



SUPER-SEMI



SUPER-MOSFET

Super Gate Metal Oxide Semiconductor Field Effect Transistor

30V Complementary Power Transistor
SGO4606T

Rev. 1.0
Aug. 2016

www.supersemi.com.cn

SGO4606T

30V Complementary MOSFET

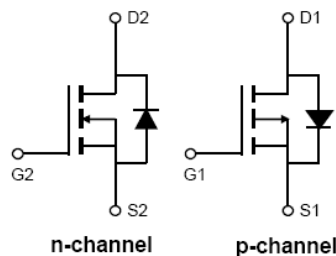
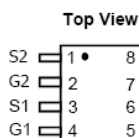
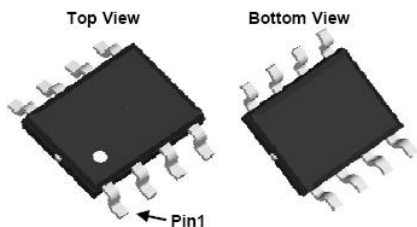
Description

The SG-MOSFET uses trench MOSFET technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of RDS(ON), Ciss and Coss. This complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

Features

- | | N-Channel | P-Channel |
|------------------------|-----------|-----------|
| • VDS | 30V | -30V |
| • ID (at Vgs=10V) | 6A | -6.5A |
| • RDS(on) (at Vgs=10V) | <29.0mΩ | <28.0mΩ |
| (at Vgs=4.5V) | <40.0mΩ | <42.0mΩ |
- Excellent Avalanche Performance

SGO4606T



Absolute Maximum Ratings

Symbol	Parameter	SGO4606T-N ch	SGO4606T-P ch	Unit
V _{DS}	Drain-Source Voltage	30	-30	V
I _D	Drain Current -Continuous (TA = 25°C) -Continuous (TA = 70°C)	6* 5*	-6.5* -5.3*	A
I _{DM}	Drain Current - Pulsed (Note 1)	30*	-30*	A
V _{GS}	Gate-Source voltage	±20	±20	V
I _{AS}	Single Pulse Avalanche Current (Note 1)	18	34	A
E _{AS}	Single Pulse Avalanche Energy L=0.1mH (Note 1)	16	58	mJ
P _D	Power Dissipation - TA = 25°C (Note 2) - TA = 70°C	2.0 1.3	2.0 1.3	W
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	-55 to +150	°C

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	SGO4606T	Unit
R _{θJA}	Maximum Junction-to-Ambient, t<10s(Note 3)	48(typ.)	°C/W
	Maximum Junction-to-Ambient, Steady-State(Note 3,4)	74(typ.)	°C/W
R _{θJL}	Maximum Junction-to-Lead, Steady-State	32(typ.)	°C/W

N-Channel Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BVDSS	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A, T_J = 25^\circ\text{C}$	30	-	-	V
IDSS	Zero Gate Voltage Drain Current	$V_{DS} = 30V, V_{GS} = 0V$ $-T_J = 55^\circ\text{C}$	-	-	1 5	μA μA
IGSSF	Gate-Body Leakage Current, Forward	$V_{GS} = 20V, V_{DS} = 0V$	-	-	100	nA
IGSSR	Gate-Body Leakage Current, Reverse	$V_{GS} = -20V, V_{DS} = 0V$	-	-	-100	nA
On Characteristics						
VGS(th)	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.0	1.8	3.0	V
RDS(on)	Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 6A$ $V_{GS} = 4.5V, I_D = 5A$	-	24 34	29 40	m Ω
gFS	Forward Transconductance	$V_{DS} = 5V, I_D = 6A$	-	15	-	S
Rg	Gate resistance	$V_{GS}=0V, V_{DS}=0V, f=1\text{MHz}$	-	3.2	-	Ω
Dynamic Characteristics						
Ciss	Input Capacitance	$V_{DS} = 15V, V_{GS} = 0V,$ $f=1\text{MHz}$	-	250	-	pF
Coss	Output Capacitance		-	45	-	pF
Crss	Reverse Transfer Capacitance		-	35	-	pF
Switching Characteristics						
td(on)	Turn-On Delay Time	$V_{DS} = 15V, R_G = 3\Omega,$ $I_D = 6A, V_{GS} = 10V$ (Note 5, 6)	-	4.5	-	ns
tr	Turn-On Rise Time		-	2.5	-	ns
td(off)	Turn-Off Delay Time		-	14.5	-	ns
tf	Turn-Off Fall Time		-	3.5	-	ns
Qg(10V)	Total Gate Charge	$V_{DS} = 15V, I_D = 6A,$ $V_{GS} = 0\sim 10V$ (Note 5, 6)	-	5.2	-	nC
Qg(4.5V)	Total Gate Charge		-	2.6	-	nC
Qgs	Gate-Source Charge		-	0.8	-	nC
Qgd	Gate-Drain Charge		-	1.3	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
IS	Maximum Continuous Drain-Source Diode Forward Current		-	-	3	A
ISM	Maximum Pulsed Drain-Source Diode Forward Current		-	-	12	A
VSD	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 1A$	-	0.7	1.0	V
trr	Reverse Recovery Time	$V_{GS} = 0V, I_S = 6A, dI_F/dt = 100A/\mu s$ (Note 5)	-	8.5	-	ns
Qrr	Reverse Recovery Charge		-	2.2	-	nC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature $T_J(\text{MAX})=150^\circ\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^\circ\text{C}$.
2. The power dissipation PD is based on $T_J(\text{MAX})=150^\circ\text{C}$, using $\leq 10s$ junction-to-ambient thermal resistance.
3. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² 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.
4. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.
5. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
6. Essentially Independent of Operating Temperature Typical Characteristics

