

## AO7600

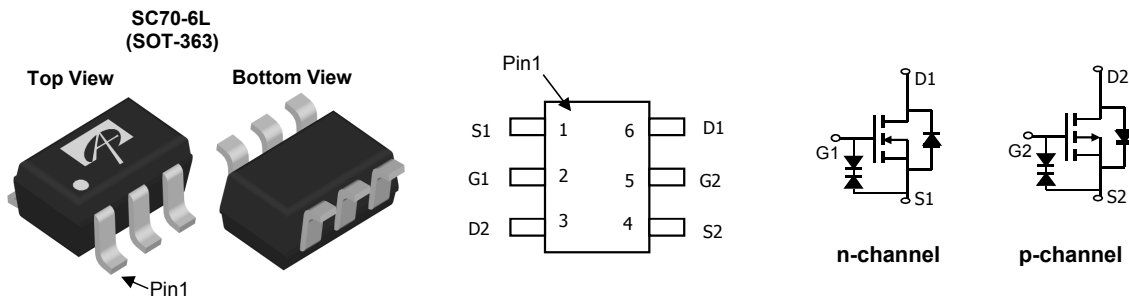
### Complementary Enhancement Mode Field Effect Transistor

#### General Description

The AO7600 uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, an inverter, and for a host of other applications. Both devices are ESD protected.

#### Features

n-channel	p-channel
$V_{DS} (V) = 20V$	-20V
$I_D = 0.9A (V_{GS}=4.5V)$	-0.6A ( $V_{GS}=-4.5V$ )
$R_{DS(ON)} < 300m\Omega (V_{GS}=4.5V)$	$R_{DS(ON)} < 550m\Omega (V_{GS}=-4.5V)$
$< 350m\Omega (V_{GS}=2.5V)$	$< 700m\Omega (V_{GS}=-2.5V)$
$< 450m\Omega (V_{GS}=1.8V)$	$< 950m\Omega (V_{GS}=-1.8V)$



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

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	$V_{DS}$	20	-20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	$\pm 8$	V
Continuous Drain Current <sup>A</sup>	$I_D$	$T_A=25^\circ C$	0.9	-0.6
		$T_A=70^\circ C$	0.7	-0.48
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	5	-3	A
Power Dissipation	$P_D$	$T_A=25^\circ C$	0.3	0.3
		$T_A=70^\circ C$	0.19	0.19
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ C$

#### Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	n-ch	360	415	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		n-ch	400	460	$^\circ C/W$
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	n-ch	300	350	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	p-ch	360	415	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		p-ch	400	460	$^\circ C/W$
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	p-ch	300	350	$^\circ C/W$

**N-Channel: Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	20			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =16V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			1 5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±8V			25	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.5	0.75	0.9	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V	5			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =4.5V, I <sub>D</sub> =0.9A T <sub>J</sub> =125°C		181 253	300 330	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =0.75A		237	350	mΩ
		V <sub>GS</sub> =1.8V, I <sub>D</sub> =0.7A		317	450	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =0.8A		2.6		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =0.5A, V <sub>GS</sub> =0V		0.69	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				0.4	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =10V, f=1MHz		101	120	pF
C <sub>oss</sub>	Output Capacitance			17		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			14		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		3	4	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V, I <sub>D</sub> =0.8A		1.57	1.9	nC
Q <sub>gs</sub>	Gate Source Charge			0.13		nC
Q <sub>gd</sub>	Gate Drain Charge			0.36		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =5V, V <sub>DS</sub> =10V, R <sub>L</sub> =12.5Ω, R <sub>GEN</sub> =6Ω		3.2		ns
t <sub>r</sub>	Turn-On Rise Time			4		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			15.5		ns
t <sub>f</sub>	Turn-Off Fall Time			2.4		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =0.8A, di/dt=100A/μs		6.7	8.1	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =0.8A, di/dt=100A/μs		1.6		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

