
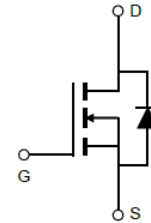
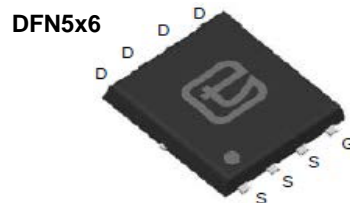


**60V N-Channel SGT MOSFET**

<p><b>General Description</b></p> <ul style="list-style-type: none"> <li>● Trench Power SGT technology</li> <li>● Very low on-resistance <math>R_{DS(ON)}</math></li> <li>● Low Gate Charge</li> <li>● Excellent Gate Charge x <math>R_{DS(ON)}</math> Product</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>● High Frequency Switching and Synchronous Rectification</li> </ul>	<p><b>Product Summary</b></p> <table border="0"> <tr> <td><math>V_{DS}</math></td> <td>60V</td> </tr> <tr> <td><math>I_D</math> (at <math>V_{GS}=10V</math>)</td> <td>60A</td> </tr> <tr> <td><math>R_{DS(ON)}</math> (at <math>V_{GS}=10V</math>)</td> <td>&lt; 9m<math>\Omega</math></td> </tr> </table> <p>100% UIS Tested</p> 	$V_{DS}$	60V	$I_D$ (at $V_{GS}=10V$ )	60A	$R_{DS(ON)}$ (at $V_{GS}=10V$ )	< 9m $\Omega$
$V_{DS}$	60V						
$I_D$ (at $V_{GS}=10V$ )	60A						
$R_{DS(ON)}$ (at $V_{GS}=10V$ )	< 9m $\Omega$						



Part Number	Package Type	Form	Marking
TSG12N06A	DFN5×6	Tape & Reel	G12N06A

**Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$  unless otherwise noted)**

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>B</sup>	$I_D$	$T_C = 25^\circ\text{C}$	60
		$T_C = 100^\circ\text{C}$	36
Pulsed Drain Current <sup>A</sup>	$I_{DM}$	240	A
Avalanche Current <sup>A</sup>	$I_{AS}$	36	A
Single Pulse Avalanche Energy $L = 0.3\text{mH}$ <sup>A</sup>	$E_{AS}$	65	mJ
Power Dissipation <sup>C</sup>	$P_D$	$T_C = 25^\circ\text{C}$	56.5
		$T_C = 100^\circ\text{C}$	44
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$

**Thermal Characteristics**

Parameter	Symbol	Maximum	Units
Maximum Junction-to-Case	$R_{\theta JC}$	1.7	$^\circ\text{C}/\text{W}$
Maximum Junction-to-Ambient			
	$R_{\theta JA}$	50	



Electrical Characteristics( $T_J = 25^\circ\text{C}$ unless otherwise noted)							
Symbol	Parameter	Conditions	Value			Units	
			Min	Typ	Max		
<b>STATIC PARAMETERS</b>							
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	60	--	--	V	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 60\text{V}, V_{GS} = 0\text{V}$	$T_J = 25^\circ\text{C}$	--	--	1	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$	--	--	100	
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}, V_{GS} = \pm 20\text{V}$	--	--	$\pm 100$	nA	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2	--	4	V	
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{V}, I_D = 20\text{A}$	--	6.5	9	$\text{m}\Omega$	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{V}, I_D = 20\text{A}$	--	85	--	S	
$V_{SD}$	Diode Forward Voltage	$I_S = 1\text{A}, V_{GS} = 0\text{V}$	--	--	1	V	
$I_S$	Maximum Body-Diode Continuous Current <sup>B</sup>		--	--	46	A	
<b>DYNAMIC PARAMETERS</b>							
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = 30\text{V}, f = 1\text{MHz}$	--	2455	--	$\text{pF}$	
$C_{oss}$	Output Capacitance		--	240	--		
$C_{rss}$	Reverse Transfer Capacitance		--	34	--		
<b>SWITCHING PARAMETERS</b>							
$Q_g$	Total Gate Charge	$V_{GS} = 10\text{V}, V_{DS} = 30\text{V}, I_D = 20\text{A}$	--	45	--	nC	
$Q_{gs}$	Gate Source Charge		--	13.5	--		
$Q_{gd}$	Gate Drain Charge		--	11.5	--		
$t_{D(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{V}, V_{DS} = 30\text{V}, I_D = 20\text{A}, R_G = 3\Omega$	--	8	--	ns	
$t_r$	Turn-On Rise Time		--	3	--		
$T_{D(off)}$	Turn-Off Delay Time		--	25	--		
$t_f$	Turn-Off Fall Time		--	4	--		
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F = 20\text{A}, di/dt = 500\text{A}/\mu\text{s}$	--	25	--	ns	
$Q_{rr}$	Body Diode Reverse Recovery Charge		--	110	--	nC	

