650V N-Channel Planar MOSFET

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

650V N-Channel Planar MOSFET

650V N-Channel Planar MOSFET Power Transistor

HRH10N65AG2Nx Data Sheet

Rev. 2024 V1.0

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650V N-Channel Planar MOSFET

Description

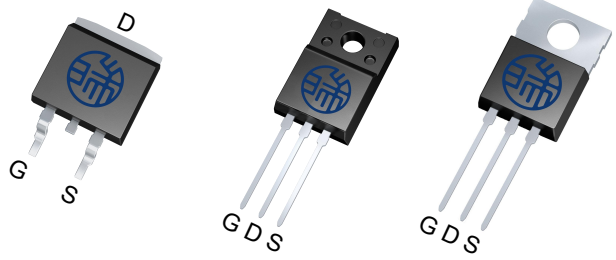
650V N-Channel Planar MOSFET

HRH10N65AG2Nx 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

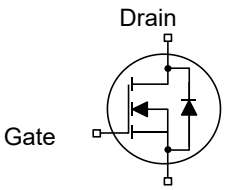
- RDSON = 0.8Ω @Vgs=10V, Id=5A
- Low gate Charge(typical 36.4nC)
- Low Crss (typical 6.9pF)
- Fast switching capability
- 100% avalanche tested
- Improved dv/dt capability
- Halogen free and RoHS compliant

TO-263 TO-220F TO-220



Applications

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



RoHS HF

Key Performance Parameters

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on),typ}$	0.8	Ω
$Q_{g,typ}$	36.4	nC
I_D	10	A
$I_{D,pulse}$	40	A

Device Marking and Package Information

Device	Package	Marking
HRH10N65AG2NP	TO-220	H10N65AG2NP
HRH10N65AG2NF	TO-220F	H10N65AG2NF
HRH10N65AG2NB	TO-263	H10N65AG2NB

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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	10	A
	T_C = 100ºC		6.3	
Pulsed Drain Current [2]		$I_{D,pulse}$	40	A
Gate-Source Voltage		V_{GS}	±30	V
Single Pulse Avalanche Energy [3]		E_{AS}	700	mJ
Peak Diode Recovery dv/dt [4]		dv/dt	5	V/ns
Power Dissipation For TO-220F		P_D	48	W
Power Dissipation For TO-220/263			120	W
Continuous Diode Forward Current		I_S	10	A
Diode Pulsed Current [2]		$I_{S,pulse}$	40	
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}	2.6	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-220/263			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	1.04	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=14mH, ID=10A, RG=25Ω, VDD=200V, Start T_J=25℃.

4) I_{SD} ≤10A, di/dt≤100A/μs, VDD≤BV_{DSS}, Start T_J=25℃.

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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	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 = 5A	--	0.8	1	Ω
Gate Resistance	R_G	f = 1.0MHz open drain	--	5.4	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} =25V f = 1.0MHz	--	1670	--	pF
Output Capacitance	C_{oss}		--	133	--	
Reverse Transfer Capacitance	C_{rss}		--	6.9	--	
Total Gate Charge	Q_g	V_{DD} = 520V, I_D = 10A V_{GS} = 10V	--	36.4	--	nC
Gate-Source Charge	Q_{gs}		--	9.8	--	
Gate-Drain Charge	Q_{gd}		--	12.4	--	
Gate Plateau Voltage	$V_{Plateau}$		--	5.05	--	V
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 325V, I_D = 10A R_G = 25Ω	--	38		ns
Turn-on Rise Time	t_r		--	67		
Turn-off Delay Time	$t_{d(off)}$		--	55		
Turn-off Fall Time	t_f		--	32		
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 10A V_{GS} = 0V	--	--	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V I_F =10A, di_F/dt = 100A/μs	--	730	--	ns
Reverse Recovery Charge	Q_{rr}		--	9.5	--	μC

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Typical Characteristics T_J = 25ºC, unless otherwise noted

