



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AON6667**

**30V Dual Complementary MOSFET**

### General Description

- Trench Power MOSFET technology
- Low  $R_{DS(ON)}$
- Low Gate Charge
- Excellent Thermal Performance
- RoHS and Halogen-Free Compliant

### Product Summary

	<u>Q1</u>	<u>Q2</u>
$V_{DS}$	30V	-30V
$I_D$ (at $V_{GS}=10V$ )	16A	-16A
$R_{DS(ON)}$ (at $V_{GS}=10V$ )	< 25mΩ	< 22mΩ
$R_{DS(ON)}$ (at $V_{GS}=4.5V$ )	< 35mΩ	< 35mΩ

### Applications

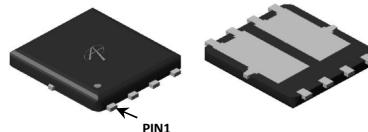
- Pch+Nch Complementary MOSFET for DC-FAN

100% UIS Tested

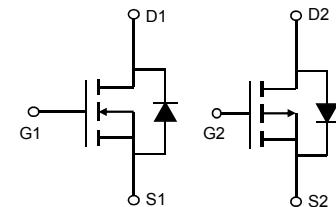
100%  $R_g$  Tested



**DFN5X6 EP2**



**Top View**



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AON6667	DFN 5x6	Tape & Reel	3000

### Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Parameter	Symbol	Max Q1	Max Q2	Units
Drain-Source Voltage	$V_{DS}$	30	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current <sup>C</sup>	$I_D$	16	-16	A
$T_C=100^\circ C$		10.5	-12.5	
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	35	-65	
Continuous Drain Current <sup>C</sup>	$I_{DSM}$	9.5	11	A
$T_A=70^\circ C$		7.5	-8.5	
Avalanche Current <sup>C</sup>	$I_{AS}$	12	-27	A
Avalanche energy <sup>C</sup>	$E_{AS}$	7	36	mJ
$V_{DS}$ Spike	$V_{SPIKE}$	36	-36	V
Power Dissipation <sup>B</sup>	$P_D$	10	20	W
$T_C=100^\circ C$		4	8	
Power Dissipation <sup>A</sup>	$P_{DSM}$	3.1	4.1	W
$T_A=70^\circ C$		2	2.6	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150		°C

### Thermal Characteristics

Parameter	Symbol	Typ Q1	Typ Q2	Max Q1	Max Q2	Units	
Maximum Junction-to-Ambient <sup>A</sup>	$t \leq 10s$	$R_{\theta JA}$	30	20	40	30	°C/W
Maximum Junction-to-Ambient <sup>A,D</sup>	Steady-State		55	48	70	65	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	9	5	12	6	°C/W

**Q1 Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$\text{ID}=250\mu\text{A}, \text{V}_{\text{GS}}=0\text{V}$	30			V
$\text{I}_{\text{DSS}}$	Zero Gate Voltage Drain Current	$\text{V}_{\text{DS}}=30\text{V}, \text{V}_{\text{GS}}=0\text{V}$ $\text{T}_J=55^\circ\text{C}$		1	5	$\mu\text{A}$
$\text{I}_{\text{GSS}}$	Gate-Body leakage current	$\text{V}_{\text{DS}}=0\text{V}, \text{V}_{\text{GS}}=\pm20\text{V}$		100	100	nA
$\text{V}_{\text{GS(th)}}$	Gate Threshold Voltage	$\text{V}_{\text{DS}}=\text{V}_{\text{GS}}, \text{I}_{\text{D}}=250\mu\text{A}$	1.5	2.1	2.6	V
$\text{R}_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$\text{V}_{\text{GS}}=10\text{V}, \text{I}_{\text{D}}=10\text{A}$ $\text{T}_J=125^\circ\text{C}$	18.5	25	35	$\text{m}\Omega$
		$\text{V}_{\text{GS}}=4.5\text{V}, \text{I}_{\text{D}}=5\text{A}$	27	35	35	$\text{m}\Omega$
$\text{g}_{\text{FS}}$	Forward Transconductance	$\text{V}_{\text{DS}}=5\text{V}, \text{I}_{\text{D}}=10\text{A}$		17	17	S
$\text{V}_{\text{SD}}$	Diode Forward Voltage	$\text{I}_{\text{S}}=1\text{A}, \text{V}_{\text{GS}}=0\text{V}$		0.75	1	V
$\text{I}_{\text{S}}$	Maximum Body-Diode Continuous Current			10	10	A
<b>DYNAMIC PARAMETERS</b>						
$\text{C}_{\text{iss}}$	Input Capacitance	$\text{V}_{\text{GS}}=0\text{V}, \text{V}_{\text{DS}}=15\text{V}, \text{f}=1\text{MHz}$		373		pF
$\text{C}_{\text{oss}}$	Output Capacitance			67		pF
$\text{C}_{\text{rss}}$	Reverse Transfer Capacitance			41		pF
$\text{R}_{\text{g}}$	Gate resistance	$\text{f}=1\text{MHz}$	0.6	1.8	2.8	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$\text{Q}_{\text{g}}(10\text{V})$	Total Gate Charge	$\text{V}_{\text{GS}}=10\text{V}, \text{V}_{\text{DS}}=15\text{V}, \text{I}_{\text{D}}=10\text{A}$		7.1	15	nC
$\text{Q}_{\text{g}}(4.5\text{V})$	Total Gate Charge			3.5	7	nC
$\text{Q}_{\text{gs}}$	Gate Source Charge			1.2		nC
$\text{Q}_{\text{gd}}$	Gate Drain Charge			1.6		nC
$\text{t}_{\text{D(on)}}$	Turn-On DelayTime	$\text{V}_{\text{GS}}=10\text{V}, \text{V}_{\text{DS}}=15\text{V}, \text{R}_{\text{L}}=1.5\Omega, \text{R}_{\text{GEN}}=3\Omega$		4.3		ns
$\text{t}_{\text{r}}$	Turn-On Rise Time			2.8		ns
$\text{t}_{\text{D(off)}}$	Turn-Off DelayTime			15.8		ns
$\text{t}_{\text{f}}$	Turn-Off Fall Time			3.0		ns
$\text{t}_{\text{rr}}$	Body Diode Reverse Recovery Time	$\text{I}_{\text{F}}=10\text{A}, \text{di/dt}=500\text{A}/\mu\text{s}$		6.0		ns
$\text{Q}_{\text{rr}}$	Body Diode Reverse Recovery Charge	$\text{I}_{\text{F}}=10\text{A}, \text{di/dt}=500\text{A}/\mu\text{s}$		6.6		nC

