

MOSFET

-104A, -40V, 5.9mΩ, P-CHANNEL MOSFET

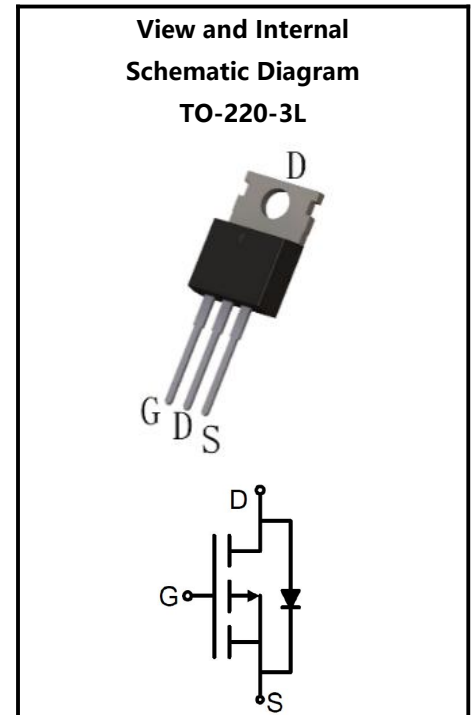
Features

- ◆ Low gate charge
- ◆ 100% UIS Tested, 100% DVDS Tested
- ◆ High Power and current handing capability
- ◆ Lead free product is acquired

Applications

- ◆ Load switch
- ◆ Power Management
- ◆ PWM Applications

Parameter	Values	Unit
BV_{DSS}	-40	V
I_D	-104	A
$R_{Dson}(max)$	5.9	mΩ
$V_{GS(th)}(Typ)$	-1.7	V



Ordering Code	Marking	Package	Packaging
X5P9P040TLB3	X5P9P040TLB3	TO-220-3L	Tube

Absolute Maximum Ratings($T_C=25^{\circ}C$, unless otherwise noted)

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Drain-Source Voltage	V_{DSS}	-	-	-40	V	-
Gate-Source Voltage	V_{GS}	-20	-	20	V	-
Continuous Drain Current(Note 1)	I_D	-	-	-104	A	$T_C=25^{\circ}C$
		-	-	-73	A	$T_C=100^{\circ}C$
Pulsed Drain Current(Note 2)	I_{DM}	-	-	-416	A	-
Single Pulse Avalanche Energy	E_{AS}	-	-	576	mJ	$L=0.5mH, V_D=-40V, T_C=25^{\circ}C$
Maximum Power Dissipation	P_D	-	-	115	W	$T_C=25^{\circ}C$
		-	-	57	W	$T_C=100^{\circ}C$
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55	-	175	$^{\circ}C$	-

Thermal Characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Thermal resistance , Junction to Case	$R_{th(J-C)}$	-	-	1.3	$^{\circ}C/W$	-

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

Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Drain-Source Breakdown Voltage	BV_{DSS}	-40	-	-	V	$V_{GS}=0V, I_D=-250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	-	-	-1	μA	$V_{DS}=-40V, V_{GS}=0V$
Gate-Body Leakage Current, Forward	I_{GSSF}	-	-	100	nA	$V_{GS}=20V, V_{DS}=0V$
Gate-Body Leakage Current, Reverse	I_{GSSR}	-	-	-100	nA	$V_{GS}=-20V, V_{DS}=0V$
Gate-Source Threshold Voltage	$V_{GS(th)}$	-1	-	-2.5	V	$V_{DS}=V_{GS}, I_D=-250\mu A$
Drain-Source On-State Resistance	$R_{DS(on)}$	-	4.5	5.9	m Ω	$V_{GS}=-10V, I_D=-20A$
		-	6.1	8.1	m Ω	$V_{GS}=-4.5V, I_D=-20A$
Gate Resistance	R_g	-	2.2	-	Ω	$V_{GS}=0V, V_{DS}=0V, f=1\text{MHz}$
Forward Transconductance	g_{fs}	-	59	-	S	$V_{DS}=-5V, I_D=-10A$

