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AOD609

Complementary Enhancement Mode Field Effect Transistor

General Description

The AOD609 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used in H-bridge, Inverters and other applications.

- RoHS Compliant
- Halogen Free*

Features

n-channel

V_{DS} (V) = 40V, I_D = 12A (V_{GS} =10V)

$R_{DS(ON)} < 30m\Omega$ (V_{GS} =10V)

$R_{DS(ON)} < 40m\Omega$ (V_{GS} =4.5V)

p-channel

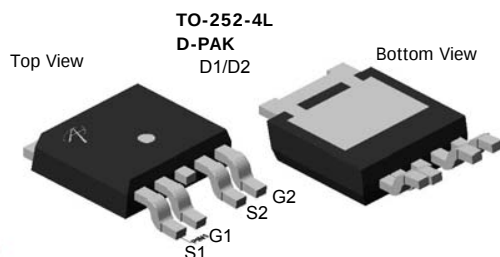
V_{DS} (V) = -40V, I_D = -12A (V_{GS} =-10V)

$R_{DS(ON)} < 45m\Omega$ (V_{GS} = -10V)

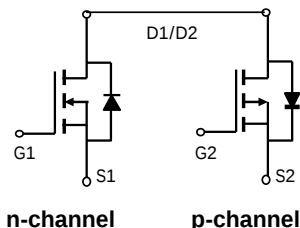
$R_{DS(ON)} < 66m\Omega$ (V_{GS} = -4.5V)

100% UIS Tested!

100% Rg Tested!



Top View
Drain Connected to Tab



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

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	V_{DS}	40	-40	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current ^{B,H}	I_D	12	-12	A
$T_C=25^\circ\text{C}$		12	-12	
$T_C=100^\circ\text{C}$		12	-12	
Pulsed Drain Current ^B	I_{DM}	30	-30	
Avalanche Current ^C	I_{AR}	14	-20	
Repetitive avalanche energy $L=0.1mH^C$	E_{AR}	9.8	20	mJ
Power Dissipation	P_D	27	30	W
$T_C=25^\circ\text{C}$		14	15	
$T_C=100^\circ\text{C}$	P_{DSM}	2	2	W
$T_A=25^\circ\text{C}$		1.3	1.3	
$T_A=70^\circ\text{C}$				
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	-55 to 175	$^\circ\text{C}$

Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	n-ch	17.4	25	$^\circ\text{C/W}$
$t \leq 10s$		n-ch	50	60	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	p-ch	16.7	25	$^\circ\text{C/W}$
Steady-State		p-ch	50	60	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	$R_{\theta JC}$	n-ch	4	5.5	$^\circ\text{C/W}$
Steady-State		p-ch	3.5	5	$^\circ\text{C/W}$

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N Channel 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 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	1.7	2.5	3	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	30			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =12A T _J =125°C		24 37	30 46	mΩ
		V _{GS} =4.5V, I _D =8A		31	40	
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =12A		25		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.76	1	V
I _S	Maximum Body-Diode Continuous Current				2	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =20V, f=1MHz		516	650	pF
C _{oss}	Output Capacitance			82		pF
C _{rss}	Reverse Transfer Capacitance			43		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		4.6	6.9	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =20V, I _D =12A		8.3	10.8	nC
Q _{gs}	Gate Source Charge			2.3		nC
Q _{gd}	Gate Drain Charge			1.6		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =20V, R _L =1.4Ω, R _{GEN} =3Ω		6.4		ns
t _r	Turn-On Rise Time			3.6		ns
t _{D(off)}	Turn-Off DelayTime			16.2		ns
t _f	Turn-Off Fall Time			6.6		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =12A, dI/dt=100A/μs		18	24	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =12A, dI/dt=100A/μs		10		nC

A: The value of R_{θJA} is measured with the device in a still air environment with T_A=25°C. The power dissipation P_{DSM} and current rating I_{DSM} are based on T_{J(MAX)}=150°C, using the steady state junction-to-ambient thermal resistance.

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 lim for cases where additional heatsinking is used.

C: Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=175°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)}=175°C. The SOA curve provides a single pulse rating.

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°C.

H: The maximum current rating is limited by bond-wires.

*This device is guaranteed green after data code 8X11 (Sep 8th 2008).