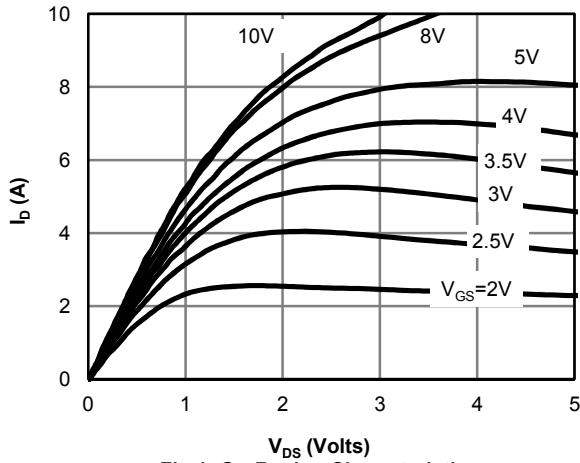
C: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

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

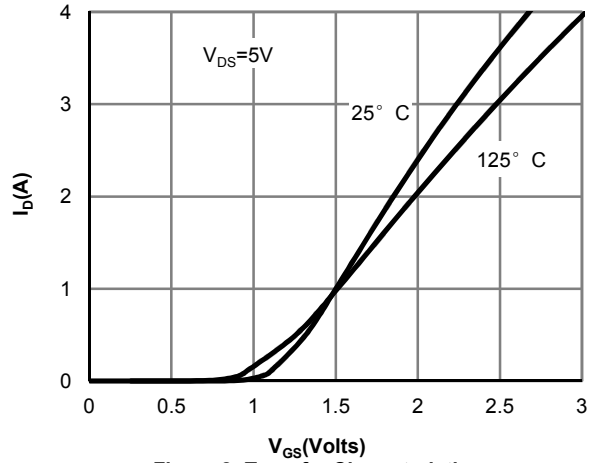
E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The SOA curve provides a single pulse rating.

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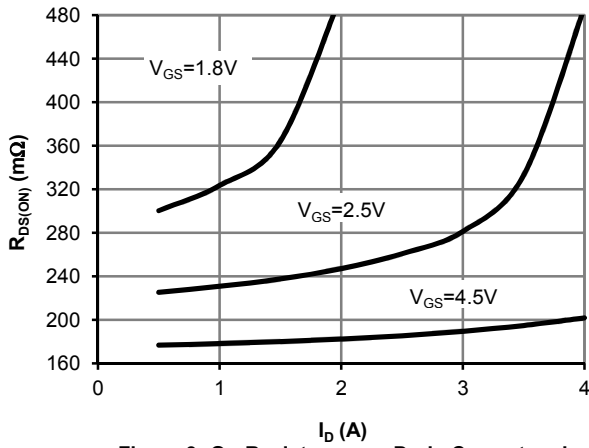
**N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



