TM6602
N and P-CHANNEL ENHANCEMENT MOSFET

General Description

The TM6602 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs form a high-speed power inverter, suitable for a multitude of applications.

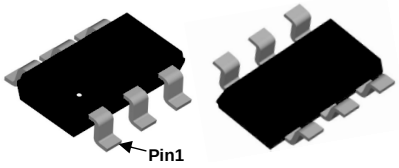
Product Summary

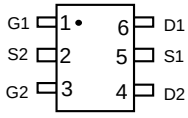
N-Channel	P-Channel
V_{DS}= 30V	-30V
I_D= 3.5A (V_{GS}=10V)	-2.7A (V_{GS}=-10V)
$R_{DS(ON)}$	$R_{DS(ON)}$
< 50mΩ (V_{GS}=10V)	< 100mΩ (V_{GS}=-10V)
< 70mΩ (V_{GS}=4.5V)	< 170mΩ (V_{GS}=-4.5V)

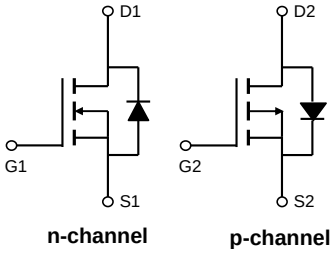
100% UIS Tested
100% R_g Tested

Green Product

SOT-23-6







Absolute Maximum Ratings T_A=25℃ unless otherwise noted

Parameter		Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage		V_{DS}	30	-30	V
Gate-Source Voltage		V_{GS}	±20	±20	V
Continuous Drain Current	T_A=25℃	I_D	3.5	-2.7	A
	T_A=70℃		3	-2.1	
Pulsed Drain Current [C]		I_{DM}	20	-15	
Power Dissipation [B]	T_A=25℃	P_D	1.15	1.15	W
	T_A=70℃		0.73	0.73	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150		℃

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	78	110	℃/W
Maximum Junction-to-Ambient [A D]	Steady-State		106	150	℃/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	64	80	℃/W

N-Channel Electrical Characteristics (T_J=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250μA, V_{GS}=0V	30			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=30V, V_{GS}=0V			1	μA
		T_J=55℃			5	
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	1.5	2	2.5	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V	20			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=3.5A		40	50	mΩ
		T_J=125℃		61	77	
		V_{GS}=4.5V, I_D=2A		52	70	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=3.5A		12		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.79	1	V
I_S	Maximum Body-Diode Continuous Current				1.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		170	210	pF
C_{oss}	Output Capacitance			35		pF
C_{rss}	Reverse Transfer Capacitance			23		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	1.7	3.5	5.3	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=15V, I_D=3.5A		4.05	5	nC
Q_g(4.5V)	Total Gate Charge			2	3	nC
Q_{gs}	Gate Source Charge			0.55		nC
Q_{gd}	Gate Drain Charge			1		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=4.2Ω, R_{GEN}=3Ω		4.5		ns
t_r	Turn-On Rise Time			1.5		ns
$t_{D(off)}$	Turn-Off DelayTime			18.5		ns
t_f	Turn-Off Fall Time			15.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=3.5A, dI/dt=100A/μs		7.5	10	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=3.5A, dI/dt=100A/μs		2.5		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25℃. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on $T_{J(MAX)}$=150℃, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150℃. Ratings are based on low frequency and duty cycles to keep initialT_J=25℃.

D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead 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-ambient thermal impedence which is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150℃. The SOA curve provides a single pulse ratin g.

