

# X2-Class HiPerFET™ Power MOSFET

**IXFA22N65X2**  
**IXFP22N65X2**  
**IXFH22N65X2**

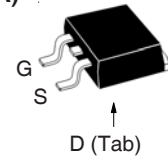
**V<sub>DSS</sub> = 650V**  
**I<sub>D25</sub> = 22A**  
**R<sub>DS(on)</sub> ≤ 145mΩ**

N-Channel Enhancement Mode  
Avalanche Rated

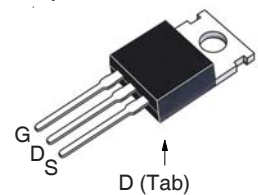


Symbol	Test Conditions	Maximum Ratings	
V <sub>DSS</sub>	T <sub>J</sub> = 25°C to 150°C	650	V
V <sub>DGR</sub>	T <sub>J</sub> = 25°C to 150°C, R <sub>GS</sub> = 1MΩ	650	V
V <sub>GSS</sub>	Continuous	±30	V
V <sub>GSM</sub>	Transient	±40	V
I <sub>D25</sub>	T <sub>C</sub> = 25°C	22	A
I <sub>DM</sub>	T <sub>C</sub> = 25°C, Pulse Width Limited by T <sub>JM</sub>	44	A
I <sub>A</sub>	T <sub>C</sub> = 25°C	5	A
E <sub>AS</sub>	T <sub>C</sub> = 25°C	1	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	50	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
F <sub>C</sub>	Mounting Force (TO-263)	10..65 / 2.2..14.6	N/lb
M <sub>d</sub>	Mounting Torque (TO-220 & TO-247)	1.13 / 10	Nm/lb.in
Weight	TO-263	2.5	g
	TO-220	3.0	g
	TO-247	6.0	g

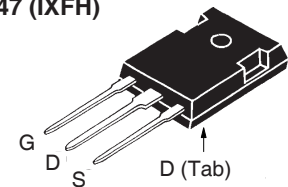
TO-263 (IXFA)



TO-220 (IXFP)



TO-247 (IXFH)



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

## 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	650		V
V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1.5mA	3.5		5.0 V
I <sub>GSS</sub>	V <sub>GS</sub> = ±30V, 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			10 μA 1.5 mA
R <sub>DS(on)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5 • I <sub>D25</sub> , Note 1			145 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	8	14	S
$R_{Gi}$	Gate Input Resistance		1.0	$\Omega$
$C_{iss}$	$V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$		2190	pF
$C_{oss}$			1450	pF
$C_{rss}$			1.3	pF
<b>Effective Output Capacitance</b>				
$C_{o(er)}$	Energy related	$V_{GS} = 0\text{V}$ $V_{DS} = 0.8 \cdot V_{DSS}$	92	pF
$C_{o(tr)}$	Time related		330	pF
$t_{d(on)}$	<b>Resistive Switching Times</b> $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$ $R_G = 10\Omega$ (External)		30	ns
$t_r$			37	ns
$t_{d(off)}$			42	ns
$t_f$			18	ns
$Q_{g(on)}$	$V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$		37	nC
$Q_{gs}$			12	nC
$Q_{gd}$			14	nC
$R_{thJC}$				0.32 $^\circ\text{C/W}$
$R_{thCS}$	TO-220		0.50	$^\circ\text{C/W}$
	TO-247		0.21	$^\circ\text{C/W}$

**Source-Drain Diode**

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max
$I_S$	$V_{GS} = 0\text{V}$			22 A
$I_{SM}$	Repetitive, pulse Width Limited by $T_{JM}$			88 A
$V_{SD}$	$I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1			1.4 V
$t_{rr}$	$I_F = 11\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$ $V_R = 100\text{V}$		145	ns
$Q_{RM}$			890	nC
$I_{RM}$			12	A

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

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

IXYS 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 @  $T_J = 25^\circ\text{C}$

