

3-Level ANPC Inverter Module

Preliminary Document NXH270A120M3F5SHG

The NXH270A120M3F5SHG is a power module in F5BP containing an A-type neutral point clamped three-level inverter. The integrated field stop trench IGBTs and FRDs and SiC MOSFET provide lower conduction and switching losses, enabling designers to achieve high efficiency, higher power and superior reliability.

Features

- A-type Neutral Point Clamped Three-level Inverter Module
- 1200 V SiC MOSFETs
- 1200 V Field Stop 7 IGBTs
- Low Inductive layout
- Solder Pins
- Integrated NTC Thermistor
- This Device is Pb-Free, Halide Free and is RoHS Compliant

Typical Applications

- Energy Storage System
- Solar Inverters

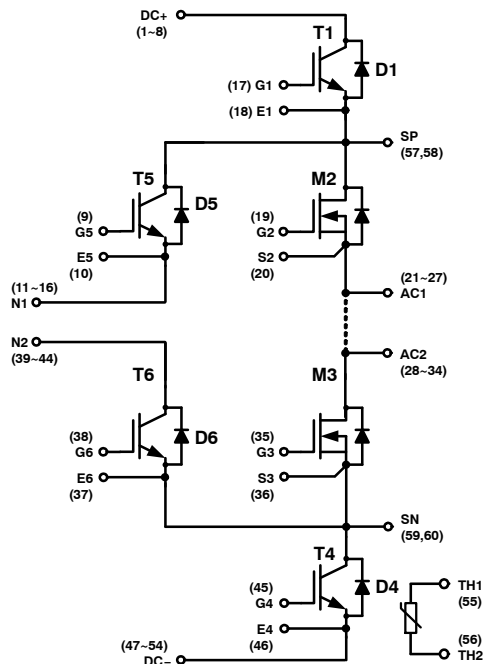
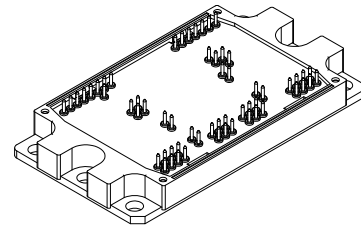


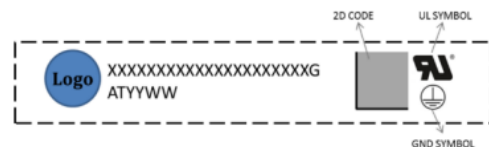
Figure 1. NXH270A120M3F5SHG Schematic Diagram

This Preliminary document is for informational purposes only. onsemi may update or withdraw it without notice. Content and referenced products are under development and subject to change.



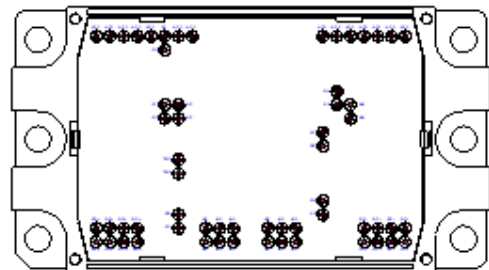
PIM-60 112.00x62.00x12.00
CASE 180DN

MARKING DIAGRAM



XXXXXX = Device Code
G = Pb-Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 4 of this data sheet.

NXH270A120M3F5SHG

MODULE CHARACTERISTICS

Operating Temperature under Switching Condition	T_{VJOP}	-40 to 175	°C
Storage Temperature Range	T_{stg}	-40 to 125	°C
Isolation Test Voltage, $t = 60$ s, 50 Hz	V_{is}	4000	V_{RMS}
Stray Inductance	L_{sCE}	10	nH
Terminal Connection Torque (M5, Screw)	M	3–5	Nm
Weight	G	260	g
Creepage Distance (Terminal to Heatsink)		17.4	mm
Creepage Distance (Terminal to Terminal)		7.0	mm
Clearance Distance (Terminal to Heatsink)		15.6	mm
Clearance Distance (Terminal to Terminal)		6.0	mm
Comparative Tracking Index	CTI	>600	

ABSOLUTE MAXIMUM RATINGS ($T_J = 25$ °C unless otherwise noted)

Parameter	Symbol	Value	Unit
-----------	--------	-------	------

SiC MOSFET (M2, M3)

Drain-Source Voltage	V_{DSS}	1200	V
Gate-Source Voltage	V_{GS}	+22/-10	V
Recommended Operating Gate-Source Voltage	V_{GS_OP}	+18/-3~-5	V
Continuous Drain Current @ $T_C = 80$ °C, ($T_{VJ} = 175$ °C)	I_D	463	A
Pulsed Peak Drain Current @ $T_C = 80$ °C ($T_{VJ} = 175$ °C), $T_{pulse} = 1$ ms	I_{Dpulse}	1200	A
Power Dissipation ($T_{VJ} = 175$ °C, $T_C = 80$ °C)	P_{tot}	826	W
Minimum Operating Junction Temperature	T_{JMIN}	-40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

OUTER and NEUTRAL POINT IGBTs (T1, T4, T5, T6)

Collector-Emitter Voltage	V_{CES}	1200	V
Gate-Emitter Voltage Positive Transient Gate-emitter Voltage ($T_{pulse} = 5$ μ s, $D < 0.10$)	V_{GE}	± 20 30	V
Continuous Collector Current @ $T_C = 80$ °C ($T_{VJ} = 175$ °C)	I_C	299	A
Pulsed Peak Collector Current @ $T_C = 80$ °C ($T_{VJ} = 175$ °C), $T_{pulse} = 1$ ms	I_{Cpulse}	800	A
Power Dissipation ($T_{VJ} = 175$ °C, $T_C = 80$ °C)	P_{tot}	742	W
Minimum Operating Junction Temperature	T_{JMIN}	-40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

OUTER and NEUTRAL POINT DIODES (D1, D4, D5, D6)

Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ $T_C = 80$ °C ($T_{VJ} = 175$ °C)	I_F	260	A
Repetitive Peak Forward Current ($T_{VJ} = 175$ °C), $T_{pulse} = 1$ ms	I_{FRM}	800	A
Maximum Power Dissipation @ $T_C = 80$ °C ($T_{VJ} = 175$ °C)	P_{tot}	463	W
Minimum Operating Junction Temperature	T_{JMIN}	-40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

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.
2. For optimum lifetime and reliability, **onsemi** recommends continuous V_{CE} (Half DC link voltage) operating conditions do not exceed 80% of the maximum ratings.