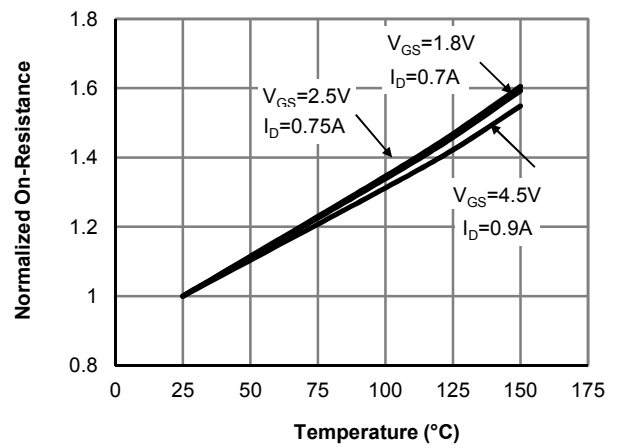
**Fig 1: On-Region Characteristics**



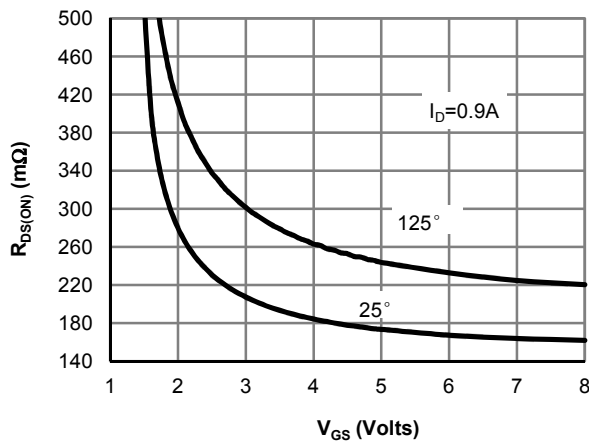
**Figure 2: Transfer Characteristics**



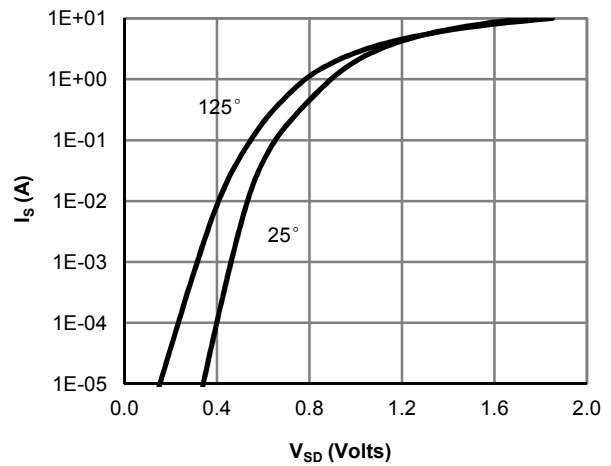
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**Figure 4: On-Resistance vs. Junction Temperature**

