F1−2PACK SiC MOSFET Module

Product Preview

NXH010P120MNF1PTNG, NXH010P120MNF1PNG

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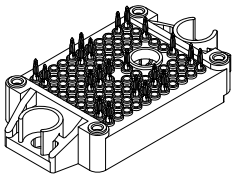


PIM18 33.8x42.5 (PRESS FIT)
CASE 180BW

General Description

The NXH010P120MNF1 is a power module containing an 10 mΩ/1200 V SiC MOSFET half bridge and a thermistor in an F1 package.

Features

- 10 MΩ/1200V SiC MOSFET Half Bridge
- Thermistor
- Options With Pre−Applied Thermal Interface Material (TIM) and Without Pre−Applied TIM
- Press−Fit Pins

Typical Applications

- Solar Inverter
- Uninterruptible Power Supplies
- Electric Vehicle Charging Stations
- Industrial Power

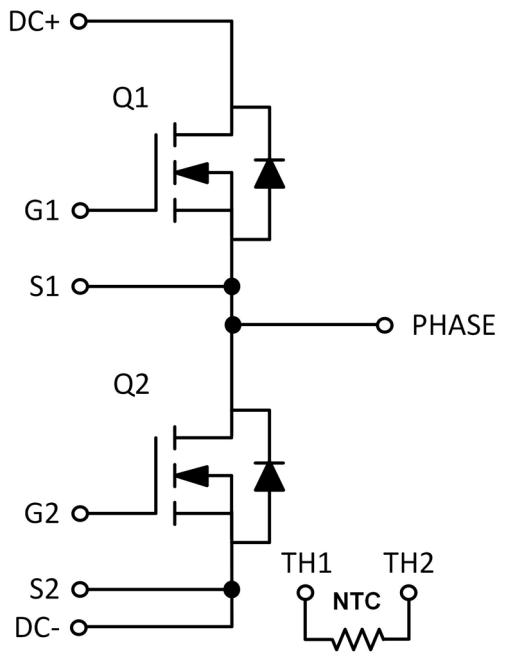
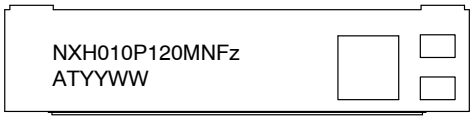


Figure 1. NXH010P120MNF1 Schematic Diagram

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

MARKING DIAGRAM



NXH010P120MNFz= Specific Device Code
z = PTNG/PNG
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

ORDERING INFORMATION

See detailed ordering and shipping information on page of this data sheet.

PIN CONNECTIONS

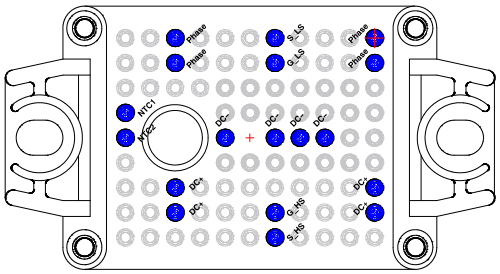


Figure 2. Pin Connections

PIN FUNCTION DESCRIPTION

Pin No.	Symbol	Description
A5	TH1	Thermistor Connection 1
A6	TH2	Thermistor Connection 2
C2	DC+	DC Positive Bus connection
C3	DC+	DC Positive Bus connection
C8	PHASE	Center point of half bridge
C9	PHASE	Center point of half bridge
E5	DC−	DC Negative Bus connection
G1	S1	Q1 Kelvin Emitter (High side switch)
G2	G1	Q1 Gate (High side switch)
G5	DC−	DC Negative Bus connection
G8	G2	Q2 Gate (Low side switch)
G9	S2	Q2 Kelvin Emitter (High side switch)
H5	DC−	DC Negative Bus connection
I5	DC−	DC Negative Bus connection
K2	DC+	DC Positive Bus connection
K3	DC+	DC Positive Bus connection
K8	PHASE	Center point of half bridge
K9	PHASE	Center point of half bridge

Table 1. ABSOLUTE MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
SIC MOSFET			
Drain−Source Voltage	V_{DSS}	1200	V
Gate−Source Voltage	V_{GS}	+25/−15	V
Continuous Drain Current @ T_c = 80°C (T_J = 175°C)	I_D	114	A
Pulsed Drain Current (T_J = 175°C)	I_{Dpulse}	342	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	250	W
Short Circuit Withstand Time @ V_{GE} = −5V/20 V, V_{CE} = 600 V, $T_J \leq$ 150°C	T_{sc}	2	μs
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
THERMAL PROPERTIES			
Storage Temperature range	T_{stg}	−40 to 150	°C
INSULATION PROPERTIES			
Isolation test voltage, t = 1 sec, 60 Hz	V_{is}	4000	V_{RMS}
Creepage distance		12.7	mm

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.

