



**AO5600E**

**Complementary Enhancement Mode Field Effect Transistor**

**General Description**

The AO5600E/L 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. AO5600E and AO5600EL are electrically identical.

- RoHS compliant
- AO5600EL is Halogen Free

**ESD PROTECTED!**

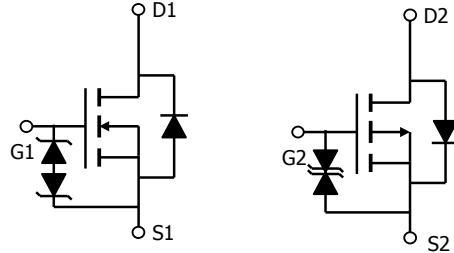
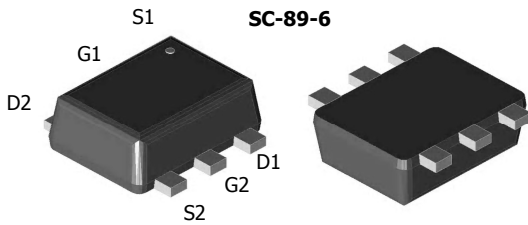
**Features**

**n-channel**

- $V_{DS}$  (V) = 20V,  $I_D$  = 0.6A ( $V_{GS}=4.5V$ )
- $R_{DS(ON)} < 0.65\Omega$  ( $V_{GS}= 4.5V$ )
- $R_{DS(ON)} < 0.75\Omega$  ( $V_{GS}= 2.5V$ )
- $R_{DS(ON)} < 0.95\Omega$  ( $V_{GS}= 1.8V$ )

**p-channel**

- $V_{DS}$  (V) = -20V,  $I_D$  = -0.5A ( $V_{GS}=-4.5V$ )
- $R_{DS(ON)} < 0.8\Omega$  ( $V_{GS}= -4.5V$ )
- $R_{DS(ON)} < 1.0\Omega$  ( $V_{GS}= -2.5V$ )
- $R_{DS(ON)} < 1.3\Omega$  ( $V_{GS}= -1.8V$ )



**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	$V_{GS}$	$\pm 8$		V
Continuous Drain Current <sup>B,H</sup>	$I_D$	$T_C=25^\circ C$	0.6	-0.5
		$T_C=100^\circ C$	0.4	-0.38
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	3	-1	A
Power Dissipation	$P_D$	$T_C=25^\circ C$	0.38	0.38
		$T_C=100^\circ C$	0.24	0.24
Junction and Storage Temperature Range	$T_J, T_{STG}$	-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	275	330	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	n-ch	360	450
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	275	330	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	p-ch	360	450
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> =20V, 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> =±4.5V			±1	μA
		V <sub>DS</sub> =0V, V <sub>GS</sub> =±8V			±100	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	0.45	0.6	1	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> =0.5A T <sub>J</sub> =125°C		0.54 0.81	0.65 1	Ω
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =0.5A		0.63	0.75	Ω
		V <sub>GS</sub> =1.8V, I <sub>D</sub> =0.3A		0.73	0.95	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =0.5A		1.5		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =0.1A, V <sub>GS</sub> =0V		0.65	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		35	45	pF
C <sub>oss</sub>	Output Capacitance		8			pF
C <sub>rss</sub>	Reverse Transfer Capacitance		6			pF
<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> =0.5A		0.63	1	nC
Q <sub>gs</sub>	Gate Source Charge		0.08			nC
Q <sub>gd</sub>	Gate Drain Charge		0.16			nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =5V, V <sub>DS</sub> =10V, R <sub>L</sub> =50Ω, R <sub>GEN</sub> =3Ω		4.5		ns
t <sub>r</sub>	Turn-On Rise Time		3.3			ns
t <sub>D(off)</sub>	Turn-Off DelayTime		70			ns
t <sub>f</sub>	Turn-Off Fall Time		35			ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =0.5A, dI/dt=100A/μs		8	10	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =0.5A, dI/dt=100A/μs		2		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<sub>θ</sub> ≤ 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.