A. The value of  $\text{R}_{\text{QJA}}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The Power dissipation  $P_{\text{DSM}}$  is based on  $\text{R}_{\text{QJA}} \leq 10\text{s}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design.

B. The power dissipation  $P_D$  is based on  $T_{\text{J(MAX)}}=150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature  $T_{\text{J(MAX)}}=150^\circ\text{C}$ .

D. The  $\text{R}_{\text{QJA}}$  is the sum of the thermal impedance from junction to case  $\text{R}_{\text{QJC}}$  and case to ambient.

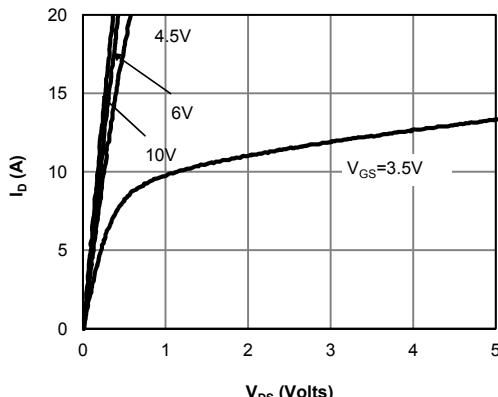
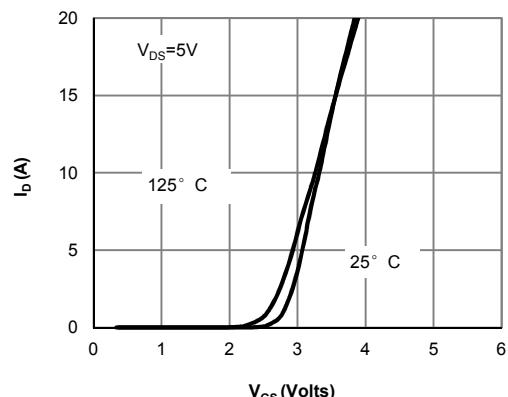
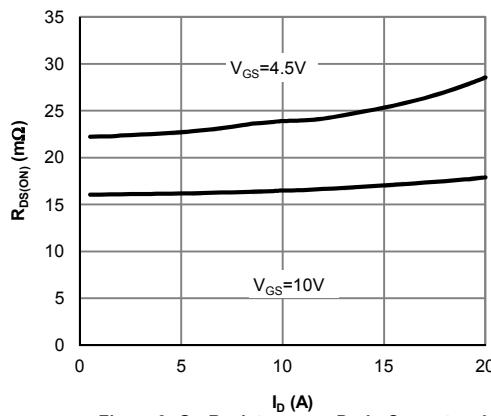
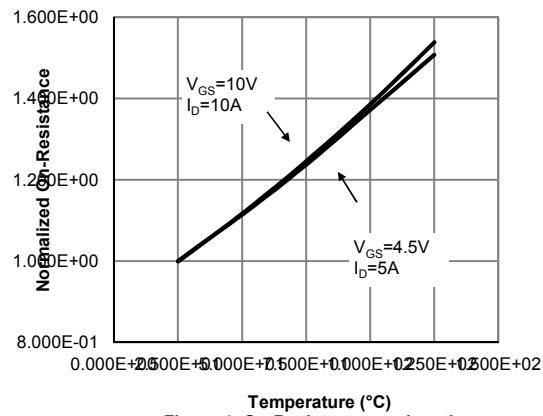
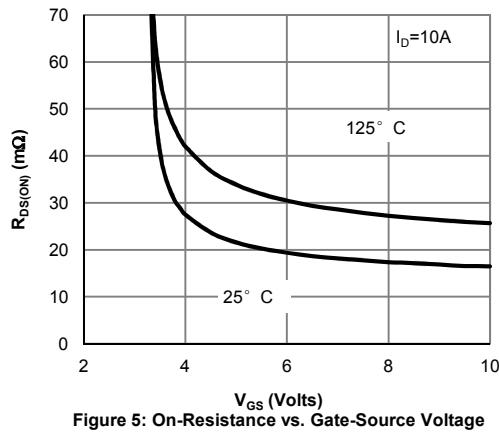
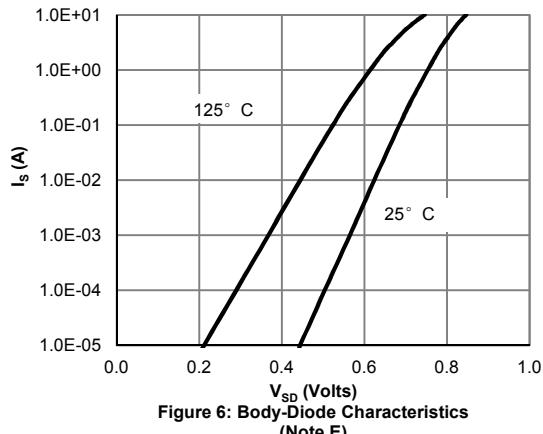
E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

