



ALPHA & OMEGA
SEMICONDUCTOR

AOD5N40/AOI5N40

400V, 4.2A N-Channel MOSFET

General Description

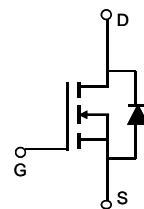
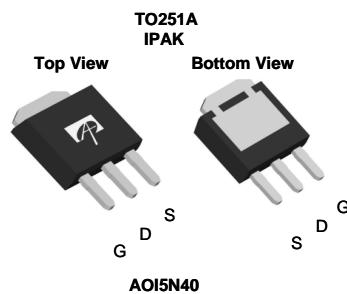
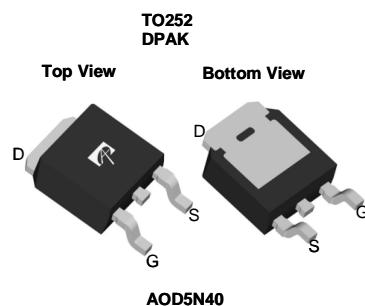
The AOD5N40 & AOI5N40 have been fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications.

By providing low $R_{DS(on)}$, C_{iss} and C_{rss} along with guaranteed avalanche capability these parts can be adopted quickly into new and existing offline power supply designs.

Product Summary

V_{DS}	500V@150°C
I_D (at $V_{GS}=10V$)	4.2A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 1.6Ω

100% UIS Tested!
100% R_g Tested!



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	400	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current ^B	I_D	4.2	A
$T_C=100^\circ\text{C}$		2.8	
Pulsed Drain Current ^C	I_{DM}	10	A
Avalanche Current ^C	I_{AR}	1.7	A
Repetitive avalanche energy ^C	E_{AR}	43	mJ
Single pulsed avalanche energy ^H	E_{AS}	86	mJ
Peak diode recovery dv/dt	dv/dt	5	V/ns
Power Dissipation ^B	P_D	78	W
$T_C=25^\circ\text{C}$		0.63	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}	$R_{θJA}$	38	55	°C/W
Maximum Case-to-sink ^A	$R_{θCS}$	-	0.5	°C/W
Maximum Junction-to-Case ^{D,F}	$R_{θJC}$	1.33	1.6	°C/W

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}, T_J=25^\circ\text{C}$	400			V
		$I_D=250\mu\text{A}, V_{GS}=0\text{V}, T_J=150^\circ\text{C}$		500		
$BV_{DSS}/\Delta T_J$	Zero Gate Voltage Drain Current	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	0.4	$V/^\circ\text{C}$		
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=400\text{V}, V_{GS}=0\text{V}$		1		μA
		$V_{DS}=320\text{V}, T_J=125^\circ\text{C}$		10		
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 30\text{V}$			± 100	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=5\text{V}, I_D=250\mu\text{A}$	3.4	4	4.5	V
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=1\text{A}$		1.25	1.6	Ω
g_{FS}	Forward Transconductance	$V_{DS}=40\text{V}, I_D=1\text{A}$		5		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.77	1	V
I_S	Maximum Body-Diode Continuous Current				4.2	A
I_{SM}	Maximum Body-Diode Pulsed Current				10	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=25\text{V}, f=1\text{MHz}$	260	331	400	pF
C_{oss}	Output Capacitance		25	42	60	pF
C_{rss}	Reverse Transfer Capacitance		1.5	3	5.5	pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	2	4	6	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=320\text{V}, I_D=4.2\text{A}$	5.5	6.9	8.5	nC
Q_{gs}	Gate Source Charge		1.5	2.0	2.5	nC
Q_{gd}	Gate Drain Charge		1	2.3	3.5	nC
$t_{D(\text{on})}$	Turn-On Delay Time	$V_{GS}=10\text{V}, V_{DS}=200\text{V}, I_D=4.2\text{A}, R_G=25\Omega$		16.5		ns
t_r	Turn-On Rise Time			15		ns
$t_{D(\text{off})}$	Turn-Off Delay Time			24		ns
t_f	Turn-Off Fall Time			11.5		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=4.2\text{A}, dI/dt=100\text{A}/\mu\text{s}, V_{DS}=100\text{V}$	125	160	200	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=4.2\text{A}, dI/dt=100\text{A}/\mu\text{s}, V_{DS}=100\text{V}$	0.7	0.93	1.2	μC

A. The value of R_{BJA} is measured with the device in a still air environment with $T_A=25^\circ\text{C}$.

B. The power dissipation P_D is based on $T_{J(\text{MAX})}=150^\circ\text{C}$ 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 $T_{J(\text{MAX})}=150^\circ\text{C}$.

