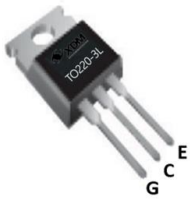
N-CHANNEL MOSFET

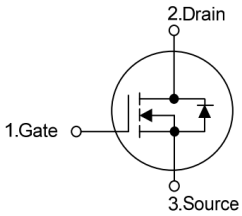
Features

- $R_{DS(on)}$=50mΩ(Typ.) @V_{GS}=10V,I_D=40A
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Easy to Parallel and Simple to Drive



Applications

- Solar inverters
- DC/DC converters
- Motor drives
- Switch Mode Power Supplies



Key Performance and Package Parameters

Order codes	V_{DS}	I_D	$R_{DS(ON)}$, Typ	T_{vjmax}	Marking	Package
XD040M020BD1H3	200V	40A	50mΩ	150°C	D40M20BD1	TO220F
XD040M020BD1L3	200V	40A	50mΩ	150°C	D40M20BD1	TO220-3L

Absolute Maximum Ratings (T_C= 25 °C unless otherwise specified.)

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	200	V
V_{GSmax}	Absolute maximum Gate-Source Voltage	±20	V
I_D	Continuous Drain Current (T_C=25 °C)	40	A
I_{DM}	Pulsed Drain Current	160	A
P_D	Maximum Power Dissipation (T_C=25 °C),TO-220F	63.7	W
	Maximum Power Dissipation (T_C=25 °C),TO-220	104	W
T_J	Operating Junction Temperature Range	-55 to 150	°C
T_{STG}	Storage Temperature Range	-55 to 150	°C

Thermal Data

Symbol	Parameter	Conditions	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Steady State)	TO220F	1.96	°C/W
		TO220	1.2	°C/W

Electrical Characteristics (T_c= 25˚C unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}= 0V, I_{DS}= 250uA	200	---	---	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=200V, V_{GS}=0V	---	---	1	uA
I_{GSS}	Gate Leakage Current, Forward	V_{GS}=±20V, V_{DS}=0V	---	---	±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}= V_{GS}, I_{DS}= 250uA	2.0	---	4.0	V
$R_{DS(ON)}$	Drain-Source On-state Resistance	V_{GS}=10V, I_{DS}=20A	--	50	60	mΩ
Q_g	Total Gate Charge	V_{DD}=160V I_{DS}=40A	---	154	---	nC
Q_{gs}	Gate-Source Charge		---	13	---	nC
Q_{gd}	Gate-Drain Charge		---	58	---	nC
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=160V, V_{GS}=15V I_{DS}=40A, R_G=25Ω	---	46	---	ns
t_r	Rise Time		--	54	--	ns
$t_{d(off)}$	Turn-off Delay Time		---	360	---	ns
t_f	Fall Time		---	96	---	ns
C_{iss}	Input Capacitance	V_{DS}=25V V_{GS}=0V f = 1MHz	---	2800	---	pF
C_{oss}	Output Capacitance		---	355	---	pF
C_{rss}	Reverse Transfer Capacitance		---	101	---	pF

Reverse Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{SD}	Diode Forward Voltage	I_{SD}=20A, V_{GS}=0V	---	---	1.4	V
t_{rr}	Diode Reverse Recovery Time	V_{GS}=0V, I_F=10A, dI_F/dt=100A/s	---	152	---	ns
Q_{rr}	Diode Reverse Recovery Charge		---	1	---	uC

