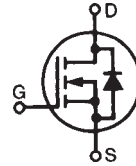


# X3-Class HiPerFET™ Power MOSFET

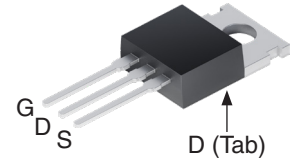
**IXFP90N20X3**  
**IXFQ90N20X3**  
**IXFH90N20X3**

**V<sub>DSS</sub> = 200V**  
**I<sub>D25</sub> = 90A**  
**R<sub>DS(on)</sub> ≤ 12.8mΩ**

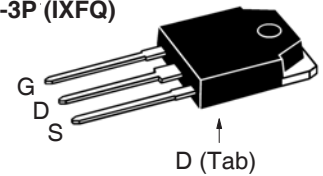
N-Channel Enhancement Mode  
Avalanche Rated



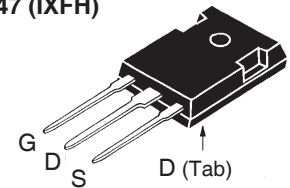
TO-220AB (IXFP)



TO-3P (IXFQ)



TO-247 (IXFH)



G = Gate      D = Drain  
S = Source    Tab = Drain

Symbol	Test Conditions	Maximum Ratings	
V <sub>DSS</sub>	T <sub>J</sub> = 25°C to 150°C	200	V
V <sub>DGR</sub>	T <sub>J</sub> = 25°C to 150°C, R <sub>GS</sub> = 1MΩ	200	V
V <sub>GSS</sub>	Continuous	±20	V
V <sub>GSM</sub>	Transient	±30	V
I <sub>D25</sub>	T <sub>C</sub> = 25°C	90	A
I <sub>DM</sub>	T <sub>C</sub> = 25°C, Pulse Width Limited by T <sub>JM</sub>	220	A
I <sub>A</sub>	T <sub>C</sub> = 25°C	45	A
E <sub>AS</sub>	T <sub>C</sub> = 25°C	1.5	J
dv/dt	I <sub>S</sub> ≤ I <sub>DM</sub> , V <sub>DD</sub> ≤ V <sub>DSS</sub> , T <sub>J</sub> ≤ 150°C	20	V/ns
P <sub>D</sub>	T <sub>C</sub> = 25°C	390	W
T <sub>J</sub>		-55 ... +150	°C
T <sub>JM</sub>		150	°C
T <sub>stg</sub>		-55 ... +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering	300	°C
T <sub>SOLD</sub>	1.6 mm (0.062in.) from Case for 10s	260	°C
M <sub>d</sub>	Mounting Torque	1.13 / 10	Nm/lb.in
Weight	TO-220	3.0	g
	TO-3P	5.5	g
	TO-247	6.0	g

## Features

- International Standard Packages
- Low R<sub>DS(ON)</sub> and Q<sub>G</sub>
- Avalanche Rated
- Low Package Inductance

## Advantages

- High Power Density
- Easy to Mount
- Space Savings

## Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- AC and DC Motor Drives
- Robotics and Servo Controls

Symbol	Test Conditions (T <sub>J</sub> = 25°C, Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	200		V
V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1.5mA	2.5		4.5 V
I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V			±100 nA
I <sub>DSS</sub>	V <sub>DS</sub> = V <sub>DSS</sub> , V <sub>GS</sub> = 0V T <sub>J</sub> = 125°C			5 μA 300 μA
R <sub>DS(on)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5 • I <sub>D25</sub> , Note 1	10.5	12.8	mΩ

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max
$g_{fs}$	$V_{DS} = 10\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1	40	67	S
$R_{Gi}$	Gate Input Resistance		1.4	$\Omega$
$C_{iss}$	$V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$		5420	pF
$C_{oss}$			930	pF
$C_{rss}$			4	pF
<b>Effective Output Capacitance</b>				
$C_{o(er)}$	Energy related	$V_{GS} = 0\text{V}$ $V_{DS} = 0.8 \cdot V_{DSS}$	420	pF
$C_{o(tr)}$	Time related		1300	pF
<b>Resistive Switching Times</b>				
$t_{d(on)}$	$V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$ $R_G = 5\Omega$ (External)		22	ns
$t_r$			26	ns
$t_{d(off)}$			62	ns
$t_f$			13	ns
$Q_{g(on)}$	$V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$		78	nC
$Q_{gs}$			23	nC
$Q_{gd}$			22	nC
$R_{thJC}$				0.32 $^\circ\text{C/W}$
$R_{thCS}$	TO-220		0.50	$^\circ\text{C/W}$
	TO-247 & TO-3P		0.25	$^\circ\text{C/W}$