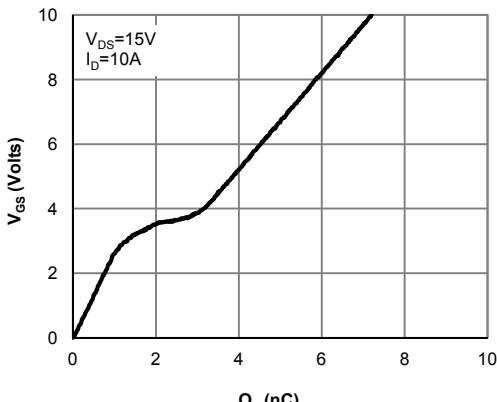
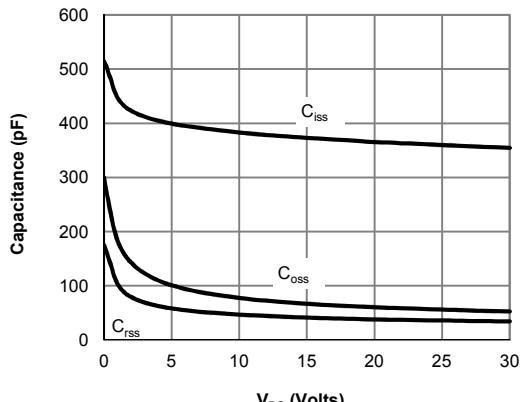
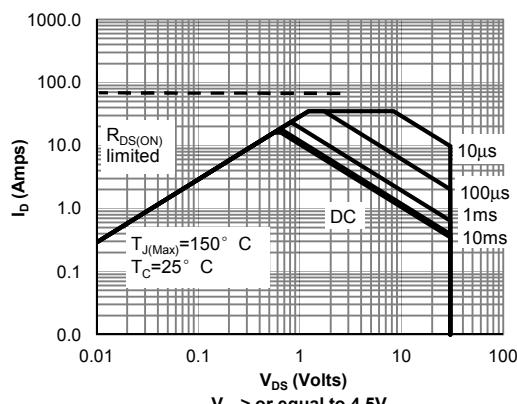
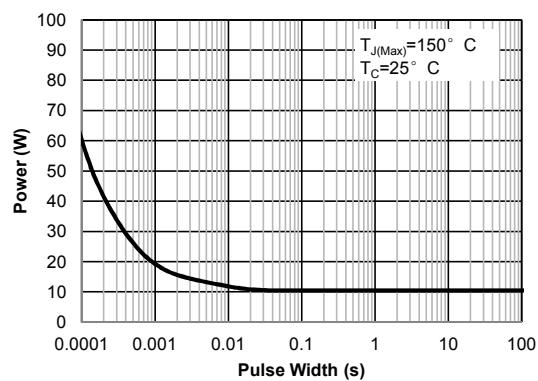
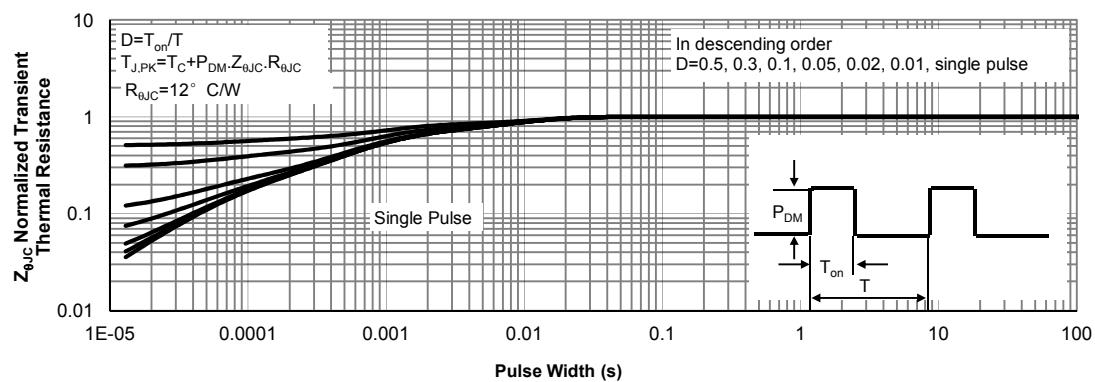
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{\text{J(MAX)}}=150^\circ\text{C}$ . The SOA curve provides a single pulse rating.