D. The R_{BJA} is the sum of the thermal impedance from junction to case R_{BJC} and case to ambient.

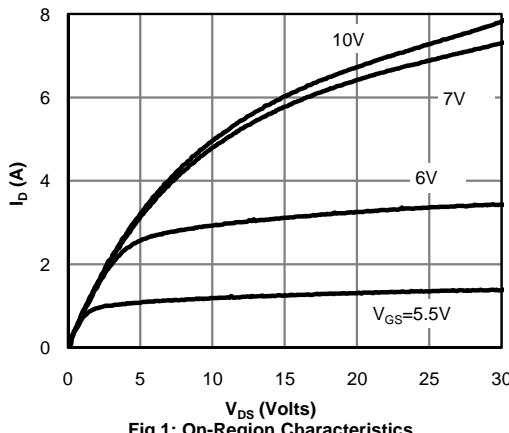
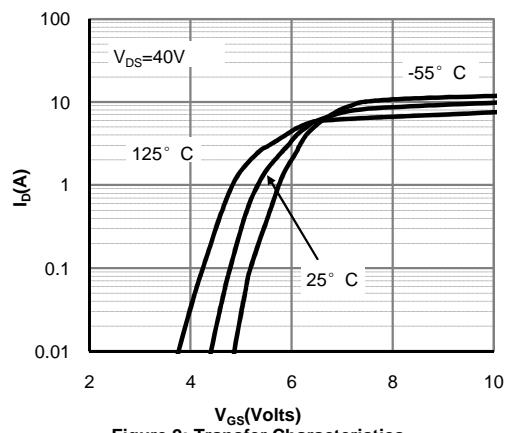
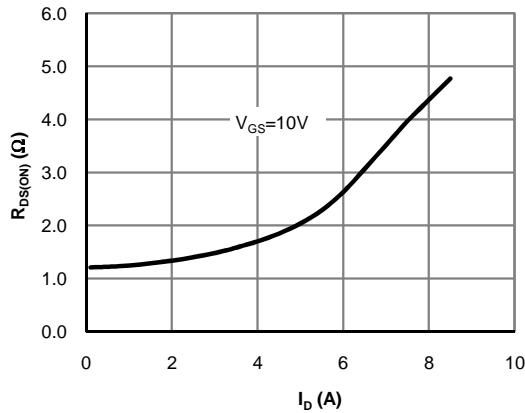
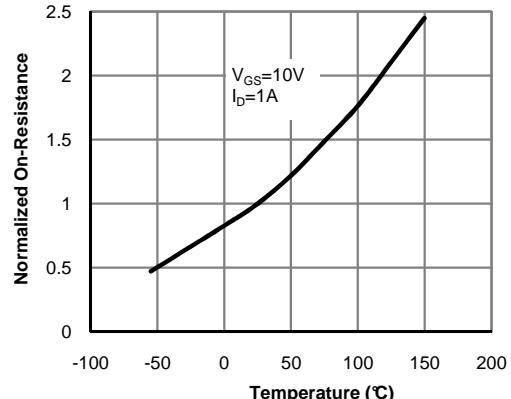
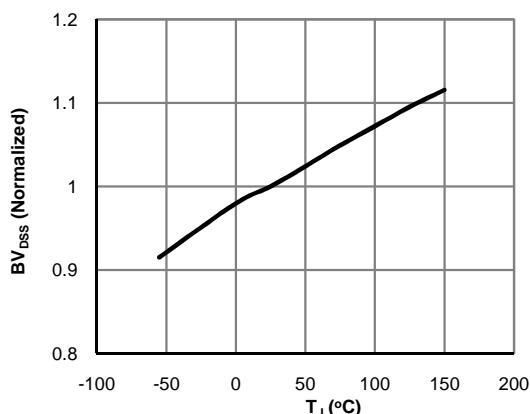
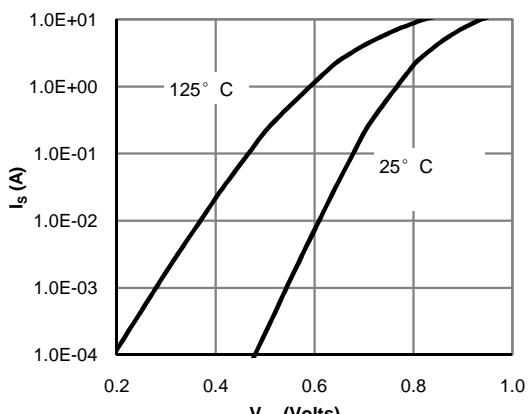
E. The static characteristics in Figures 1 to 6 are obtained using $<300\ \mu\text{s}$ pulses, duty cycle 0.5% max.

