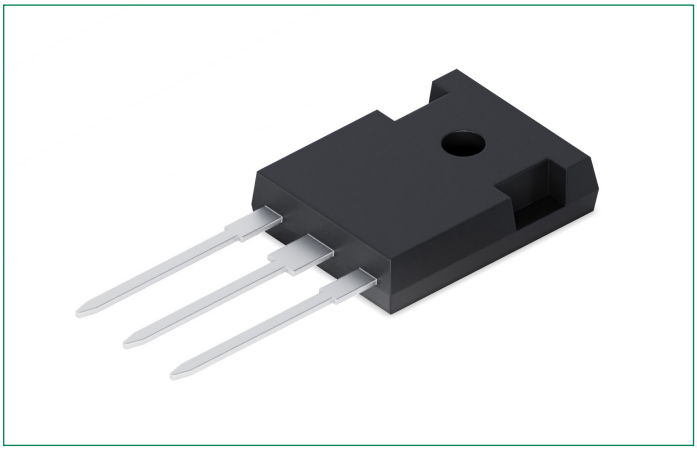
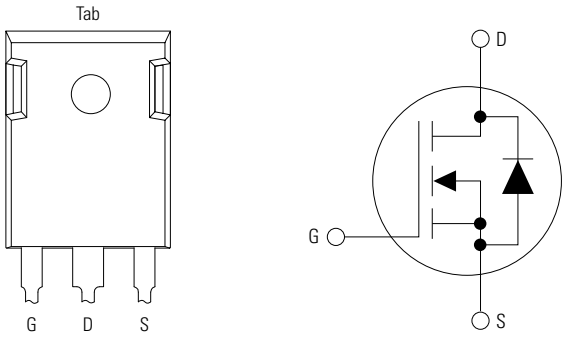
IXFH60N65X2W

650 V, 60 A, 52 mΩ, X2 Class HiPerFET™ Power MOSFET

N-Channel Enhancement Mode, Avalanche Rated, Fast Intrinsic Diode



Pinout Diagram TO-247 (IXFH)



G: Gate; **D:** Drain; **S:** Source; **Tab:** Drain

Description

The IXFH60N65X2W (TO-247) is a X2-Class HiPerFET power MOSFETs rated at 650 V breakdown voltage with 60 A continuous drain current and 52 mΩ on-resistance. It is an avalanche-rated, N-channel enhancement-mode device featuring a fast intrinsic body diode, low gate charge, and low package inductance for high power density designs. This part targets switch-mode and resonant power supplies, DC-DC converters, PFC circuits, and AC/DC motor drives and robotics applications.

Features

- International standard package
- Low $R_{DS(on)}$ and Q_g
- Avalanche rated
- Low Package Inductance

Benefits

- 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

Product Summary

Characteristic	Value	Unit
V_{DSS}	650	V
I_D @ 25 °C	60	A
$R_{DS(on)}$	≤ 52	mΩ

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Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{DSS}	Drain-Source Voltage	T_{vj} = 25 °C to 150 °C	650	V
V_{DGR}	Drain-Gate Voltage	T_{vj} = 25 °C to 150 °C, R_{GS} = 1 MΩ	650	
V_{GSS}	Gate-Source Voltage	–	±30	V
V_{GSM}	Maximum Gate-Source Voltage	–	±40	
I_D	Drain Current	T_c = 25 °C	60	A
I_{DM}	Peak Drain Current	T_c = 25 °C, pulse width limited by $T_{vj(max)}$	120	
I_{AS}	Single Pulse Avalanche Current	T_c = 25 °C	15	A
E_{AS}	Single Pulse Avalanche Energy	T_c = 25 °C	2.5	J
dv/dt	Source-Drain Diode dv/dt Capability	$I_S \le I_{DM}$, $V_{DD} \le V_{DSS}$, $T_{vj} \le$ 150 °C	50	V/ns
P_{tot}	Total Power Dissipation	T_c = 25 °C	780	W
T_{vj}	Virtual Junction Temperature Range	–	−55 to +150	°C
T_{stg}	Storage Temperature Range	–	−55 to +150	
T_{sold}	Soldering Temperature		300	°C
M_d	Mounting Torque	–	1.13 / 10	Nm/