NXH270A120M3F5SHG

ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SIC MOSFET (M2, M3)						
Zero Gate Voltage Drain Current	V _{GS} = 0 V, V _{DS} = 1200 V	I _{DSS}	–	–	1	mA
Drain-Source On Resistance	V _{GS} = 18 V, I _D = 450 A, T _{VJ} = 25 °C	R _{DS(ON)}	–	1.8	2.35	mΩ
	V _{GS} = 18 V, I _D = 450 A, T _{VJ} = 150 °C		–	3.5	–	
	V _{GS} = 18 V, I _D = 450 A, T _{VJ} = 175 °C		–	3.9	–	
Gate-Source Threshold Voltage	V _{GS} = V _{DS} , I _D = 198 mA, T _{VJ} = 25 °C (tested after I _{GSS} @ = +22 V)	V _{GS(TH)}	2.3	3.0	4.5	V
	V _{GS} = V _{DS} , I _D = 198 mA, T _{VJ} = 175 °C (tested after I _{GSS} @ = +22 V)		–	2.3	–	
Gate Leakage Current	V _{GS} = 22 V, V _{DS} = 0 V	I _{GSS}	–	–	1	μA
	V _{GS} = –10 V, V _{DS} = 0 V		–1	–	–	
Internal Gate Resistor	F = 1 MHz	R _{GINT}	–	1.5	–	Ω
Turn-on Delay Time	T _J = 25 °C V _{DS} = 800 V, I _D = 300 A V _{GS} = –5 V to +18 V, R _G = 4 Ω	t _{d(on)}	–	118.02	–	ns
Rise Time		t _r	–	77.26	–	
Turn-off Delay Time		t _{d(off)}	–	328.55	–	
Fall Time		t _f	–	38.25	–	
Turn-on Switching Loss per Pulse		E _{ON}	–	6.13	–	mJ
Turn off Switching Loss per Pulse		E _{OFF}	–	10.24	–	
Turn-on Delay Time	T _J = 150 °C V _{DS} = 800 V, I _D = 300 A V _{GS} = –5 V to +18 V, R _G = 4 Ω	t _{d(on)}	–	110.48	–	ns
Rise Time		t _r	–	73.8	–	
Turn-off Delay Time		t _{d(off)}	–	380.85	–	
Fall Time		t _f	–	39.05	–	
Turn-on Switching Loss per Pulse		E _{ON}	–	6.24	–	mJ
Turn off Switching Loss per Pulse		E _{OFF}	–	10.33	–	
Total Gate Charge	V _{DS} = 800 V, V _{GS} = –10/18 V, I _D = 225 A	Q _{G(TOTAL)}		1512		nC
Gate-Source Charge		Q _{GS}		272		
Gate-Drain Charge		Q _{GD}		336		
Input Capacitance	V _{DS} = 800 V, V _{GS} = 0 V, f = 1 MHz	C _{ISS}	–	37647.4	–	pF
Output Capacitance		C _{OSS}	–	1705.48	–	
Reverse Transfer Capacitance		C _{RSS}	–	35.58	–	
Diode Forward Voltage	V _{GS} = –5 V, I _D = 300 A, T _J = 25 °C	V _{SD}	3.5	4.44	5.5	V
	V _{GS} = –5 V, I _D = 300 A, T _J = 150 °C		–	4.06	–	
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness < 100 μm Thermal conductivity= 3.3 W/mK	R _{thJH}		0.159		°C/W
Thermal Resistance – Chip-to-case		R _{thJC}		0.115		°C/W

OUTER and NEUTRAL POINT IGBTs (T1, T4, T5, T6)

Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = 1200 V	I _{CES}	–	–	1	mA
Collector-Emitter Saturation Voltage	V _{GE} = 15 V, I _C = 270 A, T _J = 25 °C	V _{CE(sat)}	–	1.50	2.0	V
	V _{GE} = 15 V, I _C = 270 A, T _J = 175 °C		–	1.75	–	
Gate-Emitter Threshold Voltage	V _{GE} = V _{CE} , I _C = 270 mA	V _{GE(TH)}	5.0	6.0	7.0	V
Gate Leakage Current	V _{GE} = ±20 V, V _{CE} = 0 V	I _{GES}	–	–	300	nA
Internal Gate Resistor	F = 1 MHz	R _{GINT}	–	4.25	–	Ω

NXH270A120M3F5SHG

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
OUTER and NEUTRAL POINT IGBTs (T1, T4, T5, T6)						
Turn-off Safe Operating Area	V _{CC} = 800V, V _{CE} < 1200V at Chip Level, T _{VJ} < 175 °C		–	–	540	A
Total Gate Charge	V _{CE} = 800 V, V _{GE} = –15/15 V, I _C = 135 A	Q _{G(TOTAL)}	–	1904	–	nC
Gate-Emitter Charge		Q _{GE}	–	256	–	
Gate-Collector Charge		Q _{GC}	–	408	–	
Input Capacitance	V _{CE} = 20 V, V _{GE} = 0 V, f = 100 kHz	C _{IES}	–	35151.5	–	pF
Output Capacitance		C _{OES}	–	1420.23	–	
Reverse Transfer Capacitance		C _{RES}	–	188.56	–	
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness < 100 μm Thermal conductivity = 3.3 W/mK	R _{thJH}	–	0.196	–	°C/W
Thermal Resistance – Chip-to-case		R _{thJC}	–	0.128	–	°C/W

OUTER and NEUTRAL POINT DIODEs (D1, D4, D5, D6)

Diode Forward Voltage	I _F = 340 A, T _{VJ} = 25 °C	V _F	–	2.03	2.3	V
	I _F = 340 A, T _{VJ} = 175 °C		–	2.09	–	
Surge Forward Current	tp = 10 ms, T _{VJ} = 150 °C	I _{FSM}	–	–	1000	A
I _{2t}	tp = 10 ms, T _{VJ} = 150 °C	I _{2t}	–	–	5000	A ² s
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness < 100 μm Thermal conductivity = 3.3 W/mK	R _{thJH}	–	0.287	–	°C/W
Thermal Resistance – Chip-to-case		R _{thJC}	–	0.205	–	°C/W

THERMISTOR CHARACTERISTICS

Nominal Resistance	T = 25 °C	R25	–	5	–	k
Nominal Resistance	T = 100 °C	R100	–	492.2	–	
Deviation of R25		R/R	–1	–	1	%
Power Dissipation		P _D	–	5	–	mW
Power Dissipation Constant			–	1.3	–	mW/K
B-value	B(25/85), tolerance ±1%		–	3430	–	K

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

ORDERING INFORMATION

Device	Marking	Package	Shipping
NXH270A120M3F5SHG	NXH270A120M3F5SHG	F5 – PIM-60 112x62 (Pb-Free / Halide Free)	8 Units / Blister Tray

TYPICAL CHARACTERISTICS – T1, T4, T5, T6 (OUTER AND NEUTRAL POINT IGBTs)

