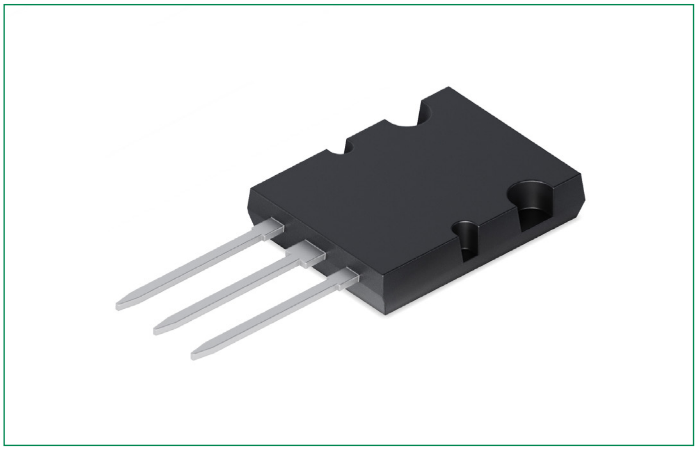
IXFB44N100P

1000 V, 220 mΩ Polar™ HiPerFET™ Power MOSFET

N-Channel Enhancement Mode



Features:

- Unclamped Inductive Switching (UIS) Rated
- Low Package Inductance
  - Easy to Drive and to Protect
- N-Channel Enhancement Mode
- Fast Intrinsic Rectifier
- Avalanche Rated
- Low $R_{DS(on)}$ and Q_G

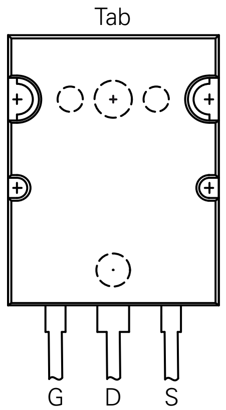
Advantages:

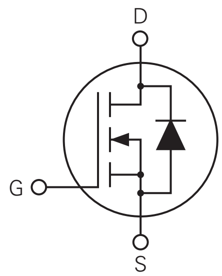
- Plus 264™ Package for Clip or Spring Mounting
- Space Savings
- High Power Density

Applications:

- Switched-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- Laser Drivers
- AC and DC Motor Controls
- Robotics and Servo Controls

Pinout Diagram (PLUS TO-264)





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

Product Summary

Characteristic	Value	Unit
V_{DSS}	1000	V
I_{D25}	44	A
$R_{DS(on)}$	220	Ω
t_{rr}	300	ns

Revised: XZ 06/08/2023

Maximum Ratings

Symbol	Characteristics	Conditions	Value	Units
V_{DSS}	Drain-Source Voltage	T_J = 25°C to 150°C	1000	V
V_{DGR}	Drain-Gate Voltage	T_J = 25°C to 150°C, R_{GS} = 1 MΩ	1000	V
V_{GSS}	Gate-Source Voltage	Continuous	±30	V
V_{GSM}		Transient	±40	
I_{D25}	Drain Current	T_C = 25°C	44	A
I_{DM}		T_C = 25°C, Pulse width limited by T_{JM}	110	
I_{AR}	Avalanche Current	T_C = 25°C	22	A
E_{AS}	Avalanche Energy	T_C = 25°C	2	J
dV/dt	Reverse Diode dV/dt	$I_S \leq I_{DM}$, $V_{DD} \leq V_{DSS}$, $T_J \leq$ 150°C	15	V/ns
P_D	Power Dissipation	T_C = 25°C	1250	W
T_J	Operating Junction Temperature	–	-55 to +150	°C
T_{JM}	Maximum Junction Temperature	–	150	
T_{stg}	Storage Temperature	–	-55 to +150	
V_{ISOL}	Isolation Voltage	50/60 Hz, $I_{ISOL} \leq$ 1 mA, t = 1 min	2500	V~
		50/60 Hz, $I_{ISOL} \leq$ 1 mA, t = 1 s	3000	
T_L	Lead Temperature for Soldering	1.6 mm (0.062 in.) from case for 10 s	300	°C
F_C	Mounting Force	–	30..120 / 6.7..27	N/lb
W	Weight	–	10	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th, JC}$	Thermal Resistance, junction-to-case	–	–	0.10	°C/W
$R_{th, CS}$	Thermal Resistance, case-to-sink	–	0.13	–	°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 = 3 mA, V_{GS} = 0 V	1000	–	–	V
$V_{GS(th)}$	Gate Threshold Voltage	I_D = 1 mA, V_{DS} = V_{GS}	3.5	–	6.5	V
I_{GSS}	Gate-Source Leakage Current	V_{DS} = 0 V, V_{GS} = ±30 V	–	–	±200	nA
I_{DSS}	Drain-Source Current	V_{DS} = V_{DSS}, V_{GS} = 0 V	–	–	50	µA
		V_{DS} = V_{DSS}, V_{GS} = 0 V, T_J = 125°C	–	–	3	mA
$R_{DS(on)}$	Drain-Source On-Resistance[1]	V_{GS} = 10 V, I_D = 0.5 x I_{D25}	–	–	220	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} = 20 V, I_D = 0.5 x I_{D25}	20	35	–	S
R_{Gi}	Gate Input Resistance	–	–	1.4	–	Ω
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 25 V, f = 1MHz	–	16.9	–	nF
C_{oss}	Output Capacitance		–	1100	–	pF
C_{rss}	Reverse Transfer Capacitance		–	184	–	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}	–	305	–	nC
Q_{gs}	Gate-Source Charge		–	104	–	
Q_{gd}	Gate-Drain Charge		–	126	–	
$t_{d(on)}$	Turn-on Delay Time	**Resistive Switching** V_{GS} = 10 V, V_{DS} = 0.5 x V_{DSS}, I_D = 0.5 x I_{D25}, $R_{G(ext)}$ = 1 Ω	–	60	–	ns
t_r	Rise Time		–	68	–	
$t_{d(off)}$	Turn-off Delay Time		–	90	–	
t_f	Fall Time		–	56	–	

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

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	–	–	44	A
I_{SM}	Diode Pulse Current	Repetitive, Pusle width limited by T_{JM}	–	–	176	A
V_{SD}	Diode Forward Voltage[1]	I_F = I_S, V_{GS} = 0 V	–	–	1.5	V
t_{rr}	Reverse Recovery Time	I_F = 22 A, -di/dt = 100 A/μs, V_r = 100 V	–	–	300	ns
Q_{rm}	Reverse Recovery Charge		–	2.5	–	μC
I_{rm}	Reverse Recovery Current		–	17.0	–	A

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

Characteristic Curves

Fig. 1. Output Characteristics @ T_J = 25ºC

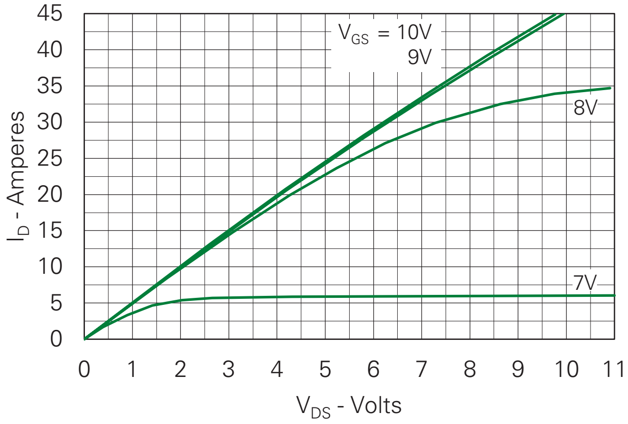


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

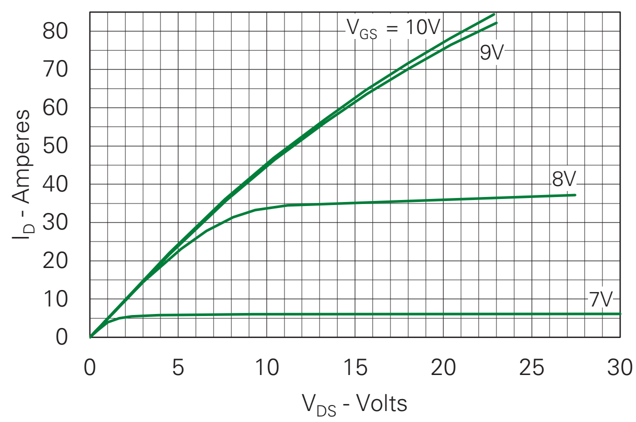


Fig. 3. Output Characteristics @ T_J = 125ºC

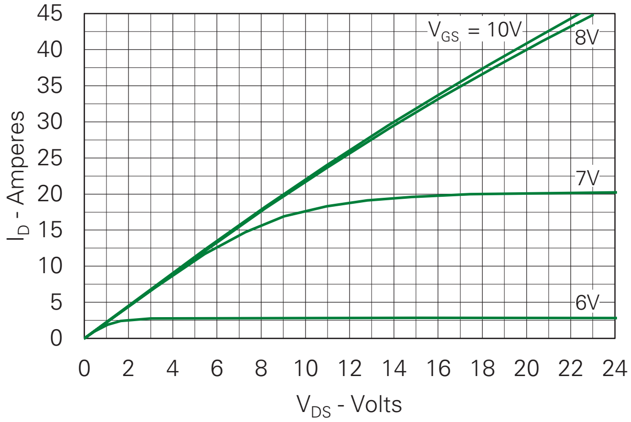


Fig. 4. $R_{DS(on)}$ Normalized to I_D = 22A Value vs. Junction Temperature

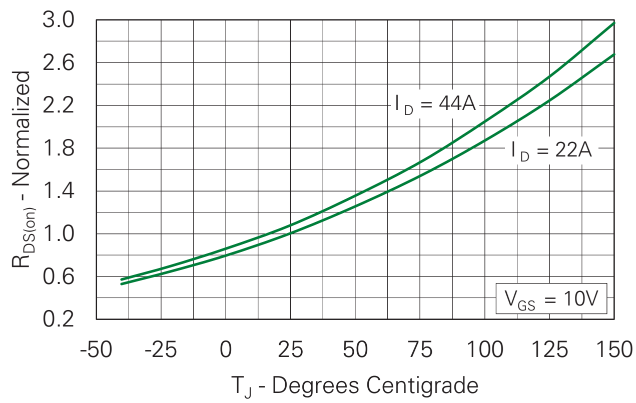


Fig. 5. $R_{DS(on)}$ Normalized to I_D = 22A Value vs. Drain Current

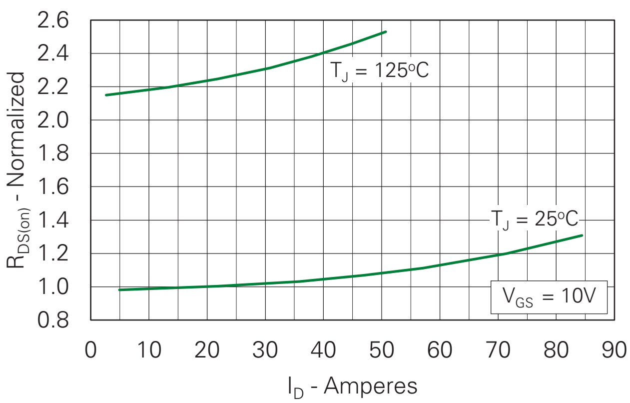


Fig. 6. Maximum Drain Current vs. Case Temperature

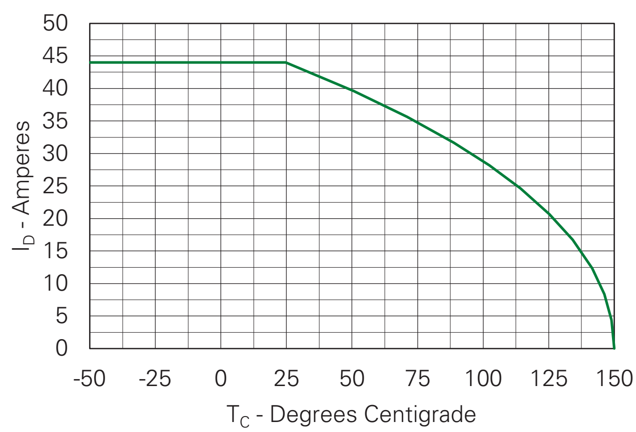


Fig. 7. Input Admittance

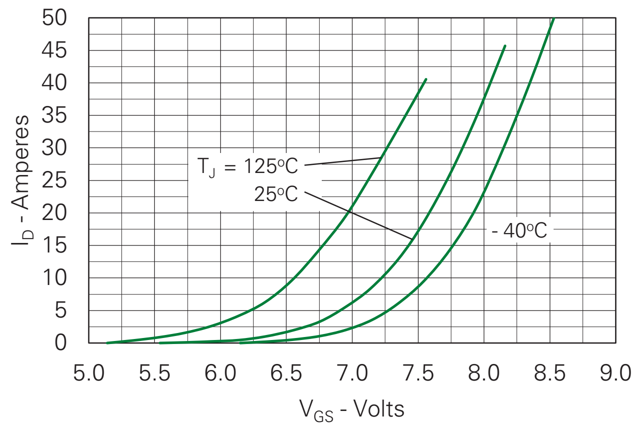


Fig. 8. Transconductance

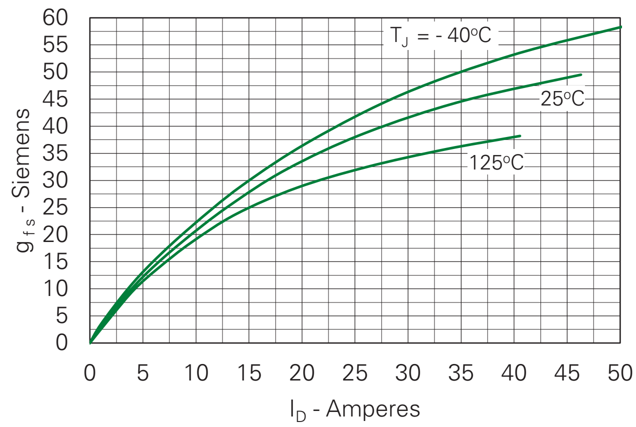


Fig. 9. Forward Voltage Drop of Intrinsic Diode

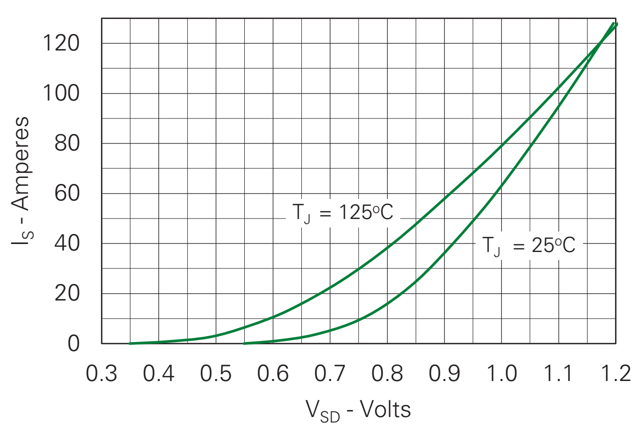


Fig. 10. Gate Charge

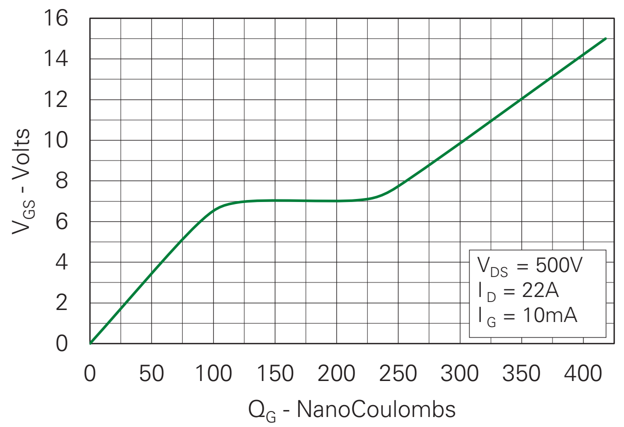


Fig. 11. Capacitance

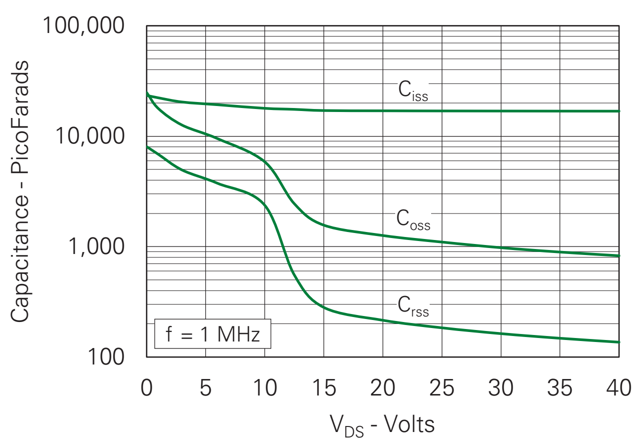
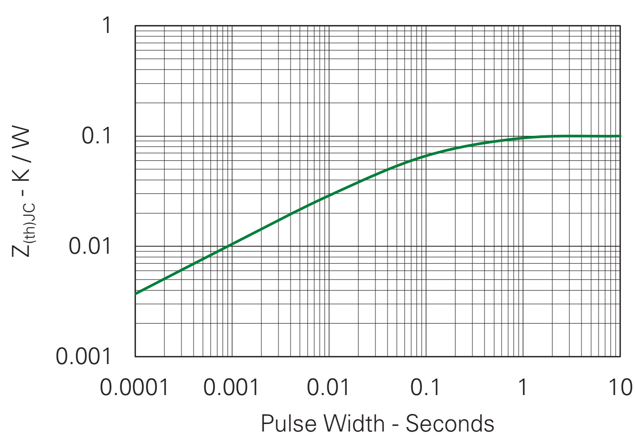
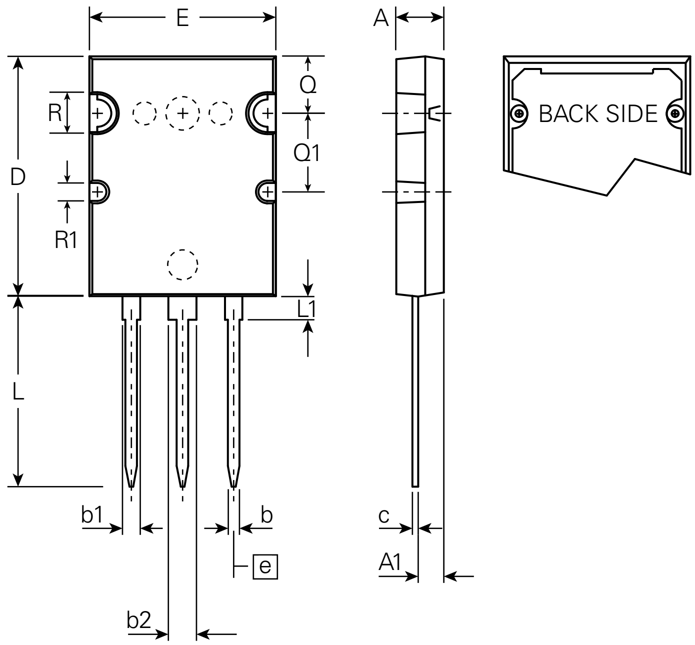


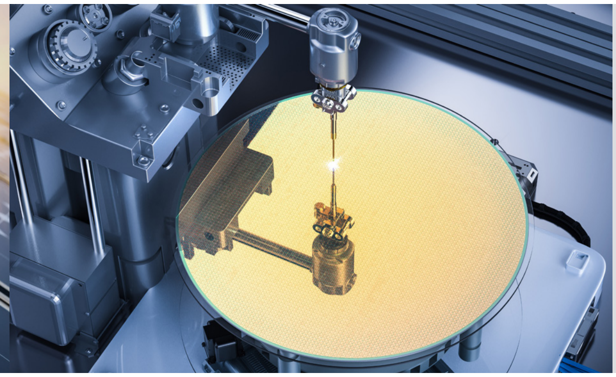
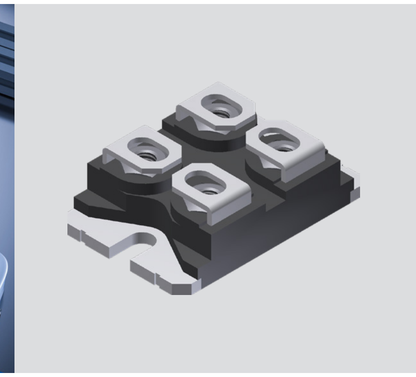
Fig. 12. Maximum Transient Thermal Impedance



Part Outline Drawing (PLUS TO-264)



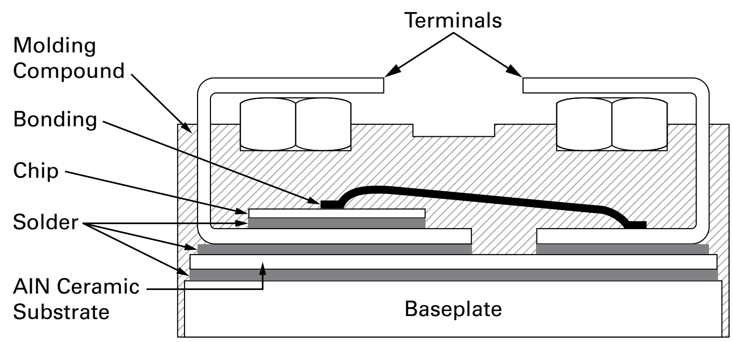
Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.185	–	0.209	4.70	–	5.31
A1	0.102	–	0.118	2.59	–	3.00
b	0.037	–	0.055	0.94	–	1.40
b1	0.087	–	0.102	2.21	–	2.59
b2	0.110	–	0.126	2.79	–	3.20
c	0.017	–	0.029	0.43	–	0.74
D	1.007	–	1.047	25.58	–	26.59
E	0.760	–	0.799	19.30	–	20.29
e	0.215 BSC			5.46 BSC		
L	0.779	–	0.842	19.79	–	21.39
L1	0.087	–	0.102	2.21	–	2.59
Q	0.240	–	0.256	6.10	–	6.50
Q1	0.330	–	0.346	8.38	–	8.79
ØR	0.155	–	0.187	3.94	–	4.75
ØR1	0.085	–	0.093	2.16	–	2.36

Isolated **mini**ature power **BLOC**K (miniBLOC™) solution for Plasma Power Supplies

Littelfuse's isolated miniBLOC™ (SOT-227B) is a discrete miniature power BLOCK, conveniently bridging the power gap between inexpensive discrete packages and full-sized power modules. Littelfuse offers a wide range of Si and SiC miniBLOC™ MOSFET solutions catering to the design demands of plasma power supplies.

The miniBLOC™ solution offering fully isolated base plate, higher power densities, faster switching speeds, wide device choice, ease of application, and long-term reliability will serve as a key enabler, providing the right solution to development needs at different power levels.



Cross-section of SOT-227B (miniBLOC)

The **mini**ature power **BLOC**K Advantage

Features

- Aluminum Nitride ceramic-based compact discrete package with electrically isolated baseplate
- Reduced overall junction-sink thermal impedance in comparison to non-isolated discretes
- Isolation up to 2.5 kV V_{RMS}/60 s or 3 kV V_{RMS}/1 s
- Extended creepage and clearance distances:
  - Terminal-terminal: clearance of up to 7 mm and creepage of up to 10.5 mm
  - Terminal-baseplate: clearance of up to 8.5 mm and creepage of up to 10.5 mm
- Discrete power block with high current-handling capability
- Low internal lead inductance < 5 nH
- Option for Kelvin-Source terminal
- Screw-mounted discrete package with four screwed terminal leads

Advantages

- Aluminum Nitride internal isolation increases power density, simplifies thermal design, improves reliability, and enables superior power cycling capability with cooler chip temperatures compared to non-isolated and conventionally isolated discretes
- Optimal for high-voltage design given the inherent isolation and extended creepage and clearance
- Reduced paralleling effort and decreased part count resulting in PCB space savings
- Higher safety overvoltage margin with reduced overvoltage stress at chip level due to lower package stray inductance
- Kelvin-Source terminal improves controllability, enabling faster switching speeds
- Rugged and stable mounting, ease of manufacturing and handling in assembly

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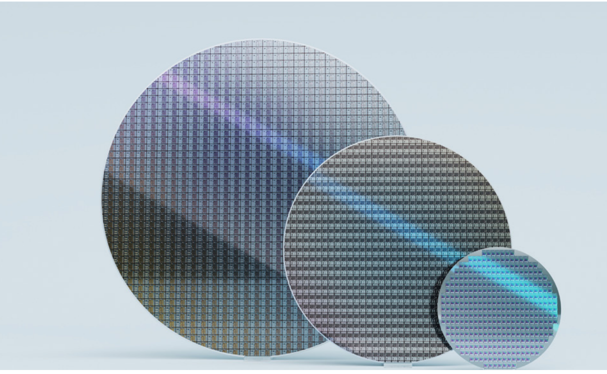
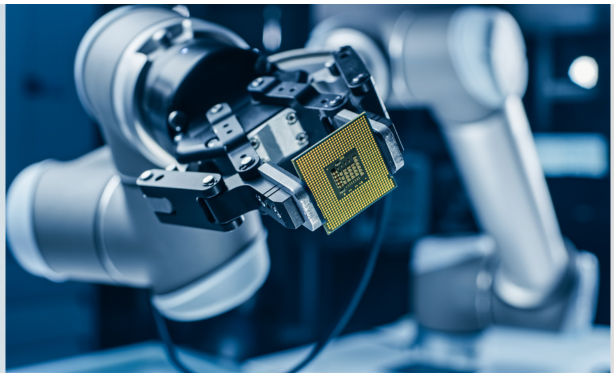




High Current (> 50 A), 650 V Ultra Junction X2-Class MOSFETs in miniBLOC™

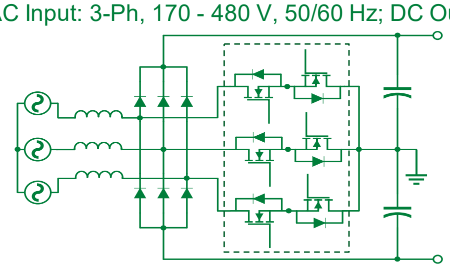
$R_{DS(on),max}$ [mΩ]	I_{D25} [A]	miniBLOC™ 
13	170	IXFN170N65X2 ●
17	145	IXFN150N65X2 ●
24	108	IXFN120N65X2 ●
30	78	IXFN100N65X2 ●
30	76	IXTN102N65X2 ●

- ● HiPerFET™ (fast-body diode) (green dot)
- ● Standard body diode (black dot)

The 650 V X2-Class Ultra Junction MOSFETs in miniBLOC™ package from Littelfuse exhibit some of the highest current ratings, lowest on-state resistances $R_{DS(on)}$, low gate charge Q_g, and superior dv/dt performance. Their superior avalanche capability further enhances device ruggedness in critical applications. Additionally, the HiPerFET™ devices with fast soft-recovery body diode have reduced switching losses and a better electromagnetic interference (EMI) behavior.

These benefits of the 650 V Ultra Junction X2-Class MOSFETs in combination with the advantages offered by the miniBLOC™ package make them a preferred choice for plasma power supplies.

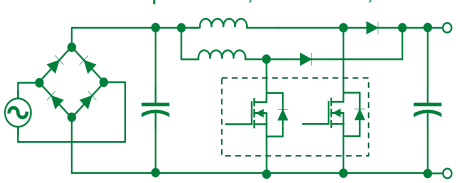
AC Input: 3-Ph, 170 - 480 V, 50/60 Hz; DC Output: 600 - 800 V



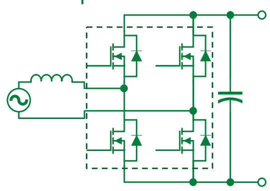
Vienna Rectifier

650 V MOSFETs

AC Input: 1-Ph, 85 - 265 V, 50/60 Hz; DC Output: < 400 V



PFC Interleaved Boost



Totem-Pole Bridgeless PFC

650 V MOSFETs

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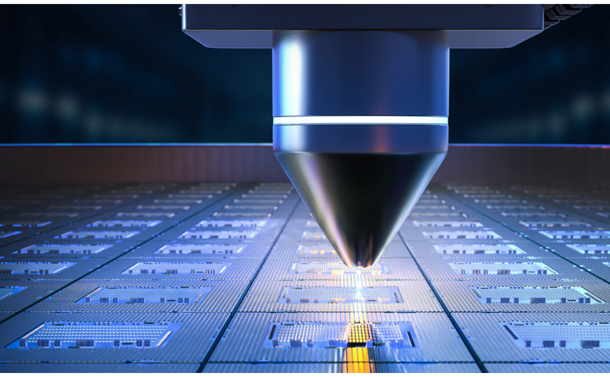
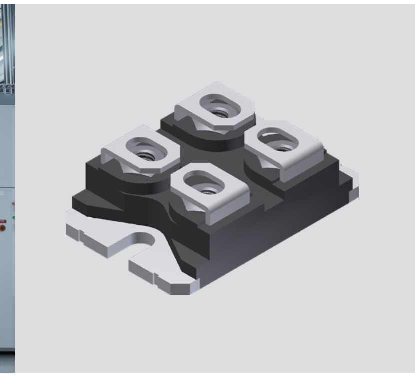




900–1200 V Polar™ HiPerFET™ in miniBLOC™

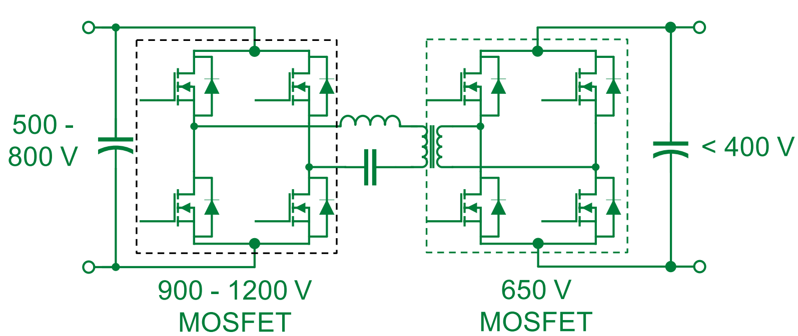
$R_{DS(on),max}$ [Ω]	I_{D25} [A]	V_{DSS} [V]	miniBLOC™ 
0.145	56	900	IXFN56N90P
0.160	43	900	IXFN52N90P
0.230	33	900	IXFN40N90P
0.21	38	1000	IXFN38N100P
0.22	37	1000	IXFN44N100P
0.32	27	1000	IXFN32N100P
0.39	23	1000	IXFN26N100P
0.26	34	1100	IXFN40N110P
0.31	32	1200	IXFN32N120P
0.35	30	1200	IXFN30N120P
0.46	23	1200	IXFN26N120P
0.57	20	1200	IXFN20N120P

Littelfuse 900–1200 V Polar™ HiPerFET™ devices are tailored to provide designers with a rugged device solution that offers the best advantage in performance and cost in high frequency applications.

These devices incorporate the Polar technology platform to achieve low on-state resistances $R_{DS(on)}$ which improves conduction behavior. The low gate charge Q_g and fast body diode results in more efficient switching at all frequencies. The dv/dt and avalanche capabilities of these devices provide additional safeguards against overvoltage transients.

The benefits of the Polar™ HiPerFET™ devices, in addition to the advantages offered by the miniBLOC™ package, make them the best solution for plasma power supplies.

DC/DC LLC Converter



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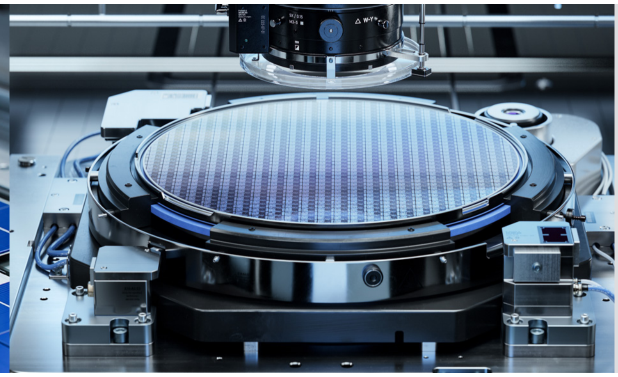
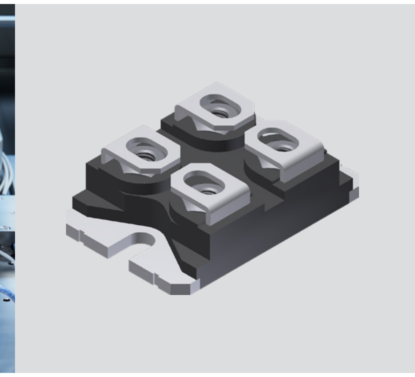




1200 V SiC MOSFETs in miniBLOC™ with Kelvin-Source

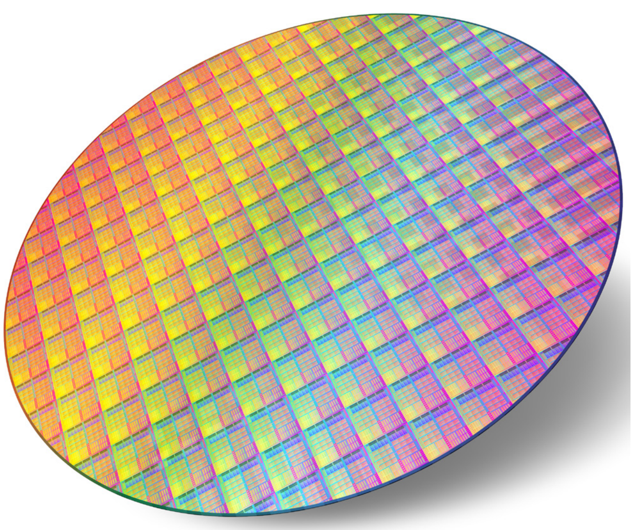
$R_{DS(on),max}$ [mΩ]	I_{D25} [A]	V_{DSS} [V]	miniBLOC™ w/ Kelvin-Source 
10	130	900	IXFN130N90SK
21	75	1200	IXFN75N120SK
32	55	1200	IXFN55N120SK
75	30	1200	IXFN30N120SK

Note: Preliminary datasheet and engineering samples available for the SiC MOSFETs in the table above

Littelfuse 1200 V SiC MOSFETs featuring low $R_{DS(on)}$ and low device capacitances, offer the highest efficiency for reduced cooling effort. The excellent conduction and switching behavior combined with higher frequency operation improves power density in the application.

The SiC MOSFETs in miniBLOC™ featuring a Kelvin-Source connection offer superior immunity to parasitic turn-on/turn-off events, thereby maximizing the high-speed switching performance of the MOSFET.

These advantages of SiC MOSFETs combined with the benefits offered by the miniBLOC™ package make them a preferred choice in Plasma Power Supplies.



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