

650V N-Channel Planar MOSFET

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

650V N-Channel Planar MOSFET

650V N-Channel Planar MOSFET Power Transistor

HRH7N65AX Data Sheet

Rev. 2022 V1.4



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Description

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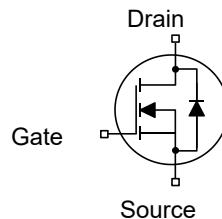
HRH7N65Ax is HRM high voltage MOSFET family based on advanced planar stripe DMOS technology. This advanced MOSFET family has optimized on-state resistance, and also provides superior switching performance and higher avalanche energy strength. This device family is suitable for high efficiency switch mode power supplies.

Features

- $R_{DS(on)}=1.2\Omega$ @ $V_{gs}=10V$, $I_d=3.5A$
- Low gate Charge(typical 25.9nC)
- Low C_{rss} (typical 3 pF)
- Fast switching capability
- 100% avalanche tested
- Improved dv/dt capability
- Halogen free and RoHS compliant

Applications

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



Key Performance Parameters

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on),typ}$	1.2	Ω
$Q_{g,typ}$	25.9	nC
I_D	7	A
$I_{D,pulse}$	28	A

Device Marking and Package Information

Device	Package	Marking
HRH7N65AP	TO-220	H7N65AP
HRH7N65AF	TO-220F	H7N65AF
HRH7N65AFT	TO-220F	H7N65AFT
HRH7N65AFN	TO-220F(细脚)	H7N65AFN
HRH7N65AD	TO-252	H7N65AD
HRH7N65AU	TO-251	H7N65AU

Absolute Maximum Ratings T _C = 25°C, unless otherwise noted				
Parameter		Symbol	Value	Unit
Drain-Source Voltage(V _{GS} =0V)		V _{DS}	650	V
Continuous Drain Current 1)	T _C = 25°C	I _D	7	A
	T _C = 100°C		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}	490	mJ
Peak Diode Recovery dv/dt 4)		dv/dt	5	V/ns
Power Dissipation For TO-220F		P _D	41	W
Power Dissipation For TO-220、TO-263、TO-252、TO-251			104	W
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	°C

Thermal Resistance For TO-220F			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	3.0	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-22、TO-252、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) $L=20\text{mH}$, $I_{AS}=7\text{A}$, $R_G=25\Omega$, $V_{DD}=80\text{V}$, Start $T_J=25^{\circ}\text{C}$.
- 4) $I_{SD} \leq 7\text{A}$, $di/dt \leq 100\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Start $T_J=25^{\circ}\text{C}$.

Electrical Characteristics T _J = 25°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 = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650V V _{GS} = 0V, T _J = 25°C	--	--	1	μA
		V _{DS} = 650V, V _{GS} = 0V, T _J = 150°C	--	--	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 = 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 = 25Ω	--	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°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/μs	--	351	--	ns
Reverse Recovery Charge	Q _{rr}		--	3.3	--	μC