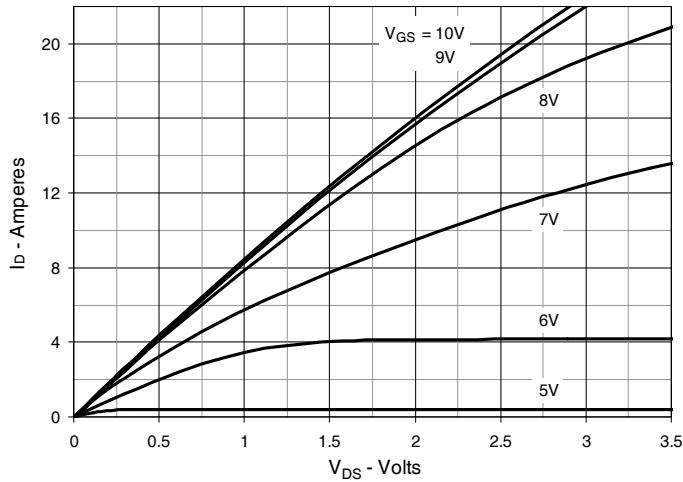


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

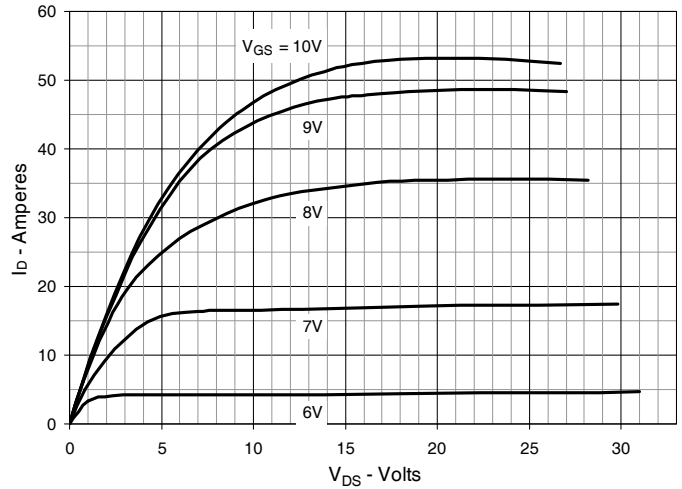


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

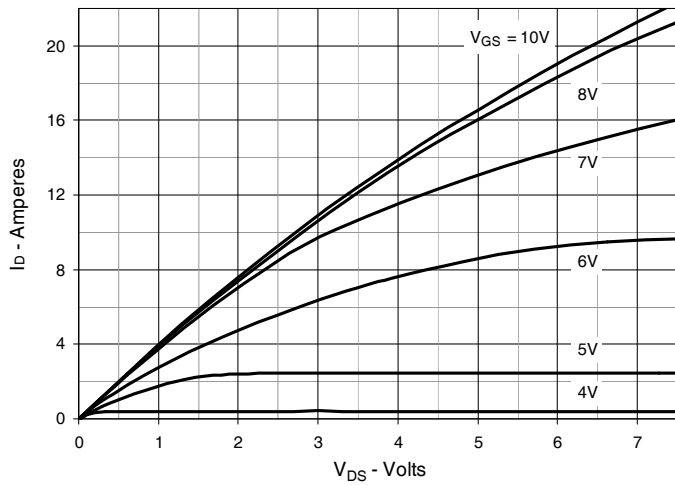


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 11A$  Value vs. Junction Temperature