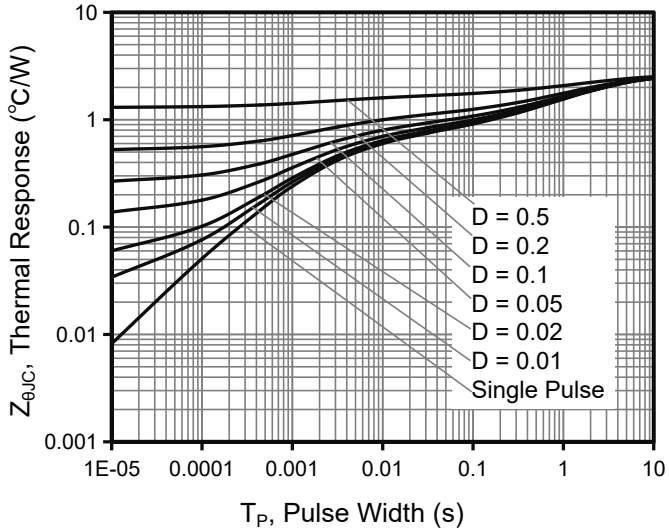

Figure 1. Transient Thermal Impedance For TO-220F

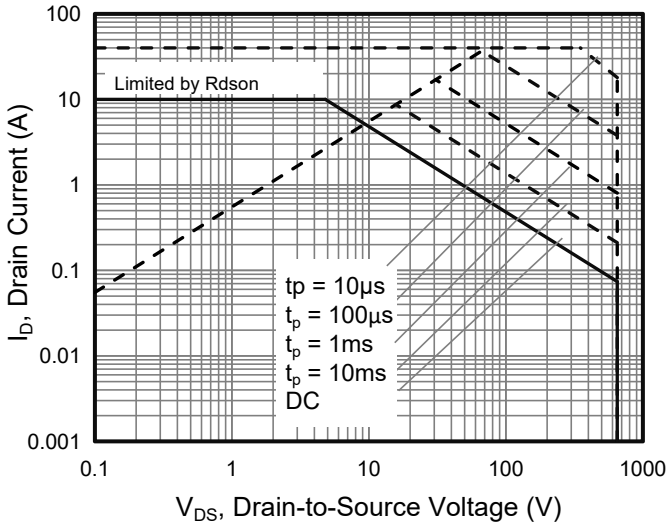

Figure 2. Safe Operation Area For TO-220F

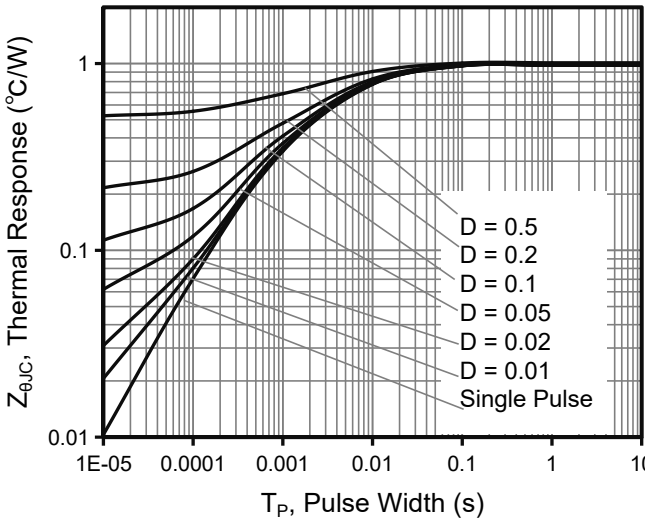

Figure 3. Transient Thermal Impedance For TO-220/263

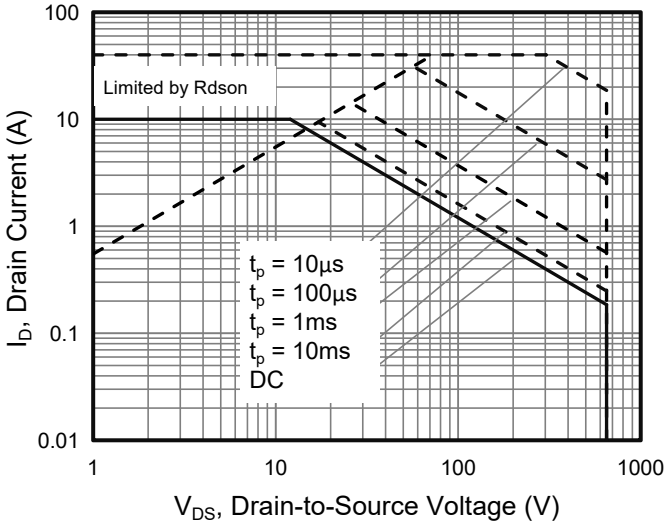

Figure 4. Safe Operation Area For TO-220/263

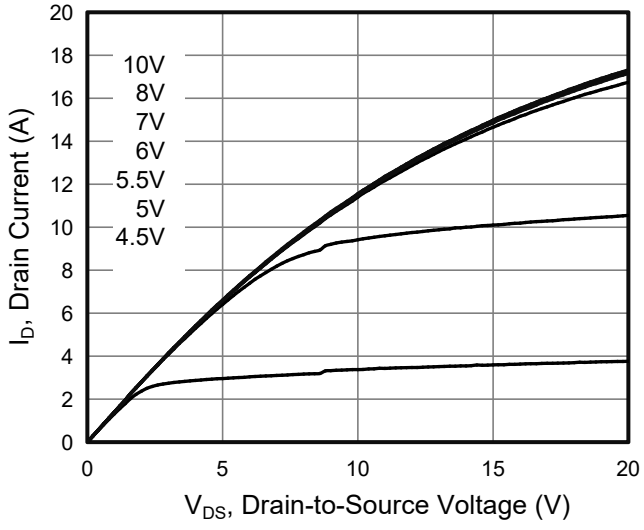

Figure 5. Output Characteristics

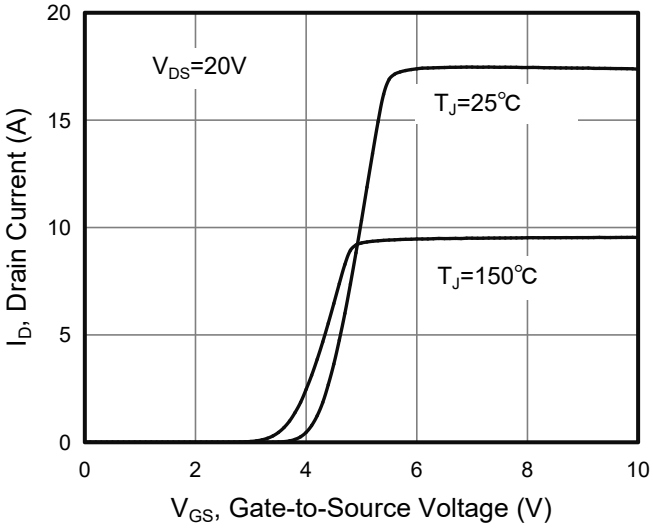

Figure 6. Transfer Characteristics

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Typical Characteristics T_J = 25ºC, unless otherwise noted