RECOMMENDED OPERATING RANGES

Rating	Symbol	Min	Max	Unit
Module Operating Junction Temperature	T_J	−40	150	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

ELECTRICAL CHARACTERISTICS

T_A = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Drain−Source Breakdown Voltage	V_{GS} = 0 V, I_D = 400 μA	$V_{(BR)DSS}$	1200	–	–	V
Zero Gate Voltage Drain Current	V_{GS} = 0 V, V_{DS} = 1200 V	I_{DSS}	–	–	200	μA
Drain−Source On Resistance	V_{GS} = 20 V, I_D = 100 A, T_J = 25°C	$R_{DS(ON)}$	–	10.5	14	mΩ
	V_{GS} = 20 V, I_D = 100 A, T_J = 125°C		–	14.1	–	
	V_{GS} = 20 V, I_D = 100 A, T_J = 150°C		–	14.5	–	
Gate−Source Threshold Voltage	V_{GS} = V_{DS}, I_D =40 mA	$V_{GS(TH)}$	1.8	2.90	4.3	V
Gate Leakage Current	V_{GS} = −10/20 V, V_{DS} = 0 V	I_{GSS}	−1000	–	1000	nA
Forward Transconductance	V_{DS} = 10 V, I_D = 100 A	g_{FS}		31		S
Internal Gate Resistance		R_G		TBD		Ω
Input Capacitance	V_{DS} = 800 V, V_{GS} = 0 V. f = 1 MHz	C_{ISS}	–	4707	–	pF
Reverse Transfer Capacitance		C_{RSS}	–	39	–	
Output Capacitance		C_{OSS}	–	548	–	
C_{OSS} Stored Energy	V_{DS} = 0 V to 800 V, V_{GS} = 0 V	E_{OSS}	–	TBD	–	μJ

ELECTRICAL CHARACTERISTICS (continued)
T_A = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Total Gate Charge	V_{DS} = 800 V. V_{GS} = 20 V. I_D = 100 A	$Q_{G(TOTAL)}$	–	454	–	nC
Gate−Source Charge		Q_{GS}	–	129	–	nC
Gate−Drain Charge		Q_{GD}	–	131	–	nC
Turn−on Delay Time	T_J = 25°C V_{DS} = 800 V, I_D = 100 A V_{GS} = −5V/18V, R_G = 3.9 Ω	$t_{d(on)}$	–	TBD	–	ns
Rise Time		t_r	–	TBD	–	
Turn−off Delay Time		$t_{d(off)}$	–	TBD	–	
Fall Time		t_f	–	TBD	–	
Turn−on Switching Loss per Pulse		E_{ON}	–	2.05	–	mJ
Turn off Switching Loss per Pulse		E_{OFF}	–	1.1	–	
Turn−on Delay Time	T_J = 150°C V_{DS} = 800 V, I_D = 100 A V_{GS} = −5V/18V, R_G = 3.9 Ω	$t_{d(on)}$	–	TBD	–	ns
Rise Time		t_r	–	TBD	–	
Turn−off Delay Time		$t_{d(off)}$	–	TBD	–	
Fall Time		t_f	–	TBD	–	
Turn−on Switching Loss per Pulse		E_{ON}	–	1.95	–	mJ
Turn off Switching Loss per Pulse		E_{OFF}	–	1.3	–	
Diode Forward Voltage	I_D = 100 A, T_J = 25°C	V_{SD}	–	3.94	6	V
	I_D = 100 A, T_J = 150°C		–	3.42	–	
Reverse Recovery Time	T_J = 25°C V_{DS} = 800 V, I_D = 100 A V_{GS} = −5V/18V, R_G = 3.9 Ω	t_{rr}	–	TBD	–	ns
Reverse Recovery Charge		Q_{rr}	–	TBD	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	TBD	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	TBD	–	A/μs
Reverse Recovery Energy		E_{rr}	–	TBD	–	μJ
Reverse Recovery Time	T_J = 25°C V_{DS} = 800 V, I_D = 100 A V_{GS} = −5V/18V, R_G = 3.9 Ω	t_{rr}	–	TBD	–	ns
Reverse Recovery Charge		Q_{rr}	–	TBD	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	TBD	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	TBD	–	A/μs
Reverse Recovery Energy		E_{rr}	–	TBD	–	μJ
Thermal Resistance − chip−to−case	M1,M2	R_{thJC}	–	0.23	–	°C/W
Thermal Resistance − chip−to−heatsink	Thermal Resistance − chip−to−heatsink, Thermal grease, Thickness = 2 Mil _2%, A = 2.8 W/mK	R_{thJH}	–	0.38	–	°C/W
THERMISTOR CHARACTERISTICS						
Nominal resistance	T = 25°C	R_{25}	–	5	–	kΩ
Nominal resistance	T = 100°C	R_{100}	–	457	–	Ω
Deviation of R25		ΔR/R	−3	–	3	%
Power dissipation		P_D	–	50	–	mW
Power dissipation constant			–	5	–	mW/K
B−value	B(25/50), tolerance ±3%		–	3375	–	K
B−value	B(25/100), tolerance ±3%		–	3455	–	K