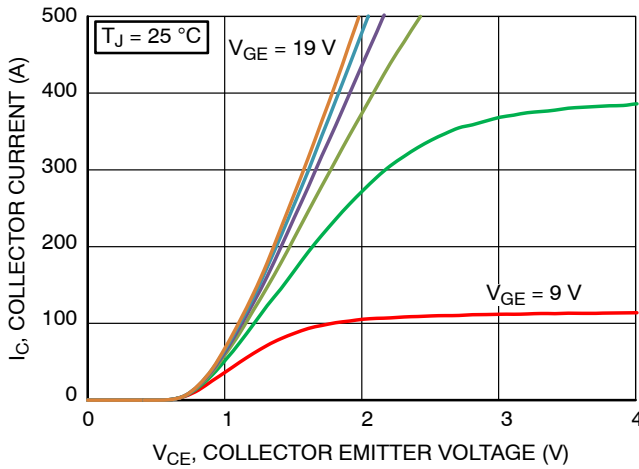


Figure 2. Typical Output Characteristics – IGBT

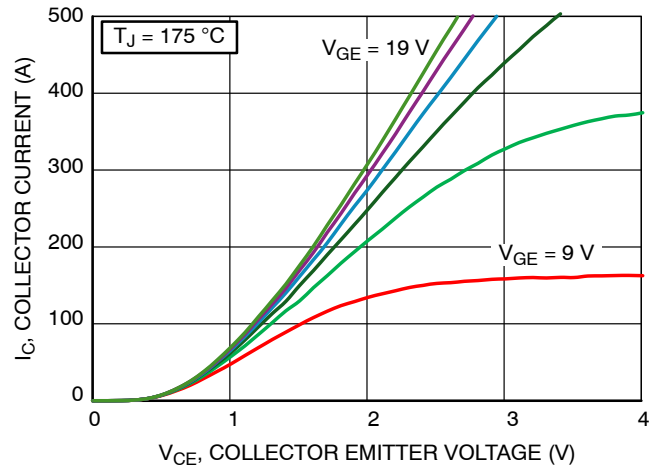


Figure 3. Typical Output Characteristics – IGBT

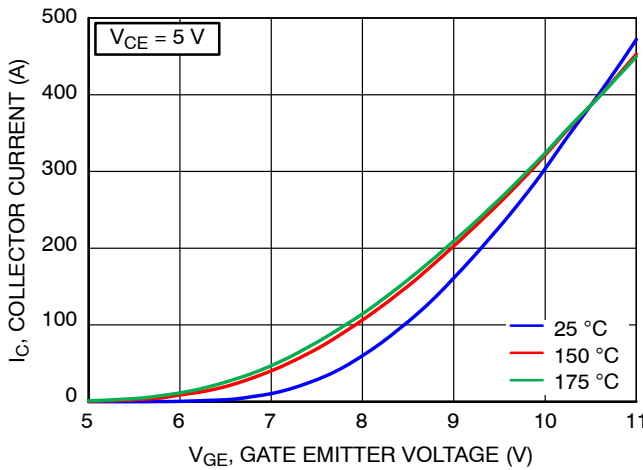


Figure 4. Transfer Characteristics – IGBT

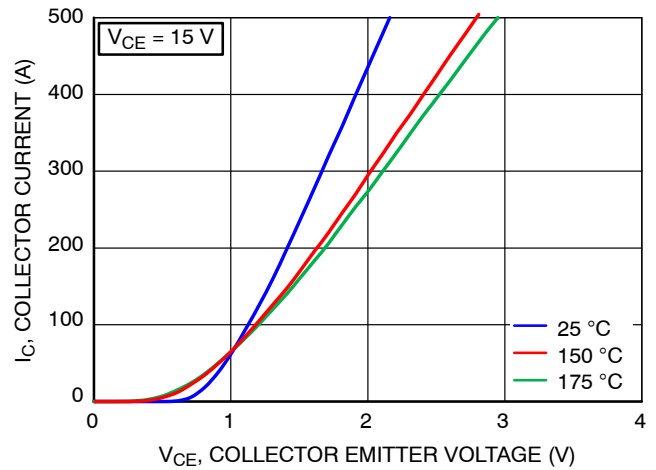


Figure 5. Saturation Voltage Characteristic – IGBT

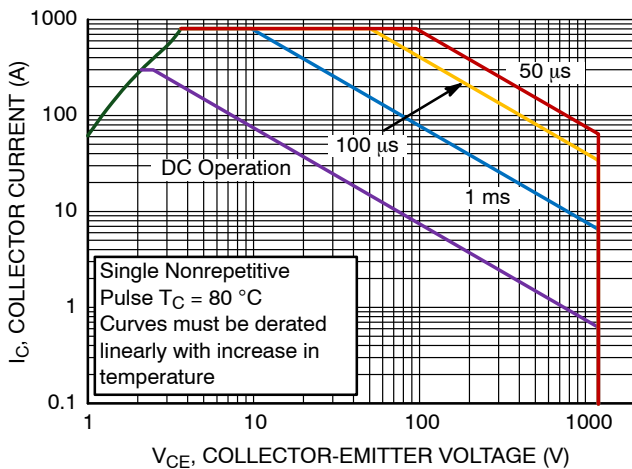


Figure 6. FBSOA

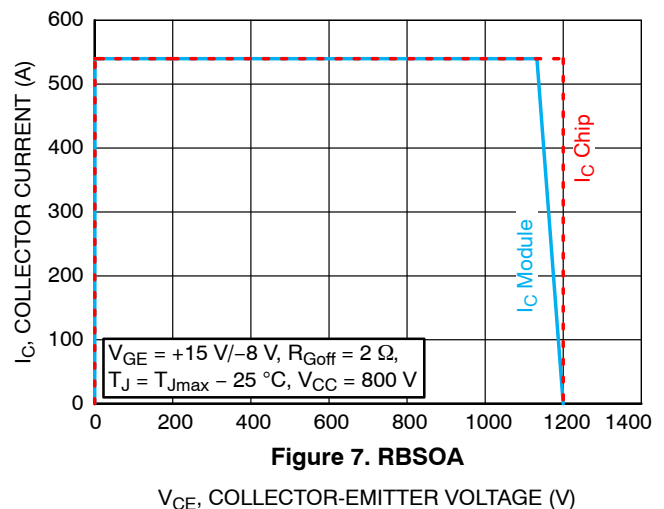


Figure 7. RBSOA

NXH270A120M3F5SHG

TYPICAL CHARACTERISTICS – T1, T4 , T5, T6 (OUTER AND NEUTRAL POINT IGBTs)