Rev4: Aug 2009

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

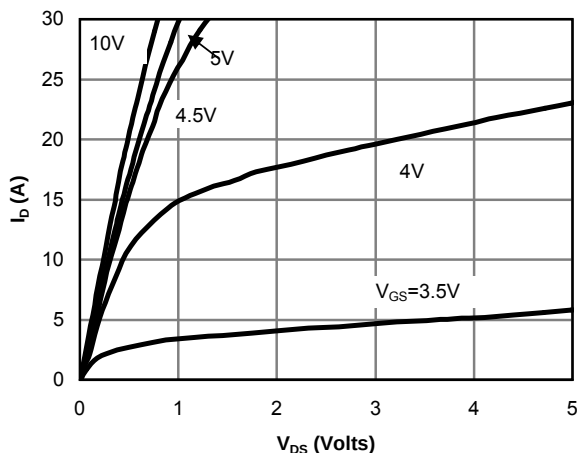


Fig 1: On-Region Characteristics

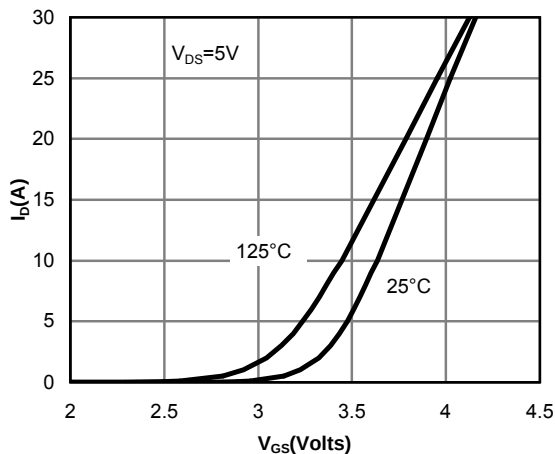


Figure 2: Transfer Characteristics

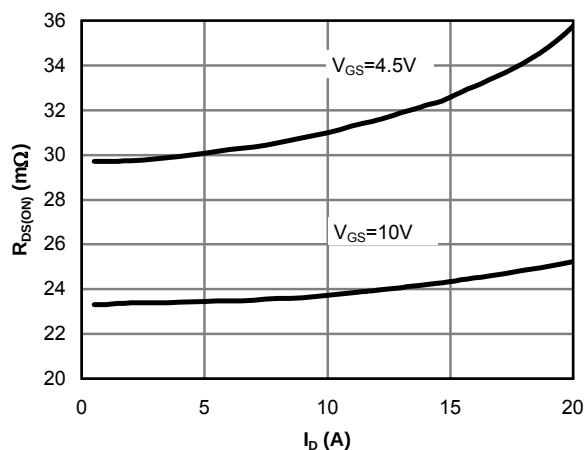


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

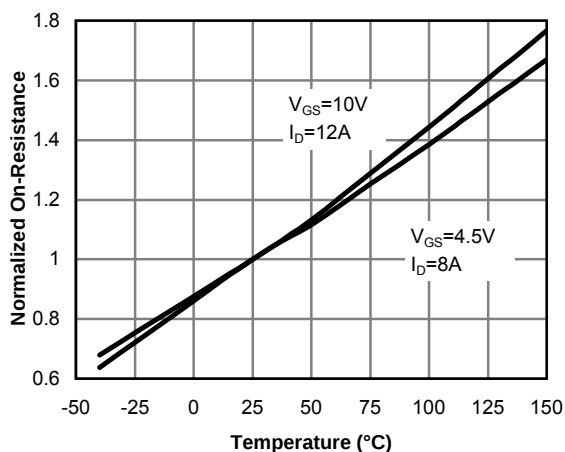


Figure 4: On-Resistance vs. Junction Temperature

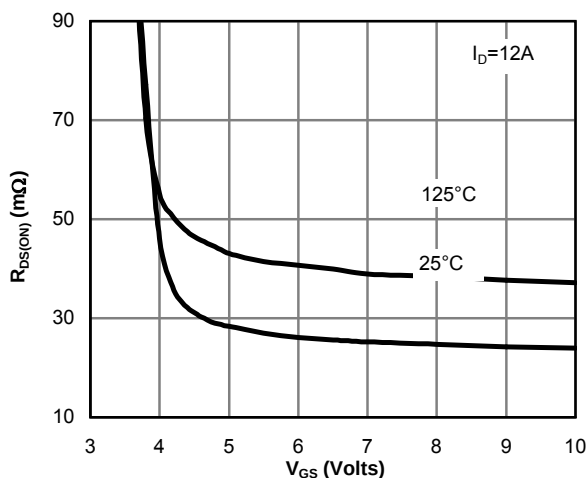