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

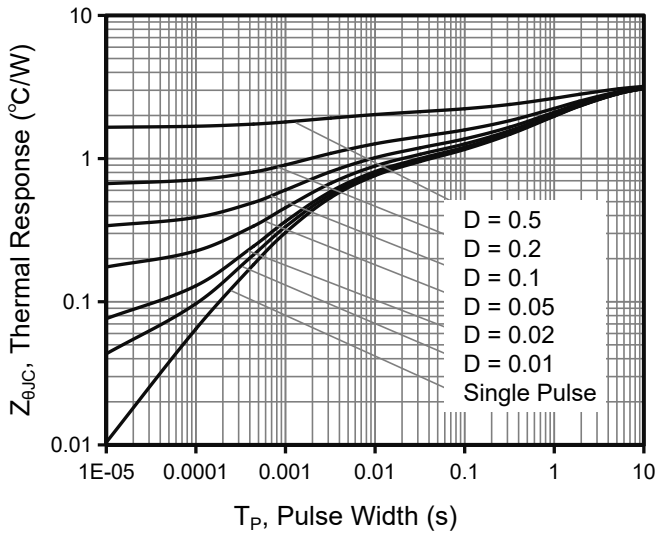


Figure 1. Transient Thermal Impedance For TO-220F

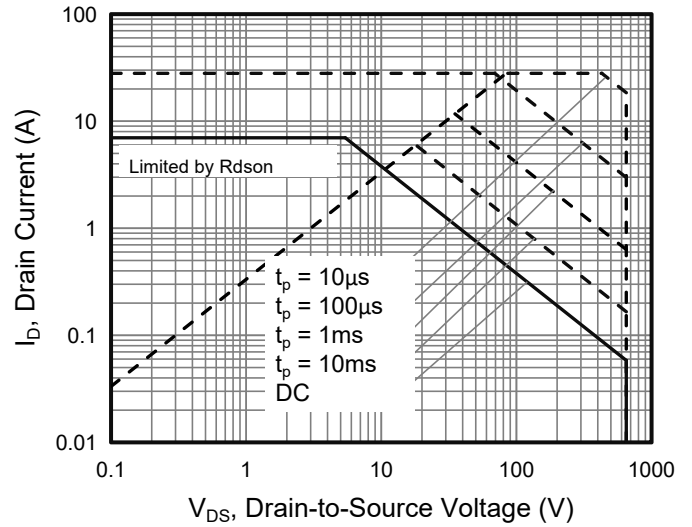


Figure 2. Safe Operation Area For TO-220F

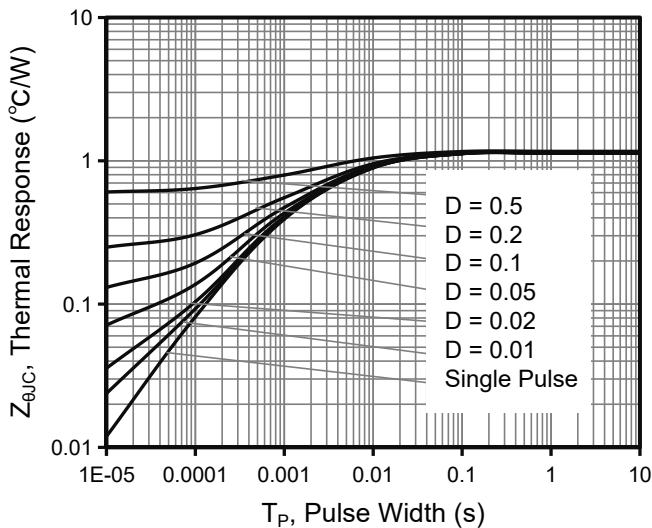


Figure 3. Transient Thermal Impedance For TO-252, TO-220, TO-251