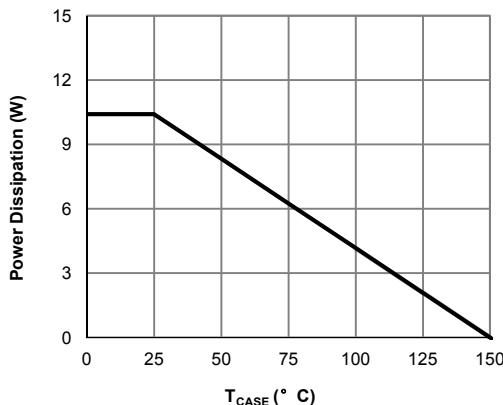
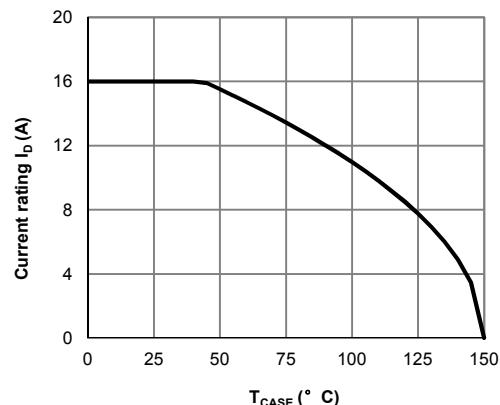
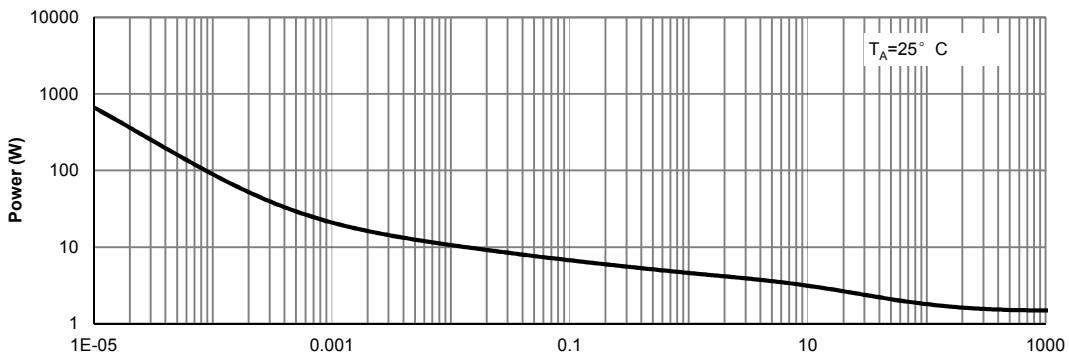
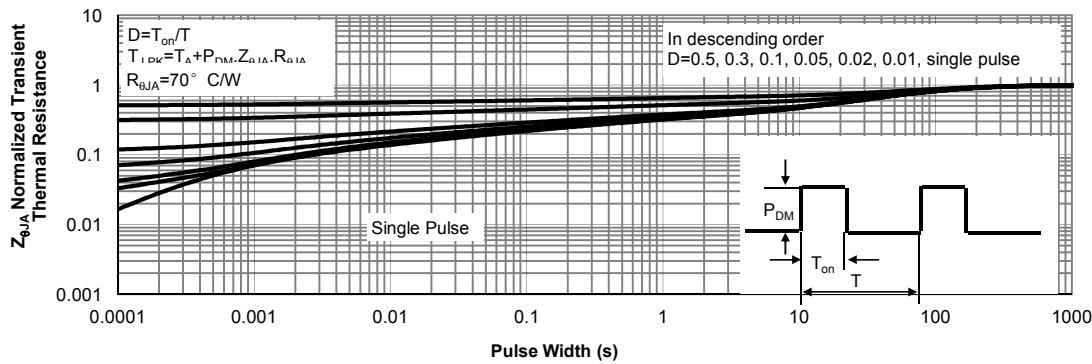
G. The maximum current rating is package limited.

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

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**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 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)**

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**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)**

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**Figure 12: Power De-rating (Note F)**

**Figure 13: Current De-rating (Note F)**

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

**Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)**

**Q2 Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$	-30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-30\text{V}$ , $V_{GS}=0\text{V}$			-1	$\mu\text{A}$
			$T_J=55^\circ\text{C}$		-5	
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm20\text{V}$			$\pm100$	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$	-1.5	-2.0	-2.5	V
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$ , $I_D=-9.7\text{A}$		16.5	22	$\text{m}\Omega$
			$T_J=125^\circ\text{C}$		24	
		$V_{GS}=-4.5\text{V}$ , $I_D=-7\text{A}$		26	35	
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-9.7\text{A}$		27		S
$V_{SD}$	Diode Forward Voltage	$I_S=-1\text{A}$ , $V_{GS}=0\text{V}$		-0.75	-1	V
$I_S$	Maximum Body-Diode Continuous Current <sup>G</sup>				-16	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$		1040		pF
$C_{oss}$	Output Capacitance			180		pF
$C_{rss}$	Reverse Transfer Capacitance			125		pF
$R_g$	Gate resistance	$f=1\text{MHz}$	2	4	6	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-9.7\text{A}$		19	30	nC
$Q_g(4.5\text{V})$	Total Gate Charge			9.6	15	nC
$Q_{gs}$	Gate Source Charge			3.6		nC
$Q_{gd}$	Gate Drain Charge			4.6		nC
$t_{D(\text{on})}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=1.5\Omega$ , $R_{\text{GEN}}=3\Omega$		10		ns
$t_r$	Turn-On Rise Time			5.5		ns
$t_{D(\text{off})}$	Turn-Off DelayTime			26.0		ns
$t_f$	Turn-Off Fall Time			9		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=-9.7\text{A}$ , $dI/dt=500\text{A}/\mu\text{s}$		11.5		ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-9.7\text{A}$ , $dI/dt=500\text{A}/\mu\text{s}$		25		nC

A. The value of  $R_{\text{DSM}}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The Power dissipation  $P_{\text{DSM}}$  is based on  $R_{\text{DSM}} \leq 10\text{s}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design.