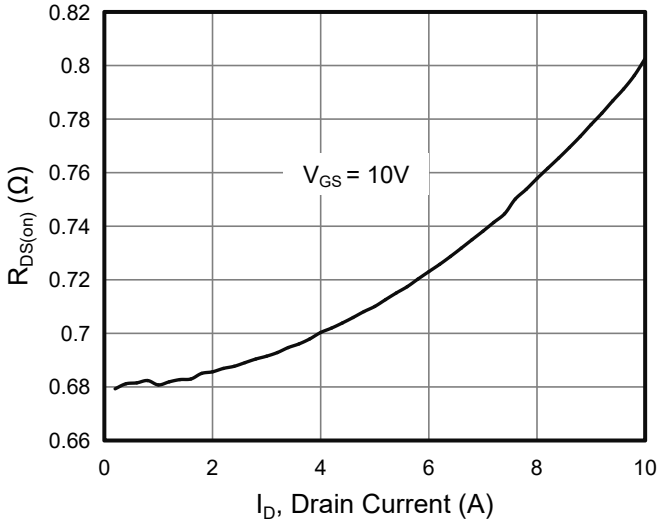

Figure 7. On-Resistance vs Drain Current

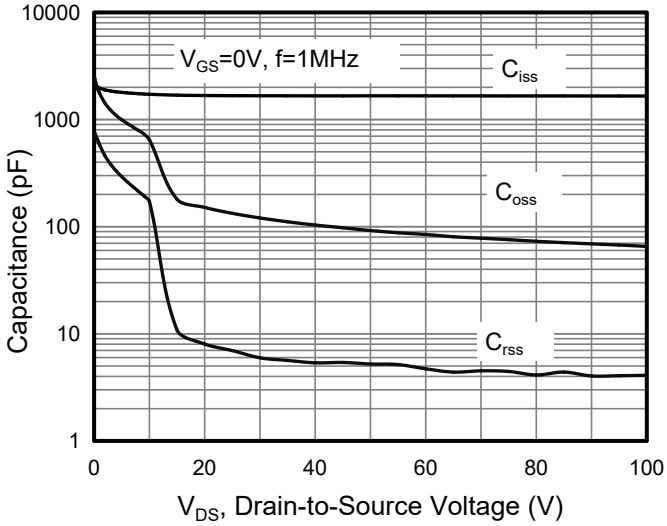

Figure 8. Capacitance

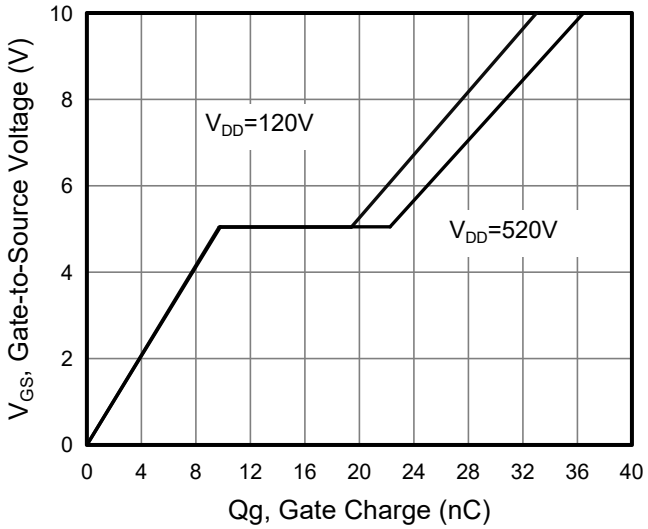

Figure 9. Gate Charge

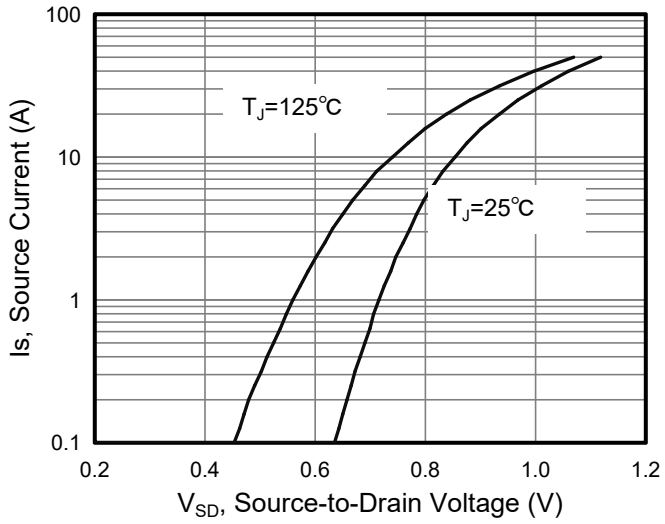

Figure 10. Body Diode Forward Voltage