N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

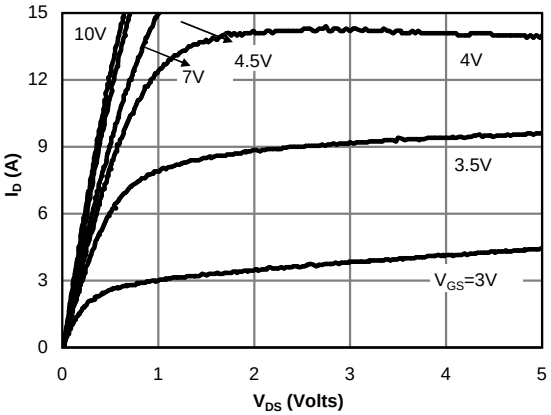


Fig 1: On-Region Characteristics (Note E)

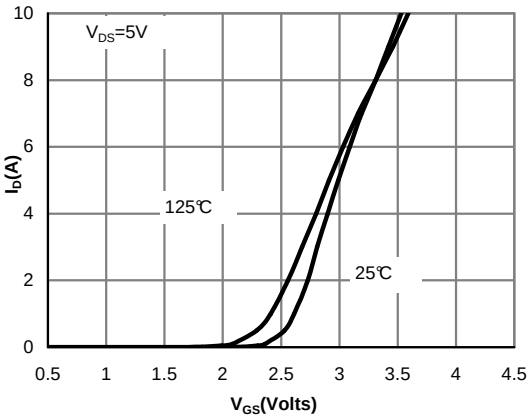


Figure 2: Transfer Characteristics (Note E)

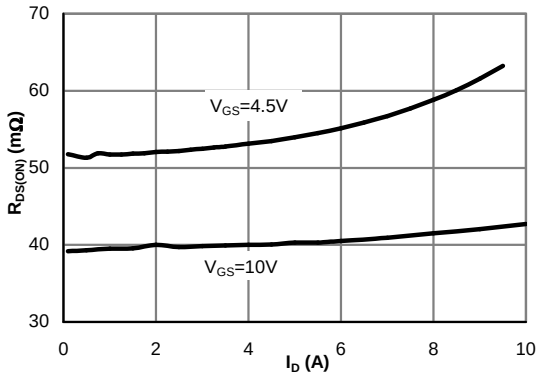


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

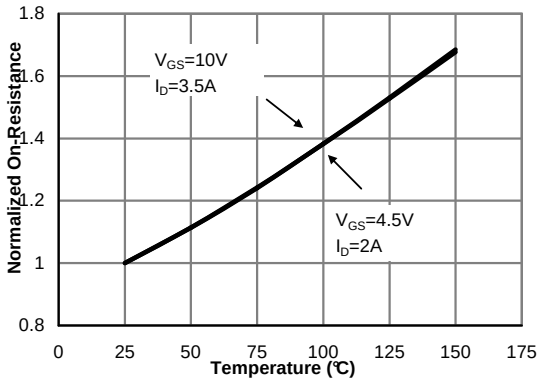


Figure 4: On-Resistance vs. Junction Temperature (Note E)

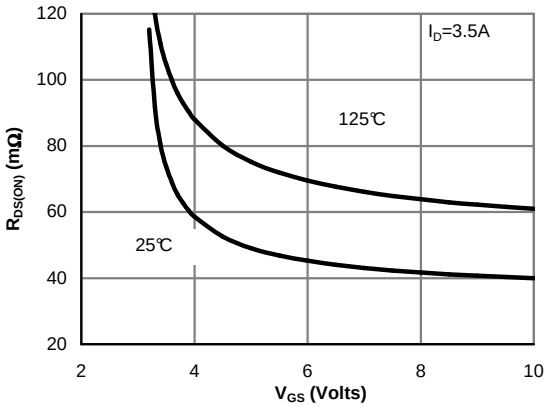


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

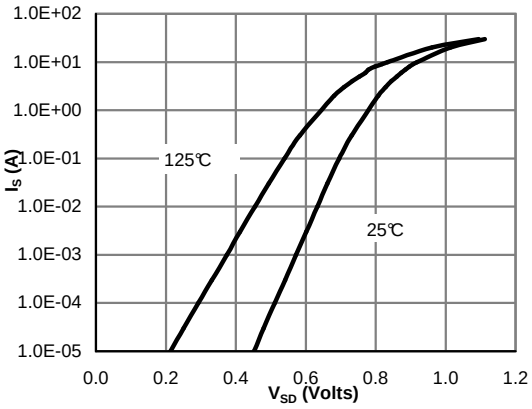


Figure 6: Body-Diode Characteristics (Note E)