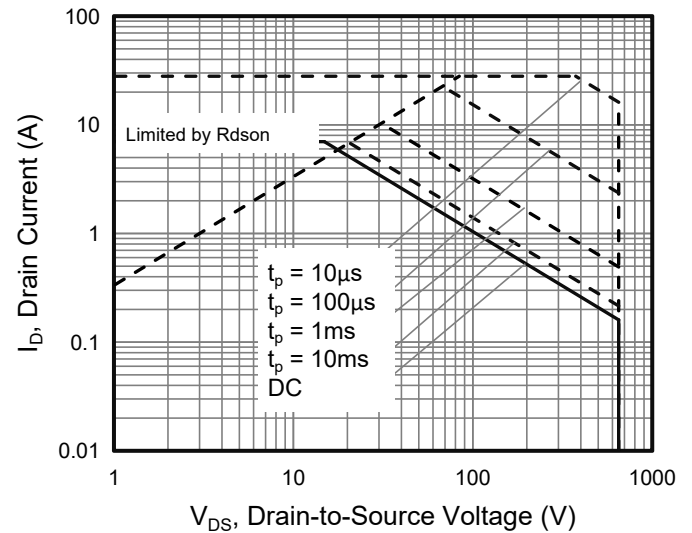


Figure 4. Safe Operation Area For TO-252, TO-220, TO-251

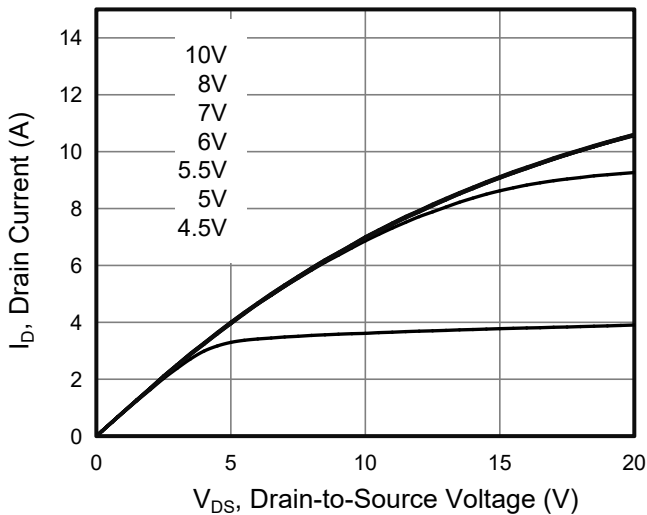


Figure 5. Output Characteristics

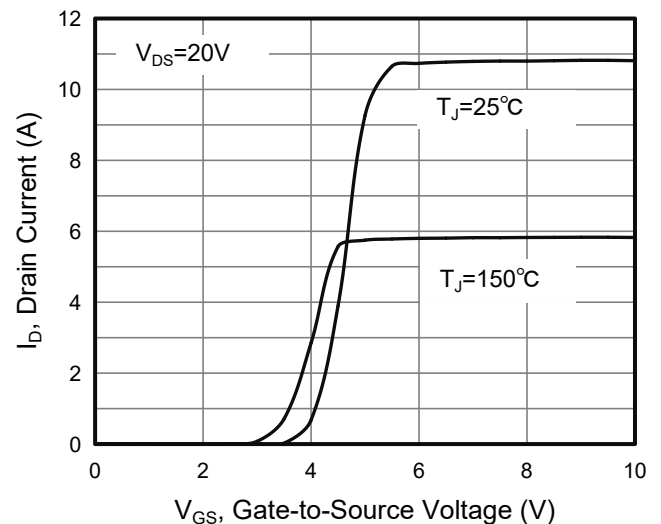


Figure 6. Transfer Characteristics

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

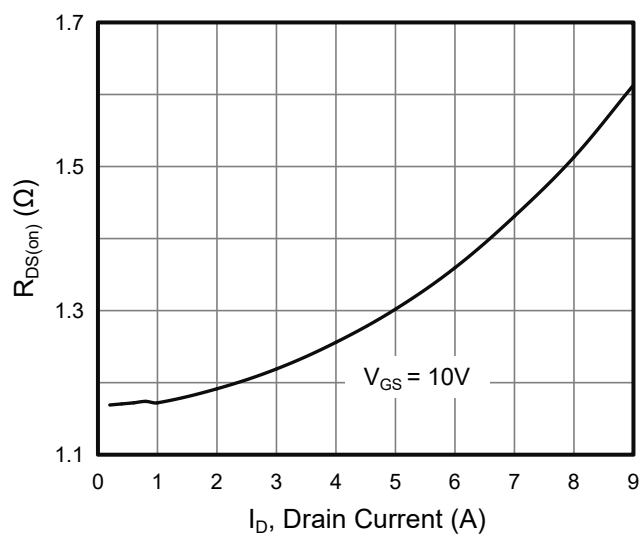