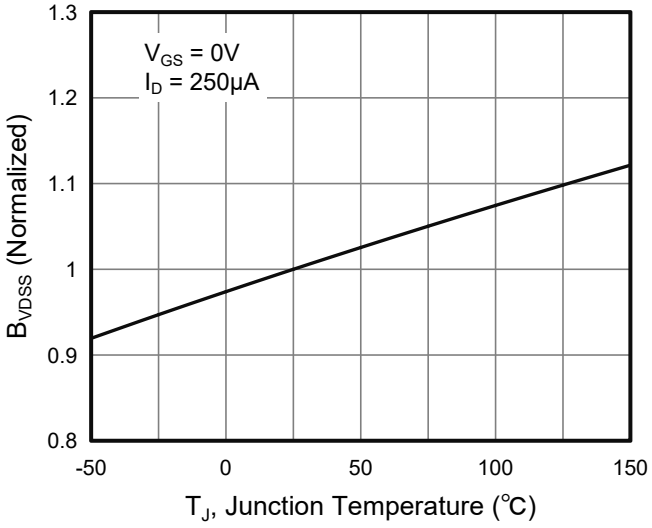

Figure 11. Breakdown Voltage vs Junction Temperature

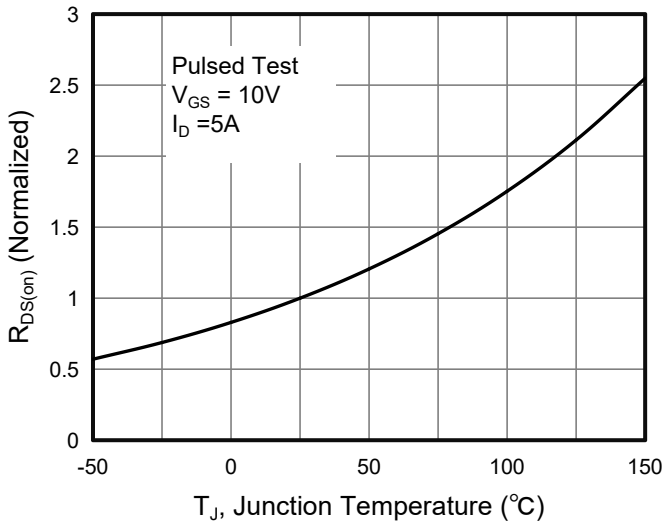

Figure 12. On-Resistance vs Temperature

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Figure A：Gate Charge Test Circuit and Waveform

