40V N-Channel SGT Power MOSFET

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

HRG40N014G Data Sheet

Rev. 2020 V1.0



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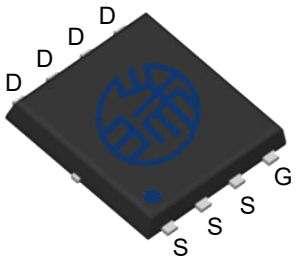
Description

N-Channel SGT Power MOSFET designed by HR-Micro Semiconductor Company, according to the advanced Trench Technology. This devices provide an excellent gate charge and $R_{DS(on)}$, which leads to extremely communication and conduction losses. So it is very suitable for DC/DC converter, ideal for high-frequency switching and synchronous rectification.

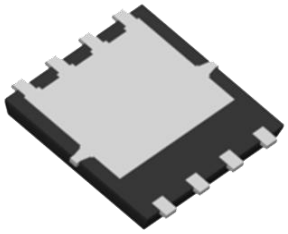
Features

- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- Pb-free lead plating

DFN5x6_8L



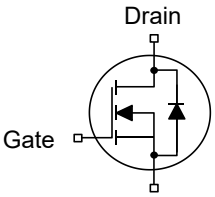
Top View



Bottom View

Applications

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



Key Performance Parameters

Parameter	Value	Unit
$V_{DS@Tc=25℃}$	40	V
$R_{DS(on),max@10V}$	1.4	mΩ
$R_{DS(on),max@4.5V}$	2	mΩ
$Q_{g,typ}$	85	nC
$I_{D@Tc=25℃}$	150	A
$I_{D,pulse}$	600	A
E_{AS} 1)	1250	mJ

Device Marking and Package Information

Device	Package	Marking
HRG40N014G	DFN5x6_8L	G40N014G

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Absolute Maximum Ratings T_A = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Values**	**Unit**
Drain-Source Voltage(V_{GS}=0V)		V_{DS}	40	V
Continuous Drain Current[2]	T_C = 25ºC	I_D	150	A
	T_C = 100ºC		102	
Pulsed Drain Current[3]		$I_{D,pulse}$	600	A
Gate-Source Voltage		V_{GSS}	±20	V
Single Pulse Avalanche Energy		E_{AS}	1250	mJ
Power Dissipation		P_D	134	W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance			
Parameter	**Symbol**	**Max.**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.93	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	ºC/W

Notes

1) L=0.5mH, V_{DD}=20V, Start T_J=25℃.

2) Limited by maximum junction temperature.

3) Repetitive Rating: Pulse width limited by maximum junction temperature.

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Electrical Characteristics T_J = 25ºC, unless otherwise noted

Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 250μA	100	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40V V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 40V V_{GS} = 0V, T_J = 125ºC	--	--	100	
Gate-Source Leakage Current	I_{GSS}	V_{GS} = ±20V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	1	1.7	2.4	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 20A	--	1.09	1.4	mΩ
		V_{GS} = 4.5V, I_D = 20A	--	1.5	2	
Gate Resistance	R_G	f = 1.0MHz open drain	--	3.4	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 20V f = 1.0MHz	--	6266	--	pF
Output Capacitance	C_{oss}		--	1417	--	
Reverse Transfer Capacitance	C_{rss}		--	89	--	
Total Gate Charge	Q_g	V_{DS} = 20V, I_D = 20A V_{GS} = 10V	--	85	--	nC
Gate-Source Charge	Q_{gs}		--	21	--	
Gate-Drain Charge	Q_{gd}		--	7	--	
Gate Plateau Voltage	$V_{Plateau}$		--	3.2	--	V
Turn-on Delay Time	$t_{d(on)}$	V_{DS} = 20V, V_{GS} = 10V I_D=20A, R_G = 6Ω	--	12	--	ns
Turn-on Rise Time	t_r		--	6.5	--	
Turn-off Delay Time	$t_{d(off)}$		--	49	--	
Turn-off Fall Time	t_f		--	8	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 75A V_{GS} = 0V	--	--	1.2	V
Continuous Diode Forward Current	I_S		--	--	150	A
Reverse Recovery Time	t_{rr}	I_F = 75A, di_F/dt = 100A/μs	--	29	--	ns
Reverse Recovery Charge	Q_{rr}		--	109	--	nC

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Typical Characteristics T_J = 25ºC, unless otherwise noted

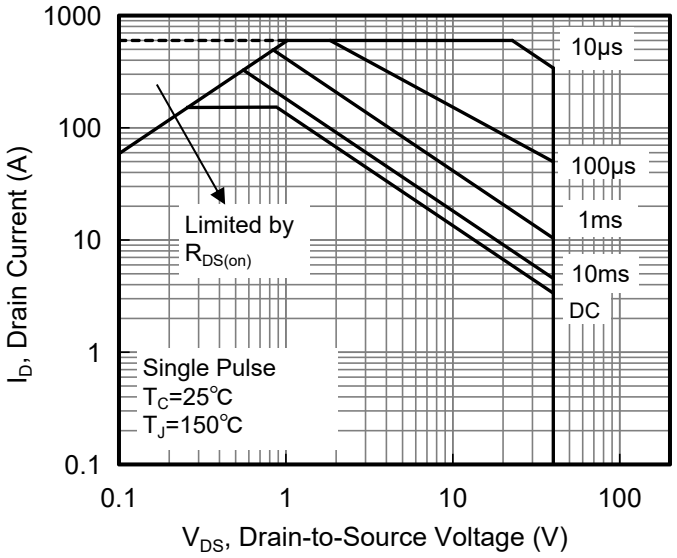


Figure 1. Maximum Safe Operating Area

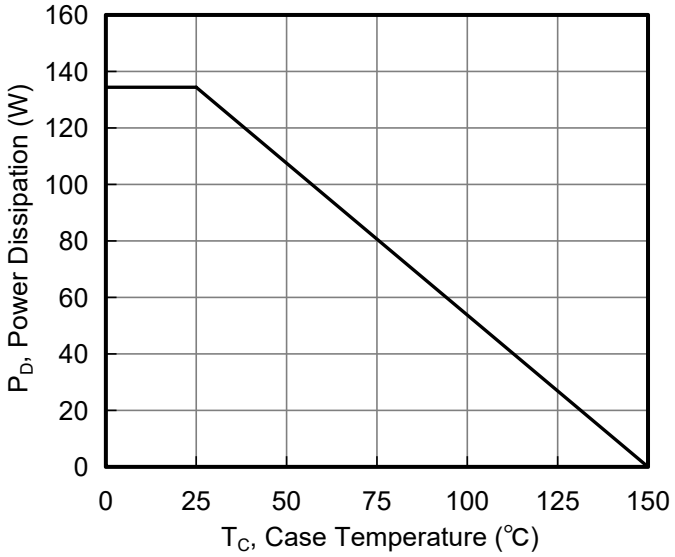


Figure 2. Maximum Power Dissipation vs Case Temperature

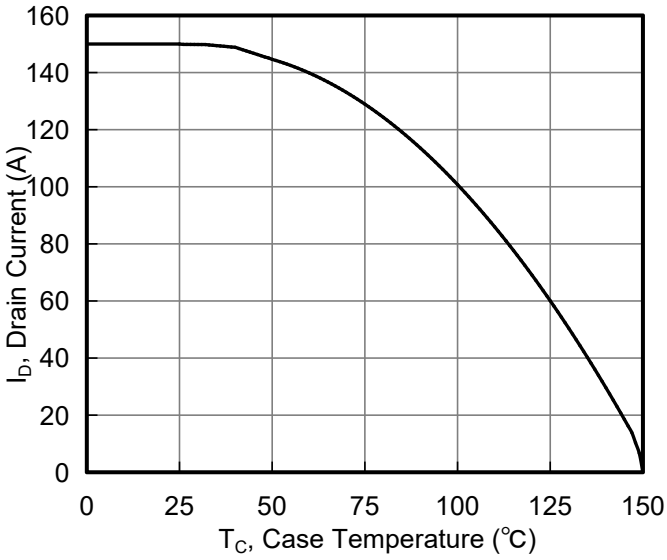


Figure 3. Maximum Continuous Drain Current vs Case Temperature