A. Single pulse width limited by maximum junction temperature.

B. The maximum current rating is package limited.

C. The power dissipation  $P_D$  is based on  $T_{J(MAX)} = 175^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.



Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	60	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	$\mu A$
		$V_{DS} = 60V, V_{GS} = 0V, T_J = 100^\circ\text{C}$	--	--	100	
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	--	4	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 20A$	--	6.5	9	m $\Omega$
Forward Transconductance (Note3)	$g_{fs}$	$V_{DS} = 5V, I_D = 20A$	--	85	--	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V,$ $V_{DS} = 30V,$ $f = 1.0\text{MHz}$	--	2455	--	$\mu F$
Output Capacitance	$C_{oss}$		--	240	--	
Reverse Transfer Capacitance	$C_{rss}$		--	34	--	
Total Gate Charge	$Q_g$	$V_{DD} = 30V, I_D = 20A,$ $V_{GS} = 10V$	--	45	--	nC
Gate-Source Charge	$Q_{gs}$		--	13.5	--	
Gate-Drain Charge	$Q_{gd}$		--	11.5	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 30V, I_D = 20A,$ $R_G = 3\Omega$	--	8	--	ns
Turn-on Rise Time	$t_r$		--	3	--	
Turn-off Delay Time	$t_{d(off)}$		--	25	--	
Turn-off Fall Time	$t_f$		--	4	--	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Body Diode Current	$I_S$	$T_C = 25^\circ\text{C}$	--	--	46	A
Pulsed Diode Forward Current	$I_{SM}$		--	--	138	
Body Diode Voltage	$V_{SD}$	$T_J = 25^\circ\text{C}, I_{SD} = 1A, V_{GS} = 0V$	--	0.72	1	V
Reverse Recovery Time	$t_{rr}$	$I_F = 20A,$ $di_F/dt = 500A/\mu s$	--	25	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	110	--	nC

**Notes**

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2.  $I_{AS} = 36A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse Width  $\leq 300\mu s, \text{Duty Cycle } \leq 1\%$



Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

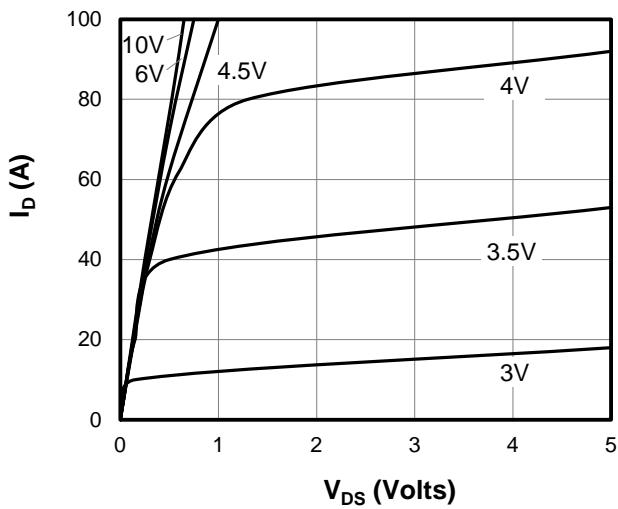


Figure 1: On-Region Characteristics

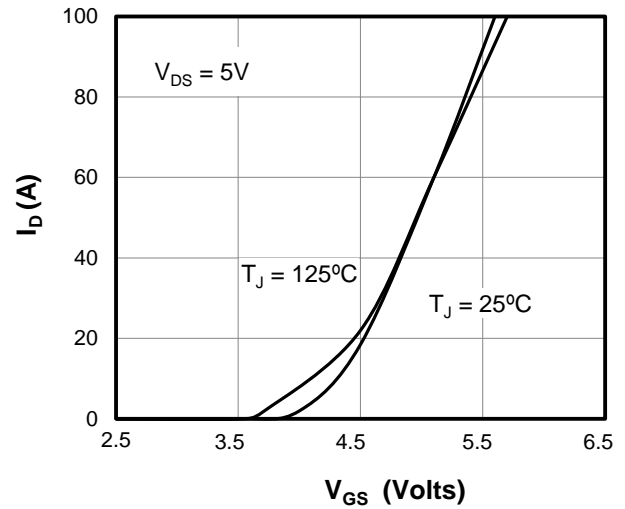


Figure 2: Transfer Characteristics

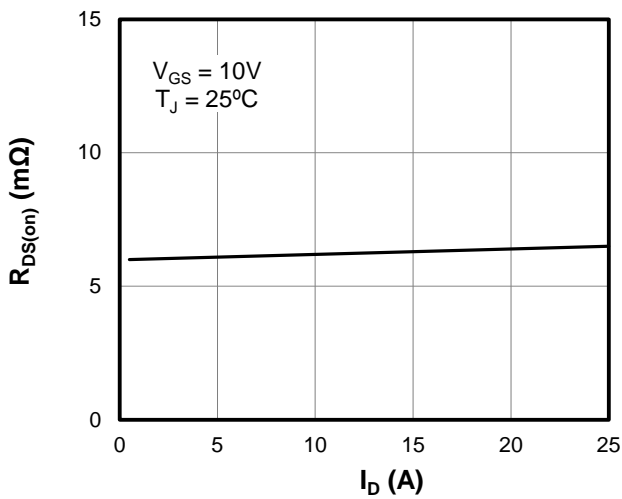


Figure 3: On-Resistance vs. Drain Current

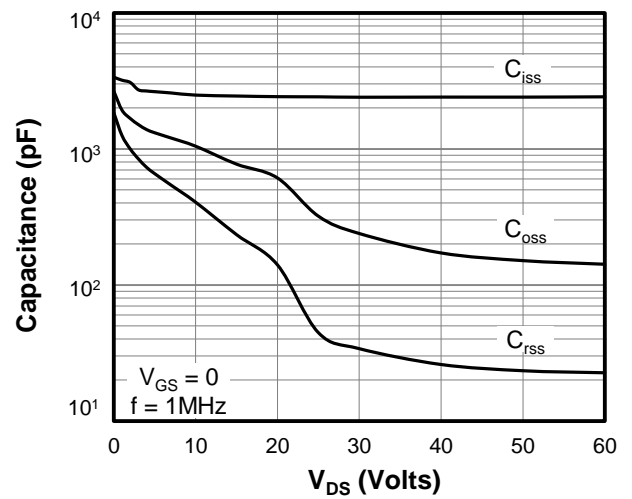


Figure 4: Capacitance Characteristics

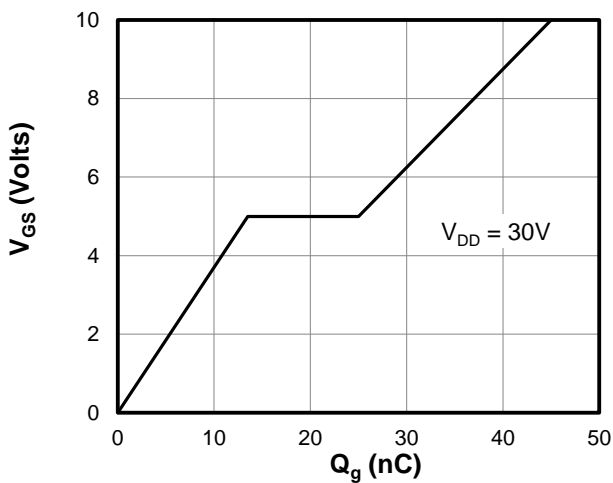


Figure 5: Gate Charge Characteristics

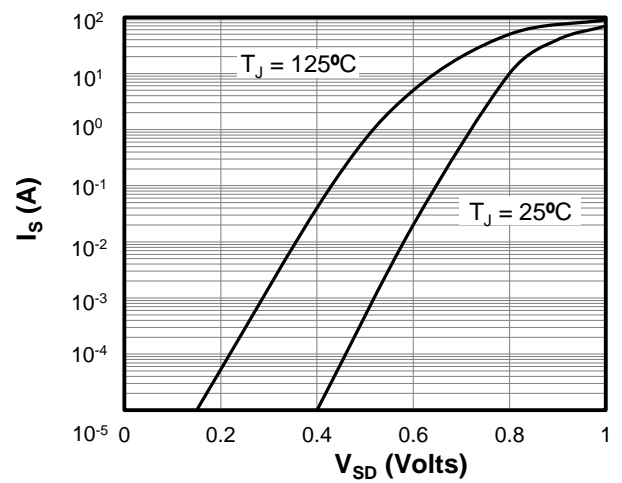


Figure 6: Body Diode Forward Voltage



Typical Characteristics  $T_J = 25^{\circ}\text{C}$ , unless otherwise noted

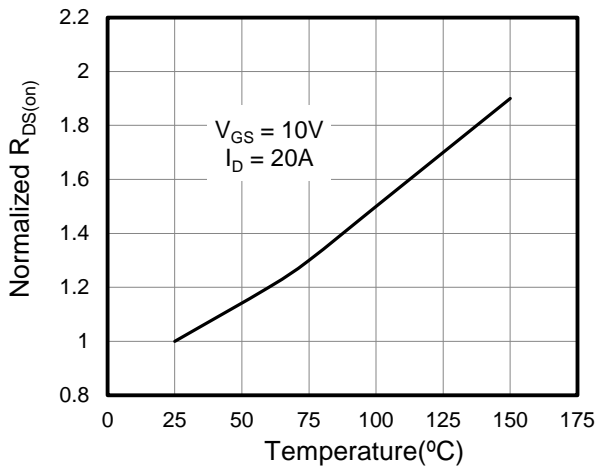


Figure 7: On-Resistance vs. Junction Temperature

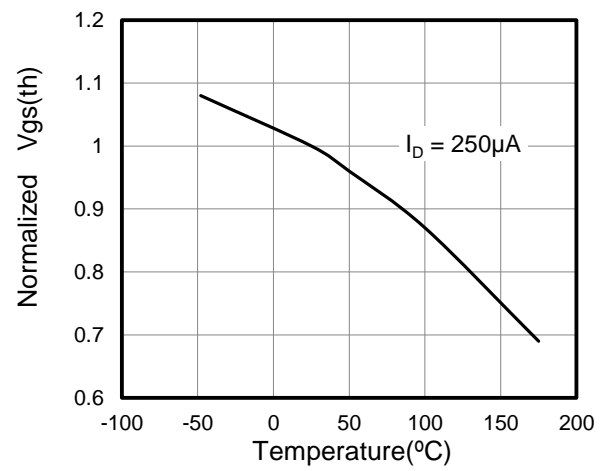


Figure 8:  $V_{GS(th)}$  vs. Junction Temperature

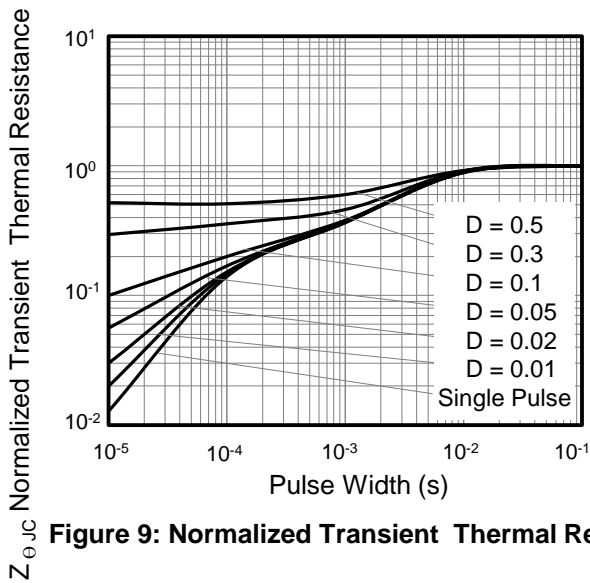