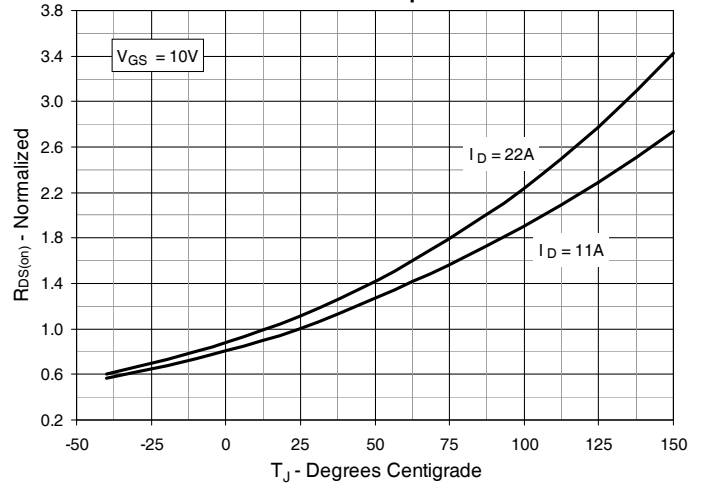


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 11A$  Value vs. Drain Current

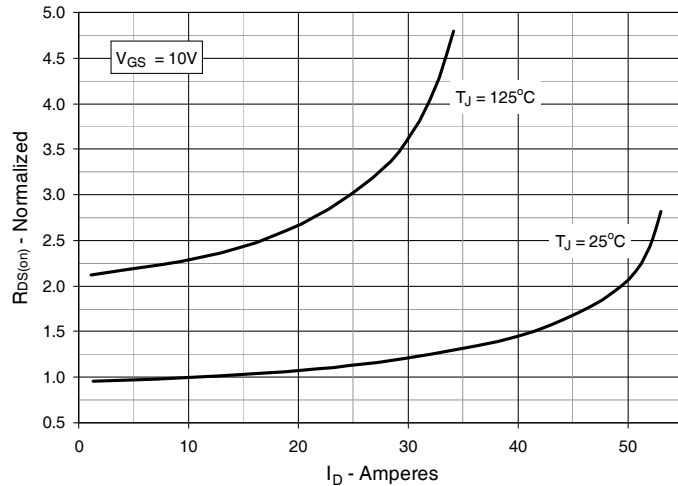
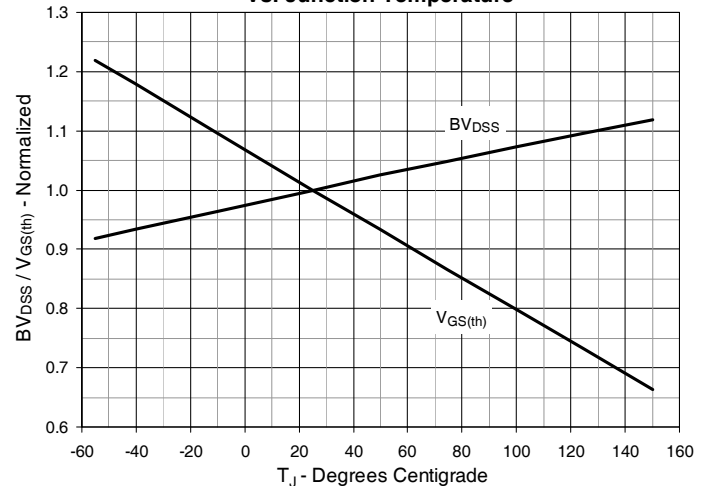
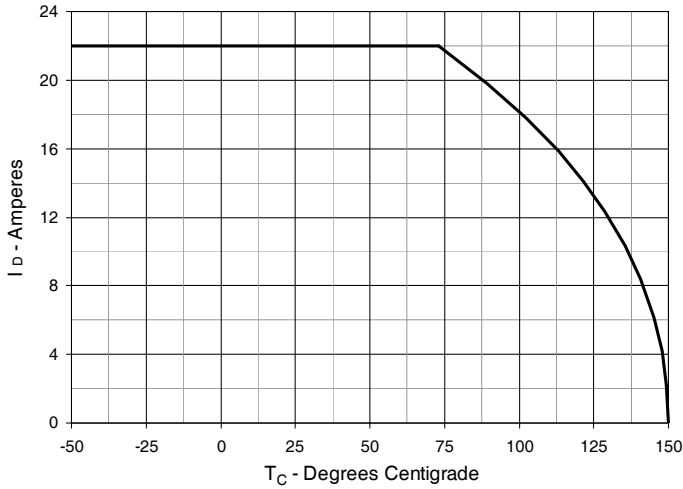


