



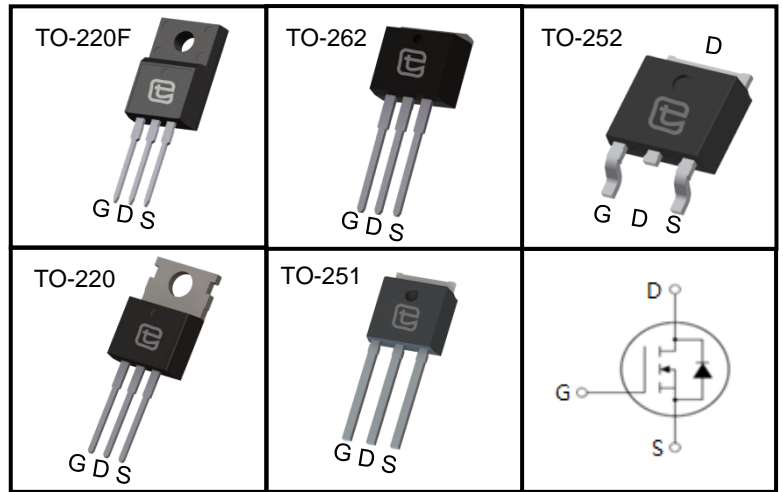
650V N-Channel MOSFET

FEATURES

- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

APPLICATIONS

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



Device Marking and Package Information					
Device	TMA6N65HG	TMC6N65HG	TMD6N65HG	TMP6N65HG	TMU6N65HG
Package	TO-220F	TO-262	TO-252	TO-220	TO-251
Marking	A6N65HG	C6N65HG	D6N65HG	P6N65HG	U6N65HG

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted							
Parameter	Symbol	Value					Unit
		TO-220F	TO-262	TO-252	TO-220	TO-251	
Drain-Source Voltage ($V_{GS} = 0\text{V}$)	V_{DSS}	650					V
Continuous Drain Current	$T_C = 25^\circ\text{C}$	6					A
	$T_C = 100^\circ\text{C}$	3.6					
Pulsed Drain Current (note1)	I_{DM}	24					A
Gate-Source Voltage	V_{GSS}	± 30					V
Single Pulse Avalanche Energy (note2)	E_{AS}	176					mJ
Avalanche Current (note1)	I_{AR}	4.2					A
Repetitive Avalanche Energy (note1)	E_{AR}	35					mJ
Reverse diode dv/dt, $V_{DS} = 0 \dots 480\text{V}$, $I_{SD} \leq I_D$	dv/dt	5					V/ns
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	54	83			W	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150					$^\circ\text{C}$

Thermal Resistance							
Parameter	Symbol	Value					Unit
		TO-220F	TO-262	TO-252	TO-220	TO-251	
Thermal Resistance, Junction-to-Case	R_{thJC}	2.3	1.5			$^\circ\text{C}/\text{W}$	
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62.5	60				



Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = 520V, V_{GS} = 0V, T_J = 125^\circ\text{C}$	--	--	100	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	3.0	--	4.0	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 3A$	--	1.65	1.9	Ω
Forward Transconductance (Note3)	g_{fs}	$V_{DS} = 10V, I_D = 3A$	--	6.5	--	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 25V,$ $f = 1.0\text{MHz}$	--	700	--	μF
Output Capacitance	C_{oss}		--	66	--	
Reverse Transfer Capacitance	C_{rss}		--	8	--	
Total Gate Charge	Q_g	$V_{DD} = 520V, I_D = 6A,$ $V_{GS} = 10V$	--	19	--	nC
Gate-Source Charge	Q_{gs}		--	3.7	--	
Gate-Drain Charge	Q_{gd}		--	11	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 400V, I_D = 6A,$ $R_G = 25\Omega$	--	13	--	ns
Turn-on Rise Time	t_r		--	20	--	
Turn-off Delay Time	$t_{d(off)}$		--	76	--	
Turn-off Fall Time	t_f		--	40	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	6	A
Pulsed Diode Forward Current	I_{SM}		--	--	24	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 6A, V_{GS} = 0V$	--	--	1.4	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0V, I_S = 10A,$ $di_F/dt = 100A/\mu s$	--	260	--	ns
Reverse Recovery Charge	Q_{rr}		--	3.8	--	μC

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 4.2A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 1\%$



