650V N-Channel Planar MOSFET

Description

650V N-Channel Planar MOSFET

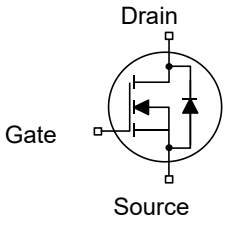
HRH20N65ANx is HRM high voltage MOSFET family based on advanced planar stripe DMOS technology. This advanced MOSFET family has optimized on-state resistance, and also provides superior switching performance and higher avalanche energy strength. This device family is suitable for high efficiency switch mode power supplies.

Features

- RDSON≤0.42Ω @Vgs=10V, Id=10A
- Ultra Low gate Charge(typical 73nC)
- Low Crss (typical 12pF)
- Fast switching capability
- 100% avalanche tested
- Improved dv/dt capability

Applications

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



RoHS

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{J,max}$	700	V
$R_{DS(on),max}$	0.42	Ω
$Q_{g,typ}$	73	nC
I_D	20	A
$I_{D,pulse}$	80	A

Device Marking and Package Information

Device	Package	Marking
HRH20N65ANF	TO-220F	H20N65ANF
HRH20N65ANP	TO-220	H20N65ANP
HRH20N65ANV	TO-3P	H20N65ANV
HRH20N65ANW	TO-247	H20N65ANW

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	20	A
	T_C = 100ºC		12	
Pulsed Drain Current[2]		$I_{D,pulse}$	80	A
Gate-Source Voltage		V_{GS}	±30	V
Single Pulse Avalanche Energy[3]		E_{AS}	1080	mJ
MOSFET dv/dt Ruggedness, V_{DS} = 0…480V		dv/dt	5	V/ns
Power Dissipation For TO-220F		P_D	219	W
Power Dissipation For TO-220/3P/247			284	
Continuous Diode Forward Current		I_S	20	A
Diode Pulsed Current[2]		$I_{S,pulse}$	80	
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}	0.57	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-220/3P/247			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	0.44	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=21.0A, Start TJ=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 = 10A	--	0.3	0.42	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	--	4348	--	pF
Output Capacitance	C_{oss}		--	287	--	
Reverse Transfer Capacitance	C_{rss}		--	12	--	
Total Gate Charge	Q_g	V_{DD} = 520V, I_D = 20A V_{GS} = 10V	--	73	--	nC
Gate-Source Charge	Q_{gs}		--	23	--	
Gate-Drain Charge	Q_{gd}		--	20	--	
Gate Plateau Voltage	$V_{Plateau}$		--	5.35	--	V
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 325V, I_D = 20A R_G = 10Ω, V_{GS} = 10V	--	30	--	ns
Turn-on Rise Time	t_r		--	61	--	
Turn-off Delay Time	$t_{d(off)}$		--	60	--	
Turn-off Fall Time	t_f		--	51	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 20A V_{GS} = 0V	--	--	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V I_F = 20A, di_F/dt = 100A/μs	--	924	--	ns
Reverse Recovery Charge	Q_{rr}		--	11.6	--	μC

Typical Characteristics T_J = 25ºC, unless otherwise noted

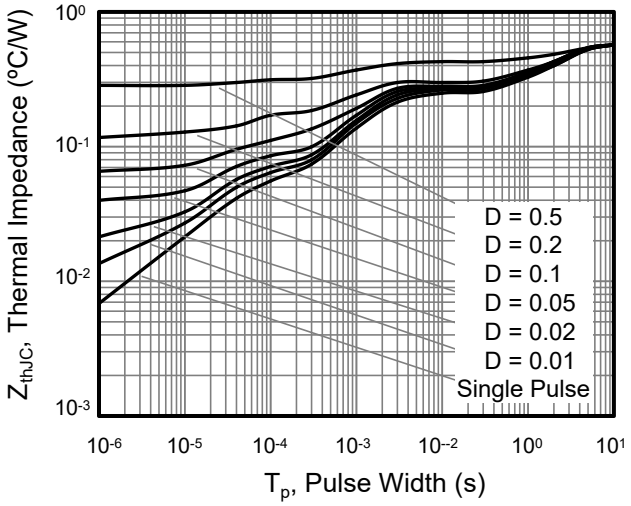


Figure 1. Transient Thermal Impedance For TO-220F

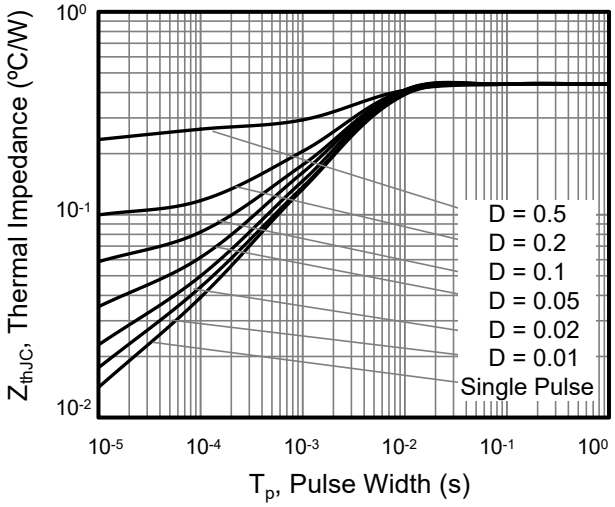


Figure 2. Transient Thermal Impedance For TO-220/3P/247

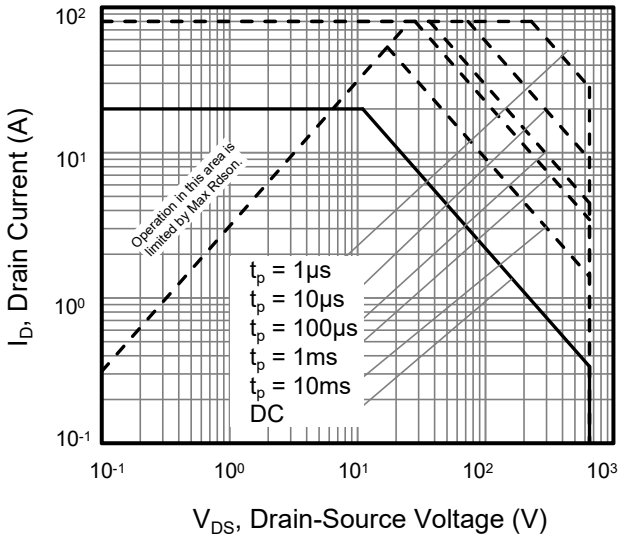


Figure 3. Safe Operation Area For TO-220F

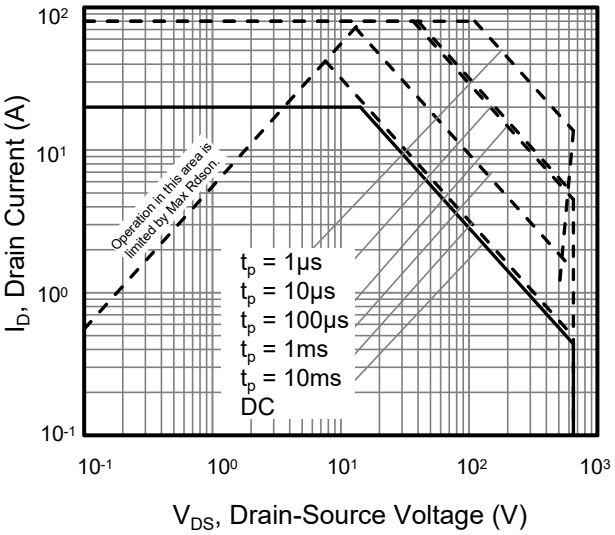


Figure 4. Safe Operation Area For TO-220/3P/247

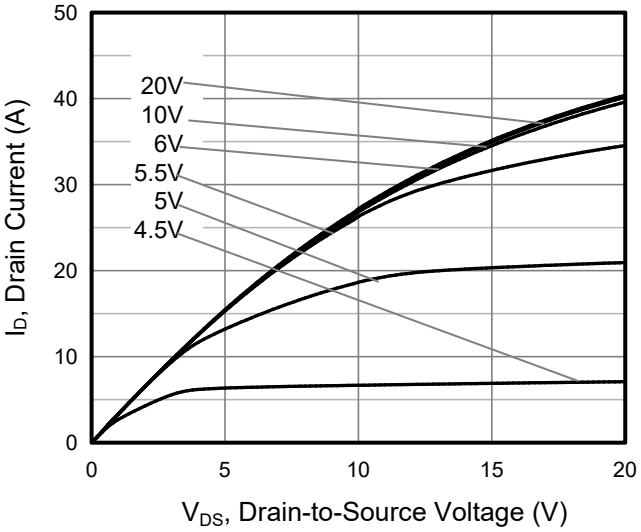


Figure 5. Output Characteristics

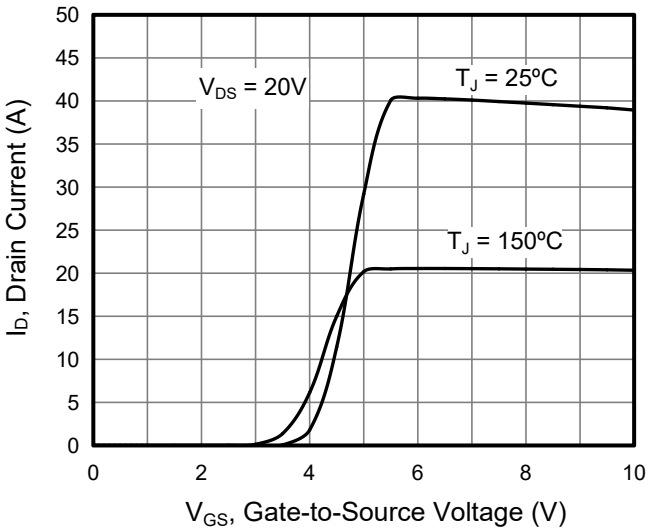


Figure 6. Transfer Characteristics

Typical Characteristics T_J = 25ºC, unless otherwise noted

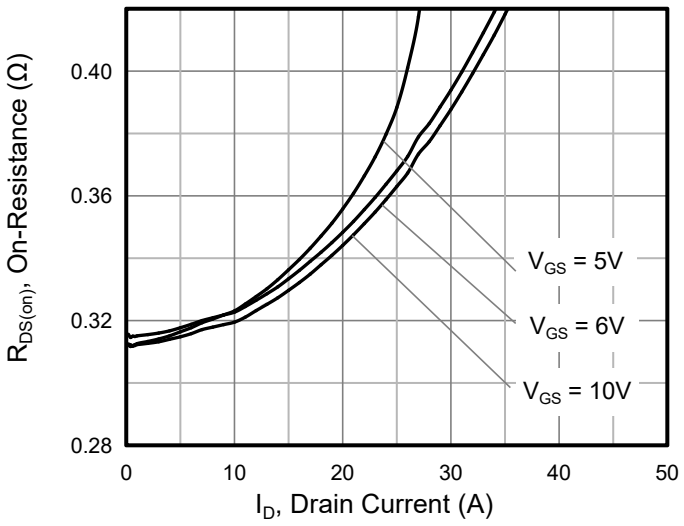


Figure 7. On-Resistance vs Drain Current

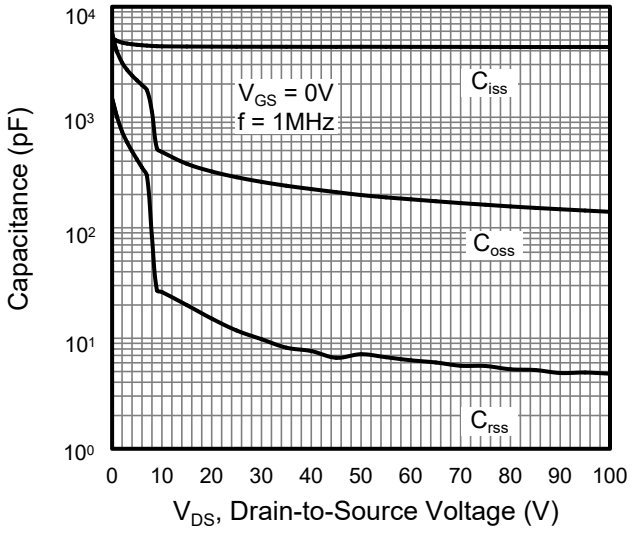


Figure 8. Capacitance

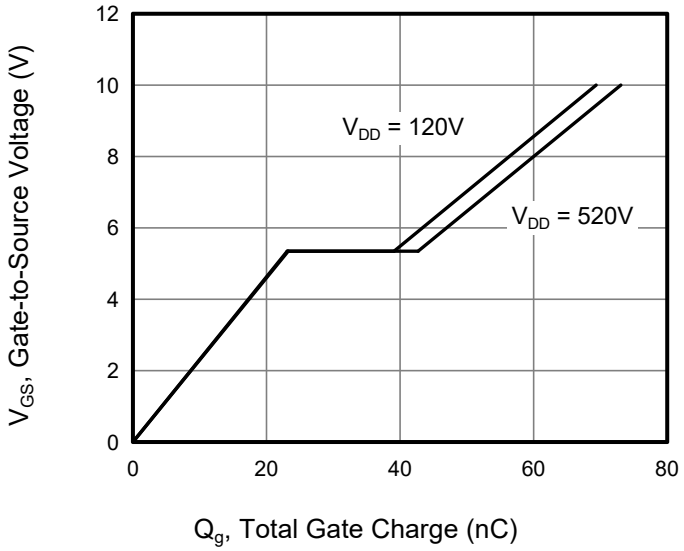


Figure 9. Gate Charge

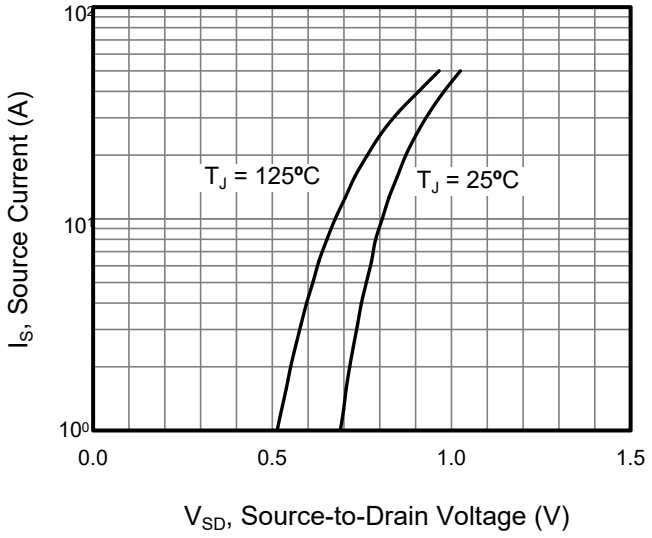


Figure 10. Body Diode Forward Voltage

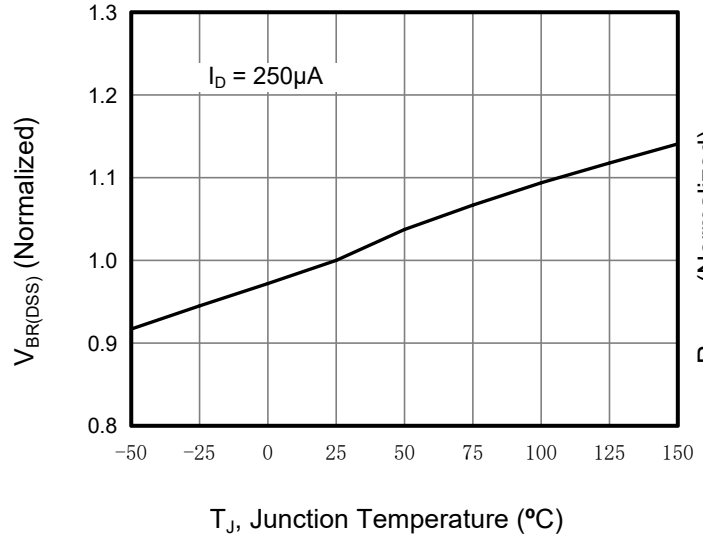


Figure 11. Breakdown Voltage vs Junction Temperature

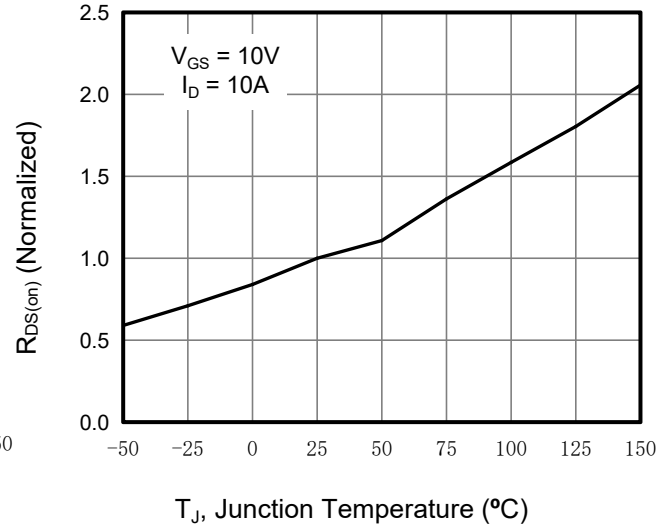


Figure 12. On-Resistance vs Temperature

Figure A：Gate Charge Test Circuit and Waveform

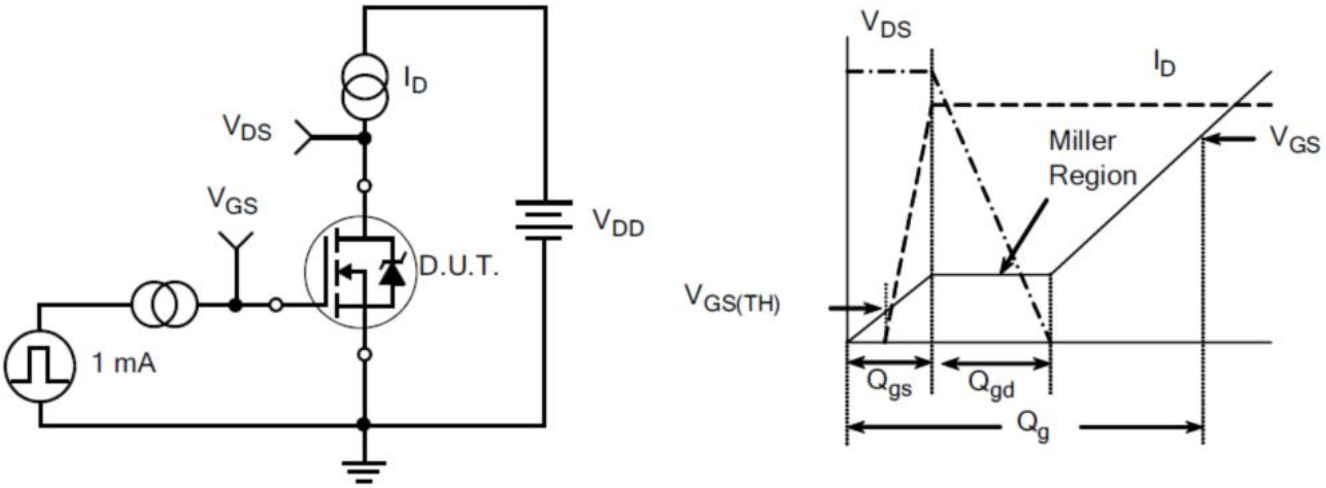


Figure B：Resistive Switching Test Circuit and Waveform

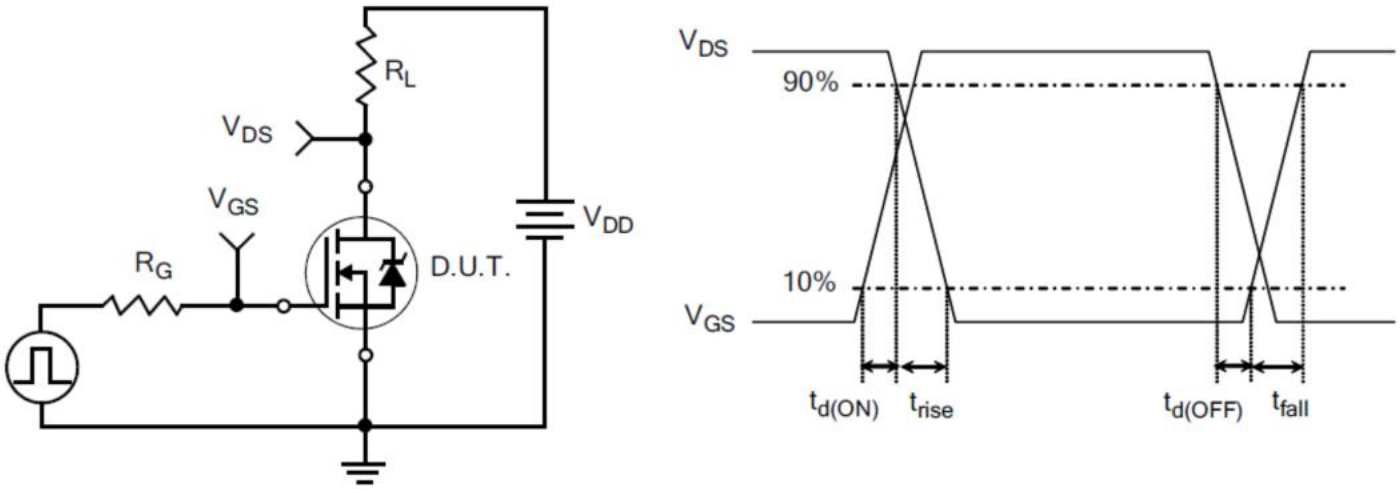
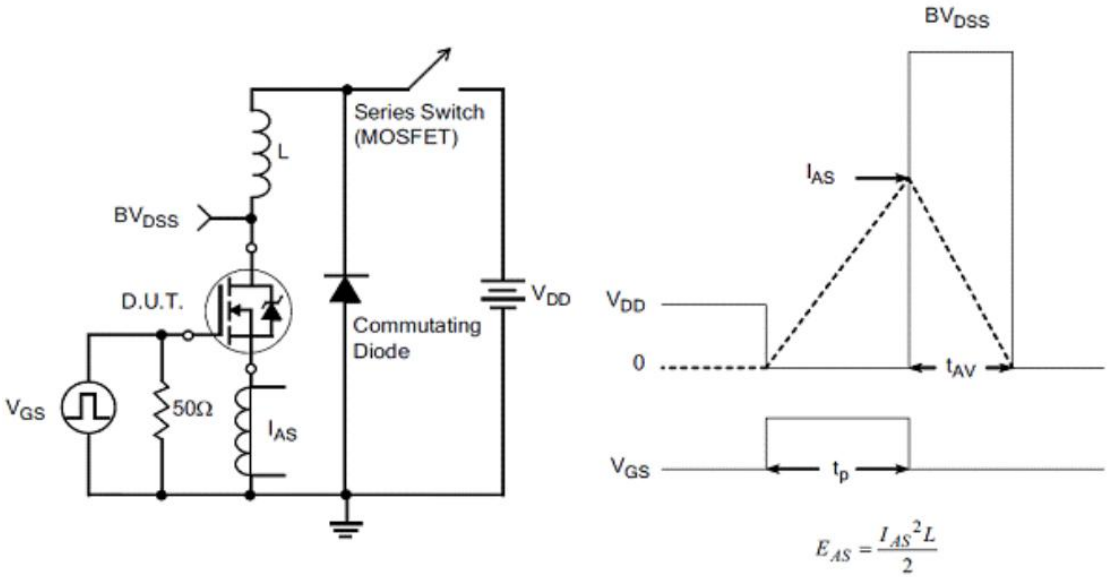
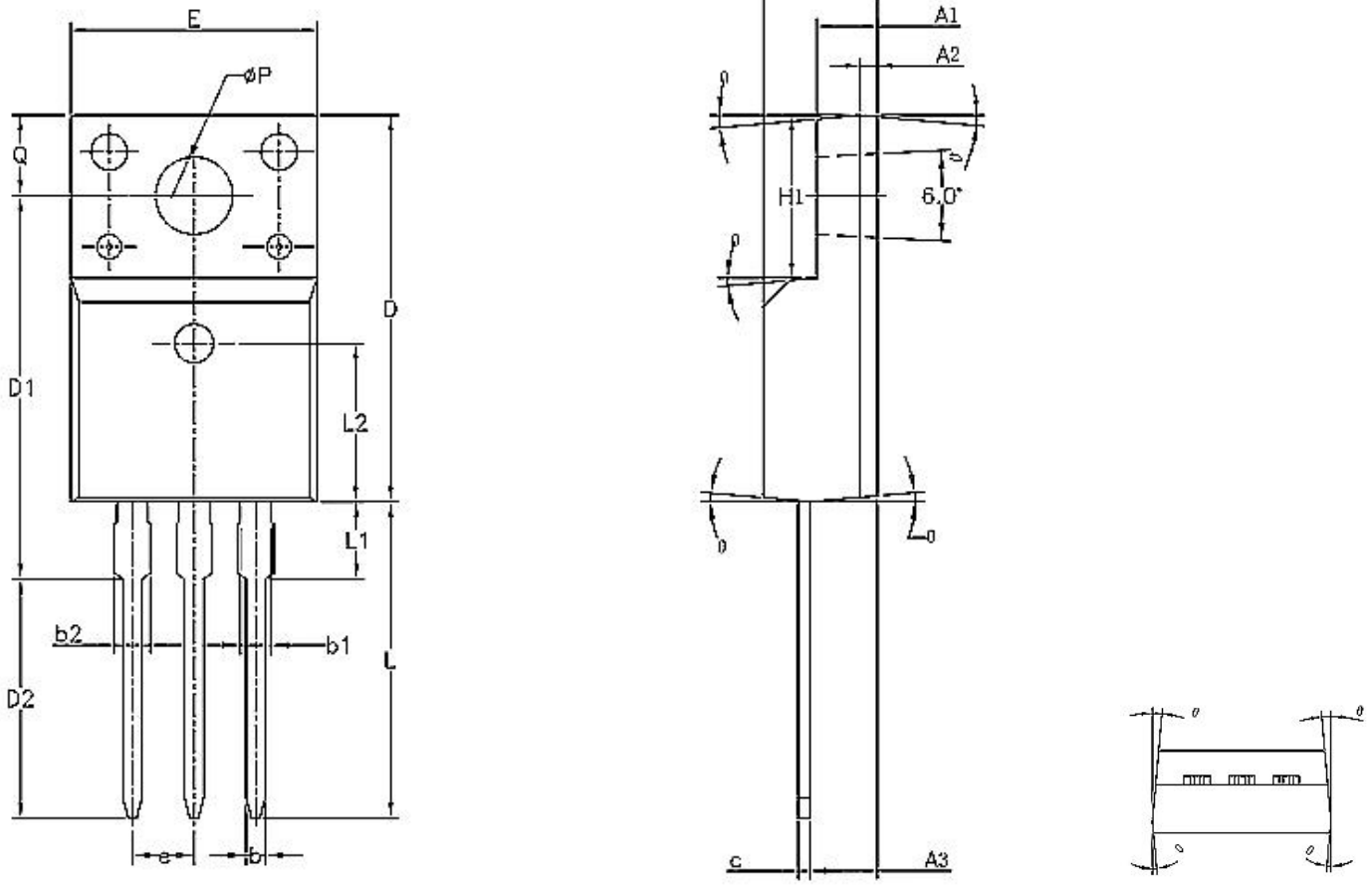


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



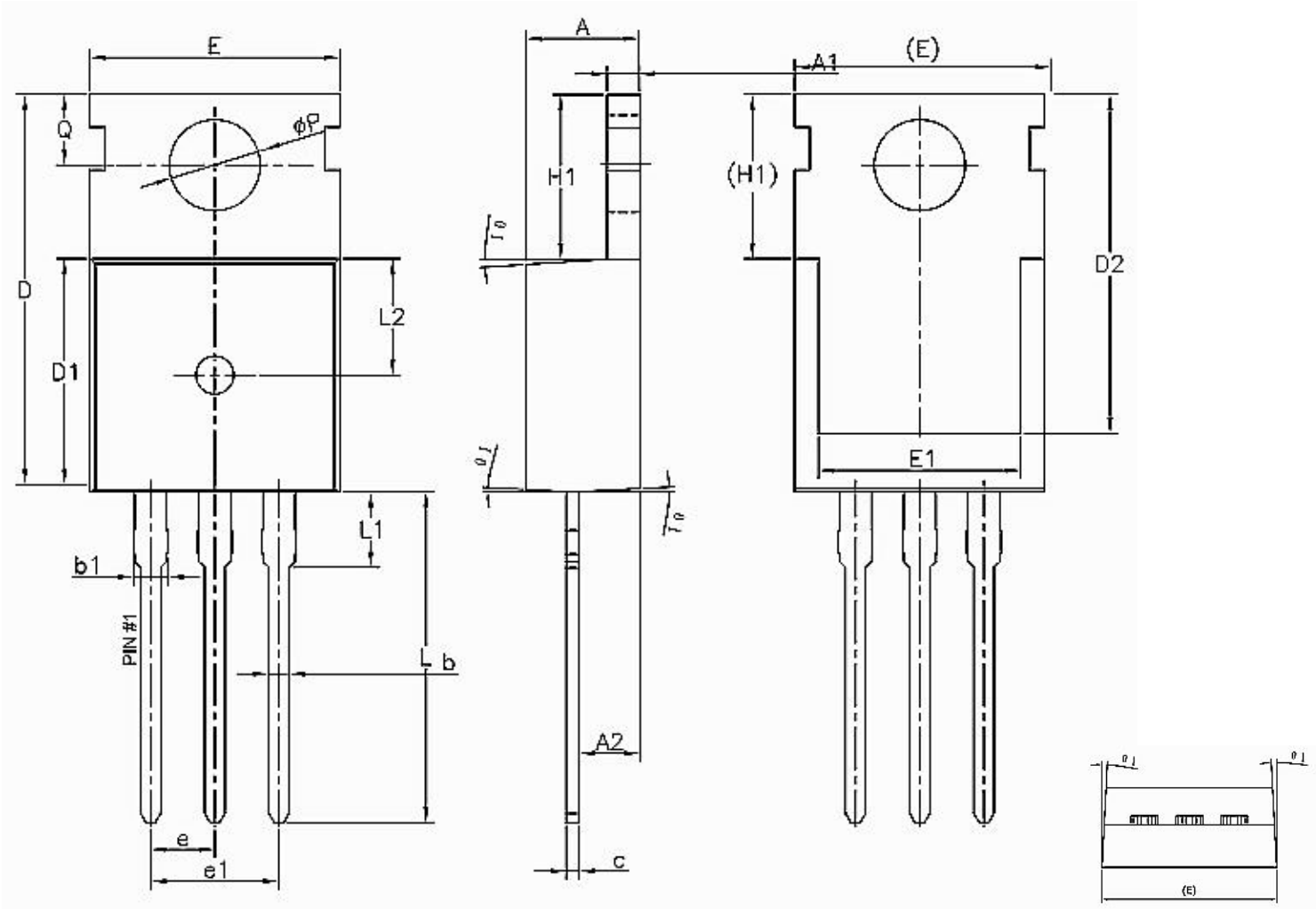
Outlines TO-220F Package



Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.70	---	0.90
b1	1.18	---	1.38
b2	---	---	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95

Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
D2	9.60	9.80	10.0
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	---	---	3.50
L2	6.50 REF		
ΦP	3.08	3.18	3.28
Q	3.20	---	3.40
θ1	1°	3°	5°

