

# 27 mΩ, 1200 V SiC Boost Module

## NXH027B120MNF2PTG

The NXH027B120MNF2PTG Silicon Boost module contains three parallel 80 mΩ, 1200 V SiC MOSFETs, five parallel 10 A, 1200 V SiC boost diodes, two parallel 150 A, 1200 V bypass diodes, one 75 A, 1200 V protection diode for the MOSFETs and an NTC thermistor. The device is packaged in an F2 package with pre-applied phase-change material and press-fit pins.

### Features

- Pre-applied Phase-change Material
- Press-fit Pins
- Pin Compatible with Full Si Boost Module
- Internal 3 Ohm Gate Resistors for the SiC MOSFETs

### Typical Applications

- Solar Inverter

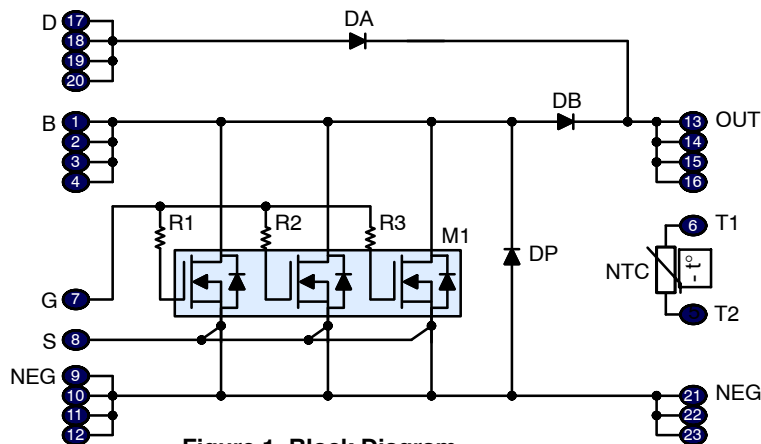
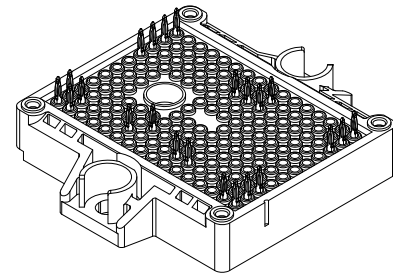
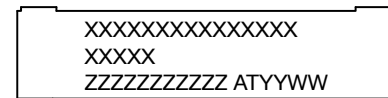


Figure 1. Block Diagram



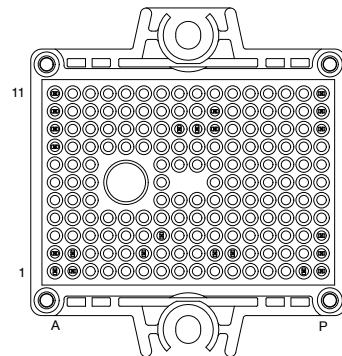
F2 BOOST  
CASE MODGZ

### MARKING DIAGRAM



XXXX = Specific Device Code  
ZZZ = Lot ID  
AT = Assembly & Test Location  
YY = Year  
WW = Work Week

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# NXH027B120MNF2PTG

**Table 1. PIN FUNCTION DESCRIPTION**

Pin	Name	Description
21	NEG	Power Ground
22	NEG	Power Ground
13	OUT	Output of Boost
14	OUT	Output of Boost
15	OUT	Output of Boost
16	OUT	Output of Boost
23	NEG	Power Ground
12	NEG	Power Ground
7	G	SiC MOSFET Gate
8	S	SiC MOSFET Source
17	D	Bypass Diode Anode
18	D	Bypass Diode Anode
6	T1	Thermistor connection 1
19	D	Bypass Diode Anode
20	D	Bypass Diode Anode
5	T2	Thermistor connection 2
1	B	Boost Switching Node
2	B	Boost Switching Node
3	B	Boost Switching Node
4	B	Boost Switching Node
9	NEG	Power Ground
10	NEG	Power Ground
11	NEG	Power Ground

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**Table 2. MAXIMUM RATINGS** (Note 1)

Rating	Symbol	Value	Unit
<b>BOOST MOSFET</b>			
Drain-Source Voltage	$V_{DSS}$	1200	V
Gate-Source Voltage	$V_{GSS}$	-6 to +22	V
Continuous Drain Current @ $T_c = 80^\circ\text{C}$ ( $T_J = 150^\circ\text{C}$ )	$I_D$	84	A
Maximum Power Dissipation ( $T_J = 150^\circ\text{C}$ )	$P_{tot}$	134	W
Minimum Operating Junction Temperature	$T_{JMIN}$	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	$T_{JMAX}$	150	$^\circ\text{C}$

**BOOST DIODE**

Peak Repetitive Reverse Voltage	$V_{RRM}$	1200	V
Continuous Forward Current @ $T_c = 80^\circ\text{C}$ ( $T_J = 150^\circ\text{C}$ )	$I_F$	85	A
Surge Forward Current, $t_p = 10$ ms	$I_{FSM}$	270	A
Power Dissipation Per Diode ( $T_J = 150^\circ\text{C}, T_h = 80^\circ\text{C}$ )	$P_{tot}$	159	W
Minimum Operating Junction Temperature	$T_{JMIN}$	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	$T_{JMAX}$	150	$^\circ\text{C}$