F: The maximum current rating is limited by bond-wires

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N-Channel TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

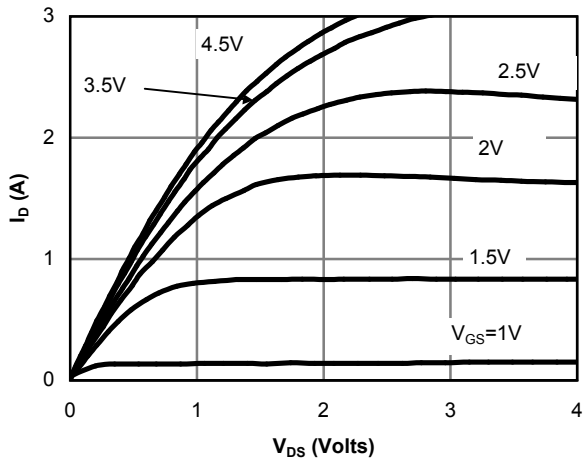


Figure 1: On-Region Characteristics

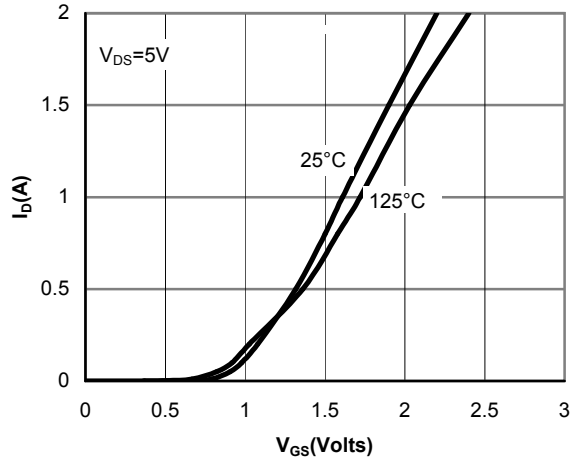


Figure 2: Transfer Characteristics

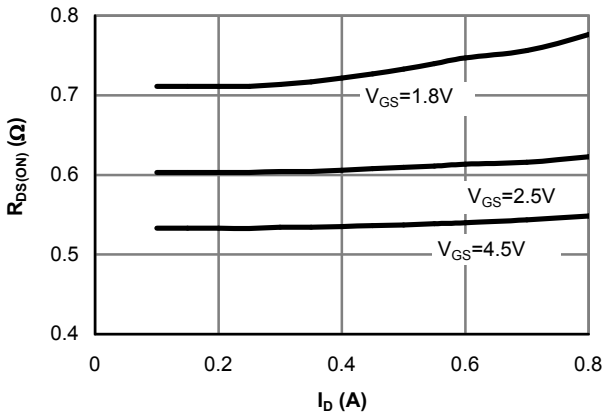