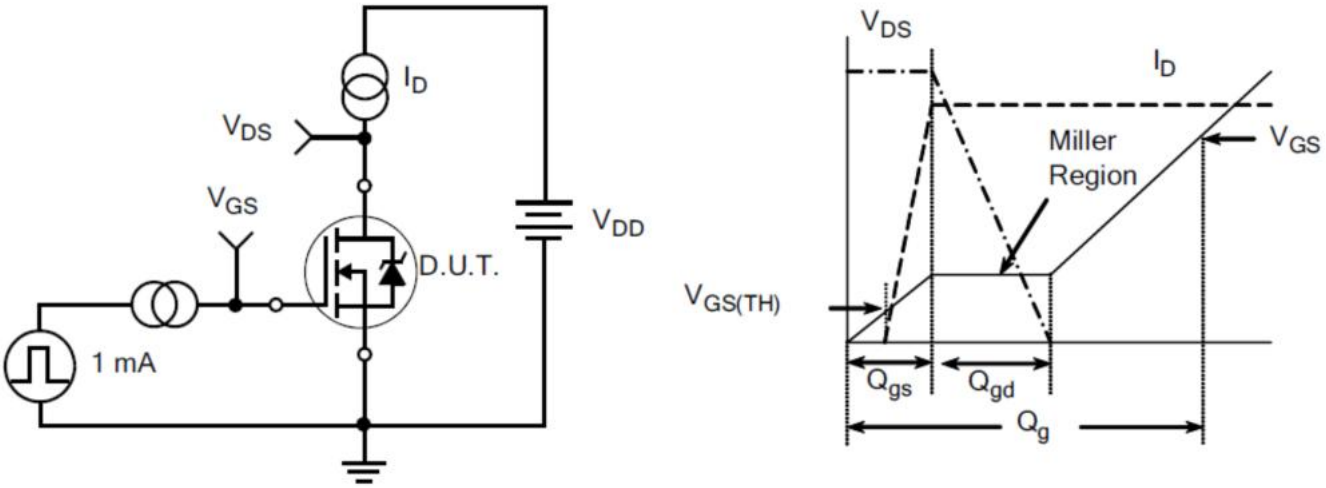


Figure B：Resistive Switching Test Circuit and Waveform

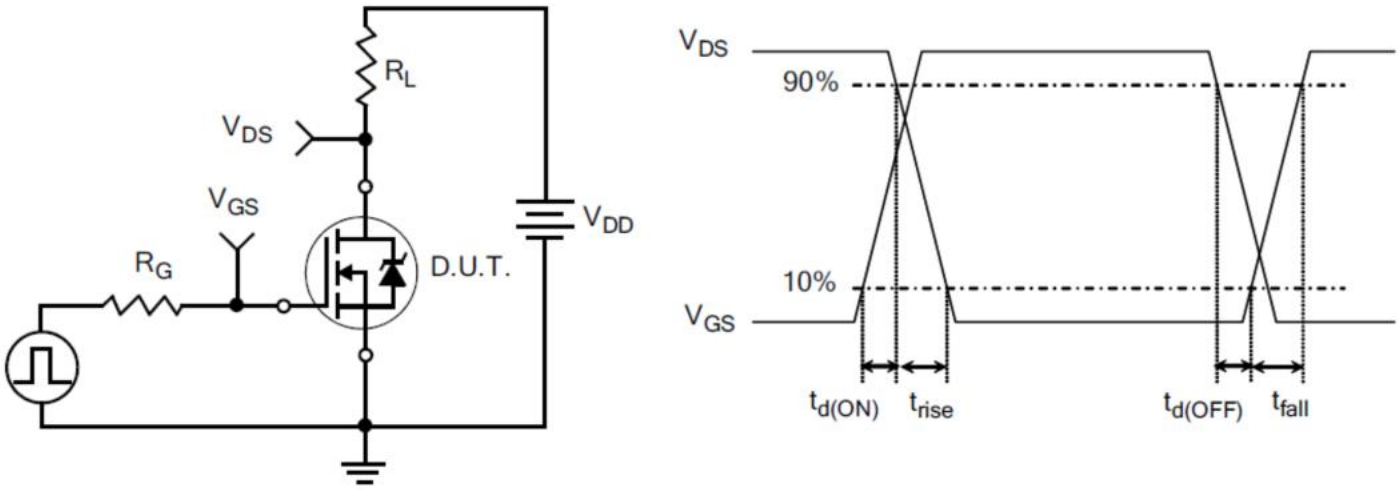
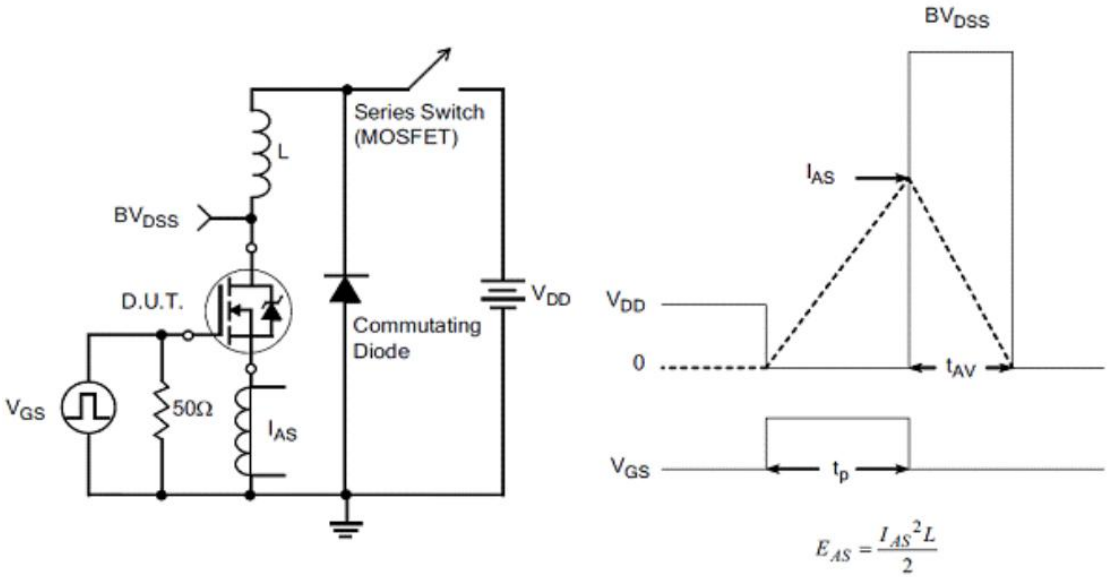


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