N-Channel Typical Performance Characteristics

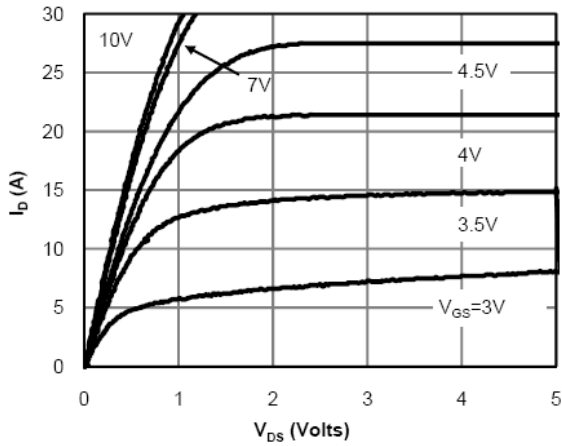


Figure 1: On-Region Characteristics

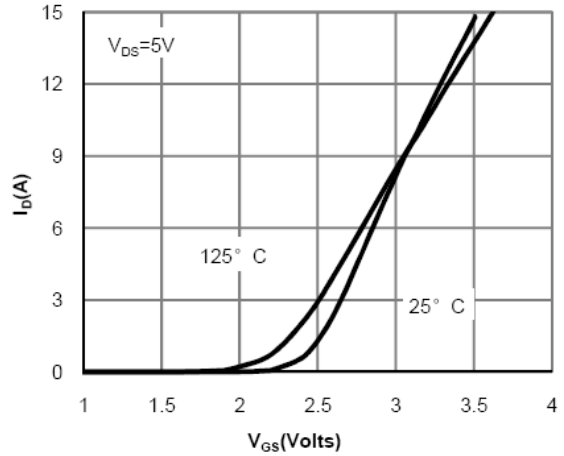


Figure 2: Transfer Characteristics

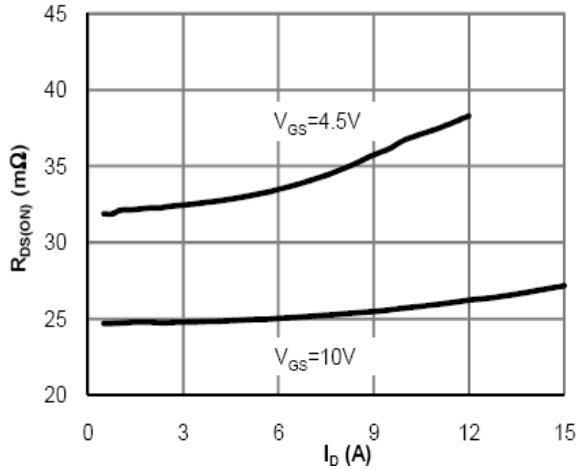


Figure 3: On-Resistance vs Drain current and Gate voltage

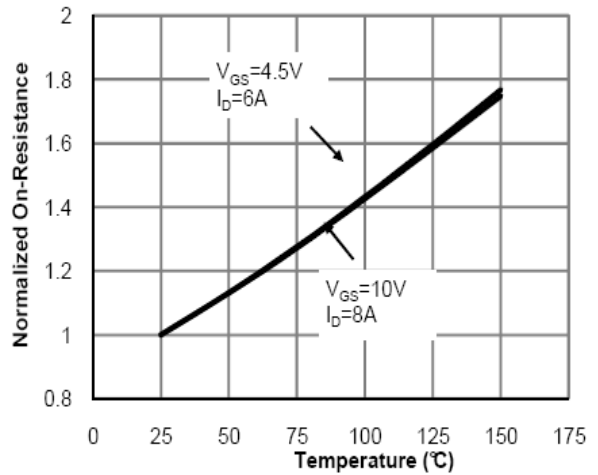


Figure 4: On-Resistance vs Junction Temperature

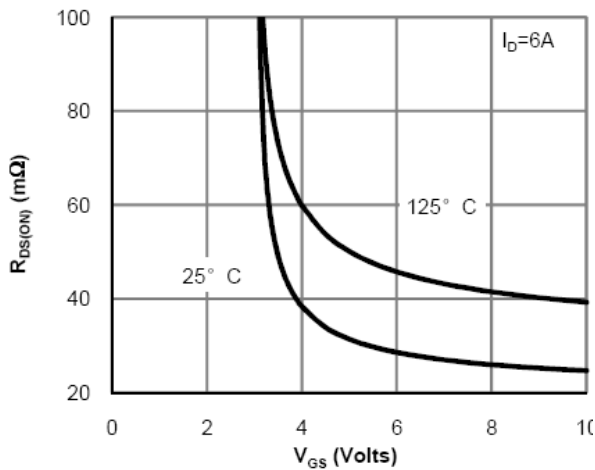


Figure 5: On-Resistance vs Gate-Source voltage

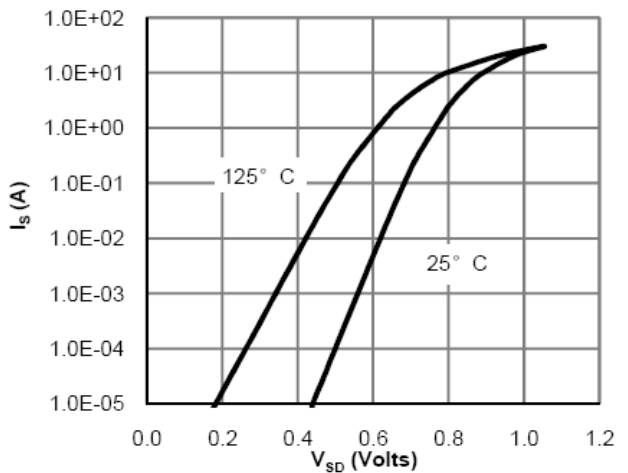


Figure 6: Body-Diode Characteristics