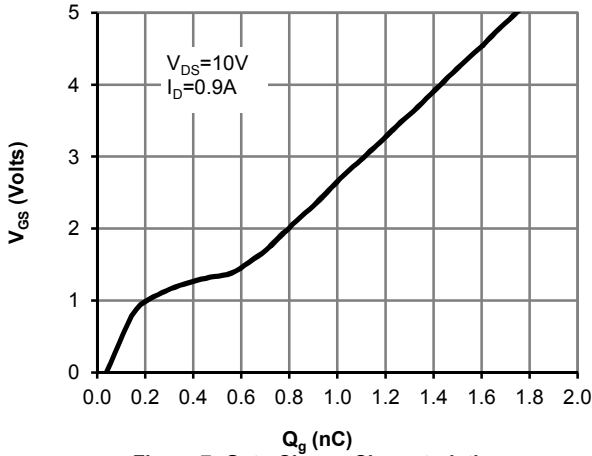


**Figure 5: On-Resistance vs. Gate-Source Voltage**

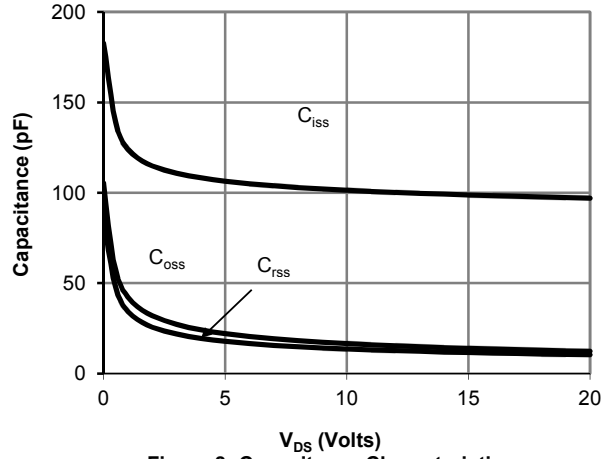


**Figure 6: Body-Diode Characteristics**

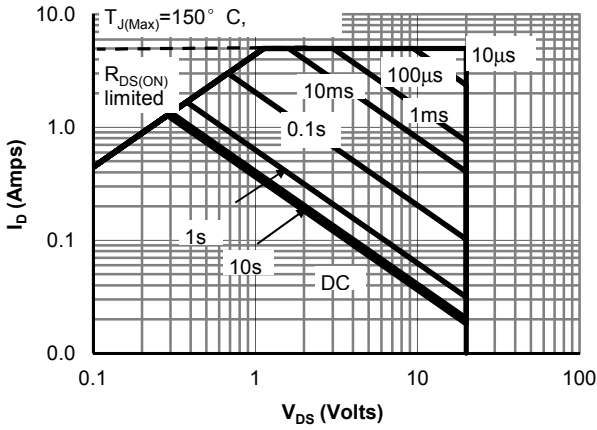
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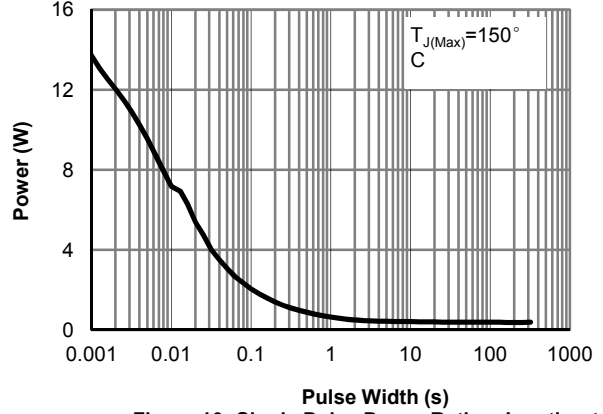
**Figure 7: Gate-Charge Characteristics**



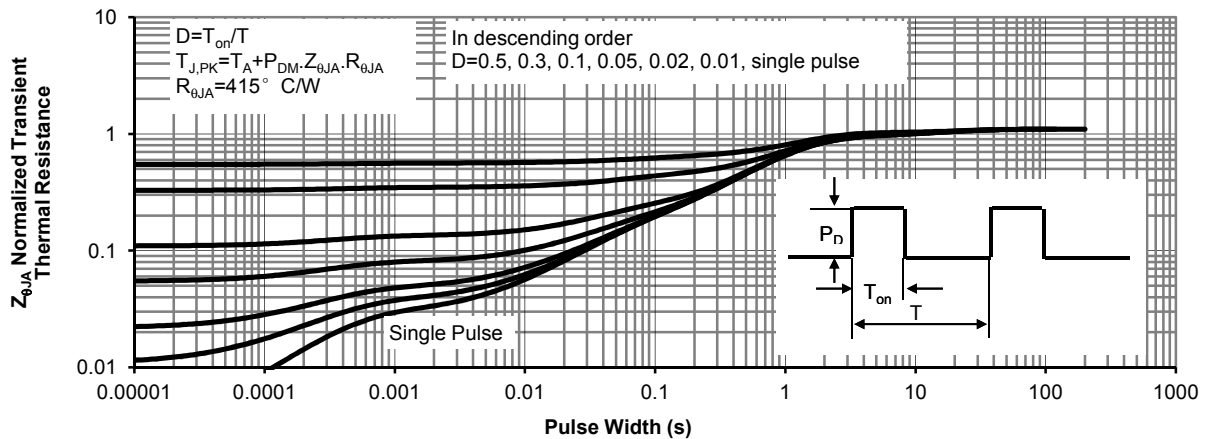
**Figure 8: Capacitance Characteristics**