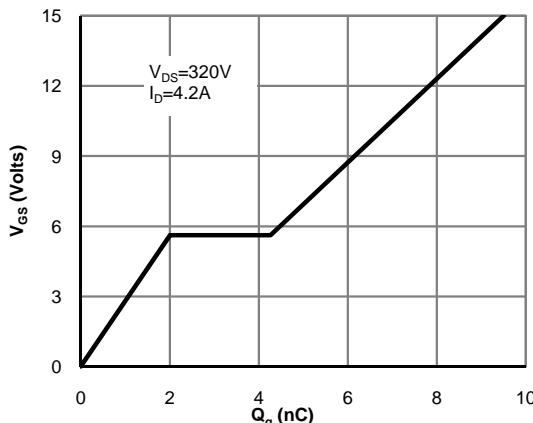
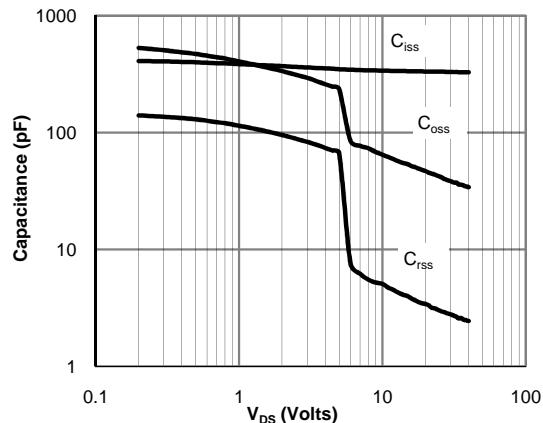
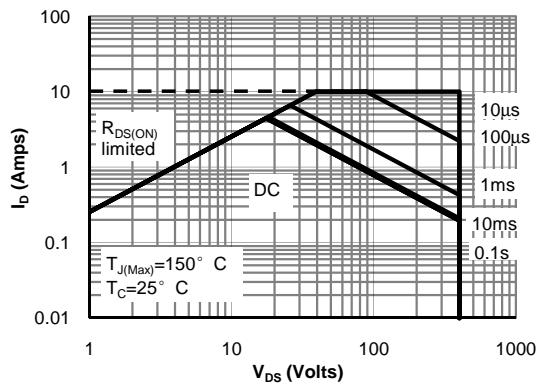
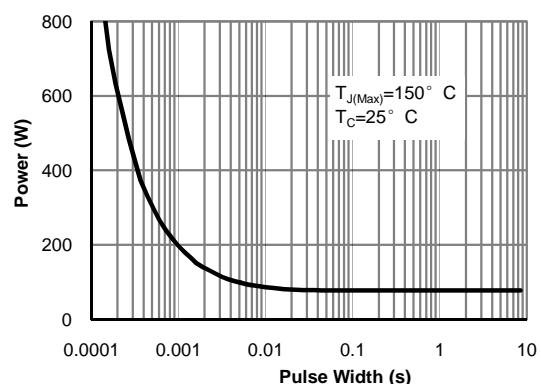
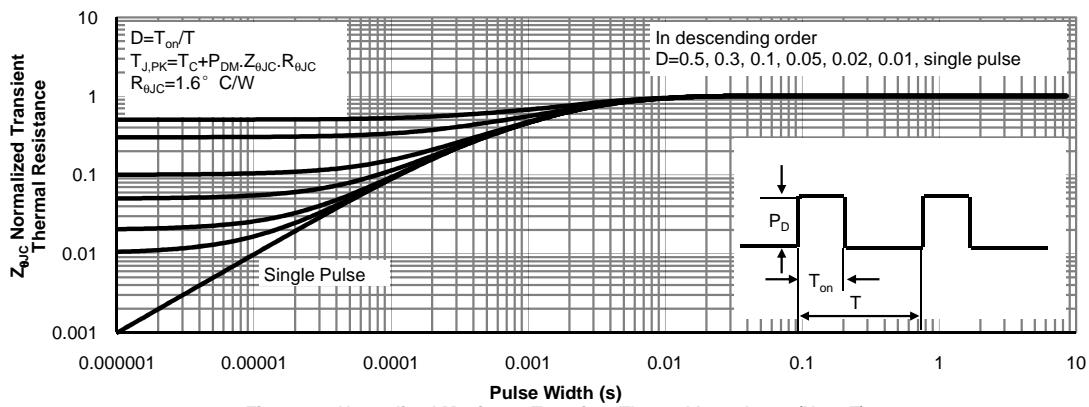
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(\text{MAX})}=150^\circ\text{C}$.

