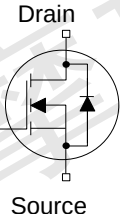


650V N-Channel Planar MOSFET



Description 650V N-Channel Planar MOSFET 7N65Ax is FnS 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.	TO-252 TO-220F TO-220FT TO-220 TO-251																		
Features ● $R_{DS(on)} \leq 1.4\Omega$ @ $V_{GS}=10V$, $I_D=3.5A$ ● Low gate Charge (typical 23.05nC) ● Low C_{rss} (typical 2.2pF) ● Fast switching capability ● 100% avalanche tested ● Improved dv/dt capability	Drain Gate Source  																		
Key Performance Parameters <table><tr><th>Parameter</th><th>Value</th><th>Unit</th></tr><tr><td>$V_{DS} @ T_{J,max}$</td><td>700</td><td>V</td></tr><tr><td>$R_{DS(on),max}$</td><td>1.4</td><td>Ω</td></tr><tr><td>$Q_{g,typ}$</td><td>23.1</td><td>nC</td></tr><tr><td>I_D</td><td>7</td><td>A</td></tr><tr><td>$I_{D,pulse}$</td><td>28</td><td>A</td></tr></table>		Parameter	Value	Unit	$V_{DS} @ T_{J,max}$	700	V	$R_{DS(on),max}$	1.4	Ω	$Q_{g,typ}$	23.1	nC	I_D	7	A	$I_{D,pulse}$	28	A
Parameter	Value	Unit																	
$V_{DS} @ T_{J,max}$	700	V																	
$R_{DS(on),max}$	1.4	Ω																	
$Q_{g,typ}$	23.1	nC																	
I_D	7	A																	
$I_{D,pulse}$	28	A																	
Device Marking and Package Information <table><tr><th>Device</th><th>Package</th><th>Marking</th></tr><tr><td>7N65AD</td><td>TO-252</td><td>7N65AD</td></tr><tr><td>7N65AF</td><td>TO-220F</td><td>7N65AF</td></tr><tr><td>7N65AFT</td><td>TO-220FT</td><td>7N65AFT</td></tr><tr><td>7N65AP</td><td>TO-220</td><td>7N65AP</td></tr><tr><td>7N65AU</td><td>TO-251</td><td>7N65AU</td></tr></table>		Device	Package	Marking	7N65AD	TO-252	7N65AD	7N65AF	TO-220F	7N65AF	7N65AFT	TO-220FT	7N65AFT	7N65AP	TO-220	7N65AP	7N65AU	TO-251	7N65AU
Device	Package	Marking																	
7N65AD	TO-252	7N65AD																	
7N65AF	TO-220F	7N65AF																	
7N65AFT	TO-220FT	7N65AFT																	
7N65AP	TO-220	7N65AP																	
7N65AU	TO-251	7N65AU																	

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted			
Parameter	Symbol	Value	Unit
Drain-Source Voltage($V_{GS}=0V$)	V_{DS}	650	V
Continuous Drain Current ¹⁾	I_D	7	A
		4.2	
Pulsed Drain Current ²⁾	$I_{D,pulse}$	28	A
Gate-Source Voltage	V_{GS}	± 30	V
Single Pulse Avalanche Energy ³⁾	E_{AS}	211	mJ
MOSFET dv/dt Ruggedness, $V_{DS} = 0 \dots 480V$	dv/dt	5	V/ns
Power Dissipation For TO-220F、TO220-FT	P_D	78	W
Power Dissipation For TO-252、TO-220、TO-251		104	
Continuous Diode Forward Current	I_S	7	A
Diode Pulsed Current ²⁾	$I_{S,pulse}$	28	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150	$^\circ\text{C}$

Thermal Resistance For TO-220F、TO-220FT			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	1.6	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-252、TO-220、TO-251			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	1.2	$^\circ\text{C/W}$
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) $L=10\text{mH}$, $I_D=5.5\text{A}$, Start $T_J=25^\circ\text{C}$

Electrical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650V$ $V_{GS} = 0V, T_J = 25^{\circ}C$	--	--	1	μA
		$V_{DS} = 650V,$ $V_{GS} = 0V, T_J = 150^{\circ}C$	--	--	100	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	--	4	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 3.5A$	--	1.2	1.4	Ω
Gate Resistance	R_G	f = 1.0MHz open drain	--	1.7	--	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{GS} = 0V, V_{DS} = 25V$ f = 1.0MHz	--	1191	--	pF
Output Capacitance	C_{oss}		--	86	--	
Reverse Transfer Capacitance	C_{rss}		--	3	--	
Total Gate Charge	Q_g	$V_{DD} = 520V, I_D = 7A$ $V_{GS} = 10V$	--	25.9	--	nC
Gate-Source Charge	Q_{gs}		--	7.1	--	
Gate-Drain Charge	Q_{gd}		--	8.0	--	
Gate Plateau Voltage	$V_{Plateau}$		--	4.9	--	V
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 325V, I_D = 7A$ $R_G = 25\Omega$	--	20		ns
Turn-on Rise Time	t_r		--	50		
Turn-off Delay Time	$t_{d(off)}$		--	90		
Turn-off Fall Time	t_f		--	55		
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	$T_J = 25^{\circ}C, I_{SD} = 7A$ $V_{GS} = 0V$	--	--	1.2	V
Reverse Recovery Time	t_{rr}	$V_R = 400V$ $I_F = 7A, di_F/dt = 100A/\mu s$	--	351	--	ns
Reverse Recovery Charge	Q_{rr}		--	3.3	--	μC

Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

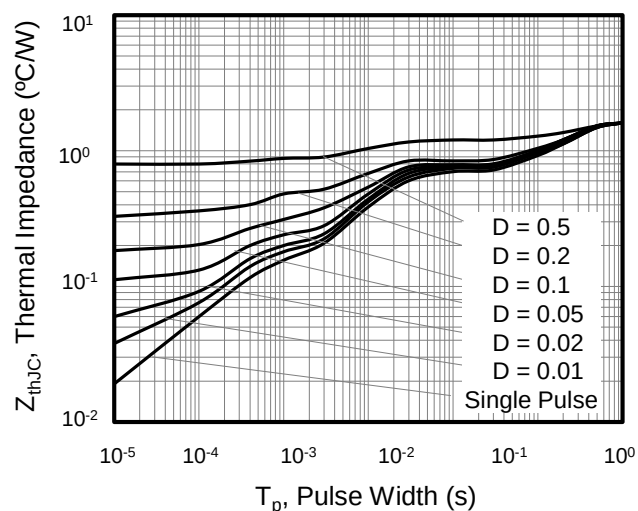


Figure 1. Transient Thermal Impedance For TO-220F, TO-220FT

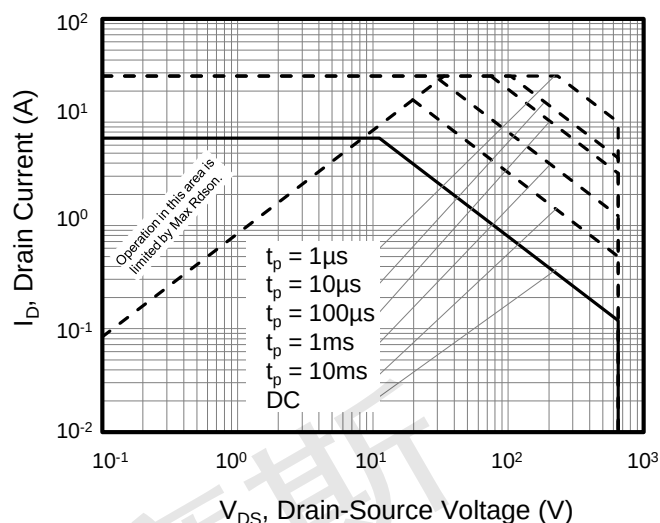


Figure 2. Safe Operation Area For TO-220F, TO-220FT

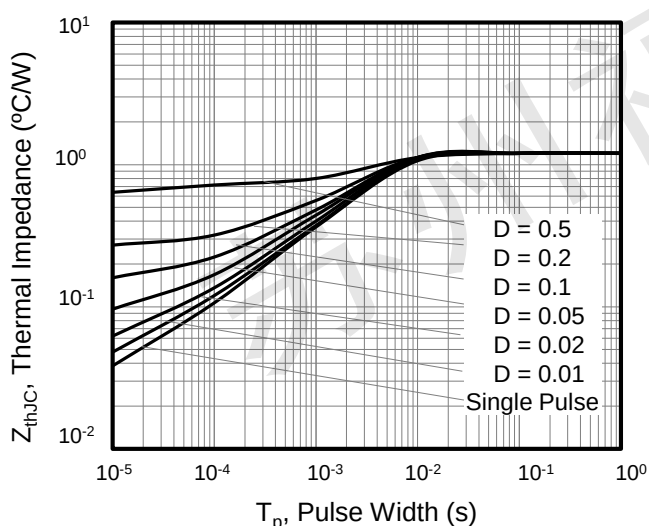


Figure 3. Transient Thermal Impedance For TO-252, TO-220, TO-251

