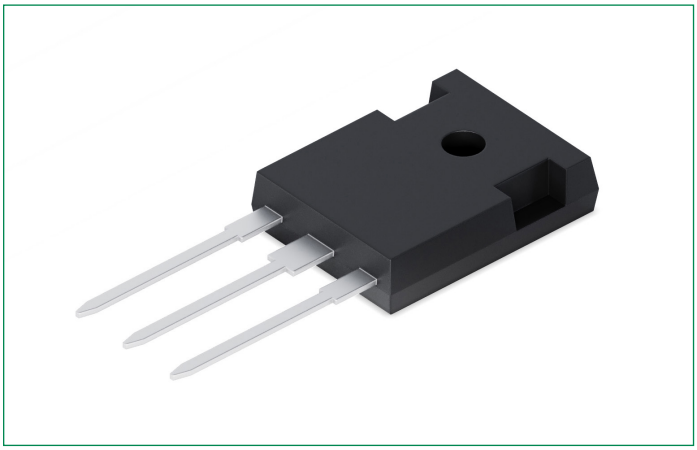
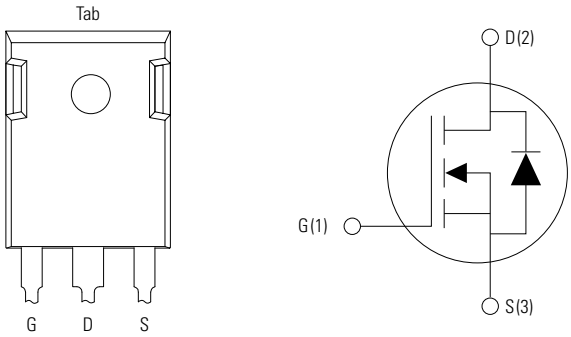
IXFH46N65X2W

650 V, 46 A, 69 mΩ, X2 Class HiPerFET™ Power MOSFET

N-Channel Enhancement Mode, Avalanche Rated



Pinout Diagram TO-247 (IXFH)



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

Features

- International standard package
- High power density
- Low $R_{DS(on)}$ and Q_g
- Avalanche rated

Benefits

- Reduced conduction losses
- Reduced driver power requirements
- 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_{D25}	46	A
$R_{DS(on)}$	≤ 69	mΩ

Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{DSS}	Drain-Source Voltage	T_{vj} = 25 °C to 150 °C	650	V
V_{GSS}	Gate-Source Voltage	–	±30	V
V_{GSM}	Transient Gate-Source Voltage	–	±40	
I_D	Drain Current	T_c = 25 °C	46	A
I_{DM}	Peak Drain Current	T_c = 25 °C, pulse width limited by $T_{vj(max)}$	92	
I_{AS}	Non-Repetitive Single Pulse Avalanche Current	T_c = 25 °C	10	A
E_{AS}	Non-Repetitive Single Pulse Avalanche Energy	T_c = 25 °C	1.3	J
I_S	Diode Forward Current	V_{GS} = 0 V	46	A
I_{SM}	Diode Peak Forward Current	Repetitive, pulse width limited by $T_{vj(max)}$	184	A
dv/dt	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	660	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_t	Mounting Torque For Terminal Screws	–	1.13 / 10	Nm/lb.in

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-Source Threshold Voltage	I_D = 4 mA, V_{GS} = V_{DS}	3.5	–	5.5	V
I_{GSS}	Gate 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	mA
$R_{DS(on)}$	Drain-Source On-Resistance[1]	V_{GS} = 10 V, I_D = 0.5 × I_{D25}	–	–	69	mΩ

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

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 × I_{D25}	24	38	–	S
$R_{g(int)}$	Internal Gate Resistance	–	–	0.9	–	Ω
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	–	4640	–	pF
C_{oss}	Output Capacitance		–	2070	–	
C_{rss}	Reverse Transfer Capacitance		–	1.6	–	
$C_{o(er)}$	Effective Output Capacitance – Energy Related	V_{GS} = 0 V, V_{DS} = 0.8 × V_{DSS}	–	173	–	pF
$C_{o(tr)}$	Effective Output Capacitance – Time Related		–	634	–	
Q_G	Total Gate Charge	V_{GS} = 10 V, V_{DS} = 0.5 × V_{DSS}, I_D = 0.5 × I_{D25}	–	90	–	nC
Q_{GS}	Gate-Source Charge		–	29	–	
Q_{GD}	Gate-Drain Charge		–	32	–	
$t_{d(on)}$	Turn-On Delay Time	Resistive Switching, V_{GS} = 10 V, V_{DS} = 0.5 × V_{DSS}, I_D = 0.5 × I_{D25}, $R_{G(ext)}$ = 3 Ω	–	28	–	ns
t_r	Rise Time		–	21	–	
$t_{d(off)}$	Turn-Off Delay Time		–	53	–	
t_f	Fall Time		–	12	–	

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

Electrical Characteristics - Body diode (T_{vj} = 25°C unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{SD}	Diode Forward Voltage[1]	$I_F = I_S$, V_{GS} = 0 V	–	–	1.4	V
t_{rr}	Reverse Recovery Time	I_F = 23 A, $-di_S/dt$ = 100 A/µs, V_R = 100 V, V_{GS} = 0 V	–	206	–	ns
Q_{rr}	Reverse Recovery Charge		–	1.90	–	µC
I_{rrm}	Peak Reverse Recovery Current		–	18.6	–	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 - MOSFET	–	–	0.19	K/W
$R_{th(c-h)}$	Thermal Resistance Case To Heat Sink - MOSFET	–	0.21	–	K/W

Package

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
G	Weight	–	–	–	6	g

Characteristic Curves

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

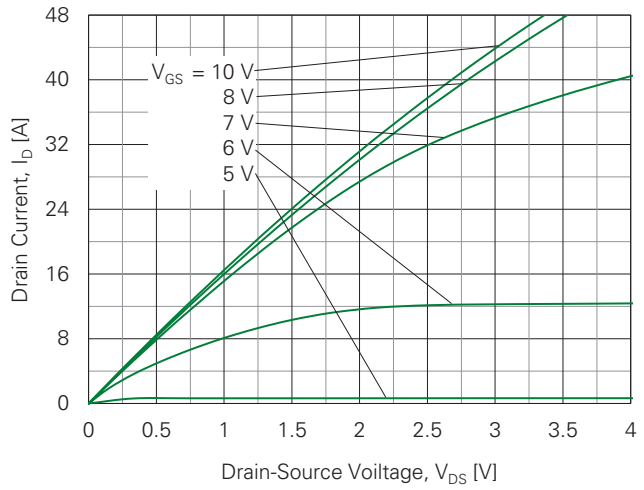


Fig. 2. Typical Extended Output Characteristics @ T_{vj} = 25 °C

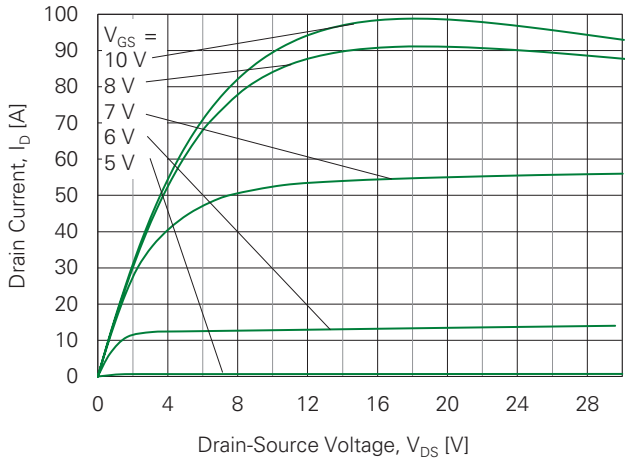


Fig. 3. Typical Output Characteristics @ T_{vj} = 125 °C

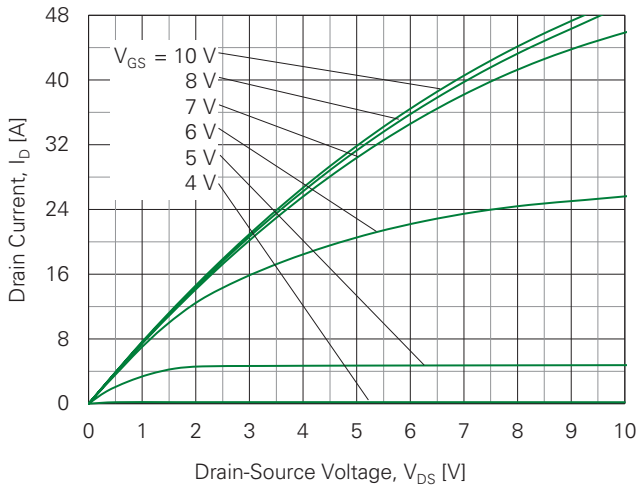


Fig. 4. Typical Drain-Source On-State Resistance (Normalized to I_D = 23 A) vs. Virtual Junction Temperature

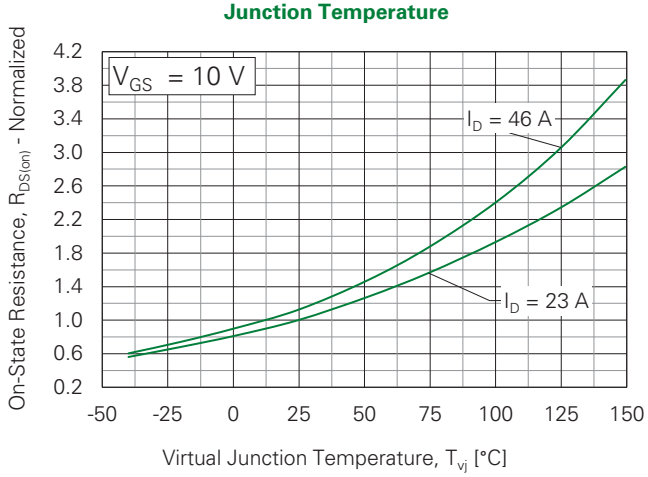


Fig. 5. Typical Drain-Source On-State Resistance (Normalized to I_D = 23 A) vs. Drain Current

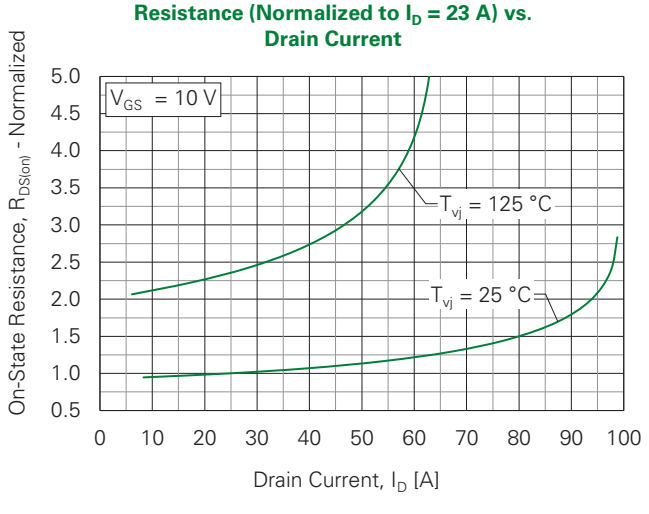


Fig. 6. Typical $V_{(BR)DSS}/V_{GS(th)}$ (Normalized) vs. Virtual Junction Temperature

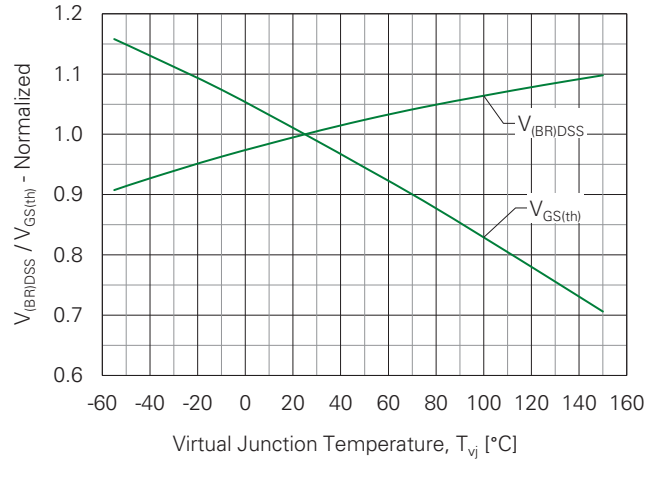


Fig. 7. Maximum Drain Current vs. Case Temperature

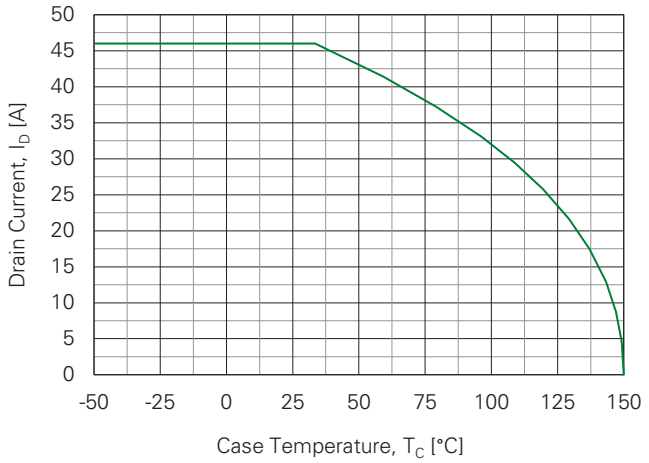


Fig. 8. Typical Transfer Characteristics

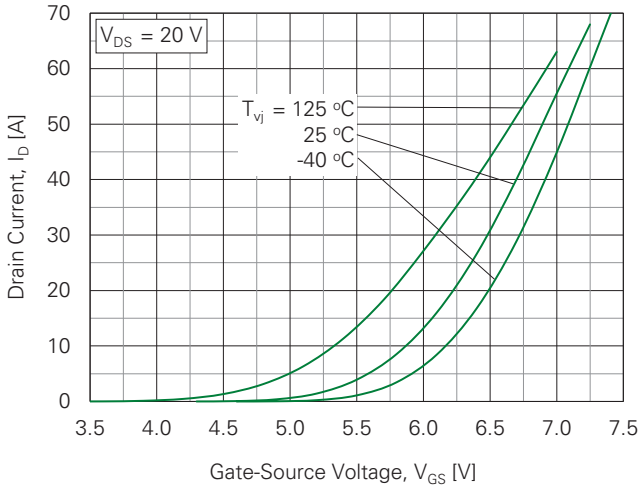


Fig. 9. Typical Transconductance

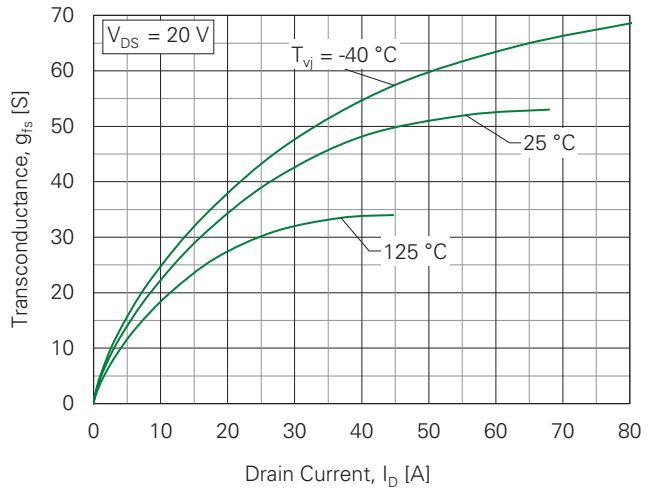


Fig. 10. Forward Voltage Drop of Intrinsic Diode

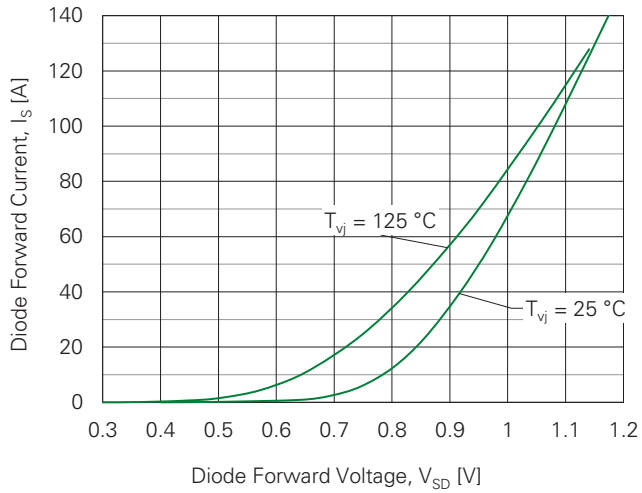


Fig. 11. Typical Gate Charge Characteristics

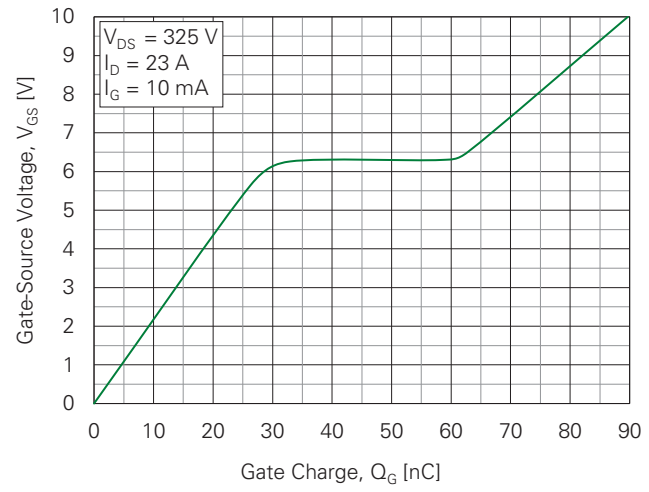


Fig. 12. Typical Junction Capacitance Characteristics

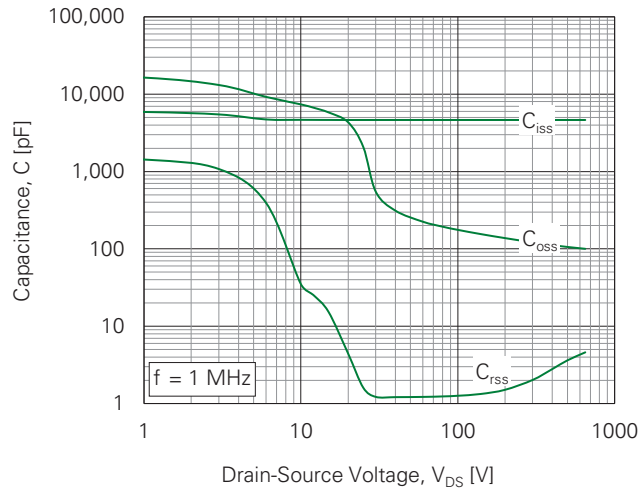


Fig. 13. Typical Output Charge Capacitance Energy vs. Drain-Source Voltage

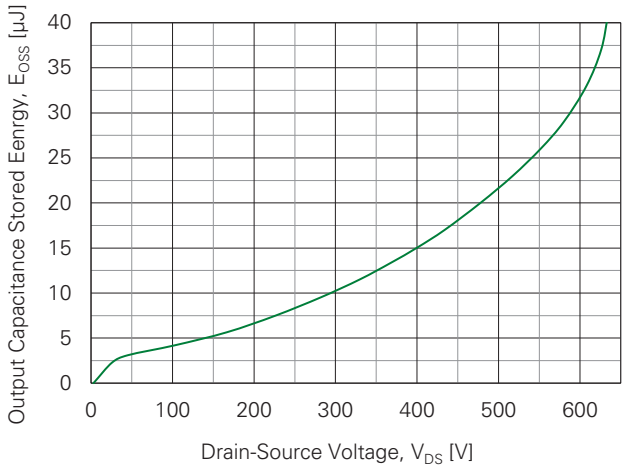


Fig. 14. Forward-Bias Safe Operating Area (FBSOA)

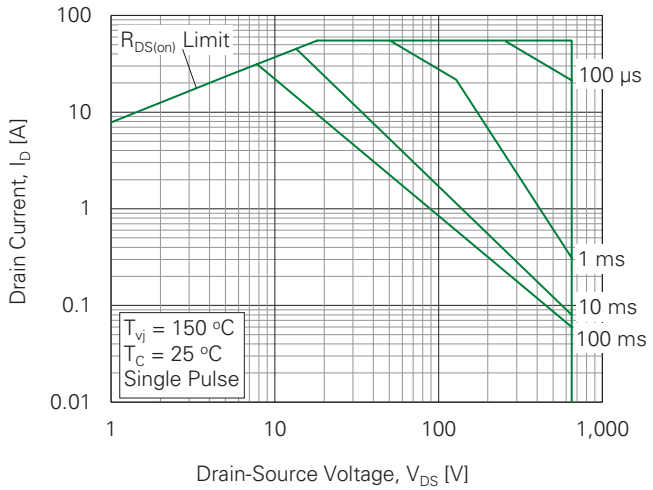
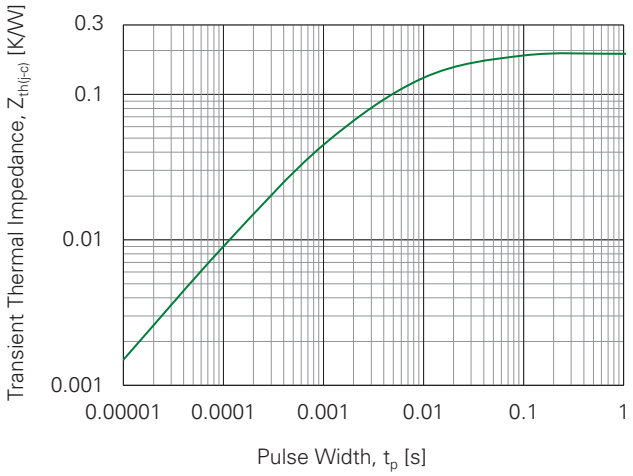
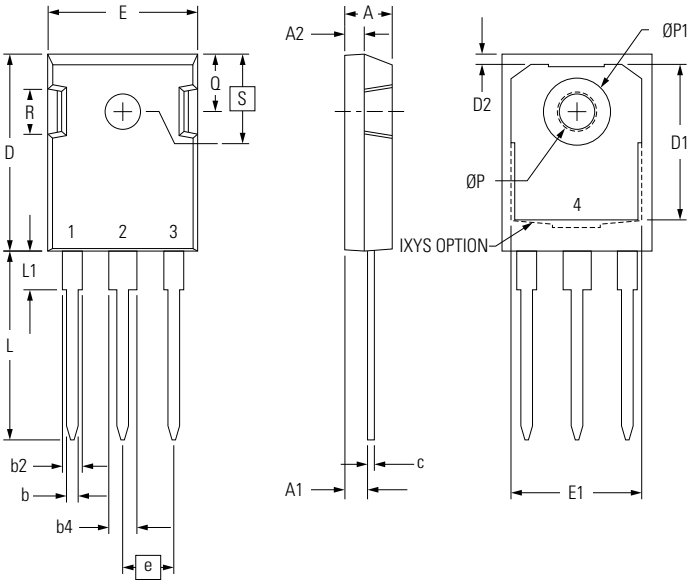


Fig. 15. Typical Transient Thermal Impedance - MOSFET



Part Outline Drawing TO-247 (IXFH)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	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		
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	4.62	–	4.83
S	0.242 BSC			6.15 BSC		

Ordering Information

Orderable Part Number	Package Type	Shipping Form	Shipping Quantity
IXFH46N65X2	TO-247 AD	Tube	30