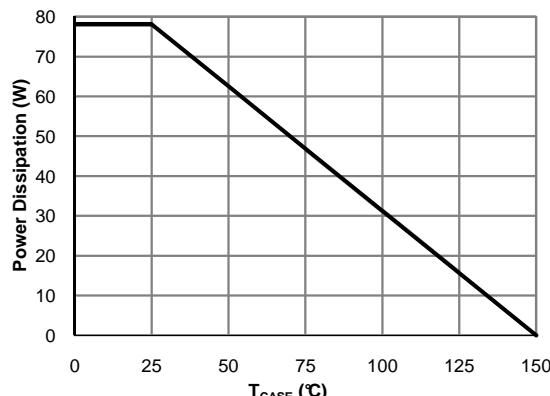
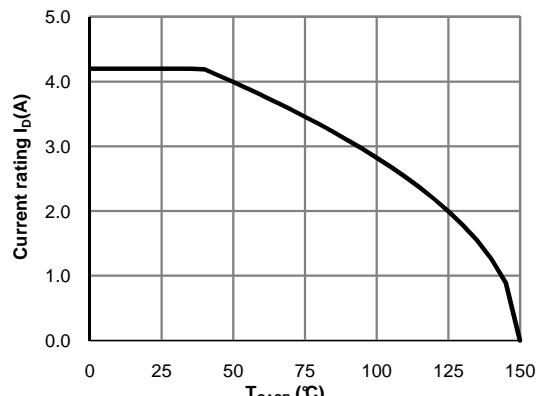
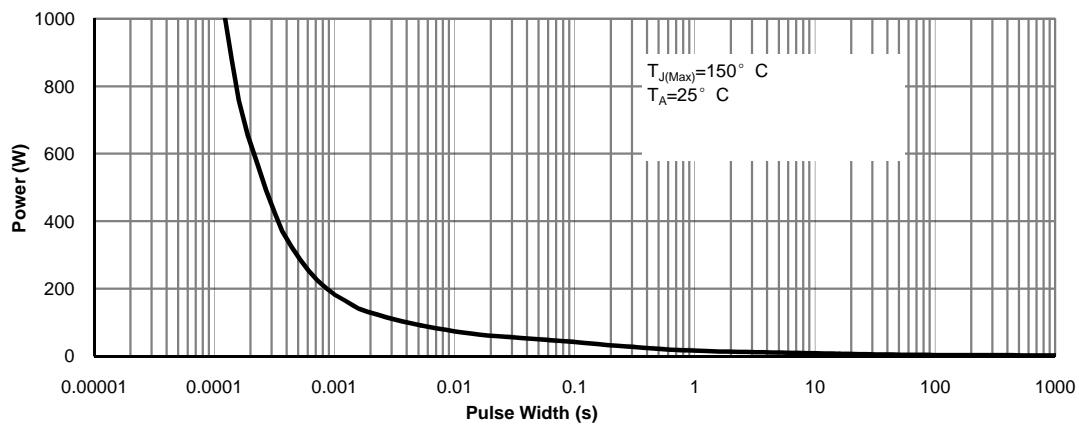
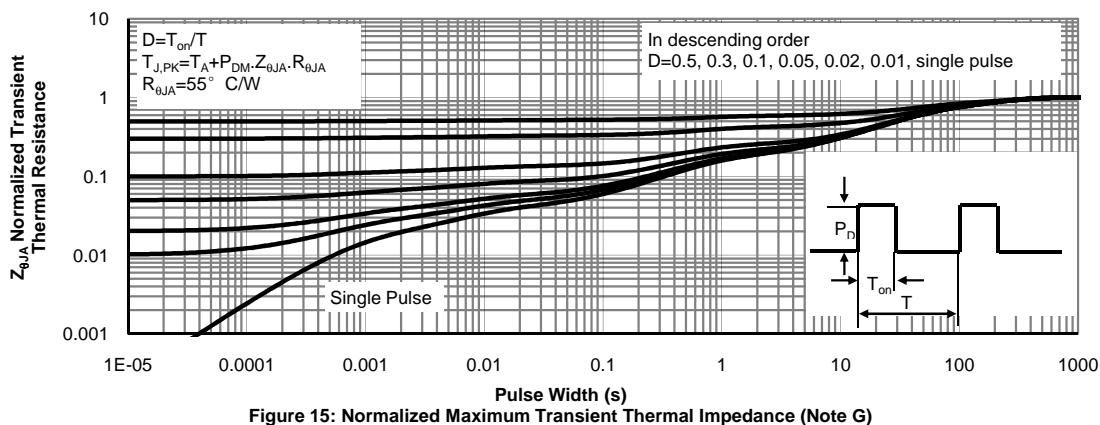
G. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$.