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

Figure 1. Output Characteristics

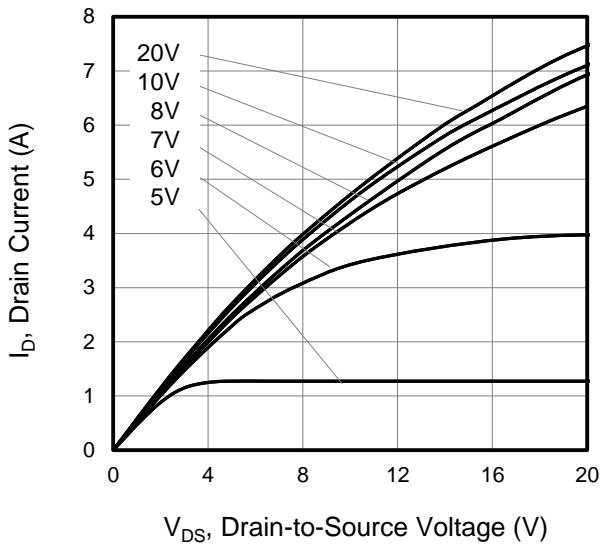


Figure 2. Transfer Characteristics

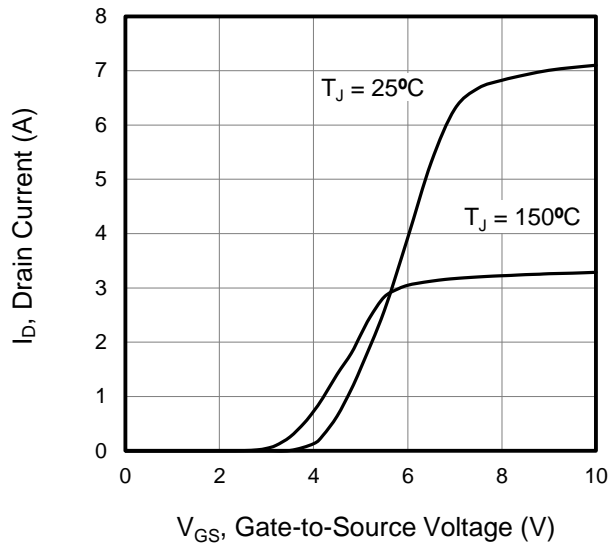


Figure 3. On-Resistance vs. Drain Current

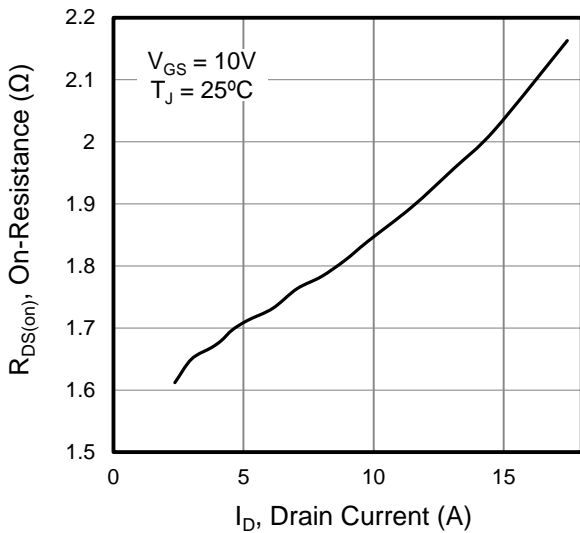


Figure 4. Capacitance

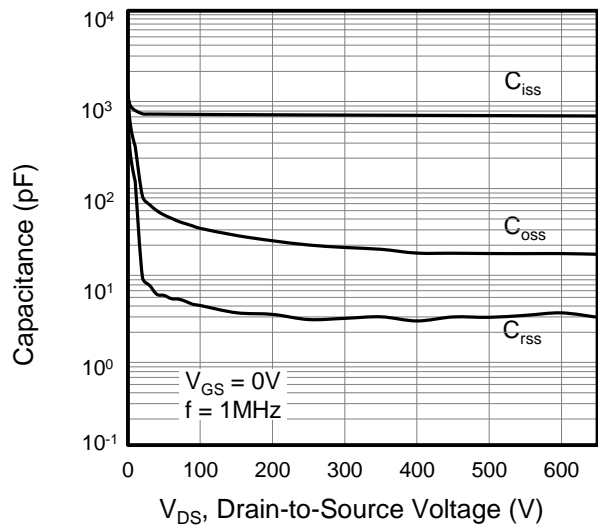


Figure 5. Gate Charge

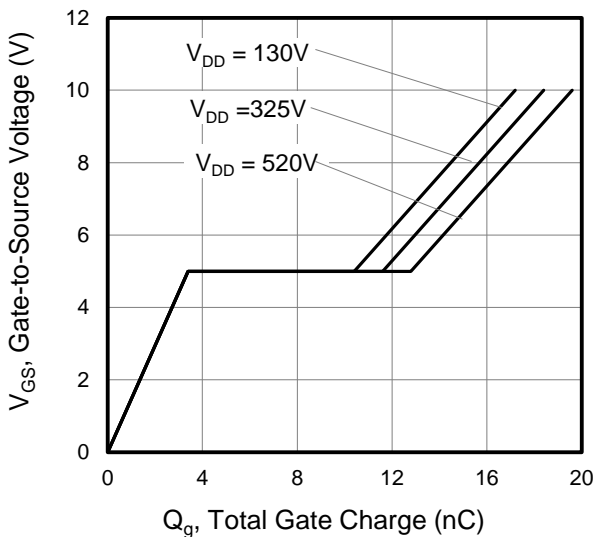
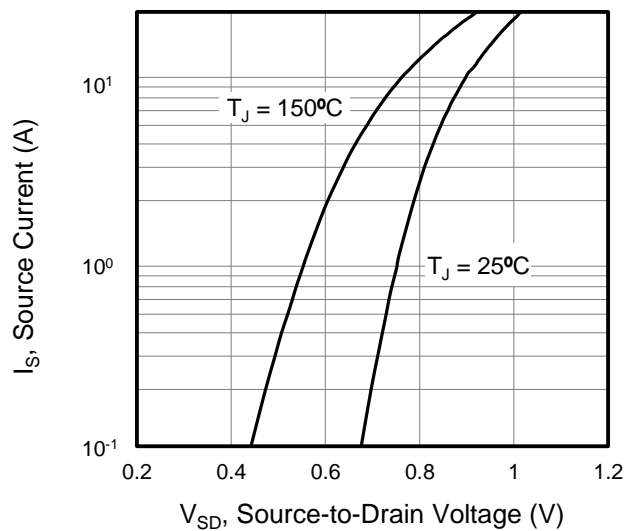