**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**

**P-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =-250μA, V <sub>GS</sub> =0V	-20			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-16V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			-1 -5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±8V			±10	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-0.5	-0.6	-0.9	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-5V	-3			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-0.6A T <sub>J</sub> =125°C		415 542	550 700	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-0.5A		590	700	mΩ
		V <sub>GS</sub> =-1.8V, I <sub>D</sub> =-0.4A		700	950	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-0.6A		1.7		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =-0.5A, V <sub>GS</sub> =0V		-0.86	-1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				-0.4	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-10V, f=1MHz		114	140	pF
C <sub>oss</sub>	Output Capacitance		17		pF	
C <sub>rss</sub>	Reverse Transfer Capacitance		14		pF	
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		12	17	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-10V, I <sub>D</sub> =-0.6A		1.44	1.8	nC
Q <sub>gs</sub>	Gate Source Charge		0.14		nC	
Q <sub>gd</sub>	Gate Drain Charge		0.35		nC	
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-10V, R <sub>L</sub> =16.7Ω, R <sub>GEN</sub> =3Ω		6.5		ns
t <sub>r</sub>	Turn-On Rise Time		6.5		ns	
t <sub>D(off)</sub>	Turn-Off DelayTime		18.2		ns	
t <sub>f</sub>	Turn-Off Fall Time		5.5		ns	
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =-0.6A, dI/dt=100A/μs		10	13	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =-0.6A, dI/dt=100A/μs		3		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

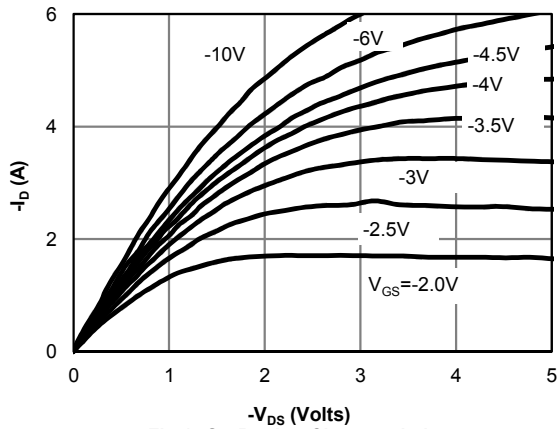
C: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D: The static characteristics in Figures 1 to 6,12,14 are obtained using <300 μs pulses, duty cycle 0.5% max.

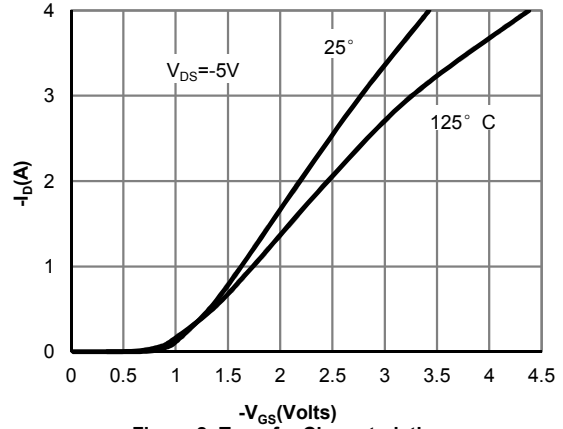
E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The SOA curve provides a single pulse rating.

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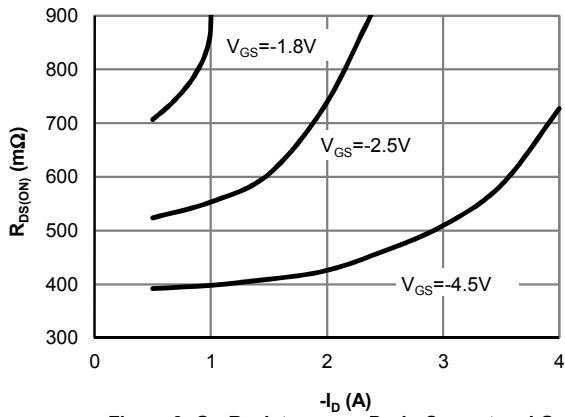
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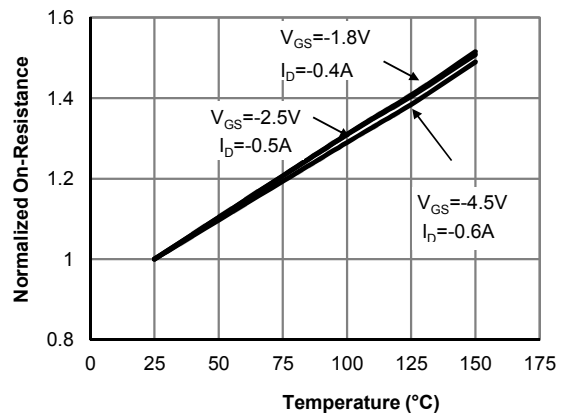
**Fig 1: On-Region Characteristics**