ORDERING INFORMATION

Orderable Part Number	Specific Device Marking	Package Type	Shipping†
NXH010P120MNF1PNG	NXH010P120MNF1PNG	F1−2PACK: Case 180BW Press−fit Pins (Pb−Free and Halide−Free)	28 Units / Blister Tray
NXH010P120MNF1PTNG	NXH010P120MNF1PTNG	F1−2PACK: Case 180BW Press−fit Pins with pre−applied thermal interface material (TIM) (Pb−Free and Halide−Free)	28 Units / Blister Tray

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

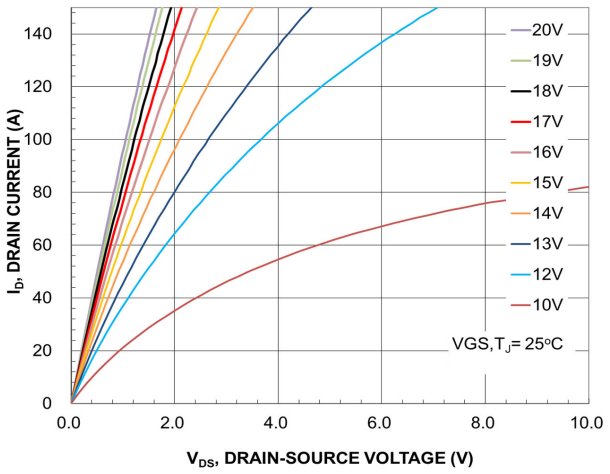


Figure 3. MOSFET Typical Output Characteristics