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs. Temperature

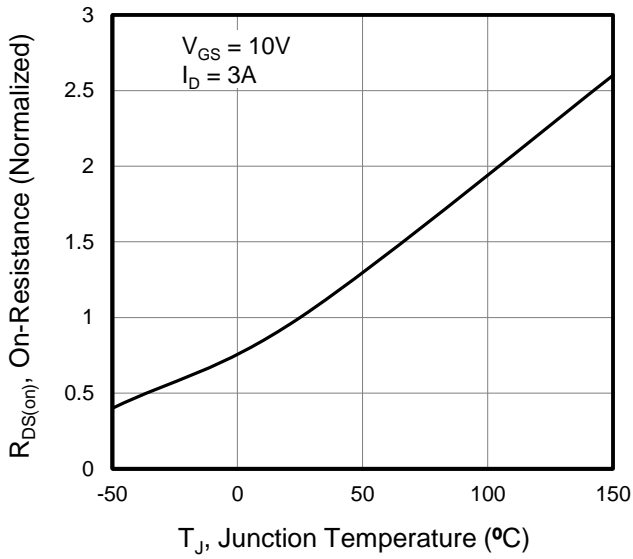


Figure 8. BV_{DSS} Variation vs. Temperature

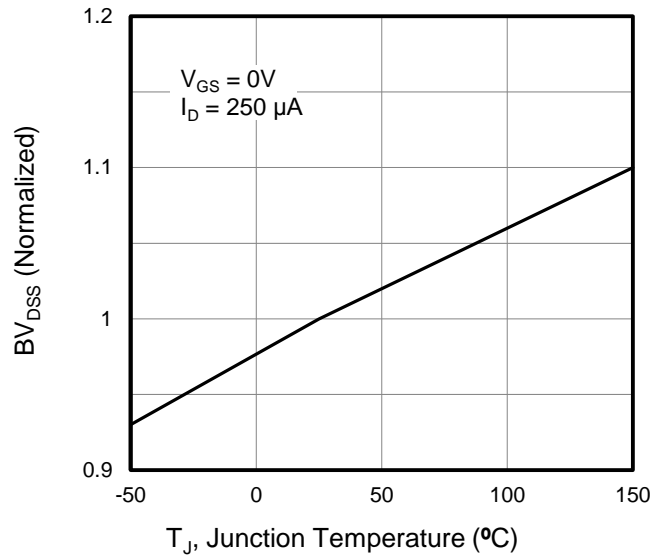


Figure 9. Transient Thermal Impedance

TO-262, TO-252, TO-220, TO-251

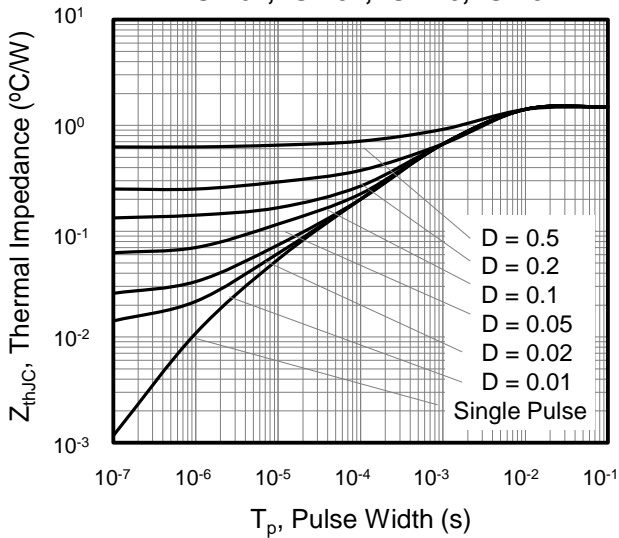