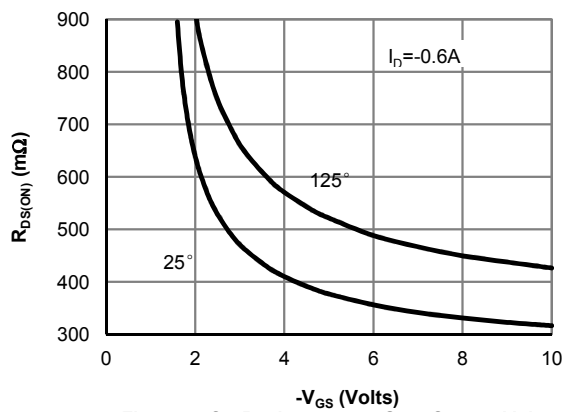
**Figure 2: Transfer Characteristics**



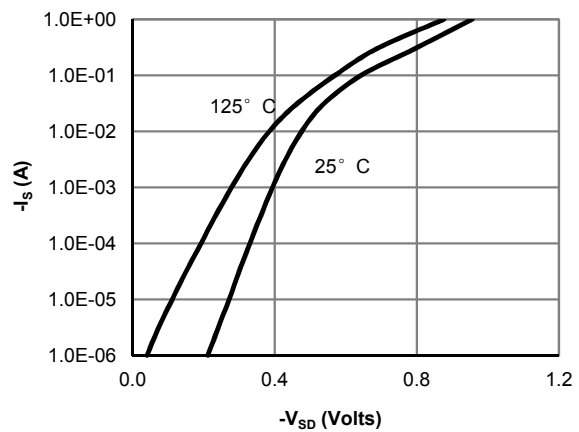
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**Figure 4: On-Resistance vs. Junction Temperature**