Figure 7. On-Resistance vs Drain Current

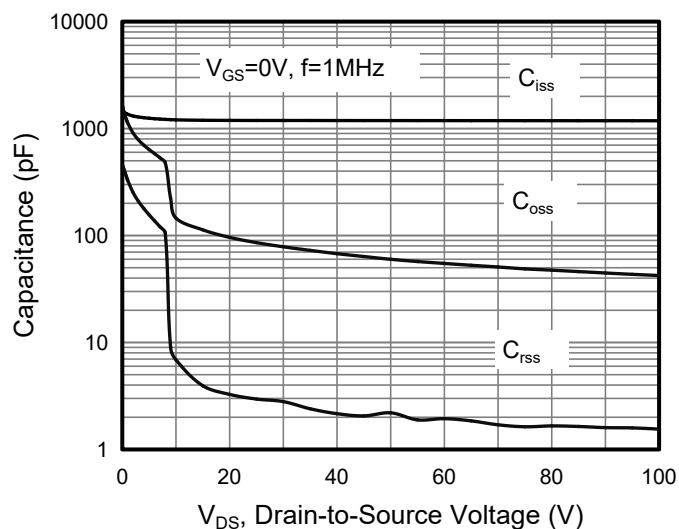


Figure 8. Capacitance

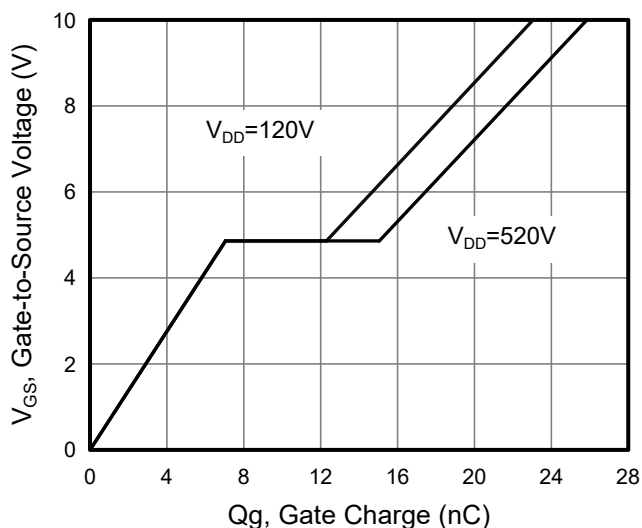


Figure 9. Gate Charge

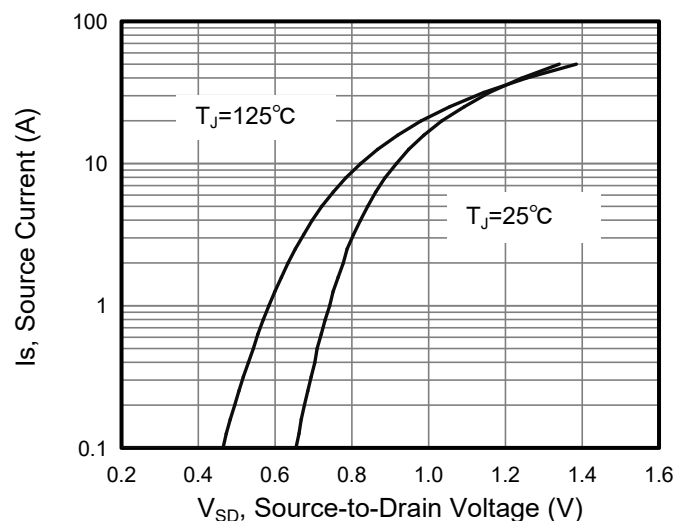


Figure 10. Body Diode Forward Voltage

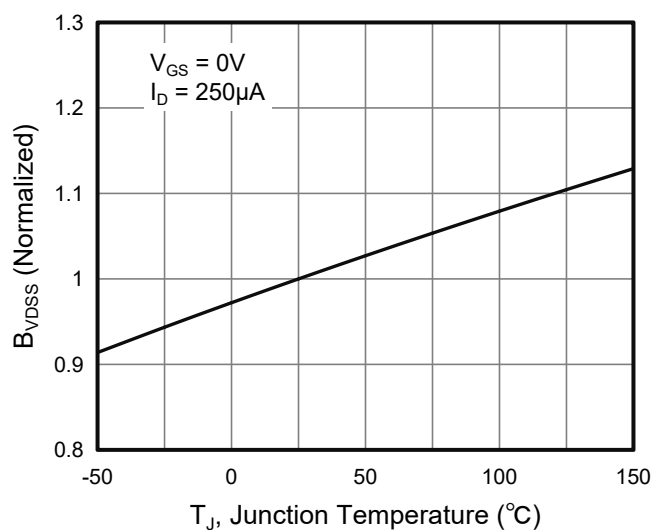


Figure 11. Breakdown Voltage vs Junction Temperature