Figure 5: On-Resistance vs. Gate-Source Voltage

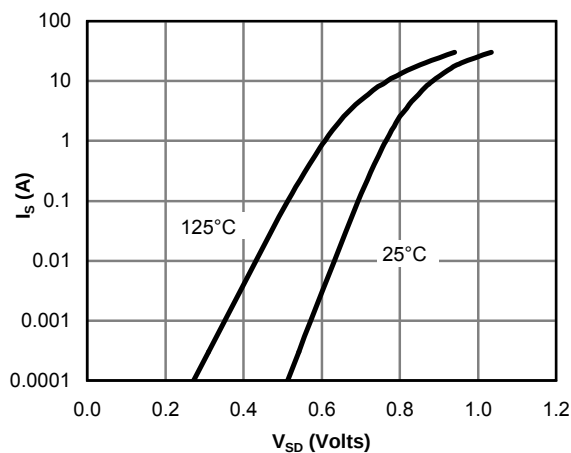


Figure 6: Body-Diode Characteristics

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

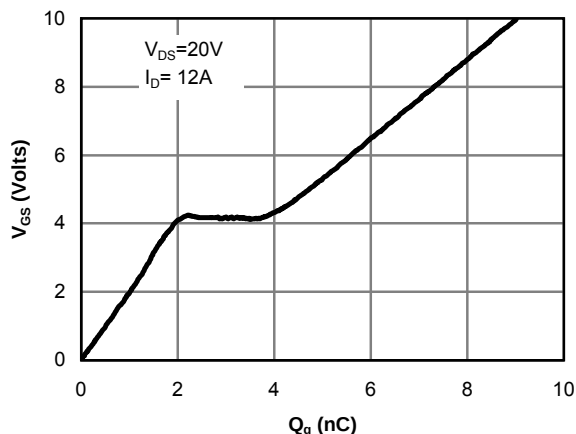


Figure 7: Gate-Charge Characteristics

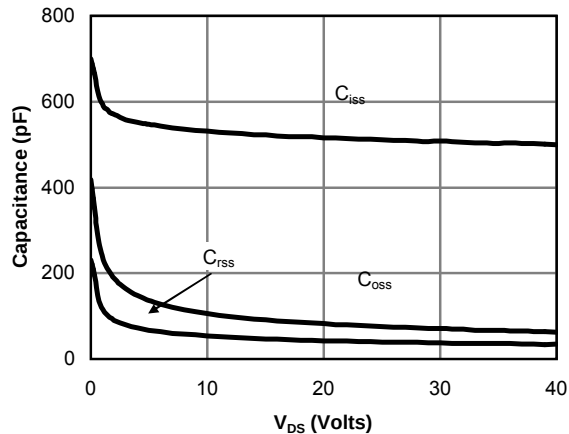


Figure 8: Capacitance Characteristics

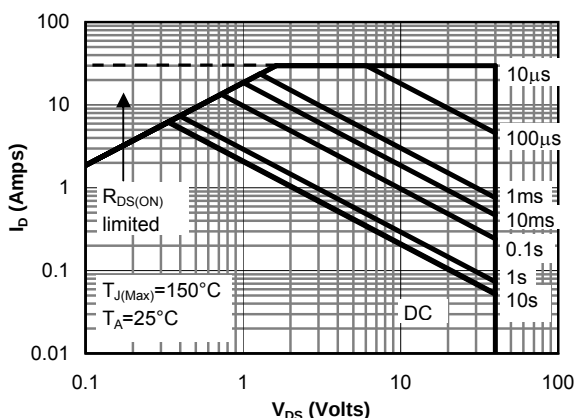


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

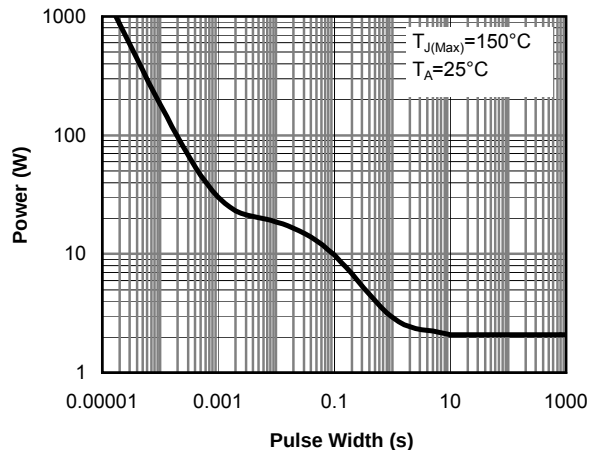