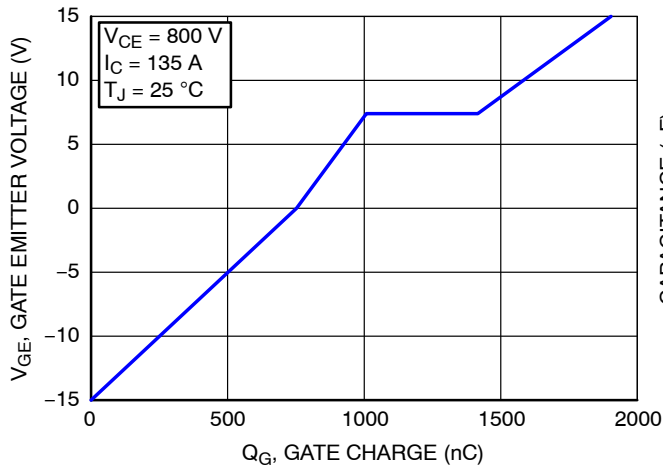


Figure 8. Gate Voltage vs. Gate Charge

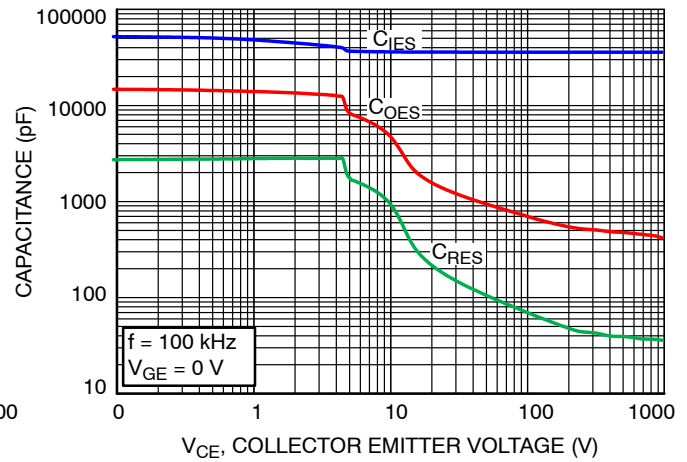


Figure 9. Capacitance Characteristics

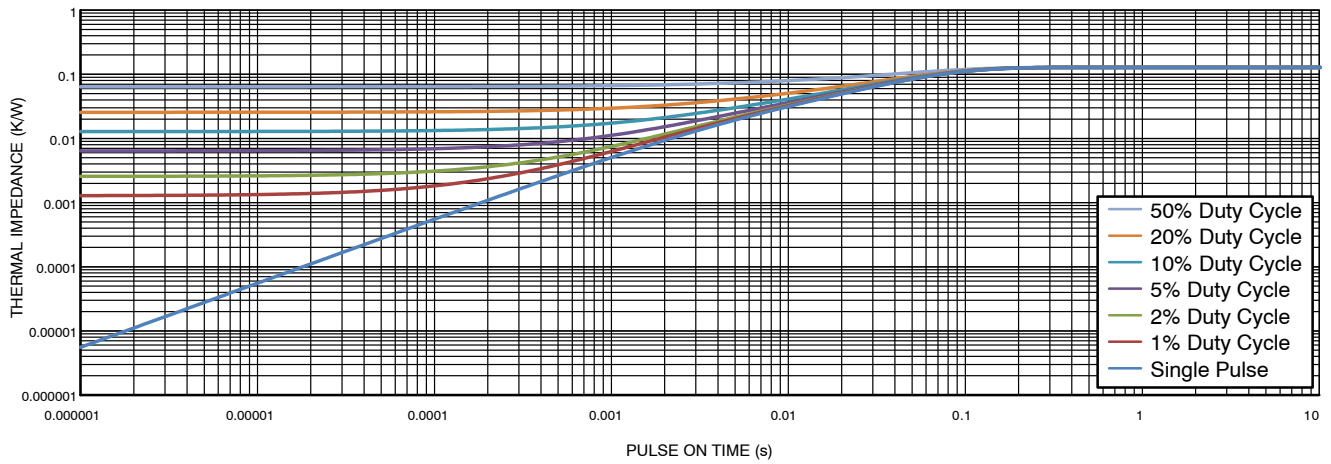


Figure 10. Transient Thermal Impedance (IGBT Z_{thjc})

TYPICAL CHARACTERISTIC – M2, M3 (SIC MOSFET)

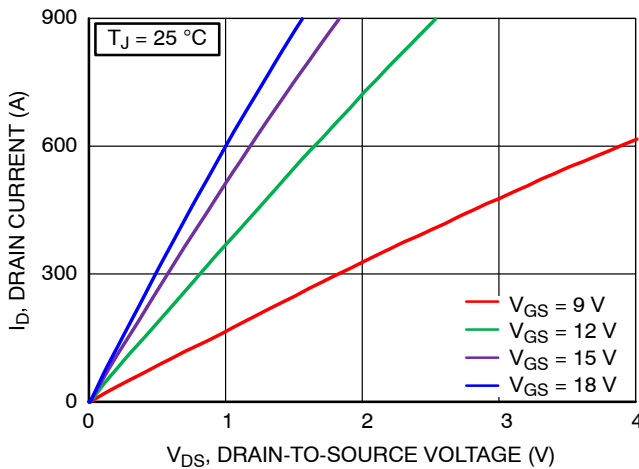


Figure 11. Typical Output Characteristics – SIC MOSFET

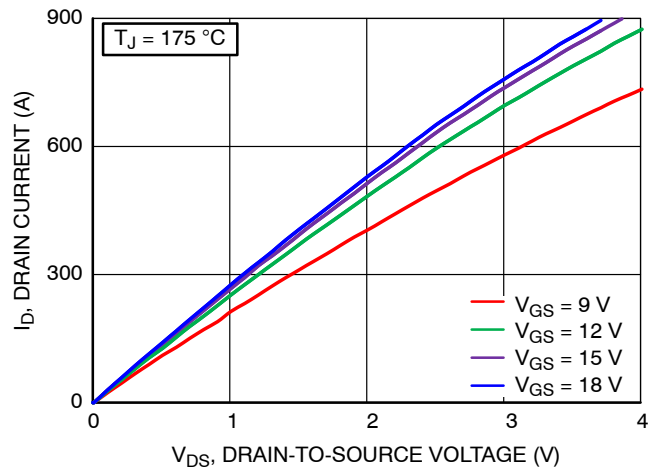


Figure 12. Typical Output Characteristics – SIC MOSFET

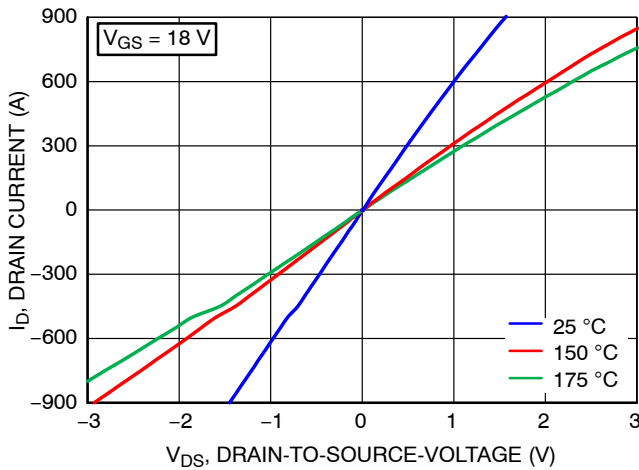


Figure 13. Typical Output Characteristics – SIC MOSFET

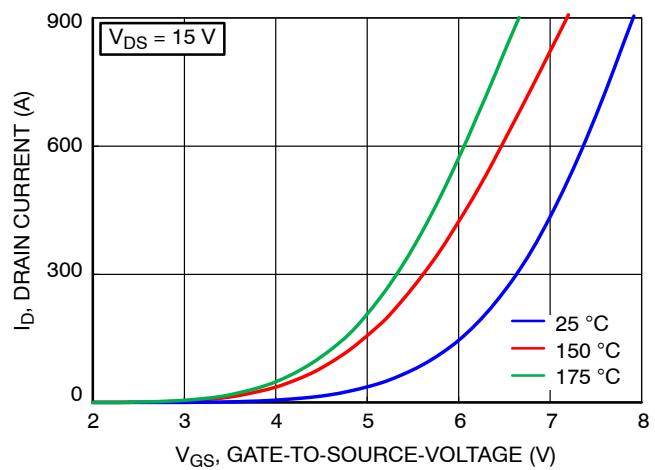


Figure 14. Typical Transfer Characteristics – SIC MOSFET

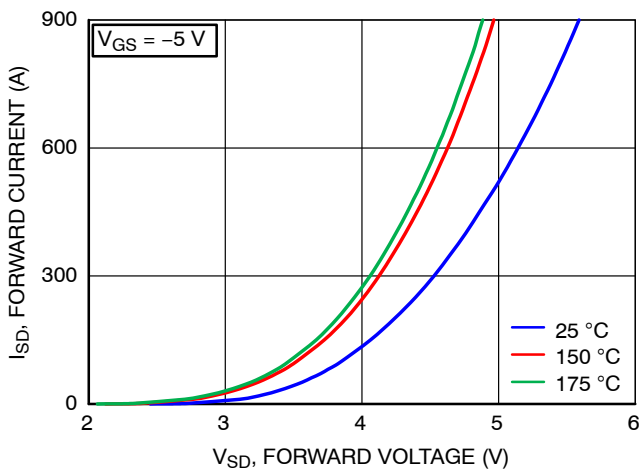


Figure 15. Typical Forward Characteristics – Body Diode

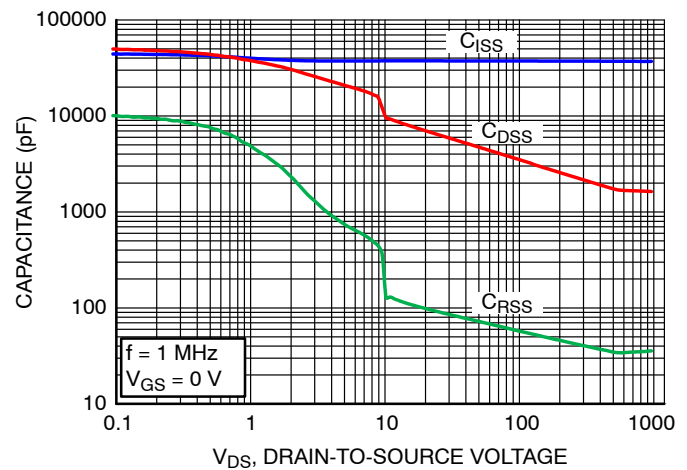


Figure 16. Capacitance Characteristics

NXH270A120M3F5SHG

TYPICAL CHARACTERISTIC – M2, M3 (SIC MOSFET)