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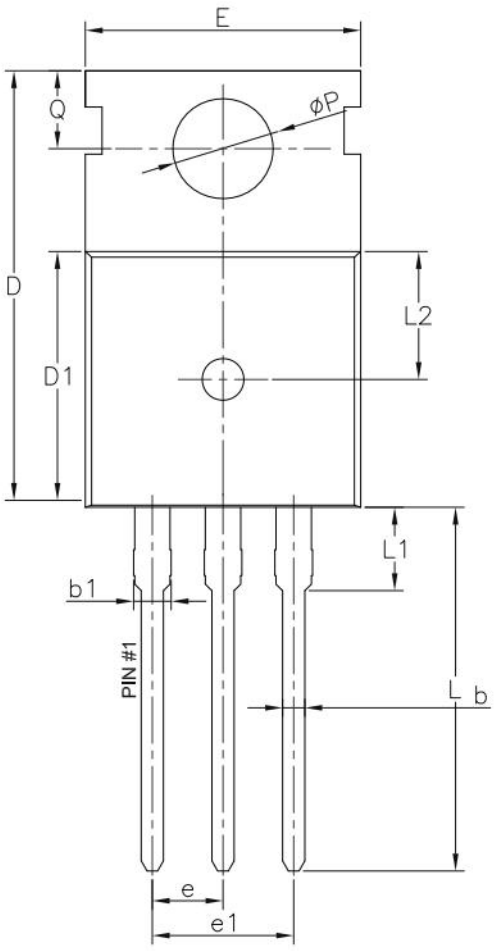
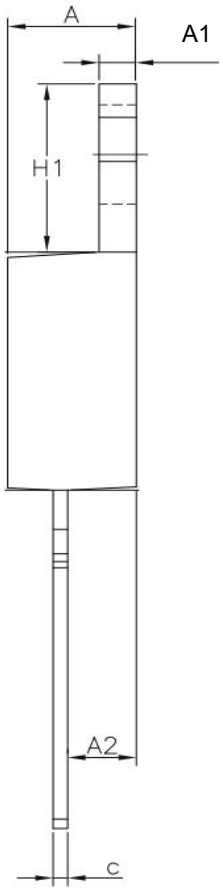
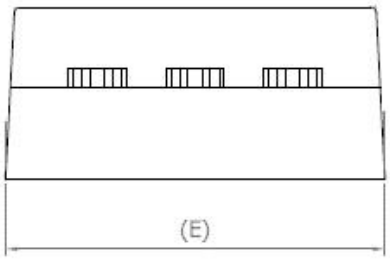
Outlines TO-220 Package