N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

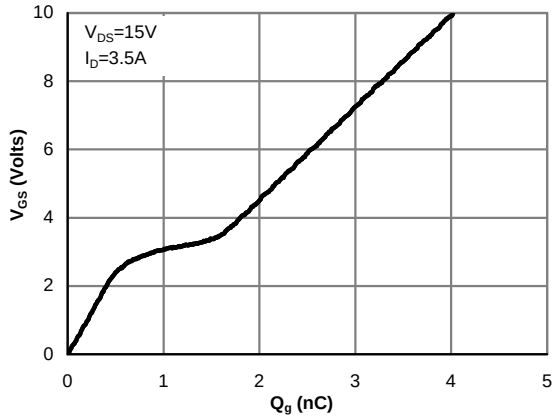


Figure 7: Gate-Charge Characteristics

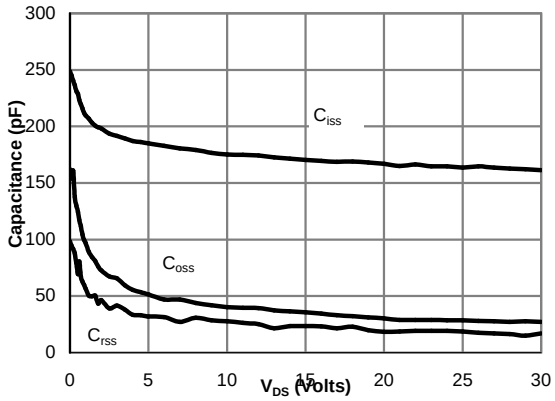


Figure 8: Capacitance Characteristics

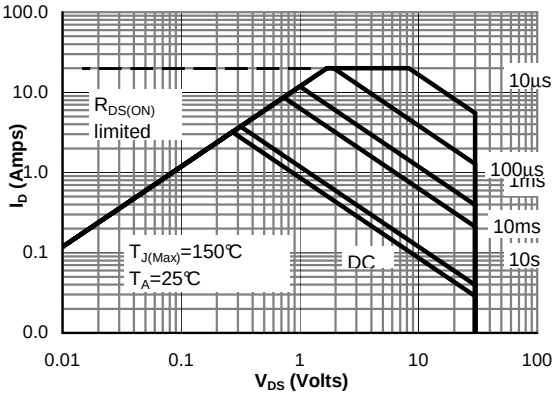


