freescale

飞思卡尔(深圳)功率半导体有限公司

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

Features

n-channel

V_{DS} (V) = 20V, I_D = 0.6A (V_{GS}=4.5V)

$R_{DS(ON)}$< 0.65Ω   (V_{GS}= 4.5V)

$R_{DS(ON)}$< 0.75Ω   (V_{GS}= 2.5V)
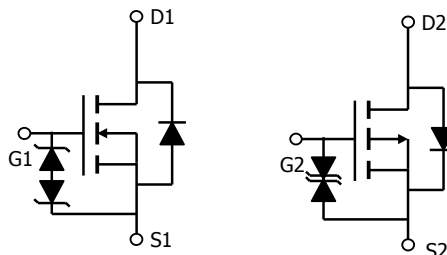
$R_{DS(ON)}$< 0.95Ω   (V_{GS}= 1.8V)

p-channel

V_{DS} (V) = -20V, I_D = -0.5A (V_{GS}=-4.5V)

$R_{DS(ON)}$< 0.8Ω   (V_{GS}= -4.5V)

$R_{DS(ON)}$< 1.0Ω   (V_{GS}= -2.5V)

$R_{DS(ON)}$< 1.3Ω   (V_{GS}= -1.8V)

RoHS Compliant

Absolute Maximum Ratings T_A=25°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}	±8		V
Continuous Drain Current [B,H]	T_C=25°C	I_D	0.6	-0.5	A
	T_C=100°C		0.4	-0.38	
Pulsed Drain Current [B]		I_{DM}	3	-1	
Power Dissipation	T_C=25°C	P_D	0.38	0.38	W
	T_C=100°C		0.24	0.24	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150		°C

Thermal Characteristics: n-channel and p-channel

Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{θJA}$	n-ch	275	330	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		n-ch	360	450	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{θJL}$	n-ch	300	350	°C/W
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{θJA}$	p-ch	275	330	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		p-ch	360	450	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{θJL}$	p-ch	300	350	°C/W

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		20			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=20V, V$_{GS}$=0V				1	µA
			T$_J$=55°C			5	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$=±4.5V				±1	µA
		V$_{DS}$=0V, V$_{GS}$=±8V				±100	µA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$ I$_D$=250µA		0.45	0.6	1	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=4.5V, V$_{DS}$=5V		3			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=4.5V, I$_D$=0.5A			0.54	0.65	Ω
			T$_J$=125°C		0.81	1	
		V$_{GS}$=2.5V, I$_D$=0.5A			0.63	0.75	Ω
		V$_{GS}$=1.8V, I$_D$=0.3A			0.73	0.95	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=5V, I$_D$=0.5A			1.5		S
V$_{SD}$	Diode Forward Voltage	I$_S$=0.1A,V$_{GS}$=0V			0.65	1	V
I$_S$	Maximum Body-Diode Continuous Current					0.4	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=10V, f=1MHz			35	45	pF
C$_{oss}$	Output Capacitance				8		pF
C$_{rss}$	Reverse Transfer Capacitance				6		pF
SWITCHING PARAMETERS							
Q$_g$	Total Gate Charge	V$_{GS}$=4.5V, V$_{DS}$=10V, I$_D$=0.5A			0.63	1	nC
Q$_{gs}$	Gate Source Charge				0.08		nC
Q$_{gd}$	Gate Drain Charge				0.16		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=5V, V$_{DS}$=10V, R$_L$=50Ω, R$_{GEN}$=3Ω			4.5		ns
t$_r$	Turn-On Rise Time				3.3		ns
t$_{D(off)}$	Turn-Off DelayTime				70		ns
t$_f$	Turn-Off Fall Time				35		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=0.5A, dI/dt=100A/µs			8	10	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=0.5A, dI/dt=100A/µs			2		nC

A: The value of R$_{θJA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=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$_{θJA}$ is the sum of the thermal impedance from junction to lead R$_{θJL}$ 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^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25°C. The SOA curve provides a single pulse rating.