SYMBOL	MIN	MAX
A	4.3	4.7
A1	1.25	1.4
A2	2.2	2.6
b	0.65	0.95
b1	1.17	1.47
c	0.4	0.6
D	15.1	16.5
D1	8.8	9.7
E	9.7	10.3
e	2.54 BSC	
e1	5.08 BSC	
H1	6.25	6.85
L	12.5	13.8
L1	---	3.5
ΦP	3.4	3.8
Q	2.6	3

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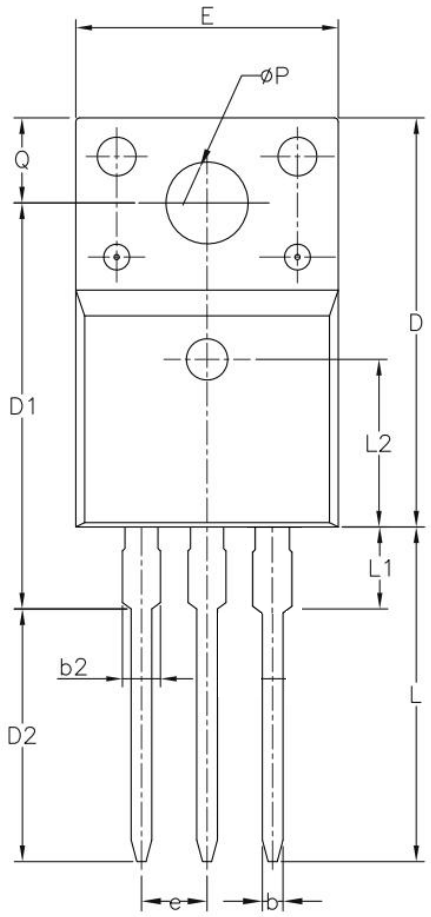
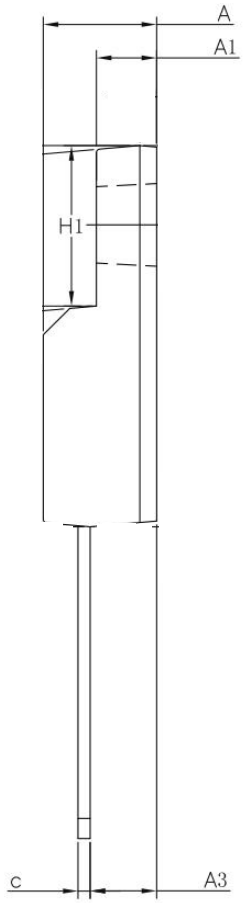
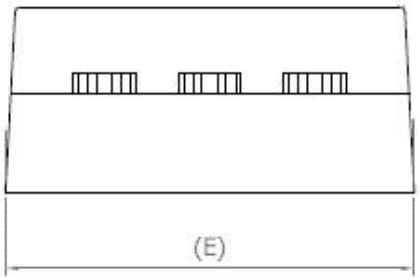
Outlines TO-220F Package







SYMBOL	MIN	MAX
A	4.45	4.9
A1	2.3	2.8
A3	2.5	3
b	0.65	0.95
b2	---	1.55
c	0.4	0.65
D	15.5	16.24
D1	15.27	16.07
E	9.96	10.36
e	2.54	
H1	6.48	6.88
L	12.5	13.5
L1	---	3.5
ΦP	3.03	3.4
Q	3.1	3.5

