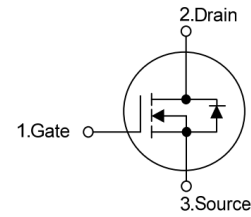


500V,20A N-CHANNEL MOSFET

Features

- $R_{DS(on)}=0.23\Omega$ (Typ.) @ $V_{GS}=10V, I_D=10A$
- Low gate charge(typ. $Q_g=50.5nc$)
- Low $R_{DS(on)}$
- 100% UIS tested



Applications

- Power factor correction
- Switched mode power supplies
- LED driver



Key Performance and Package Parameters

Order codes	V_{DS}	I_D	$R_{DS(ON)}$, Typ	T_{vjmax}	Marking	Package
XM020N500A1H3-A	500V	20A	0.23 Ω	150 $^{\circ}C$	M20N500A1A	TO220F

Absolute Maximum Ratings ($T_c=25^{\circ}C$ unless otherwise specified.)

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	500	V
V_{GSmax}	Absolute maximum Gate-Source Voltage	± 30	V
I_D	Continuous Drain Current ($T_c=25^{\circ}C$)	20	A
I_{DM}	Pulsed Drain Current	80	A
E_{AS}	Avalanche energy,single pulse(note1)	1200	mJ
P_D	Maximum Power Dissipation ($T_c=25^{\circ}C$)	37.8	W
I_S	Continuous diode forward current	20	A
$I_{S,pulse}$	Diode pilse current	80	A
T_J	Operating Junction Temperature Range	-55 to 150	$^{\circ}C$
T_{STG}	Storage Temperature Range	-55 to 150	$^{\circ}C$

Thermal Data

Symbol	Parameter	Conditions	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Steady State)	TO220F	3.3	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	TO220F	60	$^{\circ}C/W$

Electrical Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_{DS} = 250\mu A$	500	---	---	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 500V, V_{GS} = 0V$	---	---	1	μA
I_{GSS}	Gate Leakage Current, Forward	$V_{GS} = \pm 20V, V_{DS} = 0V$	---	---	± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{DS} = 250\mu A$	2.0	---	4.0	V
$R_{DS(ON)}$	Drain-Source On-state Resistance	$V_{GS} = 10V, I_{DS} = 10A$	--	0.23	0.29	Ω
Q_g	Total Gate Charge	$V_{DD} = 400V$ $I_{DS} = 20A$	---	50.5	---	nC
Q_{gs}	Gate-Source Charge		---	12.7	---	nC
Q_{gd}	Gate-Drain Charge		---	15.8	---	nC
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 250V, V_{GS} = 15V$ $I_{DS} = 10A, R_G = 5\Omega$	---	22.7	---	ns
t_r	Rise Time		--	16.4	--	ns
$t_{d(off)}$	Turn-off Delay Time		---	127	---	ns
t_f	Fall Time		---	15.2	---	ns
C_{iss}	Input Capacitance	$V_{DS} = 25V$	---	3078	---	pF
C_{oss}	Output Capacitance	$V_{GS} = 0V$	---	263	---	pF
C_{rss}	Reverse Transfer Capacitance	$f = 250\text{KHz}$	---	19	---	pF

Reverse Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{SD}	Diode Forward Voltage	$I_{SD} = 10A, V_{GS} = 0V$	---	---	1.3	V
t_{rr}	Diode Reverse Recovery Time	$V_R = 250V, I_F = 20A,$ $di_F/dt = 100A/s$	---	313.2	---	ns
Q_{rr}	Diode Reverse Recovery Charge		---	3.3	---	μC
I_{rrm}	Peak reverse recovery current		---	20.8	---	A

Notes:

1. $L = 10\text{mH}, I_{AS} = 15.5A$, Starting $T_j = 25^\circ\text{C}$

Typical Characteristics

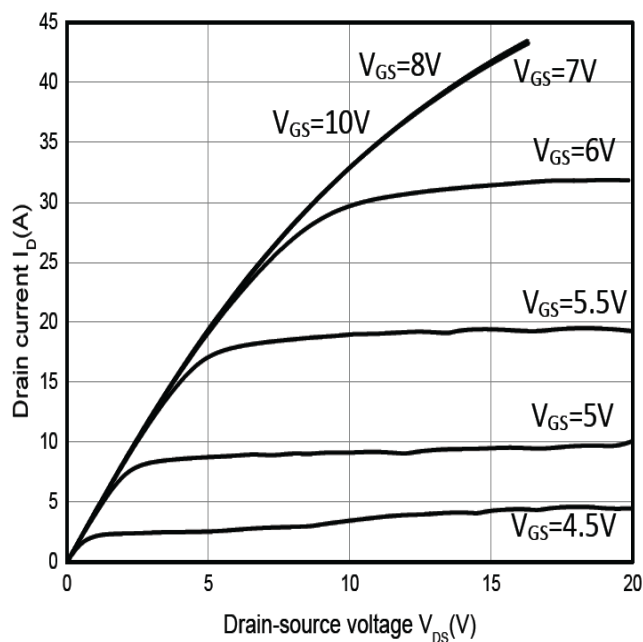


Fig.1 Output Characteristics

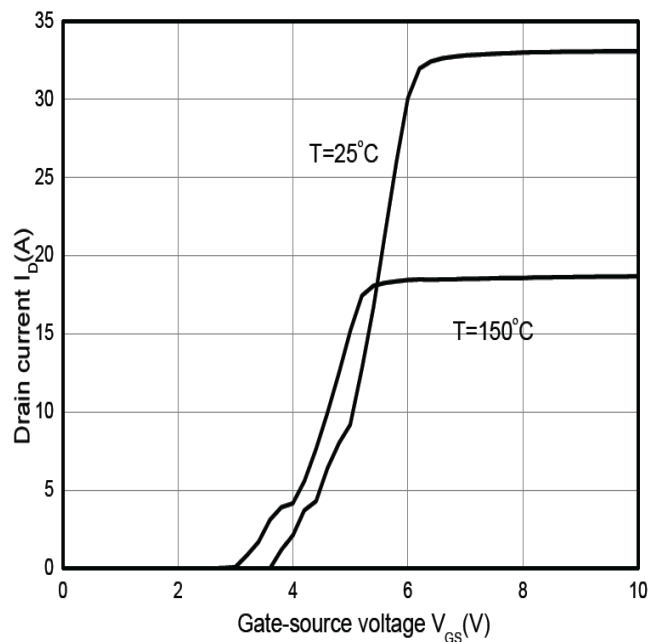


Fig.2 Transfer Characteristics