N-Channel Typical Performance Characteristics

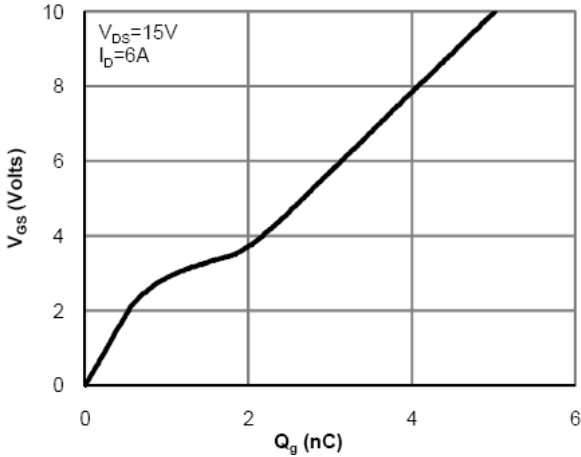


Figure 7: Gate-Charge Characteristics

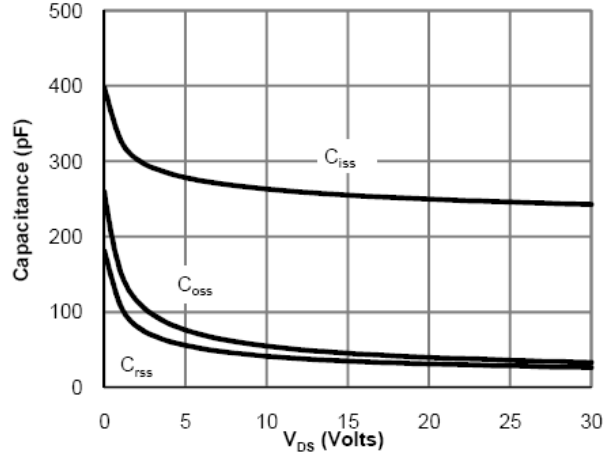


Figure 8: Capacitance Characteristics

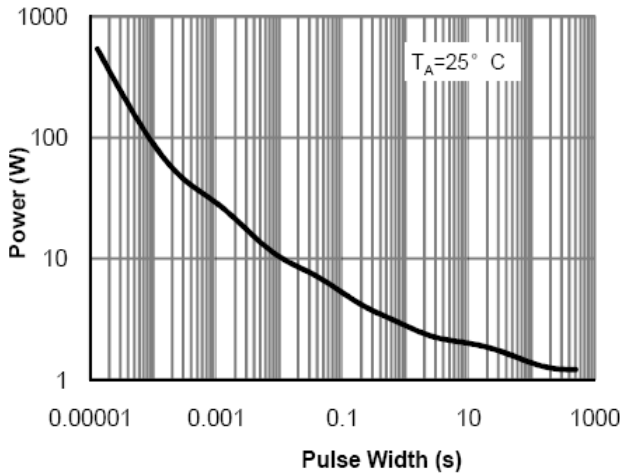


Figure 9: Single Pulse Power Rating Junction-to-Ambient

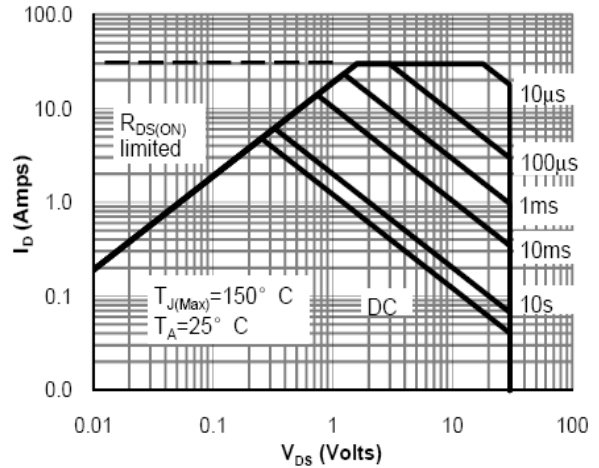


Figure 10: Maximum Forward Biased Safe Operating Area

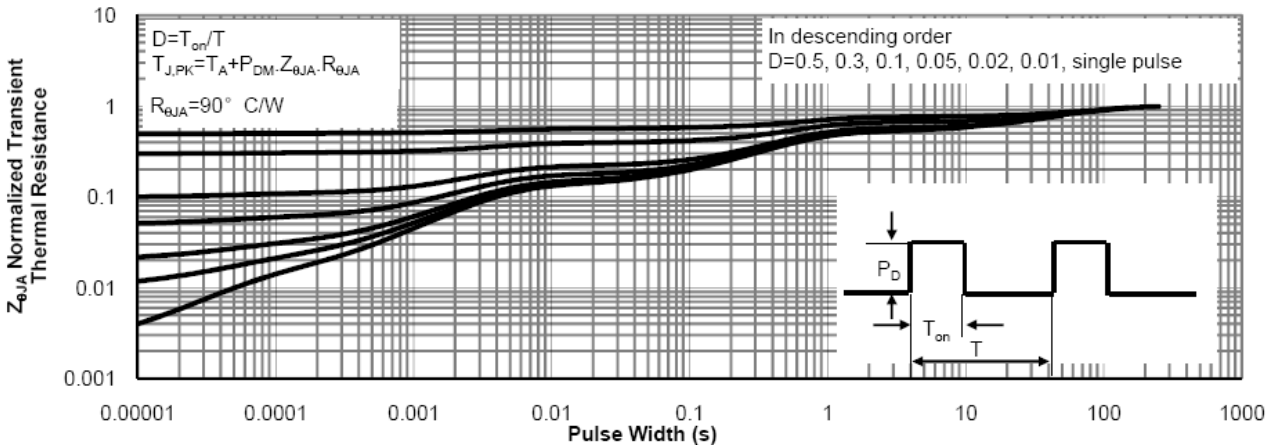
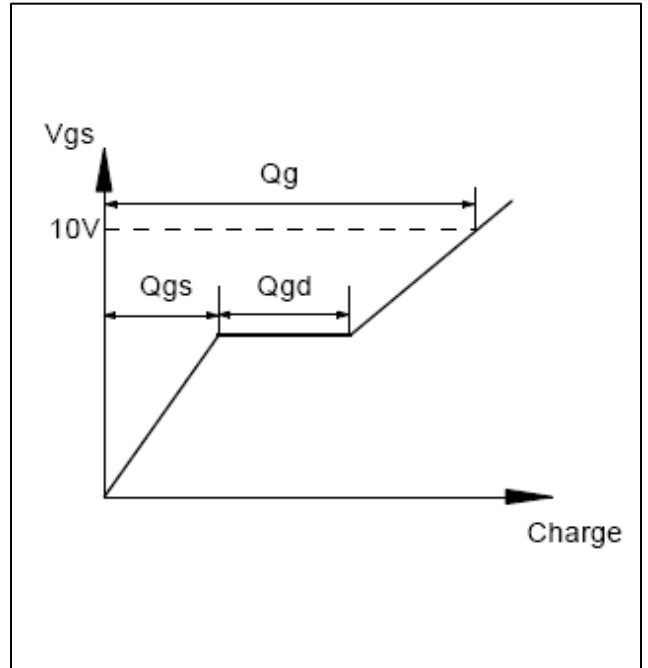
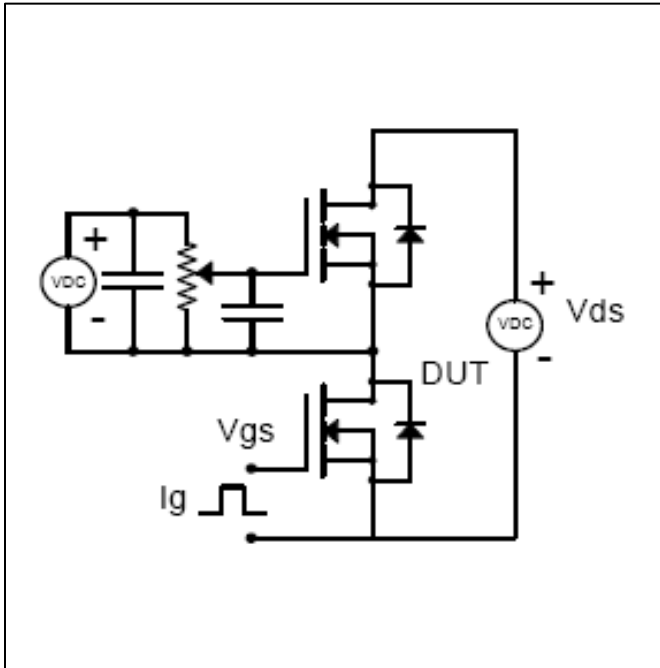
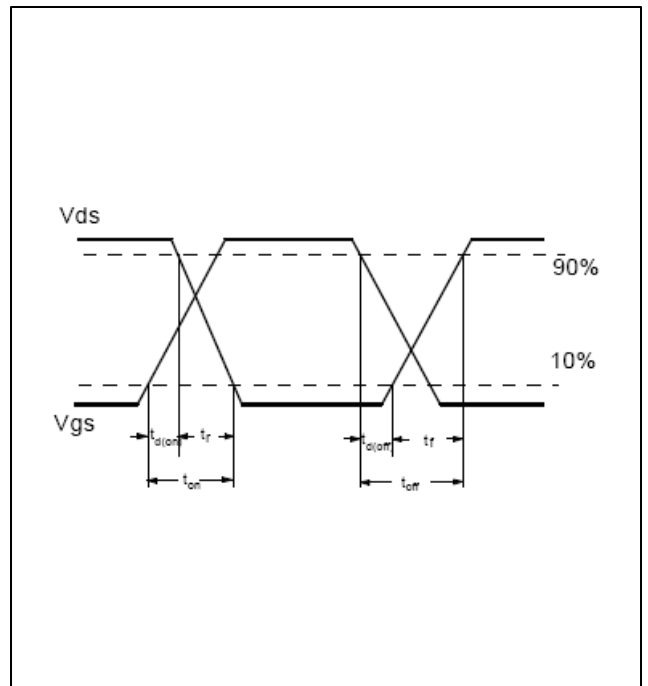
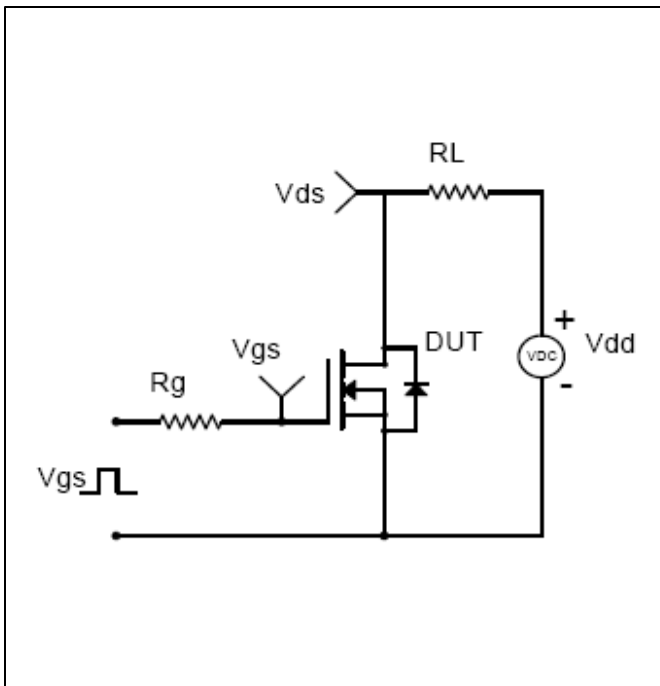