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

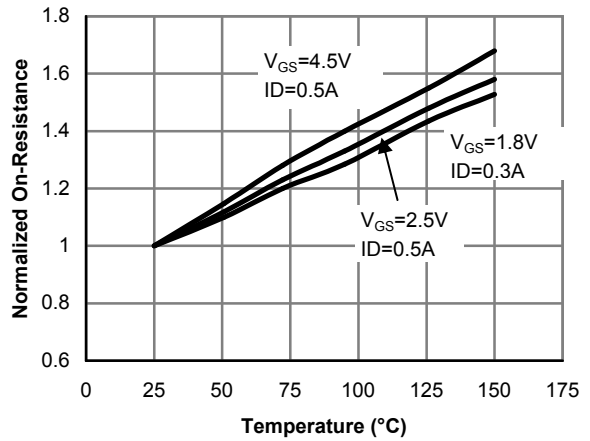


Figure 4: On-Resistance vs. Junction Temperature

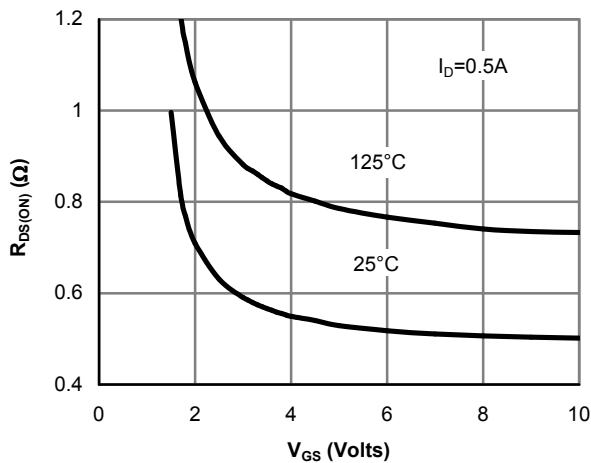


Figure 5: On-Resistance vs. Gate-Source Voltage

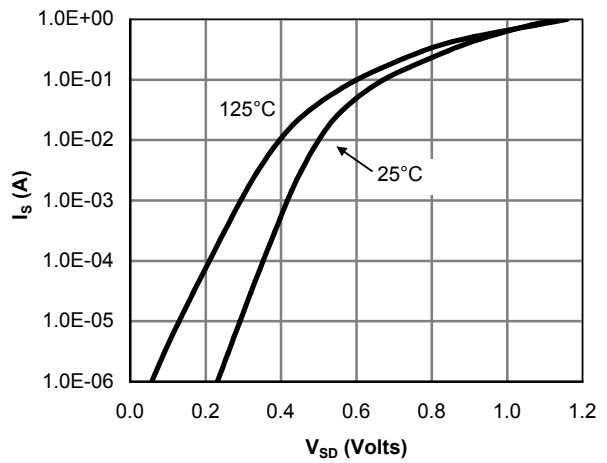


Figure 6: Body-Diode Characteristics

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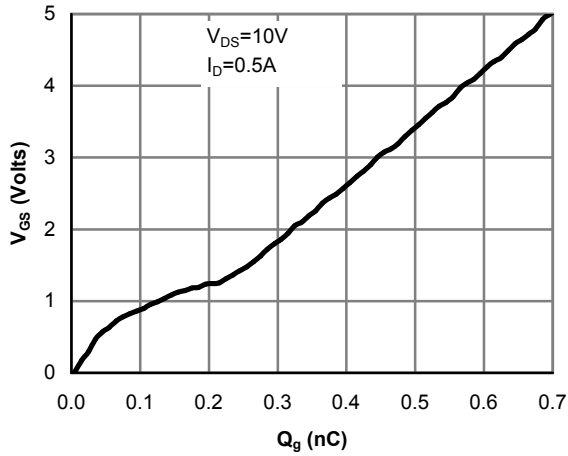