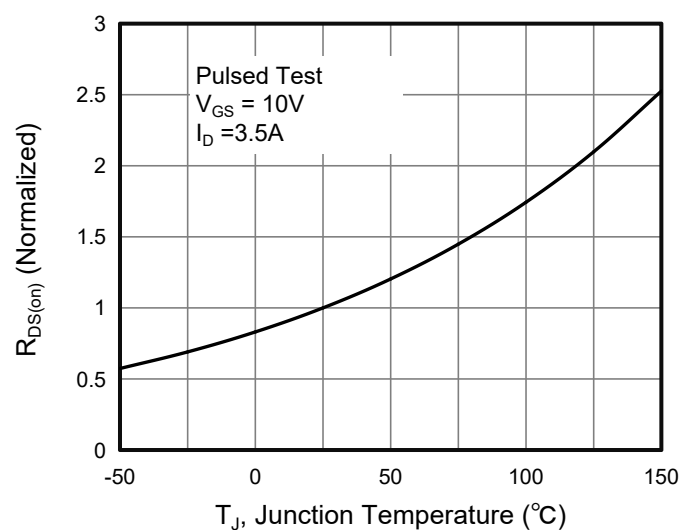


Figure 12. On-Resistance vs Temperature

Figure A: Gate Charge Test Circuit and Waveform

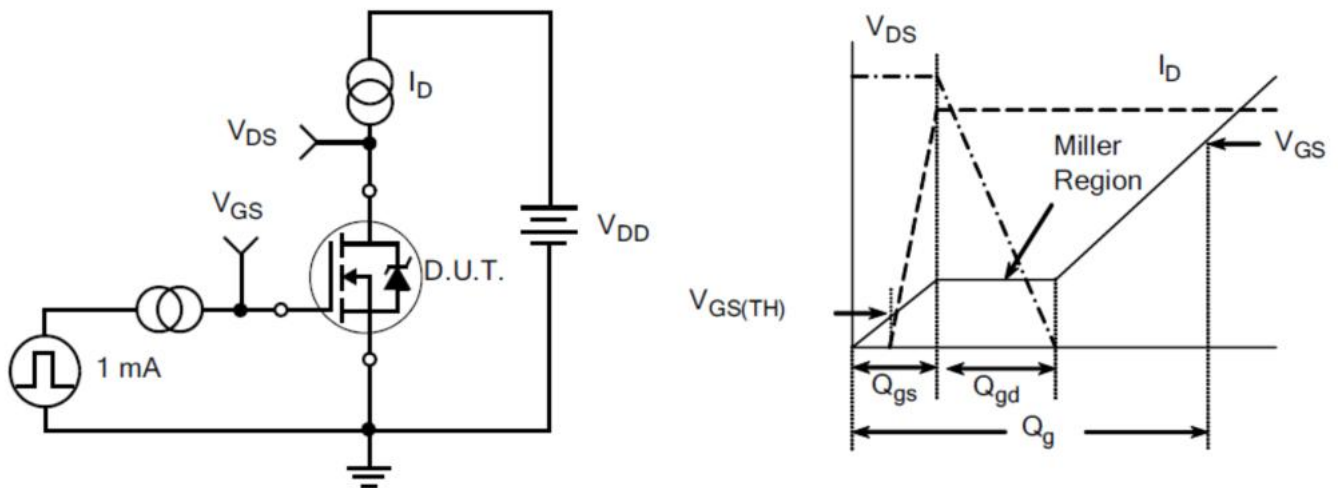


Figure B: Resistive Switching Test Circuit and Waveform

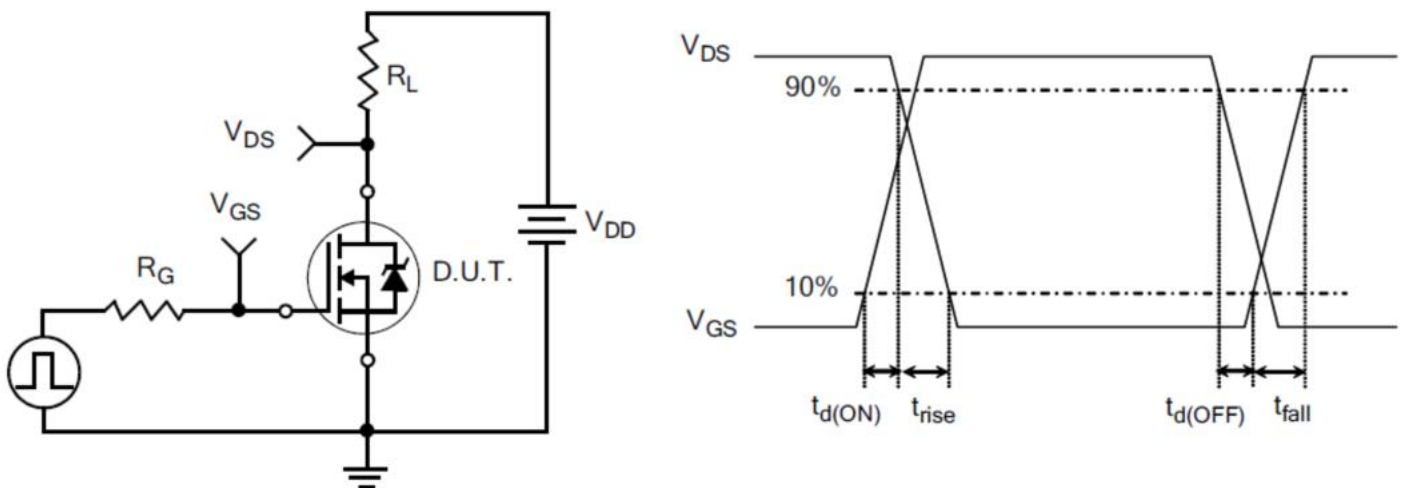
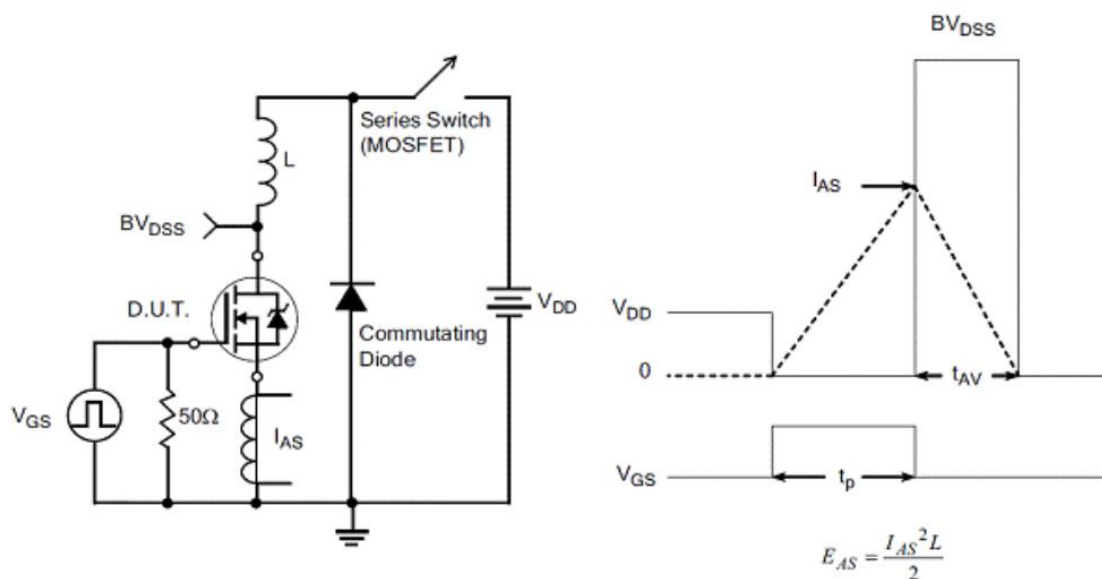
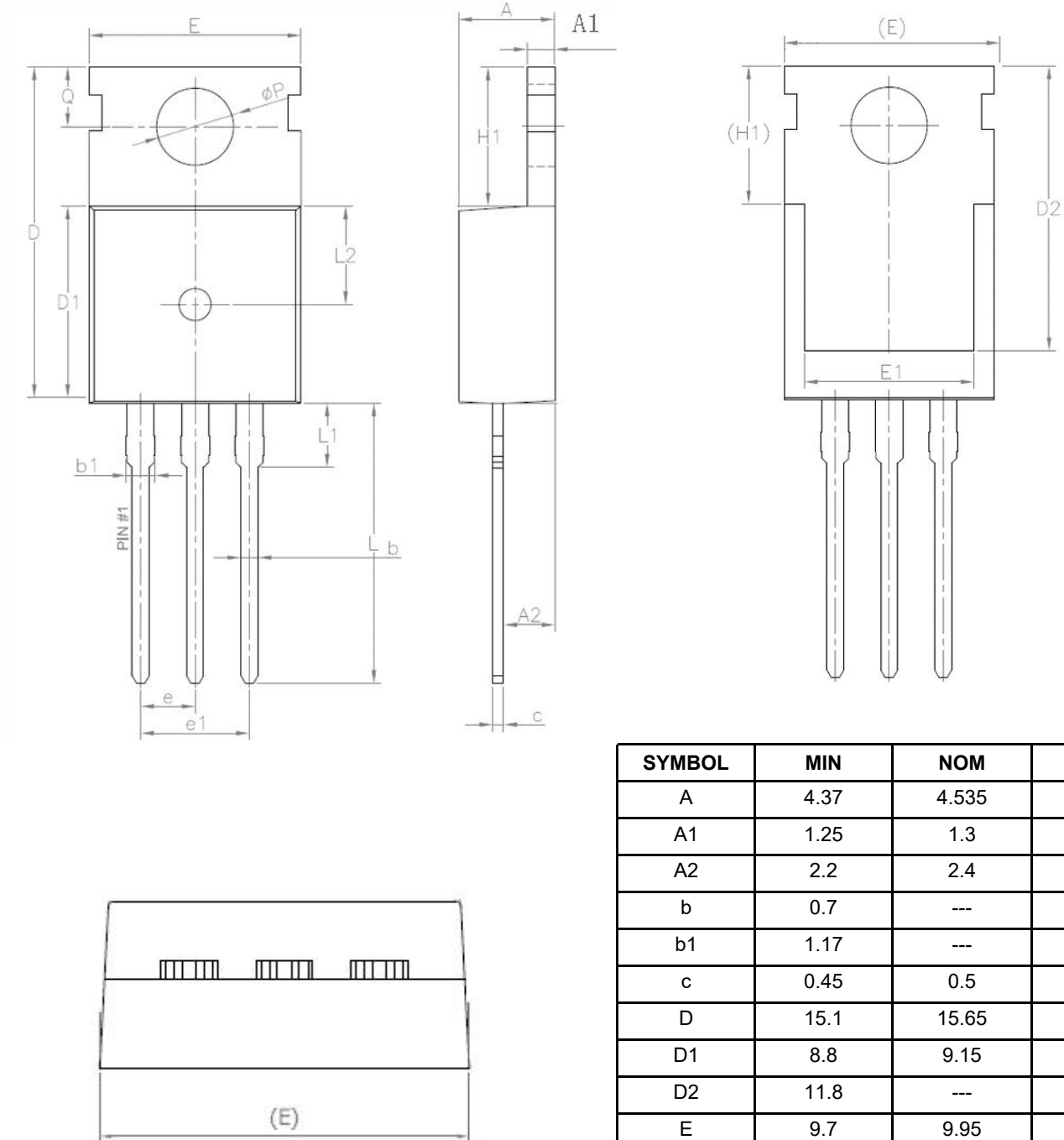