**Source-Drain Diode**

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max
$I_S$	$V_{GS} = 0\text{V}$			90 A
$I_{SM}$	Repetitive, pulse Width Limited by $T_{JM}$			360 A
$V_{SD}$	$I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1		1.4	V
$t_{rr}$	$I_F = 45\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$ $V_R = 100\text{V}$		95	ns
$Q_{RM}$			360	nC
$I_{RM}$			7.6	A

Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

Littelfuse Reserves the Right to Change Limits, Test Conditions, and Dimensions.

LF MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

4,835,592	4,931,844	5,049,961	5,237,481	6,162,665	6,404,065B1	6,683,344	6,727,585	7,005,734B2	7,157,338B2
4,860,072	5,017,508	5,063,307	5,381,025	6,259,123B1	6,534,343	6,710,405B2	6,759,692	7,063,975B2	
4,881,106	5,034,796	5,187,117	5,486,715	6,306,728B1	6,583,505	6,710,463	6,771,478B2	7,071,537	

Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$

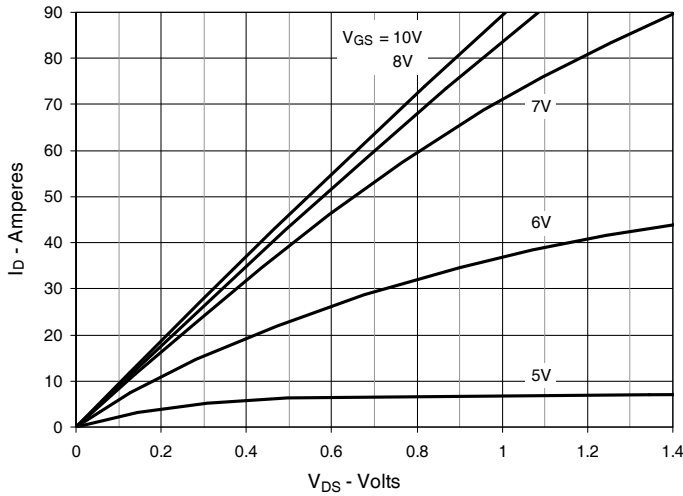


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

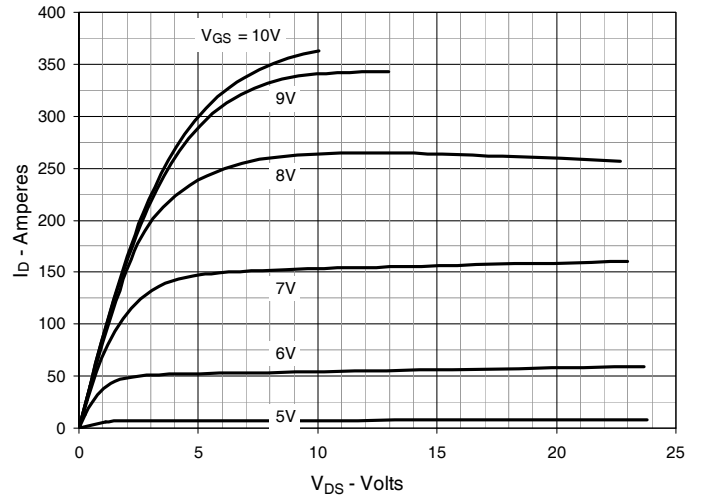


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

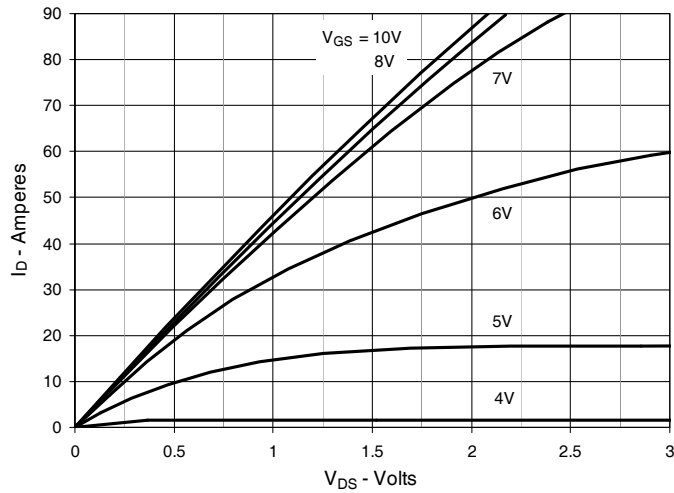


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 45\text{A}$  Value vs. Junction Temperature

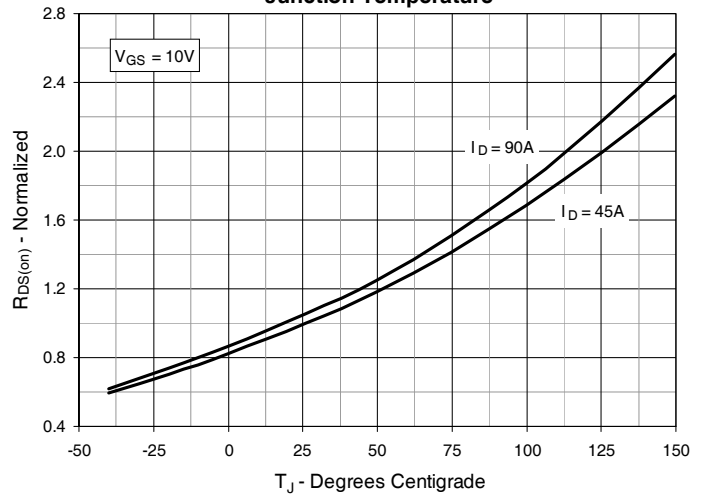


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 45\text{A}$  Value vs. Drain Current