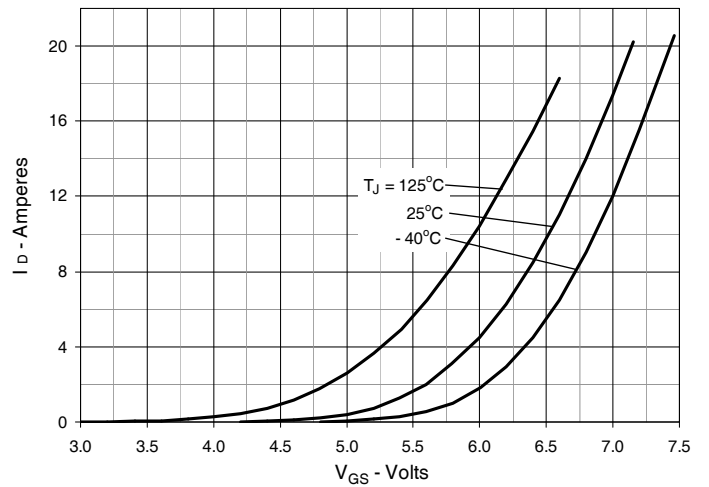
Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature



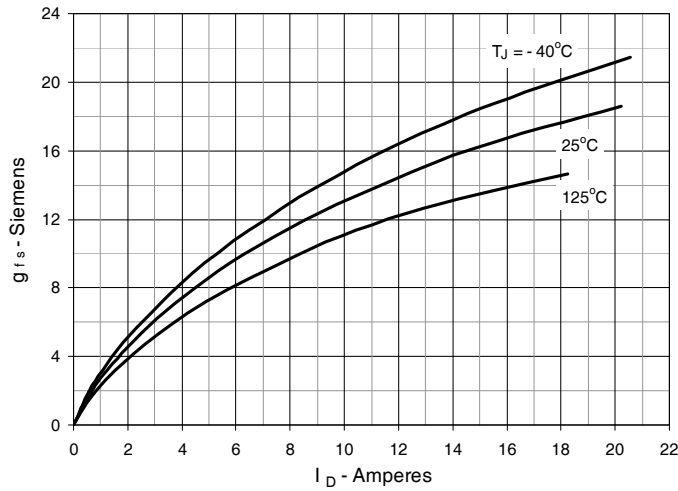
**Fig. 7. Maxing Drain Current vs. Case Temperature**