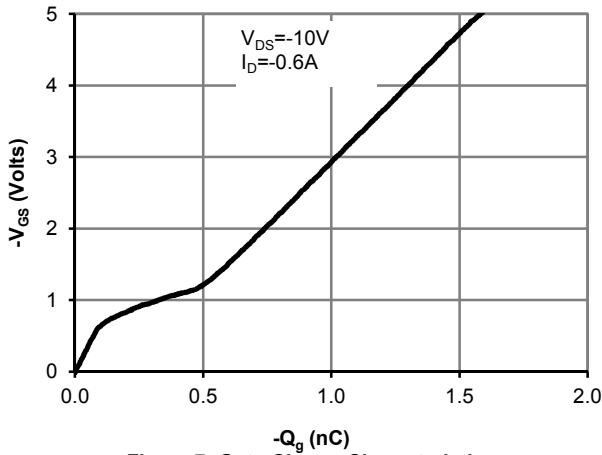


**Figure 5: On-Resistance vs. Gate-Source Voltage**

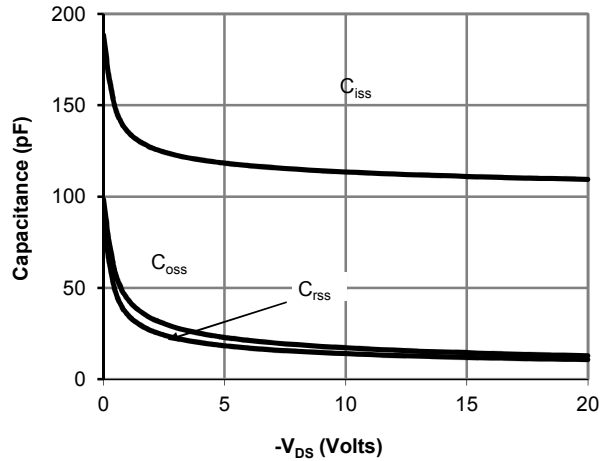


**Figure 6: Body-Diode Characteristics**

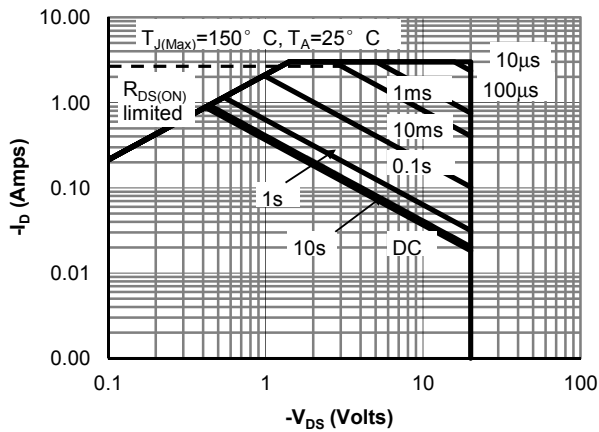
**P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



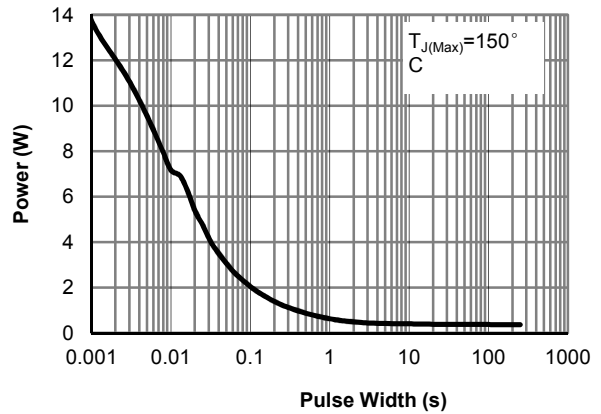
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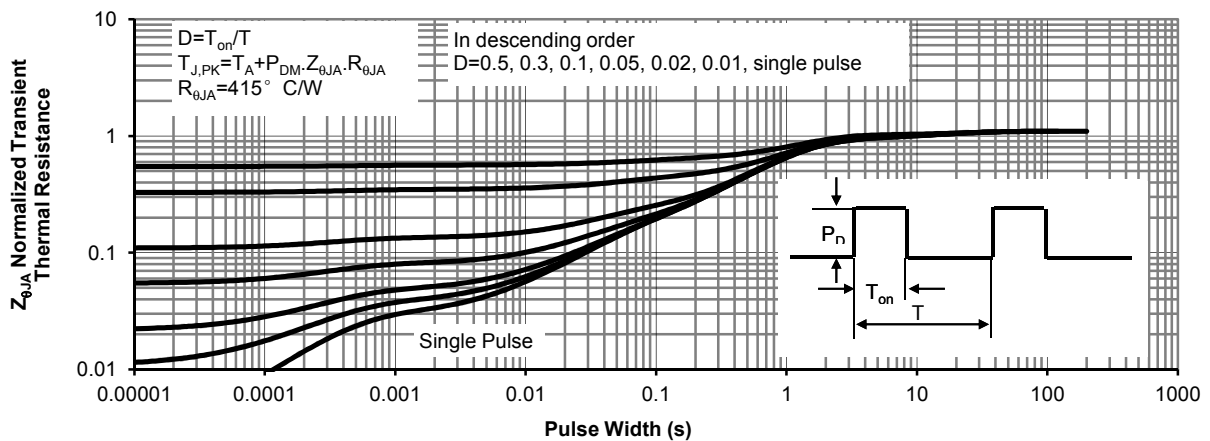
**Figure 8: Capacitance Characteristics**