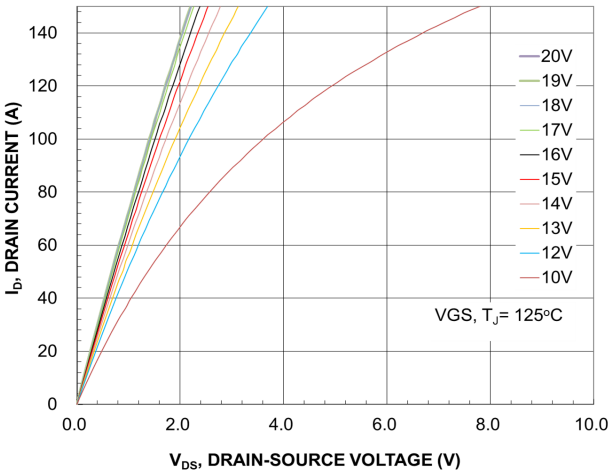


Figure 4. MOSFET Typical Output Characteristics

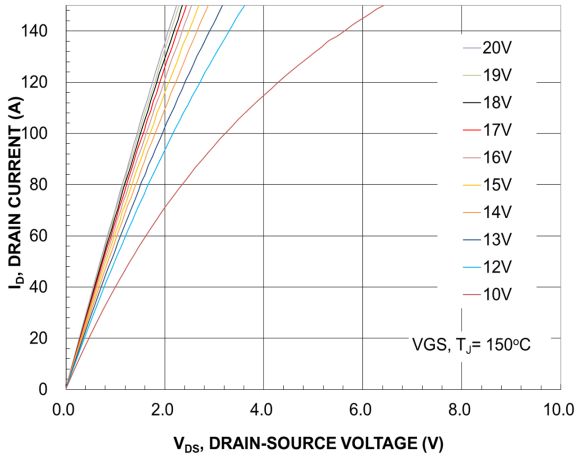


Figure 5. MOSFET Typical Output Characteristics

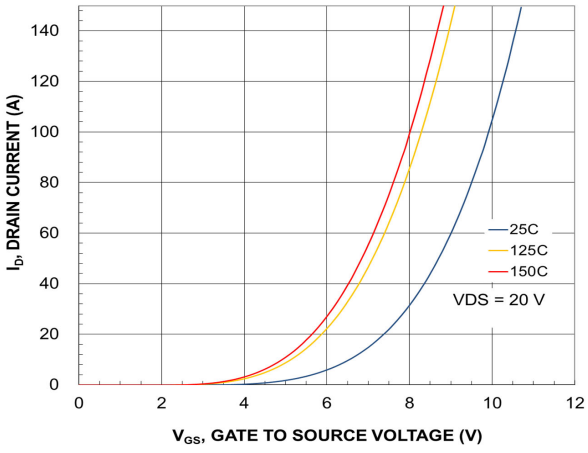


Figure 6. MOSFET Typical Transfer Characteristics

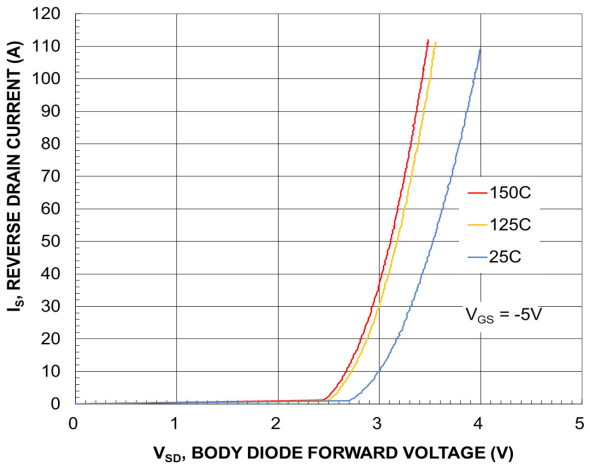


Figure 7. Body Diode Forward Characteristic

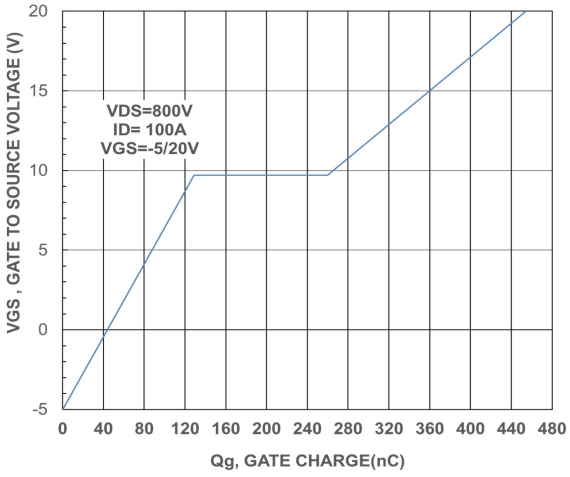


Figure 8. Gate−to−Source Voltage vs. Total Charge

TYPICAL CHARACTERISTICS

SiC MOSFET (M1, M2)

