650V N-Channel Planar MOSFET

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

650V N-Channel Planar MOSFET

650V N-Channel Planar MOSFET Power Transistor

HRH25N65ANx Data Sheet

Rev. 2023 V1.1

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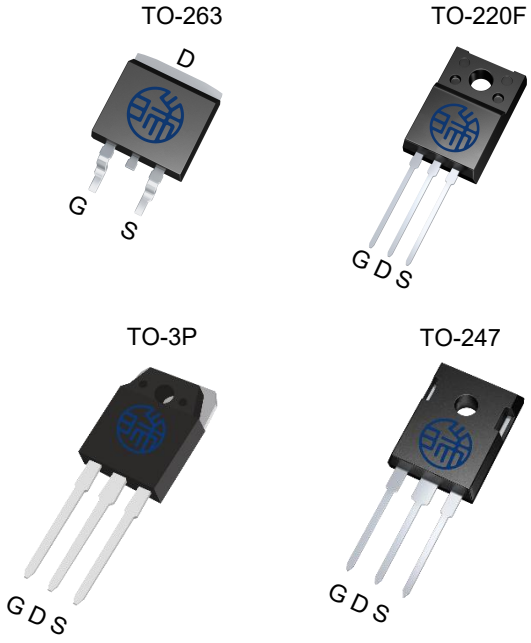
Description

650V N-Channel Planar MOSFET

HRH25N65ANx is HRM high voltage MOSFET family based on advanced planar stripe DMOS technology. This advanced MOSFET family has optimized on-state resistance, and also provides superior switching performance and higher avalanche energy strength. This device family is suitable for high efficiency switch mode power supplies.

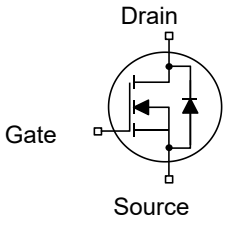
Features

- RDSON=0.27Ω @Vgs=10V, Id=12.5A
- Low gate Charge(typical 81nC)
- Low Crss (typical 3.2pF)
- Fast switching capability
- 100% avalanche tested
- Improved dv/dt capability



Applications

- Switch Mode Power Supply
- Uninterruptible Power Supply (UPS)
- TV Power
- A dapter/Charger



RoHS

Key Performance Parameters

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on),typ}$	0.27	Ω
$Q_{g,typ}$	81	nC
I_D	25	A
$I_{D,pulse}$	100	A

Device Marking and Package Information

Device	Package	Marking
HRH25N65ANF	TO-220F	H25N65ANF
HRH25N65ANFT	TO-220F	H25N65ANFT
HRH25N65ANB	TO-263	H25N65ANB
HRH25N65ANV	TO-3P	H25N65ANV
HRH25N65ANW	TO-247	H25N65ANW

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	25	A
	T_C = 100ºC		15.5	
Pulsed Drain Current [2]		$I_{D,pulse}$	100	A
Gate-Source Voltage		V_{GS}	±30	V
Single Pulse Avalanche Energy [3]		E_{AS}	1186	mJ
Peak Diode Recovery dv/dt [4]		dv/dt	5	V/ns
Power Dissipation For TO-220F		P_D	151	W
Power Dissipation For TO-263/3P/247			379	W
Continuous Diode Forward Current		I_S	25	A
Diode Pulsed Current [2]		$I_{S,pulse}$	100	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance For TO-220F			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.83	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For For TO-3P/247/263			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.33	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) L=10mH, ID=15.4A, Start T_J=25℃.

4) I_{SD} ≤25A, di/dt≤100A/μs, VDD≤BV_{DSS}, Start T_J=25℃.

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	2	--	4	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 12.5A	--	0.27	0.35	Ω
Gate Resistance	R_G	f = 1.0MHz open drain	--	1.2	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} =25V f = 1.0MHz	--	4712	--	pF
Output Capacitance	C_{oss}		--	310	--	
Reverse Transfer Capacitance	C_{rss}		--	3.2	--	
Total Gate Charge	Q_g	V_{DD} = 520V, I_D = 25A V_{GS} = 10V	--	81	--	nC
Gate-Source Charge	Q_{gs}		--	26	--	
Gate-Drain Charge	Q_{gd}		--	23	--	
Gate Plateau Voltage	$V_{Plateau}$		--	5.5	--	V
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 325V, I_D = 25A R_G = 25Ω	--	86		ns
Turn-on Rise Time	t_r		--	145		
Turn-off Delay Time	$t_{d(off)}$		--	172		
Turn-off Fall Time	t_f		--	110		
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 25A V_{GS} = 0V	--	--	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V I_F = 25A, di_F/dt = 100A/μs	--	1208	--	ns
Reverse Recovery Charge	Q_{rr}		--	8.3	--	μC