Figure 7: Gate-Charge Characteristics

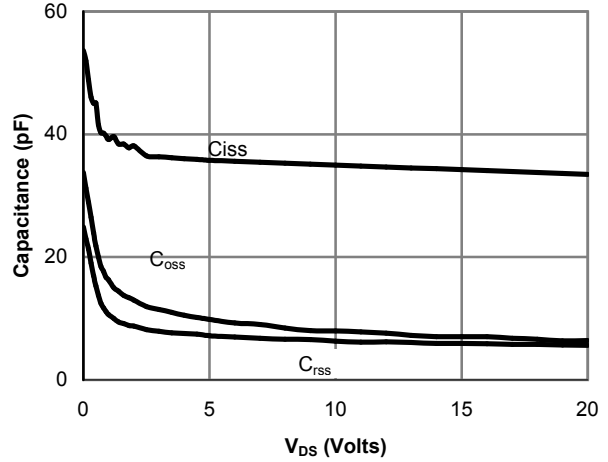


Figure 8: Capacitance Characteristics

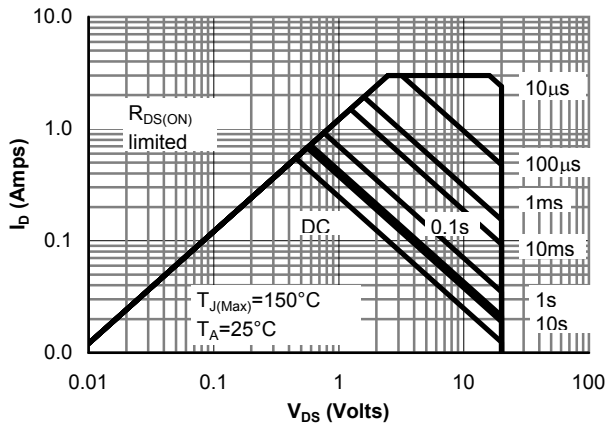


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

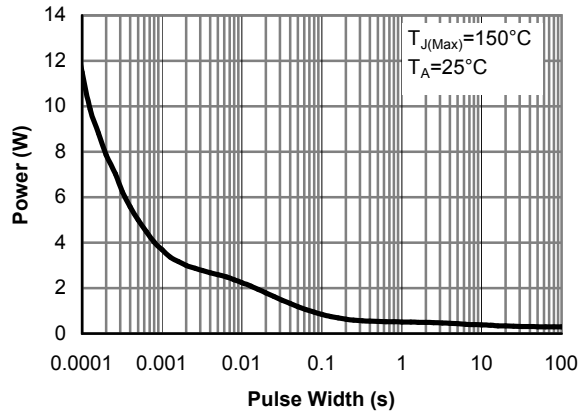


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

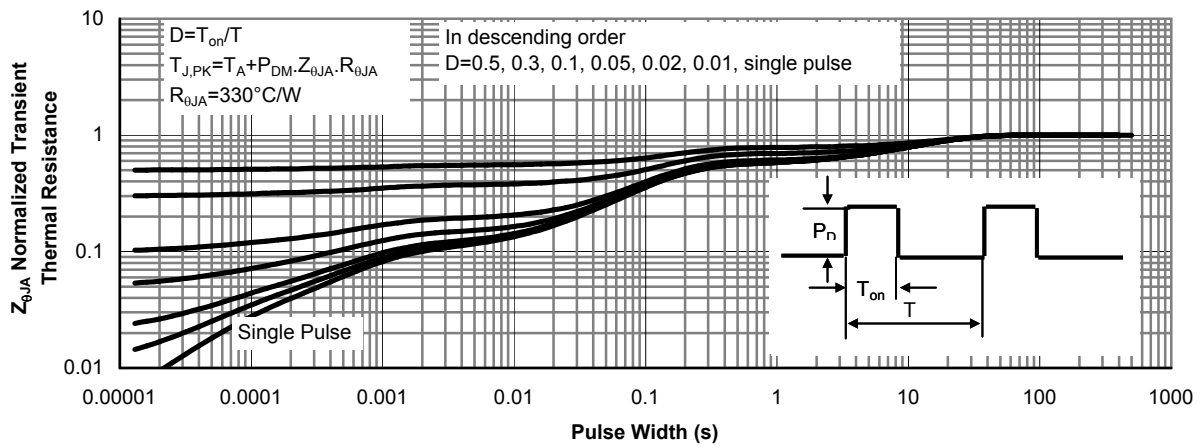


Figure 11: Normalized Maximum Transient Thermal Impedance

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$	-20			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-20\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 4.5\text{V}$			$\pm 1$	$\mu\text{A}$
		$V_{DS}=0\text{V}$ , $V_{GS}=\pm 8\text{V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$	-1	-0.6	-0.45	
$I_{D(ON)}$	On state drain current	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-5\text{V}$	-1			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-4.5\text{V}$ , $I_D=-0.5\text{A}$ $T_J=125^\circ\text{C}$		0.65 0.9	0.8 1.1	$\Omega$
		$V_{GS}=-2.5\text{V}$ , $I_D=-0.5\text{A}$		0.85	1	$\Omega$
		$V_{GS}=-1.8\text{V}$ , $I_D=-0.3\text{A}$		1.05	1.3	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-0.51\text{A}$		0.9		S
$V_{SD}$	Diode Forward Voltage	$I_S=-0.1\text{A}$ , $V_{GS}=0\text{V}$		-0.66	-1	V
$I_S$	Maximum Body-Diode Continuous Current				-0.5	A
<b>DYNAMIC PARAMETERS</b>						
$C_{ISS}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-10\text{V}$ , $f=1\text{MHz}$		72	100	pF
$C_{OSS}$	Output Capacitance			17		pF
$C_{RSS}$	Reverse Transfer Capacitance			9		pF
<b>SWITCHING PARAMETERS</b>						
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-10\text{V}$ , $R_L=50\Omega$ , $R_{GEN}=3\Omega$		60.5		ns
$t_r$	Turn-On Rise Time			150		ns
$t_{D(off)}$	Turn-Off Delay Time			612		ns
$t_f$	Turn-Off Fall Time			436		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=-0.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		27	35	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-0.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		8.3		nC