Figure 11: Maximum Transient Thermal Impedance

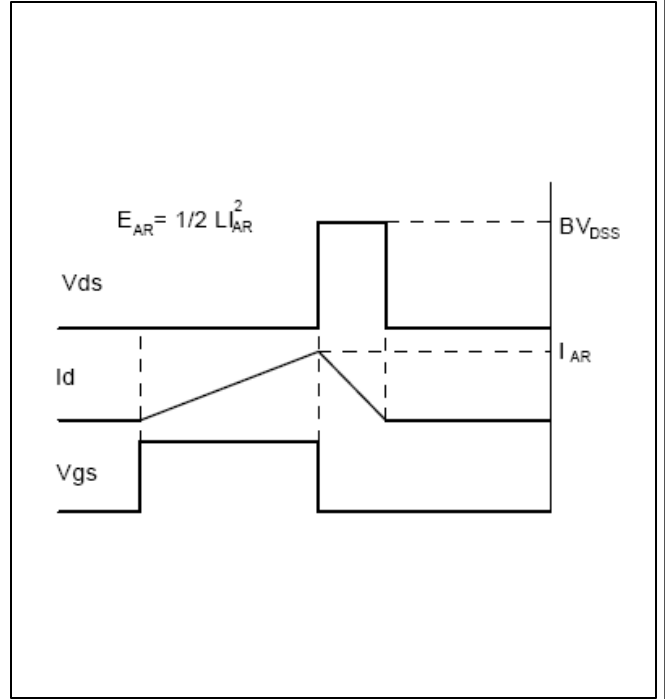
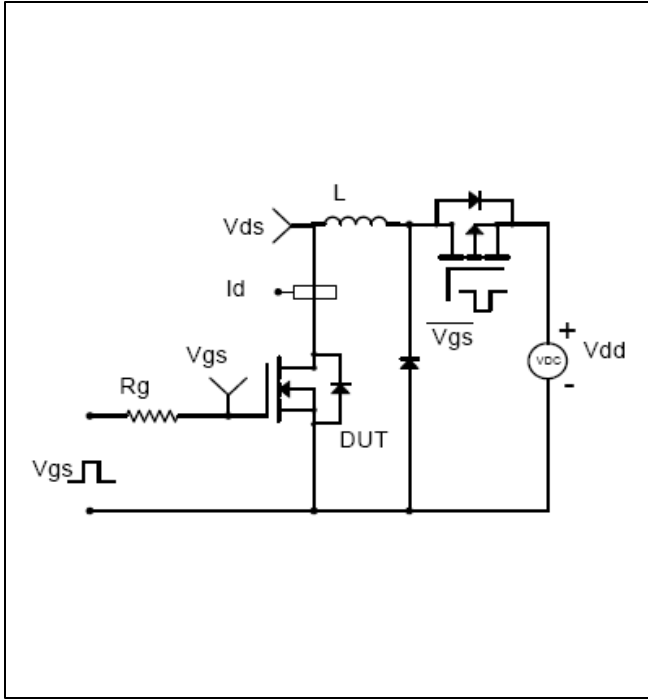
Gate Charge Test Circuit and Waveform



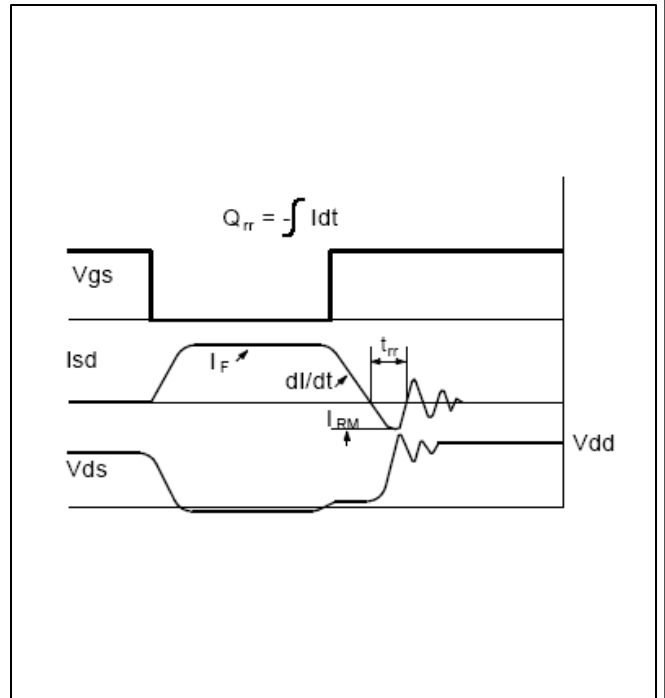
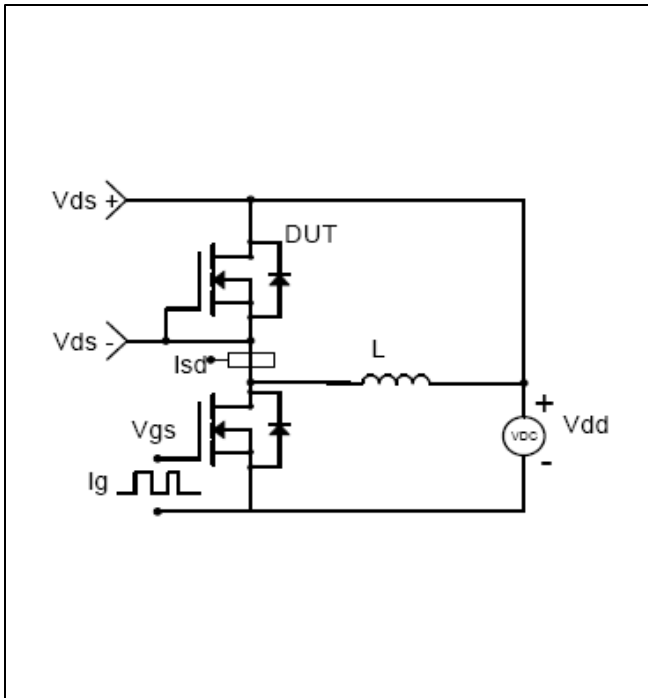
Resistive Switching Test Circuit and Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