Typical Characteristics T_J = 25ºC, unless otherwise noted

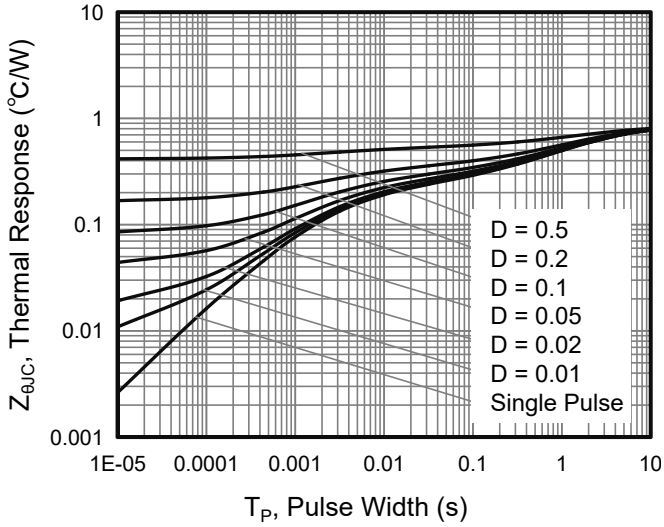


Figure 1. Transient Thermal Impedance For TO-220F

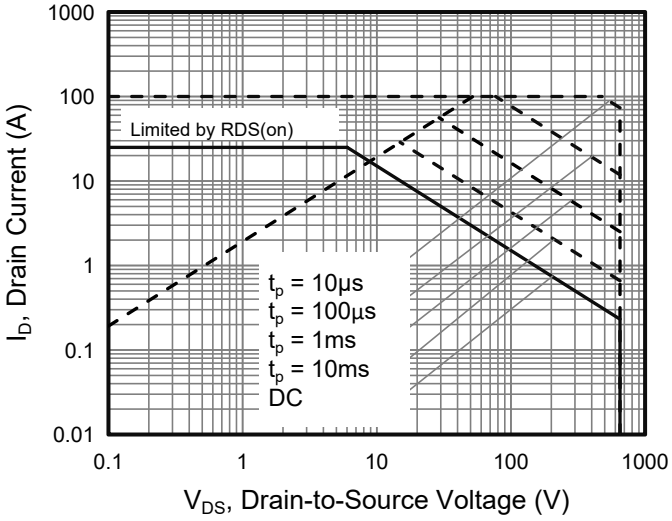


Figure 2. Safe Operation Area For TO-220F

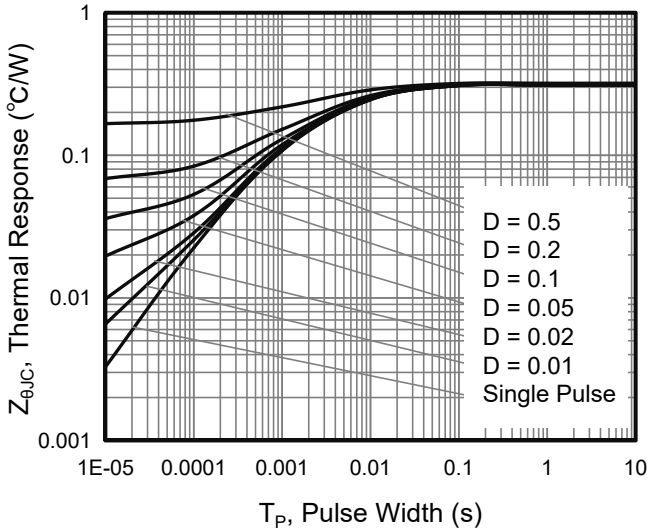


Figure 1. Transient Thermal Impedance For TO-3P/247/263

