freescale
飞思卡尔（深圳）功率半导体有限公司

AOD5N50
500V,5A N-Channel MOSFET

General Description

The AOD5N50 is fabricated using an advanced high voltage MOSFET process that is designed to deliver high

levels of performance and robustness in popular AC-DC applications.By providing low $R_{DS(on)}$, C_{iss} and C_{rss} along

with guaranteed avalanche capability this device can be adopted quickly into new and existing offline power supply

designs.

Features

V_{DS}	600V@150℃
I_D (at V_{GS}=10V)	5A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 1.6Ω

Green Product
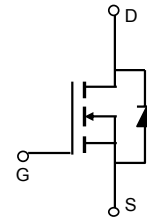
Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	500	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current[B]	T_C=25°C	I_D	5	A
	T_C=100°C		3.1	
Pulsed Drain Current [C]		I_{DM}	17	
Avalanche Current [C]		I_{AR}	2.8	A
Repetitive avalanche energy [C]		E_{AR}	118	mJ
Single plused avalanche energy [H]		E_{AS}	235	mJ
Peak diode recovery dv/dt		dv/dt	5	V/ns
Power Dissipation [B]	T_C=25°C	P_D	104	W
	Derate above 25°C		0.83	W/ °C
Junction and Storage Temperature Range		T_J, T_{STG}	-50 to 150	°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300	°C

Thermal Characteristics

Parameter	Symbol	Typical	Maximum	Units
Maximum Junction-to-Ambient [A,G]	$R_{θJA}$	43	55	°C/W
Maximum Case-to-sink [A]	$R_{θCS}$	-	0.5	°C/W
Maximum Junction-to-Case[D,F]	$R_{θJC}$	1	1.2	°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, T$_J$=25°C	500			V
		I$_D$=250µA, V$_{GS}$=0V, T$_J$=150°C		600		
BV$_{DSS}$/ΔTJ	Zero Gate Voltage Drain Current	ID=250µA, VGS=0V		0.6		V/°C
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=500V, V$_{GS}$=0V			1	µA
		V$_{DS}$=400V, T$_J$=125°C			10	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$=±30V			±100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=5V I$_D$=250µA	3.4	4.1	4.5	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=2.5A		1.2	1.6	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=40V, I$_D$=2.5A		5		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A,V$_{GS}$=0V		0.76	1	V
I$_S$	Maximum Body-Diode Continuous Current			5		A
I$_{SM}$	Maximum Body-Diode Pulsed Current			17		A
DYNAMIC PARAMETERS						
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=25V, f=1MHz	430	538	670	pF
C$_{oss}$	Output Capacitance		40	58	80	pF
C$_{rss}$	Reverse Transfer Capacitance		2.5	4.5	7	pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz	1.2	2.3	3.5	Ω
SWITCHING PARAMETERS						
Q$_g$	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=400V, I$_D$=5A	9	11.5	14	nC
Q$_{gs}$	Gate Source Charge		3	3.8	4.6	nC
Q$_{gd}$	Gate Drain Charge		2	4.1	6.2	nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=250V, I$_D$=5A, R$_G$=25Ω		18		ns
t$_r$	Turn-On Rise Time			32		ns
t$_{D(off)}$	Turn-Off DelayTime			34		ns
t$_f$	Turn-Off Fall Time			22		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=5A,dI/dt=100A/µs,V$_{DS}$=100V	145	182	220	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=5A,dI/dt=100A/µs,V$_{DS}$=100V	1.7	2.2	2.7	µC

A. The value of R$_{θJA}$ is measured with the device in a still air environment with T$_A$=25°C.

B. The power dissipation P$_D$ is based on T$_{J(MAX)}$=150°C in a TO252 package, 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.

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 <300 µs 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.

G.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.