Dynamic characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Input Capacitance	C_{iss}	-	6638	-	pF	$V_{DS}=-20V, V_{GS}=0V, f=1.0\text{MHz}$
Output Capacitance	C_{oss}	-	545	-	pF	
Reverse Transfer Capacitance	C_{rss}	-	345	-	pF	
Turn-On Delay Time	$t_{d(on)}$	-	16	-	ns	$V_{DD}=-20V, R_G=3\Omega, V_{GS}=-10V, R_L=1\Omega$
Turn-On Rise Time	t_r	-	17	-	ns	
Turn-Off Delay Time	$t_{d(off)}$	-	68	-	ns	
Turn-Off Fall Time	t_f	-	31	-	ns	

Gate charge characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Total Gate Charge	Q_g	-	118	-	nC	$V_{DS}=-20V, I_D=-20A, V_{GS}=-10V$
Gate-Source Charge	Q_{gs}	-	13	-	nC	
Gate-Drain Charge	Q_{gd}	-	22	-	nC	

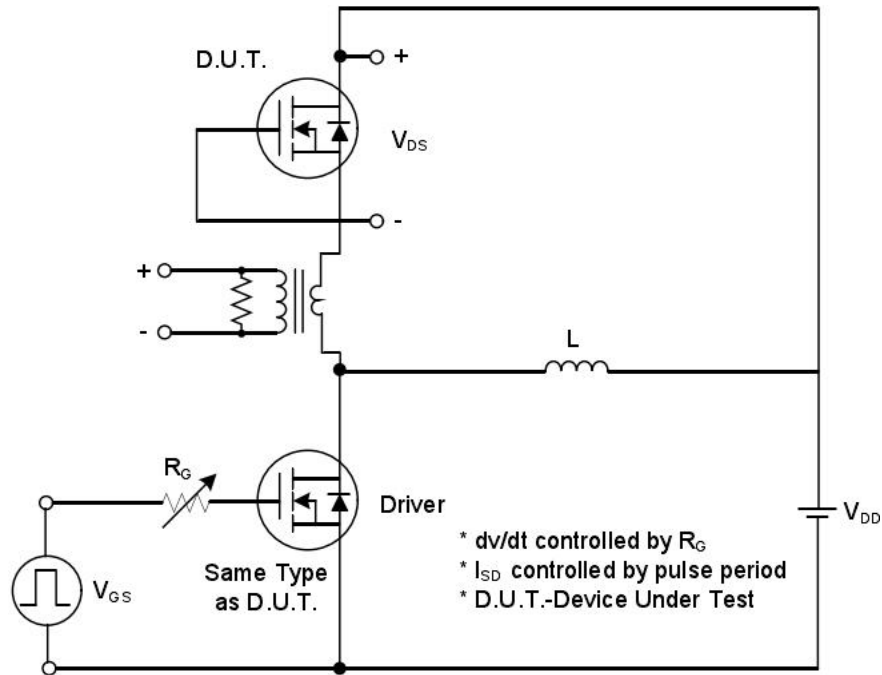
Reverse diode

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Continuous Diode Forward Current	I_{SD}	-	-	-104	A	-
Diode Forward Voltage	V_{SD}	-	-	-1.2	V	$I_S=-20A, V_{GS}=0V$
Reverse Recovery Time	t_{rr}	-	24	-	ns	$V_{GS}=0V, I_S=-20A, di/dt=-100A/\mu s$
Reverse Recovery Charge	Q_{rr}	-	140	-	nC	