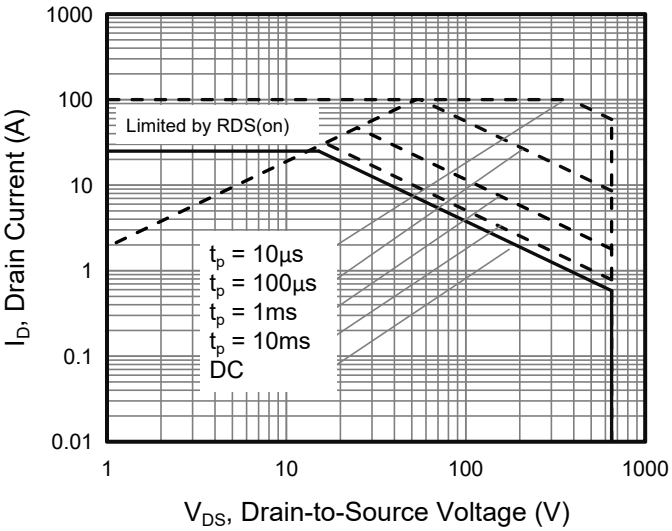


Figure 2. Safe Operation Area For TO-3P/247/263

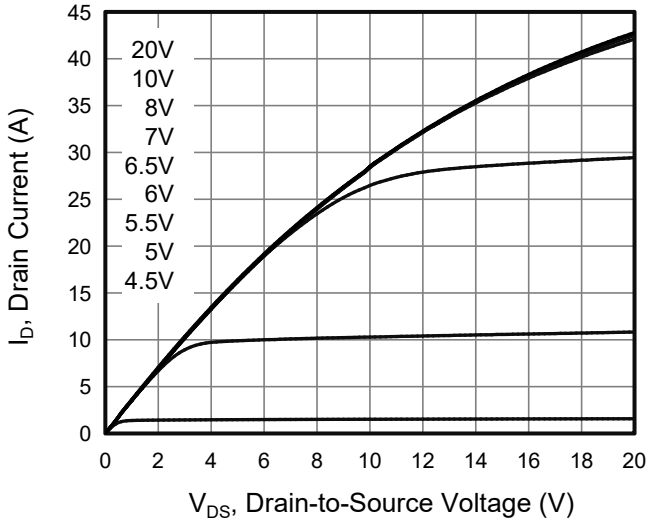


Figure 3. Output Characteristics

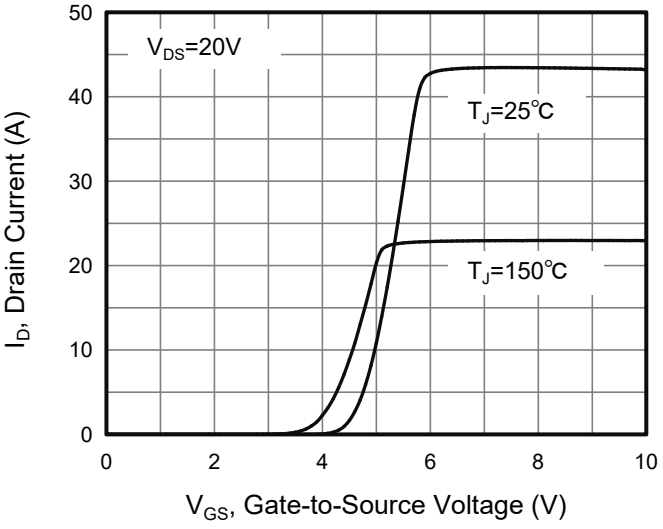


Figure 4. Transfer Characteristics

Typical Characteristics T_J = 25ºC, unless otherwise noted

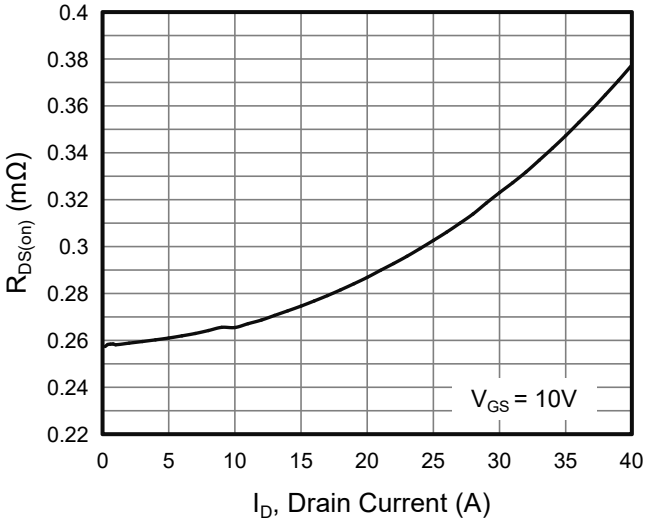


Figure 5. On-Resistance vs Drain Current