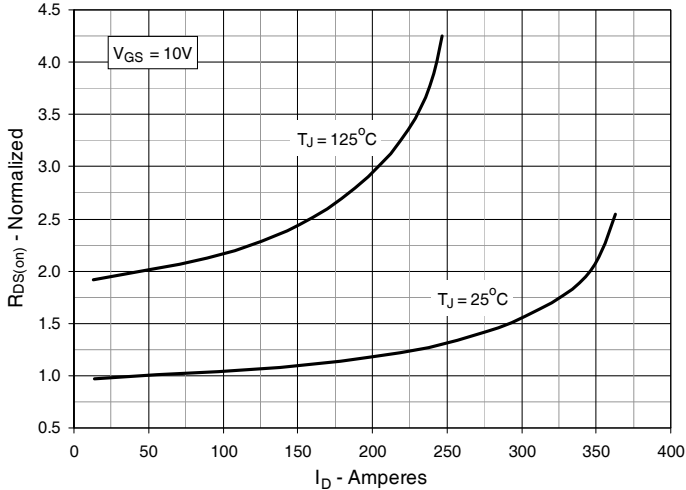


Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature

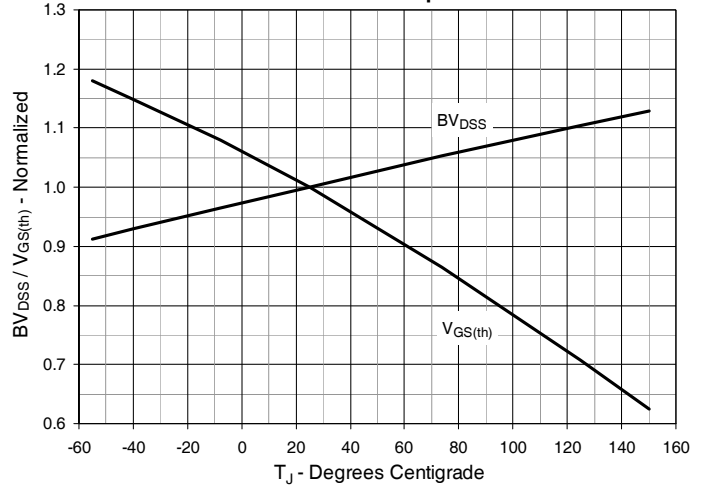


Fig. 7. Maximum Drain Current vs. Case Temperature