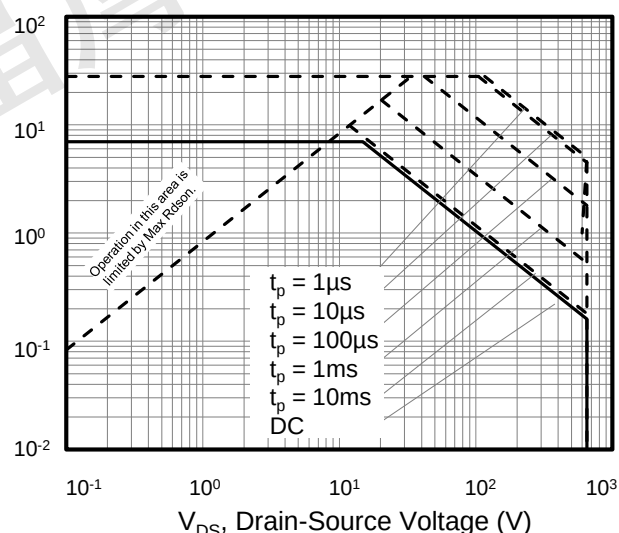


Figure 4. Safe Operation Area For TO-252, TO-220, TO-251

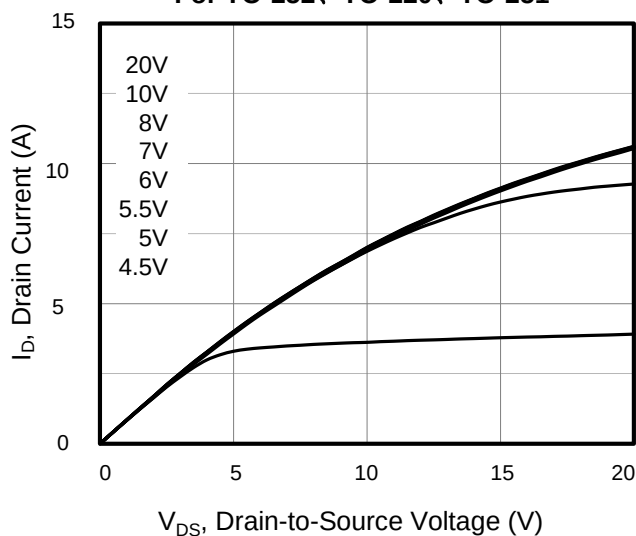


Figure 5. Output Characteristics

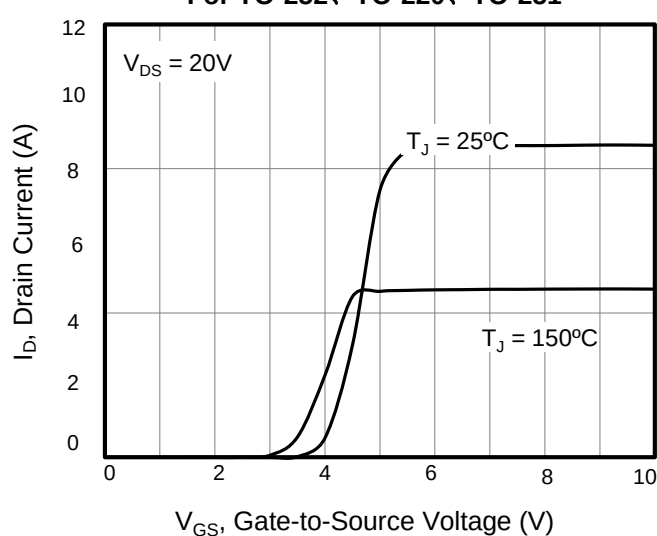


Figure 6. Transfer Characteristics

Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

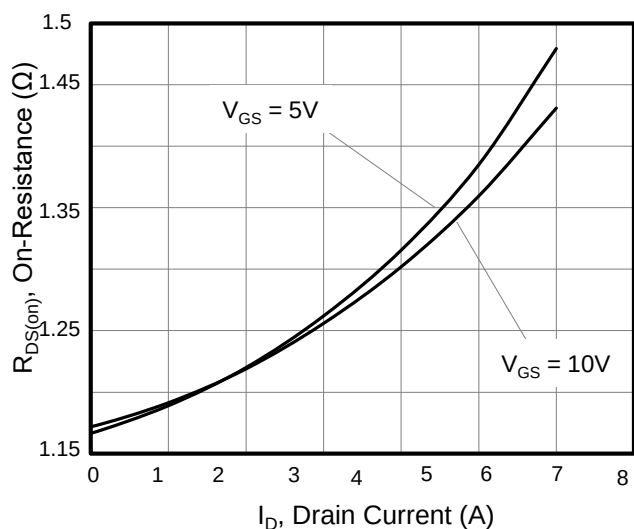