P-Channel Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A, T_J = 25^\circ\text{C}$	-30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -30V, V_{GS} = 0V$ $-T_J = 55^\circ\text{C}$	-	-	-1 -5	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 20V, V_{DS} = 0V$	-	-	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -20V, V_{DS} = 0V$	-	-	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	-1.0	-1.8	-3.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	$V_{GS} = -10V, I_D = -6.5A$ $V_{GS} = -4.5V, I_D = -5A$	-	23 35	28 42	m Ω
g _{FS}	Forward Transconductance	$V_{DS} = -5V, I_D = -6.5A$	-	18	-	S
R _g	Gate resistance	$V_{GS}=0V, V_{DS}=0V, f=1\text{MHz}$	-	3.2	-	Ω
Dynamic Characteristics						
C _{iss}	Input Capacitance	$V_{DS} = -15V, V_{GS} = 0V,$ $f=1\text{MHz}$	-	760	-	pF
C _{oss}	Output Capacitance		-	140	-	pF
C _{rss}	Reverse Transfer Capacitance		-	95	-	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	$V_{DS} = -15V, R_G = 3\Omega,$ $I_D = -6.5A, V_{GS} = -10V$ (Note 5, 6)	-	8	-	ns
t _r	Turn-On Rise Time		-	6	-	ns
t _{d(off)}	Turn-Off Delay Time		-	17	-	ns
t _f	Turn-Off Fall Time		-	5	-	ns
Q _{g(10V)}	Total Gate Charge	$V_{DS} = -15V, I_D = -6.5A,$ $V_{GS} = 0 \sim -10V$ (Note 5, 6)	-	13.6	-	nC
Q _{g(4.5V)}	Total Gate Charge		-	6.7	-	nC
Q _{gs}	Gate-Source Charge		-	2.5	-	nC
Q _{gd}	Gate-Drain Charge		-	3.2	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		-	-	-3	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		-	-	-12	A
V _{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = -1A$	-	-0.7	-1.0	V
t _{rr}	Reverse Recovery Time	$V_{GS} = 0V, I_S = -6.5A, dI_F/dt = 100A/\mu s$ (Note 5)	-	15	-	ns
Q _{rr}	Reverse Recovery Charge		-	9.7	-	nC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature $T_J(\text{MAX})=150^\circ\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^\circ\text{C}$.
2. The power dissipation PD is based on $T_J(\text{MAX})=150^\circ\text{C}$, using $\leq 10s$ junction-to-ambient thermal resistance.
3. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² 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.
4. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.
5. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
6. Essentially Independent of Operating Temperature Typical Characteristics