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design. The current rating is based on the  $t \leq 10\text{s}$  thermal resistance rating.

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

C: The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

D: The static characteristics in Figures 1 to 6,12,14 are obtained using <300  $\mu\text{s}$  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  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

F: The maximum current rating is limited by bond-wires

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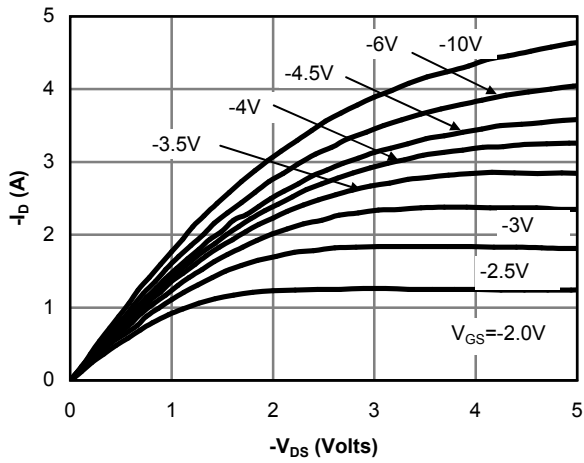


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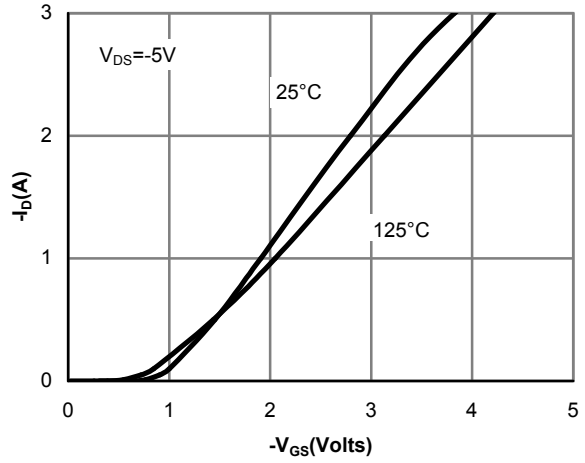


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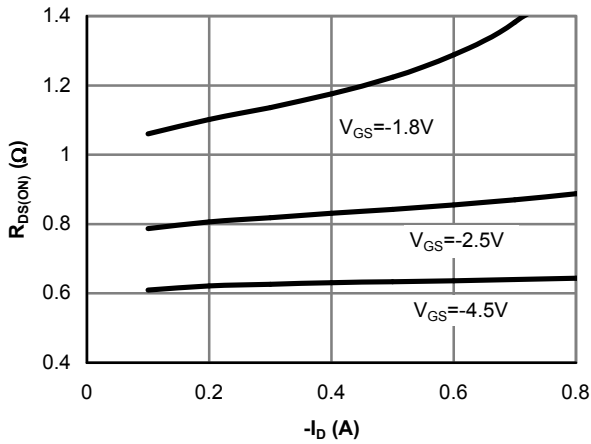


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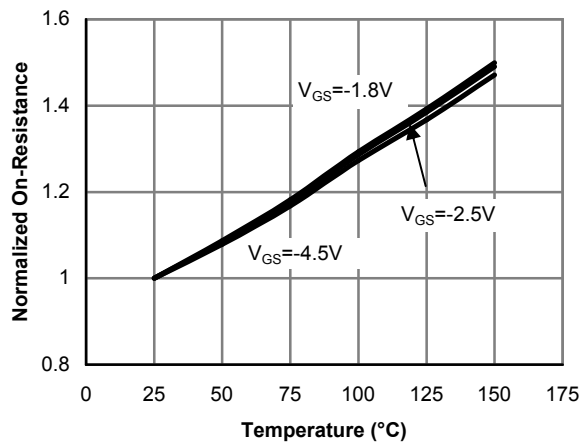