H. L=60mH, I$_{AS}$=2.8A, V$_{DD}$=150V, R$_G$=10Ω, Starting T$_J$=25°C

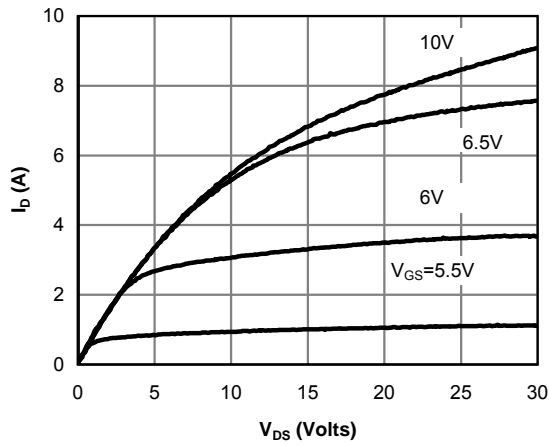## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
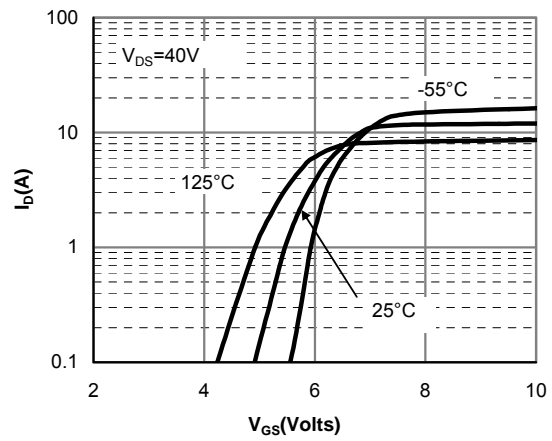

Fig 1: On-Region Characteristics
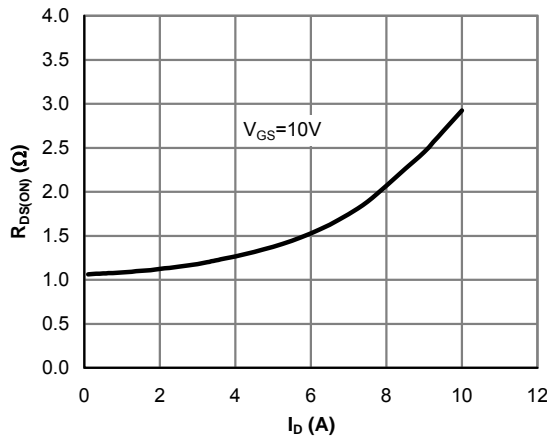

Figure 2: Transfer Characteristics

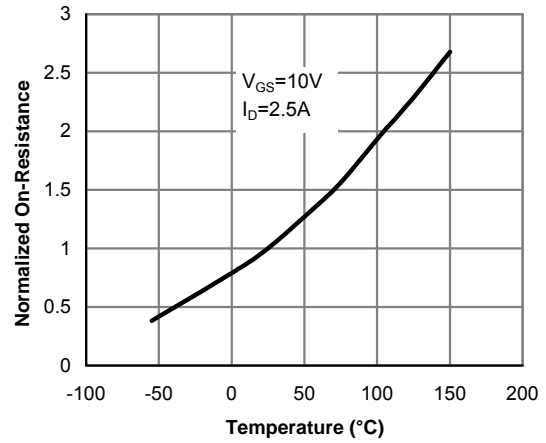Figure 3: On-Resistance vs. Drain Current and Gate Voltage

Figure 4: On-Resistance vs. Junction Temperature
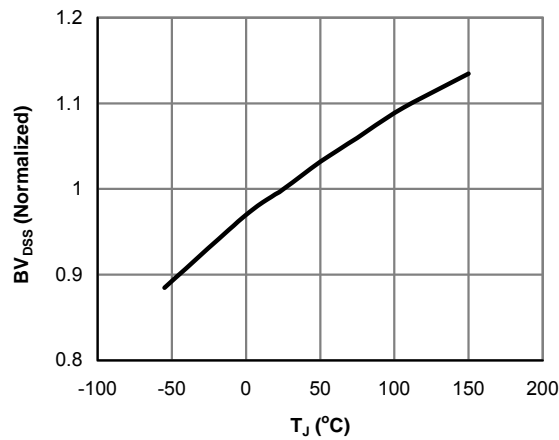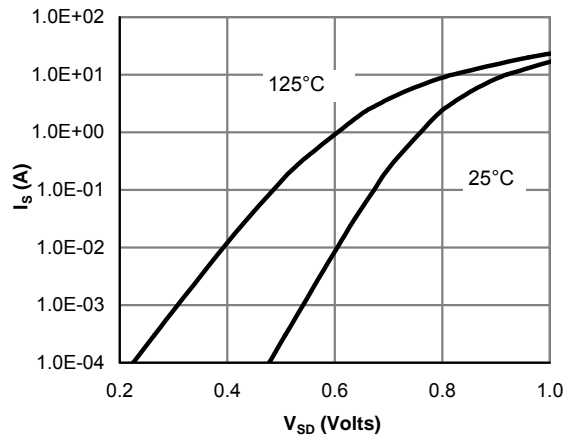