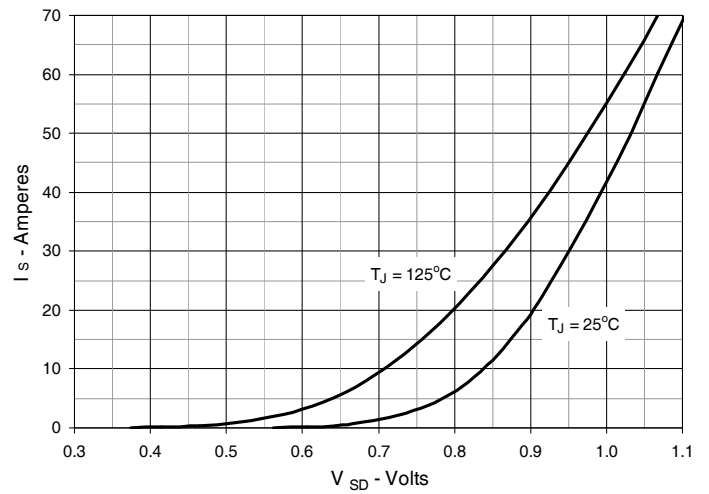
**Fig. 8. Input Admittance**



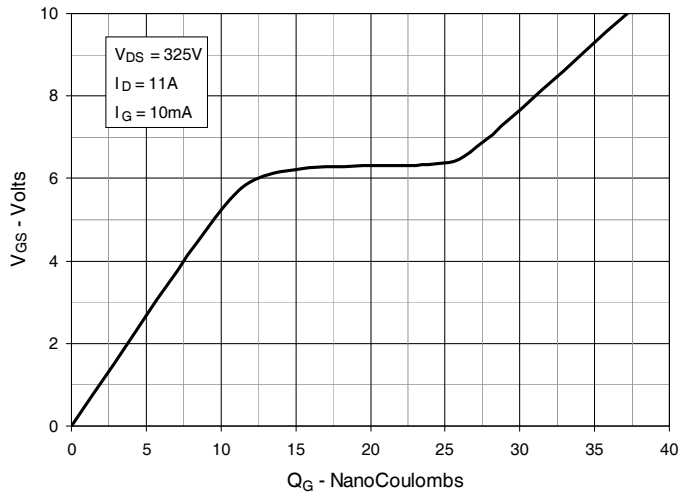
**Fig. 9. Transconductance**



**Fig. 10. Forward Voltage Drop of Intrinsic Diode**



**Fig. 11. Gate Charge**



**Fig. 12. Capacitance**

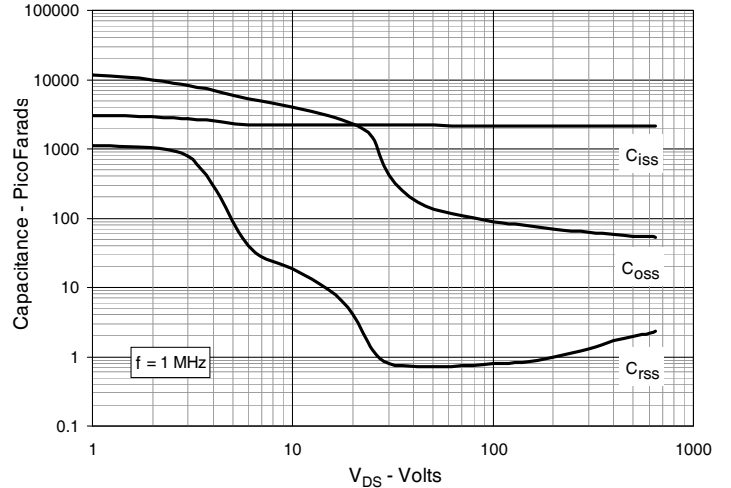


Fig. 13. Output Capacitance Stored Energy

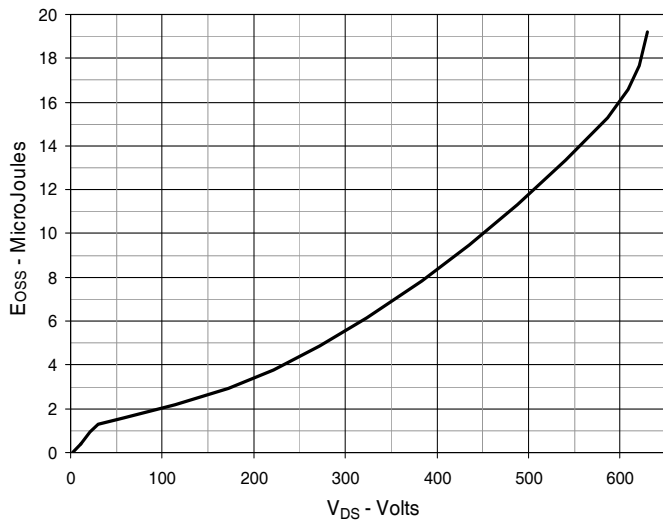


Fig. 14. Forward-Bias Safe Operating Area

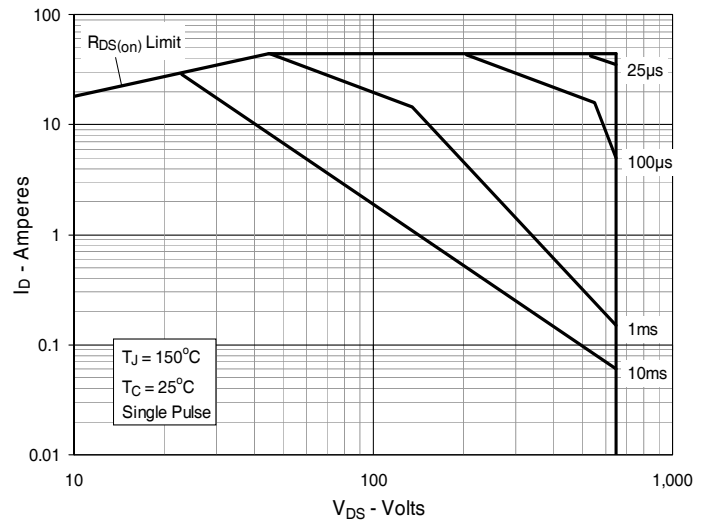
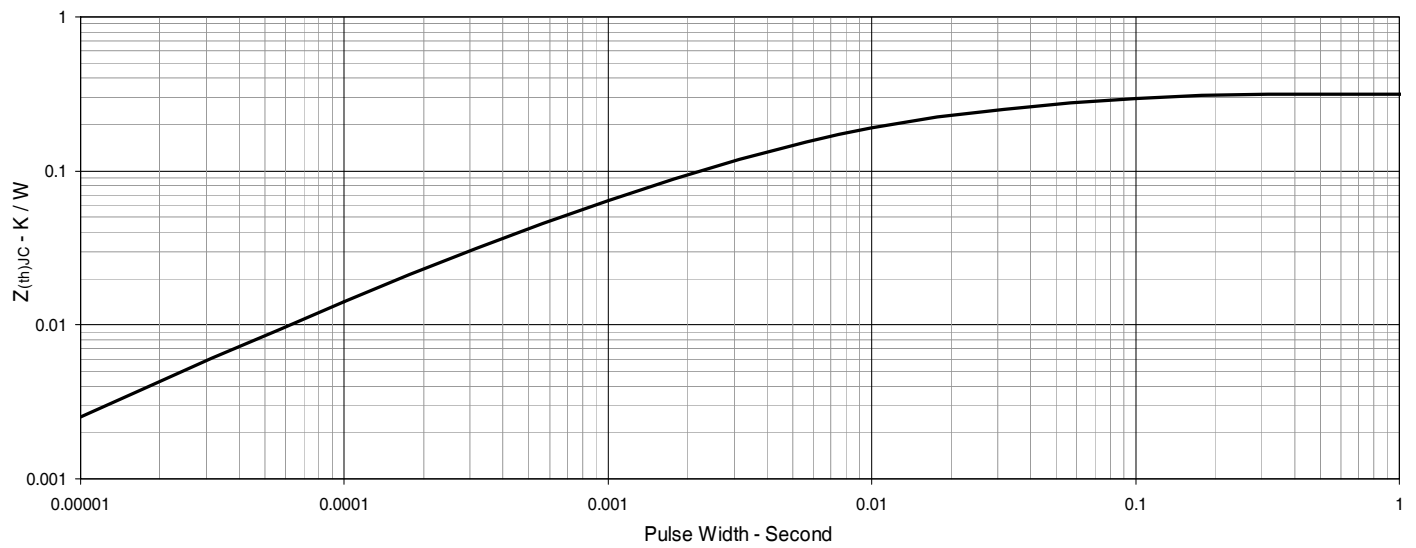
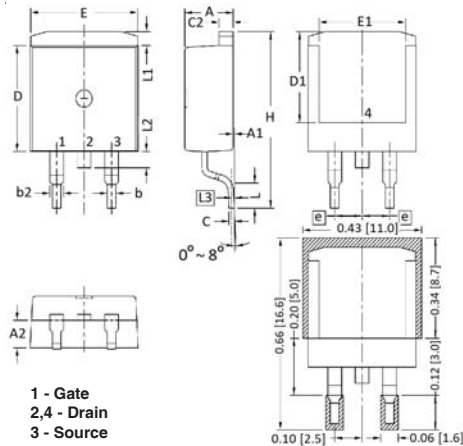