Figure 7. On-Resistance vs Drain Current

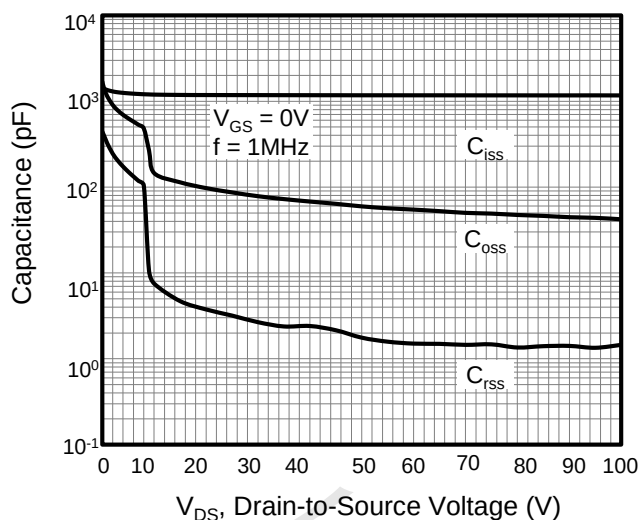


Figure 8. Capacitance

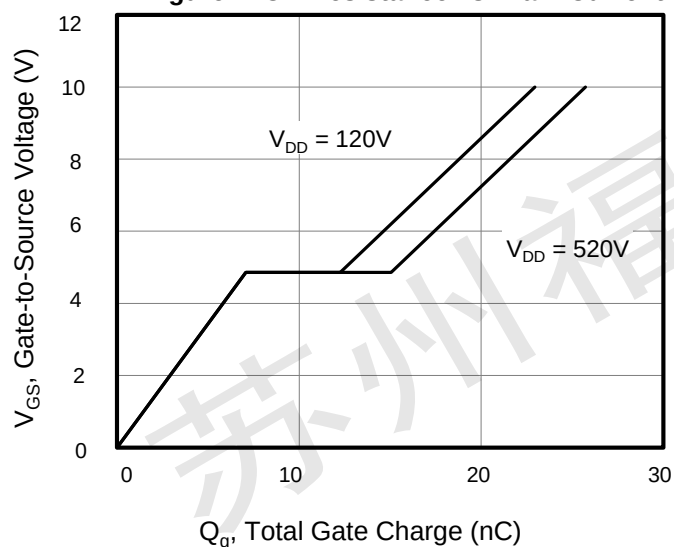


Figure 9. Gate Charge

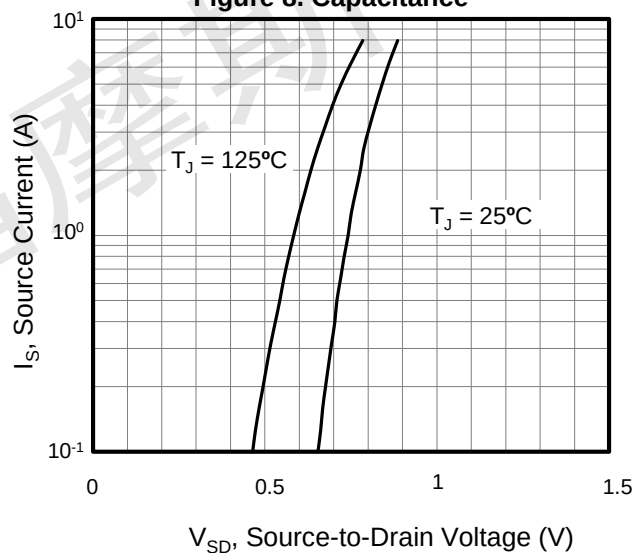


Figure 10. Body Diode Forward Voltage

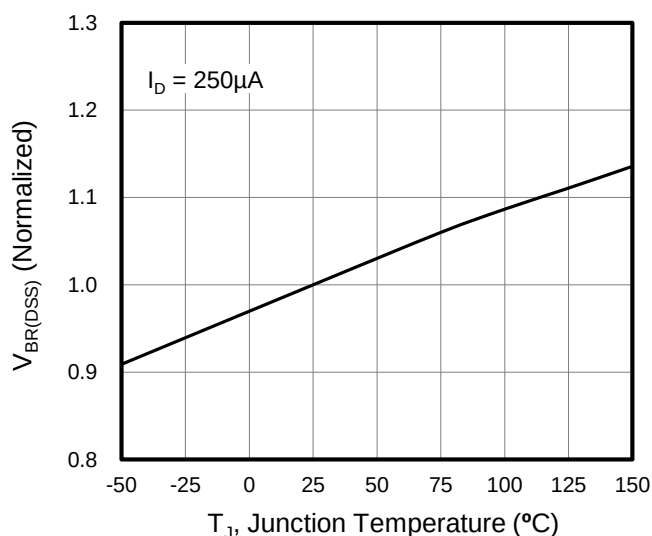


Figure 11. Breakdown Voltage vs Junction Temperature