P-Channel Typical Performance Characteristics

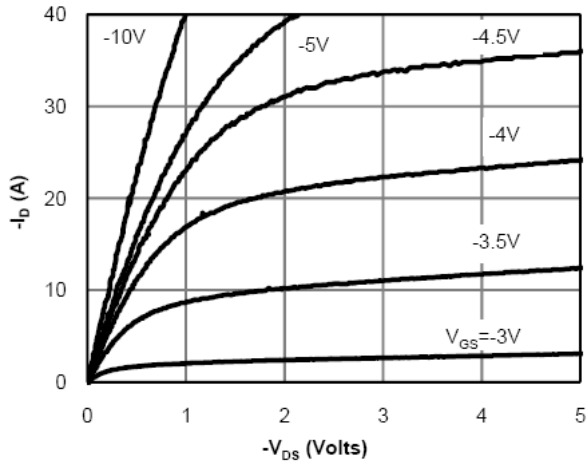


Figure 1: On-Region Characteristics

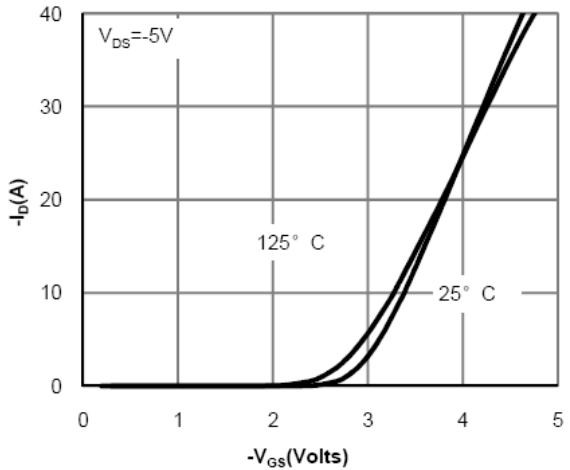


Figure 2: Transfer Characteristics

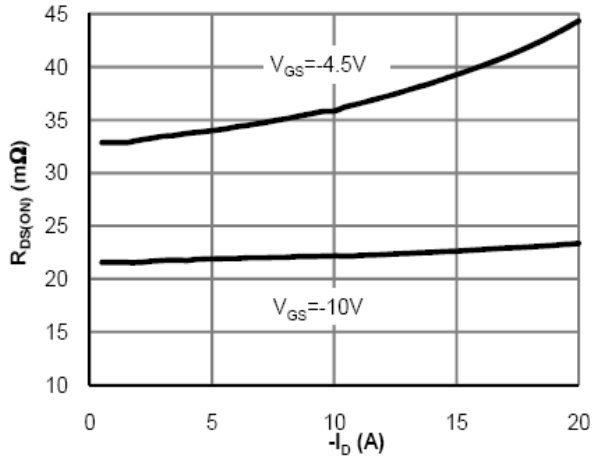


Figure 3: On-Resistance vs Drain current and Gate voltage

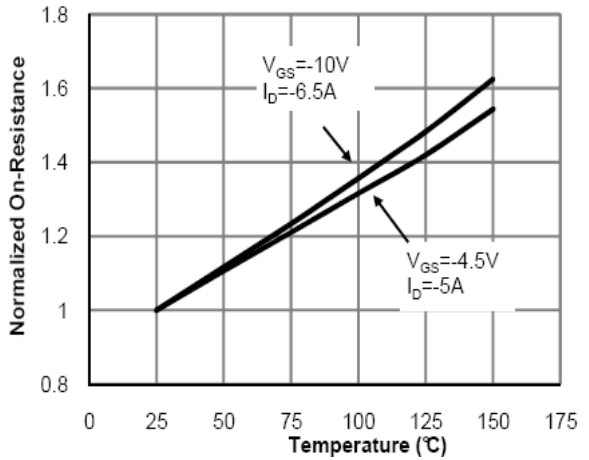


Figure 4: On-Resistance vs Junction Temperature

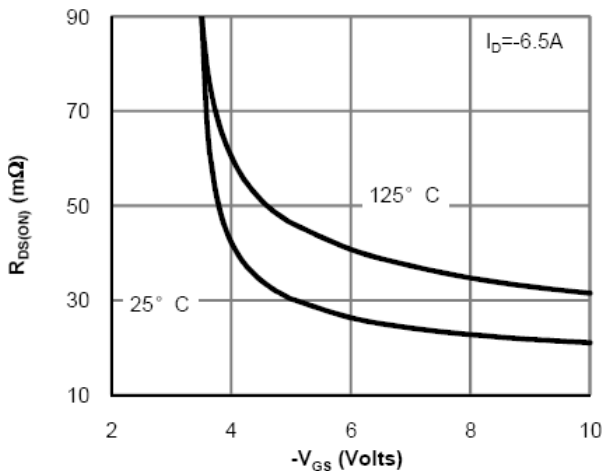


Figure 5: On-Resistance vs Gate-Source voltage

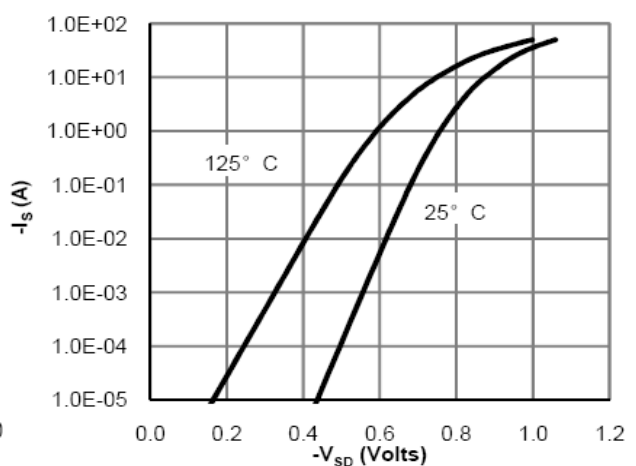


Figure 6: Body-Diode Characteristics

P-Channel Typical Performance Characteristics

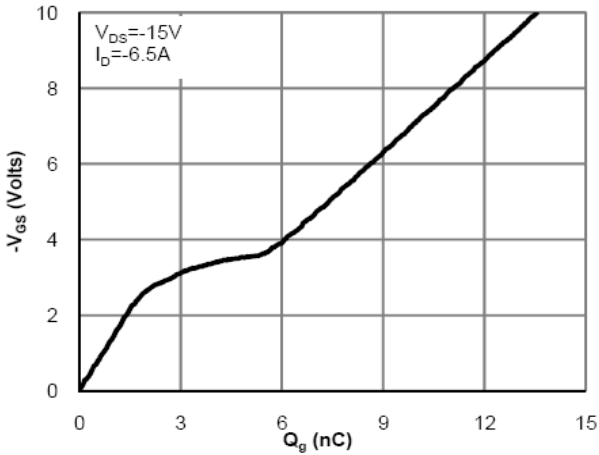