Fig. 15. Maximum Transient Thermal Impedance

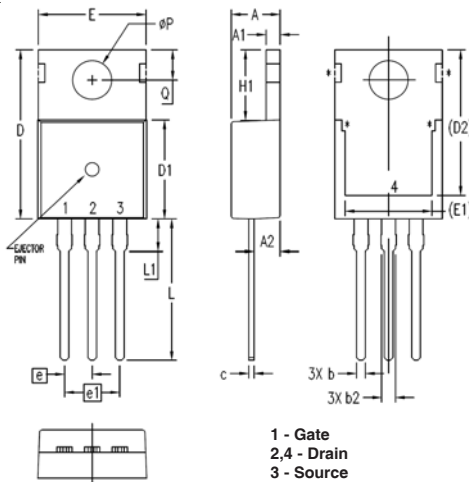


### TO-263 Outline



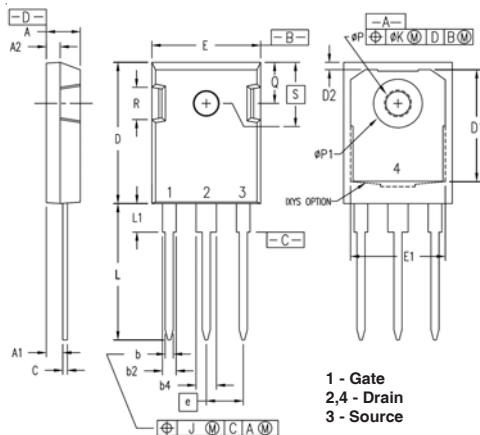
SYM	INCHES		MILLIMETER	
	MIN	MAX	MIN	MAX
A	.170	.185	4.30	4.70
A1	.000	.008	0.00	0.20
A2	.091	.098	2.30	2.50
b	.028	.035	0.70	0.90
b2	.046	.060	1.18	1.52
C	.018	.024	0.45	0.60
C2	.049	.060	1.25	1.52
D	.340	.370	8.63	9.40
D1	.300	.327	7.62	8.30
E	.380	.410	9.65	10.41
E1	.270	.330	6.86	8.38
e	.100 BSC		2.54 BSC	
H	.580	.620	14.73	15.75
L	.075	.105	1.91	2.67
L1	.039	.060	1.00	1.52
L2	—	.070	—	1.77
L3	.010 BSC		0.254 BSC	

### TO-220 Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.169	.185	4.30	4.70
A1	.047	.055	1.20	1.40
A2	.079	.106	2.00	2.70
b	.024	.039	0.60	1.00
b2	.045	.057	1.15	1.45
c	.014	.026	0.35	0.65
D	.587	.626	14.90	15.90
D1	.335	.370	8.50	9.40
(D2)	.500	.531	12.70	13.50
E	.382	.406	9.70	10.30
(E1)	.283	.323	7.20	8.20
e	.100 BSC		2.54 BSC	
e1	.200 BSC		5.08 BSC	
H1	.244	.268	6.20	6.80
L	.492	.547	12.50	13.90
L1	.110	.154	2.80	3.90
ØP	.134	.150	3.40	3.80
Q	.106	.126	2.70	3.20

### TO-247 Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.045	.055	1.14	1.40
b2	.075	.087	1.91	2.20
b4	.115	.126	2.92	3.20
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
D1	.650	.690	16.51	17.53
D2	.035	.050	0.89	1.27
E	.620	.635	15.75	16.13
E1	.545	.565	13.84	14.35
e	.215 BSC		5.45 BSC	
J	--	.010	--	0.25
K	--	.025	--	0.64
L	.780	.810	19.81	20.57
L1	.150	.170	3.81	4.32
L2	.140	.144	3.55	3.65
ØP1	.275	.290	6.99	7.37
Q	.220	.244	5.59	6.20
R	.170	.190	4.32	4.83
S	.242 BSC		6.15 BSC	



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