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

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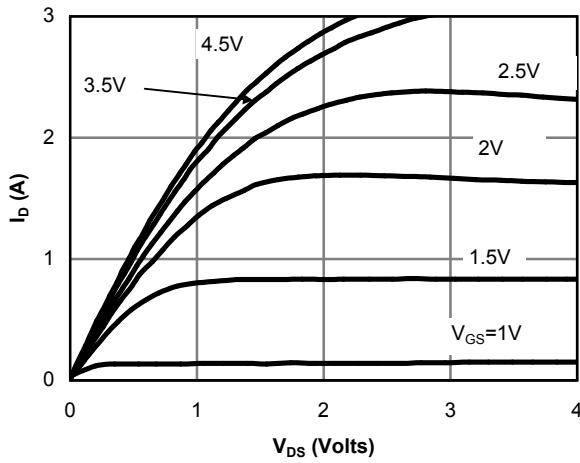**N-Channel TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**
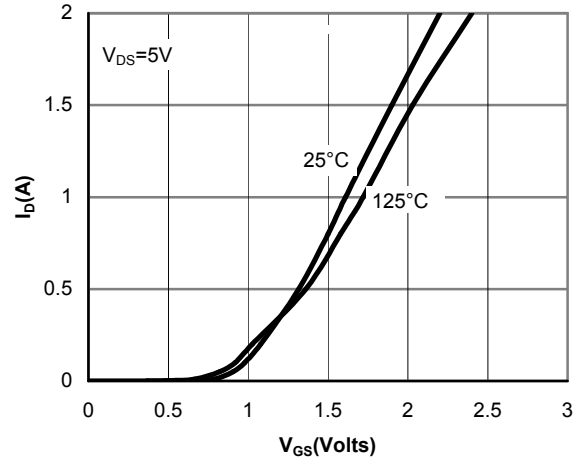
Figure 1: On-Region Characteristics

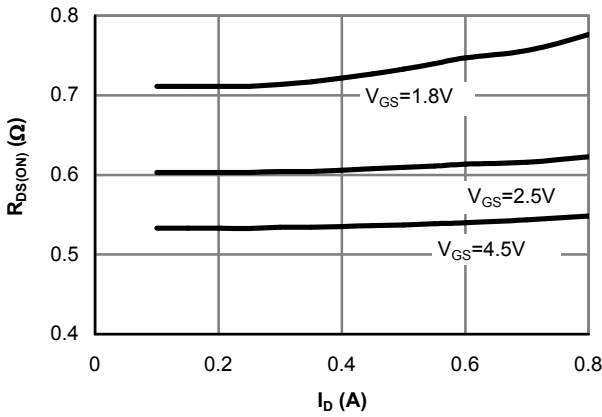Figure 2: Transfer Characteristics

Figure 3: On-Resistance vs. Drain Current and Gate Voltage
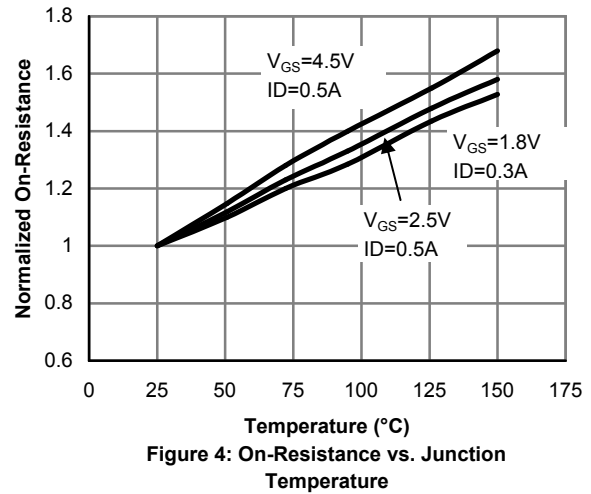
Figure 4: On-Resistance vs. Junction Temperature