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

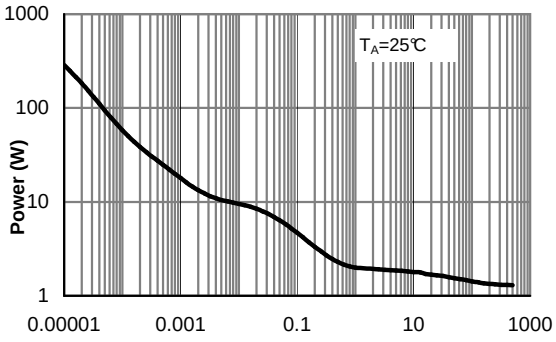


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

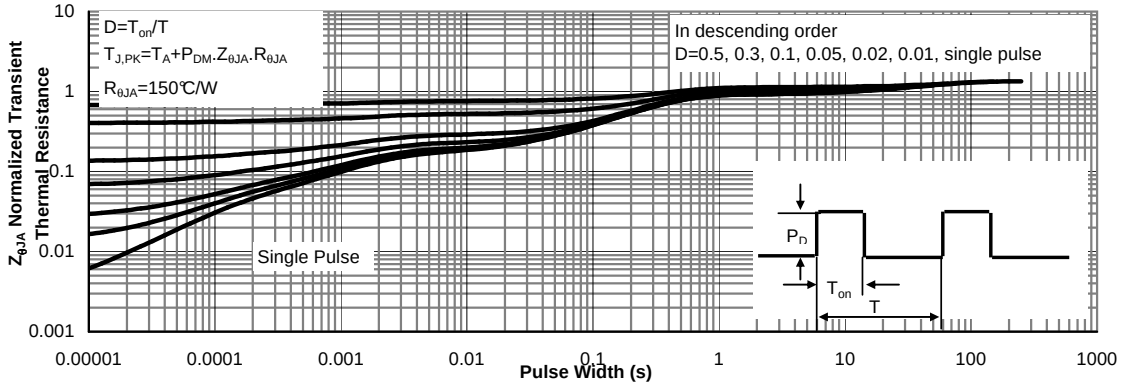
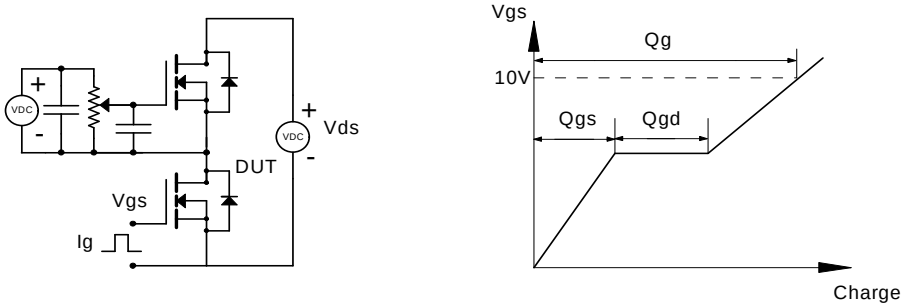
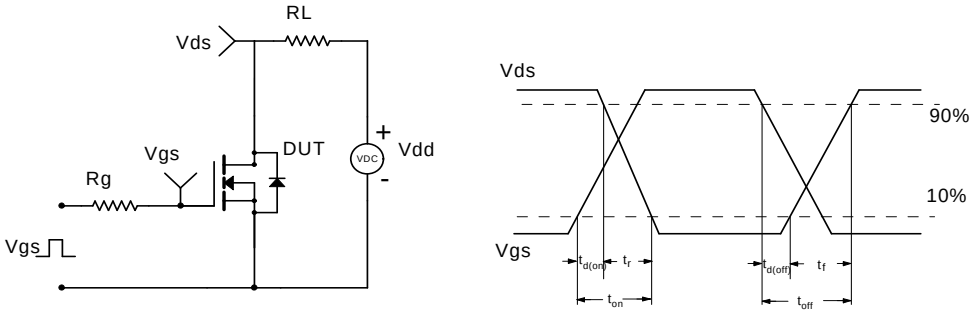