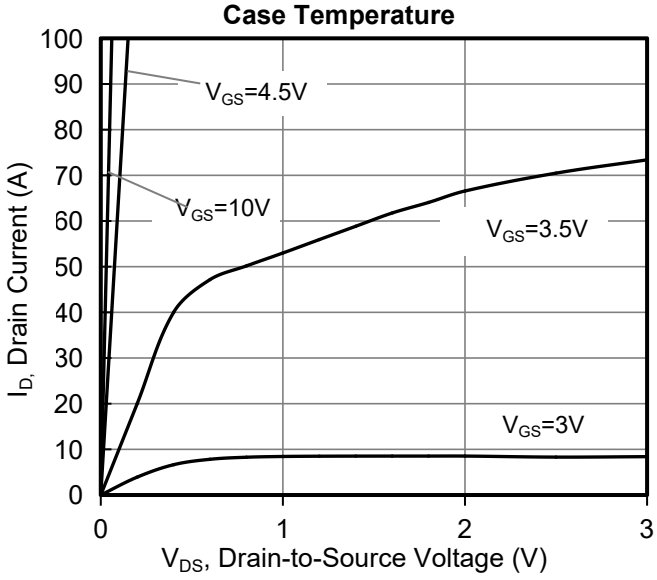


Figure 4. Typical output Characteristics

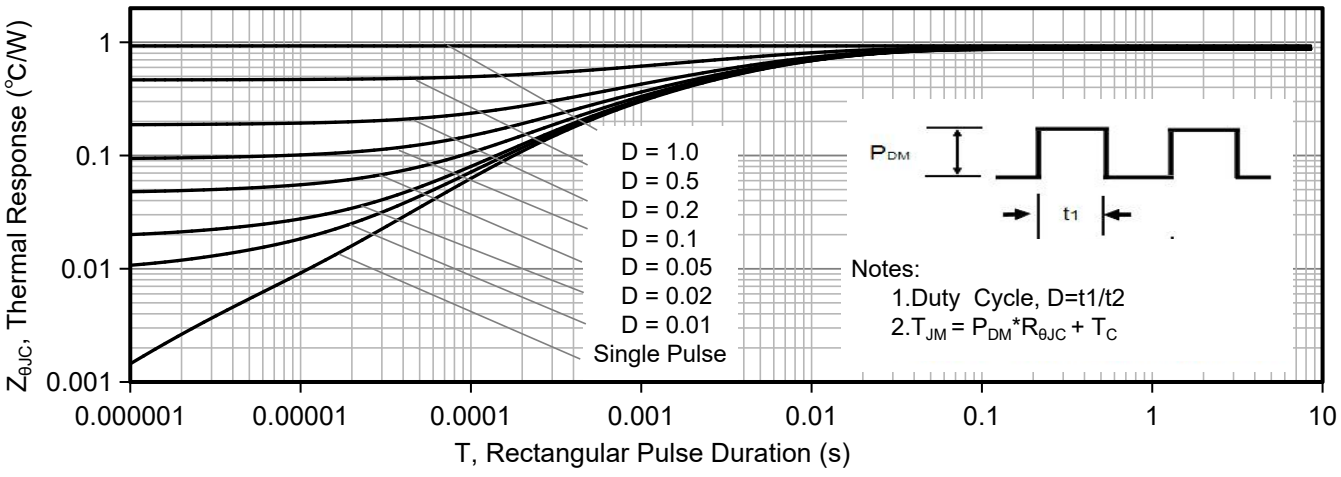


Figure 5. Maximum Effective Thermal Impedance , Junction to Case

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Typical Characteristics T_J = 25ºC, unless otherwise noted

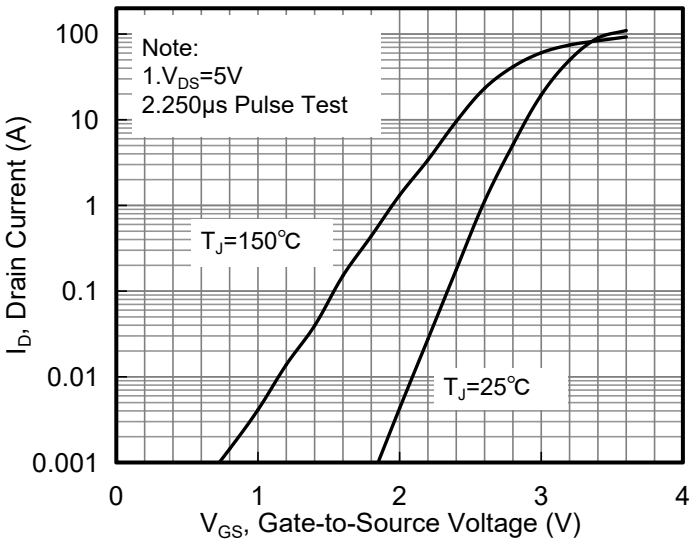


Figure 6. Typical Transfer Characteristics

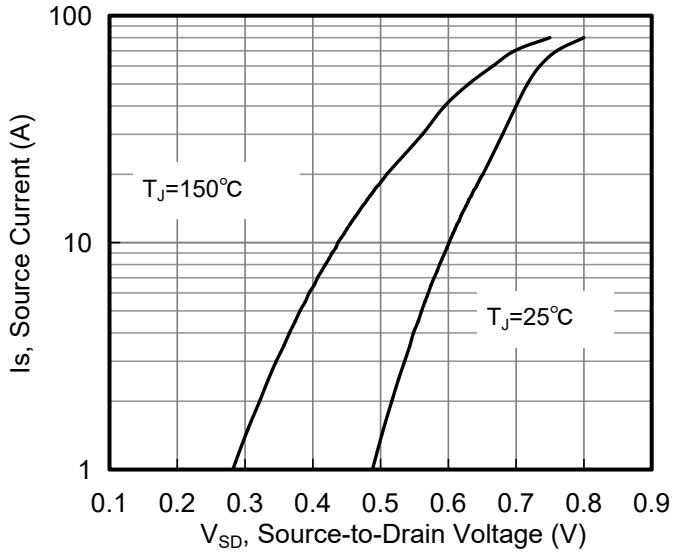


Figure 7. Typical Body Diode Transfer Characteristics

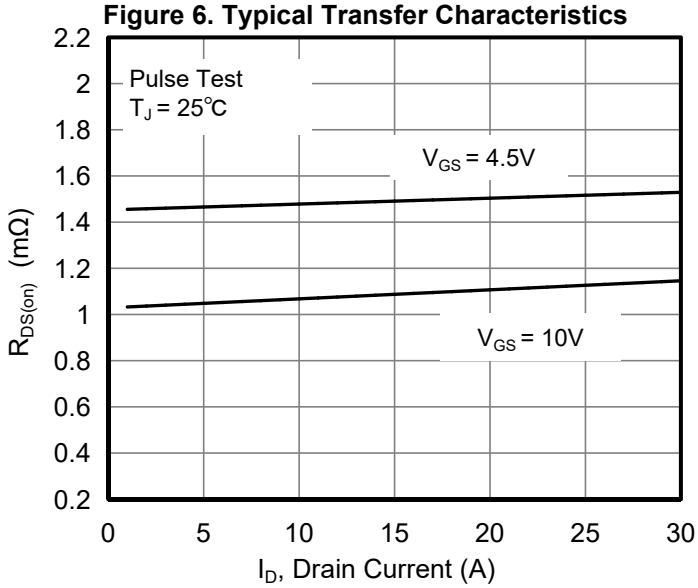


Figure 8. Drain-to-Source On Resistance vs Drain Current

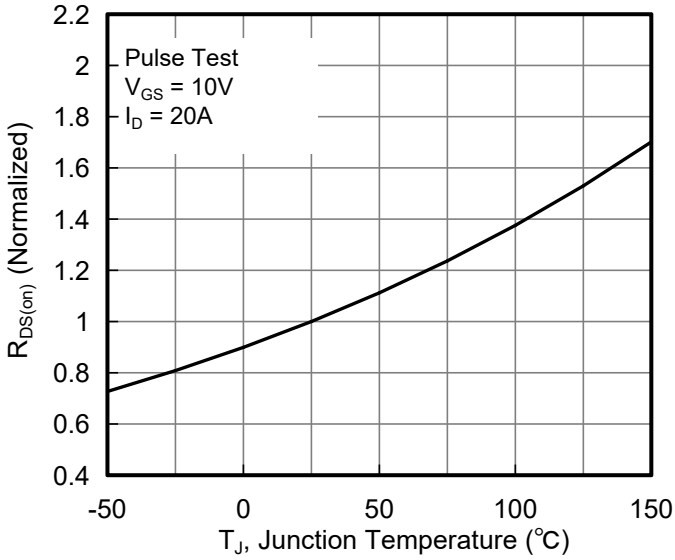


Figure 9. Normalized On Resistance vs Junction Temperature

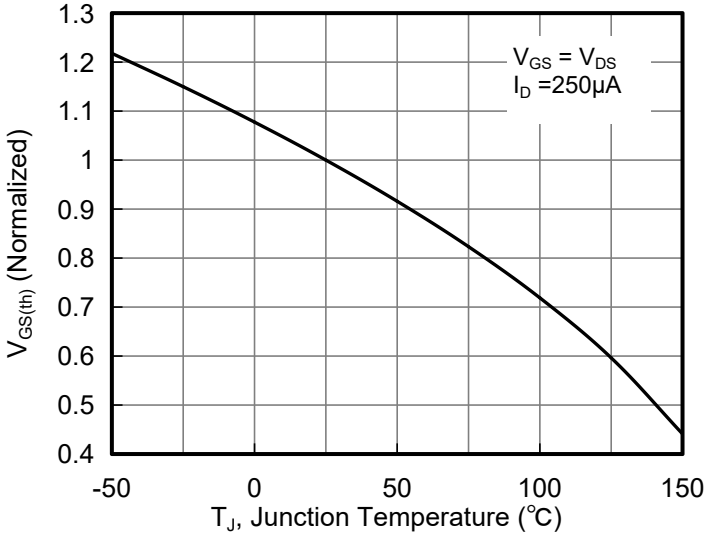


Figure 10. Normalized Threshold Voltage vs Junction Temperature

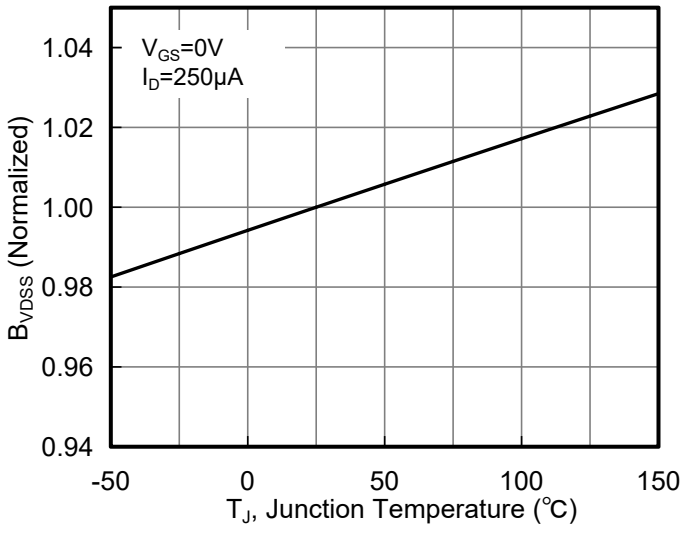


Figure 11. Normalized Breakdown Voltage vs Junction Temperature

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Typical Characteristics T_J = 25ºC, unless otherwise noted

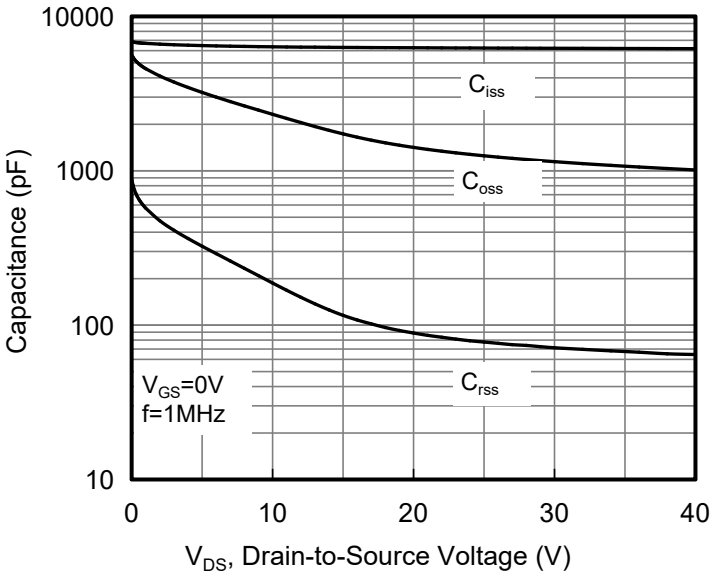


Figure 12. Capacitance Characteristics

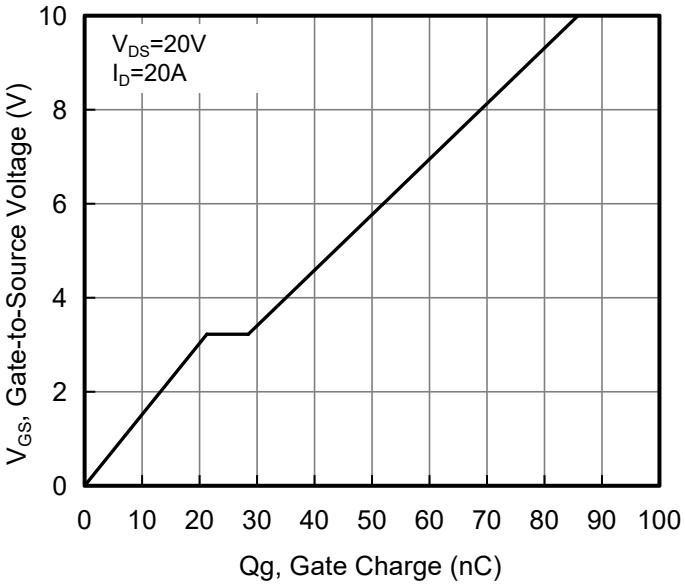


Figure 13. Typical Gate Charge vs Gate to Source Voltage

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Figure A：Gate Charge Test Circuit and Waveform

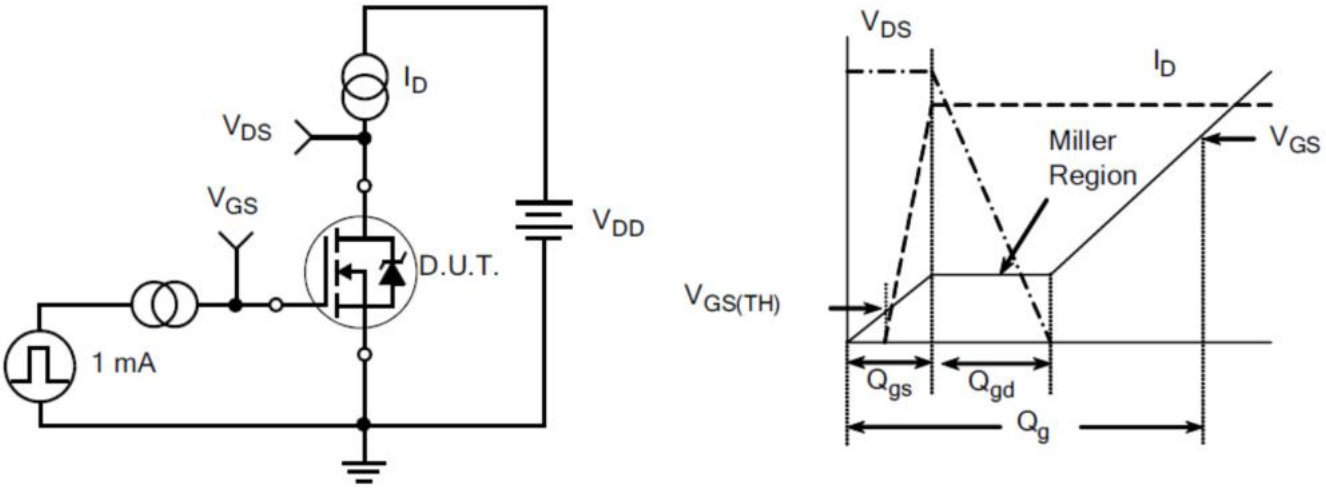


Figure B：Resistive Switching Test Circuit and Waveform

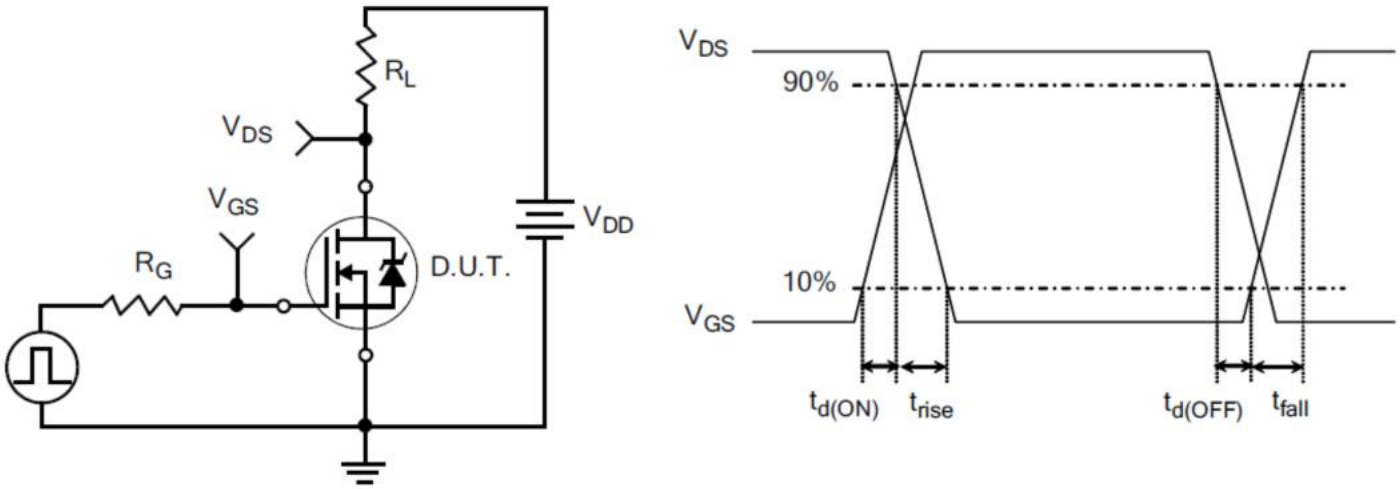
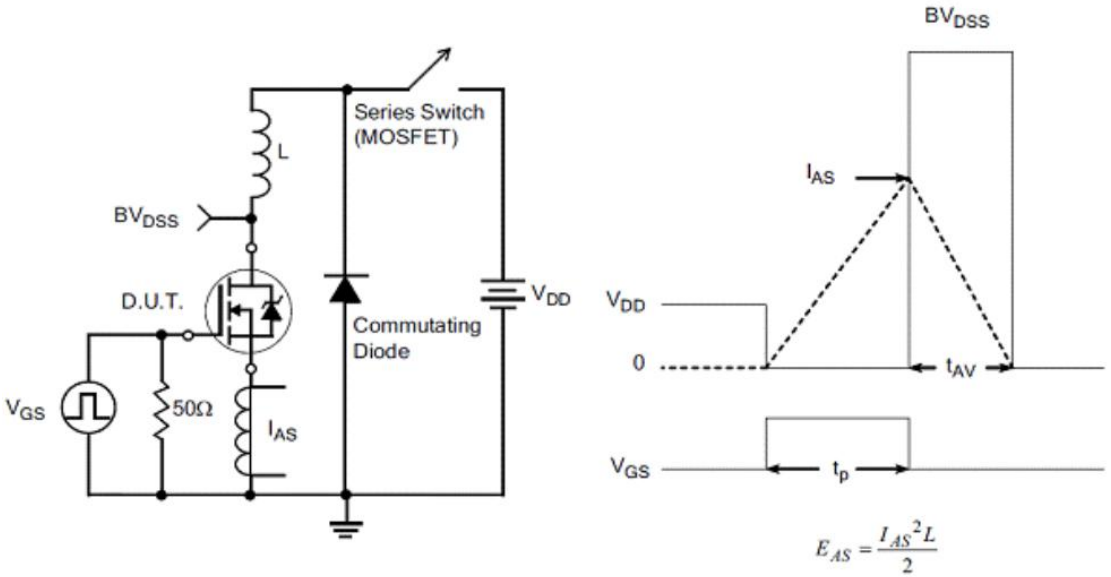
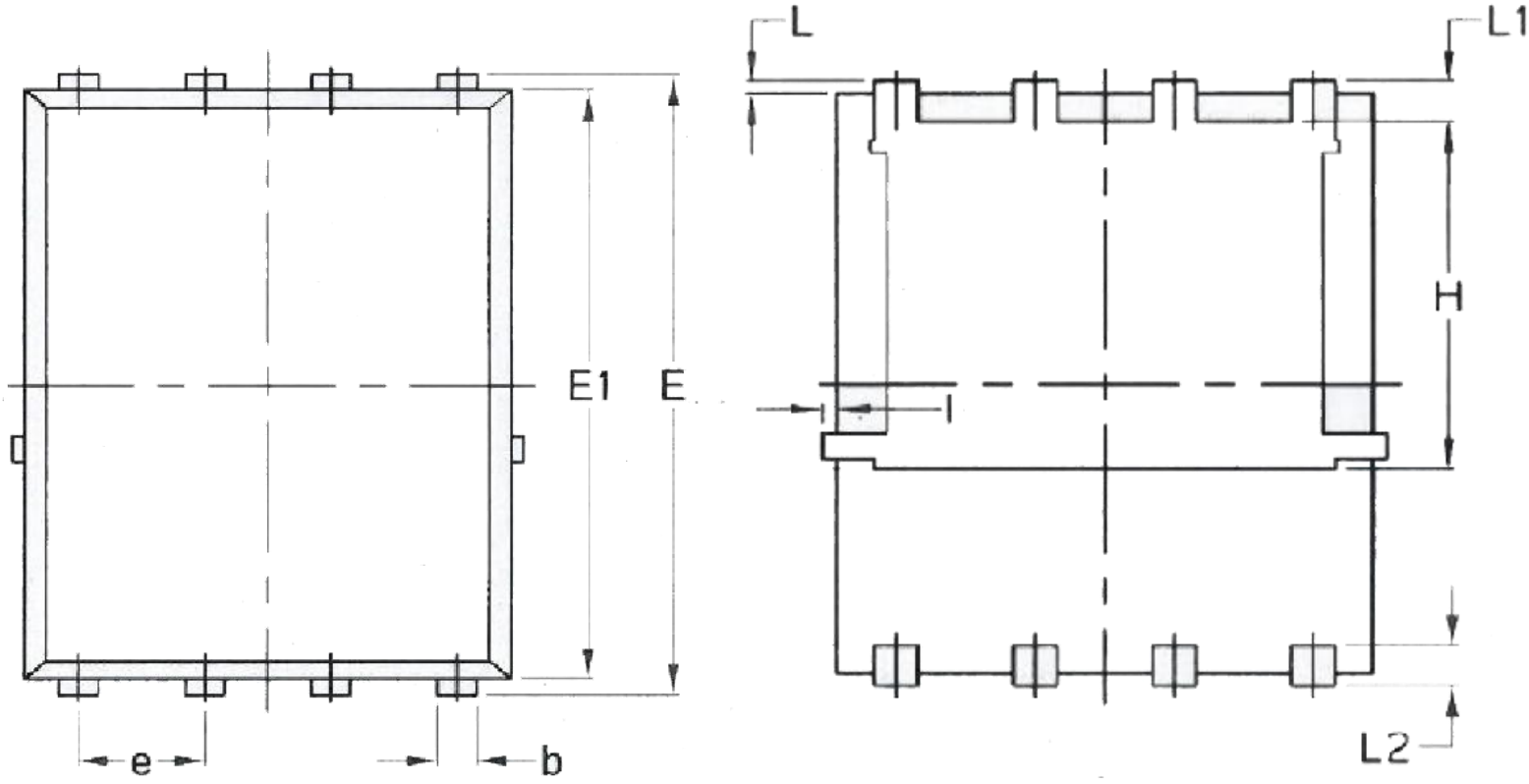


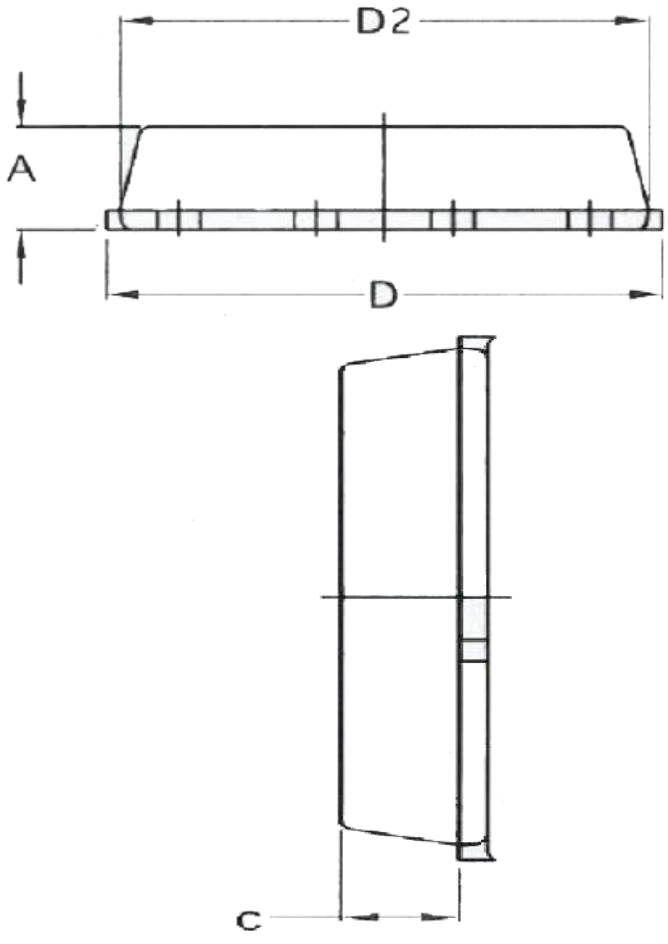
Figure C：Unclamped Inductive Switching Test Circuit and Waveform



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Outlines DFN5x6_8L Package





SYMBOL	DIMENSIONAL REQMTS		
	MIN	NOM	MAX
A	0.9	1.055	1.17
b	0.33	0.415	0.51
c	0.78	---	0.97
D	4.7	5.04	5.4
D2	4.7	4.9	5.1
E	5.75	6.025	6.25
E1	5.6	5.775	6
e	1.27 BSC		
L	0.05	0.14	0.25
L1	0.35	0.485	0.71
L2	0.35	0.485	0.71
H	3.18	3.41	3.66
I	---	---	0.18

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