B. The power dissipation  $P_D$  is based on  $T_{J(\text{MAX})}=150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature  $T_{J(\text{MAX})}=150^\circ\text{C}$ .

D. The  $R_{\text{JJA}}$  is the sum of the thermal impedance from junction to case  $R_{\text{JJC}}$  and case to ambient.

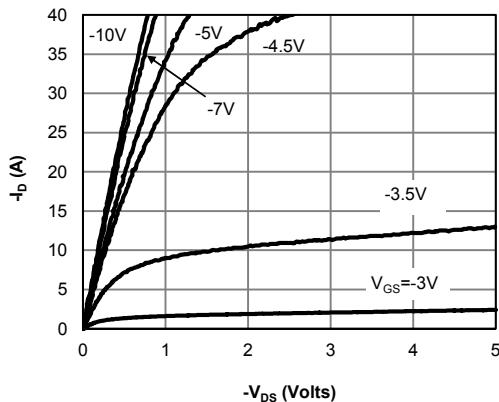
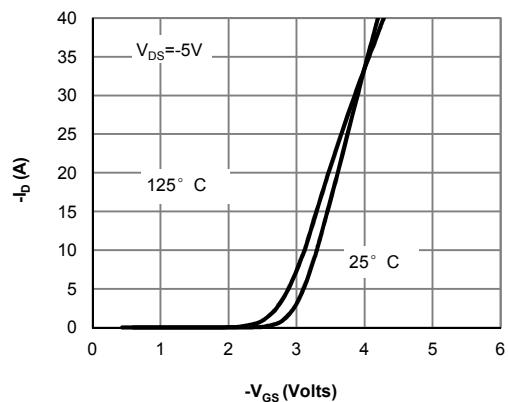
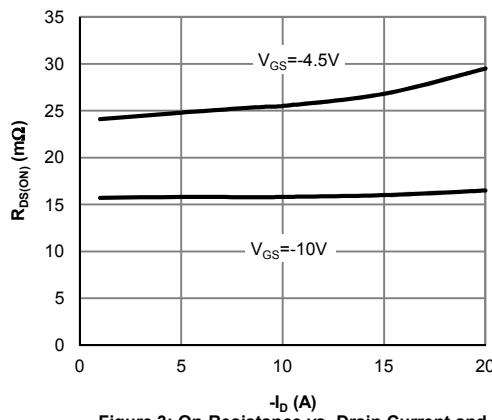
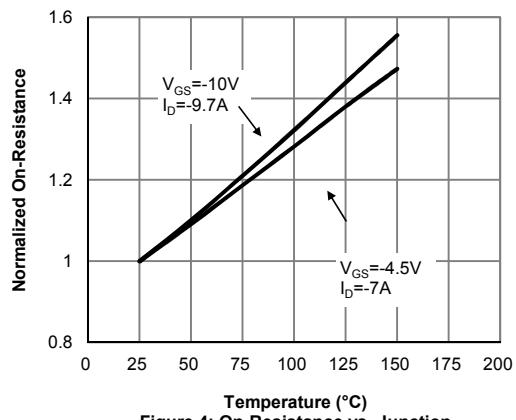
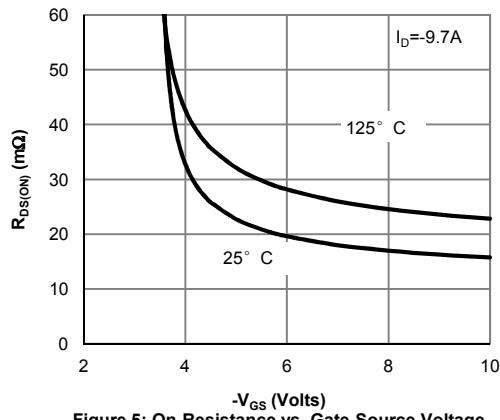
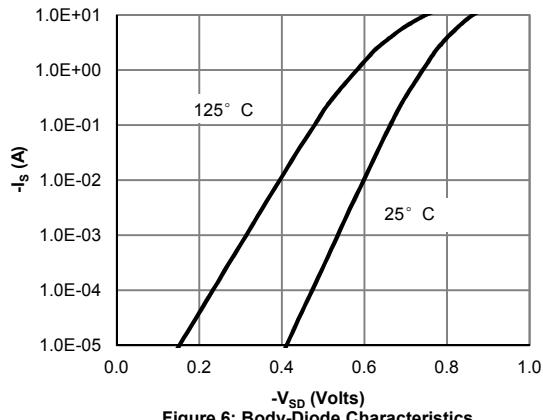
E. The static characteristics in Figures 1 to 6 are obtained using  $<300\mu\text{s}$  pulses, duty cycle 0.5% max.