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

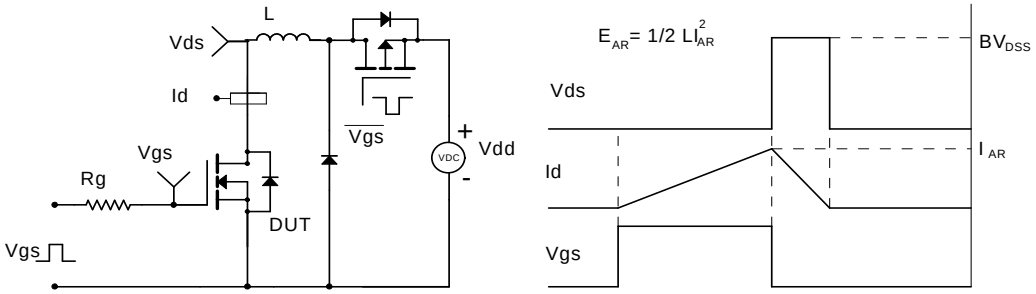
Gate Charge Test Circuit & Waveform



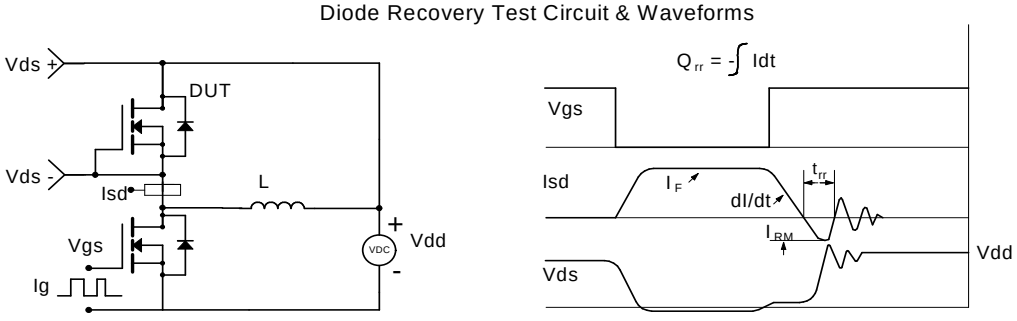
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



P-Channel Electrical Characteristics (T_J=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=-250μA, V_{GS}=0V	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-30V, V_{GS}=0V			-1	μA
		T_J=55℃			-5	
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	-1.4	-1.9	-2.4	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-15			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-2.7A		82	100	mΩ
		T_J=125℃		115	140	
		V_{GS}=-4.5V, I_D=-2A		130	170	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-2.7A		5.5		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.8	-1	V
I_S	Maximum Body-Diode Continuous Current				-1.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz		197	240	pF
C_{oss}	Output Capacitance			42		pF
C_{rss}	Reverse Transfer Capacitance			26	37	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	3.5	7.2	11.0	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=-15V, I_D=2.7A		4.3	5.2	nC
Q_g(4.5V)	Total Gate Charge			2.2	3	nC
Q_{gs}	Gate Source Charge			0.7		nC
Q_{gd}	Gate Drain Charge			1.1		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=-15V, R_L=5.55Ω, R_{GEN}=3Ω		7.5		ns
t_r	Turn-On Rise Time			4.1		ns
$t_{D(off)}$	Turn-Off DelayTime			11.8		ns
t_f	Turn-Off Fall Time			3.8		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-2.7A, dI/dt=100A/μs		11.3	14	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-2.7A, dI/dt=100A/μs		4.4		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25℃. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on $T_{J(MAX)}$=150℃, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150℃. Ratings are based on low frequency and duty cycles to keep initialT_J=25℃.

D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead 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-ambient thermal impedence which is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150℃. The SOA curve provides a single pulse ratin g.

P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

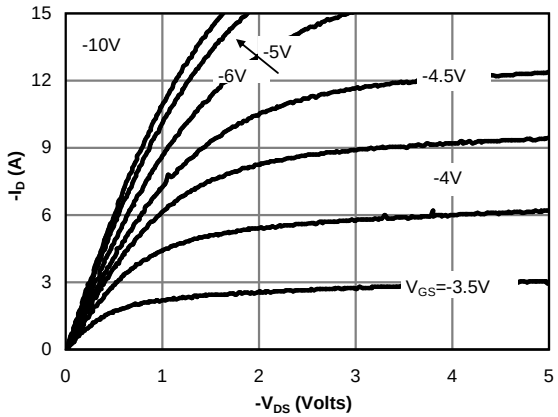


Fig 1: On-Region Characteristics (Note E)