Typical Characteristics

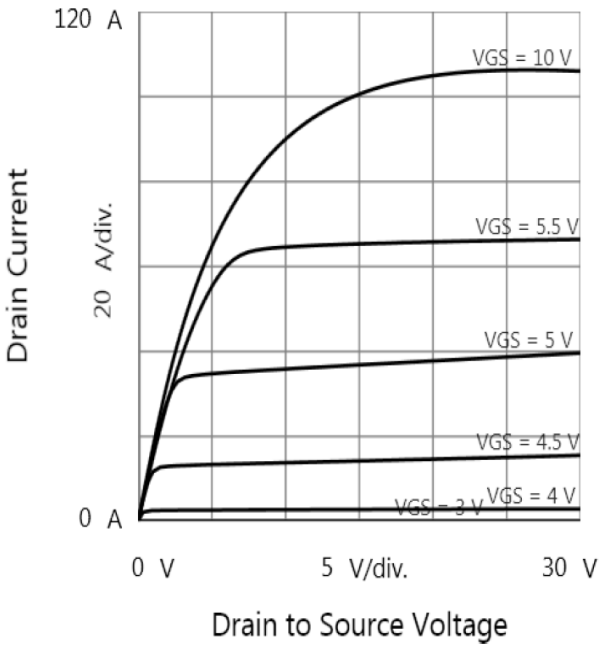


Fig.1 Output Characteristics

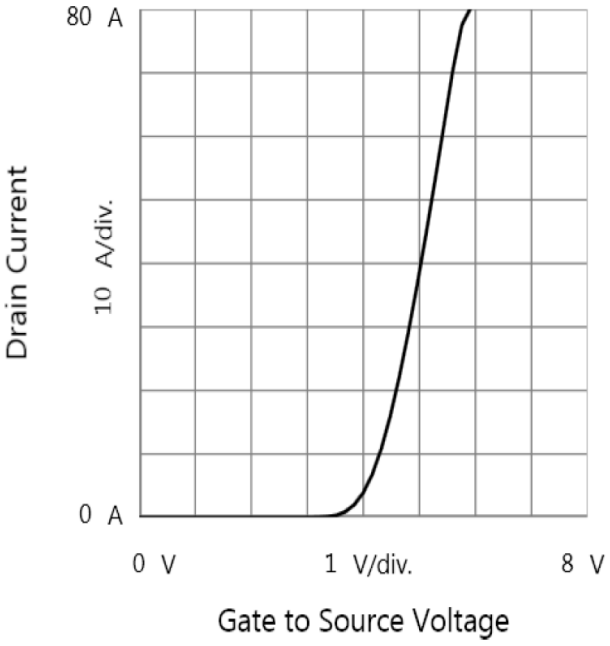


Fig.2 Output Characteristics

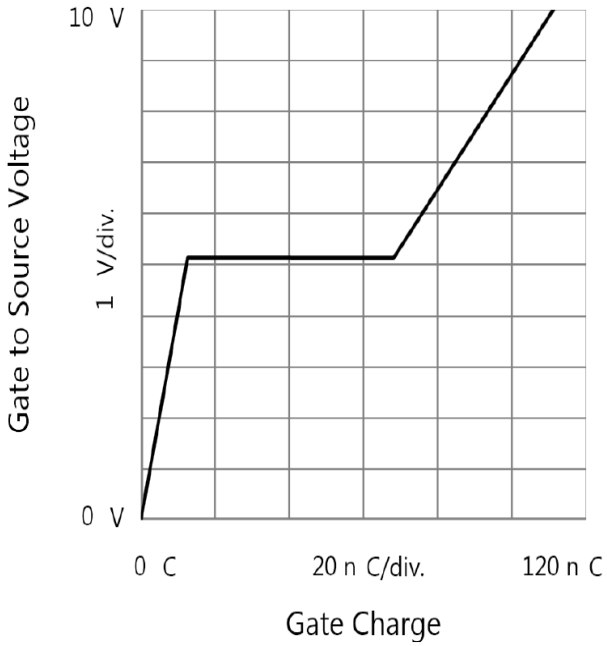


Fig.3 Drain-Source On Resistance

