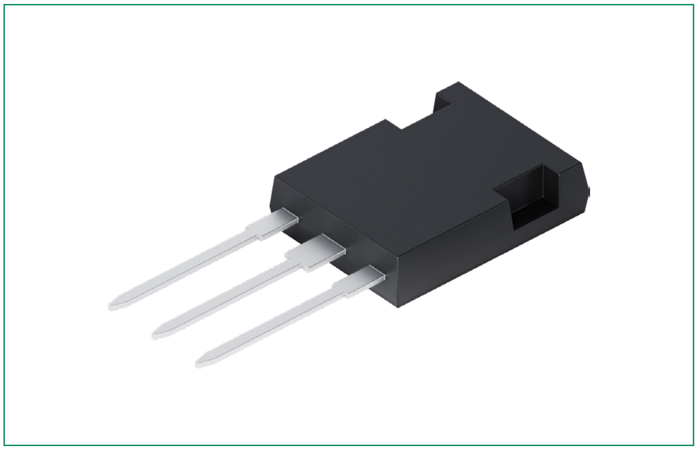
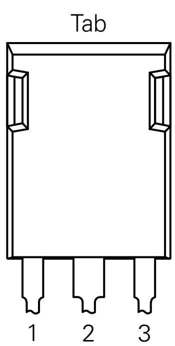
IXTX400N20X4

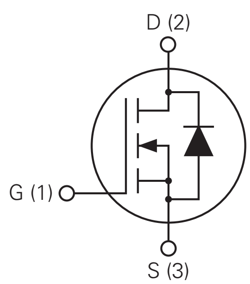
200 V, 3.3 mΩ, 400 A X4-Class Power MOSFET

N-Channel Enhancement Mode, Avalanche Rated



Pinout Diagram PLUS247 (IXTX)





1: Gate; **2:** Drain; **3:** Source; **Tab:** Drain

Features

- Low on-state resistance
- High nominal current rating
- Low gate charge
- Low thermal resistance

Benefits

- Low conduction losses, improved efficiency
- Minimized parallel connection effort with decreased part count
- Simplified driver design
- Simplified thermal design

PLUS247 Package

- PLUS package enabling higher nominal current rating and increased power density
- Pin compatibility with standard TO-247 package
- Easy upgrade of existing designs for higher power output

Applications

- DC load switch
- Battery protection
- Battery OR-ing
- Battery energy storage systems
- DC/DC buck-boost converters

Product Summary

Characteristic	Value	Unit
V_{DSS}	200	V
I_D @ 25°C (chip limit)	400	A
I_D @ 25°C (package terminal limit)	160	A
$R_{DS(on)}$	≤ 3.3	mΩ

Revised: XZ 11/25/2025 (0.7)

Maximum Ratings (T_{vj} = 25°C unless otherwise specified)

Symbol	Characteristic	Conditions	Value	Unit
V_{DSS}	Drain-source voltage	T_{vj} = 25 °C to 175 °C	200	V
V_{GSS}	Gate-source voltage	Continuous	±20	V
V_{GSM}		Transient	±30	V
I_D	Drain current[1]	T_c = 25°C	400	A
I_{DM}	Peak drain current	T_c = 25 °C, pulse width limited by $T_{vj(max)}$	1100	A
I_{tRMS}	Terminal RMS current	–	160	A
I_{AS}	Single pulse avalanche current	T_c = 25 °C	200	A
E_{AS}	Single pulse avalanche energy	T_c = 25°C	4	J
dv/dt	Diode dv/dt capability	$I_S \leq I_{DM}$, $V_{DD} \leq V_{DSS}$, $T_{vj} \leq$ 150 °C	50	V/ns
P_{tot}	Power dissipation	T_c = 25°C	1360	W
T_{vj}	Virtual junction temperature range	–	−55 to +175	°C
$T_{vj(max)}$	Maximum virtual junction temperature range	–	175	
T_{stg}	Storage temperature range	–	−55 to +175	
T_{sold}	Soldering temperature	1.6 mm (0.062 in.) from case for 10 s	300	°C
F_C	Mounting force	–	20..120/4.5..27	N/lb
W	Package weight	–	6	g

Note 1: Terminal current limit to be taken into account

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance junction to case	–	–	0.11	K/W
$R_{th(c-s)}$	Thermal resistance case to heat sink (thermal grease commonly utilized)	–	0.05	–	K/W

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	200	–	–	V
$V_{GS(th)}$	Gate threshold voltage	I_D = 250 µA, V_{GS} = V_{DS}	2.5	–	4.5	V
I_{GSS}	Gate-source leakage current	V_{DS} = 0 V, V_{GS} = ±20 V	–	–	±200	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} = 150 °C	–	–	3	mA
$R_{DS(on)}$	Drain-source on-resistance[2]	V_{GS} = 10 V, I_D = 100 A	–	–	3.30	mΩ

Note 2: 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[2]	V_{DS} = 10 V, I_D = 60 A	135	185	–	S
$R_{g(int)}$	Gate input resistance	–	–	1.26	–	Ω
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	–	27.7	–	nF
C_{oss}	Output capacitance		–	3.1	–	nF
C_{rss}	Reverse transfer capacitance		–	15	–	pF
$C_{o(er)}$	Effective output capacitance – energy related	V_{GS} = 0 V, V_{DS} = 0.8 × V_{DSS}	–	1.78	–	nF
$C_{o(tr)}$	Effective output capacitance – time related		–	7.47	–	
Q_G	Total gate charge	V_{GS} = 10 V, V_{DS} = 0.5 × V_{DSS}, I_D = 200 A	–	348	–	nC
Q_{GS}	Gate-source charge		–	118	–	
Q_{GD}	Gate-drain charge		–	80	–	
$t_{d(on)}$	Turn-on delay time	**Resistive Switching** V_{GS} = 10 V, V_{DS} = 0.5 × V_{DSS}, I_D = 200 A, $R_{G(ext)}$ = 10 Ω	–	150	–	ns
t_r	Rise time		–	480	–	
$t_{d(off)}$	Turn-off delay time		–	430	–	
t_f	Fall time		–	370	–	

Note 2: 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	–	–	400	A
I_{SM}	Diode pulse current	Repetitive, pulse width limited by $T_{vj(max)}$	–	–	1600	A
V_{SD}	Diode forward voltage[2]	I_F = 100 A, V_{GS} = 0 V	–	–	1.4	V
t_{rr}	Reverse recovery time	I_F = 100 A, −di/dt = 300 A/µs, V_R = 100 V, V_{GS} = 0 V	–	270	–	ns
Q_{rr}	Reverse recovery charge		–	1.75	–	µC
I_{rrm}	Peak reverse recovery current		–	35	–	A

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

Characteristic Curves

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

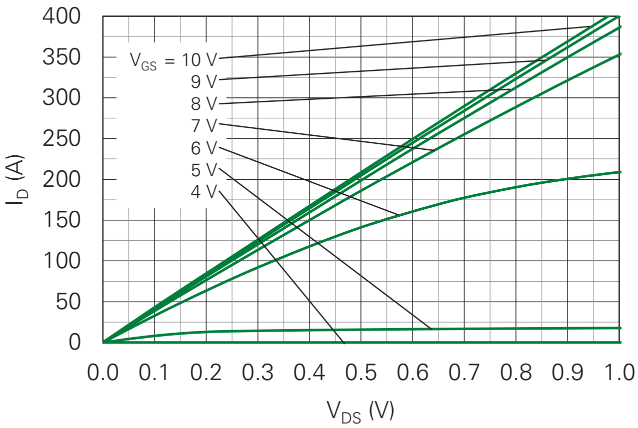


Fig. 2. Extended Output Characteristics @ T_{vj} = 25 °C

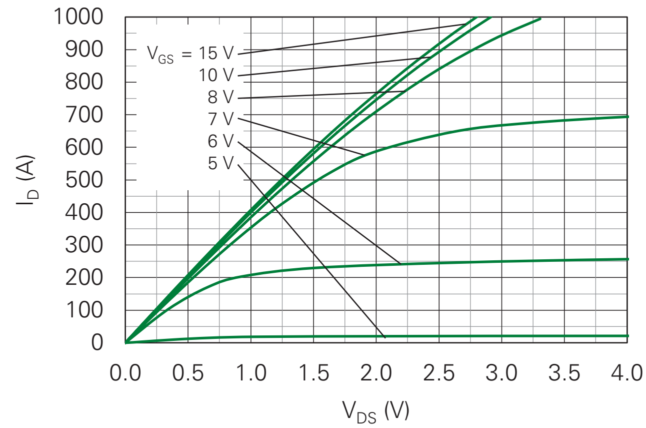


Fig. 3. Output Characteristics @ T_{vj} = 150 °C

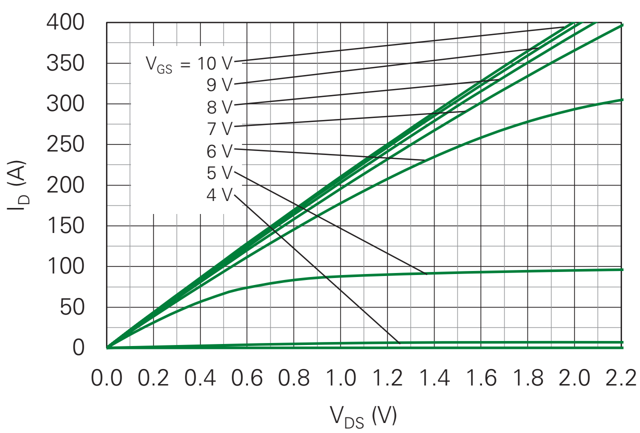


Fig. 4. $R_{DS(on)}$ Normalized to I_D = 200 A Value vs. Junction Temperature

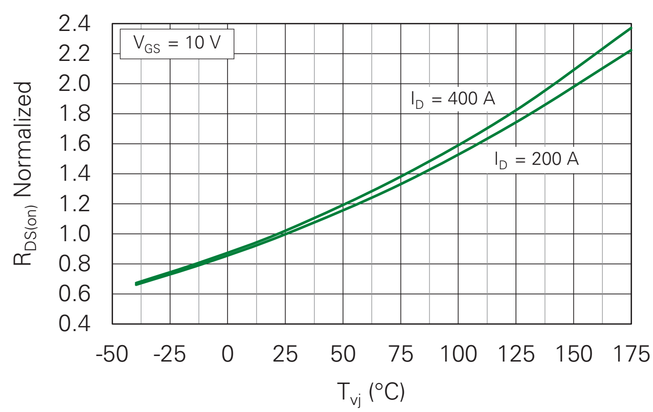


Fig. 5. $R_{DS(on)}$ Normalized to I_D = 200 A vs. Drain Current

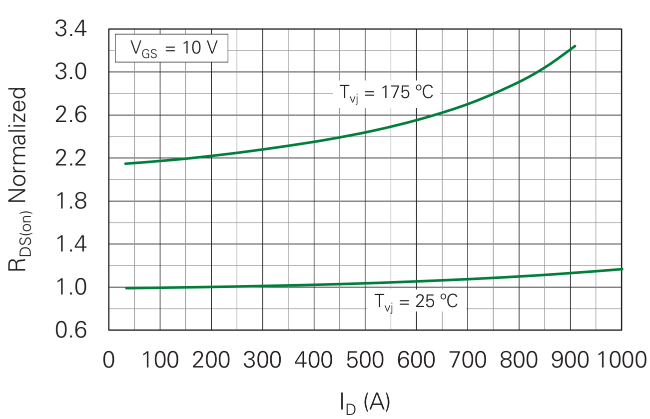


Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature

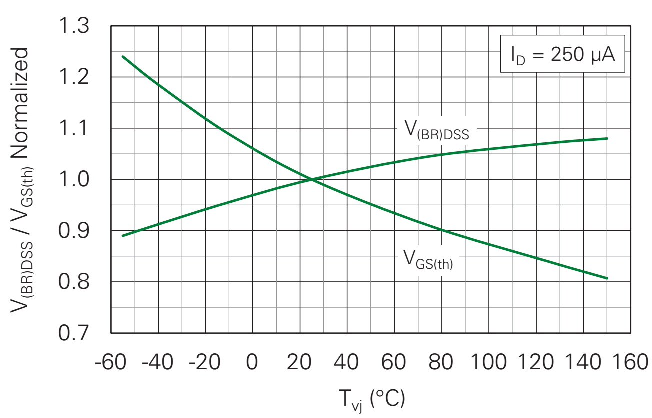


Fig. 7. Drain Current vs. Case Temperature

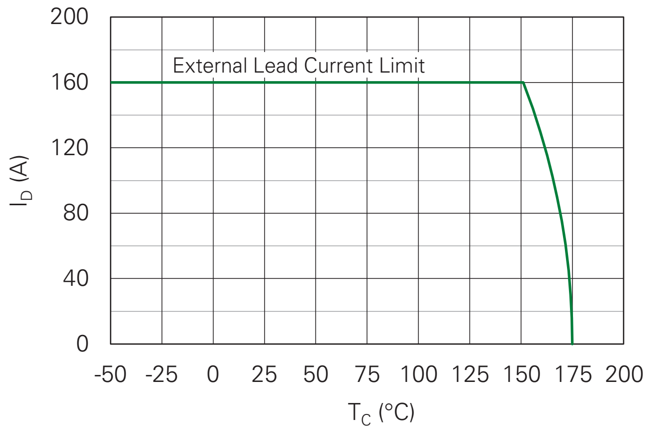


Fig. 8. Input Admittance

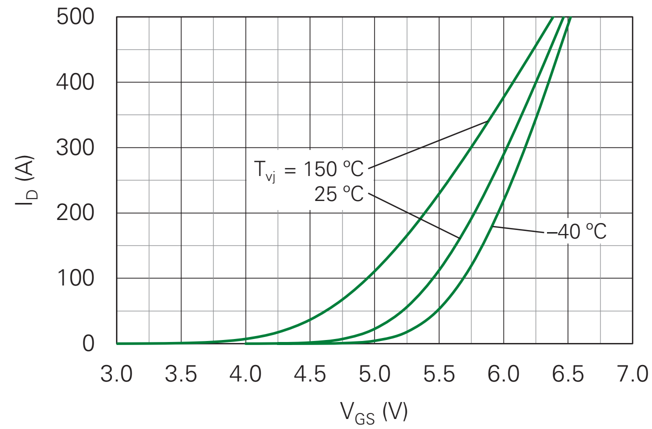


Fig. 9. Transconductance

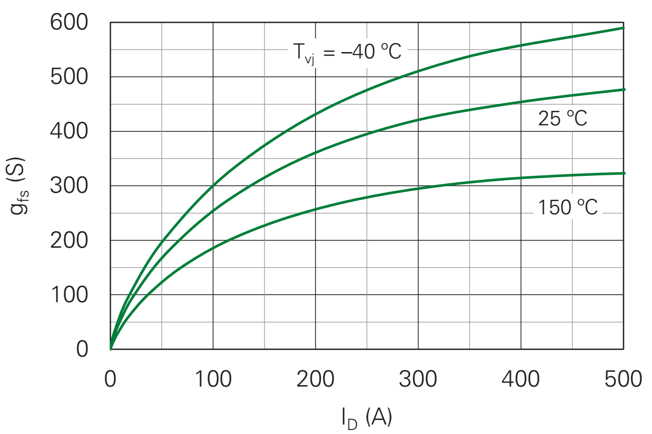


Fig. 10. Forward Voltage Drop of Intrinsic Diode

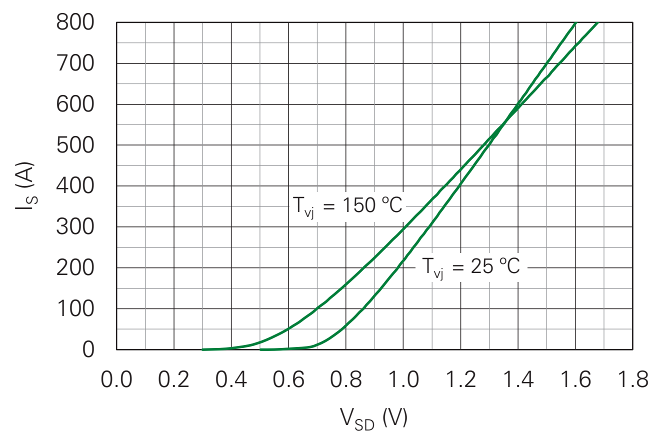


Fig. 11. Gate Charge

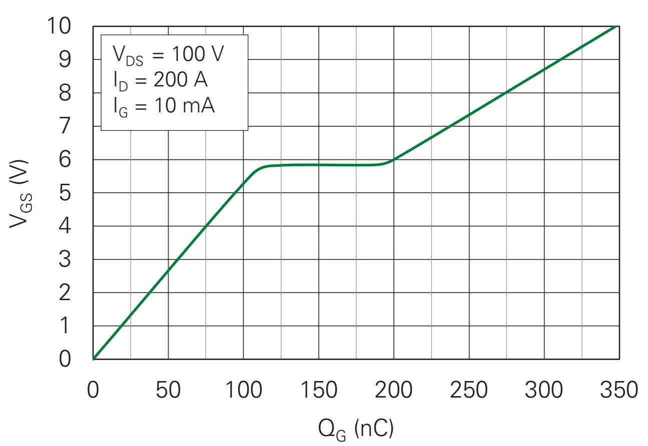


Fig. 12. Capacitance

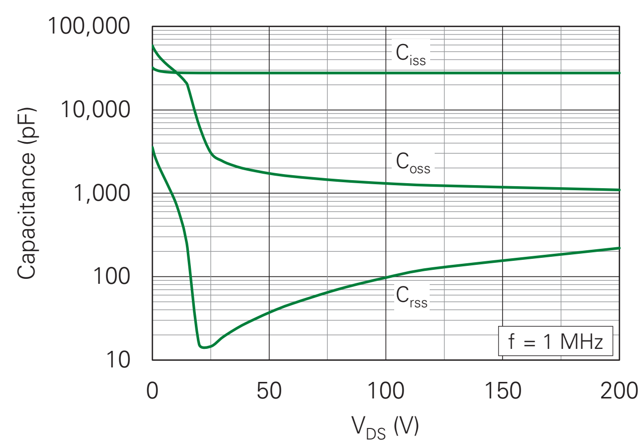


Fig. 13. Output Capacitance Stored Energy

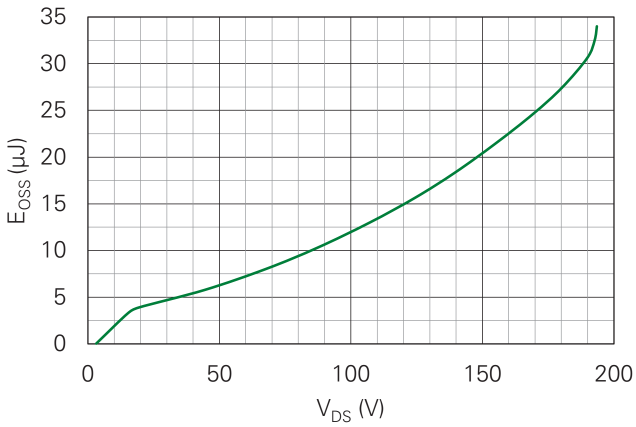


Fig. 14. Forward-Bias Safe Operating Area

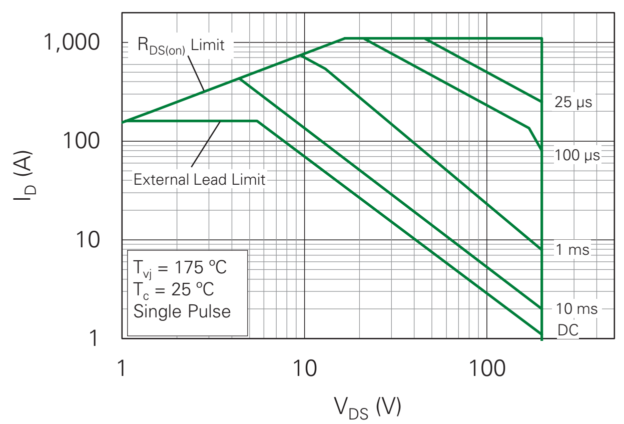


Fig. 15. Resistive Switching Times vs. Gate Resistance @ I_D = 100A

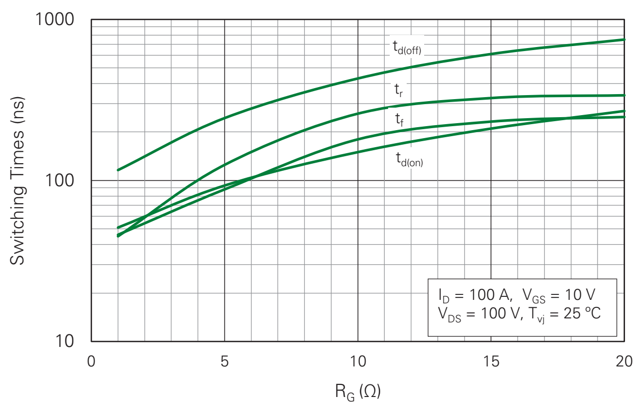
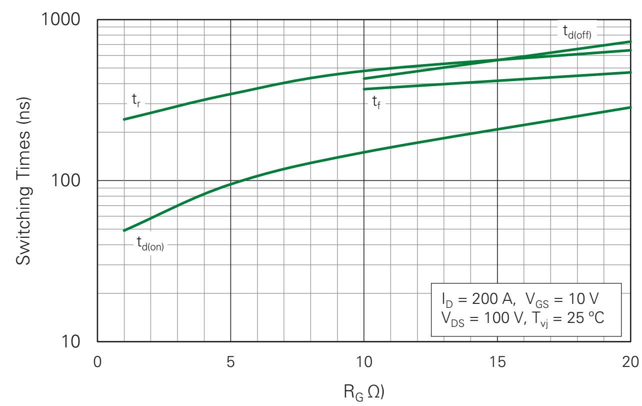


Fig. 16. Resistive Switching Times vs. Gate Resistance @ I_D = 200 A



R_G < 10 Ohm not recommended for turn-off.

Fig. 17. Resistive Switching Times vs. Drain Current

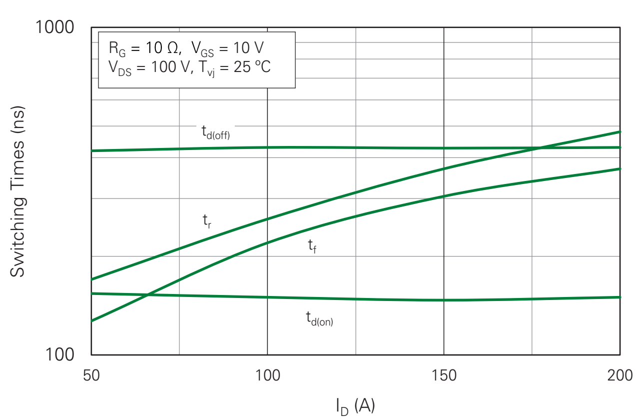
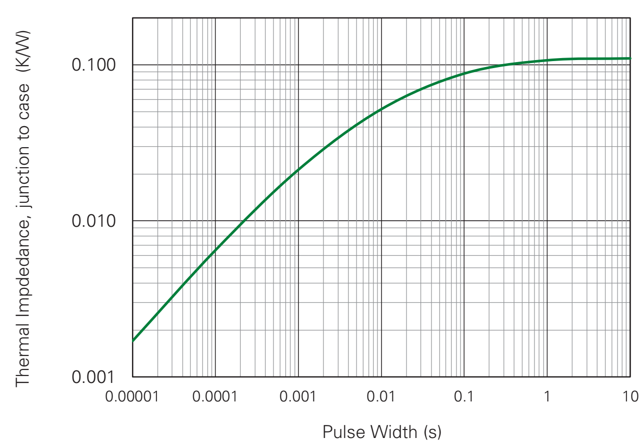
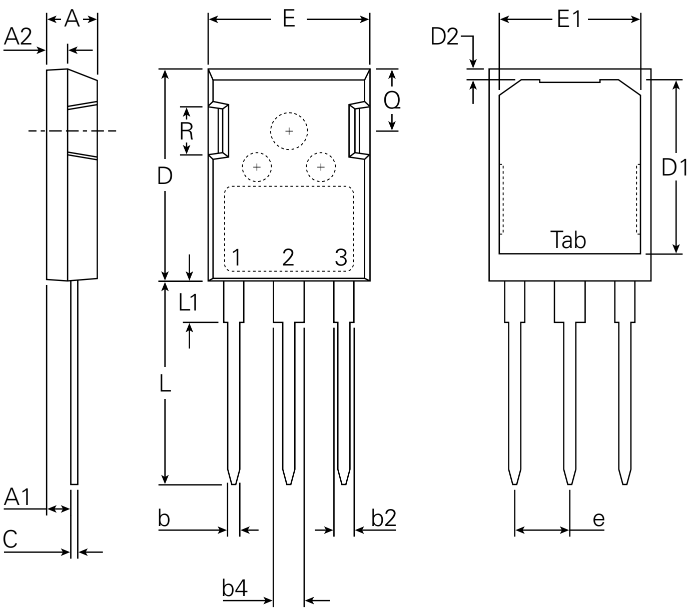


Fig. 18. Maximum Transient Thermal Impedance



Part Outline Drawing PLUS247 (IXTX)



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	15.75	–	16.13
E1	0.520	–	0.560	13.08	–	14.22
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
Q	0.220	–	0.244	5.59	–	6.20
R	0.170	–	0.190	4.32	–	4.83