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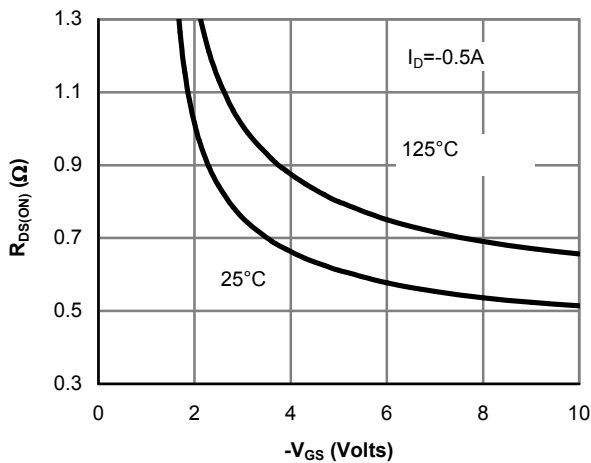


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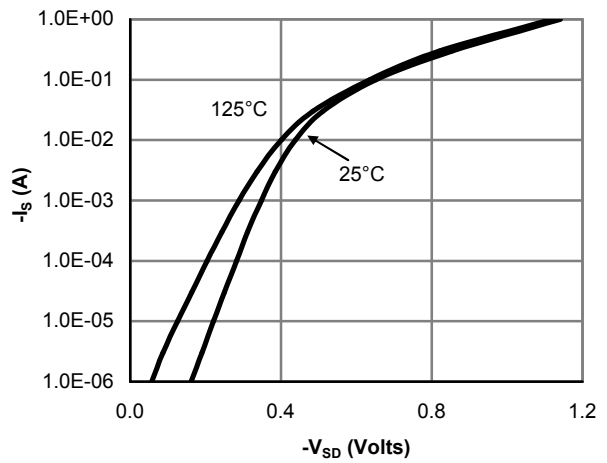


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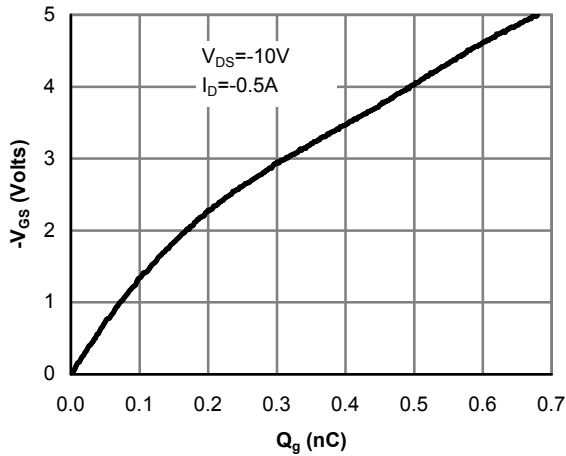


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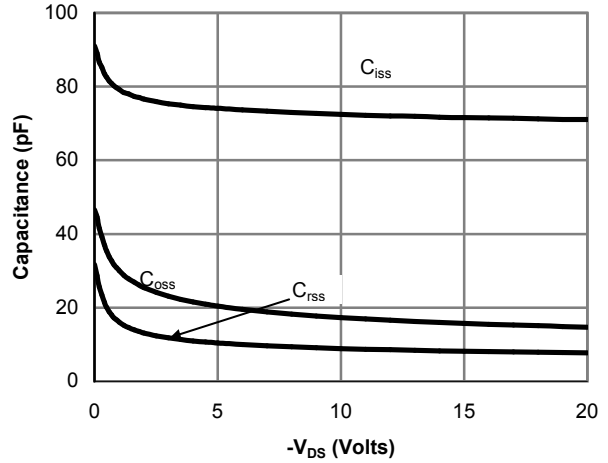