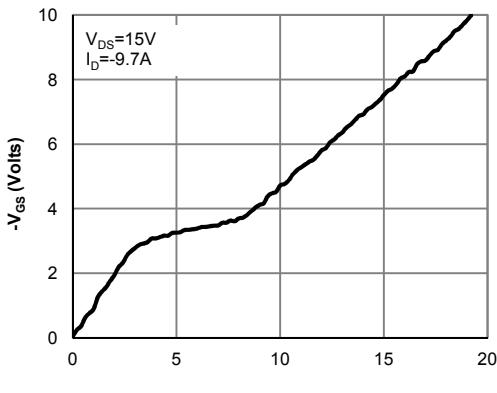
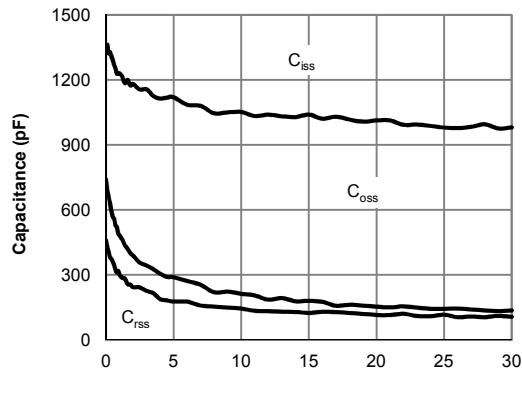
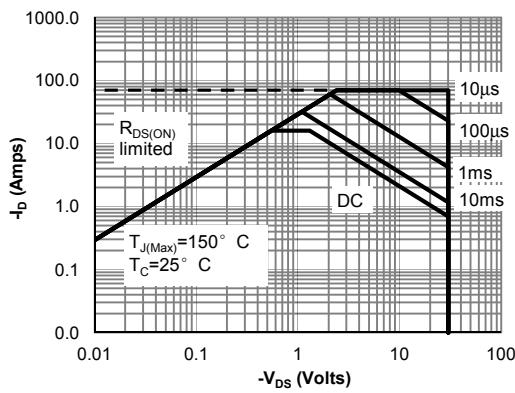
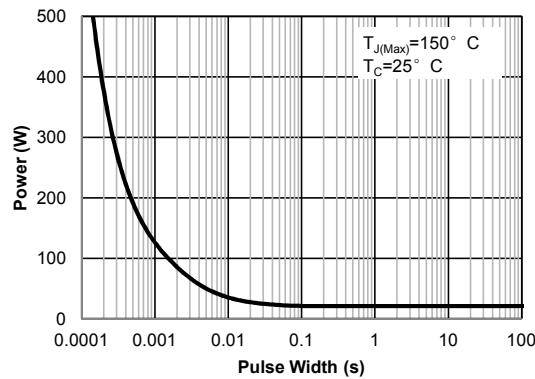
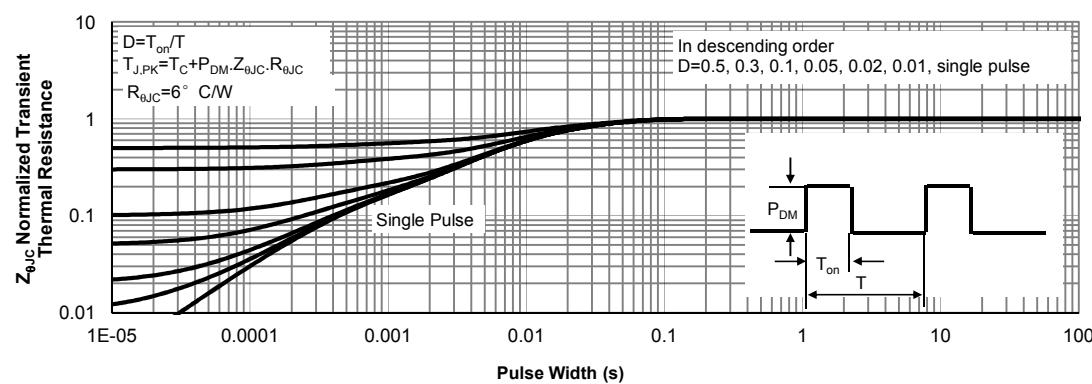
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{J(\text{MAX})}=150^\circ\text{C}$ . The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