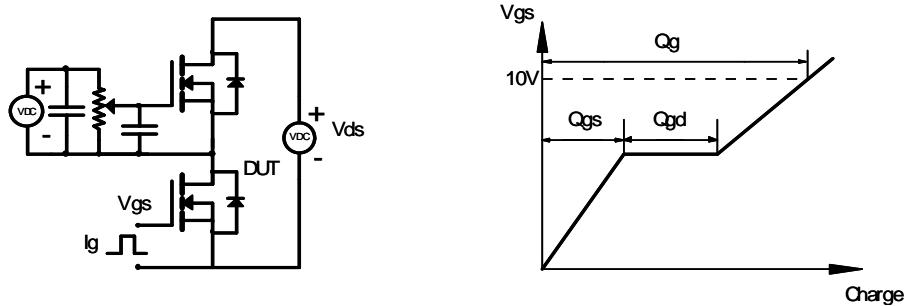
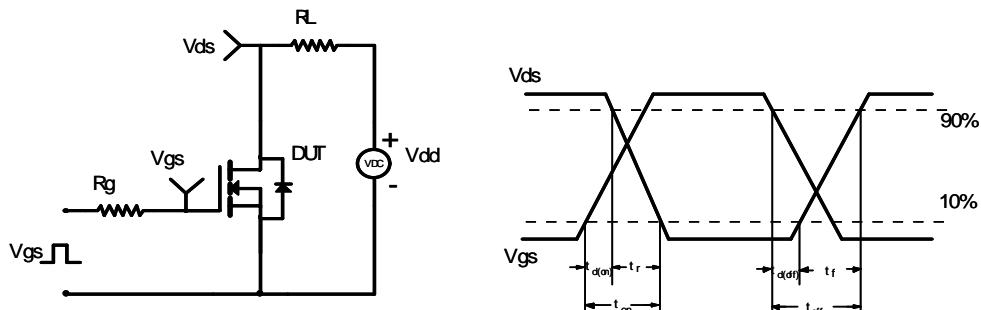
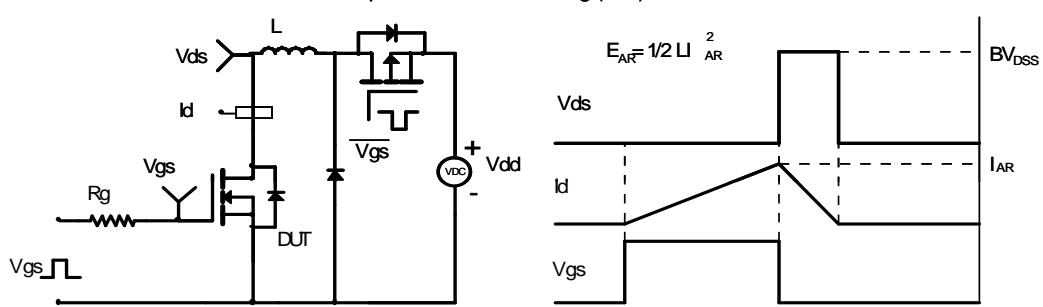
H. $L=60\text{mH}, I_{AS}=1.7\text{A}, V_{DD}=150\text{V}, R_G=10\Omega$, Starting $T_J=25^\circ\text{C}$

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Fig 1: On-Region Characteristics

Figure 2: Transfer Characteristics

Figure 3: On-Resistance vs. Drain Current and Ga 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)

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

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

Diode Recovery Test Circuit & Waveforms