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

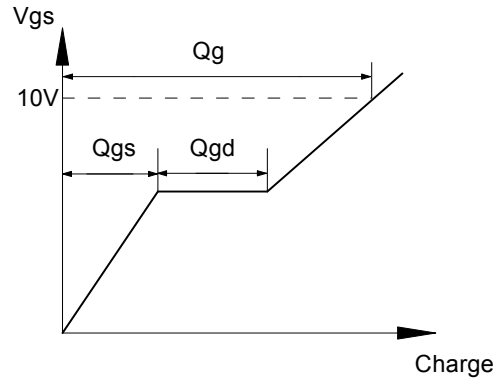
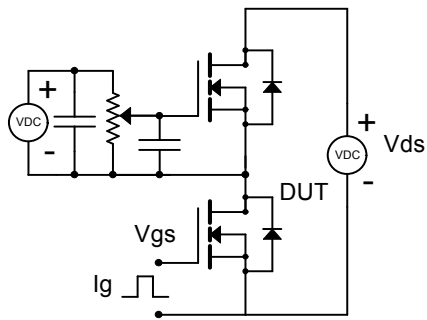


**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

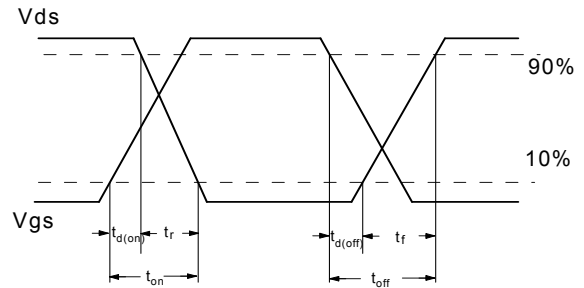
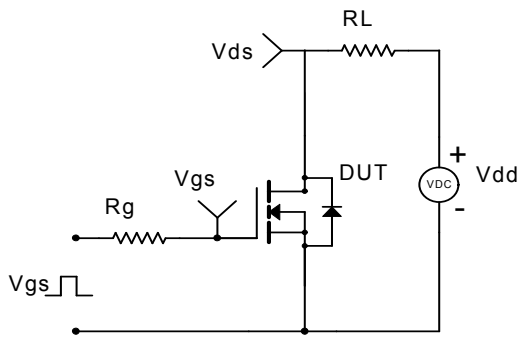


**Figure 11: Normalized Maximum Transient Thermal Impedance**

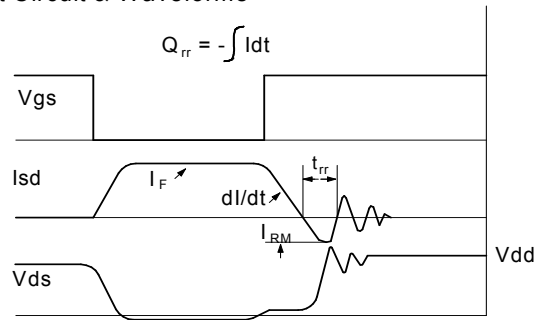
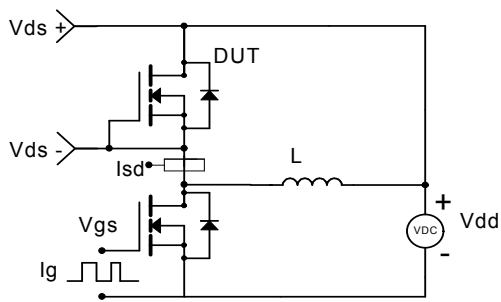
### Gate Charge Test Circuit & Waveform



### Resistive Switching Test Circuit & Waveforms



### Diode Recovery Test Circuit & Waveforms





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