Figure 10. Transient Thermal Impedance

TO-220F

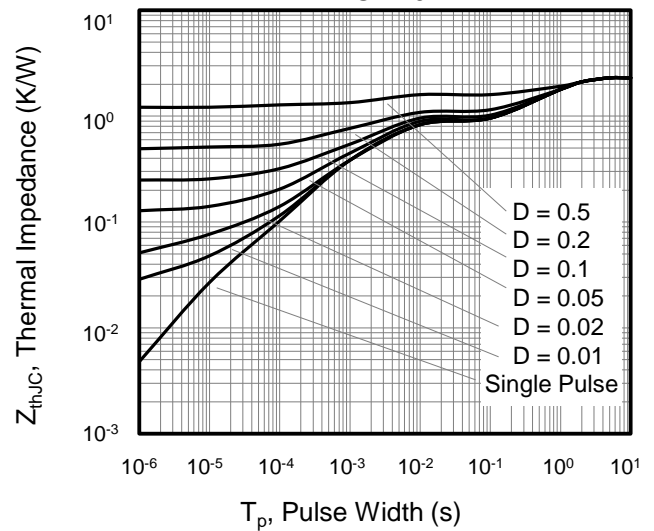


Figure 11. Safe operation area for

TO-262, TO-252, TO-220, TO-251

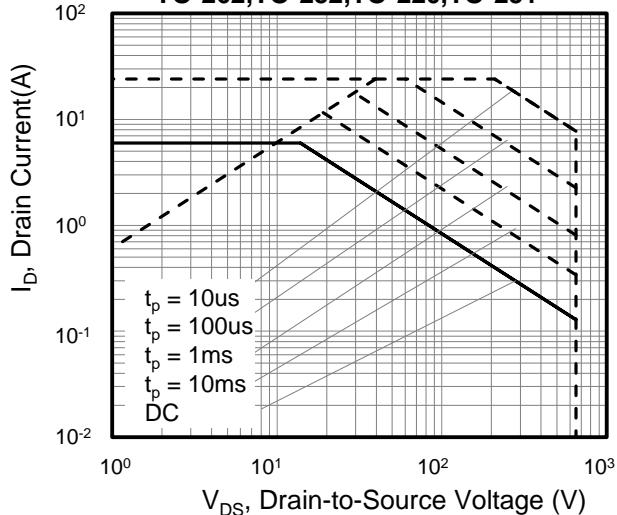


Figure 12. Safe operation area for

TO-220F

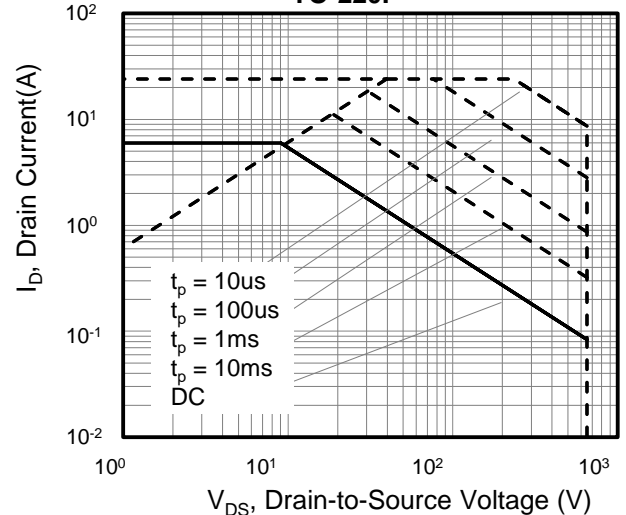