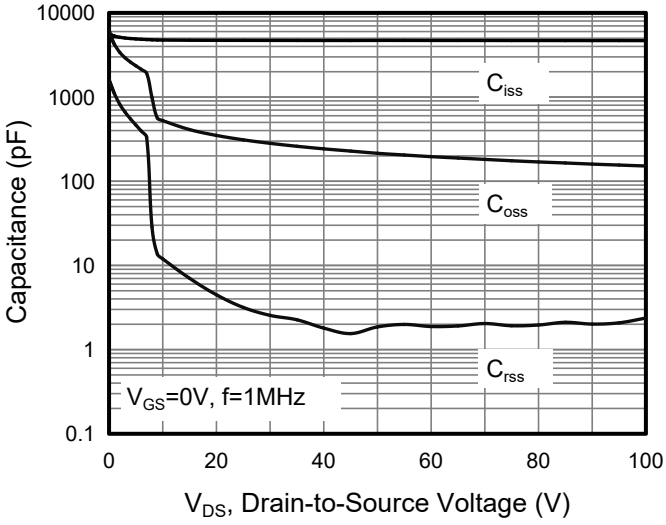


Figure 6. Capacitance

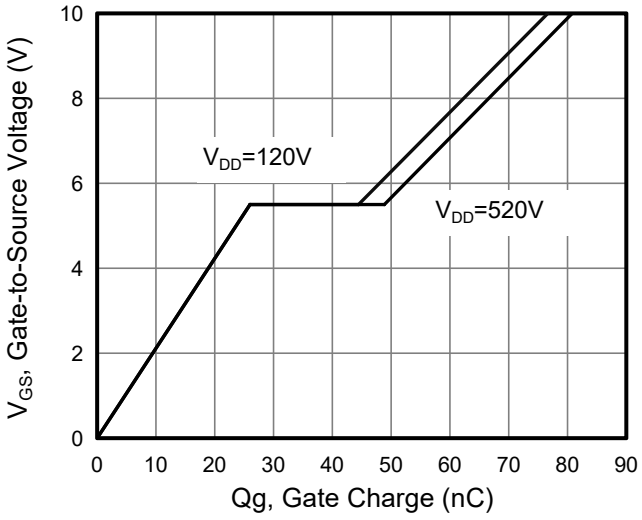


Figure 7. Gate Charge

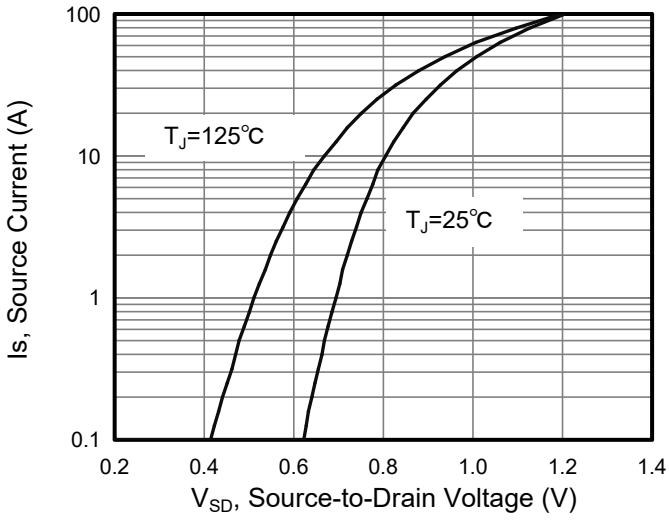


Figure 8. Body Diode Forward Voltage

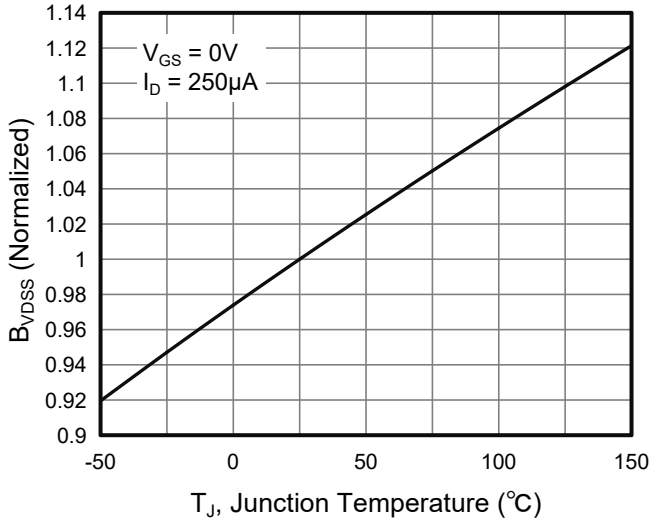


Figure 9. Breakdown Voltage vs Junction Temperature

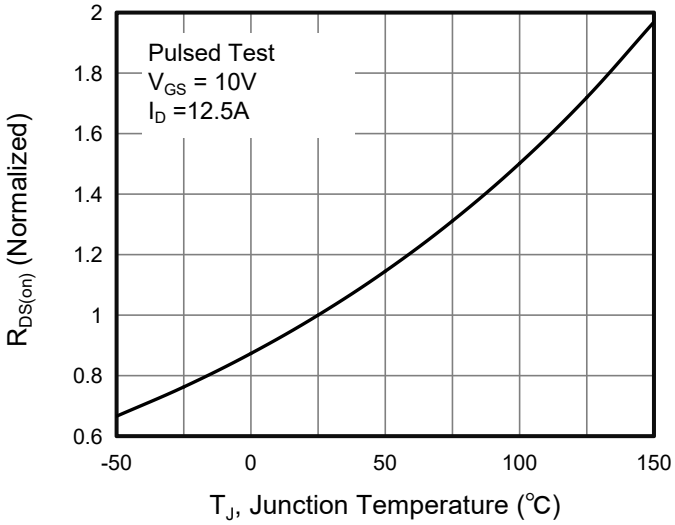