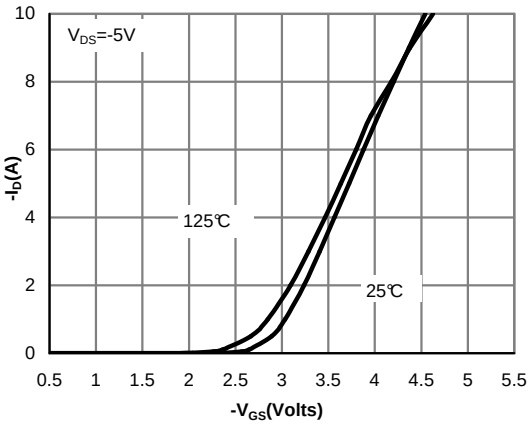


Figure 2: Transfer Characteristics (Note E)

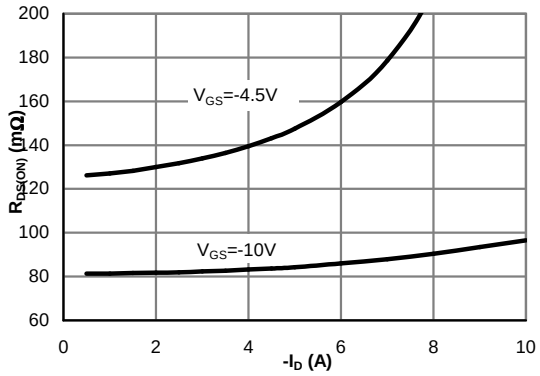


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

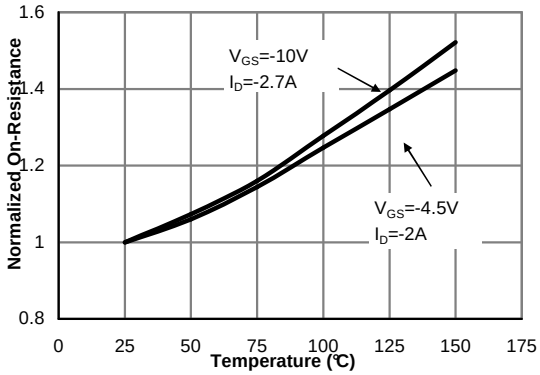


Figure 4: On-Resistance vs. Junction Temperature (Note E)

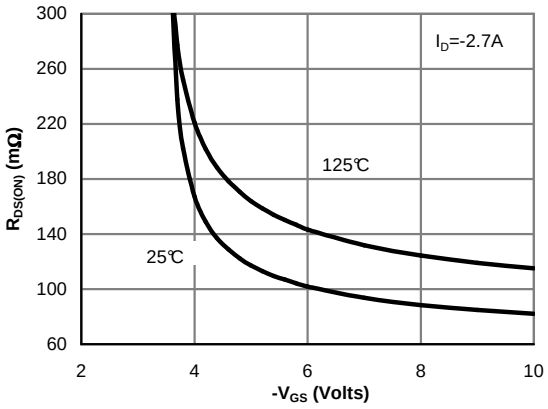


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

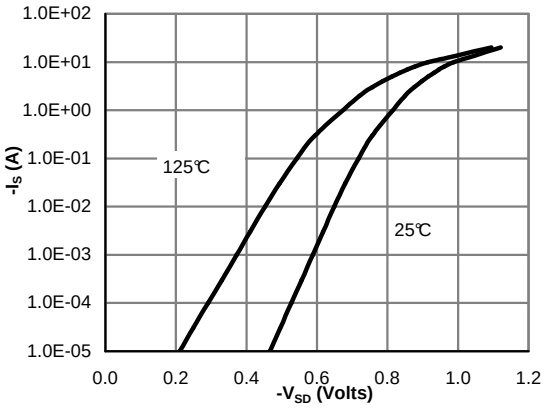


Figure 6: Body-Diode Characteristics (Note E)