**BYPASS DIODE/ PROTECTION DIODE**

Peak Repetitive Reverse Voltage	$V_{RRM}$	1200	V
Continuous Forward Current @ $T_c = 80^\circ\text{C}$ ( $T_J = 150^\circ\text{C}$ )	$I_F$	112	A
Surge Forward Current, $t_p = 10$ ms	$I_{FSM}$	400	A
Power Dissipation Per Diode ( $T_J = 150^\circ\text{C}, T_h = 80^\circ\text{C}$ )	$P_{tot}$	111	W
$I^2t$ – value (Surge applied at rated load conditions halfwave, $t_p = 10$ ms, $T_J = 150^\circ\text{C}$ )	$I^2t$	1600	$\text{A}^2\text{s}$
Minimum Operating Junction Temperature	$T_{JMIN}$	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	$T_{JMAX}$	150	$^\circ\text{C}$

**THERMAL PROPERTIES**

Storage Temperature range	$T_{stg}$	-40 to 125	$^\circ\text{C}$
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**MODULE**

Isolation test voltage, @AC 1 minute	$V_{iso}$	2500	$V_{RMS}$
Mounting Torque (Note 2)	$T_{MOUNT}$	2.4	Nm
Creepage distance: Terminal to Heatsink		11.5	mm
Creepage distance: Terminal to Terminal		6.3	mm
Clearance distance: Terminal to Heatsink		10.0	mm
Clearance distance: Terminal to Terminal		5.0	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.
2. Recommendable value: 2 to 2.4 Nm.

**Table 3. RECOMMENDED OPERATING RANGES**

Rating	Symbol	Min	Max	Unit
Module Operating Junction Temperature	$T_J$	-40	150	$^\circ\text{C}$

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.

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**Table 4. ELECTRICAL CHARACTERISTICS**  $T_J = 25^\circ\text{C}$  unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit		
<b>BOOST MOSFET CHARACTERISTICS</b>								
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	$BV_{DSS}$	1200	-	-	V		
Drain-Source Cutoff Current	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}$	$I_{DSS}$	-	-	50	$\mu\text{A}$		
Drain-Source Saturation Voltage	$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 25^\circ\text{C}$	$R_{DS(ON)}$	-	26.3	38	mohm		
	$V_{GS} = 20\text{ V}, I_D = 60\text{ A}, T_J = 150^\circ\text{C}$		-	37.9	-			
Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 13.2\text{ mA}$	$V_{GS(TH)}$	1.4	3.13	4.9	V		
Gate Leakage Current	$V_{GS} = -6\text{ V}/20\text{ V}, V_{DS} = 0\text{ V}$	$I_{GSS}$	-0.4	-	0.4	$\mu\text{A}$		
Internal Gate Resistor		$R_{gext}$	-	3	-	$\Omega$		
Turn-on Delay Time	$T_J = 25^\circ\text{C}$ $V_{DS} = 600\text{ V}, I_D = 60\text{ A}$ $V_{GS} = 18\text{ V}/0\text{ V}, R_G = 11\ \Omega$	$t_{d(on)}$	-	28.9	-	ns		
Rise Time		$t_r$	-	18.2	-			
Turn-off Delay Time		$t_{d(off)}$	-	89.1	-			
Fall Time		$t_f$	-	32.3	-			
Turn-on Switching Loss per Pulse		$E_{on}$	-	848.3	-		$\mu\text{J}$	
Turn off Switching Loss per Pulse		$E_{off}$	-	594.7	-			
Turn-on Delay Time		$T_J = 125^\circ\text{C}$ $V_{DS} = 600\text{ V}, I_D = 60\text{ A}$ $V_{GS} = 18\text{ V}/0\text{ V}, R_G = 11\ \Omega$	$t_{d(on)}$	-	24.6		-	ns
Rise Time			$t_r$	-	15.8		-	
Turn-off Delay Time	$t_{d(off)}$		-	99.5	-			
Fall Time	$t_f$		-	35.9	-			
Turn-on Switching Loss per Pulse	$E_{on}$		-	751.8	-	$\mu\text{J}$		
Turn off Switching Loss per Pulse	$E_{off}$		-	841	-			
Input Capacitance	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		$C_{iss}$	-	3687	-	pF	
Output Capacitance			$C_{oss}$	-	1420	-		
Reverse Transfer Capacitance		$C_{rss}$	-	64	-			
Total Gate Charge	$V_{DS} = 600\text{ V}, I_D = 60\text{ A}, V_{GS} = 18\text{ V}/0\text{ V}$	$Q_g$	-	135.7	-	nC		
Thermal Resistance – chip-to-case		$R_{thJC}$	-	0.38	-	$^\circ\text{C}/\text{W}$		
Thermal Resistance – chip-to-heatsink	Thermal grease, $\lambda = 2.87\text{ W/mK}$	$R_{thJH}$	-	0.60	-	$^\circ\text{C}/\text{W}$		
<b>BOOST DIODE CHARACTERISTICS</b>								
Diode Reverse Leakage Current	$V_R = 1200\text{ V}$	$I_R$	-	-	1000	$\mu\text{A}$		
Diode Forward Voltage	$I_F = 50\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	-	1.44	1.70	V		
	$I_F = 50\text{ A}, T_J = 150^\circ\text{C}$		-	1.95	-			
Reverse Recovery Time	$T_J = 25^\circ\text{C}$ $V_{DS} = 600\text{ V}, I_D = 60\text{ A}$ $V_{GS} = 18\text{ V}/0\text{ V}, R_G = 11\ \Omega$	$t_{rr}$	-	18.2	-	ns		
Reverse Recovery Charge		$Q_{rr}$	-	0.313	-	$\mu\text{C}$		
Peak Reverse Recovery Current		$I_{RRM}$	-	34.4	-	A		
Peak Rate of Fall of Recovery Current		$di/dt$	-	3814	-	$\text{A}/\mu\text{s}$		
Reverse Recovery Energy		$E_{rr}$	-	30.7	-	$\mu\text{J}$		
Reverse Recovery Time		$T_J = 125^\circ\text{C}$ $V_{DS} = 600\text{ V}, I_D = 60\text{ A}$ $V_{GS} = 18\text{ V}/0\text{ V}, R_G = 11\ \Omega$	$t_{rr}$	-	17.7	-	ns	
Reverse Recovery Charge			$Q_{rr}$	-	0.324	-	$\mu\text{C}$	
Peak Reverse Recovery Current			$I_{RRM}$	-	36.6	-	A	
Peak Rate of Fall of Recovery Current	$di/dt$		-	4333	-	$\text{A}/\mu\text{s}$		
Reverse Recovery Energy	$E_{rr}$		-	31.2	-	$\mu\text{J}$		
Thermal Resistance – chip-to-case			$R_{thJC}$	-	0.33	-	$^\circ\text{C}/\text{W}$	
Thermal Resistance – chip-to-heatsink	Thermal grease, $\lambda = 2.87\text{ W/mK}$	$R_{thJH}$	-	0.49	-	$^\circ\text{C}/\text{W}$		