Figure 10. On-Resistance vs Temperature

Figure A：Gate Charge Test Circuit and Waveform

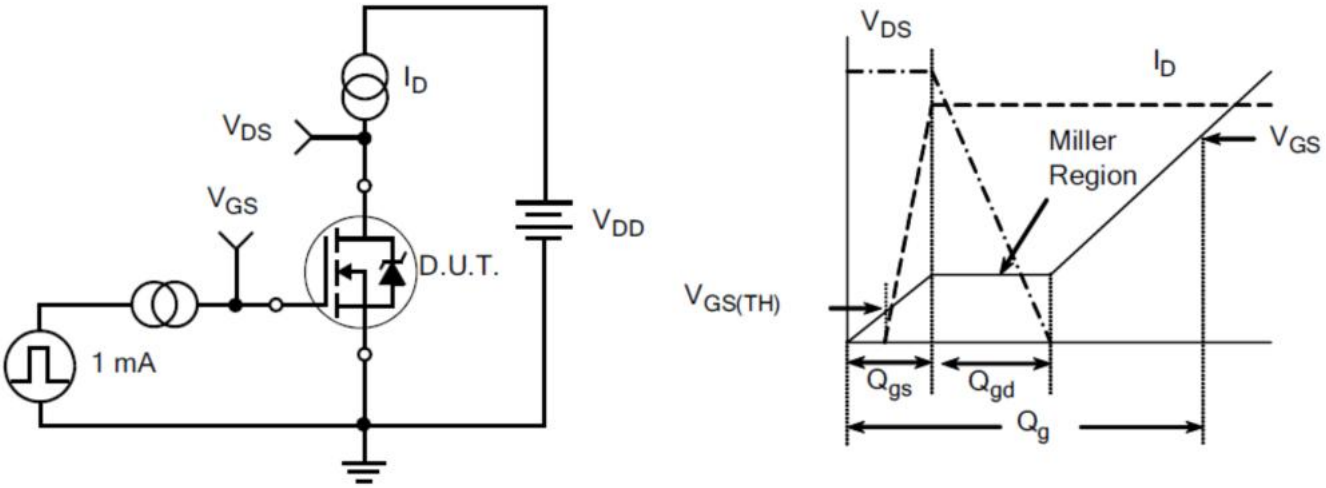


Figure B：Resistive Switching Test Circuit and Waveform

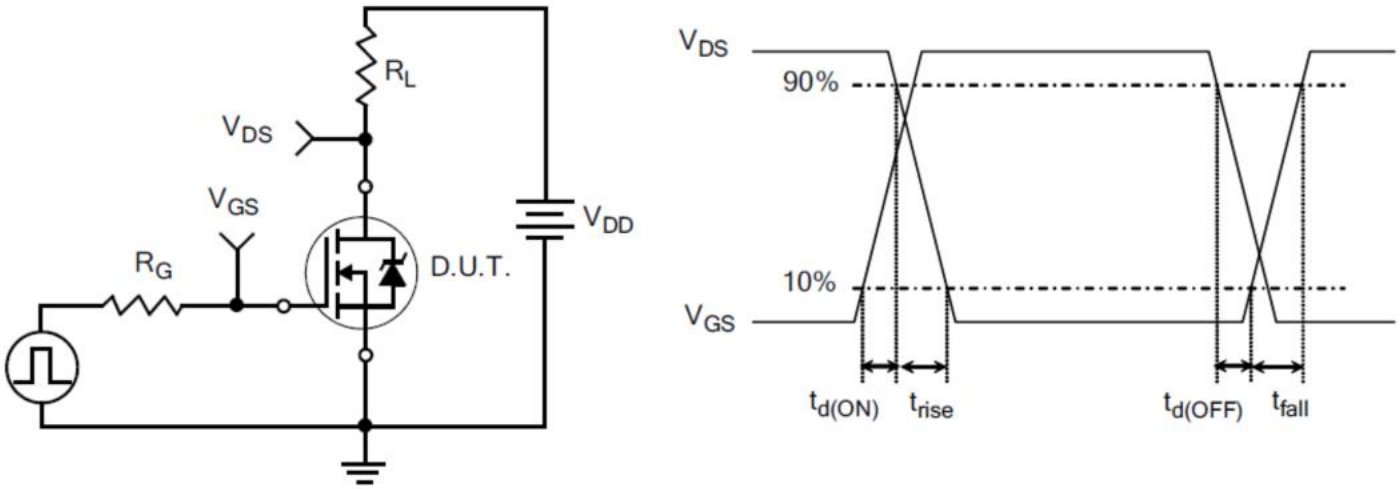
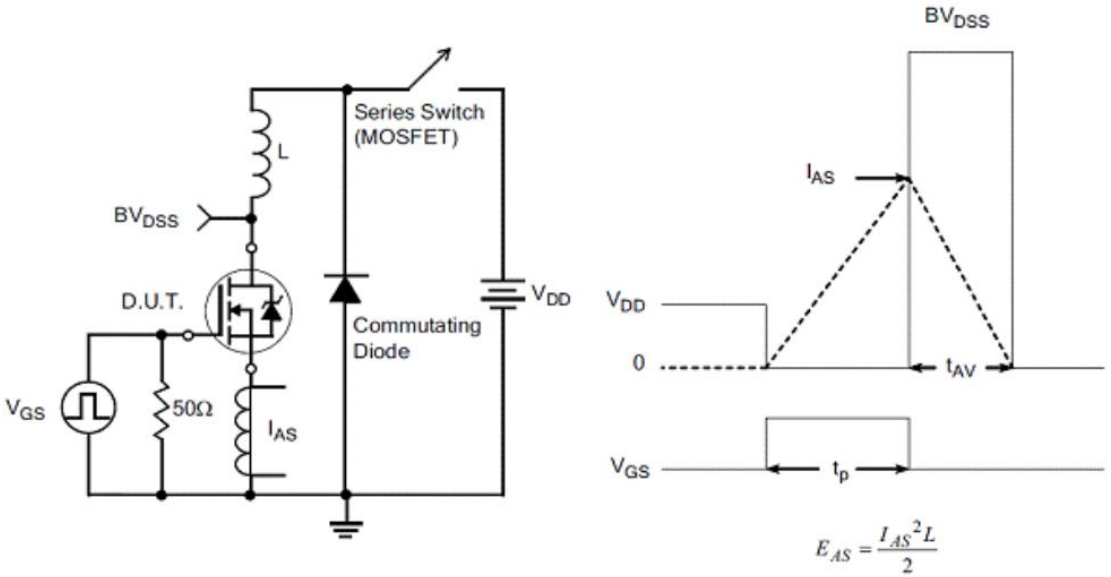
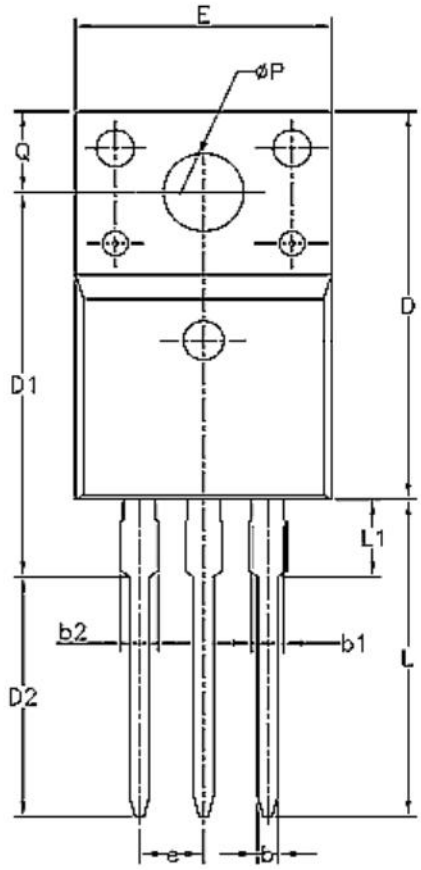
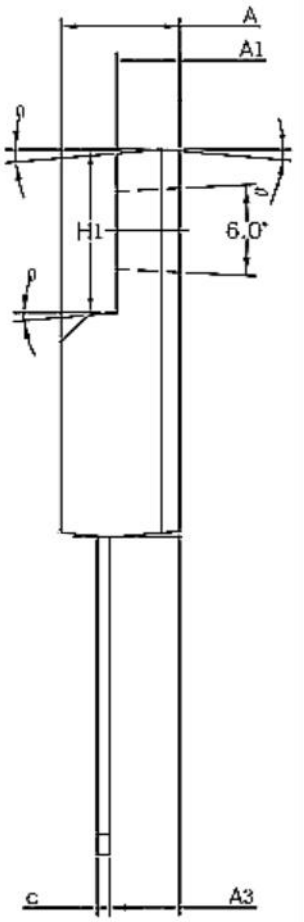