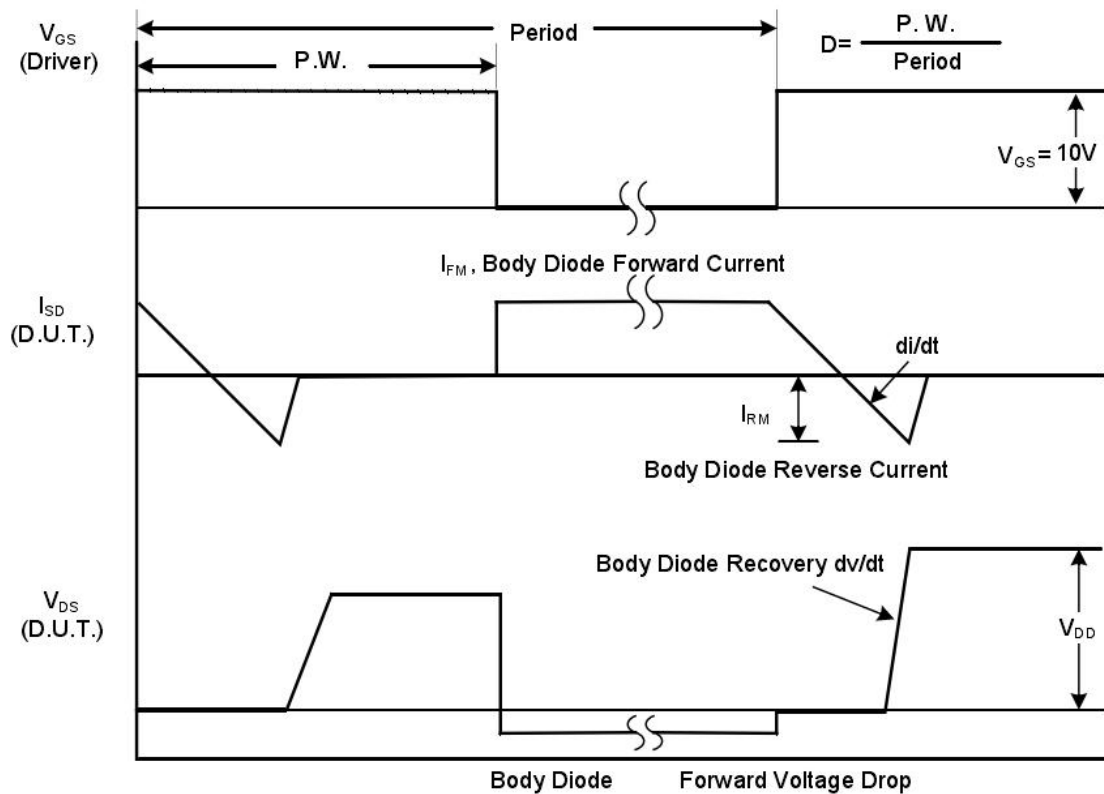
Notes

1. Computed continuous current assumes the condition of T_{j_Max} while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under $T_{j_Max} = 150^{\circ}\text{C}$.

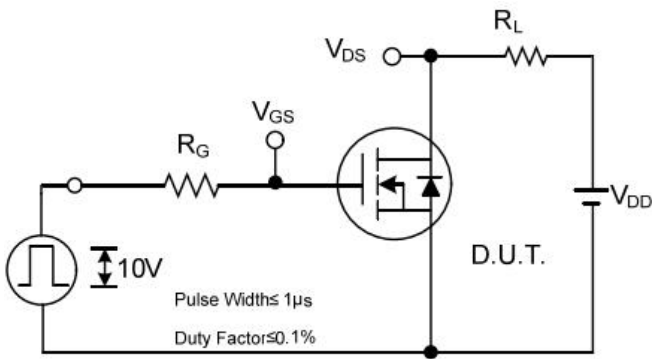
RATING AND CHARACTERISTIC CURVES



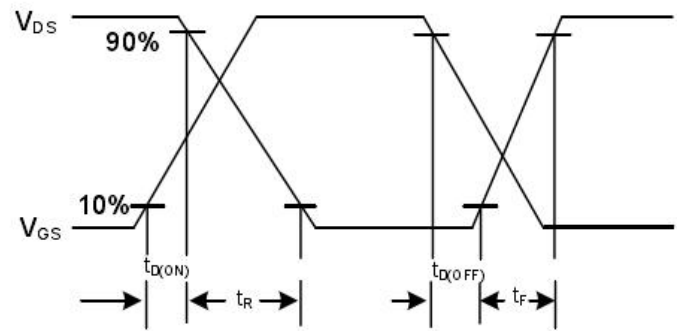
Peak Diode Recovery dv/dt Test Circuit



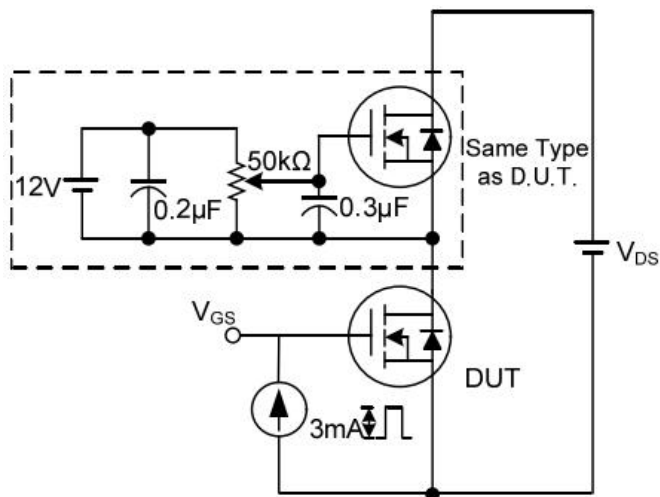
Peak Diode Recovery dv/dt Waveforms



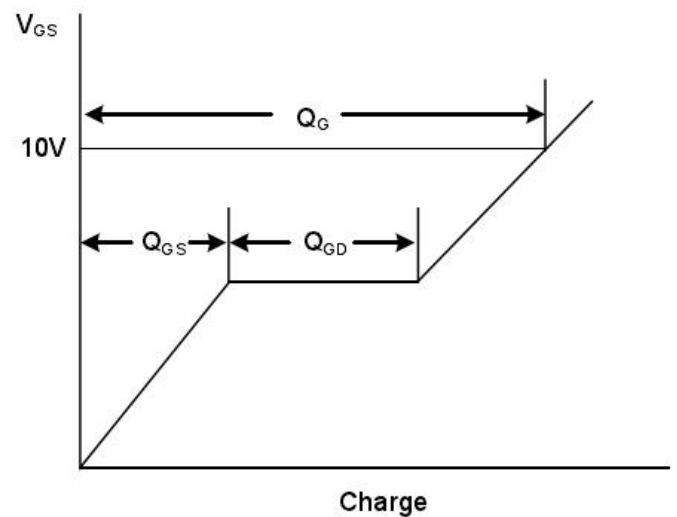
Switching Test Circuit



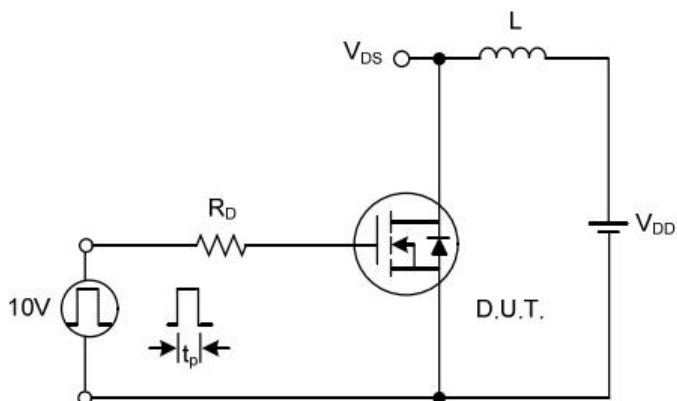
Switching Waveforms



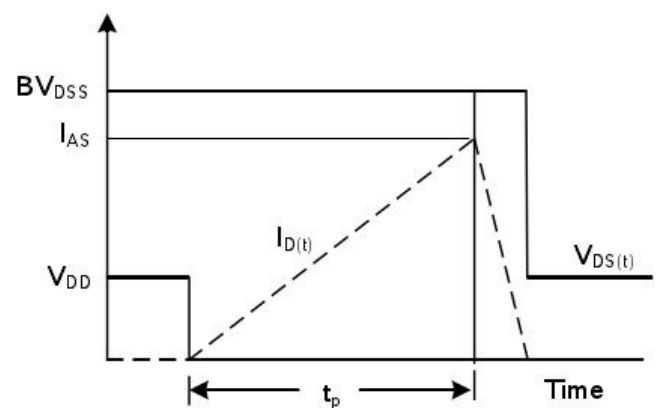
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

RATING AND CHARACTERISTIC CURVES

Figure.1 Output Characteristics

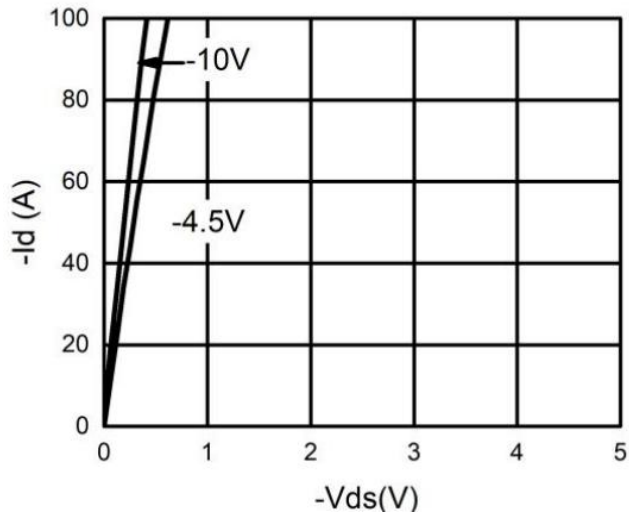


Figure.2 Transfer Characteristics

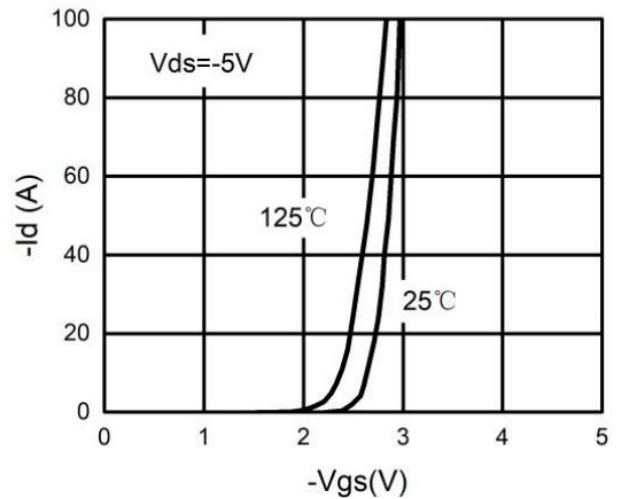


Figure.3 Power Dissipation

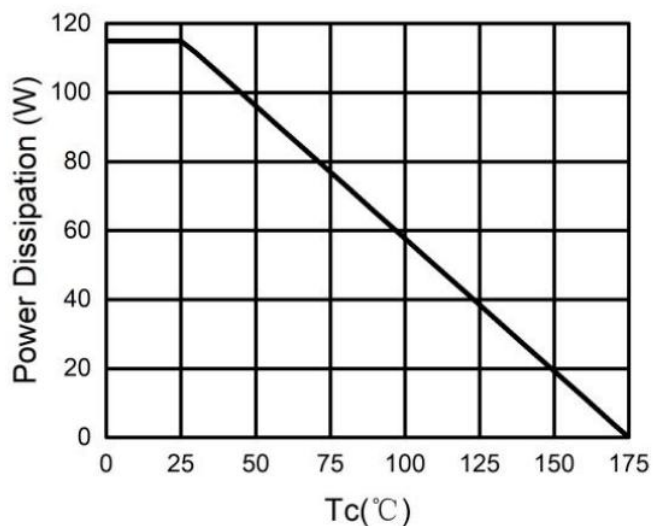


Figure.4 Drain Current

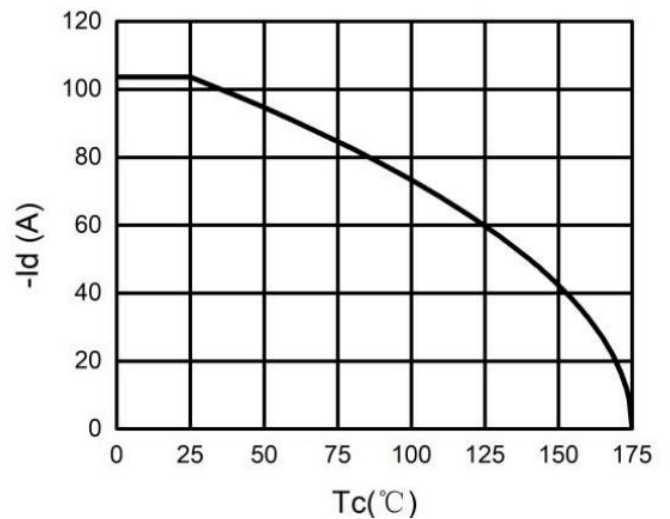


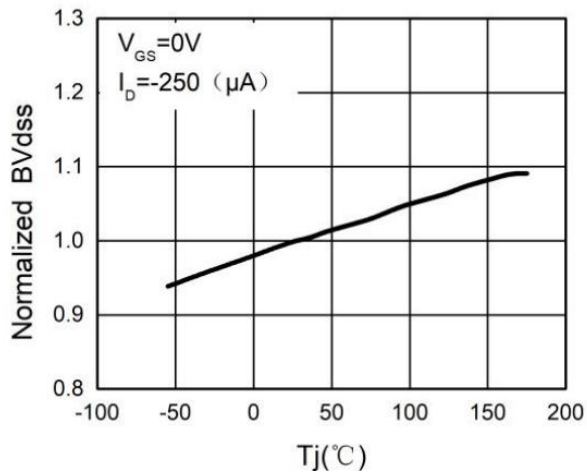
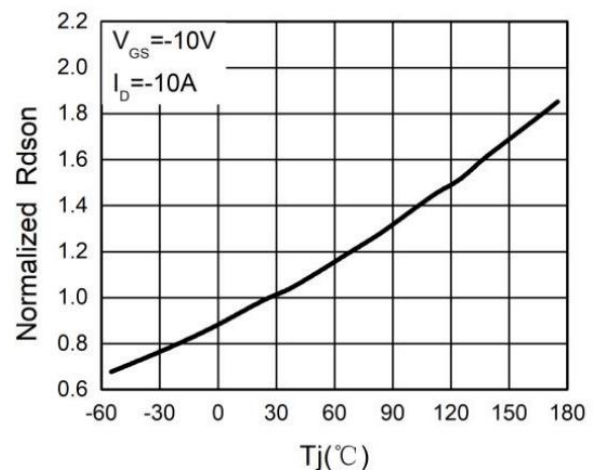
Figure.5 BV_{DSS} vs Junction Temperature

Figure.6 $R_{DS(ON)}$ vs Junction Temperature


Figure.7 Gate Charge Waveforms

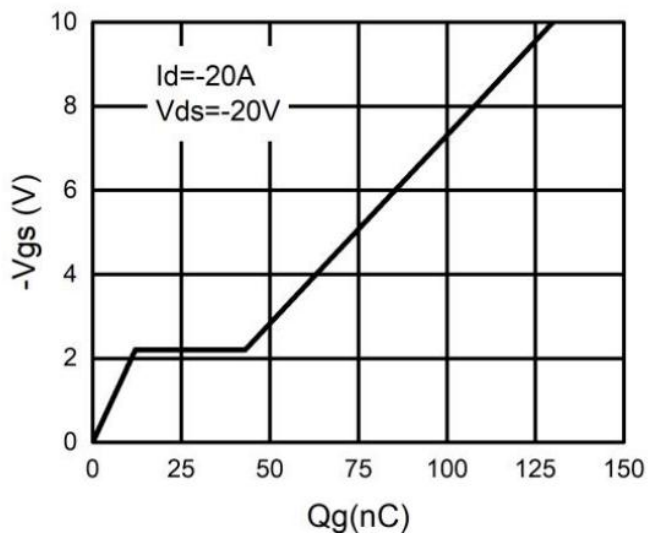


Figure.8 Capacitance

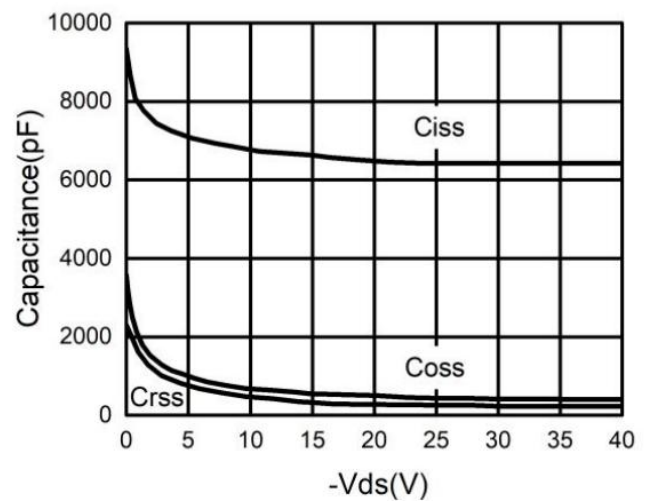


Figure.9 Body-Diode Characteristics

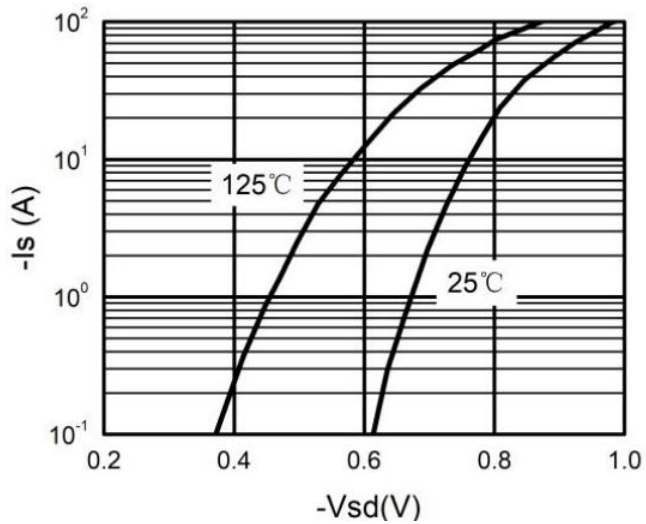
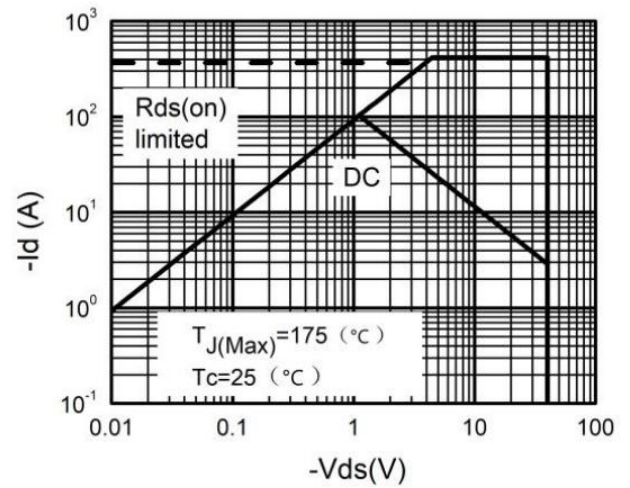
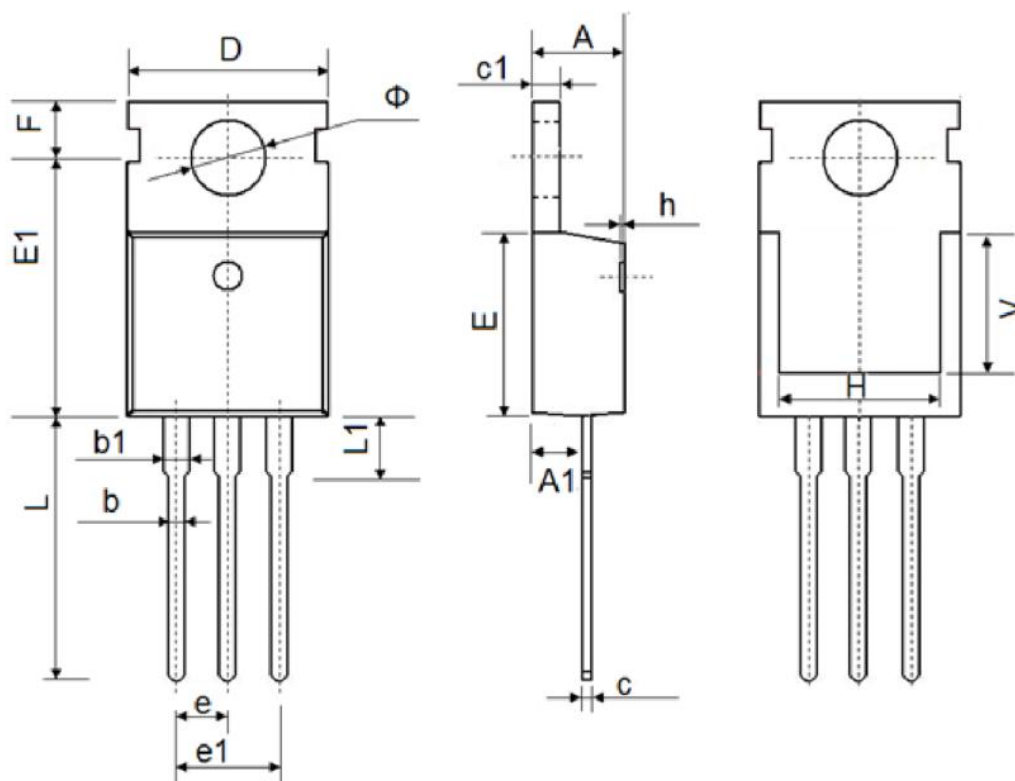


Figure.10 Maximum Safe Operating Area



Package Outline: TO-220-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.300	4.700	0.169	0.185
A1	2.200	2.600	0.087	0.102
b	0.700	0.950	0.028	0.037
b 1	1.170	1.410	0.046	0.056
c	0.450	0.650	0.018	0.026
C1	1.200	1.400	0.047	0.055
D	9.600	10.400	0.378	0.409
E	8.8500	9.750	0.348	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP		0.100TYP	
e 1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.750	14.300	0.502	0.563
L1	2.850	3.950	0.112	0.156
V	7.500 REF		0.295REF	
Φ	3.400	4.000	0.134	0.157