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

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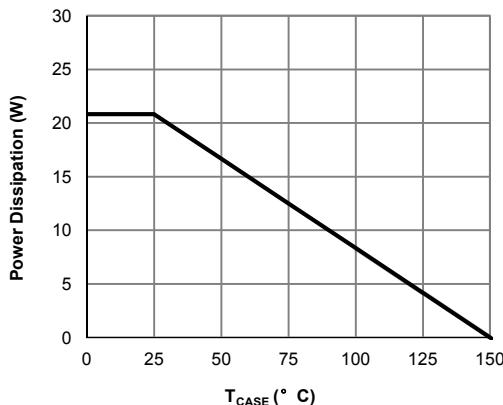
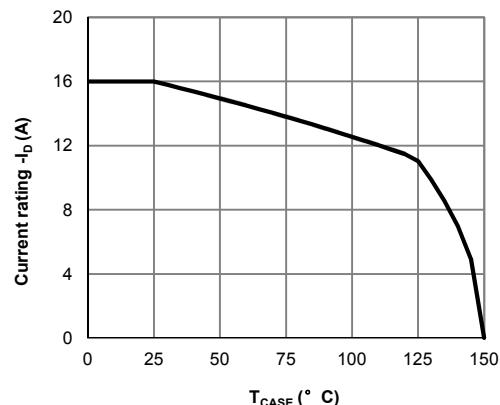
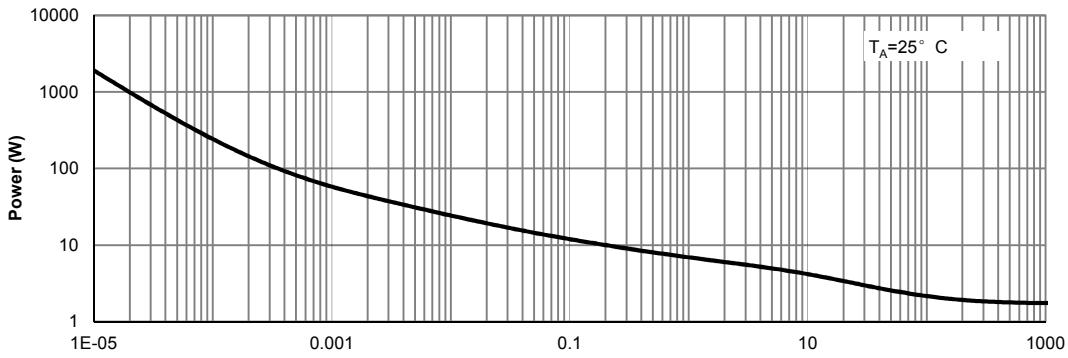
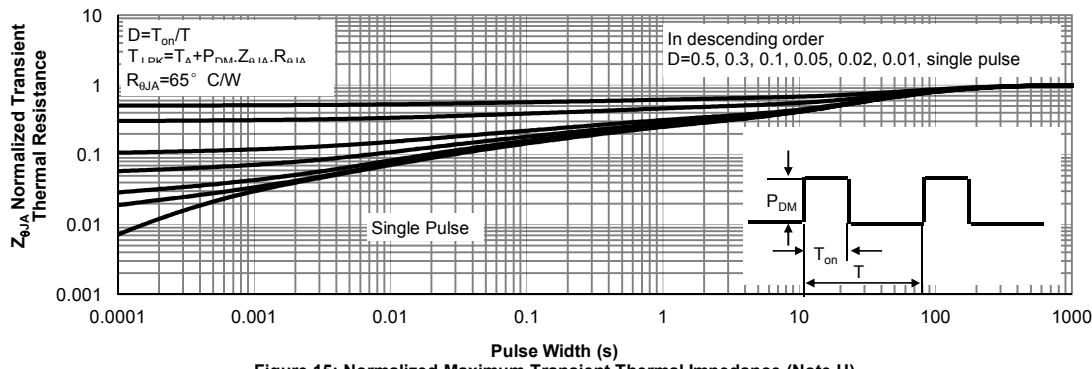
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

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**Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)**