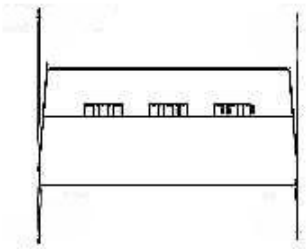
Figure C：Unclamped Inductive Switching Test Circuit and Waveform



Outlines TO-220F Package

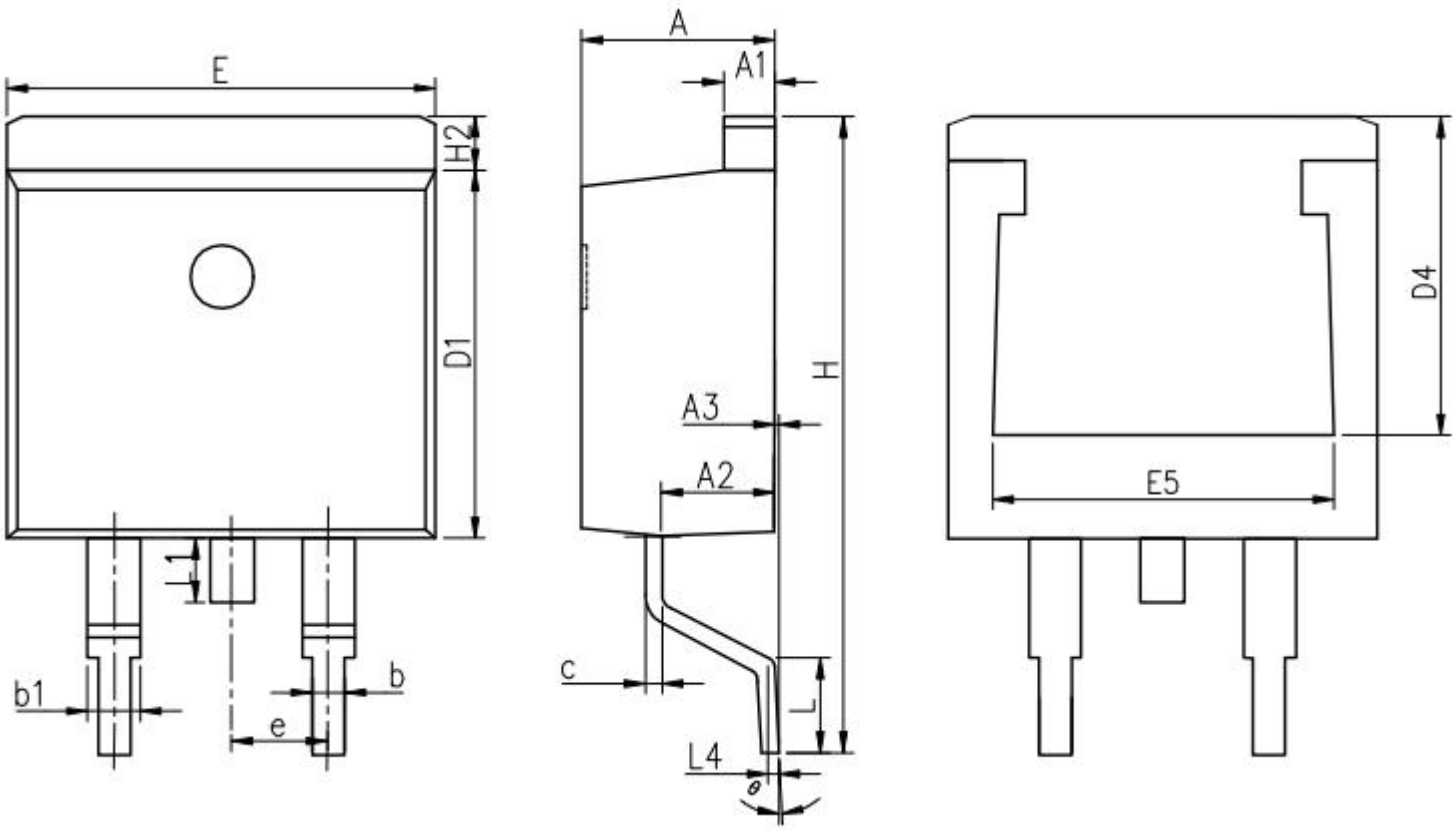






SYMBOL	MIN	NOM	MAX
A	4.5	4.7	4.9
A1	2.34	2.54	2.74
A3	2.56	2.76	2.96
b	0.7	---	0.95
b1	1.18	---	1.43
b2	---	---	1.55
c	0.4	0.5	0.65
D	15.57	15.87	16.17
D1	15.35	15.675	15.95
D2	9.6	9.875	10.15