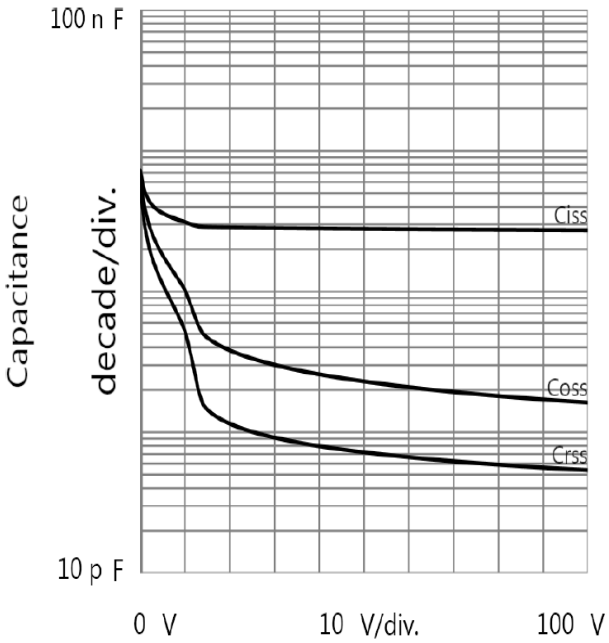


Fig.4 Capacitance

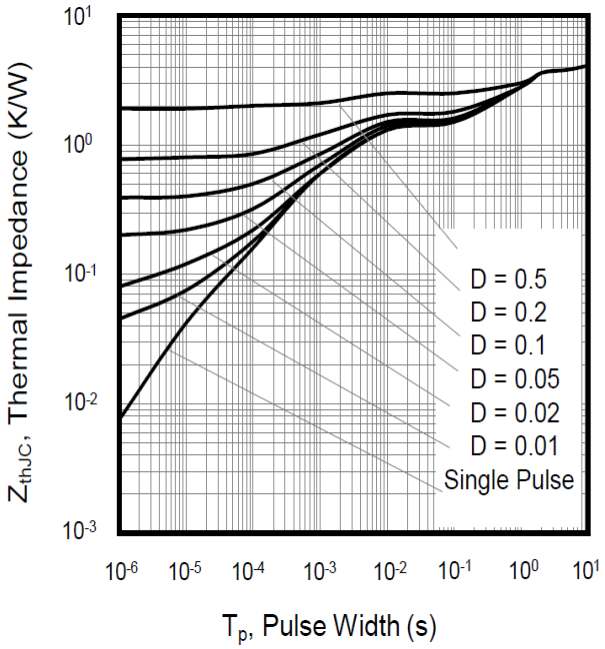


Fig.5 Transient Thermal Impedance (TO-220F)

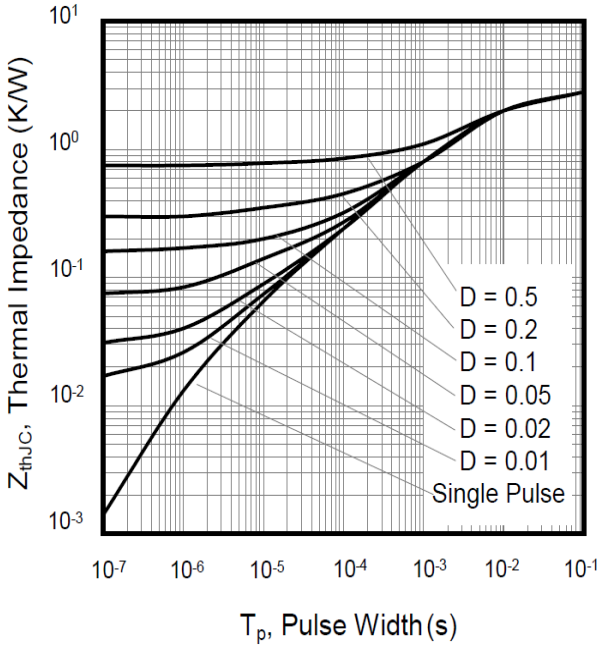


Fig.6 Transient Thermal Impedance(TO-220)