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

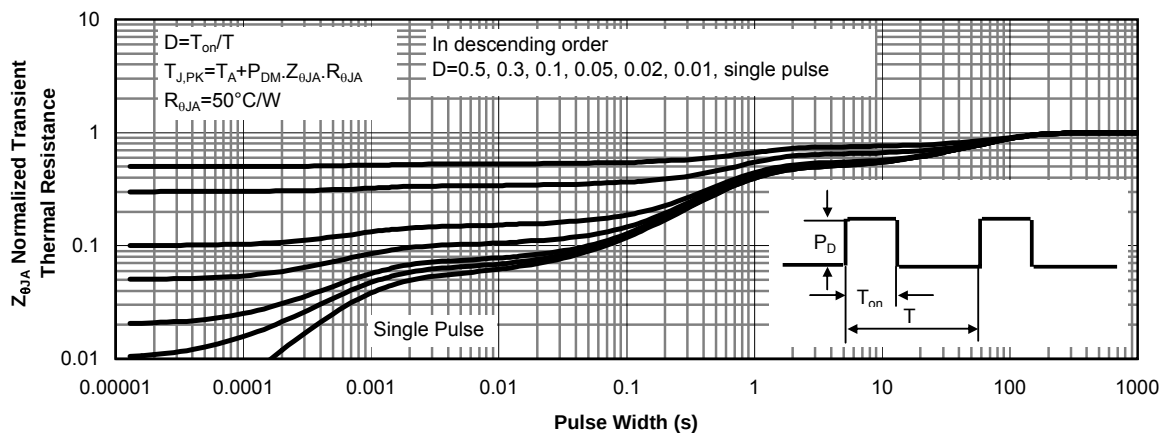
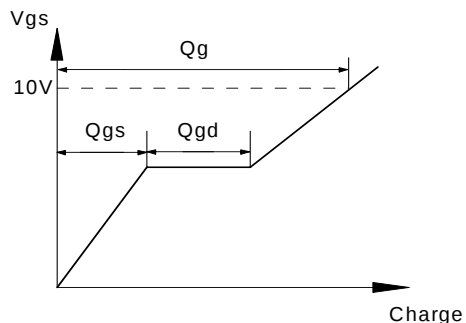
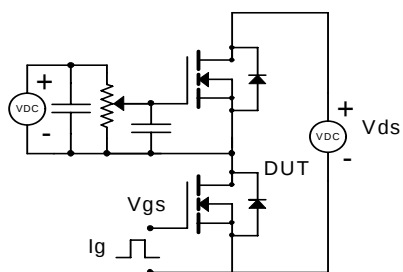


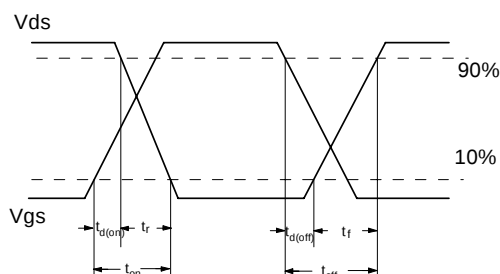
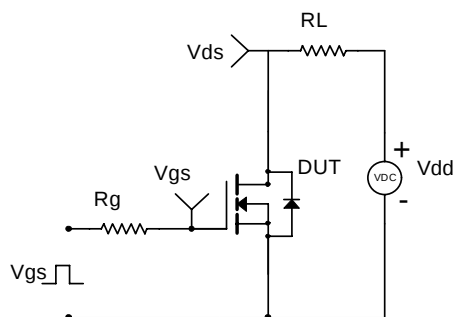
Figure 11: Normalized Maximum Transient Thermal Impedance

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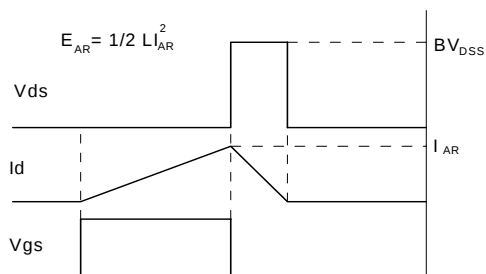
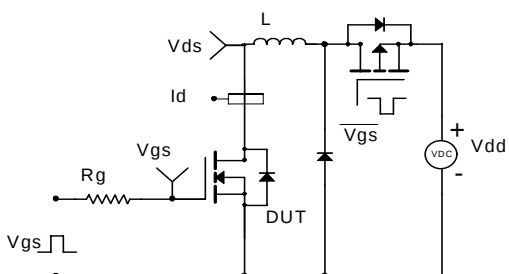
Gate Charge Test Circuit & Waveform