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**Table 4. ELECTRICAL CHARACTERISTICS**  $T_J = 25^\circ\text{C}$  unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>BYPASS DIODE CHARACTERISTICS</b>						
Diode Reverse Leakage Current	$V_R = 1200\text{ V}, T_J = 25^\circ\text{C}$	$I_R$	-	-	20	$\mu\text{A}$
Diode Forward Voltage	$I_F = 75\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	-	1.08	1.6	V
	$I_F = 75\text{ A}, T_J = 150^\circ\text{C}$		-	0.98	-	
Thermal Resistance – chip-to-case		$R_{thJC}$	-	0.21	-	$^\circ\text{C/W}$
Thermal Resistance – chip-to-heatsink	Thermal grease, $\lambda = 2.87\text{ W/mK}$	$R_{thJH}$	-	0.38	-	$^\circ\text{C/W}$
<b>PROTECTION DIODE CHARACTERISTICS</b>						
Diode Reverse Leakage Current	$V_R = 1200\text{ V}, T_J = 25^\circ\text{C}$	$I_R$	-	-	20	$\mu\text{A}$
Diode Forward Voltage	$I_F = 75\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	-	1.08	1.6	V
	$I_F = 75\text{ A}, T_J = 150^\circ\text{C}$		-	0.98	-	
Thermal Resistance – chip-to-case		$R_{thJC}$	-	0.42	-	$^\circ\text{C/W}$
Thermal Resistance – chip-to-heatsink	Thermal grease, $\lambda = 2.87\text{ W/mK}$	$R_{thJH}$	-	0.76	-	$^\circ\text{C/W}$
<b>THERMISTOR CHARACTERISTICS</b>						
Nominal resistance	$T_C = 25^\circ\text{C}$	R	-	10	-	$\text{k}\Omega$
Nominal resistance	$T_C = 100^\circ\text{C}$	R	-	936	-	$\Omega$
Deviation of R25	$T_C = 25^\circ\text{C}$	$\Delta R/R$	-3	-	3	%
Power dissipation	$T_C = 25^\circ\text{C}$	$P_D$	-	-	20	mW
B-value	B(25/50), tolerance $\pm 2\%$	B(25/50)	-	3450	3519	K
NTC reference					B	

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

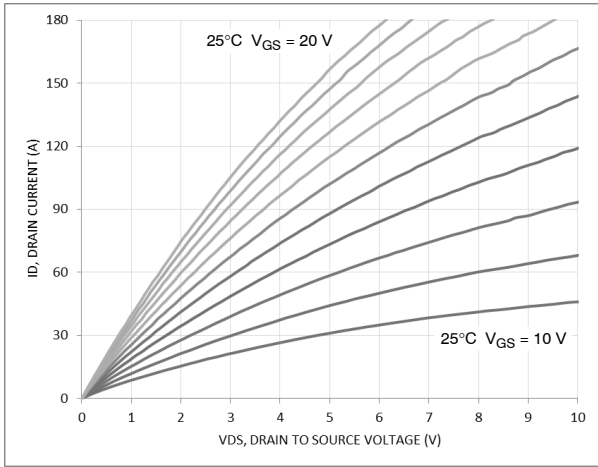
Device	Marking	Package	Shipping <sup>†</sup>
NXH027B120MNF2P2TG F2BOOST	NXH027B120MNF2P2TG	F2 BOOST Case MODGZ (Pb – Free and Halide-Free)	20 Units / Blister Tray

<sup>†</sup>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.