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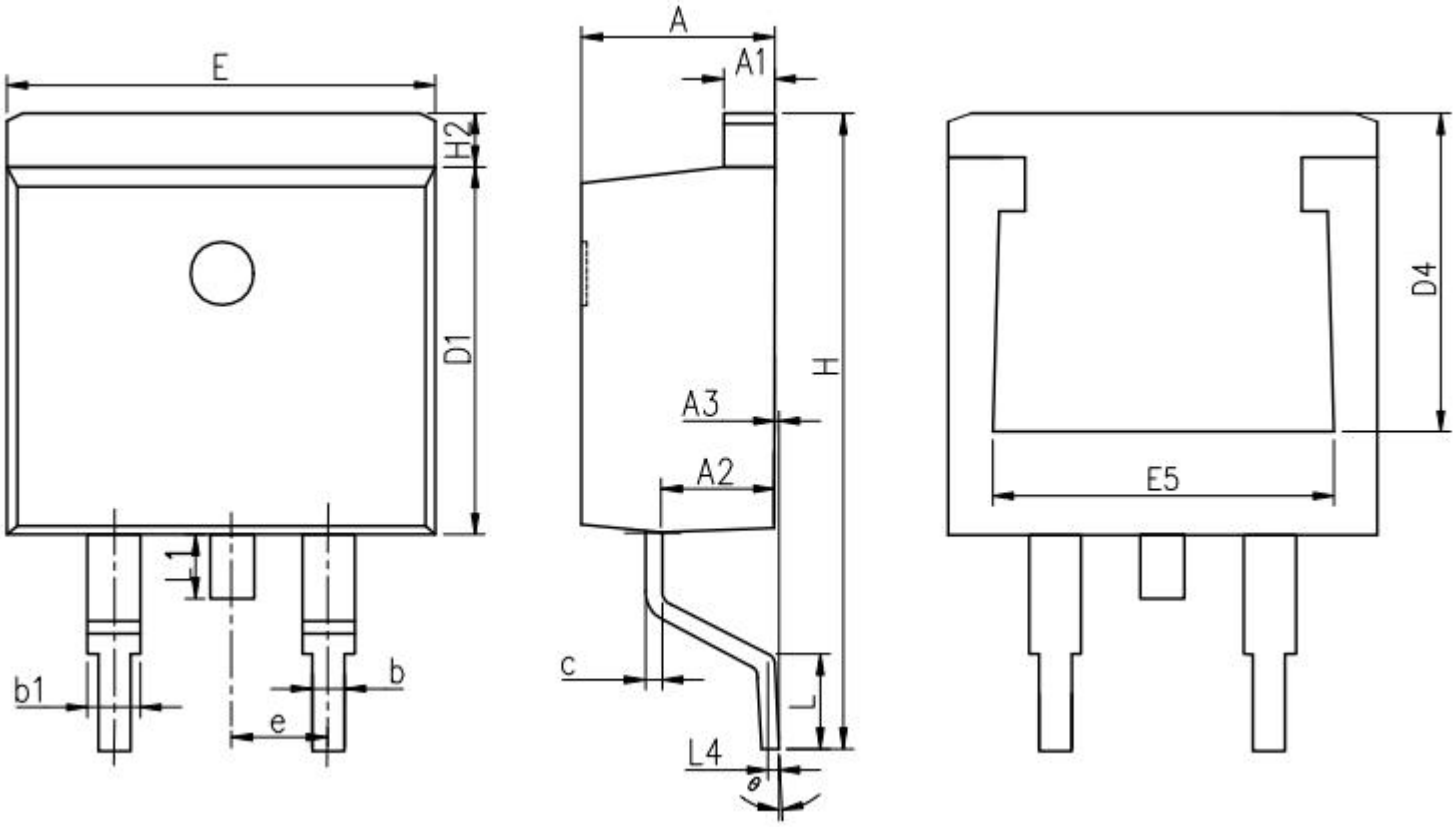
Outlines TO-263 Package



SYMBOL	MIN	MAX	SYMBOL	MIN	MAX
A	4.37	4.77	E	9.85	10.36
A1	1.22	1.42	E5	7.06	/
A2	2.34	2.89	e	2.51	2.57
A3	0	0.25	H	14.7	15.7
b	0.7	0.96	H2	1.07	1.47
b1	1.17	1.47	L	2	3
c	0.3	0.53	L1	1.2	1.7
D1	8.5	9.16	L4	0.25 BSC	
D4	6.6	---	θ	0°	9°

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