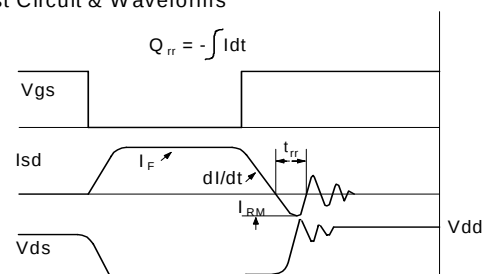
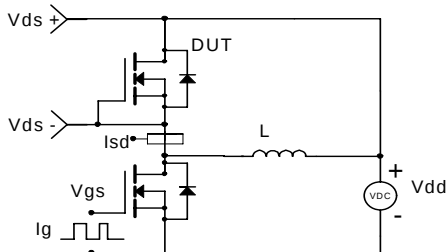
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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P-Channel 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 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	-1.7	-2	-3	V
I _{D(ON)}	On state drain current	V _{GS} = -10V, V _{DS} = -5V	-30			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} = -10V, I _D = -12A T _J =125°C		36 52	45 65	mΩ
		V _{GS} = -4.5V, I _D = -8A		51	66	
g _{FS}	Forward Transconductance	V _{DS} = -5V, I _D = -12A		22		S
V _{SD}	Diode Forward Voltage	I _S = -1A, V _{GS} =0V		-0.76	-1	V
I _S	Maximum Body-Diode Continuous Current				-2	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} = -20V, f=1MHz		900	1125	pF
C _{oss}	Output Capacitance			97		pF
C _{rss}	Reverse Transfer Capacitance			68		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		14		Ω
SWITCHING PARAMETERS						
Q _g (-10V)	Total Gate Charge	V _{GS} = -10V, V _{DS} = -20V, I _D = -12A		16.2	21	nC
Q _g (-4.5V)	Total Gate Charge			7.2	9.4	nC
Q _{gs}	Gate Source Charge			3.8		nC
Q _{gd}	Gate Drain Charge			3.5		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} = -10V, V _{DS} = -20V, R _L =1.4Ω, R _{GEN} =3Ω		6.2		ns
t _r	Turn-On Rise Time			8.4		ns
t _{D(off)}	Turn-Off DelayTime			44.8		ns
t _f	Turn-Off Fall Time			41.2		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F = -12A, dI/dt=100A/μs		21	27	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F = -12A, dI/dt=100A/μs		14		nC

A: The value of R_{θJA} is measured with the device in a still air environment with T_A=25°C. The power dissipation P_{DSM} and current rating I_{DSM} are based on T_{J(MAX)}=150°C, using t ≤ 10s junction-to-ambient thermal resistance.

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.

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)}=175°C. The SOA curve provides a single pulse rating.

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°C.

H: The maximum current rating is limited by bond-wires.

*This device is guaranteed green after data code 8X11 (Sep 8th 2008).