Electrical Characteristics – Static (T_{vj} = 25 °C unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	I_D = 1 mA, V_{GS} = 0 V	650	–	–	V
$V_{GS(th)}$	Gate Threshold Voltage	I_D = 4 mA, V_{GS} = V_{DS}	3.5	–	5.0	V
I_{GSS}	Gate-Source Leakage Current	V_{DS} = 0 V, V_{GS} = ±30 V	–	–	±100	nA
I_{DSS}	Drain-Source Leakage Current	V_{DS} = V_{DSS}, V_{GS} = 0 V	–	–	25	µA
		V_{DS} = V_{DSS}, V_{GS} = 0 V, T_{vj} = 125 °C	–	–	2.5	mA
$R_{DS(on)}$	Drain-Source On-Resistance[1]	V_{GS} = 10 V, I_D = 0.5 x I_{D25}	–	–	52	mΩ

Note 1: Pulse test, t ≤ 300 µs, duty cycle, d ≤ 2%

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Electrical Characteristics – Dynamic (T_{vj} = 25 °C unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
g_{fs}	Transconductance[1]	V_{DS} = 10 V, I_D = 0.5 x I_{D25}	23	29	–	S
$R_{g(int)}$	Gate Input Resistance	–	–	1.0	–	Ω
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	–	6300	–	pF
C_{oss}	Output Capacitance		–	3540	–	
C_{rss}	Reverse Transfer Capacitance		–	1.7	–	
$C_{o(er)}$	Effective Output Capacitance – Energy Related	Effective Output Capacitance V_{GS} = 0 V, V_{DS} = 0.8 x V_{DSS}	–	207	–	pF
$C_{o(tr)}$	Effective Output Capacitance – Time Related		–	855	–	
Q_G	Total Gate Charge	V_{GS} = 10 V, V_{DS} = 0.5 x V_{DSS}, I_D = 0.5 x I_{D25}	–	108	–	nC
Q_{GS}	Gate-Source Charge		–	40	–	
Q_{GD}	Gate-Drain Charge		–	34	–	
$t_{d(on)}$	Turn-On Delay Time	Resistive Switching Times V_{GS} = 10 V, V_{DS} = 0.5 x V_{DSS}, I_D = 0.5 x I_{D25}, $R_{G(ext)}$ = 3 Ω	–	30	–	ns
t_r	Rise Time		–	23	–	
$t_{d(off)}$	Turn-Off Delay Time		–	63	–	
t_f	Fall Time		–	12	–	

Note 1: Pulse test, t ≤ 300 µs, duty cycle, d ≤ 2 %

Source-Drain Diode Characteristics (T_{vj} = 25°C unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
I_S	Continuous Diode Forward Current	V_{GS} = 0 V	–	–	60	A
I_{SM}	Diode Pulse Current	Repetitive, pulse width limited by $T_{vj(max)}$	–	–	240	A
V_{SD}	Diode Forward Voltage[1]	I_F = I_S, V_{GS} = 0 V	–	–	1.4	V
t_{rr}	Reverse Recovery Time	I_F = 30 A, –di/dt = 100 A/µs, V_R = 100 V	–	180	–	ns
Q_{rr}	Reverse Recovery Charge		–	1.4	–	µC
I_{rrm}	Peak Reverse Recovery Current		–	16	–	A

Note 1: Pulse test, t ≤ 300 µs, duty cycle, d ≤ 2 %

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal Resistance Junction To Case	–	–	0.16	K/W
$R_{th(c-h)}$	Thermal Resistance Case To Heat Sink	–	0.21	–	K/W

Package

Symbol	Characteristic	Conditions	Value	Unit
G	Weight	–	6	g

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Characteristic Curves

Fig. 1. Typical Output Characteristics @ T_{vj} = 25 ºC

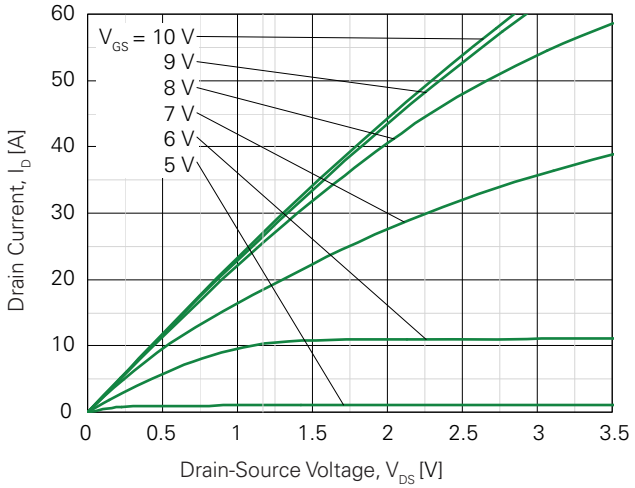


Fig. 2. Typical Extended Output Characteristics @ T_{vj} = 25 ºC

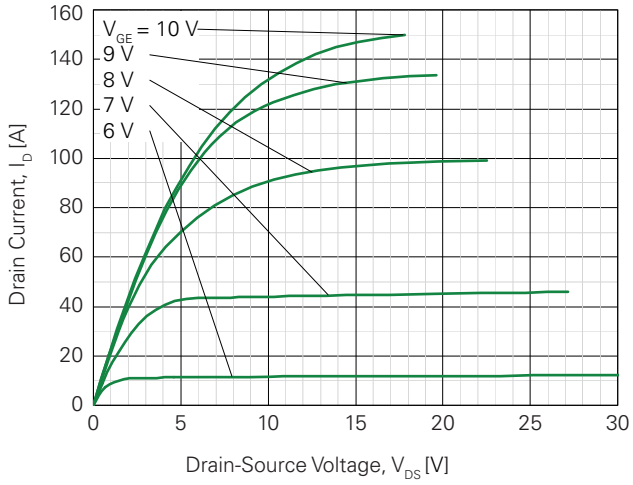


Fig. 3. Typical Output Characteristics @ T_{vj} = 125 ºC

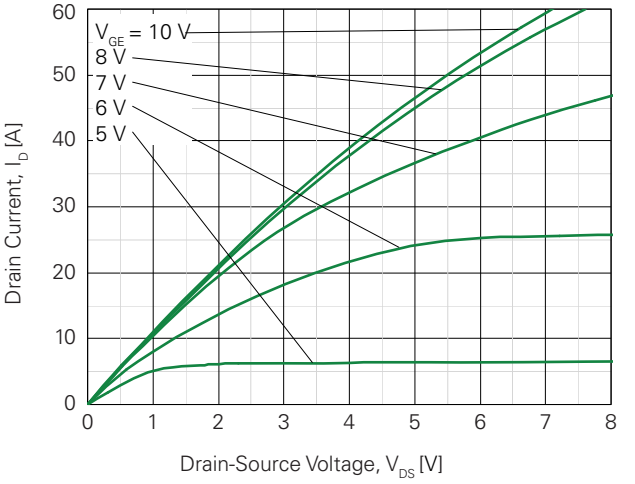


Fig. 4. $R_{DS(on)}$ Normalized to I_D = 17 A Value vs. Junction Temperature

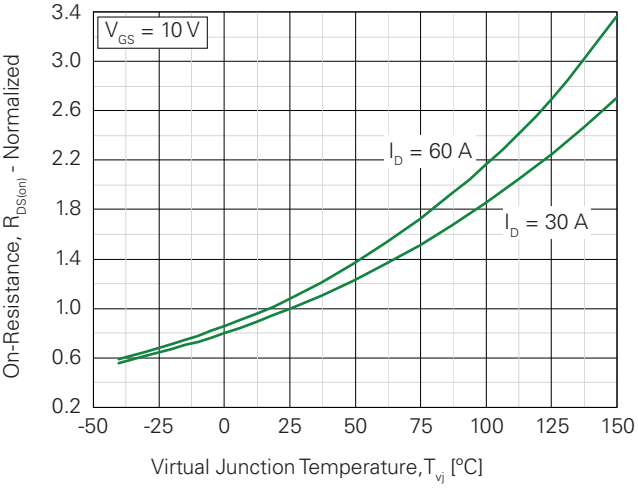


Fig. 5. $R_{DS(on)}$ Normalized to I_D = 30 A Value vs. Drain Current

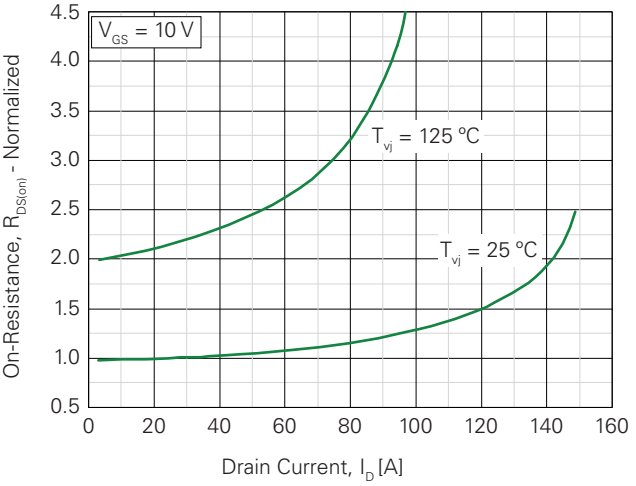
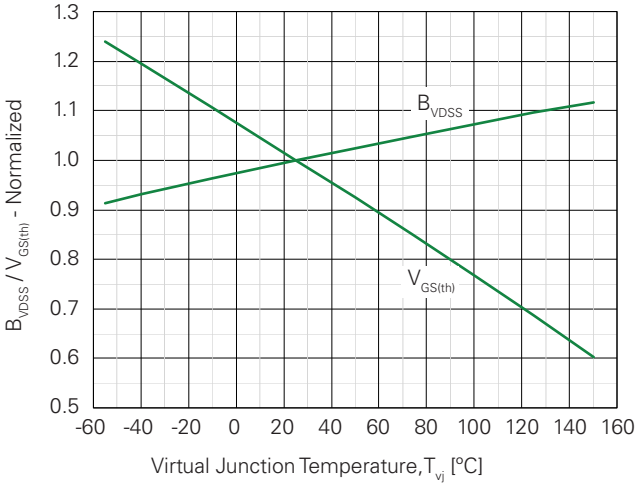


Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature



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Fig. 7. Maximum Drain Current vs. Case Temperature

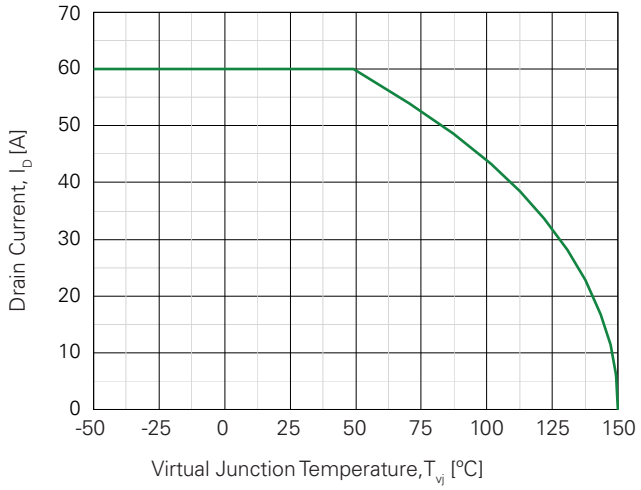


Fig. 8. Typical Transfer Characteristics

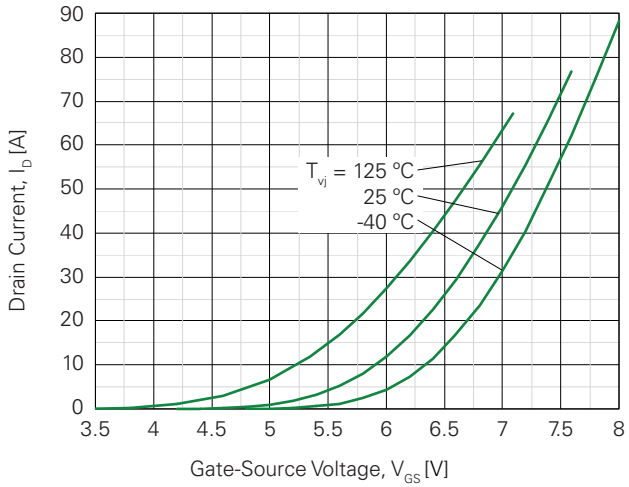


Fig. 9. Typical Transconductance

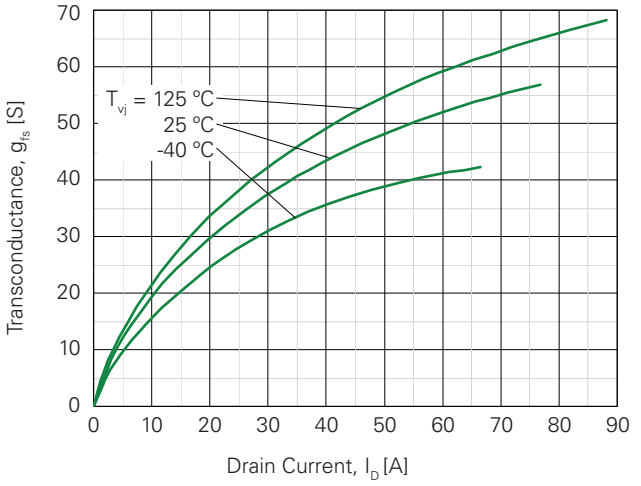


Fig. 10. Forward Voltage Drop of Intrinsic Diode

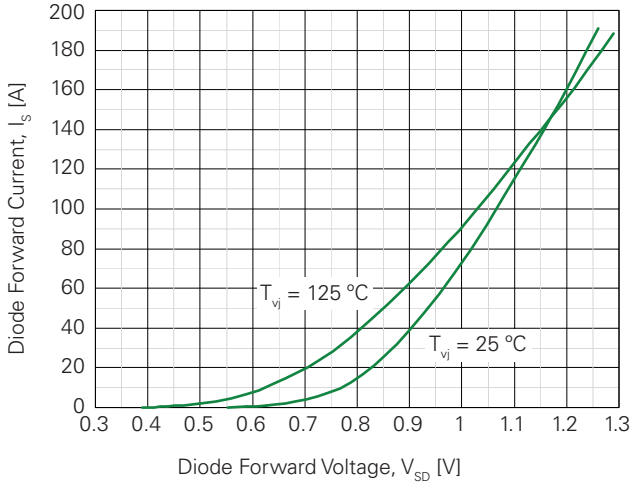


Fig. 11. Typical Gate Charge Characteristics

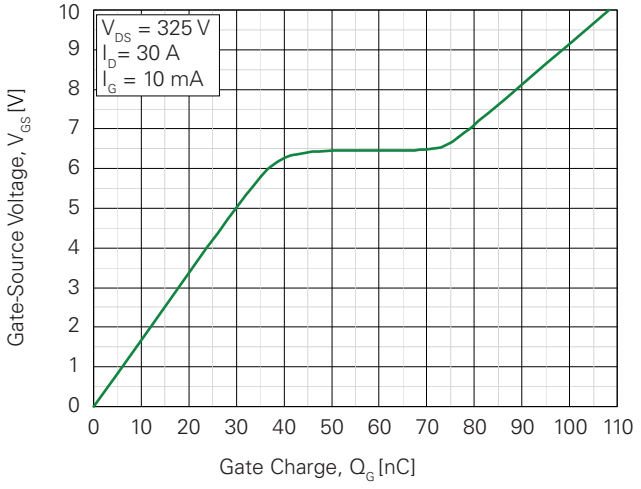
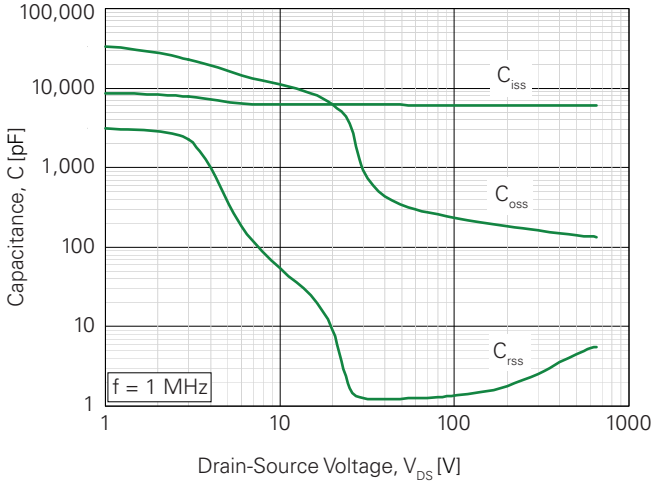


Fig. 12. Typical Junction Capacitance Characteristics



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Fig. 13. Typical Output Charge Capacitance Energy vs. Drain-Source Voltage

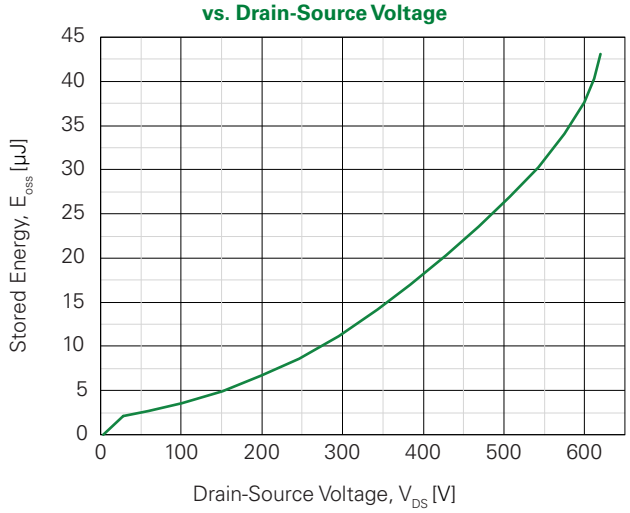


Fig. 14. Forward-Bias Safe Operating Area (FBSOA)

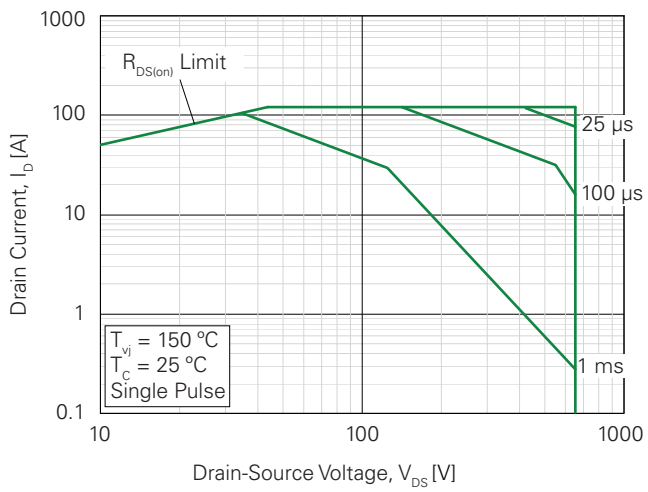
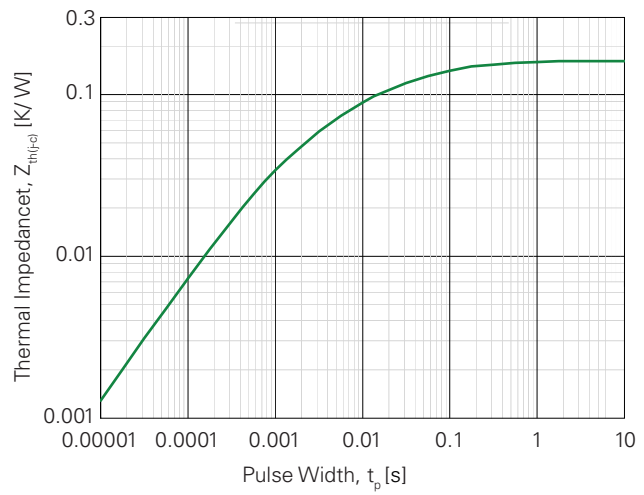
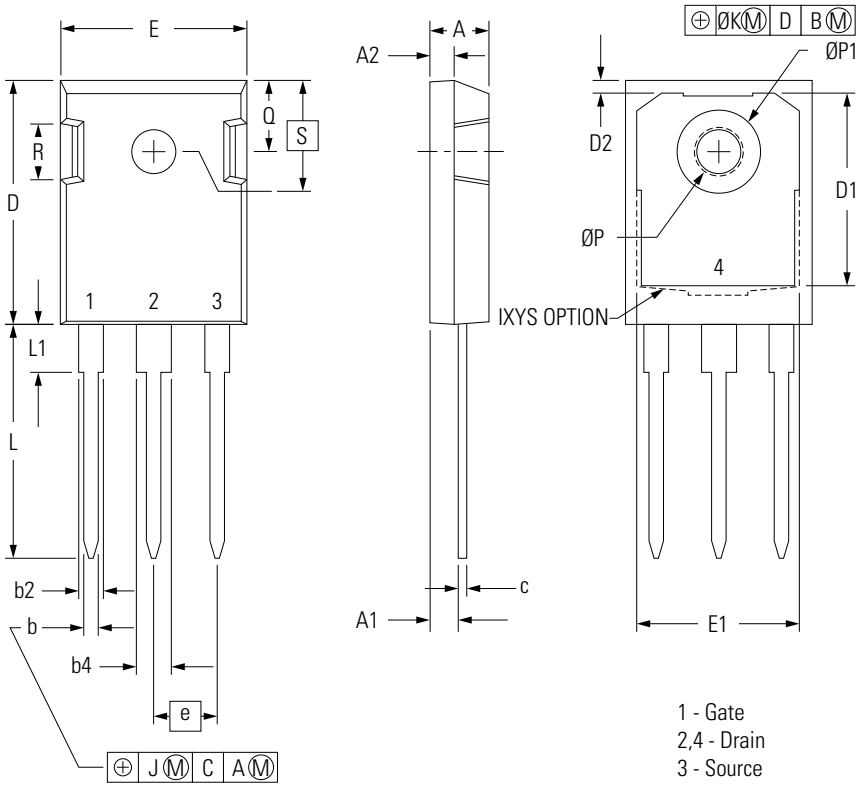


Fig. 15. Maximum Transient Thermal Impedance



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Part Outline Drawing TO-247 (IXFH)



1 - Gate
2,4 - Drain
3 - Source

Symbol	Inches		Millimeters	
	Min.	Max.	Min.	Max
A	0.190	0.205	4.83	5.21
A1	0.090	0.100	2.29	2.54
A2	0.075	0.085	1.91	2.16
b	0.045	0.055	1.14	1.40
b2	0.075	0.087	1.91	2.20
b4	0.115	0.126	2.92	3.20
c	0.024	0.031	0.61	0.80
D	0.819	0.840	20.80	21.34
D1	0.650	0.690	16.51	17.53
D2	0.035	0.050	0.89	1.27
E	0.620	0.635	15.57	16.13
E1	0.545	0.565	13.84	14.35
e	0.215 BSC		5.45 BSC	
J	-	0.010	-	0.25
K	-	0.025	-	0.64
L	0.780	0.810	19.81	20.57
L1	0.150	0.170	3.81	4.32
ØP	0.140	0.144	3.55	3.65
ØP1	0.275	0.290	6.99	7.37
Q	0.220	0.244	5.59	6.20
R	0.170	0.190	4.32	4.83
S	0.242 BSC		6.15 BSC	

Ordering Information

Orderable Part Number	Package Type	Shipping Form	Shipping Quantity
IXFH60N65X2W	TO-247	Tube	30

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