P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

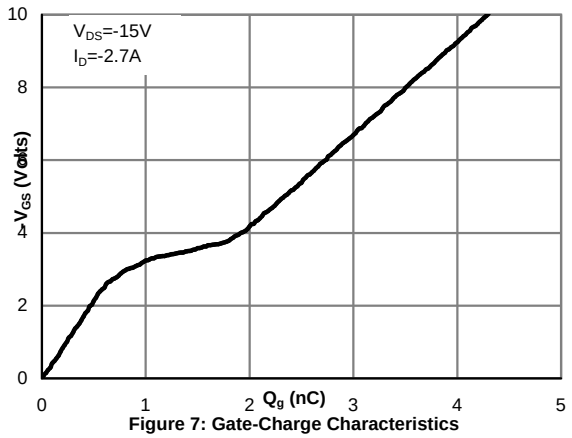


Figure 7: Gate-Charge Characteristics

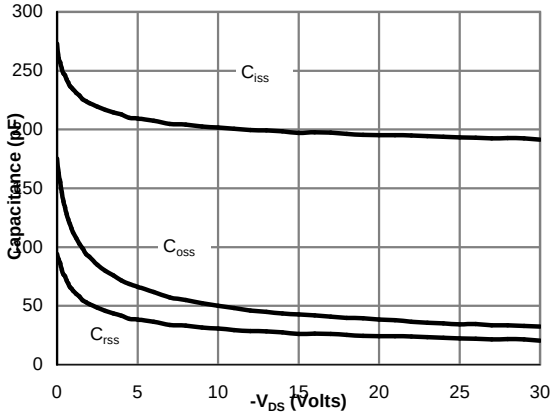


Figure 8: Capacitance Characteristics

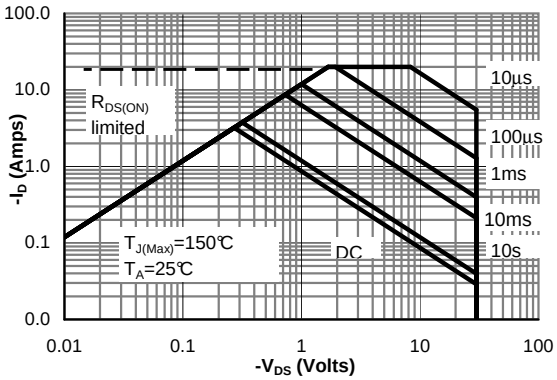


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

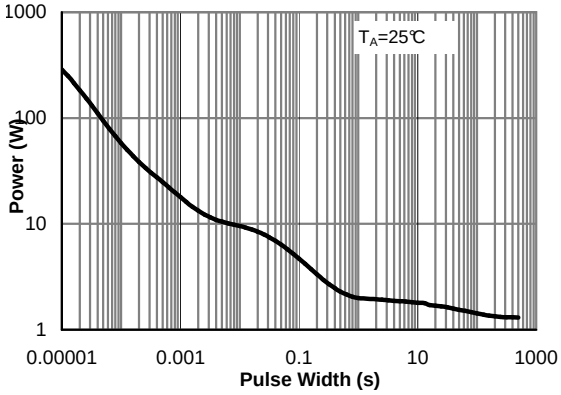


