

# PolarHV™ Power MOSFET

**IXTP 1R4N60P**  
**IXTU 1R4N60P**  
**IXTY 1R4N60P**

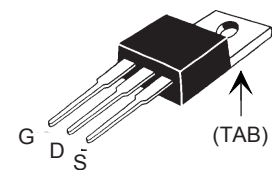
**V<sub>DSS</sub> = 600 V**  
**I<sub>D25</sub> = 1.4 A**  
**R<sub>DS(on)</sub> ≤ 9.0 Ω**

N-Channel Enhancement Mode  
Avalanche Rated

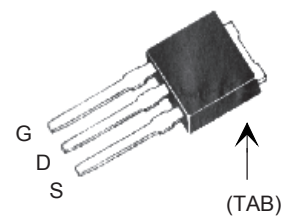


Symbol	Test Conditions	Maximum Ratings	
V <sub>DSS</sub>	T <sub>J</sub> = 25° C to 175° C	600	V
V <sub>DGR</sub>	T <sub>J</sub> = 25° C to 175° C; R <sub>GS</sub> = 1 MΩ	600	V
V <sub>GS</sub>	Continuous	±30	V
V <sub>GSM</sub>	Transient	±40	V
I <sub>D25</sub>	T <sub>C</sub> = 25° C	1.4	A
I <sub>DM</sub>	T <sub>C</sub> = 25° C, pulse width limited by T <sub>JM</sub>	2.1	A
I <sub>AR</sub>	T <sub>C</sub> = 25° C	1.4	A
E <sub>AR</sub>	T <sub>C</sub> = 25° C	5	mJ
E <sub>AS</sub>	T <sub>C</sub> = 25° C	75	mJ
dv/dt	I <sub>S</sub> ≤ I <sub>DM</sub> , di/dt ≤ 100 A/μs, V <sub>DD</sub> ≤ V <sub>DSS</sub> , T <sub>J</sub> ≤ 150° C, R <sub>G</sub> = 20 Ω	10	V/ns
P <sub>D</sub>	T <sub>C</sub> = 25° C	50	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>	1.6 mm (0.062) from case for 10 s	300	°C
T <sub>SOLD</sub>	Plastic body for 10 s	260	°C
Weight	TO-220	4.0	g
	TO-252	0.35	g
	TO-251	0.4	g

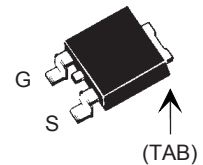
TO-220 (IXTP)



TO-251 (IXTU)



TO-252 (IXTY)



G = Gate      D = Drain  
S = Source      TAB = Drain

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> = 0 V, I <sub>D</sub> = 25 μA	600		V
V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 25 μA	3.0		5.5 V
I <sub>GSS</sub>	V <sub>GS</sub> = ±30 V <sub>DC</sub> , V <sub>DS</sub> = 0			±50 nA
I <sub>DSS</sub>	V <sub>DS</sub> = V <sub>DSS</sub> , V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125° C			1 μA 20 μA
R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.5 I <sub>D25</sub> Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 %			9.0 Ω

### Features

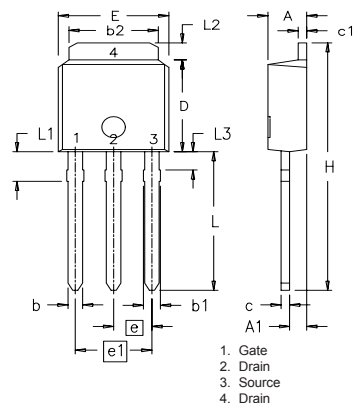
- † International standard packages
- † Unclamped Inductive Switching (UIS) rated
- † Low package inductance  
- easy to drive and to protect