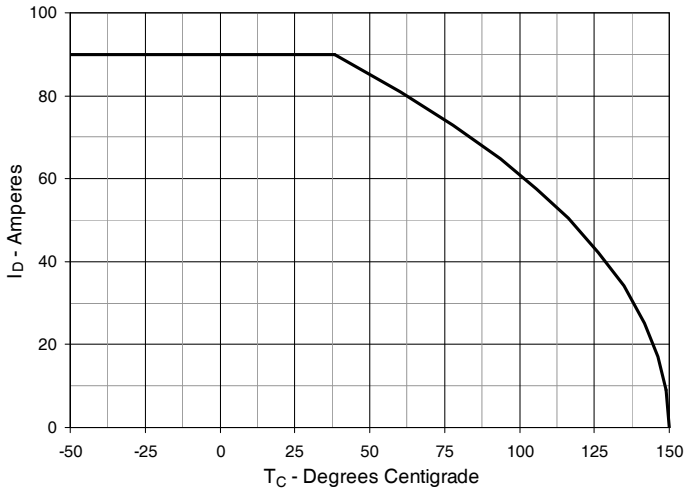


Fig. 8. Input Admittance

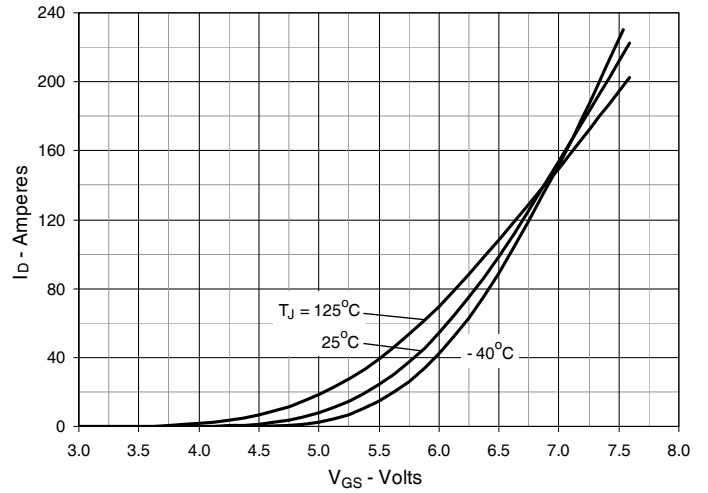


Fig. 9. Transconductance

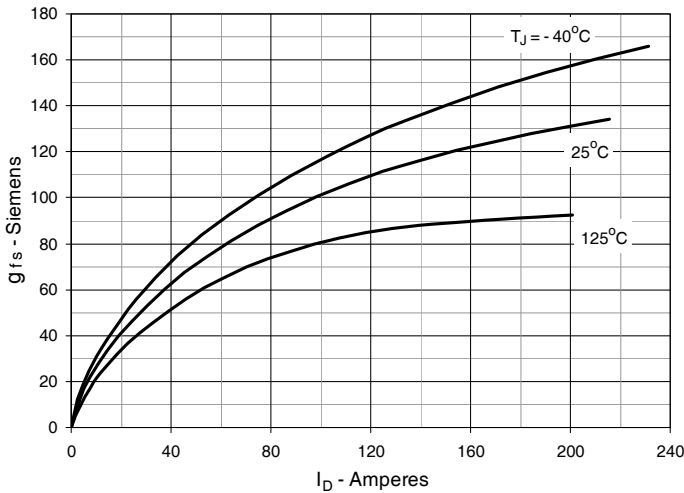


Fig. 10. Forward Voltage Drop of Intrinsic Diode