E	9.96	10.16	10.36
e	2.54 BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	---	---	3.5

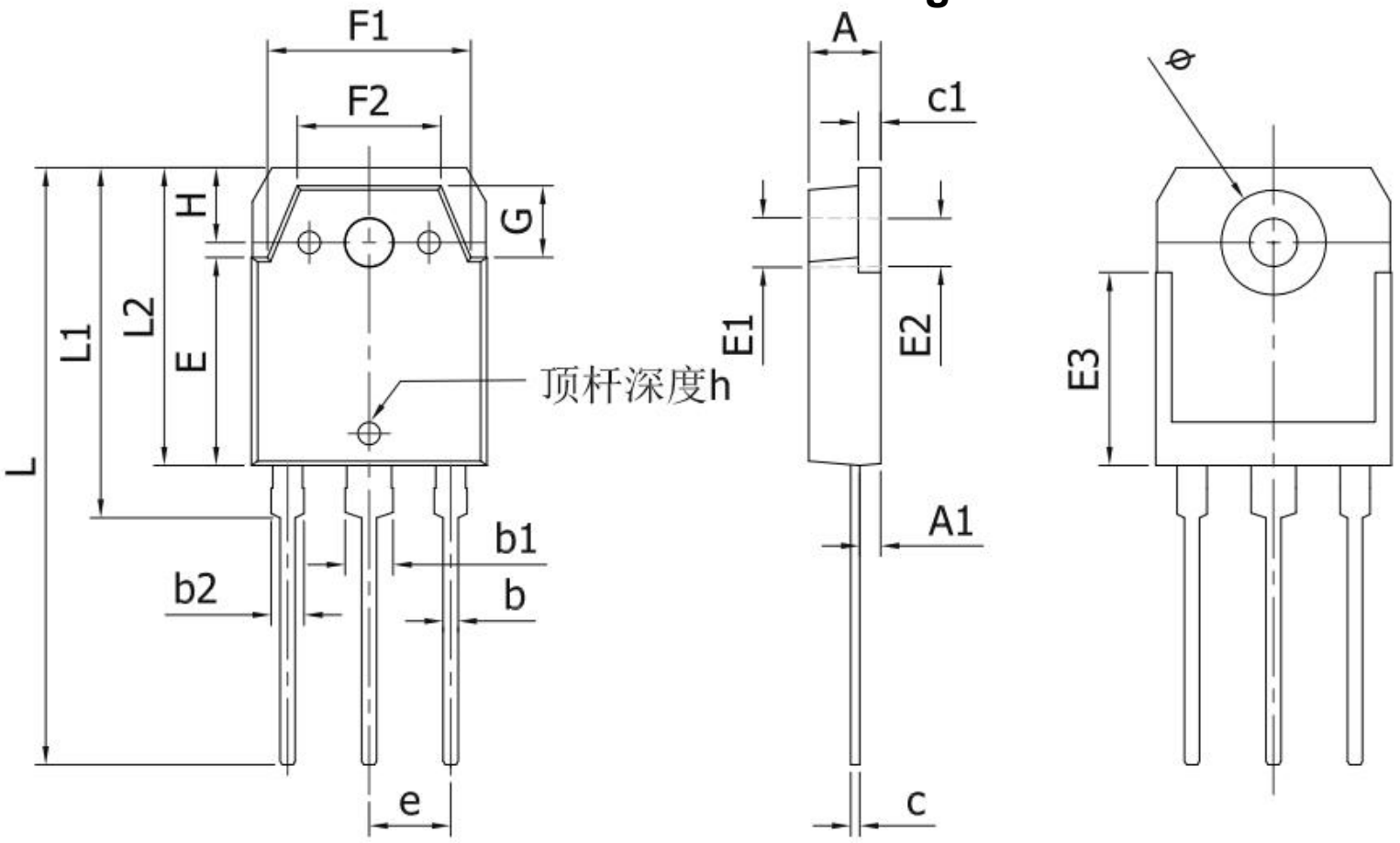
Outlines TO-263 Package

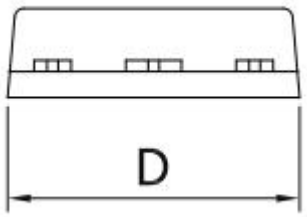


SYMBOL	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0	0.13	0.25
b	0.7	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	---	---
E	9.86	10.16	10.36