Figure 5: Break Down vs. Junction Temperature

Figure 6: Body-Diode Characteristics
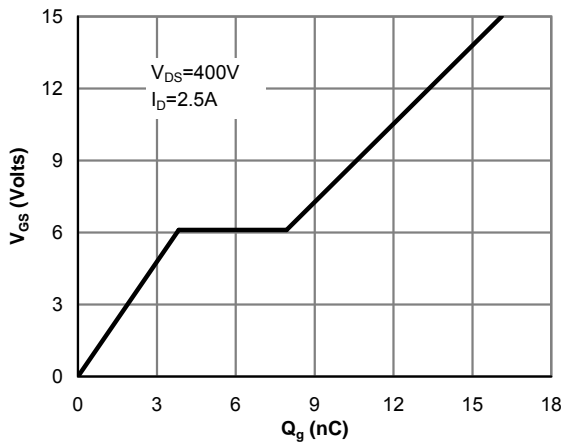
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

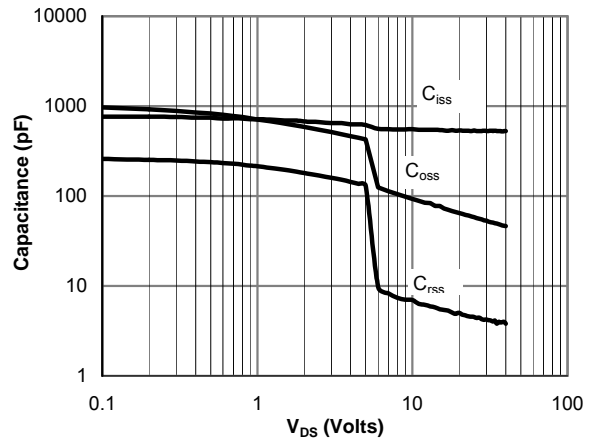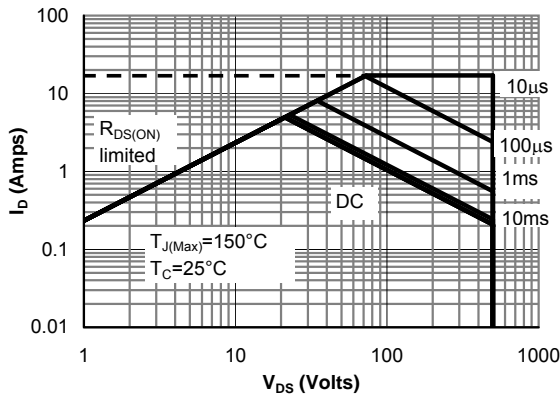Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics

Figure 9: Maximum Forward Biased Safe Operating Area (Note F)
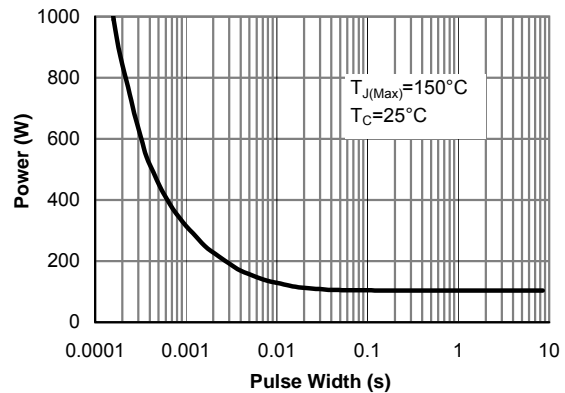
Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)
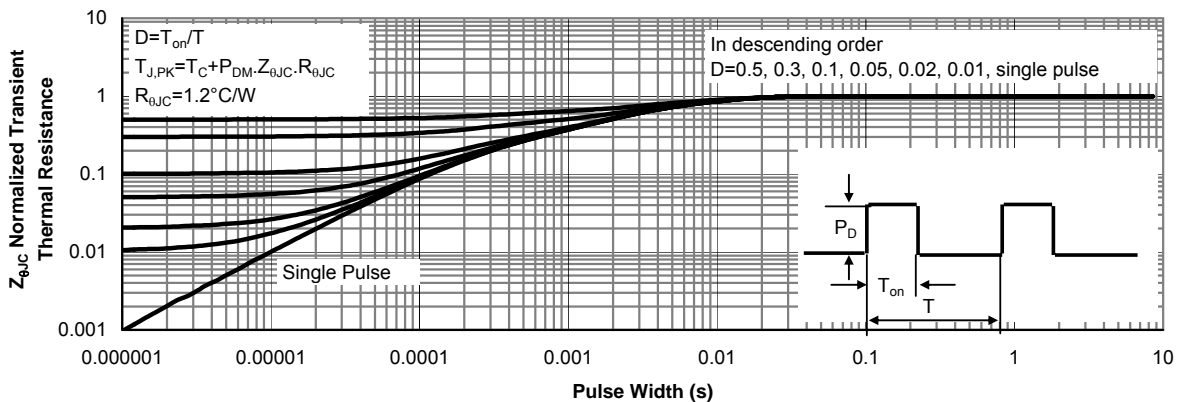
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
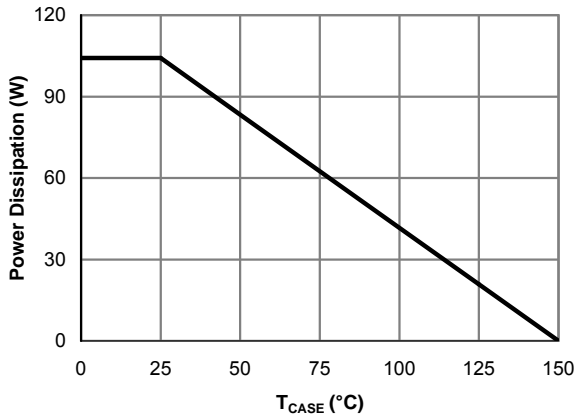
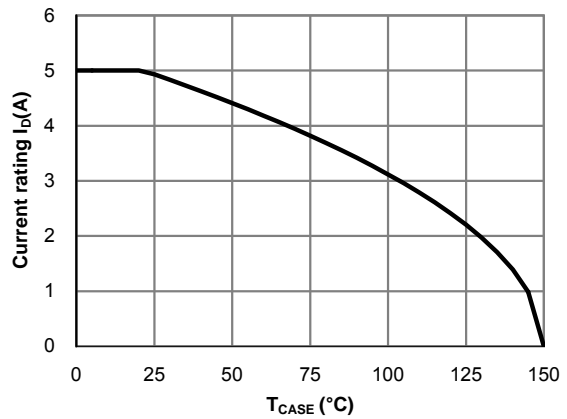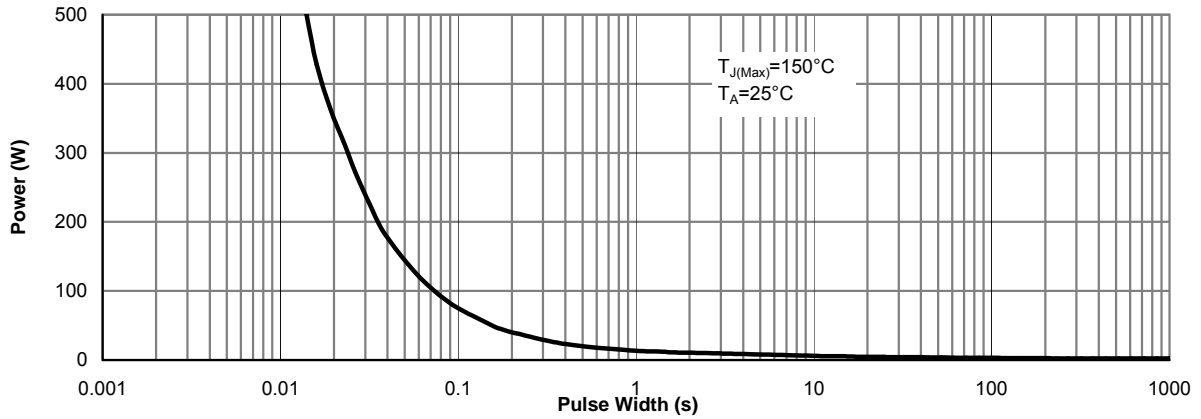**Figure 12: Power De-rating (Note B)**

Figure 13: Current De-rating (Note B)