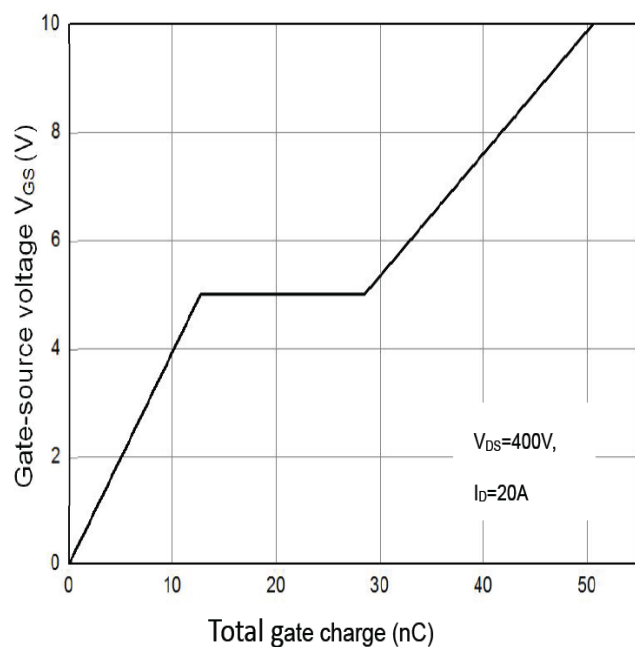


Fig.3 Drain-Source On Resistance

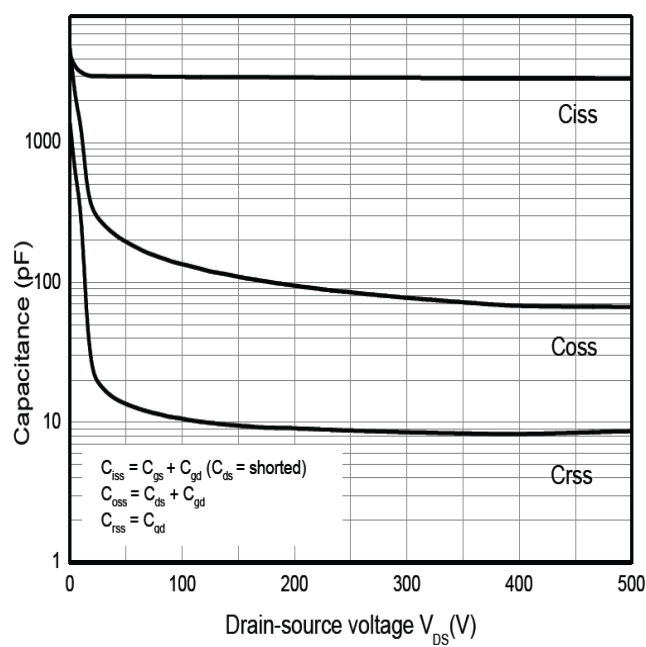


Fig.4 Capacitance

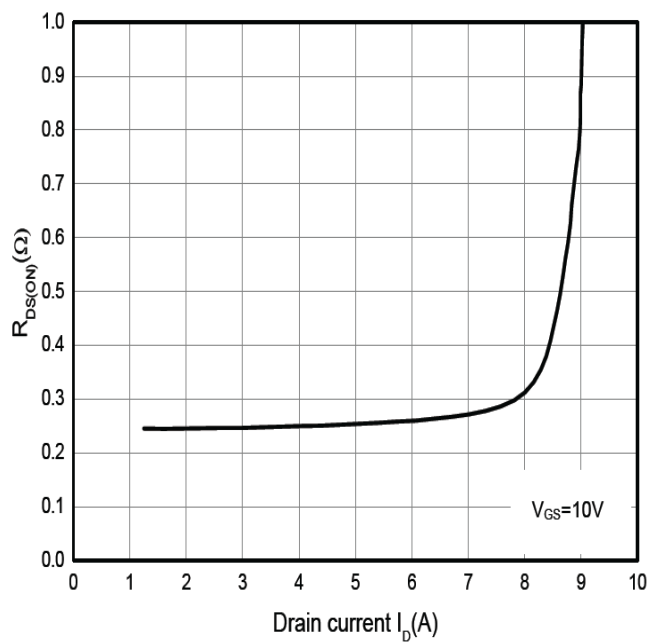


Fig.5 On-Resistance vs. Drain Current

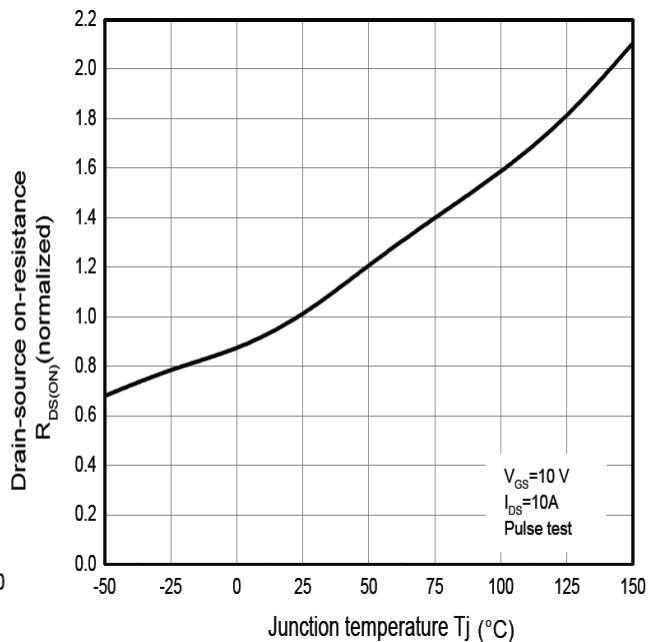