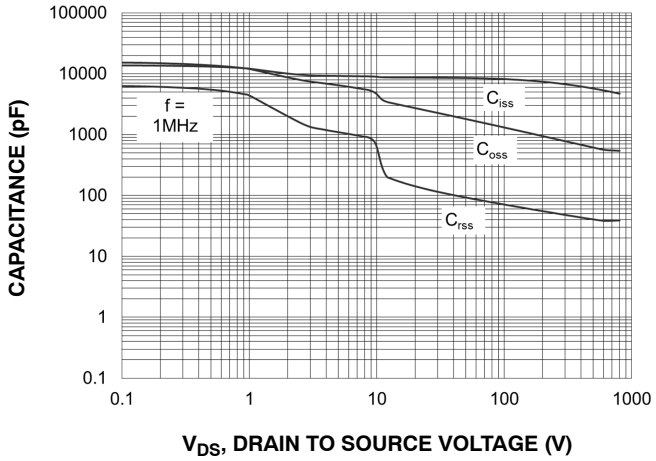


Figure 9. Capacitance vs. Drain−to−Source Voltage

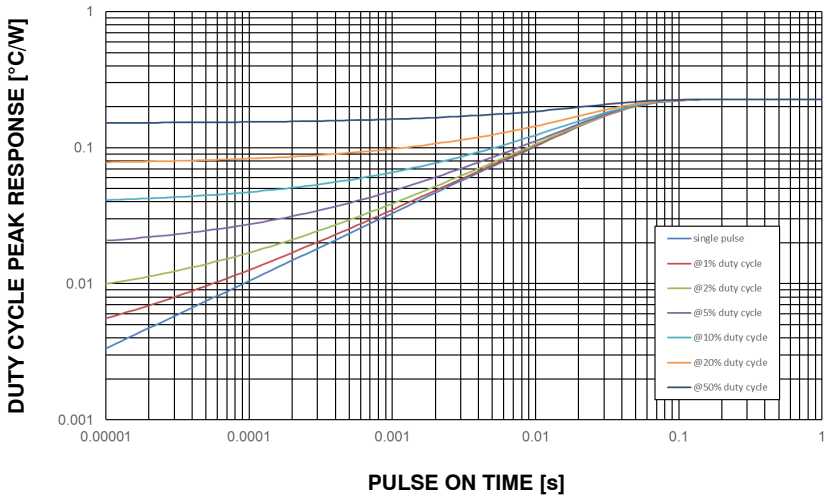
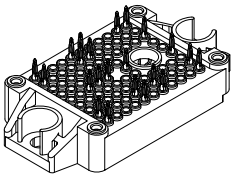


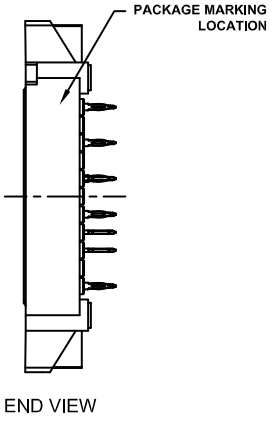
Figure 10. SiC Mosfet Junction− to−Case Transient Thermal Impedance

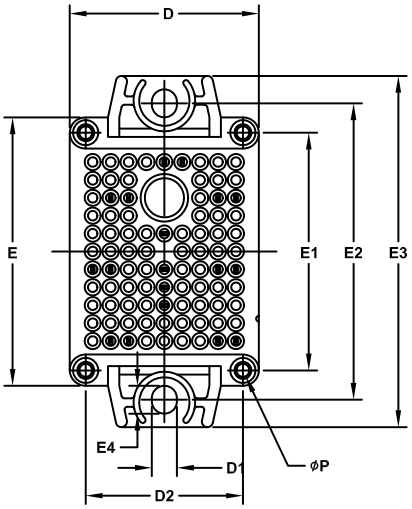
Element #	M1		M2	
	Rth (K/W)	Cth (Ws/K)	Rth (K/W)	Cth (Ws/K)
1	0.00569	0.00195	0.01290	0.00461
2	0.01079	0.00951	0.02387	0.02538
3	0.03005	0.01813	0.04253	0.02953
4	0.08398	0.08121	0.07199	0.08994
5	0.09325	0.11117	0.07823	0.06854

Figure 11. Table of Cauer Networks−M1, M2



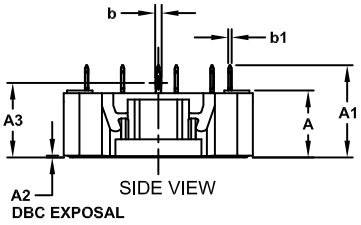
PIM18 33.8x42.5 (PRESS FIT)
CASE 180BW
ISSUE A

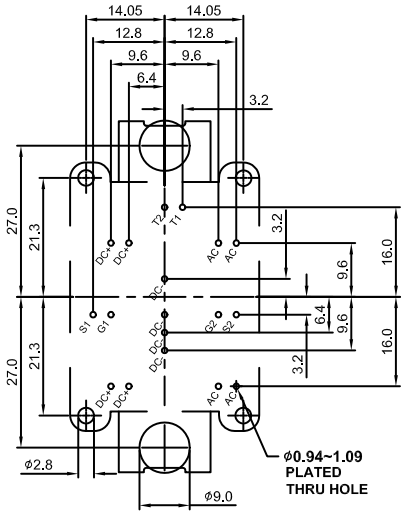




NOTES:
1. CONTROLLING DIMENSION: MILLIMETERS
2. PIN POSITION TOLERANCE IS ± 0.4mm

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	11.65	12.00	12.35
A1	16.00	16.50	17.00
A2	0.00	0.35	0.60
A3	12.85	13.35	13.85
b	1.15	1.20	1.25
b1	0.59	0.64	0.69
D	33.50	33.80	34.10
D1	4.40	4.50	4.60
D2	27.95	28.10	28.25
E	47.70	48.00	48.30
E1	42.35	42.50	42.65
E2	52.90	53.00	53.10
E3	62.30	62.80	63.30
E4	4.90	5.00	5.10
P	2.20	2.30	2.40





RECOMMENDED MOUNTING PATTERN

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