Note H)**

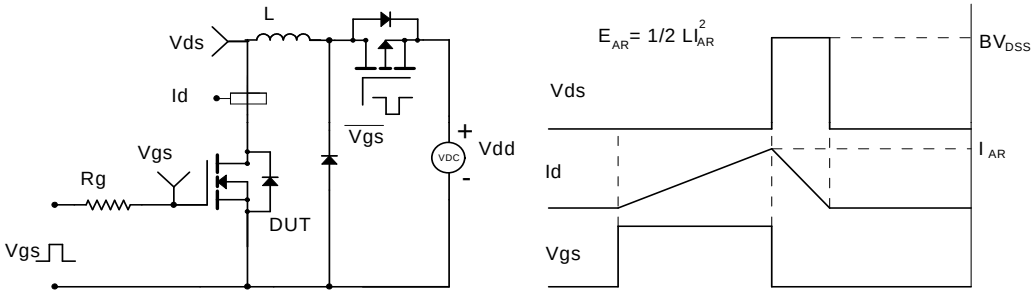
## Gate Charge Test Circuit & Waveform




## Resistive Switching Test Circuit & Waveforms




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




## Diode Recovery Test Circuit & Waveforms