Fig.6 On-Resistance vs. Temperature

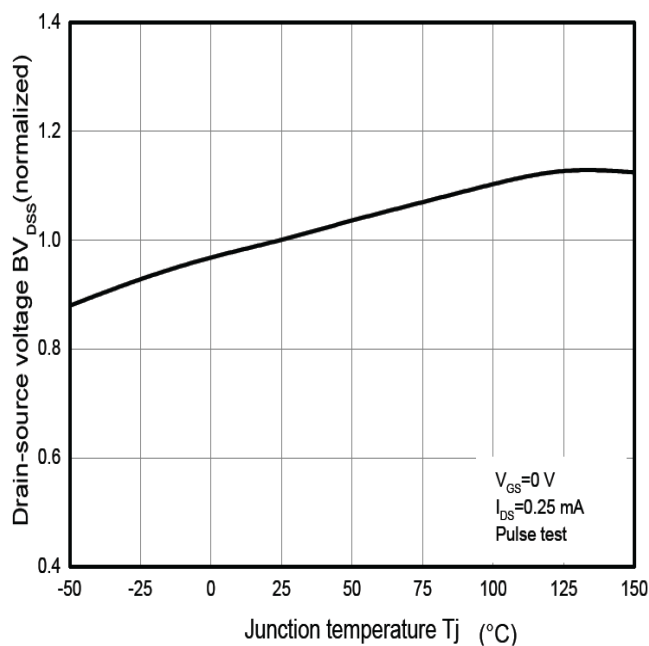


Fig.7 Breakdown Voltage vs. Temperature

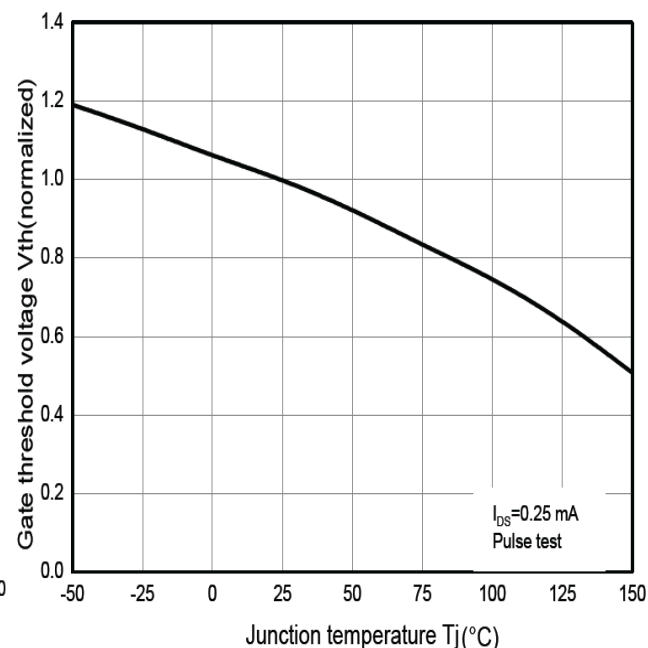


Fig.8 Threshold Voltage vs. Temperature

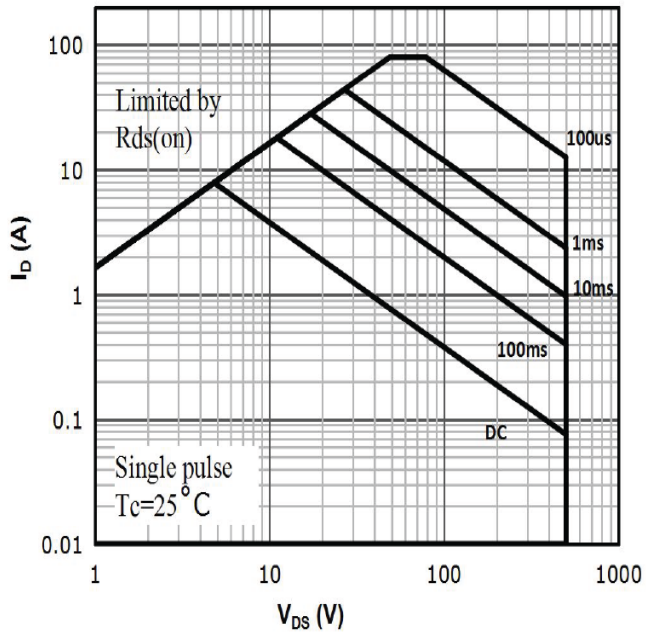