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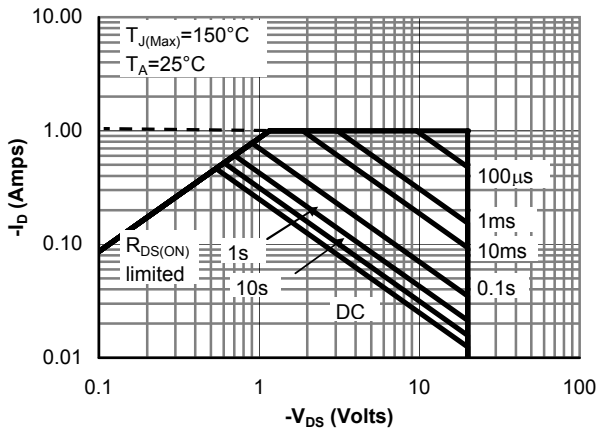


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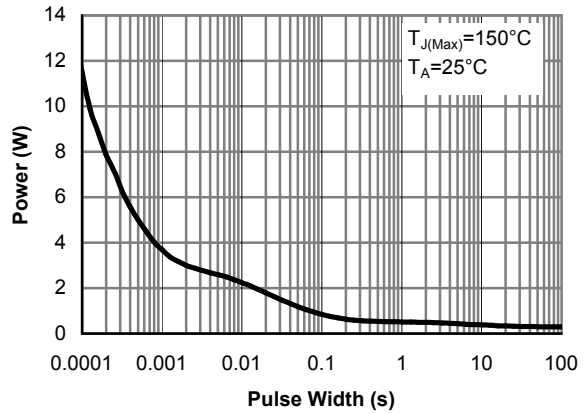


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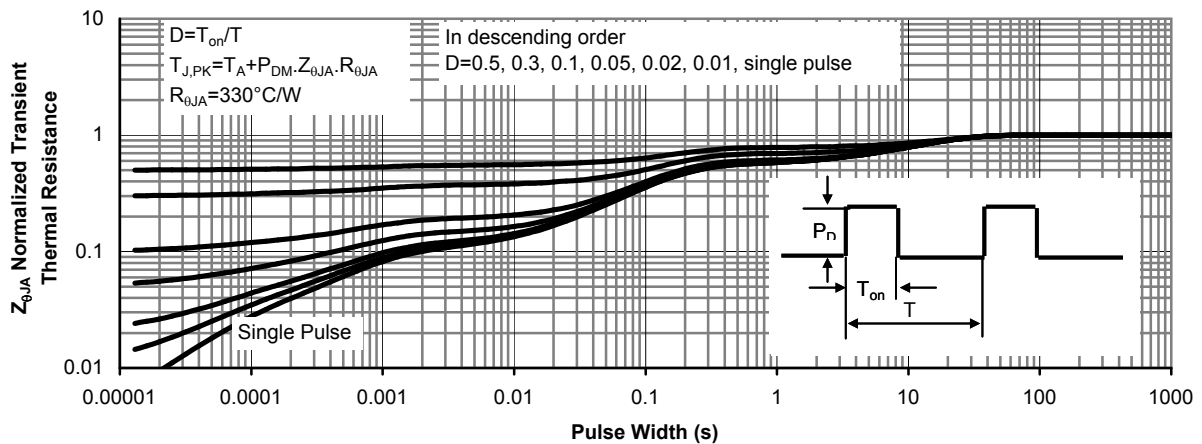
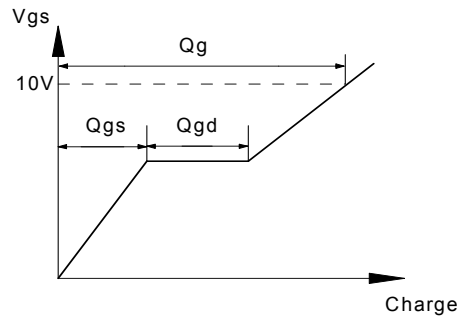
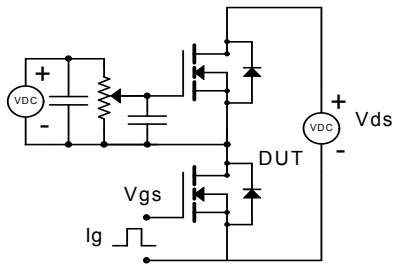
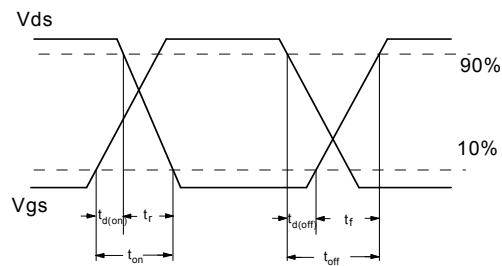
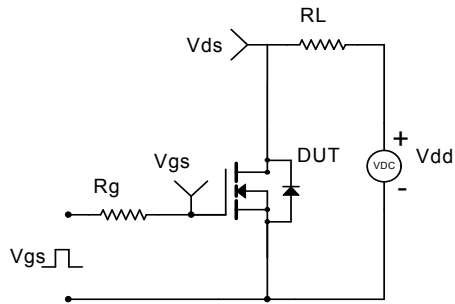