Figure C: Unclamped Inductive Switching Test Circuit and Waveform

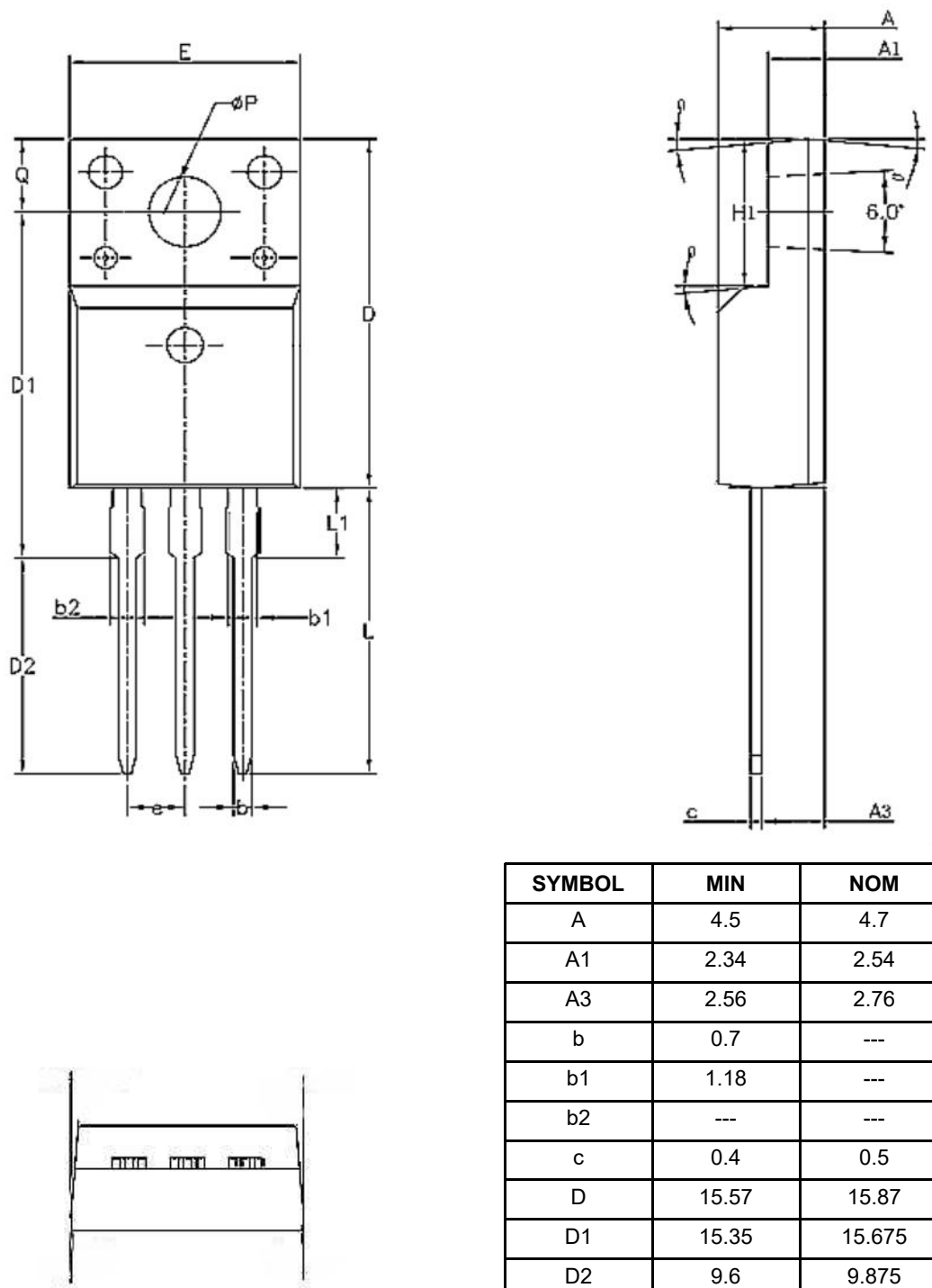


Outlines TO-220 Package



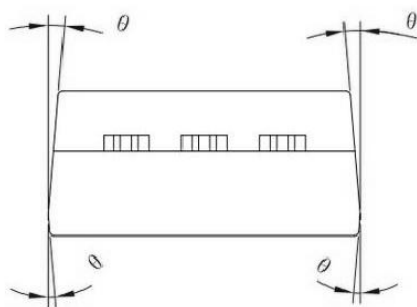
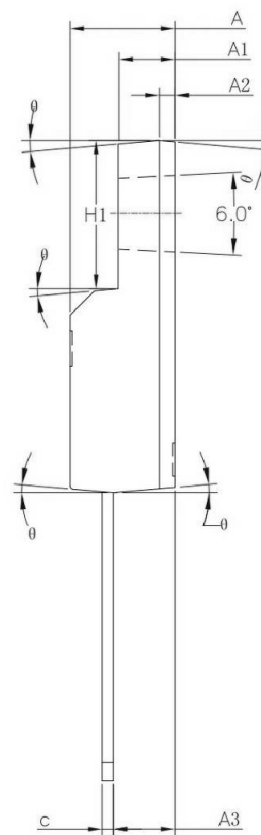
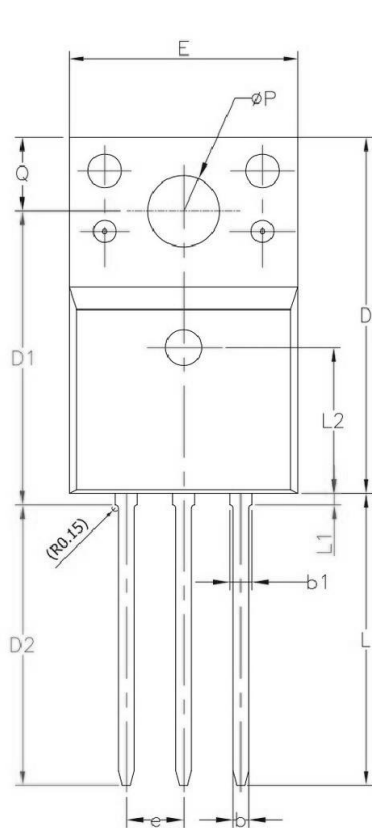
SYMBOL	MIN	NOM	MAX
A	4.37	4.535	4.7
A1	1.25	1.3	1.4
A2	2.2	2.4	2.6
b	0.7	---	0.95
b1	1.17	---	1.47
c	0.45	0.5	0.6
D	15.1	15.65	16.1
D1	8.8	9.15	9.4
D2	11.8	---	---
E	9.7	9.95	10.3
E1	7	---	---
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.5	6.85
L	12.75	13.29	13.8
L1	---	---	3.5
ΦP	3.4	3.67	3.8
Q	2.6	---	3