Figure A: Gate Charge Test Circuit & Waveforms

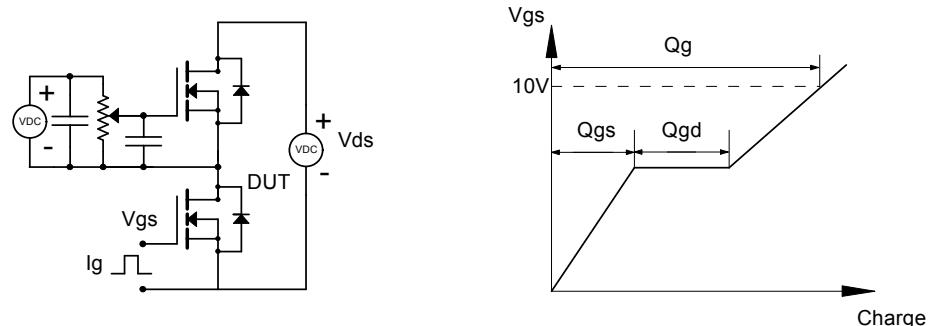


Figure B: Resistive Switching Test Circuit & Waveforms

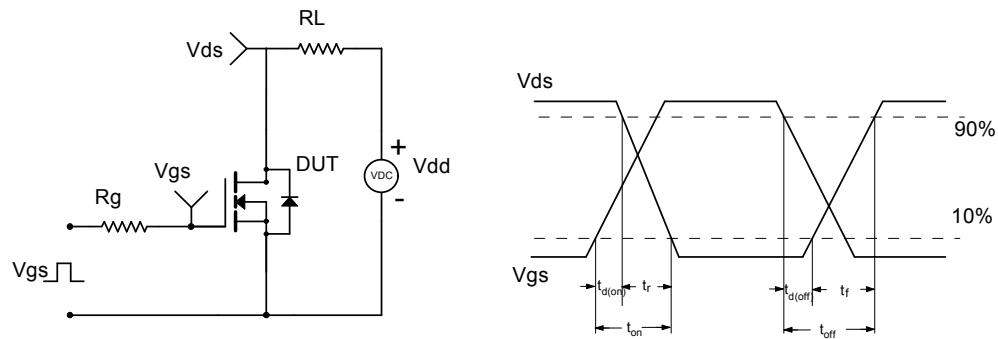


Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

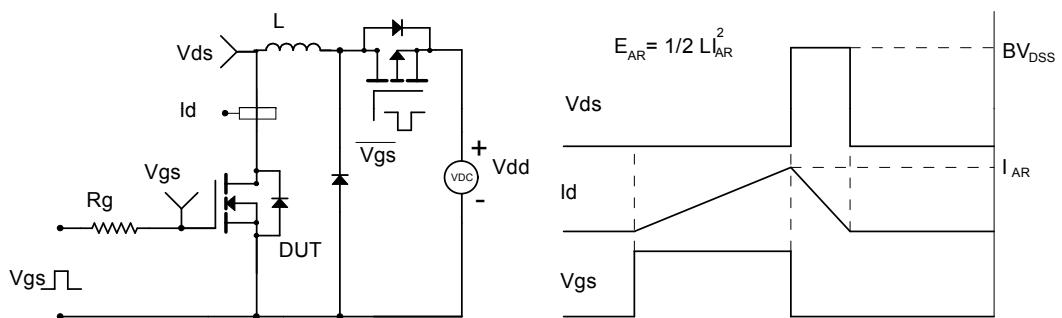
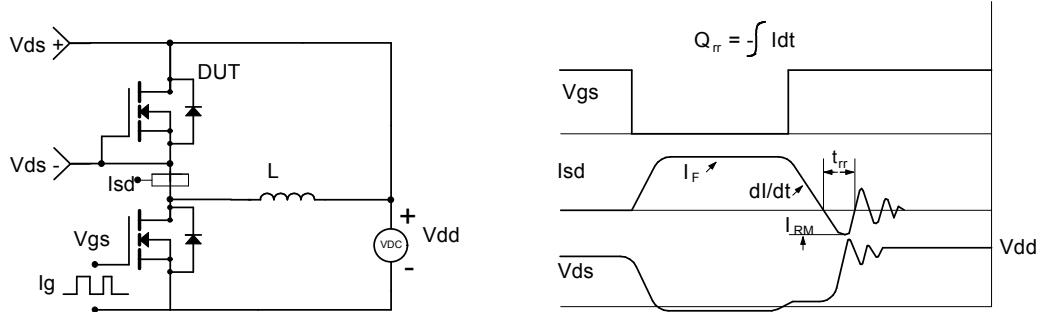
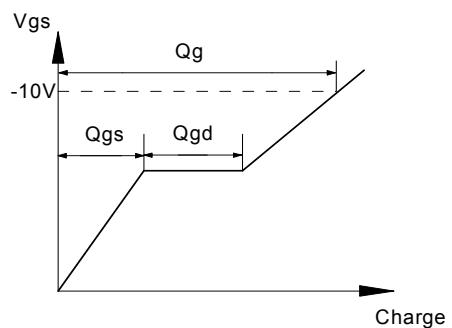
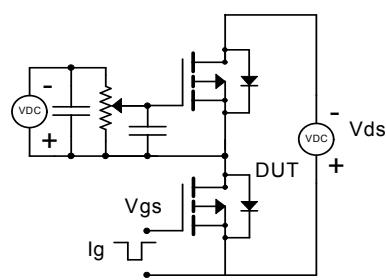
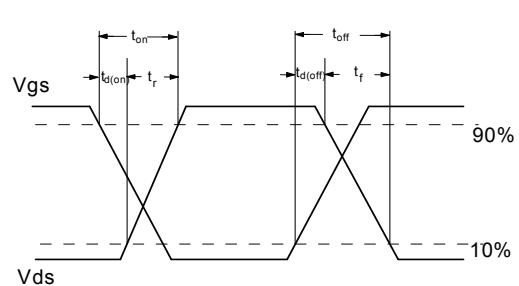
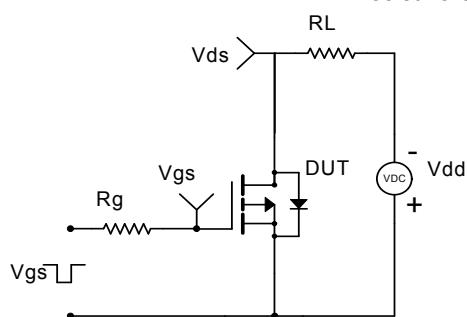
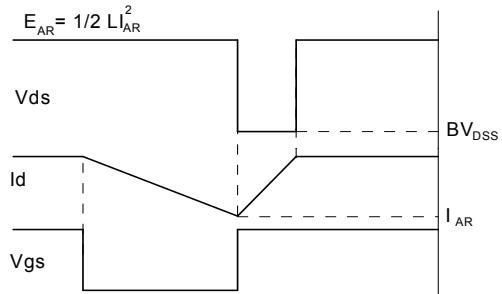
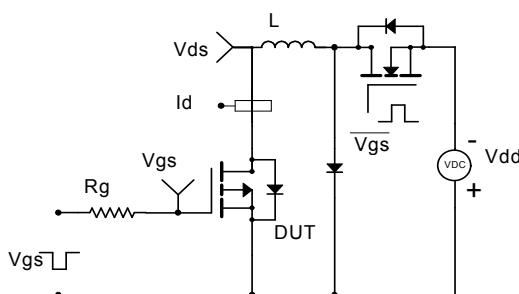


Figure D: Diode Recovery Test Circuit & Waveforms



**Gate Charge Test Circuit & Waveform**

**Resistive Switching Test Circuit & Waveforms**

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

**Diode Recovery Test Circuit & Waveforms**