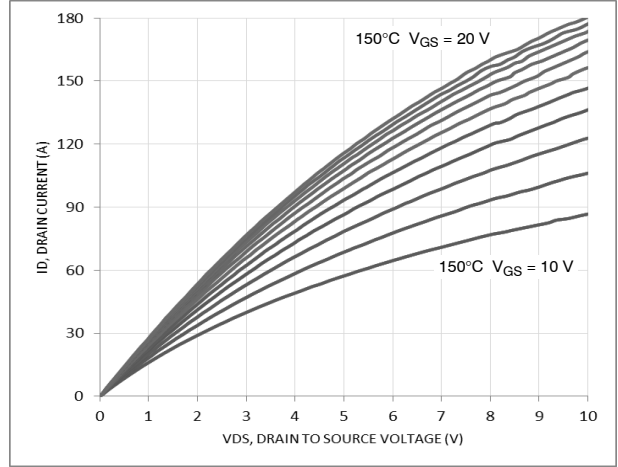
# NXH027B120MNF2PTG

## TYPICAL CHARACTERISTICS

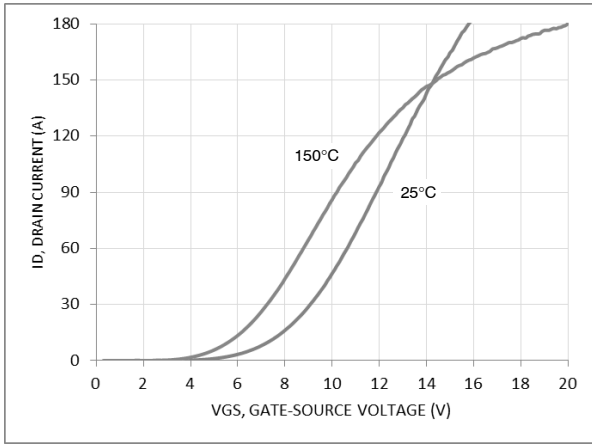
BOOST MOSFET & MOSFET PROTECTION DIODE/ BYPASS DIODE



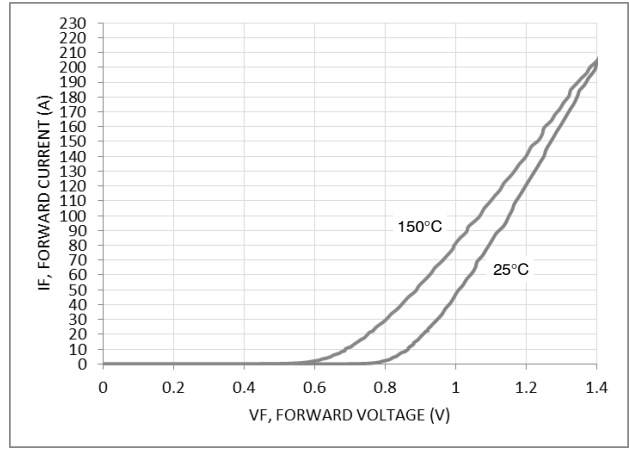
**Figure 2. MOSFET Typical Output Characteristic**



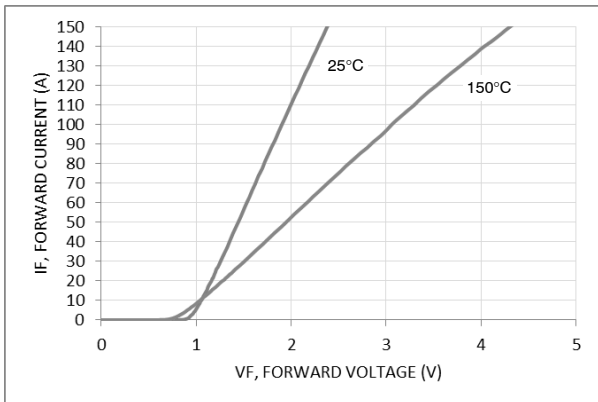
**Figure 3. MOSFET Typical Output Characteristic**



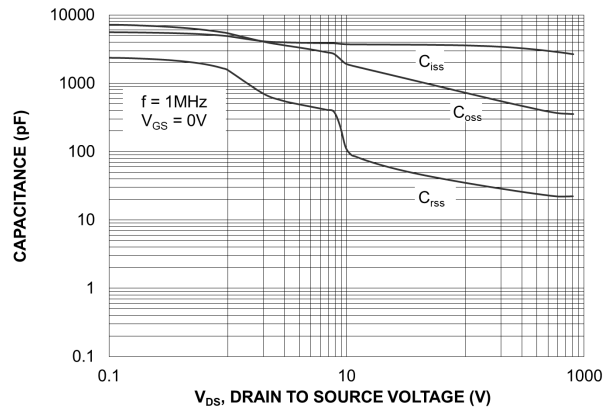
**Figure 4. MOSFET Typical Transfer Characteristics**



**Figure 5. Diode Forward Characteristics (Protection/ Bypass)**



**Figure 6. Diode Forward Characteristics (Boost Diode)**



**Figure 7. Capacitance vs. Drain to Source Voltage at  $f = 1\text{ Mhz}$**

# NXH027B120MNF2PTG

## TYPICAL CHARACTERISTICS (25°C UNLESS OTHERWISE NOTED)

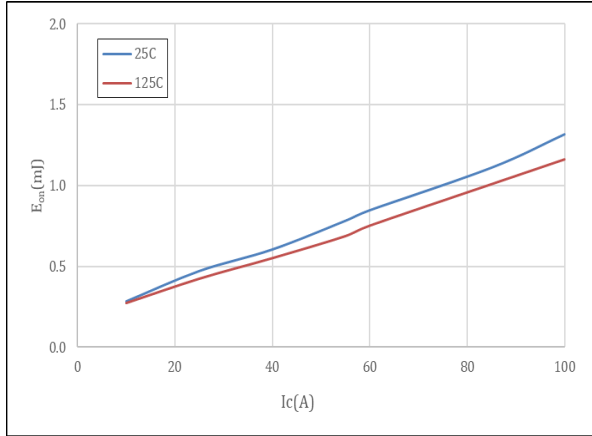


Figure 8. Typical Switching Loss Eon vs. IC

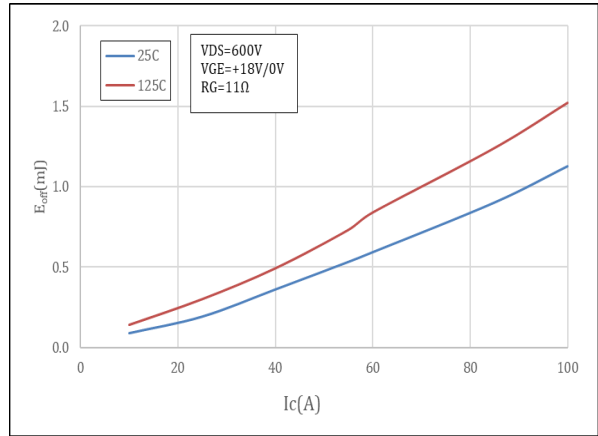


Figure 9. Typical Switching Loss Eoff vs. IC

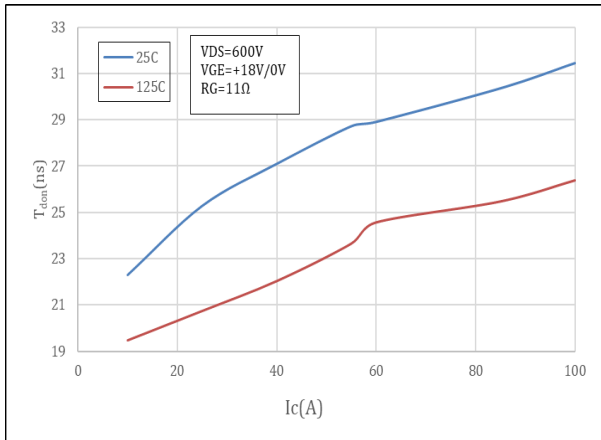


Figure 10. Typical Switching Time Tdon vs. IC

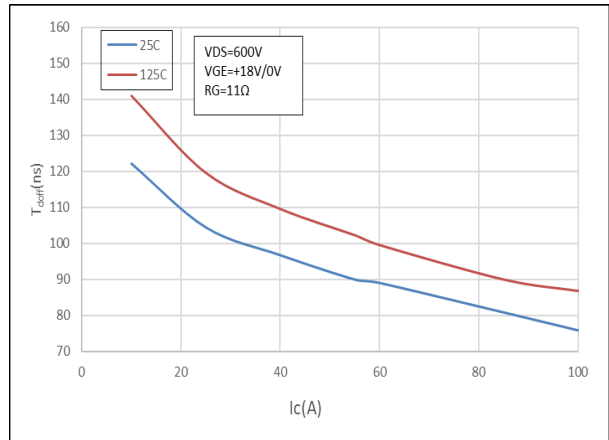


Figure 11. Typical Switching Time Tdoff vs. IC

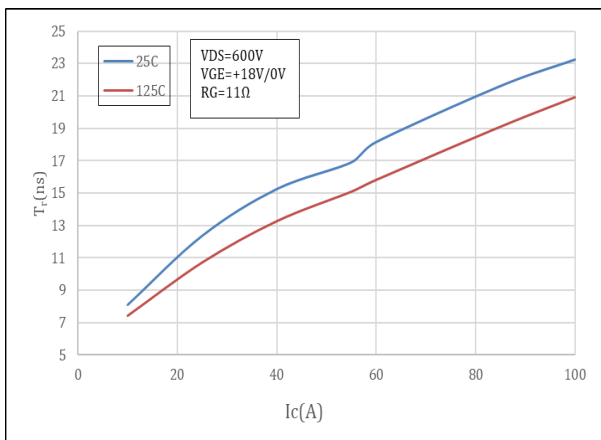


Figure 12. Typical Switching Time Trise vs. IC

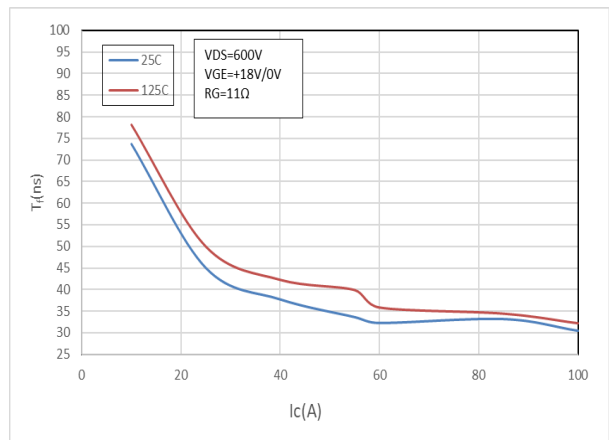


Figure 13. Typical Switching Time Tfall vs. IC

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## TYPICAL CHARACTERISTICS (25°C UNLESS OTHERWISE NOTED)

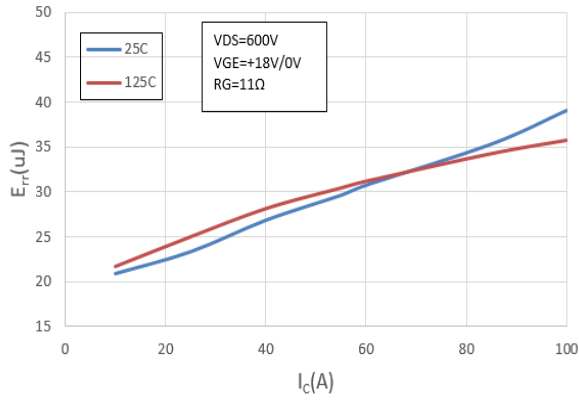


Figure 14. Typical Reverse Recovery Energy vs. IC

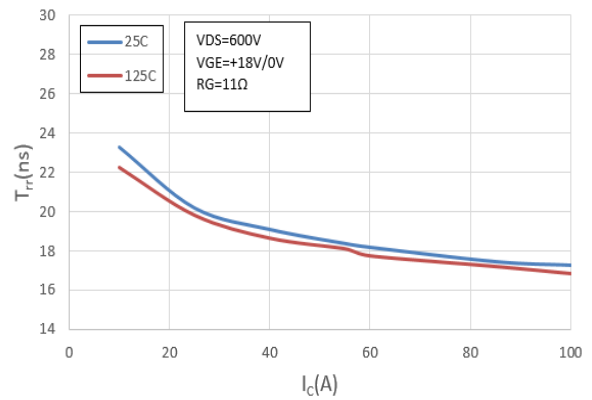


Figure 15. Typical Reverse Recovery Time vs. IC

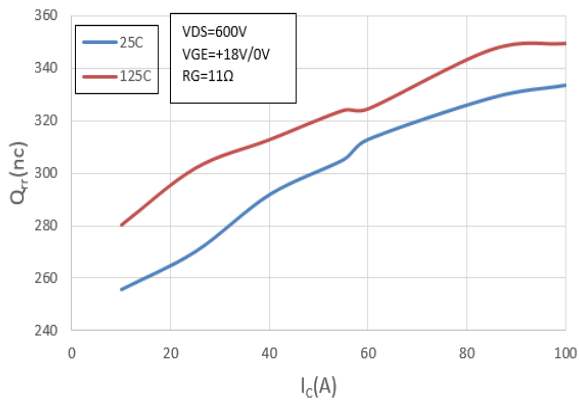


Figure 16. Typical Reverse Recovery Charge vs. IC

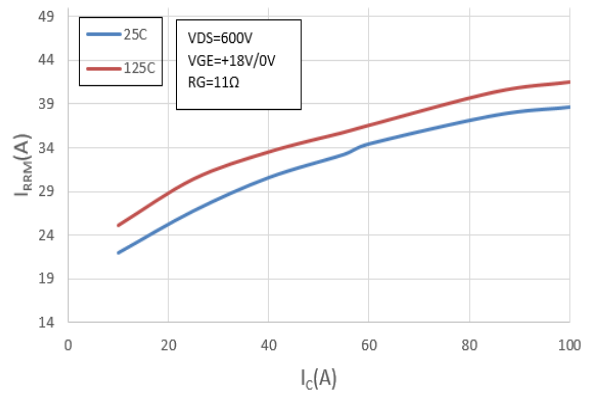


Figure 17. Typical Reverse Recovery Current vs. IC

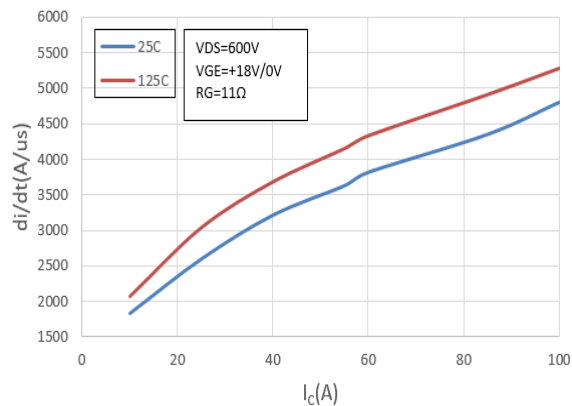


Figure 18. Typical di/dt vs. IC



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## TYPICAL CHARACTERISTICS (25°C UNLESS OTHERWISE NOTED)

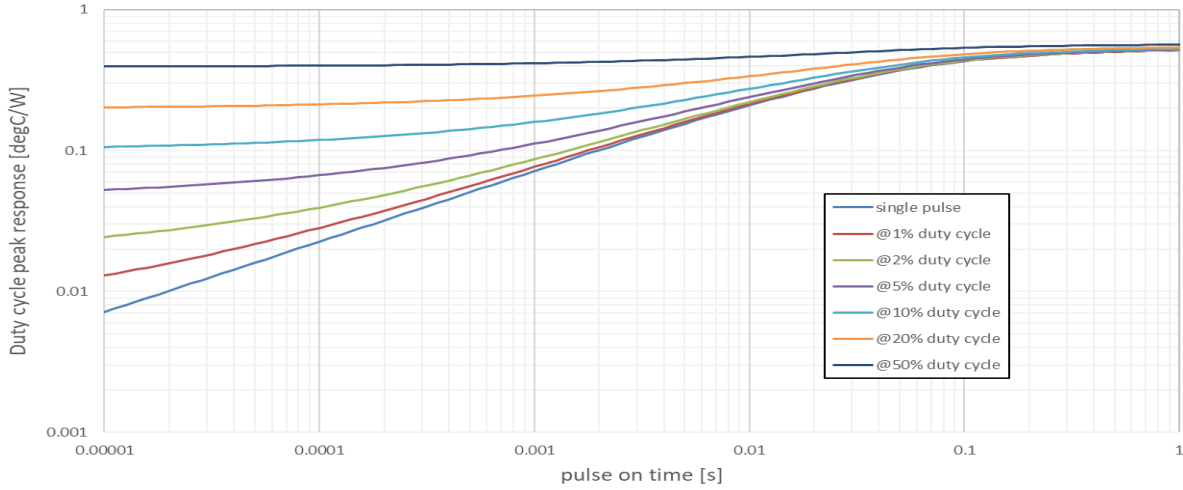


Figure 19. Boost Mosfet Junction\*to\*Heatsink Transient Thermal Impedance

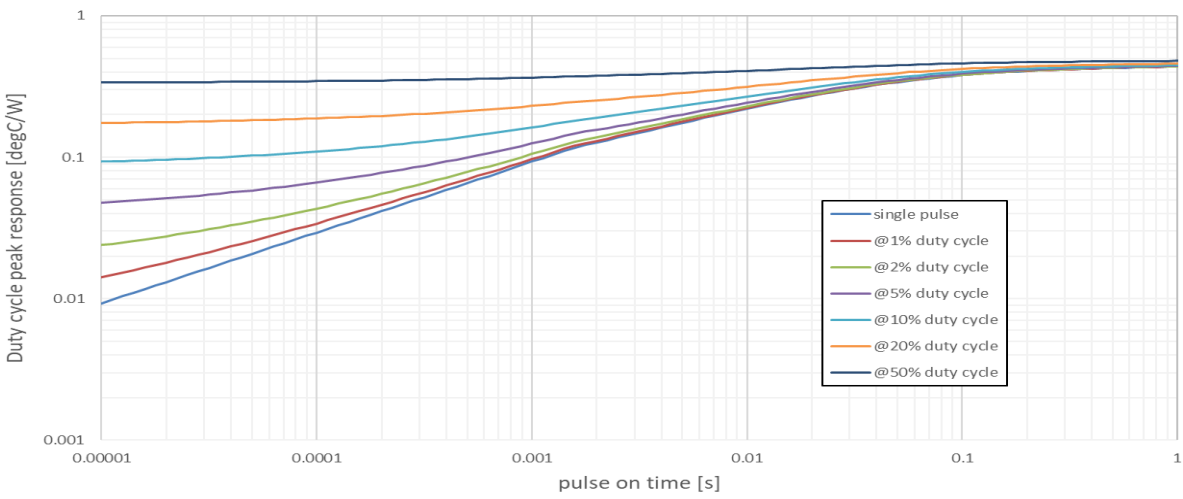


Figure 20. Boost Diode Junction\*to\*Heatsink Transient Thermal Impedance

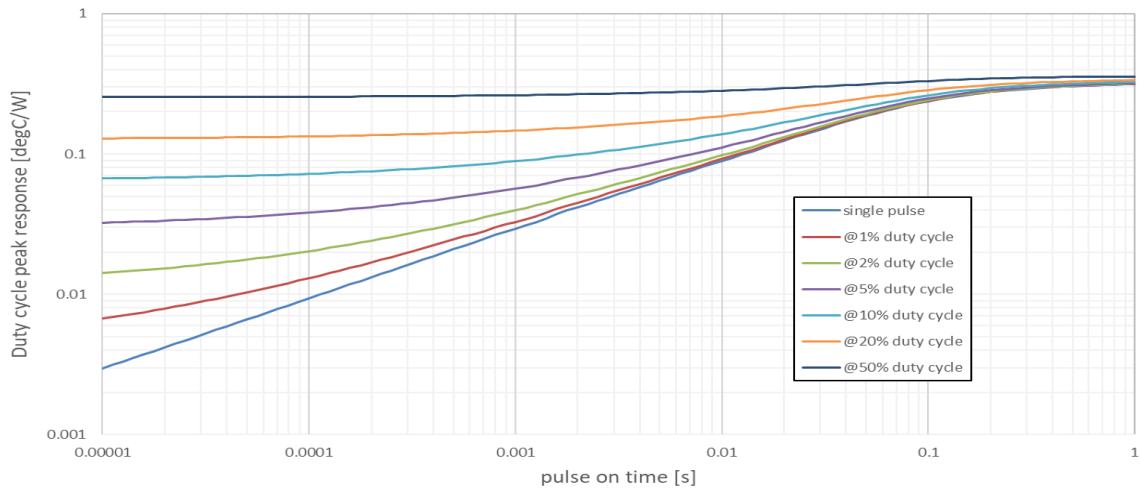


Figure 21. Bypass Diode Junction\*to\*Heatsink Transient Thermal Impedance

# NXH027B120MNF2PTG

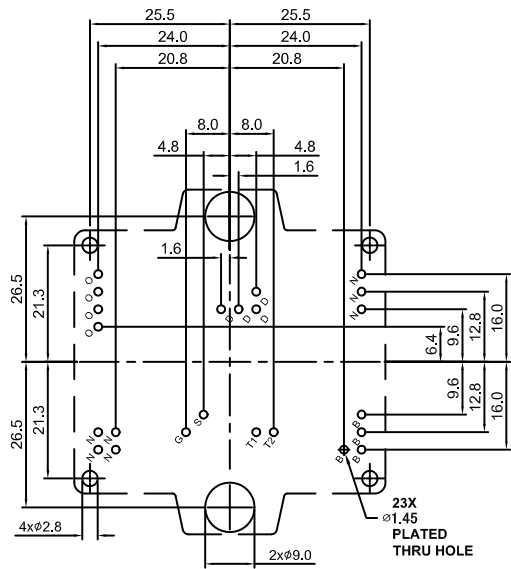
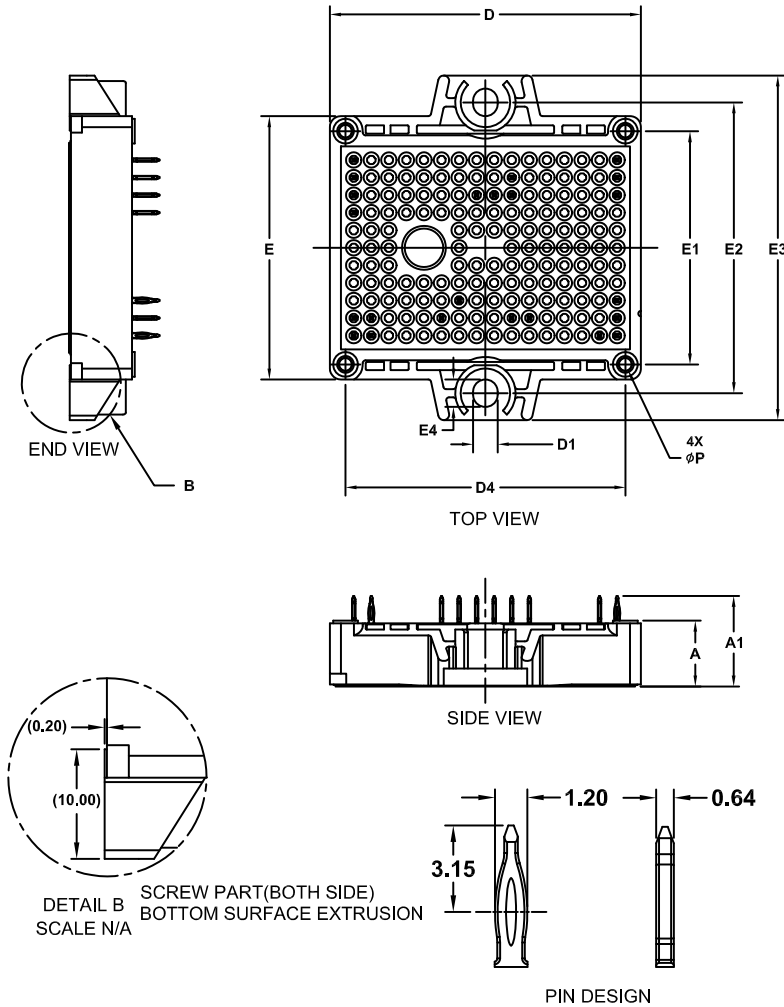
## PACKAGE DIMENSIONS

PIM23 56.7x42.5 (PRESS FIT)  
CASE MODGZ  
ISSUE A

NOTES:

1. CONTROLLING DIMENSION: MILLIMETERS

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	11.65	12.00	12.35
A1	16.00	16.50	17.00
D	56.40	56.70	57.00
D1	4.40	4.50	4.60
D4	50.85	51.00	51.15
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



PCB HOLE PATTERN  
(View from PCB Top Layer downward to backside of PCB Layer)

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