Outlines TO-220F Package



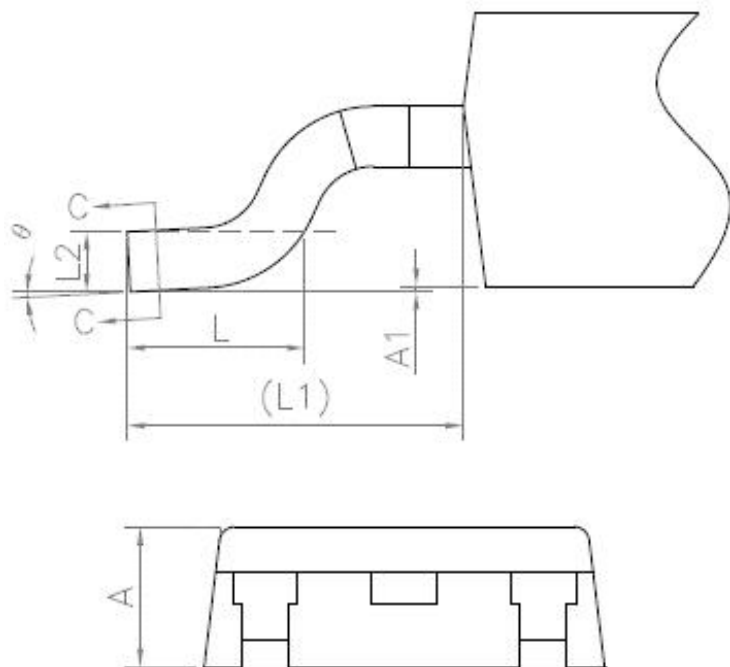
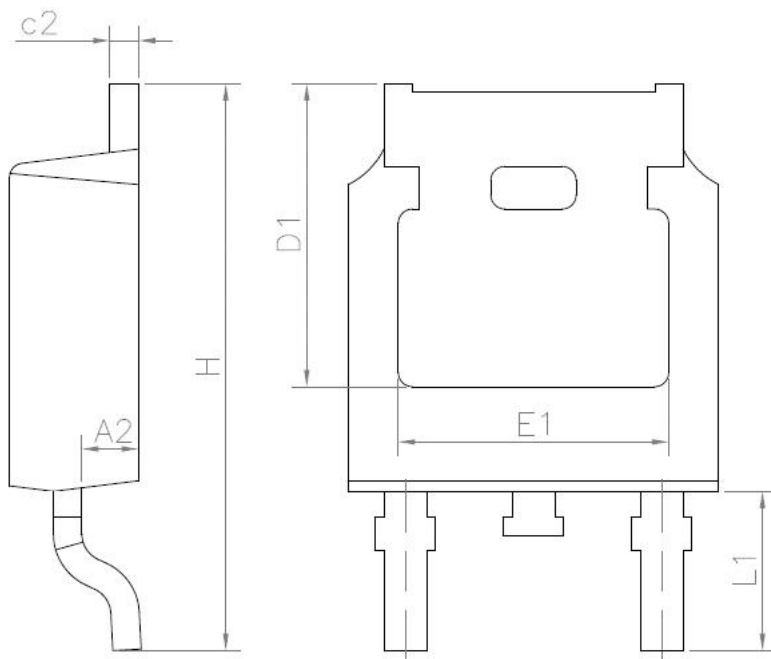
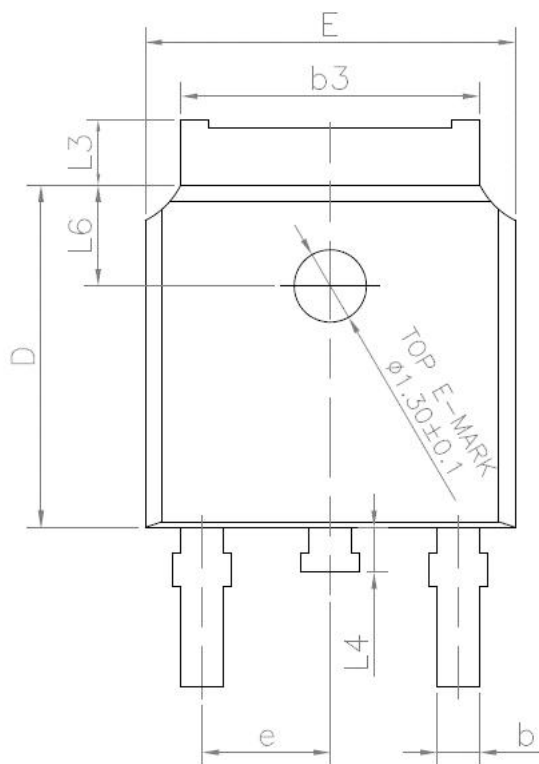
SYMBOL	MIN	NOM	MAX
A	4.5	4.7	4.9
A1	2.34	2.54	2.74
A3	2.56	2.76	2.96
b	0.7	---	0.95
b1	1.18	---	1.43
b2	---	---	1.55
c	0.4	0.5	0.65
D	15.57	15.87	16.17
D1	15.35	15.675	15.95
D2	9.6	9.875	10.15
E	9.96	10.16	10.36
e	2.54 BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	---	---	3.5