Figure 7: Gate-Charge Characteristics

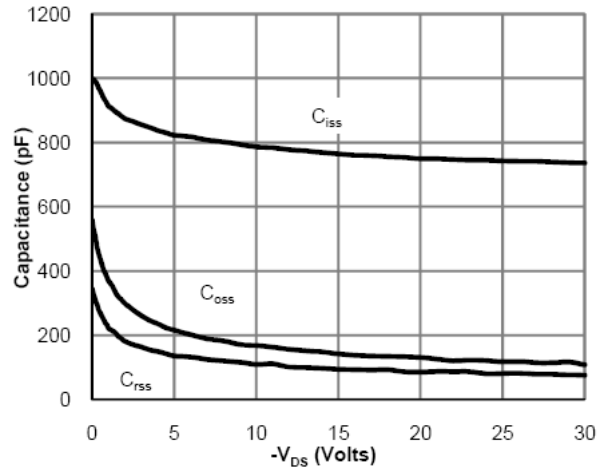


Figure 8: Capacitance Characteristics

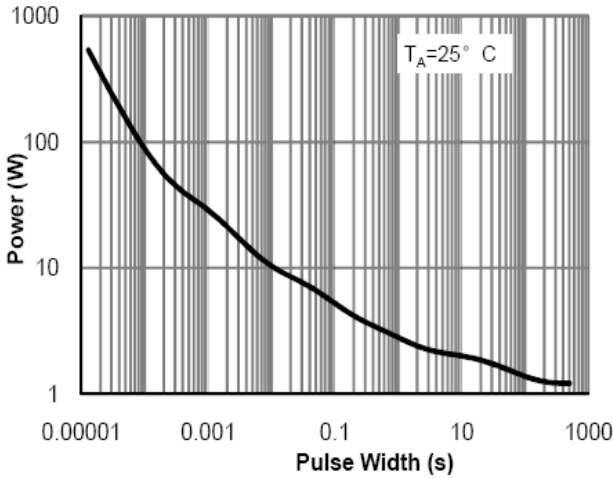


Figure 9: Single Pulse Power Rating Junction-to-Ambient

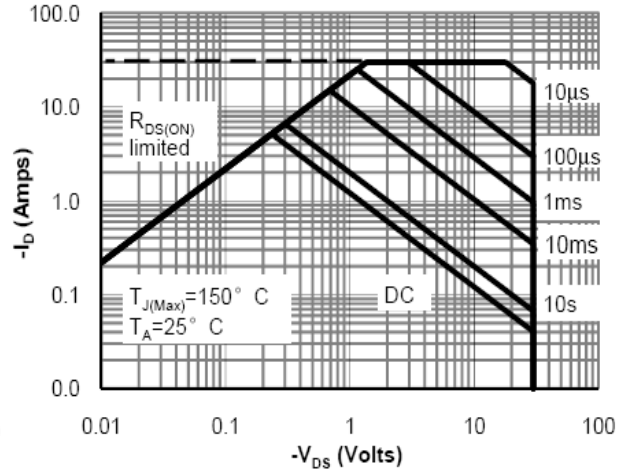


Figure 10: Maximum Forward Biased Safe Operating Area

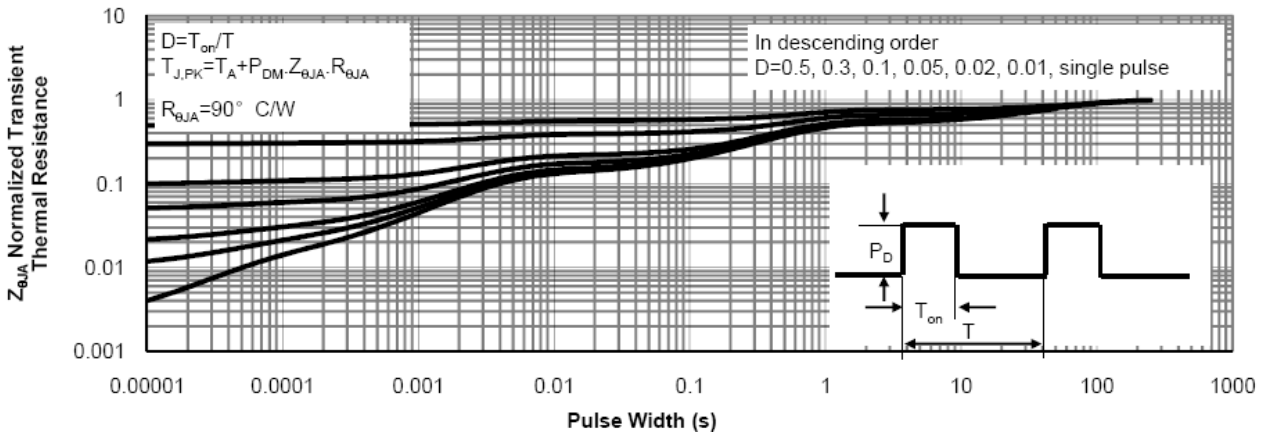
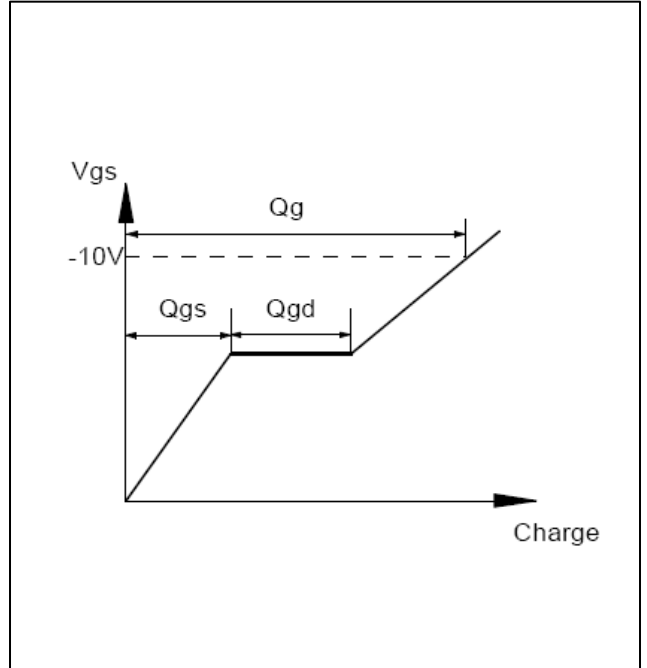
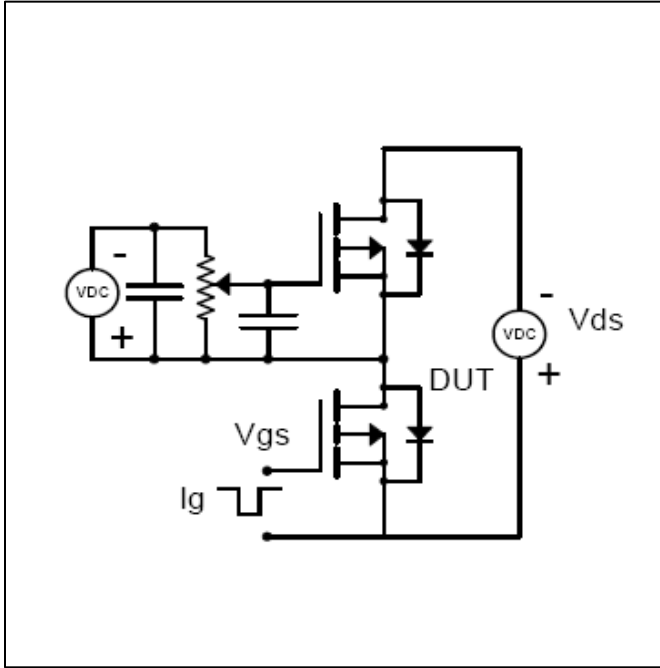
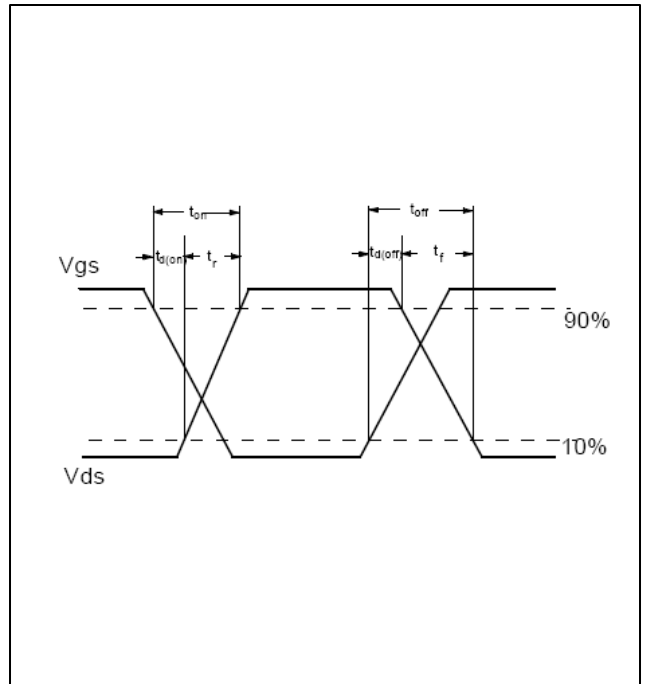
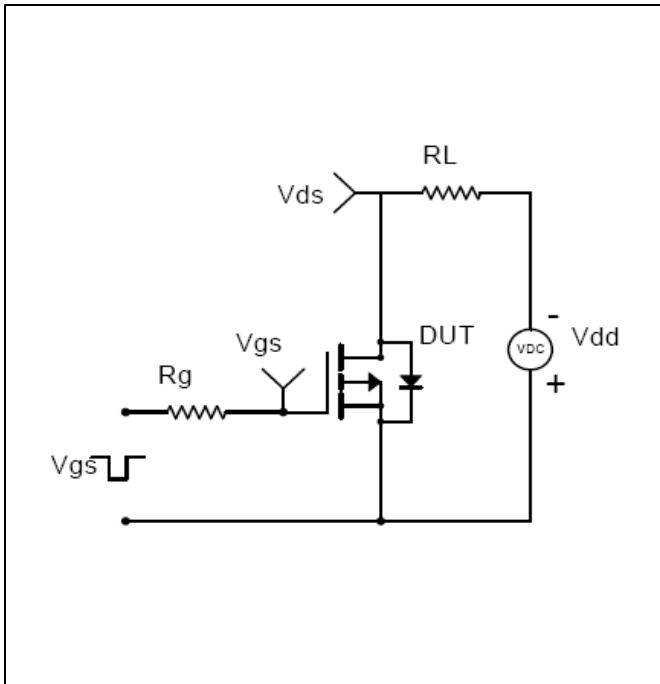


Figure 11: Maximum Transient Thermal Impedance

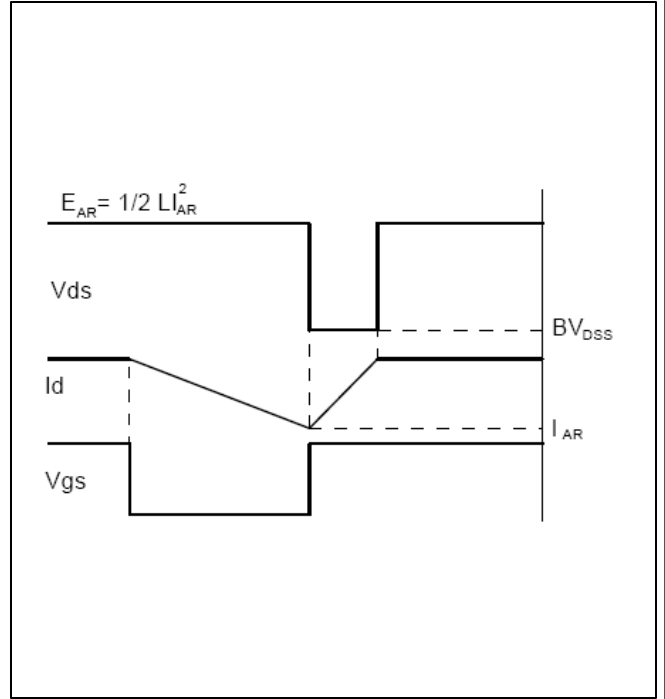
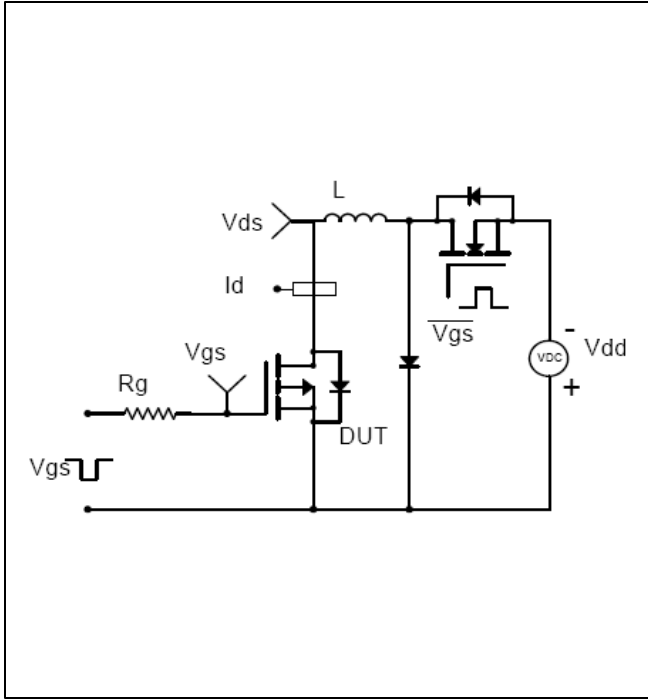
Gate Charge Test Circuit and Waveform



