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N-Channel Super-junction MOSFET Gen Ⅲ

MOSFET

Metal Oixde Semiconductor Field Effect Transistor

650V Super-junction Gen Ⅲ

650V Super-junction Gen Ⅲ Power Transistor

HRD65T180GE Data Sheet

Rev. 2020 V1.3

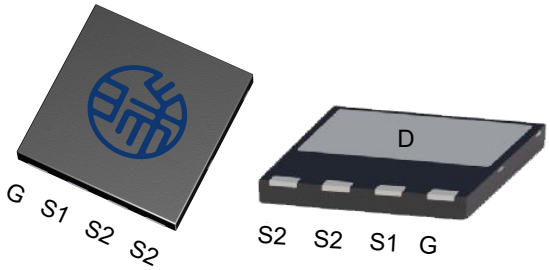
650V Super-junction Power MOSFET Gen Ⅲ

Description

650V Super-junction MOSFET Gen Ⅲ

Super-junction MOSFET Gen Ⅲ is designed by HR-Micro Semiconductor Company,according to the SJ principle.This device provide an excellent Gate charge and Rds(on),which leads to extremely communication and conduction losses .So it is very suitable for AC/DC power conversion, Laptop adapter, Lighting, and industrial power applications.

DFN 8*8

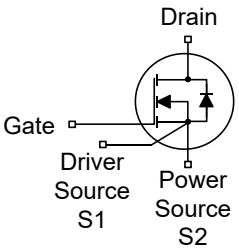


Features

- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- Easy to use/drive
- RoHS compliant

Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- Charger



RoHS

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	700	V
$R_{DS(on),max}$	0.18	Ω
$Q_{g,typ}$	32.9	nC
I_D	21	A
$I_{D,pulse}$	63	A
E_{OSS} @ 400V	4.14	μJ
Body Diode di_F/dt	500	A/μs

Device Marking and Package Information

Device	Package	Marking
HRD65T180GE	DFN8*8	D65T180GE

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Value**	**Unit**
Drain-Source voltage(V_{GS}=0V)		V_{DS}	650	V
Continuous Drain Current[1]	T_C = 25ºC	I_D	21	A
	T_C = 100ºC		12.6	
Pulsed Drain Current[2]		$I_{D,pulse}$	63	A
Gate-Source Voltage		V_{GS}	±30	V
Single Pulse Avalanche Energy		E_{AS}	497	mJ
Repetitive Avalanche Energy		E_{AR}	0.75	mJ
Avalanche Current		I_{AR}	4.1	A
MOSFET dv/dt Ruggedness, V_{DS} = 0...480V		dv/dt	50	V/ns
Power Dissipation For DFN 8*8		P_D	176	W
Continuous Diode Forward Current		I_S	17.9	A
Diode Pulsed Current[2]		$I_{S,pulse}$	63	
Reverse Diode dv/dt[3]		dv/dt	15	V/ns
Maximum Diode Commutation Speed		di_f/dt	500	A/μs
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance For DFN 8*8			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.71	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	

Notes

1) Limited by maximum junction temperature.

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

3) Identical low side and high side switch with identical R_G.

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	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 650V, V_{GS} = 0V, T_J = 150ºC	--	--	100	
Gate-Source Leakage Current	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	3	3.5	4	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 10.5A	--	0.140	0.180	Ω
Gate Resistance	R_G	f = 1.0MHz open drain	--	2.7	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 100V f = 1.0MHz	--	1517	--	pF
Output Capacitance	C_{oss}		--	51.4	--	
Reverse Transfer Capacitance	C_{rss}		--	1.7	--	
Total Gate Charge	Q_g	V_{DD} = 520V , I_D = 21A V_{GS} = 10V	--	32.9	--	nC
Gate-Source Charge	Q_{gs}		--	9.9	--	
Gate-Drain Charge	Q_{gd}		--	9.8	--	
Gate Plateau Voltage	$V_{Plateau}$		--	5.67	--	V
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V,I_D = 21A R_G = 15Ω,V_{GS} = 10V	--	13	--	ns
Turn-on Rise Time	t_r		--	13	--	
Turn-off Delay Time	$t_{d(off)}$		--	96	--	
Turn-off Fall Time	t_f		--	8	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 10.5A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V I_F = 10.5A, di_F/dt = 100A/μs	--	300	--	ns
Reverse Recovery Charge	Q_{rr}		--	3.3	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	22	--	A