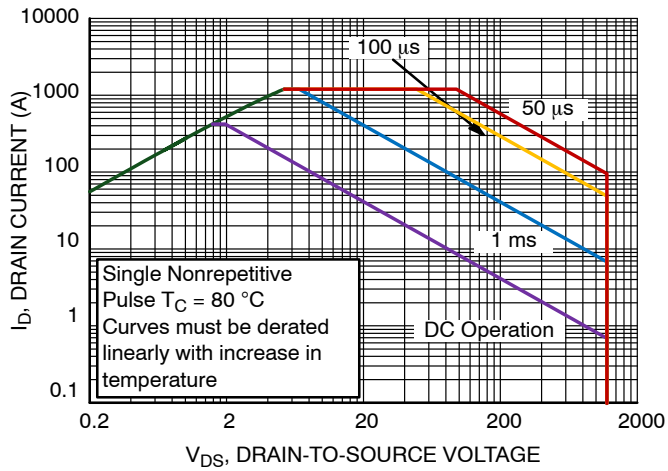


Figure 17. FBSOA

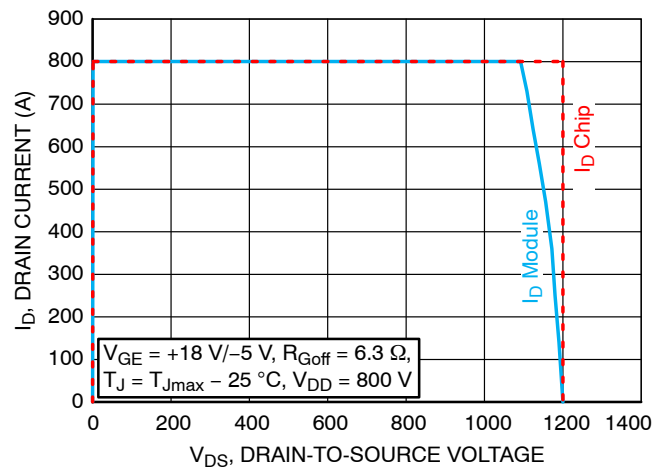


Figure 18. RBSOA

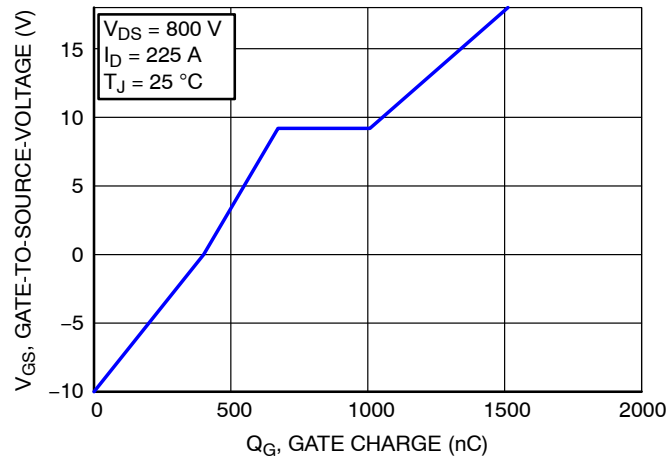


Figure 19. Gate Charge Characteristics

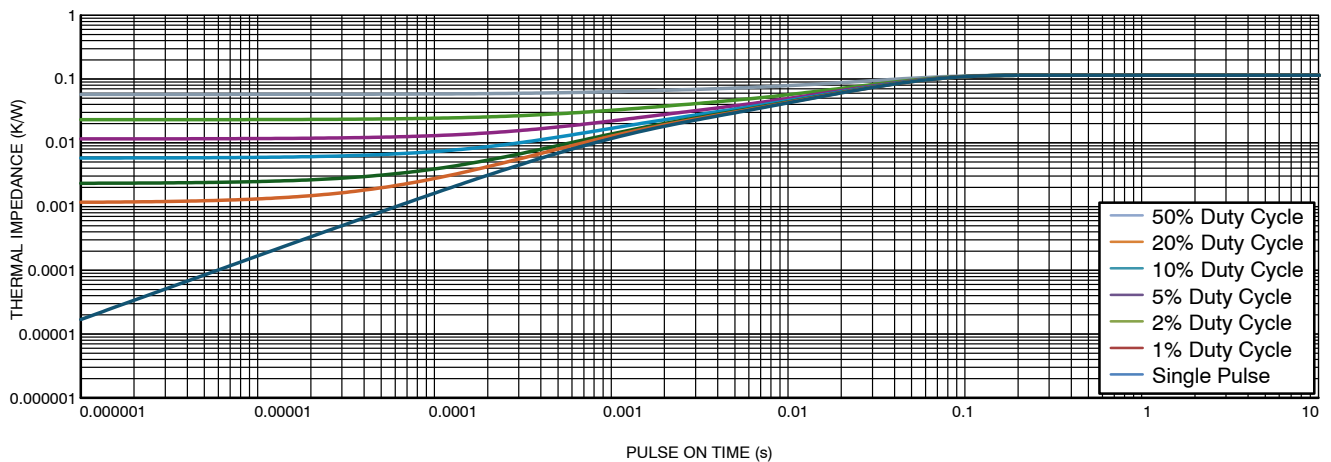


Figure 20. Transient Thermal Impedance (SIC MOSFET)

TYPICAL CHARACTERISTIC – M2, M3 (SIC MOSFET)