### Advantages

- † Easy to mount
- † Space savings
- † High power density

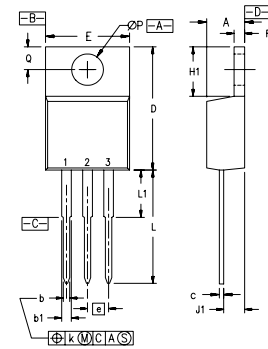
Symbol	Test Conditions	Characteristic Values		
		$(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$		
		Min.	Typ.	Max.
$g_{fs}$	$V_{DS} = 20\text{ V}; I_D = 0.5 I_{D25}, \text{ pulse test}$	0.7	1.1	S
$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$		140	pF
$C_{oss}$			17	pF
$C_{rss}$			2.4	pF
$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 0.5 I_{D25}$ $R_G = 50\ \Omega \text{ (External)}$		10	ns
$t_r$			16	ns
$t_{d(off)}$			25	ns
$t_f$			16	ns
$Q_{g(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 0.5 I_{D25}$		5.2	nC
$Q_{gs}$			1.34	nC
$Q_{gd}$			5.2	nC
$R_{thJC}$				$2.5^\circ\text{C/W}$
$R_{thCS}$	(TO-220)		0.25	$^\circ\text{C/W}$
$R_{thCS}$	(TO-251)		1.0	$^\circ\text{C/W}$

Symbol	Test Conditions	Characteristic Values		
		$(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$		
		Min.	Typ.	Max.
$I_s$	$V_{GS} = 0\text{ V}$			1.4 A
$I_{SM}$	Repetitive			4 A
$V_{SD}$	$I_F = I_s, V_{GS} = 0\text{ V},$ Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$			1.5 V
$t_{rr}$	$I_F = 1.5\text{ A}, -di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}, V_{GS} = 0\text{ V}$		500	ns

**TO-251 (IXTU) Outline**


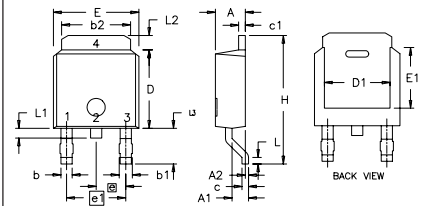
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	2.19	2.38	.086	.094
A1	0.89	1.14	0.35	.045
b	0.64	0.89	.025	.035
b1	0.76	1.14	.030	.045
b2	5.21	5.46	.205	.215
c	0.46	0.58	.018	.023
c1	0.46	0.58	.018	.023
D	5.97	6.22	.235	.245
E	6.35	6.73	.250	.265
e	2.28	BSC	.090	BSC
e1	4.57	BSC	.180	BSC
H	17.02	17.78	.670	.700
L	8.89	9.65	.350	.380
L1	1.91	2.28	.075	.090
L2	0.89	1.27	.035	.050

1. Gate
2. Drain
3. Source
4. Drain

**TO-220 (IXTP) Outline**


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

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.170	.190	4.32	4.83
b	.025	.040	0.64	1.02
b1	.045	.065	1.15	1.65
c	.014	.022	0.35	0.56
D	.580	.630	14.73	16.00
E	.390	.420	9.91	10.66
e	.100	BSC	2.54	BSC
F	.045	.055	1.14	1.40
H1	.230	.270	5.85	6.85
J1	.090	.110	2.29	2.79
k	0	.015	0	0.38
L	.500	.550	12.70	13.97
L1	.110	.230	2.79	5.84
ØP	.139	.161	3.53	4.08
Q	.100	.125	2.54	3.18