Outlines TO-220F (细脚) Package



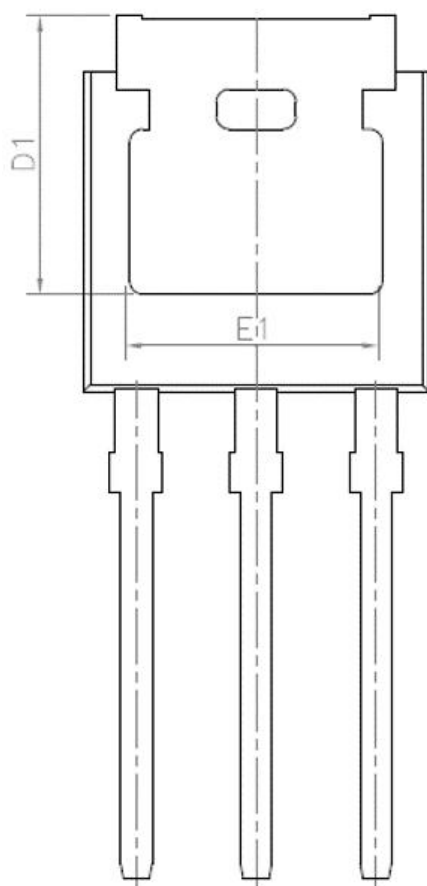
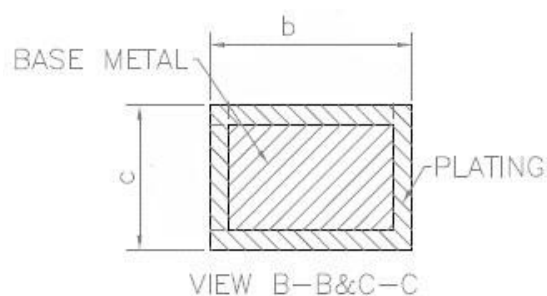
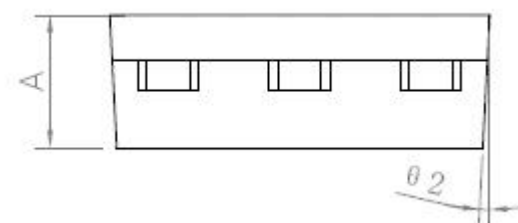
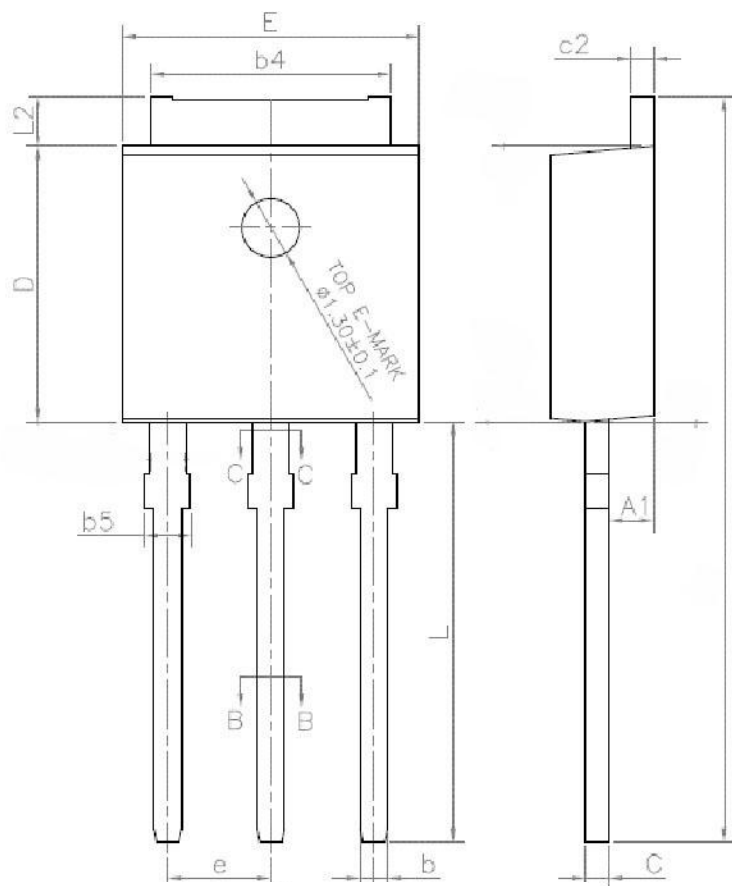
SYMBOL	MIN	NOM	MAX
A	4.5	4.7	4.83
A1	2.34	2.54	2.74
A2	0.3	---	0.7
A3	2.56	2.76	2.96
b	0.53	---	0.8
b1	0.9	---	1.15
c	0.45	0.5	0.6
D	15.47	15.87	16.27
D1	12.87	---	13.27
D2	12.28	---	12.68
E	9.86	10.16	10.46
e	2.54 BSC		
H1	6.48	---	6.88
L	12.68	12.98	13.98
L1	---	---	0.95
L2	6.50 REF		
ΦP	2.98	3.18	3.38
Q	3.15	---	3.45
θ1	1°	3°	5°

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-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

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