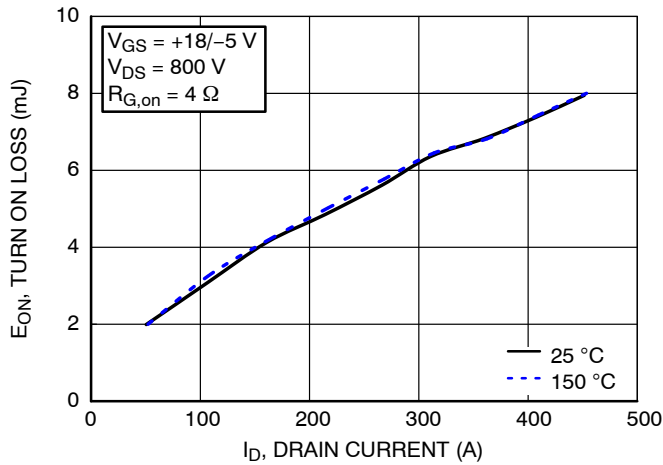


Figure 21. Typical Switching Turn on Loss vs Drain Current

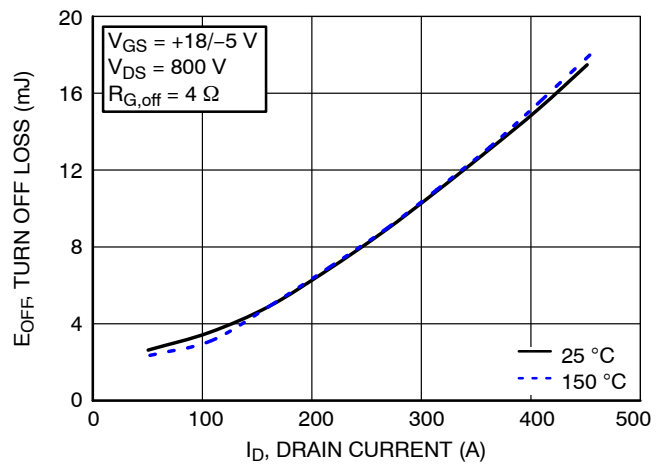


Figure 22. Typical Switching Turn off Loss vs Drain Current

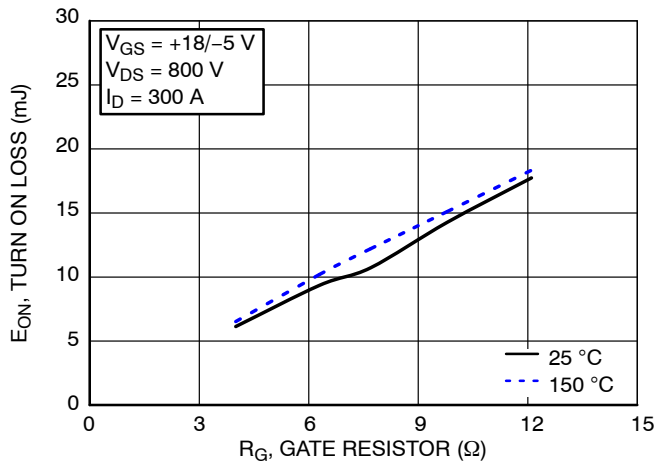


Figure 23. Typical Switching Turn on Loss vs Gate Resistance

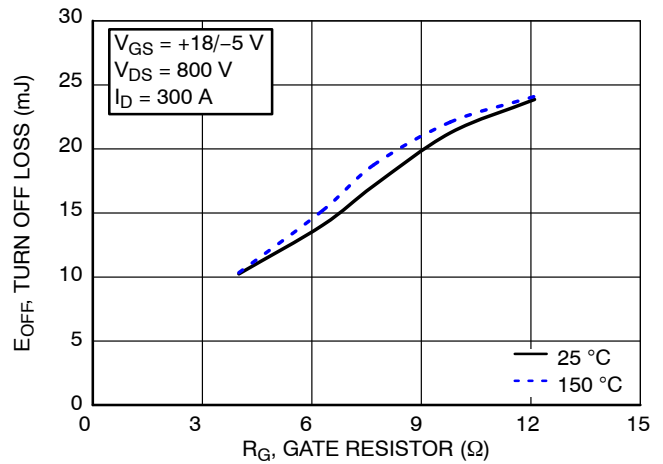


Figure 24. Typical Switching Turn off Loss vs Gate Resistance

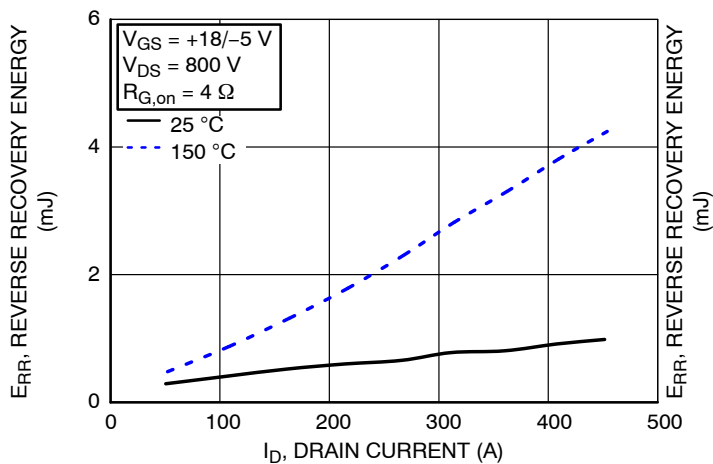


Figure 25. Typical Reverse Recovery Energy vs Drain Current

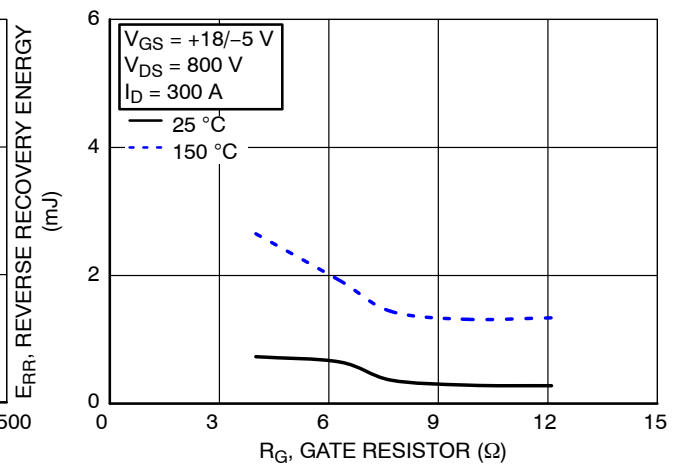


Figure 26. Typical Reverse Recovery Energy vs Gate Resistance

TYPICAL CHARACTERISTIC – M2, M3 (SIC MOSFET)

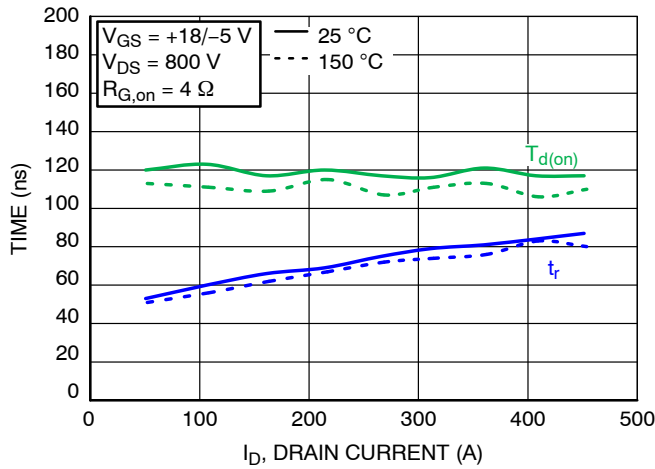


Figure 27. Typical Turn On Switching Time vs Drain Current

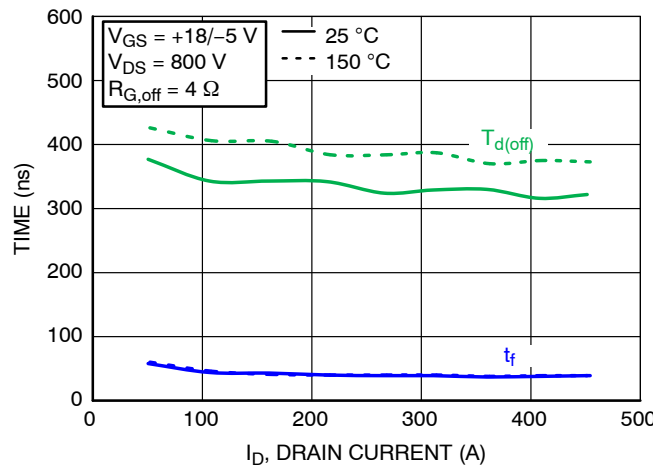


Figure 28. Typical Turn Off Switching Time vs Drain Current

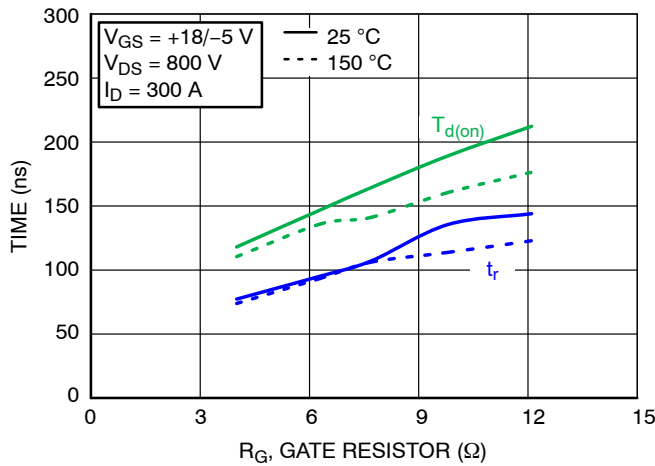


Figure 29. Typical Turn On Switching Time vs Gate Resistance

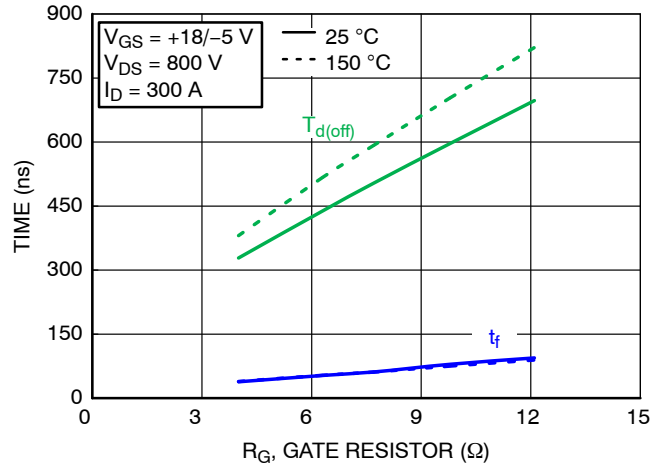


Figure 30. Typical Turn Off Switching Time vs Gate Resistance

NXH270A120M3F5SHG

TYPICAL CHARACTERISTIC – D1, D4, D5, D6 (OUTER AND NEUTRAL POINT DIODES)

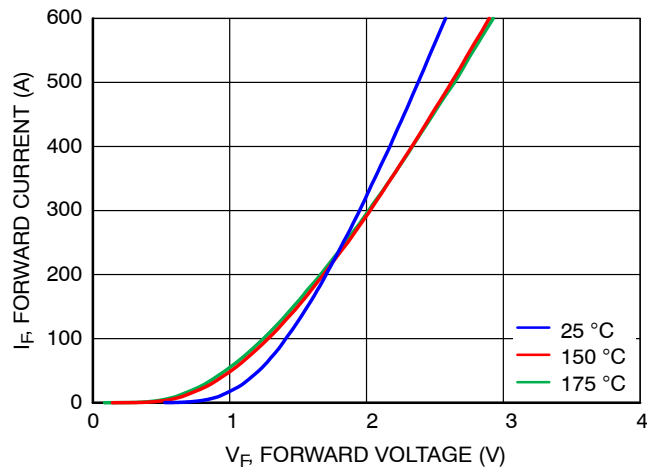


Figure 31. Typical Outer and Neutral Point Diodes Forward Characteristics

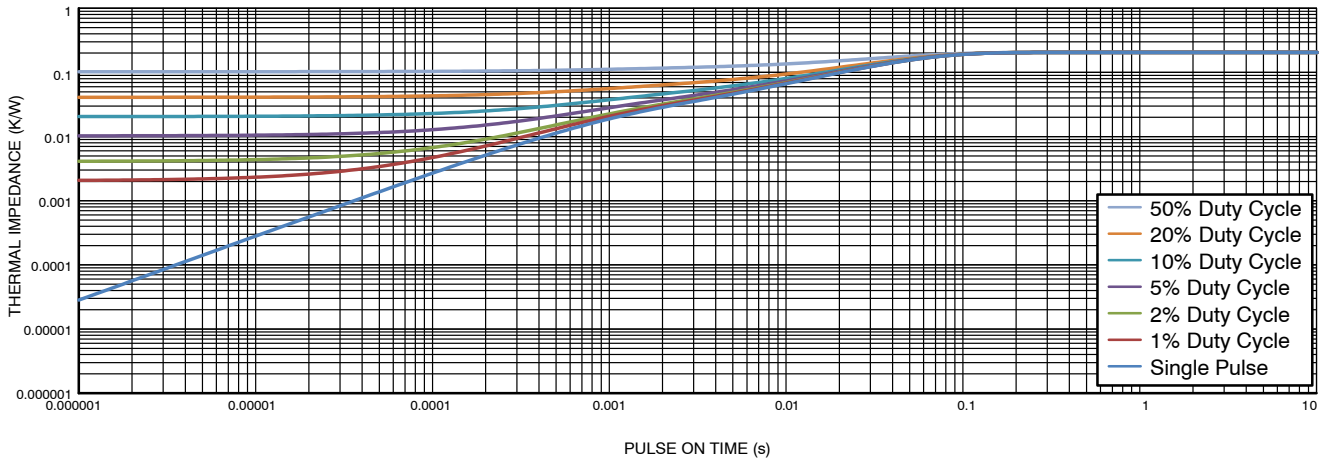


Figure 32. Transient Thermal Impedance (Outer and Neutral Point Diodes)

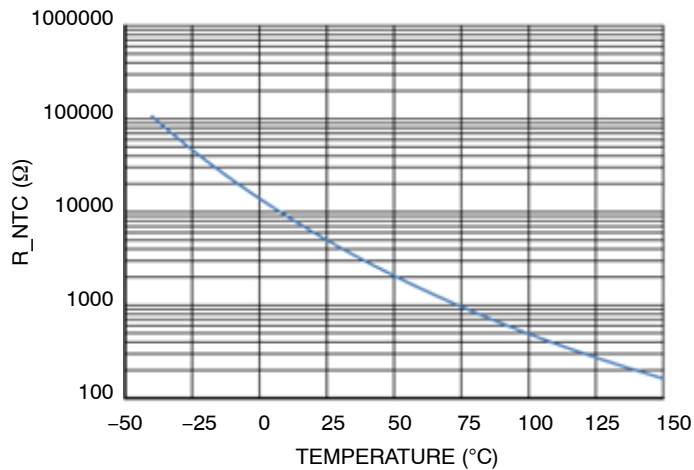


Figure 33. Temperature vs. NTC Value

NXH270A120M3F5SHG

REVISION HISTORY

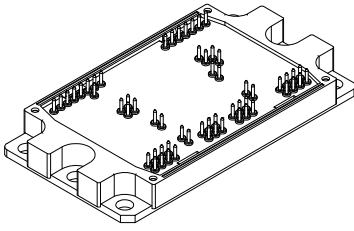
Revision	Description of Changes	Date
P0	Initial Preliminary document release.	5/12/2026
P1	P1: Change the I_D and $I_{D,pulse}$ of SiC MOSFET and I_C and $I_{C,pulse}$ of IGBT and add $V_{GS} = 18\text{ V}$, $I_D = 198\text{ mA}$, $T_{vj} = 25\text{ }^\circ\text{C}$, (tested after $I_{GSS} @ = +22\text{ V}$) for $V_{GS(TH)}$ of SiC MOSFET P2: Add Recommended Operating Gate-Source Voltage, V_{GS_OP}, $+18/-3\sim-5\text{ V}$ P3: Change the description from $R_{G,on}$ to R_G in switching test condition P4: Change the unit from μA to mA of I_{DSS} P5: Change the description from Gate-Emitter Threshold Voltage to Gate-Source Threshold Voltage for SiC MOSFET and from 322 A to 299 A for I_C of IGBT P6: Change thermal conductivity from 2.87 W/mK to 3.3 W/mK P7: Change the description from $R_{G,on}$ to $R_{G,off}$ in the plot and remove Gate-Emitter Threshold Voltage for SiC MOSFET P8: Change the description from $V_{GS} = 15\text{ V}$ to $V_{GS} = V_{DS}$	6/17/2026