SYMBOL	MIN	NOM	MAX
E5	7.06	---	---
e		2.54 BSC	
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.30	2.60
L1	1.40	1.55	1.70
L4		0.25 BSC	
θ	0°	5°	9°
Θ	0°	--	8°
Θ1	1°	3°	5°

Outlines TO-3P Package

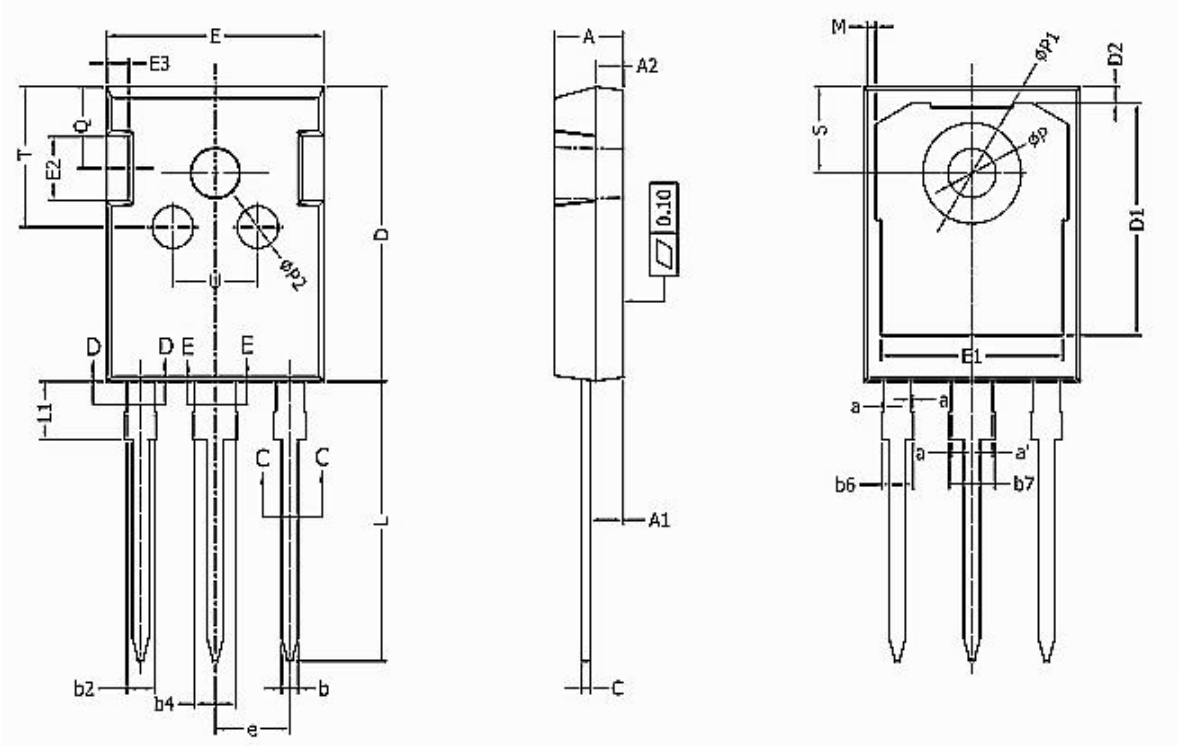


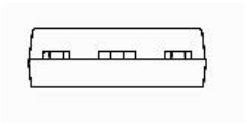


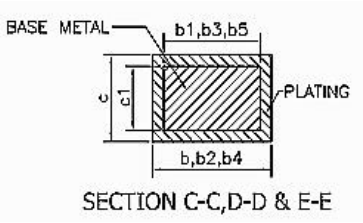
SYMBOL	MIN	NOM	MAX
A	4.6	4.8	5.0
A1	1.2	1.4	1.6
b	0.8	1	1.2
b1	2.8	3	3.2
b2	1.8	2	2.2
c	0.5	0.6	0.7
c1	1.45	1.55	1.65
D	15.45	15.65	15.85
E	13.7	13.9	14.1
E1	3.3REF		
E2	3.2REF		

SYMBOL	MIN	NOM	MAX
E3	12.9REF		
F1	13.4	13.6	13.8
F2	9.4	9.6	9.8
L	39.7	39.9	40.1
L1	23.2	23.4	23.6
L2	19.7	19.9	20.1
ø	6.9	7	7.1
G	4.6	4.8	5.0
e	5.45TYP		
H	5.0REF		
h	0.0	0.15	0.3

Outlines TO-247 Package







SYMBOL	MIN	NOM	MAX
A	4.9	5	5.1
A1	2.31	2.41	2.51
A2	1.9	2	2.1
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2	2.02
b4	2.96	---	3.06
b5	2.96	3	3.02
b6	---	---	2.25
b7	---	---	3.25
c	0.59	---	0.66
c1	0.58	0.6	0.62
D	20.9	21	21.1
D1	16.25	16.55	16.85

SYMBOL	MIN	NOM	MAX
D2	1.05	1.17	1.35
E	15.7	15.8	15.9
E1	13.1	13.3	13.5
E2	4.4	4.5	4.6
E3	2.4	2.5	2.6
e	5.436 BSC		
L	19.8	19.92	20.1
L1	---	---	4.3
M	0.35	---	0.95
P	3.4	3.5	3.6
P1	7	---	7.4
P2	2.4	2.5	2.6
Q	5.6	---	6
S	6.05	6.15	6.25
T	9.8	---	10.2
U	6	---	6.4

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