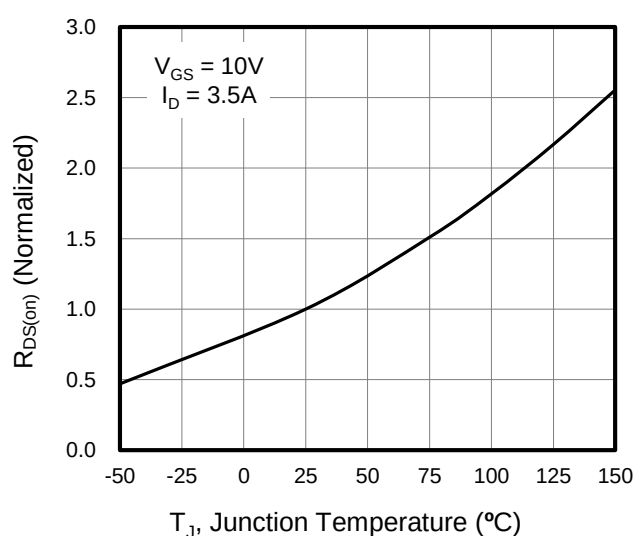


Figure 12. On-Resistance vs Temperature

Figure A: Gate Charge Test Circuit and Waveform

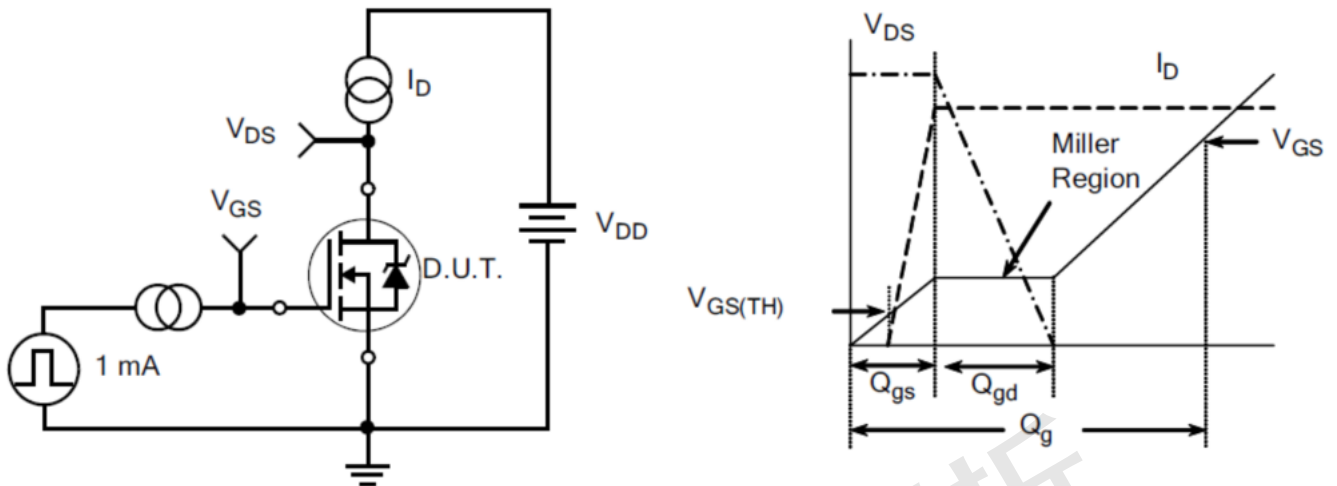


Figure B: Resistive Switching Test Circuit and Waveform

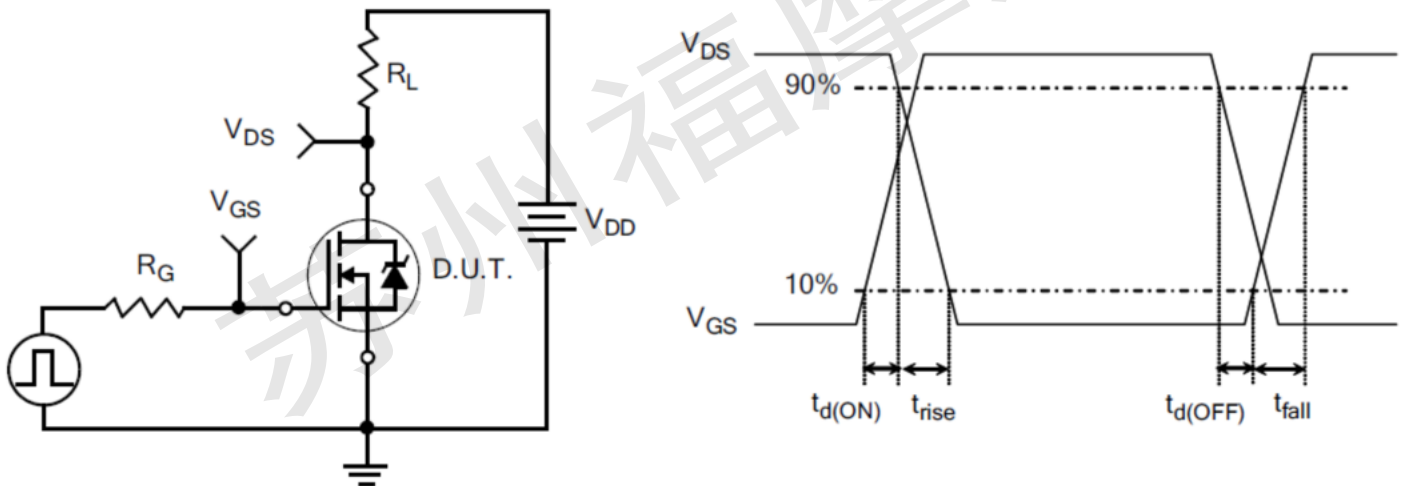
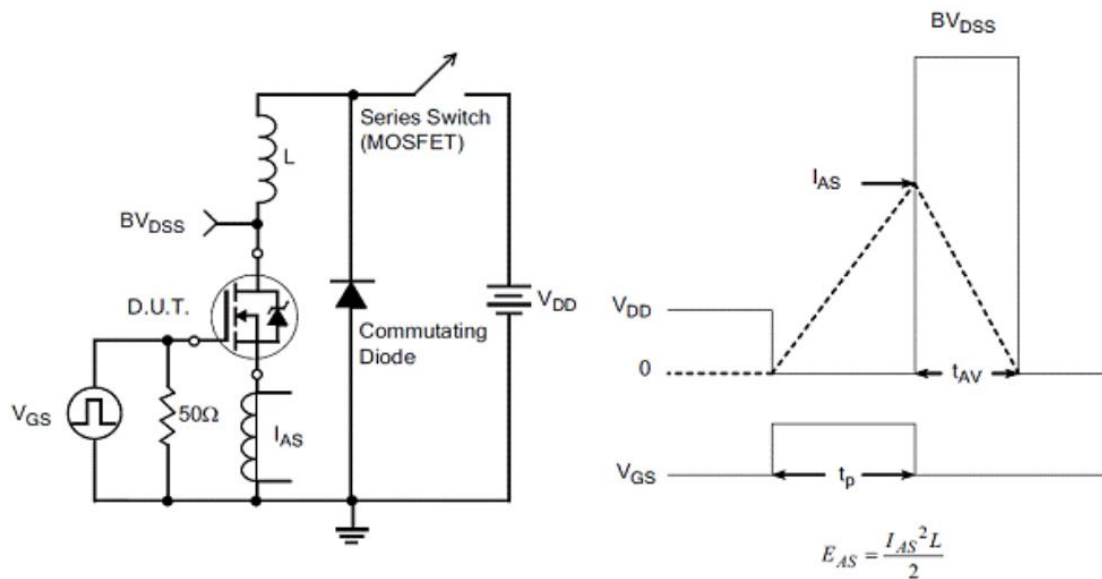
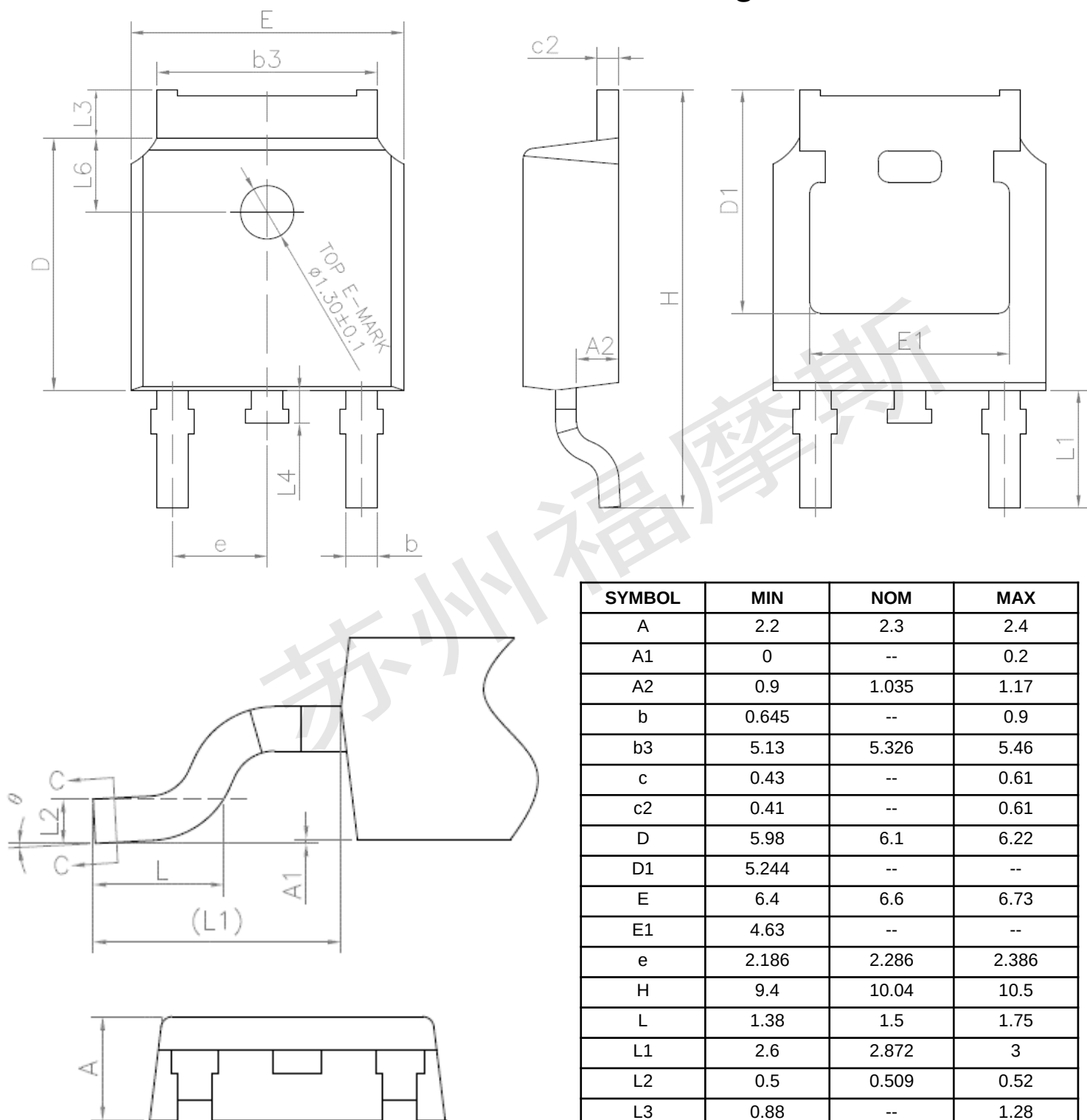