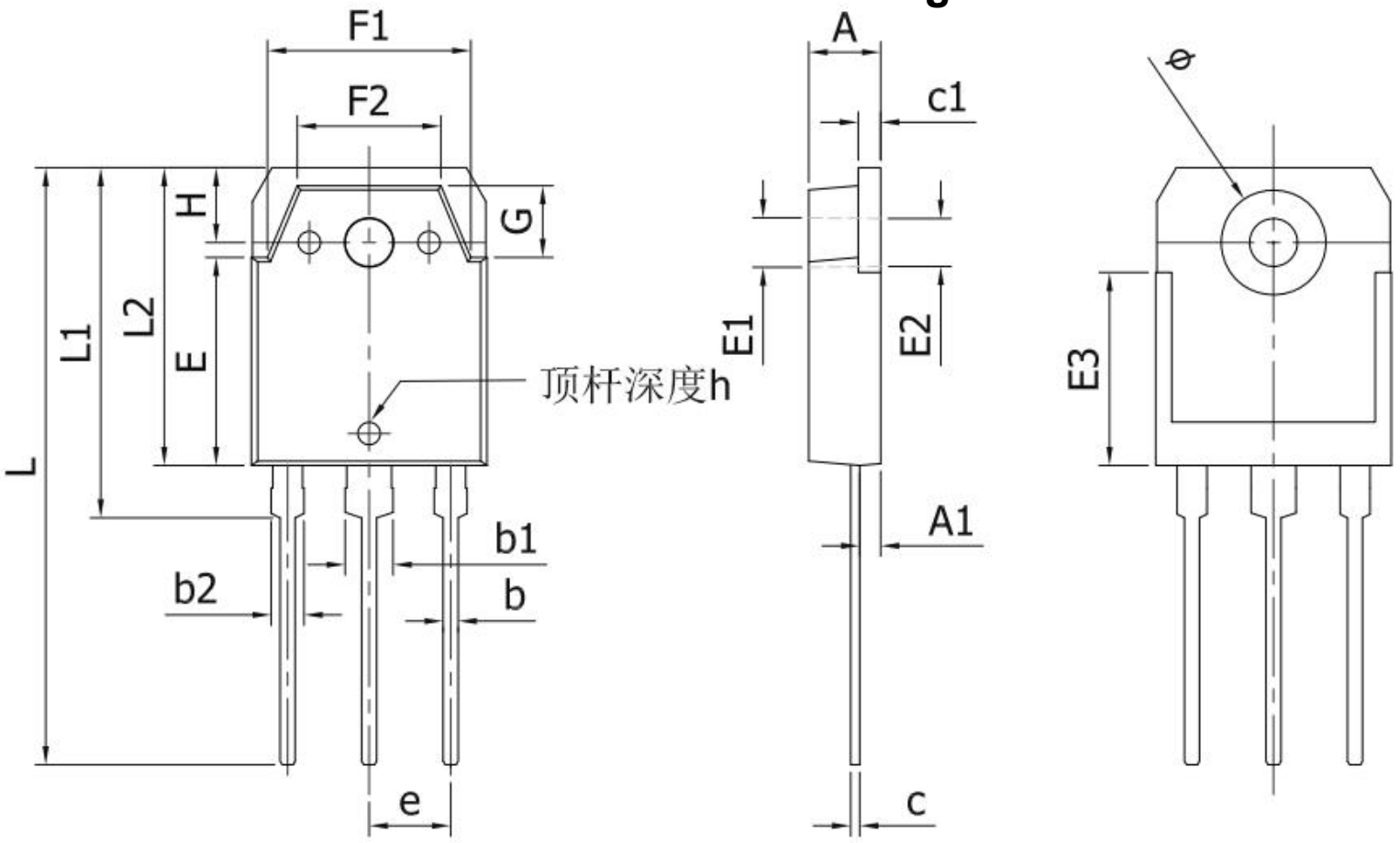
Outlines TO-220 Package

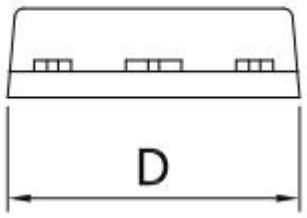


Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	---	0.90
b2	1.27	---	1.40
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	---	13.70
E	9.70	9.90	10.20

Unit:mm			
Symbol	**Min.**	**Nom**	**Max.**
E1	7.80	8.00	8.20
e	2.54 BSC		
e1	5.08 BSC		
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	---	---	3.50
L2	4.60 REF		
ΦP	3.55	3.60	3.65
Q	2.73	---	2.87
θ1	1°	3°	5°

Outlines TO-3P Package

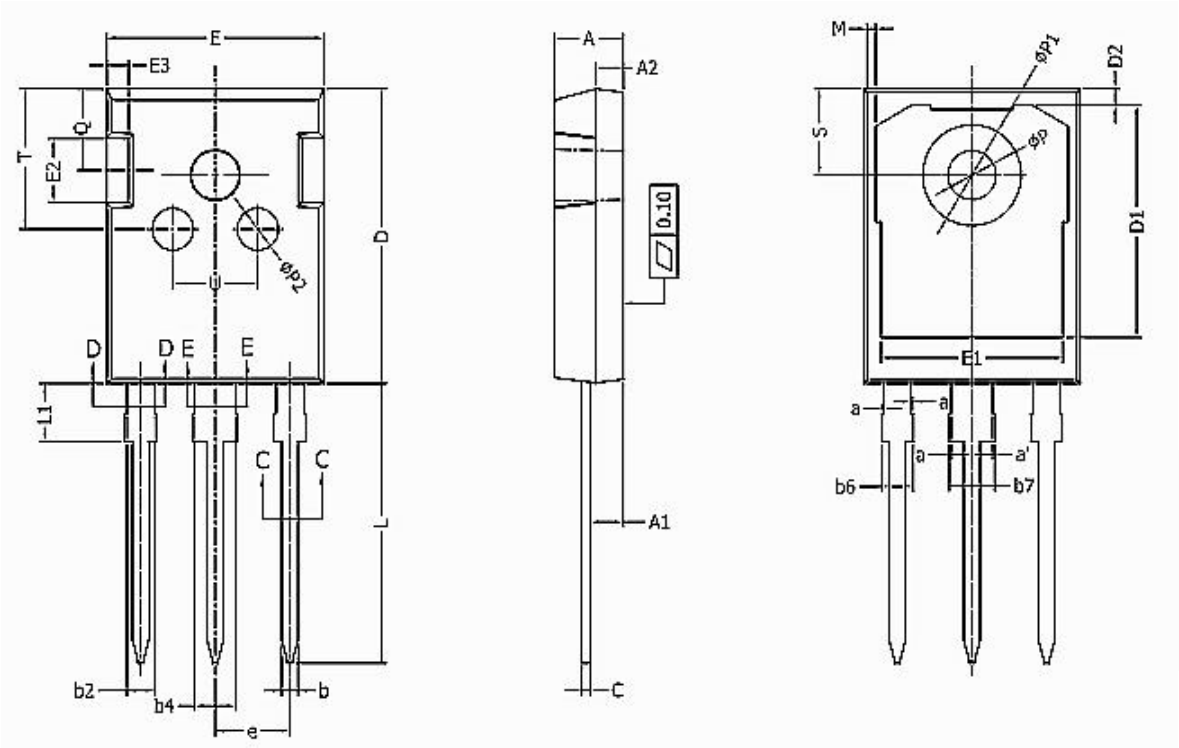


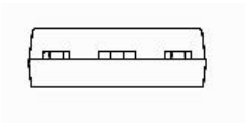


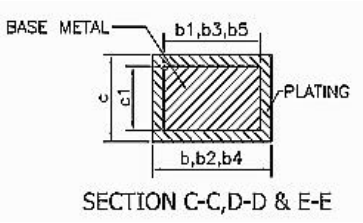
SYMBOL	MIN	NOM	MAX
A	4.6	4.8	5.0
A1	1.2	1.4	1.6
b	0.8	1	1.2
b1	2.8	3	3.2
b2	1.8	2	2.2
c	0.5	0.6	0.7
c1	1.45	1.55	1.65
D	15.45	15.65	15.85
E	13.7	13.9	14.1
E1	3.3REF		
E2	3.2REF		

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