Fig.9 Safe Operating Area

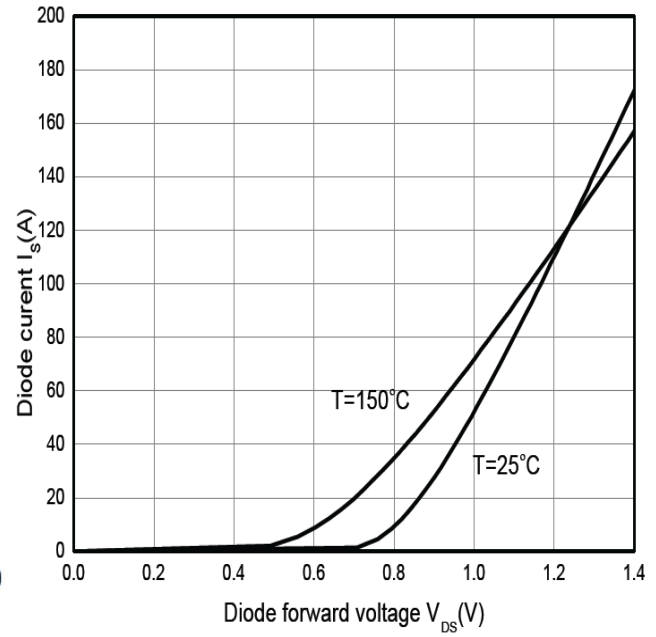


Fig.10 Body-Diode Characteristics

Avalanche Test Circuit and Waveforms

Figure A: Gate Charge Test Circuit and Waveform

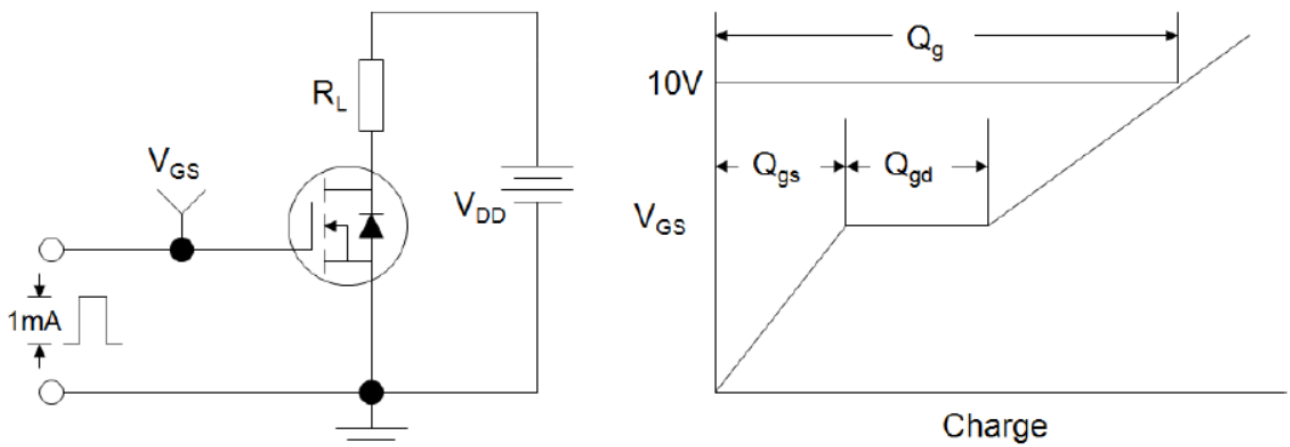


Figure B: Resistive Switching Test Circuit and Waveform

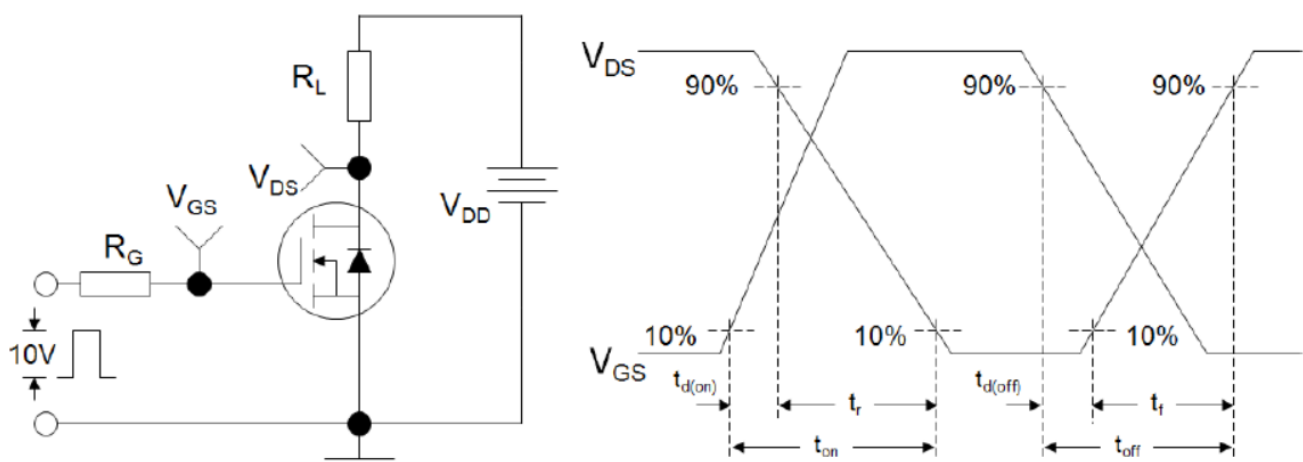
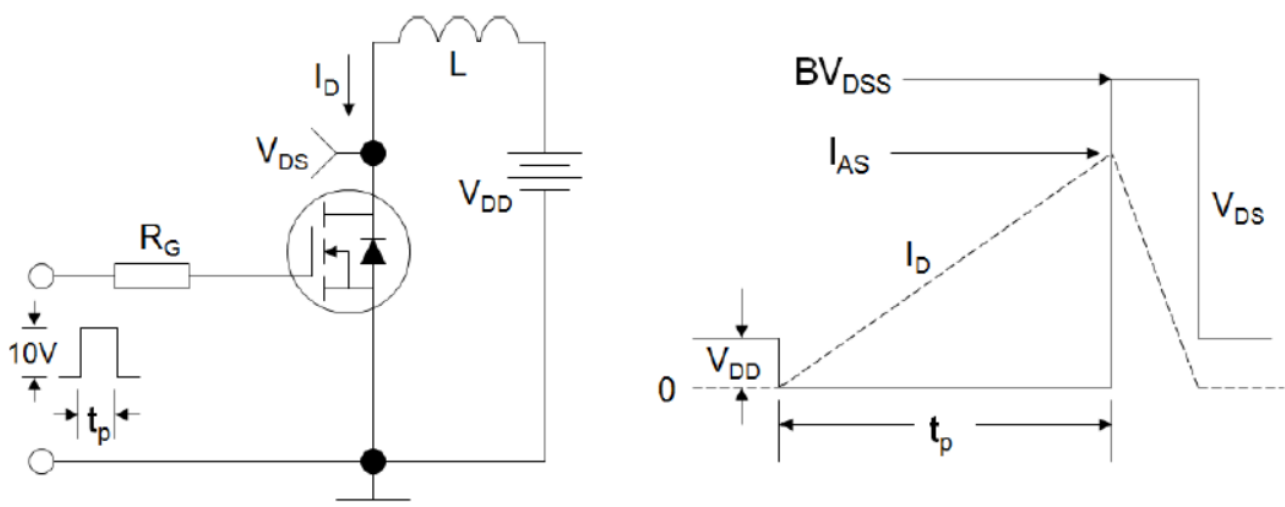
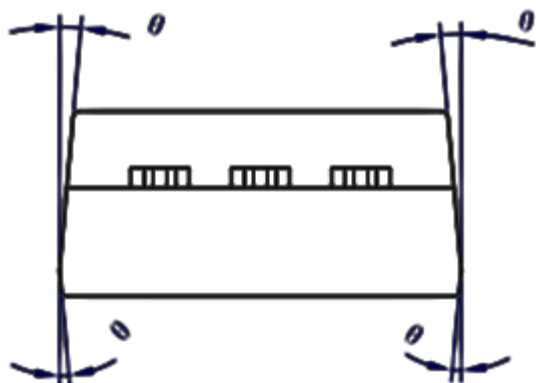
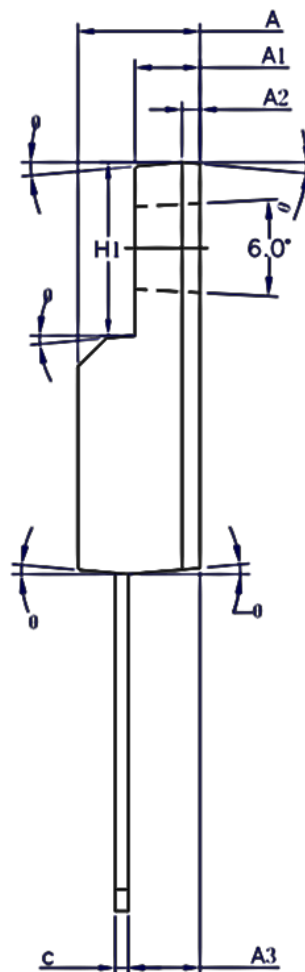
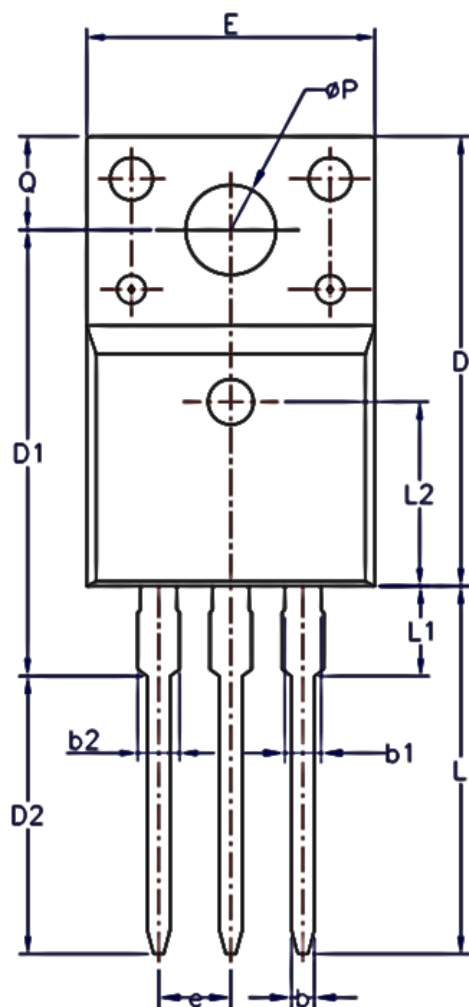


Figure C: Unclamped Inductive Switching Test Circuit and Waveform



Package Information

TO-220F-3L



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
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	—	—	3.50
L2	6.50REF		
ØP	3.08	3.18	3.28
Q	3.20	—	3.40
Ø1	1°	3°	5°