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

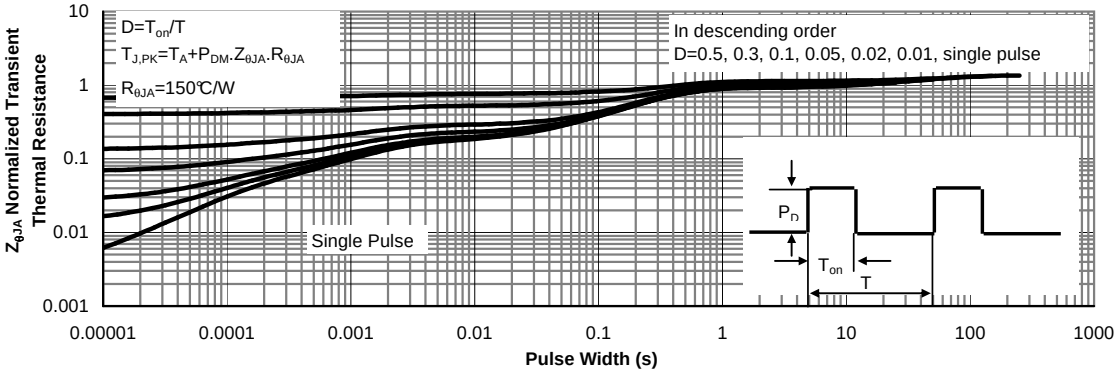
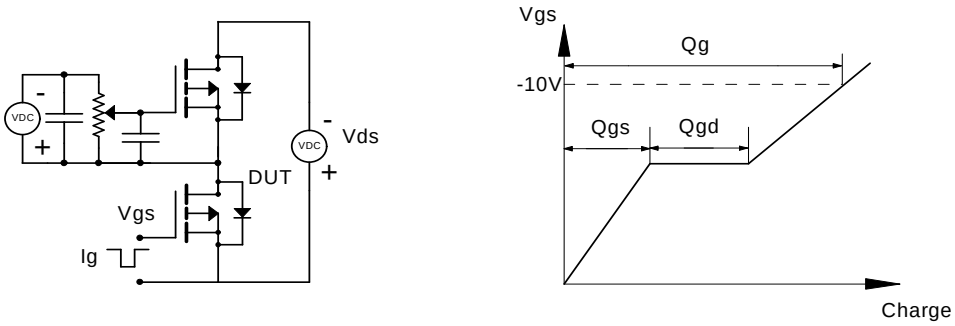
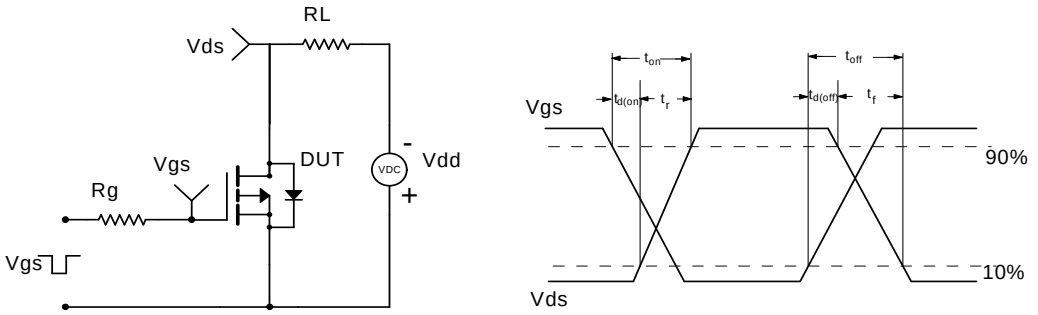


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

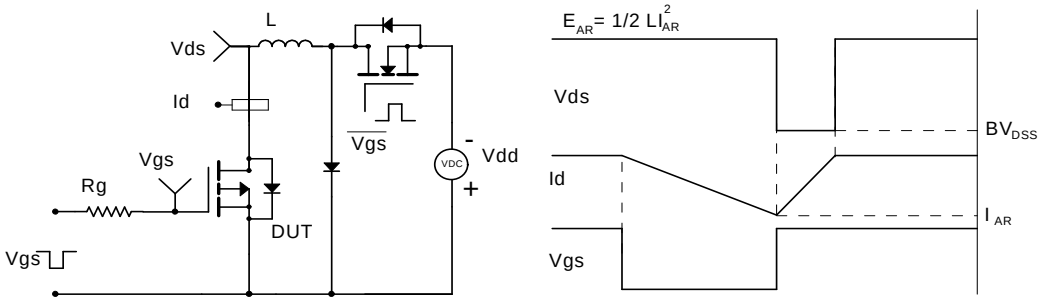
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms