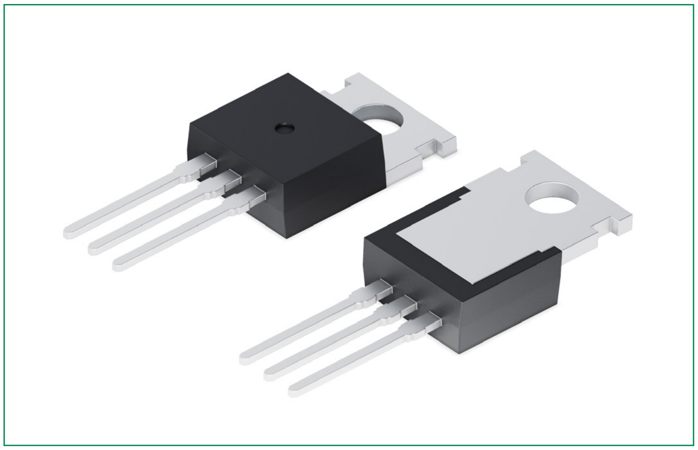
IXTP86N20X4

200 V, 13 mΩ X4-Class Power MOSFET™



Features:

- International Standard Package
- Low $R_{DS(ON)}$ and Q_G
- Avalanche Rated
- Low Package Inductance

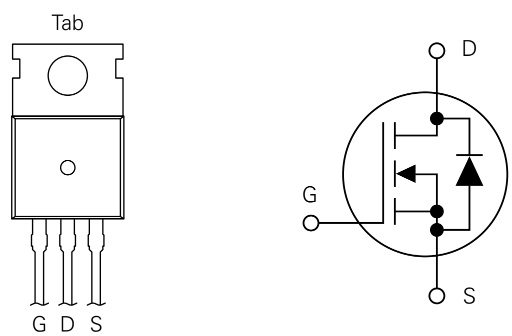
Advantages:

- 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

Pinout Diagram (TO-220-3L)



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

Product Summary

Characteristic	Value	Unit
V_{DSS}	200	V
I_{D25}	86	A
$R_{DS(on)}$	13	mΩ

Revised: XZ 05/16/2023

Maximum Ratings

Symbol	Characteristics	Conditions	Value	Units
V_{DSS}	Drain-Source Voltage	T_J = 25°C to 175°C	200	V
V_{DGR}	Drain-Gate Voltage	T_J = 25°C to 175°C, R_{GS} = 1 MΩ	200	V
V_{GS}	Gate-Source Voltage	Continuous	±20	V
V_{GSM}		Transient	±30	
I_{D25}	Drain Current	T_C = 25°C	86	A
I_{DM}		T_C = 25°C, Pulse width limited by T_{JM}	160	
I_A	Avalanche Current	T_C = 25°C	43	A
E_{AS}	Avalanche Energy	T_C = 25°C	500	mJ
dV/dt	Reverse Diode dV/dt	$I_S \le I_{DM}$, $V_{DD} \le V_{DSS}$, $T_J \le$ 150°C	50	V/ns
P_D	Power Dissipation	T_C = 25°C	300	W
T_J	Operating Junction Temperature	–	-55 to +175	°C
T_{JM}	Maximum Junction Temperature	–	175	
T_{stg}	Storage Temperature	–	-55 to +175	
T_L	Lead Temperature for Soldering	1.6 mm (0.062 in.) from case for 10 s	300	°C
M_D	Mounting Torque	–	1.13 / 10	Nm/lb.in
W	Weight	–	3	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th,\ JC}$	Thermal Resistance, junction-to-case	–	–	0.50	°C/W
$R_{th,\ CS}$	Thermal Resistance, case-to-sink	–	0.50	–	°C/W

Electrical Characteristics – Static (T_J = 25°C unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
BV_{DSS}	Drain-Source Breakdown Voltage	I_D = 250 µA, V_{GS} = 0 V	200	–	–	V
$V_{GS(th)}$	Gate Threshold Voltage	I_D = 250 µA, $V_{DS} = V_{GS}$	2.5	–	4.5	V
I_{GSS}	Gate-Source Leakage Current	V_{DS} = 0 V, V_{GS} = ±20 V	–	–	±100	nA
I_{DSS}	Drain-Source Current	$V_{DS} = V_{DSS}$, V_{GS} = 0 V	–	–	5	µA
		$V_{DS} = V_{DSS}$, V_{GS} = 0 V, T_J = 150°C	–	–	300	µA
$R_{DS(on)}$	Drain-Source On-Resistance[1]	V_{GS} = 10 V, I_D = 0.5 x I_{D25}	–	11	13	mΩ

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

Electrical Characteristics – Dynamic (T_J = 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}	50	82	–	S
R_{Gi}	Gate Input Resistance	–	–	4.75	–	Ω
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 25 V, f = 1MHz	–	2250	–	pF
C_{oss}	Output Capacitance		–	660	–	pF
C_{rss}	Reverse Transfer Capacitance		–	185	–	pF
$Q_{g(on)}$	Total Gate Charge	V_{GS} = 10 V, V_{DS} = 0.5 x V_{DSS}, I_D = 0.5 x I_{D25}	–	70	–	nC
Q_{gs}	Gate-Source Charge		–	20	–	
Q_{gd}	Gate-Drain Charge		–	38	–	
$t_{d(on)}$	Turn-on Delay Time	**Resistive Switching** V_{GS} = 10 V, V_{DS} = 0.5 x V_{DSS}, I_D = 0.5 x I_{D25}, $R_{G(ext)}$ = 10 Ω	–	27	–	ns
t_r	Rise Time		–	38	–	
$t_{d(off)}$	Turn-off Delay Time		–	76	–	
t_f	Fall Time		–	35	–	

Source-Drain Diode Characteristics (T_J = 25°C unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
I_S	Continuous Diode Forward Current	V_{GS} = 0 V	–	–	86	A
I_{SM}	Diode Pulse Current	Repetitive, Pusle width limited by T_{JM}	–	–	344	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 = 43 A, –di/dt = 200 A/μs, V_r = 100 V	–	96	–	ns
I_{rm}	Reverse Recovery Charge		–	16.7	–	A
Q_{rm}	Reverse Recovery Current		–	0.8	–	μC

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

Characteristic Curves

Fig. 1. Output Characteristics @ T_J = 25ºC

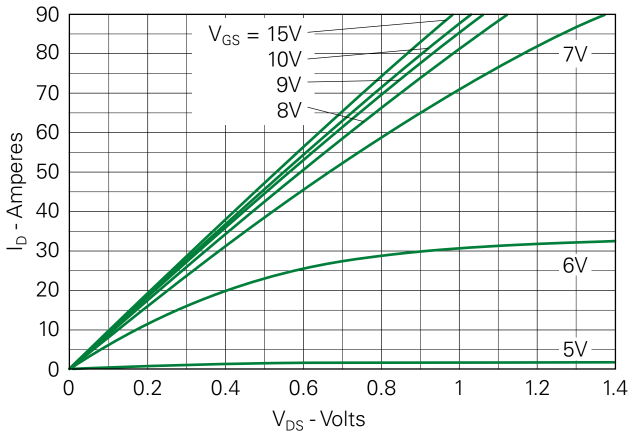


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

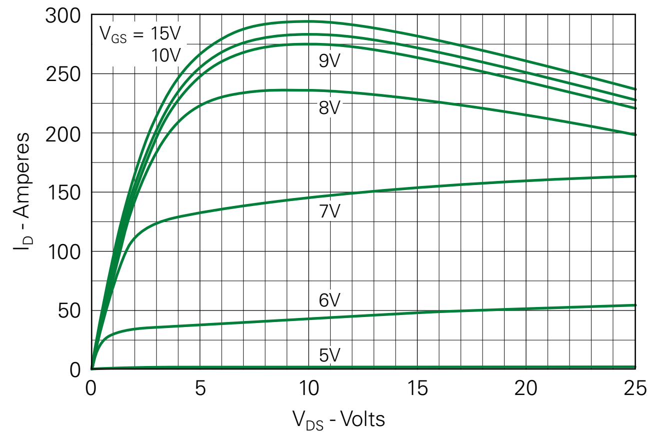


Fig. 3. Output Characteristics @ T_J = 150ºC

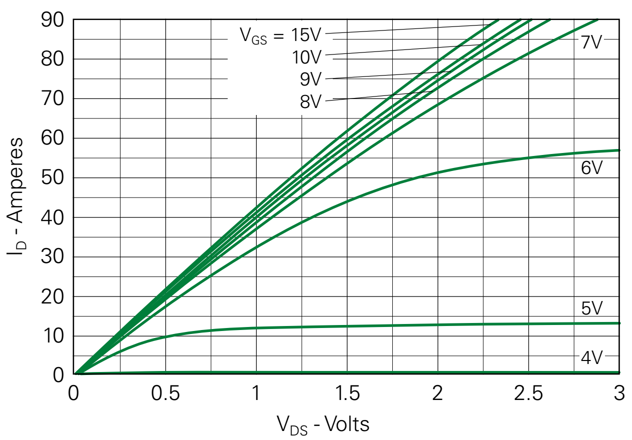


Fig. 4. $R_{DS(on)}$ Normalized to I_D = 43A Value vs. Junction Temperature

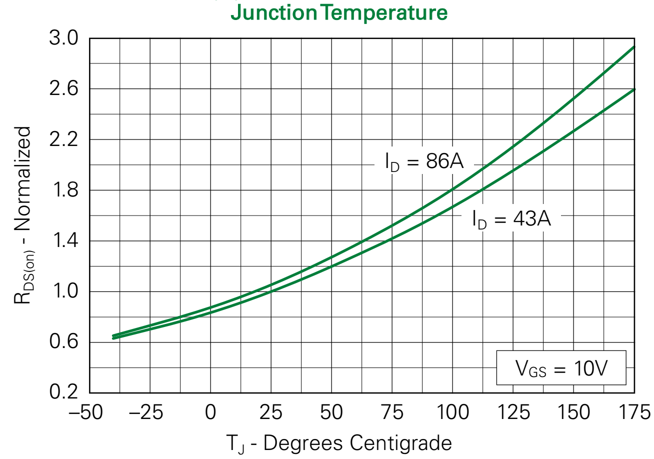


Fig. 5. $R_{DS(on)}$ Normalized to I_D = 43A Value vs. Drain Current

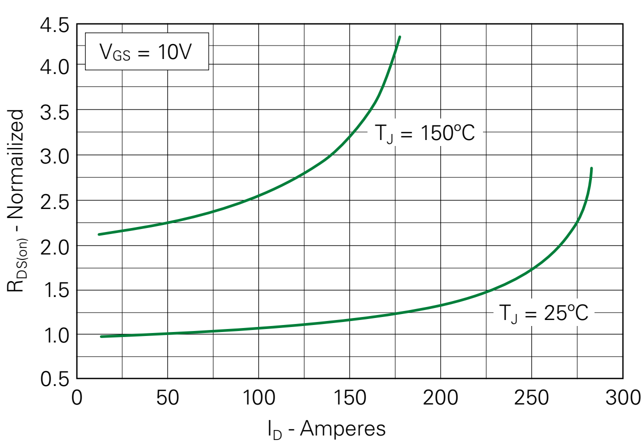
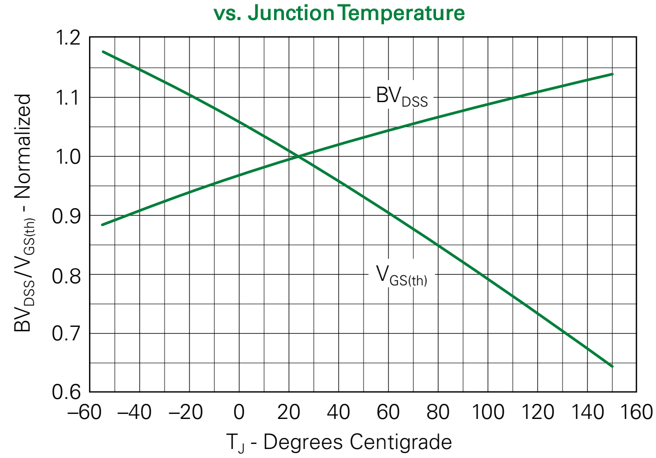


Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature



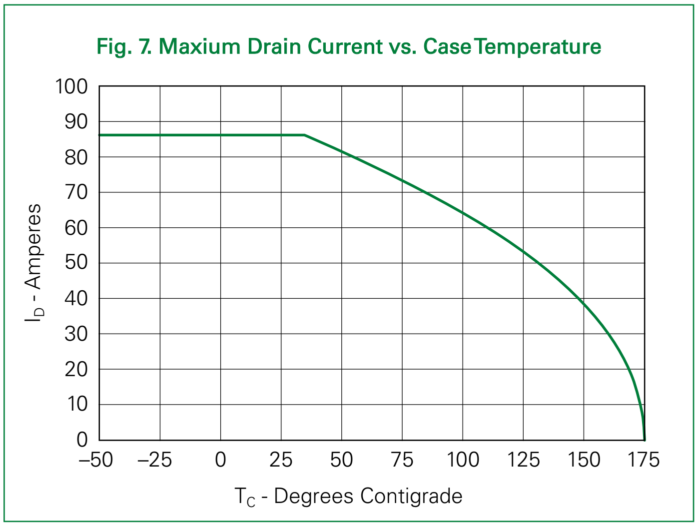


Fig. 7. Maxium Drain Current vs. Case Temperature
100
90
80
70
60
50
40
30
20
10
0
–50
–25
0
25
50
75
100
125
150
175
I_D - Amperes
T_C - Degrees Contigrade

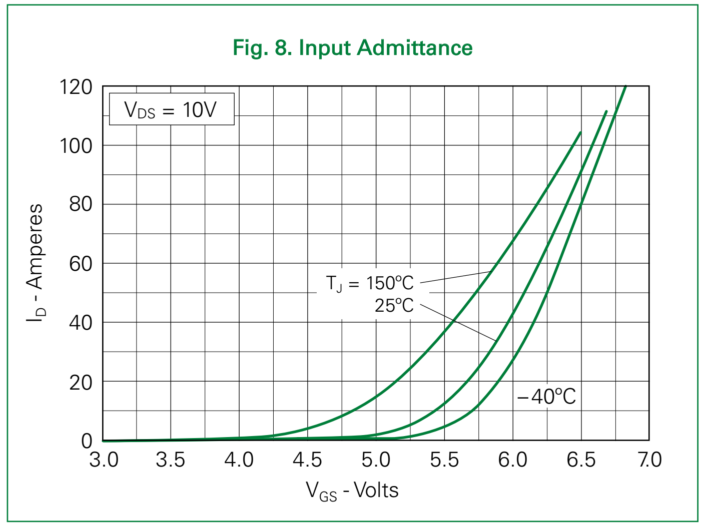


Fig. 8. Input Admittance
V_{DS} = 10V
T_J = 150ºC
25ºC
−40ºC
120
100
80
60
40
20
0
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
I_D - Amperes
V_{GS} - Volts

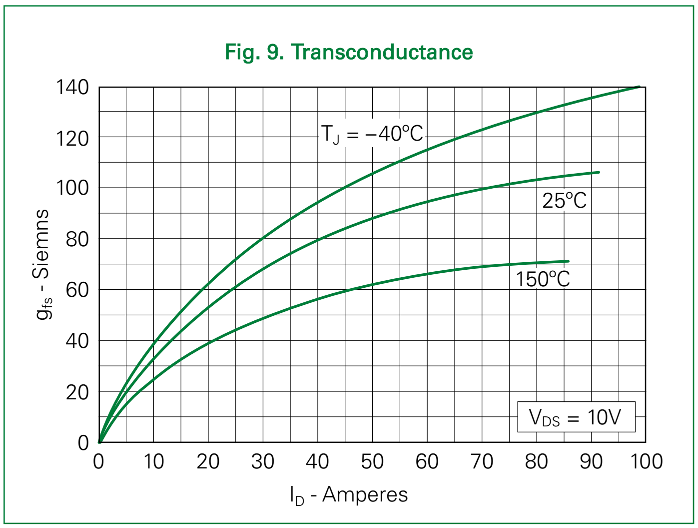


Fig. 9. Transconductance
T_J = −40ºC
25ºC
150ºC
V_{DS} = 10V
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
g_{fs} - Siemns
I_D - Amperes

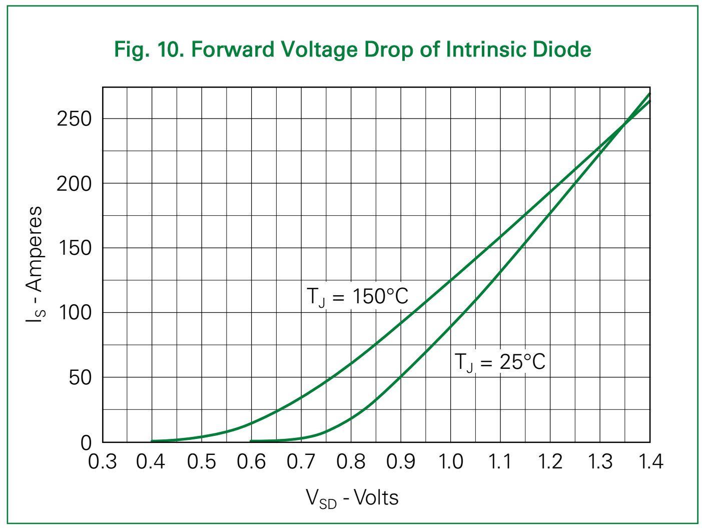


Fig. 10. Forward Voltage Drop of Intrinsic Diode
T_J = 150ºC
T_J = 25ºC
250
200
150
100
50
0
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
I_S - Amperes
V_{SD} - Volts

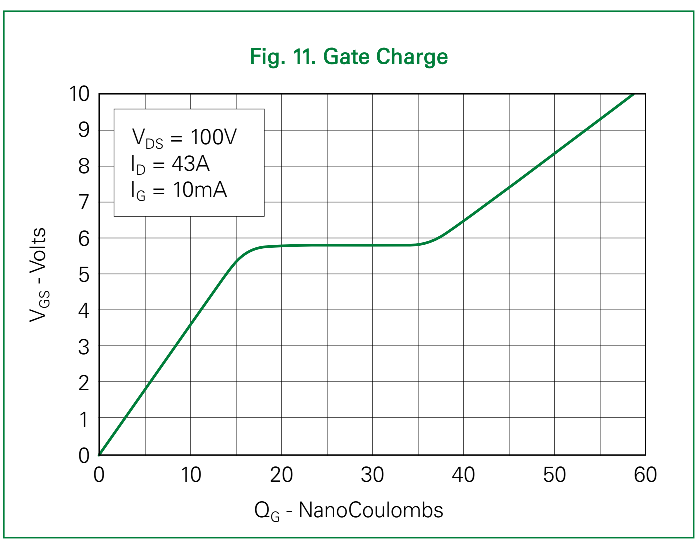


Fig. 11. Gate Charge
V_{DS} = 100V
I_D = 43A
I_G = 10mA
10
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
V_{GS} - Volts
Q_G - NanoCoulombs

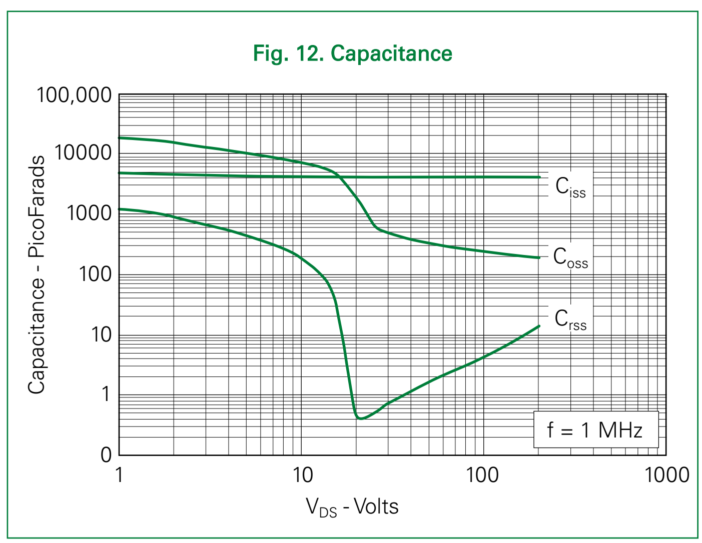


Fig. 12. Capacitance
C_{iss}
C_{oss}
C_{rss}
f = 1 MHz
100,000
10000
1000
100
10
1
0
1
10
100
1000
Capacitance - PicoFarads
V_{DS} - Volts

Fig. 13. Output Capacitance Stored Energy

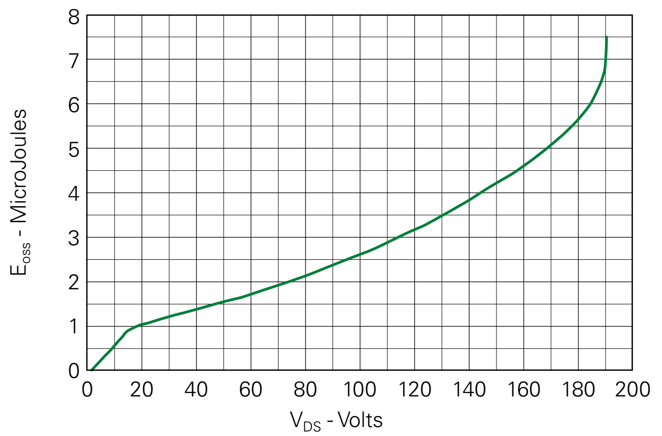


Fig. 14. Forward-Bias Safe Operating Area

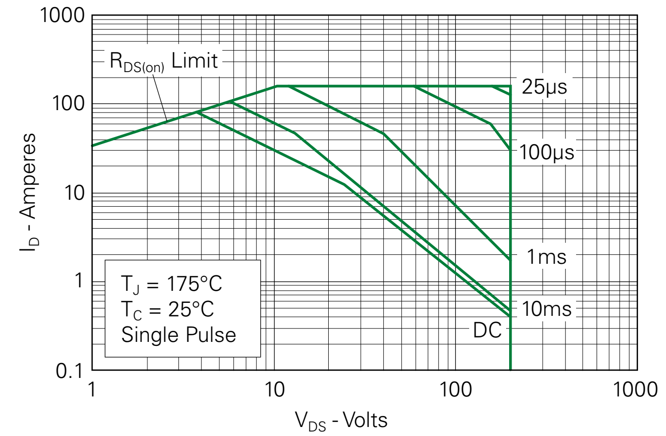
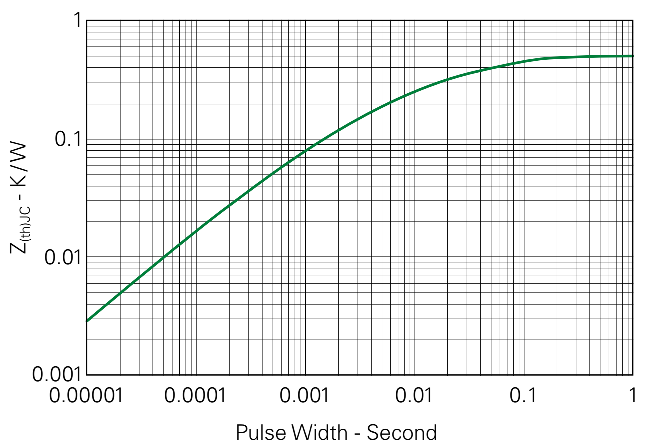
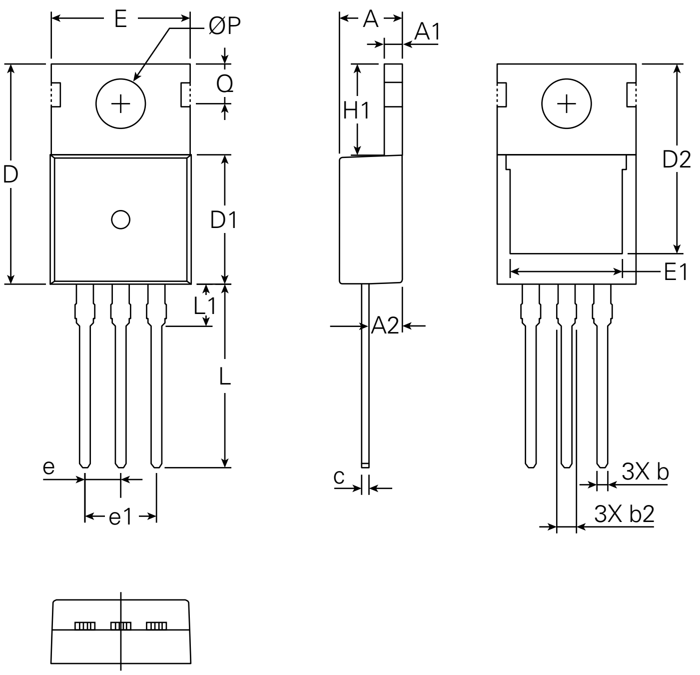


Fig. 15. Maximum Transient Thermal Impedance



Part Outline Drawing (TO-220-3L)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.169	–	0.185	4.30	–	4.70
A1	0.047	–	0.055	1.20	–	1.40
A2	0.079	–	0.106	2.00	–	2.70
b	0.024	–	0.039	0.60	–	1.00
b2	0.045	–	0.057	1.15	–	1.45
c	0.014	–	0.026	0.35	–	0.65
D	0.587	–	0.626	14.90	–	15.90
D1	0.335	–	0.370	8.50	–	9.40
(D2)	0.500	–	0.531	12.70	–	13.50
E	0.382	–	0.406	9.70	–	10.30
(E1)	0.283	–	0.323	7.20	–	8.20
e	0.100 BSC			2.45 BSC		
e1	0.200 BSC			5.08 BSC		
H1	0.244	–	0.268	6.20	–	6.80
L	0.492	–	0.547	12.50	–	13.90
L1	0.110	–	0.154	2.80	–	3.90
ØP	0.134	–	0.150	3.40	–	3.80
Q	0.106	–	0.126	2.70	–	3.20