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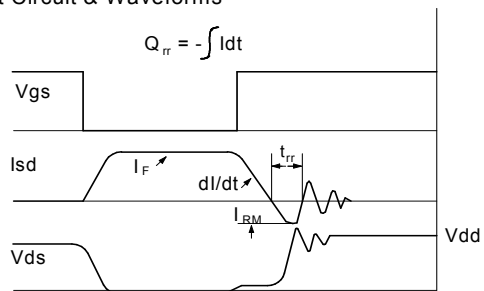
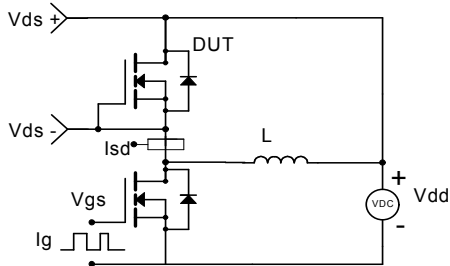
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms

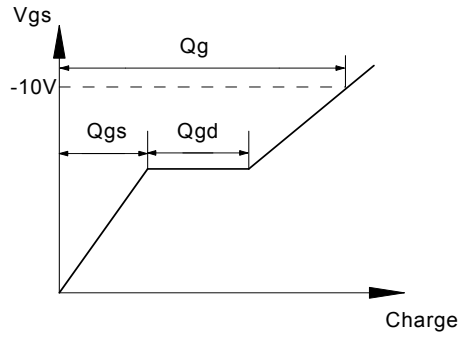
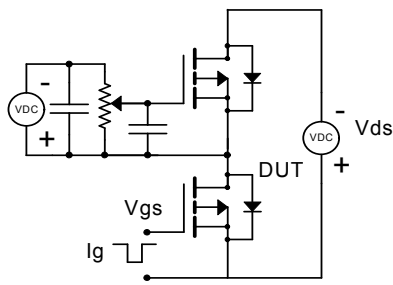


Diode Recovery Test Circuit & Waveforms

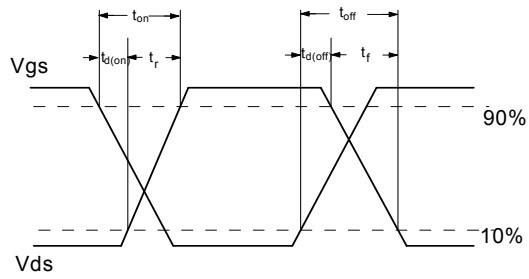
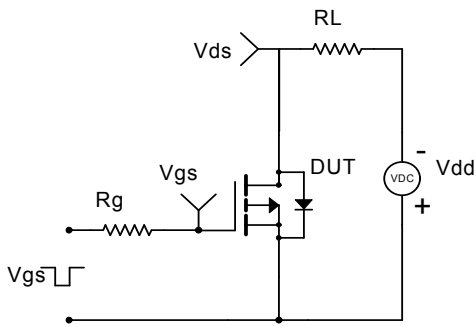




Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