Figure C: Unclamped Inductive Switching Test Circuit and Waveform

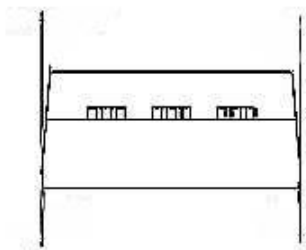
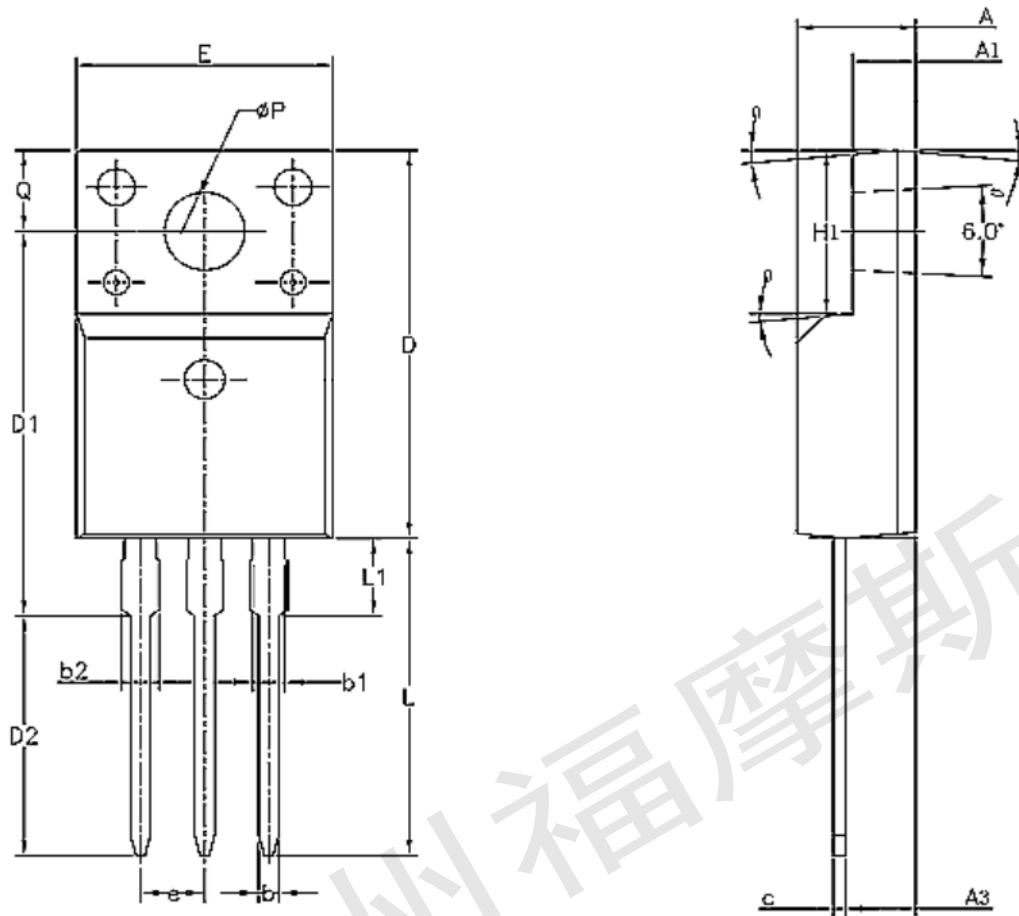


Outlines TO-252 Package



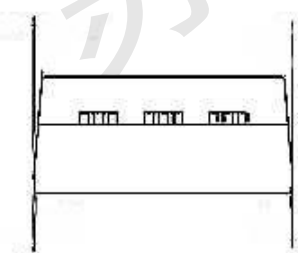
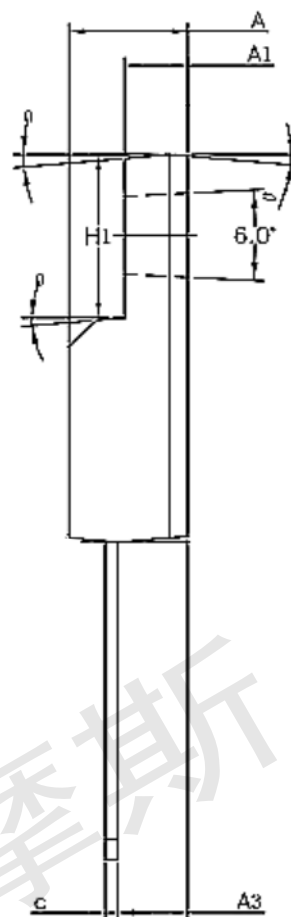
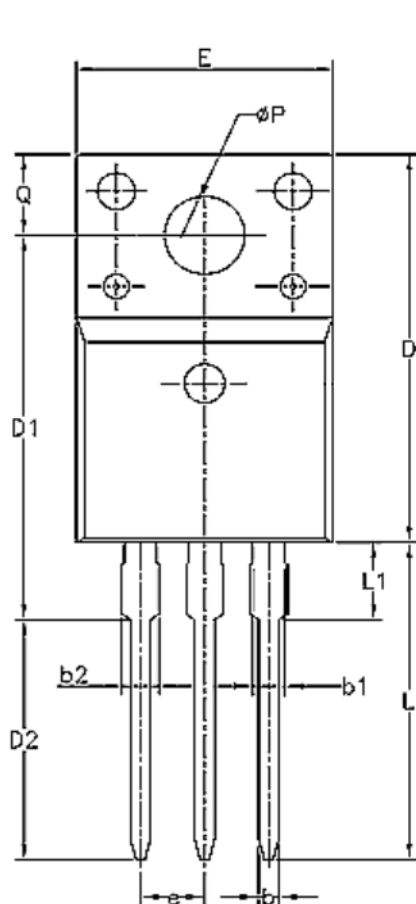
SYMBOL	MIN	NOM	MAX
A	2.2	2.3	2.4
A1	0	--	0.2
A2	0.9	1.035	1.17
b	0.645	--	0.9
b3	5.13	5.326	5.46
c	0.43	--	0.61
c2	0.41	--	0.61
D	5.98	6.1	6.22
D1	5.244	--	--
E	6.4	6.6	6.73
E1	4.63	--	--
e	2.186	2.286	2.386
H	9.4	10.04	10.5
L	1.38	1.5	1.75
L1	2.6	2.872	3
L2	0.5	0.509	0.52
L3	0.88	--	1.28
L4	0.5	--	1
L6	1.5	1.7	1.95
θ	0°	--	10°