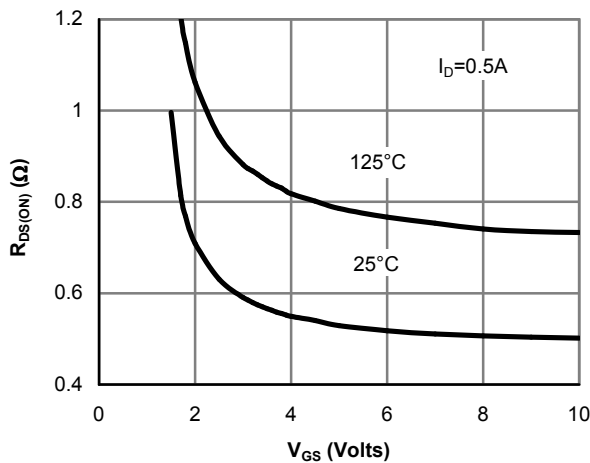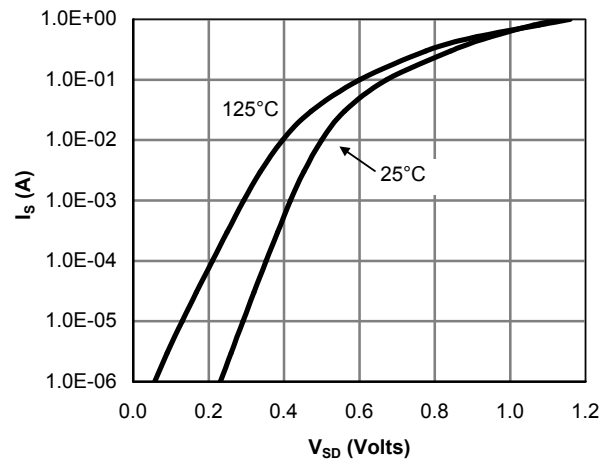Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics

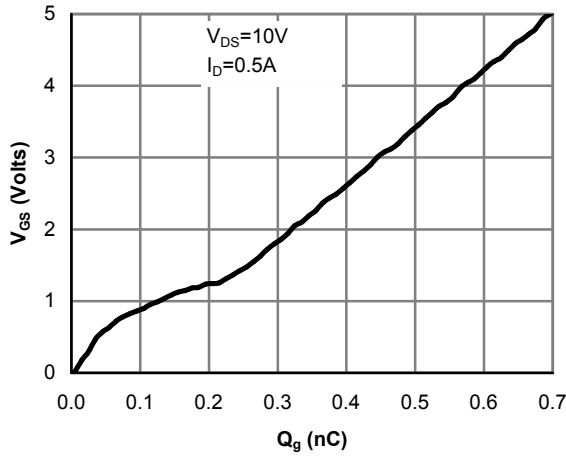## N-Channel TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
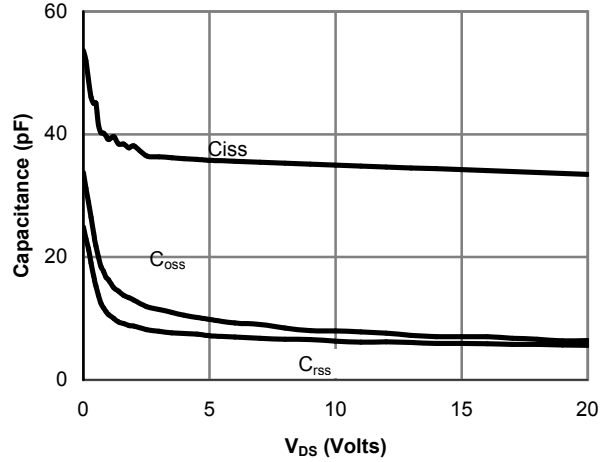
Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics
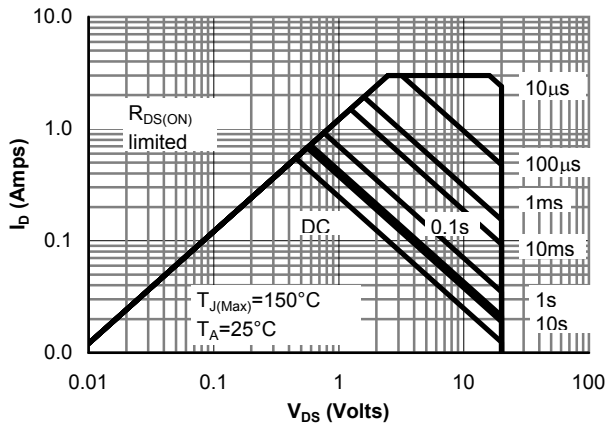
Figure 9: Maximum Forward Biased Safe Operating Area (Note E)
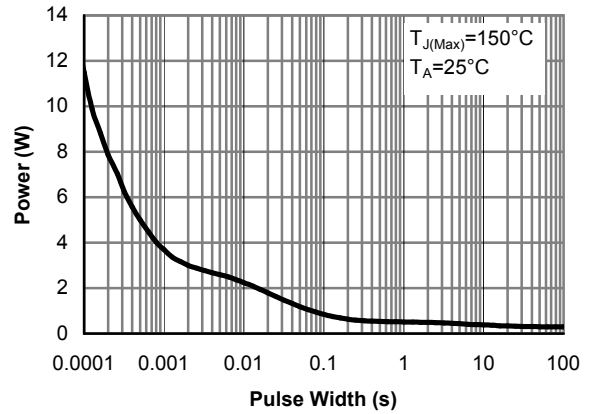
Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)
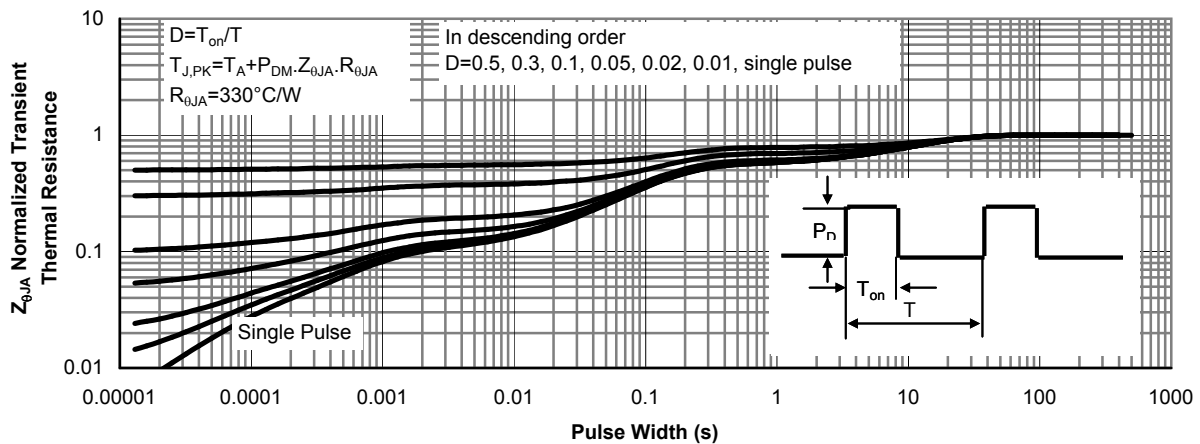
Figure 11: Normalized Maximum Transient Thermal Impedance

P-Channel Electrical Characteristics (T$_J$=25°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		-20			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=-20V, V$_{GS}$=0V				1	μA
			T$_J$=55°C			5	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$=±4.5V				±1	μA
		V$_{DS}$=0V, V$_{GS}$=±8V				±10	μA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$ I$_D$=-250μA		-1	-0.6	-0.45	
I$_{D(ON)}$	On state drain current	V$_{GS}$=-4.5V, V$_{DS}$=-5V		-1			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=-4.5V, I$_D$=-0.5A			0.65	0.8	Ω
			T$_J$=125°C		0.9	1.1	
		V$_{GS}$=-2.5V, I$_D$=-0.5A			0.85	1	Ω
		V$_{GS}$=-1.8V, I$_D$=-0.3A			1.05	1.3	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=-5V, I$_D$=-0.51A			0.9		S
V$_{SD}$	Diode Forward Voltage	I$_S$=-0.1A,V$_{GS}$=0V			-0.66	-1	V
I$_S$	Maximum Body-Diode Continuous Current					-0.5	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=-10V, f=1MHz			72	100	pF
C$_{oss}$	Output Capacitance				17		pF
C$_{rss}$	Reverse Transfer Capacitance				9		pF
SWITCHING PARAMETERS							
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=-4.5V, V$_{DS}$=-10V, R$_L$=50Ω, R$_{GEN}$=3Ω			60.5		ns
t$_r$	Turn-On Rise Time				150		ns
t$_{D(off)}$	Turn-Off DelayTime				612		ns
t$_f$	Turn-Off Fall Time				436		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=-0.5A, dI/dt=100A/μs			27	35	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=-0.5A, dI/dt=100A/μs			8.3		nC