NXH270A120M3F5SHG

PACKAGE DIMENSIONS

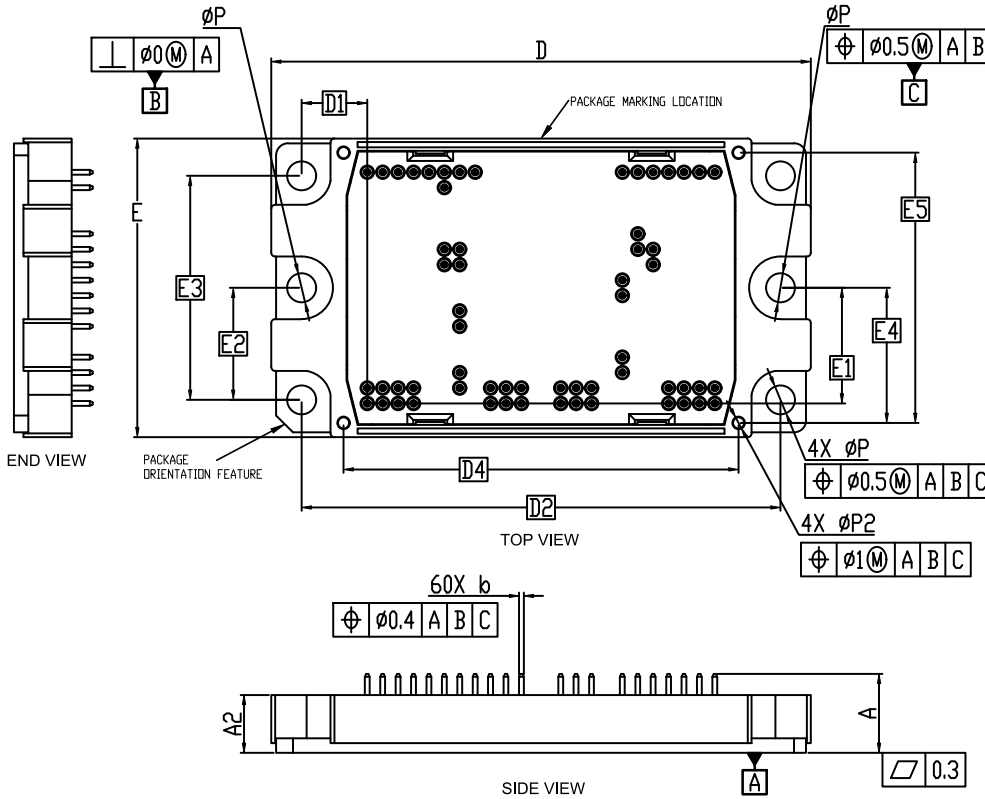
PIM-60 112.00x62.00x12.00
CASE 180DN
ISSUE O

DATE 06 NOV 2025



NOTES:

1. Dimensioning and tolerancing conform to ASME Y14.5
2. All dimensions are in millimeters.
3. Pin-grid is 3.2mm.
4. Package marking is located on the side opposite the package orientation feature.
5. The pins are gold-plated solder pin.
6. Pin Position tolerance is $\pm 0.04\text{mm}$



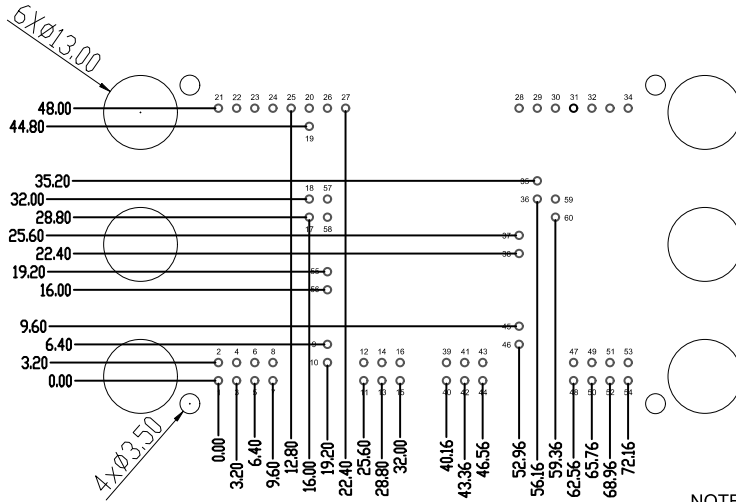
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	15.98	16.38	16.78
A2	11.70	12.00	12.30
b	0.95	1.00	1.05
D	111.60	112.00	112.40
D1		13.62 BSC	
D2		99.40 BSC	
D4		82.00 BSC	
E	61.60	62.00	62.40
E1		24.00 BSC	
E2		23.25 BSC	
E3		46.50 BSC	
E4		28.05 BSC	
E5		56.10 BSC	
P	5.90	6.00	6.10
P2	2.20	2.30	2.40

NXH270A120M3F5SHG

PACKAGE DIMENSIONS

PIM-60 112.00x62.00x12.00
CASE 180DN
ISSUE 0

DATE 06 NOV 2025



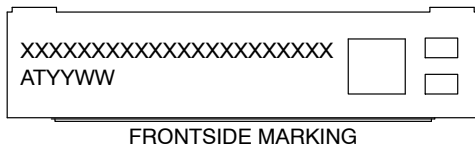
RECOMMENDED MOUNTING PATTERN

* For additional Information on our Pb-Free strategy and soldering details, please download the Onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

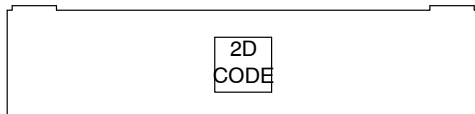
NOTE 2:

Pin table								
Pin	X	Y	Pin	X	Y	Pin	X	Y
1	0	0	23	6.4	48	45	52.96	9.6
2	0	3.2	24	9.6	48	46	52.96	6.4
3	3.2	0	25	12.8	48	47	62.56	3.2
4	3.2	3.2	26	19.2	48	48	62.56	0
5	6.4	0	27	22.4	48	49	65.76	3.2
6	6.4	3.2	28	52.96	48	50	65.76	0
7	9.6	0	29	56.16	48	51	68.96	3.2
8	9.6	3.2	30	59.36	48	52	68.96	0
9	19.2	6.4	31	62.56	48	53	72.16	3.2
10	19.2	3.2	32	65.76	48	54	72.16	0
11	25.6	0	33	68.96	48	55	19.2	19.2
12	25.6	3.2	34	72.16	48	56	19.2	16
13	28.8	0	35	56.16	35.2	57	19.2	32
14	28.8	3.2	36	56.16	32	58	19.2	28.8
15	32	0	37	52.96	25.6	59	59.36	32
16	32	3.2	38	52.96	22.4	60	59.36	28.8
17	16	28.8	39	40.16	3.2			
18	16	32	40	40.16	0			
19	16	44.8	41	43.36	3.2			
20	16	48	42	43.36	0			
21	0	48	43	46.56	3.2			
22	3.2	48	44	46.56	0			

GENERIC MARKING DIAGRAM*



FRONTSIDE MARKING



BACKSIDE MARKING

XXXXX = Specific Device Code
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales