

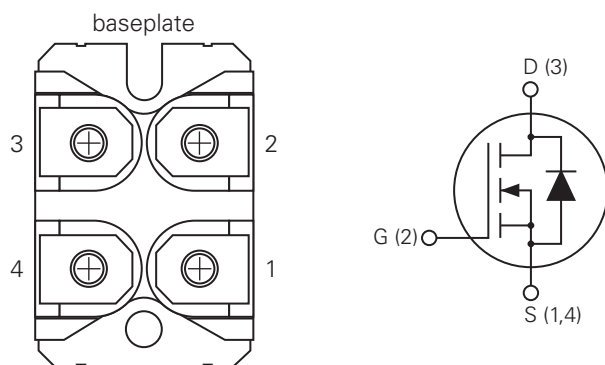
IXTN400N20X4

200 V, 3.0 m Ω , 340 A X4-Class Power MOSFET

N-Channel Enhancement Mode, Avalanche Rated



Pinout Diagram (SOT-227B, miniBLOC™)



3: Drain; **2:** Gate; **1, 4:** Source, **baseplate:** Isolated

Features

- Low $R_{DS(on)}$ and high current capability
- Low gate charge Q_g
- Compact design with high power density

Benefits

- Minimized parallel connection effort with decreased part count
- Simplified driver reduces design effort
- Cost-efficient solution with ease of assembly

SOT-227B Package

- Aluminum Nitride ceramic-based isolated package improves thermal resistance and power handling capability
- Compact discrete package with electrically isolated baseplate
- Isolation voltage 2500 V AC (RMS), 1 minute
- Low internal lead inductance with higher safety overvoltage margin
- Screw-mounted discrete package enabling rugged and stable mounting

Applications

- DC load switch
- Battery and fuel cell based energy storage systems
- Industrial and process power supplies
- Telecom and data center power supplies
- Battery formation
- Robotics and servo controls

Product Summary

Characteristic	Value	Unit
V_{DSS}	200	V
$I_D @ 25^\circ\text{C}$	340	A
$R_{DS(on)}$	≤ 3.0	m Ω

Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{DSS}	Drain-Source Voltage	$T_{vj} = 25\text{ }^{\circ}\text{C}$ to $175\text{ }^{\circ}\text{C}$	200	V
V_{GSS}	Gate-Source Voltage	Continuous	± 20	V
V_{GSM}		Transient	± 30	
I_{D25}	Drain Current	$T_c = 25\text{ }^{\circ}\text{C}$	340	A
I_{DM}		$T_c = 25\text{ }^{\circ}\text{C}$, Pulse Width Limited by $T_{vj(max)}$	1100	
$I_{L(RMS)}$	Terminal Current Limit	–	200	A
I_A	Avalanche Current	$T_c = 25\text{ }^{\circ}\text{C}$	200	A
E_{AS}	Avalanche Energy	$T_c = 25\text{ }^{\circ}\text{C}$	4	J
dv/dt	Reverse Diode dv/dt	$I_S \leq I_{DM}$, $V_{DD} \leq V_{DSS}$, $T_{vj} \leq 150\text{ }^{\circ}\text{C}$	50	V/ns
P_D	Power Dissipation	$T_c = 25\text{ }^{\circ}\text{C}$	830	W
T_{vj}	Virtual Junction Temperature Range	–	–55 to +175	$^{\circ}\text{C}$
$T_{vj(max)}$	Maximum Virtual Junction Temperature	–	175	
T_{stg}	Storage Temperature Range	–	–55 to +175	
V_{ISOL}	Isolation Voltage	50/60 Hz, $I_{ISOL} \leq 1\text{ mA}$, $t = 1\text{ min}$	2500	V~
		50/60 Hz, $I_{ISOL} \leq 1\text{ mA}$, $t = 1\text{ s}$	3000	
M_d	Mounting Torque	–	1.5/13	Nm/lb.in
	Terminal Connection Torque	–	1.3/11.5	Nm/lb.in
W	Weight	–	30	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th, JC}$	Thermal Resistance, Junction-to-Case	–	–	0.18	K/W
$R_{th, CS}$	Thermal Resistance, Case-to-Sink	–	0.05	–	K/W

Electrical Characteristics – Static ($T_{vj} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	200	–	–	V
$V_{GS(th)}$	Gate Threshold Voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = V_{DS}$	2.5	–	4.5	V
I_{GSS}	Gate-Source Leakage Current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$	–	–	± 200	nA
I_{DSS}	Drain-Source Leakage Current	$V_{DS} = V_{DSS}$, $V_{GS} = 0\text{ V}$	–	–	25	μA
		$V_{DS} = V_{DSS}$, $V_{GS} = 0\text{ V}$, $T_{vj} = 150\text{ }^{\circ}\text{C}$	–	–	3	mA
$R_{DS(on)}$	Drain-Source On-Resistance ¹	$V_{GS} = 10\text{ V}$, $I_D = 100\text{ A}$	–	–	3.00	m Ω

Note 1: Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle, $d \leq 2\%$

Electrical Characteristics – Dynamic $(T_{vj} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
g_{fs}	Transconductance ¹	$V_{DS} = 10\text{ V}, I_D = 60\text{ A}$	135	185	–	S
R_{Gi}	Gate Input Resistance	–	–	1.26	–	Ω
C_{iss}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	–	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	$V_{GS} = 0\text{ V}, V_{DS} = 0.8 \times V_{DSS}$	–	1.78	–	nF
$C_{o(tr)}$	Effective Output Capacitance – Time Related		–	7.47	–	nF
$Q_{g(on)}$	Total Gate Charge	$V_{GS} = 10\text{ V}, V_{DS} = 0.5 \times V_{DSS},$ $I_D = 200\text{ A}$	–	348	–	nC
Q_{gs}	Gate-Source Charge		–	118	–	
Q_{gd}	Gate-Drain Charge		–	80	–	
$t_{d(on)}$	Turn-on Delay Time	Resistive Switching $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \times V_{DSS},$ $I_D = 200\text{ A}, R_{G(ext)} = 1\text{ }\Omega$	–	40	–	ns
t_r	Rise Time		–	53	–	
$t_{d(off)}$	Turn-off Delay Time		–	114	–	
t_f	Fall Time		–	17	–	

Note 1: Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle, $d \leq 2\%$

Source-Drain Diode Characteristics $(T_{vj} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
I_S	Continuous Diode Forward Current	$V_{GS} = 0\text{ V}$	–	–	400	A
I_{SM}	Diode Pulse Current	Repetitive, Pulse Width Limited by T_{JM}	–	–	1600	A
V_{SD}	Diode Forward Voltage ¹	$I_F = 100\text{ A}, V_{GS} = 0\text{ V}$	–	–	1.4	V
t_{rr}	Reverse Recovery Time	$I_F = 100\text{ A}, -di/dt = 300\text{ A}/\mu\text{s},$ $V_R = 100\text{ V}, V_{GS} = 0\text{ V}$	–	270	–	ns
Q_{rr}	Reverse Recovery Charge		–	1.75	–	μC
I_{rrm}	Reverse Recovery Current		–	35	–	A

Note 1: Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle, $d \leq 2\%$

Characteristic Curves

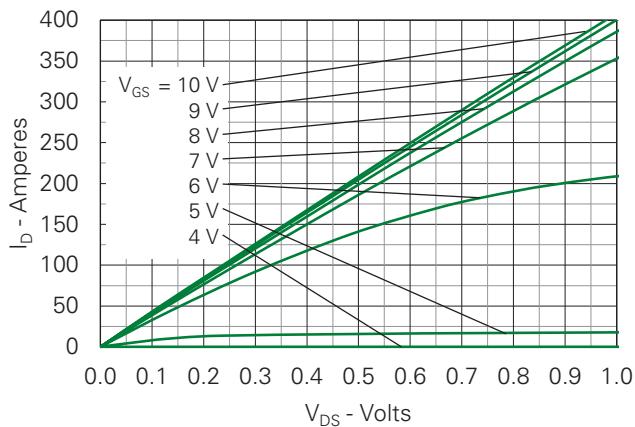
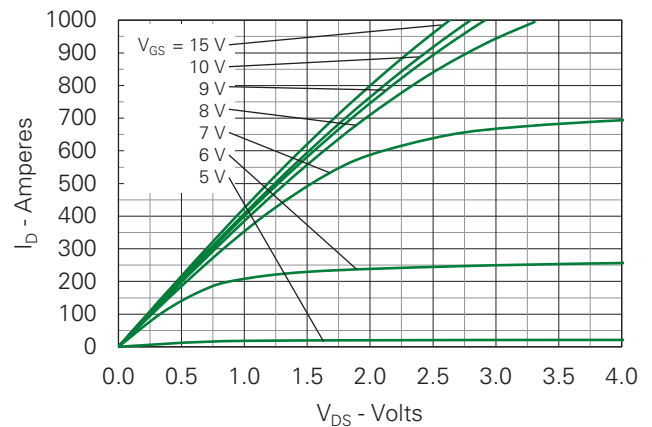
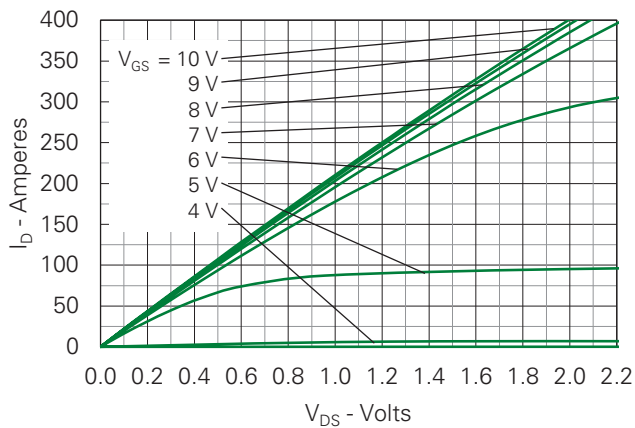
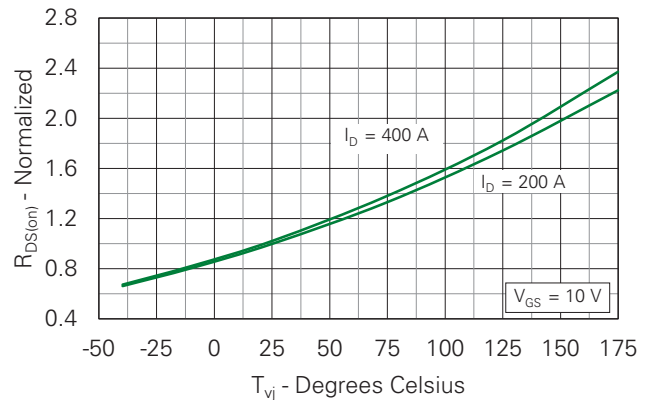
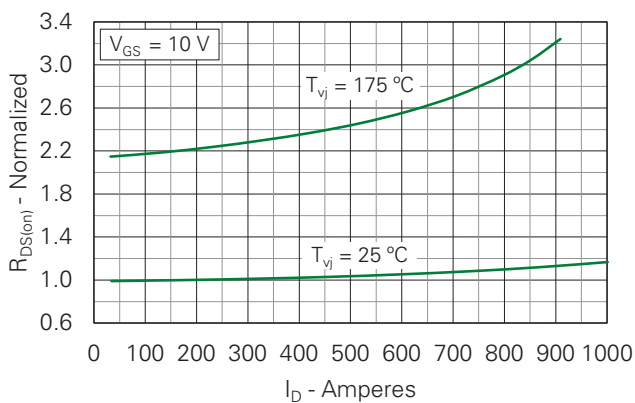
Fig. 1. Output Characteristics @ $T_{vj} = 25^\circ\text{C}$ Fig. 2. Extended Output Characteristics @ $T_{vj} = 25^\circ\text{C}$ Fig. 3. Output Characteristics @ $T_{vj} = 150^\circ\text{C}$ Fig. 4. $R_{DS(on)}$ Normalized to $I_D = 200\text{A}$ Value vs. Junction TemperatureFig. 5. $R_{DS(on)}$ Normalized to $I_D = 200\text{A}$ vs. Drain Current

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

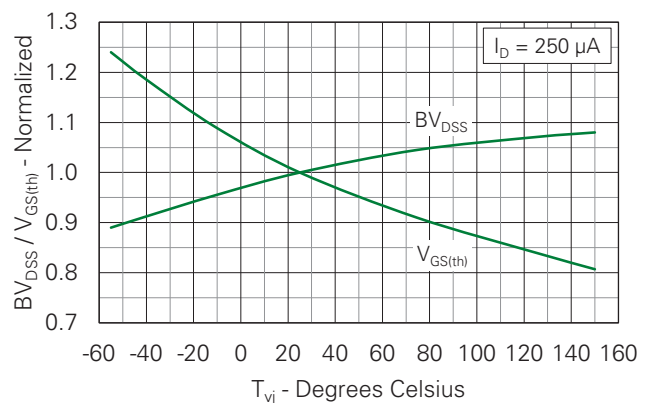


Fig. 7. Drain Current vs. Case Temperature

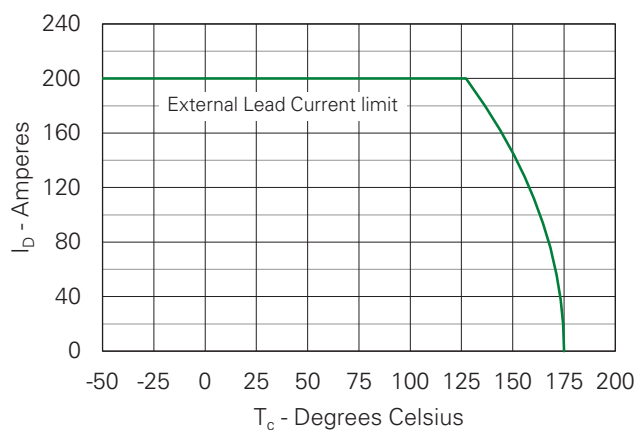


Fig. 8. Input Admittance

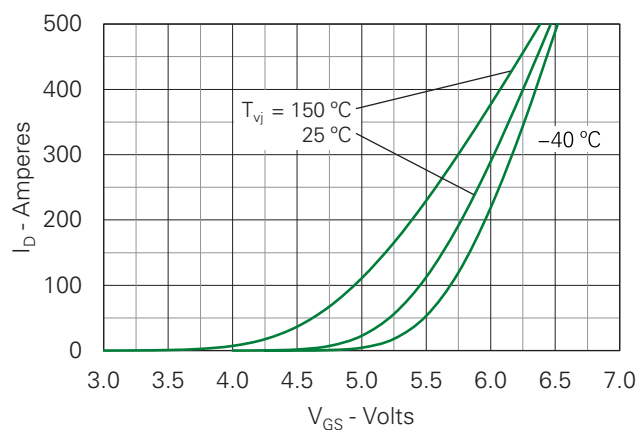


Fig. 9. Transconductance

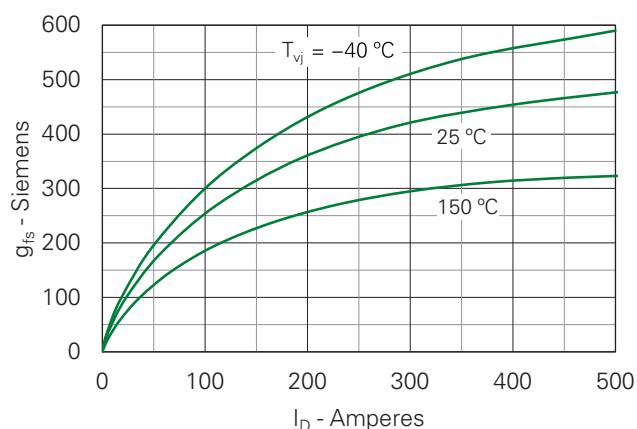


Fig. 10. Forward Voltage Drop of Intrinsic Diode

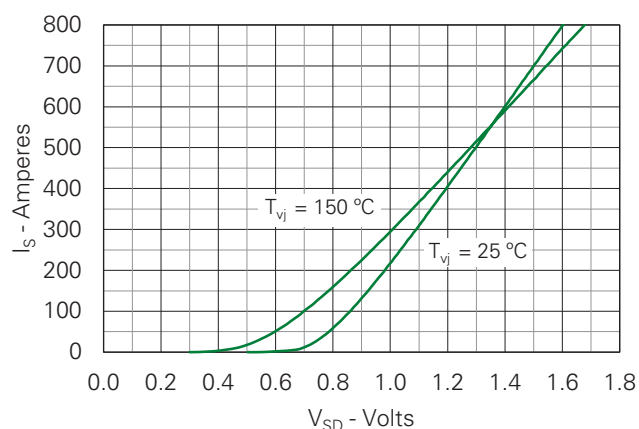


Fig. 11. Gate Charge

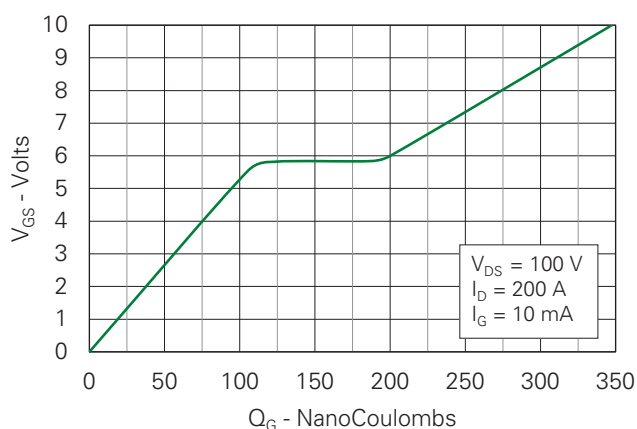


Fig. 12. Capacitance

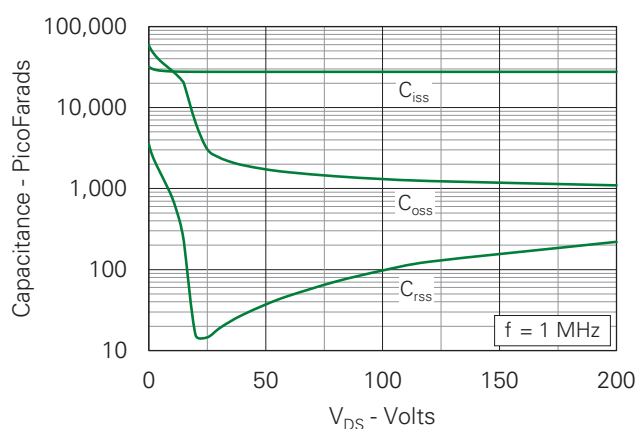


Fig. 13. Output Capacitance Stored Energy

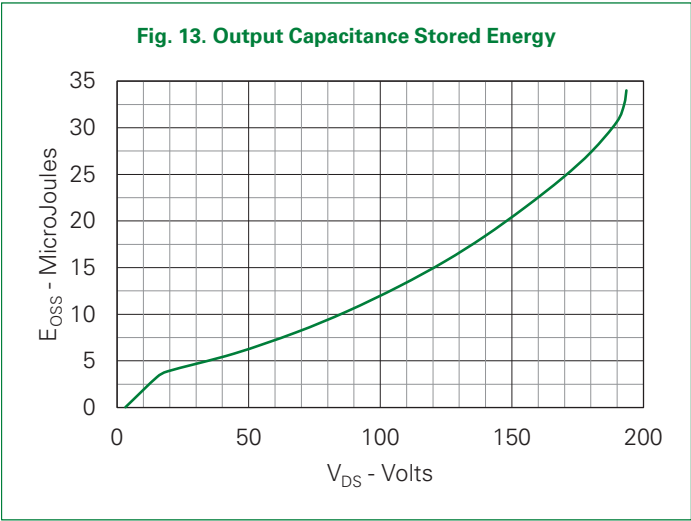


Fig. 14. Forward-Bias Safe Operating Area

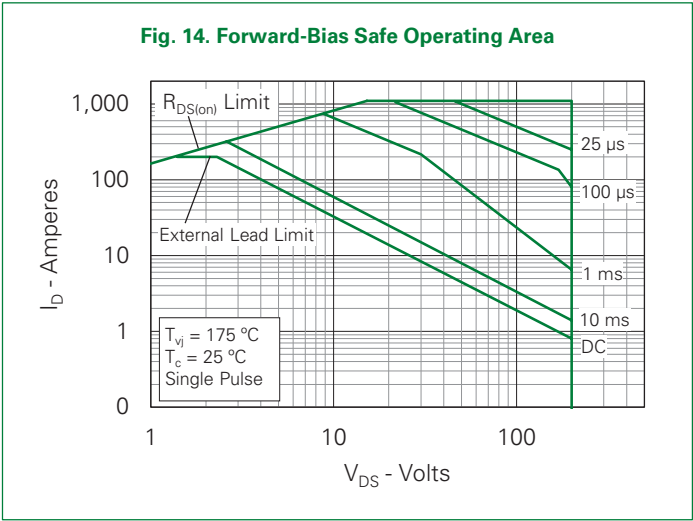
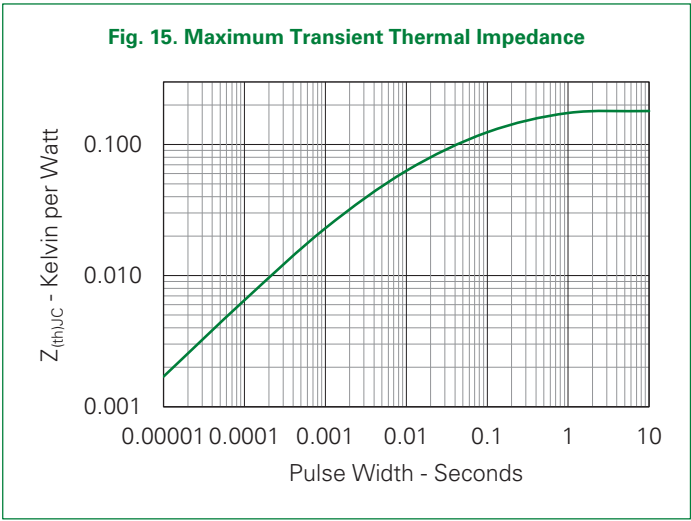
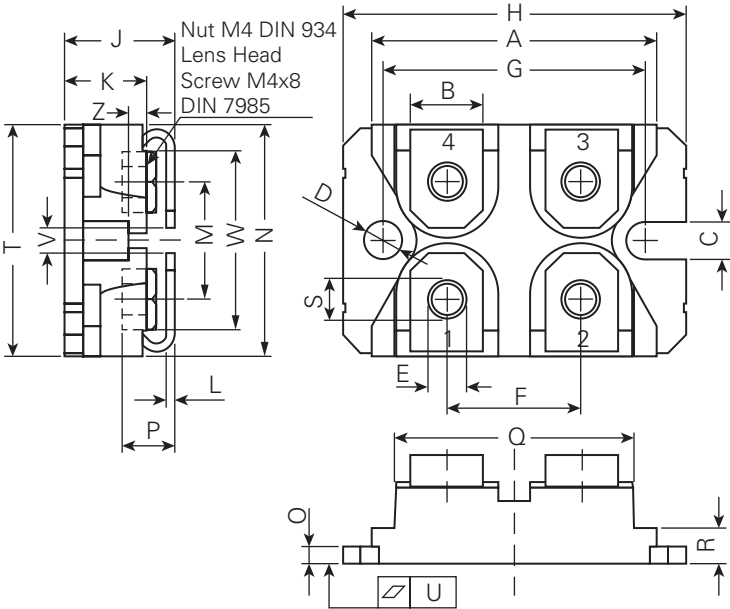


Fig. 15. Maximum Transient Thermal Impedance



Part Outline Drawing (SOT-227B, miniBLOC™)



Symbol	Inches		Millimeters	
	Min.	Max.	Min.	Max
A	1.240	1.255	31.50	31.88
B	0.307	0.323	7.80	8.20
C	0.161	0.169	4.09	4.29
D	0.161	0.169	4.09	4.29
E	0.161	0.169	4.09	4.29
F	0.587	0.595	14.91	15.11
G	1.186	1.193	30.12	30.30
H	1.488	1.505	37.80	38.23
J	0.460	0.481	11.68	12.22
K	0.351	0.378	8.92	9.60
L	0.029	0.033	0.74	0.84
M	0.492	0.516	12.50	13.10
N	0.990	1.001	25.15	25.42
O	0.077	0.084	1.95	2.13
P	0.195	0.244	4.95	6.20
Q	1.045	1.059	26.54	26.90
R	0.155	0.167	3.94	4.42
S	0.179	0.191	4.55	4.85
T	0.968	0.994	24.59	25.25
U	− 0.002	0.004	−0.05	0.10
V	0.126	0.217	3.20	5.50
W	0.780	0.830	19.81	21.08
Z	.098	0.106	2.50	2.70

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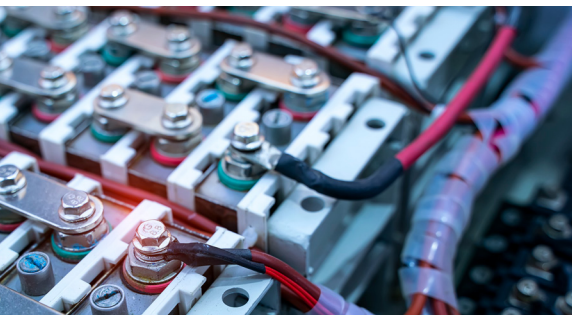
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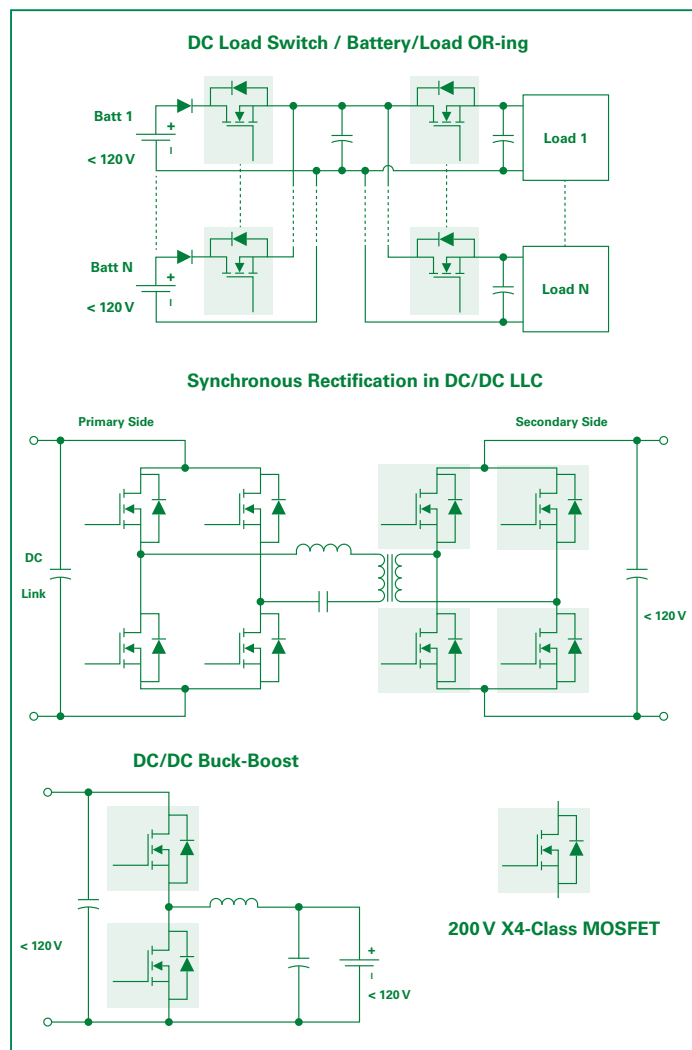


Low $R_{DS(on)}$, 400/500 A, 200 V Ultra Junction X4-Class MOSFETs

The latest addition to the Littelfuse Ultra Junction X4-Class MOSFET family portfolio, featuring one of the industry's lowest on-state resistances and highest nominal current ratings, marks a substantial leap forward in the design of low-voltage solutions within drives, power supplies, battery chargers, and load switches.

These 200 V X4-Class MOSFETs with $R_{DS(on)}$ ratings of 1.99 m Ω and 3 m Ω in SOT-227B (miniBLOC™) packages are positioned to revolutionize low-voltage applications with significant improvements in efficiency and power density.

Developed using a charged compensation principle and proprietary process, these 200 V X4-Class MOSFETs feature one of the best-in-class figures of merit, $R_{DS(on)} \times Q_g$ and $R_{DS(on)} \times R_{th(j-c)}$ compared to their predecessors, the X3-Class devices. These benefits enable designers to address several design challenges with substantial performance advancements in various low-voltage applications.



$R_{DS(on),max}$	I_{D25}	SOT-227B
[m Ω]	[A]	
1.99	500	IXTN500N20X4
3	340	IXTN400N20X4

Features

- Low on-state resistance
- High power dissipation capability
- Low junction-case thermal resistance
- High nominal current rating
- Low gate charge
- Isolated SOT-227B package with aluminium-nitride ceramic

Benefits

- Low conduction losses
- Minimized parallel connection effort with reduced part count
- Simplified driver design, minimal driver losses
- Simplified thermal design
- Compact design with increased power density
- Ease of assembly with rugged and stable mounting

Applications

- Battery Energy Storage Systems (BESS)
- DC load switch
- Battery chargers
- Battery formation
- Industrial power supplies
- Process power supplies



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