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Transient Thermal Impedance For DFN 8*8

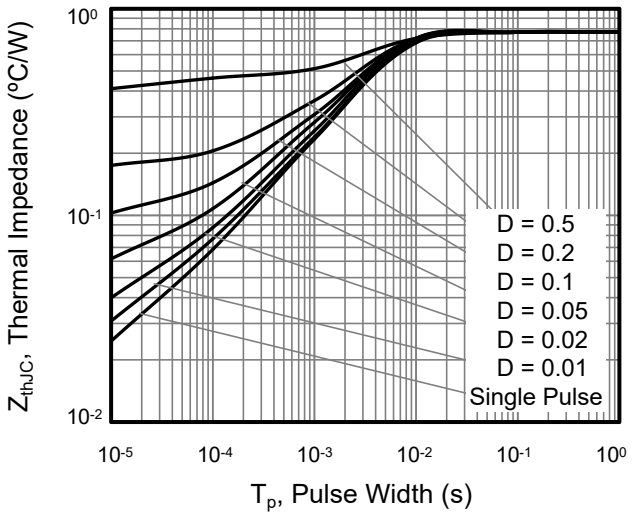


Figure 2. Safe Operation Area For DFN 8*8

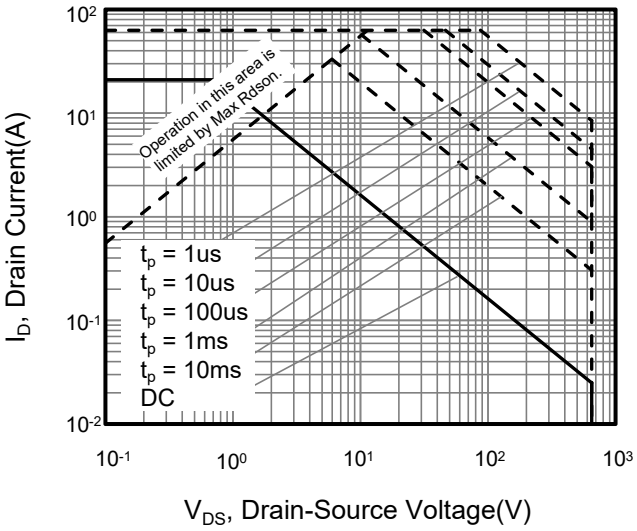


Figure 3. Output Characteristics

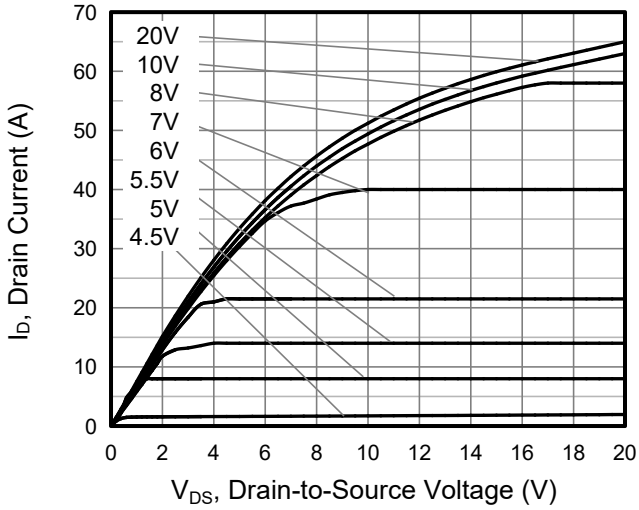


Figure 4. Transfer Characteristics

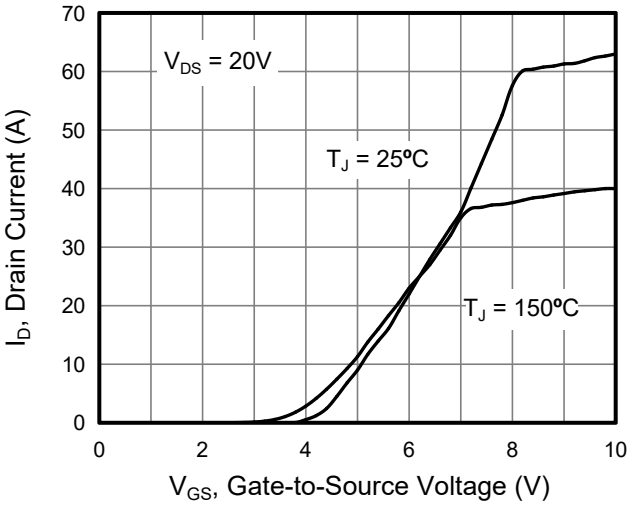


Figure 5. On-Resistance vs. Drain Current

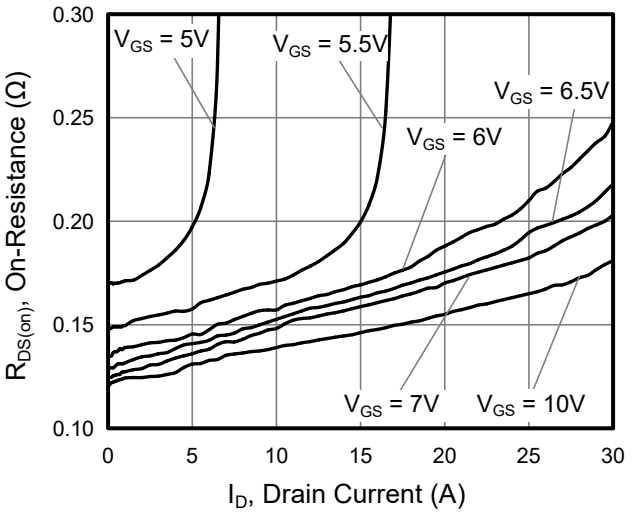
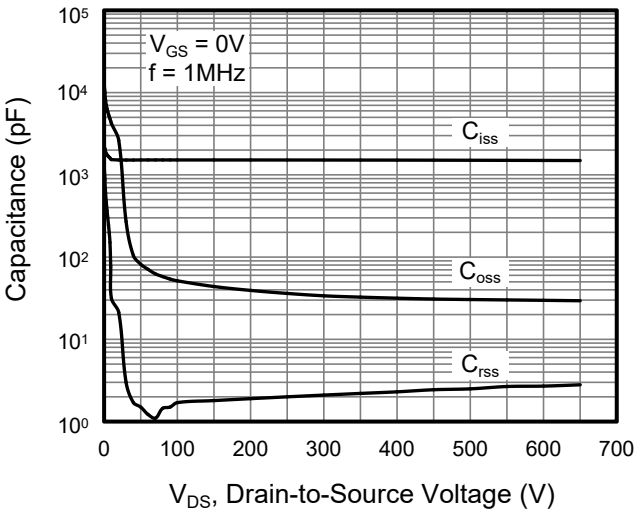


Figure 6. Capacitance



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. Gate Charge

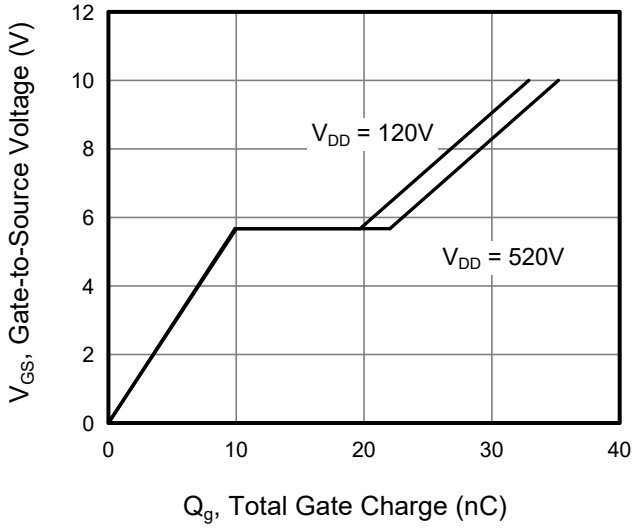


Figure 8. Body Diode Forward Voltage

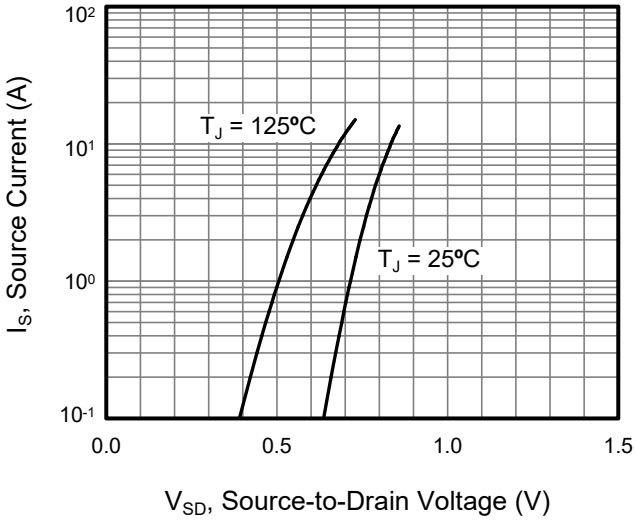


Figure 9. Typ. Coss Stored Energy

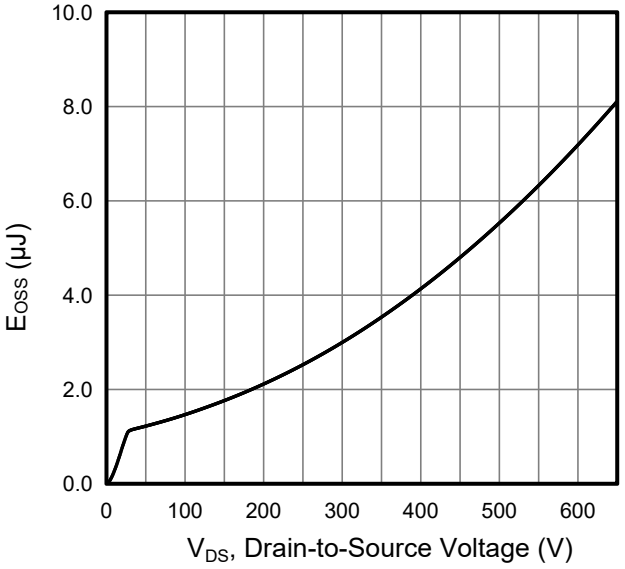


Figure 10. On-Resistance vs. Temperature

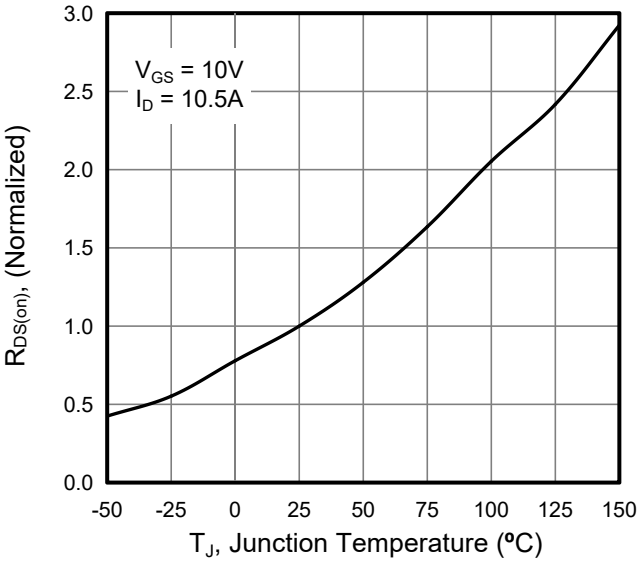


Figure 11. Breakdown Voltage vs. Junction Temperature

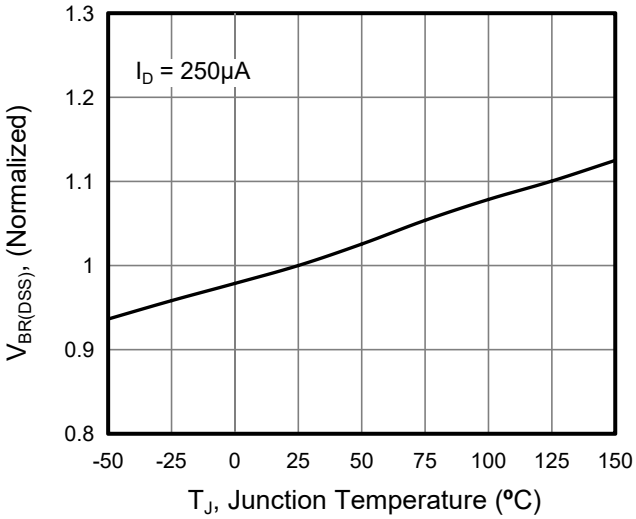


Figure A：Gate Charge Test Circuit and Waveform

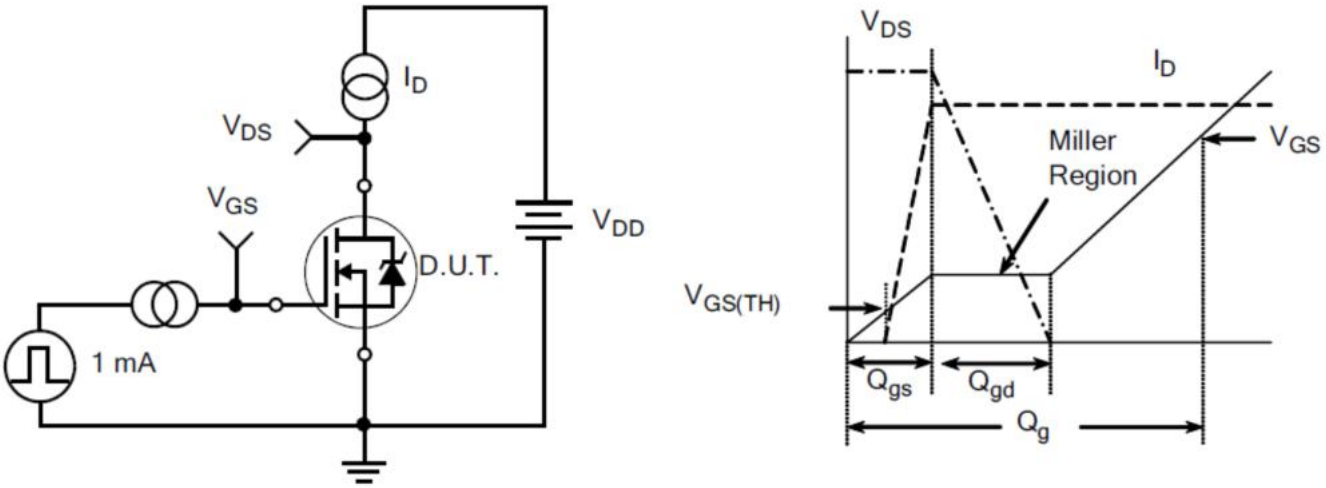


Figure B：Resistive Switching Test Circuit and Waveform

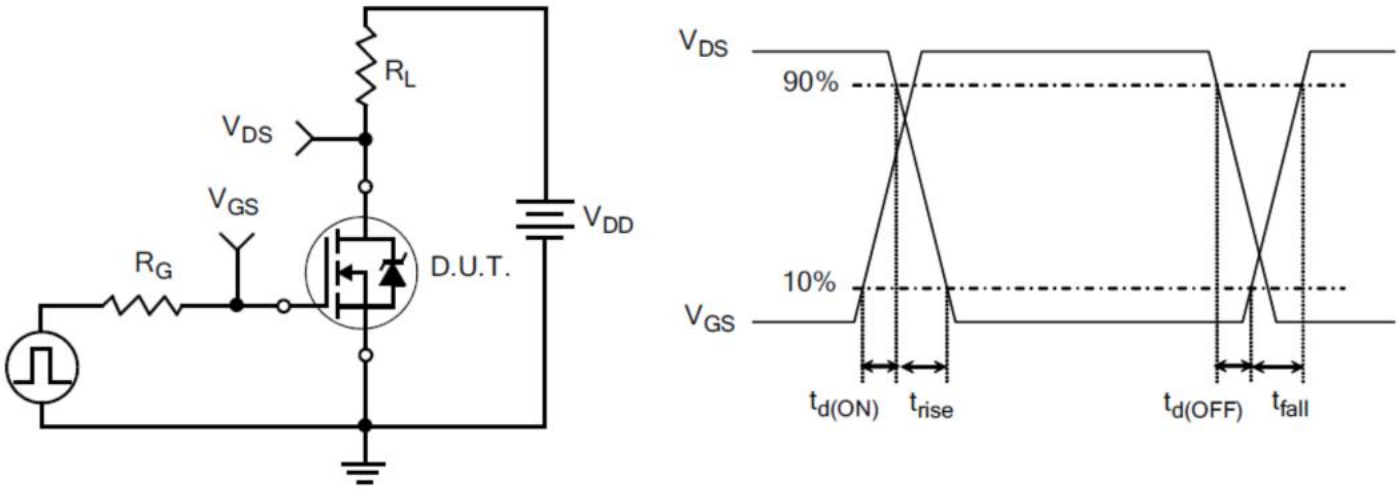