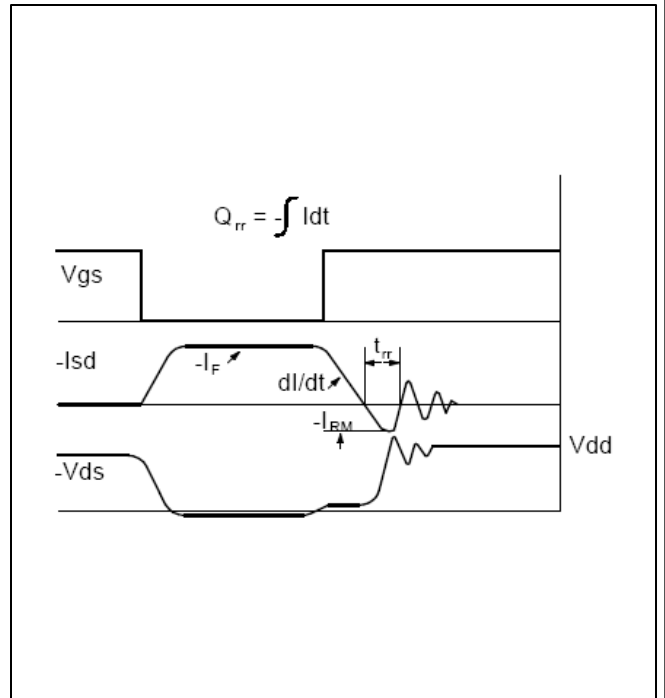
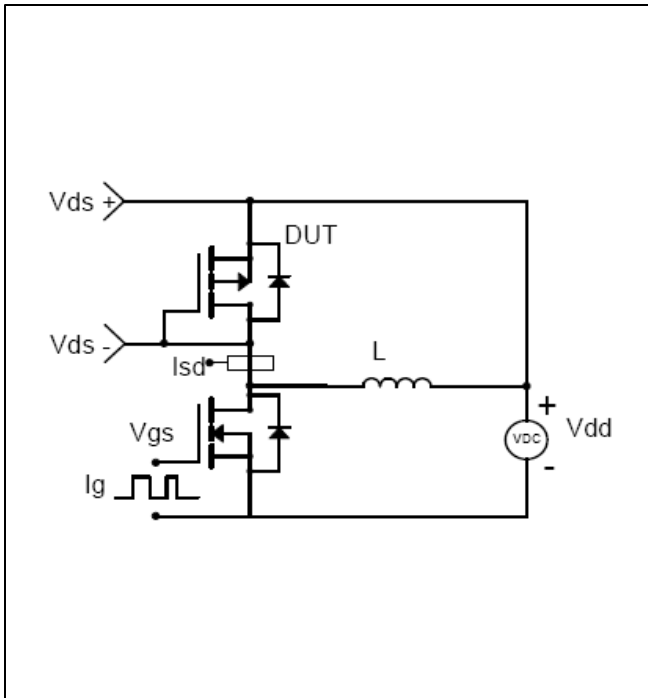
Resistive Switching Test Circuit and Waveforms

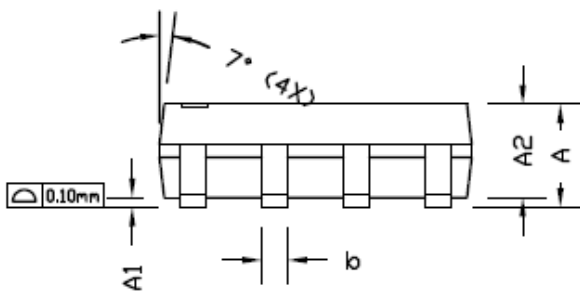
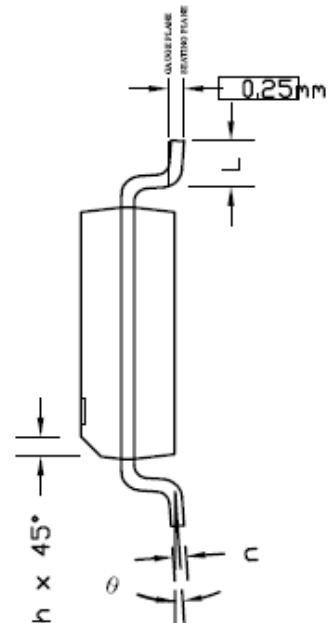
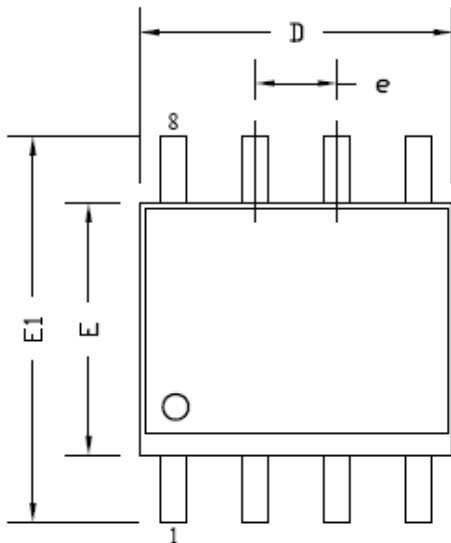


Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

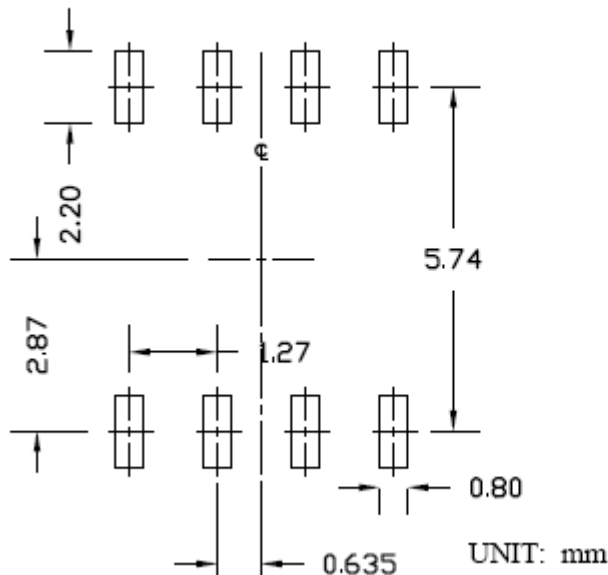


Diode Recovery Test Circuit & Waveforms





RECOMMENDED LAND PATTERN



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.35	1.65	1.75
A1	0.10	0.15	0.25
A2	1.25	1.50	1.65
b	0.31	0.41	0.51
c	0.17	0.20	0.25
D	4.80	4.90	5.00
E	3.80	3.90	4.00
e	1.27 BSC		
E1	5.80	6.00	6.20
h	0.25	0.30	0.50
L	0.40	0.69	1.27
θ	0°	4°	8°