Figure A: Gate Charge Test Circuit and Waveform

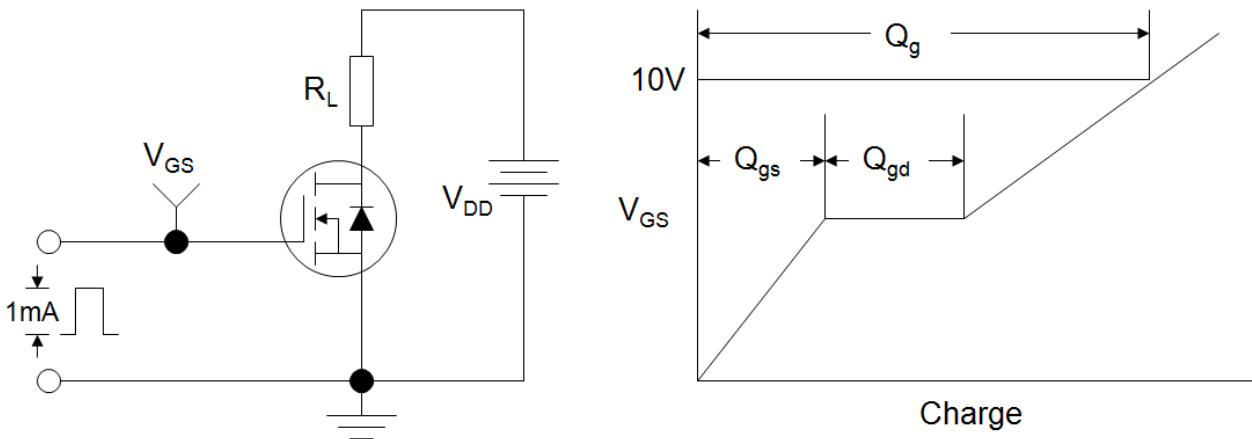


Figure B: Resistive Switching Test Circuit and Waveform

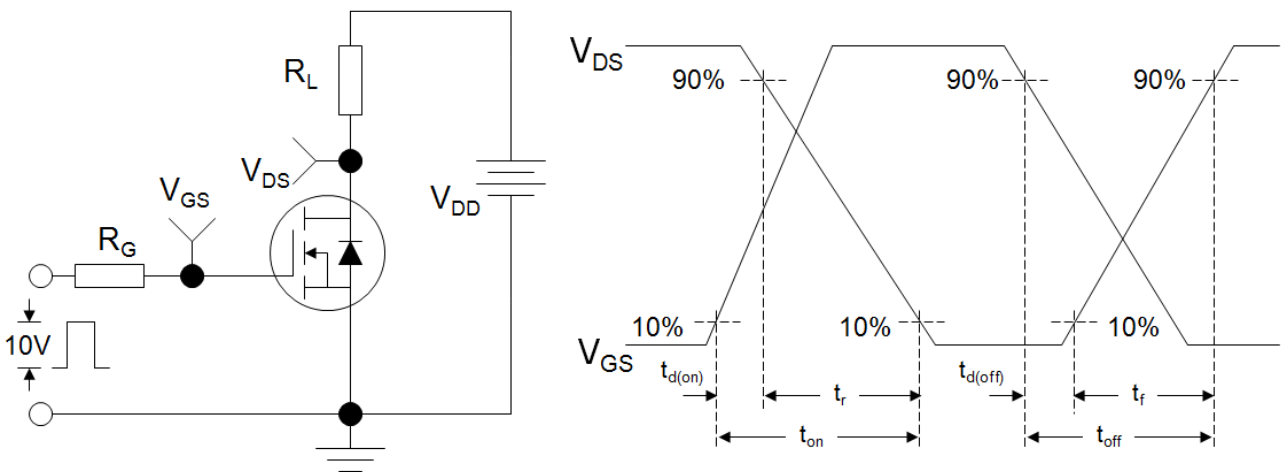
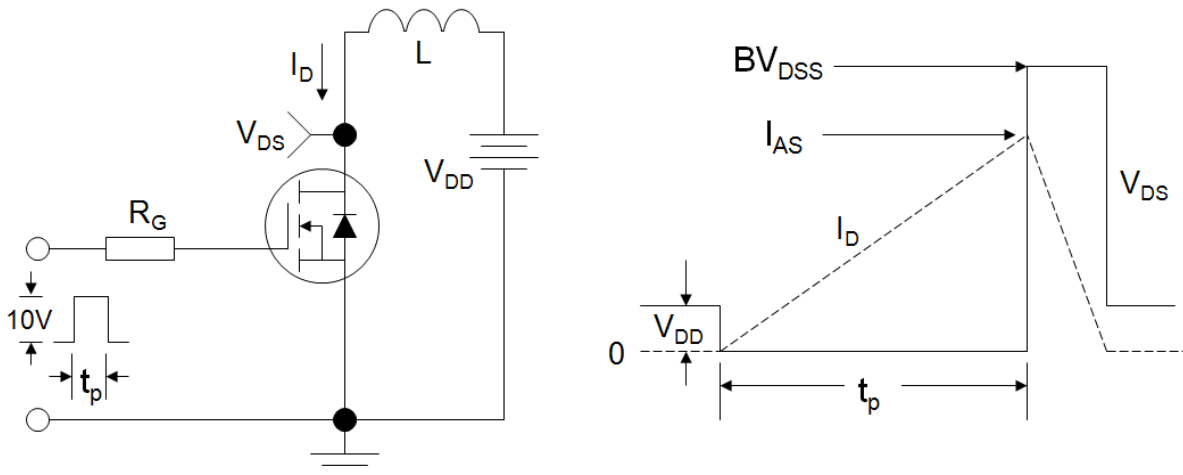
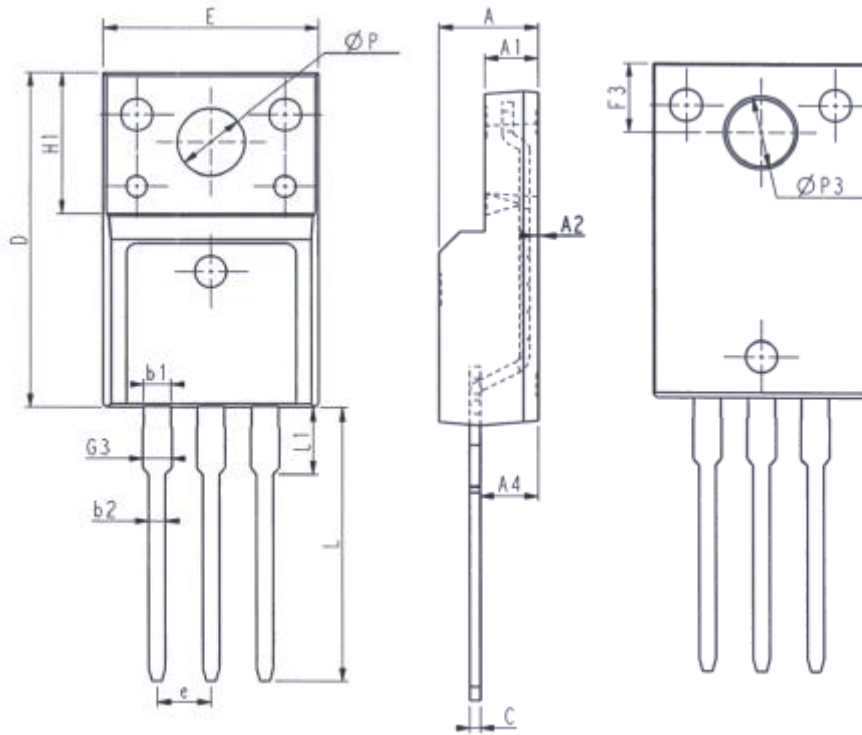