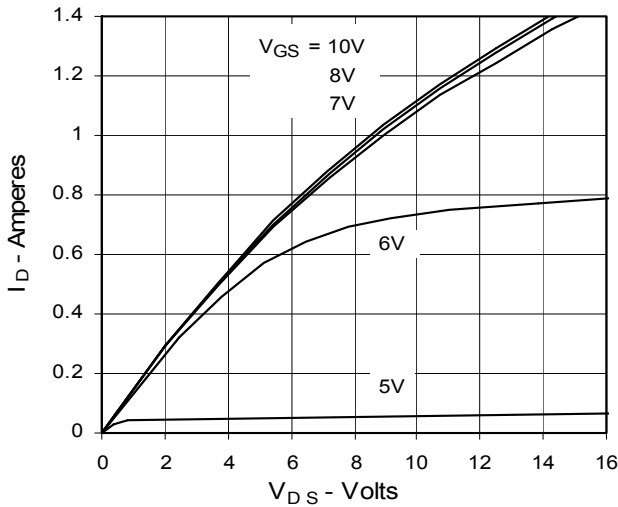
**TO-252 AA (IXTY) Outline**


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	2.19	2.38	0.086	0.094
A1	0.89	1.14	0.035	0.045
A2	0	0.13	0	0.005
b	0.64	0.89	0.025	0.035
b1	0.76	1.14	0.030	0.045
b2	5.21	5.46	0.205	0.215
c	0.46	0.58	0.018	0.023
c1	0.46	0.58	0.018	0.023
D	5.97	6.22	0.235	0.245
D1	4.32	5.21	0.170	0.205
E	6.35	6.73	0.250	0.265
E1	4.32	5.21	0.170	0.205
e	2.28	BSC	0.090	BSC
e1	4.57	BSC	0.180	BSC
H	9.40	10.42	0.370	0.410
L	0.51	1.02	0.020	0.040
L1	0.64	1.02	0.025	0.040
L2	0.89	1.27	0.035	0.050
L3	2.54	2.92	0.100	0.115

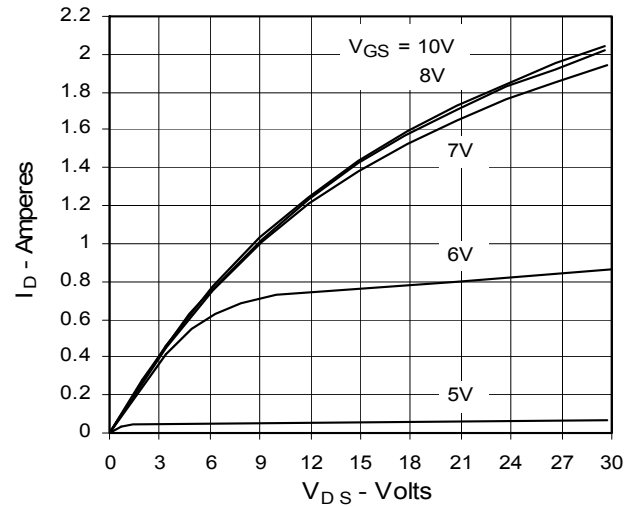
IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered by 4,835,592 4,931,844 5,049,961 5,237,481 6,162,665 6,404,065 B1 6,683,344 6,727,585  
one or more of the following U.S. patents: 4,850,072 5,017,508 5,063,307 5,381,025 6,259,123 B1 6,534,343 6,710,405B2 6,759,692  
4,881,106 5,034,796 5,187,117 5,486,715 6,306,728 B1 6,583,505 6,710,463 6,771,478 B2

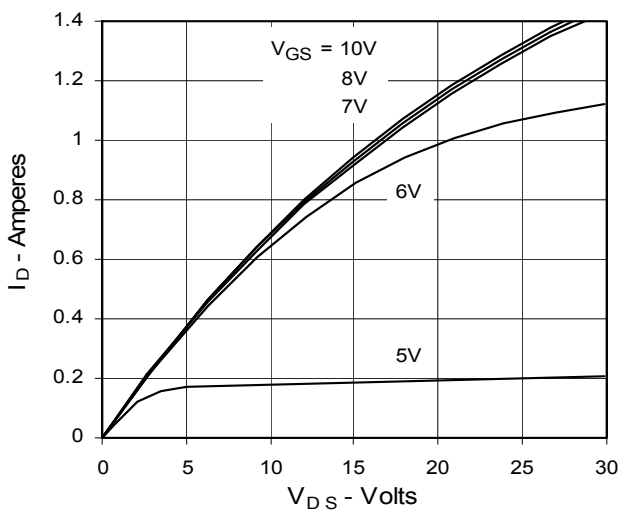
**Fig. 1. Output Characteristics**  
@ 25°C



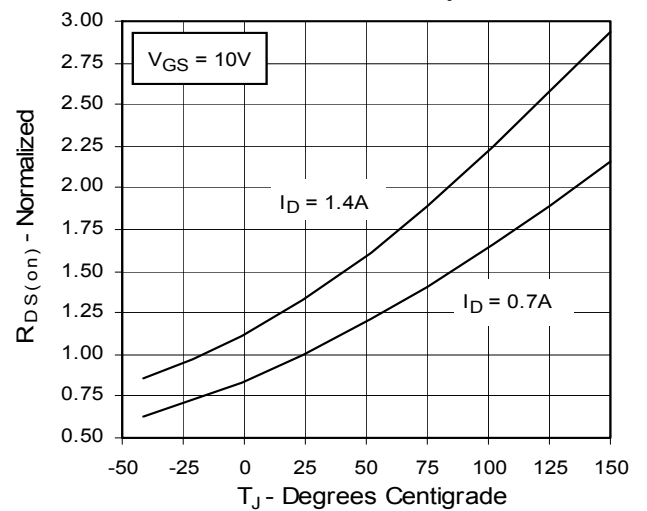
**Fig. 2. Extended Output Characteristics**  
@ 25°C



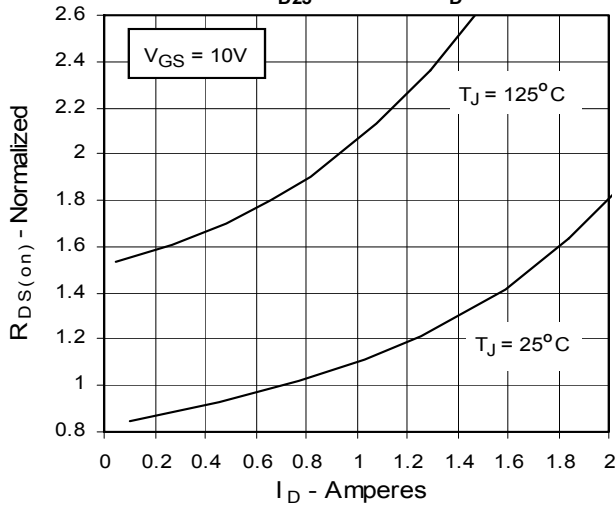
**Fig. 3. Output Characteristics**  
@ 125°C



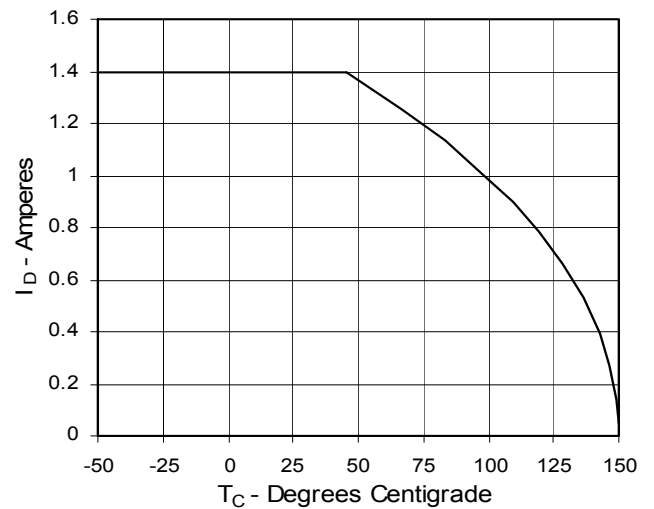
**Fig. 4.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs. Junction Temperature**



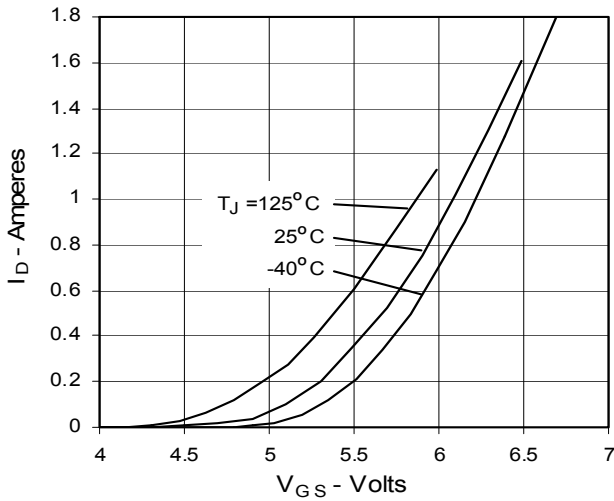
**Fig. 5.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs.  $I_D$**



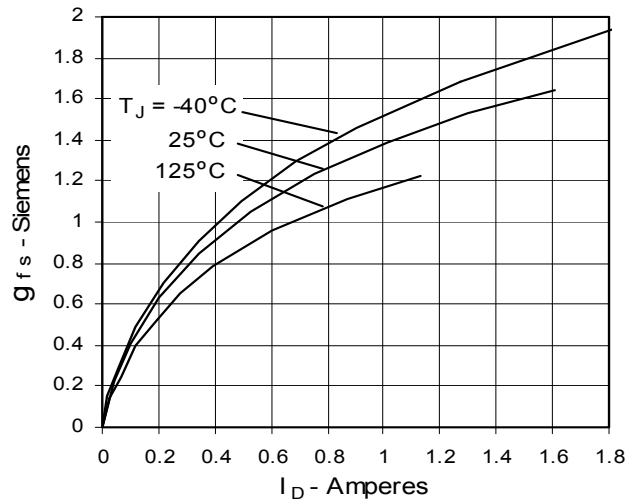
**Fig. 6. Drain Current vs. Case Temperature**



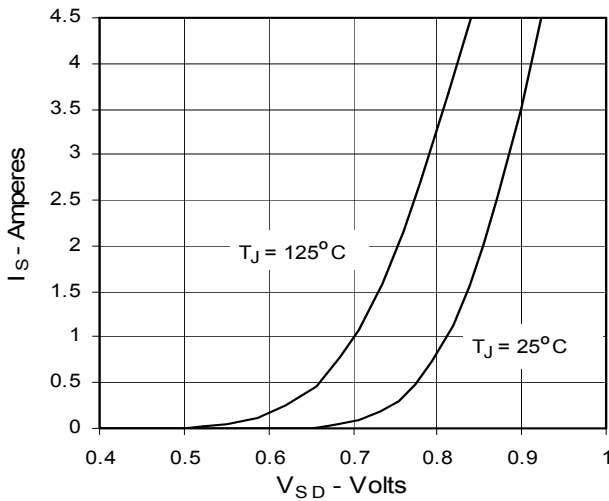
**Fig. 7. Input Admittance**



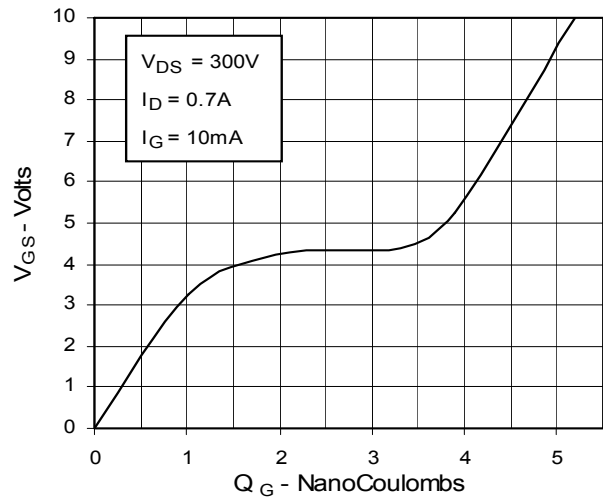
**Fig. 8. Transconductance**



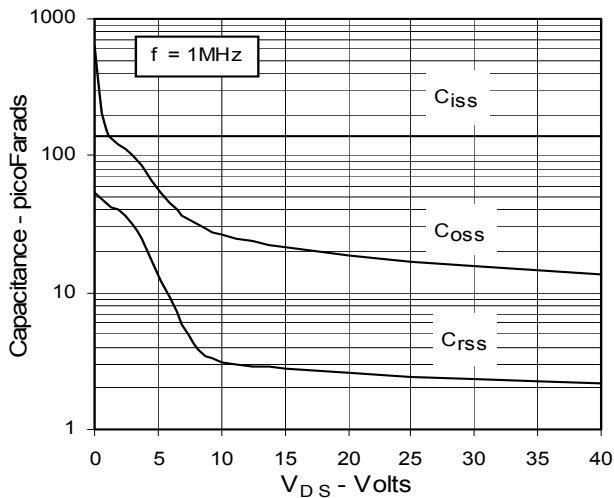
**Fig. 9. Source Current vs. Source-To-Drain Voltage**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



**Fig. 12. Maximum Transient Thermal Resistance**