Avalanche Test Circuit and Waveforms

Figure A: Gate Charge Test Circuit and Waveform

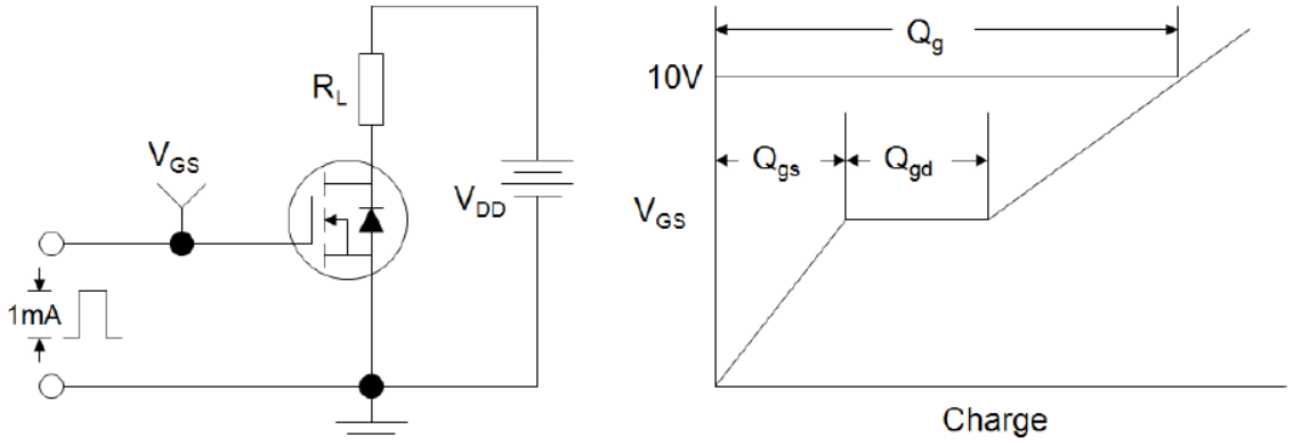


Figure B: Resistive Switching Test Circuit and Waveform

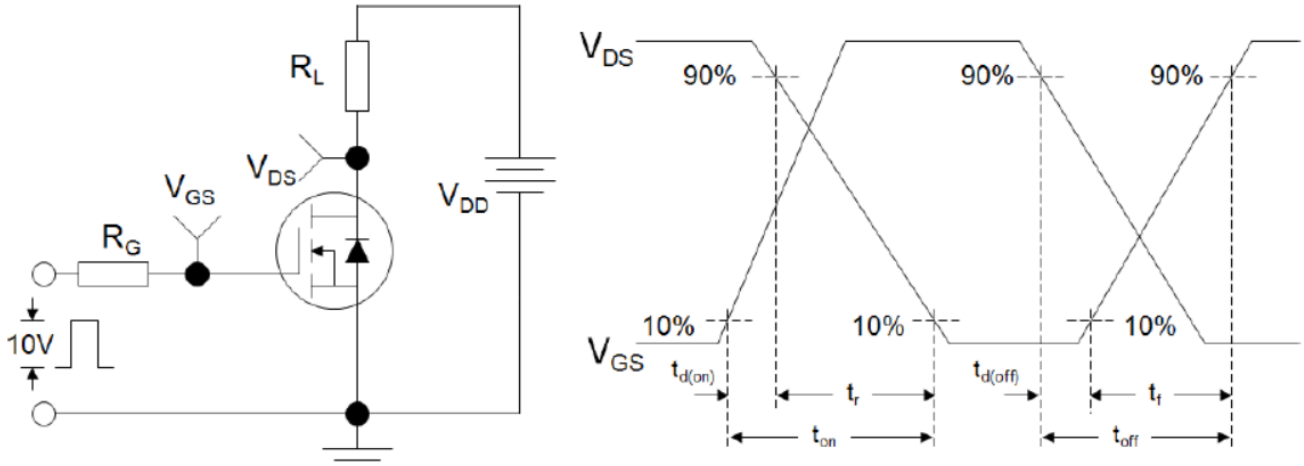
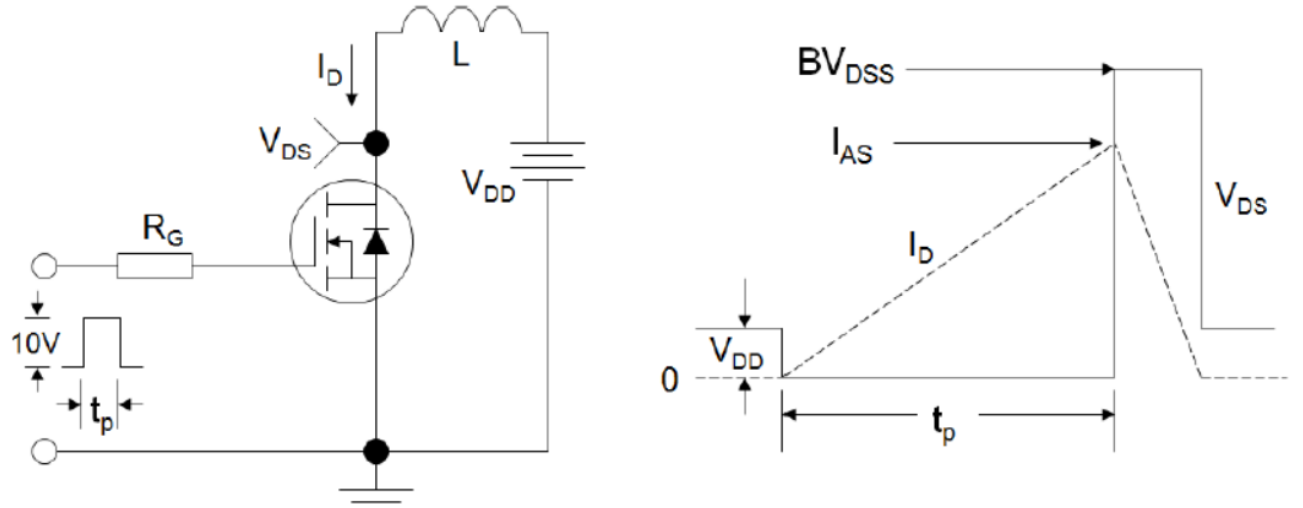
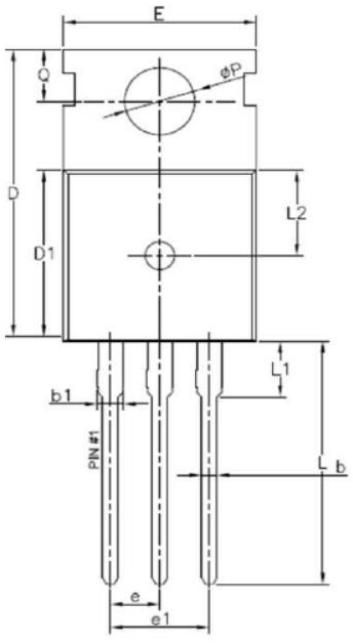


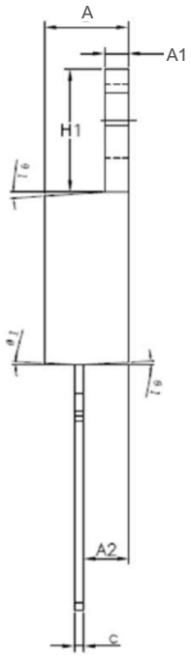
Figure C: Unclamped Inductive Switching Test Circuit and Waveform

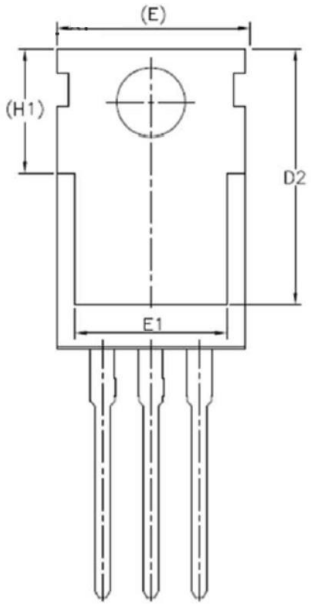


Package Information

TO-220-3L

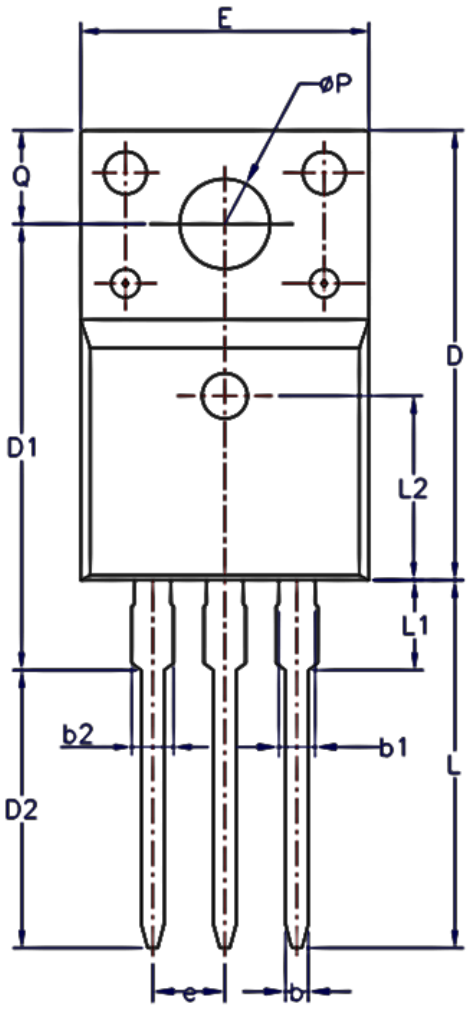


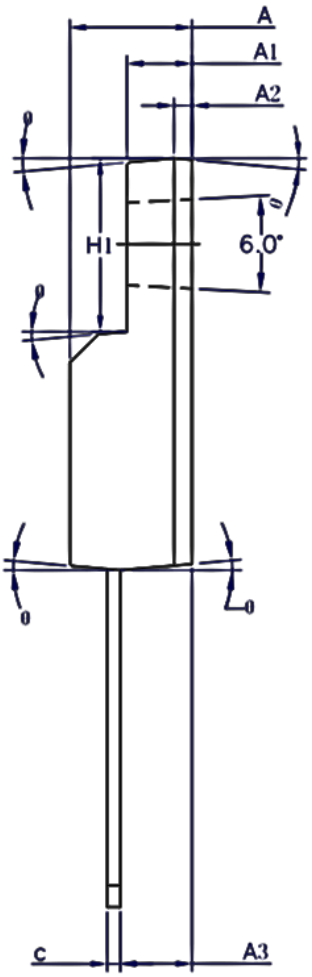


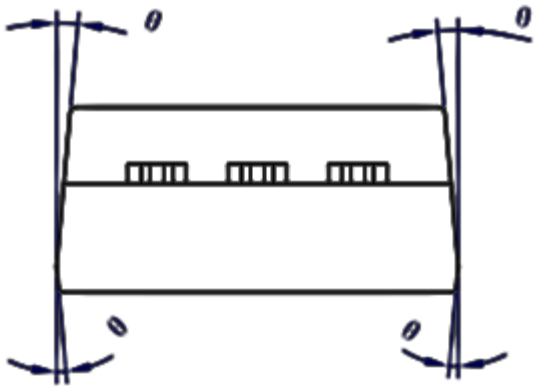


SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	–	0.90
b1	1.27	–	1.40
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	–	13.70
E	9.70	9.90	10.20
E1	7.80	8.00	8.20
e	2.54BSC		
e1	5.08BSC		
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	–	–	3.50
L2	4.60REF		
øP	3.55	3.60	3.65
Q	2.73	–	2.87
θ1	1°	3°	5°

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
θ1	1°	3°	5°