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

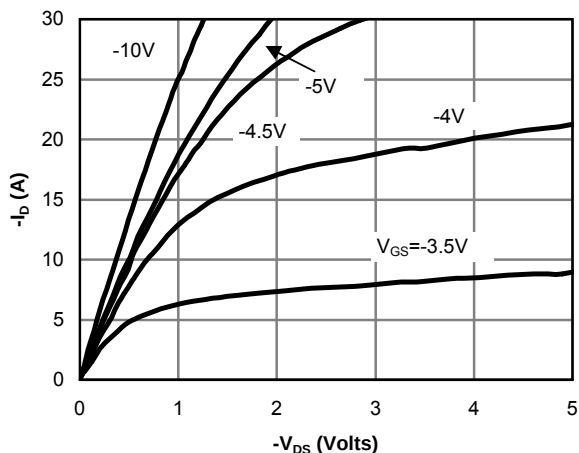


Figure 12: On-Region Characteristics

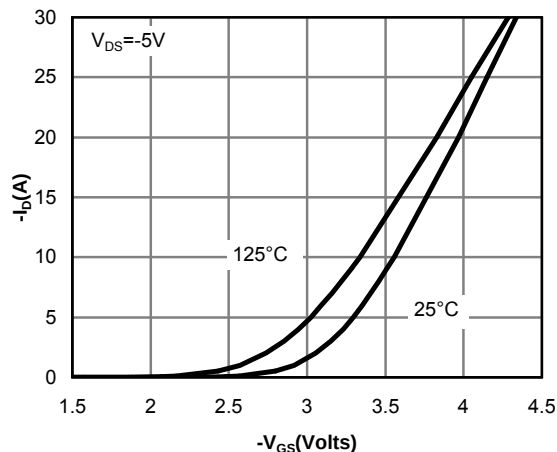


Figure 13: Transfer Characteristics

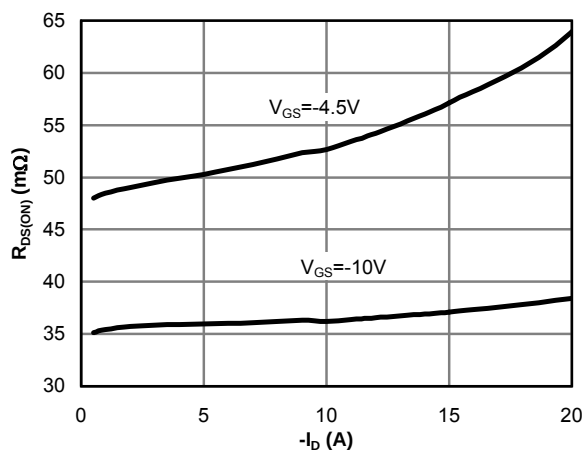


Figure 14: On-Resistance vs. Drain Current and Gate Voltage

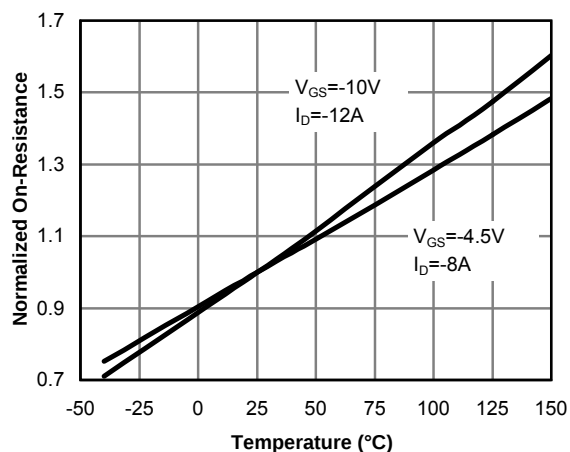


Figure 15: On-Resistance vs. Junction Temperature

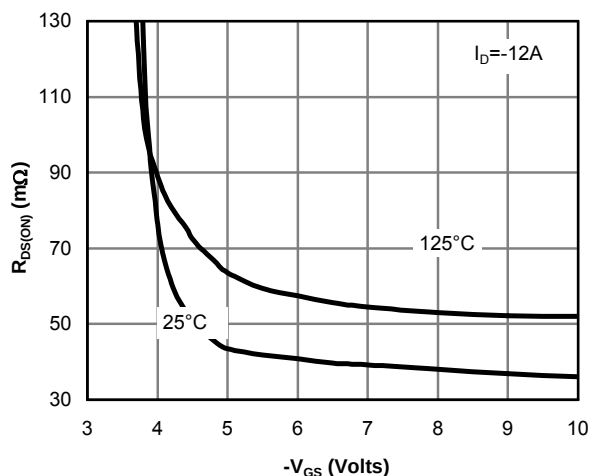


Figure 16: On-Resistance vs. Gate-Source Voltage