A: The value of R$_{θJA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=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$_{θJA}$ is the sum of the thermal impedence from junction to lead R$_{θJL}$ 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^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25°C. The SOA curve provides a single pulse rating.

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

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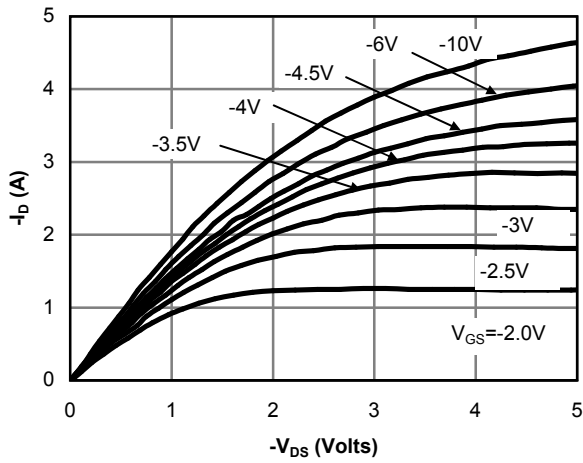
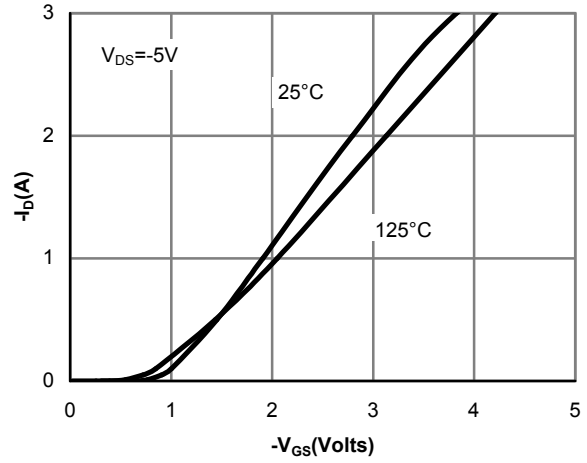Figure 1: On-Region Characteristics
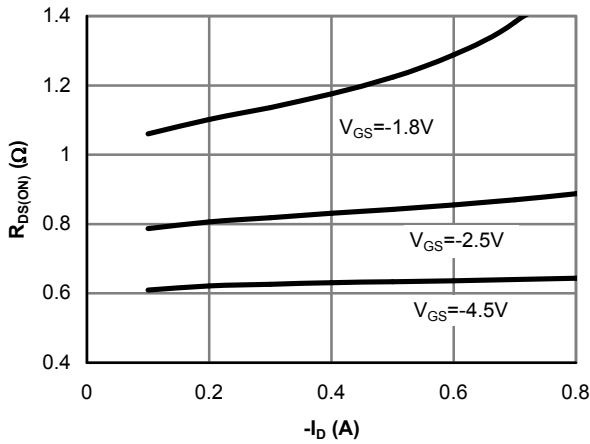
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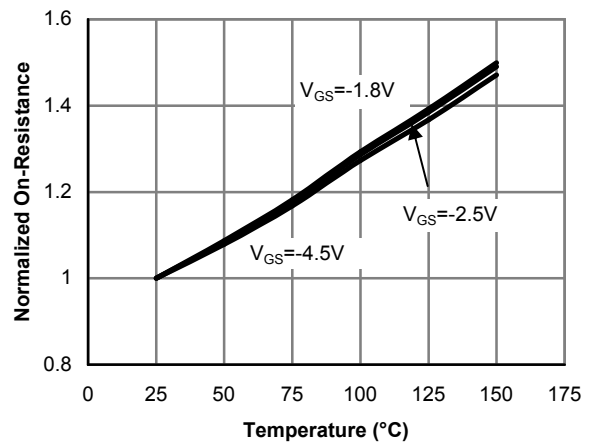
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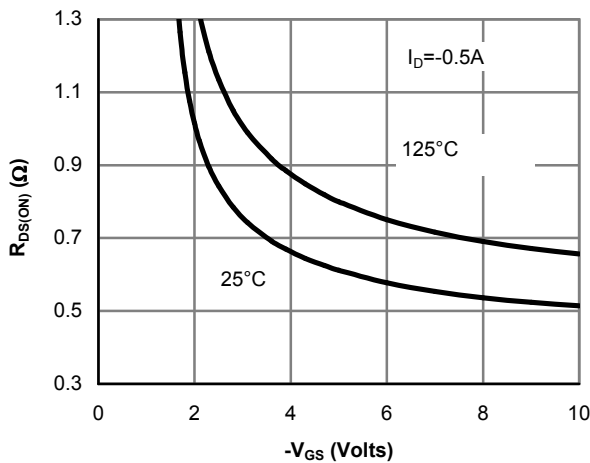
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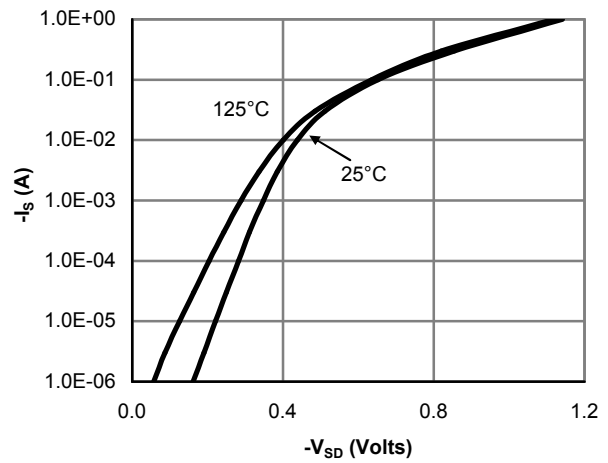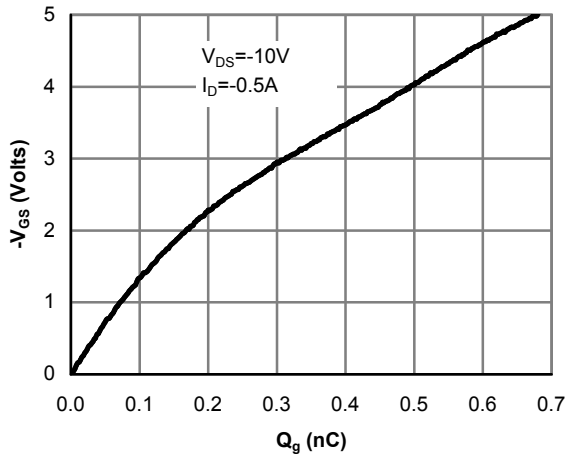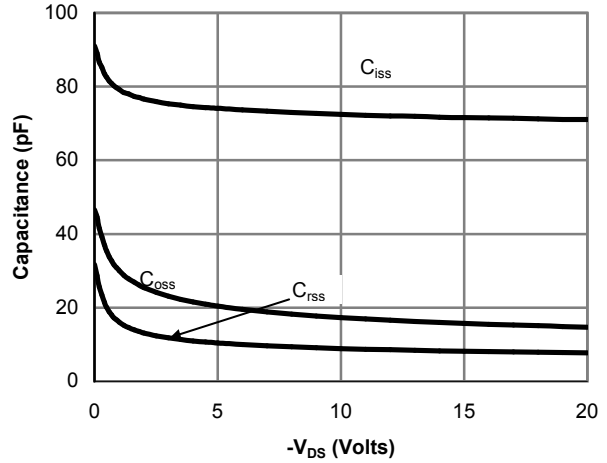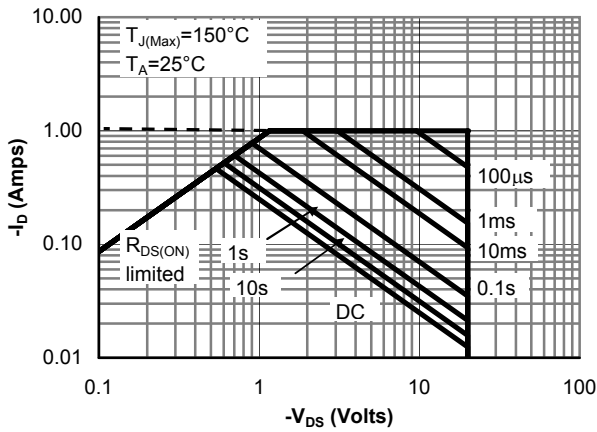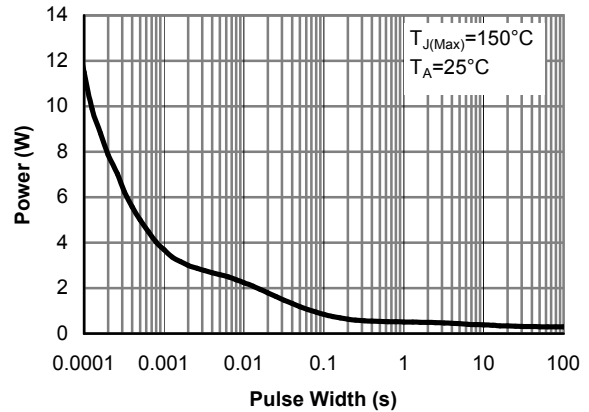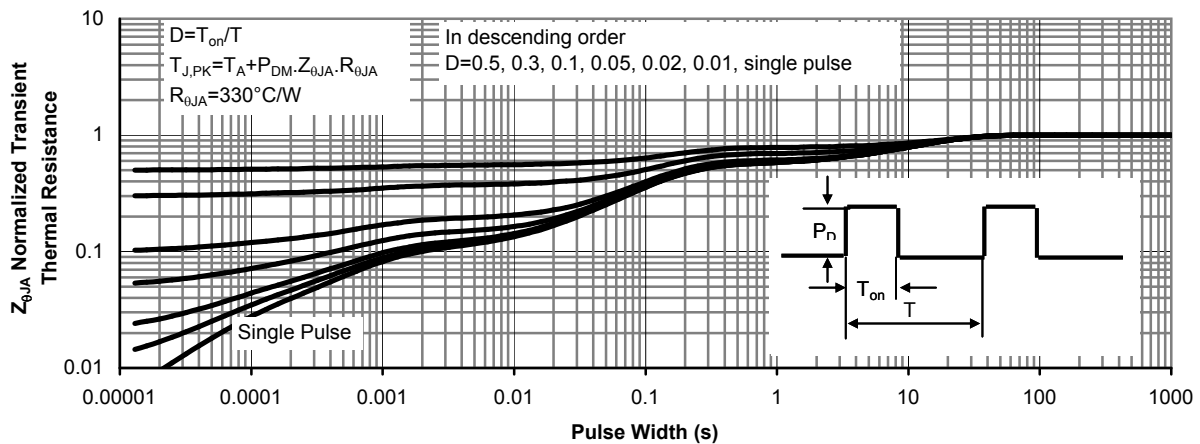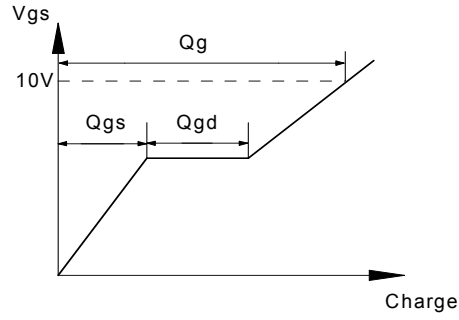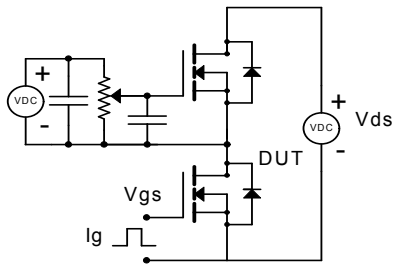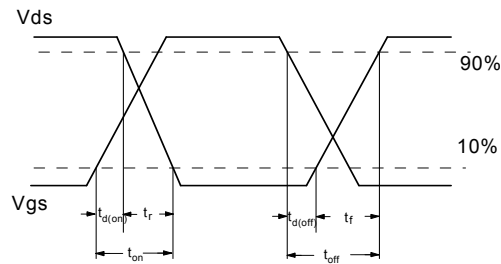
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Complementary Enhancement Mode Field Effect Transistor

P-Channel TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Gate-Charge Characteristics

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

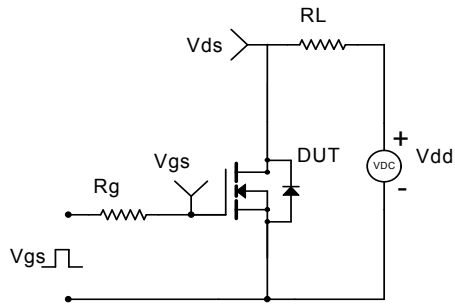**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**
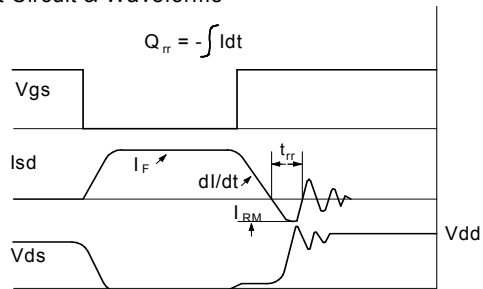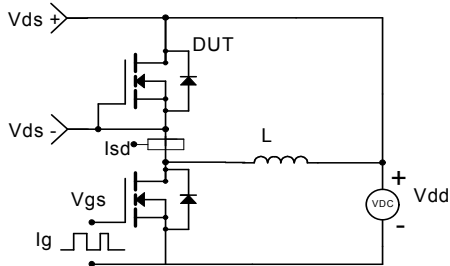

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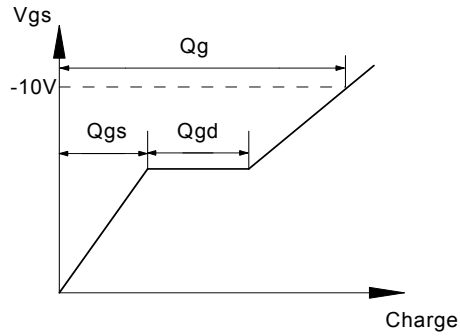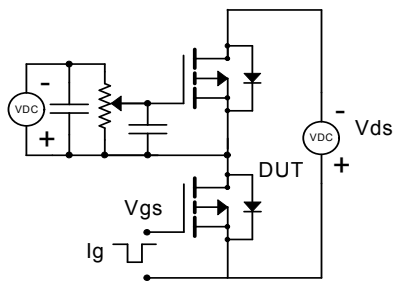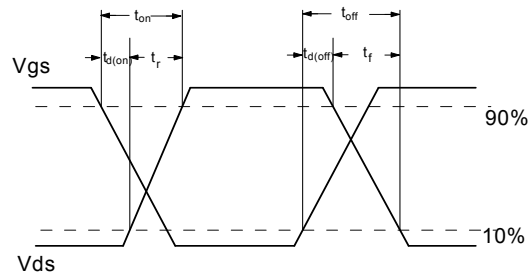
Gate Charge Test Circuit & Waveform
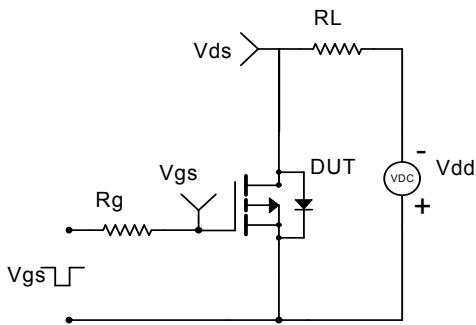

Resistive Switching Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int Idt$$

Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms

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