Figure 9: Normalized Transient Thermal Resistance

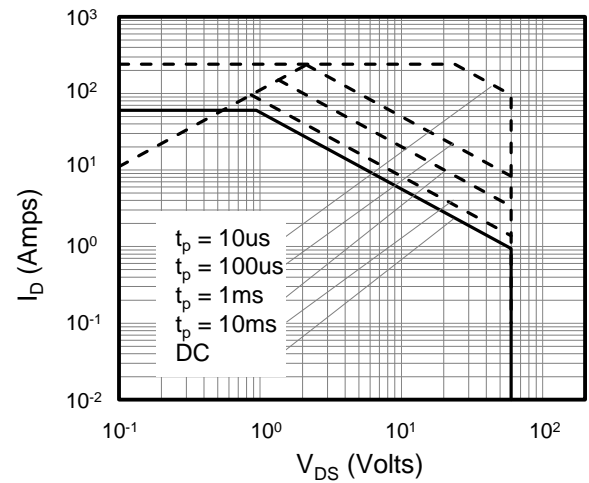


Figure 10: Safe Operating Area



Figure A: Gate Charge Test Circuit and Waveform

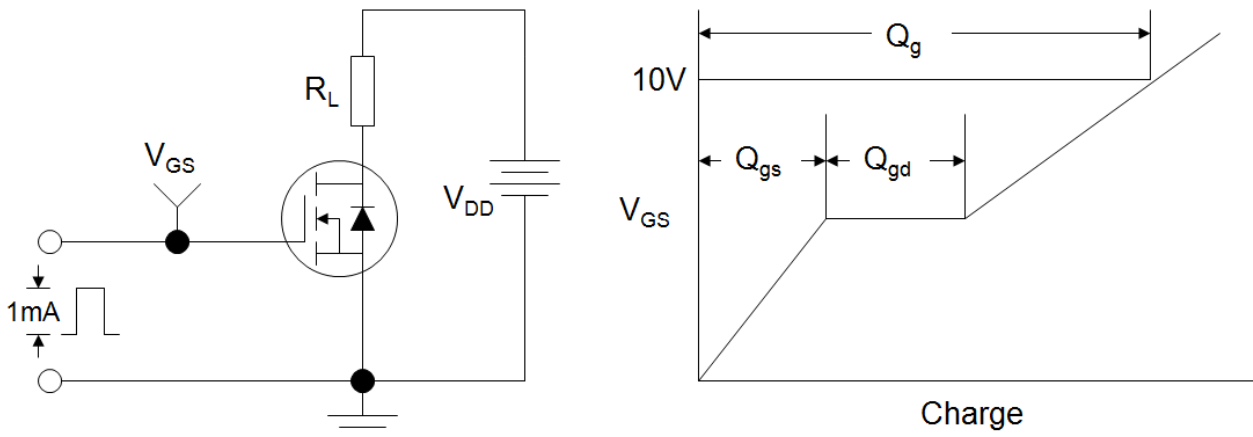


Figure B: Resistive Switching Test Circuit and Waveform

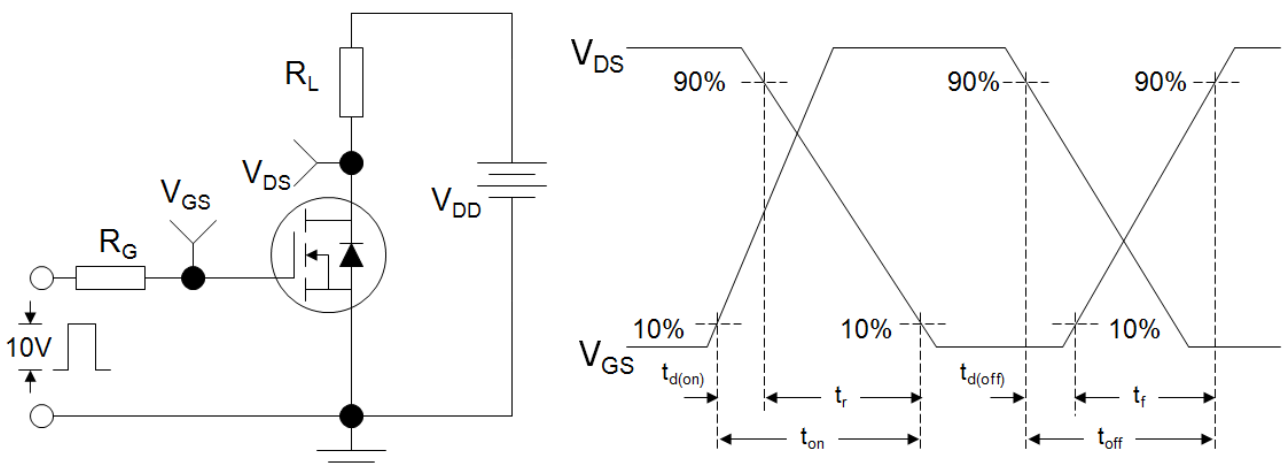
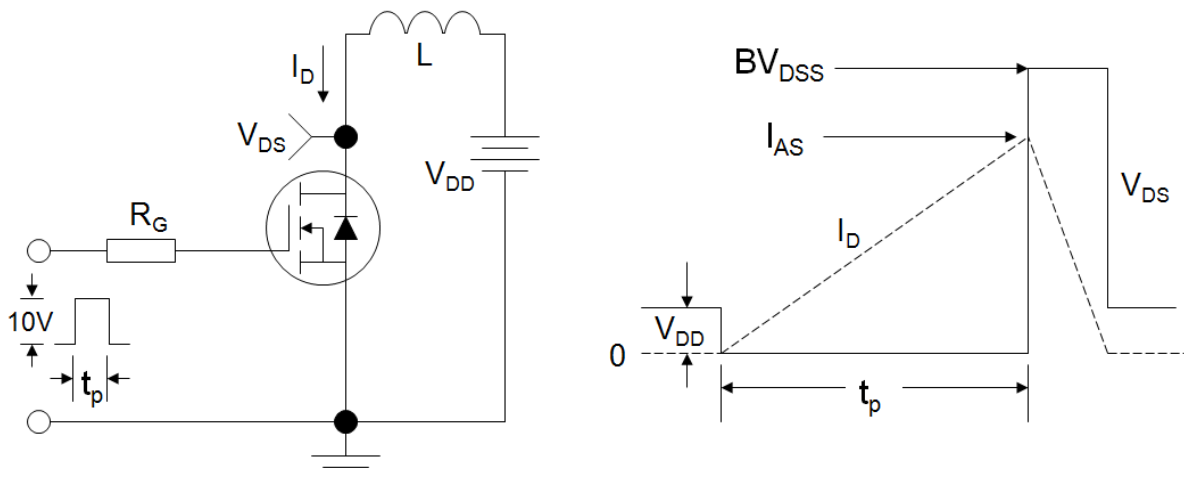
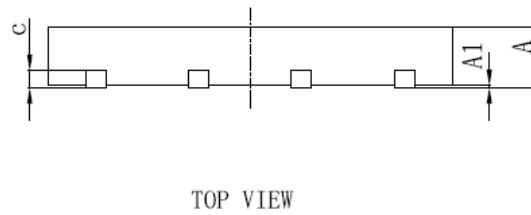
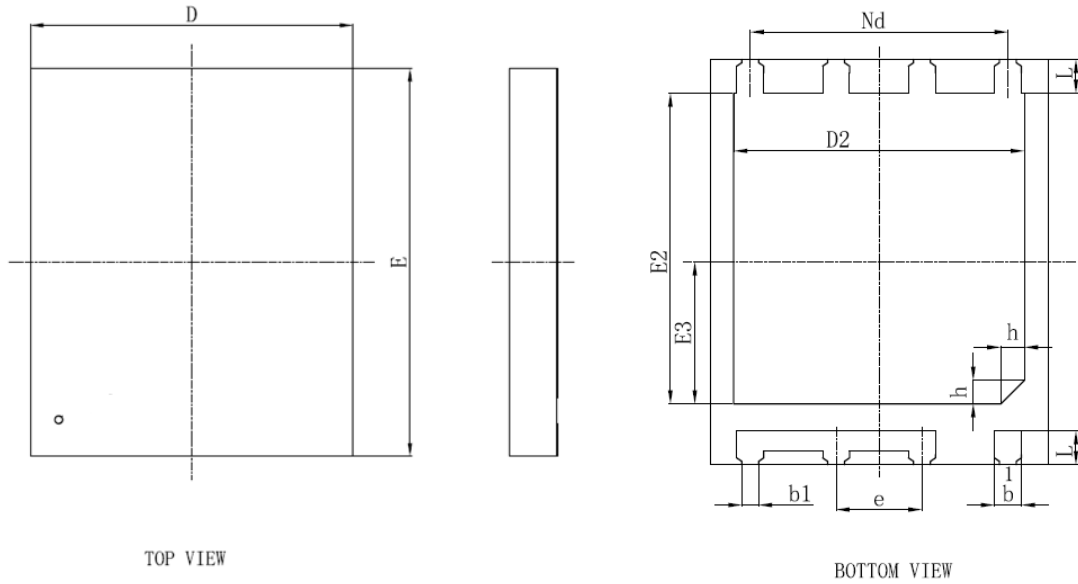


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





### DFN5×6



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.35	0.40	0.45
b1	0.25REF		
c	0.18	0.203	0.25
D	4.90	5.00	5.10
D2	4.20	4.30	4.40

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
Nd	3.81BSC		
e	1.27BSC		
E	5.90	6.00	6.10
E2	4.50	4.60	4.70
E3	2.00	2.10	2.20
L	0.45	0.50	0.55
h	0.30	0.35	0.40



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