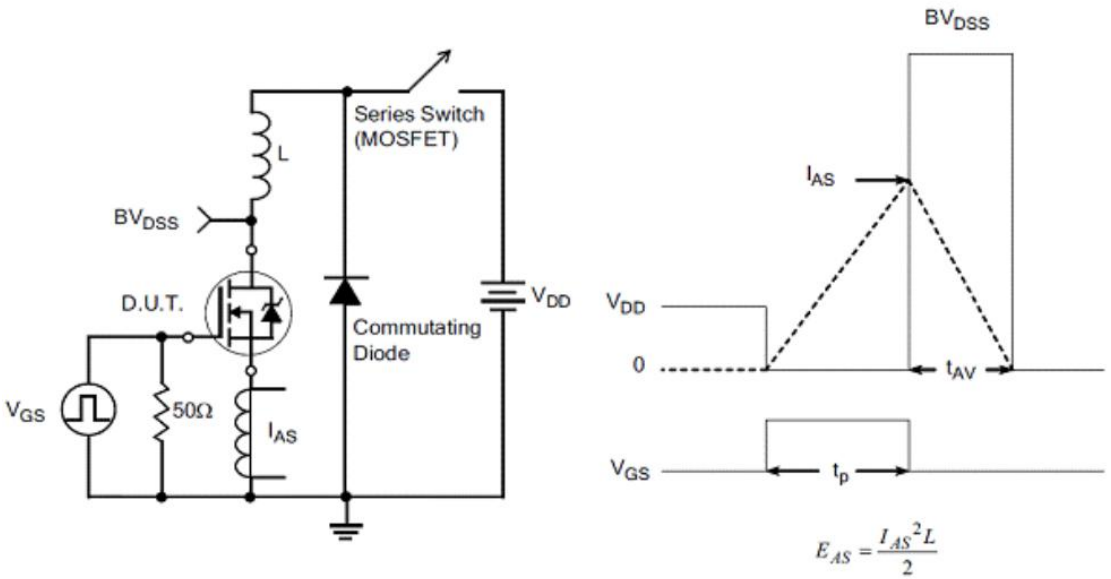
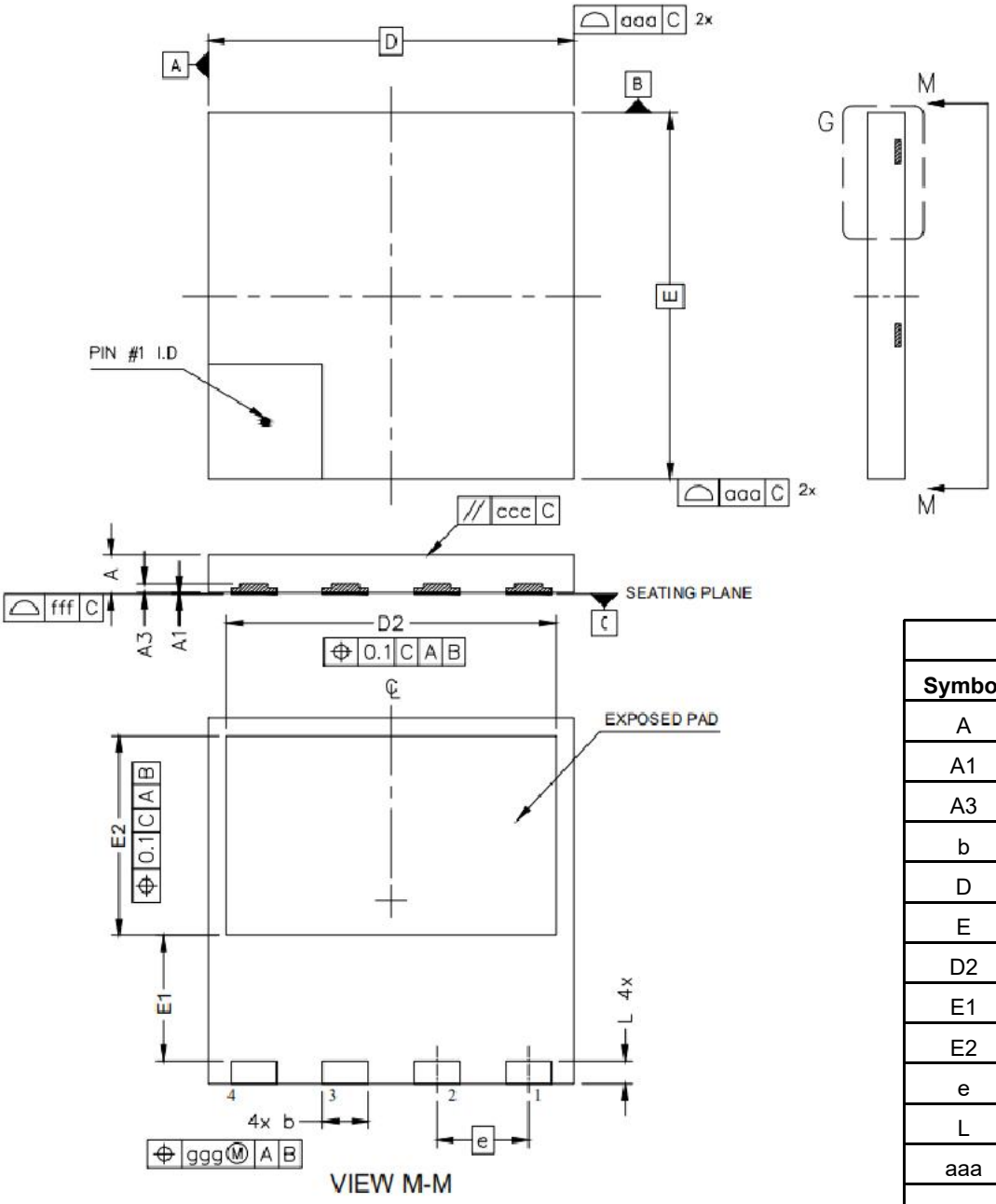


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



DFN 8*8



Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
A	0.75	---	0.95
A1	0.00	---	0.05
A3	0.10	---	0.30
b	0.90	---	1.10
D	7.90	---	8.10
E	7.90	---	8.10
D2	7.10	---	7.30
E1	2.65	---	2.85
E2	4.25	---	4.45
e	2.00 BSC		
L	0.40	---	0.60
aaa	0.10		
ggg	0.05		
ccc	0.05		
fff	0.05		

Ordering information For DFN 8*8					
Package	**Units/Reel**	**Reels/ Inner Box**	**Units/Inner Box**	**Inner Box/Carton Box**	**Units/Carton Box**
DFN 8*8	3000	1	3000	10	30000

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