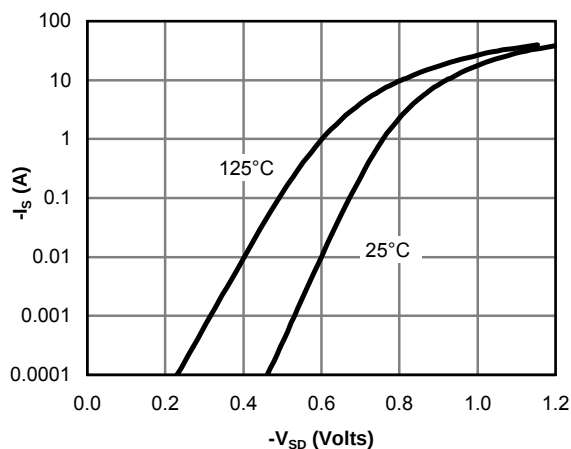


Figure 17: Body-Diode Characteristics

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

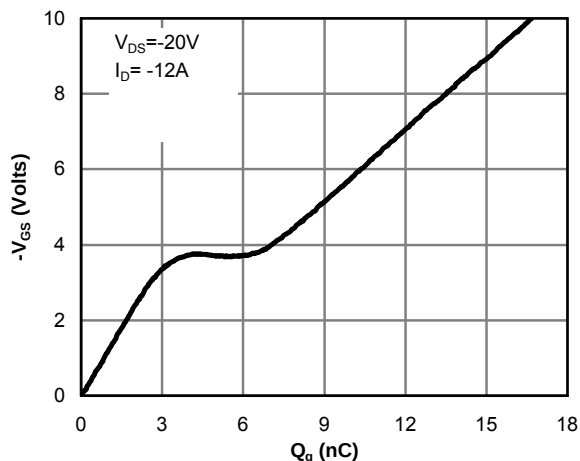


Figure 18: Gate-Charge Characteristics

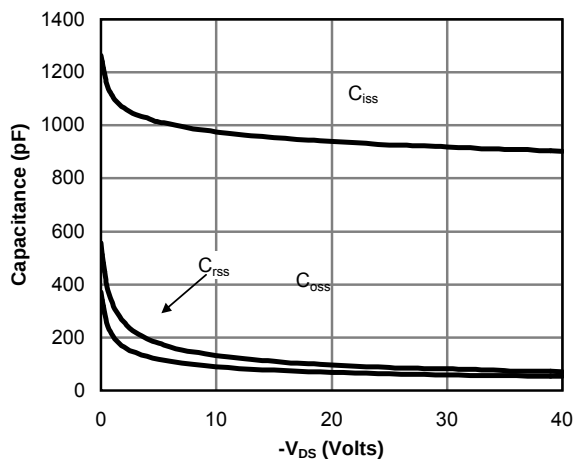


Figure 19: Capacitance Characteristics

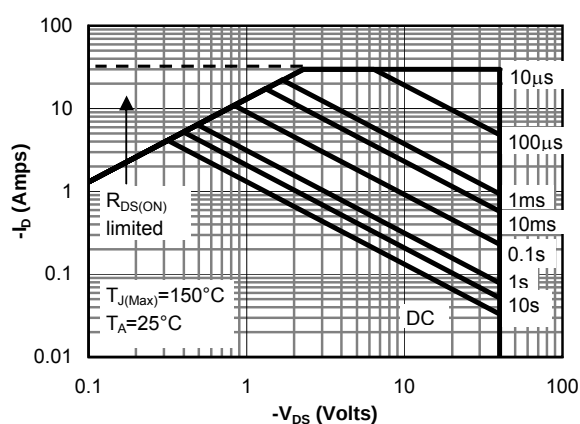


Figure 20: Maximum Forward Biased Safe Operating Area (Note E)

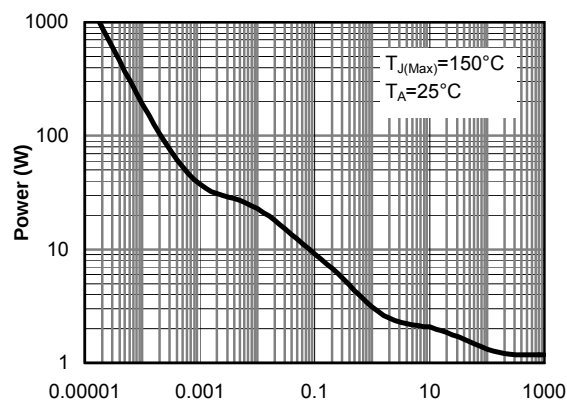


Figure 21: Single Pulse Power Rating Junction-to-Ambient (Note E)