Outlines TO-220F Package



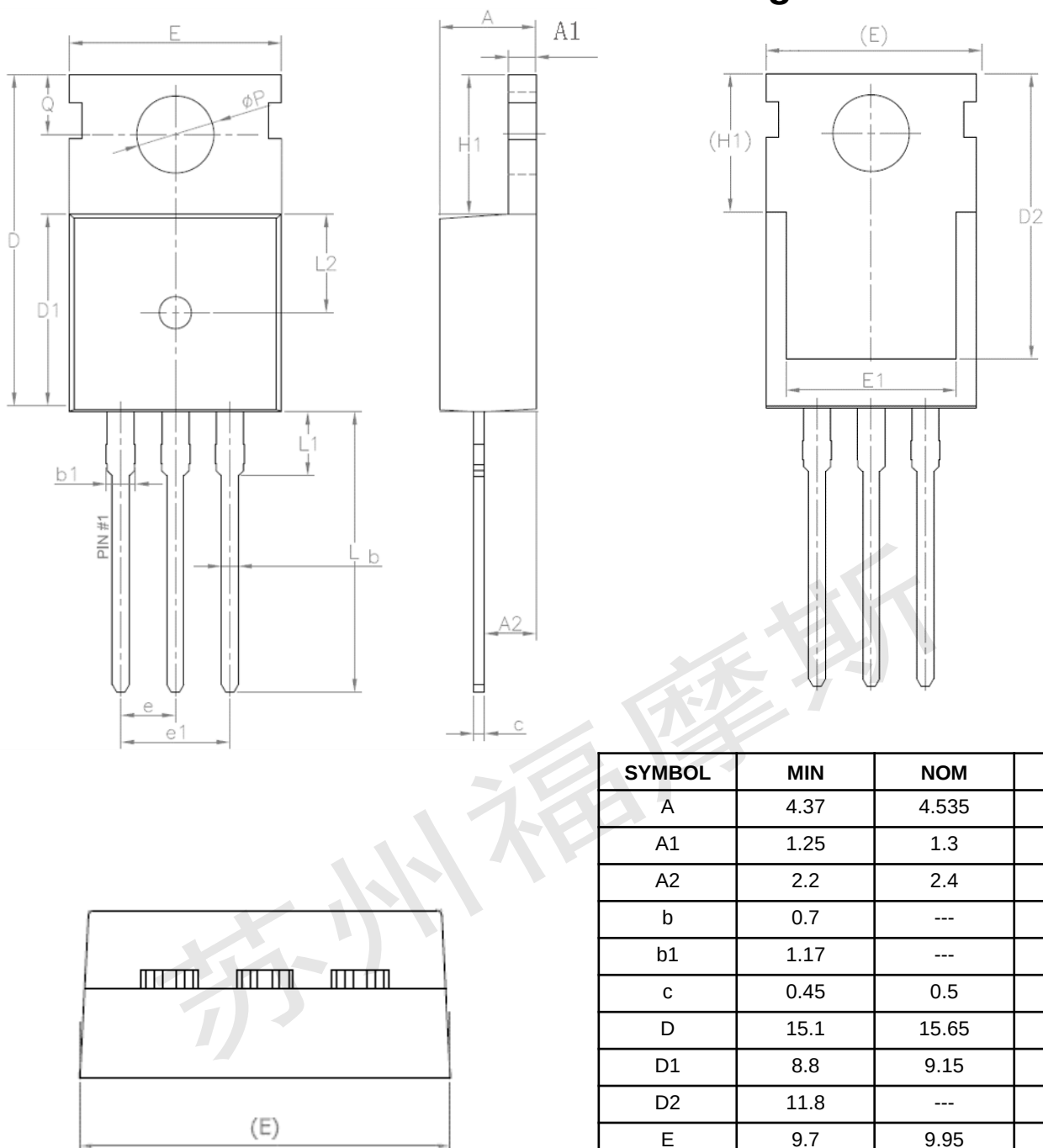
SYMBOL	MIN	NOM	MAX
A	4.5	4.7	4.9
A1	2.34	2.54	2.74
A3	2.56	2.76	2.96
b	0.7	---	0.95
b1	1.18	---	1.43
b2	---	---	1.55
c	0.4	0.5	0.65
D	15.57	15.87	16.17
D1	15.35	15.675	15.95
D2	9.6	9.875	10.15
E	9.96	10.16	10.36
e	2.54 BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	---	---	3.5