$T_{J(Max)}=150°C$
$T_A=25°C$
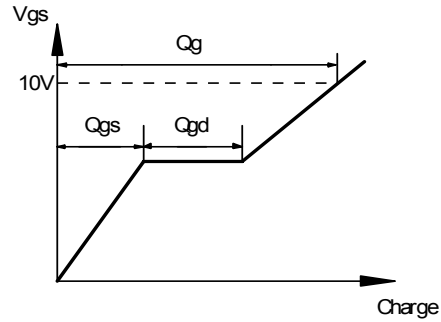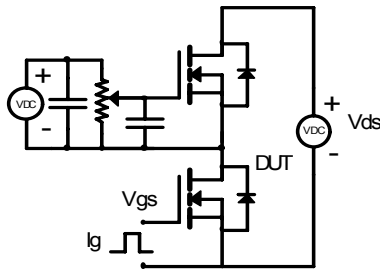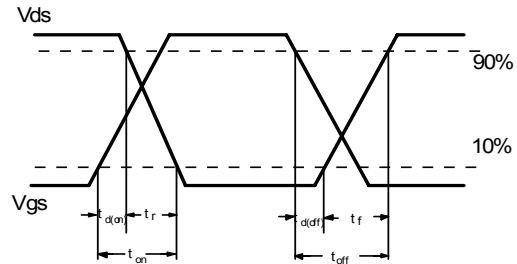
Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)

$D=T_{on}/T$
$T_{J,PK}=T_A+P_{DM}\cdot Z_{\theta JA}\cdot R_{\theta JA}$
$R_{\theta JA}=55°C/W$

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

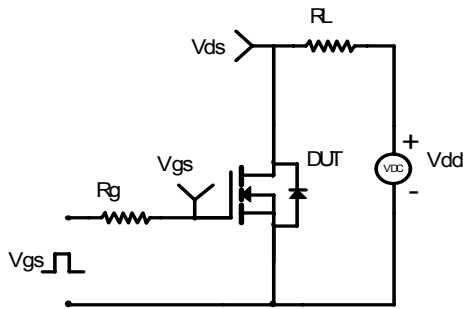Single Pulse

P_D

T_{on}

T
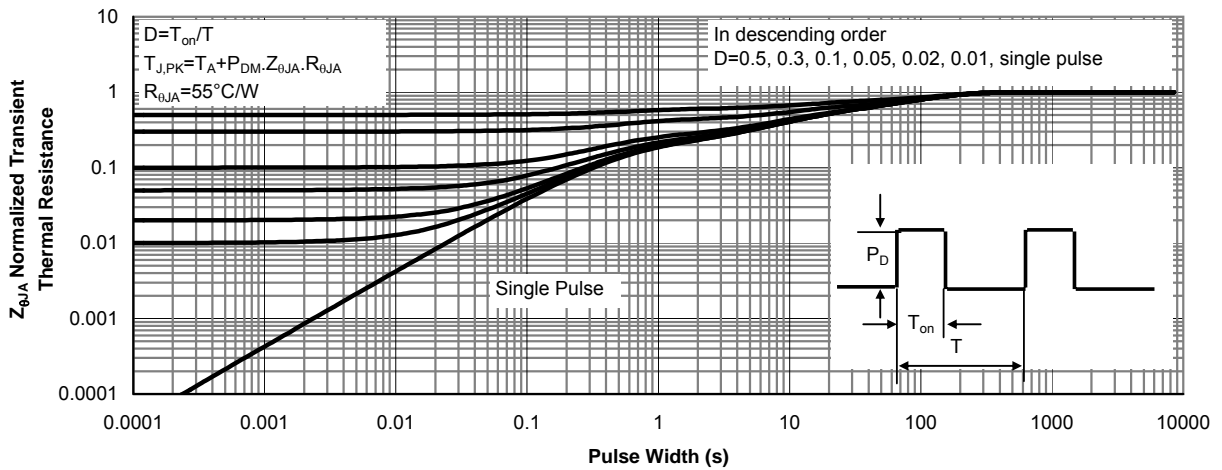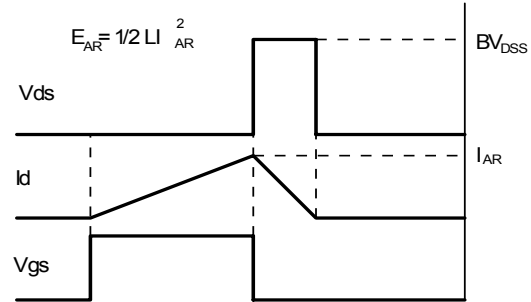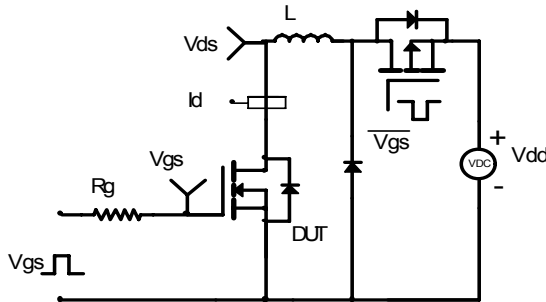
Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)

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

$$Q_{rr} = - \int I dt$$