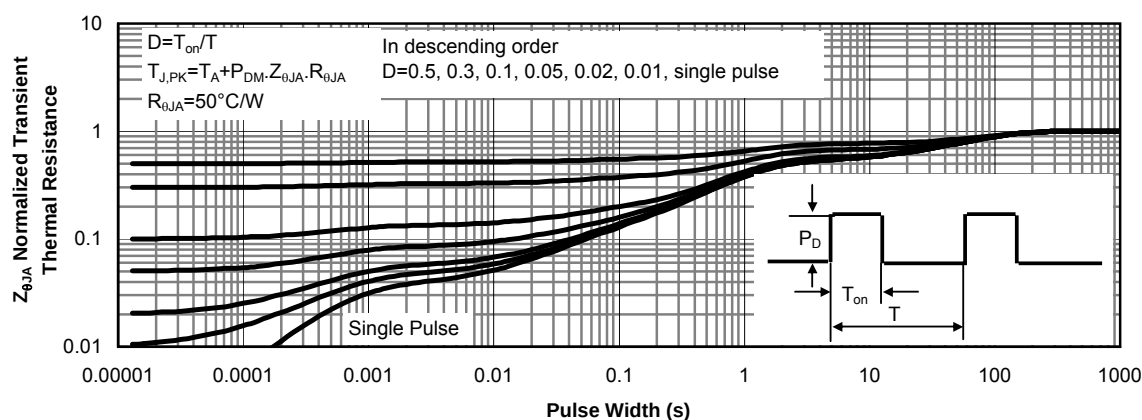
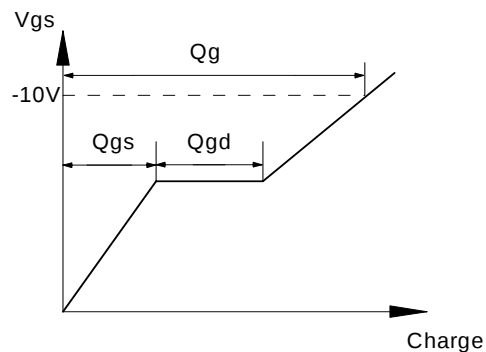
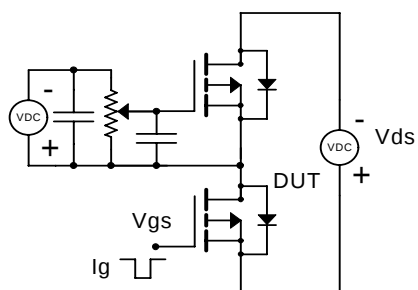


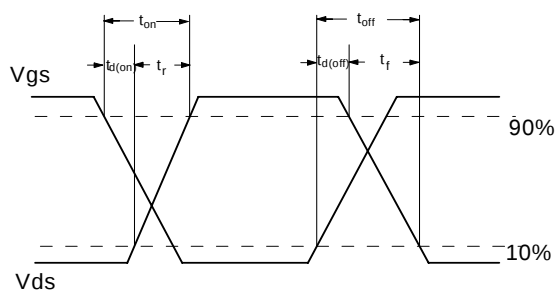
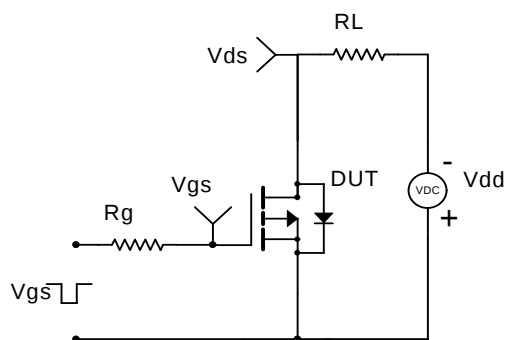
Figure 22: Normalized Maximum Transient Thermal Impedance

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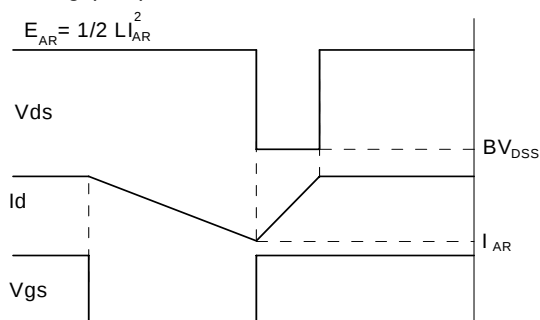
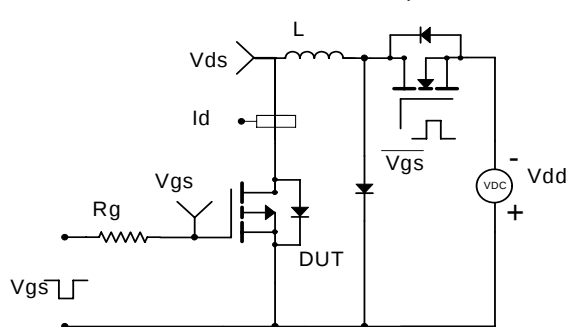
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