Outlines TO-220FT Package



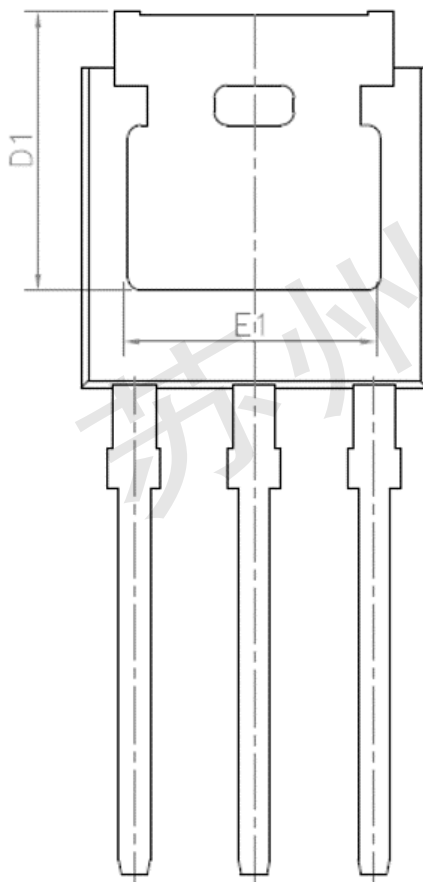
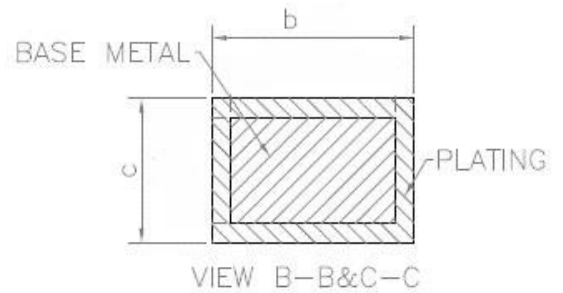
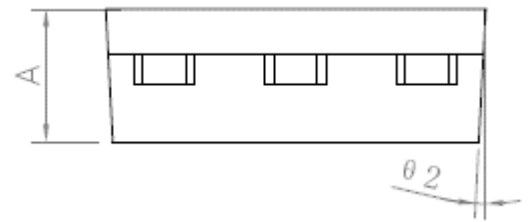
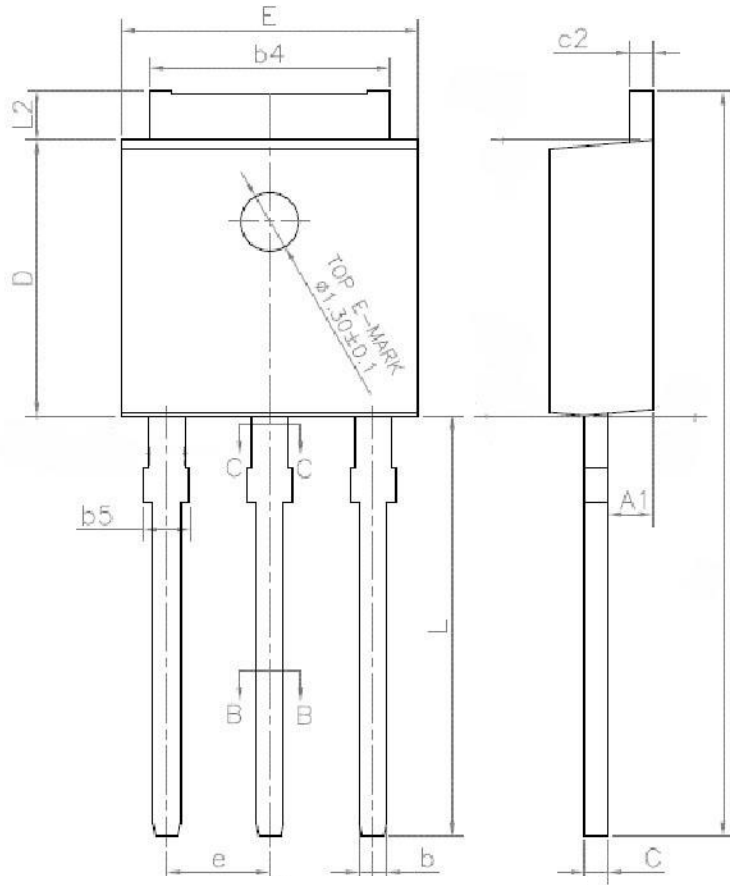
SYMBOL	MIN	NOM	MAX
A	4.5	4.7	4.9
A1	2.34	2.54	2.74
A3	2.56	2.76	2.96
b	0.7	---	0.95
b1	1.18	---	1.43
b2	---	---	1.55
c	0.4	0.5	0.65
D	15.57	15.87	16.17
D1	15.35	15.675	15.95
D2	9.6	9.875	10.15
E	9.96	10.16	10.36
e	2.54 BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	---	---	3.5

Outlines TO-220 Package



SYMBOL	MIN	NOM	MAX
A	4.37	4.535	4.7
A1	1.25	1.3	1.4
A2	2.2	2.4	2.6
b	0.7	---	0.95
b1	1.17	---	1.47
c	0.45	0.5	0.6
D	15.1	15.65	16.1
D1	8.8	9.15	9.4
D2	11.8	---	---
E	9.7	9.95	10.3
E1	7	---	---
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.5	6.85
L	12.75	13.29	13.8
L1	---	---	3.5
ΦP	3.4	3.67	3.8
Q	2.6	---	3

Outlines TO-251 Package



SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.90	1.04	1.17
b	0.56	--	0.90
b4	5.20	5.33	5.46
b5	--	--	1.05
c	0.43	--	0.61
c2	0.43	--	0.61
D	5.98	6.10	6.22
D1	5.2	--	--
E	6.40	6.60	6.73
E1	4.60	--	--
e	2.24	2.29	2.34
e1	4.47	4.57	4.67
H	16.18	16.50	16.82
L	9	9.35	9.65
L2	0.88	1.05	1.28