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





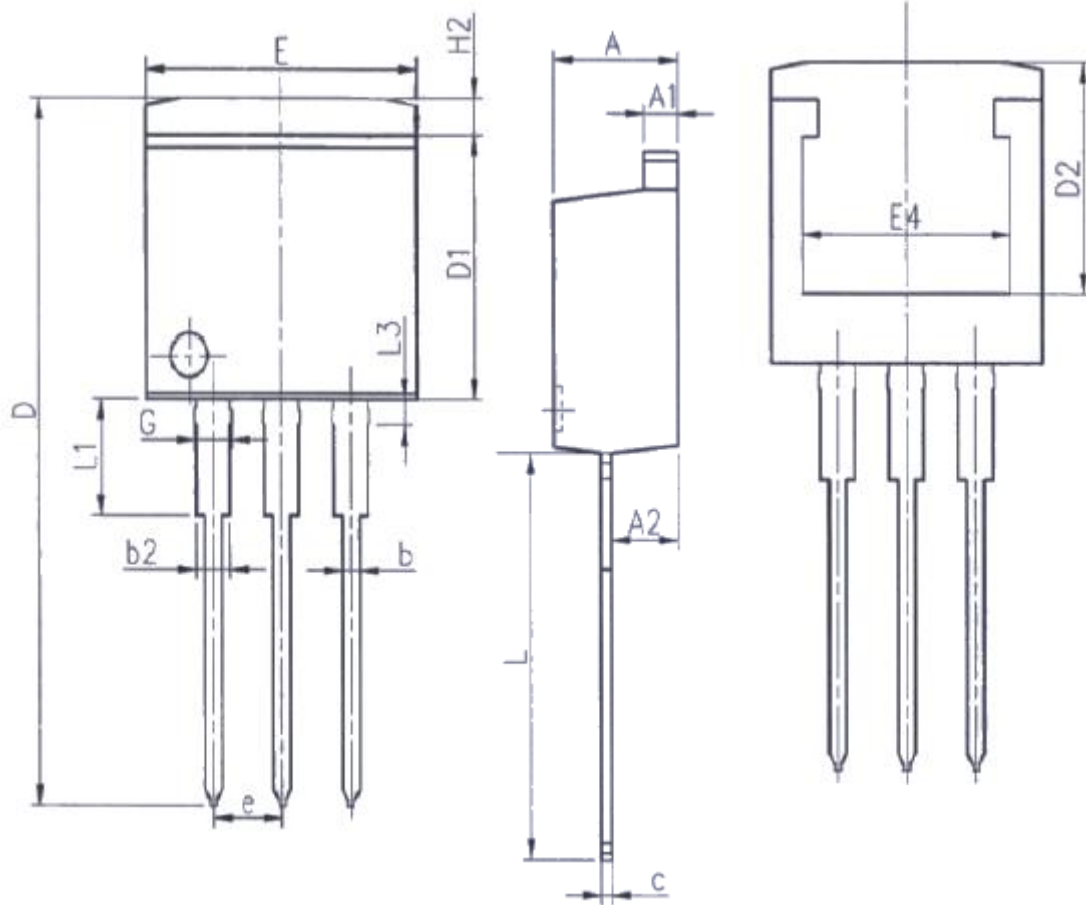
TO-220F



Unit: mm			Unit: mm		
Symbol	Min.	Max.	Symbol	Min.	Max.
E	9.96	10.36	L	12.68	13.28
A	4.50	4.90	L1	2.93	3.13
A1	2.34	2.74	P	3.03	3.38
A2	0.30	0.60	P3	3.15	3.65
A4	2.56	2.96	F3	3.15	3.45
c	0.40	0.65	G3	1.25	1.55
D	15.57	16.17	b1	1.18	1.43
H1	6.70REF		b2	0.70	0.95
e	2.54BSC				



TO-262

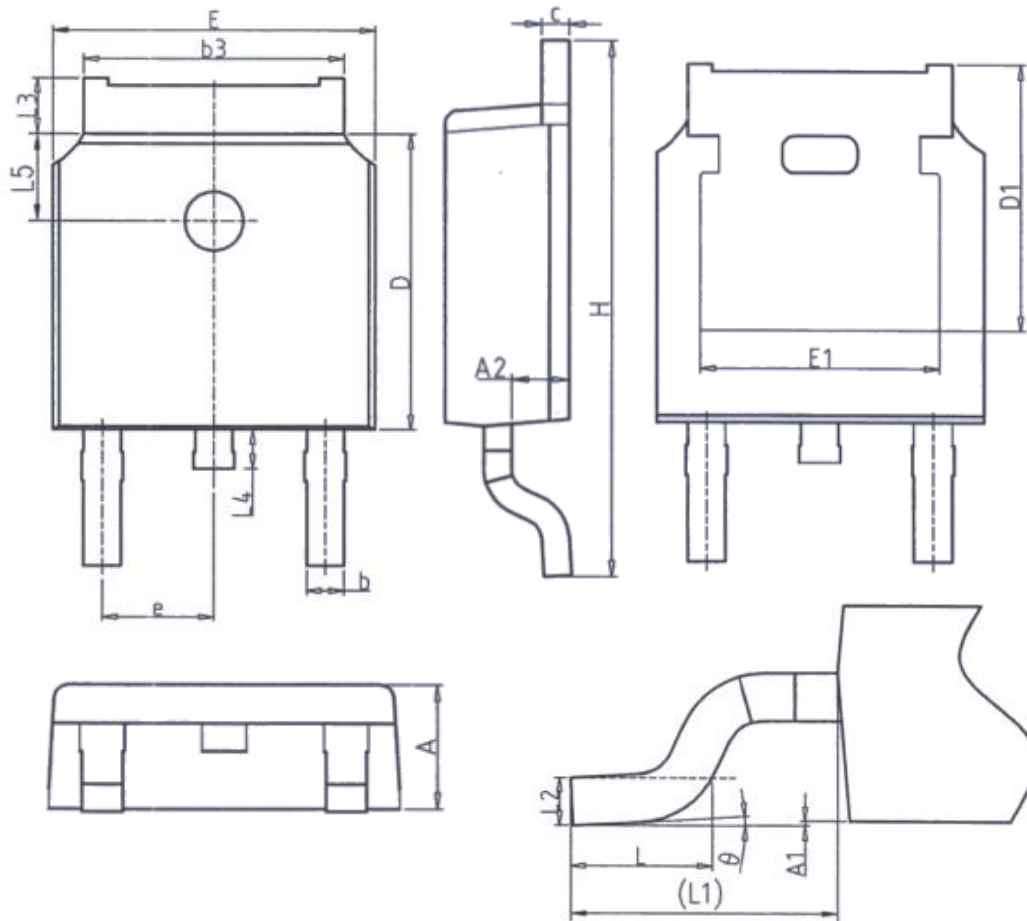


Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.22	1.42
A2	2.47	2.87
b	0.70	0.97
b2	1.17	1.42
c	0.28	0.53
D	23.20	24.02
D1	8.38	8.90
D2	6.00	-

Unit: mm		
Symbol	Min.	Max.
E	9.90	10.39
E4	7.30	-
e	2.54BSC	
G	1.25	1.50
H2	-	1.31
L	13.34	14.10
L1	3.30	4.06
L3	0.95	1.15



TO-252

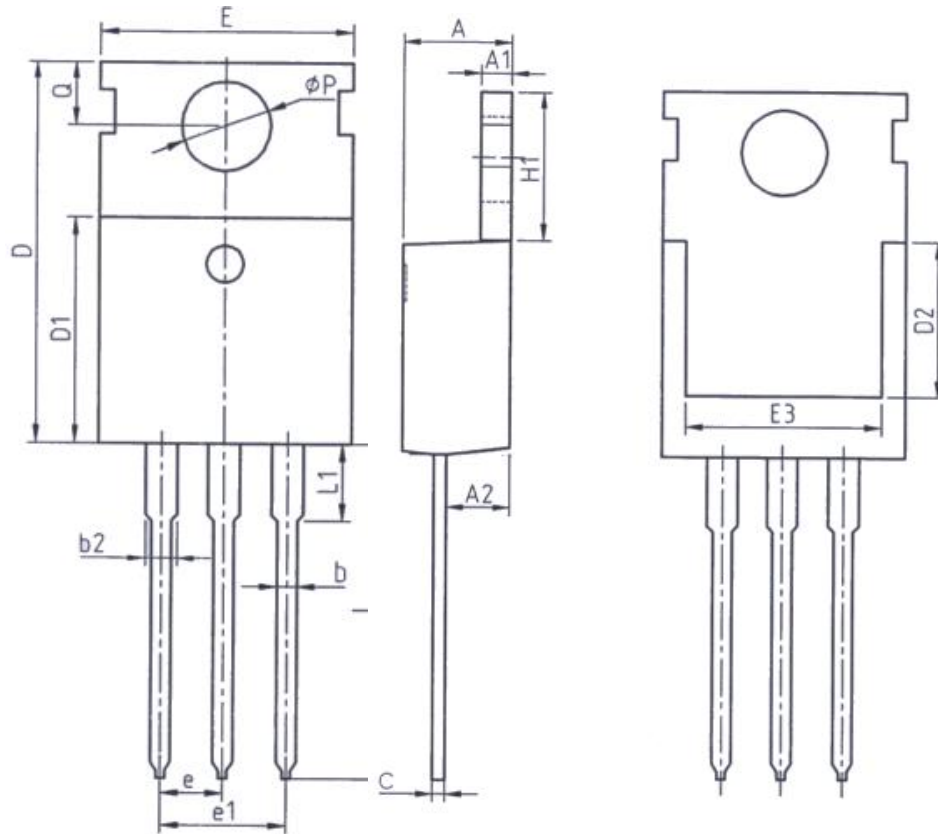


Unit: mm		
Symbol	Min.	Max.
A	2.20	2.40
A1	0.00	0.20
A2	0.97	1.17
b	0.68	0.90
b3	5.20	5.50
c	0.43	0.63
D	5.98	6.22
D1	5.30REF	
E	6.40	6.80
E1	4.63	-

Unit: mm		
Symbol	Min.	Max.
e	2.286BSC	
H	9.40	10.50
L	1.38	1.75
L1	2.90REF	
L2	0.51BSC	
L3	0.88	1.28
L4	-	1.00
L5	1.65	1.95
theta	0°	8°



TO-220

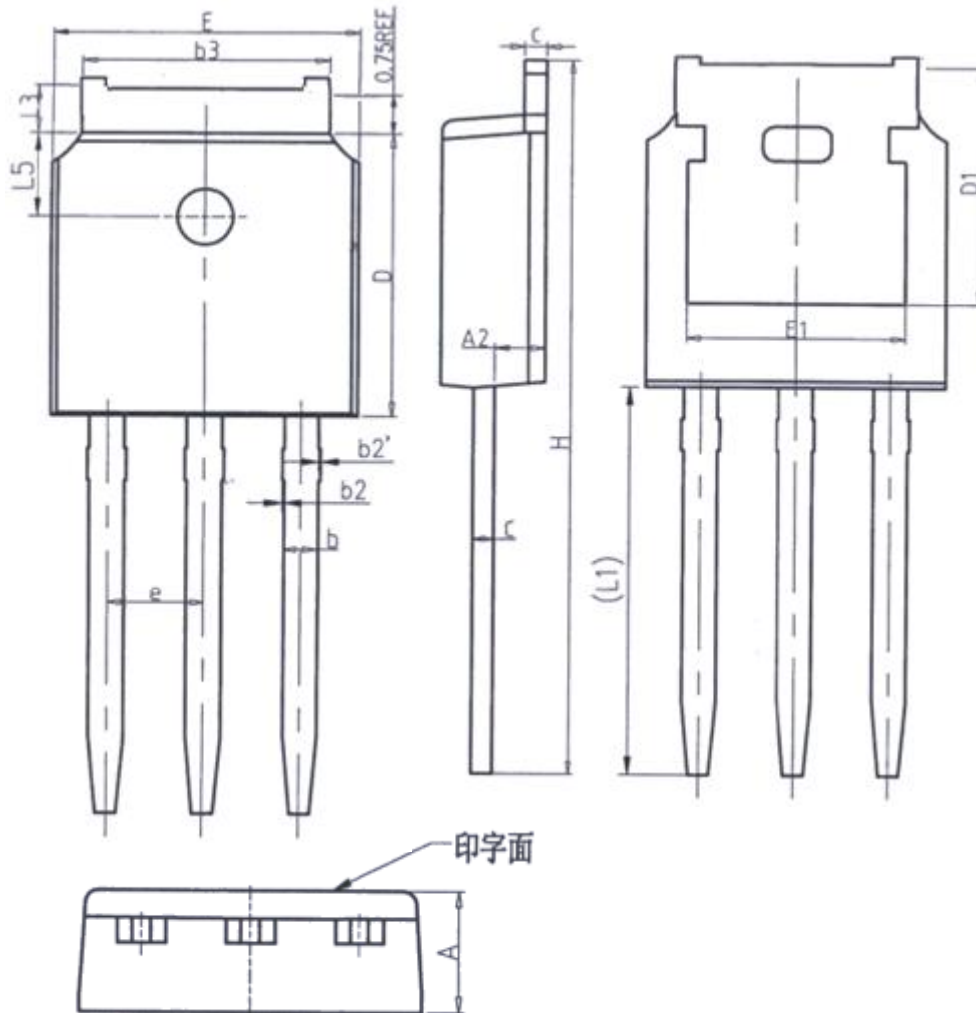


Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.25	1.45
A2	2.20	2.60
b	0.70	0.95
b2	1.17	1.47
c	0.40	0.65
D	15.10	16.10
D1	8.80	9.40
D2	5.50	-

Unit: mm		
Symbol	Min.	Max.
E	9.70	10.30
E3	7.00	-
e	2.54BSC	
e1	5.08BSC	
H1	6.25	6.85
L	12.75	13.80
L1	-	3.40
P	3.40	3.80
Q	2.60	3.00



TO-251



Unit: mm		
Symbol	Min.	Max.
A	2.20	2.40
A2	0.97	1.17
b	0.68	0.90
b2	0.00	0.10
b2'	0.00	0.10
b3	5.20	5.50
c	0.43	0.63
D	5.98	6.22

Unit: mm		
Symbol	Min.	Max.
D1	5.30REF	
E	6.40	6.80
E1	4.63	-
e	2.286BSC	
H	16.22	16.82
L1	9.15	9.65
L3	0.88	1.28
L5	1.65	1.95



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