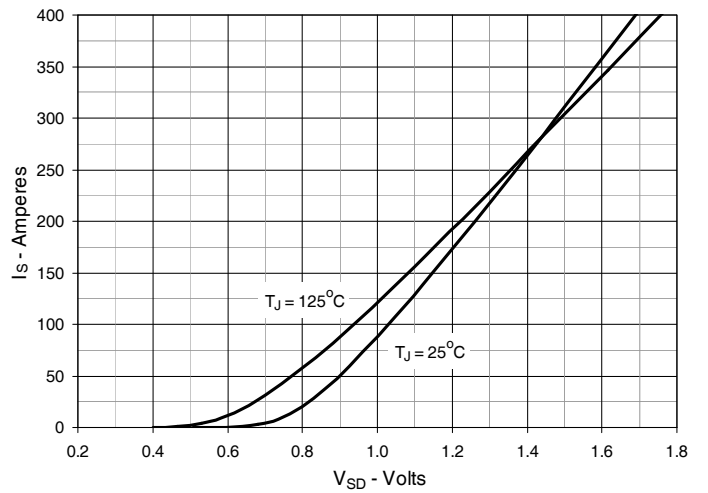


Fig. 11. Gate Charge

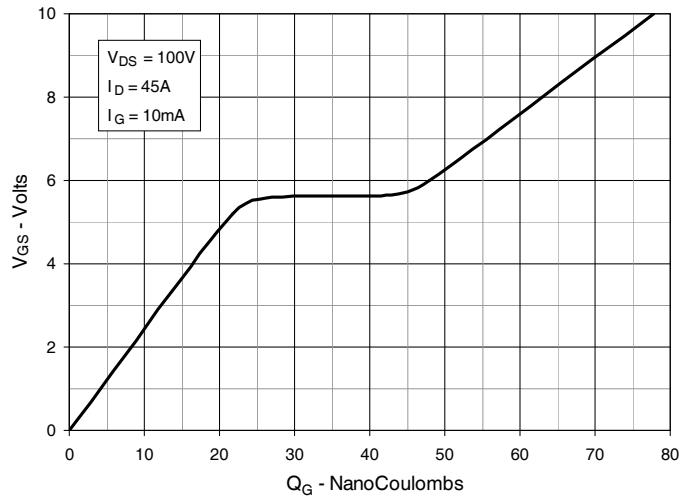


Fig. 12. Capacitance

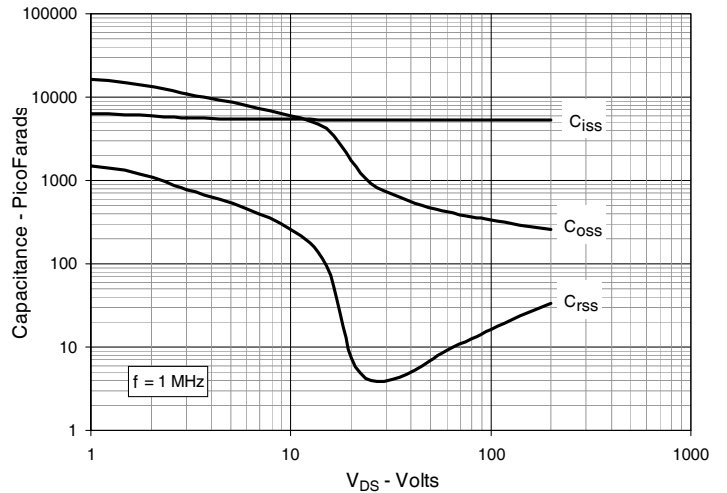


Fig. 13. Output Capacitance Stored Energy

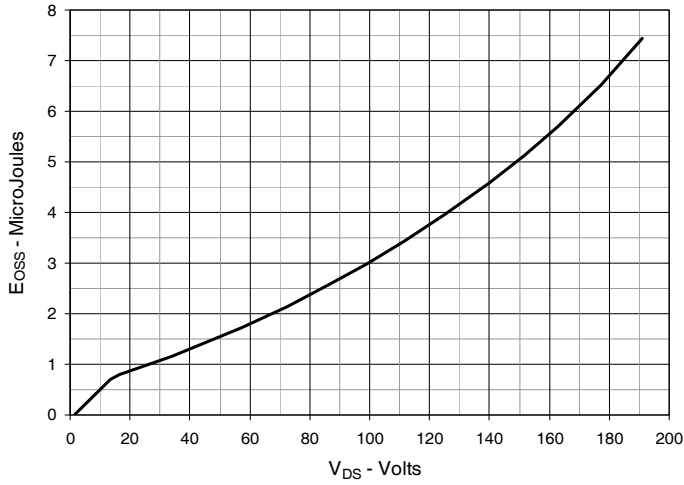


Fig. 14. Forward-Bias Safe Operating Area

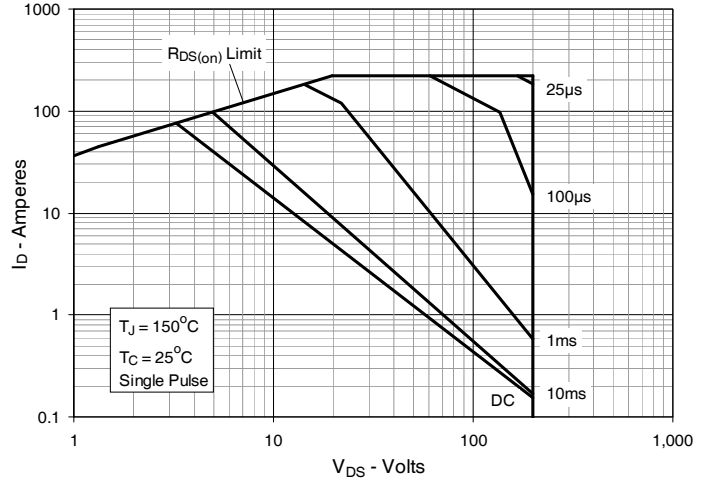
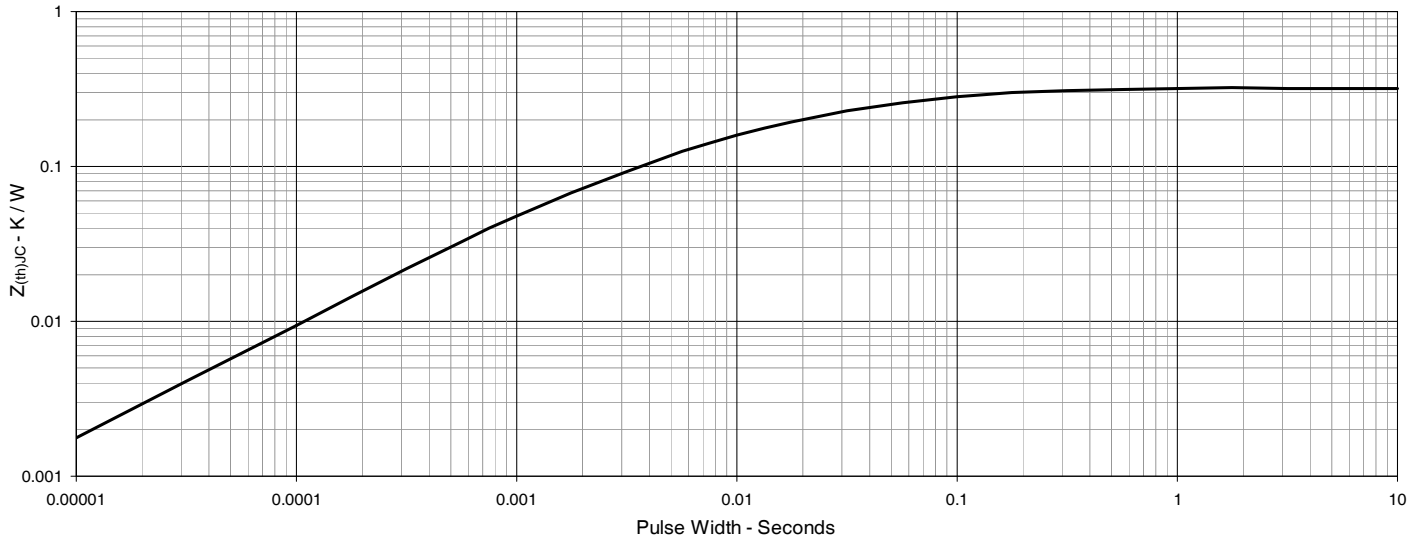
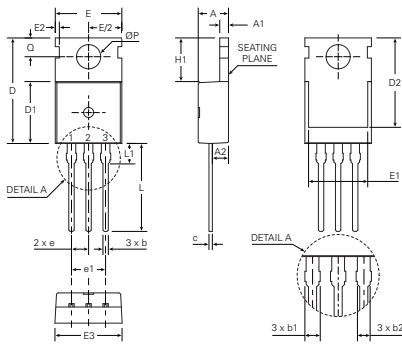


Fig. 15. Maximum Transient Thermal Impedance



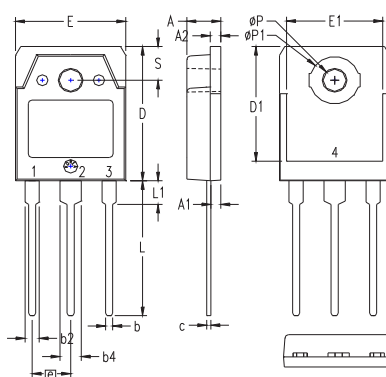
### TO-220 Outline



Pins: 1 - Gate  
2 - Drain  
3 - Source

Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max.
A	0.169	0.177	0.185	4.30	4.50	4.70
A1	0.049	0.051	0.055	1.25	1.30	1.40
A2	0.087	0.094	0.102	2.20	2.40	2.60
b	0.028	0.031	0.035	0.70	0.80	0.90
b1	0.056	0.060	0.064	1.42	1.52	1.62
b2	0.046	0.050	0.054	1.17	1.27	1.37
c	0.018	0.020	0.024	0.45	0.50	0.60
D	0.610	0.618	0.626	15.50	15.70	15.90
D1	0.354	0.362	0.370	9.00	9.20	9.40
D2	0.516	0.524	0.531	13.10	13.30	13.50
E	0.382	0.390	0.400	9.70	9.90	10.10
E1		0.346			8.80	
E2		0.024			0.60	
E3	0.386	0.394	0.402	9.80	10.00	10.20
e		0.100			2.54 BSC	
e1		0.200			5.08 BSC	
H1	0.248	0.256	0.264	6.30	6.50	6.70
L	0.507	0.515	0.523	12.88	13.08	13.28
L1		0.118			3.00	
ØP	0.134	0.142	0.150	3.40	3.60	3.80
Q	0.106	0.110	0.114	2.70	2.80	2.90

### TO-3P Outline

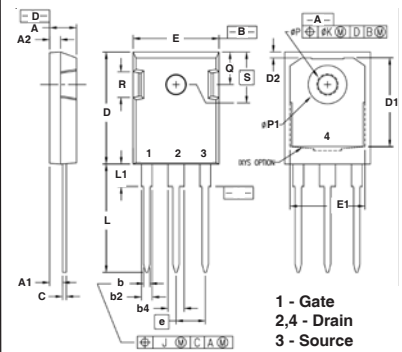


Pins: 1 - Gate  
2 - Drain  
3 - Source  
4 - Drain

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.185	.193	4.70	4.90
A1	.051	.059	1.30	1.50
A2	.057	.065	1.45	1.65
b	.035	.045	0.90	1.15
b2	.075	.087	1.90	2.20
b4	.114	.126	2.90	3.20
c	.022	.031	0.55	0.80
D	.780	.791	19.80	20.10
D1	.665	.677	16.90	17.20
E	.610	.622	15.50	15.80
E1	.531	.539	13.50	13.70
e	.215 BSC		5.45 BSC	
L	.779	.795	19.80	20.20
L1	.134	.142	3.40	3.60
ØP	.126	.134	3.20	3.40
ØP1	.272	.280	6.90	7.10
S	.193	.201	4.90	5.10

All metal area are tin plated.

### TO-247 Outline



1 - Gate  
2,4 - Drain  
3 - Source

Dim.	Millimeter		Inches	
	min	max	min	max
A	4.70	5.30	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.39	0.065	0.094
b4	2.59	3.43	0.102	0.135
c	0.38	0.89	0.015	0.035
D	20.79	21.45	0.819	0.845
D1	13.07	-	0.515	-
D2	0.51	1.35	0.020	0.053
E	15.48	16.24	0.610	0.640
E1	13.45	-	0.53	-
E2	4.31	5.48	0.170	0.216
e	5.45 BSC		0.215 BSC	
L	19.80	20.30	0.078	0.800
L1	-	4.49	-	0.177
ØP	3.55	3.65	0.140	0.144
ØP1	-	7.39	-	0.290
Q	5.38	6.19	0.212	0.244
S	6.14 BSC		0.242 BSC	

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