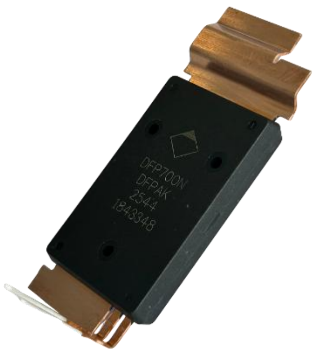
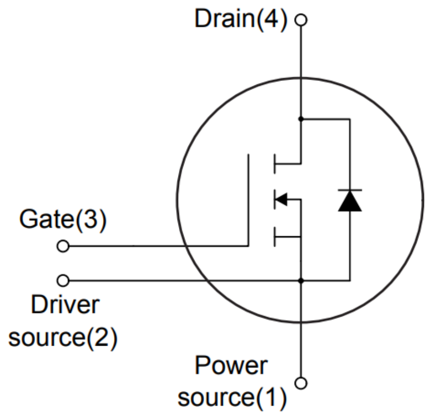
DFP500N120G1

DFPAK High Power Module



Features and Benefits

Advanced SiC MOSFET Technology
Best-in-class Rth < 0.059 °C/W and dielectric strength > 4.2kV isolation)
Very high current capability (500A) with 4 high performance SiC dies.
Vds= 1200V, Ids =500A, Rdson = 2.67mΩ Typical
50% system-level BOM reduction with highly integrated package.
Low RDS(on) over the entire temperature range
High speed switching performances
Source sensing pin for increased efficiency
Fast and robust intrinsic body diode
High operating junction temperature capability (TBD)
Full Square SOA
RoHS Lead free
Complaint to AEC-Q100 Automotive Qualification standard.



Applications

Inverter for BEV,HEV & FCEV
BLDC Motor Power Stage
High Power Charging Systems
AC/DC Converters
DC/AC Converters
DC/DC Switch Mode Power Supply

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit
Drain−Source Voltage	VDS	1200	V
Gate−Source Voltage	VGS	−10/+22	V

RECOMMENDED OPERATING CONDITIONS

Gate−Source Voltage	Vgs	−3/+18	V
Operating Junction Temperature	TJ	−55 to 175	°C
Extended Operating Junction Temperature (200h max.)	TJ,ext	−55 to 200	°C
Storage Temperature	Tstg	−55 to 125	°C

ORDERING INFORMATION

Device	DFP500N120G1
Package Type	DFPAK
Shipping	TBD

Description

The DFP500N120G1 has four silicon carbide power MOSFET devices featuring high-current capability and high-breakdown voltage. Best in class dielectric and thermal path conductivity is ensured by Single Crystal Diamond (SCD) for optimal performance and reduced junction temperature. Direct sintering of the power switches achieves remarkable electrical and thermal conductivity to the substrate, enhanced reliability and exceptional stress tolerance. The device features a very low $R_{DS(on)}$ over the entire temperature range combined with low capacitances and high switching operations to improve performance in energy efficiency, system size and weight reduction.

Electrical Ratings

Table 1. Absolute Maximum Ratings

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	Comments
$V_{(BR)DSS}$		Vgs = 0V Id = 1mA	1200			V	[-55°C ≤ Tj ≤ 175°C] Over whole temperature range
V_{GS}	Gate-source voltage (Maximum)		-10		22	V	
	Gate-source voltage (recommended operating values)		-3		18	V	
I_d	Drain current (continuous)	Vgs = 18 V Vds = 2V			350	A	indicated chip capability, depending on thermal properties of assembly (assumption: Tj=175°C,)
	Drain current (continuous)	Vgs = 18 V Vds = 2V			500	A	indicated chip capability, depending on thermal properties of assembly (assumption: Tj=25°C)
I_{DM}	Drain current (pulsed)				TBD	A	
P_{TOT}	Total power dissipation				TBD	W	
I_F	Diode forward current (continuous)	Vgs = -3 V Vds = -4V			200	A	indicated chip capability, depending on thermal properties of assembly (assumption: Tj=175°C)
	Diode forward current (continuous)	Vgs = -3 V Vds = -4V			280	A	indicated chip capability, depending on thermal properties of assembly (assumption: Tj=25°C)
$I_{F(Pulsed)}$	Pulsed peak body diode current, limited by Tjmax	Vgs = -3 V			TBD	A	
t_{sc}	Short circuit withstand time	Vgs,on = 18V; Vgs,off = -3 V, Vds = 850 V, Tj = 25°C, dI/dt < 10kA/µs		TBD		µs	

E_{sc}	Short circuit withstand energy	Vgs,on = 18 V; Vgs,off = -3 V, Vds = 850 V, Tj = 25°C, dI/dt < 10kA/µs		TBD		J	
T_J and T_{ext}	Operating Junction Temperature		-55		175	°C	
	Extended Operating Junction Temperature (200h max.)		-55		200	°C	

Table 2. Thermal Data

Symbol	Parameter	Min.	Typ.	Max.	Unit	Comments
T_{stg}	Storage Temperature	-55		200	°C	
R_{thJC}	Thermal resistance, junction-to-case		0.059		°C/W	Based on total power dissipation of 600W

Electrical Characteristics

Table 3. Static Characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	Comments
$R_{DS(on)}$	Drain-source on-resistance	Vgs = 18 V, Id = 400 A Tj = 25°C		2.67	3.75	mΩ	
	Drain-source on-resistance	Vgs = 18 V, Id = 400 A Tj = 175°C		5.25		mΩ	
$V_{GS(th)}$	Gate-Source threshold voltage	Id = 33 mA, Vgs = Vds Tj = 25°C	2.08	3.34	4.63	V	
	Gate-Source threshold voltage	Id = 33 mA, Vgs = Vds Tj = 175°C		2.6		V	
I_{dss}	Zero gate voltage drain current	Vds = 1200V, Vgs = 0 V, Tj = 25°C			100	µA	
	Zero gate voltage drain current	Vds = 1200V, Vgs = 0 V, Tj = 175°C			1000	µA	
I_{gss}	Gate-Source leakage current	Vds = 0V, Vgs = -10 V Tj = 25°C			400	nA	
	Gate-Source leakage current	Vds = 0V, Vgs = 22 V Tj = 25°C			400	nA	
V_{sd}	Diode forward voltage	VGS = −3 V, ID = 400 A TJ = 25C	3.3	4.75	6.2	V	

	Diode forward voltage	VGS = −3 V, ID = 540 A TJ = 25C	–	5.3	–	V	
	Diode forward voltage	VGS = −3 V, ID = 540 A TJ = 175C	–	4.9	–	V	

Table 4. Dynamic Characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	VDS = 800 V, VGS = 0 V, f = 1 MHz		24000		nF
C_{oss}	Output capacitance	VDS = 800 V VGS = 0 V, f = 1 MHz		880		pF
C_{rss}	Reverse transfer capacitance	VDS = 800 V VGS = 0 V, f = 1 MHz		20		pF
Rg_{int}	Total internal gate resistance	f = 1 MHz	1.58	2.3	2.95	Ω
Q_g	Total gate charge	VDD = 800 V ID = 135 A Vgs = −3/18 V		816	940	nC
Q_{gs}	Gate-source charge	TBD		TBD		nC
Q_{gd}	Gate-drain charge	TBD		TBD		nC

Table 5. Switching Energy (Inductive Load)

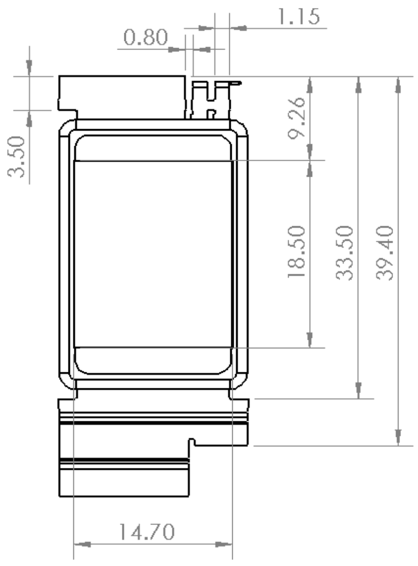
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	VGS = −3/18 V ID = 540 A VDD = 800 V Rg,(on,off) = 0.5		10.24		mJ
E_{off}	Turn-off switching energy	VGS = −3/18 V ID = 540 A VDD = 800 V Rg,(on,off) = 0.5		7.16		mJ

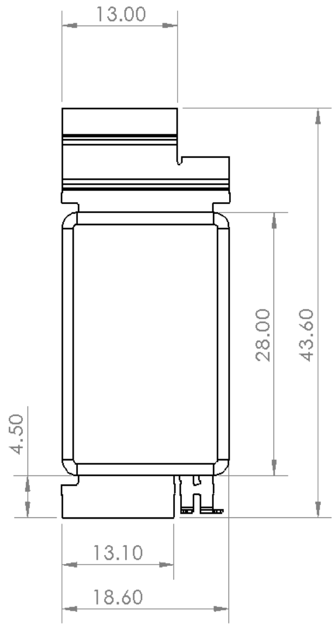
Table 6. Reverse SiC diode characteristics

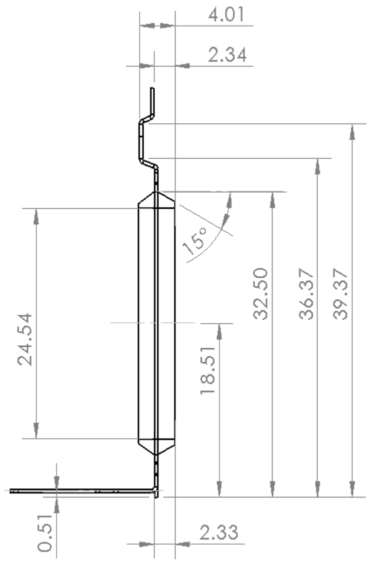
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T_{rr}	Reverse recovery time	VGS = −3 V IS = 400 A, VDS = 800 V, di/dt = 1000 A/s, TJ = 25C VGS = −3 V IS = 400 A, VDS = 800 V, di/dt = 1000 A/s, TJ = 175C		TBD		ns
Q_{rr}	Reverse recovery charge	VGS = −3 V IS = 400A, VDS = 800 V di/dt = 1000 A/s, TJ = 25C VGS = −3 V IS = 400A, VDS = 800 V di/dt = 1000 A/s, TJ = 175C		TBD		nC

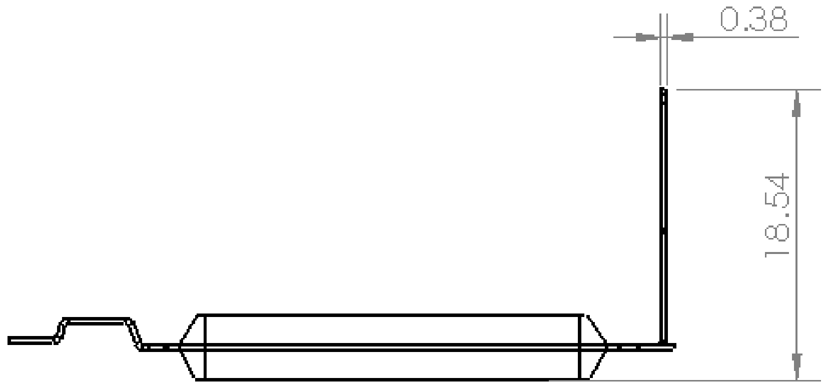
I_{RRM}	Reverse recovery current	VGS = −3 V IS = 400A, VDS = 800 V di/dt = 1000 A/s, TJ = 25C VGS = −3 V IS = 400A, VDS = 800 V di/dt = 1000 A/s, TJ =175C		TBD		A
		VGS = −3 V IS = 400A, VDS = 800 V di/dt = 1000 A/s, TJ = 25C VGS = −3 V, IS = 400A, VDS = 800 V di/dt = 1000 A/s, TJ =175C				

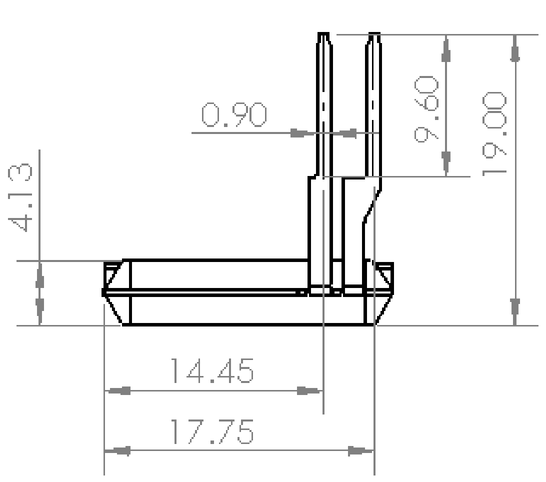
DFPAK Package Outline











Note: All dimensions expressed in millimeters